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IBM z15 Configuration Setup

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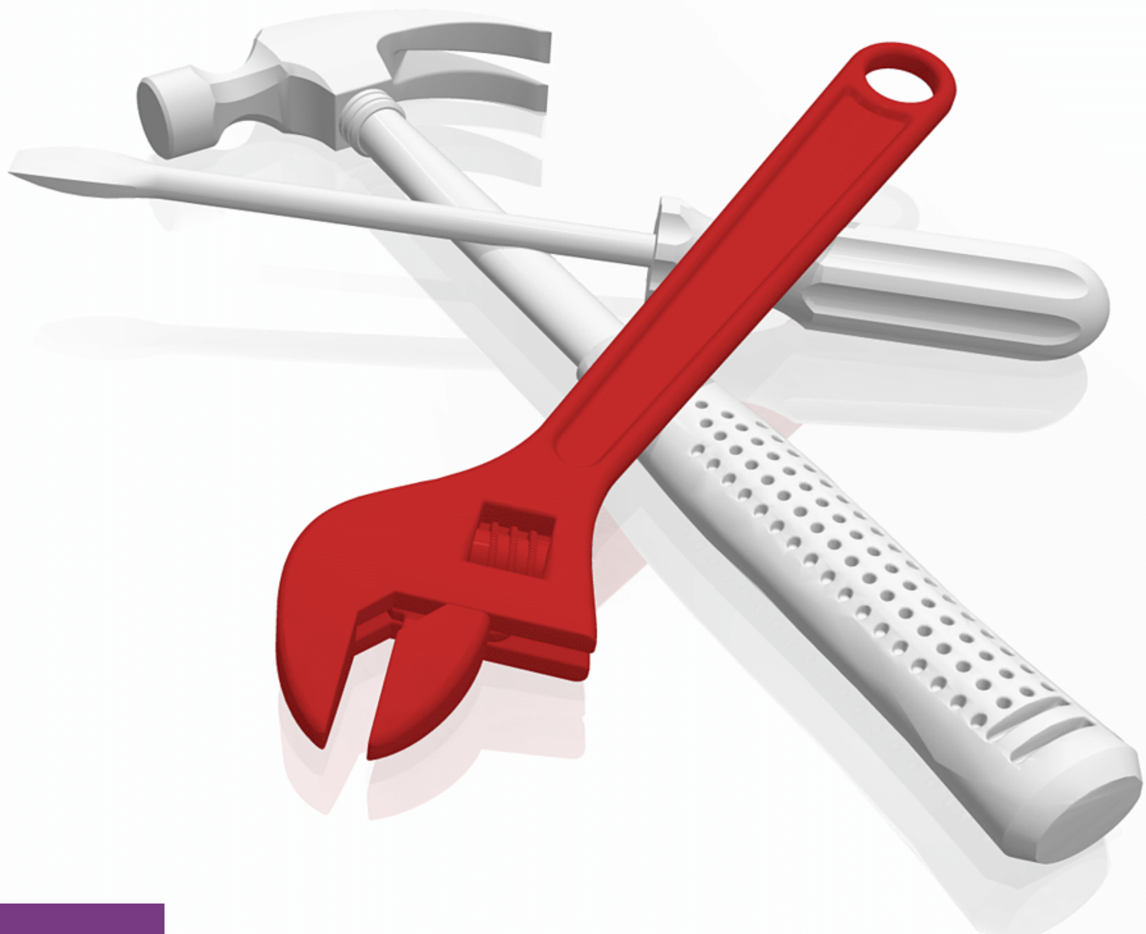

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IBM z15 Configuration Setup

August 2020

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Note: Before using this information and the product it supports, read the information in “Notices” on page ix.

First Edition (August 2020)

This edition applies to IBM z15 Machine Types 8561 and 8562.

Contents

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Preface

This IBM® Redbooks® publication helps you install, configure, and maintain the IBM z15™ (machine types 8561 and 8562) systems. The z15 systems offers new functions that require a comprehensive understanding of the available configuration options. This book presents configuration setup scenarios, and describes implementation examples in detail.

This publication is intended for systems engineers, hardware planners, and anyone who needs to understand IBM Z® configuration and implementation. Readers should be familiar with IBM Z technology and terminology. For more information about the functions of the z15 systems, see *IBM z15 Technical Introduction*, SG24-8850, *IBM z15 (8561) Technical Guide*, SG24-8851 and *IBM z15 (8562) Technical Guide*, SG24-8852.

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1

Introduction

This chapter describes the high-level goal of this book. This book covers scenarios that were devised based on best practices. The scenarios are described in subsequent chapters along with the tools that are used to implement the configurations.

This chapter includes the following sections:

- High-level goal
- Scope
- Configuration tools

1.1 High-level goal

The goal of this book is to help you plan for and complete the configuration tasks for a successful installation of the IBM z15 systems (machine types 8561 and 8562). It covers the planning and preparation tasks that are needed from when a z15 system is delivered and physically installed, up to the point when a logical partition (LPAR) is ready to be activated.

This book describes the planning considerations and configuration examples in detail from both Hardware Management Console (HMC)/Support Element (SE), and input/output definition file (IODF) perspectives.

1.2 Scope

Before you perform the planning and preparation tasks that are covered in this book, some activities must be completed:

- Customers Configuration Design: Together with your team, IBM provides design and configuration information for the installation of the z15 system that you plan to purchase.
- IBM Order to Manufacturing: Your IBM representative orders the agreed configuration. IBM makes available the download of the machine configuration as a Configuration Report File (CFR). The CFR file can be obtained from the IBM Resource Link website (authentication is required by using your IBM ID) by using a Configuration Control Number (CCN) that is provided by your IBM representative.
- Physical installation: With support from IBM, the new order or the upgrade to a z15 system is physically installed.
- HMC/Trusted Key Entry (TKE) installation: With support from IBM, the HMCs and the (optional) TKE workstations are installed and, if necessary, contents such as user profiles and API settings are migrated (in the situation where you replace the HMCs and TKEs).

Figure 1-1 on page 3 shows the steps that are required for each distinct scenario when preparing for the installation of the z15 system, which include:

- Upgrading an existing IBM z14® system to an IBM z15 system
- Installing a new IBM z15 system

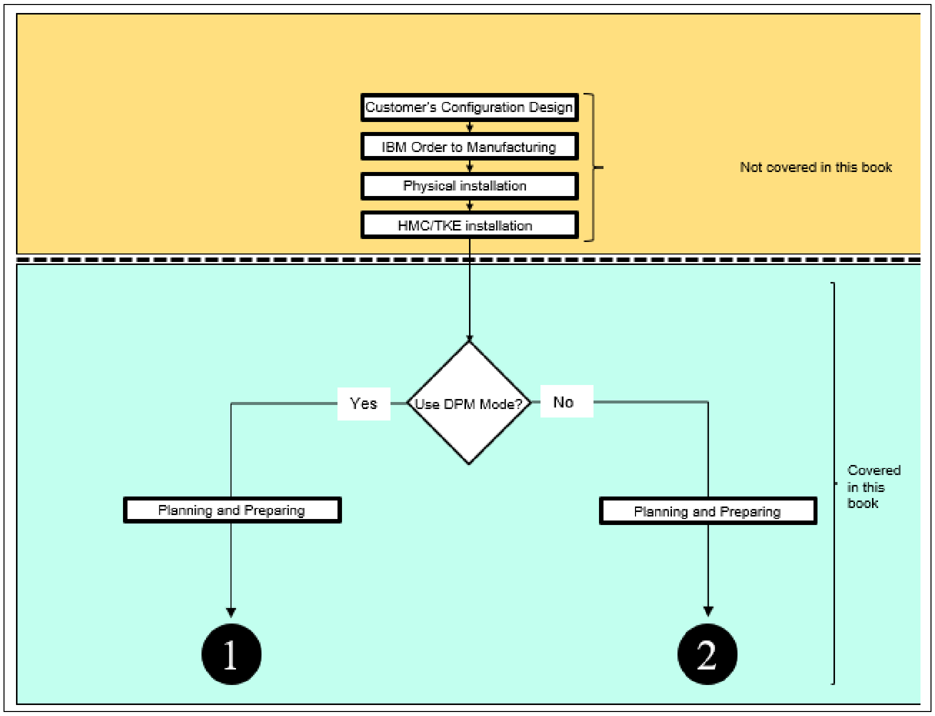


Figure 1-1 Showing the topics that are covered in this book

The flowchart in Figure 1-1 is divided in two different main sets of task streams:

- The upper stream (marked in light yellow) is based on actions that should be performed before hardware arrival, and they are not covered in this book.
- The lower stream (marked in light green) also accounts for the use of Dynamic Partition Manager (DPM) as an option.

With DPM, system administrators have a quicker and easier way to deploy Linux on IBM Z, z/VM®, kernel-based virtual machine (KVM), and Secure Service Container (SSC) LPARs. DPM is a wizard-like configuration method that runs in the HMC.

Important: When DPM is enabled, the z15 system cannot run z/OS, IBM z/VSE®, and z/TPF LPARs.

The flowchart in Figure 1-2 is divided in two different task streams:

- The stream on the left side of the flowchart is based on actions that must be performed by IBM on the SE as preparation before the z15 system is handed over to you.
- The other stream (right side of the flowchart) is based on definitions by using the DPM wizard. With the input that is provided to the DPM wizard, a configuration is activated that is used on the z15 system and the devices that are attached to it.

The actions that are defined in the two streams must be performed in sequence.

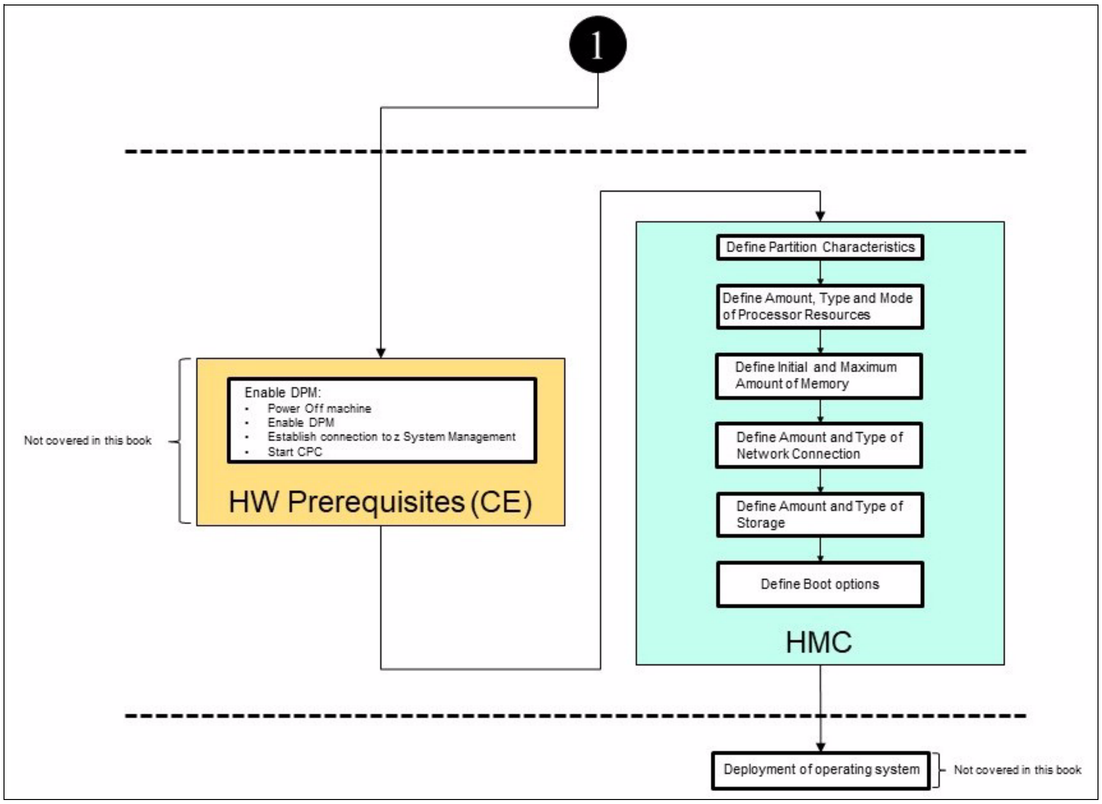


Figure 1-2 Installation flowchart applicable to both a z15 system upgrade and new installation by using DPM

DPM automatically discovers and displays the system resources that are available for use in your Linux on IBM Z, z/VM, KVM, and SSC LPARs. When using the DPM wizard, the surrounding input/output configuration data is created, which contains a description of all I/O functions and features that are used on the z15 system and the devices that are attached to it.

This book does not cover scenarios that use DPM. For more information about the use of DPM, see *IBM Z Dynamic Partition Manager (DPM) Guide*, SB10-7170-02.

The flowchart that is presented in Figure 1-3 on page 5 is divided in two different task streams:

- One stream (left side of the flowchart) is based on actions that must be performed on the HMC or the SEs.
- The other stream (right side of the flowchart) is based on definitions in the hardware configuration management program.

The actions that are defined in the two streams can have dependencies between them.

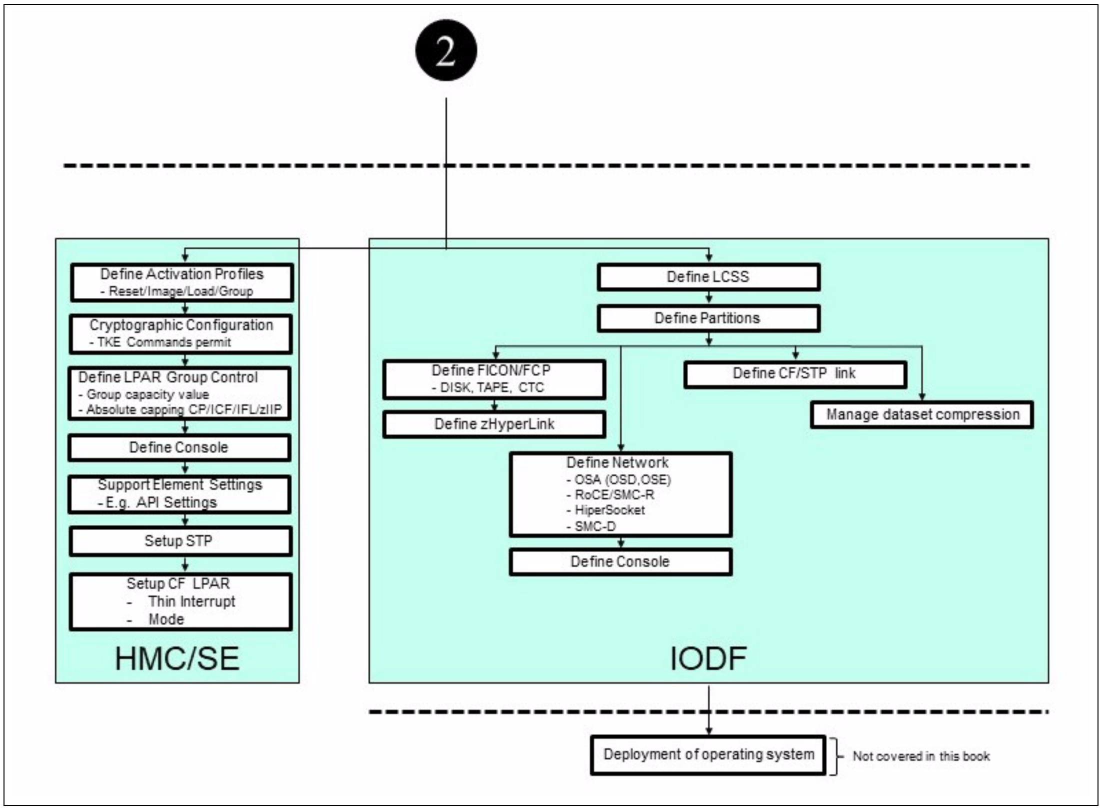


Figure 1-3 Installation flowchart that is applicable to both a z15 system upgrade and new installation

The HMC communicates with the SE (physically installed in the frame of the z15 system), which is used to communicate with the z15 hardware. On the HMC/SE, you must set some parameters so that you can activate the number of LPARs that run a supported operating system (OS).

To create an IODF (see Figure 1-3), you must do a set of activities in an application (such as Hardware Configuration Definition (HCD)), which needs a running z/OS system. The IODF can be created on a different system than the target system. There are many HMC/SE and IODF tasks that must be planned and prepared. For more information, see *I/O Configuration Using z/OS HCD and HCM*, SG24-7804.

These flowcharts are intended to act as a checklist rather than a step-by-step procedure. The steps in this book should provide enough information for you to replicate the approach in your environment.

For more information about how to deploy an OS (z/OS in this case), see *Mainframe from Scratch: Hardware Configuration and z/OS Build*, SG24-8329.

1.3 Configuration tools

Several tools are provided by IBM that can help you achieve a successful z15 installation. Whenever possible, throughout the book, lists are provided to help you go through the steps that are required to complete a specified task.

In addition to the tools and lists that are provided in this document, ensure that the planning and configuration steps are aligned with other technical departments within your organization such as storage and network administration, and with the capacity (workload) planning and cryptographic/security teams.

The configuration tools, like HCD, CHPID Mapping Tool (CMT), and the HMC and SE are covered in Chapter 2, “Planning considerations” on page 7

2

Planning considerations

This chapter describes planning and configuration considerations for the IBM z15 system. Whenever possible, worksheets that support the planning tasks are provided. Throughout this book, we provide various definition examples by using Hardware Configuration Definition (HCD) as the preferred method for the I/O configuration. Other tools, such as Hardware Configuration Manager (HCM) and ICP and input/out configuration program (IOCP) are mentioned for reference only.

This chapter also provides a short overview of tools that IBM provides to help with configuring your z15 system and information about where to obtain the tools and their intended use.

> **Naming:** The IBM z15 system consists of two models, the T01 and T02. Throughout this chapter, we refer to both models as the z15 system. Wherever features and functions differ across the models, they are explicitly mentioned.

This chapter includes the following sections:

- Scenario descriptions
- Key tools
- Extra tools
- Hardware Management Console and SE tasks
- IODF configuration

2.1 Scenario descriptions

Throughout this book, we use two distinct scenarios to explain the tasks and procedures that are involved to successfully install and configure a z15 system.

2.1.1 Scenario 1: Upgrading an existing IBM Z platform to a z15 system

This scenario assumes that an existing IBM Z platform is upgraded by using a miscellaneous equipment specification (MES) to a z15 system. The scenario includes a planned outage period for the time of the physical upgrade of the machine. The software environments that are supported by the old machine are not available during the upgrade period. The serial number of the old machine remains the same after the upgrade to the z15 system.

2.1.2 Scenario 2: Installing a new z15 system

This scenario assumes that a new z15 system is installed in an existing mainframe environment. The z15 system will be physically installed along an existing IBM Z machine. After the installation of the z15 system successfully completes and the system is handed over by IBM, the software environment on the machine to be replaced must be stopped, and recabling actions must be performed.

When recabling is complete, postinstallation activities must be performed, and the software environment can be brought back online on the new system (z15 system). An outage must be planned for this scenario, and a new serial number must be considered, so software keys for the new system must be available.

2.1.3 Planning for the scenarios

In the first scenario, the physical platform identity to be configured remains the same. No hardware configuration files must be physically migrated to another platform. The machine serial number remains the same after the upgrade, so no changes to the software licenses are required.

In the second scenario, the physical platform to be configured changes. Hardware configuration files must be prepared on the existing machine, and must be migrated to the new z15 system together with the attached cabling. The serial number changes with the activation of the z15 system, which means that planning and preparing for software license changes must be considered.

In both scenarios, we assume that bringing up the existing features and functions has the highest priority. Adding new features and functions that are acquired with the system upgrade or installed in the new z15 system have a lower priority. The elapsed time of the planned outage can vary significantly, depending on the approach that is chosen in either scenario.

In both scenarios, some information must be obtained before starting the process of changing to or installing the new z15 system:

- The new processor ID: The processor ID is used to assign a unique name to identify the processor in the HCD. For more information, see the *z/OS HCD Users Guide*, SC34-2669.
- The `CFReport` file: The `CFReport` file is downloadable from IBM Resource Link® by entering a Configuration Control Number (CCN). The CCN is provided by your IBM representative.
- The system serial number: If a new z15 system will be installed, a new serial number is provided by your IBM representative.

Also, IBM does not provide fiber optic cables as features on the z15 system. Therefore, a complete analysis must be made of the I/O connectors that are used on existing systems being upgraded to a z15 system to ensure that the appropriate fiber optic cabling is installed.

An equivalent study should be part of your preparation to install a new z15 system so that all cabling is delivered to the data center before the installation date.

All required cables for the z15 system should be identified and placed on order. Labeling all cables is required for the installation. At a minimum, the labels should identify the physical channel ID (PCHID) number.

If you already received the configuration and PCHID reports from IBM, define your coupling links to fit your planned configuration to your new or upgraded central processor complex (CPC).

2.2 Key tools

IBM provides several tools to help with the complexity of configuring an IBM Z platform. This section summarizes the various tools that are available for the IBM Z platform, and briefly outlines their benefits for the planning process.

Table 2-1 lists the machine types for the IBM Z platform. The examples in this book use tools, such as the HCD and channel path ID (CHPID) Mapping Tool (CMT) that refer to the machine type as opposed to names. For more information, see Chapter 4, “Preparing an input/out configuration program to use the CHPID Mapping Tool” on page 55.

Table 2-1 Machine types for IBM Z platforms

Name	Short name	Machine type
IBM z15 T02	z15 T02	8562
IBM z15 T01	z15 T01	8561
IBM z14 ZR1	z14 ZR1	3907
IBM z14	z14	3906
IBM z13s®	z13s	2965
IBM z13®	z13	2964

2.2.1 IBM Resource Link

The first step in planning for the installation of the z15 system is to access IBM Resource Link. You must register with Resource Link by providing a client site number, ID, and a valid email address. Your IBM representative can assist you with the registration process. After you have an IBM ID, you can customize your profile to accommodate the platforms that you are responsible for.

On the Resource Link website, you have access to various resources and tools that are designed to help the installation process. A number of tools are available to simplify the installation process of a z15 system. Even if you worked with most of these tools before, be sure to check for the latest versions that are relevant to the z15 system.

The **Education** and **Library** tabs on the website display information about the IBM Z family and some online tutorials. Under the **Tools** tab, you can download the latest version of the most frequently used tools and obtain system and configuration information.

2.2.2 Hardware Configuration Definition

HCD is a component that runs on z/OS and IBM z/VM. It supplies an interactive dialog to generate the input/output definition file (IODF) and the input/output configuration data set (IOCDS).

Consider using HCD or HCM to generate the I/O configuration rather than writing your own IOCP statements. HCD performs validation as you enter the data, thus minimizing the risk of errors. This book provides examples for using HCD, with some examples that used HCM (see “Hardware Configuration Manager” on page 10).

New hardware (a z15 system) requires program temporary fixes (PTFs) to enable definition support in HCD.

When defining devices in HCD, the hardware features can be selected according to the physical setup of the devices that are attached to the z15 system. Detailed forms and charts that describe the environment facilitate the planning process.

For more information about HCD, see IBM Knowledge Center.

Hardware Configuration Manager

HCM provides a GUI to HCD and the associated IODF. HCM runs on a workstation and can also define and store more information about the physical hardware to which the IODF is defined.

HCM does not replace HCD. It is used with HCD and the associated IODF. However, HCM can be used in a stand-alone mode after an IODF is built and the configuration files (`IODF##.HCM` or `IODF##.HCR`) are created on your HCM workstation.

For more information about HCM, see IBM Knowledge Center.

2.2.3 CHPID Mapping Tool

The CHPID Mapping Tool (CMT) provides a mechanism to map PCHIDs to CHPIDs as required on a z15 system. The CMT is optional but preferred to manually mapping the PCHIDs to CHPIDs. Using the CMT provides the best availability recommendations for a particular configuration.

Two files are needed to obtain an IODF file containing the correct PCHID numbers by using CMT:

- A production IODF file without PCHID numbers. For more information about how to obtain this file, see Chapter 4, “Preparing an input/out configuration program to use the CHPID Mapping Tool” on page 55.
- The `CFReport` file reflecting the physical configuration of the ordered z15 system, which is obtained from the Resource Link website. The CCN is generated by your IBM Client Representative when building the order for your configuration.

2.2.4 HCD and the CMT

The HCD process flow for a new z15 installation is shown in Figure 2-1.

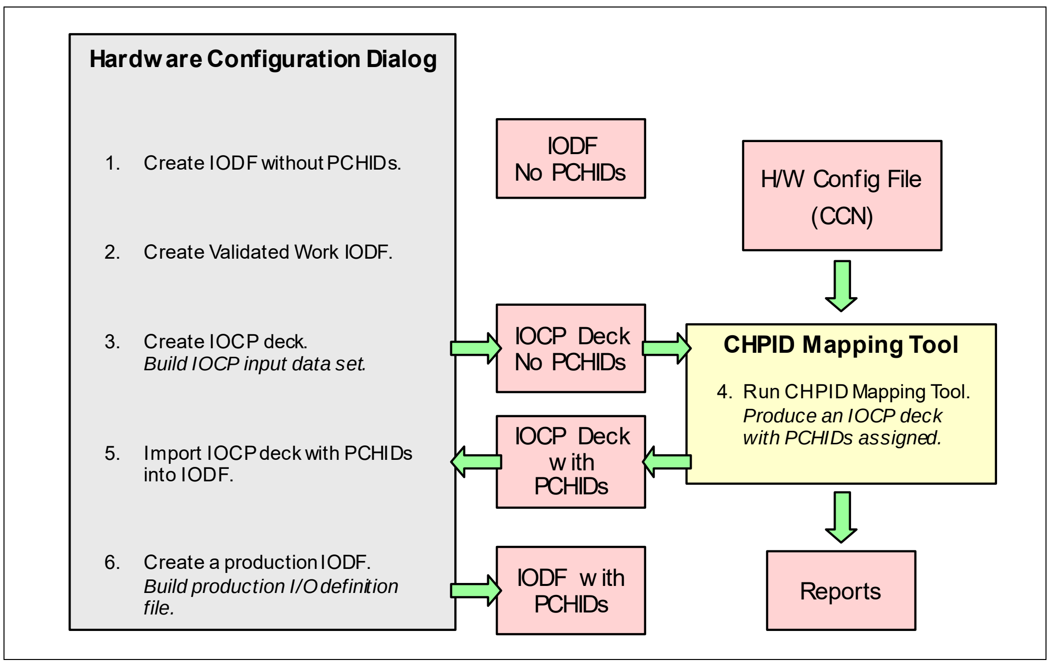


Figure 2-1 CMT: I/O configuration definition flow for a new installation

Part of the actions that are described in Figure 2-1 might also be valid for an upgrade, depending on the hardware configuration of the upgraded machine.

To download the CMT, log in to the Resource Link website with a registered Resource Link ID.

For more information, see the *CHPID Mapping Tool Users Guide*, GC28-6984. For more information about how to use the CMT, see Chapter 4, “Preparing an input/out configuration program to use the CHPID Mapping Tool” on page 55.

2.3 Extra tools

The additional tools that are described in this section are not used in this book. However, they can help speed up the process of planning and configuring specific features or functions outside of this book.

2.3.1 Input/output configuration program

ICP IOCP Version 5 Release 5.0 or later is required for a z15 system. You can define the z15 configuration by using only IOCP. However, HCD is suggested because of its verification and validation capabilities. By using ICP IOCP, it is possible to write an IOCDS in preparation for a CPC upgrade.

For more information about the changes and requirements for ICP IOCP, see *IBM Z Input/Output Configuration Program User's Guide for ICP IOCP*, SB10-7172.

2.3.2 Worldwide Port Name Prediction Tool

The Worldwide Port Name (WWPN) Prediction Tool for IBM Z Fibre Channel Protocol (FCP) Channels helps prepare configuration files that are required or generated by the IBM Z platform when FCP Channels are installed. In particular, this tool helps during the installation of new systems and system upgrades.

One of the most important configuration parameters are WWPNs, which uniquely identify physical or virtual Fibre Channel (FC) ports. They are typically used in FC storage area network (SAN) switches to assign the corresponding ports to zones of a SAN. They are used in storage subsystems to grant access from these ports to specific storage devices that are identified by logical unit numbers (LUNs).

The capability of the WWPN Prediction Tool is extended to calculate and show WWPNs for both virtual and physical ports before system installation.

The WWPN Prediction Tool is available for download from IBM Resource Link and is applicable to all Fibre Connection (IBM FICON®) channels that are defined as CHPID type FCP (for communication with SCSI devices) on a z15 system. You can access the tool at this web page by using your IBMid.

WWPN Persistence

The FCP WWPNs are determined based on the I/O serial number of the CPC, the IOCDS configuration details (for N_Port ID Virtualization (NPIV) WWPNs), and the PCHID values (for physical WWPNs). When Feature Code #0099 (WWPN Persistence) is ordered as part of a new or upgraded configuration for a z15 system, the I/O serial number part of the WWPN for the new z15 system is the same serial number as for the source machine configuration.

For more information, see this Techdoc website.

2.3.3 Coupling Facility Structure Sizer

Moving to a new z15 system means migrating to a higher Coupling Facility Control Code (CFCC) level (level 24). If your existing Coupling Facility (CF) data structures are adequately sized and you want to know how much these structures might need to grow to accommodate the same workload at the new CFCC level, you can use the current structure sizes to calculate the new sizes. The Coupling Facility Structure Sizer (CFSizer) Tool helps you evaluate the sizing of the CF structures.

Use the CFSizer tool to plan the amount of storage that must be allocated for CF partitions more accurately. You can access the tool at the CFSizer page.

2.3.4 Power estimation tool

The power estimation tool is a web-based tool that you use to estimate the power consumption for your IBM Z platform. The tool also estimates the machine’s weight.

For access to this tool, see IBM Resource Link.

2.3.5 Shared Memory Communications Applicability Tool

The Shared Memory Communications Applicability Tool (SMCAT) helps you determine the value that SMC - Remote Direct Memory Access over Converged Ethernet Express (SMC-R) and SMC - Direct Memory Access over Internal Shared Memory (SMC-D) can bring to your environment with minimal effort and minimal impact.

SMCAT is integrated within the TCP/IP stack and gathers new statistics that are used to project Shared Memory Communications (SMC) applicability and benefits for the current system. For more information, see the Shared Memory Communications Reference Information website.

2.3.6 Z Batch Network Analyzer tool

The Z Batch Network Analyzer (zBNA) tool is a PC-based productivity tool that provides a means of estimating the elapsed time for batch jobs solely based on the differences in CPU speeds for a base processor and a target processor, the number of engines on each system, and system capacities. Data sharing is not considered. zBNA provides a powerful, graphic demonstration of the z/OS batch window.

The zBNA Tool also provides the capability to project the benefits of using IBM Integrated Accelerator for zEnterprise® Data Compression (zEDC) and the ability to estimate the benefit of zHyperLink I/O activity.

The zBNA tool and its Users Guide can be downloaded from the IBM Z Batch Network Analyzer (zBNA) Tool website.

2.4 Hardware Management Console and SE tasks

This section introduces the configuration and management tasks that are available on the Hardware Management Console (HMC) and the Support Element (SE).

2.4.1 Activation profiles

Activation profiles must be customized by using the HMC. Activation profiles are required for CPC and image activation. They are used to tailor the operation of a CPC and are stored in the SE that is associated with the CPC. There are four types of activation profiles:

- Reset: A reset profile is used to activate a CPC and its images.
- Image: An image profile is used to activate an image of a CPC previously activated.
- Load: A load profile is used to load a previously activated image with a control program or operating system (OS).
- Group: A group profile is used to define the group capacity value for all logical partitions (LPARs) belonging to that group.

The default profiles of each of these types are provided. The *Activate* task activates the CPC or image. Initially, the *Default* profile is selected. You can specify an activation profile other than the Default. This feature provides you with the capability to have multiple profiles, for example, one for every IOCDS file that is managed by the CPC.

Reset profile

Every CPC in the processor cluster needs a *reset profile* to determine the mode in which the CPC Licensed Internal Code (LIC) is loaded and how much main storage is used. Using the reset profile, you must provide the order in which the LPARs will be activated during a Power on Reset (POR). The maximum number of reset profiles for each CPC is 26.

For more information about how to define a reset profile, see 5.3, “Creating a reset profile on the Support Element” on page 100.

Image profile

Select the appropriate reset profile and within the profile, select the appropriate IOCDS. The list of LPARs that are defined in the IOCDS is displayed. Parameters must be set for each LPAR before it can be activated and an IPL is run. The parameters for each LPAR define these settings:

- General: The mode of operation and its identifier
- Processor: The number of logical CPs, z Integrated Information Processors (zIIPs), and the weight assigned to the processor
- Security: The security options for this LPAR
- Storage: Memory and Virtual Flash Memory (VFM) that are assigned to this LPAR
- Options: The I/O priority and defined capacity options
- Load: The load parameters that are necessary to run an IPL for this LPAR
- Crypto: The Crypto Express parameters (also see 2.4.2, “Cryptographic configuration” on page 15)

Note: To help you gather the necessary input, a worksheet is provided with this book. For more information about downloading the worksheet that is associated with this material, see Appendix A, "Additional material" on page 387.

For more information about how to define an image profile, see 5.4, "Creating an image profile on the Support Element" on page 104.

Load profile

A *load profile* is needed to define the channel address of the device from which the OS is loaded. Depending on the SE model and machine type, the maximum number of load profiles for each CPC is 64 - 255.

Group profile

A *group profile* defines the group capacity value that can be customized in determining the allocation and management of processor resources that are assigned to the LPAR in a group. This profile does not contain the names of the LPAR images that make up the group.

2.4.2 Cryptographic configuration

The activation profile that you use to activate an LPAR prepares it for running software products that use the Crypto Express feature. Using the feature's cryptographic facilities and functions requires customizing the LPAR's activation profile to accomplish these tasks:

- Install the CP Assist for Cryptographic Functions (CPACF) Data Encryption Standard/Triple Data Encryption Standard (TDES) Enablement feature if you are planning to use Integrated Cryptographic Service Facility (ICSF).
- Give the LPAR access to at least one Crypto Express feature. This goal is accomplished by selecting from the Usage Domain Index and the Cryptographic Candidate list.
- Load the LPAR with an OS, such as z/OS, that supports using cryptographic functions.

For more information about the cryptographic feature, see 10.1, "Crypto Express7S" on page 216.

2.4.3 LPAR group control

Here are methods that can be used to limit the processor capacity usage for a single LPAR or a group of LPARs and help you control software cost:

- Edit Group Capacity: Use this method to define a group of LPARs on the same CPC and a limit for the combined capacity usage by those LPARs. The system can manage the group in such a way that the limit for Group Capacity in MSU per hour is not exceeded.
- Absolute Capping: Use this method to specify the absolute capping for the selected processor type to indicate the new setting. Absolute Capping is managed by IBM Processor Resource/System Manager (PR/SM) independent of the OS running in the capped LPARs.

Both methods (Group Capacity and Absolute Capping) can be used concurrently and in combination with LPAR capping.

Consider reevaluating the parameters in a scenario where the values must be migrated from a previous generation of the IBM Z platform to a z15 system.

Tip: Capacity management by using capping technologies is an ongoing process that must be monitored and adjusted over time. Temporary or permanent capacity changes also must be considered when using capping technologies.

A good overview of the capping technologies and 4-hour rolling average (4HRA) optimization can be found in the Capping Technologies and 4HRA Optimization document.

2.4.4 Consoles and terminals

The Open Systems Adapter (OSA) Integrated Console Controller (ICC) (OSA-ICC) function of the Open Systems Adapter-Express (OSA-Express) 1000Base-T and the OSA-Express7S Gigabit Ethernet (GbE)[1] features support TN3270 enhancements (TN3270E) and non-Systems Network Architecture (SNA) distributed function terminal (DFT) 3270 emulation. Planning for an IBM z15 OSA-ICC implementation requires input from a number of disciplines within an organization:

- IBM Z I/O subsystem configuration
- OS configuration
- OSA-Express feature configuration
- Ethernet local area network (LAN) configuration
- Client TN3270E configuration

In HCD, the OSA-Express feature must be defined to operate as an ICC. The configuration requirements are as follows:

- IBM Z I/O subsystem configuration: The same basic rules for adding an OSA-ICC adapter apply as to any other new device.
- OS configuration: To have a Nucleus Initialization Program Console available, make sure that the correct device number is defined in the HCD OS “Work with consoles” dialog.

During an upgrade from an existing IBM Z platform to a z15 system, the same definitions can be used for the new machine as on the source configuration.

The following planning topics must be considered:

- Reserve at least one OSA-Express port to be defined as channel type OSC.
- Define 3270-X Devices in HCD to act as system consoles.
- Use OSA Advanced Facilities to configure the sessions.

The OSA-Express feature also requires configuration tasks to be performed on the HMC by using the OSA Advanced Facilities task. Collect information for the following parameters before starting the configuration activities:

- OSA-ICC server: Name, Host IP address, TCP port number, Gateway IP address, the network type, and the MTU size
- OSA-ICC session definitions: Channel subsystem (CSS), the Multiple Image Facility (MIF) (LPAR) ID, Device number, LU-name, client IP address, IP Filter, the session type, defer host disconnect (DHD), response mode (RSP9), and read timeout (RTO)

Note: Consider defining multiple sessions per LPAR to allow access for a number of users concurrently.

[1] Check with your IBM Representative for the availability of support for OSA-Express7S GbE.

For an upgrade of an existing IBM Z platform to a z15 system, these definitions can be exported from the source machine by using onboard HMC facilities and imported back again after the upgrade is complete.

For more information about the definitions, see Chapter 7, “Defining console communication” on page 151. For implementation details, see the *OSA-Express Integrated Console Controller Implementation Guide*, SG24-6364.

2.4.5 Support Element settings

The SEs that are supplied with the z15 system are two appliances that are based on 1U x86 servers. Both units are installed at the top of the A frame. One is a primary SE, and the other is the alternative SE.

Generally, the SE settings are considered part of the physical installation of the z15 system, so they are not presented in this book. For a new z15 system, a new range of TCP/IP addresses must be provided by the customer to the IBM System Services Representative (IBM SSR) who performs the physical installation. As an extra measure of security, provisioning of a separate LAN segment for the management functions is preferred. During an upgrade from an older IBM Z platform to a z15 system, the current settings on the SEs should be backed up for migration purposes.

In addition to the standard SE configuration, there might be other parameters that should be backed up, such as the API settings. These parameters can be accessed through the Customize API Settings task on the SE.

2.4.6 Server Time Protocol

The Server Time Protocol (STP) provides the means by which the time of day (TOD) clocks in various systems can be synchronized by using messages that are transported over coupling links. STP operates along with the TOD-clock steering facility to provide a new timing mode, timing states, external interrupts, and machine check conditions.

STP connectivity for a z15 system: The z15 system does not support coupling connectivity by using the InfiniBand feature. The z15 system can connect only for transmitting coupling and timing (STP) data to a z13 or z13s, z14 M0x or z14 ZR1, or another z15 system with a Peripheral Component Interconnect Express (PCIe) coupling link (N-2 generations coupling link). Make sure that you have the appropriate coupling and timing connectivity in your z15 system before assigning a role in the Coordinated Timing Network (CTN) (Preferred Time Server (PTS), Backup Time Server (BTS) and Arbiter).

The HMC provides a user interface to manage an STP-only CTN. Managing system time on a z15 system with STP requires the appropriate HMC level (V2.15.0). SE menus for STP on a z15 system are no longer available.

Consider the following items when setting up an HMC for STP:

- A CTN ID, which must be unique for all IBM Z servers that are part of the CTN.
- To synchronize IBM Z servers to an External Time Source (ETS), Network Time Protocol (NTP) server information (and network connectivity that uses the NTP or NTPS protocol with optional pulses per second (PPS)) must be provided.
- The time zone offset, Daylight Saving Time offset, and leap second offset.
- Optionally, the HMC can be configured as an NTP server.

- For the IBM Z servers that are part of a CTN, STP roles must be planned (PTS, BTS, and Current Time Server (CTS), and Arbiter).
- As part of the migration, changing the CTS must be done before migration to the new platform (z15 system).

> **Note:** The z15 system supports STP stratum level 4. This feature avoids the additional complexity and expense of system reconfiguration. All systems that might become exposed to this situation should have this change installed. Stratum level 4 should be used only during a migration, and for a short period.

For more information, see Chapter 8, “Preparing for IBM Parallel Sysplex and configuring Server Time Protocol” on page 165.

2.5 IODF configuration

This section describes I/O configuration considerations in the IODF.

2.5.1 Logical channel subsystems

The IBM Z platform manages I/O resources (LPARs, channel paths, and control units (CUs), and I/O devices) by housing them in multiple logical channel subsystems (LCSSs).

A *spanned channel path* is one that can be used by partitions in more than one LCSS. You must use the same CHPID value across all LCSSs sharing a spanned channel. However, LCSSs that do not share a spanned channel can use that CHPID for other channels.

For more information, see *z/OS Hardware Configuration Definition Planning*, GA32-0907.

Your planning should consider multiple LCSSs so that you can logically partition your physical channel resources to accommodate large-scale enterprise workload connectivity and high-bandwidth demands. The z15 T01 supports six LCSSs, and the z15 T02 supports three LCSSs. The z15 T01 has four subchannel sets (SSs) in each LCSS with up to 256 channels, for a total of 1536 channels. The z15 T02 system has three SSs in each LCSS with up to 256 channels, for a total of 768 channels.

Additionally, LCSSs provide for multiple SSs for expanding the number of I/O devices that is managed in each CSS. With the z15 T01, up to four SSs of approximately 64,000 device addresses are available. The base addresses are defined to set 0 (IBM reserves 256 subchannels on set 0) and the aliases addresses are defined to set 1, set 2, and set 3.

With the z15 T02, up to three SSs of approximately 64,000 device addresses are available. The base addresses are defined to set 0 (IBM reserves 256 subchannels on set 0) and the aliases addresses are defined to set 1 and set 2.

Not all device types are eligible for nonzero SSs. SS0 can be used for any type of device. More SSs (for example, SS1) can be used only for certain classes of devices, such as parallel access volume alias devices.

For more information, see *IBM z15 (8561) Technical Guide*, SG24-8851.Use multiple SSs to move devices of eligible device types to more SSs, and then define more physical devices to SS0.

2.5.2 Logical partitions

The PR/SM feature allows a single IBM Z platform to run multiple OSs in LPAR mode. Each OS has its own LPAR, which is a separate set of system resources that includes these items:

- A portion of storage (memory).
- One or more central and specialty processors. The processors can be dedicated or shared.

Profile data can be exported on the older IBM Z platform and imported on the z15 system. If the LPAR data is imported from an older IBM Z platform, consider the LPAR sizing before the LPAR migration to the z15 system. For more information, see the *Support Element Operations Guide*.

For more information about how to define LPARs in IODF, see Chapter 3, “Preparing for a new IBM z15 system” on page 31.

Planning considerations for Virtual Flash Memory

VFM (Feature Code #0643) is available in 512 GB increments of memory. A z15 T01 can have up to 12 VFM features (four VFM features for the z15 T02). While planning your memory, you must consider your VFM requirements.

With the introduction of VFM, there are no changes to the existing OS interface for handling the storage-class memory (SCM). The OS handles VFM the same way as it does Flash Express. The allocation of VFM storage is done during LPAR activation because the LPAR hypervisor manages the partition memory.

Both the initial and maximum amounts of VFM are specified in the LPAR image profile. VFM can be added to or deleted from OSs by using existing SCM commands after the LPAR is activated. VFM allocation and definition for all partitions can be displayed on the **Storage Information** window on the HMC and by using SCM commands in z/OS.

> **VFM allocation:** The VFM values for Initial and Maximum allocations cannot be dynamically changed. One or more partitions must be activated (or reactivated) for VFM allocation changes to take effect.
>
> As a best practice, assign the maximum amount that is installable for all LPARs that are candidates for using VFM, and set Initial allocation to 0 for the LPARs that do not require immediate activation of VFM. By doing so, you ensure that you can later use any available VFM when required.
>
> At partition activation time, over-commitment of VFM storage is supported. This setting enables more storage to be added to partitions that is subject to the amount that is not assigned to other partitions.
>
> For more information, see 10.2.3, “Configuring VFM” on page 249.

If the total amount of VFM that is allocated to all active partitions is equal to the LICC value but the sum of active partition maximums is larger than the installed amount, a customer might be able to concurrently add VFM and increase allocations without reactivating partitions. This feature is illustrated in the following sections.

Non-disruptive migration

Here is an example of a non-disruptive migration:

- A z15 system has three VFM features that are installed (512 GB each), with a LICC value of 1.5 TB.
- LPAR A has 1.0 TB assigned, with a maximum value of 1.5 TB.
- LPAR B has 512 GB assigned, with a maximum value of 1.0 TB.
- You must assign 1 TB to LPAR B, but this change is not possible within the constraints of the installed VFM.
- You purchase and install another 512 GB VFM feature and install it concurrently. Now, up to 512 GB can be added concurrently to LPAR B without reactivating the LPAR.

Figure 2-2 shows the non-disruptive migration example.

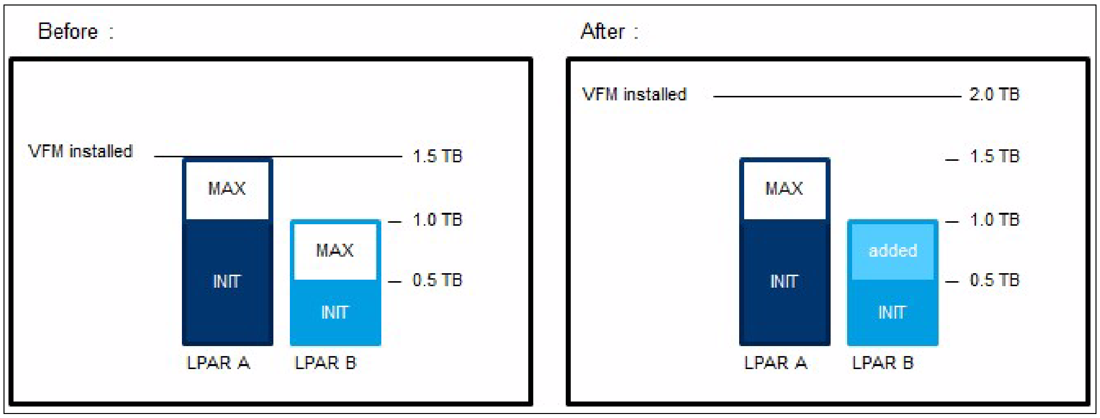


Figure 2-2 Non-disruptive VFM migration example

Disruptive migration

Here is an example of a disruptive migration:

- A z15 system has two VFM features that are installed (512 GB per feature), with a LICC value of 1.0 TB.
- LPAR A has 512 GB that is assigned, with a maximum value of 1.0 TB.
- LPAR B has 256 GB that is assigned, with a maximum value of 1.0 TB.
- You must change LPAR A so that it can have up to 1.5 TB. This change falls outside the range of the maximum installed VFM.
- You purchase and install two additional 512 GB VFM features concurrently (assuming that the memory is ordered and available). Now, you must reactive LPAR A with the new maximum VFM value of at least 1.5 TB and less than or equal to 2.0 TB.

> **Note:** Plan-Ahead Memory is no longer available on the z15 system.

Figure 2-3 shows the disruptive VFM migration example.

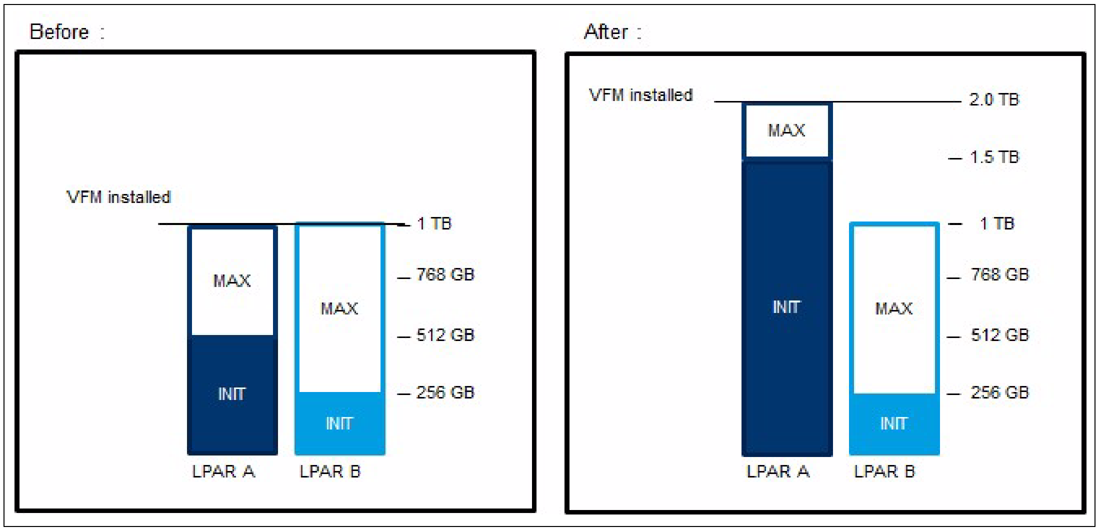


Figure 2-3 Disruptive VFM migration example

For more information about how to configure VFM, see 10.2, “Virtual Flash Memory” on page 248.

2.5.3 Storage connectivity

FICON Express16SA[2], FICON Express16S+, FICON Express16S, and FICON Express8S features provide connectivity to storage devices by using FICON or FCP. FICON Express16SA supports negotiation to 8 or 16 gigabytes per second (GBps) link data rates (no 4 Gbps support), and FICON Express16S+ and FICON Express 16S features support auto negotiation to 4 Gbps, 8 Gbps, and 16 Gbps data link rates. FICON Express8S supports auto negotiation to 2 Gbps, 4 Gbps, and 8 Gbps data link rates.

The FICON Express features support High Performance FICON for IBM Z (zHPF). zHPF is an extension to the FICON architecture that provides performance improvement for single-track and multi-track operations.

On a new z15 system, only the FICON Express16SA and Express16S+ features can be ordered. The FICON Express16S+, FICON Express16S, and FICON Express8S features can be carried forward when upgrading from an older IBM Z platform.

Note: With the FICON Express16SA and FICON Express16S+ features, *both* ports must be configured either as channel type FC or FCP. A mixed configuration is *not* allowed.

For more information about how to configure FICON Express16SA and FICON Express16S+ features, see Chapter 12, “Adding storage devices” on page 267.

[2] Only supported on the z15 T01. FICON Express16S+ features can be carried forward or ordered as a new build with the z15 T02.

IBM zHyperlink Express

zHyperLink Express is a short-distance IBM Z I/O channel that is designed for up to 10x lower latency than High Performance FICON. zHyperLink is intended to speed IBM Db2® for z/OS transaction processing and improve active log throughput. This feature is in the PCIe+ I/O drawer and is a two-port card that is used for short-distance direct connectivity between a z15 system and an IBM DS8880 system. It uses PCIe Gen3 technology with x16 lanes that are bifurcated into x8 lanes for storage connectivity.

zHyperLink Express is designed for distances up to 150 meters and support a link data rate of 8 GBps. A zHyperlink port is fully sharable between all partitions because 127 virtual functions (VFs) / PCIe function IDs (PFIDs) per link are supported.

IBM zHyperLink dramatically reduces the latency of direct access storage device I/Os by interconnecting the z15 system directly to the I/O bay of a DS8880 or later storage system. This feature improves the application response time without application changes. zHyperLink is fast enough to run I/Os synchronously so that the CPU can wait for the data, which results in the following advantages:

- No undispatch of the running task
- No CPU queuing delays to resume it
- No host CPU cache disruption
- Small I/O service time

The zHyperLInk Express adapter takes one slot on z15 PCIe+ I/O drawer, and each adapter has a single PCHID with two ports. Up to 16 zHyperLink Express adapters can be installed in one z15 system, thus having up to 32 links.

FICON connectivity to each storage system is still required for these purposes:

- For initialization of the zHyperlink connection
- For I/Os that are not eligible for zHyperlink
- For fallback when a zHyperlink request fails (for example, cache miss or busy condition)

For more information about the zHyperlink feature, see *IBM z15 Technical Guide*, SG24-8851, and *IBM Z Connectivity Handbook*, SG24-5444.

For more information about defining zHyperLink Express, see 15.2.5, “Defining a zHyperLink PCIe function” on page 377.

For more information about zHyperLink Express management, see “Managing zHyperLink Express” on page 381.

2.5.4 Network connectivity

This section provides planning considerations for deploying the following network-related features:

- OSA-Express features
- SMC:
  - SMC-R
  - SMC-D
- HiperSockets

OSA-Express

The OSA-Express features are installed in an IBM z15 PCIe+ I/O drawer. The features are available as different types and support several networking protocols. Depending on the types of OSA-Express features that are installed in the z15 system, the following attachment characteristics are supported:

- Copper-based Ethernet (1000 Mbps)
- Fiber-based GbE Short Wave (SX), and Long Wave (LX)
- Fiber-based 10-GbE Short Reach (SR) and Long Reach (LR)

Based on the intended use, the operating modes must be defined with a channel type and device address. For configuration details, see Chapter 6, “Configuring network features” on page 131 and the *OSA-Express Implementation Guide*, SG24-5948.

Starting with Driver Level 22 (HMC V2.13.0), HMC is enhanced to take advantage of the Open Systems Adapter/Support Facility (OSA/SF) function. For the OSA-Express7S, OSA-Express6S, and OSA-Express5S features, OSA/SF on the HMC is required. The OSA/SF is used primarily for these purposes:

- Manage all OSA-Express ports.
- Configure all OSA-Express non-queued direct input/output (QDIO) ports.
- Configure local Media Access Control (MAC) addresses.
- Display registered Internet Protocol Version 4 (IPv4) addresses (in use and not in use). OSA/SF is supported on an IBM Z platform for QDIO ports.
- Display registered IPv4 or IPv6 Virtual MAC addresses and virtual local area network (VLAN) IDs that are associated with all OSA-Express features that are configured as QDIO Layer 2.
- Provide status information about an OSA-Express port and its shared or exclusive use state.

For more information about the use of OSA/SF on the HMC, see 6.3, “Customizing OSA-Express by using OSA Advanced Facilities” on page 135.

Note: OSA-Express6S 1000Base-T adapter (Feature Code #0426) is the last generation of OSA-Express 1000Base-T adapters to support connections operating at 100 Mbps link speed. OSA-Express7S 1000Base-T (Feature Code #0466) supports 1000 Mbps duplex link speed only.

SMC-R

The 10 GbE RoCE Express (Feature Code #0411), the 10 GbE RoCE Express2 (Feature Code #0412), the 10 GbE RoCE Express2.1 (Feature Code #0432), the 25 GbE RoCE Express2 (Feature Code #0430), and the 25 GbE RoCE Express2.1 (Feature Code #0450) features are designed to help reduce CPU consumption for applications that use the TCP/IP stack without requiring application changes. Using the RoCE Express features also helps to reduce network latency by using the SMC-R protocol in z/OS V2.1 or later. For more information, see RFC 7609. SMC-R is transparent to applications and can be used for LPAR-to-LPAR communications on a single IBM Z platform or for server-to-server communications across multiple IBM Z platforms.

SMC-R uses existing IBM Z and industry standard communications technology:

- Remote Direct Memory Access (RDMA), which is based on queue pair (QP) technology that also uses an InfiniBand transport service type that is called reliable connected QP (RC-QP), which provides these features:
  - Represents SMC Links in a logical point-to-point connection.
  - Transports data over unique RDMA network interface cards (RNICs) that are logically bound together to form Link Groups. Link Groups are used for high availability (HA) and load balancing needs.

  Ports in the IBM Z RoCE Express features (also referred to as RNICs) are used as the physical transport layer for RDMA.
- Single-root I/O virtualization (SR-IOV) is a PCIe standard that defines extensions to PCIe specifications. SR-IOV enables sharing of RoCE Express ports between LPARs in the z15 system.

For more information about the RoCE Express features and about SMC-R, see *IBM z15 Technical Guide*, SG24-8851, and *IBM z/OS V2R2 Communications Server TCP/IP Implementation Volume 1*, SG24-8360.

Planning for an SMC-R configuration

Deployment of the RoCE Express features is supported in either point-to-point configuration or switched configurations. When planning to deploy RoCE Express features in a switched configuration, the switches must support the following requirements:

- Global Pause function frame (as described in the IEEE 802.3x standard) should be enabled.
- Priority Flow Control (PFC) should be disabled.
- Firewalls and IP Layer 3 routing are not supported.

IBM provides the Shared Memory Communications Applicability Tool (SMCAT), which helps determine the potential gains of using SMC-R in an environment (see 2.3.5, “Shared Memory Communications Applicability Tool” on page 13).

RoCE Express features port configuration:

- For 10 GbE RoCE Express2 and later features, the port number is configured with the function ID (FID) number in HCD (or IOCDS), and the port number *must* be configured (*there is no default*).
- The port number for 10 GbE RoCE Express (Feature Code #0411) is configured in a z/OS TCP/IP profile and does not change.

When defining a FID in the TCP/IP profile for 10 GbE RoCE Express2 or later features, the port number is no longer applicable.

When preparing to deploy the RoCE Express features, consider the following items:

- The RoCE Express features are native PCIe features, so the following configuration items must be provided:
  - FID
  - Type
  - PCHID
  - Virtual function ID (VFID)
  - Port number

- Determine which LPARs will be shared by one RoCE Express port.
- Assign the VFs between the sharing LPARs as needed.

For configuration details, see 15.2.3, “Defining a RoCE PCIe function” on page 370.

For 10 GbE RoCE Express2 or later features management details, see “RoCE management” on page 375.

Native PCIe feature plugging and Resource Groups

Native PCIe feature support is provided by Resource Group (RG) code running on the integrated firmware processor (IFP). For resilience, there are always four independent RGs on the system that share the IFP. For HA purposes, always use at least two PCIe features that are in different RGs, as shown in Figure 2-4.

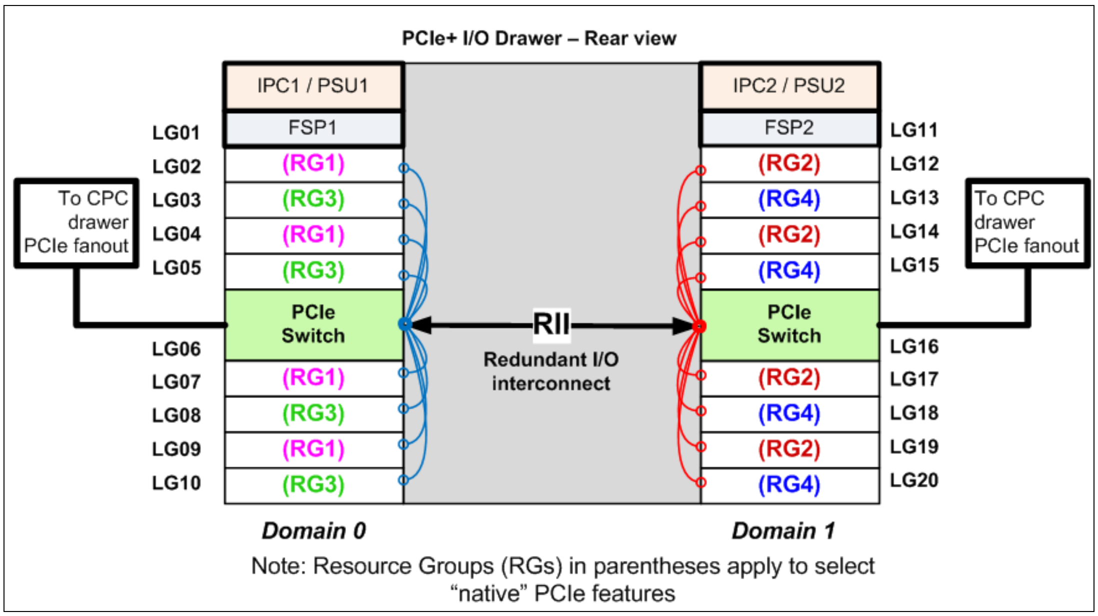


Figure 2-4 Relationship among PCIe+ I/O drawer slots, domains, and RGs in the z15 system

SMC-D

SMC-D uses ISM virtual PCIe (vPCIe) adapters to provide direct memory access (DMA) communications between LPARs inside the same IBM Z platform.

SMC-D is a protocol that allows TCP socket applications to transparently use ISM. ISM is a virtual channel like Internal Queued Direct (IQD) for HiperSockets. A virtual adapter is created in each z/OS LPAR and by using the SMC protocol, the memory is logically shared. The virtual network is provided by firmware.

SMC-R requires a TCP/IP connection and preserves the entire network infrastructure. SMC-D is also a “hybrid” solution. It uses a TCP connection to establish the SMC-D connection. The TCP path can be either through an OSA-Express port or through a HiperSockets connection. A TCP option (called SMCD) controls switching from TCP to “out of band” SMC-D. The SMC-D information is exchanged within the TCP data stream. Socket application data is exchanged through ISM (write operations). The TCP connection remains established to control the SMC-D connection.

For more information about SMC-D, see *IBM Z Connectivity Handbook*, SG24-5444 and *IBM z/OS V2R2 Communications Server TCP/IP Implementation Volume 1*, SG24-8360.

Planning for an SMC-D configuration

From a planning standpoint, SMC-D is like SMC-R, so the same planning considerations apply. The objective is to provide consistent operations and management tasks for both SMC-D and SMC-R. SMC-D uses a new virtual PCI adapter that is called ISM. The ISM interfaces are associated with IP interfaces (for example, HiperSockets or OSA-Express; ISM interfaces do not exist without an IP interface).

ISM interfaces are not defined in software. Instead, ISM interfaces are dynamically defined and created, and automatically started and stopped. You do not need to operate (start or stop) the ISM interfaces. Unlike RoCE, ISM FIDs (PFIDs) are not defined in software. Instead, they are auto-discovered based on their PNet ID.

Before implementing SMC-R or SMC-D, check your environment for the following items:

- Run SMCAT to evaluate applicability and potential value. For more information about SMCAT, see *IBM z/OS SMC Applicability Test (SMCAT)* and 2.3.5, “Shared Memory Communications Applicability Tool” on page 13.
- Review and adjust the available real memory and fixed memory usage limits (z/OS and CS) as needed. SMC requires fixed memory. You might need to review the limits and provision more real memory for z/OS.
- Review the IP topology, VLAN usage considerations, and IPSec.
- Review changes to messages, monitoring information, and diagnostic tools. There are numerous updates to these items:
  - Messages (IBM Virtual Telecommunications Access Method (IBM VTAM®) and TCP stack)
  - The **`netstat`** command (status, monitoring, and display information)
  - CS diagnostic tools (VIT, Packet trace, CTRACE, and IPCS formatted memory dumps)

For more information about SMC-D and SMC-R planning and security considerations, see IBM Knowledge Center, and select the links for SMC-R and SMC-D.

For more information about how to define SMC-D, see 15.2.2, “Defining an ISM PCIe function” on page 366.

For an overview about how to manage an SMC-D connection, see “ISM management” on page 370.

HiperSockets

HiperSockets provide the fastest TCP/IP communications between z/OS, z/VM, IBM z/VSE, and Linux LPARs within a z15 system because they act like internal VLANs by using LIC and supporting device drivers in the OSs. HiperSockets establishes a network with higher availability, security, simplicity, performance, and cost-effectiveness than can be achieved by using an external IP network.

The HiperSockets function is based on the OSA-Express QDIO protocol, so HiperSockets is called *internal queued direct input/output* (IQDIO). LIC emulates the link control layer of an OSA-Express QDIO interface and uses no physical cabling or external networking connections. Data access is performed at memory speeds, bypassing external network delays and providing users with high-speed logical LANs with minimal system and network impact.

HiperSockets can be defined as MIF-shared in a CSS and as spanned channels across multiple CSSs. A HiperSockets CHPID can be seen as an *internal LAN* to the server. The level of sharing is determined by the LPARs that you want to grant access to that LAN.

HiperSockets is supported by the following OSs:

- All in-service z/OS releases
- All in-service z/VM releases
- All in service z/VSE releases
- Linux on Z

On a z15 system, HiperSockets support the following functions:

- HiperSockets broadcast

  Supported across HiperSockets on IPv4 for applications. Applications that use the broadcast function can propagate the broadcast frames to all TCP/IP applications that are using HiperSockets. This support is applicable in Linux, z/OS, and z/VM environments.

- VLAN support

  VLANs are supported by Linux on Z and z/OS for HiperSockets. VLANs can reduce processing impact by enabling networks to be organized by traffic patterns rather than physical location. This enhancement enables traffic flow on a VLAN connection both over HiperSockets and between HiperSockets and OSA-Express Ethernet features.

- IPv6 support on HiperSockets
- HiperSockets Network Concentrator

  Traffic between HiperSockets and OSA-Express can be transparently bridged by using the HiperSockets Network Concentrator. This configuration eliminates intervening network routing processing impact, resulting in increasing performance and a simplified network configuration. This improvement is achieved by configuring a connector Linux system that has HiperSockets and OSA-Express connections that are defined to it.

- HiperSockets Layer 2 support

  HiperSockets supports two transport modes on the z15 Layer 2 (Link Layer) and Layer 3 (Network and IP Layer).

  As with Layer 3 functions, HiperSockets Layer 2 devices can be configured as primary or secondary connectors or multicast routers. These configurations enable high performance and HA Link Layer switches between the HiperSockets network and external Ethernet.

- HiperSockets multiple write facility

  HiperSockets performance is increased by enabling streaming of bulk data over a HiperSockets link between LPARs. Multiple writes with fewer I/O interrupts reduce the processor usage of both the sending and receiving LPARs, and it is supported in z/OS.

- HiperSockets Completion Queue

  The HiperSockets Completion Queue function is designed to allow HiperSockets to transfer data synchronously if possible, and asynchronously if necessary. This function combines ultra-low latency with more tolerance for traffic peaks.

  With the asynchronous support, during high volume situations, data can be temporarily held until the receiver has buffers that are available in its inbound queue. This function provides end-to-end performance improvement for LPAR to LPAR communication.

- HiperSockets Virtual Switch Bridge Support

  The z/VM virtual switch is enhanced to transparently bridge a guest virtual machine (VM) network connection on a HiperSockets LAN segment. z/VM 6.2 or later, TCP/IP, and Performance Toolkit APARs are required for this support. This bridge enables a single HiperSockets guest VM network connection to also directly communicate with the following devices:

  – Other guest VMs on the virtual switch
  – External network hosts through the virtual switch OSA UPLINK port

- zIIP-Assisted HiperSockets for large messages

  In z/OS, HiperSockets is enhanced for zIIP exploitation. Specifically, the z/OS Communications Server enables HiperSockets Multiple Write Facility processing for large outbound messages that originate from z/OS to be run on a zIIP.

  z/OS application workloads that are based on XML, HTTP, SOAP, Java, and traditional file transfer can benefit from zIIP enablement by lowering general-purpose processor usage.

  When the workload is eligible, the HiperSockets device driver layer processing (write command) is redirected to a zIIP, which unblocks the sending application.

For more information about the technical details of each function, see *IBM Z Connectivity Handbook*, SG24-5444.

2.5.5 Coupling and timing links

Support for Parallel Sysplex includes the CFCC and coupling links. Coupling connectivity in support of Parallel Sysplex environments is provided on the z15 system by the following features:

- Coupling Express LR (CELR). The feature (Feature Code #0433) has two ports coupling link connectivity for a distance up to 10 km (6.2 miles).
- Integrated Coupling Adapter Short Reach (ICA SR and ICA SR1.1, Feature Code #0172 and Feature Code #0176).
- Internal Coupling (ICs) channels operate at memory speed.

The number of physical coupling links and logical coupling CHPIDs that is supported by each z15 model can be found in *IBM Z Connectivity Handbook*, SG24-5444.

All coupling link types can be used to carry STP messages.

Note: The CELR is a two-port card that occupies one PCIe+ I/O drawer slot. Therefore, an z15 system that is configured as a stand-alone CF (SACF) for LR coupling must have at least one PCIe+ I/O drawer.

Planning considerations

The relationship between one or more CF link connections between CPCs must be configured in HCD to enable the exchange of CF link signals. HCD generates the CU and device definitions automatically if the CPCs are known within the same IODF file and the adapter ID (AID) or PCHIDs are not reserved by other definitions.

Coupling connectivity for z15 systems: The z15 system *does not support coupling connectivity by using InfiniBand features*. It can connect for transmitting coupling and timing (STP) data only to a server that is configured with ICA SR or CELR coupling, such as z13 or z13s systems, z14 or z14 ZR1 systems, or another z15 system.

To manage a z15 system in a CTN, HMC level 2.15.0 or newer must be used. The z15 SE no longer supports STP menus.

Depending on the hardware that is configured on the CPC, a different channel type must be defined.

As described in this section, depending on the type of the CF link hardware, CF links operate up to a set distance. Physical placement of the CPCs or CFs must be considered to avoid exceeding the maximum distance that is supported by the CF link. For the CELR links, Dense Wavelength Division Multiplexing (DWDM) technology can be used to extend the maximum length of the CF links.

For a list of qualified devices, see the IBM Resource Link website.

STP signals can be exchanged between two CPCs without any CF LPARs involved. If physical coupling links are established between two CPCs, HCD enables the configuration of STP links (timing-only links).

For more information, see *z/OS HCD User's Guide*, SC34-2669, and Chapter 8, "Preparing for IBM Parallel Sysplex and configuring Server Time Protocol" on page 165.

2.5.6 Planning considerations for hardware data compression

This section provides planning considerations for enabling the hardware data compression on a z15 system.

The IBM z15 processor chip has two integrated accelerators in its design: the compression co-processor (CMPCS), which is present on every core, and the IBM Integrated Accelerator for zEDC (one for each chip, which is integrated into the nest). The compression coprocessor and IBM Integrated Accelerator for zEDC use an algorithm for data compression that enables reduction in the size of data to save storage space or increase the data transfer throughput. This on-chip compression capability delivers industry-leading throughput and replaces the zEDC Express adapter on the IBM z14 system and earlier IBM Z platforms.

Here is a short summary about planning considerations for hardware data compression:

1. Planning the installation:
   - Update the IFAPRDxx PARMLIB member in z/OS V2.1 or higher.
   - Plan for IPLs before activating the software feature for the first time.
2. z/OS: Verifying the prerequisites:

   Look up the IBM.Function.zEDC FIXCAT for proper PTFs.
3. z/OS: Enabling the Priced Software Feature.

   Enabling the priced feature provides native compression support for use without using the zlib Java library.

3

Preparing for a new IBM z15 system

This chapter describes two scenarios when preparing for a z15 installation:

- Upgrading an existing IBM z14 system (M0x or ZR1) to a z15 system (T01 or T02) while maintaining your existing serial number. An upgrade includes a frame, drawers (central processor complex (CPC) and I/O), and new or carry-forward I/O features.
- Installing a new z15 system (T01 or T02) into an existing environment.

Because a wide variety of environments exists, the results that are achieved in your environment might differ from the ones that are described here.

This chapter includes the following sections:

- Supported hardware features
- Saving and restoring Open Systems Adapter-Express configuration data
- Upgrading an existing z14 system to a z15 system while maintaining the existing serial number
- Installing a new z15 system into an existing IBM Z environment

3.1 Supported hardware features

This section lists the channel (channel path ID (CHPID)) types and hardware features for the z15 T01 (8561) or z15 T02 (8562). There are no new CHPID types for the z15 system.

Here are the hardware features that are new or available for order:

- Feature Code #0436 - Fibre Connection (FICON) Express16SA Long Wave (LX)[1]
- Feature Code #0437 - FICON Express16SA Short Wave (SX)[1]
- Feature Code #0451 - zHyperLink Express1.1
- Feature Code #0442 - OSA-Express7S Gigabit Ethernet (GbE) LX[2]
- Feature Code #0443 - OSA-Express7S GbE SX[2]
- Feature Code #0444 - OSA-Express7S 10 GbE LR[2]
- Feature Code #0445 - OSA-Express7S 10 GbE SR[2]
- Feature Code #0446 - OSA-Express7S 1000BASE-T Ethernet[2]
- Feature Code #0449 - OSA-Express7S 25 GbE SR1.1
- Feature Code #0432 - RoCE Express2.1 10 GbE
- Feature Code #0450 - RoCE Express2.1 25 GbE
- Feature Code #0899 - Crypto Express7S (1 port)
- Feature Code #0898 - Crypto Express7S (2 port)
- Feature Code #0433 - Coupling Express LR (CELR)
- Feature Code #0176 - Integrated Coupling Adapter SR1.1
- Feature Code #0643 - IBM Virtual Flash Memory (VFM)

CHPID types that can be migrated (carry forward):

- Fibre Channel (FC) and Fibre Channel Protocol (FCP)
- OSC, OSD, OSE, and OSM
- CS5, CL5, and ICP
- Internal Queued Direct (IQD)

Note: The CHPID type of OSM is supported only in a Dynamic Partition Manager (DPM) enabled environment. OSM CHPID is not available for other configuration types.

Hardware features that can be migrated (carry forward):

- Feature Code #0427 - FICON Express16S+ LX
- Feature Code #0428 - FICON Express16S+ SX
- Feature Code #0418 - FICON Express16S LX
- Feature Code #0419 - FICON Express16S SX
- Feature Code #0409 - FICON Express8S LX
- Feature Code #0410 - FICON Express8S SX
- Feature Code #0429 - OSA-Express7S 25 GbE SR
- Feature Code #0422 - OSA-Express6S GbE LX
- Feature Code #0423 - OSA-Express6S GbE SX
- Feature Code #0424 - OSA-Express6S 10 GbE LR
- Feature Code #0425 - OSA-Express6S 10 GbE SR
- Feature Code #0426 - OSA-Express6S 1000BASE-T Ethernet
- Feature Code #0413 - OSA-Express5S GbE LX
- Feature Code #0414 - OSA-Express5S GbE SX
- Feature Code #0415 - OSA-Express5S 10 GbE LR
- Feature Code #0416 - OSA-Express5S 10 GbE SR

[1] Only supported by the z15 T01. FICON Express16S+ features can be carried forward or ordered as a new build with the z15 T02.

[2] Cannot be ordered with the z15 T02. The equivalent type of OSA-Express6S features can be carried forward or ordered as a new build with the z15 T02 system.

- Feature Code #0417 - OSA-Express5S 1000BASE-T Ethernet
- Feature Code #0411 - RoCE Express 10 GbE SR
- Feature Code #0412 - RoCE Express2 10 GbE
- Feature Code #0430 - RoCE Express2 25 GbE
- Feature Code #0431 - zHyperLink Express
- Feature Code #0893 - Crypto Express6S
- Feature Code #0890 - Crypto Express5S
- Feature Code #0433 - Coupling Express LR
- Feature Code #0172 - Integrated Coupling Adapter SR
- Feature Code #0901 - Regional Crypto Enablement (RCE)

Here are the CHPID types that are not migrated (no carry forward):

- CIB
- OSN
- OSX
- OSM

Here are the features that cannot be ordered or carried forward for an upgrade:

- Feature Code #3325 - FICON Express8 LX
- Feature Code #3326 - FICON Express8 SX
- Feature Code #0404 - OSA-Express4S GbE LX
- Feature Code #0405 - OSA-Express4S GbE SX
- Feature Code #0406 - OSA-Express4S 10 GbE LR
- Feature Code #0407 - OSA-Express4S 10 GbE SR
- Feature Code #0408 - OSA-Express4S 1000BASE-T Ethernet
- Feature Code #0865 - Crypto Express4S
- Feature Code #0403 - Flash Express
- Feature Code #0402 - Flash Express
- Feature Code #0170 - HCA3-O 1x LR IFB
- Feature Code #0171 - HCA3-O 12x IFB
- Feature Code #0420 - zEnterprise Data Compression (zEDC) Express
- IBM zAware Firmware

For more information about the supported I/O features, see *IBM Z Connectivity Handbook*, SG24-5444.

3.2 Saving and restoring Open Systems Adapter-Express configuration data

The three processes for Open Systems Adapter-Express (OSA-Express) cards that you might need to use when upgrading or replacing your processor are described here.

Using Open Systems Adapter/Support Facility (OSA/SF) to save and restore OSE OSA Address Table configuration data

For more information about how to save and restore any OSA-Express configuration data such the OSA Address Table (OAT), see 7.3.1, “Saving and restoring the OSA-ICC configuration” on page 158.

Exporting and importing OSA-ICC configuration data with Open Systems Adapter Advanced Facilities

If you are unfamiliar with the exporting and importing process for Open Systems Adapter (OSA) Integrated Console Controller (ICC) (OSA-ICC) Server and Session configuration data, see 7.3, “Defining a new OSA-ICC configuration by using OSA Advanced Facilities” on page 152.

Using OSA Advanced Facilities to set OSA parameters

For more information about the process of changing the OSA port speed or Media Access Control (MAC) addresses, see 6.3, “Customizing OSA-Express by using OSA Advanced Facilities” on page 135.

3.3 Upgrading an existing z14 system to a z15 system while maintaining the existing serial number

This section describes the steps to upgrade an existing z14 system that is defined in your input/output definition file (IODF) to a z15 system and keeping the system serial number.

3.3.1 Scenario overview

This scenario describes the configuration steps to upgrade an existing 3906 (z14 M04) system to an 8561 (z15 T01). The same steps apply to an upgrade of an existing 3907 (z14 ZR1) system to an 8562 (z15 T02). The key factors include:

- Hardware Configuration Definition (HCD) requires a new CPC (processor) ID for the 8561 or 8562 processors.
- Keep the same CPC name for the 8561 or 8562 (this item is optional; the CPC name can be changed).
- The 8561 or 8562 processor channels connect to the same switch ports and access the same control unit (CU) interfaces.
- The CU interfaces connect to the same switch ports.
- The starting IODF is the current 3906 or 3907 *production* IODF.
- The target IODF is a new 8561 or 8562 *work* IODF.
- HCD actions:
  - Migrate updated input/out configuration program (IOCP) statements.
  - Build production IODF.
  - Remote write IODF to input/output configuration data set (IOCDS).
- Hardware Management Console (HMC) actions:
  - Build the Reset Profile and point to the required IOCDS.
  - Build and verify the Image Profiles.
  - Build and verify the Load Profiles.
  - Perform a Power on Reset (POR).

This example uses a 3906 (z14 M04) processor with a Processor ID of `CETUS` with six channel subsystems (CSSs) (CSS ID=0 - CSS ID=5). This system is replaced by an 8561 (z15 T01) with a Processor ID of `ARIES` and six CSSs. The CPC name `CETUS` and serial number are not changed.

Table 3-1 summarizes the migration options and tool requirements. The process steps are described in "HCD: Migrating the existing 3906 IODF" on page 35.

Table 3-1 /O configuration migrated to an 8561 or 8562 system

Options and tools	Comments
Processor ID	Required to change the Processor ID to a new ID.
CPC name	Generally should be the same name.
Channel to switch port connections	Same ports.
CU to switch port connections	Same ports.
Starting IODF	Current active *production* IODF.
Target IODF	Create a *work* IODF.
HCD action	Repeat and change.
CHPID Mapping Tool (CMT)	Optional, but good for verifying configurations.
CFReport file (Configuration Control Number (CCN))	Required for CMT.
IOCP (Import from validated work IODF.)	Yes.
CMT actions (physical channel ID (PCHID) reset)	Yes.
CMT IOCP Output	Yes.
CMT Reports	Yes, CHPID and CHPID to CU Report.

HCD: Migrating the existing 3906 IODF

The following steps explain how to upgrade an existing 3906 processor in your IODF to the new 8561 processor by using HCD. Then, you migrate the I/O configuration and logical partitions (LPARs) from the 3906 to the 8561. Using HCD, the sequence of operations is as follows:

1. Creating the work IODF from the current 3906 production IODF.
2. Repeating the 3906 processor to be replaced.
3. Coupling Link information messages.
4. Deleting any unsupported items in the repeated 3906.
5. Changing the 3906 to an 8561 and deleting the 3906.
6. Deleting the 3906 processor definition.
7. Reconnecting the CF channel paths that were not migrated.
8. Using Open Systems Adapter/Support Facility (OSA/SF) to save and restore OSE OSA Address Table configuration data.
9. Exporting and importing OSA-ICC configuration data with Open Systems Adapter Advanced Facilities.
10. Using OSA Advanced Facilities to set OSA parameters.

3.3.2 Creating the work IODF from the current 3906 production IODF

HCD is the tool that is used to make a work IODF, but you start from the current production IODF that contains the 3906 processor that you are upgrading (for example, `SYS6.IODF65`).

3.3.3 Repeating the 3906 processor to be replaced

To repeat the 3906 processor in HCD, complete the following steps:

1. From the main HCD panel, select option `1.3. Processor List`.
2. In the Processor List (Figure 3-1), enter `r` (for repeat) next to the 3906 that you want to upgrade, and press Enter.

```
                                Processor List        Row 1 of 3 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
r CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 3-1 Processor List: Repeating processor

3. The Identify Target IODF panel opens. Do *one* of the following actions:
   – To retain all the other processor definitions in the IODF, press Enter.
   – Enter a different target IODF data set name. In this case, only the processor that you are repeating is retained in the target IODF.
4. The Create Work I/O Definition File panel prompts you to enter the data set name of the target IODF (for example, `SYS6.IODF66.WORK`).

5. The Repeat Processor panel opens (Figure 3-2). Enter the Processor ID of the new 8561 (in this example, `ARIES`), keep all the other fields unchanged, and press Enter.

```
+---------------------------- Repeat Processor -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . . . . . . ARIES___                                   |
|                                                                           |
| Processor type . . . . . . . : 3906                                       |
| Processor model  . . . . . . : M04                                        |
| Configuration mode . . . . . : LPAR                                       |
|                                                                           |
| Serial number  . . . . . . . . 0EE0F73906                                 |
| Description  . . . . . . . . . Cetus                                      |
|                                                                           |
| Specify SNA address only if part of a processor cluster:                  |
|                                                                           |
| Network name . . . . . . . . . IBM390PS  +                                |
| CPC name . . . . . . . . . . . CETUS     +                                |
|                                                                           |
| Local system name  . . . . . . CETUS                                      |
|                                                                           |
+-----------------------------------+                                       |
| New IODF SYS6.IODF66.WORK defined. |                                      |
+-----------------------------------+ --------------------------------------+
```

Figure 3-2 Repeat Processor: Defining a new Processor ID

3.3.4 Coupling Link information messages

You might receive severity messages (E, I, or W). As shown in Figure 3-3, `CBDG441I`, severity I messages are displayed in the example because the coupling facility (CF) Link CHPIDs were not copied to the 8561 definition.

```
+------------------------------- Message List --------------------------------+
|   Save  Query  Help                                                          |
| ---------------------------------------------------------------------------- |
|                                                                  Row 1 of 55 |
| Command ===> ____________________________________________ Scroll ===> CSR    |
|                                                                              |
| Messages are sorted by severity. Select one or more, then press Enter.       |
|                                                                              |
| / Sev Msg. ID  Message Text                                                  |
| _ I   CBDG441I The coupling facility connection between channel path         |
| #              0.F4 of processor CETUS and channel path 0.F5 of              |
| #              processor CETUS is not copied.                                 |
| _ I   CBDG441I The coupling facility connection between channel path         |
| #              0.F5 of processor CETUS and channel path 0.F4 of              |
| #              processor CETUS is not copied.                                 |
| _ I   CBDG441I The coupling facility connection between channel path         |
| #              1.F4 of processor CETUS and channel path 0.F5 of              |
| #              processor CETUS is not copied.                                 |
| _ I   CBDG441I The coupling facility connection between channel path         |
| #              1.F5 of processor CETUS and channel path 0.F4 of              |
| #              processor CETUS is not copied.                                 |
| _ I   CBDG441I The coupling facility connection between channel path         |
| #              2.E1 of processor CETUS and channel path 1.E0 of              |
+------------------------------------------------------------------------------+
```

Figure 3-3 Message List: Showing CBDG441I

To resolve this issue, complete the following steps:

1. Scroll until you reach the end of the messages and see the `CBDG271I requested action on object CETUS successfully processed` message.
2. Press PF3 or PF12 to continue. As shown in Figure 3-4, there is an extra 3906 processor that is named `ARIES`.

```
                              Processor List       Row 1 of 4 More:
Command ===> _____________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
_ ARIES    3906     M04      LPAR  0EE0F73906 Cetus
_ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 3-4 Processor List: Repeated processor

3.3.5 Deleting any unsupported items in the repeated 3906

If you are upgrading a processor that contains any CHPID types of OSN, OSX, or CIB, or function type ZEDC-EXPRESS, then these types must be deleted from the IODF before changing the processor type to 8561.

> **Note:** z15 machine type 8561 does *not* support any InfiniBand coupling links, so all CHPIDs of type CIB must be deleted in an IODF for machine type 8561 and, if necessary, replaced with either CHPID types CS5 or CL5.

To delete unsupported CHPIDs, complete the following steps:

1. From the Processor List panel, select the newly created `ARIES` processor and then press Enter, as shown in Figure 3-5.

```
                                Processor List       Row 1 of 4 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
s ARIES    3906     M04      LPAR  0EE0F73906 Cetus
_ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 3-5 Processor List: Selected processor

2. On the Channel Subsystem List panel, select definitions in `CSS ID 0`, as shown in Figure 3-6.

```
                            Channel Subsystem List    Row 1 of 6 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel subsystems, then press Enter.  To add, use F11.

Processor ID . . . : ARIES        Cetus

  CSS Devices in SS0    Devices in SS1    Devices in SS2    Devices in SS3
/ ID  Maximum + Actual  Maximum + Actual  Maximum + Actual  Maximum + Actual
s 0   65280     10540   65535     384     65535     0       65535     0
_ 1   65280     7455    65535     384     65535     0       65535     0
_ 2   65280     7263    65535     384     65535     0       65535     0
_ 3   65280     0       65535     0       65535     0       65535     0
_ 4   65280     0       65535     0       65535     0       65535     0
_ 5   65280     0       65535     0       65535     0       65535     0
```

Figure 3-6 Channel Subsystem List: Selected CSS

3. Within the selected CSS, set a filter, as shown in Figure 3-7.

```
  Goto  Filter  Backup  Query  Help
----- +-----------------------------------+ ------------------------------
      | 1  1. Set Filter                  | t      Row 1 of 86 More:
Comma |    2. Clear Filter                | ______________ Scroll ===> CSR
      |    3. Count rows on (filtered) list |
Selec +-----------------------------------+ nter. To add use F11.

Processor ID . . . . : ARIES       Cetus
Configuration mode . : LPAR
Channel Subsystem ID : 0

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 10    1B0   FC    SPAN  01  01 1C       No  Z15B-LG16-D1 TS7700
_ 11    120   FC    SPAN  01  01 26       No  Z22B-LG11-D1 TS7700
_ 12    1B1   FC    SPAN  02  02 1C       No  Z15B-LG16-D2 TS7700
_ 13    121   FC    SPAN  02  02 26       No  Z22B-LG11-D2 TS7700
_ 22    100   FCP   SHR   __  __ __       No  Z22B-LG01-D1 SAN64-K-p44
_ 23    180   FCP   SHR   __  __ __       No  Z15B-LG01-D1 SAN64-L-p44
_ 24    101   FCP   SHR   __  __ __       No  Z22B-LG01-D2 SAN64-K-p45
_ 25    181   FCP   SHR   __  __ __       No  Z15B-LG01-D2 SAN64-L-p45
_ 26    12C   FCP   SHR   __  __ __       No  Z22B-LG14-D1 SAN64-K-p46
_ 27    19C   FCP   SHR   __  __ __       No  Z15B-LG09-D1 SAN64-L-p46
```

Figure 3-7 Channel Path List: Set Filter

4. In the Filter Channel Path List panel, select channel path type `CIB`, as shown in Figure 3-8

```
+----------------------- Filter Channel Path List ------------------------+
|                                                                         |
|                                                                         |
| Specify or revise the following filter criteria.                        |
|                                                                         |
| Channel path type  . CIB                                                |
| Operation mode . . . ____  +                                            |
| Managed  . . . . . . _    (Y = Yes; N = No)   I/O Cluster ________   +  |
| Dynamic entry switch __    +                                            |
| Entry switch . . . . __    +                                            |
| CF connected . . . . _    (Y = Connected; N = Not connected)            |
| CHID AID/P PCHID/P   _____                                              |
|                                                                         |
| Description  . . . . ________________________________                   |
|                                                                         |
| Partition  . . . . . ________  +                                        |
| Connected to CUs . . _    (Y = Connected; N = Not connected)            |
|                                                                         |
|                                                                         |
|                                                                         |
|                                                                         |
+-------------------------------------------------------------------------+
```

Figure 3-8 Filter Channel Path type: Type CIB for channel path type

5. The Channel Path List panel shows channel definitions only for channel path type `CIB`. Delete these definitions as shown in Figure 3-9, and press Enter.

```
                              Channel Path List
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES       Cetus
Configuration mode . : LPAR
Channel Subsystem ID : 0

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
d F6    07/1  CIB   SPAN  __  __ __   N   No  Wrap to F7
d F7    07/2  CIB   SPAN  __  __ __   N   No  Wrap to F6
```

Figure 3-9 Channel path list: Delete all channel definitions for type CIB

6. Confirm that spanned channels will be deleted from all accessing CSSs by pressing Enter, as shown in Figure 3-10.

```
*--------------------- Confirm Delete Channel Path ---------------------*
|                                                         Row 1 of 2 | --
| Command ===> _____________________________________ Scroll ===> CSR   |
|                                                                      |
| Scroll forward to view the complete list of channel paths to be     |
| deleted. Press ENTER to confirm delete request. Press F12 to cancel |
| delete request.                                                      |
|                                                                      |
| Processor ID . . . . : ARIES       Cetus                            |
| Channel Subsystem ID : 0                                             |
|                                                                      |
|                    CHID                                              |
| CHPID   Type  Mode  AID/P                                            |
| F6      CIB   SPAN  07/1                                             |
| F7      CIB   SPAN  07/2                                             |
| ************************* Bottom of data ************************** | **
|                                                                      |
|                                                                      |
|                                                                      |
|                                                                      |
|                                                                      |
*-----------------------------------------------------------------------*
| Spanned channel paths are deleted from all accessing channel subsystems. |
*-----------------------------------------------------------------------*
```

Figure 3-10 Confirm Delete Channel Path panel

To delete unsupported Peripheral Component Interconnect Express (PCIe) functions, complete the following steps:

1. From the Processor List panel, enter `f` (Work with PCIe functions) next to the newly created `ARIES` processor and then press Enter, as shown in Figure 3-11.

```
                                Processor List       Row 1 of 4 More:
Command ===> _______________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
f ARIES    3906     M04      LPAR  0EE0F73906 Cetus
_ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 3-11 Processor List: Selected processor

2. In the PCIe Function List panel, set a filter, as shown in Figure 3-12.

```
 Goto  Filter  Backup  Query  Help
----- +-------------------------------------+ ------------------------------
      | 1  1. Set Filter                    | st     Row 1 of 54 More:
Comma |    2. Clear Filter                  | ______________ Scroll ===> CSR
      |    3. Count rows on (filtered) list |
Selec +-------------------------------------+ Enter. To add, use F11.

Processor ID . . . . : ARIES       Cetus



/ FID    CHID+  P+  VF+  Type+         UID   Description
_ 00A1   1BC    1   1    ROCE-2        ____  RoCE-2  Z15B-LG02
_ 00A2   17C    1   1    ROCE-2        ____  RoCE-2  Z22B-LG20
_ 00A3   1BC    1   2    ROCE-2        ____  RoCE-2  Z15B-LG02
_ 00A4   1BC    1   3    ROCE-2        ____  RoCE-2  Z15B-LG02
_ 00A5   17C    1   2    ROCE-2        ____  RoCE-2  Z22B-LG20
_ 00A6   17C    1   3    ROCE-2        ____  RoCE-2  Z22B-LG20
_ 00A7   1BC    2   4    ROCE-2        ____  RoCE-2  Z15B-LG02
_ 00A8   1BC    2   5    ROCE-2        ____  RoCE-2  Z15B-LG02
_ 00A9   17C    2   4    ROCE-2        ____  RoCE-2  Z22B-LG20
_ 00AA   17C    2   5    ROCE-2        ____  RoCE-2  Z22B-LG20
_ 00C1   1C0    _   1    ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20
_ 00C2   104    _   1    ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02
```

Figure 3-12 PCIe Function List: Set Filter

3. In the Filter PCIe Function List panel, select PCIe function type `ZEDC-EXPRESS`, as shown in Figure 3-13.

```
+---------------------- Filter PCIe Function List ----------------------+
|                                                                       |
|                                                                       |
| Specify or revise the following filter criteria.                      |
|                                                                       |
| CHID  . . . . . . . . . ___                                           |
| PORT  . . . . . . . . . _                                             |
|                                                                       |
| Type  . . . . . . . . . ZEDC-EXPRESS  +                               |
|                                                                       |
| Virtual Function ID . . ___                                           |
|                                                                       |
| Description . . . . . . ________________________________              |
|                                                                       |
| Partition . . . . . . . ________  +                                   |
|                                                                       |
| UIDs defined  . . . . . _  (Y = YES; N = NO)                          |
| UID . . . . . . . . . . ____                                          |
|                                                                       |
|                                                                       |
|                                                                       |
|                                                                       |
+-----------------------------------------------------------------------+
```

Figure 3-13 Filter PCIe Function List: Type ZEDC-EXPRESS

4. The PCIe Function List panel shows PCIe function definitions only for type `ZEDC-EXPRESS`. Delete these definitions as shown in Figure 3-14, and press Enter.

```
  Goto  Filter  Backup  Query  Help
----------------------------------------------------------------------------
                              PCIe Function List    Filter Mode. More:
Command ===> ______________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES       Cetus



/ FID    CHID+  P+  VF+  Type+         UID   Description
d 00C1   1C0    _   1    ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20
d 00C2   104    _   1    ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02
d 00C3   1C0    _   2    ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20
d 00C4   1C0    _   3    ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20
d 00C5   1C0    _   4    ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20
d 00C6   1C0    _   5    ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20
d 00C7   104    _   2    ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02
d 00C8   104    _   3    ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02
d 00C9   104    _   4    ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02
d 00CA   104    _   5    ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02
d 00CB   1C0    _   6    ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20
d 00CC   1C0    _   7    ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20
```

Figure 3-14 PCIe Function List: Deleting all function definitions for type zEDC Express

5. Confirm that PCIe functions to be deleted and press Enter, as shown in Figure 3-15 on page 45.

```
+--------------------- Confirm Delete PCIe function ----------------------+
|                                                            Row 1 of 16 |
| Command ===> ______________________________________ Scroll ===> CSR    |
|                                                                         |
| Scroll forward to view the complete list of PCIe functions to be      |
| deleted. Press ENTER to confirm delete request. Press F12 to cancel   |
| delete request.                                                         |
|                                                                         |
| Processor ID  . . . . : ARIES     Cetus                                 |
|                                                                         |
| FID   CHID P VF Type          UID   Description                        |
| 00C1  1C0  _ 1   ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20            |
| 00C2  104  _ 1   ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02            |
| 00C3  1C0  _ 2   ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20            |
| 00C4  1C0  _ 3   ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20            |
| 00C5  1C0  _ 4   ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20            |
| 00C6  1C0  _ 5   ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20            |
| 00C7  104  _ 2   ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02            |
| 00C8  104  _ 3   ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02            |
| 00C9  104  _ 4   ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02            |
| 00CA  104  _ 5   ZEDC-EXPRESS  ____  zEDC Express Z22B-LG02            |
| 00CB  1C0  _ 6   ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20            |
| 00CC  1C0  _ 7   ZEDC-EXPRESS  ____  zEDC Express Z15B-LG20            |
+-------------------------------------------------------------------------+
```

Figure 3-15 Confirm Delete PCIe function panel

3.3.6 Changing the 3906 to an 8561 and deleting the 3906

You can either keep the original copy of the 3906 (`CETUS`) or delete it from the IODF. In this example, keep it in the IODF for a few more steps.

To change the 3906 to an 8561, complete the following steps:

1. Enter `c` (for change) next to `ARIES` to change the 3906 to an 8561 and press Enter. The Change Process Definition panel opens (Figure 3-16).
2. Make the following updates, and press Enter:
   - Update `Processor type` to `8561`.
   - Update `Processor model` to `T01`.
   - Update the 3906 part of the `Serial number` to `8561` (that is, `0EE0F7`**`3906`** to `0EE0F7`**`8561`**).
   - Update `Description` to `Aries`.
   - Update `Local system name` to `ARIES`.

Note: Because in this example we use HCD to write an IOCDS to this 3906 in preparation for an upgrade, we must leave the Network name and CPC name set to `IBM390PS` and `CETUS`. These settings must be updated in the IODF after the 3906 is upgraded to an 8561.

```
+------------------------ Change Processor Definition ------------------------+
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Processor ID . . . . . . . . : ARIES                                         |
| Support level:                                                               |
| 3906 support                                                                 |
| Processor type . . . . . . . . 8561      +                                   |
| Processor model  . . . . . . . T01       +                                   |
| Configuration mode . . . . . . LPAR      +                                   |
|                                                                              |
| Serial number  . . . . . . . . 0EE0F78561  +                                 |
| Description  . . . . . . . . . Aries                                         |
|                                                                              |
| Specify SNA address only if part of a processor cluster:                     |
|                                                                              |
| Network name . . . . . . . . . IBM390PS  +                                   |
| CPC name . . . . . . . . . . . CETUS     +                                   |
|                                                                              |
| Local system name  . . . . . . ARIES                                         |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
```

Figure 3-16 Processors: Change Processor Definition

3. The Update Channel Path Identifiers panel opens (Figure 3-17). No changes are made in this example.

```
+--------------------- Update Channel Path Identifiers ----------------------+
|                                                                 Row 1 of 86 |
| Command ===> ________________________________________ Scroll ===> CSR      |
|                                                                             |
| Specify any changes to the channel path identifiers in the list below.     |
|                                                                             |
| Processor ID . . . . : ARIES        Aries                                  |
| Channel Subsystem ID : 0                                                   |
|                                                                             |
| CHPID  Type  Side  Until CHPID   New CHPID +                               |
| 10     FC          __            10                                        |
| 11     FC          __            11                                        |
| 12     FC          __            12                                        |
| 13     FC          __            13                                        |
| 22     FCP         __            22                                        |
| 23     FCP         __            23                                        |
| 24     FCP         __            24                                        |
| 25     FCP         __            25                                        |
| 26     FCP         __            26                                        |
| 27     FCP         __            27                                        |
| 28     FCP         __            28                                        |
| 29     FCP         __            29                                        |
| 32     FCP         __            32                                        |
+-----------------------------------------------------------------------------+
```

Figure 3-17 Processors: Update Channel Path Identifiers

4. Press Enter for each CSS ID.

5. The repeated 3906 processor is successfully changed to an 8561-T01, as shown in Figure 3-18.

```
                               Processor List       Row 1 of 4 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
_ ARIES    8561     T01      LPAR  0EE0F78561 Aries
_ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 3-18 Processor List: Changed processor

3.3.7 Deleting the 3906 processor definition

Now that the 3906 has been repeated and changed to an 8561, the original 3906 definition (CETUS) must be deleted so that the required CF Links can be restored.

To delete the 3906 processor definition, complete the following steps:

1. Enter `d` (for delete) next to the `CETUS` processor in the Processor List panel (Figure 3-19).

```
                                Processor List       Row 1 of 4 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
_ ARIES    8561     T01      LPAR  0EE0F78561 Aries
d CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 3-19 Processor List: Deleting processor

2. Press Enter to confirm the deletion of the processor (Figure 3-20).

```
                                Processor List       Row 1 of 3 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
_ ARIES    8561     T01      LPAR  0EE0F78561 Aries
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 3-20 Processor List: Processor deleted

3.3.8 Reconnecting the CF channel paths that were not migrated

Manually redefine the CF Links that you want from the ARIES (previously CETUS) processor to any other processor, along with any Internal CF links that you want. To help in this effort, you can get a CF connection report from the previous production IODF containing the 3906. Alternatively, you can make a note of all CBDG441I error messages that you received in 3.3.7, “Deleting the 3906 processor definition” on page 47.

3.3.9 Additional steps and tasks

When you are ready to map the PCHIDs from the z15 CFR file to the CHPIDs in your exported IODF, go to Chapter 4, “Preparing an input/out configuration program to use the CHPID Mapping Tool” on page 55.

To define the I/O configuration for your system, go to Chapter 5, “The production input/output definition file and setting up the central processor complex” on page 89.

3.4 Installing a new z15 system into an existing IBM Z environment

This section describes the steps for adding an IBM z15 T01 into an existing IBM Z environment.

3.4.1 Scenario overview

This scenario shows the configuration steps for defining a new 8561 processor in an existing hardware environment. The same steps apply to a new 8562 (z15 T02). The process has the following key considerations:

- HCD requires a new processor ID for the 8561 or 8562.
- HCD requires a new CPC name for the 8561 or 8562.
- The 8561 or 8562 processor connects to new switch ports and new CU interfaces.
- The CU interfaces connect to the same switch ports as they did previously.
- The starting IODF is the current production IODF.
- The target IODF is a new work IODF with an 8561 or 8562 defined.
- HCD actions:
  - Migrate updated IOCP statements.
  - Build production IODF.
  - Remote write IODF to IOCDS.
- The HMC actions:
  - Build Reset Profile and point to required IOCDS.
  - Build and verify Image Profiles.
  - Build and verify Load Profiles.
  - Run a POR.

This example defines a new 8561 (z15 T01) processor with a Processor ID of `ARIES2` and with six CSSs (CSS ID=0 - CSS ID=5). The CPC name of `ARIES2` and serial number of `02-2B7F8` are used for the 8561.

Table 3-2 summarizes the tool requirements.

Table 3-2 I/O configuration for a new (additional) 8561 processor

New (additional) 8561 processor	New (additional) 8561 processor to connect to the new switch ports and same CUs to which existing processors connect
Processor ID	Requires a new Processor ID.
CPC name	Requires a new CPC name.
Channel to switch port connections	Extra ports.
CU to switch port connections	Same ports.
Starting IODF	Current active production IODF.
Target IODF	Create a work IODF.
HCD action	Add processor.
CMT Program	Optional, but good for verifying configurations.
`CFReport File (CCN)`	Required for CMT.
IOCP (import from validated work IODF)	Yes.

New (additional) 8561 processor	New (additional) 8561 processor to connect to the new switch ports and same CUs to which existing processors connect
CMT actions (PCHID reset)	Yes.
CMT IOCP Output	Yes.
CMT Reports	Yes, CHIPID Report and CHIPID to CU Report.

HCD: Creating an 8561 IODF

The following steps explain how to define an additional 8561 processor in your existing IODF to the existing I/O configuration by using HCD:

1. Creating a work IODF from the current production IODF.
2. Adding the 8561 processor.
3. Using Open Systems Adapter/Support Facility (OSA/SF) to save and restore OSE OSA Address Table configuration data.
4. Exporting and importing OSA-ICC configuration data with Open Systems Adapter Advanced Facilities.
5. Using OSA Advanced Facilities to set OSA parameters.

3.4.2 Creating a work IODF from the current production IODF

HCD is the tool that is used to make a work IODF. In this example, we start from the current production IODF that contains the existing hardware environment that will be connected to the new 8561 processor (for example, `SYS6.IODF66`).

3.4.3 Adding the 8561 processor

To add the 8561 processor, complete the following steps:

1. From the HCD main menu, select option `1.3, Processor List`.
2. In the Processor List (Figure 3-21), press PF11, or enter `add` on the command line to add a processor, and press Enter.

```
                                Processor List        Row 1 of 4 More:
Command ===> ______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
_ ARIES    8561     T01      LPAR  0123458561 Aries
_ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 3-21 Processor List: Adding a processor

The Add Processor panel opens (Figure 3-22).

```
+------------------------------- Add Processor ------------------------------
|
|
| Specify or revise the following values.
|
| Processor ID . . . . . . . . . . ________
| Processor type . . . . . . . . . ________  +
| Processor model  . . . . . . . . ________  +
| Configuration mode . . . . . . . LPAR      +
| Number of channel subsystems . . _         +
|
| Serial number  . . . . . . . . . __________
| Description  . . . . . . . . . . ________________________________
|
| Specify SNA address only if part of a processor cluster:
|
| Network name . . . . . . . . . . ________  +
| CPC name . . . . . . . . . . . . ________  +
|
| Local system name  . . . . . . . ________
|
|
+----------------------------------------------------------------------------
```

Figure 3-22 Add Processor: Data fields to be updated

3. Specify the appropriate values. For example, specify the following settings, as shown in Figure 3-23:

Processor ID	`ARIES2`
Processor type	`8561`
Processor model	`T01`
Number of channel subsystems	(Keep this blank for now.)
Serial number	`02B7F88561`
Network name	`IBM390PS`
CPC name	`ARIES2`
Local System Name	(Keep this blank for now.)

```
+------------------------------ Add Processor -------------------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Processor ID . . . . . . . . . . ARIES2                                     |
| Processor type . . . . . . . . . 8561     +                                 |
| Processor model  . . . . . . . . T01      +                                 |
| Configuration mode . . . . . . . LPAR     +                                 |
| Number of channel subsystems . . _        +                                 |
|                                                                             |
| Serial number  . . . . . . . . . 02B7F88561                                 |
| Description  . . . . . . . . . . ________________________________           |
|                                                                             |
| Specify SNA address only if part of a processor cluster:                    |
|                                                                             |
| Network name . . . . . . . . . . IBM390PS  +                                |
| CPC name . . . . . . . . . . . . ARIES2__  +                                |
|                                                                             |
| Local system name  . . . . . . . ________                                   |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 3-23 Add Processor: Data fields updated

4. Press Enter. The Create Work I/O Definition File panel opens and prompts you to enter the data set name of the target IODF (for example, `SYS6.IODF67.WORK`).
5. Press Enter. You now have an 8561 processor that is named `ARIES2` (Figure 3-24 on page 53).

```
                               Processor List       Row 1 of 5 More:
 Command ===> _______________________________________________ Scroll ===> CSR

 Select one or more processors, then press Enter. To add, use F11.


 / Proc. ID Type +   Model +  Mode+ Serial-# + Description
 _ ARIES    8561     T01      LPAR  0123458561 Aries
 _ ARIES2   8561     T01      LPAR  02B7F88561 ______________________________
 _ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
 _ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
 _ MUSCA    3907     ZR1      LPAR  007A883907 Musca
 ******************************* Bottom of data *****************************





+------------------------------------------------------------------+
| Definition of processor ARIES2 has been extended to its maximum |
| configuration.                                                  |
+------------------------------------------------------------------+
```

Figure 3-24 Processor List: New processor added

The message at the bottom of the panel indicates that the processor definition is extended to its maximum configuration. This message is generated because part of the main storage is allocated as a fixed-size Hardware Systems Area, which is not addressable by application programs. In HCD, when you define as new or redefine a processor as an 8561[3], HCD automatically defines the maximum configuration of 6 CSSs and 85 LPARs.

6. Enter `s` next to `ARIES2`, and press Enter. The Channel Subsystem List panel opens. Here you can see six CSSs (`CSS0` - `CSS5`) that are defined with the default `MAXDEV` values for `SS0` of `65280` set by HCD and `65535` set for `SS1`, `SS2`, and `SS3` (Figure 3-25).

```
                            Channel Subsystem List    Row 1 of 6 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel subsystems, then press Enter.  To add, use F11.

Processor ID . . . : ARIES2

  CSS Devices in SS0    Devices in SS1    Devices in SS2    Devices in SS3
/ ID  Maximum + Actual  Maximum + Actual  Maximum + Actual  Maximum + Actual
_ 0   65280     0       65535     0       65535     0       65535     0
_ 1   65280     0       65535     0       65535     0       65535     0
_ 2   65280     0       65535     0       65535     0       65535     0
_ 3   65280     0       65535     0       65535     0       65535     0
_ 4   65280     0       65535     0       65535     0       65535     0
_ 5   65280     0       65535     0       65535     0       65535     0
```

Figure 3-25 Channel Subsystem List: Four subchannel sets

[3] For an 8562, HCD automatically defines the maximum configuration of three CSSs and 40 LPARs.

3.4.4 Additional steps and tasks

When you are ready to map the PCHIDs from the z15 CFR file to the CHPIDs in your exported IODF, go to Chapter 4, “Preparing an input/out configuration program to use the CHPID Mapping Tool” on page 55.

To define the I/O configuration for your system, go to Chapter 5, “The production input/output definition file and setting up the central processor complex” on page 89.

4

Preparing an input/out configuration program to use the CHPID Mapping Tool

This chapter describes a detailed system upgrade scenario to use the channel path ID (CHPID) Mapping Tool (CMT).

This chapter includes the following sections:

- Validating the work input/output definition file
- Creating the input/out configuration program file for the CHPID Mapping Tool
- Assigning CHIDs to CHPIDs by using the CMT
- Importing the CFReport file into the CMT
- Importing the IOCP file into the CMT
- Resolving CHPIDs with CHID conflicts
- Hardware resolution
- Manual mapping to resolve CIB CHPIDs
- Processing Automatic Mapping and CU Priority
- CHPIDs not connected to control units
- Creating CHPID Mapping Tool reports
- Creating an updated IOCP file
- Additional steps and processes

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, these examples can also be used with the z15 T02 (8562).

4.1 Validating the work input/output definition file

To validate the work input/output definition file (IODF) by using the Hardware Configuration Definition (HCD) component, complete the following steps:

1. Select HCD option `2.12. Build validated work I/O definition file`. Review the message list and correct any errors.
2. Press PF3 to continue. The `Requested action successfully processed` message is displayed.
3. Select HCD option `6.4. View I/O Definition File Information`. The IODF type is now indicated as `Work - Validated` (see Figure 4-1).

```
+---------------- View I/O Definition File Information -----------------+
|                                                                       |
|                                                                       |
| IODF name  . . . . . . : 'SYS6.IODF66.WORK'                           |
| IODF type  . . . . . . : Work - Validated                             |
| IODF version . . . . . : 5                                            |
|                                                                       |
| Creation date  . . . . : 2019-06-20                                   |
| Last update  . . . . . : 2019-08-16  08:52                            |
|                                                                       |
| Volume serial number . : BH6ST2                                       |
| Allocated space  . . . : 1064    (Number of 4K blocks)                |
| Used space . . . . . . : 851     (Number of 4K blocks)                |
|    thereof utilized (%)  55                                           |
| Activity logging . . . : No                                           |
| Multi-user access  . . : No                                           |
| Backup IODF name . . . :                                              |
|                                                                       |
| Description  . . . . . :                                              |
|                                                                       |
|                                                                       |
|                                                                       |
| ENTER to continue.                                                    |
+-----------------------------------------------------------------------+
```

Figure 4-1 View I/O Definition File Information: Validated work IODF

4.2 Creating the input/out configuration program file for the CHPID Mapping Tool

To create the input/out configuration program (IOCP) input data set for the CMT, complete the following steps:

1. Select HCD option `2.3. Build IOCP input data set`, and press Enter (see Figure 4-2).

```
                      z/OS V2.4 HCD
+------ Activate or Process Configuration Data ------+
|                                                     |
|                                                     |
| Select one of the following tasks.                  |
|                                                     |
| 3_  1.  Build production I/O definition file        |
|     2.  Build IOCDS                                 |
|     3.  Build IOCP input data set                   |
|     4.  Create JES3 initialization stream data      |
|     5.  View active configuration                   |
|     6.  Activate or verify configuration            |
|         dynamically                                 |
|     7.  Activate configuration sysplex-wide         |
|     8.  (no longer supported)                       |
|     9.  (no longer supported)                       |
|     10. Build I/O configuration data                |
|     11. Build and manage processor cluster          |
|         IOCDSs, IPL attributes and dynamic I/O      |
|         changes                                     |
|     12. Build validated work I/O definition file    |
|                                                     |
|                                                     |
|                                                     |
+-----------------------------------------------------+
```

Figure 4-2 Activate or Process Configuration Data: Building IOCP for ARIES

2. HCD displays the list of available processors (see Figure 4-3). Select the `ARIES` processor by entering a forward slash (/) next to it and pressing Enter.

```
+-------------------------- Available Processors ---------------------------+
|                                                                Row 1 of 3 |
| Command ===> ___________________________________________________________  |
|                                                                           |
| Select one.                                                               |
|                                                                           |
|   Processor ID  Type     Model    Mode  Description                       |
| / ARIES         8561     T01      LPAR  Aries                             |
|   LEPUS         2965     N20      LPAR  Lepus                             |
|   MUSCA         3907     ZR1      LPAR  Musca                             |
| ************************** Bottom of data****************************     |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 4-3 Available Processors: Selecting a processor for the IOCP file

3. HCD displays a panel on which you enter information about the IOCP input data set to be created (see Figure 4-4). Complete the following fields:
   - Title1: `IODF66`
   - IOCP input data set: `'SYS6.IODF66.IOCPIN.ARIES'`
   - Input to Stand-alone IOCP: `Yes`
   - Job statement information: Complete this information for your installation.

```
+------------------------- Build IOCP Input Data Set -------------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| IODF name . . . . . . . . . : 'SYS6.IODF66.WORK'                            |
| Processor ID  . . . . . . . : ARIES                                         |
| Title1 . IODF66__________________________________________________________   |
| Title2 : SYS6.IODF66.WORK - 2019-08-16 08:52                                |
|                                                                             |
| IOCP input data set                                                         |
| 'SYS6.IODF66.IOCPIN.ARIES'                                                  |
| Input to Stand-alone IOCP?  Yes  (Yes or No)                                |
|                                                                             |
| Job statement information                                                   |
| //HCD      JOB (999,POK),'FRANCO PINTO',CLASS=A,MSGCLASS=J,                 |
| // REGION=0M,NOTIFY=&SYSUID TYPRUN=HOLD                                     |
| //*                                                                         |
| /*JOBPARM SYSAFF=*,L=9999                                                   |
| //*                                                                         |
| //*OUT OUTPUT DEST=WTSCMXA.JTROY,CLASS=J,FORMS=STD,DEFAULT=YES              |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 4-4 Build IOCP Input Data Set: Data fields to be updated

4. Press Enter. HCD submits a batch job to create the data set.

5. Using an editor or browser tool of your choice, verify that the data set that you created exists and contains IOCP statements (see Figure 4-5). In this example, we used Time Sharing Option (TSO). This data set is used as input into the CMT.

```
         ID    MSG1='IODF66',                                          *
               MSG2='SYS6.IODF66.WORK - 2019-08-16 08:52',             *
               SYSTEM=(8561,1),LSYSTEM=ARIES,                          *
               TOK=('ARIES',00800221B7F8856108521329011922 8F00000000,00*
               000000,'19-08-16','08:52:13','.......','........')
         RESOURCE PARTITION=((CSS(0),(CETUS0A,A),(CETUS0B,B),(CETUS0C,C*
               ),(CETUS0D,D),(CETUS0E,E),(CETUS0F,F),(CETUS01,1),(CETUS*
               02,2),(CETUS03,3),(CETUS04,4),(CETUS05,5),(CETUS06,6),(C*
               ETUS07,7),(CETUS08,8),(CETUS09,9)),(CSS(1),(CETUS1A,A),(*
               CETUS1B,B),(CETUS1C,C),(CETUS1D,D),(CETUS1E,E),(CETUS1F,*
               F),(CETUS11,1),(CETUS12,2),(CETUS13,3),(CETUS14,4),(CETU*
               S15,5),(CETUS16,6),(CETUS17,7),(CETUS18,8),(CETUS19,9)),*
               (CSS(2),(CETUS21,1),(CETUS22,2),(CETUS23,3),(CETUS24,4),*
               (CETUS25,5),(CETUS26,6),(CETUS27,7),(CETUS28,8),(CETUS29*
               ,9),(*,A),(*,B),(*,C),(*,D),(*,E),(*,F)),(CSS(3),(*,1),(*
               *,2),(*,3),(*,4),(*,5),(*,6),(*,7),(*,8),(*,9),(*,A),(*,*
               B),(*,C),(*,D),(*,E),(*,F)),(CSS(4),(*,1),(*,2),(*,3),(**
               ,4),(*,5),(*,6),(*,7),(*,8),(*,9),(*,A),(*,B),(*,C),(*,D*
               ),(*,E),(*,F)),(CSS(5),(MCS_1,B),(*,1),(*,2),(*,3),(*,4)*
               ,(*,5),(*,6),(*,7),(*,8),(*,9),(*,A),(*,C),(*,D),(*,E),(*
               *,F)))
         FUNCTION FID=A1,VF=1,PCHID=1BC,PNETID=PERFNET,                *
               PART=((CETUS01),(CETUS0A,CETUS0B,CETUS0C,CETUS0D,CETUS0E*
               ,CETUS0F,CETUS02,CETUS03,CETUS04,CETUS05,CETUS06,CETUS07*
               ,CETUS08,CETUS09,CETUS1E,CETUS11,CETUS12,CETUS13,CETUS14*
               ,CETUS15,CETUS16,CETUS17,CETUS18,CETUS19)),TYPE=ROC2,   *
               PORT=1
         FUNCTION FID=A2,VF=1,PCHID=17C,PNETID=PERFNET,                *
```

Figure 4-5 IOCP input data set: Contents (truncated)

Part of the TOK statement is now replaced with dots (see Example 4-1).

Example 4-1 IOCP file (TOK statement)

```
TOK=('ARIES',00800221B7F885610852132901192 28F00000000,00*
000000,'19-08-16','08:52:13','.......','........')
```

These dots ensure that this IOCP file cannot be written to a processor and used for a Power on Reset (POR). This precaution is needed because this IOCP file was created from a validated work IODF and not a production IODF. IOCP files that can be used for a POR can be generated only from a production IODF.

Important: When an IOCP file is exported by using HCD from a validated work IODF, it must be imported back into HCD after the *channel IDs* (CHIDs) are completed by using the CMT. The IOCP file cannot be used directly by IOCP until the CHIDs are added.

6. Download this IOCP file from z/OS to the CMT workstation. Use a workstation file transfer facility such as FTP or the one in the IBM Personal Communications Workstation Program, or any equivalent 3270 emulation program. Be sure to use `TEXT` as the transfer type. In this example, the file is named ARIES`in.iocp`.

4.3 Assigning CHIDs to CHPIDs by using the CMT

In this section, you use the IOCP statements from HCD and the 3906 order process file (CFReport). Use the CMT to assign CHIDs to each of the CHPIDs for the 3906.

For this process, the CMT must be downloaded. For more information about downloading and installing the CMT, see 2.2.3, "CHPID Mapping Tool" on page 10. If CMT is already installed, verify that the latest updates are installed.

The version of CMT that is used for the following captures is Version 6.19. Check for the latest version by going to IBM Resource Link.

For more information, see the *CHPID Mapping Tool User's Guide*, GC28-6947.

Use the CMT to complete the following steps:

1. Import the `CFReport` file into the CMT.
2. Import the IOCP file into the CMT.
3. Resolve CHPIDs with a CHID conflict.
4. Process the hardware resolution.
5. Manually resolve the CIB or CS5 CHPIDs.
6. Set the priority for single-path control units (CUs) and other CUs that override the CMT default priorities and Automatic Mapping.
7. Resolve the CHPIDs that are not connected to CUs.
8. Create the CMT reports.
9. Create an updated IOCP file for transfer back into the IODF file.

4.4 Importing the CFReport file into the CMT

To import the `CFReport` file into the CMT, complete the following steps:

1. Start the CMT on your workstation.
2. The CMT asks for a project name and location of the CMT work files. In our example, we used `CETUS_upg` as the project name (Figure 4-6).

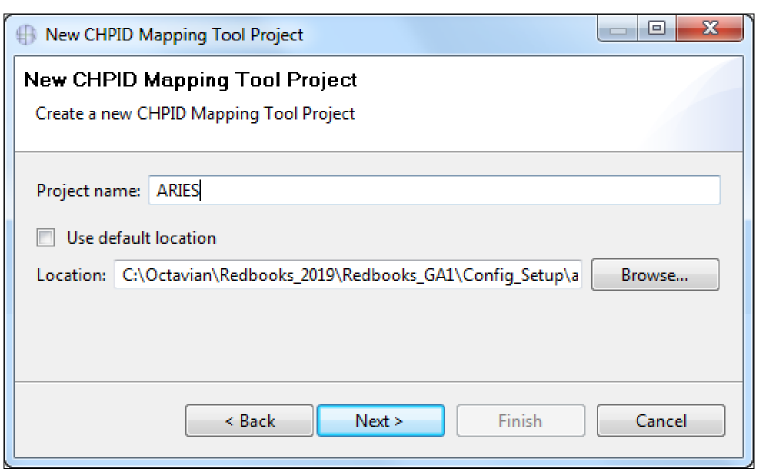


Figure 4-6 Creating a CHPID Mapping Tool Project

3. Next, specify the `CFReport`. The IOCP input file window opens. For this step, we input only the CFReport file.

> **Attention:** To import the `CFReport` file into the CMT, a Customer Number must be in the `CFReport` file.

4. Import the `CFReport` file into the CMT by specifying the name in the **CFReport** file field, and then click **Finish** (see Figure 4-7).

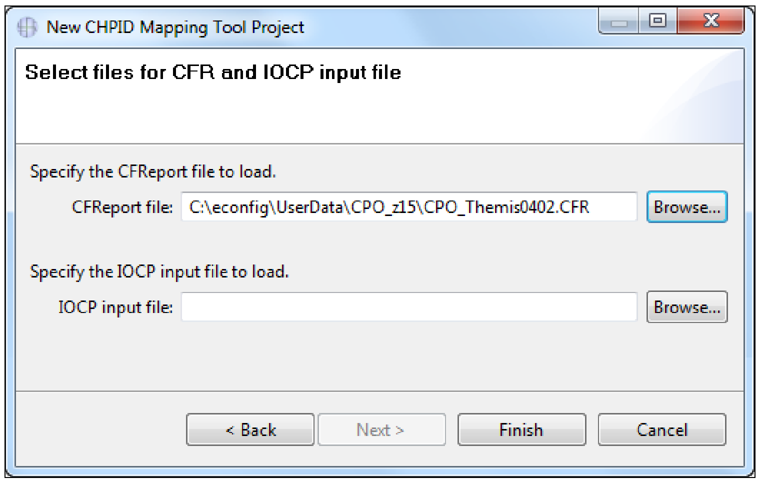


Figure 4-7 Specifying the CFReport file

If you click **Finish** but did not select an IOCP file, you receive the message that is shown in Figure 4-8. Click **OK**.

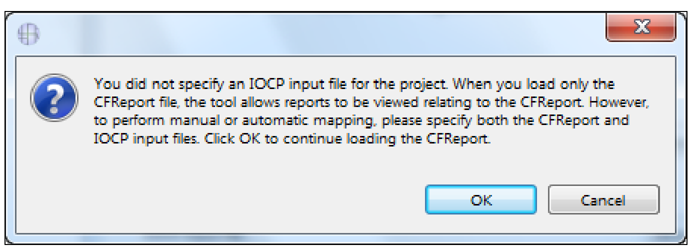


Figure 4-8 Warning message for not specifying an IOCP file

A window shows the progress of reading the CFReport file (see Figure 4-9).

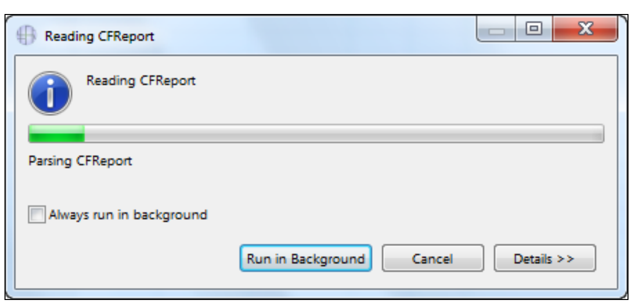


Figure 4-9 Reading the CFReport file

The information from the CFReport file is shown in the **Hardware** pane (see Figure 4-10).

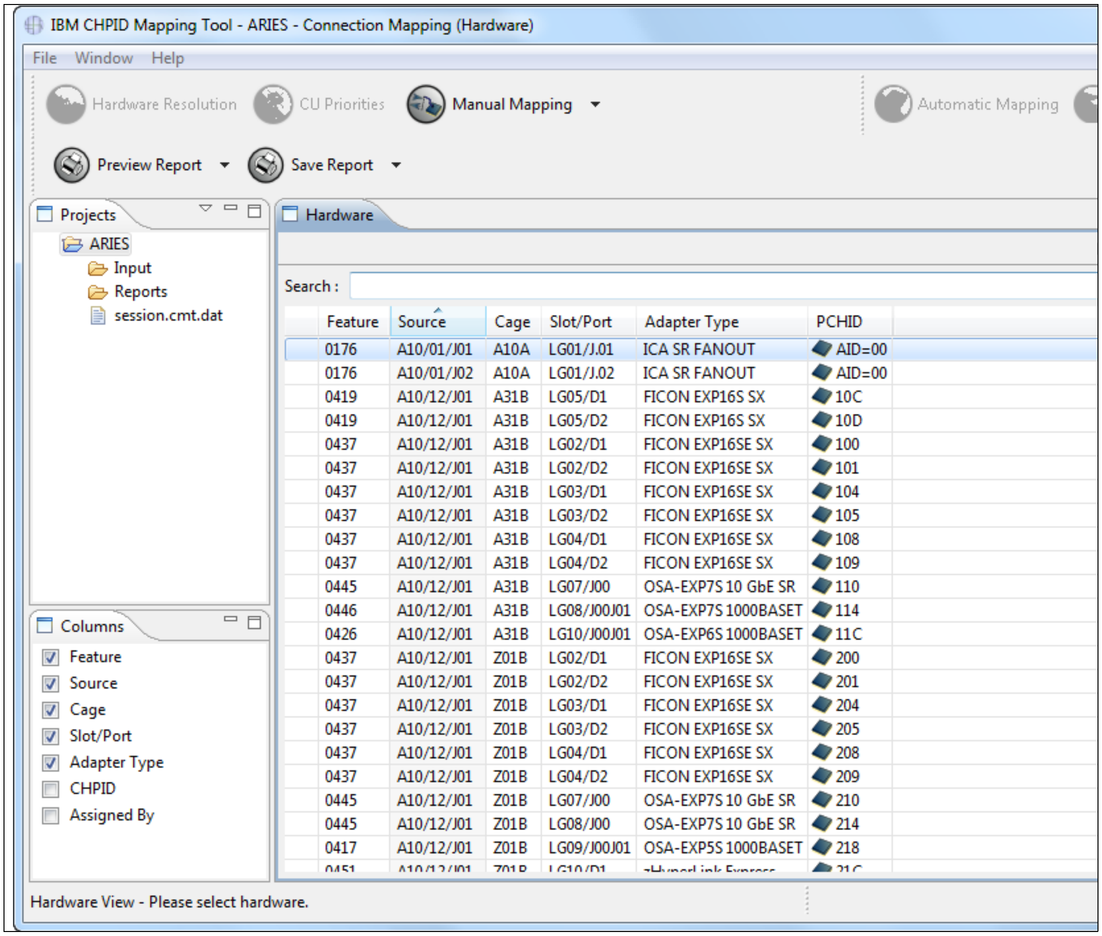


Figure 4-10 Imported CFReport file

4.5 Importing the IOCP file into the CMT

To import the validated 3906 IOCP file into the CMT, complete the following steps:

1. Right-click anywhere in the Projects window and select **Import IOCP input file** (see Figure 4-11).

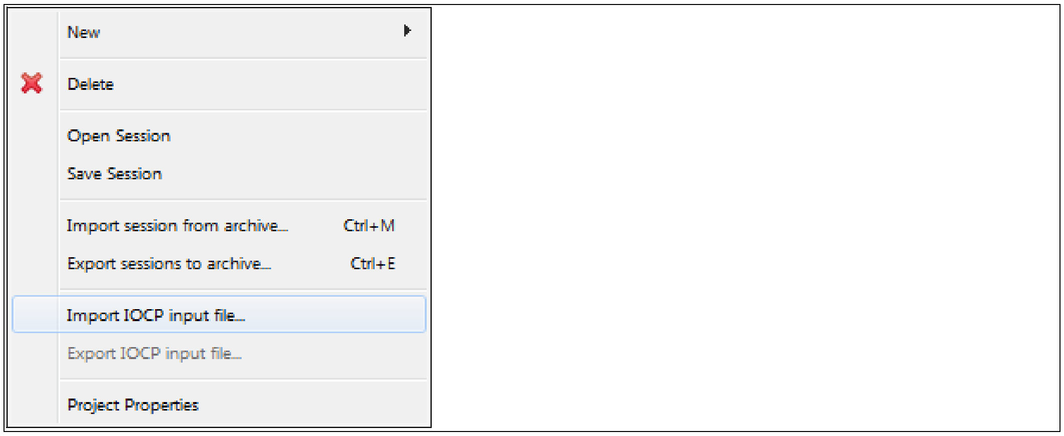


Figure 4-11 Importing the IOCP file

2. Select the IOCP file on your workstation to import into the CMT, and click **Finish** (see Figure 4-12).

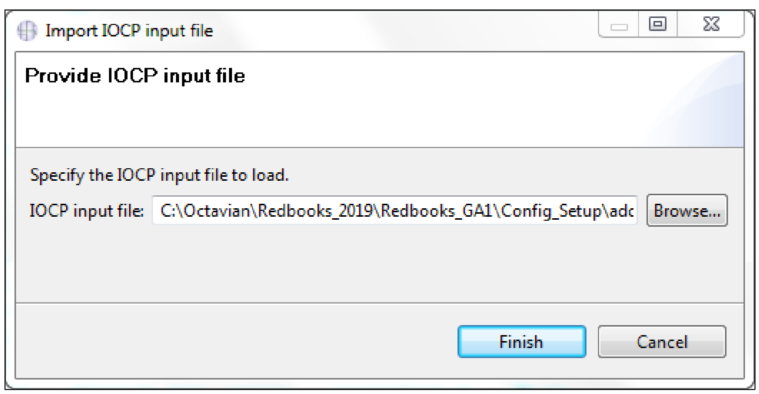


Figure 4-12 Specifying the IOCP file for import

3. In the Projects window, under the **Input** tab, expand the **IOCP** tab, right-click the IOCP file, and select **Read Selected IOCP** (see Figure 4-13).

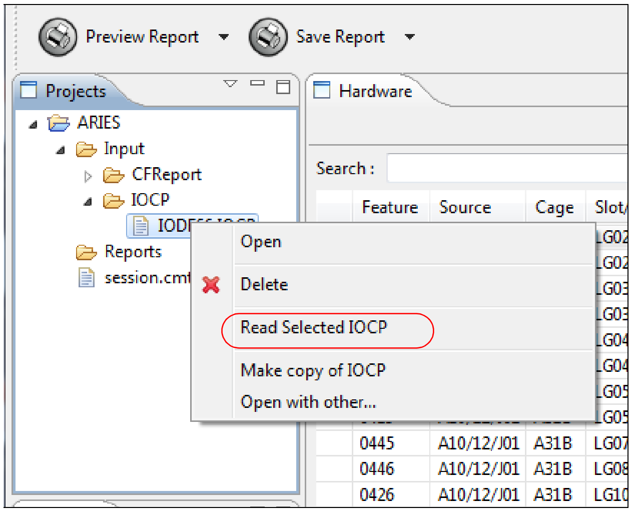


Figure 4-13 Reading the selected IOCP

A dialog box opens and shows the progress information (see Figure 4-14).

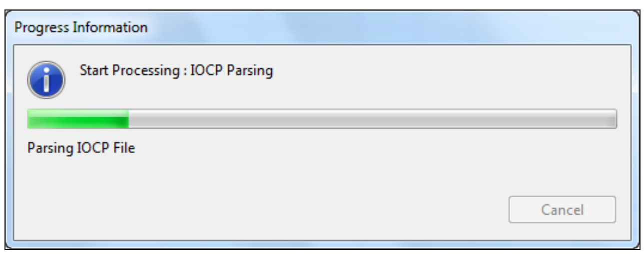


Figure 4-14 Processing the IOCP file

Another window might open and show a selection regarding what type of upgrade you are performing (see Figure 4-15):

– IOCP file represents current configuration
– IOCP file represents proposed configuration

In our example, we select **IOCP file represents proposed configuration** because we added more I/O during the upgrade process from a 3906 processor to an 8561 processor. Click **OK**.

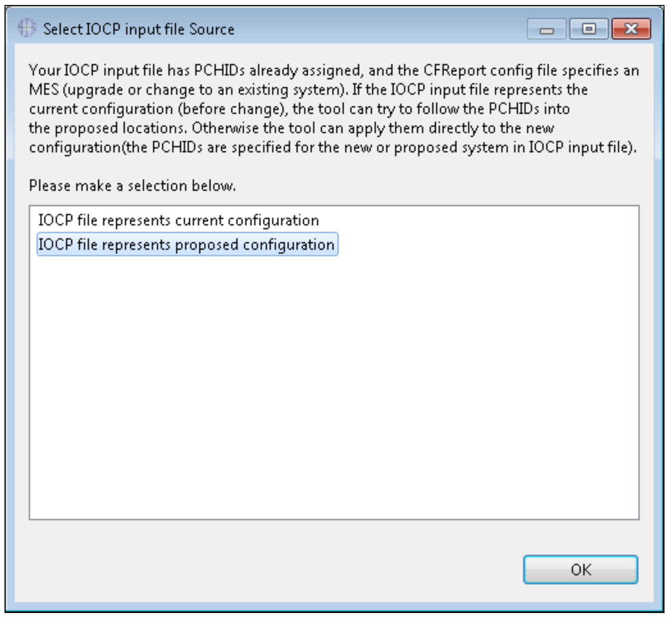


Figure 4-15 Processing the IOCP file

The CMT shows the information from the `CFReport` file and the IOCP file in the Hardware Resolution pane. By default, the Hardware Resolution view (see Figure 4-16) includes three tabbed panes:

- Projects
- Hardware Resolution
- Adapter Type Summary

Hardware Resolution is the middle pane and the Adapter Type Summary is on the right.

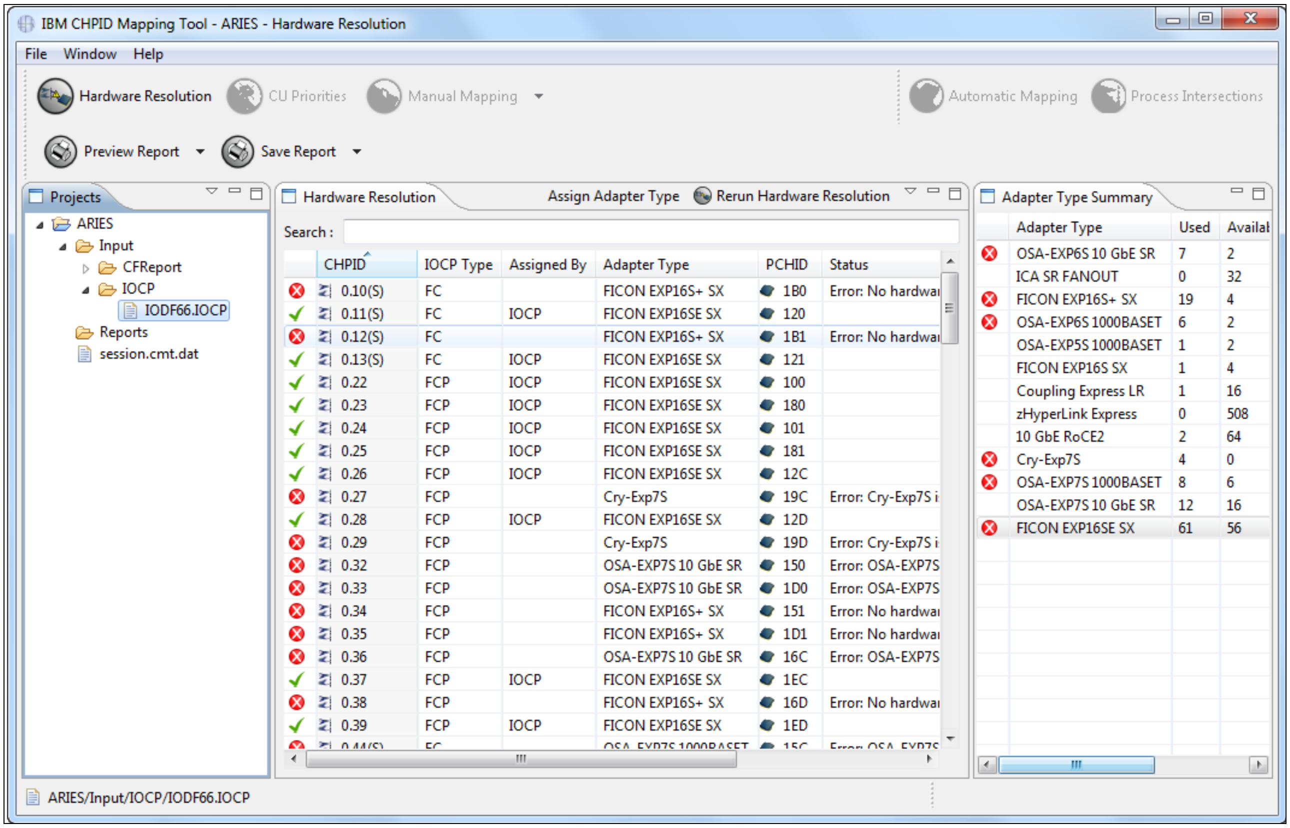


Figure 4-16 Hardware Resolution after Imported IOCP file

The Adapter Type Summary pane shows a table with helpful information. It summarizes the number of used and available channels for the hardware channel types (used, available, and device count).

In the example, the CMT might show some of the following output:

- Hardware Resolution: This window lists all CHPIDs that were found, and the Status column shows the CHPID information to be investigated. In the example, investigate the status. Table 4-1 lists status messages and possible resolutions.

Table 4-1 Status messages and possible resolutions

Status	Explanation	Resolution (if required)
No hardware found	Adapter ID (AID) values or physical channel ID (PCHID) values are present that are not found in the hardware. This situation might occur when you replace hardware for a miscellaneous equipment specification (MES) and the IOCP file contains a CHID value for the old hardware (The IOCP file contains a CHID value for the hardware being removed).	If you have any CHPIDs of IOCP type CIB or CS5, the CMT cannot automatically assign these CHPIDs. If the AID assignment in the IOCP file is not valid, you can reset it during hardware resolution. You can then use manual mapping to assign the CHPIDs to AIDs. Do the following steps for CIB or CS5 CHPIDs: 1. Remove the AID values. 2. Do one of the following tasks: - Inside the CMT, perform manual mapping to associate these CHPIDs with AIDs. - Assign the AID values outside the tool, for example, by using HCD. 3. Replace the IOCP file.
Select at least one adapter type.	An adapter type is not assigned to the current row.	Assign an adapter type to the IOCP type.
Adapter_type is not compatible with *IOCP_type*.	The adapter type that is assigned to the CHPID is not compatible with the IOCP type that is specified by the IOCP file.	See Figure 4-16 on page 66.
The required hardware for type *IOCP_type* is not available. Example: Required hardware for type Fibre Channel (FC) is not available.	The CMT found no hardware for the specified IOCP type.	You need to change the IOCP file or obtain more hardware.
CHID_1 moved to a new CHID: *CHID_2*. Example: 520 moved to 1E2.	You are replacing hardware for an MES, and the IOCP file contains a CHID value for the old hardware, which is being removed. This CHID value moved from an old machine to the CHID value for the new hardware. *CHID_1* is the first CHID value (for example, 520) and *CHID_2* is the second CHID value (for example, 1E2).	This status is an informational message; no hardware resolution is required. The message informs you of the new location so you can change this value if you prefer a different assignment.

- Manual mapping of CIB or CS5 CHPIDs: Availability Mapping cannot be used until all CIB or CS5 CHPIDs are resolved. You can use manual mapping to resolve any CIB or CS5 CHPIDS after which the Availability Mapping function is enabled for use.

- Process the CU Priorities and Automatic Mapping:
  - **Reset CHPIDs assigned by Automatic Mapping**: Selecting this option resets all CHPIDs that were processed by prior availability runs in this session.

    By default, this option is selected.
  - **Reset CHPIDs assigned by Manual Mapping**: Selecting this option resets CHPIDs that were assigned a CHID in the Manual window. If this option is not selected (it has no check mark), then availability CHIDs for these CHPIDs are not reset.

    By default, this option is not selected.
  - **Reset CHPIDs assigned by IOCP (Potential re-cabling)**: If some of the CHPIDs are assigned in the IOCP Input file, selecting this option resets the CHPIDs. Selecting this option might require recabling after availability assignments.

    Generally, select this option.
  - **Reset CHPIDs assigned by CMT for config files**: The CFReport indicates that you are doing an MES or upgrade, and you have channels or CHPIDs (or both) that might have configuration files that are associated with them. The MES or upgrade might move some of those channel cards.

    Regardless of whether the channels are moving or not, the CMT either assigns CHIDs to the logical CHPID definitions to keep the CHPID definition associated with its current configuration file, or it moves the definition to the new location where the channel is moving.

    If you reset the CMT assignments, back up the configuration file data before the MES, and restore that data to the new location (the CHID where the affected CHPIDs are assigned) before you use the CHPIDs.

    By default, this option is not selected.

  If no options are selected, availability works only on CHPIDs that have no CHIDs assigned.

  To give the CMT the most choices when you use the availability option, select **Reset CHPIDs assigned by IOCP**.

  > **Attention:** If you run **Reset CHPIDs assigned by IOCP**, it resets any previously mapped CHPID assignments and can result in recabling of the server.

  However, if you select **Reset CHPIDs assigned by Automatic Mapping**, review the intersects from availability processing carefully to ensure that preserving the prior CHPID-to-CHID relationship does not cause unacceptable availability.

4.6 Resolving CHPIDs with CHID conflicts

The CMT shows the CHPIDs with CHID conflicts (see Figure 4-17).

Search :

CHPID	IOCP Type	Assigned By	Adapter Type	PCHID	Status
0.10(S)	FC		FICON EXP16S+ SX	1B0	Error: No hardware found for PCHID: 1B0
0.11(S)	FC	IOCP	FICON EXP16SE SX	120	
0.12(S)	FC		FICON EXP16S+ SX	1B1	Error: No hardware found for PCHID: 1B1
0.13(S)	FC	IOCP	FICON EXP16SE SX	121	
0.22	FCP	IOCP	FICON EXP16SE SX	100	
0.23	FCP	IOCP	FICON EXP16SE SX	180	
0.24	FCP	IOCP	FICON EXP16SE SX	101	
0.25	FCP	IOCP	FICON EXP16SE SX	181	
0.26	FCP	IOCP	FICON EXP16SE SX	12C	
0.27	FCP		Cry-Exp7S	19C	Error: Cry-Exp7S is not compatible with FCP
0.28	FCP	IOCP	FICON EXP16SE SX	12D	
0.29	FCP		Cry-Exp7S	19D	Error: Cry-Exp7S is not compatible with FCP
0.32	FCP		OSA-EXP7S 10 GbE SR	150	Error: OSA-EXP7S 10 GbE SR is not compatible with FCP
0.33	FCP		OSA-EXP7S 10 GbE SR	1D0	Error: OSA-EXP7S 10 GbE SR is not compatible with FCP
0.34	FCP		FICON EXP16S+ SX	151	Error: No hardware found for PCHID: 151
0.35	FCP		FICON EXP16S+ SX	1D1	Error: No hardware found for PCHID: 1D1
0.36	FCP		OSA-EXP7S 10 GbE SR	16C	Error: OSA-EXP7S 10 GbE SR is not compatible with FCP
0.37	FCP	IOCP	FICON EXP16SE SX	1EC	
0.38	FCP		FICON EXP16S+ SX	16D	Error: No hardware found for PCHID: 16D
0.39	FCP	IOCP	FICON EXP16SE SX	1ED	

Figure 4-17 CHPIDs with PCHID conflicts

In the first column of every row, the Hardware Resolution pane contains either of the following symbols:

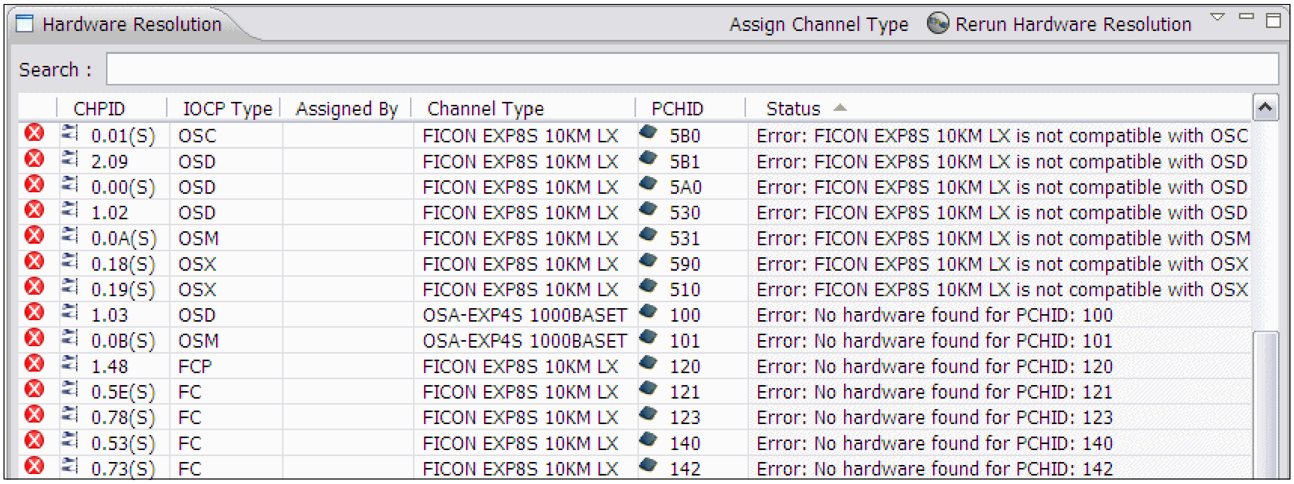
- An X in a red circle: This symbol indicates an error.
- An exclamation mark in a yellow circle: This symbol indicates a warning or attention message.
- A green check mark: This symbol indicates that the tool successfully resolved the specified Channel Type.

In this example, here are the reasons that we needed to resolve hardware resolution issues:

- The CHID channel type changed.
- The defined CHID is not compatible with the channel path at a particular location.
- Enough ports exist in the hardware.
- A type mismatch exists between a CHPID and its associated channel type.

4.7 Hardware resolution

In the example, the CMT displays an X in the first column of the Hardware Resolution pane (see Figure 4-18) that is related to these error types: `No hardware found` and `FICON EXP8S 10KM LX is not compatible with OSD`.



CHPID	IOCP Type	Assigned By	Channel Type	PCHID	Status
0.01(S)	OSC		FICON EXP8S 10KM LX	5B0	Error: FICON EXP8S 10KM LX is not compatible with OSC
2.09	OSD		FICON EXP8S 10KM LX	5B1	Error: FICON EXP8S 10KM LX is not compatible with OSD
0.00(S)	OSD		FICON EXP8S 10KM LX	5A0	Error: FICON EXP8S 10KM LX is not compatible with OSD
1.02	OSD		FICON EXP8S 10KM LX	530	Error: FICON EXP8S 10KM LX is not compatible with OSD
0.0A(S)	OSM		FICON EXP8S 10KM LX	531	Error: FICON EXP8S 10KM LX is not compatible with OSM
0.18(S)	OSX		FICON EXP8S 10KM LX	590	Error: FICON EXP8S 10KM LX is not compatible with OSX
0.19(S)	OSX		FICON EXP8S 10KM LX	510	Error: FICON EXP8S 10KM LX is not compatible with OSX
1.03	OSD		OSA-EXP4S 1000BASET	100	Error: No hardware found for PCHID: 100
0.0B(S)	OSM		OSA-EXP4S 1000BASET	101	Error: No hardware found for PCHID: 101
1.48	FCP		FICON EXP8S 10KM LX	120	Error: No hardware found for PCHID: 120
0.5E(S)	FC		FICON EXP8S 10KM LX	121	Error: No hardware found for PCHID: 121
0.78(S)	FC		FICON EXP8S 10KM LX	123	Error: No hardware found for PCHID: 123
0.53(S)	FC		FICON EXP8S 10KM LX	140	Error: No hardware found for PCHID: 140
0.73(S)	FC		FICON EXP8S 10KM LX	142	Error: No hardware found for PCHID: 142

Figure 4-18 Hardware resolution status errors

> **More information:** For more information about these error messages, see the *CHPID Mapping Tool User's Guide*, GC28-6947.

The options that must be reset are as follows:

- Resetting Incompatible (Hardware - I/O) Entries: (shown in example).
- Resetting “Error: No hardware found” Entries: (shown in example).
- Resetting “Select at least one adapter type”: (shown in example).
- Resetting “Required hardware for type IOCP_type not available”: (*not* shown in example).
- Resetting “CHID_1 moved to new channel ID: CHID_2”: (*not* shown in example).

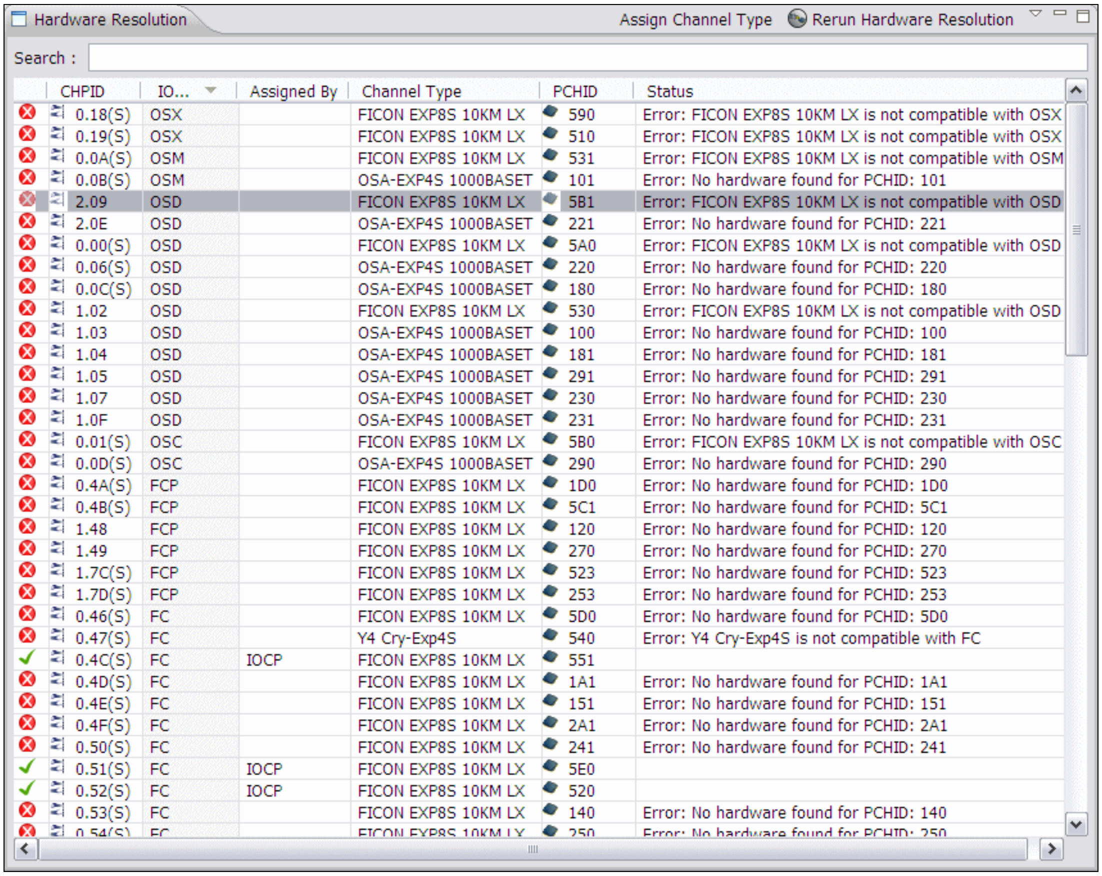
4.7.1 Resetting Incompatible (Hardware - I/O) Entries

The Channel type that is assigned for the CHPID is not compatible with the IOCP type that is specified by the IOCP file. For this mismatch, you might receive the following message:

```
Error: Channel_type is not compatible with IOCP_type.
```

You can resolve this problem by resetting the CHID. In the example, the IOCP type is OSD, but the CHID is associated with a Fibre Connection (FICON) card. You cannot assign the OSD type on the FICON card.

The CMT displays the error message in the Status column (see Figure 4-19).



Hardware Resolution | Assign Channel Type | Rerun Hardware Resolution

Search :

CHPID	IO...	Assigned By	Channel Type	PCHID	Status
0.18(S)	OSX		FICON EXP8S 10KM LX	590	Error: FICON EXP8S 10KM LX is not compatible with OSX
0.19(S)	OSX		FICON EXP8S 10KM LX	510	Error: FICON EXP8S 10KM LX is not compatible with OSX
0.0A(S)	OSM		FICON EXP8S 10KM LX	531	Error: FICON EXP8S 10KM LX is not compatible with OSM
0.0B(S)	OSM		OSA-EXP4S 1000BASET	101	Error: No hardware found for PCHID: 101
2.09	OSD		FICON EXP8S 10KM LX	5B1	Error: FICON EXP8S 10KM LX is not compatible with OSD
2.0E	OSD		OSA-EXP4S 1000BASET	221	Error: No hardware found for PCHID: 221
0.00(S)	OSD		FICON EXP8S 10KM LX	5A0	Error: FICON EXP8S 10KM LX is not compatible with OSD
0.06(S)	OSD		OSA-EXP4S 1000BASET	220	Error: No hardware found for PCHID: 220
0.0C(S)	OSD		OSA-EXP4S 1000BASET	180	Error: No hardware found for PCHID: 180
1.02	OSD		FICON EXP8S 10KM LX	530	Error: FICON EXP8S 10KM LX is not compatible with OSD
1.03	OSD		OSA-EXP4S 1000BASET	100	Error: No hardware found for PCHID: 100
1.04	OSD		OSA-EXP4S 1000BASET	181	Error: No hardware found for PCHID: 181
1.05	OSD		OSA-EXP4S 1000BASET	291	Error: No hardware found for PCHID: 291
1.07	OSD		OSA-EXP4S 1000BASET	230	Error: No hardware found for PCHID: 230
1.0F	OSD		OSA-EXP4S 1000BASET	231	Error: No hardware found for PCHID: 231
0.01(S)	OSC		FICON EXP8S 10KM LX	5B0	Error: FICON EXP8S 10KM LX is not compatible with OSC
0.0D(S)	OSC		OSA-EXP4S 1000BASET	290	Error: No hardware found for PCHID: 290
0.4A(S)	FCP		FICON EXP8S 10KM LX	1D0	Error: No hardware found for PCHID: 1D0
0.4B(S)	FCP		FICON EXP8S 10KM LX	5C1	Error: No hardware found for PCHID: 5C1
1.48	FCP		FICON EXP8S 10KM LX	120	Error: No hardware found for PCHID: 120
1.49	FCP		FICON EXP8S 10KM LX	270	Error: No hardware found for PCHID: 270
1.7C(S)	FCP		FICON EXP8S 10KM LX	523	Error: No hardware found for PCHID: 523
1.7D(S)	FCP		FICON EXP8S 10KM LX	253	Error: No hardware found for PCHID: 253
0.46(S)	FC		FICON EXP8S 10KM LX	5D0	Error: No hardware found for PCHID: 5D0
0.47(S)	FC		Y4 Cry-Exp4S	540	Error: Y4 Cry-Exp4S is not compatible with FC
0.4C(S)	FC	IOCP	FICON EXP8S 10KM LX	551	
0.4D(S)	FC		FICON EXP8S 10KM LX	1A1	Error: No hardware found for PCHID: 1A1
0.4E(S)	FC		FICON EXP8S 10KM LX	151	Error: No hardware found for PCHID: 151
0.4F(S)	FC		FICON EXP8S 10KM LX	2A1	Error: No hardware found for PCHID: 2A1
0.50(S)	FC		FICON EXP8S 10KM LX	241	Error: No hardware found for PCHID: 241
0.51(S)	FC	IOCP	FICON EXP8S 10KM LX	5E0	
0.52(S)	FC	IOCP	FICON EXP8S 10KM LX	520	
0.53(S)	FC		FICON EXP8S 10KM LX	140	Error: No hardware found for PCHID: 140
0.54(S)	FC		FICON EXP8S 10KM LX	250	Error: No hardware found for PCHID: 250

Figure 4-19 Channel_type is not compatible with IOCP_type

Complete the following steps:

1. Select the channel type **OSD**. The Status is `Error: FICON EXP8S is not compatible with OSD`. Right-click in the row and select **Reset Incompatible (Hardware - I/O) Entries** to remove the CHID values for only those rows (see Figure 4-20).

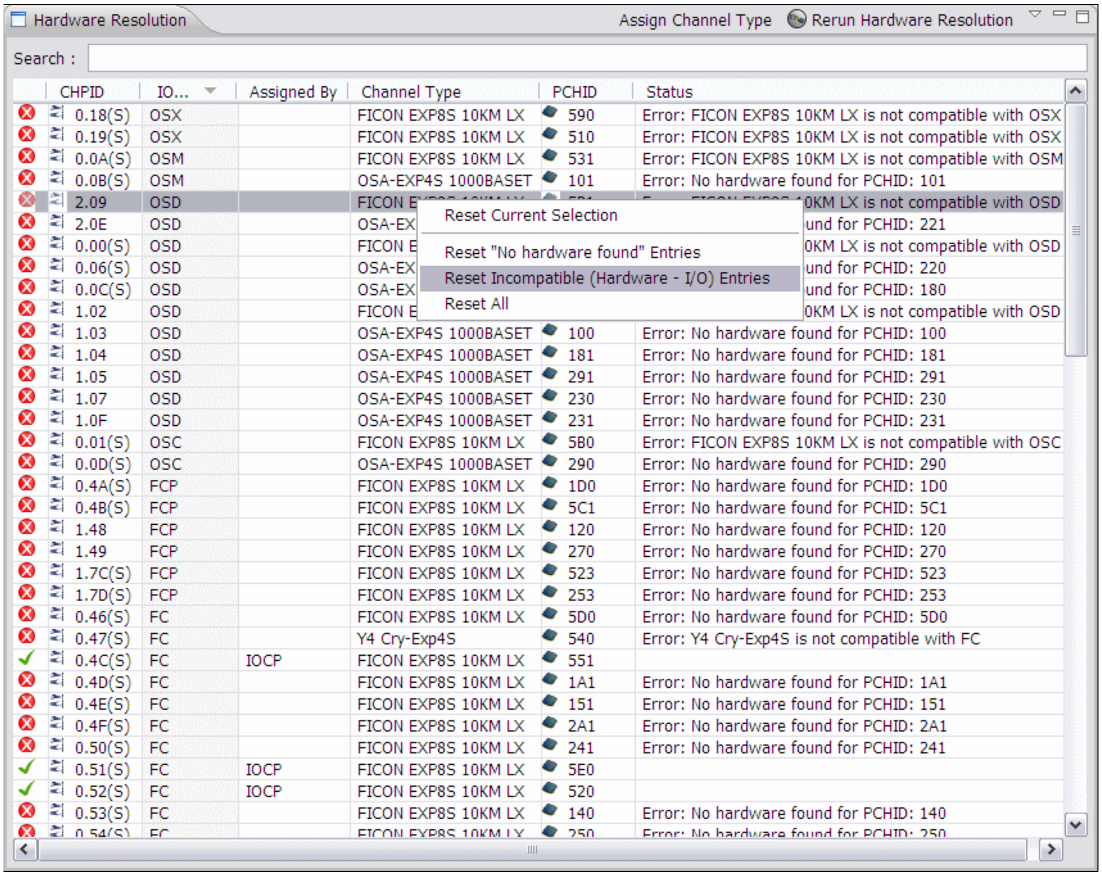
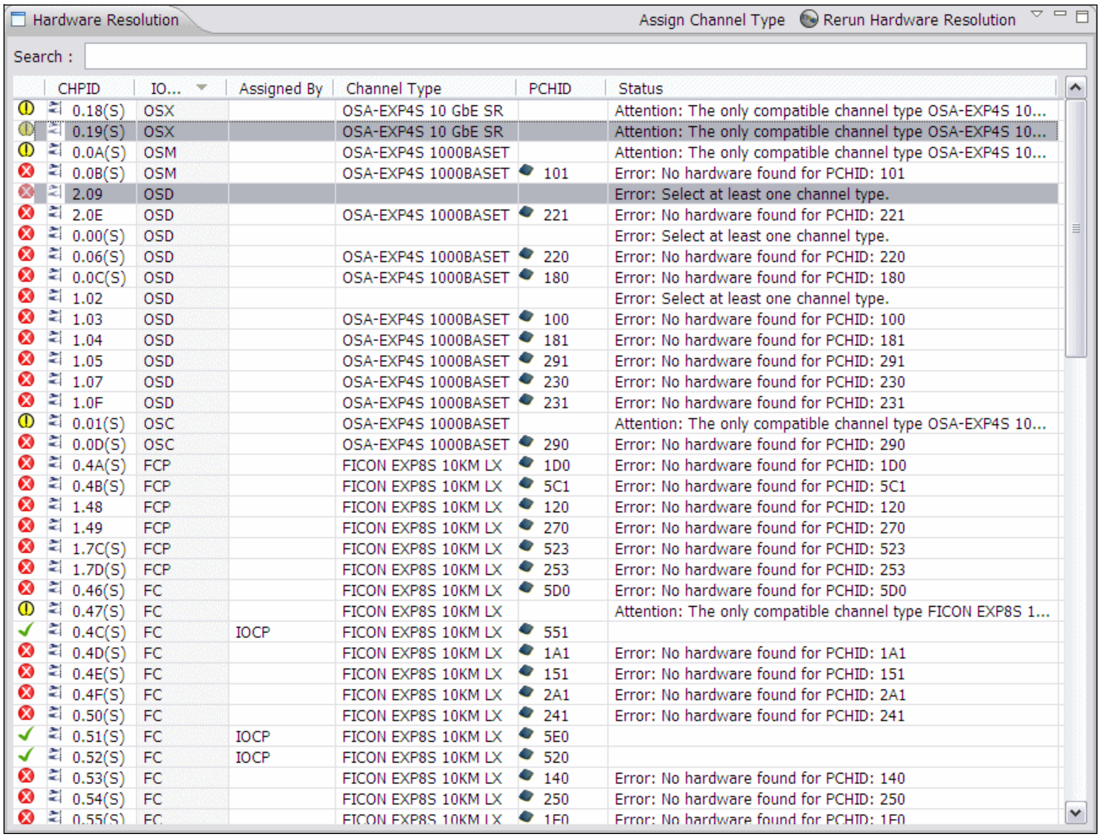


Figure 4-20 Channel_type is not compatible with IOCP_type OSD

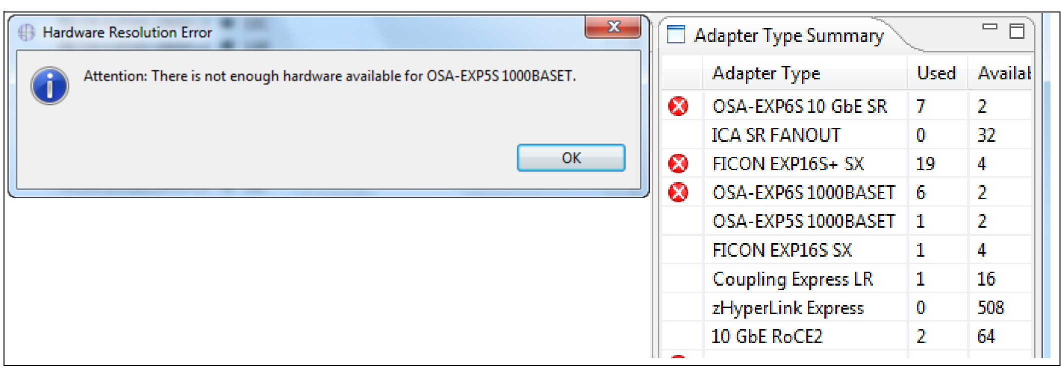
The tool replaces the X in a red circle with an **Attention** icon (exclamation mark in a yellow circle), changes the status message, and removes the CHID information (see Figure 4-21 on page 73).



CHPID	IO...	Assigned By	Channel Type	PCHID	Status
0.18(S)	OSX		OSA-EXP4S 10 GbE SR		Attention: The only compatible channel type OSA-EXP4S 10...
0.19(S)	OSX		OSA-EXP4S 10 GbE SR		Attention: The only compatible channel type OSA-EXP4S 10...
0.0A(S)	OSM		OSA-EXP4S 1000BASET		Attention: The only compatible channel type OSA-EXP4S 10...
0.0B(S)	OSM		OSA-EXP4S 1000BASET	101	Error: No hardware found for PCHID: 101
2.09	OSD				Error: Select at least one channel type.
2.0E	OSD		OSA-EXP4S 1000BASET	221	Error: No hardware found for PCHID: 221
0.00(S)	OSD				Error: Select at least one channel type.
0.06(S)	OSD		OSA-EXP4S 1000BASET	220	Error: No hardware found for PCHID: 220
0.0C(S)	OSD		OSA-EXP4S 1000BASET	180	Error: No hardware found for PCHID: 180
1.02	OSD				Error: Select at least one channel type.
1.03	OSD		OSA-EXP4S 1000BASET	100	Error: No hardware found for PCHID: 100
1.04	OSD		OSA-EXP4S 1000BASET	181	Error: No hardware found for PCHID: 181
1.05	OSD		OSA-EXP4S 1000BASET	291	Error: No hardware found for PCHID: 291
1.07	OSD		OSA-EXP4S 1000BASET	230	Error: No hardware found for PCHID: 230
1.0F	OSD		OSA-EXP4S 1000BASET	231	Error: No hardware found for PCHID: 231
0.01(S)	OSC		OSA-EXP4S 1000BASET		Attention: The only compatible channel type OSA-EXP4S 10...
0.0D(S)	OSC		OSA-EXP4S 1000BASET	290	Error: No hardware found for PCHID: 290
0.4A(S)	FCP		FICON EXP8S 10KM LX	1D0	Error: No hardware found for PCHID: 1D0
0.4B(S)	FCP		FICON EXP8S 10KM LX	5C1	Error: No hardware found for PCHID: 5C1
1.48	FCP		FICON EXP8S 10KM LX	120	Error: No hardware found for PCHID: 120
1.49	FCP		FICON EXP8S 10KM LX	270	Error: No hardware found for PCHID: 270
1.7C(S)	FCP		FICON EXP8S 10KM LX	523	Error: No hardware found for PCHID: 523
1.7D(S)	FCP		FICON EXP8S 10KM LX	253	Error: No hardware found for PCHID: 253
0.46(S)	FC		FICON EXP8S 10KM LX	5D0	Error: No hardware found for PCHID: 5D0
0.47(S)	FC		FICON EXP8S 10KM LX		Attention: The only compatible channel type FICON EXP8S 1...
0.4C(S)	FC	IOCP	FICON EXP8S 10KM LX	551	
0.4D(S)	FC		FICON EXP8S 10KM LX	1A1	Error: No hardware found for PCHID: 1A1
0.4E(S)	FC		FICON EXP8S 10KM LX	151	Error: No hardware found for PCHID: 151
0.4F(S)	FC		FICON EXP8S 10KM LX	2A1	Error: No hardware found for PCHID: 2A1
0.50(S)	FC		FICON EXP8S 10KM LX	241	Error: No hardware found for PCHID: 241
0.51(S)	FC	IOCP	FICON EXP8S 10KM LX	5E0	
0.52(S)	FC	IOCP	FICON EXP8S 10KM LX	520	
0.53(S)	FC		FICON EXP8S 10KM LX	140	Error: No hardware found for PCHID: 140
0.54(S)	FC		FICON EXP8S 10KM LX	250	Error: No hardware found for PCHID: 250
0.55(S)	FC		FICON EXP8S 10KM LX	1E0	Error: No hardware found for PCHID: 1E0

Figure 4-21 Results of resetting the incompatible type

2. The CMT now displays messages about any CHPID types that were imported from the IODF into the CMT that do not have any associated hardware support in the `CFReport` file (see Figure 4-22). Click **OK**. The same figure also shows the Adapter Type Summary details.



Adapter Type	Used	Availa
OSA-EXP6S 10 GbE SR	7	2
ICA SR FANOUT	0	32
FICON EXP16S+ SX	19	4
OSA-EXP6S 1000BASET	6	2
OSA-EXP5S 1000BASET	1	2
FICON EXP16S SX	1	4
Coupling Express LR	1	16
zHyperLink Express	0	508
10 GbE RoCE2	2	64

Figure 4-22 Required hardware unavailable

There are excessive numbers of OSC CHPID types in the example IODF to show how the CMT handles this condition.

You can use the *overdefine* option to change the CHID value to an asterisk (*) in the IODF. This way, you can retain the OSD CHPID definitions in the IODF so that you can install OSD CHIDs in the processor later.

Tip: Other CHPID types can also be *overdefined* by entering an asterisk (*) for the CHID value. Overdefining is now supported for CIB and CS5 type CHPID definitions.

Alternatively, you can remove the OSD CHPID definitions from the IODF.

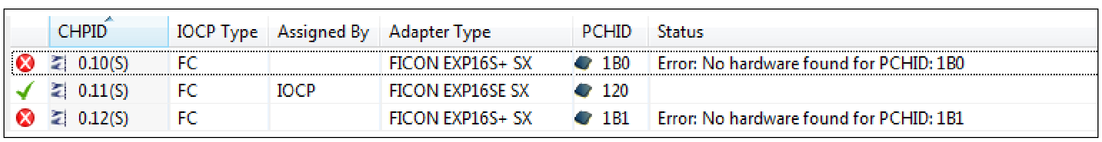
3. Return to the IODF and change the CHID values for the OSD CHPIDs (or any other CHPIDs that have no supporting hardware in the `CFReport`) to an asterisk (*).
4. Revalidate the IODF by using HCD option 2.12.
5. Re-create the IOCP statements file and transfer it to your workstation.
6. Import the IOCP file by right-clicking the Projects window and selecting **Import IOCP File**.

Tip: If you look at the IOCP statements file now, although the OSD CHPIDs are omitted from the file, but they are still defined in the IODF.

Now, when you click **Reset "*Channel-Type* is not compatible with IOCP_*type*"**, the CMT prompts you to resolve some hardware errors.

4.7.2 Resetting "Error: No hardware found" Entries

An X in a red circle in the first column indicates an error, and the Status column shows the message `Error: No hardware found` (see Figure 4-23).

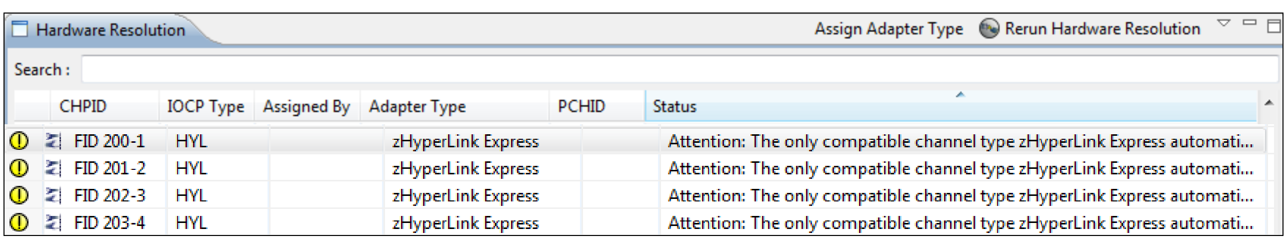


CHPID	IOCP Type	Assigned By	Adapter Type	PCHID	Status
0.10(S)	FC		FICON EXP16S+ SX	1B0	Error: No hardware found for PCHID: 1B0
0.11(S)	FC	IOCP	FICON EXP16SE SX	120	
0.12(S)	FC		FICON EXP16S+ SX	1B1	Error: No hardware found for PCHID: 1B1

Figure 4-23 Error: No Hardware found

In the example, select channel type **FC**. The status is `Error: No Hardware found`. Right-click in the row and select **Reset "No hardware found" Entries** to remove the CHID values for those rows.

The tool replaces the X with an **Attention** icon, changes the status message, and removes the CHID information (see Figure 4-24).



CHPID	IOCP Type	Assigned By	Adapter Type	PCHID	Status
FID 200-1	HYL		zHyperLink Express		Attention: The only compatible channel type zHyperLink Express automati...
FID 201-2	HYL		zHyperLink Express		Attention: The only compatible channel type zHyperLink Express automati...
FID 202-3	HYL		zHyperLink Express		Attention: The only compatible channel type zHyperLink Express automati...
FID 203-4	HYL		zHyperLink Express		Attention: The only compatible channel type zHyperLink Express automati...

Figure 4-24 Results of resetting "No hardware found"

4.7.3 Resetting "Select at least one adapter type"

The adapter type is not assigned to the current row. Assign an adapter type to the IOCP type by completing the following steps:

1. Click the **Adapter Type** column in the target row. The tool displays an arrow in the Channel Type column of the target row (see Figure 4-25).

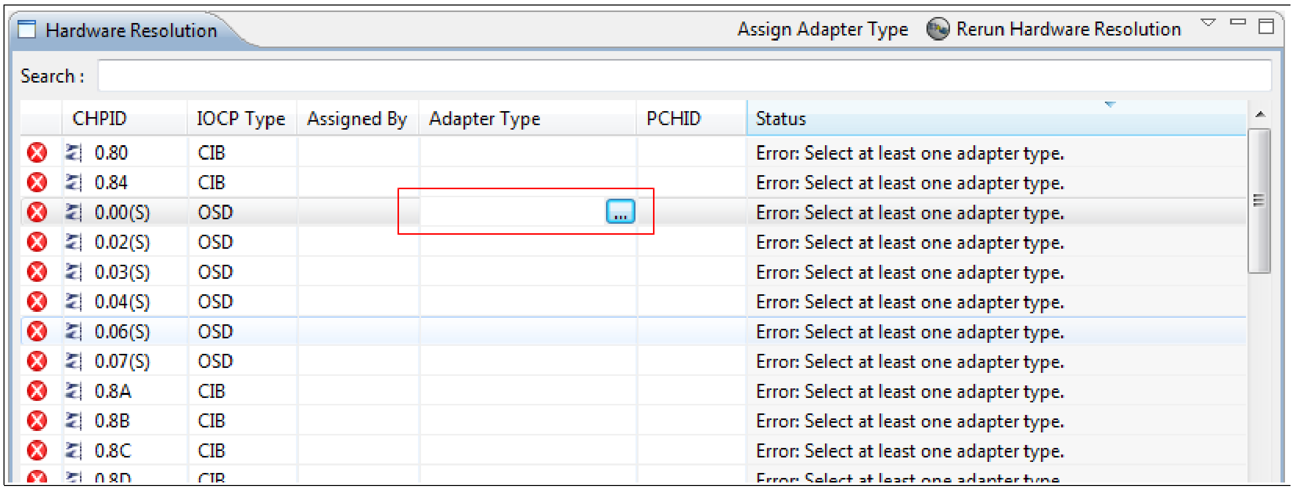


Figure 4-25 Selecting at least one adapter type

2. Click the **ellipses** (...) box.
3. The tool displays a list of available and compatible card types for the CHPID as shown in see Figure 4-26. Select an adapter type and click **OK**.
4. In the Adapter Type Summary tab, observe that the Used and Available totals change.

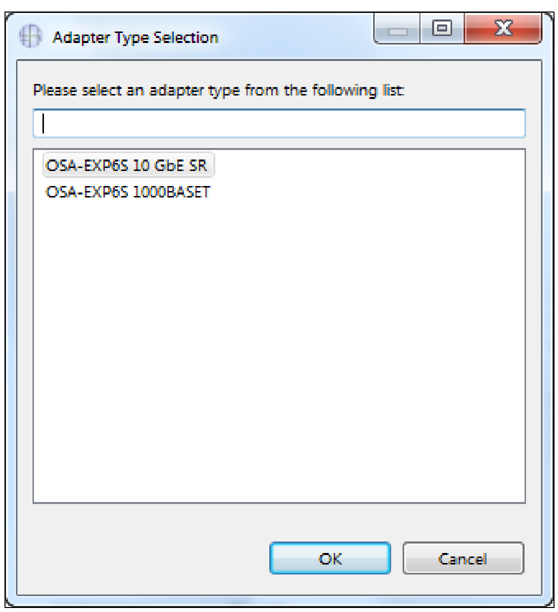


Figure 4-26 Adapter Type Selection

4.7.4 Resetting “Required hardware for type IOCP_type not available”

The CMT found no hardware for the specified IOCP type, as shown in this example message:

```
Required hardware for type CS5 not available.
```

You must change the IOCP file or obtain more hardware.

4.7.5 Resetting “CHID_1 moved to new channel ID: CHID_2”

When moving from old hardware to new hardware, for example, during a MES, the CHID value that is assigned to a feature can change. This message indicates that the IOCP file contains a CHID value for the old machine that is being removed. The CHID value is changed from the old machine to the CHID value for the new machine.

For example, *CHID_1* is the first CHID value representing the old hardware (for example, 1B0) and *CHID_2* is the new value representing the new hardware (for example, 533). In essence, the feature is present in both the old and new hardware, but its location (CHID) changed.

This status is an informational message. No hardware resolution is required. The message informs you of the new location so you can change it if you prefer a different assignment.

After you assign all Adapter Types, the **Manual Mapping** button becomes available.

4.8 Manual mapping to resolve CIB CHPIDs

In some situations, the Automatic Mapping option is not available. You cannot use automatic mapping until all CIB or CS5 CHPIDs are resolved. You can use manual mapping to resolve this task.

To resolve the CIB or CS5 CHPIDs, assign the available CHPIDs by completing the following steps:

1. Click **Manual Mapping** (see Figure 4-27).

Figure 4-27 Manual Mapping

2. Ensure that the tool is set to display Manual Mapping by clicking **Hardware** → **I/O** (see Figure 4-28).

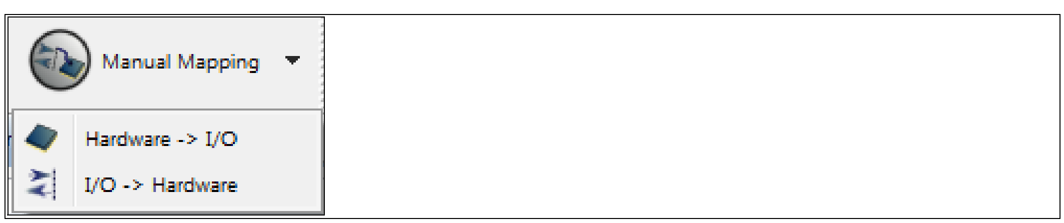


Figure 4-28 Manual Mapping of Hardware -> I/O

3. Click every row that has type Integrated Coupling Adapter Short Reach (ICA SR) in the Channel Type column. The tool displays all the available CHPIDs with IOCP type (see Figure 4-29).

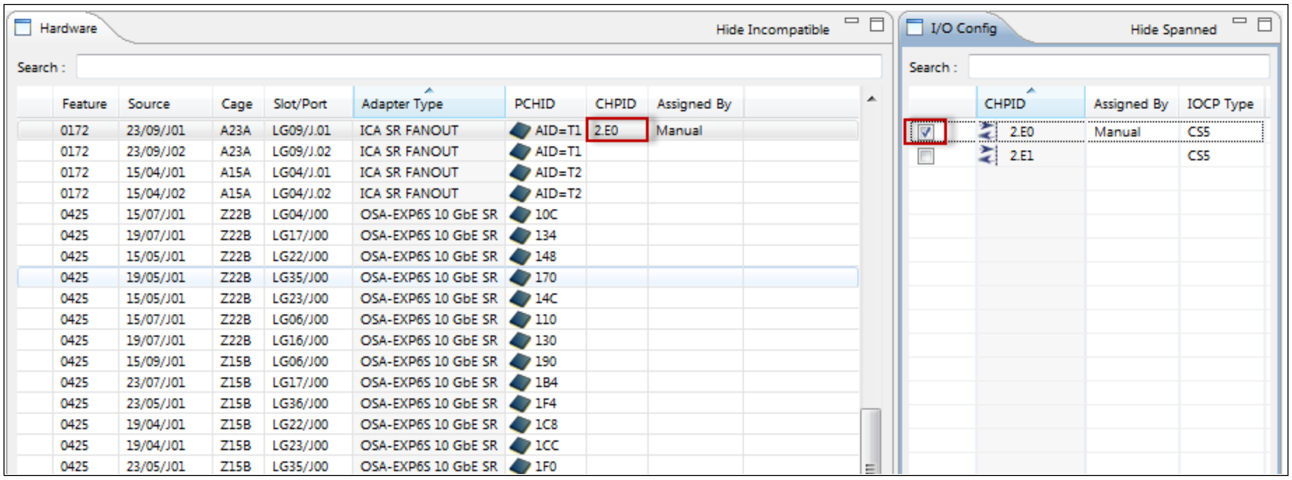


Figure 4-29 Adapter Type of HCA3 and associated CHPIDs that are assigned

4. Select one or more empty check boxes in the I/O Config pane to assign the CHPID. In the Hardware pane, the CHPID number is inserted in the CHPID column. In the Assigned By column, the value of Manual is inserted.

5. If you select more than one CHPID for an ICS SR adapter type, you see the Multiple --> value (see Figure 4-30) inserted into the CHPID and Assigned By columns.

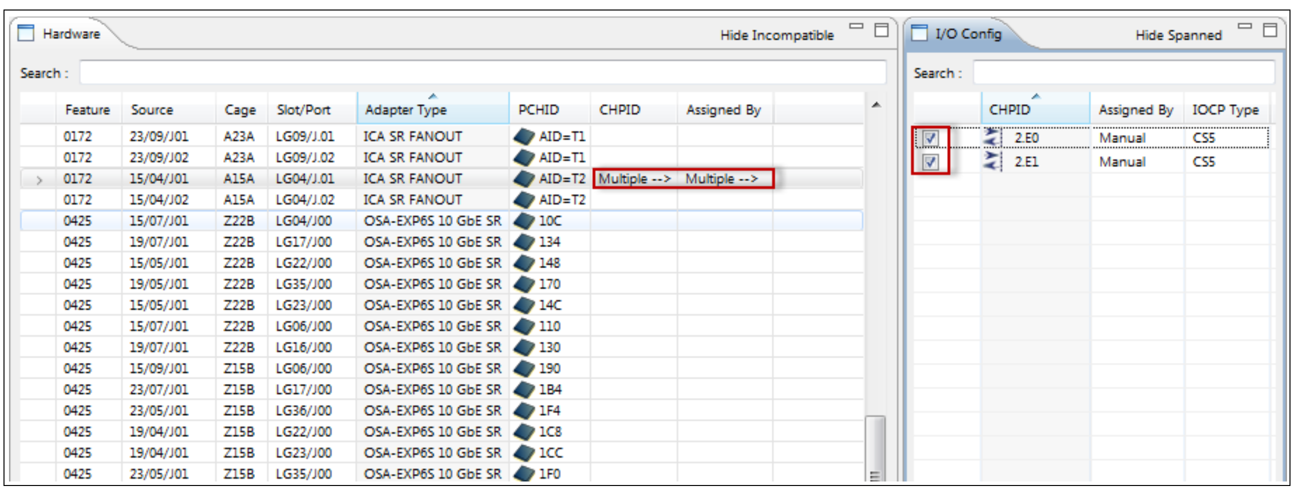


Figure 4-30 Adapter Type of HCA3 and associated multiple CHPID assigned

The **Automatic Mapping** button becomes available after you assign all the CHPIDs of IOCP type CIB or CS5.

4.9 Processing Automatic Mapping and CU Priority

If you are importing an IOCP statements file from a 2964 that had CU Priority values defined, review the CU Priority values first. The CMT can then perform the availability functions for a 3906.

You must assign priorities if you want to make some CUs more important (in the CMT processing order) than others, or have two (or more) CUs that you want the CMT to process at the same time.

Perform the first availability function by completing these steps:

1. Click **Automatic Mapping**.
2. The Reset CHPID Assignments window opens with Reset choices (see Figure 4-31). For the example, select the following two options and then click **OK**:
   - **Reset CHPIDs assigned by Automatic Mapping**
   - **Reset CHPIDs assigned by IOCP (Potential re-cabling required!)**

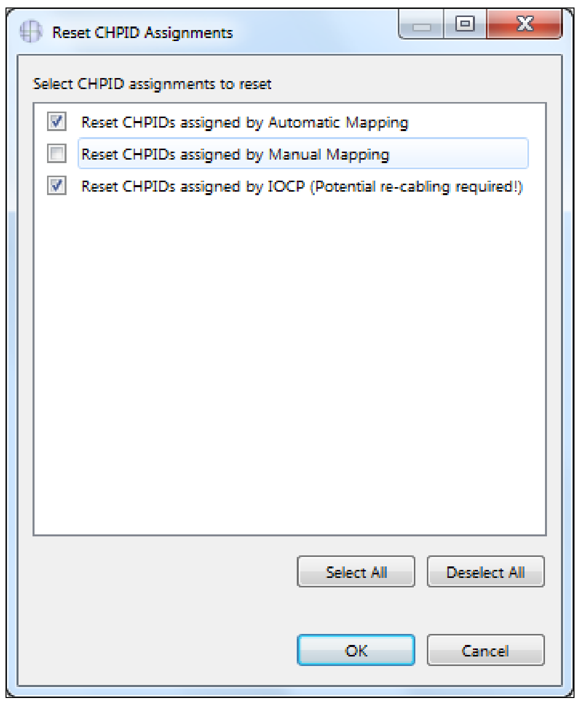


Figure 4-31 Resetting CHPID Assignments

> **Tip:** The following fourth choice is also available, but only for an upgrade or an MES:
>
> **Reset CHPIDs assigned by CMT for config files**

3. Click **OK** to confirm the reset (see Figure 4-32 on page 79).

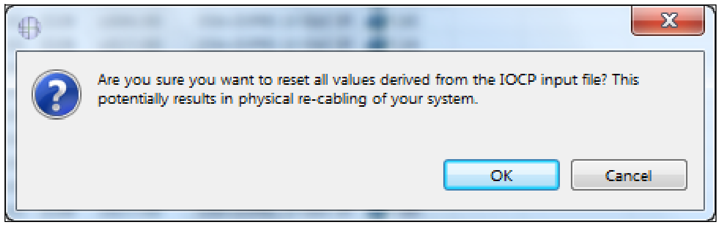


Figure 4-32 Resetting CHPID assignments warning message

4. The availability rules might differ from a 3906, so remove all CHID assignments that are still in the IOCP.
5. Click **OK**.
6. After the CMT resets the CHPIDs, it displays the result of the process (see Figure 4-33). Click **OK**.

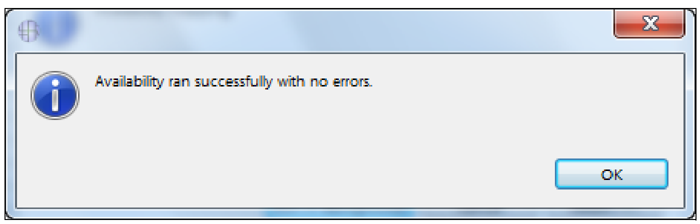


Figure 4-33 Availability ran successfully with no errors message

7. Click **OK** (see Figure 4-34).

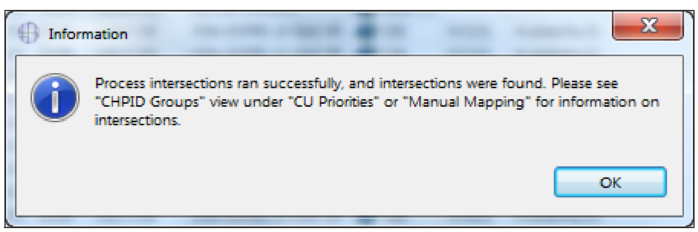


Figure 4-34 Process Intersections run successfully message

The possible intersects are as follows:

C Two or more assigned channels use the same channel card.

S More than half the assigned channels use the same InfiniBand or STI link.

M All assigned channels are supported by the same MBA group.

B More than half the assigned channels are supported by the same MBA Group.

D Assigned channels are on the same daughter card.

> **Tip:** Intersect messages inform you of a potential availability problem that is detected by the CMT. However, they do not necessarily indicate an error. It is your responsibility to evaluate whether the condition must be corrected.

8. Click **Manual Mapping**. In the CHPID Groups tab, observe any intersect warnings that were found during automatic mapping and decide whether they are acceptable (see Figure 4-35). The example returned the "C" intersect. This warning indicates that there are multiple definitions on the same I/O card.

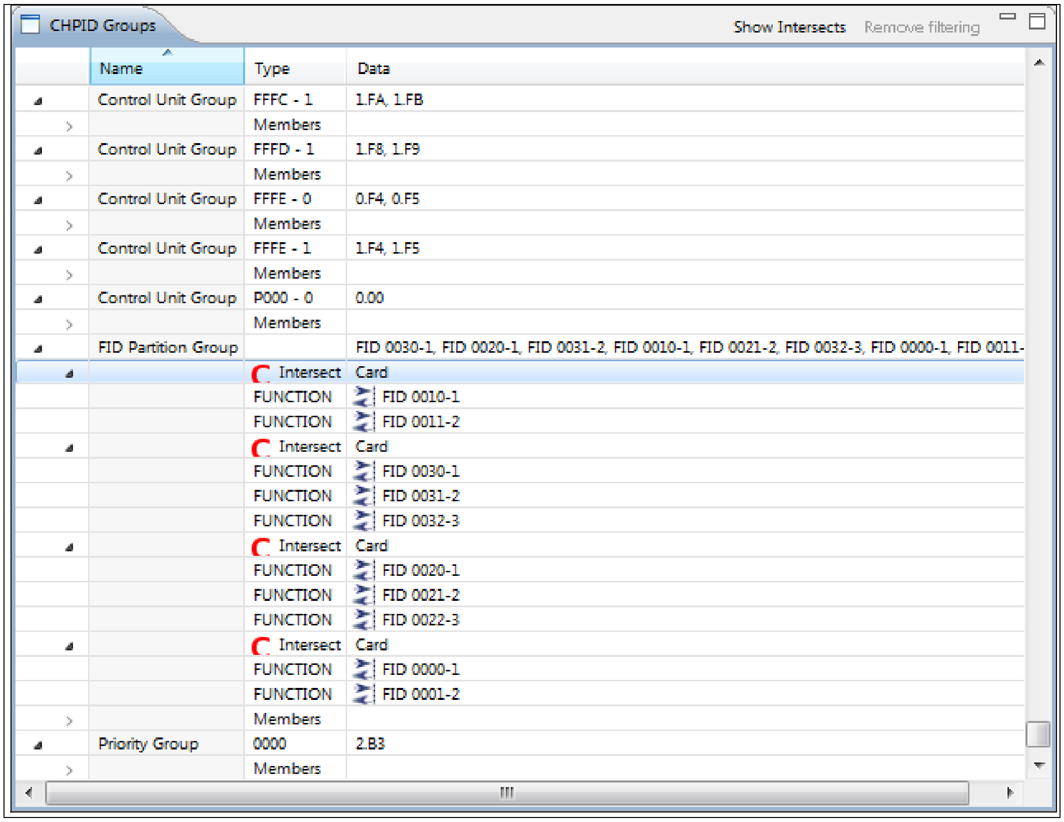


Figure 4-35 B Intersect examples

You can now display the results of the channel mapping. You can also sort the report in various ways. For example, you can see how the CMT ranked CUs.

Check and set values for items such as OSC CHPIDs and FICON CTC (FCTC) CHPIDs to ensure that the CMT allocates these CHPIDs with high CHID availability by completing the following steps:

1. Click **CU Priorities**. By default, this pane is in the center at the top.
2. In the CU Priorities pane, search in the CU Number column for the CUs that you want to set a priority for.
3. Type a priority number for the CU in the Priority column for each row. The CMT makes more related changes in the CHPID Groups panes.

4.10 CHPIDs not connected to control units

In the CU Priorities window, click in the **CU Number** column (see Figure 4-36). The CMT shows, at the end of the list, all CHPIDs that are defined in the IOCP input that are not connected to CUs. In the list of CU numbers, the letter “S” precedes all coupling CHPIDs, and the letter “P” precedes all non-coupling CHPIDs.

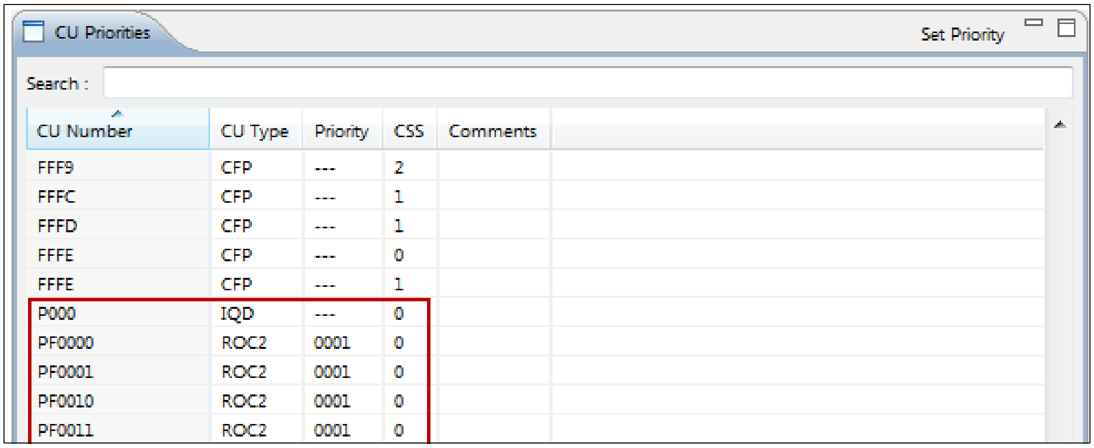


Figure 4-36 CHPIDs not connected to control units

Review the list for the following reasons:

- Perhaps you forgot to add a CHPID to a CU and must update the IOCP source before you continue in the CMT.
- The unconnected CHPIDs might be extra channels that you are ordering in anticipation of new CUs.
- The unconnected CHPIDs might be coupling links that are being used in Coupling Facility (CF) images (they do not require CUs).

If there are extra CHPIDs for anticipated new CUs, consider grouping these CHPIDs with a common priority. Having a common priority enables the availability mapping function to pick CHIDs that can afford your new CU availability.

4.11 Creating CHPID Mapping Tool reports

The CMT offers built-in reports, which are available from the top of the window. You can also print the information from the report by clicking **Print**. Figure 4-37 shows the options to create a Preview Report or Save Report.

Figure 4-37 Preview Report and Save Report buttons

Click **Preview Report** or **Save Report** to display choices (a list of types of reports). The choices are the same except that **Save Report** lists an extra selection (see Figure 4-38).

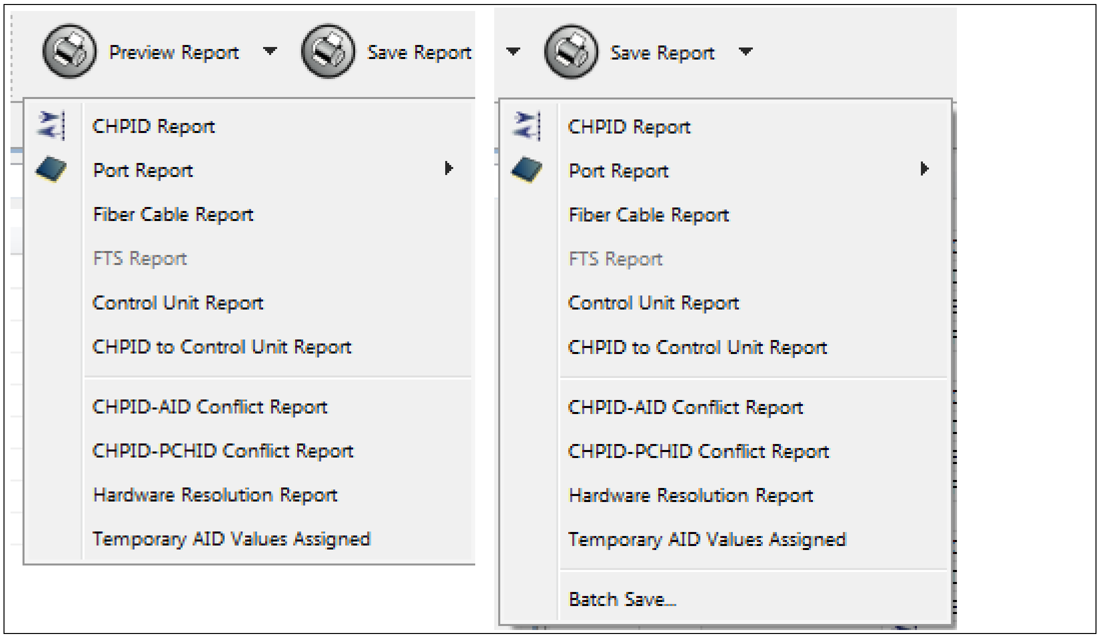


Figure 4-38 Preview Report and Save Report menus

For simplicity, only three reports are described in this example:

- The CHPID Report
- The Port Report sorted by location
- The CHPID to Control Unit Report

However, all built-in reports are printed in the same way.

The person who installs the I/O cables during system installation needs one of these reports. The Port Report sorted by location, is preferable. The installer can use this report to help with labeling the cables. The labels must include the CHID or cage/slot/port information before system delivery.

4.11.1 CHPID Report

To create the CHPID Report, complete the following steps:

1. Click **Preview Report** → **CHPID Report** (see Figure 4-39).

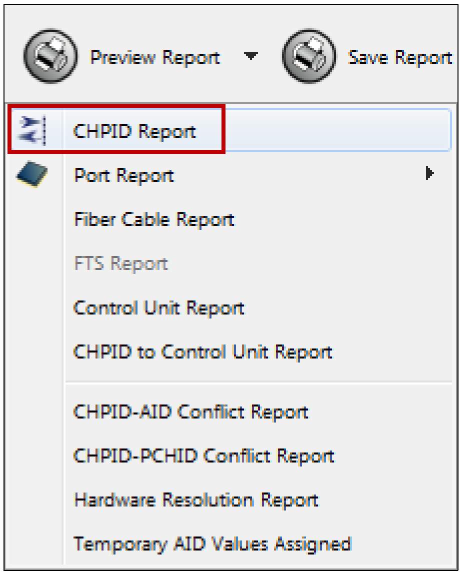


Figure 4-39 Preview report: CHPID Report

The CMT displays the CHPID Report in a **Report** tab within the CMT (see Figure 4-40).

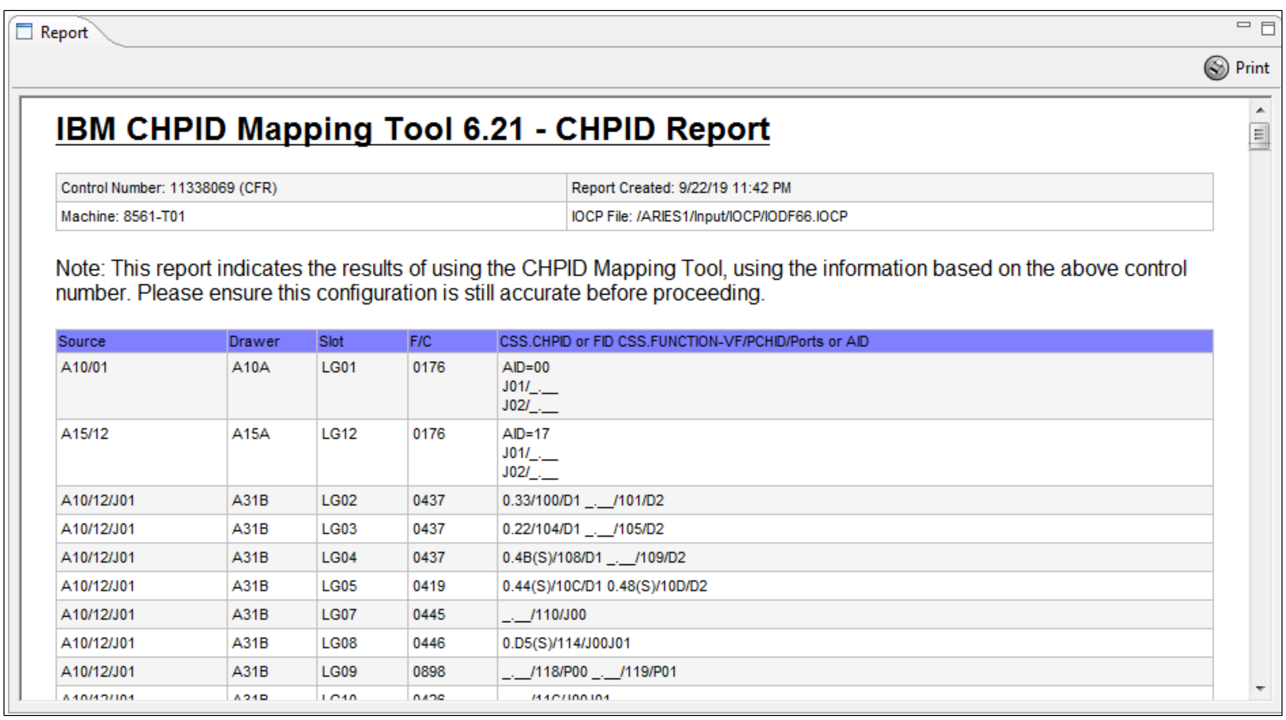


Figure 4-40 CHPID Report

> **Tip:** You can save individual reports as multiple reports in batch.

2. Click **Save Report**.

   In the example, when you click **CHPID Report**, an option window opens (see Figure 4-41). Specify a file name and an external path (location) of where to save the file. If you want to save the report in HTML, select **HTML**. The tool selects **PDF** by default. The window is similar for all type of reports. Click **Finish**.

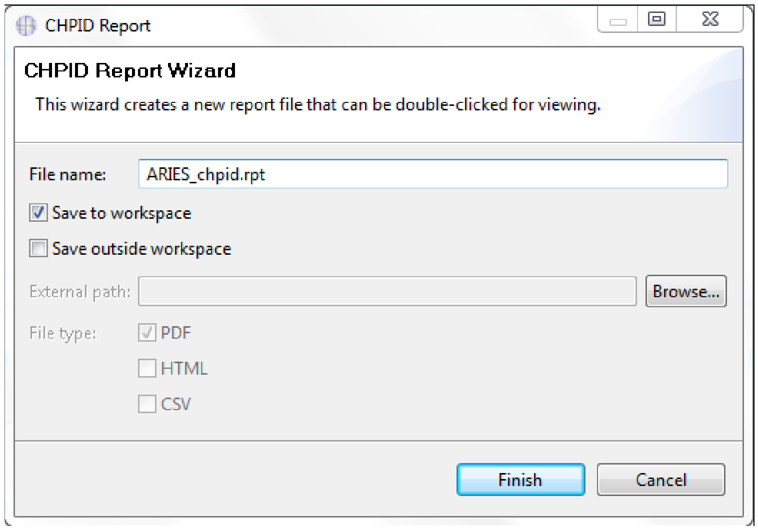
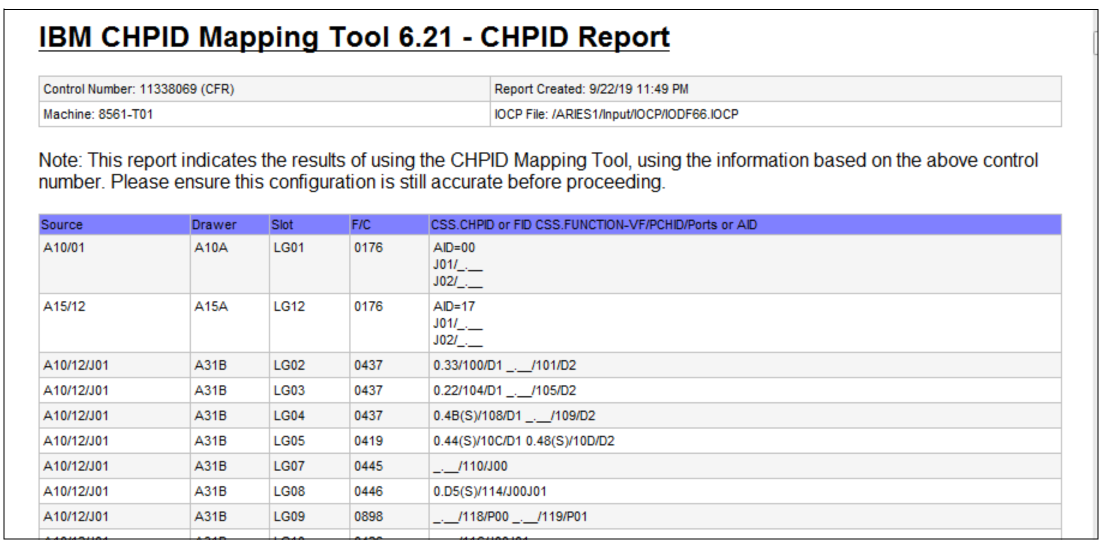


Figure 4-41 Saving the CHPID Report

The CHPID Report is created by the CMT (see Figure 4-42).



IBM CHPID Mapping Tool 6.21 - CHPID Report

Control Number: 11338069 (CFR)	Report Created: 9/22/19 11:49 PM
Machine: 8561-T01	IOCP File: /ARIES1/Input/IOCP/IODF66.IOCP

Note: This report indicates the results of using the CHPID Mapping Tool, using the information based on the above control number. Please ensure this configuration is still accurate before proceeding.

Source	Drawer	Slot	F/C	CSS.CHPID or FID CSS.FUNCTION-VF/PCHID/Ports or AID
A10/01	A10A	LG01	0176	AID=00 J01/_.__ J02/_.__
A15/12	A15A	LG12	0176	AID=17 J01/_.__ J02/_.__
A10/12/J01	A31B	LG02	0437	0.33/100/D1 _.__/101/D2
A10/12/J01	A31B	LG03	0437	0.22/104/D1 _.__/105/D2
A10/12/J01	A31B	LG04	0437	0.4B(S)/108/D1 _.__/109/D2
A10/12/J01	A31B	LG05	0419	0.44(S)/10C/D1 0.48(S)/10D/D2
A10/12/J01	A31B	LG07	0445	_.__/110/J00
A10/12/J01	A31B	LG08	0446	0.D5(S)/114/J00J01
A10/12/J01	A31B	LG09	0898	_.__/118/P00 _.__/119/P01

Figure 4-42 CHPID Report example in PDF format

At the end of this CHPID Report is a list of CHPIDs with modified CHID/AID assignments (see Figure 4-43). This report is valuable for moving cables.

CHPIDs or FUNCTIONs	Previous PCHID/AID-Port	PCHID/AID-Port	Current Location	F/C
0.10(S)	1B0	12C	A31BLG15D1	0437
0.11(S)	120	208	Z01BLG04D1	0437
0.12(S)	1B1	1E4	B17BLG13D1	0437
0.13(S)	121	184	B25BLG03D1	0437
0.22	100	104	A31BLG03D1	0437
0.23	180	204	Z01BLG03D1	0437
0.24	101	164	B33BLG13D1	0437
0.25	181	144	B33BLG03D1	0437
0.26	12C	200	Z01BLG02D1	0437

Figure 4-43 List of CHPIDs that have modified PCHID/AID assignments

4.11.2 CHPID to Port Report sorted by location

To create the Port Report sorted by location, click **Preview Report** → **Port Report** → **Sorted by Location**. The CMT displays the CHPID to Port Report in a **Report** tab within the CMT (see Figure 4-44).

IBM CHPID Mapping Tool 6.21 - CHPID to Port Report

Control Number: 11338069 (CFR)	Report Created: 9/22/19 11:55 PM
Machine: 8561-T01	IOCP File: /ARIES1/Input/IOCP/IODF66.IOCP

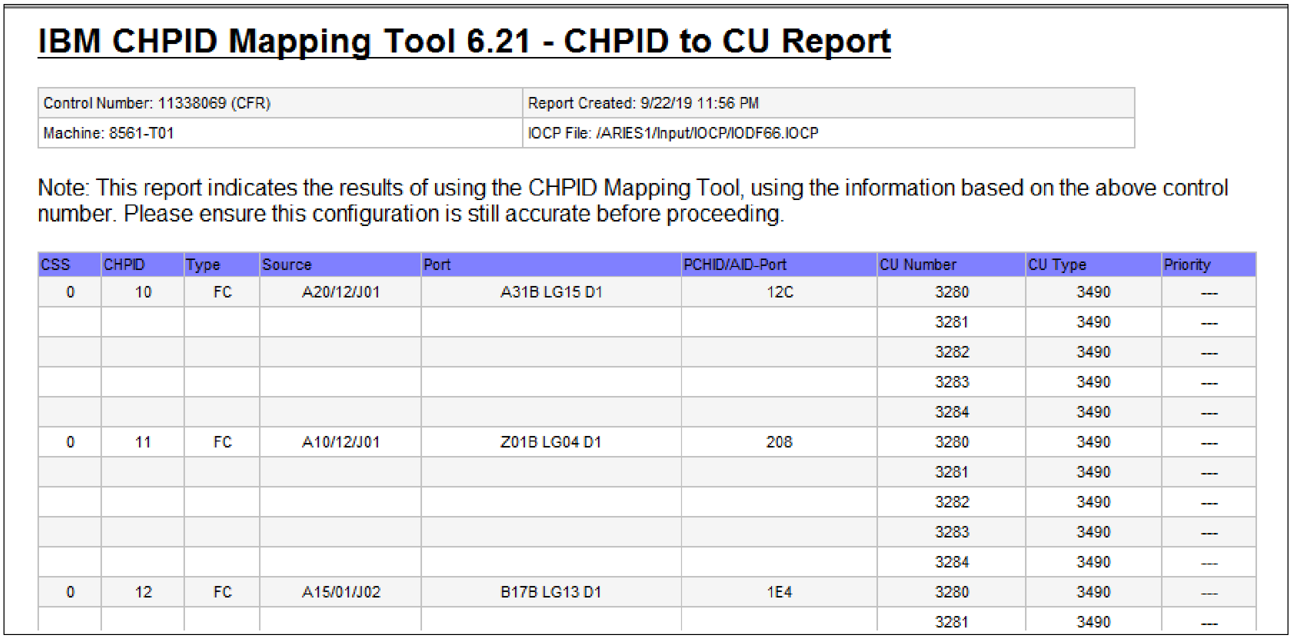
Note: This report indicates the results of using the CHPID Mapping Tool, using the information based on the above control number. Please ensure this configuration is still accurate before proceeding.

Frame / Cage	Slot or Fanout	AID or PCHID/Port	Source	Adapter Type	Assigned CHPID or Assigned FUNCTION	CHPID Origin or Function Origin
A10A	LG01	AID=00 / J.01	A10/01/J01	ICA SR FANOUT		
A10A	LG01	AID=00 / J.02	A10/01/J02	ICA SR FANOUT		
A15A	LG12	AID=17 / J.01	A15/12/J01	ICA SR FANOUT		
A15A	LG12	AID=17 / J.02	A15/12/J02	ICA SR FANOUT		
A31B	LG02	100 / D1	A10/12/J01	FICON EXP16SE SX	0.33	Availability
A31B	LG02	101 / D2	A10/12/J01	FICON EXP16SE SX		

Figure 4-44 CHPID to Port Report sorted by location

4.11.3 CHPID to CU Report

This report is created in way that is like the CHPID Report. Click **Preview Report** → **CHPID to Control Unit Report**. The CMT displays the CHPID to Control Unit Report in a **Report** tab within the CMT (see Figure 4-45).



IBM CHPID Mapping Tool 6.21 - CHPID to CU Report

Control Number: 11338069 (CFR)	Report Created: 9/22/19 11:56 PM
Machine: 8561-T01	IOCP File: /ARIES1/Input/IOCP/IODF66.IOCP

Note: This report indicates the results of using the CHPID Mapping Tool, using the information based on the above control number. Please ensure this configuration is still accurate before proceeding.

CSS	CHPID	Type	Source	Port	PCHID/AID-Port	CU Number	CU Type	Priority
0	10	FC	A20/12/J01	A31B LG15 D1	12C	3280	3490	---
						3281	3490	---
						3282	3490	---
						3283	3490	---
						3284	3490	---
0	11	FC	A10/12/J01	Z01B LG04 D1	208	3280	3490	---
						3281	3490	---
						3282	3490	---
						3283	3490	---
						3284	3490	---
0	12	FC	A15/01/J02	B17B LG13 D1	1E4	3280	3490	---
						3281	3490	---

Figure 4-45 CHPID to CU Report

4.12 Creating an updated IOCP file

Now, use CMT to create an updated IOCP file that must be imported back into the IODF by using HCD. This IOCP statements file now has CHIDs that are assigned to CHPIDs.

To create the IOCP, complete the following steps:

1. Select **File** → **Export IOCP input file** (see Figure 4-46).

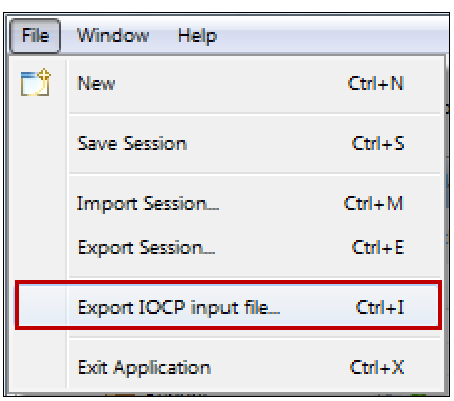


Figure 4-46 Export IOCP input file

2. Enter the Export Path and IOCP Name for the IOCP output file and click **Finish** (see Figure 4-47).

Requirement: This file must be uploaded to the z/OS image on which you have the work IODF that you used previously to create the IOCP input data set.

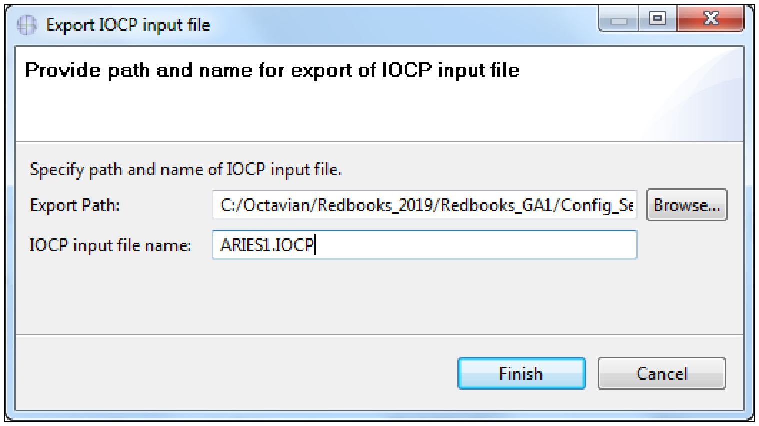


Figure 4-47 Exporting the IOCP File

3. Select **File** → **Save Session** (see Figure 4-48).

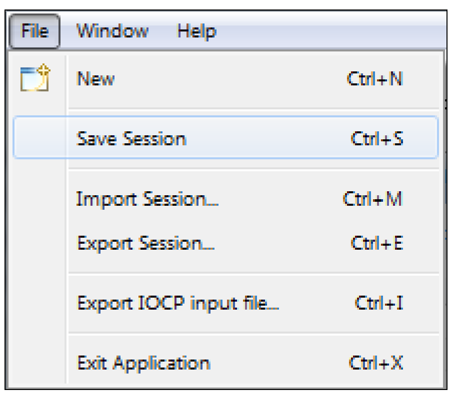


Figure 4-48 Save Session

You might want to save your project before exiting the CMT application.

4.13 Additional steps and processes

For your next steps, go to Chapter 5, “The production input/output definition file and setting up the central processor complex” on page 89.

5

The production input/output definition file and setting up the central processor complex

This chapter describes the tasks that are needed to build a production input/output definition file (IODF) and set up the central processor complex (CPC).

This chapter includes the following sections:

- Building the new production IODF
- Writing the input/out configuration program to the old CPC by using HCD
- Creating a reset profile on the Support Element
- Creating an image profile on the Support Element
- Performing a Power on Reset on the new CPC
- Building and verifying Load (IPL) profiles
- Building and verifying LOADxx members in SYS#.IPLPARM
- Communicating information about the new CPC

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

5.1 Building the new production IODF

To use the definitions that were updated in Hardware Configuration Definition (HCD), create a production IODF from your work IODF. Then, write the IODF to the input/output configuration data set (IOCDS) by using Write IOCDS in preparation for the upgrade.

Complete the following steps:

1. From the HCD main panel, select option `2. Activate or process configuration data` (see Figure 5-1).

```
                       z/OS V2.4 HCD
Command ===> _____________________________________________________

                           Hardware Configuration

Select one of the following.

2   0.  Edit profile options and policies
    1.  Define, modify, or view configuration data
    2.  Activate or process configuration data
    3.  Print or compare configuration data
    4.  Create or view graphical configuration report
    5.  Migrate configuration data
    6.  Maintain I/O definition files
    7.  Query supported hardware and installed UIMs
    8.  Getting started with this dialog
    9.  What's new in this release

For options 1 to 5, specify the name of the IODF to be used.

I/O definition file . . . 'SYS6.IODF66.WORK'                     +
```

Figure 5-1 Hardware Configuration: Activate or process configuration data

2. The Activate or Process Configuration Data panel opens (see Figure 5-2). Select option `1. Build production I/O definition file`, and then press Enter.

```
+------ Activate or Process Configuration Data ------+
|                                                     |
|                                                     |
| Select one of the following tasks.                  |
|                                                     |
| 1   1.  Build production I/O definition file        |
|     2.  Build IOCDS                                 |
|     3.  Build IOCP input data set                   |
|     4.  Create JES3 initialization stream data      |
|     5.  View active configuration                   |
|     6.  Activate or verify configuration            |
|         dynamically                                 |
|     7.  Activate configuration sysplex-wide         |
|     8.  (no longer supported)                       |
|     9.  (no longer supported)                       |
|     10. Build I/O configuration data                |
|     11. Build and manage processor cluster          |
|         IOCDSs, IPL attributes and dynamic I/O      |
|         changes                                     |
|     12. Build validated work I/O definition file    |
|                                                     |
|  F1=Help     F2=Split    F3=Exit     F9=Swap        |
| F12=Cancel                                          |
+-----------------------------------------------------+
```

Figure 5-2 Activate or Process Configuration Data: Build production I/O definition file

3. HCD displays the Message List panel (see Figure 5-3). Verify that you have only severity “W” (warning) messages and that they are normal for the configuration. Correct any other messages that should not occur and try to build the production IODF again. Continue this process until you have no messages that indicate problems.

```
+------------------------------- Message List --------------------------------
|   Save  Query  Help
| --------------------------------------------------------------------------
|                                                                Row 1 of 99
| Command ===> ___________________________________________ Scroll ===> CSR
|
| Messages are sorted by severity. Select one or more, then press Enter.
|
| / Sev Msg. ID  Message Text
| _ W   CBDG098I For operating system DBSV4SU4 and device type OSA the
| #              default of LOCANY=YES is not used for following device
| #              group(s): 1910,16 1930,16
| _ W   CBDG098I For operating system DBSV5SU4 and device type OSA the
| #              default of LOCANY=YES is not used for following device
| #              group(s): 1910,16 1930,16
| _ W   CBDG098I For operating system DBSV6SU4 and device type OSA the
| #              default of LOCANY=YES is not used for following device
| #              group(s): 1910,16 1930,16
| _ W   CBDG098I For operating system PERF4SU4 and device type OSA the
| #              default of LOCANY=YES is not used for following device
|  F1=Help        F2=Split       F3=Exit        F4=Prompt      F5=Reset
|  F7=Backward    F8=Forward     F9=Swap       F10=Actions    F12=Cancel
| F13=Instruct   F22=Command
+-----------------------------------------------------------------------------
```

Figure 5-3 Message List: Building production IODF

4. Press PF3 to continue.
5. The Build Production I/O Definition File panel opens (see Figure 5-4). Complete the Production IODF name and Volume serial number fields, and then press Enter.

```
+-------------- Build Production I/O Definition File ---------------+
|                                                                    |
|                                                                    |
| Specify the following values, and choose how to continue.         |
|                                                                    |
| Work IODF name . . . : 'SYS6.IODF66.WORK'                         |
|                                                                    |
| Production IODF name . 'SYS6.IODF67'________________________      |
| Volume serial number . IODFPK  +                                  |
|                                                                    |
| Continue using as current IODF:                                   |
| 2   1.  The work IODF in use at present                           |
|     2.  The new production IODF specified above                   |
|                                                                    |
|                                                                    |
|                                                                    |
|  F1=Help    F2=Split   F3=Exit    F4=Prompt  F9=Swap   F12=Cancel |
+--------------------------------------------------------------------+
```

Figure 5-4 Build Production I/O Definition File: Data fields to be updated

6. The Define Descriptor Fields panel opens (see Figure 5-5). Press Enter to accept the descriptor fields that are selected by HCD, or enter different values and then press Enter.

```
+-------------------- Define Descriptor Fields --------------------+
|                                                                  |
|                                                                  |
| Specify or revise the following values.                          |
|                                                                  |
| Production IODF name  . : 'SYS6.IODF67'                          |
|                                                                  |
| Descriptor field 1  . . . SYS6                                   |
| Descriptor field 2  . . . IODF67                                 |
|  F1=Help      F2=Split     F3=Exit      F5=Reset     F9=Swap     |
| F12=Cancel                                                       |
+------------------------------------------------------------------+
```

Figure 5-5 Define Descriptor Fields: Data fields to be updated

HCD displays the following message, which indicates that the production IODF was successfully created:

```
Production IODF SYS6.IODF67 created.
```

To implement the configuration on the 3906 processor in preparation for its upgrade to an 8561 processor, go to 5.2, “Writing the input/out configuration program to the old CPC by using HCD” on page 93.

5.2 Writing the input/out configuration program to the old CPC by using HCD

Now that you have a production IODF that is named `SYS6.IODF67`, you can now write the input/out configuration program (IOCP) data from the IODF to the IOCDS on the CPC that you want to upgrade (for example, CETUS).

The IOCDS are available for Power on Reset (POR) after the processor is upgraded.

To update the IOCDS by using HCD option 2.11, complete the following steps:

1. From the HCD main panel, select option `2. Activate or process configuration data` (see Figure 5-6). Ensure that the IODF is the production IODF that was created in 5.1, "Building the new production IODF" on page 90, and then press Enter.

```
                       z/OS V2.4 HCD
Command ===> _____________________________________________________

                           Hardware Configuration

Select one of the following.

2_  0.  Edit profile options and policies
    1.  Define, modify, or view configuration data
    2.  Activate or process configuration data
    3.  Print or compare configuration data
    4.  Create or view graphical configuration report
    5.  Migrate configuration data
    6.  Maintain I/O definition files
    7.  Query supported hardware and installed UIMs
    8.  Getting started with this dialog
    9.  What's new in this release

For options 1 to 5, specify the name of the IODF to be used.

I/O definition file . . . 'SYS6.IODF67'                          +
```

Figure 5-6 Hardware Configuration: Activate or process configuration data

2. The Activate or Process Configuration Data panel opens (see Figure 5-7). Select option `11. Build and manage System z cluster IOCDSs, IPL attributes and dynamic I/O changes`, and then press Enter.

```
+------ Activate or Process Configuration Data ------+
|                                                     |
|                                                     |
| Select one of the following tasks.                  |
|                                                     |
| 11  1.  Build production I/O definition file        |
|     2.  Build IOCDS                                 |
|     3.  Build IOCP input data set                   |
|     4.  Create JES3 initialization stream data      |
|     5.  View active configuration                   |
|     6.  Activate or verify configuration            |
|         dynamically                                 |
|     7.  Activate configuration sysplex-wide         |
|     8.  (no longer supported)                       |
|     9.  (no longer supported)                       |
|     10. Build I/O configuration data                |
|     11. Build and manage processor cluster          |
|         IOCDSs, IPL attributes and dynamic I/O      |
|         changes                                     |
|     12. Build validated work I/O definition file    |
|                                                     |
|  F1=Help     F2=Split    F3=Exit     F9=Swap        |
| F12=Cancel                                          |
+-----------------------------------------------------+
```

Figure 5-7 Activate or Process Configuration data: Build and manage IBM System z® cluster IOCDSs, IPL attributes, and dynamic I/O changes

This example assumes that you have connectivity to the 3906 processor that is being upgraded over the Hardware Management Console (HMC) local area network (LAN) to write an IOCDS.

If the CPC being upgraded is not accessible from the HMC LAN, create a IOCP file from HCD, then use the stand-alone IOCP process to update the IOCDS.

You can create an IOCP file by using the same process that you used to create an IOCP file for the channel path ID (CHPID) Mapping Tool (CMT).

Tip: The Support Element (SE) can read an IOCP file that is written to a USB flash memory drive.

3. The Processor Cluster List panel opens (see Figure 5-8). In the list, select the 3906 processor being upgraded by typing a forward slash (/) to update one of its IOCDSs, and then press Enter.

```
                            Processor Cluster List                Row 1 of 4
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more CPCs, then press Enter.

  --------------CPC--------------   IODF
/ SNA Address        Type   Model   Processor ID
# IBM390PS.ARIES     8561   T01
/ IBM390PS.CETUS     3906   M04     ARIES
_ IBM390PS.LEPUS     2965   N20     LEPUS
_ IBM390PS.MUSCA     3907   ZR1     MUSCA
```

Figure 5-8 System z cluster List: Selecting a processor for IOCDS replace

4. The Actions on selected CPCs panel opens (see Figure 5-9). Select option `1. Work with IOCDSs`, and then press Enter.

```
+----------------- Actions on selected CPCs ------------------+
|                                                              |
|                                                              |
| Select by number or action code and press Enter.             |
|                                                              |
| 1_  1.  Work with IOCDSs . . . . . . . . . . (s)             |
|     2.  Work with IPL attributes . . . . . . (i)             |
|     3.  Select other processor configuration (p)             |
|     4.  Work with CPC images  . . . . . . . .(v)             |
|     5.  Activate hardware changes only . . . (a)             |
|     6.  View current active configuration . .(c)             |
|     7.  Download active configuration . . . .(d)             |
|                                                              |
|  F1=Help     F2=Split    F3=Exit     F9=Swap    F12=Cancel   |
+--------------------------------------------------------------+
```

Figure 5-9 Actions on selected CPCs: Work with IOCDSs

5. The IOCDS List panel opens (see Figure 5-10). Select the IOCDS that you want to update for the 3906 replacement by typing a forward slash (/) next to it, and then press Enter.

```
                                  IOCDS List         Row 1 of 4 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or a group of IOCDSs, then press Enter.

                                             -----Token Match----- Write
/ IOCDS       Name     Type   Status     IOCDS/HSA IOCDS/Proc. Protect
_ A0.ARIES    IODF65   LPAR   Alternate  No        No          No
_ A1.ARIES    IODF66   LPAR   POR        Yes       No          Yes-POR
_ A2.ARIES    IODF62   LPAR   Alternate  No        No          No
/ A3.ARIES    IODF63   LPAR   Alternate  No        No          No
```

Figure 5-10 IOCDS List: Selecting IOCDS for replacement

6. The Actions on selected IOCDSs panel opens (see Figure 5-11). Select option `1. Update IOCDS`, and then press Enter.

```
+---------------- Actions on selected IOCDSs -----------------+
|                                                             |
|                                                             |
| Select by number or action code and press Enter.            |
|                                                             |
| 1_  1.  Update IOCDS . . . . . . . . . . . . . (u)          |
|     2.  Switch IOCDS . . . . . . . . . . . . . (s)          |
|     3.  Enable write protection  . . . . . . . (e)          |
|     4.  Disable write protection . . . . . . . (w)          |
|                                                             |
|                                                             |
|  F1=Help     F2=Split    F3=Exit     F9=Swap    F12=Cancel  |
+-------------------------------------------------------------+
```

Figure 5-11 Actions on selected IOCDSs: Update IOCDS

7. The Build IOCDSs panel opens (see Figure 5-12). Verify that all the information is correct. Complete the `Title1` field, set `Write IOCDS in preparation of upgrade` to `Yes`, and then press Enter.

```
+------------------------------- Build IOCDSs --------------------------------+
|                                                                 Row 1 of 1 |
| Command ===> ___________________________________________ Scroll ===> CSR    |
|                                                                            |
| Specify or revise the following values.                                    |
|                                                                            |
| IODF name . . . . . . . . . : 'SYS6.IODF67'                                |
|                                                                            |
| Title1 . IODF67__________________________________________________________  |
| Title2 : SYS6.IODF67 - 2019-06-20 17:28                                    |
|                                                                            |
|                            Write IOCDS in                                  |
| IOCDS        Switch IOCDS  preparation of upgrade                          |
| A3.ARIES     No            Yes                                             |
| ***************************** Bottom of data ****************************** |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|  F1=Help       F2=Split       F3=Exit       F5=Reset       F7=Backward     |
|  F8=Forward    F9=Swap       F12=Cancel                                    |
+----------------------------------------------------------------------------+
```

Figure 5-12 Build IOCDSs: Verifying IODF

> **Tip:** Specifying `Yes` in the `Write IOCDS in preparation of upgrade` field is required only when you replace or upgrade the existing hardware and want to write the IOCDS for an 8561 processor from the existing hardware. The `Yes` value enables the writing of an IOCDS that contains information that the current hardware does not recognize.

8. Because `Yes` was specified for the `Write IOCDS in preparation of upgrade` field, HCD displays a confirmation panel (see Figure 5-13). Press Enter to continue.

```
+------------------------------- Build IOCDSs --------------------------------+
|                                                                              |
+---------- Confirm Write IOCDS in preparation of processor upgrade ----------+
|                                                                  Row 1 of 1 |
| Command ===> ___________________________________________ Scroll ===> CSR    |
|                                                                              |
| Scroll forward to view the complete list of IOCDSs which will be written    |
| regardless of processor type in preparation of a processor upgrade. Press   |
| F3 or F12 to cancel, press ENTER to confirm the write request.              |
|                                                                              |
| The processor receiving the IOCDS(s) must be a CMOS processor.              |
|                                                                              |
| You will not be able to perform a POR using the new IOCDS until your        |
| processor has been upgraded. Do not make the new IOCDS the active one on    |
| your processor. Do not activate any I/O configuration changes in the IODF   |
| until your processor has been upgraded. Keep the old processor definition   |
| in an IODF until after the upgrade.                                         |
|                                                                              |
| IOCDS                                                                        |
| A3.ARIES                                                                     |
| ***************************** Bottom of data ****************************** |
|                                                                              |
|                                                                              |
|  F1=Help       F2=Split      F3=Exit       F7=Backward    F8=Forward        |
|  F9=Swap      F12=Cancel    F22=Command                                     |
+-----------------------------------------------------------------------------+
```

Figure 5-13 Build IOCDSs: Confirm write IOCDS

9. The Job Statement Information panel opens (see Figure 5-14). Enter the job statements as required by the installation, and press Enter. HCD submits the job to update the IOCDS.

Tip: Route the job to run on the image to which you are logged on. In that way, you know that the image can “see” the new 8561 processor to update its IOCDS.

```
+------------------------- Job Statement Information -------------------------+
|                                                                              |
|                                                                              |
| Specify or revise the job statement information.                            |
|                                                                              |
|                                                                              |
| Job statement information                                                    |
| //WIOCP   JOB (ACCOUNT),'NAME',MSGCLASS=T                                    |
| //*                                                                          |
| //*                                                                          |
| //*                                                                          |
| //*                                                                          |
| //*                                                                          |
|  F1=Help       F2=Split      F3=Exit       F5=Reset      F6=Previous        |
|  F9=Swap      F12=Cancel                                                     |
+-----------------------------------------------------------------------------+
```

Figure 5-14 Job Statement Information: Option to override job statement cards

10. Verify the job output to ensure that the IOCDS was written without error and to the correct IOCDS. You receive the following messages:

```
ICP057I IOCP JOB WIOCP    SUCCESSFUL.  LEVEL A3 IOCDS REPLACED.

Sev  Msgid    Message Text
 I  CBDA674I  IOCP successfully completed for A3.ARIES.
```

11. Now, if you return to HCD option 2.11 and view the IOCDS, notice that the Systems Network Architecture (SNA) Address is still `IBM390PS.CETUS` (see Figure 5-15).

```
                            Processor Cluster List                 Row 1 of 4
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more CPCs, then press Enter.

  --------------CPC--------------   IODF
/ SNA Address        Type   Model   Processor ID
# IBM390PS.ARIES     8561   T01
_ IBM390PS.CETUS     3906   M04     ARIES
_ IBM390PS.LEPUS     2965   N20     LEPUS
_ IBM390PS.MUSCA     3907   ZR1     MUSCA
```

Figure 5-15 Processor Cluster List: Selecting processor for IOCDS verify

12. Also, when you select `IBM390PS.CETUS`, notice that IOCDS A3 (to which you wrote the upgrade IODF) has a status of `Invalid` (see Figure 5-16). This error occurs because you specified `Yes` for the `Write IOCDS in preparation for upgrade` field, and the IOCDS contains IOCP statements and code that are relevant only for an 8561 processor.

    The status switches when this processor is upgraded to an 8561 processor. The 3906 IOCDS status changes to `Alternate` and the 8561 IOCDSs changes to `Invalid`.

> **Tip:** Generally, rewrite the IOCDS that is written in preparation for the upgrade at your earliest convenience. Subsequent MESs might cause an IOCDS that is written in preparation for an upgrade to become invalid.

```
                              IOCDS List         Row 1 of 4 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or a group of IOCDSs, then press Enter.

                                             -----Token Match----- Write
/ IOCDS       Name     Type   Status     IOCDS/HSA IOCDS/Proc. Protect
_ A0.ARIES    IODF65   LPAR   Alternate  No        No          No
_ A1.ARIES    IODF66   LPAR   POR        Yes       No          Yes-POR
_ A2.ARIES    IODF62   LPAR   Alternate  No        No          No
_ A3.ARIES    IODF67   LPAR   Invalid    No        Yes         No
****************************** Bottom of data ******************************
```

Figure 5-16 IOCDS List: IOCDS verified with a status of Invalid

5.3 Creating a reset profile on the Support Element

To build and activate your reset profile by using the HMC, complete the steps in this section.

5.3.1 Background activities that occurred

The following activities must have occurred before you create a reset profile:

- The 3906 processor was upgraded to an 8561-T01 processor.
- A new HMC was installed with the correct driver level to support the 8561 processor, and it is connected to the customer HMC network.

The upgraded 8561 processor (in this example ARIES) was defined to the new HMC:

- The 3906 processor, now upgraded to an 8561 processor, underwent a POR with the Diagnostic (DEFAULT) IOCDS.
- The 8561 processor had a new IOCP written to its IOCDS from the IODF (IODF67) by using HCD Option 2.11.
- The 8561 processor is now ready to be customized with specific customer definitions.

5.3.2 Building the reset profile and pointing it to the required IOCDS

Now that the IOCP file is written to an IOCDS, build a reset (POR) profile to point to that IOCDS. This reset profile performs a POR for the new 8561 processor after it is upgraded and handed over from the IBM System Services Representative (IBM SSR).

To build the profile, complete the following steps:

1. Log on to the HMC workstation that is supplied with the 8561 processor with SYSPROG authority, or use a remote web browser and select the new 8561 processor.
2. Under Systems Management, click **Systems Management** to expand the list.
3. Under Systems Management, click the radio button next to the system to select it (in this example, **ARIES**).

4. In the Tasks window, click **Operational Customization** to expand it, and select **Customize/Delete Activation Profiles** (see Figure 5-17).

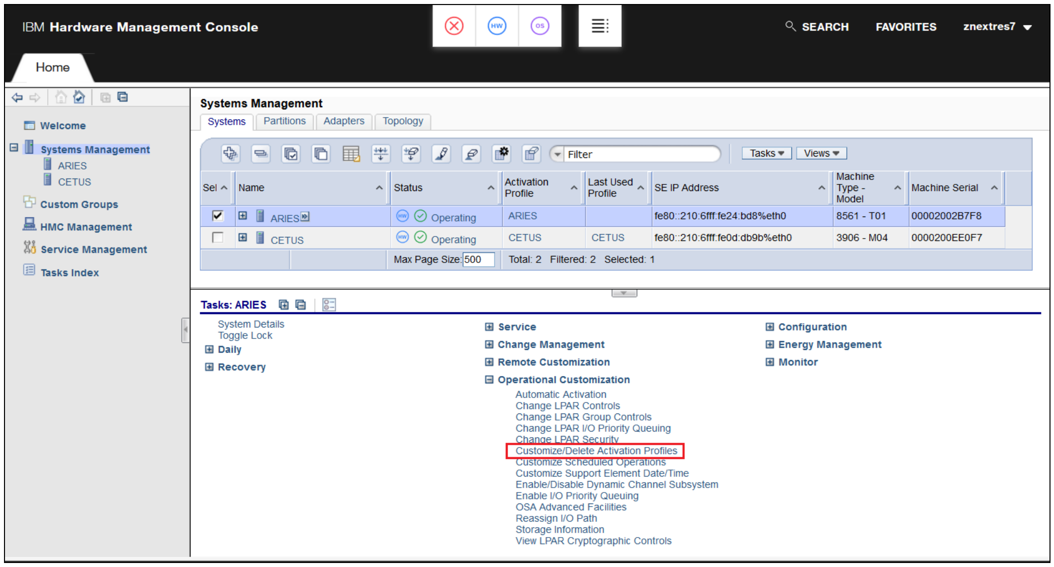


Figure 5-17 Customize/Delete Activation Profiles

5. Select the **DEFAULT** reset profile and click **Customize profile**.
6. Save this DEFAULT profile with a new profile name to be used when the POR is required (for example, TESTRESET).
7. Select the new **TESTRESET** profile and click **Customize profile**.
8. Click the IOCDS that you updated in the previous step. The ACTB0PDL message appears (see Figure 5-18).

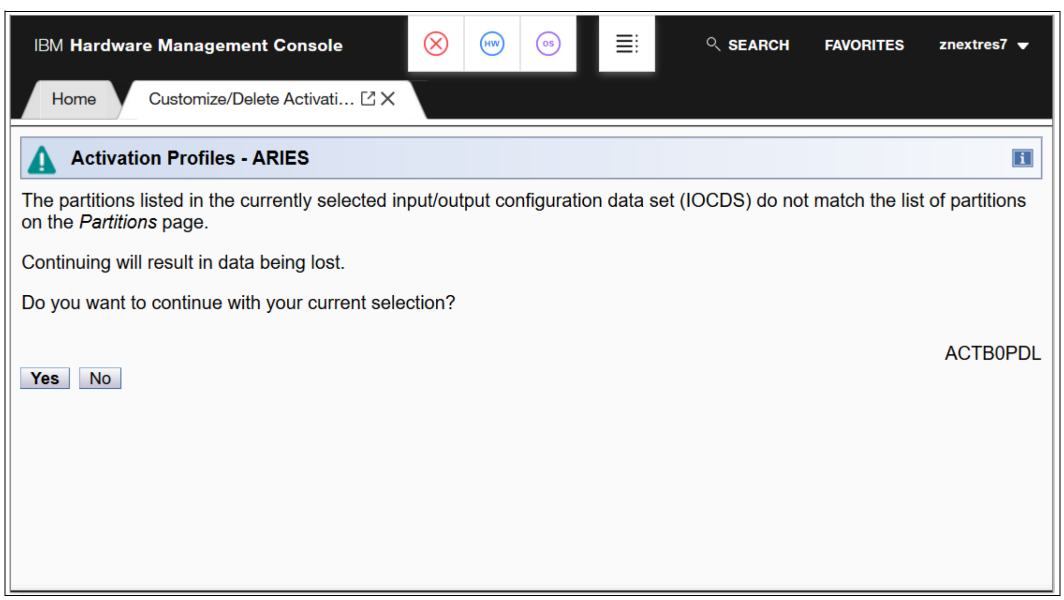


Figure 5-18 Activation Profiles: ACTB0PDL message

9. Depending on the circumstances, you can answer **Yes** or **No**. You might want to review the Partition Activation List now. For this example, click **Yes**.

10.The HMC retrieves any image profiles that match the logical partition (LPAR) names that are defined in the IOCDS that was selected. You can create image profiles for those LPAR names that it cannot retrieve.

In our example, we select **Automatically create all new images using the choices specified on this panel** and **Use the selected profile as a template when automatically creating new image profiles: DEFAULT**. Click **OK** (see Figure 5-19).

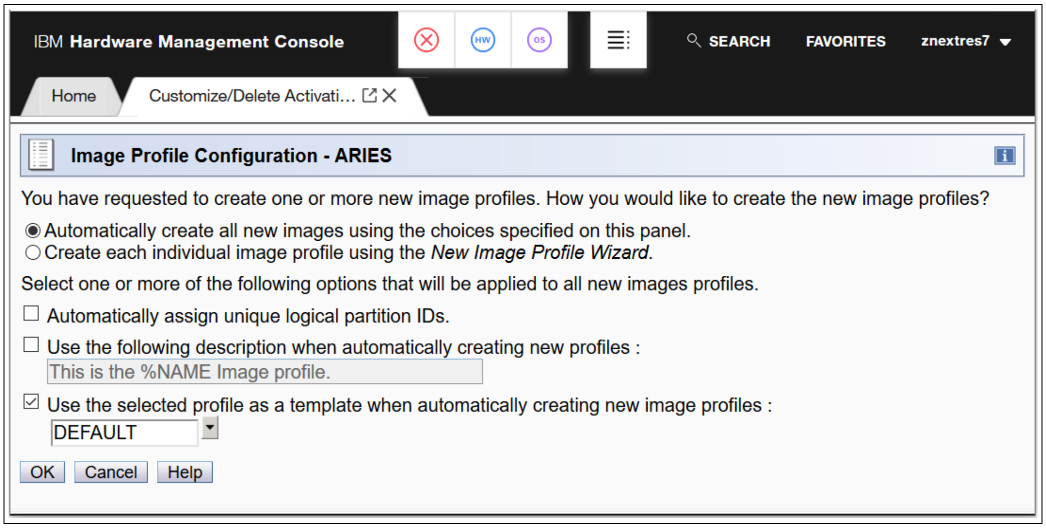


Figure 5-19 Image Profile automatic build options

11.Note the list of LPARs that were retrieved and built based on the LPARs that were defined in the selected IOCDS. Click **Save** (see Figure 5-20).

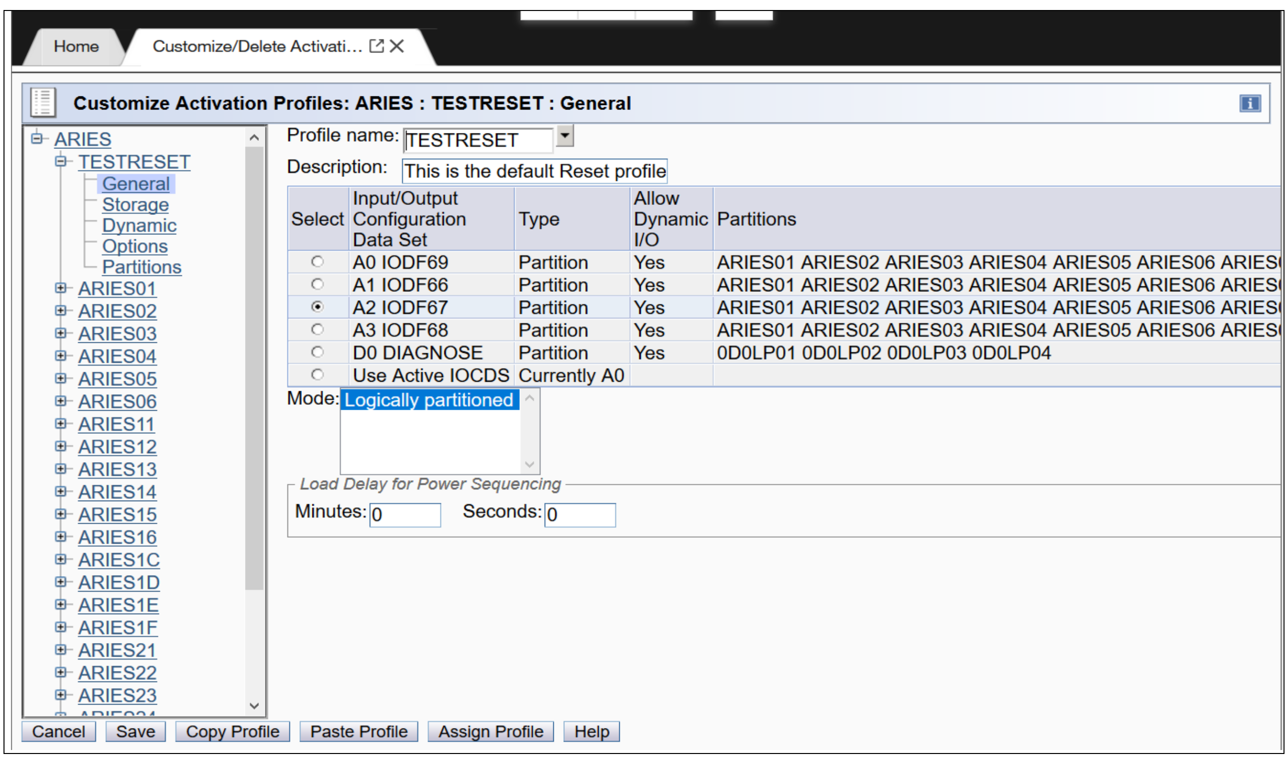


Figure 5-20 Reset and Image Profile list: Selecting IOCDS

For planning information, see Chapter 2, “Planning considerations” on page 7.

5.3.3 Setting up and verifying the reset profile

To set up and verify the reset profile, complete these steps:

1. Click **Partitions** to display the list of LPARs in the partition activation list.

   This window lists all the partitions that were retrieved by the automatic build for reset profile TESTRESET. The partition list also determines all the image profiles that would be activated if the CPC was POR.

   Here, you can tailor which image profiles are displayed and activated, and also the order of activation and the order in which they are displayed in the reset profile.

   Typing over or removing the number in the **Order** field determines how you want the Partitions in the reset profile to behave, that is, they are removed or the order is changed.

2. After you make your determinations, click **Save** (see Figure 5-21).

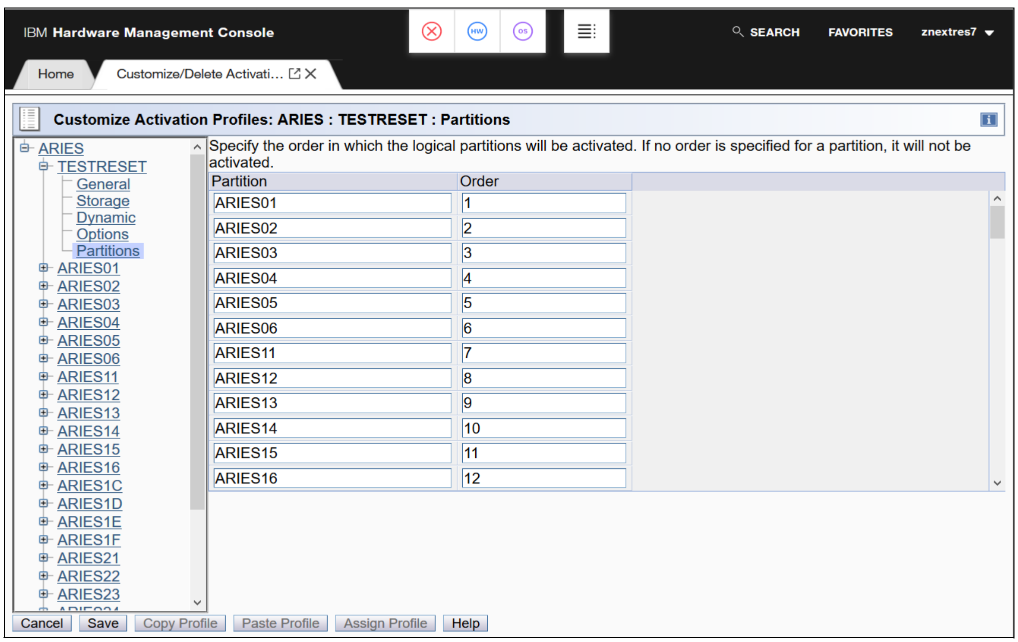


Figure 5-21 Reset and Image profile list: Updating the partition list

3. If you have any Coupling Facility (CF) partitions that are defined, HMC prompts whether you want to change the partition activation order because it is preferential but not essential that CF LPARs are activated before z/OS LPARs. Click **Yes** or **No** (see Figure 5-22).

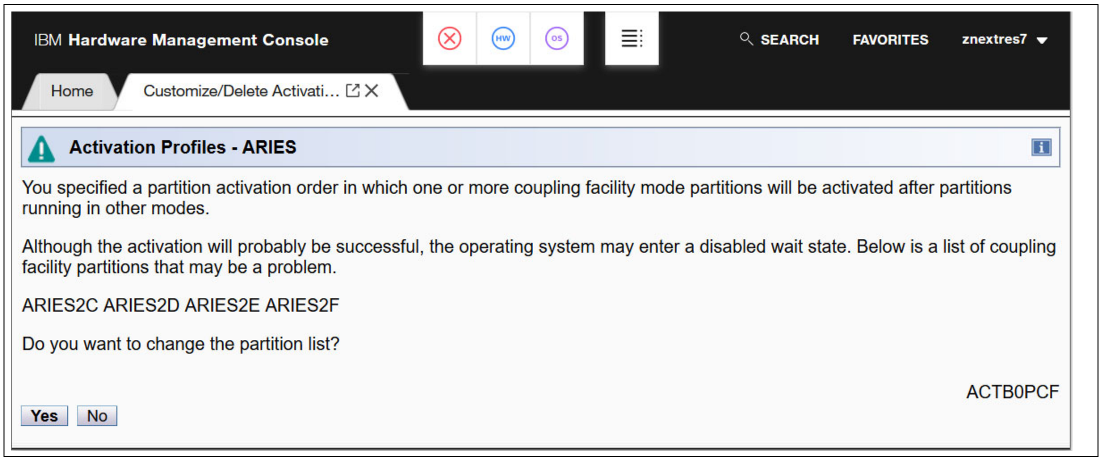


Figure 5-22 Reset and Image Profiles list: Coupling Facility LPAR verification

5.4 Creating an image profile on the Support Element

Image profiles contain all the specific parameters that relate to the partition, which include:

- General
- Processor
- Security
- Storage
- Options
- Load
- Crypto
- Time Offset

Click one of the image profiles to set up the partitions parameters. In our example, we select **ARIES21**.

5.4.1 Image Profile: General page

The General page is displayed first (see Figure 5-23 on page 105). Review the following settings:

- Description
- Partition identifier
- Mode
- Clock Type Assignment:
  - Standard time of day (TOD)
  - LPAR time offset

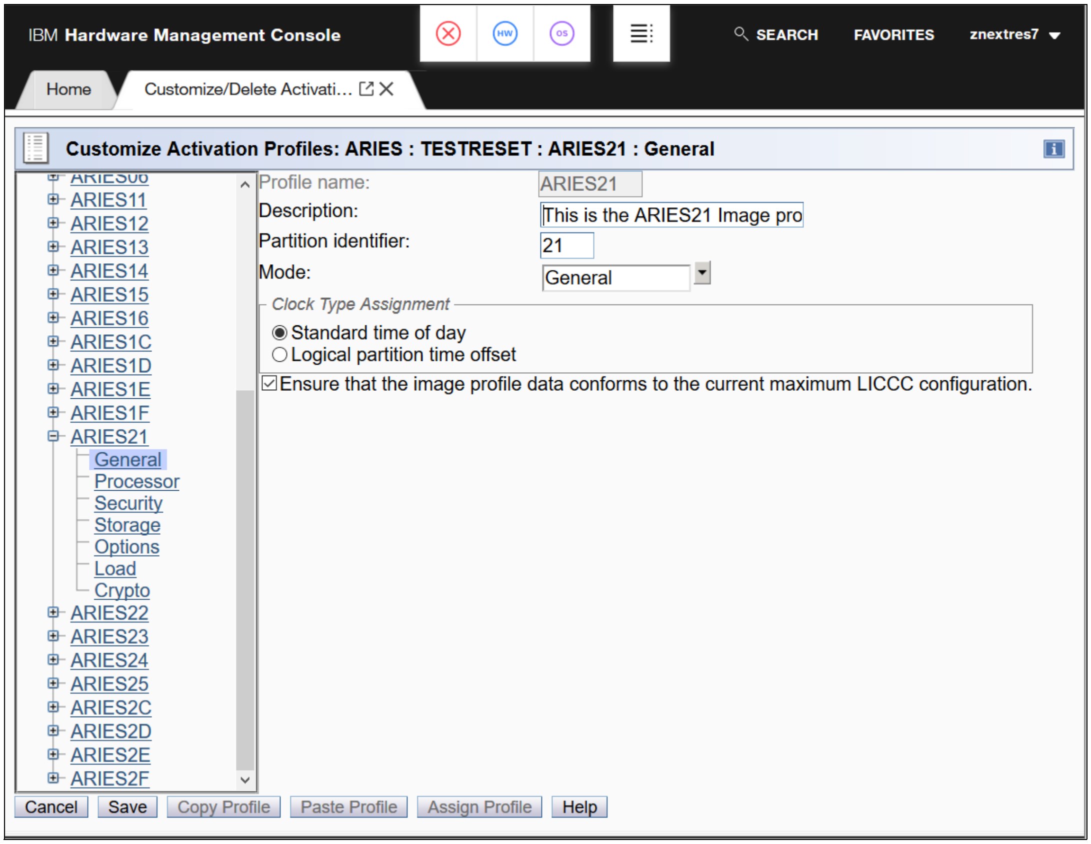


Figure 5-23 Image Profile: General

5.4.2 Image Profile: Processor page

Click the **Processor** link to set up the partition CPU and weight information (see Figure 5-24).

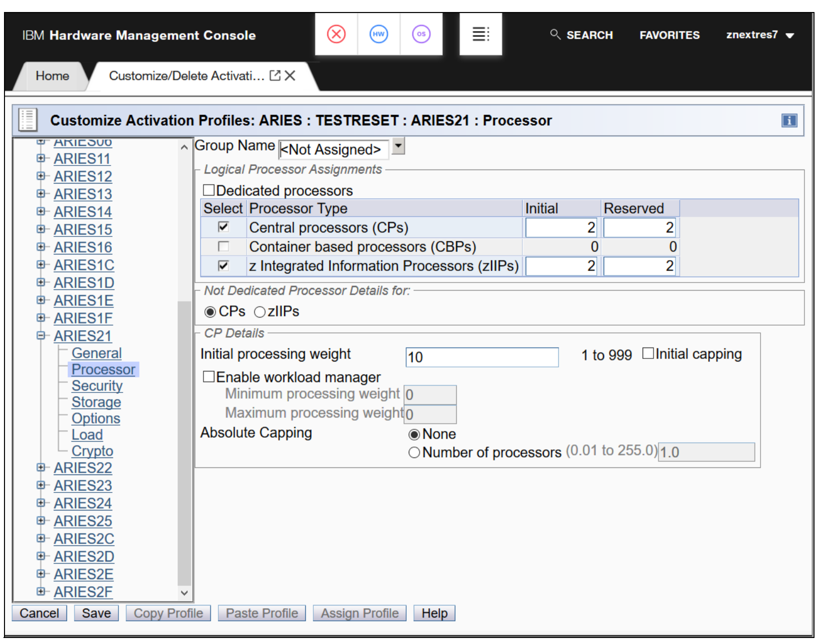


Figure 5-24 Image Profile: Processor

Review the following settings:

- Dedicated processors check box; Select first if you want to set dedicated CPs, IBM Z Integrated Information Processors (zIIPs), IFLs, or Internal Coupling Facilities (ICFs).
- Central processors (CPs) for Initial and Reserved
- Container-based processors (CBPs) for Initial and Reserved
- zIIPs for Initial and Reserved
- Not dedicated Processor Details for CPs, CBPs and zIIPs, IFLs, or ICFs
- Initial processing weight
- Initial capping
- Enable workload manager
- Absolute capping

5.4.3 Image Profile: Security page

Next, click the **Security** link to set up the partition security parameters (see Figure 5-25). Review the following settings:

- Partition Security Options
- BCPii Permissions
- Counter Facility Security Options
- Sampling Facility Security Options
- CFACF Key Management Options

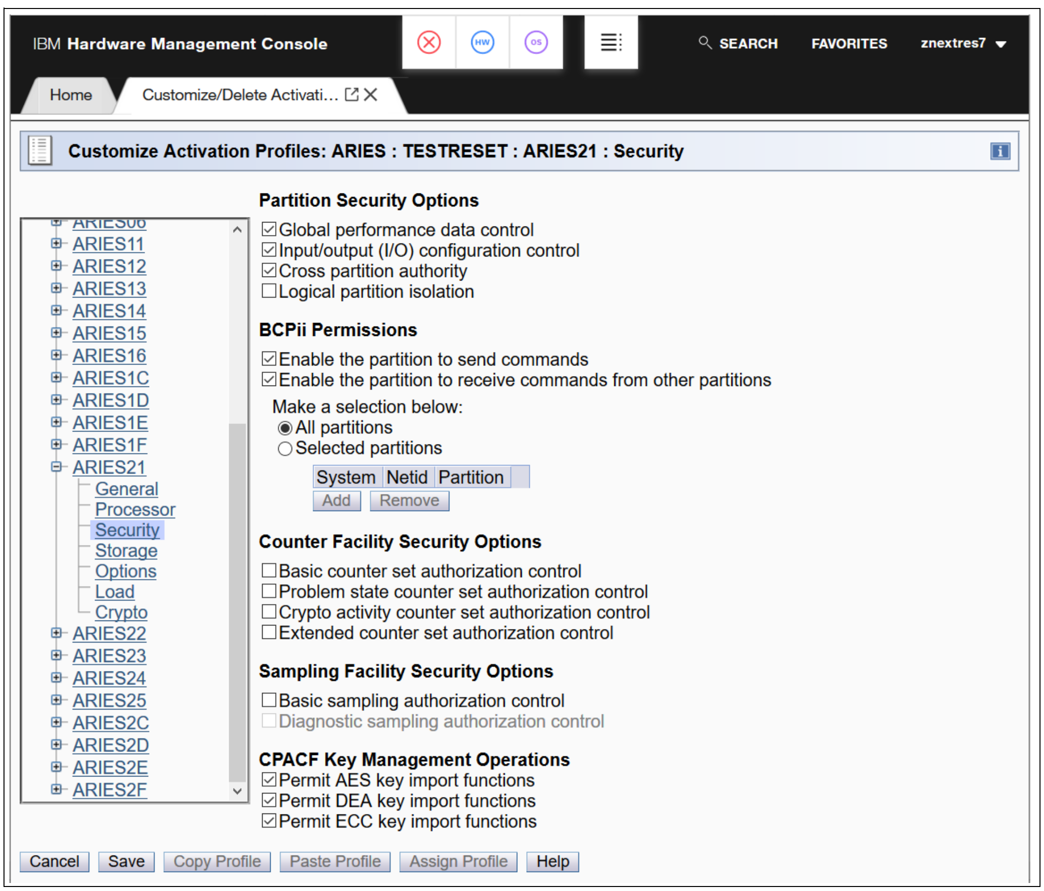


Figure 5-25 Image Profile: Security

5.4.4 Image Profile: Storage page

Click **Storage** to set up the partition Initial and Reserved storage and Virtual Flash Memory (VFM) Initial and Maximum values (see Figure 5-26). Review the following settings:

- Central Storage Amount, Initial, and Reserved
- Virtual Flash memory Initial and Maximum

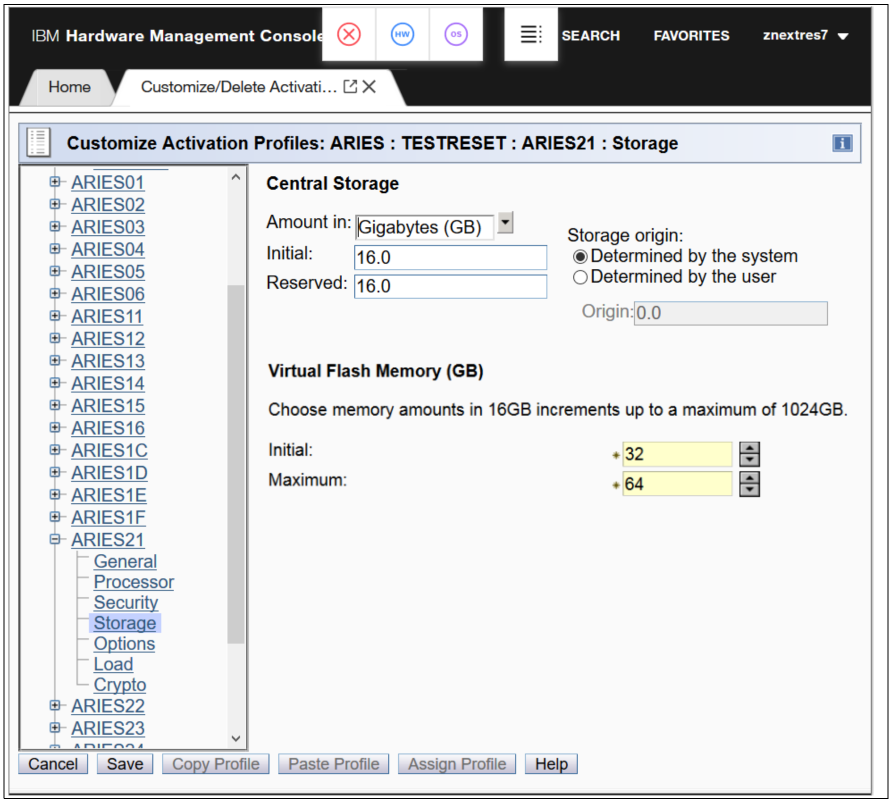


Figure 5-26 Image Profile: Storage

5.4.5 Image Profile: Options page

Click the **Options** link to set up the partitions defined capacity (see Figure 5-27). Review the following settings:

- Minimum input/output (I/O) priority
- Maximum input/output (I/O) priority
- Defined capacity
- Central processor (CP) management cluster name

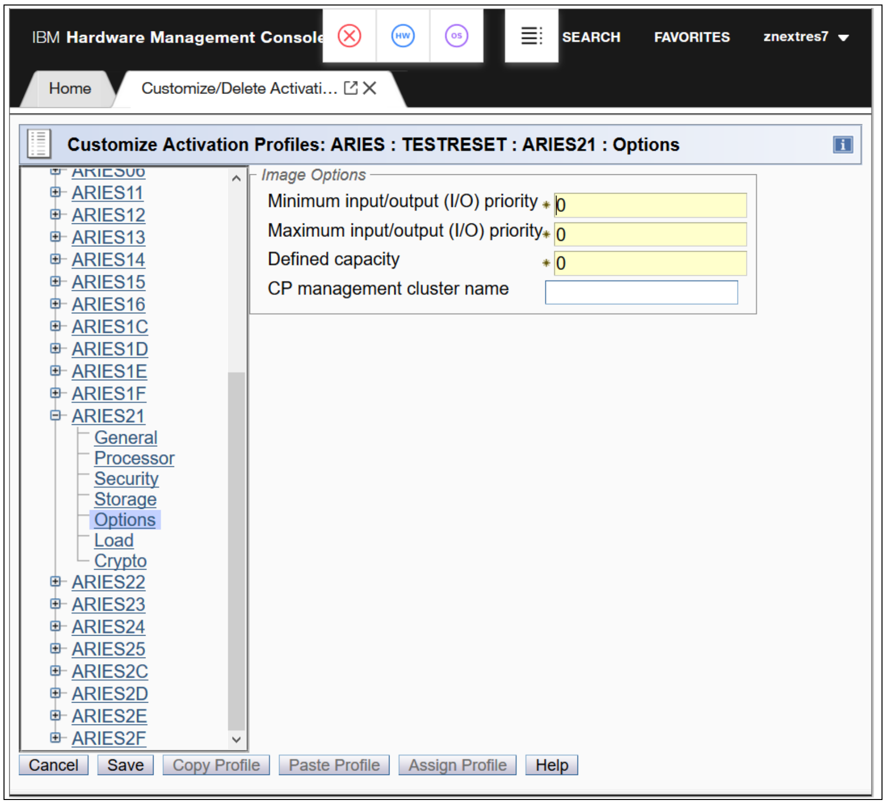


Figure 5-27 Image Profile: Options

5.4.6 Image Profile: Load page

Click the **Load** link if you want to set up any automatic load (IPL) parameters when the partition is activated by using a POR or image profile activation. If you prefer not to use IPL to load a z/OS system into a partition during a POR or image profile activation, then you can set up and activate load profiles, and then use them when they are required. This topic is mentioned in the following section (see Figure 5-28). Review the following settings:

- Load during activation check box, which determines whether the options in this panel are used.
- Load type.
- Load address.
- Time-out value.

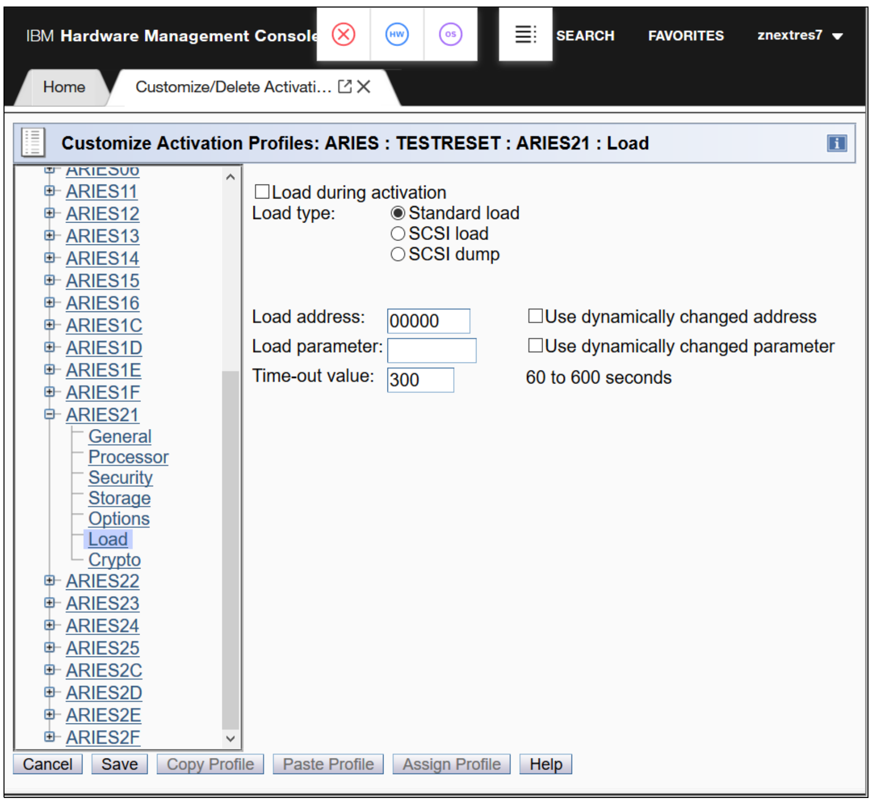


Figure 5-28 Image Profile: Load

5.4.7 Image Profile: Crypto page

Click the **Crypto** link to define the Crypto Domain Index IDs and the number of Crypto that are engines that are assigned to that Domain ID, and whether they are only a candidate or a candidate and online (see Figure 5-29). Review the following settings:

- Assigned Domains, which is where you first assign a Domain Index ID.
- Assigned Cryptos, which is where you assign which of and how many of the installed Crypto engines are assigned to the Domain ID and this partition.

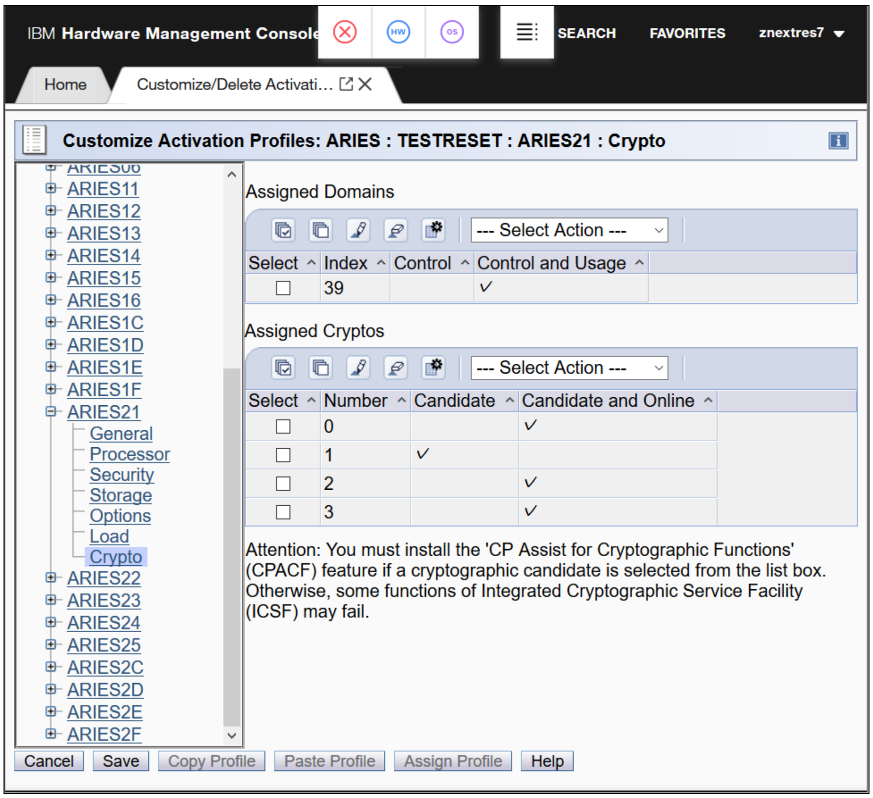


Figure 5-29 Image Profile: Crypto

5.4.8 Image Profile: Time Offset

If you selected **Logical partition time offset** in the General window, then an extra window opens in the image profile that is called Time Offset. Here, you can select the partitions time offset against the CPC time as set by the Server Time Protocol (STP) (see Figure 5-30). Review the following settings:

- Offset: Days, hours, and minutes
- Decrease or Increase time value

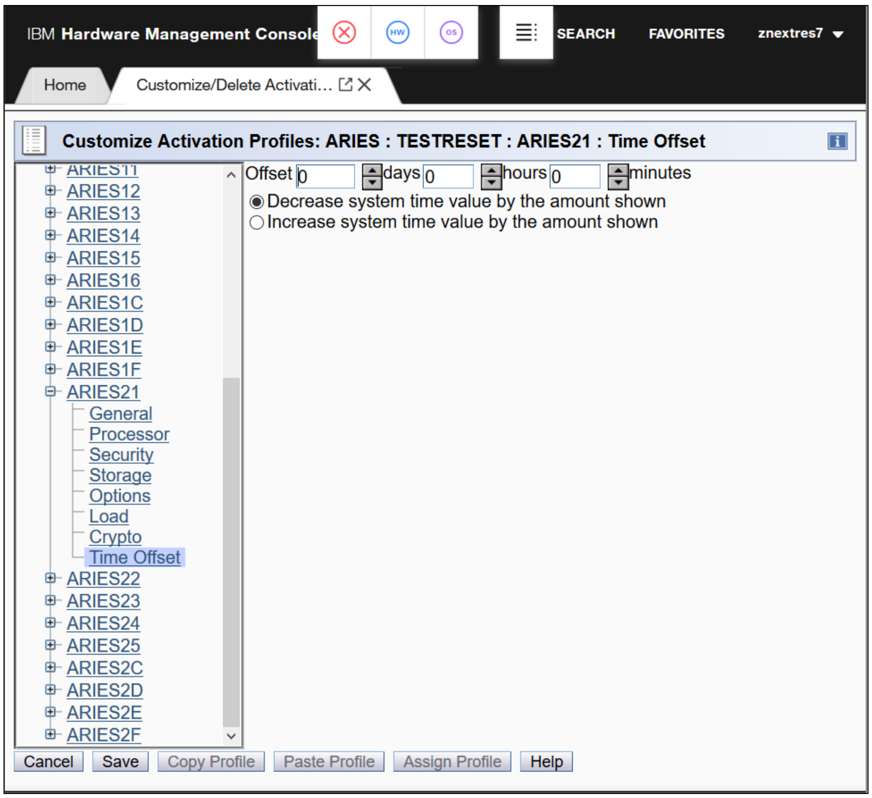


Figure 5-30 Image Profile: Time Offset

5.4.9 Image Profile: Saving

After you customize all the required image profiles for this reset profile, click **Save** to save the reset (and image) profiles for POR. If you have only a few LPARs that require activation, then perhaps it is easier to deactivate and activate those image profiles individually. (It depends on your situation.) HMC asks for confirmation to continue to save. Click **OK** (see Figure 5-31).

For planning information, see Chapter 2, “Planning considerations” on page 7.

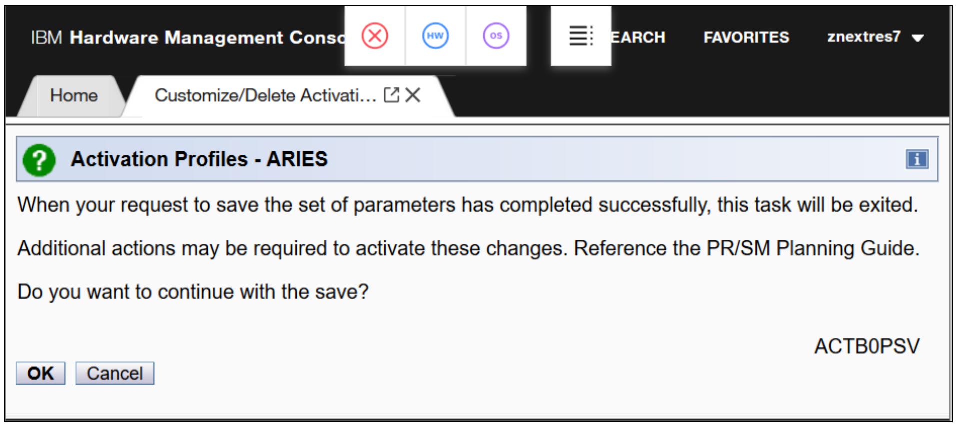


Figure 5-31 Reset and Image profile: Confirmation to save

5.5 Performing a Power on Reset on the new CPC

When the 3906 processor is upgraded to an 8561 processor, your IBM SSR performs a POR with a Diagnostic IOCDS.

After this process is complete and the IBM SSR is satisfied with the status of the processor, they hand over the processor to you. You then run another POR by using the reset profile that was created in 5.3.2, “Building the reset profile and pointing it to the required IOCDS” on page 100.

The 8561processor is now ready to be activated (POR) by using the production reset profile. As mentioned previously, this process is optional but preferred depending on how many partitions that you defined on the processor.

5.5.1 Coupling Facility Links

After the POR completes with your specific customer configuration and the coupling links come online to the CF and z/OS LPARs on this CPC and any links to other CPCs, verify that they are online and established a link. One way to do this process is to display the CHPID by using Channel Problem Determination on the HMC.

To use the Channel Problem Determination process, complete the following steps:

1. Log on by using SYSPROG authority to the HMC for the new 8561 processor.
2. Click **Systems Management** to expand the list.
3. Under Systems Management, click the radio button next to the system to select it (in this example, **ARIES**).

4. In the Tasks window, click **Recovery** to expand it, and select **Single Object Operations** (see Figure 5-32).

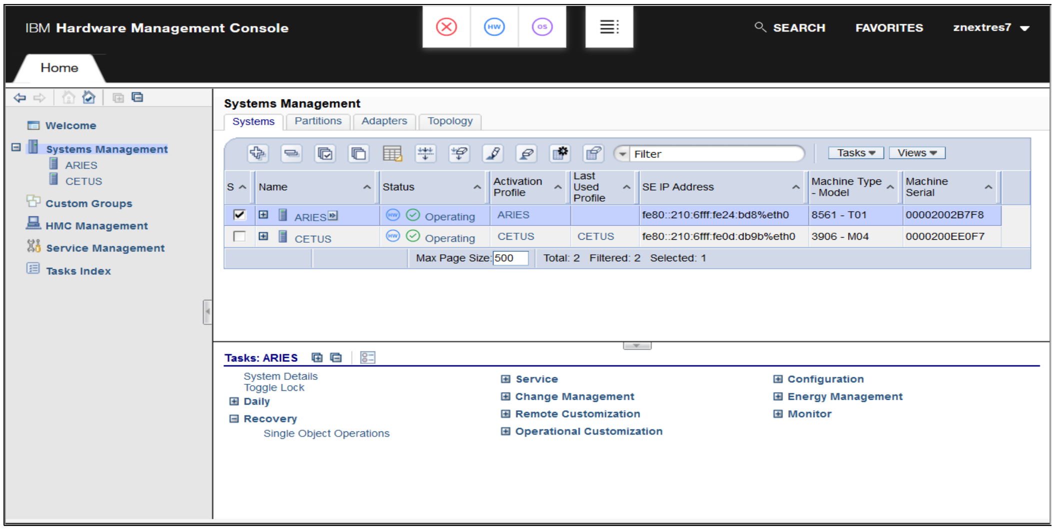


Figure 5-32 Systems Management: Main window

5. Click **OK** on the confirmation window.
6. Click **System Management** to expand the list.
7. Under Systems Management, click the CPC name to expand the options (in this example, **ARIES**).
8. Click **Partitions** to expand the list of partitions.
9. Scroll through the list of partitions until you find one of the CF partitions or z/OS partitions to which the coupling links are connected (in our example, we select **ARIES2E**).
10. Click the partition name to expand the options under the partition name.
11. Click **CHPIDs** to display the CHPID list that is specific to this LPAR (see Figure 5-33).

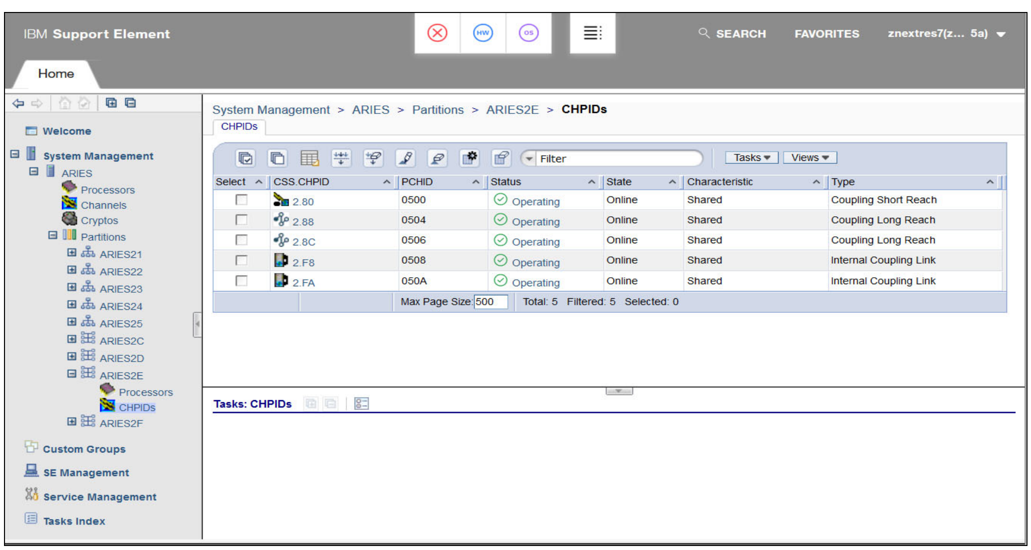


Figure 5-33 System Management: Single Object Operation

12. Select the CHPID that you want to verify. We view CHPID **2.88** (CSS=1, CHPID=88).

13. There are two ways to show the options for this CHPID: Either click the **>>** symbol next to the CHPID to expand its options, or click **CHPID Operations** to expand the options and then click **Channel Problem Determination** (see Figure 5-34).

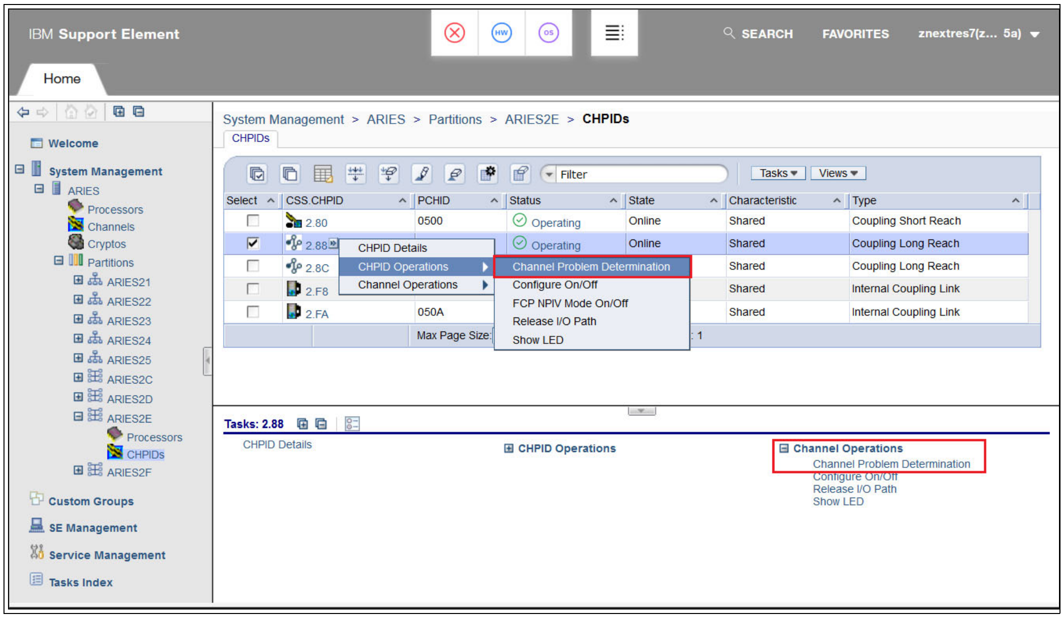


Figure 5-34 System Management: CHPID Operations

14. The HMC shows the Channel Problem Determination options. Select **Analyze channel information**, and then click **OK** (see Figure 5-35).

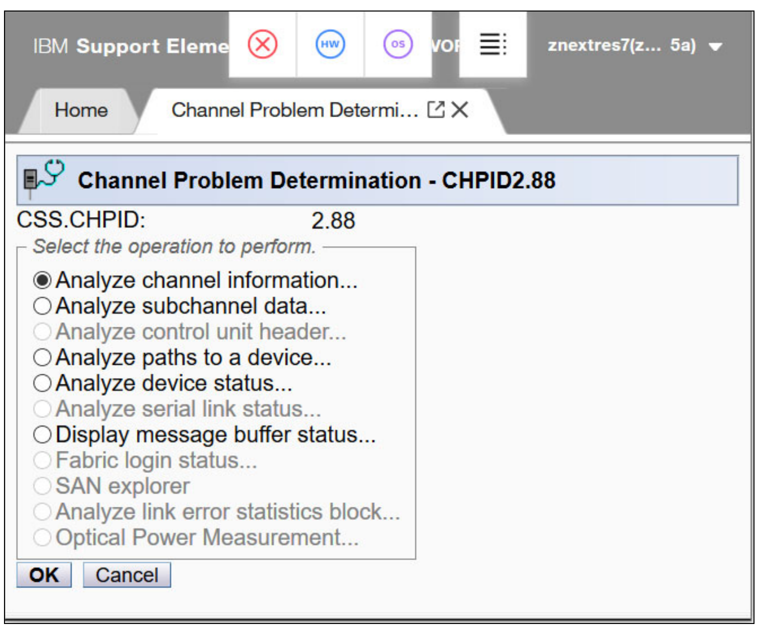


Figure 5-35 Channel Problem Determination: Analyze channel information

Note the following items (see Figure 5-36):

– State: Online
– Status: Operating
– Node type: Attached
– Node status: Valid
– Type/model: 2965-N20 (device that the CHPID is connected to)
– Seq. number: BB4B7 (serial number of the device that the CHPID is connected to)
– Tag: EC (in this case, the destination CHPID of CHPID 88)

Note the physical channel ID (PCHID) of 0504. This PCHID number is allocated by the CPC when this particular CHPID (Coupling Express LR (CELR)) is defined to the HSA configuration.

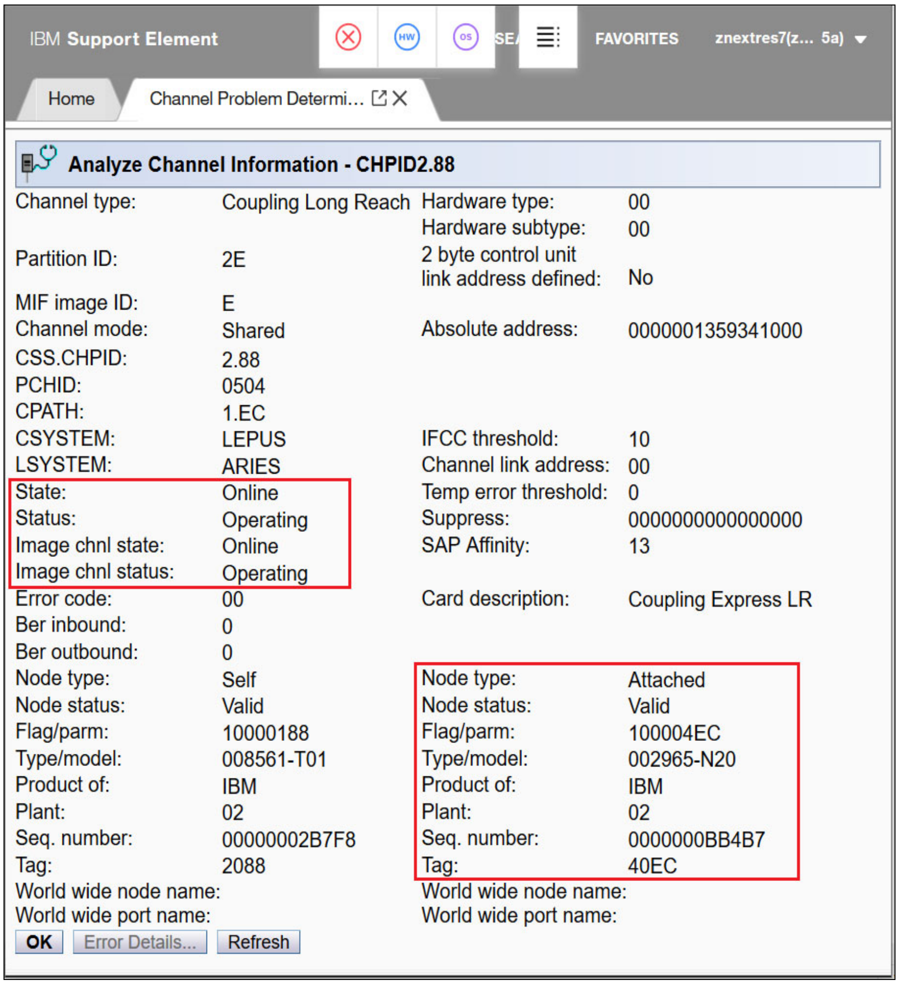


Figure 5-36 Channel Problem Determination: Display

This window verifies that the CHPID is online and operating, and also what the CHPID (cable) is connected to.

15.Continue to verify all other CF links that are defined and online.

5.5.2 Dynamic I/O configuration for stand-alone CF

Many customers have stand-alone coupling facilities (SACFs). A true SACF cannot change the I/O configuration dynamically because of a missing HCD running on the CPC. Changing the I/O configuration for such a CPC is cumbersome and error-prone, and it requires a POR of the CPC.

Dynamic configuration capabilities for SACFs were added to the z14 system (Driver level 36) and is available on the z15 system.

To prepare your environment to use this implementation, complete the following steps. A short description of the new options on the processors cluster list is included at the end of this topic.

1. Prerequisites:

   The target and the source CPCs must be a z14 (Driver level 36) or a z15 system.

   The following z/OS APARs[1] for dynamic I/O configuration for SACF should be installed so that their functions are available:

   – OA54912.

   – IO25603.

   – OA53952.

   – OA55404.

   Ensure that the SACF has the correct support level selected like one of the levels that are shown in Figure 5-37.

```
+-------------------------- Supported Processors
|                                                R
| Command ===> ___________________________________
|
| Select one to view more details.
|
|   Processor
|   Type-Model Support Level
|   3906-M03   3906 support
|   3906-M03   3906 GA2 support       <===
|   3906-M04   3906 support
|   3906-M04   3906 GA2 support       <===
|   3906-M05   3906 support
|   3906-M05   3906 GA2 support       <===
|   3907-LR1   3907 LinuxONE support
|   3907-LR1   3907 GA2 support
|   3907-ZR1   3907 support
|   3907-ZR1   3907 GA2 support       <===
|   8561-T01   8561 support           <===
+--------------------------------------------------
```

Figure 5-37 Support level that is needed

[1] For z/OS V2R1, V2R2, and V2R3.

2. Provide the necessary authorization rights on your z/OS system that you use to initiate the hardware only activation.

   Profiles CBD.CPC.ACTIVATE.NetId.NAU in class FACILTY NetId and NAU, as defined on the SE and shown in the Processor Cluster List panel:

   – READ is required for viewing and downloading the active configuration.

   – UPDATE is required for activating hardware changes only.

   Note: For more information about this topic, see “Defining IBM RACF® profiles” in *z/OS HCD User's Guide*, SC34-2669.

3. Define a Master Control Service (MCS) firmware partition LPAR that is named `MCS_1` if your SACF is a z14 (Driver level 36) or a z15 system:

   – Using HCD, define a `MCS_1` (MCS) partition of type FW (firmware) in LPAR number B of the highest channel subsystem (CSS) on the CF.

   – At the appropriate firmware level, the LPAR contains the code that is responsible for dynamic activation of hardware changes.

   – For example, if you are defining the `MCS_1` partition for the first time, you must do the following tasks:

      i. Using HCD, select the `highest*` CSS ID for the SACF.

      ii. Change the partition name of image number B from `*` to `MCS_1`.

      iii. Set the UID Uniqueness to `NO`.

      iv. Set the Usage type to `FW`.

      v. Build a production IODF.

      Note: The `highest*` CSS is CSS ID 5 on the z14 and z15 T01, and it is CSS ID 2 on z14 ZR1 and z15 T02.

An example of defining the MCS partition is shown in Figure 5-38.

```
+---------------------------- Partition List --------------------------
|   Goto  Backup  Query  Help
| ----------------------------------------------------------------------
|
| Command ===> ________________________________________ Scroll ===> PAGE
|
| Select one or more partitions, then press Enter. To add, use F11.
|
| Processor ID  . . . . : CETUS     Cetus
| Configuration mode  . : LPAR
| Channel S +---------- Change Internal Partition Definition ----------+
|           |                                                          |
| / Partiti |                                                          |
| _ *       | Specify or revise the following values.                  |
| _ *       |                                                          |
| C *       | Partition name . . . MCS_1                               |
| _ *       | Partition number . : B      (same as MIF image ID)       |
| _ *       | Partition usage  . : FW                                  |
| _ *       | UID uniqueness . . : N        (Y/N)                      |
| _ *       |                                                          |
|  F1=Help  | Description  . . . . Master Control Service FW lpar__    |
|  F7=Backw |                                                          |
| F12=Cance |                                                          |
+---------- |  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset    |
            |  F9=Swap   F12=Cancel                                  |
            +----------------------------------------------------------+
```

Figure 5-38   HCD defining MCS_1 LPAR

After you successfully define the `MCS_1` LPAR, you see something like what is shown in Figure 5-39.

```
+---------------------------- Partition List -------------------------
|   Goto  Backup  Query  Help
| ---------------------------------------------------------------------
|                                                            Row 1 of
| Command ===> ________________________________________ Scroll ===> PAG
|
| Select one or more partitions, then press Enter. To add, use F11.
|
| Processor ID  . . . . : CETUS     Cetus
| Configuration mode  . : LPAR
| Channel Subsystem ID  : 5
|
| / Partition Name   Number Usage + UID Description
| _ MCS_1            B      FW      N   Master Control Service FW LPAR
| _ *                2      CF/OS   N   _______________________________
| _ *                3      CF/OS   N   _______________________________
```

Figure 5-39   MCS_1 LPAR created

4. Verify that the `MCS_1` LPAR is on your z15 processor definition:

   – When you create a CPC (8561) in the updated version of HCD / Hardware Configuration Manager (HCM), the MCS firmware partition is created automatically.

   – You can check the partition by going to the Partition List panel of the highest CSS ID of the z15 system (CSS ID 5 on an 8561 processor), as shown in Figure 5-40.

```
+---------------------------- Partition List --------
|   Goto  Backup  Query  Help
| ---------------------------------------------------
|
| Command ===> _______________________________________
|
| Select one or more partitions, then press Enter. To
|
| Processor ID  . . . . : ARIES     Aries
| Configuration mode  . : LPAR
| Channel Subsystem ID  : 5
|
| / Partition Name   Number Usage + UID Description
| _ MCS_1            B      FW      N   ______________
| _ *                1      CF/OS   N   ______________
| _ *                2      CF/OS   N   ______________
| _ *                3      CF/OS   N   ______________
```

Figure 5-40   MCS_1 LPAR automatically created on a z15 system

5. Using HCD to write a new IOCDS.

   To write a IOCDS, complete the following steps:

   a. Use the IODF that has the `MCS_1` LPAR created or defined and write an IOCDS to the SACF.

   b. Use HCD 2.11 and select `Work with IOCDSs`, as shown in Figure 5-41.

```
Goto  Query  Help
----------- +----------------- Actions on selected CPCs ---------
            |
mmand ===>  |
            | Select by number or action code and press Enter.
lect one or |
            | 1_  1.  Work with IOCDSs . . . . . . . . . . (s)
----------- |     2.  Work with IPL attributes . . . . . . (i)
SNA Address |     3.  Select other processor configuration (p)
IBM390PS.AR |     4.  Work with CPC images  . . . . . . . .(v)
IBM390PS.CE |     5.  Activate hardware changes only . . . (a)
IBM390PS.LE |     6.  View current active configuration . .(c)
IBM390PS.MU |     7.  Download active configuration . . . .(d)
*********** |
            |  F1=Help     F2=Split    F3=Exit     F9=Swap    F12
            +-----------------------------------------------------
```

Figure 5-41   HCD selecting Work with IOCDSs

c. Select the IOCDS to use, as shown in Figure 5-42.

```
                               IOCDS List            Row 1 of 4 More:
Command ===> ______________________________________________ Scroll ==

Select one or a group of IOCDSs, then press Enter.

                                            -----Token Match----- Write
/ IOCDS       Name     Type    Status       IOCDS/HSA IOCDS/Proc. Protect
_ A0.ARIES    IODF69   LPAR    POR          Yes       No          Yes-POR
/ A1.ARIES    IODF66   LPAR    Alternate    No        No          No
_ A2.ARIES    IODF67   LPAR    Alternate    No        No          No
_ A3.ARIES    IODF68   LPAR    Alternate    No        No          No
******************************* Bottom of data ***********************
```

Figure 5-42 Selecting the IOCDS

6. Activate the CPC (POR) with a new IOCDS.

   Verify that the RESET profile has **Allow dynamic changes to the channel subsystem input/output definition** selected, as shown in Figure 5-43.

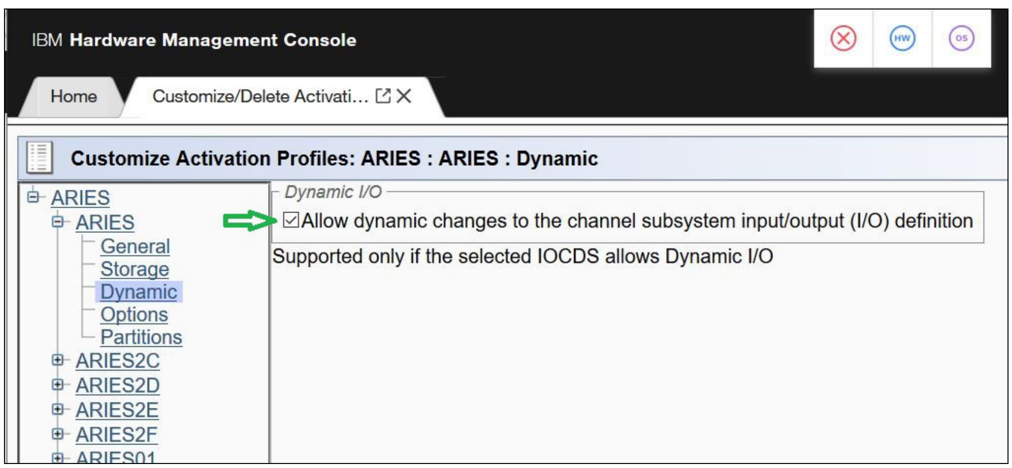


Figure 5-43 Allow dynamic changes to the channel subsystem input/output definition selected

7. After you perform the initial POR, update the reset profile by selecting **Use Active IOCDS**, which is necessary for future activations and PORs in order for the POR to complete by using the current IOCDS that was activated and written by using the HCD, as shown in Figure 5-44 on page 121.

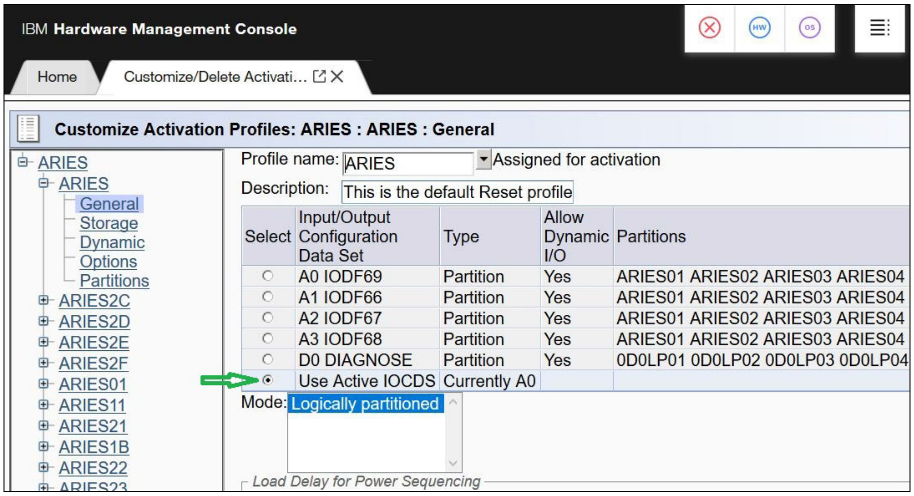


Figure 5-44 Using Active IOCDS

Note: The system is prepared for Dynamic I/O config for SACF.

8. Make the necessary connectivity changes in your production IODF.
9. Activate the hardware configuration from an updated HCD/HCM running in z/OS LPAR on a remote z14 (Driver level 36) or z15 system by selecting HCD option `2.11 Activate Hardware changes only (a)`, as shown in Figure 5-45.

```
  Goto  Query  Help
------------- +----------------- Actions on selected CPCs ------
              |
Command ===>  |
              | Select by number or action code and press Enter.
Select one or |
              | 5_  1.  Work with IOCDSs . . . . . . . . . . (s)
  ----------- |     2.  Work with IPL attributes . . . . . . (i)
/ SNA Address |     3.  Select other processor configuration (p)
/ IBM390PS.AR |     4.  Work with CPC images  . . . . . . . .(v)
_ IBM390PS.CE |     5.  Activate hardware changes only . . . (a)
_ IBM390PS.LE |     6.  View current active configuration . .(c)
_ IBM390PS.MU |     7.  Download active configuration . . . .(d)
************* |
              |  F1=Help     F2=Split     F3=Exit     F9=Swap
              +-------------------------------------------------
```

Figure 5-45 Activate hardware changes only

After selecting `Activate hardware changes only (a)` with no recovery required, the activation parameters are presented, shown on Figure 5-46.

```
+----------------- Activate New Hardware Configuration ------------------+
¦ CBDPDY50                                                               ¦
¦                                                                        ¦
¦ Specify or revise the values for IODF activation.                      ¦
¦                                                                        ¦
¦ Currently active IODF . : SYS6.IODF00                                  ¦
¦    Processor ID . . . . : ARIES                                        ¦
¦                                                                        ¦
¦ IODF to be activated  . : SYS6.IODF42                                  ¦
¦    Processor ID . . . . . ARIES     +                                  ¦
¦                                                                        ¦
¦ Test only  . . . . . . . . . . . . . . . . . . . . . Yes  (Yes or No)  ¦
¦ Allow hardware deletes (FORCE, FORCE=DEVICE) . . . . No   (Yes or No)  ¦
¦ Delete partition access to CHPIDs unconditionally                      ¦
¦ (FORCE=CANDIDATE)  . . . . . . . . . . . . . . . . . No   (Yes or No)  ¦
¦                                                                        ¦
¦ F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap    ¦
¦ F12=Cancel                                                             ¦
+------------------------------------------------------------------------+
```

Figure 5-46 Activation parameters

Note: The parameters are the same as for hardware and software (full) activation, but without a target OS configuration and Eligible Device Table (EDT). It is a hardware-only change.

The result is presented the same way as before. After some time (the activation runs synchronously and blocks the screen), you see the results as the normal HCD Message List. It is written to the HCD message log and SYSLOG.

On the HCD panel (message list), you can see something similar to what is shown in Figure 5-47 on page 123.

```
+------------------------------- Message List --------------------------------+
¦   Save  Query  Help                                                          ¦
¦ ------------------------------------------------------------------------     ¦
¦ CBDPMSGO                                                          Row 1 of 4 ¦
¦ Command ===> ___________________________________________ Scroll ===> PAGE    ¦
¦                                                                              ¦
¦ Messages are sorted by severity. Select one or more, then press Enter.       ¦
¦                                                                              ¦
¦ / Sev Msg. ID  Message Text                                                  ¦
¦ _ E   CBDA887I Following devices are to be added to processor ARIES:         ¦
¦ #              0.FF84-0.FF8F,1.FF84-1.FF8F                                   ¦
¦ _ E   CBDA889I Following control units are to be modified for processor     ¦
¦ #              ARIES: 0.FFCC,1.FFCC                                          ¦
¦ _ E   CBDD800I All change requests were successfully executed               ¦
¦ ***************************** Bottom of data ****************************** ¦
¦                                                                              ¦
¦  F1=Help        F2=Split       F3=Exit        F4=Prompt      F5=Reset        ¦
¦  F7=Backward    F8=Forward     F9=Swap       F10=Actions    F12=Cancel       ¦
¦ F13=Instruct   F22=Command                                                   ¦
+------------------------------------------------------------------------------+
```

Figure 5-47 Activation result

10. Similar to any other activation process, you should write a IOCDS to SACF, switch to the newly written IOCDS, and ensure that `Use Active IOCDS` is selected in the RESET profile.

11. Configure the newly added HW to SACF and/or Activate New image message:

   – On the CF side, you can check the status (by running the **`Display CHP`** command) and configure channels online (by running the **`Configure xx online`** command) from the Operating System Messages task for the respective CF LPAR, as shown in Figure 5-48.

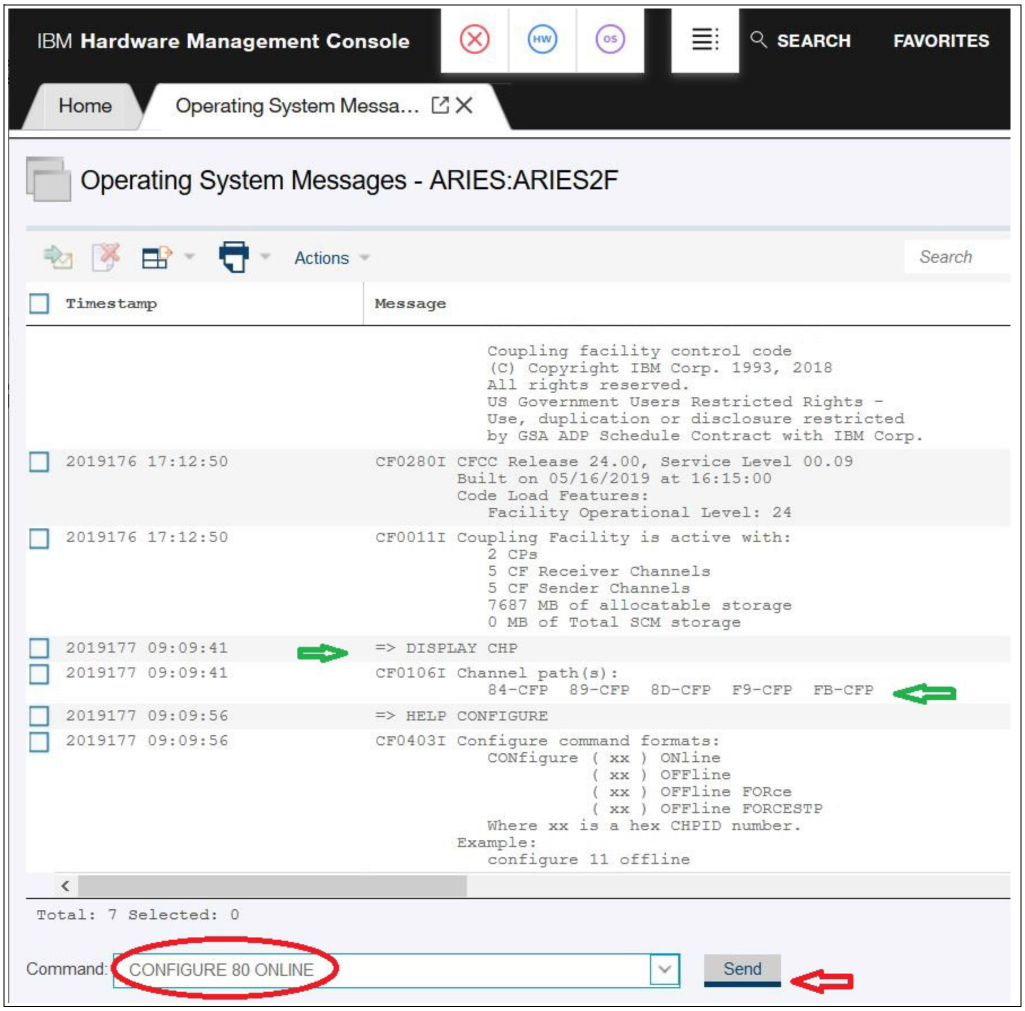


Figure 5-48 CF Operating System Message

   – On the z/OS side:

      • Activate IODF in z/OS LPARs by using the recommended approach.

        Software changes (with VALIDATE) in all images and hardware change in the last image per CPC. Write IOCDSs to z/OS CPCs and switch IOCDSs.

      • Ensure that newly added links are ONLINE to the respective z/OS LPARs.

        There are some commands that you can use to check the links, such as displaying the CHPIDs status or displaying the CF connectivity:

```
DISPLAY M=CHP
DISPLAY CF
DISPLAY CF,CFNAME=
```

        If some links are not in the expected state on the z/OS side, you can try to put them online by running the **`CF CHP(xx),online`** command.

Here are the new options on the Processor Cluster List (HCD option 2.11) for SACF activation:

- Use `View current active configuration (c)` to get information about the actual active configuration for the selected processor, as shown in Figure 5-49.

```
+------------------------- View Active Configuration -------------------------+
¦ CBDPDY60                                                                    ¦
¦                                                                             ¦
¦ Currently active IODF  . . . . : SYS6.IODF00                                ¦
¦ Currently active configuration : ARIES                                      ¦
¦                                                                             ¦
¦ HSA token  . . . . . . . . : ARIES    19-05-04 14:14:22 SYS6     IODF00     ¦
¦                                                                             ¦
¦ Recovery required  . . . . . . . : No                                       ¦
¦ Target IODF  . . . . . . . . . :                                            ¦
¦ Target configuration . . . . . :                                            ¦
¦                                                                             ¦
¦  F1=Help     F2=Split    F3=Exit     F9=Swap    F12=Cancel                  ¦
+-----------------------------------------------------------------------------+
```

Figure 5-49 View Active Configuration

- Use `Download active configuration (c)` only when requested by IBM service personnel. This option shows a panel like Figure 5-50.

```
+--------------------- Download Active Configuration -------------------------+
¦ CBDPUTA4                                                                    ¦
¦                                                                             ¦
¦ Selected SNA address . : NETID.NAU                                          ¦
¦ Currently active IODF  : SYS6.IODF00                                        ¦
¦                                                                             ¦
¦ Specify the following value.                                                ¦
¦                                                                             ¦
¦ Target IODF name  _____________________________________  +                  ¦
¦                                                                             ¦
¦  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap        ¦
¦ F12=Cancel                                                                  ¦
+-----------------------------------------------------------------------------+
```

Figure 5-50 Download Active Configuration

Note: The active configuration is not available after each POR of the CPC.

- Use `Activate hardware changes only (a)` to activate a Dynamic I/O configuration for SACF, as shown in step 9 on page 121.

5.6 Server Time Protocol configuration

Now that the CF links are verified as connected and online, you can set up the STP configuration.

The STP or Manage System Time option on the HMC under Configuration uses a GUI.

> **Note:** SE 2.15.0 (z15 system) no longer supports the System (Sysplex) Time task. The System (Sysplex) Time task was replaced by the Manage System Time task on the HMC.

For more information about the new GUI and how to set up the STP Coordinated Timing Network (CTN), see Chapter 8, “Preparing for IBM Parallel Sysplex and configuring Server Time Protocol” on page 165.

5.7 Building and verifying Load (IPL) profiles

The CPC underwent POR, the images profiles are defined and activated, the CF links are verified, and the STP and its roles are set up. Now, you can define a Load (IPL) profile to use to activate (perform an IPL) an LPAR.

To build a Load profile, complete the following steps:

1. Log on by using SYSPROG authority to the HMC for the new 8561 processor.
2. Under Systems Management, click **Systems Management** to expand the list.
3. Under Systems Management, select the radio button next to the system to select it (in this example, **ARIES**).
4. On the Tasks window, click **Operational Customization** to expand it, and select **Customize/Delete Activation Profiles** (see Figure 5-51).

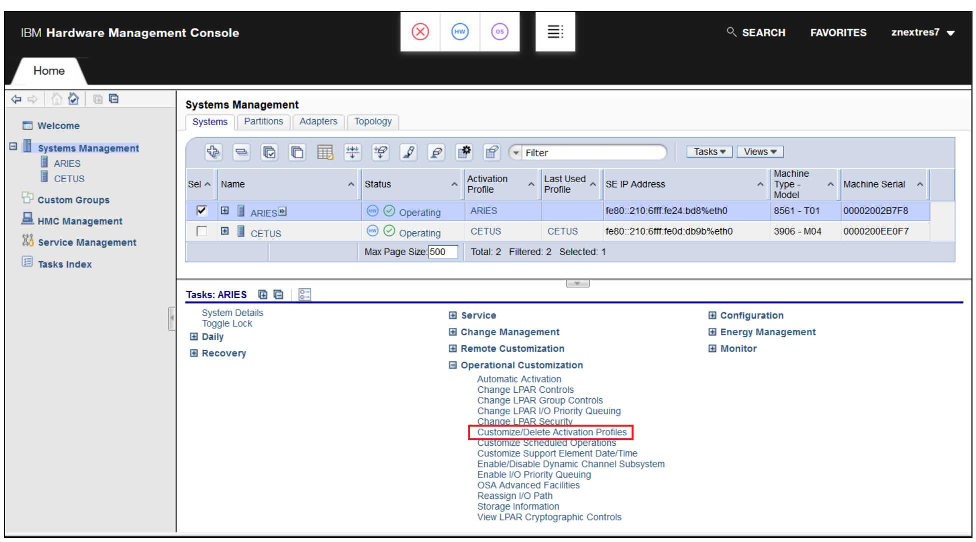


Figure 5-51 Systems Management: Main display

5. Select the DEFAULTLOAD load profile and click **Customize profile**.

6. Enter the required parameters that are specific to your installation to perform an IPL:
   – Profile name: Type your preferred profile name over DEFAULTLOAD.
   – Description: Enter your preferred description.
   – Load type: Standard load.
   – Load address: The device address of the IPL volume (96D5).
   – Load parameter: 944301M1:
      • **9443**: The device address of the IODF volume
      • **01**: The suffix of the LOADxx member in SYS#.IPLPARM on device 9443
      • **M**: Automatic IPL
      • **1**: SYS1.NUCLEUS

   Figure 5-52 shows an example.

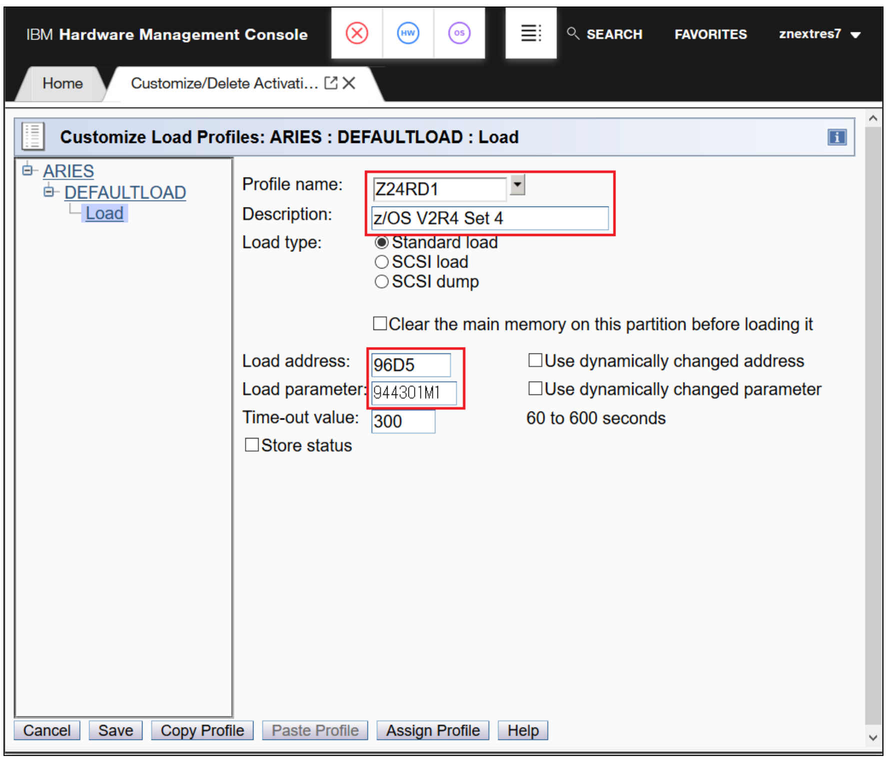


Figure 5-52 Customize Load Profiles: Load

7. Click **Save**, and then click **OK** to continue to the Save window (see Figure 5-53).

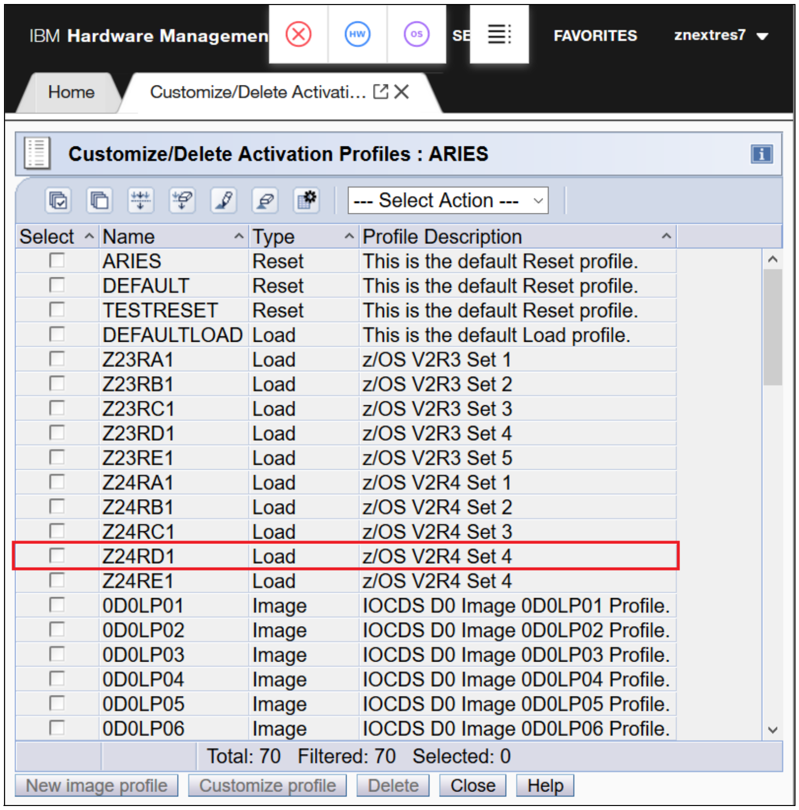


Figure 5-53 Customize Load Profiles: New Load profile

For planning information, see Chapter 2, "Planning considerations" on page 7.

5.8 Building and verifying LOADxx members in SYS#.IPLPARM

A `LOADxx` suffix is required to perform an IPL. This data set member is stored in `SYS#.IPLPARM` on the volume that the IODF is written to. In our example, this volume is 9443 (`IODFPK`). The # is the value that you use in your installation for `SYS#` data sets. The # may be any number 0 - 9, for example, `SYS0.IPLPARM`.

If you prefer to use the `HWNAME` keyword to point to the Processor ID, update this parameter to point to the new Processor ID (in this example, from `ARIES`). Sometimes the `LPARNAME` keyword is also used in the `LOADxx` members, and it might need to be reviewed or updated, such as `ARIES21`.

> **Note:** If you are going to share a `LOADxx` member with many partitions, then the `HWNAME` and `LPARNAME` keywords are required.

To build and verify `LOADxx` members in `SYS#.IPLPARM`, complete the following steps:

1. Log on by using Time Sharing Option (TSO) to a system that has access to the `SYS#.IPLPARM` data set that is on the IODF volume that you use to perform the IPL.
2. Edit data set `SYS#.IPLPARM` and edit member `LOADxx`. Figure 5-54 shows the settings that are used in our example:
   - The `HWNAME` keyword is set to `ARIES`.
   - The `LPARNAME` keyword is set to `ARIES21`.
   - The `IODF` keyword is set to ****** (where ** directs the IPL to look at what IODF / IOCP underwent a POR into the CPCs HSA, and then look on the IODF volume for that corresponding IODF). A specific IODF suffix number can be defined in the `LOADxx` member if you must override the HSA match.
   - The IODF keyword points to the High-Level Qualifier of the IODF data set (`SYS6`) and the operating system configuration (OSCONFIG) that this system uses (`ITSO`). The OSCONFIG is the other part of an IODF that the IPL uses to determine which devices it can access, along with Nucleus Initialization Program Consoles and Esoterics.
   - The remaining parameters are used for z/OS and not for the IODF.

```
  File  Edit  Edit_Settings  Menu  Utilities  Compilers  Test  Help
-------------------------------------------------------------------------------
EDIT       SYS0.IPLPARM(LOAD01) - 01.99                   Columns 00001 00072
Command ===>                                                 Scroll ===> CSR
000038 *-----------DEFINITION FOR SC76-------------*
000039 HWNAME   CETUS
000040 LPARNAME CETUS21
000041 IODF     ** SYS6     ITSO     01 Y
000042 SYSPLEX  PLEX76   Y
000043 SYSCAT   BH6CAT123CMCAT.BH6CAT
000044 PARMLIB  SYS1.PARMLIB
000045 PARMLIB  SYS1.IBM.PARMLIB
000046 PROCVIEW CORE,CPU_OK
000047 HWNAME   ARIES
000048 LPARNAME ARIES21
000049 IODF     ** SYS6     ITSO     01 Y
000050 SYSPLEX  PLEX76   Y
000051 SYSCAT   BH6CAT123CMCAT.BH6CAT
000052 PARMLIB  SYS1.PARMLIB
000053 PARMLIB  SYS1.IBM.PARMLIB
000054 PROCVIEW CORE,CPU_OK
```

Figure 5-54 z/OS: SYS#.IPLPARM: LOADxx member

5.9 Communicating information about the new CPC

Now that you made a new CPC with a new name in the configuration, you might want to communicate the new configuration specifics to the operations and support community in your organization.

6

Configuring network features

This chapter explains how to configure your network to connection to your z15 system.

This chapter includes the following sections:

- Preparing to define and customize Open Systems Adapter-Express
- Defining OSA-Express to your I/O configuration
- Customizing OSA-Express by using OSA Advanced Facilities
- Shared Memory Communications (SMC-R and SMC-D)
- Channel-to-channel connections

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

6.1 Preparing to define and customize Open Systems Adapter-Express

To define Open Systems Adapter-Express (OSA-Express) to your I/O configuration, you need the following information:

- The Open Systems Adapter (OSA) operation mode (channel path ID (CHPID) type)
- The physical channel ID (PCHID) of OSA-Express and the CHPID number that is associated with that PCHID
- The CHPID access list and the candidate list within the logical channel subsystem (LCSS)
- The `CNTLINIT` number and the `IODEVICE` number

These operations are described in detail in Chapter 13, “Adding network devices” on page 287.

Depending on your network configuration and environment, you can perform OSA-Express customization by using OSA Advanced Facilities. OSA Advanced Facilities are used for customizing the following settings:

- OSA Address Table (OAT) and Systems Network Architecture (SNA) timer
- Physical port speed
- Media Access Control (MAC) address

These settings are described in 6.3, “Customizing OSA-Express by using OSA Advanced Facilities” on page 135.

6.2 Defining OSA-Express to your I/O configuration

Defining the OSA-Express involves these high-level steps:

- Choosing the OSA-Express CHPID type.
- Defining the OSA-Express to I/O configuration.
- Confirming your OSA-Express I/O definition.

6.2.1 Choosing the OSA-Express CHPID type

Before using OSA-Express, you must choose the CHPID type. A summary of CHPID types that are supported in a z15 system is shown in Table 6-1. For more information, see the *Open Systems Adapter-Express Customer's Guide and Reference,* SA22-7935, and the *IBM Z Connectivity Handbook*, SG24-5444.

Table 6-1 Summary of OSA-Express CHPID types that are supported in a z15 system

CHPID type	OSA-Express operation mode
OSE	Non-Queued Direct Input/Output (QDIO) mode for SNA and TCP/IP networking (1000Base-T only)
OSD	QDIO mode for TCP/IP networking (1000Base-T, 1-Gigabit Ethernet (GbE), 10 GbE, and 25 GbE)
OSC	Open Systems Adapter Integrated Console Controller (OSA-ICC) (1000Base-T only)
OSM	1000Base-T in a Dynamic Partition Manager (DPM) environment only

Note: CHPID types OSN and OSX are not supported by z15 systems.

6.2.2 Defining the OSA-Express to I/O configuration

You must define CHPID, `CNTLUNIT`, and `IODEVICE` to use OSA-Express. For more information about how to define an I/O configuration by using Hardware Configuration Definition (HCD), see Chapter 13, “Adding network devices” on page 287.

6.2.3 Confirming your OSA-Express I/O definition

You can confirm your definition by running the following z/OS command:

```
DISPLAY M=CHP(xx)
```

You can confirm the CHPID path status by running the command that is shown in Figure 6-1.

```
D M=CHP(E3)

IEE174I 17.35.42 DISPLAY M 825
CHPID E3:  TYPE=11, DESC=OSA DIRECT EXPRESS, ONLINE
DEVICE STATUS FOR CHANNEL PATH E3
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
01E3 +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +
SWITCH DEVICE NUMBER = NONE
PHYSICAL CHANNEL ID = 0150
PNETID 1 = PERFNET
************************ SYMBOL EXPLANATIONS ************************
+ ONLINE    § PATH NOT VALIDATED   - OFFLINE    . DOES NOT EXIST
* PHYSICALLY ONLINE   $ PATH NOT OPERATIONAL
```

Figure 6-1 OSD D M=CHP

To confirm the channel path to a device, run the following command:

```
DISPLAY M=DEV(xxxx)
```

The node descriptor information that is returned includes the emulated control units (CUs) 1730.008 and 1732.001 that are used for the OSA-Express6S port. Also included is the 3907 machine type and serial number, as shown in Figure 6-2.

```
D M=DEV(1E30)

IEE174I 17.37.56 DISPLAY M 827
DEVICE 01E30   STATUS=ONLINE
CHP                   E3
ENTRY LINK ADDRESS    ..
DEST LINK ADDRESS     0D
PATH ONLINE           Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL      Y
MANAGED               N
CU NUMBER             1E30
INTERFACE ID          5000
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND        = 001730.009.IBM.02.85610002B7F8.E300
SCP TOKEN NED    = 001730.009.IBM.02.85610002B7F8.E300
SCP DEVICE NED   = 001732.001.IBM.02.85610002B7F8.E300
```

Figure 6-2 The OSD M=DEV command

You can confirm the device number and the status by running the following command:

```
DISPLAY U
```

The device number and type of device that are defined are shown in Figure 6-3.

```
D U,,,1E30,1

IEE457I 17.39.46 UNIT STATUS 831
UNIT TYPE STATUS        VOLSER     VOLSTATE      SS
1E30 OSA  O                                       0

D U,,,1E3F,1

IEE457I 17.42.00 UNIT STATUS 833
UNIT TYPE STATUS        VOLSER     VOLSTATE      SS
1E3F OSAD O-RAL                                   0
```

Figure 6-3 The OSD D U,,,device command

6.3 Customizing OSA-Express by using OSA Advanced Facilities

OSA Advanced Facilities is a tool that is integrated into the Hardware Management Console (HMC). To start OSA Advanced Facilities, log in to the HMC with the proper authority, and select the central processor complex (CPC) that requires OSA customization. Then, select **Operational Customization** → **OSA Advanced Facilities** (Figure 6-4).

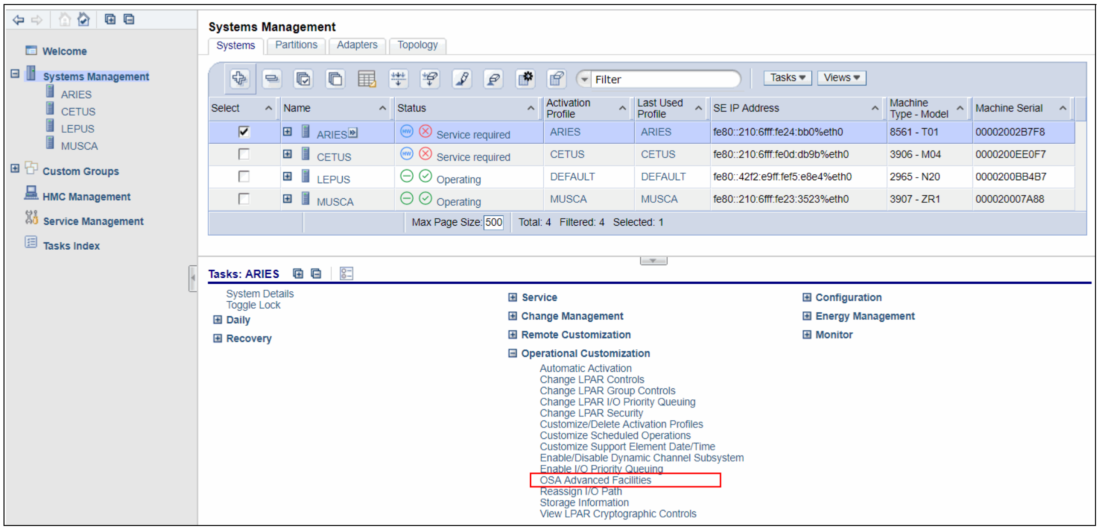
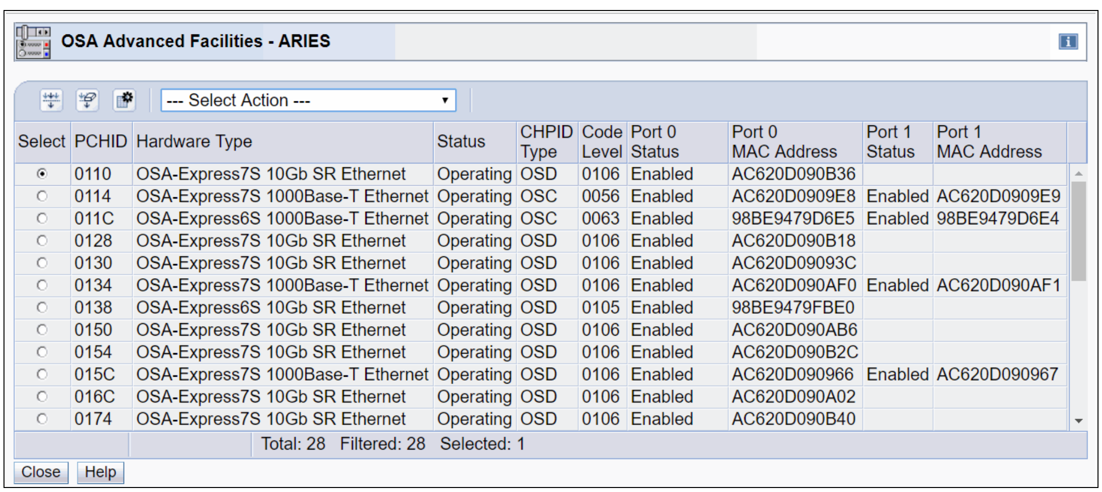


Figure 6-4 HMC OSA Advanced Facility selection

The OSA Advanced Facilities window that is shown in Figure 6-5 opens.



Select	PCHID	Hardware Type	Status	CHPID Type	Code Level	Port 0 Status	Port 0 MAC Address	Port 1 Status	Port 1 MAC Address
◉	0110	OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0106	Enabled	AC620D090B36		
○	0114	OSA-Express7S 1000Base-T Ethernet	Operating	OSC	0056	Enabled	AC620D0909E8	Enabled	AC620D0909E9
○	011C	OSA-Express6S 1000Base-T Ethernet	Operating	OSC	0063	Enabled	98BE9479D6E5	Enabled	98BE9479D6E4
○	0128	OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0106	Enabled	AC620D090B18		
○	0130	OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0106	Enabled	AC620D09093C		
○	0134	OSA-Express7S 1000Base-T Ethernet	Operating	OSD	0106	Enabled	AC620D090AF0	Enabled	AC620D090AF1
○	0138	OSA-Express6S 10Gb SR Ethernet	Operating	OSD	0105	Enabled	98BE9479FBE0		
○	0150	OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0106	Enabled	AC620D090AB6		
○	0154	OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0106	Enabled	AC620D090B2C		
○	015C	OSA-Express7S 1000Base-T Ethernet	Operating	OSD	0106	Enabled	AC620D090966	Enabled	AC620D090967
○	016C	OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0106	Enabled	AC620D090A02		
○	0174	OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0106	Enabled	AC620D090B40		

Total: 28 Filtered: 28 Selected: 1

Close Help

Figure 6-5 OSA Advanced Facilities initial window

6.3.1 Configuring OAT and the SNA LLC2 timer for an OSE channel

When you define OSA-Express as an OSE channel (non-QDIO mode), you must customize the OAT *except* for the following uses:

- Use *only* the default OAT and do *not* use (require) port sharing.
- OSA-Express Direct SNMP subagent.

For more information, see *Open Systems Adapter-Express Customer's Guide and Reference,* SA22-7935.

You can edit OAT by using the Open Systems Adapter/Support Facility (OSA/SF). OSA/SF is a tool for customizing OSA-Express. The OSA/SF tool is available on the HMC as a submenu of OSA Advanced Facilities.

For other CHPID types, OSA/SF is not required. If you must change the port speed or the MAC address, you can configure them from OSA Advanced Facilities. The OSA CHPID type and OSA/SF requirements are listed in Table 6-2.

Table 6-2 OSA/SF and OSA CHPID reference

OSA CHPID type	OSA/SF
OSE	Required
OSD	Not required
OSC	Not supported
OSM	Not supported

Note: CHPID types OSN and OSX are not supported by z15 systems.

When you use a SNA network that uses an OSE channel and must change the SNA timer (SNA LLC2 parameter), you must customize the parameters in OSA Advanced Facilities. For more information, see *Open Systems Adapter-Express Customer's Guide and Reference,* SA22-7935.

If you are upgrading from z13 or z14 systems to z15 T01, or if you are upgrading a z14 ZR1 system to a z15 T02, and your configuration uses the OSA-Express5S or OSA-Express6S 1000Base-T feature, your OSE configuration is automatically migrated. After this process completes, check the configuration in OSA/SF on the HMC.

Customizing the OAT and the SNA timer

Note: Before you customize OAT and the SNA timer by using OSA/AF on the HMC, see *Open Systems Adapter/Support Facility on the Hardware Management Console,* SC14-7580. You can download it from IBM Resource Link.

To customize the OAT and the SNA timer for an OSE channel, complete the following steps:

1. Start OSA Advanced Facilities.
2. The OSA Advanced Facilities window opens (Figure 6-6). Select the OSE channel PCHID that you want to customize. In this example, we select PCHID 0174. Then, select **Card specific advanced facilities** from the **Select Action** menu, as shown in Figure 6-6.

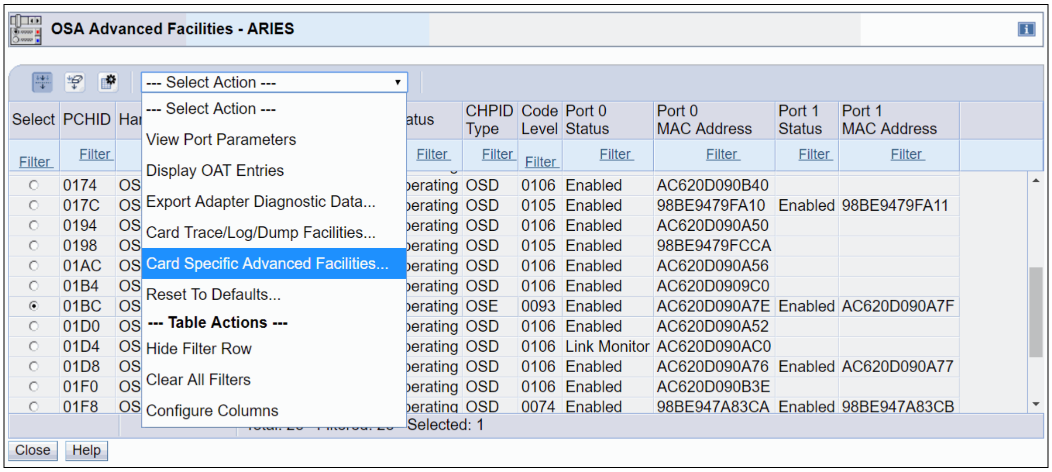


Figure 6-6 Entering OSA/SF on the HMC

3. The Advanced Facilities window opens (Figure 6-7). To edit OAT and the SNA timer entries, select **Panel configuration options** and click **OK**.

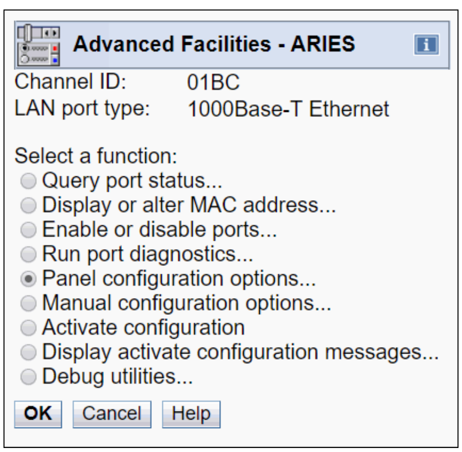


Figure 6-7 OSA/SF on the HMC Panel configuration options

4. The Panel Configuration Options window opens (Figure 6-8). You can define these items:

Edit OAT entries By selecting this option, you can edit the OAT and SNA definition. An OAT entry defines the data path between an OSA feature port and a logical partition (LPAR) image.

Edit SNA timers By selecting this option, you can enter the SNA timer values.

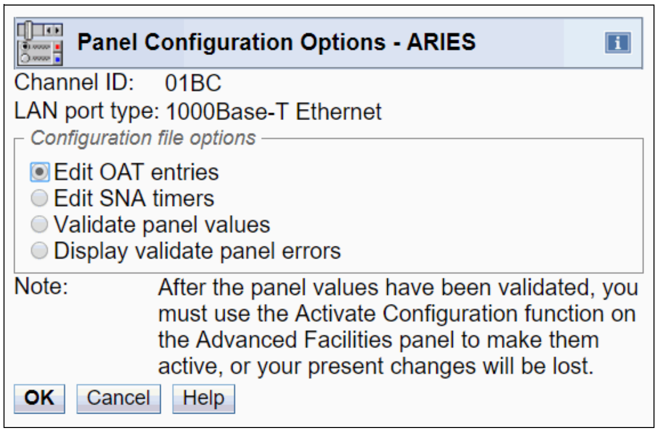
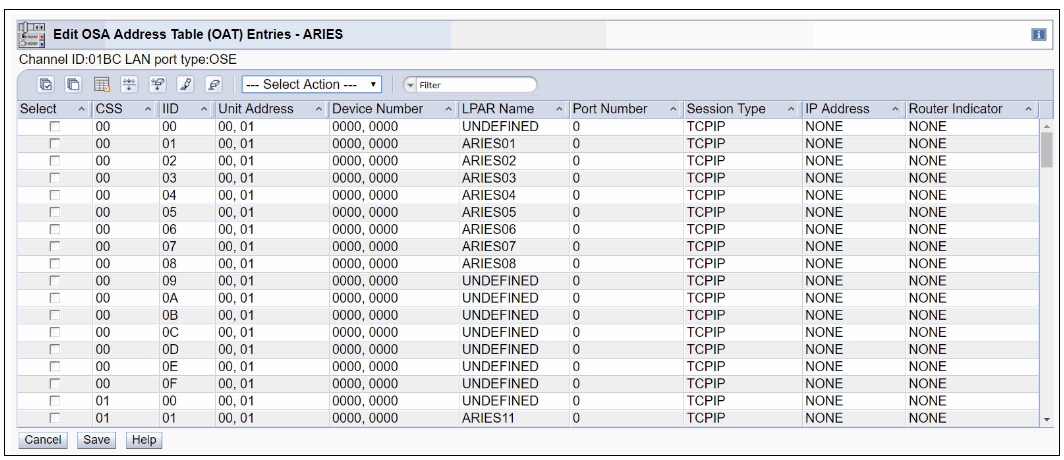


Figure 6-8 OSA/SF on the HMC: Configuration file options

5. Choose **Edit OAT entries**, and the Edit OSA Address Table (OAT) Entries window opens, as shown in Figure 6-9.



Select	CSS	IID	Unit Address	Device Number	LPAR Name	Port Number	Session Type	IP Address	Router Indicator
	00	00	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	00	01	00, 01	0000, 0000	ARIES01	0	TCPIP	NONE	NONE
	00	02	00, 01	0000, 0000	ARIES02	0	TCPIP	NONE	NONE
	00	03	00, 01	0000, 0000	ARIES03	0	TCPIP	NONE	NONE
	00	04	00, 01	0000, 0000	ARIES04	0	TCPIP	NONE	NONE
	00	05	00, 01	0000, 0000	ARIES05	0	TCPIP	NONE	NONE
	00	06	00, 01	0000, 0000	ARIES06	0	TCPIP	NONE	NONE
	00	07	00, 01	0000, 0000	ARIES07	0	TCPIP	NONE	NONE
	00	08	00, 01	0000, 0000	ARIES08	0	TCPIP	NONE	NONE
	00	09	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	00	0A	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	00	0B	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	00	0C	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	00	0D	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	00	0E	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	00	0F	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	01	00	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
	01	01	00, 01	0000, 0000	ARIES11	0	TCPIP	NONE	NONE

Figure 6-9 OSA/SF on HMC: Edit OSA Address Table (OAT) Entries window

6. To edit, select the device in the left column, as shown in Figure 6-10. Click **Select Action** and choose either **Edit as TCP/IP entry** or **Edit as SNA entry** for the selected device.

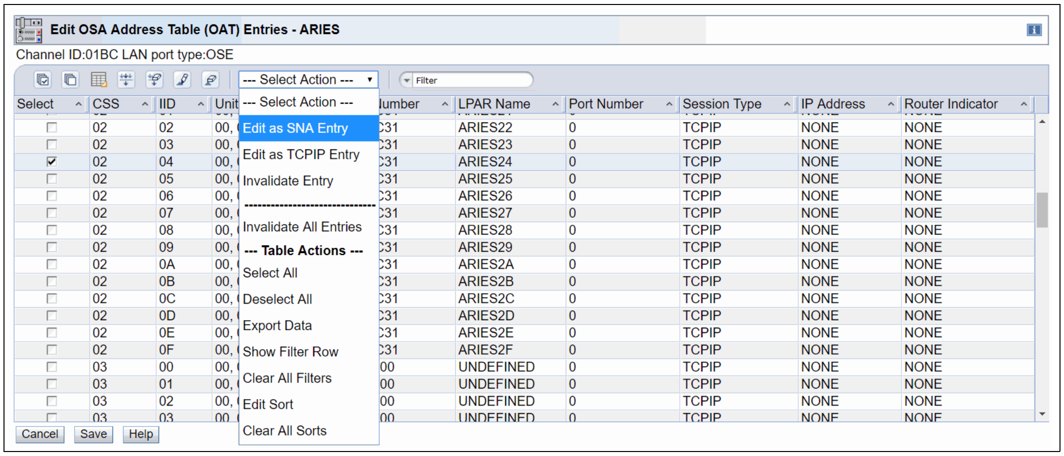


Figure 6-10 OSA/SF on the HMC: Select Action for Edit OSA Address Table (OAT) Entries window

7. Select **Edit as SNA Entry**, and the OSA Address Table (OAT) Entry window that is shown in Figure 6-11 opens. Select the appropriate SNA entry and click **OK**.

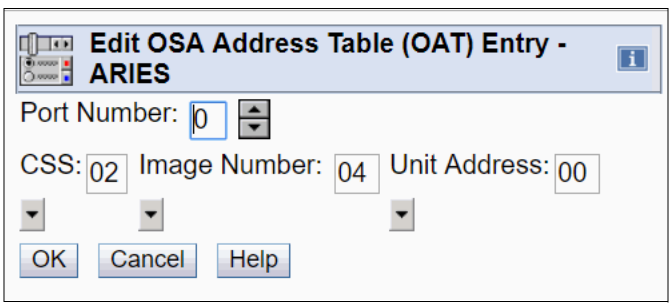


Figure 6-11 OSA/SF on the HMC: Edit SNA entry window

8. Select **Edit as TCP/IP Entry**, and the Edit OSA Address Table (OAT) Entry that is shown in Figure 6-12 opens. Enter and select the appropriate TCP/IP parameters here, and then click **OK**.

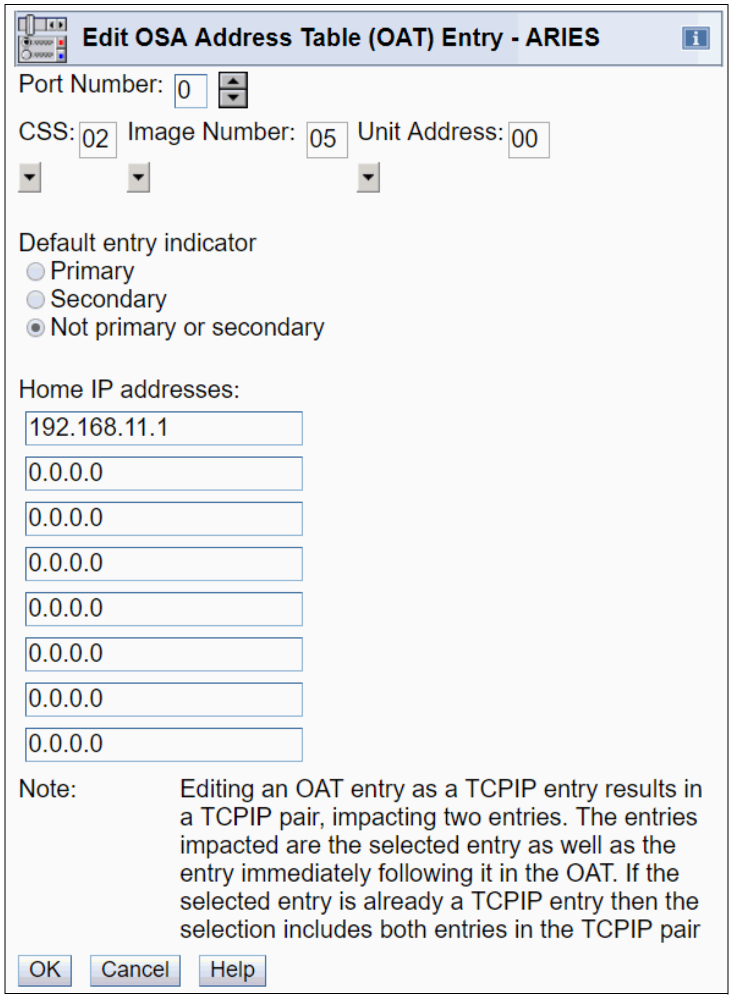
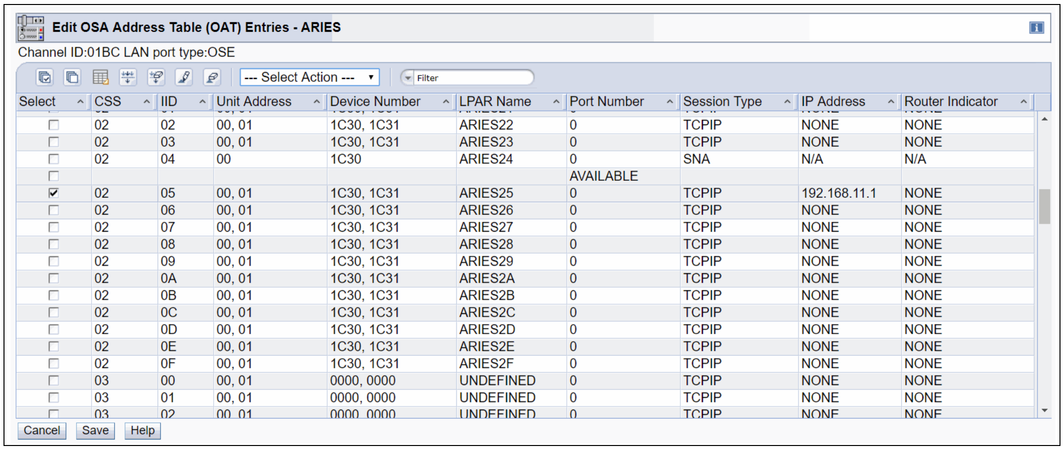


Figure 6-12 OSA/SF on the HMC: Edit TCP/IP entry window

9. After editing the TCP/IP entry or SNA entry, the Edit OSA Address Table (OAT) Entries window opens again. Confirm that your entries are displayed in this window. Figure 6-13 shows that the TCP/IP entry and SNA entry can be confirmed. Click **Save** to save the configuration.



Select	CSS	IID	Unit Address	Device Number	LPAR Name	Port Number	Session Type	IP Address	Router Indicator
☐	02	02	00, 01	1C30, 1C31	ARIES22	0	TCPIP	NONE	NONE
☐	02	03	00, 01	1C30, 1C31	ARIES23	0	TCPIP	NONE	NONE
☐	02	04	00	1C30	ARIES24	0	SNA	N/A	N/A
☐						AVAILABLE			
☑	02	05	00, 01	1C30, 1C31	ARIES25	0	TCPIP	192.168.11.1	NONE
☐	02	06	00, 01	1C30, 1C31	ARIES26	0	TCPIP	NONE	NONE
☐	02	07	00, 01	1C30, 1C31	ARIES27	0	TCPIP	NONE	NONE
☐	02	08	00, 01	1C30, 1C31	ARIES28	0	TCPIP	NONE	NONE
☐	02	09	00, 01	1C30, 1C31	ARIES29	0	TCPIP	NONE	NONE
☐	02	0A	00, 01	1C30, 1C31	ARIES2A	0	TCPIP	NONE	NONE
☐	02	0B	00, 01	1C30, 1C31	ARIES2B	0	TCPIP	NONE	NONE
☐	02	0C	00, 01	1C30, 1C31	ARIES2C	0	TCPIP	NONE	NONE
☐	02	0D	00, 01	1C30, 1C31	ARIES2D	0	TCPIP	NONE	NONE
☐	02	0E	00, 01	1C30, 1C31	ARIES2E	0	TCPIP	NONE	NONE
☐	02	0F	00, 01	1C30, 1C31	ARIES2F	0	TCPIP	NONE	NONE
☐	03	00	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
☐	03	01	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE
☐	03	02	00, 01	0000, 0000	UNDEFINED	0	TCPIP	NONE	NONE

Figure 6-13 OSA/SF on the HMC: Edit OSA Address Table (OAT) Entries window after editing

10. Select **Edit SNA timers** in the Panel Configuration Options window to change the SNA timer setting. Figure 6-14 shows the window in which you can edit the values. You can set the parameters for port 0 and 1 individually.

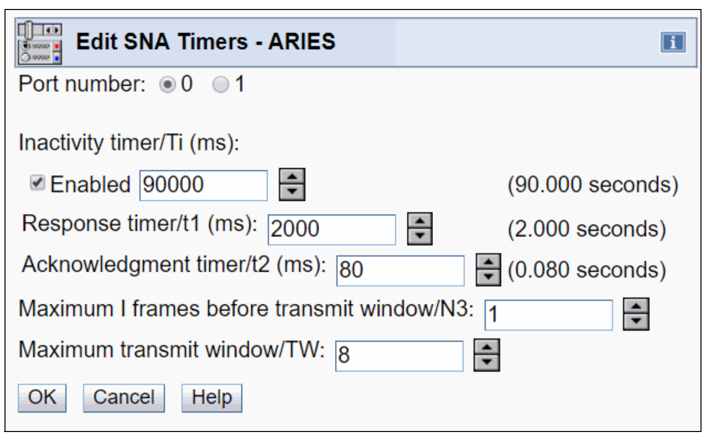


Figure 6-14 OSA/SF on the HMC: Edit SNA Timers window

11. When you complete editing the OAT entries or the SNA timer, the Panel Configuration Options window opens again. To activate the settings, you must validate them by selecting **Validate panel values**. Then, click **OK** (see Figure 6-15).

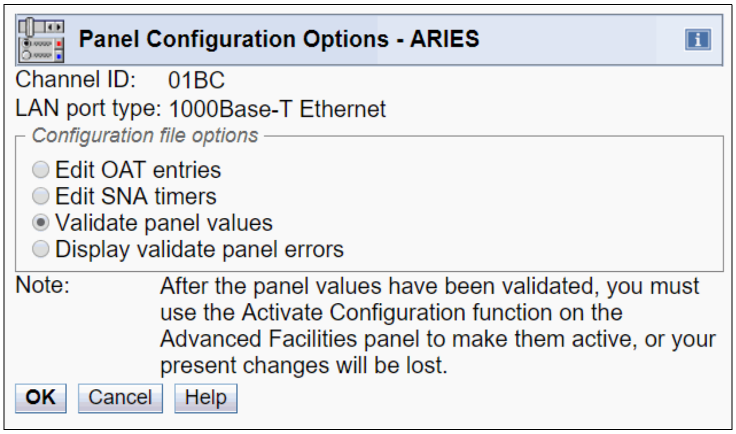


Figure 6-15 OSA/SF on the HMC: Validate panel values

12. If all of the parameters are entered correctly, a window like the one shown in Figure 6-16 opens.

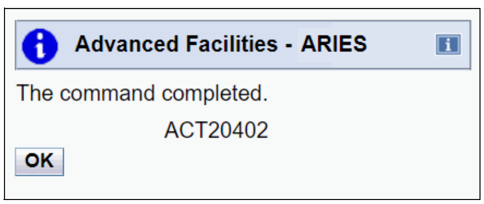


Figure 6-16 OSA/SF on HMC: Validate window value with success

If any of the parameters that were entered are wrong, a window with an ACT20425 message opens. To identify the error, select **Display validate panel errors**, and correct the error. Then, validate the panel values again until the error is fixed.

13. To activate your OSA configuration, select **Activate configuration** from the Advanced Facilities window, and click **OK** (Figure 6-17).

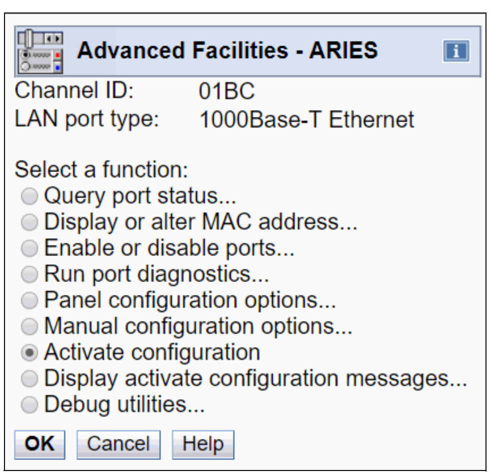


Figure 6-17 OSA/SF on the HMC: Activate configuration

14.The confirmation window that is shown in Figure 6-18 opens. Click **Yes** to continue.

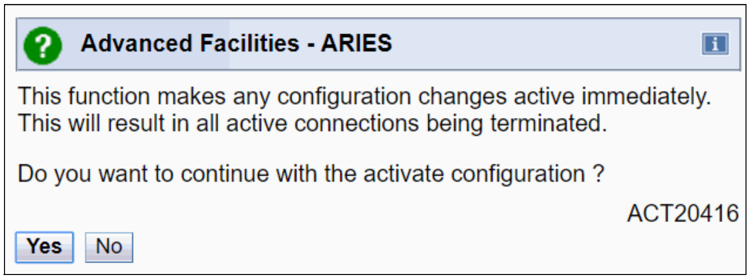


Figure 6-18 OSA/SF on the HMC: Confirm activation

15.When the activation is successful, the window that is shown in Figure 6-19 opens. Click **OK** to complete the process.

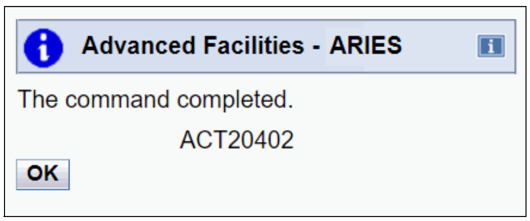


Figure 6-19 OSA/SF on the HMC: message when activation completed

16.To make the changes effective, you must bring the CHPID OFFLINE from all the LPARs that share the OSA CHPID, and then bring the CHIPID ONLINE.

17.If you select **Manual configuration options** (Figure 6-7 on page 137), the window that is shown in Figure 6-20 opens. In this window, you can import and export the source file of OAT through a USB device or FTP, create a configuration file on the editor on HMC, and edit the source file. For more information, see *Open Systems Adapter/Support Facility on the Hardware Management Console,* SC14-7580.

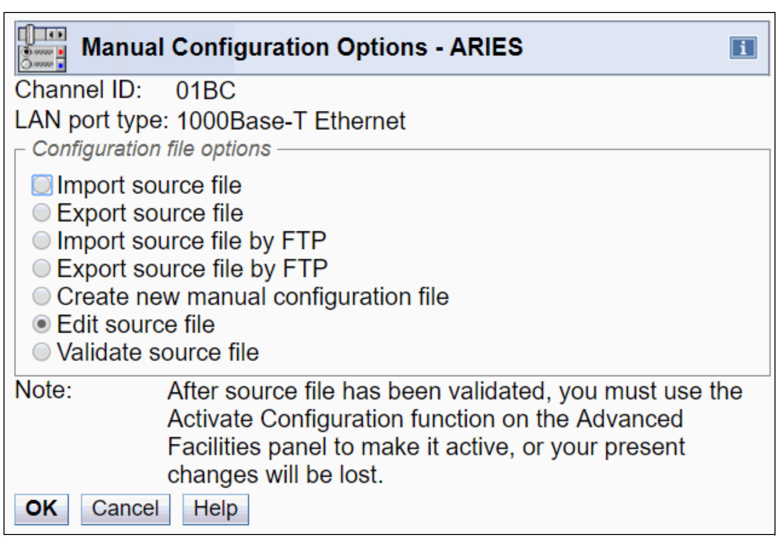


Figure 6-20 OSA/SF on the HMC: Manual Configuration options

6.3.2 Setting OSA parameters by using OSA Advanced Facilities

If you want to change the port speed or MAC address of an OSA-Express5S/6S/7S feature, you can use OSA Advanced Facilities. Normally, changing MAC address is required for SNA networks.

> **Port speed:** You can set the port speed to only 100 Mbps with the OSA-Express5S/6S 1000BASE-T features. The OSA-Express7S 1000Base-T feature does not have this capability.
>
> You cannot set the port speed to 1000 Mbps with the OSA-Express5S/6S 1000BASE-T features. If you want the port speed to run at 1000 Mbps, you must select **Auto Negotiate**.

Setting the OSA port speed

To change the port speed, complete the following steps:

1. Log on to the HMC, select the CPC that you want to operate, and then click **Open OSA Advanced Facilities**.
2. Select the PCHID of the OSA channel for which you must set the card mode. Select **Card specific advanced facilities** and click **OK**.
3. Select **Set card mode** and click **OK** (Figure 6-21).

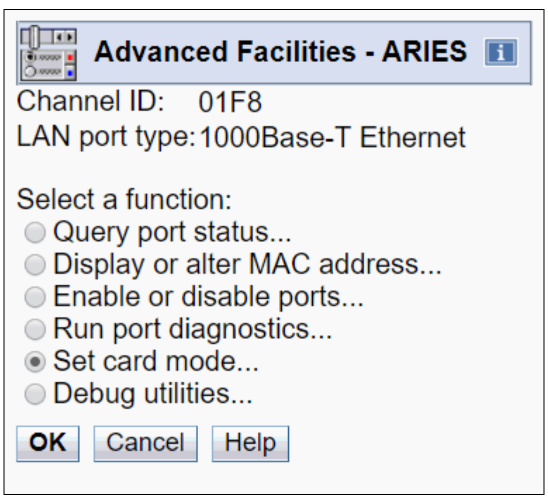


Figure 6-21 Selecting the card mode definition

4. The Set Card Mode or Speed window opens (Figure 6-22). Select the correct port speed from the Speed/Mode list. You can set the speed of port 0 and 1 individually. Click **OK**.

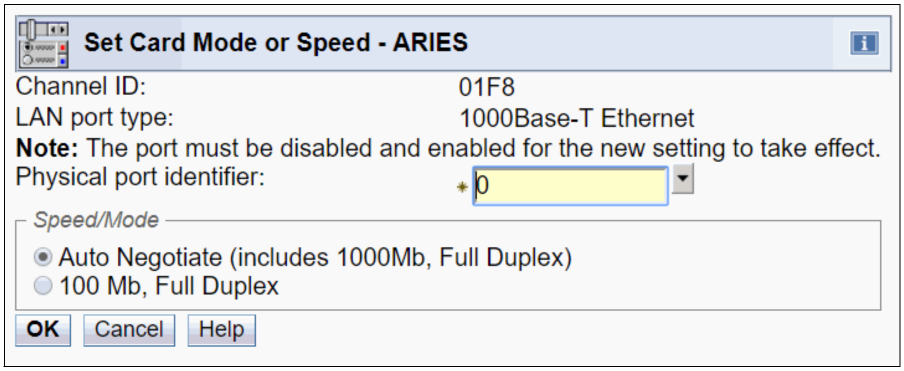


Figure 6-22 Set card mode or speed

5. To make the changes effective, you must configure CHPID OFFLINE and ONLINE from every LPAR where this CHPID is defined.

Changing the OSA MAC address

To change the MAC address, complete the following steps:

1. Log on to the HMC, open OSA Advanced Facilities, and select the PCHID that you want to customize.
2. The Advanced Facilities window opens (Figure 6-23). Select **Display or alter MAC address**, and then click **OK**.

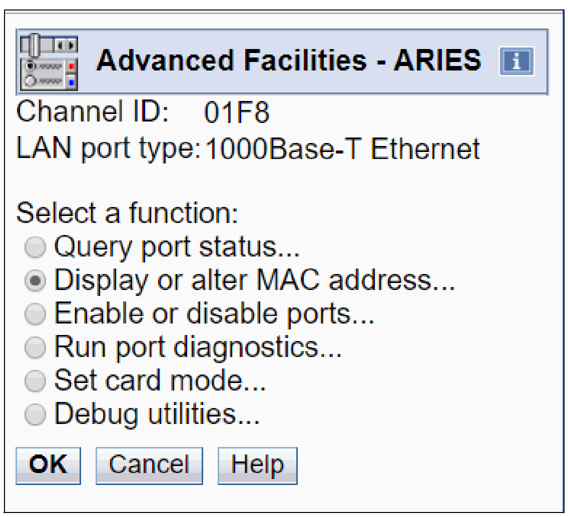


Figure 6-23 Display or alter MAC address

3. The Display or alter MAC address window opens (Figure 6-24). Set the MAC address that you want and then click **OK**.

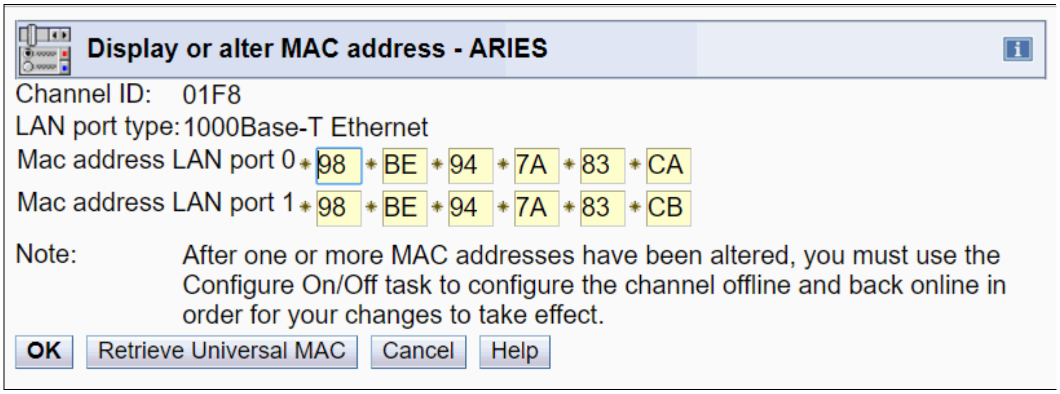


Figure 6-24 Display or alter MAC address values

4. To reflect the modification, you must configure CHPID OFFLINE and ONLINE from every LPAR where this CHPID is defined.

6.3.3 Confirming your OSA customization

To confirm your customization of OSA Advanced Facility, open OSA Advanced Facility again and confirm whether your definitions are reflected correctly. Also, check the device status from your networking software, such as TCP/IP and Virtual Telecommunications Access Method (VTAM).

6.4 Shared Memory Communications (SMC-R and SMC-D)

For more information about how to plan for and configure SMC - Remote Direct Memory Access over Converged Ethernet Express (SMC-R), see 2.5.4, “Network connectivity” on page 22 and 15.2.3, “Defining a RoCE PCIe function” on page 370.

For more information about how to configure SMC - Direct Memory Access over Internal Shared Memory (SMC-D), see 15.2.2, “Defining an ISM PCIe function” on page 366.

6.5 Channel-to-channel connections

This section describes the configuration steps for channel-to-channel (CTC) connections. If your system has programs such as VTAM or global resource serialization (GRS), then you must configure Fibre Connection (FICON) CTC (FCTC) links.

6.5.1 FICON CTC: Preparing

FCTC does not require that you explicitly define the CTC CU function to one channel side or the other. The channel itself decides which side contains the CU function. Both sides of an FCTC connection use a Fibre Channel (FC) channel path that is defined to one or more FCTC CUs representing the target systems for the CTC connections.

A logical address is required when the FC channel path is attached to a shared FC channel path to identify the LPAR to communicate with. When attached to an unshared FC channel path, the logical address must be zero or not specified. For more information, see the CTC Definitions page.

FCTC communication within a single processor complex can be accomplished with a single FC channel path connecting to FC switch. Both sides of the CTC connection are represented by the same single FC channel path. This configuration results in these advantages:

- Reducing the number of channels that are required.
- Simplified configuration design.
- Simplified configuration definition.

6.5.2 FICON CTC: Implementation

The following considerations apply to all FCTC configurations:

- The server at each end of an FCTC connection uses a FICON native (CHPID type FC) channel.
- The FICON native channel at each end of the CTC connection has an FCTC CU that is defined.
- The FCTC devices on the FCTC CU are defined as type FCTC.
- The FCTC control function on the IBM Z platform can communicate with an FCTC CU that is defined on a FICON native channel on any server that supports FICON.
- The FICON native channel at each end of the FCTC connection supports the FCTC CUs, and also communicates with other FICON native CUs, such as disk and tape.

In an FCTC configuration, FCTC CUs are defined at each end, but only one end provides the FCTC CU function. During initialization of the logical connection between two ends of an FCTC connection, the channel that provides the FCTC CU function is determined by using an algorithm. This process results in balancing the number of FCTC CU functions that each end of the logical connection is providing. The algorithm uses the channel with the lower FC worldwide name (WWN) to provide the FCTC CU function.

FICON native channel CTC communication does *not* require a pair of channels because it can communicate with any FICON native channel that has a corresponding FCTC CU that is defined. This configuration means that FCTC communications can be provided by using only a single FICON native channel per server.

For more information about how to implement FCTC, see the following publications:

- *FICON CTC Implementation*, REDP-0158
- *FICON Planning and Implementation Guide*, SG24-6497
- *I/O Configuration Using z/OS HCD and HCM*, SG24-7804

6.5.3 FICON CTC: Management

After you activate the FCTC configuration and connect all the cables, verify whether the CHPIDs are online and operating by using either z/OS or the Support Element (SE):

- Checking the status by using z/OS commands.

  If you are interested in checking the status of CHPIDs 44 and 45, run the **`D M=CHP(44)`** and **`D M=CHP(54)`** commands, as shown in Figure 6-25.

```
D M=CHP(44)
IEE174I 17.00.05 DISPLAY M 006
CHPID 44:  TYPE=1B, DESC=FICON SWITCHED, ONLINE
DEVICE STATUS FOR CHANNEL PATH 44
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0463 +  +  +  +  .  .  .  .  .  .  .  .  .  .  .  .
SWITCH DEVICE NUMBER = NONE
ATTACHED ND = 008960.F64.IBM.CA.1000010546MH
PHYSICAL CHANNEL ID = 0148
FACILITIES SUPPORTED = ZHPF
************************ SYMBOL EXPLANATIONS ************************
+ ONLINE    @ PATH NOT VALIDATED   - OFFLINE    . DOES NOT EXIST
* PHYSICALLY ONLINE   $ PATH NOT OPERATIONAL

D M=CHP(54)
IEE174I 16.56.43 DISPLAY M 985
CHPID 54:  TYPE=1B, DESC=FICON SWITCHED, ONLINE
DEVICE STATUS FOR CHANNEL PATH 54
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0263 +  +  +  +  .  .  .  .  .  .  .  .  .  .  .  .
SWITCH DEVICE NUMBER = NONE
ATTACHED ND = 008960.F64.IBM.CA.1000010546MH
PHYSICAL CHANNEL ID = 0149
FACILITIES SUPPORTED = ZHPF
************************ SYMBOL EXPLANATIONS ************************
+ ONLINE    @ PATH NOT VALIDATED   - OFFLINE    . DOES NOT EXIST
* PHYSICALLY ONLINE   $ PATH NOT OPERATIONAL
```

Figure 6-25 DISPLAY FCTC on system SC74

- Checking the status by using the SE:
  - From the HMC, select the CPC (under Systems Management) where the CHPID/PCHID you want to verify is and click **Single Object Operations** (under the **Recovery** task options).
  - On the SE, select the same CPC and click **Channels**. Look for the PCHID you are interested in checking the status of. The result is shown in Figure 6-26.

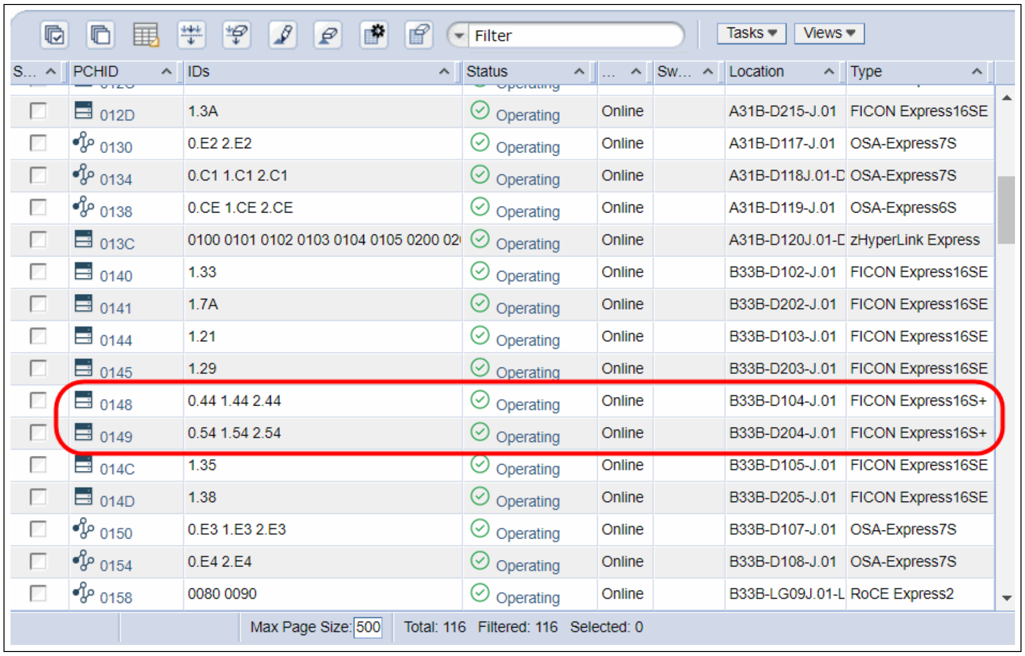


Figure 6-26 Using the SE to verify channel FCTC by using the CPC view

- To get more details about the PCHID, click the PCHID to open the details window that is shown in Figure 6-27.

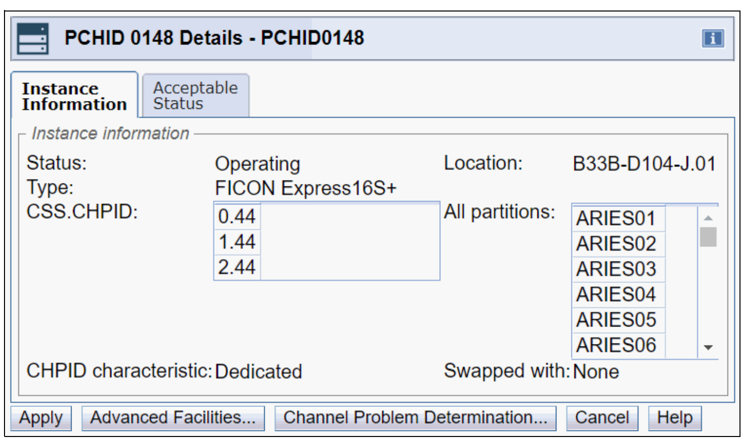


Figure 6-27 FCTC PCHID details

– Another way to check the status is from the LPAR view. Select the LPAR and then the CHPIDs option under that LPAR. You can look for the CHPID and check the status, as shown in Figure 6-28.

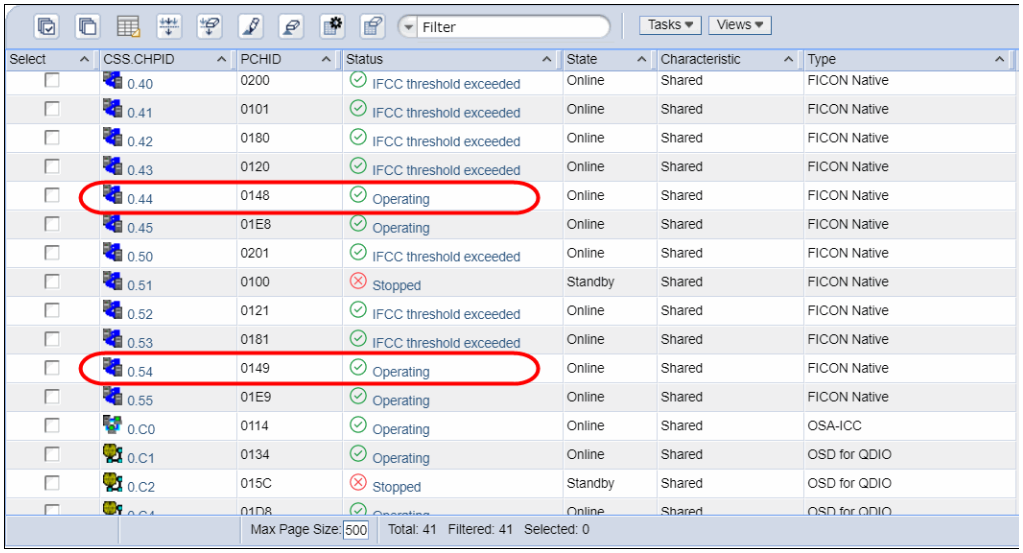


Figure 6-28 Verifying channel FCTC by using the LPAR view

– For more details, click the CHPID, as shown in Figure 6-29.

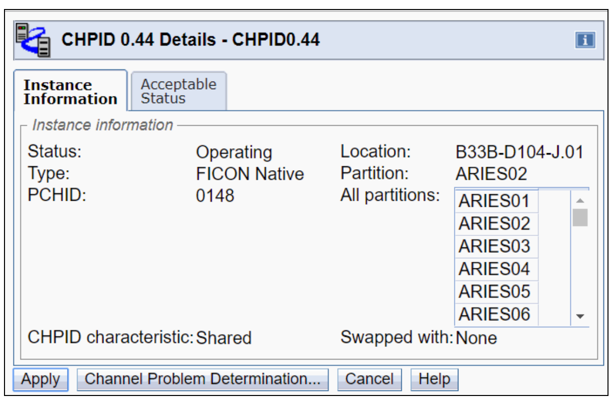


Figure 6-29 FCTC CHPID details

7

Defining console communication

This chapter includes the following sections:

- Preparing a console definition
- Defining the OSA-ICC
- Defining a new OSA-ICC configuration by using OSA Advanced Facilities
- Verifying the OSA-ICC definition

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

7.1 Preparing a console definition

A non-Systems Network Architecture (SNA) console is a console that is required for IPL, z/OS system operation, and management. You must define at least one non-SNA console to your z/OS system. To define the non-SNA console, use the Open Systems Adapter-Express (OSA-Express) Integrated Console Controller (ICC) (OSA-ICC) function. For more information, see *Open Systems Adapter Integrated Console Controller User's Guide*, SC27-9003. The following steps are required:

1. Define the OSC channel path ID (CHPID) and the `CNTLUNIT`.
2. Define the 3270-X `IODEVICE`.
3. Configure OSA-ICC by using the Open Systems Adapter (OSA) Advanced Facilities.
4. Export / import the OSA-ICC configuration (optional).
5. Activate the OSA-ICC configuration by using the OSA Advanced Facilities.
6. Set up IBM Personal Communications.

Note: Channel type OSC is supported on the OSA-Express 1000Base-T type adapters only. The OSA-Express7S 1000Base-T Adapter supports connections at 1000 Mbps only.

You must configure OSA-ICC when you upgrade to a z15 system from an older IBM Z generation where OSA-ICC definitions exist or when installing a new z15 system and non-SNA consoles are required. For an *upgrade* from a z14 system, the OSA-ICC configuration is automatically upgraded to a z15 system.

7.2 Defining the OSA-ICC

Before you perform OSA-ICC configuration, you must define the OSC CHPID, `CNTLUNIT`, and 3270-X `IODEVICE` to the I/O configuration. Defining the OSC channel by using the Hardware Configuration Definition (HCD) is described in Chapter 13, “Adding network devices” on page 287, and Chapter 11, “Adding logical partitions and operating system configurations” on page 261.

7.3 Defining a new OSA-ICC configuration by using OSA Advanced Facilities

When installing a new z15, you must configure OSA-ICC from scratch. To create an OSA-ICC configuration, complete the following steps:

1. Log on to the Hardware Management Console (HMC), select the central processor complex (CPC), and open OSA Advanced Facilities.
2. Select the OSC physical channel ID (PCHID) to use for the OSA-ICC configuration, and select **Card specific advanced facilities** (Figure 7-1 on page 153).

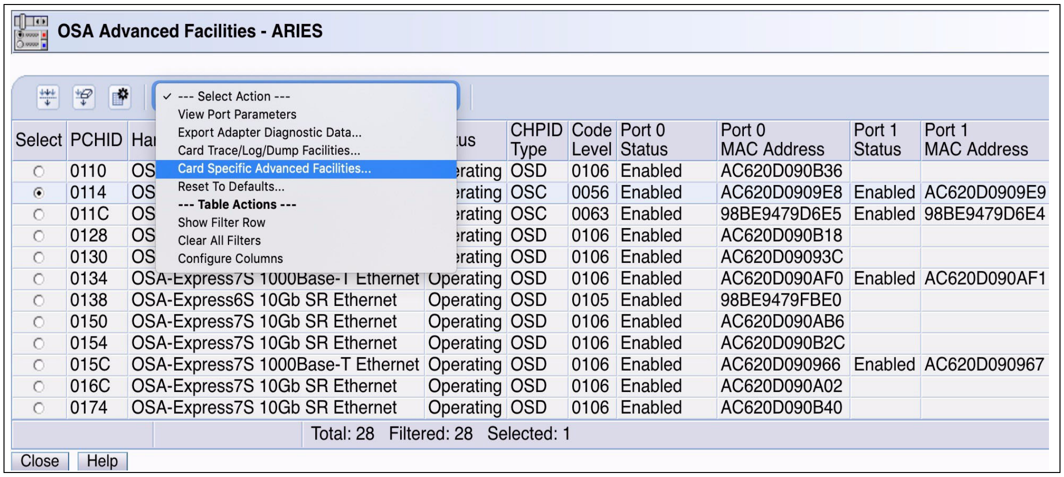


Figure 7-1 Card Specific Advanced Facilities

3. Select **Panel configuration options** and click **OK** (Figure 7-2).

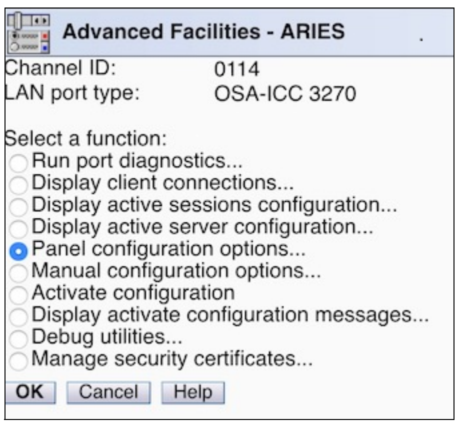


Figure 7-2 Panel configuration options

4. The Panel Configuration Options window opens (Figure 7-3). Define the session and server configurations in this window, and validate those values. In this example, we define the server configuration first, and then define the session configuration. To edit the server configuration, select **Edit server configuration** and click **OK**.

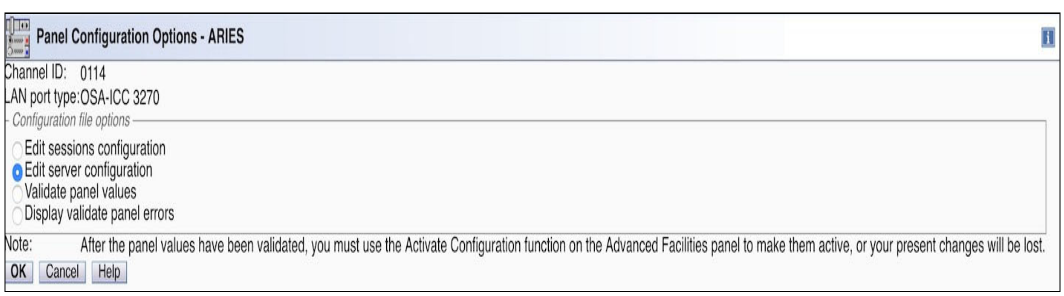


Figure 7-3 Edit server configuration

5. The Edit server configuration window opens. Enter the necessary values on this window. Figure 7-4 shows our sample configuration. Click **OK** to save.

Figure 7-4 Edit server configuration window

6. The command is completed (ACT20402) window opens. Click **OK** to return to the Panel Configuration Options window.
7. Next, define the session configuration. Select **Edit sessions configuration** and click **OK**. The window that is shown in Figure 7-5 opens.

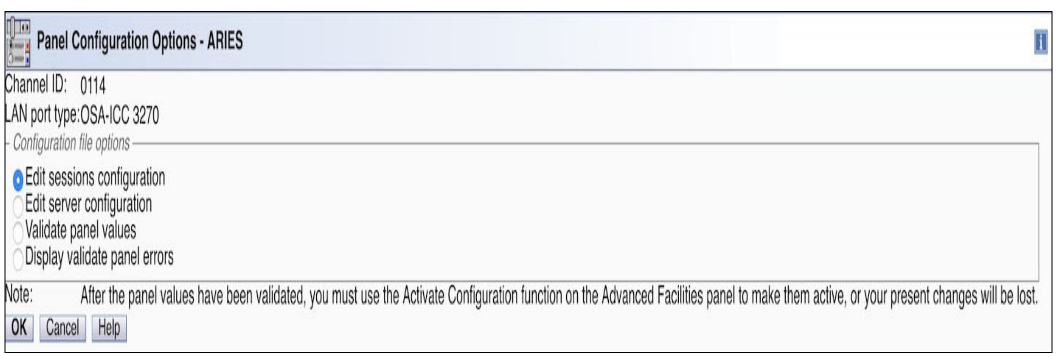


Figure 7-5 Edit session configuration

8. The Edit Sessions Configuration window opens (Figure 7-6). To configure a session, select a number from the Session Index column and click **Change**.

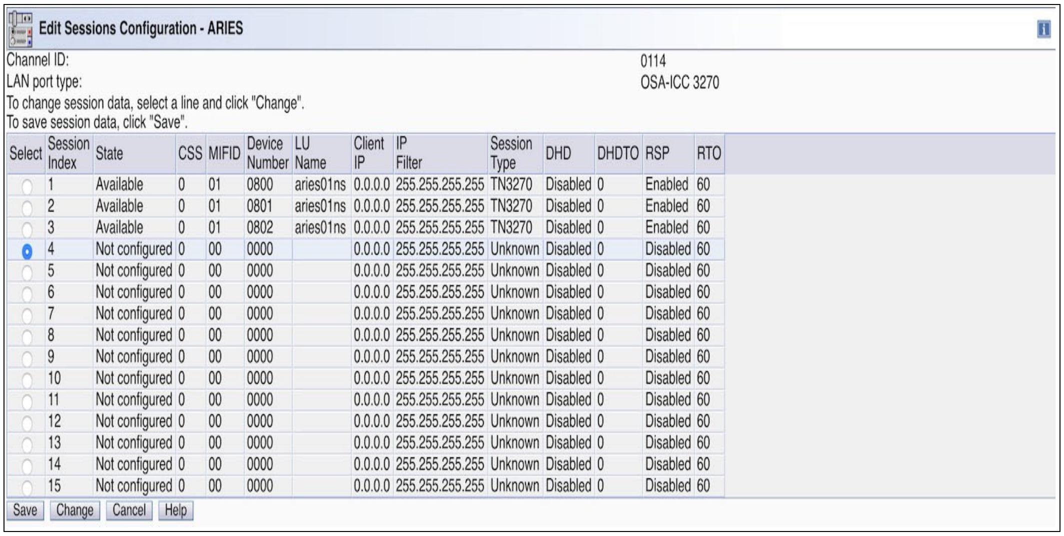


Figure 7-6 Edit Sessions Configuration selection

9. The Edit Session Configuration window opens. Define the session parameter here. Click **OK** to save (Figure 7-7).

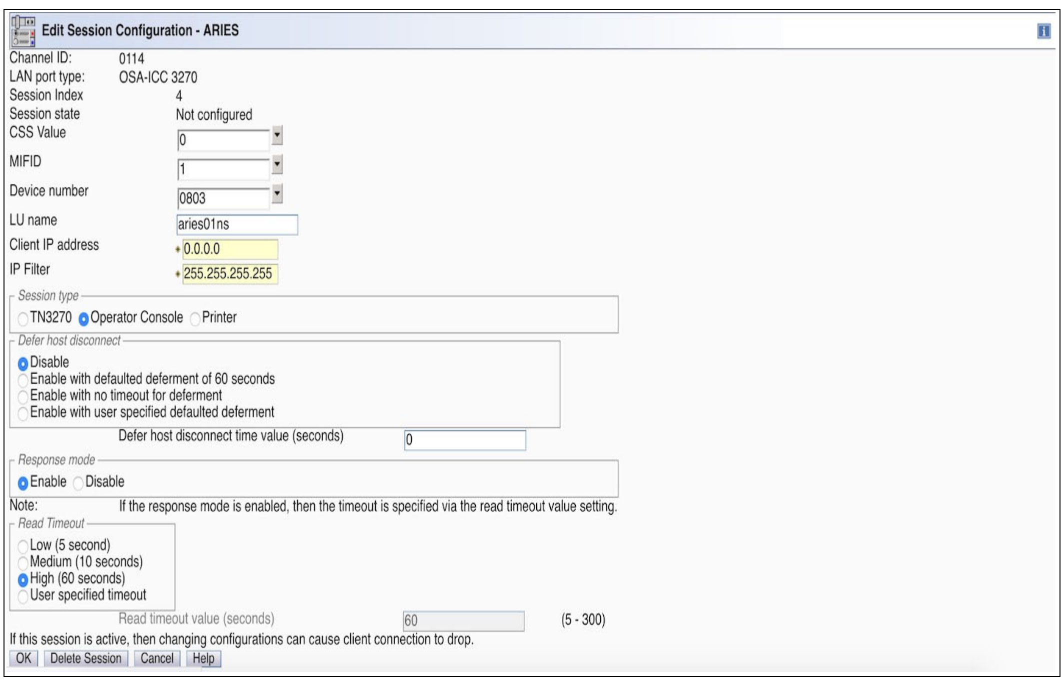
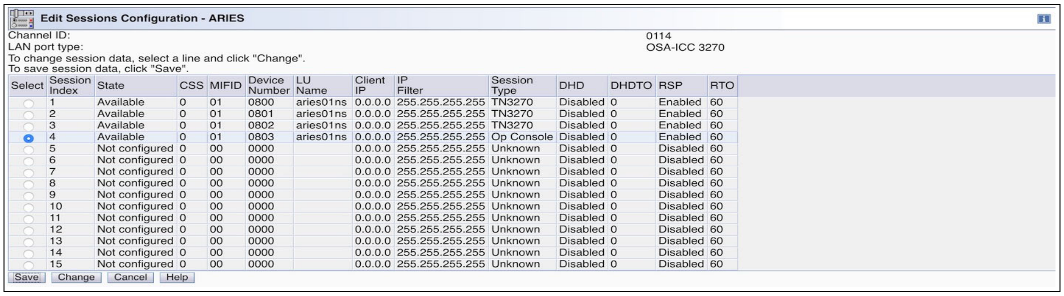


Figure 7-7 Edit Session Configuration input

10. The Edit Sessions Configuration window opens again (Figure 7-8). Be sure that your input values are displayed correctly. To save the session values, click **Save**.



Edit Sessions Configuration - ARIES

Channel ID: 0114
LAN port type: OSA-ICC 3270
To change session data, select a line and click "Change".
To save session data, click "Save".

Select	Session Index	State	CSS	MIFID	Device Number	LU Name	Client IP	IP Filter	Session Type	DHD	DHDTO	RSP	RTO
	1	Available	0	01	0800	aries01ns	0.0.0.0	255.255.255.255	TN3270	Disabled	0	Enabled	60
	2	Available	0	01	0801	aries01ns	0.0.0.0	255.255.255.255	TN3270	Disabled	0	Enabled	60
	3	Available	0	01	0802	aries01ns	0.0.0.0	255.255.255.255	TN3270	Disabled	0	Enabled	60
	4	Available	0	01	0803	aries01ns	0.0.0.0	255.255.255.255	Op Console	Disabled	0	Enabled	60
	5	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	6	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	7	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	8	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	9	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	10	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	11	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	12	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	13	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	14	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60
	15	Not configured	0	00	0000		0.0.0.0	255.255.255.255	Unknown	Disabled	0	Disabled	60

Save Change Cancel Help

Figure 7-8 Edit Sessions Configuration after define values

11. The command completed (ACT20402) window opens. Click **OK**.

12. The Panel Configuration Options window opens again (Figure 7-9). Now, you can validate the values. Select **Validate panel values** and click **OK**.

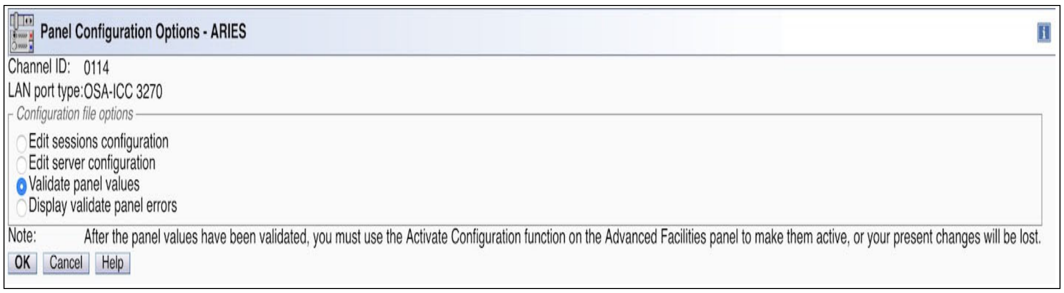


Figure 7-9 Display Validate panel values

13. If the configuration data is correct, the command completed (ACT20402) window opens.

If an error is encountered, a window like Figure 7-10 opens. You can confirm the error by selecting **Display validate panel errors**, as shown in on Figure 7-11 on page 157, in Panel Configuration Options (Figure 7-9). Correct the error, and select again **Validate panel values** to recheck.

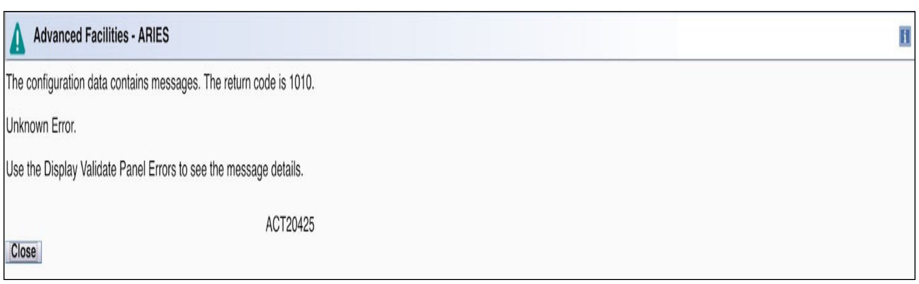


Figure 7-10 Panel Configuration Options error found

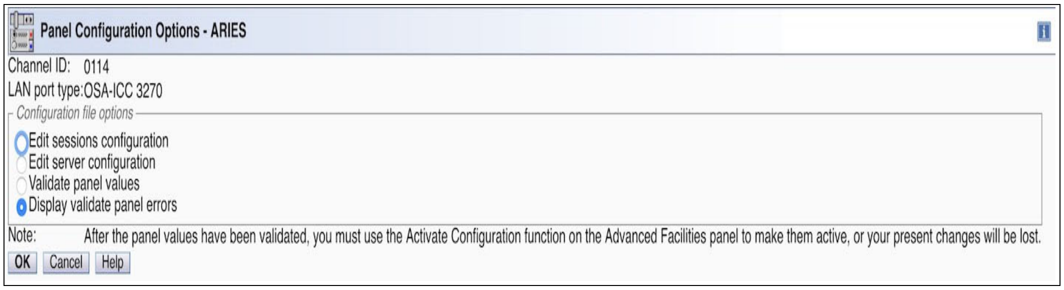


Figure 7-11 Panel Display validate panel errors

In Figure 7-12, the window shows the details of the error message.

Figure 7-12 Detailed error message

14. When the validation is complete without any errors, you can activate the OSA-ICC configuration. To activate the configuration, exit the **Panel Configuration Options** window by clicking **Cancel**, and then select **Activate configuration** in the Advanced Facilities window (Figure 7-13).

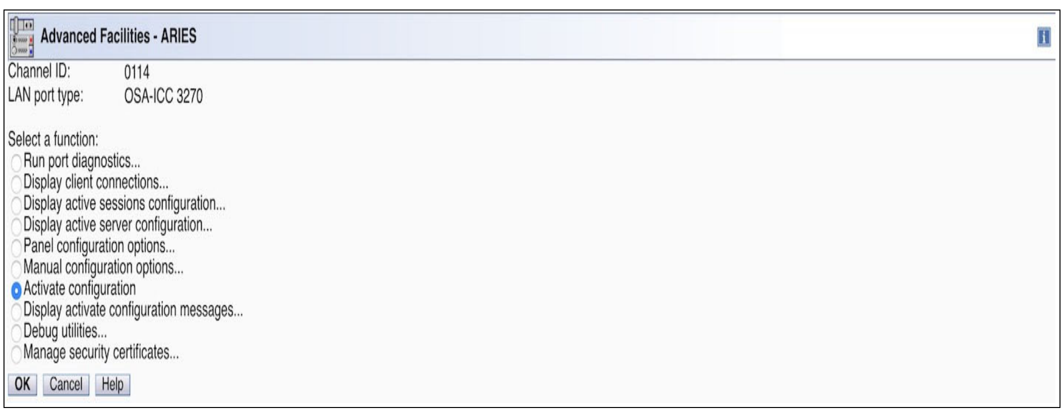


Figure 7-13 Activate configuration

15. The confirmation window opens. Click **Yes** to continue (Figure 7-14).

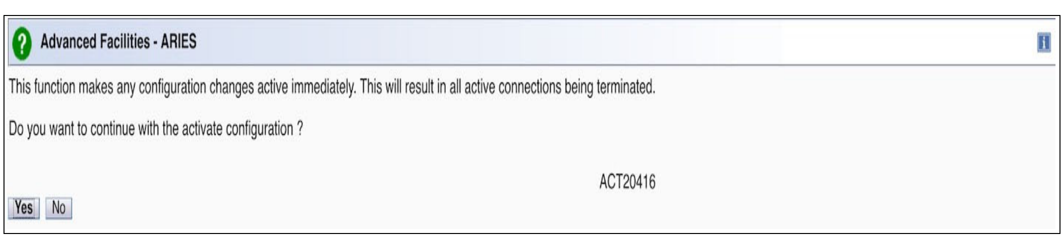


Figure 7-14 Activate configuration confirmation

16.When the activation is complete, the message that is shown in Figure 7-15 is displayed.

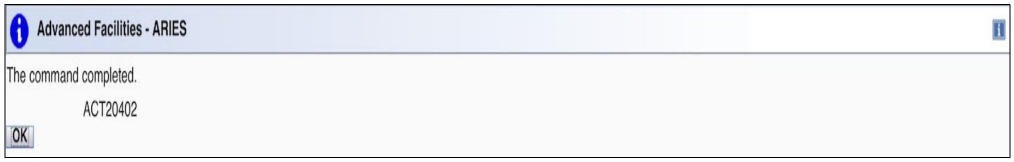


Figure 7-15 Activate configuration success

7.3.1 Saving and restoring the OSA-ICC configuration

During an upgrade, you can export an OSA-ICC configuration file from the source IBM Z CPC and import it to the z15 system. This section describes how to export and import the OSA-ICC configuration file by using HMC and an FTP server that is part of the same local area network (LAN) segment.

Exporting the OSA-ICC configuration file by using OSA Advanced Facilities

In this example, we export the OSA-ICC configuration file from a z15 system to an FTP server and import the file to the same z15 system from the same FTP server. You can also import or export the configuration file by using FTP.

To export the OSA-ICC configuration file, complete the following steps:

1. Before you try to export a source file to an FTP server, make sure the FTP server is reachable from this particular HMC:
   a. Contact your LAN administration and ask for the host name and TCP/IP address of the FTP server that is connected to the same subnet. From the HMC Welcome window, click **HMC Management**, as show on Figure 7-16.

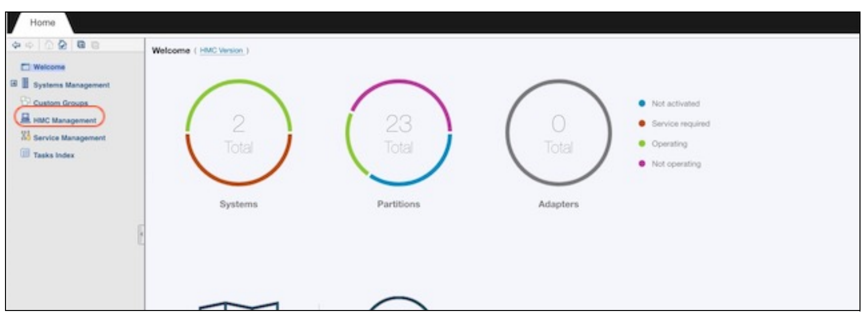


Figure 7-16 Click "HMC Management" to get to the network diagnostic information

   b. On the HMC Management window, click **Network Diagnostic Information** to get to the Network Diagnostic Information window, as shown in Figure 7-17 on page 159.

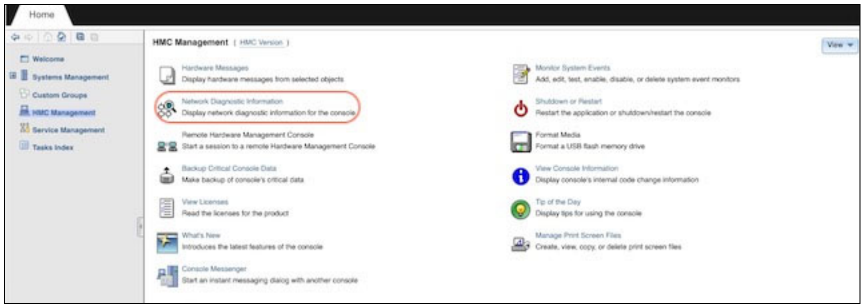


Figure 7-17 Clicking Network Diagnostic Information to ping the FTP server

c. On the **Ping** tab of the Network Diagnostic Information window, enter the TCP/IP Address of the FTP server and click **Ping**. You should see the ping statistics, which indicates that this HMC has a connection to the FTP server, as shown in Figure 7-18.

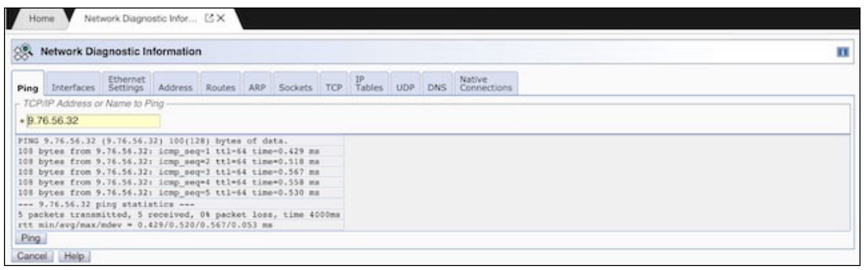


Figure 7-18 Network Diagnostic Information: Using the ping function to verify the physical connection between this HMC and the FTP server

2. Log on to the HMC, select the CPC that you want to operate, and open the OSA Advanced Facility.
3. Select the OSC CHPID to export the OSA-ICC configuration file, select **Card Specific Advanced Facilities,** select **Manual configuration options**, then click **OK** (Figure 7-19).

Figure 7-19 Manual configuration options

4. The Manual Configuration Options window opens (Figure 7-20). Select **Export source file by FTP** and click **OK**.

Figure 7-20 Export source file by FTP

5. The window prompts you for the FTP server information and the location of the file to export. For our example, we enter `OSC0114.txt` as in Figure 7-21. Click **Export**. The HMC task writes the source file for the PCHID that was selected on to the FTP server and displays a message when it completes (Figure 7-22). Click **OK**.

Figure 7-21 Export file: Specify the FTP server, and file path and name

The HMC displays the ACT20402 window. Click **OK**.

Figure 7-22 ACT20421 window display

6. Click **Cancel** to exit all of the OSA Advanced Facilities windows.

Example 7-1 shows a source file on the USB flash drive.

Example 7-1 OSA-ICC: Sample source file

```
<OSC_SERVER>
<OSC_PHYSICAL_PORT0>
  HOST_IP= 192.168.70.98
  SUBNET_MASK= 255.255.240.0
  PORT= 1024
  SECURE_PORT= 0
  HOST_LL_ADDRESS/PREFIX=  fe80::ae62:dff:fe09:9e8/64
  ADDR_TYPE= LINK_LOCAL
  HOST_IPV6_ADDRESS/PREFIX=  ::/0
  IPV6_PORT= 0
  IPV6_SECURE_PORT= 0
  ETHERNET_FRAME= DIX
  MTU= 1492
  NAME= ARIESIC2
</OSC_PHYSICAL_PORT0>

<OSC_PHYSICAL_PORT1>
  HOST_IP= 9.76.56.55
  SUBNET_MASK= 255.255.255.0
  PORT= 1025
  SECURE_PORT= 0
  HOST_LL_ADDRESS/PREFIX=  fe80::ae62:dff:fe09:9e9/64
  ADDR_TYPE= LINK_LOCAL
  HOST_IPV6_ADDRESS/PREFIX=  ::/0
  IPV6_PORT= 0
  IPV6_SECURE_PORT= 0
  ETHERNET_FRAME= DIX
  MTU= 1492
```

```
  NAME= ARIESIC2
</OSC_PHYSICAL_PORT1>

  TLS_VERSION= 1.0
  DEFAULT_GATEWAY= 9.76.56.1
  IPV6_DEFAULT_GATEWAY=  ::
</OSC_SERVER>


<CONFIG_SESSION>
<SESSION1>
  CSS= 00 IID= 01 DEVICE= 0800
  GROUP=  "aries01ns"
  CONSOLE_TYPE= 1    RESPONSE= ON    READ_TIMEOUT= 60
</SESSION1>

<SESSION2>
...
...
</CONFIG_SESSION>
```

Editing the source file for OSA-ICC

When your OSA-ICC configuration for z15 (such as the `IODEVICE`, `CSSID`, and `MIFID` of logical partitions (LPARs)) is changed, you must edit the OSA-ICC source file to match the new configuration. For more information about editing the source file, see *Open Systems Adapter Integrated Console Controller User's Guide,* SC27-9003.

Importing the OSA-ICC source file to z15 systems

To import the source file and activate the configuration of the OSA-ICC on the new z15 system, complete the following steps:

1. Before you import the source file from the FTP server, make sure that the FTP server is reachable from this particular HMC. For more information about how to make sure that the FTP server is reachable, see step 1 on page 158.
2. Log on to the HMC, select the CPC that you want to operate, and open OSA Advanced Facility.
3. Select OSC CHPID to import the OSA-ICC configuration file. Then, select **Card specific advanced facilities**.
4. Select **Manual configuration options** and click **OK**.
5. The Manual Configuration Options window opens. Select **Import source file by FTP** and click **OK** (Figure 7-23).

Figure 7-23 Importing a source file

6. You are prompted to provide the FTP server and file location information (Figure 7-24). Click **Import**.

Figure 7-24 Importing a file

7. The next window (Figure 7-25) indicates that the source file import is complete. Click **OK** to continue, and then remove the USB flash drive.

Figure 7-25 Import file successful

8. After importing the source file, you must validate it and activate the configuration.

7.4 Verifying the OSA-ICC definition

This section presents some tools that you can use to verify the OSA-ICC configuration.

7.4.1 z/OS commands

You can check your definition by using the following z/OS commands:

- **`DISPLAY M=CHP(xx)`**

  Check whether the `CHPID DESC` is displayed as `OSA CONSOLE` (Figure 7-26).

```
D M=CHP(C0)
IEE174I 09.58.19 DISPLAY M 059
CHPID C0:  TYPE=14, DESC=OSA CONSOLE, ONLINE
DEVICE STATUS FOR CHANNEL PATH C0
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0010 $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@
0078 $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@
0080 +  +  +  $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@
SWITCH DEVICE NUMBER = NONE
PHYSICAL CHANNEL ID = 0114
************************ SYMBOL EXPLANATIONS ************************
+ ONLINE    @ PATH NOT VALIDATED   - OFFLINE    . DOES NOT EXIST
* PHYSICALLY ONLINE   $ PATH NOT OPERATIONAL
```

Figure 7-26 OSC D M=CHP

- **DISPLAY M=DEV(xxxx)**

  Using this command, you can confirm the channel path to a device. The node descriptor information that is returned includes the emulated control unit (CU) 2074. Also included is the 3906 machine type and serial number (Figure 7-27).

```
D M=DEV(800)
IEE174I 09.59.48 DISPLAY M 061
DEVICE 00800   STATUS=ONLINE
CHP                   C0
ENTRY LINK ADDRESS    ..
DEST LINK ADDRESS     0D
PATH ONLINE           Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL      Y
MANAGED               N
CU NUMBER             1B00
INTERFACE ID          1400
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND         = NOT AVAILABLE
SCP TOKEN NED     = 002074.   .IBM.02.85610002B7F8.C000
SCP DEVICE NED    = 002074.002.IBM.02.85610002B7F8.C000
```

Figure 7-27 OSC D M=DEV(xxx)

- **DISPLAY U**

  Using this command, you can confirm the device number and the status. Check whether the device number and type are defined correctly (Figure 7-28).

```
D U,,,800,1
IEE457I 10.01.24 UNIT STATUS 065
UNIT TYPE STATUS        VOLSER     VOLSTATE      SS
0800 3270 O                                       0
```

Figure 7-28 OSC D U,,,device

7.4.2 OSA-ICC console initial window

When you complete setting up IBM Personal Communications, you see the OSA-ICC initial window, as shown in Figure 7-29. Check whether the OSA-ICC definitions are reflected correctly.

If you do not see the initial window, check your definition in the OSA-ICC or IBM Personal Communications session setup.

```
 **      OSC Index 01 connected to ARIESIC2 via IP Addr 9.76.56.55:1025      **
 **       LT Index=00 CSSID=00 MIFID=01 CU=0  UA=00  LUName=aries01ns        **
 **       Type=8561-T01 Mfg=IBM SN=00000002B7F8 CHPID=C0 Status=Active       **



9.57.247.177:58297
```

Figure 7-29 OSA-ICC initial window

8

Preparing for IBM Parallel Sysplex and configuring Server Time Protocol

This chapter describes the preparation tasks for IBM Parallel Sysplex and how to configure time synchronization with Server Time Protocol (STP).

This chapter includes the following sections:

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

8.1 Preparing for Parallel Sysplex

If your z15 system is a member of a Parallel Sysplex or if you create a Parallel Sysplex that involves a z15 system, time synchronization among central processor complexes (CPCs) is required. For time synchronization, you must use the STP feature (Feature Code #1021). In addition to the time synchronization, the following tasks are required to create a Parallel Sysplex:

1. Defining Coupling Facility (CF) links.
2. Defining Fibre Connection (FICON) channel-to-channel (CTC) (FCTC) connections (optional).
3. Defining the CF logical partition (LPAR).
4. Defining the CF LPAR image profile in Hardware Management Console (HMC).
5. Configuring STP.

Defining CF (coupling) links is described in Chapter 9, “Defining Coupling Facility links” on page 197. Defining the image profile is described in 5.4, “Creating an image profile on the Support Element” on page 104.

8.2 Preparing for non-sysplex system time synchronization

If your z15 system is not part of a Parallel Sysplex but you want to synchronize the time among multiple CPCs, you need the STP function and STP-only (timing) links. These configuration steps are required:

1. Defining STP-only (timing) links.
2. Configuring STP.

Defining STP-only (timing) links is described in 9.4, “Defining an STP timing-only link by using ICA SR” on page 207.

This chapter describes how to set up STP on the z15 T01.

8.3 Server Time Protocol overview

STP provides time synchronization among multiple CPCs in a Coordinated Timing Network (CTN). A CTN is a collection of servers that are synchronized to a time protocol that is called Coordinated Server Time (CST). The STP function (feature) is implemented in the Licensed Internal Code (LIC) as a chargeable feature. You must order STP enablement Feature Code #1021 to use STP.

For more information about STP concepts and planning information, see *Server Time Protocol Planning Guide*, SG24-7280 and *IBM Z Server Time Protocol Guide*, SG24-8480.

With z15 systems, STP stratum level 4[1] is supported. Timekeeping information is transmitted over coupling links. Figure 8-1 shows a diagram of a CTN.

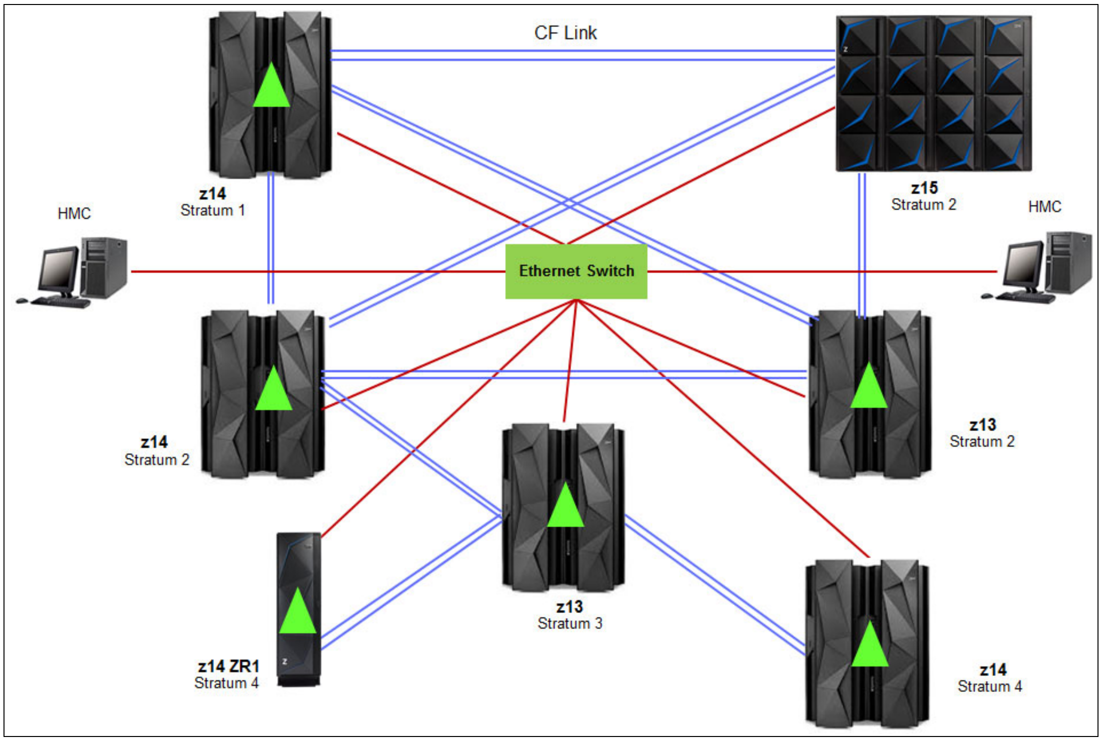


Figure 8-1 STP only CTN connectivity

> **Note:** z15 supports STP timing mode only (can be part of an STP-only CTN). The z15 system cannot be in the same sysplex or CTN with any IBM Z systems earlier than a z13 system.

8.3.1 Using External Time Source

STP retrieves the time from a Network Time Protocol (NTP) server through the NTP client on the Support Element (SE). STP synchronizes the time of day (TOD) to the External Time Source (NTP server) that is accessed through the NTP client on the SE. To access the External Time Source (ETS), the SE requires network connectivity to the NTP server.

To provide NTP data to the NTP client on the SE, you have two options:

- Connect the NTP server directly to the SE-HMC network.
- Use HMC as an NTP server.

> **Note:** You cannot set up the HMC as an ETS by using a dial-out configuration. You must provide network connectivity to an NTP server.

For security reasons, the NTP server should not be directly attached to the SE-HMC network (firewall separation is recommended). If a firewall configuration is not possible, HMC can act as an NTP server, so HMC can be used as an NTP server for STP. For more information, see 8.4, “Configuring the HMC as an NTP server” on page 168.

[1] Although STP stratum level 4 is supported, it should not be used for permanent configurations. Stratum 4 should be used for transitional configurations, during CTN maintenance.

Figure 8-2 shows a sample ETS configuration for the STP.

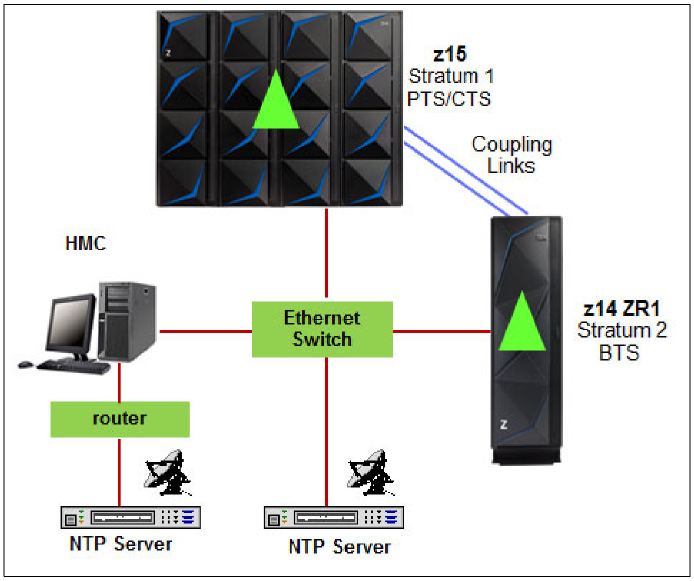


Figure 8-2 Example configuration: NTP server on the HMC

Especially for the financial markets, very tight time accuracy is demanded by the authorities of various countries. The US Financial Industry Regulatory Authority (FINRA) announced that computer clocks that are used to record events in national market system (NMS) securities and over-the-counter (OTC) equity securities must be synchronized to within a 50-millisecond drift tolerance of the National Institute of Standards and Technology (NIST) atomic clock. Also, the European Union demands in their Markets in Financial Instruments Directive (MIFID II) regulation that the maximum divergence from Coordinated Universal Time is 100 microseconds.

Unfortunately, the accuracy of the interface with an NTP server to maintain CST accuracy that is provided by STP is 100 milliseconds to the time that is provided by the NTP server. To meet the clock synchronization requirements of FINRA and MIFID II, the NTP server must have a pulses per second (PPS) output signal that can achieve time accuracy within 10 microseconds. If your configuration requires the NTP server with PPS capability, the NTP server that is configured as the ETS must be attached directly to the SE network, and the PPS cable must be attached directly to the PPS port on the CPCs that have the Preferred Time Server (PTS) and Backup Time Server (BTS) roles.

For more information about this topic, see *STP recommendations for the FINRA clock synchronization requirements*.

8.4 Configuring the HMC as an NTP server

This section describes how to set up the HMC as an NTP server to be used as ETS for your CTN. The HMC can synchronize its time to an NTP server that is connected to the corporate network or available from the NTP pool on the internet.

The NTP server capability on the HMC addresses the potential security concerns that might arise if you attach an external (internet) NTP server directly to the HMC/SE network. However, when you use the NTP server on the HMC as ETS for your CTN, no PPS capability is available.

In HMC Version 2.14.0, NTP Broadband Authentication that uses symmetric key (NTP V3-V4) and autokey (NTP V4) is supported. For more information about NTP Broadband Authentication, see 8.4.2, “NTP Broadband Authentication (optional)” on page 172.

8.4.1 Configuring the HMC time source to act as an NTP server

To configure the HMC time source to act as an NTP server, complete the following steps:

1. Open **Customize Console Date and Time** on the HMC. This task is available in the HMC Management section (Figure 8-3).

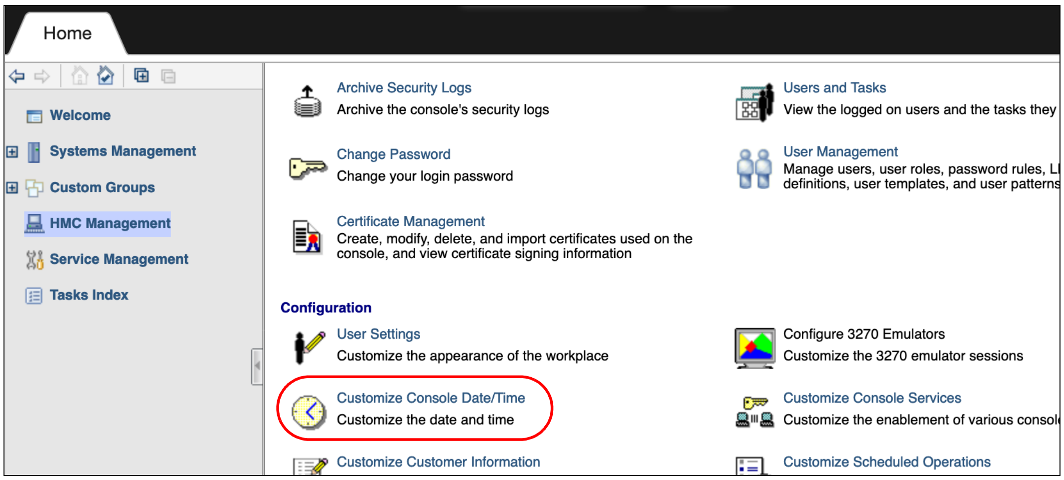


Figure 8-3 Customize Console Date and Time selection

2. The Date and Time window opens. Select **Network Time Protocol (NTP)** from Time Source (Figure 8-4).

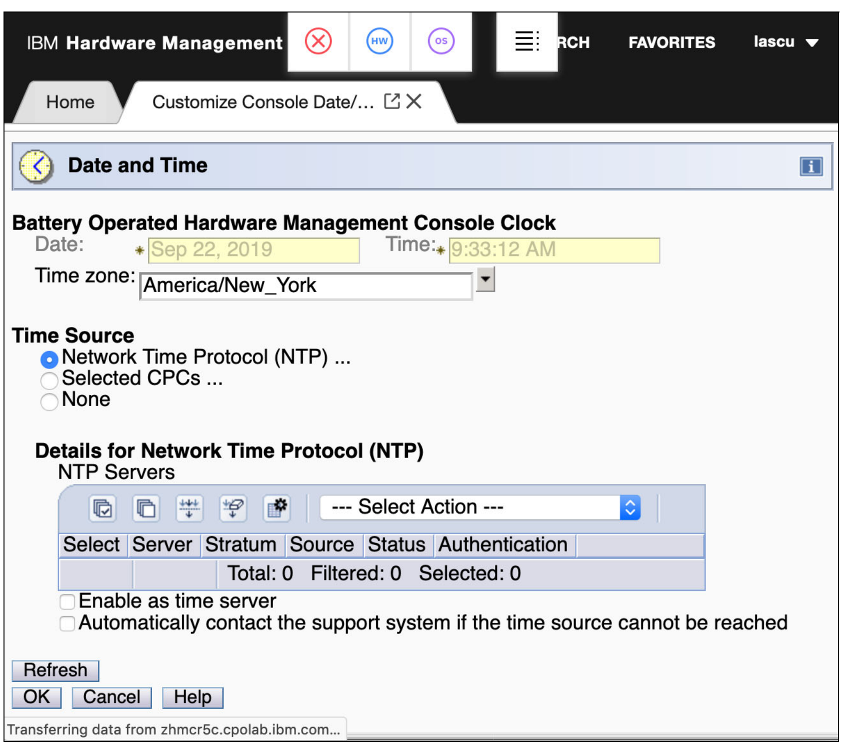


Figure 8-4 Customize Console Date and Time initial window

3. Select **Add Server** from the **Select Action** list (Figure 8-5).

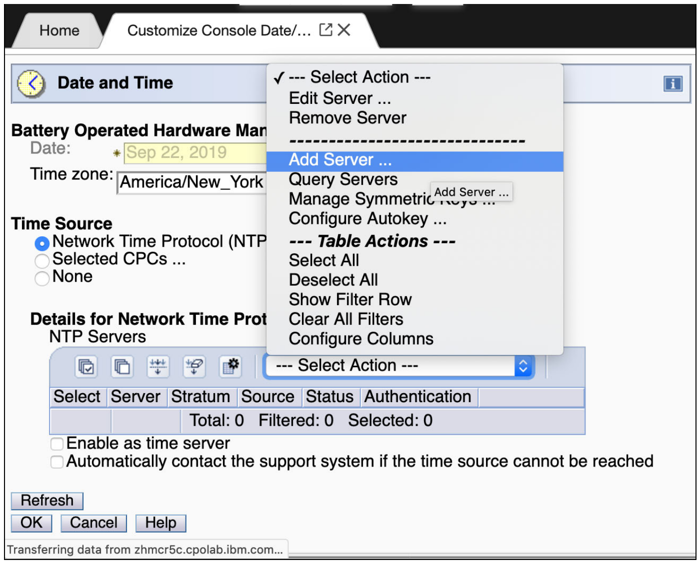


Figure 8-5 Customize Console Date and Time - Add Server

4. The **Add Network Time Server** window opens. In this window, you can set the values in the following fields:

   – **Enter the time server host name or IP address:** This mandatory field is the IP address or host name of the NTP server. For the example configuration, `1.pool.ntp.org` is the NTP server.

   – **Authentication Selection:** You can define this field if you want to use NTP Broadband Authentication Support function. If you do not use NTP Broadband Authentication Support function, select **None**.

   Click **OK** when finished (Figure 8-6).

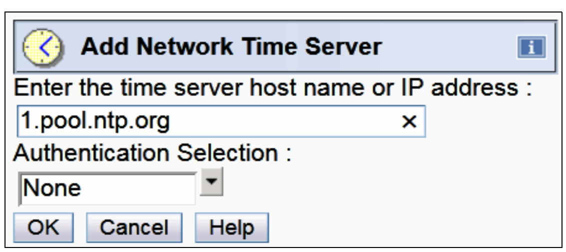


Figure 8-6 Add Network Time Server

> **Tip:** Using a host name requires you to customize and enable Domain Name Services on the HMC. To complete this task, click **Customize Network Setting** → **Name services** in the Hardware Management Console Setting Work Area.

5. During this process, the HMC initiates communication with the NTP server that is specified. You can add multiple NTP servers by repeating step 4. Generally, define at least two NTP servers.

   If the NTP server that is specified is not reachable, the Unable To Access Server window opens, as shown in Figure 8-7 on page 171. Click **Yes** if you still want to add the NTP server.

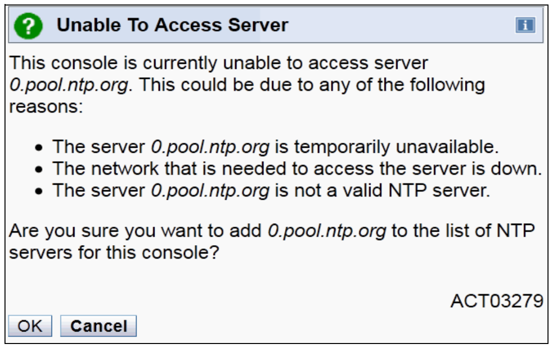


Figure 8-7 Unable To Access Server ACT03279 message

6. After NTP servers are successfully added to the HMC, the Customize Console Date and Time window looks similar to Figure 8-8. Select **Enable as time server** and click **OK**.

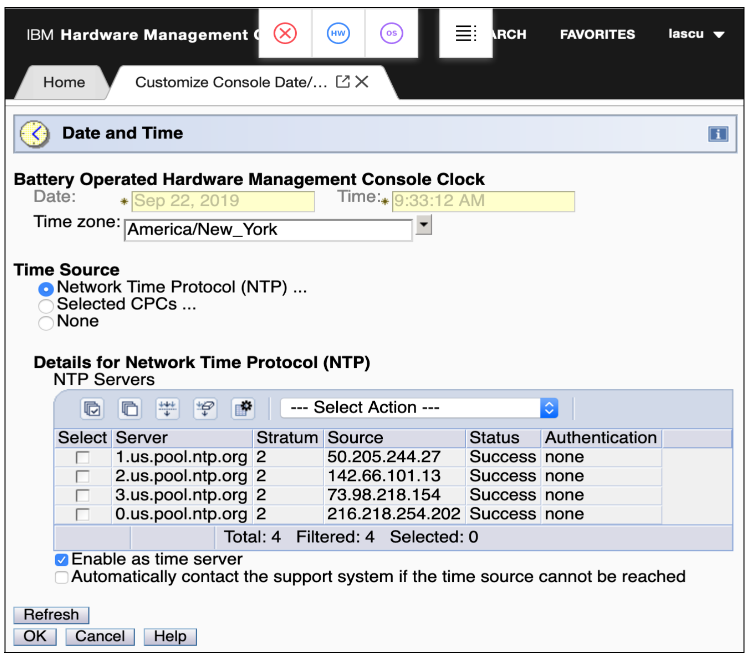


Figure 8-8 Configuring an NTP Server

7. In the Turning On NTP window, confirm that you want to enable the HMC as the time server. Click **OK**.
8. After processing completes, the NTP Successfully Turned On window opens. Click **Close**. This is the last step to set the HMC as an NTP server for STP.

> **Consideration:** If more than one NTP server is defined, you cannot specify which server is the primary server. The NTP service on the HMC takes any defined NTP server and tries to contact it. If it succeeds, that server is used as the time source until either the server in question is no longer available or the console is restarted. If it cannot communicate with that server, it tries another one in the list.
>
> The check box on the Configure NTP Setting window is used only for actions in the **Select Action** list, and not for setting a primary or preferred NTP server.

8.4.2 NTP Broadband Authentication (optional)

HMC supports NTP Broadband Authentication. Configure the (optional) NTP Broadband Authentication if your HMC requires it. NTP server authentication provides an increased level of security in the following situations:

- When using a proxy to access an outside network

  NTP requests are User Datagram Protocol (UDP) socket packets, so they cannot pass through a proxy. The proxy must be configured as an NTP server to get to target servers on the internet.

- When using a firewall

  NTP requests can pass through a firewall. If you use a firewall to access an outside NTP server, use the HMC authentication to ensure untampered time stamps.

Two authentication methods are supported for NTP:

- Symmetric key (NTP V3-V4) authentication

  Symmetric key encryption uses the same key for both encryption and decryption. When the HMC is acting as the client, the symmetric key index that is specified on each NTP server definition must be present in the key file. The specified key index, key type, and the key string must align with the specified key information of the target server. Likewise, if the HMC is acting as a server, the client-specified key information must match the same key index on the server. Symmetric key supports Network Address Translation (NAT).

- Autokey (NTP V4) authentication

  Autokey uses public key cryptography. The key generation for the HMC NTP is done by clicking **Generate Local Host Key** in the Autokey Configuration window. Clicking this button runs the **`ntp-keygen`** command, which generates the specific key and certificate for this system. Autokey authentication is not available with a NAT firewall.

Setting up a symmetric key

To set up a symmetric key, complete these steps:

1. Open the Customize Console Date/Time window. This is the same operation that is described in step 1 on page 169.
2. Select **Manage Symmetric keys** from the **Select Action** list in Details for Network Time Protocol (NTP), as shown in Figure 8-9 on page 173.

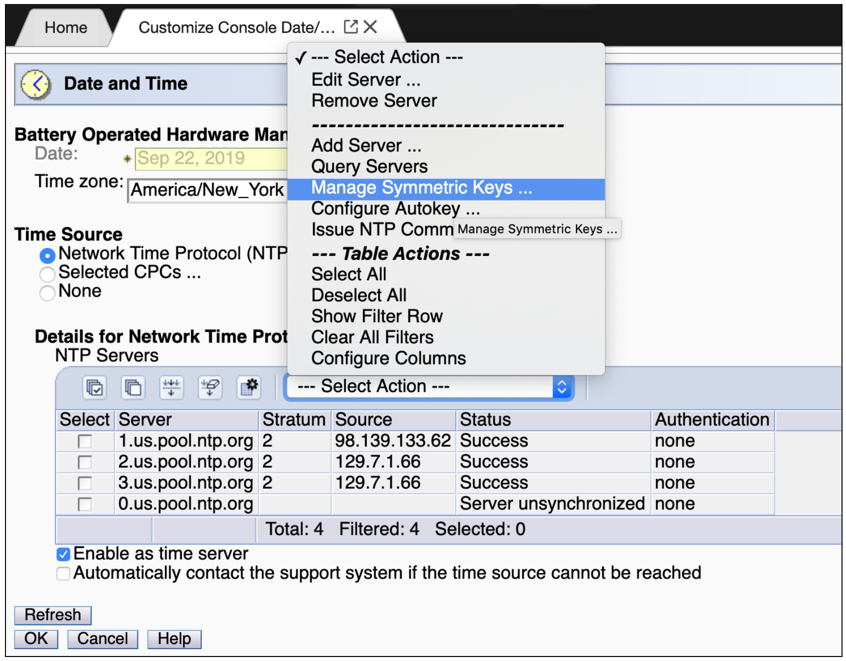


Figure 8-9 Customize Console Date and Time: Manage Symmetric Keys

3. The Manage Symmetric Keys window opens (Figure 8-10). Click **Select Action** → **Add Key**.

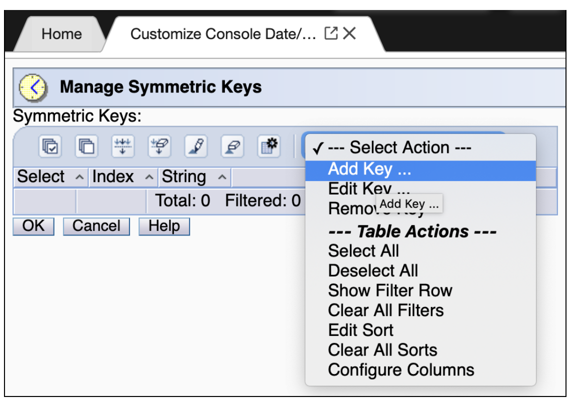


Figure 8-10 Add Symmetric Key

4. The Add Symmetric Key Data window opens (Figure 8-11). The following data must be entered:

   Key index A numeric value in the range 1 - 65534.

   Key string The key string can be up to 40 characters long. If the string is 40 characters long, the characters must be hexadecimal ASCII characters (0 - 9, a - f). If the string is fewer than 40 characters long, the characters can be any printable ASCII character.

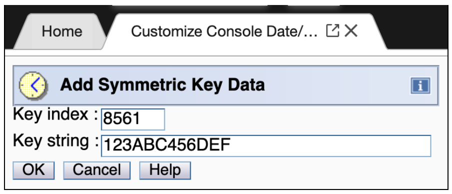


Figure 8-11 Add Symmetric Key Data

5. The Enter Symmetric Key window opens. Click **Close** to add the symmetric key.
6. The key is displayed in the Manage Symmetric Keys window (Figure 8-12). You can enter more key data in this window by repeating the previous steps. Click **OK** to proceed if no more keys are needed.

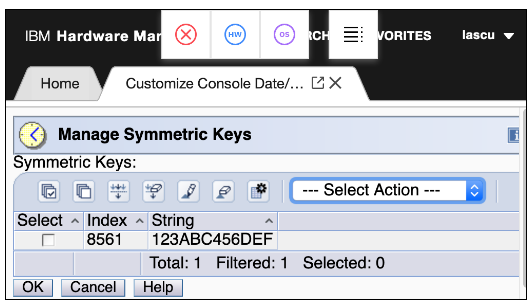


Figure 8-12 Symmetric Key list

7. The completion window opens. Click **Close** to return to the Configure NTP Settings window.
8. You can define a Symmetric Key to NTP server in two ways:
   – Define an NTP server and specify a symmetric key.
   – Modify an existing NTP server to use a symmetric key

   For this example, modify the NTP server that is identified by 9.12.5.155 (IP address) by using a symmetric key.
9. Select the check box for the server name that you want to modify, and then select **Select Action** → **Edit Server** (Figure 8-13 on page 175).

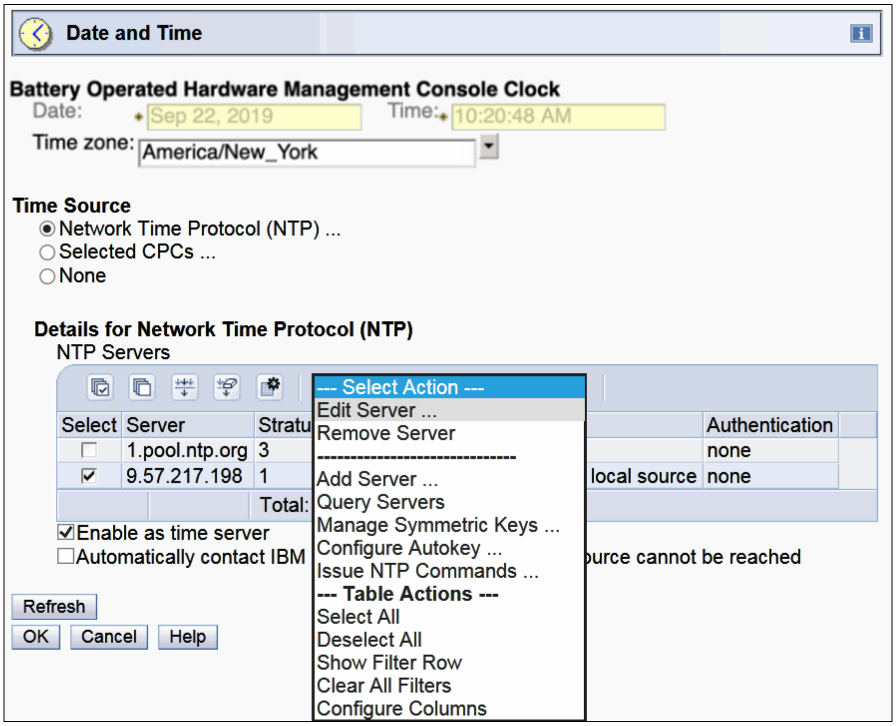


Figure 8-13 Customize Console Date and Time: Edit NTP Server

10. In the Edit Network Time Server window (Figure 8-14), select the appropriate key number in the **Symmetric Key** field. In this example, we select key 3906. Click **OK** to continue.

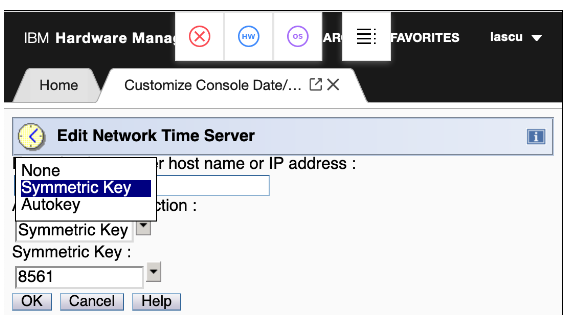


Figure 8-14 Adding NTP Server with Authentication

11. The next window (Figure 8-15) indicates that the modification is complete. Click **Close**.

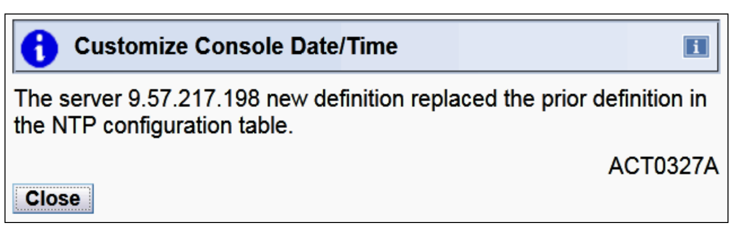


Figure 8-15 Completed message for adding NTP Server with Authentication

12.You are returned to the Date and Time window (Figure 8-9 on page 173). Make sure that the key that you selected is displayed in the Authentication column and the Status is Success, and the key that you specified is displayed.

Configuring NTP authentication by using Autokey

To configure Autokey, complete the following steps:

1. Open the Customize Console Date/Time window. This is the same operation that is described in step 1 on page 169.
2. Click **Select Action** → **Configure Autokey** under the Details for Network Time Protocol (NTP) section (Figure 8-16).

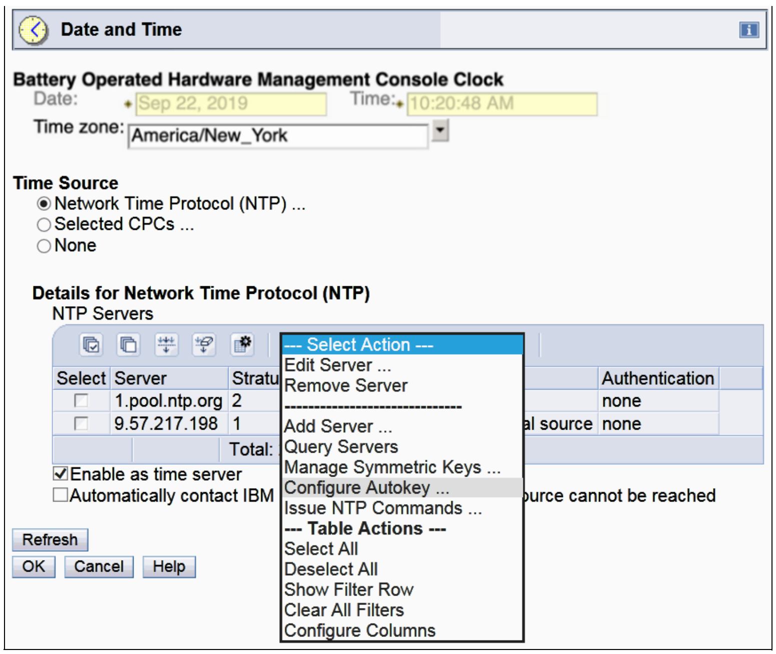


Figure 8-16 Customize Console Date and Time: Configure Autokey

3. The Autokey Configuration window opens (Figure 8-17). To generate keys, click **Generate**.

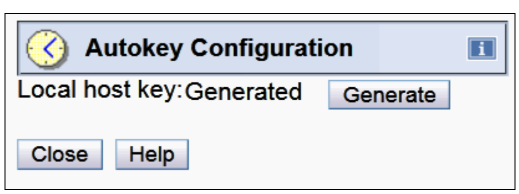


Figure 8-17 Generate Autokey

4. When generating the Autokey is successful, the confirmation window (Figure 8-18) opens. Click **Close**.

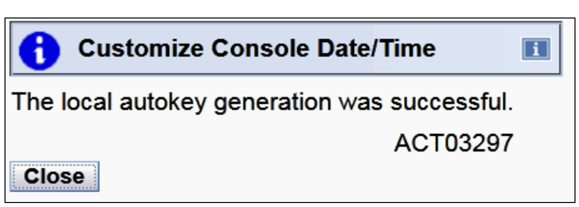


Figure 8-18 Autokey generation successful

5. You can define an Autokey to NTP in these cases:
   – Define an NTP server and specify an Autokey.
   – Modify an existing NTP server to use an Autokey.

   In this example (see Figure 8-19), we modify the existing NTP server `9.57.217.198` to use the Autokey configuration.
6. Select the server that you want to modify, and then click **Select Action** → **Edit Server**.
7. The Edit Network Time Server window opens (Figure 8-19). Select **Autokey** under Authentication Selection, and then click **OK**.

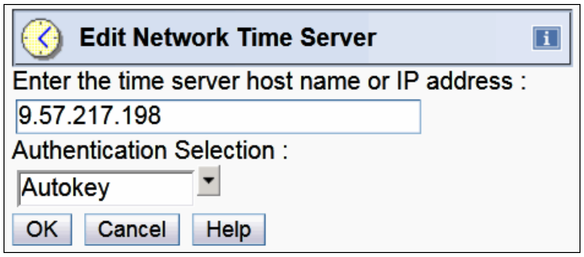


Figure 8-19 Edit Network Time Server for Autokey

8. The next window (Figure 8-20) indicates that the modification completed successfully. Click **Close**.

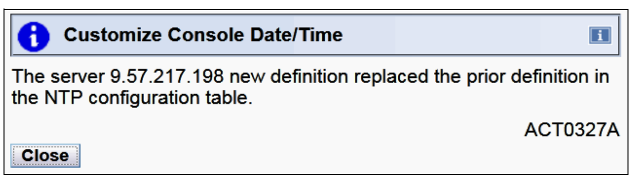


Figure 8-20 NTP setting change confirmation window

9. Return to the Configure NTP Setting window. Make sure that `autokey` is listed in the Authentication column, and its status is `Success`.

8.5 HMC V2.15.0 (Manage System Time task)

You can set up STP by using the HMC Manage System Time task. HMC Version 2.14.0 brings the following changes:

- The HMC task menu title changed from System (Sysplex) time to Manage System Time.
- The CTN topology is displayed as a graph.
- Wizard format operations are supplied for STP actions, such as setting up the CTN and changing the STP server roles.

Figure 8-21 displays the Manage System Time task initial window on the HMC. The CTN configuration for any CPC object that is managed by this HMC can be displayed. You can display any CTN by clicking the down arrow icon next to the CTN ID name. You can enter the configuration wizard from menu below the STP ACTIONS.

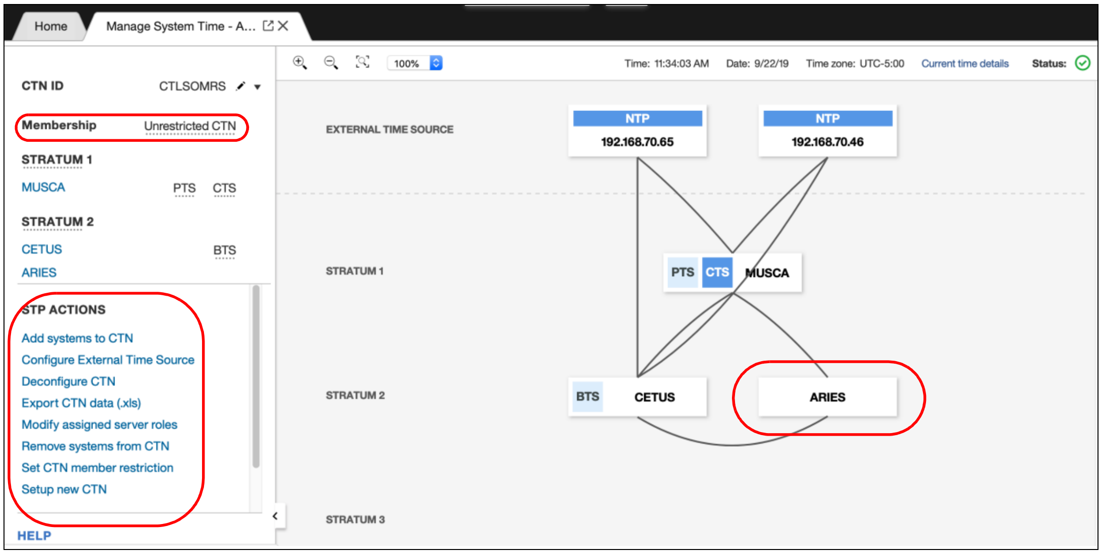


Figure 8-21 Manage System Time initial window

In the Manage System Time initial window, the CTN topology appears as a graph. You can identify the stratum level and the role of the CPC. You can also identify the status of each CTN component, such as CPC, CF LINK, and ETS, by clicking the respective objects.

Figure 8-22 shows the details of a CPC in the CTN.

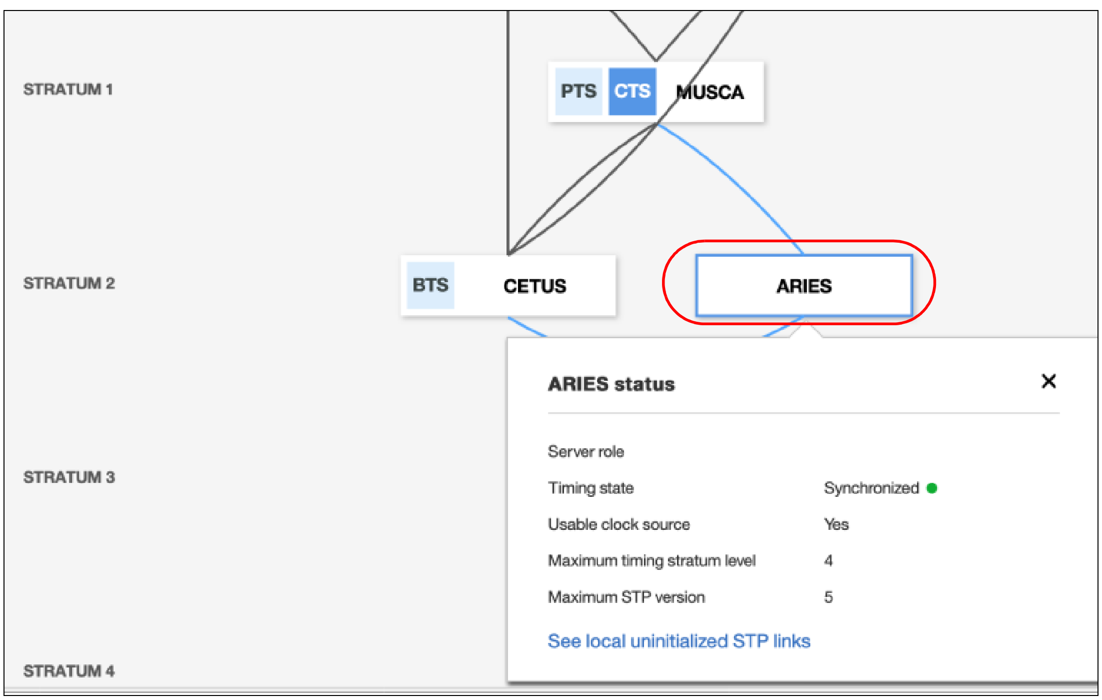


Figure 8-22 CPC status display

Figure 8-23 on page 179 shows the details of a coupling link.

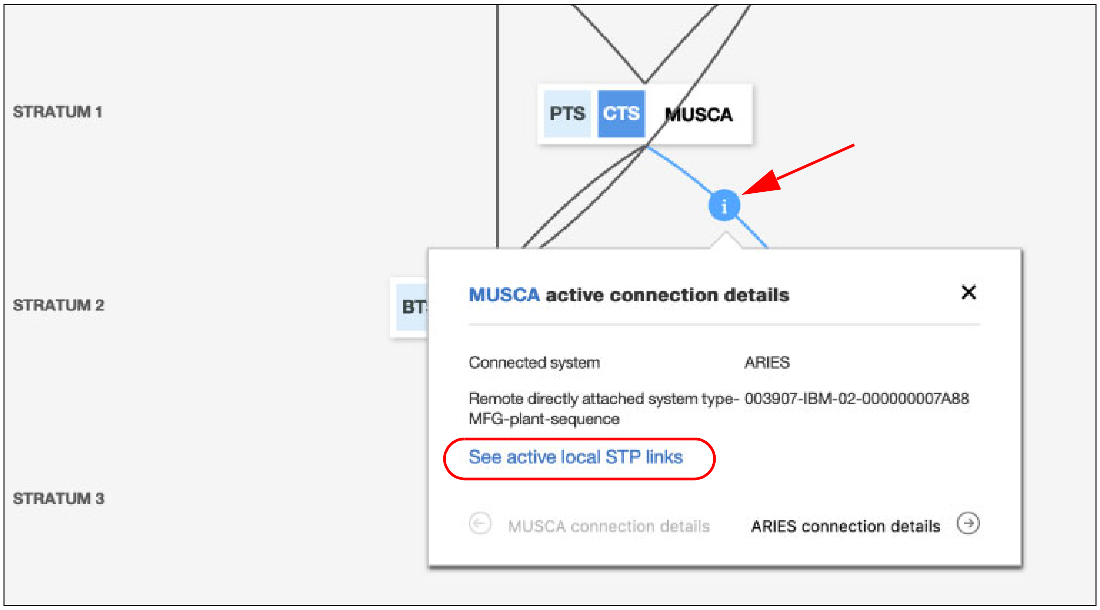


Figure 8-23 Coupling/timing link status display

Note: In z15 SE (Driver 41) systems, the System (Sysplex) Time was removed. You must use the HMC (Version 2.15.0) Manage System Time task to configure STP on a z15 system.

8.5.1 Setting CTN member restrictions

For a single-server CTN or a dual-server CTN, you can restrict the CTN membership by selecting the **Only allow the server(s) specified above to be in the CTN** parameter in this menu. This configuration saves the configuration across Power on Resets (PORs) for STP-only CTNs with one or two servers (also known as *bounded CTN*).

8.6 Single-server STP-only CTN

This section describes how to configure a new STP-only CTN. This scenario applies to a newly installed z15 system or isolated STP-only CTN for testing purposes.

This example defines a STP-only CTN that is named *ITSOTEST*. In this CTN configuration, we define the z15 system (ARIES) and two NTP servers as ETS. The NTP servers to be used as ETS are defined to the HMC (Figure 8-24). This configuration is a single CPC STP-only CTN, so no BTS and ARBITER is configured.

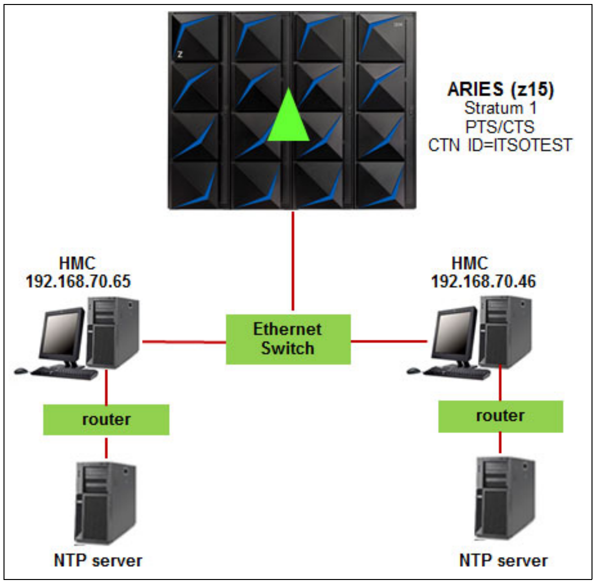


Figure 8-24 STP-only CTN configuration: Single CPC example

Before you configure STP, see *IBM Z Server Time Protocol Guide*, SG24-8480.

8.6.1 Configuring a new STP-only CTN

To configure a new STP-only CTN, select the **Setup new CTN** menu from **STP ACTIONS** list in the **Manage System Time** task. To set up new STP-only CTN, complete these steps:

1. In the HMC, select the CPC to configure STP and Manage System Time, under the Configuration task (Figure 8-25).

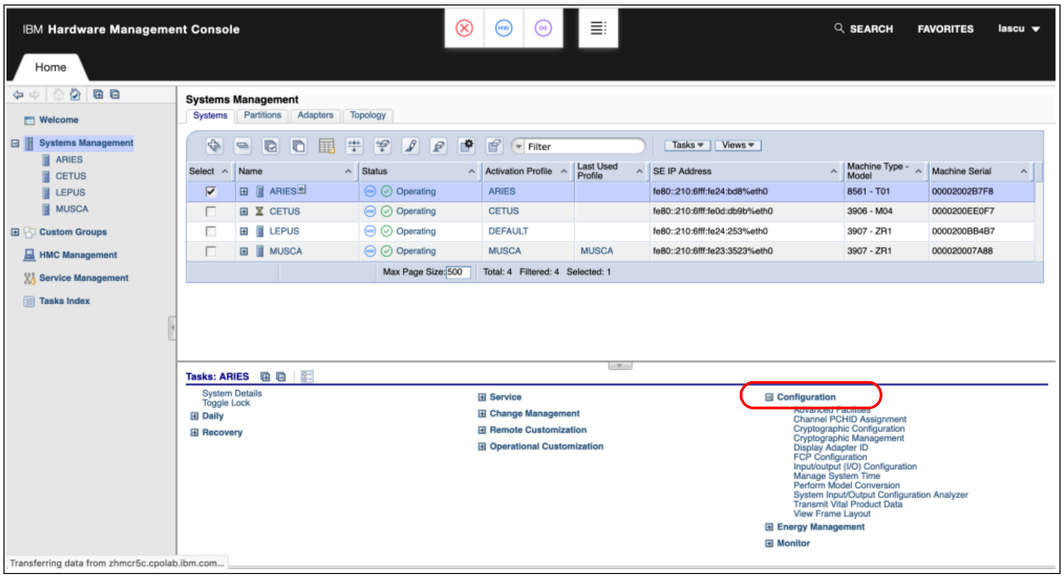


Figure 8-25 Manage System Time: CPC selection

2. The Manage system Time window opens. If you defined CPC objects that configured a CTN, the CTN configuration is displayed. To define a new CTN, select **Setup new CTN** from **STP ACTIONS** (Figure 8-26).

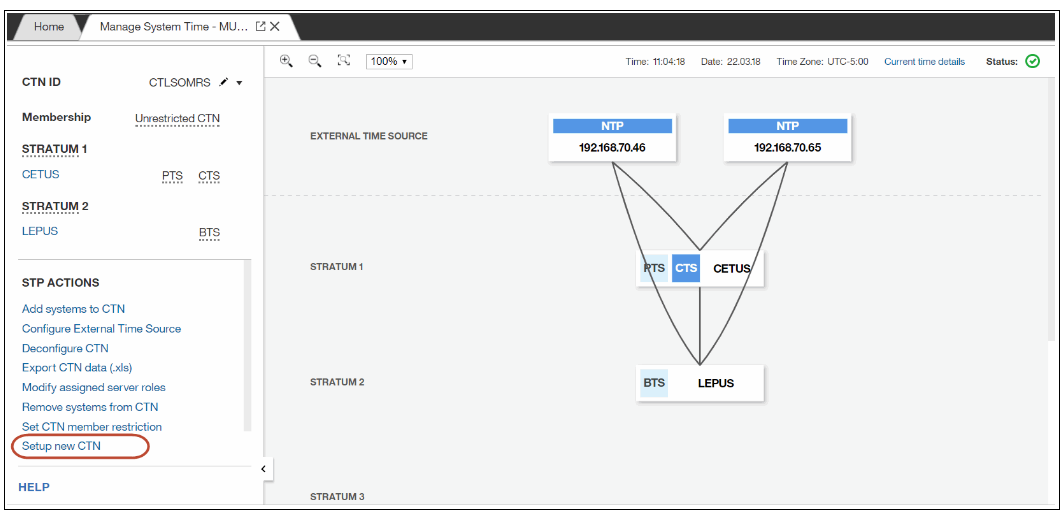


Figure 8-26 Setup new CTN

3. The Set the Coordinated Timing Network (CTN) ID window opens. Enter the CTN ID into the column. Click **NEXT** to continue (Figure 8-27).

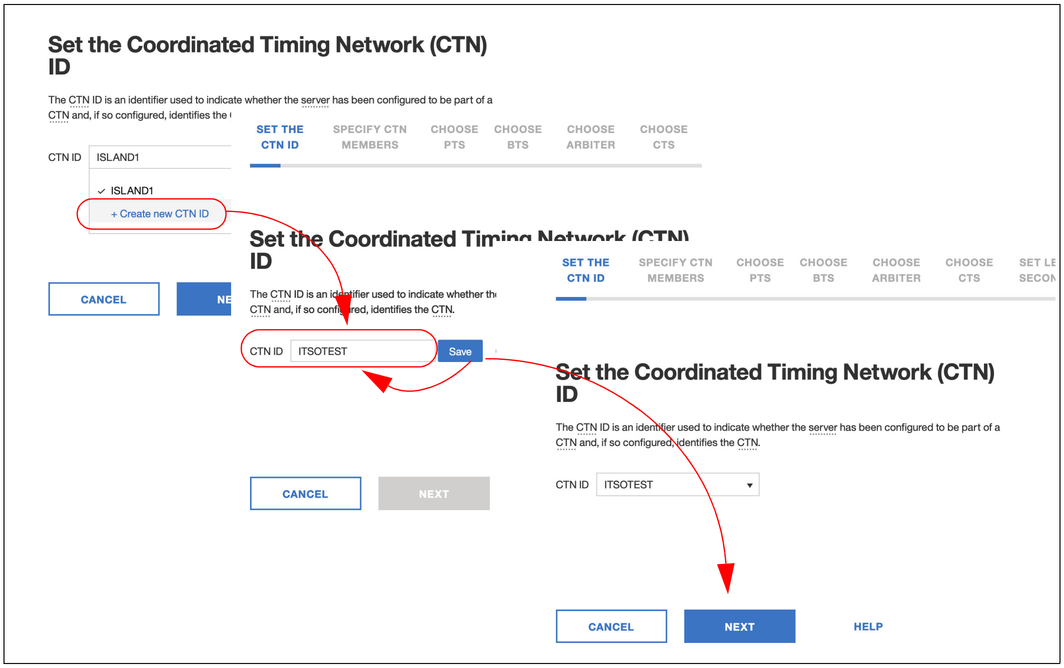


Figure 8-27 Set the Coordinated Timing Network (CTN) ID window

4. The Specify Coordinated Timing Network (CTN) members window opens. Select the CPC name (only CPCs not belonging to a CTN are shown). In this example, only one CPC (ARIES) is displayed. Select the CPC and click **NEXT** to continue (Figure 8-28).

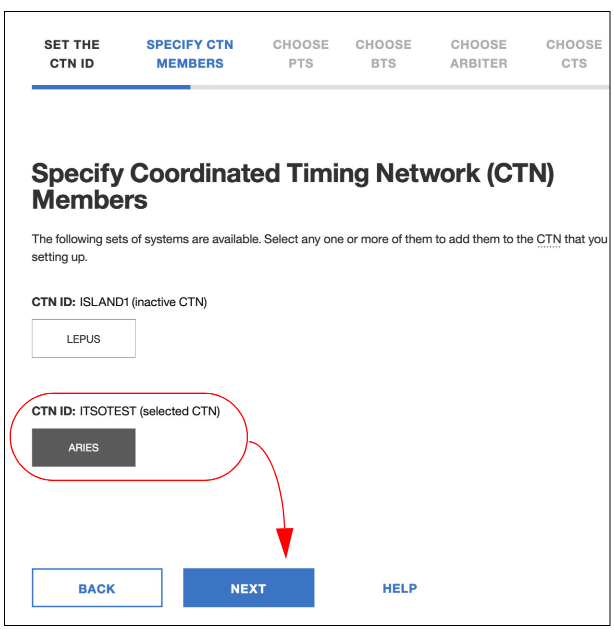


Figure 8-28 Specify Coordinated Timing Network (CTN) Members window

5. The Choose Preferred Time Server window opens. Select the CPC name for the PTS (Figure 8-29).

> **Note:** Because ARIES is the only CPC (server) in the CTN, the CHOOSE BTS and CHOOSE ARBITER steps are not available.

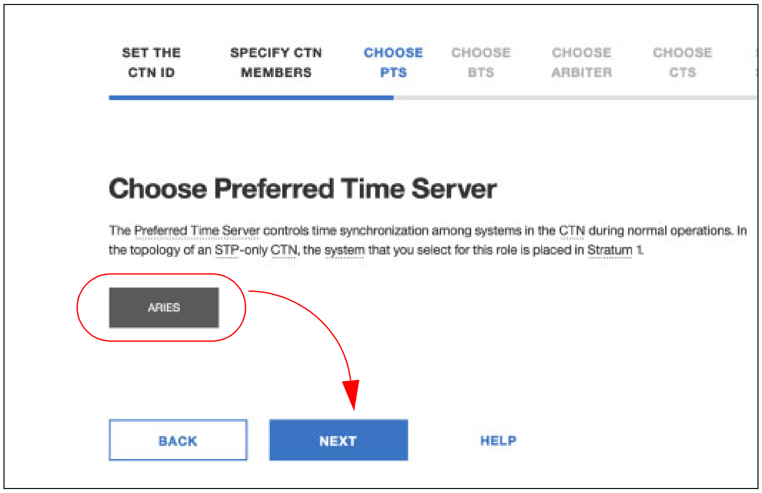


Figure 8-29   Choose Preferred Time Server window

6. The Choose Current Time Server window opens. We select **ARIES** for Current Time Server (CTS). Click **NEXT** to continue (Figure 8-30).

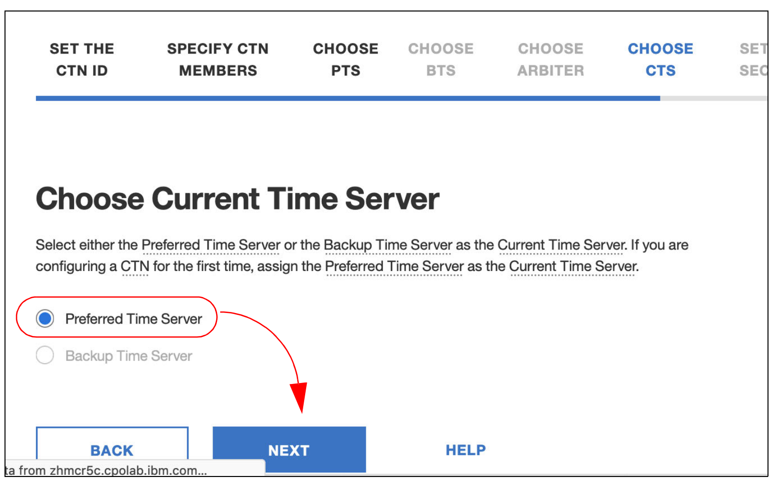


Figure 8-30   Choose Current Time Server window

7. The Set leap second window opens. Define the applicable value for the leap seconds offset here, and then click **NEXT** to continue (Figure 8-31).

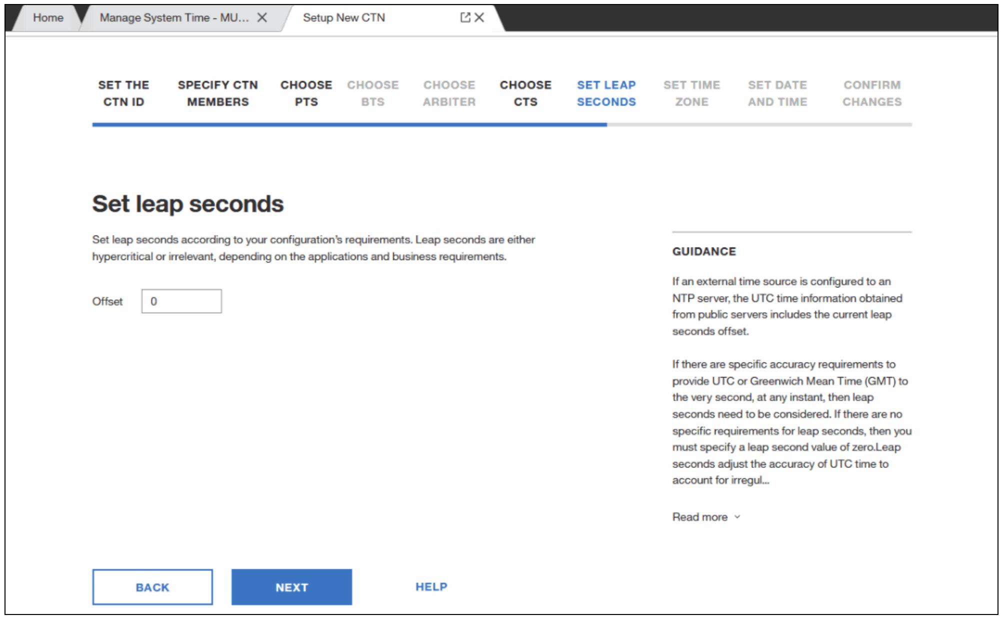


Figure 8-31 Set leap seconds window

8. The Set time zone window opens. Specify the following two parameters:

   – **Adjust time zone offset**

   – **Clock adjustment for Daylight Saving Time**

   Select the appropriate items from the list. These parameters are used when initializing time for the CTS that is defined in step 9 on page 185. We define **Eastern Time** for the Time Zone offset and **Automatically adjust** for Daylight Saving Time. Click **NEXT** to continue (Figure 8-32 on page 185).

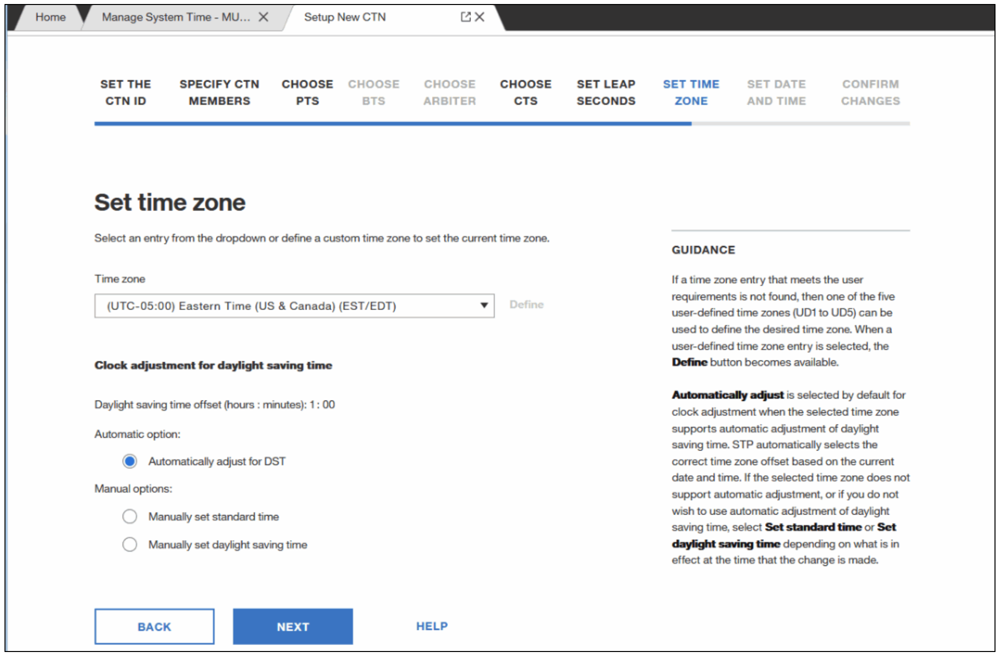


Figure 8-32 Set time zone

9. The Set date and time window for initializing the time opens. Select one of the following three items to initialize the time:
   - **Use the configured External Time Source to set date and time**: You can set ETS during the initializing time process.
   - **Set date and time**: Select this option when you set the date and time for CTS manually.
   - **Modify time by delta to set date and time**: Select this option when you set the current TOD of CTS for initializing the time and specify a delta from the TOD.

In this example, we select **Use the configured External Time Source to set date and time**, and click **NEXT** to continue (Figure 8-33).

Note: Selecting **Use the configured External Time Source to set date and time** enables accurate setting of the initial time, so generally use this option.

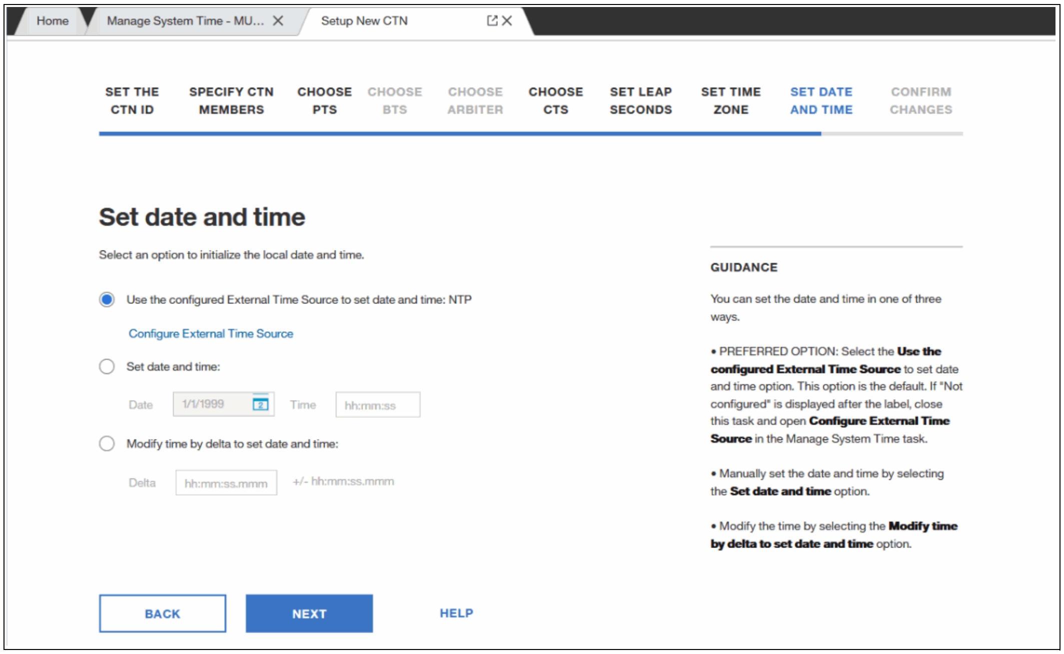


Figure 8-33 Set date and time window

10. The Confirm Changes window opens (Figure 8-34). The topology of the CTN that you defined is displayed graphically.

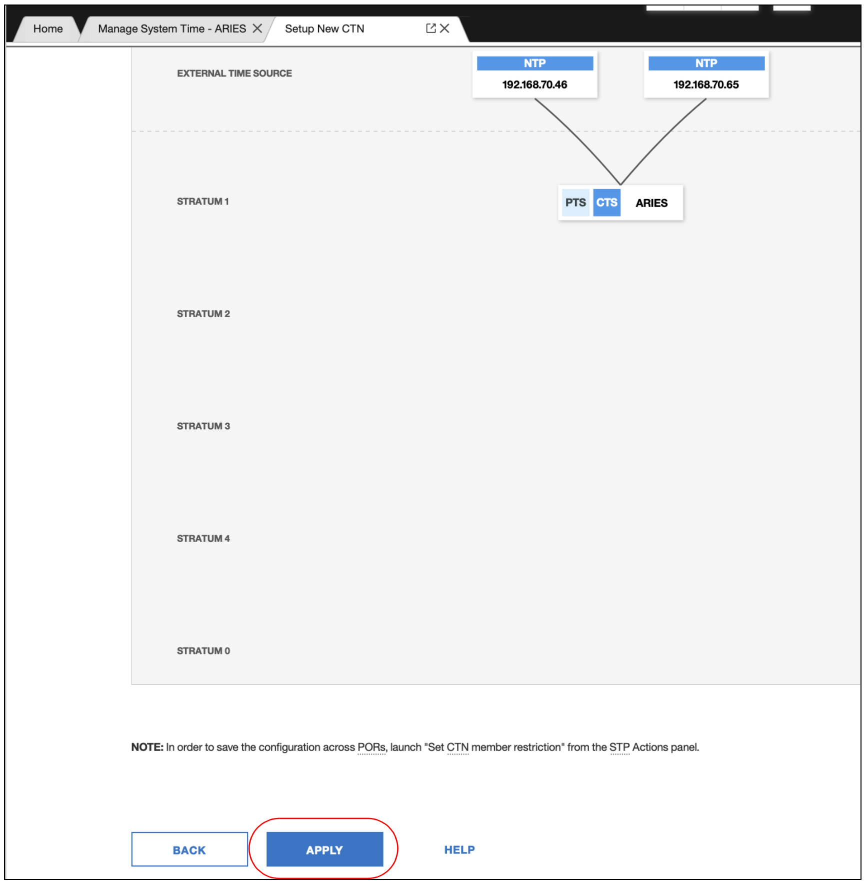


Figure 8-34 Confirm Changes window

11. The Creating CTN progress is shown until the operation completes successfully, followed by the ACT39277I success window (Figure 8-35). Click **Close** to go back to the initial window.

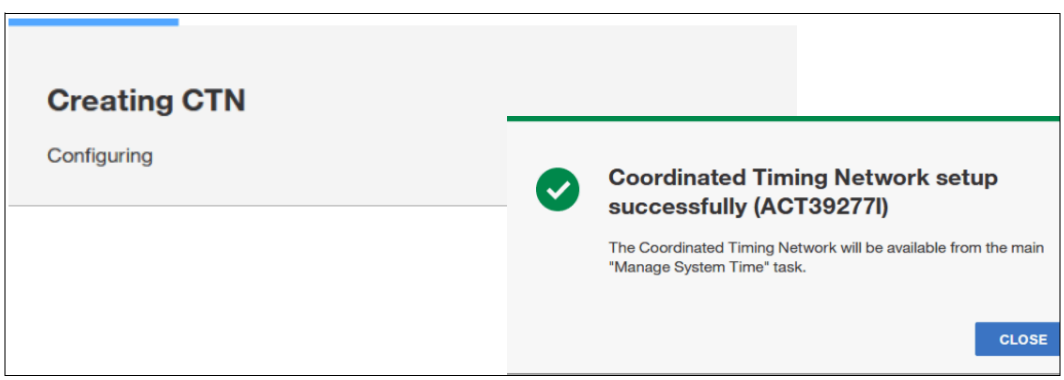


Figure 8-35 Creating CTN window / ACT39277I Success window

8.6.2 Verifying the new CTN configuration

When the new CTN configuration completes, the Manage System Time initial window opens. Check that the following items are defined correctly on this window (Figure 8-36):

- Status
- CTN ID
- Time / Date / Time zone
- Stratum Level
- STP Role

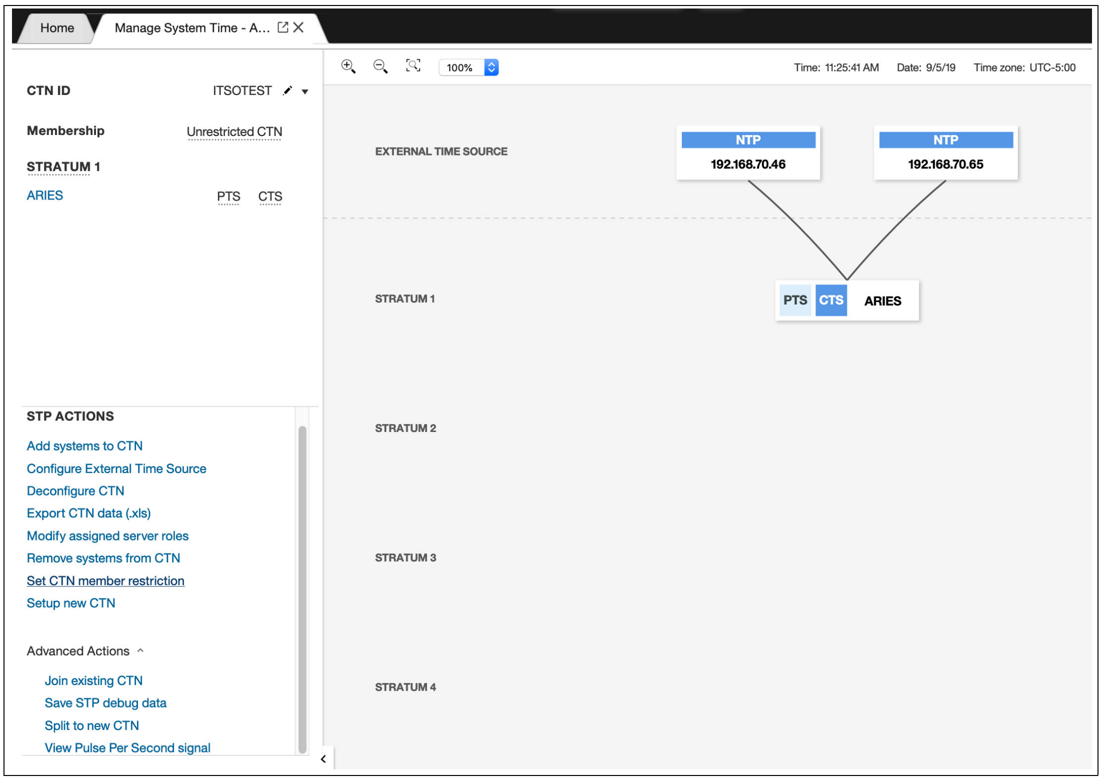


Figure 8-36 New CTN

You can also check the status of STP by running the z/OS **D ETR** command (Figure 8-37).

```
D ETR
IEA386I 13.15.59 TIMING STATUS 951
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOTEST
  THE STRATUM 1 NODE ID = 008561.T01.IBM.02.000000007A88
  THIS IS THE PREFERRED TIME SERVER
```

Figure 8-37 z/OS D ETR command

8.6.3 Configure External Time Source window

After the new CTN configuration is complete, you can configure the ETS. In this example, we define two HMCs configured as an NTP server for ETS (Figure 8-26 on page 181). If your CTN is configured with more than two CPCs, you can set individual ETS for PTS and BTS.

Complete the following steps:

1. Open the **Manage System Time** task and select **Configure External Time Source** from the **STP ACTIONS** list.
2. The Select the system on which to modify the External Time Source (ETS) window opens. Select the CPC to modify the ETS setting for. We select **ARIES** (the only CPC in this CTN) in this window. Click **NEXT** to continue (Figure 8-38).

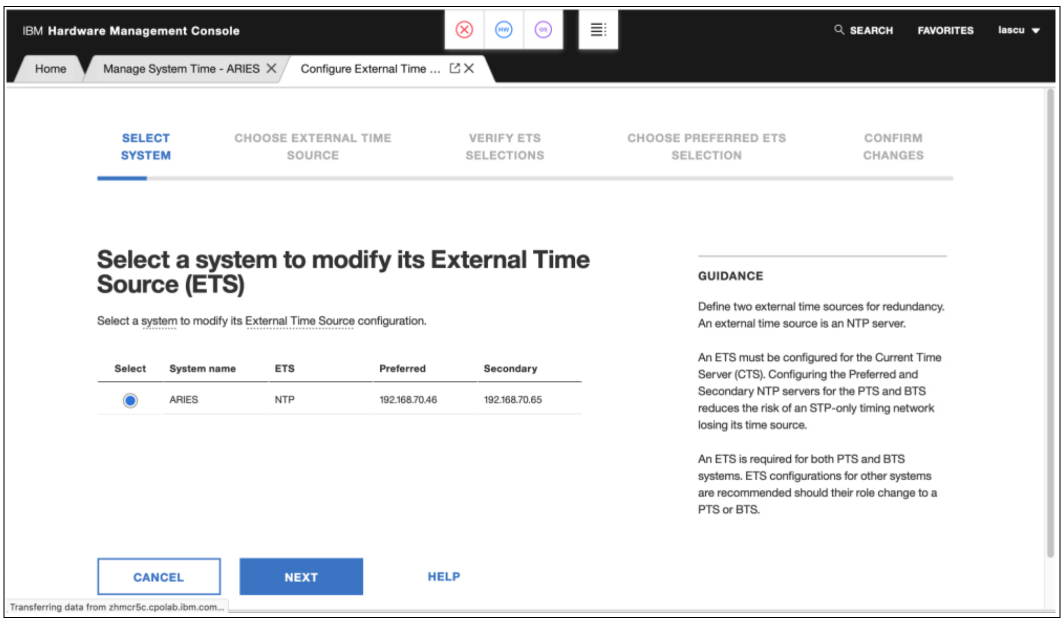


Figure 8-38 Select the system on which to modify the External Time Source (ETS) window

3. The Choose External Time Source window opens. We select **Use NTP**. Click **NEXT** to continue (Figure 8-39).

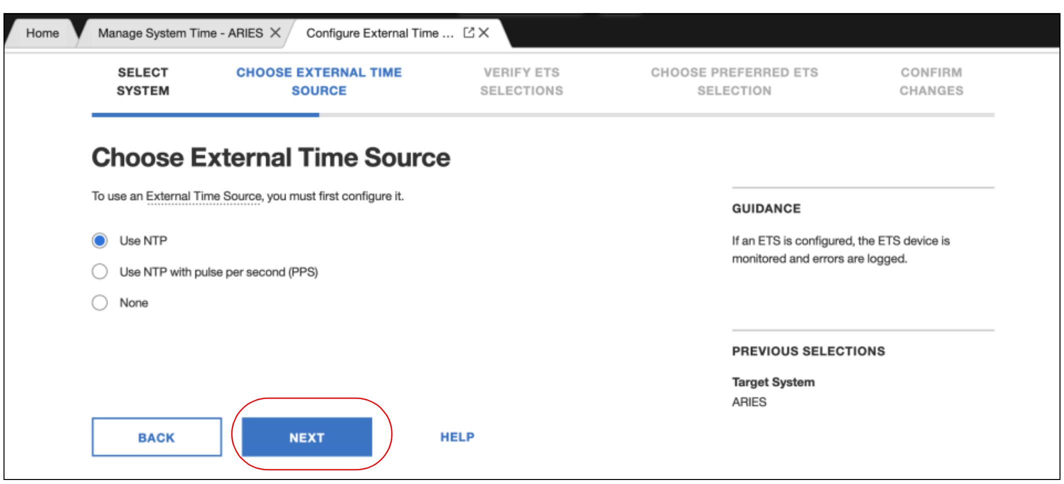


Figure 8-39 Choose External Time Source window

4. The Verify Network Time Protocol server(s) window opens. You can define up to two NTP servers by specifying either the IP address or the host name (IP label) of the NTP server by clicking the **pencil** icon. After adding the IP address or host name, select the **Enabled** switch icon, and then click **TEST CONNECTIVITY** to ensure that the NTP server is reachable. If the connectivity test is successful, the ACT3929I window opens and the **Check the Connection status** row shows *No errors*. Click **NEXT** to continue (Figure 8-40).

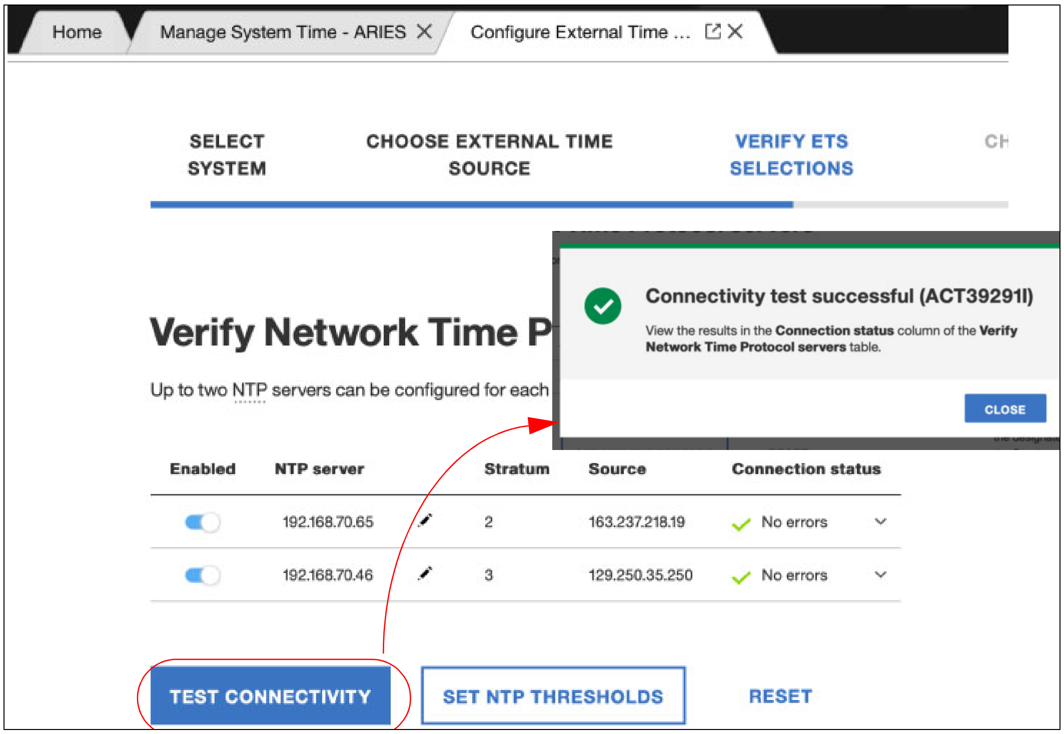


Figure 8-40   Verify Network Time Protocol servers window

If you need to set NTP thresholds, click **Set NTP Thresholds** and specify the parameter. You can set the NTP Stratum level threshold and the Source ID time threshold (Figure 8-41).

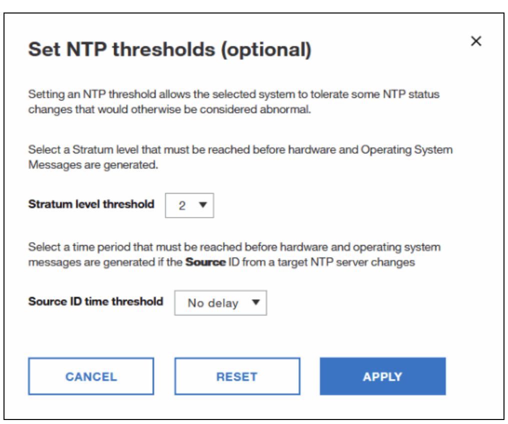


Figure 8-41   Set NTP Thresholds (optional) window

5. The Choose the preferred NTP server window opens. Select one of the NTP servers to be the preferred server. In our example, we select `192.168.70.46` as the preferred NTP server. Click **NEXT** to continue (Figure 8-42).

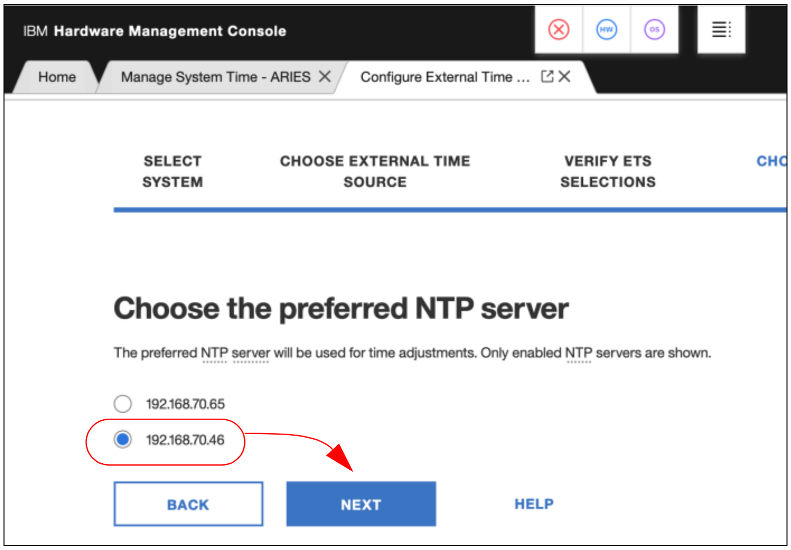


Figure 8-42 Choose the preferred NTP server window

6. The Confirm External Time Source configuration window opens. Verify and click **APPLY** to complete the definition (Figure 8-43).

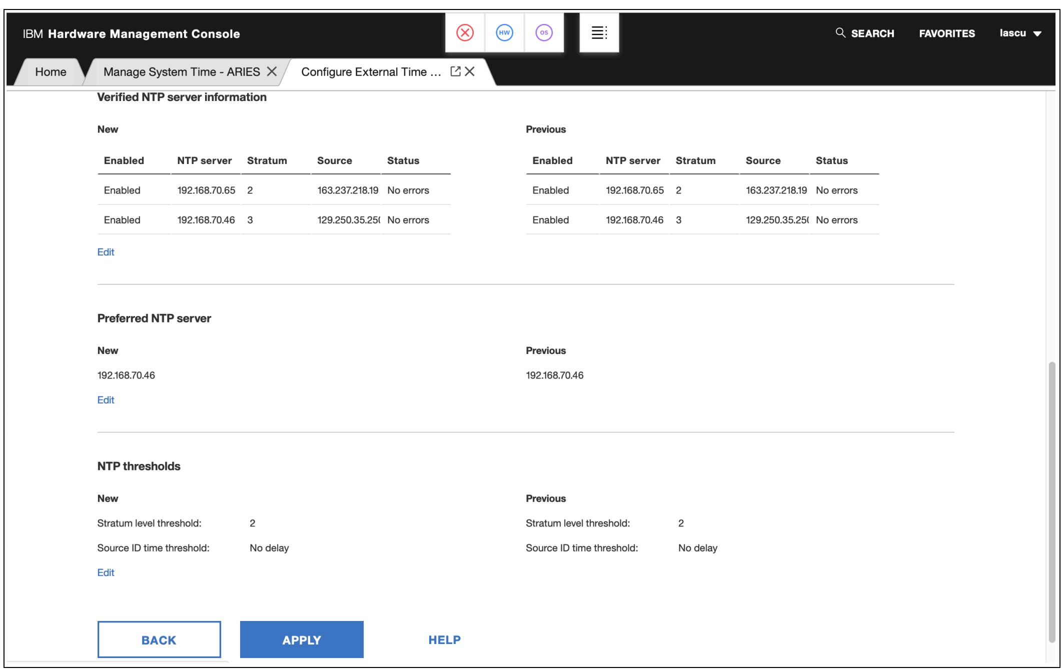


Figure 8-43 Confirm External Time Source configuration window

7. The Set ETS configuration (ACT 39145) window opens. Click **DONE** to finish. (Figure 8-44). If no changes were made, the ACT39290I window open and confirms the configuration.

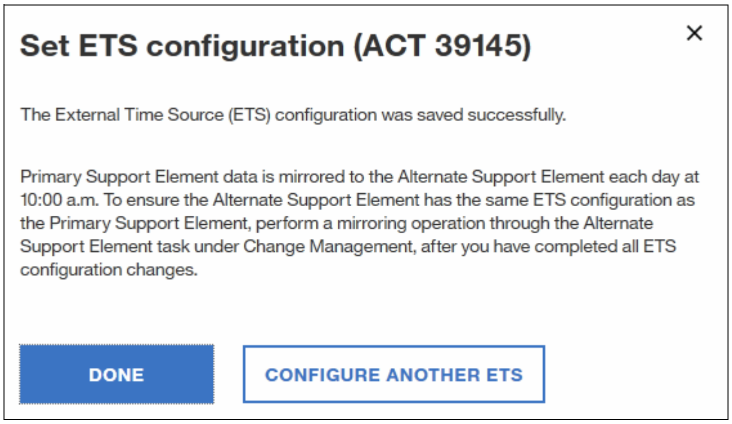


Figure 8-44 ETS configured successfully (ACT39145)

8.6.4 Verifying the ETS configuration

From the Manage System Time initial window, check whether the defined ETS is displayed (**External Time Source)** as shown in Figure 8-45.

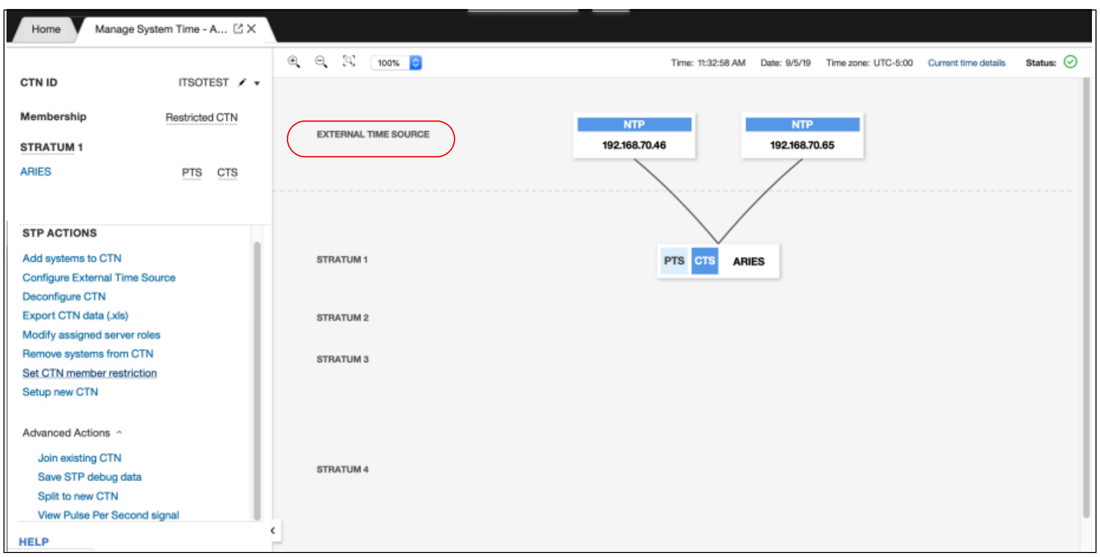


Figure 8-45 Verifying the ETS configuration

8.7 Adding a z15 system to an existing CTN

This section describes the procedure that is used to add a z15 system to an existing CTN. In the diagram that is shown in Figure 8-46, we add a z15 system (ARIES) to the existing CTN with the ID CTLSOMRS. At the beginning, the ARIES CPC is connected through coupling links to both MUSCA and CETUS, but it is not assigned to any CTN. When added to the CTN, ARIES becomes a Stratum 2 server.

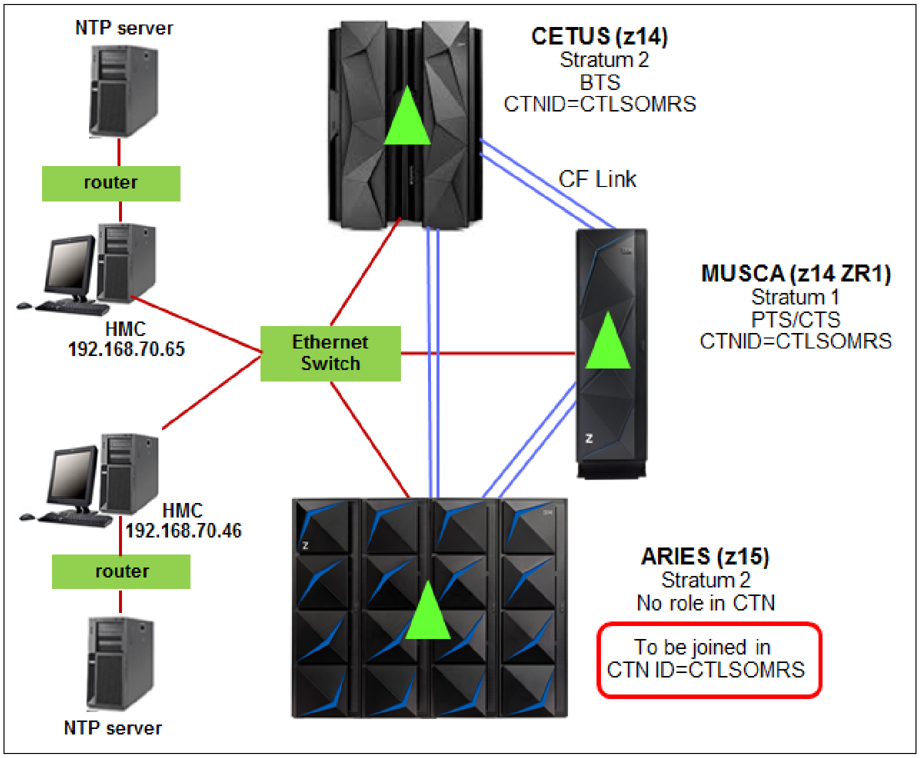


Figure 8-46 Scenario to add a z15 system to an existing CTN

8.7.1 HMC operations to add the CPC to the CTN

To add a CPC to an existing STP-only CTC, complete the following steps:

1. Open the **Manage System Time** task from the HMC, and select **Add systems to CTN** from **STP ACTIONS** (Figure 8-47).

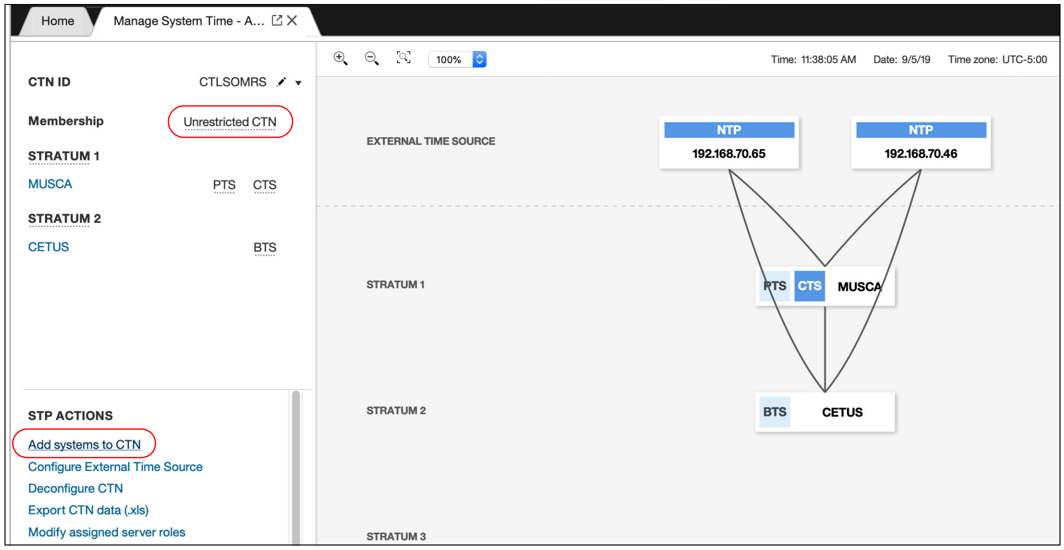


Figure 8-47 Add systems to CTN

> **Note:** Before adding a CPC to an existing CTN, ensure that **Allow any server to be a member of the CTN** is selected in the **Coordinated Timing Network (CTN) member restriction preferences**.

2. The Specify Coordinated Timing Network (CTN) Members window opens. In this window, select the CPC name that does not belong to any CTN (**ARIES**). Click **NEXT** to continue (Figure 8-48).

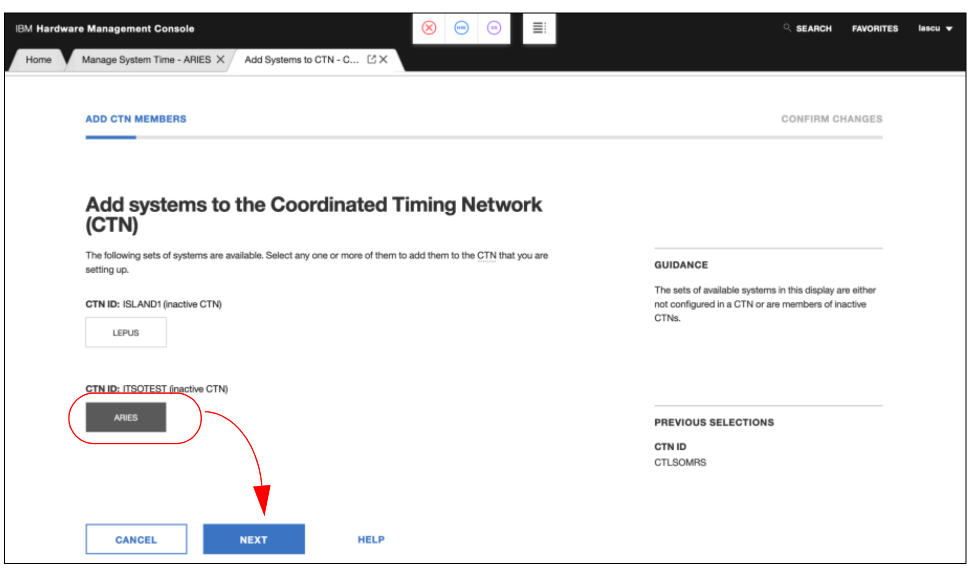


Figure 8-48 Specify Coordinated Timing Network (CTN) Members window

3. The **Confirm Changes** window opens. In this case, ARIES is added as a Stratum 2 server. Click **APPLY** to continue (Figure 8-49).

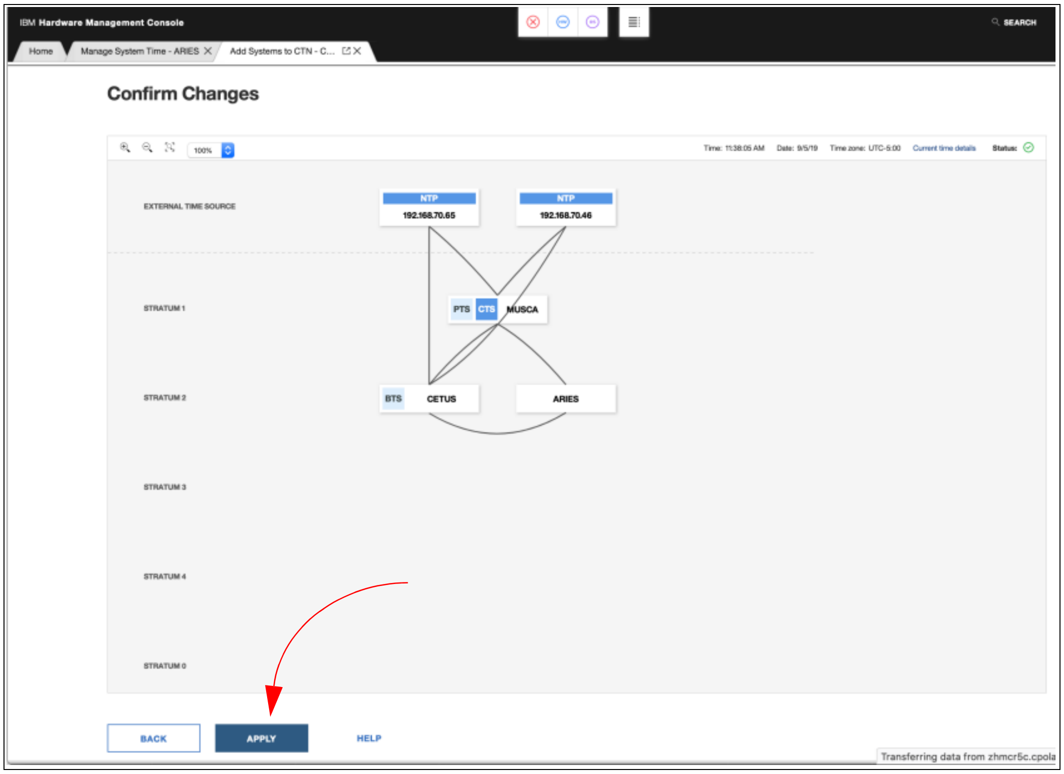


Figure 8-49 Confirm Changes window

4. You see the Local CTN ID change confirmation for ARIES (Figure 8-50). After you select **APPLY**, the Complete message window opens. Click **Close** to complete the operation.(Figure 8-50).

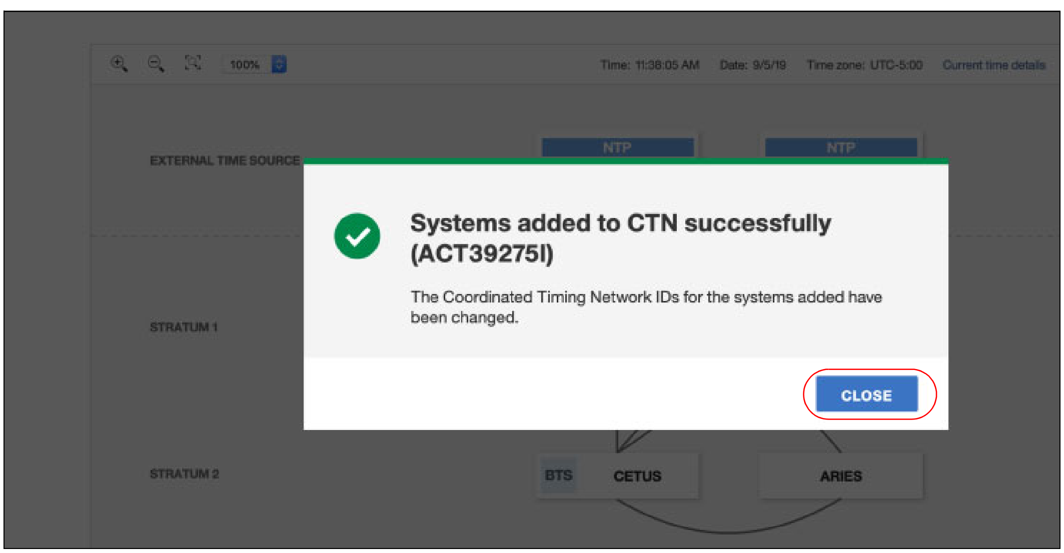


Figure 8-50 Local CTN ID change confirmation (ACT37363)

9

Defining Coupling Facility links

This chapter describes the coupling connectivity options and the Parallel Sysplex clustering enhancements that are available on z15 systems. Coupling link configuration examples for Parallel Sysplex and Server Time Protocol (STP) are shown as well.

This chapter includes the following sections:

> **Note:** The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

9.1 Coupling connectivity options for Parallel Sysplex on z15 systems

Coupling connectivity for Parallel Sysplex on z15 systems can use Coupling Express Long Reach (CELR) and Integrated Coupling Adapter Short Reach (ICA SR). The ICA SR feature is designed to support distances of up to 150 meters. The CELR feature supports distances up to 10 km unrepeated between systems, and up to 100 km with qualified Dense Wavelength Division Multiplexer. The available options for coupling links on z15 systems are shown in Figure 9-1.

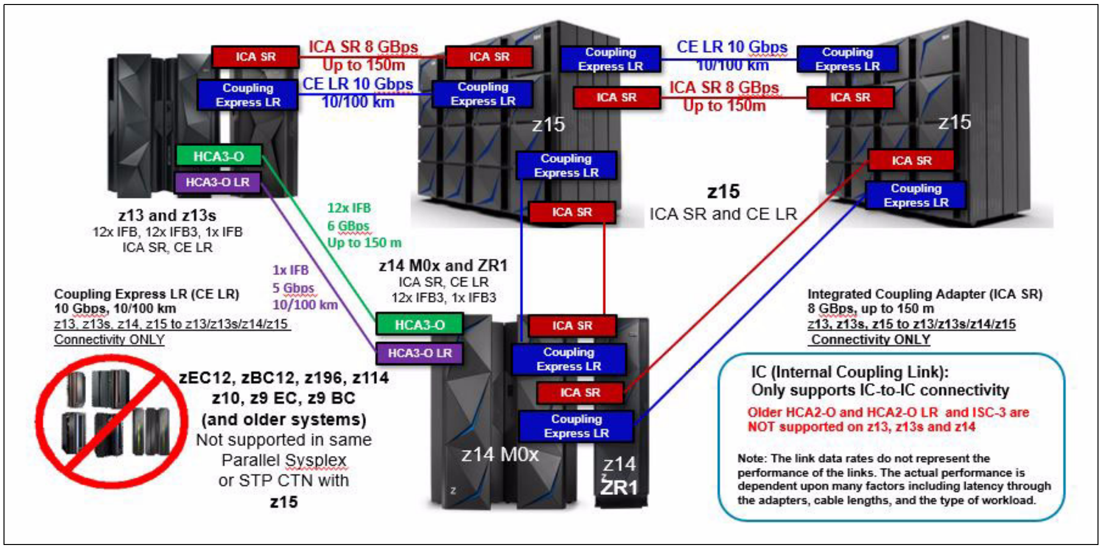


Figure 9-1 z15 coupling connectivity

Internal Coupling (IC) links are supported and used for internal communication between logical partitions (LPARs) on the same central processor complex (CPC) running coupling facilities (CFs) and z/OS images. The connection is emulated in Licensed Internal Code (LIC) and provides fast and secure memory-to-memory communications between LPARs within a single system. No physical cabling is required. For IC, an ICP type channel path ID (CHPID) is used.

Note: Both z15 models do not support InfiniBand coupling links; only ICA SR and CELR external coupling links are supported.

Ordering a z15 system as a Stand-alone Coupling Facility (SACF) results in a z15 system that is equipped with at least one Peripheral Component Interconnect Express (PCIe) Gen3+ I/O drawer.

9.1.1 Preparing to define Coupling Facility links

A good starting point for implementing coupling links is accurate and current documentation that clearly illustrates all connections that are needed for the new or upgraded CPC.

When installing coupling links, ensure that you ordered enough ports to support your configuration with physical feature redundancy. Your Parallel Sysplex should be configured for the highest possible availability.

Parallel Sysplex failure independence is a function of a z/OS to CF relationship and the removal of single points of failure. For example, all connections to a structure on a SACF are failure-independent. With an ICF, all connections from z/OS images on the same footprint are failure-dependent.

For more information, see *Coupling Facility Configuration Options*, ZSW01971, which can be found at the Parallel Sysplex on IBM Z website.

Evaluate whether the configuration includes any channel features that are not supported on the z15 system. The configuration should be reviewed for any channel types that cannot be carried forward or connected to the z15 system.

Another important point is to ensure that all CPCs are connected to the z15 system by using coupling links as follows: Only N, N-1, and N-2 Z generations can coexist in the same Parallel Sysplex or Coordinated Timing Network (CTN). For example, the z15 system provides coupling connectivity back to z13, z13s, z14 M0x, and z14 ZR1 systems only through ICA SR and CELR features. (No direct connectivity to zEC12 or zBC12 systems is supported.)

Note: Deactivate any coupling link on other connected systems before an upgrade, or you might experience configuration errors.

If a z15 system plays a CTN role (Preferred Time Server (PTS), Backup Time Server (BTS), or Arbiter), then the other CTN role-playing CPCs must have coupling connectivity to the z15 system (N, N-1, and N-2).

If coupling links will be connected across sites by using Dense Wavelength Division Multiplexing (DWDM), you must verify whether the DWDM equipment that you plan to use supports the respective coupling link technology and is qualified for the STP.

Note: Do not use DWDM equipment that is not qualified by IBM to transport STP information.

For more information about the supported coupling link features, see *IBM Z Connectivity Handbook*, SG24-5444.

9.2 Defining Coupling Express Long Reach

This section describes the implementation of the CELR feature. The definition of this CF link is part of the activity that is called *Define CF/STP link*, which is shown in Figure 1-3 on page 5.

In this example, we show how to define a coupling link between a z15 system and a z14 system by using CHPID type CL5 (see Figure 9-2).

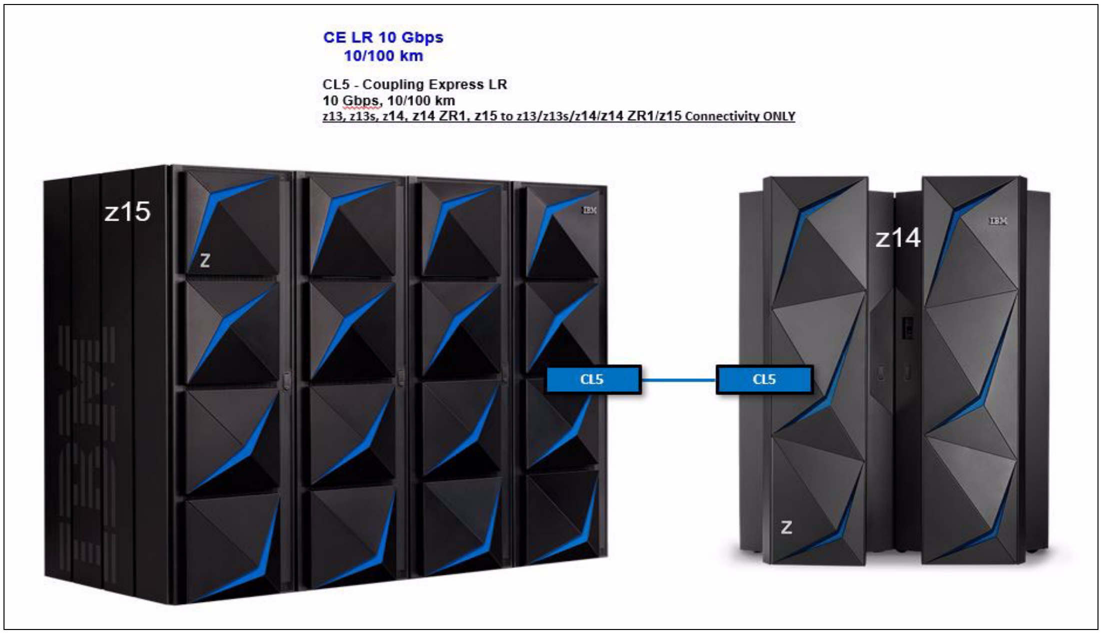


Figure 9-2 CF link connection that uses CL5

CELR is defined in an input/output configuration data set (IOCDS) like PSIFB. Even though this feature is a PCIe feature, a physical channel ID (PCHID) is used instead of an adapter ID (AID) to identify the physical card.

Example 9-1 shows a sample extract of the input/out configuration program (IOCP) to define the new CHPID Type CL5 on the z14 system that connects to a z15 system.

Example 9-1 IOCP definitions for CHPID Type CL5 on a z14 system

```
ID     ..                                                    *
       ..                                                    *
       SYSTEM=(3906,1),LSYSTEM=CETUS,                        *
       TOK=('CETUS',008001117A883906095804670118074F00000000,00*
       000000,'18-03-15','09:58:04','........','........')
RESOURCE PARTITION=((CSS(0),(CETUS0A,A),..                   *
       ),(CETUS0D,D),(CETUS0E,E),(CETUS0F,F),(CETUS01,1),(CETUS*
       ..                                                    *
       (CSS(2),(CETUS2A,A),(CETUS2B,B),(CETUS2C,C),(CETUS2D,D),*
       (CETUS2E,E),..                                        *
CHPID  PATH=(CSS(2),E9),SHARED,PARTITION=((CETUS2E),(=)),    *
       CPATH=(CSS(1),E9),CSYSTEM=ARIES,PORT=2,PCHID=13C,     *
       TYPE=CL5
```

Example 9-2 shows a sample extract of the corresponding IOCP definition for a connecting CHPID Type CL5 on a z15 system.

Example 9-2 IOCP definitions for CHPID Type CL5 on a z15 system

```
ID    ..                                                      *
      ..                                                      *
      SYSTEM=(8561,1),LSYSTEM=ARIES,                          *
      TOK=('ARIES',008001117A8885610958046701180 74F00000000,00*
      000000,'18-03-15','09:58:04','........','........')
RESOURCE PARTITION=((CSS(0),(ARIES0A,A),..                    *
      RIES07,7),(ARIES08,8),(ARIES09,9)),(CSS(1),(ARIES1A,A),(*
      ARIES1B,B),(ARIES1C,C),(ARIES1D,D),(ARIES1E,E),(ARIES1F,*
      F),(ARIES11,1),..                                       *
CHPID PATH=(CSS(1),E9),SHARED,PARTITION=((ARIES11),(=)),      *
      CPATH=(CSS(2),E9),CSYSTEM=CETUS,PORT=2,PCHID=124,       *
      TYPE=CL5
```

> **Note:** When you connect CF sender and CF receiver channel paths, or CF peer channel paths, the Hardware Configuration Definition (HCD) proposes a CF control unit (CU), and device numbers that must be defined for a CF sender channel. (CF receiver channels do not require CUs and devices to be defined.)

For more information about how to define CHPID Type CL5 in HCD, see 14.2.4, “Defining CL5 CHPIDs” on page 348.

9.2.1 CELR: Verifying the configuration

After you activate the new configuration with the new CELR CF links and all the cables are connected, verify whether the CHPIDs are online and operating by using z/OS or the Support Element (SE) windows:

- Checking the status by using z/OS commands.

  For example, if you are interested in checking the status of CHPID E9, run the **D M=CHP(E9)** command, as shown in Example 9-3.

  Example 9-3 Displaying the status of CHPID E9

```
D M=CHP(E9)
IEE174I 16.04.03 DISPLAY M 738
CHPID E9:  TYPE=34, DESC=COUPLING OVER ROCE, ONLINE
COUPLING FACILITY 008561.IBM.02.000000007A88
                  PARTITION: 1F  CPCID: 00
NAMED CF77        CONTROL UNIT ID: FFFD

PATH        PHYSICAL              LOGICAL  CHANNEL TYPE      CAID PORT
E9 / 0507   ONLINE                ONLINE   CL5 10GbE-RoCE    013C  02

COUPLING FACILITY SUBCHANNEL STATUS
 TOTAL:   48   IN USE:   48   NOT USING:    0   NOT USABLE:    0
 OPERATIONAL DEVICES / SUBCHANNELS:
     FFA4 / 3C40     FFA5 / 3C41     FFA6 / 3C42     FFA7 / 3C43
     FFA8 / 3C44     FFA9 / 3C45     FFAA / 3C46     FFAB / 3C47
     FFBC / 3C48     FFBD / 3C49     FFBE / 3C4A     FFBF / 3C4B
     FFC0 / 3C4C     FFC1 / 3C4D     FFC2 / 3C4E     FFC3 / 3C4F
```

```
FFC4 / 3C50     FFC5 / 3C51     FFC6 / 3C52     FFC7 / 3C53
FFC8 / 3C54     FFC9 / 3C55     FFCA / 3C56     FFCB / 3C57
```

- Checking the status by using the SE windows by completing the following steps:

  a. From the Hardware Management Console (HMC), select the CPC (under Systems Management) where the CHPID/PCHID that you want to verify is, and click **Single Object Operations** (under Recovery task options).

  b. On the SE, select the same CPC and click **Channels**, as shown in Figure 9-3.

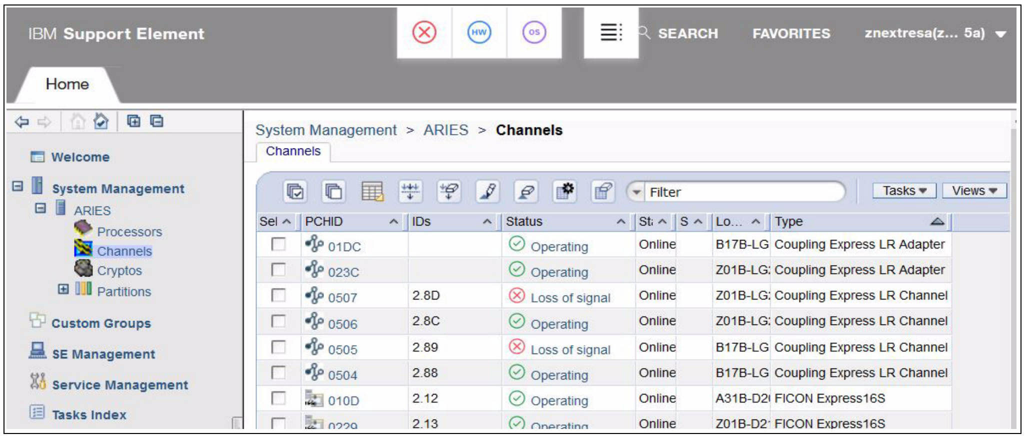


Figure 9-3 SE Systems Management and channels

  c. Look for the PCHID that you are interested in checking the status of. The result looks like what is shown in Figure 9-4.

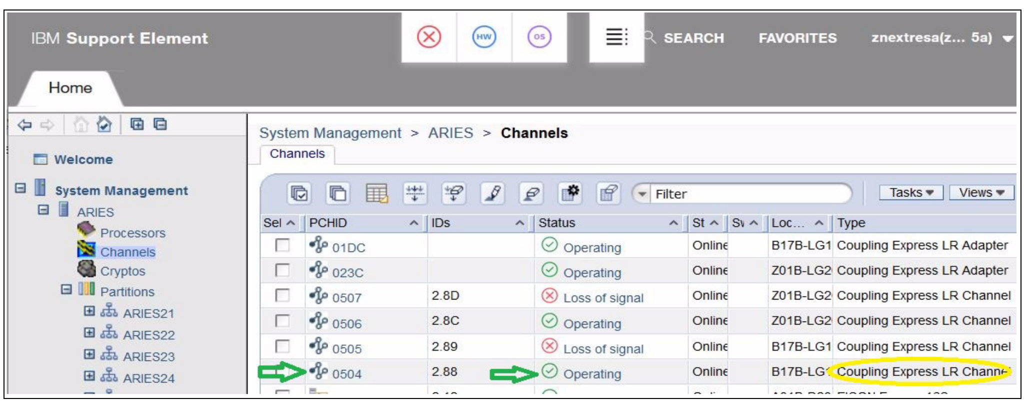


Figure 9-4 Verifying channel CL5 by using the CPC view

  d. For more information about the PCHID, click the PCHID to show its details, as shown in Figure 9-5 on page 203.

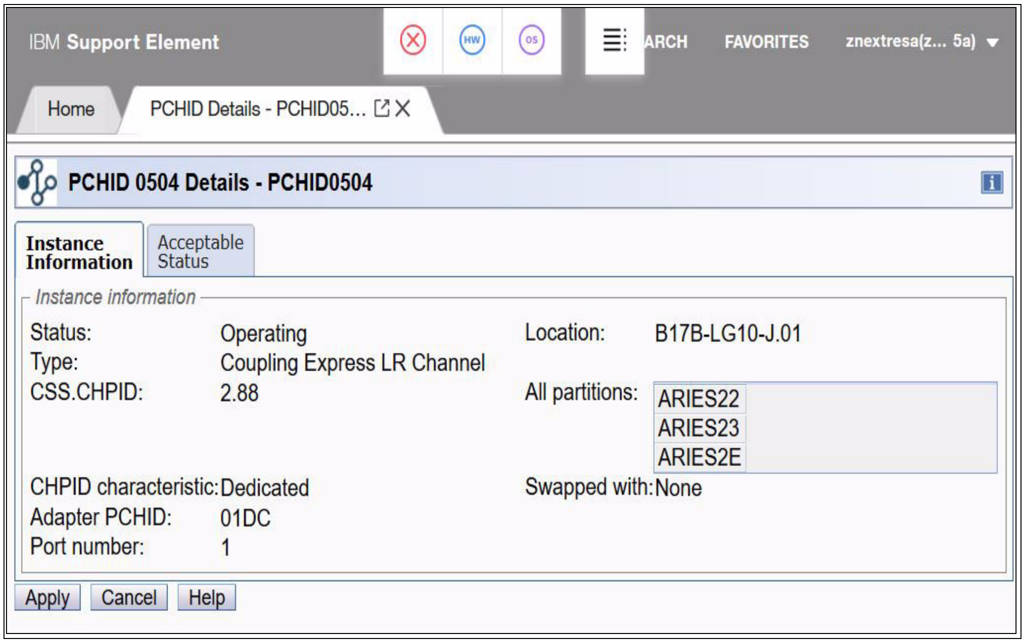


Figure 9-5 CL5 PCHID details

You can also check the status from the LPAR view. Select the LPAR that you want to check the CHPID status of, and select the channels option under that LPAR. Now, you can look for the CHPID and check the status, as shown in Figure 9-6.

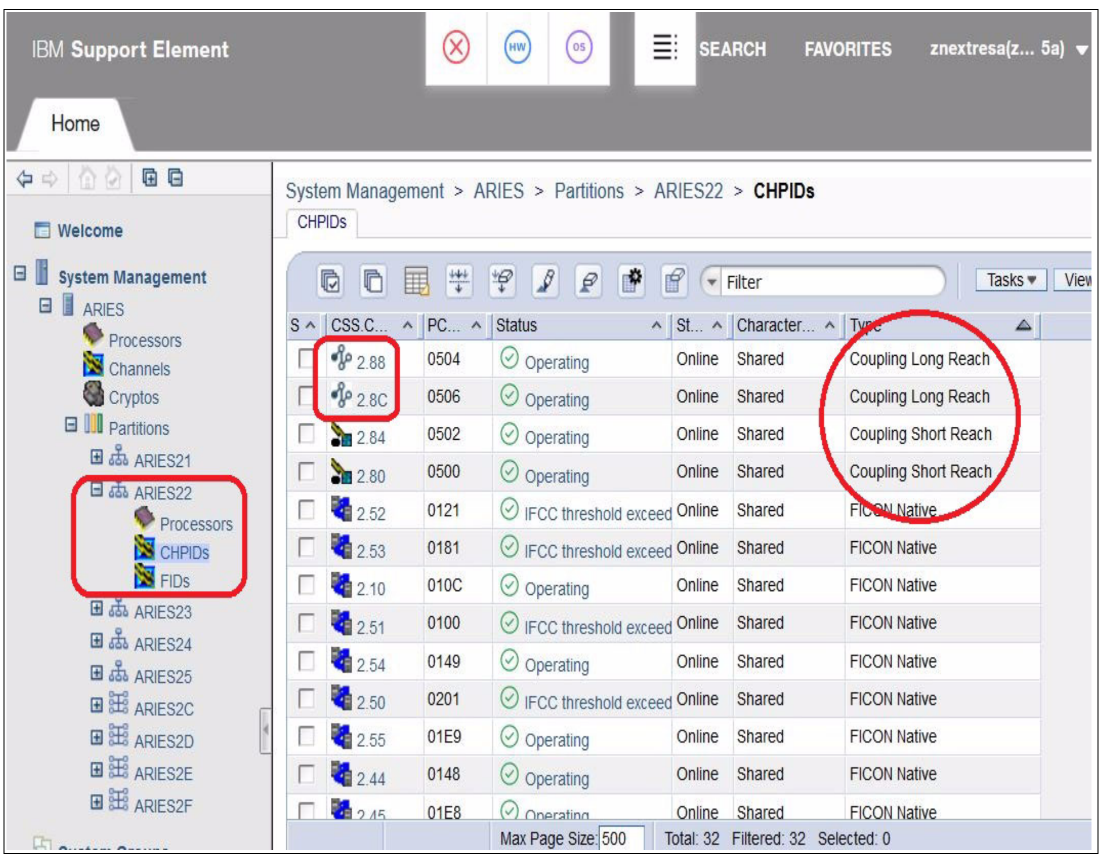


Figure 9-6 SE Verify channel LPAR view

9.3 Defining Integrated Coupling Adapter Short Reach

This section describes the implementation of coupling links by using the ICA SR feature. The definition of this CF link is part of the activity that is called *Define CF/STP link*, which is shown in Figure 1-3 on page 5.

In this example, we show how to define a coupling link between a z15 system and a z14 system by using CHPID type CS5 (see Figure 9-7).

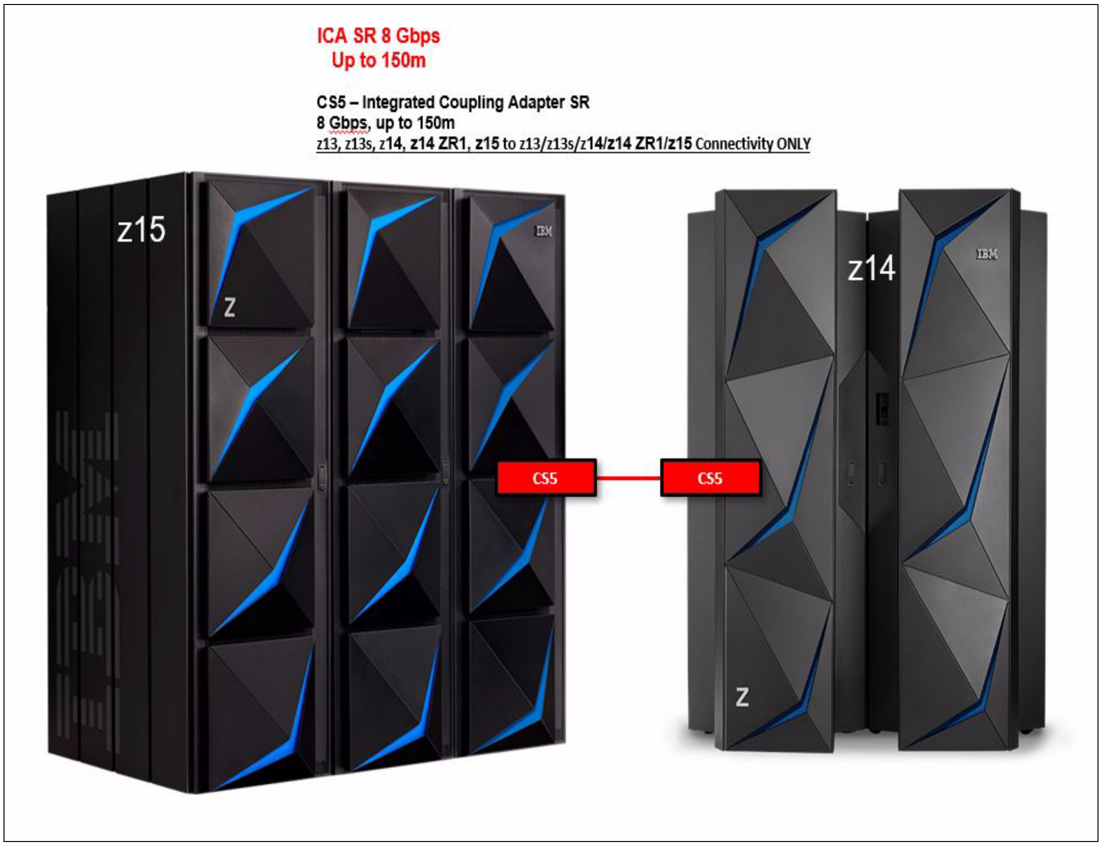


Figure 9-7 CF link CS5 connection from a z15 system to a z14 system

The ICA SR is defined in IOCDS like PSIFB by using an AID to identify the physical card. Example 9-4 shows a sample of the IOCP defining the CS5 CHPID.

Example 9-4 IOCP definitions for CHPID Type CS5 on a z14 system

```
ID     ..                                                      *
       ..                                                      *
       SYSTEM=(3906,1),LSYSTEM=CETUS,                          *
       TOK=('CETUS',008001117A8839060958046701180 74F00000000,00*
       000000,'18-03-15','09:58:04','........','........')
RESOURCE PARTITION=((CSS(0),(CETUS0A,A),..                     *
       (CSS(2),(CETUS2A,A),(CETUS2B,B),(CETUS2C,C),(CETUS2D,D),*
       (CETUS2E,E),..                                          *
CHPID PATH=(CSS(2),E0),SHARED,PARTITION=((CETUS2E),(=)),       *
       CPATH=(CSS(1),E5),CSYSTEM=ARIES,AID=20,PORT=1,TYPE=CS5
```

Example 9-5 shows a sample extract of the corresponding IOCP definition for a connecting CHPID Type CS5 on a z15 system.

Example 9-5 IOCP definitions for CHPID Type CS5 on a z15 system

```
ID    ..                                                     *
      ..                                                     *
      SYSTEM=(8561,1),LSYSTEM=ARIES,                         *
      TOK=('ARIES',008001117A8885610958046701180 74F00000000,00*
      000000,'18-03-15','09:58:04','........','........')
RESOURCE PARTITION=((CSS(0),(ARIES0A,A),..                   *
      USCA07,7),(ARIES08,8),(ARIES09,9)),(CSS(1),(ARIES1A,A),(*
      ARIES1B,B),(ARIES1C,C),(ARIES1D,D),(ARIES1E,E),(ARIES1F,*
      F),(ARIES11,1),..                                      *
CHPID PATH=(CSS(1),E5),SHARED,PARTITION=((ARIES11),(=)),     *
      CPATH=(CSS(2),E0),CSYSTEM=CETUS,AID=16,PORT=2,TYPE=CS5
```

For more information about how to define CHPID Type CS5 in the HCD, see 14.2.3, “Defining a Coupling Facility link with CS5 CHPIDs” on page 345.

9.3.1 ICA SR: Verifying the configuration

After activating the new configuration with the ICA SR CF links and all cables are connected, verify whether the CHPIDs are online and operating by using a z/OS command or the SE windows:

- Checking status by using the z/OS command.

  For example, if you are interested in checking the status of CHPID E1, run a **D M=CHP(E1)** command, as shown in Example 9-6.

  Example 9-6 Display status of CHPID E1

```
D M=CHP(E1)
IEE174I 16.20.22 DISPLAY M 758
CHPID E1:  TYPE=33, DESC=COUPLING OVER PCIE, ONLINE
COUPLING FACILITY 008561.IBM.02.000000007A88
                  PARTITION: 1F  CPCID: 00
NAMED CF77        CONTROL UNIT ID: FFFD

PATH       PHYSICAL              LOGICAL  CHANNEL TYPE      CAID PORT
E1 / 0503  ONLINE                ONLINE   CS5 8X-PCIE3      0020  02

COUPLING FACILITY SUBCHANNEL STATUS
 TOTAL:   48   IN USE:   48   NOT USING:    0   NOT USABLE:    0
 OPERATIONAL DEVICES / SUBCHANNELS:
     FFA4 / 3C40     FFA5 / 3C41     FFA6 / 3C42     FFA7 / 3C43
     FFA8 / 3C44     FFA9 / 3C45     FFAA / 3C46     FFAB / 3C47
     FFBC / 3C48     FFBD / 3C49     FFBE / 3C4A     FFBF / 3C4B
     FFC0 / 3C4C     FFC1 / 3C4D     FFC2 / 3C4E     FFC3 / 3C4F
     FFC4 / 3C50     FFC5 / 3C51     FFC6 / 3C52     FFC7 / 3C53
     FFC8 / 3C54     FFC9 / 3C55     FFCA / 3C56     FFCB / 3C57
```

- Checking the status by using SE windows by completing the following steps:

   a. From the HMC, select the CPC (under Systems Management) where the CHPID/PCHID that you want to verify is, and click **Single Object Operations** (under Recovery task options).

   b. On the SE, select the same CPC and click **Channels**, as shown in Figure 9-8.

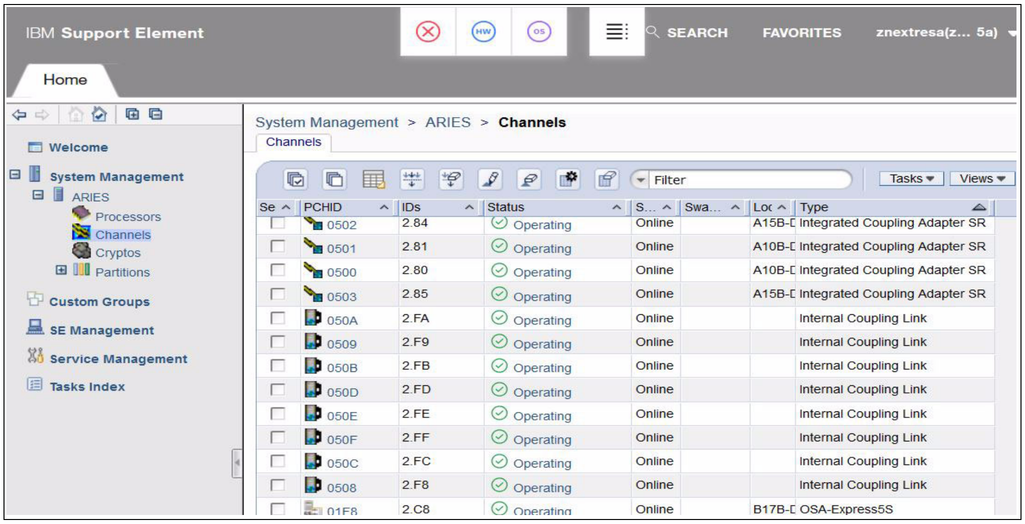


Figure 9-8 SE Systems Management and channels

   c. Look for the PCHID that you are interested in checking the status for. The result looks like what is shown in Figure 9-9.

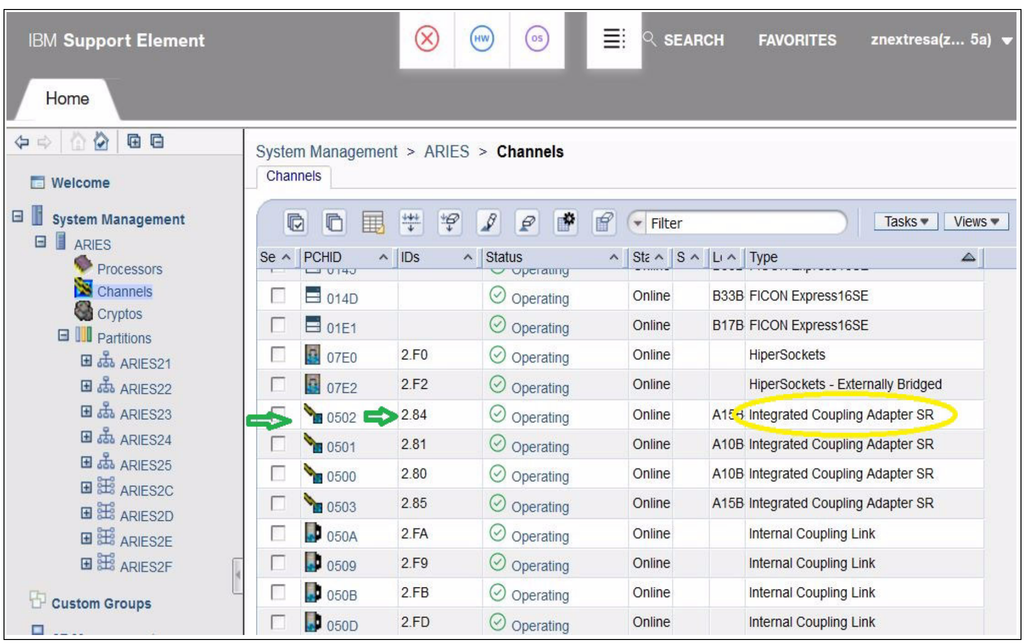


Figure 9-9 Verifying channel CS5 by using the CPC view

   d. For more information about the PCHID, click the PCHID to show a result like what is shown in Figure 9-10 on page 207.

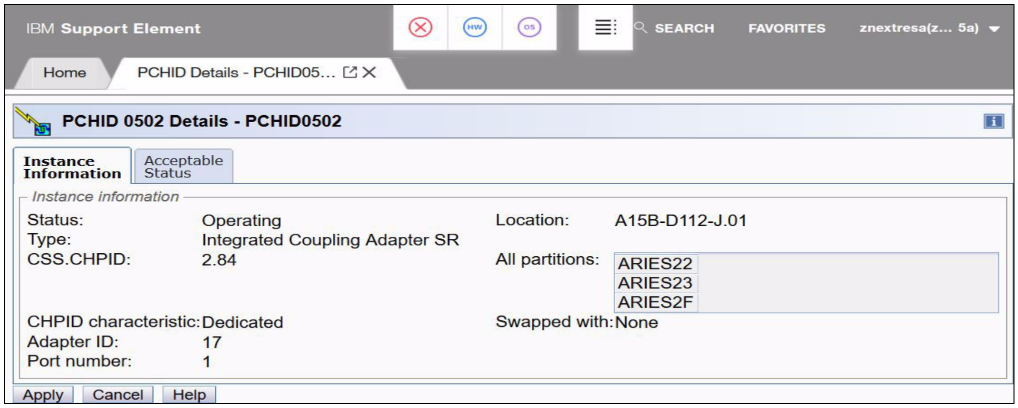


Figure 9-10 CS5 PCHID details

Another option is to check the status from the LPAR view. Select the LPAR that you are interested in checking the CHPID status of, and select the **Channels** option under that LPAR. Now, you can look for the CHPID and check the status, as shown in Figure 9-11.

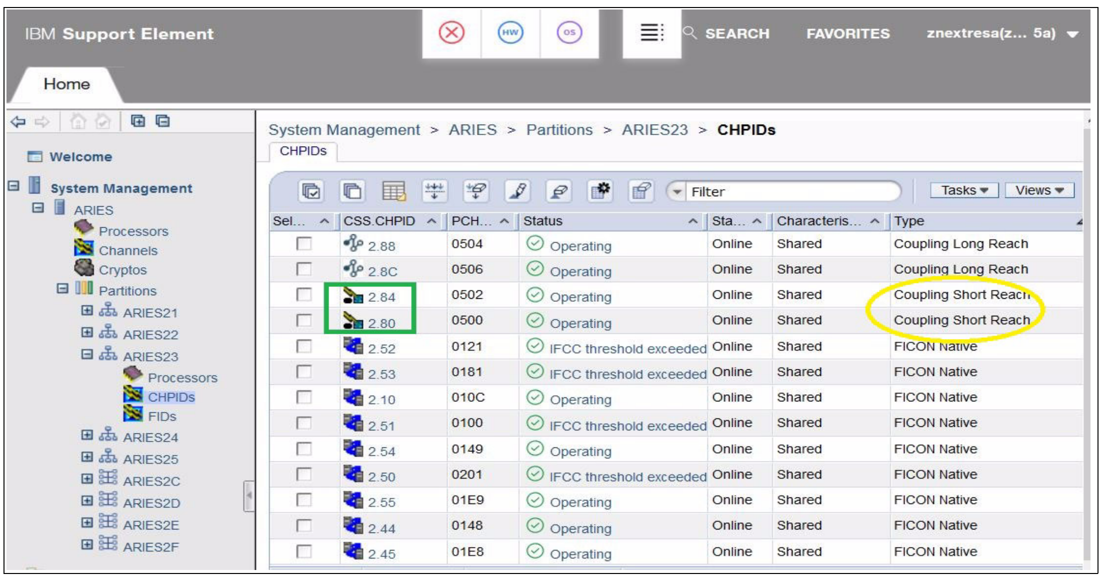


Figure 9-11 SE Verify channel LPAR view

9.4 Defining an STP timing-only link by using ICA SR

This section describes how to configure a timing-only link (for STP messages) over ICA SR connectivity.

9.4.1 STP timing-only link: Implementation

In this section, a CHPID type (CS5) connection is used to show an example of an STP timing-only link definition. The definition of the STP timing-only link is part of the *Define CF/STP link* activity that is shown in Figure 1-3 on page 5.

A coupling link connection between a z15 system and a z14 system by using CS5 CHPIDs is used as an example of how to define an STP timing-only link (see Figure 9-12).

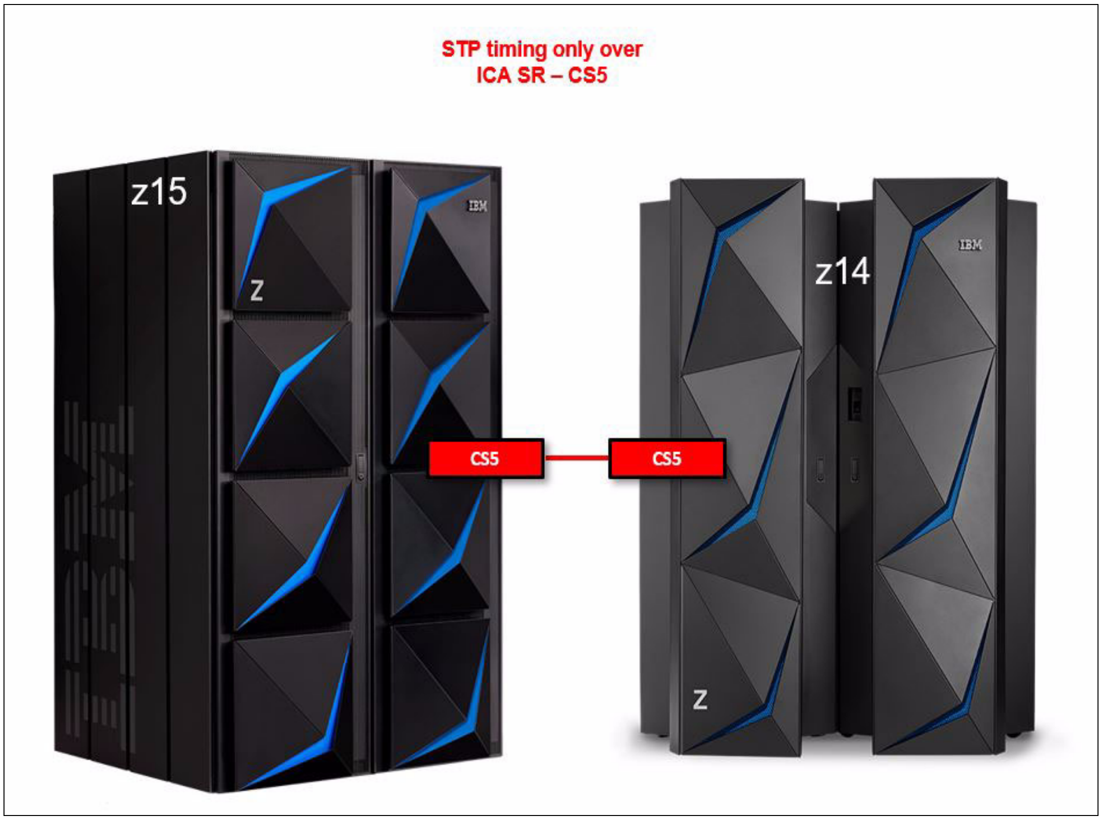


Figure 9-12 STP timing-only link connection from a z15 system to a z14 system (over CS5)

A timing-only link ICA SR is defined in the IOCDS like an ICA SR. The only difference is the CU type, which is *STP* in this case. Example 9-7 shows a sample IOCP defining the CS5 CHPID for timing-only links on the z14 side.

Example 9-7 IOCP defining STP timing-only link on a z14 system by using CS5

```
ID      ..                                                       *
        ..                                                       *
        SYSTEM=(3906,1),LSYSTEM=CETUS,                           *
        TOK=('CETUS',00800112E0F73906094704240118061F00000000,00*
        000000,'18-03-02','09:47:04','SYS9','IODF78')
RESOURCE PARTITION=((CSS(0),(CETUS0A,A),..                       *
        (CSS(2),(CETUS2A,A),(CETUS2B,B),(CETUS2C,C),(CETUS2D,D),*
        (CETUS2E,E),(CETUS2F,F),(CETUS21,1),..                   *
CHPID PATH=(CSS(2),E0),SHARED,PARTITION=((CETUS21),(=)),         *
        CPATH=(CSS(1),E5),CSYSTEM=ARIES,AID=20,PORT=1,TYPE=CS5
CHPID PATH=(CSS(2),E1),SHARED,PARTITION=((CETUS21),(=)),         *
        CPATH=(CSS(1),E0),CSYSTEM=ARIES,AID=20,PORT=2,TYPE=CS5
CNTLUNIT CUNUMBR=FFFD,PATH=((CSS(2),E9,ED,E1,E4,E5,E0)),         *
        UNIT=STP
```

Example 9-8 on page 209 shows a sample IOCP defining the CS5 CHPID for timing-only links on the z15 side.

Example 9-8 IOCP defining STP timing-only link on a z15 system by using CS5

```
ID    ..                                                      *
      ..                                                      *
      SYSTEM=(8561,1),LSYSTEM=ARIES,                          *
      TOK=('ARIES',00800112E0F7856109470424011806 1F00000000,00*
      000000,'18-03-02','09:47:04','SYS9','IODF78')
RESOURCE PARTITION=((CSS(0),(ARIES0A,A),..                    *
      USCA07,7),(ARIES08,8),(ARIES09,9)),(CSS(1),(ARIES1A,A),(*
      ARIES1B,B),(ARIES1C,C),(ARIES1D,D),(ARIES1E,E),(ARIES1F,*
      F),(ARIES11,1),..                                       *
CHPID PATH=(CSS(1),E4),SHARED,PARTITION=((ARIES11),(=)),      *
      CPATH=(CSS(2),E5),CSYSTEM=CETUS,AID=16,PORT=1,TYPE=CS5
CHPID PATH=(CSS(1),E5),SHARED,PARTITION=((ARIES11),(=)),      *
      CPATH=(CSS(2),E0),CSYSTEM=CETUS,AID=16,PORT=2,TYPE=CS5
CNTLUNIT CUNUMBR=FFFC,PATH=((CSS(1),E9,EC,E0,E1,E4,E5)),
   UNIT=STP
```

The sequence of steps to define the STP timing-only link connection between a z15 system and a z14 system by using CS5 CHPIDs through HCD is the same as for defining the CF links to a connection.

For more information about how to define CHPID Type CS5 in HCD, see 14.2.3, “Defining a Coupling Facility link with CS5 CHPIDs” on page 345.

Complete the following steps:

1. On the CF links connection step, after including the data that is related to the CPC CETUS side of the connection, type `YES` on the `Timing-only link` option of the Connect to CF Channel Path panel (Figure 9-13), and press Enter.

```
Goto  Filter  Backup  Query  Help
+--------------- Connect to CF Channel Path ----------------+ ---------
|                                                            |
|                                                            | ==> PAGE
| Specify the following values.                              |
|                                                            |
| Source processor ID  . . . . . : ARIES                     |
| Source channel subsystem ID  . : 2                         |
| Source channel path ID . . . . : 80                        |
| Source channel path type . . . : CS5                       |
|                                                            |
| Destination processor ID . . . . . . CETUS     +           |  -CU-  -#-
| Destination channel subsystem ID . . 2   +                 |  Type  Dev
| Destination channel path ID  . . . . E4  +                 |
|                                                            |  CFP   8
| Timing-only link . . . . . . . . . . YES                   |  CFP   32
|                                                            |  CFP   8
|                                                            |  STP
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset  |  CFP   32
|  F9=Swap    F12=Cancel                                     |  STP
+------------------------------------------------------------+  CFP   32
F8       Y  ICP  SHR  N     ARIES.2    F9       Y  ICP  SHR    CFP   7
```

Figure 9-13 STP timing-only link from a z15 system to a z14 system by using CS5

2. After accepting or overriding the CU and Device numbers for both processors, HCD returns to the CF Channel Path Connectivity List panel (Figure 9-14). You can see that the STP timing-only links are now connected.

```
---------------------------------------------------------------------------
                     CF Channel Path Connectivity List             Row 5 of
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : ARIES     Aries
Source channel subsystem ID . : 2
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  De
_ 80  1DC/1 Y  CS5  SHR  N     CETUS.2    E4  104/1 N  CS5  SHR    STP
```

Figure 9-14 STP timing-only links connected

9.4.2 STP timing-only links: Verifying the configuration

After activating the new configuration with the ICA SR links defined as STP timing-only links and all cables are connected, verify whether the CHPIDs are online and operating by using z/OS or the SE windows.

The same process that you used for ICA SR links should be followed to check the status (online and operating) of the CS5 CHPIDs that were defined to work as STP timing-only links.

Complete the steps that are described in 9.3.1, “ICA SR: Verifying the configuration” on page 205 by using the respective CHPID/PCHID of the links for which you are interested in checking the status.

9.5 CF LPAR setup and Coupling Facility Control Code Level 24

The intention of this section is to remind you of the configuration aspects that are related to a CF LPAR, such as the possible sysplex configuration with a z15 system, memory considerations due to the new CF Level, and the changes in Coupling Facility Control Code (CFCC) Level 24.

As previously mentioned in the installation flow chart (Figure 1-3 on page 5), the following aspects must be considered for the activity *Setup CF LPAR*:

- z15 models support active participation in the same Parallel Sysplex with these servers:
  - IBM z14 (M/T 3906) and IBM z14 ZR1 (M/T 3907) systems
  - IBM z13 (M/T 2964) and IBM z13s (M/T 2965) systems

  This means:

  - Configurations with z/OS on one of these servers can add a z15 system to their Parallel Sysplex for either a z/OS or a CF image.
  - Configurations with a CF on one of these servers can add a z15 system to their Parallel Sysplex for either a z/OS or a CF image.

- Memory considerations:
  - Memory planning must consider the CFCC memory and structure size increases that are associated with a new level of the CFCC.
  - LPARS running the CFCC code may increase storage requirements when moving from CF Level 23 (or earlier) to CF Level 24.
  - As a best practice, use the Coupling Facility Structure Sizer (CFSizer) Tool, which you can find at Parallel Sysplex on IBM Z (under Tools - Sizer Utility).
  - Additionally, as in prior CF Levels, ensure that the CF LPAR has at least 512 MB storage for the CFCC microcode

9.5.1 Coupling Facility Control Code Level 24

The new CFCC Level 24 introduces changes and improvements in the following areas:

- Fair Latch Manager 2 (FLM2).
- Message Path SYID Resiliency Enhancement.
- Shared-Engine CF Default changed to `DYNDISP=THIN`.

  Thin Interrupt support has now been available since zEC12 and zBC12 systems, and has proven to be efficient and performant in numerous shared-engine CF configurations. The z15 system makes `DYNDISP=THIN` the default mode of operation for CF images that use shared processors.

For more information about the enhancements that were made in CF level 24, see *IBM z15 (8561) Technical Guide*, SG24-8851.

9.6 Dynamic I/O for stand-alone CF

A SACF cannot change the I/O configuration dynamically because of a missing HCD running in the IBM Z server. Changing the I/O configuration for such a server is cumbersome, error-prone, and requires a Power on Reset (POR).

Dynamic configuration capabilities for stand-alone coupling facilities (SACFs) were added to the z14 system (Driver Level 36).

SACFs have no co-resident z/OS (with HCD) images that can make hardware-only dynamic I/O configuration changes on behalf of the CF partitions. Therefore, these I/O changes require disruptive Initial Microcode Loads (IMLs) of the SACF CPC, which causes sysplex availability and complexity issues.

With this new support, a Master Control Service (MCS) Linux-based HCD image starts on the SACF CPC to perform this role, which provides a simple, dynamically activated change to the active input/output definition file (IODF) with no IML required.

For more information, see the *IBM z15 (8561) Technical Guide*, SG24-8851.

> **Note:** For remote dynamic I/O activation to run on an IBM Z system, Driver Level 36 or later is needed.

9.6.1 Preparation steps

If you are not using a z15 system, you must plan and perform a firmware update to Driver Level 36 and HMC V2.14.1 on your earlier IBM Z generation.

Complete the following steps:

1. Install the program temporary fixes (PTFs) for APARs for z/OS (OA54912) and Hardware Configuration Manager (HCM) (IO25603). Make sure that the servers in the same Parallel Sysplex are running on Driver Level 36 or higher, and then select the processor to update the definitions on the appropriate server, as shown in Figure 9-15.

```
+--------------------------- Supported Processors
|                                                   R
| Command ===> ___________________________________
|
| Select one to view more details.
|
|   Processor
|   Type-Model Support Level
|   3906-M03   3906 support
|   3906-M03   3906 GA2 support        <===
+--------------------------------------------------
```

Figure 9-15 Update 3906 processor definition to new support level

2. Define Partition B' in the `highest*` channel subsystem (CSS) with the name `MCS_1` for the CF processor.

> **Note:** The `highest*` CSS is CSS ID 5 for the z14 (M0x) and z15 T01, and CSS ID 2 for the z15 T02 and z14 ZR1 systems.

Using the HCD, you the panel what is shown in Figure 9-16 on page 213.

```
+---------------------------- Partition List --------------------------
|   Goto  Backup  Query  Help
| ----------------------------------------------------------------------
|
| Command ===> ________________________________________ Scroll ===> PAGE
|
| Select one or more partitions, then press Enter. To add, use F11.
|
| Processor ID . . . . : CETUS     Cetus
| Configuration mode  . : LPAR
| Channel S +---------- Change Internal Partition Definition ----------+
|           |                                                          |
| / Partiti |                                                          |
| _ *       | Specify or revise the following values.                  |
| _ *       |                                                          |
| C *       | Partition name . . . MCS_1                               |
| _ *       | Partition number . : B      (same as MIF image ID)       |
| _ *       | Partition usage  . : FW                                  |
| _ *       | UID uniqueness . . : N        (Y/N)                      |
| _ *       |                                                          |
|  F1=Help  | Description  . . . . Master Control Service FW lpar__    |
|  F7=Backw |                                                          |
| F12=Cance |                                                          |
+---------- |  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset    |
            |  F9=Swap   F12=Cancel                                    |
            +----------------------------------------------------------+
```

Figure 9-16 HCD change to the internal partition definition

Using the HCM, you see the window that shown in Figure 9-17.

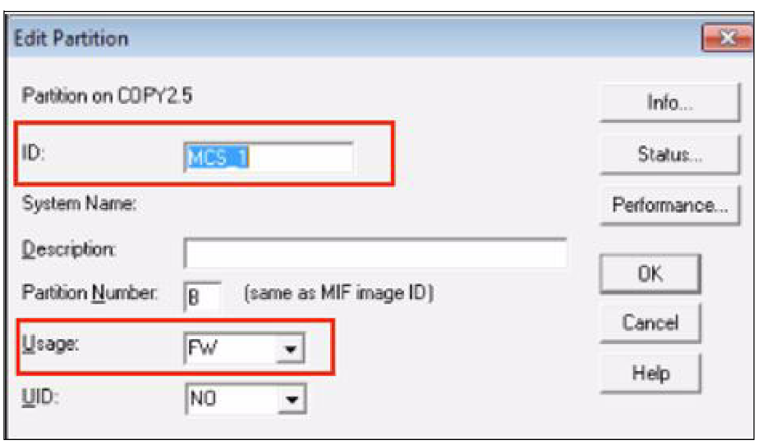


Figure 9-17 HCM edit partition definition

3. To do the activation, update the IOCDS with the updated configuration to the CF processor, and then perform a POR of the CF.

   After this “last” POR is done on the SACF CPC, then all subsequent dynamic I/O changes can be done dynamically.

The dynamic activation is like the existing remote dynamic activation on a server that supports z/OS LPARs, but for hardware only changes.

For more information about how to implement this new support, see 5.5.2, “Dynamic I/O configuration for stand-alone CF” on page 116.

9.6.2 IBM Processor Resource/System Manager solution

With z14 and z15 systems, dynamic activation of a new or changed IODF on a SACF CPC is supported:

- Without requiring a POR/IML
- Without requiring the presence (on the same CPC) of any z/OS or z/VM image running an HCD instance

Here is a base IBM Processor Resource/System Manager (PR/SM) solution:

- The MCS LPAR is a firmware LPAR.
- The solution is fully managed by the IBM Z firmware.
- The solution is included with the base firmware (no need to order a feature code).

You must do a POR with an IOCDS that includes and establishes the MCS LPAR on the SACF CPC before this new capability can be used. After this “last” POR is done on the SACF CPC, then all subsequent I/O changes can be done dynamically.

The MCS HCD appliance LPAR on z14 and z15 systems is driven by an updated HCD/HCM running in an z/OS LPAR on a remote IBM Z (Driver Level 35 or newer) system, as shown on Figure 9-18.

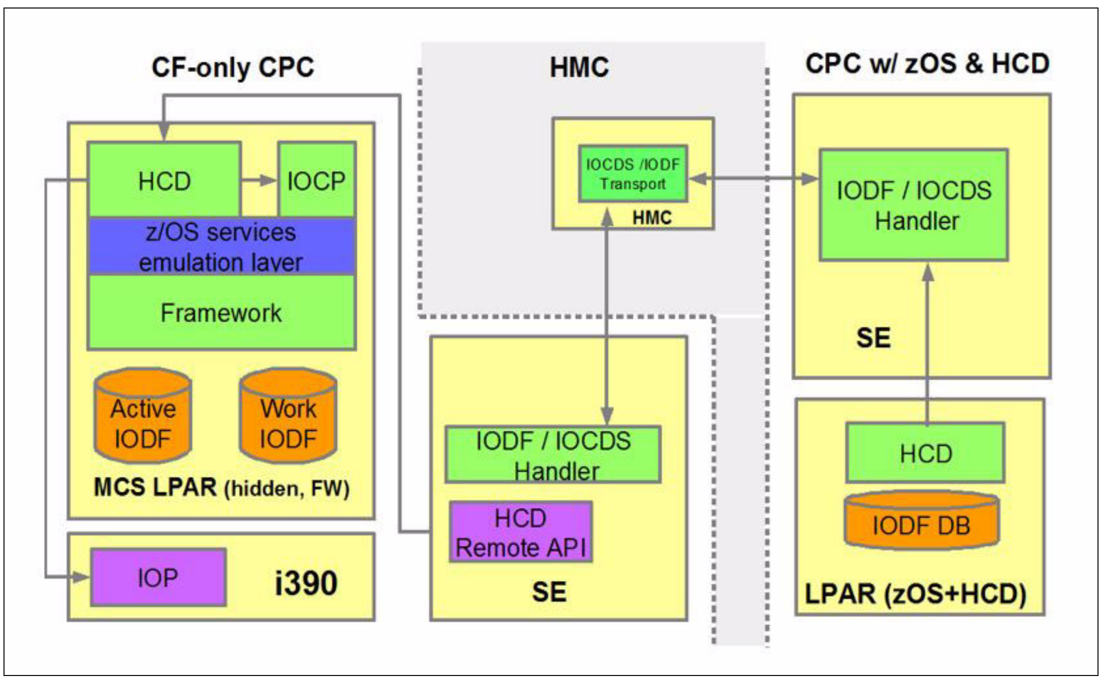


Figure 9-18 Dynamic I/O for a stand-alone CF

10

Specialized features

This chapter covers the configuration of all the specialized features that are available for IBM z15 systems.

This chapter includes the following sections:

- Crypto Express7S
- Virtual Flash Memory

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

10.1 Crypto Express7S

This section provides information about the configuration of the Crypto Express7S feature on an IBM z15 system. It covers cryptographic domains, configuration rules, and what to consider when you are planning for a nondisruptive installation of cryptographic features.

The chapter includes the steps for defining and configuring the Crypto Express7S feature to a logical partition (LPAR).

This section includes the following topics:

- Crypto Express7S overview
- Planning for a Crypto Express7S configuration
- Configuring Crypto Express7S
- Handling cryptographic coprocessors by using ICSF

10.1.1 Crypto Express7S overview

There are three generations of cryptographic coprocessors[1] that are supported for z15 systems:

- Crypto Express5S, Feature Code #0890, carry forward only (miscellaneous equipment specification (MES) from z13, z14, or z14 ZR1 systems)
- Crypto Express6S, Feature Code #0893, carry forward only (MES from z13, z14, or z14 ZR1 systems)
- Crypto Express7S, Feature Codes 0899 (one adapter on card) and 0898 (two adapters on card)

This section describes the Crypto Express7S features for the z15 system.

Each cryptographic coprocessor of a z15 T01 has 85 physical sets of registers (on a z15 T02, it has 40 physical sets of registers), which corresponds to the maximum number of LPARs running on a z15 T01 and z15 T02. Each of these 85 (on z15 T02: 40) sets belongs to a domain as follows:

- A cryptographic domain index, in the range of 0 - 84 (0 - 39 on z15 T02), is allocated to an LPAR by the definition of the partition in its image profile. The same domain must also be allocated to the Integrated Cryptographic Service Facility (ICSF) instance running in the LPAR that uses the Options data set.
- Each ICSF instance accesses only the master keys that correspond to the domain number that is specified in the LPAR image profile at the Support Element (SE) and in its Options data set. Each ICSF instance sees a logical cryptographic coprocessor that consists of the physical cryptographic engine and the unique set of registers (the domain) that is allocated to this LPAR.

[1] Regional Crypto Enablement (RCE) is also supported, but it is not covered here.

The installation of CP Assist for Cryptographic Functions (CPACF) Data Encryption Standard (DES) / Triple Data Encryption Standard (TDES) Enablement (Feature Code #3863) is one of the prerequisites for using the special hardware cryptographic feature in a z15 system. Feature Code #3863 enables the following functions:

- For data privacy and confidentially: DES, TDES, Advanced Encryption Standard (AES) for 128-bit, 192-bit, and 256-bit keys. Also with Feature Code #3863, the Modulo arithmetic unit is enabled, which supports Elliptic Curve Cryptography for verification and signing by using NIST P256, P384, and P521 curves; and Ed25519 and Ed448-Goldilocks curves with clear keys.
- For data integrity: Secure Hash Algorithm-1 (SHA-1) 160-bit, and SHA-2 for 224-, 256-, 384-, and 512-bit support. SHA-3 for 224-, 256- 384-, and 512-bit support, and SHAKE for 128- and 256-bit support. SHA-1, SHA-2, and SHA3 are enabled on all z15 systems, and they do not require the no-charge enablement Feature Code 3863.
- For Key Generation: Pseudo-Random Number Generation (PRNG), Deterministic Random Number Generation (DRNG), and True Random Number Generation (TRNG).
- For message authentication code: Single-key message authentication code and double-key message authentication code.

The total number of cryptographic Peripheral Component Interconnect Express (PCIe) adapters (combined Crypto Express7S, Crypto Express6S, or Crypto Express5S features) cannot exceed 40 per z15 T01 and T02. Up to 16 Crypto Express6S or Crypto Express5S features can be carried forward from z13, z14, or z14 ZR1 systems; the rest must be Crypto Express7S features.

The initial order for Crypto Express7S is two features (two PCIe adapters for Feature Code #0899, and four PCIe adapters for Feature Code #0898). After the initial order, the minimum order is one feature.

Each Crypto Express7S Feature Code #0899 contains one PCIe adapter, and each Crypto Express7S Feature Code #0898 contains one PCIe adapter. The adapter can be in the following configurations:

- Common Cryptographic Architecture (CCA) Coprocessor (CEX7C)
- Public Key Cryptography Standards (PKCS) #11 (EP11) Coprocessor (CEX7P)
- Accelerator (CEX7A)

During the feature installation, the PCIe adapter is configured by default as the CCA coprocessor.

The configuration of the Crypto Express7S adapter as an EP11 coprocessor requires a Trusted Key Entry (TKE) workstation Hardware 9.2 (Feature Code #0087 for the rack-mounted workstation, and Feature Code #0088 for the tower workstation) with TKE 9.2 Licensed Internal Code (LIC) (Feature Code #0881).

The Crypto Express7S feature does not use channel path IDs (CHPIDs) from the channel subsystem (CSS) pool. However, the Crypto Express7S feature requires one slot in a PCIe I/O drawer, and one physical channel ID (PCHID) for each PCIe cryptographic adapter.

Table 10-1 summarizes the cryptographic feature codes for a z15 system.

Table 10-1 Cryptographic feature codes

Feature code	Description
#3863	CPACF enablement This feature is a prerequisite to use CPACF (except for SHA-1, SHA-2, and SHA-3) and cryptographic coprocessor hardware.
#0898	Crypto Express7S (2 port) card A maximum of eight features can be ordered (minimum of two adapters). This feature is optional, and each feature contains two PCIe cryptographic adapters (an adjunct processor). This feature is supported by only z15 T01 and z15 T02.
#0899	Crypto Express7S (1 port) card A maximum of 16 features can be ordered (minimum of two adapters). This feature is optional, and each feature contains one PCIe cryptographic adapter (an adjunct processor). This feature is supported by only z15 T01 and z15 T02.
#0893	Crypto Express6S card This feature cannot be ordered for a new z15 system, but only on a carry forward MES from a z14 system. A maximum of 16 features can be ordered (minimum of two adapters). This feature is optional, and each feature contains one PCIe cryptographic adapter (an adjunct processor). This feature is supported by z15 T01, z15 T02, z14, and z14 ZR1 systems.
#0890	Crypto Express5S card This feature cannot be ordered for a new z15 system, but only on a carry forward MES from z13 or z14 systems. The maximum supported number of Crypto Express5S and Crypto Express6S is 16 total. This feature is optional, and each feature contains one PCIe cryptographic adapter (an adjunct processor). This feature is supported by z15 T01, z15 T02, z14, z14 ZR1, z13, and z13s systems.
#0088	TKE tower workstation A TKE provides basic key management (key identification, exchange, separation, updates, and backup) and security administration. It is optional for running a Crypto Express feature in CCA mode in a non-PCI-compliant environment. It is required for running in EP11 mode and CCA mode with full PCI compliance. The TKE workstation has one Ethernet port, and supports connectivity to an Ethernet local area network (LAN) operating at 10, 100, or 1000 Mbps. It also requires Feature Code #0157. Up to 10 features combined with 0087 per z15 T01 and z15 T02 can be ordered.
#0157	TKE Table Top Keyboard/Monitor/Mouse A table top monitor with a US English language keyboard. There is a touchpad for pointing, and a country-specific power cord.
#0087	TKE rack-mounted workstation The rack-mounted version of the TKE, which needs a customer-provided standard 19-inch rack. It also requires Feature Code #0156. When using smart card readers, an extra customer-provided tray is needed. Up to 10 features combined with 0088 per z15 T01 and z15 T02 can be ordered.
#0156	TKE Rack Keyboard/Monitor/Mouse A 1U rack-mounted display and keyboard with a built-in pointing device. The keyboard comes in the English language.

Feature code	Description
#0881	TKE 9.2 LIC Included with the TKE tower workstation Feature Code #0088 and the TKE rack-mounted workstation Feature Code #0087 for z15. Earlier versions of TKE features (Feature Codes #0080,# 0081, #0085, and #0086) also can be upgraded to TKE 9.2 LIC if the TKE is assigned to a z14 or later system.
#0891	TKE Smart Card Reader Access to information in the smart card is protected by a PIN. One Feature Code includes two smart card readers, two cables to connect to the TKE workstation, and 20 smart cards.
#0900	TKE extra smart cards When one Feature Code is ordered, 10 smart cards are included. The order increment is 1 - 99 (990 blank smart cards).

Note: You might need the TKE workstation including TKE Smart Card Reader while you run CEX in CCA mode to meet certain security standards requirements.

For more information about the Crypto Express7S feature and the corresponding crypto features, see *IBM z15 (8561) Technical Guide*, SG24-8851.

10.1.2 Planning for a Crypto Express7S configuration

Note: Toleration support for Crypto Express7S coprocessors that are available on z15 systems, which treats Crypto Express7S cryptographic coprocessors and accelerators as Crypto Express6S coprocessors and accelerators, is included in z/OS V2.4, and also for z/OS V2.3, z/OS V2.2, and z/OS V2.1 in the Cryptographic Support for z/OS V2R1 – z/OS V2R3 (HCR77D0) web deliverables. Support can be downloaded from the z/OS downloads website.

Exploitation support for Crypto Express7S coprocessors on z15 systems requires z/OS V2.4, V2.3, or V2.2 with Enhanced Cryptographic Support for z/OS V2.2 – z/OS V2.4 (HCD77D1). It also can be downloaded from the z/OS downloads website.

ICSF enhancements in z/OS V2.4 for the Crypto Express7S updates include support to use the new algorithm support and extend existing support for asymmetric algorithms. For the latest MCL bundle requirements, see the *Driver Level 41 Exception Letter*.

The z15 system always operates in LPAR mode. The concept of *dedicated coprocessor* does not apply to the PCIe adapter. A PCIe adapter, whether configured as a coprocessor or accelerator, is made available to LPARs as directed by the domain assignment and the candidate list. This process occurs regardless of the shared or dedicated status that is given to the central processors (CPs) in the partition.

The z15 T01 enables up to 85 LPARs to be active concurrently. The z15 T02 enables up to 40 LPARs to be active concurrently.

Each PCIe adapter on a Crypto Express7S feature supports 85 domains on a z15 T01 and 40 domains on a z15 T02, whether it is configured as a Crypto Express7S coprocessor or a Crypto Express7S accelerator.

For availability reasons, the minimum configuration consists of two Crypto Express7S features so that every potential LPAR can have access to two cryptographic adapters on two different cards.

More Crypto Express7S features might be needed to satisfy application performance and availability requirements:

- For availability, spread the assignment of multiple PCIe adapters of the same type (accelerator or coprocessor) to one LPAR across features in multiple I/O domains.
- Using retained private keys on a PCIe adapter that is configured as a Crypto Express7S coprocessor creates an application single point of failure. This point of failure exists because RSA-retained private keys are not copied or backed up.
- There is an intrusion latch within the PCIe adapter logic that is set when the feature is removed from the system. If the feature is reinstalled and power is applied, the coprocessor keys and secrets are zeroed and the intrusion latch is reset.

  If a TKE workstation is available, disable the PCIe adapter the TKE workstation before you remove the feature from the system. When the feature is reinstalled, the coprocessor keys and secrets are not zeroed. The intrusion latch is reset, and the coprocessor remains in the disabled state. The PCIe adapter then can be enabled from the TKE and normal operations can resume.

  Plan the definition of domain indexes and cryptographic coprocessor numbers in the Candidate list for each LPAR to prepare the cryptographic configuration. You can also define or change that cryptographic definition dynamically to an active LPAR with a running system. For more information, see “Change LPAR Cryptographic Controls function” on page 227.
- Crypto Express7S features can be installed concurrently when all physical requirements are fulfilled. Dynamically enabling a new PCIe adapter to a partition requires these configurations:
  - At least one usage domain index must be defined to the LPAR.
  - The cryptographic coprocessor numbers must be defined in the partition candidate list.
- The same usage domain index can be defined more than once across multiple LPARs. However, the cryptographic coprocessor number that is coupled with the usage domain index that is specified must be unique across all *active* LPARs.

  The same cryptographic coprocessor number and usage domain index combination can be defined for more than one LPAR. This feature can be used, for example, to define a configuration for backup situations. In this case, only one of the LPARs can be active at any one time.
- Newly installed Crypto Express7S features are assigned coprocessor numbers sequentially during the Power on Reset (POR) that follows the installation.

  However, when a Crypto Express7S feature is installed concurrently by using the Nondisruptive Hardware Change task, the installation might select an out-of-sequence coprocessor number from the unused range. In this case, communicate the cryptographic coprocessor numbers that you want to use to the IBM installation team.

  When the task is used to concurrently remove a PCI cryptographic feature, the coprocessor number is automatically freed.

Table 10-2 on page 221 is a simplified configuration map (for a z15 T01; on z15 T02 the last column should be for Domain Index 39). Each row identifies a PCIe adapter, and each column identifies a domain index number. Each cell entry indicates the LPAR to be assigned to the cryptographic coprocessor number that is coupled with the usage domain index.

Table 10-2 Planning for logical partitions, domains, and PCIe adapter numbers

PCIe adapter	**Domain index 0**	**Domain index 1**	**Domain index 2**	**.../...**	**Domain index 84**
PCIe adapter 0	LP00 LP02	LP04	LP05		
PCIe adapter 1	LP01 LP02				
PCIe adapter 2					
…					
…					
PCIe adapter 37					
PCIe adapter 38					
PCIe adapter 39					

Table 10-2 illustrates these characteristics:

- LPARs LP00 and LP01 use domain 0 (zero), but are assigned different PCIe adapters. There is no conflict. They can be concurrently active.
- LPAR LP02 uses domain 0 (zero) on the set of cryptographic adapters that are already defined to LP00 and LP01. Therefore, LP02 cannot be active concurrently with either LP00 or LP01. However, the definition might be valid for backup situations.
- LPARs LP04 and LP05 use different domain numbers for PCIe cryptographic adapter 0 (zero), so there is no conflict. The combination of domain number and cryptographic coprocessor number is unique across partitions.

Important: Any combination of PCIe adapter and domain index should contain only one active LPAR. The combination of cryptographic coprocessor number and usage domain index must be unique across all *active* LPARs.

For more information about the Crypto Express7S feature for IBM Z, see *IBM z15 (8561) Technical Guide*, SG24-8851.

10.1.3 Configuring Crypto Express7S

This section provides steps for configuring Crypto Express7S for the IBM z15 server.

The z15 operates only in LPAR mode. For each LPAR that requires access to a PCIe adapter, which is configured as either an accelerator or a coprocessor, the required information must be defined in the partition image profile. This technique ensures the correct use of the cryptographic features when the associated partition is activated.

Concurrent changes to the Crypto Express7S features and controls when the partition is already activated are provided by special functions on the SE.

Checking whether the CPACF DES / TDES Enablement feature is installed

The z15 Feature Code #3863 enables the DES and TDES algorithms on the CPACF. It is one of the prerequisites for using the Crypto Express7S feature. You must verify whether the CPACF feature is correctly installed on the processor before you configure cryptographic functions. This information is displayed in the SE and can be verified by completing the following steps:

1. Log on to the SE directly or click **Single Object Operations** from the Hardware Management Console (HMC).
2. Open the **System details** menu of the central processor complex (CPC) at the SE workplace. The system details window opens (Figure 10-1).

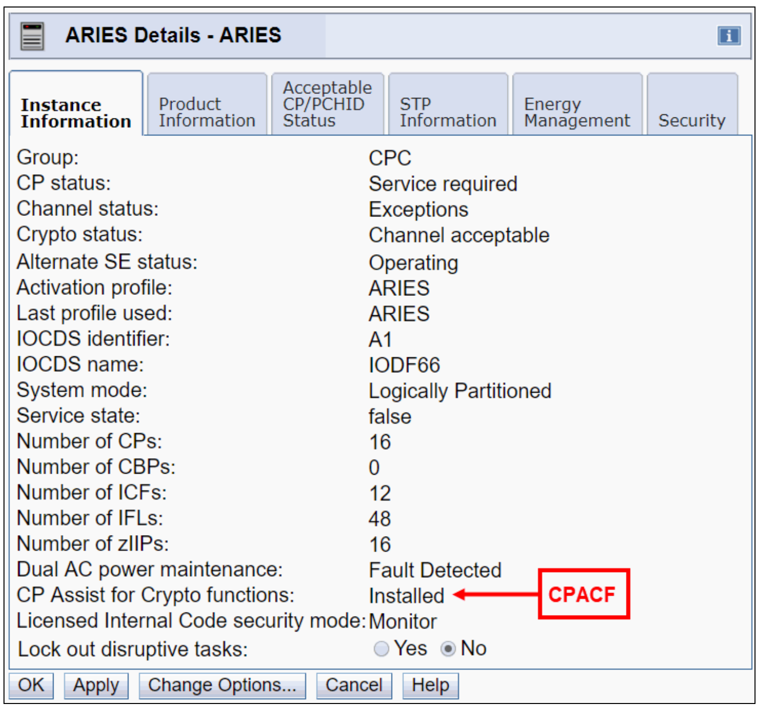


Figure 10-1 System details: CPACF installed

3. Click the **Instance Information** tab, and verify that the CPACF DES/TDES Enablement Feature Code #3863 is installed:
   – If the window shows the message “CP Assist for Crypto Functions: Installed”, the CPACF enablement Feature Code #3863 is enabled.
   – If the window shows the message “CP Assist for Crypto Functions: Not installed”, Feature Code #3863 is not installed. You can still customize the partition image profiles, but the cryptographic functions do not operate.

Logical partition cryptographic definition

The next step is to define the following cryptographic resources in the image profile for each LPAR:

- Usage domain index
- Control domain index
- PCI Cryptographic Coprocessor Candidate List
- PCI Cryptographic Coprocessor Online List

This task is accomplished by using the Customize/Delete Activation Profile task, which is in the Operational Customization Group, either from the HMC or from the SE. Modify the cryptographic initial definition from the Crypto option in the image profile, as shown in Figure 10-2. After this definition is modified, any change to the image profile requires you to DEACTIVATE and ACTIVATE the LPAR for the change to take effect. Therefore, this kind of cryptographic definition is disruptive to a running system.

> **Tip:** Operational changes can be made by using the Change LPAR Cryptographic Controls task from the SE, which reflects the cryptographic definitions in the image profile for the partition. With this function, you can dynamically add and remove the cryptographic feature without stopping a running operating system (OS). For more information about using this function, see "Change LPAR Cryptographic Controls function" on page 227.

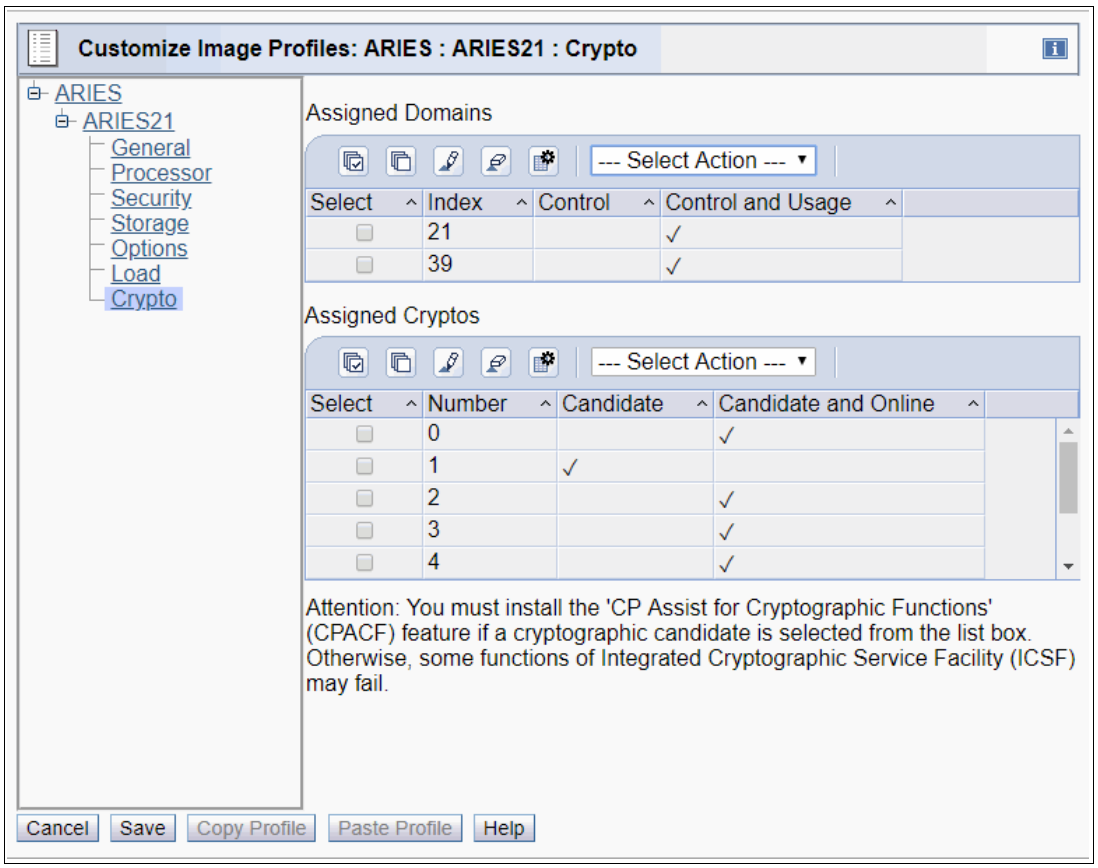


Figure 10-2 Customize Image Profiles: Crypto

The cryptographic resource definitions have the following meanings:

- Control Domain

  Identifies the cryptographic coprocessor domains that can be administered from this LPAR if it is being set up as the TCP/IP host for the TKE.

  If you are setting up the host TCP/IP in this LPAR to communicate with the TKE, the partition is used as a path to other domains' Master Keys. Indicate all the control domains that you want to access (including this partition's own control domain) from this partition.

- Control and Usage Domain

  Identifies the cryptographic coprocessor domains that are assigned to the partition for all cryptographic coprocessors that are configured on the partition. The usage domains cannot be removed if they are online.

  The numbers that are selected must match the domain numbers that are entered in the Options data set when you start this partition instance of ICSF.

  The same usage domain index can be used by multiple partitions regardless to which CSS they are defined. However, the combination of PCIe adapter number and usage domain index number must be unique across all active partitions.

- Cryptographic Candidate list

  Identifies the cryptographic coprocessor numbers that are eligible to be accessed by this LPAR. From the list, select the coprocessor numbers, in the range 0 - 15, that identify the PCIe adapters to be accessed by this partition.

  No error condition is reported when a cryptographic coprocessor number, which is selected in the partition candidate list, is available to the partition when the partition is activated, either because it is configured off or not installed. The cryptographic coprocessor number is ignored and the activation process continues.

  If the cryptographic coprocessor number and usage domain index combination for the coprocessor that is selected is already in use by another active LPAR, the activation of the LPAR fails (see Figure 10-3). In this conflicting case, you must review the cryptographic information for all active LPARs from the **Summary** tab of the View LPAR Cryptographic Controls task (see Figure 10-5 on page 227). Resolve the error based on the collected data by assigning a unique combination of PCIe adapter number and usage domain index number.

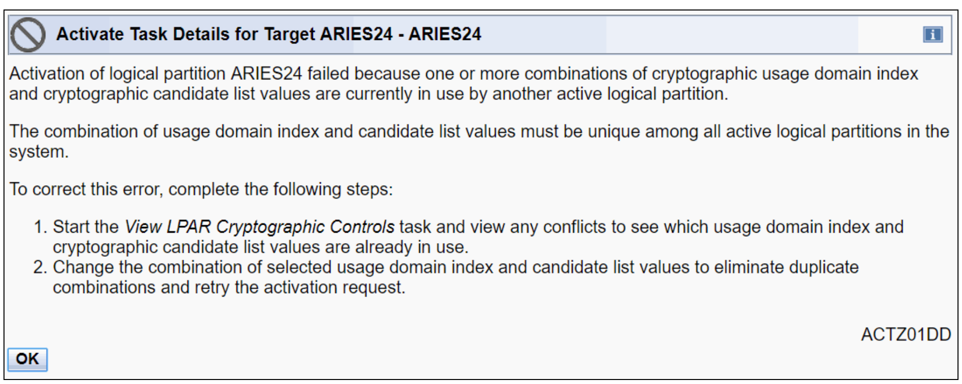


Figure 10-3 Activation of LPAR failed: ACTZ01DD

- Cryptographic Online list

  Identifies the cryptographic coprocessor numbers that are automatically brought online during LPAR activation. The numbers that are selected in the online list must also be part of the candidate list.

  After the next partition activation, installed PCI Cryptographic Coprocessors that are in the partition's PCI Cryptographic Coprocessor Candidate list but not on the PCI Cryptographic Coprocessor Online list are in a *configured off* state (Standby). They can later be configured online to the partition by selecting **Configure On/Off** from the SE. For more information, see "Configuring a Crypto Express7S online or offline on a logical partition" on page 238.

When the partition is activated, no error condition is reported if a cryptographic coprocessor number that is selected in the partition's online list is not installed. The cryptographic coprocessor is ignored and the activation process continues.

When a cryptographic coprocessor number that is selected in the partition's online list was previously configured to an *off* state to the partition, it is automatically configured back to an *on* state when the partition is activated. The cryptographic online list is always selected from the image profile for each LPAR.

Cryptographic configuration by using the Support Element

From the SE, you can do these tasks:

- Display PCI Cryptographic Configuration.
- Display LPAR cryptographic controls (domain index and candidate/online lists for activated partitions).
- Reconfigure the coprocessor from and to the accelerator.
- Configure a cryptographic coprocessor and accelerator on or off to an LPAR.
- Change LPAR cryptographic controls to an LPAR.

These tasks require you to work from the SE. To get to the appropriate SE task, log on to the SE directly or click **Single Object Operations** from the HMC.

Cryptographic management

After you select the CPCs, click **Cryptographic Management** in the Configuration section.

Figure 10-4 shows the Cryptographic Management window. Use this window to obtain the installed cryptographic configuration (the association of the cryptographic number and the card serial number).

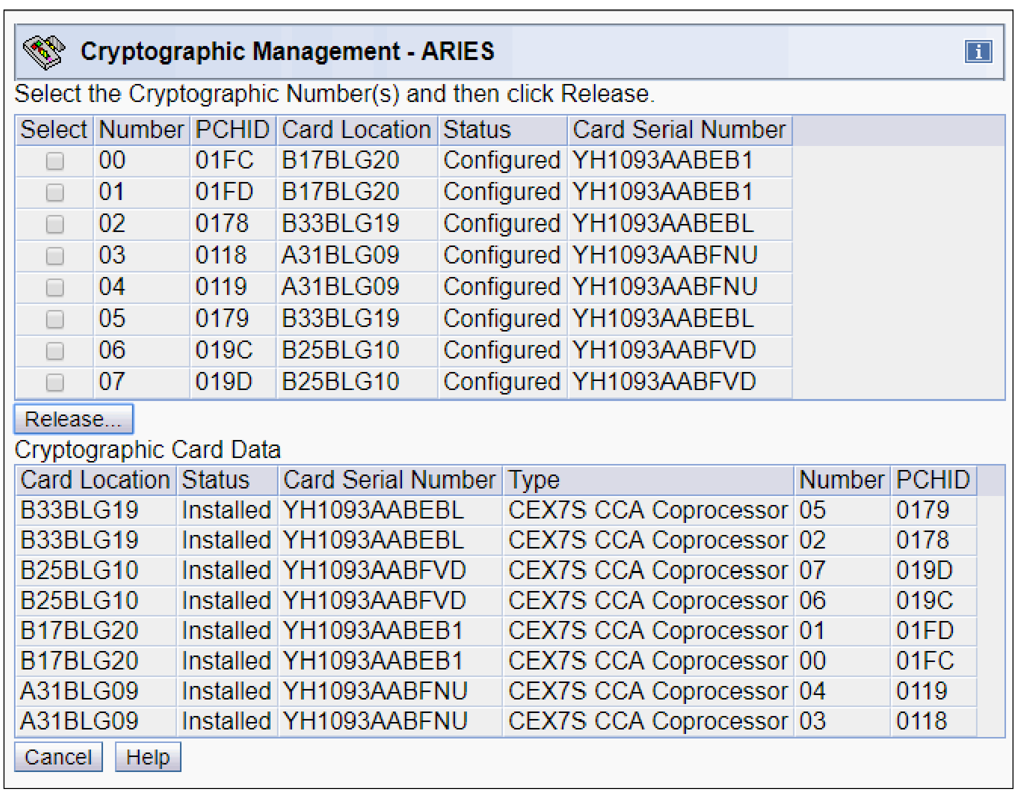


Figure 10-4 SE Cryptographic Management

- View installed cryptographic features, including their statuses and assigned PCHIDs and coprocessor numbers. Each PCIe adapter is assigned to a coprocessor number, in the range 0 - 15, as part of the configuration process. The assignment is made when the feature is installed.
- View coprocessor numbers that are still assigned to removed cryptographic features.
- Initiate the release of coprocessor numbers. Remove the relationship only when a Crypto Express7S feature is permanently removed from the CPC.

  The release option removes the relationship between a PCI cryptographic feature serial number and the assigned coprocessor numbers. Removing the relationship frees the coprocessor numbers, making them available to be assigned to a new feature serial number.

  > **Important:** The coprocessor numbers are assigned to the feature serial number, *not* to the installed location. If a feature is removed from one location to be reinstalled in another location, the coprocessor number assignment remains.

View LPAR Cryptographic Controls task

You can view active partition cryptographic definitions from the SE by selecting the CPCs and clicking **View LPAR Cryptographic Controls** in the Operational Customization pane.

The window that opens shows the definition of Usage and Control domain indexes, and PCI Cryptographic candidate and online lists. The information is provided only for active LPARs.

> **Tip:** You can review the PCI Cryptographic candidate lists and usage domain indexes that are assigned for all active LPAR from the **Summary** tab (see Figure 10-5 on page 227). The usage domain index, in combination with the cryptographic number that is selected in the candidate list, must be unique across all partitions that are defined to the CPC. Therefore, this new tab is useful when you define or change the usage domain index for an LPAR.

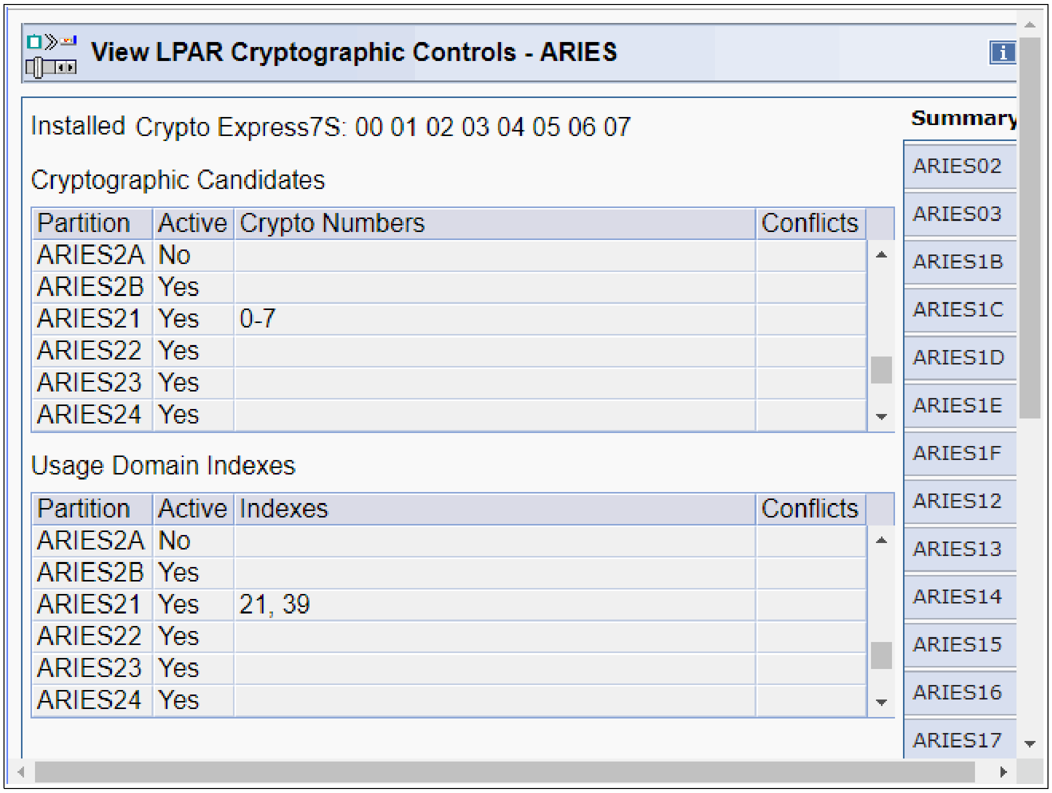


Figure 10-5 View LPAR Cryptographic Controls

This window is for informational purposes only. You can see the definitions, but you cannot change them by using this window. Modifying the cryptographic coprocessor on/off status requires using the Configure On/Off task, which is described in “Configuring a Crypto Express7S online or offline on a logical partition” on page 238.

Change LPAR Cryptographic Controls function

For each LPAR, you can define these attributes:

- Usage domain index
- Control domain index
- Cryptographic Coprocessor Candidate list
- Cryptographic Coprocessor Online list

Using the Change LPAR Cryptographic Controls function, which is included in the SE for the z14 ZR1 system, you can do these tasks:

- Add a cryptographic coprocessor to an LPAR for the first time.
- Add a cryptographic coprocessor to an LPAR using a cryptographic coprocessor.
- Remove a cryptographic coprocessor from an LPAR.
- Zeroize or clear the cryptographic secure keys for a usage domain.

Dynamic assignment of the cryptographic definition to the partition

All the cryptographic functions that are defined in the image profile can be dynamically changed by using the Change LPAR Cryptographic Controls task at the SE. For more information about defining functions in the image profile, see “Logical partition cryptographic definition” on page 222.

Select the **Control** and **Usage** for each domain and the cryptographic **Candidate** and **Online** for each crypto (see Figure 10-6).

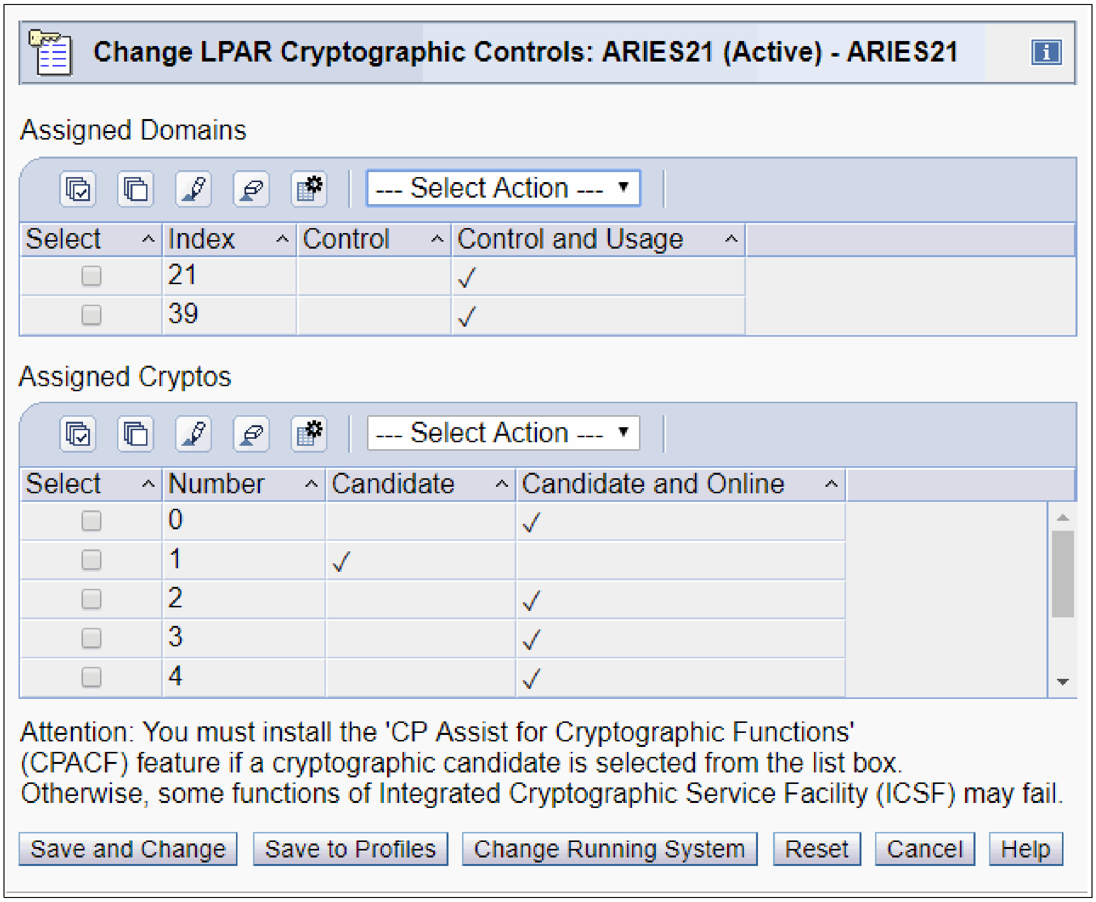


Figure 10-6 Change LPAR Cryptographic Controls: Change Running System

After selecting the appropriate boxes, you can do these tasks:

- Save these settings to the image profile without changing the running system.
- Change the running system without saving the definition to the image profile, which means after a reactivation of the partition your changes are lost.

> **Remember:** Changes to the Cryptographic Coprocessor Online List are ignored when this option is selected.

- Save the definitions to the image profile and activate the changes immediately to the partition.

When you add or change the control or usage domain index and cryptographic coprocessor number dynamically for a running system, a confirmation message appears. After processing, a status window opens and indicates the result of a dynamic addition or change of a cryptographic definition to an LPAR (see Figure 10-7).

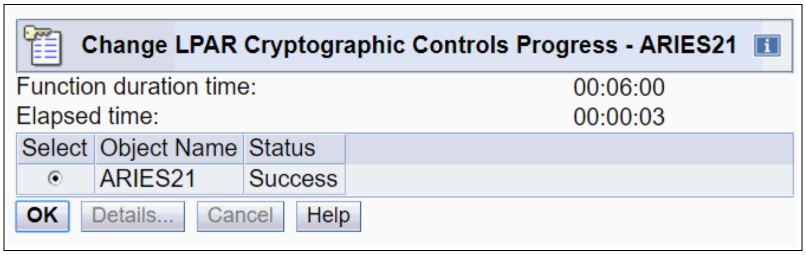


Figure 10-7 SE: Change LPAR Cryptographic Controls

Dynamic removal of the cryptographic definition

You can remove the cryptographic definition from an LPAR dynamically by using the Change LPAR Cryptographic Controls task. This section addresses the related issues and describes the procedure.

Complete the following steps:

1. Before you change the cryptographic settings by using the Change LPAR Cryptographic Controls task, verify that the cryptographic lists that you want to remove from an LPAR are offline (Standby). For more information about setting the cryptographic channel status, see “Configuring a Crypto Express7S online or offline on a logical partition” on page 238. If you try to remove the lists dynamically while they are online, the change fails and you receive the message that is shown in Figure 10-8.

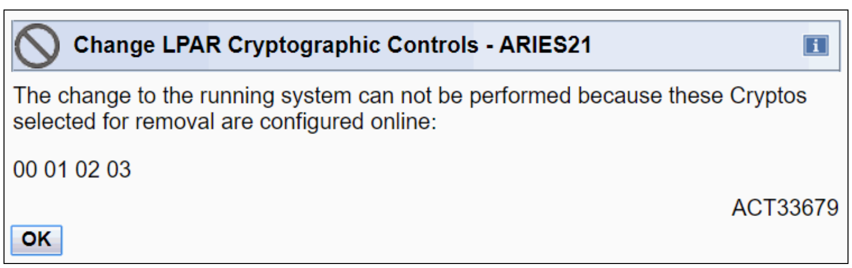


Figure 10-8 SE: Change LPAR Cryptographic Controls: ACT33679

   In addition to adding or changing cryptographic settings for an LPAR, you can remove the Control and Usage domains or Cryptographic Candidate lists for an LPAR from the Change LPAR Cryptographic Controls window (see Figure 10-6 on page 228).

   After clearing the definitions for an LPAR, remove a definition dynamically by clicking **Change Running System**. To save the new configuration to the image profile without changing the running system, select **Save to Profiles**. With **Save and Change**, the removal becomes concurrently active, and the removed cryptographic coprocessor also is not used for the next image activation.

2. When you remove the only definition of the cryptographic lists, the zeroize window opens (see Figure 10-9).

> **Consideration:** Because you cannot see all cryptographic information, including the usage domains for other LPARs, you might need to check the information in the **View LPAR Cryptographic Controls** window before you continue. For more information about zeroize, see “Reconfiguration of the PCIe adapter type” on page 231.

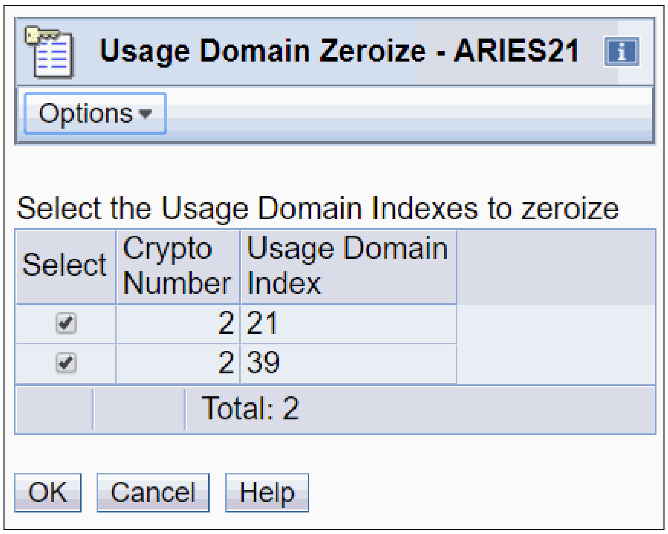


Figure 10-9 SE: Change LPAR Cryptographic Controls: Zeroize

3. In the confirmation window (see Figure 10-10), click **OK** to dynamically change the cryptographic settings. You also must enter your user password to confirm this change. After processing, a status window indicates the result of the dynamic change of cryptographic definition to an LPAR.

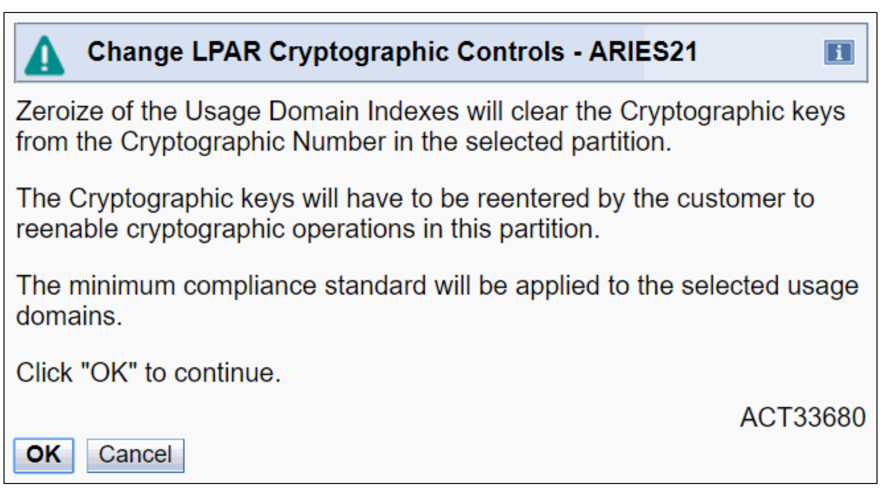


Figure 10-10 SE: Change LPAR Cryptographic Controls: ACT33680

Reconfiguration of the PCIe adapter type

Each PCIe Crypto Express7S feature can be configured either as a coprocessor or as an accelerator. Each Crypto Express7S feature can be set in these configurations:

- CCA Coprocessor (CEX7C)
- PKCS #11 (EP11) Coprocessor (CEX7P)
- Accelerator (CEX7A)

Whether it is configured as a coprocessor or an accelerator, each PCIe Cryptographic adapter can be shared among 85 LPARs.

To reconfigure the cryptographic coprocessor, it must be offline to all LPARs. To put a cryptographic coprocessor online or offline on an LPAR requires using the Configure On/Off task, which is described in "Configuring a Crypto Express7S online or offline on a logical partition" on page 238. In the following example, we reconfigure the cryptographic coprocessor number 05, which is set offline to all LPARs.

Configuring a CCA coprocessor as an accelerator

During the installation of a Crypto Express7S feature, the PCIe Cryptographic adapter is configured by default as a CCA coprocessor. The reconfiguration is fully supported in LIC.

When a PCIe adapter is configured as a CCA coprocessor, it can still run accelerator functions, albeit much more slowly than when configured as accelerator. When it is configured as an accelerator, it cannot run coprocessor functions.

When a PCIe adapter is configured as an EP11 coprocessor, a TKE workstation is required for the management of the Crypto Express7S. For more information about configuring an EP11 coprocessor, see "Configuring a CCA coprocessor as an EP11 coprocessor" on page 235.

To reconfigure the PCIe adapter from coprocessor to accelerator, complete the following steps:

1. Select the CPC that has cryptographic coprocessor adapters that you want to reconfigure, and then click the **Cryptographic Configuration** task in the Configuration Group.
2. The reconfiguration is enabled only for PCIe adapters that are off. Therefore, be sure that the PCIe Cryptographic adapter status for that cryptographic coprocessor channel is unconfigured. If necessary, set the PCIe Cryptographic adapter to **Off** for all partitions that have it in their candidate list. To set the PCIe Cryptographic adapter to **Off**, use the procedure that is described in "Configuring a Crypto Express7S online or offline on a logical partition" on page 238.

3. Select the number of the cryptographic coprocessor channel (see Figure 10-11) and click **Crypto Type Configuration**.

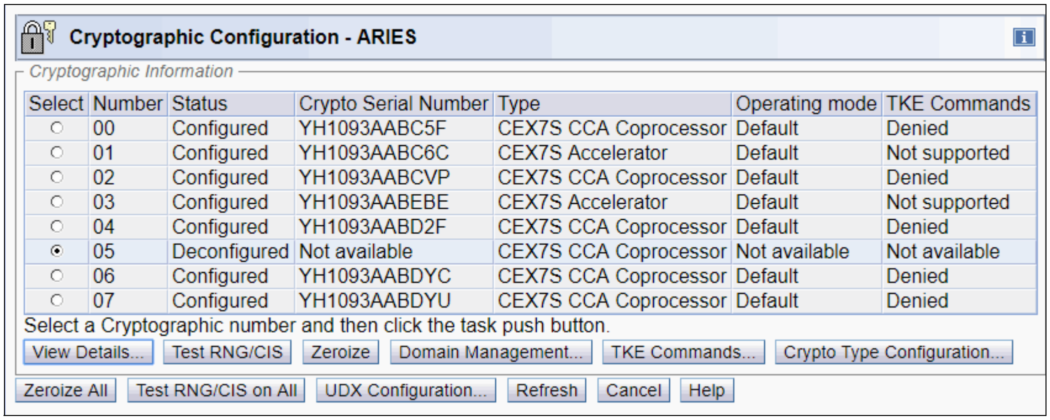


Figure 10-11 Cryptographic Configuration task (unconfigured)

4. Change the configuration for the cryptographic coprocessor adapter. The selected cryptographic coprocessor channel is configured as a coprocessor (see Figure 10-12). Select **Accelerator**.

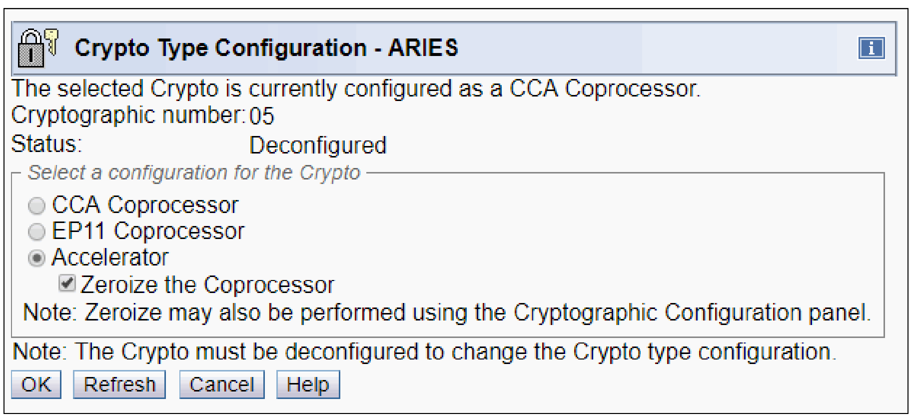


Figure 10-12 Crypto Type Configuration (CCA coprocessor to accelerator)

By selecting **Accelerator**, you can zeroize the selected coprocessor by also selecting **Zeroize the Coprocessor** on the Crypto Type Configuration window. However, clear the **Zeroize the Coprocessor** check box and click **OK**.

> **Important:** Zeroizing one or all cryptographic coprocessors clears their configuration data and all cryptographic keys. Zeroizing also erases configuration data from the SE hard disk drive (HDD) (for example, UDX files). Zeroize cryptographic coprocessors manually only when necessary, typically when the cryptographic coprocessor configuration data must be erased completely. In normal cases, be sure to clear the check box for each cryptographic channel.

5. Click **Yes** (see Figure 10-13 on page 233).

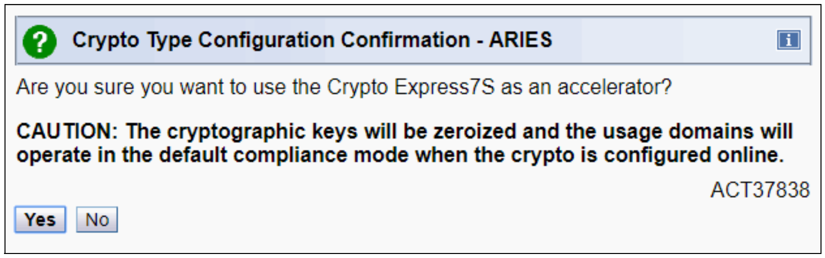


Figure 10-13 Crypto Type Configuration Confirmation for accelerator

6. Verify that your request completed successfully. Click **OK**.
7. You are returned to the Crypto Type Configuration window. Click **Cancel**. You are returned to the Cryptographic Configuration window. Confirm that the target cryptographic channel changed to the cryptographic accelerator type. The Crypto Serial Number, Operating Mode, and TKE Commands should be "Not available" until the cryptography is set to Online again, as described in "Configuring a Crypto Express7S online or offline on a logical partition" on page 238.

   After you perform this task and go back to the Cryptographic Configuration window, the information in Figure 10-14 appears.

> **Note:** UDX support is *not* available for a Crypto Express7S that is defined as an EP11 coprocessor and accelerator.

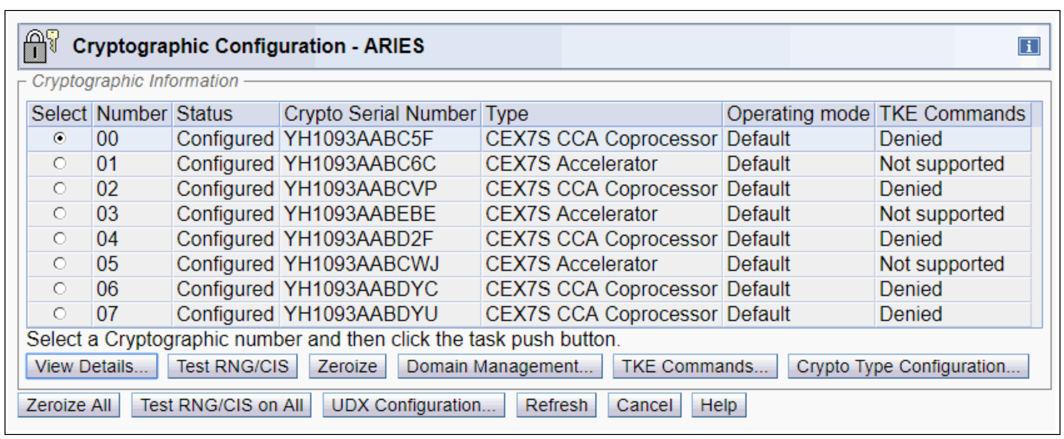


Figure 10-14 Cryptographic Configuration (Accelerator online)

8. Click **View Details** for detailed information (see Figure 10-15).

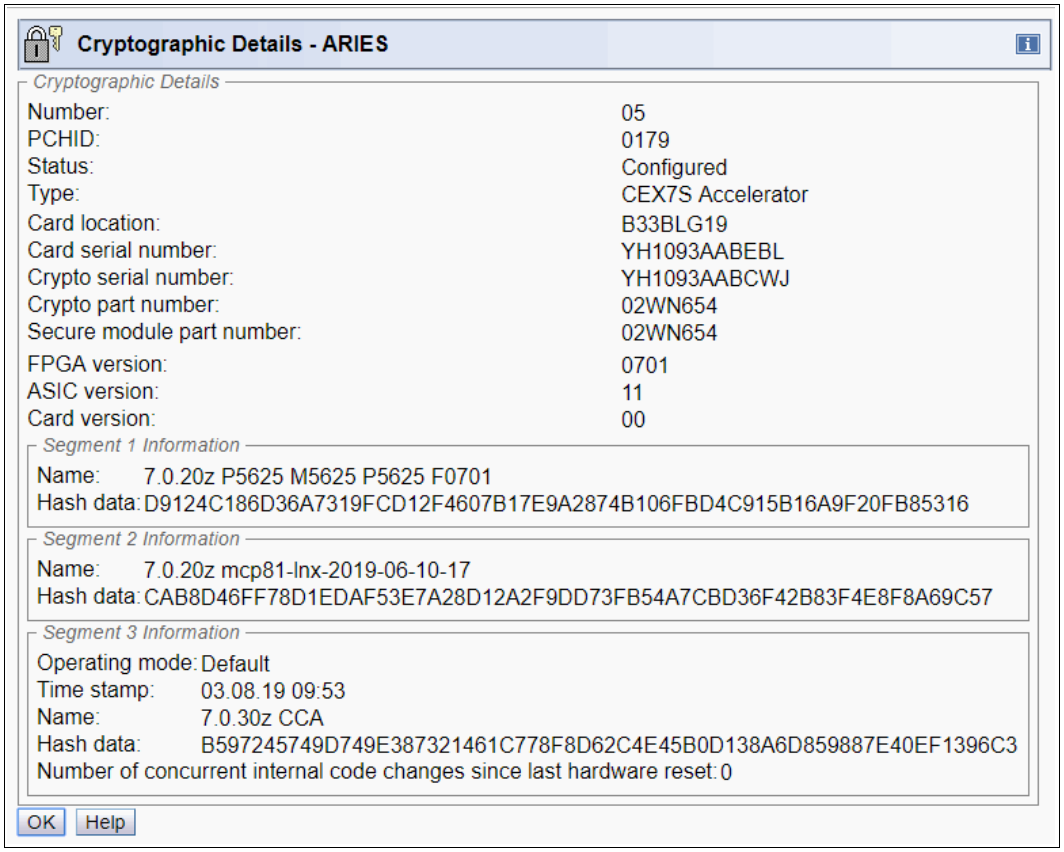


Figure 10-15 Cryptographic Details (Accelerator)

The Cryptographic Type is now a Crypto Express7S Accelerator. The adapter was zeroized during the type-changing procedure.

The procedure for changing the type of the cryptographic configuration from an accelerator to a coprocessor is complete. To change the accelerator back to a coprocessor, the same procedure can be used, but select **Coprocessor** instead of **Accelerator**, as shown in Figure 10-12 on page 232.

The result of this change is shown in Figure 10-16 on page 235.

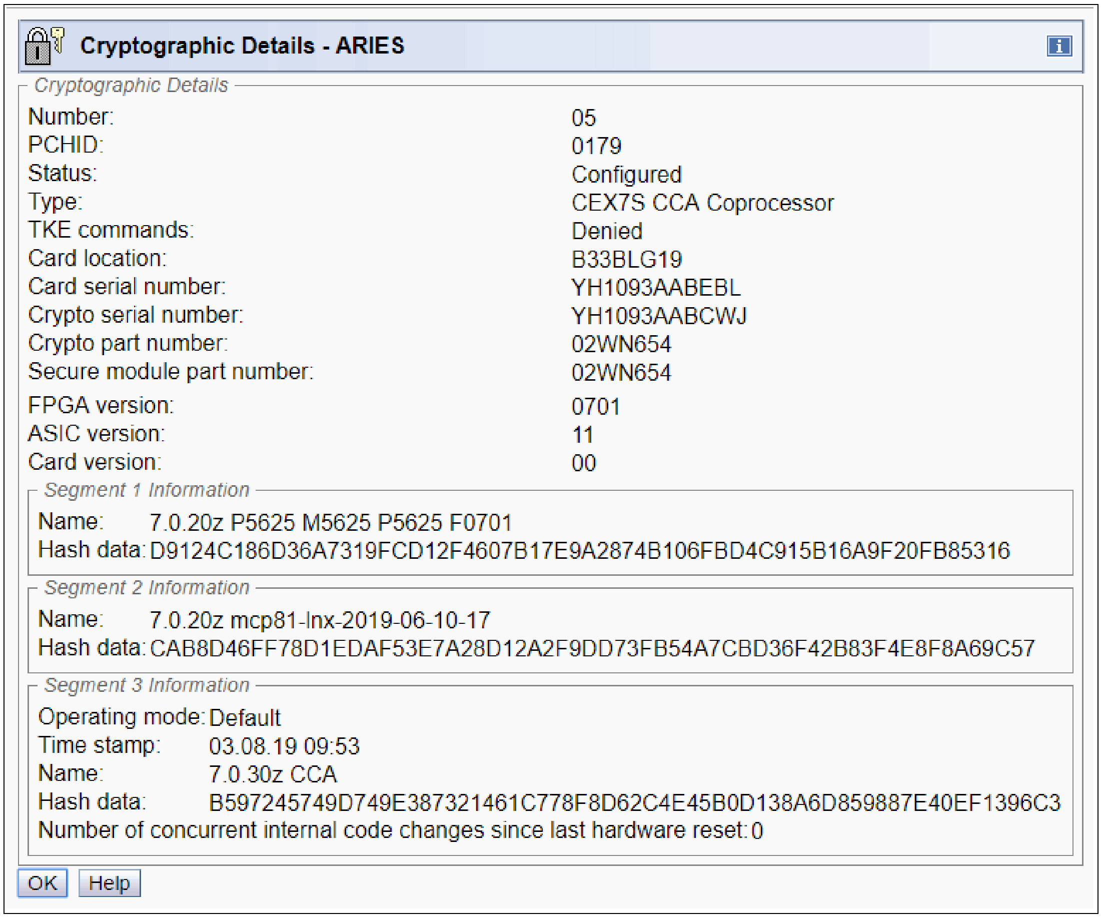


Figure 10-16 SE: Cryptographic Details (CCA Coprocessor)

Configuring a CCA coprocessor as an EP11 coprocessor

To configure a CCA coprocessor as an EP11 coprocessor, complete the following steps:

1. Select the CPC that has cryptographic coprocessor adapters that you want to reconfigure and click **Cryptographic Configuration** in the CPC Configuration Group.
2. The reconfiguration is enabled only for PCIe adapters that are set to **Off**, so be sure the PCIe Cryptographic adapter status for that cryptographic coprocessor channel is unconfigured (Figure 10-11 on page 232). If necessary, set the PCIe Cryptographic adapter to **Off** for all partitions that have it in their candidate list. To set the PCIe Cryptographic adapter to **Off**, use the procedure that is described in “Configuring a Crypto Express7S online or offline on a logical partition” on page 238.
3. Select the number of the cryptographic coprocessor channel and click **Crypto Type Configuration**.

4. Change the configuration for the cryptographic coprocessor adapter. Select **EP11 Coprocessor** (see Figure 10-17), which by default, automatically selects the **Zeroize the coprocessor** option. Click **OK**.

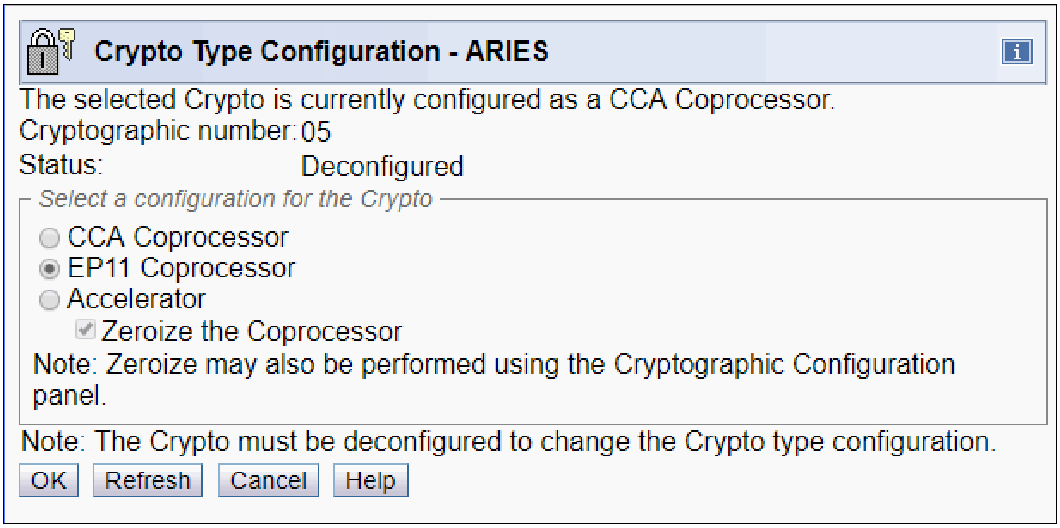


Figure 10-17 Crypto Type Configuration (CCA Coprocessor to EP11 Coprocessor)

5. Confirm your selection by clicking **Yes** (see Figure 10-18).

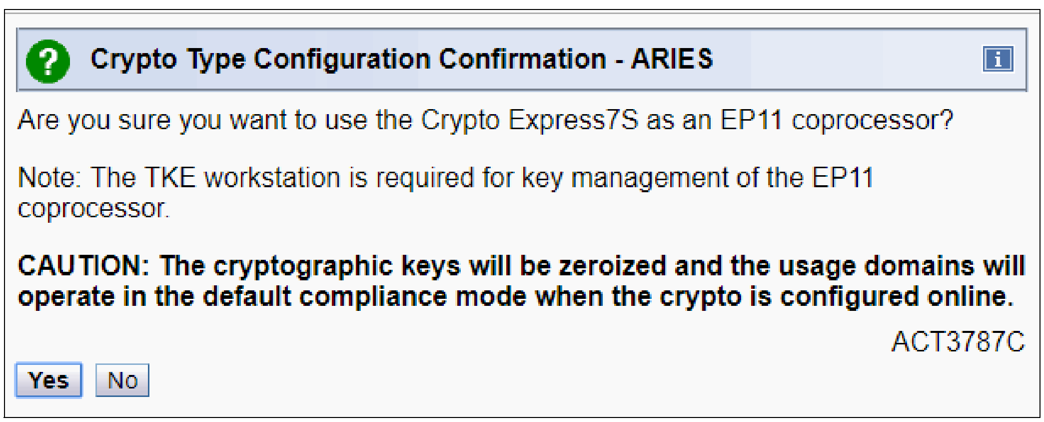


Figure 10-18 Crypto Type Configuration Confirmation for EP11 Coprocessor

6. Check that your request completed successfully. Click **OK** to return to the Crypto Type Configuration window.
7. Click **Cancel** on the Crypto Type Configuration window to return to the Cryptographic Configuration window. You can confirm that the target cryptographic channel changed to the EP11 Coprocessor type in the Cryptographic Configuration task window. The Crypto Serial Number, Operating Mode, and TKE Commands should be “Not available” until the cryptography is set to Online again, as described in “Configuring a Crypto Express7S online or offline on a logical partition” on page 238.

After you complete this task and return to the Cryptographic Configuration window, the information in Figure 10-19 appears.

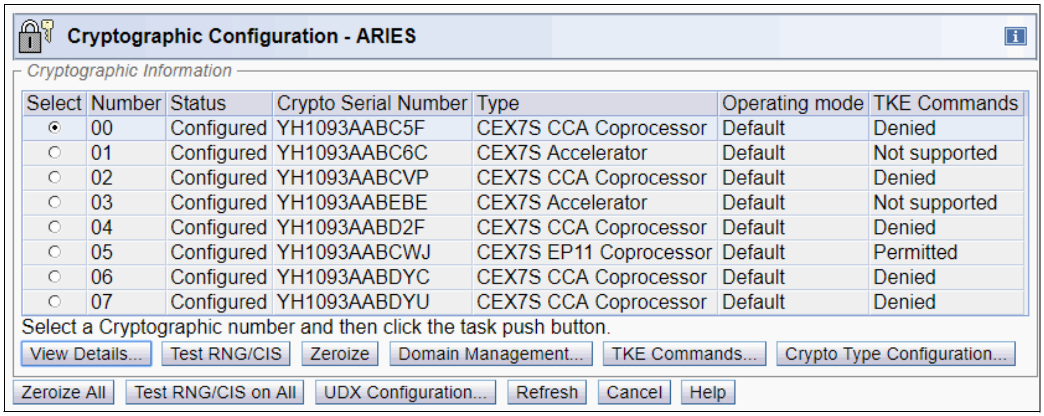


Figure 10-19 Cryptographic Configuration (EP11 Coprocessor online)

8. Click **View Details** to display the detailed information, as shown in Figure 10-20.

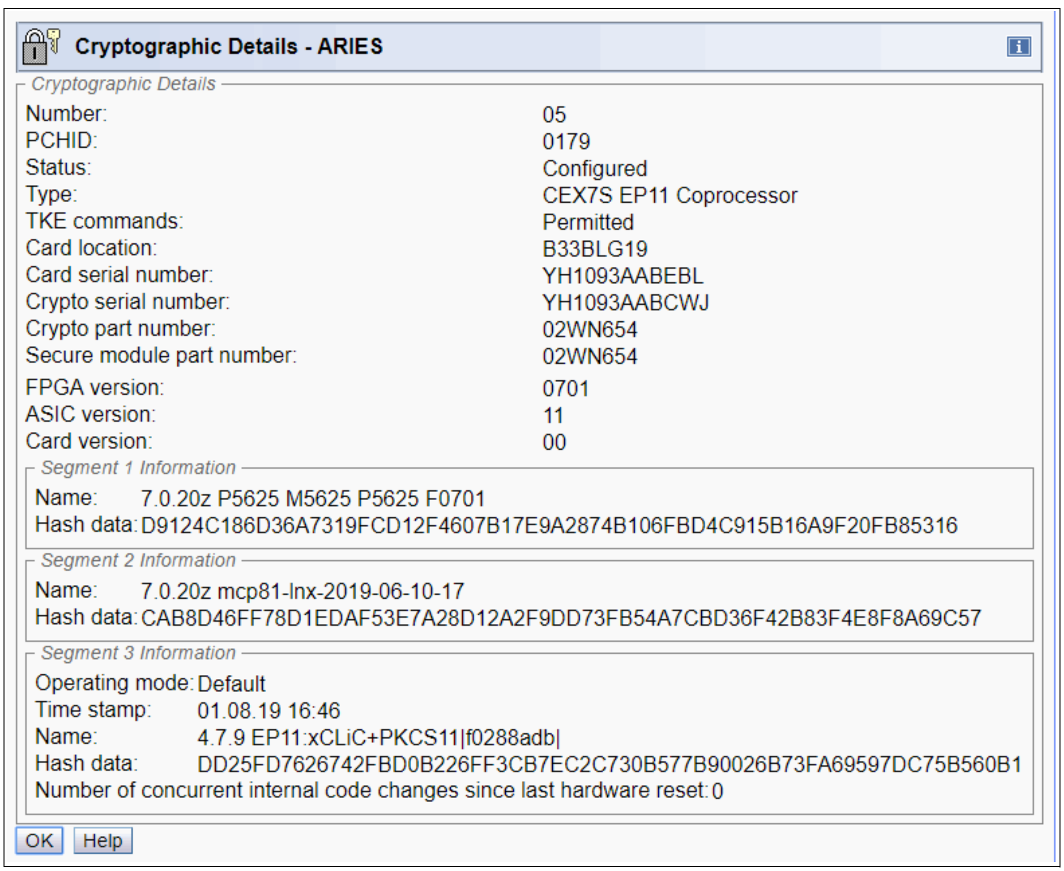


Figure 10-20 Cryptographic details (EP11 Coprocessor)

The Cryptographic Type is now a Crypto Express7S EP11 Coprocessor.

This step completes changing the type of the cryptographic configuration from a CCA Coprocessor to an EP11 coprocessor. To change the configuration back to a CCA Coprocessor, the same procedure can be used, but select **CCA Coprocessor** instead of **EP11 Coprocessor**.

You can also switch the configuration mode from Accelerator to EP11 Coprocessor and from EP11 to Accelerator by using the same process, but selecting **Accelerator** or **EP11 Coprocessor** as required.

> **Requirement:** To manage a Crypto Express7S feature that is configured as an EP11 coprocessor, the TKE workstation is required.

Configuring a Crypto Express7S online or offline on a logical partition

For some changes to the cryptographic settings to the LPAR, you must configure the Crypto Express7S online or offline. If you can reactivate (DEACTIVATE and ACTIVATE) the image for the LPARs whose cryptographic online lists were updated, this dynamic operation is not needed.

Setting a Crypto Express7S to an online state

To set a Crypto Express7S online, complete the following steps:

1. From the SE, select the **System Management** function.
2. Select the server, click **Partitions**, and then select the LPAR.
3. Click the **Cryptos** selection for the target LPAR.
4. In the Cryptos page, select the Crypto IDs to be changed. Figure 10-21 shows that on server ARIES to LPAR ARIES21, four cryptographic coprocessors are defined: One CCA coprocessor (ID 00, PCHID 0178), one EP11 coprocessor (ID 02, PCHID 0118), and two accelerators (IDs 01 and 03, PCHIDs 01FC and 019C). The IDs 00, 02 and 03 are online, and the Accelerator ID 01 is offline. We now want to also set this accelerator online.

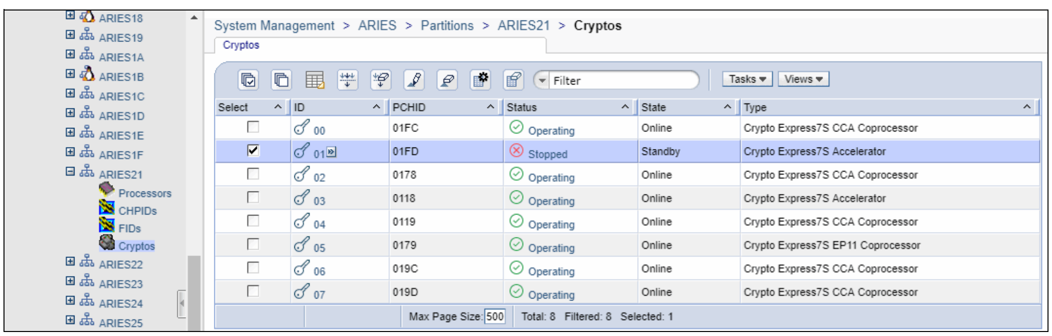


Figure 10-21 System Management: LPAR Crypto Selection Standby

5. Select the cryptographic coprocessor and click **Tasks** → **Crypto Service Operations** → **Configure On/Off task** (see Figure 10-22 on page 239). This task controls the online or offline (standby) state of a cryptographic processor for LPARs that are defined in the cryptographic processor's candidate list.

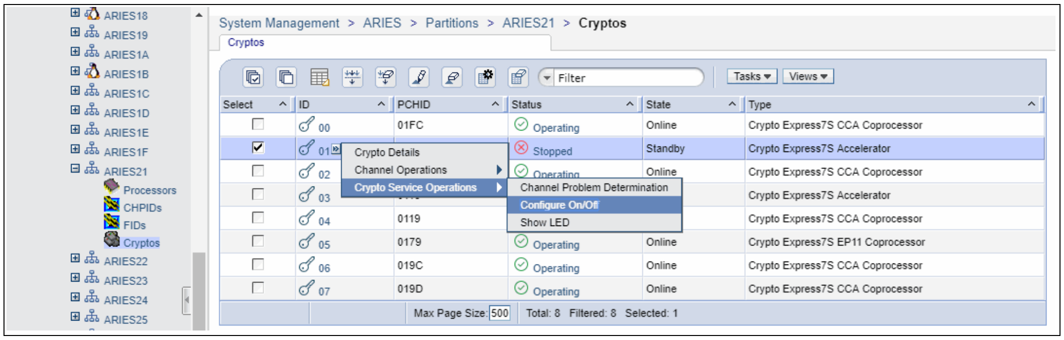


Figure 10-22 Crypto Service Operations: LPAR Crypto Selection Configure Online

6. Select the cryptographic coprocessor channel number that you want, and then click **Select Action** → **Toggle** to switch from Standby to Online (see Figure 10-23). If you want multiple cryptographic channels concurrently, select **Toggle All On**.

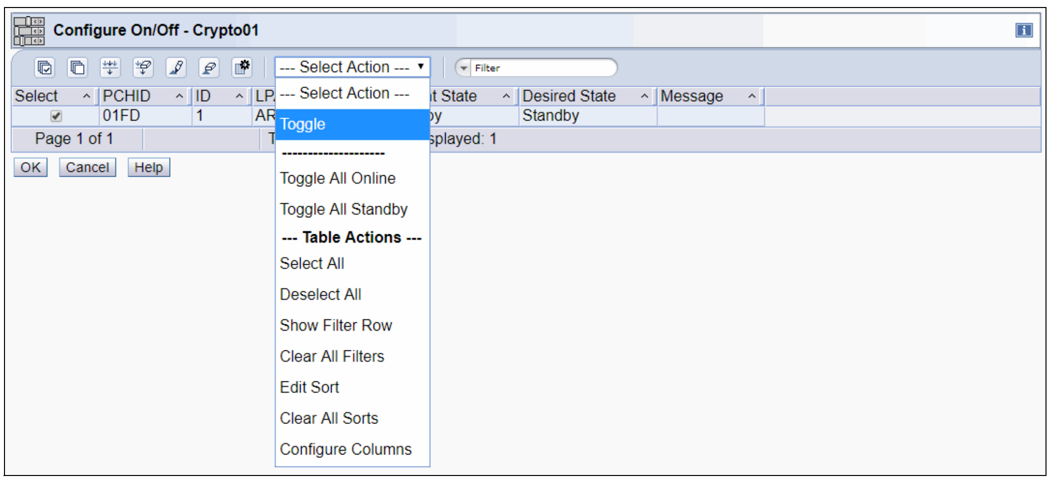


Figure 10-23 Configure On/Off (Standby)

7. After confirming that your requested cryptographic coprocessor channel is set to the wanted state of Online, click **OK** (see Figure 10-24).

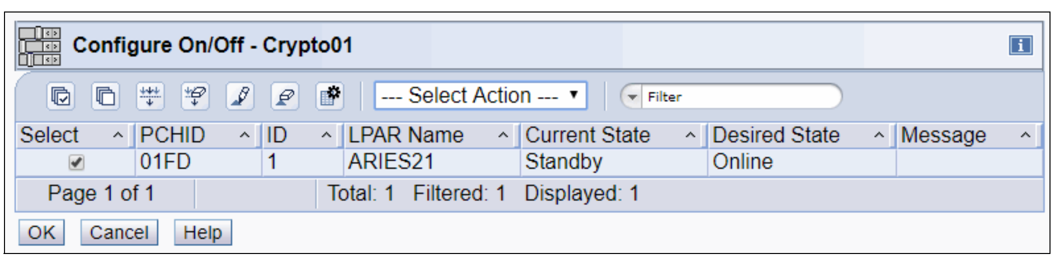


Figure 10-24 Configure On/Off (Standby to Online)

8. Confirm that your request completed (see Figure 10-25). Click **OK**.

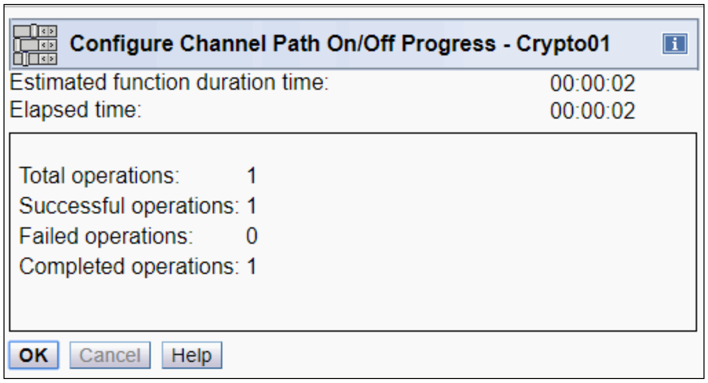


Figure 10-25 Configure On/Off (Standby to Online) completed

9. You can now view the contents of the Cryptos window of the LPAR to confirm that the cryptographic channels are now in the Operating status (see Figure 10-26).

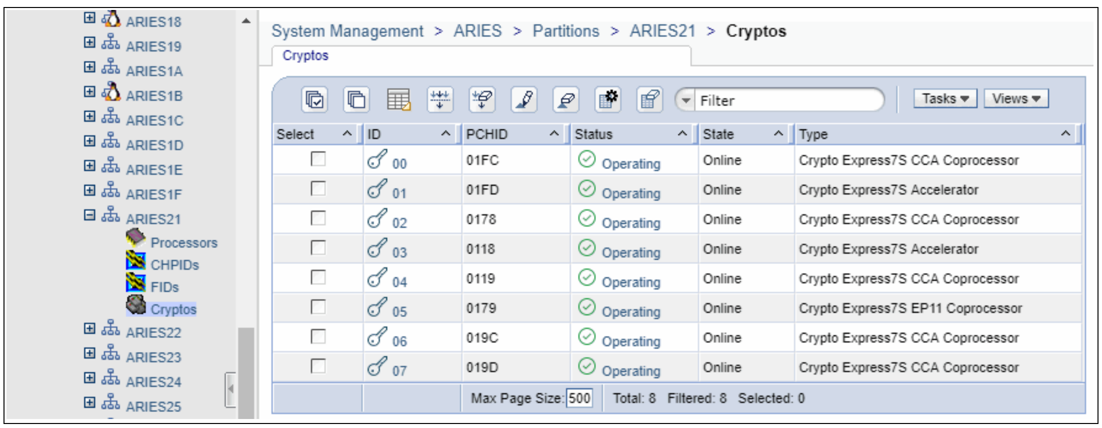


Figure 10-26 System Management: LPAR Crypto Selection Online

Changing a cryptographic channel to standby (offline) status

To change the cryptographic channel status, complete the following steps:

1. Select the LPAR whose Crypto IDs you want to change to Standby. For example, select the accelerator (03) that is in an online state. Click **Tasks** → **Crypto Service Operations** → **Configure On/Off task** (see Figure 10-27).

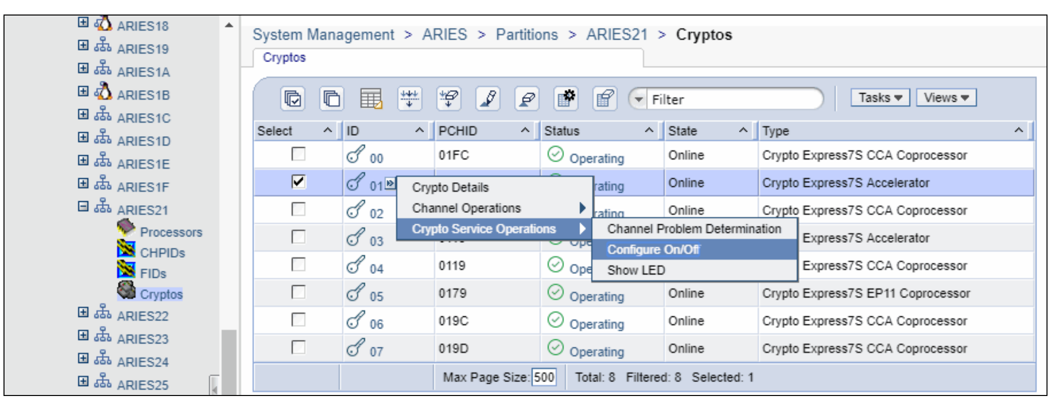


Figure 10-27 Crypto Service Operations: LPAR Crypto Selection, Configure Offline

2. Select the cryptographic coprocessor channel number that you want, and click **Select Action** → **Toggle All Standby** to switch from Online to Standby (see Figure 10-28).

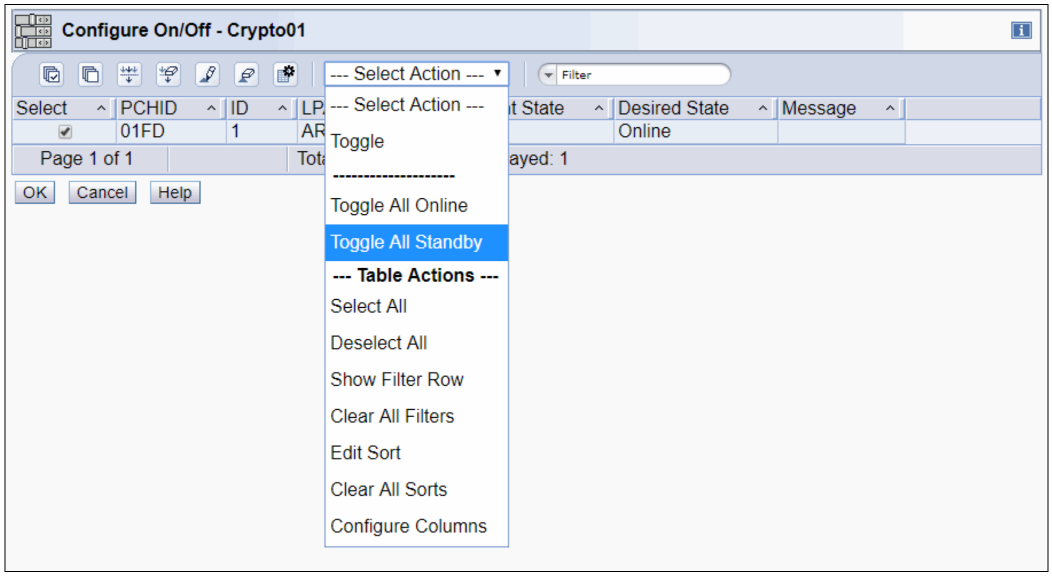


Figure 10-28 Configure On/Off (Online)

3. After you confirm that the state for your requested cryptographic channel is Standby, click **OK** (see Figure 10-29).

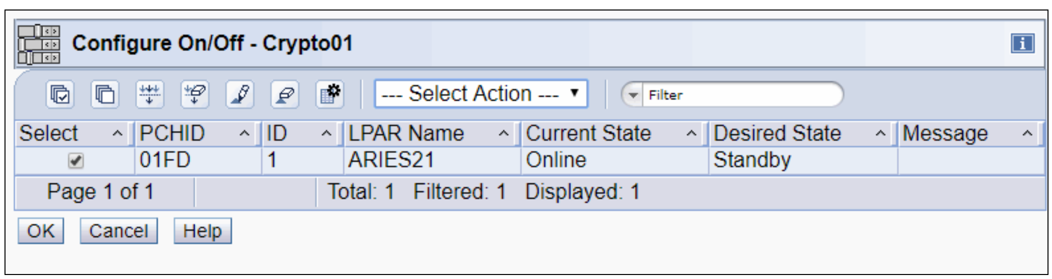


Figure 10-29 Configure On/Off (Online to Standby)

4. Because taking a cryptographic coprocessor offline can be disruptive to your application, a confirmation is required. The task must be confirmed by entering the user password (see Figure 10-30).

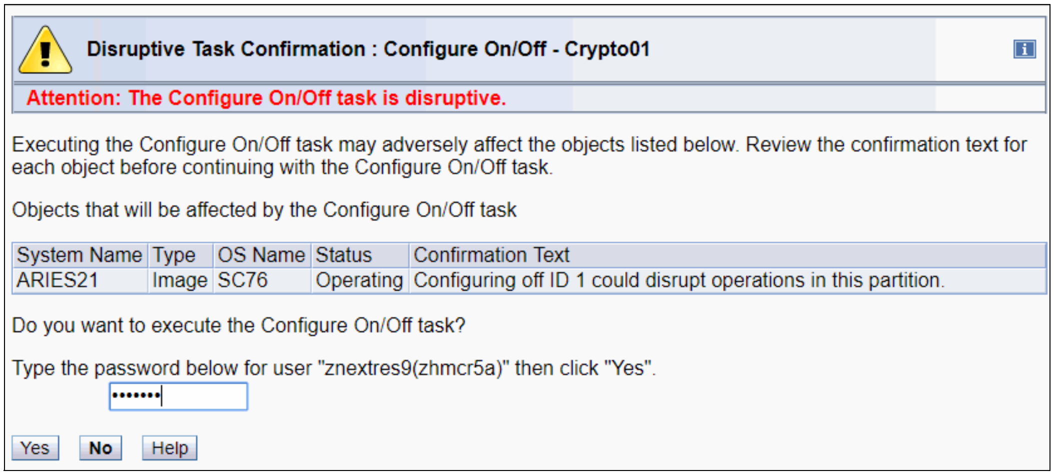


Figure 10-30 Configure On/Off (Online to Standby): Confirmation

5. Confirm that your request completed (see Figure 10-31). Click **OK**.

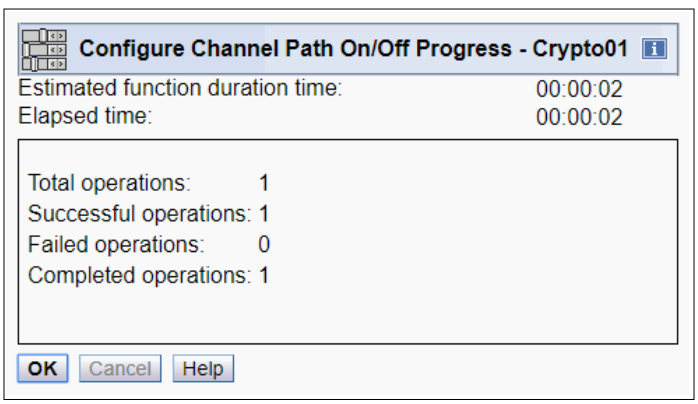


Figure 10-31 Config On/Off (Online to Standby) completed

10.1.4 Handling cryptographic coprocessors by using ICSF

ICSF provides an Interactive System Productivity Facility (ISPF) Coprocessor Management panel where you can display or change the status (Active or Deactivate) of cryptographic coprocessors. This action affects only the coprocessor status of ICSF, and has no effect on the Online/Standby hardware status that is displayed on the z15 SE.

It is not the purpose of this section to show how to create, load, and manage keys in the cryptographic adapters. For that information, see the ICSF literature. This section shows only how to activate and deactivate a cryptographic coprocessor and display the hardware status.

Complete the following steps:

1. From the ICSF main panel (see Figure 10-32), select option 1 to open the ICSF Coprocessor Management panel.

```
HCR77D1  -------------- Integrated Cryptographic Service Facility -------------
OPTION ===>
System Name:  SC76                           Crypto Domain: 39
Enter the number of the desired option.

  1  COPROCESSOR MGMT -  Management of Cryptographic Coprocessors
  2  KDS MANAGEMENT   -  Master key set or change, KDS Processing
  3  OPSTAT           -  Installation options
  4  ADMINCNTL        -  Administrative Control Functions
  5  UTILITY          -  ICSF Utilities
  6  PPINIT           -  Pass Phrase Master Key/KDS Initialization
  7  TKE              -  TKE PKA Direct Key Load
  8  KGUP             -  Key Generator Utility processes
  9  UDX MGMT         -  Management of User Defined Extensions

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     disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Press ENTER to go to the selected option.
Press END   to exit to the previous menu.
```

Figure 10-32 Integrated Cryptographic Support Facility main panel

Cryptographic coprocessors that are currently configured on the partition are listed in the ICSF Coprocessor Management panel (see Figure 10-33).

```
------------------------- ICSF Coprocessor Management -------- Row 1 to 8 of 8
COMMAND ===>                                                 SCROLL ===> PAGE

 Select the cryptographic features to be processed and press ENTER.
 Action characters are: A, D, E, K, R, S and V. See the help panel for details.

  CRYPTO    SERIAL
  FEATURE   NUMBER    STATUS                AES   DES   ECC   RSA   P11
  -------   --------  --------------------  ---   ---   ---   ---   ---
.   7C00    93AABC5F  Active                 A     A     A     A
.   7A01    N/A       Active
.   7C02    93AABCVP  Master key incorrect   U     U     U     U
.   7A03    N/A       Active
.   7C04    93AABD2F  Master key incorrect   U     U     U     U
.   7P05    93AABCWJ  Active                                         I
.   7C06    93AABDYC  Master key incorrect   U     U     U     U
.   7C07    93AABDYU  Master key incorrect   U     U     U     U
****************************** Bottom of data *******************************
```

Figure 10-33 ICSF Coprocessor Management

When a coprocessor is configured offline to the LPAR from the SE (standby status), it is shown as `Offline` in the ICSF Coprocessor Management panel (see Figure 10-34).

```
------------------------- ICSF Coprocessor Management -------- Row 1 to 8 of 8
COMMAND ===>                                                  SCROLL ===> PAGE

 Select the cryptographic features to be processed and press ENTER.
 Action characters are: A, D, E, K, R, S and V. See the help panel for details.

  CRYPTO    SERIAL
  FEATURE   NUMBER    STATUS               AES   DES   ECC   RSA   P11
  -------   --------  -------------------- ---   ---   ---   ---   ---
.   7C00    93AABC5F  Active                A     A     A     A
.   7A01    N/A       Active
.   7C02    93AABCVP  Master key incorrect  U     U     U     U
.   7A03    N/A       Offline
.   7C04    93AABD2F  Master key incorrect  U     U     U     U
.   7P05    93AABCWJ  Active                                        I
.   7C06    93AABDYC  Master key incorrect  U     U     U     U
.   7C07    93AABDYU  Master key incorrect  U     U     U     U
******************************* Bottom of data ********************************
```

Figure 10-34 ICSF Coprocessor Management (Candidate only - Standby)

A cryptographic coprocessor becomes visible to ICSF Coprocessor Management when the coprocessor number is part of the partition candidate list and the coprocessor is first brought online to the partition in either of these ways:

– At the time the partition is activated, if the coprocessor is installed and the coprocessor number is part of the partition Online list.

– When the coprocessor is first configured online to the partition by using the Config On/Off task from the SE Workplace.

2. In the list (see Figure 10-35), enter `A` or `D` to switch a coprocessor status to `Active` or `Deactivated`.

```
------------------------- ICSF Coprocessor Management -------- Row 1 to 8 of 8
COMMAND ===>                                                  SCROLL ===> PAGE

 Select the cryptographic features to be processed and press ENTER.
 Action characters are: A, D, E, K, R, S and V. See the help panel for details.

  CRYPTO    SERIAL
  FEATURE   NUMBER    STATUS               AES   DES   ECC   RSA   P11
  -------   --------  -------------------- ---   ---   ---   ---   ---
.   7C00    93AABC5F  Active                A     A     A     A
.   7A01    N/A       Active
.   7C02    93AABCVP  Master key incorrect  U     U     U     U
d   7A03    N/A       Active
.   7C04    93AABD2F  Master key incorrect  U     U     U     U
.   7P05    93AABCWJ  Active                                        I
.   7C06    93AABDYC  Master key incorrect  U     U     U     U
.   7C07    93AABDYU  Master key incorrect  U     U     U     U
******************************* Bottom of data ********************************
```

Figure 10-35 ICSF Coprocessor Management (Online)

When a coprocessor is deactivated through ICSF (see Figure 10-36), it cannot be used by applications that run in that system image. The EP11 coprocessor configuration requires a TKE workstation.

Generally, deactivate an active coprocessor from the ICSF Coprocessor Management panel before it is configured off from the SE.

Note: If you do not deactivate the coprocessor first, some jobs might not be rerouted correctly.

```
------------------------- ICSF Coprocessor Management -------- Row 1 to 8 of 8
COMMAND ===>                                                 SCROLL ===> PAGE

 Select the cryptographic features to be processed and press ENTER.
 Action characters are: A, D, E, K, R, S and V. See the help panel for details.

  CRYPTO    SERIAL
  FEATURE   NUMBER    STATUS                AES   DES   ECC   RSA   P11
  -------   --------  --------------------  ---   ---   ---   ---   ---
.   7C00    93AABC5F  Active                 A     A     A     A
.   7A01    N/A       Active
.   7C02    93AABCVP  Master key incorrect   U     U     U     U
.   7A03    N/A       Deactivated
.   7C04    93AABD2F  Master key incorrect   U     U     U     U
.   7P05    93AABCWJ  Active                                         I
.   7C06    93AABDYC  Master key incorrect   U     U     U     U
.   7C07    93AABDYU  Master key incorrect   U     U     U     U
******************************* Bottom of data ********************************
```

Figure 10-36 SF Coprocessor Management (Deactivated)

The Active/Deactivated status that is viewed from ICSF Coprocessor Management does not change the Online/Standby status that is set from the z15 SE.

Figure 10-37 shows ICSF Coprocessor Hardware Status panel.

```
---------------------- ICSF - Coprocessor Hardware Status ---------------------
COMMAND ===>                                                  SCROLL ===>
                                                             CRYPTO DOMAIN: 39

REGISTER STATUS                  COPROCESSOR 7C00
                                                                   More:     +
 Crypto Serial Number          : 93AABC5F
 Status                        : ACTIVE
 PCI-HSM Compliance Mode       : INACTIVE
 Compliance Migration Mode     : INACTIVE
 AES Master Key
   New Master Key register     : EMPTY
     Verification pattern      :
   Old Master Key register     : EMPTY
     Verification pattern      :
   Current Master Key register : VALID
     Verification pattern      : 1300CF50ECF4DEA6
 DES Master Key
   New Master Key register     : EMPTY
     Verification pattern      :
     Hash pattern              :
                               :
   Old Master Key register     : EMPTY
     Verification pattern      :
     Hash pattern              :
                               :
   Current Master Key register : VALID
     Verification pattern      : 29069A18A233405A
     Hash pattern              : 5F3E03EC3E4CC653
                               : E3717DBBD26D1555
 ECC Master Key
   New Master Key register     : EMPTY
     Verification pattern      :
   Old Master Key register     : EMPTY
     Verification pattern      :
   Current Master Key register : VALID
     Verification pattern      : AFDEEE7A0AB38568
 RSA Master Key
   New Master Key register     : EMPTY
     Verification pattern      :
                               :
   Old Master Key register     : EMPTY
     Verification pattern      :
                               :
   Current Master Key register : VALID
     Verification pattern      : 8622947EAD0C1766
                               : 4940E6D7E030F9A5

Press ENTER to refresh the hardware status display.
```

Figure 10-37 ICSF Coprocessor Hardware Status

Help information from the ICSF Coprocessor Management panel (see Figure 10-38 and Figure 10-39 on page 248) describes valid actions and status information for each type of cryptographic coprocessor.

```
----------------------- Help for Coprocessor Management -----------------------
COMMAND ===>
Press enter to page through this help.
                                                                   More:     +
The Coprocessor Management panel displays the status of all cryptographic
coprocessors installed.  Select the coprocessors to be processed.

Prefix     Type of cryptographic coprocessor        Valid action characters
------     ---------------------------------        -----------------------
  2C        Crypto Express2 Coprocessor              a, d, e, k, r, s, v
  2A        Crypto Express2 Accelerator              a, d
  3C        Crypto Express3 Coprocessor              a, d, e, k, r, s, v
  3A        Crypto Express3 Accelerator              a, d
  4A        Crypto Express4 Accelerator              a, d
  4C        Crypto Express4 CCA coprocessor          a, d, e, k, r, s, v
  4P        Crypto Express4 PKCS #11 coprocessor     a, d, r, s, v
  5A        Crypto Express5 Accelerator              a, d
  5C        Crypto Express5 CCA coprocessor          a, d, e, k, r, s, v
  5P        Crypto Express5 PKCS #11 coprocessor     a, d, r, s, v
  6A        Crypto Express6 Accelerator              a, d
  6C        Crypto Express6 CCA coprocessor          a, d, e, k, r, s, v
  6P        Crypto Express6 PKCS #11 coprocessor     a, d, r, s, v
  7A        Crypto Express7 Accelerator              a, d
  7C        Crypto Express7 CCA coprocessor          a, d, e, k, r, s, v
  7P        Crypto Express7 PKCS #11 coprocessor     a, d, r, s, v

Action characters:  (entered on the left of the coprocessor number)
 'a'      Makes available a coprocessor previously deactivated by a 'd'.
 'd'      Makes a coprocessor unavailable.
 'e'      Selects the coprocessor for master key entry.
 'k'      Selects the coprocessor for operational key load.
 'r'      Causes the coprocessor domain role to be displayed.
 's'      Causes complete hardware status to be displayed.
 'v'      Causes the coprocessor default role to be displayed with offsets.
The action character 'e' cannot be combined with any other action characters.
The action character 'k' may be specified on only one coprocessor.
The action character 's' may not be specified for both CCA and
  PKCS #11 coprocessors at the same time.

Status:
  - Active:               The feature is available for work.
  - Offline:              The feature is installed but not available to ICSF.
  - Deactivated:          The feature has been deactivated (see action
                            characters)
  - Busy:                 The feature is temporarily busy.
  - Hardware error:       The feature has been stopped.
  - Disabled by TKE:      The feature has removed from service by a TKE
                            workstation.
  - Master key incorrect: At least one master key is incorrect.
  - Being reconfigured:   An error has been detected and being checked by the
                            configuration task
```

Figure 10-38 Help for Coprocessor Management (part 1 of 2)

```
  - Initializing stage 1: The feature has been detected by the configuration
                            task. No status is available.
  - Initializing stage 2: The feature is being reset by the configuration
                            task. No status is available.
  - Initializing stage 3: The feature is being readied by configuration
                            task. No status is available.
  - Unknown response:     The feature has returned a return/reason code
                            combination that ICSF does not recognize.
  - Hung User on Feature: The feature is not responding. One or more users
                            hold the feature latch. If this problem persists
                            please take a dump and contact IBM service.
                            You will need to recycle ICSF to reclaim use of
                            the feature.
  - Bad feature response: An unexpected response was received from a feature.
  - Retry limit reached:  Initialization of the feature failed.
  - Unknown feature type: A feature has a type that is not recognized by ICSF.
  - Repeat failures:      A feature has experienced repeated failures
                            and recovered.  The feature is made inactive and
                            will require manual intervention to cause ICSF
                            to attempt to use it again.

Cryptographic Coprocessor Master Key State:
    A:  Master key Verification Pattern matches the Key Store (CKDS, PKDS, or
        TKDS) and the master key is available for use
    C:  Master key Verification Pattern matches the Key Store, but the master
        key is not available for use
    E:  Master key Verification Pattern mismatch for Key Store or, for P11, no
        TKDS was specified in the options data set
    I:  The Master key Verification Pattern in the Key Store is not set,
        so the contents of the Master key are Ignored
    U:  Master key is not initialized
    -:  Not supported
     :  Not applicable

    F3 = END HELP
```

Figure 10-39 Help for Coprocessor Management (part 2 of 2)

10.2 Virtual Flash Memory

This section provides information about the configuration of the Virtual Flash Memory (VFM) feature on an z15 system. It covers the following topics:

- VFM overview
- Planning for VFM configuration
- Configuring VFM
- VFM management

10.2.1 VFM overview

The VFM is the replacement for the Flash Express features that were available on the zEC12, zBC12, z13, and z13s systems. VFM offers up to 6.0 TB on z15 T01 and 2.0 TB on z15 T02 systems of VFM in 512 GB increments. No application changes are required to change from Flash Express to VFM.

VFM is designed to help improve availability and handling of paging workload spikes when running z/OS V2.1, V2.2, z/OS V2.3, or V2.4. With this support, z/OS is designed to help improve system availability and responsiveness by using VFM across transitional workload events, such as market openings and diagnostic data collection. z/OS is also designed to help improve processor performance by supporting middleware exploitation of pageable large (1 MB) pages.

Using VFM can help availability by reducing latency from paging delays that can occur at the start of the workday or during other transitional periods. It is also designed to help eliminate delays that can occur when collecting diagnostic data during failures. VFM can also be used in Coupling Facility (CF) images to provide extended capacity and availability for workloads by using IBM WebSphere® MQ Shared Queues structures.

VFM can help organizations meet their most demanding service level agreements and compete more effectively. VFM is easy to configure provide rapid time to value.

For more information about the VFM feature, see *IBM z15 Technical Guide*, SG24-8851.

10.2.2 Planning for VFM configuration

For planning considerations, see “Planning considerations for Virtual Flash Memory” on page 19.

10.2.3 Configuring VFM

The assignment of VFM to LPARs is exclusively done with the definitions in the image activation profiles.

> **Note:** Unlike the Flash Express cards, the allocation of VFM to LPARs cannot be altered to an activated LPAR. So, the **Manage Flash Allocation** selection on the HMC is not supported for z15 systems.

Consider the following items when you allocate VFM to a partition:

- When an allocation is first defined, you must set the initial and maximum allocation in 16 GB increments.
- A storage-class memory (SCM) allocation is put online to the z/OS image that is assigned to the partition at IPL time unless the z/OS image is configured not to do so.
- z/OS enables more memory to be configured online, up to the maximum memory that is defined in this window or up to the maximum VFM that is available and not used by other LPARs.
- Minimum amounts are allocated from the available pool, so they cannot be overallocated.
- Maximum amounts can be overallocated up to the VFM LICCC value of the z15 system.
- Maximum amounts must be greater than or equal to the initial amounts.

To allocate VFM to a partition, select the LPAR on the HMC and click **Operational Customization** → **Customize/Delete Activation Profiles**. Then, select the image profile and click **Customize profile**. The Initial and the Maximum values for the VFM are specified on the **Storage** tab. This configuration is shown in Figure 10-40.

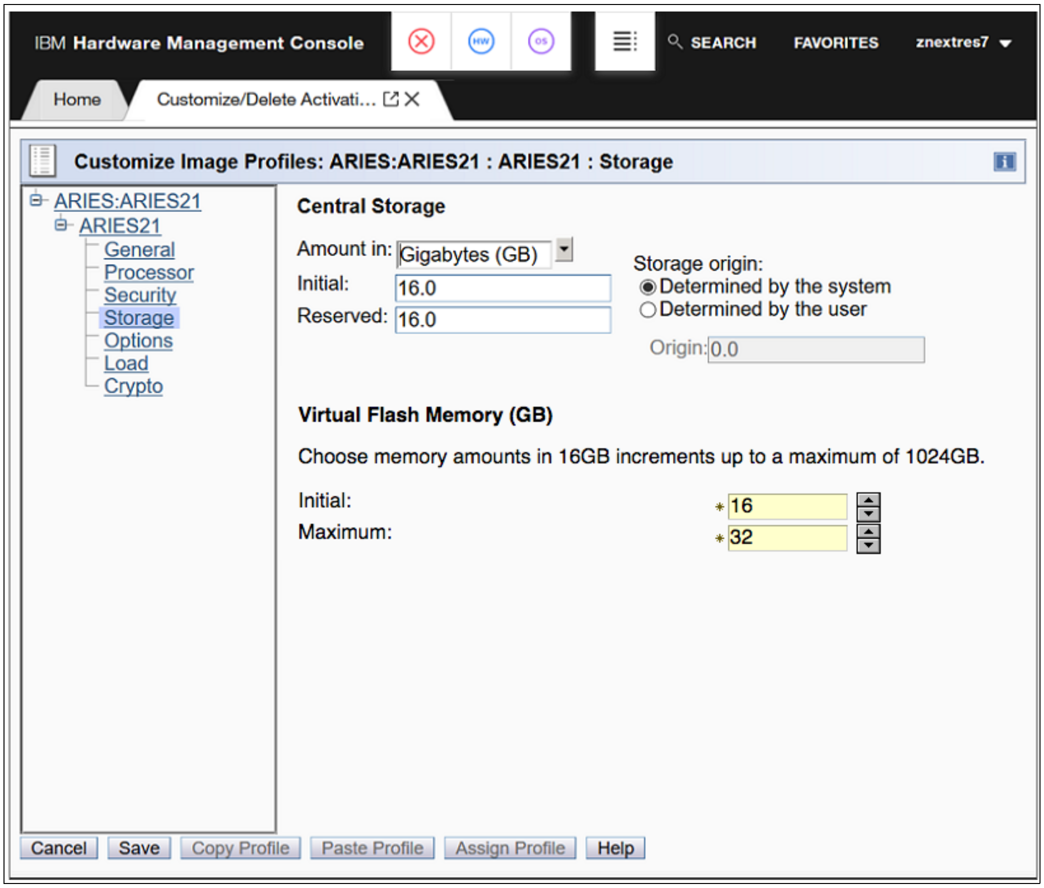

Figure 10-40 Virtual Flash Memory allocation in an image profile

In this example, the initial value is set to 16 GB, and the maximum value is set to 32 GB. The z15 system has two VFM features that are installed, which enables a maximum of 1024 GB allocated to the LPAR.

These definitions do not change the settings of a running LPAR. They are used only for the activation of the LPAR. A newly activated LPAR starts with the specified amount of initial VFM.

If in the image activation profile of an LPAR an amount of initial VFM storage greater than the available amount of deallocated VFM on the z15 system is specified, the activation of this LPAR fails with message ACTZ01EB, as illustrated in Figure 10-41.

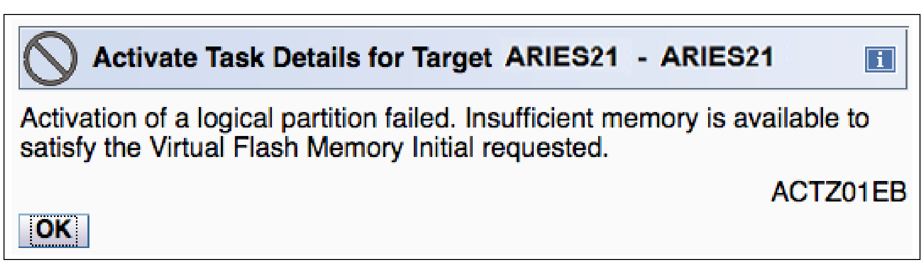

Figure 10-41 Insufficient VFM available: ACTZ01EB

Note: For a CF LPAR, it is also possible to define an initial value and a higher maximum value for VFM in the image profile. However, it does not make sense to set the maximum value higher than the initial value because the Coupling Facility Control Code (CFCC) does not support any command to set any reserved memory online.

10.2.4 VFM management

The memory allocation of a z15 system is shown on the SE in the Storage Information window. To view it, click the server and select **Operational Customization** → **Storage Information**. The Base System Storage Allocation window opens, as shown in Figure 10-42.

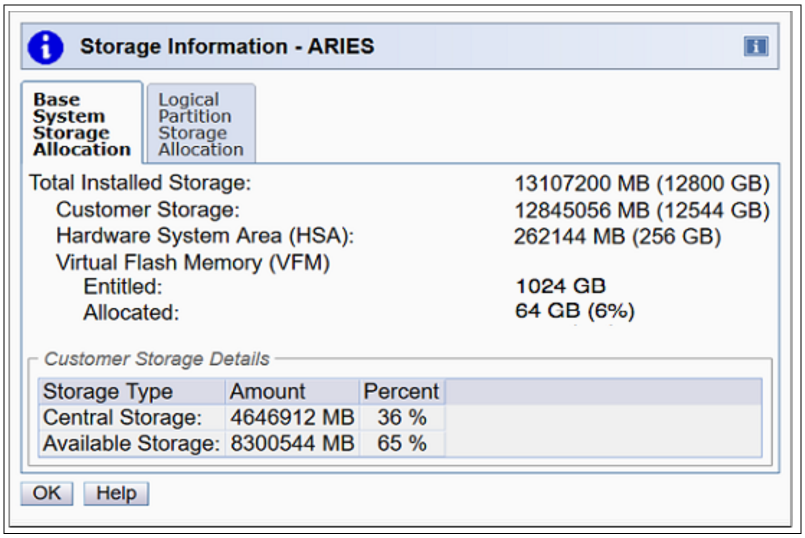

Figure 10-42 Storage Information: Base System Storage Allocation

The z15 system in our examples (ARIES) has 1024 GB installed, of which 64 GB are allocated to activated LPARs.

The Logical Partition Storage Allocation window shows the VFM allocation of the LPARs. For every LPAR, the initial and the maximum amount of VFM is listed (which were specified in the image activation profile), and the currently allocated amount, as shown in Figure 10-43.

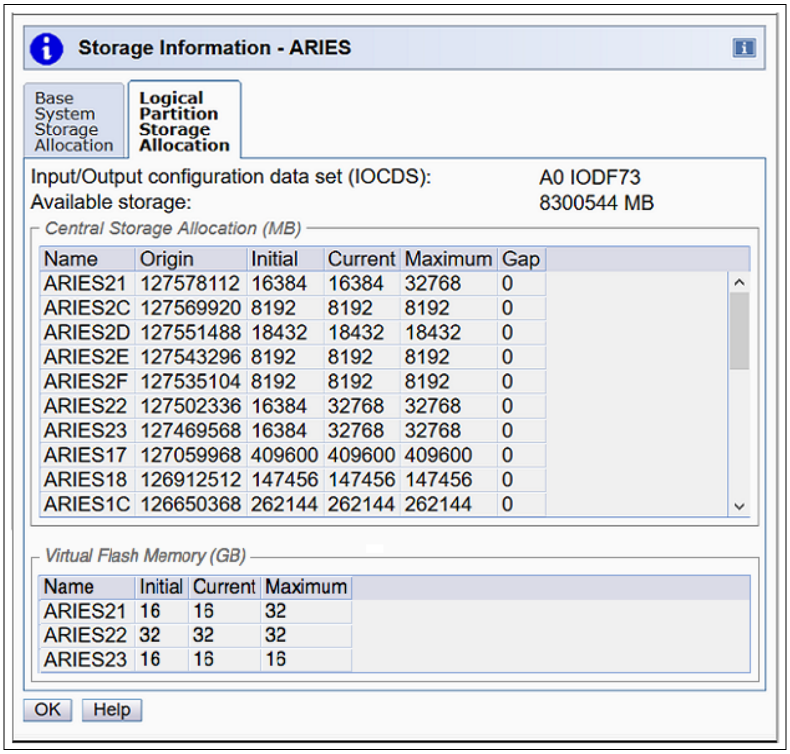

Figure 10-43 Storage Information: Logical Partition Storage Allocation

In z/OS for Flash Express and VFM, the **`PAGESCM`** parameter is supported in `IEASYSxx`. The syntax is shown in Example 10-1. This parameter determines whether and how much SCM is made available to an LPAR at IPL time.

Example 10-1 PAGESCM parameter

```
PAGESCM={xxxxxxM                    }
        {xxxxxxG                    }
        {xxT                        }
        {ALL                        }
        {NONE                       }
        {0                          }
```

This parameter specifies the minimum amount of SCM that should be made available for use as auxiliary storage. The system reserves this amount of SCM during IPL for subsequent use as auxiliary storage. Extra SCM is allocated on an as-needed basis if use of this initial amount of SCM is exceeded.

You can specify the following value ranges for the **`PAGESCM`** parameter to reserve SCM for paging at IPL:

`xxxxxxM`
: Specifies the amount of SCM to reserve for paging at IPL in megabytes. This value can be 1 - 6 decimal digits.

`xxxxxxG`
: Specifies the amount of SCM to reserve for paging at IPL in gigabytes. This value can be 1 - 6 decimal digits.

xxT	Specifies the amount of SCM to reserve for paging at IPL in terabytes. This value can be 1 - 2 decimal digits. The maximum amount of SCM supported for paging is 16 TB.
`ALL`	Reserves all SCM for paging at IPL.
`NONE`	SCM is not used for paging. This parameter remains in effect until the next IPL.
0 | 0M | 0G | 0T	Indicates that no SCMs are reserved for paging at IPL. Instead, SCM is allocated as needed based on paging demand.
`Default value`	ALL.
`Associated parmlib member`:	None.

The **CONFIG SCM** command is used to set SCM online or offline to an LPAR (Example 10-2).

Example 10-2 CONFIG SCM

```
CONFIG SCM(ddddddddM|G|T),ONLINE|ON
CONFIG SCM(ddddddddM|G|T),OFFLINE|OFF
CONFIG SCM(scm_ranges),OFFLINE|OFF
```

The system reconfigures SCM both logically and physically. To bring SCM online, a number must be specified. To take SCM offline, a range of starting and ending addresses of the SCM blocks must be specified.

The command has the following values:

ddddddddM|G|T The amount of SCM to be reconfigured. Specify up to eight decimal digits followed by a multiplier (M = megabytes, G = gigabytes, or T = terabytes) for this amount. Check your processor configuration for the supported SCM increment sizes. The value for *dddddddd* must be a multiple of the SCM increment size (usually 2, 4, or 8), and cannot exceed `16T`.

Instead of specifying a decimal amount, you can alternatively specify a hexadecimal amount, with or without a multiplier, in the following format:

`X'xxxxxx'`

For example:

`X'123456789A00000'`

`X'123'M`

You can use underscore characters in any hexadecimal specification for more clarity. Underscore characters in the specification are ignored during processing.

Attention: If you take SCM offline and do not specify one or more `scm_ranges`, the system selects which SCM increments to take offline.

`ONLINE` **or** `ON`	The system brings the specified amount of SCM online. `ONLINE` is the default value if only `CONFIG SCM` is specified. The system rejects the command if you specify these values: – A value that is not a multiple of the SCM increment size. – A value that exceeds the total amount of SCM that is defined to this partition. – A value that is not a valid amount of SCM (0, for example). – SCM is not supported or not defined on the system.
`OFFLINE` **or** `OFF`	The system takes the specified amount or specified ranges of SCM offline.

> **Attention:** Taking SCM offline can affect data reliability and performance. Consider these implications before taking SCM offline:
>
> - Your system must have enough auxiliary storage, which can include SCM and must include page data sets, to back critical system data. The **`CONFIG SCM OFFLINE`** command fails if taking the specified number of SCMs offline results in leaving auxiliary storage more than 50% full.
> - SCM is used for paging critical address spaces and common address spaces. An insufficient amount of SCM causes those address spaces to demote the larger pages to page-to-page data sets, which can lead to a loss of critical data during a DASD IBM HyperSwap® scenario.
> - SCM is used for paging large pages. If there is an insufficient amount of SCM, 1 MB large pages are demoted to 256 4-KB pages and page-to-page data sets, which can negatively affect system performance.

`scm_ranges`	Specifies a range of SCMs or a list of ranges that are separated by commas that are identified by *ddd*{*M*|*G*|*T*} - *ddd*{*M*|*G*|*T*}, for example, 0G - 16G or 32G - 64G. The starting and ending addresses for each range of SCMs must be multiples of the increment size.

The **`DISPLAY ASM`** and **`DISPLAY M`** commands are enhanced to display information and statuses that are related to VFM:

`DISPLAY ASM`	Lists the SCM status along with the paging data set status.
`DISPLAY ASM,SCM`	Displays a summary of SCM usage.
`DISPLAY M=SCM`	Displays SCM online or offline and increment information.
`DISPLAY M=SCM(DETAIL)`	Displays detailed increment-level information.

> **Tip:** You might notice a difference in usage numbers between the **`DISPLAY M=SCM`** and **`DISPLAY ASM`** commands. The difference is because of how ASM perceives its use of the cache of available SCM block IDs that ASM maintains. To ASM, some block IDs are not in use because they were not assigned to page out requests. However, to the **`DISPLAY M=SCM`** command processor, block IDs are in use because they were assigned to ASM for its use.

VFM storage can also be used by CF LPARs running CFCC Level 24 on z15, like Flash Express can be used by CF LPARs running CFCC Level 19 (on zEC12 and zBC12) or CFCC Level 20 or 21 (on z13 and z13s systems). Systems without this support cannot connect to or rebuild a structure by using SCM storage.

In 10.2.3, “Configuring VFM” on page 249, we allocate an initial VFM of 16 GB to the LPAR ARIES21, and a maximum VFM of 32 GB, as shown in Figure 10-40 on page 250. Now, from ARIES21, which is running the z/OS image SC76, we run the IBM MVS™ **DISPLAY IPLINFO,PAGESCM** command. Example 10-3 shows the results.

Example 10-3 DISPLAY IPLINFO,PAGESCM

```
DISPLAY IPLINFO,PAGESCM
IEE255I SYSTEM PARAMETER 'PAGESCM': NOT_SPECIFIED
```

Because no **PAGESCM** parameter is specified, the default value of ALL is used. If a VFM allocation is defined for the LPAR and PAGESCM=ALL is specified (or kept at the default), then at IPL time, the initial amount of VFM that is specified is used automatically by z/OS for paging. Likewise, if a specific amount is specified, this amount is made available for paging.

From SC76, run the enhanced **DISPLAY ASM** and **DISPLAY M** commands to display the VFM SCM-related information and status. The result for each command is shown in Example 10-4.

Example 10-4 Display commands

```
DISPPLAY ASM
IEE200I 12.04.41 DISPLAY ASM 799
TYPE     FULL STAT   DEV  DATASET NAME
PLPA      28%   OK  9A0B  PAGE.SC76.PLPA
COMMON     0%   OK  9A0B  PAGE.SC76.COMMON
LOCAL      0%   OK  9A36  PAGE.SC76.LOCAL01
LOCAL      0%   OK  9AB6  PAGE.SC76.LOCAL02
LOCAL      0%   OK  9B36  PAGE.SC76.LOCAL03
SCM        0%   OK   N/A   N/A
PAGEDEL COMMAND IS NOT ACTIVE

DISPLAY ASM,SCM
IEE207I 12.05.26 DISPLAY ASM 801
STATUS      FULL              SIZE             USED         IN-ERROR
IN-USE        0%         4,194,304           20,247                0

DISPLAY M=SCM
IEE174I 12.06.04 DISPLAY M 803
STORAGE-CLASS MEMORY STATUS
32G DEFINED
ONLINE
 0G-16G
16G OFFLINE-AVAILABLE
1% IN USE
SCM INCREMENT SIZE IS 16G
DISPLAY M=SCM(DETAIL)
IEE174I 12.06.53 DISPLAY M 805
STORAGE-CLASS MEMORY STATUS - INCREMENT DETAIL
32G DEFINED
ADDRESS  IN USE  STATUS
     0G      1%  ONLINE
ONLINE: 16G  OFFLINE-AVAILABLE: 16G  PENDING OFFLINE: 0G
1% IN USE
SCM INCREMENT SIZE IS 16G
```

From these commands, you see that 32 GB of VFM is defined, but only 16 GB are online, and the other 16 GB are offline-available.

To vary an additional 16 GB VFM online to the example LPAR, run the **CONFIG SCM(xxG),ONLINE** command, as shown in Example 10-5. The amount of VFM that is configured online must be specified according to the supported increment size. From these displays, the supported increment size is 16G.

Example 10-5 CONFIG SCM(16G),ONLINE

```
CONFIG SCM(16G),ONLINE
IEE195I SCM LOCATIONS 16G TO 32G ONLINE
IEE712I CONFIG   PROCESSING COMPLETE
```

Run the **DISPLAY ASM** and **DISPLAY M** commands again to display the status of the VFM and see that the 16 GB additional value is now online and available (Example 10-6).

Example 10-6 Post configuration displays

```
DISPLAY ASM
IEE200I 12.10.14 DISPLAY ASM 845
TYPE     FULL STAT   DEV  DATASET NAME
PLPA      28%   OK  9A0B  PAGE.SC76.PLPA
COMMON     0%   OK  9A0B  PAGE.SC76.COMMON
LOCAL      0%   OK  9A36  PAGE.SC76.LOCAL01
LOCAL      0%   OK  9AB6  PAGE.SC76.LOCAL02
LOCAL      0%   OK  9B36  PAGE.SC76.LOCAL03
SCM        0%   OK   N/A   N/A
PAGEDEL COMMAND IS NOT ACTIVE

DISPLAY ASM,SCM
IEE207I 12.10.41 DISPLAY ASM 847
STATUS      FULL               SIZE             USED         IN-ERROR
IN-USE        0%          8,388,608           20,247                0

DISPLAY M=SCM
IEE174I 12.08.47 DISPLAY M 843
STORAGE-CLASS MEMORY STATUS
32G DEFINED
ONLINE
 0G-32G
0G OFFLINE-AVAILABLE
0% IN USE
SCM INCREMENT SIZE IS 16G

DISPLAY M=SCM(DETAIL)
IEE174I 12.11.46 DISPLAY M 849
STORAGE-CLASS MEMORY STATUS - INCREMENT DETAIL
32G DEFINED
ADDRESS  IN USE  STATUS
     0G      1%  ONLINE
    16G      0%  ONLINE
ONLINE: 32G  OFFLINE-AVAILABLE: 0G  PENDING OFFLINE: 0G
0% IN USE
SCM INCREMENT SIZE IS 16G
```

When displaying the Storage Information windows on the SE again (compare to Figure 10-42 on page 251 and Figure 10-43 on page 252), this change in LPAR ARIES21 is reflected.

In Figure 10-44, the amount of allocated VFM went up to 80 GB (compared to the 64 GB in Figure 10-42 on page 251).

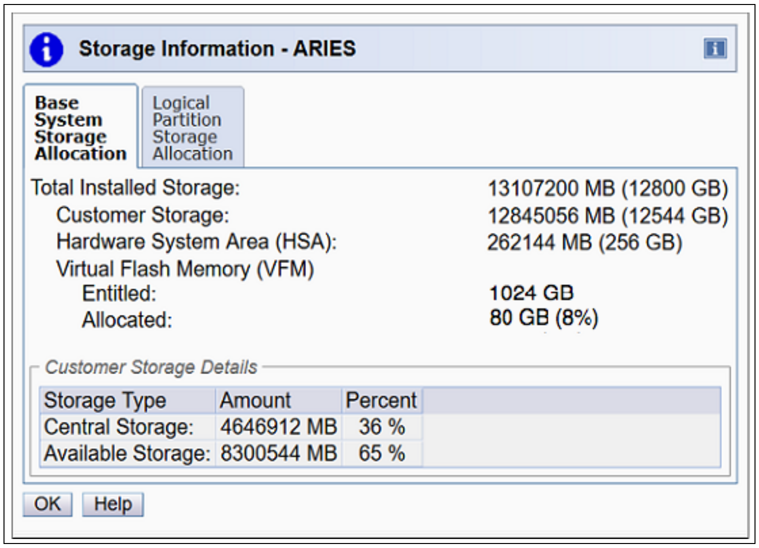

Figure 10-44 Results of CONFIG SCM(16G),ONLINE in LPAR ARIES21 - Base System Storage Allocation

In Figure 10-45, the amount of VFM allocated to LPAR ARIES21 went up to 32 GB.

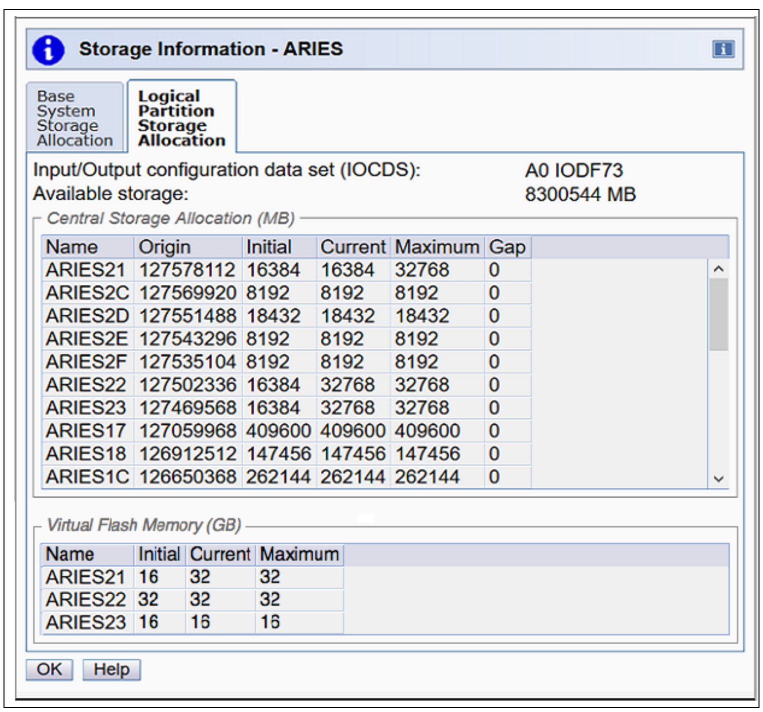

Figure 10-45 Results of CONFIG SCM(16G),ONLINE in LPAR ARIES21 - Logical Partition Storage Allocation

You also can set VFM offline, even to an amount that is lower than the initial value that is specified in the image activation profile. If for LPAR ARIES21 the amount of online VFM is reduced to 0 GB by running **`CONFIG SCM(32G),OFFLINE`**, which results in the Storage Information windows displayed in Figure 10-46 and Figure 10-47. In Figure 10-46, the amount of allocated VFM went down to 48 GB.

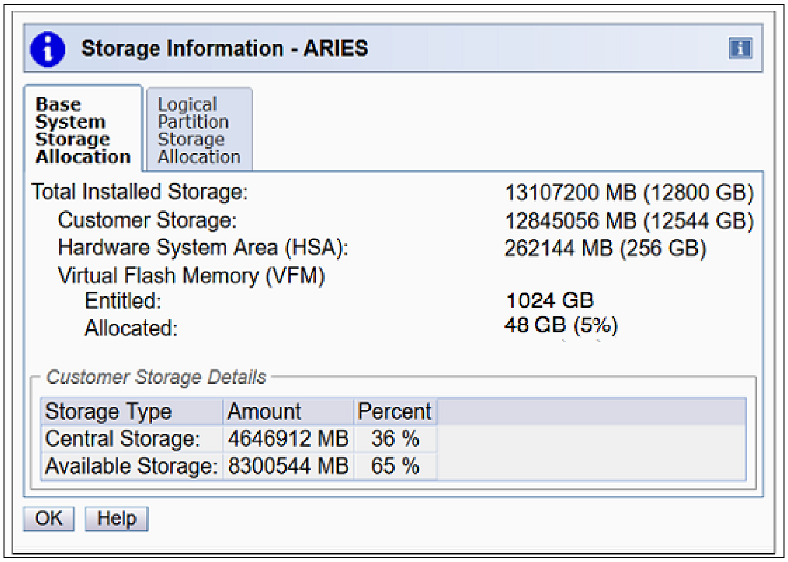

Figure 10-46 Results after CONFIG SCM(32G),OFFLINE in LPAR ARIES21 - Base System Storage Allocation

In Figure 10-47, the amount of VFM allocated to LPAR ARIES21 went down to 0 GB, which is lower than the initial 16 GB.

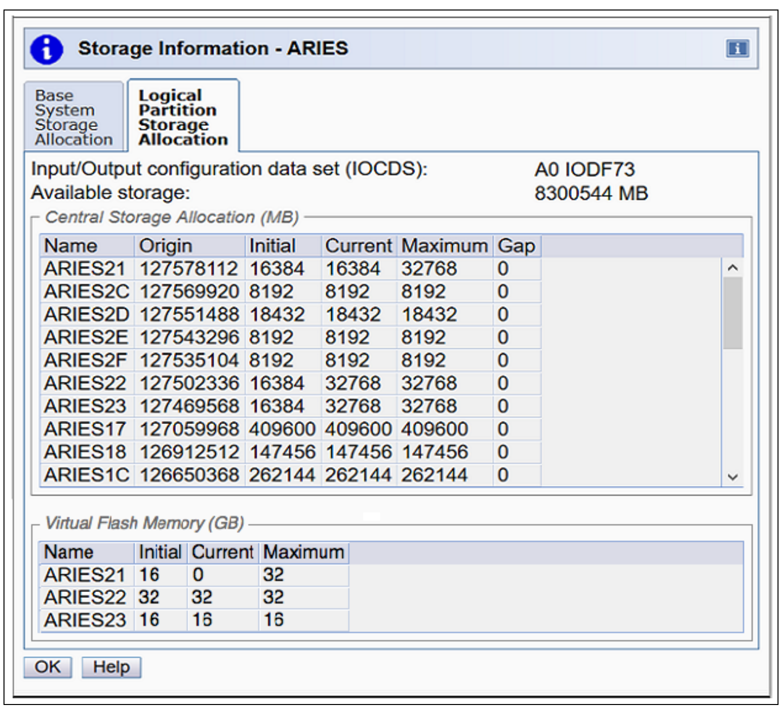

Figure 10-47 Results after CONFIG SCM(32G),OFFLINE in LPAR ARIES21 - Logical Partition Storage Allocation

Note: An LPAR uses only the amount of VFM activated for that LPAR. VFM that is set offline by the OS is returned to be used by other LPARs.

The allocation of VFM to a CF LPAR is done in the same way as for z/OS LPARs, which is described in 10.2.3, “Configuring VFM” on page 249. The amount of SCM that is allocated to a CF LPAR can be displayed in the Operating System Messages window at the HMC.

For example, LPAR ARIES2F, which allocated 32 GB of initial VFM storage, has a message that shows the amount of SCM available, as shown in Example 10-7.

Example 10-7 CFCC messages with SCM

```
CF0280I CFCC Release 24.00, Service Level 00.09
        Built on 05/16/2019 at 16:15:00
        Code Load Features:
           Facility Operational Level: 24

CF0011I Coupling Facility is active with:
           2 CPs
           5 CF Receiver Channels
           5 CF Sender Channels
           7687 MB of allocatable storage
           32768 MB of Total SCM storage
```

The CF must know the algorithm of how the structure is used by the application. Currently, this algorithm is defined only for IBM MQ shared queues. To use this function, assign flash memory to your coupling facilities (CFs) and update your structure definitions in your CFRM policy with the new parameters `SCMMAXSIZE` and `SCMALGORITHM`. For more information, see *z/OS MVS Setting Up a Sysplex*, SA23-1399.

IBM MQ for z/OS Version 7 or later enables the migration of IBM MQ shared queue objects to flash memory when the structure utilization exceeds the defined threshold. The IBM MQ objects are fetched back to real CF Storage when requested. This process provides an overflow capability for IBM MQ shared queues to handle workload peaks.

IBM Resource Measurement Facility (RMF) provides measurement data and reporting capabilities for VFM and Flash Express. The support enhances RMF Postprocessor and Monitor III reports with various new CF SCM statistics.

CF SCM statistics are provided in these reports:

- RMF Postprocessor Coupling Facility Activity (CFACT) report
- RMF Monitor III Coupling Facility Overview (CFOVER) report
- RMF Monitor III CFACT report

11

Adding logical partitions and operating system configurations

This chapter describes the steps for adding logical partitions (LPARs) and operating system configurations (OSCONFIGs) to your input/output definition file (IODF). It includes a list of these potential configuration items and a short description about how to do each of them by using a Hardware Configuration Definition (HCD).

Note: Not all of the following configuration items are necessarily required for your installation. In addition, the examples that are presented are not exhaustive.

This chapter shows only the definition process. If you want a deeper understanding about how to use HCD and Fibre Connection (FICON), see these resources:

- *I/O Configuration Using z/OS HCD and HCM*, SG24-7804
- *FICON Planning and Implementation Guide*, SG24-6497

This chapter includes the following sections:

- Defining more I/O by using HCD
- OSCONFIGs and logical partition definitions

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

11.1 Defining more I/O by using HCD

When defining new I/O components in an IODF, certain definitions like OSCONFIGs, partitions, FICON switches, control units (CUs), and devices must be done first. After these items are defined, the connections can be made:

- Defining an extra OSCONFIG
- Defining extra operating system LPARs in a channel subsystem

The following I/O definitions use HCD to demonstrate the examples. The examples in this section continue the work example `ITSO1.IODF66.WORK`.

11.2 OSCONFIGs and logical partition definitions

This section covers defining OSCONFIGs, LPARs, and FICON switches.

11.2.1 Defining an extra OSCONFIG

Here are the prerequisites for a new OSCONFIG:

- OSCONFIG name:
  - Eligible Device Table ID (EDT ID): Esoterics / VIO.
  - Consoles.
- To add devices to Esoterics and Consoles, they first must be added to an OSCONFIG.

To add an OSCONFIG by using HCD, complete the following steps:

1. From the main HCD panel, select option `1.1. Operating system configurations`.
2. In the command line, enter `add` (see Figure 11-1) to add an OSCONFIG.
3. Make the following updates, and press Enter:
   - Update `OS configuration ID type` to `ITSOTEST`.
   - Update `Description` to `ITSO test OSCONFIG for z15`.

```
+---------------- Add Operating System Configuration -----------------+
|                                                                      |
|                                                                      |
| Specify or revise the following values.                              |
|                                                                      |
| OS configuration ID  . . . . . ITSOTEST                              |
| Operating system type  . . . . MVS       +                           |
|                                                                      |
| Description  . . . . . . . . . ITSO test OSCONFIG for z15______      |
|                                                                      |
| OS config ID for D/R site  . . ________  (generated for GDPS)        |
|                                                                      |
|                                                                      |
|  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset   F9=Swap      |
| F12=Cancel                                                           |
+----------------------------------------------------------------------+
```

Figure 11-1 Operating System Configuration: Add OSCONFIG

4. To add an EDT ID, enter `s` next to the new OSCONFIG (see Figure 11-2 on page 263).

```
                   Operating System Configuration List           Row 1 of 15
Command ===> ___________________________________________ Scroll ===> CSR

Select one or more operating system configurations, then press Enter. To
add, use F11.

/ Config. ID  Type     Gen  Description                      D/R site OS ID
_ ITSO        MVS           All ITSO devices
s ITSOTEST    MVS           ITSO test OSCONFIG for z15
_ ZOSMAINT    MVS           z/OS Central Mgmt Image
_ ZOS22BAS    MVS           z/OS 2.2 Serverpac with P1D SSs
_ ZOS22MLZ    MVS           z/OS 2.2 MLZ - clone of p1c
_ ZOS22MPL    MVS           z/OS 2.2 demo clone of p1g
```

Figure 11-2 Operating System Configuration: Add EDT

5. In the command line, enter `add` (see Figure 11-3) to add an EDT.
6. Update `EDT identifier` to `00`, and press Enter.

```
+-------------------------------- Add EDT --------------------------------+
|                                                                         |
|                                                                         |
| Specify the following values.                                           |
|                                                                         |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15            |
|                                                                         |
| EDT identifier . . . 00                                                 |
| Description  . . . . ________________________________                   |
|                                                                         |
|  F1=Help     F2=Split    F3=Exit     F5=Reset    F9=Swap    F12=Cancel  |
+-------------------------------------------------------------------------+
```

Figure 11-3 Operating System Configuration: Add EDT

7. Enter `s (work with esoterics)` next to `EDT 00`, and press Enter (see Figure 11-4).

```
+------------------------------- EDT List --------------------------------+
|   Goto  Backup  Query  Help                                             |
| ----------------------------------------------------------------------  |
|                                                              Row 1 of 1 |
| Command ===> _______________________________________ Scroll ===> CSR    |
|                                                                         |
| Select one or more EDTs, then press Enter. To add, use F11.             |
|                                                                         |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15            |
|                                                                         |
| / EDT Last Update By       Description                                  |
| s 00  2019-06-21  Z15RES1  ________________________________             |
| *************************** Bottom of data **************************** |
```

Figure 11-4 Operating System Configuration: Work with Esoterics

8. In the command line, enter add (see Figure 11-5) to add an Esoteric.
9. Make the following updates, and press Enter:
   – Update Esoteric name to ITSOES01.
   – Update VIO eligible to Yes (if you want to make this Esoteric VIO eligible). This setting is normally used for an Esoteric called VIO.
   – Update Token to 1.

```
+---------------------------- Esoteric List -----------------------------+
|   Goto  Filter  Backup  Query  Help                                    |
| - +--------------------- Add Esoteric ---------------------+ --------- |
|   |                                                        |           |
| C |                                                        | ==> CSR   |
|   | Specify the following values.                          |           |
| S |                                                        | 11.       |
|   | +-oteric name  . . . ITSOES01                          |           |
| C | VIO eligible . . . . Yes    (Yes or No)                |           |
| E | Token  . . . . . . . 1___                              |           |
|   |                                                        |           |
| / |                                                        |           |
| * |  F1=Help    F2=Split   F3=Exit    F5=Reset   F9=Swap   | ********** |
|   | F12=Cancel                                             |           |
|   +--------------------------------------------------------+           |
|                                                                        |
```

Figure 11-5 Operating System Configuration: Add Esoteric

10. After you add devices to the OSCONFIG ITSOTEST in the following examples, you can add those device definitions to an Esoteric or Console if applicable.

11.2.2 Defining extra operating system LPARs in a channel subsystem

Here are considerations for a new (unreserved) partition:

- Partition name
- Number
- Usage
- Description
- To add channel path IDs (CHPIDs) to a partition, they first must be defined to the processor.
- Renaming an existing partition is a two-step process:
  a. It must be redefined as reserved (Partition name = *).
  a. The IODF must be activated on the processor, redefined to the new name, and then the IODF must be activated on the processor.

To change a reserved partition to an active partition in a channel subsystem (CSS), complete the following steps:

1. From the main HCD panel, select option 1.3. Processors.
2. Type s next to the processor that you want to add a partition to, and press Enter.
3. Type p next to the CSS ID that you want to add a partition to, and press Enter.

4. Type `c` next to the Reserved Partition that you want to unreserve (we use ID 1 for this example), and press Enter.
5. Make the following updates (see Figure 11-6), and press Enter:
   a. Update `Partition Name` to `ARIES21` (a naming standard based on `CSS=2`, `Partition =1`).
   b. Review `Partition usage` and change if required. We use `OS` in this example.
   c. Update `Description` to `ARIES21` to test the operating system (OS) partition.

```
+----------------------------- Partition List -----------------------------+
|   Goto  Backup  Query  Help                                              |
| ------------------------------------------------------------------------ |
|                                                                          |
| Command ===> ________________________________________ Scroll ===> CSR    |
|                                                                          |
| Select one or more partitions, then press Enter. To add, use F11.        |
|                                                                          |
| Processor +-------------- Change Partition Definition ---------------+   |
| Configura |                                                          |   |
| Channel S |                                                          |   |
|           | Specify or revise the following values.                  |   |
| / Partiti |                                                          |   |
| c *       | Partition name . . . ARIES21                             |   |
| _ *       | Partition number . . 1      (same as MIF image ID)       |   |
| _ *       | Partition usage  . . OS     +                            |   |
| _ *       | UID uniqueness . . . N        (Y/N)                      |   |
| _ *       |                                                          |   |
| _ *       | Description  . . . . ARIES21 test OS partition_______    |   |
| _ *       |                                                          |   |
|  F1=Help  |                                                          |   |
|  F7=Backw |  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset    |   |
| F12=Cance |  F9=Swap   F12=Cancel                                    |   |
+---------- +----------------------------------------------------------+ --+
```

Figure 11-6 Processors: Change Partition Definition

12

Adding storage devices

This chapter describes how to define Fibre Connection (FICON) switches and FICON channel path IDs (CHPIDs), and connect them to a direct access storage device control unit (CU). It includes a list of these potential configuration items and a short description about how to configure each of them by using Hardware Configuration Definition (HCD).

Note: Not all of the following configuration items are necessarily required for your installation. In addition, the examples that are presented are not exhaustive.

This chapter shows only the definition process. If you want a deeper understanding about how to use HCD and FICON, see these resources:

- *I/O Configuration Using z/OS HCD and HCM*, SG24-7804
- *FICON Planning and Implementation Guide*, SG24-6497

This chapter includes the following sections:

- Defining more I/O by using HCD
- FICON CHPIDs, switches, and direct access storage device control units

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

12.1 Defining more I/O by using HCD

When defining new I/O components in an input/output definition file (IODF), certain definitions like operating system configurations (OSCONFIGs), partitions, FICON switches, CUs, and devices must be done first. After these items are defined, the connections can be made:

- Defining FICON switches (directors, storage area networks, and storage area network switches)
- Defining FICON CHPIDs and connecting them to a FICON switch
- Defining FICON CHPIDs for a direct connection to a 2107 control unit
- Defining FICON CHPIDs for switch connections to a 2107 control unit
- Defining 3390B devices to an OSCONFIG and EDTs / Esoteric

The following I/O definitions use HCD to demonstrate the examples. The examples continue by using the work example `ITSO.IODF66.WORK`.

12.1.1 Defining FICON switches (directors, storage area networks, and storage area network switches)

The following items are considerations for a new FICON switch:

- Switch ID
- Switch type
- Serial number (optional)
- Description (optional)
- Switch address
- Installed port range
- Switch CU number
- Switch device number

To add a FICON Switch by using HCD, complete the following steps:

1. From the main HCD panel, select option `1.2. Switches`.
2. In the command line, enter `add` (see Figure 12-1 on page 269) to add a switch.
3. Make the following updates (we used a switch ID value of `41`), and press Enter:
   - Update `Switch ID` to `41`.
   - Update `Switch type` to `2032`.
   - Update `Description` to `ITSO test storage area network (SAN) definition`.
   - Update `Switch address` to `41`.
   - Update `Installed port range` to `00` and `FE`.
   - Update `Switch CU number` to `0041`.
   - Update `Switch device number` to `0041`.

```
+---------------------------- Add Switch ----------------------------+
|                                                                    |
|                                                                    |
| Specify or revise the following values.                            |
|                                                                    |
| Switch ID . . . . . . . . 41  (00-FF)                              |
| Switch type . . . . . . . 2032          +                          |
| Serial number . . . . . . __________                               |
| Description . . . . . . . ITSO test SAN definition________         |
| Switch address  . . . . . 41  (01-EF) for a FICON switch           |
|                                                                    |
| Specify the port range to be installed only if a larger range      |
| than the minimum is desired.                                       |
|                                                                    |
| Installed port range  . . 00  -  FE  +                             |
|                                                                    |
| Specify either numbers of existing control unit and device, or     |
| numbers for new control unit and device to be added.               |
|                                                                    |
| Switch CU number(s) . . . 0041  ____  ____  ____  ____  +          |
| Switch device number(s) . 0041  ____  ____  ____  ____             |
|  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset   F9=Swap    |
| F12=Cancel                                                         |
+--------------------------------------------------------------------+
```

Figure 12-1   Switches: Add Switch

Figure 12-2 shows the new FICON switch definition.

```
                                 Switch List          Row 1 of 3 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more switches, then press Enter. To add, use F11.

                                                                  CU   Dev
/ ID Type +        Ad Serial-# + Description                      Num. Num.
_ 01 2032          01 10546MH    8960-F64 SAN64B-6 SW 01          0001 0001
_ 02 2032          02 10546MD    8960-F64 SAN64B-6 SW 03          0002 0002
_ 41 2032          41 __________ ITSO test SAN definition         0041 0041
******************************* Bottom of data *******************************






+----------------------------------------------------------------------+
| Switch control unit(s) 0041 and device(s) 0041 defined, but not yet |
| connected to both a processor and an operating system.               |
+----------------------------------------------------------------------+
```

Figure 12-2   Switches: FICON switch added

12.2 FICON CHPIDs, switches, and direct access storage device control units

This section covers defining FICON CHPIDs, and then connecting them to FICON switches and a direct access storage device CU.

12.2.1 Defining FICON CHPIDs and connecting them to a FICON switch

Here are considerations for a new FICON CHPID:

- CHPID
- Channel ID (CHID)
- Channel path type
- Operational mode
- Description
- Dynamic entry switch ID
- Entry switch ID
- Entry port
- Partition access list

Here are more considerations:

- For performance and redundancy, determine how many CHPIDs are required to connect to the FICON switch and then to one or more CUs.
- For performance and redundancy, determine how many I/O cards of that feature are installed in the processor and to what Peripheral Component Interconnect Express (PCIe) ports and on which central processor complex (CPC) drawer do the I/O cards connect to. (For a list of installed hardware, see the physical channel ID (PCHID)/CHID report.)
- After a CHPID is defined, it can then be added to a predefined partition in that channel subsystem (CSS).
- After a CHPID is defined, it can then be connected to a FICON switch.
- After a CHPID is defined, it can then be connected to a CU (covered in a later step).

To define a FICON CHPID, connect to a FICON switch and provide access to a partition. Then, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a CHPID to, and press Enter.
3. Enter `s` next to the CSS ID that you want to add a CHPID to, and press Enter.
4. In the command line, enter `add` (see Figure 12-3 on page 271) to add a CHPID.
5. Make the following updates, and press Enter:
   - Update `Channel path ID` to `14`.
   - Update `Channel ID` to `114`.
   - Update `Channel path type` to `FC`.
   - Update `Operational mode` to `SHR`.
   - Update `Description` to whatever description that you want.
   - Update `Dynamic entry switch ID` to `41`.
   - Update `Entry switch ID` to `41` (optional but preferred).
   - Update `Entry port` to `10` (optional but preferred).

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : ARIES        Aries                                 |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 2                                                  |
|                                                                           |
| Channel path ID  . . . . 14    +            Channel ID  114  +            |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . FC    +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . FC#0428 16Gb FICON Exp16S+ SX___                 |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  41  + (00 - FF)                                  |
| Entry switch ID  . . . . 41  +                                            |
| Entry port . . . . . . . 10  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 12-3 Processors: Add Channel Path

HCD now prompts you to select which partition the CHPID should have access to.

6. Type forward slash (/) next to the partition you want (see Figure 12-4), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                                Row 1 of 1 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the access list.           |
|                                                                           |
| Channel subsystem ID : 2                                                  |
| Channel path ID  . . : 14     Channel path type  . : FC                    |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                     |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 2      ARIES21          1      OS    ARIES21 test OS partition          |
| *************************** Bottom of data ****************************  |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|  F1=Help       F2=Split      F3=Exit       F5=Reset      F6=Previous      |
|  F7=Backward   F8=Forward    F9=Swap      F12=Cancel                      |
+---------------------------------------------------------------------------+
```

Figure 12-4 Processors: Define Access List

Because we have only one partition that is defined in this CSS, we do not see the Define Candidate List panel, even though we defined the CHPID as SHR.

HCD returns to the Channel Path List and shows the CHPID that was defined (see Figure 12-5).

```
                              Channel Path List       Row 1 of 1 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES2
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
```

Figure 12-5 Processors: Channel Path List

12.2.2 Defining FICON CHPIDs for a direct connection to a 2107 control unit

Here are considerations for a new FICON CHPID:

- CHPID
- CHID
- Channel path type
- Operational mode
- Description
- Partition access list

Here are more considerations:

- For performance and redundancy, determine how many CHPIDs are required to connect to the FICON Switch and then to one or more CUs.
- For performance and redundancy, determine how many I/O cards of that feature are installed in the processor and to what PCIe ports on what CPC drawer do the I/O cards connect to. (For a list of installed hardware, see the PCHID/CHID report.)
- After a CHPID is defined, it can then be added to a predefined partition in that CSS.
- The CHPID can then be connected to a CU (covered in a later step).

> **Note:** For FICON Express16S+ (Feature Code #0428) and FICON Express16SA (Feature Code #0436 and Feature Code #0437), defining both Fibre Channel (FC) and Fibre Channel Protocol (FCP) CHPID types on the same I/O card is not supported. HCD issues the following warning message during a Validate or Build Production for an IODF:
>
> ```
> W   CBDA963I Chpid type mix detected on processor ARIES for channels:
>              0.29, 0.31, 0.30, 0.44
> ```

To define a FICON CHPID that connects directly to a CU and provides access to a partition, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a CHPID to, and press Enter.

3. Enter `s` next to the CSS ID that you want to add a CHPID to, and press Enter.
4. In the command line, enter `add` to add a CHPID.
5. Make the following updates (see Figure 12-6), and press Enter:
   - Update `Channel path ID` to `15`.
   - Update `Channel ID` to `115`.
   - Update `Channel path type` to `FC`.
   - Update `Operational mode` to `SHR`.
   - Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                            |
|                                                                            |
| Specify or revise the following values.                                    |
|                                                                            |
| Processor ID . . . . : ARIES                                               |
| Configuration mode . : LPAR                                                |
| Channel Subsystem ID : 2                                                   |
|                                                                            |
| Channel path ID  . . . . 15    +           Channel ID  115  +             |
| Number of CHPIDs . . . . 1                                                 |
| Channel path type  . . . FC    +                                           |
| Operation mode . . . . . SHR   +                                           |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +       |
| Description  . . . . . . FC#0428 16Gb FICON Exp16S+ SX___                  |
|                                                                            |
| Specify the following values only if connected to a switch:                |
| Dynamic entry switch ID  __  + (00 - FF)                                   |
| Entry switch ID  . . . . __  +                                             |
| Entry port . . . . . . . __  +                                             |
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap       |
| F12=Cancel                                                                 |
+----------------------------------------------------------------------------+
```

Figure 12-6 Processors: Add Channel Path

6. Type forward slash (/) next to the partition that you want CHPID to have access to (see Figure 12-7), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                               Row 1 of 1 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the access list.           |
|                                                                           |
| Channel subsystem ID : 2                                                  |
| Channel path ID  . . : 15     Channel path type  . : FC                   |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 2      ARIES21          1      OS    ARIES21 test OS partition          |
| *************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|  F1=Help       F2=Split      F3=Exit       F5=Reset      F6=Previous      |
|  F7=Backward   F8=Forward    F9=Swap      F12=Cancel                      |
+---------------------------------------------------------------------------+
```

Figure 12-7 Processors: Define Access List

Because only one partition is defined in this CSS, we do not see the Define Candidate List panel, even though we defined the CHPID as SHR.

HCD now returns to the Channel Path List panel showing the CHPID that was defined (see Figure 12-8).

```
                              Channel Path List      Row 1 of 2 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
****************************** Bottom of data ****************************
```

Figure 12-8 Processors: Channel Path List

12.2.3 Defining FICON CHPIDs for switch connections to a 2107 control unit

There are two ways to define FICON connections to a CU: One is through a FICON switch, and the other is direct connected.

The direct connect method is used in an environment where there is only one processor. The FICON switch method is used where multiple processors must connect to the same CUs. This situation might not always be the case.

Here are considerations for connecting a FICON CHPID to a direct access storage device CU and its devices:

- For performance and redundancy, determine how many CHPIDs are required to connect to the FICON switch and then to one or more CUs.
- For FICON switch connections, there is usually a minimum of two FICON switches that the FICON CHPIDs connect through, primarily for failure or service redundancy of the FICON switches.
- For this example, we connect to a predefined 2107 CU (A000), with a CUADD of 40 and devices A000-A0EF (3390B) and A0F0-A0FF (3390A).

> **Note:** For FICON Express16S+ (Feature Code #0428) and FICON Express16SA (Feature Code #0436 and Feature Code #0437), defining both FC and FCP CHPID types on the same I/O card is not supported. HCD issues the following warning message during a Validate or Build Production for an IODF:
>
> ```
> W   CBDA963I Chpid type mix detected on processor ARIES for channels:
>              0.29, 0.31, 0.30, 0.44
> ```

To define FICON CHPIDs for a switch connection, complete the following steps:

1. From the main HCD panel, select option `1.4. Control units`.
2. Scroll through the CU list until you find the CU that you want to connect to, or in the command line enter `L A000`. In our example, we use `A000`.
3. Enter `c` next to the CU definition, and press Enter.

4. Make the following updates for a FICON switch connection (see Figure 12-9), and press Enter:

   a. Update `Connected to switches` to `41`. Switch `41` is the switch ID that we defined in the previous example.

   b. Update `Ports` to `11`. Port `11` is the FICON switch port that the CU connects to (also known as the Destination Link Address (DLA) of the FICON CHPID).

```
+----------------- Change Control Unit Definition ------------------+
|                                                                    |
|                                                                    |
| Specify or revise the following values.                            |
|                                                                    |
| Control unit number  . . . . A000  +                               |
|                                                                    |
| Control unit type  . . . . . 2107          +                       |
|                                                                    |
| Serial number  . . . . . . . __________   +                        |
| Description  . . . . . . . . DS8886 - SU2 - SSID=A000              |
|                                                                    |
| Connected to switches  . . . 41  __  __  __  __  __  __  __   +    |
| Ports  . . . . . . . . . . . 11  __  __  __  __  __  __  __   +    |
|                                                                    |
| Define more than eight ports . . 2   1.  Yes                       |
|                                      2.  No                        |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset   F9=Swap    |
| F12=Cancel                                                         |
+--------------------------------------------------------------------+
```

Figure 12-9 Control units: Change Control Unit Definition

HCD now shows the Select Processor / CU panel. This panel is where the connection is now made between the FICON CHPID (14) and the CU FICON Switch Port (11) through the FICON switch (41).

5. Enter `c` next to the `Processor.CSS` that contains the partition that we want to have access to the CU and also has access to the CHPID that we want to connect to the CU. In our example, we use `ARIES.2`, and then press Enter.

6. Make the following updates to define the Processor / CU connection panel (see Figure 12-10 on page 277), and press Enter:

   a. Update `Channel path IDs` to `14`. CHPID 14 is the CHPID that we defined in the previous example.

   b. Update `Link address` to `4111`. Link address 4111 is FICON switch 41 and CU Port 11.

   c. Update `Unit address` to `00`. Unit Address (UA) of 00 is the starting UA number on the CHPID.

   d. Update `Number of units` to `256`. Number of units of 256 equals A000-A0FF (that is, 00-FF or 256).

   e. Update `Logical address` to `40`. Logical address of 40 is the CUADD or the CU ADDress that is defined in the DS8886 that defines the location of the devices in the DS8886.

```
                              Select Processor / CU
+---------------------- Change Control Unit Definition -----------------------+
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Control unit number  . : A000        Type . . . . . . : 2107                 |
| Processor ID . . . . . : ARIES                                               |
| Channel Subsystem ID . : 2                                                   |
|                                                                              |
| Channel path IDs . . . . 14    __   __   __   __   __   __   __    +        |
| Link address . . . . . . 4111  ____ ____ ____ ____ ____ ____ ____  +        |
|                                                                              |
| Unit address . . . . . . 00    __   __   __   __   __   __   __    +        |
| Number of units  . . . . 256   ___  ___  ___  ___  ___  ___  ___             |
|                                                                              |
| Logical address  . . . . 40  + (same as CUADD)                               |
|                                                                              |
| Protocol . . . . . . . . __  + (D, S or S4)                                  |
| I/O concurrency level  . _   + (1, 2 or 3)                                   |
|                                                                              |
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap         |
| F12=Cancel                                                                   |
+------------------------------------------------------------------------------+
```

Figure 12-10 Control units: Change Control Unit Definition detail

HCD now shows the Modify Device Parameters panel where you can override the UA numbers. For a 2107 direct access storage device CU definition, the starting UA is usually `00` and the ending UA is `FF`, giving you 256 direct access storage device definitions for the CU.

7. In our example, we do not change the defaults that are proposed by HCD (see Figure 12-11). Press Enter.

```
+------------------------- Modify Device Parameters --------------------------+
|                                                   Row 1 of 2 More:       > |
| Command ===> __________________________________________ Scroll ===> CSR    |
|                                                                             |
| Specify or revise any changes to the device parameters in the list below.  |
| To view attached control units, scroll to the right.                       |
|                                                                             |
| Processor ID . . . . : ARIES                                                |
| Channel Subsystem ID : 2                                                    |
|                                                                             |
| ---------Device---------     ---UA----                 Preferred Exposure  |
| No., Range Type         SS+ Old New + Time-Out STADET CHPID +   Device     |
| A000,240   3390B        _   00  00    No       Yes    __                   |
| A0F0,016   3390A        1   F0  F0    No       Yes    __                   |
| **************************** Bottom of data ****************************** |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|  F1=Help       F2=Split      F3=Exit       F4=Prompt      F5=Reset          |
|  F7=Backward   F8=Forward    F9=Swap      F12=Cancel                        |
+-----------------------------------------------------------------------------+
```

Figure 12-11 Control units: Modify Device Parameters

HCD returns to the Select Processor / CU panel, which shows the CHPID (14) to DLA (11) through the FICON switch (41) connection definition (see Figure 12-12 on page 279).

```
                              Select Processor / CU    Row 1 of 18 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : A000     Control unit type . . . : 2107

             ---------------Channel Path ID . Link Address + ---------------
/ Proc.CSSID 1------ 2------ 3------ 4------ 5------ 6------ 7------ 8------
_ ARIES.2    14.4111 _______ _______ _______ _______ _______ _______ _______
_ ARIES.0    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.1    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.3    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.4    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.5    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.2    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.3    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.4    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.5    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.2    _______ _______ _______ _______ _______ _______ _______ _______
```

Figure 12-12 Processors: Select Processor / CU: CHPID to Link address connection

By pressing F20 (Right), you can see the other parts of the definition summary.

For a FICON direct connection to this CU definition, you omit the Link address values.

To define the Processor / CU connection (see Figure 12-13), update `Channel path IDs` to `15`, and press Enter.

```
                             Select Processor / CU
+---------------------- Change Control Unit Definition -----------------------+
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Control unit number  . : A000         Type . . . . . . : 2107                |
| Processor ID . . . . . : ARIES                                               |
| Channel Subsystem ID . : 2                                                   |
|                                                                              |
| Channel path IDs . . . . 14    15    __    __    __    __    __    __    +   |
| Link address . . . . . . 4111  ____  ____  ____  ____  ____  ____  ____  +   |
|                                                                              |
| Unit address . . . . . . 00    __    __    __    __    __    __    __    +   |
| Number of units  . . . . 256   ___   ___   ___   ___   ___   ___   ___       |
|                                                                              |
| Logical address  . . . . 40  + (same as CUADD)                               |
|                                                                              |
| Protocol . . . . . . . . __  + (D, S or S4)                                  |
| I/O concurrency level  . _   + (1, 2 or 3)                                   |
|                                                                              |
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap         |
| F12=Cancel                                                                   |
+------------------------------------------------------------------------------+
```

Figure 12-13 Control units: Change Control Unit Definition detail

8. HCD again shows the Modify Device Parameters panel where you can override the UA numbers. Press Enter to continue.

HCD returns to the Select Processor / CU panel showing the CHPID (15) connection definition (see Figure 12-14).

```
                            Select Processor / CU    Row 1 of 18 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : A000     Control unit type . . . : 2107

             ---------------Channel Path ID . Link Address + ---------------
/ Proc.CSSID 1------ 2------ 3------ 4------ 5------ 6------ 7------ 8------
_ ARIES.2    14.4111 15      _______ _______ _______ _______ _______ _______
_ ARIES.0    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.1    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.3    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.4    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.5    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.2    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.3    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.4    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.5    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.2    _______ _______ _______ _______ _______ _______ _______ _______
```

Figure 12-14 Processors: Select Processor / CU: CHPID to Link address connection

Although a mixture of FICON switched and FICON direct connections are not recommended to the same CU, this configuration is possible.

A typical scenario might be where you were moving from direct connected direct access storage device to a FICON switch connected direct access storage device, but you cannot take the direct access storage device offline to live systems.

12.2.4 Defining 3390B devices to an OSCONFIG and EDTs / Esoteric

The OSCONFIG name is the part of an IODF that determines what devices a z/OS system may access when it IPLs. Additionally, the partition that the z/OS system is restarted in also must have access to the CHPIDs that connect to the CUs and devices that match in the OSCONFIG.

The OSCONFIG also contains Esoterics device groups that are defined in Eligible Device Tables (EDTs) within an OSCONFIG.

Esoterics device groups are used to request allocation of a device that was defined in an Esoteric device group when using the **`UNIT =`** parameter in a **`JCL DD`** statement. However, this allocation can be overridden or intercepted by using DFSMS.

The OSCONFIG name includes these items:

- EDT ID: Esoterics / VIO
- Consoles

Here are the considerations for adding devices to an OSCONFIG and Esoteric:

- Adding a device to an OSCONFIG does not necessarily mean that the z/OS system has access to that device.
- Does the device need to be added to an Esoteric device group? Mostly, this item is installation-specific.
- The example adds the predefined 2107 devices A000-A0EF (3390B) and A0F0-A0FF (3390A).

To define 3390B devices to an OSCONFIG and EDT/Esoteric, complete the following steps:

1. From the main HCD panel, select option `1.5. I/O Devices`.
2. Scroll through the I/O Device List until you find the device number that you want to add to the OSCONFIG, or in the command line enter `L A000`. In our example, we use `A000`.
3. Enter `c` next to one or more device numbers, and press Enter.

   HCD displays the Change Device Definition panel where you can modify the CU that the devices are attached to (see Figure 12-15). Press Enter.

```
+------------------------- Change Device Definition --------------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Device number . . . . . . . : A000  (0000 - FFFF)                           |
| Number of devices . . . . . : 240                                           |
| Device type . . . . . . . . : 3390B                                         |
|                                                                             |
| Serial number . . . . . . . . __________  +                                 |
| Description . . . . . . . . . ________________________________              |
|                                                                             |
| Volume serial number . . . . . ______  + (for DASD)                         |
|                                                                             |
| PPRC usage . . . . . . . . . . _  + (for DASD)                              |
|                                                                             |
| Connected to CUs . A000  ____  ____  ____  ____  ____  ____  ____  +        |
|                                                                             |
| ENTER to continue.                                                          |
|                                                                             |
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap        |
| F12=Cancel                                                                  |
+-----------------------------------------------------------------------------+
```

Figure 12-15 I/O Devices: Change Device Definition

HCD displays the Device / Processor Definition panel where you can modify some of the Device parameters relating to Subchannel Set (SS), UA, and the Explicit Device Candidate List.

4. Enter `c` next to the Proc.CCSID item if you want to modify any of these parameters (see Figure 12-16), or press Enter to accept the defaults.

```
+---------------------- Device / Processor Definition -----------------------+
|                                                                 Row 1 of 1 |
| Command ===> __________________________________________ Scroll ===> CSR    |
|                                                                            |
| Select processors to change device/processor definitions, then press       |
| Enter.                                                                     |
|                                                                            |
| Device number  . . : A000       Number of devices  . : 240                 |
| Device type  . . . : 3390B                                                 |
|                                                                            |
|                                           Preferred  Device Candidate List |
| / Proc.CSSID  SS+  UA+  Time-Out  STADET  CHPID +    Explicit        Null  |
| c ARIES.2     0    00   No        Yes     __         No              ___   |
| ***************************** Bottom of data ***************************** |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|  F1=Help       F2=Split      F3=Exit       F4=Prompt      F5=Reset         |
|  F6=Previous   F7=Backward   F8=Forward    F9=Swap       F12=Cancel        |
+----------------------------------------------------------------------------+
```

Figure 12-16 I/O Devices: Device / Processor Definition continued

5. Next is the HCD panel, where you Define Devices to the Operating System Configuration. Scroll through the list of OSCONFIG definitions until you find the OSCONFIG that you want to add to the devices to, or in the command line enter `L ITSOTEST`. In our example, we use `ITSOTEST`.
6. Enter `s` next to the OSCONFIG, and press Enter.

   HCD displays the device parameters and features that are applicable to that particular device type. In our example, we add 3390B and 3390A devices to `ITSOTEST`.

7. Make the following updates to define the Processor / CU connection (see Figure 12-17), and press Enter:
   - Update `OFFLINE` to `No` (if you want these devices to be Online during IPL time).
   - Update `DYNAMIC` to `Yes` (if you want the device to be changeable dynamically).
   - Update `LOCANY` to `Yes` (if the device UCB can be in 31-bit storage).
   - Update `WLMPAV` to `Yes` (if you want the device to be managed by Workload Manager).
   - Update `READ-ONLY` to `No` (use to set secondary devices to read only).
   - Update `SHARED` to `Yes` (if the device is going to be shared between other systems).
   - Update `SHAREDUP` to `No` (must be set to `No` if Shared is set to `Yes`).

```
+-------------------- Define Device Parameters / Features --------------------+
|                                                                  Row 1 of 7 |
| Command ===> ___________________________________________ Scroll ===> CSR    |
|                                                                             |
| Specify or revise the values below.                                         |
|                                                                             |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15                |
| Device number  . . : A000         Number of devices  : 240                  |
| Device type  . . . : 3390B                                                  |
|                                                                             |
| Parameter/                                                                  |
| Feature    Value +          R Description                                   |
| OFFLINE    No                 Device considered online or offline at IPL    |
| DYNAMIC    Yes                Device supports dynamic configuration         |
| LOCANY     Yes                UCB can reside in 31 bit storage              |
| WLMPAV     Yes                Device supports work load manager             |
| READ-ONLY  No                 Restrict access to read requests (SEC or NO)  |
| SHARED     Yes                Device shared with other systems              |
| SHAREDUP   No                 Shared when system physically partitioned     |
| ***************************** Bottom of data ****************************** |
|                                                                             |
|  F1=Help       F2=Split      F3=Exit       F4=Prompt     F5=Reset           |
|  F7=Backward   F8=Forward    F9=Swap      F12=Cancel                        |
+-----------------------------------------------------------------------------+
```

Figure 12-17 I/O Devices: Define Device Parameters / Features

The Assign/Unassign Device to Esoteric panel opens, where you can specify which Esoteric (if any) that you want the devices to be added to.

8. In the Assign/Unassign the Device to Esoteric panel (see Figure 12-18) under `Assigned`, enter `Yes`, and press Enter.

```
+-------------------- Define Device Parameters / Features --------------------+
|                                                                   Row 1 of 7 |
| Command ===> ___________________________________________ Scroll ===> CSR    |
|                                                                              |
| Specify or revise the values below.                                          |
|                                                                              |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15                 |
| Device number  . . : A000         Number of devices  : 240                   |
| Device type  . . . : 3390B                                                   |
|                                                                              |
| Parameter/                                                                   |
| Feature    Value +          R Description                                   |
| OFFLINE    No                 Device considered online or offline at IPL    |
| DYNAMIC    Yes                Device supports dynamic configuration         |
| LOCANY     Yes                UCB can reside in 31 bit storage              |
| WLMPAV     Yes                Device supports work load manager             |
| READ-ONLY  No                 Restrict access to read requests (SEC or NO)  |
| SHARED     Yes                Device shared with other systems              |
| SHAREDUP   No                 Shared when system physically partitioned     |
| ***************************** Bottom of data ****************************** |
|                                                                              |
|  F1=Help       F2=Split       F3=Exit       F4=Prompt      F5=Reset          |
|  F7=Backward   F8=Forward     F9=Swap      F12=Cancel                        |
+------------------------------------------------------------------------------+
```

Figure 12-18 I/O Devices: Assign/Unassign Device to Esoteric

9. The final panel opens and shows that the devices are defined to the OSCONFIG (see Figure 12-19). Press Enter to return to the I/O Device List.

```
+----------- Define Device to Operating System Configuration -----------+
|                                                           Row 1 of 15 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                       |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                       |
| Device number  . : A000          Number of devices  : 240             |
| Device type  . . : 3390B                                              |
|                                                                       |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                       |
| / Config. ID   Type     SS Description                    Defined     |
| _ ITSO         MVS         All ITSO devices                           |
| _ ITSOTEST     MVS      0  ITSO test OSCONFIG for z15       Yes        |
| _ ZOSMAINT     MVS         z/OS Central Mgmt Image                     |
| _ ZOS22BAS     MVS         z/OS 2.2 Serverpac with P1D SSs            |
| _ ZOS22MLZ     MVS         z/OS 2.2 MLZ - clone of p1c                |
| _ ZOS22MPL     MVS         z/OS 2.2 demo clone of p1g                 |
| _ ZOS22P0B     MVS         z/OS 2.2 Clone of ZOS22BAS                 |
| _ ZOS22P0C     MVS         z/OS 2.2 Serverpac with P1D SSs            |
| _ ZOS22P0D     MVS         z/OS 2.2 Clone of ZOS22P0B                 |
|  F1=Help       F2=Split      F3=Exit       F4=Prompt     F5=Reset     |
|  F6=Previous   F7=Backward   F8=Forward    F9=Swap      F12=Cancel    |
+-----------------------------------------------------------------------+
```

Figure 12-19 I/O Devices: Assign/Unassign Device to Esoteric completed

The same steps can now be performed for the remaining devices A0F0-A0FF (3390A) for this example.

13

Adding network devices

This chapter describes how to define OSC, OSD, OSE, and Internal Queued Direct (IQD) channel path IDs (CHPIDs); control units (CUs); and devices.

Here is a list of these potential configuration items and a short description about how to do each of them by using Hardware Configuration Definition (HCD).

Note: Not all of the following configuration items are necessarily required for your installation. In addition, the examples that are presented are not exhaustive.

This chapter includes the following sections:

- Defining more I/O by using HCD
- Open Systems Adapter CHPID definitions
- IQD CHPIDs for HiperSockets

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

13.1 Defining more I/O by using HCD

When defining I/O components in an input/output definition file (IODF), certain definitions like operating system configurations (OSCONFIGs), partitions, Fibre Connection (FICON) switches, CUs, and devices must be done first. After these items are defined, then the connections can be made:

- Defining OSC CHPIDs
- Defining OSC CHPID connections to an OSC control unit
- Defining 3270-X devices to an OSCONFIG
- Defining 3270-X devices to the Nucleus Initialization Program Console List within an OSCONFIG
- Defining OSD CHPIDs
- Defining OSD CHPID connections to an OSA control unit
- Defining OSA and OSAD devices to an OSCONFIG
- Defining OSE CHPIDs
- Defining OSE CHPID connections to an OSA control unit
- Defining OSA and OSAD devices to an OSCONFIG
- Defining IQD CHPIDs
- Defining IQD CHPID connections to an IQD control unit
- Defining IQD devices to an OSCONFIG

The following I/O definitions use HCD to demonstrate the examples. The examples continue with the work example `SYS6.IODF29.WORK`.

13.2 Open Systems Adapter CHPID definitions

This section covers defining OSC, OSD, and OSE CHPIDs, and their CUs and devices.

13.2.1 Defining OSC CHPIDs

When defining an OSC connection, first you must determine which type of Open Systems Adapter-Express (OSA-Express) feature that you need for your configuration:

- Fiber optical cable-based features:
  - OSA-Express7S Gigabit Ethernet (GbE) Short Wave (SX) or Long Wave (LX)[1]
  - OSA-Express7S 10 GbE SR or LR[1]
  - OSA-Express7S 25 GbE SR
  - OSA-Express6S GbE SX or LX
  - OSA-Express6S 10 GbE SR or Long Reach (LR)
  - OSA-Express6S 25 GbE SR
- Copper wire-based (unshielded twisted pair) feature:
  - OSA-Express7S 1000BASE-T[1]
  - OSA-Express6S 1000BASE-T

[1] Not supported by the z15 T02. The equivalent type of OSA-Express6S features can be used with the z15 T02.

Here are considerations for a new OSC CHPID:

- CHPID
- Channel ID (CHID).
- Channel path type.
- Operational mode.
- Description.
- Partition access list.
- For performance and redundancy, determine how many I/O cards of that feature are installed in the processor and to what Peripheral Component Interconnect Express (PCIe) ports on what central processor complex (CPC) drawer that the I/O cards connect to. (For a list of installed hardware, see the physical channel ID (PCHID)/CHID report.)

To define an OSC CHPID and provide access to a partition, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a CHPID to, and press Enter.
3. Enter `s` next to the channel subsystem (CSS) ID that you want to add a CHPID to, and press Enter.
4. In the command line, enter `add` (see Figure 13-1) to add a CHPID.
5. Make the following updates, and press Enter:
   a. Update `Channel path ID` to `C6`.
   b. Update `Channel ID` to `11C`.
   c. Update `Channel path type` to `OSC`.
   d. Update `Operational mode` to `SHR`.
   e. Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : ARIES                                              |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 2                                                  |
|                                                                           |
| Channel path ID  . . . . C6    +           Channel ID  11C  +             |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . OSC   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . FC#0446 OSA Express7S 1000Base-T                 |
|                                                                           |
| Specify the following values only if connected to a switch:              |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-1 Processors: Add Channel Path - OSC

6. HCD prompts you to select which partition the CHPID should have access to. Enter a forward slash (/) next to the partition that you want (see Figure 13-2), and press Enter.

```
+-------------------------- Define Access List ---------------------------+
|                                                              Row 1 of 6 |
| Command ===> _________________________________________ Scroll ===> CSR   |
|                                                                         |
| Select one or more partitions for inclusion in the access list.         |
|                                                                         |
| Channel subsystem ID : 2                                                |
| Channel path ID  . . : C6     Channel path type  . : OSC                |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                  |
|                                                                         |
| / CSS ID Partition Name   Number Usage Description                      |
| / 2      ARIES21          1      OS    ARIES21 test OS partition        |
| / 2      ARIES22          2      CF/OS                                  |
| / 2      ARIES23          3      CF/OS                                  |
| / 2      ARIES24          4      CF/OS                                  |
| / 2      ARIES25          5      CF/OS                                  |
| / 2      ARIES26          6      CF/OS                                  |
| *************************** Bottom of data **************************** |
|                                                                         |
|                                                                         |
|                                                                         |
|                                                                         |
|                                                                         |
+-------------------------------------------------------------------------+
```

Figure 13-2 Processors: Define Access List - OSC

In this example, because we select all partitions to the Access List, we do not see the Define Candidate List panel, even though we defined the CHPID as SHR.

HCD now returns to the Channel Path List, and you see the CHPID that was defined (see Figure 13-3).

```
                              Channel Path List      Row 1 of 3 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
****************************** Bottom of data ******************************
```

Figure 13-3 Processors: Channel Path List - OSC

13.2.2 Defining OSC CHPID connections to an OSC control unit

The only way to define an Open Systems Adapter (OSA) connection to its CU is direct connected.

You might want to connect the OSC CU definition to multiple CPCs even though the physical OSC is still unique to any one CPC. Also, you might want to span the OSC over multiple CSSs within a CPC.

Here are considerations for connecting an OSC CHPID to an OSC CU and its 3270-X devices:

- Determine how many OSCs are required to provide a primary and secondary/backup network connection.
- The example connects to a predefined OSC CU (1C60) and 3270-X devices 0700-070F.

To define OSC CHPID connections to an OSC CU, complete the following steps:

1. From the main HCD panel, select option `1.4. Control units`.
2. Scroll through the CU list until you find the CU that you want to connect to, or in the command line enter `L 1C60`. In our example, we use `1C60`.
3. Enter `c` next to the CU definition, and press Enter.
4. Make any changes to the CU definition that you want (see Figure 13-4), and press Enter.

```
+----------------- Change Control Unit Definition ------------------+
|                                                                   |
|                                                                   |
| Specify or revise the following values.                           |
|                                                                   |
| Control unit number  . . . . 1C60  +                              |
|                                                                   |
| Control unit type  . . . . . OSC          +                       |
|                                                                   |
| Serial number  . . . . . . . __________  +                        |
| Description  . . . . . . . . ________________________________     |
|                                                                   |
| Connected to switches  . . . __  __  __  __  __  __  __  __  +    |
| Ports  . . . . . . . . . . . __  __  __  __  __  __  __  __  +    |
|                                                                   |
| Define more than eight ports . . 2   1.  Yes                      |
|                                      2.  No                       |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset   F9=Swap   |
| F12=Cancel                                                        |
+-------------------------------------------------------------------+
```

Figure 13-4 Control units: Change Control Unit Definition - OSC

HCD now shows the Select Processor / CU panel. This panel is where the connection is now made between the OSC CHPID (C6) and the CU (1C60).

5. Enter `c` next to the `Processor.CSS` that contains the partition that you want to have access to the CU and also has access to the CHPID you want to connect to the CU. Then, press Enter.

6. Update `Channel path IDs` to `C6` to define the Processor / CU connection (see Figure 13-5). CHPID C6 is the CHPID we defined in the previous example. Press Enter.

```
                             Select Processor / CU
+---------------------- Change Control Unit Definition -----------------------+
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Control unit number  . : 1C60        Type . . . . . . : OSC                  |
| Processor ID . . . . . : ARIES                                               |
| Channel Subsystem ID . : 2                                                   |
|                                                                              |
| Channel path IDs . . . . C6    __    __    __    __    __    __    __    +   |
| Link address . . . . . . ____  ____  ____  ____  ____  ____  ____  ____  +   |
|                                                                              |
| Unit address . . . . . . 00    __    __    __    __    __    __    __    +   |
| Number of units  . . . . 254   ___   ___   ___   ___   ___   ___   ___       |
|                                                                              |
| Logical address  . . . . __  + (same as CUADD)                               |
|                                                                              |
| Protocol . . . . . . . . __  + (D, S or S4)                                  |
| I/O concurrency level  . _   + (1, 2 or 3)                                   |
|                                                                              |
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap         |
| F12=Cancel                                                                   |
+------------------------------------------------------------------------------+
```

Figure 13-5 Control units: Change Control Unit Definition detail - OSC

7. HCD now shows the Modify Device Parameters panel where you can override the Unit Address (UA) numbers. For most OSA definitions, the UA starts at `00`.

8. Update `UA New` to `00` to define the Modify Device Parameters (see Figure 13-6), and press Enter.

```
+------------------------- Modify Device Parameters -------------------------+
|                                                    Row 1 of 3 More:      > |
| Command ===> __________________________________________ Scroll ===> CSR    |
|                                                                            |
| Specify or revise any changes to the device parameters in the list below.  |
| To view attached control units, scroll to the right.                       |
|                                                                            |
| Processor ID . . . . : ARIES                                               |
| Channel Subsystem ID : 2                                                   |
|                                                                            |
| ---------Device---------     ---UA----                 Preferred Exposure  |
| No., Range Type         SS+ Old New + Time-Out STADET CHPID +   Device     |
| 0700,016   3270-X        _   10  00    No       No     __                  |
| ***************************** Bottom of data ***************************** |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|  F1=Help       F2=Split      F3=Exit       F4=Prompt     F5=Reset          |
|  F7=Backward   F8=Forward    F9=Swap      F12=Cancel                       |
+----------------------------------------------------------------------------+
```

Figure 13-6 Control units: Modify Device Parameters - OSC

HCD now returns to the Select Processor / CU panel showing the CHPID (C6) connection definition (see Figure 13-7).

```
                           Select Processor / CU    Row 1 of 24 More:
Command ===> ___________________________________________ Scroll ===> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : 1C60     Control unit type . . . : OSC

             ---------------Channel Path ID . Link Address + ---------------
/ Proc.CSSID 1------ 2------ 3------ 4------ 5------ 6------ 7------ 8------
_ ARIES.0    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.1    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.2    C6      _______ _______ _______ _______ _______ _______ _______
_ ARIES.3    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.4    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.5    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.2    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.3    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.4    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.5    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.2    _______ _______ _______ _______ _______ _______ _______ _______
```

Figure 13-7 Processors: Select Processor / CU: CHPID to Link address connection - OSC

9. By pressing F20 (Right), you can see the other parts of the definition summary.

13.2.3 Defining 3270-X devices to an OSCONFIG

The OSCONFIG name is the part of an IODF that determines what devices a z/OS system can access when it undergoes an IPL. Additionally, the partition that the z/OS system is restarted in also must be able to access the CHPIDs that connect to the CUs and devices that match in the OSCONFIG.

The OSCONFIG also contains Esoterics device groups, which are defined in Eligible Device Tables (EDTs) within an OSCONFIG. OSA definitions usually do not use Esoterics.

Here are considerations for adding devices to an OSCONFIG:

- Adding a device to an OSCONFIG does not necessarily mean that the z/OS system can access that device.
- In this example, we add the predefined OSC devices 0700-070F (3270-X).

To define 3270-X devices to an OSCONFIG, complete the following steps:

1. From the main HCD panel, select option `1.5. I/O Devices`.
2. Scroll through the I/O Device List until you find the device number that you want to add to the OSCONFIG, or in the command line enter `L 0700`. In our example, we use `0700`.
3. Enter `c` next to one or more device numbers, and press Enter.
4. HCD displays the Change Device Definition panel where you can modify the CU that the devices are attached to (see Figure 13-8 on page 295). Press Enter.

```
+------------------------- Change Device Definition --------------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Device number  . . . . . . . : 0700  (0000 - FFFF)                          |
| Number of devices  . . . . . : 16                                           |
| Device type  . . . . . . . . : 3270-X                                       |
|                                                                             |
| Serial number  . . . . . . . . __________  +                                |
| Description  . . . . . . . . . ________________________________             |
|                                                                             |
| Volume serial number . . . . . ______  + (for DASD)                         |
|                                                                             |
| PPRC usage . . . . . . . . . . _  + (for DASD)                              |
|                                                                             |
| Connected to CUs . 1C60  ____  ____  ____  ____  ____  ____  ____   +       |
|                                                                             |
| ENTER to continue.                                                          |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-8 I/O Devices: Change Device Definition - OSC

5. HCD now displays the Device / Processor Definition panel where you may modify some of the device parameters relating to SS, UA, and the Explicit Device Candidate List (Figure 13-9).

```
+---------------------- Device / Processor Definition -----------------------+
|                                                                Row 1 of 1 |
| Command ===> __________________________________________ Scroll ===> CSR    |
|                                                                            |
| Select processors to change device/processor definitions, then press      |
| Enter.                                                                     |
|                                                                            |
| Device number  . . : 0700       Number of devices  . : 16                 |
| Device type  . . . : 3270-X                                                |
|                                                                            |
|                                          Preferred  Device Candidate List |
| / Proc.CSSID  SS+  UA+  Time-Out  STADET  CHPID +    Explicit       Null  |
| _ ARIES.2     0    00   No        No      __         No             ___   |
| *************************** Bottom of data ****************************** |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
```

Figure 13-9 I/O Devices: Device / Processor Definition continued - OSC

6. In the HCD panel, we define devices to the OSCONFIG. Scroll through the list of OSCONFIG definitions until you find the OSCONFIG that you want to add to the devices to, or in the command line enter `L ITSOTEST`. In our example, we use `ITSOTEST`.
7. Enter `s` next to the OSCONFIG, and press Enter.

   HCD displays the device parameters and features that are applicable to that device type. In our example, we add 3270-X devices to `ITSOTEST`.
8. Make the following updates to define the Device Parameter (see Figure 13-10), and press Enter:
   - Update `OFFLINE` to `No` (if you want these devices to be online during IPL time).
   - Update `DYNAMIC` to `Yes` (if you want the device to be dynamically changeable).
   - Update `LOCANY` to `Yes` (if the device UCB can be in 31-bit storage).
   - Update `DOCHAR` to `Yes` (if you want to use the US character set).

```
+-------------------- Define Device Parameters / Features --------------------+
|                                                              Row 1 of 22 |
| Command ===> ___________________________________________ Scroll ===> CSR    |
|                                                                             |
| Specify or revise the values below.                                         |
|                                                                             |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15                |
| Device number  . . : 0700         Number of devices  : 16                   |
| Device type  . . . : 3270-X                                                 |
|                                                                             |
| Parameter/                                                                  |
| Feature    Value +         R Description                                    |
| OFFLINE    No                Device considered online or offline at IPL     |
| DYNAMIC    Yes               Device has been defined to be dynamic          |
| LOCANY     Yes               UCB can reside in 31 bit storage               |
| ASCACHAR   No                ASCII A Character Generator                    |
| ASCBCHAR   No                ASCII B Character Generator                    |
| DOCHAR     Yes               United States English Character Generator      |
| FRCHAR     No                French Character Generator                     |
| GRCHAR     No                German Character Generator                     |
| KACHAR     No                Katakana Character Generator                   |
| UKCHAR     No                United Kingdom English Character Generator     |
| AUDALRM    No                Audible Alarm                                  |
+-----------------------------------------------------------------------------+
```

Figure 13-10 I/O Devices: Define Device Parameters / Features - OSC

9. The Assign/Unassign Device to Esoteric panel opens. You can specify which Esoteric (if any) that you want the devices to be added to. Press Enter (see Figure 13-11).

   In this example, we add only the OSC/3270-X devices to the OSCONFIG `ITSOTEST` and not to any Esoterics in this example.

```
+----------- Define Device to Operating System Configuration -----------+
|                                                            Row 2 of 15 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                        |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                        |
| Device number  . : 0700          Number of devices  : 16              |
| Device type  . . : 3270-X                                             |
|                                                                        |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                        |
| / Config. ID   Type     SS Description                     Defined    |
| _ ITSOTEST     MVS      0  ITSO test OSCONFIG for z15       Yes        |
| _ ZOSMAINT     MVS         z/OS Central Mgmt Image                     |
| _ ZOS22BAS     MVS         z/OS 2.2 Serverpac with P1D SSs             |
| _ ZOS22MLZ     MVS         z/OS 2.2 MLZ - clone of p1c                 |
| _ ZOS22MPL     MVS         z/OS 2.2 demo clone of p1g                  |
| _ ZOS22P0B     MVS         z/OS 2.2 Clone of ZOS22BAS                  |
| _ ZOS22P0C     MVS         z/OS 2.2 Serverpac with P1D SSs             |
| _ ZOS22P0D     MVS         z/OS 2.2 Clone of ZOS22P0B                  |
| _ ZOS23BAA     MVS         z/OS 2.3 based from ZOSMAINT                |
| _ ZOS23BAS     MVS         z/OS 2.3 base system                        |
| _ ZOS23P0F     MVS         z/OS 2.3 Base + Subsystems                  |
+------------------------------------------------------------------------+
```

Figure 13-11   I/O Devices: Define Device to Operating System Configuration - OSC

10. The final panel opens and shows that the devices are defined to the OSCONFIG. Press Enter to return to the I/O Device List.

13.2.4 Defining 3270-X devices to the Nucleus Initialization Program Console List within an OSCONFIG

The Nucleus Initialization Program Console List determines the device addresses that are eligible to receive Nucleus Initialization Program or IPL messages in the early startup stages of when z/OS is started.

The devices first must be defined to an OSCONFIG so that they can be added to a Nucleus Initialization Program Console List within an OSCONFIG.

The Nucleus Initialization Program Console List also determines which console receives the Nucleus Initialization Program/IPL messages first. If that console is unavailable, then the Nucleus Initialization Program tries the next device in the list until all devices in the list are tried.

If the Nucleus Initialization Program cannot write IPL messages to any 3270-X device in the list, then the messages are written to the Hardware Management Console (HMC) Operating System Messages panel.

To view these messages, complete the following steps:

1. Select the logical partition (LPAR) for IPL on the HMC.
2. Click the **>>** breakout symbol next to the LPAR name.
3. Select **Daily** → **Operating System Messages**, as shown in Figure 13-12.

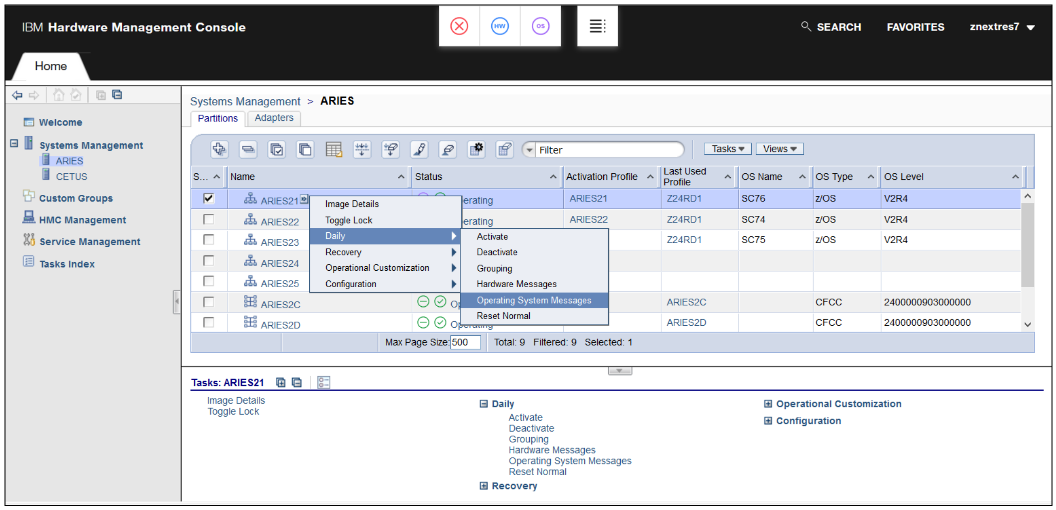

Figure 13-12 Operating System Messages

Commands and displays can be entered into the Command field (see Figure 13-13).

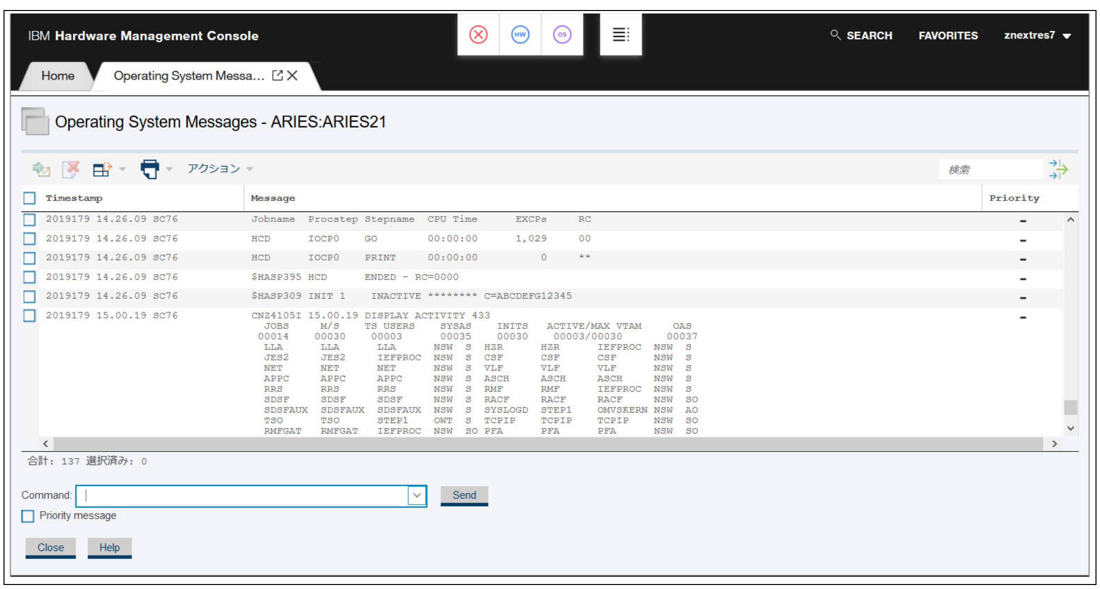

Figure 13-13 Operating System Messages command interface

Here are considerations for adding devices to a Nucleus Initialization Program Console List within an OSCONFIG:

- Adding a device to a Nucleus Initialization Program Console List within an OSCONFIG does not necessarily mean that Nucleus Initialization Program may write IPL messages to that device.
- The devices that are defined in the Nucleus Initialization Program Console List also need CU and CHPID access to the partition where z/OS is being started.

- On the HMC under OSA Advanced Facilities, the OSC (Open Systems Adapter Integrated Console Controller (ICC) (OSA-ICC) console Server and Session definitions must be defined and activated.
- A valid 3270-X session (that uses IBM PCOM or an equivalent 3270 emulator) also must be connected to the OSA-ICC Session. This configuration enables a valid session to be established to the OSA-ICC for Nucleus Initialization Program messages to be delivered to that device.
- In this example, we add the predefined OSC devices 0700-0701 (3270-X).

To define 3270-X devices to the Nucleus Initialization Program within an OSCONFIG, complete the following steps:

1. From the main HCD panel, select option `1.1. Operating system configurations` to display the Operating System Configuration List.
2. Scroll through the list of OSCONFIG definitions until you find the OSCONFIG that you want to add to the 3270-X devices to the Nucleus Initialization Program Console List, or in the command line enter `L ITSOTEST`. In our example, we use `ITSOTEST`.
3. Enter `n` next to the OSCONFIG, and press Enter.

   HCD displays the defined devices in the Nucleus Initialization Program Console List (see Figure 13-14).

```
+--------------------------- NIP Console List ----------------------------+
|   Goto  Backup  Query  Help                                              |
| ---------------------------------------------------------------------   |
|                                                                          |
| Command ===> _______________________________________ Scroll ===> CSR    |
|                                                                          |
| Select one or more consoles, then press Enter. To add, use F11.         |
|                                                                          |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15            |
|                                                                          |
|   Order   Device                                                         |
| / Number  Number  Device Type                                            |
| *************************** Bottom of data **************************** |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
```

Figure 13-14 OCSONFIGs: NIP Console List

In our example, there are no devices that are defined in the Nucleus Initialization Program Console List.

4. In the command line, enter `add` (see Figure 13-15) to add a 3270-X device to the Nucleus Initialization Program Console List.
5. Update `Device number of console` to `0700`, and press Enter.

```
+--------------------------- NIP Console List ----------------------------+
|   Goto  Backup  Query  Help                                              |
| ---------------------------------------------------------------------    |
|                                                                          |
| Command ===> _______________________________________ Scroll ===> CSR    |
|                                                                          |
| Select one or more consoles, then press Enter. To add, use F11.         |
|                                                                          |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15            |
|                  +-------------- Add NIP Console ---------------+        |
|   Order   Device |                                              |        |
| / Number  Number |                                              |        |
| **************** | Specify the following values.                | *****  |
|                  |                                              |        |
|                  | Device number of console . . . . . . 0700    |        |
|                  |                                              |        |
|                  | Order number . . . . . . . . . . . . 1       |        |
|                  |                                              |        |
|                  |                                              |        |
|                  |                                              |        |
|                  +----------------------------------------------+        |
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
```

Figure 13-15 OSCONFIGs: Add NIP Console

Because this device entry is the first one in the list, the order is 1 (see Figure 13-16 on page 301).

```
+--------------------------- NIP Console List ----------------------------+
|   Goto  Backup  Query  Help                                              |
| ----------------------------------------------------------------------  |
|                                                              Row 1 of 1 |
| Command ===> _______________________________________ Scroll ===> CSR    |
|                                                                          |
| Select one or more consoles, then press Enter. To add, use F11.         |
|                                                                          |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15            |
|                                                                          |
|   Order   Device                                                         |
| / Number  Number  Device Type                                            |
| _   1     0700    3270-X                                                 |
| ************************** Bottom of data ***************************** |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
```

Figure 13-16 OCSONFIGs: NIP Console added

6. Add device 0701 to the Nucleus Initialization Program Console List (see Figure 13-17).

```
+--------------------------- NIP Console List ----------------------------+
|   Goto  Backup  Query  Help                                              |
| ----------------------------------------------------------------------  |
|                                                              Row 1 of 2 |
| Command ===> _______________________________________ Scroll ===> CSR    |
|                                                                          |
| Select one or more consoles, then press Enter. To add, use F11.         |
|                                                                          |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15            |
|                                                                          |
|   Order   Device                                                         |
| / Number  Number  Device Type                                            |
| _   1     0700    3270-X                                                 |
| _   2     0701    3270-X                                                 |
| ************************** Bottom of data ***************************** |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
```

Figure 13-17 OCSONFIGs: Extra NIP Console added

13.2.5 Defining OSD CHPIDs

When defining an OSD connection, first you must determine which type of OSA-Express feature that you need for your configuration:

- Fiber optical cable-based features:
  - OSA-Express7S GbE SX or LX[2]
  - OSA-Express7S 10 GbE SR or LR[2]
  - OSA-Express7S 25 GbE SR
  - OSA-Express6S GbE SX or LX
  - OSA-Express6S 10 GbE SR or LR
  - OSA-Express6S 25 GbE SR
- Copper wire-based (unshielded twisted pair) feature:
  - OSA-Express7S 1000BASE-T[2]
  - OSA-Express6S 1000BASE-T

Here are considerations for a new OSD CHPID:

- CHPID.
- CHID.
- Channel path type.
- Operational mode.
- Description.
- Partition access list.
- For performance and redundancy, determine how many I/O cards of that feature are installed in the processor and to what PCIe ports on what CPC drawer does the I/O cards connect to. (For a list of installed hardware, see the PCHID/CHID report.)

To define an OSD CHPID and provide access to a partition, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a CHPID to, and press Enter.
3. Enter `s` next to the CSS ID that you want to add a CHPID to, and press Enter.
4. In the command line, enter `add` (see Figure 13-18 on page 303) to add a CHPID.
5. Make the following updates, and press Enter:
   - Update `Channel path ID` to `E1`.
   - Update `Channel ID` to `128`.
   - Update `Channel path type` to `OSD`.
   - Update `Operational mode` to `SHR`.
   - Update `Description` to the description that you want.

[2] Not supported by the z15 T02. The equivalent type of OSA-Express6S features can be used with the z15 T02.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : ARIES                                              |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 2                                                  |
|                                                                           |
| Channel path ID  . . . . E1    +           Channel ID  128  +             |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . OSD   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . FC#0445 OSA Express7s 10GbE SR                   |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-18 Processors: Add Channel Path - OSD

6. HCD now prompts you to specify `Will greater than 160 TCP/IP stacks be required for this channel?` The default is `No`, which we use for our example (see Figure 13-19). Press Enter.

```
+----------- Allow for more than 160 TCP/IP stacks -----------+
|                                                             |
|                                                             |
| Specify Yes to allow more than 160 TCP/IP stacks,           |
| otherwise specify No. Specifying Yes will cause priority    |
| queuing to be disabled.                                     |
|                                                             |
| Will greater than 160 TCP/IP stacks                         |
| be required for this channel?  . . . No                     |
|                                                             |
|                                                             |
+-------------------------------------------------------------+
```

Figure 13-19 Processors: Allow for more than 160 TCP/IP stacks - OSD

7. Next, HCD now prompts you to add or modify any physical network IDs. We do not use any physical network ID definitions for the OSD definition in this example.

8. Leave the default option for Physical Network IDs as blank fields (see Figure 13-20), and press Enter.

```
+--------------------- Add/Modify Physical Network IDs ---------------------+
|                                                                           |
|                                                                           |
| If the Channel ID (CHID) is associated to one or more physical networks,  |
| specify each physical network ID corresponding to each applicable         |
| physical port.                                                            |
|                                                                           |
| Physical network ID 1  . . ________________                               |
| Physical network ID 2  . . ________________                               |
| Physical network ID 3  . . ________________                               |
| Physical network ID 4  . . ________________                               |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-20 Processors: Add/Modify Physical Network IDs - OSD

9. HCD prompts you to select which partition the CHPID should have access to. Enter a forward slash (/) next to the partition that you want (see Figure 13-21), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                               Row 1 of 6 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the access list.          |
|                                                                           |
| Channel subsystem ID : 2                                                  |
| Channel path ID  . . : E1     Channel path type  . : OSD                 |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                   |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 2      ARIES21          1      OS    ARIES21 test OS partition          |
| / 2      ARIES22          2      CF/OS                                    |
| / 2      ARIES23          3      CF/OS                                    |
| / 2      ARIES24          4      CF/OS                                    |
| / 2      ARIES25          5      CF/OS                                    |
| / 2      ARIES26          6      CF/OS                                    |
| *************************** Bottom of data **************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-21 Processors: Define Access List - OSD

Because we select all partitions to the access list, we do not see the Define Candidate List panel, even though we defined the CHPID as `SHR`.

The HCD now returns to the Channel Path List panel and shows you the CHPID that was defined (see Figure 13-22).

```
                              Channel Path List      Row 1 of 4 More:      >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+           Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
```

Figure 13-22 Processors: Channel Path List - OSD

13.2.6 Defining OSD CHPID connections to an OSA control unit

The only way to define an OSA connection to its CU is direct connected.

You might want to connect the OSA CU definition to multiple CPCs even though the physical OSA is still unique to any one CPC. Also, you might want to span the OSA over multiple CSSs within a CPC.

Here are considerations for connecting an OSD CHPID to an OSA CU and its OSA/OSAD devices:

- Determine how many OSAs are required to provide a primary and secondary/backup network connection.
- The example connects to a predefined OSA CU (1E10), OSA devices 1E10 - 1E1E, and OSAD device 1E1F.

To define OSD CHPID connections to an OSA CU, complete the following steps:

1. From the main HCD panel, select option `1.4. Control units`.
2. Scroll through the CU list until you find the CU that you want to connect to, or in the command line enter `L 1E10`. In our example, we use `1E10`.
3. Enter `c` next to the CU definition, and press Enter.

4. Make any changes to the CU definition that you want (see Figure 13-23), and press Enter.

```
+----------------- Change Control Unit Definition ------------------+
|                                                                   |
|                                                                   |
| Specify or revise the following values.                           |
|                                                                   |
| Control unit number  . . . . 1E10  +                              |
|                                                                   |
| Control unit type  . . . . . OSA           +                      |
|                                                                   |
| Serial number  . . . . . . . __________  +                        |
| Description  . . . . . . . . 10G Fiber - AIRES                    |
|                                                                   |
| Connected to switches  . . . __  __  __  __  __  __  __  __  +    |
| Ports  . . . . . . . . . . . __  __  __  __  __  __  __  __  +    |
|                                                                   |
| Define more than eight ports . . 2   1.  Yes                      |
|                                      2.  No                       |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
+-------------------------------------------------------------------+
```

Figure 13-23 Control units: Change Control Unit Definition - OSD

HCD now shows the Select Processor / CU panel, where the connection is now made between the OSD CHPID (E1) and the CU (1E10).

5. Enter `c` next to the `Processor.CSS` that contains the partition that you want to access the CU and also access the CHPID that you want to connect to the control unit. Press Enter.

6. Update `Channel path IDs` to `E1` to define the Processor / CU connection (see Figure 13-24). CHPID E1 is the CHPID that we defined in the previous example. Press Enter.

```
                            Select Processor / CU
+---------------------- Change Control Unit Definition -----------------------+
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Control unit number  . : 1E10        Type . . . . . . : OSA                  |
| Processor ID . . . . . : ARIES                                               |
| Channel Subsystem ID . : 2                                                   |
|                                                                              |
| Channel path IDs . . . . E1    __    __    __    __    __    __    __    +   |
| Link address . . . . . . ____  ____  ____  ____  ____  ____  ____  ____  +   |
|                                                                              |
| Unit address . . . . . . 00    __    __    __    __    __    __    __    +   |
| Number of units  . . . . 255   ___   ___   ___   ___   ___   ___   ___       |
|                                                                              |
| Logical address  . . . . __  + (same as CUADD)                               |
|                                                                              |
| Protocol . . . . . . . . __  + (D, S or S4)                                  |
| I/O concurrency level  . _   + (1, 2 or 3)                                   |
|                                                                              |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
```

Figure 13-24 Control units: Change Control Unit Definition detail - OSD

7. HCD now shows the Modify Device Parameters panel where you may override the UA numbers. For most OSA definitions, the UA starts at `00`.

8. Make the following updates to define the Modify Device Parameters (see Figure 13-25), and press Enter:
   - Update `UA New` to `00` for the OSA device type.
   - Update `UA New` to `FE` for the OSAD device type.

```
+------------------------- Modify Device Parameters --------------------------+
|                                                    Row 1 of 2 More:       > |
| Command ===> __________________________________________ Scroll ===> CSR     |
|                                                                              |
| Specify or revise any changes to the device parameters in the list below.  |
| To view attached control units, scroll to the right.                        |
|                                                                              |
| Processor ID . . . . : ARIES                                                |
| Channel Subsystem ID : 2                                                    |
|                                                                              |
| ---------Device---------     ---UA----                 Preferred Exposure  |
| No., Range Type         SS+ Old New + Time-Out STADET CHPID +   Device      |
| 1E10,015   OSA           _   10  00    No       No     __                   |
| 1E1F,001   OSAD          _   1F  FE    No       No     __                   |
| ***************************** Bottom of data ***************************** |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
```

Figure 13-25 Control units: Modify Device Parameters - OSD

HCD now returns to the Select Processor / CU panel, which shows the CHPID (E1) connection definition (see Figure 13-26 on page 309).

```
 Select Processor / CU    Row 1 of 24 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : 1E10     Control unit type . . . : OSA

             ---------------Channel Path ID . Link Address + ---------------
/ Proc.CSSID 1------ 2------ 3------ 4------ 5------ 6------ 7------ 8------
_ ARIES.0    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.1    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.2    E1      _______ _______ _______ _______ _______ _______ _______
_ ARIES.3    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.4    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.5    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.2    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.3    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.4    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.5    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.2    _______ _______ _______ _______ _______ _______ _______ _______
```

Figure 13-26 Processors: Select Processor / CU: CHPID to Link address connection - OSD

Press F20 (Right) to see the other parts of the definition summary.

13.2.7 Defining OSA and OSAD devices to an OSCONFIG

The OSCONFIG name is the part of an IODF that determines what devices a z/OS system may access when it undergoes an IPL. Additionally, the partition that the z/OS system is started in also must have access to the CHPIDs that connect to the CUs and devices that match in the OSCONFIG.

The OSCONFIG also contains Esoterics device groups, which are defined in EDTs within an OSCONFIG. OSA definitions usually do not use Esoterics.

Here are considerations for adding devices to an OSCONFIG:

- Adding a device to an OSCONFIG does not necessarily mean that the z/OS system has access to that device.
- In this example, we add the predefined OSA devices 1E10 - 1E1F (OSA/OSAD).

To define OSA and OSAD devices to an OSCONFIG, complete the following steps:

1. From the main HCD panel, select option `1.5. I/O Devices`.
2. Scroll through the I/O Device List until you find the device number that you want to add to the OSCONFIG, or in the command line enter `L 1E10`. In our example, we use `1E10`.

   Because OSA and OSAD are two different device types, they must be added separately to the OSCONFIG.
3. Enter `c` next to one or more device numbers, and press Enter.

4. HCD displays the Change Device Definition panel, where you may modify the CU that the devices are attached to (see Figure 13-27). Press Enter.

```
+------------------------ Change Device Definition -------------------------+
|                                                                          |
|                                                                          |
| Specify or revise the following values.                                  |
|                                                                          |
| Device number . . . . . . . : 1E10  (0000 - FFFF)                        |
| Number of devices  . . . . . : 15                                        |
| Device type  . . . . . . . . : OSA                                       |
|                                                                          |
| Serial number  . . . . . . . . __________  +                             |
| Description  . . . . . . . . . ________________________________          |
|                                                                          |
| Volume serial number . . . . . ______  + (for DASD)                      |
|                                                                          |
| PPRC usage . . . . . . . . . . _  + (for DASD)                           |
|                                                                          |
| Connected to CUs . 1E10  ____  ____  ____  ____  ____  ____  ____  +     |
|                                                                          |
| ENTER to continue.                                                       |
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
```

Figure 13-27 I/O Devices: Change Device Definition - OSD

5. HCD now displays the Device / Processor Definition panel, where you may modify some of the Device parameters relating to SS, UA, and the Explicit Device Candidate List. Type `c` next to the `Proc.CCSID` item if you want to modify any of these parameters (see Figure 13-28 on page 311), or press Enter to accept the defaults.

```
+---------------------- Device / Processor Definition -----------------------+
|                                                                  Row 1 of 1 |
| Command ===> __________________________________________ Scroll ===> CSR     |
|                                                                             |
| Select processors to change device/processor definitions, then press        |
| Enter.                                                                      |
|                                                                             |
| Device number  . . : 1E10       Number of devices  . : 15                   |
| Device type  . . . : OSA                                                    |
|                                                                             |
|                                           Preferred  Device Candidate List |
| / Proc.CSSID  SS+  UA+  Time-Out  STADET  CHPID +    Explicit        Null  |
| _ ARIES.2     0    00   No        No      __         No              ___   |
| ***************************** Bottom of data ****************************** |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-28 I/O Devices: Device / Processor Definition continued - OSD

6. The HCD panel opens, where we define devices to the OSCONFIG. Scroll through the list of OSCONFIG definitions until you find the OSCONFIG that you want to add the devices to, or in the command line enter `L ITSOTEST`. In our example, we use `ITSOTEST`.
7. Enter `s` next to the OSCONFIG, and press Enter.

   HCD displays the device parameters and features that are applicable to that device type. In our example, we add OSA devices to `ITSOTEST`.

8. Make the following updates to define the device parameter (see Figure 13-29), and press Enter:
   - Update `OFFLINE` to `No` (if you want these devices to be online during IPL time).
   - Update `DYNAMIC` to `Yes` (if you want the device to be changeable dynamically).
   - Update `LOCANY` to `Yes` (if the device UCB can be in 31-bit storage).

```
+-------------------- Define Device Parameters / Features --------------------+
|                                                                  Row 1 of 3 |
| Command ===> ___________________________________________ Scroll ===> CSR    |
|                                                                             |
| Specify or revise the values below.                                         |
|                                                                             |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15                |
| Device number  . . : 1E10         Number of devices  : 15                   |
| Device type  . . . : OSA                                                    |
|                                                                             |
| Parameter/                                                                  |
| Feature    Value +          R Description                                   |
| OFFLINE    No                 Device considered online or offline at IPL    |
| DYNAMIC    Yes                Device has been defined to be dynamic         |
| LOCANY     Yes                UCB can reside in 31 bit storage              |
| **************************** Bottom of data ****************************** |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-29 I/O Devices: Define Device Parameters / Features - OSD

9. The Assign/Unassign Device to Esoteric panel opens, where you can specify which Esoteric (if any) that you want the devices to be added to. We add only the OSA/OSAD devices to the OSCONFIG `ITSOTEST` and not to any Esoterics in this example. Press Enter (see Figure 13-30 on page 313).

```
+----------- Define Device to Operating System Configuration -----------+
|                                                             Row 1 of 15 |
| Command ===> _____________________________________ Scroll ===> CSR      |
|                                                                         |
| Select OSs to connect or disconnect devices, then press Enter.          |
|                                                                         |
| Device number  . : 1E10          Number of devices  : 15                |
| Device type  . . : OSA                                                  |
|                                                                         |
| Subchannel Sets used in processor configurations  : 0                   |
|                                                                         |
| / Config. ID   Type     SS Description                      Defined     |
| _ ITSO         MVS      0  All ITSO devices                 Yes         |
| _ ITSOTEST     MVS      0  ITSO test OSCONFIG for z15       Yes         |
| _ ZOSMAINT     MVS      0  z/OS Central Mgmt Image          Yes         |
| _ ZOS22BAS     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes         |
| _ ZOS22MLZ     MVS      0  z/OS 2.2 MLZ - clone of p1c      Yes         |
| _ ZOS22MPL     MVS      0  z/OS 2.2 demo clone of p1g       Yes         |
| _ ZOS22P0B     MVS      0  z/OS 2.2 Clone of ZOS22BAS       Yes         |
| _ ZOS22P0C     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes         |
| _ ZOS22P0D     MVS      0  z/OS 2.2 Clone of ZOS22P0B       Yes         |
| _ ZOS23BAA     MVS      0  z/OS 2.3 based from ZOSMAINT     Yes         |
| _ ZOS23BAS     MVS      0  z/OS 2.3 base system            Yes         |
+-------------------------------------------------------------------------+
```

Figure 13-30 I/O Devices: Define Device to Operating System Configuration - OSD

10. The final panel opens and shows that the devices are defined to the OSCONFIG. Press Enter to return to the I/O Device List.

11.Perform the same action of adding OSAD device 1E1F to OSCONFIG ITSOTEST. Press Enter (see Figure 13-31).

```
+----------- Define Device to Operating System Configuration -----------+
|                                                            Row 1 of 15 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                        |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                        |
| Device number  . : 1E1F          Number of devices  : 1               |
| Device type  . . : OSAD                                               |
|                                                                        |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                        |
| / Config. ID   Type     SS Description                     Defined    |
| _ ITSO         MVS      0  All ITSO devices                Yes        |
| _ ITSOTEST     MVS      0  ITSO test OSCONFIG for z15      Yes        |
| _ ZOSMAINT     MVS      0  z/OS Central Mgmt Image         Yes        |
| _ ZOS22BAS     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes       |
| _ ZOS22MLZ     MVS      0  z/OS 2.2 MLZ - clone of p1c      Yes       |
| _ ZOS22MPL     MVS      0  z/OS 2.2 demo clone of p1g       Yes       |
| _ ZOS22P0B     MVS      0  z/OS 2.2 Clone of ZOS22BAS       Yes       |
| _ ZOS22P0C     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes       |
| _ ZOS22P0D     MVS      0  z/OS 2.2 Clone of ZOS22P0B       Yes       |
| _ ZOS23BAA     MVS      0  z/OS 2.3 based from ZOSMAINT     Yes       |
| _ ZOS23BAS     MVS      0  z/OS 2.3 base system             Yes       |
+------------------------------------------------------------------------+
```

Figure 13-31 I/O Devices: Define Device to Operating System Configuration continued - OSD

13.2.8 Defining OSE CHPIDs

When defining an OSE connection, first you must determine that one of the following copper wire-based (unshielded twisted pair) features is available:

- OSA-Express7S 1000BASE-T[3]
- OSA-Express6S 1000BASE-T

Here are considerations for a new OSE CHPID:

- CHPID.
- CHID.
- Channel path type.
- Operational mode.
- Description.
- Partition access list.
- For performance and redundancy, determine how many I/O cards of that feature are installed in the processor and to what PCIe ports on what CPC drawer does the I/O cards connect to. (For a list of installed hardware, see the PCHID/CHID report.)

To define an OSE CHPID and provide access to a partition, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a CHPID to, and press Enter.
3. Enter `s` next to the CSS ID that you want to add a CHPID to, and press Enter.
4. In the command line, enter `add` (see Figure 13-32 on page 315) to add a CHPID.

[3] Not supported by the z15 T02. The equivalent type of OSA-Express6S features can be used with the z15 T02.

5. Make the following updates and press Enter:

   – Update `Channel path ID` to `C3`.
   – Update `Channel ID` to `1BC`.
   – Update `Channel path type` to `OSE`.
   – Update `Operational mode` to `SHR`.
   – Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : ARIES                                              |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 2                                                  |
|                                                                           |
| Channel path ID  . . . . C3    +           Channel ID  1BC  +             |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . OSE   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . FC#0446 OSA Express7S 1000Base-T                |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-32   Processors: Add Channel Path - OSE

6. HCD now prompts you to select which partition that the CHPID should have access to. Enter a forward slash (/) next to the partition that you want (see Figure 13-33), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                                 Row 1 of 6 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                            |
| Select one or more partitions for inclusion in the access list.           |
|                                                                            |
| Channel subsystem ID : 2                                                   |
| Channel path ID  . . : C3     Channel path type  . : OSE                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                            |
| / CSS ID Partition Name   Number Usage Description                         |
| / 2      ARIES21          1      OS    ARIES21 test OS partition           |
| _ 2      ARIES22          2      CF/OS                                      |
| _ 2      ARIES23          3      CF/OS                                      |
| _ 2      ARIES24          4      CF/OS                                      |
| _ 2      ARIES25          5      CF/OS                                      |
| _ 2      ARIES26          6      CF/OS                                      |
| *************************** Bottom of data **************************** |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
```

Figure 13-33 Processors: Define Access List - OSE

7. Because we have more that one partition that is defined in this CSS, HCD prompts us to define any Candidate list access. In our example, we do not define any Candidate list access (see Figure 13-34 on page 317). Press Enter.

```
+-------------------------- Define Candidate List --------------------------+
|                                                                Row 1 of 5 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the candidate list.        |
|                                                                           |
| Channel subsystem ID : 2                                                  |
| Channel path ID  . . : C3     Channel path type  . : OSE                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| _ 2      ARIES22          2      CF/OS                                    |
| _ 2      ARIES23          3      CF/OS                                    |
| _ 2      ARIES24          4      CF/OS                                    |
| _ 2      ARIES25          5      CF/OS                                    |
| _ 2      ARIES26          6      CF/OS                                    |
| *************************** Bottom of data ****************************  |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-34 Processors: Define Access List - OSE

The HCD returns to the Channel Path List panel and shows you the CHPID that was defined (see Figure 13-35).

```
                              Channel Path List      Row 1 of 5 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
```

Figure 13-35 Processors: Channel Path List - OSE

13.2.9 Defining OSE CHPID connections to an OSA control unit

The only way to define an OSA connection to its CU is direct connected.

You might want to connect the OSA CU definition to multiple CPCs even though the physical OSA is still unique to any one CPC. Also, you might want to span the OSA over multiple CSSs within a CPC.

Here are considerations for connecting an OSE CHPID to an OSA CU and its OSA/OSAD devices:

- Determine how many OSAs are required to provide a primary and secondary/backup network connection.
- This example connects to a predefined OSA CU (1C30), OSA devices 1C30 - 1C3E, and OSAD device 1C3F.

To define OSE CHPID connections to an OSA CU, complete the following steps:

1. From the main HCD panel, select option `1.4. Control units`.
2. Scroll through the CU list until you find the CU that you want to connect to, or in the command line enter `L 1C30`. In our example, we use `1C30`.
3. Enter `c` next to the CU definition, and press Enter.
4. Make any changes to the CU definition that you want (see Figure 13-36), and press Enter.

```
+----------------- Change Control Unit Definition ------------------+
|                                                                    |
|                                                                    |
| Specify or revise the following values.                            |
|                                                                    |
| Control unit number  . . . . 1C30  +                               |
|                                                                    |
| Control unit type  . . . . . OSA            +                      |
|                                                                    |
| Serial number  . . . . . . . __________  +                         |
| Description  . . . . . . . . 1KBT Copper - AIRES                   |
|                                                                    |
| Connected to switches  . . . __ __ __ __ __ __ __ __  +            |
| Ports  . . . . . . . . . . . __ __ __ __ __ __ __ __  +            |
|                                                                    |
| Define more than eight ports . . 2   1.  Yes                       |
|                                      2.  No                        |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

Figure 13-36 Control units: Change Control Unit Definition - OSE

5. HCD now shows the Select Processor / CU panel, which is where the connection is now made between the OSE CHPID (C3) and the CU (1C30). Enter `c` next to the `Processor.CSS` that contains the partition that you want to access the CU and also access the CHPID that you want to connect to the CU. Press Enter.

6. Update `Channel path IDs` to `C3` to define the Processor / CU connection (see Figure 13-37). CHPID C3 is the CHPID that we defined in the previous example. Press Enter.

```
                              Select Processor / CU
+---------------------- Change Control Unit Definition -----------------------+
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Control unit number  . : 1C30        Type . . . . . . : OSA                  |
| Processor ID . . . . . : ARIES                                               |
| Channel Subsystem ID . : 2                                                   |
|                                                                              |
| Channel path IDs . . . . C3    __    __    __    __    __    __    __     +  |
| Link address . . . . . . ____  ____  ____  ____  ____  ____  ____  ____   +  |
|                                                                              |
| Unit address . . . . . . 00    __    __    __    __    __    __    __     +  |
| Number of units  . . . . 255   ___   ___   ___   ___   ___   ___   ___        |
|                                                                              |
| Logical address  . . . . __  + (same as CUADD)                               |
|                                                                              |
| Protocol . . . . . . . . __  + (D, S or S4)                                  |
| I/O concurrency level  . _   + (1, 2 or 3)                                   |
|                                                                              |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
```

Figure 13-37 Control units: Change Control Unit Definition detail - OSE

7. HCD now shows the Modify Device Parameters panel, where you may override the UA numbers. For OSA definitions, the UA usually starts at `00`.

8. Make the following updates to define the Modify Device Parameters (see Figure 13-38), and press Enter:

   – Update `UA New` to `00` for the OSA device type.
   – Update `UA New` to `FE` for the OSAD device type.

```
+------------------------- Modify Device Parameters -------------------------+
|                                                  Row 1 of 2 More:       > |
| Command ===> __________________________________________ Scroll ===> CSR   |
|                                                                           |
| Specify or revise any changes to the device parameters in the list below. |
| To view attached control units, scroll to the right.                      |
|                                                                           |
| Processor ID . . . . : ARIES                                              |
| Channel Subsystem ID : 2                                                  |
|                                                                           |
| ---------Device---------     ---UA----                Preferred Exposure |
| No., Range Type          SS+ Old New + Time-Out STADET CHPID +   Device   |
| 1C30,015   OSA           _   30  00    No       No     __                 |
| 1C3F,001   OSAD          _   3F  FE    No       No     __                 |
| ***************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-38 Control units: Modify Device Parameters - OSE

HCD returns to the Select Processor / CU panel, which shows the CHPID (C3) connection definition (see Figure 13-39 on page 321).

```
                             Select Processor / CU    Row 1 of 24 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : 1C30     Control unit type . . . : OSA

             ---------------Channel Path ID . Link Address + ---------------
/ Proc.CSSID 1------ 2------ 3------ 4------ 5------ 6------ 7------ 8------
_ ARIES.0    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.1    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.2    C3      _______ _______ _______ _______ _______ _______ _______
_ ARIES.3    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.4    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.5    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.2    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.3    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.4    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.5    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.2    _______ _______ _______ _______ _______ _______ _______ _______
```

Figure 13-39 Processors: Select Processor / CU: CHPID to Link address connection - OSE

9. By pressing F20 (Right), you can see the other parts of the definition summary.

13.2.10 Defining OSA and OSAD devices to an OSCONFIG

The OSCONFIG name is the part of an IODF that determines what devices a z/OS system can access when it undergoes an IPL. Additionally, the partition that the z/OS system is started in also must have access to the CHPIDs that connect to the CUs and devices that match in the OSCONFIG.

The OSCONFIG also contains Esoterics device groups, which are defined in EDTs within an OSCONFIG. OSA definitions usually do not use Esoterics.

Here are considerations for adding devices to an OSCONFIG:

- Adding a device to an OSCONFIG does not necessarily mean that the z/OS system has access to that device.
- In this example, we add the predefined OSA devices 1C30 - 1C3F (OSA/OSAD).

To define OSA and OSAD devices to an OSCONFIG, complete the following steps:

1. From the main HCD panel, select option `1.5. I/O Devices`.
2. Scroll through the I/O Device List until you find the device number that you want to add to the OSCONFIG, or in the command line enter `L 1C30`. In our example, we use `1C30`.

   Because OSA and OSAD are two different device types, they must be added separately to the OSCONFIG.
3. Enter `c` next to the device numbers, and press Enter.

4. HCD displays the Change Device Definition panel where you may modify the CU that the devices are attached to (see Figure 13-40). Press Enter.

```
+------------------------ Change Device Definition -------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Device number  . . . . . . . : 1C30  (0000 - FFFF)                        |
| Number of devices  . . . . . : 15                                         |
| Device type  . . . . . . . . : OSA                                        |
|                                                                           |
| Serial number  . . . . . . . . __________  +                              |
| Description  . . . . . . . . . ________________________________           |
|                                                                           |
| Volume serial number . . . . . ______  + (for DASD)                       |
|                                                                           |
| PPRC usage . . . . . . . . . . _  + (for DASD)                            |
|                                                                           |
| Connected to CUs . 1C30  ____  ____  ____  ____  ____  ____  ____  +      |
|                                                                           |
| ENTER to continue.                                                        |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-40 I/O Devices: Change Device Definition - OSE

5. HCD now displays the Device / Processor Definition panel where you may modify some of the device parameters relating to SS, UA, and the Explicit Device Candidate List. Type `c` next to the `Proc.CCSID` item if you want to modify any of these parameters (see Figure 13-41 on page 323), or press Enter to accept the defaults.

```
+---------------------- Device / Processor Definition -----------------------+
|                                                                  Row 1 of 1 |
| Command ===> __________________________________________ Scroll ===> CSR     |
|                                                                             |
| Select processors to change device/processor definitions, then press        |
| Enter.                                                                      |
|                                                                             |
| Device number  . . : 1C30       Number of devices  . : 15                   |
| Device type  . . . : OSA                                                    |
|                                                                             |
|                                          Preferred  Device Candidate List |
| / Proc.CSSID  SS+  UA+  Time-Out  STADET  CHPID +    Explicit        Null  |
| _ ARIES.2     0    00   No        No      __         No              ___   |
| **************************** Bottom of data **************************** |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-41 I/O Devices: Device / Processor Definition continued - OSE

6. Next is the HCD panel, where we define devices to the OSCONFIG. Scroll through the list of OSCONFIG definitions until you find the OSCONFIG that you want to add the devices to, or in the command line enter `L ITSOTEST`. In our example, we use `ITSOTEST`.
7. Enter `s` next to the OSCONFIG, and press Enter.

   HCD displays the Device Parameters and Features applicable to that particular device type. In our example, we add OSA devices to `ITSOTEST`.

8. Make the following updates to define the Device Parameter (see Figure 13-42), and press Enter:
   - Update `OFFLINE` to `No` (if you want these devices to be online during IPL time).
   - Update `DYNAMIC` to `Yes` (if you want the device to be changeable dynamically).
   - Update `LOCANY` to `Yes` (if the device UCB can be in 31-bit storage).

```
+-------------------- Define Device Parameters / Features --------------------+
|                                                                  Row 1 of 3 |
| Command ===> ___________________________________________ Scroll ===> CSR    |
|                                                                             |
| Specify or revise the values below.                                         |
|                                                                             |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15                |
| Device number  . . : 1C30         Number of devices  : 15                   |
| Device type  . . . : OSA                                                    |
|                                                                             |
| Parameter/                                                                  |
| Feature    Value +          R Description                                   |
| OFFLINE    No                 Device considered online or offline at IPL    |
| DYNAMIC    Yes                Device has been defined to be dynamic         |
| LOCANY     Yes                UCB can reside in 31 bit storage              |
| ***************************** Bottom of data ****************************** |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-42 I/O Devices: Define Device Parameters / Features - OSE

9. The Assign/Unassign Device to Esoteric panel opens, where you can specify which Esoteric (if any) that you want the devices to be added to. We add only the OSA/OSAD devices to the OSCONFIG `ITSOTEST` and not to any Esoterics in this example. Press Enter (see Figure 13-43).

```
+----------- Define Device to Operating System Configuration -----------+
|                                                           Row 1 of 15 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                       |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                       |
| Device number  . : 1C30          Number of devices  : 15              |
| Device type  . . : OSA                                                |
|                                                                       |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                       |
| / Config. ID   Type     SS Description                    Defined     |
| _ ITSO         MVS      0  All ITSO devices               Yes         |
| _ ITSOTEST     MVS      0  ITSO test OSCONFIG for z15     Yes         |
| _ ZOSMAINT     MVS      0  z/OS Central Mgmt Image        Yes         |
| _ ZOS22BAS     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes       |
| _ ZOS22MLZ     MVS      0  z/OS 2.2 MLZ - clone of p1c    Yes         |
| _ ZOS22MPL     MVS      0  z/OS 2.2 demo clone of p1g     Yes         |
| _ ZOS22P0B     MVS      0  z/OS 2.2 Clone of ZOS22BAS     Yes         |
| _ ZOS22P0C     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes       |
| _ ZOS22P0D     MVS      0  z/OS 2.2 Clone of ZOS22P0B     Yes         |
| _ ZOS23BAA     MVS      0  z/OS 2.3 based from ZOSMAINT   Yes         |
| _ ZOS23BAS     MVS      0  z/OS 2.3 base system           Yes         |
+-----------------------------------------------------------------------+
```

Figure 13-43 I/O Devices: Define Device to Operating System Configuration - OSE

10. The final panel opens and show that the devices are defined to the OSCONFIG. Press Enter to return to the I/O Device List.

11. Now, perform the same action of adding an OSAD device `1C3F` to OSCONFIG `ITSOTEST`.

12. Press Enter (see Figure 13-44).

```
+----------- Define Device to Operating System Configuration -----------+
|                                                             Row 1 of 15 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                       |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                       |
| Device number  . : 1C3F          Number of devices  : 1               |
| Device type  . . : OSAD                                               |
|                                                                       |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                       |
| / Config. ID   Type     SS Description                    Defined     |
| _ ITSO         MVS      0  All ITSO devices               Yes         |
| _ ITSOTEST     MVS      0  ITSO test OSCONFIG for z15     Yes         |
| _ ZOSMAINT     MVS      0  z/OS Central Mgmt Image        Yes         |
| _ ZOS22BAS     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes       |
| _ ZOS22MLZ     MVS      0  z/OS 2.2 MLZ - clone of p1c    Yes         |
| _ ZOS22MPL     MVS      0  z/OS 2.2 demo clone of p1g     Yes         |
| _ ZOS22P0B     MVS      0  z/OS 2.2 Clone of ZOS22BAS     Yes         |
| _ ZOS22P0C     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes       |
| _ ZOS22P0D     MVS      0  z/OS 2.2 Clone of ZOS22P0B     Yes         |
| _ ZOS23BAA     MVS      0  z/OS 2.3 based from ZOSMAINT   Yes         |
| _ ZOS23BAS     MVS      0  z/OS 2.3 base system          Yes         |
+-----------------------------------------------------------------------+
```

Figure 13-44 I/O Devices: Define Device to Operating System Configuration continued - OSE

13.3 IQD CHPIDs for HiperSockets

This section describes the process to define IQD CHPIDs and their CUs and devices.

13.3.1 Defining IQD CHPIDs

When you define HiperSockets, use the CHPID type of IQD Communication. IQD CHPID also requires the virtual channel ID (VCHID) statement. The valid range for the VCHIDs are 7C0 - 7FF.

Like ICP CHPIDs, IQD CHPIDs are defined logically and internally to the processor and require no installed hardware (PCHIDs). However, a maximum of up to 32 high-speed virtual local area network (VLAN) attachments may be defined.

Each of the logical IQD VCHIDs can support only one CHPID, but the CHPIDs may be spanned across multiple CSSs.

Here are considerations for a new IQD CHPID:

- CHPID
- VCHID
- Channel path type
- Operational mode
- Description
- Partition access list

To define an IQD CHPID and provide access to a partition, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Type `s` next to the processor that you want to add a CHPID to, and press Enter.
3. Type `s` next to the CSS ID that you want to add a CHPID to, and press Enter.
4. In the command line, enter `add` (see Figure 13-45) to add a CHPID.
5. Make the following updates and press Enter:
   - Update `Channel path ID` to `F0`.
   - Update `Channel ID` to `7E0`.
   - Update `Channel path type` to `IQD`.
   - Update `Operational mode` to `SHR`.
   - Update `Description` to the description that you want.

```
+--------------------------- Add Channel Path ----------------------------+
|                                                                         |
|                                                                         |
| Specify or revise the following values.                                 |
|                                                                         |
| Processor ID . . . . : ARIES                                            |
| Configuration mode . : LPAR                                             |
| Channel Subsystem ID : 2                                                |
|                                                                         |
| Channel path ID  . . . . F0    +           Channel ID  7E0  +           |
| Number of CHPIDs . . . . 1                                              |
| Channel path type  . . . IQD   +                                        |
| Operation mode . . . . . SHR   +                                        |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________  +     |
| Description  . . . . . . IQD Internal Queued Direct Comms               |
|                                                                         |
| Specify the following values only if connected to a switch:             |
| Dynamic entry switch ID  __  + (00 - FF)                                |
| Entry switch ID  . . . . __  +                                          |
| Entry port . . . . . . . __  +                                          |
|                                                                         |
|                                                                         |
+-------------------------------------------------------------------------+
```

Figure 13-45 Processors: Add Channel Path - IQD

HCD now prompts you to specify the IQD Channel Parameters, where you set the maximum frame size in KB and what IQD function is used.

6. Leave the default option of `16` for the Maximum frame size, and select option `1. Basic HiperSockets` for the IQD function (see Figure 13-46). Press Enter.

```
+------------------- Specify IQD Channel Parameters --------------------+
|                                                                        |
|                                                                        |
| Specify or revise the values below.                                    |
|                                                                        |
| Maximum frame size in KB . . . . . . 16  +                             |
|                                                                        |
| IQD function . . . . . . . . . . . . 1   1.  Basic HiperSockets        |
|                                          2.  IEDN Access (IQDX)        |
|                                          3.  External Bridge           |
|                                                                        |
| Physical network ID  . . . . . . . . ________________                  |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
+------------------------------------------------------------------------+
```

Figure 13-46 Processors: Specify IQD Channel Parameters - IQD

HCD prompts you to select which partitions the CHPID should have access to.

7. Type forward slash (/) next to the needed partitions (see Figure 13-47), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                                Row 1 of 6 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                            |
| Select one or more partitions for inclusion in the access list.            |
|                                                                            |
| Channel subsystem ID : 2                                                   |
| Channel path ID  . . : F0     Channel path type  . : IQD                   |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                     |
|                                                                            |
| / CSS ID Partition Name   Number Usage Description                         |
| / 2      ARIES21          1      OS    ARIES21 test OS partition           |
| / 2      ARIES22          2      CF/OS                                     |
| _ 2      ARIES23          3      CF/OS                                     |
| _ 2      ARIES24          4      CF/OS                                     |
| _ 2      ARIES25          5      CF/OS                                     |
| _ 2      ARIES26          6      CF/OS                                     |
| *************************** Bottom of data ***************************** |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
```

Figure 13-47 Processors: Define Access List - IQD

HCD now displays the Define Candidate List panel. In our example, we do not select any Candidate LPARs for this IQD CHPID. Press Enter.

The HCD returns to the Channel Path List and show you the CHPID that was defined (see Figure 13-48).

```
                              Channel Path List      Row 1 of 6 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
******************************* Bottom of data *******************************
```

Figure 13-48 Processors: Channel Path List - IQD

13.3.2 Defining IQD CHPID connections to an IQD control unit

The only way to define an IQD connection to its CU is direct connected. You might want to span the IQD CHPID over multiple CSSs within a CPC.

Here are considerations for connecting an IQD CHPID to an IQD CU and its IQD devices:

- Determine how many IQDs are required to provide the required HiperSocket bandwidth.
- In this example, we connect to a predefined IQD CU (F000) and IQD devices 0FA0 - 0FBF.

To define IQD CHPID connections to an IQD CU, complete the following steps:

1. From the main HCD panel, select option `1.4. Control units`.
2. Scroll through the CU list until you find the CU that you want to connect to, or in the command line enter `L F000`. In our example, we use `F000`.
3. Enter `c` next to the CU definition, and press Enter.

4. Make any changes to the CU definition that you want (see Figure 13-49), and press Enter.

```
+----------------- Change Control Unit Definition ------------------+
|                                                                    |
|                                                                    |
| Specify or revise the following values.                            |
|                                                                    |
| Control unit number  . . . . F000  +                               |
|                                                                    |
| Control unit type  . . . . . IQD          +                        |
|                                                                    |
| Serial number  . . . . . . . __________  +                         |
| Description  . . . . . . . . ________________________________      |
|                                                                    |
| Connected to switches  . . . __ __ __ __ __ __ __ __  +            |
| Ports  . . . . . . . . . . . __ __ __ __ __ __ __ __  +            |
|                                                                    |
| Define more than eight ports . . 2   1.  Yes                       |
|                                      2.  No                        |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

Figure 13-49 Control units: Change Control Unit Definition - IQD

5. HCD now shows the Select Processor / CU panel. This panel is where the connection is made between the IQD CHPID (F0) and the CU (F100). Enter `c` next to the `Processor.CSS` that contains the partition that you want to access the CU and the CHPID that you want to connect to the CU. Press Enter.

6. Update Channel path ID `F0` to define the Processor / CU connection (see Figure 13-50), and press Enter.

```
 Select Processor / CU
+---------------------- Change Control Unit Definition -----------------------+
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Control unit number  . : F000        Type . . . . . . : IQD                  |
| Processor ID . . . . . : ARIES                                               |
| Channel Subsystem ID . : 2                                                   |
|                                                                              |
| Channel path IDs . . . . F0    __    __    __    __    __    __    __    +   |
| Link address . . . . . . ____  ____  ____  ____  ____  ____  ____  ____  +   |
|                                                                              |
| Unit address . . . . . . 00    __    __    __    __    __    __    __    +   |
| Number of units  . . . . 256   ___   ___   ___   ___   ___   ___   ___        |
|                                                                              |
| Logical address  . . . . __  + (same as CUADD)                               |
|                                                                              |
| Protocol . . . . . . . . __  + (D, S or S4)                                  |
| I/O concurrency level  . _   + (1, 2 or 3)                                   |
|                                                                              |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
```

Figure 13-50 Control units: Change Control Unit Definition detail - IQD

7. HCD now shows the Modify Device Parameters panel, where you may override the UA numbers. For IQD definitions, the UA starts at `00`. Update `UA New` to `00` for the IQD device type to define the Modify Device Parameters (see Figure 13-51), and press Enter.

```
+------------------------- Modify Device Parameters --------------------------+
|                                                     Row 1 of 1 More:       > |
| Command ===> __________________________________________ Scroll ===> CSR     |
|                                                                             |
| Specify or revise any changes to the device parameters in the list below.   |
| To view attached control units, scroll to the right.                        |
|                                                                             |
| Processor ID . . . . : ARIES                                                |
| Channel Subsystem ID : 2                                                    |
|                                                                             |
| ---------Device---------     ---UA----                 Preferred Exposure   |
| No., Range Type          SS+ Old New + Time-Out STADET CHPID +   Device     |
| 0FA0,032   IQD           _   A0  00    No       No     __                   |
| ***************************** Bottom of data ****************************** |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-51 Control units: Modify Device Parameters - IQD

HCD returns to the Select Processor / CU panel and shows the CHPID (F0) connection definition (see Figure 13-52 on page 333).

```
                             Select Processor / CU    Row 1 of 24 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : F000     Control unit type . . . : IQD

             ---------------Channel Path ID . Link Address + ---------------
/ Proc.CSSID 1------ 2------ 3------ 4------ 5------ 6------ 7------ 8------
_ ARIES.0    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.1    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.2    F0      _______ _______ _______ _______ _______ _______ _______
_ ARIES.3    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.4    _______ _______ _______ _______ _______ _______ _______ _______
_ ARIES.5    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.2    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.3    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.4    _______ _______ _______ _______ _______ _______ _______ _______
_ CETUS.5    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.0    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.1    _______ _______ _______ _______ _______ _______ _______ _______
_ LEPUS.2    _______ _______ _______ _______ _______ _______ _______ _______
```

Figure 13-52 Processors: Select Processor / CU: CHPID to Link address connection - IQD

8. By press F20 (Right), you can see the other parts of the definition summary.

13.3.3 Defining IQD devices to an OSCONFIG

The OSCONFIG name is the part of an IODF that determines what devices a z/OS system has access to when it undergoes an IPL. Additionally the partition that the z/OS system is started in must have access to the CHPIDs that connect to the CUs and devices that match in the OSCONFIG.

The OSCONFIG also contains Esoterics device groups that are defined in EDTs within an OSCONFIG. IQD definitions usually do not use Esoterics.

Here are considerations for adding devices to an OSCONFIG:

- Adding a device to an OSCONFIG does not necessarily mean that the z/OS system has access to that device.
- In this example, we add the predefined IQD devices 0FA0 - 0FBF (IQD).

To define IQD devices to an OSCONFIG, complete the following steps:

1. From the main HCD panel, select option `1.5. I/O Devices`.
2. Scroll through the I/O Device List until you find the device number that you want to add to the OSCONFIG, or in the command line enter `L 0FA0`. In our example, we use `0FA0`.
3. Enter `c` next to one or more device numbers, and press Enter.

4. HCD displays the Change Device Definition panel, where you may modify the CU that the devices are attached to (see Figure 13-53). Press Enter.

```
+------------------------- Change Device Definition --------------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Device number  . . . . . . . : 0FA0  (0000 - FFFF)                          |
| Number of devices  . . . . . : 32                                           |
| Device type  . . . . . . . . : IQD                                          |
|                                                                             |
| Serial number  . . . . . . . . __________  +                                |
| Description  . . . . . . . . . ________________________________             |
|                                                                             |
| Volume serial number . . . . . ______  + (for DASD)                         |
|                                                                             |
| PPRC usage . . . . . . . . . . _  + (for DASD)                              |
|                                                                             |
| Connected to CUs . F000  ____  ____  ____  ____  ____  ____  ____  +        |
|                                                                             |
| ENTER to continue.                                                          |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-53 I/O Devices: Change Device Definition - IQD

5. HCD now displays the Device / Processor Definition panel, where you may modify some of the device parameters relating to SS, UA, and the Explicit Device Candidate List. Enter `c` next to the `Proc.CCSID` item if you want to modify any of these parameters (see Figure 13-54), or press Enter to accept the defaults.

```
+--------------------- Device / Processor Definition -----------------------+
|                                                                Row 1 of 1 |
| Command ===> __________________________________________ Scroll ===> CSR   |
|                                                                           |
| Select processors to change device/processor definitions, then press     |
| Enter.                                                                    |
|                                                                           |
| Device number  . . : 0FA0       Number of devices  . : 32                 |
| Device type  . . . : IQD                                                  |
|                                                                           |
|                                          Preferred  Device Candidate List |
| / Proc.CSSID  SS+  UA+  Time-Out  STADET  CHPID +    Explicit       Null  |
| _ ARIES.2     0    00   No        No      __         No             ___   |
| **************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-54 I/O Devices: Device / Processor Definition continued - IQD

6. The HCD panel where we define devices to the OSCONFIG is displayed. Scroll through the list of OSCONFIG definitions until you find the OSCONFIG that you want to add to the devices to, or in the command line enter `L ITSOTEST`. In our example, we use `ITSOTEST`.
7. Enter `s` next to the OSCONFIG, and press Enter.

   HCD displays the device parameters and features that are applicable to that device type. In our example, we add IQD devices to `ITSOTEST`.

8. Make the following updates to define the Device Parameter (see Figure 13-55), and press Enter:

   – Update `OFFLINE` to `No` (if you want these devices to be online during IPL time).
   – Update `DYNAMIC` to `Yes` (if you want the device to be changeable dynamically).
   – Update `LOCANY` to `Yes` (if the device UCB can be in 31-bit storage).

```
Esssssssssssssssssssss Define Device Parameters / Features ssssssssssssssssssssN
e                                                                    Row 1 of 3 e
e Command ===> ___________________________________________ Scroll ===> CSR    e
e                                                                               e
e Specify or revise the values below.                                           e
e                                                                               e
e Configuration ID . : ITSOTEST     ITSO test OSCONFIG for z15                  e
e Device number  . . : 0FA0         Number of devices  : 32                     e
e Device type  . . . : IQD                                                      e
e                                                                               e
e Parameter/                                                                    e
e Feature    Value +         R Description                                      e
e OFFLINE    No                Device considered online or offline at IPL       e
e DYNAMIC    Yes               Device has been defined to be dynamic            e
e LOCANY     Yes               UCB can reside in 31 bit storage                 e
e **************************** Bottom of data ***************************** e
e                                                                               e
e                                                                               e
e                                                                               e
e                                                                               e
e                                                                               e
e                                                                               e
e                                                                               e
DssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssM
```

Figure 13-55 I/O Devices: Define Device Parameters / Features - IQD

9. The Assign/Unassign Device to Esoteric panel is displayed, where you can specify which Esoteric (if any) that you want the devices to be added to. We add only the IQD devices to the OSCONFIG `ITSOTEST` and not to any Esoterics in this example. Press Enter (see Figure 13-56).

```
+----------- Define Device to Operating System Configuration -----------+
|                                                           Row 1 of 15 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                       |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                       |
| Device number  . : 0FA0           Number of devices  : 32             |
| Device type  . . : IQD                                                |
|                                                                       |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                       |
| / Config. ID   Type     SS Description                    Defined     |
| _ ITSO         MVS      0  All ITSO devices               Yes         |
| _ ITSOTEST     MVS      0  ITSO test OSCONFIG for z15     Yes         |
| _ ZOSMAINT     MVS      0  z/OS Central Mgmt Image        Yes         |
| _ ZOS22BAS     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes       |
| _ ZOS22MLZ     MVS      0  z/OS 2.2 MLZ - clone of p1c    Yes         |
| _ ZOS22MPL     MVS      0  z/OS 2.2 demo clone of p1g     Yes         |
| _ ZOS22P0B     MVS      0  z/OS 2.2 Clone of ZOS22BAS     Yes         |
| _ ZOS22P0C     MVS      0  z/OS 2.2 Serverpac with P1D SSs  Yes       |
| _ ZOS22P0D     MVS      0  z/OS 2.2 Clone of ZOS22P0B     Yes         |
| _ ZOS23BAA     MVS      0  z/OS 2.3 based from ZOSMAINT   Yes         |
| _ ZOS23BAS     MVS      0  z/OS 2.3 base system           Yes         |
+-----------------------------------------------------------------------+
```

Figure 13-56 I/O Devices: Define Device to Operating System Configuration - IQD

10. The final panel opens and shows that the devices are defined to the OSCONFIG. Press Enter to return to the I/O Device List.

14

Adding coupling connectivity

This chapter describes the steps to define CS5, CL5, and ICP channel path ID (CHPID) types, and the Coupling Facility (CF) links between these CHPID types.

It provides a list of these potential configuration items and a short description about how to do each of them by using a Hardware Configuration Definition (HCD).

Note: Not all of the following configuration items are necessarily required for your installation. In addition, the examples that are presented are not exhaustive.

This chapter includes the following sections:

- Defining more I/O by using an HCD
- Coupling Facility logical partitions, CS5, CL5, and ICP CHPIDs

Note: The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

14.1 Defining more I/O by using an HCD

When defining new I/O components in an input/output definition file (IODF), certain definitions like operating system configurations (OSCONFIGs), partitions, Fibre Connection (FICON) switches, control units (CUs), and devices must be done first. After these items are defined, then the connections can be made:

- Defining Coupling Facility LPARs in a channel subsystem
- Defining CS5 CHPIDs
- Defining a Coupling Facility link with CS5 CHPIDs
- Defining CL5 CHPIDs
- Defining a Coupling Facility link with CL5 CHPIDs
- Defining ICP CHPIDs
- Defining a Coupling Facility link with ICP CHPIDs

The following I/O definitions use HCD to demonstrate the examples. The examples in this chapter continue the work example that was created in the previous chapters (for example, `SYS6.IODF66.WORK`).

14.2 Coupling Facility logical partitions, CS5, CL5, and ICP CHPIDs

This section covers defining CF logical partitions (LPARs) and the definitions for CS5, CL5, and ICP CHPID types.

14.2.1 Defining Coupling Facility LPARs in a channel subsystem

Here are considerations for a new (unreserved) partition:

- Partition name.
- Number.
- Usage.
- Description.
- To add CHPIDs to a partition, they first must be defined to the processor.
- Renaming an existing partition is a two-step process:

   a. Redefine the partition as reserved (`Partition name = *`), and activate the IODF on the processor.

   b. Redefine the partition with the new name, and activate the IODF on the processor.

To change a reserved partition to an active partition in a channel subsystem (CSS), complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a partition to, and press Enter.
3. Enter `p` next to the CSS ID that you want to add a partition to, and press Enter.
4. Enter `c` next to the Reserved Partition that you want to unreserve (we use `ID E` for this example), and press Enter.

5. Make the following updates (see Figure 14-1), and press Enter:
   – Update `Partition Name` to `ARIES2E` (a naming standard based on `CSS=2`, `Partition =E`).
   – Review `Partition usage` and change it if required. We use `CF` in this example.
   – Update `Description` to `ARIES2E test CF partition`.

```
+----------------------------- Partition List -----------------------------+
|   Goto  Backup  Query  Help                                               |
| ----------------------------------------------------------------------    |
|                                                                           |
| Command ===> ________________________________________ Scroll ===> CSR     |
|                                                                           |
| Select one or more partitions, then press Enter. To add, use F11.         |
|                                                                           |
| Processor +-------------- Change Partition Definition ---------------+    |
| Configura |                                                          |    |
| Channel S |                                                          |    |
|           | Specify or revise the following values.                  |    |
| / Partiti |                                                          |    |
| c *       | Partition name . . . ARIES2E                             |    |
| _ *       | Partition number . . E      (same as MIF image ID)       |    |
| ********* | Partition usage  . . CF     +                            |  * |
|           | UID uniqueness . . . N        (Y/N)                      |    |
|           |                                                          |    |
|           | Description  . . . . ARIES2E test CF partition           |    |
|           |                                                          |    |
|           |                                                          |    |
|           |                                                          |    |
|           |                                                          |    |
+---------- +----------------------------------------------------------+ --+
```

Figure 14-1 Processors: Change Partition Definition - Coupling Facility

14.2.2 Defining CS5 CHPIDs

When defining a CS5 CHPID to create a CF link between a CF LPAR and a z/OS LPAR, first determine which z/OS LPARs require access to which CF LPARs, how many CF links are required, and to how many different physical processors.

CS5 CF CHPIDs are defined by using Feature Code #0176 (Integrated Coupling Adapter Short Reach (ICA SR) 2 Links) cards that are installed on the central processor complex (CPC) drawer instead of in the PCIe+ I/O drawer.

The ICA SR card has two ports (Port 1 and Port 2) that provide two physical connections to another ICA SR card on the same or different processor.

Each of the ports can have up to four CHPIDs defined to these ports.

Here are considerations for a new CS5 CHPID:

- CHPID.
- Channel path type.
- Operational mode.
- Description.
- Adapter ID (AID).
- Adapter port.

- Partition access list.
- For performance and redundancy, determine how many AID cards are installed in the processor and to what Peripheral Component Interconnect Express (PCIe) slot on what CPC drawer (for a list of installed hardware, see the physical channel ID (PCHID) / channel ID (CHID) report).

To define a CS5 CHPID and provide access to a partition, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a CHPID to, and press Enter.
3. Enter `s` next to the CSS ID that you want to add a CHPID to, and press Enter.
4. In the command line, enter `add` (see Figure 14-2) to add a CHPID.
5. Make the following updates and press Enter:
   - Update `Channel path ID` to `80`.
   - Update `Channel path type` to `CS5`.
   - Update `Operational mode` to `SHR`.
   - Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : ARIES                                              |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 2                                                  |
|                                                                           |
| Channel path ID  . . . . 80    +            Channel ID  ___  +            |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . CS5   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . FC#0176 ICA SR 2 Links__________                 |
|                                                                           |
| Specify the following values only if connected to a switch:              |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 14-2 Processors: Add Channel Path - CS5

6. HCD prompts you to specify the adapter and port of the HCA attributes. Make the following updates (see Figure 14-3), and press Enter:
   – Update `Adapter of the HCA` to `00`.
   – Update `Port on the HCA` to `1`.

```
+------------------ Specify HCA Attributes -------------------+
|                                                             |
|                                                             |
| Specify or revise the values below.                         |
|                                                             |
| Adapter ID of the HCA  . . 00  +                            |
| Port on the HCA  . . . . . 1   +                            |
|                                                             |
|                                                             |
|                                                             |
|                                                             |
+-------------------------------------------------------------+
```

Figure 14-3 Processors: Specify HCA Attributes - CS5

7. HCD prompts you to select which partitions the CHPID should have access to. Type forward slash (/) next to the wanted partitions (see Figure 14-4), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                               Row 1 of 7 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the access list.           |
|                                                                           |
| Channel subsystem ID : 2                                                  |
| Channel path ID  . . : 80     Channel path type  . : CS5                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 2      ARIES2E          E      CF    ARIES2E test CF partition          |
| / 2      ARIES21          1      OS    ARIES21 test OS partition          |
| _ 2      ARIES22          2      CF/OS                                    |
| _ 2      ARIES23          3      CF/OS                                    |
| _ 2      ARIES24          4      CF/OS                                    |
| _ 2      ARIES25          5      CF/OS                                    |
| _ 2      ARIES26          6      CF/OS                                    |
| **************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 14-4 Processors: Define Access List - CS5

8. Because more partitions than the selected two are defined, the Define Candidate List panel opens. For this example, we do not add any partitions to the candidate list. Press Enter. HCD returns to the Channel Path List and shows you the CHPID that was defined (see Figure 14-5).

```
                              Channel Path List      Row 1 of 8 More:      >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ 80    00/1  CS5   SHR   __  __ __   N   No  FC#0176 ICA SR 2 Links
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
```

Figure 14-5 Processors: Channel Path List - CS5

9. Proceed to define an extra CS5 CHPID as `84` to the same LPARs as `AID=17`, `Port=1` (see Figure 14-6).

```
                              Channel Path List      Row 1 of 8 More:      >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ 80    00/1  CS5   SHR   __  __ __   N   No  FC#0176 ICA SR 2 Links
_ 84    17/1  CS5   SHR   __  __ __   N   No  FC#0176 ICA SR 2 Links
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
******************************* Bottom of data *******************************
```

Figure 14-6 Processors: Channel Path List - CS5

14.2.3 Defining a Coupling Facility link with CS5 CHPIDs

The only way to define a CS5 CHPID to another CS5 CHPID is direct connected.

Here are considerations for creating a CF link by using CS5 CHPIDs:

- The ICA SR connection is a physical cable between two Feature Code #0176 cards on the same or different processors.
- Up to four logical CHPIDs per port can be defined over that physical connection.
- Determine how many CS5 CF links are required to provide enough primary and secondary links and coupling bandwidth.
- Determine which z/OS LPARs on the same or different processors need access to the CF LPARs.
- CF links provide Server Time Protocol (STP) connectivity for a Coordinated Timing Network (CTN) between processors and a sysplex.
- In this example, we connect two CS5 CHPIDs (80 and 84) on the same processor.

To define a CF link with CS5 CHPIDs, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to create the first CF link from, and press Enter.
3. Enter `s` next to the CSS ID that has the CS5 CHPID definition that you want to create the first CF link from, and press Enter.
4. Scroll through the Channel Path List until you find the first CS5 CHPID that you want to connect from, or in the command line enter `L 80`. In our example, we use `80`.
5. Enter `f` next to the CHPID definition (see Figure 14-7), and press Enter.

```
                              Channel Path List      Row 1 of 8 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
f 80    00/1  CS5   SHR   __  __ __   N   No  FC#0176 ICA SR 2 Links
_ 84    17/1  CS5   SHR   __  __ __   N   No  FC#0176 ICA SR 2 Links
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
****************************** Bottom of data ******************************
```

Figure 14-7 Processors: CF Channel Path Connectivity List - CS5

6. On the next panel, HCD prompts you to specify the second CS5 CHPID that you want to connect to. Scroll through the Channel Path List until you find the second CS5 CHPID you want to connect to, or in the command line enter `L 84`. In our example, we use `84`.

7. Enter p next to the CHPID definition (see Figure 14-8), and press Enter.

```
 CF Channel Path Connectivity List              Row 1 of 2
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : ARIES
Source channel subsystem ID . : 2
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 80  00/1  Y  CS5  SHR  N
p 84  17/1  Y  CS5  SHR  N
******************************* Bottom of data ********************************
```

Figure 14-8 Processors: CF Channel Path Connectivity List - CS5

8. HCD prompts you to specify which CF channel path to connect to. Make the following updates (see Figure 14-9), and press Enter:
   – Update `Destination processor ID` to `ARIES`.
   – Update `Destination channel subsystem ID` to `2`.
   – Update `Destination channel path ID` to `80`.

```
+---------------- Connect to CF Channel Path -----------------+
|                                                             |
|                                                             |
| Specify the following values.                               |
|                                                             |
| Source processor ID  . . . . . : ARIES                      |
| Source channel subsystem ID  . : 2                          |
| Source channel path ID . . . . : 84                         |
| Source channel path type . . . : CS5                        |
|                                                             |
| Destination processor ID . . . . . . ARIES___  +            |
| Destination channel subsystem ID . . 2   +                  |
| Destination channel path ID  . . . . 80  +                  |
|                                                             |
| Timing-only link . . . . . . . . . . No                     |
|                                                             |
|                                                             |
|                                                             |
|                                                             |
+-------------------------------------------------------------+
```

Figure 14-9 Processors: Connect to CF Channel Path - CS5

9. HCD checks the available CU numbers and device addresses starting at FFFF and working backwards to provide suggestions. These suggestions can be overridden or accepted. We accept the suggestions for the second CS5 CHPID (see Figure 14-10), and press Enter.

```
+----------------- Add CF Control Unit and Devices ------------------+
|                                                                    |
|                                                                    |
| Confirm or revise the CF control unit number and device numbers    |
| for the CF control unit and devices to be defined.                 |
|                                                                    |
| Processor ID . . . . . . . : ARIES                                 |
| Channel subsystem ID . . . : 2                                     |
| Channel path ID  . . . . . : 84         Operation mode . . : SHR   |
| Channel path type  . . . . : CS5                                   |
|                                                                    |
| Control unit number  . . . . FFF3  +                               |
|                                                                    |
| Device number  . . . . . . . FFD4                                  |
| Number of devices  . . . . . 8                                     |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

Figure 14-10   Processors: Add CF Control Unit and Devices - CS5

10. HCD provides suggested CU numbers and device addresses for the first CS5 CHPID (see Figure 14-11). Observe that the CU number is the same and that eight devices were allocated. Press Enter.

```
+----------------- Add CF Control Unit and Devices ------------------+
|                                                                    |
|                                                                    |
| Confirm or revise the CF control unit number and device numbers    |
| for the CF control unit and devices to be defined.                 |
|                                                                    |
| Processor ID . . . . . . . : ARIES                                 |
| Channel subsystem ID . . . : 2                                     |
| Channel path ID  . . . . . : 80         Operation mode . . : SHR   |
| Channel path type  . . . . : CS5                                   |
|                                                                    |
| Control unit number  . . . . FFF3  +                               |
|                                                                    |
| Device number  . . . . . . . FFC4                                  |
| Number of devices  . . . . . 8                                     |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

Figure 14-11   Processors: Add CF Control Unit and Devices - CS5

HCD provides a summary of the Source and Destination CF Connectivity List (see Figure 14-12).

```
                     CF Channel Path Connectivity List              Row 1 of 2
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : ARIES
Source channel subsystem ID . : 2
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 80  00/1  Y  CS5  SHR  N     ARIES.2    84  17/1  Y  CS5  SHR    CFP   8
_ 84  17/1  Y  CS5  SHR  N     ARIES.2    80  00/1  Y  CS5  SHR    CFP   8
******************************* Bottom of data ********************************
```

Figure 14-12 Processors: Add CF Channel Path Connectivity List - CS5

14.2.4 Defining CL5 CHPIDs

When defining a CL5 CHPID to create a CF link between a CF LPAR and a z/OS LPAR, determine which z/OS LPARs require access to which CF LPARs, how many CF links are required, and to how many different physical processors.

CL5 CF CHPIDs are defined by using Feature Code #0433 (Coupling Express LR (CELR)) cards, which are installed in the PCIe+ I/O drawer instead of on the CPC drawer.

The CELR card has two ports (Port 1 and Port 2), which provide two physical connections between another CELR card on the same or different processor.

Each of the ports can have up to four CHPIDs defined.

Here are considerations for a new CL5 CHPID:

- CHPID.
- CHID.
- Channel path type.
- Operational mode.
- Description.
- Partition access list.
- For performance and redundancy, determine how many CL5 cards are installed in the processor and to what PCIe slot on what CPC drawer does the I/O cards connect to (for a list of installed hardware, see the PCHID / CHID report).

To define a CL5 CHPID and provide access to a partition, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a CHPID to, and press Enter.
3. Enter `s` next to the CSS ID that you want to add a CHPID to, and press Enter.

4. In the command line, enter `add` (see Figure 14-13) to add a CHPID.
5. Make the following updates and press Enter:
   - Update `Channel path ID` to `88`.
   - Update `Channel ID` to `1DC`.
   - Update `Channel path type` to `CL5`.
   - Update `Operational mode` to `SHR`.
   - Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : ARIES                                              |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 2                                                  |
|                                                                           |
| Channel path ID  . . . . 88    +           Channel ID  1DC  +            |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . CL5   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . FC#0433 Coupling Express LR_____                 |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 14-13 Processors: Add Channel Path - CL5

6. HCD prompts you to specify the coupling PCHID/Port attributes. Update `Coupling Port` to `1` (see Figure 14-14), and press Enter.

```
Essssssssss Specify Coupling Pchid/Port Attribute ssssssssssN
e                                                           e
e                                                           e
e Specify or revise the values below.                       e
e                                                           e
e Physical channel ID  . . . 1DC                            e
e Coupling port  . . . . . . 1   +                          e
e                                                           e
e                                                           e
e                                                           e
e                                                           e
DssssssssssssssssssssssssssssssssssssssssssssssssssssssssssM
```

Figure 14-14 Processors: Specify Coupling PCHIDs/Port Attributes - CL5

7. HCD prompts you to select which partitions the CHPID should have access to. Enter forward slash (/) next to the partitions that you want (see Figure 14-15), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                                Row 1 of 9 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the access list.          |
|                                                                           |
| Channel subsystem ID : 2                                                  |
| Channel path ID  . . : 88     Channel path type  . : CL5                 |
| Operation mode . . . : SPAN   Number of CHPIDs . . : 1                   |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 2      ARIES2E          E      CF    ARIES2E test CF partition          |
| / 2      ARIES21          1      OS    ARIES21 test OS partition          |
| _ 2      ARIES22          2      CF/OS                                    |
| _ 2      ARIES23          3      CF/OS                                    |
| _ 2      ARIES24          4      CF/OS                                    |
| _ 2      ARIES25          5      CF/OS                                    |
| _ 2      ARIES26          6      CF/OS                                    |
| **************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 14-15 Processors: Define Access List - CL5

8. Because more partitions than the selected two are defined, the Define Candidate List panel opens. For this example, we do not add any partitions in the access list. Press Enter. HCD returns to the Channel Path List and shows you the CHPID that was defined (see Figure 14-16).

```
                              Channel Path List      Row 1 of 10 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ 80    00/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 84    17/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 88    1DC/1 CL5   SHR   __  __ __   N   No  FC#0433 Coupling Express LR
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
```

Figure 14-16 Processors: Channel Path List - CL5

9. Define an extra CL5 CHPID as `8C` to the same LPARs as `CHID=23C, Port=1` (see Figure 14-17).

```
                              Channel Path List      Row 1 of 10 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ 80    00/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 84    17/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 88    1DC/1 CL5   SHR   __  __ __   N   No  FC#0433 Coupling Express LR
_ 8C    23C/1 CL5   SHR   __  __ __   N   No  FC#0433 Coupling Express LR
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
```

Figure 14-17 Processors: Channel Path List - CL5

14.2.5 Defining a Coupling Facility link with CL5 CHPIDs

The only way to define a CL5 CHPID to another CL5 CHPID is direct connected.

Here are considerations for creating a CF link by using CL5 CHPIDs:

- The CELR connection is a physical cable between two Feature Code #0433 cards on the same or different processors.
- Up to four logical CHPIDs per port can be defined over that physical connection.
- Determine how many CL5 CF links are required to provide enough primary and secondary links and coupling bandwidth.
- Determine which z/OS LPARs on the same or different processors need access to the CF LPARs.
- CF links also provide STP connectivity for a CTN between processors and a sysplex.
- In this example, we connect two CL5 CHPIDs (88 and 8C) on the same processor.

To define a CF link with CL5 CHPIDs, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to create the first CF link from, and press Enter.
3. Enter `s` next to the CSS ID that has the CL5 CHPID definition that you want to create the first CF link from, and press Enter.
4. Scroll through the Channel Path List until you find the first CL5 CHPID that you want to connect from, or in the command line enter `L 88`. In our example, we use `88`.

5. Enter `f` next to the CHPID definition (see Figure 14-18), and press Enter.

```
                              Channel Path List      Row 5 of 10 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+             Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
f 88    1DC/1 CL5   SHR   __  __ __   N   No  FC#0433 Coupling Express LR
_ 8C    23C/1 CL5   SHR   __  __ __   N   No  FC#0433 Coupling Express LR
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
```

Figure 14-18 Processors: CF Channel Path Connectivity List - CL5

6. HCD prompts you to specify the second CL5 CHPID that you want to connect to. Scroll through the Channel Path List until you find the second CL5 CHPID that you want to connect to, or in the command line enter `L 8C`. In our example, we use `8C`.
7. Type `p` next to the CHPID definition (see Figure 14-19), and press Enter.

```
                     CF Channel Path Connectivity List              Row 1 of 4
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : ARIES
Source channel subsystem ID . : 2
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 80  00/1  Y  CS5  SHR  N     ARIES.2    84  17/1  Y  CS5  SHR    CFP   8
_ 84  17/1  Y  CS5  SHR  N     ARIES.2    80  00/1  Y  CS5  SHR    CFP   8
_ 88  1DC/1 Y  CL5  SHR  N
p 8C  23C/1 Y  CL5  SHR  N
```

Figure 14-19 Processors: CF Channel Path Connectivity List - CL5

8. HCD prompts you to specify which CF channel path to connect to. Make the following updates (see Figure 14-20), and press Enter:
   – Update `Destination processor ID` to `ARIES`.
   – Update `Destination channel subsystem ID` to `2`.
   – Update `Destination channel path ID` to 88.

```
+---------------- Connect to CF Channel Path -----------------+
|                                                              |
|                                                              |
| Specify the following values.                                |
|                                                              |
| Source processor ID  . . . . . : ARIES                       |
| Source channel subsystem ID  . : 2                           |
| Source channel path ID . . . . : 8C                          |
| Source channel path type . . . : CL5                         |
|                                                              |
| Destination processor ID . . . . . . ARIES     +             |
| Destination channel subsystem ID . . 2   +                   |
| Destination channel path ID  . . . . 88  +                   |
|                                                              |
| Timing-only link . . . . . . . . . . No                      |
|                                                              |
|                                                              |
|                                                              |
|                                                              |
+--------------------------------------------------------------+
```

Figure 14-20 Processors: Connect to CF Channel Path - CL5

9. HCD checks the available CU numbers and device addresses starting at FFFF and works backwards to provide suggestions. These suggestions can be overridden or accepted. We accept the suggestions for the second CL5 CHPID (see Figure 14-21), and press Enter.

```
+----------------- Add CF Control Unit and Devices -------------------+
|                                                                      |
|                                                                      |
| Confirm or revise the CF control unit number and device numbers      |
| for the CF control unit and devices to be defined.                   |
|                                                                      |
| Processor ID . . . . . . . : ARIES                                   |
| Channel subsystem ID . . . : 2                                       |
| Channel path ID  . . . . . : 8C         Operation mode . . : SHR     |
| Channel path type  . . . . : CL5                                     |
|                                                                      |
| Control unit number  . . . . FFF3  +                                 |
|                                                                      |
| Device number  . . . . . . . FFBC                                    |
| Number of devices  . . . . . 8                                       |
|                                                                      |
|                                                                      |
|                                                                      |
|                                                                      |
+----------------------------------------------------------------------+
```

Figure 14-21 Processors: Add CF Control Unit and Devices - CL5

10. HCD provides suggested CU numbers and device addresses for the first CL5 CHPID (see Figure 14-22). Observe that the CU number is the same and that eight devices were allocated. Press Enter.

```
+----------------- Add CF Control Unit and Devices ------------------+
|                                                                    |
|                                                                    |
| Confirm or revise the CF control unit number and device numbers    |
| for the CF control unit and devices to be defined.                 |
|                                                                    |
| Processor ID . . . . . . . : ARIES                                 |
| Channel subsystem ID . . . : 2                                     |
| Channel path ID  . . . . . : 88        Operation mode . . : SHR    |
| Channel path type  . . . . : CL5                                   |
|                                                                    |
| Control unit number  . . . . FFF3  +                               |
|                                                                    |
| Device number  . . . . . . . FF42                                  |
| Number of devices  . . . . . 8                                     |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

Figure 14-22 Processors: Add CF Control Unit and Devices - CL5

HCD provides a summary of the Source and Destination CF Connectivity List (see Figure 14-23).

```
                     CF Channel Path Connectivity List              Row 1 of 6
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : ARIES
Source channel subsystem ID . : 2
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 88  1DC/1 Y  CL5  SHR  N     ARIES.2    8C  23C/1 Y  CL5  SHR    CFP   8
_ 8C  23C/1 Y  CL5  SHR  N     ARIES.2    88  1DC/1 Y  CL5  SHR    CFP   8
******************************* Bottom of data ******************************
```

Figure 14-23 Processors: Add CF Channel Path Connectivity List - CL5

14.2.6 Defining ICP CHPIDs

When defining an ICP CHPID to create a CF link between a CF LPAR and a z/OS LPAR, determine which z/OS LPARs require access to which CF LPARs, and how many CF links are required within the same physical processor.

ICP CF CHPIDs are defined logically and internally to the processor and require no installed hardware.

Note: The maximum number of ICP CHPIDs for a z15 (T01 and T02) is 64.

Each of the logical ICP links can support only one CHPID at each end of the link. However, the CHPIDS can be spanned across multiple CSSs.

Here are considerations for a new ICP CHPID:

- CHPID
- Channel path type
- Operational mode
- Description
- Partition access list

To define an ICP CHPID and provide access to a partition, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to add a CHPID to, and press Enter.
3. Enter `s` next to the CSS ID that you want to add a CHPID to, and press Enter.
4. In the command line, enter `add` (see Figure 14-24) to add a CHPID.
5. Make the following updates, and press Enter:
   - Update `Channel path ID` to `FC`.
   - Update `Channel path type` to `ICP`.
   - Update `Operational mode` to `SHR`.
   - Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : ARIES                                              |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 2                                                  |
|                                                                           |
| Channel path ID  . . . . FC    +           Channel ID  ___  +             |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . ICP   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . ICP Internal Coupling Peer______                 |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 14-24 Processors: Add Channel Path - ICP

6. HCD prompts you to select which partitions the CHPID should have access to. Enter a forward slash (/) next to the partitions that you want (see Figure 14-25), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                                Row 1 of 7 |
| Command ===> ________________________________________ Scroll ===> CSR     |
|                                                                           |
| Select one or more partitions for inclusion in the access list.           |
|                                                                           |
| Channel subsystem ID : 2                                                  |
| Channel path ID  . . : FC     Channel path type  . : ICP                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 2      ARIES2E          E      CF    ARIES2E test CF partition          |
| / 2      ARIES21          1      OS    ARIES21 test OS partition          |
| _ 2      ARIES22          2      CF/OS                                    |
| _ 2      ARIES23          3      CF/OS                                    |
| _ 2      ARIES24          4      CF/OS                                    |
| _ 2      ARIES25          5      CF/OS                                    |
| _ 2      ARIES26          6      CF/OS                                    |
| *************************** Bottom of data ****************************   |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 14-25 Processors: Define Access List - ICP

Because more partitions than the selected two are defined, the Define Candidate List panel opens. For this example, we do not add any partitions in the access list. Press Enter.

HCD returns to the Channel Path List and shows you the CHPID that was defined (see Figure 14-26).

```
                              Channel Path List      Row 1 of 11 More:      >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No  FC#0428 16Gb FICON Exp16S+ SX
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ 80    00/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 84    17/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 88    1DC/1 CL5   SHR   __  __ __   Y   No  FC#0433 Coupling Express LR
_ 8C    23C/1 CL5   SHR   __  __ __   Y   No  FC#0433 Coupling Express LR
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
_ FC    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
```

Figure 14-26 Processors: Channel Path List - ICP

7. Define an extra ICP CHPID as `ED` to the same LPARs (see Figure 14-27).

```
 Channel Path List      Row 2 of 12 More:      >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ 80    00/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 84    17/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 88    1DC/1 CL5   SHR   __  __ __   Y   No  FC#0433 Coupling Express LR
_ 8C    23C/1 CL5   SHR   __  __ __   Y   No  FC#0433 Coupling Express LR
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
_ FC    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
_ FD    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
```

Figure 14-27 Processors: Channel Path List - ICP

14.2.7 Defining a Coupling Facility link with ICP CHPIDs

The only way to define an ICP CHPID to another ICP CHPID is as a logical internal connection within the processor.

Here are considerations for creating a CF link by using ICP CHPIDs:

- Each of the logical ICP links can support only one CHPID at each end of the link.
- Determine how many ICP CF links are required to provide enough coupling bandwidth.
- Determine which z/OS LPARs on the same processors need access to the CF LPARs.
- In this example, we connect two ICP CHPIDs (Fibre Channel (FC) and FD) on the same processor.

To define a CF link with ICP CHPIDs, complete the following steps:

1. From the main HCD panel, select option `1.3. Processors`.
2. Enter `s` next to the processor that you want to create the first CF link from, and press Enter.
3. Enter `s` next to the CSS ID that has the ICP CHPID definition that you want to create the first CF link from, and press Enter.
4. Scroll through the Channel Path List until you find the first ICP CHPID that you want to connect from, or in the command line enter `L FC`. In our example, we use `FC`.
5. Enter `f` next to the CHPID definition (see Figure 14-28), and press Enter.

```
                              Channel Path List      Row 2 of 12 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter. To add use F11.

Processor ID . . . . : ARIES
Configuration mode . : LPAR
Channel Subsystem ID : 2

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 15    115   FC    SHR   __  __ __       No  FC#0428 16Gb FICON Exp16S+ SX
_ 80    00/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 84    17/1  CS5   SHR   __  __ __   Y   No  FC#0176 ICA SR 2 Links
_ 88    1DC/1 CL5   SHR   __  __ __   Y   No  FC#0433 Coupling Express LR
_ 8C    23C/1 CL5   SHR   __  __ __   Y   No  FC#0433 Coupling Express LR
_ C3    1BC   OSE   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ C6    11C   OSC   SHR   __  __ __       No  FC#0446 OSA Express7S 1000Base-T
_ E1    128   OSD   SHR   __  __ __       No  FC#0445 OSA Express7s 10GbE SR
_ F0    7E0   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
f FC    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
_ FD    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
```

Figure 14-28 Processors: CF Channel Path Connectivity List - ICP

6. HCD prompts you to specify the second ICP CHPID that you want to connect to. Scroll through the Channel Path List until you find the second ICP CHPID that you want to connect to, or in the Command Line, enter `L ED`. In our example, we use `FD`.

7. Type p next to the CHPID definition (see Figure 14-29), and press Enter.

```
                     CF Channel Path Connectivity List              Row 1 of 6
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : ARIES
Source channel subsystem ID . : 2
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 80  00/1  Y  CS5  SHR  N     ARIES.2    84  17/1  Y  CS5  SHR    CFP   8
_ 84  17/1  Y  CS5  SHR  N     ARIES.2    80  00/1  Y  CS5  SHR    CFP   8
_ 88  1DC/1 Y  CL5  SHR  N     ARIES.2    8C  23C/1 Y  CL5  SHR    CFP   8
_ 8C  23C/1 Y  CL5  SHR  N     ARIES.2    88  1DC/1 Y  CL5  SHR    CFP   8
_ FC        Y  ICP  SHR  N
p FD        Y  ICP  SHR  N
```

Figure 14-29 Processors: CF Channel Path Connectivity List - ICP

8. HCD prompts you to specify which CF channel path to connect to. Make the following updates (see Figure 14-30), and press Enter:
   – Update `Destination processor ID` to `ARIES`.
   – Update `Destination channel subsystem ID` to `2`.
   – Update `Destination channel path ID` to `FC`.

```
+---------------- Connect to CF Channel Path -----------------+
|                                                              |
|                                                              |
| Specify the following values.                                |
|                                                              |
| Source processor ID  . . . . . : ARIES                       |
| Source channel subsystem ID  . : 2                           |
| Source channel path ID . . . . : FD                          |
| Source channel path type . . . : ICP                         |
|                                                              |
| Destination processor ID . . . . . . ARIES     +             |
| Destination channel subsystem ID . . 2   +                   |
| Destination channel path ID  . . . . FC  +                   |
|                                                              |
| Timing-only link . . . . . . . . . . No                      |
|                                                              |
|                                                              |
|                                                              |
|                                                              |
+--------------------------------------------------------------+
```

Figure 14-30 Processors: Connect to CF Channel Path - ICP

9. HCD checks the available CU numbers and device addresses starting at FFFF and works backwards to provide suggestions. These suggestions can be overridden or accepted. We accept the suggestions for the second ICP CHPID (see Figure 14-31), and press Enter.

```
+----------------- Add CF Control Unit and Devices ------------------+
|                                                                    |
|                                                                    |
| Confirm or revise the CF control unit number and device numbers   |
| for the CF control unit and devices to be defined.                |
|                                                                    |
| Processor ID . . . . . . . : ARIES                                |
| Channel subsystem ID . . . : 2                                    |
| Channel path ID  . . . . . : FD        Operation mode . . : SHR   |
| Channel path type  . . . . : ICP                                  |
|                                                                    |
| Control unit number  . . . . FFF3  +                              |
|                                                                    |
| Device number  . . . . . . . FF3B                                 |
| Number of devices  . . . . . 7                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

Figure 14-31 Processors: Add CF Control Unit and Devices - ICP

10. HCD provides suggested CU numbers and device addresses for the first ICP CHPID (see Figure 14-32). Observe that the CU number is the same and that seven devices were allocated. Press Enter.

```
+----------------- Add CF Control Unit and Devices ------------------+
|                                                                    |
|                                                                    |
| Confirm or revise the CF control unit number and device numbers   |
| for the CF control unit and devices to be defined.                |
|                                                                    |
| Processor ID . . . . . . . : ARIES                                |
| Channel subsystem ID . . . : 2                                    |
| Channel path ID  . . . . . : FC        Operation mode . . : SHR   |
| Channel path type  . . . . : ICP                                  |
|                                                                    |
| Control unit number  . . . . FFF3  +                              |
|                                                                    |
| Device number  . . . . . . . FF34                                 |
| Number of devices  . . . . . 7                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

Figure 14-32 Processors: Add CF Control Unit and Devices - ICP

HCD provides a summary of the Source and Destination CF Connectivity List (see Figure 14-33).

```
                     CF Channel Path Connectivity List             Row 1 of 6
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : ARIES
Source channel subsystem ID . : 2
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ FC        Y  ICP  SHR  N     ARIES.2    FD        Y  ICP  SHR    CFP   7
_ FD        Y  ICP  SHR  N     ARIES.2    FC        Y  ICP  SHR    CFP   7
******************************* Bottom of data *******************************
```

Figure 14-33   Processors: Add CF Channel Path Connectivity List - ICP

15

Adding Peripheral Component Interconnect Express devices

This chapter describes the steps to define Peripheral Component Interconnect Express (PCIe) functions, features, and devices for Internal Shared Memory (ISM), Remote Direct Memory Access over Converged Ethernet (RoCE), and zHyperLink.

It includes a list of these potential configuration items and a short description about how to do each of them by using Hardware Configuration Definition (HCD). It also includes an overview of PCIe functions.

> **Note:** Not all of the following configuration items are necessarily required for your installation. In addition, the examples that are presented are not exhaustive.

This chapter includes the following sections:

- Defining PCIe functions by using HCD
- PCIe feature definitions

> **Note:** The examples that are shown in this chapter are based on the z15 T01 (8561). However, the examples can also be used with the z15 T02 (8562).

15.1 Defining PCIe functions by using HCD

When defining new I/O components in an input/output definition file (IODF), certain definitions like operating system configurations (OSCONFIGs), partitions, Fibre Connection (FICON) switches, control units (CUs), and devices must be done first. After these items are defined, then the following connections can be made:

- Defining an ISM PCIe function
- Defining a RoCE PCIe function
- Defining a zHyperLink PCIe function

The following I/O definitions use HCD to demonstrate the examples. This section continues to use the work example `SYS6.IODF79.WORK`.

> **Note:** Starting with the IBM z15, the zEnterprise Data Compression (zEDC) PCIe feature is no longer available as a separate hardware feature, Compression functions are implemented directly on the processor chip. Therefore, an HCD configuration is no longer required.

15.2 PCIe feature definitions

This section provides a brief overview of the **`Function`** statement and covers defining ISM, RoCE, and zHyperLink PCIe features.

15.2.1 Overview

PCIe adapters that are attached to a system can provide the operating system (OS) with various so-called PCIe functions to be used by entitled logical partitions (LPARs).

Currently, HCD supports the following features:

- ISM PCIe Adapter. A virtual PCIe (vPCIe) adapter for which a virtual channel ID (VCHID) must be defined.
- RoCE. PCIe functions of type RoCE and RoCE-2 may be assigned to external physical networks by specifying corresponding PNET IDs.
- Regional Crypto Enablement (RCE). This PCIe function type is used for IBM approved vendor crypto adapters, and is not in the scope of this book.

> **Note:** The support of virtual functions (VFs), the allowed range of VFIDs, and support of PNETIDs depends on the processor type and support level. For more information, see *Input/Output Configuration Program User’s Guide*, SB10-7172. HCD offers prompts for VFIDs and ensures that the validation rules are fulfilled.

HCD provides dialog boxes to define, change, delete, and view PCIe functions, and to control which LPARs access which PCIe functions.

In addition, HCD provides the following reports:

- The PCIe Function Summary Report displays the partitions in the access and candidate lists, which are entitled to access the available PCIe functions.
- The PCIe Function Compare Report shows the changes of PCIe functions between processors of two IODFs.

HCD supports the new I/O configuration statement **FUNCTION** for defining and configuring PCIe functions.

The input/output (I/O) subsystem, which controls channel operations, requires specific data about the hardware I/O configuration.

To define PCIe functions for the I/O subsystem, you must specify the following items:

- LPARs
- PCIe adapter functions on the central processor complex (CPC) and their assignment to LPARs.

A PCIe function is defined by a unique identifier, the function ID (FID). Each function specifies a function type and a channel ID (CHID). Multiple functions may be specified to the same CHID value if each of these functions defines a unique VF number when defining a PCIe function. Example 15-1 shows definitions for a zHyperLink card for Port 1 and multiple VFIDs, each assigned to a specific LPAR.

Example 15-1 zHyperLink definitions

```
RESOURCE PARTITION=((CSS(0),(ARIES01,1),(ARIES02,2),(ARIES03,3*
                ),(ARIES04,4),(ARIES05,5),(ARIES06,6),(ARIES07,7),(ARIES*
                08,8),(*,9),(*,A),(*,B),(*,C),(*,D),(*,E),(*,F)),(CSS(1)*
                ,(ARIES1A,A),(ARIES1B,B),(ARIES1C,C),(ARIES1D,D),(ARIES1*
                E,E),(ARIES1F,F),(ARIES11,1),(ARIES12,2),(ARIES13,3),(AR*
                IES14,4),(ARIES15,5),(ARIES16,6),(ARIES17,7),(ARIES18,8)*
                ,(ARIES19,9)),(CSS(2),(ARIES2A,A),(ARIES2B,B),(ARIES2C,C*
                ),(ARIES2D,D),(ARIES2E,E),(ARIES2F,F),(ARIES21,1),(ARIES*
                22,2),(ARIES23,3),(ARIES24,4),(ARIES25,5),(ARIES26,6),(A*
                RIES27,7),(ARIES28,8),(ARIES29,9)),(CSS(3),(*,1),(*,2),(*
                *,3),(*,4),(*,5),(*,6),(*,7),(*,8),(*,9),(*,A),(*,B),(*,*
                C),(*,D),(*,E),(*,F)),(CSS(4),(*,1),(*,2),(*,3),(*,4),(**
                ,5),(*,6),(*,7),(*,8),(*,9),(*,A),(*,B),(*,C),(*,D),(*,E*
                ),(*,F)),(CSS(5),(MCS_1,B),(*,1),(*,2),(*,3),(*,4),(*,5)*
                ,(*,6),(*,7),(*,8),(*,9),(*,A),(*,C),(*,D),(*,E),(*,F)))
*
************************************************************************
*****SYNCH_IO
************************************************************************
**
         FUNCTION FID=100,VF=1,PCHID=13C,PART=((ARIES01),(=)),TYPE=HYL,*
               PORT=1
         FUNCTION FID=101,VF=2,PCHID=13C,PART=((ARIES21),(=)),TYPE=HYL,*
               PORT=1
         FUNCTION FID=102,VF=3,PCHID=13C,PART=((ARIES22),(=)),TYPE=HYL,*
               PORT=1
         FUNCTION FID=103,VF=4,PCHID=13C,PART=((ARIES23),(=)),TYPE=HYL,*
               PORT=1
         FUNCTION FID=104,VF=5,PCHID=13C,PART=((ARIES24),(=)),TYPE=HYL,*
               PORT=1
```

```
         FUNCTION FID=105,VF=6,PCHID=13C,PART=((ARIES25),(=)),TYPE=HYL,*
               PORT=1
**
```

Table 15-1 shows the list of applicable functions to the various function types.

Table 15-1 Keyword applicability for functions

Function	Function type				
	HYL	ISM	RCE	RoCE	ROC2
Physical channel ID (PCHID)	Yes	No	Yes	Yes	Yes
VCHID	No	Yes	No	No	No
PNETID	No	Yes	No	Yes	Yes
PORT	Yes	No	No	No	Yes
Virtual function (VF)	Yes	Yes	No	Yes	Yes

For more information about the maximum values for each machine type, see *IBM Z Input/Output Configuration Program User's Guide,* SB10-7172.

15.2.2 Defining an ISM PCIe function

The z15 system supports ISM vPCIe devices to enable optimized cross-LPAR TCP communications by using socket-based direct memory access (DMA), that is, SMC - Direct Memory Access over Internal Shared Memory (SMC-D).

SMC-D uses a vPCIe adapter and is configured like a physical PCIe device. There are up to 32 ISM adapters, each with a unique Physical Network ID per CPC.

Internal Shared Memory technology

ISM is a virtual PCI network adapter that enables direct access to shared virtual memory, providing highly optimized network communications for OSs within the same IBM Z platform.

Virtual memory is managed by each z/OS (similar to SMC - Remote Direct Memory Access over Converged Ethernet Express (SMC-R) logically shared memory) following the existing IBM Z PCIe I/O translation architecture.

For more information about the management of SMC-D, see *IBM z/OS V2R2 Communications Server TCP/IP Implementation Volume 1: Base Functions, Connectivity, and Routing*, SG24-8360.

ISM configuration

In this example, we define these items:

- CHID=7F1 to FIDs 0040 (VF=1) and 0041 (VF=2) on CPC = ARIES
- CHID=7F2 to FIDs 0050 (VF=1) and 0051 (VF=2) on CPC = ARIES

Complete the following steps:

1. From the main HCD panel, select option `1.3. Processor List`.
2. Enter `f` (work with PCIe functions) next to the processor (`ARIES`) to which you want to define the ISM functions, as shown in Figure 15-1, and press Enter.

```
                                Processor List       Row 1 of 4 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
f ARIES    8561     T01      LPAR  0123458561 Aries
_ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 15-1 Processor List: Adding PCIe functions to a processor - ISM

3. To add a PCIe function, enter `add` on the command line in the PCIe Function List panel (Figure 15-2).

```
                              PCIe Function List     Row 1 of 32 More:
Command ===> add____________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES        Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
```

Figure 15-2 PCIe Function List: Adding PCIe functions to a processor - ISM

4. Make the following updates (Figure 15-3), and press Enter:
   – Update `Function ID` to `0040`.
   – Update `Type` to `ISM`.
   – Update `Channel ID` to `7F1`.
   – Update `Virtual Function ID` to `1`.
   – Update `Description` to the description that you want.

```
*---------------------------- Add PCIe Function ----------------------------*
|                                                                            |
|                                                                            |
| Specify or revise the following values.                                    |
|                                                                            |
| Processor ID . . . . : ARIES        Aries                                  |
|                                                                            |
| Function ID . . . . . . 0040                                               |
| Type . . . . . . . . . ISM            +                                    |
|                                                                            |
| Channel ID . . . . . . . . . . . 7F1  +                                    |
| Port . . . . . . . . . . . . . . _    +                                    |
| Virtual Function ID . . . . . . 1    +                                     |
| Number of virtual functions . . 1                                          |
| UID . . . . . . . . . . . . . . ____                                       |
|                                                                            |
| Description . . . . . . . . . . ISM FID=0040 VFID=1 CHID=7F1____           |
|                                                                            |
|                                                                            |
|                                                                            |
*----------------------------------------------------------------------------*
```

Figure 15-3 PCIe Function List: Adding PCIe functions to a processor - ISM

5. Update `Physical network ID` to `PERFNET` in the Add/Modify Physical Network IDs panel (Figure 15-4), and press Enter.

```
*--------------------- Add/Modify Physical Network IDs ---------------------*
|                                                                            |
|                                                                            |
| If the Channel ID (CHID) is associated to one or more physical networks,   |
| specify each physical network ID corresponding to each applicable          |
| physical port.                                                             |
|                                                                            |
| Physical network ID 1 . . PERFNET_________                                 |
| Physical network ID 2 . . ________________                                 |
| Physical network ID 3 . . ________________                                 |
| Physical network ID 4 . . ________________                                 |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
*----------------------------------------------------------------------------*
```

Figure 15-4 Add/Modify Physical Network IDs: Adding network ID - ISM

6. Select the required Access LPAR for Function access list. In our example, we use LPAR `AREIS21(OS)`. Press Enter (Figure 15-5).

```
*--------------------------- Define Access List ----------------------------*
|                                                              Row 29 of 39 |
| Command ===> ________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one partition for the access list.                                 |
|                                                                           |
| Function ID  . . . . : 0040                                               |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| _ 2      ARIES2F          F      CF    Redbooks CF87                      |
| / 2      ARIES21          1      OS    Redbooks SC76                      |
| _ 2      ARIES22          2      OS    Redbooks SC74                      |
| _ 2      ARIES23          3      OS    Redbooks SC75                      |
| _ 2      ARIES24          4      OS    Redbooks SC80                      |
| _ 2      ARIES25          5      OS    Redbooks SC81                      |
| _ 2      ARIES26          6      OS    Redbooks SC03                      |
| _ 2      ARIES27          7      OS    Redbooks SC60                      |
| _ 2      ARIES28          8      OS                                        |
| _ 2      ARIES29          9      OS                                        |
| _ 5      MCS_1            B      FW                                        |
| *************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
*---------------------------------------------------------------------------*
```

Figure 15-5 Define Access List: Selecting partition for Function access - ISM

7. Select any Candidate LPARs for Function access list. In our example, we do *not* select any candidate LPARs. Press Enter.

   HCD returns to the PCIe Function List panel where you can see that the function is now defined (Figure 15-6).

```
                              PCIe Function List     Row 1 of 33 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES        Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
_ 0040   7F1    _   1    ISM           ____  ISM FID=0040 VFID=1 CHID=7F1
```

Figure 15-6 PCIe Function List: Function now created - ISM

8. Now, define the other FIDs according to the example so far (Figure 15-7).

```
                              PCIe Function List     Row 1 of 36 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES        Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
_ 0040   7F1    _   1    ISM           ____  ISM FID=0040 VFID=1 CHID=7F1
_ 0041   7F1    _   2    ISM           ____  ISM FID=0041 VFID=2 CHID=7F1
_ 0050   7F2    _   1    ISM           ____  ISM FID=0050 VFID=1 CHID=7F2
_ 0051   7F2    _   2    ISM           ____  ISM FID=0051 VFID=2 CHID=7F2
```

Figure 15-7 PCIe Function List: All Functions now created - ISM

ISM management

From an operational standpoint, SMC-D is like SMC-R. However, SMC-D uses DMA instead of Remote Direct Memory Access (RDMA), and it uses a virtual PCI adapter that is called ISM rather than an RDMA network interface card (RNIC). The ISM interfaces are associated with IP interfaces (for example, HiperSockets or Open Systems Adapter-Express (OSA-Express)), and are dynamically created, automatically started and stopped, and auto-discovered.

SMC-D over ISM does not use queue pair (QP) technology like SMC-R. Therefore, links and Link Groups based on QPs (or other hardware constructs) are not applicable to ISM. SMC-D protocol has a design concept of a “logical point-to-point connection” that is called an SMC-D link.

> **Note:** The SMC-D information in the `netstat` command output is related to ISM link information (not Link Groups).

15.2.3 Defining a RoCE PCIe function

As mentioned in 2.5.4, “Network connectivity” on page 22, the following features are supported on the z15 system:

- 10 Gigabit Ethernet (GbE) RoCE Express (Feature Code #0411, carry forward only)
- 10 GbE RoCE Express2 (Feature Code #0412, carry forward only)
- 10 GbE RoCE Express2.1 (Feature Code #0432)
- 25 GbE RoCE Express2 (Feature Code #0430, carry forward only)
- 25 GbE RoCE Express2.1 (Feature Code #0450)

This section provides information about the configuration of the SMC-R on a z15 system.

RoCE overview

The IBM Z RoCE Express features are native PCIe features, so the HCD and input/out configuration program (IOCP) definition rule differ from a non-native PCIe card such as OSA-Express. Here are the rules:

- The PCIe function ID (PFID) must be defined in HCD or Hardware Configuration Manager (HCM) to create IOCP input:
  - FID is a three hexadecimal value (range 000 - FFF), which specifies the PCIe function.
  - The PFID *cannot* be assigned to a channel subsystem (CSS), so any LPAR can be defined to a function.
  - The PFID has a `PARTITION` parameter that dedicates it to one LPAR or enables reconfiguration among a group of LPARs. A function cannot be defined as *shared*.
  - In z/OS system commands, a PFID is represented as `PFID`.
- If the intended PCIe hardware supports multiple partitions, it has a decimal virtual function (VF) number (VF=) in the range 1 - *n*, where *n* is the maximum number of partitions that the PCIe feature supports.
- Other parameters that are specific to the PCIe feature. For example, the IBM RoCE Express requires a Physical Network Identifier (PNETID=), and the IBM Z RoCE Express2 feature supports a port identifier (PORT=).
- For function mapping to hardware, assign a PCHID to identify the hardware feature in a specific PCIe I/O drawer and the slot to be used for the defined function. The following methods can be used:
  - Manually, by using the configurator (eCONFIG) PCHID report.
  - Using the channel path ID (CHPID) Mapping Tool (CMT) and the eConfig Configuration Report File (CFR) input.

> **Note:** Unlike CHPIDs, multiple functions can be mapped to the same PCHID. This approach is conceptually like mapping multiple InfiniBand coupling CHPIDs to the same adapter and port.
>
> The example in the following section is for a 10 GbE RoCE Express2 Card. The same principles also apply to the other supported RoCE Express cards on z15 systems.

RoCE configuration

For more information about the PCHID and Resource Group (RG), see the PCHID report for the processor (see Example 15-2).

Example 15-2 PCHID Report: RoCE information from the PCHID report

```
 Machine: 8561-T01 NEW1
  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
  Source          Drwr  Slot  F/C    PCHID/Ports or AID             Comment
  B10/LG12/J01    B33B  09    0412   158/D1D2           RG1
  A15/LG01/J01    B25B  19    0412   1B8/D1D2           RG2
  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Legend:
  Source  Book Slot/Fanout Slot/Jack
  RG1     Resource Group 1
  0412    10GbE  RoCE Express
  RG2     Resource Group 2
```

In this example, we define these items:

- PCHID 158 to Function IDs 0081 (VF 2) Port 1 and 0091 (VF 2) Port 2 on CPC ARIES to Physical Network ID 1 PERFNET
- PCHID 1B8 to Function IDs 00A1 (VF 2) Port 1and 00B1 (VF 2) Port 2 on CPC ARIES to Physical Network ID 1 PERFNET

Complete the following steps:

1. From the main HCD panel, select option `1.3. Processor List`.
2. Enter `f` (work with PCIe functions) next to the processor (`CETUS`) to which you want to define the RoCE-2 functions, and press Enter. See Figure 15-8.

```
                                Processor List       Row 1 of 4 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
f ARIES    8561     T01      LPAR  0123458561 Aries
_ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 15-8 Processor List: Adding PCIe functions to a processor - RoCE-2

3. To add a PCIe function, enter `add` on the command line in the PCIe Function List panel (see Figure 15-9).

```
                              PCIe Function List     Row 1 of 36 More:
Command ===> add____________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES        Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
```

Figure 15-9 PCIe Function List: Adding PCIe functions to a processor - RoCE-2

4. Make the following updates (see Figure 15-10 on page 373), and press Enter:
   - Update `Function ID` to `0081`.
   - Update `Type` to `ROCE-2`.
   - Update `Channel ID` to `158`.
   - Update `Port` to `1`.
   - Update `Virtual Function ID` to `2`.
   - Update `Description` to the description that you want.

```
*---------------------------- Add PCIe Function ----------------------------*
|                                                                            |
|                                                                            |
| Specify or revise the following values.                                    |
|                                                                            |
| Processor ID  . . . . : ARIES        Aries                                 |
|                                                                            |
| Function ID . . . . . . 0081                                               |
| Type  . . . . . . . . . ROCE-2        +                                    |
|                                                                            |
| Channel ID . . . . . . . . . . . 158  +                                    |
| Port . . . . . . . . . . . . . . 1    +                                    |
| Virtual Function ID  . . . . . . 2__  +                                    |
| Number of virtual functions  . . 1                                         |
| UID  . . . . . . . . . . . . . . ____                                      |
|                                                                            |
| Description  . . . . . . . . . . RoCE-2 FID=0081 VFID=2 CHID=158_         |
|                                                                            |
|                                                                            |
|                                                                            |
*----------------------------------------------------------------------------*
```

Figure 15-10 PCIe Function List: Adding PCIe functions to a processor - RoCE-2

5. Update `Physical network ID` to `PERFNET` in the Add/Modify Physical Network IDs panel (see Figure 15-11), and press Enter.

```
*--------------------- Add/Modify Physical Network IDs ----------------------*
|                                                                            |
|                                                                            |
| If the Channel ID (CHID) is associated to one or more physical networks,   |
| specify each physical network ID corresponding to each applicable          |
| physical port.                                                             |
|                                                                            |
| Physical network ID 1  . . PERFNET                                         |
| Physical network ID 2  . . ________________                                |
| Physical network ID 3  . . ________________                                |
| Physical network ID 4  . . ________________                                |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
*----------------------------------------------------------------------------*
```

Figure 15-11 Add/Modify Physical Network IDs: Adding network ID - RoCE-2

6. Select the required Access LPAR for Function access list. In our example, we use LPAR CETUS21 (OS). Press Enter (see Figure 15-12).

```
Command ===> ________________________________________ Scroll ===> CSR

Select one partition for the access list.

Function ID  . . . . : 0081

/ CSS ID Partition Name   Number Usage Description
_ 2      ARIES2F          F      CF    Redbooks CF87
/ 2      ARIES21          1      OS    Redbooks SC76
_ 2      ARIES22          2      OS    Redbooks SC74
_ 2      ARIES23          3      OS    Redbooks SC75
_ 2      ARIES24          4      OS    Redbooks SC80
_ 2      ARIES25          5      OS    Redbooks SC81
_ 2      ARIES26          6      OS    Redbooks SC03
_ 2      ARIES27          7      OS    Redbooks SC60
_ 2      ARIES28          8      OS
_ 2      ARIES29          9      OS
_ 5      MCS_1            B      FW
*************************** Bottom of data ****************************
```

Figure 15-12 Define Access List: Selecting the partition for function access - RoCE-2

7. Select the Any Candidate LPARs for Function access list. In our example, we do not select any candidate LPARs. Press Enter.

   HCD returns to the PCIe Function List panel where you can see the function defined (see Figure 15-13).

```
                              PCIe Function List     Row 6 of 35 More:
Command ===> ______________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES        Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
_ 0081   158    1   2    ROCE-2        ____  RoCE-2 FID=0081 VFID=2 CHID=158
```

Figure 15-13 PCIe Function List: Function now created - RoCE-2

8. Define the other Function IDs according to the example so far (see Figure 15-14).

```
                              PCIe Function List     Row 5 of 36 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES       Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
_ 0080   158    1   1    ROCE-2        ____  ZOS23BAA
_ 0081   158    1   2    ROCE-2        ____  RoCE-2 FID=0081 VFID=2 CHID=158
_ 0090   158    2   1    ROCE-2        ____  ZOS23BAA
_ 0091   158    2   2    ROCE-2        ____  RoCE-2 FID=0091 VFID=2 CHID=158
_ 00A0   1B8    1   1    ROCE-2        ____  ZOS23BAA
_ 00A1   1B8    1   2    ROCE-2        ____  RoCE-2 FID=00A1 VFID=2 CHID=1B8
_ 00B0   1B8    2   1    ROCE-2        ____  ZOS23BAA
_ 00B1   1B8    2   2    ROCE-2        ____  RoCE-2 FID=00B1 VFID=2 CHID=1B8
```

Figure 15-14 PCIe Function List: All Functions now created - RoCE-2

RoCE management

This section introduces the z/OS commands that a related to the IBM Z RoCE Express PCIe features, and shows the responses on our test system.

DISPLAY PCIE command

You can use the **DISPLAY PCIE** command to display these items:

- All registered device drivers (with assigned printable names).
- All available or in-use PCIe functions and their associated device types.
- Information about a specific PCIe device with a list of the client address spaces that use the device.

Example 15-3 is an example of the **DISPLAY PCIE** command. You can confirm the FID and VFID that you defined. The FID is represented as PFIDs.

Example 15-3 Example of D PCIE command

```
DISPLAY PCIE
IQP022I 12.12.41 DISPLAY PCIE 360
PCIE     0010 ACTIVE
PFID      DEVICE TYPE NAME        STATUS  ASID  JOBNAME  CHID VFN  PN
00000101  8GB zHyperLink          ALLC                   013C 0002 1
00000201  8GB zHyperLink          ALLC                   013C 0002 2
00000301  8GB zHyperLink          ALLC                   021C 0002 1
00000401  8GB zHyperLink          ALLC                   021C 0002 2
00000081  RoCE Express2           CNFG                   0158 0002 1
00000091  RoCE Express2           CNFG                   0158 0002 2
000000A1  RoCE Express2           CNFG                   01B8 0002 1
000000B1  RoCE Express2           CNFG                   01B8 0002 2
```

Example 15-4 is an example of the **DISPLAY PCIE,PFID=pfid** command. After you define the new PCIe function, enter this command and confirm that its status is ACTIVE.

Example 15-4 Example of DISPLAY PCIE,PFID=pfid command

```
DISPLAY PCIE,PFID=0A3
IQP024I 12.14.07 DISPLAY PCIE 362
PCIE     0010 ACTIVE
PFID      DEVICE TYPE NAME        STATUS  ASID  JOBNAME  CHID VFN  PN
00000091  RoCE Express2           CNFG                   0158 0002 2
 CLIENT ASIDS: NONE
 PNetID 1: PERFNET
```

Example 15-5 is example of the **DISPLAY PCIE,DD** command. You can confirm the details of the device drives that are installed in the system.

Example 15-5 Example of DISPLAY PCIE,DD command

```
DISPLAY PCIE,DD
IQP023I 12.15.24 DISPLAY PCIE 364
PCIE     0010 ACTIVE
DEV TYPE   DEVICE TYPE NAME
10140613   8GB zHyperLink
15B36750   10GbE RoCE
15B31003   10GbE RoCE
15B31004   10GbE RoCE Express
15B31016   RoCE Express2
15B31014   RoCE Express2
101404ED   ISM
```

The CONFIG command

You can use the **CONFIG** command to bring the PFID online or offline.

Example 15-6 is an example of a **CONFIG PFID(xx),ONLINE** command.

Example 15-6 Example of a CONFIG PFID(xx),ONLINE command

```
CONFIG PFID(B1),ONLINE
IEE504I PFID(B1),ONLINE
IEE712I CONFIG   PROCESSING COMPLETE
```

Example 15-7 is an example of a **CONFIG PFID(xx),OFFLINE** command.

Example 15-7 Example of a CF PFID(x),OFFLINE command

```
CONFIG PFID(B1),OFFLINE
IEE504I PFID(B1),OFFLINE
IEE712I CONFIG   PROCESSING COMPLETE
```

For more information about how to manage a RoCE Express feature, see *IBM z/OS V2R2 Communications Server TCP/IP Implementation Volume 1: Base Functions, Connectivity, and Routing*, SG24-8360.

15.2.4 IBM Integrated Accelerator for zEDC

On the z15 system, an IBM Integrated Accelerator for zEDC replaces the IBM zEDC Express PCIe adapter.

The z15 processor chip has two integrated accelerators in the design. IBM integrated on-chip compression uses an algorithm for file compression that reduces the size of data to save storage space or increase the data transfer rate. This on-chip compression capability delivers industry-leading throughput and replaces the zEDC Express adapter on the z14 and earlier systems. There are no more input/output configuration data set (IOCDS) definitions that are needed to use the compression function.

However, all data interchange remains compatible. z15 and zEDC capable CPCs co-exist. Data that is compressed and written with zEDC is read and decompressed by z15 systems.

> **Note:** All z/OS configuration prerequisites stay the same. BSAM / QSAM and SMF Logstream compression still need software enablement as a chargeable feature.

15.2.5 Defining a zHyperLink PCIe function

The zHyperLink Express is a direct-connect, short-distance IBM Z I/O feature that works with a High-Performance FICON storage area network (SAN) infrastructure.

IBM zHyperLink dramatically reduces latency by interconnecting the z15 system directly to the I/O bay of the DS8880 storage system or later.

zHyperLink uses a PCIe feature that is called zHyperLink Express (Feature Code #0451 or Feature Code #0431).

There are two ports per feature, and up to 127 VFIDs can be defined per port.

zHyperLink configuration

In this example, we define these items:

- CHID=13C to FID = 0101, VFIDs = 2, Port = 1, on CPC = ARIES
- CHID=13C to FID = 0201, VFIDs = 2, Port = 2, on CPC = ARIES
- CHID=21C to FID = 0301, VFIDs = 2, Port = 1, on CPC = ARIES
- CHID=21C to FID = 0401, VFIDs = 2, Port = 2, on CPC = ARIES

Complete the following steps:

1. From the main HCD panel, select option `1.3. Processor List`. Enter `f` (work with PCIe functions) next to the processor (`CETUS`) to which you want to define the zHyperLink functions, and press Enter (see Figure 15-15).

```
                                 Processor List       Row 1 of 4 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more processors, then press Enter. To add, use F11.


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
f ARIES    8561     T01      LPAR  0123458561 Aries
_ CETUS    3906     M04      LPAR  0EE0F73906 Cetus
_ LEPUS    2965     N20      LPAR  0BB4B72965 Lepus
_ MUSCA    3907     ZR1      LPAR  007A883907 Musca
```

Figure 15-15 Processor List: Adding PCIe functions to a processor - zHyperLink

2. To add a PCIe function, enter `add` on the command line in the PCIe Function List panel (Figure 15-16).

```
                               PCIe Function List     Row 1 of 32 More:
Command ===> add____________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES        Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
```

Figure 15-16 PCIe Function List: Adding PCIe functions to a processor - zHyperLink

3. Make the following updates (Figure 15-17), and press Enter:
   - Update `Function ID` to `101`.
   - Update `Type` to `ZHYPERLINK`.
   - Update `Channel ID` to `13C`.
   - Update `Port ID` to `1`.
   - Update `Virtual Function ID` to `2`.
   - Update `Description` to the description that you want.

```
*---------------------------- Add PCIe Function ----------------------------*
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : ARIES        Aries                                 |
|                                                                           |
| Function ID . . . . . . 0101                                              |
| Type . . . . . . . . . ZHYPERLINK    +                                    |
|                                                                           |
| Channel ID . . . . . . . . . . . 13C  +                                   |
| Port . . . . . . . . . . . . . . 1    +                                   |
| Virtual Function ID . . . . . . 2__  +                                    |
| Number of virtual functions . . 1                                         |
| UID . . . . . . . . . . . . . . ____                                      |
|                                                                           |
| Description . . . . . . . . . . zHYL FID=0101 VFID=2 CHID=13C___          |
|                                                                           |
|                                                                           |
|                                                                           |
*---------------------------------------------------------------------------*
```

Figure 15-17 PCIe Function List: Adding PCIe functions to a processor - zHyperLink

4. Select the required Access LPAR for Function access list. In our example, we use LPAR `CETUS21 (OS)`. Press Enter (see Figure 15-18).

```
*--------------------------- Define Access List ----------------------------*
|                                                             Row 30 of 39 |
| Command ===> ________________________________________ Scroll ===> CSR    |
|                                                                          |
| Select one partition for the access list.                                |
|                                                                          |
| Function ID  . . . . : 0101                                              |
|                                                                          |
| / CSS ID Partition Name   Number Usage Description                       |
| / 2      ARIES21          1      OS    Redbooks SC76                     |
| _ 2      ARIES22          2      OS    Redbooks SC74                     |
| _ 2      ARIES23          3      OS    Redbooks SC75                     |
| _ 2      ARIES24          4      OS    Redbooks SC80                     |
| _ 2      ARIES25          5      OS    Redbooks SC81                     |
| _ 2      ARIES26          6      OS    Redbooks SC03                     |
| _ 2      ARIES27          7      OS    Redbooks SC60                     |
| _ 2      ARIES28          8      OS                                      |
| _ 2      ARIES29          9      OS                                      |
| _ 5      MCS_1            B      FW                                      |
| *************************** Bottom of data ***************************** |
|                                                                          |
|                                                                          |
|                                                                          |
*--------------------------------------------------------------------------*
```

Figure 15-18 Define Access List: Selecting the partition for function access - zHyperLink

5. Select the Any Candidate LPARs for Function access list. In our example, we do *not* select any candidate LPARs. Press Enter.

   HCD returns to the PCIe Function List panel, where you can see the function now defined (see Figure 15-19).

```
                              PCIe Function List    Row 14 of 33 More:
Command ===> _______________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES        Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
_ 0101   13C    1   2    ZHYPERLINK    ____  zHYL FID=0101 VFID=2 CHID=13C
```

Figure 15-19 PCIe Function List: Function now created - zHyperLink

6. Now, define the other Function IDs according to the example so far (see Figure 15-20).

```
                              PCIe Function List    Filter Mode. More:
Command ===> ______________________________________________ Scroll ===> CSR

Select one or more PCIe functions, then press Enter. To add, use F11.

Processor ID . . . . : ARIES       Aries



/ FID    CHID+  P+  VF+  Type+         UID   Description
_ 0101   13C    1   2    ZHYPERLINK    ____  zHYL FID=0101 VFID=2 CHID=13C
_ 0201   13C    2   2    ZHYPERLINK    ____  zHYL FID=0201 VFID=2 CHID=13C
_ 0301   21C    1   2    ZHYPERLINK    ____  zHYL FID=0301 VFID=2 CHID=21C
_ 0401   21C    2   2    ZHYPERLINK    ____  zHYL FID=0401 VFID=2 CHID=21C
```

Figure 15-20 PCIe Function List: All Functions now created - zHyperLink

Managing zHyperLink Express

To enable IBM Db2 to use zHyperLinks, the Db2 zParm must be modified to enable zHyperLink, as shown in the example in Figure 15-21.

```
DSNIIPA3             INSTALL DB2 - DATA PARAMETERS PANEL
===>

Check parameters and reenter to change:
 1 PERMANENT UNIT NAME    ==> 3390     Device type for MVS catalog and
                                       partitioned data sets
 2 TEMPORARY UNIT NAME    ==> SYSDA    Device type for temporary data sets
 3 DB2 zHyperlinks SCOPE  ==> ENABLE   Scope of zHyperlinks I/O connections:
                                       (ENABLE, DISABLE, DATABASE, LOG)

                                         ---------------- SMS -----------------
                              VOL/SER    DATA CLASS    MGMT CLASS    STOR CLASS
                              -------    ----------    ----------    ----------
 4 CLIST ALLOCATION       ==> ______ ==> ________  ==> ________  ==> ________
 5 NON-VSAM DATA          ==> ______ ==> ________  ==> ________  ==> ________
 6 VSAM CATALOG, DEFAULT, ==> ______ ==> ________  ==> ________  ==> ________
   AND WORK FILE DATABASE
 7 LOG COPY 1, BSDS 2     ==> ______ ==> ________  ==> ________  ==> ________
 8 LOG COPY 2, BSDS 1     ==> ______ ==> ________  ==> ________  ==> ________



PRESS:  ENTER to continue   RETURN to exit   HELP for more information
```

Figure 15-21 Db2 zParm: zHyperLink

The acceptable values for the Db2 zHyperLink Scope are the following ones:

`ENABLE` Db2 requests the zHyperLink protocol for all eligible I/O requests.

`DISABLE` Db2 does not use the zHyperLink for any I/O requests.

`DATABASE` Db2 requests the zHyperLink protocol for only database synchronous read I/Os.

`LOG` Db2 requests the zHyperLink protocol for only log write I/Os.

Note: Db2 V12 with APAR PH05030 supports zHyperLink writes for active Db2 logs, and APAR OA52876 provides read support for VSAM data sets.

To enable z/OS for zHyperLink, the **`ZHPF=YES`** and **`ZHYPERLINK OPER=ALL`** statements must be added to the `IECIOSxx` parmlib member, as shown in Example 15-8.

Example 15-8 IECIOSxx parmlib enabled for zHyperLink read I/Os

```
VIEW       SYS1.PARMLIB(IECIOS00 ) - 01.22                  Columns 00001 00072
Command ===>                                                  Scroll ===> PAGE
****** ***************************** Top of Data ******************************
000001 CTRACE(CTIIOS00)
000006 HYPERPAV=XPAV
000007 MIDAW=YES
000008 ZHPF=YES
000009 ZHYPERLINK OPER=ALL
****** **************************** Bottom of Data ****************************
```

This process can also be done dynamically by entering the **`SETIOS ZHYPERLINK,OPER=ALL`** console command. The corresponding display command is **`DISPLAY IOS,ZHYPERLINK`**, as shown in Example 15-9.

Example 15-9 DISPLAY IOS,ZHYPERLINK

```
D IOS,ZHYPERLINK
IOS634I 14.16.46 IOS SYSTEM OPTION 375
ZHYPERLINK IS ENABLED FOR READ AND WRITE OPERATIONS
```

The **`DISPLAY PCIE`** command can be used to display the available PFIDs for zHyperLink, as shown in Example 15-10.

Example 15-10 DISPLAY PCIE

```
D PCIE
IQP022I 14.18.53 DISPLAY PCIE 377
PCIE     0010 ACTIVE
PFID      DEVICE TYPE NAME        STATUS  ASID  JOBNAME  CHID VFN  PN
00000081  RoCE Express2           CNFG                   0158 0002 1
00000091  RoCE Express2           CNFG                   0158 0002 2
000000A1  RoCE Express2           CNFG                   01B8 0002 1
000000B1  RoCE Express2           CNFG                   01B8 0002 2
00000101  8GB zHyperLink          CNFG                   013C 0002 1
00000201  8GB zHyperLink          CNFG                   013C 0002 2
00000301  8GB zHyperLink          CNFG                   021C 0002 1
00000401  8GB zHyperLink          CNFG                   021C 0002 2
```

Example 15-11 shows the **DISPLAY PCIE=pfid** command to display a specific zHyperLink PFID.

Example 15-11 DiSPLAY PCIE=pfid

```
DISPLAY PCIE,PFID=0201
IQP024I 14.53.34 DISPLAY PCIE 431
PCIE     0010 ACTIVE
PFID      DEVICE TYPE NAME         STATUS  ASID  JOBNAME  CHID VFN  PN
00000201  8GB zHyperLink           ALLC    0017  IOSAS    013C 0002 2
 CLIENT ASIDS: NONE
 CU WWNN: 5005076306FFD680  CU Link Id: 0380
 S/W State: Allocated
 Port State: Operational
 CU Node Descriptor: 002107.981.IBM.75.0000000FAT71
```

The results of running the **DISPLAY M=CU(cun)** command against a CU that is enabled for zHyperLink are shown in Example 15-12.

Example 15-12 DISPLAY M=CU(cun)

```
DISPLAY M=CU(9000)
IEE174I 14.56.31 DISPLAY M 439
CONTROL UNIT 9000
CHP                    8C   94   AC   D6   B4   BC   C4   CC
ENTRY LINK ADDRESS     C535 C543 C343 20F7 C907 C903 C713 C74A
DEST LINK ADDRESS      C330 C340 C530 C540 C730 C740 C930 C940
CHP PHYSICALLY ONLINE  Y    Y    Y    Y    Y    Y    Y    Y
PATH VALIDATED         Y    Y    Y    N    Y    N    Y    Y
MANAGED                N    N    N    N    N    N    N    N
ZHPF - CHPID           Y    Y    Y    Y    Y    Y    Y    Y
ZHPF - CU INTERFACE    Y    Y    Y    N    Y    N    Y    Y
INTERFACE ID           0010 0011 0012 .... 0140 .... 0142 0143
MAXIMUM MANAGED CHPID(S) ALLOWED = 0
DESTINATION CU LOGICAL ADDRESS = 00
CU ND            = 002107.981.IBM.75.0000000FAT71.0010
CU NED           = 002107.981.IBM.75.0000000FAT71.0000
TOKEN NED        = 002107.900.IBM.75.0000000FAT71.0000
WWNN             = 5005076306FFD680
FUNCTIONS ENABLED = ZHPF, ZHYPERLINK, XPAV
XPAV CU PEERS     = 9000, 9200
DEFINED DEVICES
  09000-0907F
DEFINED PAV ALIASES
  19000-1907F
ZHYPERLINKS
PFID      PCHID  Port  LinkId  S/W St   Port St
00001004  013C   01    0180    Alloc    Oper
00001005  013C   01    0180    Alloc    Oper
00001006  013C   01    0180    Alloc    Oper
00001007  013C   01    0180    Alloc    Oper
00001104  0178   01    0580    Alloc    Oper
00001105  0178   01    0580    Alloc    Oper
00001106  0178   01    0580    Alloc    Oper
00001107  0178   01    0580    Alloc    Oper
00001204  017C   01    0780    Alloc    Oper
```

```
00001205  017C   01    0780    Alloc    Oper
00001206  017C   01    0780    Alloc    Oper
00001207  017C   01    0780    Alloc    Oper
00001304  021C   01    0380    Alloc    Oper
00001305  021C   01    0380    Alloc    Oper
00001306  021C   01    0380    Alloc    Oper
00001307  021C   01    0380    Alloc    Oper
```

The results for the **DISPLAY M=DEV(devno)** command against a device that is enabled for zHyperLink are shown in Example 15-13.

Example 15-13   DISPLAY M=DEV(devno)

```
DISPLAY M=DEV(9000)
IEE174I 15.06.09 DISPLAY M 447
DEVICE 09000   STATUS=ONLINE
ENTRY LINK ADDRESS    C535 C543 C343 20F7 C907 C903 C713 C74A
DEST LINK ADDRESS     C330 C340 C530 C540 C730 C740 C930 C940
PATH ONLINE           Y    Y    Y    N    Y    N    Y    Y
CHP PHYSICALLY ONLINE Y    Y    Y    Y    Y    Y    Y    Y
PATH OPERATIONAL      Y    Y    Y    N    Y    N    Y    Y
MANAGED               N    N    N    N    N    N    N    N
CU NUMBER             9000 9000 9000 9000 9000 9000 9000 9000
INTERFACE ID          0010 0011 0012 .... 0140 .... 0142 0143
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND         = 002107.981.IBM.75.0000000FAT71.0010
SCP TOKEN NED     = 002107.900.IBM.75.0000000FAT71.0000
SCP DEVICE NED    = 002107.900.IBM.75.0000000FAT71.0000
WWNN              = 5005076306FFD680
HYPERPAV ALIASES CONFIGURED = 128
ZHYPERLINKS AVAILABLE = 16
FUNCTIONS ENABLED = MIDAW, ZHPF, XPAV, ZHYPERLINK
```

This display command is enhanced with the new parameter **ZHYPERLINK** to show whether the device can use zHyperLink. The response is shown for a device that can use zHyperLink in an z/OS environment that is enabled for read only, as shown in Example 15-14.

Example 15-14   DISPLAY M=DEV(devno),ZHYPERLINK: Device enabled for zHyperLink

```
DISPLAY M=DEV(7000),ZHYPERLINK
IEE587I 15.57.37 DISPLAY M 456
DEVICE 07000   STATUS=ONLINE
DEVICE IS ENABLED FOR ZHYPERLINK
READ OPERATIONS ARE ENABLED
WRITE OPERATIONS ARE DISABLED FOR THE FOLLOWING REASON(S):
  ZHYPERLINK WRITES ARE DISABLED FOR THE SYSTEM
  CONTROL UNIT DOES NOT SUPPORT ZHYPERLINK WRITES
```

The result for a device that cannot use zHyperLink is shown in Example 15-15.

Example 15-15   DISPLAY M=DEV(devno,ZHYPERLINK: Device not enabled for zHyperLink

```
DISPLAY M=DEV(265E),ZHYPERLINK
IEE587I 15.59.25 DISPLAY M 473
DEVICE 0265E   STATUS=ONLINE
```

```
DEVICE IS DISABLED FOR ZHYPERLINK FOR THE FOLLOWING REASON(S):
  CONTROL UNIT DOES NOT SUPPORT ZHYPERLINK
  THERE ARE NO ZHYPERLINKS AVAILABLE
WRITE OPERATIONS ARE DISABLED FOR THE FOLLOWING REASON(S):
  ZHYPERLINK WRITES ARE DISABLED FOR THE SYSTEM
```

A

Additional material

This book refers to additional material that can be downloaded from the internet as described in the following sections.

Locating the web material

The web material that is associated with this book is available in softcopy on the internet from the IBM Redbooks web server:

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The additional web material that accompanies this book includes the following file:

File name	*Description*
8860_DH2_Image_worksheet.xlsx	Worksheet for gathering setup information

Downloading and extracting the web material

Create a subdirectory (folder) on your workstation, and extract the contents of the web material compressed file into this folder.

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