ibm.com/redbooks

IBM z17 Configuration Setup

Ewerson Palacio

Volkmar Langer

Hongshou Liu

Patterson Monteiro

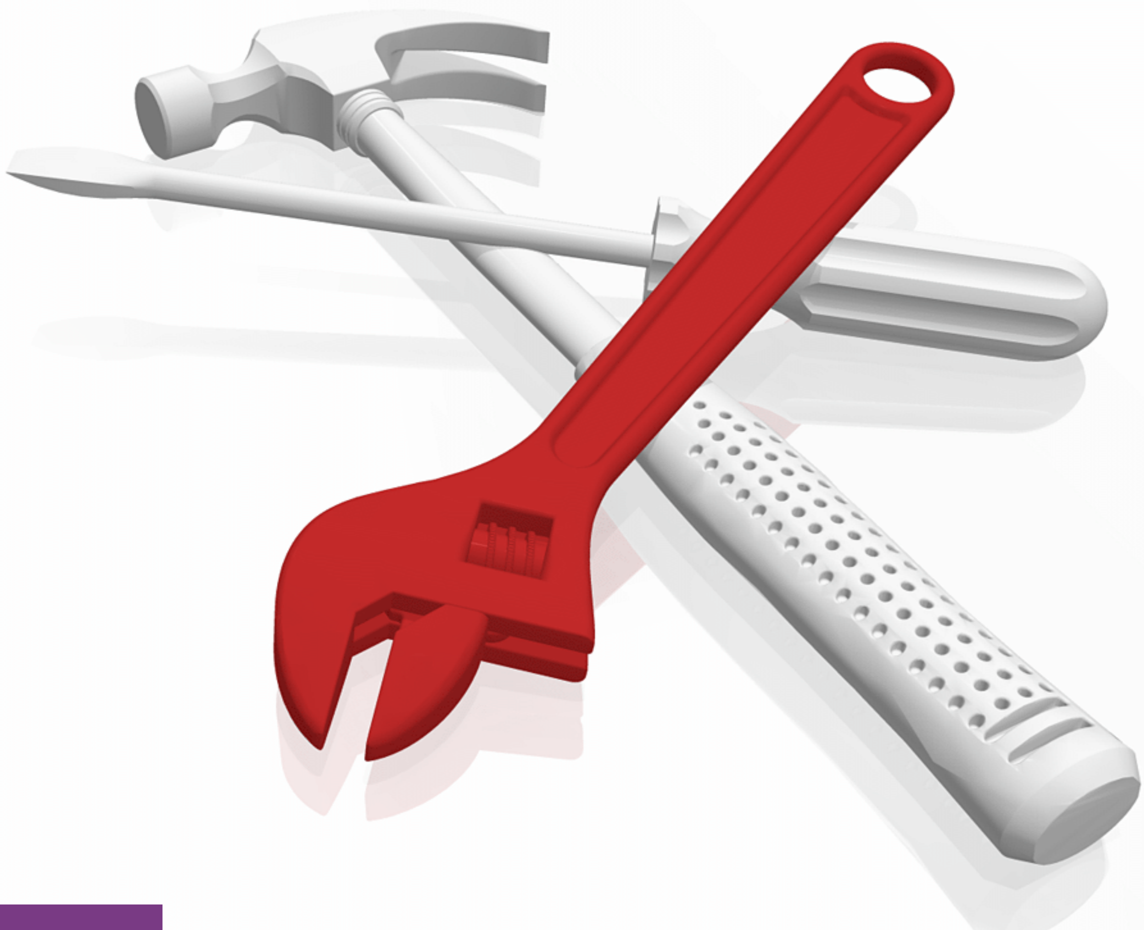
Nelson Oliveira

Elcio Pineschi

Franco Pinto

Ryotaroh Sawada

Martin Söllig



IBM Z

Redbooks

IBM Redbooks

IBM z17 Configuration Setup

December 2025

SG24-8581-00

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

First Edition (December 2025)

This edition applies to IBM z17 machine type 9175.

Contents

Notices ix
Trademarks x

Preface xi
Authors xi
Now you can become a published author, too! xii
Comments welcome xii
Stay connected to IBM Redbooks xiii

Chapter 1. Introduction 1
1.1 High-level goal 2
1.2 Scope 2
1.3 Configuration tools 6
1.4 Preview of IBM z17 server changes 6

Chapter 2. Planning considerations 7
2.1 Scenario descriptions 8
2.1.1 Upgrading an existing IBM Z server to an IBM z17 8
2.1.2 Installing a new IBM z17 8
2.1.3 Planning for the scenarios 8
2.2 Key tools 9
2.2.1 IBM Resource Link 10
2.2.2 Hardware Configuration Definition 11
2.2.3 IBM Z Connectivity Mapping Tool 12
2.2.4 HCD and the CMT 12
2.3 Extra tools 13
2.3.1 Input/Output Configuration Program 13
2.3.2 Worldwide Port Name Prediction Tool 14
2.3.3 Coupling Facility Structure Sizer 14
2.3.4 Power estimation tool 14
2.3.5 Shared Memory Communications Applicability Tool 15
2.3.6 IBM Z Batch Network Analyzer tool 15
2.4 Hardware Management Appliance 15
2.4.1 Activation profiles 15
2.4.2 Cryptographic configuration 17
2.4.3 LPAR group control 17
2.4.4 Consoles and terminals 18
2.4.5 Hardware Management Appliance 19
2.4.6 Hardware Management Console considerations 20
2.4.7 Support Element settings 24
2.4.8 Network Time Protocol 25
2.4.9 Precision Time Protocol 25
2.4.10 Server Time Protocol 25
2.4.11 Pulse per second 26
2.4.12 External time sources and STP planning considerations 26
2.5 IODF configuration 28
2.5.1 Channel subsystems 28
2.5.2 Logical partitions 28
2.5.3 Storage connectivity 31

2.5.4 Network connectivity . . . 32
2.5.5 Coupling and timing links . . . 36
2.5.6 Planning considerations for hardware data compression . . . 37

Chapter 3. Preparing an IBM z17 system . . . 39
3.1 Supported hardware features . . . 40
3.2 Saving and restoring Open Systems Adapter-Express configuration data . . . 41
3.3 Upgrading an IBM z16 to an IBM z17 while maintaining the serial number . . . 41
3.3.1 Scenario overview . . . 41
3.3.2 Creating the work IODF from the current 3931 production IODF . . . 43
3.3.3 Repeating the 3931 processor to be replaced . . . 43
3.3.4 Coupling Link information messages . . . 44
3.3.5 Deleting any unsupported items in the repeated 3931 . . . 45
3.3.6 Changing the 3931 to a 9175 and deleting the 3931 . . . 54
3.3.7 Deleting the 3931 processor definition . . . 55
3.3.8 Reconnecting the CF channel paths that were not migrated . . . 57
3.3.9 Additional steps and tasks . . . 57
3.4 Installing a new IBM z17 . . . 57
3.4.1 Creating a work IODF from the current production IODF . . . 58
3.4.2 Adding the 9175 processor . . . 59
3.4.3 Additional steps and tasks . . . 62

Chapter 4. Preparing an IOCP input file to use the IBM Z CMT . . . 63
4.1 Creating a copy of an existing IODF from an IBM z16 server . . . 64
4.1.1 Changing the processor type . . . 67
4.1.2 Validating the work input/output definition file . . . 68
4.2 Creating the IOCP file for use with the CMT . . . 70
4.3 Assigning CHIDs to CHPIDs by using the CMT . . . 73
4.4 Importing the CFR file and the IOCP input file into the CMT . . . 74
4.5 Building the initial overview . . . 75
4.6 Assigning missing feature types . . . 78
4.7 Resetting incompatible (hardware - I/O) entries . . . 80
4.7.1 Assigning PCHID entries to function IDs . . . 82
4.8 Creating CMT reports . . . 83
4.8.1 CHPID Report . . . 84
4.9 Creating an updated IOCP file . . . 87
4.10 Additional steps and processes . . . 88

Chapter 5. Building the production input/output definition file and setting up the central processor complex . . . 89
5.1 Building the new production IODF . . . 90
5.2 Writing the IOCP to the old CPC by using HCD . . . 93
5.3 Creating a reset profile on the Support Element . . . 101
5.3.1 Background activities that occurred . . . 101
5.3.2 Building the reset profile and pointing it to the required IOCDS . . . 101
5.3.3 Setting up and verifying the reset profile . . . 104
5.4 Creating an image profile on the Support Element . . . 105
5.4.1 Image profile: General page . . . 105
5.4.2 Image profile: Processor page . . . 106
5.4.3 Image profile: Security page . . . 107
5.4.4 Image Profile: Storage page . . . 108
5.4.5 Image profile: Options page . . . 108
5.4.6 Image profile: Load page . . . 110
5.4.7 Image profile: Crypto page . . . 110

5.4.8 Image profile: Time Offset . . . 112
5.4.9 Image profile: Saving . . . 112
5.5 Performing a power-on reset on the new CPC . . . 113
5.5.1 Coupling Facility links . . . 113
5.5.2 Remote dynamic activation of I/O configurations for SACFs, Linux on IBM Z, and z/TPF . . . 117
5.6 Server Time Protocol configuration . . . 123
5.7 Building and verifying load (IPL) profiles . . . 123
5.8 Building and verifying LOADxx members in SYS#.IPLPARM . . . 126
5.9 Communicating information about the new CPC . . . 127

Chapter 6. Configuring network features . . . 129
6.1 Configuring OSA for OSA-Express and Network Express Adapter . . . 130
6.1.1 Open Card Specific Advanced Facilities . . . 132
6.1.2 Displaying or altering the MAC address . . . 132
6.1.3 Enabling or disabling ports . . . 133
6.1.4 Set card mode . . . 133
6.2 Verifying the OSA configuration . . . 134
6.3 Configuring Shared Memory Communications (SMC-D and SMC-R) . . . 134
6.3.1 Defining SMC-R . . . 135
6.3.2 Defining SMC-D . . . 135

Chapter 7. Defining console communication . . . 137
7.1 Preparing a console definition . . . 138
7.2 Defining the OSA-ICC . . . 138
7.3 Configuring an OSA-ICC configuration by using OSA Advanced Facilities . . . 138
7.3.1 Saving and restoring the OSA-ICC configuration . . . 145
7.4 Verifying the OSA-ICC definition . . . 152
7.4.1 z/OS commands . . . 152
7.4.2 OSA-ICC console initial window . . . 153

Chapter 8. Preparing for IBM Parallel Sysplex and Server Time Protocol . . . 155
8.1 Preparing for a Parallel Sysplex . . . 156
8.2 Preparing for non-sysplex system time synchronization . . . 156
8.3 Server Time Protocol overview . . . 156
8.3.1 External Time Source . . . 158
8.3.2 Configuring the HMC as an NTP server . . . 159
8.4 HMC 2.17.0 (Manage System Time task) . . . 160
8.4.1 Setting CTN member restrictions . . . 163
8.4.2 HMC operations to add a CPC to the CTN . . . 164
8.4.3 Verifying the new CTN configuration . . . 166

Chapter 9. Defining Coupling Facility links . . . 169
9.1 Coupling connectivity options for Parallel Sysplex on IBM z17 . . . 170
9.1.1 Preparing to define Coupling Facility links . . . 171
9.2 Defining Coupling Express3 Long Reach . . . 172
9.2.1 CE3 LR 10 Gb (CL5) connections: . . . 173
9.2.2 Verifying the CE3 LR 10 Gb (CL5) configuration . . . 174
9.2.3 CE3 LR 25 Gb (CL6) connections . . . 178
9.2.4 Verifying the CE3 LR 25 Gb (CL6) configuration . . . 180
9.3 Defining Integrated Coupling Adapter Short Reach . . . 182
9.3.1 ICA SR: Verifying the configuration . . . 184
9.4 Defining an STP timing-only link by using ICA SR . . . 187
9.4.1 STP timing-only link: Implementation . . . 187

9.4.2 Verifying the STP timing-only links configuration 190
9.5 CF LPAR setup and Coupling Facility Control Code Level 26 190
9.5.1 Coupling Facility Control Code Level 26. 191
9.6 Dynamic I/O for Stand-alone Coupling Facility 191
9.6.1 IBM Processor Resource/System Manager solution. 192

Chapter 10. Specialized features 193
10.1 Crypto Express8S 194
10.1.1 Crypto Express8S overview 194
10.1.2 Planning for a Crypto Express8S configuration 197
10.1.3 Configuring Crypto Express8S 199
10.1.4 Handling cryptographic coprocessors by using ICSF 221
10.2 Virtual Flash Memory 227
10.2.1 VFM overview 228
10.2.2 Planning for VFM configuration. 228
10.2.3 Configuring VFM 228
10.2.4 VFM management 230

Chapter 11. Adding logical partitions and operating system configurations 241
11.1 Preliminary actions 242
11.2 Defining a new OSCONFIG 242
11.3 Defining an LPAR 243
11.3.1 Defining an LPAR by using HCD 244
11.3.2 Defining an image profile on the HMA 245

Chapter 12. Adding storage devices 247
12.1 Defining more I/O by using HCD. 248
12.1.1 Defining FICON switches 248
12.2 FICON CHPIDs, switches, and DASD CUs 250
12.2.1 Defining FICON CHPIDs and connecting them to a FICON switch 250
12.2.2 Defining FICON CHPIDs for a direct connection to a 2107 control unit 253
12.2.3 Defining FICON CHPIDs for switch connections to a 2107 control unit 256
12.2.4 Defining 3390B devices to an OSCONFIG, Eligible Device Tables, and Esoteric device groups 262

Chapter 13. Adding network devices 269
13.1 Summary of network devices that are defined in this chapter. 270
13.2 Defining OSC (Integrated Console Controller) 270
13.2.1 Defining OSC CHPIDs 270
13.2.2 Defining OSC CHPID connections to an OSC CU 273
13.2.3 Defining 3270-X devices to an OSCONFIG 274
13.2.4 Defining 3270-X devices to the NIP Console List within an OSCONFIG 277
13.2.5 Verifying the OSC definition 281
13.3 Defining OSD (QDIO) 281
13.3.1 Defining OSD CHPIDs 281
13.3.2 Defining OSD CHPID connections to an OSA CU 285
13.3.3 Defining OSA devices to an OSCONFIG (OSD CHIPDs). 287
13.3.4 Verifying the OSD definition 290
13.4 Network Express for channel type OSH 291
13.4.1 Defining OSH CHIPDs 292
13.4.2 Defining OSH CHPID connections to an OSA CU 295
13.4.3 Defining OSA devices to an OSCONFIG (OSH CHIPDs). 295
13.4.4 Verifying the OSH definition 295
13.5 IQD CHPIDs for HiperSockets 297

13.5.1 Defining IQD CHPIDs 297
13.5.2 Defining IQD CHPID connections to an IQD CU. 300
13.5.3 Defining IQD devices to an OSCONFIG 303
13.5.4 Verifying the IQD definition 305

Chapter 14. Adding coupling connectivity 307
14.1 Defining more I/O by using HCD 308
14.2 Coupling Facility logical partitions; CS5, CL5, and CL6; and ICP CHPIDs 308
14.2.1 Defining Coupling Facility LPARs in a channel subsystem 308
14.2.2 Defining the CS5 CHPIDs 309
14.2.3 Defining a Coupling Facility link with CS5 CHPIDs 313
14.2.4 Defining CL5 and CL6 CHPIDs 316
14.2.5 Defining a Coupling Facility link with CL5 or CL6 CHPIDs 322
14.2.6 Defining ICP CHPIDs 326
14.2.7 Defining a Coupling Facility link with ICP CHPIDs 330

Chapter 15. Adding Peripheral Component Interconnect Express devices 335
15.1 Defining PCIe functions by using HCD 336
15.2 Defining the PCIe features 336
15.2.1 Overview 336
15.2.2 Defining an ISM PCIe function 339
15.2.3 Defining a NETH PCIe function. 343
15.2.4 Defining a zHyperLink PCIe function 349

Chapter 16. Defining channel-to-channel connections 357
16.1 Understanding Fibre Connection channel-to-channel. 358
16.2 Defining FCTC 358
16.3 Verifying the FCTC configuration 361
16.3.1 Checking the status by using z/OS commands. 361
16.3.2 Checking the status by using the Support Element 361

Appendix A. Additional material 363
Locating the web materials 363
Using the web materials. 363
Downloading and extracting the web material 363

Abbreviations and acronyms 365

Related publications 367
IBM Redbooks 367
Other publications 367
Online resources 368
Help from IBM 369

Notices

This information was developed for products and services offered in the US. This material might be available from IBM in other languages. However, you may be required to own a copy of the product or product version in that language in order to access it.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive, MD-NC119, Armonk, NY 10504-1785, US

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM websites are provided for convenience only and do not in any manner serve as an endorsement of those websites. The materials at those websites are not part of the materials for this IBM product and use of those websites is at your own risk.

IBM may use or distribute any of the information you provide in any way it believes appropriate without incurring any obligation to you.

The performance data and customer examples cited are presented for illustrative purposes only. Actual performance results may vary depending on specific configurations and operating conditions.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to actual people or business enterprises is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. The sample programs are provided "AS IS", without warranty of any kind. IBM shall not be liable for any damages arising out of your use of the sample programs.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at "Copyright and trademark information" at http://www.ibm.com/legal/copytrade.shtml

The following terms are trademarks or registered trademarks of International Business Machines Corporation, and might also be trademarks or registered trademarks in other countries.

Db2®
DS8000®
FICON®
GDPS®
HyperSwap®
IBM®
IBM Z®
IBM z16®
Parallel Sysplex®
RACF®
Redbooks®
Redbooks (logo) ®
Resource Link®
VTAM®
z/OS®
z/VM®
z15®
z16®
z17™

The following terms are trademarks of other companies:

Evolution, are trademarks or registered trademarks of Kenexa, an IBM Company.

The registered trademark Linux® is used pursuant to a sublicense from the Linux Foundation, the exclusive licensee of Linus Torvalds, owner of the mark on a worldwide basis.

Java, and all Java-based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

Other company, product, or service names may be trademarks or service marks of others.

Preface

This IBM Redbooks® publication helps you install, configure, and maintain IBM z17™ (machine type 9175) systems. IBM z17 systems offer 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 wants to understand IBM Z® configuration and implementation. Readers must be familiar with IBM Z technology and terminology.

For more information about the functions of IBM z17 systems, see *IBM z17 Technical Introduction*, SG24-8580 and *IBM z16 (3931) Technical Guide*, SG24-8951.

Authors

This book was produced by a team of specialists from around the world working at IBM Redbooks, Poughkeepsie Center.

Ewerson Palacio is an IBM Redbooks Project Leader. He holds a bachelor's degree in math and computer science. He worked at IBM Brazil for over 40 years and retired in 2017 as an IBM Distinguished Engineer. Ewerson co-authored many IBM Z Redbooks and created and presented ITSO seminars around the world.

Volkmar Langer is an IBM MVS Senior Systems Programmer at Dataport in Germany. He has more than 35 years of experience in IBM z/OS® and IBM Z hardware. For more than 25 years, he has been responsible for the concepts and design of Dataport's z/OS Sysplex environments, including logical partition (LPAR) design and disaster recovery concepts. His areas of expertise include z/OS, IBM Parallel Sysplex®, Job Entry Subsystem 2 (JES2), Hardware Configuration Definition (HCD), Hardware Management Console (HMC), and Software Management (SMP/E).

Hongshuo Liu is an IT Specialist in IBM Japan. She has 9 years of experience in the IBM Z field. Her areas of expertise include IBM Z hardware and IBM z/OS. She is a member of a team that supports IBM Z hardware and software for multiple major banks.

Patterson Marletta Monteiro is a Consultant Client Availability Leader in Brazil. He has 23 years of experience working with banks in Brazil on the IBM Z platform. He holds a degree in computer science from UNISA and a MBA in communication and networks from the University of São Paulo (Escola Politécnica). His areas of expertise include IBM z/OS and Communications Server.

Nelson Oliveira is a Consultant and IT Specialist with IBM Brazil. He has 33 years of experience in the field of mainframe technology. His areas of expertise include IBM z/OS, JES2, Parallel Sysplex, high availability (HA), IBM Geographically Dispersed Parallel Sysplex (IBM GDPS®), and the IBM Z platform.

Elcio Pineschi is an IT Project Manager at Caixa Econômica Federal, one of the major banks in Brazil. He holds a degree in electrical engineering from Universidade Estadual do Rio de Janeiro and a Master of Science (MSc) degree in computer engineering from Universidade Federal do Rio de Janeiro. He has 25 years of experience working with IBM® mainframe system support.

Franco Pinto is an IBM Z Client Architect with IBM Switzerland. He has more than 30 years of experience in the mainframe and IBM z/OS fields. His areas of expertise include IBM Z technical pre-sales covering mainframe sizing, installation planning, and support for existing and new IBM Z functions. In his current role, he supports clients and IBM Business Partners in determining how to best use the wide portfolio of IBM products and services.

Ryotaroh Sawada is a Consultant IT Specialist who is based in Japan. He has 17 years of experience providing technical support for IBM Z clients. His areas of expertise include IBM Z hardware, z/OS, and systems management on the mainframe. He has co-authored several IBM Z Redbooks publications on topics that range from the IBM z14 ZR1 to the IBM z16®.

Martin Söllig is an IBM Z Technical Specialist who is based in Germany. He has 34 years of experience in the IBM Z field and holds a degree in mathematics from the University of Hamburg. His expertise includes IBM z/OS, IBM Z hardware (particularly in Parallel Sysplex and GDPS) environments), and cryptography on IBM Z.

Thanks to the following people for their contributions to this project:

Robert Haimowitz and Bill White
IBM Redbooks, Poughkeepsie Center

Patty Driever, David Hollar, Dave Surman
IBM Poughkeepsie

Jason Stapels, John Troy, Robert Miekle
IBM US

Now you can become a published author, too!

Here’s an opportunity to spotlight your skills, grow your career, and become a published author—all at the same time! Join an IBM Redbooks residency project and help write a book in your area of expertise, while honing your experience using leading-edge technologies. Your efforts will help to increase product acceptance and customer satisfaction, as you expand your network of technical contacts and relationships. Residencies run from two to six weeks in length, and you can participate either in person or as a remote resident working from your home base.

Find out more about the residency program, browse the residency index, and apply online at:

ibm.com/redbooks/residencies.html

Comments welcome

Your comments are important to us!

We want our books to be as helpful as possible. Send us your comments about this book or other IBM Redbooks publications in one of the following ways:

- Use the online **Contact us** review Redbooks form found at:

  ibm.com/redbooks

- Send your comments in an email to:

  redbooks@us.ibm.com

- Mail your comments to:

  IBM Corporation, IBM Redbooks
  Dept. HYTD Mail Station P099
  2455 South Road
  Poughkeepsie, NY 12601-5400

Stay connected to IBM Redbooks

- Find us on Facebook:

  http://www.facebook.com/IBMRedbooks

- Follow us on Twitter:

  http://twitter.com/ibmredbooks

- Look for us on LinkedIn:

  http://www.linkedin.com/groups?home=&gid=2130806

- Explore new Redbooks publications, residencies, and workshops with the IBM Redbooks weekly newsletter:

  https://www.redbooks.ibm.com/Redbooks.nsf/subscribe?OpenForm

- Stay current on recent Redbooks publications with RSS Feeds:

  http://www.redbooks.ibm.com/rss.html

1 Introduction

This chapter presents the high-level goal of this book. It covers scenarios that are from best practices. Subsequent chapters describe the scenarios and the tools that are used to implement the configurations.

> **Notes:** The IBM z17 generation is available in one configuration: the IBM z17 Model ME1. This model is built in a 19-inch form factor that is designed to fit inside a standard 19-inch rack and can scale from 1 - 4 frames, depending on the configuration. The IBM z17 ME1 helps ensure continuity and upgradeability from the IBM z16 A01 and IBM z15® T01. It offers five orderable features: Max43, Max90, Max136, Max183, and Max208.

This chapter includes the following topics:

- High-level goal
- Scope
- Configuration tools
- Preview of IBM z17 server changes

1.1 High-level goal

The goal of this book is to guide readers in planning and completing the configuration tasks that are required for a successful installation of IBM z17 machine type 9175 systems. It covers the planning and preparation tasks that are required from the time an IBM z17 system is delivered and physically installed to the point when a logical partition (LPAR) is ready for activation.

This book details the planning considerations and configuration examples from the perspectives of the Hardware Management Appliance (HMA), Support Element (SE), and input/output definition file (IODF).

1.2 Scope

Before performing the planning and preparation tasks that are covered in this book, complete the following activities:

- Customer configuration design

  Working with the customer's team, IBM provides design and configuration information for the installation of the planned IBM z17 system.

- IBM order to manufacturing

  The IBM representative orders the approved configuration. IBM makes the machine configuration available for download as a CFReport. Obtain the CFReport file from the IBM Resource Link® (authentication with a registered IBMid is required) by using the Configuration Control Number (CCN) that is provided by the IBM representative.

- Physical installation

  With IBM Support, the new-order machine or a frame-roll upgrade to an IBM z17 system is physically installed.

  > **Note:** A frame-roll upgrade includes exchanging the existing frames with newly delivered frames and central processor complex (CPC) drawers while retaining the machine serial number.
  >
  > **Note:** The IBM z17 server does not support Hardware Management Consoles (HMCs) as separate physical equipment. HMC functions are provided by ordering the HMA feature. The optional HMA feature provides redundant HMC functions and is supported by the SE server in the IBM Z server A frame. As a best practice, order at least one HMA feature, with a maximum of two per site.

- Trusted Key Entry (TKE) Installation

  With IBM Support, optional TKE workstations are installed. If necessary, contents such as user profiles and API settings are migrated when replacing the TKE workstations.

Figure 1-1 on page 3 shows the steps that are required for each distinct scenario when preparing for the installation of the IBM z17 system, which includes the following steps:

- Upgrading an existing IBM z15 or z16 system to an IBM z17 system
- Installing a new IBM z17 system

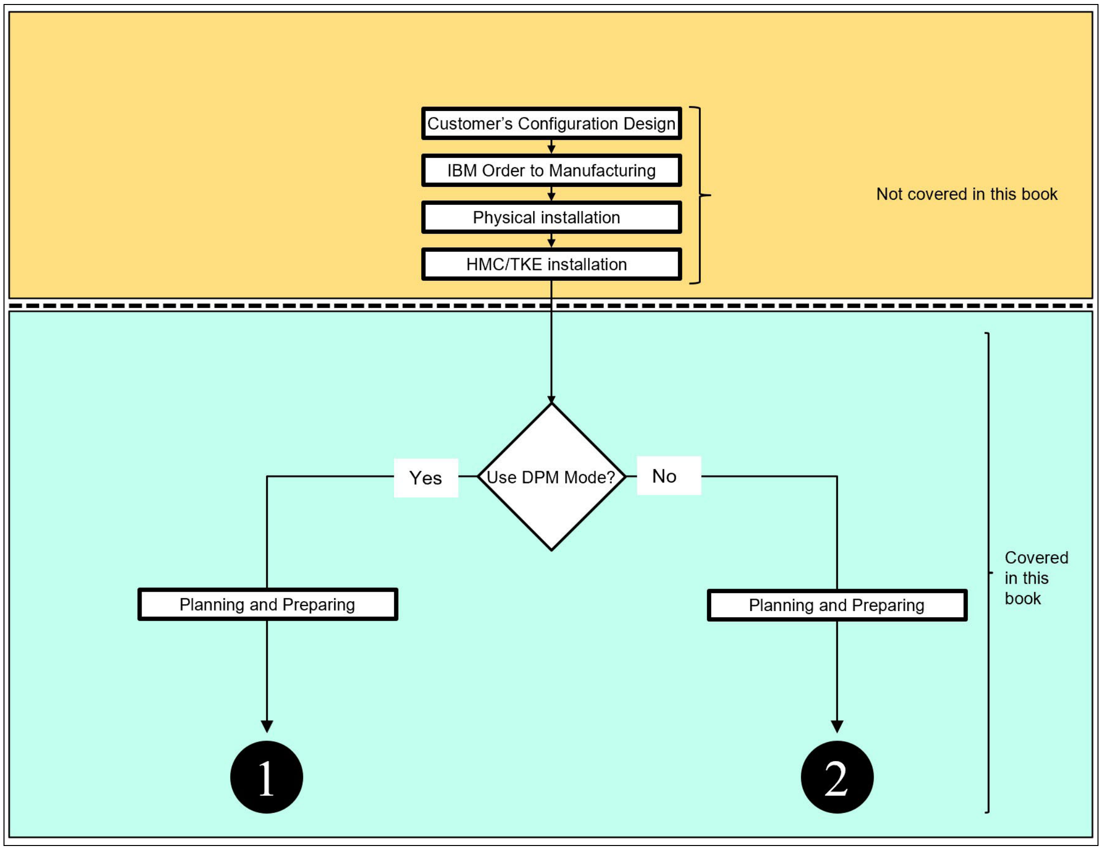


Figure 1-1 Showing the topics that are covered in this book

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

- The upper stream (marked in light yellow) represents actions that should be performed before hardware arrival. These actions are not covered in this book.
- The lower stream (marked in light green) includes the option to use Dynamic Partition Manager (DPM). DPM provides system administrators with a quicker and simpler way to deploy Linux on IBM Z, IBM z/VM®, Kernel-based Virtual Machine (KVM), and Secure Service Container (SSC) logical partitions (LPARs). DPM is a wizard-like configuration method that runs in the HMA.

Important: When DPM is enabled, the IBM z17 system cannot run z/OS, 21st Century System VSEn R6.3.1, or z/TPF LPARs.

The flowchart in Figure 1-2 illustrates the required tasks to install DPM and define the LPAR operating characteristics by using the HMC function. The flowchart is divided into two task streams:

- The stream that is marked in light yellow represents actions that IBM must perform on the SE before handing over the IBM z17 system to the customer.
- The stream that is marked in light green describes the configuration flow for a partition by using the DPM application. Based on the input that is provided to DPM, the application activates a configuration that the IBM z17 system uses to host an operating system (OS).

Perform the actions that are defined in the two streams in sequence.

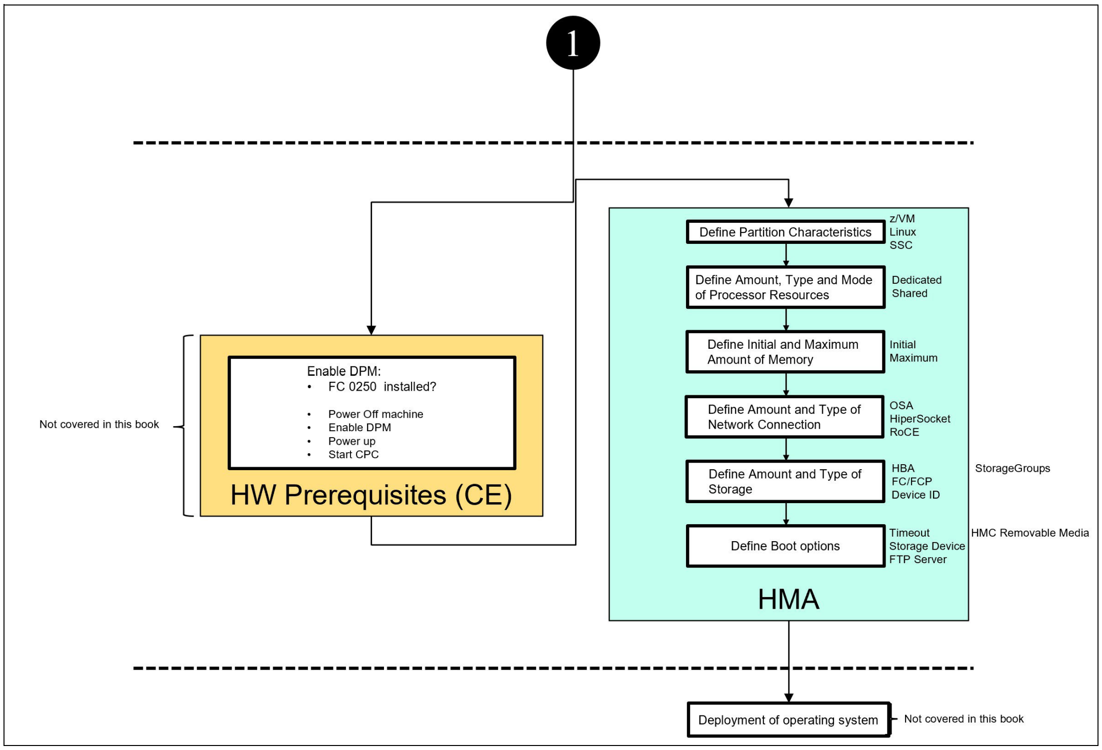


Figure 1-2 Installation flowchart for an IBM z17 system upgrade and a new installation that uses DPM

DPM automatically discovers and displays the system resources that are available for use in Linux on IBM Z, IBM z/VM, KVM, and SSC LPARs. When DPM is used, it creates partition configuration data that contains descriptions of all I/O functions and features that are used on the IBM z17 system, all compute and memory resources, and all cryptographic assignments.

> **Note:** This book does not cover scenarios that use DPM. For more information about using DPM, see *IBM Dynamic Partition Manager (DPM) Guide*, SB10-7182.

The flowchart in Figure 1-3 on page 5 illustrates the additional tasks that are required to complete the installation. The flowchart is divided into two task streams:

- The left side of the flowchart represents actions that must be performed by using the HMC function or the SE function of the HMA.
- The right side of the flowchart represents definitions in the hardware configuration management program.

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

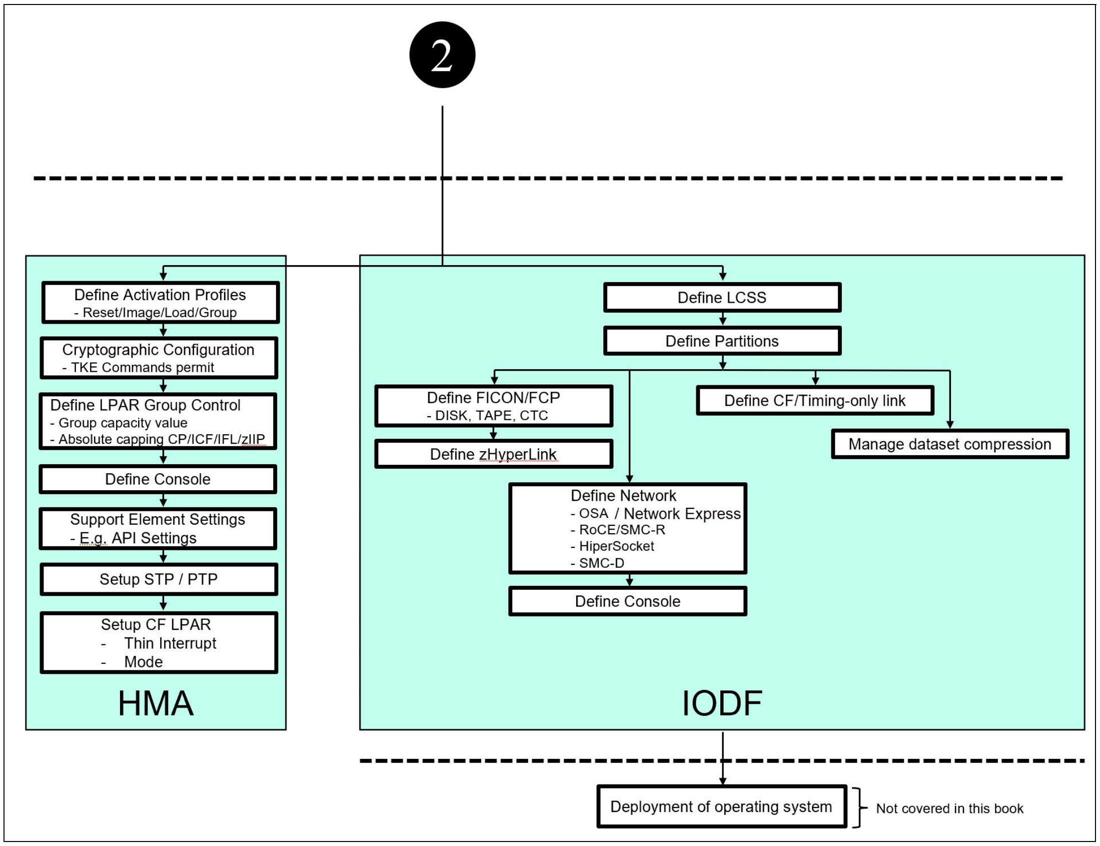


Figure 1-3 Installation flowchart for an IBM z17 system (applicable to a new system or an upgrade)

The HMA communicates with the SE, which is physically installed in the A frame of the IBM z17 system. The SE server provides communication with the IBM z17 hardware.

On the HMC, set the parameters to activate the required number of LPARs that run a supported OS. To create an IODF (see Figure 1-3), perform a set of activities in an application such as Hardware Configuration Definition (HCD), which requires a running z/OS system. The IODF can be created on a system other than the target system.

Multiple HMC/SE and IODF tasks 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 serve as a checklist rather than a step-by-step procedure. The steps in this book provide enough information to replicate the approach in a customer environment.

For more information about deploying an operating system (OS), specifically z/OS, see *Mainframe from Scratch: Hardware Configuration and z/OS Build*, SG24-8329.

1.3 Configuration tools

IBM provides several tools that can help achieve a successful IBM z17 installation. Whenever possible throughout this book, lists are provided to guide readers 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 align with other technical departments within the organization, such as storage and network administration, capacity (workload) planning, and cryptographic and security teams.

Configuration tools such as HCD, IBM Z Connectivity Mapping Tool (CMT), and the HMA are described in Chapter 2, "Planning considerations" on page 7.

1.4 Preview of IBM z17 server changes

The IBM z17 server is the next generation of CPC for z/OS and other IBM Z OSs. It was announced in the client letter AD25-0015. Compared to previous hardware generations (IBM z15 server to IBM z16 server), the IBM z17 server implements changes in the I/O connectivity design of the server hardware, primarily based on the new Data Processing Unit (DPU) for I/O Acceleration. The implementation of the DPU is transparent.

New I/O adapters are available with the IBM z17 server. This book describes the integration of the new features into the IODF. It outlines approaches for upgrading an I/O configuration from an existing IBM z15 or IBM z16 processor to an IBM z17 server, and the steps that are required to make a newly built IBM z17 server available.

The book illustrates changes in the configuration tasks that are required, particularly in the networking area. With the IBM z17 server, new Fibre Connection (IBM FICON®) adapters are available. The specifics and configuration tasks are described in the following chapters.

Carrying forward Open Systems Adapter (OSA) Express adapters from previous IBM Z server generations is possible. Although this approach simplifies the upgrade process, switching to Network Express adapters, which are new with the IBM z17 server, provides several advantages. Network Express adapters are simpler to define and provide the opportunity to consolidate to fewer ports, which reduces the number of adapters.

2

Planning considerations

This chapter presents planning and configuration considerations for the IBM z17 system. Whenever possible, worksheets that support the planning tasks are included. Throughout this book, various definition examples use Hardware Configuration Definition (HCD) as the preferred method for I/O configuration. Other tools, such as the Hardware Configuration Manager (HCM) and Input/Output Configuration Program (IOCP), are mentioned for reference.

Naming: This publication targets the IBM z17 ME1 system. Throughout this chapter, the system might be referred to as IBM z17.

This chapter also provides a short overview of tools that IBM offers to assist with configuring the IBM z17 system, along with information about where to obtain the tools and their intended use.

This chapter includes the following topics:

- Scenario descriptions
- Key tools
- Extra tools
- Hardware Management Appliance
- 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 an IBM z17 system:

- Upgrading an existing IBM Z server to an IBM z17
- Installing a new IBM z17

2.1.1 Upgrading an existing IBM Z server to an IBM z17

This scenario assumes that an existing IBM Z system is upgraded by using a Miscellaneous Equipment Specification (MES) to an IBM z17 system. The scenario includes a planned outage period during the physical upgrade of the system. The software environments that are supported by the machine type before the upgrade are not available during the upgrade period. The serial number of the system remains the same after the upgrade to the IBM z17 system.

2.1.2 Installing a new IBM z17

This scenario assumes that a new IBM z17 system is installed within an existing mainframe environment. The IBM z17 system is physically installed alongside an existing IBM Z system. After the installation of the IBM z17 system is successfully completed and the system is handed over by IBM, stop the software environment on the system to be replaced and perform recabling actions.

When recabling is complete, perform postinstallation activities, and bring the software environment back online on the new IBM z17 system. Plan an outage for this scenario, and account for the new serial number. Ensure that the software keys for the new system are available before the migration.

2.1.3 Planning for the scenarios

In the first scenario, the physical platform identity (machine serial number) remains the same. No hardware configuration files need to be physically migrated to another platform. No changes to the software licenses are required for products that are tied to the machine serial number.

Note: Software licensing might change depending on the machine capacity.

In the second scenario, the physical platform changes. Prepare hardware configuration files on the existing system, and migrate them to the new IBM z17 system along with the attached cabling. The serial number changes with the activation of the IBM z17 system, so planning and preparation for software license changes must be completed beforehand.

In both scenarios, 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 IBM z17 system has a lower priority. The elapsed time of the planned outage can vary depending on the approach that is chosen in either scenario.

In both scenarios, obtain the following information before starting the process of changing to or installing the new IBM z17 system:

- The new processor ID

  The processor ID assigns a unique name to identify the processor in HCD. For more information, see the *z/OS HCD User's Guide*, SC34-2669.
- The CFReport file:

  Download the CFReport file from IBM Resource Link by entering a Configuration Control Number (CCN). The CCN is provided by an IBM representative.
- The system serial number

  If a new IBM z17 system is installed, the IBM representative provides a new serial number.

IBM does not provide fiber optic cables as features on the IBM z17 system. Therefore, perform a complete analysis of the I/O connectors that are used on existing systems that are upgraded to an IBM z17 system to help ensure that the appropriate fiber optic cabling is installed. Perform an equivalent study as part of the preparation to install a new IBM z17 system to help ensure that all cabling is delivered to the data center before the installation date.

Identify all required cables for the IBM z17 system and place them on order. Label all cables for the installation. At a minimum, labels must identify the physical channel ID (PCHID) number.

If the configuration and PCHID reports have already been received from IBM, define the coupling links to fit the planned configuration for the new or upgraded CPC.

Note: Physical HMCs are not orderable or supported for a new-build IBM z17 system or systems that are upgraded to IBM z17. HMC functions for an IBM z17 system are provided by the IBM Z Hardware Management Appliance (HMA) optional feature (Feature Code 0355).

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, 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 HCD and IBM Z Connectivity Mapping Tool (CMT), which refer to the machine type instead of names. For more information, see Chapter 4, "Preparing an IOCP input file to use the IBM Z CMT" on page 63.

Table 2-1 Machine types for IBM Z platforms

Name	Machine type
IBM z17 ME1	9175
IBM z16 A02 and IBM z16 AGZ	3932
IBM z16 A01	3931

Name	Machine type
IBM z15 T02	8562
IBM z15 T01	8561

2.2.1 IBM Resource Link

The first step in planning the installation of the IBM z17 system is to access IBM Resource Link. Request access to IBM Resource Link on the IBM Resource Link website. Your IBM representative can assist with the registration process. After registering for an IBMid, customize the profile to accommodate the platforms for which the user is responsible. After completing the registration process with IBM, credentials are provided to log on to the organization's section of IBM Resource Link.

On the Resource Link website, users have access to various resources and tools that are designed to assist with the installation process. Several tools are available to simplify the installation process for an IBM z17 system. Even if these tools were used previously, verify that the latest versions that are relevant to the IBM z17 system are available.

Figure 2-1 shows the Resource Link main page.

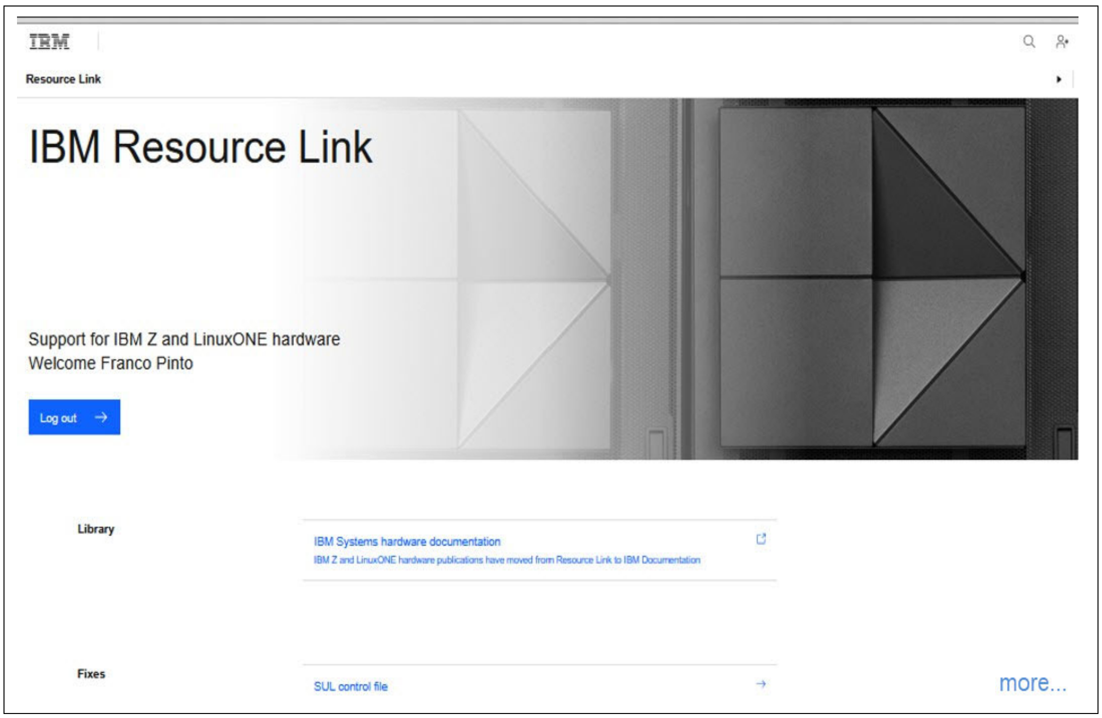


Figure 2-1 Resource Link main page

- The Library section of the page links to the hardware documentation in IBM Docs.
- The Fixes section provides access to SUL control files, firmware downloads, and requests for remote code downloads.
- The Problem Solving section links to the IBM Z and LinuxONE Security Portal, and to the Call Home Connect Cloud webpage.
- The System/Solution Assurance section provides access to the Technical Delivery Assurance (TDA) forms.

- The Tools section provides links to the following support tools:
  - 1090 support (z/PDT)
  - IBM Z CMT
  - Customized installation manual search
  - Customized planning aids search
  - File upload
  - Host key document search
  - IBM Z APIs
  - Power and weight estimation
  - Worldwide port name (WWPN) tool
- The Capacity on Demand section provides access to the Customer Initiated Upgrade area of IBM Resource Link.

IBM Call Home Connect Cloud is a web application that enables IBM hardware clients to view and monitor key status indicators for their Call Home-enabled IBM hardware assets. Offered at no additional cost to all IBM hardware clients, the website displays information about the following items:

- Critical cases and alerts
- Warranty and maintenance contract status
- Last contact status
- Current software and firmware levels and upgrade recommendations
- Asset details, such as the following items:
  - Summary data about open and closed cases, with links to IBM Support for detailed viewing
  - Detailed alerts about various Call Home-related events
  - Related assets
  - Current installed code levels and code level installation history (for selected products)
  - Links to product-specific support information
  - IBM Z system information reports

2.2.2 Hardware Configuration Definition

HCD runs on IBM z/OS and IBM z/VM. It provides an interactive dialog that generates 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 validates the data as you enter it, which minimizes the risk of errors. This book provides examples that use HCD, and some examples that use HCM (see “Hardware Configuration Manager” on page 12).

> **Note:** New hardware (an IBM z17 system) requires Program Temporary Fixes (PTFs) to enable definition support for Unit Information Modules (UIMs) in HCD.

When you define devices in HCD, you can select the hardware features according to the physical setup of the devices that are attached to the IBM z17. Detailed forms and charts that describe the environment help you plan the configuration.

For more information about HCD, see IBM Documentation.

Hardware Configuration Manager

HCM provides a GUI for HCD and the associated IODF. HCM runs on a workstation and can define and store more information about the physical hardware that the IODF describes.

HCM does not replace HCD. It works with HCD and the associated IODF. However, you can use HCM in stand-alone mode after you build an IODF and create the configuration files (`IODF##.HCM` or `IODF##.HCR`) on your HCM workstation.

For more information about HCM, see z/OS and z/VM HCM User's Guide.

2.2.3 IBM Z Connectivity Mapping Tool

The IBM Z CMT provides a mechanism to map channel path IDs (CHPIDs) to PCHIDs on an IBM z17 system. Using the CMT is preferable to manually mapping CHPIDs to PCHIDs. Using the CMT supports the best availability practices for a configuration.

Two files are required to obtain an IODF that contains the correct PCHID numbers by using the CMT:

- A copy of a production IODF, also called a work IODF, without PCHID numbers. For more information about how to obtain this file, see Chapter 4, "Preparing an IOCP input file to use the IBM Z CMT" on page 63.
- The CFReport file reflects the physical configuration of the ordered IBM z17 and is obtained from the Resource Link website. To obtain the CFReport, you must provide the corresponding machine CCN. Your IBM representative generates the CCN when building the order for your configuration.

2.2.4 HCD and the CMT

Figure 2-2 on page 13 shows the HCD process flow for a new IBM z17 installation.

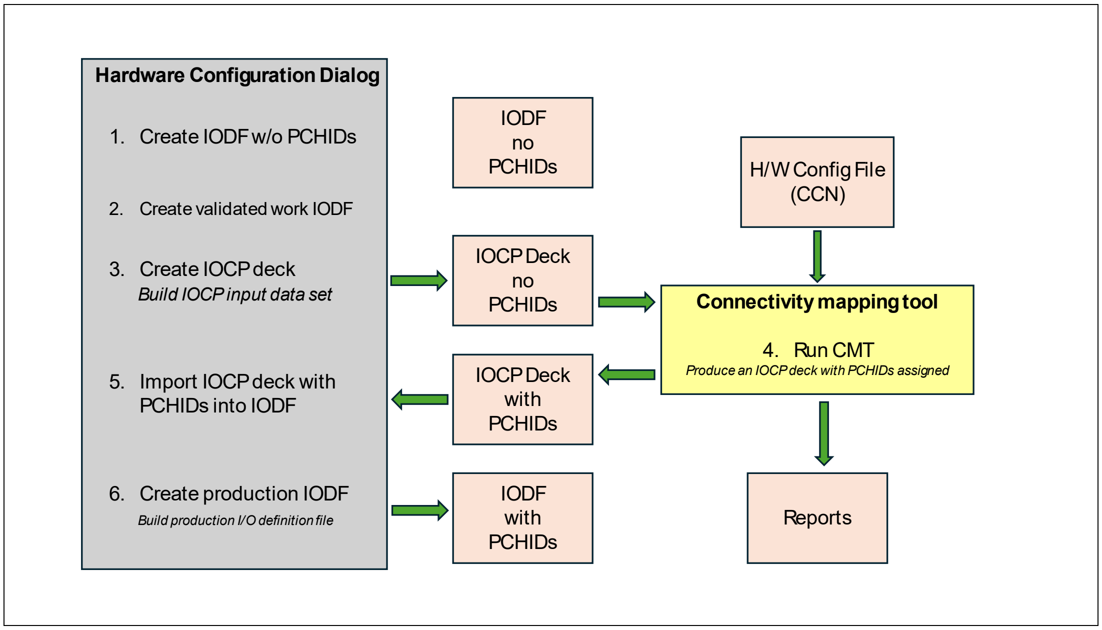


Figure 2-2 CMT I/O configuration definition flow for a new installation

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

To download the CMT, log in to IBM Resource Link with a registered IBMid and select **Tools**.

For more information, see *Connectivity Mapping Tool Users Guide*, GC28-7058, which is available at IBM Resource Link.

For more information about how to use the CMT, see Chapter 4, “Preparing an IOCP input file to use the IBM Z CMT” on page 63.

2.3 Extra tools

This book does not use the extra tools that are described in this section. However, you can use them to accelerate the planning and configuration of specific features or functions that are not covered in this book.

2.3.1 Input/Output Configuration Program

IOCP 7.1.0 or later is required for an IBM z17[1]. You can define the IBM z17 configuration by using IOCP alone. However, using HCD is a best practice because of its verification and validation capabilities.

By using IOCP, you can create an IOCDS in preparation for a CPC upgrade.

For more information about the changes and requirements for ICP/IOCP, see *Input/Output Configuration Program User's Guide for ICP IOCP*, SB10-7183.

[1] IOCP 6.1.2 is required for the IBM z16 A02 and IBM z16 AGZ.

2.3.2 Worldwide Port Name Prediction Tool

The Worldwide Port Name (WWPN) Prediction Tool for Fibre Channel Protocol (FCP) channels helps you prepare configuration files that are required or generated by the IBM Z platform when FCP channels are configured. This tool is useful during the installation of new systems and system upgrades.

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

The WWPN Prediction Tool can calculate and display WWPNs for both virtual and physical ports before system installation.

The WWPN Prediction Tool, which applies to a CPC in IBM Processor Resource/System Manager (PR/SM) mode, is available for download from IBM Resource Link. It applies to all Fibre Connection (FICON) channels that are defined as CHPID type FCP (for communication with SCSI devices) on an IBM z17. You can access the tool on IBM Resource Link by using your IBMid or by going to the IBM Resource Link home page and selecting **Tools** → **WWPN Tool**.

WWPN Persistence

FCP WWPNs are determined by the I/O serial number of the CPC, the IOCDS configuration details (for N_Port ID Virtualization and WWPNs), and the PCHID values (for physical WWPNs).

When you order WWPN Persistence (Feature Code 0099[2]) as part of a new or upgraded configuration for an IBM z17 system, the I/O serial number portion of the WWPN for the new IBM z17 system matches the serial number of the source machine configuration.

2.3.3 Coupling Facility Structure Sizer

When you move to a new IBM z17 system, you migrate to a higher Coupling Facility Control Code (CFCC) level (Level 26). If your existing Coupling Facility (CF) data structures are adequately sized and you want to determine how much these structures might need to grow to support the same workload at the new CFCC level, 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 storage allocation for CF partitions more accurately. You can access the tool on the CFSizer page.

2.3.4 Power estimation tool

The power estimation tool is a web-based application that helps you estimate the power consumption for your IBM Z platform. For the IBM z17 system, based on the installed features, the tool also estimates the system's weight, air flow, exhaust temperature, individual phase currents, and power cord wattage.

[2] Feature Code 0099 is an information-only feature that you must order to maintain I/O serial numbers when a new system replaces an existing system in your data center. This option eliminates the need to reconfigure zoning in SAN switches and LUN masking in storage controllers.

For access to this tool, see IBM Resource Link.

2.3.5 Shared Memory Communications Applicability Tool

Use the Shared Memory Communications Applicability Tool (SMCAT) to evaluate Internet Protocol network traffic and plan for potential use of Shared Memory Communications–Remote Direct Memory Access over Converged Ethernet Express (SMC-R). To perform the evaluation, you do not need to enable the SMC-R function on any system or enable Remote Direct Memory Access over Converged Ethernet (RoCE) Express on an IBM z15 or IBM z16 system, or Network Express on IBM z17.

This tool is important on IBM z15 and IBM z16 systems because to use SMC-R, you must acquire a RoCE Express adapter. On IBM z17 systems, SMC-R communication is enabled when you associate a Network Express adapter with a NETH Peripheral Component Interconnect Express (PCIe) function.

For more information, see Shared Memory Communications Applicability Tool[3].

2.3.6 IBM Z Batch Network Analyzer tool

IBM Z Batch Network Analyzer (zBNA) is a no-charge, “as is,” workstation-based productivity tool that helps you understand the batch window and estimate the CPU upgrade effect by performing “what-if” analyses. Use zBNA to evaluate the impact of new technology exploitation, such as IBM zEnterprise Data Compression (zEDC), DFSMS Encryption, zHyperLink, and IBM Z Sort. zBNA provides a powerful graphical demonstration of the z/OS batch window, which you can automatically capture in a report file by using the Named Favorites feature.

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

2.4 Hardware Management Appliance

This section describes the configuration and management tasks that you can perform on the Service Element (SE) function, which is part of the HMA of the SE server.

> **Note:** The IBM z17 server does not support HMCs as separate physical equipment. The HMC functions are provided when you order the HMA feature. For more information about HMA details, see 2.4.5, “Hardware Management Appliance” on page 19.

2.4.1 Activation profiles

Customize activation profiles by using the HMA. Activation profiles are required for CPC and image activation. They tailor the operation of a CPC and are stored in the SE appliance that is associated with the CPC.

[3] This link directs you to the z/OS V3R1 documentation site. The SMCAT is also available in z/OS V2R5 and z/OS V2R4 with support extension.

There are four types of activation profiles:

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

Default profiles for each of these types are provided. The Activate task activates the CPC or image. Initially, the Default profile is selected, but you can specify a different activation profile. This feature enables you to maintain multiple profiles, such as one for each IOCDS file that is managed by the CPC.

Reset profile

Each CPC in the processor cluster requires a reset profile to determine the mode in which the CPC Licensed Internal Code (LIC) loads and the amount of physical memory that is available. By using the reset profile, you must specify the order in which the LPARs are activated during a power-on reset (POR). Each CPC can have a maximum of 26 reset profiles.

For more information about how to define a reset profile, see 5.3, “Creating a reset profile on the Support Element” on page 101.

Image profile

Each LPAR has an image profile. The image profile defines the number of CPs that the image uses and whether these CPs are dedicated to the partition or shared. The image profile also assigns the amount of initial and reserved storage that each partition uses and identifies the IOCDS slot in the SE that contains the I/O configuration to load into the Hardware System Area (HSA). Depending on the SE model and machine type, the maximum number of image profiles that are allowed for each CPC is 64 – 255.

The parameters for each LPAR define these settings:

- General: The profile name and description, the partition identifier, and the mode of operation.
- Processor: The number of logical CPs, IBM Z Integrated Information Processors (zIIPs), and the initial processing weight that is assigned to the LPAR.
- Security: The security options for this LPAR, the BCPii permissions, the counter facility security options, the sampling facility security options, and the CP Assist for Cryptographic Functions (CPACF) key management operations.
- Storage: The total and initial amounts of memory that are assigned to this LPAR and the Virtual Flash Memory (VFM) allocation for this LPAR (if VFM is present).
- Options: The I/O priority, defined capacity options, and the CP management cluster name.
- Load: The load type and address parameters that are required to run an initial program load (IPL) for this LPAR.
- Crypto: The Crypto Express parameters (see 2.4.2, “Cryptographic configuration” on page 17).

> **Note:** To help you gather the necessary input, this book provides a worksheet. For more information about downloading the worksheet that is associated with this material, see Appendix A, “Additional material” on page 363.

For more information about how to define an image profile, see 5.4, “Creating an image profile on the Support Element” on page 105.

Load profile

You need a *load profile* 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 Central Processor Complex (CPC) is 64 – 255.

Group profile

A group profile defines the group capacity value that can be customized to determine 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.

A *group profile* defines the group capacity value, which you can customize to determine how processor resources are allocated and managed for the LPARs in a group. This profile does not include the names of the LPAR images that belong to the group.

2.4.2 Cryptographic configuration

The activation profile that you use to activate an LPAR prepares it to run software products that can use the Crypto Express feature. To use the cryptographic facilities and functions of the feature, you must customize the LPAR activation profile to complete the following tasks:

- Install the CPACF Data Encryption Standard Enablement feature (Feature Code 3863) if you plan to use the Integrated Cryptographic Service Facility (ICSF).
- Provide the LPAR with access to at least one Crypto Express feature by selecting from the Usage Domain Index and the Cryptographic Candidate list.
- Load the LPAR with an operating system (OS), such as z/OS that supports cryptographic functions.

For more information about the cryptographic features, see 10.1, “Crypto Express8S” on page 194.

2.4.3 LPAR group control

This task enables you to view or change a group assignment for LPARs. The task displays the group name, member partitions, and group capacity value, which you can customize to determine how processor resources are allocated and managed for the group. You can also change a group assignment dynamically for active LPARs.

The following methods can be used to limit processor capacity usage for a single LPAR or a group of LPARs and to help you control software costs:

- Edit Group Capacity: Use this window to view or change a group assignment for LPARs. The window displays the group name, member partitions, group capacity value, and absolute capping setting, which you can customize to determine how processor resources are allocated and managed for the group. The system manages the group so that the limit for group capacity in MSU per hour is not exceeded.
- Absolute Capping: Use this field to change the absolute capping of LPARs in a group that share processors. The absolute capping value can be None or a processor count 0.01 - 255.0. Absolute capping is managed by PR/SM and is independent of the OS that runs in the capped LPARs.

Both methods (Group Capacity and Absolute Capping) can be used concurrently and with LPAR capping. Consider reevaluating the parameters in scenarios where values must be migrated from a previous generation of IBM Z to an IBM z17 system.

Tip: Capacity management by using capping technologies is an ongoing process that you must monitor and adjust over time. Also consider temporary or permanent capacity changes when you use capping technologies.

For more information and an overview of the capping technologies and 4-hour rolling average (4HRA) optimization, see Capping Technologies and 4HRA Optimization.

2.4.4 Consoles and terminals

The OSA-Express Integrated Console Controller (OSA-ICC) provides consoles and terminals. OSA-ICC requires OSA-Express7S 1.2 GbE Short Wave (SX) or Long Wave (LX) features to support TN3270 enhancements (TN3270E) and non-Systems Network Architecture (SNA) Distributed Function Terminal (DFT) 3270 emulation.

Planning an IBM z17 OSA-ICC implementation requires input from several disciplines within your organization, including the following areas:

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

Note: The IBM z17 server does not support the OSA-Express 1000BaseT adapter, except as a carry-forward feature from the IBM z15 server. Define channel type OSC only on the OSA-Express7S GbE 1.2 SX or LX (Feature Code 0442 or Feature Code 0443).

The IBM z17 server supports the use of Transport Layer Security (TLS) protocols 1.2 and 1.3 to establish secure connections to terminals and consoles.

In HCD, you must define the OSA-Express feature to operate as CHPID type OSC.

The configuration requirements are as follows:

- IBM Z I/O subsystem configuration: The same basic rules for adding an OSA-ICC adapter apply as for any other new device.
- OS configuration: To make a Nucleus Initialization Program (NIP) console available, ensure 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 an IBM z17 system, you can use the same OSA-ICC definitions for the new system as in the source configuration.

Consider the following planning topics:

- Reserve at least one OSA-Express7S 1.2 GbE SX or LX port with the correct support to be defined as channel type OSC.
- Define 3270-X devices in HCD to act as system consoles or terminals.
- Use OSA Advanced Facilities to configure the sessions.

Also perform OSA-Express feature configuration tasks on the HMC function by using the OSA Advanced Facilities task. Before you start configuration activities on port 0 and port 1, collect information for the following parameters:

- OSA-ICC server: Name, host IP address, mask, TCP port number, secure TCP port number, MTU size, gateway IP address, and minimum TLS version.
- OSA-ICC session definitions: Channel subsystem (CSS), multiple image facility (MIF) (LPAR) ID, device number, LU-name, client IP address, IP filter, session type, defer host disconnect (DHD), response mode (RSP), and read timeout (RTO).

Note: Consider defining multiple sessions per LPAR to allow concurrent access for several users. A maximum of 120 valid subchannels can be used on an OSC channel path.

For an upgrade of an existing IBM Z server to an IBM z17 system, these definitions can be exported from the source machine by using onboard HMC functions and imported back again after the upgrade is complete.

When you upgrade an existing IBM Z server to an IBM z17 system, you can export these definitions from the source system by using onboard HMC functions and import them again after the upgrade is complete.

For more information about the definitions and implementation details, see Chapter 7, “Defining console communication” on page 137.

2.4.5 Hardware Management Appliance

The HMA is a closed system appliance, which means that you cannot install other applications on it. The HMA runs a set of hardware management functions.

The HMC code runs as an application on two high-performance, top-of-rack servers. The HMC functions operate as peers and support data replication. The HMA can operate on IBM z17, IBM z16, or IBM z15 systems. One HMA feature (Feature Code 0355) provides two HMAs. The HMAs run on both of the integrated 1U, top-of-rack SE servers.

Figure 2-3 shows the physical location of the redundant 1U, rack-mounted SE servers that support the HMA on a fully equipped IBM z17 system.

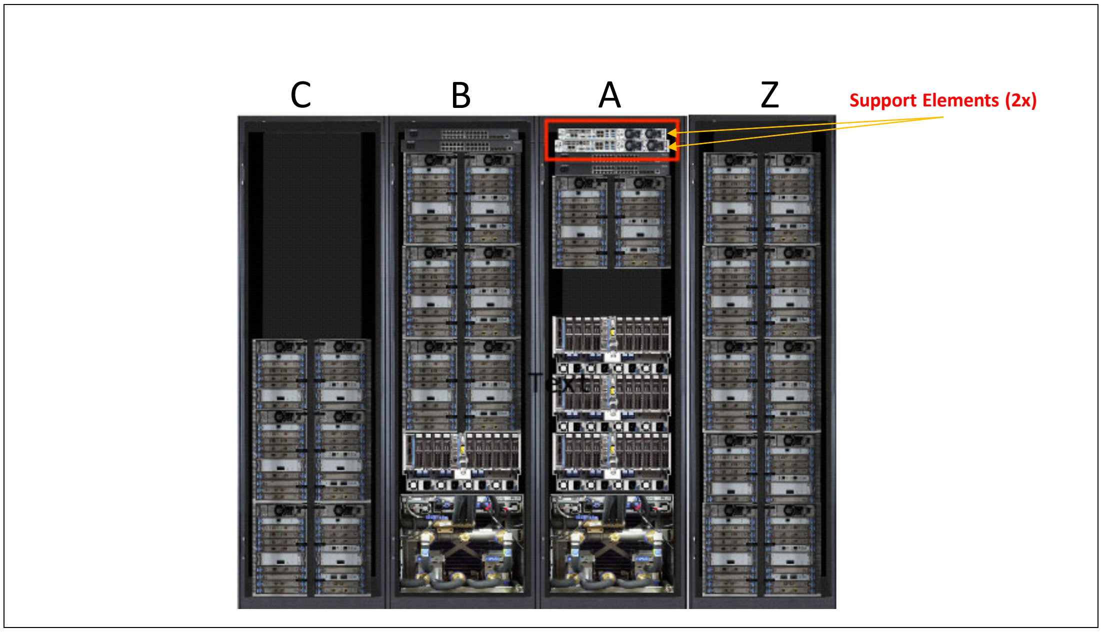


Figure 2-3 Back view of an IBM z17 server showing the location of the SE servers

2.4.6 Hardware Management Console considerations

With IBM z17 and the HMA, the SE Console function is a licensed application that provides the tasks that you use to monitor and operate your system. The appliance is included with each SE server that is installed on top of the IBM z17 A frame. One SE function operates as the designated primary (active) SE, and the other operates as the designated alternative (backup) SE. As with the HMC function, the SEs are closed systems, and you cannot install other applications in the same environment.

Figure 2-4 on page 21 shows the evolution of the HMC and SE environment, including the HMA offering that was introduced with the IBM z15 system.

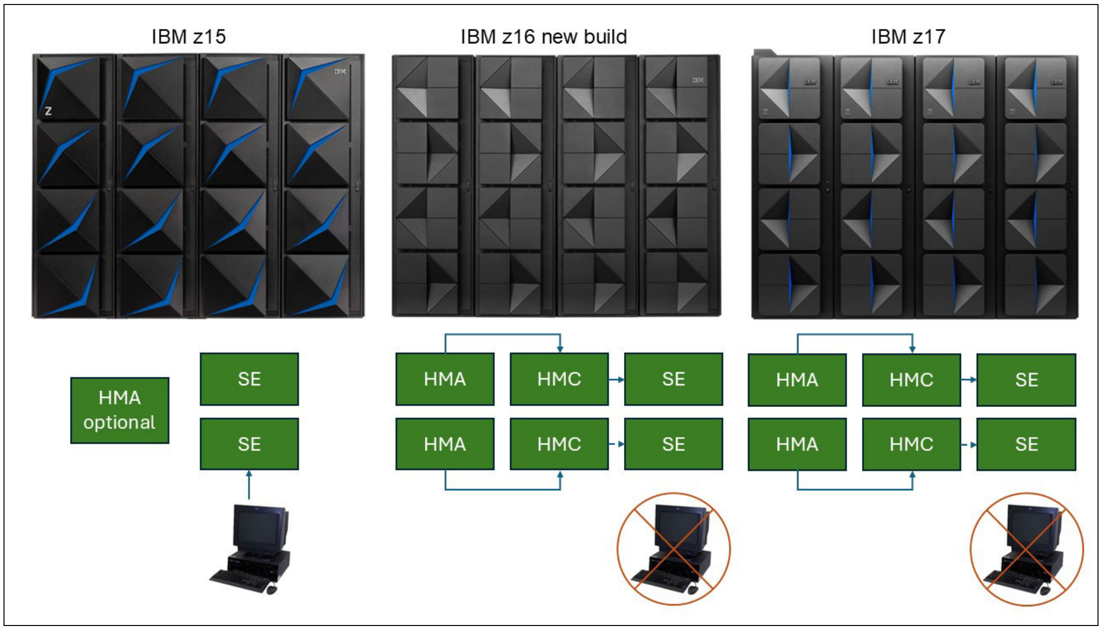


Figure 2-4 Evolution of the HMC/SE environment

You use the HMC function to set up, manage, monitor, and operate one or more CPCs. The HMC function manages IBM Z hardware and its LPARs and provides support applications. At least one HMC function is required to operate an IBM Z system. A single HMC function can manage multiple IBM Z CPCs.

When you perform tasks at the HMC function, the commands are routed to the primary SE function of the IBM z17 system. The SE function then issues those commands to the targeted CPC.

For more information about Feature Codes for the supported physical HMCs, see 10.1 “HMC and SE introduction”, in the *IBM z17 (9175) Technical Guide*, SG24-8579.

HMC users

Password rules for all default users have changed. In 2018, the State of California passed the password law that prohibits the use of default passwords in connected devices (see California SB-327). The law requires that any default passwords that are included with connected devices be changed during installation or be unique for each device.

IBM implements these rules on all IBM z17 systems worldwide. Therefore, when you first log on as a default user, you are required to change the password. You are responsible for maintaining passwords for all user accounts.

> **Note:** The default users that are predefined on IBM z17 systems are ACSADMIN and SERVICE. Former users such as ADVANCED, OPERATOR, SYSPROG, STORAGEADMIN, and other individual users can be re-created by using the HMC ACSADMIN user ID. However, default user roles ADVANCED, OPERATOR, STORAGEADMIN, and SYSPROG continue to be included, so you can create user IDs from them.

Because the password for the SERVICE default user must be changed, you must establish a plan to manage authorized access to this password for the following reasons:

- The IBM Systems Service Representative (IBM SSR) who performs service visits might vary from one visit to another.
- IBM SSRs might arrive at any time, including during off-hours, to perform planned maintenance or unplanned repair activities on an IBM Z server.
- Be prepared to provide the user ID and password to the IBM SSR upon arrival at your site.
- Maintain a list of unique service user IDs and passwords.
- Establish a process to hand over user IDs and passwords to the IBM SSR to avoid service delays.

The configure data replication task

Data replication among the various HMCs provides a simple and effective way to keep all parameters and settings synchronized.

When data is replicated from one HMC function to another, the internal level indicator for the replicated data increments each time that the data changes on the source HMC. Each HMC function tracks the level indicator for each data type and rejects data from a source HMC when the level indicator is not greater than the one on the receiving HMC.

The HMC data replication service setup is a wizard-guided process that you perform on the HMC function. When you are logged on as the ACSADMIN user, click **Task Index** on the left side of the window, and then click **Configure Data Replication**.

Figure 2-5 on page 23 and Figure 2-6 on page 23 show the entry level for setting up the data replication task.

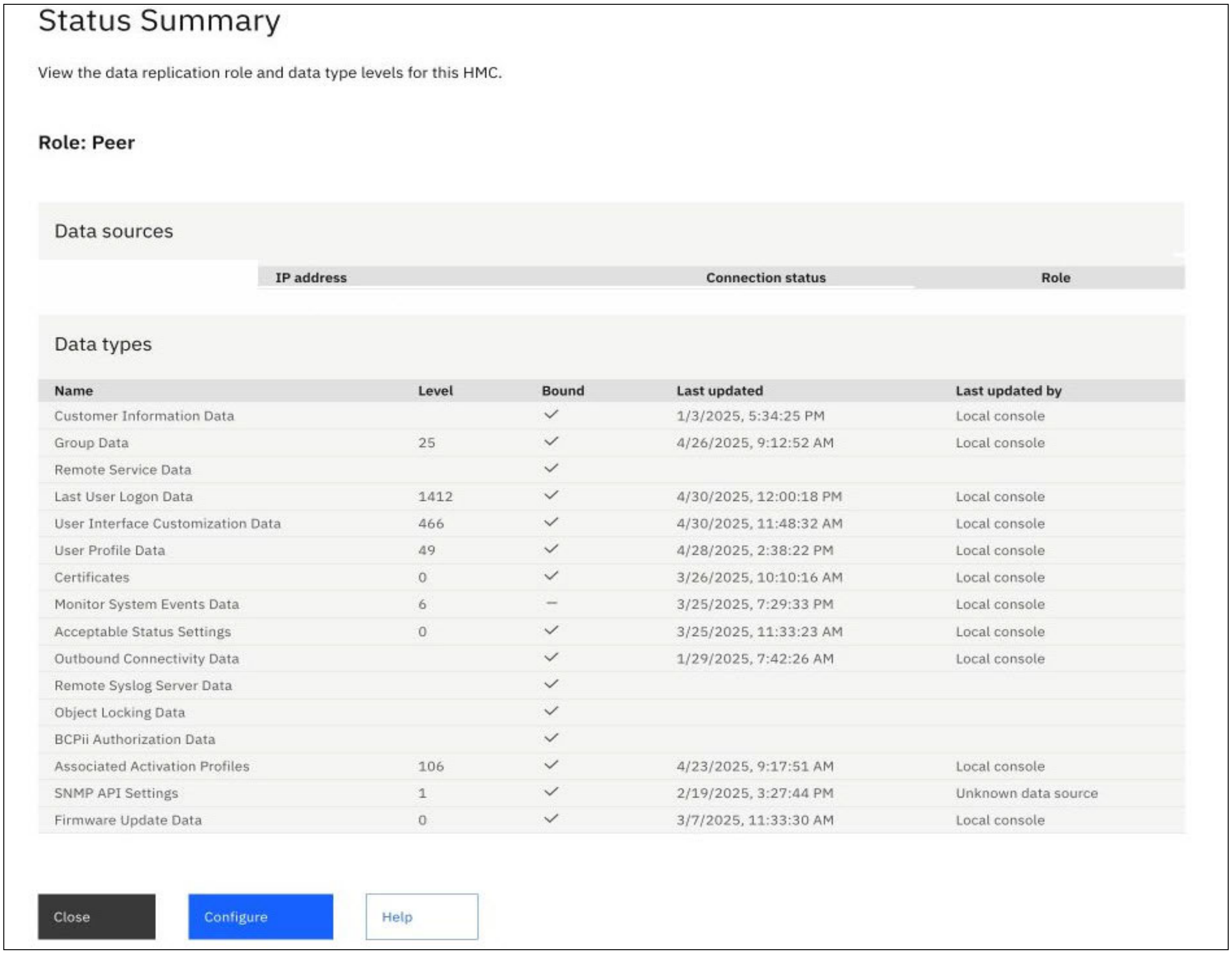


Figure 2-5 Entry window for configuring an HMC data replication task

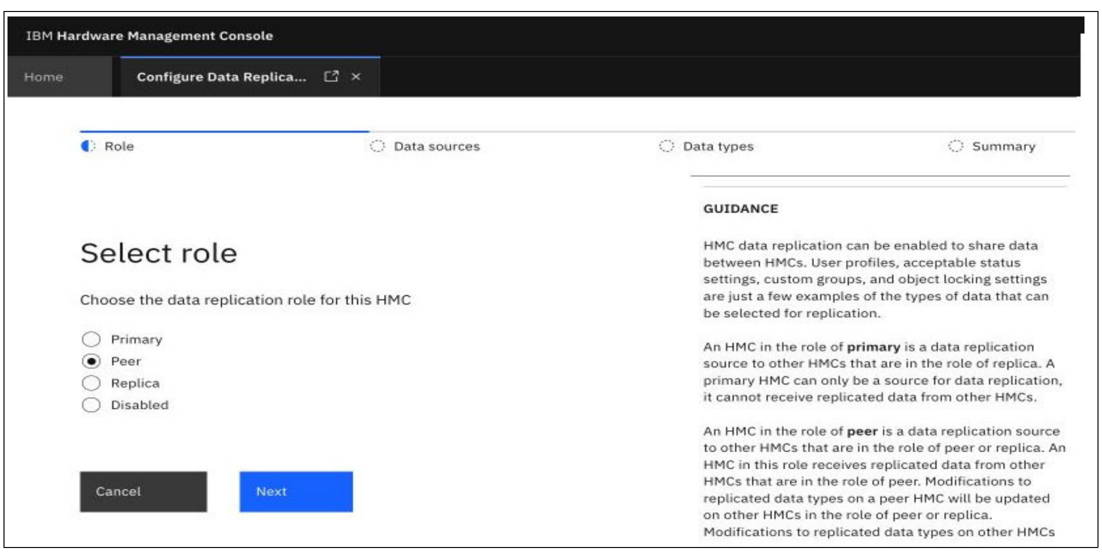


Figure 2-6 HMC role selection for replication

Follow the windows and complete the setup of the data replication task.

2.4.7 Support Element settings

The HMAs that are supplied with the IBM z17 system consist of two appliances that are supported by the 1U HMA servers. Both SE server units are installed at the top of the A frame. One server runs the primary SE function, and the other runs the alternative SE function.

In general, the SE settings are considered part of the physical installation of the IBM z17 system and are therefore not presented in this book. For a new IBM z17 system, you must provide a new range of TCP/IP addresses to the IBM SSR who performs the physical installation. As an extra security measure, you should provision a separate LAN segment for management functions. During an upgrade from a previous generation IBM Z platform to an IBM z17 system, you should back up the current settings on the SEs for migration purposes.

In addition to the standard SE configuration, you might need to back up other parameters, such as the API settings. You can access these parameters through the Customize API Settings task on the SE function.

You can carry forward any default user IDs from a previous HMC level to the new HMC levels as part of a MES upgrade or by selecting User **profile data for the Save/Restore customizable console data** or **Configuration Data Replication** tasks by using the ACSADMIN role on the HMC function.

Figure 2-7 shows the main selection window on the SE.

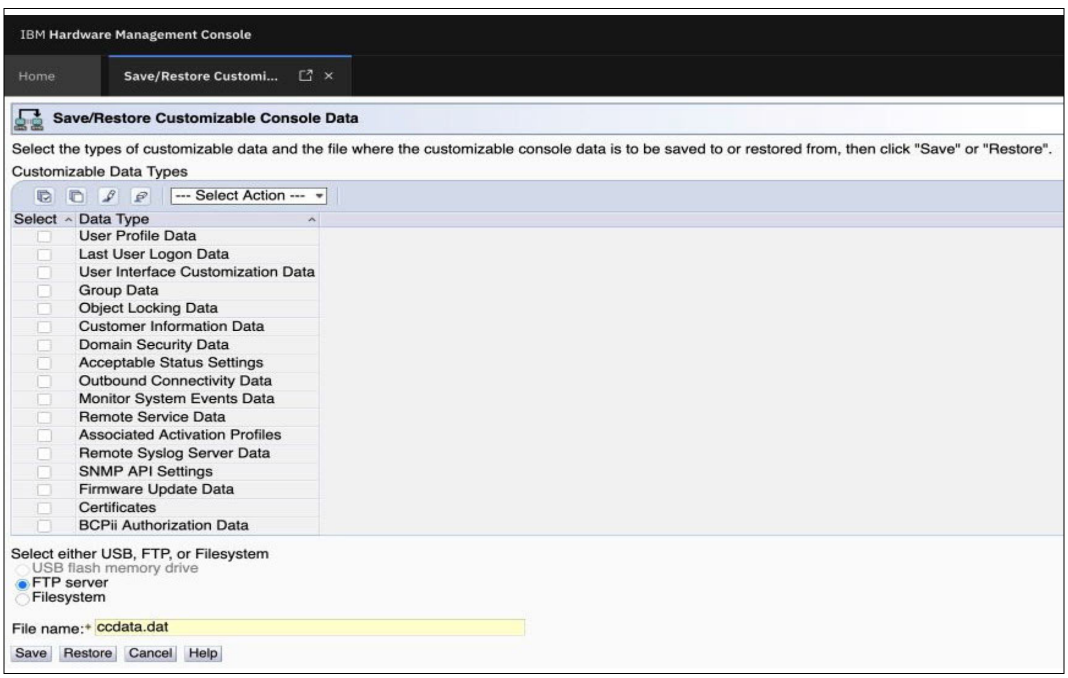


Figure 2-7 Save/Restore Customizable Console Data

In Figure 2-7, the option to save data to an FTP server is selected. At the time of writing, the USB interfaces on the 1U SE servers were available to clients. However, it is a best practice to provide access to an FTP server for all clients that are connected to the HMC LAN.

2.4.8 Network Time Protocol

The Network Time Protocol (NTP) is a networking protocol that synchronizes clocks between computer systems over packet-switched, variable-latency data networks. NTP has been in operation since 1985 and is one of the oldest internet protocols still in use. David L. Mills of the University of Delaware designed NTP.

NTP synchronizes participating computers to within a few milliseconds of Coordinated Universal Time (UTC). It uses the intersection algorithm, a modified version of Marzullo's algorithm[4] to select accurate time servers and to mitigate the effects of variable network latency.

2.4.9 Precision Time Protocol

The Precision Time Protocol (PTP) standard synchronizes the real-time clocks of devices in networked distributed systems with high accuracy and precision. The protocol applies to systems in which devices communicate through networks, including Ethernet. The standard supports multicast communication, unicast communication, or both.

PTP enables heterogeneous systems that include clocks with varying precision, resolution, and stability to synchronize with a grandmaster clock. The protocol supports synchronization within the submicrosecond range while using minimal network bandwidth and local clock computing resources. The protocol enhances synchronization accuracy to better than 1 nanosecond.

2.4.10 Server Time Protocol

The Server Time Protocol (STP) is a time synchronization architecture that enables multiple servers to maintain synchronized time with each other and to form a Coordinated Timing Network (CTN). STP is a message-based protocol that transmits timekeeping information between servers and CFs over the following link types:

- Integrated Coupling Adapter Short Reach (ICA SR) channel type CS5 links IBM z15 and IBM z16 systems only.
- ICA SR 1.1 links IBM z15, IBM z16, and IBM z17 systems.
- ICA SR 2.0 links IBM z15, IBM z16, and IBM z17 systems.
- Coupling Express2 Long Reach (CE2 LR) channel type CL5 links IBM z15 and IBM z16 systems. It also links IBM z17 systems that are equipped with Coupling Express3 Long Reach 10G.
- Coupling Express3 Long Reach 25G channel type CL6 links only to other Coupling Express3 Long Reach 25G channels.

STP operates with the time-of-day (TOD) clock steering facility to provide a new timing mode, timing states, external interrupts, and machine check conditions.

[4] Marzullo's algorithm, which Keith Marzullo developed in 1984, is an agreement algorithm that selects sources to estimate accurate time from multiple noisy time sources. NTP uses a modified form of this algorithm, which is called the intersection algorithm, which returns a larger interval for more statistical sampling.

2.4.11 Pulse per second

Beginning with the introduction of IBM STP for IBM Z in 2005 - 2006, the NTP is supported as an external time reference for STP. When the accuracy capability of NTP alone was insufficient to meet applicable industry regulations, IBM Z clients could supplement NTP with pulse per second (PPS) capability through a coaxial cable connection from the same time server that provides the NTP connection.

For more information, see IBM z16 STP Time Direct to CPC PTP/NTP Accuracy Performance.

2.4.12 External time sources and STP planning considerations

The external time sources (ETSs) NTP, PTP, and PPS are used by the CPC to maintain the most accurate possible time.

Before the IBM z16, ETS was limited to two time sources, either NTP or PTP. The CPC used the primary source while it was functional and switched to the backup only when the primary ETS became unavailable.

Each CPC drawer in an IBM z17 system includes two oscillator cards for time services. Each oscillator card has one port for PPS and one port for ETS (NTP or PTP), as shown in Figure 2-8.

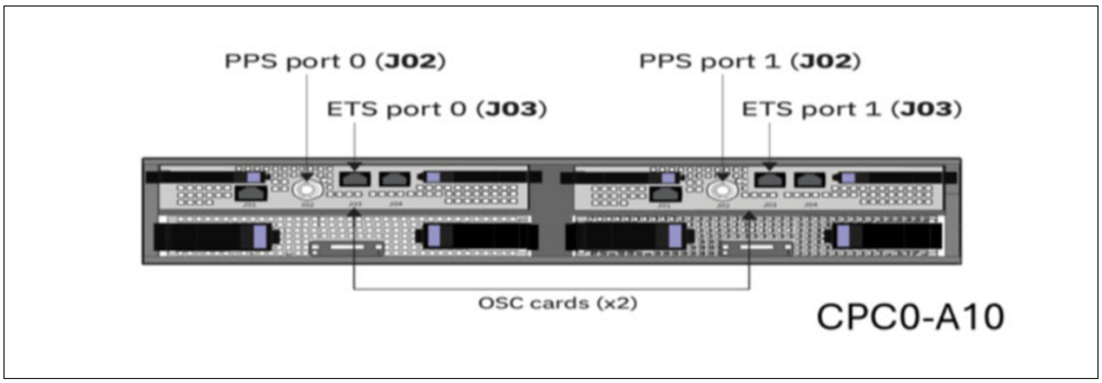


Figure 2-8 ETS ports of a CPC drawer

Beginning with the IBM z17 system, you can connect up to three NTP sources and up to two PTP sources to the CPC. However, you can connect only two time source cables to an IBM z17 system for NTP and PTP, even if more CPC drawers and ETS ports are available in the CPC. Therefore, you must use switches to connect more than two ETSs of the NTP or PTP type to the CPC. The PPS signal connects through its dedicated coaxial PPS port.

> **Note:** For accuracy reasons, use either NTP combined with PPS or NTP combined with PTP for optimal results. If possible, omit PPS in favor of PTP.

The CPC considers all connected time sources to obtain the most accurate possible time. The advantage of the NTP is that it can be secured by using Network Time Security (NTS), The advantage of the PTP is its higher accuracy.

By combining both protocol types and multiple sources, you can achieve the highest reliability and accuracy for ETS. Figure 2-9 shows an example of how multiple time sources connect to the CPC. If the CPC has only one CPC drawer, all ETS cabling connects to that drawer instead of being distributed across two drawers.

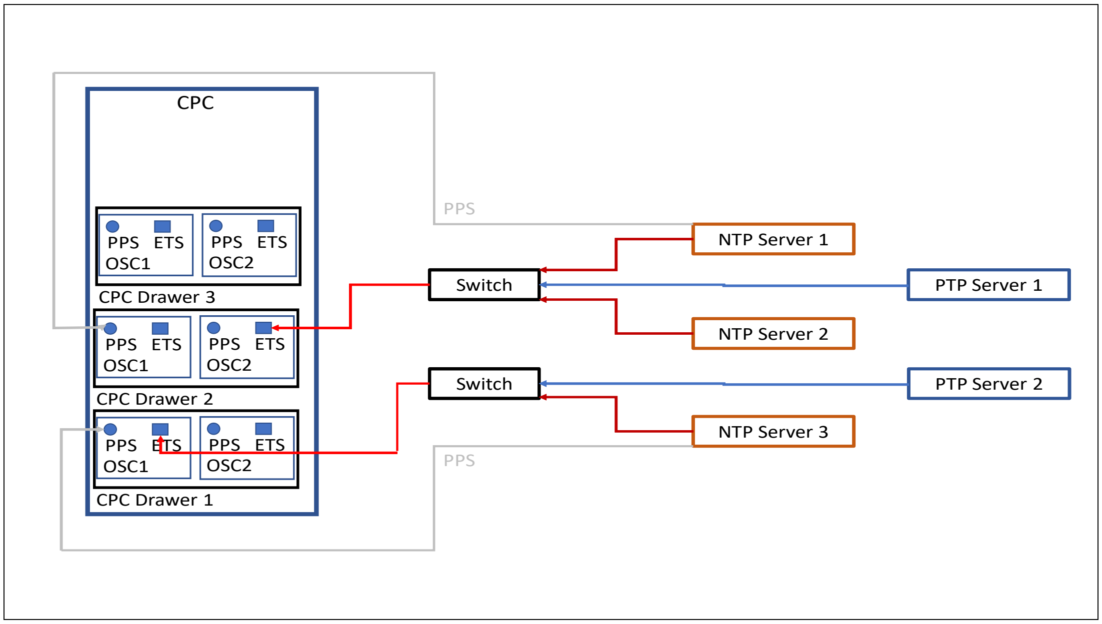


Figure 2-9 Connecting multiple NTP and PTP sources to a CPC

IBM Z servers implement a CTN by using coupling links to synchronize time among multiple IBM Z servers. One component that uses the CTN is the Sysplex Time Protocol. Setting up CTN and Sysplex Time Protocol is described in more detail in Chapter 8, “Preparing for IBM Parallel Sysplex and Server Time Protocol” on page 155.

CTN connectivity for an IBM z17 system: Timing data is exchanged among IBM Z servers by using coupling links. An IBM z17 system can connect to the IBM z15 and IBM z16 server families, and to extra IBM z17 systems that use compatible coupling links (N–2 generation coupling links). Ensure that your IBM z17 system has the appropriate coupling and timing connectivity before you assign a role in the CTN: Preferred Time Server (PTS), Backup Time Server (BTS), or Arbiter.

Note: Beginning with the IBM z15 system, support for STP stratum level 4 is provided. This feature helps avoid the additional complexity and cost of system reconfiguration. Install this change on all systems that might be exposed to this situation. Stratum level 4 should be used only during migration and for a short period. Although STP stratum level 4 is supported, you should not use it for permanent configurations. Use stratum level 4 only for transitional configurations during CTN maintenance.

For more information, see Chapter 8, “Preparing for IBM Parallel Sysplex and Server Time Protocol” on page 155.

2.5 IODF configuration

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

2.5.1 Channel subsystems

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

A *spanned channel path* is a channel that partitions in more than one LCSS can use. Use the same CHPID value across all LCSSs that share a spanned channel. However, LCSSs that do not share a spanned channel can assign that CHPID to other channels.

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

> **Note:** In this book, the designations *CSS* and *LCSS* are used synonymously.

When planning your configuration, consider multiple LCSSs so that you can logically partition physical channel resources to accommodate large-scale enterprise workload connectivity and high-bandwidth demands. The IBM z17 Model ME1 supports six LCSSs and includes four subchannel sets (SSs) in each LCSS, with up to 256 channels per LCSS, for a total of 1,536 channels.

LCSSs also provide multiple SSs to expand the number of I/O devices that are managed in each CSS. With the IBM z17 Model ME1, up to four SSs are supported, with 65,280 devices in SS0 and 65,535 devices in each of the other SSs. The direct access storage device (DASD) base addresses are defined in SS0. IBM reserves 256 subchannels in set 0, and the alias addresses are assigned to SS1, SS2, and SS3.

Not all device types are eligible for nonzero SSs. SS0 can be used for any device type. Extra SSs, such as SS1, can be used only for specific device classes, such as parallel access volume alias devices.

For more information, see *IBM z17 (9175) Technical Guide*, SG24-8579. Use multiple SSs to move eligible device types to other SSs, and then define more physical devices in SS0.

2.5.2 Logical partitions

With the PR/SM feature, a single IBM Z server can run multiple OSs and CFs in LPAR mode. Each OS and each CF runs in its own LPAR, which contains a separate set of system resources, including the following items:

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

You can export profile data from an older IBM Z platform and import it to the IBM z17 system. If you import LPAR data from an older IBM Z platform, consider the LPAR sizing before migrating to the IBM z17 system. For more information, see the *Support Element Operations Guide* (link requires a valid IBM Resource Link user ID to access).

For more information about how to define LPARs in IODF, see Chapter 3, “Preparing an IBM z17 system” on page 39.

Planning considerations for Virtual Flash Memory

VFM (Feature Code 0566) is available in 512 GB increments of memory. The IBM z17 Model ME1 can include up to 12 VFM features. When planning your memory configuration, you must consider your VFM requirements.

With the introduction of VFM, the existing OS interface for handling storage-class memory (SCM) remains unchanged. The allocation of VFM storage occurs during LPAR activation because the LPAR hypervisor manages partition memory.

You specify both the initial and maximum amounts of VFM in the LPAR image profile. You can add or remove VFM from OSs by using existing SCM commands after the LPAR is activated. You can display VFM allocation and definitions for all partitions in the Storage Information window on the HMC or by using SCM commands in z/OS.

> **VFM allocation:** The VFM values for initial and maximum allocations cannot be changed dynamically. Activate or reactivate one or more partitions for VFM allocation changes to take effect.
>
> As a best practice, assign the maximum installable amount of VFM to all LPARs that are candidates for using it, and set the initial allocation to 0 (zero) for LPARs that do not require immediate activation. This approach helps ensure that you can later use any available VFM when required.
>
> At partition activation time, overcommitment of VFM storage is supported. This setting enables extra storage to be added to partitions, subject to the amount that is not assigned to other partitions.
>
> For more information, see 10.2.3, “Configuring VFM” on page 228.

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

Non-disruptive migration

The following example illustrates a non-disruptive migration scenario:

- An IBM z17 system has three VFM features that are installed (512 GB each), resulting in 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.

If you attempt to assign 1 TB to LPAR B, the change is not possible within the constraints of the installed VFM. You can purchase and install an extra 512 GB VFM feature concurrently. After installation, you can add up to 512 GB concurrently to LPAR B without reactivating the partition.

Figure 2-10 shows the non-disruptive migration example.

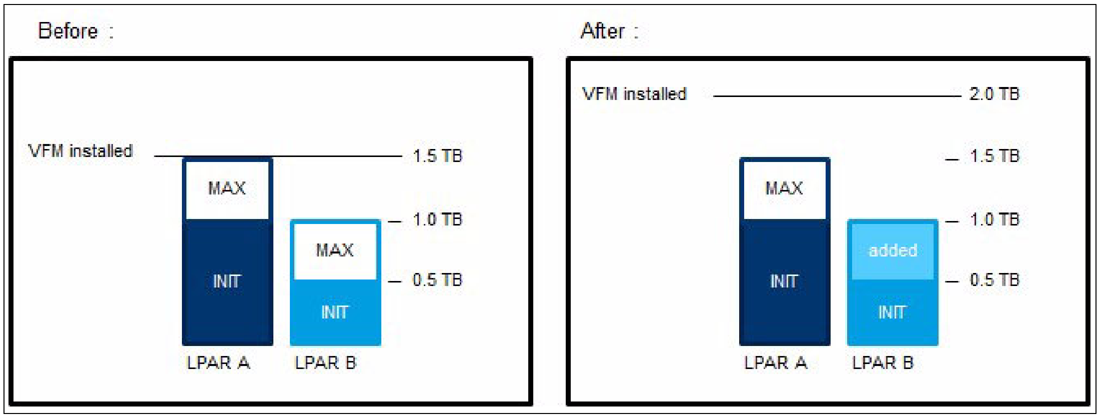


Figure 2-10 Non-disruptive VFM migration example

Disruptive migration

The following example illustrates a disruptive migration scenario:

- An IBM z17 system has two VFM features installed (512 GB per feature), resulting in a LICC value of 1.0 TB.
- LPAR A has 512 GB assigned, with a maximum value of 1.0 TB.
- LPAR B has 256 GB assigned, with a maximum value of 1.0 TB.

Change LPAR A so that it can have up to 1.5 TB. This change exceeds the range of the currently installed VFM. You can purchase and install two extra 512 GB VFM features concurrently, assuming that the memory is ordered and available. After installation, you must reactivate LPAR A with a new maximum VFM value of at least 1.5 TB and no greater than 2.0 TB.

Note: Plan-Ahead Memory is not available on the IBM z17.

Figure 2-11 shows the disruptive VFM migration example.

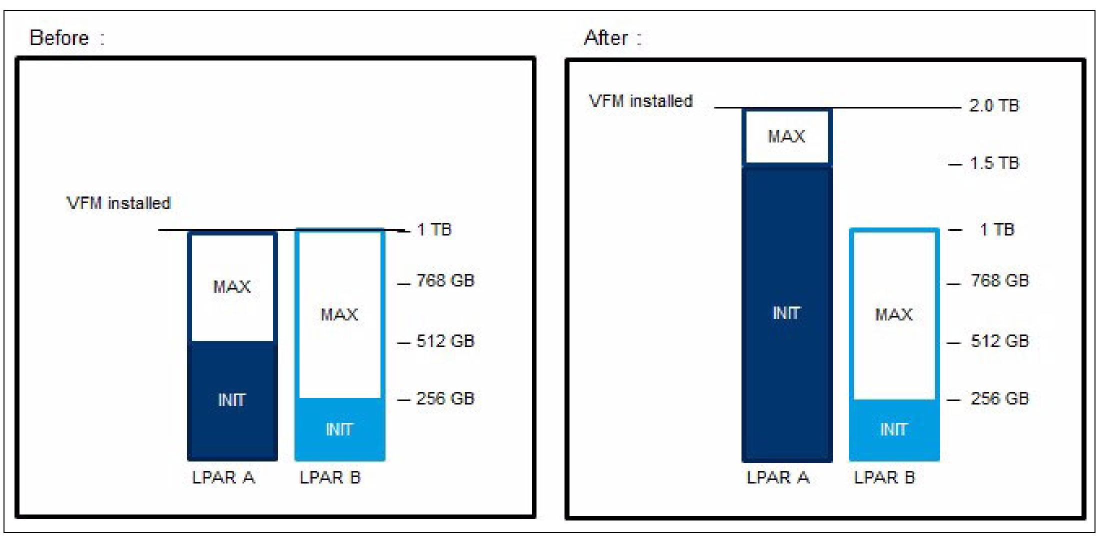


Figure 2-11 Disruptive VFM migration example

For more information about how to configure VFM, see 10.2, “Virtual Flash Memory” on page 227.

2.5.3 Storage connectivity

The FICON Express32-4P and FICON Express16SA (upgrade only) features provide connectivity to storage devices by using FICON or FCP. The FICON Express32-4P feature supports negotiation to 8 gigabits per second, 16 gigabits per second, or 32 gigabits per second (Gbps) link data rates. 8 Gbps transfer rates can be achieved through a FICON Director with 8 or 16 Gbps optics. The FICON Express16SA feature supports 8 Gbps and 16 Gbps data link rates.

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

On a new IBM z17 system, you can order only the FICON Express32-4P features. You can carry forward the FICON Express16SA feature when upgrading from an older IBM Z system.

> **Note:** With the FICON Express32-4P and FICON Express16SA features, you must configure all ports either as channel type FC or FCP. A mixed configuration is *not* allowed.

For more information about how to configure the FICON Express32-4P feature, see Chapter 12, “Adding storage devices” on page 247.

IBM zHyperlink Express

The zHyperLink Express feature is a short-distance IBM Z I/O channel that provides up to 10 times lower latency than zHPF. This feature is in the PCIe+ I/O drawer and is a two-port adapter that provides short-distance, direct connectivity between an IBM z17 system and an IBM DS8000® Storage System. Supply a 24x MTP–MTP cable for each port of the zHyperLink Express feature.

The zHyperLink Express feature supports distances up to 150 meters and a link data rate of 8 GBps. Each zHyperLink port is fully sharable among all partitions because up to 127 virtual functions (VFs) or PCIe function IDs (PFIDs) per link are supported.

IBM zHyperLink reduces the latency of DASD I/O operations by directly interconnecting the IBM z17 system to the I/O bay of a DS8880 or later storage system. This feature improves application response time without requiring application changes. zHyperLink is fast enough to run I/O operations synchronously, enabling the CPU to wait for the data. This capability provides the following advantages:

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

The zHyperLink Express adapter occupies one slot in an IBM z17 PCIe+ I/O drawer, and each adapter includes a single PCHID with two ports. You can install up to 16 zHyperLink Express adapters in one IBM z17 system, providing up to 32 ports.

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

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

zHyperLink reads are used by IBM Db2® for synchronous reads and by VSAM for reads (except NSR sequential). zHyperLink writes are used by Db2 for the active log. zHyperLink is also supported by IBM MQ, improving active log throughput and reducing IBM MQ transaction time by up to 3.5 times.

For more information about the zHyperLink feature, see the following resources:

- *IBM z17 (9175) Technical Guide*, SG24-8579
- *IBM z16 (3931) Technical Guide*, SG24-8951
- *IBM z16 A02 and IBM z16 AGZ Technical Guide*, SG24-8952
- *IBM Z Connectivity Handbook*, SG24-5444
- *Getting Started with IBM zHyperLink for z/OS*, REDP-5493

For more information about defining zHyperLink Express, see 15.2.4, “Defining a zHyperLink PCIe function” on page 349.

For more information about zHyperLink Express management, see “Managing zHyperLink Express” on page 352.

2.5.4 Network connectivity

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

- Network Express Adapter
- OSA-Express
- Shared Memory Communication (SMC)
  - SMC-R
  - SMC - Direct Memory Access over Internal Shared Memory (SMC-D)
- HiperSockets

Network Express Adapter

Starting with IBM z17, the new Network Express Adapter is supported. It combines the functions:

- OSH Channel type: Supports all functions that are available with OSD over OSA-Express but uses the Enhanced Queued Direct I/O (EQDIO) architecture.
- NETH Function type: Supports SMC-R communication.

Note: IBM z17 no longer supports RoCE Express adapters.

The Network Express Adapter has two ports. Each port is represented by its own PCHID. Each of the two PCHIDs can be defined for OSH and NETH at the same time. As a result, network features can be consolidated.

The Network Express Adapter operates in OSH mode for OSA traffic by using enhanced QDIO (eQDIO). This mode is equivalent to OSD (using Queued Direct I/O (QDIO)) on the OSA-Express adapter.

Note: eQDIO is not supported for Linux on IBM Z running natively in an LPAR.

If you run Linux on IBM Z under z/VM, you can define OSH to a VSWITCH in z/VM and connect Linux to this VSWITCH.

The Network Express Adapter is offered as four variations:

- Network Express 10G Long Reach (LR) (Feature Code 0525)
- Network Express 10G Short Reach (SR) (Feature Code 0524)
- Network Express 25G LR (Feature Code 0527)
- Network Express 25G SR (Feature Code 0526)

You do not need to perform any actions in OSA Advanced Facilities on the HMC to define or configure OSH and NETH. For more information about defining OSH, see 13.4, “Network Express for channel type OSH” on page 291. For more information about defining NETH, see 15.2.3, “Defining a NETH PCIe function” on page 343.

OSA-Express

IBM installs the OSA-Express features into an IBM z17 PCIe+ I/O drawer. These features are available in different types and support various networking protocols.

> **Note:** The operation mode OSE is no longer supported on IBM z17. More planning is required to migrate from OSE to OSD.

Define the operating modes with a channel type and device address that are based on the intended usage. For more information about operation mode OSD, see Chapter 6, “Configuring network features” on page 129. For more information about operation mode OSC, see Chapter 7, “Defining console communication” on page 137. For more information about both operation modes, see *OSA-Express Implementation Guide*, SG24-5948.

Starting with Driver Level 22 (HMC 2.13.0), the HMC includes enhancements that use OSA Advanced Facilities. For all supported OSA-Express features, OSA Advanced Facilities on the HMC is required. OSA Advanced Facilities on the HMC is used primarily for the following purposes:

- Manage all OSA-Express ports.
- Configure all OSA-Express OSA-ICC ports.
- Configure local Media Access Control (MAC) addresses.
- Display the OSA Address Table (OAT) to verify registered Internet Protocol Version 4 (IPv4) addresses that are in use 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 configured as QDIO Layer 2.
- Provide status information about an OSA-Express port.

For more information about using OSA Advanced Facilities on the HMC, see Chapter 6, “Configuring network features” on page 129.

The OSA-Express feature is available in the following variations:

- OSA-Express 7S 1000BaseT (Feature Code 0446) [5,6]
- OSA-Express 7S 1 GbE LX (Feature Code 0442) and SX (Feature Code 0443)
- OSA-Express 7S 10G LR (Feature Code 0444) and SR (Feature Code 0445)
- OSA-Express 7S 1.2 1 GbE LX (Feature Code 0454) and SX (Feature Code 0455)
- OSA-Express 7S 1.2 10G LR (Feature Code 0456) and SR (Feature Code 0457)
- OSA-Express 7S 1.2 25G LR (Feature Code 0460) and SR (Feature Code 0459)

[5] Only available as carry forward from IBM z15
[6] Only for operation mode OSD

Shared Memory Communication

The SMC protocol helps reduce CPU consumption, decrease latency, and increase throughput for TCP/IP traffic between LPARs on IBM Z platforms. After a TCP/IP connection is established over standard communication channels (OSD, OSH, or HiperSockets), both communication endpoints can negotiate to use SMC for ongoing transmissions if a suitable SMC infrastructure is available and associated with the initial communication channel. SMC operates transparently to applications.

When using the TCP/IP protocol, each transmission must pass through all TCP/IP layers on both endpoints. This processing effort is avoided when using SMC, which reduces CPU consumption and latency for TCP/IP workloads.

SMC is available in two versions:

- SMC version 1 connectivity is limited to hosts that are directly attached to a single common IP subnet. It operates purely at Layer 2. In addition, the same PNETID must be defined for the SMC function and for the associated OSA or Network Express Adapter.
- SMC version 2 reuses the existing SMCv1 (CLC and LLC) messages but does not require a PNETID for SMC-D to be defined for the SMC function or the associated OSA. In addition, SMCv2 traffic is not limited to a single common IP subnet and can be routed.

For more information about the SMC message (wire) flows, see RFC 7609.

To use SMC, you must do further configuration at the level of the TCPIP stack. For more information, see *z/OS Communications Server: IP Configuration Guide*, SC27-3650.

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

- Run the SMCAT to evaluate its 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 15.
- Review and adjust the available real memory and fixed memory usage limits for z/OS and CS as needed. SMC requires fixed memory. Review the limits and provision more real memory for z/OS.
- Review the IP topology, VLAN usage considerations (IPsec is not supported).
- Review the changes to the messages, monitoring information, and diagnostic tools. The following items include several updates:
  - Messages for IBM Virtual Telecommunications Access Method (IBM VTAM®) and the TCP/IP stack
  - The `netstat` command (status, monitoring, and display information)
  - CS diagnostic tools, including VIT, packet trace, CTRACE, and IPCS formatted memory dumps

SMC-R

Shared Memory Communications that uses RDMA over Converged Ethernet (RoCE) is referred to as SMC-R. It enables SMC communication between LPARs on different CPCs. The NETH function that is available with the Network Express Adapter provides this capability. The NETH function must be associated with either an OSH channel on the same PCHID as the NETH function or an OSD channel on an OSA-Express adapter.

You can deploy NETH features in either point-to-point or switched configurations. When you plan to deploy NETH features in a switched configuration, ensure that the switches support the following requirements:

- Global Pause function frame (as described in the IEEE 802.3x standard) is enabled.
- Priority Flow Control (PFC) is disabled.

The definition of NETH is described in more detail in 15.2.3, “Defining a NETH PCIe function” on page 343.

SMC-D

SMC that uses Internal Shared Memory (ISM) is referred to as SMC-D. It enables SMC communication between LPARs within the same CPC.

SMC-D uses ISM virtual PCIe (vPCIe) adapters to provide direct memory access (DMA) communication between LPARs within the same IBM Z server. The SMC-D protocol enables TCP socket applications to use ISM transparently. ISM functions as a virtual channel similar to Internal Queued Direct (IQD) for HiperSockets. A virtual adapter is created in each z/OS LPAR. When you use the SMC protocol, memory is logically shared. Firmware provides the virtual network.

The definition of ISM is described in more detail in 15.2.2, “Defining an ISM PCIe function” on page 339.

HiperSockets

The HiperSockets function is based on the OSA-Express QDIO protocol and is referred to as internal queued direct input/output (IQDIO). LIC emulates the link control layer of an OSA-Express QDIO interface and does not use physical cabling or external networking connections. Data access occurs at memory speeds, bypassing external network delays and providing high-speed logical LANs with minimal system and network impact.

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

HiperSockets are supported by the following OSs:

- All in-service z/OS releases
- All in-service z/VM releases
- 21st Century Software VSEn 6.3.1 and later
- Linux on IBM Z

For more information about the definition of HiperSockets, see 13.5, “IQD CHPIDs for HiperSockets” on page 297.

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

2.5.5 Coupling and timing links

Support for Parallel Sysplex includes the CFCC that runs in an LPAR and the coupling links. The IBM z17 provides coupling connectivity for Parallel Sysplex environments through the following features:

- Coupling Express3 LR (CE3 LR) 10G (Feature Code 0498): Provides two-port coupling link connectivity for distances up to 10 km (6.2 miles). It s compatible with Coupling Express LR (CE LR) and Coupling Express2 LR (CE2 LR) links from N-1 or N-2 generation IBM servers.
- Coupling Express3 LR 25G (Feature Code 0499): Provides two-port coupling link connectivity for distances up to 10 km (6.2 miles). It is compatible only with CE3 LR.
- ICA SR 2.0 (Feature Code 0216): Compatible with ICA SR and ICA SR 1.1.
- Internal Coupling (IC) channels: Operate at memory speeds.

The number of physical coupling links and logical coupling CHPIDs that are supported by each IBM z17 is provided in the *IBM Z Connectivity Handbook*, SG24-5444.

All coupling link types except IC links can carry STP or PTP messages.

Note: The CE3 LR is a two-port adapter that occupies one PCIe+ I/O drawer slot. Therefore, an IBM z17 that is configured as a Stand-Alone Coupling Facility (SACF) must include at least one PCIe+ I/O drawer for LR coupling.

Planning consideration

Configure the relationship between one or more CF link connections among CPCs in HCD to enable the exchange of CF link signals. HCD automatically generates the CU and device definitions if the CPCs are defined within the same IODF and the AID or PCHIDs are not reserved by other definitions.

Coupling connectivity for IBM z17: The IBM z17 supports coupling connectivity with IBM z15 T01 and IBM z15 T02 systems. Coupling is supported only through ICA SR, ICA SR 1.1, CE LR, and CE2 LR links. N-3 connectivity for coupling links is unsupported.

To manage an IBM z17 system in a CTN, you must use HMC 2.17.0 or later. The IBM z17 SE no longer includes STP menus.

As described in this section, CF links operate up to a specific distance, depending on the type of CF link hardware. Consider the physical placement of the CPCs or CFs to avoid exceeding the maximum distance that is supported by the CF link. For CE3 LR links, Dense Wavelength Division Multiplexing (DWDM) technology can extend the maximum length of CF links.

For a list of qualified devices, log in to the IBM Resource Link website by using a registered Resource Link ID.

STP or PTP signals can be exchanged between two CPCs without involving any CF LPARs. If physical coupling links are established between two CPCs, HCD enables you to configure 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 Server Time Protocol" on page 155.

2.5.6 Planning considerations for hardware data compression

This section describes planning considerations for enabling hardware data compression on an IBM z17 system.

The IBM z17 Telum II chip design incorporates a compression unit, the IBM Integrated Accelerator for zEDC, and a Compression Coprocessor (CMPSC) that is implemented on every processing unit (PU) core. Improved data compression operations are achieved through one dedicated compression coprocessor per PU and new hardware instructions.

The compression coprocessor and the IBM Integrated Accelerator for zEDC use data compression algorithms that reduce data size to save storage space or increase data transfer throughput.

The following list summarizes planning considerations for hardware data compression:

1. Planning the installation
   - Update the `IFAPRDxx` PARMLIB member in z/OS.
   - 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 the required PTFs.
3. z/OS: Enabling the priced software feature

   Enables native compression support for use on z/OS libraries that are eligible for compression by zEDC. The zlib Java library is provided by IBM “as is.”

3

Preparing an IBM z17 system

This chapter describes two scenarios for preparing an IBM z17 installation:

- Upgrading an existing IBM z15 T01 or IBM z16 A01 to an IBM z17 ME1 while maintaining the existing serial number. The upgrade includes the frames, central processor complex (CPC) drawers (CPC and PCIe+ I/O drawers), and new or carry-forward I/O features.
- Installing a new IBM z17 ME1 in an existing environment.

Because many environments exist, the results that are achieved in each environment might differ from the ones that are described in this publication.

Naming: The IBM z17 system that is targeted by this publication consists of an IBM z17 ME1. Throughout this chapter, this publication refers to this machine as IBM z17.

This chapter includes the following topics:

- Supported hardware features
- Saving and restoring Open Systems Adapter-Express configuration data
- Upgrading an IBM z16 to an IBM z17 while maintaining the serial number
- Installing a new IBM z17

3.1 Supported hardware features

This section lists the channel path ID (CHPID) types and hardware features for the IBM z17 ME1 (9175).

Here are the CHPID types:

- OSH (for the Network Express Adapter)
- Fibre Channel (FC) / Fibre Channel Protocol (FCP) Fibre Connection (FICON) (The Express32-4P Port adapter is new in IBM z17.)
- CL6

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

- Feature Code 0216 - Integrated Coupling Adapter Short Reach (SR) 2.0
- Feature Code 0351 - zHyperLink Express2.0
- Feature Code 0387 - FICON Express32G-4P Long Wave (LX)
- Feature Code 0388 - FICON Express32G-4P Short Wave (SX)
- Feature Code 0454 - OSA-Express7S 1.2 GbE LX
- Feature Code 0455 - OSA-Express7S 1.2 GbE SX
- Feature Code 0456 - OSA-Express7S 1.2 10 GbE Long Reach (LR)
- Feature Code 0457 - OSA-Express7S 1.2 10 GbE SR
- Feature Code 0459 - OSA-Express7S 1.2 25 GbE SR
- Feature Code 0460 - OSA-Express7S 1.2 25 GbE LR
- Feature Code 0498 - Coupling Express3 LR 10 Gb
- Feature Code 0499 - Coupling Express3 LR 25 Gb
- Feature Code 0524 - Network Express SR 10G
- Feature Code 0525 - Network Express LR 10G
- Feature Code 0526 - Network Express SR 25G
- Feature Code 0527 - Network Express LR 25G
- Feature Code 0566 - IBM Virtual Flash Memory (VFM)
- Feature Code 0909 - Crypto Express8S (1 port)
- Feature Code 0908 - Crypto Express8S (2 ports)

Here are the CHPID types that can be migrated (carry forward):

- FC and FCP
- OSC and OSD
- CS5, CL5, and Input/Output Configuration Program (ICP)
- Internal Queued Direct (IQD)

Here are the hardware features that can be migrated (carry forward):

- Feature Code 0446 - OSA-Express7S 1000Base-T Ethernet (IBM z15 only)
- Feature Code 0442 - OSA-Express 7S GbE LX (IBM z15 only)
- Feature Code 0443 - OSA-Express 7S GbE SX (IBM z15 only)
- Feature Code 0444 - OSA-Express 7S 10 GbE LR (IBM z15 only)
- Feature Code 0445 - OSA-Express 7S 10 GbE SR (IBM z15 only)
- Feature Code 0454 - OSA-Express7S 1.2 GbE LX
- Feature Code 0455 - OSA-Express7S 1.2 GbE SX
- Feature Code 0456 - OSA-Express7S 1.2 10 GbE LR
- Feature Code 0457 - OSA-Express7S 1.2 10 GbE SR
- Feature Code 0459 - OSA-Express7S 1.2 25 GbE SR
- Feature Code 0460 - OSA-Express7S 1.2 25 GbE LR
- Feature Code 0898 - Crypto Express7S (1 port)
- Feature Code 0899 - Crypto Express7S (2 ports)

- Feature Code 0436 - FICON Express16SA LX
- Feature Code 0437 - FICON Express16SA SX
- Feature Code 0461 - FICON Express32S LX
- Feature Code 0462 - FICON Express32S SX

> **Note:** When migrating from an IBM z15 to an IBM z17, all defined CHPIDs with type OSM must be deleted without any replacement.
>
> CHPID type OSE is no longer supported on IBM z17.
>
> **Note:** OSA-Express7S 1000BaseT is not supported for CHPID type OSC on an IBM z17. OSC requires an OSA-Express7S 1.2 GbE SX/LX adapter.
>
> OSA Epress7S 1000BaseT can be carried forward for CHPID type OSD only from an IBM z15.

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

This section describes two processes for Open Systems Adapter (OSA) adapters that you might need to use when you upgrade or replace your processor:

- Exporting and importing OSA-ICC configuration data with OSA Advanced Facilities

  For more information about the exporting and importing process for OSA-Integrated Console Controller (OSA-ICC) Server and Session configuration data, see 7.3, “Configuring an OSA-ICC configuration by using OSA Advanced Facilities” on page 138.

- Using OSA Advanced Facilities to set OSA parameters

  For more information about the process of changing the Media Access Control (MAC) addresses, see 6.1, “Configuring OSA for OSA-Express and Network Express Adapter” on page 130.

3.3 Upgrading an IBM z16 to an IBM z17 while maintaining the serial number

This section describes the steps that you must follow to upgrade an existing IBM z16 defined in your input/output definition file (IODF) to an IBM z17 while keeping the system serial number.[1]

3.3.1 Scenario overview

This scenario describes either the configuration steps to upgrade an existing IBM z16 A01 or an IBM z15 T01 to an IBM z17.

[1] Experienced Hardware Configuration Definition (HCD) users can perform this upgrade by changing the processor type and model of the existing IBM z16 processor definition to an IBM z17 and then by using the Build Production feature.

Here are the key factors:

- HCD requires a new CPC ID for the machine type 9175 processor.
- You can keep the same CPC name for the 9175. Optional because the CPC name can be changed.
- The 9175 processor channels connect to the same switch ports and access the same control unit (CU) interfaces.
- The CU interfaces continue to connect to the same switch ports.
- The starting IODF is the current 3931 production IODF.
- The target IODF is a new 9175 work IODF.

Here are the HCD actions:

- Migrate updated Input/Output Configuration Program (IOCP) statements.
- Build a production IODF.
- Remotely write the IODF to the input/output configuration data set (IOCDS).

Here are the 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 3931 (IBM z16 A01) processor with a processor ID of PAVO and six channel subsystems (CSSs) (CSS ID 0 – CSS ID 5). This system is replaced with a 9175 (IBM z17 ME1) that has a processor ID of MENSA and six CSSs. The CPC name PAVO and the serial number remain unchanged.

Table 3-1 summarizes the migration options and tool requirements. The process steps are described in “HCD: Migrating the existing 3931 IODF”.

Table 3-1 I/O configuration that is migrated to a 9175 system

Options and tools	**Comments**
Processor ID	Must change the Processor ID to a new ID.
CPC name	Local System 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.
Connectivity CHPID Mapping Tool (CMT)	Optional, but good for verifying configurations.
CFReport file (Configuration Control Number (CCN))	Required for the CMT.
IOCP (Import from validated work IODF)	Yes.

Options and tools	Comments
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 3931 IODF

The following steps explain how to upgrade an existing 3931 processor in your IODF to a new 9175 processor by using HCD. Then, you migrate the I/O configuration and logical partitions (LPARs) from the 3931 to the 9175.

Using HCD, perform the following sequence of operations:

1. Create the work IODF from the current 3931 production IODF.
2. Repeat the 3931 processor definition to be replaced.
3. Review coupling link information messages.
4. Delete any unsupported items in the repeated 3931 processor definition.
5. Add replacements for the unsupported items that you deleted in step 4.
6. Change the 3931 processor definition to a 9175 and delete the 3931.
7. Reconnect the CF channel paths that were not migrated.
8. Export and import OSA-ICC configuration data by using OSA Advanced Facilities.
9. Use OSA Advanced Facilities to set OSA parameters.

3.3.2 Creating the work IODF from the current 3931 production IODF

You use HCD to create a work IODF, starting from the production IODF that contains the 3931 processor that you are upgrading (for example, `SYS9.IODF80`).

3.3.3 Repeating the 3931 processor to be replaced

To repeat the 3931 processor in HCD, complete the following steps:

1. From the main HCD panel, select `1.3, Processor List`.
2. In the Processor List panel (Figure 3-1), enter `r` (for repeat) next to the 3931 processor that you want to upgrade, and press Enter.

```
Processor List        Row 1 of 2 More:
Command ===> ________________________________________________ Scroll ===> CSR

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


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
r PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
```

Figure 3-1 Processor List: Repeating processor

3. The Identify Target IODF panel opens. Complete *one* of the following actions:
   - To retain all other processor definitions in the IODF, press Enter.
   - Enter a different target IODF data set name. In this case, only the processor that you repeat 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, `ZNEXT01.IODF89.WORK`).
5. The Repeat Processor panel opens (Figure 3-2). Enter the processor ID of the new 3931 (in this example, `MENSA`), keep all other fields unchanged, and press Enter.

```
*----------------------------- Repeat Processor ------------------------------*
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Processor ID . . . . . . . . . MENSA___                                      |
|                                                                              |
| Processor type . . . . . . . : 3931                                          |
| Processor model  . . . . . . : A01                                           |
| Configuration mode . . . . . : LPAR                                          |
|                                                                              |
| Serial number  . . . . . . . . 071A083931                                    |
| Description  . . . . . . . . . Pavo                                          |
|                                                                              |
| Specify SNA address only if part of a processor cluster:                     |
|                                                                              |
| Network name . . . . . . . . . IBM390PS  +                                   |
| CPC name . . . . . . . . . . . PAVO      +                                   |
|                                                                              |
| Local system name  . . . . . . PAVO                                          |
|                                                                              |
*---------------------------------------*                                      |
| New IODF ZNEXT01.IODF89.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 on page 45, severity I messages are displayed because the Coupling Facility (CF) link channel path identifiers (CHPIDs) were not copied to the new 3931 processor definition.

```
*------------------------------- Message List --------------------------------*
|   Save  Query  Help                                                         |
| -------------------------------------------------------------------------- |
|                                                                 Row 1 of 31 |
| 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        |
| #              3.80 of processor PAVO and channel path 2.D2 of              |
| #              processor VELA is not copied.                                |
| _ I   CBDG441I The coupling facility connection between channel path        |
| #              3.84 of processor PAVO and channel path 2.D6 of              |
| #              processor VELA is not copied.                                |
| _ I   CBDG441I The coupling facility connection between channel path        |
| #              3.F8 of processor PAVO and channel path 3.F9 of              |
| #              processor PAVO is not copied.                                |
| _ I   CBDG441I The coupling facility connection between channel path        |
| #              3.F9 of processor PAVO and channel path 3.F8 of              |
| #              processor PAVO is not copied.                                |
| _ I   CBDG441I The coupling facility connection between channel path        |
| #              3.FA of processor PAVO and channel path 3.FB of              |
*-----------------------------------------------------------------------------*
```

Figure 3-3 Message List: Showing CBDG441I

To resolve this issue, complete the following steps:

1. Scroll to the end of the messages until you see the `CBDG271I Requested action on object PAVO successfully processed` message.
2. Press PF3 or PF12 to continue. As shown in Figure 3-4, an extra 3931 processor that is named `MENSA` is displayed.

```
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
_ MENSA    3931      A01      LPAR  071A083931 Pavo
_ PAVO     3931      A01      LPAR  071A083931 Pavo
_ VELA     3932      AGZ      LPAR  087F283932 Vela
```

Figure 3-4 Processor List: Repeated processor

3.3.5 Deleting any unsupported items in the repeated 3931

When you upgrade a processor to an IBM z17 that contains a CHPID type OSE, change this CHPID type to OSD, OSH (TCP/IP), or Enterprise Extender (for Systems Network Architecture (SNA) protocol only) configuration.

> **Note:** Delete CHPIDs of type OSM in an IODF for machine type 9175.

To delete unsupported CHPIDs, complete the following steps:

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

```
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
s MENSA    3931     A01      LPAR  071A083931 Pavo
_ PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
```

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 . . . : MENSA        Pavo

  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     5806    65535     0       65535     0       65535     0
_ 1   65280     6766    65535     0       65535     0       65535     0
_ 2   65280     7070    65535     0       65535     0       65535     0
_ 3   65280     5120    65535     0       65535     0       65535     0
_ 4   65280     4126    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 43 More:
Comma |    2. Clear Filter                  | ______________ Scroll ===> CSR
      |    3. Count rows on (filtered) list |
Selec *-------------------------------------* nter. To add use F11.

Processor ID . . . . : MENSA        Pavo
Configuration mode . : LPAR
Channel Subsystem ID : 0

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 10    100   FC    SPAN  01  01 1C       No  TS7760A
_ 11    144   FC    SPAN  01  01 1D       No  TS7760A
_ 12    184   FC    SPAN  02  02 1C       No  TS7760A
_ 13    1C0   FC    SPAN  02  02 1D       No  TS7760A
_ 40    101   FC    SPAN  01  01 24       No  DASD
_ 41    145   FC    SPAN  02  02 24       No  DASD
_ 42    185   FC    SPAN  01  01 25       No  DASD
_ 43    1C1   FC    SPAN  02  02 25       No  DASD
_ 44    120   FC    SPAN  01  01 1E       No  FCTC
_ 45    160   FC    SPAN  02  02 1E       No  FCTC
_ 50    121   FC    SPAN  01  01 2A       No  DASD
```

Figure 3-7   Channel Path List: Set Filter

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

```
*----------------------- Filter Channel Path List -------------------------*
|                                                                          |
|                                                                          |
| Specify or revise the following filter criteria.                         |
|                                                                          |
| Channel path type  . OSE                                                 |
| 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 OSE for channel path type

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

```
                               Channel Path List     Filter Mode. More:
Command ===> ______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Pavo
Configuration mode . : LPAR
Channel Subsystem ID : 0

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
d B4    1CC   OSE   SPAN  __  __ __       No  1KBT  7S On loan to Redbooks
```

Figure 3-9 Channel path list: Deleting all channel definitions for type OSE

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

```
*--------------------- Confirm Delete Channel Path ---------------------*
|                                                            Row 1 of 1 | --
| 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 . . . . : MENSA        Pavo                              |
| Channel Subsystem ID : 0                                              |
|                                                                       |
|                     CHID                                              |
| CHPID   Type  Mode  AID/P                                             |
| B4      OSE   SPAN  1CC                                               |
| ************************** Bottom of data *************************** | **
|                                                                       |
|                                                                       |
|                                                                       |
|                                                                       |
|                                                                       |
|                                                                       |
*-----------------------------------------------------------------------*
| Spanned channel paths are deleted from all accessing channel subsystems. |
*-----------------------------------------------------------------------*
```

Figure 3-10 Confirm Delete Channel Path panel

Note: When you upgrade a processor that contains any Peripheral Component Interconnect Express (PCIe) **`FUNCTION`** statements of type ROCE or ROCE-2, delete these **`FUNCTION`** statements from the IODF before changing the processor type to 9175. These **`FUNCTION`** statements are replaced by NETH **`FUNCTION`** statements.

For more information about the new NETH PCIe function that supports SMC - Remote Direct Memory Access over Converged Ethernet Express (SMC-R) for IBM z17, see Chapter 15, “Adding Peripheral Component Interconnect Express devices” on page 335.

7. If ROCE-2 **FUNCTION** statements are defined on the 3931 processor, remove them. If you need to define the equivalent **FUNCTION** statements again on the 9175, produce a printout of the current definitions for reference. From the HCD main panel, select `option 3 Print or compare configuration data`, as shown in Figure 3-11.

```
z/OS V3.1 HCD
Command ===>
________________________________________________________________

                          Hardware Configuration

Select one of the following.

3   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 . . . 'ZNEXT01.IODF89.WORK'                  +
```

Figure 3-11 Selecting the Print option

8. From the Print or Compare Configuration Data panel, select `option 1 Print configuration reports`, as shown in Figure 3-12.

```
*------------ Print or Compare Configuration Data ------------*
|                                                              |
|                                                              |
| Select one of the following tasks.                           |
|                                                              |
| 1_  1.  Print configuration reports                          |
|     2.  Print the activity log                               |
|     3.  View the activity log                                |
|     4.  Compare IODFs                                        |
|     5.  Compare CSS / operating system views                 |
|                                                              |
|                                                              |
|                                                              |
*--------------------------------------------------------------*
```

Figure 3-12 Selecting Print configuration reports

9. From Print Configuration Reports panel, select `CSS report`, as shown in Figure 3-13.

```
*----------------------- Print Configuration Reports ------------------------*
|                                                                            |
|                                                                            |
| Select the types of report that you want, and specify the values below.   |
|                                                                            |
| IODF name  : 'ZNEXT01.IODF89.WORK'                                         |
|                                                                            |
| Types of report                  Limit reports                             |
| /  CSS report                    1  1. Yes                                 |
| _  Switch report                    2. No                                  |
| _  OS report                                                               |
| _  CTC connection report                                                   |
| _  I/O path report                                                         |
|    (may invoke I/O Autoconfiguration (zDAC))                               |
|                                                                            |
| Job statement information                                                  |
| //ZNEXT01H  JOB (SG248581),'FPINTO HCD',                                   |
| //          MSGCLASS=X,CLASS=A,MSGLEVEL=(1,1),                             |
| //          NOTIFY=&SYSUID                                                 |
| /*JOBPARM LINES=9999                                                       |
| //*                                                                        |
| //*                                                                        |
|                                                                            |
*----------------------------------------------------------------------------*
```

Figure 3-13 Selecting CSS report to save Functions information

10. From the Available CSS Report Types option panel, select `CSS summary reports`, as shown in Figure 3-14.

```
*------- Available CSS Report Types --------*
|                                           |
|                                           |
| Select one or more.                       |
|                                           |
| /  CSS summary reports                    |
| _  Channel path detail reports            |
| _  Control unit detail report             |
| _  Device detail report                   |
|                                           |
|                                           |
|                                           |
|                                           |
*-------------------------------------------*
```

Figure 3-14 Selecting CSS summary reports from the CSS Report Types options panel

11. From the Limit Reports panel, select the `MENSA` processor ID, as shown in Figure 3-15 on page 51.

```
*------------------------ Limit Reports -------------------------*
|                                                                |
|                                                                |
| To limit the reports, specify the following criteria related  |
| to the IODF in access.                                         |
|                                                                |
|                                                                |
|                                  Applicable for:               |
| Processor ID . . . . MENSA    +  CSS, CTC, I/O path reports    |
| Partition name . . . ________ +  CSS, CTC, I/O path report     |
| OS configuration ID  ________ +  OS, I/O path report           |
| Switch ID  . . . . . __       +  switch report                 |
|                                                                |
| Specify the sysplex and system name to gather the actual       |
| configuration from. (Blanks default to the local system.)     |
|                                                                |
| Sysplex name . . . . ________    I/O path report               |
| System name  . . . . ________    I/O path report               |
|                                                                |
|                                                                |
|                                                                |
*----------------------------------------------------------------*
```

Figure 3-15 Selecting the processor ID of the previously defined processor

12. After the resulting Batch job successfully runs, a list of defined **FUNCTION** statements is printed, as shown in Figure 3-16.

```
 PCIe FUNCTION SUMMARY REPORT
 PROCESSOR ID  MENSA    TYPE  3931     MODEL  A01      CONFIGURATION MODE: LPAR

FID  VF   PF CHID  PORT  TYPE         PM UID   DESCRIPTION
____ ___  __ _____ ____  ____________ __ ____  ________________________________
2435   5     19C   2     ZHYPERLINK
3101   1     11C   1     ROCE-2                10GbE
3131   2     11C   1     ROCE-2                10GbE
3132   3     11C   1     ROCE-2                10GbE
3133   4     11C   1     ROCE-2                10GbE
3134   5     11C   1     ROCE-2                10GbE
3135   6     11C   1     ROCE-2                10GbE
3138  11     11C   1     ROCE-2                10GbE
3145   7     11C   1     ROCE-2                10GbE
3146   8     11C   1     ROCE-2                10GbE
3147   9     11C   1     ROCE-2                10GbE
3148  10     11C   1     ROCE-2                10GbE
3201   1     11C   2     ROCE-2                10GbE
3231   2     11C   2     ROCE-2                10GbE
3232   3     11C   2     ROCE-2                10GbE
3233   4     11C   2     ROCE-2                10GbE
3234   5     11C   2     ROCE-2                10GbE
3235   6     11C   2     ROCE-2                10GbE
```

Figure 3-16 Partial output of CSS Report

13. To delete the ROCE-2 Functions, select option `f` for `MENSA` on the Processor List panel, as shown in Figure 3-17.

```
 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
 f MENSA    3931     A01      LPAR  071A083931 Pavo
 _ PAVO     3931     A01      LPAR  071A083931 Pavo
 _ VELA     3932     AGZ      LPAR  087F283932 Vela
```

Figure 3-17 Selecting MENSA to work with PCIe FUNCTIONS

14. On the PCIe Function List panel, set a filter for ROCE-2, as shown in Figure 3-18.

```
 Goto  Filter  Backup  Query  Help
 ----- *--------------------------------------*
------------------------------
       | 1  1. Set Filter                     | st    Row 1 of 136 More:
 Comma |    2. Clear Filter                   | ______________ Scroll ===>
CSR
       |    3. Count rows on (filtered) list |
 Selec *--------------------------------------* Enter. To add, use F11.

 Processor ID . . . . : MENSA       Pavo



 / FID    CHID+ P+  VF+ PF Type+        UID   Description
 _ 1031   7C6   _   1   _  ISM          ____  SC76
 _ 1032   7C6   _   2   _  ISM          ____  SC74
 _ 1033   7C6   _   3   _  ISM          ____  SC75
 _ 1034   7C6   _   4   _  ISM          ____  SC80
 _ 1035   7C6   _   5   _  ISM          ____  SC81
 _ 1036   7C6   _   6   _  ISM          ____  RDBKZVM0
 _ 1037   7C6   _   7   _  ISM          ____  RDBKESI3
 _ 1038   7C6   _   8   _  ISM          ____  SC01
 _ 1039   7C6   _   9   _  ISM          ____  WTSCNET
 _ 103A   7C6   _   10  _  ISM          ____  WTSCMXA
 _ 103B   7C6   _   11  _  ISM          ____  RDBKPOK
 _ 1041   7C6   _   12  _  ISM          ____  RDBKZVM1
```

Figure 3-18 Setting a filter for a specific `FUNCTION`

15. Mark all the resulting entries and delete them, as shown in Figure 3-19 on page 53.

```
*----------------------- Filter PCIe Function List -----------------------*
|                                                                         |
|                                                                         |
| Specify or revise the following filter criteria.                        |
|                                                                         |
| CHID  . . . . . . . . . ___                                             |
| PORT  . . . . . . . . . _                                               |
|                                                                         |
| Type  . . . . . . . . . ROCE-2       +                                  |
|                                                                         |
| Virtual Function ID . . ___                                             |
|                                                                         |
| Description . . . . . . ________________________________                |
|                                                                         |
| Partition . . . . . . . ________  +                                     |
|                                                                         |
| UIDs defined  . . . . . _  (Y = YES; N = NO)                            |
| UID . . . . . . . . . . ____                                            |
|                                                                         |
|                                                                         |
|                                                                         |
|                                                                         |
*-------------------------------------------------------------------------*
```

Figure 3-19 Selecting ROCE-2 as the PCIe function list type and press ENTER

16. Mark all ROCE-2 functions for deletion and select `Delete`, as shown in Figure 3-20.

```
Goto  Filter  Backup  Query  Help
------------- *------------- Actions on selected PCIe Function -------------*
              |                                                             |
Command ===>  |                                                             |
              | Select by number or action code and press Enter.            |
Select one or |                                                             |
              |d__  1.  Add like . . . . . . . . . . . . . . (a)            |
Processor ID  |     2.  Change . . . . . . . . . . . . . . . (c)            |
              |     3.  Delete . . . . . . . . . . . . . . . (d)            |
              |     4.  View . . . . . . . . . . . . . . . . (v)            |
              |                                                             |
/ FID   CHID  |                                                             |
( 3101  11C   *-------------------------------------------------------------*
_ 3131  11C   1   2   _  ROCE-2        ____  10GbE
_ 3132  11C   1   3   _  ROCE-2        ____  10GbE
_ 3133  11C   1   4   _  ROCE-2        ____  10GbE
_ 3134  11C   1   5   _  ROCE-2        ____  10GbE
_ 3135  11C   1   6   _  ROCE-2        ____  10GbE
_ 3138  11C   1   11  _  ROCE-2        ____  10GbE
_ 3145  11C   1   7   _  ROCE-2        ____  10GbE
_ 3146  11C   1   8   _  ROCE-2        ____  10GbE
_ 3147  11C   1   9   _  ROCE-2        ____  10GbE
_ 3148  11C   1   10  _  ROCE-2        ____  10GbE
) 3201  11C   2   1   _  ROCE-2        ____  10GbE
```

Figure 3-20 Using "(" and ")" to mark a block of entries for deletion

3.3.6 Changing the 3931 to a 9175 and deleting the 3931

You can either keep the original copy of the 3931 (`PAVO`) or delete it from the IODF. In this example, keep it in the IODF for a few more steps.

To change the 3931 to a 9175, complete the following steps:

1. Enter `c` (for change) next to `PAVO` to change the 3931 to a 9175 and press Enter. The Change Process Definition panel opens (Figure 3-21).
2. Make the following updates, and press Enter:
   - Update `Processor type` to `9175`.
   - Update `Processor model` to `ME1`.
   - Update the 3931 part of the `Serial number` to `9175` (that is, 012345*3931* to 012345*9175*).
   - Update `Description` to `Mensa`.
   - Update `Local system name` to `Mensa`.

> **Note:** In this example, HCD writes an IOCDS to the 3931 in preparation for an upgrade. Leave the Network name and CPC name set to `IBM390PS` and `PAVO`. Update these settings in the IODF after the 3931 is upgraded to a 9175.

```
*------------------------ Change Processor Definition ------------------------*
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Processor ID . . . . . . . . : MENSA                                        |
| Support level:                                                              |
| 3931 support                                                                |
| Processor type . . . . . . . . 9175      +                                  |
| Processor model  . . . . . . . ME1       +                                  |
| Configuration mode . . . . . . LPAR      +                                  |
|                                                                             |
| Serial number  . . . . . . . . 071A089175  +                                |
| Description  . . . . . . . . . Mensa                                        |
|                                                                             |
| Specify SNA address only if part of a processor cluster:                    |
|                                                                             |
| Network name . . . . . . . . . IBM390PS  +                                  |
| CPC name . . . . . . . . . . . PAVO      +                                  |
|                                                                             |
| Local system name  . . . . . . Mensa                                        |
|                                                                             |
|                                                                             |
*-----------------------------------------------------------------------------*
```

Figure 3-21 Processors: Change Processor Definition

3. The Update Channel Path Identifiers panel opens (Figure 3-22). No changes are made in this example.

```
*-------------------- Update Channel Path Identifiers ----------------------*
|                                                                Row 1 of 42 |
| Command ===> __________________________________________ Scroll ===> CSR   |
|                                                                            |
| Specify any changes to the channel path identifiers in the list below.    |
|                                                                            |
| Processor ID . . . . : MENSA        Mensa                                 |
| Channel Subsystem ID : 0                                                  |
|                                                                            |
| CHPID  Type  Side  Until CHPID   New CHPID +                              |
| 10     FC          __            10                                       |
| 11     FC          __            11                                       |
| 12     FC          __            12                                       |
| 13     FC          __            13                                       |
| 40     FC          __            40                                       |
| 41     FC          __            41                                       |
| 42     FC          __            42                                       |
| 43     FC          __            43                                       |
| 44     FC          __            44                                       |
| 45     FC          __            45                                       |
| 50     FC          __            50                                       |
| 51     FC          __            51                                       |
| 52     FC          __            52                                       |
*----------------------------------------------------------------------------*
```

Figure 3-22 Processors: Update Channel Path Identifiers

4. Press Enter for each CSS ID.
5. The repeated 3931 processor is successfully changed to a 9175-ME1, as shown in Figure 3-23.

```
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
_ MENSA    9175     ME1      LPAR  071A089175 Mensa
_ PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
```

Figure 3-23 Processor List: Changed processor

3.3.7 Deleting the 3931 processor definition

Now that the 3931 is repeated and changed to a 9175, the original 3931 definition (PAVO) must be deleted so that the required CF links can be restored.

To delete the 3931 processor definition, complete the following steps:

1. Enter `d` (for delete) next to the `PAVO` processor in the Processor List panel (Figure 3-24).

```
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
_ MENSA    9175     ME1      LPAR  071A089175 Mensa
d PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
```

Figure 3-24 Processor List: Deleting the processor

2. Press Enter to confirm the deletion of the processor (Figure 3-25).

```
*-------------------- Confirm Delete Processor ---------------------*
|                                                         Row 1 of 1 |
| Command ===> ________________________________ Scroll ===> CSR      |
|                                                                    |
| Scroll forward to view the complete list of processors to be      |
| deleted. Press ENTER to confirm delete request. Press F12 to      |
| cancel delete request.                                            |
|                                                                    |
| Processor ID Type     Model    Description                        |
| PAVO         3931     A01      Pavo                               |
| ************************ Bottom of data ************************* |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
*--------------------------------------------------------------------*
```

Figure 3-25 Confirming the deletion of the source processor

The source processor 3931 is deleted (Figure 3-26 on page 57).

```
Processor List        Row 1 of 2 More:
Command ===> _______________________________________________ Scroll ===> CSR

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


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
_ MENSA    9175     ME1      LPAR  071A089175 Mensa
_ VELA     3932     AGZ      LPAR  087F283932 Vela
```

Figure 3-26 Processor List: Processor deleted

3.3.8 Reconnecting the CF channel paths that were not migrated

Manually redefine the CF links from the MENSA (previously PAVO) processor to any other processor, along with any internal CF links that you require. To help with this task, obtain a CF connection report from the previous production IODF that contains the 3931. Alternatively, note all CBDG441I error messages that you received in 3.3.7, “Deleting the 3931 processor definition” on page 55.

3.3.9 Additional steps and tasks

When you are ready to map the PCHIDs from the IBM z17 CFReport file to the CHPIDs in your exported IODF, see Chapter 4, “Preparing an IOCP input file to use the IBM Z CMT” on page 63.

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

3.4 Installing a new IBM z17

This scenario describes the configuration steps for defining a new 9175 processor in an existing hardware environment.

The process includes the following key considerations:

- HCD requires a new processor ID for the 9175.
- HCD requires a new CPC name for the 9175.
- The 9175 processor connects to new switch ports and new CU interfaces.
- The CU interfaces connect to the same switch ports as before.
- The starting IODF is the current production IODF.
- The target IODF is a new work IODF with a 9175 defined.
- HCD actions:
  - Migrate updated IOCP statements.
  - Build a production IODF.
  - Remote write an IODF to IOCDS.
- HMC actions:
  - Build the Reset Profile and point to the required IOCDS.
  - Build and verify Image Profiles.
  - Build and verify Load Profiles.
  - Run a POR.

This example defines a new 9175 (IBM z17 ME1) processor with a processor ID of MENSA2 and six CSS identifiers (CSS ID=0 through CSS ID=5). The CPC name MENSA2 and serial number 02-B9FB8 are used for the 9175.

Table 3-2 summarizes the tool requirements.

Table 3-2 I/O configuration for a new (additional) 9175 processor

New (additional) 9175 processor	New (additional) 9175 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 a processor.
CMT Program	Optional, but good for verifying configurations.
CFReport File (CCN)	Required for the CMT.
IOCP (import from validated work IODF)	Yes.
CMT actions (PCHID reset)	Yes.
CMT IOCP Output	Yes.
CMT Reports	Yes. CHIPID Report and CHIPID to CU Report.

HCD: Creating a 9175 IODF

The following steps explain how to define an extra 9175 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 9175 processor.
3. Exporting and importing OSA-ICC configuration data with OSA Advanced Facilities.
4. Using OSA Advanced Facilities to set OSA parameters.

3.4.1 Creating a work IODF from the current production IODF

HCD is the tool that you use to create a work IODF. In this example, start from the current production IODF that contains the existing hardware environment to be connected to the new 9175 processor (for example, `SYS9.IODF80`).

3.4.2 Adding the 9175 processor

To add the 9175 processor, complete the following steps:

1. From the HCD main menu, select option `1.3. Processor List`.
2. In the Processor List (Figure 3-27), press PF11, or enter `add` on the CLI to add a processor, 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
_ MENSA    9175     ME1      LPAR  0123459175 Mensa
_ PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
```

Figure 3-27 Processor List: Adding a processor

The Add Processor panel opens (Figure 3-28).

```
*------------------------------- 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 3-28 Add Processor: Data fields to be updated

3. Specify the appropriate values. For example, specify the following settings, as shown in Figure 3-29:

Processor ID	`MENSA2`
Processor type	`9175`
Processor model	`ME1`
Number of channel subsystems	(Keep this blank for now.)
Serial number	`02B9FB89175`
Network name	`IBM390PS`
CPC name	`MENSA2`
Local System Name	(Keep this blank for now.)

```
*------------------------------ Add Processor -------------------------------*
|                                                                            |
|                                                                            |
| Specify or revise the following values.                                    |
|                                                                            |
| Processor ID . . . . . . . . . . MENSA2                                    |
| Processor type . . . . . . . . . 9175     +                                |
| Processor model  . . . . . . . . ME1      +                                |
| Configuration mode . . . . . . . LPAR     +                                |
| Number of channel subsystems . . _        +                                |
|                                                                            |
| Serial number  . . . . . . . . . 2B9FB89175                                |
| Description  . . . . . . . . . . ________________________________          |
|                                                                            |
| Specify SNA address only if part of a processor cluster:                   |
|                                                                            |
| Network name . . . . . . . . . . IBM390PS  +                               |
| CPC name . . . . . . . . . . . . MENSA2    +                               |
|                                                                            |
| Local system name  . . . . . . . ________                                  |
|                                                                            |
|                                                                            |
*----------------------------------------------------------------------------*
```

Figure 3-29 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, `SYS9.IODF90.WORK`).
5. Press Enter. You now have a 9175 processor that is named MENSA2 (Figure 3-30 on page 61).

```
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
_ MENSA    9175     ME1      LPAR  0123459175 Mensa
_ MENSA2   9175     ME1      LPAR  2B9FB89175 ______________________________
_ PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
****************************** Bottom of data ****************************





*-----------------------------------------------------------------*
| Definition of processor MENSA2 has been extended to its maximum |
| configuration.                                                  |
*-----------------------------------------------------------------*
```

Figure 3-30   Processor List: New processor added

The message at the bottom of the panel appears because HCD automatically populates the processor with all allowed CSSs and reserved partitions. In HCD, when you define or redefine a processor as a 9175, HCD no longer defines or allows you to define partitions 0xB - 0xF in CSS5. These partitions are reserved for IBM internal use. HCD automatically defines the maximum configuration of six CSSs and 85 LPARs.

6. Enter S next to `MENSA2`, and press Enter. The Channel Subsystem List panel opens. You can view six CSSs (CSS0 - CSS5), which are defined with the default `MAXDEV` values: 65280 for SS0, set by HCD, and 65535 for SS1, SS2, and SS3 (Figure 3-31).

```
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 . . . : MENSA2

  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 3-31   Channel Subsystem List: Four subchannel sets

3.4.3 Additional steps and tasks

When you are ready to map the PCHIDs from the IBM z17 CFReport file to the CHPIDs in your exported IODF, see Chapter 4, “Preparing an IOCP input file to use the IBM Z CMT” on page 63.

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

4

Preparing an IOCP input file to use the IBM Z CMT

This chapter describes how to prepare an Input/Output Configuration Program (IOCP) input file to use the IBM Z Connectivity Mapping Tool (CMT).

Naming: The IBM Z server that is targeted by this publication is the IBM z17 ME1. Throughout this chapter, we might refer to this machine as the IBM z17.

This chapter describes a series of steps where a new IBM z17 is installed in place of an already running IBM z16.

This chapter includes the following topics:

- Creating a copy of an existing IODF from an IBM z16 server
- Creating the IOCP file for use with the CMT
- Assigning CHIDs to CHPIDs by using the CMT
- Importing the CFR file and the IOCP input file into the CMT
- Building the initial overview
- Assigning missing feature types
- Resetting incompatible (hardware - I/O) entries
- Creating CMT reports
- Creating an updated IOCP file
- Additional steps and processes

4.1 Creating a copy of an existing IODF from an IBM z16 server

To create an exact copy of a defined IBM Z server in Hardware Configuration Definition (HCD), complete the following steps:

1. Go to the main HCD panel, and select the current input/output definition file (IODF). Determine the currently active IODF by using a command processor and entering the command **`D IOS,CONFIG`**, as shown in Example 4-1.

Example 4-1 Displaying the active IODF file name

```
D IOS CONFIG
IOS506I 14.17.31 I/O CONFIG DATA 727
ACTIVE IODF DATA SET = SYS9.IODF91
CONFIGURATION ID = ITSO           EDT ID = 01
TOKEN:  PROCESSOR DATE     TIME     DESCRIPTION
 SOURCE: PAVO     25-05-02 14:49:52 SYS9     IODF91
ACTIVE CSS:  3    SUBCHANNEL SETS CONFIGURED: 0, 1, 2, 3
CHANNEL MEASUREMENT BLOCK FACILITY IS ACTIVE
SUBCHANNEL SET FOR PPRC PRIMARY: INITIAL = 0   ACTIVE = 0
HYPERSWAP FAILOVER HAS OCCURRED: NO
LOCAL SYSTEM NAME (LSYSTEM): PAVO
```

2. Start the HCD application, and enter the active IODF data set name in the `I/O definition file` field. Enter `option 1 Define, modify, or view configuration data`, as shown in Figure 4-1.

```
z/OS V3.1 HCD
Command ===> ________________________________________________________________

                           Hardware Configuration

Select one of the following.

1_  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 . . . 'SYS9.IODF91'                          +
```

Figure 4-1 Initializing HCD with the active IODF file

3. Select option `3. Processors` to access the Processor List and add the active IODF file.
4. Select the source processor for the copy operation by placing an `r` in front of the central processor complex (CPC) to be copied, as shown in Figure 4-2 on page 65.

```
Goto  Filter  Backup  Query  Help
------------------------------------------------------------------------------
                                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
_ MENSA    9175     ME1      LPAR  0B9FB89175 Mensa
r PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
******************************* Bottom of data ********************************
```

Figure 4-2 Selecting the processor to be copied

5. The Identify Target IODF panel appears, where you can enter the target IODF into which the configuration data is repeated. Leave the setting as it is.
6. When you attempt to change an active IODF, HCD automatically performs a copy operation of the selected active IODF. In the next panel, Create Work I/O Definition File, specify a new target IODF name for the work file. Adjust the space allocation of the new file according to the number of changes that you plan to apply. Adhere to the valid rules for allocating new datasets in your environment, as shown in Figure 4-3.

```
Goto  Filter  Backup  Query  Help
- *------------------------- Identify Target IODF --------------------------*
  |                                                                          |
C |   *----------------- Create Work I/O Definition File -----------------* |
  | S |                                                                   | |
S |   |                                                                   | |
  | T | The current IODF is a production IODF and therefore cannot be     | |
  |   | updated. To create a new work IODF based on the current           | |
/ |   | production IODF, specify the following values.                    | |
_ |   |                                                                   | |
r |   | IODF name  . . . . . . 'ZNEXT01.IODF92.WORK'                      | |
_ *-- |                                                                   | *
***** | Volume serial number . BH5ST6  +                                  | ***
      |                                                                   |
      | Space allocation . . . 2048    (Number of 4K blocks)              |
      | Activity logging . . . no     (Yes or No)                         |
      | Multi-user access  . . No     (Yes or No)                         |
      |                                                                   |
      |                                                                   |
      *-------------------------------------------------------------------*
```

Figure 4-3 Specifying the allocation parameters for the work IODF file

7. On the Repeat Processor panel, enter the values for Processor ID, Description, and Local System Name, as shown in Figure 4-4.

```
*---------------------------- Repeat Processor -----------------------------*
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . . . . . . PAVO2___                                   |
|                                                                           |
| Processor type . . . . . . . : 3931                                       |
| Processor model  . . . . . . : A01                                        |
| Configuration mode . . . . . : LPAR                                       |
|                                                                           |
| Serial number  . . . . . . . . 071A083931                                 |
| Description  . . . . . . . . . Pavo2                                      |
|                                                                           |
| Specify SNA address only if part of a processor cluster:                  |
|                                                                           |
| Network name . . . . . . . . . IBM390PS  +                                |
| CPC name . . . . . . . . . . . PAVO      +                                |
|                                                                           |
| Local system name  . . . . . . PAVO2                                      |
|                                                                           |
*-----------------*                                                         |
| Input required. |                                                         |
*-----------------* --------------------------------------------------------*
```

Figure 4-4 Specifying the new processor ID, description, and the local system name

The copy operation does not copy definitions that lead to duplicate entries. Therefore, be prepared to see several informational messages, as shown in Example 4-2.

Example 4-2 Messages that might appear during the copy operation

```
/ Sev Msg. ID  Message Text
_ I   CBDG441I The coupling facility connection between channel path
#              3.80 of processor PAVO and channel path 2.D2 of
#              processor VELA is not copied.
_ I   CBDG441I The coupling facility connection between channel path
#              3.81 of processor PAVO and channel path 3.86 of
#              processor MENSA is not copied.
_ I   CBDG441I The coupling facility connection between channel path
#              3.84 of processor PAVO and channel path 2.D6 of
#              processor VELA is not copied.
_ I   CBDG441I The coupling facility connection between channel path
#              3.85 of processor PAVO and channel path 3.84 of
#              processor MENSA is not copied.
_ I   CBDG441I The coupling facility connection between channel path
#              3.88 of processor PAVO and channel path 3.88 of
_ I   CBDG271I Requested action on object PAVO successfully processed.
```

Make sure that the copy operation processed successfully. If so, an extra processor is created, including all basic definitions of the source processor, as shown in Figure 4-5 on page 67.

```
 Goto  Filter  Backup  Query  Help
 ------------------------------------------------------------------------------
                                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
 _ MENSA    9175     ME1      LPAR  0B9FB89175 Mensa
 _ PAVO     3931     A01      LPAR  071A083931 Pavo
 _ PAVO2    3931     A01      LPAR  071A083931 Pavo2
 _ VELA     3932     AGZ      LPAR  087F283932 Vela
 ******************************* Bottom of data ********************************
```

Figure 4-5 The newly created processor

4.1.1 Changing the processor type

After the selected processor is copied, change the processor type. Complete the following steps:

1. On the Processor List panel, select the processor by entering `C` in front of it to change the machine type.
2. On the Change Processor Definition panel, apply the change for the appropriate processor type, model, and serial number, as shown in Figure 4-6. Press F4 to display the prompting options.

```
 *------------------------ Change Processor Definition ------------------------*
 |                                                                              |
 |                                                                              |
 | Specify or revise the following values.                                      |
 |                                                                              |
 | Processor ID . . . . . . . . : PAVO2                                         |
 | Support level:                                                               |
 | 3931 support                                                                 |
 | Processor type . . . . . . . . 9175      +                                   |
 | Processor model  . . . . . . . ME1       +                                   |
 | Configuration mode . . . . . . LPAR      +                                   |
 |                                                                              |
 | Serial number  . . . . . . . . 071A089175  +                                 |
 | Description  . . . . . . . . . Pavo2                                         |
 |                                                                              |
 | Specify SNA address only if part of a processor cluster:                     |
 |                                                                              |
 | Network name . . . . . . . . . IBM390PS  +                                   |
 | CPC name . . . . . . . . . . . PAVO      +                                   |
 |                                                                              |
 | Local system name  . . . . . . PAVO2                                         |
 |                                                                              |
 |                                                                              |
 *------------------------------------------------------------------------------*
```

Figure 4-6 Changing the processor type and serial number

The change process does not allow unsupported features to be carried over to the new processor type.

3. Delete any unsupported entries from the copied processor before you change the processor type. Follow the indications in the error messages, as shown in Figure 4-7.

```
*------------------------------- Message List --------------------------------*
|   Save  Query  Help                                                         |
| --------------------------------------------------------------------------  |
|                                                                Row 1 of 184 |
| Command ===> ___________________________________________ Scroll ===> CSR    |
|                                                                             |
| Messages are sorted by severity. Select one or more, then press Enter.      |
|                                                                             |
| / Sev Msg. ID  Message Text                                                 |
| _ E   CBDG614I Function type ROCE-2 of function 3101 is not supported       |
| #              by processor PAVO2.                                          |
| _ E   CBDG614I Function type ROCE-2 of function 3131 is not supported       |
| #              by processor PAVO2.                                          |
| _ E   CBDG614I Function type ROCE-2 of function 3132 is not supported       |
| #              by processor PAVO2.                                          |
| _ E   CBDG614I Function type ROCE-2 of function 3133 is not supported       |
| #              by processor PAVO2.                                          |
| _ E   CBDG614I Function type ROCE-2 of function 3134 is not supported       |
| #              by processor PAVO2.                                          |
| _ E   CBDG614I Function type ROCE-2 of function 3135 is not supported       |
| #              by processor PAVO2.                                          |
*--------------------------------------------------------------* pported      |
| The change of processor rules leads to invalid definitions. |               |
*--------------------------------------------------------------* -------------*
```

Figure 4-7 Partial list of errors while trying to change the processor type

4.1.2 Validating the work input/output definition file

To validate the work IODF by using the 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 message `Requested action successfully processed` is displayed.

3. Select HCD option `6.4 View I/O Definition File Information`. The IODF type is now indicated as `Work – Validated`, as shown in Figure 4-8.

```
*---------------- View I/O Definition File Information -----------------*
|                                                                       |
|                                                                       |
| IODF name  . . . . . . : 'ZNEXT01.IODF92.WORK'                        |
| IODF type  . . . . . . : Work - Validated                             |
| IODF version . . . . . : 5                                            |
|                                                                       |
| Creation date  . . . . : 2025-05-07                                   |
| Last update  . . . . . : 2025-05-07  15:26                            |
|                                                                       |
| Volume serial number . : BH5ST6                                       |
| Allocated space  . . . : 2048    (Number of 4K blocks)                |
| Used space . . . . . . : 768     (Number of 4K blocks)                |
|    thereof utilized (%)  94                                           |
| Activity logging . . . : No                                           |
| Multi-user access  . . : No                                           |
| Backup IODF name . . . :                                              |
|                                                                       |
| Description  . . . . . :                                              |
|                                                                       |
|                                                                       |
|                                                                       |
| ENTER to continue.                                                    |
*-----------------------------------------------------------------------*
```

Figure 4-8 View I/O Definition File Information: Validated work IODF

4.2 Creating the IOCP file for use with the CMT

To create the ICOP 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 4-9).

```
*------ 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 4-9 Activate or Process Configuration Data: Building IOCP for PAVO2

2. HCD displays the list of available processors (see Figure 4-10). Select the PAVO2 processor by entering an s next to it and pressing Enter.

```
*------ Activate or Process Configuration Data ------*
C |                                                  | ___________________
  *------------------------- Available Processors ---------------------------*
  |                                                               Row 1 of 4 |
  | Command ===> __________________________________________________________   |
S |                                                                          |
  | Select one.                                                              |
2 |                                                                          |
  |   Processor ID  Type     Model    Mode  Description                      |
  |   MENSA         9175     ME1      LPAR  Mensa                            |
  |   PAVO          3931     A01      LPAR  Pavo                             |
  | s PAVO2         9175     ME1      LPAR  Pavo2                            |
  |   VELA          3932     AGZ      LPAR  Vela                             |
  | *************************** Bottom of data ***************************** |
  |                                                                          |
  |                                                                          |
  |                                                                          |
  |                                                                          |
F |                                                                          |
  |                                                                          |
I |                                                                          |
  |                                                                          |
  |                                                                          |
  *--------------------------------------------------------------------------*
```

Figure 4-10 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 create (see Figure 4-11). Complete the following fields:
   - Title1: `PAV02 IODF92`
   - IOCP input dataset: `'ZNEXT01.IODF92.INPUT.IOCP'`
   - 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 . . . . . . . . . : 'ZNEXT01.IODF92.WORK'                       |
 | Processor ID  . . . . . . . : PAV02                                       |
 | Title1 . PAV02 IODF92                                                     |
 | Title2 : ZNEXT01.IODF92.WORK - 2025-05-13 16:34                           |
 |                                                                           |
 | IOCP input data set                                                       |
 | 'ZNEXT01.IODF92.INPUT.IOCP'____________________________                   |
 | Input to Stand-alone IOCP?  Yes  (Yes or No)                              |
 |                                                                           |
 | Job statement information                                                 |
 | //ZNEXT01H  JOB (SG248581),'FPINTO HCD',                                  |
 | //          MSGCLASS=X,CLASS=A,MSGLEVEL=(1,1),                            |
 | //          NOTIFY=&SYSUID                                                |
 | /*JOBPARM LINES=9999                                                      |
 | //*                                                                       |
 | //*                                                                       |
 |                                                                           |
 |                                                                           |
 *---------------------------------------------------------------------------*
```

Figure 4-11 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 whether the data set that you created exists and contains IOCP statements (see Example 4-3). This example uses Time Sharing Option (TSO). This dataset is used as an input into the CMT.

Example 4-3 Top of the IOCP input dataset (truncated)

```
ID     MSG1='PAV02 IODF92',                                    *
       MSG2='ZNEXT01.IODF92.WORK - 2025-05-13 10:54',          *
       SYSTEM=(9175,1),LSYSTEM=PAV02,                          *
       TOK=('PAV02',008003321A083931105439380125133F00000000,00*
       000000,'25-05-13','10:54:39','........','........')
RESOURCE PARTITION=((CSS(0),(PAV00A,A),(PAV00B,B),(PAV00C,C),(*
       PAV00D,D),(PAV00E,E),(PAV001,1),(PAV002,2),(PAV003,3),(P*
       AV004,4),(PAV005,5),(PAV006,6),(PAV007,7),(PAV008,8),(PA*
       V009,9),(*,F)),(CSS(1),(PAV01A,A),(PAV01B,B),(PAV01C,C),*
       (PAV01D,D),(PAV01E,E),(PAV01F,F),(PAV011,1),(PAV012,2),(*
       PAV013,3),(PAV014,4),(PAV015,5),(PAV016,6),(PAV017,7),(P*
       AV018,8),(PAV019,9)),(CSS(2),(PAV02A,A),(PAV02B,B),(PAV0*
       2C,C),(PAV02D,D),(PAV021,1),(PAV022,2),(PAV023,3),(PAV02*
       4,4),(PAV025,5),(PAV026,6),(PAV027,7),(PAV028,8),(PAV029*
       ,9),(*,E),(*,F)),(CSS(3),(PAV03A,A),(PAV03B,B),(PAV03C,C*
       ),(PAV03D,D),(PAV03E,E),(PAV03F,F),(PAV031,1),(PAV032,2)*
```

```
,(PAV033,3),(PAV034,4),(PAV035,5),(PAV036,6),(PAV037,7),*
(PAV038,8),(PAV039,9)),(CSS(4),(PAV041,1),(PAV042,2),(PA*
V043,3),(PAV044,4),(PAV045,5),(PAV046,6),(PAV047,7),(PAV*
```

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

Example 4-4 IOCP file (TOK statement)

```
TOK=('PAV02',008003321A083931105439380125133F00000000,00*
      000000,'25-05-13','10:54:39','........','........')
```

These dots help ensure that the IOCP file cannot be written to a processor or used for a power-on reset (POR). This precaution is necessary because the IOCP file is created from a validated work IODF rather than a production IODF. IOCP files that can be used for a POR are generated only from a production IODF.

> **Important:** When you export an IOCP file by using HCD from a validated work IODF, you must import it 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 the IOCP file from z/OS to the CMT workstation. Use a workstation file transfer facility, such as SFTP, the IBM Personal Communications Workstation Program, or any equivalent 3270 emulation program. Use TEXT as the transfer type. In this example, the file is named `ZNEXT01.IODF92.INPUT.IOCP`.

4.3 Assigning CHIDs to CHPIDs by using the CMT

In this section, use the IOCP statements from HCD and the 9175 order process file (CFReport). Use the CMT to assign CHIDs to each of the channel path IDs (CHPIDs) for the 9175.

Download the CMT for this process. For more information about downloading and installing the CMT, see 2.2.3, "IBM Z Connectivity Mapping Tool" on page 12. If the CMT is already installed, verify that the latest updates are applied.

The version of the CMT that supports IBM z17 and is used for the following examples is Version 1.0.0. Check for the latest version at IBM Resource Link.

For more information, see the *CMT User's Guide,* GC28-7058, which is also available at IBM Resource Link.

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 coupling link between 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 CFR file and the IOCP input file into the CMT

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

1. Start the CMT on your workstation (Figure 4-12).

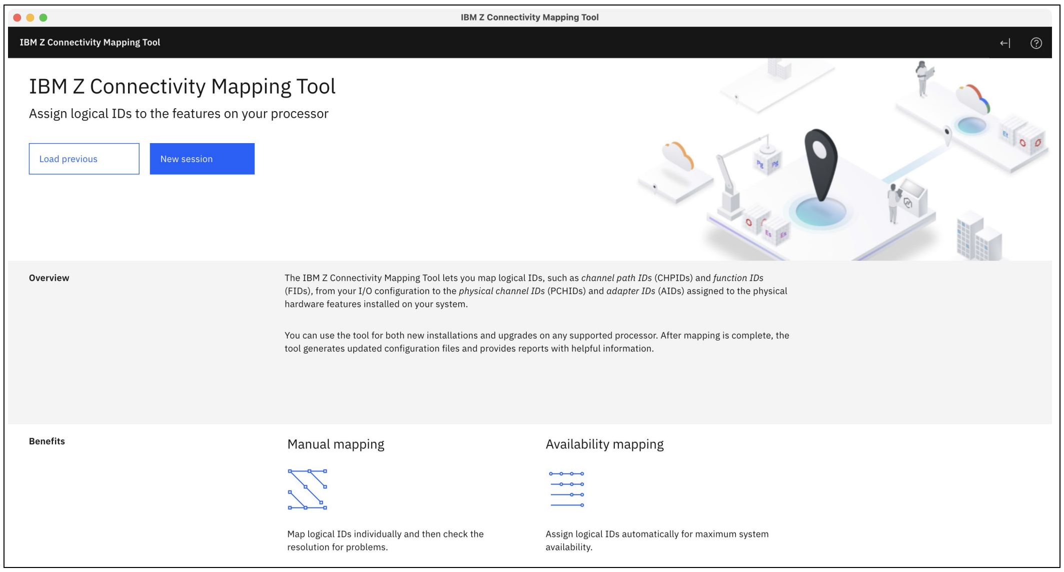


Figure 4-12 The CMT starting page

2. The CMT asks for a session name, the CFR report, and the IOCP input file. This example uses `PAV022z17` as the session name (Figure 4-13).

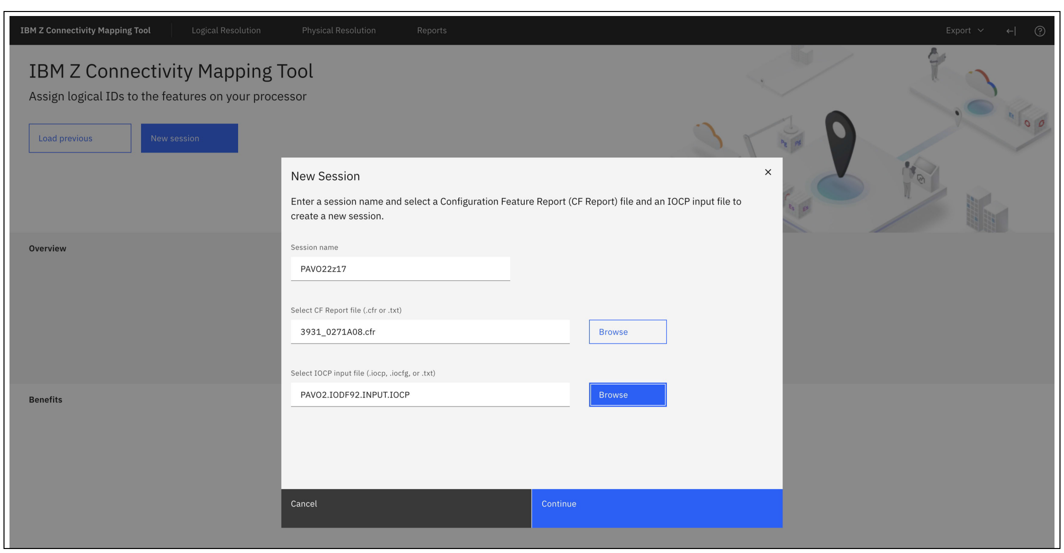


Figure 4-13 Creating a CMT session and loading the files

3. To import the validated 9175 IOCP file into the CMT, enter the values into the create session window, as shown in Figure 4-13, and click **Continue**.

Note: The function to produce location reports based only on the CFR file is planned for the next version of the IBM Z CMT

4.5 Building the initial overview

The New Session window contains information about the new session and the input files, as shown in Figure 4-14. Because this scenario is an upgrade scenario, CMT detects both processor types and prompts you to select which representation to use. Select **Proposed configuration** so that CMT can assign the CHIDs for the new processor type.

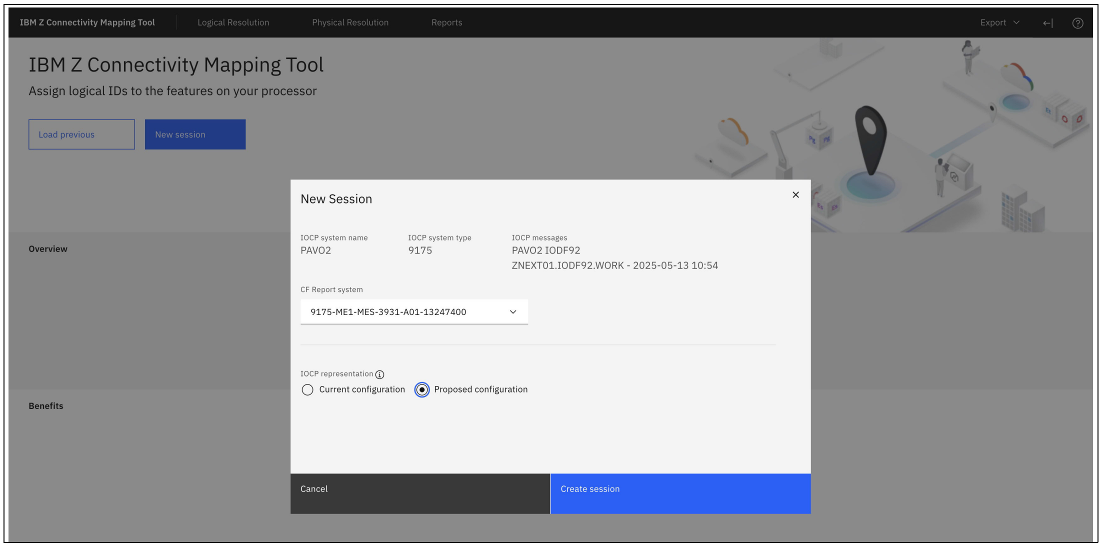


Figure 4-14   New Session window with session information

Click **Create session**. The Logical resolution window opens, as shown in Figure 4-15.

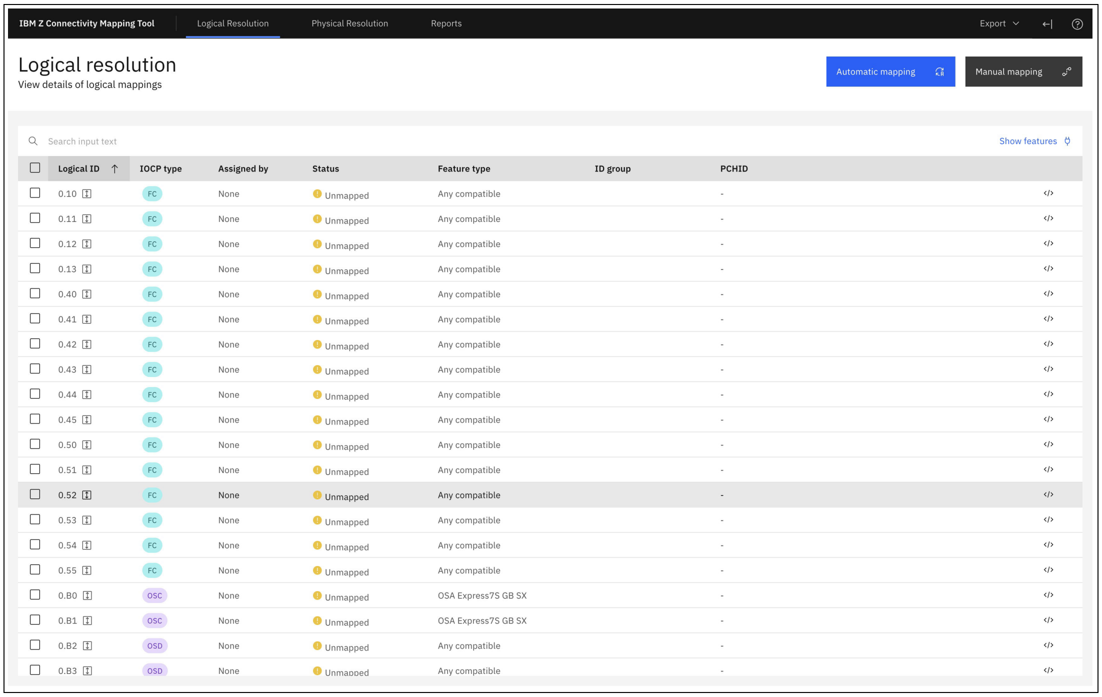


Figure 4-15 Logical resolution window

The CMT displays information from the CFReport file and the IOCP file in the Logical resolution window by default. At the top of the window, you can select one of three options, as shown in Figure 4-15:

- Logical Resolution
- Physical Resolution
- Reports

On the Logical resolution window, the logical IDs display the logical channel subsystem (LCSS) and the channel path in the format `CSS.CHPID`. They also display the IOCP type (channel type that is derived from the IOCP input file) and the assigned feature type, if available.

The Physical resolution window shows a table that shows the physical location of the ordered features and, if available, the logical IDs that are assigned to physical channel IDs (PCHIDs), as shown in Figure 4-16 on page 77.

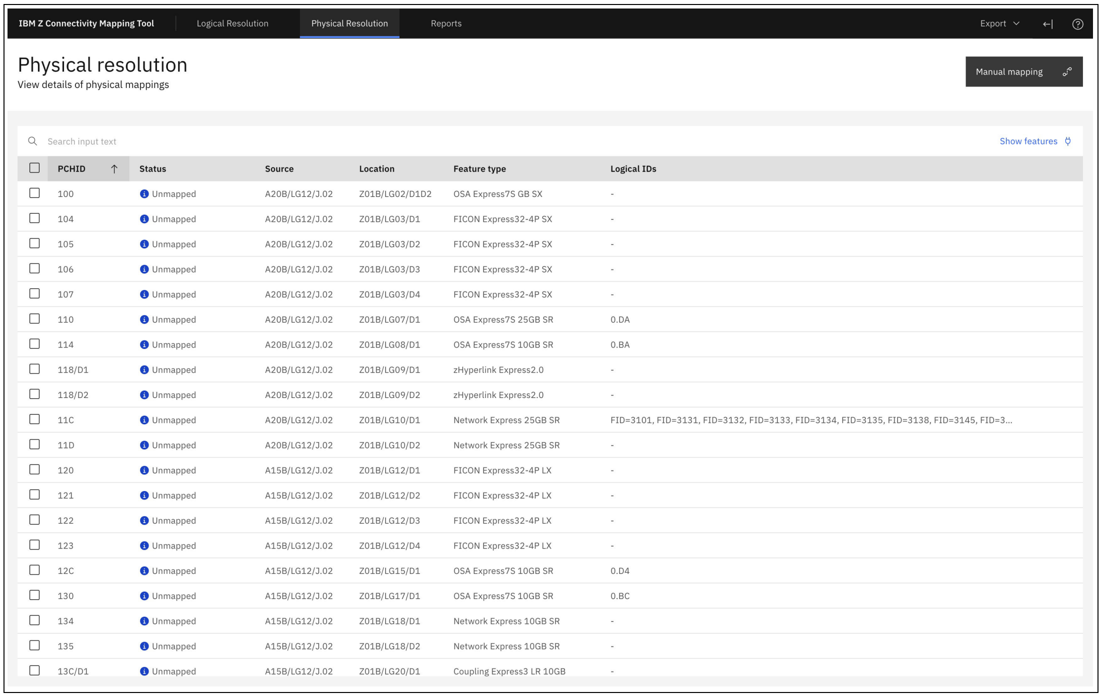


Figure 4-16 Physical resolution showing the availability of physical resources

To see a summary of the number of used and available features, click **Show features**, as shown in Figure 4-17.

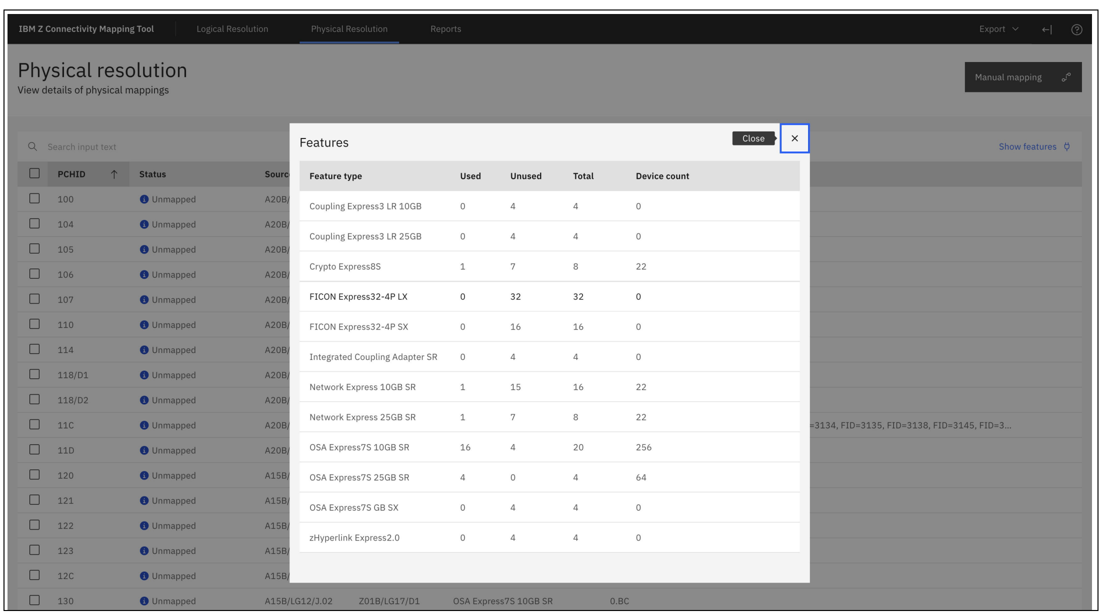


Figure 4-17 Show features window

4.6 Assigning missing feature types

In the Logical resolution window, the CMT displays the automatically detected features, all channel types, and the logical IDs (CHPIDs) that are derived from the IOCP.

Assign the appropriate features by completing the following steps:

1. Select all logical IDs with IOCP type FC,
2. Click Assign feature type, and assign the FICON Express32 – 4P Long Wave (LX) adapter, as shown in Figure 4-18.

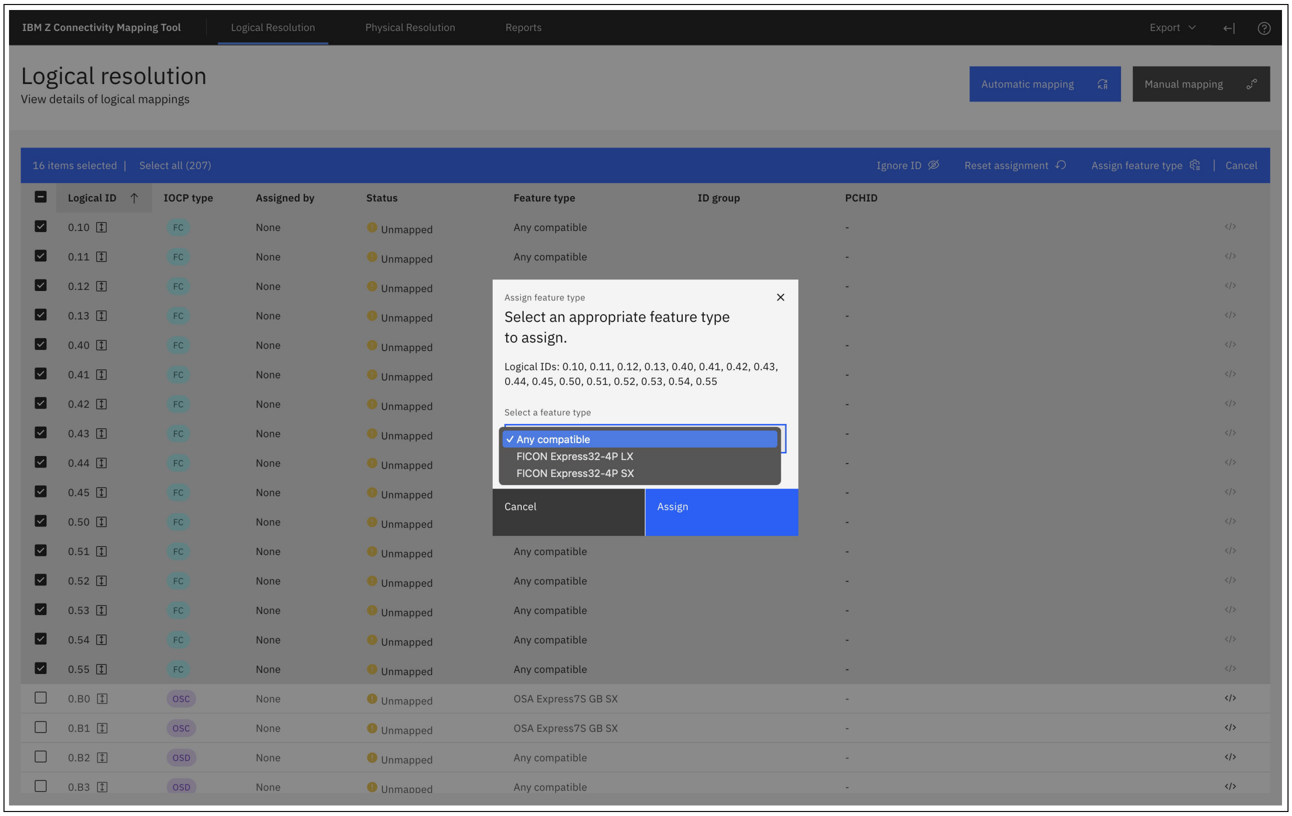


Figure 4-18 Assign features to selected IOCP types and Logical IDs

The CMT assigns the selected feature type to the Logical ID, as shown in Figure 4-19 on page 79.

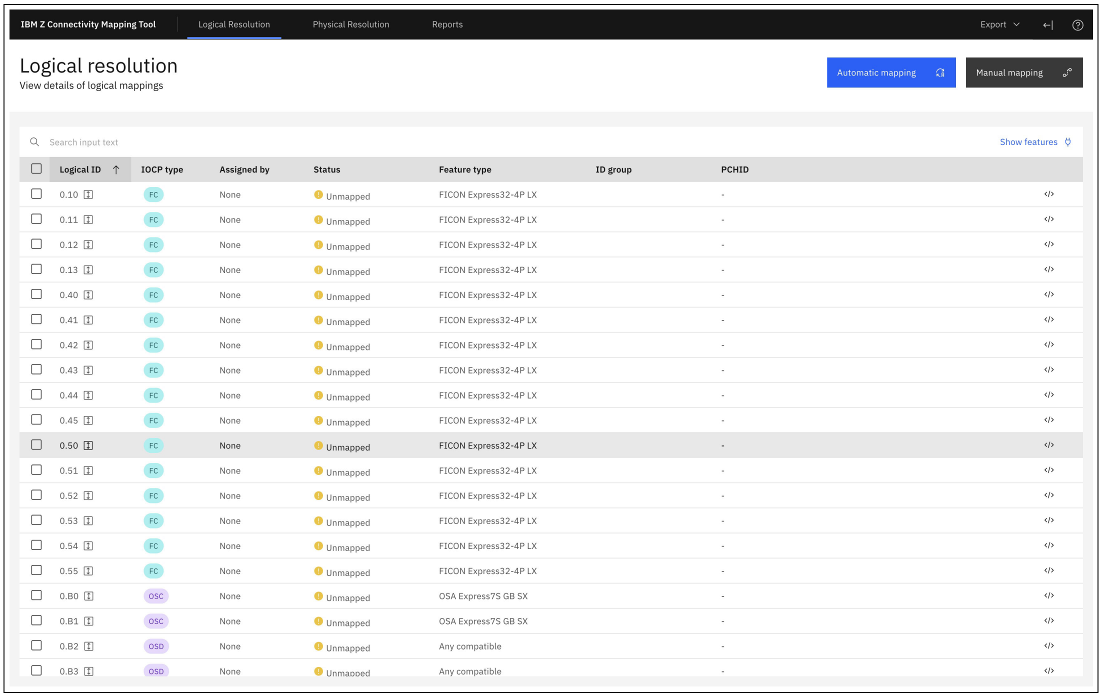


Figure 4-19 Logical resolution window with selected features assigned

Because the 9175 configuration contains both Network Express 10 Gb Short Reach (SR)/Long Reach (LR) and Network Express 25 Gb SR/LR adapters, you must manually assign the appropriate adapter type to the IOCP type.

3. Select the logical IDs for which you plan to use the same feature.
4. Click **Assign feature type** to display a list of available features for the IOCP type, as shown in Figure 4-20.

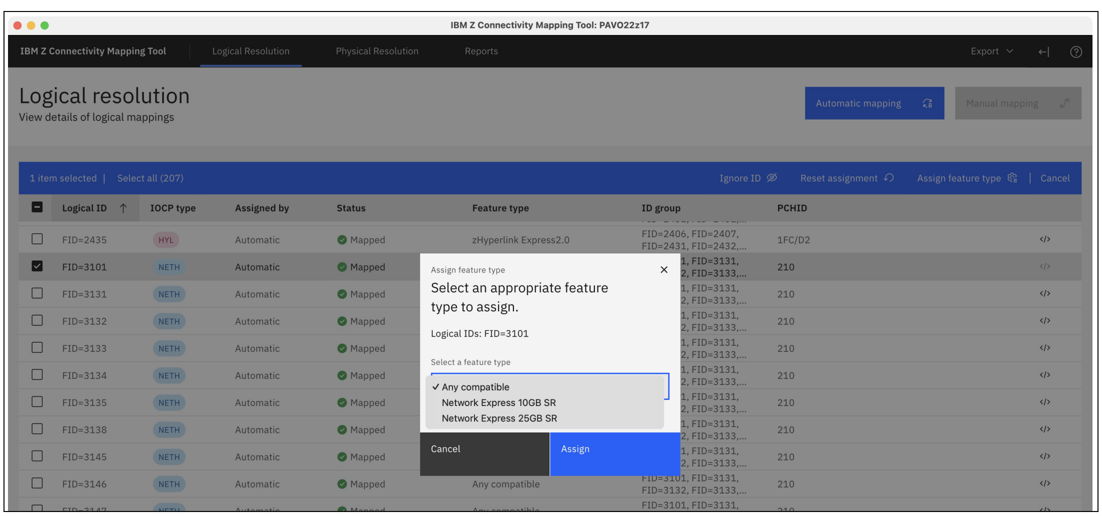


Figure 4-20 Assigning the appropriate feature type to the IOCP type

4.7 Resetting incompatible (hardware - I/O) entries

In this example, use CMT to manually assign a physical adapter ID (AID) and port designation to CL5 coupling links. Figure 4-21 shows an example of a misconfigured coupling link. The AID and port designation are derived from the IBM z16 configuration, which does not match the new IBM z17 configuration.

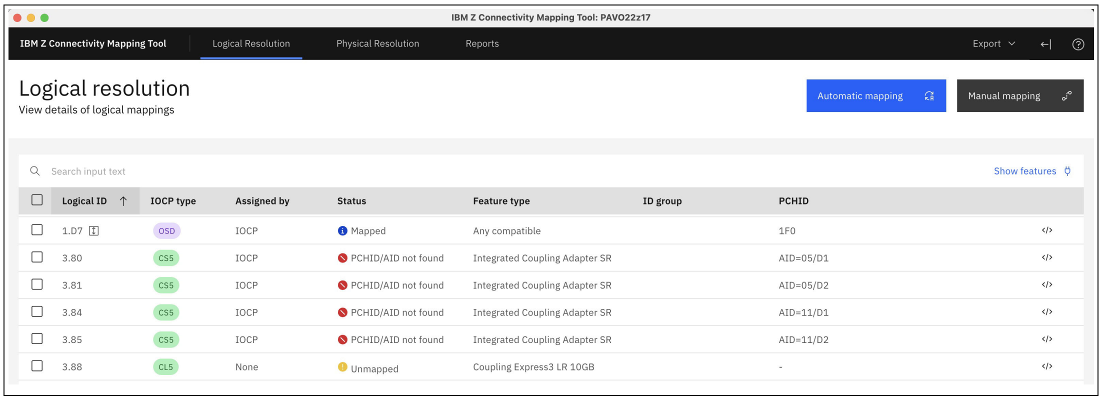


Figure 4-21 CS5 Coupling Links with definition errors

Complete the following steps:

1. Remove the current assignment by selecting the logical ID in the left pane, and then click **Reset assignment**, as shown in Figure 4-22.

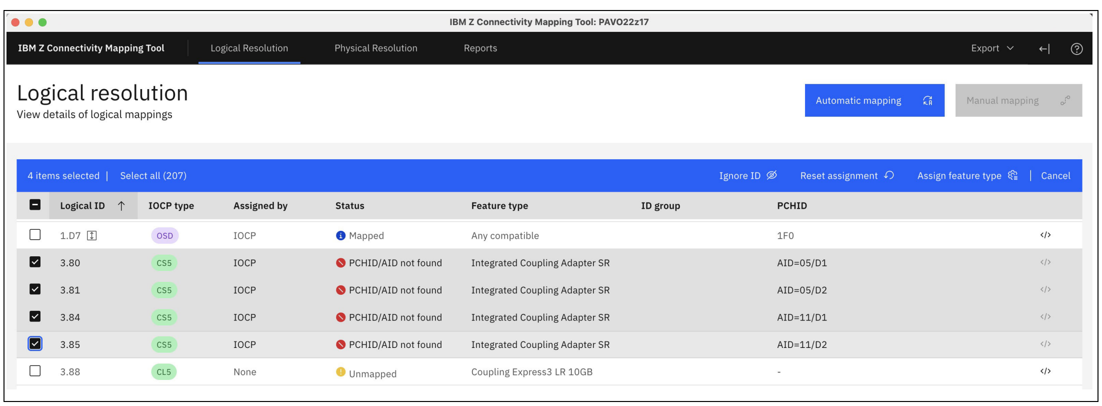


Figure 4-22 Preparing to reset assignments

2. After resetting the assignments, reselect the logical ID, and click **Manual Mapping**. In the window that opens, you can assign the AID and port combination that is present on the upgraded 9175 configuration, as shown in Figure 4-23 on page 81.

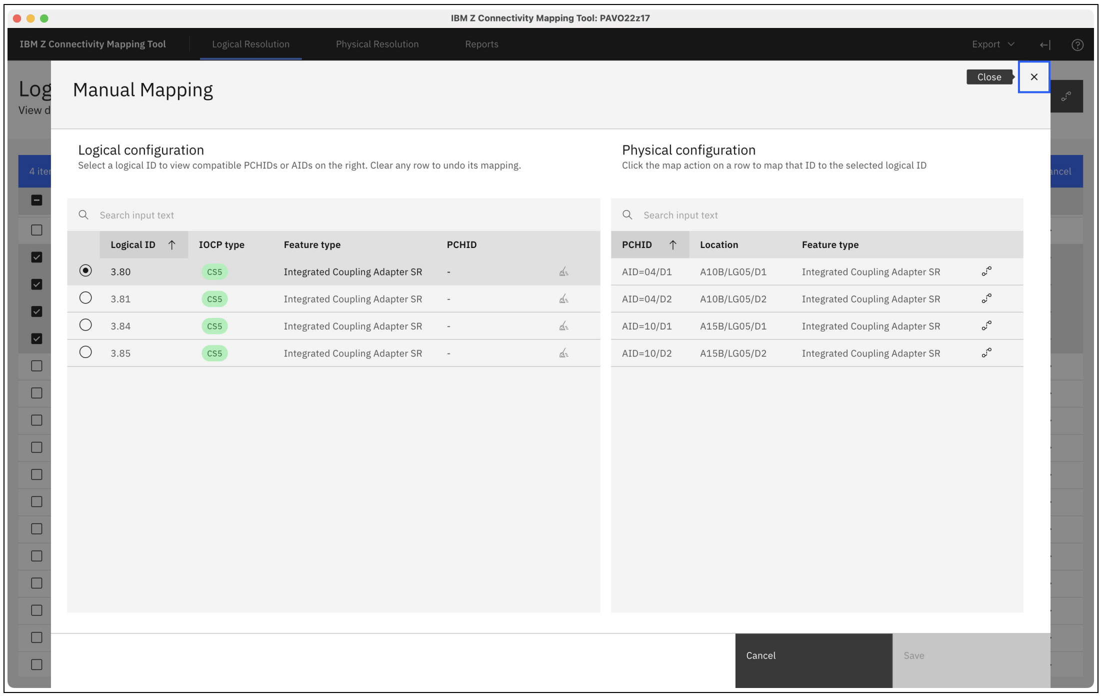


Figure 4-23 Assign AID/Port to coupling links

3. Assign the AID and port to the appropriate logical ID by clicking the MAP symbol in the right pane of the Manual Mapping window. Then, in the lower right of the window, click **Save**. The correct AID and port combination is now assigned, as shown in Figure 4-24.

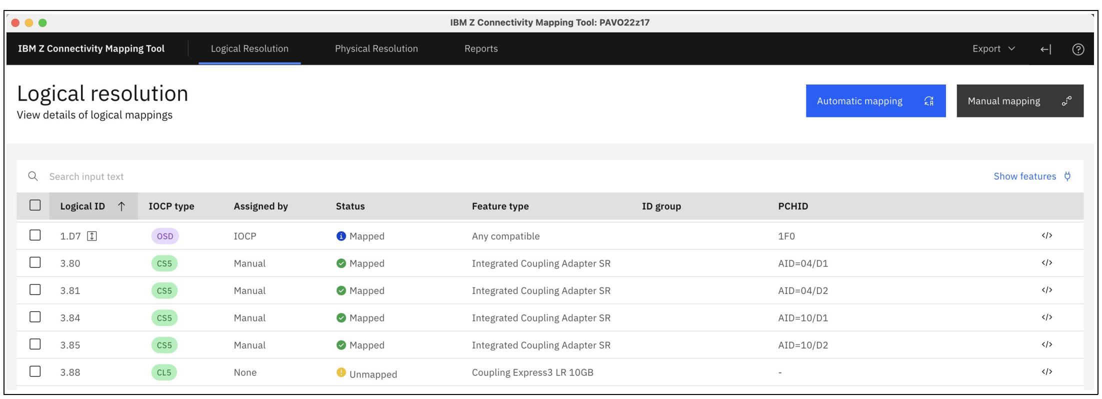


Figure 4-24 Successful AID and port assignment

Note: For more information about these error messages, see the *Connectivity Mapping Tool User's Guide*, GC28-7058.

4.7.1 Assigning PCHID entries to function IDs

Function IDs (FIDs) are ported from the previous configuration and must be reassigned to new PCHIDs because of the new HyperLink adapters, as shown in Figure 4-25.

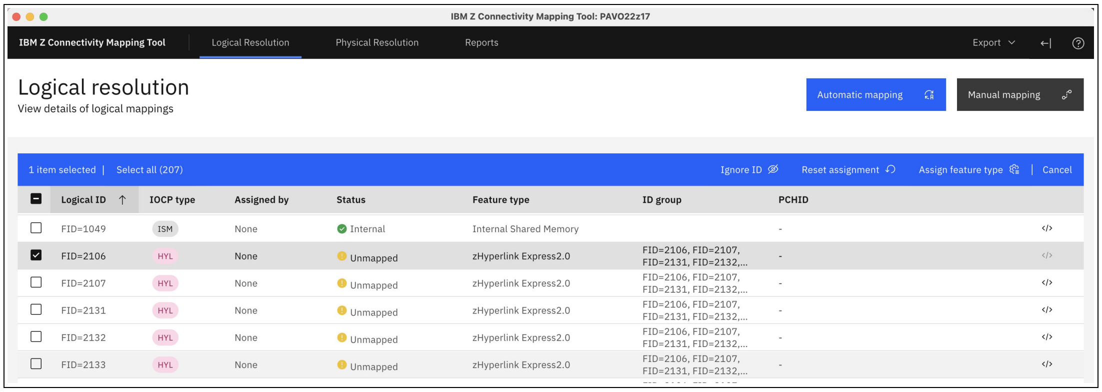


Figure 4-25 HyperLink Functions missing PCHIDs

Select the FID with the lowest number, and in the upper right of the window, click **Manual Mapping**, select the PCHID for this function, and click **Save**. CMT automatically assigns the PCHID for the entire group of FIDs, as shown in Figure 4-26.

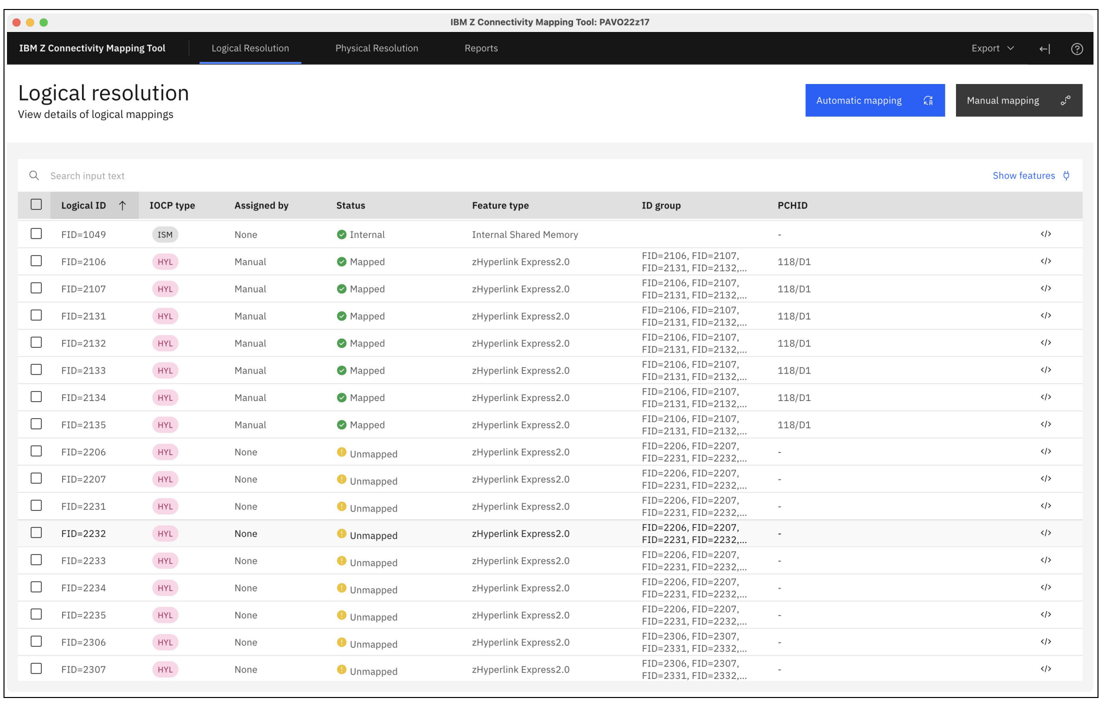


Figure 4-26 PCHID that is assigned to a whole group of HYL FIDs

4.8 Creating CMT reports

The CMT provides built-in reports that you can access from the top of the window by clicking **Reports**. You can also export the information as a CSV file from the report by clicking **Download CSV** in the lower right of each tile.

Figure 4-27 shows the options to create a preview report or download a report.

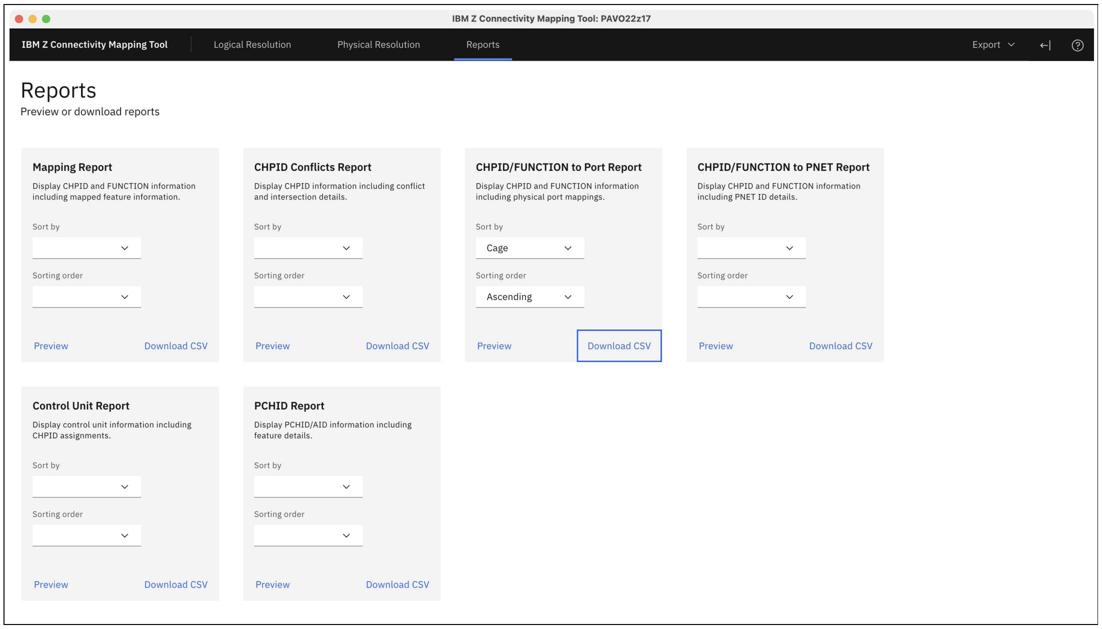


Figure 4-27 Preview or download reports window

Click **Sort by** and **Sort order** in the appropriate tile, and then click **Preview Report** or **Download CSV** to display the results or export them as a CSV file, as shown in Figure 4-28.

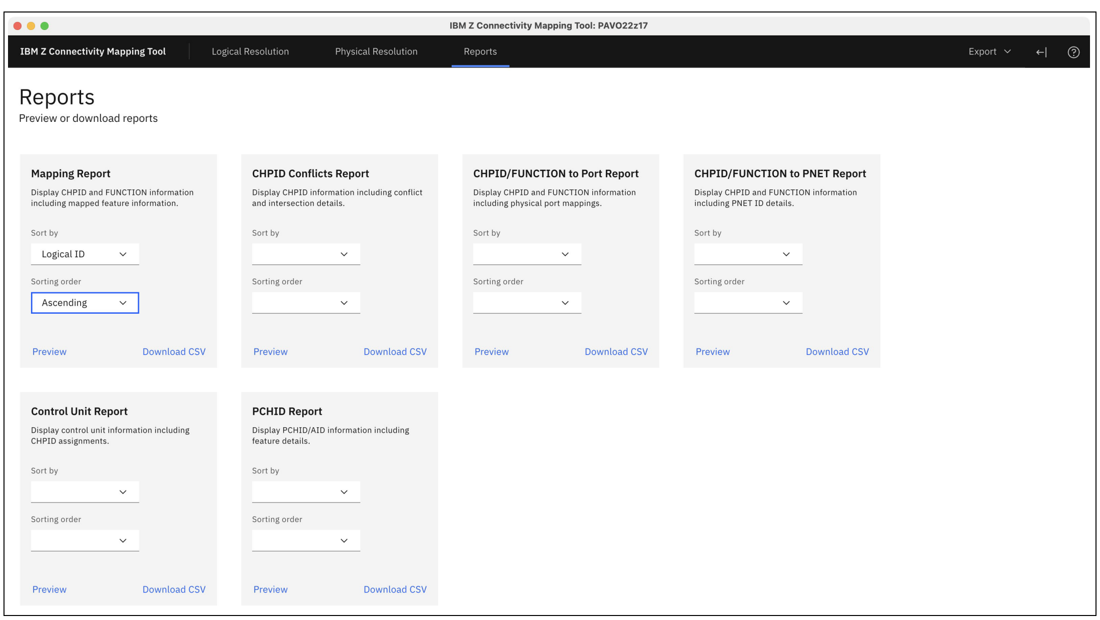
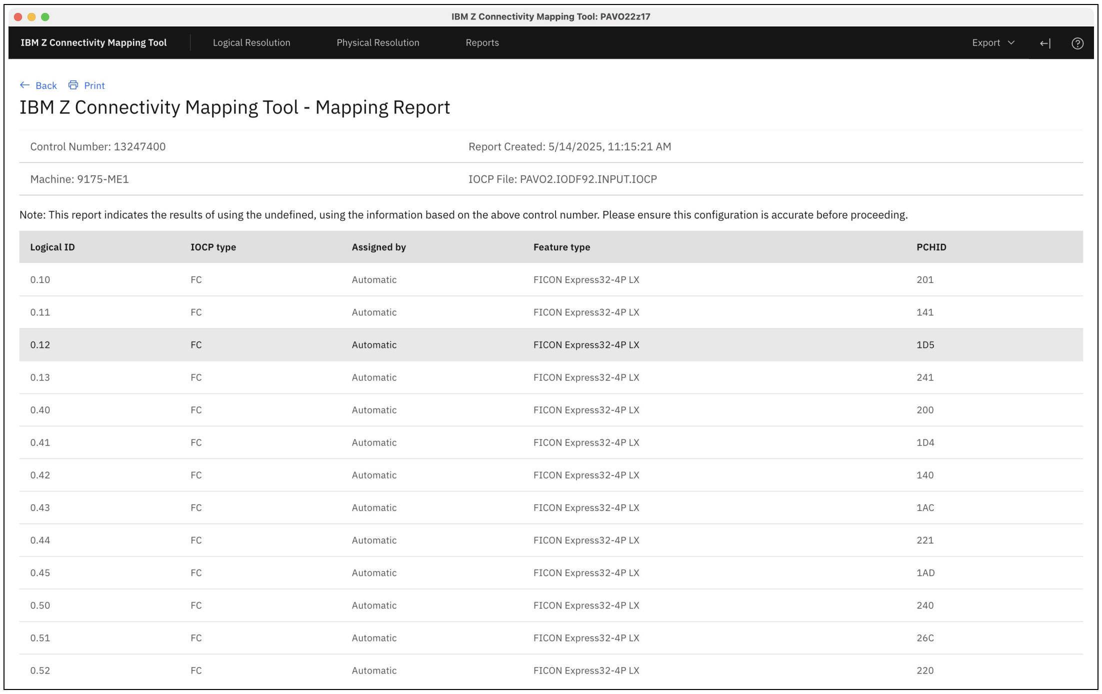


Figure 4-28 Selecting Mapping Report sorted by logical ID

Figure 4-29 shows the selection criteria for a CHPID report.



Logical ID	IOCP type	Assigned by	Feature type	PCHID
0.10	FC	Automatic	FICON Express32-4P LX	201
0.11	FC	Automatic	FICON Express32-4P LX	141
0.12	FC	Automatic	FICON Express32-4P LX	1D5
0.13	FC	Automatic	FICON Express32-4P LX	241
0.40	FC	Automatic	FICON Express32-4P LX	200
0.41	FC	Automatic	FICON Express32-4P LX	1D4
0.42	FC	Automatic	FICON Express32-4P LX	140
0.43	FC	Automatic	FICON Express32-4P LX	1AC
0.44	FC	Automatic	FICON Express32-4P LX	221
0.45	FC	Automatic	FICON Express32-4P LX	1AD
0.50	FC	Automatic	FICON Express32-4P LX	240
0.51	FC	Automatic	FICON Express32-4P LX	26C
0.52	FC	Automatic	FICON Express32-4P LX	220

Figure 4-29 Preview of CHPID mapping report

You can print or export the report to PDF by clicking the Print symbol at the upper left of the window.

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 created in the same way.

4.8.1 CHPID Report

To create the CHPID report, complete the following steps.

1. On the CMT main window, select **Reports** from the top of the window.
2. In the Mapping Report tile, click **Sort by**, select **Logical ID**, and then click **Sort by** again to select **Ascending**.

   Figure 4-28 on page 83 and Figure 4-29 shows the selection process and the resulting report.

CHPID to Port Report sorted by location

To create the Port Report sorted by location, on the Reports window, select the **CHPID/FUNCTION to Port Report** tile. Then, click **Sort by**, select **Cage**, and click **Sort by** again to select **Ascending**, as shown in Figure 4-30 on page 85.

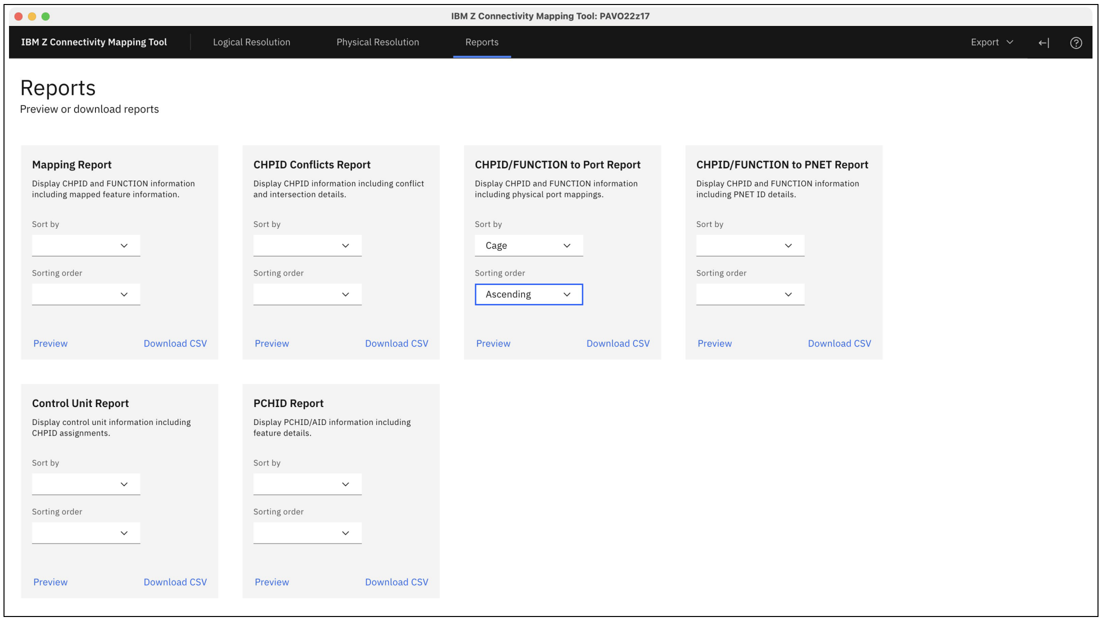
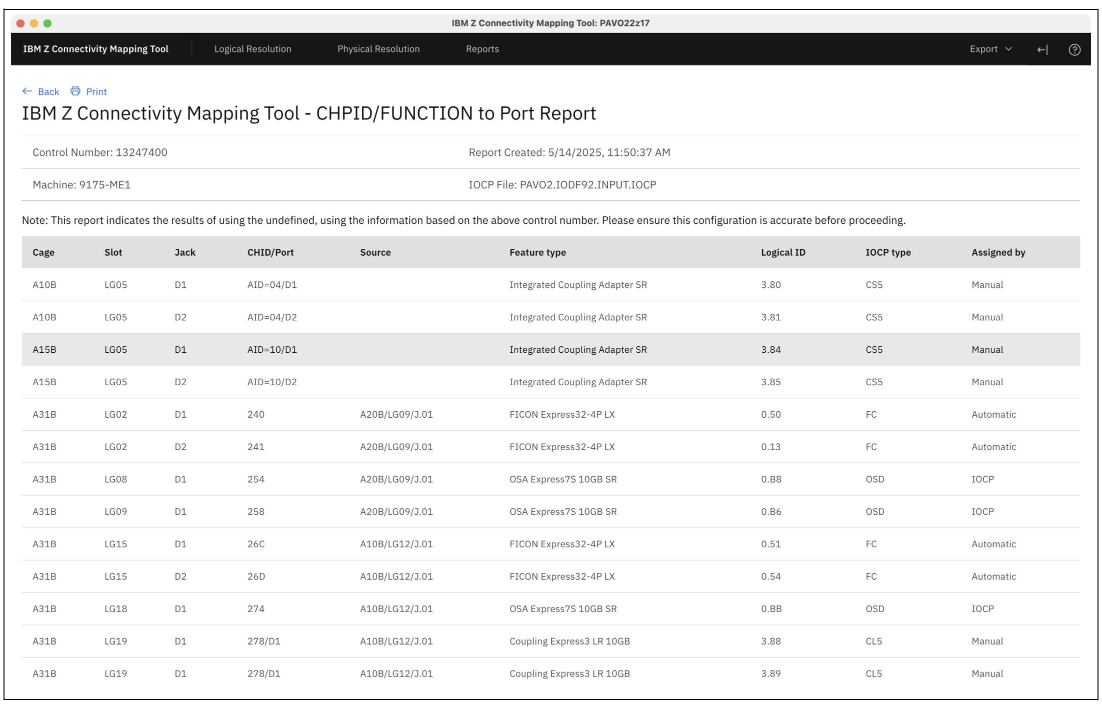


Figure 4-30 Selecting CHPID report sorted by physical location

The person who installs the I/O cables during system installation requires one of these reports. The Port Report Sorted by Location is preferred. The installer can use this report to assist with labeling the cables. The labels must include the CHID or cage, slot, and port information before system delivery, as shown in Figure 4-31.



Cage	Slot	Jack	CHID/Port	Source	Feature type	Logical ID	IOCP type	Assigned by
A10B	LG05	D1	AID=04/D1		Integrated Coupling Adapter SR	3.80	CS5	Manual
A10B	LG05	D2	AID=04/D2		Integrated Coupling Adapter SR	3.81	CS5	Manual
A15B	LG05	D1	AID=10/D1		Integrated Coupling Adapter SR	3.84	CS5	Manual
A15B	LG05	D2	AID=10/D2		Integrated Coupling Adapter SR	3.85	CS5	Manual
A31B	LG02	D1	240	A20B/LG09/J.01	FICON Express32-4P LX	0.50	FC	Automatic
A31B	LG02	D2	241	A20B/LG09/J.01	FICON Express32-4P LX	0.13	FC	Automatic
A31B	LG08	D1	254	A20B/LG09/J.01	OSA Express7S 10GB SR	0.B8	OSD	IOCP
A31B	LG09	D1	258	A20B/LG09/J.01	OSA Express7S 10GB SR	0.B6	OSD	IOCP
A31B	LG15	D1	26C	A10B/LG12/J.01	FICON Express32-4P LX	0.51	FC	Automatic
A31B	LG15	D2	26D	A10B/LG12/J.01	FICON Express32-4P LX	0.54	FC	Automatic
A31B	LG18	D1	274	A10B/LG12/J.01	OSA Express7S 10GB SR	0.BB	OSD	IOCP
A31B	LG19	D1	278/D1	A10B/LG12/J.01	Coupling Express3 LR 10GB	3.88	CL5	Manual
A31B	LG19	D1	278/D1	A10B/LG12/J.01	Coupling Express3 LR 10GB	3.89	CL5	Manual

Figure 4-31 Sample output CHPID mapping report sorted by physical location

CHPID to Control Unit Report

The Control Unit report provides an overview of all installed CUs, their types, the attached CHPIDs, and the channel subsystem (CSS) source.

To generate the report, on the Reports window, select the **Control Unit Report** tile. Then, click **Sort by**, select **CSS**, and click **Sorting order** to select **Ascending**, as shown in Figure 4-32.

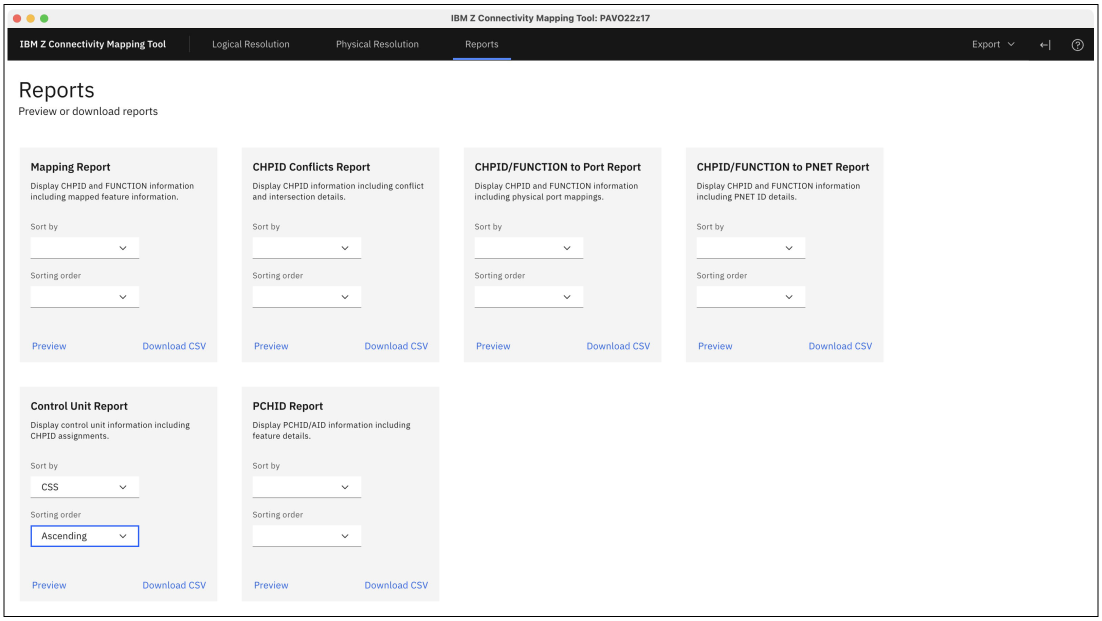


Figure 4-32 Selection options for the Control Unit Report

Figure 4-33 shows an example of a Control Unit Report.

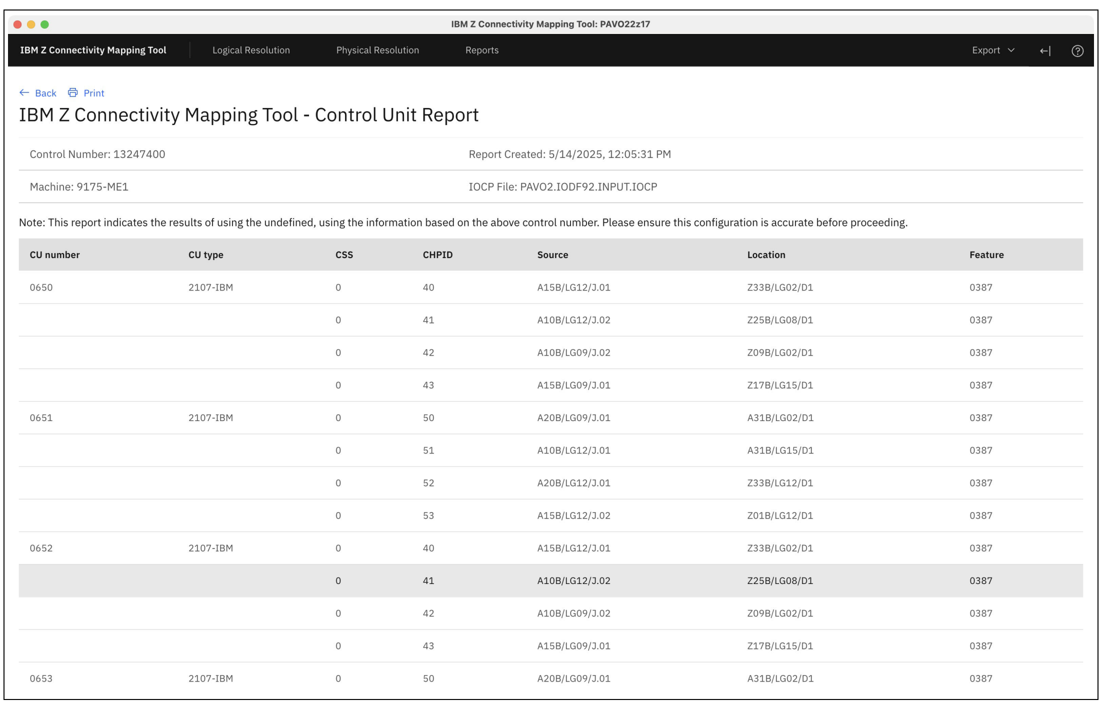


Figure 4-33 Example of a Control Unit Report

4.9 Creating an updated IOCP file

After all indicated conditions are resolved, you can use CMT to create an updated IOCP file that includes the inserted PCHIDs. You can then upload the file into the logical partition (LPAR) where HCD is running. After you upload the file, you can merge it with the IODF that is used to produce the IOCP input file for CMT.

To create the updated IOCP file, complete the following steps:

1. From the main window, select **Export** → **Export IOCP Input File** in the upper right, as shown in Figure 4-34.

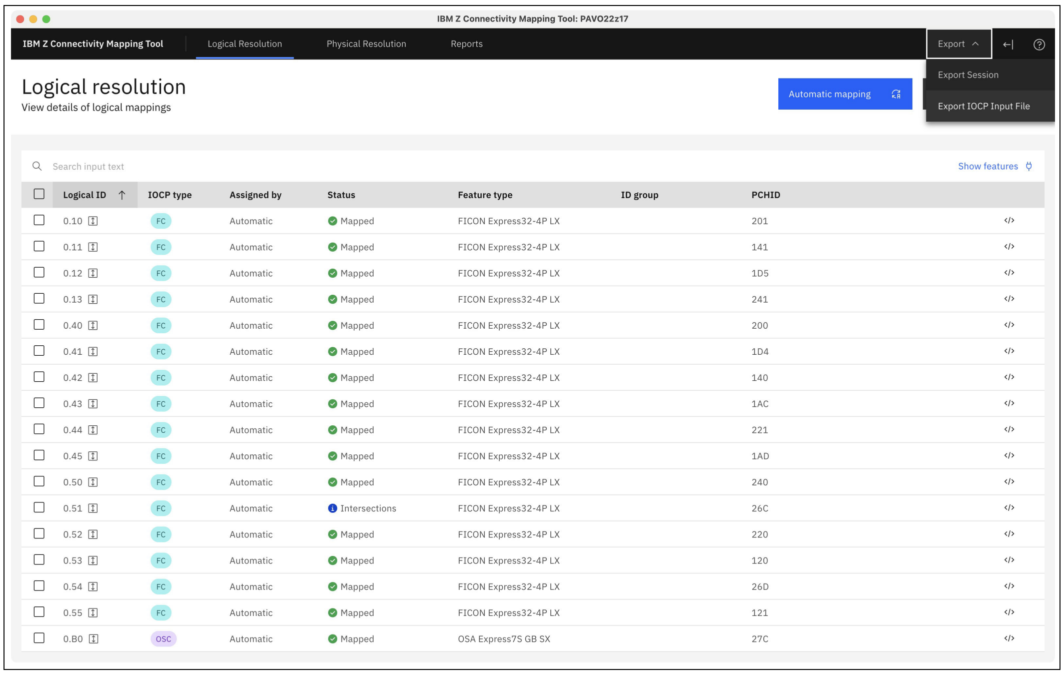


Figure 4-34 Preparing to export the current session or the updated IOCP file

2. Select the destination, click **Export Updated IOCP**, and enter the Export Path and IOCP Name for the IOCP output file, as shown in Figure 4-35.

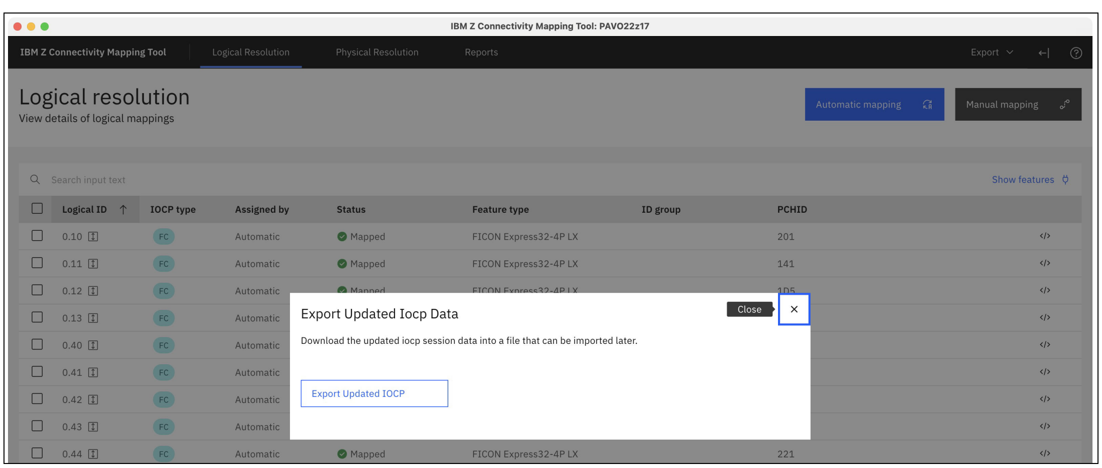


Figure 4-35 Running the export and defining the name and location of the file

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.

Saving the session for later reference can be useful. To do so, complete the following steps:

1. In the Logical resolution window, select **Export** → **Export Session** at the upper right.
2. In the Export CMT Session window, click **Export Session**, and enter the Export Path and Session Name.

4.10 Additional steps and processes

You might want to perform a PCHID migration before you build a production IODF. For more information, see *CHPID Mapping Tool User's Guide*, GC28-7024 and Chapter 5, “Building the production input/output definition file and setting up the central processor complex” on page 89.

5

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

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

Naming: The IBM z17 systems that are targeted by this publication consist of IBM z17 ME1. Throughout this chapter, these machines are referred to as IBM z17.

Note: Although IBM z15 T01 (8561) and IBM z16 A01 (3931) systems are upgradeable to IBM z17 ME1 (9175), this chapter describes the configuration steps that are required to upgrade an existing IBM z16 to an IBM z17.

This chapter includes the following topics:

- Building the new production IODF
- Writing the IOCP 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

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.` Confirm the `I/O definition file` name at the bottom of the panel. (see Figure 5-1).

```
z/OS V3.1 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 . . . 'ZNEXT01.IODF89.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 only severity “W” (warning) messages appear and confirm that they are normal for the configuration. Correct any messages that should not occur, and then attempt to build the production IODF again. Continue this process until no messages 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
| #              groups: 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
| #              groups: 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
| #              groups: 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 a 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 . . . : 'ZNEXT01.IODF89.WORK'                       |
|                                                                    |
| Production IODF name . 'SYS9.IODF81'________________________       |
| 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                    |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

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  . : 'SYS9.IODF81'                          |
|                                                                  |
| Descriptor field 1  . . . SYS9                                   |
| Descriptor field 2  . . . IODF81                                 |
|  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 SYS9.IODF81 created.
```

5.2 Writing the IOCP to the old CPC by using HCD

After you create the production IODF that is named SYS9.IODF81, write the Input/Output Configuration Program (IOCP) data from the IODF to the IOCDS on the CPC that you plan to upgrade (for example, PAVO). The IOCDS is available for power-on reset (POR) after the processor upgrade.

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 V3.1 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 . . . 'SYS9.IODF81'                          +
```

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

2. The Activate or Process Configuration Data panel opens (see Figure 5-7 on page 95). Select option `11. Build and manage processor 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 processor cluster IOCDSs, IPL attributes, and dynamic I/O changes

This example assumes connectivity to the 3931 processor that is being upgraded through the Hardware Management Console (HMC) local area network (LAN) to write an IOCDS.

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

Create an IOCP file by using the same process that is used to create an IOCP file for the IBM Z Connectivity Mapping Tool (CMT).

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

3. The Processor Cluster List panel opens (see Figure 5-8). In the list, select the 3931 processor being upgraded by typing a forward slash (/) to update one of its IOCDSs, and then press Enter.

```
 Processor Cluster List                  Row 1 of 6
Command ===> _______________________________________________ Scroll ===> PAGE

Select one or more CPCs, then press Enter.

  --------------CPC--------------   IODF
/ SNA Address        Type   Model   Processor ID
# IBM390PS.HYDRA     8562   LT2
# IBM390PS.INDUS     3931   LA1
# IBM390PS.MENSA     9175   ME1
# IBM390PS.NORMA     3932   LA2
/ IBM390PS.PAVO      3931   A01     MENSA
_ IBM390PS.VELA      3932   AGZ     VELA
```

Figure 5-8 IBM 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 HW changes remotely to a supported         |
|         processor. . . . . . . . . . . . . . . . . . (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 on page 97). Select the IOCDS that you want to update for the 3931 replacement by typing a forward slash (/) next to it, and then press Enter.

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

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

                                           -----Token Match----- Write
/ IOCDS       Name     Type   Status     IOCDS/HSA IOCDS/Proc. Protect
_ A0.MENSA    IODF78   LPAR   Alternate  No        No          No
_ A1.MENSA    IODF79   LPAR   Alternate  No        No          No
_ A2.MENSA    IODF80   LPAR   POR        No        No          Yes
/ A3.MENSA    IODF77   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)            |
|                                                              |
|                                                              |
|                                                              |
+--------------------------------------------------------------+
```

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 ===> PAGE   |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| IODF name . . . . . . . . . : 'SYS9.IODF81'                                 |
|                                                                             |
| Title1 . IODF81_________________________________________________________    |
| Title2 : SYS9.IODF81 - 2025-04-25 09:47                                     |
|                                                                             |
|                            Write IOCDS in                                   |
| IOCDS        Switch IOCDS  preparation of upgrade                           |
| A3.MENSA     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 the IODF

Tip: Specifying `Yes` in the `Write IOCDS in preparation of upgrade` field is required only when replacing or upgrading the existing hardware and when writing the IOCDS for a 9175 processor from the existing hardware. The `Yes` value enables writing 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 on page 99). Press Enter to continue.

```
+---------- Confirm Write IOCDS in preparation of processor upgrade ----------+
|                                                                  Row 1 of 1 |
| Command ===> ____________________________________________ Scroll ===> PAGE  |
|                                                                             |
| Scroll forward to view the complete list of IOCDSs that 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 IOCDSs 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.MENSA                                                                    |
| ***************************** Bottom of data ****************************** |
|                                                                             |
|                                                                             |
|  F1=Help       F2=Split      F3=Exit       F7=Backward    F8=Forward        |
|  F9=Swap      F12=Cancel                                                    |
+-----------------------------------------------------------------------------+
```

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 9175 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 adapters

10. Verify the job output to help 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.MENSA.
```

11. If you return to HCD option 2.11 and view the IOCDS, you see that the Systems Network Architecture (SNA) address is still `IBM390PS.PAVO` (see Figure 5-15).

```
 Processor Cluster List                 Row 1 of 6
Command ===> ______________________________________________ Scroll ===> PAGE

Select one or more CPCs, then press Enter.

  --------------CPC--------------   IODF
/ SNA Address        Type   Model   Processor ID
# IBM390PS.HYDRA     8562   LT2
# IBM390PS.INDUS     3931   LA1
# IBM390PS.MENSA     9175   ME1
# IBM390PS.NORMA     3932   LA2
_ IBM390PS.PAVO      3931   A01     MENSA
_ IBM390PS.VELA      3932   AGZ     VELA
```

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

12. When you select `IBM390PS.PAVO`, you see that IOCDS A3 (to which the upgrade IODF was written) has a status of `Invalid` (see Figure 5-16). This error occurs because `Yes` was specified for the `Write IOCDS in preparation for upgrade` field, and the IOCDS contains IOCP statements and code that are relevant only to a 9175 processor.

    The status changes when the processor is upgraded to a 9175 processor. The 9175 IOCDS status changed to `Alternate`, and the 3931 IOCDS status changed to `Invalid`.

> **Tip:** Rewrite the IOCDS that is written in preparation for the upgrade at the earliest opportunity. Subsequent Miscellaneous Equipment Specifications (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.MENSA    IODF78   LPAR   Alternate  No        No          No
_ A1.MENSA    IODF79   LPAR   Alternate  No        No          No
_ A2.MENSA    IODF80   LPAR   POR        No        No          Yes
_ A3.MENSA    IODF81   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

This section describes how to build and activate your reset profile by using the HMC.

5.3.1 Background activities that occurred

The following activities are performed to upgrade to a 9175-ME1 processor:

- A new HMC is installed with the correct driver level to support the 9175 processor and is connected to the customer HMC network.
- The upgraded 9175 processor (in this example, MENSA) is defined to the new HMC.
- The 3931 processor, now upgraded to a 9175 processor, performs a POR with the Diagnostic (DEFAULT) IOCDS.
- A new IOCP is written to the 9175 processor IOCDS from the IODF (IODF81) by using HCD Option 2.11.
- The 9175 processor is ready to be customized with specific customer definitions.

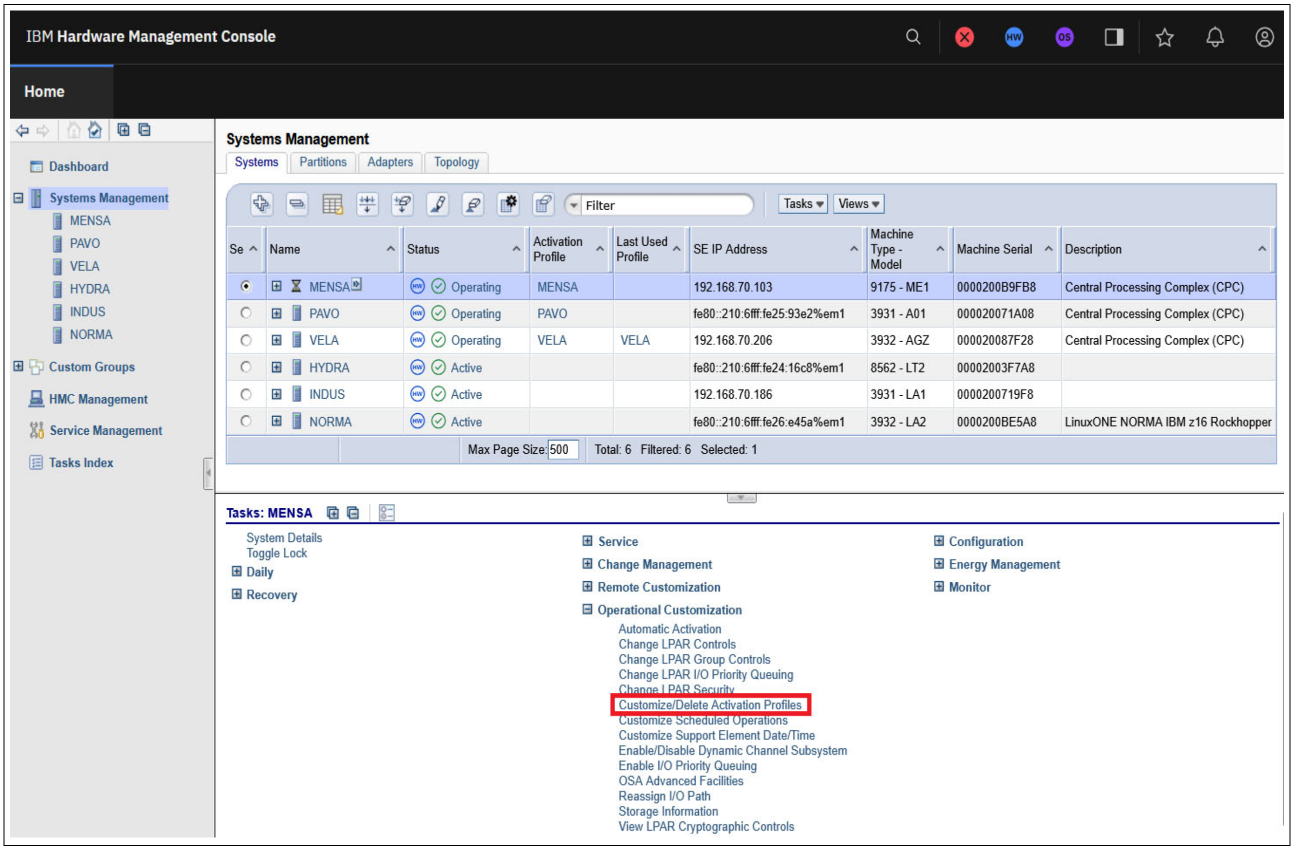
5.3.2 Building the reset profile and pointing it to the required IOCDS

After the IOCP file is written to an IOCDS, build a reset (POR) profile that points to that IOCDS. This reset profile performs a POR for the new 9175 processor after the upgrade and handover 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 9175 processor by using SYSPROG authority, or use a remote web browser to select the new 9175 processor.
2. Under Systems Management, click **Systems Management** to expand the list.
3. Under Systems Management, select the radio button next to the system (in this example, MENSA).

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



Se	Name	Status	Activation Profile	Last Used Profile	SE IP Address	Machine Type - Model	Machine Serial	Description
●	MENSA	Operating	MENSA		192.168.70.103	9175 - ME1	0000200B9FB8	Central Processing Complex (CPC)
○	PAVO	Operating	PAVO		fe80::210:6fff:fe25:93e2%em1	3931 - A01	000020071A08	Central Processing Complex (CPC)
○	VELA	Operating	VELA	VELA	192.168.70.206	3932 - AGZ	000020087F28	Central Processing Complex (CPC)
○	HYDRA	Active			fe80::210:6fff:fe24:16c8%em1	8562 - LT2	00002003F7A8	
○	INDUS	Active			192.168.70.186	3931 - LA1	0000200719F8	
○	NORMA	Active			fe80::210:6fff:fe26:e45a%em1	3932 - LA2	0000200BE5A8	LinuxONE NORMA IBM z16 Rockhopper

Figure 5-17 Customize/Delete Activation Profiles

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

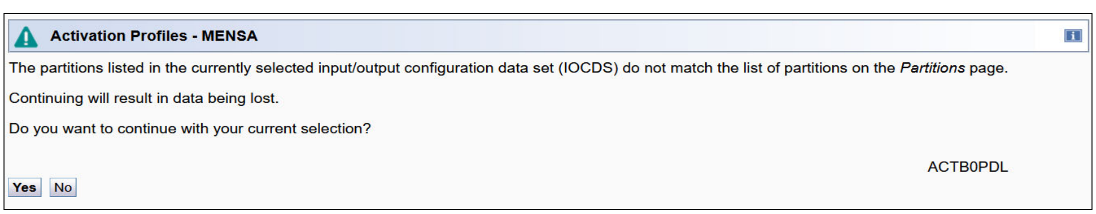


Figure 5-18 Activation Profiles: ACTB0PDL message

9. Depending on the circumstances, click **Yes** or **No**. Review the Partition Activation List if necessary. For this example, click **Yes**.
10. The HMC retrieves any image profiles that match the logical partition (LPAR) names that are defined in the selected IOCDS. Create image profiles for any LPAR names that the HMC cannot retrieve.

In this example, 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).

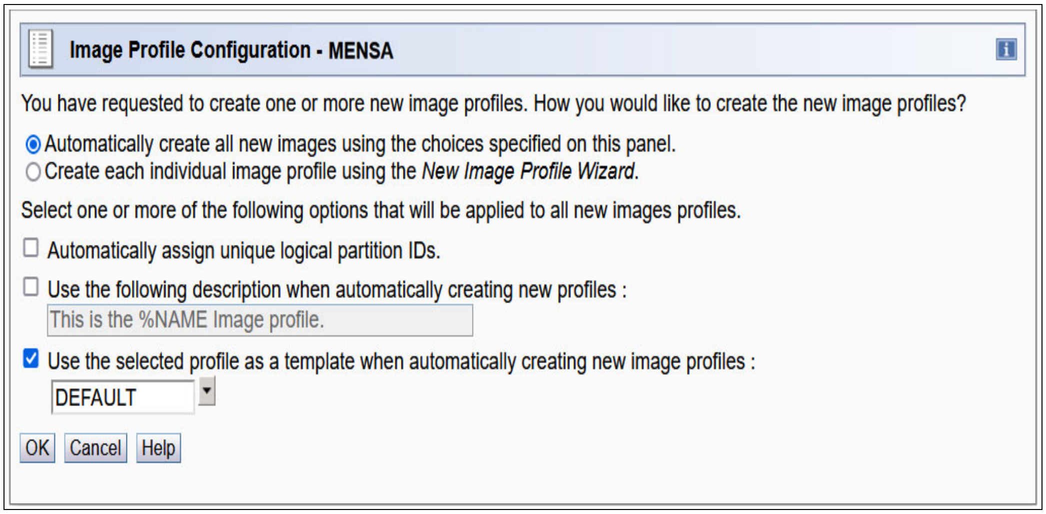


Figure 5-19 Image Profile automatic build options

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).

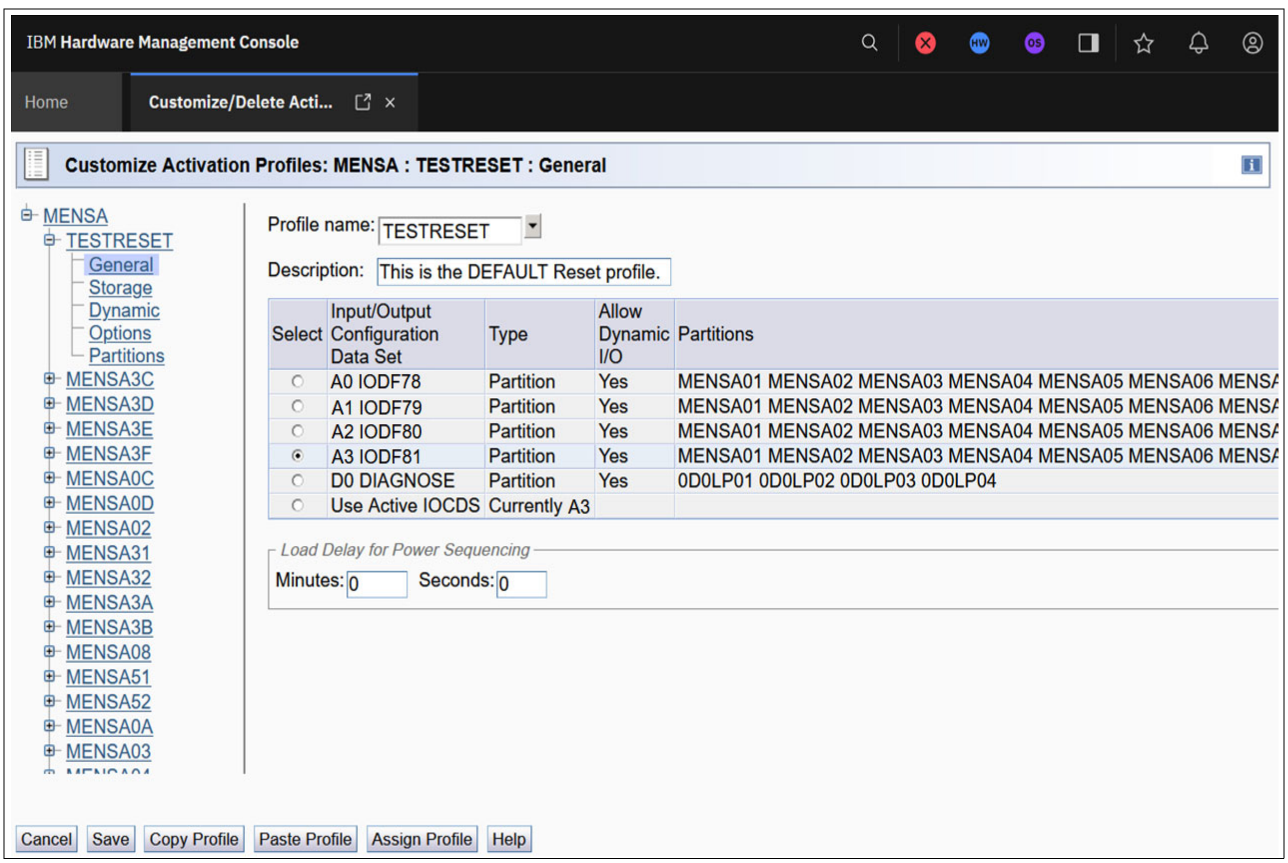


Figure 5-20 Reset and Image Profile list: Selecting IOCDS

For more information about planning, 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 the following steps:

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

   This window lists all partitions that were retrieved by the automatic build for the reset profile TESTRESET. The partition list also determines all image profiles that are activated when the CPC performs a POR.

   You can tailor which image profiles are displayed and activated, and the activation order and the display order in the reset profile.

   Type over or remove the number in the Order field to determine how the partitions in the reset profile behave. The partitions are either removed or reordered.

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

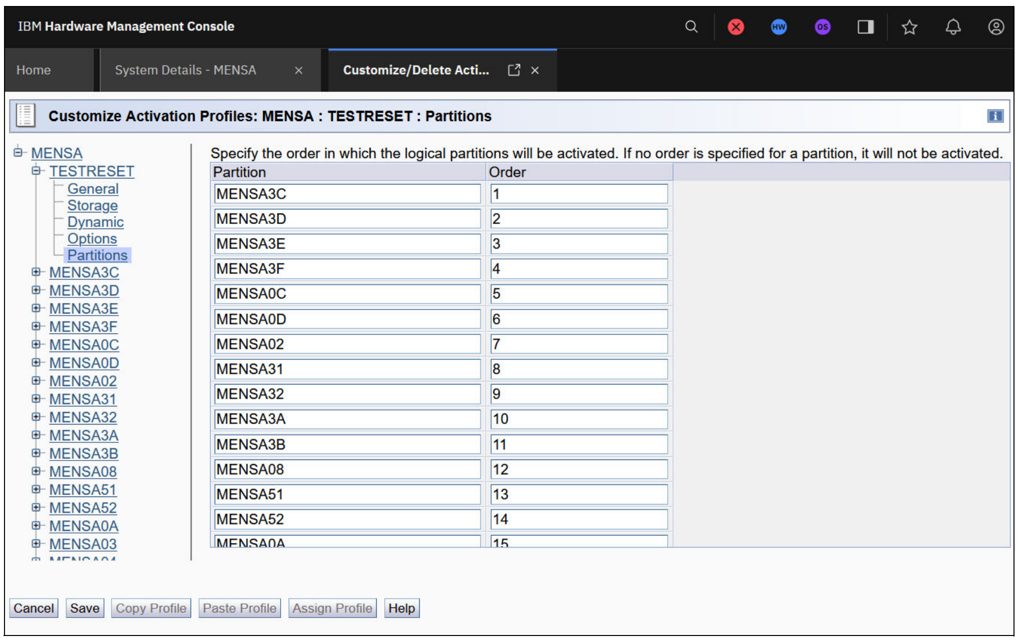


Figure 5-21 Reset and Image profile list: Updating the partition list

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).

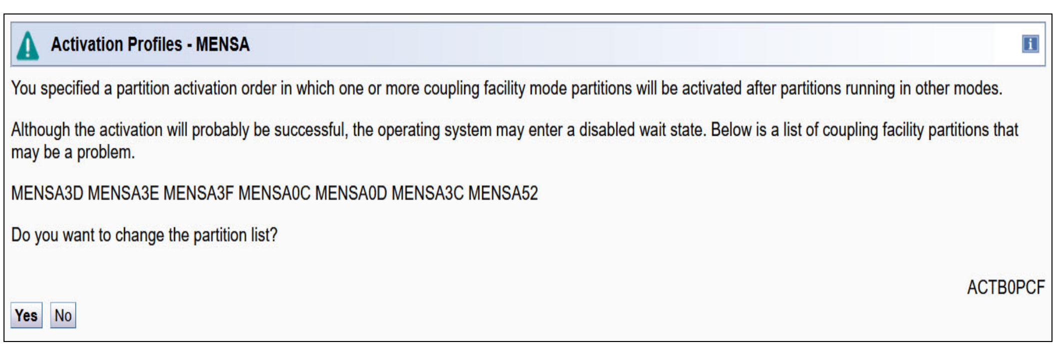


Figure 5-22 Reset and Image Profiles list: Coupling Facility LPAR verification

5.4 Creating an image profile on the Support Element

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

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

Click one of the image profiles to set up the partition parameters. In this example, click **MENSA32**.

5.4.1 Image profile: General page

The General page is displayed first (see Figure 5-23).

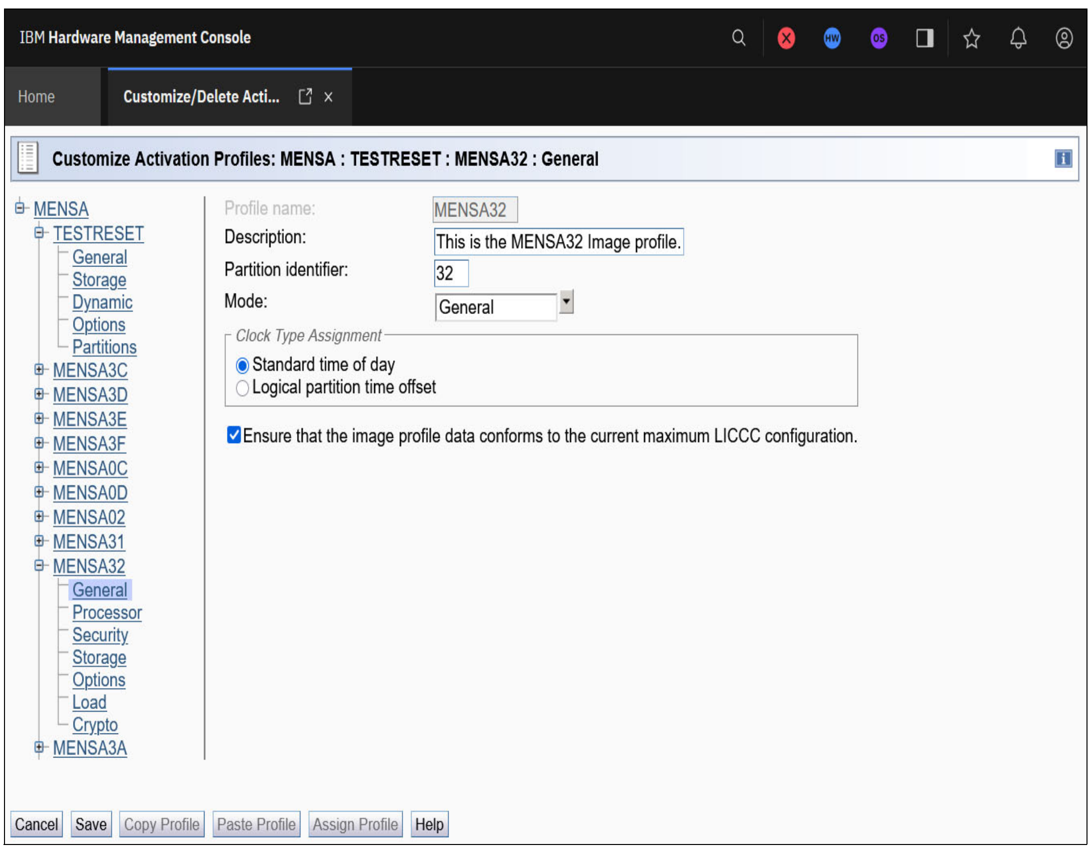


Figure 5-23 Image profile: General

Review the following settings:

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

5.4.2 Image profile: Processor page

To set up the partition CPU and weight information, click the **Processor** link (see Figure 5-24).

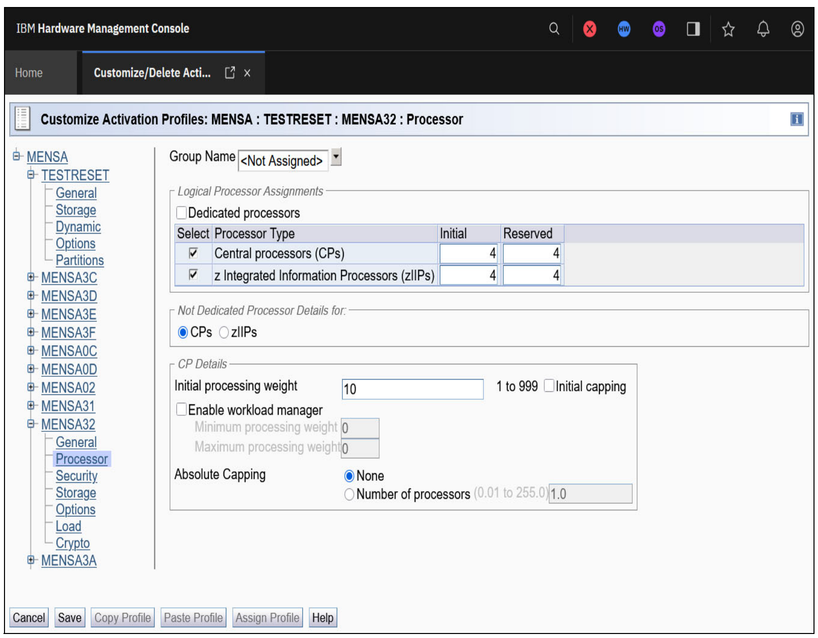


Figure 5-24 Image profile: Processor

Review the following settings:

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

5.4.3 Image profile: Security page

To set up the partition security parameters, click the **Security** link (see Figure 5-25).

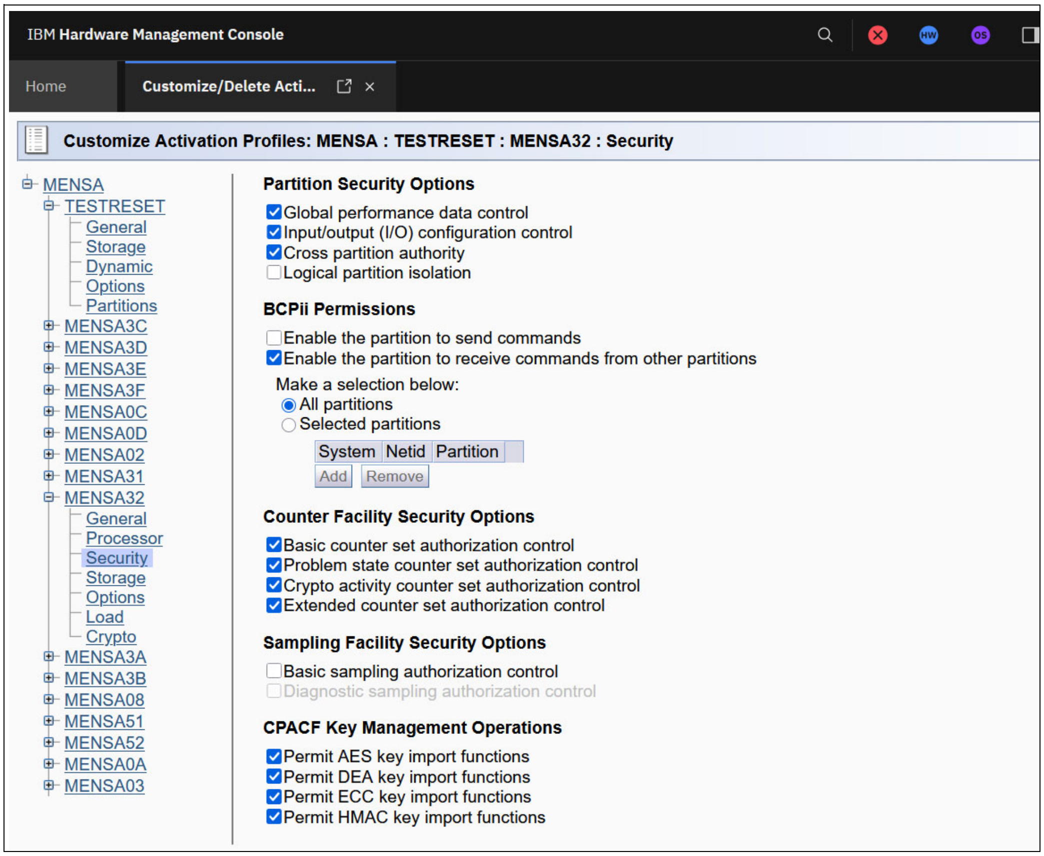


Figure 5-25 Image profile: Security

Review the following settings:

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

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).

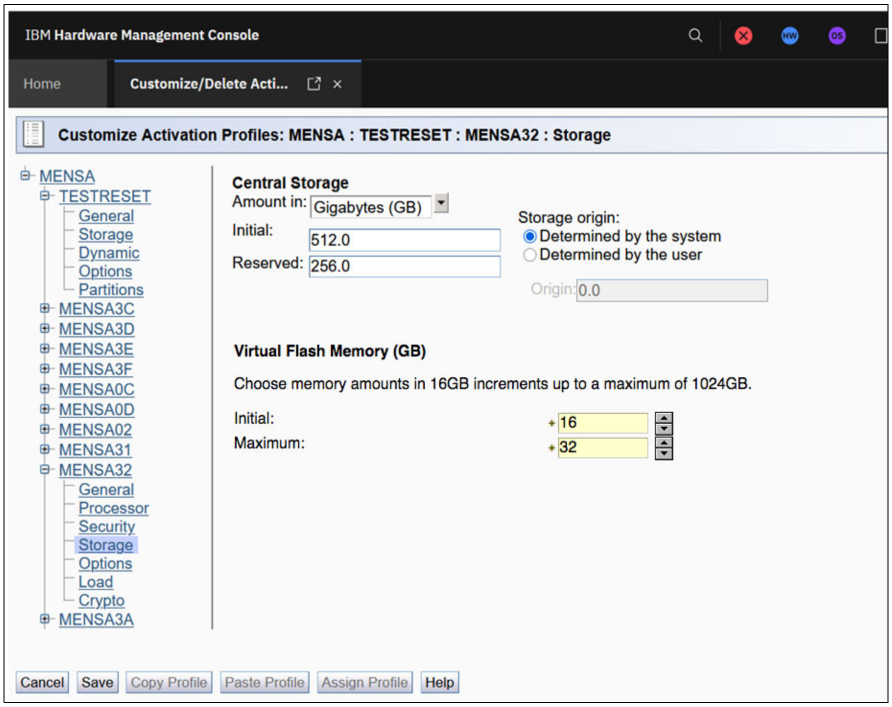


Figure 5-26 Image profile: Storage

Review the following settings:

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

5.4.5 Image profile: Options page

To set up the partitions defined capacity, click the **Options** link (see Figure 5-27 on page 109).

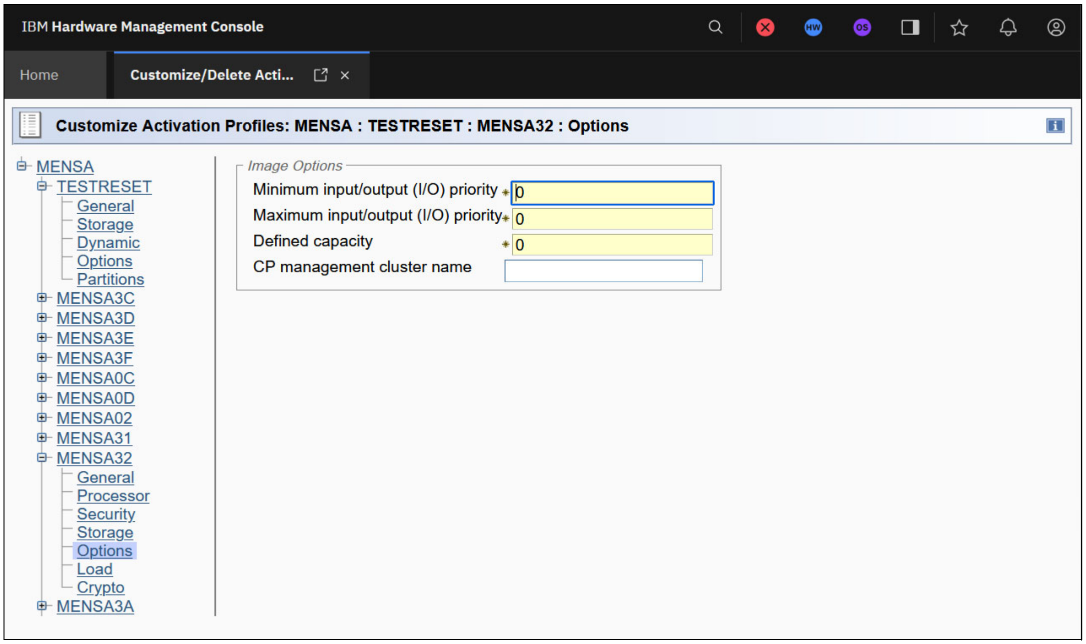


Figure 5-27 Image profile: Options

Review the following settings:

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

5.4.6 Image profile: Load page

To set up automatic load (IPL) parameters when the partition is activated by using a POR or image profile activation, click the **Load** link, as shown in Figure 5-28.

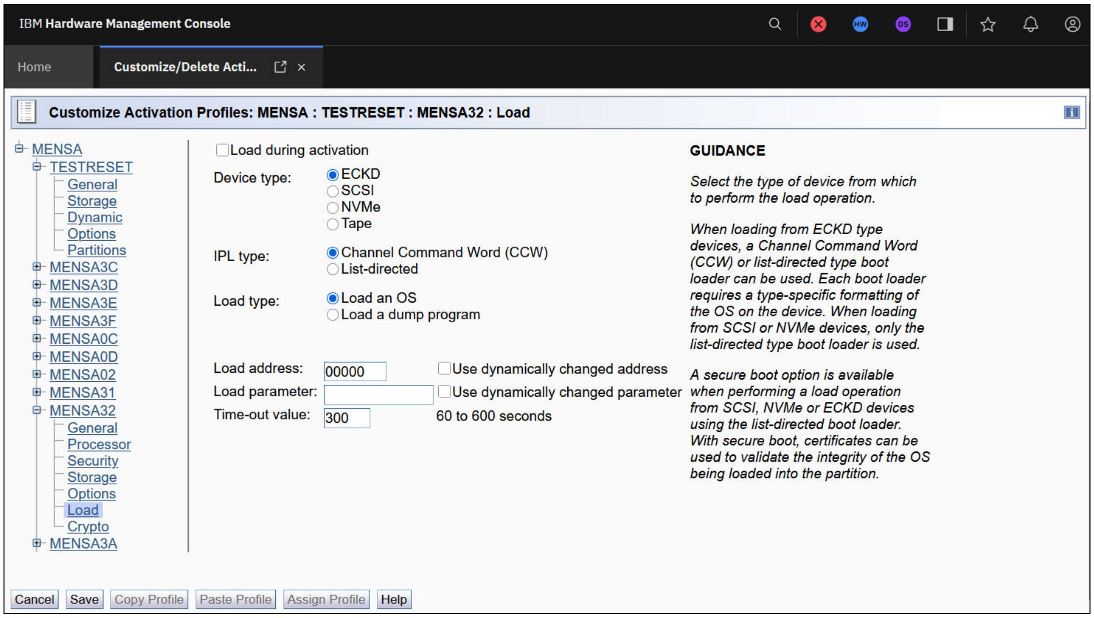


Figure 5-28 Image profile: Load

If you do not use an IPL to load a z/OS system into a partition during a POR or image profile activation, set up and activate load profiles, and use them when required.

5.4.7 Image profile: Crypto page

To define the Crypto Domain Index IDs, specify the number of crypto engines that are assigned to each Domain ID, and indicate whether they are candidates only or candidates and online (see Figure 5-29 on page 111), click the **Crypto** link.

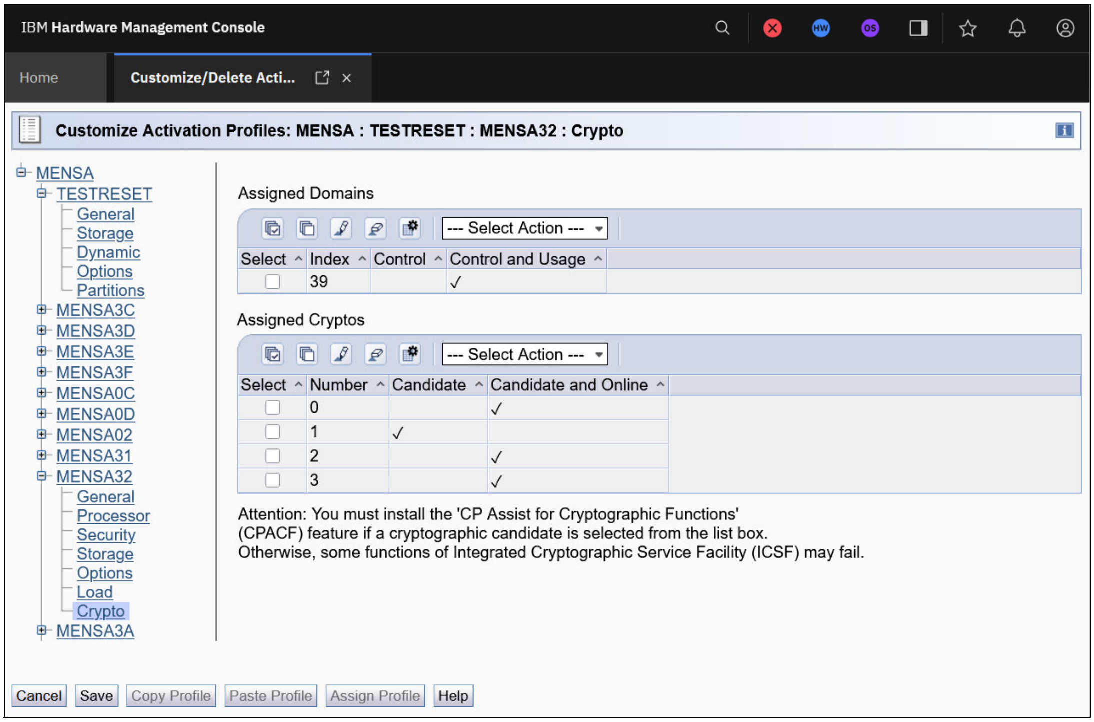


Figure 5-29 Image profile: Crypto

Review the following settings:

- Assigned Domains: Assign the Domain Index ID.
- Assigned Cryptos: Specify which and how many of the installed crypto engines are assigned to the Domain ID and to this partition.

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 partition time offset against the CPC time as set by the Server Time Protocol (STP) (see Figure 5-30).

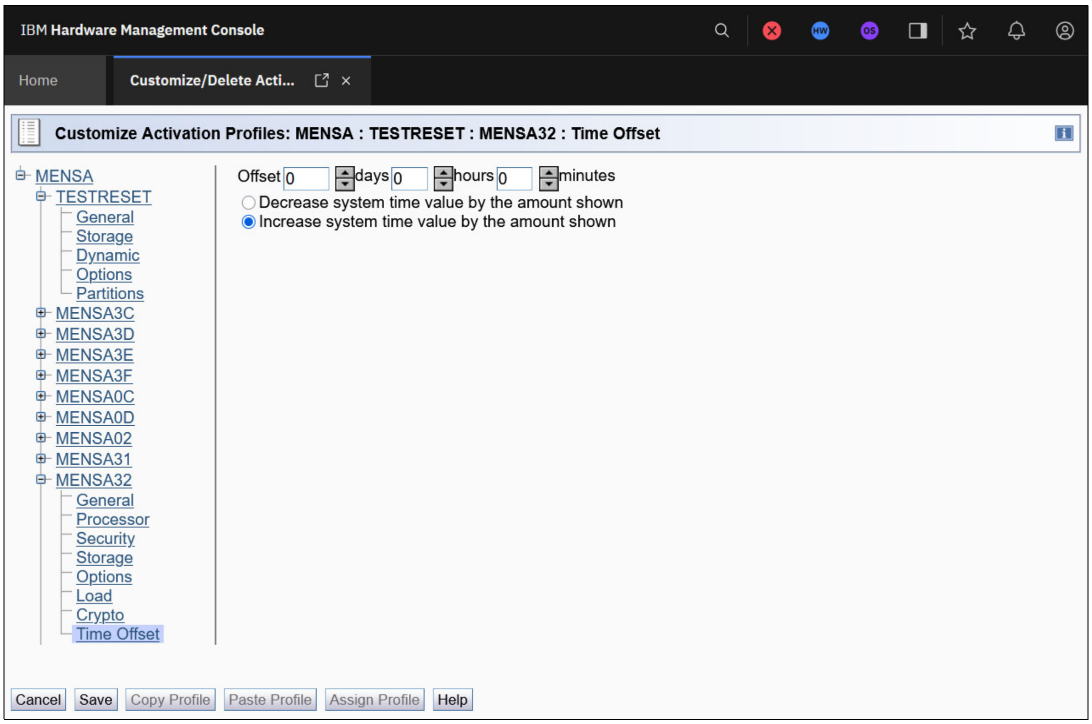


Figure 5-30 Image Profile: Time Offset

Review the following settings:

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

5.4.9 Image profile: Saving

After customizing all required image profiles for this reset profile, click **Save** to store the reset and image profiles for the POR.

If only a few LPARs require activation, it might be simpler to deactivate and activate those image profiles individually, depending on the configuration.

The HMC prompts for confirmation to continue the save operation. Click **OK** (see Figure 5-31 on page 113).

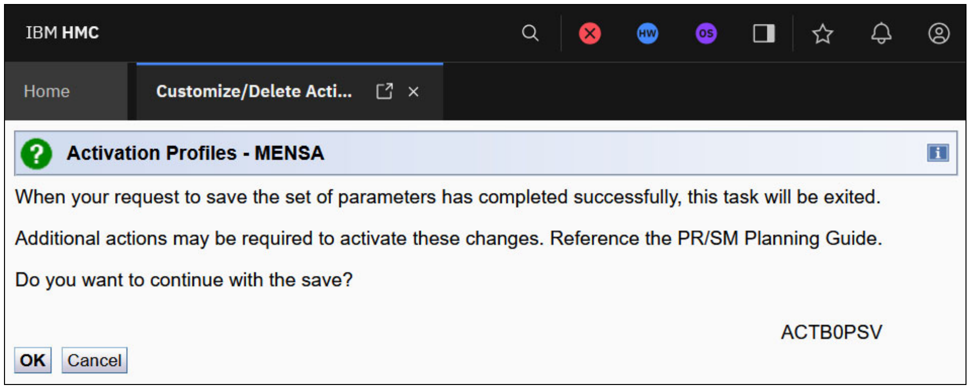


Figure 5-31 Reset and Image profile: Confirmation to save

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

5.5 Performing a power-on reset on the new CPC

When the 3931 processor is upgraded to a 9175 processor, the IBM SSR performs a POR by using a Diagnostic IOCDS.

After this process is complete and the IBM SSR verifies the processor status, the processor is handed over for customer use. You can then perform 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 101.

The 9175 processor is ready to be activated (POR) by using the production reset profile. This process is optional but a best practice, depending on the number of partitions that are defined on the processor.

5.5.1 Coupling Facility links

After the POR completes with the 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 the links are online and established.

One way to verify the link status is to display the channel path ID (CHPID) by using the Channel Problem Determination function on the HMC.

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

1. Log on to the HMC for the new 9175 processor by using SYSPROG authority.
2. Click **Systems Management** to expand the list.
3. Under Systems Management, select the radio button next to the system (in this example, MENSA).

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

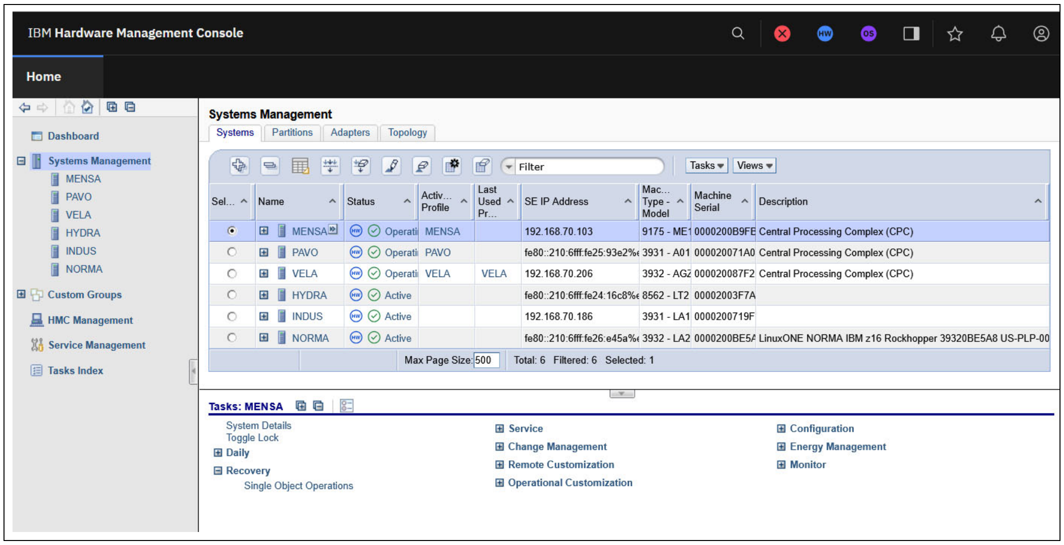


Figure 5-32 Systems Management: Main window

5. Click **OK** in the confirmation window.
6. Click **Systems Management** to expand the list.
7. Under Systems Management, click the CPC name to expand the options (in this example, MENSA).
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 this example, select MENSA3E).
10. Click the partition name to expand the options that are available for that partition.
11. Click **CHPIDs** to display the CHPID list that is specific to this LPAR (see Figure 5-33).

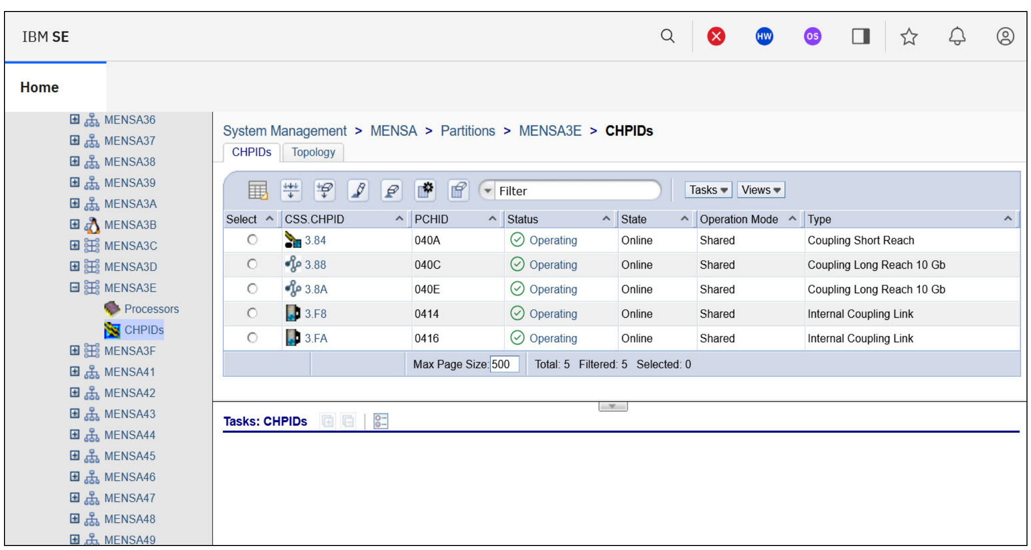


Figure 5-33 System Management: Single Object Operation

12. Select the CHPID that you want to verify, which in this example is CHPID 3.84 (CSS=3, CHPID=84).
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).

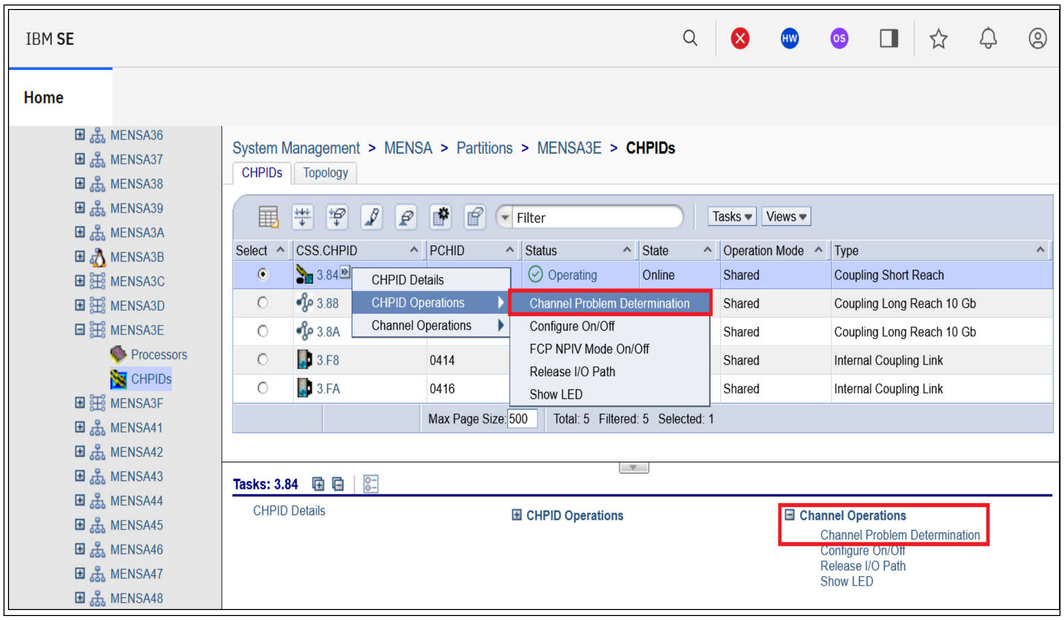


Figure 5-34 System Management: CHPID Operations

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

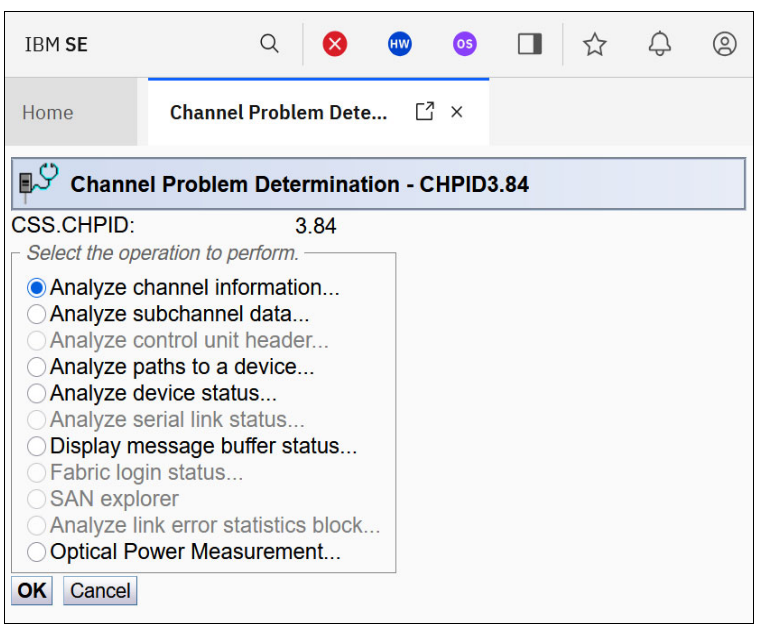


Figure 5-35 Channel Problem Determination: Analyze channel information

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

– State: Online
– Status: Operating
– Node type: Attached
– Node status: Valid
– Type/model: 3931-A01 (device that the CHPID is connected to)
– Seq. number: 71A08 (serial number of the device that the CHPID is connected to)
– Tag: 85 (in this case, the destination CHPID of CHPID 84)

Note the physical channel ID (PCHID) of 040A. This PCHID number is allocated by the CPC when this particular CHPID (Integrated Coupling Adapter Short Reach (ICA SR)) is defined to the Hardware System Area (HSA) configuration.

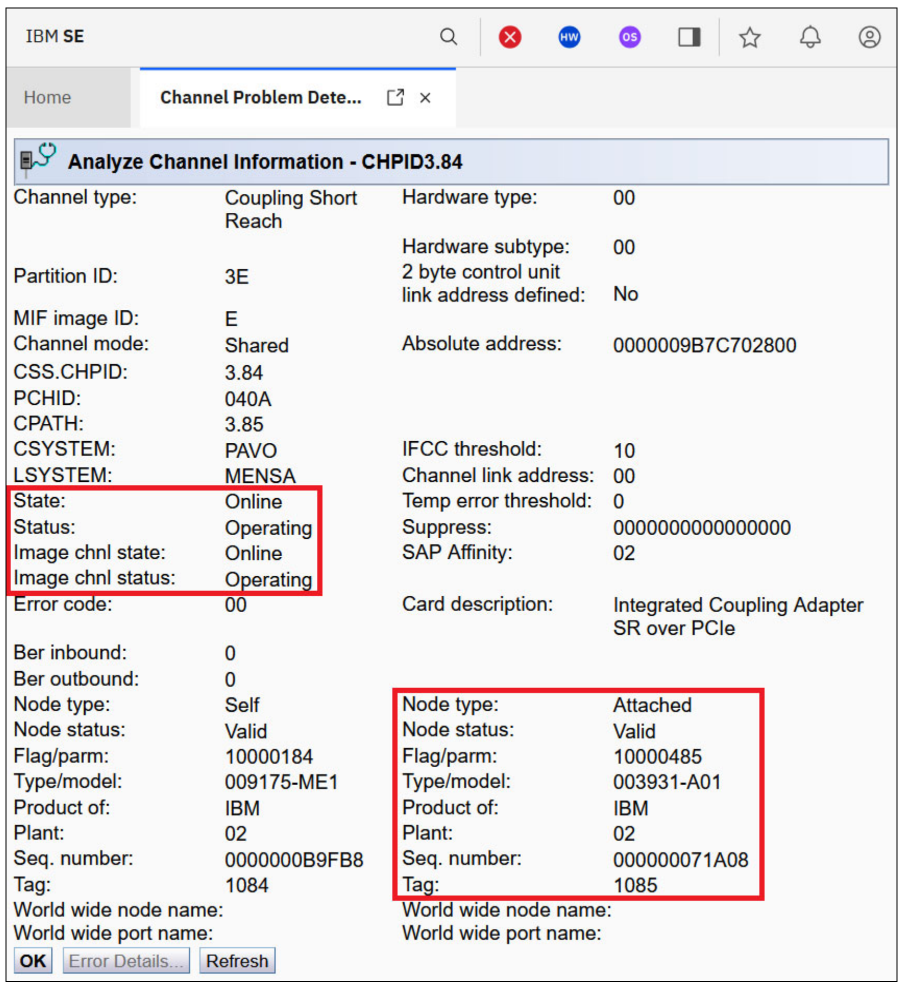


Figure 5-36 Channel Problem Determination: Display

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 Remote dynamic activation of I/O configurations for SACFs, Linux on IBM Z, and z/TPF

Dynamic configuration capabilities for stand-alone coupling facilities (SACFs) were introduced on the IBM z14 system (driver level 36) and are available on the IBM z15 and later systems.

IBM extended dynamic activation of I/O configurations to Linux on IBM Z and z/TPF that run on an IBM z16 CPC. This support is applicable only when both the driving CPC and the target CPC are IBM z17 or IBM z16 systems with the required firmware support (Bundle S24 or higher) and when the driving system runs z/OS 2.4 or later with APAR OA65559 applied.

Remote activation of dynamic changes eliminates the need for disruptive hardware or firmware actions, such as a POR or an initial microcode load (IML) to instantiate configuration changes. This capability reduces or eliminates client workload impact that would otherwise result from performing these disruptive actions.

IBM z17 provides a supported capability to drive hardware-only I/O configuration changes from a driving z/OS HCD instance to a remote target CPC, which can be a SACF, Linux on IBM Z, or z/TPF system.

Complete the following steps:

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

2. Verify the RESET profile.

   Verify that the RESET profile has **Allow dynamic changes to the channel subsystem input/output definition** selected, as shown in Figure 5-37.

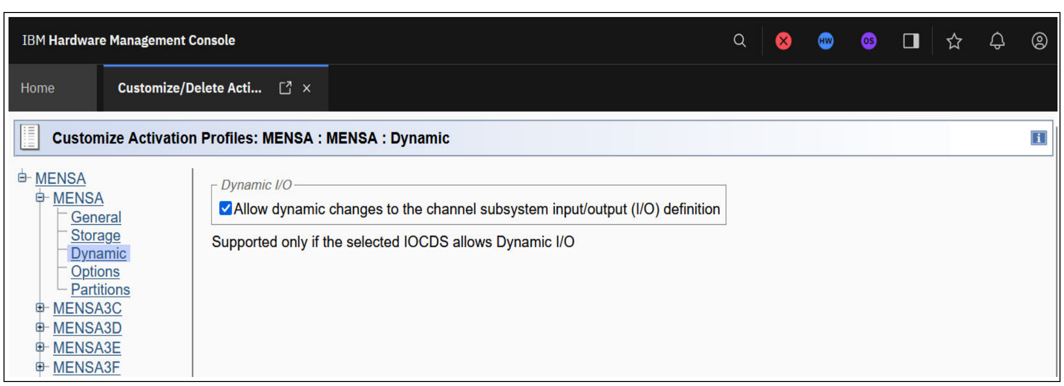


Figure 5-37 Allow dynamic changes to the channel subsystem input/output definition selected

3. After you perform the initial POR, update the reset profile by selecting **Use Active IOCDS**, which is necessary for future activations and PORs for the POR to complete by using the current IOCDS that was activated and written by using HCD, as shown in Figure 5-38.

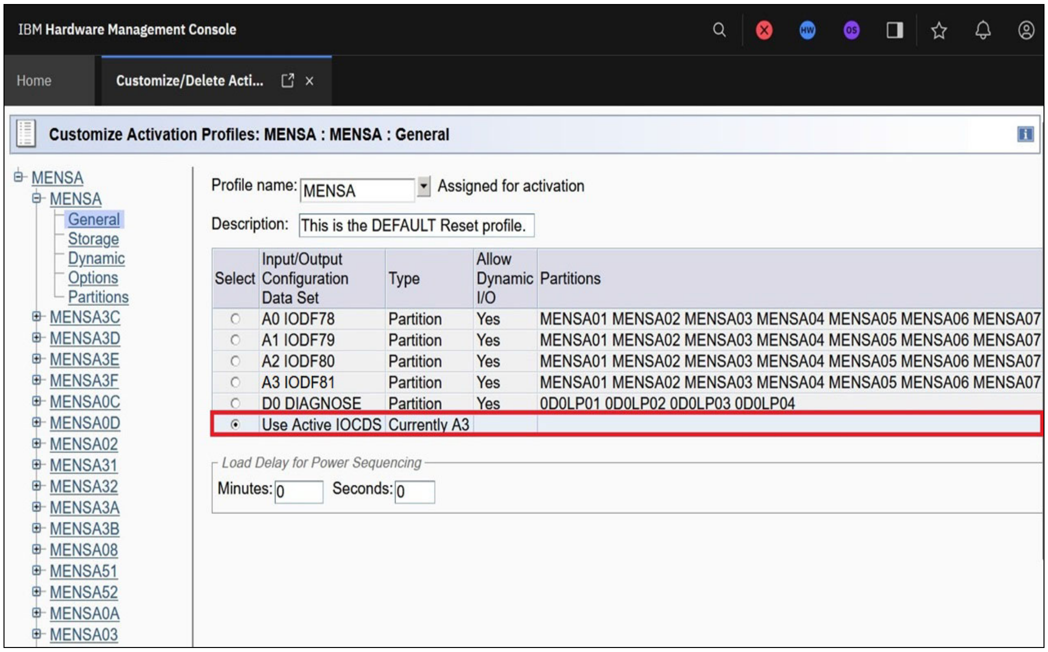


Figure 5-38 Using Active IOCDS

> **Note:** The system is prepared for Dynamic I/O config for SACF. IBM z16 A01, IBM z16 A02, and IBM z16 AGZ or later systems support dynamic I/O config for SACF without the MCS_1 partition.

4. Make the necessary connectivity changes in your production IODF.
5. Activate the hardware configuration from an updated HCD or Hardware Configuration Manager (HCM) running in z/OS LPAR on a remote CPC by selecting HCD option `2.11 Activate HW changes remotely to a supported processor (a)`, as shown in Figure 5-39 on page 119.

```
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.HY |     4.  Work with CPC images . . . . . . . . . . . . (v)    |
# IBM390PS.IN |     5.  Activate HW changes remotely to a supported         |
/ IBM390PS.ME |         processor. . . . . . . . . . . . . . . . . . (a)    |
# IBM390PS.NO |     6.  View current active configuration  . . . . . (c)    |
_ IBM390PS.PA |     7.  Download active configuration  . . . . . . . (d)    |
_ IBM390PS.VE |                                                              |
************* |                                                              | *
              +--------------------------------------------------------------+
```

Figure 5-39   Activating hardware changes only

After selecting `Activate HW changes remotely to a supported processor (a)` with no recovery required, the activation parameters are presented, as shown in Figure 5-40.

```
+------- Activate New Hardware Configuration to a supported processor -------+
|                                                                             |
|                                                                             |
| Specify or revise the values for IODF activation.                          |
|                                                                             |
| Source IODF . . . . . . : SYS9.IODF81                                      |
| Processor ID  . . . . . : MENSA                                            |
|                                                                             |
| Target IODF . . . . . . : SYS9.IODF82                                      |
| Processor ID  . . . . . . MENSA     + (press PF1 for supported processor   |
|                                       information)                         |
|                                                                             |
| 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 5-40   Activation parameters

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

The result is presented in the same way as before. After some time (the activation runs synchronously and blocks the panel), 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 5-41.

```
+------------------------------- 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 MENSA:        ¦
¦ #              0.FF84-0.FF8F,1.FF84-1.FF8F                                  ¦
¦ _ E   CBDA889I Following control units are to be modified for processor    ¦
¦ #              MENSA: 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 5-41 Activation result

6. 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.
7. Configure the newly added hardware to SACF and Activate New image message:
   - On the CF side, 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 5-42 on page 121.

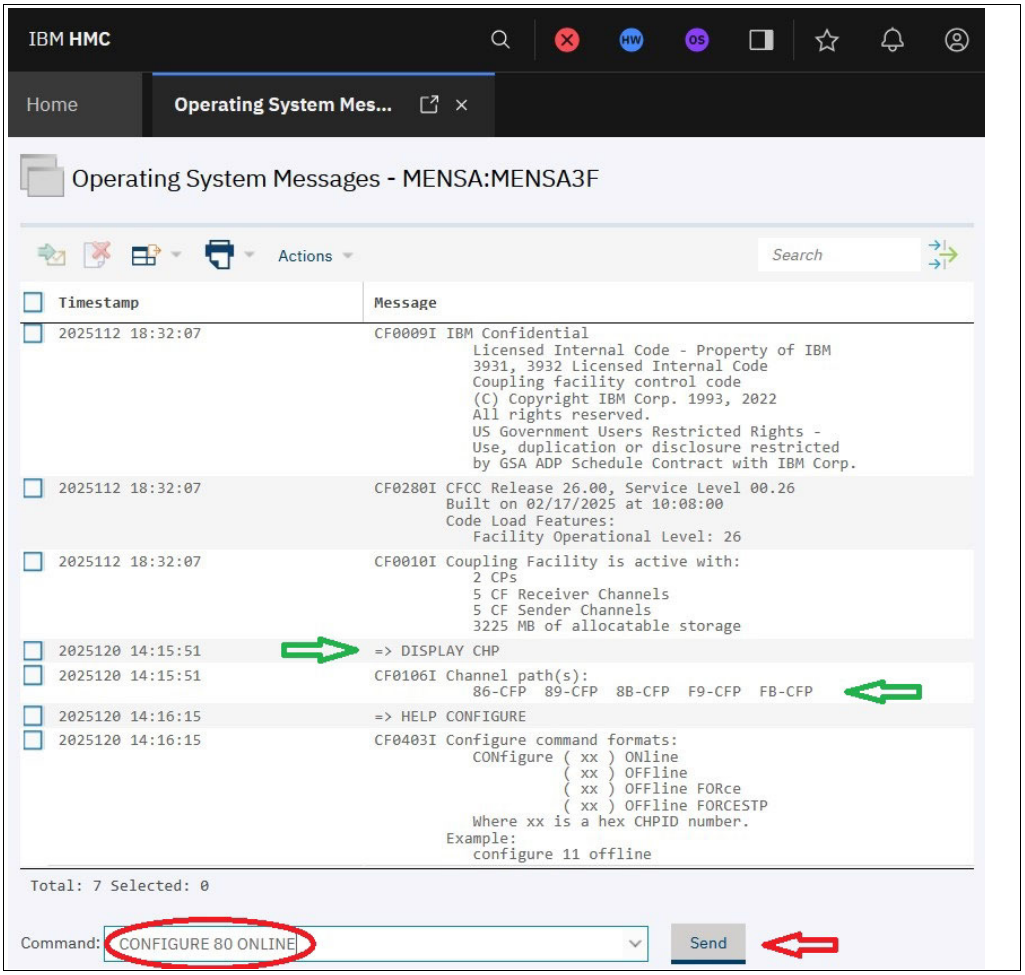


Figure 5-42 CF Operating System Message

– On the z/OS side:

i. Activate IODF in z/OS LPARs by using the best practice approach.

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

ii. 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 active configuration for the selected processor, as shown in Figure 5-43.

```
+------------------------ View Active Configuration -------------------------+
|                                                                            |
|                                                                            |
| Source IODF . . . . . . : SYS9.IODF82                                      |
| Processor ID  . . . . . : MENSA                                            |
|                                                                            |
| HSA token . . . . . . . : MENSA    25-05-05 17:58:11                       |
|                                                                            |
| Recovery required . . . : No                                               |
| Target IODF . . . . . . : SYS9.IODF82                                      |
| Processor ID  . . . . . : MENSA                                            |
|                                                                            |
|  F1=Help     F2=Split    F3=Exit     F9=Swap    F12=Cancel                 |
+----------------------------------------------------------------------------+
```

Figure 5-43 View Active Configuration

- Use `Download active configuration (d)` only when requested by IBM service personnel. This option opens a panel like Figure 5-44.

```
+---------------------- Download Active Configuration -----------------------+
|                                                                            |
|                                                                            |
| Selected SNA address  . : IBM390PS.MENSA                                   |
| Source IODF . . . . . . : SYS9.IODF82                                      |
|                                                                            |
| Specify the following value.                                               |
|                                                                            |
| Target IODF name  . . . . ____________________________________________  +  |
|                                                                            |
|                                                                            |
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap       |
| F12=Cancel                                                                 |
+----------------------------------------------------------------------------+
```

Figure 5-44 Download Active Configuration

> **Note:** This option is available when you dynamically activate a configuration, but is not available when you activate a new configuration using a POR.

- Use `Activate HW changes remotely to a supported processor (a)` to activate a Dynamic I/O configuration for SACF, as shown in step 5 on page 118.

5.6 Server Time Protocol configuration

After you verify that the CF links are connected and online, set up the STP configuration.

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

For more information about the GUI and how to set up the STP Coordinated Timing Network (CTN), see Chapter 8, “Preparing for IBM Parallel Sysplex and Server Time Protocol” on page 155.

5.7 Building and verifying load (IPL) profiles

After the CPC completes the POR and the configuration steps are finished, define a load (IPL) profile to activate an LPAR.

To build a load profile, complete the following steps:

1. Log on to the HMC for the new 9175 processor by using SYSPROG authority.
2. Under Systems Management, click **Systems Management** to expand the list.
3. Under Systems Management, select the radio button next to the system that you want to work with (in this example, MENSA).
4. In the Tasks window, click **Operational Customization** to expand it, and then select **Customize/Delete Activation Profiles** (see Figure 5-45).

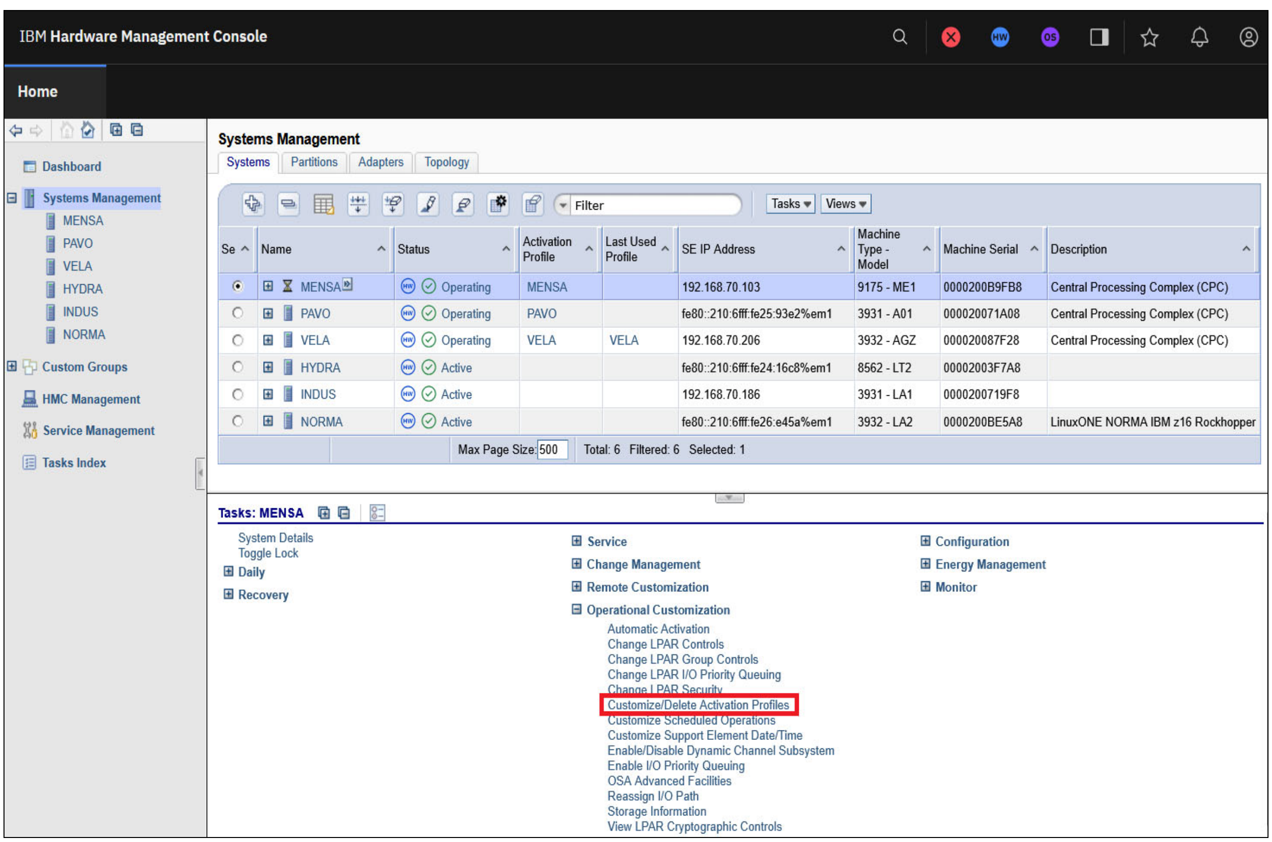


Figure 5-45 Systems Management: Main display

5. Select the DEFAULTLOAD load profile and click **Customize profile**, as shown in Figure 5-46.

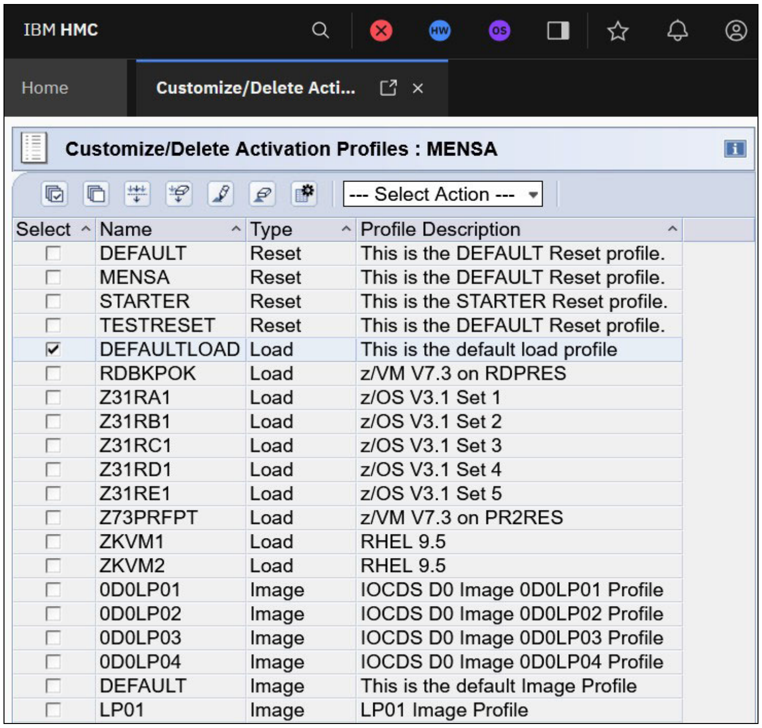


Figure 5-46 DEFAULTLOAD load profile

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.
   - Device type: ECKD.
   - IPL type: Channel Command Word (CCW).
   - Load type: Load an OS.
   - Options: Select **Clear the main memory before loading** if you clear main memory storage on the LPAR before a load.
   - Load address: The device address of the IPL volume (A075).
   - Load parameter: A04C01M1.
     - A04C: The device address of the IODF volume
     - 01: The suffix of the LOADxx member in SYS#.IPLPARM on device A04C
     - M: Automatic IPL
     - 1: SYS1.NUCLEUS

Figure 5-47 shows an example.

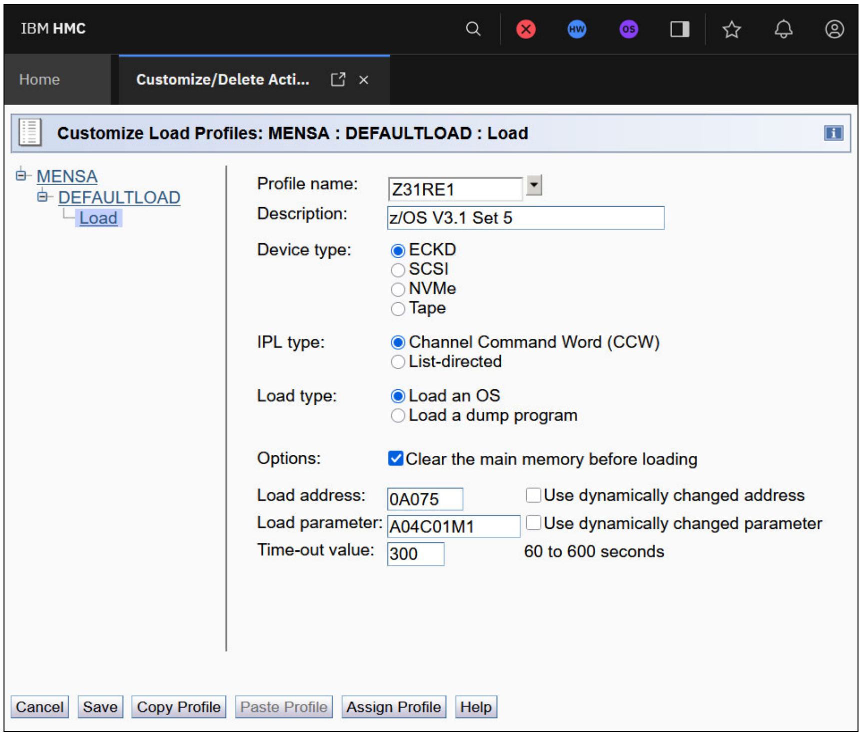


Figure 5-47 Customize Load Profiles: Load

7. Click **Save**, and then click **OK** to continue to the Save window (see Figure 5-48).

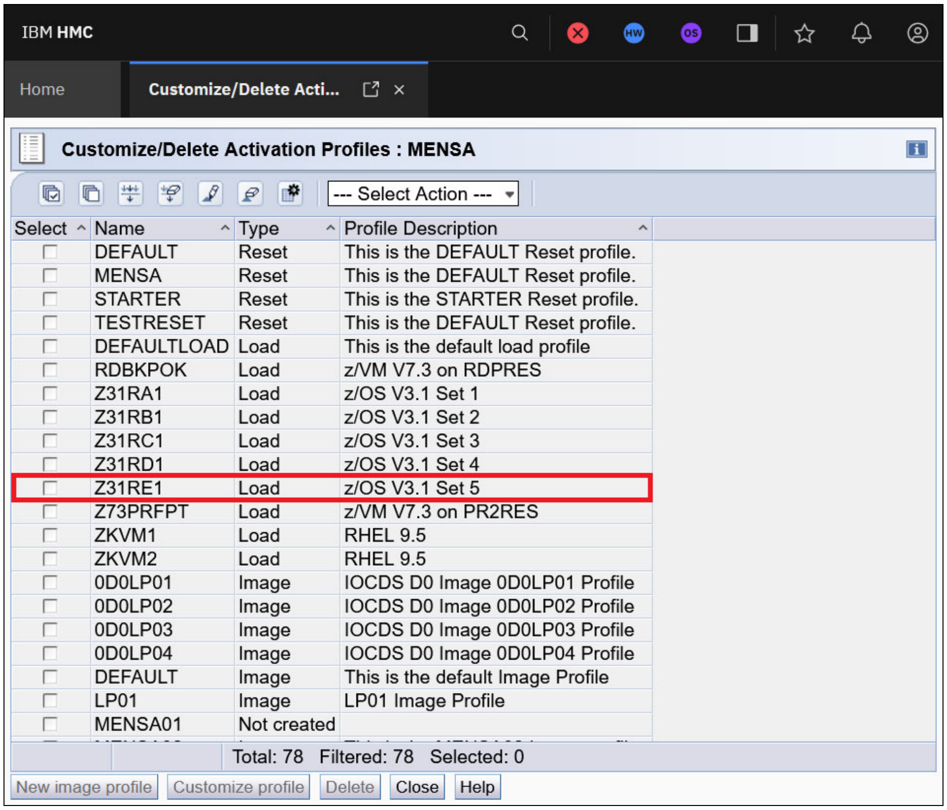


Figure 5-48 Customize Load Profiles: New Load profile

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

5.8 Building and verifying LOADxx members in SYS#.IPLPARM

Specify a `LOADxx` suffix to perform an IPL. The system stores this data set member in `SYS#.IPLPARM` on the volume that contains the IODF. In this example, the volume is A04C (`IODFPK`). The number sign (#) represents the value that you use in your installation for `SYS#` datasets. The number sign can be any value 0 - 9, for example, `SYS0.IPLPARM`.

If you prefer to use the **`HWNAME`** keyword to reference the Processor ID, update this parameter to reference the new Processor ID (in this example, MENSA). Sometimes the **`LPARNAME`** keyword is also used in the `LOADxx` members, and it might need to be reviewed or updated, such as MENSA32.

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

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

1. Log on to a system that has access to the SYS#.IPLPARM dataset on the IODF volume that you use to perform the IPL by using the Time Sharing Option (TSO).
2. Edit the SYS#.IPLPARM dataset and edit member LOADxx. Figure 5-49 shows the settings that are used in this example.
   - Set the **HWNAME** keyword to MENSA.
   - Set the **LPARNAME** keyword to MENSA32.
   - Set the **IODF** keyword to ** (the double asterisks direct the IPL to identify which IODF or IOCP underwent a POR into the CPC's HSA, and then locate the corresponding IODF on the IODF volume). You can define a specific IODF suffix number in the LOADxx member if you must override the HSA match.
   - The **IODF** keyword identifies the high-level qualifier of the IODF data set (SYS9) and the operating system configuration (OSCONFIG) that the 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 (NIP) consoles and esoterics.
   - The remaining parameters apply to z/OS and not to the IODF.

```
File  Edit  Edit_Settings  Menu  Utilities  Compilers  Test  Help
-------------------------------------------------------------------------------
EDIT       SYS0.IPLPARM(LOAD01) - 01.99                   Columns 00001 00072
Command ===>                                                 Scroll ===> CSR
000015 *-----------DEFINITION FOR SC75-------------*
000016 HWNAME   VELA
000017 LPARNAME VELA23
000018 SYSPLEX  PLEX75   Y
000019 IODF     ** SYS9     ITSO     01 Y
000020 SYSCAT   BH5CAT123CMCAT.BH5CAT
000021 NUCLST   4A
000022 PARMLIB  SYS1.PARMLIB
000023 PARMLIB  SYS1.IBM.PARMLIB
000024 PROCVIEW CORE,CPU_OK
000025 *-----------
000026 HWNAME   MENSA
000027 LPARNAME MENSA32
000028 SYSPLEX  PLEX75   Y
000029 IODF     ** SYS9     ITSO     01 Y
000030 SYSCAT   BH5CAT123CMCAT.BH5CAT
000031 NUCLST   4A
000032 PARMLIB  SYS1.PARMLIB
000033 PARMLIB  SYS1.IBM.PARMLIB
000034 PROCVIEW CORE,CPU_OK
```

Figure 5-49 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 the network features of the IBM z17 ME1 system so that you can connect it to your network.

Naming: This publication covers the IBM z17 ME1. Throughout this chapter, these machines are referred to as IBM z17.

Note: The channel path ID (CHPID) type OSE is not supported on IBM z17 systems, either on OSA-Express or on Network Express. The Remote Direct Memory Access over Converged Ethernet (RoCE) adapters that were available on previous machines (IBM z15 (Feature Code 0411) and IBM z16 (Feature Codes 0412, 0430, 0432, 0440, 0441, 0443, 0450, and 0452)) are not supported on IBM z17. The only adapter type that provides RoCE functions for IBM z17 is the Network Express Adapter with the NETH Peripheral Component Interconnect Express (PCIe) function, which is described in Chapter 15, “Adding Peripheral Component Interconnect Express devices” on page 335.

This chapter includes the following topics:

- Configuring OSA for OSA-Express and Network Express Adapter
- Verifying the OSA configuration
- Configuring Shared Memory Communications (SMC-D and SMC-R)

6.1 Configuring OSA for OSA-Express and Network Express Adapter

You can define OSA communications either on an OSA-Express7S (see "OSA-Express" on page 33 for a complete list of supported OSA-Express features) with channel type OSD or on a Network Express Adapter with channel type OSH. Aside from this difference, the I/O definition for OSA is the same for both adapter types.

To configure OSA, define the CHPID, control unit (CU), and devices in the I/O configuration by using Hardware Configuration Definition (HCD). This process is explained in detail in Chapter 13, "Adding network devices" on page 269.

You can customize OSA for either OSD or OSH by using OSA Advanced Facilities on the Hardware Management Console (HMC). OSA Advanced Facilities is a tool that is integrated into the HMC.

To start OSA Advanced Facilities, log in to the HMC with the appropriate authority, and select the central processor complex (CPC) that requires OSA customization. Then, select **Operational Customization** → **OSA Advanced Facilities** (Figure 6-1).

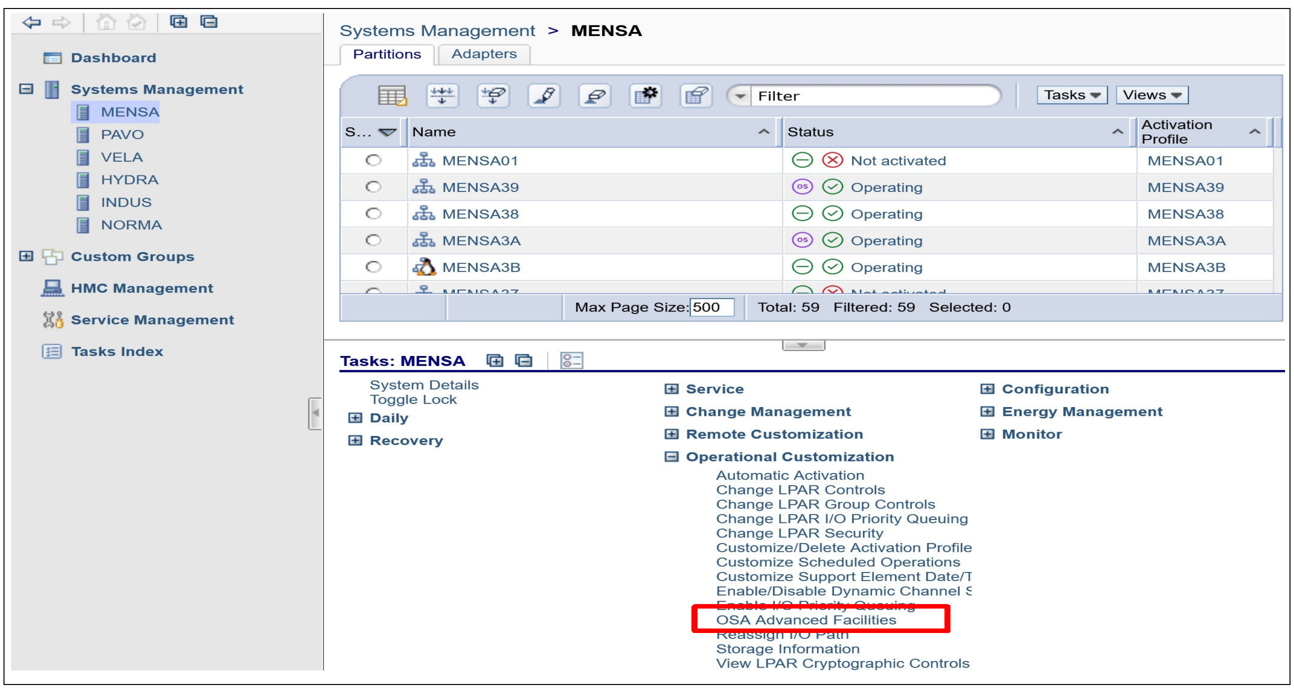
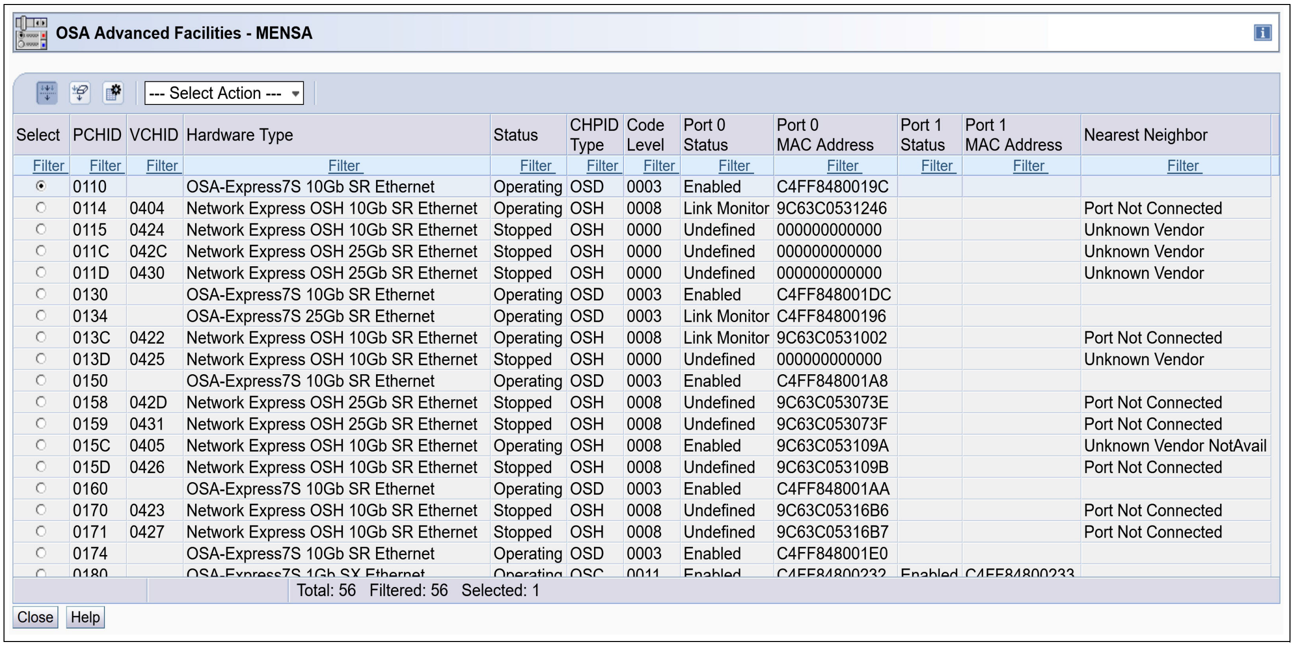


Figure 6-1 Selecting OSA Advanced Facilities from CPC

The OSA Advanced Facilities window opens, as shown in Figure 6-2 on page 131.



OSA Advanced Facilities - MENSA

--- Select Action ---

Select	PCHID	VCHID	Hardware Type	Status	CHPID Type	Code Level	Port 0 Status	Port 0 MAC Address	Port 1 Status	Port 1 MAC Address	Nearest Neighbor
Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
	0110		OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0003	Enabled	C4FF8480019C			
	0114	0404	Network Express OSH 10Gb SR Ethernet	Operating	OSH	0008	Link Monitor	9C63C0531246			Port Not Connected
	0115	0424	Network Express OSH 10Gb SR Ethernet	Stopped	OSH	0000	Undefined	000000000000			Unknown Vendor
	011C	042C	Network Express OSH 25Gb SR Ethernet	Stopped	OSH	0000	Undefined	000000000000			Unknown Vendor
	011D	0430	Network Express OSH 25Gb SR Ethernet	Stopped	OSH	0000	Undefined	000000000000			Unknown Vendor
	0130		OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0003	Enabled	C4FF848001DC			
	0134		OSA-Express7S 25Gb SR Ethernet	Operating	OSD	0003	Link Monitor	C4FF84800196			
	013C	0422	Network Express OSH 10Gb SR Ethernet	Operating	OSH	0008	Link Monitor	9C63C0531002			Port Not Connected
	013D	0425	Network Express OSH 10Gb SR Ethernet	Stopped	OSH	0000	Undefined	000000000000			Unknown Vendor
	0150		OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0003	Enabled	C4FF848001A8			
	0158	042D	Network Express OSH 25Gb SR Ethernet	Stopped	OSH	0008	Undefined	9C63C053073E			Port Not Connected
	0159	0431	Network Express OSH 25Gb SR Ethernet	Stopped	OSH	0008	Undefined	9C63C053073F			Port Not Connected
	015C	0405	Network Express OSH 10Gb SR Ethernet	Operating	OSH	0008	Enabled	9C63C053109A			Unknown Vendor NotAvail
	015D	0426	Network Express OSH 10Gb SR Ethernet	Stopped	OSH	0008	Undefined	9C63C053109B			Port Not Connected
	0160		OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0003	Enabled	C4FF848001AA			
	0170	0423	Network Express OSH 10Gb SR Ethernet	Stopped	OSH	0008	Undefined	9C63C05316B6			Port Not Connected
	0171	0427	Network Express OSH 10Gb SR Ethernet	Stopped	OSH	0008	Undefined	9C63C05316B7			Port Not Connected
	0174		OSA-Express7S 10Gb SR Ethernet	Operating	OSD	0003	Enabled	C4FF848001E0			
	0180		OSA-Express7S 1Gb SX Ethernet	Operating	OSC	0011	Enabled	C4FF84800232	Enabled	C4FF84800233	

Total: 56 Filtered: 56 Selected: 1

Close Help

Figure 6-2 OSA Advanced Facilities initial window

This chapter is concerned with only OSH and OSD channels. In the OSA Advanced Facilities initial window (Figure 6-2) the channel types OSC and NETH are also listed. The OSC type channels are covered in Chapter 7, “Defining console communication” on page 137, and the NETH function is covered in Chapter 15, “Adding Peripheral Component Interconnect Express devices” on page 335.

6.1.1 Open Card Specific Advanced Facilities

From the initial window, select the OSA-Express (OSD) or Network Express Adapter (OSH) physical channel ID (PCHID) that you want to customize. Then, from the menu at the top of the window, select **Card Specific Advanced Facilities**, as shown in Figure 6-3.

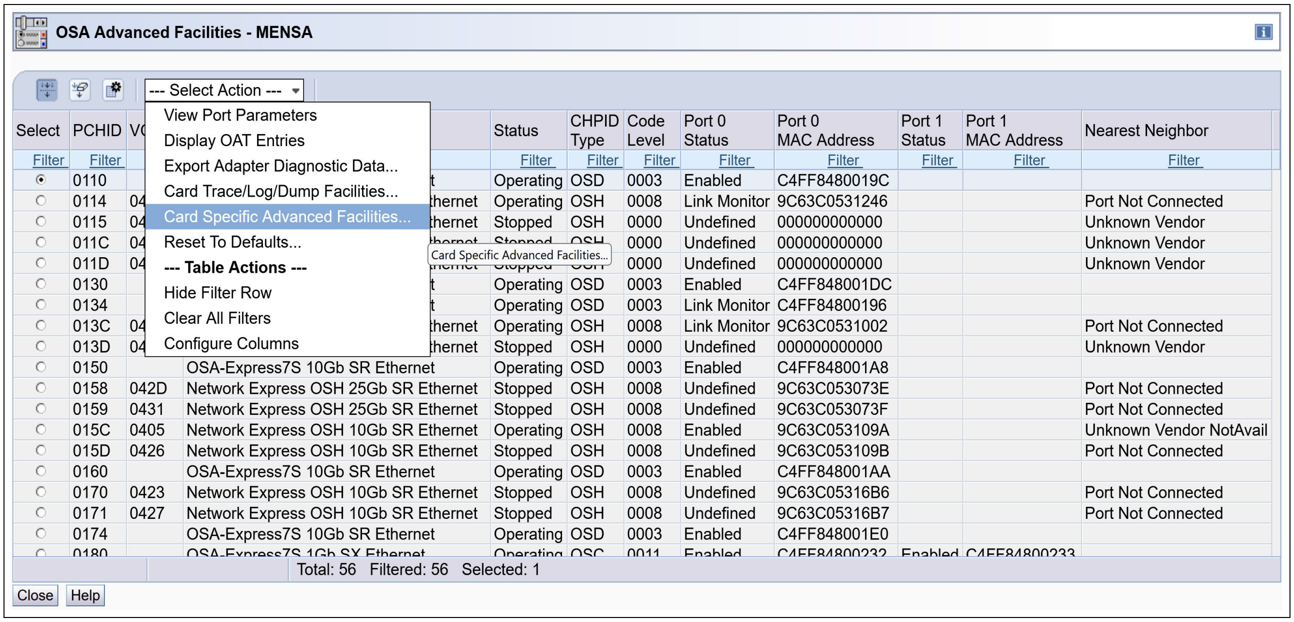


Figure 6-3 Selecting Card Specific Advanced Facilities

Depending on the selected channel type, a selection window opens that you can use to choose some or all of the following configuration options:

- Display or modify the Media Access Control (MAC) address (OSD and OSH)
- Enable or disable ports (OSD and OSH)
- Set the card mode (only OSD; local area network (LAN) port type 1000Base-T Ethernet)

6.1.2 Displaying or altering the MAC address

To display or alter the MAC address, select **Display or alter MAC address**. This option is available for OSD and OSH channels.

After selecting this option and pressing **OK**, the Display or alter MAC address window opens (Figure 6-4). Set the MAC address that you want and then click **OK**.

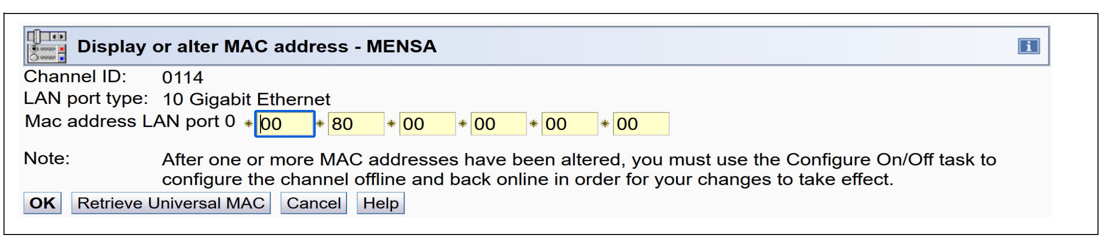


Figure 6-4 OSA/SF on the HMC: Display or alter MAC address value

For OSA-Express Adapters with two ports, the MAC addresses of both ports are shown in the window, and you can change the MAC addresses of both ports concurrently.

To activate the modification, configure CHPID OFFLINE and ONLINE from each logical partition (LPAR) where the CHPID is defined.

6.1.3 Enabling or disabling ports

You can use the configuration options Enable port or Disable port for OSD and OSH channels. After you select this option and press **OK**, the Enable Disable Port window opens (Figure 6-5).

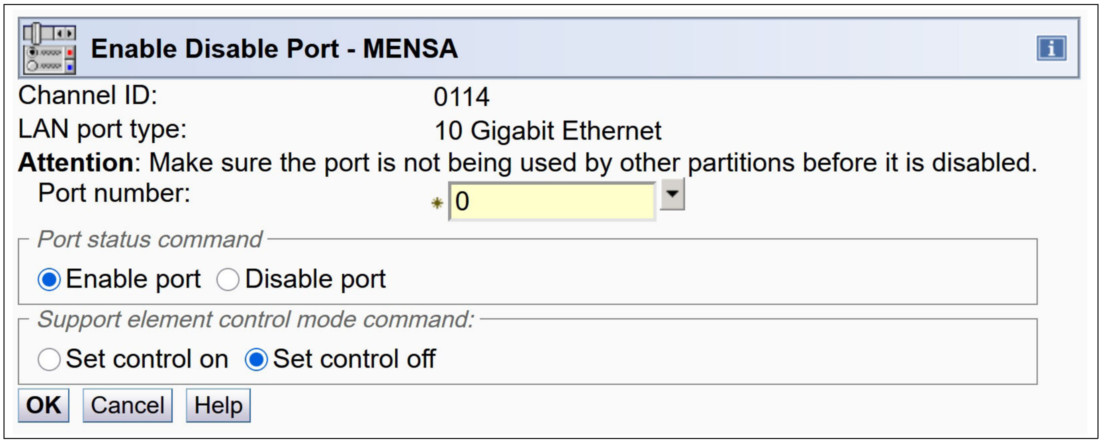


Figure 6-5 Enable port or Disable port options

In this window, select the port that you want to enable or disable. The port selection is always shown, even if the selected PCHID has only one port, such as for the new Network Express Adapter. In that case, the port selection offers only the value “0.”

After selecting the port, you can choose whether to enable or disable it. You can also set the Support Element (SE) control to “on” or “off.” When you set this option to “on,” the PCHID allows configuration commands only from the service element.

Click **OK** to apply your selection.

Note: On IBM z17, the option “Support element control mode command” is not available.

6.1.4 Set card mode

The configuration option “Set card mode” is only available for channel type OSD on OSA-Express7S 1000BaseT on IBM z15.

On IBM z16 and IBM z17, OSA-Express7S 1000BaseT (Feature Code 0446) supports only auto-negotiate. The OSA automatically negotiates the best speed (100 Mbps or 1000 Mbps) and duplex mode (Full or Half) with the switch or router to which it is connected.

6.2 Verifying the OSA configuration

For OSD and OSH channel types, you can find the “Query port status” option in the card-specific advanced facilities, as shown in Figure 6-6.

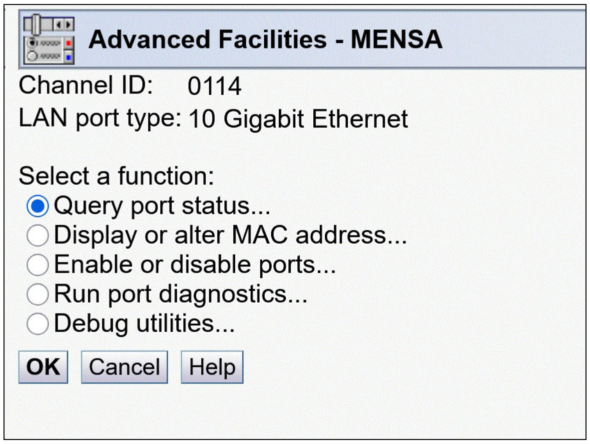


Figure 6-6 OSA card-specific advanced facilities

Select this option and click **OK** to show the current port status, as shown in Figure 6-7.

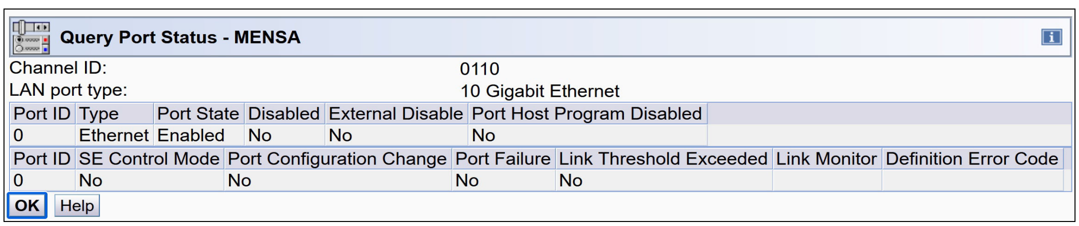


Figure 6-7 Query port status

6.3 Configuring Shared Memory Communications (SMC-D and SMC-R)

The concept of Shared Memory Communications (SMC) is described in detail in “Shared Memory Communication” on page 34. You can use SMC to target a remote machine, which is called SMC - Remote Direct Memory Access over Converged Ethernet Express (SMC-R) by using the RoCE function. You can also target an LPAR within the same CPC by using SMC with Internal Shared Memory (ISM). This configuration is called SMC - Direct Memory Access over Internal Shared Memory (SMC-D).

In both cases (SMC-R and SMC-D), you must establish the SMC connection by using a TCP connection. Therefore, each SMC function must be paired with a corresponding OSD, OSH[1], or Internal Queued Direct (IQD) channel for the initiating TCP connection.

If you define a PNETID for the OSD or OSH channel that is used to establish the TCP connection, you must specify the same PNETID for the corresponding NETH or ISM function.

[1] For SMC-R that is paired with OSH, both definitions (OSH and NETH) must be for the same PCHID.

6.3.1 Defining SMC-R

The SMC-R function for IBM z17 is provided by the Network Express Adapter only. The name of the RoCE PCIe function to be defined is NETH, and the definition of this function is explained in detail in 15.2.3, “Defining a NETH PCIe function” on page 343.

6.3.2 Defining SMC-D

The SMC-D function is provided by defining the ISM function. It is described in detail in 15.2.2, “Defining an ISM PCIe function” on page 339.

7

Defining console communication

Naming: The IBM z17 system that is describe by this publication is IBM z17 ME1 (9175). Throughout this chapter, this machine is referred to as the IBM z17.

Note: Not all of the following configuration items are required for your installation. In addition, the examples that are provided are not exhaustive.

This chapter includes the following topics:

- Preparing a console definition
- Defining the OSA-ICC
- Configuring a new OSA-ICC by using OSA Advanced Facilities
- Verifying the OSA-ICC definition

7.1 Preparing a console definition

A non-Systems Network Architecture (SNA) console is required for IPL, z/OS system operation, and system management. Define at least one non-SNA console for your z/OS system. To define the non-SNA console, use the Open Systems Adapter-Express Integrated Console Controller (OSA-ICC) function. For more information, see *Open Systems Adapter Integrated Console Controller User's Guide*, SC27-9003.

Note: The definitions in this publication were created by using IBM Personal Communications. You can use other emulation-compatible products that are available in the marketplace.

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 and 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-Express7S 1.2 GbE Short Wave (SX) and Long Wave (LX) adapters only.

Configure OSA-ICC when you upgrade to IBM z17 from an older IBM Z generation where OSA-ICC definitions exist or when installing a new IBM z17 and non-SNA consoles are required.

7.2 Defining the OSA-ICC

Before you perform the OSA-ICC configuration, define the OSC CHPID, CNTLUNIT, and 3270-X IODEVICE to the I/O configuration by using Hardware Configuration Definition (HCD). This definition is described in Chapter 13, “Adding network devices” on page 269.

7.3 Configuring an OSA-ICC configuration by using OSA Advanced Facilities

When you install a new IBM z17, configure OSA-ICC from scratch. To create an OSA-ICC configuration, complete the following steps:

1. Log on to the Hardware Management Console (HMC), open OSA Advanced Facilities, and select the central processor complex (CPC).
2. Select the OSC physical channel ID (PCHID) that you will use for the OSA-ICC configuration, and then select **Card Specific Advanced Facilities** (see Figure 7-1 on page 139).

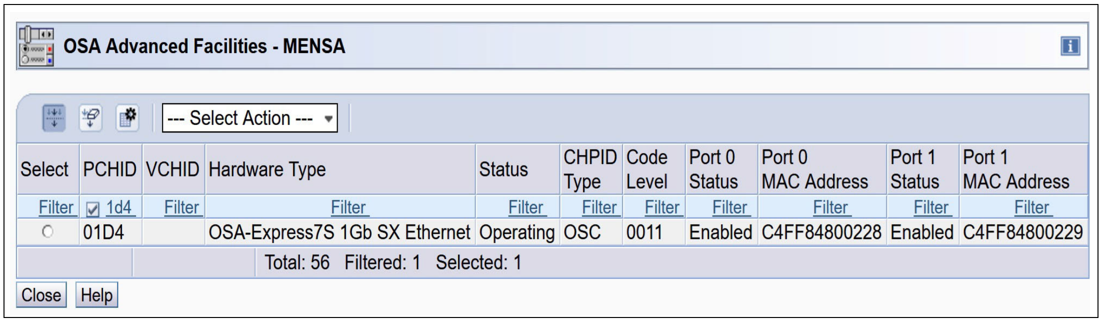


Figure 7-1 HMC: Card Specific Advanced Facilities

> **Note:** In z17, there is a new column in OSA Advanced Facilities that is called VCHID. The OSC channel does not use the VCHID definition.

3. Select **Panel configuration options** and click **OK** (Figure 7-2).

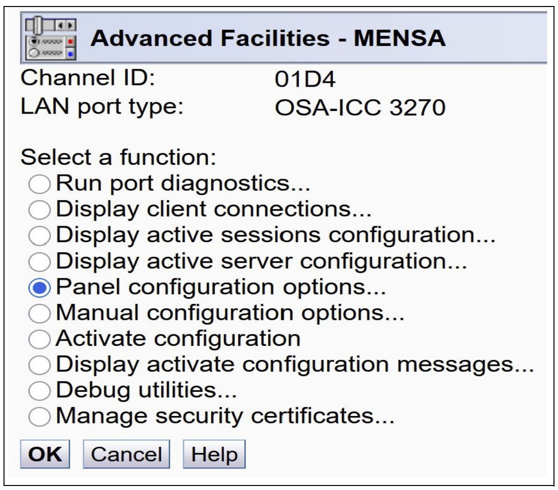


Figure 7-2 HMC: Panel configuration options

4. The Panel Configuration Options window opens (see Figure 7-3). Define the session and server configurations in this window, and validate the values. In this example, the server configuration is defined first, followed by the session configuration. To edit the server configuration, select **Edit server configuration**, and then click **OK**.

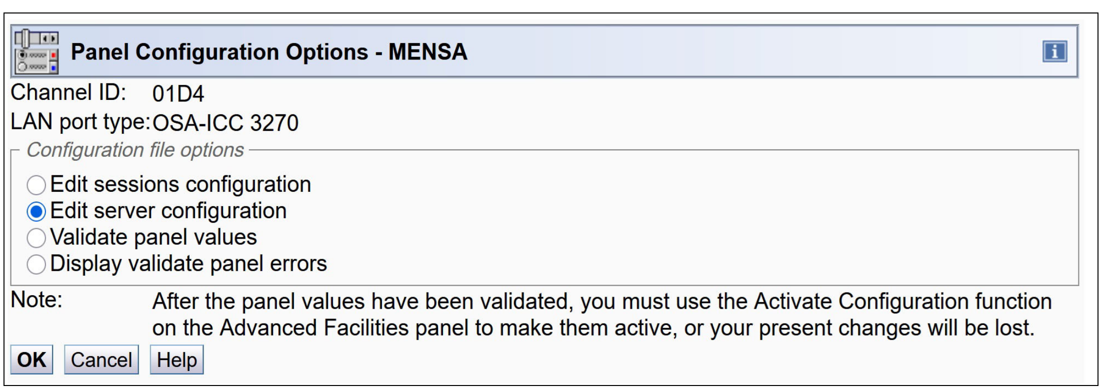


Figure 7-3 HMC: Edit server configuration

5. The Edit Server Configuration window opens. Enter the necessary values on this window. Figure 7-4 shows a sample configuration. Click **OK** to save.

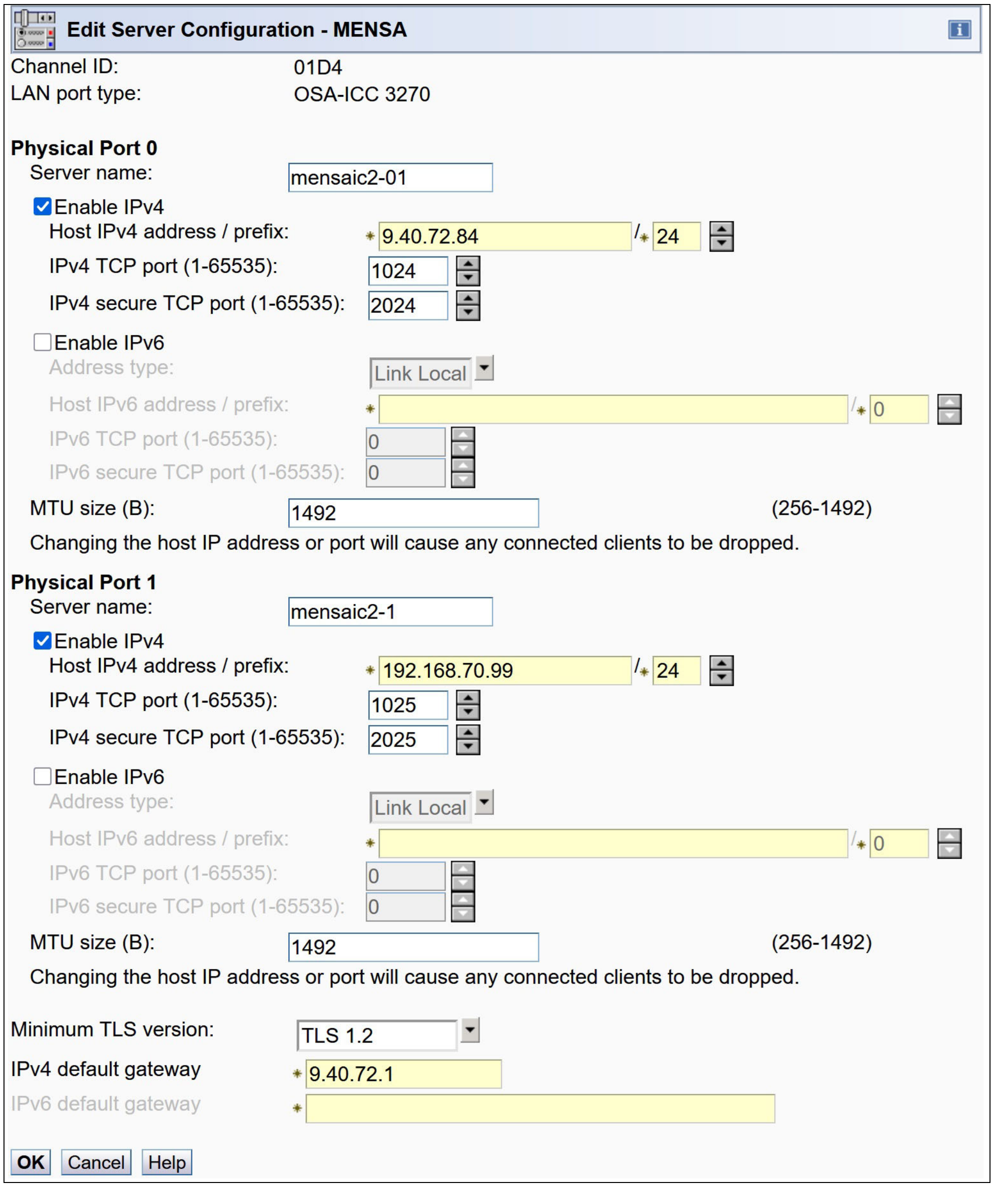


Figure 7-4 HMC: Edit Server Configuration window

> **Note:** Starting with IBM z17, OSC can use TLS 1.3 support.

For more information, see the *OSA-Express Integrated Console Controller Implementation Guide*, SG24-6364.

6. The command is completed (ACT20402) and the 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**. Figure 7-5 on page 141 shows the window that opens.

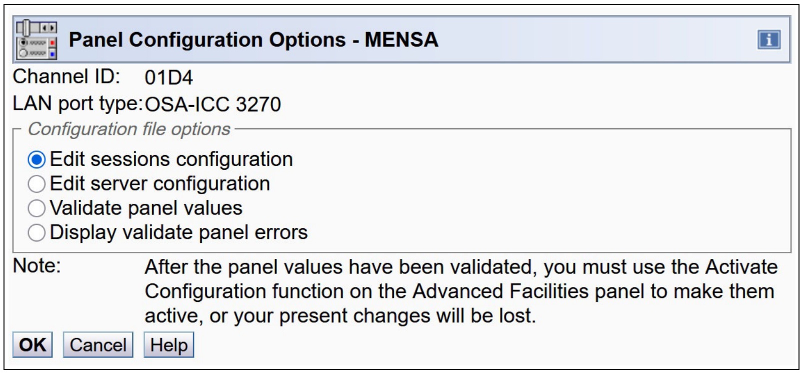


Figure 7-5 Edit sessions configuration

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**.

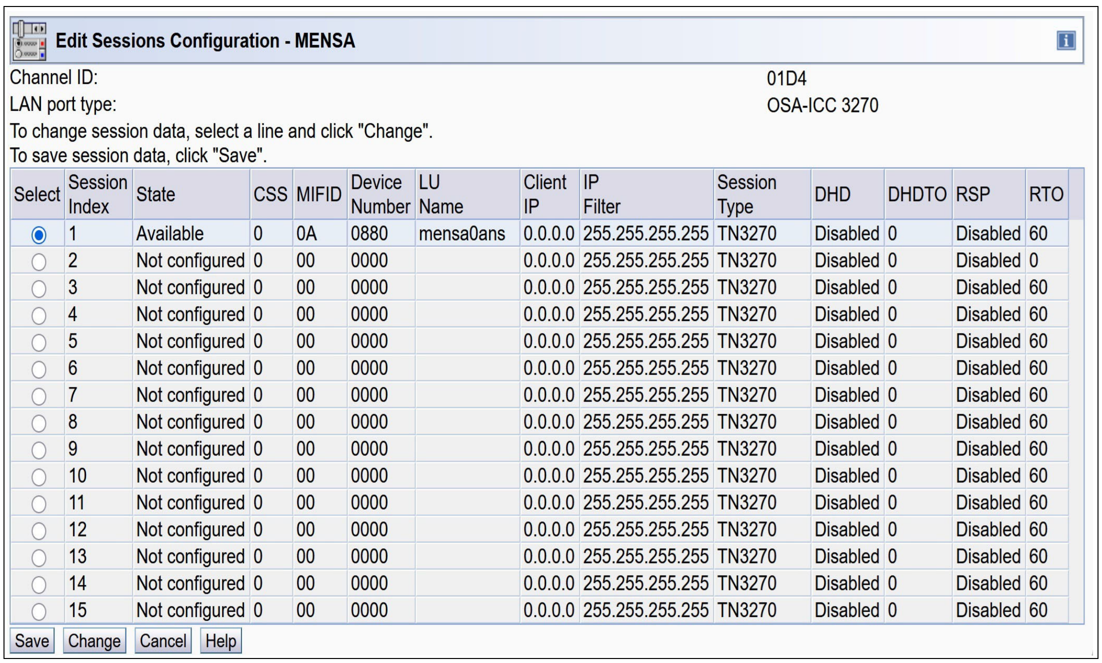


Figure 7-6 HMC: Edit Sessions Configuration selection

9. The Edit Session Configuration window opens. Define the session parameter here. Click **OK** to save the configuration (Figure 7-7).

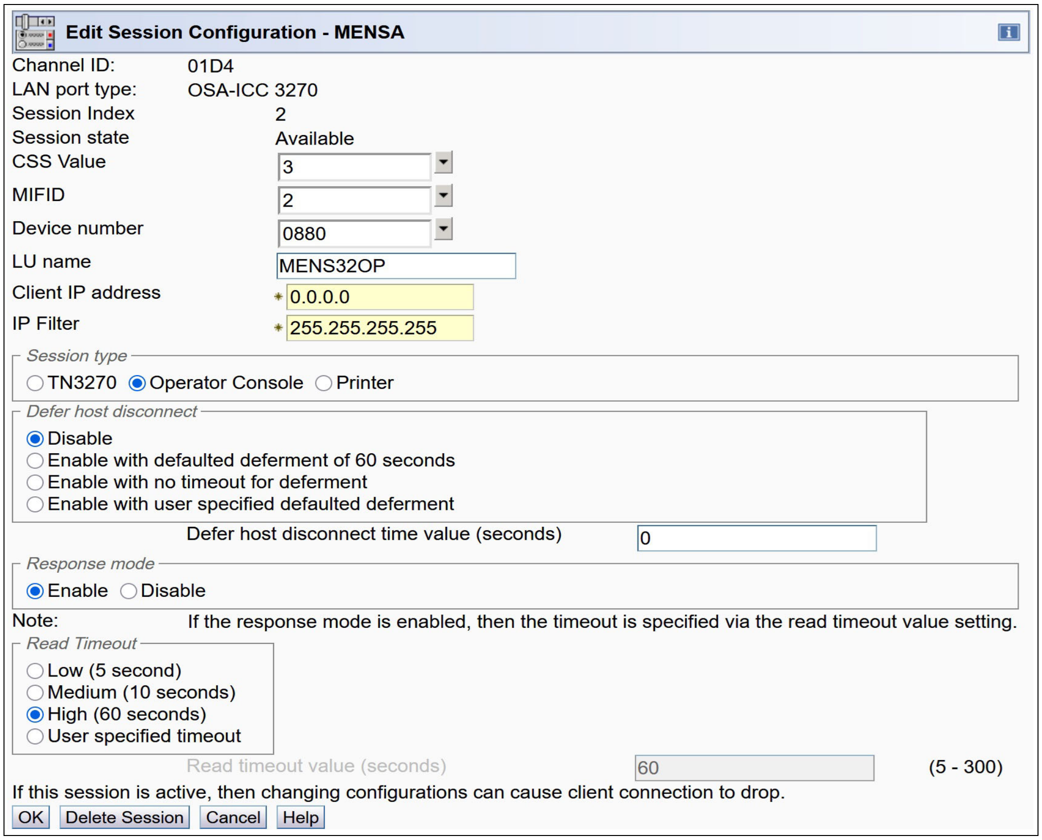


Figure 7-7 HMC: Edit Session Configuration input

10. The Edit Sessions Configuration window opens again (Figure 7-8). Ensure that your input values are displayed correctly. To save the session values, click **Save**.

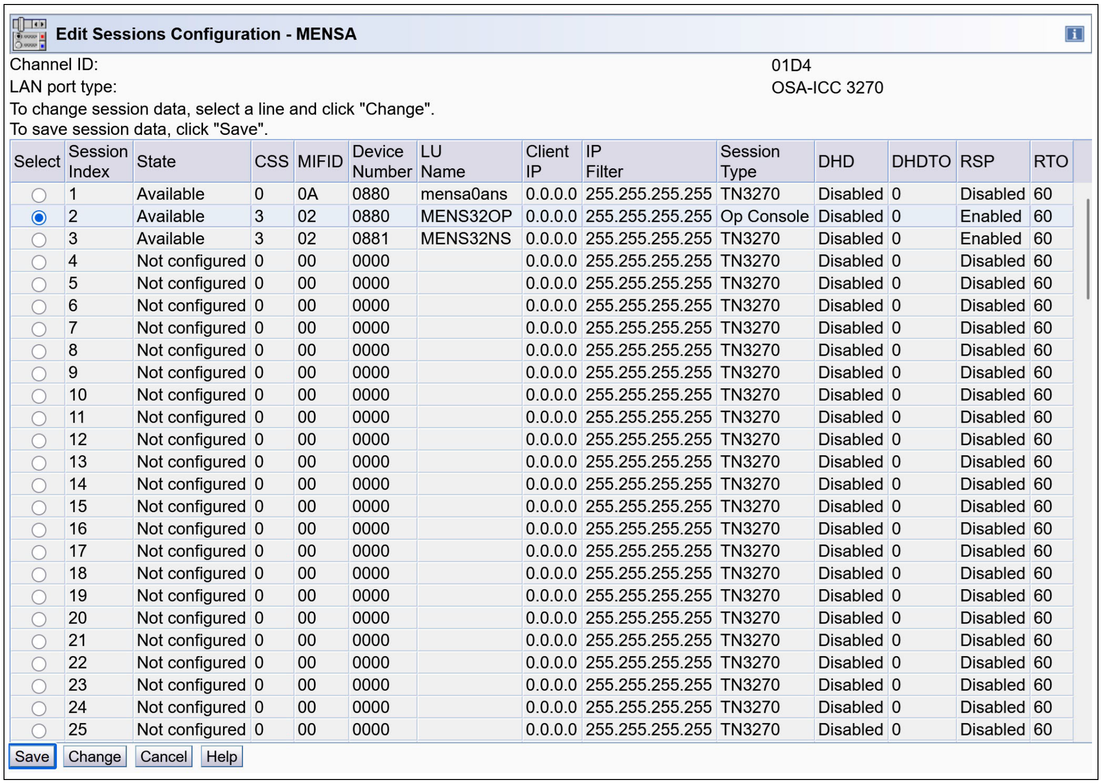


Figure 7-8 HMC: Edit Sessions Configuration after you define the values

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**.

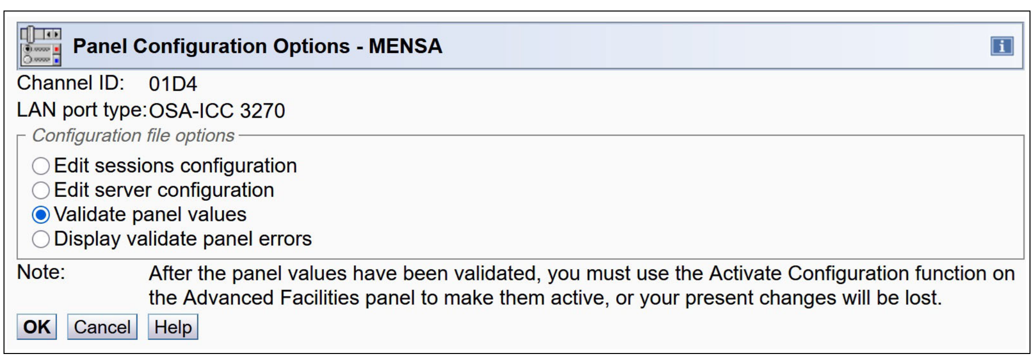


Figure 7-9 HMC: Validate panel values

13. If the configuration data is correct, the command completed (ACT20402) window opens. If an error occurs, a window similar to the one that is shown in Figure 7-10 opens. You can confirm the error by selecting **Display validate panel errors**, as shown in Figure 7-11, in the Panel Configuration Options window (see Figure 7-12). Correct the error, and then select **Validate panel values** again to recheck.

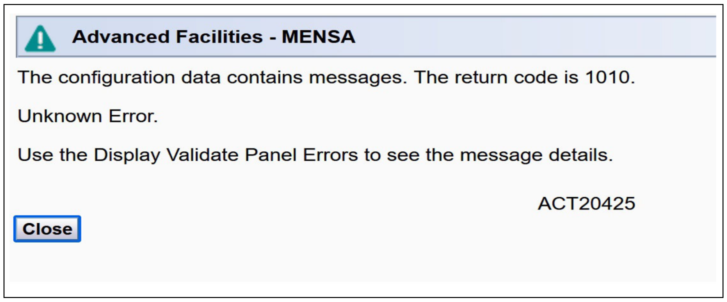


Figure 7-10 HMC: Panel Configuration Options error found

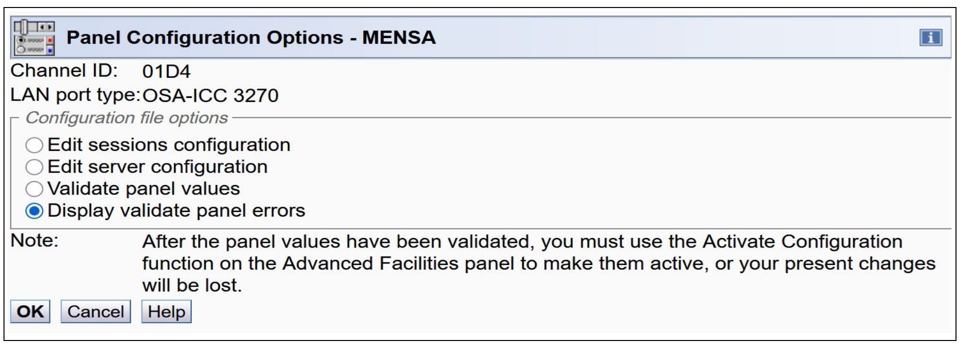


Figure 7-11 HMC: Display validate panel errors

Figure 7-12 shows the details of the error message.

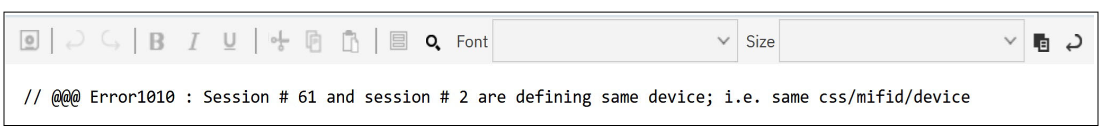


Figure 7-12 HMC: Detailed error message

14. When the validation completes without 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 (see Figure 7-13 on page 145).

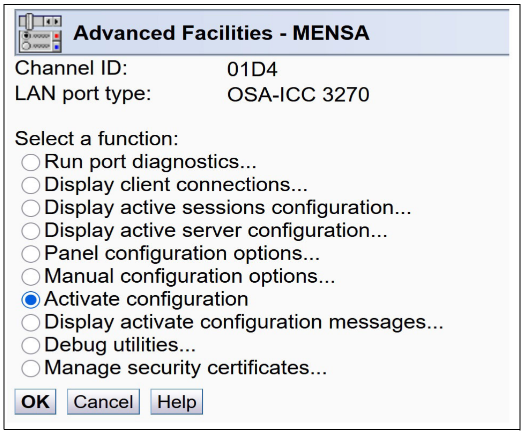


Figure 7-13 HMC: Activate configuration

15. The confirmation window opens. Click **Yes** to continue (Figure 7-14).

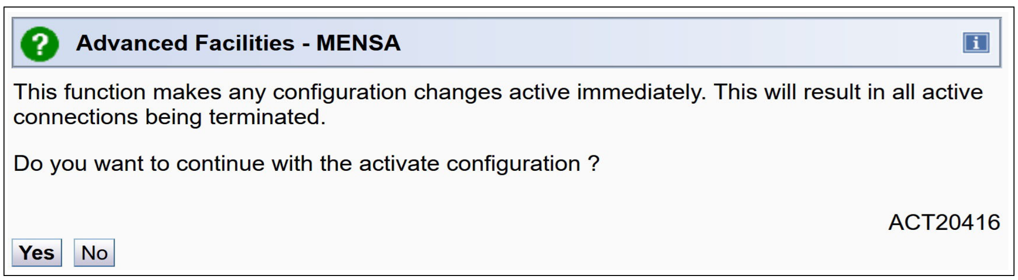


Figure 7-14 HMC: Activate configuration confirmation

16. When the activation completes, the message that is shown in Figure 7-15 appears.

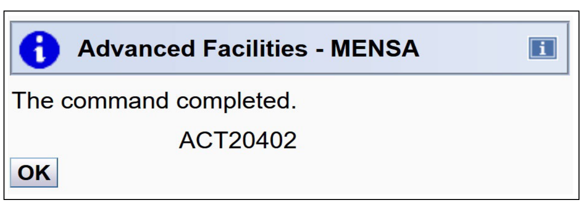


Figure 7-15 HMC: Activate configuration success

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 IBM z17 system. This section describes how to export and import the OSA-ICC configuration file by using the 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, the OSA-ICC configuration file is exported from an IBM z17 system to an FTP server and then imported to the same IBM z17 system from the same FTP server. You can also import or export the configuration file by using a USB flash drive.

To export the OSA-ICC configuration file, complete the following steps:

1. Before you try to export a source file to an FTP server, ensure that the FTP server is reachable from this particular HMC:

   a. Contact your LAN administration and ask for the hostname and TCP/IP address of the FTP server that is connected to the same subnet. In the HMC Welcome window, click **HMC Management**, as shown in Figure 7-16.

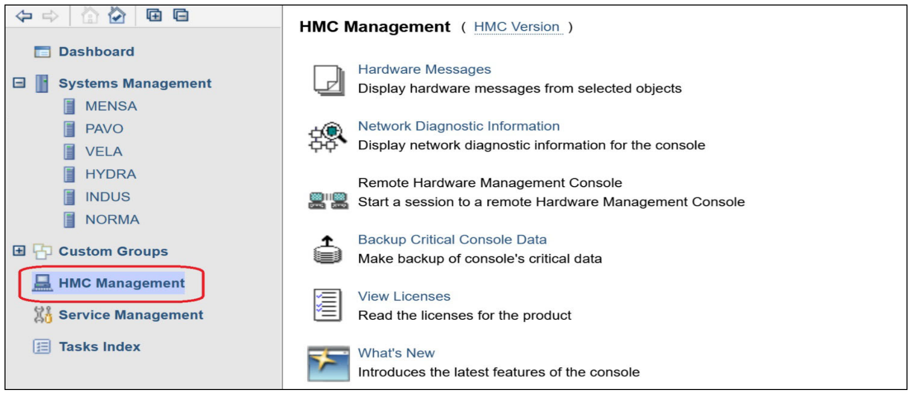


Figure 7-16 HMC: Clicking HMC Management to get to the network diagnostic information

   b. In the HMC Management window, click **Network Diagnostic Information** to get to the Network Diagnostic Information window, as shown in Figure 7-17.

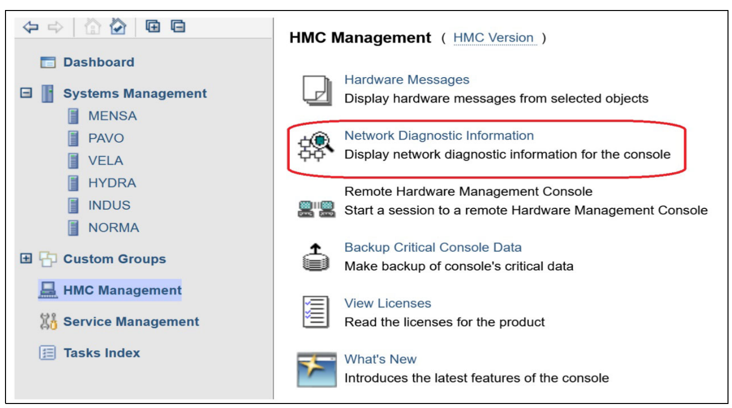


Figure 7-17 HMC: Clicking Network Diagnostic Information to ping the FTP server

   c. In 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 indicate that this HMC has a connection to the FTP server, as shown in Figure 7-18 on page 147.

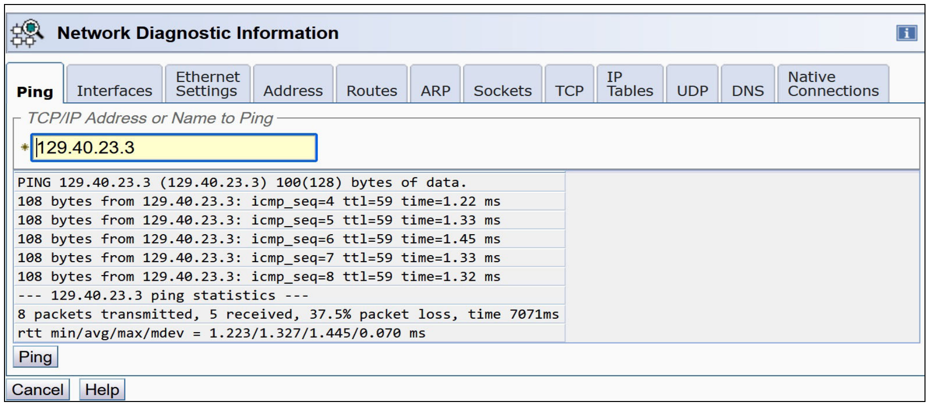


Figure 7-18 HMC - Network Diagnostic Information: Verifying the physical connection between this HMC and the FTP server

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**, and then select **Manual configuration options**. Click **OK** (Figure 7-19).

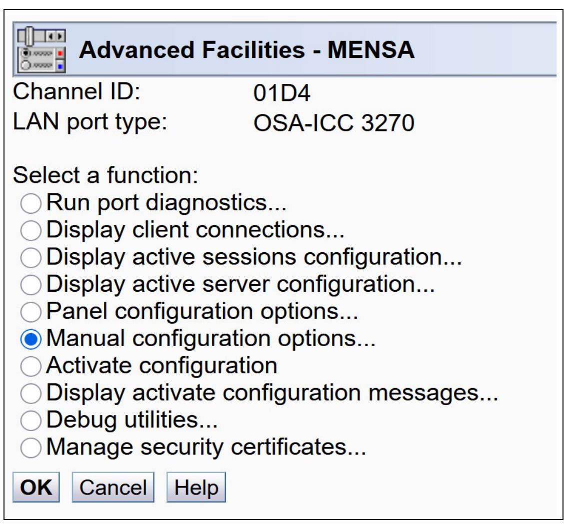


Figure 7-19 HMC: Manual configuration options

4. The Manual Configuration Options window opens (Figure 7-20). Select **Export source file by FTP** and click **OK**.

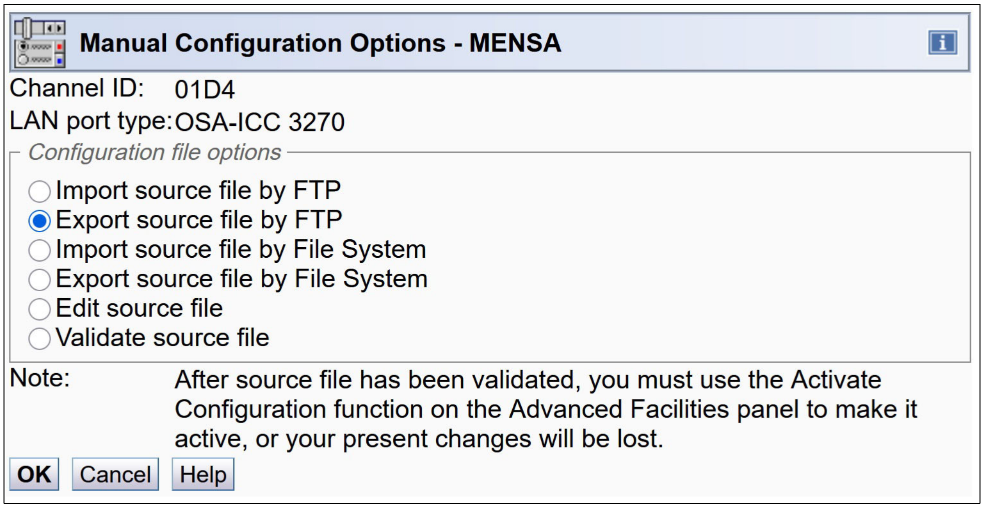


Figure 7-20 HMC: Export source file by FTP

5. The window prompts you for the FTP server information and the location of the file to export. For this example, enter `osaicc_1D4.txt`, as shown 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**.

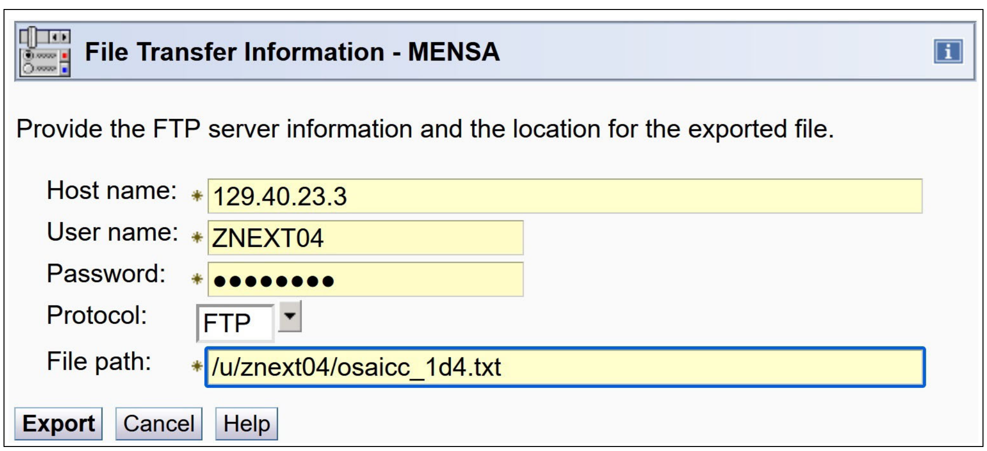


Figure 7-21 HMC - Export file: Specifying the FTP server, and file path and name

The HMC displays the ACT20402 window. Click **OK**.

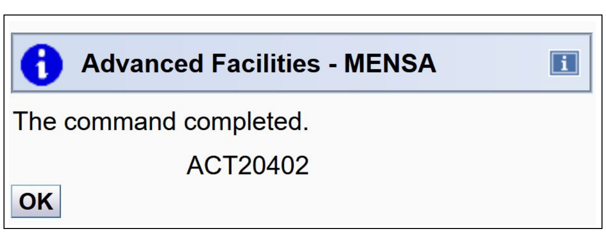


Figure 7-22 HMC: ACT20421 window display

6. Click **Cancel** to exit all OSA Advanced Facilities windows.

Example 7-1 shows an extract from the source file that was transferred to the FTP server.

Example 7-1 OSA-ICC: Sample source file

```
<OSC_SERVER>
<OSC_PHYSICAL_PORT0>
  HOST_IP= 9.40.72.84
  SUBNET_MASK= 255.255.255.0
  PORT= 1024
  SECURE_PORT= 2024
  HOST_LL_ADDRESS/PREFIX=  fe80::c6ff:84ff:fe80:228/64
  ADDR_TYPE= LINK_LOCAL
  HOST_IPV6_ADDRESS/PREFIX=  ::/0
  IPV6_PORT= 0
  IPV6_SECURE_PORT= 0
  ETHERNET_FRAME= DIX
  MTU= 1492
  NAME= mensaic2-01
</OSC_PHYSICAL_PORT0>

<OSC_PHYSICAL_PORT1>
  HOST_IP= 192.168.70.99
  SUBNET_MASK= 255.255.255.0
  PORT= 1025
  SECURE_PORT= 2025
  HOST_LL_ADDRESS/PREFIX=  fe80::c6ff:84ff:fe80:229/64
  ADDR_TYPE= LINK_LOCAL
  HOST_IPV6_ADDRESS/PREFIX=  ::/0
  IPV6_PORT= 0
  IPV6_SECURE_PORT= 0
  ETHERNET_FRAME= DIX
  MTU= 1492
  NAME= mensaic2-1
</OSC_PHYSICAL_PORT1>

  TLS_VERSION= 1.2
  DEFAULT_GATEWAY= 9.40.72.1
  IPV6_DEFAULT_GATEWAY=  ::
</OSC_SERVER>

<CONFIG_SESSION>
<SESSION1>
  CSS= 00 IID= 0A DEVICE= 0880
  GROUP=  "mensa0ans"
  CONSOLE_TYPE= 1    RESPONSE= OFF    READ_TIMEOUT= 60
</SESSION1>
<SESSION2>
...
...
</CONFIG_SESSION>
```

Editing the source file for OSA-ICC

When the OSA-ICC configuration for IBM z17 (such as the IODEVICE, CSSID, and MIFID of logical partitions (LPARs)) changes, 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 IBM z17

To import the source file and activate the configuration of the OSA-ICC on the new IBM z17, complete the following steps:

1. Before you import the source file from the FTP server, ensure 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 146.
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).

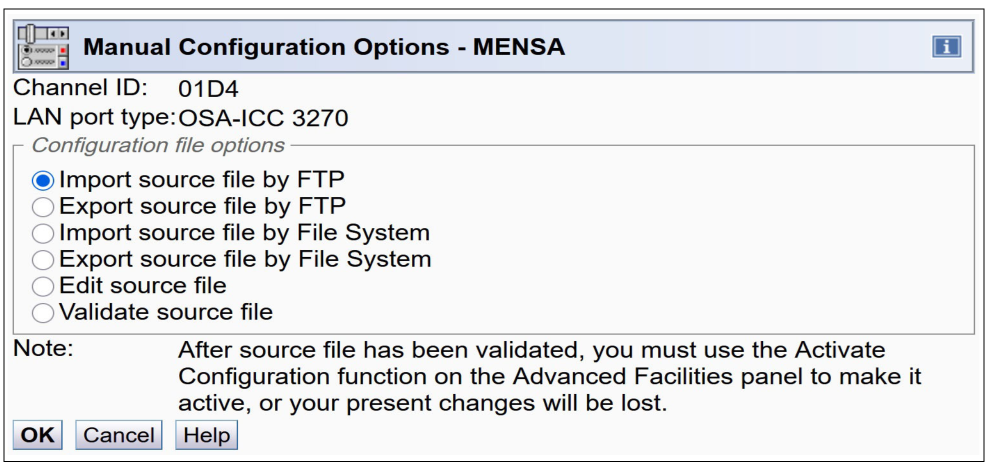


Figure 7-23 HMC: Importing a source file

6. You are prompted to provide the FTP server and file location information (Figure 7-24). Click **Import**.

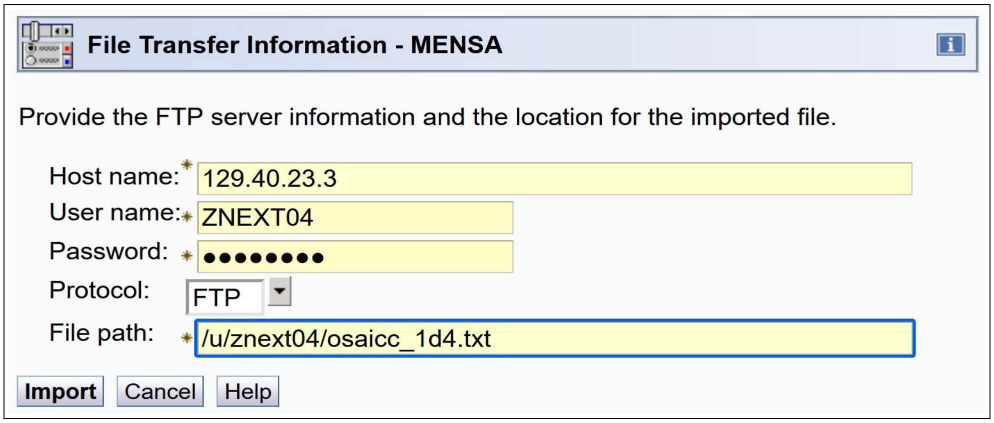


Figure 7-24 HMC: Importing a file

7. Figure 7-25 indicates that the source file import is complete. Click **OK** to continue.

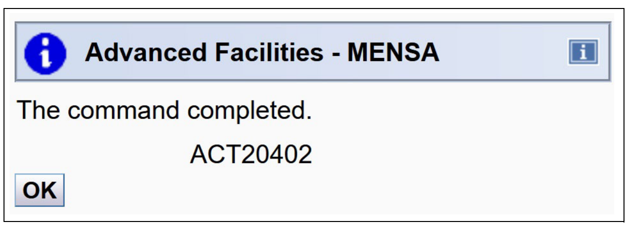


Figure 7-25 HMC: Importing file successful

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 commands that you can use to verify the OSA-ICC configuration. Before starting, the system programmer must activate the new I/O to change a running configuration.

7.4.1 z/OS commands

You can check your definition by using the following z/OS commands:

- **`DISPLAY M=CHP(xx)`**

  Checks whether the `CHPID DESC` is displayed as `OSA CONSOLE` (Figure 7-26).

```
D M=CHP(B1)
IEE174I 21.21.33 DISPLAY M 767
CHPID B1:  TYPE=14, DESC=OSA CONSOLE, ONLINE
DEVICE STATUS FOR CHANNEL PATH B1
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0088 +  +  $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@ $@
SWITCH DEVICE NUMBER = NONE
PHYSICAL CHANNEL ID = 01D4
************************ 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) 1B10. Also included is the 9175 machine type and serial number, as shown in Figure 7-27.

```
D M=DEV(880)
IEE174I 21.22.06 DISPLAY M 769
DEVICE 00880   STATUS=ONLINE
CHP                   B1
ENTRY LINK ADDRESS    ..
DEST LINK ADDRESS     0D
PATH ONLINE           Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL      Y
MANAGED               N
CU NUMBER             1B10
INTERFACE ID          D400
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND         = NOT AVAILABLE
SCP TOKEN NED     = 002074.   .IBM.02.9175000B9FB8.B100
SCP DEVICE NED    = 002074.002.IBM.02.9175000B9FB8.B100
```

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,,,880,1
IEE457I 21.22.44 UNIT STATUS 771
UNIT TYPE STATUS       VOLSER     VOLSTATE      SS
0880 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 02 connected to mensaic2-01 via IP Addr 9.40.72.84:1024     **
 **        LT Index=06 CSSID=03 MIFID=02 CU=0  UA=00  LUName=MENS320P        **
 **       Type=9175-ME1 Mfg=IBM SN=0000000B9FB8 CHPID=B1 Status=Active       **


9.67.186.61:63237
```

Figure 7-29 OSA-ICC initial window

8

Preparing for IBM Parallel Sysplex and Server Time Protocol

This chapter describes the preparation tasks for IBM Parallel Sysplex and how to configure time synchronization with Server Time Protocol (STP).

Note: The examples that are shown in this chapter are based on the IBM z17 ME1 (9175).

This chapter includes the following topics:

- Preparing for a Parallel Sysplex
- Preparing for non-sysplex system time synchronization
- Server Time Protocol overview
- Configuring the HMC as an NTP server
- HMC 2.17.0 (Manage System Time task)

8.1 Preparing for a Parallel Sysplex

If your IBM z17 is a member of a Parallel Sysplex or if you create a Parallel Sysplex that involves an IBM z17, time synchronization among central processor complexes (CPCs) is required. For time synchronization, use the STP feature (Feature Code 1021).

In addition to the time synchronization, you must follow many steps to create a Parallel Sysplex. For more information, see *MVS Setting Up a Sysplex*, SA23-1399-60.

Some of those steps are performed when you are installing an IBM z17:

1. Define Coupling Facility (CF) links.
2. Define Fibre Connection (FICON) channel-to-channel (FCTC) connections (optional).
3. Define the CF logical partition (LPAR).
4. Define the CF LPAR image profile in the Hardware Management Console (HMC).
5. Configure STP.

For more information, see the following chapters:

- Defining CF (coupling) links is described in Chapter 9, “Defining Coupling Facility links” on page 169.
- Defining channel-to-channel (CTC) is described in Chapter 16, “Defining channel-to-channel connections” on page 357.
- Defining the CF LPAR is described on 14.2.1, “Defining Coupling Facility LPARs in a channel subsystem” on page 308.
- Defining the image profile is described in 5.4, “Creating an image profile on the Support Element” on page 105.

8.2 Preparing for non-sysplex system time synchronization

If your IBM z17 is not part of a Parallel Sysplex but you want to synchronize the time among multiple CPCs, you need the STP function and timing-only links. The following configuration steps are required:

1. Define timing-only links.
2. Configure STP.

Defining timing-only links is described in 9.4, “Defining an STP timing-only link by using ICA SR” on page 187.

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 is implemented in the Licensed Internal Code (LIC) as a chargeable feature. You must order STP enablement Feature Code 1021 to use STP.

In a timing network that is based on STP, the concept of *stratum levels* defines the hierarchy of servers in the timing network:

- A stratum 1 server is the highest level in the hierarchy of a timing network that uses STP to synchronize with CST. The stratum 1 server has a direct connection to the Precision Time Protocol (PTP) or Network Time Protocol (NTP) servers.
- Stratum 2 and stratum 3 levels are determined by how many stratum levels they are away from stratum 1.
- A server that uses STP messages to synchronize with a stratum 1 server is referred to as a stratum 2 server.
- Similarly, a server that uses STP messages to synchronize with a stratum 2 server is referred to as a stratum 3 server.
- Stratum level 4 servers use STP messages to synchronize with a stratum 3 server and have no direct STP link connections to the stratum level 1 server, which is the Current Time Server (CTS).

For more information about STP concepts and planning information, see *IBM Z Time Synchronization Implementation Guide*, SG24-8480.

Beginning with IBM z15, STP stratum level 4 is supported. Timekeeping information is transmitted over coupling links.

> **Note:** Stratum 4 is a temporary status that allows more flexibility to move and replace machines and to reconfigure the CTN. Although STP stratum level 4 is supported, it should not be used in permanent configurations. Stratum 4 should be used only for transitional configurations during CTN maintenance.

Figure 8-1 shows a diagram of a CTN.

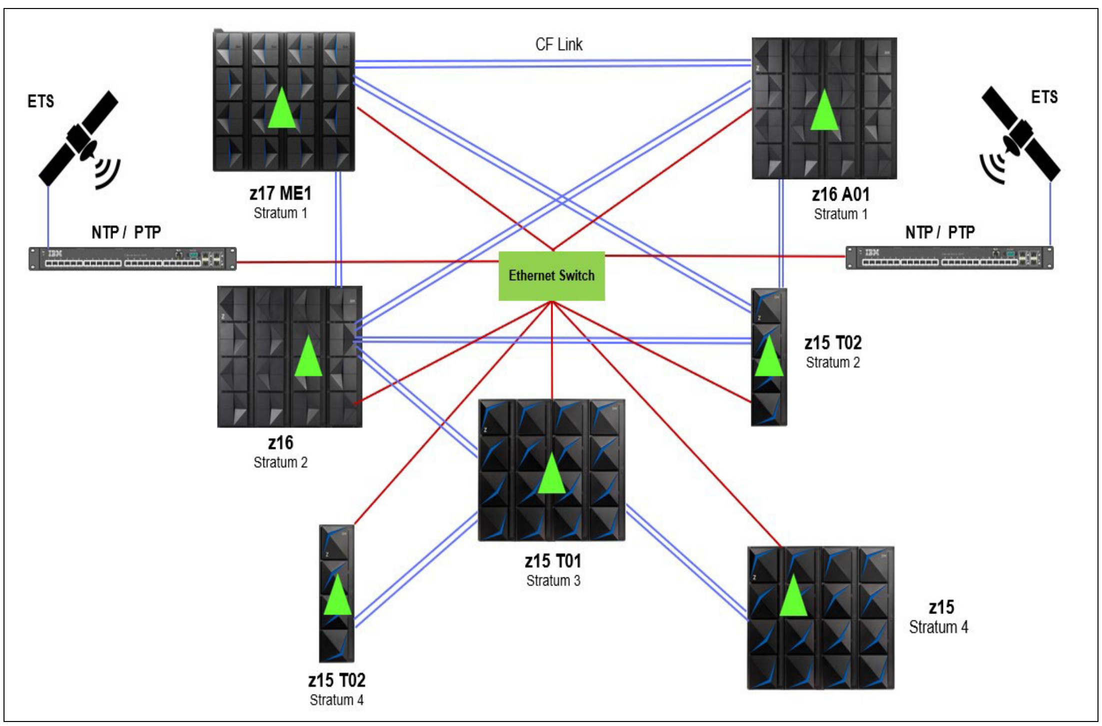


Figure 8-1 Diagram of a CTN

Note: Figure 8-1 on page 157 shows only one Ethernet switch to simplify the figure. As a best practice, use at least two Ethernet switches in your configuration to improve availability.

8.3.1 External Time Source

For IBM Z machines before IBM z15, the external time reference is typically NTP. Starting with IBM z15, support for IEEE 1588 (PTP) was added. Before IBM z16, the external time reference network connectivity occurred through the internal Support Element (SE) management network interface.

With IBM z17 and IBM z16, you can access the External Time Source (ETS) by connecting the CPC directly to the client network. This connection provides access to the PTP or NTP time reference and bypasses the SE and the internal network. PTP or NTP traffic is delivered to the CPC through Ethernet connectivity to the IBM z17 CPC drawer. The hardware features timestamping capabilities, enabling IBM z17 to use the accuracy of PTP. In IBM z17, a container firmware partition provides time protocol support for both NTP and PTP.

For clients requiring a Coordinated Universal Time accuracy under 100 milliseconds, pulse per second (PPS) connectivity is also available. To provide NTP or PTP data, connect the NTP or PTP servers directly to the CPC.

Note: With IBM z17, a new BMC or OSC card is implemented. Each CPC drawer includes two combined BMC or OSC cards, each with one PPS port and one ETS port (RJ45 Ethernet, supporting both PTP and NTP). For PPS signal redundancy, connect two PTP or PPS ports. Ensure that point-to-point connections do not exceed 150 meters.

Figure 8-2 on page 159 shows a sample PTP ETS configuration for the STP.

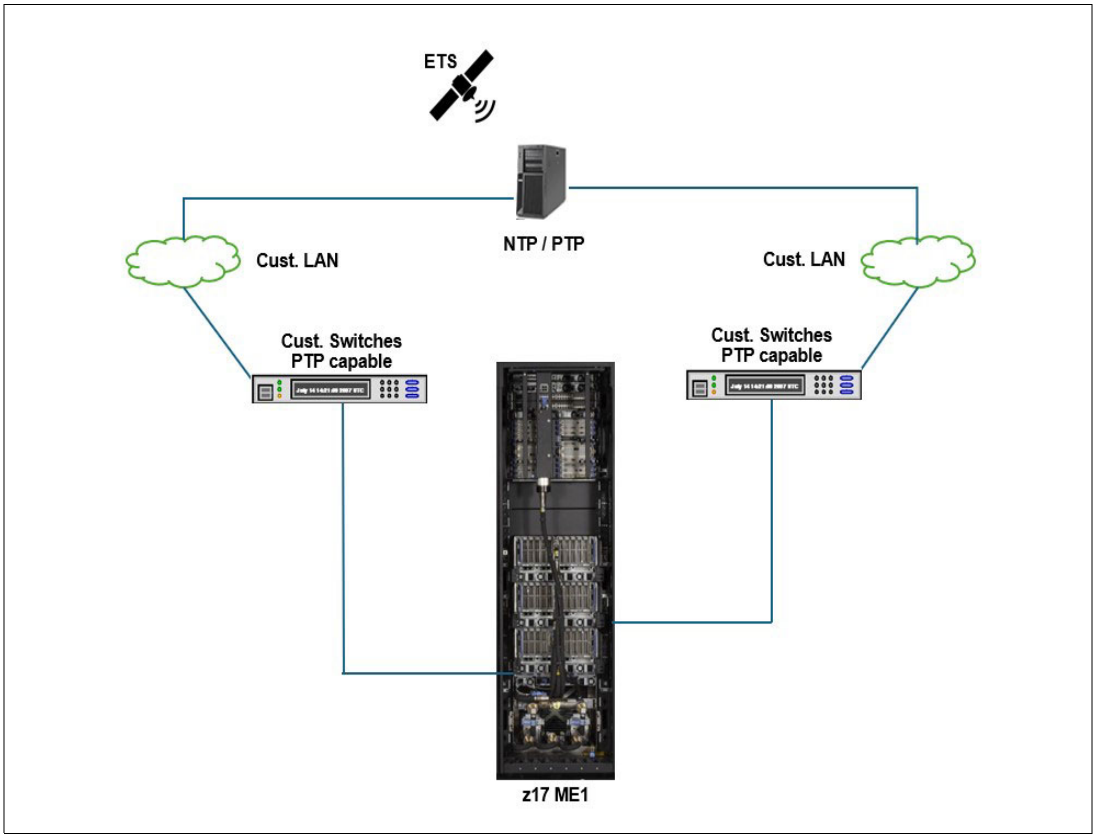


Figure 8-2 Example configuration: PTP time server configuration

For more information about this topic, see "STP PTP/NTP Time Direct to CEC Accuracy Performance".

8.3.2 Configuring the HMC as an NTP server

On IBM z17, up to three NTP servers and two PTP servers can connect directly to the CPC. In addition, NTP can be secured with Network Time Security (NTS). This configuration is considered as a best practice and provides the highest accuracy and availability for External Time Sources (ETSs).

However, potential security concerns can arise when you connect the CPC to a network other than the physically isolated Support Element (SE) local area network (LAN). For these cases, although not recommended, you can define an NTP server on the Hardware Management Console (HMC) and use it as the ETS for your Coordinated Timing Network (CTN).

The HMC includes two physically isolated LAN ports. One port connects to the SE LAN, and the other port can connect to an external NTP server. The NTP server on the HMC can access another NTP server through a separate LAN connection to obtain its time reference (see Figure 8-3). The NTP server function on the HMC provides only NTP, not PTP or PPS. This configuration provides less accuracy and redundancy than the recommended setup with multiple directly connected time sources.

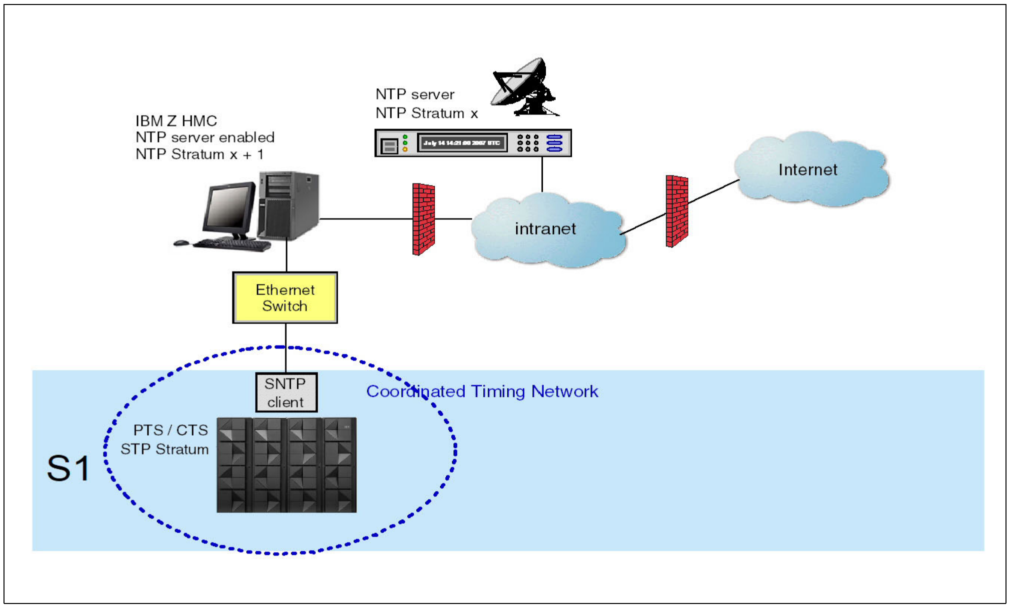


Figure 8-3   An HMC configured as an NTP server

> **Note:** As a best practice for security reasons, connect the ETS ports to a protected network through a firewall to access external time servers (PTP or NTP). This best practice also applies to ETS connectivity directly to the CPC.

For more information, see *IBM Z Time Synchronization Implementation Guide*, SG24-8480.

8.4 HMC 2.17.0 (Manage System Time task)

Set up STP through the HMC Manage System Time task.

Figure 8-4 on page 161 shows the initial window of the Manage System Time task on the HMC.

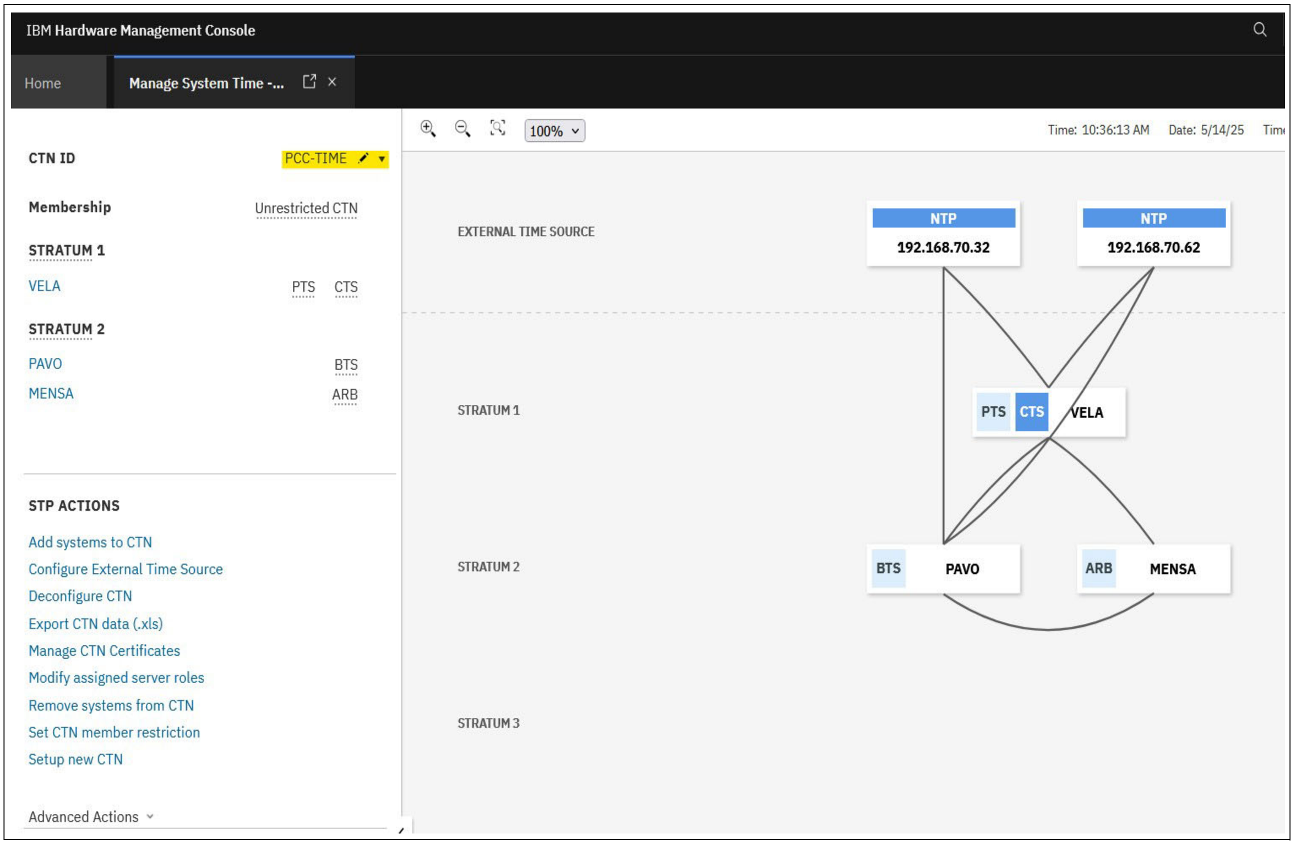


Figure 8-4 A CTN with two external time sources

You can display the CTN configuration for any CPC object that the HMC manages. To display a CTN, click the down arrow icon next to the CTN ID name. Access the configuration wizard from the menu under STP ACTIONS.

> **Note:** NTP servers that are configured as an ETS show their IP addresses instead of server names.

In the initial window of the Manage System Time task, the CTN topology appears as a graph. 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, as shown in Figure 8-5 for a CPC and in Figure 8-6 on page 163 for a CF link.

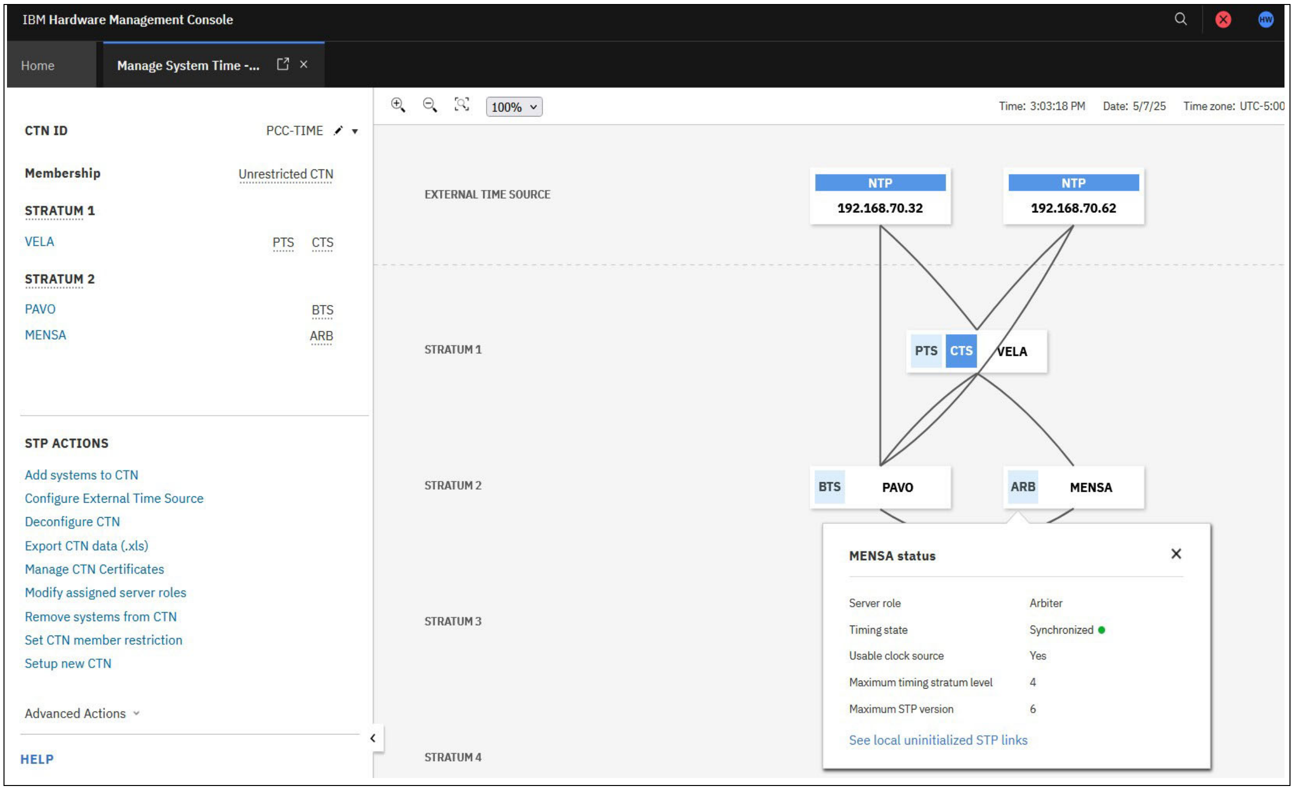


Figure 8-5 CPC status display

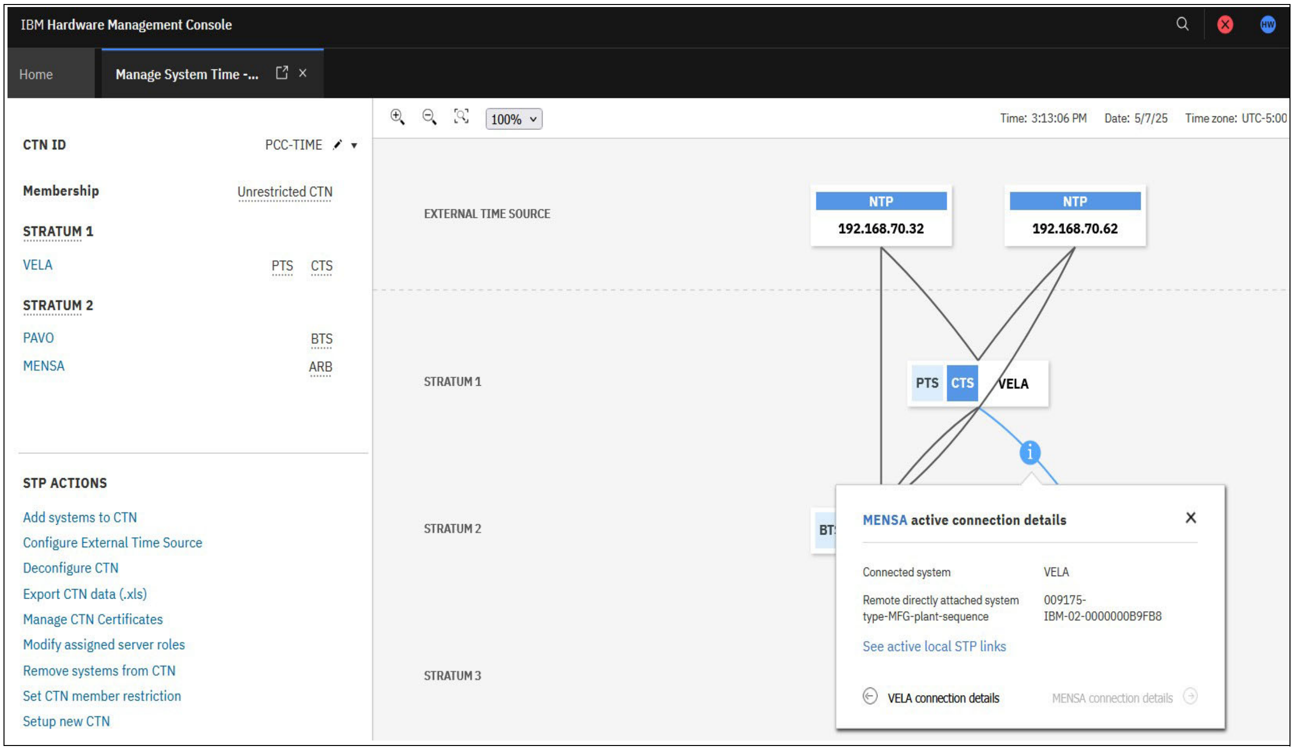


Figure 8-6   Coupling and timing link status display

8.4.1 Setting CTN member restrictions

For a single-server or dual-server CTN, restrict CTN membership by selecting **Only allow the server(s) specified above to be in the CTN** in this menu. This setting preserves the configuration across power-on resets (PORs) for STP-only CTNs with one or two servers, also known as *bounded CTNs*.

8.4.2 HMC operations to add a CPC to the CTN

To add a CPC to an existing STP-only CTN, complete the following steps:

1. Open the **Manage System Time** task from the HMC, and select **Add CPC to CTN** from **STP ACTIONS** (Figure 8-7).

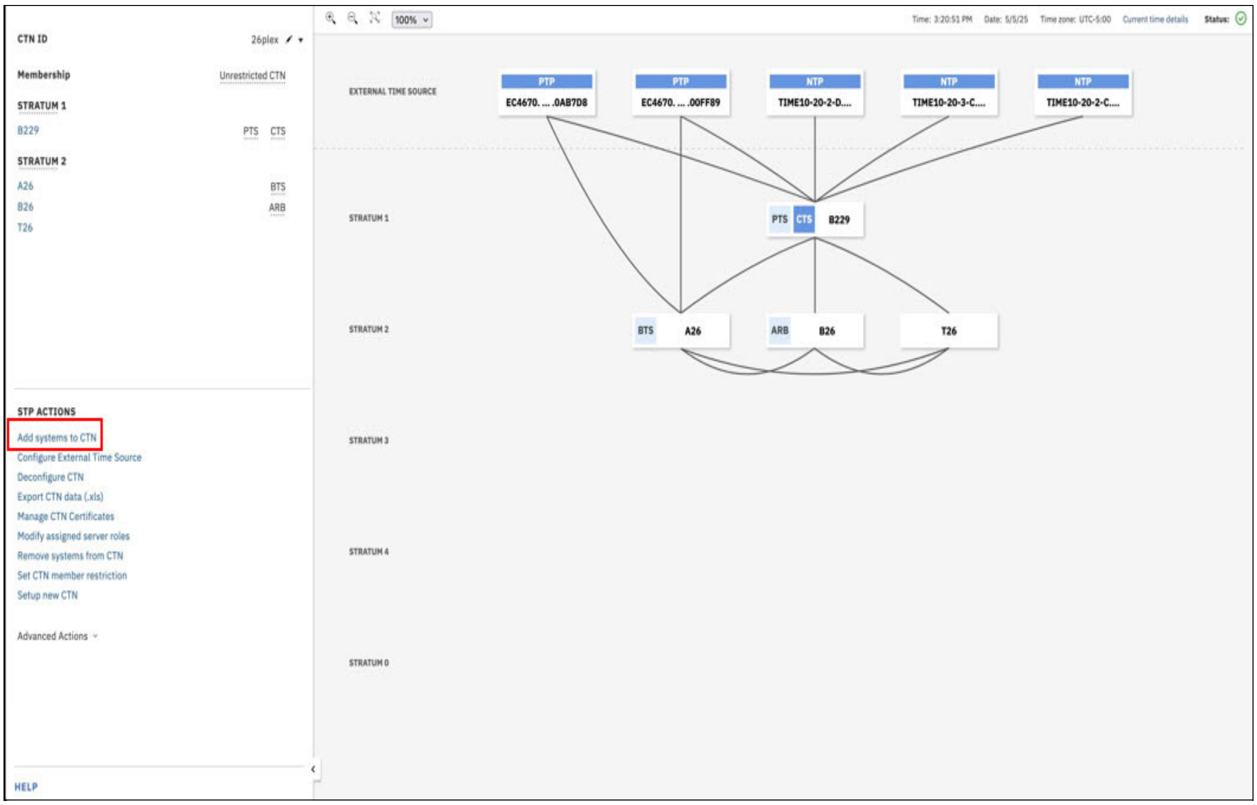


Figure 8-7 Add a CPC to a CTN

> **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**. The “Membership” information should show “Unrestricted CTN”.

2. The Specify Coordinated Timing Network (CTN) Members window opens. In this window, select the CPC name that does not belong to any CTN and should be added to your CTN. In this example, we chose CPC **A26** (Figure 8-8). Click **Next** to continue.

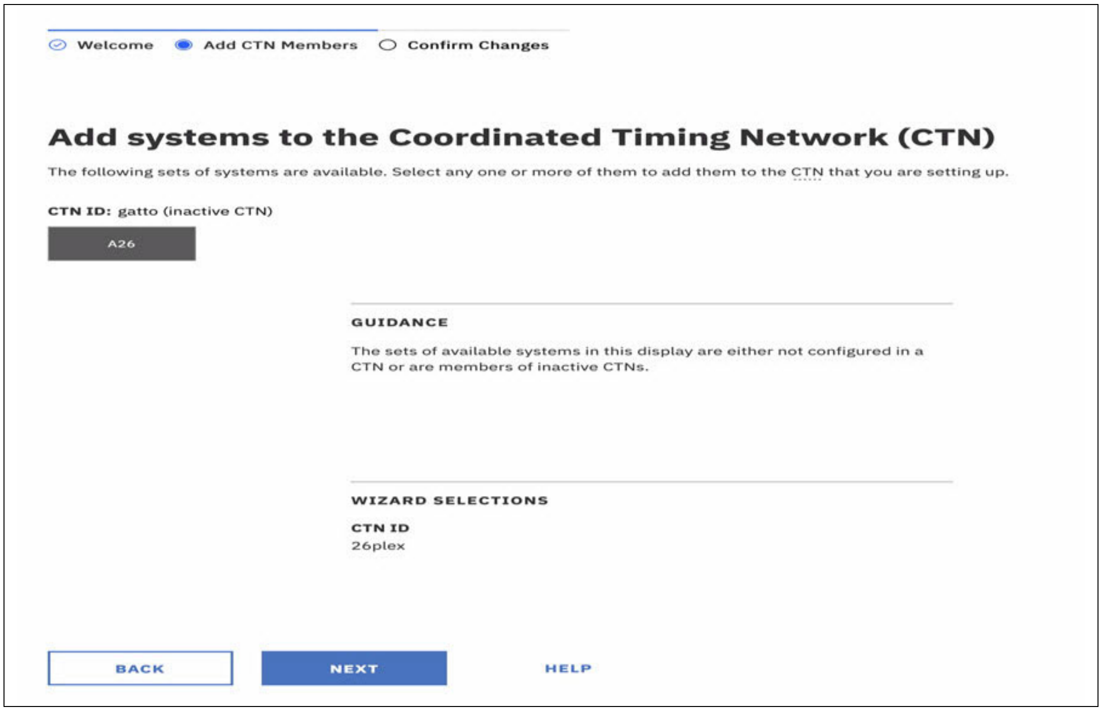


Figure 8-8 Adding a system to a CTN

3. The Confirm Changes window opens and shows you how and on which STRATUM level the new CPC will be added, as shown in Figure 4. Click **APPLY** to continue.

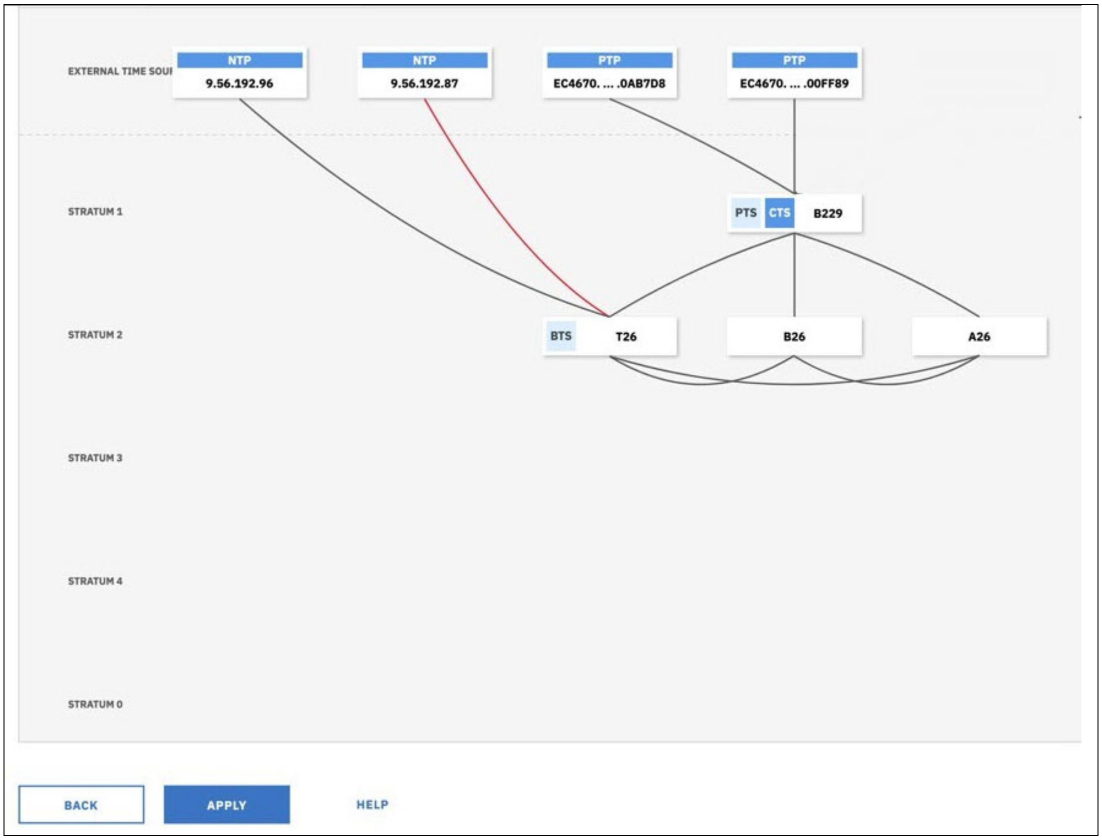


Figure 8-9 Clicking APPLY to add a CPC to a CTN

4. You see the Local CTN ID change confirmation for the selected CPC. After you select **APPLY**, the Complete message window opens. Click **Close** to complete the operation.

8.4.3 Verifying the new CTN configuration

When the new CTN configuration completes, the Manage System Time initial window opens again, showing the changed CTN.

Check that the following items are defined correctly in the window:

- Status
- CTN ID
- Time / Date / Time zone
- Stratum Level
- STP Role

You can also check the status of STP by running the z/OS **D ETR** command (Example 8-1).

Example 8-1 The D ETR display command

```
D ETR
IEA386I 11.48.43 TIMING STATUS 977
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = PCC-TIME     ETS ID = DNTP (Direct attachment using NTP)
  ETS Timing Precision = 2
  THE STRATUM 1 NODE ID = 003932.AGZ.IBM.02.000000087F28
  THIS IS THE ARBITER SERVER
  NUMBER OF USABLE TIMING LINKS =  7
```

For more information, see *IBM Z Time Synchronization Implementation Guide*, SG24-8480.

9

Defining Coupling Facility links

This chapter describes the coupling connectivity options and the Parallel Sysplex clustering enhancements that are available on an IBM z17 system. This chapter also provides coupling link configuration examples for Parallel Sysplex and Server Time Protocol (STP).

For more information about the enhancements that were made in Coupling Facility (CF) level 26, see *IBM z17 (9175) Technical Guide*, SG24-8579.

Note: The examples that are shown in this chapter are based on the IBM z17 ME1 (9175).

This chapter includes the following topics:

- Coupling connectivity options for Parallel Sysplex on IBM z17
- Defining Coupling Express3 Long Reach
- Defining Integrated Coupling Adapter Short Reach
- Defining an STP timing-only link by using ICA SR
- CF LPAR setup and Coupling Facility Control Code Level 26
- Dynamic I/O for Stand-alone Coupling Facility

9.1 Coupling connectivity options for Parallel Sysplex on IBM z17

Coupling connectivity for Parallel Sysplex on IBM z17 can use Coupling Express3 Long Reach (CE3 LR) and Integrated Coupling Adapter Short Reach 2.0 (ICA SR 2.0) features. The ICA SR feature supports distances of up to 150 meters. The CE3 LR feature supports distances up to 10 kilometers unrepeated between systems and up to 100 kilometers when used with a qualified Dense Wavelength Division Multiplexer (DWDM). The available options for coupling links on IBM z17 are shown in Figure 9-1.

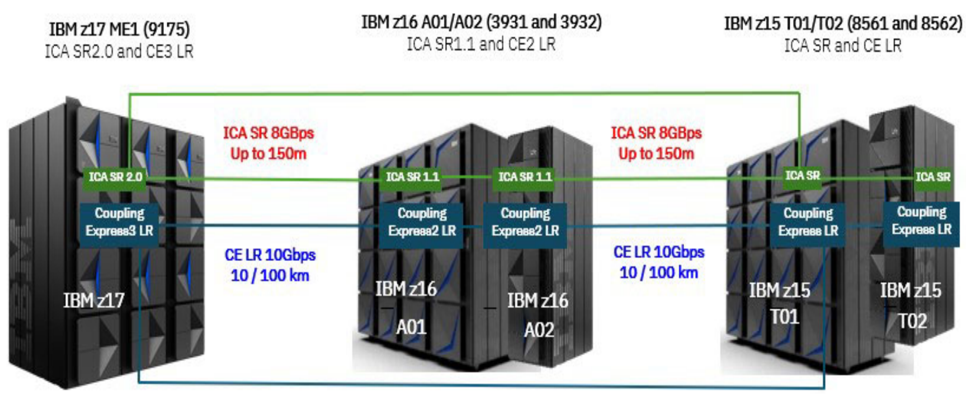


Figure 9-1 IBM z17 coupling connectivity

Internal Coupling (IC) links support internal communication between logical partitions (LPARs) on the same central processor complex (CPC) that runs Coupling Facilities (CFs) and z/OS images. The Licensed Internal Code (LIC) emulates the connection and provides fast, secure memory-to-memory communication between LPARs within a single system. No physical cabling is required for IC links. IC links use an Input/Output Configuration Program (ICP)-type channel path ID (CHPID).

Note: ICA SR, ICA SR 1.1, Coupling Express LR (CE LR), and Coupling Express2 LR (CE2 LR) are not available on IBM z17, either as new builds or carry-forward features. Only ICA SR 2.0 and CE3 LR external coupling links are supported.

9.1.1 Preparing to define Coupling Facility links

A good starting point for implementing coupling links is accurate, up-to-date documentation that clearly illustrates all required connections for the new or upgraded CPC.

When installing coupling links, ensure that you order enough ports to support your configuration and provide physical feature redundancy. Configure your Parallel Sysplex for the highest possible availability.

Parallel Sysplex failure independence depends on the z/OS to CF relationship and the elimination of single points of failure. For example, all connections to a structure on a Stand-alone Coupling Facility (SACF) are failure-independent. With an Internal Coupling Facility (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 IBM downloads website.

Evaluate the configuration to determine whether it includes any channel features that are not supported on IBM z17. Review the configuration for any channel types that cannot be carried forward or connected to IBM z17.

Ensure that all CPCs are connected to IBM z17 by using coupling links as follows: Only N, N-1, and N-2 IBM Z generations can coexist in the same Parallel Sysplex or STP Coordinated Timing Network (CTN). For example, IBM z17 provides coupling connectivity to IBM z16 A01 and IBM z16 A02 and IBM z15 T01 and IBM z15 T02 systems only through ICA SR 2.0 and CE3 LR features.

Note: Before performing an upgrade, deactivate any coupling links on other connected systems to prevent configuration errors.

If an IBM z17 serves in a CTN role (Preferred Time Server (PTS), Backup Time Server (BTS), or Arbiter), the other CTN role-playing CPCs must have coupling connectivity to IBM z17 systems of generations N, N-1, and N-2.

If coupling links connect across sites by using Dense Wavelength Division Multiplexing (DWDM), verify that the DWDM equipment you plan to use supports the respective coupling link technology and is qualified for 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 Express3 Long Reach

This section describes the implementation of the CE3 LR feature. Defining this CF link is part of the Define CF/STP link activity, which is shown in Figure 1-3 on page 5.

On IBM z17, the long-reach coupling link adapter hardware is upgraded from CE2 LR to the new Coupling Express3 Long Reach (CE3 LR) CX6-Long Wave (LX) adapter. A maximum of 32 CE3 LR adapters are supported per CPC.

The new CE3 LR adapter supports two varieties of optics: 10 Gb, as in previous models, and a new 25 Gb option that provides higher bandwidth and greater capacity and potential throughput.

When configured to use 10 Gb optics, the adapter remains compatible with existing CE LR and CE2 LR (CL5) links on previous systems such as IBM z16 and IBM z15, and is represented as a CL5 coupling link type.

Note: CL5 connects only to CL5. Use it for connections to previous systems that use CL5 or to other IBM z17 systems that still use CL5.

CE3 LR coexistence and migration are critical for the following reasons:

- IBM z17 CE3 LR 10 Gb links connect to existing CE LR links on IBM z15 and CE2 LR links on IBM z16 by using the same long-reach cabling.
- IBM z17 introduces support for CE3 LR 25 Gb Coupling Link adapters that provide long-distance coupling link connectivity with 25-Gb bandwidth (CL6), while continuing to support the existing 10-Gb bandwidth through CE3 LR 10 Gb (CL5). Plan the migration from CL5 to CL6 Coupling Links.

Important: The hardware generation that follows IBM z17 is planned to be the last IBM Z generation to support 10 Gb bandwidth (CL5) coupling links. The subsequent hardware generation is planned to support only 25 Gb bandwidth (CL6) coupling links for long-distance coupling link connectivity.

When configured to use 25 Gb optics, the adapter is incompatible with existing CE LR and CE2 LR CL5 links on previous systems and can connect only to another 25 Gb CE3 LR adapter. Because of this incompatibility, IBM defines and uses a new CL6 coupling link type.

- CL6 connects only to CL6. Use it only for connections to other IBM z17 systems that use CL6.
- Other than the higher bandwidth and new link type, CL6 functions similarly to CL5, except in the Hardware Configuration Definition (HCD) definitions:
  - CL5 defaults to the definition of eight subchannels or devices per CHPID, with an option for 32.
  - CL6 reverses this configuration: It defaults to 32 subchannels or devices per CHPID, with an option for eight.
- Because of its higher bandwidth, CL6 operates in a higher path selection preference tier than CL5. When other factors are equal, the system prefers CL6 CHPIDs over CL5.

9.2.1 CE3 LR 10 Gb (CL5) connections:

Figure 9-2 shows an example of a coupling link connection between an IBM z17 and an IBM z16 or IBM z15 that uses CHPID type CL5.

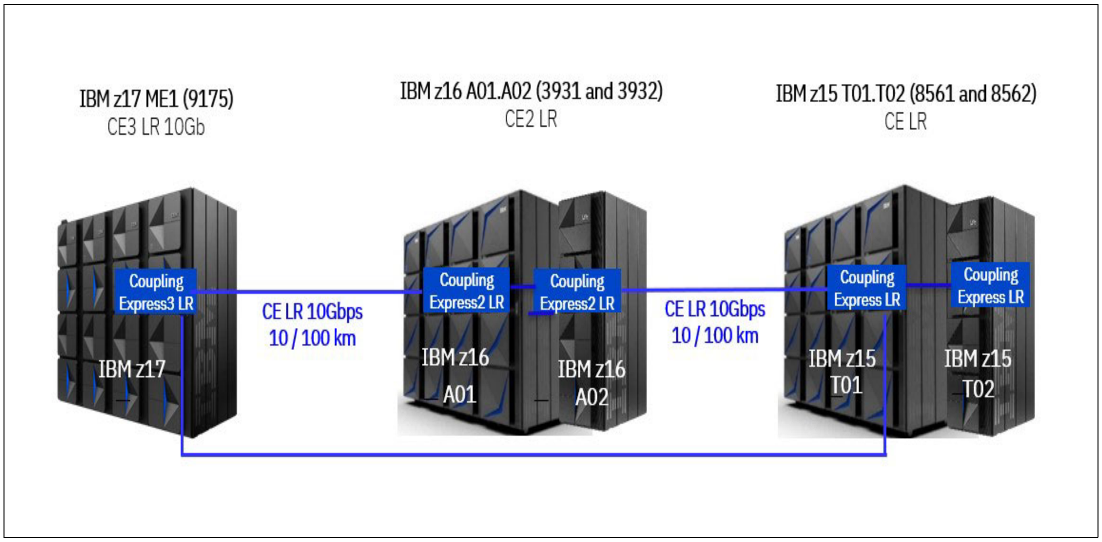


Figure 9-2 CF link connection that uses CL5

CE3 LR 10 Gb CL5 is defined in an input/output configuration data set (IOCDS). Although this feature is a Peripheral Component Interconnect Express (PCIe) feature, a physical channel ID (PCHID) is used instead of an adapter ID (AID) to identify the physical adapter.

Example 9-1 shows a sample extract from the Input/Output Configuration Program (IOCP) that defines the new CHPID type CL5 on IBM z16, which connects to IBM z17.

Example 9-1 IOCP definitions for CHPID Type CL5 on an IBM z16

```
ID     ..                                                         *
       ..                                                         *
       SYSTEM=(3931,1),LSYSTEM=PAVO,                              *
       TOK=('PAVO',008003009FB89175143413700125107F00000000,000*
       00000,'25-04-04','08:09:52','SYS9','IODF79')
RESOURCE PARTITION=((CSS(0),(PAVO0A,A),..                         *
       PAVO0C,C),(PAVO0D,D),(PAVO0E,E),(PAVO0F,F),(PAVO01,1),(P*
       ..                                                         *
       (CSS(3),(PAVO3A,A),(PAVO3B,B),(PAVO3C,C),(PAVO3D,D),(PAV*
       03E,E),..                                                  *
CHPID PATH=(CSS(3),88),SHARED,PARTITION=((PAVO3E),(=)),           *
       CPATH=(CSS(3),88),CSYSTEM=MENSA,PORT=1,PCHID=40C,          *
       TYPE=CL5
```

Example 9-2 shows a sample extract of the corresponding IOCP definition for a connecting CHPID Type CL5 on an IBM z17.

Example 9-2 IOCP definitions for CHPID Type CL5 on an IBM z17 system

```
ID    ..                                                      *
      ..
      SYSTEM=(9175,1),LSYSTEM=MENSA,                          *
      TOK=('MENSA',008003009FB89175143413700125107F00000000,00*
      000000,'25-04-17','14:34:13','SYS9','IODF79')
RESOURCE PARTITION=((CSS(0),(MENSA0A,A),(MENSA0B,B),(MENSA0C,C*
      ),(MENSA0D,D),(MENSA01,1),(MENSA02,2),(MENSA03,3),(MENSA*
      ..
      F,F),(MENSA31,1),(MENSA32,2),(MENSA33,3),(MENSA34,4),(ME*
      NSA35,5),...                                            *
CHPID PATH=(CSS(3,5),88),SHARED,                              *
      PARTITION=((CSS(3),(MENSA32,MENSA3E),(=)),(CSS(5),(MENSA*
      51),(=))),CPATH=(CSS(3),88),CSYSTEM=PAVO,PORT=1,        *
      PCHID=17C,TYPE=CL5
```

Note: When you connect CF sender and receiver channel paths or CF peer channel paths, 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 or devices to be defined.

For more information about how to define CHPID Type CL5 in HCD, see 14.2.4, “Defining CL5 and CL6 CHPIDs” on page 316.

9.2.2 Verifying the CE3 LR 10 Gb (CL5) configuration

After you activate the new configuration with the new CE3 LR (10 Gb) 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 88, run the **`D M=CHP(88)`** command, as shown in Example 9-3.

  Example 9-3 Displaying the status of CHPID 88

```
D M=CHP(88)
IEE174I 09.27.10 DISPLAY M 378
CHPID 88:  TYPE=34, DESC=COUPLING OVER ROCE 10G, ONLINE
COUPLING FACILITY 003931.IBM.02.000000071A08
                  PARTITION: 3E  CPCID: 00
NAMED CF78        CONTROL UNIT ID: FFF0

PATH        PHYSICAL              LOGICAL  CHANNEL TYPE      CAID POR
88 / 040C   ONLINE                ONLINE   CL5 10GbE-RoCE    017C  01

COUPLING FACILITY SUBCHANNEL STATUS
 TOTAL:   96   IN USE:   72   NOT USING:    0   NOT USABLE:   24
 OPERATIONAL DEVICES / SUBCHANNELS:
     FD2E / 170D     FD2F / 170E     FD30 / 170F     FD31 / 1710
     FD32 / 1711     FD33 / 1712     FD34 / 1713     FD35 / 1714
     FD36 / 1715     FD37 / 1716     FD38 / 1717     FD39 / 1718
```

```
FD3A / 1719     FD3B / 171A     FD3C / 171B     FD3D / 171C
FD3E / 171D     FD3F / 171E     FD40 / 171F     FD41 / 1720
FD42 / 1721     FD43 / 1722     FD44 / 1723     FD45 / 1724
FD46 / 1725     FD47 / 1726     FD48 / 1727     FD49 / 1728
FD4A / 1729     FD4B / 172A     FD4C / 172B     FD4D / 172C
FDF5 / 172D     FDF6 / 172E     FDF7 / 172F     FDF8 / 1730
FDF9 / 1731     FDFA / 1732     FDFB / 1733     FDFC / 1734
FDFD / 1735     FDFE / 1736     FDFF / 1737     FE00 / 1738
FE01 / 1739     FE02 / 173A     FE03 / 173B     FE04 / 173C
FE05 / 173D     FE06 / 173E     FE07 / 173F     FE08 / 1740
FE09 / 1741     FE0A / 1742     FE0B / 1743     FE0C / 1744
FE0D / 1745     FE0E / 1746     FE0F / 1747     FE10 / 1748
FE11 / 1749     FE12 / 174A     FE13 / 174B     FE14 / 174C
FE35 / 174D     FE36 / 174E     FE37 / 174F     FE38 / 1750
FE39 / 1751     FE3A / 1752     FE3B / 1753     FE3C / 1754
FE3D / 1755     FE3E / 1756     FE3F / 1757     FE40 / 1758
FE41 / 1759     FE42 / 175A     FE43 / 175B     FE44 / 175C
FE45 / 175D     FE46 / 175E     FE47 / 175F     FE48 / 1760
FE49 / 1761     FE4A / 1762     FE4B / 1763     FE4C / 1764
FE4D / 1765     FE4E / 1766     FE4F / 1767     FE50 / 1768
FE51 / 1769     FE52 / 176A     FE53 / 176B     FE54 / 176C
```

- 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.

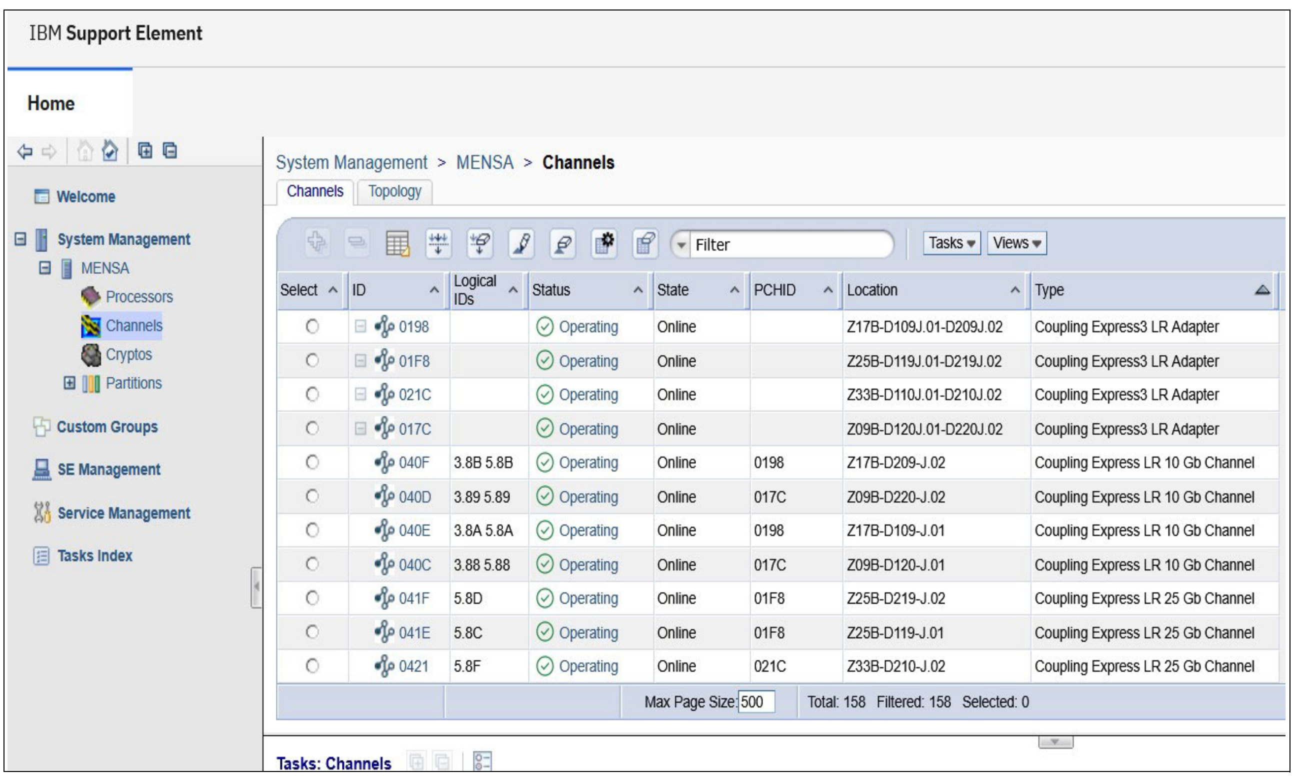


Figure 9-3 SE Systems Management and channels

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.

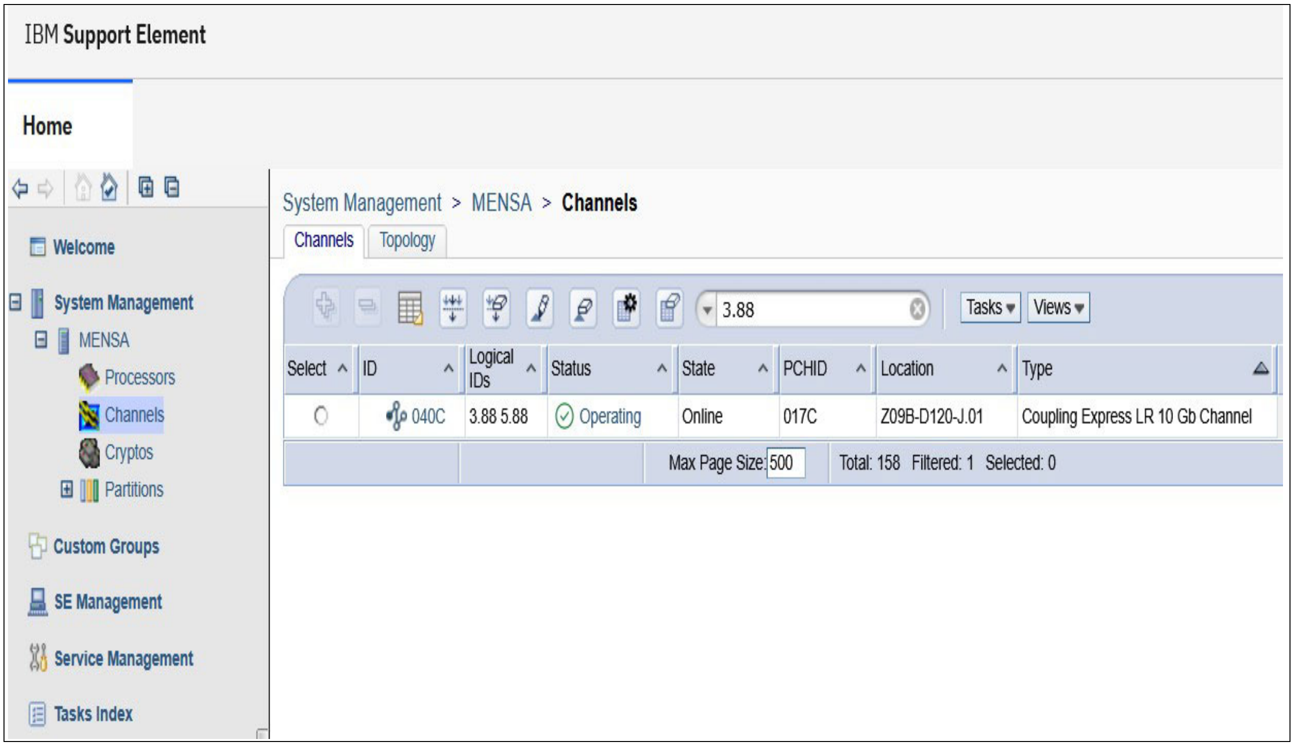


Figure 9-4 Verifying channel CL5 by using the CPC view

For more information about the PCHID, click the PCHID to show its details, as shown in Figure 9-5.

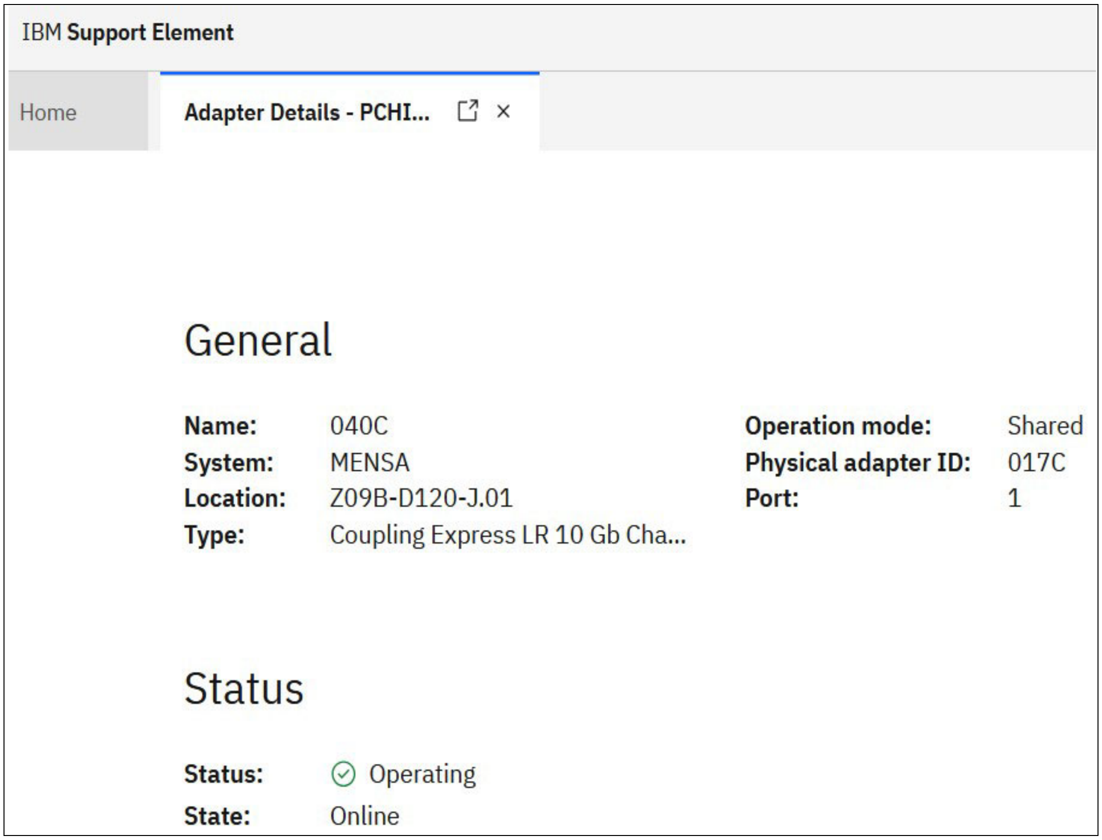


Figure 9-5 CL5 PCHID details

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.

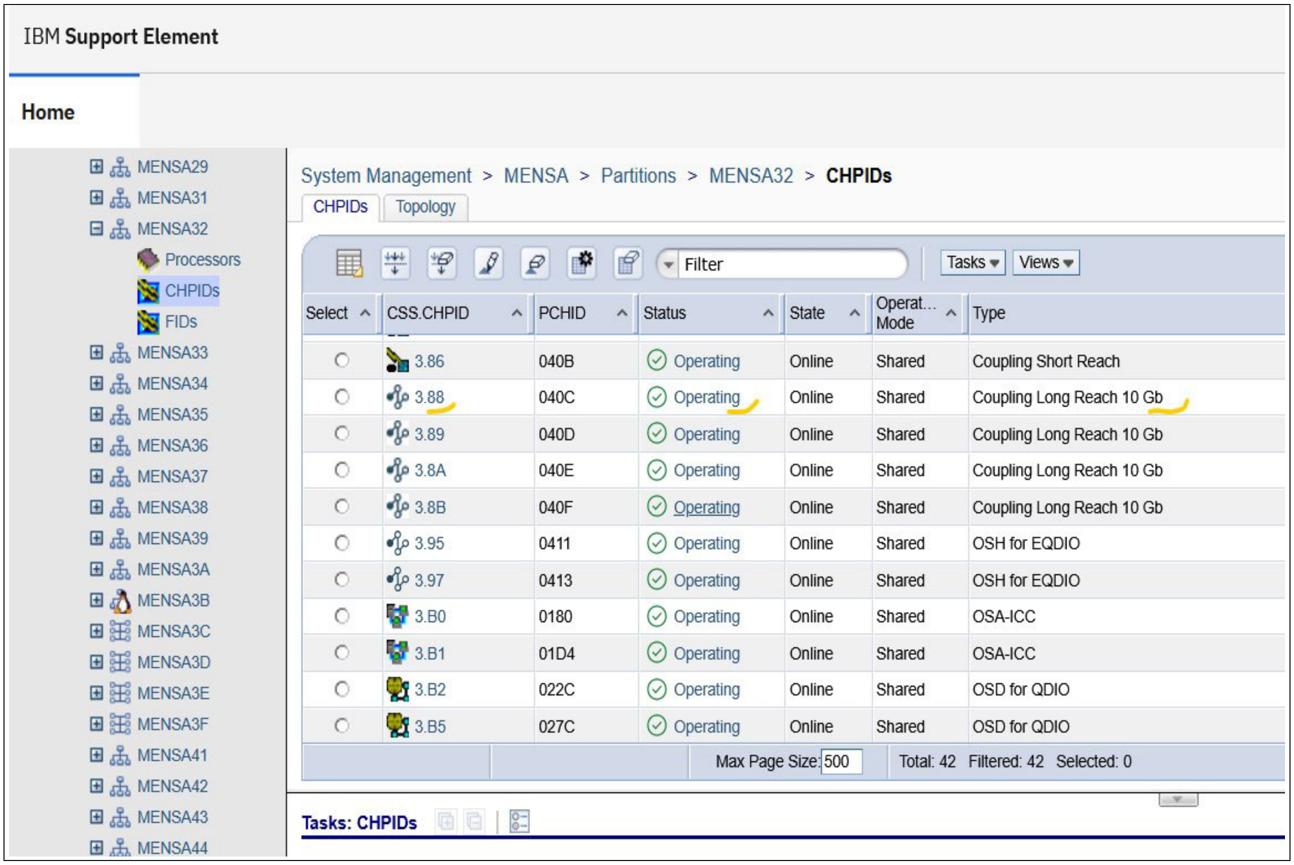


Figure 9-6 SE Verify channel LPAR view

9.2.3 CE3 LR 25 Gb (CL6) connections

This example shows the connection of a coupling link between two IBM z17 systems by using CHPID type CL6 (see Figure 9-7 on page 179).

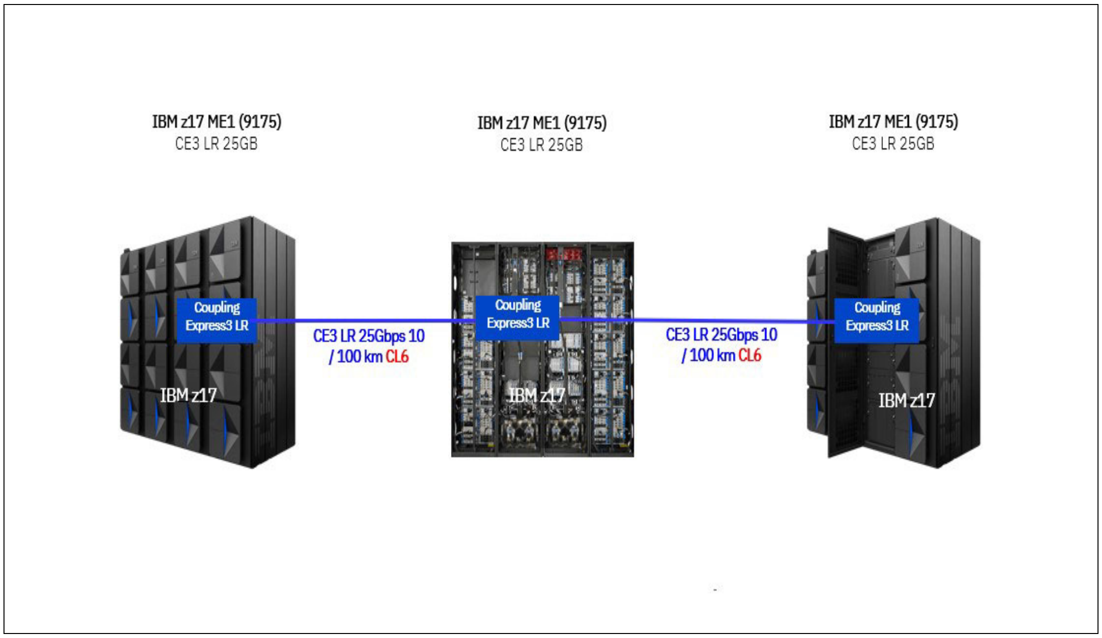


Figure 9-7 CF link connection that uses CL6

External connectivity between IBM z17 systems supports the new 25 Gb CE3 LR links. These connections are defined as a new CHPID type that is called CL6, replacing the CL5 type that is used for CE3 LR 10 Gb links. CL6 channels are defined in the same way as CL5 channels but default to 32 subchannels or devices per CHPID, with an option for eight.

Example 9-4 shows a sample extract from the corresponding IOCP definition for a connecting CHPID type CL5 on an IBM z17.

Example 9-4 IOCP definitions for CHPID Type CL6 on a z17 system

```
ID     MSG1='IODF79',MSG2='SYS9.IODF79 - 2025-04-17 14:34',     *
       SYSTEM=(9175,1),LSYSTEM=MENSA,                           *
       TOK=('MENSA',008003009FB89175143413700125107F00000000,00*
       000000,'25-04-17','14:34:13','SYS9','IODF79')
       .....
RESOURCE PARTITION=((CSS(3),(MENSA3A,A),(MENSA3B,B),(MENSA3C,C*
       ),(MENSA3D,D),(MENSA3E,E),(MENSA3F,F),(MENSA31,1),(MENSA*
       32,2),(MENSA33,3),(MENSA34,4),(MENSA35,5),(MENSA36,6),(M*
       ENSA37,7),(MENSA38,8),(MENSA39,9))),                     *
       .....
CHPID PATH=(CSS(3),C0),SHARED,PARTITION=((MENSA32),(=)),        *
       TPATH=((CSS(3),MENSA,C4),(CSS(3),MENSA,C0,FFE8,FD0E,32))*
       ,DESC='LR 25G',PORT=1,PCHID=1F8,TYPE=CL6
CHPID PATH=(CSS(3),C1),SHARED,PARTITION=((MENSA32),(=)),        *
       TPATH=((CSS(3),MENSA,C5),(CSS(3),MENSA,C1,FFE8,FCEE,32))*
       ,DESC='LR 25G',PORT=2,PCHID=1F8,TYPE=CL6
CHPID PATH=(CSS(3),C2),SHARED,PARTITION=((MENSA32),(=)),        *
       TPATH=((CSS(3),MENSA,C6),(CSS(3),MENSA,C2,FFE9,FC7E,32))*
       ,DESC='LR 25G',PORT=1,PCHID=1F8,TYPE=CL6
CHPID PATH=(CSS(3),C3),SHARED,PARTITION=((MENSA32),(=)),        *
       TPATH=((CSS(3),MENSA,C7),(CSS(3),MENSA,C3,FFE9,FC5E,32))*
       ,DESC='LR 25G',PORT=2,PCHID=1F8,TYPE=CL6
CHPID PATH=(CSS(3),C4),SHARED,PARTITION=((MENSA3E),(=)),        *
```

```
      TPATH=((CSS(3),MENSA,C0,FFE8,FD0E,32),(CSS(3),MENSA,C4))*
      ,DESC='LR 25G',PORT=1,PCHID=21C,TYPE=CL6
CHPID PATH=(CSS(3),C5),SHARED,PARTITION=((MENSA3E),(=)),      *
      TPATH=((CSS(3),MENSA,C1,FFE8,FCEE,32),(CSS(3),MENSA,C5))*
      ,DESC='LR 25G',PORT=2,PCHID=21C,TYPE=CL6
CHPID PATH=(CSS(3),C6),SHARED,PARTITION=((MENSA3F),(=)),      *
      TPATH=((CSS(3),MENSA,C2,FFE9,FC7E,32),(CSS(3),MENSA,C6))*
      ,DESC='LR 25G',PORT=1,PCHID=21C,TYPE=CL6
CHPID PATH=(CSS(3),C7),SHARED,PARTITION=((MENSA3F),(=)),      *
      TPATH=((CSS(3),MENSA,C3,FFE9,FC5E,32),(CSS(3),MENSA,C7))*
      ,DESC='LR 25G',PORT=2,PCHID=21C,TYPE=CL6
```

Referring to the configuration in Example 9-4 on page 179, in HCD of the CF Channel Path Connectivity List panel, you can see the CF links that are connected, including several CL6 links, as shown in Example 9-5.

Example 9-5 CF Channel Path Connectivity List

```
---------------------------------------------------------------------------
                      CF Channel Path Connectivity List             Row 1 of 10
 Command ===> ____________________________________________ Scroll ===> PAGE

 Select one or more channel paths, then press Enter.

 Source processor ID . . . . . : MENSA     Mensa
 Source channel subsystem ID . : 5
 Source partition name . . . . : *

   ----------Source----------   -----------Destination-----------   -CU-  -#-
 / CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
 _ 85  04/2  Y  CS5  SHR  N     VELA.2     D3  04/2  Y  CS5  SHR    CFP   32
 _ 87  10/2  Y  CS5  SHR  N     VELA.2     D7  06/2  Y  CS5  SHR    CFP   32
 _ 88  17C/1 Y  CL5  SPAN N     PAVO.3     88  1B8/1 Y  CL5  SHR    CFP   32
 _ 89  17C/2 Y  CL5  SPAN N     PAVO.3     8B  1DC/2 Y  CL5  SHR    CFP   32
 _ 8A  198/1 Y  CL5  SPAN N     PAVO.3     8A  1DC/1 Y  CL5  SHR    CFP   32
 _ 8B  198/2 Y  CL5  SPAN N     PAVO.3     89  1B8/2 Y  CL5  SHR    CFP   32
 _ 8C  1F8/1 N  CL6  SHR  N     MENSA.5    8E  21C/1 Y  CL6  SHR    CFP   32
 _ 8D  1F8/2 N  CL6  SHR  N     MENSA.5    8F  21C/2 Y  CL6  SHR    CFP   32
 _ 8E  21C/1 Y  CL6  SHR  N     MENSA.5    8C  1F8/1 N  CL6  SHR    CFP   32
 _ 8F  21C/2 Y  CL6  SHR  N     MENSA.5    8D  1F8/2 N  CL6  SHR    CFP   32
 ******************************* Bottom of data ******************************
```

9.2.4 Verifying the CE3 LR 25 Gb (CL6) configuration

After you activate the configuration with the new CE3 LR 25 Gb CF links and connect all cables, verify that the CHPIDs are online and operating by using z/OS or the SE windows.

You can check the status by using z/OS commands. For example, to check the status of CHPID 88, run the **D M=CHP(C0)** command, as shown in Example 9-6 on page 181.

Example 9-6 Displaying the status of CHPID C0

```
D M=CHP(C0)
IEE174I 15.21.52 DISPLAY M 549
CHPID C0:  TYPE=37, DESC=COUPLING OVER ROCE 25G, ONLINE
COUPLING FACILITY 009175.IBM.02.0000000B9FB8
                  PARTITION: 3E  CPCID: 00
NAMED CF76        CONTROL UNIT ID: FFE8

PATH        PHYSICAL              LOGICAL  CHANNEL TYPE      CAID PORT
C0 / 041E   ONLINE                ONLINE   CL6 25GbE-RoCE    01F8  01

COUPLING FACILITY SUBCHANNEL STATUS
 TOTAL:   80   IN USE:   80   NOT USING:    0   NOT USABLE:    0
 OPERATIONAL DEVICES / SUBCHANNELS:
     FCEE / 1839     FCEF / 183A     FCF0 / 183B     FCF1 / 183C
     FCF2 / 183D     FCF3 / 183E     FCF4 / 183F     FCF5 / 1840
     FCF6 / 1841     FCF7 / 1842     FCF8 / 1843     FCF9 / 1844
     FCFA / 1845     FCFB / 1846     FCFC / 1847     FCFD / 1848
     FCFE / 1849     FCFF / 184A     FD00 / 184B     FD01 / 184C
     FD02 / 184D     FD03 / 184E     FD04 / 184F     FD05 / 1850
     FD06 / 1851     FD07 / 1852     FD08 / 1853     FD09 / 1854
     FD0A / 1855     FD0B / 1856     FD0C / 1857     FD0D / 1858
     FD0E / 1859     FD0F / 185A     FD10 / 185B     FD11 / 185C
     FD12 / 185D     FD13 / 185E     FD14 / 185F     FD15 / 1860
     FD16 / 1861     FD17 / 1862     FD18 / 1863     FD19 / 1864
     FD1A / 1865     FD1B / 1866     FD1C / 1867     FD1D / 1868
     FD1E / 1869     FD1F / 186A     FD20 / 186B     FD21 / 186C
     FD22 / 186D     FD23 / 186E     FD24 / 186F     FD25 / 1870
     FD26 / 1871     FD27 / 1872     FD28 / 1873     FD29 / 1874
     FD2A / 1875     FD2B / 1876     FD2C / 1877     FD2D / 1878
     FF80 / 17CD     FF81 / 17CE     FF82 / 17CF     FF83 / 17D0
     FF84 / 17D1     FF85 / 17D2     FF86 / 17D3     FF87 / 17D4
     FFF0 / 17D5     FFF1 / 17D6     FFF2 / 17D7     FFF3 / 17D8
     FFF4 / 17D9     FFF5 / 17DA     FFF6 / 17DB     FFF7 / 17DC
```

You can also check the status by using the SE windows by completing the following steps:

1. From the HMC, select the CPC (under Systems Management) where the CHPID or PCHID that you want to verify is, and click **Single Object Operations** (under Recovery task options).

2. On the SE, select the same CPC and click **Channels**, as shown in Figure 9-8.

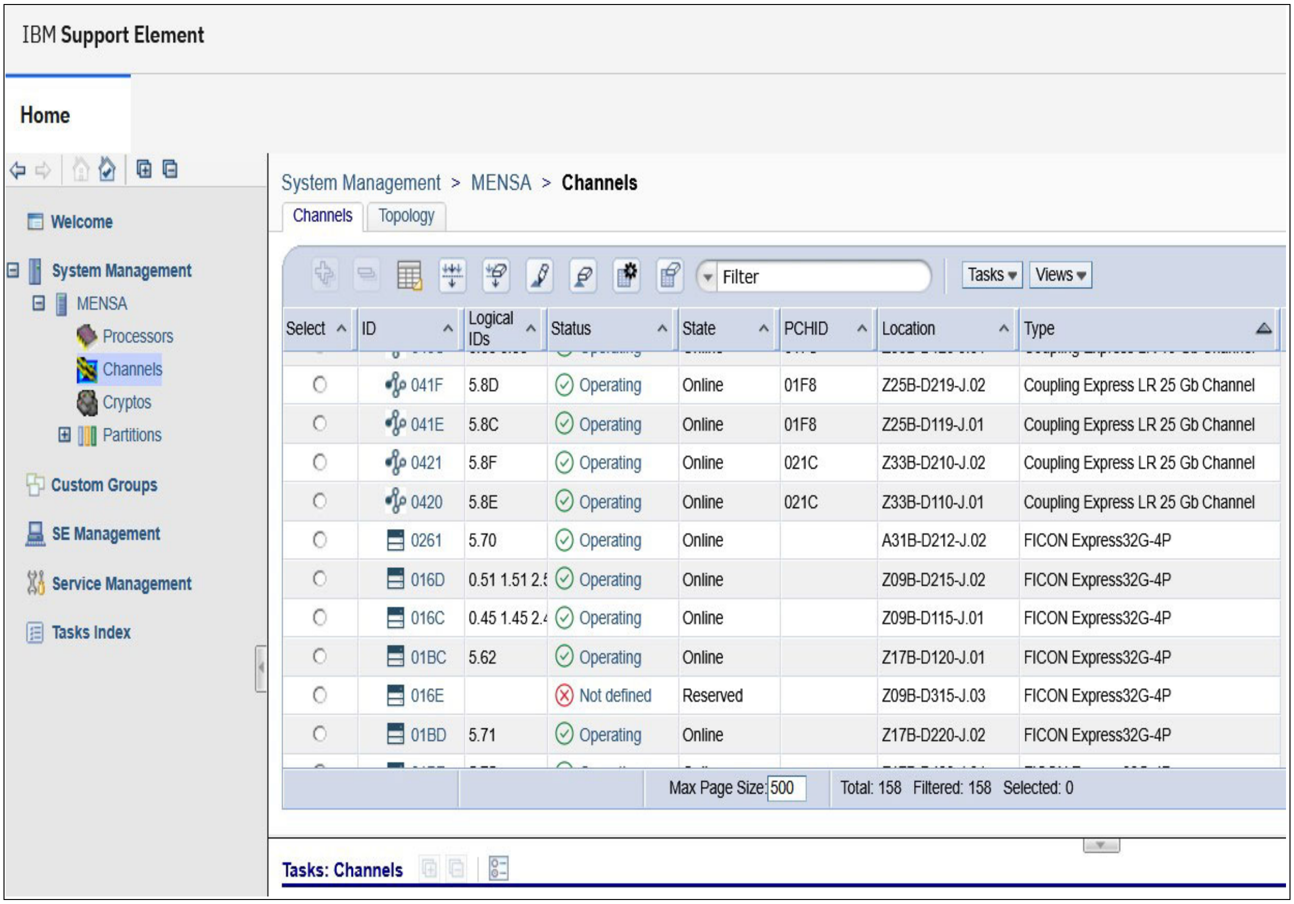


Figure 9-8 CL6 on SE Systems Management and channels

9.3 Defining Integrated Coupling Adapter Short Reach

This section describes the implementation of coupling links by using the ICA SR 2.0 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.

The ICA SR adapter on IBM z17 is changing from ICA SR 1.1 to a new ICA SR 2.0 adapter.

Note: ICA SR and ICA SR 1.1 will not be available on IBM z17.

ICA SR on IBM z17 is a follow-on to the ICA SR 1.0 and ICA SR 1.1 that is fully compatible with ICA SR and ICA SR 1.1. It has the following characteristics:

- Improved large block write command completion without direct memory access request (DREQ)
- Per-message protocol selection (versus full port)
- Fan-out in the CPC drawer, with 2 ports per fan-out with 150 as the maximum ICA SR distance
- Remains as link type CS5

- 8 primary send buffers per CHPID
- Four logical CHPIDs per port
- Maximum of 48 adapters (96 ports) per CPC

This section shows how to define a coupling link between an IBM z17 system and an IBM z15 or z16 system by using CHPID type CS5 (see Figure 9-9).

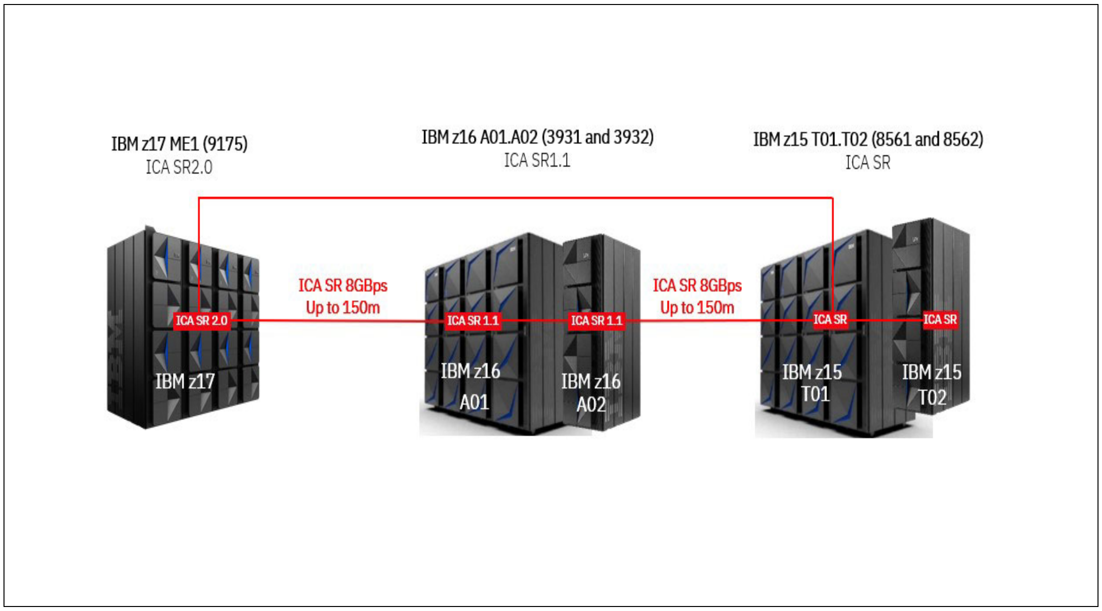


Figure 9-9 CF link CS5 connection from an IBM z17 to an IBM z15 or z16

The ICA SR is defined in an IOCDS-like PSIFB by using an AID to identify the physical adapter. Example 9-7 shows a sample extract of the corresponding IOCP definition for a connecting CHPID Type CS5 on an IBM z17.

Example 9-7 IOCP definitions for CHPID Type CS5 on an IBM z17

```
ID      MSG1='IODF79',MSG2='SYS9.IODF79 - 2025-04-17 14:34',     *
        SYSTEM=(9175,1),LSYSTEM=MENSA,                           *
        TOK=('MENSA',008003009FB8917514341370012510 7F00000000,00*
        000000,'25-04-17','14:34:13','SYS9','IODF79')
RESOURCE PARTITION=((CSS(0),(MENSA0A,A),(MENSA0B,B),(MENSA0C,C*
        ),(MENSA0D,D),(MENSA01,1),(MENSA02,2),(MENSA03,3),(MENSA*
        ....
        F,F),(MENSA31,1),(MENSA32,2),(MENSA33,3),(MENSA34,4),(ME*
        NSA35,5),(MENSA36,6),(MENSA37,7),(MENSA38,8),(MENSA39,9)*
        ....
CHPID PATH=(CSS(3),84),SHARED,                                   *
        PARTITION=((MENSA3E,MENSA32),(=)),CPATH=(CSS(3),85),     *
        CSYSTEM=PAVO,AID=04,PORT=1,TYPE=CS5
CHPID PATH=(CSS(3),86),SHARED,                                   *
        PARTITION=((MENSA3F,MENSA32),(=)),CPATH=(CSS(3),81),     *
        CSYSTEM=PAVO,AID=10,PORT=1,TYPE=CS5
```

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 313.

9.3.1 ICA SR: Verifying the configuration

After activating the configuration with the ICA SR CF links and all cables connected, verify whether the CHPIDs are online and operating by using a z/OS command or the SE windows.

You can check the status by using z/OS commands. For example, if you are interested in checking the status of CHPID 84, run a **D M=CHP(84)** command, as shown in Example 9-8.

Example 9-8 Displaying the status of CHPID 84

```
D M=CHP(84)
IEE174I 10.44.29 DISPLAY M 287
CHPID 84:  TYPE=33, DESC=COUPLING OVER PCIE, ONLINE
COUPLING FACILITY 003931.IBM.02.000000071A08
                  PARTITION: 3F  CPCID: 00
NAMED CF79        CONTROL UNIT ID: FFFB

PATH       PHYSICAL              LOGICAL  CHANNEL TYPE     CAID PORT
84 / 040A  ONLINE                ONLINE   CS5 8X-PCIE3     0004  01

COUPLING FACILITY SUBCHANNEL STATUS
 TOTAL:   96   IN USE:   72   NOT USING:    0   NOT USABLE:   24
 OPERATIONAL DEVICES / SUBCHANNELS:
     FD75 / 176D     FD76 / 176E     FD77 / 176F     FD78 / 1770
     FD79 / 1771     FD7A / 1772     FD7B / 1773     FD7C / 1774
     FD7D / 1775     FD7E / 1776     FD7F / 1777     FD80 / 1778
     FD81 / 1779     FD82 / 177A     FD83 / 177B     FD84 / 177C
     FD85 / 177D     FD86 / 177E     FD87 / 177F     FD88 / 1780
     FD89 / 1781     FD8A / 1782     FD8B / 1783     FD8C / 1784
     FD8D / 1785     FD8E / 1786     FD8F / 1787     FD90 / 1788
     FD91 / 1789     FD92 / 178A     FD93 / 178B     FD94 / 178C
     FDB5 / 178D     FDB6 / 178E     FDB7 / 178F     FDB8 / 1790
     FDB9 / 1791     FDBA / 1792     FDBB / 1793     FDBC / 1794
     FDBD / 1795     FDBE / 1796     FDBF / 1797     FDC0 / 1798
     FDC1 / 1799     FDC2 / 179A     FDC3 / 179B     FDC4 / 179C
     FDC5 / 179D     FDC6 / 179E     FDC7 / 179F     FDC8 / 17A0
     FDC9 / 17A1     FDCA / 17A2     FDCB / 17A3     FDCC / 17A4
     FDCD / 17A5     FDCE / 17A6     FDCF / 17A7     FDD0 / 17A8
     FDD1 / 17A9     FDD2 / 17AA     FDD3 / 17AB     FDD4 / 17AC
     FE75 / 17AD     FE76 / 17AE     FE77 / 17AF     FE78 / 17B0
     FE79 / 17B1     FE7A / 17B2     FE7B / 17B3     FE7C / 17B4
     FE7D / 17B5     FE7E / 17B6     FE7F / 17B7     FE80 / 17B8
     FE81 / 17B9     FE82 / 17BA     FE83 / 17BB     FE84 / 17BC
     FE85 / 17BD     FE86 / 17BE     FE87 / 17BF     FE88 / 17C0
     FE89 / 17C1     FE8A / 17C2     FE8B / 17C3     FE8C / 17C4
     FE8D / 17C5     FE8E / 17C6     FE8F / 17C7     FE90 / 17C8
     FE91 / 17C9     FE92 / 17CA     FE93 / 17CB     FE94 / 17CC
```

You can also check the status by using the SE windows by completing the following steps:

1. From the HMC, select the CPC (under Systems Management) where the CHPID or PCHID that you want to verify is, and click **Single Object Operations** (under Recovery task options).
2. On the SE, select the same CPC and click **Channels**, as shown in Figure 9-10 on page 185.

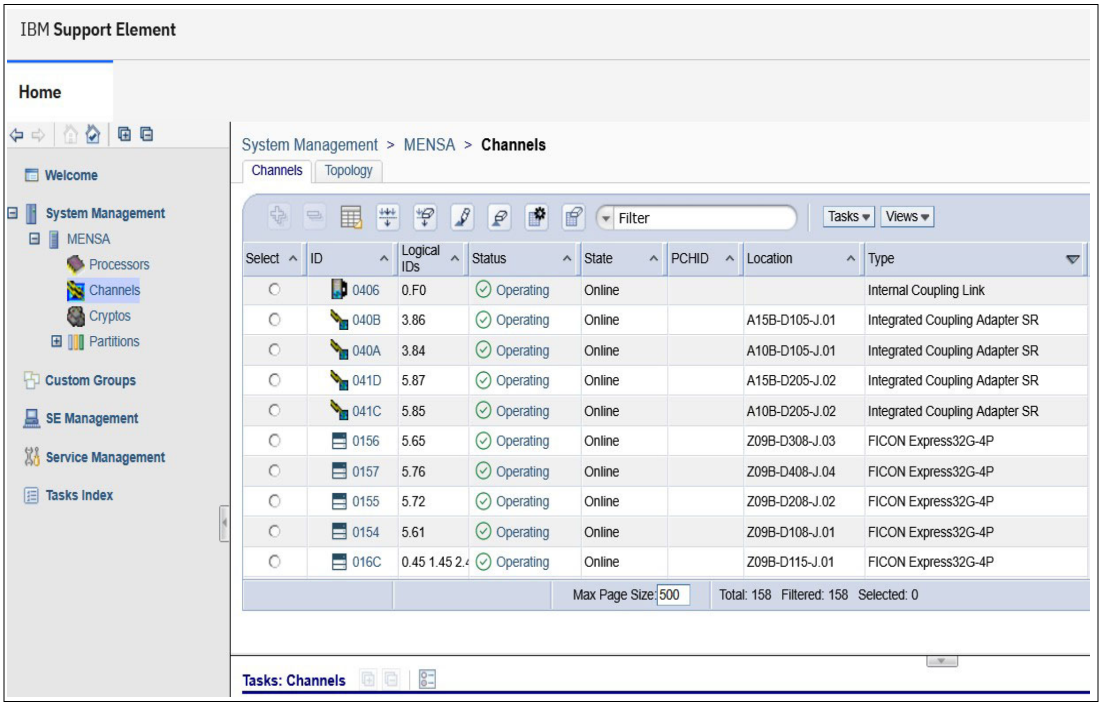


Figure 9-10 CS5 on SE Systems Management and channels

Look for the PCHID that you are interested in checking the status for. The result looks similar to what is shown in Figure 9-11.

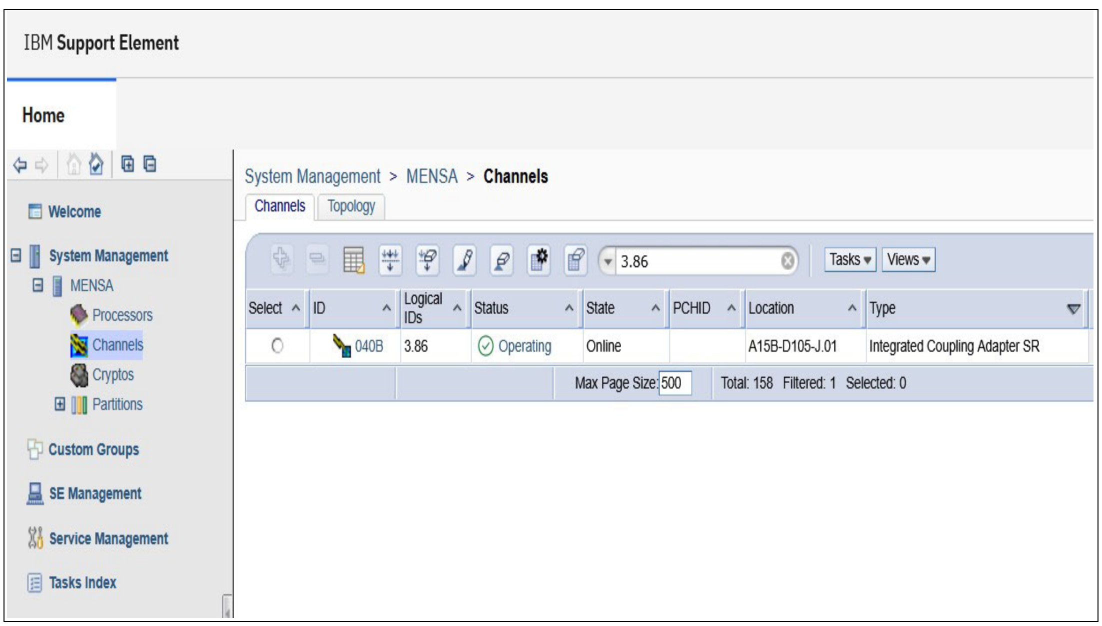


Figure 9-11 Verifying the channel CS5 by using the CPC view

3. For more information about the PCHID, click the PCHID. The result looks like what is shown in Figure 9-12.

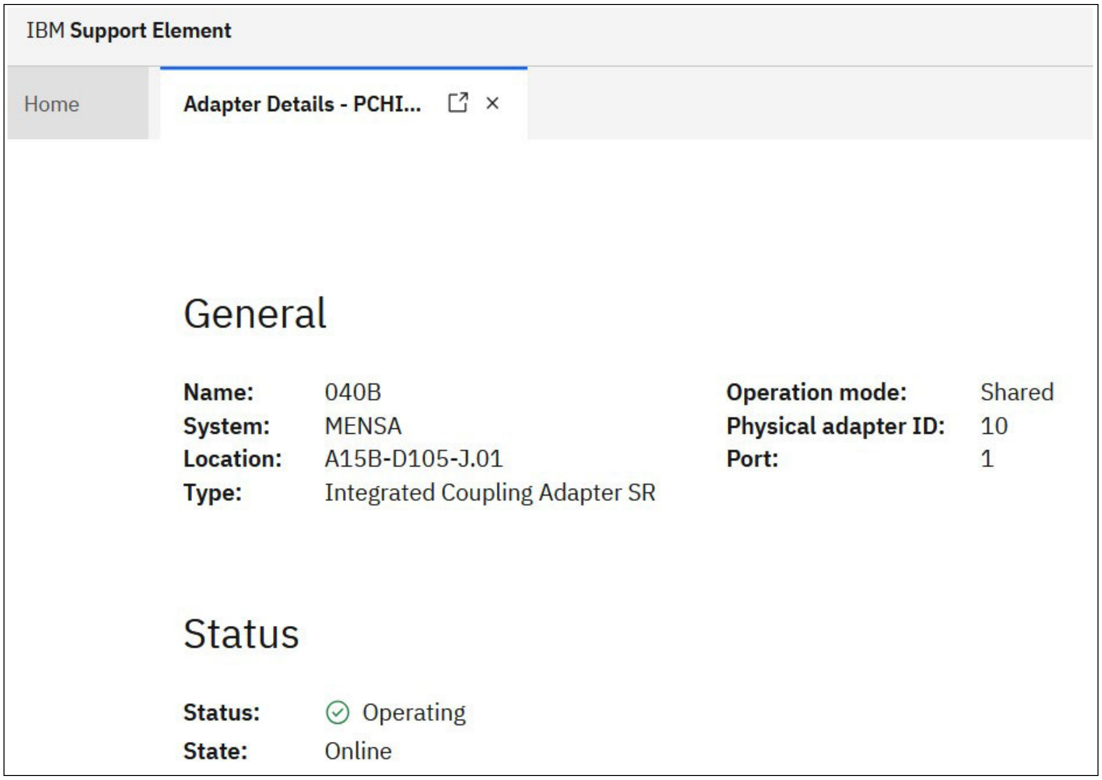


Figure 9-12   CS5 PCHID details

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 9-13 on page 187.

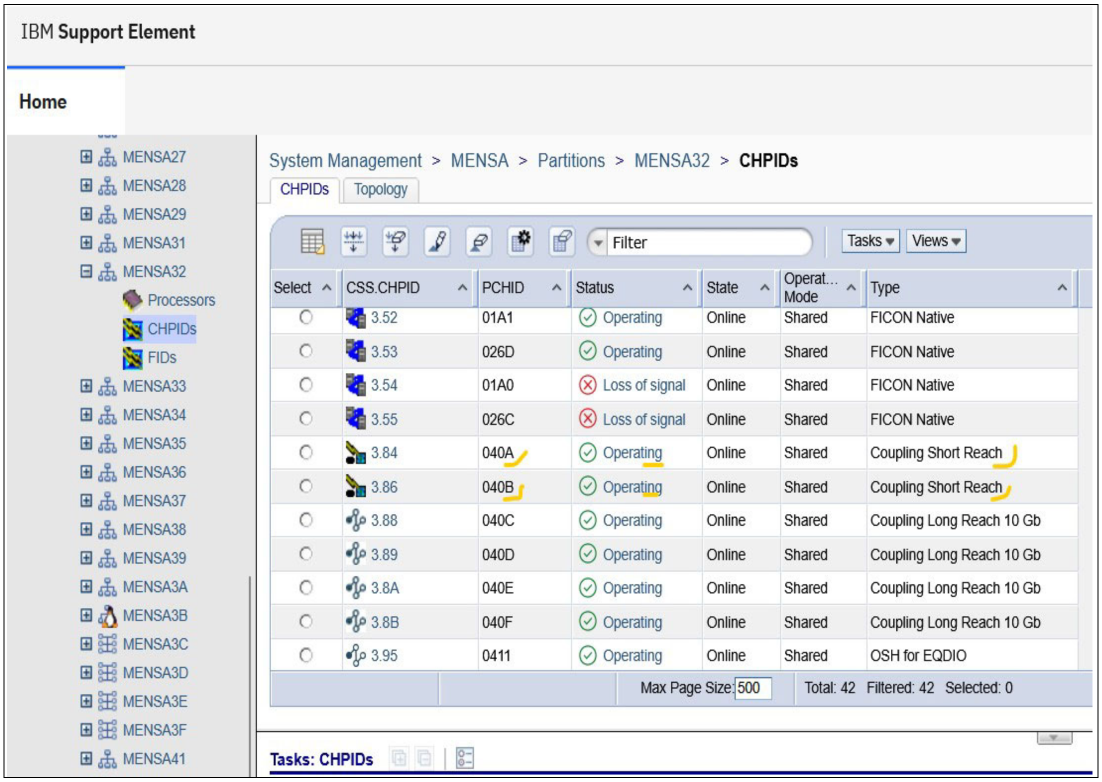


Figure 9-13 CS5 SE Verify channel LPAR view

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

This section uses a CHPID type CS5 connection to show an example of an STP timing-only link definition. Defining the STP timing-only link is part of the Define CF/STP link activity, which is shown in Figure 1-3 on page 5.

A coupling link connection between an IBM z17 and an IBM z16 that uses CS5 CHPIDs serves as an example of how to define an STP timing-only link (see Figure 9-14).

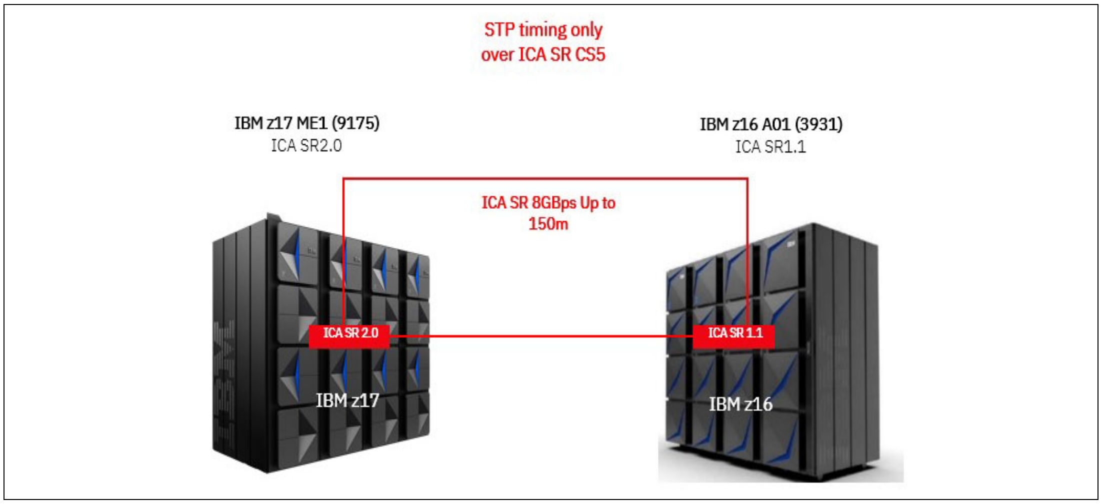


Figure 9-14 STP timing-only link connection from an IBM z17 to an IBM z16 (over CS5)

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 9-9 shows a sample IOCP defining the CS5 CHPID for timing-only links on the IBM z17 side.

Example 9-9 IOCP defining STP timing-only link on an IBM z17 by using CS5

```
ID      MSG1='IODF79',MSG2='SYS9.IODF79 - 2025-04-17 14:34',     *
        SYSTEM=(9175,1),LSYSTEM=MENSA,                           *
        TOK=('MENSA',008003009FB89175143413700125107F00000000,00*
        000000,'25-04-17','14:34:13','SYS9','IODF79')
RESOURCE PARTITION=((CSS(0),(MENSA0A,A),(MENSA0B,B),(MENSA0C,C*
        ),(MENSA0D,D),(MENSA01,1),(MENSA02,2),(MENSA03,3),(MENSA*
        ....
        F,F),(MENSA31,1),(MENSA32,2),(MENSA33,3),(MENSA34,4),(ME*
        NSA35,5),(MENSA36,6),(MENSA37,7),(MENSA38,8),(MENSA39,9)*
        ....
CHPID PATH=(CSS(3),84),SHARED,                                   *
        PARTITION=((MENSA3E,MENSA32),(=)),CPATH=(CSS(3),85),     *
        CSYSTEM=PAVO,AID=04,PORT=1,TYPE=CS5
CHPID PATH=(CSS(3),86),SHARED,                                   *
        PARTITION=((MENSA3F,MENSA32),(=)),CPATH=(CSS(3),81),     *
        CSYSTEM=PAVO,AID=10,PORT=1,TYPE=CS5
        ....
CNTLUNIT CUNUMBR=FFFC,PATH=((CSS(3),84,86)),UNIT=STP
```

The sequence of steps to define the STP timing-only link connection between an IBM z17 and an IBM z16 by using CS5 CHPIDs through HCD is the same as for defining the CF links to a regular CF 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 313.

Complete the following steps:

1. On the CF links connection step, after including the data that is related to the CPC MENSA side of the connection, type `YES` on the `Timing-only link` option of the Connect to CF Channel Path panel (see Example 9-10), and press Enter.

Example 9-10 STP timing-only link from z17 to z16

```
Goto  Filter  Backup  Query  Help
 +---------------- Connect to CF Channel Path -----------------+ ---------
 |                                                             |
 |                                                             | ==> PAGE
 | Specify the following values.                               |
 |                                                             |
 | Source processor ID  . . . . . : MENSA                      |
 | Source channel subsystem ID  . : 3                          |
 | Source channel path ID . . . . : 84                         |
 | Source channel path type . . . : CS5                        |
 |                                                             |
 | Destination processor ID . . . . . . PAVO  +                |  -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     PAVO.2    F9        Y  ICP  SHR     CFP   7
```

2. After accepting or overriding the CU and Device numbers for both processors, HCD returns to the CF Channel Path Connectivity List panel (see Example 9-11). You can see that the STP timing-only links are now connected.

Example 9-11 STP timing-only links connected

```
Goto  Filter  Backup  Query  Help
 ----------------------------------------------------------------------
                     CF Channel Path Connectivity List            Row
 Command ===> ____________________________________________ Scroll ===> P

 Select one or more channel paths, then press Enter.

 Source processor ID . . . . . : MENSA     Mensa
 Source channel subsystem ID . : 3
 Source partition name . . . . : *

   ----------Source----------   -----------Destination-----------   -CU-
 / CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type
 _ 84  04/1  N  CS5  SHR  N     PAVO.3     85  11/2  N  CS5  SHR    STP
 _ 86  10/1  N  CS5  SHR  N     PAVO.3     81  05/2  N  CS5  SHR    STP
```

9.4.2 Verifying the STP timing-only links configuration

After you activate the configuration with the ICA SR links defined as STP timing-only links and connect all cables, verify that the CHPIDs are online and operating by using z/OS or the Support Element (SE) windows.

Follow the same process that you used for ICA SR links to check the status (online and operating) of the CS5 CHPIDs that are defined to operate as STP timing-only links.

Complete the steps that are described in 9.3.1, “ICA SR: Verifying the configuration” on page 184 by using the respective CHPID or PCHID of the links for which you want to check the status.

9.5 CF LPAR setup and Coupling Facility Control Code Level 26

This section reminds you of configuration aspects that are related to a CF LPAR, including possible sysplex configurations with IBM z17, memory considerations for the new CF level, and changes in Coupling Facility Control Code (CFCC) Level 26.

As shown in Figure 1-3 on page 5, consider the following aspects for the Setup CF LPAR activity:

- IBM z17 servers support active participation in the same Parallel Sysplex and coupling link connections with the following servers:
  - IBM z16 A01 or IBM z16 A02
  - IBM z15 T01 or IBM z15 T02

    This situation applies to both direct CPC to CPC connectivity and presence anywhere in the sysplex, regardless of direct or indirect connectivity.

    - Configurations with z/OS on one of these servers can add an IBM z17 server to the sysplex for either a z/OS or CF image.
    - Configurations with a CF on one of these servers can also add an IBM z17 server to the sysplex for either a z/OS or CF image.
    - Use ICA SR or CE LR coupling links.
- Memory considerations:
  - Plan memory to account for CFCC memory and structure size increases that are associated with a new CFCC level. LPARs that run CFCC code might require more storage when moving from CF Level 25 (or earlier) to CF Level 26. Structure size requirements increase because the CF internal data structures for CF structure objects must expand to accommodate new functions and capabilities.
  - As a best practice, always resize CF structures during any CFLEVEL upgrade. Use the following tools and capabilities:
    - The z/OSMF Sysplex Management Application, CFRM Policy Editor, and CF structure sizing capability for CFLEVEL 26.
    - The Coupling Facility Structure Sizer (CFSizer) Tool or the batch SIZER utility.

> **Note:** For resizing your CF structures as needed, make the corresponding changes to your CFRM policy `INITSIZE` and `SIZE` values.

9.5.1 Coupling Facility Control Code Level 26

CFCC Level 26 introduces changes and improvements in the following areas:

- Simplification

  Support for CF Flash Memory (VFM) and CF images that use dedicated genera-purpose (GP) processors is removed.

- Parallel Sysplex scalability, virtualization, consolidation, and density

  GA1 base hardware and firmware enhancements

- Increased ICP buffers per CHPID from seven to eight.
  - IBM z17 always uses eight buffers.
  - Improved capacity and throughput for IC channels.
  - HCD and (IOCP updates allow seven or eight subchannels or devices per ICP CHPID (the default is eight).
- Capacity limits

  A maximum of 384 coupling CHPIDs of all types are supported per CPC, with up to 64 ICP CHPIDs and four CHPIDs per port.

For more information about the enhancements that were made in CF level 25, see *IBM z17 (9175) Technical Guide*, SG24-8579.

9.6 Dynamic I/O for Stand-alone Coupling Facility

Before IBM z14 GA2 (Driver 36), a SACF could not change the I/O configuration dynamically because HCD was not available on the IBM Z server. Changing the I/O configuration for such a server was cumbersome, error-prone, and required a power-on reset (POR).

Dynamic configuration capabilities for SACFs were introduced with IBM z14 GA2 and are enabled by default on IBM z15, IBM z16, and IBM z17.

With this support, an activation service (firmware function) starts on the SACF CPC to perform this role. This service enables simple, dynamically activated I/O changes without requiring an Initial Microcode Load (IML).

With IBM z15, IBM z16, and IBM z17, new firmware communication pathways exist from the driving HCD that manages input/output definition file (IODF) changes through the HMC and SE to the SACF CPC, and ultimately to the Master Control Service (MCS) activation service (firmware function). These pathways are used for the following purposes:

- Passing the modified target configuration
- Driving the dynamic I/O activation and associated recovery and management functions

For more information, see *IBM z17 (9175) Technical Guide*, SG24-8579.

The dynamic activation operates similarly to the existing remote dynamic activation on a server that supports z/OS LPARs, but it applies only to hardware changes.

For more information about how to implement this support, see 5.5.2, “Remote dynamic activation of I/O configurations for SACFs, Linux on IBM Z, and z/TPF” on page 117.

9.6.1 IBM Processor Resource/System Manager solution

With IBM z15, IBM z16, and IBM z17, dynamic activation of a new or changed IODF on a SACF CPC is supported.

This support operates without requiring a POR or IML and without requiring the presence of any z/OS or z/VM image running an HCD instance on the same CPC.

This capability is a base IBM Processor Resource/System Manager (PR/SM) solution and does not require the use of Dynamic Partition Manager (DPM) mode. A firmware function provides a firmware-based appliance version of the HCD instance.

The solution is fully managed by IBM Z firmware. It is included with the base firmware and does not require ordering a Feature Code. The firmware LPAR is activated by default on IBM z15, IBM z16, and IBM z17.

The firmware appliance LPAR on a supported system is driven by an updated HCD running in a z/OS LPAR on a remote IBM Z system, as shown in Figure 9-15.

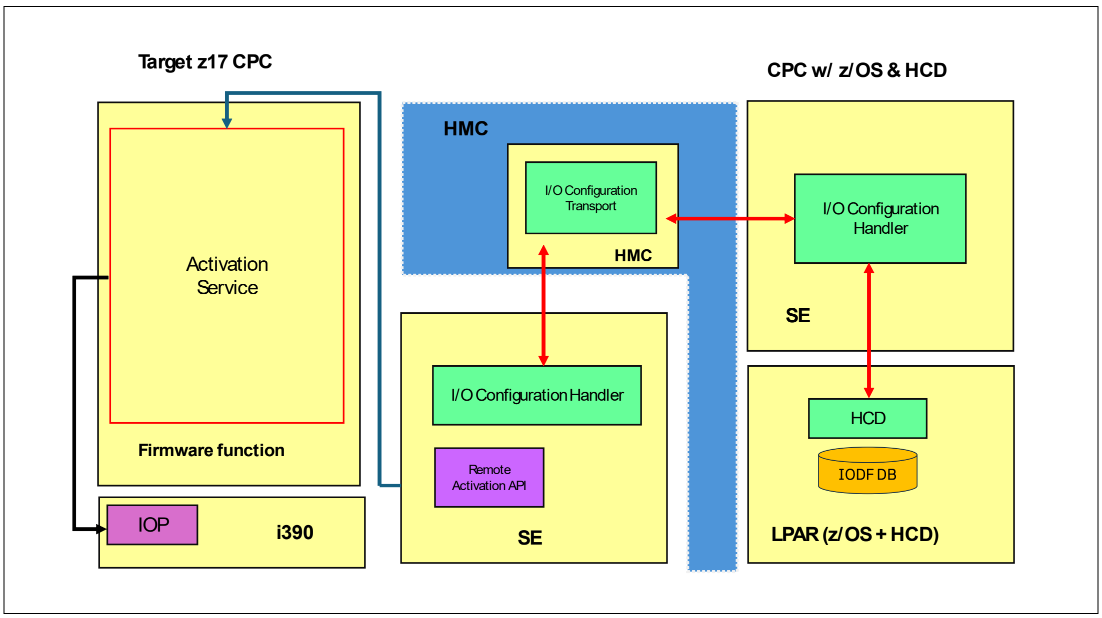


Figure 9-15 Dynamic I/O for a Stand-alone Coupling Facility

10

Specialized features

This chapter covers the configuration of all specialized features that are available for IBM z17 systems.

Note: The examples that are shown in this chapter are based on the IBM z17 ME1 (9175). However, these examples can also be used with the IBM z16 A01 (3931), the IBM z16 A02, and the IBM z16 AGZ (3932).

This chapter includes the following topics:

- Crypto Express8S
- Virtual Flash Memory

10.1 Crypto Express8S

This section describes the configuration of the Crypto Express8S feature on IBM z17. It covers cryptographic domains, configuration rules, and considerations for planning a nondisruptive installation of cryptographic features.

This chapter includes the steps for defining and configuring the Crypto Express8S feature for a logical partition (LPAR).

This section includes the following topics:

- Crypto Express8S overview
- Planning for a Crypto Express8S configuration
- Configuring Crypto Express8S
- Handling cryptographic coprocessors by using ICSF

10.1.1 Crypto Express8S overview

Two generations of cryptographic coprocessors[1] are supported on IBM z17:

- Crypto Express7S: Feature Code 0899 (one adapter per card) and Feature Code 0898 (two adapters per card). Carry-forward only as a Miscellaneous Equipment Specification (MES) from IBM z15 or IBM z16.
- Crypto Express8S: Feature Code 0909 (one adapter per card) and Feature Code 0908 (two adapters per card). Available as a new build or carry-forward (MES) from IBM z16.

This section describes the Crypto Express8S features for the IBM z17 system.

Each cryptographic coprocessor on an IBM z17 Model ME1 includes 85 physical sets of registers, which correspond to the maximum number of LPARs that can run on an IBM z17 Model ME1. Each of these sets belongs to a domain, as follows:

- A cryptographic domain index of 0 – 84 is allocated to an LPAR through the partition definition 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 recognizes a logical cryptographic coprocessor that consists of the physical cryptographic engine and the unique set of registers (the domain) that are allocated to that LPAR.

[1] Regional Crypto Enablement (RCE) is also supported, but it is not covered here.

Installing CP Assist for Cryptographic Functions (CPACF) Enablement (Feature Code 3863) is a prerequisite for using the hardware cryptographic feature on IBM z17. Feature Code 3863 enables the following functions:

- Data privacy and confidentiality

  Enables Data Encryption Standard (DES), Triple Data Encryption Standard (TDES), and Advanced Encryption Standard (AES) for 128-bit, 192-bit, and 256-bit keys. Feature Code 3863 also enables the modulo arithmetic unit, which supports Elliptic Curve Cryptography for verification and signing by using NIST P256, P384, and P521 curves; Brainpool curves P256, P384, and P512; and Edwards curves Ed25519 and Ed448 with clear keys.

- Data integrity

  Enables Secure Hash Algorithm-1 (SHA-1) 160-bit and SHA-2 for 224-bit, 256-bit, 384-bit, and 512-bit support. Also enables SHA-3 for 224-bit, 256-bit, 384-bit, and 512-bit support, and SHAKE for 128-bit and 256-bit support. SHA-1, SHA-2, and SHA-3 are enabled on all IBM z17 ME1 systems and do not require the no-charge enablement Feature Code 3863.

- Key generation

  Enables Pseudo-Random Number Generation (PRNG), Deterministic Random Number Generation (DRNG), and True Random Number Generation (TRNG).

- Message authentication code

  Enables single-key and double-key message authentication code functions.

The total number of cryptographic Peripheral Component Interconnect Express (PCIe) adapters, combining Crypto Express8S and Crypto Express7S features, cannot exceed 60 per IBM z17 system.

You can use up to 16 features with one HSM adapter (Crypto Express7S or Crypto Express8S) or up to 30 features with two HSM adapters (Crypto Express7S two-port or Crypto Express8S two-port), resulting in a total of 60 HSM adapters.

The initial order for Crypto Express8S includes two features: two HSM adapters for Feature Code 0909 and four HSM adapters for Feature Code 0908. After the initial order, the minimum order quantity is one feature.

Each Crypto Express8S feature (Feature Code 0909) includes one HSM adapter, and each Crypto Express8S feature (Feature Code 0908) includes two HSM adapters.

Each adapter can be configured in one of the following modes:

- Common Cryptographic Architecture (CCA) coprocessor (CEX8C)
- Public Key Cryptography Standards (PKCS) #11 (EP11) coprocessor (CEX8P)
- Accelerator (CEX8A)

During feature installation, the PCIe adapter is configured by default as a CCA coprocessor.

Configuring the Crypto Express8S adapter as a Public Key Cryptography Standards (PKCS) #11 (EP11) coprocessor requires a Trusted Key Entry (TKE) workstation: Feature Code 0057 for the rack-mounted workstation or Feature Code 0058 for the tower workstation, with TKE 10.1 Licensed Internal Code (LIC) Feature Code 0883. Older TKEs (Feature Code 0085 and Feature Code 0086) can be carried forward and converted by replacing the installed Crypto adapter with a 4770 Crypto adapter (Feature Code 0851).

The Crypto Express8S feature does not use channel path IDs (CHPIDs) from the channel subsystem (CSS) pool. However, the Crypto Express8S 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 IBM z17.[2]

Table 10-1 Cryptographic feature codes

Feature Code	Description
3863	CPACF enablement This feature is a prerequisite for using CPACF, except for SHA-1, SHA-2, and SHA-3, and cryptographic coprocessor hardware.
0908	Crypto Express8S (2-port) card A maximum of 30 features can be ordered for an IBM z17 Model ME1, with a minimum of two adapters. This optional feature includes two PCIe cryptographic adapters, which function as adjunct processors. This feature is supported on IBM z16 and IBM z17 systems.
0909	Crypto Express8S (1-port) card A maximum of 16 features can be ordered, with a minimum of two adapters. This optional feature includes one PCIe cryptographic adapter, which functions as an adjunct processor. This feature is supported only on IBM z16 and IBM z17 systems.
0898	Crypto Express7S (2-port) card This feature cannot be ordered for a new IBM z17 Model ME1 system; it is available only as a carry-forward MES from an IBM z15 or IBM z16 system. A maximum of 30 features can be carried forward for an IBM z17 Model ME1, with a minimum of two adapters for all models. This optional feature includes two PCIe cryptographic adapters, which function as adjunct processors. This feature is supported on IBM z17, IBM z16, and IBM z15 systems.
0899	Crypto Express7S (1-port) card This feature cannot be ordered for a new IBM z17 Model ME1 system; it is available only as a carry-forward MES from an IBM z15 or IBM z16 system. A maximum of 16 features can be carried forward, with a minimum of two adapters. This optional feature includes one PCIe cryptographic adapter, which functions as an adjunct processor. This feature is supported only on IBM z17, IBM z16, and IBM z15 systems.
0058	TKE tower workstations A TKE workstation provides basic key management functions, including key identification, exchange, separation, updates, and backup, and security administration. The TKE workstation is optional when running a Crypto Express feature in CCA mode in a non-PCI-compliant environment. It is required when operating in EP11 mode or in CCA mode with full PCI compliance. The TKE workstation includes one Ethernet port and supports connectivity to an Ethernet local area network (LAN) operating at 10 Mbps, 100 Mbps, or 1000 Mbps. The TKE workstation also requires Feature Code 0157. Up to 10 features combined with Feature Code 0057 can be ordered per IBM z17 system.
0157	TKE Table Top Keyboard/Monitor/Mouse A tabletop monitor that includes a US English-language keyboard, a touchpad for pointing, and a country-specific power cord.
0057	TKE rack-mounted workstation The rack-mounted version of the TKE workstation requires a customer-provided standard 19-inch rack. This version also requires Feature Code 0156. When smart card readers are used, an extra customer-provided tray is required. Up to 10 features combined with Feature Code 0058 can be ordered per IBM z17 system.

[2] Other IBM Z servers are also listed where applicable.

Feature Code	Description
0156	TKE Rack Keyboard/Monitor/Mouse The 1U rack-mounted display includes a keyboard with a built-in pointing device. The keyboard is provided in the US English language.
0883	TKE 10.1 LIC This feature is included with the TKE tower workstation (Feature Code 0058) and the TKE rack-mounted workstation (Feature Code 0057) for IBM z17. Earlier versions of the TKE features (Feature Code 0085 and Feature Code 0086) can be upgraded to TKE 10.1 LIC by replacing the installed Crypto adapter with a 4770 Crypto adapter (Feature Code 0851) if the TKE is assigned to an IBM z15 or later system.
0886	TKE Smart Card Reader Access to information on the smart card is protected by a personal identification number (PIN). Each Feature Code includes two smart card readers, two cables for connection to the TKE workstation, and 20 smart cards. Older smart card readers (Feature Code 0885 and Feature Code 0891) can be carried forward.
0889	TKE extra smart cards When one Feature Code is ordered, 10 smart cards are included. The order increments are 1 - 99, for a total of up to 990 blank smart cards. Older smart cards (Feature Code 0892 and Feature Code 0900) can be carried forward.

Note: You might need the TKE workstation, including the TKE Smart Card Reader, when you run the CEX feature in CCA mode to meet specific security standards requirements.

For more information about the Crypto Express8S feature and the corresponding crypto features, see *IBM z17 (9175) Technical Guide*, SG24-8579.

10.1.2 Planning for a Crypto Express8S configuration

Note: You require new ICSF support to administer a Crypto Express8S coprocessor that uses a TKE workstation because it uses quantum algorithms.

The new function is available in z/OS 2.5 or z/OS 3.1 (base level HCR77D2). When you use new quantum-safe algorithms and share a KDS in a sysplex, ensure that HCR77D2 is installed on all systems.

All supported levels of ICSF automatically detect the available hardware cryptographic capabilities where they run and enable functions as needed. No new hardware toleration is necessary. If you want to use new capabilities, ICSF support is required.

For the latest MCL bundle requirements, see the *Driver Level 61 Exception Letter*.

IBM z17 ME1 always operates in LPAR mode. The concept of a dedicated coprocessor does not apply to a PCIe adapter. A PCIe adapter, whether configured as a coprocessor or an accelerator, is available to LPARs as directed by the domain assignment and the candidate list. This process occurs regardless of whether the central processors (CPs) in the partition are shared or dedicated.

IBM z17 ME1 enables up to 85 LPARs to be active concurrently. Each PCIe adapter on a Crypto Express8S feature supports 85 domains, whether it is configured as a Crypto Express8S coprocessor or a Crypto Express8S accelerator.

For availability, configure at least two Crypto Express8S features so that every potential LPAR can access two cryptographic adapters on different cards.

More Crypto Express8S features might be needed to satisfy application performance and availability requirements:

- For availability, distribute the assignment of multiple PCIe adapters of the same type (accelerator or coprocessor) for one LPAR across features in multiple I/O domains.
- Using retained private keys on a PCIe adapter that is configured as a Crypto Express8S coprocessor creates a single point of failure for the application. This point of failure exists because RSA-retained private keys are not copied or backed up.
- An intrusion latch within the PCIe adapter logic 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 before removing 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. Then, enable the PCIe adapter from the TKE so that normal operations can resume.

  Plan the domain index and cryptographic coprocessor number definitions in the candidate list for each LPAR to prepare the cryptographic configuration. You can also define or change that cryptographic definition dynamically for an active LPAR with a running system. For more information, see “Change LPAR Cryptographic Controls function” on page 205.
- You can install Crypto Express8S features concurrently when all physical requirements are met. To dynamically enable a new PCIe adapter for a partition, ensure that these configurations are defined:
  - At least one usage domain index must be defined for the LPAR.
  - The cryptographic coprocessor numbers must be defined in the partition candidate list.
- You can define the same usage domain index more than once across multiple LPARs. However, the cryptographic coprocessor number that is coupled with the specified usage domain index must be unique across all active LPARs.

  You can define the same cryptographic coprocessor number and usage domain index combination for more than one LPAR. Use this configuration, for example, for backup situations. In this case, only one of the LPARs can be active at any one time.
- When you install new Crypto Express8S features, they are assigned coprocessor numbers sequentially during the power-on reset (POR) that follows installation. When you install a Crypto Express8S feature 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 you use the task to concurrently remove a PCI cryptographic feature, the coprocessor number is automatically freed.

Table 10-2 on page 199 shows a simplified configuration map for IBM z17 ME1. Each row represents a PCIe adapter, and each column represents a domain index number. Each cell entry shows the LPAR that is assigned to the cryptographic coprocessor number 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 57					
PCIe adapter 58					
PCIe adapter 59					

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 Express8S feature for IBM Z, see *IBM z17 (9175) Technical Guide*, SG24-8579.

10.1.3 Configuring Crypto Express8S

This section provides steps for configuring Crypto Express8S for IBM z17 ME1.

The IBM z17 ME1 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 helps ensure the correct usage of the cryptographic features when the associated partition is activated.

Concurrent changes to the Crypto Express8S features and controls when the partition is already activated are provided by special functions on the SE.

Checking whether the CPACF Enablement feature is installed

Feature Code 3863 on the IBM z17 ME1 enables various algorithms (for a list of supported algorithms, see 10.1.1, “Crypto Express8S overview” on page 194) through the CPACF. It is one of the prerequisites for using the Crypto Express8S feature. 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). The system details window opens (Figure 10-1).

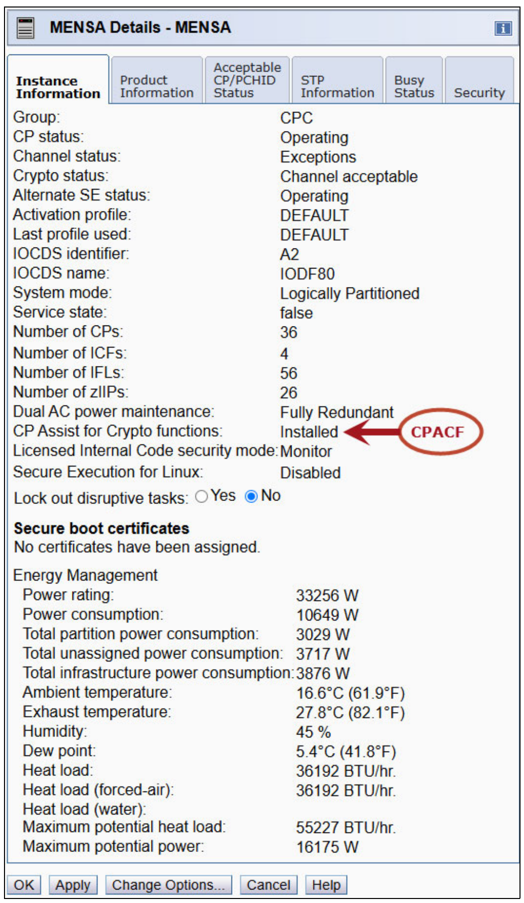


Figure 10-1 System details: CPACF installed

3. Click the **Instance Information** tab, and verify that the CPACF 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

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

Complete this task by using the Customize/Delete Activation Profile task in the Operational Customization Group, either from the HMC or from the SE. Modify the initial cryptographic definition from the Crypto option in the image profile, as shown in Figure 10-2.

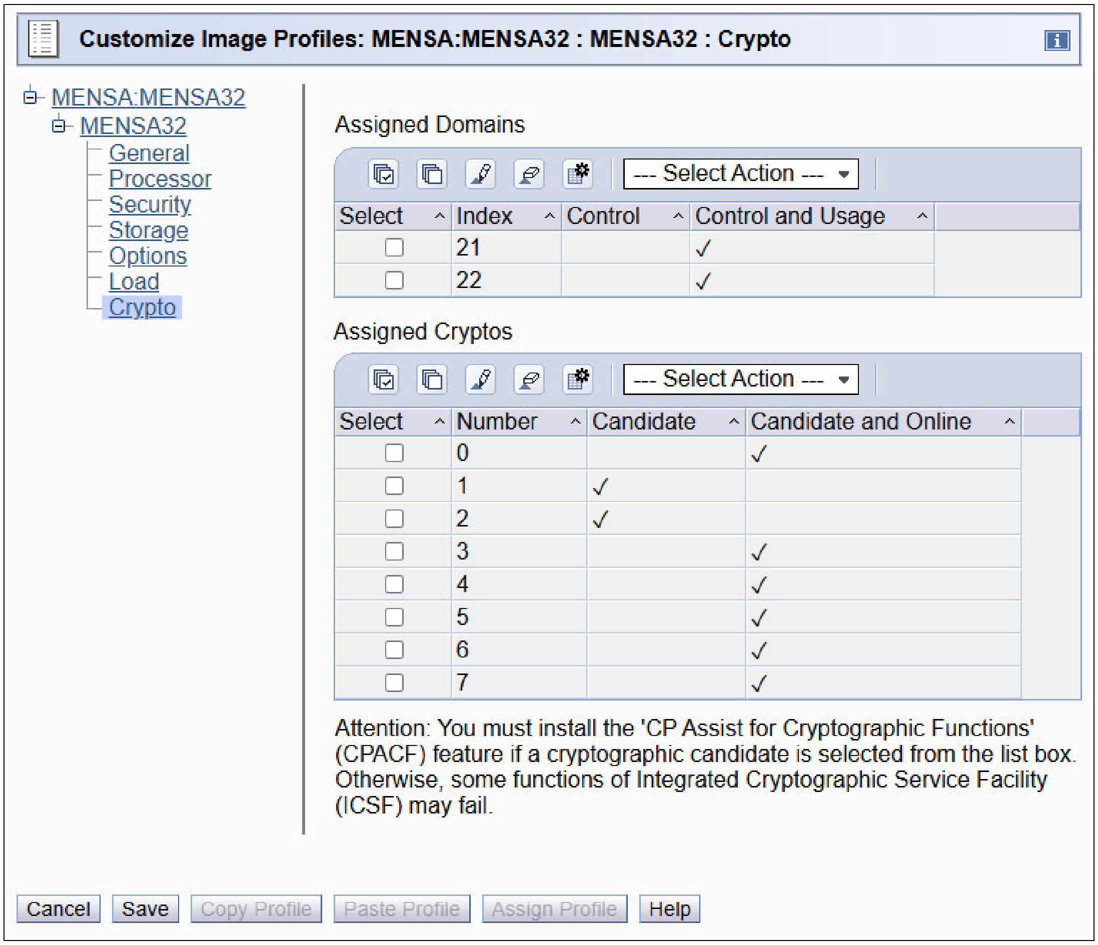


Figure 10-2 Customize Image Profiles: Crypto

After you modify this definition, any change to the image profile requires you to deactivate and activate the LPAR for the change to take effect. Therefore, this cryptographic definition is disruptive to a running system and requires an LPAR restart.

> **Tip:** You can make operational changes by using the Change LPAR Cryptographic Controls task from the SE. This task reflects the cryptographic definitions in the image profile for the partition. With this function, you can dynamically add or remove a cryptographic feature without stopping the running operating system (OS). For more information about this function, see “Change LPAR Cryptographic Controls function” on page 205.

The cryptographic resource definitions are described as follows:

- Control Domain

  Identifies the cryptographic coprocessor domains that you can administer from this LPAR when it is set up as the TCP/IP host for the TKE.

  When you set up the host TCP/IP in this LPAR to communicate with the TKE, the partition serves as a path to the Master Keys of other domains. Indicate all control domains that you want to access, including this partition's own control domain.

- Control and Usage Domain

  Identifies the cryptographic coprocessor domains that are assigned to the partition for all cryptographic coprocessors configured on that partition. You cannot remove usage domains while they are online.

  The selected numbers must match the domain numbers that are entered in the Options data set when you start this partition's instance of ICSF.

  The same usage domain index can be used by multiple partitions regardless of the CSS to which 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 coprocessor numbers 0 – 15, which identify the PCIe adapters to be accessed by this partition.

  No error condition is reported when a cryptographic coprocessor number that is selected in the partition candidate list is unavailable to the partition during activation, 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 selected coprocessor is in use by another active LPAR, activation of the LPAR fails (see Figure 10-3). In this conflicting case, review the cryptographic information for all active LPARs from the **Summary** tab of the View LPAR Cryptographic Controls task (see Figure 10-4 on page 203). Resolve the error by assigning a unique combination of PCIe adapter number and usage domain index number based on the collected data.

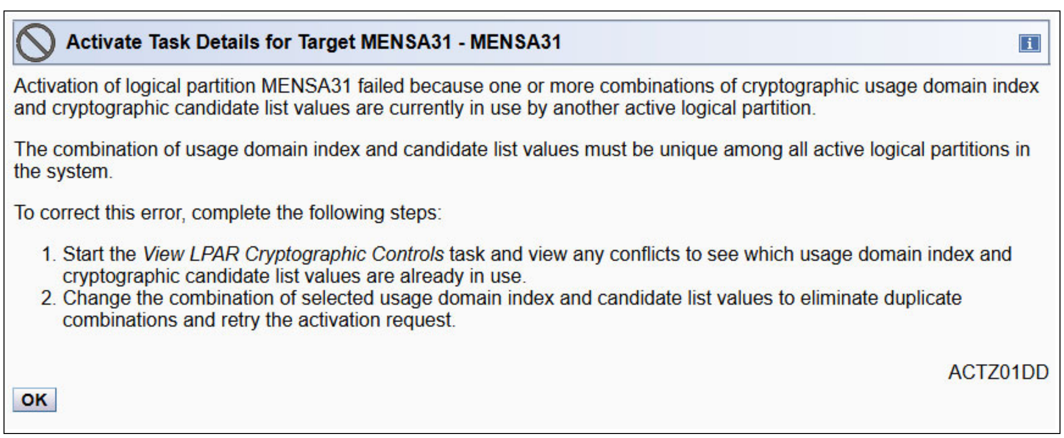


Figure 10-3 Activation of LPAR failed: ACTZ01DD

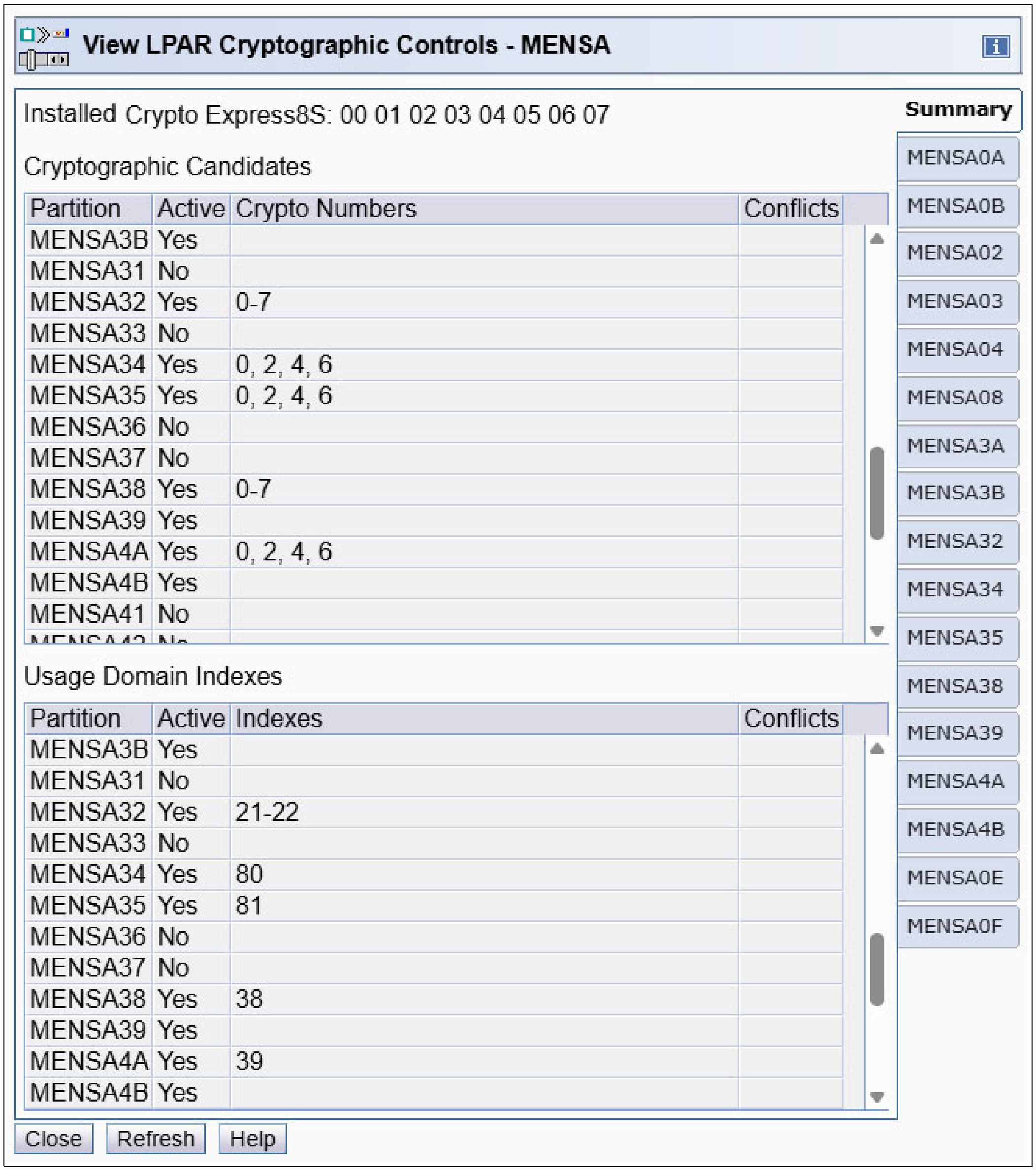


Figure 10-4 View LPAR Cryptographic Controls

- 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 included in 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 in the PCI Cryptographic Coprocessor Online List are placed in a configured-off (standby) state. You can later configure them online to the partition by selecting **Configure On/Off** from the SE. For more information, see "Configuring a Crypto Express8S online or offline on a logical partition" on page 217.

  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 for 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 or 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

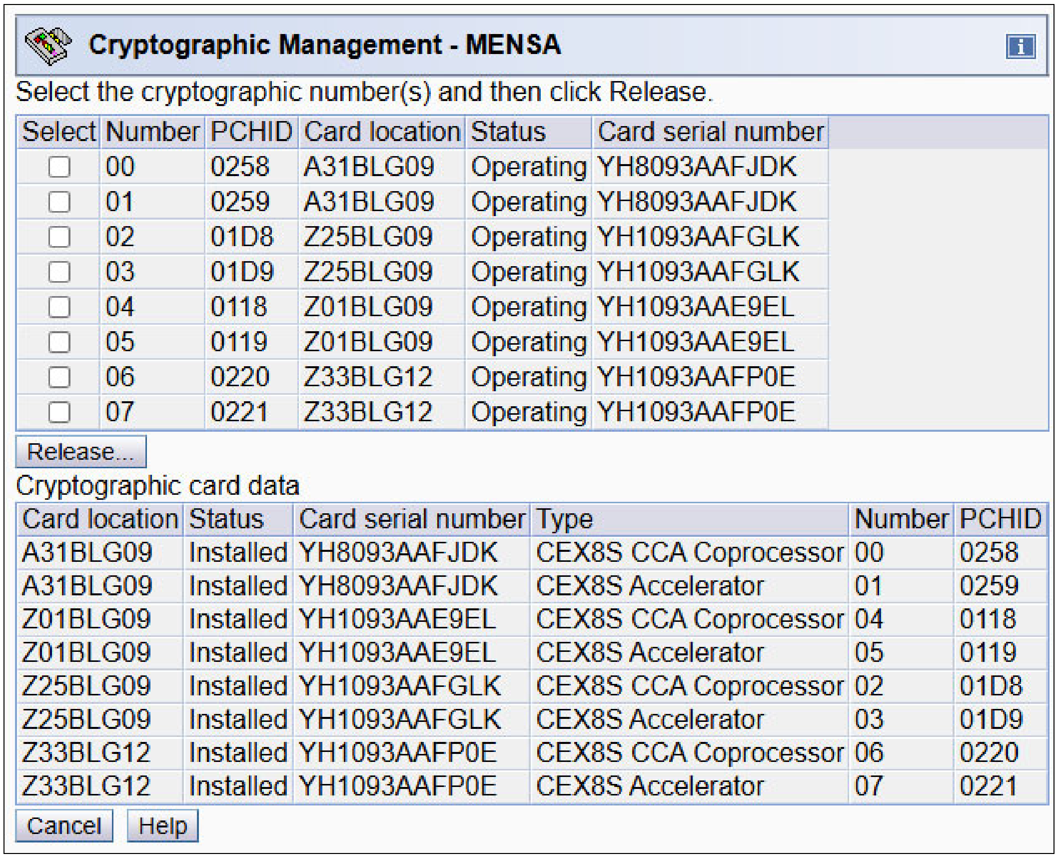
After you select the CPCs, click **Cryptographic Management** in the Configuration section.

Figure 10-5 on page 205 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). You can do the following tasks from this window:

- View installed cryptographic features, including their statuses and assigned PCHIDs and coprocessor numbers. Each PCIe adapter is assigned to a coprocessor number 0 - 59 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 Express8S 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.



Select	Number	PCHID	Card location	Status	Card serial number
☐	00	0258	A31BLG09	Operating	YH8093AAFJDK
☐	01	0259	A31BLG09	Operating	YH8093AAFJDK
☐	02	01D8	Z25BLG09	Operating	YH1093AAFGLK
☐	03	01D9	Z25BLG09	Operating	YH1093AAFGLK
☐	04	0118	Z01BLG09	Operating	YH1093AAE9EL
☐	05	0119	Z01BLG09	Operating	YH1093AAE9EL
☐	06	0220	Z33BLG12	Operating	YH1093AAFP0E
☐	07	0221	Z33BLG12	Operating	YH1093AAFP0E

Card location	Status	Card serial number	Type	Number	PCHID
A31BLG09	Installed	YH8093AAFJDK	CEX8S CCA Coprocessor	00	0258
A31BLG09	Installed	YH8093AAFJDK	CEX8S Accelerator	01	0259
Z01BLG09	Installed	YH1093AAE9EL	CEX8S CCA Coprocessor	04	0118
Z01BLG09	Installed	YH1093AAE9EL	CEX8S Accelerator	05	0119
Z25BLG09	Installed	YH1093AAFGLK	CEX8S CCA Coprocessor	02	01D8
Z25BLG09	Installed	YH1093AAFGLK	CEX8S Accelerator	03	01D9
Z33BLG12	Installed	YH1093AAFP0E	CEX8S CCA Coprocessor	06	0220
Z33BLG12	Installed	YH1093AAFP0E	CEX8S Accelerator	07	0221

Figure 10-5 SE Cryptographic Management

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 10-4 on page 203). The usage domain index, 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.

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 the **Configure On/Off** task, which is described in “Configuring a Crypto Express8S online or offline on a logical partition” on page 217.

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

By using the Change LPAR Cryptographic Controls function, which is included in the SE for IBM z17 ME1, you can do these tasks:

- Add a cryptographic coprocessor to an LPAR for the first time.
- Add a cryptographic coprocessor to an LPAR that uses 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 201.

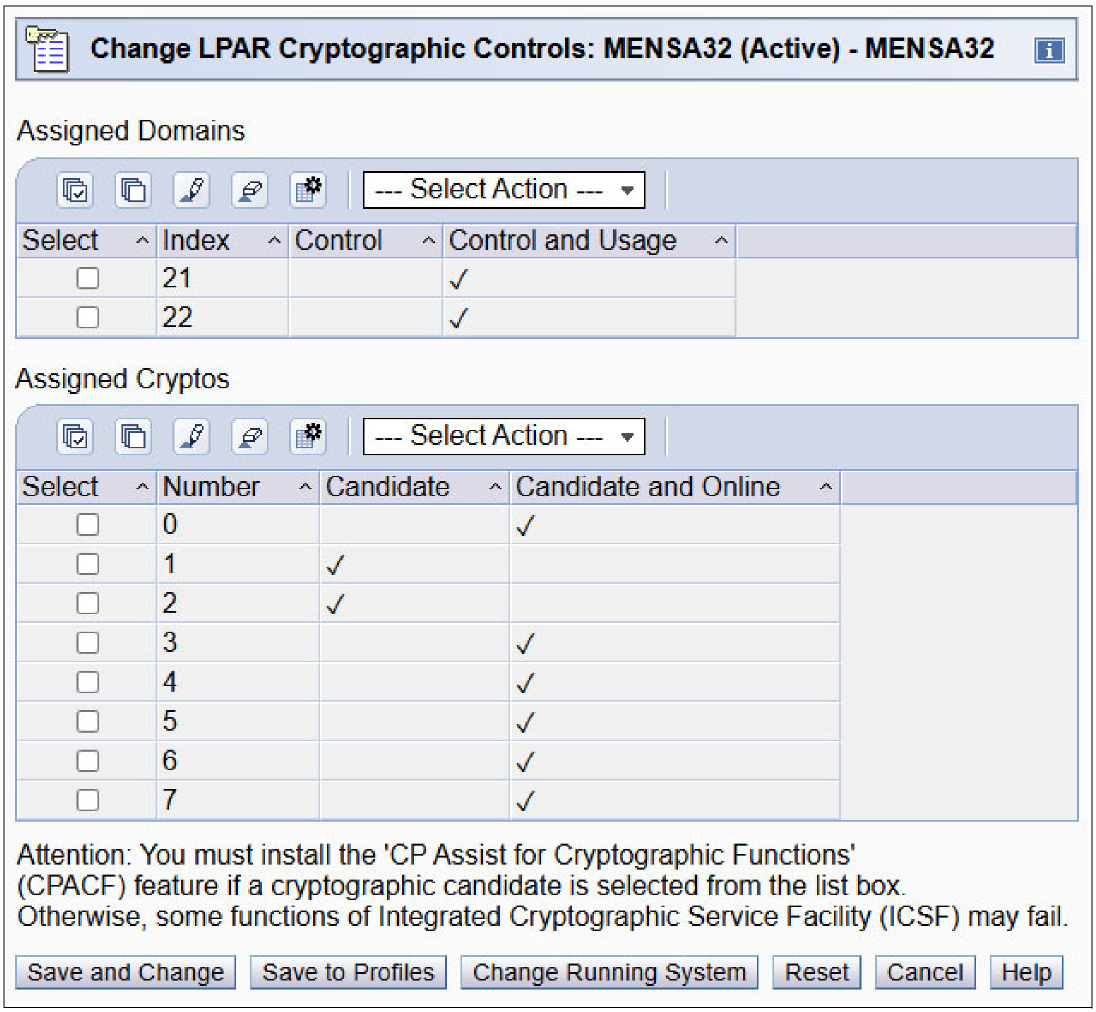


Figure 10-6 Change LPAR Cryptographic Controls: Change Running System

Select **Control** and **Usage** for each domain and **Candidate** and **Online** for each crypto adapter (see Figure 10-6).

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 that after a reactivation of the partition that 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).

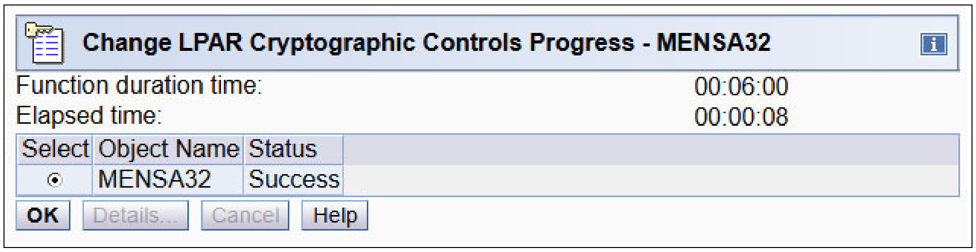


Figure 10-7 SE: Change LPAR Cryptographic Controls

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 Express8S online or offline on a logical partition" on page 217. 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.

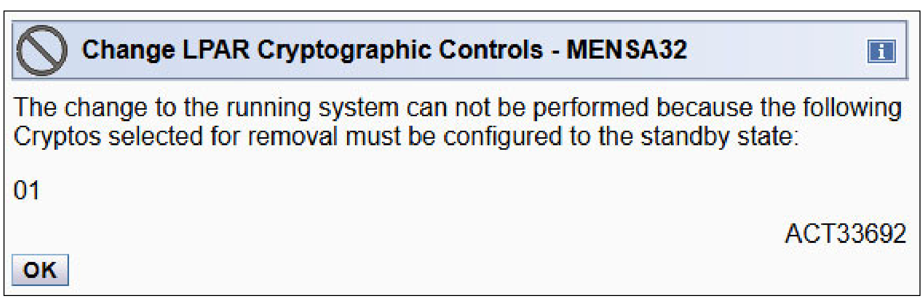


Figure 10-8 SE: Change LPAR Cryptographic Controls - ACT33692

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 206).

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 is also 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, check the information in the View LPAR Cryptographic Controls window before you continue. For more information about zeroize, see “Reconfiguring the PCIe adapter type” on page 209.

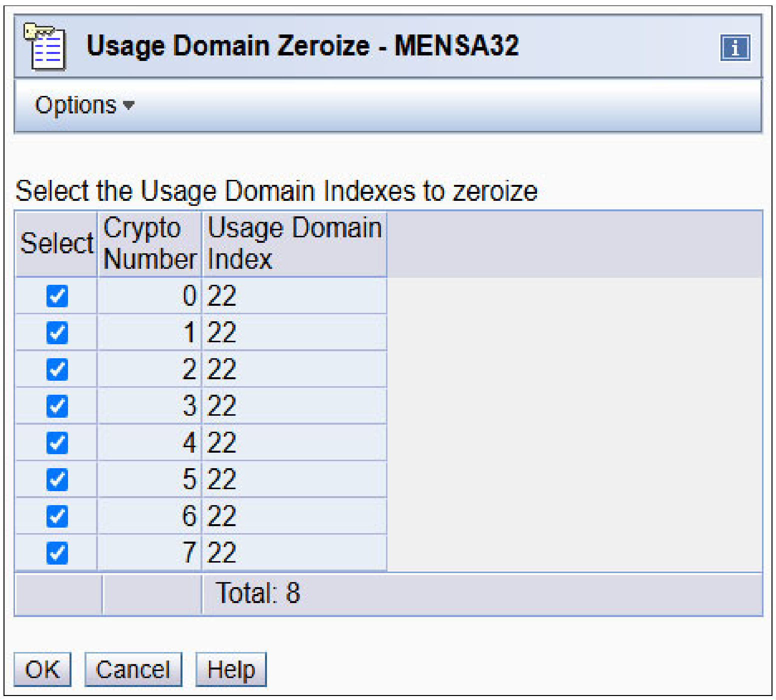


Figure 10-9 SE: Change LPAR Cryptographic Controls - Zeroize

3. In the confirmation window (see Figure 10-10 on page 209), click **OK** to dynamically change the cryptographic settings. Also 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.

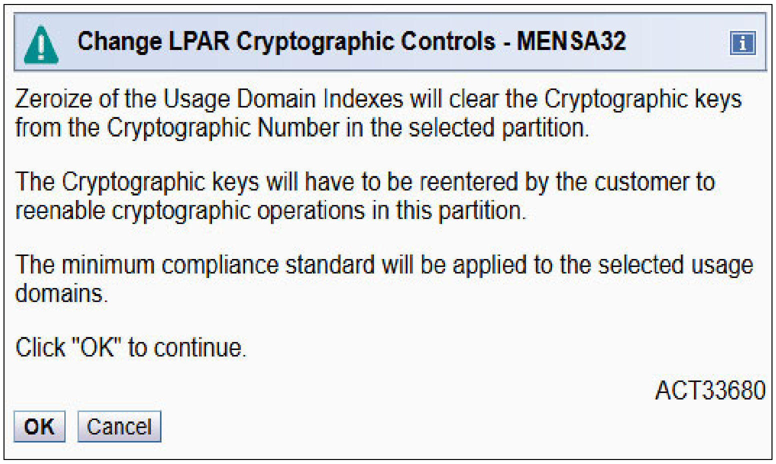


Figure 10-10 SE: Change LPAR Cryptographic Controls - ACT33680

Reconfiguring the PCIe adapter type

You can configure each PCIe Crypto Express8S feature as either a coprocessor or an accelerator. Each Crypto Express8S feature can be configured in one of the following modes:

- CCA Coprocessor (CEX8C)
- PKCS #11 (EP11) Coprocessor (CEX8P)
- Accelerator (CEX8A)

Whether configured as a coprocessor or an accelerator, each PCIe cryptographic adapter can be shared among up to 85 LPARs.

To reconfigure a cryptographic coprocessor, ensure that it is offline to all LPARs. To place a cryptographic coprocessor online or offline on an LPAR, use the Configure On/Off task, as described in “Configuring a Crypto Express8S online or offline on a logical partition” on page 217.

In the following example, the cryptographic coprocessor number 05 is reconfigured while it is offline to all LPARs.

Configuring a CCA coprocessor as an accelerator

During the installation of a Crypto Express8S feature, the PCIe cryptographic adapter is configured by default as a CCA coprocessor. Reconfiguration is fully supported in LIC.

When a PCIe adapter is configured as a CCA coprocessor, it can still perform accelerator functions, although at a slower rate than when configured as an accelerator. When configured as an accelerator, it cannot perform coprocessor functions.

When a PCIe adapter is configured as an EP11 coprocessor, a TKE workstation is required to manage the Crypto Express8S feature. For more information about configuring an EP11 coprocessor, see “Configuring a CCA coprocessor as an EP11 coprocessor” on page 214.

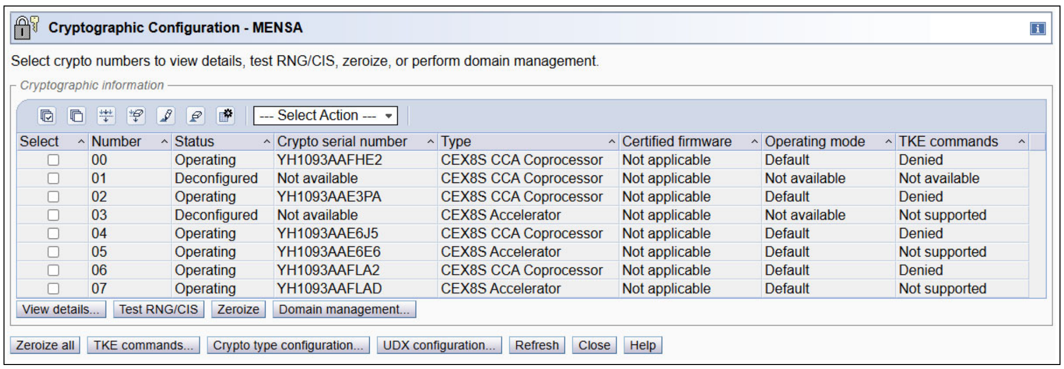
To reconfigure the PCIe adapter from a coprocessor to an accelerator, complete the following steps:

1. Select the CPC that contains the cryptographic coprocessor adapters to reconfigure, and then click **Cryptographic Configuration** in the Configuration Group.

   Reconfiguration is enabled only for PCIe adapters that are offline. Ensure that the PCIe cryptographic adapter status for the cryptographic coprocessor channel is unconfigured.

   If necessary, set the PCIe cryptographic adapter to **Off** for all partitions that include it in their candidate list by using the procedure that is described in““Configuring a Crypto Express8S online or offline on a logical partition” on page 217.

2. Select the cryptographic coprocessor channel number (see Figure 10-11), and then click **Crypto Type Configuration**.



Select	Number	Status	Crypto serial number	Type	Certified firmware	Operating mode	TKE commands
☐	00	Operating	YH1093AAFHE2	CEX8S CCA Coprocessor	Not applicable	Default	Denied
☐	01	Deconfigured	Not available	CEX8S CCA Coprocessor	Not applicable	Not available	Not available
☐	02	Operating	YH1093AAE3PA	CEX8S CCA Coprocessor	Not applicable	Default	Denied
☐	03	Deconfigured	Not available	CEX8S Accelerator	Not applicable	Not available	Not supported
☐	04	Operating	YH1093AAE6J5	CEX8S CCA Coprocessor	Not applicable	Default	Denied
☐	05	Operating	YH1093AAE6E6	CEX8S Accelerator	Not applicable	Default	Not supported
☐	06	Operating	YH1093AAFLA2	CEX8S CCA Coprocessor	Not applicable	Default	Denied
☐	07	Operating	YH1093AAFLAD	CEX8S Accelerator	Not applicable	Default	Not supported

Figure 10-11 Cryptographic Configuration task (unconfigured)

3. Change the configuration for the cryptographic coprocessor adapter. The selected cryptographic coprocessor channel is configured as a coprocessor (see Figure 10-12 on page 211). Select **Accelerator**.

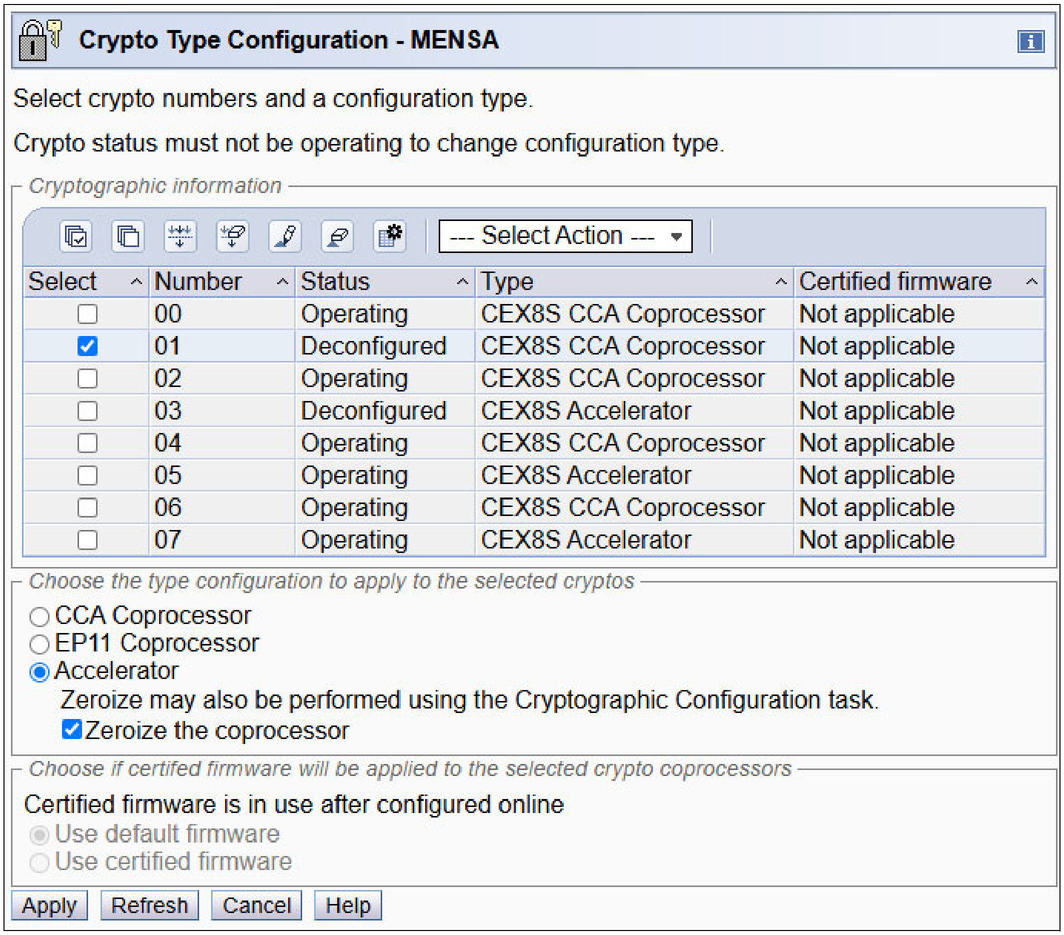


Figure 10-12 Crypto Type Configuration (CCA coprocessor to accelerator)

By selecting **Accelerator**, you can zeroize the selected coprocessor by also selecting **Zeroize the Coprocessor** on the Crypto Type Configuration window. Clear the **Zeroize the Coprocessor** checkbox and click **Apply**.

> **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 checkbox for each cryptographic channel.

4. Click **Yes** (see Figure 10-13).

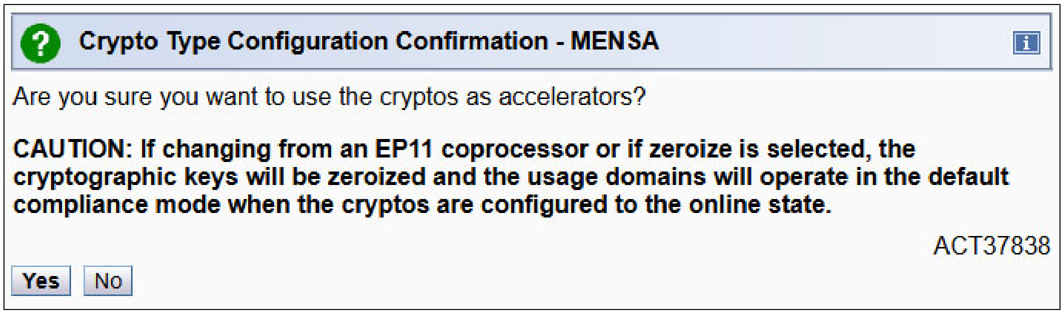


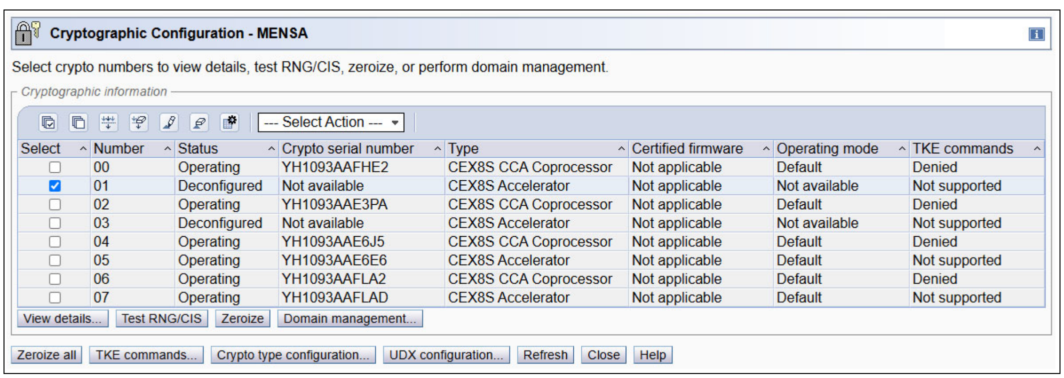
Figure 10-13 Crypto Type Configuration Confirmation for Accelerator

5. Verify that your request completed successfully. Click **OK**.
6. The system returns you to the Crypto Type Configuration window. Click **Cancel**. The system then returns you 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 display as "Not available" until cryptography is set to online again, as described in "Configuring a Crypto Express8S online or offline on a logical partition" on page 217.

   After you perform this task, return to the Cryptographic Configuration window, where the information that is shown in Figure 10-14 appears.

> **Note:** UDX support is *not* available for a Crypto Express8S that is defined as an EP11 coprocessor and accelerator.



Select	Number	Status	Crypto serial number	Type	Certified firmware	Operating mode	TKE commands
☐	00	Operating	YH1093AAFHE2	CEX8S CCA Coprocessor	Not applicable	Default	Denied
☑	01	Deconfigured	Not available	CEX8S Accelerator	Not applicable	Not available	Not supported
☐	02	Operating	YH1093AAE3PA	CEX8S CCA Coprocessor	Not applicable	Default	Denied
☐	03	Deconfigured	Not available	CEX8S Accelerator	Not applicable	Not available	Not supported
☐	04	Operating	YH1093AAE6J5	CEX8S CCA Coprocessor	Not applicable	Default	Denied
☐	05	Operating	YH1093AAE6E6	CEX8S Accelerator	Not applicable	Default	Not supported
☐	06	Operating	YH1093AAFLA2	CEX8S CCA Coprocessor	Not applicable	Default	Denied
☐	07	Operating	YH1093AAFLAD	CEX8S Accelerator	Not applicable	Default	Not supported

Figure 10-14 Cryptographic Configuration (Accelerator)

7. For more information, click **View Details** (see Figure 10-15).

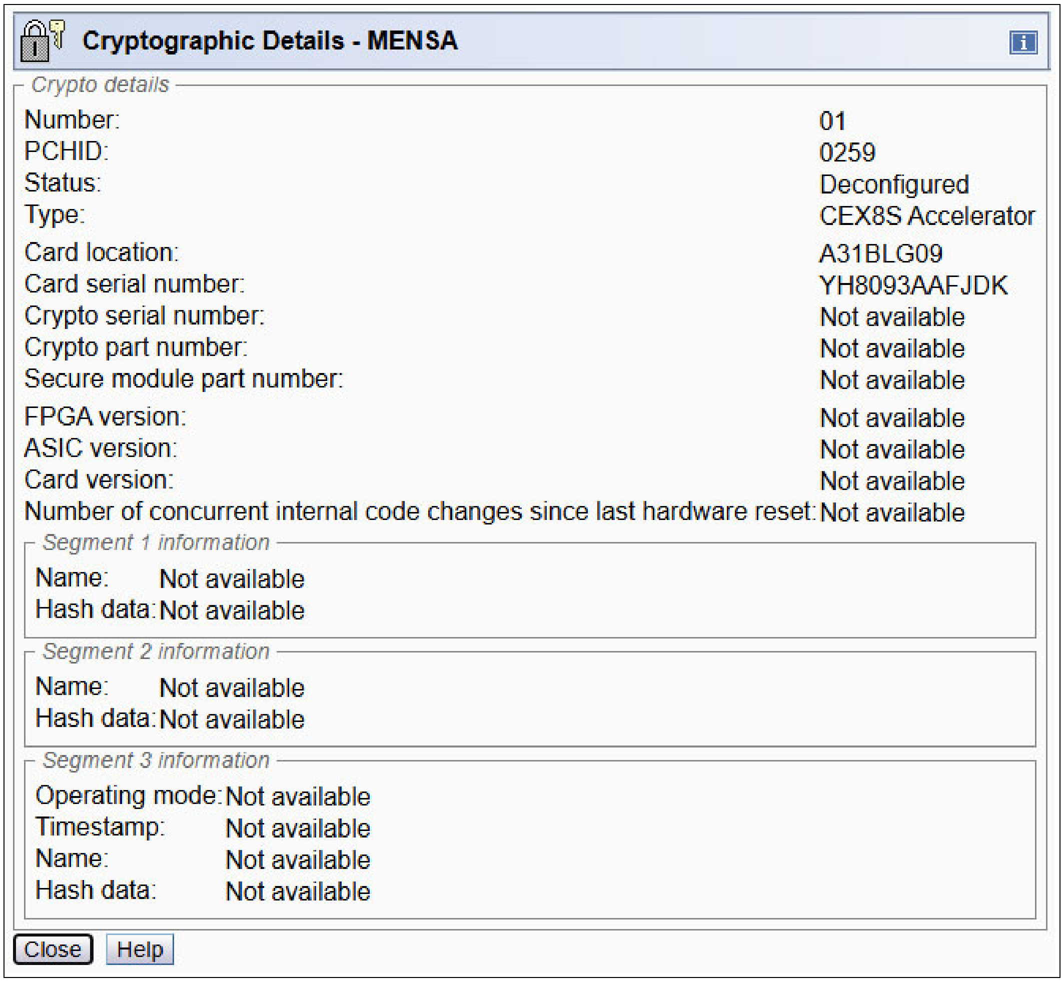


Figure 10-15 Cryptographic Details (Accelerator)

The cryptographic type is now set to Crypto Express8S Accelerator. The adapter is not zeroized during the type change procedure.

Information displayed as Not available becomes available only after the crypto adapter is set to online, as described in “Setting a Crypto Express8S to an online state” on page 217.

The procedure to change the cryptographic configuration type from a coprocessor to an accelerator is complete. To change the accelerator back to a coprocessor, use the same procedure and select **Coprocessor** instead of **Accelerator**, as shown in Figure 10-12 on page 211.

Figure 10-16 shows the result of this change.

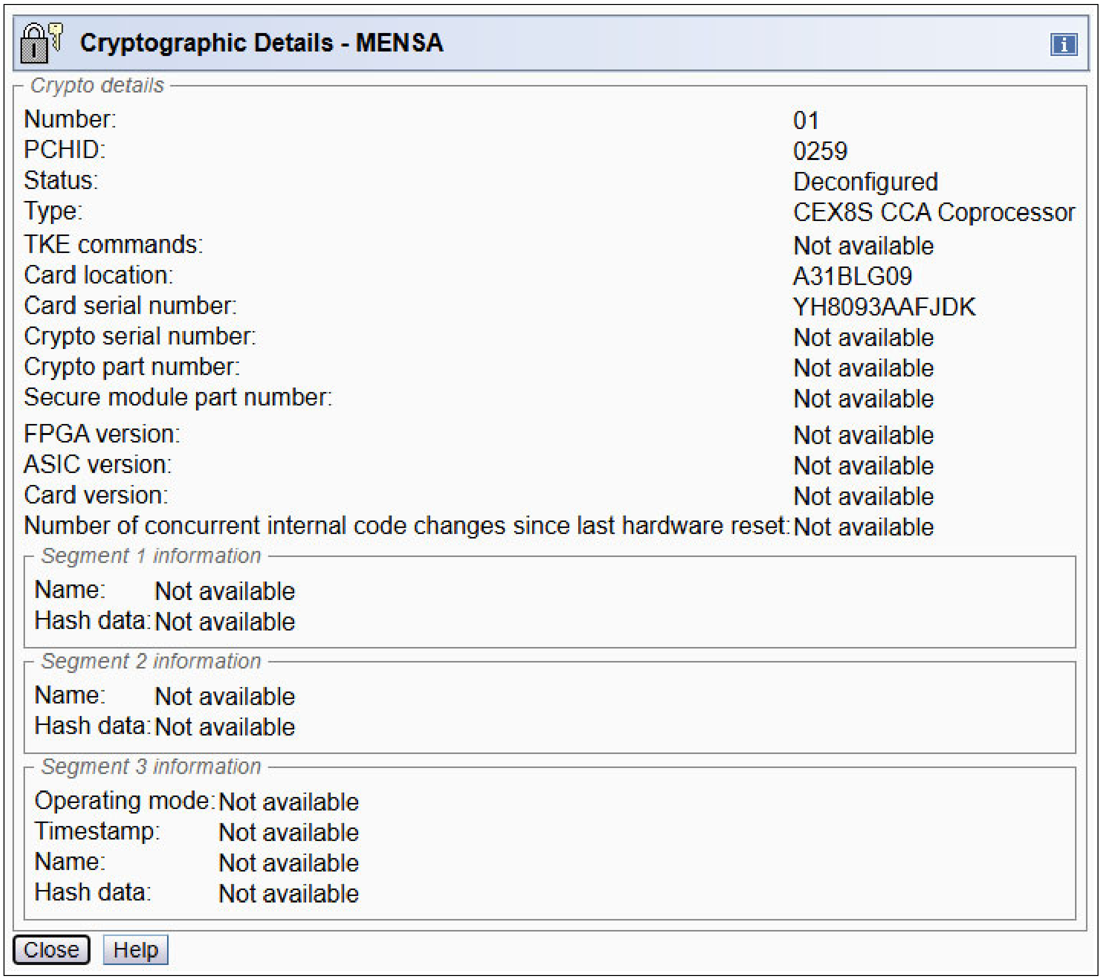


Figure 10-16 Cryptographic Details (CCA Coprocessor)

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 contains the cryptographic coprocessor adapters to reconfigure, and then click **Cryptographic Configuration** in the CPC Configuration Group.
2. Reconfiguration is enabled only for PCIe adapters that are set to **Off**. Ensure that the PCIe cryptographic adapter status for the cryptographic coprocessor channel is unconfigured (see Figure 10-11 on page 210). If necessary, set the PCIe cryptographic adapter to **Off** for all partitions that include it in their candidate list. To set the PCIe cryptographic adapter to **Off**, use the procedure that is described in “Configuring a Crypto Express8S online or offline on a logical partition” on page 217.
3. Select the cryptographic coprocessor channel number, and then click **Crypto Type Configuration**.
4. Change the configuration of the cryptographic coprocessor adapter. Select **EP11 Coprocessor** (see Figure 10-17 on page 215). This selection automatically enables the **Zeroize the coprocessor** option by default. Click **Apply**.

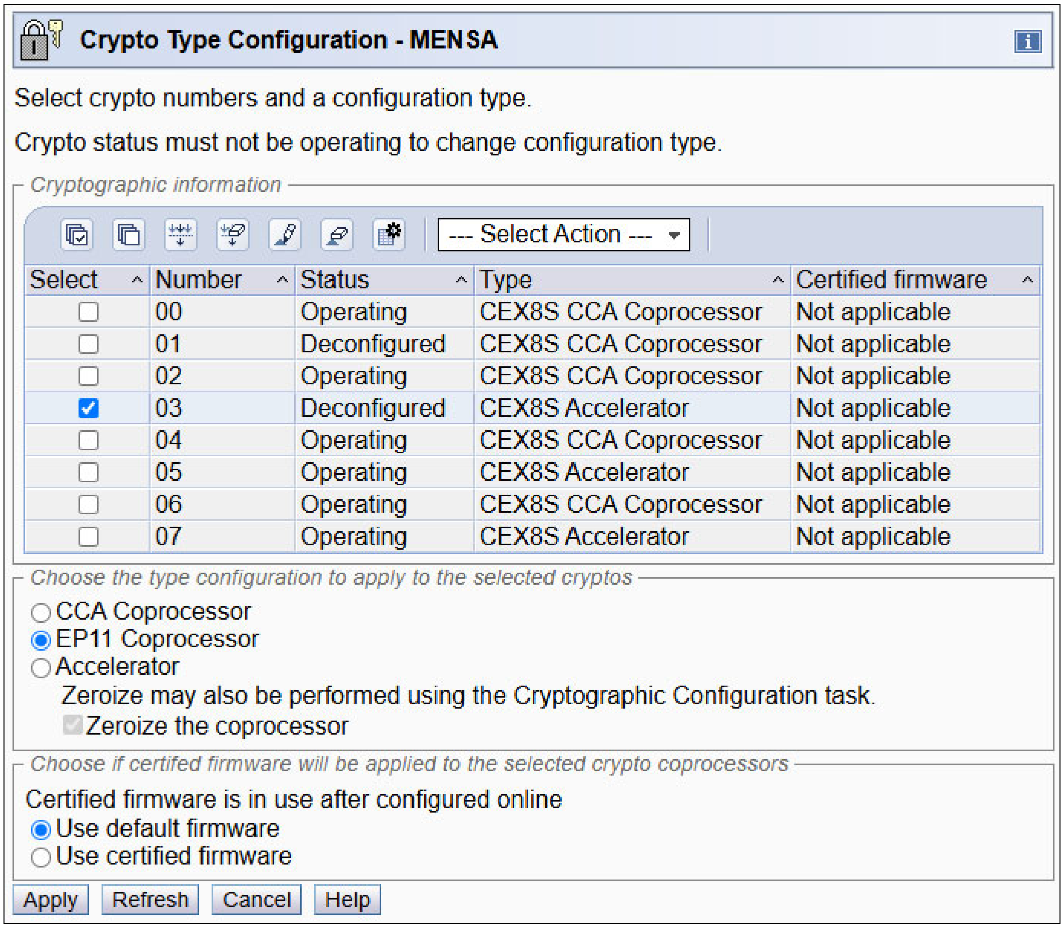


Figure 10-17 Crypto Type Configuration (CCA Coprocessor to EP11 Coprocessor)

5. Confirm your selection by clicking **Yes** (see Figure 10-18).

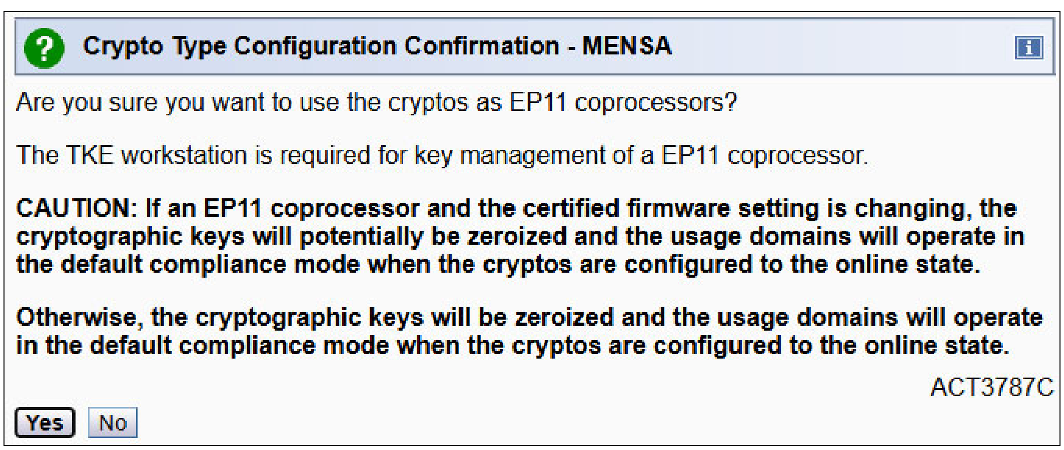


Figure 10-18 Crypto Type Configuration Confirmation for EP11 Coprocessor

6. Check that your request completed successfully. Click **OK** to return to the Crypto Type Configuration window.
7. Click **Cancel** in the Crypto Type Configuration window to return to the Cryptographic Configuration window. 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 display as “Not available” until the cryptography is set to online again, as described in “Configuring a Crypto Express8S online or offline on a logical partition” on page 217.

After you complete this task, return to the Cryptographic Configuration window, where the information that is shown in Figure 10-19 appears.

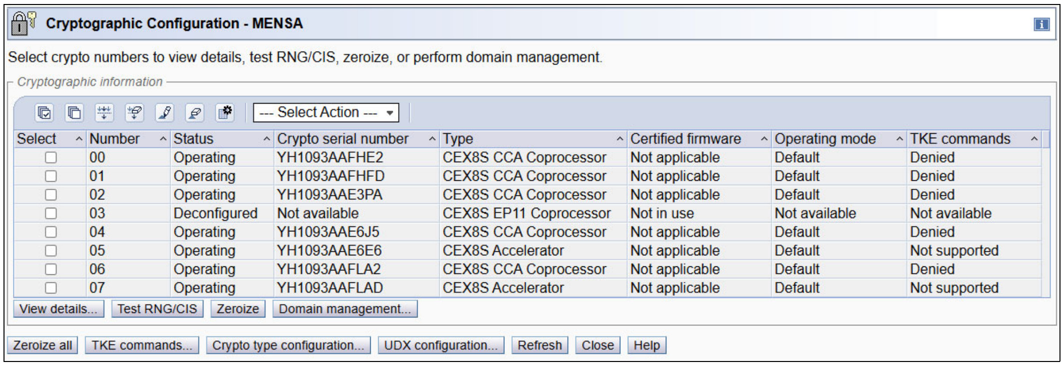


Figure 10-19 Cryptographic Configuration (EP11 Coprocessor)

8. Click **View Details** to display the detailed information, as shown in Figure 10-20.

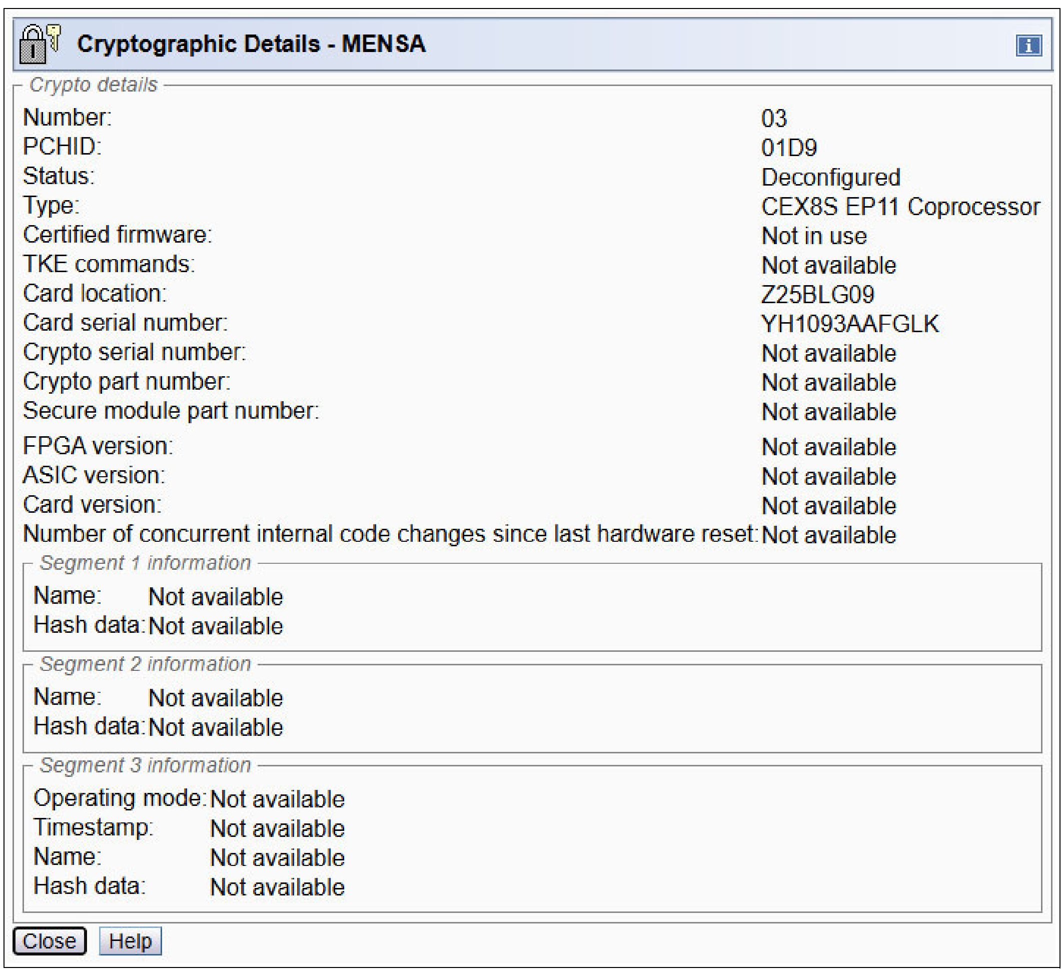


Figure 10-20 Cryptographic details (EP11 Coprocessor)

The Cryptographic Type is now a Crypto Express8S EP11 Coprocessor.

All the information that is displayed as “Not available” is available only after the crypto adapter is set online, as described in “Setting a Crypto Express8S to an online state” on page 217.

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, use the same procedure 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 Express8S feature that is configured as an EP11 coprocessor, use the TKE workstation.

Configuring a Crypto Express8S online or offline on a logical partition

For some changes to the cryptographic settings of an LPAR, you must configure the Crypto Express8S feature 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 required.

Setting a Crypto Express8S to an online state

To set a Crypto Express8S feature online, complete the following steps:

1. From the SE, select **System Management**.
2. Select the server, click **Partitions**, and then select the target LPAR.
3. Click **Cryptos** for the target LPAR.
4. On the Cryptos page, select the Crypto IDs to change.

   Figure 10-21 shows that on server MENSA, LPAR MENSA32 has eight defined cryptographic coprocessors: four CCA coprocessors (IDs 00, 02, 04, and 06; PCHIDs 0258, 01D8, 0118, and 0220) and four accelerators (IDs 01, 03, 05, and 07; PCHIDs 0259, 01D9, 0119, and 0221). IDs 00, 01, 02, 03, 04, 06, and 07 are online, and accelerator ID 05 is offline. You can also set up this accelerator online.

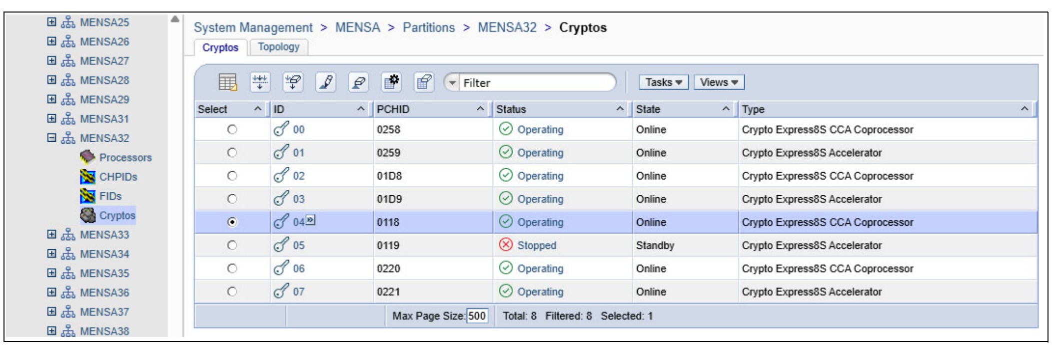


Figure 10-21 System Management: LPAR Crypto Selection Standby

5. Select the cryptographic coprocessor, and then select **Tasks Crypto Service Operations Configure On/Off task** (see Figure 10-22). 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 select **Select Action Toggle** to switch from Standby to Online (see Figure 10-23). If you want multiple cryptographic channels concurrently, select **Toggle All On**.

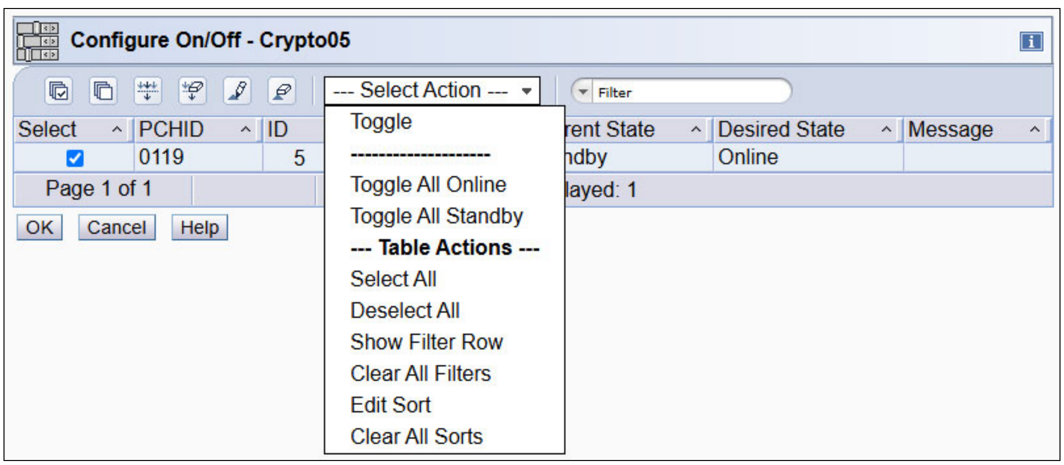


Figure 10-23 Configure On/Off (Standby)

7. After confirming that your requested cryptographic coprocessor channel is set to the state of Online, click **OK** (see Figure 10-24).

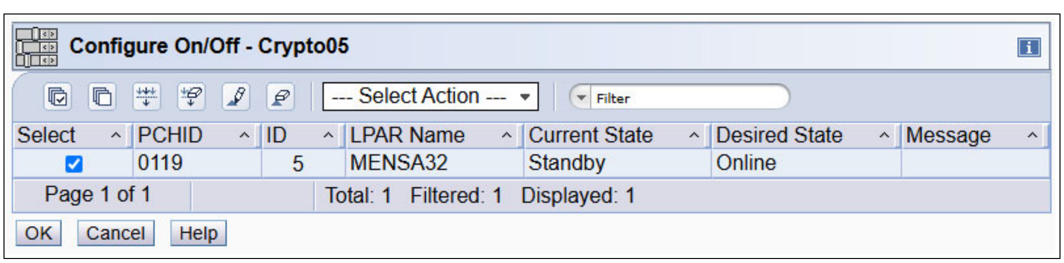


Figure 10-24 Configure On/Off (Standby to Online)

8. Confirm that your request completed (see Figure 10-25). Click **OK**.

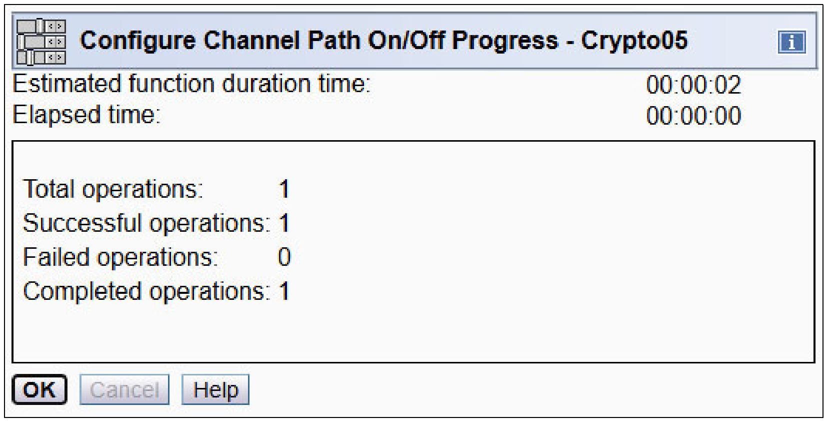


Figure 10-25 Configure On/Off (Standby to Online) completed

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).

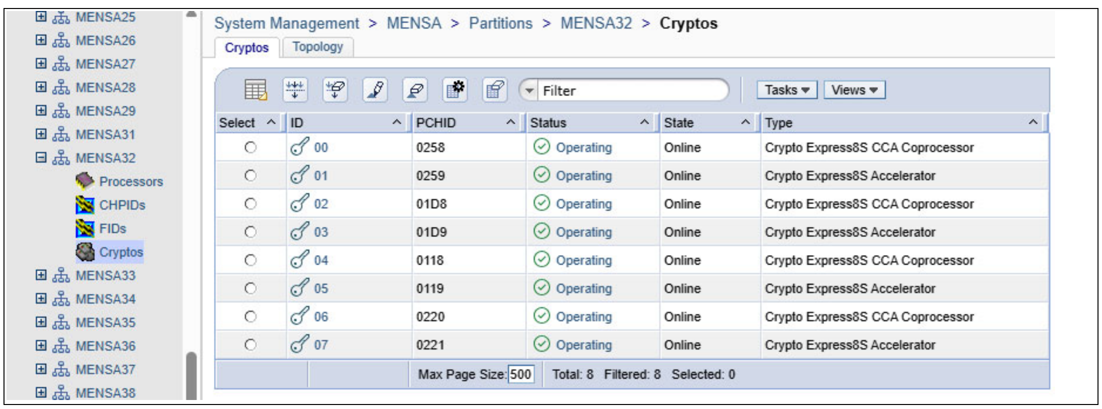


Figure 10-26 System Management: LPAR Crypto Selection Online

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 that you want to change to Standby. For example, select the accelerator (03) that is in an online state. Select **Tasks Crypto Service Operations Configure On/Off task** (see Figure 10-27).

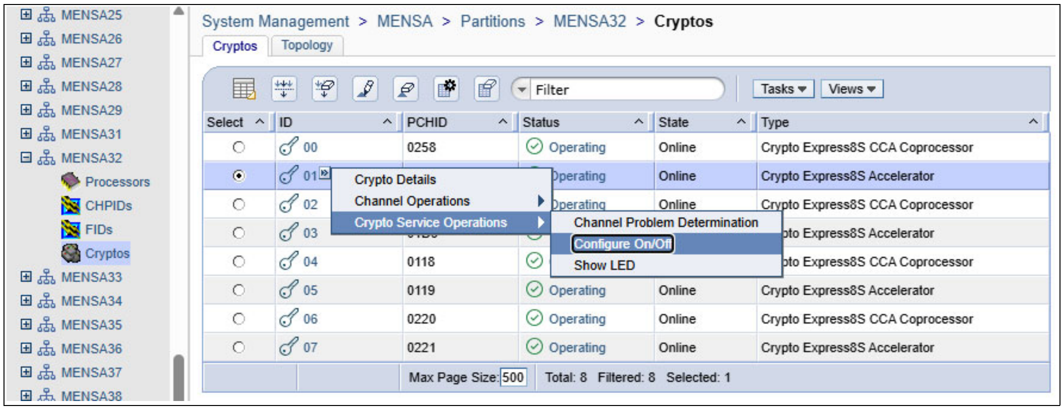


Figure 10-27 Crypto Service Operations: LPAR Crypto Selection - Configure Offline

2. Select the cryptographic coprocessor channel number that you want, and select **Select Action Toggle All Standby** to switch from Online to Standby (see Figure 10-28).

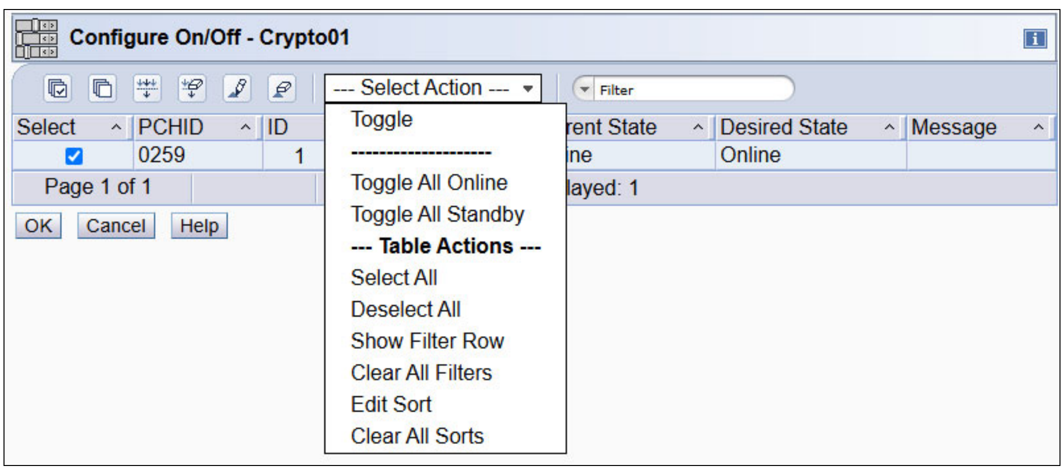


Figure 10-28 Configure On/Off (Online)

3. After you confirm that the state for your requested cryptographic channel is Standby, click **OK** (see Figure 10-29).

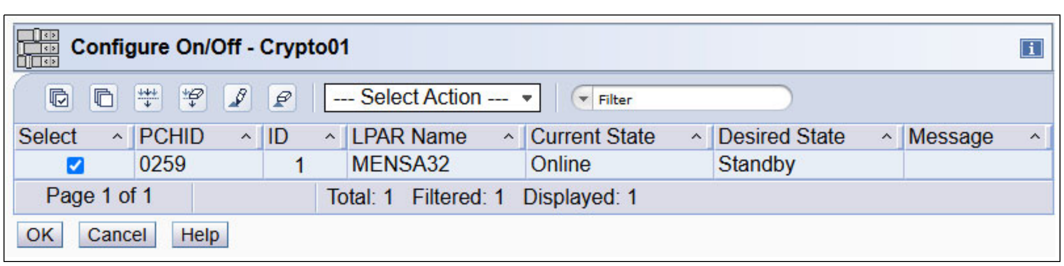


Figure 10-29 Configure On/Off (Online to Standby)

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).

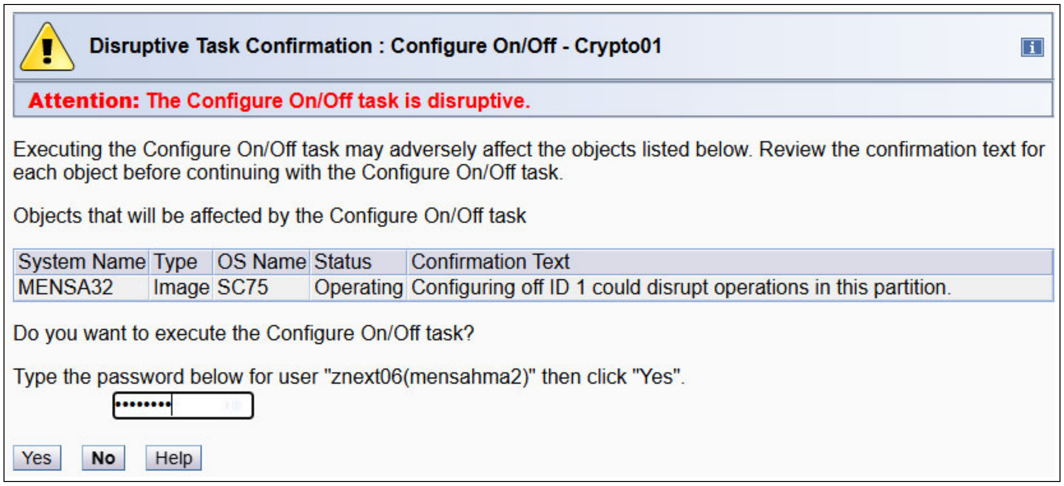


Figure 10-30 Configure On/Off (Online to Standby): Confirmation

5. Confirm that your request completed (see Figure 10-31). Click **OK**.

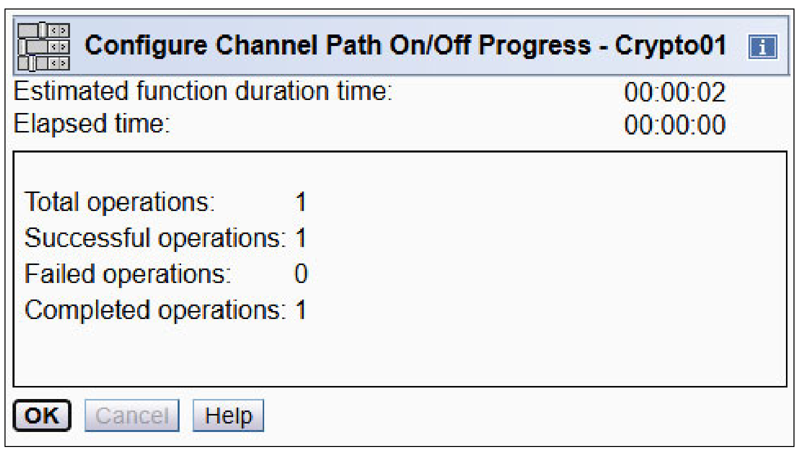


Figure 10-31 Config On/Off (Online to Standby) completed

10.1.4 Handling cryptographic coprocessors by using ICSF

ICSF provides an Interactive System Productivity Facility (ISPF) Coprocessor Management panel that enables you to display or change the status (Active or Deactivate) of cryptographic coprocessors. This action affects only the coprocessor status within ICSF and does not affect the Online or Standby hardware status that the IBM z17 SE shows.

This section does not describe how to create, load, or manage keys in the cryptographic adapters. For more information, see the ICSF documentation. This section describes only how to activate or 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.

```
HCR77E0 -------------- Integrated Cryptographic Service Facility -------------
OPTION ===> 1
System Name:  SC75                           Crypto Domain: 22
Enter the number of the wanted 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

     Licensed Materials - Property of IBM
     5655-ZOS Copyright IBM Corp. 1989, 2023.
     US Government Users Restricted Rights - Use, duplication or
     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 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
  -------   --------  -------------------- ---   ---   ---   ---   ---
_   8C00    93AAFHE2  Active                A     A     A     A
_   8A01    N/A       Active
_   8C02    93AAE3PA  Active                A     A     A     A
_   8A03    N/A       Active
_   8C04    93AAE6J5  Active                A     A     A     A
_   8A05    N/A       Active
_   8C06    93AAFLA2  Active                A     A     A     A
_   8A07    N/A       Active
****************************** 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
  -------   --------  -------------------- ---   ---   ---   ---   ---
_   8C00    93AAFHE2  Active                A     A     A     A
_   8A01    N/A       Active
_   8C02    93AAE3PA  Active                A     A     A     A
_   8A03    N/A       Offline
_   8C04    93AAE6J5  Active                A     A     A     A
_   8A05    N/A       Active
_   8C06    93AAFLA2  Active                A     A     A     A
_   8A07    N/A       Active
******************************* 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
  -------   --------  -------------------- ---   ---   ---   ---   ---
_   8C00    93AAFHE2  Active                A     A     A     A
_   8A01    N/A       Active
_   8C02    93AAE3PA  Active                A     A     A     A
d   8A03    N/A       Active
_   8C04    93AAE6J5  Active                A     A     A     A
_   8A05    N/A       Active
_   8C06    93AAFLA2  Active                A     A     A     A
_   8A07    N/A       Active
******************************* 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
  -------   --------  -------------------  ---   ---   ---   ---   ---
_   8C00    93AAFHE2  Active                A     A     A     A
_   8A01    N/A       Active
_   8C02    93AAE3PA  Active                A     A     A     A
_   8A03    N/A       Deactivated
_   8C04    93AAE6J5  Active                A     A     A     A
_   8A05    N/A       Active
_   8C06    93AAFLA2  Active                A     A     A     A
_   8A07    N/A       Active
******************************* 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 IBM z17 SE.

Figure 10-37 shows ICSF Coprocessor Hardware Status panel for adapters 8C00 and 8C02.

```
---------------------- ICSF - Coprocessor Hardware Status ---------------------
COMMAND ===>                                                   SCROLL ===>
                                                              CRYPTO DOMAIN: 22

REGISTER STATUS                  COPROCESSOR 8C00        COPROCESSOR 8C02
                                                                  More:     +
 Crypto Serial Number          : 93AAFHE2                93AAE3PA
 Status                        : ACTIVE                  ACTIVE
 PCI-HSM Compliance Mode       : INACTIVE                INACTIVE
 Compliance Migration Mode     : INACTIVE                INACTIVE
 AES Master Key
   New Master Key register     : EMPTY                   EMPTY
     Verification pattern      :
   Old Master Key register     : EMPTY                   EMPTY
     Verification pattern      :
   Current Master Key register : VALID                   VALID
     Verification pattern      : 1300CF50ECF4DEA6        1300CF50ECF4DEA6
 DES Master Key
   New Master Key register     : EMPTY                   EMPTY
     Verification pattern      :
   Old Master Key register     : EMPTY                   EMPTY
     Verification pattern      :
   Current Master Key register : VALID                   VALID
     Verification pattern      : 29069A18A233405A        29069A18A233405A
ECC Master Key
   New Master Key register     : EMPTY                   EMPTY
     Verification pattern      :
   Old Master Key register     : EMPTY                   EMPTY
     Verification pattern      :
   Current Master Key register : VALID                   VALID
     Verification pattern      : AFDEEE7A0AB38568        AFDEEE7A0AB38568
 RSA Master Key
   New Master Key register     : EMPTY                   EMPTY
     Verification pattern      :
                               :
   Old Master Key register     : EMPTY                   EMPTY
     Verification pattern      :
                                :
   Current Master Key register : VALID                   VALID

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 227) 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
------     ---------------------------------        -----------------------
  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
  8A        Crypto Express8 Accelerator              a, d
  8C        Crypto Express8 CCA coprocessor          a, d, e, k, r, s, v
  8P        Crypto Express8 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 characters' 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 been 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 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 keystore (CKDS, PKDS, or
        TKDS) and the master key is available for use
    C:  Master key Verification Pattern matches the keystore, but the master
        key is not available for use
    E:  Master key Verification Pattern mismatch for keystore or for P11, no
        TKDS was specified in the options data set
    I:  The Master key Verification Pattern in the keystore 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 the IBM z17 ME1. It covers the following topics:

- VFM overview
- Planning for VFM configuration
- Configuring VFM
- VFM management

10.2.1 VFM overview

VFM offers up to 6.0 TB on the IBM z17 ME1 and can be ordered in 512 GB increments.

VFM is designed to improve the availability and handling of paging workload spikes when running on a supported z/OS version. With this support, z/OS improves system availability and responsiveness by using VFM during transitional workload events, such as market openings and diagnostic data collection. z/OS also improves processor performance by supporting middleware usage of pageable large (1 MB) pages.

Using VFM improves availability by reducing latency from paging delays that occur at the start of the workday or during other transitional periods. It also eliminates delays that can occur when collecting diagnostic data during failures.

With CFLEVEL 26, included in IBM z17 Driver Level 61, support for using VFM for Coupling Facility (CF) images is removed. If a client uses VFM as an overflow mechanism for IBM MQ Shared Queue structures, the client should plan to use other alternatives, such as larger CF structures, IBM MQ shared message datasets (SMDS), or IBM MQ techniques to offload IBM MQ message data to Db2.

VFM helps organizations meet demanding service-level agreements and compete more effectively. It is simple to configure and provides rapid time to value.

For more information about the VFM feature, see *IBM z17 (9175) Technical Guide*, SG24-8579.

10.2.2 Planning for VFM configuration

For planning considerations, see “Planning considerations for Virtual Flash Memory” on page 29.

10.2.3 Configuring VFM

You assign VFM to LPARs exclusively through the definitions in the image activation profiles.

> **Note:** Unlike Flash Express cards, you cannot alter the allocation of VFM to LPARs on an activated LPAR. Therefore, Manage Flash Allocation on the HMC is not supported for IBM z15 T01, IBM z15 T02, IBM z16 A01, IBM z16 A02, IBM z16 AGZ, and IBM z17 ME1 systems.

Consider the following items when allocating VFM to a partition:

- When an allocation is first defined, set the initial and maximum allocation in 16 GB increments.
- The system places a storage-class memory (SCM) allocation 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 extra memory to be configured online, up to the maximum memory that is defined in this window or up to the maximum VFM available and not used by other LPARs.
- The system allocates minimum amounts from the available pool, and they cannot be overallocated.

- The system can overallocate maximum amounts up to the VFM LICCC value of the IBM z17 ME1.
- 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 select **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.

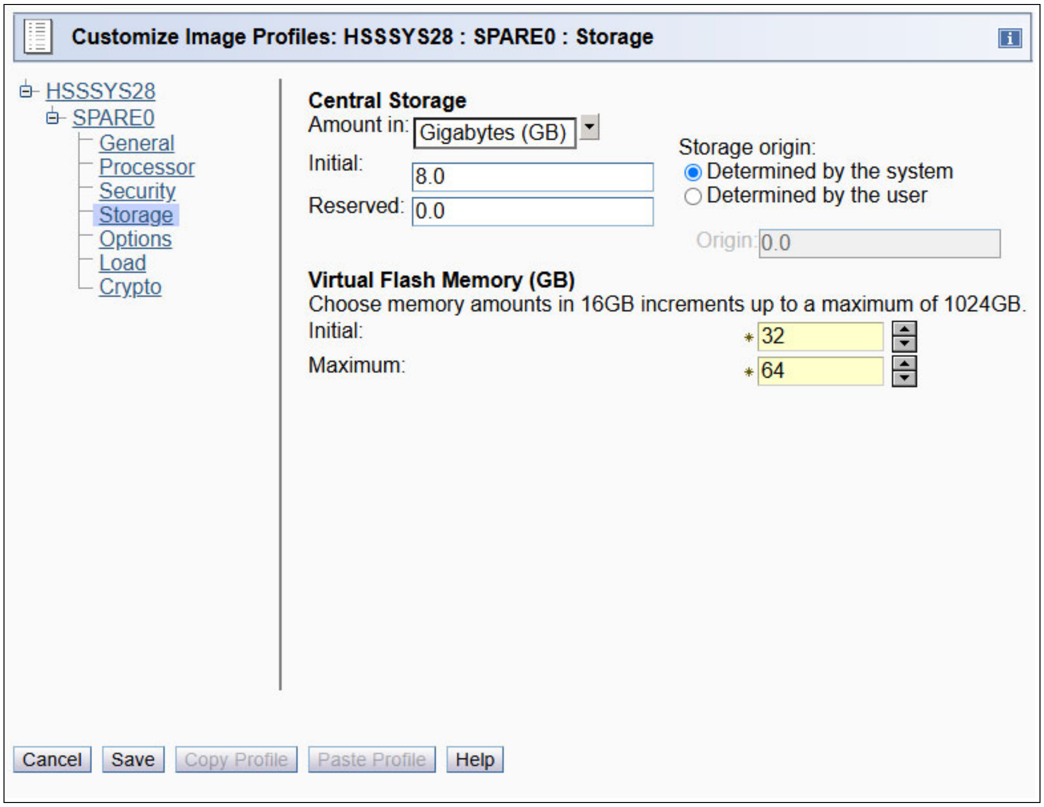


Figure 10-40 Virtual Flash Memory allocation in an image profile

In this example, the initial value is set to 32 GB, and the maximum value is set to 64 GB. The IBM z17 ME1 system has two VFM features that are installed, which enables a maximum of 1024 GB that can be 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 IBM z17 ME1 is specified, the activation of this LPAR fails with message ACTZ01EB, as illustrated in Figure 10-41.

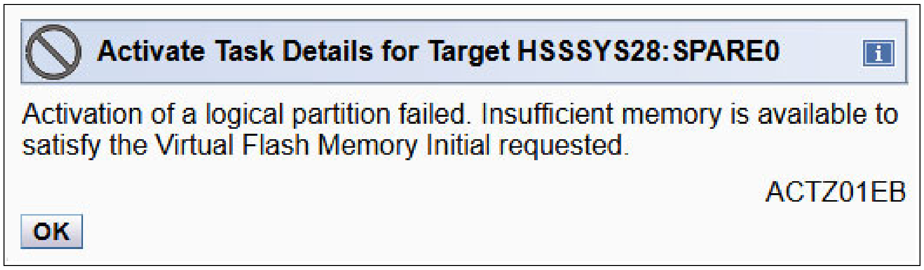


Figure 10-41 Insufficient VFM available: ACTZ01EB

10.2.4 VFM management

The memory allocation of an IBM z17 ME1 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.

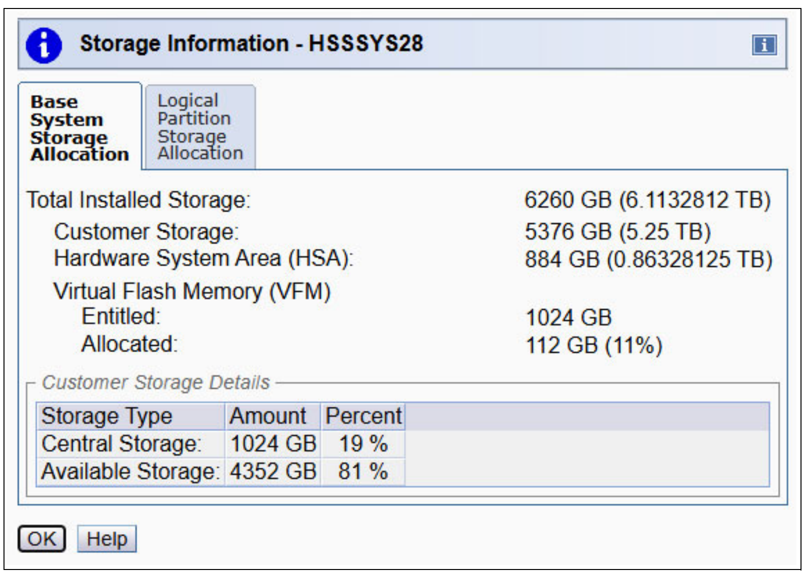


Figure 10-42 Storage Information: Base System Storage Allocation

The IBM z17 ME1 in our example (HSSSYS28) has 1024 GB installed, of which 112 GB is 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 amounts of VFM are listed (which were specified in the image activation profile), and the currently allocated amount, as shown in Figure 10-43.

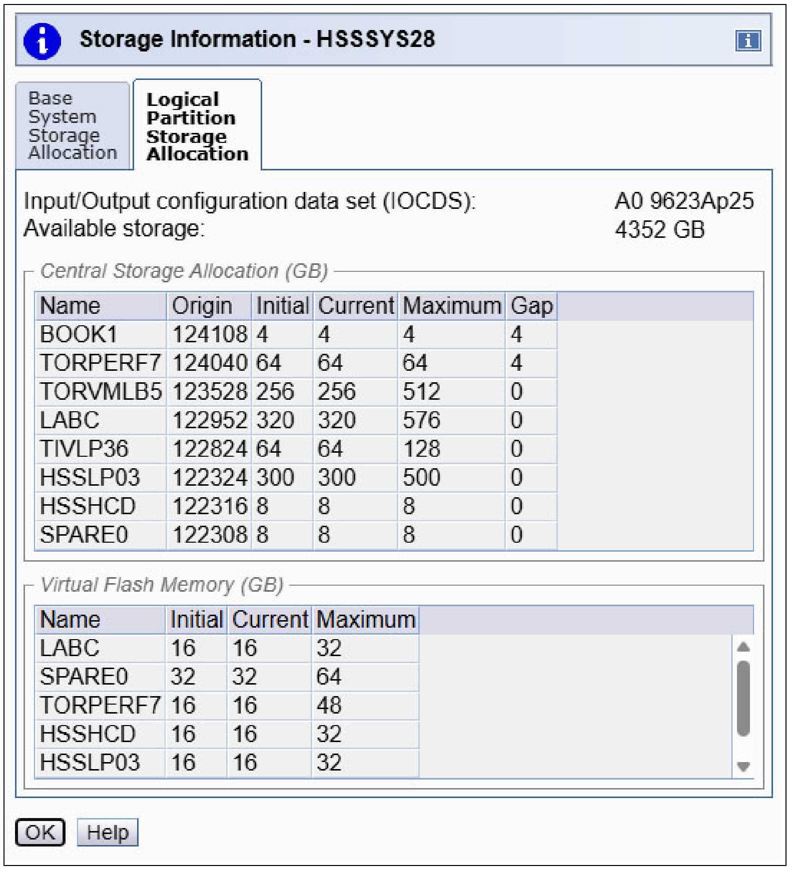


Figure 10-43 Storage Information: Logical Partition Storage Allocation

In z/OS for 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 The 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 usage 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:

<xxxxxx>M	Specifies the amount of SCM to reserve for paging at IPL in megabytes. This value can be 1 - 6 decimal digits.
<xxxxxx>G	Specifies the amount of SCM to reserve for paging at IPL in gigabytes. This value can be 1 - 6 decimal digits.
<xx>T	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:

<dddddddd><M>|<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 datasets to back critical system data. The **`CONFIG SCM OFFLINE`** command fails if taking the specified number of SCMs offline results in auxiliary storage being 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 datasets, which can lead to a loss of critical data during a direct access storage device (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 datasets, 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 observe a difference in usage numbers between the **`DISPLAY M=SCM`** and **`DISPLAY ASM`** commands. The difference occurs because of how ASM perceives its usage of the cache of available SCM block IDs that it maintains. ASM considers some block IDs not in use because they are not assigned to page-out requests. However, the **`DISPLAY M=SCM`** command processor considers block IDs used because they are assigned to ASM for its use.

In the example in 10.2.3, “Configuring VFM” on page 228, we allocate an initial VFM of 32 GB to the LPAR SPARE0, and a maximum VFM of 64 GB, as shown in Figure 10-40 on page 229. Now, from SPARE0, which is running the z/OS image HSSHCD, 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 the **PAGESCM** parameter is *not* 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 HSSHCD, 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

```
DISPLAY ASM
IEE200I 11.54.04 DISPLAY ASM 259
TYPE     FULL STAT   DEV  DATASET NAME
PLPA      53%   OK  26E0  PAGE.HSSHCD.PLPA
COMMON     8%   OK  26E0  PAGE.HSSHCD.COMMON
LOCAL      0%   OK  26E0  PAGE.HSSHCD.LOCAL
SCM        0%   OK   N/A   N/A
PAGEDEL COMMAND IS NOT ACTIVE

DISPLAY ASM,SCM
IEE207I 11.55.26 DISPLAY ASM 261
STATUS      FULL               SIZE             USED         IN-ERROR
IN-USE        0%          8,388,608           14,307                0

DISPLAY M=SCM
IEE174I 11.56.19 DISPLAY M 263
STORAGE-CLASS MEMORY STATUS
64G DEFINED
ONLINE
0G-32G
32G OFFLINE-AVAILABLE
0% IN USE
SCM INCREMENT SIZE IS 16G

DISPLAY M=SCM(DETAIL)
IEE174I 11.57.11 DISPLAY M 272
STORAGE-CLASS MEMORY STATUS - INCREMENT DETAIL
64G DEFINED
ADDRESS  IN USE  STATUS
     0G      0%  ONLINE
    16G      0%  ONLINE
ONLINE: 32G  OFFLINE-AVAILABLE: 32G  PENDING OFFLINE: 0G
0% IN USE
SCM INCREMENT SIZE IS 16G
```

From these commands, you see that 64 GB of VFM is defined, but only 32 GB are online, and the other 32 GB are offline-available.

To vary an extra 32 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(32G),ONLINE
IEE195I SCM LOCATIONS 32G TO 64G 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 extra value is now online and available (Example 10-6).

Example 10-6 Post-configuration displays

```
DISPLAY ASM
IEE200I 12.01.43 DISPLAY ASM 284
TYPE     FULL STAT   DEV  DATASET NAME
PLPA      53%   OK  26E0  PAGE.HSSHCD.PLPA
COMMON     8%   OK  26E0  PAGE.HSSHCD.COMMON
LOCAL      0%   OK  26E0  PAGE.HSSHCD.LOCAL
SCM        0%   OK   N/A   N/A
PAGEDEL COMMAND IS NOT ACTIVE

DISPLAY ASM,SCM
IEE207I 12.02.36 DISPLAY ASM 286
STATUS      FULL              SIZE             USED         IN-ERROR
IN-USE        0%        16,777,216           14,307                0

DISPLAY M=SCM
IEE174I 12.03.27 DISPLAY M 288
STORAGE-CLASS MEMORY STATUS
64G DEFINED
ONLINE
 0G-64G
0G OFFLINE-AVAILABLE
0% IN USE
SCM INCREMENT SIZE IS 16G

DISPLAY M=SCM(DETAIL)
IEE174I 12.04.12 DISPLAY M 290
STORAGE-CLASS MEMORY STATUS - INCREMENT DETAIL
64G DEFINED
ADDRESS  IN USE  STATUS
     0G      0%  ONLINE
    16G      0%  ONLINE
    32G      0%  ONLINE
    48G      0%  ONLINE
ONLINE: 64G  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 230 and Figure 10-43 on page 231), this change in LPAR HSSHCD is reflected.

In Figure 10-44, the amount of allocated VFM went up to 144 GB (compared to the 112 GB in Figure 10-42 on page 230).

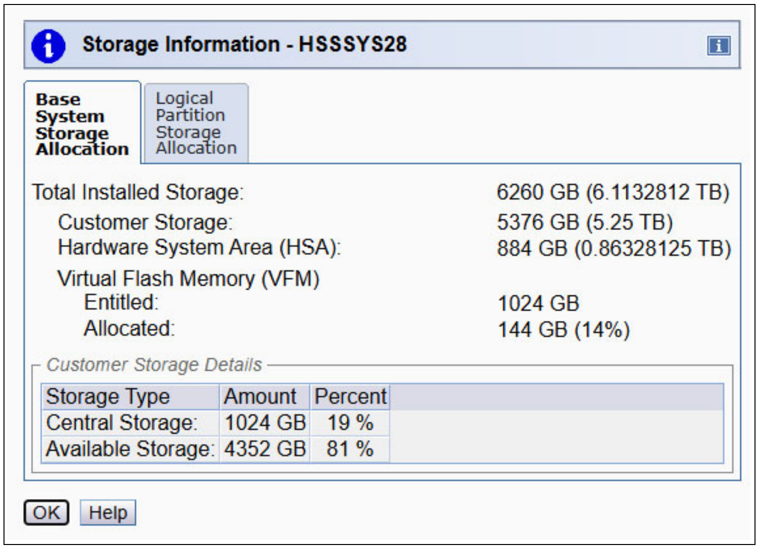


Figure 10-44 Results of CONFIG SCM(32G),ONLINE in LPAR SPAR0 - Base System Storage Allocation

In Figure 10-45, the amount of VFM that is allocated to LPAR SPARE0 went up to 64 GB.

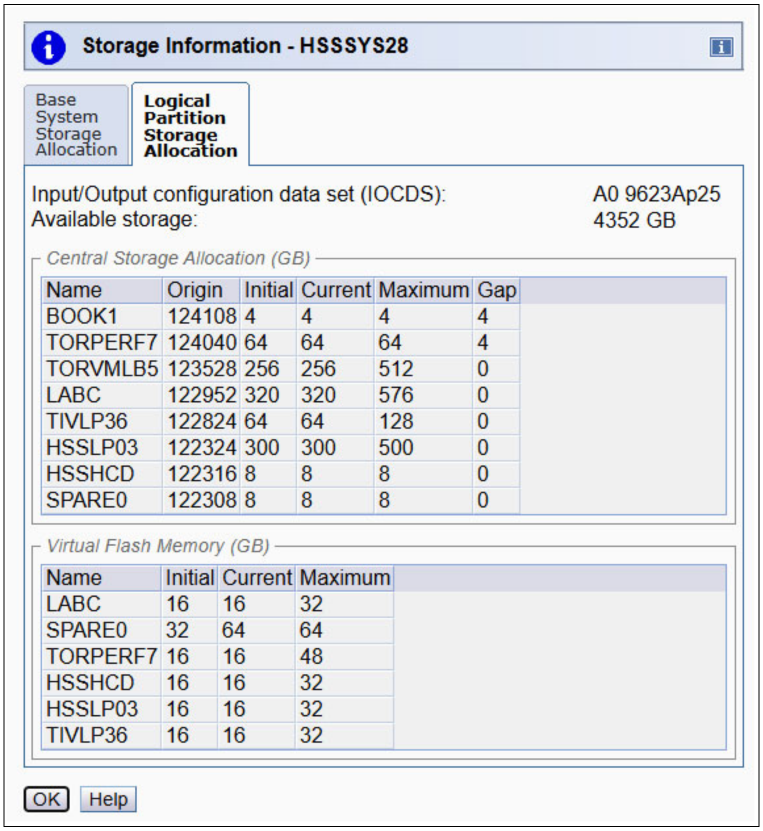


Figure 10-45 Results of CONFIG SCM(32G),ONLINE in LPAR SPARE0 - Logical Partition Storage Allocation

You can also set VFM offline, even to an amount that is lower than the initial value that is specified in the image activation profile. For LPAR SPARE0, where the amount of online VFM is reduced to 0 GB by running **CONFIG SCM(64G),OFFLINE**, you see the results in the Storage Information windows that are shown in Figure 10-46 and Figure 10-47 on page 239. In Figure 10-46, the amount of allocated VFM went down to 80 GB.

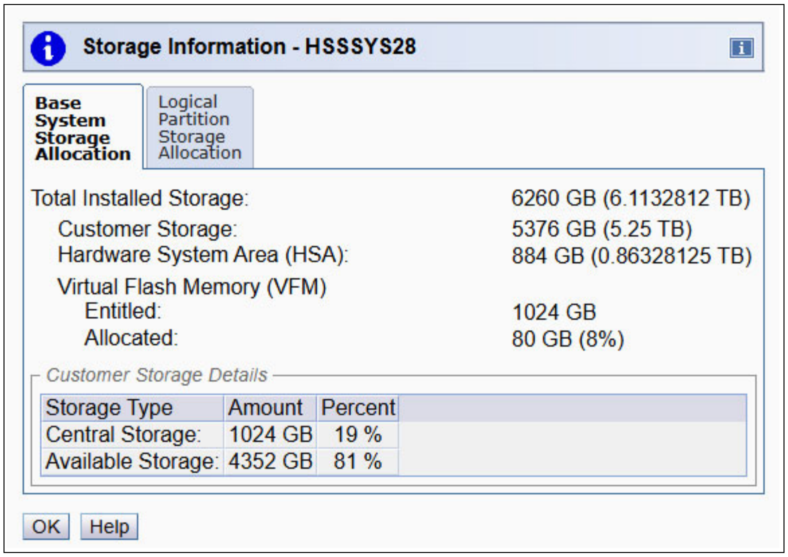


Figure 10-46 Results after CONFIG SCM(64G),OFFLINE in LPAR SPARE0 - Base System Storage Allocation

In Figure 10-47 on page 239, the amount of VFM allocated to LPAR SPARE0 went down to 0 GB, which is lower than the initial 32 GB.

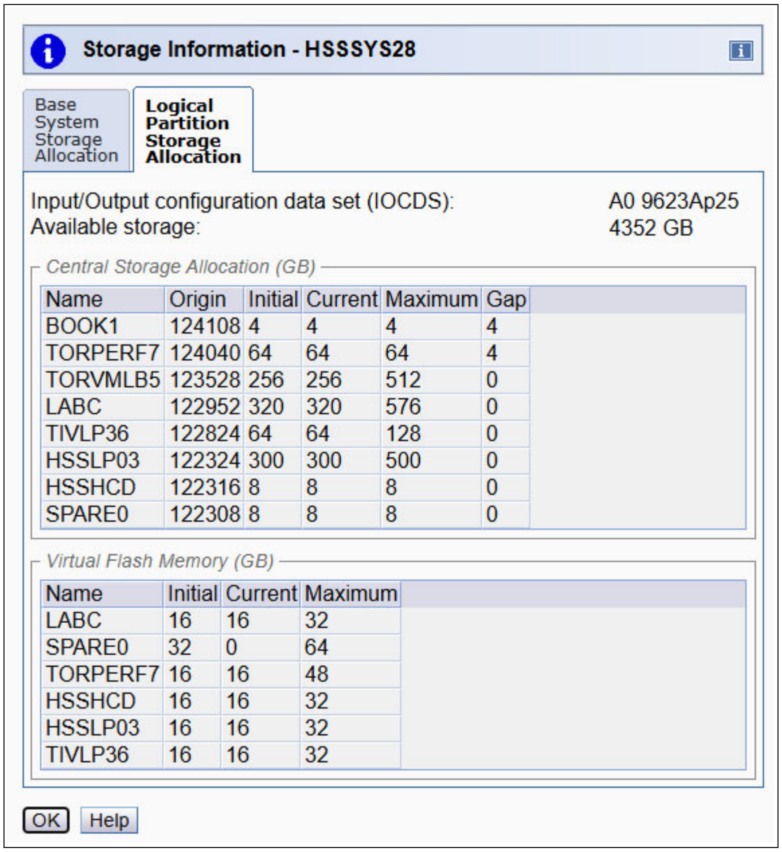


Figure 10-47 Results after CONFIG SCM(64G),OFFLINE in LPAR SPARE0 - Logical Partition Storage Allocation

Note: An LPAR uses only the amount of VFM that is activated for that LPAR. VFM that is set offline by the OS is returned to be used by other LPARs.

Important: The allocation of VFM to a CFLPAR is no longer supported on z17 ME1. With CFLEVEL 26, which comes with the IBM z17 Driver Level 61, support for VFM for CF images was removed. If a client was using VFM as an “overflow” mechanism for IBM MQ Shared Queue structures, the client should plan to use other alternatives, such as using larger CF structures, using IBM MQ shared message datasets (SMDS), or using IBM MQ techniques to offload IBM MQ message data to Db2.

11

Adding logical partitions and operating system configurations

This chapter describes how to add logical partitions (LPARs) and operating system configurations (OSCONFIGs) to the input/output definition file (IODF). It includes a list of potential configuration items and brief descriptions of how to perform each task by using Hardware Configuration Definition (HCD).

Naming: This publication covers IBM z17 ME1. Throughout this chapter, these machines are referred to as IBM z17.

Note: Not all configuration items are required for your installation, and the examples that are provided are not exhaustive.

This chapter focuses on the definition process. For a deeper understanding of how to use HCD, see these resources:

- *I/O Configuration Using z/OS HCD and HCM*, SG24-7804
- *z/OS HCD Planning,* GA32-0907 in IBM Documentation

This chapter includes the following topics:

- Preliminary actions
- Defining a new OSCONFIG
- Defining an LPAR

11.1 Preliminary actions

When defining new OSCONFIGs or LPARs, you might also need to define new devices such as consoles, network devices, and storage devices. These definition actions should be completed beforehand and are covered in the chapters of this book.

11.2 Defining a new OSCONFIG

An OSCONFIG describes the z/OS view of devices that are attached to a partition, including their operational behavior, parameters, and features. An LPAR defines the hardware runtime environment for an operating system (OS) and the devices that are visible to it.

To create an OSCONFIG, select option `1.1` from the primary HCD menu. Enter `add` in the CLI to open the panel that is shown in Figure 11-1. Enter the name of the new OSCONFIG and a description.

```
+---------------- Add Operating System Configuration -----------------+
|                                                                     |
|                                                                     |
| Specify or revise the following values.                             |
|                                                                     |
| OS configuration ID  . . . . . ITSOTEST                             |
| Operating system type  . . . . MVS      +                           |
|                                                                     |
| Description  . . . . . . . . . ITSO test OSCONFIG for IBM z17__     |
|                                                                     |
| 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 Add Operating System Configuration

When you return to the list of OS configurations, enter `S` before your new configuration to define a new Esoteric Device Table (EDT) for the OSCONFIG. Assign it a number, such as `00`, and provide a description, as shown in Figure 11-2 on page 243.

```
+-------------------------------- Add EDT --------------------------------+
|                                                                          |
|                                                                          |
| Specify the following values.                                            |
|                                                                          |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for IBM z17         |
|                                                                          |
| EDT identifier . . . 00                                                  |
| Description  . . . . ________________________________                    |
|                                                                          |
|  F1=Help     F2=Split    F3=Exit     F5=Reset    F9=Swap    F12=Cancel   |
+--------------------------------------------------------------------------+
```

Figure 11-2 Add EDT

Next, enter `S` in front of the listed new EDT. On the list of esoterics, enter `add` into the CLI to open the Add Esoteric panel. Add the required esoterics, as shown in Figure 11-3.

```
+--------------------- Add Esoteric ---------------------+
|                                                        |
|                                                        |
| Specify the following values.                          |
|                                                        |
| Esoteric name  . . . ITSOES01                          |
| VIO eligible . . . . Yes    (Yes or No)                |
| Token  . . . . . . . 1___                              |
|                                                        |
|                                                        |
|  F1=Help    F2=Split   F3=Exit    F5=Reset   F9=Swap   |
| F12=Cancel                                             |
+--------------------------------------------------------+
```

Figure 11-3 Add Esoteric

Before adding devices to the esoterics, you must first add them to the OSCONFIG. Access the I/O Device List by running **`GOTO DEV`**. Select `C` for the device or device group that you want to add to the OSCONFIG. One of the subsequent panels is Define Device to Operating System Configuration. Here, you can add the devices to your new OS configuration by entering `S` in front of the OSCONFIG.

After adding devices to the OSCONFIG, return to the Esoteric List of your OS configuration and add devices to the different esoterics.

11.3 Defining an LPAR

An LPAR is a hardware definition of a runtime environment for an OS and the devices that are visible from it.

Defining an LPAR consists of two separate actions:

1. Define the LPAR by using HCD.
2. Define the Image profile on the Hardware Management Appliance (HMA).

To define an LPAR, you need at least the following information:

- Channel subsystem (CSS) where the LPAR will be placed
- Partition name
- Partition number (identifier)
- Usage (for example, Coupling Facility (CF))
- Channel path IDs (CHPIDs) that will be accessible from this LPAR

11.3.1 Defining an LPAR by using HCD

The HCD initially defines a central processor complex (CPC) with all available channel subsystems (CSSs) and LPARs predefined. The partitions are initially defined as reserved LPARs, meaning that they are defined with a partition name of * and a usage of `CF/OS`.

To add an LPAR to a CSS, complete the following steps:

1. Select `1.3 (Processors)` from the HCD main menu. Then, select the CPC to which you want to add the LPAR. Next, select the list of partitions of the CSS where the new partition will be added by entering `P` in front of that CSS. The Partition List window opens, as shown in Figure 11-4.

```
+---------------------------- Partition List -----------------------------+
|   Goto  Backup  Query  Help                                             |
| ----------------------------------------------------------------------- |
|                                                           Row 2 of 15   |
| Command ===> ________________________________________ Scroll ===> PAGE  |
|                                                                         |
| Select one or more partitions, then press Enter. To add, use F11.       |
|                                                                         |
| Processor ID  . . . . : MENSA     Mensa                                 |
| Configuration mode  . : LPAR                                            |
| Channel Subsystem ID  : 3                                               |
|                                                                         |
| / Partition Name   Number Usage + UID Description                       |
| C *                2      CF/OS   N   ________________________________  |
| _ *                3      CF/OS   N   ________________________________  |
| _ *                4      CF/OS   N   ________________________________  |
| _ *                5      CF/OS   N   ________________________________  |
| _ *                6      CF/OS   N   ________________________________  |
| _ *                7      CF/OS   N   ________________________________  |
| _ *                8      CF/OS   N   ________________________________  |
|  F1=Help       F2=Split      F3=Exit       F4=Prompt     F5=Reset       |
|  F7=Backward   F8=Forward    F9=Swap      F10=Actions   F11=Add         |
| F12=Cancel    F13=Instruct  F22=Command                                 |
+-------------------------------------------------------------------------+
```

Figure 11-4 Partition List

2. Change the definition of a reserved LPAR by entering `C` in front of the chosen LPAR. The Change Partition Definition panel opens, as shown in Figure 11-5 on page 245.

```
+------------- Change Partition Definition --------------+
|                                                        |
|                                                        |
| Specify or revise the following values.                |
|                                                        |
| Partition name . . . MENSA32                           |
| Partition number . . 2      (same as MIF image ID)     |
| Partition usage  . . OS     +                          |
| UID uniqueness . . . N        (Y/N)                    |
|                                                        |
| Description  . . . . MENSA32 test OS partition         |
|                                                        |
|                                                        |
|  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset  |
|  F9=Swap   F12=Cancel                                  |
+--------------------------------------------------------+
```

Figure 11-5 Change Partition Definition

3. Change the partition name to the wanted name and update the usage to `CF` for a Coupling LPAR or `OS` for an LPAR that will run an OS. Add a description for the partition. Do not change the partition number.

If you want to rename a partition, change the partition definition. However, activating an I/O definition containing such a change fails because you cannot rename existing, non-reserved partitions. Therefore, you must follow these three steps:

1. Define an I/O configuration with the partition changed to a reserved partition, stop and deactivate the LPAR, and activate the new configuration.
2. On the HMA, change the name of the image profile to the new partition name by opening it with **Customize profile**, changing the name at the top of the definition panel, and selecting **Save**.
3. Define another I/O configuration starting from the original I/O definition with the partition changed to the wanted name, and activate the new configuration.

Using the original I/O definition as the source for step 3 helps retain the original CHPIDs that are attached to the partition. Otherwise, this information is lost after changing the partition to reserved and back to a named partition.

11.3.2 Defining an image profile on the HMA

After activating the I/O configuration that contains the new LPAR definition, define the image profile on the HMA, which is described in 5.4, “Creating an image profile on the Support Element” on page 105.

12

Adding storage devices

This chapter describes how to define Fibre Connection (FICON) switches and FICON channel path IDs (CHPIDs) and how to connect them to a direct access storage device (DASD) control unit (CU). It includes a list of potential configuration items and a brief description of how to configure each item by using Hardware Configuration Definition (HCD).

This chapter shows only the definition process. For a deeper understanding of how to use HCD and FICON, see the following resources:

- *I/O Configuration Using z/OS HCD and HCM*, SG24-7804
- *FICON Planning and Implementation Guide*, SG24-6497
- *z/OS HCD Planning*, GA32-0907

Note: The IBM z17 systems that are targeted by this publication consist of the IBM z17 ME1 model. Throughout this chapter, these machines are referred to as IBM z17.

The examples in this chapter are based on the IBM z17 ME1 (9175).

Not all of the following configuration items are required for your installation. The examples that are provided are not exhaustive.

This chapter includes the following topics:

- Defining more I/O by using HCD
- FICON CHPIDs, switches, and DASD CUs

12.1 Defining more I/O by using HCD

When you define new I/O components in an input/output definition file (IODF), certain definitions, such as operating system configurations (OSCONFIGs), partitions, FICON switches, CUs, and devices, must be completed first. After you define these items, you can create the connections. You define the following items:

- Defining FICON 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, Eligible Device Tables, and Esoteric device groups

The following I/O definitions use HCD to demonstrate the examples. The examples continue by using the working example `SYS9.IODF81.WORK`.

12.1.1 Defining FICON switches

The following items are considerations for new FICON switches (directors, storage area networks (SANs), and SAN switches):

- 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 CLI, enter `add` (see Figure 12-1 on page 249) to add a switch.
3. Make the following updates (this example use 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 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  ____  ____  ____  ____             |
|                                                                    |
|                                                                    |
+--------------------------------------------------------------------+
```

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 DASD CUs

This section describes the following topics:

- 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, Eligible Device Tables, and Esoteric device groups

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 to one or more CUs.
- For performance and redundancy, determine how many I/O cards of that feature are installed in the processor, to which Peripheral Component Interconnect Express (PCIe) ports they are connected, and on which central processor complex (CPC) drawer the I/O cards are installed. (For a list of installed hardware, see the physical channel ID (PCHID) and CHID report.)
- After you define a CHPID, you can add it to a predefined partition in the channel subsystem (CSS).
- After you define a CHPID, you can connect it to a FICON switch.
- After you define a CHPID, you can connect it to a CU.

To define a FICON CHPID, connect to a FICON switch and provide access to a partition. Then, complete the following steps[1]:

1. From the main Hardware Configuration Definition (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. Press PF11, or in the CLI enter `add` (see Figure 12-3 on page 251) 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`.

[1] Earlier in this book, the best practice was to use the IBM Z Connectivity Mapping Tool (CMT) to assign the PCHID. For completeness, these steps show how to assign them by using HCD.

– 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 . . . . : MENSA        Mensa                                 |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| 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  . . . . . . #0388 32Gb FICON Exp32G 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

The HCD now prompts you to select which partition the CHPID should have access to.

6. Type forward slash (/) next to the partition that 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 : 3                                                   |
| Channel path ID  . . : 14     Channel path type  . : FC                    |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                     |
|                                                                            |
| / CSS ID Partition Name   Number Usage Description                         |
| / 3      MENSA32          2      OS    MENSA32 test OS partition           |
| *************************** Bottom of data ***************************** |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
```

Figure 12-4 Processors: Define Access List

Because you have only one partition that is defined in this CSS, you do not see the Define Candidate List panel, even though you defined the CHPID as SHR.

The 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 . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No #0388 32Gb FICON Exp32G 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

Use the direct connect method in an environment that includes only one processor. Use the FICON switch method, which is described in 12.2.3, "Defining FICON CHPIDs for switch connections to a 2107 control unit" on page 256, in environments where multiple processors must connect to the same CUs. This configuration might not always apply.

Consider the following factors when connecting a FICON CHPID to a DASD CU and its devices:

- For performance and redundancy, determine how many I/O cards of that feature are installed in the processor, to which PCIe ports they are connected, and on which CPC drawer the I/O cards are on. (For a list of installed hardware, see the PCHID and CHID) report.)
- After you define a CHPID, you can add it to a predefined partition in the CSS.
- You can connect the CHPID to a CU.

> **Note:** For FICON Express16SA (Feature Code #0436 and Feature Code #0437), FICON Express32S (Feature Code #0461 and Feature Code #0462), and FICON Express32G (Feature Code #0387 and Feature Code #0388), defining both Fibre Channel (FC) and Fibre Channel Protocol (FCP) CHPID types on the same I/O adapter is not supported. No mix of these CHPID types is supported on IBM z16 or IBM z17 systems. The HCD issues the following error message during a Validate or Build Production operation for an IODF:
>
> `CBDA964I Chpid type mix detected on processor MENSA for channels: 1.6C, 0.6D`

To define a FICON CHPID that connects directly to a CU and provides access to a partition, complete the following steps[2]:

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. Press PF11 or in the CLI, enter `add` to add a CHPID. In this scenario, use the IBM Z Connectivity Mapping Tool (CMT) to assign the physical channel ID (PCHID). For completeness, these steps show how to assign it by using HCD.

[2] Earlier in this book, the best practice was to use the IBM Z CMT to assign the PCHID. For completeness, these steps show how to assign them by using HCD.

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 . . . . : MENSA        Mensa                                 |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| 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  . . . . . . #0388 32Gb FICON Exp32G SX____                 | |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

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 on page 255), 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 : 3                                                 |
| Channel path ID  . . : 15     Channel path type  . : FC                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                   |
|                                                                          |
| / CSS ID Partition Name   Number Usage Description                       |
| / 3      MENSA32          2      OS    MENSA32 test OS partition         |
| **************************** Bottom of data ***************************** |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
```

Figure 12-7 Processors: Define Access List

Because only one partition is defined in this CSS, you do not see the Define Candidate List panel, even though you 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 . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

       CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 14    114   FC    SHR   41  41 10       No #0388 32Gb FICON Exp32G SX
_ 15    115   FC    SHR   __  __ __       No #0388 32Gb FICON Exp32G 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

You can define FICON connections to a CU in two ways: through a FICON switch or by using a direct connection, which is described in 12.2.2, “Defining FICON CHPIDs for a direct connection to a 2107 control unit” on page 253.

Use the direct connect method in an environment that includes only one processor. Use the FICON switch method in environments where multiple processors must connect to the same CUs. This configuration might not always apply.

- For FICON switch connections, use at least two FICON switches that the FICON CHPIDs connect through to provide failure or service redundancy.

> **Note:** The device type of the CU depends on the storage server. An IBM DS8000 server uses a CU type of 2107.

- In this example, the connection is made to a predefined 2107 CU (A000) with a control unit address (CUADD) of 40 and devices A000 – A0EF (3390B) and A0F0 – A0FF (3390A).

> **Note:** For FICON Express16SA (Feature Code #0436 and Feature Code #0437), FICON Express32S (Feature Code #0461 and Feature Code #0462), and FICON Express32G (Feature Code #0387 and Feature Code #0388), defining both FC and FCP CHPID types on the same I/O card is not supported. No mixture of these CHPID types is supported on IBM z16 or IBM z17 systems. The HCD issues the following error message during a Validate or Build Production operation for an input/output definition file (IODF):
>
> `CBDA964I Chpid type mix detected on processor MENSA for channels: 1.6C, 0.6D`

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 CLI, enter `L A000`. This example uses `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 on page 257), and press Enter:
   a. Update `Connected to switches` to `41`. Switch 41 is the switch ID that was 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  . . . . . . . . DS8950F - SU2 - SSID=A000            |
|                                                                   |
| Connected to switches  . . . 41  __  __  __  __  __  __  __  +    |
| Ports  . . . . . . . . . . . 11  __  __  __  __  __  __  __  +    |
|                                                                   |
| Define more than eight ports . . 2   1.  Yes                      |
|                                      2.  No                       |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
+-------------------------------------------------------------------+
```

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 you want to access the CU and access the CHPID that you want to connect to the CU. In this example, use `MENSA.3`, and then press Enter.

6. Make the following updates to define the Processor / CU connection panel (see Figure 12-10), and press Enter:
   a. Update `Channel path IDs` to `14`. CHPID 14 is the CHPID that you defined in 12.2.1, “Defining FICON CHPIDs and connecting them to a FICON switch” on page 250.
   b. Update `Link address` to `4111`. The link address 4111 is FICON switch 41 and CU Port 11.
   c. Update `Unit address` to `00`. The unit address (UA) of 00 is the starting UA number on the CHPID.
   d. Update `Number of units` to `256`. The number of units of 256 equals A000 - A0FF (that is, 00 - FF or 256).
   e. Update `Logical address` to `40`. The logical address of 40 is the CUADD that is defined in the DS8950F that defines the location of the devices in the DS8950F.

```
                              Select Processor / CU
+---------------------- Change Control Unit Definition -----------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Control unit number  . : A000        Type . . . . . . : 2107                |
| Processor ID . . . . . : MENSA       Mensa                                  |
| Channel Subsystem ID . : 3                                                  |
|                                                                             |
| 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)                                  |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

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 DASD CU definition, the starting UA is usually `00` and the ending UA is `FF`, giving you 256 DASD definitions for the CU.

7. In this example, 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 ===> PAGE     |
|                                                                              |
| Specify or revise any changes to the device parameters in the list below.   |
| To view attached control units, scroll to the right.                         |
|                                                                              |
| Processor ID . . . . : MENSA        Mensa                                    |
| Channel Subsystem ID : 3                                                     |
|                                                                              |
| ---------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 ****************************** |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
```

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).

```
                             Select Processor / CU    Row 1 of 15 More:       >
Command ===> _______________________________________________ Scroll ===> PAGE

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------
_ MENSA.0    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.1    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.2    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.3    14.4111 _______ _______ _______ _______ _______ _______ _______
_ MENSA.4    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.5    _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.0     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.1     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.2     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.3     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.4     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.5     _______ _______ _______ _______ _______ _______ _______ _______
_ VELA.0     _______ _______ _______ _______ _______ _______ _______ _______
_ VELA.1     _______ _______ _______ _______ _______ _______ _______ _______
_ VELA.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 on page 261), 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 . . . . . : MENSA       Mensa                                  |
 | Channel Subsystem ID . : 3                                                  |
 |                                                                             |
 | 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. The HCD again shows the Modify Device Parameters panel where you can override the UA numbers. Press Enter to continue.

The HCD returns to the Select Processor / CU panel showing the CHPID (15) connection definition (see Figure 12-14).

```
                              Select Processor / CU    Row 1 of 15 More:       >
Command ===> _______________________________________________ Scroll ===> PAGE

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------
_ MENSA.3    14.4111 15      _______ _______ _______ _______ _______ _______
_ MENSA.0    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.1    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.2    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.4    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.5    _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.0     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.1     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.2     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.3     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.4     _______ _______ _______ _______ _______ _______ _______ _______
_ PAVO.5     _______ _______ _______ _______ _______ _______ _______ _______
_ VELA.0     _______ _______ _______ _______ _______ _______ _______ _______
_ VELA.1     _______ _______ _______ _______ _______ _______ _______ _______
_ VELA.2     _______ _______ _______ _______ _______ _______ _______ _______
```

Figure 12-14 Processors: Select Processor / CU: CHPID to Link address connection

Although a mixture of FICON switched and FICON direct connections to the same CU is not recommended, this configuration is possible. A typical scenario might occur when you are moving from a direct-connect DASD to a FICON switch that is connected DASD, but the DASD cannot be taken offline from active systems.

12.2.4 Defining 3390B devices to an OSCONFIG, Eligible Device Tables, and Esoteric device groups

The OSCONFIG name is the part of an IODF that determines which devices a z/OS system can access when it starts. The partition in which the z/OS system is restarted must also have access to the CHPIDs that connect to the CUs and devices that are defined in the OSCONFIG.

The OSCONFIG also contains esoteric device groups that are defined in Eligible Device Tables (EDTs) within the OSCONFIG.

Esoteric device groups are used to request the allocation of a device that is defined in an esoteric device group when you use 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:

- Device Parameters and Features
- EDT ID: Esoterics / VIO
- Nucleus Initialization Program (NIP) Consoles

Here are the considerations for adding devices to an OSCONFIG and Esoteric device group:

- 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 or 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 CLI, enter `L A000`. This example uses `A000`.
3. Enter `c` next to one or more device numbers, and press Enter.

   The 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.                                                          |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 12-15 I/O Devices: Change Device Definition

   The HCD displays the Device / Processor Definition panel where you can modify some of the Device parameters that are related to the 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 ===> PAGE  |
|                                                                           |
| 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 MENSA.3     0    00   No        Yes     __         No             ___   |
| ***************************** Bottom of data **************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 12-16 I/O Devices: Device / Processor Definition continued

5. Next is the HCD panel, where you 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 CLI, enter `L ITSOTEST`. This example uses `ITSOTEST`.

6. Enter `s` next to the OSCONFIG, and press Enter.

   HCD displays the device parameters and features that are applicable to that device type. In this example, 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 ===> PAGE   |
|                                                                              |
| Specify or revise the values below.                                          |
|                                                                              |
| Configuration ID . : ITSOTEST     ITSO test OSCONFIG for IBM z17            |
| 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 ****************************** |
|                                                                              |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
```

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.

```
+-------------------- Assign/Unassign Device to +-oteric --------------------+
|                                                                 Row 1 of 1 |
| Command ===> __________________________________________ Scroll ===> PAGE   |
|                                                                            |
| Specify Yes to assign or No to unassign.  To view devices already          |
| assigned to esoteric, select and press Enter.                              |
|                                                                            |
| Configuration ID : ITSOTEST          ITSO test OSCONFIG for IBM z17        |
| Device number  . : A000              Number of devices  : 240              |
| Device type  . . : 3390B             Generic  . . . . . : 3390             |
|                                                                            |
| / EDT.Esoteric  Assigned  Starting Number Number of Devices                |
| _ 00.ITSOES01   Yes       ____            ____                             |
| **************************** Bottom of data ***************************** |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
```

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 11 |
| 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                           |
| _ ITSOBLD      MVS         ITSO + CPO devices                         |
| _ ITSOTEST     MVS      0  ITSO test OSCONFIG for IBM z17   Yes      |
| _ PRF1         MVS         Proof Points                               |
| _ WAT1         MVS         Watsonx                                    |
| _ ZOSMAINT     MVS         z/OS Central Mgmt Image                    |
| _ ZOSMESUR     MVS         z/OS systems to monitor all                |
| _ ZOS24BAS     MVS         z/OS 2.4 base system                       |
| _ ZOS24P1K     MVS         z/OS 2.4 P1K study system                  |
| _ ZOS25BAS     MVS         z/OS 2.5 inital system                     |
| _ ZOS25POP     MVS         z/OS 2.5 POP system                        |
+-----------------------------------------------------------------------+
```

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 (Integrated Console Controller (ICC)), OSD (Queued Direct I/O (QDIO)), OSH (Enhanced QDIO), and Internal Queued Direct (IQD) channel path IDs (CHPIDs), along with the respectivecontrol units (CUs) and devices.

For more information, see the *Input/Output Configuration Program User's Guide for ICP IOCP*, SB10-7183.

> **Note:** IBM z17 does not support CHPID type OSE.

A *channel path* is the connection between the channel subsystem (CSS) and CUs that enables the CSS to communicate with I/O devices.

A *CU* provides the capability that is necessary to operate and control an I/O device.

An *I/O device* is the endpoint of the communication link.

This chapter provides a list of potential configuration items and a brief description of how to configure each item by using Hardware Configuration Definition (HCD).

> **Naming:** The IBM z17 system that is targeted by this publication is the IBM z17 ME1 (9175) model. Throughout this chapter, this machine is referred to as the IBM z17.
>
> Not all of the following configuration items are required for your installation. In addition, the examples that are provided are not exhaustive.

This chapter includes the following topics:

- Summary of network devices that are defined in this chapter
- Defining OSC (Integrated Console Controller)
- Defining OSD (QDIO)
- Network Express for channel type OSH
- IQD CHPIDs for HiperSockets

13.1 Summary of network devices that are defined in this chapter

When you define I/O components in an IODF, certain definitions, such as operating system configurations (OSCONFIGs), partitions, Fibre Connection (FICON) switches, CUs, and devices, must be completed first. After you define these items, you can create the additional definitions:

- Defining OSC (Integrated Console Controller)
- Defining OSD (QDIO)
- Network Express for channel type OSH
- IQD CHPIDs for HiperSockets

Note: This book uses definitions that were created on z/OS Version 3, Release 1. All definitions and values are examples only.

13.2 Defining OSC (Integrated Console Controller)

This section covers defining the OSC CHPIDs, CUs, and devices.

13.2.1 Defining OSC CHPIDs

The Open Systems Adapter Integrated Console Controller (OSA-ICC) function requires a unique CHPID, CU, and device definition. You create these definitions by using HCD or the Input/Output Configuration Program (IOCP), which defines the Open Systems Adapter–Express (OSA-Express) feature in the I/O hardware configuration.

When you define an OSC connection, first determine which type of OSA-Express feature that you need for your configuration. See Table 13-1.

Table 13-1 OSA-Express required channel type for OSC

Networking features	Feature Code	Ports per Feature Code
OSA-Express7S 1.2 Short Wave (SX) 1G	0455	2
OSA-Express7S 1.2 Long Wave (LX) 1G	0454	2

Note: Starting with IBM z17, OSA-Express7S 1000BaseT supports only channel path type OSD.

Here are the parameters for the definition of OSC 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 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) or 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 CSS ID that you want to add a CHPID to, and press Enter.
4. Press PF11 or in the CLI, enter `add` (see Figure 13-1) to add a CHPID.
5. Make the following updates, and press Enter:
   a. Update `Channel path ID` to `B1`.
   b. Update `Channel ID` to `1D4`.
   c. Update `Channel path type` to `OSC` (to define the OSA-ICC function).
   d. Update `Operational mode` to `SHR` (to share this channel path among logical partitions (LPARs) or even SPAN to share over multiple CSSs).
   e. Update `Description` to the description that you want.

```
+--------------------------- Add Channel Path ----------------------------+
|                                                                         |
|                                                                         |
| Specify or revise the following values.                                 |
|                                                                         |
| Processor ID . . . . : MENSA        Mensa                               |
| Configuration mode . : LPAR                                             |
| Channel Subsystem ID : 3                                                |
|                                                                         |
| Channel path ID  . . . . B1    +           Channel ID  1D4  +           |
| Number of CHPIDs . . . . 1                                              |
| Channel path type  . . . OSC   +                                        |
| Operation mode . . . . . SHR   +                                        |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +    |
| Description  . . . . . . #0454 OSA-Express7S 1.2 GbE LX               | |
|                                                                         |
| 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

Note: As a best practice, use a meaningful description, which serves as a reference point in HCD.

6. HCD prompts you to select the partitions to access the CHPID. Enter a forward slash (/) next to the partitions that you want (see Figure 13-2) and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                              Row 12 of 15 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the access list.          |
|                                                                           |
| Channel subsystem ID : 3                                                  |
| Channel path ID  . . : B1     Channel path type  . : OSC                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 3      MENSA36          6      OS    RDBKAIWK                           |
| / 3      MENSA37          7      OS    RDBKESI3                           |
| / 3      MENSA38          8      OS    WTSCO1                             |
| / 3      MENSA39          9      OS    WTSCNET                            |
| **************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-2 Processors: Define Access List - OSC

In this example, because you select all partitions to the Access List, you do not see the Define Candidate List panel, even though you 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     Filter Mode. More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ B1    1D4   OSC   SHR   __  __ __       No #0454 OSA-Express7S 1.2 GbE LX
****************************** Bottom of data *******************************
```

Figure 13-3 Processors: Channel Path List - OSC

13.2.2 Defining OSC CHPID connections to an OSC CU

OSC CU numbers come from the common pool of 0000 - FFFE. The HCD default unit address (UA) range for the 254 devices is 00 - FD. Devices with UAs FE and FF are not allowed. You can define an Open Systems Adapter (OSA) connection to its CU only as a direct connection.

The following considerations apply when you connect an OSC CHPID to an OSC CU and its 3270-X devices:

- Determine how many OSCs are required to provide primary and secondary (backup) network connections.
- The example connects to a predefined OSC CU at address 1B10 and 3270-X devices 0880 - 088F.

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 CLI, enter `L 1B10`. This example uses `1B10`.
3. Enter `c` next to the CU definition, and press Enter.
4. Changes 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  . . . . 1B10  +                              |
|                                                                   |
| Control unit type  . . . . . OSC          +                       |
|                                                                   |
| Serial number  . . . . . . . __________  +                        |
| Description  . . . . . . . . ________________________________     |
|                                                                   |
| Connected to switches  . . . __ __ __ __ __ __ __ __  +           |
| Ports  . . . . . . . . . . . __ __ __ __ __ __ __ __  +           |
|                                                                   |
| Define more than eight ports . . 2   1.  Yes                      |
|                                      2.  No                       |
|                                                                   |
+-------------------------------------------------------------------+
```

Figure 13-4 Control units: Change Control Unit Definition - OSC

5. Enter `c` next to the `Processor.CSS` that contains the partition that you want to access the CU and access the CHPID that you want to connect to the CU. Then, press Enter.

6. Update `Channel path IDs` to `B1` to define the Processor / CU connection (see Figure 13-5). Press Enter.

```
+--------------------- Change Control Unit Definition ----------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Control unit number  . : 1B10         Type . . . . . . : OSC             |
| Processor ID . . . . . : MENSA        Mensa                               |
| Channel Subsystem ID . : 3                                                |
|                                                                           |
| Channel path IDs . . . . B1    __    __    __    __    __    __    __    + |
| 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)                                |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-5 Control units: Change Control Unit Definition detail - OSC

7. HCD now shows the Select Processor / CU panel. This panel is where the connection is now made between the OSC CHPID (B1) and the CU (1B10). Press Enter again to return to the Control Unit List panel.

13.2.3 Defining 3270-X devices to an OSCONFIG

The OSCONFIG name identifies the portion of the IODF that determines which devices a z/OS system can access during an IPL. The partition in which the z/OS system is restarted must also be able to access the CHPIDs that connect to the CUs and devices that are defined in the OSCONFIG.

The OSCONFIG also contains Esoteric device groups, which are defined in Eligible Device Tables (EDTs) within the OSCONFIG. OSA definitions usually do not use Esoteric device groups.

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 0880 - 088F (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 CLI, enter `L 0880`. This example uses `0880`.
3. Enter `c` next to one or more device numbers, and press Enter.

4. The HCD displays the Change Device Definition panel where you can modify the CU that the devices are attached to (see Figure 13-6). Press Enter.

```
+------------------------- Change Device Definition --------------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Device number  . . . . . . . : 0880  (0000 - FFFF)                          |
| Number of devices  . . . . . : 16                                           |
| Device type  . . . . . . . . : OSC                                          |
|                                                                             |
| Serial number  . . . . . . . __________  +                                  |
| Description  . . . . . . . . ________________________________               |
|                                                                             |
| Volume serial number . . . . . ______  + (for DASD)                         |
|                                                                             |
| PPRC usage . . . . . . . . . . _  + (for DASD)                              |
|                                                                             |
| Connected to CUs . 1B10  ____  ____  ____  ____  ____  ____  ____  +        |
|                                                                             |
| ENTER to continue.                                                          |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-6   I/O Devices: Change Device Definition - OSC

Note: You can use a maximum of 120 valid subchannels on an OSC channel path, even though you may define more than this number. The Support Element (SE) enforces this maximum when sessions are configured under Advanced Facilities.

5. HCD now displays the Device / Processor Definition panel where you may modify some of the device parameters relating to the subchannel set (SS), UA, and the Explicit Device Candidate List (see Figure 13-7).

```
+----------------------- Device / Processor Definition ------------------------+
|                                                                 Row 1 of 1 |
| Command ===> __________________________________________ Scroll ===> CSR     |
|                                                                            |
| Select processors to change device/processor definitions, then press       |
| Enter.                                                                     |
|                                                                            |
| Device number  . . : 0880       Number of devices  . : 16                  |
| Device type  . . . : 3270-X                                                |
|                                                                            |
|                                          Preferred  Device Candidate List |
| / Proc.CSSID  SS+  UA+  Time-Out  STADET  CHPID +    Explicit       Null  |
| _ MENSA.3     0    00   No        No      __         No             ___   |
| ***************************** Bottom of data ***************************** |
+----------------------------------------------------------------------------+
```

Figure 13-7   I/O Devices: Device / Processor Definition continued - OSC

6. In the HCD panel, define devices to the OSCONFIG. Scroll through the list of OSCONFIG definitions until you find the OSCONFIG that to which you want to add to the devices, or in the CLI, enter `L MENSA32`. This example uses `MENSA32`.

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 this example, we add 3270-X devices to `MENSA32`.

8. Make the following updates to define the Device Parameter (see Figure 13-8), 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 . : MENSA32      Z17 CONFIG SETUP                          |
| Device number  . . : 0880         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 13-8 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 13-9 on page 277).

   In this example, we add only the OSC/3270-X devices to the OSCONFIG `MENSA32` and not to any Esoterics.

```
+----------- Define Device to Operating System Configuration -----------+
|                                                            Row 1 of 11 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                        |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                        |
| Device number  . : 0880          Number of devices  : 16              |
| Device type  . . : 3270-X                                              |
|                                                                        |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                        |
| / Config. ID   Type     SS Description                     Defined    |
| _ ITSO         MVS      0  All ITSO devices                 Yes        |
| _ ITSOBLD      MVS      0  ITSO + CPO devices               Yes        |
| _ MENSA32      MVS      0  Z17 CONFIG SETUP                 Yes        |
| _ PRF1         MVS      0  Proof Points                     Yes        |
| _ WAT1         MVS      0  Watsonx                          Yes        |
| _ ZOSMAINT     MVS      0  z/OS Central Mgmt Image          Yes        |
| _ ZOSMESUR     MVS      0  z/OS systems to monitor all      Yes        |
| _ ZOS24BAS     MVS      0  z/OS 2.4 base system             Yes        |
| _ ZOS24P1K     MVS      0  z/OS 2.4 P1K study system        Yes        |
| _ ZOS25BAS     MVS      0  z/OS 2.5 inital system           Yes        |
| _ ZOS25POP     MVS      0  z/OS 2.5 POP system              Yes        |
+------------------------------------------------------------------------+
```

Figure 13-9 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 NIP Console List within an OSCONFIG

The Nucleus Initialization Program (NIP) Console List identifies the device addresses that are eligible to receive NIP or IPL messages during the early startup stages of z/OS initialization. First define the devices in an OSCONFIG before adding them to a NIP Console List within that OSCONFIG.

The NIP Console List also determines which console receives the NIP or IPL messages first. If that console is unavailable, the NIP attempts to use the next device in the list until all devices are attempted. If the NIP cannot write IPL messages to any 3270-X device in the list, 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 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 13-10.

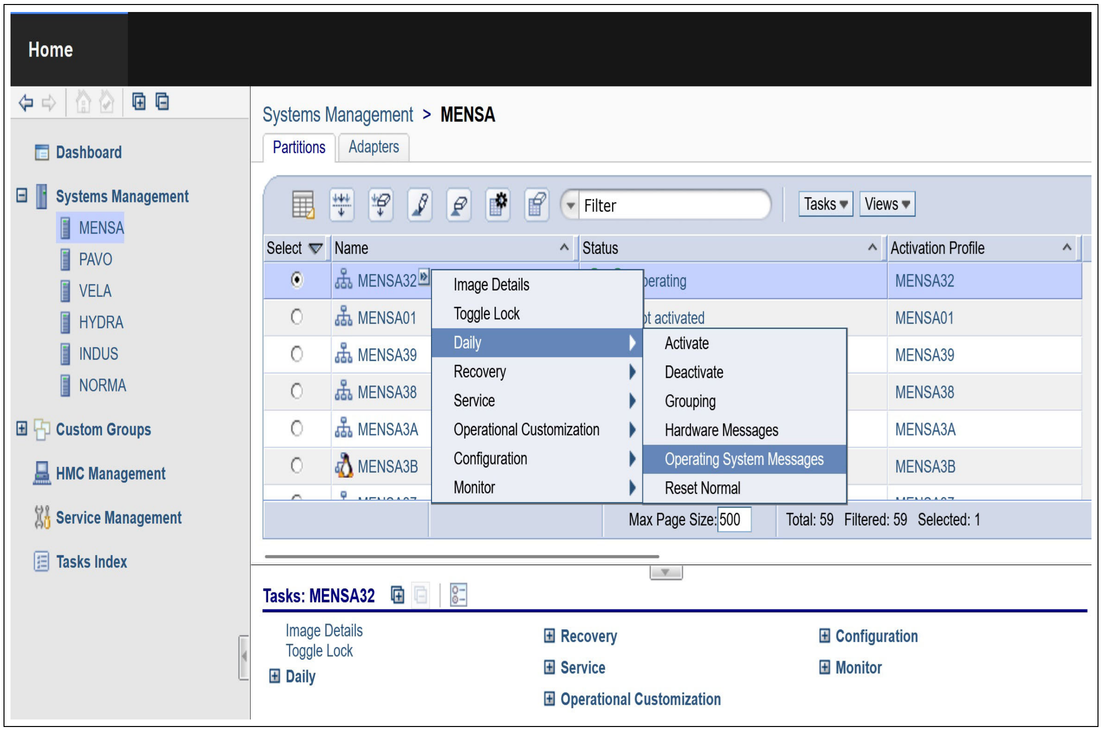


Figure 13-10 Operating System Messages

Commands and displays can be entered into the Command field (see Figure 13-11).

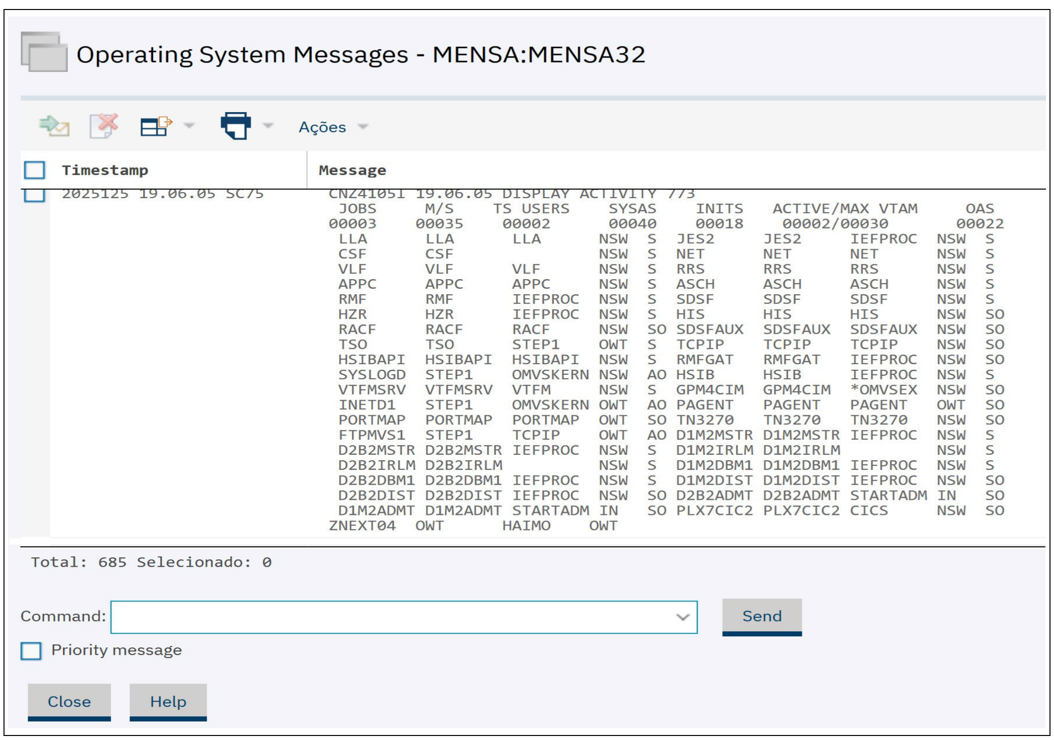


Figure 13-11 Operating System Messages command interface

The following considerations apply when you add devices to a NIP Console List within an OSCONFIG:

- Adding a device to a NIP Console List within an OSCONFIG does not necessarily mean that the NIP can write IPL messages to that device. The devices that are defined in the NIP Console List must also have CU and CHPID access to the partition where z/OS is being started.
- On the HMC under OSA Advanced Facilities, you must define and activate the OSC (OSA-ICC) console server and session definitions. A valid 3270-X session that uses IBM Personal Communications or an equivalent 3270 emulator must also be connected to the OSA-ICC session. This configuration enables a valid session to be established with the OSA-ICC so that NIP messages can be delivered to that device.

In this example, you add the predefined OSC devices 0880 through 088F (3270-X).

To define 3270-X devices to the NIP 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 NIP Console List, or in the CLI, enter `L MENSA32`. This example uses `MENSA32`.
3. Enter `n` next to the OSCONFIG, and press Enter.

   The HCD displays the defined devices in the NIP Console List (see Figure 13-12).

```
+-------------------------- NIP Console List ---------------------------+
|   Goto  Backup  Query  Help                                            |
| ---------------------------------------------------------------------- |
|                                                                        |
| Command ===> _______________________________________ Scroll ===> CSR   |
|                                                                        |
| Select one or more consoles, then press Enter. To add, use F11.        |
|                                                                        |
| Configuration ID . : MENSA32      Z17 - CONFIG SETUP                   |
|                                                                        |
|   Order   Device                                                       |
| / Number  Number  Device Type                                          |
| *************************** Bottom of data *************************** |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
|                                                                        |
+------------------------------------------------------------------------+
```

Figure 13-12 OCSONFIGs: NIP Console List

In this example, there are no devices that are defined in the NIP Console List.

4. In the CLI, enter `add` (see Figure 13-13) to add a 3270-X device to the NIP Console List.
5. Update `Device number of console` to `0880`, 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 . : MENSA32      Z17 CONFIG SETUP                      |
|                  +-------------- Add NIP Console ---------------+       |
|   Order   Device |                                              |       |
| / Number  Number |                                              |       |
| **************** | Specify the following values.                | ***** |
|                  |                                              |       |
|                  | Device number of console . . . . . . 880_    |       |
|                  |                                              |       |
|                  | Order number . . . . . . . . . . . . 1       |       |
|                  |                                              |       |
|                  |                                              |       |
|                  |                                              |       |
|                  +----------------------------------------------+       |
|                                                                         |
|                                                                         |
+-------------------------------------------------------------------------+
```

Figure 13-13 OSCONFIGs: Add NIP Console

Because this device entry is the first one in the list, the order is 1 (see Figure 13-14).

```
+--------------------------- 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 . : MENSA32      Z17 CONFIG SETUP                      |
|                                                                         |
|   Order   Device                                                        |
| / Number  Number  Device Type                                           |
| _   1     0880    3270-X                                                |
| *************************** Bottom of data **************************** |
|                                                                         |
|                                                                         |
+-------------------------------------------------------------------------+
```

Figure 13-14 OCSONFIGs: NIP Console added

6. Add device `0881` to the NIP Console List (see Figure 13-15 on page 281).

```
+--------------------------- 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 . : MENSA32      Z17 CONFIG SETUP                      |
|                                                                         |
|   Order   Device                                                        |
| / Number  Number  Device Type                                           |
| _   1     0881    3270-X                                                |
| _   2     0880    3270-X                                                |
| *************************** Bottom of data **************************** |
+-------------------------------------------------------------------------+
```

Figure 13-15 OCSONFIGs: Extra NIP Console added

13.2.5 Verifying the OSC definition

For more information about how to verify OSC definition, see 7.4, “Verifying the OSA-ICC definition” on page 152.

13.3 Defining OSD (QDIO)

This section covers defining OSD CHPIDs, CUs, and devices.

13.3.1 Defining OSD CHPIDs

QDIO is a highly efficient data transfer architecture that dramatically improves data transfer speed and efficiency for TCP/IP traffic. QDIO mode is referred to as OSD because the CHPID type that is coded in the IOCDS is OSD.

Note: The IBM z17 introduces a new adapter that is called Network Express, which represents the next generation of OSA-Express technology. It is a best practice to migrate OSD channels to the new channel type of OSH.

When defining an OSD connection, first determine which type of OSA-Express feature that you need for your configuration (see Table 13-2).

Table 13-2 IBM z17 - New build and carry forward

Networking features	Feature Code	New build (NB) or carry forward
OSA-Express 7S GbE LX	0442	Carry forward from z15 only
OSA-Express 7S GbE SX	0443	Carry forward from z15 only
OSA-Express 7S 10 GbE Long Reach (LR)	0444	Carry forward from z15 only

Networking features	**Feature Code**	**New build (NB) or carry forward**
OSA-Express 7S 10 GbE Short Reach (SR)	0445	Carry forward from z15 only
OSA-Express7S 1.2 SX 1G	0455	Carry forward-NB
OSA-Express7S 1.2 LX 1G	0454	Carry forward-NB
OSA-Express7S 1.2 SR 10G	0457	Carry forward-NB
OSA-Express7S 1.2 LR 10G	0456	Carry forward-NB
OSA-Express7S 1.2 SR 25G	0459	Carry forward-NB
OSA-Express7S 1.2 LR 25G	0460	Carry forward-NB
OSA-Express7S 1000BaseT	0446	Carry forward from z15 only

Note: Starting with IBM z17, OSA-Express7S 1000BaseT supports only the OSD channel type.

Here are the 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 adapters of that feature are installed in the processor and identify the PCIe ports and CPC drawers to which the I/O cards connect. (For a list of installed hardware, see the PCHID or 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 CLI, enter `add` to add a CHPID. (see Figure 13-16 on page 283)
5. Make the following updates, and press Enter:
   - Update `Channel path ID` to `D8`.
   - Update `Channel ID` to `174`.
   - Update `Channel path type` to `OSD`.
   - Update `Operational mode` to `SHR`. (to share this channel path among LPARs or even SPAN to share over multiple CSSs)
   - Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : MENSA       Mensa                                  |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| Channel path ID  . . . . D8    +           Channel ID  174  +             |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . OSD   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . #0445 OSA-Express7S 10 GbE SRX                 |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
+---------------------------------------------------------------------------+
```

Figure 13-16 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 you use for this example (see Figure 13-17). For more information, see the *IBM Z Connectivity Handbook*, SG24-5444. 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 13-17 Processors: Allow for more than 160 TCP/IP stacks - OSD

7. Next, HCD now prompts you to add or modify any physical network IDs. In this example, you do not use any physical network ID definitions for the OSD definition.

8. The default option for Physical Network IDs is blank fields. Keep the defaults (see Figure 13-18), 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 13-18 Processors: Add/Modify Physical Network IDs - OSD

9. HCD prompts you to select the partitions that have access to the CHPID. Enter a forward slash (/) next to the partitions that you want (see Figure 13-19), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                              Row 12 of 15 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                          |
| Select one or more partitions for inclusion in the access list.          |
|                                                                          |
| Channel subsystem ID : 3                                                 |
| Channel path ID  . . : D8     Channel path type  . : OSD                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                          |
| / CSS ID Partition Name   Number Usage Description                       |
| / 3      MENSA36          6      OS    RDBKAIWK                          |
| / 3      MENSA37          7      OS    RDBKESI3                          |
| / 3      MENSA38          8      OS    WTSC01                            |
| / 3      MENSA39          9      OS    WTSCNET                           |
| **************************** Bottom of data ***************************** |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
```

Figure 13-19 Processors: Define Access List - OSD

Because you select all partitions to the access list in this example, you do not see the Define Candidate List panel, even though you 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 13-20).

```
-------------------------------------------------------------------------------
                              Channel Path List     Filter Mode. More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+             Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ D8    174   OSD   SHR   __  __ __       No #0445 OSA-Express7S 10 GbE SRX
******************************* Bottom of data ********************************
```

Figure 13-20 Processors: Channel Path List - OSD

13.3.2 Defining OSD CHPID connections to an OSA CU

All OSA QDIO channels support 480 UAs, also known as subchannels. Although the 480 subchannels can be distributed across multiple LPARs, only 255 UAs can be assigned to a single LPAR. This limitation exists because only one CU is defined on the OSA port. One CU can accommodate a maximum of 256 devices per LPAR, with one device that is reserved for hardware, that is, the X'FF' UA.

You can define an OSA connection to its CU only as a direct connection.

You might want to connect the OSA CU definition to multiple CPCs, even though the physical OSA remains unique to a single CPC. You might also want to span the OSA across multiple CSS configurations within a CPC.

Here are considerations for connecting an OSD CHPID to an OSA CU and its OSA devices:

- Determine how many OSAs are required to provide a primary and secondary or backup network connection.
- The example connects to a predefined OSA CU (1D80) and OSA devices 1D80 - 1D8F.

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 CLI, enter `L 1D80`. This example uses `1D80`.
3. Enter `c` next to the CU definition, and press Enter.

4. Change the CU definition to what you want (see Figure 13-21), and press Enter.

```
+----------------- Change Control Unit Definition ------------------+
|                                                                    |
|                                                                    |
| Specify or revise the following values.                            |
|                                                                    |
| Control unit number  . . . . 1D80  +                               |
|                                                                    |
| Control unit type  . . . . . OSA           +                       |
|                                                                    |
| Serial number  . . . . . . . __________  +                         |
| Description  . . . . . . . . #0445 OSA-Express7S 10 GbE SRX     |
|                                                                    |
| Connected to switches  . . . __ __ __ __ __ __ __ __  +           |
| Ports  . . . . . . . . . . . __ __ __ __ __ __ __ __  +           |
|                                                                    |
| Define more than eight ports . . 2   1.  Yes                       |
|                                      2.  No                        |
|                                                                    |
+--------------------------------------------------------------------+
```

Figure 13-21   Control units: Change Control Unit Definition - OSD

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 CU. Press Enter.
6. Update `Channel path IDs` to `D8` to define the Processor / CU connection (see Figure 13-22). Press Enter.

```
+---------------------- Change Control Unit Definition -----------------------+
|                                                                              |
|                                                                              |
| Specify or revise the following values.                                      |
|                                                                              |
| Control unit number  . : 1D80        Type . . . . . . : OSA                  |
| Processor ID . . . . . : MENSA       Mensa                                   |
| Channel Subsystem ID . : 3                                                   |
|                                                                              |
| Channel path IDs . . . . D8    __    __    __    __    __    __    __    +   |
| 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 13-22   Control units: Change Control Unit Definition detail - OSD

Note: For OSD configurations, UA FF is not allowed.

7. HCD now shows the Select Processor / CU panel, where the connection is now made between the OSD CHPID (D8) and the CU (1D80), as shown in Figure 13-23. Press Enter, and press Enter again to return to the Control Unit List panel.

```
 Select Processor / CU    Row 1 of 15 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : 1D80     Control unit type . . . : OSA

             ---------------Channel Path ID . Link Address + ---------------
/ Proc.CSSID 1------ 2------ 3------ 4------ 5------ 6------ 7------ 8------
_ MENSA.3    D8      _______ _______ _______ _______ _______ _______ _______
_ MENSA.0    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.1    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.2    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.4    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.5    _______ _______ _______ _______ _______ _______ _______ _______
```

Figure 13-23 Control units: Select Processor / CU - OSD

13.3.3 Defining OSA devices to an OSCONFIG (OSD CHIPDs)

The OSCONFIG name identifies the portion of the IODF that determines which devices a z/OS system can access during an IPL. The partition in which the z/OS system is started must also have access to the CHPIDs that connect to the CUs and devices that are defined in the OSCONFIG.

The OSCONFIG also contains Esoteric device groups, which are defined in EDTs within the OSCONFIG. OSA definitions usually do not use Esoteric device groups.

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, you add the predefined OSA devices 1D80 - 1D8F (OSA).

To define OSA 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 CLI, enter `L 1D80`. This example uses `1D80`.
3. Enter `c` next to one or more device numbers, and press Enter.

4. The HCD displays the Change Device Definition panel, where you may modify the CU that the devices are attached to (see Figure 13-24). Press Enter.

```
+------------------------- Change Device Definition --------------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Device number  . . . . . . . : 1D80  (0000 - FFFF)                          |
| Number of devices  . . . . . : 16                                           |
| Device type  . . . . . . . . : OSA                                          |
|                                                                             |
| Serial number  . . . . . . . __________  +                                  |
| Description  . . . . . . . . ________________________________               |
|                                                                             |
| Volume serial number . . . . ______  + (for DASD)                           |
|                                                                             |
| PPRC usage . . . . . . . . . _  + (for DASD)                                |
|                                                                             |
| Connected to CUs . 1D80  ____  ____  ____  ____  ____  ____  ____  +        |
|                                                                             |
| ENTER to continue.                                                          |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-24   I/O Devices: Change Device Definition - OSD

Note: The OSD definition without the OSAD device is UA FE. OSA Advanced Facilities on the HMC does not need the OSAD device. This device was used to communicate between the OSA and the operating system running OSA/SF.

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 13-25), 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  . . : 1D80       Number of devices  . : 16                 |
| Device type  . . . : OSA                                                  |
|                                                                           |
|                                         Preferred  Device Candidate List |
| / Proc.CSSID  SS+  UA+  Time-Out  STADET  CHPID +    Explicit       Null  |
| _ MENSA.3     0    00   No        No      __         No             ___   |
| ***************************** Bottom of data ***************************** |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-25   I/O Devices: Device / Processor Definition continued - OSD

6. The HCD panel opens, where you 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 CLI, enter `L MENSA32`. This example uses `MENSA32`.
7. Enter `s` next to the OSCONFIG, and press Enter.

   The HCD displays the device parameters and features that are applicable to that device type. In this example, you add OSA devices to `MENSA32`.
8. Make the following updates to define the device parameter (see Figure 13-26), 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 . : MENSA32      Z17 CONFIG SETUP                          |
| Device number  . . : 1D80         Number of devices  : 16                   |
| 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 13-26 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. In this example, you add only the OSA devices to the OSCONFIG `MENSA32` and not to any Esoterics in this example. Press Enter (see Figure 13-27).

```
+----------- Define Device to Operating System Configuration -----------+
|                                                           Row 1 of 11 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                       |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                       |
| Device number  . : 1D80          Number of devices  : 16              |
| Device type  . . : OSA                                                |
|                                                                       |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                       |
| / Config. ID   Type     SS Description                   Defined      |
| _ MENSA32      MVS      0  Z17 CONFIG SETUP              Yes          |
| _ PRF1         MVS         Proof Points                               |
| _ WAT1         MVS         Watsonx                                    |
+-----------------------------------------------------------------------+
```

Figure 13-27 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.

13.3.4 Verifying the OSD definition

This section presents some commands that you can use to verify the OSD configuration. Before starting, the system programmer must activate the new I/O to change a running configuration.

You can check your definitions by using the following z/OS commands:

- **`DISPLAY M=CHP(xx)`**

  Using this command, you can check whether the `CHPID DESC` is displayed as `OSA DIRECT EXPRESS` (Figure 13-28).

```
D M=CHP(D8)
IEE174I 16.13.28 DISPLAY M 545
CHPID D8:  TYPE=11, DESC=OSA DIRECT EXPRESS, ONLINE
DEVICE STATUS FOR CHANNEL PATH D8
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
01D8 +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +
SWITCH DEVICE NUMBER = NONE
PHYSICAL CHANNEL ID = 0174
OPERATING SPEED = 10G
************************ SYMBOL EXPLANATIONS ************************
+ ONLINE    @ PATH NOT VALIDATED   - OFFLINE    . DOES NOT EXIST
* PHYSICALLY ONLINE   $ PATH NOT OPERATIONAL
```

Figure 13-28 OSD 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 CU1D80. Also included is the 9175 machine type and serial number, as shown in Figure 13-29.

```
D M=DEV(1D80)
IEE174I 16.15.57 DISPLAY M 547
DEVICE 01D80   STATUS=ONLINE
CHP                   D8
ENTRY LINK ADDRESS    ..
DEST LINK ADDRESS     0D
PATH ONLINE           Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL      Y
MANAGED               N
CU NUMBER             1D80
INTERFACE ID          7400
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND         = 001730.009.IBM.02.9175000B9FB8.D800
SCP TOKEN NED     = 001730.009.IBM.02.9175000B9FB8.D800
SCP DEVICE NED    = 001732.001.IBM.02.9175000B9FB8.D800
```

Figure 13-29 OSD 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 13-30). OSD uses three devices (Read, Write, and Datapath).

```
D U,,,1D80,3
IEE457I 16.35.54 UNIT STATUS 585
UNIT TYPE STATUS        VOLSER     VOLSTATE      SS
1D80 OSA  A-BSY                                   0
1D81 OSA  A                                       0
1D82 OSA  A-BSY                                   0
```

Figure 13-30 OSD D U,,,device

13.4 Network Express for channel type OSH

The IBM z17 introduces a new adapter that is called Network Express, which represents the next generation of OSA-Express and Remote Direct Memory Access over Converged Ethernet (RoCE) adapters. In a single adapter, Network Express provides the new channel type OSH and the new PCI function NETH for Shared Memory Communications–Remote Direct Memory Access over Converged Ethernet Express (SMC-R). Both the NETH PCI function and an OSH CHPID can coexist on the same PCHID. This section covers HCD definitions for the OSH channel type only.

OSH uses Enhanced QDIO (EQDIO) which offers better performance than QDIO, It reduces latency, improves CPU usage and virtualization scale, and simplifies all definitions. In addition, the new channel type OSH provides the following features:

- All functions that are available with OSD.
- A short list of additional parameters, which reduces configuration and setup time.
- All static IBM Virtual Telecommunications Access Method (VTAM) TRLE and many TCP/IP interface statements were eliminated, and no port parameter definition is required.
- Each interface is defined with a single device. Control read/write devices were replaced with control queues.
- All OSH ports are optical and the default MTU is 9000 (Jumbo Frame).
- An OSH channel path is associated with a single port on a Network Express card. Each port has a unique PCHID.

For more information about HCD definitions to PCI function NETH, see 15.2.3, “Defining a NETH PCIe function” on page 343.

13.4.1 Defining OSH CHIPDs

When defining an OSH CHIPD, first you must determine which type of Network Express feature that you need for your configuration (See Table 13-3).

Table 13-3 IBM z17 Network Express Adapters

Feature	Feature	CHPID Type	Operating system support
Network Express 10G LR	0525	OSH	z/OS, z/VM, or z/TPF
Network Express 10G SR	0524	OSH	z/OS, z/VM, or z/TPF
Network Express 25G LR	0527	OSH	z/OS, z/VM, or z/TPF
Network Express 25G SR	0526	OSH	z/OS, z/VM, or z/TPF

Here are the considerations for a new OSH 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 that the I/O cards connect to. (For a list of installed hardware, see the PCHID or CHID report.)

To define an OSH 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 CLI, enter `add` (see Figure 13-31 on page 293) to add a CHPID.
5. Make the following updates and press Enter:
   - Update `Channel path ID` to `91`.
   - Update `Channel ID` to `13C`.
   - Update `Channel path type` to `OSH`.
   - Update `Operational mode` to `SHR` (to share this channel path among LPARs or even SPAN to share over multiple CSSs).
   - Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : MENSA       Mensa                                  |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| Channel path ID  . . . . 91    +           Channel ID  13C  +             |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . OSH   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . #0524 Network Express 10Gb SR_                 |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-31 Processors: Add Channel Path - OSH

6. The HCD now prompts you to specify *Is* `the channel path used for link aggregation?` The default is `No`, which you use for this example (see Figure 13-32). Press Enter.

```
+---------- Channel path used for link aggregation -----------+
|                                                             |
|                                                             |
| Specify Yes if the channel path is used for link            |
| aggregation, otherwise specify No.                          |
|                                                             |
| Is the channel path used for link                           |
| aggregation? . . . . . . . . . . . . No                     |
|                                                             |
|                                                             |
|                                                             |
+-------------------------------------------------------------+
```

Figure 13-32 Processors: Channel path used for link aggregation - OSH

> **Note:** Link aggregation is a z/VM feature that combines multiple OSA networking ports into a single logical connection to increase total throughput beyond the capacity of a single link. It also provides redundancy, allowing all but one of the physical links in a link aggregation group to fail without loss of connectivity.
>
> To use this function, a NETH function cannot coexist with the OSH channel path on the same PCHID.

7. The HCD now prompts you to add or modify any physical network IDs. You do not use any physical network ID definitions for the OSH definition in this example.

8. Keep the default option for Physical Network IDs as blank fields (see Figure 13-33), 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 13-33 Processors: Add/Modify Physical Network IDs - OSH

Note: When both an OSH channel path and a NETH function are defined on the same port of a network adapter, z/OS Communications Server requires that the PNETID keyword is specified and OSH channel path and a NETH function must have the same pnetid. This example does not use NETH.

9. The HCD prompts you to select the partitions that will have access to the CHPID. Enter a forward slash (/) next to the partitions that you want (see Figure 13-34), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                              Row 13 of 15 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the access list.          |
|                                                                           |
| Channel subsystem ID : 3                                                  |
| Channel path ID  . . : 91     Channel path type  . : OSH                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 3      MENSA37          7      OS    RDBKESI3                           |
| / 3      MENSA38          8      OS    WTSC01                             |
| / 3      MENSA39          9      OS    WTSCNET                            |
| *************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-34 Processors: Define Access List - OSH

Because you select all partitions to the access list, you do not see the Define Candidate List panel, even though you defined the CHPID as SHR.

10.The HCD now returns to the Channel Path List panel and shows you the CHPID that was defined (see Figure 13-35).

```
------------------------------------------------------------------------------
                              Channel Path List     Filter Mode. More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 91    13C   OSH   SHR   __  __ __       No #0524 Network Express 10Gb SR
******************************* Bottom of data ********************************
```

Figure 13-35 Processors: Channel Path List - OSH

13.4.2 Defining OSH CHPID connections to an OSA CU

A valid subchannel for an OSH device can have any UA in the range 00 - FE. The X'FF' UA is reserved to hardware. A maximum of 256 valid subchannels can be defined on an OSH channel path.

OSH connections to an OSA CU ARE defined like OSD. For more information, see 13.3.2, “Defining OSD CHPID connections to an OSA CU” on page 285.

13.4.3 Defining OSA devices to an OSCONFIG (OSH CHIPDs)

Channel types OSH and OSD use the same device type OSA, but OSH requires only one device to be defined for a TCP/IP stack. OSD requires three devices. For more information, see 13.3.3, “Defining OSA devices to an OSCONFIG (OSD CHIPDs)” on page 287.

> **Note:** The OSAD function is not available with OSH channels.

13.4.4 Verifying the OSH definition

This section presents some commands that you can use to verify the OSH configuration. Before starting, the system programmer must activate the new I/O to change a running configuration.

You can check your definition by using the following z/OS commands:

- **DISPLAY M=CHP(xx)**

  Using this command, you can check whether the `CHPID DESC` is displayed as `OSA HYBRID` (Figure 13-36).

```
D M=CHP(91)
IEE174I 16.44.59 DISPLAY M 601
CHPID 91:  TYPE=35, DESC=OSA HYBRID, ONLINE
DEVICE STATUS FOR CHANNEL PATH 91
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0191 +  +  +  +  +  +  +  +  .  .  .  .  .  .  .  +
SWITCH DEVICE NUMBER = NONE
PHYSICAL CHANNEL ID = 013C
************************ SYMBOL EXPLANATIONS ************************
+ ONLINE    @ PATH NOT VALIDATED   - OFFLINE    . DOES NOT EXIST
* PHYSICALLY ONLINE   $ PATH NOT OPERATIONAL
```

Figure 13-36 OSH 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 CU 1910. Also included is the 9175 machine type and serial number, as shown in Figure 13-37.

```
D M=DEV(1910)
IEE174I 17.42.39 DISPLAY M 646
DEVICE 01910   STATUS=ONLINE
CHP                   91
ENTRY LINK ADDRESS    ..
DEST LINK ADDRESS     0D
PATH ONLINE           Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL      Y
MANAGED               N
CU NUMBER             1910
INTERFACE ID          0004
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND         = 710003.010.IBM.02.9175000B9F  .9100
SCP TOKEN NED     = 001730.010.IBM.02.9175000B9F  .9100
SCP DEVICE NED    = 001732.010.IBM.02.9175000B9F  .9100
```

Figure 13-37 OSH 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 13-38 on page 297). OSH uses only one device.

```
D U,,,1910,3
IEE457I 16.53.04 UNIT STATUS 611
UNIT TYPE STATUS       VOLSER     VOLSTATE      SS
1910 OSA  A-BSY                                  0
1911 OSA  O                                      0
1912 OSA  O                                      0
```

Figure 13-38 OSH D U,,,device

13.5 IQD CHPIDs for HiperSockets

The HiperSockets function, also known as IQDIO, is an integrated function of the firmware of IBM Z CPCs. It provides users with attachment to high-speed logical local area networks (LANs) with minimal system and network resource usage. HiperSockets provides internal virtual local area networks (VLANs), which are internet protocol networks in IBM Z servers.

This section describes the process to define IQD CHPIDs and their CUs and devices.

13.5.1 Defining IQD CHPIDs

When you define HiperSockets, use the CHPID channel type IQD. IQD CHPID also requires a static virtual channel ID (VCHID) statement.

> **Note:** Starting with IBM z17, the VCHID range expanded and now is 0x400 - 0x7FF. Static VCHIDs, which are used for IQD and Internal Shared Memory (ISM), are in the range 0x7C0 - 0x7FF. For more information about ISM, see 15.2.2, “Defining an ISM PCIe function” on page 339.

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 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 CLI, enter `add` (see Figure 13-39 on page 298) to add a CHPID.

5. Make the following updates and press Enter:
   - Update `Channel path ID` to `F0`.
   - Update `Channel ID` to `7C1`.
   - Update `Channel path type` to `IQD`.
   - Update `Operational mode` to `SHR` (to share this channel path among LPARs or even SPAN to share over multiple CSSs).
   - Update `Description` to the description that you want.

```
+---------------------------- Add Channel Path -----------------------------+
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : MENSA        Mensa                                 |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| Channel path ID  . . . . F0    +           Channel ID  7C1  +             |
| 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 13-39   Processors: Add Channel Path - IQD

The 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. Keep the default option of `16` for the Maximum frame size, and select option `1. Basic HiperSockets` for the IQD function (see Figure 13-40). 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 13-40 Processors: Specify IQD Channel Parameters - IQD

Note: Each CHPID has a configurable frame size (16 KB, 24 KB, 40 KB, or 64 KB) that supports optimizing per HiperSocket LAN for small packets versus large packets.

7. The HCD prompts you to select the partitions that have access to the CHPID. Type forward slash (/) next to the needed partitions (see Figure 13-41), and press Enter.

```
+--------------------------- Define Access List ----------------------------+
|                                                              Row 13 of 15 |
| Command ===> __________________________________________ Scroll ===> CSR    |
|                                                                           |
| Select one or more partitions for inclusion in the access list.           |
|                                                                           |
| Channel subsystem ID : 3                                                  |
| Channel path ID  . . : F0     Channel path type  . : IQD                  |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                    |
|                                                                           |
| / CSS ID Partition Name   Number Usage Description                        |
| / 3      MENSA37          7      OS    RDBKESI3                           |
| / 3      MENSA38          8      OS    WTSC01                             |
| / 3      MENSA39          9      OS    WTSCNET                            |
| **************************** Bottom of data ***************************** |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+
```

Figure 13-41 Processors: Define Access List - IQD

HCD now displays the Define Candidate List panel. In this example, you do not select any Candidate LPARs for this IQD CHPID. Press Enter.

The HCD returns to the Channel Path List and shows the CHPID that was defined (see Figure 13-42).

```
------------------------------------------------------------------------------
                              Channel Path List     Filter Mode. More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ F0    7C1   IQD   SHR   __  __ __       No  IQD Internal Queued Direct Comms
******************************* Bottom of data ********************************
```

Figure 13-42 Processors: Channel Path List - IQD

13.5.2 Defining IQD CHPID connections to an IQD CU

The only way to define an IQD connection to its CU is as direct connect. 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, you connect to a predefined IQD CU (F001) and IQD devices F000 - 701F.

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 CLI, enter `L F001`. This example uses `F001`.
3. Enter `c` next to the CU definition, and press Enter.

4. Change the CU definition that you want as needed (see Figure 13-43), and press Enter.

```
+---------------- Change Control Unit Definition -----------------+
|                                                                 |
|                                                                 |
| Specify or revise the following values.                         |
|                                                                 |
| Control unit number  . . . . F001  +                            |
|                                                                 |
| Control unit type  . . . . . IQD          +                     |
|                                                                 |
| Serial number  . . . . . . . __________  +                      |
| Description  . . . . . . . .                                    |
|                                                                 |
| Connected to switches  . . . __ __ __ __ __ __ __ __  +         |
| Ports  . . . . . . . . . . . __ __ __ __ __ __ __ __  +         |
|                                                                 |
| Define more than eight ports . . 2   1.  Yes                    |
|                                      2.  No                     |
|                                                                 |
|                                                                 |
|                                                                 |
|                                                                 |
|                                                                 |
|                                                                 |
+-----------------------------------------------------------------+
```

Figure 13-43 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 (F001). 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 CHPID F0 to define the Processor / CU connection (see Figure 13-44), and press Enter.

```
+--------------------- Change Control Unit Definition ----------------------+
|                                                                            |
|                                                                            |
| Specify or revise the following values.                                    |
|                                                                            |
| Control unit number  . : F001        Type . . . . . . : IQD                |
| Processor ID . . . . . : MENSA       Mensa                                 |
| Channel Subsystem ID . : 3                                                 |
|                                                                            |
| 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 13-44   Control units: Change Control Unit Definition detail - IQD

Note: The control unit address (CUADD) range defines the number of devices that you can define for this CU. You can define a smaller address range, but 256 provides the maximum number of devices per CU. If you must define more than 256 devices per channel, you must define more CUs for that channel.

7. The HCD returns to the Select Processor / CU panel and shows the CHPID (F0) connection definition (see Figure 13-45). Press Enter again to return to the Control Unit List panel.

```
 .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
                            Select Processor / CU    Row 1 of 15 More:      >
Command ===> _______________________________________________ Scroll ===> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : F001     Control unit type . . . : IQD

             ---------------Channel Path ID . Link Address + ---------------
/ Proc.CSSID 1------ 2------ 3------ 4------ 5------ 6------ 7------ 8------
_ MENSA.0    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.1    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.2    _______ _______ _______ _______ _______ _______ _______ _______
_ MENSA.3    F0      _______ _______ _______ _______ _______ _______ _______
```

Figure 13-45   Control units: Select Processor / CU - IQD

13.5.3 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. Also, 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.
- You can define up to 256 devices per CU.
- In this example, you add the predefined IQD devices F000 - F01F (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 CLI, enter `L F000`. This example uses `F000`.
3. Enter `c` next to one or more device numbers, and press Enter.
4. The HCD displays the Change Device Definition panel, where you may modify the CU that the devices are attached to (see Figure 13-46). Press Enter.

```
+------------------------- Change Device Definition --------------------------+
|                                                                             |
|                                                                             |
| Specify or revise the following values.                                     |
|                                                                             |
| Device number  . . . . . . . : F000  (0000 - FFFF)                          |
| Number of devices  . . . . . : 32                                           |
| Device type  . . . . . . . . : IQD                                          |
|                                                                             |
| Serial number  . . . . . . . . __________  +                                |
| Description  . . . . . . . . . ________________________________             |
|                                                                             |
| Volume serial number . . . . . ______  + (for DASD)                         |
|                                                                             |
| PPRC usage . . . . . . . . . . _  + (for DASD)                              |
|                                                                             |
| Connected to CUs . F001  ____  ____  ____  ____  ____  ____  ____  +        |
|                                                                             |
| ENTER to continue.                                                          |
|                                                                             |
+-----------------------------------------------------------------------------+
```

Figure 13-46 I/O Devices: Change Device Definition - IQD

5. The 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 13-47), 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  . . : F000       Number of devices  . : 32                  |
| Device type  . . . : IQD                                                   |
|                                                                            |
|                                          Preferred  Device Candidate List |
| / Proc.CSSID  SS+  UA+  Time-Out  STADET  CHPID +    Explicit       Null  |
| _ MENSA.3     0    00   No        No      __         No             ___   |
| ***************************** Bottom of data ***************************** |
|                                                                            |
+----------------------------------------------------------------------------+
```

Figure 13-47 I/O Devices: Device / Processor Definition continued - IQD

6. The HCD panel where you 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 CLI, enter `L MENSA32`. This example uses `MENSA32`.
7. Enter `s` next to the OSCONFIG, and press Enter.

   The HCD displays the device parameters and features that are applicable to that device type. In this example, you add IQD devices to `MENSA32`.
8. Make the following updates to define the Device Parameter (see Figure 13-48), 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 . : MENSA32      Z17 - CONFIG SETUP                        |
| Device number  . . : F000         Number of devices  : 32                   |
| Device type  . . . : IQD                                                    |
|                                                                             |
| 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 13-48 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. In this example, you add only the IQD devices to the OSCONFIG `MENSA32` and not to any Esoterics in this example. Press Enter (see Figure 13-49).

```
+----------- Define Device to Operating System Configuration -----------+
|                                                            Row 1 of 11 |
| Command ===> _____________________________________ Scroll ===> CSR    |
|                                                                        |
| Select OSs to connect or disconnect devices, then press Enter.        |
|                                                                        |
| Device number  . : F000          Number of devices  : 32             |
| Device type  . . : IQD                                                |
|                                                                        |
| Subchannel Sets used in processor configurations  : 0                 |
|                                                                        |
| / Config. ID   Type     SS Description                  Defined      |
| _ ITSO         MVS         All ITSO devices                            |
| _ ITSOBLD      MVS         ITSO + CPO devices                          |
| _ MENSA32      MVS      0  Z17 - CONFIG SETUP              Yes        |
| _ PRF1         MVS         Proof Points                                |
| _ WAT1         MVS         Watsonx                                     |
+------------------------------------------------------------------------+
```

Figure 13-49 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.

13.5.4 Verifying the IQD definition

This section presents some commands that you can use to verify the IQD configuration. Before you start, the system programmer must activate the new I/O to change a running configuration.

You can check your definitions by using the following z/OS commands:

- **`DISPLAY M=CHP(xx)`**

  Using this command, you can check whether the `CHPID DESC` is displayed as `INTERNAL QUEUED DIRECT COMM` (Figure 13-50).

```
D M=CHP(F0)
IEE174I 18.20.29 DISPLAY M 740
CHPID F0:  TYPE=24, DESC=INTERNAL QUEUED DIRECT COMM, ONLINE
DEVICE STATUS FOR CHANNEL PATH F0
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0F00 +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +
0F01 +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +
SWITCH DEVICE NUMBER = NONE
ATTRIBUTES = MFS(16KB)
************************ SYMBOL EXPLANATIONS ************************
+ ONLINE    @ PATH NOT VALIDATED   - OFFLINE    . DOES NOT EXIST
* PHYSICALLY ONLINE   $ PATH NOT OPERATIONAL
```

Figure 13-50 IQD 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 CU F001, as shown in Figure 13-51.

```
D M=DEV(F000)
IEE174I 18.30.41 DISPLAY M 745
DEVICE 0F000   STATUS=ONLINE
CHP                   F0
ENTRY LINK ADDRESS    ..
DEST LINK ADDRESS     0D
PATH ONLINE           Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL      Y
MANAGED               N
CU NUMBER             F001
INTERFACE ID          F000
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND         =       .   .   .  .            .F000
SCP TOKEN NED     =       .   .   .  .            .F000
```

Figure 13-51 IQD 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 13-52). IQD uses three devices (Read, Write, and Datapath).

```
D U,,,F000,3
IEE457I 18.33.03 UNIT STATUS 747
UNIT TYPE STATUS        VOLSER     VOLSTATE      SS
F000 OSA  A-BSY                                   0
F001 OSA  A                                       0
F002 OSA  A-BSY                                   0
```

Figure 13-52 IQD D U,,,device

14

Adding coupling connectivity

This chapter describes the steps to define CS5, CL5, CL6, and Input/Output Configuration Program (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 Hardware Configuration Definition (HCD).

> **Naming:** The IBM z17 system that is targeted by this publication is the IBM z17 ME1 (9175) model. Throughout this chapter, this machine is referred to as the IBM z17.
>
> Not all of the following configuration items are required for your installation. In addition, the examples that are provided are not exhaustive.

This chapter includes the following topics:

- Defining more I/O by using HCD
- Coupling Facility logical partitions; CS5, CL5, and CL6; and ICP CHPIDs

14.1 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, Fibre Connection (FICON) switches, control units (CUs), and devices must be done first. After these items are defined, then the connections can be made. Perform the following tasks:

- Defining Coupling Facility LPARs in a channel subsystem
- Defining the CS5 CHPIDs
- Defining a Coupling Facility link with CS5 CHPIDs
- Defining CL5 and CL6 CHPIDs
- Defining a Coupling Facility link with CL5 or CL6 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, `SYS9.IODF81.WORK`).

The following I/O definitions use HCD to demonstrate the examples. The examples in this chapter continue the working example that you created in the previous chapters (for example, `SYS9.IODF81.WORK`).

14.2 Coupling Facility logical partitions; CS5, CL5, and CL6; and ICP CHPIDs

This section covers defining CF logical partitions (LPARs), and the definitions for CS5, CL5, CL6, and ICP CHPID types.

14.2.1 Defining Coupling Facility LPARs in a channel subsystem

The following considerations apply when you create a (unreserved) partition:

- Partition name
- Number
- Usage
- Description
- To add CHPIDs to a partition, you must first define them to the processor.
- You can rename an existing partition by completing the following steps:

  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 (`ID E` for this example), and press Enter.
5. Make the following updates (see Figure 14-1), and press Enter:
   - Update `Partition Name` to `MENSA3E` (a naming standard based on `CSS=3`, `Partition =E`).
   - Review `Partition usage` and change it if required. You use `CF` in this example.
   - Update `Description` to `Redbooks CF76`.

```
 *---------------------------- 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 |                                                           |   |
| _ *       | Partition name . . . MENSA3E                              |   |
| _ *       | Partition number . . E      (same as MIF image ID)        |   |
| c *       | Partition usage  . . CF     +                             |   |
| _ *       | UID uniqueness . . . N       (Y/N)                        |   |
| ********* |                                                           | * |
|           | Description  . . . . Redbooks CF76                        |   |
|           |                                                           |   |
|           |                                                           |   |
|           |                                                           |   |
*-----------*-----------------------------------------------------------*---*
```

Figure 14-1 Processors: Change Partition Definition - Coupling Facility

14.2.2 Defining the 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 #0216 (Integrated Coupling Adapter Short Reach 2.0 (ICA SR 2.0), which are two port (link) adapters 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 that are 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) or 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 channel subsystem (CSS) ID that you want to add a CHPID to, and press Enter.
4. Press PF11, or in the CLI, enter `add` (see Figure 14-2) to add a CHPID.
5. Make the following updates and press Enter:
   - Update `Channel path ID` to `84`.
   - 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 . . . . : MENSA       Mensa                                  |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| Channel path ID  . . . . 84    +           Channel ID ___  +              |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . CS5   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . #0216 ICA SR 2.0 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 `04`.
   – Update `Port on the HCA` to `1`.

```
*------------------ Specify HCA Attributes -------------------*
|                                                             |
|                                                             |
| Specify or revise the values below.                         |
|                                                             |
| Adapter ID of the HCA  . . 04  +                            |
| 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 15 |
| Command ===> _________________________________________ Scroll ===> CSR |
|                                                                        |
| Select one or more partitions for inclusion in the access list.        |
|                                                                        |
                                                                          
| Channel subsystem ID : 3                                               |
| Channel path ID  . . : 84     Channel path type  . : CS5               |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                 |
|                                                                        |
| / CSS ID Partition Name   Number Usage Description                     |
| _ 3      MENSA3A          A      OS    WTSCMXA                         |
| _ 3      MENSA3B          B      OS    RDBKPOK                         |
| _ 3      MENSA3C          C      CF    Redbooks CF86                   |
| _ 3      MENSA3D          D      CF    Redbooks CF87                   |
| / 3      MENSA3E          E      CF    Redbooks CF76                   |
| _ 3      MENSA3F          F      CF    Redbooks CF77                   |
| _ 3      MENSA31          1      OS    RDBKCRYP                        |
| / 3      MENSA32          2      OS    WTSC75                          |
| _ 3      MENSA33          3      OS    RDBKAIDV                        |
| _ 3      MENSA34          4      OS    WTSC80                          |
| _ 3      MENSA35          5      OS    WTSC81                          |
| _ 3      MENSA36          6      OS    RDBKAIWK                        |
*------------------------------------------------------------------------*
```

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, you do not add any partitions to the candidate list. Press Enter. The 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 7 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA       Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+           Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 54    1A0   FC    SPAN  01  __ __       No  FCTC 32G LX
_ 55    26C   FC    SPAN  02  __ __       No  FCTC 32G LX
_ 84    04/1  CS5   SHR   __  __ __   N   No #0216 ICA SR 2.0 Links
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 97    278   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
****************************** Bottom of data *******************************
```

Figure 14-5 Processors: Channel Path List - CS5

9. Define an extra CS5 CHPID as 86 to the same LPARs as `AID=10`, `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 . . . . : MENSA       Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+           Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 54    1A0   FC    SPAN  01  __ __       No  FCTC 32G LX
_ 55    26C   FC    SPAN  02  __ __       No  FCTC 32G LX
_ 84    04/1  CS5   SHR   __  __ __   N   No  #0216 ICA SR 2.0 Links
_ 86    10/1  CS5   SHR   __  __ __   N   No  #0216 ICA SR 2.0 Links
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 97    278   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
****************************** 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 as direct connect.

Here are considerations for creating a CF link by using CS5 CHPIDs:

- The ICA SR connection is a physical cable between two ICA SR adapters on the same or different processors. ICA SR 2.0 is compatible with ICA SR and ICA SR 1.1.
- 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, you connect two CS5 CHPIDs (84 and 86) 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 CLI, enter `L 84`. This example uses `84`.
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 . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 54    1A0   FC    SPAN  01  __ __       No  FCTC 32G LX
_ 55    26C   FC    SPAN  02  __ __       No  FCTC 32G LX
f 84    04/1  CS5   SHR   __  __ __   N   No  #0216 ICA SR 2.0 Links
_ 86    10/1  CS5   SHR   __  __ __   N   No  #0216 ICA SR 2.0 Links
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 97    278   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
****************************** 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 that you want to connect to, or in the CLI, enter `L 86`. This example uses `86`.

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 . . . . . : MENSA     Mensa
Source channel subsystem ID . : 3
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 84  04/1  Y  CS5  SHR  N
p 86  10/1  Y  CS5  SHR  N
******************************* Bottom of data ********************************
```

Figure 14-8 Processors: CF Channel Path Connectivity List - CS5

8. The 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 `MENSA`.
   – Update `Destination channel subsystem ID` to 3.
   – Update `Destination channel path ID` to `84`.

```
*---------------- Connect to CF Channel Path -----------------*
|                                                             |
|                                                             |
| Specify the following values.                               |
|                                                             |
| Source processor ID  . . . . . : MENSA                      |
| Source channel subsystem ID  . : 3                          |
| Source channel path ID . . . . : 86                         |
| Source channel path type . . . : CS5                        |
|                                                             |
| Destination processor ID . . . . . . MENSA     +            |
| Destination channel subsystem ID . . 3   +                  |
| Destination channel path ID  . . . . 84  +                  |
|                                                             |
| Timing-only link . . . . . . . . . . No                     |
|                                                             |
|                                                             |
|                                                             |
|                                                             |
*-------------------------------------------------------------*
```

Figure 14-9 Processors: Connect to CF Channel Path - CS5

9. The 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. For this example, 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 . . . . . . . : MENSA                                   |
| Channel subsystem ID . . . : 3                                       |
| Channel path ID  . . . . . : 86         Operation mode . . : SHR     |
| Channel path type  . . . . : CS5                                     |
|                                                                      |
| Control unit number  . . . . FFFE  +                                 |
|                                                                      |
| Device number  . . . . . . . FFF8                                    |
| Number of devices  . . . . . 8                                       |
|                                                                      |
|                                                                      |
|                                                                      |
|                                                                      |
*----------------------------------------------------------------------*
```

Figure 14-10 Processors: Add CF Control Unit and Devices - CS5

10. The HCD provides suggested CU numbers and device addresses for the first CS5 CHPID (see Figure 14-11). The CU number is the same and 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 . . . . . . . : MENSA                                   |
| Channel subsystem ID . . . : 3                                       |
| Channel path ID  . . . . . : 84         Operation mode . . : SHR     |
| Channel path type  . . . . : CS5                                     |
|                                                                      |
| Control unit number  . . . . FFFE  +                                 |
|                                                                      |
| Device number  . . . . . . . FFF0                                    |
| Number of devices  . . . . . 8                                       |
|                                                                      |
|                                                                      |
|                                                                      |
|                                                                      |
*----------------------------------------------------------------------*
```

Figure 14-11 Processors: Add CF Control Unit and Devices - CS5

The 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 . . . . . : MENSA     Mensa
Source channel subsystem ID . : 3
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 84  04/1  Y  CS5  SHR  N     MENSA.3    86  10/1  Y  CS5  SHR    CFP   8
_ 86  10/1  Y  CS5  SHR  N     MENSA.3    84  04/1  Y  CS5  SHR    CFP   8
****************************** Bottom of data ********************************
```

Figure 14-12 Processors: Add CF Channel Path Connectivity List - CS5

14.2.4 Defining CL5 and CL6 CHPIDs

When defining a CL5 or CL6 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 #0498 (Coupling Express3 LR (CE3 LR) 10G) adapters and CL6 CF CHPIDs are defined by using Feature Code #0499 (CE3 LR 25G) adapters, which are installed in the PCIe+ I/O drawer instead of on the CPC drawer.

The CE3 Long Reach (LR) card has two ports (Port 1 and Port 2), which provide two physical connections between another Coupling Express LR (CE LR) card on the same or different processor. CHPID type CL5 can also connect to a CE LR (Feature Code #0433) on IBM z15, or a Coupling Express2 LR (CE2 LR) (Feature Code #0434) on IBM z16. However, CHPID type CL6 can connect only to a CE3 LR 25G (Feature Code #0499) on IBM z17. Each of the ports can have up to four CHPIDs that are defined.

Here are considerations for a new CL5 and CL6 CHPID:

- CHPID
- CHID
- Channel path type
- Operational mode
- Description
- Partition access list

For performance and redundancy, determine how many CL5 and CL6 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 or 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 CLI, 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 `17C`.
   - 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 . . . . : MENSA        Mensa                                 |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| Channel path ID  . . . . 88    +           Channel ID  17C  +             |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . CL5   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . #0498 Coupling Express3 LR 10G                 | |
|                                                                           |
| 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.

```
*----------- Specify Coupling Pchid/Port Attribute -----------*
|                                                             |
|                                                             |
| Specify or revise the values below.                         |
|                                                             |
| Physical channel ID  . . . 17C                              |
| Coupling port  . . . . . . 1   +                            |
|                                                             |
|                                                             |
|                                                             |
|                                                             |
*-------------------------------------------------------------*
```

Figure 14-14 Processors: Specify Coupling PCHIDs/Port Attributes - CL5

7. The 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 15 |
| Command ===> _________________________________________ Scroll ===> CSR   |
|                                                                          |
| Select one or more partitions for inclusion in the access list.         |
|                                                                          |
| Channel subsystem ID : 3                                                 |
| Channel path ID  . . : 88     Channel path type  . : CL5                 |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                   |
|                                                                          |
| / CSS ID Partition Name   Number Usage Description                      |
| _ 3      MENSA3A          A      OS    WTSCMXA                          |
| _ 3      MENSA3B          B      OS    RDBKPOK                          |
| _ 3      MENSA3C          C      CF    Redbooks CF86                    |
| _ 3      MENSA3D          D      CF    Redbooks CF87                    |
| / 3      MENSA3E          E      CF    Redbooks CF76                    |
| _ 3      MENSA3F          F      CF    Redbooks CF77                    |
| _ 3      MENSA31          1      OS    RDBKCRYP                         |
| / 3      MENSA32          2      OS    WTSC75                           |
| _ 3      MENSA33          3      OS    RDBKAIDV                         |
| _ 3      MENSA34          4      OS    WTSC80                           |
| _ 3      MENSA35          5      OS    WTSC81                           |
| _ 3      MENSA36          6      OS    RDBKAIWK                         |
*--------------------------------------------------------------------------*
```

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, you do not add any partitions in the access list. Press Enter. The HCD returns to the Channel Path List and shows you the CHPID that was defined (see Figure 14-16 on page 319).

```
                   Channel Path List      Row 1 of 9 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 54    1A0   FC    SPAN  01  __ __       No  FCTC 32G LX
_ 55    26C   FC    SPAN  02  __ __       No  FCTC 32G LX
_ 84    04/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 86    10/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 88    17C/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 97    278   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
******************************* Bottom of data ********************************
```

Figure 14-16 Processors: Channel Path List - CL5

9. Define an extra CL5 CHPID as `8A` to the same LPARs as `CHID=198, 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 . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 54    1A0   FC    SPAN  01  __ __       No  FCTC 32G LX
_ 55    26C   FC    SPAN  02  __ __       No  FCTC 32G LX
_ 84    04/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 86    10/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 88    17C/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 8A    198/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 97    278   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
```

Figure 14-17 Processors: Channel Path List - CL5

You can define CL6 CHPIDs by using similar steps. To define a CL6 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 CLI, enter `add` (see Figure 14-18) to add a CHPID.
5. Make the following updates and press Enter:
   - Update `Channel path ID` to `8C`.
   - Update `Channel ID` to `1F8`.
   - Update `Channel path type` to `CL6`.
   - Update `Operational mode` to `SHR`.
   - Update `Description` to the description that you want.

```
*---------------------------- Add Channel Path -----------------------------*
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : MENSA        Mensa                                 |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| Channel path ID  . . . . 8C    +           Channel ID  1F8  +             |
| Number of CHPIDs . . . . 1                                                |
| Channel path type  . . . CL6   +                                          |
| Operation mode . . . . . SHR   +                                          |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________   +      |
| Description  . . . . . . #0499 Coupling Express3 LR 25G                 |
|                                                                           |
| Specify the following values only if connected to a switch:               |
| Dynamic entry switch ID  __  + (00 - FF)                                  |
| Entry switch ID  . . . . __  +                                            |
| Entry port . . . . . . . __  +                                            |
|                                                                           |
|                                                                           |
*---------------------------------------------------------------------------*
```

Figure 14-18 Processors: Add Channel Path - CL6

6. The HCD prompts you to specify the coupling PCHID/Port attributes. Update `Coupling Port` to `1` (see Figure 14-19), and press Enter.

```
*----------- Specify Coupling Pchid/Port Attribute -----------*
|                                                             |
|                                                             |
| Specify or revise the values below.                         |
|                                                             |
| Physical channel ID  . . . 1F8                              |
| Coupling port  . . . . . . 1   +                            |
|                                                             |
|                                                             |
|                                                             |
|                                                             |
*-------------------------------------------------------------*
```

Figure 14-19 Processors: Specify Coupling PCHIDs/Port Attributes - CL6

7. The 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 14-20), and press Enter.

```
*---------------------------- Define Access List -----------------------------*
|                                                                 Row 1 of 15 |
| Command ===> _________________________________________ Scroll ===> CSR     |
|                                                                             |
| Select one or more partitions for inclusion in the access list.             |
|                                                                             |
| Channel subsystem ID : 3                                                    |
| Channel path ID  . . : 8C     Channel path type  . : CL6                    |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                      |
|                                                                             |
| / CSS ID Partition Name   Number Usage Description                          |
| _ 3      MENSA3A          A      OS    WTSCMXA                              |
| _ 3      MENSA3B          B      OS    RDBKPOK                              |
| _ 3      MENSA3C          C      CF    Redbooks CF86                        |
| / 3      MENSA3D          D      CF    Redbooks CF87                        |
| _ 3      MENSA3E          E      CF    Redbooks CF76                        |
| _ 3      MENSA3F          F      CF    Redbooks CF77                        |
| _ 3      MENSA31          1      OS    RDBKCRYP                             |
| _ 3      MENSA32          2      OS    WTSC75                               |
| _ 3      MENSA33          3      OS    RDBKAIDV                             |
| / 3      MENSA34          4      OS    WTSC80                               |
| _ 3      MENSA35          5      OS    WTSC81                               |
| _ 3      MENSA36          6      OS    RDBKAIWK                             |
*-----------------------------------------------------------------------------*
```

Figure 14-20 Processors: Define Access List - CL6

8. Because more partitions than the selected two are defined, the Define Candidate List panel opens. For this example, you do not add any partitions in the access list. Press Enter. The HCD returns to the Channel Path List and shows you the CHPID that was defined (see Figure 14-21).

```
                  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 . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+             Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 54    1A0   FC    SPAN  01  __ __       No  FCTC 32G LX
_ 55    26C   FC    SPAN  02  __ __       No  FCTC 32G LX
_ 84    04/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 86    10/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 88    17C/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 8A    198/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 8C    1F8/1 CL6   SHR   __  __ __   N   No  #0499 Coupling Express3 LR 25G
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
```

Figure 14-21 Processors: Channel Path List - CL6

9. Define an extra CL6 CHPID as `8E` to the same LPARs as `CHID=21C, Port=1` (see Figure 14-22).

```
                  Channel Path List      Row 1 of 12 More:       >
Command ===> ______________________________________________ Scroll ===> CSR


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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+             Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 54    1A0   FC    SPAN  01  __ __       No  FCTC 32G LX
_ 55    26C   FC    SPAN  02  __ __       No  FCTC 32G LX
_ 84    04/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 86    10/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 88    17C/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 8A    198/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 8C    1F8/1 CL6   SHR   __  __ __   N   No  #0499 Coupling Express3 LR 25G
_ 8E    21C/1 CL6   SHR   __  __ __   N   No  #0499 Coupling Express3 LR 25G
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
```

Figure 14-22 Processors: Channel Path List - CL6

14.2.5 Defining a Coupling Facility link with CL5 or CL6 CHPIDs

The only way to define a CL5 CHPID to another CL5 CHPID or a CL6 CHPID to another CL6 CHPID is as direct connect.

Here are considerations for creating a CF link by using CL5 or CL6 CHPIDs:

- The CE LR connection is a physical cable between two CE LR adapters. A CL5 CHPID can connect to another CL5 CHPID on IBM z15, IBM z16, or IBM z17, but a CL6 CHPID can connect only to another CL6 CHPID on IBM z17 machines.
- Up to four logical CHPIDs per port can be defined over that physical connection.
- Determine how many CL5 and CL6 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, you connect two CL5 CHPIDs (88 and 8A) on the same processor.

To define a CF link with CL5 CHPIDs, complete the following steps. You can define a CF link with CL6 CHPIDs with the same 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 CLI, enter `L 88`. This example uses 88.
5. Enter `f` next to the CHPID definition (see Figure 14-23), and press Enter.

```
                              Channel Path List      Row 1 of 12 More:       >
Command ===> _______________________________________________ Scroll ===> CSR


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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+             Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 54    1A0   FC    SPAN  01  __ __       No  FCTC 32G LX
_ 55    26C   FC    SPAN  02  __ __       No  FCTC 32G LX
_ 84    04/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
_ 86    10/1  CS5   SHR   __  __ __   Y   No  #0216 ICA SR 2.0 Links
f 88    17C/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 8A    198/1 CL5   SHR   __  __ __   N   No  #0498 Coupling Express3 LR 10G
_ 8C    1F8/1 CL6   SHR   __  __ __   N   No  #0499 Coupling Express3 LR 25G
_ 8E    21C/1 CL6   SHR   __  __ __   N   No  #0499 Coupling Express3 LR 25G
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
```

Figure 14-23 Processors: CF Channel Path Connectivity List - CL5

6. The 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 CLI, enter `L 8A`. This example uses 8A.
7. Type `p` next to the CHPID definition (see Figure 14-24), 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 . . . . . . : MENSA     Mensa
Source channel subsystem ID . . : 3
Source partition name . . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 84  04/1  Y  CS5  SHR  N     MENSA.3    86  10/1  Y  CS5  SHR    CFP   8
_ 86  10/1  Y  CS5  SHR  N     MENSA.3    84  04/1  Y  CS5  SHR    CFP   8
_ 88  17C/1 Y  CL5  SHR  N
p 8A  198/1 Y  CL5  SHR  N
_ 8C  1F8/1 Y  CL6  SHR  N
_ 8E  21C/1 Y  CL6  SHR  N
******************************* Bottom of data ********************************
```

Figure 14-24 Processors: CF Channel Path Connectivity List - CL5

8. The HCD prompts you to specify which CF channel path to connect to. Make the following updates (see Figure 14-25), and press Enter:
   - Update `Destination processor ID` to `MENSA`.
   - Update `Destination channel subsystem ID` to 3.
   - Update `Destination channel path ID` to 88.

```
*---------------- Connect to CF Channel Path -----------------*
|                                                              |
|                                                              |
| Specify the following values.                                |
|                                                              |
| Source processor ID  . . . . . : MENSA                       |
| Source channel subsystem ID  . : 3                           |
| Source channel path ID . . . . : 8A                          |
| Source channel path type . . . : CL5                         |
|                                                              |
| Destination processor ID . . . . . . MENSA     +             |
| Destination channel subsystem ID . . 3   +                   |
| Destination channel path ID  . . . . 88  +                   |
|                                                              |
| Timing-only link . . . . . . . . . . No                      |
|                                                              |
|                                                              |
|                                                              |
|                                                              |
*--------------------------------------------------------------*
```

Figure 14-25 Processors: Connect to CF Channel Path - CL5

9. The 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. Accept the suggestions for the second CL5 CHPID (see Figure 14-26), 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 . . . . . . . : MENSA                                  |
| Channel subsystem ID . . . : 3                                      |
| Channel path ID  . . . . . : 8A        Operation mode . . : SHR     |
| Channel path type  . . . . : CL5                                    |
|                                                                     |
| Control unit number  . . . . FFFE  +                                |
|                                                                     |
| Device number  . . . . . . . FF88                                   |
| Number of devices  . . . . . 8                                      |
|                                                                     |
|                                                                     |
|                                                                     |
|                                                                     |
*---------------------------------------------------------------------*
```

Figure 14-26 Processors: Add CF Control Unit and Devices - CL5

10. The HCD provides suggested CU numbers and device addresses for the first CL5 CHPID (see Figure 14-27). The CU number is the same and 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 . . . . . . . : MENSA                                  |
| Channel subsystem ID . . . : 3                                      |
| Channel path ID  . . . . . : 88         Operation mode . . : SHR    |
| Channel path type  . . . . : CL5                                    |
|                                                                     |
| Control unit number  . . . . FFFE  +                                |
|                                                                     |
| Device number  . . . . . . . FF80                                   |
| Number of devices  . . . . . 8                                      |
|                                                                     |
|                                                                     |
|                                                                     |
|                                                                     |
*---------------------------------------------------------------------*
```

Figure 14-27 Processors: Add CF Control Unit and Devices - CL5

The HCD provides a summary of the Source and Destination CF Connectivity List (see Figure 14-28).

```
              CF Channel Path Connectivity List             Row 1 of 6
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : MENSA     Mensa
Source channel subsystem ID . : 3
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 84  04/1  Y  CS5  SHR  N     MENSA.3    86  10/1  Y  CS5  SHR    CFP   8
_ 86  10/1  Y  CS5  SHR  N     MENSA.3    84  04/1  Y  CS5  SHR    CFP   8
_ 88  17C/1 Y  CL5  SHR  N     MENSA.3    8A  198/1 Y  CL5  SHR    CFP   8
_ 8A  198/1 Y  CL5  SHR  N     MENSA.3    88  17C/1 Y  CL5  SHR    CFP   8
_ 8C  1F8/1 Y  CL6  SHR  N
_ 8E  21C/1 Y  CL6  SHR  N
****************************** Bottom of data *******************************
```

Figure 14-28 Processors: Add CF Channel Path Connectivity List - CL5

A CF link with CL6 CHPIDs can be connected with the same steps. Unlike CL5 CHPIDs, CL6 CHPIDs default to a definition of 32 subchannels or devices per CHPID, with an option for 8. After Connecting the CL6 CHPIDs, you can confirm the Source and Destination information in HCD CF Connectivity List (see Figure 14-29).

```
              CF Channel Path Connectivity List            Row 1 of 6
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : MENSA     Mensa
Source channel subsystem ID . : 3
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 84  04/1  Y  CS5  SHR  N     MENSA.3    86  10/1  Y  CS5  SHR    CFP   8
_ 86  10/1  Y  CS5  SHR  N     MENSA.3    84  04/1  Y  CS5  SHR    CFP   8
_ 88  17C/1 Y  CL5  SHR  N     MENSA.3    8A  198/1 Y  CL5  SHR    CFP   8
_ 8A  198/1 Y  CL5  SHR  N     MENSA.3    88  17C/1 Y  CL5  SHR    CFP   8
_ 8C  1F8/1 Y  CL6  SHR  N     MENSA.3    8E  21C/1 Y  CL6  SHR    CFP   32
_ 8E  21C/1 Y  CL6  SHR  N     MENSA.3    8C  1F8/1 Y  CL6  SHR    CFP   32
******************************* Bottom of data ********************************
```

Figure 14-29 Processors: Add CF Channel Path Connectivity List - CL5 and CL6

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 an IBM z17 ME1 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 CLI, enter `add` (see Figure 14-30 on page 327) to add a CHPID.

```
*---------------------------- Add Channel Path -----------------------------*
|                                                                           |
|                                                                           |
| Specify or revise the following values.                                   |
|                                                                           |
| Processor ID . . . . : MENSA       Mensa                                  |
| Configuration mode . : LPAR                                               |
| Channel Subsystem ID : 3                                                  |
|                                                                           |
| 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 14-30 Processors: Add Channel Path - ICP

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.

6. The 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 14-31), and press Enter.

```
*--------------------------- Define Access List ----------------------------*
|                                                               Row 1 of 15 |
| Command ===> _________________________________________ Scroll ===> CSR    |
|                                                                            |
| Select one or more partitions for inclusion in the access list.           |
|                                                                            |
| Channel Subsystem ID : 3                                                   |
| Channel path ID  . . : FC     Channel path type  . : ICP                   |
| Operation mode . . . : SHR    Number of CHPIDs . . : 1                     |
|                                                                            |
| / CSS ID Partition Name   Number Usage Description                        |

| _ 3      MENSA3A          A      OS    WTSCMXA                           |
| _ 3      MENSA3B          B      OS    RDBKPOK                           |
| _ 3      MENSA3C          C      CF    Redbooks CF86                     |
| _ 3      MENSA3D          D      CF    Redbooks CF87                     |
| / 3      MENSA3E          E      CF    Redbooks CF76                     |
| _ 3      MENSA3F          F      CF    Redbooks CF77                     |
| _ 3      MENSA31          1      OS    RDBKCRYP                          |
| / 3      MENSA32          2      OS    WTSC75                            |
| _ 3      MENSA33          3      OS    RDBKAIDV                          |
| _ 3      MENSA34          4      OS    WTSC80                            |
| _ 3      MENSA35          5      OS    WTSC81                            |
| _ 3      MENSA36          6      OS    RDBKAIWK                          |
*----------------------------------------------------------------------------*
```

Figure 14-31 Processors: Define Access List - ICP

Because more partitions than the selected two are defined, the Define Candidate List panel opens. For this example, you 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 14-32 on page 329).

```
                   Channel Path List      Row 5 of 13 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 88    17C/1 CL5   SHR   __  __ __   Y   No  #0498 Coupling Express3 LR 10G
_ 8A    198/1 CL5   SHR   __  __ __   Y   No  #0498 Coupling Express3 LR 10G
_ 8C    1F8/1 CL6   SHR   __  __ __   Y   No  #0499 Coupling Express3 LR 25G
_ 8E    21C/1 CL6   SHR   __  __ __   Y   No  #0499 Coupling Express3 LR 25G
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 97    278   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ FC    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
******************************* Bottom of data ********************************
```

Figure 14-32 Processors: Channel Path List - ICP

7. Define an extra ICP CHPID as `FD` to the same LPARs (see Figure 14-33).

```
                   Channel Path List      Row 6 of 14 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 8A    198/1 CL5   SHR   __  __ __   Y   No  #0498 Coupling Express3 LR 10G
_ 8C    1F8/1 CL6   SHR   __  __ __   Y   No  #0499 Coupling Express3 LR 25G
_ 8E    21C/1 CL6   SHR   __  __ __   Y   No  #0499 Coupling Express3 LR 25G
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 97    278   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ FC    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
_ FD    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
```

Figure 14-33 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, you connect two ICP CHPIDs (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 CLI, enter `L FC`. This example uses `FC`.
5. Enter `f` next to the CHPID definition (see Figure 14-34), and press Enter.

```
                    Channel Path List      Row 6 of 14 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa
Configuration mode . : LPAR
Channel Subsystem ID : 3

        CHID+             Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
_ 8A    198/1 CL5   SHR   __  __ __   Y   No  #0498 Coupling Express3 LR 10G
_ 8C    1F8/1 CL6   SHR   __  __ __   Y   No  #0499 Coupling Express3 LR 25G
_ 8E    21C/1 CL6   SHR   __  __ __   Y   No  #0499 Coupling Express3 LR 25G
_ 94    19C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 95    1B0   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
_ 96    25C   OSH   SPAN  __  __ __       No  NetExpSR 10G IBM Redbooks 9.
_ 97    278   OSH   SHR   __  __ __       No  NetExpSR 10G IBM Redbooks 129.
f FC    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
_ FD    _____ ICP   SHR   __  __ __   N   No  ICP Internal Coupling Peer
```

Figure 14-34 Processors: CF Channel Path Connectivity List - ICP

6. The 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 CLI, enter `L FD`. This example uses `FD`.

7. Type p next to the CHPID definition (see Figure 14-35), and press Enter.

```
----------------------------------------------------------------------------
                     CF Channel Path Connectivity List             Row 1 of 8
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : MENSA     Mensa
Source channel subsystem ID . : 3
Source partition name . . . . : *

  ----------Source----------   -----------Destination-----------   -CU-  -#-
/ CHP CHID  CF Type Mode Occ   Proc.CSSID CHP CHID  CF Type Mode   Type  Dev
_ 84  04/1  Y  CS5  SHR  N     MENSA.3    86  10/1  Y  CS5  SHR    CFP   8
_ 86  10/1  Y  CS5  SHR  N     MENSA.3    84  04/1  Y  CS5  SHR    CFP   8
_ 88  17C/1 Y  CL5  SHR  N     MENSA.3    8A  198/1 Y  CL5  SHR    CFP   8
_ 8A  198/1 Y  CL5  SHR  N     MENSA.3    88  17C/1 Y  CL5  SHR    CFP   8
_ 8C  1F8/1 Y  CL6  SHR  N     MENSA.3    8E  21C/1 Y  CL6  SHR    CFP   32
_ 8E  21C/1 Y  CL6  SHR  N     MENSA.3    8C  1F8/1 Y  CL6  SHR    CFP   32
_ FC        Y  ICP  SHR  N
p FD        Y  ICP  SHR  N
```

Figure 14-35 Processors: CF Channel Path Connectivity List - ICP

8. The HCD prompts you to specify which CF channel path to connect to. Make the following updates (see Figure 14-36), and press Enter:
   - Update `Destination processor ID` to `MENSA`.
   - Update `Destination channel subsystem ID` to 3.
   - Update `Destination channel path ID` to `FC`.

```
*---------------- Connect to CF Channel Path -----------------*
|                                                             |
|                                                             |
| Specify the following values.                               |
|                                                             |
| Source processor ID  . . . . . : MENSA                      |
| Source channel subsystem ID  . : 3                          |
| Source channel path ID . . . . : FD                         |
| Source channel path type . . . : ICP                        |
|                                                             |
| Destination processor ID . . . . . . MENSA     +            |
| Destination channel subsystem ID . . 3   +                  |
| Destination channel path ID  . . . . FC  +                  |
|                                                             |
| Timing-only link . . . . . . . . . . No                     |
|                                                             |
|                                                             |
|                                                             |
|                                                             |
*-------------------------------------------------------------*
```

Figure 14-36 Processors: Connect to CF Channel Path - ICP

9. The 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. On IBM z17, ICP CHPIDs can be defined with eight subchannels or devices per CHPID, although a configuration with 7 subchannels or devices is allowed and supported by HCD. Accept the suggestions for the second ICP CHPID (see Figure 14-37), 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 . . . . . . . : MENSA                                  |
| Channel subsystem ID . . . : 3                                      |
| Channel path ID  . . . . . : FD        Operation mode . . : SHR     |
| Channel path type  . . . . : ICP                                    |
|                                                                     |
| Control unit number  . . . . FFFE  +                                |
|                                                                     |
| Device number  . . . . . . . FF78                                   |
| Number of devices  . . . . . 8                                      |
|                                                                     |
|                                                                     |
|                                                                     |
|                                                                     |
*---------------------------------------------------------------------*
```

Figure 14-37 Processors: Add CF Control Unit and Devices - ICP

10. The HCD provides suggested CU numbers and device addresses for the first ICP CHPID (see Figure 14-38). The CU number is the same and 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 . . . . . . . : MENSA                                  |
| Channel subsystem ID . . . : 3                                      |
| Channel path ID  . . . . . : FC        Operation mode . . : SHR     |
| Channel path type  . . . . : ICP                                    |
|                                                                     |
| Control unit number  . . . . FFFE  +                                |
|                                                                     |
| Device number  . . . . . . . FF70                                   |
| Number of devices  . . . . . 8                                      |
|                                                                     |
|                                                                     |
|                                                                     |
|                                                                     |
*---------------------------------------------------------------------*
```

Figure 14-38 Processors: Add CF Control Unit and Devices - ICP

The HCD provides a summary of the Source and Destination CF Connectivity List (see Figure 14-39).

```
                     CF Channel Path Connectivity List            Row 7 of 8
Command ===> ____________________________________________ Scroll ===> CSR

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : MENSA     Mensa
Source channel subsystem ID . : 3
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     MENSA.3    FD        Y  ICP  SHR    CFP   8
_ FD        Y  ICP  SHR  N     MENSA.3    FC        Y  ICP  SHR    CFP   8
******************************* Bottom of data ********************************
```

Figure 14-39 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), Network Express (NETH), and IBM 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.

> **Naming:** The IBM z17 system that is targeted by this publication is the IBM z17 ME1 (9175) model. Throughout this chapter, this machine is referred to as the IBM z17.
>
> Not all of the following configuration items are required for your installation. In addition, the examples that are provided are not exhaustive.

This chapter includes the following topics:

- Defining PCIe functions by using HCD
- Defining the PCIe features

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 definitions can be made:

- Defining an ISM PCIe function that is associated with Hypersocket (Internal Queued Direct (IQD)), Open Systems Adapter (OSA) Express (OSD) or Network Express (OSH) for SMC - Direct Memory Access over Internal Shared Memory (SMC-D) virtual network connection (internal).
- Defining a NETH PCIe function that is associated with a Network Express adapter for SMC - Remote Direct Memory Access over Converged Ethernet Express (SMC-R) communication.
- Defining a HYL (zHyperLink) PCIe function.

Note: Starting with the IBM z15, the IBM 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.

Note: IBM z17 no longer supports Remote Direct Memory Access over Converged Ethernet (RoCE) Express adapters and the PCIe ROC and ROC2 functions. SMC-R communication is enabled by associating a Network Express adapter port with a NETH PCIe function.

15.2 Defining the PCIe features

This section provides a brief overview of the `FUNCTION` statement and covers the HCD definitions of ISM, Network Express (NETH), and zHyperLink (HYL) PCIe features.

15.2.1 Overview

PCIe adapters that are attached to a system can provide the operating system (OS) with various “PCIe functions” that are used by entitled logical partitions (LPARs).

Currently, HCD supports the following features for an IBM z17:

- ISM PCIe Adapter: A virtual PCIe (vPCIe) adapter for SMC-D communications, for which a virtual channel ID (VCHID) must be defined.
- Network Express: PCIe functions of type NETH for SMC-R may be assigned to external physical networks by specifying corresponding PNETIDs.
- zHyperLink: Requires a PCIe function of type HYL with an attribute for identifying a port on the adapter to which the function is related.

Ab 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.

An Input/Output Configuration Program (IOCP) supports the I/O configuration statement **`FUNCTION`** for defining and configuring PCIe functions. To define PCIe functions for the I/O subsystem, specify at least the following parameters:

`FID`: The function number that identifies the function. This number is a four-digit hexadecimal arbitrary number and is unique for the entire central processor complex (CPC). On IBM z17, the maximum function ID (FID) is 4FFF. An adapter can have multiple FIDs that are associated with it.

`CHID`: Specifies either a physical channel (PCHID) or a virtual channel (VCHID) that is associated with the function.

`PART`: Specifies the availability of FIDs to LPARs. There is at most one partition that is designated as the *access* LPAR, and a group of LPARs that is specified as the *candidate list*. The access LPAR is the one that has the channel path online after a power-on reset (POR). Partitions in the candidate list can access the function through reconfiguration commands. Functions cannot be shared by multiple LPARs concurrently.

`VF`: Specifies a virtual function (VF) so that multiple LPARs can use the same CHIDs (PCHID or port, or VCHID) that are associated with a function.

`TYPE`: The type of the VF. This publication describes the ISM (SMC-D), NETH (SMC-R), and HYL (zHyperLink) function types.

`PNETID`: Up to four physical network identifiers that are used for the ISM and NETH functions.

> **Note:** The support of VFs, the allowed range of virtual function IDs (VFIDs), and the support of PNETIDs depends on the processor type and support level. For more information, see *Input/Output Configuration Program User's Guide for ICP IOCP*, SB10-7183. An HCD offers prompts for VFIDs and helps ensure that the validation rules are fulfilled.

The following configurations show how these definitions are made in HCD panels for the functions that are covered in this publication.

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),(MENSA0A,A),(MENSA0B,B),(MENSA0C,C*
          ),(MENSA0D,D),(MENSA01,1),(MENSA02,2),(MENSA03,3),(MENSA*
          04,4),(MENSA05,5),(MENSA06,6),(MENSA07,7),(MENSA08,8),(M*
          ENSA09,9),(*,E),(*,F)),(CSS(1),(MENSA11,1),(MENSA12,2),(*
          MENSA13,3),(MENSA14,4),(MENSA15,5),(MENSA16,6),(MENSA17,*
          7),(*,8),(*,9),(*,A),(*,B),(*,C),(*,D),(*,E),(*,F)),(CSS*
          (2),(MENSA21,1),(MENSA22,2),(MENSA23,3),(MENSA24,4),(MEN*
          SA25,5),(MENSA26,6),(MENSA27,7),(MENSA28,8),(MENSA29,9),*
          (*,A),(*,B),(*,C),(*,D),(*,E),(*,F)),(CSS(3),(MENSA3A,A)*
          ,(MENSA3B,B),(MENSA3C,C),(MENSA3D,D),(MENSA3E,E),(MENSA3*
          F,F),(MENSA31,1),(MENSA32,2),(MENSA33,3),(MENSA34,4),(ME*
          NSA35,5),(MENSA36,6),(MENSA37,7),(MENSA38,8),(MENSA39,9)*
          ),(CSS(4),(MENSA4A,A),(MENSA4B,B),(MENSA41,1),(MENSA42,2*
          ),(MENSA43,3),(MENSA44,4),(MENSA45,5),(MENSA46,6),(MENSA*
          47,7),(MENSA48,8),(MENSA49,9),(*,C),(*,D),(*,E),(*,F)),(*
          CSS(5),(MENSA51,1),(MENSA52,2),(*,3),(*,4),(*,5),(*,6),(*
          *,7),(*,8),(*,9),(*,A)))
***********************************************************************
* FOR zHyperLink
***********************************************************************
FUNCTION FID=2102,VF=1,PCHID=1FC,PART=((MENSA02),(=)),        *
          TYPE=HYL,PORT=1
FUNCTION FID=2108,VF=2,PCHID=1FC,PART=((MENSA08),(=)),        *
          TYPE=HYL,PORT=1
FUNCTION FID=2132,VF=3,PCHID=1FC,PART=((MENSA32),(=)),        *
          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 (zHyperLink)	**ISM (SMC-D)**	**NETH (SMC-R)**
Physical channel ID (PCHID)	Yes	No	Yes
VCHID	No	Yes	No
PNETID	No	Yes	Yes
PORT	Yes	No	No
VF	Yes	Yes	Yes

For more information about the maximum values for each machine type, see *IBM Z Input/Output Configuration Program User's Guide for ICP IOCP*, SB10-7183.

15.2.2 Defining an ISM PCIe function

The IBM z17 system supports ISM vPCIe devices to enable optimized, cross-LPAR TCP communications by using socket-based direct memory access (DMA), that is, Shared Memory Communication - Direct (SMC-D) over ISM.

ISM overview

ISM is defined as PCIe devices. VCHIDs and FIDs or VFs must be defined in HCD. A VCHID represents a vPCIe adapter, which also represents a unique isolated ISM network with a unique PNETID.

IBM z17 supports up to 32 ISM VCHIDs per CPC and up to 255 VFs per VCHID. Each VF represents a TCP/IP stack that can communicate over the same ISM VCHID with other LPARs in the same CPC. On IBM z17. the VCHID is a three-digit hexadecimal number in the range 7C0 - 7FF.

For more information about the managerment of SMC-D, see *z/OS Communications Server: IP Configuration Guide*

ISM configuration

The following example shows the PCIe definition for an ISM network in VCHID 7F1 and PNETID PERFNET. Here are the function definitions:

- `CHID=7F1` to FID 0040 (`VF=1`) for LPAR MENSA32 on `CPC=MENSA`
- `CHID=7F1` to FID 0041 (`VF=2`) for LPAR MENSA33 on `CPC=MENSA`

Figure 15-1 shows a diagram for the example configuration.

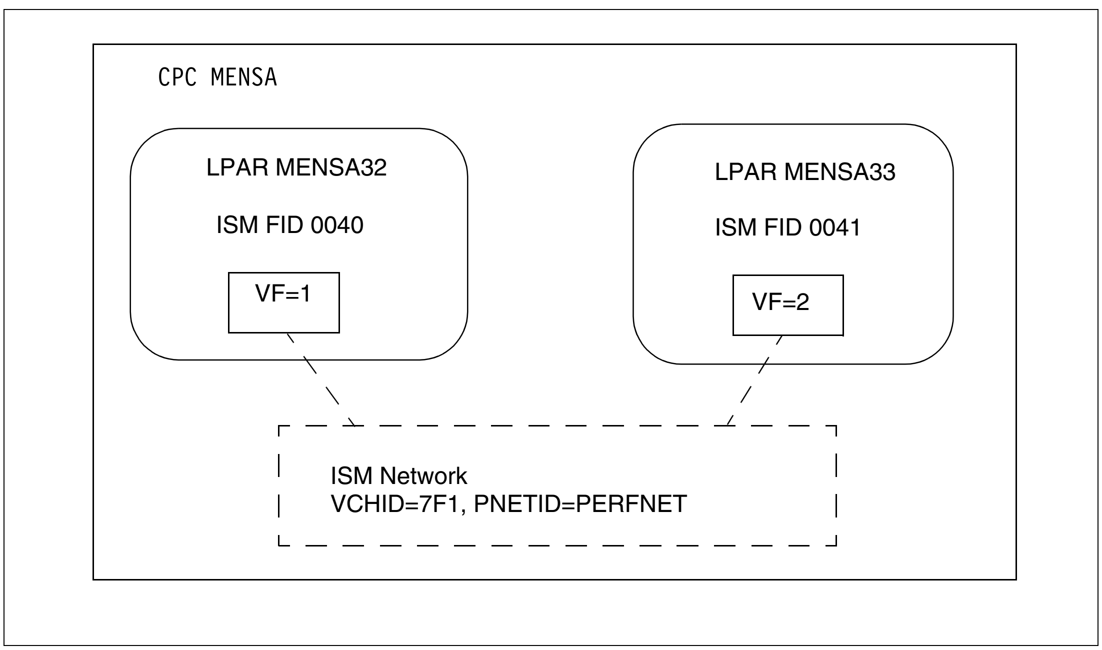


Figure 15-1 ISM network for sample definitions

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 (`MENSA`) to which you want to define the ISM functions, as shown in Figure 15-2, and press Enter.

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

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


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
f MENSA    9175     ME1      LPAR  0B9FB89175 Mensa
_ PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
******************************* Bottom of data ********************************
```

Figure 15-2 Processor List: Work with PCIe functions - ISM

3. To add a PCIe function, enter `add` on the CLI in the PCIe Function List panel (Figure 15-3).

```
------------------------------------------------------------------------------
                              PCIe Function List     Row 1 of 22 More:       >
Command ===> add____________________________________________ Scroll ===> PAGE

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

Processor ID . . . . : MENSA        Mensa



/ FID    CHID+ P+  VF+ PF Type+         UID   Description
```

Figure 15-3 PCIe Function List: Add line command - ISM

4. Make the following updates (Figure 15-4 on page 341), 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 . . . . . . . : MENSA       Mensa                              ·
·                                                                             ·
· Function ID  . . . . . . . . 0040                                           ·
· Type . . . . . . . . . . . . ISM_________  +                                ·
·                                                                             ·
· Channel ID . . . . . . . . . 7F1  +                                         ·
· Port . . . . . . . . . . . . _    +                                         ·
· Virtual Function ID  . . . . 1__  +     Physical Function    _  (Y/N)       ·
· Number of virtual functions  1                                              ·
· UID  . . . . . . . . . . . . ____                                           ·
·                                                                             ·
· Description  . . . . . . . . ISM FID=0040 VFID=1 CHID=7F1____               ·
·                                                                             ·
·                                                                             ·
·                                                                             ·
·······························································································
```

Figure 15-4 PCIe Function List: Add PCIe function - ISM

5. Update `Physical network ID` 1 to `PERFNET` in the Add/Modify Physical Network IDs panel (Figure 15-5), 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  . . ________________                                 ·
·                                                                             ·
·                                                                             ·
·                                                                             ·
·  F1=Help     F2=Split    F3=Exit     F5=Reset    F9=Swap    F12=Cancel      ·
·······························································································
```

Figure 15-5 Add PCIe Function: Add/Modify Physical Network IDs - ISM

6. Select the access LPAR for the function. In this example, you use LPAR `MENSA32(OS)`. Press Enter (Figure 15-6).

```
···························· Define Access List ·····························
·                                                               Row 29 of 57 ·
· Command ===> _________________________________________ Scroll ===> CSR    ·
·                                                                           ·
· Select one partition for the access list.                                 ·
·                                                                           ·
· Function ID  . . . . : 0040                                               ·
·                                                                           ·
· / CSS ID Partition Name   Number Usage Description                        ·
· _ 2      MENSA29          9      OS                                       ·
· _ 3      MENSA3A          A      OS    WTSCMXA                            ·
· _ 3      MENSA3B          B      OS    RDBKPOK                            ·
· _ 3      MENSA3C          C      CF    Redbooks CF86                      ·
· _ 3      MENSA3D          D      CF    Redbooks CF87                      ·
· _ 3      MENSA3E          E      CF    Redbooks CF76                      ·
· _ 3      MENSA3F          F      CF    Redbooks CF77                      ·
· _ 3      MENSA31          1      OS    RDBKCRYP                           ·
· / 3      MENSA32          2      OS    WTSC75                             ·
· _ 3      MENSA33          3      OS    RDBKAIDV                           ·
· _ 3      MENSA34          4      OS    WTSC80                             ·
· _ 3      MENSA35          5      OS    WTSC81                             ·
· _ 3      MENSA36          6      OS    RDBKAIWK                           ·
· _ 3      MENSA37          7      OS    RDBKESI3                           ·
·····························································································
```

Figure 15-6 Add PCIe Function: Define Access List - ISM

7. The HCD now shows the `Define Candidate List` panel. In this panel, select which partitions can access the function in addition to the access partition. In this example, 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 15-7).

```
------------------------------------------------------------------------------
                              PCIe Function List     Row 1 of 23 More:       >
Command ===> _______________________________________________ Scroll ===> PAGE

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

Processor ID . . . . : MENSA        Mensa



/ FID    CHID+ P+  VF+ PF Type+         UID   Description
_ 0040   7F1   _   1   _  ISM           ____  ISM FID=0040 VFID=1 CHID=7F1
```

Figure 15-7 PCIe Function List: Function now created - ISM

8. Define the other FID according to the example so far (Figure 15-8).

```
------------------------------------------------------------------------------
                              PCIe Function List     Row 1 of 26 More:       >
Command ===> _______________________________________________ Scroll ===> PAGE

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

Processor ID . . . . : MENSA       Mensa



/ FID    CHID+ P+  VF+ PF 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
```

Figure 15-8 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 (IQD), OSA-Express (OSD) and Network Express Adapters (OSH)), 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. The 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 NETH PCIe function

RoCE adapters along with PCIe functions ROCE and ROC2 are no longer supported on IBM z17. This section provides information about configuring the new NETH PCIe function to enable SMC-R in the Network Express Adapters of the IBM z17.

NETH overview

An OSH channel path and NETH functions can be defined on the same port of a Network Express adapter. Each port is a separate PCHID and for this reason functions of type NETH do not support the `PORT` parameter. By allowing OSH and NETH to co-exist on the same port, z/OS Communications Server can initialize an SMC-R network by using a single port. This chapter describes the NETH definitions. OSH definitions are described in 13.4, “Network Express for channel type OSH” on page 291.

On IBM z17, there is a maximum of 4096 NETH PCIe functions per CPC and up to 123 NETH VFs can be defined per PCHID.

NETH configuration

The following example defines two NETH PCIe functions in two Network Express Adapter ports (each port is a different PCHID) for LPAR MENSA32 by using PNETID REDBOOKS129. The function definitions are:

- `PCHID=1B0` to FID 3432 (`VF=1`) for LPAR MENSA32 on `CPC=MENSA`
- `PCHID=278` to FID 3632 (`VF=1`) for LPAR MENSA32 on `CPC=MENSA`

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 (`MENSA`) to which you want to define the NETH functions, and press Enter (see Figure 15-9).

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

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


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
f MENSA    9175     ME1      LPAR  0B9FB89175 Mensa
_ PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
****************************** Bottom of data *******************************
```

Figure 15-9 Processor List: Work with PCIe functions - NETH

3. To add a PCIe function, enter `add` on the CLI in the PCIe Function List panel (see Figure 15-10).

```
------------------------------------------------------------------------------
                              PCIe Function List     Row 1 of 22 More:      >
Command ===> add____________________________________________ Scroll ===> PAGE

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

Processor ID . . . . : MENSA        Mensa



/ FID    CHID+ P+  VF+ PF Type+         UID   Description
```

Figure 15-10 PCIe Function List: Add line command - NETH

4. Make the following updates (see Figure 15-11 on page 345), and press Enter:
   - Update `Function ID` to `3432`.
   - Update `Type` to `NETH`.
   - Update `Channel ID` to `1B0`.
   - 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 . . . . . . . : MENSA       Mensa                           ·
·                                                                          ·
· Function ID  . . . . . . . . 3432                                        ·
· Type . . . . . . . . . . . . NETH________  +                             ·
·                                                                          ·
· Channel ID . . . . . . . . . 1B0  +                                      ·
· Port . . . . . . . . . . . . _    +                                      ·
· Virtual Function ID  . . . . 1__  +     Physical Function    _  (Y/N)    ·
· Number of virtual functions  1                                           ·
· UID  . . . . . . . . . . . . ____                                        ·
·                                                                          ·
· Description  . . . . . . . . NETH FID=3432 VFID=1 CHID=1B0___            ·
·                                                                          ·
·                                                                          ·
·                                                                          ·
·····························································································
```

Figure 15-11 PCIe Function List: Add PCIe function - NETH

5. Answer `NO` in the Allow Promiscuous Mode panel (see Figure 15-12)

```
··················· Allow Promiscuous Mode ··················
·                                                           ·
·                                                           ·
· Specify Yes to indicate that the FID is allowed to use    ·
· promiscuous mode when enabled by the operating system,    ·
· otherwise specify No.                                     ·
·                                                           ·
· Promiscuous Mode . . . . . . . . . . NO                   ·
·                                                           ·
·                                                           ·
·                                                           ·
·····························································
```

Figure 15-12 Add PCIe Function: Allow Promiscuous Mode - NETH

> **Note:** The new OSH CHIPD of IBM z17 uses EQDIO instead of Queued Direct I/O (QDIO). The option to allow a function to be in promiscuous mode is necessary to support existing client capability because Linux does not support EQDIO.

6. Update `Physical network ID 1` to `REDBOOKS129` in the Add/Modify Physical Network IDs panel (see Figure 15-13), 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  . . REDBOOKS129_____                              ·
· Physical network ID 2  . . ________________                              ·
· Physical network ID 3  . . ________________                              ·
· Physical network ID 4  . . ________________                              ·
·                                                                          ·
·                                                                          ·
·                                                                          ·
·                                                                          ·
····························································································
```

Figure 15-13 Add PCIe Function: Add/Modify Physical Network IDs - NETH

7. Select the required Access LPAR for Function access list. In this example, use LPAR MENSA32(OS). Press Enter (see Figure 15-14).

```
··························· Define Access List ···························
·                                                          Row 29 of 57 ·
· Command ===> ________________________________________ Scroll ===> CSR   ·
·                                                                        ·
· Select one partition for the access list.                              ·
·                                                                        ·
· Function ID  . . . . : 3432                                            ·
·                                                                        ·
· / CSS ID Partition Name   Number Usage Description                     ·
· _ 2      MENSA29          9      OS                                    ·
· _ 3      MENSA3A          A      OS    WTSCMXA                         ·
· _ 3      MENSA3B          B      OS    RDBKPOK                         ·
· _ 3      MENSA3C          C      CF    Redbooks CF86                   ·
· _ 3      MENSA3D          D      CF    Redbooks CF87                   ·
· _ 3      MENSA3E          E      CF    Redbooks CF76                   ·
· _ 3      MENSA3F          F      CF    Redbooks CF77                   ·
· _ 3      MENSA31          1      OS    RDBKCRYP                        ·
· / 3      MENSA32          2      OS    WTSC75                          ·
· _ 3      MENSA33          3      OS    RDBKAIDV                        ·
· _ 3      MENSA34          4      OS    WTSC80                          ·
· _ 3      MENSA35          5      OS    WTSC81                          ·
· _ 3      MENSA36          6      OS    RDBKAIWK                        ·
· _ 3      MENSA37          7      OS    RDBKESI3                        ·
··························································································
```

Figure 15-14 Add PCIe Function: Define Access List - NETH

8. The HCD now shows the `Define Candidate List` panel. In this panel, select which partitions can access the function in addition to the access partition. In this example, do *not* select any candidate LPARs. Press Enter.

   The HCD returns to the PCIe Function List panel where you can see the function that is defined (see Figure 15-15).

```
------------------------------------------------------------------------------
                              PCIe Function List    Row 25 of 25 More:      >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa



/ FID    CHID+ P+  VF+ PF Type+         UID   Description
_ 3432   1B0   _   1   _  NETH          ____  NETH FID=3432 VFID=1 CHID=1B0
******************************* Bottom of data ********************************
```

Figure 15-15 PCIe Function List: Function now created - NETH

9. Define the other FID according to the example so far (see Figure 15-16).

```
------------------------------------------------------------------------------
                              PCIe Function List    Row 25 of 26 More:      >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa



/ FID    CHID+ P+  VF+ PF Type+         UID   Description
_ 3432   1B0   _   1   _  NETH          ____  NETH FID=3432 VFID=1 CHID=1B0
_ 3632   278   _   1   _  NETH          ____  NETH FID=3632 VFID=1 CHID=278
******************************* Bottom of data ********************************
```

Figure 15-16 PCIe Function List: All Functions now created - NETH

NETH management

This section introduces the z/OS commands that are related to the NETH PCIe functions, and shows the responses on our test system.

The 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 15-2 is an example of the **DISPLAY PCIE** command. You can confirm the FID and VFN that you defined. The FID is represented as PCIe function IDs (PFIDs). Both FIDs are still in the stand by (STNBY) status. Later, you bring the FIDs online.

Example 15-2 Example of the D PCIE command

```
DISPLAY PCIE
IQP022I 10.30.54 DISPLAY PCIE 072
PCIE     0012 ACTIVE
PFID      DEVICE TYPE NAME        STATUS  ASID  JOBNAME  CHID VFN  PN
00002332  8GB zHyperLink          ALLC    0019  IOSAS    0218 0003 1
00002432  8GB zHyperLink          ALLC    0019  IOSAS    0218 0003 2
00003632  Network Express         STNBY                  0278 0001
00003432  Network Express         STNBY                  01B0 0001
00002132  8GB zHyperLink          ALLC    0019  IOSAS    01FC 0003 1
00002232  8GB zHyperLink          ALLC    0019  IOSAS    01FC 0003 2
```

Example 15-3 is an example of the **DISPLAY PCIE,PFID=pfid** command. After you define the new PCIe function, you can see more details for this particular FID with this command.

Example 15-3 Example of the DISPLAY PCIE,PFID=pfid command

```
DISPLAY PCIE,PFID=3632
IQP024I 10.34.56 DISPLAY PCIE 074
PCIE     0012 ACTIVE
PFID      DEVICE TYPE NAME        STATUS  ASID  JOBNAME  CHID VFN  PN
00003632  Network Express         STNBY                  0278 0001
 CLIENT ASIDS: NONE
 PNetID 1: REDBOOKS129
```

Example 15-4 is an example of the **DISPLAY PCIE,DD** command. You can confirm the details of the device drivers that are installed in the system. In the display output, you see the new Network Express driver.

Example 15-4 Example of the DISPLAY PCIE,DD command

```
DISPLAY PCIE,DD
IQP023I 10.41.13 DISPLAY PCIE 088
PCIE     0012 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
15B3101E   Network Express
101404ED   ISM
```

The CONFIG command

You can use the **CONFIG** command to bring the PFID online or offline.

Example 15-5 on page 349 is an example of a **CONFIG PFID(xx),ONLINE** command.

Example 15-5 Example of a CONFIG PFID(xx),ONLINE command

```
CONFIG PFID(3632),ONLINE
IEE504I PFID(3632),ONLINE
IEE712I CONFIG   PROCESSING COMPLETE
```

Example 15-6 is an example of a **CONFIG PFID(xx),OFFLINE** command.

Example 15-6 Example of a CF PFID(xx),OFFLINE command

```
CONFIG PFID(3632),OFFLINE
IEE505I PFID(3632),OFFLINE
IEE712I CONFIG   PROCESSING COMPLETE
```

15.2.4 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 reduces latency by interconnecting the IBM z17 directly to the I/O bay of the DS8880 storage system or later.

zHyperLink overview

zHyperLink uses a PCIe feature that is called zHyperLink Express2.0 (Feature Code #0351).

There are two ports per feature, and up to 127 VFIDs can be defined per port.

zHyperLink configuration

The following items are defined in this example:

- `CHID=1FC` to `FID = 2132, VFIDs = 3, Port = 1,` on `CPC = MENSA`
- `CHID=1FC` to `FID = 2232, VFIDs = 3, Port = 2,` on `CPC = MENSA`
- `CHID=218` to `FID = 2332, VFIDs = 3, Port = 1,` on `CPC = MENSA`
- `CHID=218` to `FID = 2432, VFIDs = 3, Port = 2,` on `CPC = MENSA`

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 (`MENSA`) to which you want to define the zHyperLink functions, and press Enter (see Figure 15-17).

```
-------------------------------------------------------------------------------
                                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
f MENSA    9175     ME1      LPAR  0B9FB89175 Mensa
_ PAVO     3931     A01      LPAR  071A083931 Pavo
_ VELA     3932     AGZ      LPAR  087F283932 Vela
****************************** Bottom of data ********************************
```

Figure 15-17 Processor List: Work with PCIe functions - zHyperLink

2. To add a PCIe function, enter `add` on the CLI in the PCIe Function List panel (Figure 15-18).

```
------------------------------------------------------------------------------
                              PCIe Function List     Row 1 of 22 More:       >
Command ===> add____________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa



/ FID    CHID+ P+  VF+ PF Type+         UID   Description
```

Figure 15-18 PCIe Function List: Add line command - zHyperLink

3. Make the following updates (Figure 15-19), and press Enter:
   - Update `Function ID` to `2132`.
   - Update `Type` to `ZHYPERLINK`.
   - Update `Channel ID` to `1FC`.
   - Update `Port ID` to `1`.
   - Update `Virtual Function ID` to 3.
   - Update `Description` to the description that you want.

```
............................. Add PCIe Function .............................
.                                                                           .
.                                                                           .
. Specify or revise the following values.                                   .
.                                                                           .
. Processor ID . . . . . . . : MENSA        Mensa                           .
.                                                                           .
. Function ID  . . . . . . . . 2132                                         .
. Type . . . . . . . . . . . . ZHYPERLINK    +                              .
.                                                                           .
. Channel ID . . . . . . . . . 1FC  +                                       .
. Port . . . . . . . . . . . . 1    +                                       .
. Virtual Function ID  . . . . 3    +     Physical Function    _  (Y/N)     .
. Number of virtual functions  1                                            .
. UID  . . . . . . . . . . . . ____                                         .
.                                                                           .
. Description  . . . . . . . . ZHYL FID=2132 VFID=3 CHID=1FC                .
.                                                                           .
.                                                                           .
.                                                                           .
.............................................................................
```

Figure 15-19 PCIe Function List: Add PCIe Function - zHyperLink

4. Select the required `Access LPAR for Function` access list. In this example, you use LPAR `MENSA32(OS)`. Press Enter (see Figure 15-20).

```
··························· Define Access List ····························
·                                                              Row 29 of 57 ·
· Command ===> _________________________________________ Scroll ===> CSR    ·
·                                                                           ·
· Select one partition for the access list.                                 ·
·                                                                           ·
· Function ID  . . . . : 2132                                               ·
·                                                                           ·
· / CSS ID Partition Name   Number Usage Description                        ·
· _ 2      MENSA29          9      OS                                       ·
· _ 3      MENSA3A          A      OS    WTSCMXA                            ·
· _ 3      MENSA3B          B      OS    RDBKPOK                            ·
· _ 3      MENSA3C          C      CF    Redbooks CF86                      ·
· _ 3      MENSA3D          D      CF    Redbooks CF87                      ·
· _ 3      MENSA3E          E      CF    Redbooks CF76                      ·
· _ 3      MENSA3F          F      CF    Redbooks CF77                      ·
· _ 3      MENSA31          1      OS    RDBKCRYP                           ·
· / 3      MENSA32          2      OS    WTSC75                             ·
· _ 3      MENSA33          3      OS    RDBKAIDV                           ·
· _ 3      MENSA34          4      OS    WTSC80                             ·
· _ 3      MENSA35          5      OS    WTSC81                             ·
· _ 3      MENSA36          6      OS    RDBKAIWK                           ·
· _ 3      MENSA37          7      OS    RDBKESI3                           ·
·············································································
```

Figure 15-20 Add PCIe Function: Define Access List - zHyperLink

5. The HCD now shows the `Define Candidate List` panel. In this panel, select which partitions can access the function in addition to the access partition. In this example, do *not* select any candidate LPARs. Press Enter.

   The HCD returns to the PCIe Function List panel, where you can see the function now defined (see Figure 15-21).

```
-------------------------------------------------------------------------------
                              PCIe Function List     Row 7 of 23 More:       >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa



/ FID    CHID+ P+  VF+ PF Type+         UID   Description
_ 2132   1FC   1   3   _  ZHYPERLINK    ____  ZHYL FID=2132 VFID=3 CHID=1FC
```

Figure 15-21 PCIe Function List: Function now created - zHyperLink

6. Define the other FIDs according to the example so far (see Figure 15-22).

```
-----------------------------------------------------------------------------
                              PCIe Function List    Filter Mode. More:      >
Command ===> _______________________________________________ Scroll ===> CSR

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

Processor ID . . . . : MENSA        Mensa



/ FID    CHID+ P+   VF+ PF Type+         UID   Description
_ 2132   1FC   1    3   _  ZHYPERLINK    ____  ZHYL FID=2132 VFID=3 CHID=1FC
_ 2232   1FC   2    3   _  ZHYPERLINK    ____  ZHYL FID=2232 VFID=3 CHID=1FC
_ 2332   218   1    3   _  ZHYPERLINK    ____  ZHYL FID=2332 VFID=3 CHID=218
_ 2432   218   2    3   _  ZHYPERLINK    ____  ZHYL FID=2432 VFID=3 CHID=218
******************************* Bottom of data ********************************
```

Figure 15-22 PCIe Function List: All Functions now created - zHyperLink

Managing zHyperLink Express

At the time of writing, the only IBM Db2 and IBM MQ use zHyperLinks. Db2 can use zHyperLinks for both database reads and active logs writes. IBM MQ can use only zHyperLinks for active log writing. Db2 12 is the first version of Db2 to support zHyperLinks. IBM MQ started supporting zHyperLink in Version 9.4. To use zHyperLink in either Db2 or IBM MQ, first enable it in z/OS.

z/OS

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 15-7. In z/OS 3.1, the zHyperlink facility is disabled on the system by default.

Example 15-7 IECIOSxx parmlib enabled for zHyperLink

```
BROWSE    SYS1.PARMLIB(IECIOS00) - 01.20           Line 0000000000 Col 001 080
 Command ===>                                                  Scroll ===> CSR
********************************* Top of Data **********************************
HYPERPAV=XPAV
ZHPF=YES
ZHYPERLINK,OPER=ALL
******************************** Bottom of Data ********************************
```

Note: z/OS 3.1 introduces a new parameter **READLIMIT=n** in the **ZHYPERLINK** statement of the IECIOSxx parmlib member. zHyperLink read is enabled for Db2 objects with a CI size less than or equal to the current **READLIMIT** setting in KB. If no value is specified, like in Example 15-7, then the default value is used. This default depends on the storage controller that is attached to the channel. For the original zHyperLink capability, the default is 4K (+32 bytes). For IBM System Storage DS8000 G10 and later, the default is 16K (+32 bytes).

For more information about the **READLIMIT** parameter, see ZHYPERLINK

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 15-8.

Example 15-8 DISPLAY IOS,ZHYPERLINK

```
D IOS,ZHYPERLINK
IOS634I 11.25.29 IOS SYSTEM OPTION 311
ZHYPERLINK IS ENABLED FOR READ AND WRITE OPERATIONS
ZHYPERLINK READ DATA LIMIT IS SET TO THE DEFAULT
```

The **DISPLAY PCIE** command can be used to display the available PFIDs for zHyperLink, as shown in Example 15-9.

Example 15-9 DISPLAY PCIE

```
DISPLAY PCIE
IQP022I 10.30.54 DISPLAY PCIE 072
PCIE     0012 ACTIVE
PFID      DEVICE TYPE NAME        STATUS  ASID  JOBNAME  CHID VFN  PN
00002332  8GB zHyperLink          ALLC    0019  IOSAS    0218 0003 1
00002432  8GB zHyperLink          ALLC    0019  IOSAS    0218 0003 2
00003632  Network Express         STNBY                  0278 0001
00003432  Network Express         STNBY                  01B0 0001
00002132  8GB zHyperLink          ALLC    0019  IOSAS    01FC 0003 1
00002232  8GB zHyperLink          ALLC    0019  IOSAS    01FC 0003 2
```

Example 15-10 shows the **DISPLAY PCIE,PFID=pfid** command to display a specific zHyperLink PFID.

Example 15-10 DISPLAY PCIE,PFID=pfid

```
D PCIE,PFID=2132
IQP024I 12.00.22 DISPLAY PCIE 355
PCIE     0012 ACTIVE
PFID      DEVICE TYPE NAME        STATUS  ASID  JOBNAME  CHID VFN  PN
00002132  8GB zHyperLink          ALLC    0019  IOSAS    01FC 0003 1
 CLIENT ASIDS: NONE
 CU WWNN: 500507630BFFD055  CU Link Id: 0081
 S/W State: Allocated
 Port State: Operational
 CU Node Descriptor: 002107.998.IBM.75.0000000LTV61
```

The results of running the **DISPLAY M=CU(cun)** command against a CU that is enabled for zHyperLink are shown in Example 15-11.

Example 15-11 DISPLAY M=CU(cun)

```
D M=CU(696)
IEE174I 09.35.22 DISPLAY M 859
CONTROL UNIT 0696
CHP                   40   41   42   43
ENTRY LINK ADDRESS    0112 0212 0115 0215
DEST LINK ADDRESS     0103 0203 0104 0204
CHP PHYSICALLY ONLINE Y    Y    N    Y
PATH VALIDATED        Y    Y    N    Y
MANAGED               N    N    N    N
```

```
ZHPF - CHPID          Y    Y    Y    Y
ZHPF - CU INTERFACE   Y    Y    N    Y
INTERFACE ID          0100 0030 .... 0230
CONNECTION SECURITY   None None None None
MAXIMUM MANAGED CHPID(S) ALLOWED = 0
DESTINATION CU LOGICAL ADDRESS = 96
CU ND           = 002107.998.IBM.75.0000000LTV61.0100
CU NED          = 002107.998.IBM.75.0000000LTV61.9600
TOKEN NED       = 002107.900.IBM.75.0000000LTV61.9600
WWNN            = 500507630BFFD055
FUNCTIONS ENABLED = ZHPF, ZHYPERLINK, XPAV
XPAV CU PEERS     = 0692, 0694, 0696, 0698
DEFINED DEVICES
  08400-084EF
DEFINED PAV ALIASES
  084F0-084FF
USABLE HYPERPAV ALIASES = 16
ZHYPERLINK READ DATA LIMIT IS 4K
ZHYPERLINKS
  PFID      PCHID  Port  LinkId  S/W St   Port St
  00002132  01FC   01    0081    Alloc    Oper
  00002232  01FC   02    0181    Alloc    Oper
  00002332  0218   01    0281    Alloc    Oper
  00002432  0218   02    0381    Alloc    Oper
```

The results for the **DISPLAY M=DEV(devno)** command against a device that is enabled for zHyperLink are shown in Example 15-12.

Example 15-12 DISPLAY M=DEV(devno)

```
D M=DEV(8400)
IEE174I 09.46.40 DISPLAY M 863
DEVICE 08400   STATUS=ONLINE
CHP                   40   41   42   43
ENTRY LINK ADDRESS    0112 0212 0115 0215
DEST LINK ADDRESS     0103 0203 0104 0204
PATH ONLINE           Y    Y    N    Y
CHP PHYSICALLY ONLINE Y    Y    N    Y
PATH OPERATIONAL      Y    Y    N    Y
MANAGED               N    N    N    N
CU NUMBER             0696 0696 0696 0696
INTERFACE ID          0100 0030 .... 0230
CONNECTION SECURITY   None None None None
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 96
SCP CU ND         = 002107.998.IBM.75.0000000LTV61.0100
SCP TOKEN NED     = 002107.900.IBM.75.0000000LTV61.9600
SCP DEVICE NED    = 002107.900.IBM.75.0000000LTV61.9600
WWNN              = 500507630BFFD055
HYPERPAV ALIASES CONFIGURED = 16
ZHYPERLINKS AVAILABLE = 4
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/write, as shown in Example 15-13.

Example 15-13 DISPLAY M=DEV(devno),ZHYPERLINK: Device enabled for zHyperLink

```
D M=DEV(8400),ZHYPERLINK
IEE587I 09.48.48 DISPLAY M 869
DEVICE 08400   STATUS=ONLINE
DEVICE IS ENABLED FOR ZHYPERLINK
READ AND WRITE OPERATIONS ARE ENABLED
ZHYPERLINKS AVAILABLE = 4
ZHYPERLINK READ DATA LIMIT IS 4K
```

The result for a device that cannot use zHyperLink is shown in Example 15-14.

Example 15-14 DISPLAY M=DEV(devno),ZHYPERLINK: Device not enabled for zHyperLink

```
DISPLAY M=DEV(8400),ZHYPERLINK
IEE587I 09.48.30 DISPLAY M 867
DEVICE 08000   STATUS=OFFLINE
DEVICE IS DISABLED FOR ZHYPERLINK FOR THE FOLLOWING REASON(S):
  THERE ARE NO ZHYPERLINKS AVAILABLE
```

Db2

To enable IBM Db2 to use zHyperLinks, the Db2 zParm must be modified to enable zHyperLink, as shown in Figure 15-23.

```
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 15-23 Db2 zParm: zHyperLink

Here are the acceptable values for Db2 13 zHyperLink Scope:

ENABLE	Db2 requests the zHyperLink protocol for all eligible I/O requests.
DISABLE	Db2 does not use zHyperLink protocol for any I/O requests.
DATABASE	Db2 requests the zHyperLink protocol for only database synchronous read I/Os.
ACTIVELOG	Db2 requests the zHyperLink protocol only for active log-write I/Os.

Note: For the zHyperLink protocol to be enabled for I/O requests by the Db2 system, in addition to specifying a value of `ENABLE`, `DATABASE`, or `ACTIVELOG` for the **`ZHYPERLINK`** parameter, the SMS storage class of the Db2 data sets must be enabled for zHyperLink eligibility by using the Integrated Storage Management Facility (ISMF).

For more information about the usage of zHyperLink in Db2, see Installing or migrating to Db2 13.

IBM MQ

You can configure IBM MQ to use zHyperLink by using one of the following methods:

- Specify **`ZHYLINK(YES)`** in the log parameters.
- Issue the command **`SET LOG ZHYLINK(YES)`**.

For more information about IBM MQ and zHyperlink, see Configuring Queue Managers on z/OS.

16

Defining channel-to-channel connections

This chapter describes the configuration steps for Fibre Connection channel-to-channel (FCTC). FCTC can be needed for IBM Virtual Telecommunications Access Method (VTAM) or global resource serialization (GRS) communications or for IBM z/VM Single System Image Communications.

> **Naming:** The IBM z17 system that is targeted by this publication is the IBM z17 ME1 (9175) model. Throughout this chapter, this machine is referred to as the IBM z17.

This chapter includes the following topics:

- Understanding Fibre Connection channel-to-channel
- Defining FCTC
- Verifying the FCTC configuration

16.1 Understanding Fibre Connection channel-to-channel

FCTC is used to connect two logical partitions (LPARs) directly by using Fibre Connection (FICON). The connected partitions can be on the same central processor complex (CPC) or on different CPCs. FCTC is used for communication between these partitions. Possible users of FCTC include VTAM and GRS in z/OS, and the single system image (SSI) cluster in z/VM.

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 (LPARs) for the CTC connections.

A logical address (control unit address (CUADD)) is required in the definition of the CU representing the target system when the FC channel path is attached to a shared FC channel path to identify the LPAR to communicate with. This CUADD must be the number of the target LPAR prefixed with the channel subsystem (CSS) number of the target LPAR.

When attached to an unshared FC channel path, the CUADD must be zero or not specified. For more background information, see the CTC Definitions page.

FCTC communication within a single CPC can be accomplished with a single FC channel path connecting to an FC switch. Both sides of the CTC connection are represented by the same single FC channel path. This configuration results in the following advantages:

- Reduced number of channels
- Simplified configuration design
- Simplified configuration definition

The following considerations apply to all FCTC configurations:

- The server at each end of an FCTC connection uses a FICON native (channel path ID (CHPID) type FC) channel.
- The FICON native channel at each end of the CTC connection has an FCTC CU defined.
- The FCTC devices on the FCTC CU are defined as type FCTC.
- The FICON native channel at each end of the FCTC connection supports the FCTC CUs.

In an FCTC configuration, FCTC CUs are defined at each end, but only one end provides the FCTC CU function during operation. 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.

For more information about how to implement FCTC, see the following publications:

- *FICON Planning and Implementation Guide*, SG24-6497
- *FICON CTC Implementation*, REDP-0158
- *I/O Configuration Using z/OS HCD and HCM*, SG24-7804

16.2 Defining FCTC

To define FCTC, complete the following steps.

1. From the main Hardware Configuration Definition (HCD) panel, select the work input/output definition file (IODF), and then select option `1.3 Processors`.
2. Enter `S` next to the CPC that you want to work with.
3. Enter `S` next to the CSS that contains the FCTC channel to open the Channel Path List.

4. Add the required CHPID by pressing F11 if it is not yet defined, or change the CHPID that will be used as the FCTC by entering `C` next to it, as shown in Figure 16-1. The CHPID must be a FICON CHPID (`FC`).

```
+-------------------- Change Channel Path Definition ----------------------+
|                                                                          |
|                                                                          |
| Specify or revise the following values.                                  |
|                                                                          |
| Processor ID . . . . : MENSA       Mensa                                 |
| Configuration mode . : LPAR                                              |
| Channel Subsystem ID : 0                                                 |
|                                                                          |
| Channel path ID  . . . . 44    +           Channel ID  12C  +            |
| Channel path type  . . . FC    +                                         |
| Operation mode . . . . . SPAN  +                                         |
| Managed  . . . . . . . . No   (Yes or No)   I/O Cluster ________  +      |
| Description  . . . . . . FCTC 32G LX                                     |
|                                                                          |
| Specify the following values only if connected to a switch:              |
|                                                                          |
| Dynamic entry switch ID  01  + (00 - FF)                                 |
| Entry switch ID  . . . . 01  +                                           |
| Entry port . . . . . . . 17  +                                           |
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap     |
| F12=Cancel                                                               |
+--------------------------------------------------------------------------+
```

Figure 16-1 Defining the channel for a CTC

5. Enter `S` next to the CHPID to open the Control Unit List for that CHPID.

6. Add a CU by pressing F11 for each target LPAR that will be connected through this FCTC, as shown in Figure 16-2.

```
+------------------------- Add Control Unit --------------------------+
|                                                                     |
|                                                                     |
| Specify or revise the following values.                             |
|                                                                     |
| Control unit number  . . . . 444B  +                                |
| Control unit type  . . . . . FCTC_________  +                       |
|                                                                     |
| Serial number  . . . . . . . __________                             |
| Description  . . . . . . . . CTC to MENSA4B__________________       |
|                                                                     |
| Connected to switches  . . . 01  __ __ __ __ __ __ __  +            |
| Ports  . . . . . . . . . . . 17  __ __ __ __ __ __ __  +            |
|                                                                     |
| If connected to a switch:                                           |
|                                                                     |
| Define more than eight ports . . 2   1.  Yes                        |
|                                      2.  No                         |
| Propose CHPID/link addresses and                                    |
| unit addresses . . . . . . . . . 2   1.  Yes                        |
|                                      2.  No                         |
|  F1=Help    F2=Split   F3=Exit    F4=Prompt  F5=Reset   F9=Swap     |
| F12=Cancel                                                          |
+---------------------------------------------------------------------+
```

Figure 16-2 Defining an FCTC control unit

The CU type must be FCTC, and the CUADD must represent the LPAR number, including the CSS number. For example, if the LPAR number is 11 (B) in CSS number 4, the CUADD is 4B. You can define up to 256 unit addresses (UAs), starting with 00, for each CU.

7. To add device definitions to the CU, enter S next to the CU to open the I/O Device List. Add devices of type FCTC by pressing F11 as needed for your configuration, as shown in Figure 16-3 on page 361.

```
+------------------------------- Add Device -------------------------------+
|                                                                          |
|                                                                          |
| Specify or revise the following values.                                  |
|                                                                          |
| Device number  . . . . . . . . 4420  + (0000 - FFFF)                     |
| Number of devices  . . . . . . 2___                                      |
| Device type  . . . . . . . . . FCTC_________   +                         |
|                                                                          |
| Serial number  . . . . . . . . __________                                |
| Description  . . . . . . . . . CTC to MENSA4B__________________          |
|                                                                          |
| Volume serial number . . . . . ______  (for DASD)                        |
|                                                                          |
| PPRC usage . . . . . . . . . . _  + (for DASD)                           |
|                                                                          |
| Connected to CUs . . 444B  ____  ____  ____  ____  ____  ____  ____  +   |
|                                                                          |
|                                                                          |
|                                                                          |
|  F1=Help     F2=Split    F3=Exit     F4=Prompt   F5=Reset    F9=Swap     |
| F12=Cancel                                                               |
+--------------------------------------------------------------------------+
```

Figure 16-3 Defining an FCTC device

16.3 Verifying the FCTC configuration

After you activate the IODF with the FCTC configuration and complete all physical cabling for the FCTC, verify that the FCTC connection is operational by using one of the following options:

- Checking the status by using z/OS commands
- Checking the status by using the Support Element

16.3.1 Checking the status by using z/OS commands

For example, if CHPID 44 is defined for FCTC usage and the FCTC CU uses devices 4E30 - 4E33, run the z/OS system command **`D M=CHP(44)`**. The output shows the CHPID as `ONLINE` and the devices as online, indicated by a plus sign (+).

16.3.2 Checking the status by using the Support Element

To check the status by using the Support Element (SE), complete the following steps.

1. From the Hardware Management Appliance (HMA), select the CPC under Systems Management that contains the CHPID or physical channel ID (PCHID) that you want to verify, and click **Single Object Operations** under the Recovery task options. This action opens the SE.
2. On the SE, select the same CPC and click **Channels**. Locate the PCHID whose status you want to check. The PCHID is shown as `Operational` and `Online`.
3. To view more details about the PCHID, click the PCHID to open the details window.

You can also check the status from the LPAR view. Select the LPAR, and then select **CHPIDs** under that LPAR. Locate the CHPID and check its status. The CHPID is shown as `Operational` and `Online`. To view more details, click the CHPID.

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 materials

The web material that is associated with this book is available in softcopy on the internet from the IBM Redbooks web server:

https://www.redbooks.ibm.com/abstracts/sg248960.html

Alternatively, you can go to the IBM Redbooks website:

ibm.com/redbooks

Search for SG24-8960, select the title, and then click **Additional materials** to open the directory that corresponds with the IBM Redbooks form number, SG24-8960.

Using the web materials

The additional web materials that accompany this book includes the following files:

File name	*Description*
Relocation Services Inventory.pdf	System Discontinuance or Relocation form
8460_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.

Abbreviations and acronyms

4HRA	4-hour rolling average
AES	Advanced Encryption Standard
AID	adapter ID
BTS	Backup Time Server
CCA	Common Cryptographic Architecture
CCN	Configuration Control Number
CE LR	Coupling Express LR
CE2 LR	Coupling Express2 LR
CE3 LR	Coupling Express3 LR
CF	Coupling Facility
CFCC	Coupling Facility Control Code
CHID	channel ID
CHPID	channel path ID
CMT	IBM Z Connectivity Mapping Tool
CP	central processor
CPACF	CP Assist for Cryptographic Functions
CPC	central processor complex
CSS	channel subsystem
CST	Coordinated Server Time
CTC	channel-to-channel
CTN	Coordinated Timing Network
CTS	Current Time Server
CU	control unit
CUADD	control unit address
DASD	direct access storage device
DES	Data Encryption Standard
DFT	Distributed Function Terminal
DHD	defer host disconnect
DLA	Destination Link Address
DMA	direct memory access
DPM	Dynamic Partition Manager
DREQ	direct memory access request
DRNG	Deterministic Random Number Generation
DWDM	Dense Wavelength Division Multiplexing
EDT	Eligible Device Table
ETS	External Time Source
FC	Fibre Channel
FCP	Fibre Channel Protocol
FCTC	Fibre Connection channel-to-channel
FICON	Fibre Connection
FID	function ID
Gbps	gigabits per second
GRS	global resource serialization
HA	high availability
HCD	Hardware Configuration Definition
HCM	Hardware Configuration Manager
HDD	hard disk drive
HMA	Hardware Management Appliance
HMC	Hardware Management Console
HSA	Hardware System Area
IBM	International Business Machines Corporation
IBM SSR	IBM Systems Service Representative
IC	Internal Coupling
ICA SR	Integrated Coupling Adapter Short Reach
ICC	Integrated Console Controller
ICF	Internal Coupling Facility
ICP	Input/Output Configuration Program
ICSF	Integrated Cryptographic Service Facility
IML	Initial Microcode Load
IOCDS	input/output configuration data set
IOCP	Input/Output Configuration Program
IODF	input/output definition file
IPv4	Internet Protocol Version 4
IQD	Internal Queued Direct
IQDIO	internal queued direct input/output
ISM	Internal Shared Memory
ISPF	Interactive System Productivity Facility
JES2	Job Entry Subsystem 2
KVM	Kernel-based Virtual Machine
LAN	local area network
LCSS	logical channel subsystem

LIC	Licensed Internal Code
LPAR	logical partition
LR	Long Reach
LUN	logical unit number
LX	Long Wave
MAC	Media Access Control
MCS	Master Control Service
MES	Miscellaneous Equipment Specification
MIF	multiple image facility
NIP	Nucleus Initialization Program
NTP	Network Time Protocol
OAT	OSA Address Table
OS	operating system
OSA	Open Systems Adapter
OSCONFIG	operating system configuration
PCHID	physical channel ID
PCIe	Peripheral Component Interconnect Express
PFC	Priority Flow Control
PFID	PCIe function ID
PKCS	Public Key Cryptography Standards
POR	power-on reset
PPS	pulse per second
PR/SM	IBM Processor Resource/System Manager
PRNG	Pseudo-Random Number Generation
PTF	Program Temporary Fix
PTP	Precision Time Protocol
PTS	Preferred Time Server
QDIO	Queued Direct I/O
QP	queue pair
RCE	Regional Crypto Enablement
RDMA	remote direct memory access
RNIC	RDMA network interface card
RoCE	Remote Direct Memory Access over Converged Ethernet
RTO	read timeout
SACF	Stand-alone Coupling Facility
SAN	storage area network
SCM	storage-class memory
SE	Support Element
SMC	Shared Memory Communications
SMC-D	SMC - Direct Memory Access over Internal Shared Memory
SMC-R	SMC - Remote Direct Memory Access over Converged Ethernet Express
SMCAT	Shared Memory Communications Applicability Tool
SNA	Systems Network Architecture
SR	Short Reach
SS	subchannel set
SSC	Secure Service Container
STP	Server Time Protocol
SX	Short Wave
TDES	Triple Data Encryption Standard
TKE	Trusted Key Entry
TOD	time of day
TRNG	True Random Number Generation
TSO	Time Sharing Option
UA	unit address
VCHID	virtual channel ID
VF	virtual function
VFID	virtual function ID
VFM	Virtual Flash Memory
VLAN	virtual local area network
vPCIe	virtual PCIe
VTAM	Virtual Telecommunications Access Method
WWPN	worldwide port name
zBNA	IBM Z Batch Network Analyzer
zEDC	IBM zEnterprise Data Compression
zHPF	IBM High Performance FICON for IBM Z
zIIP	IBM Z Integrated Information Processor

Related publications

The publications that are listed in this section are considered suitable for a more detailed discussion of the topics that are covered in this book.

IBM Redbooks

The following IBM Redbooks publications provide additional information about the topic in this document. Some publications referenced in this list might be available in softcopy only.

- *FICON Planning and Implementation Guide*, SG24-6497
- *I/O Configuration Using z/OS HCD and HCM*, SG24-7804
- *IBM z/OS V2R2 Communications Server TCP/IP Implementation Volume 1: Base Functions, Connectivity, and Routing*, SG24-8360
- *IBM z17 (9175) Technical Guide*, SG24-8579
- *IBM z17 Technical Introduction*, SG24-8580
- *IBM Z Connectivity Handbook*, SG24-5444
- *IBM Z Time Synchronization Implementation Guide*, SG24-8480
- *Mainframe from Scratch: Hardware Configuration and z/OS Build*, SG24-8329
- *OSA-Express Implementation Guide*, SG24-5948
- *OSA-Express Integrated Console Controller Implementation Guide*, SG24-6364
- *Server Time Protocol Implementation Guide*, SG24-7281
- *Server Time Protocol Planning Guide*, SG24-7280
- *Server Time Protocol Recovery Guide*, SG24-7380

You can search for, view, download, or order these documents and other Redbooks, Redpapers, web docs, drafts, and additional materials, at the following website:

ibm.com/redbooks

Other publications

These publications are also relevant as further information sources:

- *CHPID Mapping Tool User's Guide*, GC28-7024
- *Connectivity Mapping Tool User's Guide*, GC28-7058
- *Coupling Facility Configuration Options*, ZSW01971
- *IBM Dynamic Partition Manager (DPM) Guide*, SB10-7182
- *Input/Output Configuration Program User's Guide for ICP IOCP*, SB10-7183
- *MVS Setting Up a Sysplex*, SA23-1399-60
- *Open Systems Adapter Integrated Console Controller User's Guide*, SC27-9003
- *OSA-Express Integrated Console Controller Implementation Guide*, SG24-6364

- *z/OS and z/VM HCM User's Guide,* SC34-2670-60
- *z/OS Communications Server: IP Configuration Guide*, SC27-3650
- *z/OS Hardware Configuration Definition Planning*, GA32-0907
- *z/OS HCD User's Guide*, SC34-2669

Online resources

These websites are also relevant as further information sources:

- Configuring queue managers on z/OS

  https://www.ibm.com/docs/en/ibm-mq/9.4.x?topic=configuring-queue-managers-zos
- IBM z/OS SMC Applicability Tool

  https://community.ibm.com/community/user/viewdocument/ibm-zos-smc-applicability-tool?CommunityKey=406e5630-08ab-45a7-8592-d1c960f86311&tab=librarydocuments
- *IBM z16 Server Time Protocol (STP): PTP/NTP Time Direct to CEC Accuracy Performance*

  https://www.ibm.com/support/pages/ibm-z16-server-time-protocol-stp-ptpntp-time-direct-cec-accuracy-performance-0
- *IBM z16 STP Time Direct to CPC PTP/NTP Accuracy Performance*

  https://www.ibm.com/support/pages/system/files/inline-files/WP%20Time%20Direct%20to%20CEC%20Accuracy%20Performance%20Dec%202023_0.pdf
- IBM z17 makes more possible (client letter)

  https://www.ibm.com/docs/en/announcements/z17-makes-more-possible
- IBM Call Home Collect Cloud

  https://www.ibm.com/support/call-home-connect/cloud/
- IBM Documentation

  https://www.ibm.com/docs/en
- IBM Resource Link

  https://resourcelink.cis.ibm.net/support/resourcelink/
- IBM Shared Memory Communications over RDMA (SMC-R) Protocol

  https://datatracker.ietf.org/doc/html/rfc7609
- IBM Z Batch Network Analyzer

  https://www.ibm.com/support/pages/ibm-z-batch-network-analyzer
- SMC-AT reference information

  https://www.ibm.com/docs/en/zos/3.1.0?topic=information-smc-reference#smcat_reference
- *z/OS Communications Server: IP Configuration Guide*

  https://www.ibm.com/docs/en/zos/3.1.0?topic=server-zos-communications-ip-configuration-guide
- ZHYPERLINK

  https://www.ibm.com/docs/en/zos/3.1.0?topic=parameters-zhyperlink

Help from IBM

- IBM Support and downloads

  ibm.com/support
- Services from IBM Consulting

  ibm.com/services
- IBM Training

  ibm.com/training

Redbooks

IBM z17 Configuration Setup

SG24-8581-00

ISBN 0738462373

(0.5” spine)
0.475”<->0.873”
250 <-> 459 pages

SG24-8581-00

ISBN 0738462373

Printed in U.S.A.