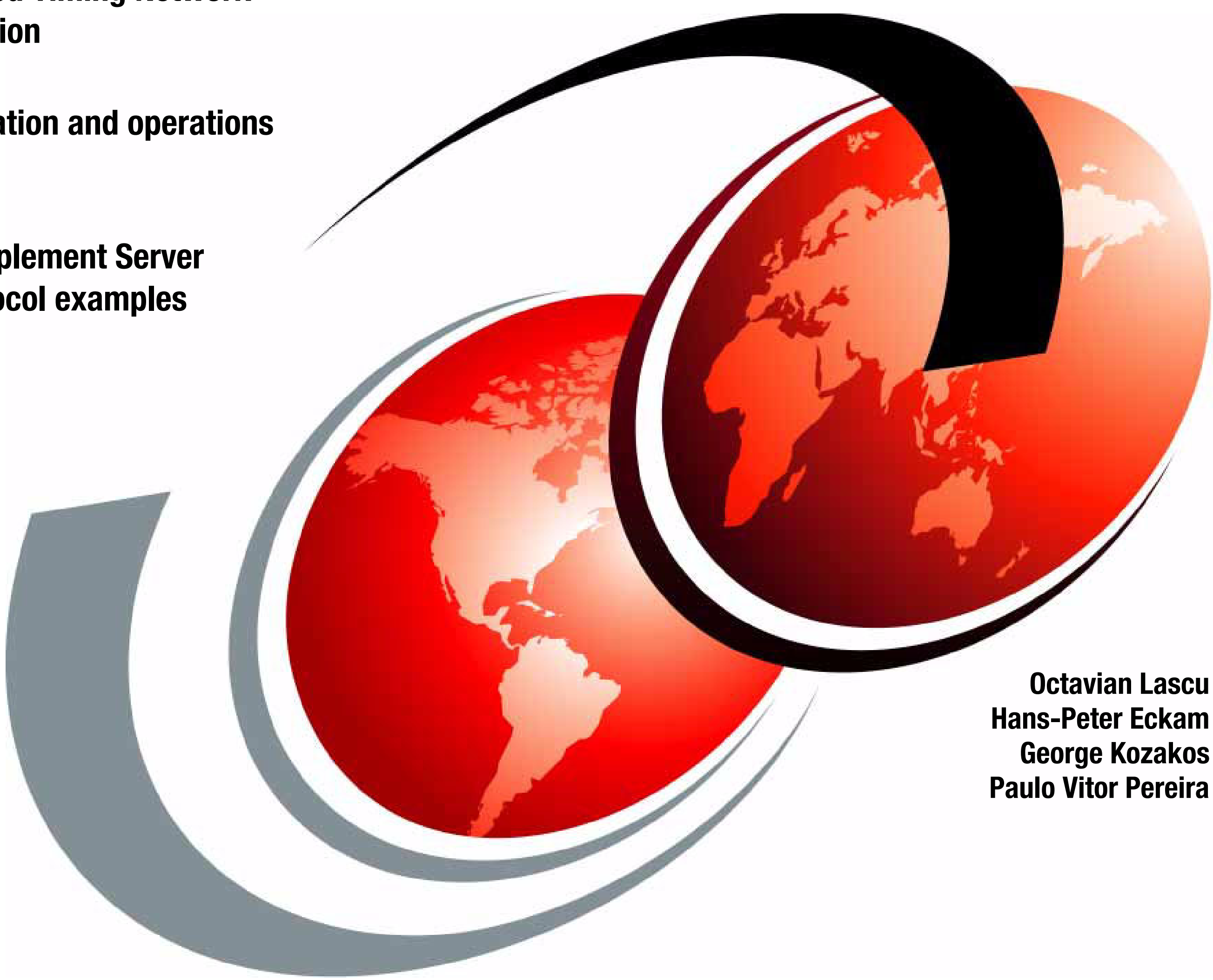
Server Time Protocol Implementation Guide

Coordinated Timing Network configuration

Administration and operations tasks

How to implement Server Time Protocol examples



Octavian Lascu
Hans-Peter Eckam
George Kozakos
Paulo Vitor Pereira

Redbooks

ibm.com/redbooks

International Technical Support Organization

Server Time Protocol Implementation Guide

June 2013

SG24-7281-03

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

Fourth Edition (June 2013)

This edition applies to the Server Time Protocol Facility on IBM System z10 Enterprise Class (z10 EC), System z10 Business Class (z10 BC), System z9 Enterprise Class (z9 EC), and System z9 Business Class (z9 BC).

Contents

Notices

This information was developed for products and services offered in the U.S.A.

IBM might not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information about 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 give you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: 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. Certain states 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 supply in any way it believes appropriate without incurring any obligation to you.

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.

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 the names and addresses used by an actual business enterprise 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.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. These and other IBM trademarked terms are marked on their first occurrence in this information with the appropriate symbol (® or ™), indicating US registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the web at http://www.ibm.com/legal/copytrade.shtml

The following terms are trademarks of the International Business Machines Corporation in the United States, other countries, or both:

ESCON®
FICON®
GDPS®
Global Technology Services®
IBM®
MVS™
Parallel Sysplex®
Redbooks®
Redbooks (logo) ®
Resource Link®
Sysplex Timer®
System z10®
System z9®
System z®
z/OS®
z/VM®
z10™
z9®
zEnterprise®

The following terms are trademarks of other companies:

Microsoft, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

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

Preface

Server Time Protocol (STP) is a server-wide facility that is implemented in the Licensed Internal Code (LIC) of IBM® zEnterprise® EC12 (zEC12), IBM zEnterprise 196 (z196), IBM zEnterprise 114 (z114), IBM System z10®, and IBM System z9®. It provides improved time synchronization in both a sysplex or non-sysplex configuration.

This IBM Redbooks® publication will help you configure a Mixed or STP-only Coordinated Timing Network. It is intended for technical support personnel requiring information about:

- Installing and configuring a Coordinated Timing Network
- Using STP functions and operations
- Migrating to a Coordinated Timing Network from various timing environments

Readers are expected to be familiar with IBM System z® technology and terminology. For planning, see our companion book, *Server Time Protocol Planning Guide,* SG24-7280. For information about how to recover your STP environment functionality, see *Server Time Protocol Recovery Guide*, SG24-7380.

Authors

This book was produced by a team of specialists from around the world working at the International Technical Support Organization, Poughkeepsie Center.

Octavian Lascu is a Project Leader at the International Technical Support Organization, Poughkeepsie Center. He writes extensively and teaches IBM classes worldwide on subjects such as cross-platform clustering and High Performance Computing. Before joining the ITSO 11 years ago, Octavian worked in Global Technology Services®, Romania, as a Senior IT Consultant.

Hans-Peter Eckam is a Support Center Specialist in the IBM Hardware Support Center in Mainz, Germany. Hans-Peter joined IBM in 1986 and has 19 years of experience supporting System z clients. His areas of expertise include System z, Sysplex Timer®, Server Time Protocol, and connectivity such as ESCON®, FICON®, and InfiniBand.

George Kozakos is a Senior IT Specialist with IBM Australia. He has more than 25 years of experience in MVS™ system programming. George's areas of expertise include Server Time Protocol and GDPS®. He holds degrees in Computing Science and Pure Mathematics.

Paulo Vitor Pereira is an IT Specialist in STG Lab Services in São Paulo, Brazil. He joined IBM in 2009 and has six years of experience in System z. His areas of expertise include z/OS®, WLM, z/BX, and System z hardware.

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

William G. White, Alfred Schwab (editor)
International Technical Support Organization, Poughkeepsie Center

Donald J. Smith, Richard M Hamilton, Steve Cherniak, Michael Snihur
IBM Poughkeepsie

Gregory K. Hutchison
IBM Gaithersburg

Thanks to the authors of the previous editions of this book:

- Authors of the first edition, *Server Time Protocol Implementation Guide*, published in July 2007, were:

  Noshir Dhondy, Hans-Peter Eckam, Marcel Jaeckel, George Ng, Frank Packheiser, and Bernard Tanguy.

- Authors of the second edition, *Server Time Protocol Implementation Guide*, published in May 2009, were:

  Noshir Dhondy, Hans-Peter Eckam, Steffen Feddersen, Filip Frkovic, Gary Hines, and George Ng.

- Authors of the third edition, Server Time Protocol Implementation Guide, published in July 2010, were:

  Noshir Dhondy, Hans-Peter Eckam, Andy Kilhoffer, Jeremy Koch, Hao Shen, Martin Söllig, and Ray Takabe.

Thanks to the ITSO support team:
Robert Haimowiz, Donald R Brennan and Roy P Costa
International Technical Support Organization, Poughkeepsie Center

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 ITSO 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 e-mail to:

  redbooks@us.ibm.com

- Mail your comments to:

  IBM Corporation, International Technical Support Organization
  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/IBM-Redbooks
- 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

Summary of changes

This section describes the technical changes made in this edition of the book and in previous editions. This edition might also include minor corrections and editorial changes that are not identified.

Summary of Changes
for SG24-7281-03
for Server Time Protocol Implementation Guide
as created or updated on October 31, 2016.

June 2013, Fourth Edition

This revision reflects the addition, deletion, or modification of new and changed information described below.

New information

- Enhanced accuracy provided by an NTP server with pulse per second (PPS)
- Support of IBM zEnterprise servers (zEC12, z196, and z114)
- STP Version 4 updates
- Hardware Management Console Application V2.12.0
- Network Time Protocol server on the Hardware Management Console
- NTP authentication support on the HMC

Changed information

- Network Time Protocol (NTP) client support
- Support of IBM System z10 Enterprise Class server
- Hardware Management Console Application V2.11.1
- External Time Source Configuration tab on the System (Sysplex) Time task
- Exploitation of Going Away Signal for STP recovery
- Removal of operating systems no longer supported
- Removal of Mardware Management Console dial out support

Part 1

Setting up the Coordinated Timing Network

In this part, we introduce the basic operations for a user to set up a Coordinated Timing Network (CTN) implementing Server Time Protocol (STP). STP is designed to provide the capability for multiple servers and Coupling Facilities to maintain time synchronization with each other without requiring an IBM Sysplex Timer. STP can help provide functional and economic benefits when compared with the Sysplex Timer. STP allows concurrent migration from an External Timer Reference (ETR) network, and it can coexist with the ETR network. We describe the steps needed to:

- Configure an External Time Source (ETS).
- Migrate from an ETR-based CTN to a Mixed CTN.
- Activate an STP-only CTN.

Overview

The STP design has introduced a new concept called Coordinated Timing Network. A CTN is a collection of servers and Coupling Facilities that are time synchronized to a time value called Coordinated Server Time. Typically, implementation of a Coordinated Timing Network has two paths:

- Migration from an existing ETR network
  - If one or more servers in the planned CTN are not STP enabled or one or more z/OS images are not running z/OS V1.7 or a later version, then the implementation is restricted to a Mixed CTN.
  - When all servers in the planned CTN are STP enabled and all z/OS images are running z/OS V1.7 or later, then implementation can be a Mixed CTN followed by a migration to an STP-only CTN.

- Implementation of an STP-only CTN without an existing Sysplex Timer

> **Important:** In an STP environment, if you plan to change your cabling topology, make sure that you understand the CTN roles of the servers subject to re-cabling, and perform the following tasks prior to any disruptive action:
>
> - Update the IOCP for affected servers
> - Test the changed links by configuring the channels online

  – All servers must be STP enabled, and z/OS system images must be V1.7 or later.
  – An STP-only CTN can also be configured in a single server environment to take advantage of an external time source.
  – z/OS system images can be at any supported release if they use the SIMETRID statement in the CLOCKxx member of SYS1.PARMLIB.

In the setup section, the optional ETS feature is being configured in the first step, as we recommend using the ETS to initialize the time when activating an STP-only CTN.

The STP feature FC1021 is a chargeable feature, and must be ordered for each server and coupling facility (CF) that will participate in a CTN.

Installation of the feature is nondisruptive, but z/OS images must be IPLed after installation to recognize the new functions.

After installation of the STP feature, the server is STP enabled and STP windows are available from the System (Sysplex) Time task on the Support Element and HMC.

On the Hardware Management Console, default user IDs and roles are defined for operator, advanced operator, system programmer, HMC access administrator, and service representative. By default, only the system programmer and service representative roles are authorized to access the System (Sysplex) Time task.

The Access Administrator can assign new user IDs and passwords by using the user profiles task from the Console Actions Work Area. We recommend that access to the System (Sysplex) Time task be restricted to trained users.

An education module, *Introduction to Server Time Protocol (STP)*, is available in the education section of the IBM Resource Link® website at:

https://www.ibm.com/servers/resourcelink

For planning information, see *Server Time Protocol Planning Guide,* SG24-7280-03, and *Server Time Protocol Recovery Guide*, SG24-7380-01.

1

Configuring an External Time Source

In this chapter, we introduce detailed procedures for configuring External Time Source (ETS) for an STP-only Coordinated Timing Network (CTN). We discuss the following possible configurations:

- Configuring an NTP server
  - Configuring an NTP server on the HMC and enabling HMC to act as an NTP server
  - Configuring an NTP server on the PTS/CTS or BTS
- Configuring an NTP server with pulse per second option
- Configuring dial out on the HMC[1]
- Migrating an External Time Source

[1] Dial Out HMC function is available up to HMC 2.11.1. Starting with HMC 2.12.0 dial out support has been removed, thus it cannot be used for setting up dial out to a telephone time service.

1.1 External Time Source

To maintain time accuracy, the STP facility supports connectivity to an External Time Source (ETS). Using an ETS, regular adjustments might be performed either manually or automatically.

In a Mixed Coordinated Timing Network (CTN), if the Sysplex Timer has an ETS already configured, it will be used and time accuracy will be maintained by the Sysplex Timer. The Sysplex Timer ETS operation is not discussed in this book.

In an STP-only CTN, the Sysplex Timer is no longer used. Therefore, if an external time source will be used to maintain time accuracy, configure it prior to:

- Migrating from a Mixed to an STP-only CTN.
- Configuring a new STP-only CTN. If the ETS is used to initialize the Coordinated Server Time, the ETS must be configured before initializing the time.

The ETS can be configured as:

- NTP server
- NTP server with pulse per second (PPS) output
- Dial out to a telephone time service

Important: The dial-out option to a telephone time service is available up to HMC Version 2.11.1. Starting with HMC Version 2.12.0 the dial-out option is no longer available because this HMC does not support a modem connection.

1.1.1 ETS configuration considerations

The NTP server needs to be configured on the server that will be assigned as the Current Time Server, and it will be accessed once a server is configured as the Current Time Server within the CTN.

The ETS configuration of the PTS and the BTS can be different. For example, the PTS can use NTP, whereas the BTS can be configured for dial out on the HMC. The actual ETS type being used depends on which server is the Current Time Server. A CTS change (from PTS to the BTS) might result in another ETS being used to steer the CTS.

If an NTP server or an NTP server with PPS is used as ETS and configured on both the PTS and the BTS, the ETS operation is executed by both Support Elements. However, only the CTS utilizes the time information to steer the CST. Configuring an NTP server on the BTS allows:

- Continuous NTP access if the BTS takes over as the CTS.
- Continuous NTP server availability if the NTP server or PPS output at the PTS becomes unavailable. See sections “ETS recovery using NTP servers” and “ETS recovery using NTP servers with PPS” in *Server Time Protocol Recovery Guide*, SG24-7380.

1.1.2 Dialing out to a telephone time service

Important: Starting with HMC Version 2.12.0, the dial-out option is no longer available because this HMC does not support a modem connection, and thus it is not possible to configure dial-out ETS.

Using the dial out to a telephone time service consists of the following steps:

1. Configure an HMC to dial out to a telephone time service. At the Customize Outbound Connectivity task on the HMC, check both of the following check boxes to enable the configuration of the external time source:
   - Enable local system as a call-home server.
   - Allow external time source dialing using the local modem.

   Note: Configure the ETS on multiple HMCs to have an alternate HMC for ETS queries.

2. Configure STP to use the dial out service as an ETS.
3. Add scheduled operations to the Preferred Time Server (PTS) and the Backup Time Server (BTS), if applicable, to access the ETS. The HMC and SE support automatic retrieval of the time from a time service and automatic update of CST on a scheduled basis.

   Setting up a schedule to dial out to the time service automatically can be done from the HMC. One of the following operations can be requested:
   - A single scheduled operation at a specified date and time
   - A recurring scheduled operation that occurs at a specified frequency

   Scheduled operations that are to be executed by a server that is not the Current Time Server are ignored. At the scheduled time, the SE requests the HMC to dial out to the time service. The HMC sends the difference with the time obtained from the service to the STP facility, which makes gradual adjustments by steering the CST to the time obtained from the external time source.

1.2 Configuring an NTP server

The first ETS option is to use an NTP server. The NTP server can be either an external time source device available from several timekeeping device manufacturers, a local NTP server, or an NTP server configured on the HMC.

Starting with HMC Version 2.12.0, the HMC has implemented the capability to be set up to use authentication support when contacting a defined NTP server. This can be achieved by either using a symmetric key or an autokey.

This section assumes that the NTP server configured on the HMC will be used as the ETS. It first describes how the HMC can be enabled as an NTP server and then describes the steps required for the SNTP client on the SE to be configured to use the HMC's NTP server.

To retrieve time information used to steer the CST, STP uses the NTP client running on the Service Element (SE). The NTP client requires a LAN connection to an NTP server.

The NTP server can be either an appliance (external time source device) available from several timekeeping device manufacturers, a local NTP server, or an NTP server configured on the HMC. The NTP traffic between the Simple Network Time Protocol (SNTP) client (running on the Support Element) and the NTP server is not encrypted.

The NTP server or the NTP server with PPS configured as the ETS must be attached directly to the SE LAN. The SE LAN is considered in many configurations to be a private and dedicated LAN and must be kept as isolated as possible. Providing the HMC with the capability to act as an NTP server addresses a potential security concern, because the HMC is normally attached to the SE LAN.

The Simple Network Time Protocol (SNTP) client running on the Support Element can be connected to one HMC network adapter (eth0), as shown in Figure 1-1. The other HMC network adapter (eth1) is connected to the corporate network. Configuring an NTP server on the HMC can also be considered as a backup solution to provide NTP server redundancy. Note that the NTP server configured on the HMC is not capable of providing a pulse per second output.

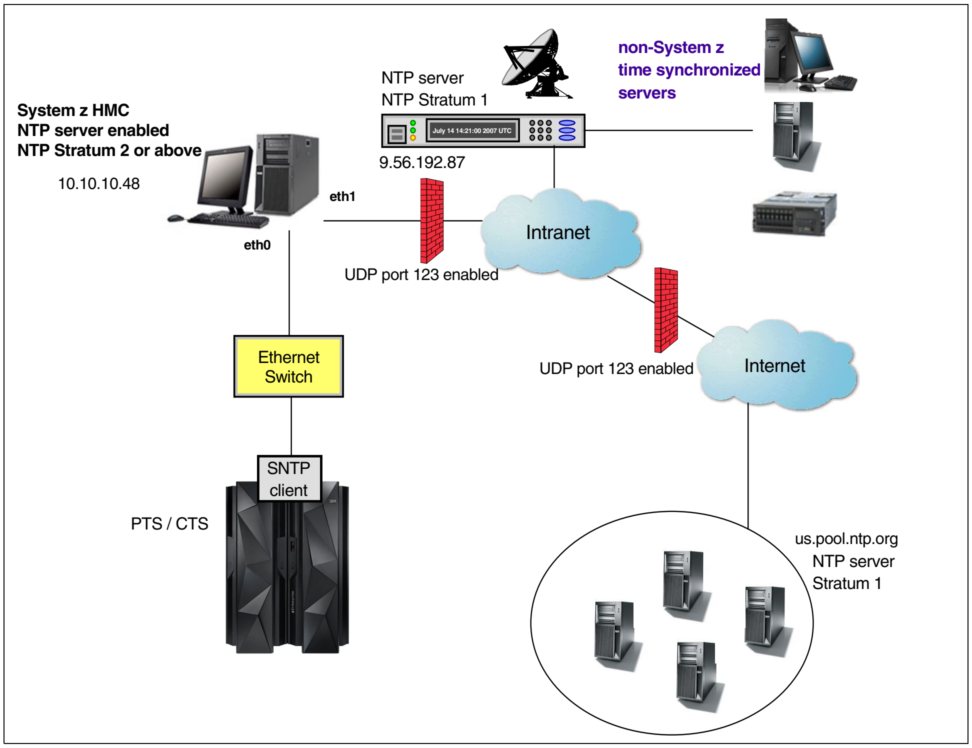


Figure 1-1 Example configuration - NTP server on HMC

1.2.1 NTP authentication support

The NTP server configured on the HMC can access another NTP server through a separate LAN connection. Starting with HMC Version 2.12.0 the connection between the HMC and the NTP server can be configured to use authentication support. When defining an NTP server (HMC Version 2.12.0 and above) you must choose between the following three authentication selections:

- None: If the NTP server does not support authentication or you decide to configure the NTP server without the authentication capability.
- Symmetric Key: If the NTP server has been set up to use Symmetric MD5 keys (NTP Version 3 and 4).
- Autokey: If the NTP server has been set up to use the autokey facility. This function can only be used if there is no network address translating (NAT) firewall between the HMC and the target NTP server (NTP Version 4).

You can define multiple NTP servers on the HMC while the authentication can be different for each NTP server.

1.2.2 Configuring an NTP server on the HMC

Maintaining HMC time accuracy is desirable if you plan to enable your HMC to act as an NTP server. In this section we also discuss how to enable the HMC to act as an NTP server that can be used as an External Time Source for the CTN.

Note: For HMC to access NTP servers on corporate network or Internet through a firewall requires UDP port 123 being enabled on the client firewall to allow NTP traffic between the local NTP server (running on HMC) and remote NTP servers.

Adjusting HMC time to an NTP server

To configure an NTP server on the HMC, click **Customize Console Date and Time** at the appropriate HMC. This task is available in the HMC Management section. Selecting the **Configure NTP Settings** tab displays a window (Figure 1-2).

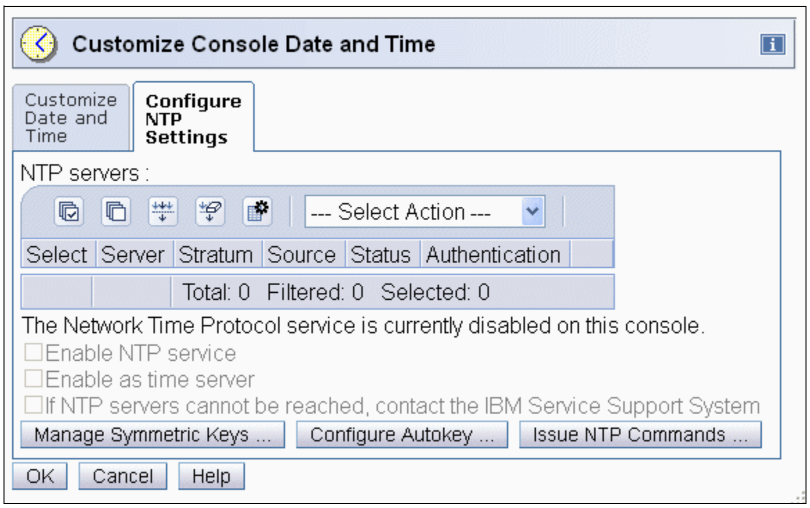


Figure 1-2 Customize Console Date and Time

Manage Symmetric Keys

The target NTP server configuration might be a mixture of NTP server without authentication, Symmetric Key authentication, or the autokey capability. If HMC authentication is used, the setup for the keys needs to be performed first. If it is planned to use a Symmetric Key for the communication of this HMC to any target NTP server, the keys will be set up first. Later, when the NTP server is entered, the association to a specific key will be established:

1. From the Configure NTP settings tab click **Manage Symmetric Keys** (Figure 1-3 on page 8).

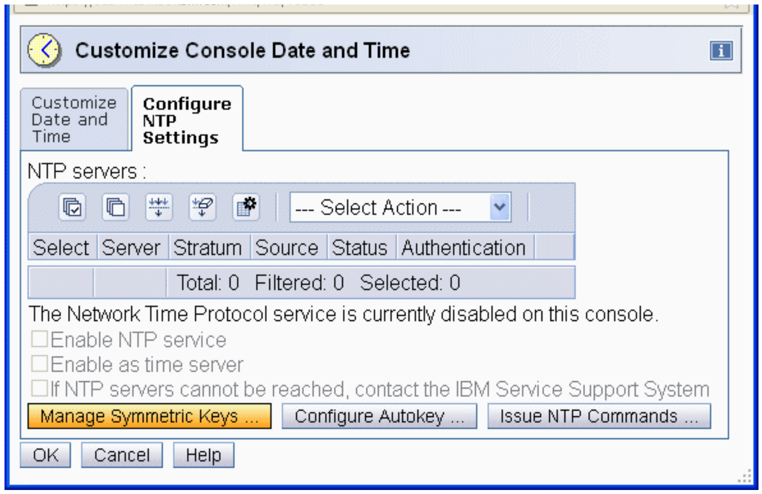


Figure 1-3 Manage Symmetric Keys in Configure NTP Settings

2. Initially no key exists. Click **Add Key** from the Select Action pull-down menu (Figure 1-4).

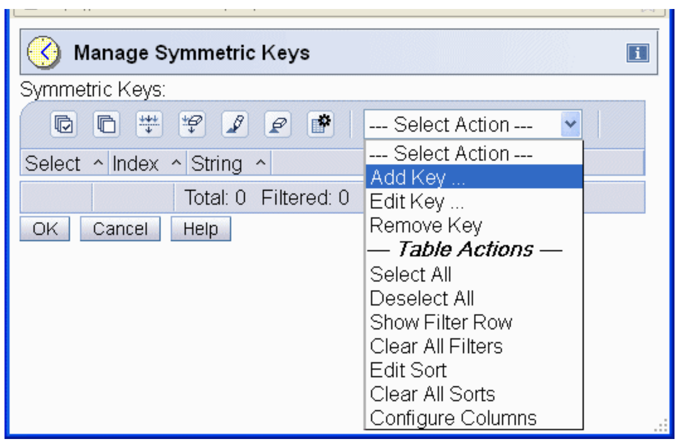


Figure 1-4 Add Symmetric Key

3. The Key index and the Key string must be entered in the Add Symmetric Key Data panel (Figure 1-5). They need to match the definition in the target NTP server. Click **OK** when done. Repeat the steps if the NTP server has multiple keys defined and you want to optionally switch to a different key at any time later.

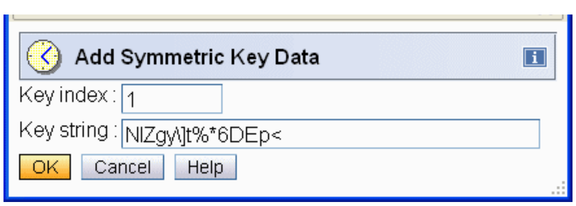


Figure 1-5 Add Key index and string

4. Once all the keys and strings have been entered, you can verify them in the Manage Symmetric Key panel and click **OK** to confirm the configuration (Figure 1-6 on page 9).

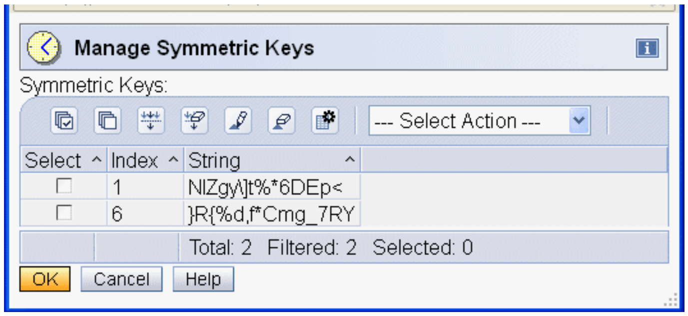


Figure 1-6 Manage Symmetric Keys - final view

5. The final confirmation for the symmetric key definition is shown. Click **OK** to confirm (Figure 1-7).

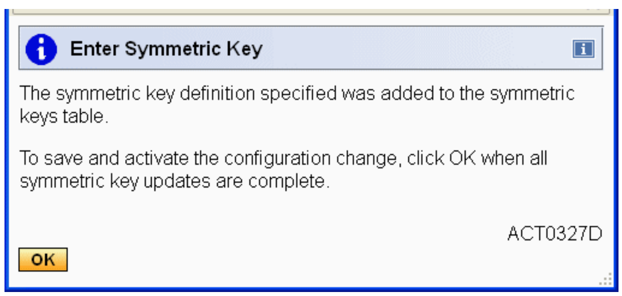


Figure 1-7 Symmetric Key definition confirmation

Configure Autokey

The target NTP server configuration might be a mixture of NTP server without authentication, symmetric key authentication, or the autokey capability. If HMC authentication is used, the setup for the keys needs to performed first. If it is planned to use an Autokey authentication for the communication of this HMC to any target NTP server, the HMC key file needs to be generated first. Later, when the NTP server is entered, the association to this HMC key file will be established:

1. From the Configure NTP Settings tab click **Configure Autokey** (Figure 1-8).

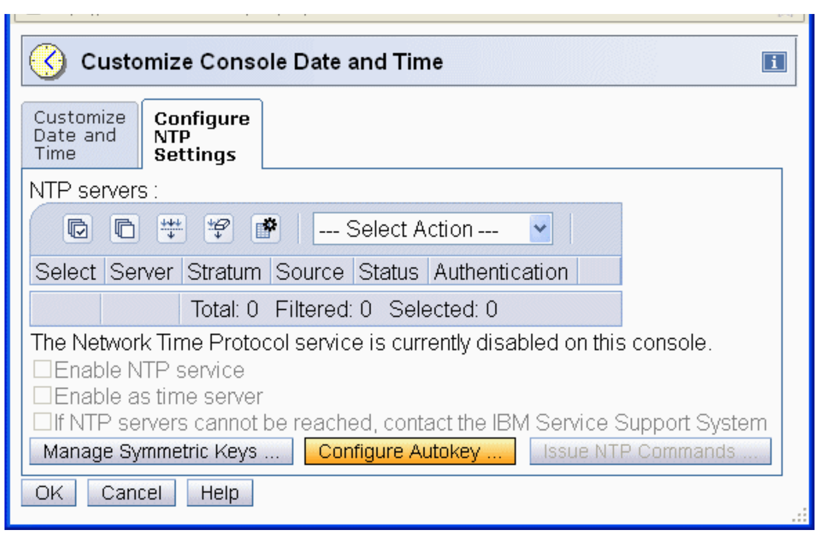


Figure 1-8 Manage Symmetric Keys in Configure NTP Settings

2. In the Autokey Configuration panel select **Generate Local Hosts Key** to generate and store the local key file and certificate for this HMC (Figure 1-9). This needs to be done only once. If the Autokey Configuration panel shows an Autokey is already configured as shown in Figure 1-11, it basically means that an autokey was previously already configured. A new Local Host Key file can be generated any time.

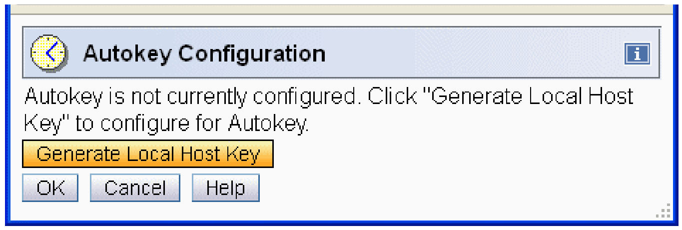


Figure 1-9 Generate the Local Host Key file on the HMC

3. Select **OK** once the successful message ACT03297 is displayed; see Figure 1-10.

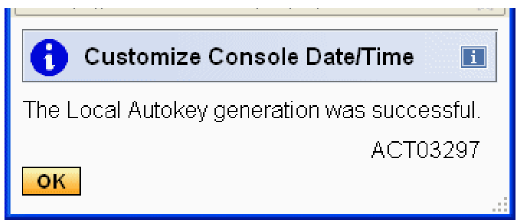


Figure 1-10 Autokey successfully generated

4. The Autokey has been successfully configured as shown in Figure 1-11. Select **OK** to leave the Autokey Configuration display.

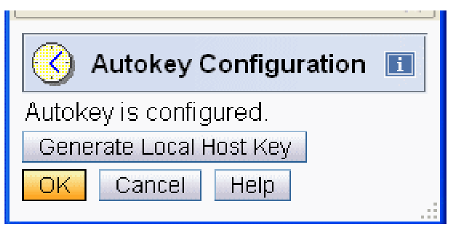


Figure 1-11 Autokey is configured

Adding an NTP server to the HMC

1. On the Customize Console Date and Time panel, click **Select Action** and select **Add Server** (Figure 1-12 on page 11).

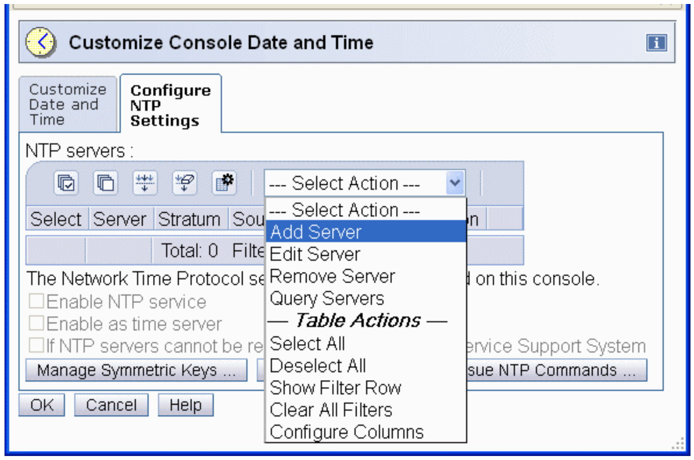


Figure 1-12 Add NTP Server

2. The server host name or the IP address of a known NTP server must be entered in this window. You can define an NTP server that is available on the corporate network (9.56.192.87, as shown in Figure 1-1 on page 6). Figure 1-13 shows the IP address of a Stratum 1 NTP server on the corporate network.

   NTP authentication: Symmetric key works for servers that are on the web. Autokey works as well, but cannot work if going through a Network Address Translation (NAT) firewall.

   Specify which authentication should be used. This can be either **None**, **Symmetric Key** or **Autokey**. The Symmetric Key index needs to be selected if the Authentication Symmetric Key has been chosen. The list of previously entered Key strings is listed. Select **OK** to save the Network Time Server information.

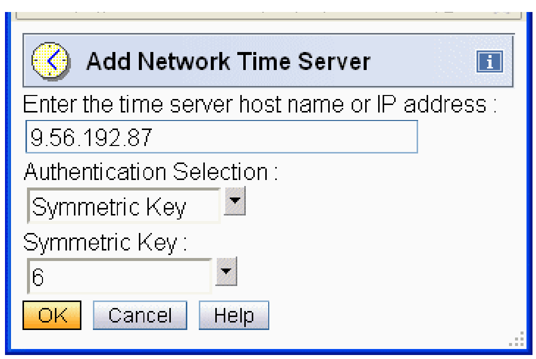


Figure 1-13 NTP server on the corporate network to be accessed by the HMC

3. When **OK** is clicked, an information window displays to indicate that the NTP server has been added (Figure 1-14 on page 11).

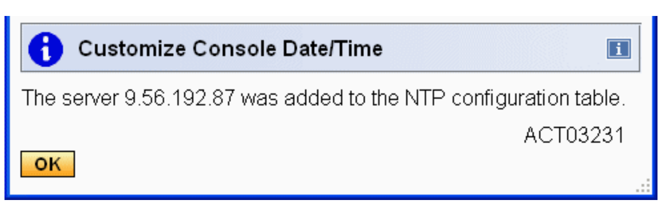


Figure 1-14 Message ACT03231 - Add NTP server information

4. Selecting **OK** displays the Customize Console Date and Time window (Figure 1-15).

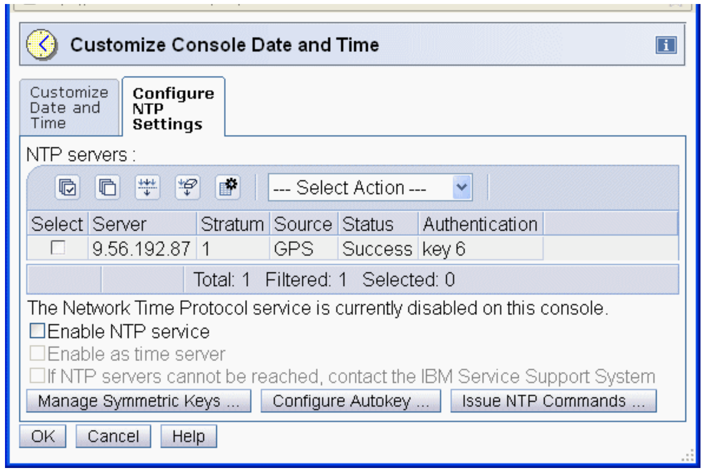


Figure 1-15 Corporate NTP server added

5. As shown in Figure 1-15, the new added NTP server (IP address 9.56.192.87) is an NTP Stratum 1 server, and its clock source is GPS (Table 1-1 on page 21). `Success` in the Status column indicates that it is a valid and usable time source for this HMC. The Authentication method is Symmetric key while key 6 is currently being used. Click **Query Servers** from the **Select Action** pull-down menu anytime to check the validation of all selected NTP servers. Also, the active key can be changed any time by selecting an NTP server and choosing **Edit Server** from the **Select Action** pull-down menu.
6. As shown in Figure 1-1 on page 6, you can also define an NTP source that is available through the Internet. From the **Select Action** menu on the Customize Console Date and Time window click **Add Server** to bring up a new window (Figure 1-16). The web address of the NTP server needs to be entered here. There is no authentication that can be used, and the Authentication Selection is therefore set to **None**.

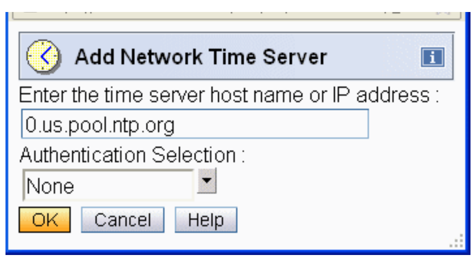


Figure 1-16 Add an Internet - network time server

7. The use of a web address requires you to customize and enable Domain Name Services on the HMC. For this, use the task **Customize Network Settings** → **Name services** in the Hardware Management Console Setting Work Area.

> **Tip:** If the HMC is used as an NTP client/server, this step must be done **on the HMC** and **not** the Support Element.

8. When **OK** is clicked, message ACT03231 is displayed to indicate that the NTP server has been added. The Add Server function can be repeated until all NTP servers have been added. This example shows that three NTP servers have been defined on the HMC.

9. The final panel listing all defined NTP servers with their status at the time of the last query is shown. The Network Time Protocol services are still disabled at that point in time. The final step to enable the NTP services on this HMC is done by selecting **Enable NTP services**, as shown in Figure 1-17.

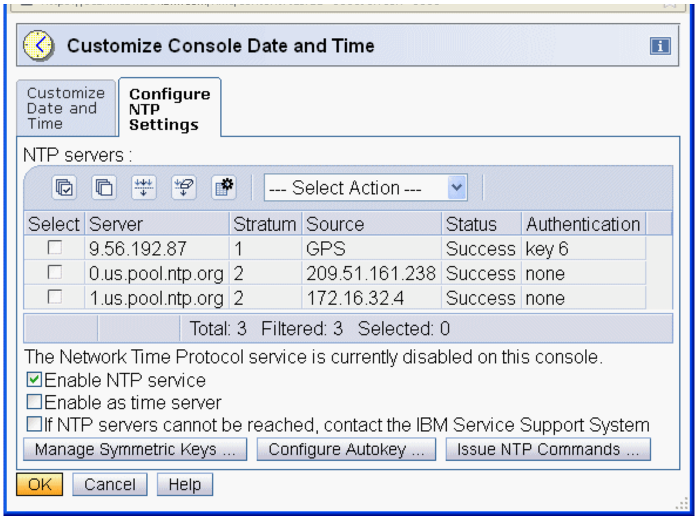


Figure 1-17 Enable Network Time Protocol service

10. Once Enable NTP service is checked, click **OK** to enable this console to synchronize its clock. Confirmation request ACT03237 is displayed (Figure 1-18).

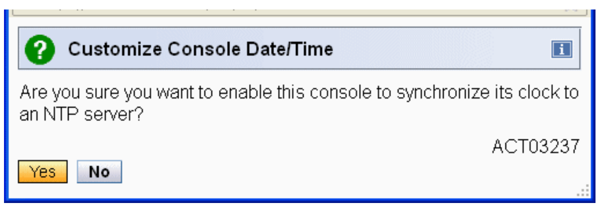


Figure 1-18 NTP server enable confirmation request ACT03237

11. Select **Yes** to synchronize this HMC to the NTP server. Message ACT03241 confirms the attachment to the NTP server (Figure 1-19 on page 14). Select **OK**; this closes the Customize Console Date/Time panel.

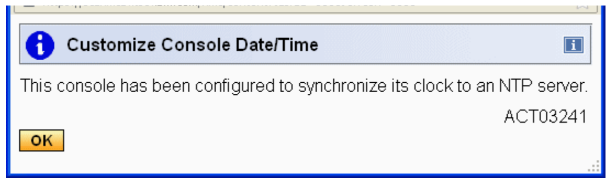


Figure 1-19 NTP server enable confirmation message ACT03241

> **NTP server selection:** If more than one NTP server has been defined, you do not have the capability to specify which server is the primary server. The NTP service on HMC takes the defined NTP servers and tries to contact them. It looks at all of the servers and determines which one is the most accurate, based on stratum, dispersion, and consistency based on other servers.
>
> For example, if you have four servers, and one has a significantly different time difference from the other three, that server will be considered an outlyer and will not be considered as a potential time server, until it ceases to be an outlyer.

1.2.3 Configuring HMC as an NTP server

At this point, the HMC has the NTP service enabled and gets its time from an NTP server. To enable the NTP server function on the HMC:

1. Check the **Enable as time server** check box (Figure 1-20).

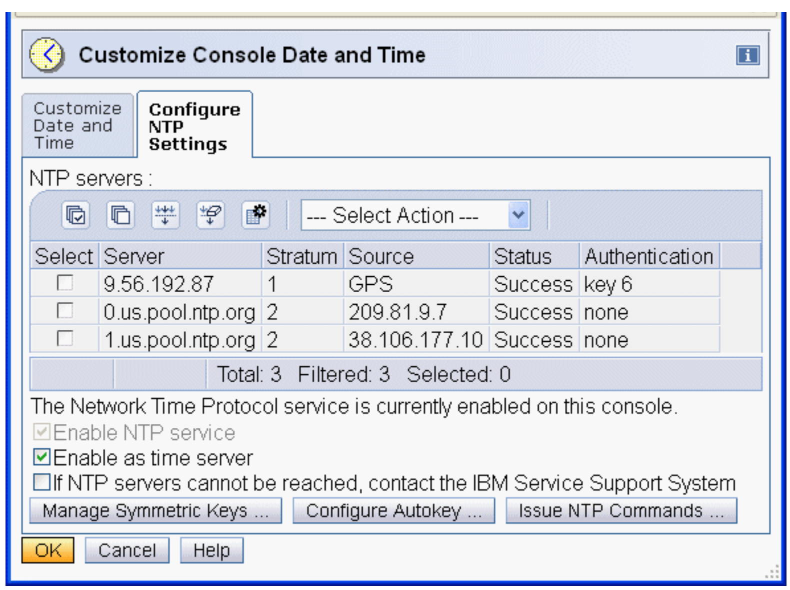


Figure 1-20 Enable HMC as time server

2. Selecting **OK** displays a confirmation window (Figure 1-21).

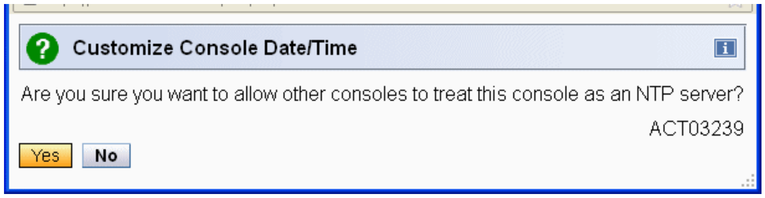


Figure 1-21 Message ACT03239 - Enable as time server confirmation

3. Selecting **Yes** saves and enables the time server function. An information window displays (Figure 1-22).

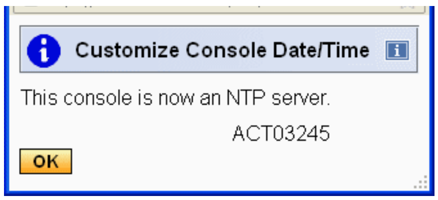


Figure 1-22 Message ACT03245 - NTP server function enabled

4. After **OK** is clicked, select **HMC Management** → **Customize Console Date and Time** again, and the Customize Console Date and Time window displays (Figure 1-23).

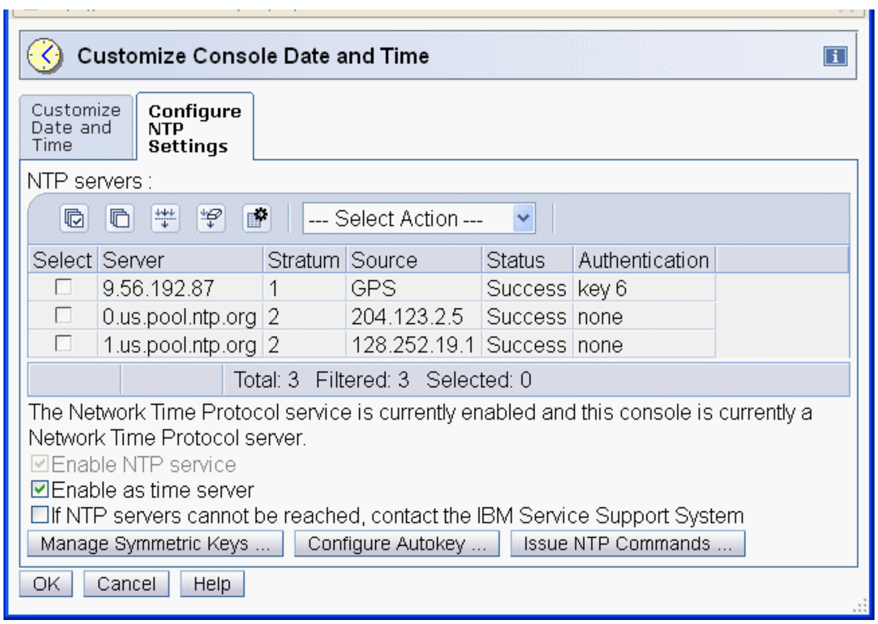


Figure 1-23 Customize Console Date and Time - NTP server function enabled

The option is given to release a service call to the IBM Service Support System if any of the given NTP servers cannot be reached. Set the checkmark next to **If NTP servers cannot be reached, contact the IBM Service Support System**.

1.2.4 Removing an NTP server from the HMC

If one or multiple NTP servers need to be removed:

1. Select the check box of the NTP servers and click **Remove Server** in the Select Action pull-down menu (Figure 1-24).

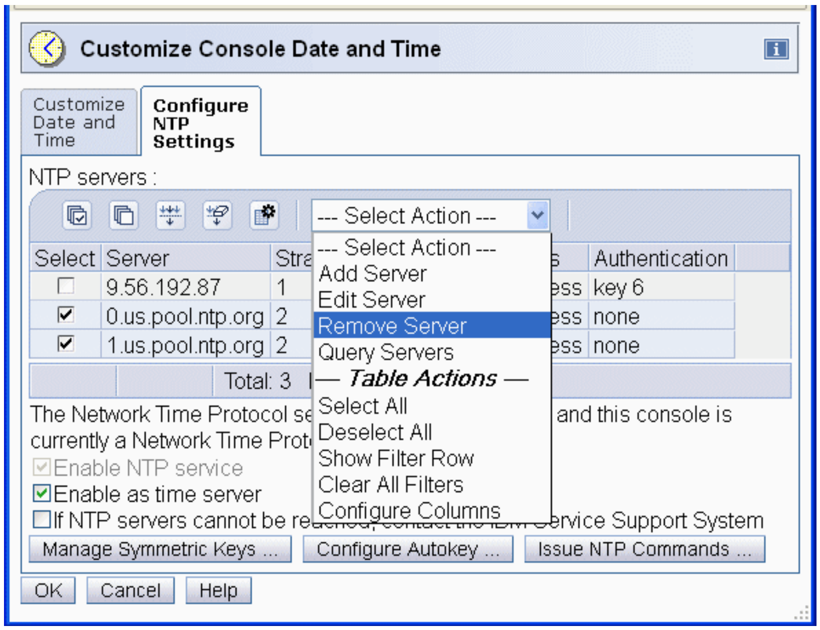


Figure 1-24 Remove two NTP servers

Note: Multiple NTP servers can be selected for removal at the same time.

2. Selecting **Remove NTP Server** displays a confirmation window (Figure 1-25).

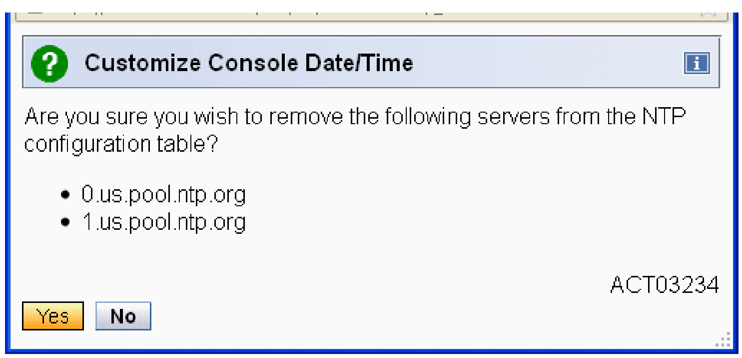


Figure 1-25 Message ACT03234 - Removal confirmation

3. When **Yes** is selected, the NTP servers are removed and an information window displays (Figure 1-26).

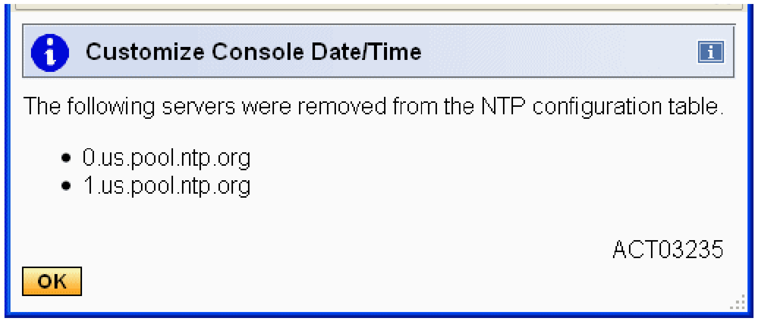


Figure 1-26 Message ACT03235 - NTP servers removed

4. If there is a need to remove the last NTP server, you can select it and click **Remove Server** in the Select Action pull-down menu (Figure 1-27).

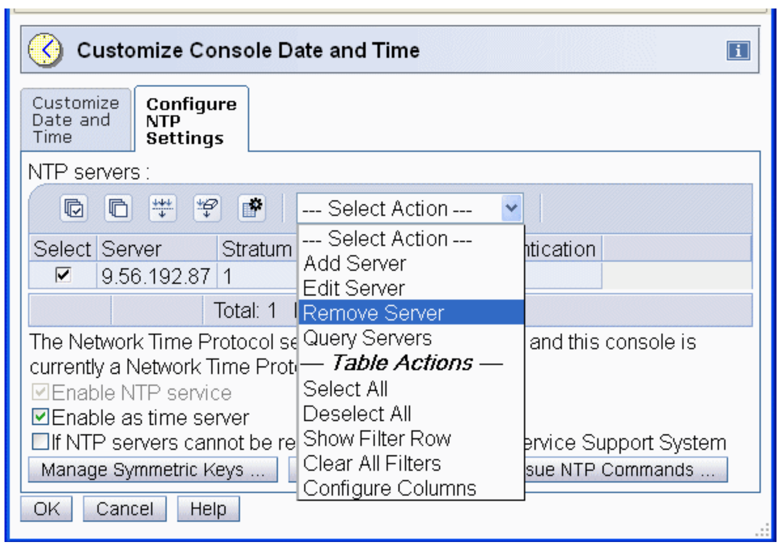


Figure 1-27 Remove last NTP server

A confirmation window displays (Figure 1-28).

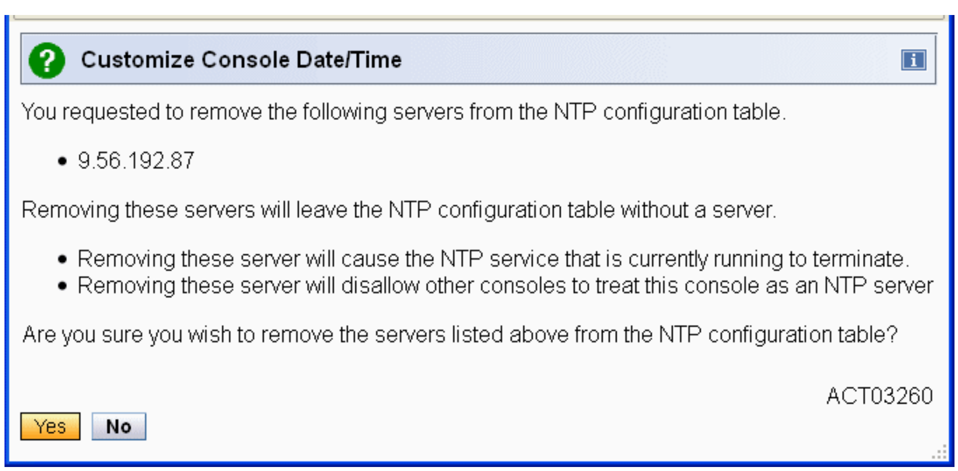


Figure 1-28 Message ACT03260 - Last NTP server removal confirmation

5. When **Yes** is selected, the last NTP server is removed and an information window displays (Figure 1-29).

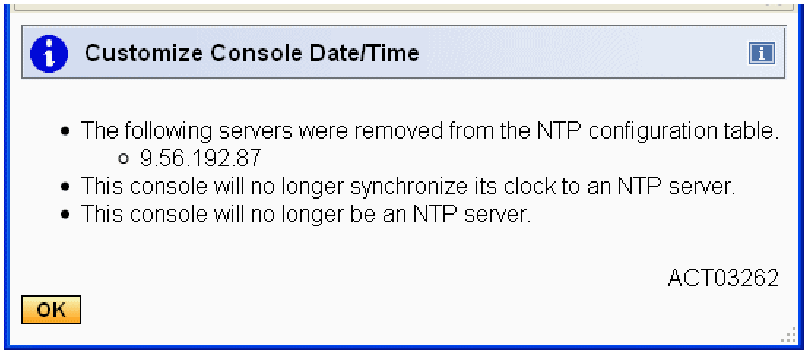


Figure 1-29 Message ACT03262 - Last NTP server removed

Note that the HMC is no longer acting as an NTP server and no longer synchronizes its time to an NTP server. The Customize Console Date and Time window gets closed when you click **OK**.

1.2.5 Configuring an NTP server on the PTS/CTS or BTS

The example in this section uses the NTP server defined on the HMC as described in 1.2.3, "Configuring HMC as an NTP server" on page 14.

The Simple Network Time Protocol client that runs on the Support Element (SE) on the Primary Time Server/Current Time Server (PTS/CTS) must be configured to communicate with an NTP server. Only the CTS is used to steer the Coordinated Server Time (CST). However, in an STP-only CTN where the NTP client function is used, configure the NTP function on each server that can potentially have a role in the CTS.

If the PTS/CTS fails, the Backup Time Server (if configured) takes over the CTS role and is able to steer the CST to its external time source. In case the NTP server configured to the PTS fails, the BTS calculates the required adjustment and propagates it to the PTS. Coupling connectivity is utilized for this communication. For detailed recovery information, see *Server Time Protocol Recovery Guide*, SG24-7380.

From the HMC workplace:

1. Select the servers to be set up. Click the **System (Sysplex) Time** option in the Configuration section. Select the **ETS Configuration** tab (Figure 1-30).

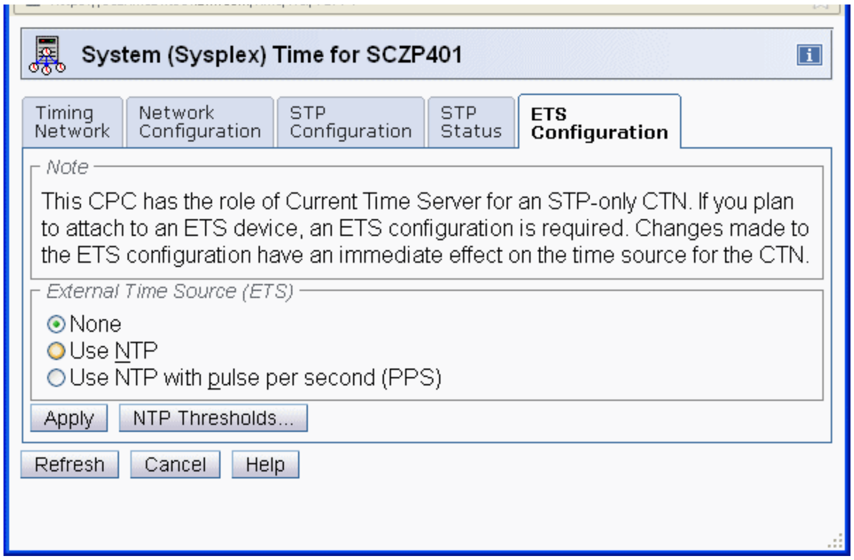


Figure 1-30 ETS Configuration: Use the NTP selection

The ETS Configuration tab displays for all servers that support NTP to allow an ETS configuration for every server that could potentially act as the CTS in the future.

> **Note:** A z990 and z890 server does not support NTP and will not display the ETS Configuration tab, even though these servers can be part of the STP-only CTN.
>
> **Important:** An IBM System zEC12 server is not supported in the same CTN with z9 EC, z9 BC, z990, or z890 servers. An IBM System z196 or z114 is not supportd in the same CTN with z990 or z890 servers.

2. Selecting **Use NTP** displays the NTP Time Server information table. When at least one **Configured** check box is selected, the IP address or web address entered will be used as an NTP server (Figure 1-31 on page 20).
3. The use of a web address requires you to customize and enable Domain Name Services on the SE. For this, use the task **Customize Network Settings** → **Name services** in the Support Element Console Applications.

> **Tip:** If the HMC is used as an NTP client/server, this step must be done **on the HMC** and **not** the Support Element.

4. Up to two NTP servers can be configured for each supported CPC. A preferred NTP server is chosen by selecting the appropriate **Select** radio button. This NTP server is called the *selected* NTP server. If only one NTP server is configured, the select radio button must be checked (Figure 1-31 on page 20).

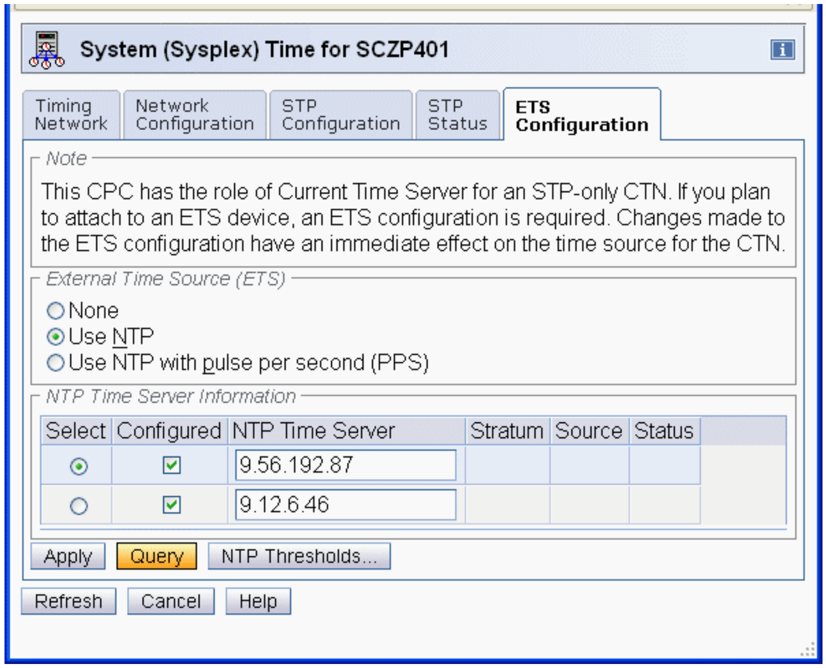


Figure 1-31 ETS Configuration: Configure and select the NTP server

5. Clicking **Query** tests the designated servers, and message ACT39142 displays (Figure 1-32).

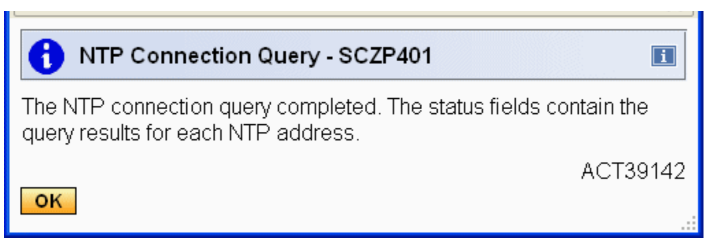


Figure 1-32 Message ACT39142 - NTP connection query

6. The Stratum level, Source, and Status table fields for the corresponding NTP server will be filled in (Figure 1-33 on page 21).

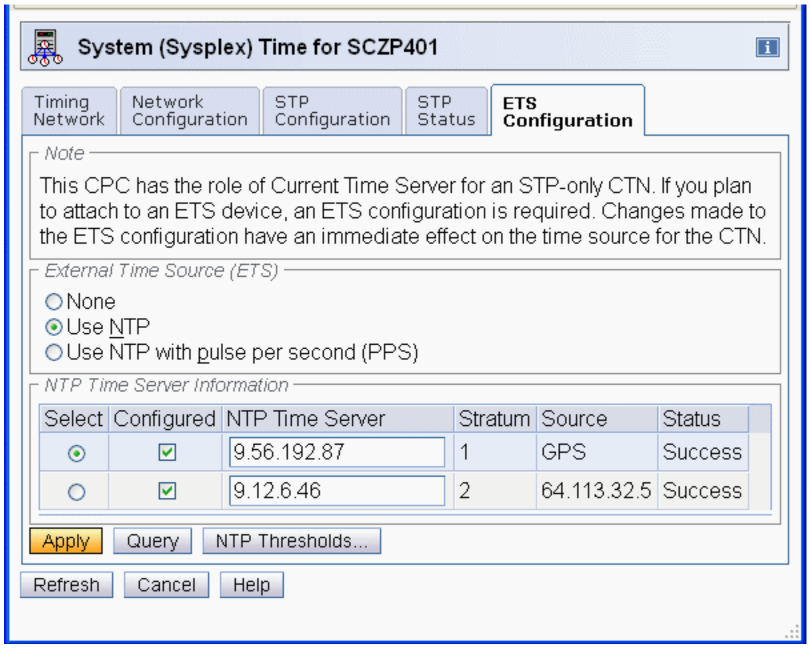


Figure 1-33 ETS Configuration: Query results

7. The Status column displays `Success` if the related NTP server is accessible. A list of possible status fields is available by clicking **Help** on the ETS Configuration tab.
8. The Source column (see Figure 1-33) contains a description of the time source for the NTP server provided as information by the NTP server. Typically, the source for Stratum 1 servers will be GPS, or radio signals such as WWV. Table 1-1 shows a list of examples of known Stratum 1 source values. For NTP servers not at Stratum 1, this field contains the IP address of the higher stratum NTP server (64.113.32.5, as shown in Figure 1-33). This field is blank if the server is not available.

Table 1-1 NTP Stratum 1 clock sources

NTP source	Displayed source text	Description of source ID
ACTS	ACTS	NIST telephone modem service
CESM	Cesium	Calibrated Cesium clock
CHU	CHU	Ottawa (Canada) Radio 3330, 7335, 14760 kHz
DCF	DCF	Mainflingen (Germany) Radio 77.5 kHz
GOES	GOES	Geostationary Orbit Environment Satellite
GPS	GPS	Global Positioning Service
HBG	HBG	Prangins, HB 75 kHz
IRIG	IRIG	Inter-Range Instrumentation Group
JJY	JJY	Fukushima, JP 40 kHz, Saga, JP 60 kHz
LOCL	Local	Un-calibrated local clock
LORC	LORAN-C	LORAN-C radio-navigation system
MSF	MSF	Rugby (UK) Radio 60 kHz

NTP source	Displayed source text	Description of source ID
OMEG	OMEGA	OMEGA radio-navigation system
PPS	PPS	Calibrated quartz clock or other pulse-per-second source
PTB	PTB	PTB (Germany) telephone modem service
RBDM	Rubidium	Calibrated Rubidium clock
TDF	TDF	Allouis (France) Radio 164 kHz
USNO	USNO	USNO telephone modem service
WWV	WWV	Ft. Collins (US) Radio 2.5, 5, 10, 15, 20 MHz
WWVB	WWVB	Boulder (US) Radio 60 kHz
WWVH	WWVH	Kaui, Hawaii (US) Radio 2.5, 5, 10, 15 MHz

9. If two NTP servers have been configured, checks are made to compare the accuracy of the NTP servers. If a divergence is detected, the message in the Status column indicates success, but a note below the NTP server information table will indicate the divergence.
10. When you click **Apply**, the NTP server configuration is saved on the Support Element and message ACT39145 displays (Figure 1-34). The configuration takes effect immediately if only one NTP server is configured.

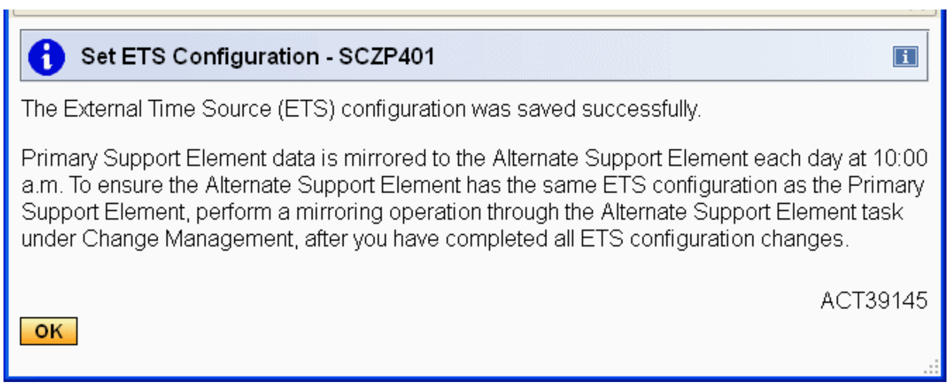


Figure 1-34 ETS configuration saved - mirroring information

If two NTP servers are configured, clicking **Apply** causes a verification of the NTP servers first. This helps you to choose the best NTP server as the selected one. Depending on the result, one of the following message windows might appear:

– If the selected NTP server has a higher Stratum level than the non-selected NTP server, the message shown in Figure 1-35 displays. In this case, you might consider defining the nonselected NTP server as the selected one.

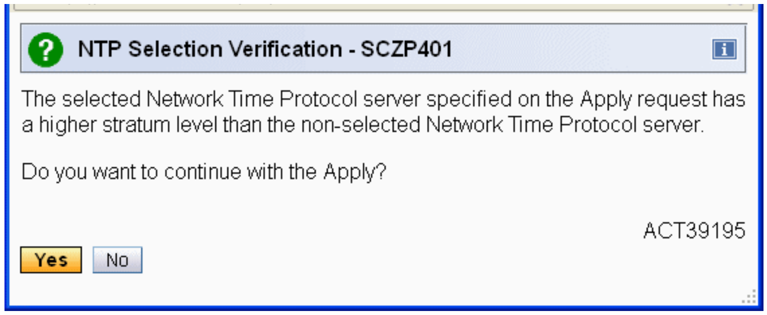


Figure 1-35 Message ACT39195 - Selected NTP has higher Stratum level

– The message shown in Figure 1-36 displays if the selected NTP server is less accurate than the nonselected NTP server. In this case, you might consider defining the nonselected NTP server as the selected one.

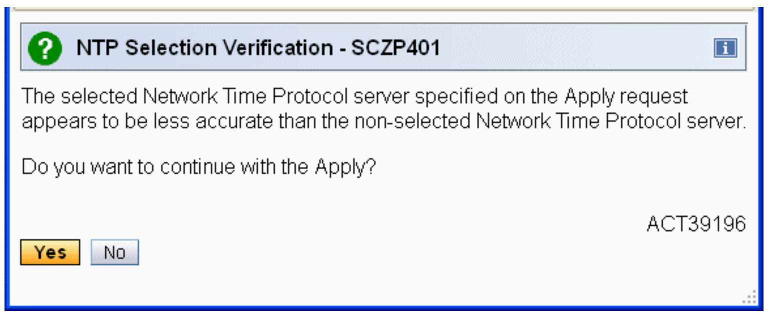


Figure 1-36 Message ACT39196 - NTP Selection Verification

11. There might be good reasons for such configurations. However, clicking **Yes** saves the NTP server configuration on the Support Element and the configuration takes effect. A message window displays (Figure 1-37).

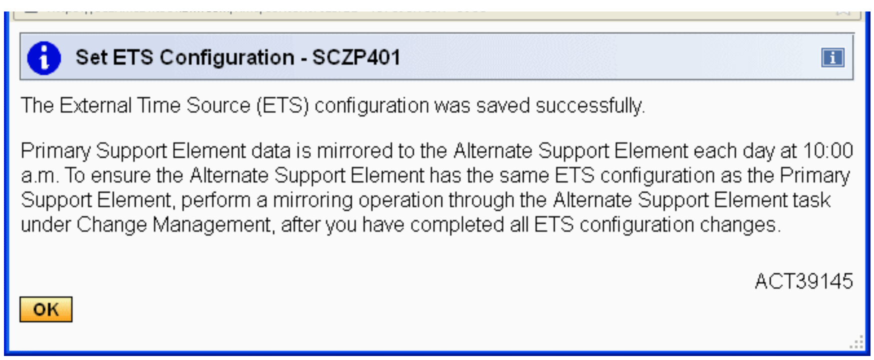


Figure 1-37 Message ACT39145 - ETS configuration saved successfully

12. In case the same IP address has been configured for both NTP servers, message ACT39206 displays (Figure 1-38 on page 24). Even if this is a valid configuration, it is a good idea to configure a separate NTP server for redundancy.

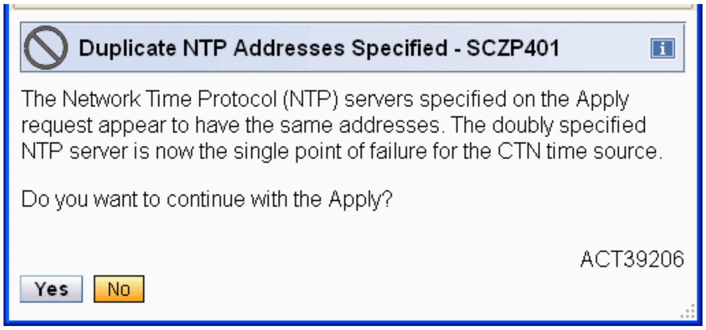


Figure 1-38 Message ACT39206 - Duplicate IP address

13. It is strongly advised to define two different NTP servers in order to have redundant NTP server capability; select **No** and define a different NTP server. Systems zEC12, z196, and z114 have the capability to define an optional NTP threshold. Select **NTP Thresholds** from the ETS Configuration (Figure 1-39).

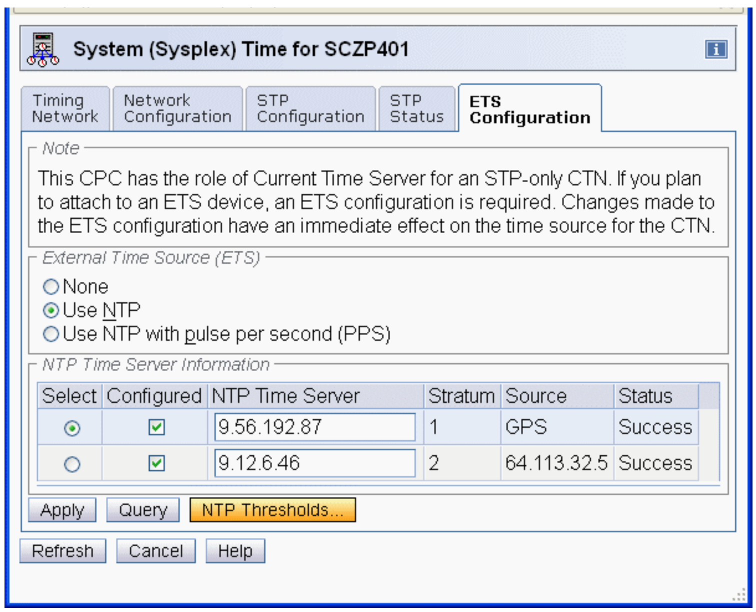


Figure 1-39 External TIme Source Configuration - NTP Thresholds

14. Setting an NTP threshold can be considered optional and is intended to tolerate certain NTP status changes that can be considered as normal. In the NTP Threshold panel select a Stratum level that must be reached before hardware and Operating System Messages are generated. Similarly, select a time period that must be reached before hardware and Operating System Messages are generated if the Source ID from a target NTP server changes. Select the **Stratum level threshold** and **Source ID time threshold** from the pull-down menu and select **OK** (Figure 1-40 on page 25).

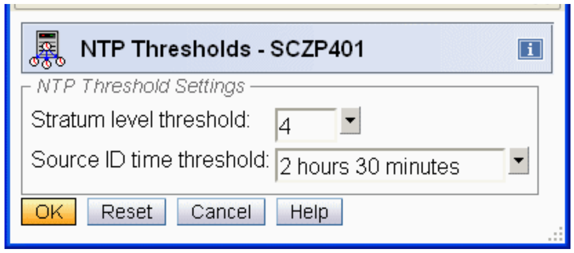


Figure 1-40 NTP thresholds

15. Once the NTP servers and the optional NTP threshold are configured and applied, the selected NTP server is used for time adjustments.
16. NTP server accessibility is checked once every 10 minutes, with a time adjustment issued every hour. In the case of NTP server access failures, or changes in stratum level or source ID, a hardware message is posted. No user message displays on the HMC when STP accesses the NTP server.

    When a time adjustment is requested, a message is generated in the Support Element Console Events log. Table 1-2 shows the sample messages.
17. To view the console log from the HMC application, first select the CTS, then:
    a. Select **Recovery** → **Single Object Operations** to log on to the Support Element.
    b. From the SE workplace, select **Service Management** → **View Console Events**.

Table 1-2 Support Element Console events

Date	Time	Console event
09/21/2012	11:17:03.940	This CPC is requesting an adjustment to the Coordinated Server Time after contacting an External Time Source via NTP server: 9.56.192.87[-0.000171 seconds].
09/21/2012	10:17:03.780	This CPC is requesting an adjustment to the Coordinated Server Time after contacting an External Time Source via NTP server: 9.56.192.87 [-0.000838 seconds].
09/21/2012	09:17:03.820	This CPC is requesting an adjustment to the Coordinated Server Time after contacting an External Time Source via NTP server: 9.56.192.87 [0.001748 seconds].

18. You might need to remove an NTP server. To do this, the configured check box of the appropriate NTP server needs to be *unchecked*. There might be reasons to remove the last NTP server (Figure 1-41 on page 26).

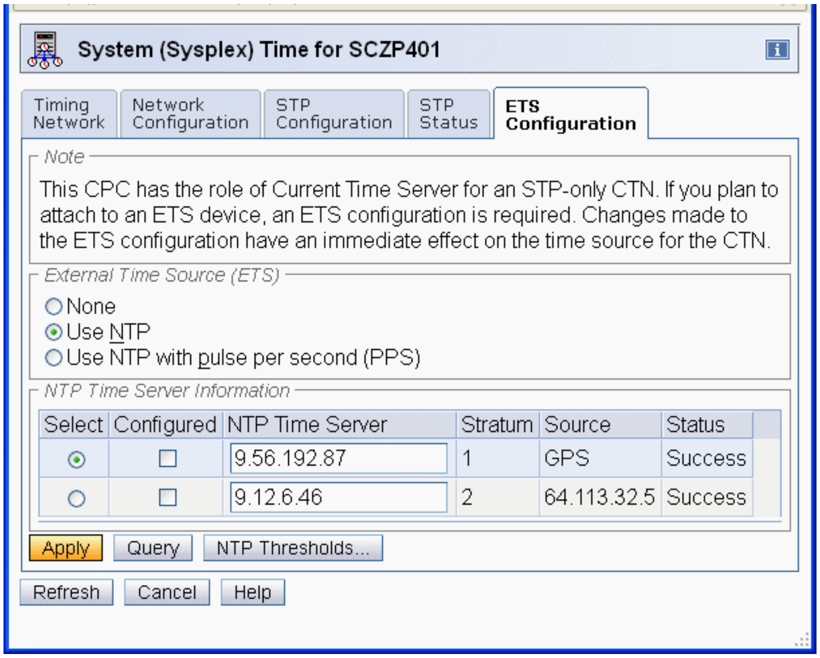


Figure 1-41 ETS Configuration - Remove last NTP server

19. When you click **Apply**, the message shown in Figure 1-42 displays.

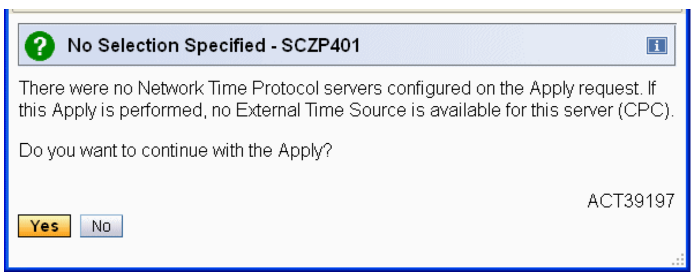


Figure 1-42 Message ACT39197 - Removing last NTP server

20. Clicking **Yes** confirms the request, and the new NTP configuration is saved on the Support Element. An information window displays (Figure 1-43).

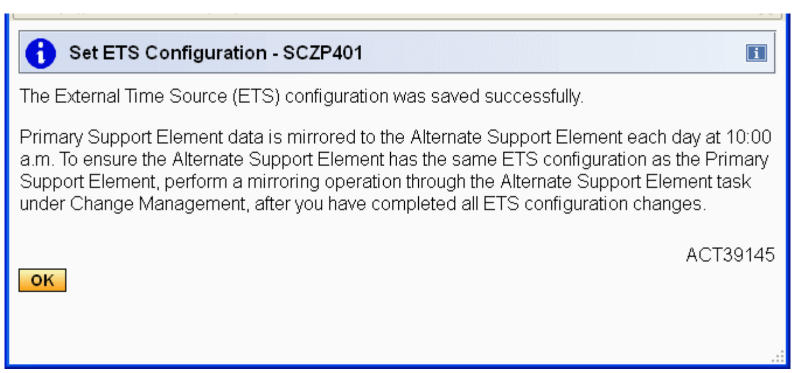


Figure 1-43 Message ACT39145 - ETS configuration saved successfully

1.3 Configuring an NTP server with pulse per second option

The pulse per second (PPS) output option, offered by certain NTP server hardware vendors, is utilized in addition to the NTP time information. The time accuracy of an STP-only CTN has been improved by adding the capability to configure an NTP server that has a pulse per second output signal. This type of device is available world-wide from several vendors that provide network timing solutions. Figure 1-44 depicts the configuration that we used for this example.

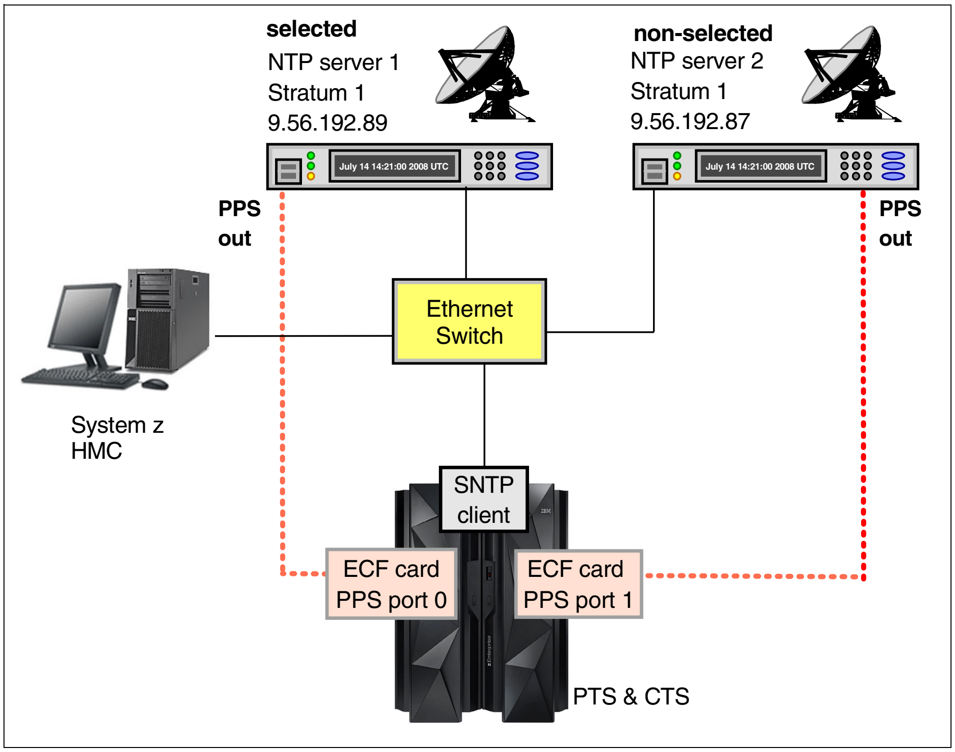


Figure 1-44 ETS using NTP with PPS

> **Note:** The NTP server that can be configured on the HMC is not able to provide a PPS signal.

STP was designed to track to the highly stable, accurate PPS signal from the NTP server and maintain an accuracy of 10 microseconds, as measured at the PPS input of the System z server. In comparison, STP configured to use a dial-out time service or an NTP server without the PPS output option is designed to provide a time accuracy of 100 milliseconds to the ETS.

The PPS output is connected to the PPS ports on the ETR cards of the System z10 or System z9 server, or to the PPS ports on the ECF card for System zEC12, z196, and z114.

To configure the NTP server with PPS:

1. Click the server to be set up for NTP on the HMC. Click the **System (Sysplex) Time** option in the Tasks section, select the **ETS Configuration** tab and select **Use NTP with pulse per second** (Figure 1-45).

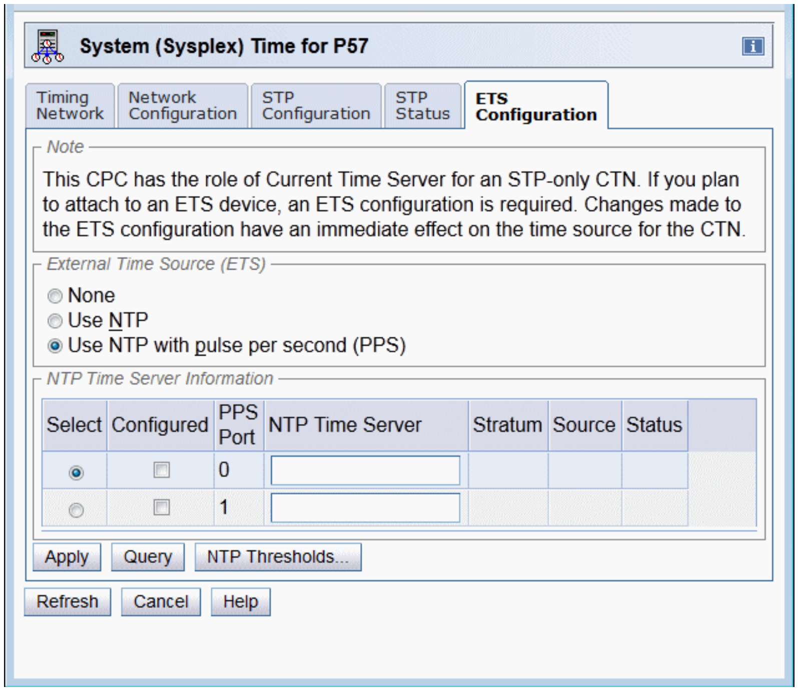


Figure 1-45 ETS Configuration - Use NTP with pulse per second (PPS)

2. Selecting the **Use NTP with pulse per second (PPS)** radio button displays the NTP Time Server Information table. When at least one Configured check box is selected, the IP address or web address entered in the NTP Time Server column is used as the NTP server address (Figure 1-46 on page 29).

3. The use of a web address requires that the Support Element be customized with Domain Name Services enabled. Select the task **Customize Network Settings** → **Name services** in the Support Element Console Applications.

> **Tip:** If the HMC is used as an NTP client/server, this step must be done **on the HMC,** and **not** the Support Element.

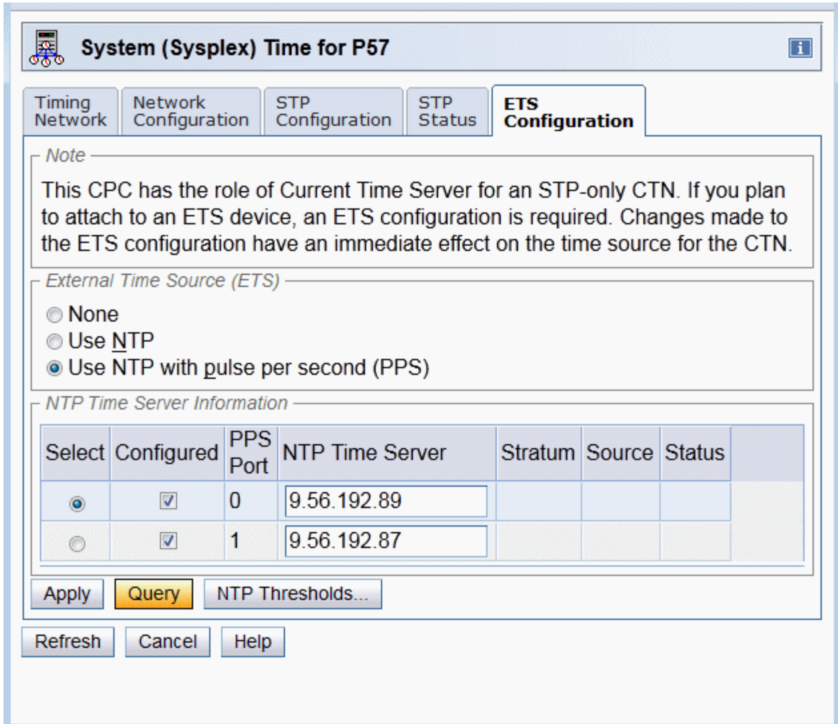


Figure 1-46 ETS Configuration - NTP with pulse per second (PPS) configured

4. The PPS Port column indicates the NTP server to PPS port correlation. As shown in Figure 1-46, PPS Port 0 corresponds to the NTP server defined in the upper row of the NTP Time Server Information table. The PPS output of this NTP server needs to be connected to PPS port 0 on the ECF card for System zEC12, z196 and z114 (ETR card on the z10). PPS Port 1 corresponds to the NTP server defined in the lower row of the NTP Time Server Information table. The PPS output of this NTP server needs to be connected to PPS port 1 on the ECF card.

   The *Installation Manual for Physical Planning* (IMPP) manual for each server provides a description and location of the ECF or ETR feature cards. See "Related publications" on page 425 for information about these manuals.

> **Note:** You are responsible for defining the correct NTP server IP address and connecting the corresponding PPS port to the correct ECF or ETR card port.

5. Up to two NTP servers can be configured. A preferred NTP server is chosen by selecting the appropriate **Select** radio button. This NTP server is called the *selected* NTP server. If only one NTP server will be configured, the Select radio button *must* be checked.
6. Clicking **Query** tests the IP connectivity, and message ACT39142 displays (Figure 1-47).

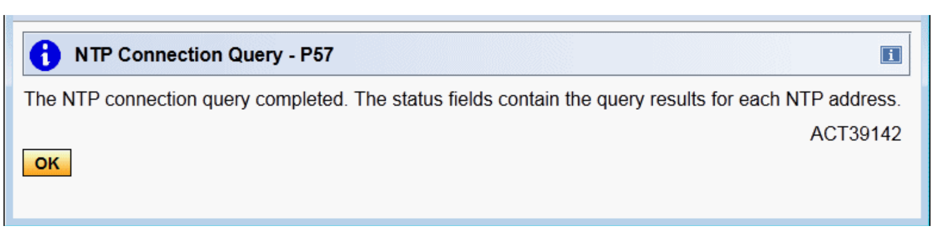


Figure 1-47 Message ACT39142 - NTP Connection Query

7. The Stratum level, Source, and Status table fields for the corresponding NTP server are filled in (Figure 1-48 on page 30).
8. The Status column displays `Success` if the related NTP server is accessible. A list of possible status fields is available by clicking **Help** on the ETS Configuration tab.
9. The Source field contains a description of the time source for the NTP server provided as information by the NTP server. Typically, the source for Stratum 1 servers is GPS or radio signals such as WWV. Table 1-1 on page 21 provides a list of examples of known Stratum 1 source values. This field is blank if the server is not available. The NTP configuration is not applied so far, and the PPS port status indicates **Not configured** for both PPS ports.

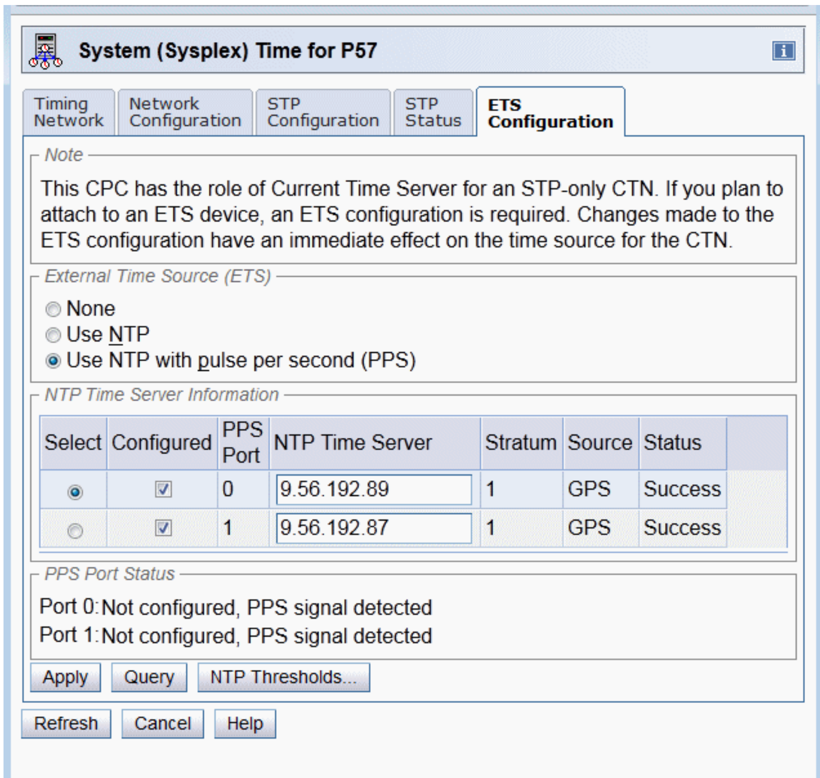


Figure 1-48 NTP Server query done

10. If two NTP servers have been configured, checks are made to compare the time at the NTP servers. If a divergence is detected between the two NTP servers, the message in the Status column indicates `Success`, but a note displays below the NTP Time Server Information table.
11. When you click **Apply**, the NTP server configuration is saved on the Support Element, and message ACT39145 displays (Figure 1-49 on page 31). The configuration takes effect immediately if only one NTP server is configured.

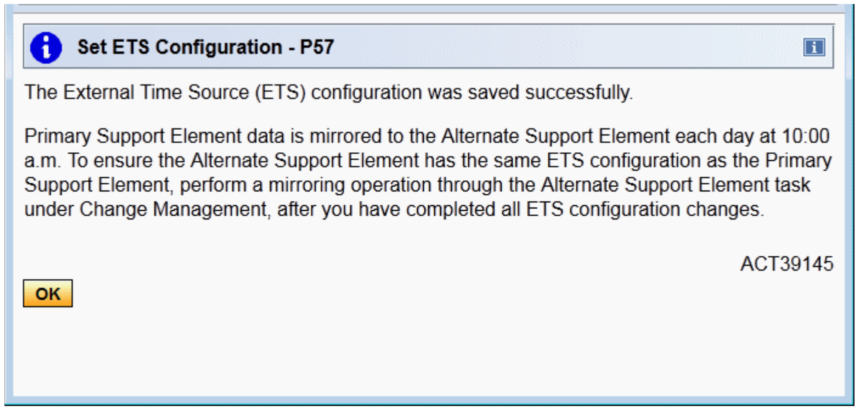


Figure 1-49 Message ACT39145 - ETS configuration saved successfully

12. If two NTP servers are configured, clicking **Apply** causes a verification of the NTP server first. This helps you choose the best NTP server as the selected one. Depending on the result, message ACT39196 might display (Figure 1-50).

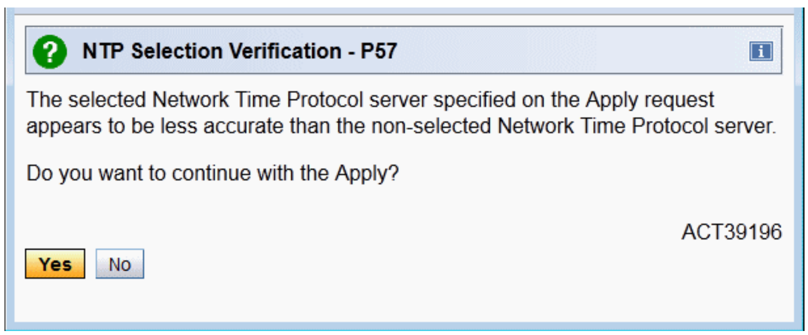


Figure 1-50 Message ACT39196 - The selected NTP server is less accurate

13. If the selected NTP server is less accurate than the nonselected NTP server, message ACT39196 displays (Figure 1-50). In this case, consider assigning the nonselected NTP server as the selected one.
14. There might be good reasons for such a configuration. However, clicking **Yes** (Figure 1-50) saves the NTP server configuration on the Support Element, and the configuration takes effect. Message ACT39145 displays (Figure 1-51).

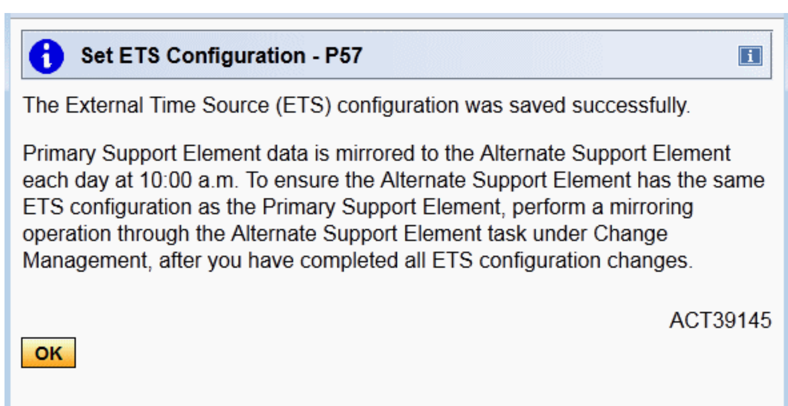


Figure 1-51 Message ACT39145 - ETS configuration saved successfully

15. The System (Sysplex) Time window returns and the PPS Port Status fields display the status after refresh (Figure 1-52). The possible port status messages are:

   – Not configured
   – No PPS signal
   – Acquiring consistent NTP information
   – Configuration error
   – Adjusting for PPS signal
   – Capable of tracking to PPS signal
   – Tracking to PPS signal

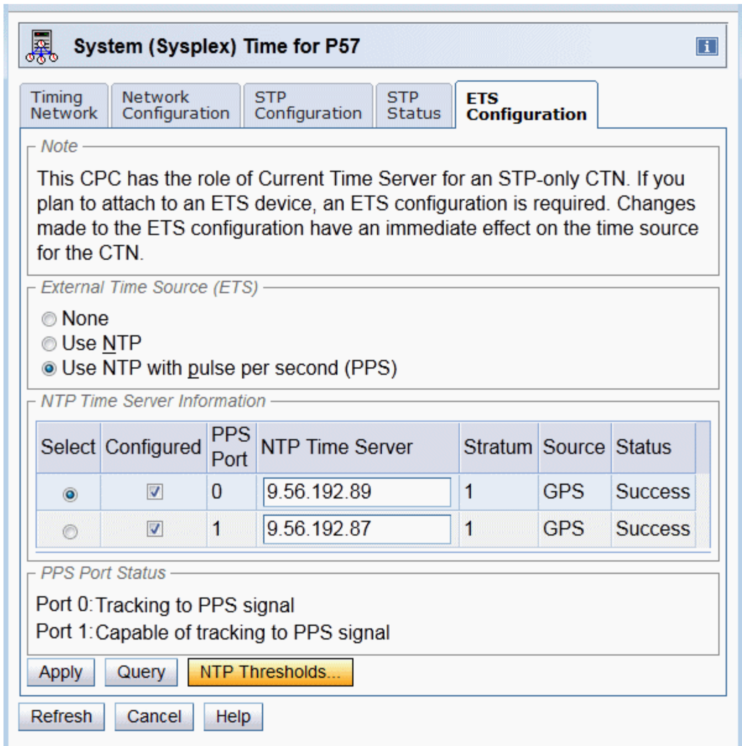


Figure 1-52 ETS configuration

16. You can click **Help** for more information regarding the PPS Port Status field.

17. System zEC12, z196 and z114 have the capability to define an optional NTP threshold. Select **NTP Thresholds** from the ETS Configuration tab (Figure 1-52). This opens the NTP Threshold Settings shown in Figure 1-53.

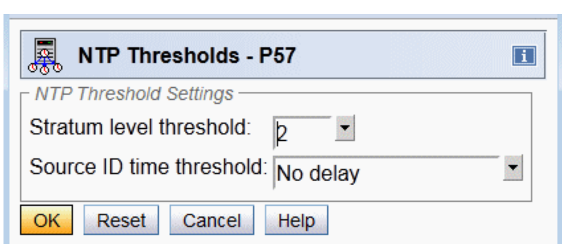


Figure 1-53 NTP threshold specification

18. Setting an NTP threshold can be considered optional and is intended to tolerate certain NTP status changes that can be considered as normal. In the NTP Threshold panel select a Stratum level that must be reached before hardware and Operating System Messages are generated. Similarly, select a time period that must be reached before hardware and

Operating System Messages are generated if the Source ID from a target NTP server changes. Select **Stratum level threshold** and **Source ID time threshold** from the pull-down menu and select **OK** (Figure 1-53).

19. Once the NTP servers and the optional NTP threshold are configured and the configuration is applied, the selected NTP server with PPS is used for time adjustments (unless one of the previously mentioned problems is encountered). NTP server availability is checked every minute when STP is utilizing the PPS signal.

20. If the NTP server cannot be accessed, or in case of failures or changes in the stratum level or source ID, a hardware message is posted, as well as a z/OS message (z/OS 1.11 or later). The PPS signal is sampled every second. If the PPS signal is not available or is unusable for more than two seconds, a hardware message is issued and STP tries to utilize another PPS signal. If no other PPS signal is available, STP uses the NTP time information (time accuracy downgraded from 10 microseconds to 100 milliseconds). For detailed recovery information, refer to *Server Time Protocol Recovery Guide*, SG24-7380.

21. If an NTP server must be removed, the configured check box of the appropriate NTP server needs to be unchecked. There might be reasons to remove the last NTP server (Figure 1-54). Removing an NTP server also deconfigures its associated PPS signal because the NTP server and its PPS signal are correlated.

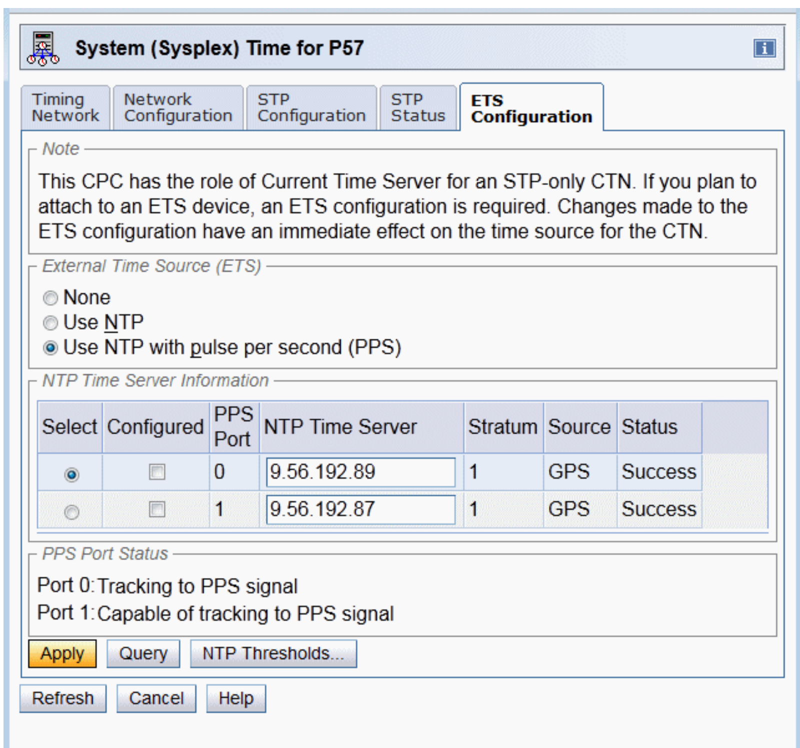


Figure 1-54 ETS Configuration - Remove last NTP server with PPS

22. When you click **Apply**, the message ACT39197 displays (Figure 1-55 on page 34).

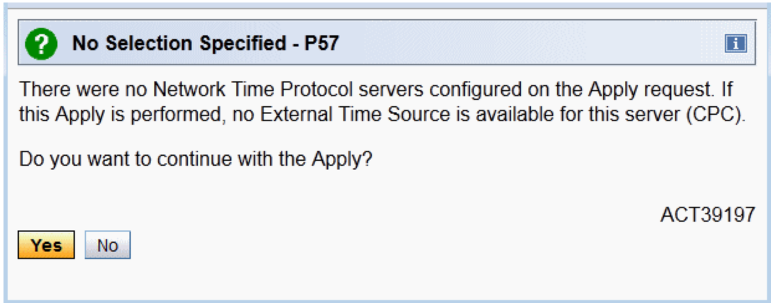


Figure 1-55 Message ACT39197 - Removing last NTP server

23. Clicking **Yes** confirms the removal of the last NTP server, and the NTP configuration is saved on the Support Element. The information message ACT39145 displays (Figure 1-56).

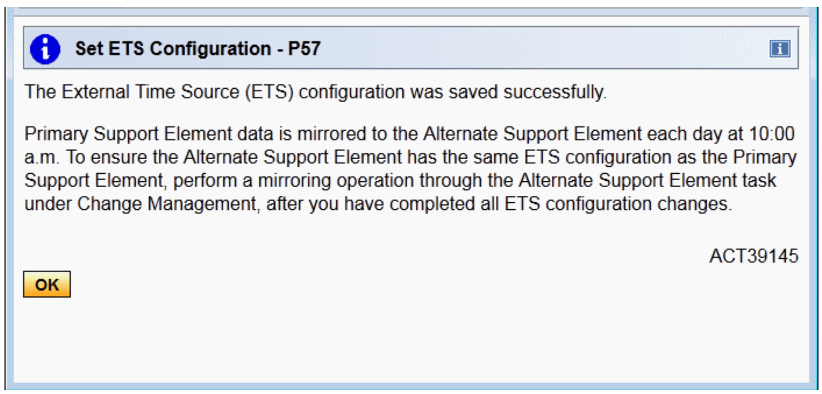


Figure 1-56 Message ACT30145 - ETS configuration saved successfully

1.4 Configuring dial out on the HMC

This section provides information about how to configure the External Time Source to use dial out on the Hardware Management Console.

> **Note:** The dial-out option is available up to HMC Version 2.11.1. Starting with HMC Version 2.12.0 the dial-out option is not available since it does not support a modem connection anymore.

1.4.1 HMC setup for ETS dial-out configuration

The HMC setup can be considered the first step for the ETS dial-out configuration. It makes the HMC capable of dialing to a time service provider.

To configure the dial-out connection:

1. Select the **Service Management** task on the Hardware Management Console application. Click the **Customize Outbound Connectivity** option available in the Work pane. Figure 1-57 shows the Call-Home Server Consoles task.

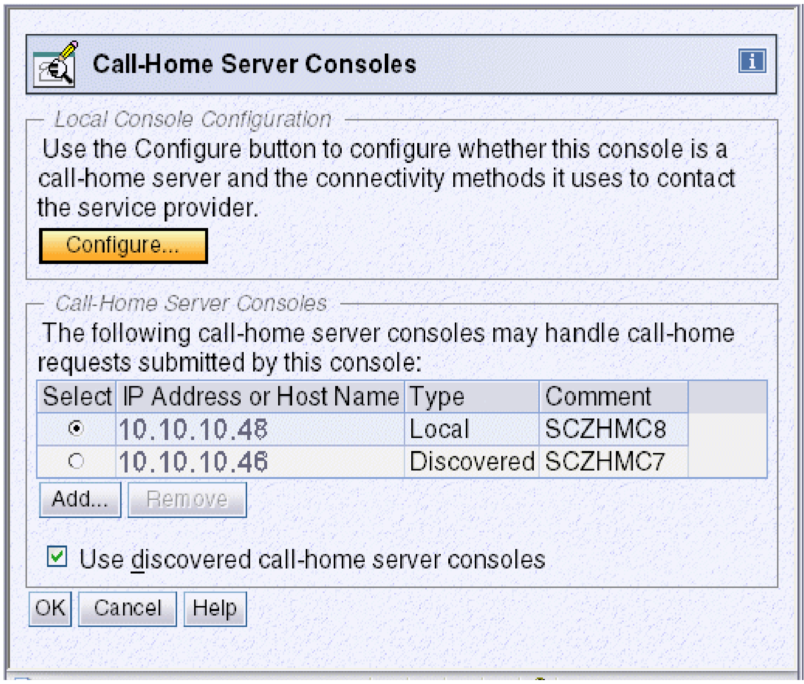


Figure 1-57 Call-Home Server Consoles

2. After clicking **Configure**, the Outbound Connectivity Setting window displays (Figure 1-58).

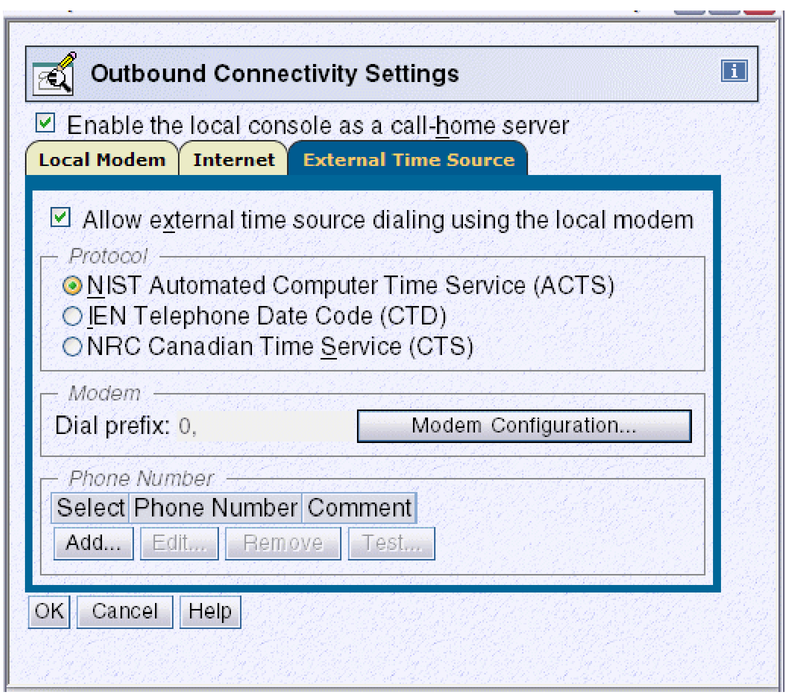


Figure 1-58 Outbound Connectivity Setting - External Time Source

3. From the External Time Source tab, check **Allow external time source dialing using the local modem** to enable protocol configuration. Three protocols are available:
   - National Institute of Standards and Technology (NIST), representing the Automated Computer Time Service (ACTS), which is typically used in the USA
   - Istituto Elettrotecnico Nazionale (IEN), representing the Telephone Date Code (CTD), which is typically used in Europe
   - National Research Council (NRC), representing the Canadian Time Service (CTS), which is typically used in Canada

   For each country, the time service must be contacted to verify the protocol that they support and the phone number to be used.
4. After clicking **Modem Configuration**, you can specify tone or pulse dialing. Wait for a dial tone, Enable speaker, and Dial prefix (Figure 1-59).

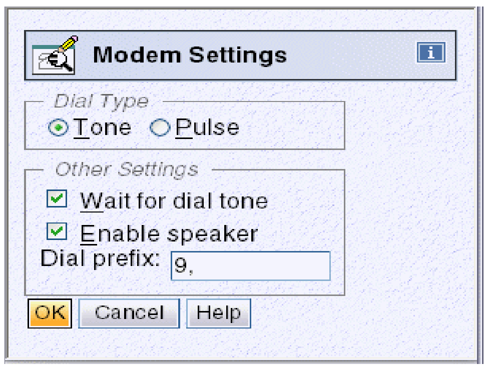


Figure 1-59 Modem Settings window

5. Once the Customize Modem Setting task has been completed, the telephone number can be added by clicking **Add** in the External Time Source tab. Figure 1-60 shows the Add External Time Source Phone Number window.

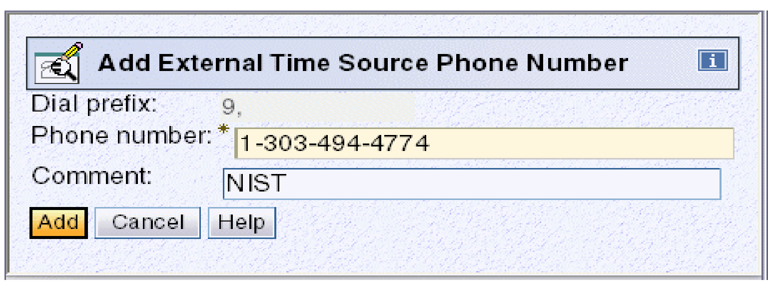


Figure 1-60 Add External Time Source Phone Number window

6. When the dial out phone number has been added, the **Test** button in the Customize Outbound Connectivity window becomes selectable and must be used to ensure that the correct configuration and connectivity to the time service provider has been accomplished (Figure 1-61).

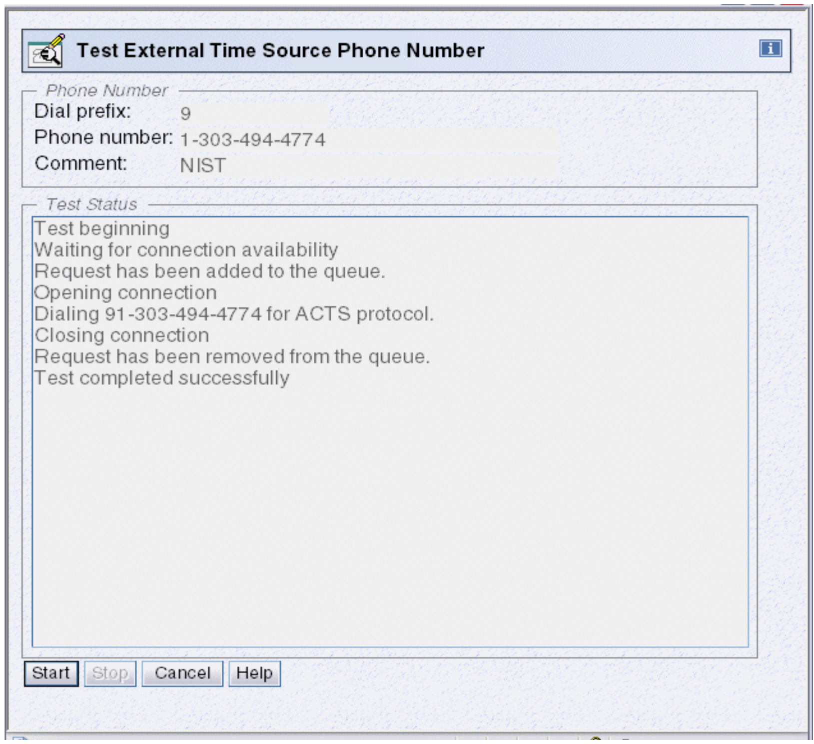


Figure 1-61 Test External Time Source Phone Number

This completes the first step of the ETS dial-out configuration.

The HMC is now capable of handling ETS requests. For redundancy in case of HMC failure, we suggest configuring a second HMC for ETS dial-out capability. This can be achieved by doing the same steps for the second HMC that has all the CTS candidates defined.

1.4.2 Configuring to use dial out as External Time Source

To make the STP facility steer the CST to the time obtained from the dial-out function on the HMC, the Current Time Server needs to be configured to choose dial out as the External Time Source for STP. Do this configuration on any server that will be assigned as the Current Time Server for redundancy, especially for BTS.

Note: The default selection is to use dial out as ETS.

The steps are:

1. To select the servers to be set up, click **Configuration** → **System (Sysplex) Time** from HMC Workplace, and select the **ETS Configuration** tab (Figure 1-62).

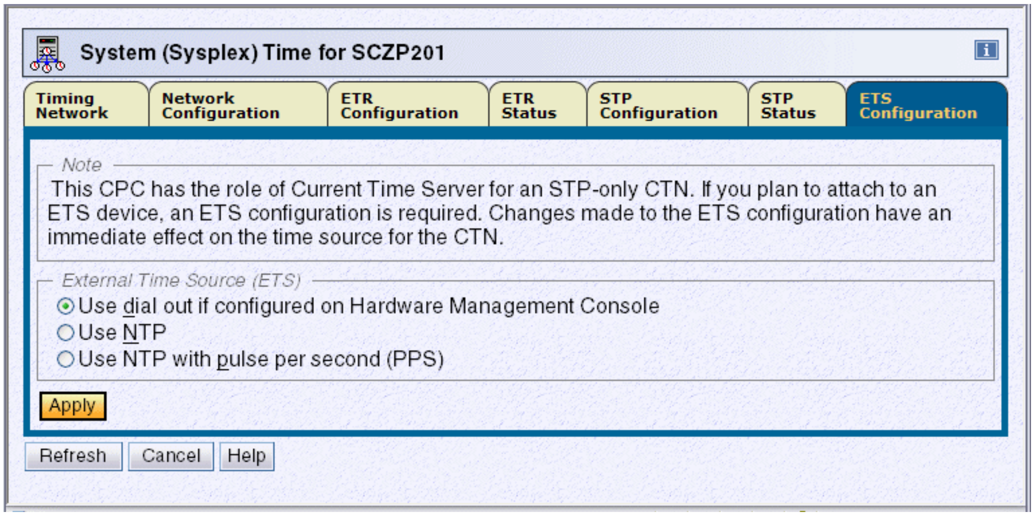


Figure 1-62 ETS Configuration tab - Use dial out

2. Select the **Use dial out if configured on Hardware Management Console** radio button and click **Apply** to accomplish the configuration.

1.4.3 Configuring the ETS dial-out schedule

The second part of the ETS dial-out configuration can be achieved by adding scheduled operations to the Support Element of the servers that are CTS candidates (PTS and BTS) and are using the HMC ETS dial-out function:

1. Select the server as the target object, then select **Operational Customization** → **Customize Scheduled Operations** → **Options** → **New**, which opens the Add a Scheduled Operation task (Figure 1-63).

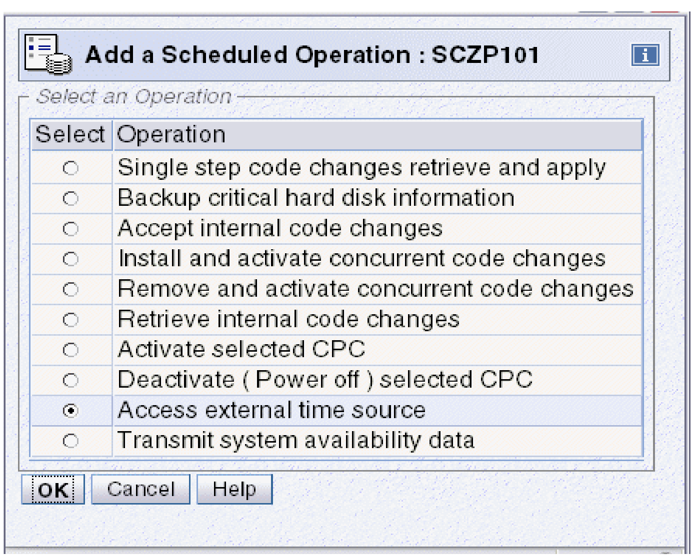


Figure 1-63 Add a Scheduled Operation

2. Set the radio button to **Access external time source** and click **OK**. The "Set up a Scheduled Operation" task opens (Figure 1-64).

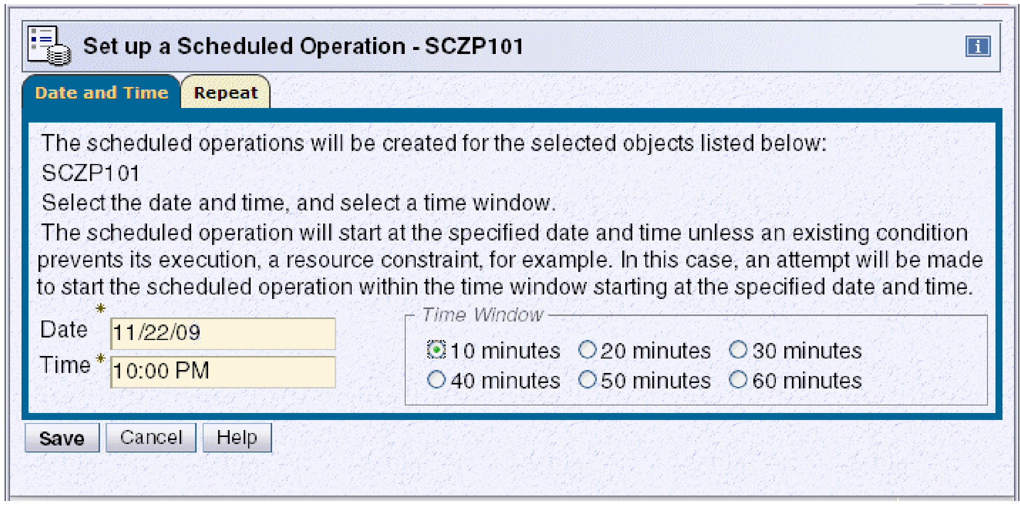


Figure 1-64 Set up a Scheduled Operation - Date and Time tab

3. Enter the date and time of the scheduled operation. The default time window of 10 minutes is sufficient in case this scheduled operation is prevented by any resource constraint. For the ETS query, we suggest that a repeated scheduled operation be set up for periodic time adjustment to continuously maintain time accuracy. By selecting the **Repeat** tab, the repeat option is shown (Figure 1-65).
4. Click **Set up a repeated scheduled operation**. Depending on the time accuracy requirement, select one or more days for the ETS to be contacted. Selecting an interval of one week has the ETS contacted once a week on the selected days. Check the option **Repeat indefinitely** to make sure that this scheduled operation never expires.

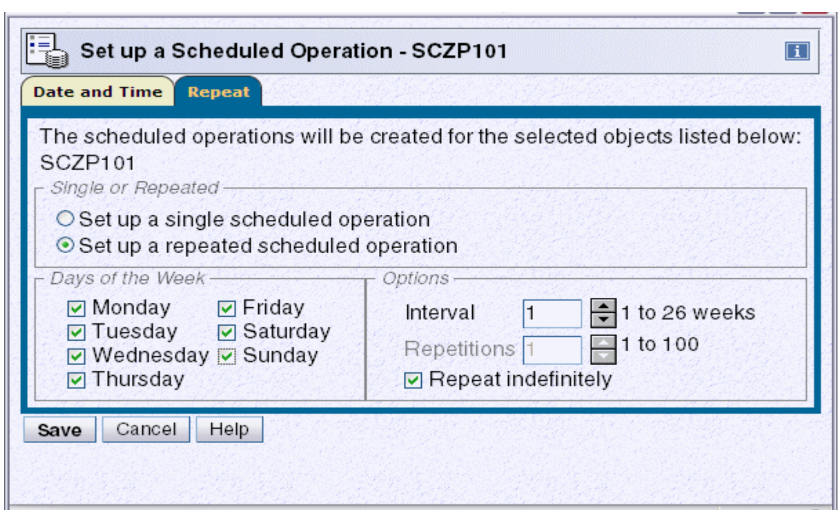


Figure 1-65 Set up a Scheduled Operation - Repeat tab

As previously mentioned, this scheduled operation setup needs to be done for those SEs that are using the HMC ETS dial-out function.

> **Note:** No user message displays on the HMC when a dial out to the external time source occurs. But when STP generates a time adjustment, an entry message is generated in the Support Element Console Events log. To visualize the console log from the HMC application, first select the CTS, then:
>
> 1. Select **Recovery** → **Single Object Mode** to log on to the Support Element.
> 2. From the SE workplace, select **Service Management** → **View Console Events**.

1.5 Migrating an External Time Source

An existing External Time Source (ETS) may need to be reconfigured or migrated for certain reasons. Reconfigurations within the ETS do not affect the CTN operations. The only effect that may need to be considered can be a temporary loss of the External Time Source that has no impact to STP, but might cause the CTN to slowly drift away from ETS. Since a migration to a different ETS usually does not last over a long period of time, the drift can be considered to be insignificant.

> **Note:** Starting with HMC level 2.12.0 the HMC dial-out External Time Source option is no longer available. A migration to a dial-out ETS, therefore, is beyond the scope of this section.
>
> The following migration example may refer to an ETS interruption, which is independent from STP operations. It does *not* have any impact to the CTN, except a slow drift away from ETS depending on the period of time the access to ETS is unavailable.

In this section we describe the following migration scenarios:

- Migration from no ETS configuration to either NTP, or NTP with PPS
- Migration from a dial-out ETS configuration to either NTP, or NTP with PPS

Depending on ETS and Server availability, the ETS migration can be performed without drifting away from the external time reference. It is assumed that network connectivity as well as PPS port connectivity (if applicable) have already been established.

1.5.1 Migration from no ETS configuration to either NTP, or NTP with PPS

Since the starting point of this migration is a CTN that is not attached to an External Time Source (ETS) so far, this migration to NTP or NTP with PPS can be considered a new ETS configuration. The CTN was previously not steered to any ETS and the accuracy of the CTN time was based on the initial time setup accuracy and possible subsequent manual time adjustments.

The key migration steps are:

1. If an HMC is used as NTP server, follow the steps to configure the HMC as NTP server as described in 1.2.2, “Configuring an NTP server on the HMC” on page 7 and 1.2.3, “Configuring HMC as an NTP server” on page 14.
2. Configure the NTP server using the Sysplex Timer panel of the PTS - ETS tab as described in 1.2.5, “Configuring an NTP server on the PTS/CTS or BTS” on page 18 or 1.3, “Configuring an NTP server with pulse per second option” on page 27.

3. Define the NTP server using the same steps at the BTS if not already done. The purpose of this step is to have NTP server redundancy across both servers that can become the Current Timer Server.
4. Verify the final ETS status on the Sysplex Timer ETS tab. The status column for NTP and NTP with PPS are the same. In addition, the NTP with PPS configuration does list the PPS Port Status (Figure 1-66):
   – The NTP server previously added shows status **success**.
   – The NTP server with PPS additionally shows PPS Port Status **Tracking to PPS signal** or **Capable of tracking to PPS signal** (only for NTP with PPS).

   Because this CTN was not steered to an ETS previously, the time difference of the CTN to the newly added ETS might be more than 60 seconds, which prevents the automatic steering to start. The status would show “**CPC/NTP time difference > 60 seconds**”. This problem can be corrected concurrently based on operational constraints. This is discussed in more detail in the *Server Time Protocol Recovery Guide*, SG24-7380, Section 6.3, “Synchronizing the CTN to an ETS when the time difference is greater than the 60 second threshold”.

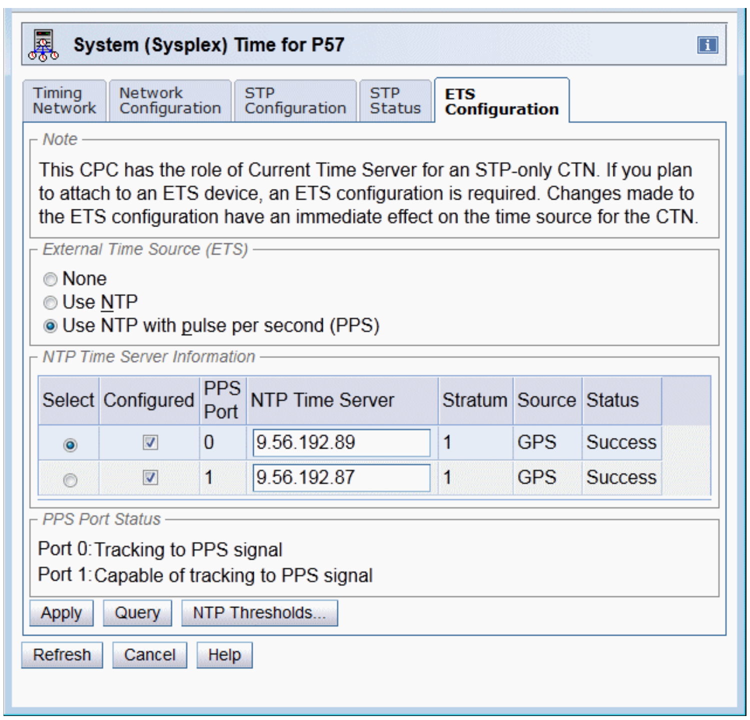


Figure 1-66 ETS configuration CTS - NTP server setup

1.5.2 Migration from a dial-out configuration to either NTP, or NTP with PPS

The starting configuration is an ETS dial-out setup that is to be replaced by either NTP, or an NTP server with PPS capability. In this section we discuss different migration scenarios.

Switching to a non-HMC NTP server

There will be no ETS interruption. Switching from an HMC dial-out ETS to a different NTP source can be done at any time and does not cause any interruption to the External Time Source. Perform the following reconfiguration steps:

1. Define the new NTP server to the Support Element of the Current Time Server. It is suggested to also configure the NTP server to the Support Element of all other servers

that can become the CTS. This is typically the BTS, but can be any other server as well. For details refer to 1.2.5, “Configuring an NTP server on the PTS/CTS or BTS” on page 18 (a final setup example is shown in Figure 1-67) or 1.3, “Configuring an NTP server with pulse per second option” on page 27 (a final setup example for NTP with PPS is shown in Figure 1-68).

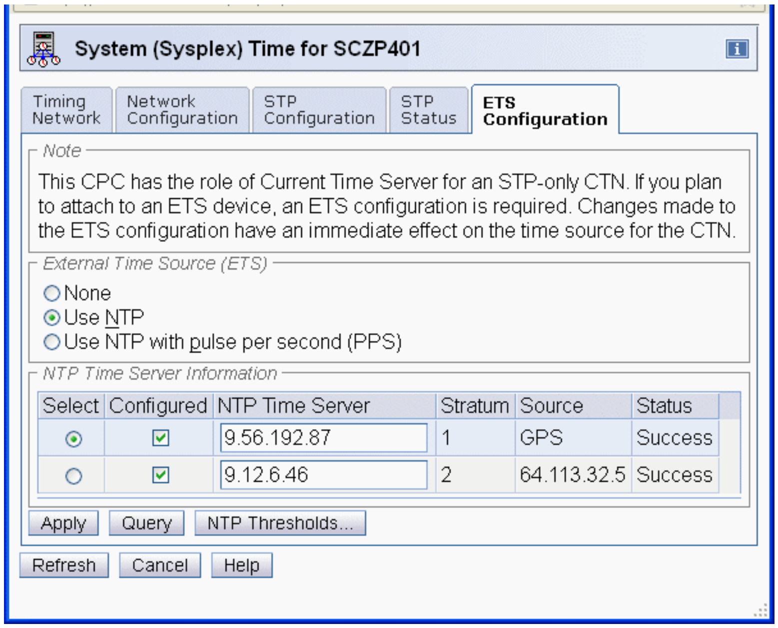


Figure 1-67 NTP server example

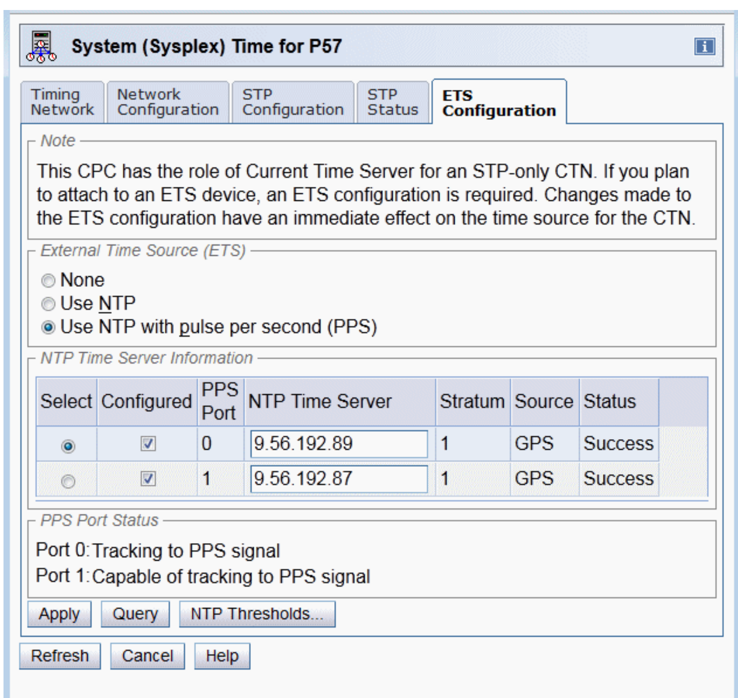


Figure 1-68 NTP with a PPS server example

2. Delete the scheduled operation from all Support Elements that are currently configured to use the ETS dial-out capability. Select the servers to be changed, select **Operational**

Customization, then select **Customize Scheduled Operations**. In the list of scheduled operations select all operations of type “Access external time source” (this might be multiple) and click **Options** and **Delete** (Figure 1-69).

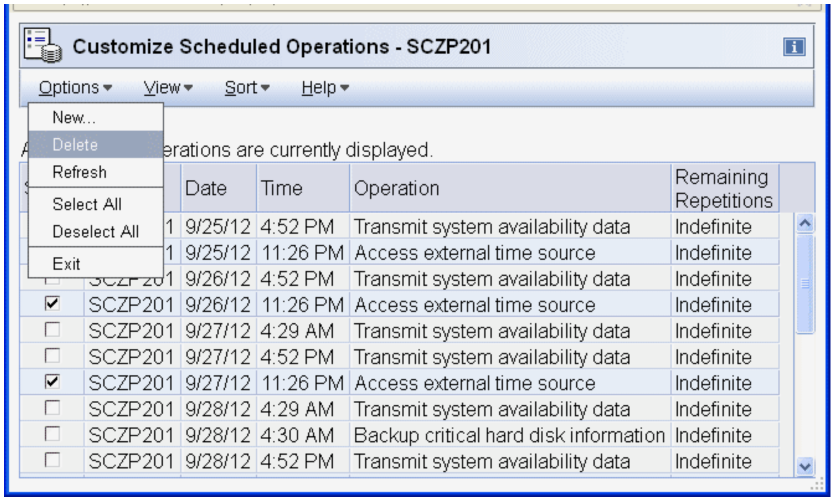


Figure 1-69 Delete dial out scheduled operation

3. On the “Confirm the action” panel click **OK** (Figure 1-70).

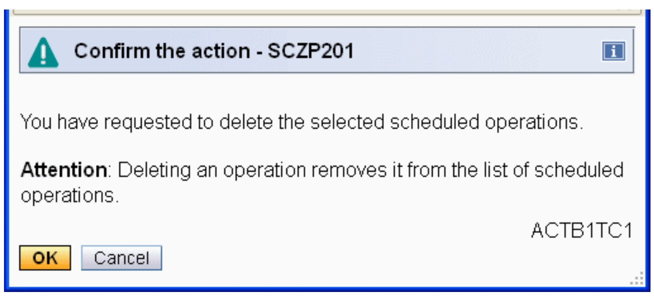


Figure 1-70 Delete scheduled operation confirmation

4. The final Customize Scheduled Operations panel confirms: there are no more access external time source scheduled operations to be executed (Figure 1-71).

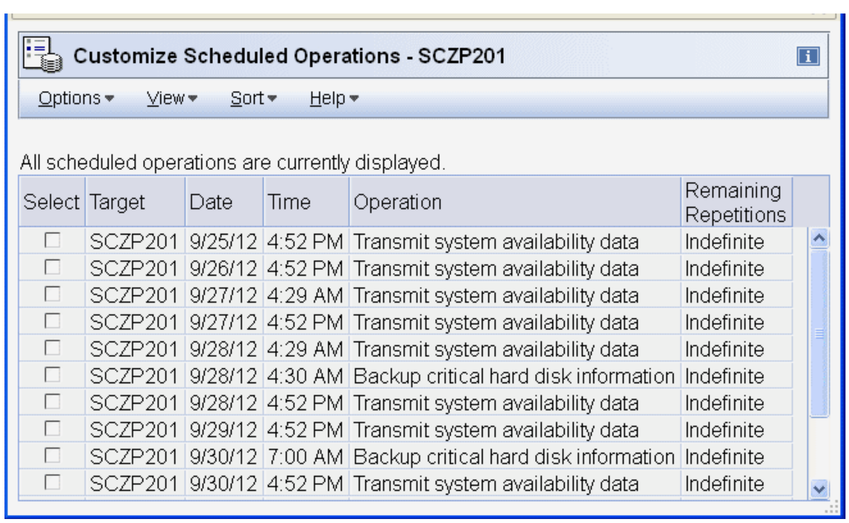


Figure 1-71 Customize Scheduled Operations - access external time source removed

Repeat this step for every Support Element that was setup to access the external time source. This is most likely the PTS and the BTS, but could theoretically be any server.

Switching to another HMC acting as NTP server

The starting configuration is an ETS dial-out setup that is to be replaced by an HMC that will be set up to act as NTP server. Since an HMC cannot have an antenna attached, the HMC can only be an NTP Stratum 2 ETS, and does not provide the PPS capability.

Since the HMC that is already, or will be, set up to act as NTP server is a different one than the HMC that is providing the dial-out capability, this migration is without any interruption to the ETS.

Perform the following steps:

1. If not already done, set up the target HMC to act as server. Follow the steps given in 1.2.2, "Configuring an NTP server on the HMC" on page 7. If there is another HMC that is planned to additionally provide the NTP server function, perform the same steps for that HMC. An example is shown in Figure 1-72.

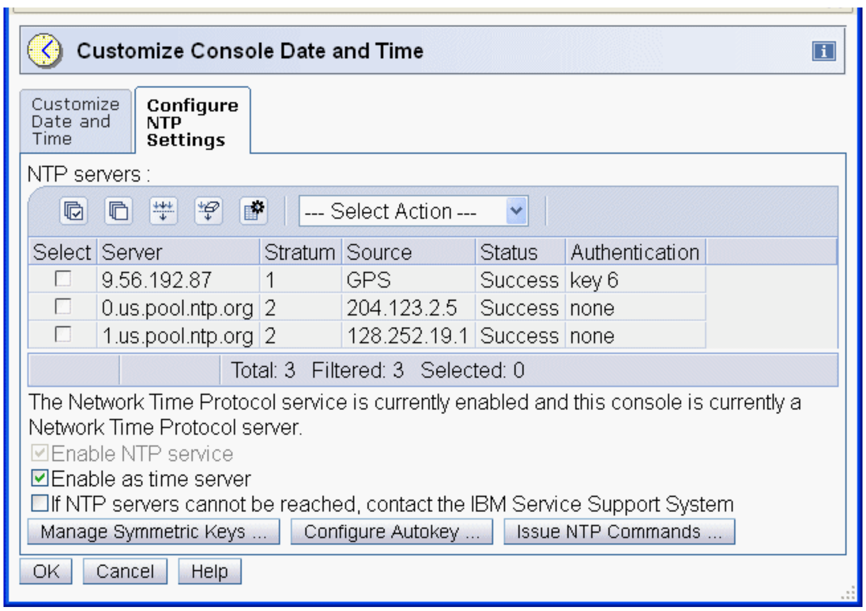


Figure 1-72 HMC NTP server example

2. Define the new NTP server to the Support Element of the Current Time Server. It is suggsted to also configure the NTP server to the Support Element of all other servers that can become the CTS. This is typically the BTS, but can be any other server as well.

   For details refer to 1.2.5, "Configuring an NTP server on the PTS/CTS or BTS" on page 18. The target NTP server configuration can also be a combination of NTP servers such as one HMC acting as NTP server and one Stratum 1 (GPS attached) NTP server as shown in Figure 1-73 on page 45.

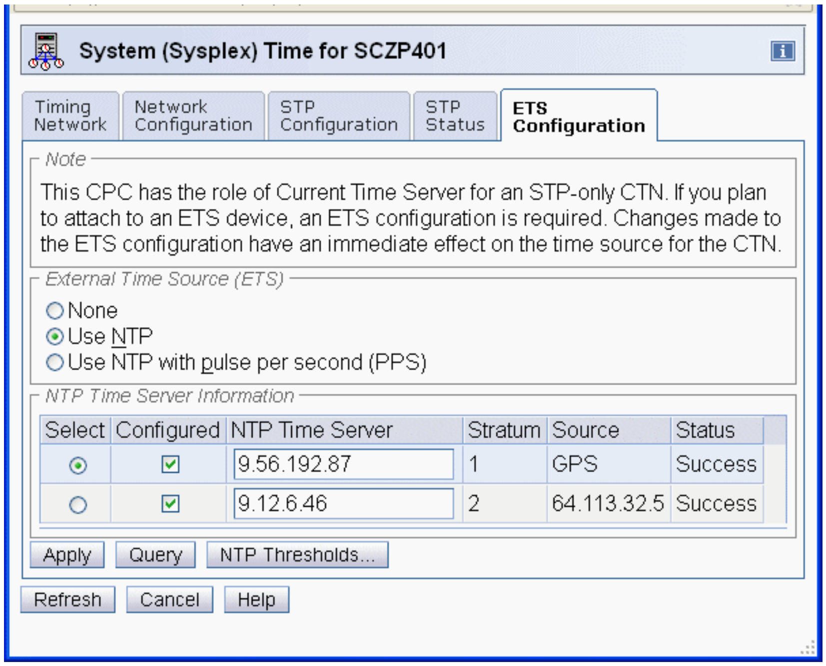


Figure 1-73 NTP server example

3. Delete the scheduled operation from all Support Elements that are currently configured to use the ETS dial-out capability. Select the servers to be changed, select **Operational Customization**, select **Customize Scheduled Operations**. In the list of scheduled operations select all operations of type **Access external time source** (this might be multiple) and click **Options** and **Delete** (Figure 1-74).

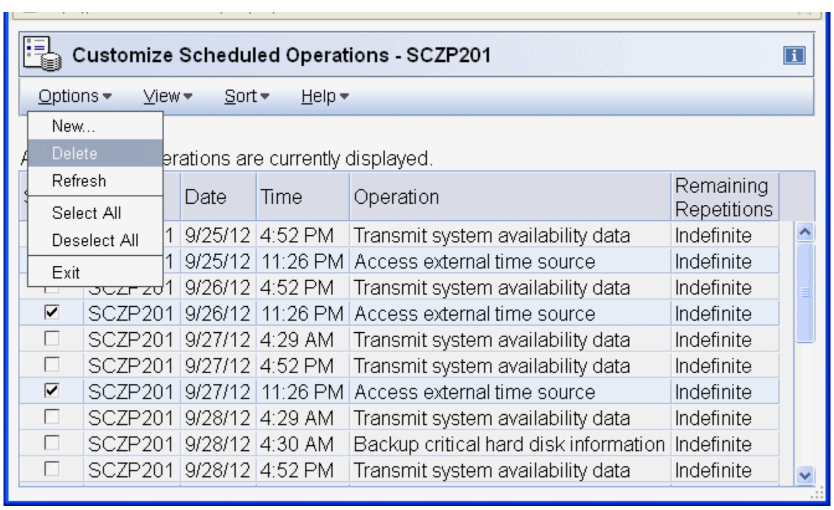


Figure 1-74 Delete dial-out scheduled operation

4. On the “Confirm the action” panel click **OK** (Figure 1-75 on page 46).

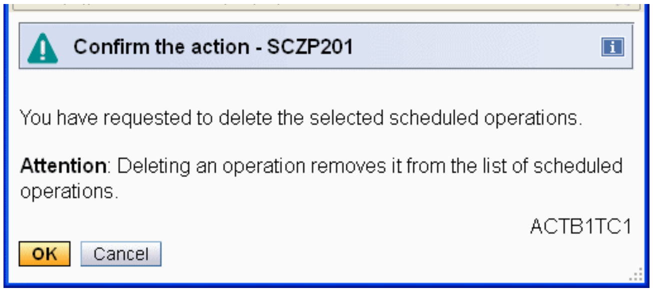


Figure 1-75 Delete scheduled operation confirmation

5. The final Customize Scheduled Operations panel confirms: there are no more access external time source scheduled operations to be executed (Figure 1-76).

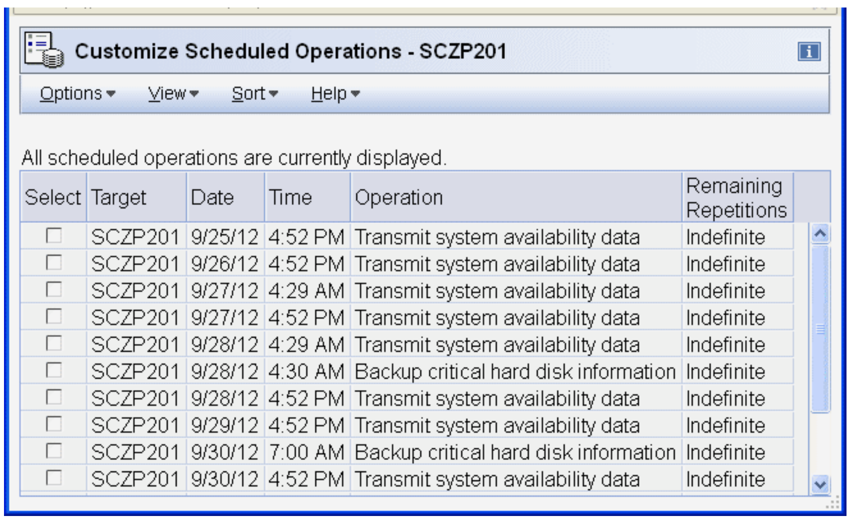


Figure 1-76 Customize Scheduled Operations - access external time source removed

Repeat this step for every Support Element that was set up to access the external time source. This is most likely the PTS and the BTS, but could theoretically be any server.

Switching the HMC to NTP (HMC Version 2.11.1 and earlier)

The starting configuration is an ETS dial-out setup that will be switched to NTP by changing the HMC from currently providing the dial-out capability to act as an NTP server. The key steps are switching the HMC to act as NTP server (using the same HMC) followed by reconfiguring the Support Elements to NTP. Because this HMC is currently providing the dial-out option, it can only be HMC Version 2.11.1 or earlier versions.

Because an HMC cannot have an antenna attached to it, the HMC can only become an NTP Stratum 2 ETS and does not provide the PPS capability.

Because the reconfiguration is done on the HMC that is currently providing the dial-out capability, the migration is going to interrupt the ETS synchronization for a short period of time. This will *not* impact the CTN operation. To switch the HMC to NTP, perform the following steps:

1. Delete the scheduled operation from all Support Elements that are currently configured to use the ETS dial-out capability. Select the servers to be changed, select **Operational Customization**, then select **Customize Scheduled Operations**. In the list of scheduled

operations select all operations of type **Access external time source** (this might be multiple) and click **Options** and **Delete** (Figure 1-77 on page 47).

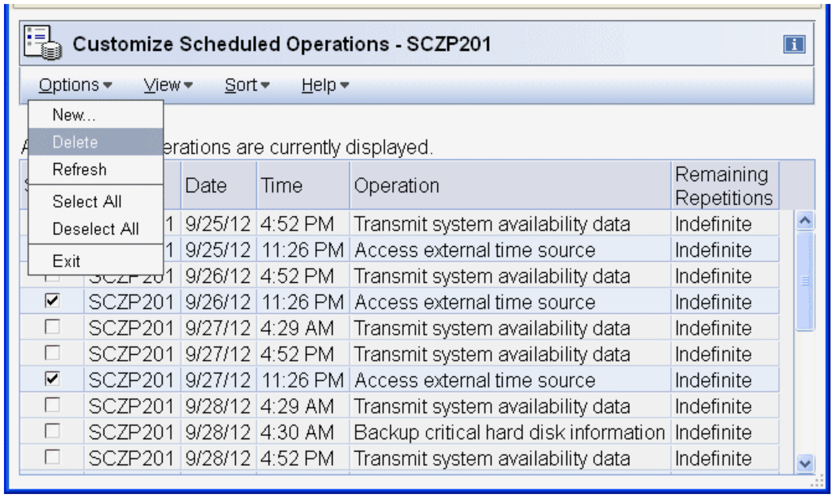


Figure 1-77 Delete dial-out scheduled operation

2. On the “Confirm the action” panel click **OK** (Figure 1-78).

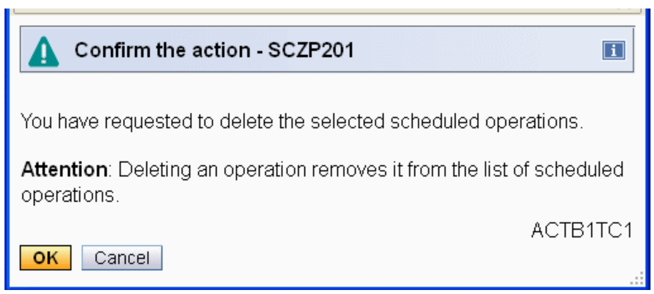


Figure 1-78 Delete scheduled operation confirmation

3. The final Customize Scheduled Operations panel confirms: there are no more access external time source scheduled operations to be executed (Figure 1-79).

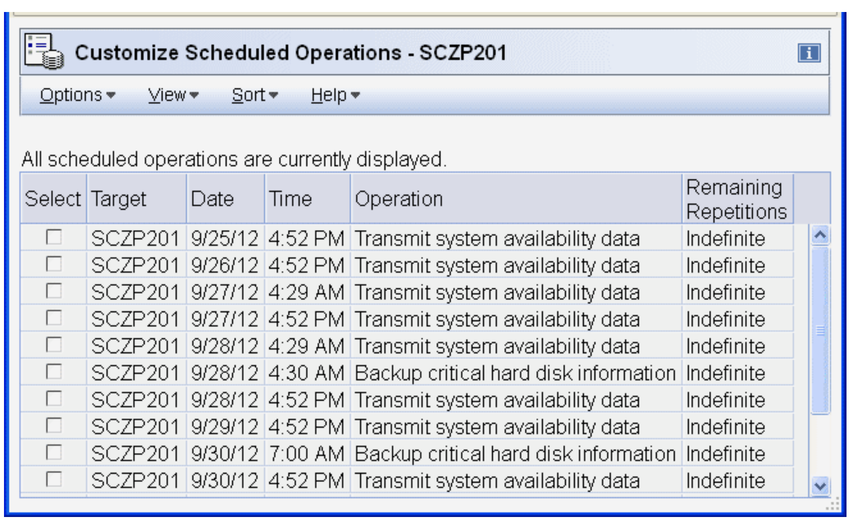


Figure 1-79 Customize Scheduled Operations - access external time source removed

Repeat this step for every Support Element that was set up to access the external time source. This is most likely the PTS and the BTS, but could theoretically be any server.

4. Reconfigure the HMC to act as server. To configure an NTP server on the HMC, click **Customize Console Date and Time** at the appropriate HMC. This task is available in the HMC Management section. Selecting the **Configure NTP Settings** tab displays a window (Figure 1-80).

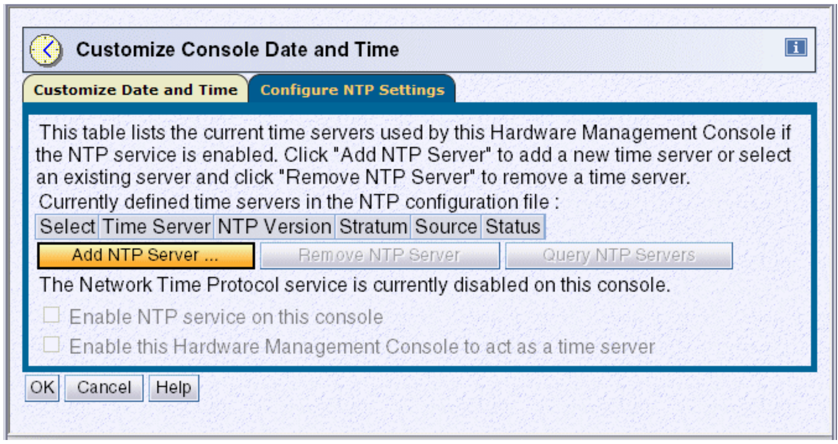


Figure 1-80 Customize Console Date and Time

5. Click **Add NTP Server** to bring up a new window (Figure 1-81). The server host name or the IP address of a known NTP server must be entered in this window.
6. Enter the IP address of the NTP server the HMC should be synchronized with (10.10.1.53) as shown in Figure 1-81 and click **OK**.

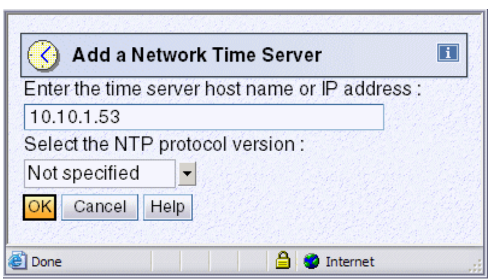


Figure 1-81 NTP server example

7. The information window ACT03231 confirms that the NTP server has been added; click **OK**.

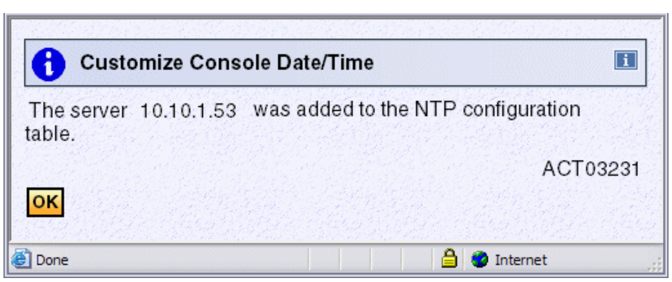


Figure 1-82 Message ACT03231 - Add NTP server information

8. A final HMC NTP server setup is shown in Figure 1-83 on page 49.

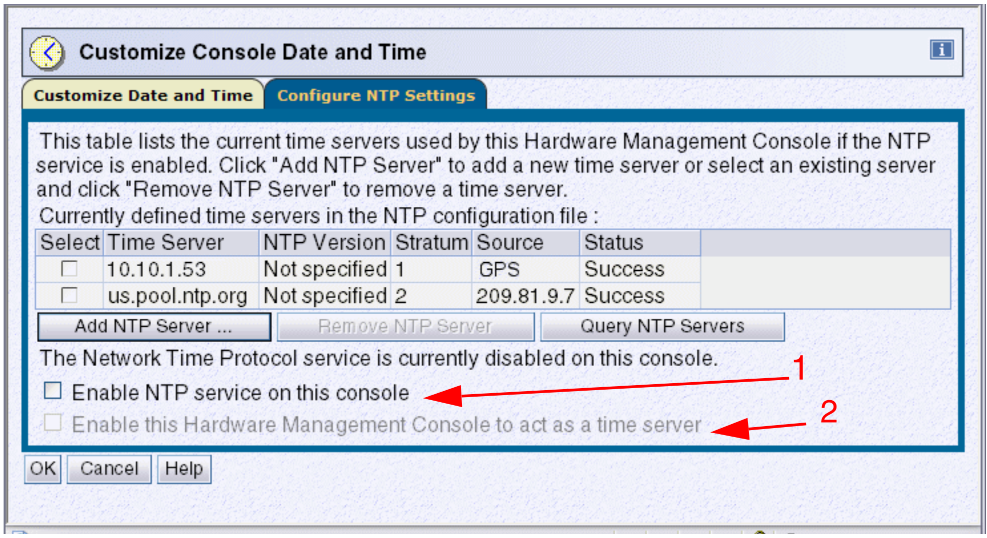


Figure 1-83 HMC NTP server configuration example - HMC version 2.11.1 and before

If there is another HMC that is planned to additionally provide the NTP server function, perform the same steps for that HMC.

If you want to configure the HMC as NTP server, you need first to enable the NTP client service (number 1 in Figure 1-83). This allows HMC to synchronize its time to one of the defined NTP servers. Furthermore, to enable the NTP server service on the HMC, you need to check the “Enable this Hardware Management Console to act as a time server” tick box (number 2 in Figure 1-83).

9. Define the new NTP server to the Support Element of the Current Time Server. It is suggested to also configure the NTP server to the Support Element of all other servers that can become the CTS. This is typically the BTS, but can be any other server as well. For details refer to 1.2.5, “Configuring an NTP server on the PTS/CTS or BTS” on page 18. The target NTP server configuration can also be a combination of NTP servers such as one HMC acting as NTP server and one Stratum 1 (GPS attached) NTP server as shown in Figure 1-84 on page 50.

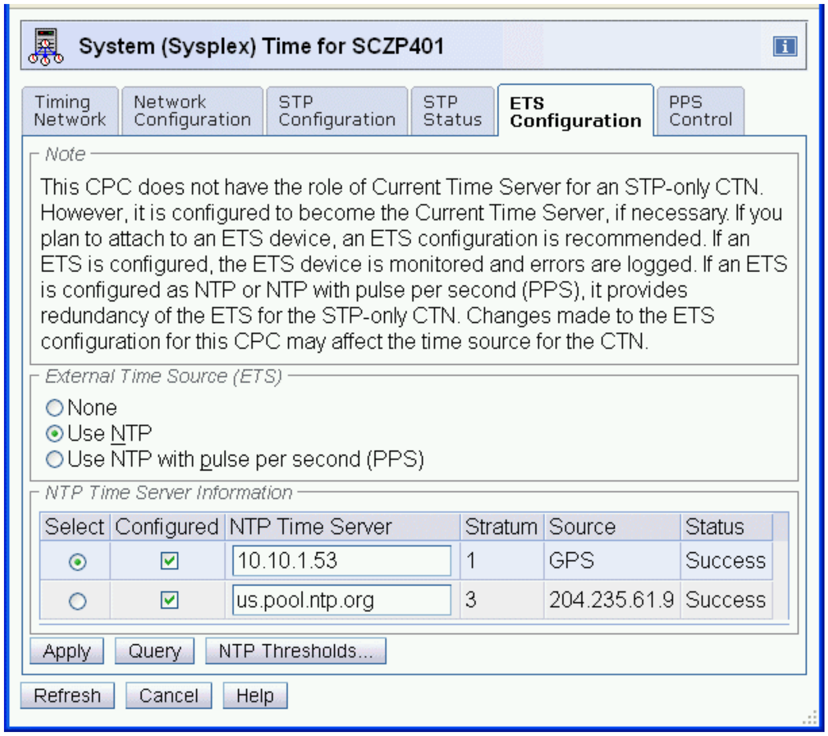


Figure 1-84 NTP server example

Upgrading the HMC to Version 2.12.0 or above

The starting configuration is an ETS dial-out setup that will be switched to NTP within an HMC version upgrade from 2.11.1 (or below) to HMC version 2.12.0 (or above). The HMC version upgrade itself is not within the scope of this section.

Because an HMC cannot have an antenna attached to it, the HMC can only become an NTP Stratum 2 ETS and does not provide the PPS capability.

Because the reconfiguration is done on the HMC that is currently providing the dial-out capability, the migration is going to interrupt the ETS synchronization. This will *not* impact the CTN operation. To remove the ETS dial-out operation on HMC, perform the following steps:

1. Delete the scheduled operation from all Support Elements that are currently configured to use the ETS dial-out capability. Select the servers to be changed, select **Operational Customization**, then select **Customize Scheduled Operations**. In the list of scheduled operations select all operations of type “Access external time source” (this might be multiple) and click **Options** and **Delete** (Figure 1-85 on page 51).

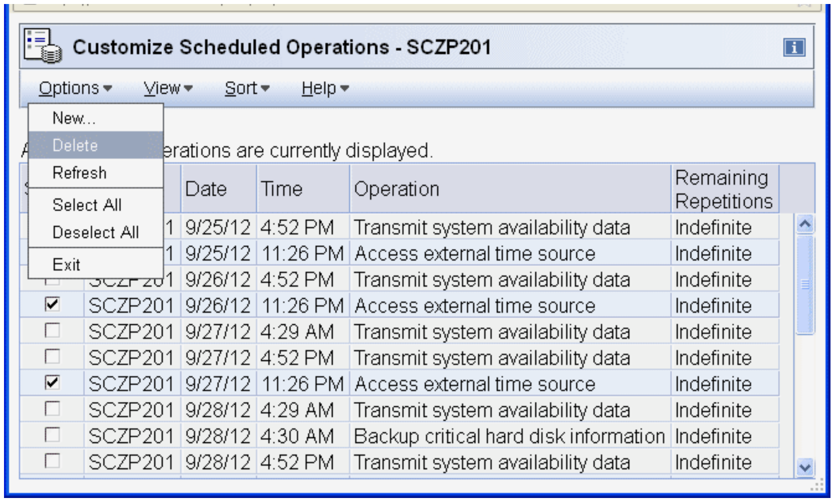


Figure 1-85 Delete dial-out scheduled operation

2. On the "Confirm the action" panel click **OK** (Figure 1-86).

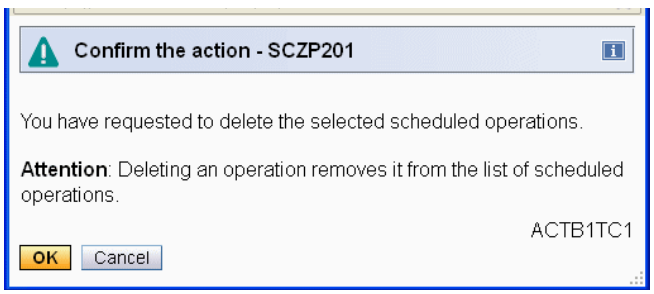


Figure 1-86 Delete scheduled operation confirmation

3. The final Customize Scheduled Operations panel confirms: there are no more access external time source scheduled operations to be executed (Figure 1-87).

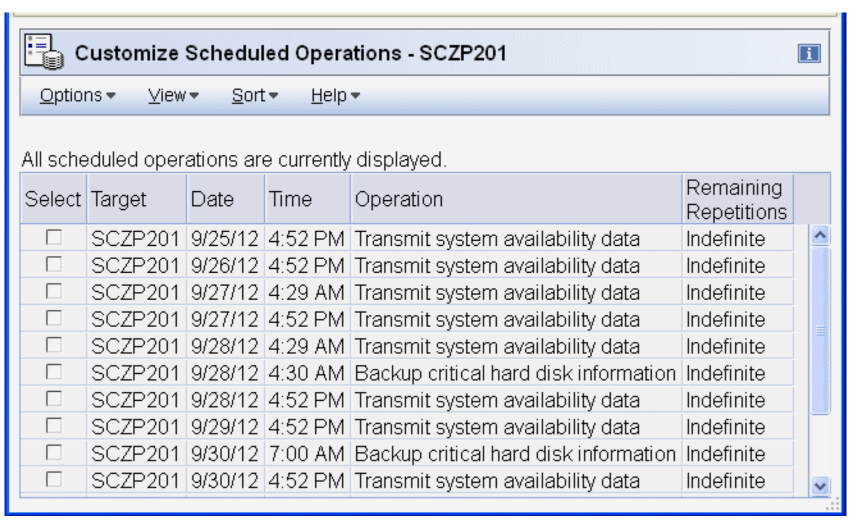


Figure 1-87 Customize Scheduled Operations - access external time source removed

Repeat this step for every Support Element that was set up to access the external time source. This is most likely the PTS and the BTS, but could theoretically be any server.

4. Have the IBM SSR perform the version update of the HMC. This upgrade removes the ETS dial-out capability of this HMC.
5. Set up the HMC to act as server. Follow the steps given in 1.2.2, “Configuring an NTP server on the HMC” on page 7. If there is another HMC that is planned to additionally provide the NTP server function, perform the same steps for that HMC. An example is shown in Figure 1-88.

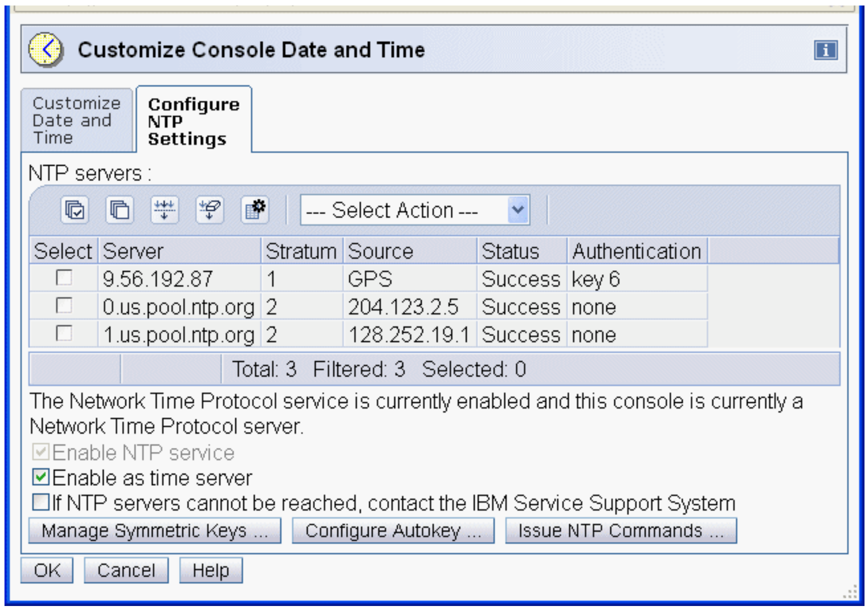


Figure 1-88 HMC NTP server example

6. Define the new NTP server to the Support Element of the Current Time Server. It is suggested to also configure the NTP server to the Support Element of all other servers that can become the CTS. This is typically the BTS, but can be any other server as well.

   For details refer to 1.2.5, “Configuring an NTP server on the PTS/CTS or BTS” on page 18. The target NTP server configuration can also be a combination of NTP servers such as one HMC acting as NTP server and one Stratum 1 (GPS attached) NTP server, as shown in Figure 1-89 on page 53.

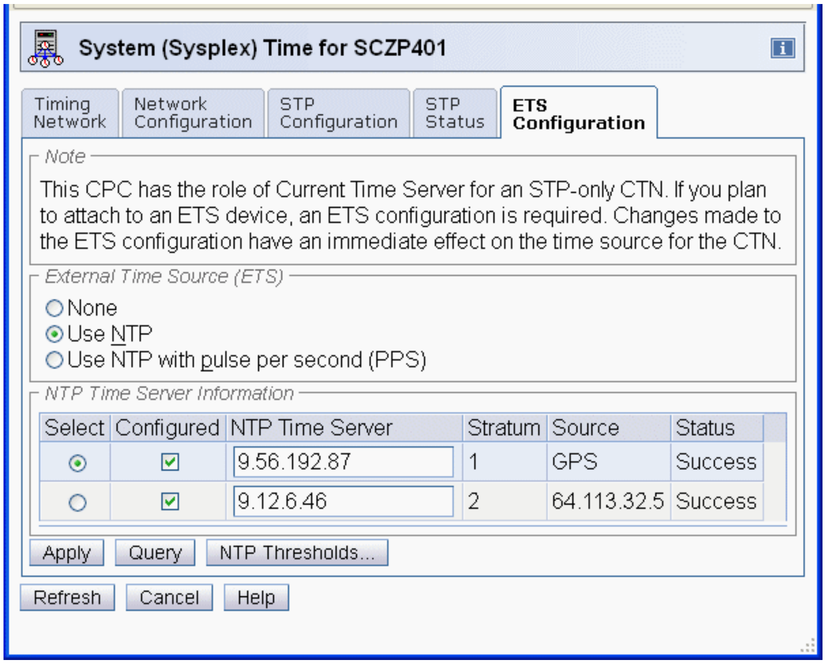


Figure 1-89 NTP server example

2

Migrating from ETR to STP-only CTN

In this chapter we describe how to migrate an existing External Timer Reference (ETR) network configuration to an STP-only CTN configuration and present the migration results. The starting point is an existing ETR network configuration consisting of one or more servers and Sysplex Timers. The intermediate status is a Mixed CTN, first in ETR timing mode, then in STP timing mode, preparing the migration to an STP-only CTN.

Important:

- An IBM System zEC12 server cannot be in the same CTN as z9 or previous servers.
- The IBM System z196 and z114 servers cannot be in the same CTN as z990 or z980.
- zEC12 will be the last server to support connections to a Mixed CTN

2.1 Overview

We assume that the Sysplex Timers are installed (optionally attached to an External Time Source) and that the time zone, leap seconds, date, and time have been set. The steps to configure an ETR network are not covered in this book. For details about how to do this, see *S/390 Time Management and IBM 9037 Sysplex Timer,* SG24-2070. We also assume that all servers or CFs that are going to join the CTN have a valid ETR Network ID configured and ETR connectivity already exists.

> **Important:**
>
> - An IBM System zEC12 server cannot be in the same CTN as z9 or previous servers.
> - The IBM System z196 and z114 servers cannot be in the same CTN as z990 or z980.
> - zEC12 will be the last server to support connections to a Mixed CTN.

A typical sequence for a migration from an ETR environment to an STP-only CTN consists of the following steps:

1. Configuring the CTN ID on each server already installed and part of the ETR network.

   Assigning the CTN ID makes the server STP configured in a Mixed CTN. This step must be repeated on each server that will participate in the CTN.

2. Optional: Changing the server timing mode for one server from ETR to STP.

   In a Mixed CTN, it is best for at least two Stratum 1 servers to be available during normal operations.

3. Adding a new server in STP timing mode.

   This is an optional step when a new server is added to the configuration without connection to the Sysplex Timer, and the server must be time synchronized with servers already configured in the Mixed CTN.

4. Migrating the Mixed CTN to an STP-only CTN.

This section only covers a typical implementation sequence. Part 3, “Migration scenarios” on page 263 provides step-by-step installation and migration examples.

2.2 Configuring the CTN ID

Figure 2-1 shows the migration scenario for this chapter.

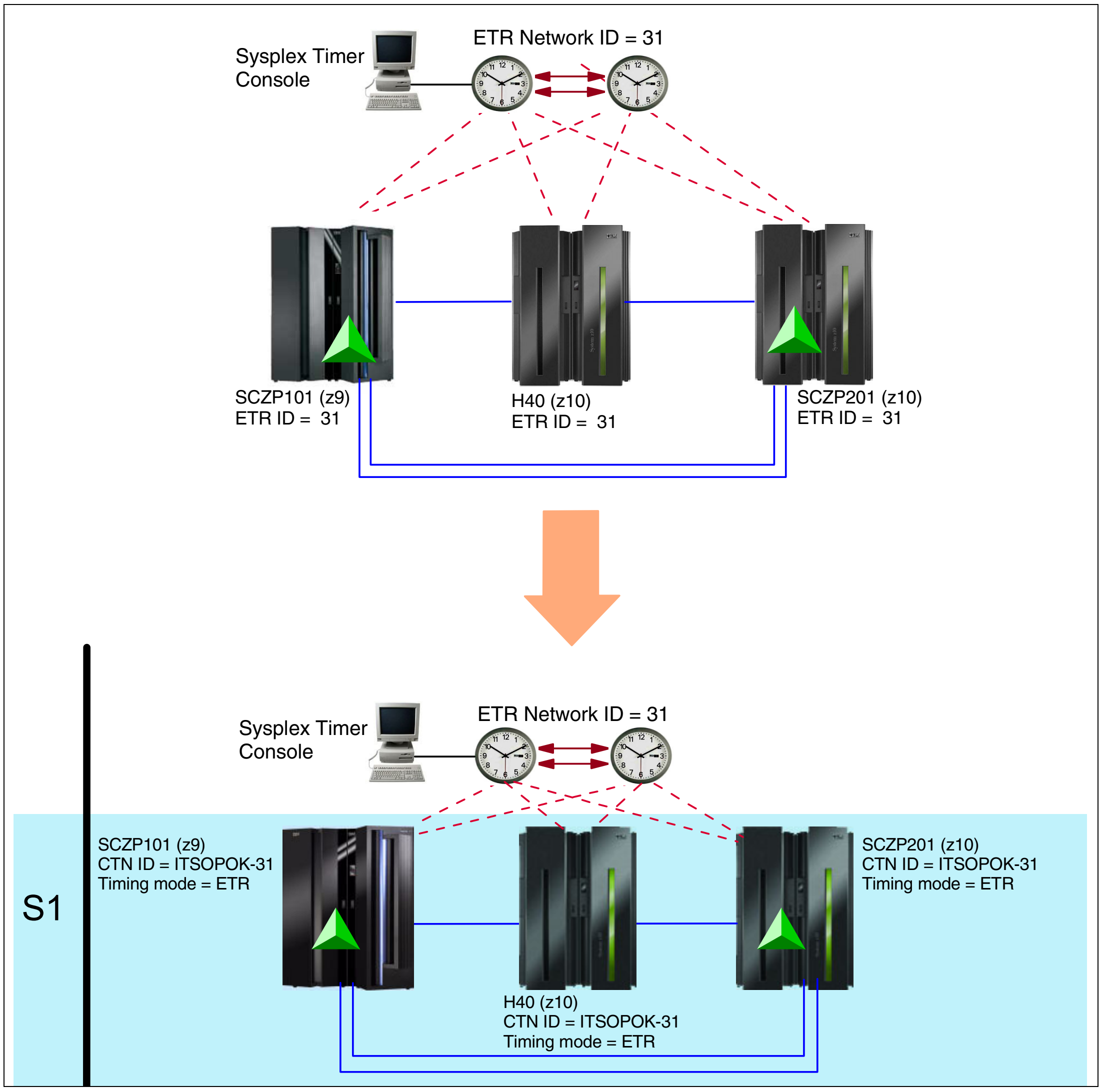


Figure 2-1 Migration step 1 - Configuring the CTN ID on each server

The CTN ID is an identifier that is used to indicate that the server has been configured to be part of a CTN.

The CTN ID has the format [STP Network ID] - [ETR Network ID] and is the basis for the establishment of the Coordinated Timing Network. The format of these fields is:

```
CTN ID = “cccccccc - xx”
```

Where *cccccccc* is the STP Network ID and *xx* is the ETR Network ID:

- The STP network ID is case sensitive and is one to eight characters. The valid characters are A – Z, a – z, 0 – 9, -, and _.
- The ETR Network ID is a numeric value ranging between 0 and 31.

For a Mixed CTN, we assume that the ETR Network ID is already set (Figure 2-3 and Figure 2-4 on page 59). If the ETR ID is blank, the server is not part of an existing ETR network.

To configure a Mixed CTN, the starting point is at least one STP-enabled server, synchronized to a Sysplex Timer. In this example, a server named SCZP201 is used. The server is STP-enabled and has ETR ports enabled. The System (Sysplex) Timer task displays all STP and ETR tabs.

The Timing Network tab (Figure 2-2) indicates that the server is in an ETR network, with ETR Network ID = 31.

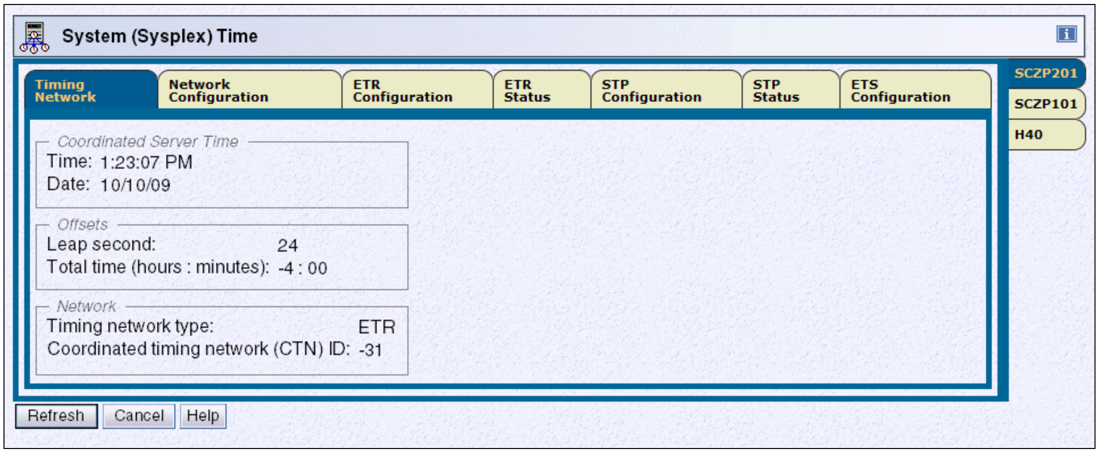


Figure 2-2 Timing Network tab - ETR network

> **Important:** When two or more servers are selected in the System (Sysplex) Time task, it is necessary to click **Refresh** to update the displayed configuration information for *all* servers.

The ETR Configuration window (Figure 2-3) and the ETR Status window show that connections to the Sysplex Timer are operational.

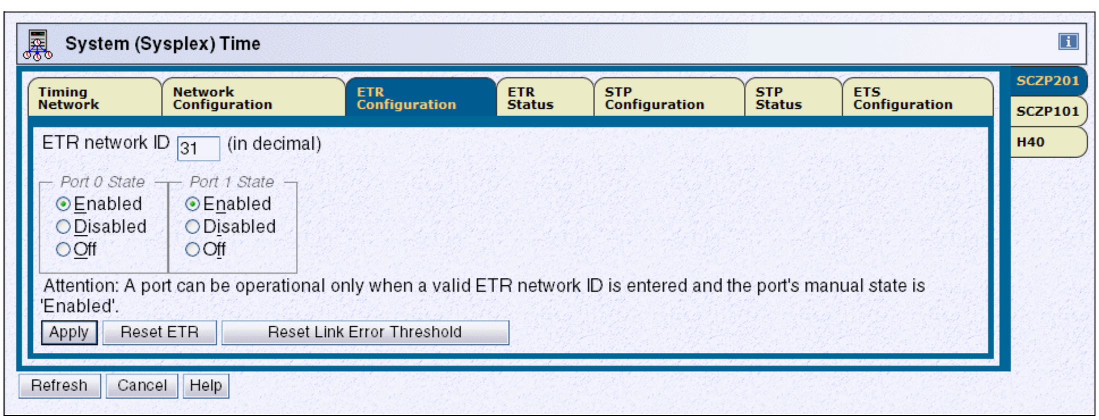


Figure 2-3 ETR Configuration tab

Figure 2-4 shows the ETR Status.

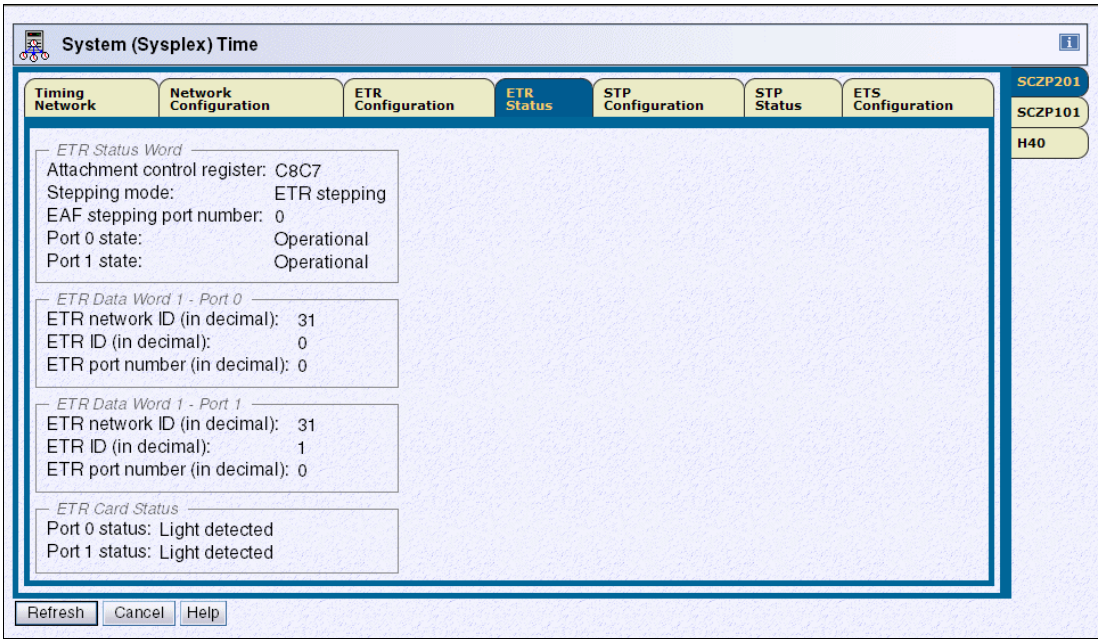


Figure 2-4 ETR Status tab: ETR network

2.2.1 Setting the STP network ID

Applying the STP network ID on an STP-enabled server configures the server STP and activates the Mixed CTN. The STP network ID is entered in the STP Configuration tab (Figure 2-5). This is a *local* change and is only effective for this server (SCZP201).

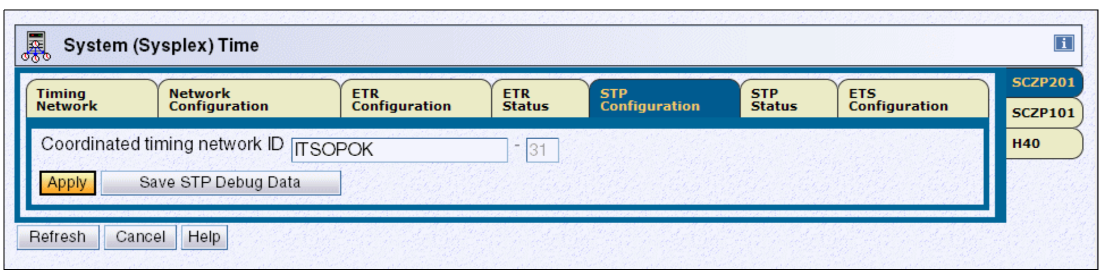


Figure 2-5 STP Configuration tab

When you click **Apply**, the HMC issues a confirmation message (Figure 2-6). Although the message indicates that the server is joining a Mixed CTN, adding the STP Network ID on the first server activates the Mixed CTN.

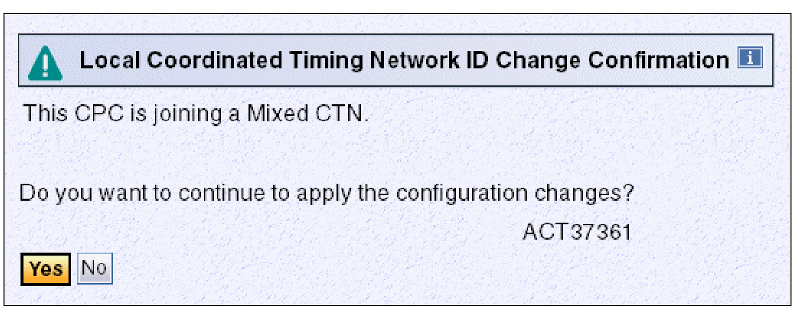


Figure 2-6 Message ACT37361 - Local Coordinated Timing Network ID Change Confirmation

Clicking **Yes** on the confirmation message displays the ACT37315 message (Figure 2-7).

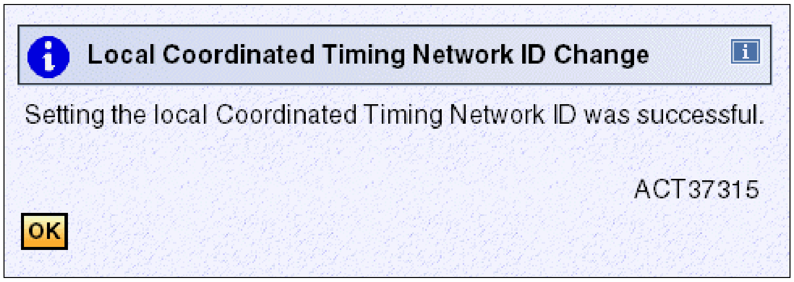


Figure 2-7 Message ACT37315 - Local Coordinated Timing Network ID Change

The server is now STP configured and participates in a Mixed CTN.

Verification on the HMC

To verify the successful configuration of the Mixed CTN, select the **Timing Network** tab.

As shown in Figure 2-8, the Network section indicates that the timing network type is a Mixed CTN. The CTN ID comprises both the STP network ID [ITSOPOK] and the ETR Network ID [31]. The CTN time source indicates a *Sysplex Timer connection*.

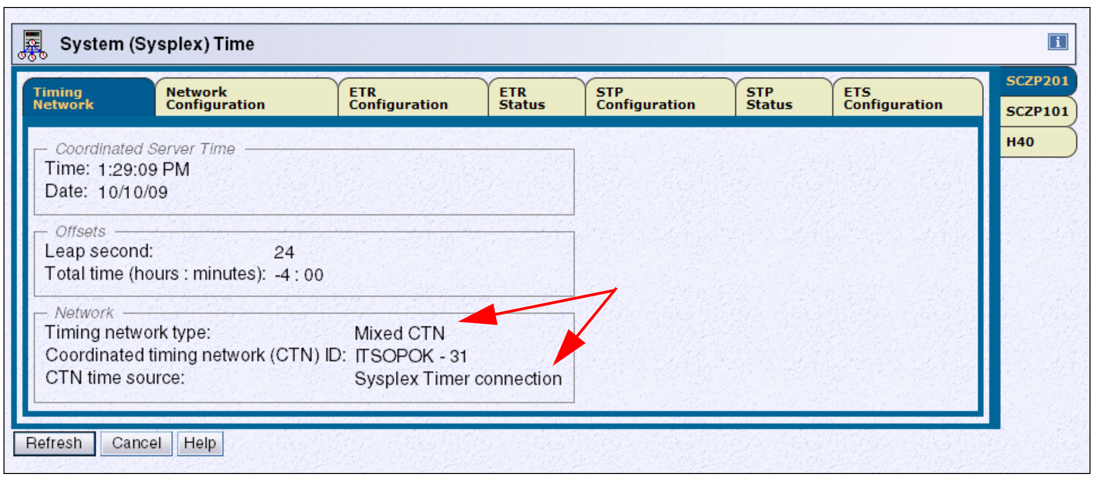


Figure 2-8 System (Sysplex) Time - Timing Network tab

The STP Status tab for SCZP201 (Figure 2-9) now shows that the server is in ETR timing mode and is a Stratum 1. Notice that in the System Information section there are no STP links initialized yet because, at this point, there is only one server that is STP configured. Coupling links only initialize for STP when servers at *both* ends of the link are STP configured with the same CTN ID.

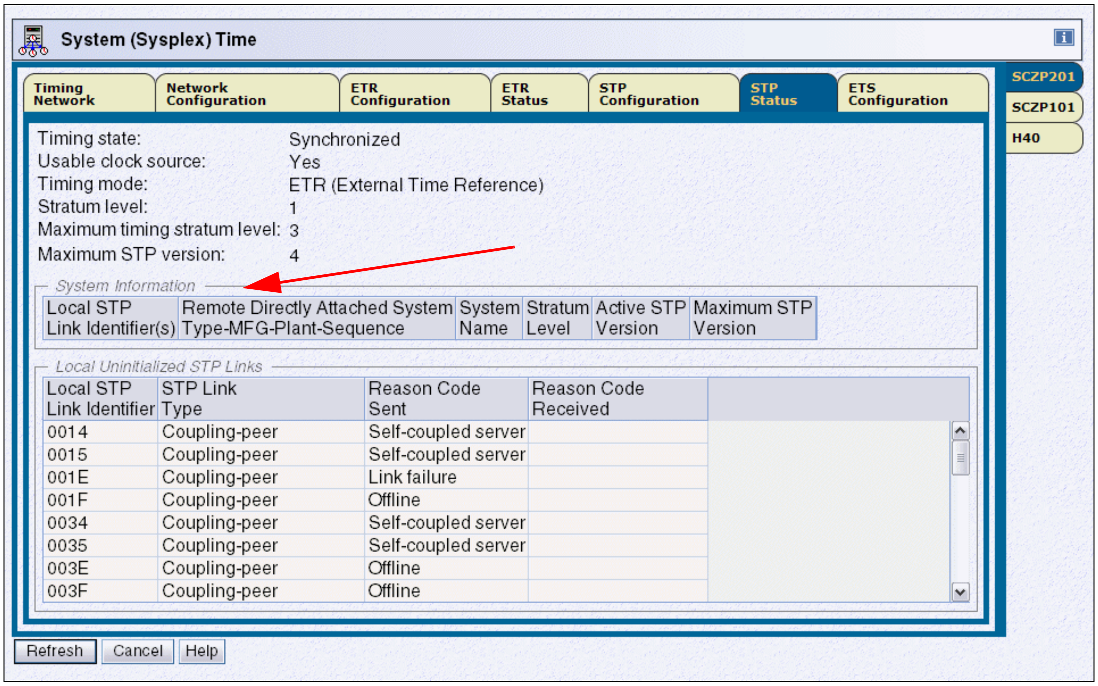


Figure 2-9 STP Status tab - SCZP201

Verification in z/OS

On a z/OS image on SCZP201, the DISPLAY ETR command yields the z/OS message IEA282I, which now indicates the CTN ID in the last line shown in Example 2-1. The output also shows the synchronization mode, along with the ETR port details.

Example 2-1 DISPLAY ETR command and response in ETR mode

```
D ETR
IEA282I 13.31.58 TIMING STATUS 504
SYNCHRONIZATION MODE = ETR
  CPC PORT 0    <== ACTIVE       CPC PORT 1
  OPERATIONAL                    OPERATIONAL
  ENABLED                        ENABLED
  ETR NET ID=31                  ETR NET ID=31
  ETR PORT=00                    ETR PORT=00
  ETR ID=00                      ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Once the CTN has been activated and connectivity has been established where necessary, other servers can join this CTN by configuring them with the same CTN ID.

2.2.2 Configuring other servers

Other STP-enabled servers or CFs can be STP configured to join the Mixed CTN. Making each server STP configured is accomplished in exactly the same way as configuring the server in the previous step.

Servers or CFs with active links to a Sysplex Timer are still running in ETR timing mode. To avoid a single point of failure in the CTN, have at least two Stratum 1 servers available during normal operations.

The server or CF must be STP configured with the same CTN ID. This is done from the STP configuration window (Figure 2-10). In this example, a z990 server named SCZP101 that is already part of ETR network [31] is being configured to join the CTN [ITSOPOK] - [31] that was activated in the previous step.

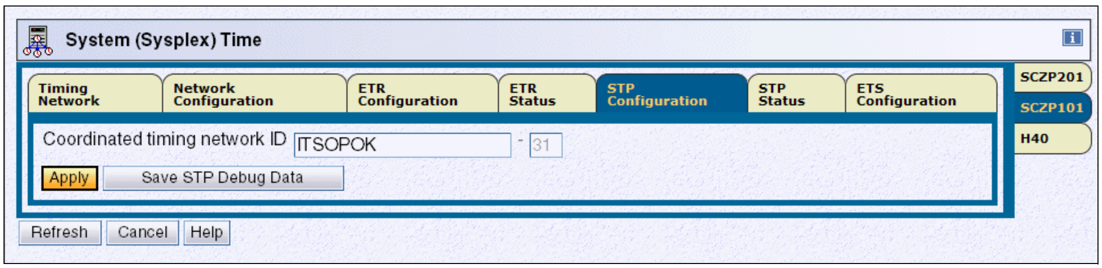


Figure 2-10 STP Configuration tab - SCZP101

When you click **Apply**, confirmation message ACT37361 is issued (Figure 2-6 on page 59). Clicking **Yes** in the confirmation message displays ACT37315 (Figure 2-7 on page 60).

The server is now STP configured with CTN ID = [ITSOPOK] - [31].

Verification on the HMC

The server STP configuration can be verified from the Timing Network tab (Figure 2-11).

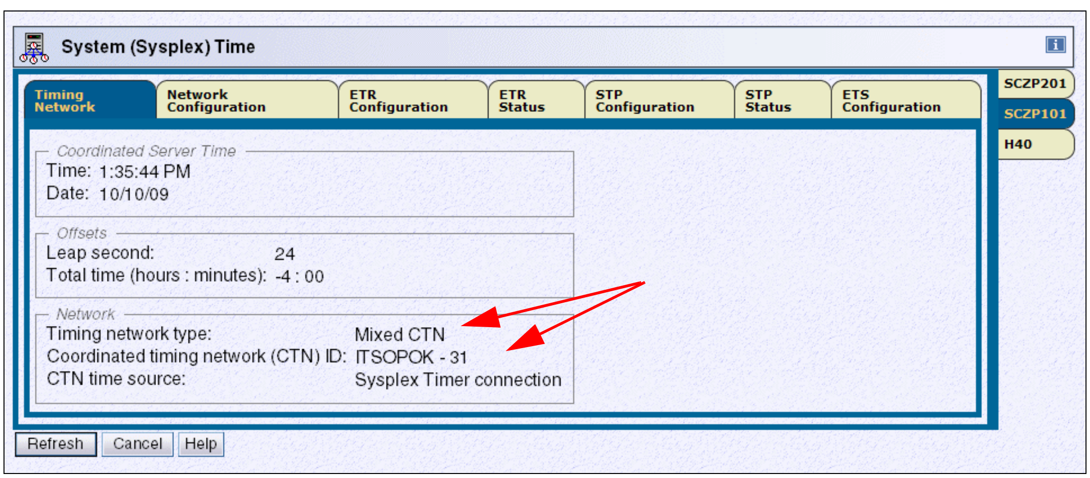


Figure 2-11 Timing Network tab - SCZP101

The Timing network type now indicates that the server is a member in a Mixed CTN, with the Coordinated Timing Network ID = [ITSOPOK] - [31].

The STP Status window (Figure 2-12) indicates that the server timing mode is still ETR.

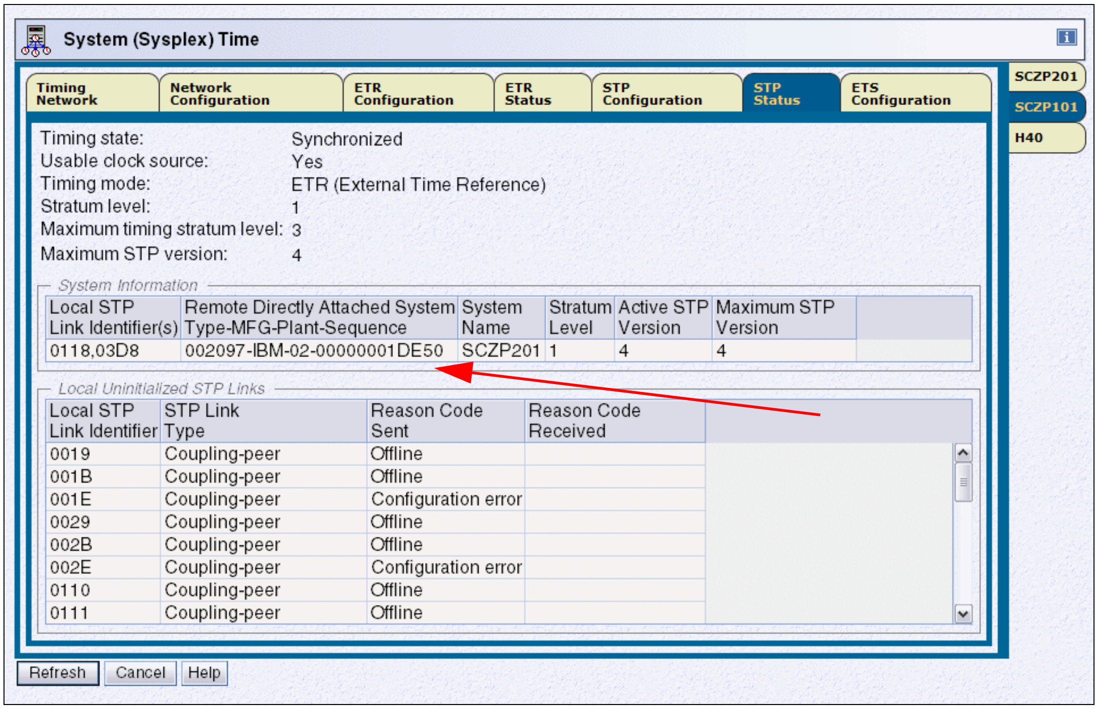


Figure 2-12 STP Status tab - SCZP901

If the server or CF added has coupling link connectivity to the first server configured in the Mixed CTN (SCZP201 in our example), the STP Status tab also reflects the fact that coupling links are initialized for STP because both ends of the link are configured. Similar information is now reflected on the STP Status tab at the other end of the links on server SCZP201.

Verification in z/OS

In the z/OS image on SCZP901, the response to the DISPLAY ETR command yields z/OS message IEA282I, which indicates the CTN ID (Example 2-2). The message also indicates the synchronization mode along with the ETR details.

Example 2-2 DISPLAY ETR command and response in ETR mode

```
D ETR
IEA282I 13.38.18 TIMING STATUS 570
SYNCHRONIZATION MODE = ETR
  CPC PORT 0    <== ACTIVE        CPC PORT 1
  OPERATIONAL                     OPERATIONAL
  ENABLED                         ENABLED
  ETR NET ID=31                   ETR NET ID=31
  ETR PORT=01                     ETR PORT=01
  ETR ID=01                       ETR ID=00
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Other STP-enabled servers or CFs synchronized in the same ETR network (using the same ETR Network ID) can be configured into the Mixed CTN using the same method.

2.3 Changing the server timing mode

Figure 2-13 illustrates the migration scenario for this section.

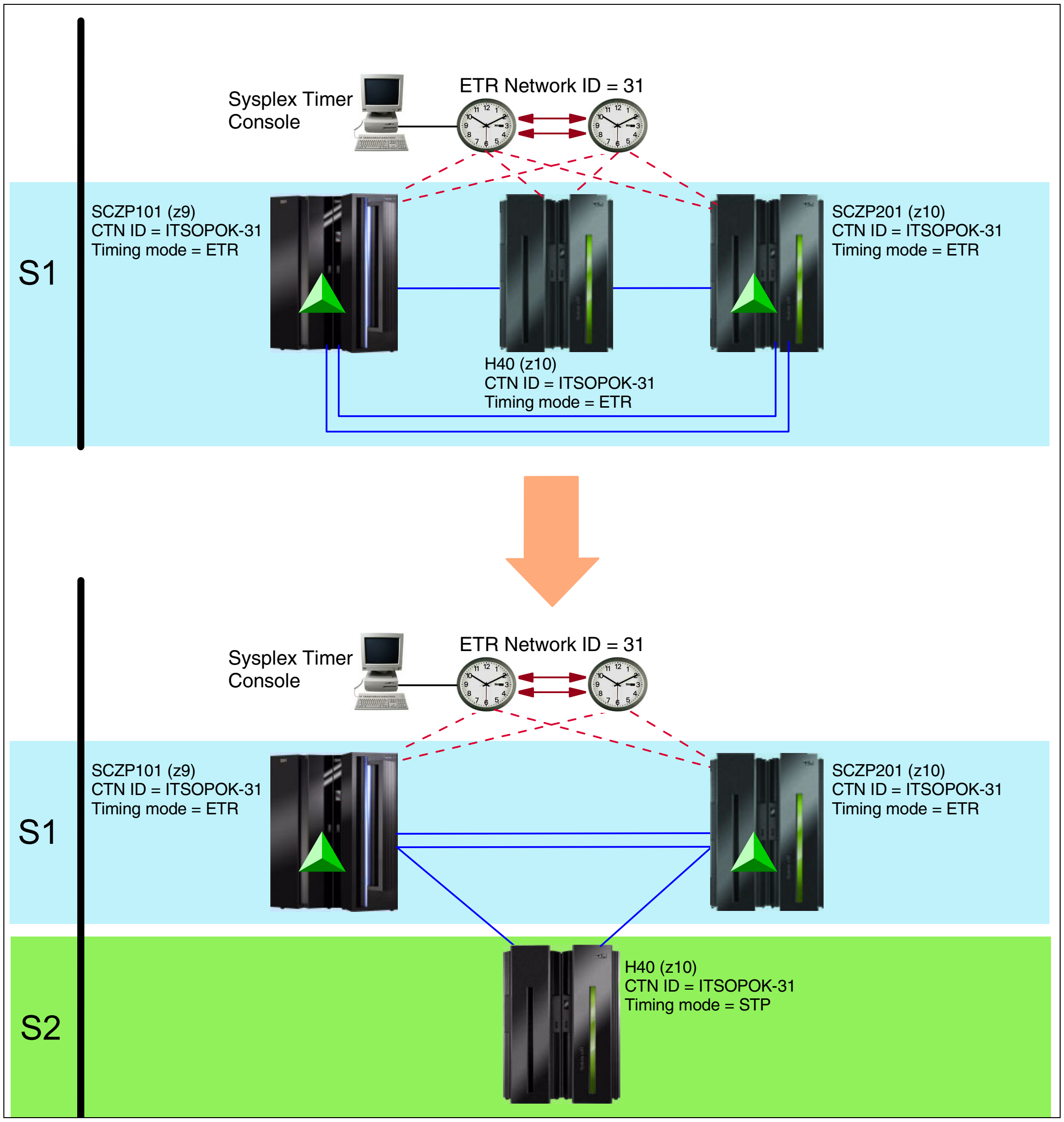


Figure 2-13 Migration step 2 - Changing the server timing mode for one server from ETR to STP

A Mixed CTN always uses a Sysplex Timer as its time source. However, certain servers in a Mixed CTN can be configured to be synchronized directly to the Sysplex Timer (in ETR timing mode), and certain servers can be synchronized using STP messages (STP timing mode).

Changing the timing mode from ETR to STP can be considered as a first step of a phased migration to an STP-only CTN. Alternatively, the Mixed CTN can be migrated to an STP-only CTN in a one-step operation.

Note: As long as the configuration stays a Mixed CTN, the Sysplex Timer is the CTN time source and at least one server *must* remain in ETR timing mode.

To eliminate a single point of failure, leave at least two servers in ETR timing mode. For the same reason, it is a good idea for servers in STP timing mode to be connected by coupling links to at least two servers.

Changing a server from ETR to STP timing mode

The procedure described in this section shows how to migrate a server from ETR to STP timing mode.

The server or CF to be configured to STP timing mode needs to have coupling link connectivity to other STP configured servers in the CTN so that STP messages can be exchanged. Remember that this procedure cannot be used for the last server within the CTN (or rather, with the last two servers, because in a Mixed CTN it is good practice to preserve two Stratum 1 servers, which remain in ETR timing mode).

> **Important:** You must *not* disable the ETR ports on the last Stratum 1 server because this removes the time source for the entire Mixed CTN.

Disabling the ETR ports on a server causes the server to switch to STP timing mode if there is STP connectivity to another Stratum 1 or Stratum 2 server in the same CTN.

In our example, a third server named H40 in ETR timing mode has been added to the CTN by following the procedure described in 2.2.2, "Configuring other servers" on page 62. The ETR ports of server H40 will be disabled to show the change of the timing mode.

Before disabling the ports, the attached system's connectivity must be verified from the STP Status tab. The ETR ports of the server H40 are enabled and operational, and the server is therefore currently in ETR timing mode.

The ETR ports are to be disabled from the ETR Configuration tab. Figure 2-14 shows the ETR ports being disabled for server H40.

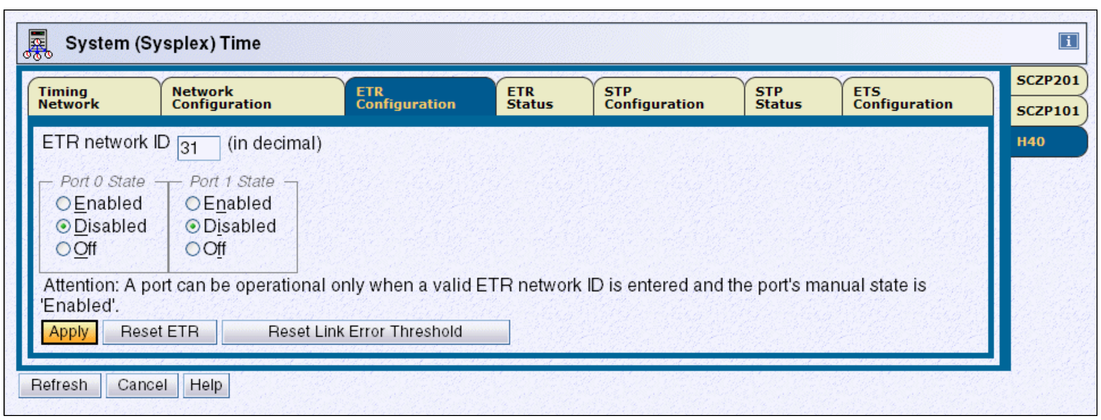


Figure 2-14 System (Sysplex) Time - ETR Configuration tab

When you click **Apply**, the Port State Change Confirmation message ACT37388 displays (Figure 2-15).

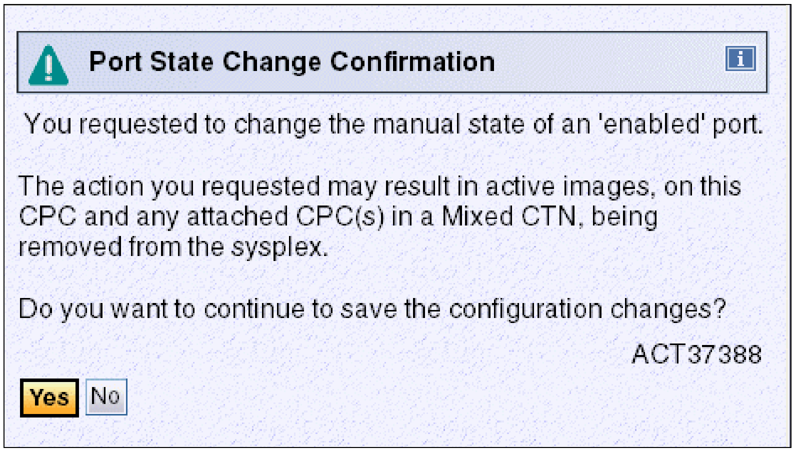


Figure 2-15 Message ACT37388 - Port State Change Confirmation

Click **Yes** and the message ACT37301 displays (Figure 2-16).

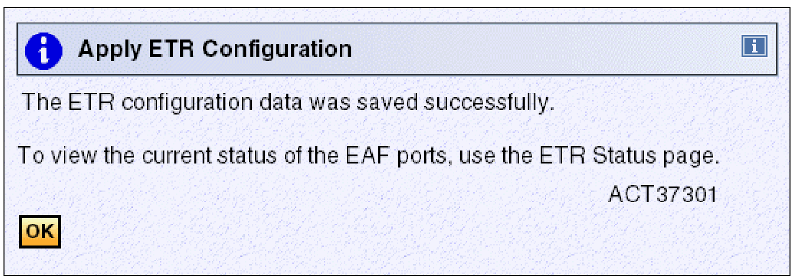


Figure 2-16 Message ACT37301 - Apply ETR Configuration

The change from ETR to STP timing mode can be reversed. Returning the server to ETR timing mode is accomplished by enabling the ETR ports from the ETR Configuration tab. This causes the server to change back to ETR timing mode.

Verification on the HMC

The timing mode after the ports are disabled can be checked using the STP Status tab. Figure 2-17 shows the results for the H40 server:

- The timing mode changed from ETR to STP.
- The Stratum level changed from Stratum 1 to Stratum 2.

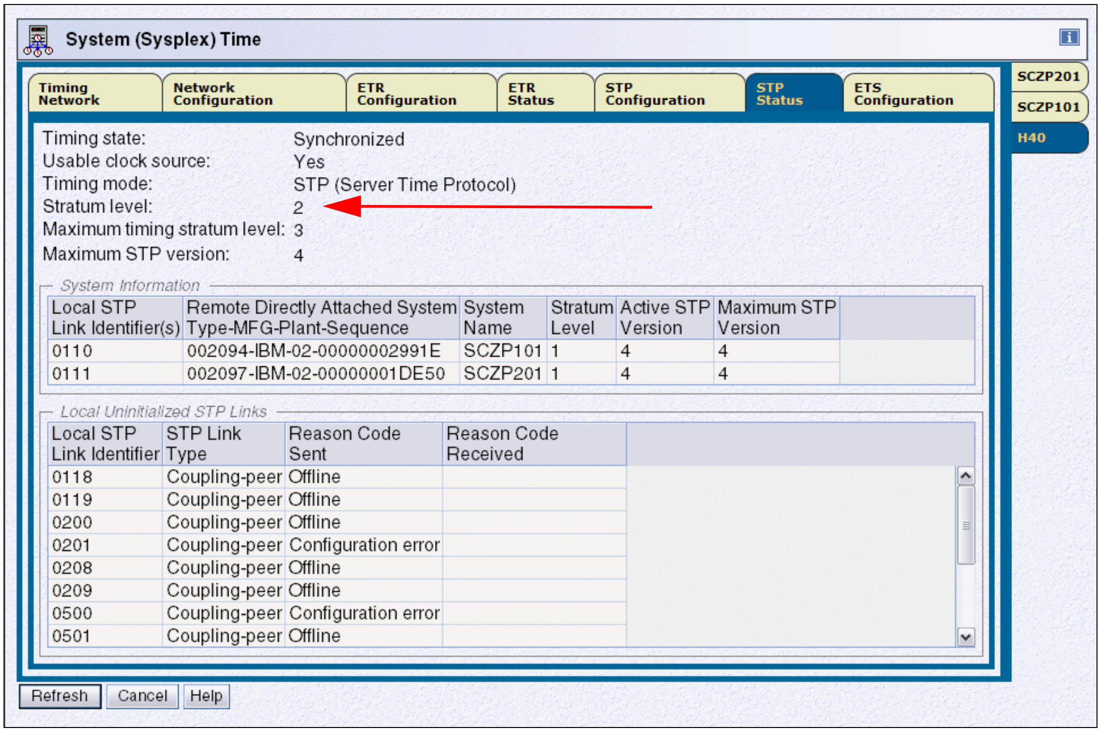


Figure 2-17 STP Status tab - STP timing mode (Stratum 2)

From z/OS

When its server is switched from ETR to STP timing mode, the response to the DISPLAY ETR command on a z/OS image on H40 shows key differences (Example 2-3):

- The message number changes from IEA282I (ETR) to IEA386I (STP).
- Synchronization mode now indicates STP.
- The Stratum level is shown.
- The number of usable timing links[1] displays.
- No ETR information displays.

Example 2-3 DISPLAY ETR command and response in STP mode

```
D ETR
IEA386I 13.54.37 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK -31
  NUMBER OF USABLE TIMING LINKS =  2
```

[1] The number of usable timing links for STP timing mode synchronization is given only on a non-Stratum 1 CEC because the Stratum 1 server does not need this information (Example 2-5 on page 76).
There are additional messages if the server has less than two timing links to each of its potential timing sources.
If the server has only one usable timing link, the following message displays:
--> IEA382I THIS SERVER HAS ONLY ONE LINK AVAILABLE FOR TIMING PURPOSES
If the server has timing link connections to only one server with a higher stratum, the following message displays:
--> IEA383I THIS SERVER RECEIVES TIMING SIGNALS FROM ONLY ONE NETWORK NODE

2.4 Adding a new server in STP timing mode

Figure 2-18 illustrates the migration scenario for this section.

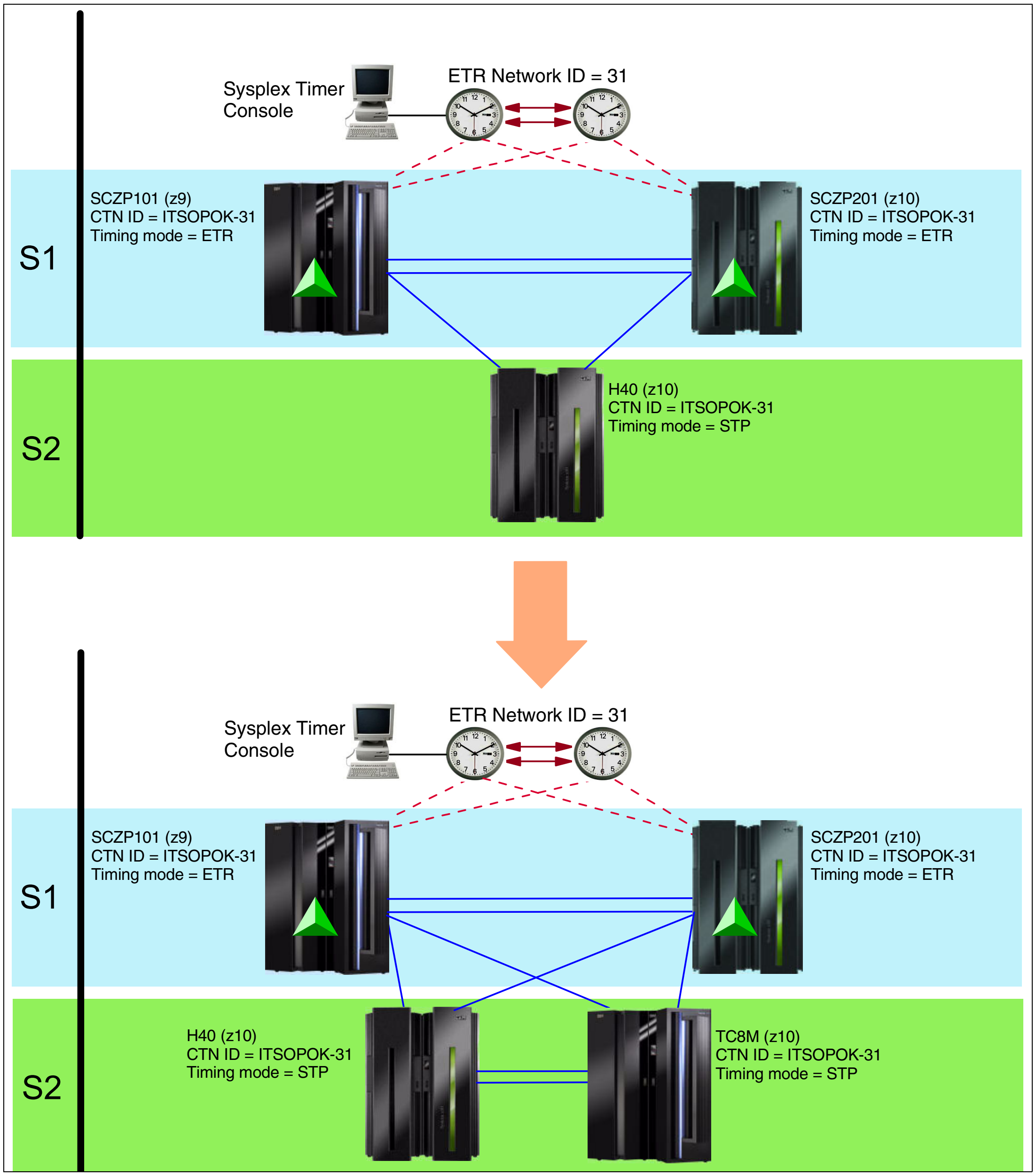


Figure 2-18 Migration step 3 - Adding a new server in STP timing mode

Once the Mixed CTN has been configured, new servers can be added to the configuration. If STP is enabled, the new server can be configured to join the CTN. This is always done by setting the CTN ID on the new server. Even when the new server is not connected to the Sysplex Timer, it can be configured to join the Mixed CTN using STP timing mode. The server or CF to be added needs to have coupling link connectivity to other STP-configured servers in the CTN so that STP messages can flow between servers.

The addition of a new server is accomplished by defining its CTN ID to match the CTN ID already in use by the Mixed CTN.

Setting the CTN ID is done using one of the following methods, depending on whether the server to be added has ETR ports installed:

- If the server has ETR ports installed, the CTN ID is defined in two steps:
  a. Enter the ETR Network ID on the ETR Configuration tab.
  b. Enter the STP ID on the STP Configuration tab.
- If the server does not have ETR ports installed, the System (Sysplex) Time task does not display the ETR tabs. In this case, the CTN ID is defined by entering both the STP ID and the ETR Network ID on the STP Configuration tab.

The configuration presented is a Mixed CTN consisting of servers SCZP101, SCZP201, and H40. Server TC8M is added to this CTN using STP timing mode.

From the ETR Configuration tab

If the new server has ETR ports installed, definition of the ETR Network ID is done from the ETR Configuration tab.

From the ETR Configuration tab, set both the Port 0 and Port 1 states to Disabled and enter the ETR Network ID to match that of the existing Mixed CTN. When you click **Apply**, the CTN ID for the server becomes [ ] - [31], in line with the value already defined in our example Mixed CTN (Figure 2-19).

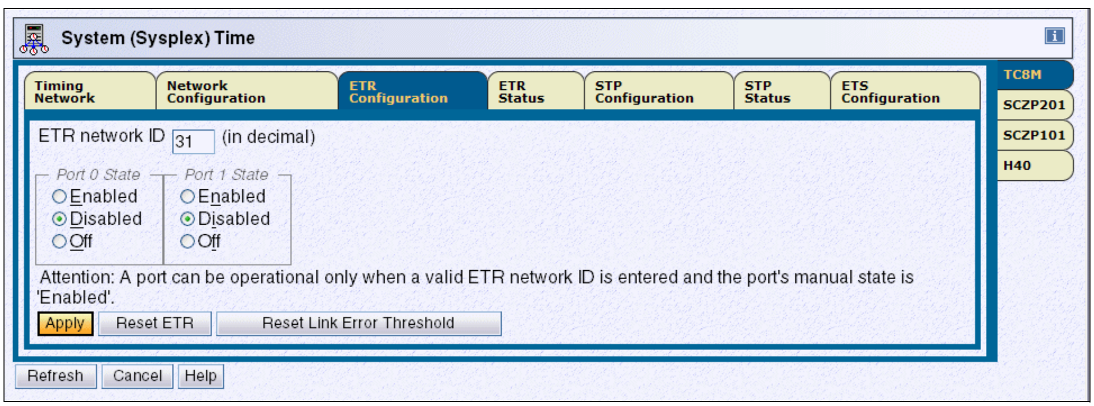


Figure 2-19 ETR Configuration tab - Define ETR Network ID

From the STP Configuration tab

If the ETR Network ID has already been defined from the ETR Configuration tab, enter only the STP ID. The ETR Network ID field is read only. It displays the value entered in the previous step (Figure 2-20).

If the ETR Network ID has not been defined from the ETR Configuration tab because the server does not have an ETR feature:

1. Enter the STP ID value in the STP ID part of the CTN ID ([ITSOPOK] in our example).
2. Enter the ETR Network ID value in the ETR Network ID part of the CTN ID ([31] in our example).

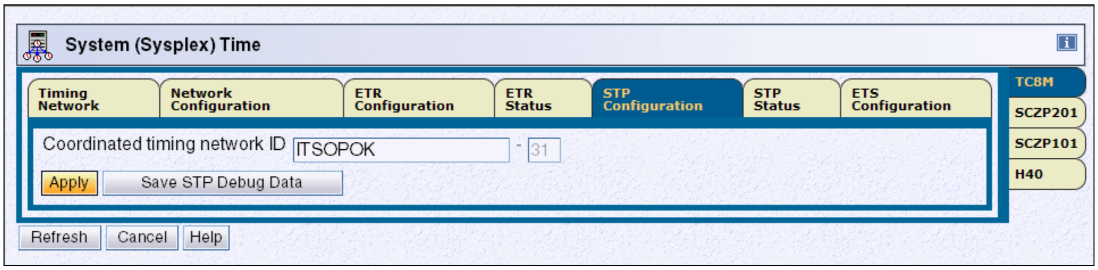


Figure 2-20 STP Configuration tab - Define STP ID

When you click **Apply**, the CTN ID for the server becomes [ITSOPOK] - [31], which is in line with the value defined for the Mixed CTN. If the server has coupling link connectivity to other Stratum 1 or Stratum 2 servers in the Mixed CTN, STP automatically joins the server to the Mixed CTN.

Chapter 12, “Mixed CTN: Adding a server in STP timing mode” on page 321, provides a detailed example.

2.5 Migrating from Mixed CTN to an STP-only CTN

Figure 2-21 illustrates he migration scenario for this section.

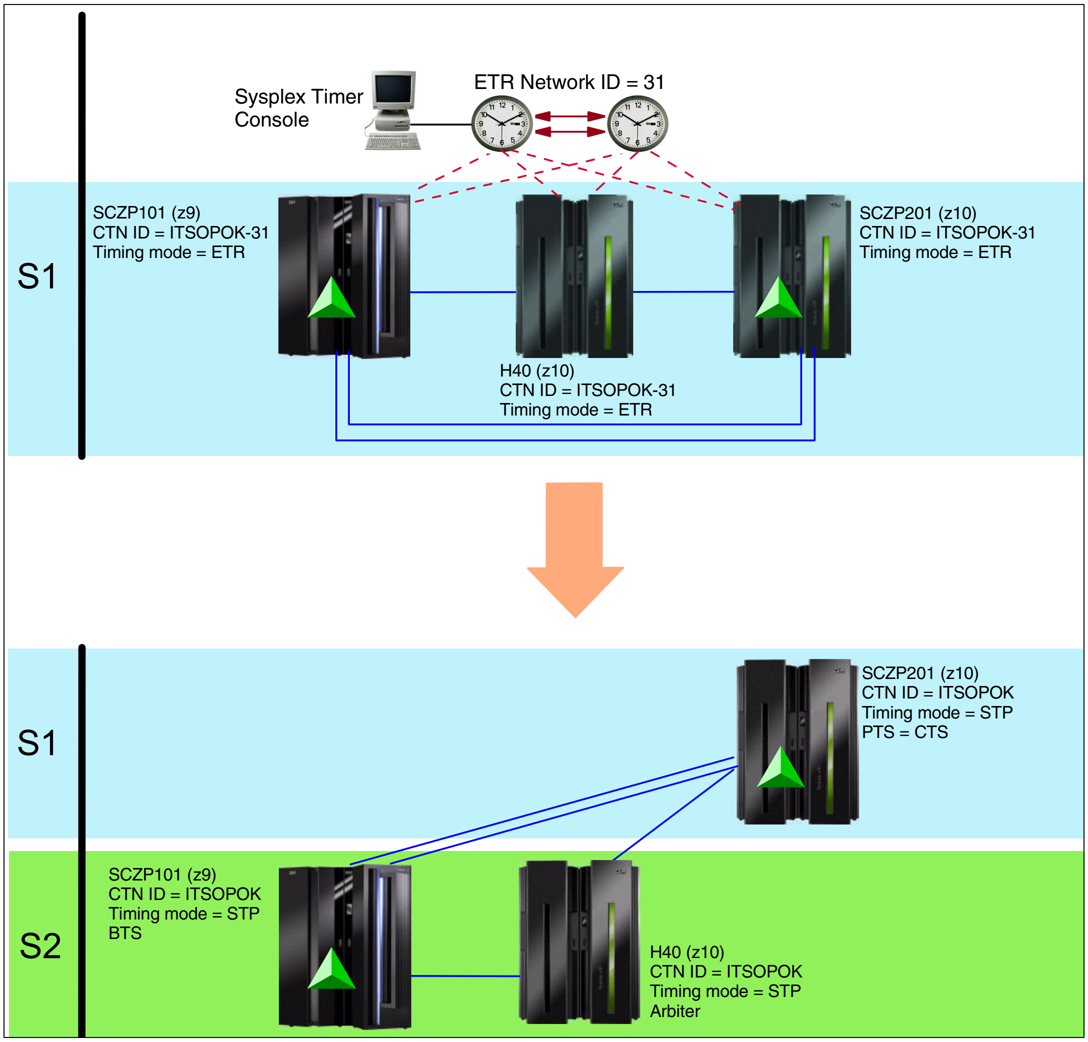


Figure 2-21 Migration step 4 - Migrating the Mixed CTN to an STP-only CTN

The final migration step is a global step that changes the entire CTN from a Mixed CTN to an STP-only CTN. All servers are in ETR timing mode and are migrated to STP timing mode in one single step.

Once migration is complete, only the STP network ID remains in the CTN ID.

2.5.1 Assigning CTN roles

The roles are assigned from the Network Configuration tab. This task must be accomplished from the server that will become the Current Time Server (CTS) in the STP-only CTN.

Assigning server roles is a global change to the CTN. It causes the CTN to transition from a Mixed CTN to an STP-only CTN.

For each of the roles—Preferred Time Server (PTS), Backup Time Server (BTS), and Arbiter—there are drop-down boxes listing the servers that can be selected. The roles being assigned require server connectivity through coupling links:

- The BTS must have connectivity to the PTS and to the Arbiter if one is being configured.
- An Arbiter cannot be configured without a BTS. The Arbiter must have connectivity to the PTS and to the BTS.

Any attempt to assign a role to a server that does not have the required connectivity to the other configured roles fails unless the Force configuration option is used.

Select the PTS, the BTS, and the Arbiter if one is available. Select either the Preferred Time Server or Backup Time Server to be the Current Time Server and click **Apply**.

Figure 2-22 shows a target configuration where SCZP201 is assigned the PTS and CTS roles, SCZP101 is assigned the BTS role, and H40 is the Arbiter. All servers are participating in a Mixed CTN with CTN ID [ITSOPOK] - [31], as indicated by the Coordinated timing network ID field at the bottom of the window.

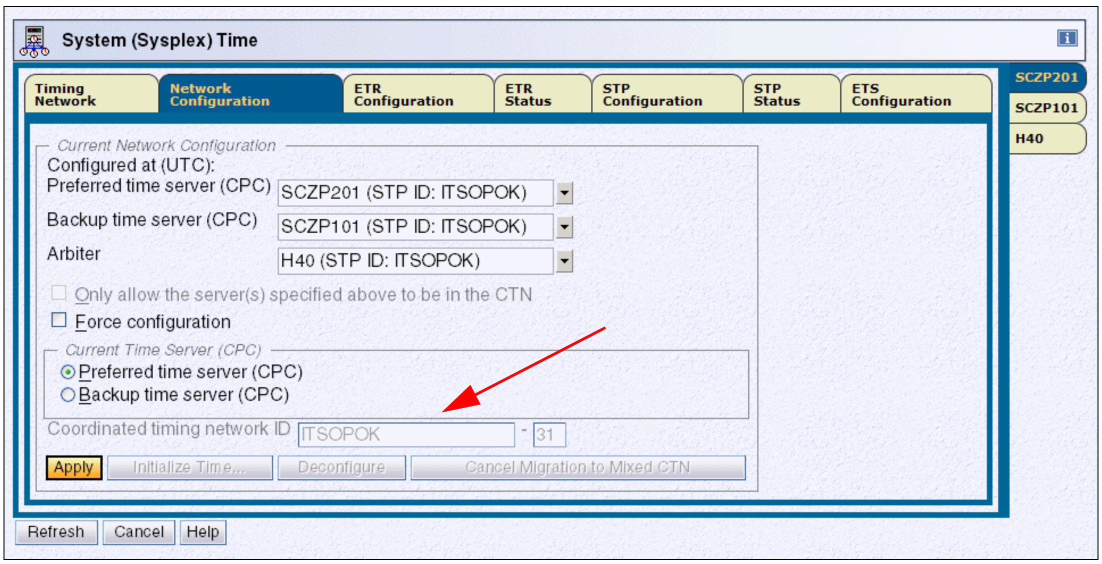


Figure 2-22 Network Configuration tab - Mixed CTN to STP-only CTN

When the configuration request is issued, the Global Timing Network ID Change Confirmation message ACT37355 displays (Figure 2-23).

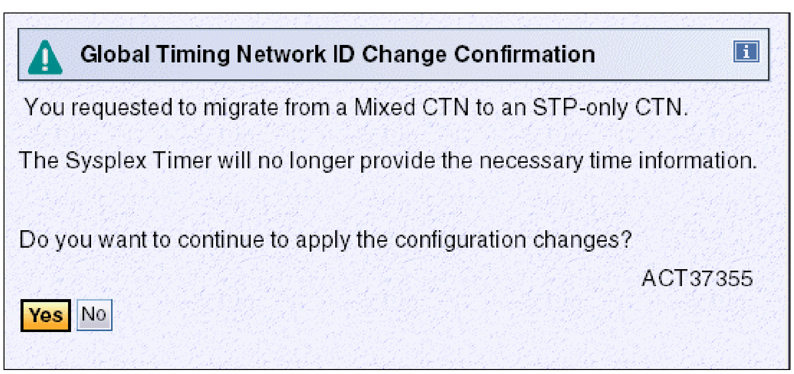


Figure 2-23 Message ACT37355 - Global Timing Network ID Change Confirmation

Click **Yes**. The process takes several seconds and then message ACT37341 displays (Figure 2-24).

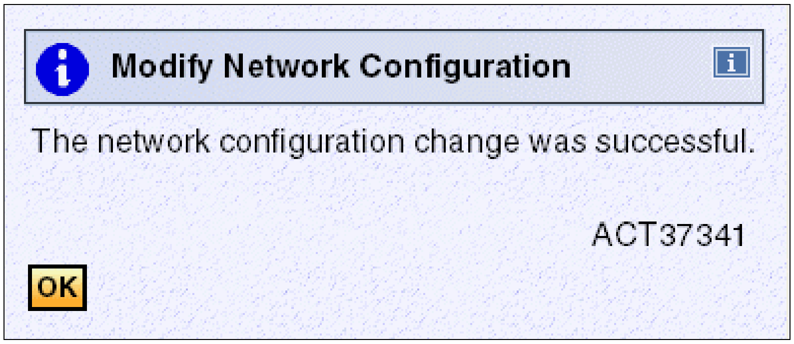


Figure 2-24 Message ACT37341 - Modify Network Configuration successful

The migration from a Mixed CTN to an STP-only CTN is also reflected by the z/OS system images on the servers (Example 2-4). The example shows the z/OS messages for three system images on servers being migrated.

Because every system image goes through a CTN ID change, there is a short period of time where XCF notes a synchronization discrepancy. This is indicated by XCF message IXC439E. This can be considered normal during a migration from a Mixed CTN to an STP-only CTN. The final message IXC435I informs you of the successful CTN ID change.

Example 2-4 Syslog message flow during STP-only activation

```
-> SC74 (running on SCZP201)
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
*IEA393I ETR PORT 0 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
*IEA393I ETR PORT 1 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.
 IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 854
         FOR SYSTEM: SC74
         PREVIOUS CTNID:   ITSOPOK -31
         CURRENT  CTNID:   ITSOPOK
*IXC439E ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOT SYNCHRONIZED 855
         TO THE SAME TIME REFERENCE.
        SYSTEM: SC74  IS USING CTNID: ITSOPOK
        SYSTEM: SC75  IS USING CTNID: ITSOPOK -31
        SYSTEM: SC73  IS USING CTNID: ITSOPOK -31

-> SC75 (running on SCZP101)
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
*IEA393I ETR PORT 0 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
*IEA393I ETR PORT 1 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 25
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 0B
 IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 640
         FOR SYSTEM: SC75
         PREVIOUS CTNID:   ITSOPOK -31
         CURRENT  CTNID:   ITSOPOK
*IXC439E ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOT SYNCHRONIZED 641
         TO THE SAME TIME REFERENCE.
        SYSTEM: SC74  IS USING CTNID: ITSOPOK
```

```
        SYSTEM: SC75  IS USING CTNID: ITSOPOK
        SYSTEM: SC73  IS USING CTNID: ITSOPOK -31

-> SC73 (running on H40)
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 25
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 0B
 IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 517
         FOR SYSTEM: SC75
         PREVIOUS CTNID:   ITSOPOK -31
         CURRENT  CTNID:   ITSOPOK
 IXC435I ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOW SYNCHRONIZED 518
         TO THE SAME TIME REFERENCE.
        SYSTEM: SC74  IS USING CTNID: ITSOPOK
        SYSTEM: SC75  IS USING CTNID: ITSOPOK
        SYSTEM: SC73  IS USING CTNID: ITSOPOK
```

The CTN is now STP-only. All ETR ports on the servers are disabled. However, leave the ETR links in place for a certain period of time to allow for a back-out plan. Depending on individual change management constraints, the ETR links can be disconnected once a migration back to a Mixed CTN is no longer being considered.

Because the time within the STP-only CTN can slowly drift, configure an external time source, as outlined in Chapter 1, “Configuring an External Time Source” on page 3.

2.5.2 Time-zone offset adjustment

A migration from a Mixed CTN to an STP-only CTN inherits the time and the total offset from the Sysplex Timer. However, the CTN does not yet have a time zone algorithm defined.

Following a Mixed to STP-only migration (Figure 2-25), the Timing Network tab displays the total time (hours : minutes) for the offset. This only occurs when the time zone information (incorporating a daylight saving time offset, if any) has been inherited from a Sysplex Timer. It indicates that a time zone offset entry has not been defined and must be set.

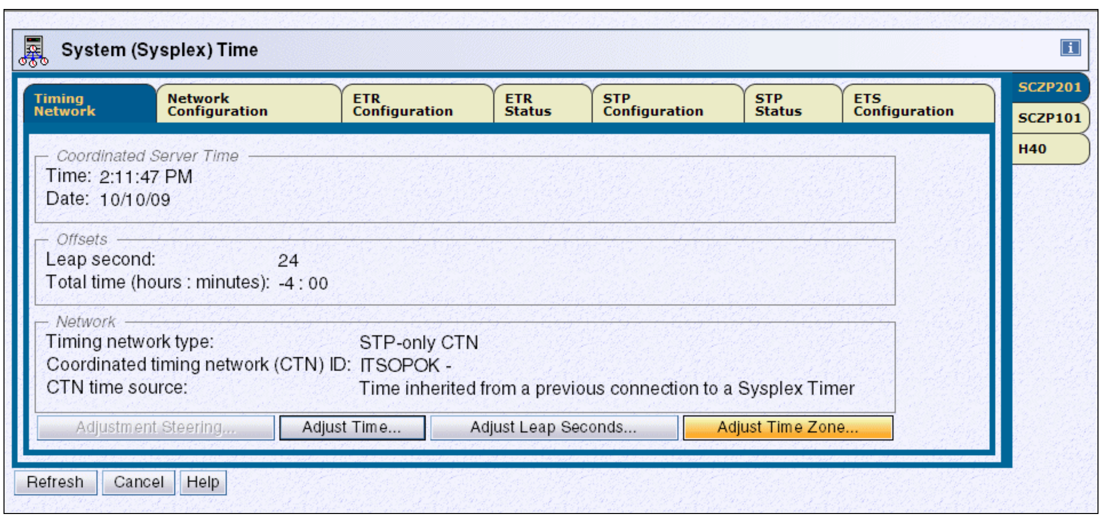


Figure 2-25 Timing Network tab

Note: If a time zone algorithm is not defined after a migration to STP-only CTN, it is not possible to schedule the next daylight saving time adjustment.

Selection of a time zone algorithm must be initiated from the CTS. The Adjust Time Zone button is only enabled on the CTS.

On the Timing Network tab, click **Adjust Time Zone** to display the Adjust Time Zone Offset window (Figure 2-26).

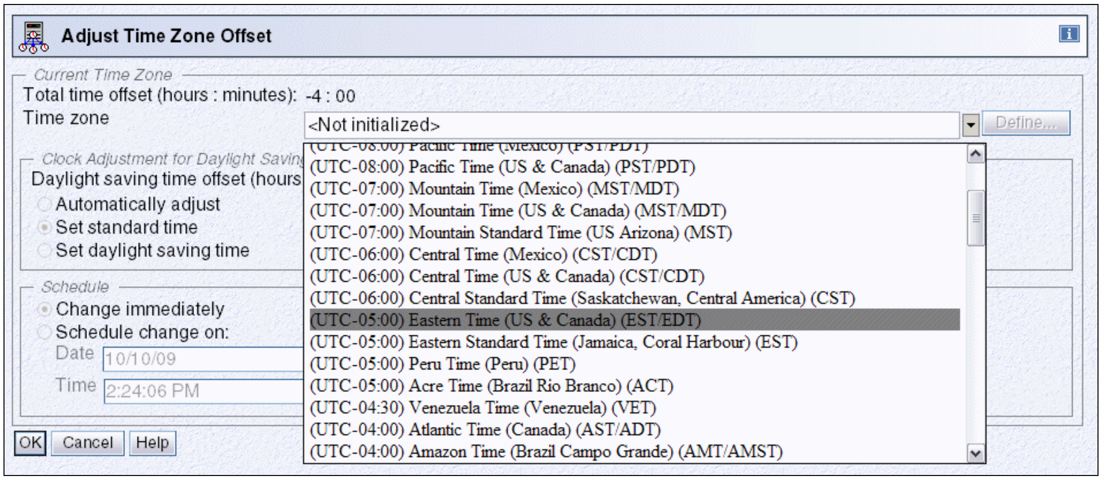


Figure 2-26 Timing Network tab - Adjust Time Zone Offset

From this window, select one of the supported time zones that is provided by default or use one of the five user-defined time zones to customize an entry to specifically meet your requirements.

Three choices must be made on the Adjust Time Zone Offset window:

- Select one of the values from the Time zone drop-down menu. Following a migration, the time zone is <*Not initialized*>. For the subsequent example shown, a time zone of (UTC-05:00) Eastern Time (US & Canada) (EST/EDT) has been selected from the drop-down menu.
- Click a radio button in the Clock Adjustment for Daylight Saving Time section to choose a Daylight Saving Time offset.

  Automatically adjust is selected by default when the time zone selected supports automatic adjustment of daylight saving time. Otherwise, the button is disabled. If this option is selected, STP automatically selects the correct time zone offset based on the current date and time.

  If the selected time zone does not support automatic adjustment or if the user does not wish to use automatic adjustment of daylight saving time, select **Set standard time** or **Set daylight saving time** depending on what is in effect at the time that the change is made.
- In the Schedule section, click one of the radio buttons to choose when the time zone adjustment should be initiated. Following a Mixed to STP-only migration, select **Change Immediately**. The change takes place when you click **OK**.

  Details of the Adjust Time Zone Offset window are discussed in 6.6.5, “STP offset adjustments” on page 228.

Click **OK** to save the settings and return to the Timing Network tab.

Note the changes in Figure 2-27 as compared to Figure 2-25 on page 74:

- The Total time offset field is no longer displayed after a time zone offset has been set and activated.
- The time zone offset from the UTC value is set to -5:00 and the daylight saving time value is set to 1:00, reflecting the changes made in Figure 2-26 on page 75.

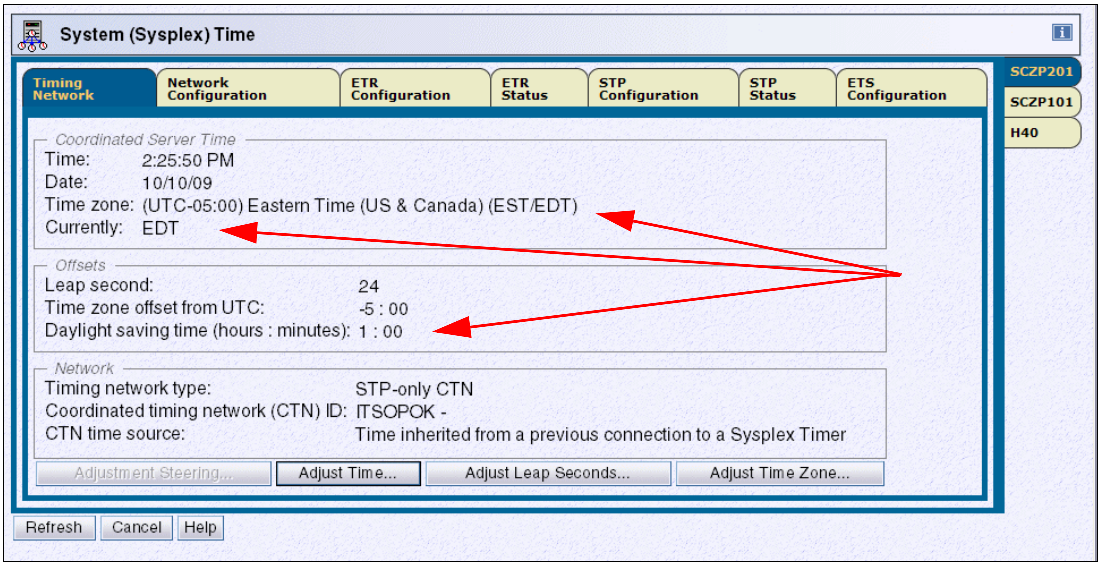


Figure 2-27 Timing Network tab - After Time Zone Offset adjustment

At this stage, the time zone has been defined for a given period, the current example being standard time.

Verification on the HMC

After the STP-only CTN has been activated, run the following checks and notice the changes.

To verify the successful activation of the STP-only CTN, select the **Timing Network** tab in the System (Sysplex) Time task on the HMC workplace (Figure 2-27). The Network section indicates:

- Timing network type: STP-only CTN.
- Coordinated Timing Network (CTN) ID [ITSOPOK] is present, but the ETR Network ID is no longer part of the CTN ID.

When a CTN is migrated from a Mixed CTN to an STP-only CTN, the time is inherited from the Sysplex Timer. If there is no external time source configured that changes the time source, the information is reflected in the CTN time source that is shown in the last line of the Timing Network tab.

Verification in z/OS

The z/OS display commands DISPLAY ETR and DISPLAY XCF,S,ALL retrieve information that identifies the Timing Network as an STP-only CTN (Example 2-5 and Example 2-6 on page 77).

Example 2-5 DISPLAY ETR commands and responses

```
RO *ALL,D ETR 548
SC74      RESPONSES ---------------------------------------------------
IEA386I 14.30.30 TIMING STATUS 547
```

```
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE PREFERRED TIME SERVER
SC75     RESPONSES ---------------------------------------------------
IEA386I 14.30.30 TIMING STATUS 713
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE BACKUP TIME SERVER
  NUMBER OF USABLE TIMING LINKS =  3
SC73     RESPONSES ---------------------------------------------------
IEA386I 14.30.30 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE ARBITER SERVER
  NUMBER OF USABLE TIMING LINKS =  2
```

In response to the DISPLAY ETR command, the message ID is no longer IEA282I, but IEA386I. Message IEA386I holds information that reflects the STP timing mode.

Example 2-6   DISPLAY XCF,SYSTEM,ALL command and response

```
D XCF,S,ALL
IXC335I  14.32.54  DISPLAY XCF 550
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME        SYSTEM STATUS
SC75     2094 991E   1C   10/10/2009 14:32:50 ACTIVE        TM=STP
SC74     2097 DE50   2C   10/10/2009 14:32:53 ACTIVE        TM=STP
SC73     2097 961F   1A   10/10/2009 14:32:54 ACTIVE        TM=STP
```

The timing mode for all systems in the sysplex is now STP.

3

Configuring an STP-only CTN

In this chapter we describe how to configure and activate an STP-only CTN. This scenario applies to configurations with no previous time synchronization network.

In the scenarios we present in this chapter we cover:

- Setting the CTN ID
- Initializing the time
- Assigning the CTN roles
- Adding a new server
- Saving the STP configuration across PORs (one- or two-server CTN)
- Case study: Configuring a single-server CTN

3.1 Overview

The starting configuration for this scenario consists of one or more STP-enabled servers that need to be configured into an STP-only CTN.

The sequence of steps to configure an STP-only CTN is:

1. Set the CTN ID. In this case, this consists of only the STP ID portion.
2. Initialize the time. This includes setting the time zone, leap seconds, date, and time.
3. Assign CTN roles.

If using an ETS, dial out from the HMC, NTP server, or NTP server with pulse per second (PPS) must be configured and tested before setting up the CTN. More information about the dial-out function at the HMC and the required setup for the HMC/SE can be found in 1.4.1, "HMC setup for ETS dial-out configuration" on page 34.

Our test configuration consists of two zEnterprise servers connected to one NTP server and one NTP server configured on the HMC (Figure 3-1).

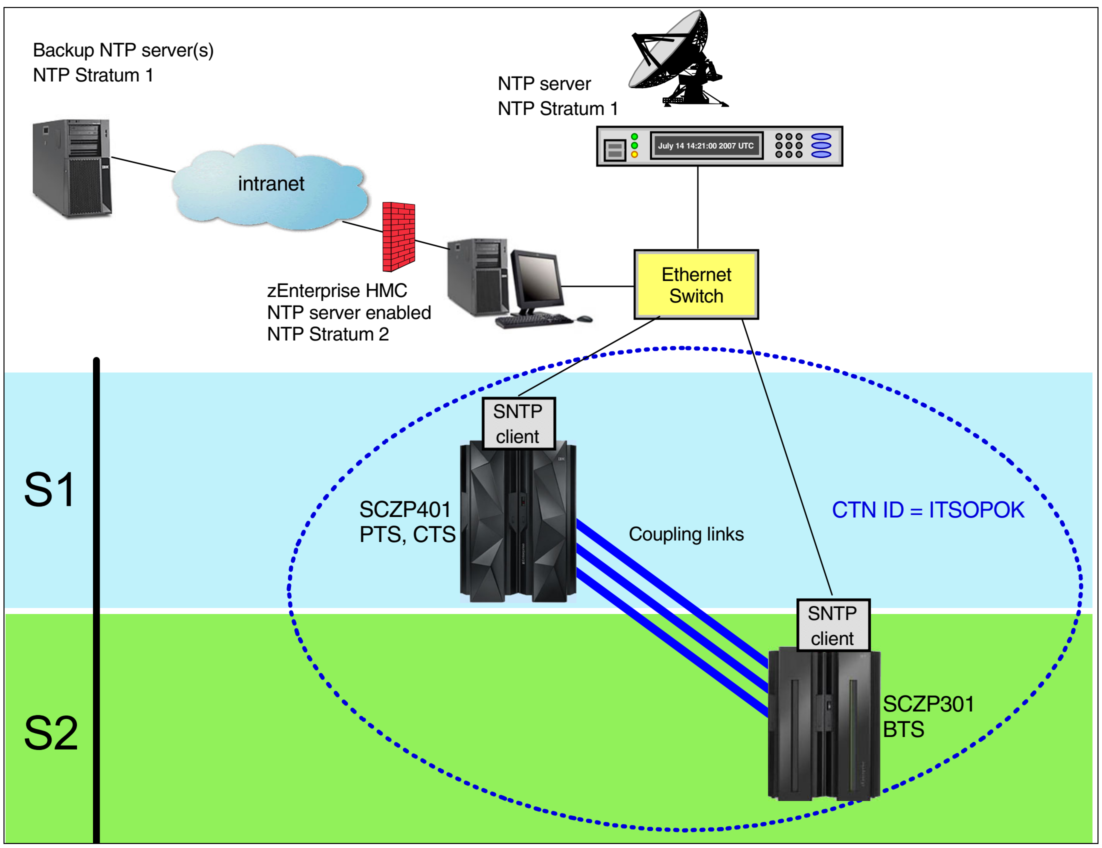


Figure 3-1 Test configuration

3.2 Setting the CTN ID

In this section, we discuss setting the CTN ID, which is an identifier used to indicate whether the server has been configured to be part of a CTN and, if so configured, identifies the CTN.

The CTN ID has the format [STP Network ID] - [ETR Network ID] and is the basis for establishing the Coordinated Timing Network.

The format of these fields is CTN ID = [*cccccccc*] - [*xx*], where [*cccccccc*] is the STP Network ID and [*xx*] is the ETR Network ID.

- The STP Network ID is case sensitive and is one to eight characters. The valid characters are A – Z, a – z, 0 – 9, -, and _.
- The ETR Network ID is always null for an STP-only CTN.

Setting the STP network ID

The STP network ID is entered using the STP Configuration tab (Figure 3-2). The same CTN ID must be entered on every server that will participate in the STP-only CTN.

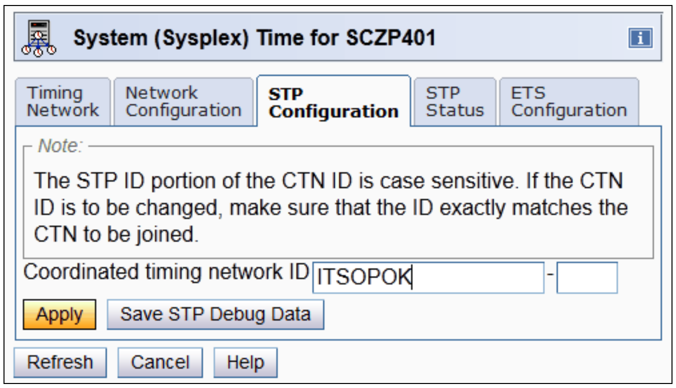


Figure 3-2 System (Sysplex) Time - STP Configuration tab

3.3 Initializing the time

The Initialize Time button is only enabled if the CTS and PTS roles have not been assigned yet and only after the CTN ID has been defined for the server that will become the CTS and PTS.

> **Important:** Initializing the time must be done on the server that will become the Current Time Server for the STP-only CTN.

The Initialize Time button is accessed from the Network Configuration tab (Figure 3-3).

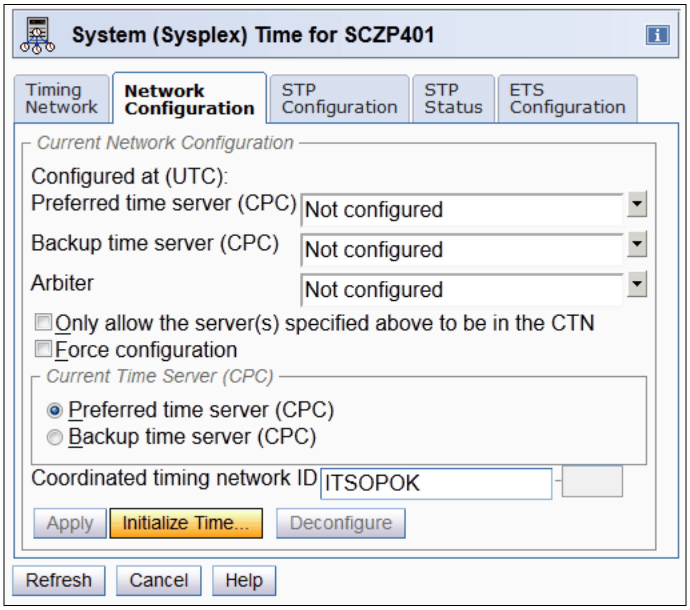


Figure 3-3 Initialize Time button

Clicking **Initialize Time** displays the Initialize Time window (Figure 3-4). There are three radio buttons on the window, each representing a task that needs to be completed before a network configuration can be applied to an STP-only CTN. The three tasks related to initializing the time are:

- Set leap seconds.
- Set time zone.
- Set date and time.

As each task is completed, the corresponding box in the Complete column is selected.

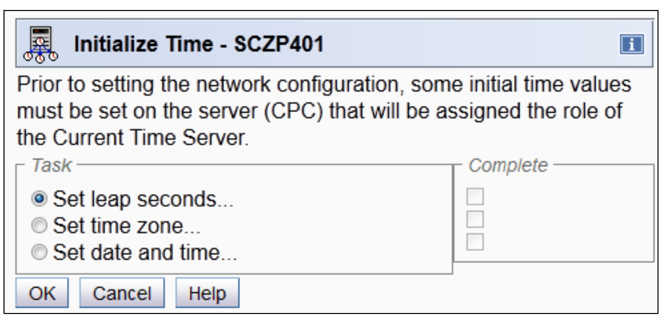


Figure 3-4 HMC workplace - Initialize Time

3.3.1 Setting the leap seconds

Since January 1st, 1972, occasional corrections of exactly one second, called a leap second, have been inserted into the Coordinated Universal Time (UTC) scale to always keep UTC time within 0.9 second of UT1.

Leap seconds are either hypercritical or completely irrelevant, depending on the applications and business requirements:

- If there are specific accuracy requirements to provide UTC or Greenwich Mean Time (GMT) to the very second, at any instant, then leap seconds need to be considered.

  Examples of such specific requirements are legal or contractual requirements for time stamps to be within a certain tolerance of UTC, or time stamp use for time-dependant banking, scientific, or navigational purposes.

  To account for leap-second corrections, the total accumulated number of leap seconds since January 1972 *must* be entered when setting the time.

- Most sites have little awareness of leap seconds and ongoing leap second adjustments, and therefore this setting probably can be ignored. If there are no specific requirements for leap seconds, then you should specify a leap second value of zero.

Figure 3-5 shows the initial Adjust Leap Seconds Offset window. Although the installation might not be sensitive to leap seconds, a valid leap seconds offset value needs to be entered to complete the initialize time task. If leap seconds are not used, enter a value of zero.

Note: At the time of writing, the number of leap seconds was 25. The latest adjustment occurred on June 30th, 2012.

Figure 3-5 Initialize time - Set leap seconds

3.3.2 Setting the time zone

The window shown in Figure 3-6 is used to set the initial time zone parameters for the CTN. The current time zone needs to be set by selecting an entry from the Time zone drop-down box.

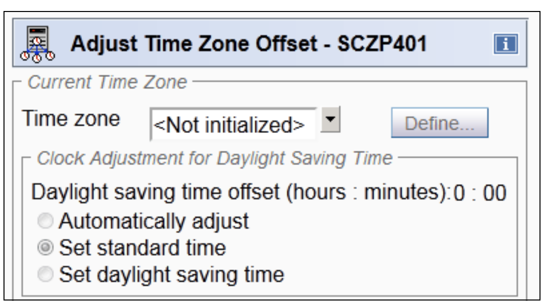


Figure 3-6 Adjust Time Zone Offset - Initial view

By selecting the Time zone drop-down arrow (Figure 3-7 on page 84), all of the provided time zones that are supported are shown. Each of the supported time zone entries has a defined offset from UTC, and might optionally have a time zone algorithm defined, which is used for daylight saving time offset adjustment purposes. The time zone algorithm defines:

- Daylight saving offset
- Optional: Daylight saving automatic adjustment information:
  - Daylight saving date and time start algorithm
  - Daylight saving date and time end algorithm

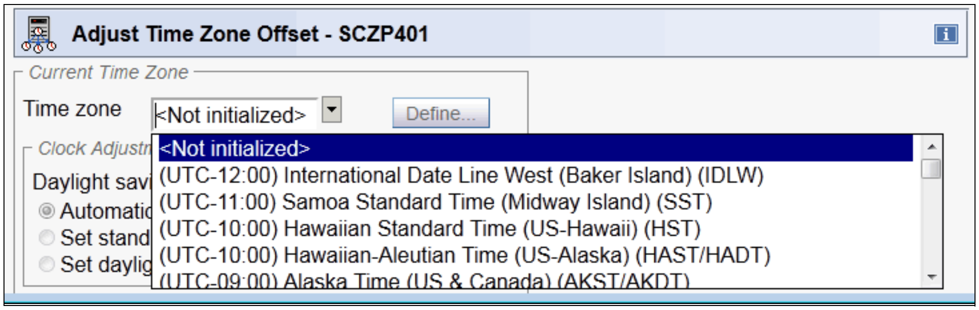


Figure 3-7 Time zone drop-down menu

Automatically adjust is selected by default when the time zone selected supports automatic adjustment of daylight saving time. Otherwise, this button is disabled.

Even if automatic adjustment is supported, you still have the option of selecting Set standard time or Set daylight saving time. If automatic adjustment for daylight saving time is not supported by the selected time zone, you need to decide whether the time zone algorithm selected requires a daylight saving time adjustment and select the **Set standard time** or **Set daylight saving time** radio button accordingly.

If a time zone entry that meets the user requirements cannot be found, then one of the five user-defined time zones (that is, UD1 to UD5) can be used to define the desired time zone. If a user-defined time zone entry is selected, the Define button is enabled. It is used to display the Define Time Zone Algorithm window (Figure 3-8).

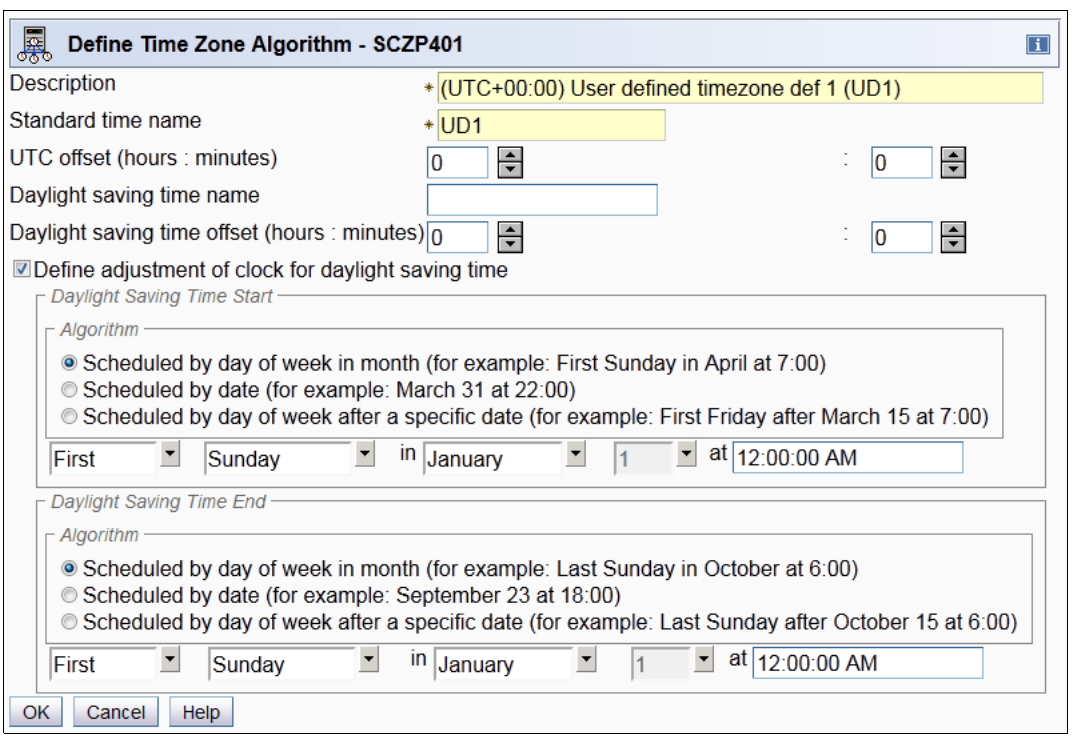


Figure 3-8 Define Time Zone Algorithm

The Description (maximum 80 characters) and Standard time name fields (maximum four characters) must be entered. Otherwise, an error message displays when you click **OK**. The standard time name is an abbreviation displayed on various windows to differentiate standard time from daylight saving time.

The UTC offset must be entered in +/- hours and minutes and ranges from -14 to +14 hours.

Also, if the time zone is subject to daylight saving time adjustments, then the daylight saving time name and daylight saving offset must be specified. Optionally, algorithms for daylight saving time start and daylight saving time end can be defined to support automatic clock adjustment by selecting the **Define adjustment of clock for daylight saving time** option. The algorithm is saved when you click **OK**, but it is not sent to the STP facility until you click **OK** in the Adjust Time Zone Offset window.

3.3.3 Setting the date and time

The final task in the sequence is to initialize the date and time. Several methods are provided:

- If the local date and time are to be set to specific values, click **Set date and time**. Date and time values can be entered in each field. The value filled in is the current time from the Support Element (SE) of the server on which the configuration task is being performed. An icon is also available to display an additional calendar dialog box.
- If an ETS is configured, initialize the date and time by selecting the **Use External Time Source to set date and time** option. This ensures that the Coordinated Server Time matches the time source.

  Click the **Use External Time Source to set date and time** option (Figure 3-9). Click **OK**.

Figure 3-9 Set date and time through the external time source

The Support Element or HMC accesses the ETS to calculate the difference between the server time of day (TOD) clock and the time obtained from the external time source, either using dial out or NTP server (with or without PPS). When access to the ETS is successful, the resulting time value is not displayed to you but instead passed directly to the STP facility when you click **OK**.

Message ACT37382 displays upon successful completion of the set date and time operation (Figure 3-10). Click **OK**.

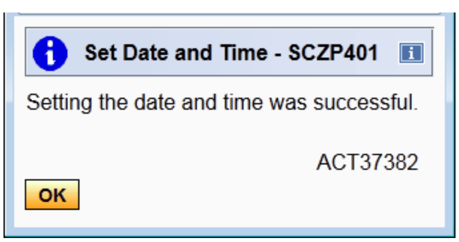


Figure 3-10 Message ACT37382 - Set Date and Time successful

The Initialize Time window (Figure 3-11 on page 86) displays again.

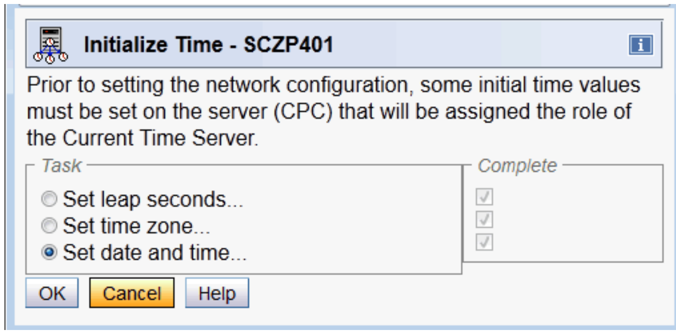


Figure 3-11 Initialize Time complete

To verify the date and time set by accessing the external time source, you can optionally select the **Set Date and Time** radio button a second time and click **OK** (Figure 3-12).

Figure 3-12 Set date and time through the external time source

This is the only way that you can verify the information obtained from the external time source. To leave the window without making any changes, click **Cancel**.

- A delta value can be specified by selecting **Modify time by delta to set date and time**. The value specified is either positive (default) or negative and is entered in the *+/-hh:mm:ss.mmm* format.

Regardless of the method chosen, STP uses the information to calculate the Coordinated Server Time and set the server's' TOD clock when you click **OK**.

At this point, the tasks on the Initialize Time window have a check mark in the Complete column (Figure 3-11 on page 86). Click **Cancel** to exit the initialize time task and return to the Network Configuration tab.

The Coordinated Server Time is passed to other participating servers in the CTN when the server roles and the Current Time Server are assigned, as described in 3.4, "Assigning the CTN roles" on page 87.

3.4 Assigning the CTN roles

Now that the initialize time task has been completed, the Apply button on the Network Configuration window is enabled (Figure 3-13). The server roles can be assigned.

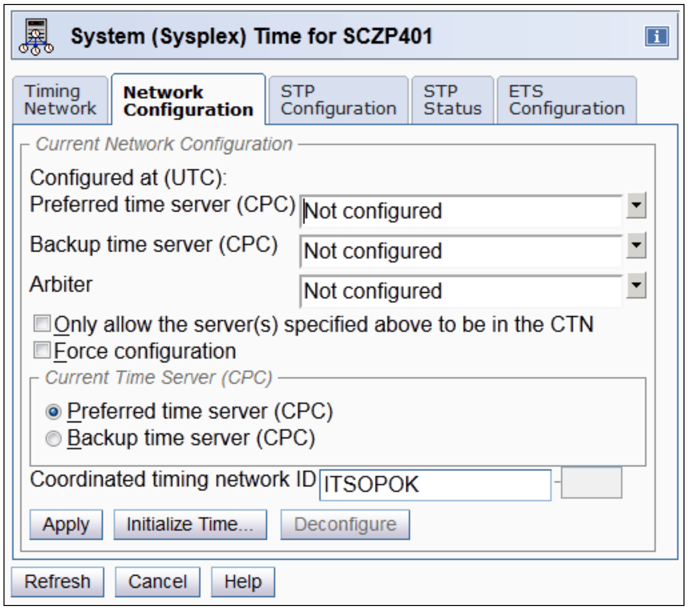


Figure 3-13 Network Configuration tab after time initialization

Note: Although it is possible to assign all roles in one step, it is best to perform this using two configuration changes. Performing the role assignment in two steps ensures that server connectivity checks are performed when assigning the BTS and Arbiter roles.

The CTN roles are assigned from the Network Configuration tab. The task must be accomplished from the server that will become the Current Time Server in the STP-only CTN:

1. Assign the PTS role, selecting the **Force configuration** check box.

   The configuration of a new STP-only CTN requires the selection of the **Force configuration** check box (Figure 3-14). This option bypasses a number of validity checks of server connectivity. Force configuration specifies whether connectivity between the Preferred Time Server and other servers with a defined role are verified when a change in configuration is requested.

   Note: If the new STP-only CTN consists of only one server, select the **Only allow the servers specified above to be members of the CTN** option. This prevents the server from being deconfigured when performing a power-on reset or power-off/on cycle. However, this option also limits the CTN to one server, unless the option is deselected, which can be performed concurrently at any time.

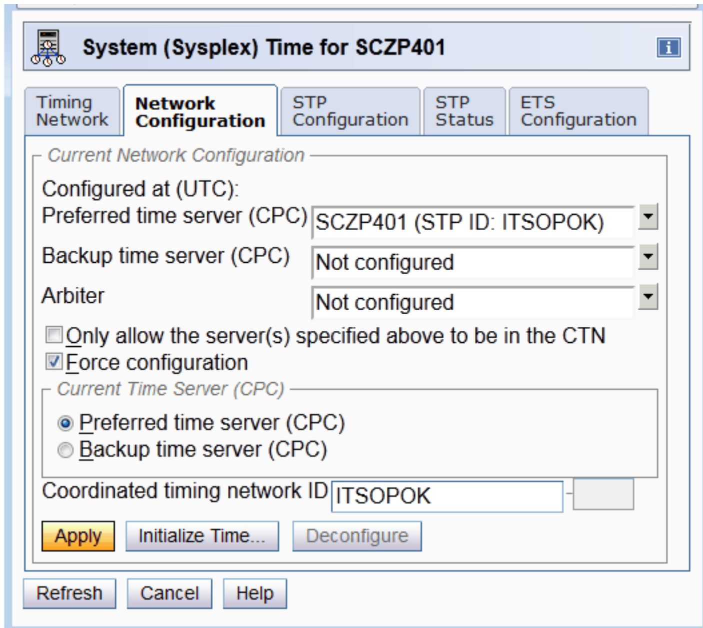


Figure 3-14 Configuring the PTS

2. Assign the BTS, applicable for two or more servers (Figure 3-15). Do not select the **Force Configuration** check box, so that appropriate connectivity checks can be performed by STP.

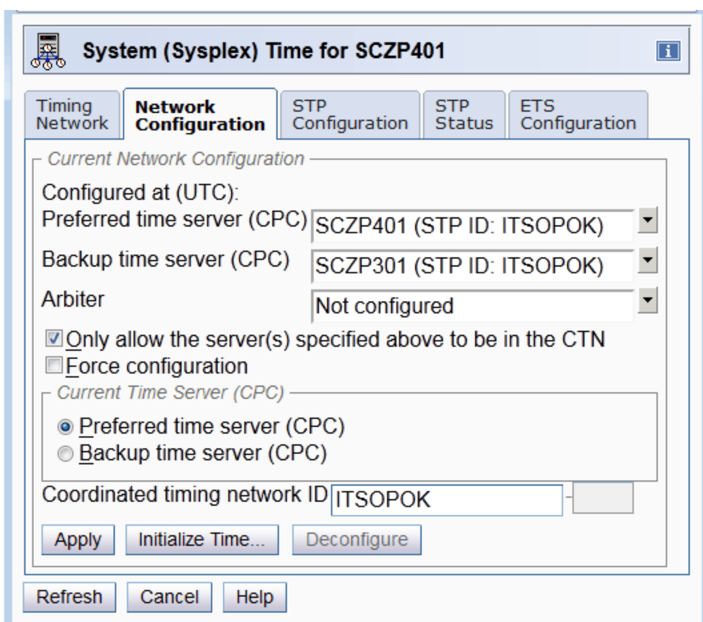


Figure 3-15 Configuring server roles in a two-CEC CTN

3. For three or more servers in the CTN, you can also assign the Arbiter. For each of the roles (PTS, BTS, and Arbiter), there are drop-down boxes listing the STP-capable servers currently available to the HMC. In this case, the **Only allow the servers specified above to be members of the CTN** check box must be unchecked so that additional servers can be configured in the CTN (Figure 3-16 on page 89).

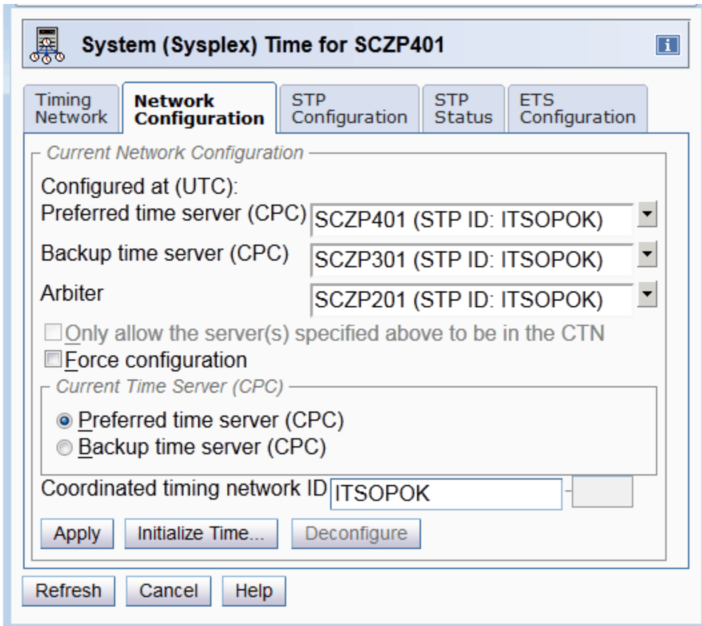


Figure 3-16 Assigning PTS, BTS, and Arbiter at CTN configuration time

3.4.1 Assigning the CTS and PTS

Select the PTS from the drop-down box listing. Because this is a new STP-only CTN where there is no CTS configured yet, the **Force configuration** check box must be selected. If the force option is not used, the request is rejected and message ACT37346 (Figure 3-17) displays. Click **OK** to return to the Network Configuration tab.

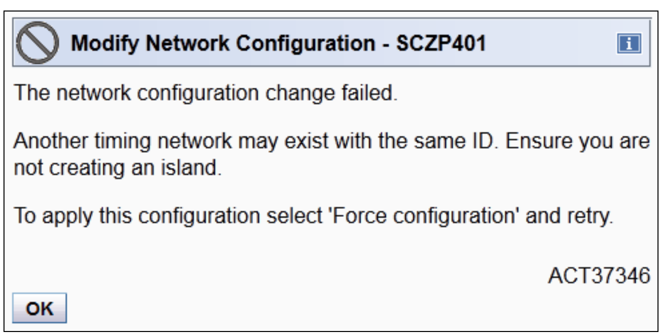


Figure 3-17 Message ACT37346 - Force configuration required

In Figure 3-18 on page 90, on the Network Configuration tab, the radio button in the Current Time Server (CPC) section is pointing to the PTS. Because the PTS will be the only server assigned in this first step, it has to be the CTS. Check the **Force configuration** box. This option *must* be specified when configuring a new STP-only CTN for the first time to bypass connectivity verification, as a Current Time Server does not yet exist.

Also, if this CTN consists of only one server, select the **Only allow the server(s) specified above to be members of the CTN** option to ensure that the CTN is not deconfigured during any power-on reset or power-off/on done on the CTS.

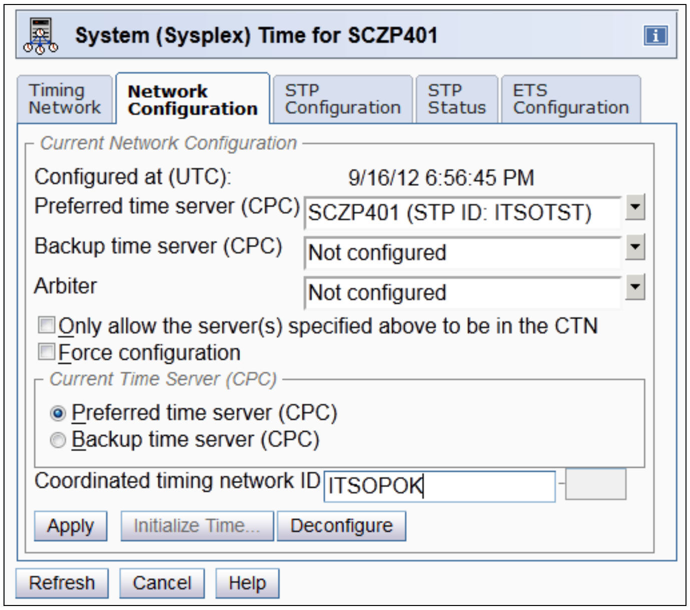


Figure 3-18 Network Configuration tab - Define the CTS

Since the **Force configuration** option is selected, the Network Configuration Change Confirmation message ACT37348 displays (Figure 3-19).

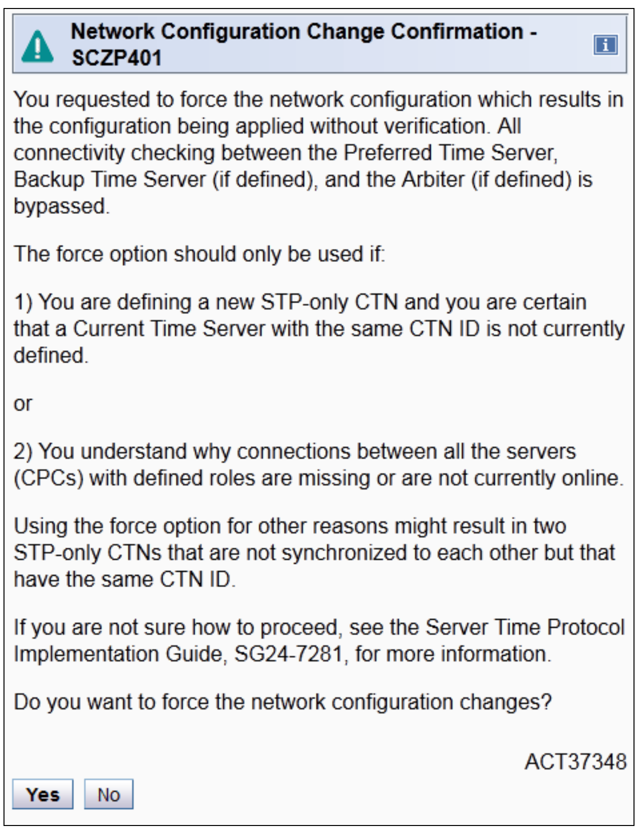


Figure 3-19 Message ACT37348 - Network Configuration Change Confirmation

Click **Yes** to confirm. The assignment of the CTS globally transitions all servers with the same CTN ID to STP timing mode. This is confirmed by message ACT37341 (Figure 3-20 on page 91).

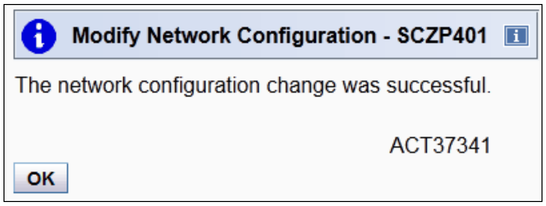


Figure 3-20 Message ACT37341 - Modify Network Configuration successful

3.4.2 Assigning the BTS and the Arbiter

If the configuration contains more than one server, the second step is to assign other roles. The BTS role and optional Arbiter role (recommended for a CTN consisting of three or more servers) can be assigned (Figure 3-21). Because the CTS already exists, the Force configuration option is not required and is not a good idea in this step.

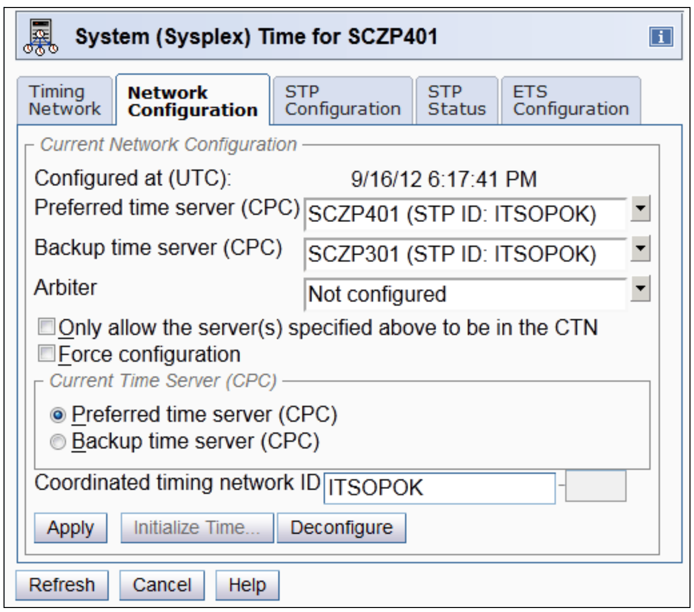


Figure 3-21 Network Configuration tab - Define BTS

Because there are two servers in our STP-only CTN (Figure 3-1 on page 80), only PTS and BTS are defined. However, any role that is going to be assigned requires server communication through coupling links to any other role within the CTN. Any attempt to assign a server role while there is no coupling link communication to the other roles in the CTN fails unless the Force configuration option is used.

If a CTN consists of only two servers, select the **Only allow the server(s) specified above to be members of the CTN** option to ensure that the CTN does not get deconfigured during any power-on reset or power-off/on done on the CTS.

The CTS can be assigned to either the PTS or the BTS. Select the appropriate radio button for the CTS and click **Apply**.

The Network Configuration Change Confirmation message ACT37357 displays (Figure 3-22 on page 92).

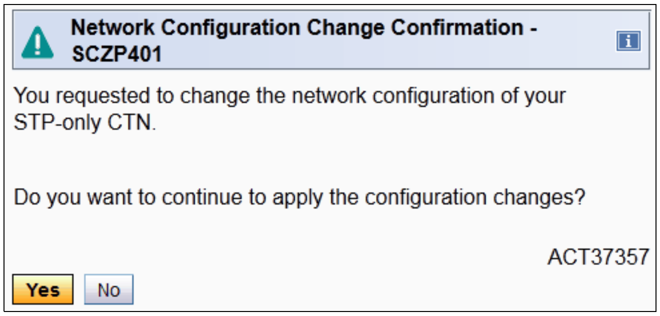


Figure 3-22 Message ACT37357 - Network Configuration Change Confirmation

Click **Yes** in the confirmation window. The Modify Network Configuration successful message ACT37341 displays (Figure 3-23).

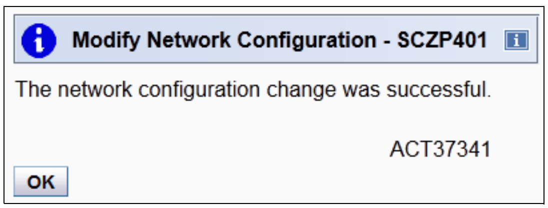


Figure 3-23 Message ACT37341 - Modify Network Configuration

This completes the CTN configuration.

After the STP-only CTN has been configured, other STP-enabled servers can be configured to join this CTN. This is accomplished by setting the same CTN ID for them, as explained in 3.2, "Setting the CTN ID" on page 80. The Initialize Time task cannot be invoked when a new server joins an existing CTN because the new server picks up the Coordinated Server Time from the existing CTN.

Verification on the HMC

To verify the successful activation of the STP-only CTN, select the **Timing Network** tab (Figure 3-24 on page 93). The Network portion indicates:

- The Timing network type is STP-only CTN.
- The CTN Time Source is an NTP server.

The CTN time source reflects where the Coordinated Server Time is currently being steered from. Note that the Time field of the Coordinated Server Time section identifies the current time on the server.

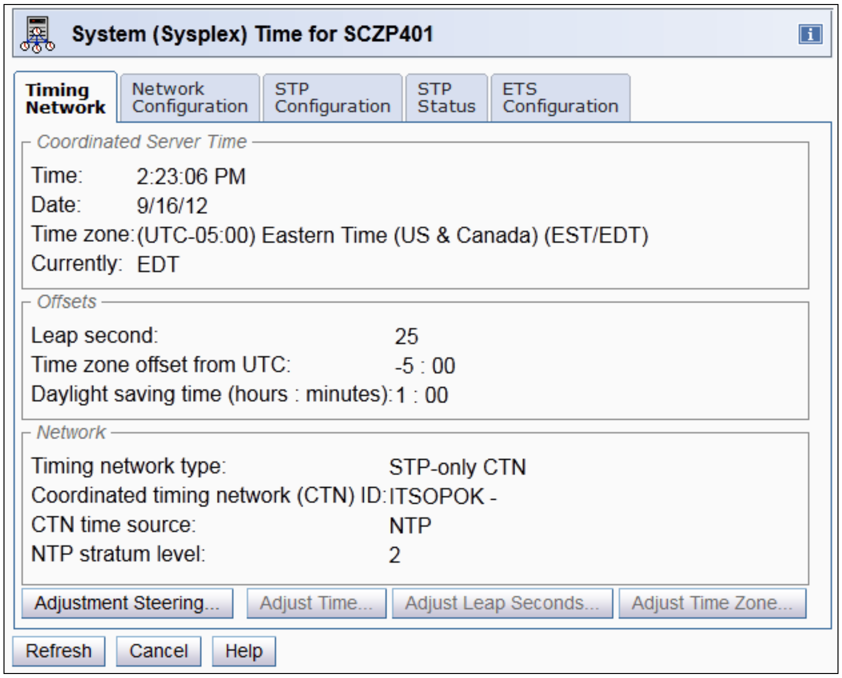


Figure 3-24 System (Sysplex) Time - Timing Network tab

The timing mode and Stratum level can be displayed from the STP Status tab:

- The server must be in STP timing mode.
- The server that has been assigned to be the Current Time Server is Stratum 1.
- Other servers that have operational STP timing links to the CTS are Stratum 2.
- Servers that do not have an operational STP timing link to the CTS but that have an operational STP timing link to any Stratum 2 server are Stratum 3.

Figure 3-25 shows SCZP401 in STP timing mode. (It is the Stratum 1 server.)

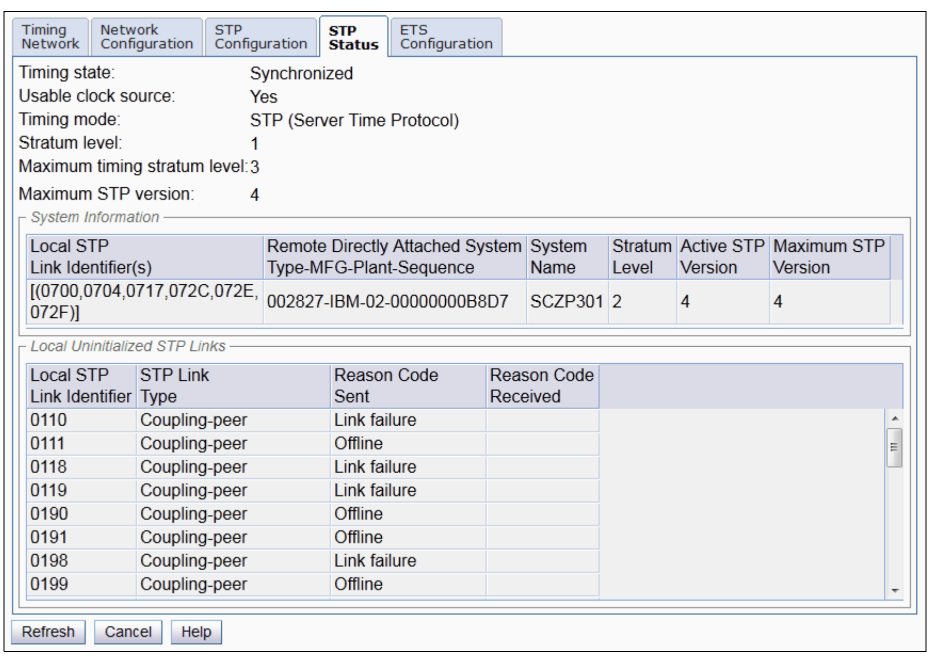


Figure 3-25 STP Status tab - Stratum 1

Figure 3-26 shows SCZP301 in STP timing mode. It has connectivity to the current Stratum 1 server and is therefore a Stratum 2 server.

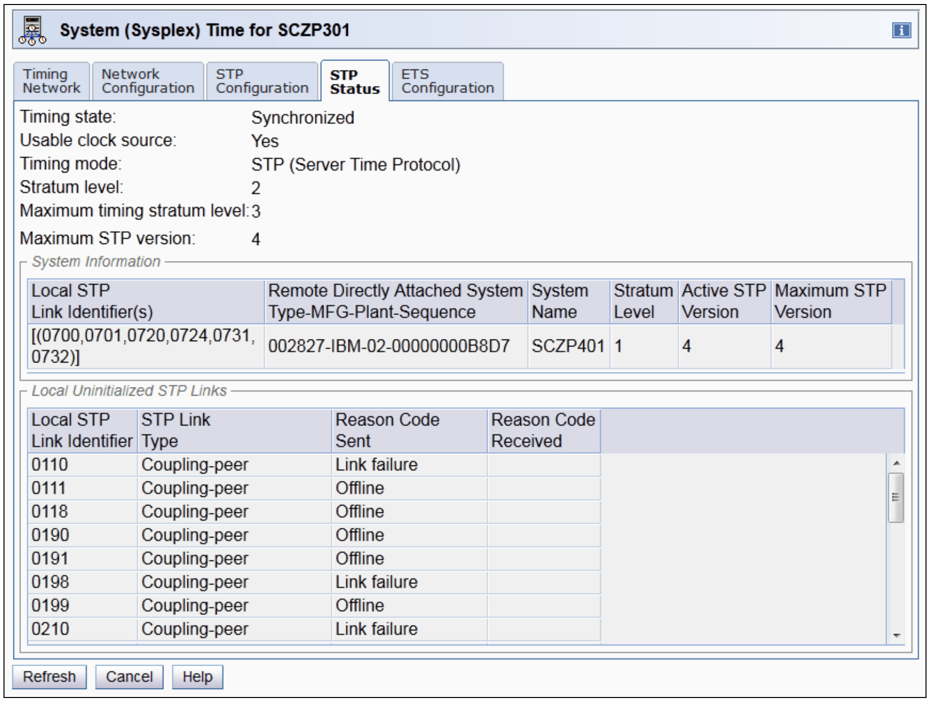


Figure 3-26 STP timing mode - Stratum 2

Verification in z/OS

The Stratum level and synchronization status can be verified from the z/OS side as well. The z/OS command DISPLAY ETR returns message IEA386I and displays the following information:

- Synchronization mode
- Stratum level
- The node ID of the current Stratum 1 server in the CTN
- The server role, if applicable
- The number of usable timing links (does not apply for the CTS)

Example 3-1 shows the output of the DISPLAY ETR command for z/OS system images SC74 on the PTS (SCZP401) and SC75 on the BTS (SCZP301).

Example 3-1 DISPLAY ETR commands and responses

```
SC74 RESPONSES ---------------------------------------------------
IEA386I 13.13.51 TIMING STATUS 620
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002827.H43.IBM.02.00000000B8D7
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
SC75 RESPONSES ---------------------------------------------------
IEA386I 13.15.23 TIMING STATUS 292
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
```

```
  THE STRATUM 1 NODE ID = 002827.H43.IBM.02.00000000B8D7
  THIS IS THE BACKUP TIME SERVER
  NUMBER OF USABLE TIMING LINKS = 11
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

The DISPLAY XCF,SYSPLEX command identifies the timing mode of all sysplex members that are STP (Example 3-2).

Example 3-2 DISPLAY XCF,SYSPLEX command and response

```
D XCF,SYSPLEX
IXC336I  13.18.43  DISPLAY XCF 623
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2827 B8D7   01   09/21/2012 13:18:43 ACTIVE         TM=STP
SC75     2817 3BD5   05   09/21/2012 13:18:38 ACTIVE         TM=STP

SYSTEM STATUS DETECTION PARTITIONING PROTOCOL CONNECTION EXCEPTIONS:
  NONE

SYSPLEX INITIALIZATION TIME: 09/16/2012 13:45:31.128859
```

3.5 Adding a new server

Once the new STP-only CTN is operational, it is possible for a new server to join the CTN at any time. This is always done by setting the CTN ID on the new server. The addition of a new server is accomplished by defining, on the new server, the same CTN ID that is defined on the existing STP-only CTN.

Important: If the configuration for the CTN has been saved (so-called *bounded* CTN), no other server can join this CTN unless the “Only allow the server specified above to be members of the CTN” option (Figure 3-28 on page 96) is deselected on the Network Configuration tab of the Current Time Server of the existing CTN. This can be performed concurrently at any time.

Defining the STP ID

On the new server, from the STP Configuration tab, enter the STP ID value in the STP ID part of the CTN ID. Assuming that it is best for the server to join our existing CTN, the same STP ID currently given for SCZP401/SCZP301 ([ITSOPOK], Figure 3-27), needs to be entered.

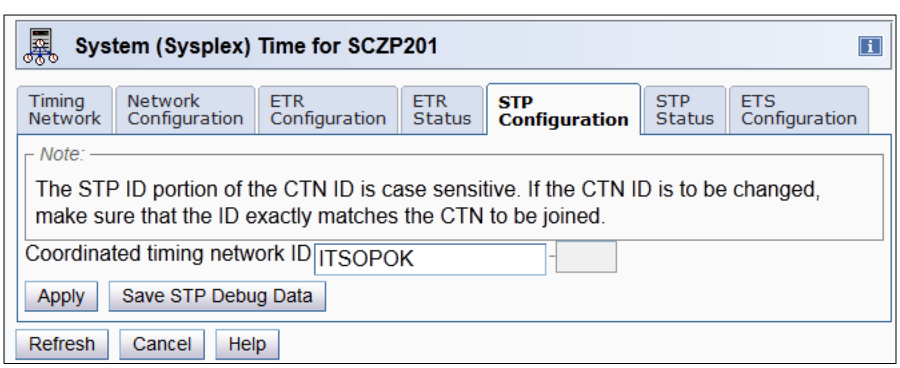


Figure 3-27 System (Sysplex) Time - STP Configuration tab

When you click **Apply**, the CTN ID for the server becomes [ITSOPOK], which is the value defined for the existing STP-only CTN. If the server has coupling link connectivity to a Stratum 1 or Stratum 2 server, STP automatically detects it and joins the server to the STP-only CTN.

The STP connectivity is only successful if the existing CTN was not configured to be restricted to its current servers. This option is called “Only allow the server specified above to be members of the CTN” and is available from the Network Configuration tab. If this option was used at the time that the existing STP-only CTN was created, the new server succeeds the CTN ID configuration, but does not join the existing CTN. As a consequence, the coupling links that do connect the server stay in the Local Uninitialized STP Links (available on the STP Status tab).

For detailed steps for adding a new server to the STP-only CTN, see Chapter 4, “STP-only CTN: Adding a server in STP timing mode” on page 107.

3.6 Saving the STP configuration across PORs

STP provides an option to save the configuration across power-on resets (PORs) for STP-only CTNs with one or two servers. The selection of this option is made via the **Only allow the server(s) specified above to be in the CTN** check box on the Network Configuration tab (Figure 3-28). When **Only allow the server(s) specified above to be in the CTN** has been selected, the CTN’s timing and configuration settings are saved so that they will not need to be re-entered after a loss of power or a POR of the servers.

Note: For brevity’s sake, the capability implemented by selecting **Only allow the server(s) specified above to be in the CTN** is referred to as the *save configuration* feature, and CTNs for which this capability is selected are referred to as *bounded* CTNs.

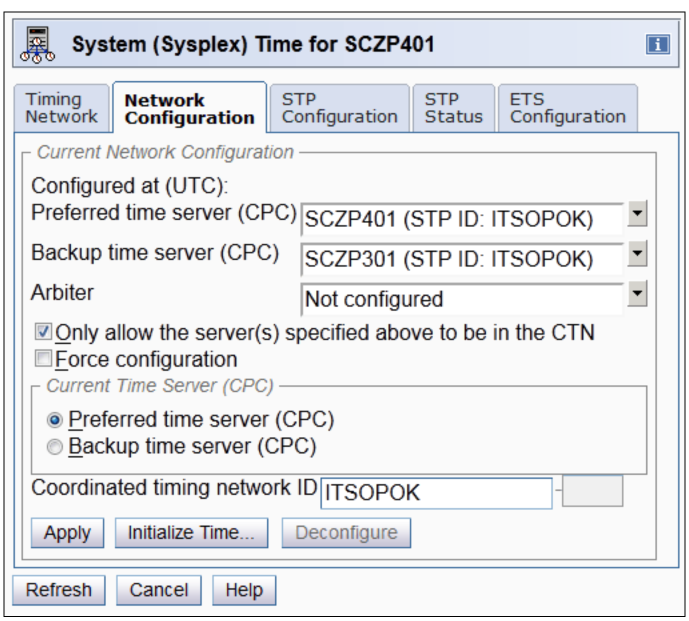


Figure 3-28 Restricting a new CTN to only two servers

3.6.1 Single-server CTN configuration

In this section, we discuss the implementation of a single-server STP-only CTN.

Prerequisites

For a single-server bounded CTN, the CTN must contain only a single server and be operating in STP-only mode. The configuration data saved includes both the server's role as the PTS/CTS reflected on the Network Configuration tab (Figure 3-29) and the timing configuration reflected on the Timing Network tab (Figure 3-30) of the System (Sysplex) Time task.

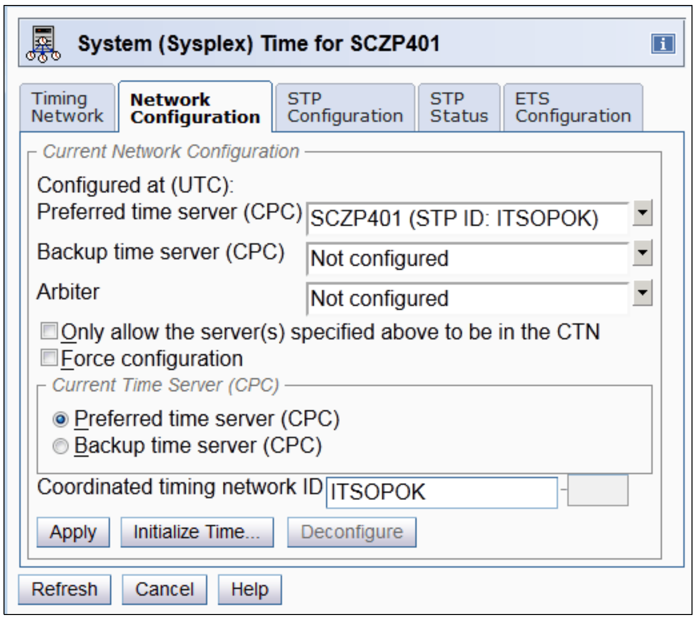


Figure 3-29 Single CEC Network Configuration tab

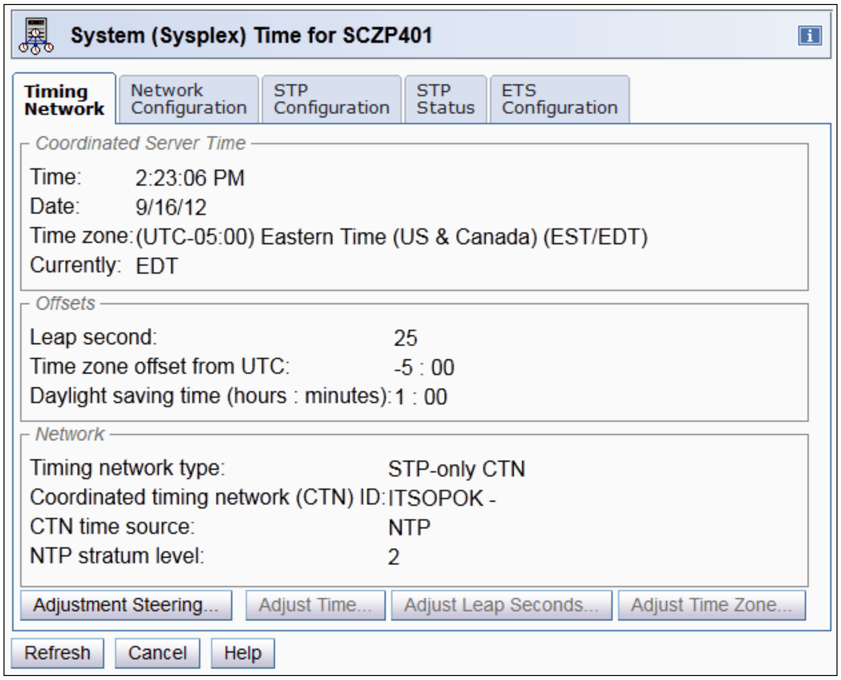


Figure 3-30 Timing Network tab for single CEC

Saving the configuration

To implement a single-server CTN that saves the STP configuration for this CTN across PORs, select **Only allow the server(s) specified above to be in the CTN**, and then select **Apply** on the Network Configuration tab (Figure 3-31). The timing and configuration data are now retained in the event of a loss of power or a power-on reset of the server. When power is restored, the server resumes its role as PTS/CTS using the timing configuration information previously provided.

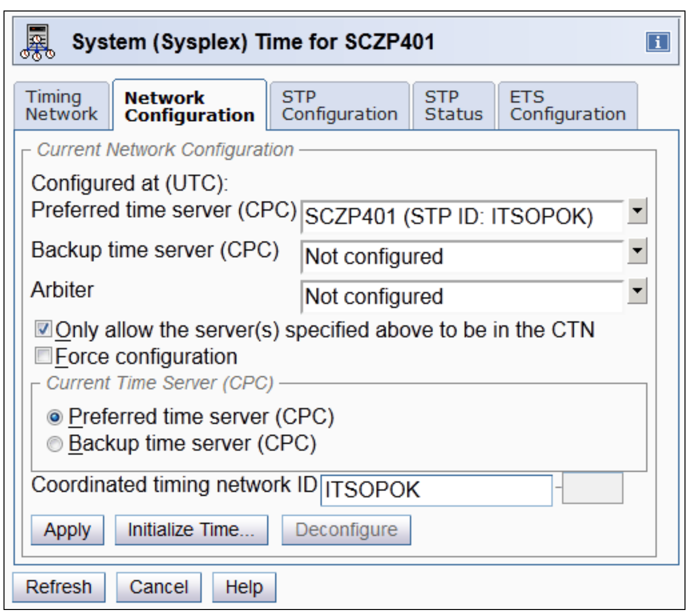


Figure 3-31 Enabling configuration save for single CEC CTN

Note: If the save configuration feature is used to limit the CTN to a one-server CTN, no other server can join this CTN unless this option is deselected in the Network Configuration window of the Current Time Server of the existing CTN.

This restriction can be removed concurrently at any time by deselecting **Only allow the server(s) specified above to be in the CTN**.

3.6.2 Two-server CTN saving its STP configuration across PORs

In this section, we discuss the implementation of a dual-server STP-only CTN.

Prerequisites

For a dual-server bounded CTN, the CTN must contain two servers and be operating in STP-only mode. The servers that support STP are:

- z9 EC or BC with MCL bundle 44 (or higher)
- z10 EC or BC with MCL bundle 26 (or higher)
- z196 or z114
- zEC12

Note: A z9 EC or BC cannot be in the same CTN as a zEC12. This configuration is not supported.

Since the PTS/CTS is a single point of failure, define BTS in a dual-server CTN. For the remainder of this section, we assume that the CTN has been configured with both a PTS/CTS and a BTS.

The configuration data saved includes the servers' roles as the PTS/CTS and BTS, reflected on the Network Configuration tab (Figure 3-32), as well as the timing configuration reflected on the Timing Network tab (Figure 3-33 on page 100) of the System (Sysplex) Time task.

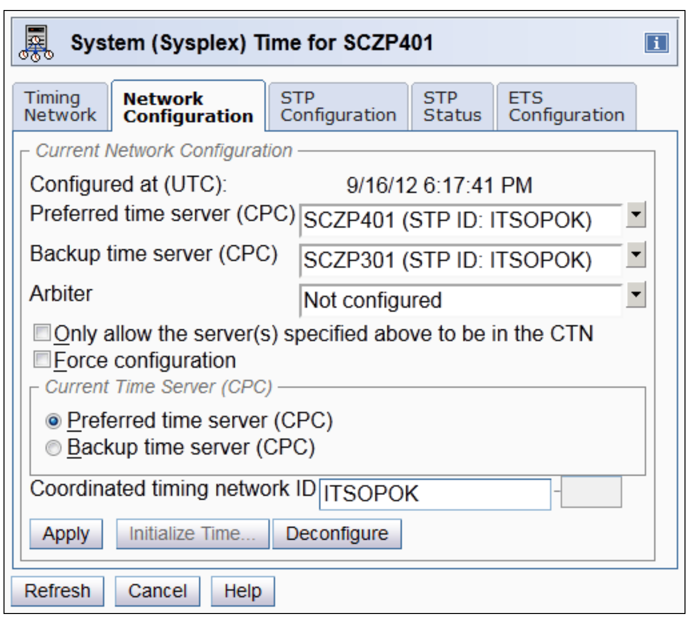


Figure 3-32 Two CEC configuration Network Configuration tab

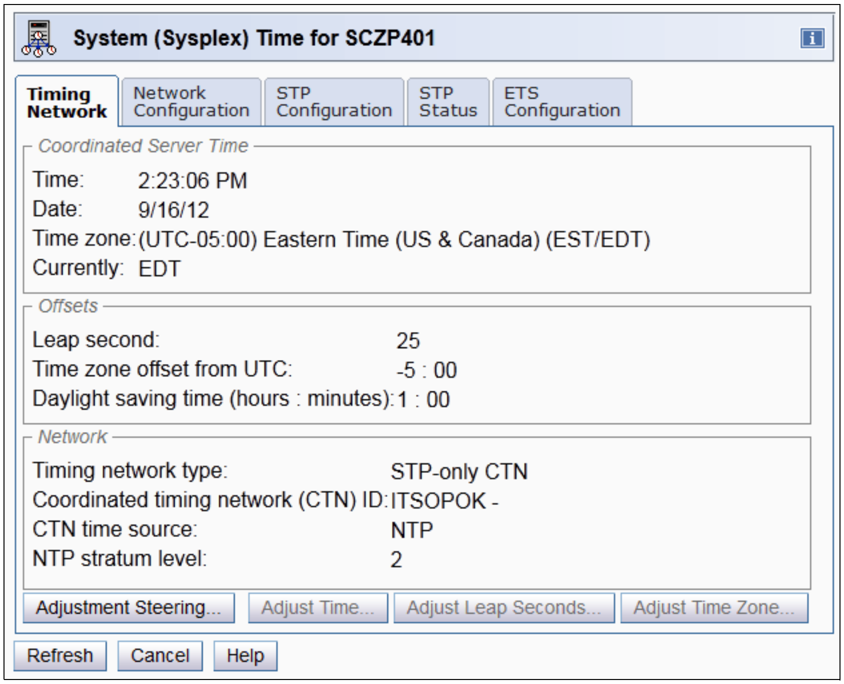


Figure 3-33 Timing Network tab in a dual CEC configuration

Saving the configuration

To implement a dual-server bounded CTN, select **Only allow the server(s) specified above to be in the CTN**, and then select **Apply** on the Network Configuration tab (Figure 3-34). The timing and configuration data are now retained in the event of a loss of power or a power-on reset of the servers.

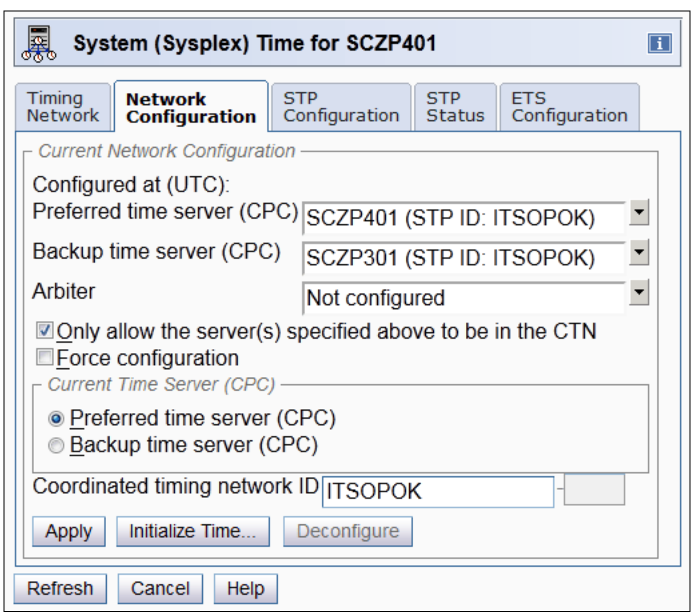


Figure 3-34 Saving STP configuration across PORs in a two CEC configuration

The two servers must be able to communicate via coupling links or this action is not permitted. This restriction cannot be circumvented by additionally selecting **Force**

configuration. Selecting both **Force configuration** and **Only allow the server(s) specified above to be in the CTN** results in an error message.

When power is restored to both servers and coupling link path connectivity is reestablished, the servers resume their roles as PTS/CTS and BTS, using the timing configuration information previously provided. If power is only restored to one server or coupling link, then connectivity is not reestablished, and additional recovery actions are required, as outlined in *Server Time Protocol Recovery Guide*, SG24-7380.

> **Important:** If the save configuration feature is used to limit the CTN to a dual-server CTN, a number of restrictions apply:
>
> - No other server can join the CTN.
> - The CTN ID cannot be changed.
> - No server role assignment changes can be made.
> - No reverse migration from STP-only to a mixed CTN.
>
> These restrictions can be removed at any time by deselecting **Only allow the server(s) specified above to be in the CTN** from the CTS, as long as the two servers can communicate via coupling links.

3.7 Case study: Configuring a single-server CTN

The starting configuration for this scenario is one STP-enabled server that needs to be configured into an STP-only CTN.

There are three ways to configure an external time source for an STP-only CTN:

- NTP server without PPS (simply an NTP server)
- NTP server with PPS
- Dial out on the HMC[1]

More information about the dial-out function at the HMC and the required setup for the HMC/SE can be found in 1.4.1, “HMC setup for ETS dial-out configuration” on page 34.

Our sample configuration consists of one zEnterprise server connected to one NTP server and one NTP server configured on the HMC (Figure 3-35 on page 102).

[1] Starting with HMC 2.12.0 dial out support has been discontinued, thus dial out ETS configuration is no longer available.

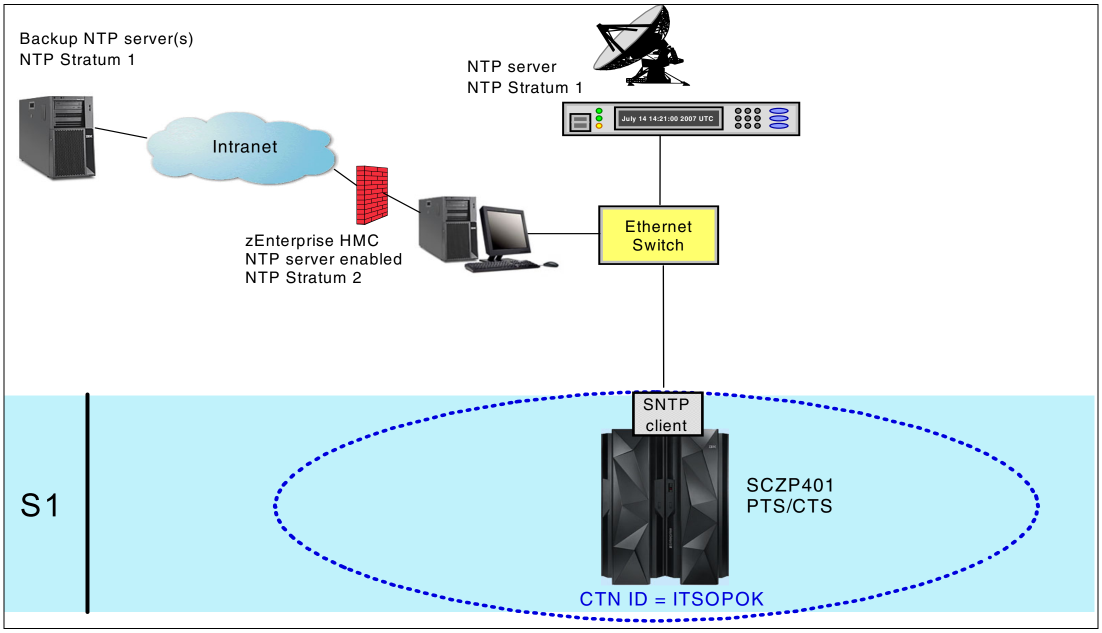


Figure 3-35 Test configuration

The sequence of steps to configure an STP-only CTN is:

1. Set the CTN ID. In this case, it consists of only the STP ID portion. See 3.2, “Setting the CTN ID” on page 80, for details.
2. Initialize the time. This includes setting the time zone, leap seconds, date, and time. See 3.3, “Initializing the time” on page 81, for details.
3. Assign CTN roles. In the case of a single-server CTN, only the PTS/CTS role is assigned

Note: The zEC12 HMC (Application level 2.12.0) does not support dial out.

Assigning the CTN roles

After the Initialize Time task has been completed, the Apply button on the Network Configuration window is enabled (Figure 3-36). The server roles can now be assigned.

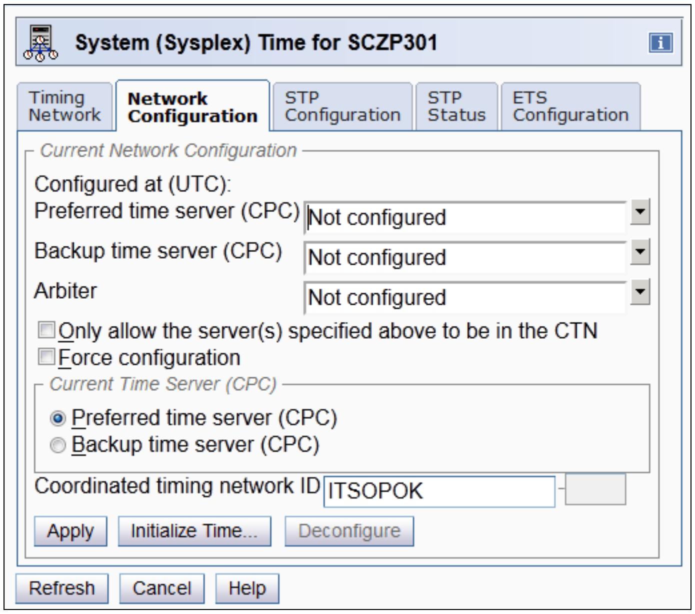


Figure 3-36 Network Configuration tab after time initialization

The CTN roles are assigned from the Network Configuration tab:

1. Assign the PTS role from the drop-down menu. Note that the radio button in the Current Time Server (CPC) section (Figure 3-37) points to the PTS. Because the PTS is the only time server assigned, it has to be the CTS.

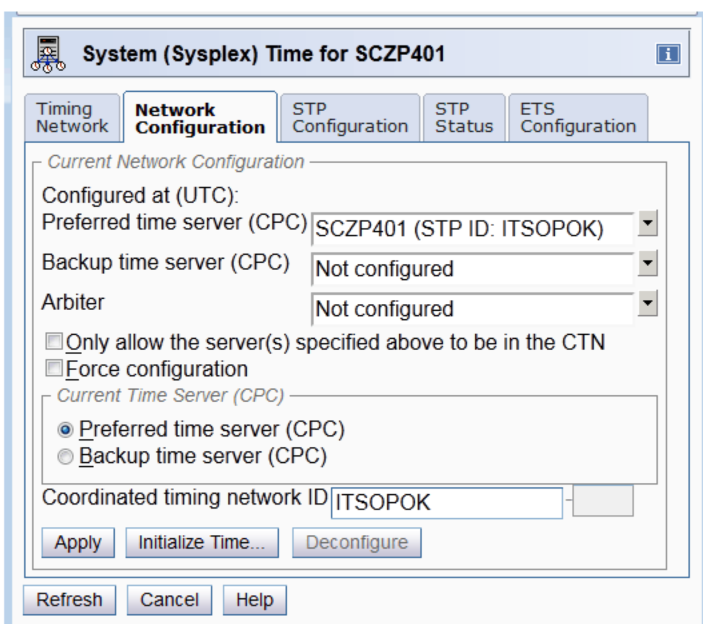


Figure 3-37 Assigning PTS for the new single-server STP-only CTN

2. Select the **Force configuration** check box. This option *must* be specified when configuring a new STP-only CTN for the first time to bypass connectivity verification, as a Current Time Server does not yet exist.
3. Since the new STP-only CTN consists of only one server, select the **Only allow the server(s) specified above to be members of the CTN** option. This prevents the server from getting deconfigured when doing a power-on reset or power off/on. However, this option also limits the CTN to one server, unless the option is deselected, which can be performed concurrently at any time.
4. Select **Apply** to activate your selections (Figure 3-38).

> **Note:** If **Only allow the server(s) specified above to be members of the CTN** is selected, no other server can join this CTN unless this option is deselected in the Network Configuration window.
>
> This restriction can be removed at any time by deselecting **Only allow the server(s) specified above to be in the CTN**.

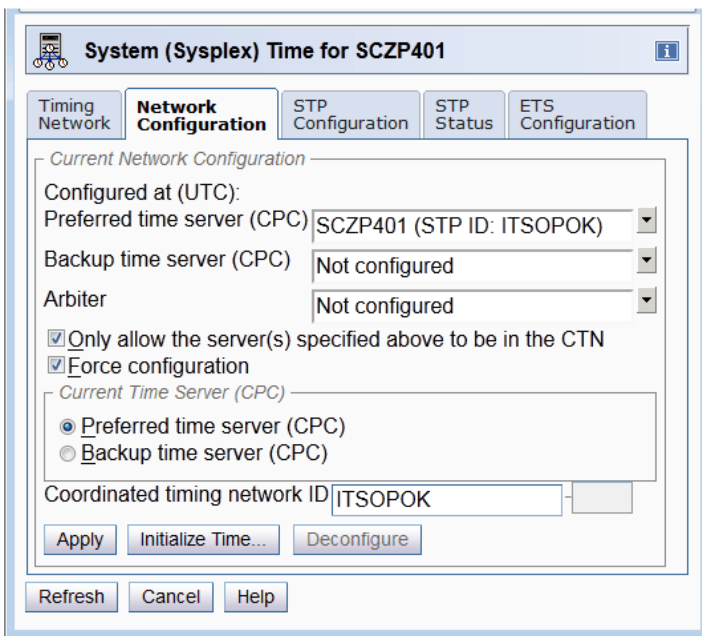


Figure 3-38 Selecting "Force configuration" for the first server of the new CTN

5. Since the **Force configuration** option is selected, the Network Configuration Change Confirmation message ACT37348 displays (Figure 3-19 on page 90).

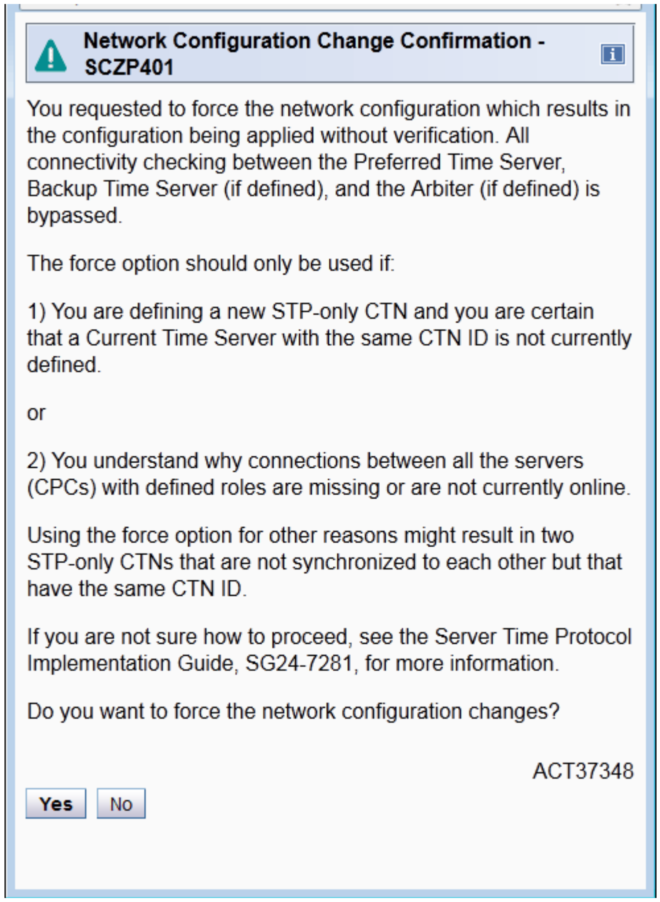


Figure 3-39 Message ACT37348 - Network Configuration Change Confirmation

6. Click **Yes** to confirm. This is confirmed by message ACT37341 (Figure 3-40).

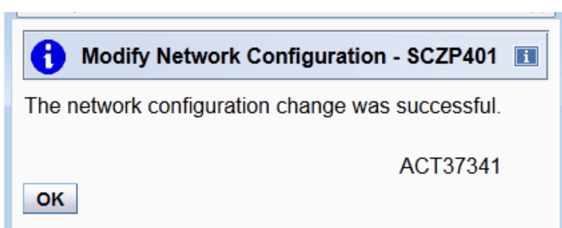


Figure 3-40 Message ACT37341 - Modify Network Configuration successful

The configuration of the single-server CTN is now complete. Figure 3-41 shows the resulting STP-only CTN.

Figure 3-41 Single-server STP-only CTN

4

STP-only CTN: Adding a server in STP timing mode

In the example in this chapter[1], one server is added to our sample STP-only CTN configuration. The new server *must* be added in STP timing mode to participate in the STP-only Coordinated Timing Network (CTN).

We cover the following topics:

- "Starting point" on page 108
- "Adding the server" on page 112
- "End point" on page 117

An STP-only CTN consists of servers in STP timing mode, with the server assigned as the Current Time Server (CTS) providing the timing source for the CTN.

This scenario proceeds to the point at which the new server joins the STP-only CTN, and the server time is adjusted to match the other servers already in the CTN. As a result, the time of day (TOD) clock is modified from local TOD stepping mode to STP timing mode in line with the Coordinated Server Time being provided by STP timing messages from attached servers.

Important: In an STP environment, if you plan to change your cabling topology, make sure that you understand the CTN roles of the servers subject to re-cabling, and perform the following tasks prior to any disruptive action:

- Update the IOCP for affected servers
- Test the changed links by configuring the channels online

[1] See "Prerequisites" on page 263.

4.1 Starting point

The starting point for this scenario is an STP-only CTN (Figure 4-1).

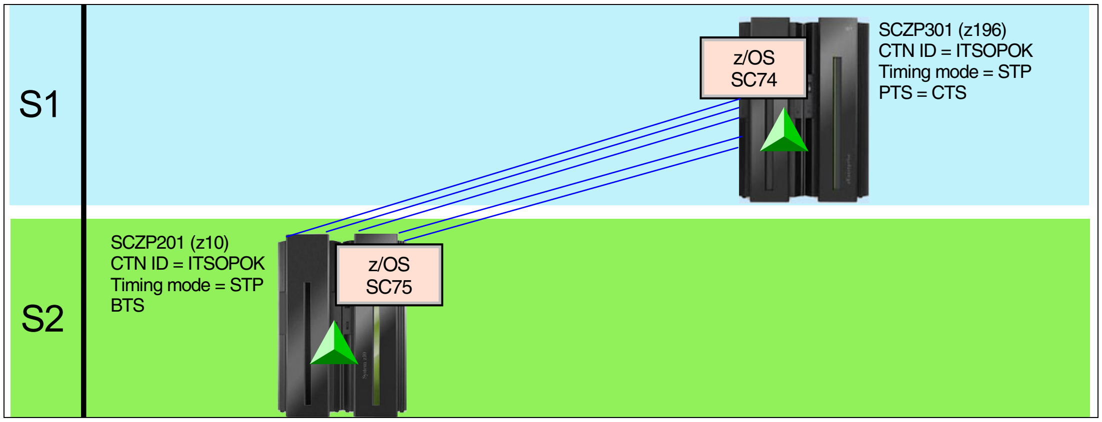


Figure 4-1 STP Implementation environment - STP-only CTN

The STP-only CTN consists of two servers:

- SCZP301 is the Current Time Server.
- SCZP201 is the Backup Time Server (BTS).

The SCZP301 and SCZP201 servers are connected to each other in a redundant configuration using five coupling links, and each server has a z/OS image and Coupling Facility defined.

Since this starting configuration consists of two servers only, the configuration was previously saved across POR by selecting the function *Only allow the server(s) above to be in the CTN*. Because a three-or-more server CTN cannot be saved across PORs, this function must be deselected before a new server can join the CTN.

An additional server, SCZP401, will be added to the STP-only CTN in STP timing mode and will also be assigned to become the Arbiter within the CTN.

4.1.1 z/OS DISPLAY ETR command

Figure 4-2 shows the output from the DISPLAY ETR command entered on the SC74 image, on SCZP301.

```
RO *ALL,D ETR
SC74     RESPONSES ---------------------------------------------------
IEA386I 10.38.49 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002817.M32.IBM.02.0000000B3BD5
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
SC75     RESPONSES ---------------------------------------------------
IEA386I 10.38.50 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002817.M32.IBM.02.0000000B3BD5
  THIS IS THE BACKUP TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
  NUMBER OF USABLE TIMING LINKS =  5
```

Figure 4-2 DISPLAY ETR display - SC74 on SCZP301, STP-only CTN

This display shows that z/OS images SC74 and SC75 are resident on servers in an STP-only CTN. SC74 is on the PTS, and SC75 is on the BTS.

4.1.2 z/OS DISPLAY XCF command

Figure 4-3 shows the output from the z/OS DISPLAY XCF command entered on the SC74 image, on SCZP301.

```
D XCF,S
IXC336I  10.41.22 DISPLAY XCF 960
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2817 3BD5   2C   09/22/2012 10.41.19 ACTIVE        TM=STP
SC75     2097 DE50   1C   09/22/2012 10.41.21 ACTIVE        TM=STP
```

Figure 4-3 DISPLAY XCF display - SC74 on SCZP301, STP-only CTN

This display shows that all z/OS images are in STP timing mode. They are all resident on separate servers, as evidenced by the different serial numbers.

4.1.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) Time selection for each server. Only the tabs for the SCZP401 server are shown in this section.

Timing Network tab

Figure 4-4 on page 110 shows the Timing Network tab for the SCZP401 server.

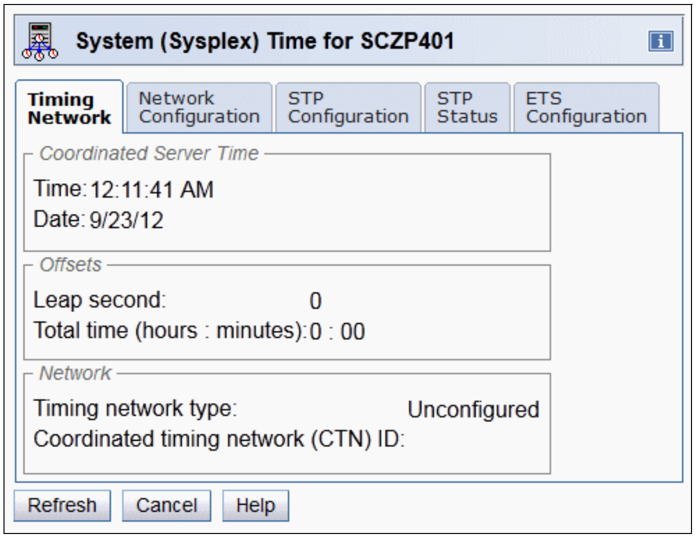


Figure 4-4 Timing Network tab (SCZP401)

This shows that the SCZP401 server is not configured in a CTN, and therefore is running in local TOD stepping mode.

Network Configuration tab

Figure 4-5 shows the Network Configuration tab for the SCZP401 server.

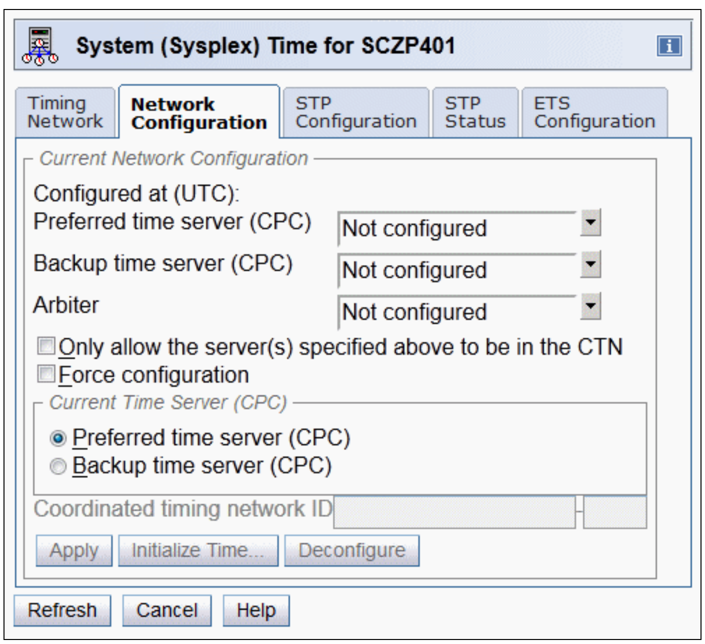


Figure 4-5 Network Configuration tab (SCZP401)

Because SCZP401 is not STP configured, the Preferred Time Server, Backup Time Server, and Arbiter fields are not applicable, and the Coordinated Timing Network ID field is blank. Also, the Apply, Initialize Time, and Deconfigure buttons are disabled.

STP Configuration tab

Figure 4-6 on page 111 shows the STP Configuration tab for the SCZP401 server.

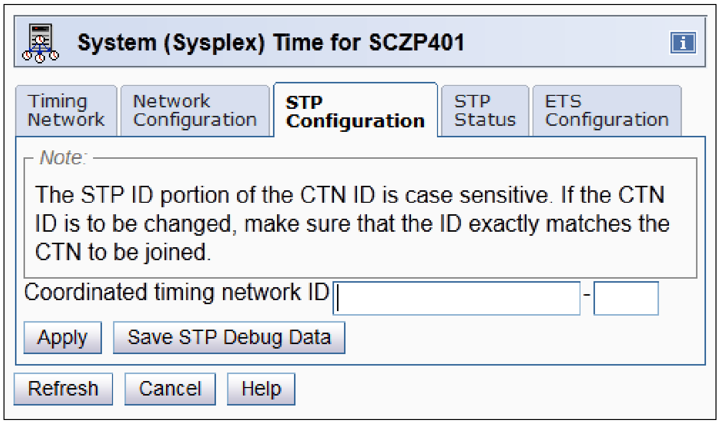


Figure 4-6 STP Configuration tab (SCZP401)

Because the SCZP401 server has not been configured for STP, this tab shows the CTN ID field as blank.

STP Status tab

Figure 4-7 shows the STP Status tab for the SCZP401 server.

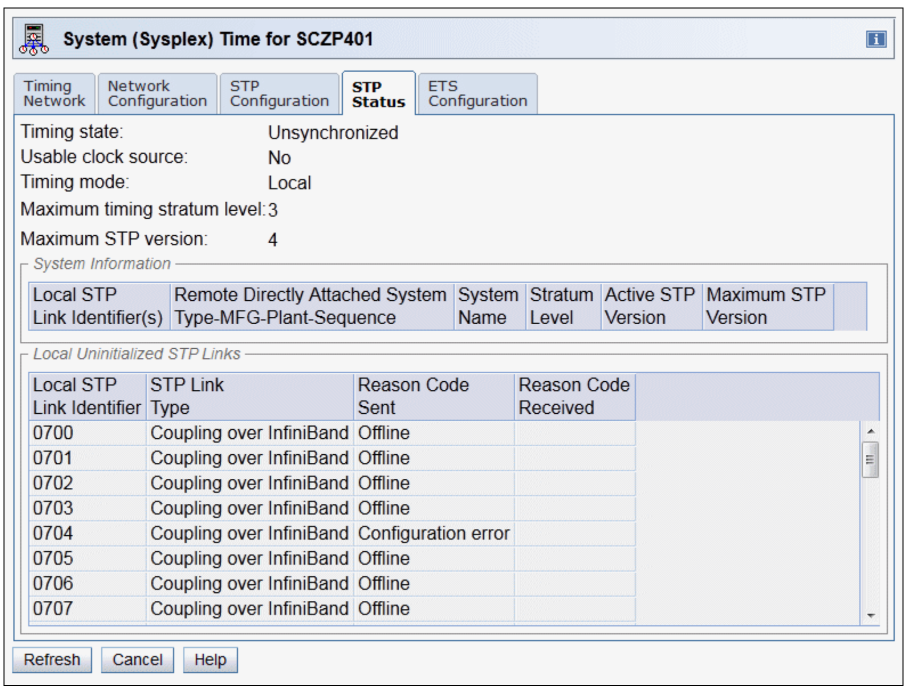


Figure 4-7 STP Status tab (SCZP401)

The SCZP401 server is shown as unsynchronized because it has no usable clock source. It is running in local TOD stepping mode. No stratum level is shown.

Also, the SCZP401 server does not have a CTN ID defined and is therefore not STP configured, so no servers display in the Remote Directly Attached Systems section, as SCZP401 is unable to send or receive STP control and timing messages. However, this tab displays the links defined in the IOCDS that are *eligible* for the exchange of STP messages once the STP ID portion of the CTN ID is defined.

Note: Each link remains in an *uninitialized* state until the servers at both ends of the link have a matching CTN ID defined that contains a valid STP ID.

4.2 Adding the server

The addition of a new server to an existing STP-only CTN involves defining the CTN ID on the new server to match the value already in use by the CTN. In our sample configuration, the CTN ID in use is [ITSOPOK] - [ ], so the new server must also have this value defined in line with existing servers.

Table 4-1 shows the before and after configuration details.

Table 4-1 Server configuration: adding a new server (SCZP401)

	Server	CTN ID		Server role	Timing mode	Stratum level
		STP ID	ETR ID			
Before migration	SCZP201	ITSOPOK		BTS	STP	2
	SCZP301	ITSOPOK		PTS & CTS	STP	1
	SCZP401	Null	Null		LOCAL	Not defined
After migration	SCZP201	ITSOPOK		BTS	STP	2
	SCZP301	ITSOPOK		PTS & CTS	STP	1
	SCZP401	ITSOPOK		Arbiter	STP	2

Note: The prerequisite STP preparation tasks are assumed to have been completed for this new server.

The new server also requires coupling link connectivity to the existing servers in the STP-only CTN. These links may be either coupling links or timing-only links, depending on the configuration.

The sample configuration uses both coupling links and timing-only links, because the new server attaches to two servers with Coupling Facilities (SCZP201 and SCZP301).

Removing the Save Config across POR option from existing CTN

Since the new Server SCZP401 is planned to join the current CTN, the option **Only allow server(s) specified above to be in the CTN** needs to be removed. This optional function can be used only in a single-server STP-only CTN or in a two-server STP-only CTN. Because our target configuration is a three-server CTN, this selection needs to be removed using the Current Time Server System (Sysplex) Time task.

At the HMC workplace, perform the following steps:

1. Highlight the **SCZP301** server (*Current Time Server* of the *existing CTN*) and select **System (Sysplex) Time**.
2. Click the **Network Configuration** tab.
3. Deselect the option **Only allow server(s) specified above to be in the CTN** and click **Apply** (Figure 4-8 on page 113).

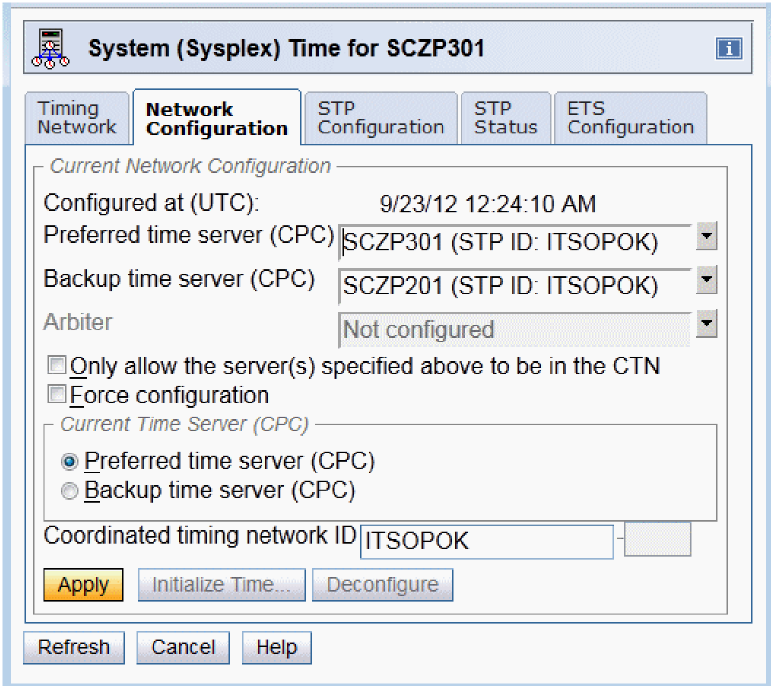


Figure 4-8 Remove the save STP configuration option from the existing CTN

4. Select **Yes** on the configuration change confirmation panel (Figure 4-9).

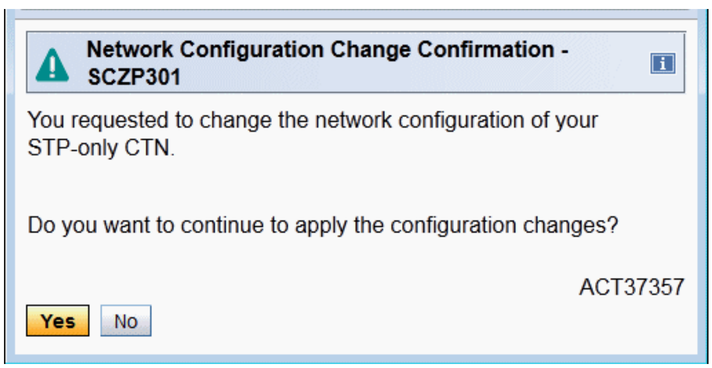


Figure 4-9 Configuration change confirmation - ACT37357

5. Select **OK** on the final confirmation message (Figure 4-10).

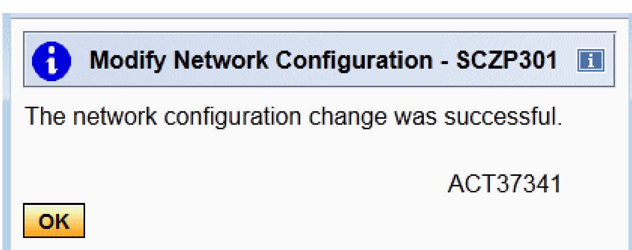


Figure 4-10 Configuration change confirmation - ACT373341

The existing CTN configuration has been changed; the CTN can now be joined by another server given that the connectivity and STP definition requirements are met.

Defining the STP ID on SCZP401

At the HMC workplace, perform the following steps:

1. Highlight the **SCZP401** server and select **System (Sysplex) Time**.
2. Click the **STP Configuration** tab.
3. Enter the required STP ID (in our case ITSOPOK) in the Coordinated Timing Network ID field (Figure 4-11). Click **Apply**.

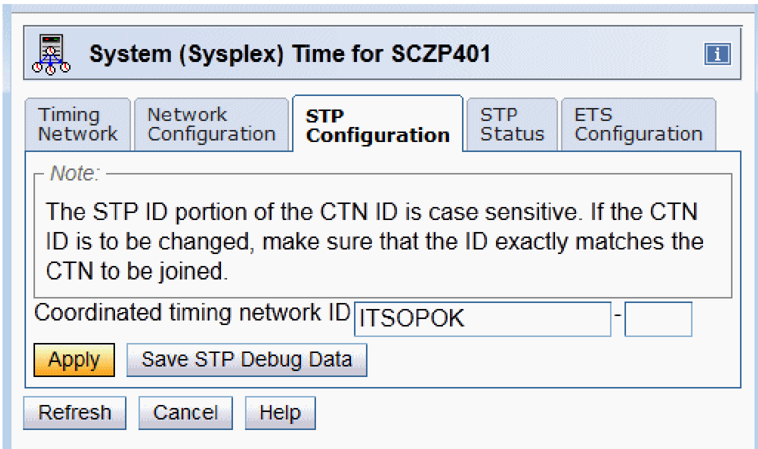


Figure 4-11 STP Configuration tab (SCZP401)

This displays the Local Coordinated Timing Network ID Change Confirmation, message ACT37363 (Figure 4-12).

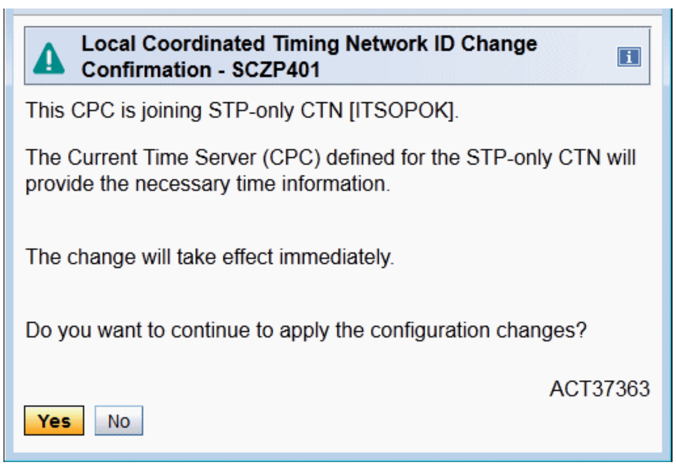


Figure 4-12 Message ACT37363 - Local CTN ID Change (SCZP401)

Note: The word *local* is included in this window to indicate that this change only applies to the selected server. It is *not* a global change, and thus it will *not* be propagated automatically throughout the CTN.

4. Confirm by clicking **Yes**. This displays the Local Coordinated Timing Network ID Change, message ACT37315 (Figure 4-13). Click **OK**.

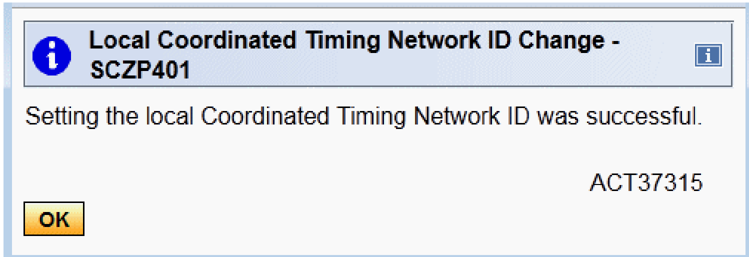


Figure 4-13 Message ACT37315 - CTN ID change success (SCZP401)

The new server, SCZP401, is now a member of the CTN ITSOPOK. From the STP Status panel the following can be confirmed for server SCZP401 (Figure 4-14):

- Server SCZP401 **Timing state** is **Synchronized**.
- Server SCZP401 is **Stratum level 2**.
- Server SCZP401 is connected to server SCZP301 through 6 CHPIDs (2 physical links) and to server SCZP201 through 4 CHPIDs (2 physical links).

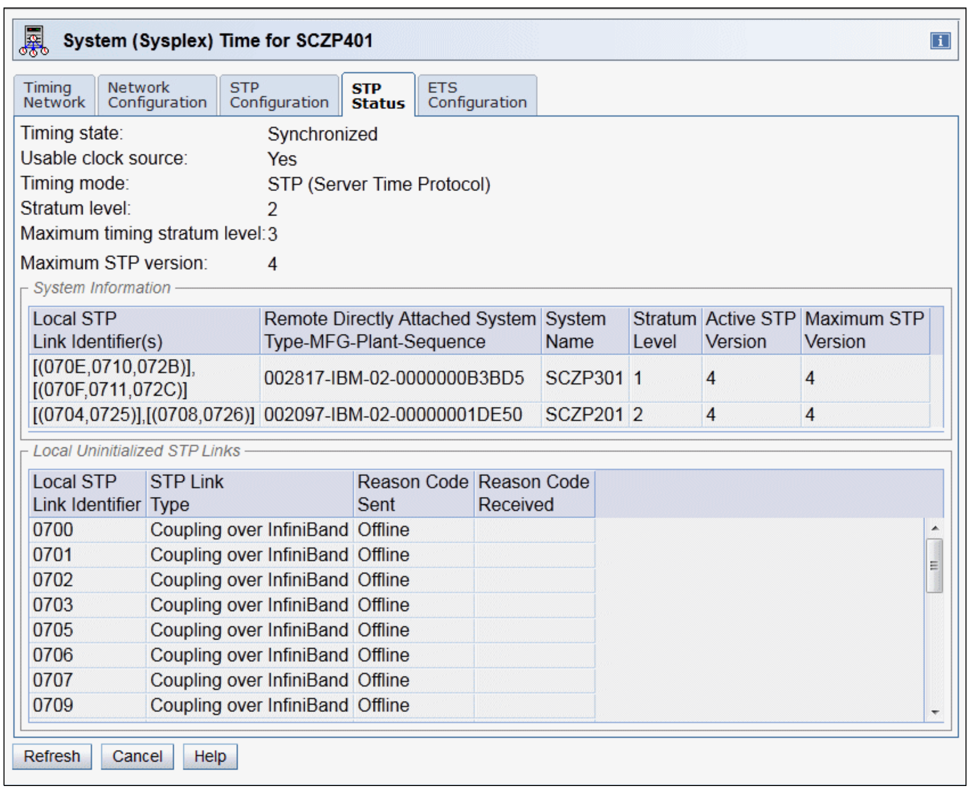


Figure 4-14 STP status of server SCZP401 after joining the CTN ITSOPOK

Assigning the Arbiter role to server SCZP401

Since the Arbiter-assisted recovery can be considered a more robust recovery mechanism, it is suggested to assign this role to the newly configured server in the CTN. More detailed planning considerations may need to be done in order to decide which role will be placed on which server; in this example the Arbiter role will be placed on the newly added server SCZP401.

Assigning the Arbiter is a global network configuration change and needs to be performed from the designated Current Time Server. At the HMC workplace, perform the following steps:

1. Highlight the **SCZP301** (CTS) server and select **System (Sysplex) Time**.
2. Click the **Network Configuration** tab.
3. Select server **SCZP401** from the Arbiter pull-down menu (Figure 4-15).
4. Select **Apply**.

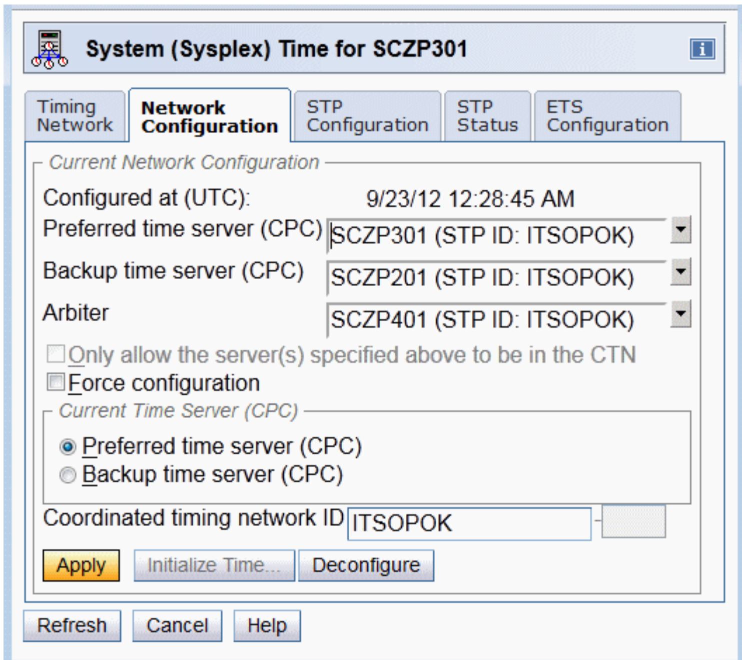


Figure 4-15 Assigning server SCZP401 as Arbiter

5. Select **Yes** on the configuration change confirmation panel (Figure 4-16).

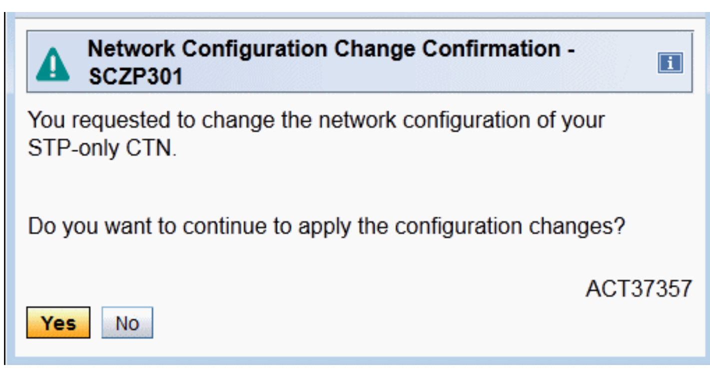


Figure 4-16 Configuration change confirmation - ACT37357

6. Select **OK** on the final confirmation message (Figure 4-17 on page 117).

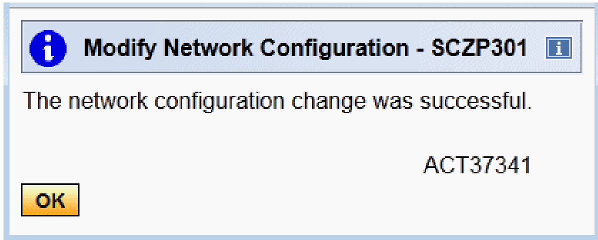


Figure 4-17 Configuration change confirmation - ACT373341

4.3 End point

The topology diagram of our sample configuration has been updated to include the new server (SCZP401) operating in STP timing mode (Figure 4-18).

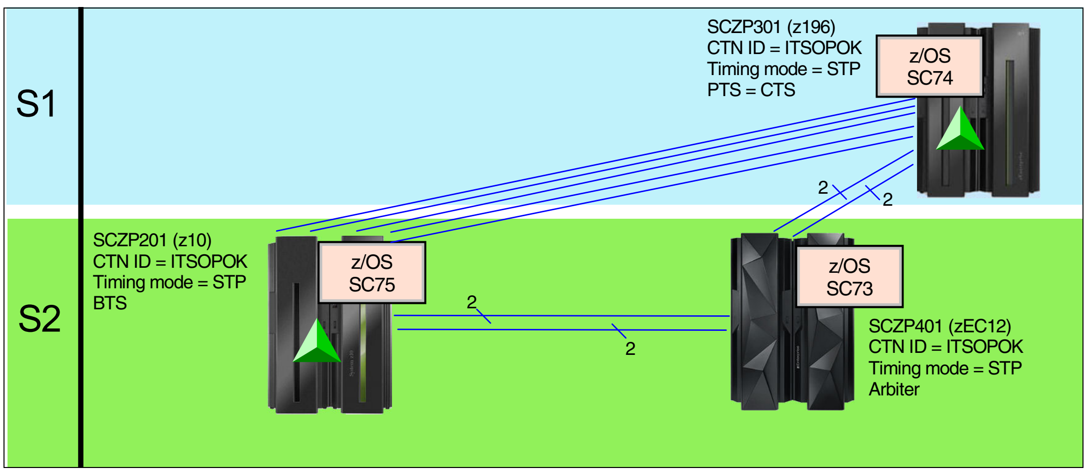


Figure 4-18 STP Implementation environment - STP-only CTN with new server (SCZP401)

There are six coupling channels (two physical links) between the existing server, SCZP301, and the new server, SCZP401, as evidenced by various HMC workplace displays.

The new server, SCZP401, is receiving timing messages from SCZP301 (Stratum 1) and from SCZP201 (Stratum 2) over the Coupling Facility links.

The STP clock selection algorithms favor a Stratum 1 server over a Stratum 2 server as the preferred clock source, so SCZP401 selects SCZP301 as its timing source and enters the CTN as a Stratum 2.

z/OS image SC73 is now IPLed on SCZP401 to issue z/OS commands.

4.3.1 z/OS DISPLAY ETR command

Figure 4-19 shows the output from the DISPLAY ETR command entered on the SC73 image, on SCZP401.

```
D ETR
IEA386I 16.48.33 TIMING STATUS 712
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  THIS IS THE ARBITER SERVER
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002817.M32.IBM.02.0000000B3BD5
  NUMBER OF USABLE TIMING LINKS =  10
```

Figure 4-19 DISPLAY ETR - SC73 image on SCZP401, STP-only CTN

This display shows that SC73 is resident on a server operating in STP timing mode as a Stratum 2. It is participating in an STP-only CTN with a CTN ID of [ITSOPOK] - [] and has ten links available for timing messages (six CF channels through two physical links to SCZP301 and four CF channels through two physical links to SCZP201).

4.3.2 z/OS DISPLAY XCF command

Figure 4-20 shows the output from the z/OS DISPLAY XCF command entered on the SC73 image, on TC8M.

```
D XCF,S
IXC336I  16.57.37 DISPLAY XCF 966
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2817 3BD5   2C   09/23/2012 16:57:35 ACTIVE        TM=STP
SC75     2097 DE50   1C   09/23/2012 16:57:34 ACTIVE        TM=STP
SC73     2827 B8D7   1A   09/23/2012 16:57:37 ACTIVE        TM=STP
```

Figure 4-20 DISPLAY XCF - SC72 image on TC8M, STP-only CTN

This display shows that all z/OS images in the sysplex configuration are resident on servers operating in STP timing mode. Each of these z/OS images is resident on a separate server, as evidenced by the different serial numbers.

4.3.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) Time selection for each server. Only the tabs for the SCZP401 server are shown.

Timing Network tab

Figure 4-21 shows the Timing Network tab for the SCZP401 server.

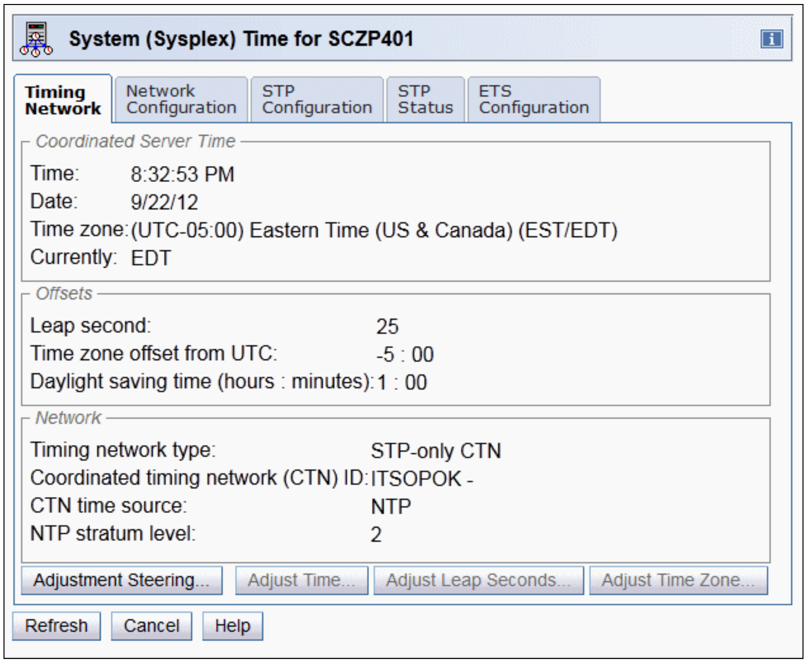


Figure 4-21 Timing Network tab (SCZP401)

This shows that the SCZP401 server is now in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ]. The same tab is shown on all servers in the STP-only CTN. However, only the Current Time Server has the Adjust Time, Adjust Leap Seconds, and Adjust Time Zone tabs enabled.

The CTN time source field indicates that the time initialization of this CTN is through the Stratum 2 NTP server.

The leap second offset (set to 25), the time zone offset and the current Daylight saving time offset are shown. These may be modified using the **Adjust Leap Seconds** and **Adjust Time Zone** buttons accordingly (only available on the Current Time Server).

Network Configuration tab

Figure 4-22 shows the Network Configuration tab for the SCZP401 server.

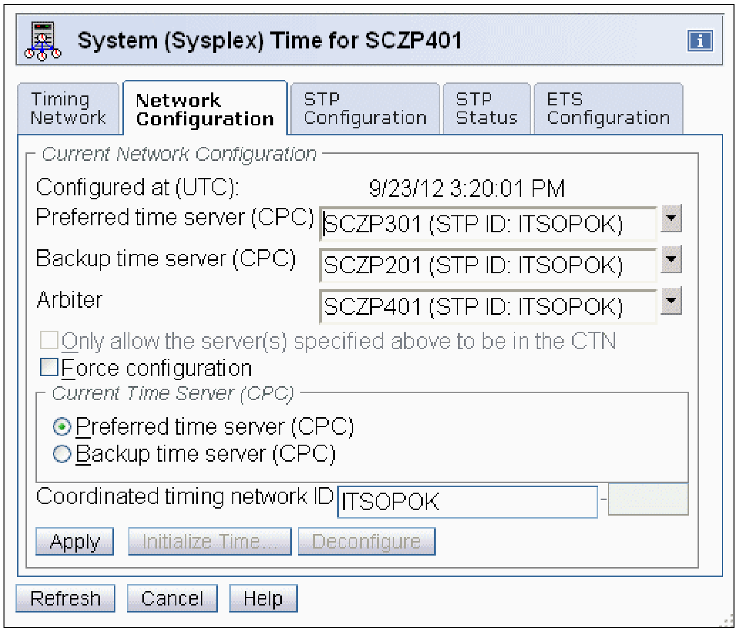


Figure 4-22 Network Configuration tab (SCZP401)

This tab shows the server roles within the STP-only CTN and indicates which server is the Current Time Server. The CTN ID is also displayed. The same tab is shown on all servers in the STP-only CTN.

The Preferred Time Server, Backup Time Server, Arbiter, Current Time Server, and CTN ID fields may all be modified from this tab. However, the modifications are only accepted if they are performed on the server that *is going to become the CTS* once the network reconfiguration is complete.

Modifications performed from the Network Configuration tab are *global* and, as such, are propagated throughout the STP-only CTN.

The CTN ID can be changed to either of the following:

- Specify a different STP ID for the STP-only CTN.
- Define an ETR Network ID that will migrate the STP-only CTN to a Mixed CTN.

STP Configuration tab

Figure 4-23 shows the STP Configuration tab for the SCZP401 server.

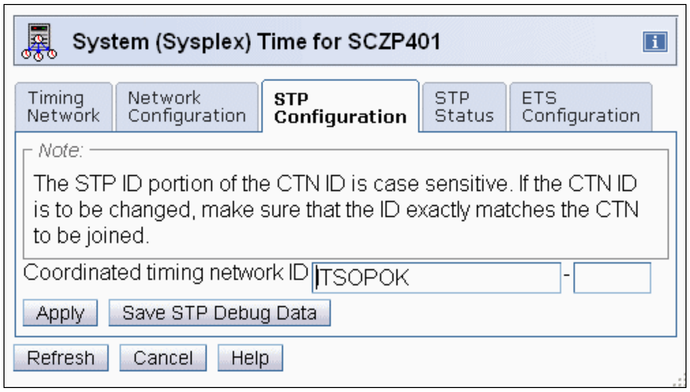


Figure 4-23 STP Configuration tab (SCZP401)

This tab shows that the SCZP401 server is in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ], where ITSOPOK is the STP ID.

STP Status tab

Figure 4-24 shows the STP Status tab for the SCZP401 server.

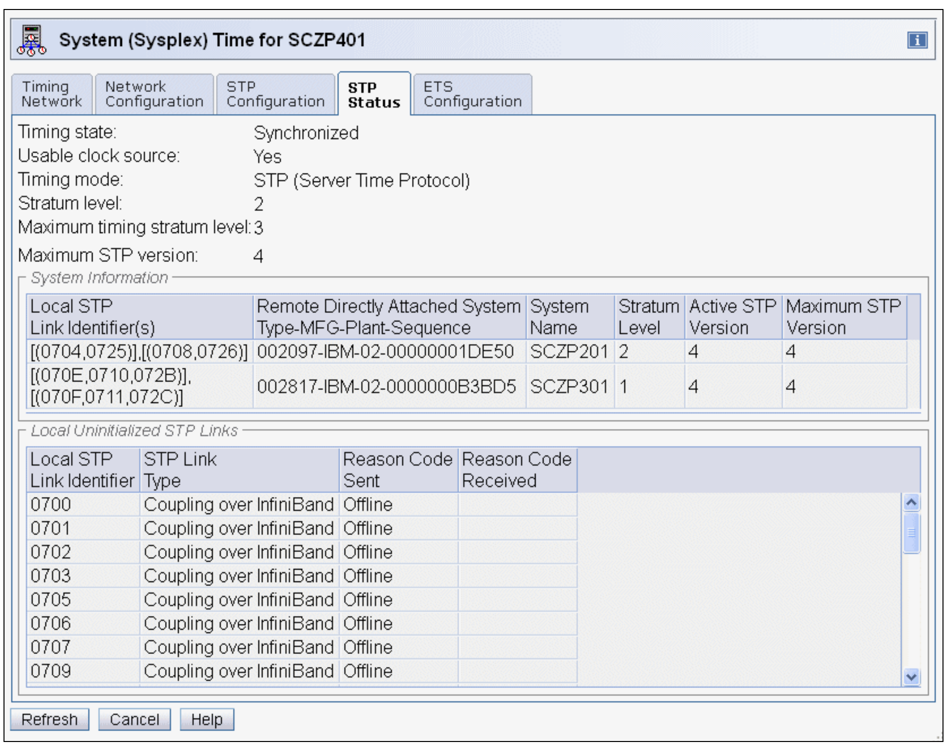


Figure 4-24 STP Status tab (SCZP401)

The SCZP401 server is shown to be synchronized in the STP-only CTN as a Stratum 2 server.

The Remote Directly Attached Systems section shows connectivity to other STP-configured servers. The SCZP301 server is the Stratum 1 server, and the SCZP201 server is a Stratum 2.

Part 2

CTN operations

This part discusses z/OS commands and Hardware Management Console (HMC) windows that are available to display or manage either a Mixed CTN or an STP-only CTN. The three chapters included in this part are:

5

Operations in an ETR and Mixed CTN

A Mixed Coordinated Timing Network (CTN) is a timing network that contains a collection of servers and has at least one Server Time Protocol (STP)-configured server stepping to timing signals provided by the Sysplex Timer. The STP-configured servers not stepping to a Sysplex Timer achieve synchronization by exchanging STP messages. The CTN ID contains a valid STP Network ID and an External Timer Reference (ETR) network ID.

This chapter discusses the following topics:

- Minimum requirements
- Monitoring the Mixed CTN using the HMC
- Monitoring the Mixed CTN using z/OS commands
- Configuring a Mixed CTN
- CTN configuration changes
- Time management: various considerations to be aware of while operating in a Mixed CTN environment
- Local time changes

5.1 Minimum requirements

When a Mixed CTN configuration is active, the Sysplex Timer provides the timekeeping information. The minimum requirements to configure a Mixed CTN are:

- There must be at least one STP-enabled server to configure a Mixed CTN.

> **Important:** To avoid a single point of failure in a Mixed CTN, have a minimum of two STP-configured servers stepping to timing signals received from the Sysplex Timers before configuring any other server using STP messages for synchronization.

- The STP-enabled server or CF must be attached to a Sysplex Timer, or a pair of Sysplex Timers configured in an Expanded Availability configuration.
- The STP-enabled server or CF must be configured with the same CTN ID, with the format:

  `[STP Network ID] - [ETR Network ID]`

Given these requirements, in a typical Mixed CTN environment there are:

- One or more STP-configured servers synchronized to the Sysplex Timers through ETR links. These servers are Stratum 1 servers in ETR timing mode.
- One or more STP-configured servers synchronized to either a Stratum 1 or Stratum 2 server by exchanging STP messages through coupling links. Stratum 2 and Stratum 3 servers are in STP timing mode.

> **Note:** Non-STP capable servers might also be time synchronized from the same Sysplex Timers but are not part of the Mixed CTN. They are not discussed in the ensuing examples.

5.2 Monitoring the Mixed CTN using the HMC

In a Mixed CTN, the Sysplex Timer console provides the user interface for all time-related functions, such as time initialization, time adjustment, and so on. This is not different from the operations in an ETR network. However, the HMC is used to initialize or modify the CTN ID. The HMC can also be used to configure the ETS prior to a STP-only migration.

> **Restriction:** The information in this section refers to servers z10, z9, z990 and z890. Although newer servers, such as z196, z114, and zEC12, can stiil be part of a mixed CTN, these servers are only supported in the same CTN with z10 servers. For more details, refer to Chapter 2, “Planning hardware and software”, and Chapter 3, “Operations”, in *Server Time Protocol Planning Guide,* SG24-7280.

The features installed on the server determine the tabs that are available on the System (Sysplex) Time task:

- If only the ETR feature is installed, the System (Sysplex) Time task displays:

  `ETR Configuration and ETR Status`

- If the ETR feature and the Server Time Protocol (STP) feature are both installed, the System (Sysplex) Time task displays:
  - For the z890 and z990 driver 55 K:

        - Timing Network
        - Network Configuration
        - ETR Configuration and ETR Status
        - STP Configuration and STP Status
    - For the System z10 at driver 76D (and 79F) and System z9 at driver 67L:
        - Timing Network
        - Network Configuration
        - ETR Configuration and ETR Status
        - STP Configuration and STP Status
        - ETS Configuration
- If only the Server Time Protocol (STP) feature is installed, the System (Sysplex) Time task displays the following tabs:
    - For the z890 and z990 driver 55 K:
        - Timing Network
        - Network Configuration
        - STP Configuration and STP Status
    - For the System z10 at driver 76D (and 79F) and the System z9 at driver 67L:
        - Timing Network
        - Network Configuration
        - STP Configuration and STP Status
        - ETS Configuration
- If neither the ETR nor the STP feature is installed, the System (Sysplex) Time task is not available.

Although invoking the System (Sysplex) Time task is not disruptive to logical partitions, the Secondary Object Notification for Disruptive Task message displays whenever the task is called (Figure 5-1). This message reminds the user that time configuration commands can potentially be disruptive to operating system images on the target server.

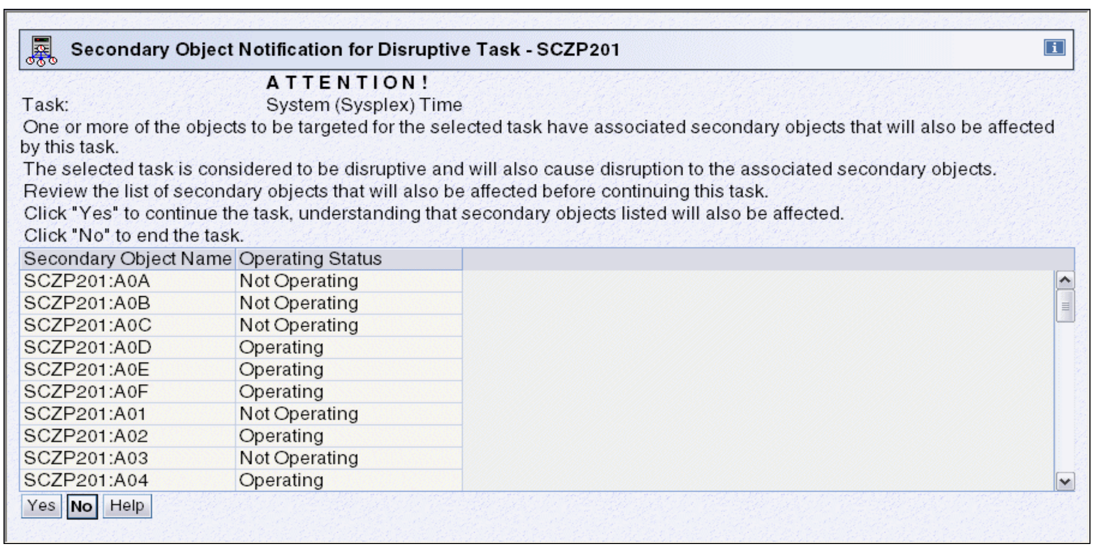


Figure 5-1 Secondary Object Notification for Disruptive Task

The following sections provide a brief description of the tabs available in the System (Sysplex) Time task and the operations that can be performed through these tabs.

Important: When two or more servers are selected in the System (Sysplex) Time task, it is necessary to click **Refresh** to update the displayed configuration information for *all* servers.

5.2.1 Timing Network tab

Use this tab to view the settings of the timing network. This window displays overall timing information for the ETR network or Coordinated Timing Network (CTN), including the current date and time, local time offsets, and general timing network information.

This tab is display-only, and information displayed is the same for all servers in the same ETR network or Mixed CTN configuration (CTN and ETR ID information can only be entered or modified in the HMC).

Figure 5-2 shows the Timing Network tab for an STP-enabled server in an ETR network. Figure 5-3 shows the Timing Network tab for a server STP configured in a Mixed CTN.

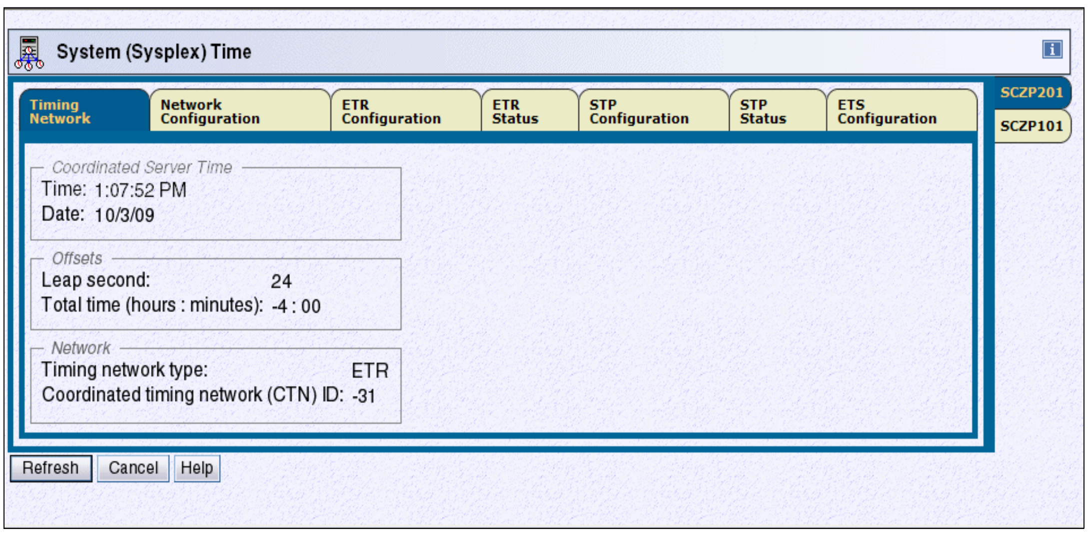


Figure 5-2 Timing Network tab - ETR network

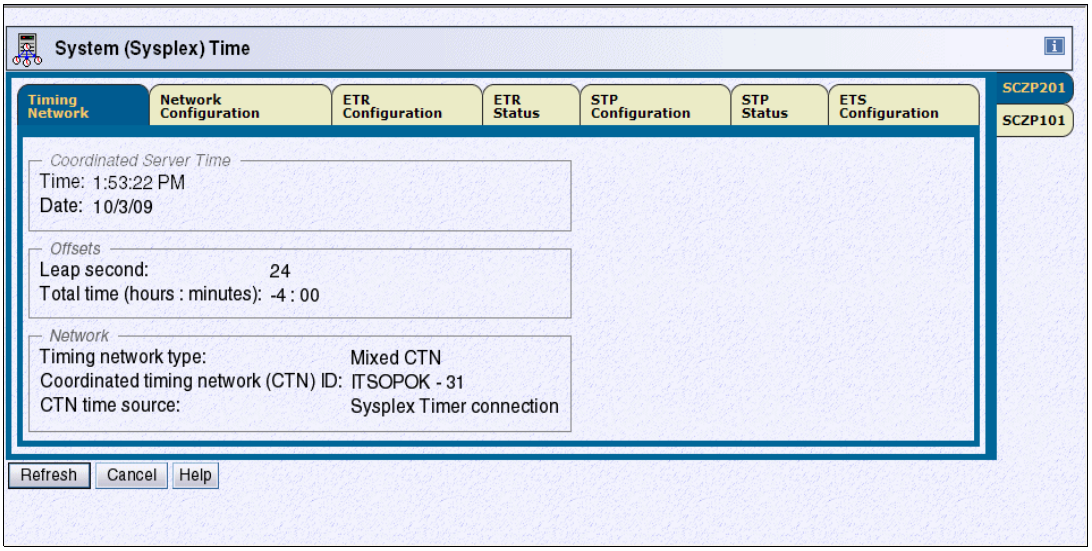


Figure 5-3 Timing Network tab - Mixed CTN

The information displayed on this tab is:

- Coordinated Server Time: The local time and date for the ETR network or Mixed CTN.
- Offsets: The current offsets for an ETR network or a Mixed CTN. If the network is uninitialized, all values are zero.
  - Leap second displays the current number of leap seconds in effect for the network.
  - Total time displays the total time offset between current local time and Coordinated Universal Time (UTC). This includes the current time zone and daylight saving time offset set at the Sysplex Timer console.
- Timing network type displays in which type of network the server is participating. In an ETR network or Mixed CTN, the possible values are:
  - ETR: Directly attached to Sysplex Timers. The Sysplex Timer provides the time information.
  - Mixed CTN: Directly attached to Sysplex Timers or attached to an STP-capable server. The Sysplex Timer provides the time information.
- Coordinated Timing Network (CTN) ID displays the ID for the Coordinated Timing Network that the server is participating in. The format is [STP ID] - [ETR ID].

  If the server is not a member of any timing network, there is no value in this field. If a server is a member of an ETR network, the STP ID is blank (Figure 5-2 on page 128). If a server is a member of a Mixed CTN, both STP ID and ETR ID are not blank (Figure 5-3 on page 129).
- CTN time source identifies the clock source according to the STP facility. CTN time source is not displayed for an ETR network. When the server is in a Mixed CTN, the possible values are:
  - Sysplex Timer connection: The time source is the Sysplex Timer.
  - Uninitialized: if the server is set up in a Mixed CTN but the time source has not yet been assigned.

  When a migration from an STP-only CTN has been initiated, possible values are:
  - Migration from an STP-only CTN to a Mixed CTN is in progress: A migration procedure is currently running, but the server is still in an STP-only CTN. The transition from STP-only to Mixed CTN only occurs when the procedure completes.

– Migration from an STP-only CTN to a Mixed CTN failed to complete: A migration procedure has stopped due to a problem or has been cancelled by the user. The CTN remains an STP-only CTN.

5.2.2 Network Configuration tab

In a Mixed CTN, the Network Configuration tab is only used to initiate the migration to an STP-only CTN.

Figure 5-4 shows the Network Configuration tab in a Mixed CTN. The Apply button is enabled, but none of the server roles are defined, and the following are disabled:

- The Coordinated Timing Network (CTN) ID field
- The Initialize Time button
- The Deconfigure button
- The Cancel Migration to Mixed CTN button

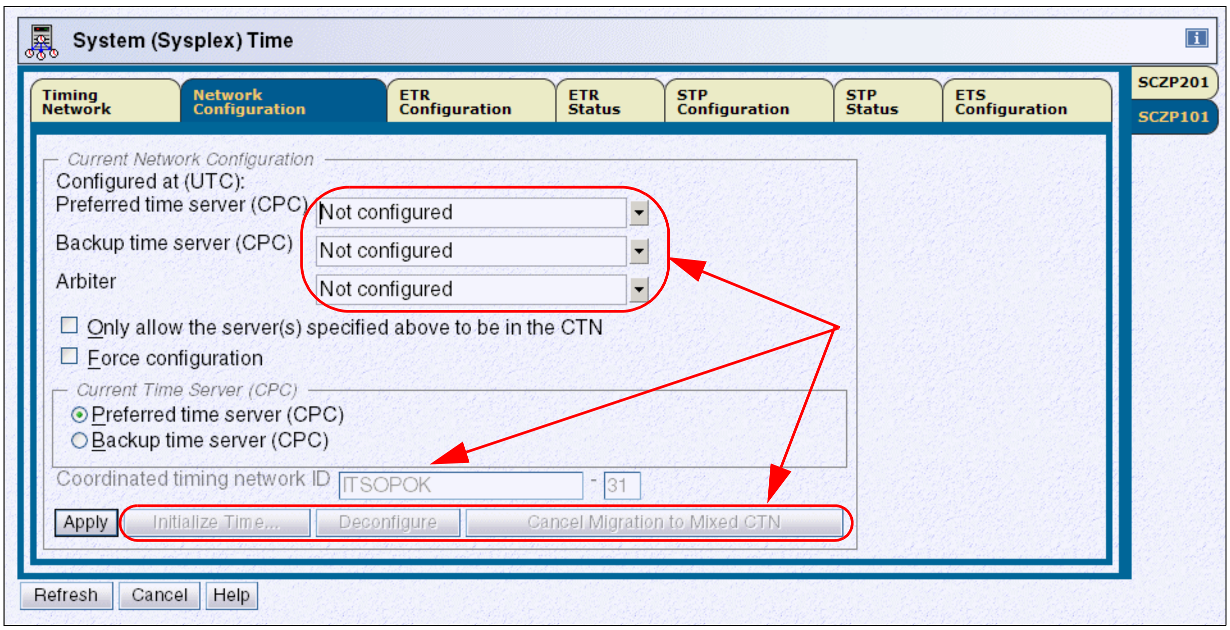


Figure 5-4 Network Configuration tab

The Apply button is used to configure server roles and to initiate the migration from a Mixed CTN to STP-only CTN.

When a Mixed CTN is *already* configured, and a valid server is selected from the Preferred Time Server drop-down menu, clicking **Apply** causes the entire CTN to globally transition from a Mixed CTN to a STP-only CTN.

Note: Configuration changes made in this window affect all servers in the CTN.

The information on the Network Configuration tab is the same for all servers participating in the CTN. However, when the HMC being used does not have connectivity to all servers' Support Elements (SEs) in the CTN, there might be differences in the way the information displays on the Network Configuration and the STP Status tabs.

5.2.3 ETR Configuration tab

The ETR Configuration tab only displays when ETR cards are installed in the server. Configuration changes made on this window only affect this particular server. They are *not* globally applied to the entire CTN.

This tab is used to configure the ETR Attachment Facility (EAF) ports in the server. The ETR Attachment Facility provides two ports that allow the server to synchronize to the Sysplex Timer. It is possible to set and display the state for each EAF port and the ETR Network ID for both EAF ports:

- ETR Network ID: specifies the External Timer Reference network ID of the attached Sysplex Timers. The network ID is a decimal number of 0 – 31. It indicates the Sysplex Timer network to which the EAF must be synchronized.

  If a network ID is not specified, the server is not configured to be part of an ETR network or Mixed CTN.

  When a server leaves a Mixed CTN and joins an STP-only CTN, the ETR Network ID value is removed.

- Port 0 State and Port 1 State can be enabled or disabled.
  - Enabled: allows the ETR Attachment Facility port to be operational.

    Figure 5-5 shows the view from a server in a Mixed CTN that is in ETR timing mode. In ETR timing mode, the ETR ports are normally enabled.

    In a Mixed CTN, successfully enabling Ports 0 and 1 changes the timing mode from STP to ETR. The server switches from Stratum 2 to Stratum 1.

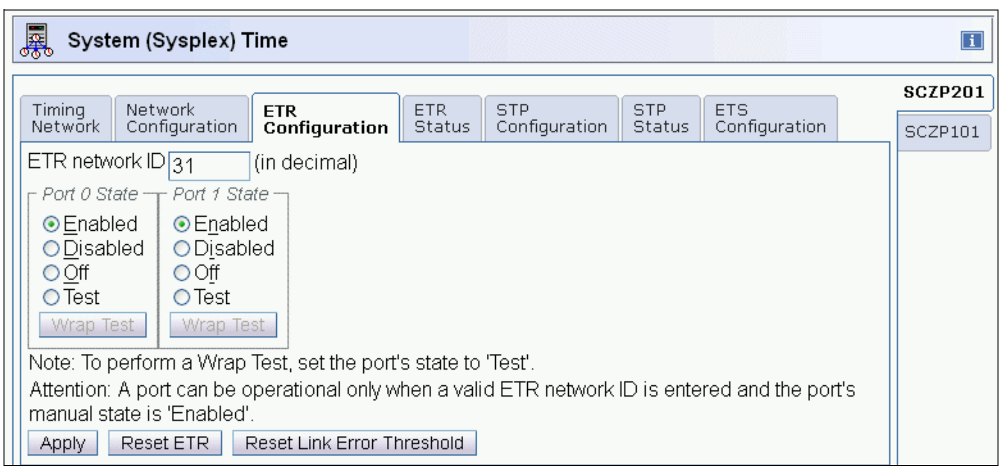


Figure 5-5 ETR Configuration tab - Server in ETR timing mode

  - Disabled: prevents the ETR Attachment Facility port from being operational. The EAF port is allowed to enter the semi-operational state, and the control program can read information being transmitted.
  - Off: prevents the ETR attachment facility from using this port.
  - Test: used to perform a wrap test (wrap plug must be available)

For a server that is in STP timing mode, the ETR ports are disabled (Figure 5-6).

Provided that the server has STP connectivity to another server in the Mixed CTN, disabling ports 0 and 1 changes the timing mode from ETR to STP. The server switches from Stratum 1 to Stratum 2 or 3.

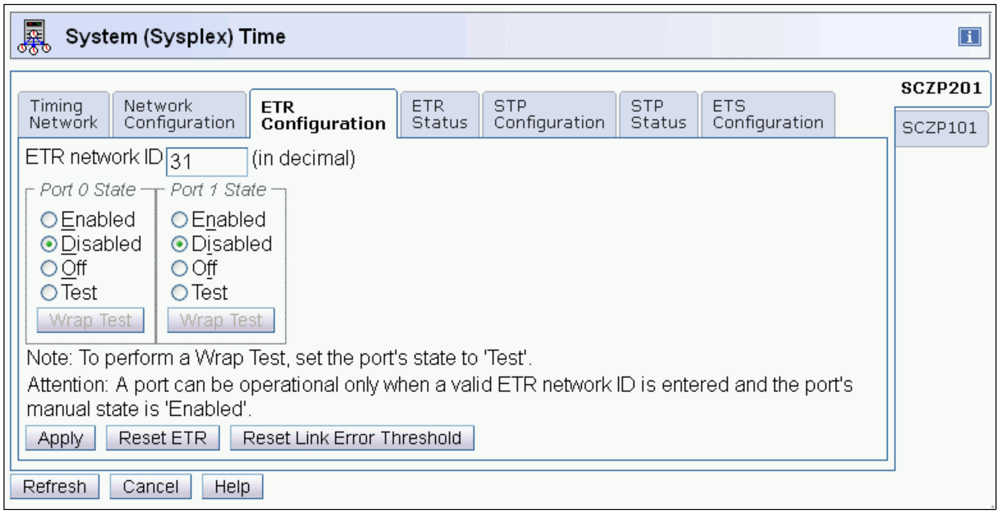


Figure 5-6 ETR Configuration tab - Server in STP timing mode

- The Reset ETR button re-initializes the ETR Attachment Facility (EAF) ports without a power-on reset of the entire server.

  The re-initialization of the ports is only necessary if the EAF has been determined to be in a solid hard error state after reaching the error threshold. Note that as long as the ports are fenced, their state can be displayed as semi-operational on the ETR Status tab.

  After the problem has been fixed, a reset of the EAF ports is needed to allow them to become operational again. If the ports do not require re-initialization and the **Reset ETR** button is clicked, message ACT37308 displays (Figure 5-7).

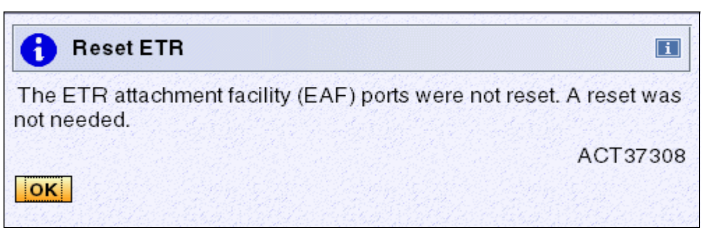


Figure 5-7 Message ACT37308 - Reset ETR

- The Reset Link Error Threshold button is used to reset the link error threshold and error time stamps and collect ETR error data.

  The link error threshold and error time stamps are used to prevent posting the same link error codes within a 24-hour period. However, when ETR link problems are being repaired, it is important to know whether a problem still exists. Resetting the link error threshold and error time stamps ensures that the immediate result of a repair action is observed.

Selecting this button also collects ETR data used to resolve ETR and Sysplex Timer problems. This data is collected concurrently. After this button is clicked, message ACT37309 displays (Figure 5-8).

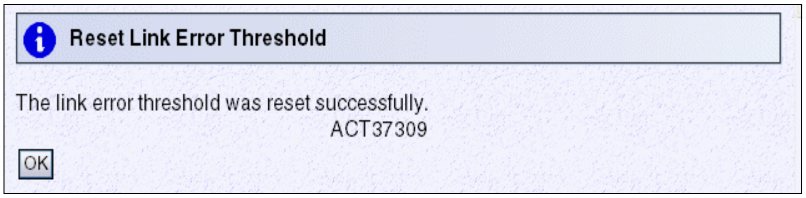


Figure 5-8 Message ACT37309 - Reset Link Error Threshold success

5.2.4 ETR Status tab

This tab displays the status of the ETR Attachment Facility ports that attach Sysplex Timers to the server. The ETR Status tab displays the ETR status word, ETR data word 1 of each EAF port of a Sysplex Timer, and the ETR card status. This tab only displays when the ETR feature is installed in the server.

This is a display-only tab. Any modifications to the ETR configuration, such as setting the ETR Network ID and ETR unit IDs, must be done using the Sysplex Timer console.

- ETR Status Word displays the current configuration of the ETR Attachment Facility ports sent by the Sysplex Timer. The information displayed indicates the state or mode of the ETR Attachment Facility ports.
  - Attachment control register indicates the current value in the ETR attachment control register.
  - Stepping mode identifies which mode is used to synchronize the time of day (TOD) clock. The stepping mode can be either ETR stepping or local.
  - EAF stepping port number indicates the port number for the ETR Attachment Facility stepping mode. When the EAF is in ETR-stepping mode, the stepping port number displays. When the EAF is in the local-stepping mode, the stepping port number displayed is zero.
  - Port state (0, 1) indicates whether the EAF port is available to the selected system for synchronizing its TOD clock with the attached Sysplex Timer.
- ETR Data Word 1 (Port 0, 1) displays data of the ETR Attachment Facility (EAF) ports as sent by the Sysplex Timer. The information displays link-connection information.
  - ETR Network ID (in decimal) identifies the ETR network of the Sysplex Timer to which the ETR Attachment Facility ports are connected.
  - ETR ID (in decimal) identifies the Sysplex Timer that sends the ETR-data word.
  - ETR port number (in decimal) identifies the port number of the Sysplex Timer output port that sends the ETR-data word.
- ETR Card Status displays the status of the External Timer Reference card installed in the server. This field indicates whether the port is able to receive and process optical signals from its attached Sysplex Timer.

  The *state* of a port describes its ability to communicate with its host system. The *status* of a port describes its ability to receive and process signals from its attached Sysplex Timer.

  To synchronize the TOD clock of the selected system, a port must be able to communicate with the system, and it must be able to receive and normally process optical signals from its attached Sysplex Timer. A port meets these requirements when its state is operational and its status is *light detected*, respectively.

The port statuses are:

– Light detected: indicates that the EAF port is receiving optical signals from the Sysplex Timer and is processing them normally

– Loss of light: indicates that the EAF port is not receiving an optical signal from the Sysplex Timer, or it is receiving a signal that is too weak to process

Information displayed varies slightly depending on whether the server is in ETR timing mode or in STP timing mode.

- For a server in ETR timing mode (Figure 5-9):
  – ETR Status Word → Stepping Mode is ETR stepping.
  – ETR Status Word → Port 0 State and Port 1 State shows Operational.
  – The ETR port number in the ETR Data Word sections reflects the Sysplex Timer port to which the two server ports are cabled.

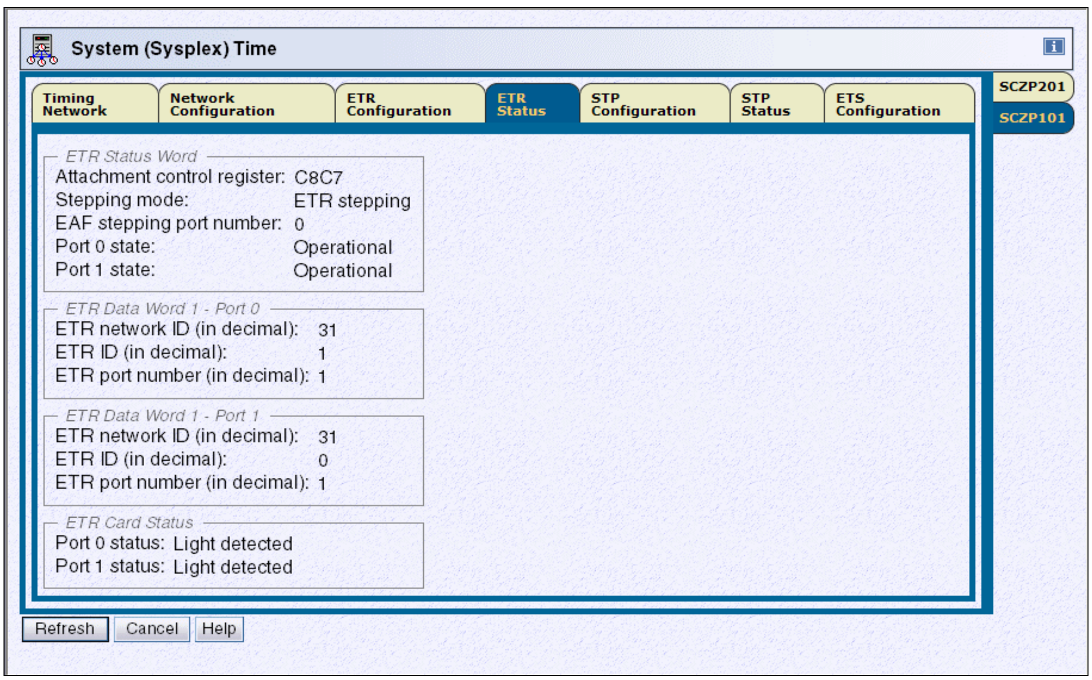


Figure 5-9 ETR Status tab - Server in ETR timing mode

- For a server in STP timing mode (Figure 5-10):
  - ETR Status Word → Stepping Mode is Local.
  - ETR Status Word → Port 0 State and Port 1 State shows Semi-operational because the ETR ports have been disabled.
  - The ETR port number in the ETR Data Word section reflects the Sysplex Timer port to which the two server ports are cabled.

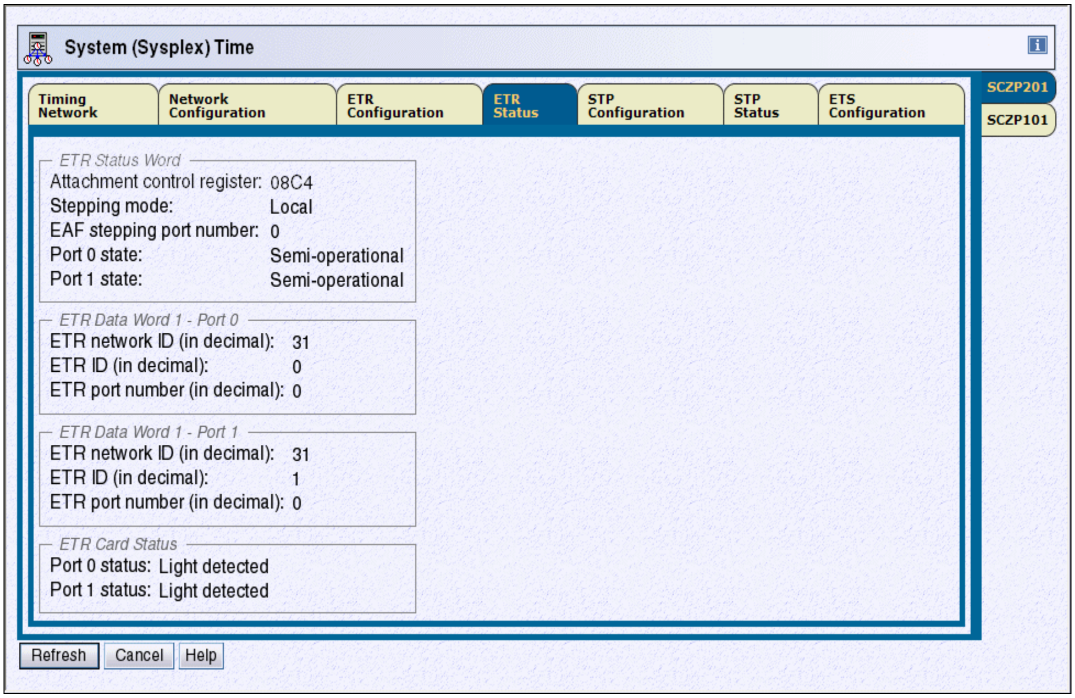


Figure 5-10 ETR Status tab - Server in STP timing mode

STP Configuration tab

The STP Configuration tab shows the Coordinated Timing Network ID for the server. In a Mixed CTN, the tab is used to enter the STP Network ID for the server in order to join a CTN or to remove the server from a CTN by blanking out the STP network ID. If a server with no ETR feature installed joins a Mixed CTN, the ETR ID is also specified on this tab.

Configuration changes made on this tab only affect this particular server. They are not applied to the entire CTN.

When migration from an STP-only CTN to a Mixed CTN has been initiated, the Apply button is disabled until the process is complete.

- Coordinated Timing Network ID: specifies the ID for the Coordinated Timing Network in which the server is participating. The form is [STP ID] - [ETR ID].
  - If the server is not a member of any timing network, there is no value in the fields.
  - If the server is participating in an ETR network, the CTN ID displays -[ETR ID].
  - If the server is participating in a Mixed CTN, the CTN ID displays [STP ID] - [ETR ID].

> **Note:** The valid characters for the STP ID are A – Z, a – z, 0 – 9, -, and _. The STP ID is case-sensitive.

To join a Mixed CTN or STP-only CTN, a valid STP ID must be specified. To leave a Mixed CTN, the STP ID must be removed (nullified). This results in the server participating in an ETR network, if a valid ETR ID is specified, or no timing network.

When a server has the ETR feature installed, the ETR ID portion displays to assist the user, but a change is not allowed (Figure 5-11). To change the ETR ID, the ETR Configuration tab must be used.

When a server does not have the ETR feature installed, an ETR ID can be specified so that the server can participate in a Mixed CTN. The ID must be the same as the ETR Network ID of the Sysplex Timer that is the time source for the Mixed CTN, even though the server is not physically connected to the Sysplex Timer. To leave a Mixed CTN, the ETR ID must be removed. This results in the server participating in an STP-only CTN (if the STP ID is specified) or no timing network.

- Save STP Debug Data button: collects data used for STP problem determination. The data is collected concurrently. The STP debug data file is automatically sent back to the IBM Service Support System.

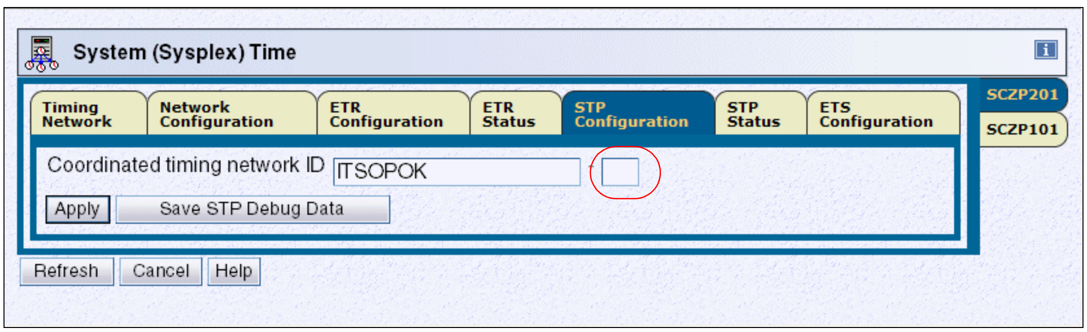


Figure 5-11 STP Configuration tab

STP Status tab

The STP Status tab is used to view the STP status information for a specific server. The information includes:

- Timing state: indicates the timing state in which the server is operating. The value can be *unsynchronized*, *synchronized*, or *stopped*. If it has a value other than synchronized, then the server is not actively participating in an ETR network or CTN.
- Usable clock source: indicates whether a usable clock source is available in order to synchronize the server TOD. The value is yes or no.
- Timing mode: indicates whether the TOD clock is attempting to synchronize to a timing network, and if so what type of network it is. In a Mixed CTN, the values can be ETR (external time reference), STP (Server Time Protocol), or local if a time source has not yet been configured.
- Stratum level: indicates the hierarchy of this server within the CTN. The value can be 1, 2, or 3. A stratum level of 0 indicates that the server has no time source. This line is not displayed when the server is in ETR timing mode and did not join a Mixed CTN yet.
- Maximum timing stratum level: contains a number indicating how far a server can be from the Stratum 1 and still be in a synchronized state. The maximum timing stratum level is 3.
- Maximum STP version: specifies a number indicating the maximum level of STP facility code supported by this server.
- System Information: This table identifies the remote servers that are directly attached to this server for STP purposes.

This server's coupling links or time-only links that are initialized to transport STP messages are listed using the PCHID addresses and are grouped according to the system that is directly attached to the links. Additionally, the stratum level, active STP version, and maximum STP version for each directly attached system is shown.

Servers with different maximum STP versions can coexist in the same CTN. When the local and remote servers do not have the same maximum STP version installed, communication between the servers uses the lowest version installed. The STP version used is indicated in the active STP version column.

Connecting the information provided in this table from all servers in the STP-only CTN can help build a topology diagram of the CTN at that precise moment in time. If a CTN reconfiguration command has been applied from any other tab in the System (Sysplex) Time task, it is necessary to first click **Refresh** to ensure the validity of the information displayed.

- Local Uninitialized STP links: This table identifies all possible coupling links defined in the Input Output Configuration Data Set (IOCDS) that might be used by this server to exchange STP messages.

  All links in this table are in the uninitialized state. The table shows the STP link identifier (physical channel ID (PCHID) without any channel path identifier (CHPID) information), link type, the reason code sent, and the reason code received. The reason code (for example, offline or link failure) identifies the reason that STP has not initialized the link. The help function is available to look up any specific reason code.

The STP Status tab is display-only and appears slightly different depending on whether it is addressing a server that is in ETR timing mode or a server in STP timing mode.

On a server in ETR timing mode, timing mode is ETR (External Time Reference) and Stratum level is 1 (Figure 5-12).

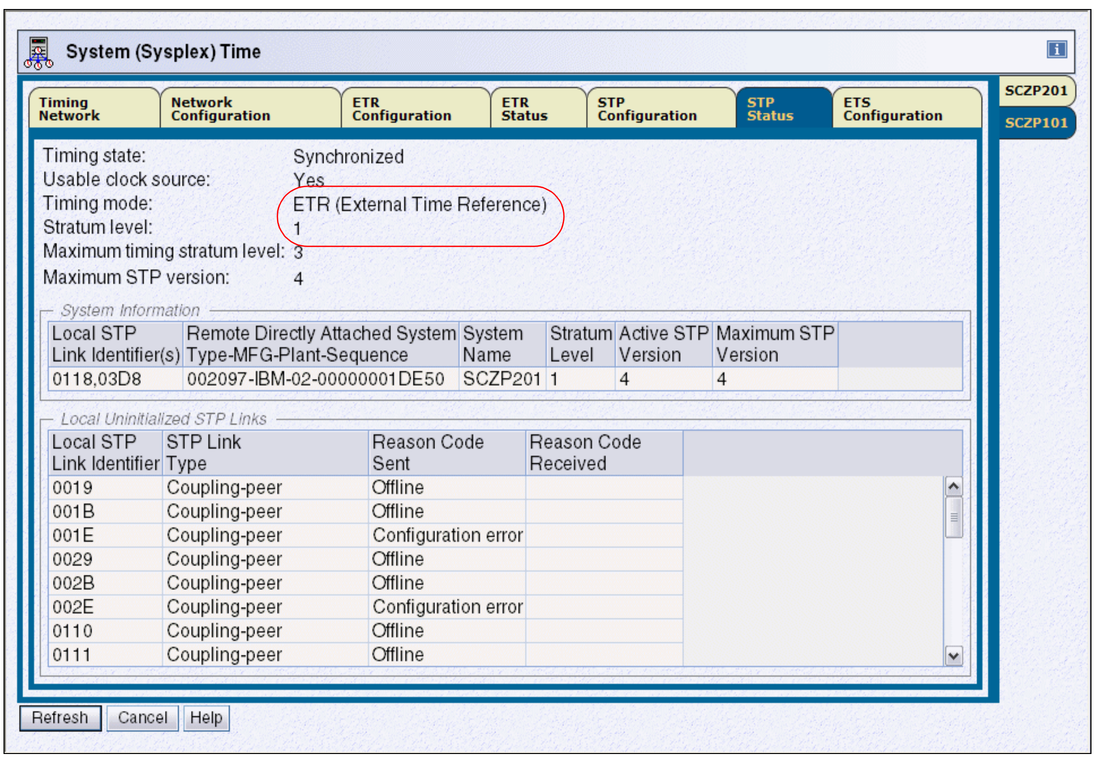


Figure 5-12 STP Status - Server in ETR timing mode

On a server in STP timing mode, timing mode is STP (Server Time Protocol). The Stratum level value can be 2 or 3. In the example in Figure 5-13, the Stratum level is 2.

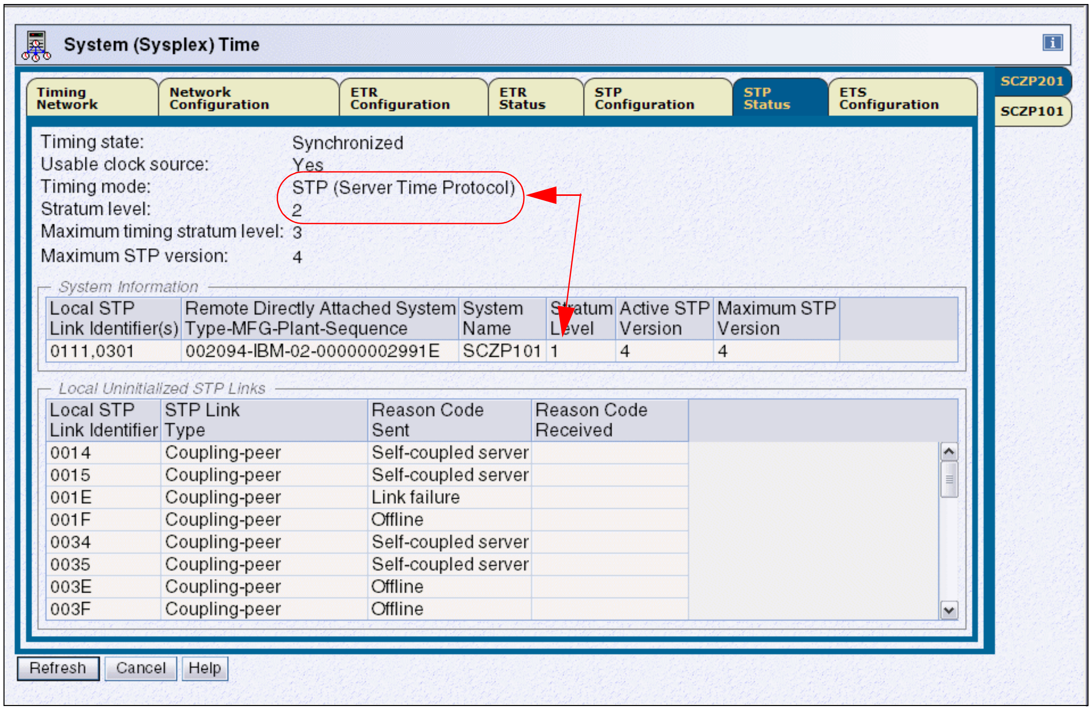


Figure 5-13 STP Status tab - Server in STP timing mode

5.2.5 ETS configuration

With driver 67L on the System z9 and driver 76D or later on the System z10, the System (Sysplex) Time task is enhanced to support the use of NTP servers as external time sources in an STP-only CTN. To support both dial out and NTP, the user needs to configure which method will be used. The configuration of the ETS method will be done through the new ETS Configuration tab in the System (Sysplex) Time task shown here.

After the migration to an STP-only CTN, the external time source selection specified in the ETS Configuration window is only used to adjust the central processing complex (CPC) time if that SE is representing the Current Time Server (CTS). Despite that, the ETS Configuration window displays for all CPCs that support NTP, regardless the CTN type. That enables the ETS configuration of every existing CPC in a Mixed CTN before migrating to an STP-only network.

A newly installed CPC, which joins this Mixed CTN and becomes a CTS candidate when migrating to a STP-only configuration in the future, can also be configured at installation time. It is typical for the CTS to be the Preferred Time Server (PTS). If there is already a configured Backup Time Server (BTS), it is a very good idea to configure a viable ETS as well. There are three ETS types available (Figure 5-14):

- Selecting the **Use dial out if configured on Hardware Management Console** radio button specifies that the ETS is the dial out mechanism if configured on the HMC Customize Console Date/Time task.
- Selecting the **Use NTP** radio button displays the NTP Time Server Information table, which allows one or two NTP time servers to be configured. Once configured, the **Query** button tests the NTP Time Server's accesses and fills in the Stratum, Source, and Status fields.
- Selecting the **Use NTP with pulse per second (PPS)** radio button displays the NTP Time Server Information table, which allows one or two NTP time servers to be configured. Once configured, the **Query** button tests the NTP Time Server's accesses. The PPS Port, Stratum, Source, and Status fields will be filled. The PPS Port Status displays below the NTP Time Server Information table.

See 1.1, "External Time Source" on page 4, for more information.

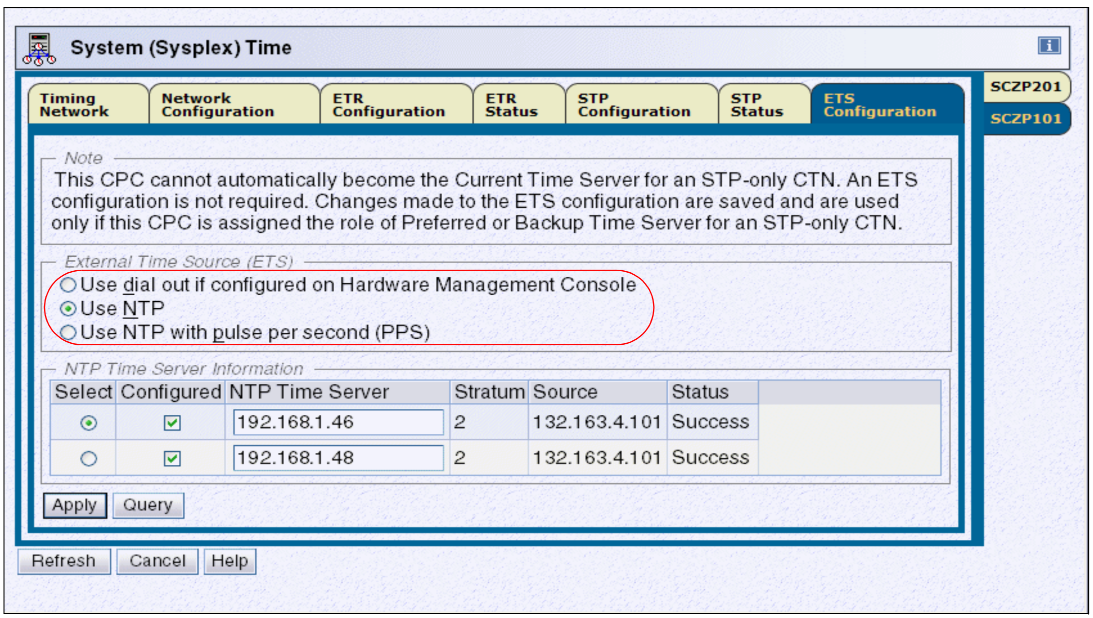


Figure 5-14 ETS Configuration tab - CTN not configured

Clicking **Apply** saves the configuration. The configured ETS can be used to adjust the CST once the CTN is migrated to STP-only. The message ACT39145 displays (Figure 5-15).

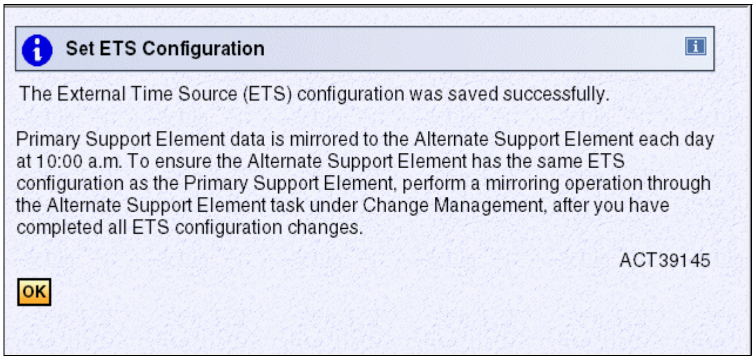


Figure 5-15 Message ACT39145 - Saved ETS configuration

In HMC menus, CPCs that do not support NTP (z990 and z890) do not display the ETS Configuration tab for the target CPCs. However, these servers can continue to be part of the STP-only CTN using an NTP server as the ETS.

5.3 Monitoring the Mixed CTN using z/OS commands

The output from various z/OS commands that display time-related information varies depending on:

- Which server is hosting the z/OS system
- The type of timing network
- The timing mode that the server is using

5.3.1 z/OS commands

In this section, we discuss the z/OS commands for monitoring a Mixed CTN.

DISPLAY ETR

Prior to STP, the DISPLAY ETR (D ETR) command was used to display the synchronization mode and the status of the ETR ports seen by z/OS.

With STP support, the command itself has not changed and no new options have been provided. However, the output has been updated to support various STP environments and displays STP-related information where applicable.

Mixed CTN on a server in ETR timing mode

When a server has joined a Mixed CTN through the process of defining a CTN ID but is still directly synchronized to a Sysplex Timer, then the DISPLAY ETR command shows both Sysplex Timer related information and CTN ID information (Figure 5-16).

```
D ETR
IEA282I 14.48.26 TIMING STATUS 951
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=01                   ETR PORT=01
  ETR ID=01                     ETR ID=00
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Figure 5-16 z/OS DISPLAY ETR in a Mixed CTN with ETR timing mode

Note that the format is similar to the information returned from a DISPLAY ETR command issued in a ETR network configuration, except that an extra line is added to the output display to show the CTN ID.

In a Mixed CTN on a server in ETR timing mode, the DISPLAY ETR command shows that:

- The Synchronization Mode is ETR.
- An extra informational line indicates the CTN ID ([ITSOPOK] - [31] in our example).

Mixed CTN on a server in STP timing mode

It is also possible to have servers in a Mixed CTN that are synchronized using STP messages, without an active connection to a Sysplex Timer. These servers can be either Stratum 2 or Stratum 3 servers in STP timing mode.

When a server is in STP timing mode in a Mixed CTN, the CTN ID contains both the STP ID and ETR Network ID components. Figure 5-17 on page 142 shows a DISPLAY ETR command example, where:

- Synchronization Mode is STP.
- Stratum Level is 2.
- The CTN ID contains both the STP ID [ITSOPOK] and the ETR Network ID [31].
- The number of usable timing links is 2.
- There is an indication that the server only has a single source of timing signals.

Although there are two coupling links initialized for STP, they are both connected to a single server. This indicates a single point of failure in the configuration. The DISPLAY ETR output in Figure 5-17 matches the information displayed on the STP Status tab in Figure 5-13 on page 138.

```
D ETR
IEA386I 14.51.27 TIMING STATUS 888
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK -31
  NUMBER OF USABLE TIMING LINKS =  2
  THIS SERVER HAS ONLY A SINGLE SOURCE OF TIMING SIGNALS
```

Figure 5-17 z/OS DISPLAY ETR in a Mixed CTN with ETR timing mode

Note: The number of usable timing links is only displayed for a Stratum 2 or a Stratum 3 server that is hosting the z/OS image. The z/OS image on the Stratum 1 server does not show the number of usable timing links because the server does not rely on external STP links. For a Stratum 2 or Stratum 3 server, only STP *initialized* links to a Stratum 1 or a Stratum 2 are included in the number of usable timing links.

SETETR PORT=n

The SETETR command can only be used to enable ETR ports that have been previously disabled by z/OS as a consequence of a hardware error. This command cannot be used when the server is in STP timing mode. If it is, the z/OS message IEA384I displays:

```
IEA384I SETETR COMMAND IS NOT VALID IN STP TIMING MODE
```

DISPLAY XCF,SYSPLEX, ALL[1]

The DISPLAY XCF,SYSPLEX,ALL command displays the system status, timing mode, and the last recorded system status monitor time stamp for each system in the sysplex.

Figure 5-18 shows a Mixed CTN where:

- SC74 is in STP timing mode, as indicated by TM=STP.
- SC75 is in ETR timing mode, as indicated by TM=ETR.

```
D XCF,SYSPLEX,ALL
IXC335I  14.53.36  DISPLAY XCF 969
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/03/2009 14:53:33 ACTIVE        TM=STP
SC75     2094 991E   1C   10/03/2009 14:53:36 ACTIVE        TM=ETR
```

Figure 5-18 z/OS DISPLAY XCF,SYSPLEX,ALL in a Mixed CTN

DISPLAY CF

The DISPLAY CF command does not directly provide information regarding the CTN type or timing mode of the server. However, the output displays the CF Request Time Ordering status. If the CTN is a Mixed CTN or STP-only CTN in a Parallel Sysplex® configuration, the requirement is that all servers support the Message Time Ordering Facility (MTOF).

[1] For z/OS 1.13 and later, command syntax is **D XCF,SYSPLEX**, and the message id is **IXC336I**

Note: CF Request Time Ordering is also referred to as the MTOF.

The DISPLAY CF command can be used to verify whether MTOF is required and enabled (Figure 5-19).

```
D CF
IXL150I  14.55.46  DISPLAY CF 975
COUPLING FACILITY 002094.IBM.02.00000002991E
                  PARTITION: 2C  CPCID: 00
                  CONTROL UNIT ID: FFFC
NAMED CF7B
COUPLING FACILITY SPACE UTILIZATION
. . . . . . . .

    CFCC RELEASE 15.00, SERVICE LEVEL 02.09
    BUILT ON 04/30/2009 AT 14:18:00
    COUPLING FACILITY HAS 1 SHARED AND 0 DEDICATED PROCESSORS
    DYNAMIC CF DISPATCHING: ON

CF REQUEST TIME ORDERING: REQUIRED AND ENABLED

. . . . .
```

Figure 5-19 z/OS DISPLAY CF

STP requires that each coupling facility within a Parallel Sysplex is *enabled* for CF Request Time Ordering before migration of any server within the Parallel Sysplex to either a Mixed CTN or a STP-only CTN. If this is not the case, the coupling facility becomes unusable and all structures require rebuilding into a CF Request Time Ordering *enabled* coupling facility.

Figure 5-20 displays the other CF Request Time Ordering messages that could appear in the output of the DISPLAY CF command.

```
CF REQUEST TIME ORDERING: NOT-REQUIRED AND ENABLED
CF REQUEST TIME ORDERING: NOT-REQUIRED AND NOT-ENABLED
CF REQUEST TIME ORDERING: REQUIRED AND NOT-ENABLED
CF REQUEST TIME ORDERING: REQUIRED AND WILL NOT BE ENABLED
REASON: FUNCTION NOT INSTALLED ON THIS SYSTEM
REASON: ETR NOT CONNECTED TO COUPLING FACILITY
REASON: REQUEST TIME ORDERING FUNCTION FAILURE
REASON: REQUEST TIME ORDERING NOT INSTALLED ON THIS SYSTEM
REASON: ETR NETID MISMATCH - CF ETR NETID: etr netid
REASON: CTNID MISMATCH - CF CTNID: cfstpid
REASON: CF IS OUT OF SYNCH WITH TIMING NETWORK
```

Figure 5-20 Possible CF Request Time Ordering messages

5.3.2 Coupling facility commands

In a Parallel Sysplex environment, coupling facilities require time awareness to support CF Request Time Ordering (MTOF) when in a Mixed CTN or a STP-only CTN. The server TOD is used for this purpose.

Coupling facilities also support the concept of time zone offset, which is used only for the purpose of time stamping messages that are displayed on the console.

Unlike z/OS, there is no Coupling Facility Control Code (CFCC) command available to display the time. However, all messages that appear on the CF console include a time stamp in local time format, which is the server TOD with the time-zone offset applied.

Therefore, the current local date and time at the CF console can be indirectly determined by entering any command (valid or invalid) and reviewing the time stamp in the response.

Because the CF supports a local time format that incorporates the time-zone offset, it also provides methods to both display the current time-zone offset setting and to change it if required.

DISPLAY TIMEZONE

Use the CFCC DISPLAY TIMEZONE command to display the current time-zone offset being used by the coupling facility. This produces a single line indicating how many hours and minutes the current time zone is east or west of Greenwich mean time (Figure 5-21).

```
2009276 11:06:47 => DISPLAY TIMEZONE
2009276 11:06:47 CF0271I Timezone is 04:00 West of Greenwich Mean Time.
```

Figure 5-21 CFCC DISPLAY TIMEZONE command

TIMEZONE

The CFCC supports the TIMEZONE command, allowing the time-zone offset to be changed if this is a requirement. The syntax is:

```
TIMEZone {0|hh|hh:mm|:mm} {East|West}
```

Use this command to adjust the local time displayed in messages on the coupling facility console for the onset and removal of daylight saving time (Figure 5-22).

```
2009276 15:17:31 => TIMEZONE 05:00 west
2009276 14:17:31 CF0271I Timezone is 05:00 West of Greenwich Mean Time
```

Figure 5-22 CFCC TIMEZONE command

Coupling facility implications at daylight saving time changes

When a CF image partition is activated and the server is using Server Time Protocol or a Sysplex Timer source, the CFCC uses only one of the time offset options:

- The logical partition time offset specified in the image profile *User Specified Time Offset*
- The TIMEZ offset

The TIMEZ offset overrides the logical partition time offset. We recommend that the TIMEZ command be used for DST changes, as described in *Coupling Facility - TIMEZ Command during Daylight Saving Time Changes* at:

http://w3-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD103077

5.4 Configuring a Mixed CTN

This section discusses how to configure a Mixed CTN starting from an ETR-only CTN.

5.4.1 CTN ID initialization

The Sysplex Timer is the time source in a Mixed CTN, so to avoid a single point of failure, at least two servers or CFs must be in ETR timing mode (Stratum 1). For the same reason, if Stratum 2 servers or CFs are configured in the Mixed CTN, each must be connected to at least two Stratum 1 servers or CFs, with at least two coupling links to each Stratum 1 server or CF.

When more than two servers or CFs are configured in a Mixed CTN, additional (STP) Stratum 1 servers (besides the two recommended) can be individually configured in STP timing mode. Changing the timing mode for a given server or CF is done by disabling its ETR ports from the ETR Configuration tab. (The procedure is described in 5.5.2, “Changing a server to STP timing mode” on page 147.)

Applying the STP Network ID as the first portion of the CTN ID activates a Mixed CTN. The STP Network ID is entered on the STP Configuration tab (Figure 5-23). The same CTN ID needs to be entered on every server that will participate in the Mixed CTN.

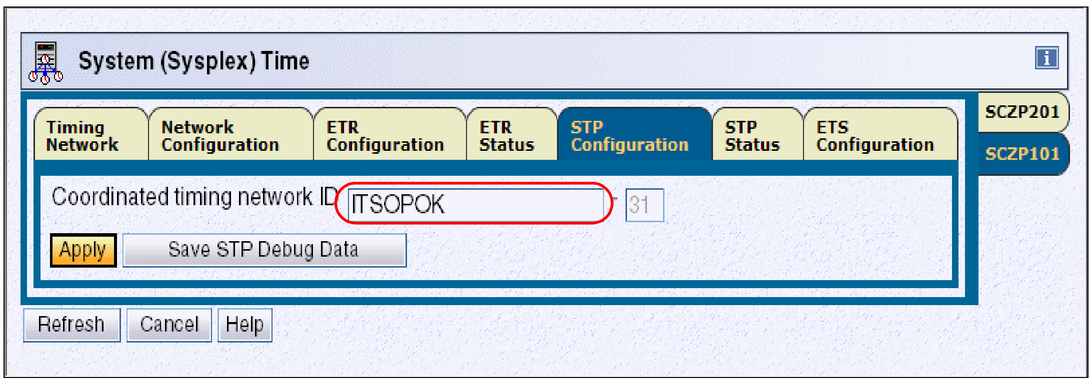


Figure 5-23 System (Sysplex) Time - STP Configuration tab

The CTN ID format is [STP Network ID] - [ETR Network ID]. If the server has the ETR feature installed, the ETR Network ID already assigned to the ETR network is grayed out and cannot be changed. Only the STP Network ID portion of the CTN ID is specified. When the configuration is applied, the Local Coordinated Timing Network ID Change Confirmation message ACT37361 displays (Figure 5-24).

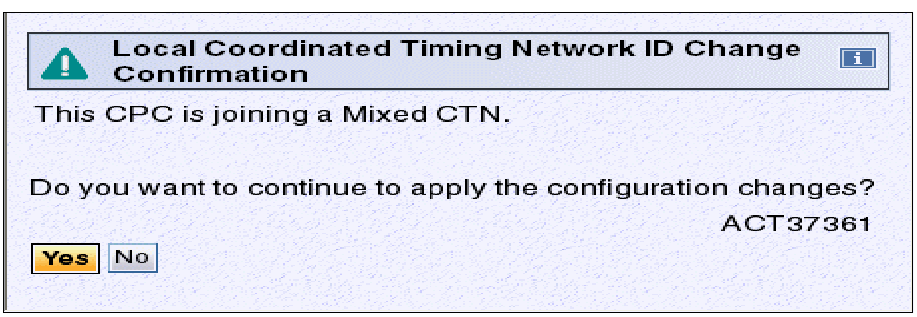


Figure 5-24 Message ACT37361 - Local Coordinated Timing Network ID Change Confirmation

When the change is complete, the server is defined in a Mixed CTN, with CTN ID = [ITSOPOK] - [31].

The server is now STP configured. The response to the z/OS DISPLAY ETR command, message IEA282I, now includes the CTN ID (Example 5-1).

Example 5-1 DISPLAY ETR command and response

```
D ETR
IEA282I 14.39.57 TIMING STATUS 292
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=01                   ETR PORT=01
  ETR ID=01                     ETR ID=00
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

5.4.2 Time initialization

In an ETR-only network or a Mixed CTN environment, the Sysplex Timer provides the timekeeping information. When migrating from an ETR network to a Mixed CTN, the following timing information is inherited from the Sysplex Timer:

- Date and time
- Leap second offset
- Total time-zone offset (the combination of time-zone offset and DST offset)

If there are specific requirements to provide accurate time relative to an external time standard for data processing applications, consider using the external time source (ETS) function. In a Mixed CTN, the ETS function is provided by the Sysplex Timer.

5.5 CTN configuration changes

In this section we discuss CTN configuration changes.

5.5.1 Changing the CTN ID

In a Mixed CTN, a global CTN ID change cannot be made using the Network Configuration tab. No global change is possible.

However, a change of the STP ID from the STP Configuration tab is possible for each individual server.

If a server already participates in a Mixed CTN and the current STP ID is changed, the server leaves the current Mixed CTN to join another one or create a new one. Figure 5-25 illustrates this change. The CTN ID is changed from [ITSOPOK] - [31] to [ITSOnew] - [31].

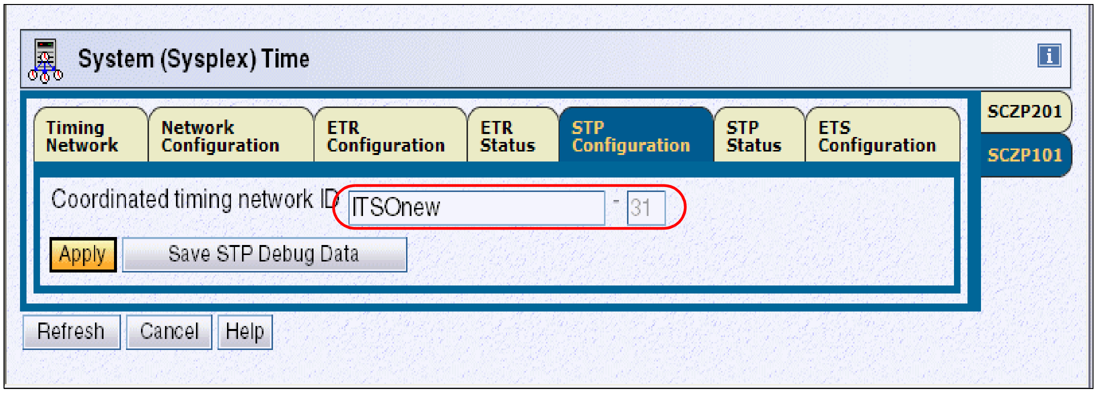


Figure 5-25 STP Configuration tab - Changed STP ID

> **Important:** Cross System Coupling Facility (XCF) tolerates a mismatch of the STP Network ID between systems for a matter of seconds only. When the timing limit is reached, those systems with inconsistent CTN IDs are varied out of the sysplex. Consequently, where multiple servers are involved, this operation is not a good idea, as the manual actions might exceed the XCF time limit.

Message ACT37364 (Figure 5-26) is issued and requires confirmation.

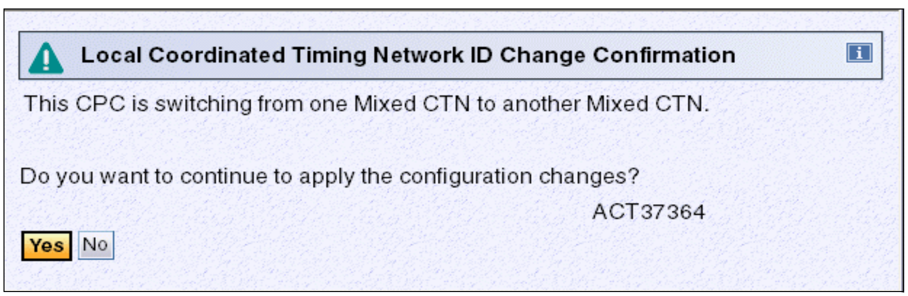


Figure 5-26 Message ACT37364 - Local Coordinated Timing Network ID Change Confirmation

When the change is complete, message ACT37315 displays and the server is STP configured with CTN ID = [ITSOnew] - [31].

To leave a Mixed CTN, remove the STP ID in the STP Configuration window. This results in the server participating in an ETR-only network (if an ETR ID is specified) or no timing network.

5.5.2 Changing a server to STP timing mode

When a Mixed CTN has been configured, it is possible to change the timing mode of one or more servers from ETR to STP timing mode.

The server being migrated to STP timing mode must have connectivity to an existing Stratum 1 or Stratum 2 server for the operation to be successful. Otherwise, the server transitions to local mode.

For each server that is to be migrated to STP timing mode:

1. From the STP Status tab, verify that the server has STP connectivity to an acceptable time source. In the System Information area of the System (Sysplex) Time task of the server, verify the Local STP Link Identifier to ensure that there is least one PCHID initialized to a Stratum 1 or Stratum 2 server. An attempt to connect to a Stratum 3 server would fail since the target server would become a Stratum 4 (not supported in STP).

   For example, Figure 5-27 shows that the SCZP201 server has two PCHIDs initialized to communicate to a Stratum 1 server with system name SCZP101. The SCZP201 server can be switched to STP timing mode. However, the resulting configuration has a single point of failure because SCZP201 is connected to only one Stratum 1 server.

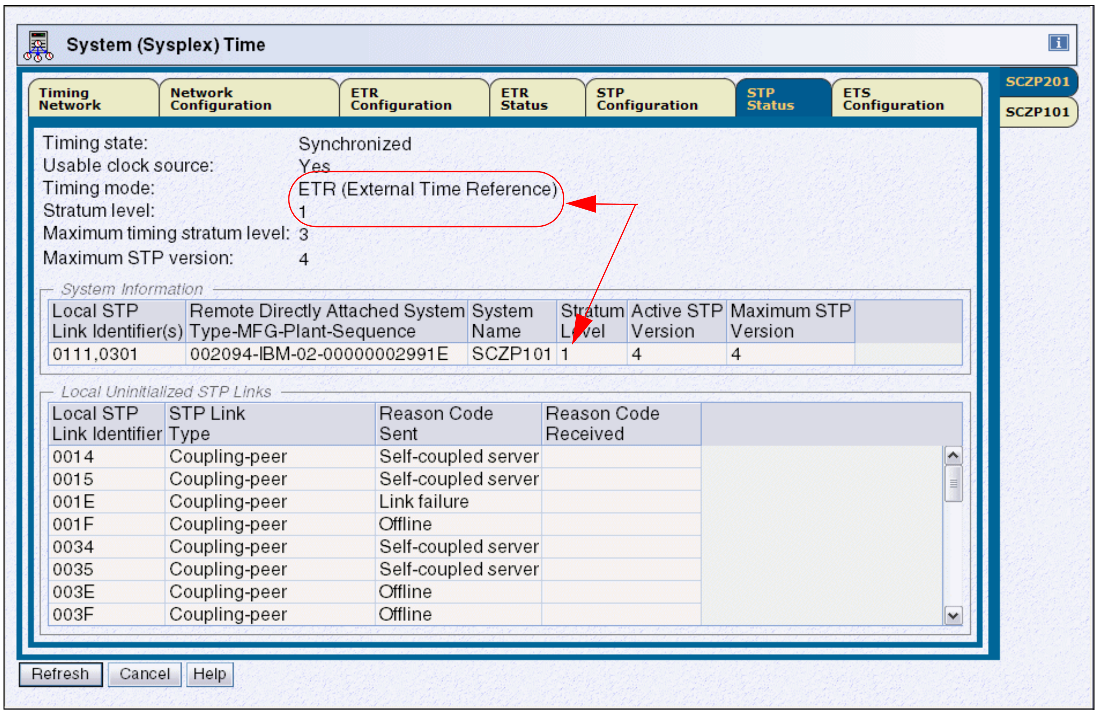


Figure 5-27 STP Status tab - Stratum 1

2. From the ETR Configuration tab of the server, disable the ETR ports by selecting the **Disabled** radio buttons for each port and then click **Apply** (Figure 5-28). The server recognizes the loss of the Sysplex Timer signals and automatically switches to STP timing mode. The server synchronizes to an existing Stratum 1 or Stratum 2 server using STP messages.

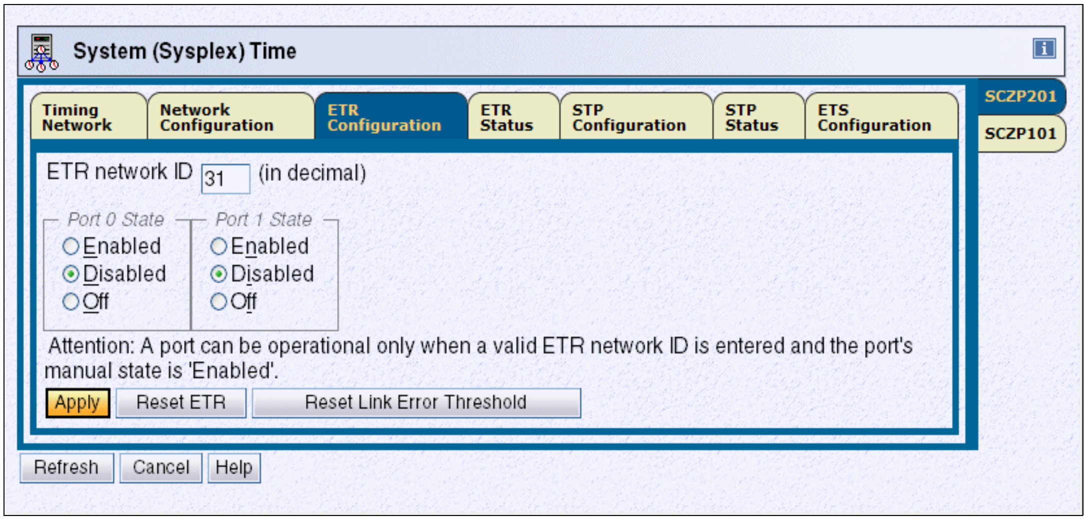


Figure 5-28   ETR Configuration tab - Disable ETR ports

3. Operation completion can be verified on the STP Status tab (Figure 5-29). Click **Refresh** to update the configuration information. The Stratum level value of 2 indicates that the server's migration to STP timing mode was successful.

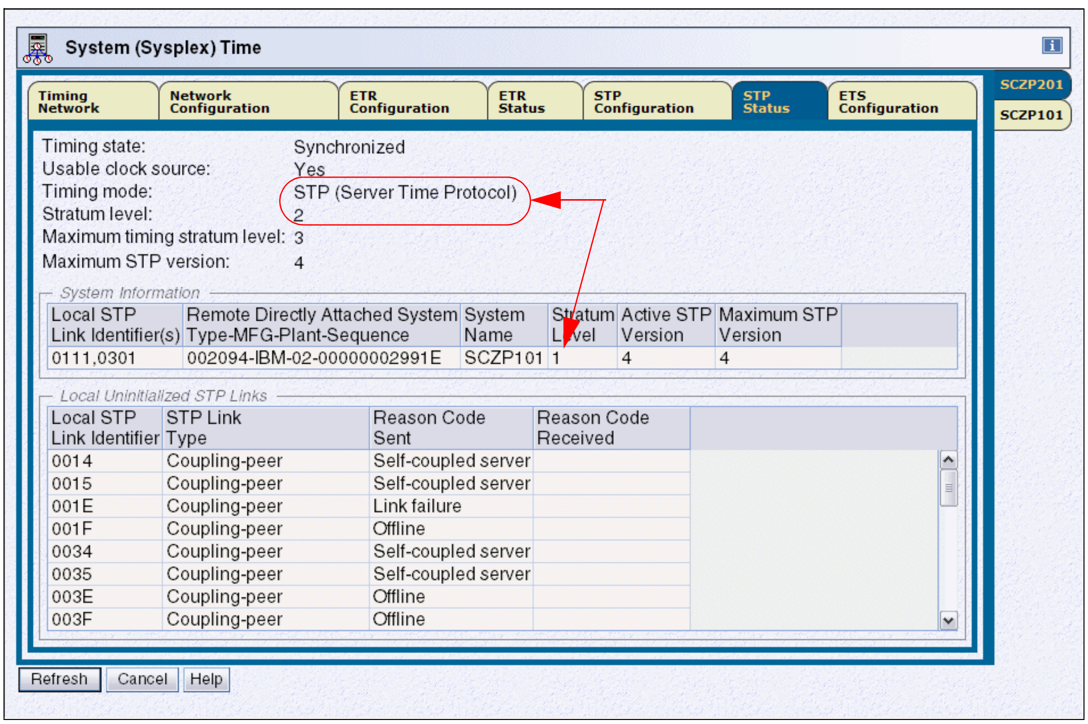


Figure 5-29   STP Status tab - Stratum 2

The new timing mode and Stratum level are also reflected on the STP information tab in the CPC Details (SCZP201) (Figure 5-30).

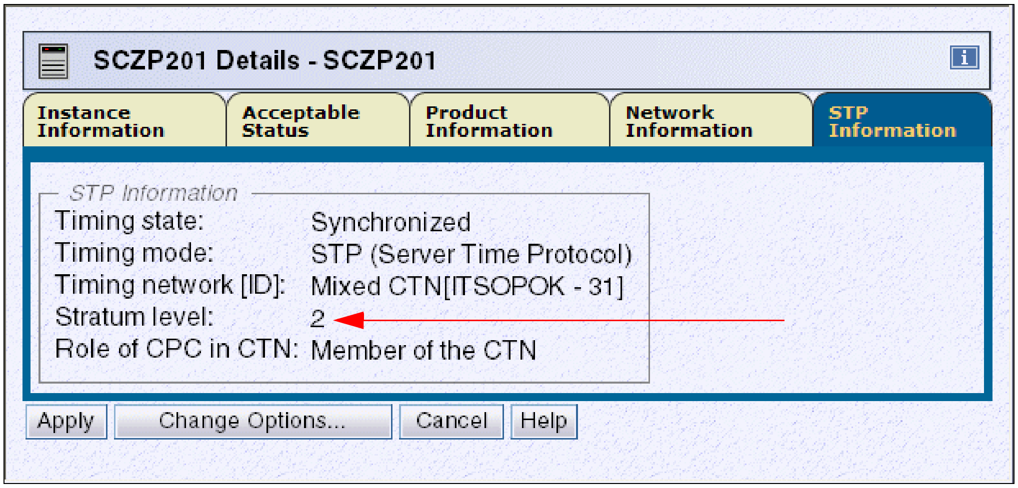


Figure 5-30 CPC details - STP Information tab

5.6 Time management

When a Mixed CTN configuration is active, the Sysplex Timer provides and manages the timekeeping information, so time management operations normally performed through the Sysplex Timer are also valid in a Mixed CTN.

External Time Source

In a Mixed CTN, the existing Sysplex Timer is the time source for the CTN. If an external time source is attached to the Sysplex Timer, it is configured using the Sysplex Timer console. Time management functions normally performed through the Sysplex Timer are still performed on the Sysplex Timer console (and not on the HMC) and are valid also in a Mixed CTN, but now have an effect on the entire CTN, including servers operating in STP Timing mode.

5.7 Local time changes

z/OS allows either STCK time, UTC time, or local time to be obtained depending on the requirements. The difference between UTC time and local time is, under normal circumstances, the time-zone offset. The time-zone offset can be managed at the z/OS level by specifying the ETRZONE=NO and STPZONE=NO options in the CLOCKxx PARMLIB member. The relevant option that applies depends on whether the server is in ETR timing mode or STP timing mode.

The TIMEZONE parameter in the CLOCKxx member is used to set the time-zone offset at IPL, and a number of z/OS SET commands can be used to dynamically adjust this offset if required. Similarly, the coupling facility supports the concept of time-zone offset and allows dynamic modification of the time-zone offset.

z/OS commands

On a z/OS system, the local date and time can be modified dynamically. The ability to do this depends on what options have been specified in the CLOCKxx member at IPL.

Table 5-1 z/OS time adjustment through command cross-reference

Option	Adjust time using z/OS command		
	Local time ZONE=LT	**UTC time ZONE=UTC**	**STCK time STCK**
ETRMODE NO, ETRZONE NO	Yes	Yes [a]	Yes [a]
ETRMODE YES, ETRZONE NO	Yes	No	No
ETRMODE YES, ETRZONE YES	No	No	No
STPMODE NO, STPZONE NO	Yes	Yes [a]	Yes [a]
STPMODE YES, STPZONE NO	Yes	No	No
STPMODE YES, STPZONE YES	No [b]	No	No

a. If ETRMODE NO and STPMODE YES (the default) is specified z/OS will issue IEA888A to prompt the operator to set the TOD clock during system initialization. This will occur regardless of whether OPERATOR PROMPT or NOPROMPT has been specified. IEA888A is issued as system initialization has detected that STPMODE YES was requested but STP is not available. The operator is prompted to notify that local Server time is being used and allow the time to be adjusted if required. IEA888A is issued regardless of whether OPERATOR PROMPT or NOPROMPT is specified in CLOCKxx. For more information, go to the following website:
http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/FLASH10576

b. If ERTMODE YES and ETRZONE YES, or STPMODE YES and STPZONE YES are specified, any attempt to change the local time or date produces the z/OS message IEA279I: **IEA279I ALL CLOCK RELATED SET COMMANDS ARE IGNORED WHEN IN STP MODE**. If a server is in ETR or STP mode with ETRZONE NO or STPZONE NO, then SET CLOCK commands to change the local time are allowed.

DISPLAY TIME

The DISPLAY TIME command can be used to display the local time and date and the UTC time and date (Figure 5-31).

```
DISPLAY TIME
IEE136I LOCAL: TIME=15.07.47 DATE=2009.276  UTC: TIME=19.07.47 DATE=2009.276
```

Figure 5-31 z/OS DISPLAY TIME command

SET DATE

The SET DATE command can be used to change the local date, but only in the circumstances given in Table 5-1. The syntax is:

`SET DATE=`*`yyyy.ddd`*

This command has the following restrictions:

- *yyyy* is the year and must be in the range 1900 - 2042. The value specified must consist of four digits and must be within 70 years of the UTC date, or the SET command is ignored.
- *ddd* is the day and must be in the range 001 - 366 and meet leap (bisect) year restrictions.

The maximum date that can be specified is 2042.260.

SET CLOCK

The SET CLOCK command is used to change the local time and is also restricted to the settings given in Table 5-1. The syntax is:

```
SET CLOCK=hh.mm.ss
```

This command is used in conjunction with the SET DATE command to set a maximum value of 23.53.47 on 2042.260. The server's TOD clock is not updated by this command, and neither is the logical TOD of the logical partition on which this z/OS image is operating. The change made by this command is effective for the duration of this IPL only.

Also, z/OS does not change the date when the new time implies a change of date, so either use the DATE parameter or wait for the time to pass midnight if the new time is for tomorrow.

SET RESET

The SET RESET command causes the time-zone offset to be reset to the value that was read in from the CLOCKxx member during IPL causing the local date and time to be changed accordingly. The syntax is:

```
SET RESET
```

This annuls all previous SET DATE, SET CLOCK, and SET TIMEZONE commands, and re-establishes the relationship of:

```
local date and time = UTC date and time + time-zone offset
```

SET TIMEZONE

The SET TIMEZONE command is new in z/OS V1.7 and may be used to change the time-zone offset to a separate value from that specified at IPL through the TIMEZONE parameter in CLOCKxx. This automatically adjusts the local date and time accordingly. The syntax is:

```
SET TIMEZONE={W|E}.hh[.mm]
```

The time-zone offset direction is west (W) or east (E). West is the default if the offset is not specified. The value for *hh* must be between 00 and 15, and the value for *mm* must be between 00 and 59.

The daylight saving time changes may be handled manually using the SET CLOCK command rather than having it done automatically through the Sysplex Timer.

Using this method, there is always a degree of error, as the difference between the local time and the UTC time will not exactly match the time-zone offset that would have been achieved by updating the TIMEZONE statement in CLOCKxx and IPLing.

The new z/OS SET TIMEZONE command overcomes this problem by applying the correct offset value in the CVTLDTO field, causing an exact time-zone offset to be applied.

6

Operations in an STP-only CTN

An STP-only CTN contains a collection of servers configured in STP timing mode. An STP-only CTN can only be configured with STP-enabled servers. None of the servers in an STP-only CTN can be in External Timer Reference (ETR) timing mode. The Sysplex Timer does not provide stepping signals to any server in the CTN.

This chapter discusses the operations required to manage time and the CTN in an STP-only CTN. The operations are discussed both from a hardware (Hardware Management Console, or HMC) and software (z/OS) standpoint. This chapter discusses the following topics:

- Minimum requirements
- Monitoring an STP-only CTN using the HMC
- Monitoring an STP-only CTN using z/OS commands
- Configuring an STP-only CTN
- CTN configuration changes
- Time management
- Local time changes

6.1 Minimum requirements

An STP-only CTN is a timing network in which all servers are configured to be in STP timing mode. At a minimum, before an STP-only CTN configuration can become active and servers can exchange timekeeping messages, the following conditions need to be met:

- There must be at least one STP-enabled server to configure an STP-only CTN.
- The STP-enabled servers must be configured with the same CTN ID, with the format STP network ID - ETR Network ID. The STP network ID can be from one to eight characters in length.

  Valid characters are upper case letters A – Z, lower case letters a – z, numerals 0 – 9, dash (-), and underscore (_). The STP network ID is case sensitive.

  In an STP-only CTN, the ETR Network ID must not be specified. After the CTN ID is assigned, the servers are STP configured.
- If the STP-only CTN is *not* the result of a migration from the Mixed CTN, time has to be initialized.

  If the STP-only CTN *is* the result of a migration from a Mixed CTN, time information is inherited from the Sysplex Timer.
- The Preferred Time Server and the Current Time Server must be assigned. The server assigned the role of Current Time Server becomes the active Stratum 1. In most cases, the Preferred Time Server is also the Current Time Server.
- An optional Backup Time Server can be assigned. If three or more servers or CFs are configured in the CTN and a Backup Time Server is assigned, an Arbiter can also be assigned.

Assigning a PTS and BTS requires coupling connectivity between the PTS and the BTS. Assigning a PTS, BTS, and Arbiter requires coupling link connectivity between each server. Any attempt to assign a BTS or Arbiter role to a server that does not have the required coupling link connectivity fails unless the Force configuration option is used. Use of this option is discussed in detail in 6.5.4, “Changing the server roles” on page 200.

The servers that are planned to be synchronized to either the preferred or the Backup Time Servers need coupling link connectivity (ISC-3 Peer, ICB-4, or InfiniBand) to the servers to which they are planned to be synchronized. All servers in an STP-only CTN are in STP timing mode.

6.2 Monitoring an STP-only CTN using the HMC

In an STP-only CTN, the HMC provides the user interface for all time-related functions, such as time initialization and time adjustment. This is different from the operations in an ETR network, where these tasks are performed at the Sysplex Timer console. Figure 6-1 on page 155 shows the System (Sysplex) Time console for IBM System zEC12, z166, and z114.

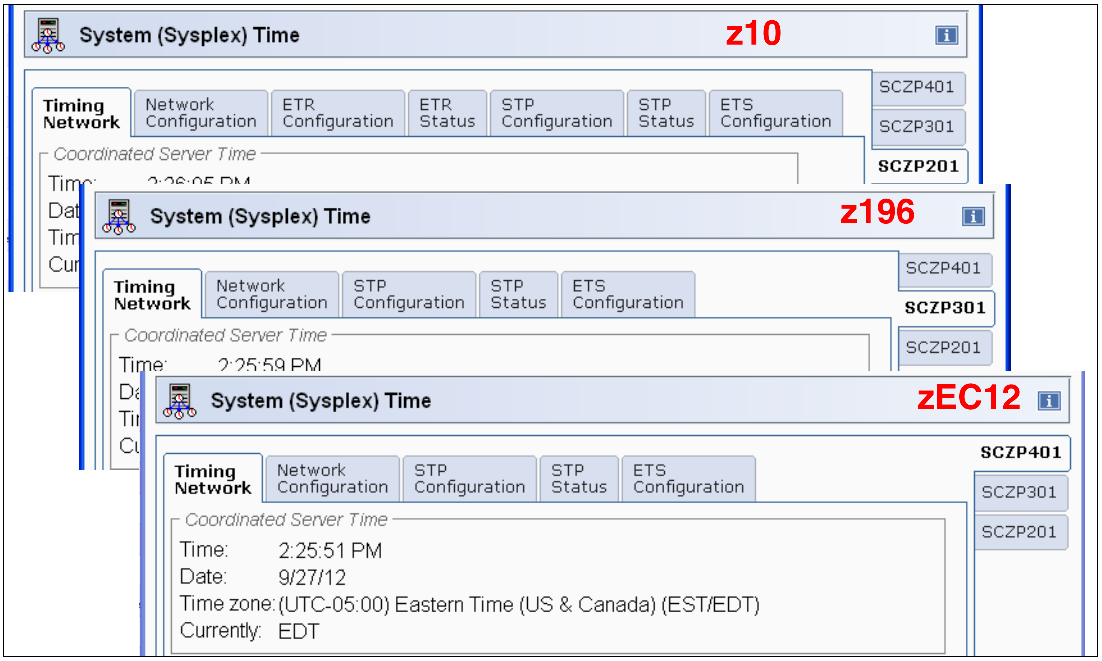


Figure 6-1 System (Sysplex) Time tabs

The number of tabs displayed on the HMC task *System (Sysplex) Time* along the top varies, depending on the type of server and the features are installed on it, as shown in Table 6-1.

Multiple CPCs can be selected (this requires *Multiple object selection* to be enabled for the user ID being used), which displays them as tabs on the right side of the window.

Table 6-1 Tabs displayed on the server

Server[a]	**Timing network**	**Network config**	**ETR config**	**ETR status**	**STP config**	**STP status**	**ETS config**
zEC12 (STP only)	✓	✓			✓	✓	✓
z196 (STP only)	✓	✓			✓	✓	✓
z10[b] w/ETR and STP feature	✓	✓	✓	✓	✓	✓	✓
z9 w/ETR and STP feature	✓	✓	✓	✓	✓	✓	✓
z9 w/STP feature only	✓	✓			✓	✓	✓
z990/z890[c] w/ETR and STP features	✓	✓	✓	✓	✓	✓	
z990/890[c] w/STP feature only	✓	✓			✓	✓	
All Servers w/ETR feature only			✓	✓			

a. z9 and earlier generation servers are *not* supported in the same CTN with the zEC12 server.
b. z10 includes the ETR feature, by default.
c. z990/z890 servers are not supported in the same CTN with the z196/z114 or newer servers.

In an STP-only CTN, additional buttons are available on the System (Sysplex) Time tabs for the management of time, leap seconds, and time zones. These buttons are available on every server in the STP-only CTN, but are only enabled on the Current Time Server to ensure that all time and offset adjustments are done at the CTN time source. Adjustments made on the CTS are distributed throughout the CTN. In an STP-only CTN, the ETS Configuration tab on the CTS allows you to adjust the Coordinated Server Time (CST) using one of the NTP time servers as a source.

> **Important:** When two or more servers are selected in the System (Sysplex) Time task, it is necessary to click **Refresh** to update the configuration information for *all* displayed servers.

6.2.1 Timing Network tab

Use this tab to view the CTN settings. This tab displays overall timing information for the CTN, including the current date and time, local time offsets, and general timing network information.

The window appears slightly different depending on whether it is viewed from the CTS or another server in the CTN, and on whether the server has NTP client support (with or without PPS). The ETS Configuration tab only displays when NTP client support is available on the target server.

Figure 6-2 shows the view from the Current Time Server in a CTN with two servers:

- The Adjust Time, Adjust Leap Seconds, and Adjust Time buttons are enabled. Time adjustments are only permitted from the Current Time Server. These buttons are only enabled on the server that is the Current Time Server.

  The Adjustment Steering button is enabled after the first adjustment is made and remains enabled (Figure 6-2).

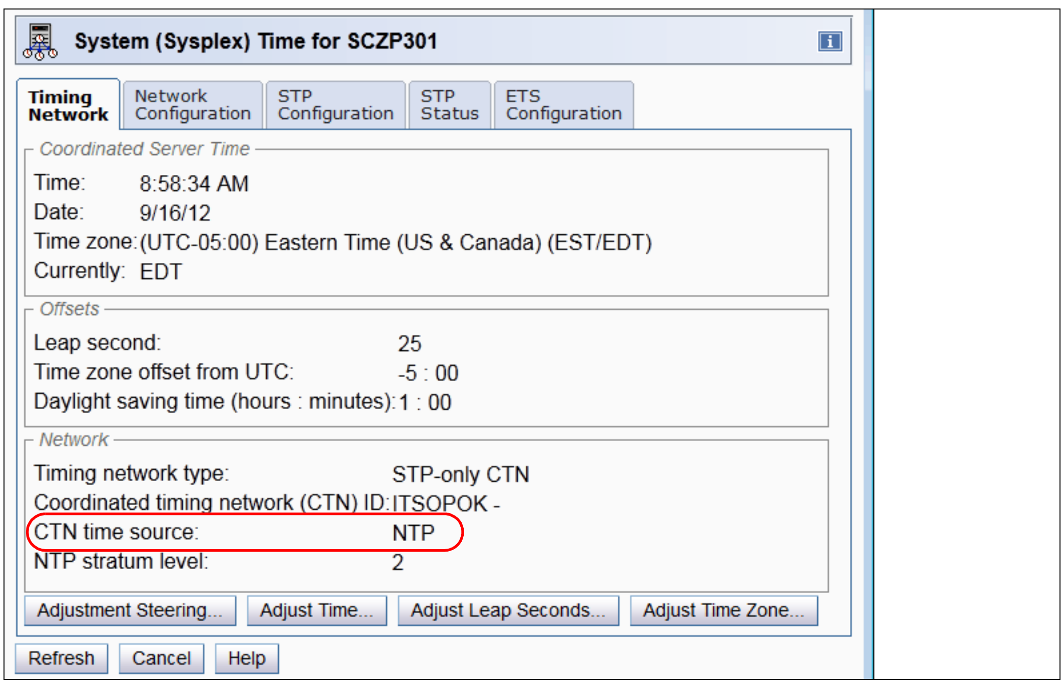


Figure 6-2 Timing Network tab from Current Time Server

  Information about leap seconds, time zone, and daylight saving time displays in the Offsets section of the window. See 6.6.2, "Time adjustment" on page 217, for time and offsets adjustments.

- CTN time source (see Figure 6-2) identifies where the clock source is according to the STP facility.

When the server is in an STP-only CTN, the possible values are:

– Time set manually on console
– Dial-out time source through the Hardware Management Console[1]
– NTP
– NTP with pulse per second
– Previous adjustment interrupted due to a network configuration change
– Time inherited from a previous connection to a Sysplex Timer
– Migration from an STP-only CTN to a Mixed CTN is in progress
– Migration from an STP-only to a Mixed CTN failed to complete

When the CTN time source is either NTP or NTP with pulse per second (PPS), and if the Current Time Server cannot obtain the NTP information from its configured NTP time servers, then the NTP information from the Backup Time Server is used (or from the Preferred Time Server, if the Backup Time Server is the Current Time Server). If this happens, the CTN time source also identifies the source server. This is described in detail in the *Server Time Protocol Recovery Guide*, SG24-7380.

When the CTN time source indicates NTP, the Network section of the window may also display additional information:

- When a time adjustment is active and the target server has NTP client support, the Network section shows the NTP stratum level.
  – If the NTP stratum level is 1, the NTP source ID displays.
  – If the NTP stratum level is greater than 1, the NTP source ID is not shown.

  The Adjustment Steering button is enabled after the first adjustment is made.
- When the time source is NTP but the target server does not have NTP client support (for example, z990 or z890), the NTP stratum level and NTP source ID are not displayed, regardless of whether a time adjustment is active.

  The Adjustment Steering button is enabled after the first adjustment is made and can be used to display detailed information about the last adjustment.

When the CTN time source is NTP but no time adjustment is active, then the NTP stratum level and NTP source ID are not displayed.

When the Adjustment Steering button is enabled, information about the last time adjustment can be displayed (Figure 6-3).

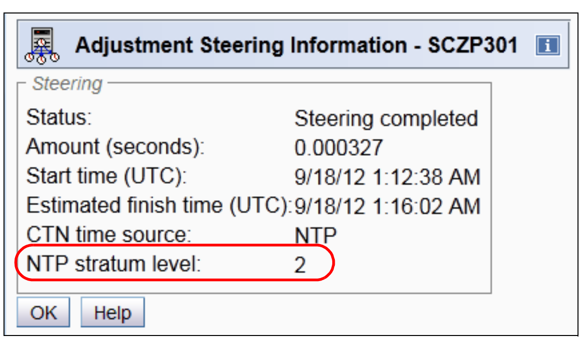


Figure 6-3 NTP Adjustment Steering Information

When the Adjustment Steering results are the result of HMC dial-up or from a manual adjustment, the NTP stratum level and the NTP source ID are not displayed.

[1] Dial out not available for HMC version 2.12.0 and later.

6.2.2 Network Configuration tab

This tab shows the current STP-only CTN configuration. Changes made on this tab affect all servers that are members of the STP-only CTN. This is commonly called a *global* change in the CTN versus a *local* change in the CTN.

This window appears slightly different depending on whether it is viewed from the Current Time Server or another server in the CTN. Figure 6-4 shows the view from the Current Time Server. The Deconfigure button is enabled.

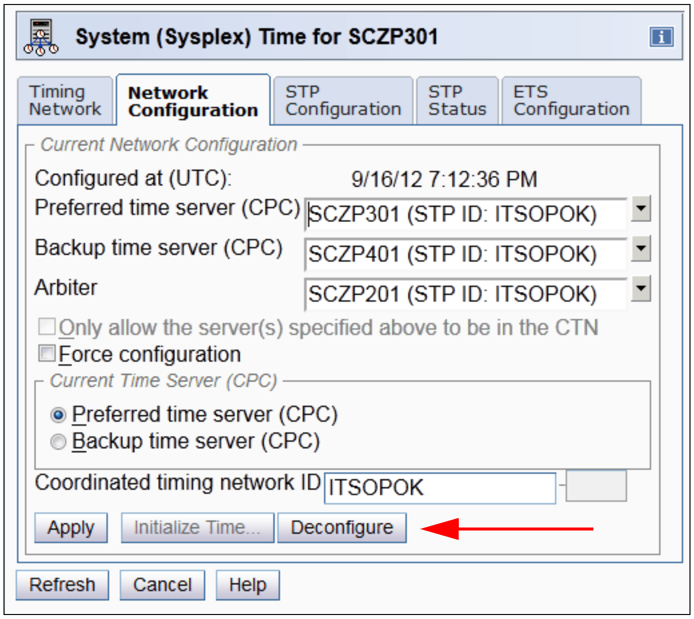


Figure 6-4 Network Configuration tab from Current Time Server

Figure 6-5 shows the view from a server that is not a CTS. The Deconfigure button is disabled.

> **Important:** Deconfiguring the CTN is only permitted from the current time server (CTS).

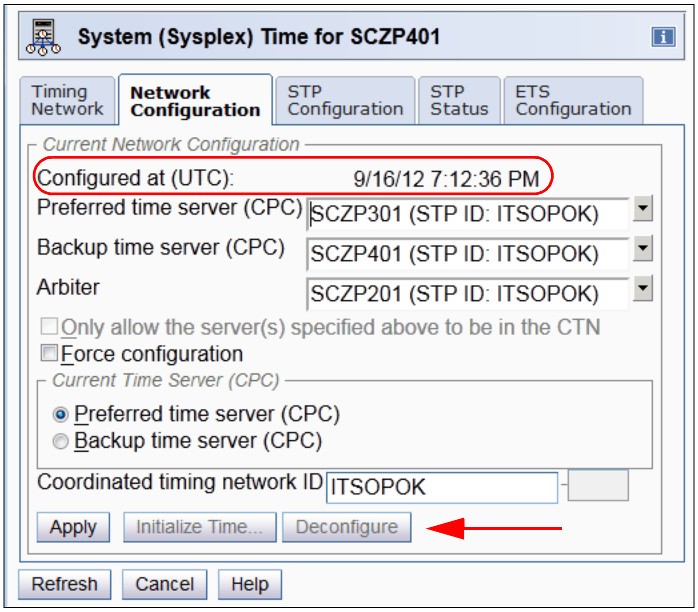


Figure 6-5 Network Configuration tab - View from Backup Time Server

Note the following points:

- Configured at (UTC) displays the UTC time when this configuration was applied.
- Current Time Server specifies whether the Preferred Time Server or the Backup Time Server is, or will become, the Current Time Server. The Current Time Server identifies the server that is the Stratum 1 for the STP-only CTN.
- In the Current Network Configuration section, the Preferred Time Server, Backup Time Server, and Arbiter fields each display a drop-down list of selectable servers.
  - **Preferred Time Server** identifies the server (CPC) that is the current Preferred Time Server or that will become the Preferred Time Server for the CTN. If a Preferred Time Server is not defined, `Not configured` displays in this field.

    To reassign the role, select another server from the list by using the down arrow next to the field and making a selection.
  - **Backup Time Server** identifies the server (CPC) that is the current Backup Time Server or that will become the Backup Time Server for the CTN. If a Backup Time Server is not defined, `Not configured` displays in this field.

    To reassign the role, select another server from the list by using the down arrow next to the field and make a selection.
  - **Arbiter** identifies the server (CPC) that is the current Arbiter or the new Arbiter for the CTN. If an Arbiter is not defined, `Not configured` displays in this field.

    To reassign the role, select another server from the list by using the down arrow next to the field and make a selection.

  Which servers display in the drop-down list depends on information drawn from the HMC and the STP facility. Under normal circumstances, when LAN connectivity exists between the HMC and the servers, and STP connectivity exists between all of the servers (CPCs), the list looks the same for all servers participating in the same CTN. All STP-capable servers connected to the HMC are listed.

  In a normal situation, when the HMC has connectivity to the server, the STP ID information (STP ID: xxxxx) is shown if there is an initialized STP link to the target server and the server participates to the same CTN. If the HMC has lost connectivity to a server in the CTN, the server entry displays information based on the CPC descriptor node ID. For example, consider the configuration shown in Figure 6-6.

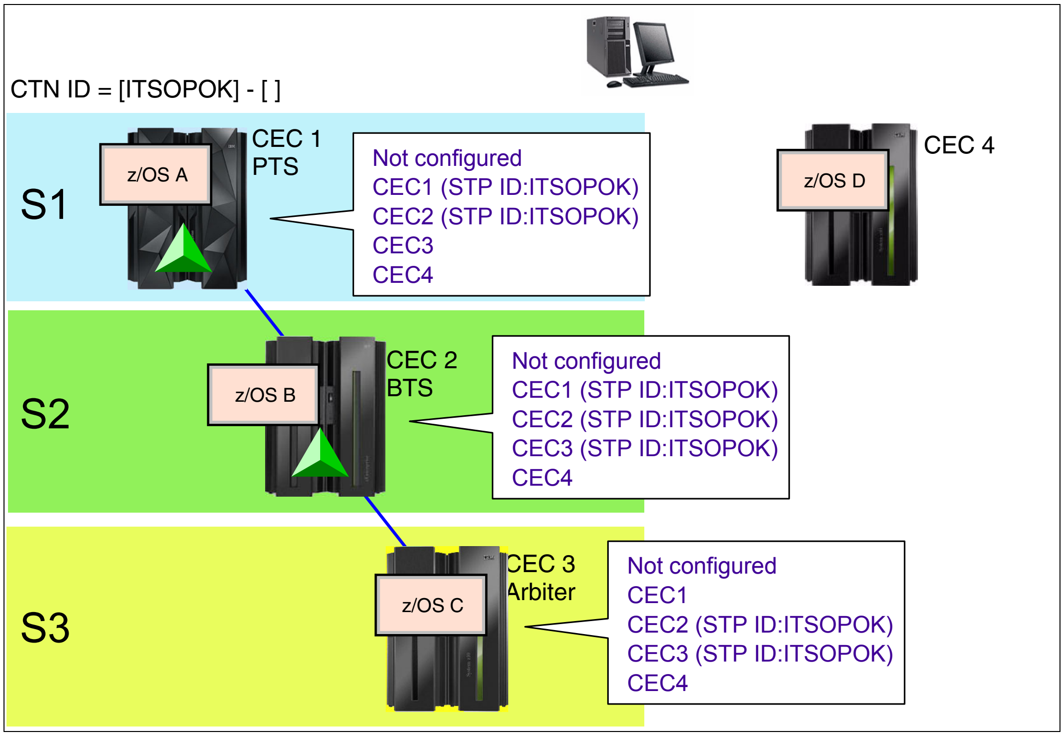


Figure 6-6 Network configuration - Role assignment drop-down list

The HMC has connectivity to the CEC1, CEC2, CEC3, and CEC4 servers. All servers are connected to the HMC and are STP-capable. The captions indicate the drop-down lists displayed in the Network Configuration window when assigning roles.

CEC4 is STP-capable but is either not STP configured or configured in another CTN. For this reason the STP ID portion for CEC4 is not shown.

The CEC1, CEC2, and CEC3 servers are part of CTN [ITSOPOK]. However, the (STP ID: ITSOPOK) visibility varies per server:

- On CEC1, the (STP ID: ITSOPOK) part is only shown for CEC2 because there is no STP-initialized link between CEC1 and CEC3.
- On CEC2, the (STP ID: ITSOPOK) part displays for CEC1 and CEC3 because both conditions are satisfied:
  - CEC2 has initialized STP links to both CEC1 and CEC3.
  - The STP ID on CEC1 and CEC3 is the same as the one on CEC2.
- On CEC3, the (STP ID: ITSOPOK) is only shown for itself and CEC2 because there is no STP initialized link between CEC3 and CEC1.

Additional information about the status of the links between servers is also available from the STP Status tab for each server.

Figure 6-7 on page 162 shows the Network Configuration window following a Mixed CTN to STP-only migration. The following information and actions are available:

- “Only allow the servers specified above to be members of the CTN” limits a CTN to a single-server or dual-server configuration. This option is used to save the CTN configuration across a power-on reset or power off/on for the servers specified.

- Force configuration specifies whether connectivity between the Current Time Server and other servers with a defined role will be verified when a change in configuration is requested.
  - When Force configuration is checked, the configuration change is applied without verification. The change is accepted even if connections between the Current Time Server and other specified server roles are not online or do not exist.
  - When Force configuration is not selected, various verifications are done prior to allowing the configuration to be set. For example, connections between the Preferred Time Server, Backup Time Server (if present), and Arbiter (if present) are verified. If the connections are not online, the configuration request fails.

  > **Important:** The Force configuration option *must* be specified when configuring a new STP-only CTN for the first time to bypass connectivity verification, because a Current Time Server does not yet exist. This is *not* applicable to a migration scenario from Mixed CTN to STP-only.

- Coordinated Timing Network ID specifies the ID for the Coordinated Timing Network in which the server is participating. The form is [STP ID] - [ETR ID].
  - If the server is not a member of any timing network, there are no values in the fields.
  - When the server is participating in an STP-only CTN, the field shows [STP ID]. The valid characters for the STP ID are A – Z, a – z, 0 – 9, -, and _.

    > **Important:** STP ID is *case sensitive*. You might end up with separate Coordinated Timing Networks, that is, one with lower case and one with upper case characters.

  - Changes made to the Coordinated Timing Network ID are applied to the entire CTN. If a valid STP ID exists, changing the ID results in all servers in the STP-only CTN becoming members of a different CTN.

  To migrate an STP-only CTN to a Mixed CTN, you have to supply the ETR Network ID then click **Apply** to initiate the migration process. Several confirmation messages are issued before the migration process begins.

- Cancel Migration to Mixed CTN is used to cancel a migration from an STP-only to a Mixed CTN process after a successful migration initiation. If the migration is cancelled, the Current Time Server defined for the STP-only CTN continues to provide the time information to all members of the STP-only CTN.

  This button is only enabled when a migration to a Mixed CTN has been initiated; that is, an ETR Network ID number has been entered in the CTN ID field on the Network Configuration window, **Apply** has been clicked, and confirmation messages have been accepted.

  The migration process cannot be cancelled if an error occurred, if the procedure is close to completion, or if it has completed.

  Until the migration is complete, the Apply, Initialize Time, and Deconfigure buttons are disabled. An information message displays (Figure 6-7).

  The Initialize Time task is described in 6.4.4, “Time initialization” on page 181.

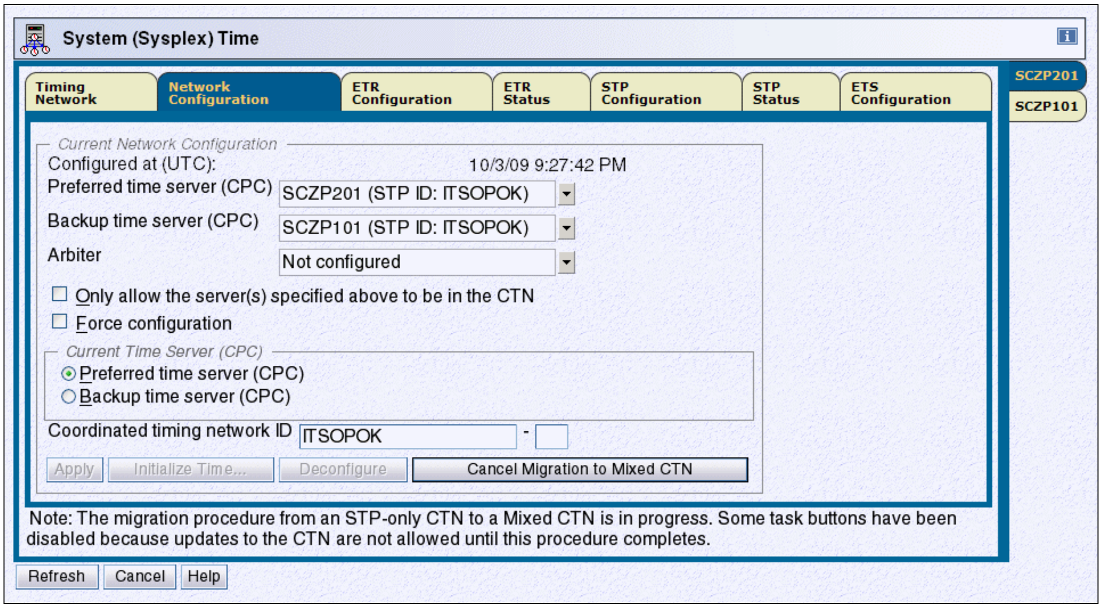


Figure 6-7 Network Configuration tab after migration from STP-only to Mixed CTN

- Deconfigure is used to deconfigure the Preferred Time Server, Backup Time Server, and Arbiter. This action is disruptive to all z/OS images that need time synchronization. Consider this action only if the Current Time Server must no longer provide time information to the entire STP-only CTN.

  Deconfigure is only available from the Current Time Server.

> **Attention:** Deconfiguring the CTN results in the loss of the clock source for all servers in the CTN. This action is disruptive to all z/OS images, running in a sysplex or non-sysplex, when running with STPMODE YES.
>
> Only use Deconfigure to shut down the entire CTN.

6.2.3 ETR Configuration tab

The ETR Configuration tab, even though available from the System (Sysplex) Time task if the ETR feature is installed, is not used in an STP-only CTN. The ETR Network ID is blank and the ETR Ports are disabled (Figure 6-8).

A configuration change made in this window removes the server from the STP-only CTN. The change only affects this particular server. The configuration request is rejected if the action is attempted on the Current Time Server.

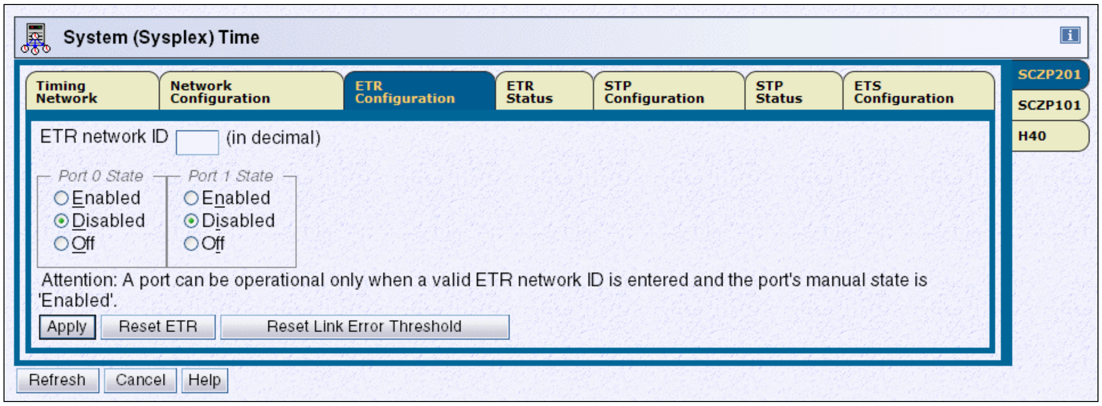


Figure 6-8 ETR Configuration tab - Server in STP timing mode

6.2.4 ETR Status tab

The ETR status tab, even though available from the System (Sysplex) Time task if the ETR feature is installed, is seldom used in an STP-only CTN. This tab is for display only (Figure 6-9).

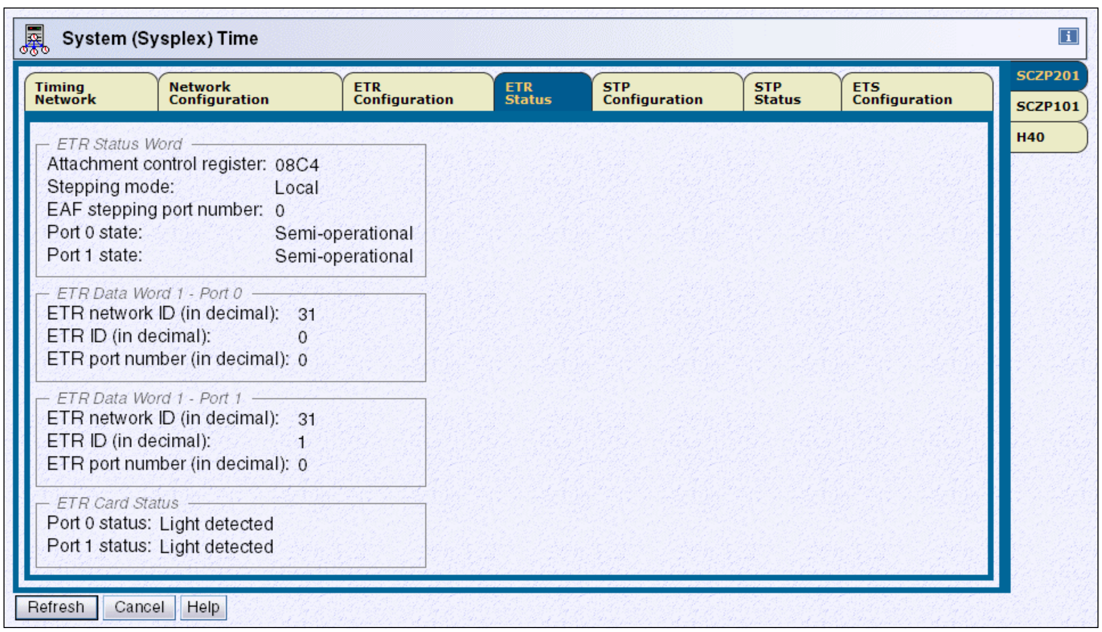


Figure 6-9 ETR Status tab - Server in STP timing mode

In an STP-only CTN, the ETR Status Word Stepping Mode is Local. This window is only useful for displaying the configuration and status of the Sysplex Timer connections when a migration from an STP-only CTN to a Mixed CTN is planned. Even though the ports are disabled, the ETR links are monitored and z/OS message IEA393I is posted when a failure occurs. This allows a failing link to be repaired before migrating to a Mixed CTN.

In an STP-only CTN, the state of the ports is *semi-operational* because the ports were automatically disabled. The port status is *light detected*, indicating that the Sysplex Timer links are still connected and the Sysplex Timers ports are online.

If the server has the PTS or BTS role and the external time source is configured to use NTP with pulse per second, Port 0 state and Port 1 state show that the PPS ports on the ETR card are being used. The ETR Data Word and ETR Card Status sections are not applicable when using PPS (Figure 6-10).

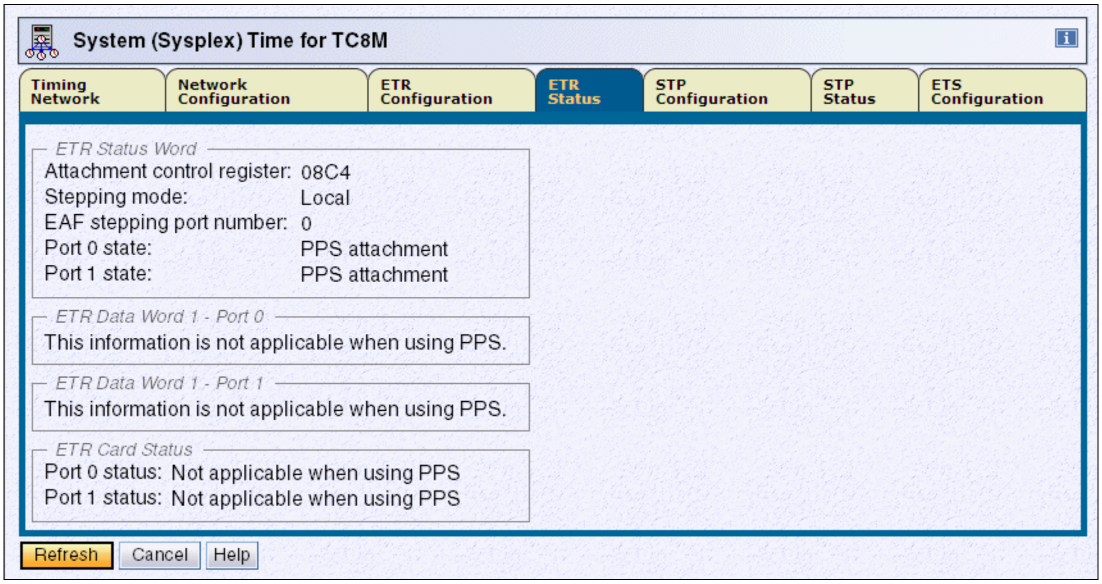


Figure 6-10 ETR Status tab - Server configured with NTP and PPS

6.2.5 STP Configuration tab

The STP Configuration tab (Figure 6-11) is used to enter the STP ID for the server to join a CTN, or to remove the server from a CTN by blanking out the STP ID.

- Coordinated Timing Network ID: specifies the ID for the Coordinated Timing Network in which the server is participating.

  The form is [STP ID] - [ETR ID]. When the server is participating in an STP-only CTN, the CTN ID displays [STP ID].

> **Note:** The valid characters for the STP ID are A – Z, a – z, 0 – 9, -, and _. The STP ID is case sensitive.

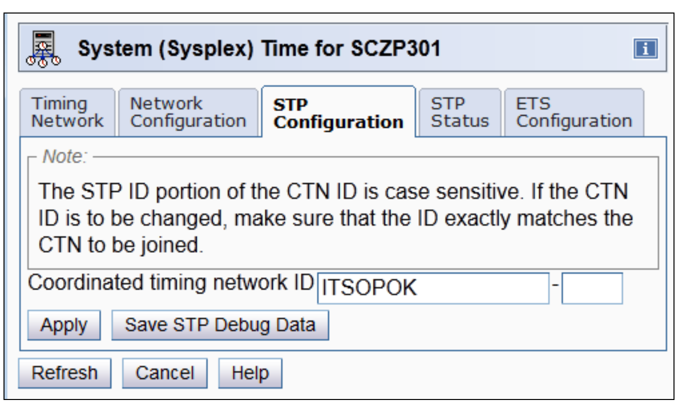


Figure 6-11 STP Configuration tab

To join an STP-only CTN, a valid STP ID must be specified. To leave an STP-only CTN, the STP ID must be removed (nullified).

A configuration change made on this tab affects only this particular server. It is *not* globally applied to an entire timing network. The configuration request is rejected if the action is attempted on the Current Time Server.

- Save STP Debug Data: collects data used for STP problem determination. The data is collected concurrently. The STP debug data file is automatically sent back to the IBM Service Support System. Only use this button upon request from the IBM Support Center.

  A configuration change made on this tab affects only this particular server. It is *not* globally applied to an entire timing network.

6.2.6 STP Status tab

The STP Status tab (Figure 6-12) is used to view the STP status information for a specific server. The information includes:

- Timing state: Indicates the timing state the server is operating in. The status is *Unsynchronized*, *Synchronized*, or *Stopped*. If it has a value of anything other than *Synchronized*, the server is not actively participating in a CTN.
- Usable clock source: Indicates whether a usable clock source is available to synchronize the server TOD. Possible values are *yes* or *no*.

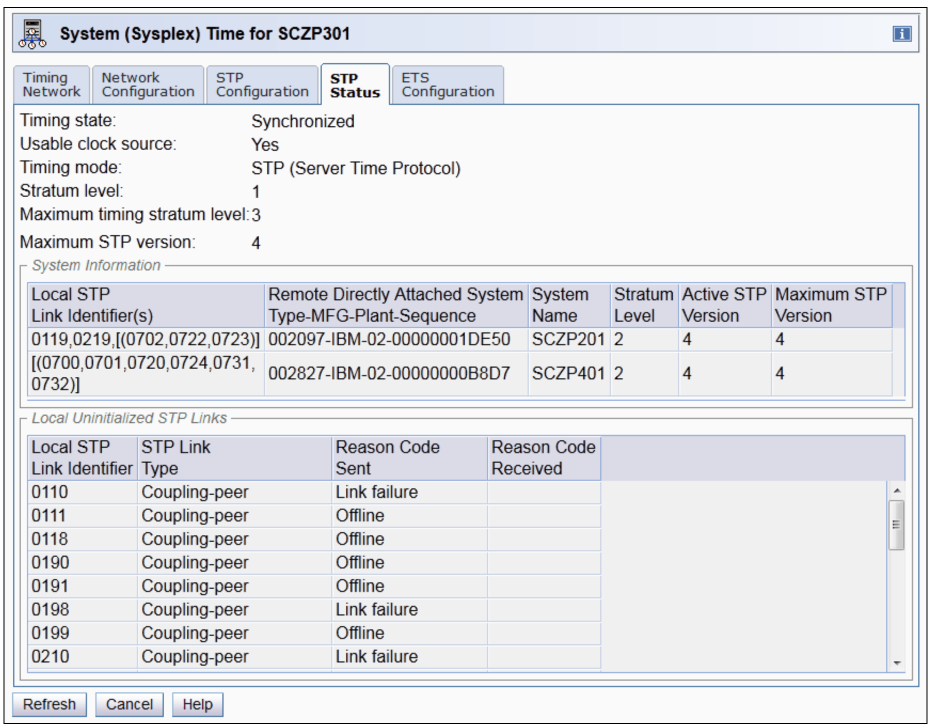


Figure 6-12 STP Status tab: displayed from Stratum 1 server

- Timing mode: Indicates whether the TOD clock is attempting to synchronize to a timing network and if so, what type of network it is. When the server is participating in an STP-only CTN, the value should be Server Time Protocol (STP).
- Stratum level: Indicates the hierarchy of this server within the CTN. The value can be 1, 2, or 3. A stratum level of 0 indicates that the server has no time source.
- Maximum timing stratum level: Contains a number indicating how far a server can be from the Stratum 1 and still be in a synchronized state. The maximum timing stratum level is 3.

- Maximum STP version: Specifies a number indicating the maximum level of STP facility code supported by this server.
- System Information: This table identifies the remote servers that are directly attached to this server for STP purposes.

  This server's coupling links that are initialized to transport STP messages are listed using the PCHID addresses, and are grouped according to the system that is directly attached to the links. Additionally, the stratum level, active STP version, and maximum STP version for each directly attached system are shown.

  Servers with different maximum STP versions can coexist in the same CTN. When the local and remote servers do not have the same maximum STP version installed, communication between the servers uses the lowest version installed, which is indicated in the active STP version column.

  Using the information provided in this table, across all servers in the STP-only CTN, can help build a topology diagram of the CTN at that precise moment in time. If a CTN reconfiguration command has been applied from any other tab in the System (Sysplex) Time task, it is necessary to first click **Refresh** to ensure the validity of the information displayed.
- Local Uninitialized STP links: This table identifies all the possible coupling links defined in the IOCDS that may be used by this server to exchange STP messages.

  This table identifies this server's coupling links that may not be used to exchange STP messages with other servers. All links in this table are in an uninitialized state. The table shows the STP link identifier (PCHID, but without any CHPID information), link type, Reason Code Sent, and Reason Code Received.

  The Uninitialized Reason Code (for example, Offline or Link Failure) identifies the reason that STP has not initialized the link. The Help function is available to look up any specific reason code.
- On a server in STP timing mode, timing mode is STP (Server Time Protocol). Stratum level values can be 1, 2, or 3. The example shown in Figure 6-12 on page 165 provides information for the Current Time Server, which is Stratum 1. Examples in this section show STP status tabs with maintenance for Maximum STP Version 4.

Figure 6-13 shows the view from a Stratum 2 server.

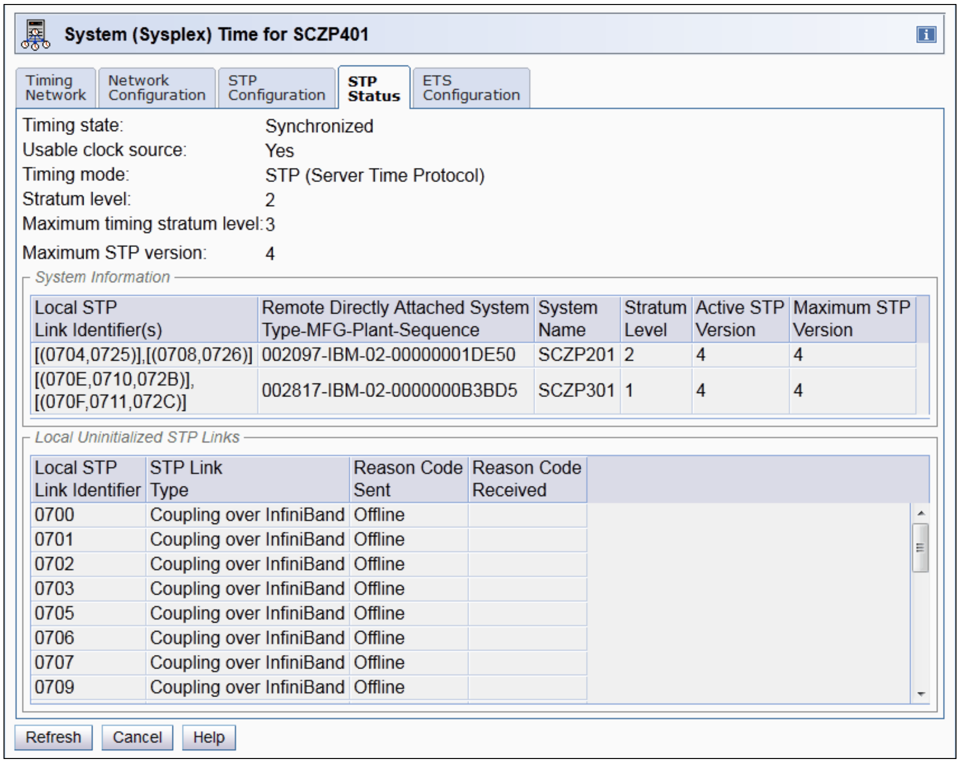


Figure 6-13 STP Status tab - Displayed from a Stratum 2 server

6.2.7 ETS Configuration tab

Configuration of the ETS method is performed through the ETS Configuration tab in the System (Sysplex) Time task on the HMC, and it is shown in Figure 6-14 on page 168.

After a migration to an STP-only CTN, the time source selection specified on the ETS Configuration tab is only used to adjust the Coordinated Server Time (CST) through the CTS (Current Time Server) CPC.

However, the ETS Configuration window displays for all CPCs that support NTP, regardless of the type of CTN. This enables the ETS configuration of every existing CPC before its migration to an STP-only CTN.

A newly installed CPC, which will join this CTN and will be a candidate to become the CTS when migrating to a STP-only CTN in the future, can also be configured at installation time. It is typical for the CTS to be the PTS. If there is a configured BTS, configure it with a viable ETS as well. If the PTS cannot access the NTP server or the PPS signal from the NTP server (which is the ETS for this server), the BTS, if configured to a separate NTP server, might be able to calculate the adjustment required and propagate it to the PTS. The PTS, in turn, performs the necessary time adjustment.

You have the following options:

- Selecting **None** means that this server will not be able to steer the CTN in case this CPC becomes the CTS.
- Selecting the **Use NTP** radio button displays the NTP Time Server Information table. See 1.2, “Configuring an NTP server” on page 5 for more information about this topic.

  When an NTP server is configured, clicking **Query** tests the NTP Time Server’s access and fills the Stratum, Source, and Status fields. In addition, a Select column displays where the user can chose a preferred NTP server (Figure 6-14 on page 168).

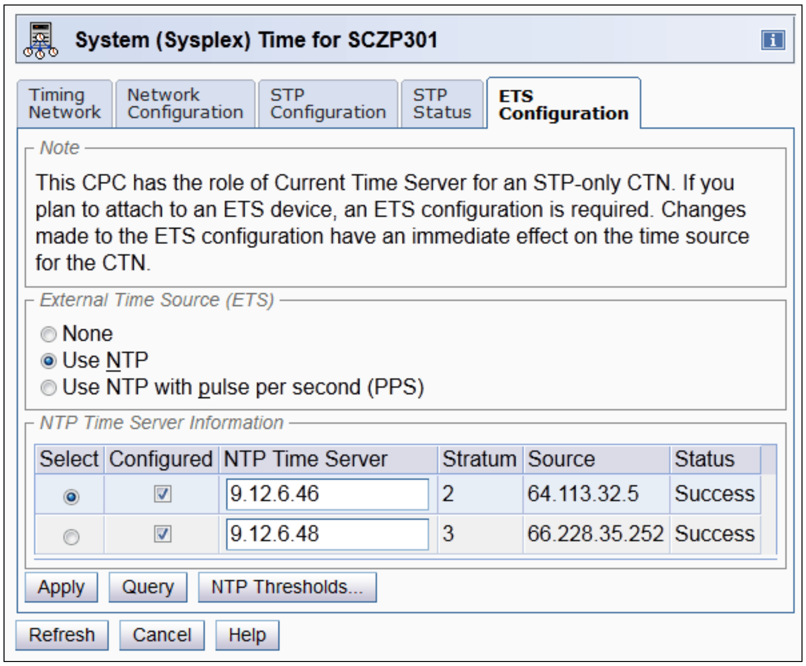


Figure 6-14 NTP Time Server Information table

- Selecting **Use NTP with pulse per second (PPS)** displays the NTP Time Server Information table. In addition, the PPS Port column displays, showing which NTP server corresponds to which PPS port. A PPS Port Status section displays to indicate the status of the PPS ports (Figure 6-15).

  The possible port status messages are:

  – Not configured
  – No PPS signal
  – Acquiring consistent NTP information
  – Configuration error
  – Adjusting for PPS signal
  – Capable of tracking to PPS signal
  – Tracking to PPS signal

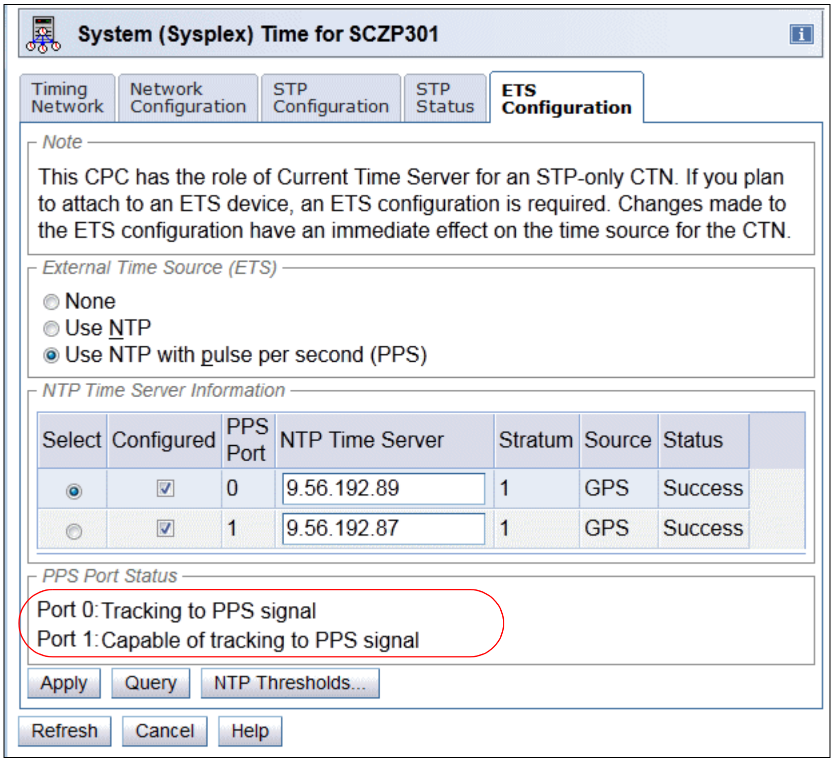


Figure 6-15 NTP Time Server and PPS information

See 1.3, "Configuring an NTP server with pulse per second option" on page 27. The PPS Port Status displays when the configured External Time Source (ETS) is NTP with PPS and the server (CPC) has the role of PTS or BTS in an STP-only CTN.

Important: Starting w/ HMC version 2.12.0, the HMC dial out capability has been removed. If you have an HMC version 2.11.1 or earlier (with STP support), you can still use the dial out option.

Selecting **Use dial out if configured on Hardware Management Console** specifies that the ETS will be the dial out mechanism if configured on the HMC Customize Outbound Connectivity task. See 1.2, "Configuring dial out on the HMC" on page 5.

6.3 Monitoring an STP-only CTN using z/OS commands

The output from various z/OS commands that display time-related information varies, depending on the following conditions:

- Which server is hosting the z/OS system
- The type of timing network
- The timing mode that the server is using

6.3.1 z/OS commands

The following z/OS commands are used to monitor an STP-only CTN.

DISPLAY ETR

Prior to STP, the DISPLAY ETR command was used to display the synchronization mode and the status of the ETR ports as seen by z/OS.

With STP support, even though there is no ETR in an STP-only CTN, the command itself has not changed, but is also used to display information about the STP-only CTN. The output has been updated to support various STP environments, and displays STP-related information where applicable.

In an STP-only CTN, the TOD clock is being steered to the time provided by the CTS. No reference to a Sysplex Timer displays.

The output from the DISPLAY ETR command in an STP-only CTN incorporates the following additional information:

- Node ID information for the CTS server
- Informational lines whose display varies depending on:
  - CTN topology.
  - Where the DISPLAY ETR command is being executed from. If the command is issued from the Preferred Time Server, Backup Time Server, or Arbiter, a line displays indicating what server role has been assigned to that particular server.

In an STP-only CTN, on Preferred Time Server, no Arbiter

In an STP-only CTN (Figure 6-16), the DISPLAY ETR command shows:

- Synchronization mode as STP.
- CTN ID that contains only the STP ID (that is, ITSOPOK).
- Server role, if it has been configured for this server. This is the Preferred Time Server.
- An optional information line if an Arbiter has not been configured. If an Arbiter has been configured for the example, the last informational line is not displayed.

```
D ETR
IEA386I 17.21.13 TIMING STATUS 368
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002827.H43.IBM.02.00000000B8D7
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 6-16 z/OS DISPLAY ETR in STP-only CTN, Preferred Time Server, no Arbiter

The Current Time Server is the active Stratum 1 server in an STP-only CTN. There can only be one active Stratum 1 server in an STP-only CTN, and only the Preferred Time Server or the Backup Time Server can be assigned to be the active Stratum 1 server. Because this is an STP-only CTN and DISPLAY ETR indicates that the server is a Stratum 1, we can conclude that the Preferred Time Server also acts as the Current Time Server.

In an STP-only CTN, on Backup Time Server, no Arbiter

The information shown in Figure 6-17 is similar to that shown in Figure 6-16 on page 170, except that the DISPLAY ETR command was issued from the Backup Time Server. If an Arbiter has been configured, the last line in Figure 6-17 is not displayed.

```
D ETR
IEA386I 17.23.44 TIMING STATUS 476
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002827.H43.IBM.02.00000000B8D7
  THIS IS THE BACKUP TIME SERVER
  NUMBER OF USABLE TIMING LINKS = 15
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 6-17 z/OS DISPLAY ETR in STP-only CTN, Backup Time Server, no Arbiter

In an STP-only CTN, on Arbiter

As in Figure 6-18, the server role of Arbiter displays when the DISPLAY ETR command is issued from the Arbiter in a configuration with all three server roles defined.

```
D ETR
IEA386I 17.27.11 TIMING STATUS 938
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002827.H43.IBM.02.00000000B8D7
  THIS IS THE ARBITER SERVER
  NUMBER OF USABLE TIMING LINKS =  9
```

Figure 6-18 z/OS DISPLAY ETR in STP-only CTN - Arbiter

In an STP-only CTN, on a member of the CTN

In Figure 6-19, the STP-only CTN only has a PTS defined. There is no Backup Time Server or Arbiter. In this example, the DISPLAY ETR command was issued from a server with no special role assigned.

```
D ETR
IEA386I 17.30.47 TIMING STATUS 483
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002827.H43.IBM.02.00000000B8D7
  NUMBER OF USABLE TIMING LINKS = 15
  THIS STP NETWORK HAS NO BACKUP TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 6-19 z/OS DISPLAY ETR in STP-only CTN - Member of the CTN

The number of usable timing links accounts for the number of STP-initialized links that supply, or *can* supply, timing information to this server. This is why this line does not appear in the D ETR output of a Current Time Server because it is the source of timing information. A Stratum 2 server includes links to another Stratum 2 server because, if it were to transition to a Stratum 3 server, those links become sources of timing signals.

SETETR PORT=n

The SETETR command can only be used to enable ETR ports that have been previously disabled by z/OS as a consequence of hardware error. This command cannot be used when the server is in STP timing mode. If the command is attempted on a server in STP timing mode, z/OS message IEA384I displays:

```
IEA384I SETETR COMMAND IS NOT VALID IN STP TIMING MODE
```

DISPLAY XCF,SYSPLEX

The DISPLAY XCF,SYSPLEX command displays the system status and the last recorded system status monitor time stamp for each system in the sysplex.

Figure 6-20 shows an STP-only CTN where both SC74 and SC75 are in STP timing mode, as indicated by TM=STP.

```
D XCF,SYSPLEX
IXC336I  17.33.37  DISPLAY XCF 371
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME          SYSTEM STATUS
SC74     2827 B8D7   01   09/27/2012 17:33:37 ACTIVE        TM=STP
SC75     2817 3BD5   05   09/27/2012 17:33:32 ACTIVE        TM=STP
```

Figure 6-20 z/OS DISPLAY XCF,SYSPLEX,ALL - STP-only CTN

DISPLAY CF

The DISPLAY CF command does not directly provide information regarding the CTN type or timing mode of the server. However, the output does display the CF Request Time Ordering status (MTOF). If the CTN is a Mixed CTN or STP-only CTN in a Parallel Sysplex configuration, the requirement is that all servers support MTOF.

The DISPLAY CF command can be used to verify whether MTOF is required and enabled (Figure 6-21).

```
D CF
IXL150I  17.35.47  DISPLAY CF 373
COUPLING FACILITY 002817.IBM.02.0000000B3BD5
                  PARTITION: 0D  CPCID: 00
                  CONTROL UNIT ID: FFDB
NAMED CF7B
COUPLING FACILITY SPACE UTILIZATION
...<<snippet>>....
MAX REQUESTED DUMP SPACE:                                       0 M
   VOLATILE:           YES       STORAGE INCREMENT SIZE:         1 M
    CFLEVEL:            17
    CFCC RELEASE 17.00, SERVICE LEVEL 10.15
    BUILT ON 07/18/2012 AT 13:09:00
    COUPLING FACILITY HAS 1 SHARED AND 0 DEDICATED PROCESSORS
    DYNAMIC CF DISPATCHING: ON
    COUPLING FACILITY IS NOT STANDALONE

CF REQUEST TIME ORDERING: REQUIRED AND ENABLED

COUPLING FACILITY SPACE CONFIGURATION
                          IN USE          FREE          TOTAL
CONTROL SPACE:              51 M         532 M          583 M
NON-CONTROL SPACE:           0 M           0 M            0 M
...<<snippet>>....
```

Figure 6-21 z/OS DISPLAY CF command

STP requires that each coupling facility within a Parallel Sysplex is *enabled* for CF Request Time Ordering before migration of any server within the Parallel Sysplex to either a Mixed or STP-only CTN. If this is not the case, the coupling facility becomes unusable and all structures require rebuilding into a CF Request Time Ordering *enabled* coupling facility if possible.

Note: CF Request Time Ordering is also referred to as the Message Time Ordering Facility (MTOF).

For images running on zEC12 servers, the D CF,CFNAME=cfname command also displays the **AID** and **PORT**, as shown in Figure 6-22 on page 174.

```
D CF,CFNAME=CF7B
IXL150I  13.39.55  DISPLAY CF 228
COUPLING FACILITY 002817.IBM.02.0000000B3BD5
                  PARTITION: 0D  CPCID: 00
                  CONTROL UNIT ID: FFDB
NAMED CF7B
COUPLING FACILITY SPACE UTILIZATION
 ALLOCATED SPACE                  DUMP SPACE UTILIZATION
  STRUCTURES:          49 M        STRUCTURE DUMP TABLES:          0 M
  DUMP SPACE:           2 M                  TABLE COUNT:          0
 FREE SPACE:          532 M       FREE DUMP SPACE:                 2 M
TOTAL SPACE:          583 M      TOTAL DUMP SPACE:                 2 M
                                MAX REQUESTED DUMP SPACE:          0 M
   VOLATILE:           YES        STORAGE INCREMENT SIZE:          1 M
    CFLEVEL:            17
    CFCC RELEASE 17.00, SERVICE LEVEL 10.15
    BUILT ON 07/18/2012 AT 13:09:00
    COUPLING FACILITY HAS 1 SHARED AND 0 DEDICATED PROCESSORS
    DYNAMIC CF DISPATCHING: ON
    COUPLING FACILITY IS NOT STANDALONE

CF REQUEST TIME ORDERING: REQUIRED AND ENABLED

COUPLING FACILITY SPACE CONFIGURATION
                          IN USE           FREE           TOTAL
CONTROL SPACE:              51 M          532 M           583 M
NON-CONTROL SPACE:           0 M            0 M             0 M

PATH        PHYSICAL              LOGICAL  CHANNEL TYPE      AID  PORT
B2 / 0710   ONLINE                ONLINE   CIB 12X-IFB3      000A  02
B6 / 0711   ONLINE                ONLINE   CIB 12X-IFB3      001A  02

COUPLING FACILITY SUBCHANNEL STATUS
 TOTAL:   14   IN USE:   14   NOT USING:    0   NOT USABLE:    0
 OPERATIONAL DEVICES / SUBCHANNELS:
     FD39 / 1D64     FD3A / 1D65     FD3B / 1D66     FD3C / 1D67
     FD3D / 1D68     FD3E / 1D69     FD3F / 1D6A     FD47 / 1D6B
     FD48 / 1D6C     FD49 / 1D6D     FD4A / 1D6E     FD4B / 1D6F
     FD4C / 1D70     FD4D / 1D71
```

Figure 6-22   z/OS DISPLAY CF command on zEC12

Figure 6-23 displays the other CF Request Time Ordering messages that might appear in the output of DISPLAY CF.

```
CF REQUEST TIME ORDERING: REQUIRED AND ENABLED
CF REQUEST TIME ORDERING: NOT-REQUIRED AND ENABLED
CF REQUEST TIME ORDERING: NOT-REQUIRED AND NOT-ENABLED
CF REQUEST TIME ORDERING: REQUIRED AND NOT-ENABLED
CF REQUEST TIME ORDERING: REQUIRED AND WILL NOT BE ENABLED
REASON: FUNCTION NOT INSTALLED ON THIS SYSTEM
REASON: ETR NOT CONNECTED TO COUPLING FACILITY
REASON: REQUEST TIME ORDERING FUNCTION FAILURE
REASON: REQUEST TIME ORDERING NOT INSTALLED ON THIS SYSTEM
REASON: CTNID MISMATCH - CF CTNID: cfstpid
REASON: ETR NETID MISMATCH - CF ETR NETID: etr netid
REASON: CF IS OUT OF SYNCH WITH TIMING NETWORK
```

Figure 6-23 Possible CF Request Time Ordering messages

6.3.2 Coupling facility commands

In a Parallel Sysplex environment, coupling facilities require time awareness to support CF Request Time Ordering (MTOF) when in a Mixed CTN or STP-only CTN. The server TOD is used for this purpose.

Coupling facilities also support the concept of time zone offset, which is used only for the purpose of time stamp messages that are displayed on the console.

Unlike z/OS, there is no CFCC command available to display time. However, all messages that appear on the CF console include a time stamp in local time format, which is the server TOD with the time zone offset applied.

Therefore, the current local date and time at the CF console can be indirectly determined by entering any command (valid or invalid) and reviewing the time stamp in the resulting response.

Because the CF supports a local time format that incorporates the time zone offset, it also provides methods to both display the current time zone offset setting and to change it if required.

DISPLAY TIMEZONE

Use the CFCC DISPLAY TIMEZONE command to display the current time zone offset being used by the coupling facility. This produces a single line indicating how many hours and minutes the current time zone is east or west of Greenwich Mean Time (GMT) (Figure 6-24).

```
2012271 17:57:48 => DISPLAY TIMEZONE
2012271 17:57:48 CF0271I Timezone is 04:00 West of Greenwich Mean Time.
```

Figure 6-24 CFCC DISPLAY TIMEZONE command

TIMEZONE

The CFCC supports the TIMEZONE command that allows the time zone offset to be changed, if required. The syntax is:

```
TIMEZone {0|hh|hh:mm|:mm} {East|West}
```

Use this command to adjust the local time displayed in messages on the coupling facility console for the onset and removal of daylight saving time (Figure 6-25).

```
2005272 11:17:31 => TIMEZONE 05:00 west
2005272 10:17:31 CF0271I Timezone is 05:00 West of Greenwich Mean Time
```

Figure 6-25 CFCC TIMEZONE command

Coupling facility implications at daylight saving time changes

When a CF image partition is activated and it is connected to a Sysplex Timer, the CFCC uses only one of the following time offset options:

- The logical partition time offset specified in the image profile.
- The TIMEZONE offset. The TIMEZONE offset overrides the logical partition time offset.

Use the TIMEZONE command for DST changes, as described at the following web page:

http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD103077

6.3.3 z/VM commands

If your z/VM® LPAR has been configured for STP time synchronization, you can perform a number of administrative tasks that will allow you to retrieve information pertaining to STP.

Configuration

Changing the STP time zone in the z/VM LPAR configuration file is shown in Figure 6-26.

```
/**********************************************************************/
/*                         Features Statement                        */
/**********************************************************************/


 Features ,
   Disable ,                       /* Disable the following features */
     Set_Privclass ,               /* Disallow SET PRIVCLASS command */
     Auto_Warm_IPL ,               /* Prompt at IPL always           */
     Clear_TDisk   ,               /* Don't clear TDisks at IPL time */
   Enable,
     STP_TZ ,                      /* timezone from STP on CPC       */
   Retrieve ,                      /* Retrieve options               */
     Default  20 ,                 /* Default.... default is 20      */
     Maximum  255 ,                /* Maximum.... default is 255     */
   MaxUsers noLimit ,              /* No limit on number of users    */
   Passwords_on_Cmds ,             /* What commands allow passwords? */
     Autolog  yes ,                /* ... AUTOLOG does               */
     Link     yes ,                /* ... LINK does                  */
     Logon    yes ,                /* ... and LOGON does, too        */
   Vdisk Userlim 144000 blocks     /* Maximum vdisk allowed per user */
```

Figure 6-26 System configuration with STP enabled

z/VM commands

This section presents the commands used to retrieve timing information in a z/VM LPAR. Querying STP information using the **Q STP** command shows that STP is active (Figure 6-27).

```
11:02:54 Q STP
11:02:54 Server Time Protocol synchronization activated.
```

Figure 6-27 Querying STP information

Testing the impact that changing the time zone has on z/VM

First we issue the **QUERT TIME** command in z/VM (Figure 6-28). Notice the time in the highlighted information. The command has been issued on a system located in the US Eastern Standard Time zone, before entering the time zone information in the HMC.

```
11:02:52 Q T
11:02:52 TIME IS 11:02:52 EDT SUNDAY 09/23/12
11:02:52 CONNECT= 00:01:00 VIRTCPU= 000:00.00 TOTCPU= 000:00.02
```

Figure 6-28 Query time information in z/VM

Next, we also query the time zone information (Figure 6-29).

```
11:02:59 Q TIMEZONES
11:02:59 Zone  Direction   Offset   Status         Boundary
11:02:59 UTC     ----     00.00.00  Inactive
11:02:59 GMT     ----     00.00.00  Inactive
11:02:59 EDT     West     04.00.00  Active-(STP)
11:02:59 EST     West     05.00.00  Inactive-(STP) 02:01:09 11/04/12
```

Figure 6-29 Checking time zone

If STP_TZ has been set in the z/VM LPAR configuration, the **Q TIMEZONES** command will retrieve this information from STP. We change the time zone in the HMC panels, which triggers the time zone change in z/VM also.

The following messages are displayed on the operator console and in the MAINT user console:

```
10:06:55 HCPTZN6759I The time zone has changed to EST.
```

After the time zone change, the **Q TIMEZONES** command displays the information shown in Figure 6-30.

```
10:08:34 Q TIMEZONES
10:08:34 Zone  Direction   Offset   Status         Boundary
10:08:34 UTC     ----     00.00.00  Inactive
10:08:34 GMT     ----     00.00.00  Inactive
10:08:34 EDT     West     04.00.00  Inactive-(STP) 19:00:00 00/30/00
10:08:34 EST     West     05.00.00  Active-(STP)
```

Figure 6-30 Querying time zone information after changing the time zone

And the **Q TIME** command reflects the summer time for US EST, as shown in Figure 6-31.

```
10:08:31 Q T
10:08:31 TIME IS 10:08:31 EST SUNDAY 09/23/12
10:08:31 CONNECT= 00:06:39 VIRTCPU= 000:00.00 TOTCPU= 000:00.02
```

Figure 6-31 Time information with daylight saving in effect

Testing z/VM when server loses STP synchronization, then time synchronization is restored

We check whether STP is active using the **Q STP** command:

```
10:08:33 Q STP
10:08:33 Server Time Protocol synchronization activated.
```

The STP Status pane on the HMC in the System (Sysplex) Time task shows that the Timing state is Synchronized.

If the server loses synchronization, the messages shown in Figure 6-32 will be displayed on the OPERATOR console (one message per virtual CPU).

```
11:11:57 HCPMCI9101I MACHINE CHECK ON CPU 0000.  MCIC = 04000F3F 403B0000
11:11:57 HCPMCI9109I System operation continues.
11:11:57 HCPSTI988I TOD Clock synchronization suspended
11:11:57 HCPSTI985E STP clock source is not usable
```

Figure 6-32 OPERATOR console message when synchronization is lost

We check in the STP status pane on the HMC for the Timing state - Not synchronized, and also query STP information in z/VM. The Q STP shows that synchronization is suspended:

```
11:13:35 Q STP
11:13:35 Server Time Protocol synchronization suspended.
```

When the failure is repaired, STP synchronization is restored and the message presented in Figure 6-33 is displayed in the z/VM OPERATOR console.

```
11:15:18 HCPMCI9101I MACHINE CHECK ON CPU 0000.  MCIC = 04000F3F 403B0000
11:15:18 HCPMCI9109I System operation continues.
11:15:18 HCPSTI986I TOD Clock synchronized via STP
```

Figure 6-33 Message on OPERATOR console after STP synchronization restored

The STP Status pane on the HMC in the System (Sysplex) Time task shows again that the Timing state is Synchronized. We issue the Q STP command to check:

```
11:16:21 Q STP
11:16:21 Server Time Protocol synchronization activated.
```

6.4 Configuring an STP-only CTN

This section discusses configuration in an STP-only CTN.

Note: Unless otherwise specified, operations in this section are performed on the HMC. The HMC controlling the CTN *must* be at the highest level for the servers that can become STP Stratum 1.

The starting point is that one or more STP-enabled servers need to be configured into an STP-only CTN.

Follow these steps to configure an STP-only CTN:

1. Establish connectivity between the CEC Support Element and an NTP server that is, or is connected to, a reliable source of time.
2. Set the CTN ID on each server to be configured in the STP-only CTN. In the case of an STP-only CTN, the CTN ID only contains the STP ID portion.
3. Configure NTP or NTP with PPS as the external time source.
4. Initialize the time. This includes setting the time zone, leap seconds, and date and time. If an NTP server is configured, date and time should be initialized by using the ETS option.
5. Assign the CTN roles.

In the following sections, we explain each of these steps in greater detail.

6.4.1 Support Element-to-NTP server connectivity

We assume that the NTP server has been set up and its connectivity to the Support Element has been established before the configuration of the STP-only CTN. See the 1.1, “External Time Source” on page 4.

6.4.2 CTN ID initialization

On a server where the STP feature has just been installed, the CTN ID field on the STP Configuration tab is initially blank, as shown in the HMC window in Figure 6-34.

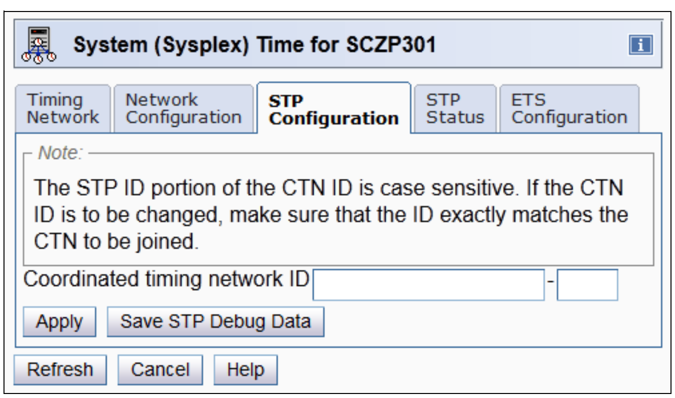


Figure 6-34 STP Configuration tab - CTN ID

The CTN ID format is [STP Network ID] - [ETR Network ID] and is the basis for establishing the Coordinated Timing Network. The ETR Network ID is always null for an STP-only CTN.

In an STP-only CTN, the CTN ID only contains the STP ID portion. The STP network ID is case sensitive and is one to eight characters. The valid characters are A – Z, a – z, 0 – 9, -, and _. The STP Network ID is entered in the STP Configuration tab (Figure 6-35). The same CTN ID must be entered on every server that will participate in the STP-only CTN.

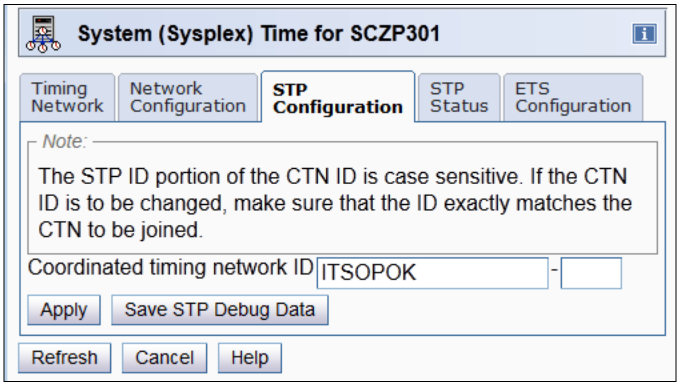


Figure 6-35 STP Configuration tab with a new CTN ID

Fill in a value for the STP ID field (for example, ITSOTST) and click **Apply**. The confirmation message ACT37363 displays (Figure 6-36).

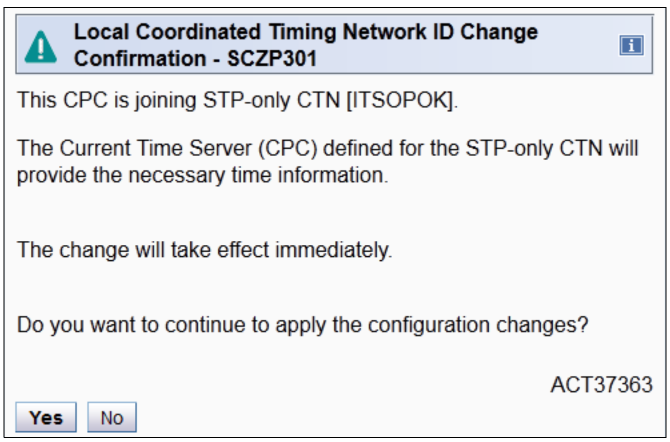


Figure 6-36 Local Coordinated Timing Network ID change confirmation

Clicking **Yes** results in the ACT37315 message being displayed (Figure 6-37).

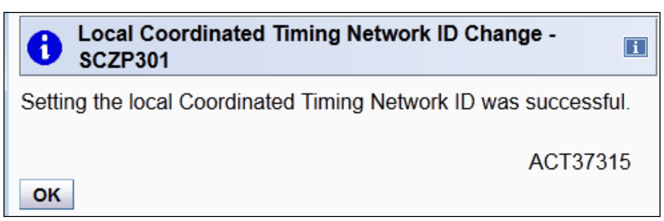


Figure 6-37 ACT37315 message - Successful CTN ID setting

After the STP ID has been accepted, the server is STP configured. Because no role has been defined yet, the CTN still has no timing source and it remains a Stratum 0 at this stage.

6.4.3 Configuring an NTP server or an NTP server with PPS as the ETS

The ETS has to be configured for an NTP server or an NTP server with PPS before initializing the CTN time. See 1.1, "External Time Source" on page 4.

6.4.4 Time initialization

When migrating from a Mixed CTN to an STP-only CTN, the timing information is inherited from the Sysplex Timer. When configuring a new STP-only CTN, the time information must be entered on the server that will become the Current Time Server. This is done from the Network Configuration tab on the HMC. The method does not depend on the number of servers in the CTN.

The following sequence of time initialization steps consists of a newly installed, single CEC CTN. The same sequence applies to a multiserver CTN.

After the server is STP configured but not part of a CTN, the Initialize Time button on the Network Configuration tab is enabled and selectable (Figure 6-38).

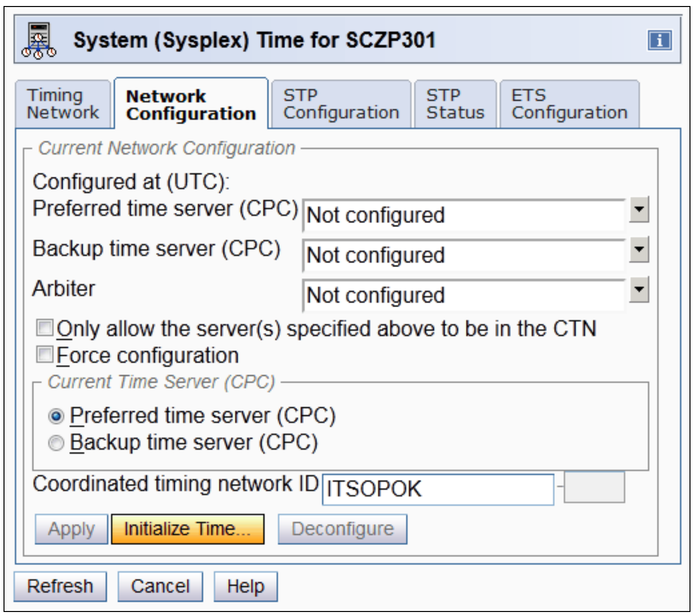


Figure 6-38 Network Configuration tab - Initialize Time button enabled

The initialize time button is only selectable when the CTN has not yet been initialized, such as for a new installation or for a previously active CTN that has been deconfigured (either intentionally or following a CTN failure).

> **Important:** Initializing the time *must* be performed on the server that will become the CTS.

Click **Initialize Time** and the main Initialize Time window displays (Figure 6-39).

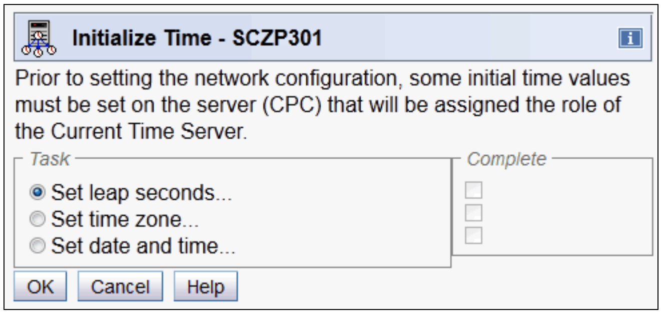


Figure 6-39 Network Configuration tab - Initialize Time anchor window

The Initialize Time window anchors the various time initialization tasks and options. The time initialization process consists of the following three tasks:

1. Set leap seconds.
2. Set time zone.
3. Set date and time.

These three tasks must each be completed before a network configuration can be applied for an STP-only CTN. The first task is to set the leap seconds.

Initialize time: Set leap seconds

To set leap seconds:

1. Select the **Set leap seconds** radio button and click **OK**. The Adjust Leap Second Offset displays (Figure 6-40).

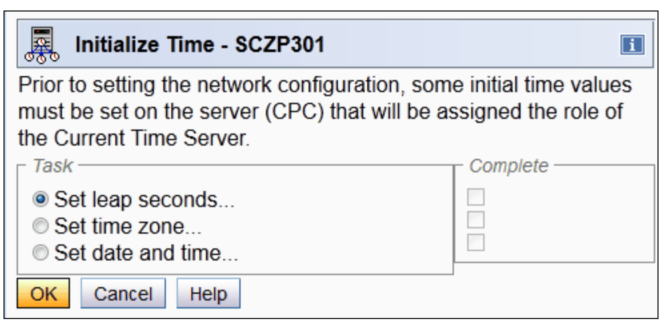


Figure 6-40 Initialize Time - Set leap seconds

2. To account for leap second corrections, the total accumulated number of leap seconds since January 1972 must be entered when setting the time. Most installations have little awareness of leap seconds and on-going leap second adjustments. However, an offset value must be specified to complete the task (Figure 6-41).

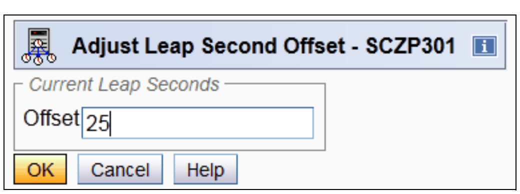


Figure 6-41 Initialize time - Adjust leap Second Offset

If leap seconds are not used, specify a value of 0 in the Offset input box. Otherwise, enter the current leap seconds value. Do not enter any other value.

> **Note:** If an external time source is configured to an NTP server, the UTC time information obtained from public servers *includes* the current leap seconds offset.

We discuss z/OS considerations for further leap seconds adjustments in 6.6.5, "STP offset adjustments" on page 228. Also see *STP Planning Guide,* SG24-7280, for information about the use of leap seconds.

3. Click **OK**. If successful, the completion message ACT37322 displays (Figure 6-42).

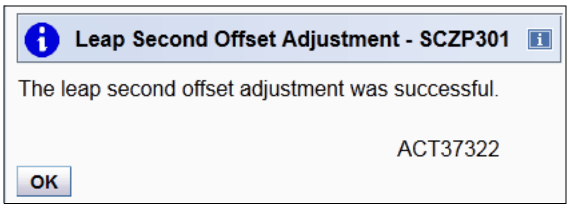


Figure 6-42 Leap Second Offset Adjustment successful message

4. Click **OK** to clear this message and return to the main Initialize Time window.

Initialize time: Set time zone

In Figure 6-43, you can see that the Set time zone radio button is preselected and there is a grayed-out check box in the Complete column next to the Set leap seconds task. This indicates that the first task, setting leap seconds, has already been successfully completed.

Perform the following steps:

1. Select the **Set time zone** radio button and click **OK**.

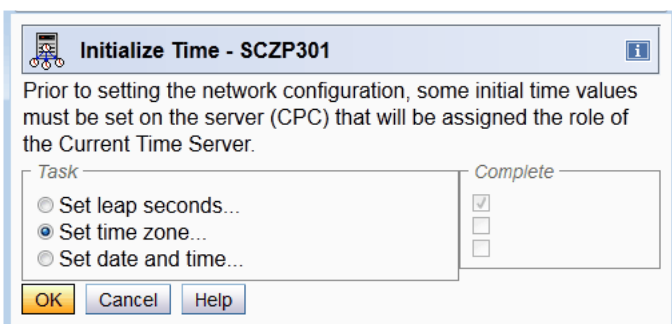


Figure 6-43 Initialize Time - Set time zone

As shown in Figure 6-44, the Time Zone drop-down selection is initially set to `<Not Initialized>`.

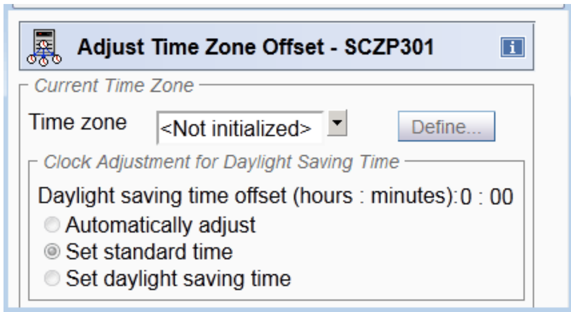


Figure 6-44 Initialize Time - Adjust Time Zone Offset - Not initialized

2. Select a value from the Time Zone drop-down menu (Figure 6-45).

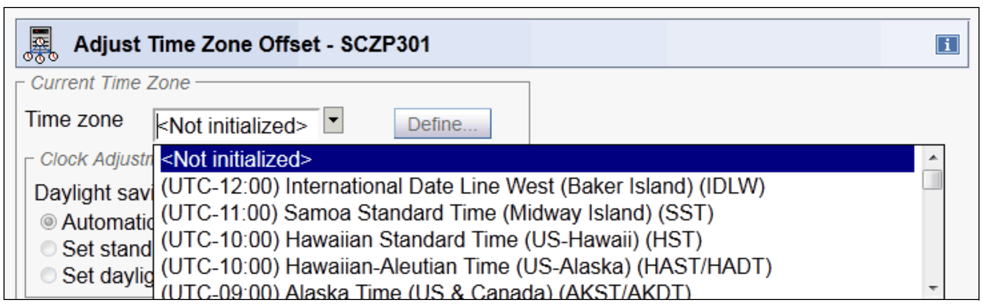


Figure 6-45 Initialize Time - Adjust Time Zone Offset - Time zone selection

If a time zone entry that meets the user requirements cannot be found, then one of the five user-defined time zones (that is, UD1 to UD5) may be used to define the desired time zone.

If a user-defined time zone entry is selected, the Define button is enabled, and the Define Time Zone Algorithm window becomes available (Figure 6-46 on page 185).

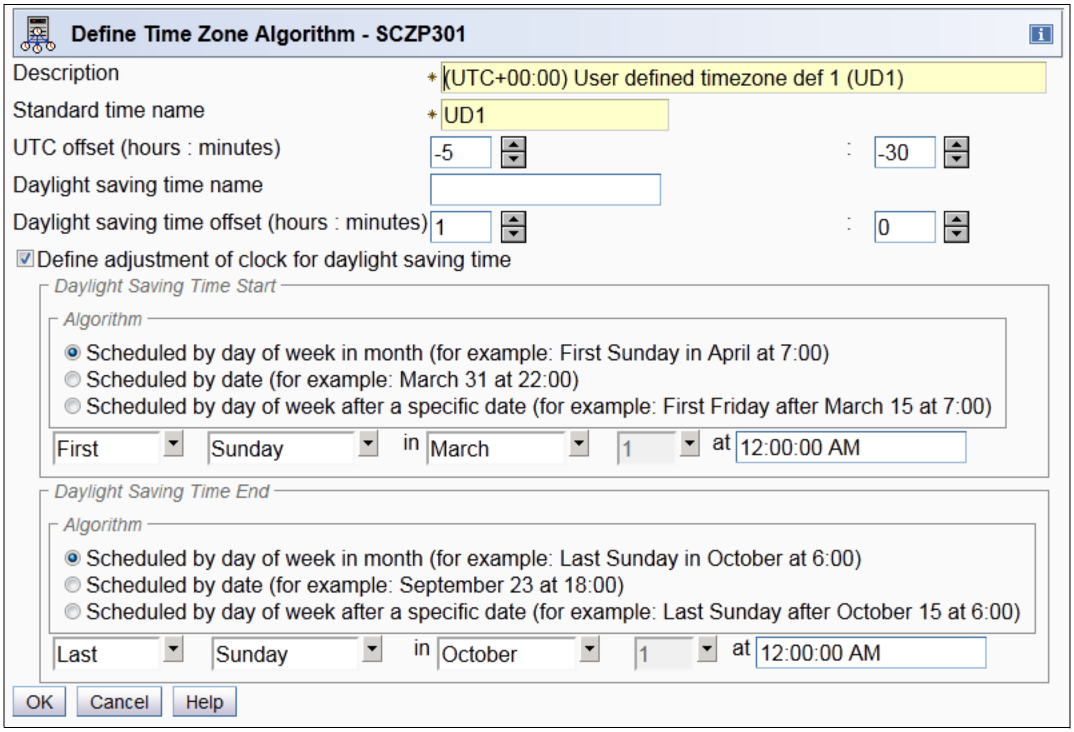


Figure 6-46 Initialize Time - User-defined time zone

The Description (maximum 80 characters) and Standard time name fields (maximum four characters) must be filled in. Otherwise, an error message displays when **OK** is clicked. The standard time name is an abbreviation displayed in various windows to differentiate standard time from daylight saving time.

The UTC offset must be entered in +/- hours and minutes and ranges from -14 to +14 hours.

Also, if the time zone is subject to daylight saving time adjustments, the daylight saving time name and daylight saving offset must be specified. Optionally, algorithms for daylight saving time start and daylight saving time end can be defined to support automatic clock adjustment by selecting the **Define adjustment of clock for daylight saving time** option. The algorithm is saved when **OK** is clicked, but it is not sent to the STP facility until **OK** is clicked in the Adjust Time Zone Offset window; see Figure 6-45 on page 184.

3. Select one of the radio buttons for clock adjustment for daylight saving time.

   The Automatically adjust radio button is enabled and selected by default when the time zone selected supports automatic adjustment of daylight saving time. Otherwise, this button is disabled.

   If automatic adjustment for daylight saving time is not supported by the selected time zone, or if you prefer to manually control the daylight saving time, select the **Set standard time** or **Set daylight saving time** radio buttons, accordingly; see Figure 6-44 on page 184.

   See *STP Planning Guide,* SG24-7280, for information about the use of automatic adjustment.

In Figure 6-44 on page 184, the Set standard time button is selected. Click **OK**. Completion message ACT37328 displays (Figure 6-47).

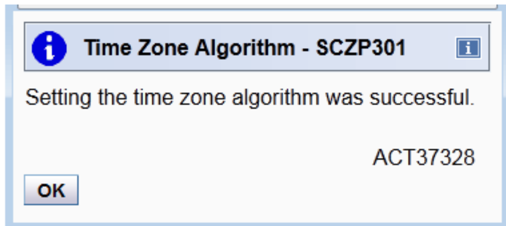


Figure 6-47 Time Zone Algorithm successful apply message

4. Click **OK** to clear the message and return to the Initialize Time window (Figure 6-48).

Initialize Time: Set date and time

In the Initialize Time window, notice that the Set date and time radio button is automatically preselected and that there is now a second grayed-out check box in the Complete column next to the Set time zone task. This indicates that both the Set leap seconds and Set time zone tasks have been successfully completed.

As in Figure 6-48, select the **Set date and time** radio button and click **OK**.

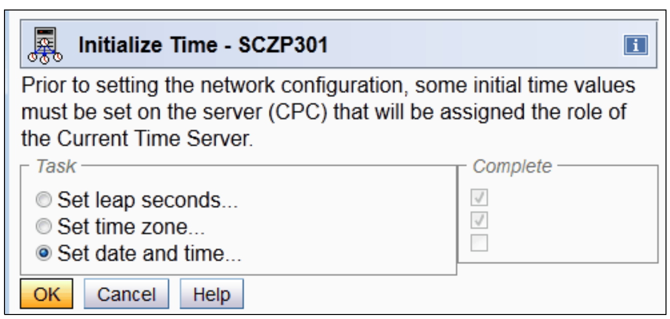


Figure 6-48 Initialize Time - Set date and time

The window shown in Figure 6-49 displays.

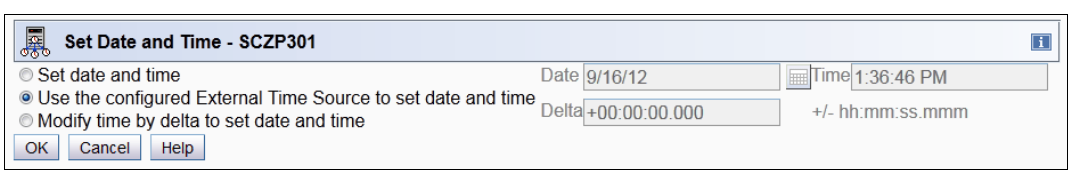


Figure 6-49 Set Date and Time through External Time Source

Three time initialization methods are provided:

- Set date and time.

  Select this option to manually set the date and time to specific values. When selected, the initial values that appear in the fields are taken from the current time from the Support Element of the server on which the configuration task is being performed. An icon beside the date field is also available to display a calendar dialog box.

- Use External Time Source to set date and time.

Use this option (Figure 6-49 on page 186) to attain greater accuracy to UTC. After being configured through the steps listed in 1.1, “External Time Source” on page 4, the ETS may be used to calculate the difference between the server’s time and UTC.

Using the Support Element or the HMC, access the ETS to calculate the difference between the server TOD clock and the time obtained from the external time source, which can be either dial out, or an NTP server with or without PPS. When access to the ETS is successful, the resulting time value is not displayed to the user and is instead passed directly to the STP facility when **OK** is clicked.

Message ACT37382 displays upon successful completion of the Set Date and Time operation (Figure 6-50). Click **OK**.

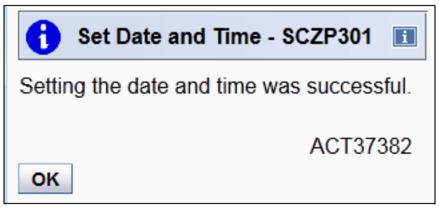


Figure 6-50 Set Date and Time - Successful

The Initialize Time window displays again. To verify the date and time set by accessing the external time source, the user can optionally select the **Set Date and Time** radio button a second time and click **OK** (Figure 6-51). This is the only way that the user can verify the information obtained from the external time source.

To leave the window without making any changes, click **Cancel**.

> **Attention:** After using the ETS to set the date and time, go *back* into the Set Date and Time window, shown in Figure 6-51, to verify that a date and time were obtained.

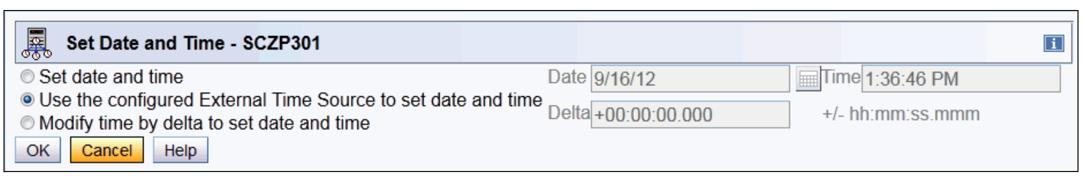


Figure 6-51 Confirm Date and Time set by External Time Source

- Modify time by delta to set date and time.

  Alternatively, you can specify a delta value that may be either positive (default) or negative, and that is entered in the *+/-hh:mm:ss.mmm* format (Figure 6-52).

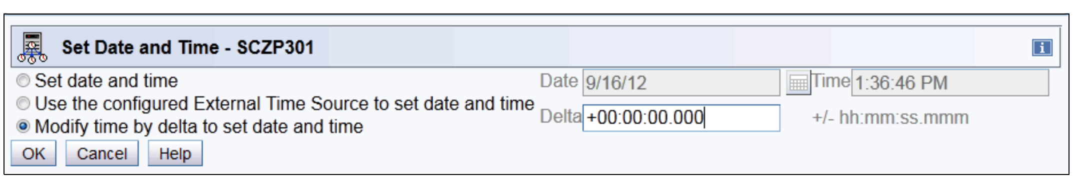


Figure 6-52 Set Date and Time - Modify time by delta

Click **OK**. Regardless of the method chosen, the server TOD is set to the resulting date and time when you click **OK**. If successful, confirmation message ACT37382 displays. Click **OK** to clear the message and return to the Initialize Time window.

6.4.5 Completing time initialization

Observe that the Set date and time radio button is still preselected (Figure 6-53) and that all three check boxes in the Complete column are grayed out. This indicates that all tasks necessary to initialize the time have been successfully completed.

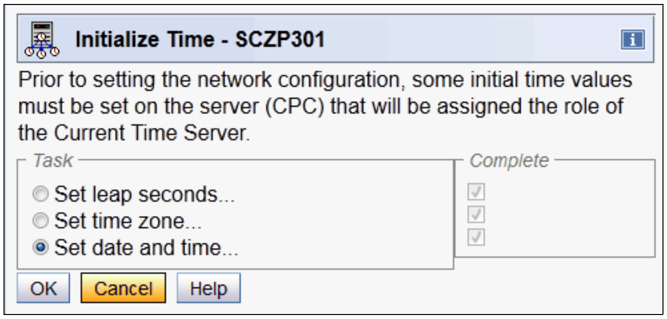


Figure 6-53 Initialize Time - All tasks complete

Clicking **OK** causes the Set date and time process to be repeated again, because the Set date and time radio button is preselected. To exit out of the Initialize Time task, click **Cancel**. This returns control to the Network Configuration tab (Figure 6-54).

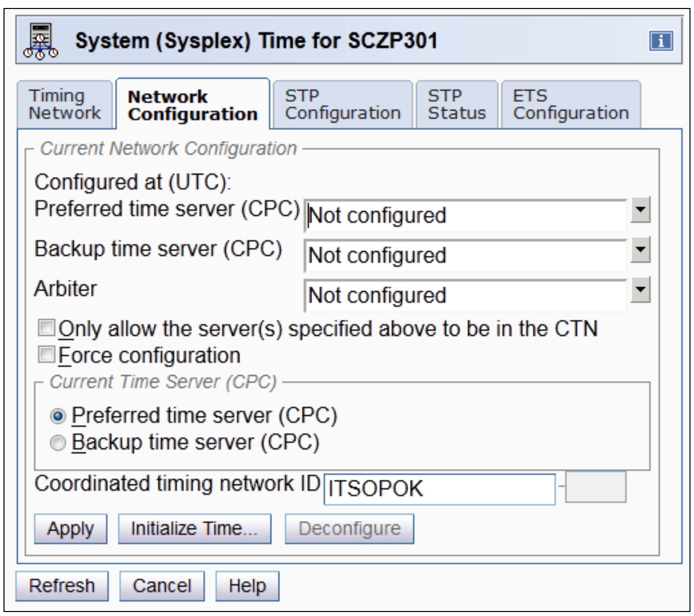


Figure 6-54 Network Configuration tab - After time has been initialized

The Coordinated Server Time is passed to other participating servers in the CTN when the server roles and the Current Time Server are assigned, as described in the next section.

Notice that now, because the server TOD has been initialized, the Apply button is enabled. The Initialize Time button remains enabled. Any of the steps in the Initialize Time task can be repeated until the CTN *is made active by assigning a CTS*. After configuration of the server roles and activation of the STP-only CTN, the Initialize Time button becomes disabled and the task cannot be performed again unless the timing network is deconfigured, which is disruptive to the Coordinated Server Time.

At this point, server role definitions and activation of the STP-only CTN can proceed.

6.4.6 Defining server roles

Activation of an STP-only CTN is done by configuring a Current Time Server. The configuration change is done from the Network Configuration tab (Figure 6-55). The change must be initiated from the server that will become the CTS.

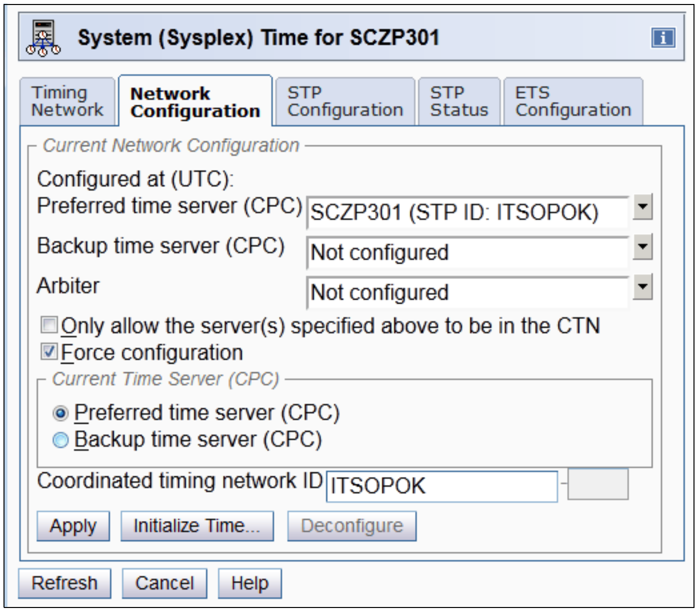


Figure 6-55 Network Configuration tab - Force configuration selected

Here we consider a CTN with two servers. The time initialization was performed. When the PTS/CTS and the BTS will be configured, define the server roles in two steps.

For a single CEC CTN, perform only the first step to configure the PTS/CTS:

1. Configure only the Current Time Server using the Force configuration option (Figure 6-55).

   Because the Force configuration option is checked, the Network Configuration Change Confirmation message (Figure 6-56) displays when you click **Apply**. Read the message carefully.

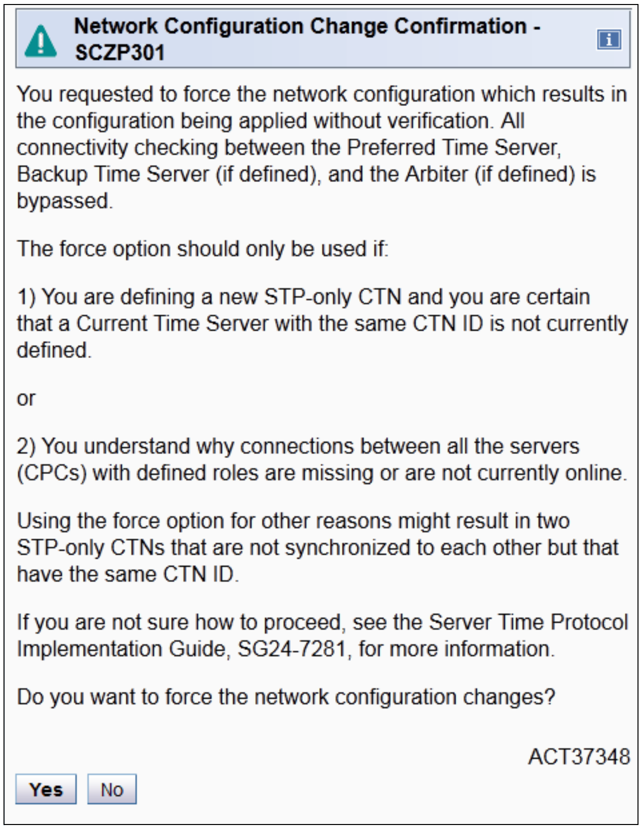


Figure 6-56 Network Configuration Change Confirmation

Note that this is one of two situations in which the Force configuration must be used. We discuss the second situation later in this chapter.

> **Note:** The Force configuration option in *not* selected during a migration from a Mixed CTN to an STP-only even though it might sound like you are defining a new STP-only CTN.

The Current Time Server specified can only be the Preferred Time Server. When the configuration is applied, the assignment of the CTS globally transitions all servers with the same CTN ID-to-STP timing mode.

Upon completion, message ACT37341 displays (Figure 6-57).

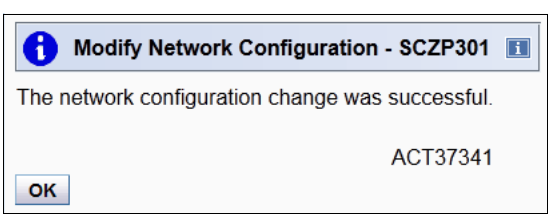


Figure 6-57 Modify Network Configuration - Successful

> **Important:** If the CTN consists of a single server, the next step is skipped.

2. Configure additional server roles for the Backup Time Server and Arbiter. If the STP-only CTN consists of two servers, the Arbiter remains unassigned.

   Because there is already a CTS assigned, this is a modification of an existing CTN configuration, and use of the Force configuration check box is not needed.

   Modification of the server roles in an existing STP-only CTN is described in 6.5.4, “Changing the server roles” on page 200.

   From the HMC, the role and stratum level of a server can be easily verified from the CPC details about the STP Information tab (Figure 6-58).

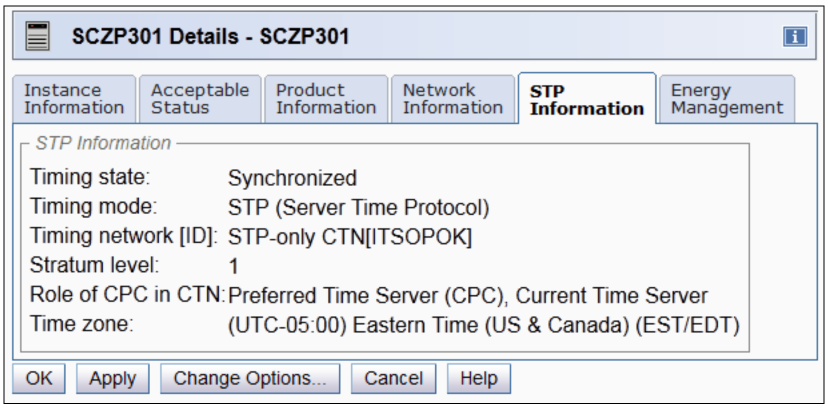


Figure 6-58 CPC Details - STP Information tab

6.5 CTN configuration changes

This section discusses CTN configuration changes.

6.5.1 Changing the CTN ID

The STP facility supports modification of the CTN ID in either a Mixed CTN or a STP-only CTN. For example, if the CTN ID contains a value no longer relevant, this can be changed dynamically for the entire CTN without an outage. Recall that with ETR, a change in the ETR Network ID was disruptive to the Sysplex.

Important: The only field within the CTN ID that can be changed dynamically is the STP network ID. In a Mixed CTN, the ETR Network ID forms the second part of the CTN ID. This second field requires an outage of all systems within the CTN to force this change.

Considerations for a CTN ID change in an STP-only CTN

This is a global change made from the Network Configuration tab on the Current Time Server. Because only one change is necessary for the entire CTN, this is a valid operation (Figure 6-59).

Important: In an STP-only CTN, changing the STP network ID must be made from the Current Time Server. Otherwise, the request is rejected.

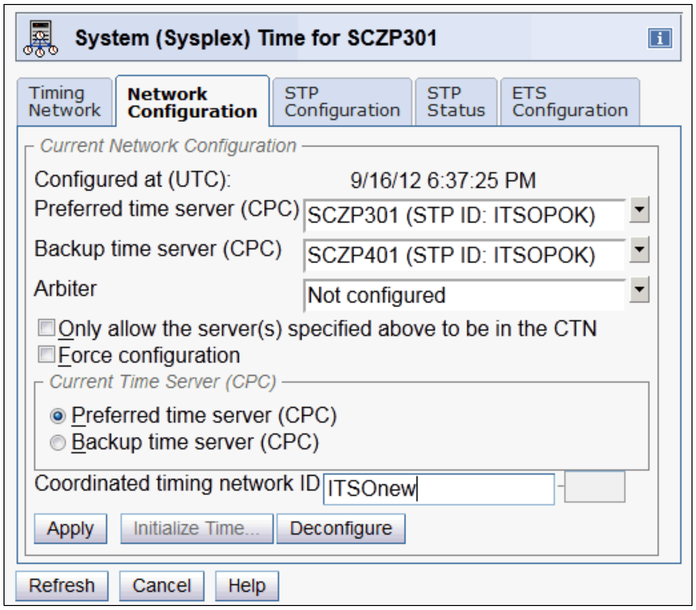


Figure 6-59 Network Configuration tab - Change CTN ID

As shown in Figure 6-59, the CTN ID selected is ITSOnew. After clicking **Apply** a confirmation window (Figure 5-50) reminds you that this is a global change. Selecting **Yes** propagates the new CTN ID in a coordinated fashion to all servers within the CTN.

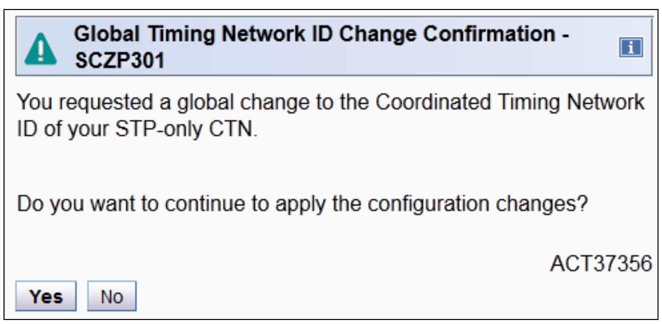


Figure 6-60 Global Timing Network ID Change Confirmation

Temporary inconsistent CTN ID within the CTN

During a CTN ID change, all z/OS systems and Coupling Facilities running on the servers might not recognize the CTN ID change at exactly the same time.

This can cause an inconsistent timing source scenario to occur in the interim between various components in the sysplex until the new CTN ID has been fully implemented across the CTN. This temporary condition is recognized, tolerated for 30 seconds and indicated by IXC439E, and automatically resolved. When the change has completed on all servers IXC435I is then issued.

During this period, various timing-related error messages might be sent to the console by both Cross System Coupling Facility (XCF) and Cross Systems Extended Services (XES) as inconsistent CTN IDs between z/OS logical partitions and coupling facilities are detected.

6.5.2 Changing the CTS

The STP facility supports dynamically changing the Current Time Server role to a separate server. For example, in a maintenance situation when there is a need to remove the Current Time Server role from a particular server, changing the Current Time Server is done without disruption to the z/OS and coupling facility components within the CTN. An informational z/OS message is produced to inform the operations staff that the CTS role has changed. The z/OS message is:

```
IEA395I THE CURRENT TIME SERVER HAS CHANGED TO THE ccccccccc
```

Where *ccccccccc* is PREFERRED or BACKUP.

However, there is no such message produced at the coupling facility. A recovery event affecting the current CTS might similarly result in an automatic CTS configuration change.

The role change can be confirmed by issuing a DISPLAY ETR command and identifying which server is performing the Stratum 1 role (Figure 6-61).

```
D ETR
IEA386I 17.19.59 TIMING STATUS 795
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002827.S18.IBM.02.00000002991E
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 6-61 z/OS DISPLAY ETR - STP-only CTN - Current Time Server

From the HMC, the Network Configuration tab within the System (Sysplex) Time task is used to change the CTS assignment from one server to another.

Under normal circumstances, the Preferred Time Server is also the Current Time Server. Use any of the following methods to move the Current Time Server role to another server in the CTN, depending on the requirements:

- Switch the Current Time Server from the Preferred Time Server to the Backup Time Server.

  This facility is provided specifically for a scenario in which the intent is to remove the Preferred Time Server for maintenance purposes and there is a need to relocate the Current Time Server function for the duration. After the maintenance has been completed, reverse the process to restore the original CTN configuration.

- Retain the Current Time Server as the Preferred Time Server and reconfigure the CTN to a new Preferred Time Server.

  This method provides greater flexibility. It utilizes a server role change to move the role of the Current Time Server to another server.

  This can be used in a scenario where permanent changes are made to the CTN configuration. Depending on the requirements, a number of incremental changes could be made or combined into a single network configuration change.

- Switch the Current Time Server from the Preferred Time Server to the Backup Time Server and at the same time, reconfigure the CTN to define a new Backup Time Server.

  This is a combination of the two previous methods and can be performed as a single reconfiguration change.

> **Note:** Regardless of which method is chosen to move the Current Time Server function, there is one rule that applies in all timing network reconfiguration circumstances: The CTN configuration changes must be done from the server that *will become* the Current Time Server when the reconfiguration is complete.

6.5.3 CTS reassignment and ETS considerations

Reconfiguration of the CTS from one server to another has an effect on the Coordinated Server Time because when the new CTS is configured, its ETS configuration becomes active for the CTN at the time that the configuration switch occurs.

If the ETS is configured on the target CTS to dial out with NTP or NTP with PPS, the following actions occur:

- Any ongoing time adjustment is cancelled.
- A new time adjustment is generated from the new external time source configured.

The following sections describe the sequence when the CTS reconfiguration changes the ETS from dial out to a NTP client, or from a NTP client to dial out. Changes from the NTP client to NTP client or dial out to dial out are not described here, but would show a similar sequence of events.

Changing ETS from dial out to NTP server

> **Important:** This scenario assumes that you have an HMC that has the dial out capability (V2.11.1 or earlier). In case you plan to add a new zEC12 server as an STP Stratum 1 candidate (HMC version 2.12.0 or later), you must use NTP or NTP with PPS as ETS for this server.

In this scenario (shown in Figure 6-62):

- Server CEC2 is the BTS and the CTS, and is set up to use dial out if configured on the Hardware Management Console.
- Server CEC1 is part of the same CTN. It is the PTS but not the CTS. NTP is configured as its external time source.

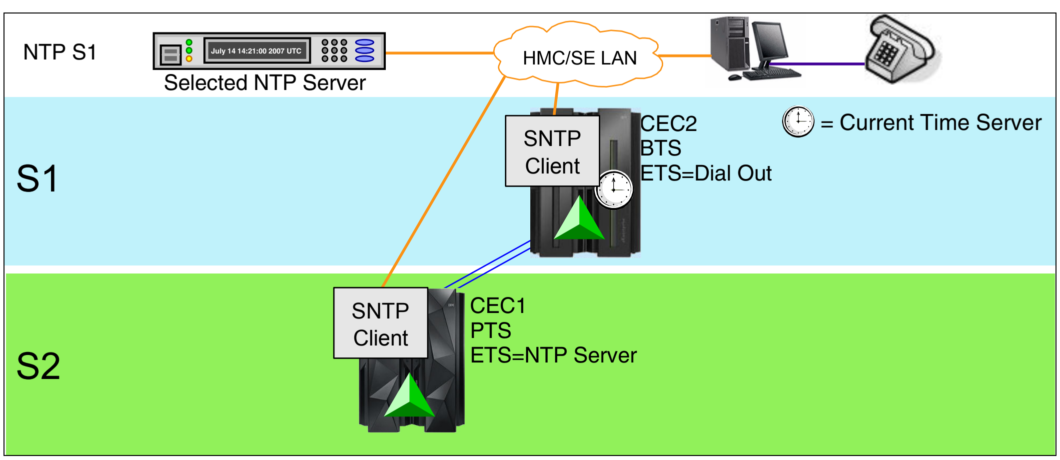


Figure 6-62 Changing ETS from dial out to NTP server

The following steps show the reconfiguration of the CTS from CEC2 to CEC1:

1. Display the CEC1 CPC Details → STP Information window (Figure 6-63). Note that CEC1 is indeed Stratum 2 because even though it is the PTS, it is not the CTS.

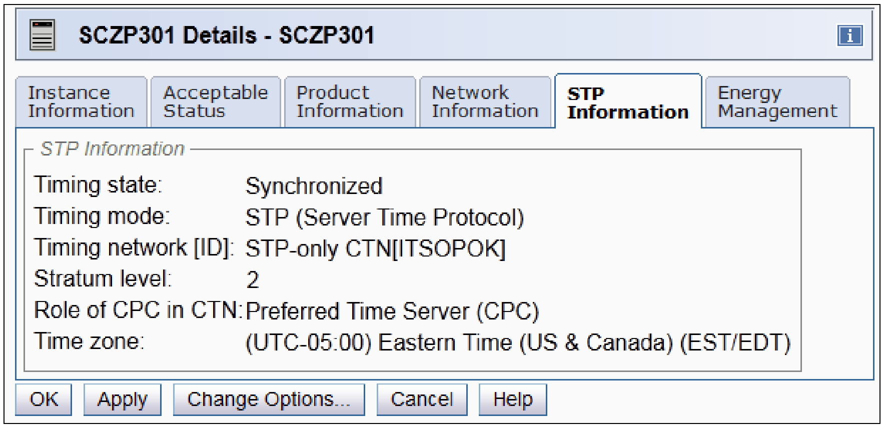


Figure 6-63 CPC Details of CEC1 (PTS but Stratum 2)

2. In the System (Sysplex) Time task from **CEC1**, go to the **ETS Configuration** tab, and query the NTP Time Server information field (Figure 6-64). Also note the statements in the top portion of the window indicating that because this server is not the CTS, changes made to the ETS configuration have no immediate effect on the CTN.

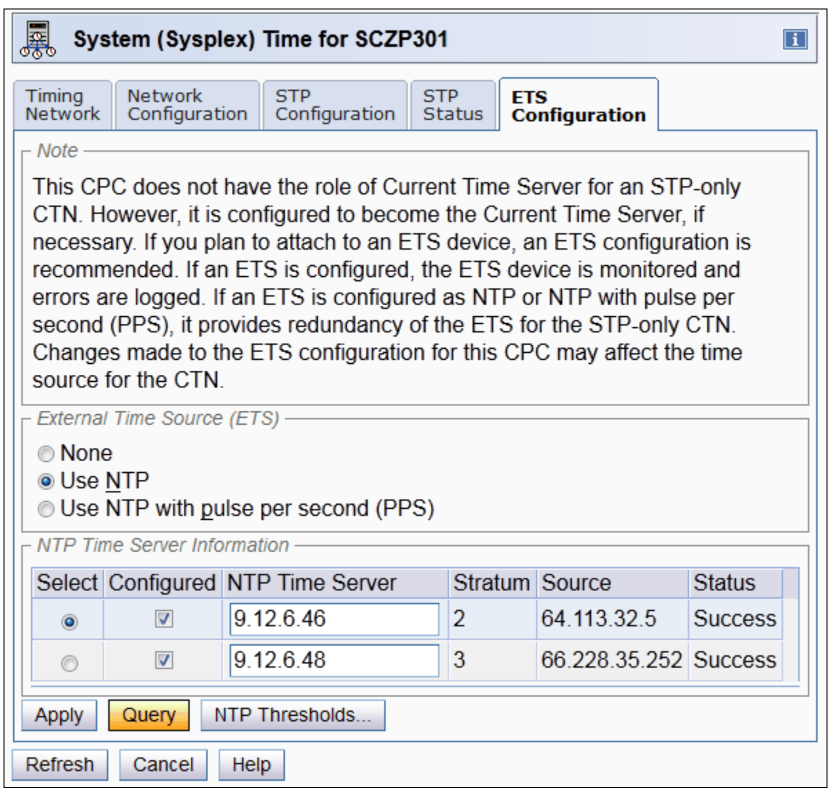


Figure 6-64 ETS Configuration tab

> **Note:** On the ETS Configuration tab, whenever changes are made to the NTP Time Server Information portion, ensure that you click **Apply**.

Figure 6-65 shows the NTP Connection Query Completion message.

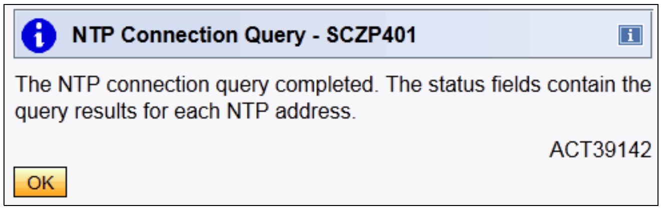


Figure 6-65 NTP Connection Query Completion

3. Figure 6-66 shows the Network Configuration tab. A request is issued to reconfigure the CTN so that CEC1 becomes the CTS.

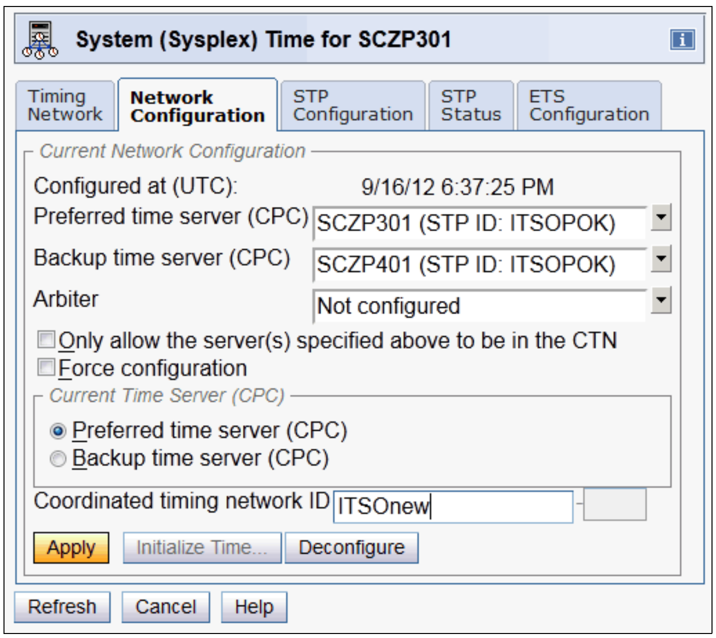


Figure 6-66 Network Configuration tab - Assigning CTS role to PTS

4. The Network Configuration Change Confirmation message ACT37357 displays (Figure 6-67). Click **Yes** to confirm.

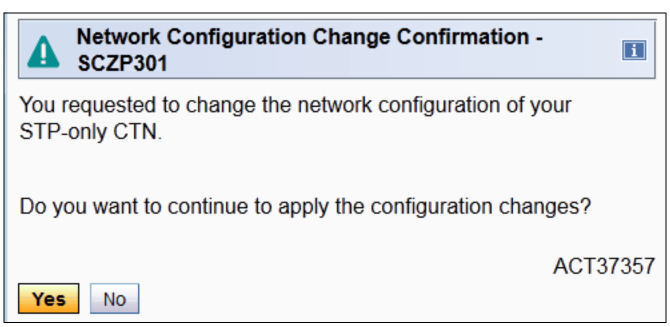


Figure 6-67 Network Configuration Change Confirmation

5. When the reconfiguration is complete, CEC1 becomes the CTS. Click **Refresh** to update the information. The Timing Network tab (Figure 6-68) shows that the CTN Time Source is NTP, the NTP Stratum Level is 1, and the NTP Source ID is GPS. The Adjustment Steering button is now enabled because a new time adjustment has been generated.

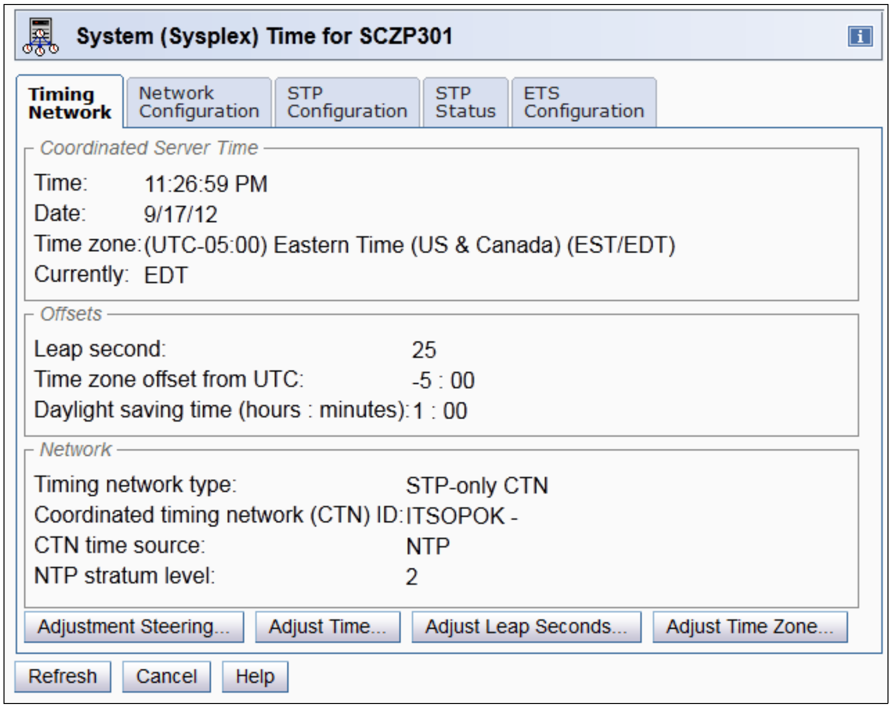


Figure 6-68 Timing Network tab - CTN time source changed to NTP

6. When you click **Adjustment Steering**, the Adjustment Steering Information window displays (Figure 6-69). It shows the steering adjustment data, including the difference between the NTP external reference and the Coordinated Server Time. It also estimates when the steering process will finish.

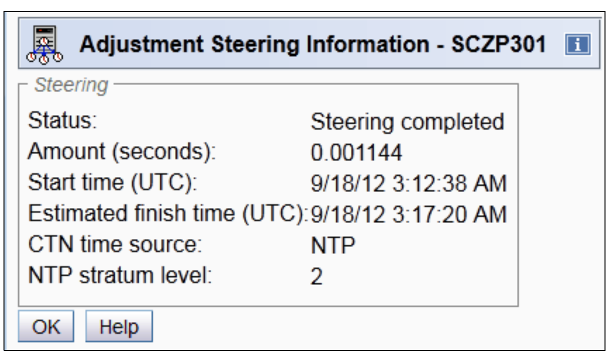


Figure 6-69 Adjustment Steering Information

Changing ETS from NTP server to dial out

Note: This scenario is presented simply for completeness of the information, because it is highly unlikely to revert to a dial out ETS configuration after you have included a zEC12 in your CTN. This scenario pertains to older servers (z196, z114, and earlier generations).

This scenario assumes that you have an HMC which has the dial out capability (V2.11.1 or earlier). In case you plan to add a new zEC12 server as an STP Stratum 1 candidate (HMC version 2.12.0 or later) you must use NTP or NTP w/ PPS as ETS for this server.

In this scenario (as shown in Figure 6-70):

- CEC2 is part of the CTN. It is the BTS, and is set up to use dial out if configured on the Hardware Management Console.
- CEC1 is part of the same CTN. It is the PTS and the CTS, and NTP is configured as its external time source.

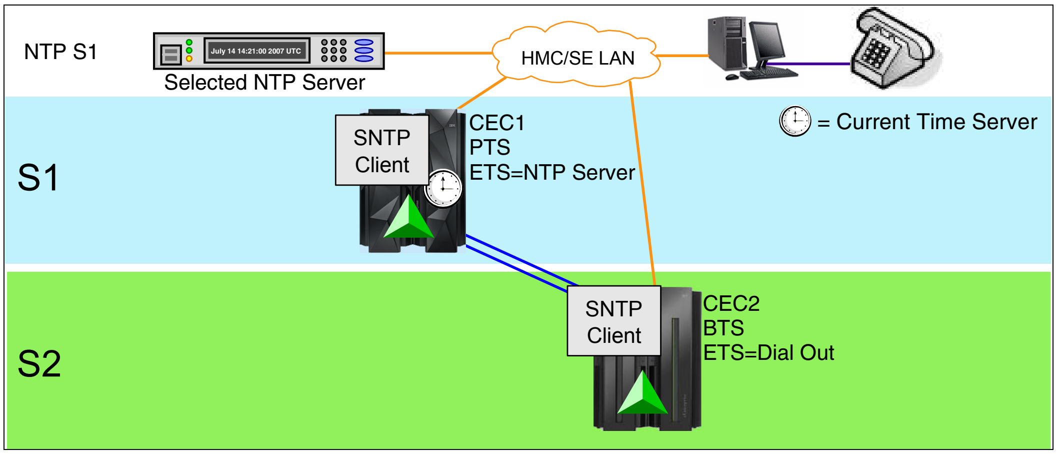


Figure 6-70 Changing ETS from NTP server to dial out

To reconfigure the CTS from CEC1 to CEC2:

1. Select the **Network Configuration** tab for CEC2 to assign it as the new CTS (Figure 6-71).

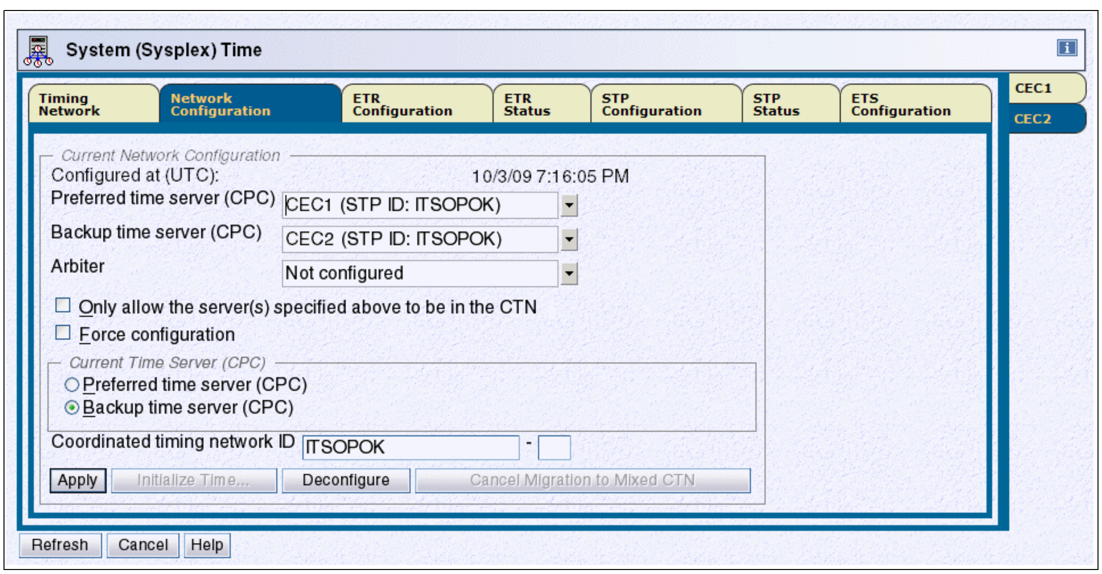


Figure 6-71 Network Configuration tab for CEC2

2. The Network Configuration Change Confirmation message ACT37357 displays. Click **Yes**. Message ACT37341 displays (Figure 6-72).

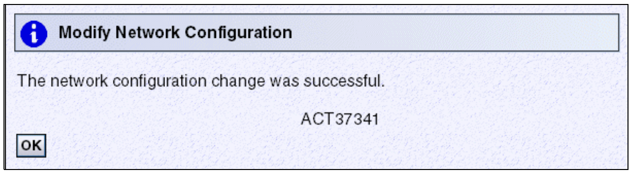


Figure 6-72 Modify Network Configuration

3. Click **OK** to return to the Network Timing tab (Figure 6-73). The CTN Time source now indicates “Dial up time source via the Hardware Management Console”. The Adjustment Steering button is enabled.

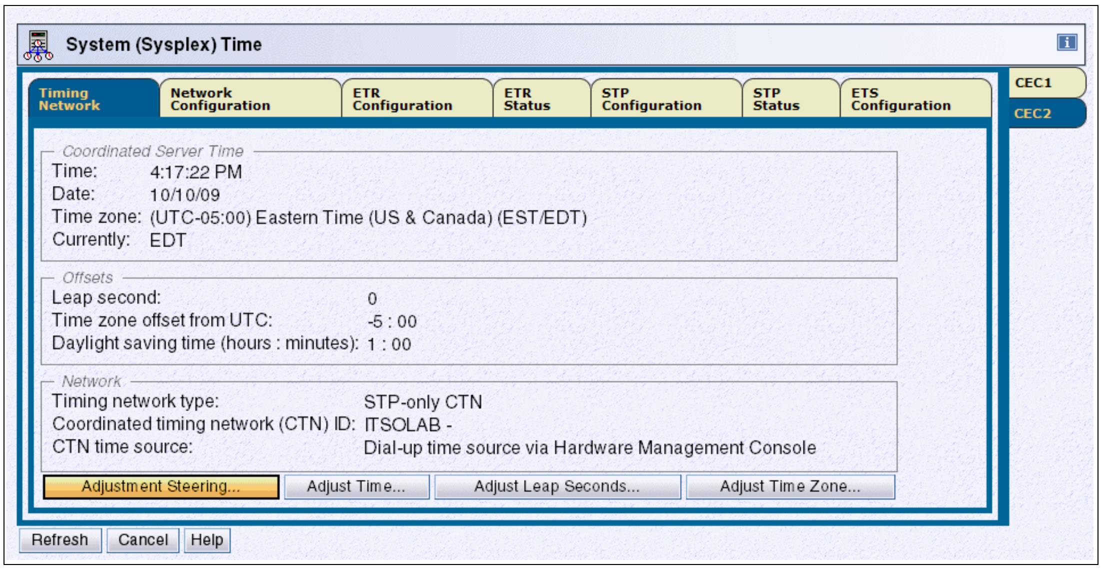


Figure 6-73 Timing Network Tab - CTN time source now HMC dial-up

4. Click **Adjustment Steering**, and the Adjustment Steering Information displays (Figure 6-74).

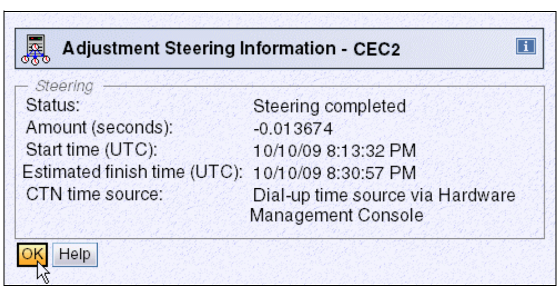


Figure 6-74 Adjustment Steering Information

5. On the CPC Details window (Figure 6-75) the STP Information shows that CEC1 is the PTS but is no longer the CTS.

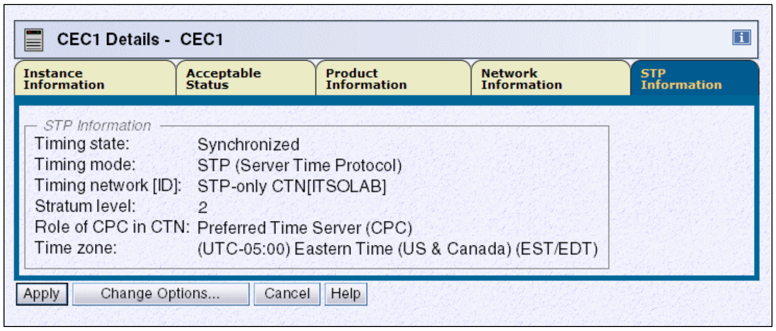


Figure 6-75 CPC Details for CEC1

6.5.4 Changing the server roles

The STP-only CTN roles of Preferred Time Server, Backup Time Server, and Arbiter are displayed and modified using the Network Configuration tab within the System (Sysplex) Time task.

The restrictions associated with changing the CTN roles are the same as when initially converting to an STP-only CTN:

- Only the Preferred Time Server role needs to be defined. This server automatically becomes the Current Time Server. Running without a Backup Time Server is not advisable, because the Preferred Time Server becomes a single point of failure in the CTN.
- An Arbiter can only be defined if a Backup Time Server has also been defined. The roles of Backup Time Server and Arbiter can be removed by assigning these as *not configured*.
- No server can assume multiple roles.

Tip: The same rule applies to changing the CTN server roles as it does to changing the Current Time Server, namely that the CTN configuration changes must be performed from the server that *will become* the Current Time Server when the reconfiguration is complete.

Reconfiguring the PTS, BTS, and Arbiter

There is no requirement to stage changes in increments, although this is possible. All the server roles within an STP-only CTN may be redefined in one single reconfiguration request.

Consider the initial configuration (shown in Figure 6-76). It is possible in one single request to the System (Sysplex) Task to perform the following tasks:

- Reconfigure all three roles.
  - Preferred Time Server
  - Backup Time Server
  - Arbiter
- Change the Current Time Server from the PTS to the BTS.

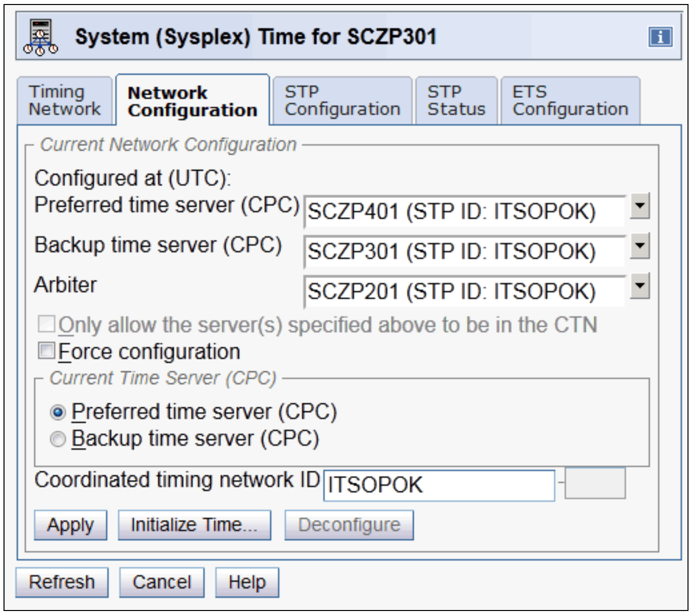


Figure 6-76 Network Configuration tab - Initial view

To adhere to the rule, after all changes are made, ask yourself:

1. PTS or BTS: Who has the radio button selected for Current Time Server?
2. Which server is assigned the role of [answer of question 1]?
3. Am I on the Network Configuration tab belonging to server [answer of question 3]?

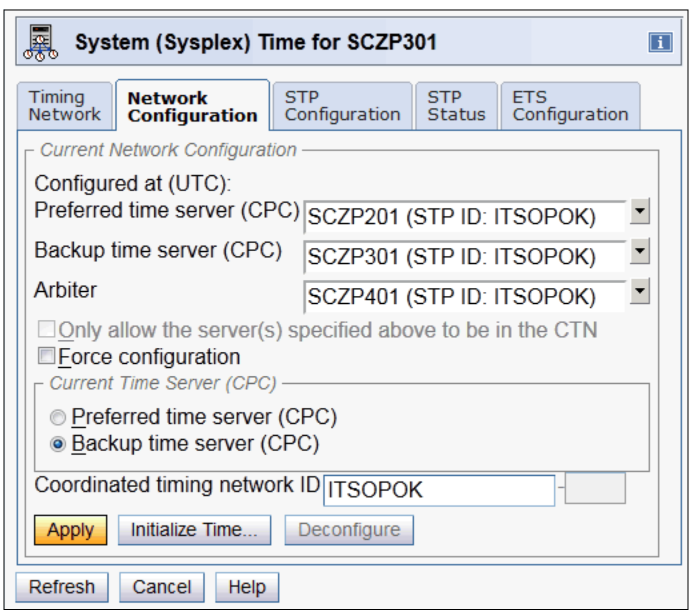


Figure 6-77 Reassigning roles from Network Configuration tab

Based on the changes to be applied in Figure 6-77 on page 201, if the configuration changes are attempted from either SCZP101 or H40, error message ACT37336 is displayed (Figure 6-78).

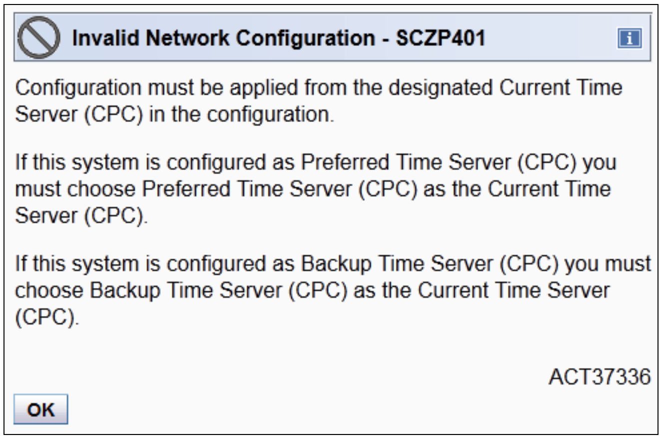


Figure 6-78 Invalid Network Configuration message

Also, before allowing a configuration change to proceed, the STP facility checks that initialized STP links exist between the servers that are defined under the various roles. Figure 6-79 shows that no initialized STP links exist between H40 and any other servers. This might be a result of all coupling links being configured off, or a hardware maintenance outage on the servers.

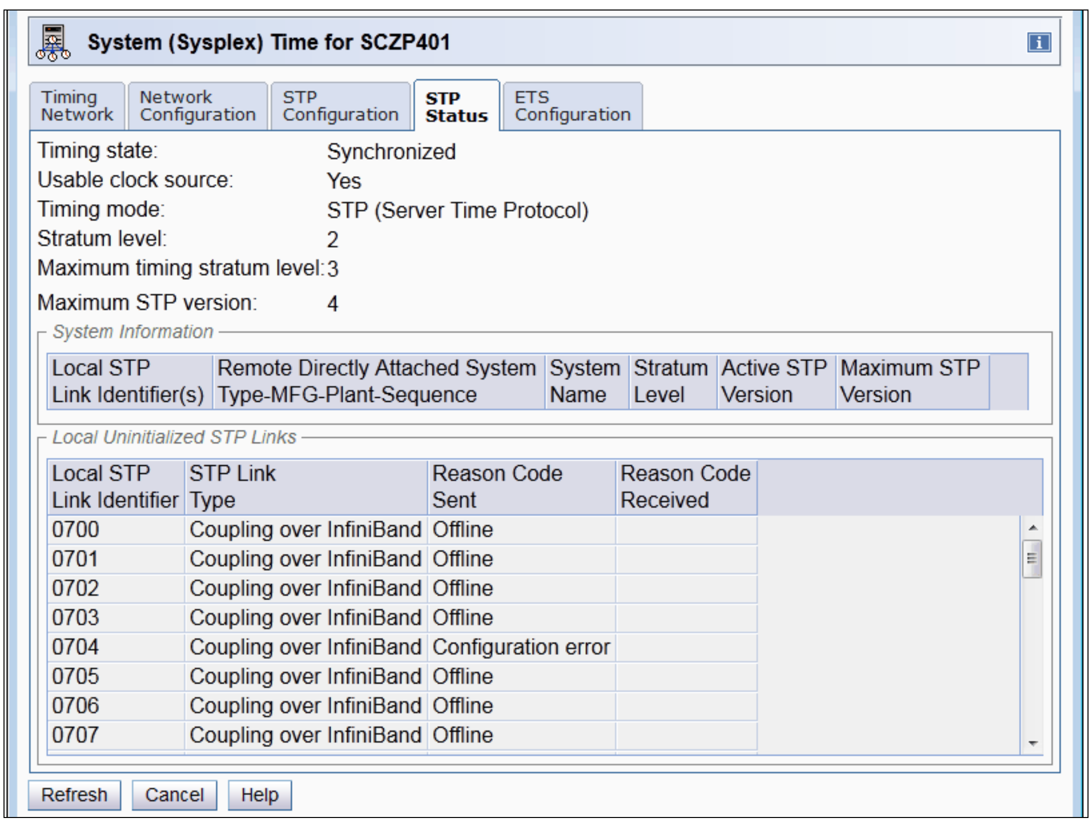


Figure 6-79 No initialized STP links between SCPZ401 and SCZP301 or SCZP201

If connectivity conditions are not satisfied, the configuration request is rejected. An error message displays depending on which connection is missing. Figure 6-80 shows there are no links between BTS and PTS.

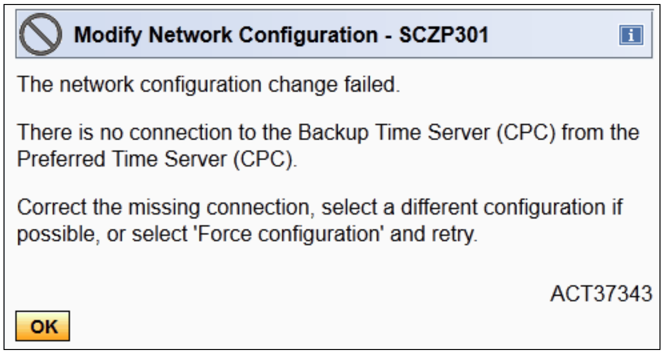


Figure 6-80 Modify Network Configuration - No links between BTS and PTS

Figure 6-81 shows there are no links between the Arbiter and CTS.

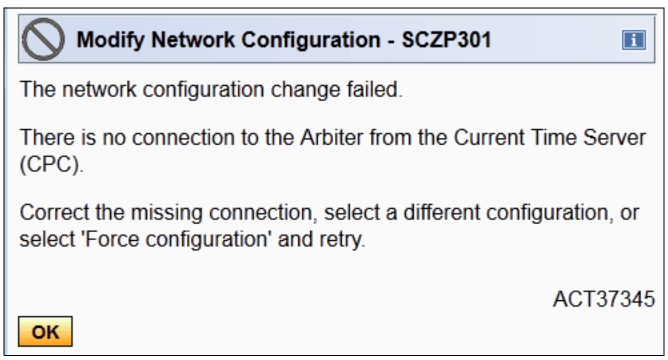


Figure 6-81 Modify Network Configuration - No links between Arbiter and CTS

Figure 6-82 shows that there are no links between the Arbiter and BTS.

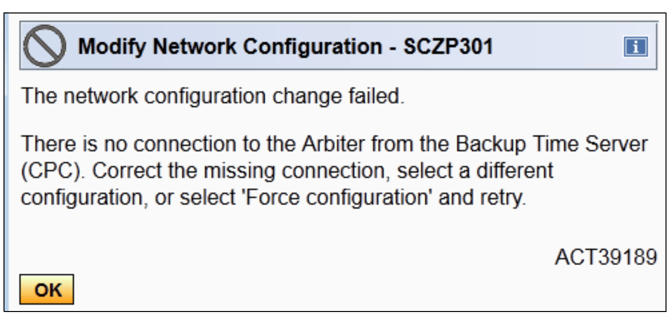


Figure 6-82 Modify Network Configuration - No links between Arbiter and BTS

Force configuration

If it is understood that connectivity requirements are not being met at the time that a reconfiguration is being performed, use the **Force configuration** option to bypass the checking (Figure 6-83).

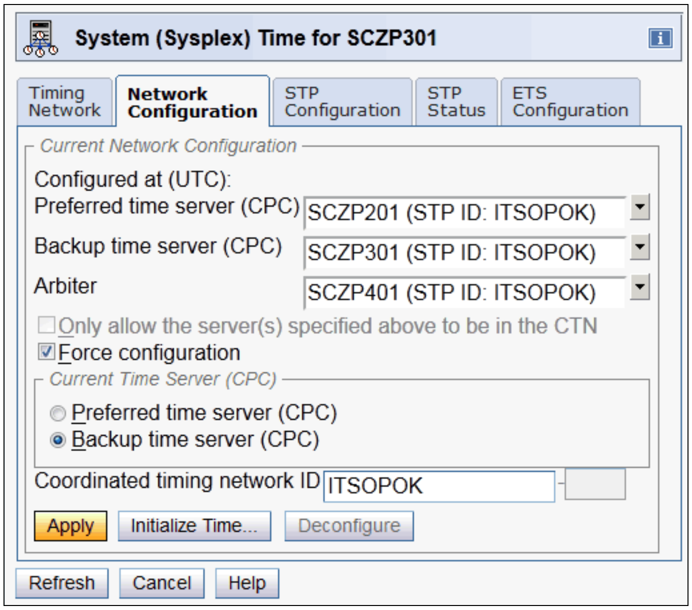


Figure 6-83 Network Configuration tab - Force configuration selected

This is one of two scenarios whereby the **Force configuration** option is enabled, as described in the warning message displayed (Figure 6-84) after you click **Apply**.

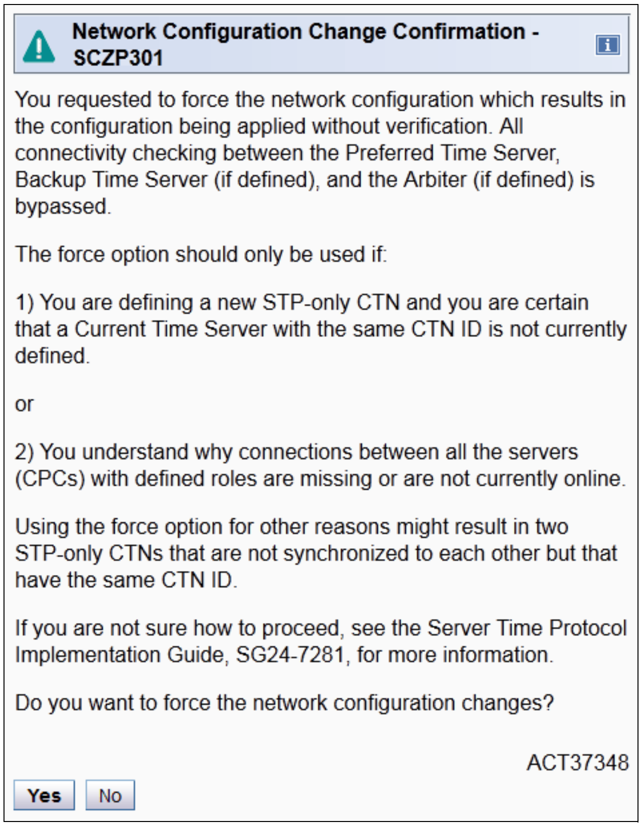


Figure 6-84 Network Configuration Change Confirmation

The other scenario pertains to configuring an STP-only CTN from scratch described in 6.4, “Configuring an STP-only CTN” on page 178. Again, this does *not* pertain to a migration from a Mixed CTN to an STP-only CTN.

The message in Figure 6-85 displays when the configuration change is successful.

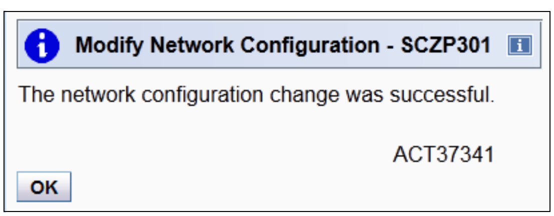


Figure 6-85 Modify Network Configuration message

Attention: Use Force configuration with care, because it might unintentionally implement an STP-only CTN that is not tolerant of Current Time Server failure.

The Force configuration option only bypasses the connectivity checking, as previously outlined. It does not allow reconfigurations that are invalid, such as a CTN with an Arbiter defined but no Backup Time Server specified.

Configuring a Backup Time Server

Definition of a Backup Time Server is optional and is done using the Network Configuration tab by specifying the required server in the Backup Time Server box and clicking **Apply** (Figure 6-86).

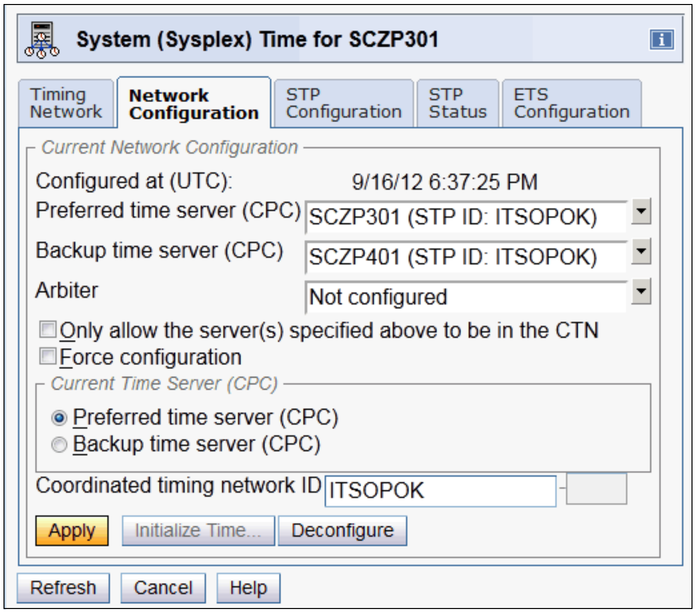


Figure 6-86 Network Configuration tab - BTS defined

Because this is a network configuration change, it needs to be performed from the Current Time Server. As shown in Figure 6-86, the preferred (and current) time server is SCZP201, so this reconfiguration request must be performed from server SCZP201.

Recommendation: Configuring a Backup Time Server is optional, but a useful idea. Otherwise, the Preferred Time Server is a single point of failure in the CTN.

A Backup Time Server needs direct timing link connectivity to the Preferred Time Server. This is verified as part of the reconfiguration process (unless the Force configuration option has been selected).

There are no messages sent to the z/OS console during the definition of the Backup Time Server, unlike the removal of the Backup Time Server that causes message IEA389I for automation purposes (see “Removing the Backup Time Server” on page 210).

Alternately, issue the z/OS DISPLAY ETR command before the reconfiguration and determine that the CTN does not have a Backup Time Server (Figure 6-87).

The last two lines of the display indicate that there is only a Preferred Time Server configured, and that neither a Backup Time Server or an Arbiter have been configured.

```
D ETR
IEA386I 19.36.33 TIMING STATUS 385
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002817.S18.IBM.02.00000002991E
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO BACKUP TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 6-87 z/OS DISPLAY ETR - Backup Time Server is not configured

After the reconfiguration is complete, issue the DISPLAY ETR again. The absence of the second-to-last line of Figure 6-88 indicates that the CTN now supports a Backup Time Server.

```
D ETR
IEA386I 20.06.18 TIMING STATUS 395
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002817.S18.IBM.02.00000002991E
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 6-88 z/OS DISPLAY ETR - Backup Time Server is configured

Configuring an Arbiter

Defining an Arbiter is optional and is performed on the Network Configuration tab by specifying the required server in the Arbiter box and clicking **Apply**. Because this is a CTN configuration change, it needs to be performed from the Current Time Server.

> **Recommendation:** Configuring an Arbiter is optional, but is a useful idea to enhance the failure detection and recovery capabilities of an STP-only CTN.

If an Arbiter is included in a STP-only CTN, then ensure that a Backup Time Server is also defined. Otherwise, the reconfiguration is rejected.

The role of the Arbiter is to assist in reconfiguring the Current Time Server role from the Preferred Time Server to the Backup Time Server in recovery scenarios. As a result, the Arbiter must have link connectivity to both of these servers. Any attempt to assign an Arbiter without having the required coupling link connectivity to the PTS and BTS fails.

> **Note:** The connectivity check can be bypassed by specifying Force configuration on the Network Configuration tab. However, do not do this under normal circumstances.

No z/OS messages are produced during definition of an Arbiter. As with the Backup Time Server, issue the z/OS DISPLAY ETR command to determine whether the STP-only CTN has an Arbiter defined (Figure 6-89).

```
D ETR
IEA386I 21.02.15 TIMING STATUS 405
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002817.S18.IBM.02.00000002991E
  THIS IS THE PREFERRED TIME SERVER
```

Figure 6-89 z/OS DISPLAY ETR - Arbiter defined

As in Figure 6-89, the absence of a line pertaining to the presence of an Arbiter (as compared to Figure 6-88 on page 207) indicates that an Arbiter is defined.

Configuring the same server to multiple CTN server roles

Each of the server roles in the CTN must be allocated to a separate server or set to a value of Not Configured, except for the Preferred Time Server, which must be defined.

If an attempt is made to assign multiple roles to the same server, the configuration request is rejected and message ACT37338 displays (Figure 6-90).

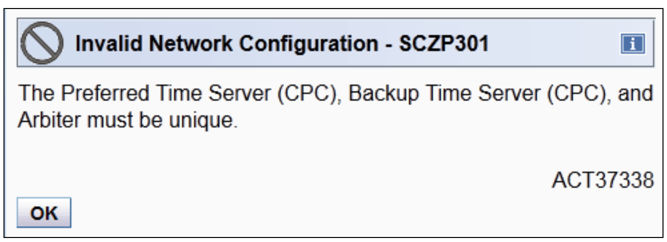


Figure 6-90 Invalid Network Configuration - Roles must be unique

Removing the Preferred Time Server

All STP-only CTNs need to have a Preferred Time Server defined. Any attempt to set the Preferred Time Server to <Not Configured> in an initialized CTN is rejected as an invalid configuration and causes message ACT37332 to be displayed (Figure 6-91).

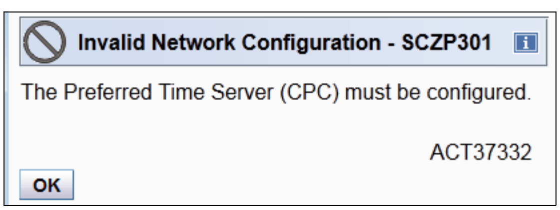


Figure 6-91 Invalid Network Configuration - PTS must be configured

The Preferred Time Server role can only be removed by deconfiguring the STP-only CTN by using the **Deconfigure** button.

Removing the Arbiter

The Arbiter may be removed from an STP-only CTN. The Arbiter can be removed without regard to the Current Time Server role. Successful removal of the Arbiter does not produce any messages at the z/OS console.

Issue the DISPLAY ETR command to determine whether the CTN currently has an Arbiter defined. Figure 6-92 demonstrates issuing DISPLAY ETR from the Backup Time Server in a configuration without an Arbiter. The last line of the display indicates the absence of an Arbiter in the configuration.

```
D ETR
IEA386I 17.19.59 TIMING STATUS 428
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002827.S18.IBM.02.00000002991E
  THIS IS THE BACKUP TIME SERVER
  NUMBER OF USABLE TIMING LINKS =  6
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 6-92 z/OS DISPLAY ETR - No Arbiter

Figure 6-93 demonstrates issuing DISPLAY ETR from the Backup Time Server in a configuration *with* an Arbiter.

This is almost identical to the display in Figure 6-92, except that the message indicating the absence of an Arbiter does not appear in Figure 6-93.

```
D ETR
IEA386I 18.06.54 TIMING STATUS 216
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002827.C24.IBM.02.000000026A3A
  THIS IS THE BACKUP TIME SERVER
  NUMBER OF USABLE TIMING LINKS =  7
```

Figure 6-93 z/OS DISPLAY ETR: Arbiter present

Removing the Backup Time Server

There might be a requirement to remove the Backup Time Server role from the CTN. This can be achieved from the Network Configuration tab by setting the Backup Time Server field to **Not configured** (Figure 6-94).

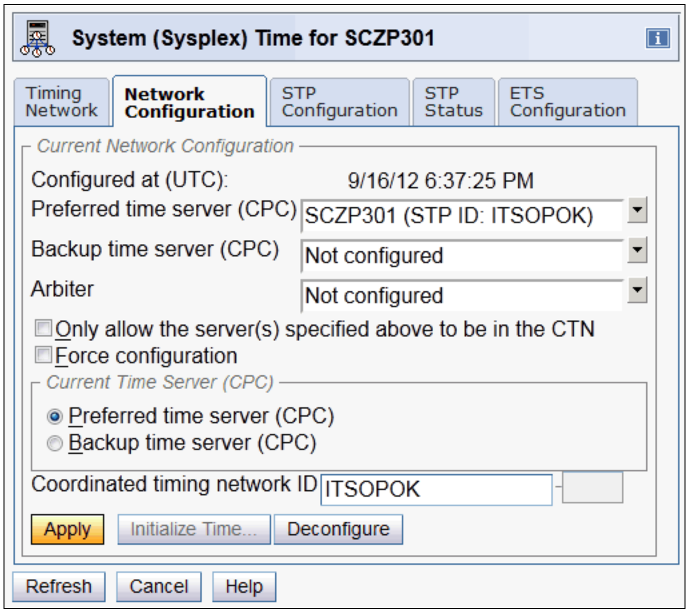


Figure 6-94 Network Configuration tab - BTS definition removed

Before the BTS can be removed, the user needs to make sure that the Arbiter is not defined and that the BTS is not the Current Time Server; otherwise, an error message displays.

The example shown in Figure 6-95 results in a failure, because a configuration with an Arbiter but no BTS is not valid.

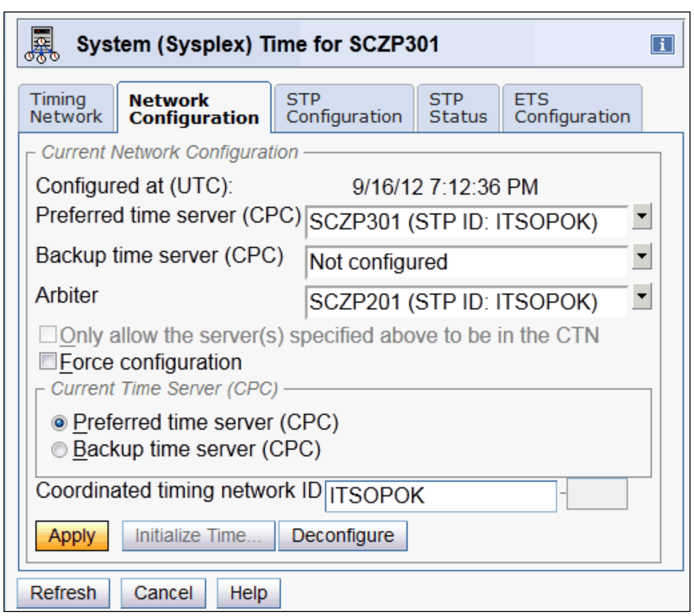


Figure 6-95 Network Configuration tab - Arbiter defined without BTS

The error message ACT37333 displays (Figure 6-96). In this case, the Arbiter must also be removed before the Backup Time Server can be removed.

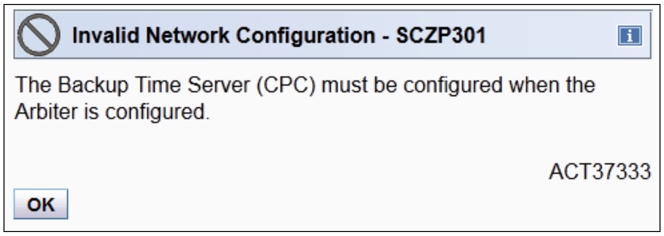


Figure 6-96 Invalid Network Configuration - BTS must be configured

If the Backup Time Server is also the Current Time Server, the request also fails, and the error message ACT37336 displays (Figure 6-97).

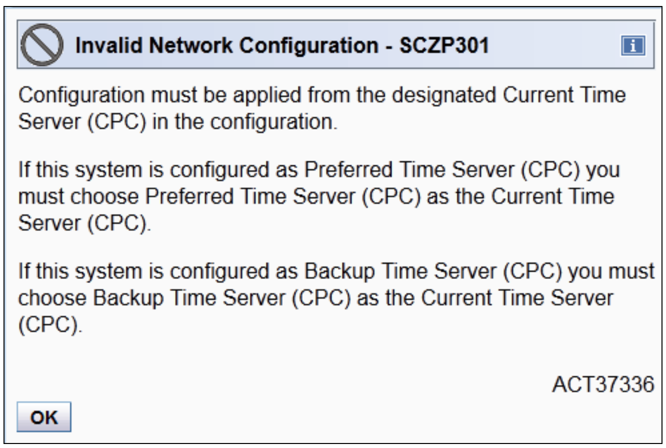


Figure 6-97 Invalid Network Configuration - Must be applied from CTS

When removal of the Backup Time Server is successful, z/OS message IEA389I displays on each z/OS console, warning that the CTN no longer has a time server backup available:

```
IEA389I THIS STP NETWORK HAS NO SERVER TO ACT AS BACKUP
```

This is the *only* message that displays during a reconfiguration of the STP roles. There are no equivalent messages displayed when a Backup Time Server is added to the CTN, or upon removal or addition of an Arbiter.

Use the DISPLAY ETR command to determine whether the CTN currently has a Backup Time Server defined.

The presence of the last two lines in Figure 6-98 indicates that both the Backup Time Server and Arbiter roles are not currently defined. Absence of the Backup Time Server automatically implies that there is no Arbiter, because a configuration with a Preferred Time Server and an Arbiter but no Backup Time Server is not valid.

```
D ETR
IEA386I 15.41.12 TIMING STATUS 470
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002817.S18.IBM.02.00000002991E
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO BACKUP TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 6-98 z/OS DISPLAY ETR - Backup server and Arbiter not defined

Deconfiguring a CTN

Through the HMC, it is possible to deconfigure the STP-only CTN by removing the roles of the Preferred Time Server, Backup Time Server, and Arbiter.

> **Attention:** Deconfiguring the CTN results in the loss of the clock source for all servers in the CTN. This action is disruptive to all z/OS images, running in a sysplex or non-sysplex, when running with STPMODE YES.
>
> Deconfigure should only be used to shut down the entire CTN.

This Deconfigure button is accessed from the Network Configuration tab and is only enabled on the Current Time Server (Figure 6-99).

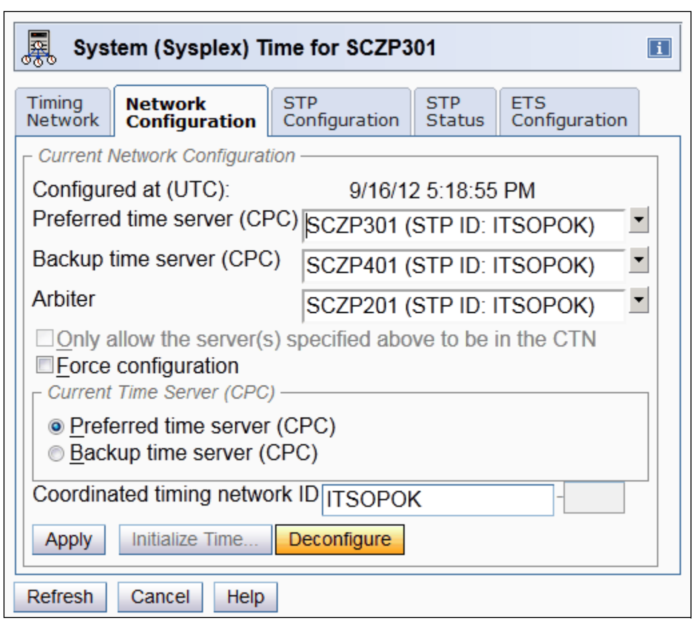


Figure 6-99 Network Configuration tab - Deconfigure

When you click **Deconfigure**, confirmation message ACT37384 displays (Figure 6-100).

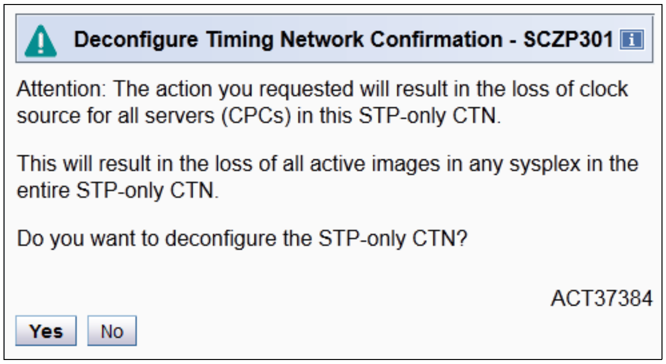


Figure 6-100 Deconfigure Timing Network Confirmation message

Clicking **Yes** results in the loss of the clock source for all servers in the STP-only CTN, which in turn causes the loss of all active sysplex images and access to coupling facilities using CF Request Time Ordering. In essence, this operation renders all servers to Stratum 0.

To reestablish a deconfigured CTN, see Chapter 7, “Operational considerations” on page 243

6.6 Time management

In this section we discuss time management.

6.6.1 Adding an ETS to an existing CTN

There are several possible configurations that can already be in use for an STP-only CTN as a starting point. Moreover, when migrating from an STP-only CTN to an STP-only CTN with the NTP client, the effect on the CTN depends on the role of the server being configured:

- If the Current Time Server is configured to use an NTP server or an NTP server with PPS, the NTP client on the CTS accesses the NTP server and the time adjustments are used to steer the Coordinated Server Time. This occurs when the NTP configuration is applied on the ETS configuration tab.
- If the server that is configured to use an NTP server or an NTP server with PPS is not the Current Time Server (but is either the PTS or the BTS), the NTP client on the PTS or BTS accesses the NTP time server, but the time adjustments may not be used to steer the Coordinated Server Time. Instead, the NTP server will be monitored as long as it is not the CTS. This monitoring is done to detect an NTP server access problem. The NTP server is used to steer the Coordinated Server Time when the server becomes the CTS or the NTP server on the CTS is not accessible. See “ETS recovery using NTP servers” and “ETS recovery using NTP servers with PPS” in the *Server Time Protocol Recovery Guide*, SG24-7380, for more details.
- If the server that is configured to use an NTP server or an NTP server with PPS is neither the PTS nor the BTS, the NTP server is not accessed, and its availability has no immediate effect on the CTN.

Table 6-2 gives an overview of the dependencies of the current role of a server in an STP-only CTN and the ETS configuration usage.

Table 6-2 Server role in an STP-only CTN and NTP client support enabled

CTS	Current role in the STP-only CTN	ETS configuration required	ETS configuration effect
Yes	PTS or BTS	Yes	Immediately
No	PTS or BTS	No, but suggested	When server becomes CTS
No	Not PTS nor BTS	No, but suggested	When a server is defined as PTS or BTS and becomes CTS

Note: The ETS configuration is stored at the target server, independent of the current role of this server.

To configure the ETS to use an NTP server in an STP-only CTN:

1. Connect an NTP server to an STP-capable server that is already part of or that will become part of an STP-only CTN. The LAN connectivity between the NTP server and the Support Element network varies depending on the user requirements and preexisting environments. See 1.2, “Configuring an NTP server” on page 5, for more information.
2. On the ETS Configuration tab, select **Use NTP** or **Use NTP with pulse per second (PPS)** and configure the appropriate NTP servers.
3. Reassign CTN roles if necessary.

Configuring an NTP server

Without regular adjustment, the time within the CTN slowly drifts, which might or might not be acceptable depending on the time accuracy requirements.

First, configure the NTP client function on the PTS/CTS. If the selected NTP server is valid but the time difference between the NTP server and the Coordinated Server Time is more than 60 seconds, an error status of `CPC/NTP time difference > 60 seconds` displays (Figure 6-101).

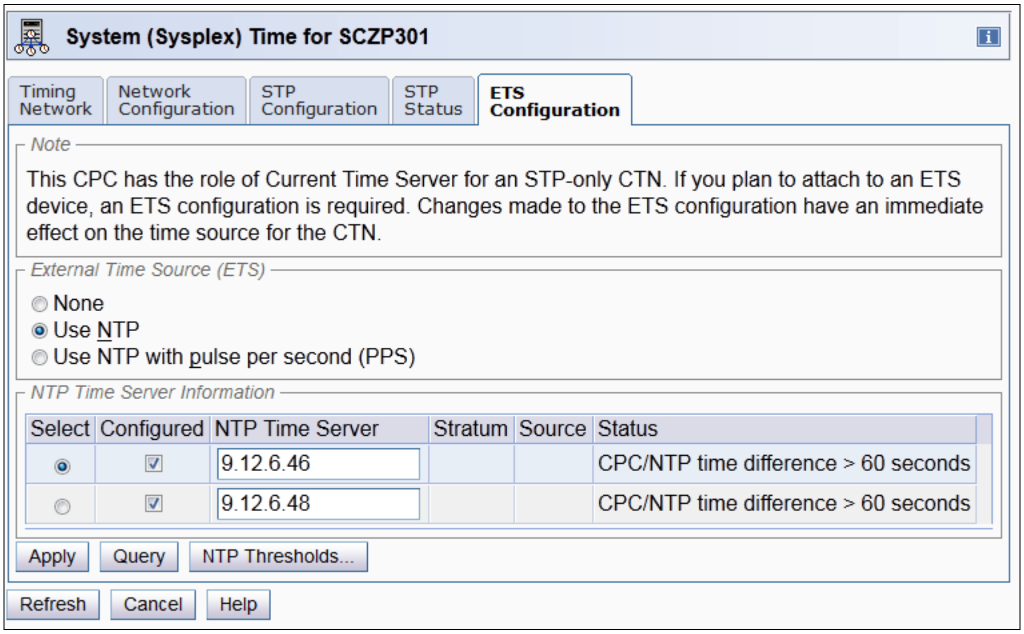


Figure 6-101 ETS Configuration tab - NTP time difference > 60 seconds

This can occur, for example, if this is a new STP-only CTN and time was initially entered manually without referencing an ETS. Another example might be that the time was inherited from a Sysplex Timer during a Mixed CTN to STP-only CTN migration and the time on the Sysplex Timer had not referenced an ETS ever.

This condition does not prohibit you from configuring the NTP server as an ETS. However, in this case the STP facility does not automatically create a time adjustment to steer the CST to the time provided by the NTP server configured at the CTS because it can only track to under 60 seconds. You must manually adjust the time in increments of 60 seconds (and let the steering complete) until the difference is under 60 seconds, at which point the STP facility is then able to automatically make time adjustments and steer the CST. Figure 6-102 shows the results for our example when we select **Adjust Time** on the Timing Network tab.

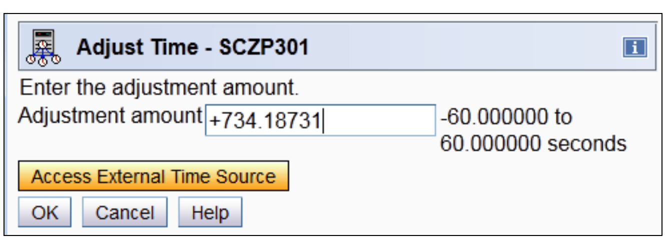


Figure 6-102 Adjust time accessing an ETS that differs from the CST by over 60 seconds

We have to replace +734.18731 with +60, let the steering complete, and repeat this a dozen times until +14.18731 is left over, at which point the STP facility is able to take over and make automatic adjustments. This example is an extreme case because each 60-second steering iteration takes about 17.5 days, for a total of 210 days.

If there is no error, the new ETS configuration becomes instantly active when you click **Apply**, and STP creates a time adjustment to steer the current server time to the time provided by the NTP server configured at the CTS. The Adjustment Steering button on the Timing Network tab provides information about this created time adjustment and its completion time.

Verification

To verify, follow these steps:

- From the HMC

  To verify the successful configuration of the ETS, select the **Timing Network** tab (Figure 6-103). The Network portion indicates that:

  – The timing network type is STP-only CTN.
  – The CTN time source is NTP.
  – The NTP stratum level is 1.
  – The NTP source ID is GPS.

  The CTN time source reflects from where the Coordinated Server Time is currently being steered. Typically, the user must expect to see one of the NTP server clock sources described in Table 1-1 on page 21.

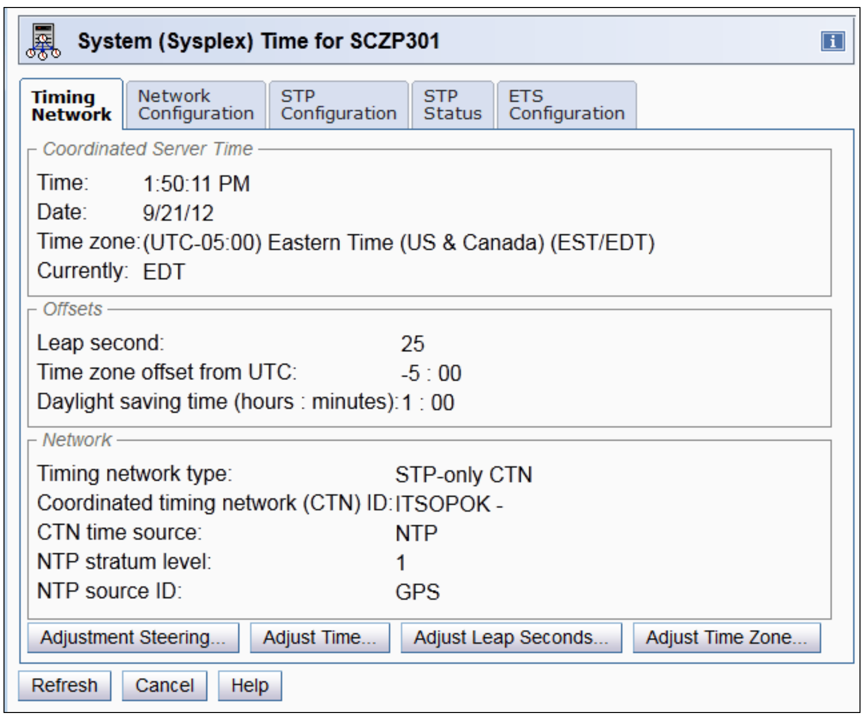


Figure 6-103 Timing Network tab - CTN time source indicates NTP

After clicking **Adjustment Steering**, the Adjustment Steering Information window displays (Figure 6-104). The following information is given:

- The status, which can be:
  - Steering completed
  - Steering in progress
  - Tracking to PPS signal
- The difference between the NTP server time and the CST.
- The time that the adjustment started.
- The estimated time to finish the adjustment. This information is not shown if NTP with pulse per second is used.
- The CTN time source is NTP.
- The NTP stratum level.
- The NTP source ID, only displayed if the STP server is a Stratum 1.

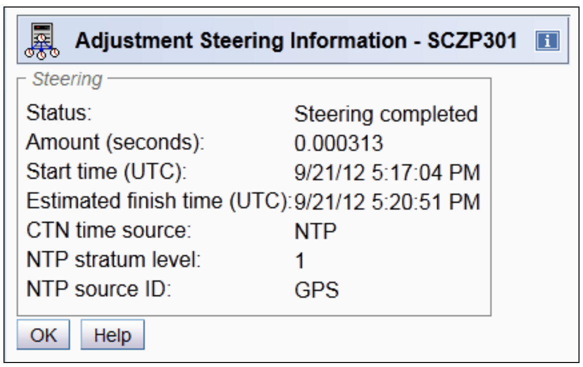


Figure 6-104 Adjustment Steering Information

- From z/OS

  z/OS images have no knowledge of the external time source, whether the server is configured to dial out, an NTP server, or an NTP server with PPS. Only the server stratum level and synchronization status can be verified from a z/OS image.

6.6.2 Time adjustment

Without regular adjustment, the time within the CTN slowly drifts, which might or might not be acceptable depending on the time accuracy requirements. Adjustments to time can be made either manually through application of an adjustment offset or automatically using a previously configured ETS. In either case, the adjustments are made in small enough increments that the operating system and subsystem software are unaware that time is speeding up or slowing down. This capability is known as *steering*.

When an ETS is used, it needs to be configured before it can be used to steer the time. After the ETS is configured, the current server time is typically adjusted to the ETS automatically on a periodic basis. You can also choose manual adjustment using the ETS.

The ETS can be achieved either through a dial out telephone connection through a modem on the HMC, or through the NTP client function at the SE connected to an NTP server or an NTP server with PPS. Time adjustments are only permitted from the Current Time Server, which propagates the adjustments throughout the STP-only CTN.

The following adjustments are possible:

- Adjustment steering

  STP supports adjustment steering, which allows the time at the Current Time Server to be changed by up to +/- 60 seconds. Adjustments greater than 60 seconds can be implemented in multiple increments of +/- 60 seconds. This might take considerable elapsed time to achieve.

  The offset specified is gradually incorporated into the STP messages in small enough increments or decrements such that the operating systems, subsystems, and applications are unaware that time is speeding up or slowing down.

  The input of the offset to be steered out is done either manually, or through the ETS. When an ETS is used, it is invoked manually, configured to run on a regular basis using Customize Scheduled Operations on the Support Element, or is invoked automatically if using an NTP server (see item 15 on page 25).

  Note: In an STP-only CTN, the rate at which adjustment steering is applied is approximately a one-second adjustment every 7 hours. Compared to ETR network or Mixed CTN, the Sysplex Timer provides steering at a rate of a one-second adjustment approximately every 11 hours.

- Base steering

  Base steering is similar to adjustment steering. This is an automatic function requiring no user control. It is performed at the Current Time Server, and requires a dial out or a Stratum 1 NTP server configured as ETS.

  By comparing the UTC time obtained from multiple dial out events with the corresponding Current Time Server time values, STP can compute the amount of drift that has occurred between the dial out events. This represents the inherent inaccuracy of the Current Time Server oscillator over time.

  With this information, STP can automatically introduce a compensation offset into the timing messages by additional steering to counter the drift. As a result, the Current Time Server self-corrects over time so that the offset returned from future dial out events approaches zero as greater accuracy is achieved.

Time adjustments can only be performed at the Current Time Server. This may be done in the following ways:

- Manually
- Manually through an external time source
- Automatically by scheduling a dial out to a time service
- Automatically by configuring an NTP server or NTP server with PPS

The manual time adjustments are performed by using the Adjust Time button on the Timing Network tab.

The Adjustment Steering button allows the current steering status to be displayed. It is initially grayed out and disabled (Figure 6-105), but becomes enabled after the first time adjustment and remains enabled as long as the STP-only CTN is configured.

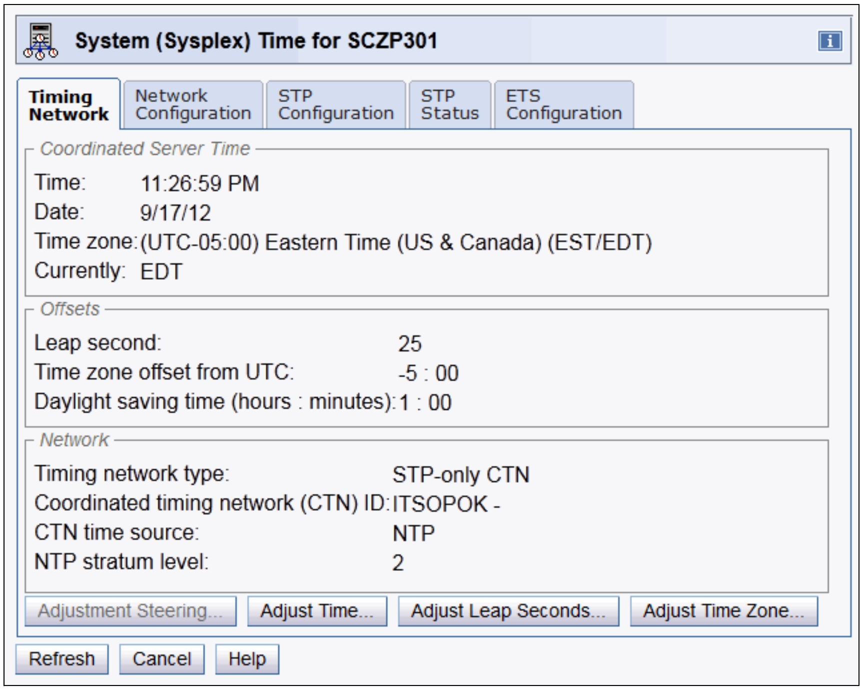


Figure 6-105 Timing Network tab - Prior to first time adjustment

All manual time adjustments in an STP-only CTN are done through the Adjust Time button on the Timing Network tab.

Creating a manual time adjustment

In Figure 6-106, the Adjust Time window displays when the Adjust Time button is clicked.

Through the Adjust Time window, it is possible to manually initiate a time adjustment and to modify or delete a previous time adjustment that is still in progress.

For a manual time adjustment, an adjustment amount needs to be entered. Presumably, the user has previously determined the offset correction required, so it is just a case of entering the appropriate value with a positive (+) or negative (-) correction direction indication.

Figure 6-106 illustrates a positive adjustment of 2 seconds. Click **OK**.

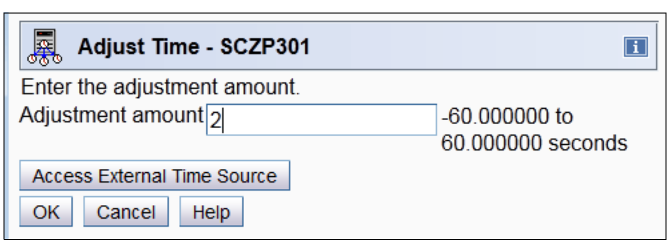


Figure 6-106 Adjust time by +2 seconds

If an acceptable value is entered message ACT37326 displays, indicating that the adjustment steering has been activated and an estimate is provided as to when the steering is expected to complete (Figure 6-107).

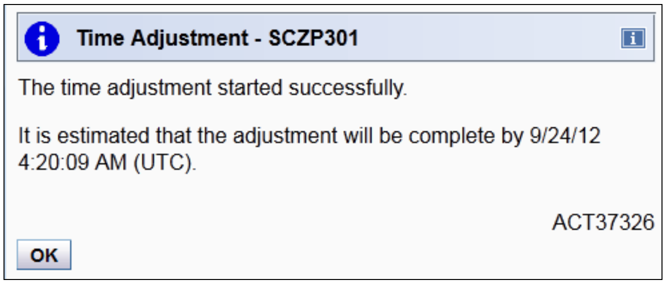


Figure 6-107 Time Adjustment window - Estimated completion time

Click **OK** to return to the Timing Network tab. When a time adjustment is in progress, the Adjustment Steering button on the Timing Network tab becomes active, as compared to Figure 6-105 on page 219, where it was grayed out.

In Figure 6-108, the CTN time source field is set to "Time set manually on console," which indicates that time was manually entered.

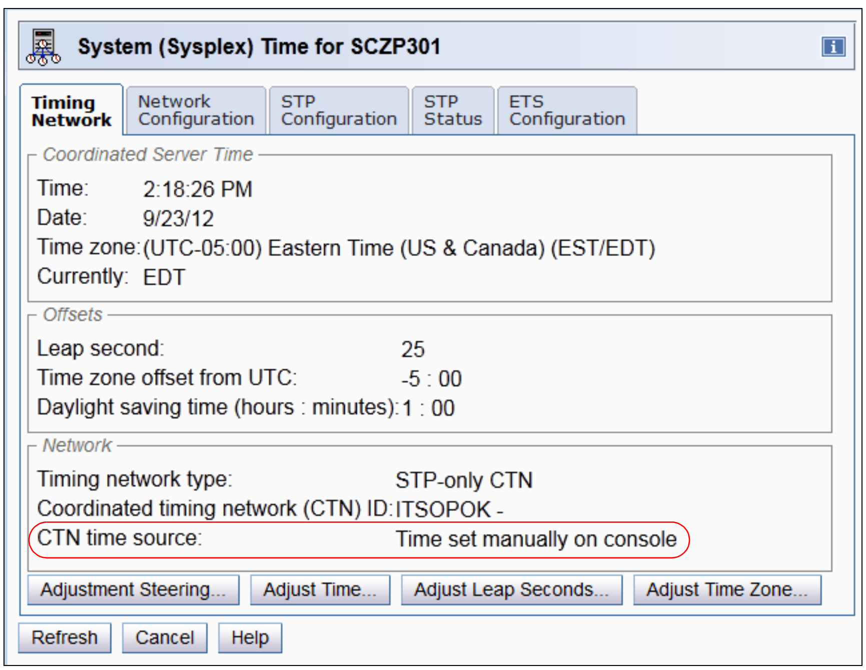


Figure 6-108 Timing Network tab - CTN time source shows that time was set manually

Click **Adjustment Steering** to display information about the currently active steering request, including the adjustment amount, start time, and estimated finish time.

The Adjust Time button is only enabled on the Current Time Server. However, when a time adjustment has been entered, the **Adjustment Steering** button is enabled on all servers in the CTN. Visibility of the adjustment steering information is not restricted to the current time server.

As shown in Figure 6-109, the CTN time Source field is set to “Time set manually on console,” which indicates that the time was adjusted manually. Click **OK** to return to the Timing Network tab.

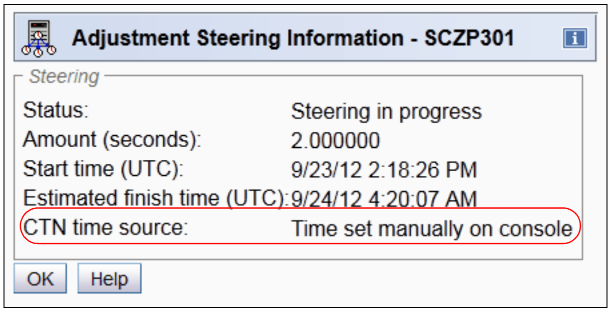


Figure 6-109 Adjustment Steering Information - CTN time source shows time set manually

Modifying a manual time adjustment

When a time adjustment is in progress, the Adjustment Steering button becomes active after the first time adjustment and remains enabled as long as the STP-only CTN is configured. The Adjust Time button on the Timing Network tab remains active, allowing the activation and specification of a new time adjustment request.

The process of modifying a manual time adjustment is similar to creating a manual time adjustment (see “Creating a manual time adjustment” on page 219). Each time that you click Adjust Time, a new request to adjust the time is sent to the STP facility. As a consequence, the new request replaces the existing request, causing new values to be calculated for adjustment amount, start time, and estimated finish time. These new values are subsequently displayed through the Adjustment Steering window.

Deleting a manual time adjustment

To terminate a manual time adjustment that is currently being applied:

1. Go to the **Timing Network** tab.
2. Click **Adjust Time**.
3. On the Adjust Time window, enter a new adjustment amount value of zero (Figure 6-110).

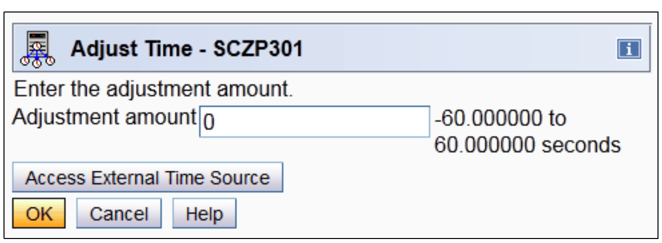


Figure 6-110 Adjust Time window - 0 entered to remove previous manual time adjustment

Specifying a value of zero is interpreted as a deletion of the currently active manual time adjustment. Selecting **OK** presents the message in Figure 6-111.

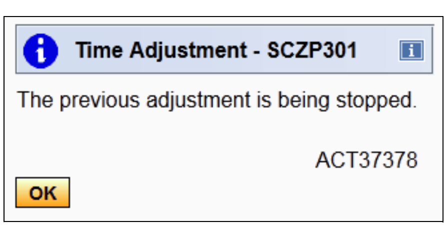


Figure 6-111 Time Adjustment - Previous time adjustment is being stopped message

6.6.3 Manual Time Adjustment through external time source

If installed and configured, an external time source (ETS) may be used to calculate the adjustment offset to be used in the Adjust Time window rather than entering the value manually.

The ETS provides the current UTC time, which is compared with the TOD of the Current Time Server, and the calculated difference (either positive or negative) is used to populate the adjustment amount field.

> **Tip**: Using the Access External Time Source button on the Adjust Time window is an excellent way to accurately determine the time difference between the Current Time Server and UTC time.

Creating a manual time adjustment via ETS

The normal context for NTP is an hourly automatic adjustment (that is, there is no need to manually adjust the time). Although the Adjustment Steering Information window (Figure 6-109 on page 221) provides the delta amount with the NTP server, the (manual) Adjust Time window may also be used to verify new configured NTP servers.

The ETS configured in this example is HMC Dial-up time source.

To perform a manual time adjustment through ETS:

1. Go to the **Timing Network** tab.
2. Click **Adjust Time** to open the Adjust Time window (Figure 6-112).

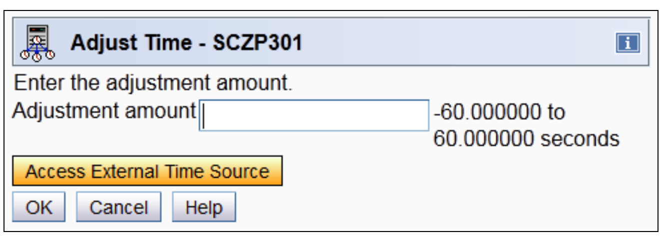


Figure 6-112 Adjust Time window - Select Access ETS

3. Instead of specifying an adjustment amount, click **Access External Time Source**.

   An ETS request is submitted. When the process completes successfully, the Adjust Time window displays and the difference between the Current Time Server time and the UTC time returned from the ETS is calculated and placed in the Adjustment amount field. As shown in Figure 6-113, the value returned is -0.000726 seconds. The adjustment amount may then be modified if required and applied as though it were manually entered (Figure 6-113 on page 222).

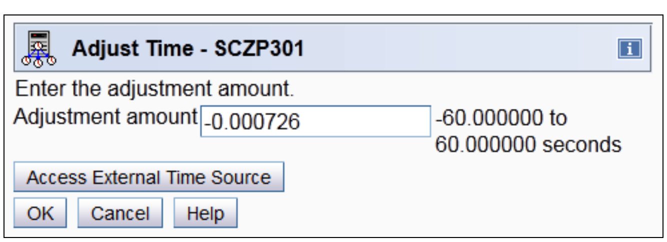


Figure 6-113 Adjust Time window - Accessing ETS to get adjustment amount

Note: The Adjustment amount returned by the External Time Source might not be within the +/- 60 second requirement of the Adjust Time window. The value returned needs to be reviewed for validity before clicking **OK**. Values larger than +/-60 seconds need to be applied in multiple increments until the total offset adjustment is accounted for.

Error message ACT37325 (Figure 6-114) displays if the adjustment amount is not within the +/- 60 seconds boundary. Click **OK** to return to the Adjust Time window.

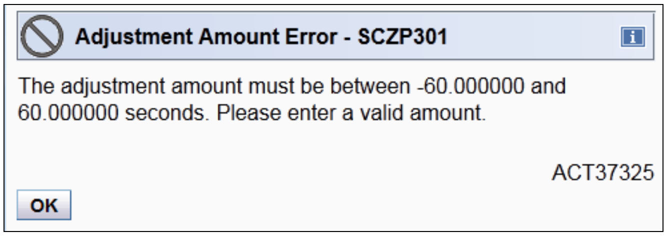


Figure 6-114 Adjustment Amount Error

4. In the window shown in Figure 6-113 on page 222, click **OK**. If an acceptable value is entered message ACT37326 displays, indicating that the time adjustment has been activated, and an estimate is provided as to when the steering is expected to complete (Figure 6-115).

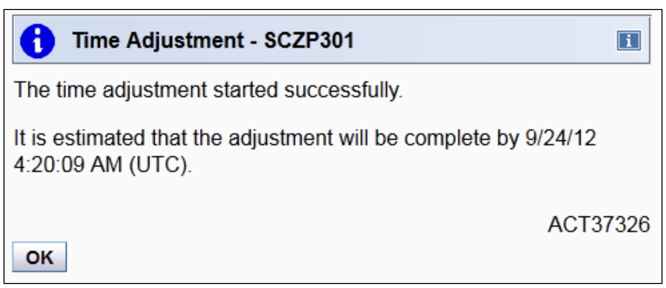


Figure 6-115 Time Adjustment window - Estimated completion time for current time adjustment

5. Click **OK** to return to the Timing Network tab.

   As shown in Figure 6-116, note that the CTN time source field is set to “Dial-up time source via Hardware Management Console,” which indicates that the time was adjusted through the ETS.

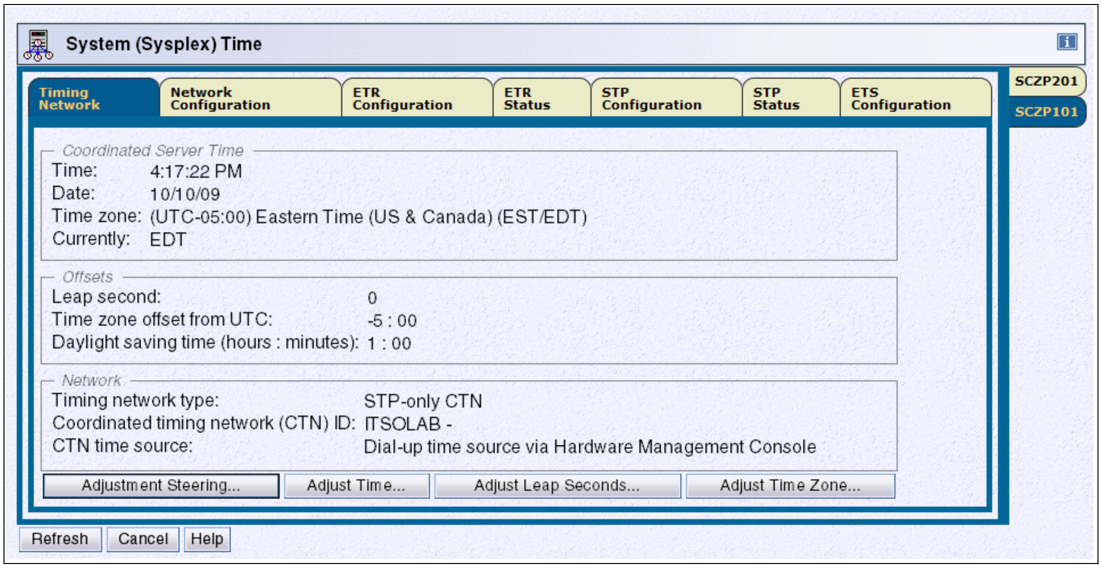


Figure 6-116 Timing Network tab - Adjustment Steering button now enabled

6. Click **Adjustment Steering** to display information about the currently active adjustment steering request, including the adjustment amount, start time, and estimated finish time.
7. As shown in Figure 6-117, the Source field is set to "Dial-up time source via Hardware Management Console," which indicates that the time was adjusted through the ETS and is the same as what appears in Figure 6-116 on page 224. The estimated finish time is the same as what appears in Figure 6-115 on page 223. Click **OK** to return to the Timing Network tab.

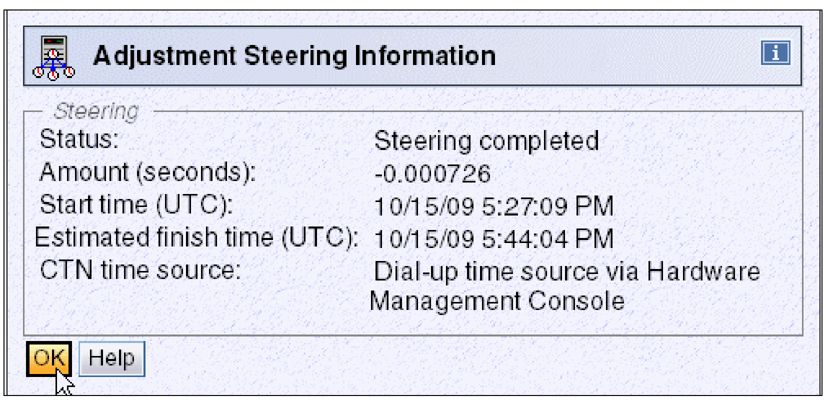


Figure 6-117 Adjustment Steering Information window - Steering completed

8. Click **OK** to return to the Timing Network tab.

Modifying a manual time adjustment through ETS

This process is similar to the process described in "Creating a manual time adjustment via ETS" on page 222. The adjustment amount for the subsequent request can be entered either of the following ways:

- Manually
- Through the ETS, to populate the Adjustment amount field with a value representing the calculated offset between UTC time, as provided by the ETS and the Current Time Server time

Deleting a manual time adjustment through ETS

This process is similar to the process described in “Deleting a manual time adjustment” on page 221. Deletion of an existing time adjustment is done through initiation of a subsequent request specifying an offset value of zero.

6.6.4 Scheduled time adjustment through External Time Source

For ETS considerations, see 1.1, “External Time Source” on page 4.

All timing adjustments in an STP-only CTN are issued from the Current Time Server. Therefore, the scheduled call to the ETS must be defined to the Support Element of the Current Time Server.

> **Note:** Changing the Current Time Server from the Preferred Time Server to the Backup Time Server might invalidate a scheduled operation to dial an ETS. Define the same scheduled operation on both the Preferred Time Server and the Backup Time Server to ensure that the time adjustment completes successfully on one of the servers, regardless of the Current Time Server location.

Creating a scheduled time adjustment through ETS using HMC dial out

To do this, follow these steps:

1. In the HMC task list, select **Operational Customization** → **Customize Scheduled Operations** (Figure 6-118).

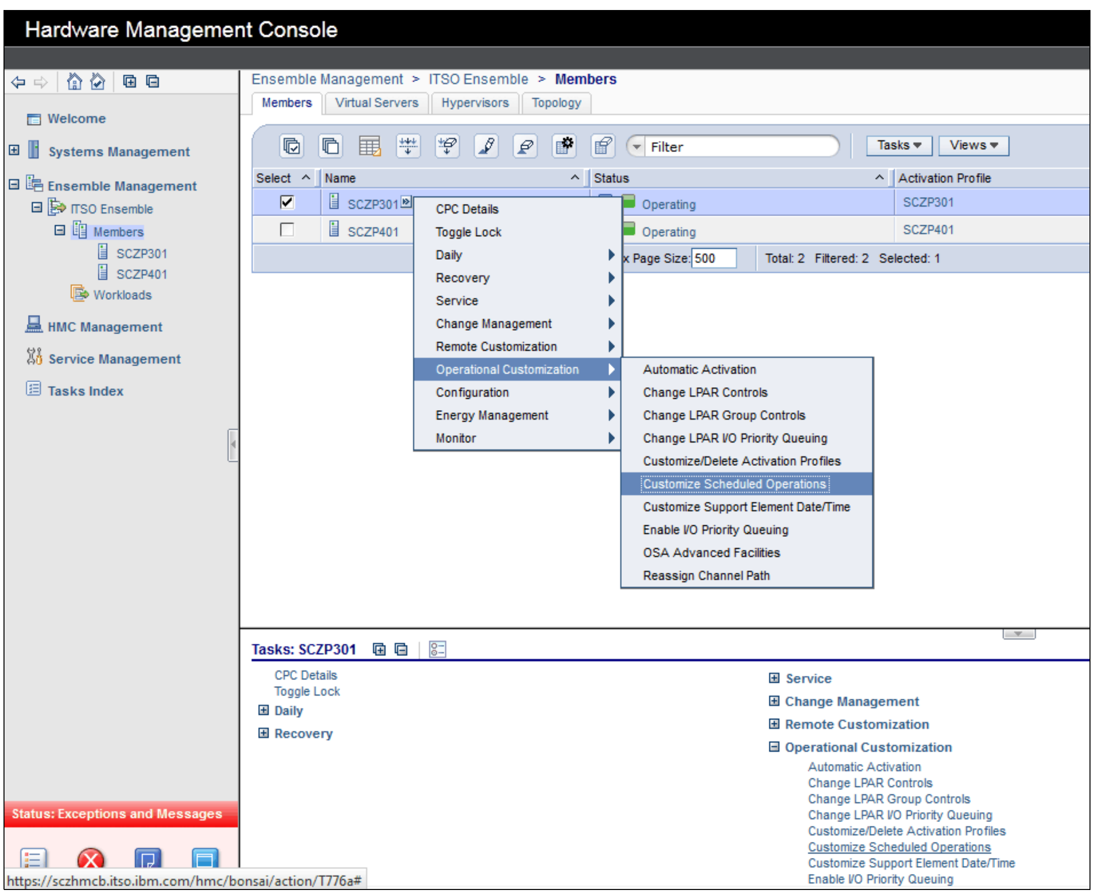


Figure 6-118 Customize Scheduled Operations task

The Customize Scheduled Operations window (Figure 6-119) displays scheduled operations already defined to the Support Element.

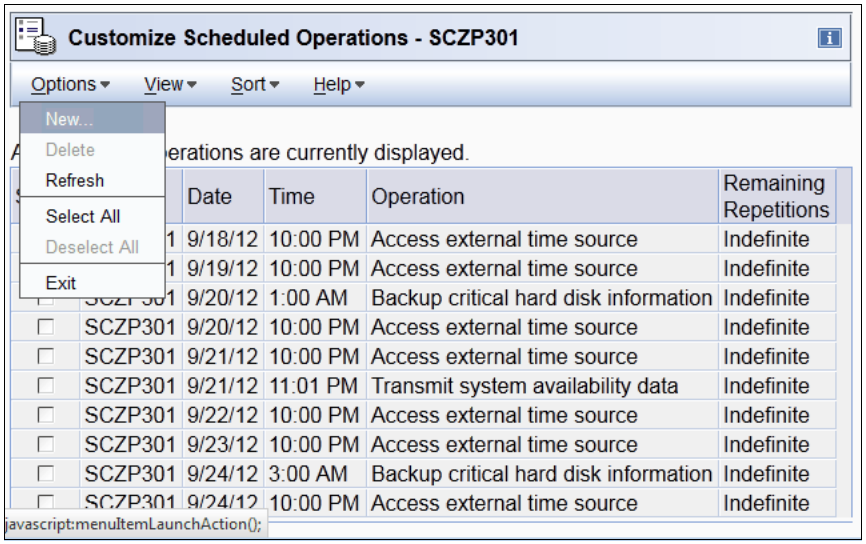


Figure 6-119 Customize Scheduled Operations task

2. Select **Options** → **New** to create a new entry. The Add a Scheduled Operation window displays (Figure 6-120), allowing the selection of the type of new scheduled operation to be created. Select the **Access external time source** radio button and click **OK**.

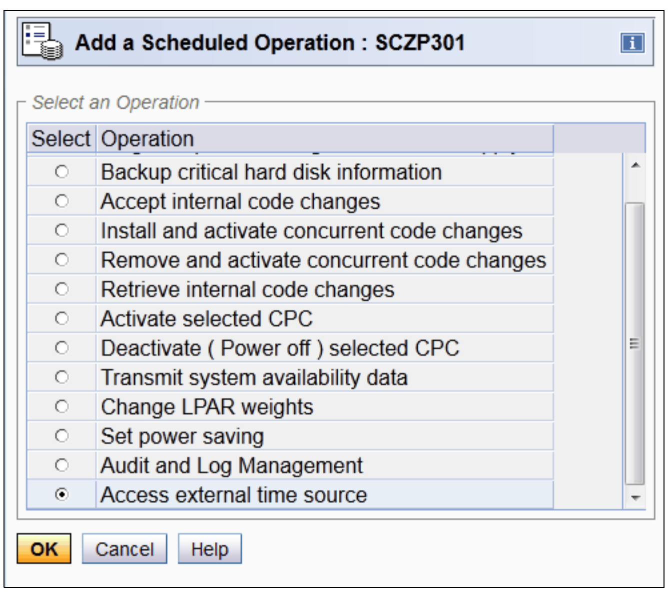


Figure 6-120 Add a Scheduled Operation

The window shown in Figure 6-121 displays, allowing a date and time to be entered. The newly scheduled operation can be saved immediately after the Date, Time, and Time window settings have been made, which causes a single occurrence entry to be created.

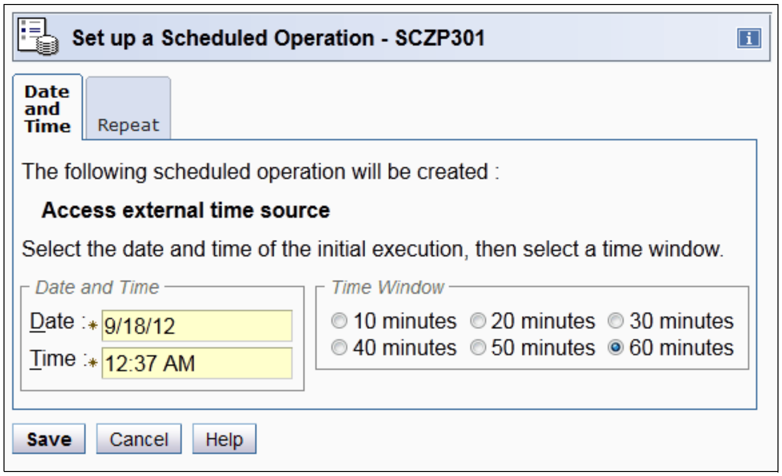


Figure 6-121 Set up a Scheduled Operation window - Date and Time tab

3. Further settings (if required) need to be entered using the Repeat tab to define a recurring scheduled operation (Figure 6-122).

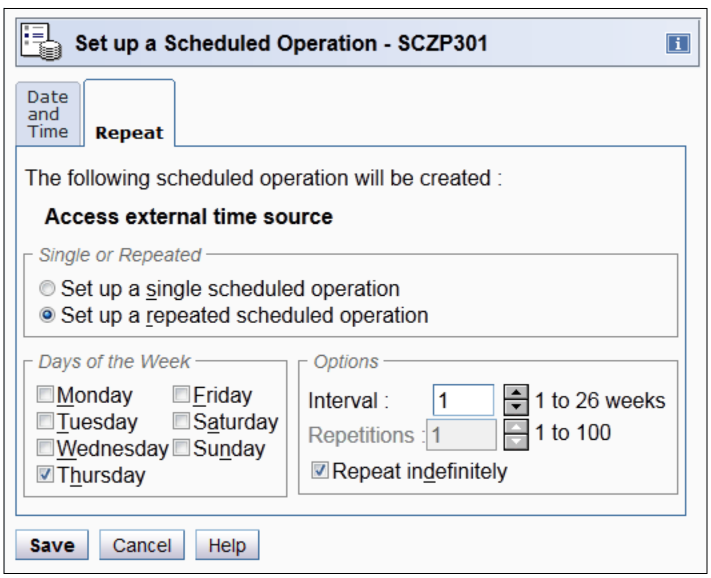


Figure 6-122 Set up a Scheduled Operation window - Repeat tab

4. Various options regarding days of the week, interval between repetitions, and specific number of repetitions are available. After the settings are correct, the new entry can be saved by clicking **Save**. A confirmation message then displays (Figure 6-123).

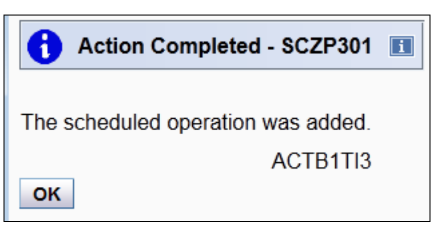


Figure 6-123 Action Completed

Modifying a scheduled time adjustment through ETS

There is no option provided to modify an existing entry within scheduled operations at the Support Element. The only method available is to delete the scheduled time adjustment and then define a new adjustment, as described in the preceding section, to recreate the entry with the modification as required.

Deleting a scheduled time adjustment through ETS

To delete an existing scheduled operation:

1. Go to the Customized Scheduled Operations window (Figure 6-119 on page 226).
2. Select the entry to be deleted.
3. From the action bar, select **Options** → **Delete**. This displays confirmation message ACTB1TC1 (Figure 6-124).

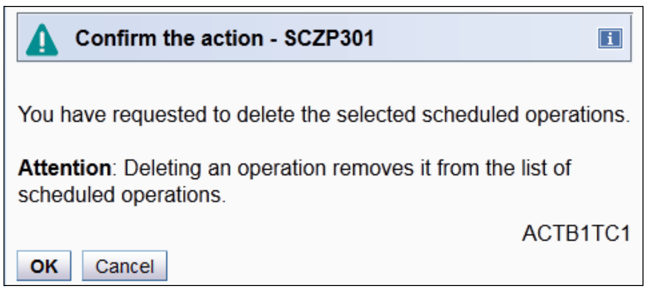


Figure 6-124 Confirm the action to remove selected scheduled operation

4. Click **OK** to confirm the entry deletion.

6.6.5 STP offset adjustments

The STP timing message includes:

- Coordinated server time
- Leap second offset
- Time zone offset
- Daylight saving time offset

These values are transmitted from the CTS to all servers in the CTN. How the z/OS system image uses these values depends on options specified in the TIME macro in combination with options specified in CLOCKxx at IPL.

Different time results can be received depending on the options specified in the TIME macro (Table 6-3).

Table 6-3 TIME macro options

Option	TIME macro with ZONE=LT	TIME macro with ZONE=UTC	TIME macro with STCK
Include TOD in result.	Yes	Yes	Yes
Include leap second offset.	Yes	Yes	No
Include time-zone offset.	Yes	No	No

In addition, the parameters specified in the CLOCKxx member at IPL determine where these values are obtained.

See Table 6-4 for a z/OS system resident on a server in ETR timing mode.

Table 6-4 z/OS system on a server in ETR timing mode

Option	ETRMODE=NO ETRZONE=NO	ETRMODE=YES ETRZONE=NO	ETRMODE=YES ETRZONE=YES
Step TOD to Sysplex Timer.	No	Yes	Yes
Include leap second offset from Sysplex Timer.	No	Yes	Yes
Include time-zone offset from ETR.	No	No	Yes
Include time-zone offset from CLOCKxx.	Yes	Yes	No
Allow local time adjustment via z/OS SET commands.	Yes	Yes	No

Similarly, an equivalent table can be established with STP-related parameters for z/OS systems resident on a server in STP timing mode (Table 6-5).

Table 6-5 z/OS system on a server in STP timing mode

Option	STPMODE=NO STPZONE=NO	STPMODE=YES STPZONE=NO	STPMODE=YES STPZONE=YES
Step TOD to Current Time Server.	No	Yes	Yes
Include leap second offset from Current Time Server.	No	Yes	Yes
Include time-zone offset from Current Time Server.	No	No	Yes
Include time-zone offset from CLOCKxx.	Yes	Yes	No
Allow local time adjustment via z/OS SET commands.	Yes	Yes	No

Leap second considerations

Operating system and subsystem components use the STCK time format because this is not subject to either leap second offset or time zone offset changes. Two successive invocations of the Assembler TIME macro in STCK format yield different results, and the second result is later than the first result.

Attention: Despite the fact that leap seconds are not included in STCK time, the application of positive leap second offset changes can be disruptive and must be done with extreme caution.

During the implementation of a *positive* leap second offset change, z/OS becomes non-dispatchable for the duration of the delta between the current leap second offset and the new leap second offset to insert the delta between STCK time and UTC time.

The non-dispatchability can potentially lead to time-out scenarios between z/OS and network-connected off-host components that are time sensitive.

Example 6-1 assumes that a program is displaying time in various formats at the rate of one line per second. The user notices that the current leap second offset is set to 18 by mistake and decides to set it to the currently correct value of 23, resulting in a positive 5-second delta.

Example 6-1 Positive leap second offset change

```
STCK:           ZONE=LT      ZONE=UTC      CVTTZ
18:35:58       14:35:40      18:35:40      FFFFCA5B
18:35:59       14:35:41      18:35:41      FFFFCA5B      <- Leap second offset
applied

z/OS made non-dispatchable for 5 seconds

18:36:05       14:35:42        18:35:42    FFFFCA5B
18:36:06       14:35:43        18:35:43    FFFFCA5B

The Time zone offset is -4 hours. The high order words of the CVTLDTO field are
stored in the CVTTZ field in units of 1.048576 seconds and can be converted to
seconds as follows:
X'FFFFCA5B' (-13733) * 1.048576 = -14400 seconds = -4 hours
```

The non-dispatchability is required to insert the leap second difference between STCK time and UTC time. In effect, the positive leap second offset delta is subtracted from the current UTC time, which causes duplicate UTC time stamps if the non-dispatch ability is not in effect for the same interval.

Negative leap second offset changes are implemented directly by adding the leap second offset delta to the current UTC time. In this case, there is no requirement for z/OS to be made non-dispatchable, because this does not result in duplicate UTC time stamps, and therefore there is minimal disruption.

Example 6-2 assumes that the current leap second offset is set to 28 by mistake and that the user decides to set it to the currently correct value of 23, resulting in a negative 5-second delta.

Example 6-2 Negative leap second offset change

```
STCK:           ZONE=LT      ZONE=UTC      CVTTZ
18:35:58       14:35:30      18:35:30      FFFFCA5B
18:35:59       14:35:31      18:35:31      FFFFCA5B      <- Leap second offset
applied
18:36:00       14:35:37      18:35:37      FFFFCA5B
18:36:01       14:35:38      18:35:38      FFFFCA5B
```

There will not be any requirement to perform such a change, because leap second offset changes have always been positive thus far.

Time zone considerations

Like the leap second offset, the time zone offset is applied in a single positive or negative amount rather than being spread over a period of time. This is implemented through a direct modification to the high word of CVTLDTO field (CVTTZ), which is in units of 1.048576 seconds.

Time zone offset changes do not affect operating system or subsystem components, because these use the Assembler TIME macro with the STCK or ZONE=UTC parameters, which do not incorporate the time zone offset. However, applications that use local time obtained using ZONE=LT might be impacted, depending on how time is used within the application logic.

Positive time zone offset changes are usually the result of the onset of daylight saving time (*spring forward*). These changes result in the delta between the old time zone offset and the new time zone offset being added to the time returned from ZONE=LT.

Example 6-3 assumes that the time zone offset is being changed from -4 hours to -3 hours as the result of a daylight saving time change. The leap second offset is 22 seconds.

Example 6-3 Positive time-zone offset change

```
STCK:            ZONE=LT      ZONE=UTC      CVTTZ
18:35:57        14:35:35      18:35:35      FFFFCA5B
18:35:58        14:35:36      18:35:36      FFFFCA5B      <- Time Zone offset
applied
18:35:59        15:35:37      18:35:37      FFFFD7C4
18:36:00        15:35:38      18:35:38      FFFFD7C4
```

In this scenario, the ZONE=LT time jumps forward by the delta amount, so there is no potential for duplicate time stamps to be returned to your application. However, if your applications are using ZONE=LT format time for interval calculation purposes, then they might potentially be impacted by the unexpected time change.

Negative time zone offset changes usually occur at the end of the daylight saving time period (*fall back*) through subtraction of the daylight saving time offset.

Negative time-zone offset changes are also implemented through direct modification of the CVTLDTO field. However, in this scenario, the offset delta is subtracted from the time returned through ZONE=LT, resulting in a duplicate time stamps for the duration of the offset.

Example 6-4 assumes that the time zone offset is being changed from -3 hours to -4 hours as the result of a daylight saving time change. The leap second offset is 22 seconds.

Example 6-4 Negative time-zone offset change

```
STCK:            ZONE=LT      ZONE=UTC      CVTTZ
18:35:57        15:35:35      18:35:35      FFFFD7C4
18:35:58        15:35:36      18:35:36      FFFFD7C4      <- Time Zone offset applied
18:35:59        14:35:37      18:35:37      FFFFCA5B
18:36:00        14:35:38      18:35:38      FFFFCA5B
```

The duplicate time stamp effect might be quite dangerous for applications using the ZONE=LT time format. Therefore, changes of this nature need to be done with this in mind.

Important: Applications must be reviewed on an individual basis to determine whether positive or negative adjustments to the time zone offset can be dynamically tolerated before such adjustments are applied.

Often, a positive offset adjustment can be applied dynamically. However, a negative offset adjustment requires an application outage for the duration of the adjustment to avoid the duplicate time stamp effect.

In ETR timing mode, when a daylight saving time change occurs, message IEA271I is issued by z/OS images running on the server:

```
IEA271I ETR TIME OFFSET CHANGES HAVE OCCURRED.
```

When the server is in STP timing mode and a daylight saving time change occurs, a new message IEA392I is issued:

```
IEA392I STP TIME OFFSET CHANGES HAVE OCCURRED
```

Automation rules that rely on message IEA271I must be changed.

Leap second offset adjustment

Note: Only perform leap second offset adjustments if your environment is sensitive to leap second changes.

If the applications at your site are sensitive to leap seconds, then the Leap Second adjustment window must be used to apply the leap second offsets when they become available.

To adjust leap seconds, follow these steps:

1. Go to the **Timing Network** tab of the Current Time Server (Figure 6-125).

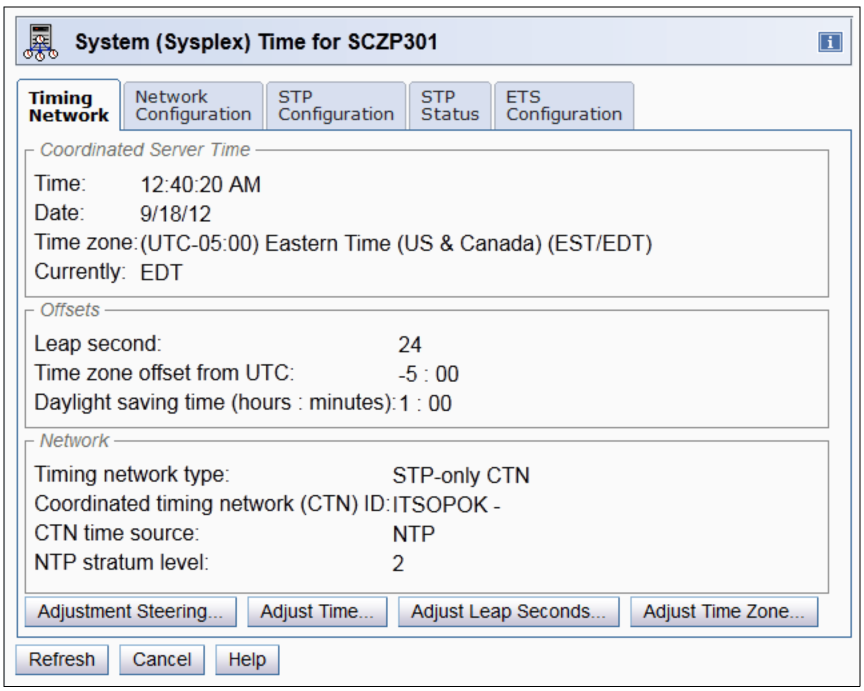


Figure 6-125 Timing Network tab - Leap seconds = 23

   Note that the Leap Second field of the Offsets section is set to 23.

2. Click **Adjust Leap Seconds** to display the Adjust Leap Second Offset window (Figure 6-125).

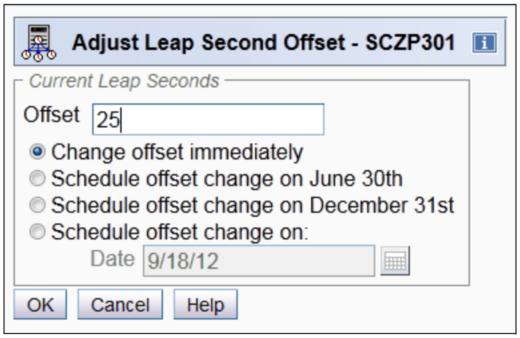


Figure 6-126 Adjust Leap Second Offset

When the Adjust Leap Second Offset window displays, the current leap second offset in effect for the STP-only CTN value displays in the Offset input box.

This value might have been inherited from the ETR during the migration process from an ETR-only network, or have been set through the Initialize Time function, as documented in 6.4.4, “Time initialization” on page 181.

3. Enter a new value in the Offset input box. Enter 24, as shown in Figure 6-126.
4. Schedule the change (immediate or on a later date) and click **OK** to return to the Timing Network tab.

   The Leap second field in the Offsets section of the Timing Network tab displays the new value of 24 (Figure 6-127).

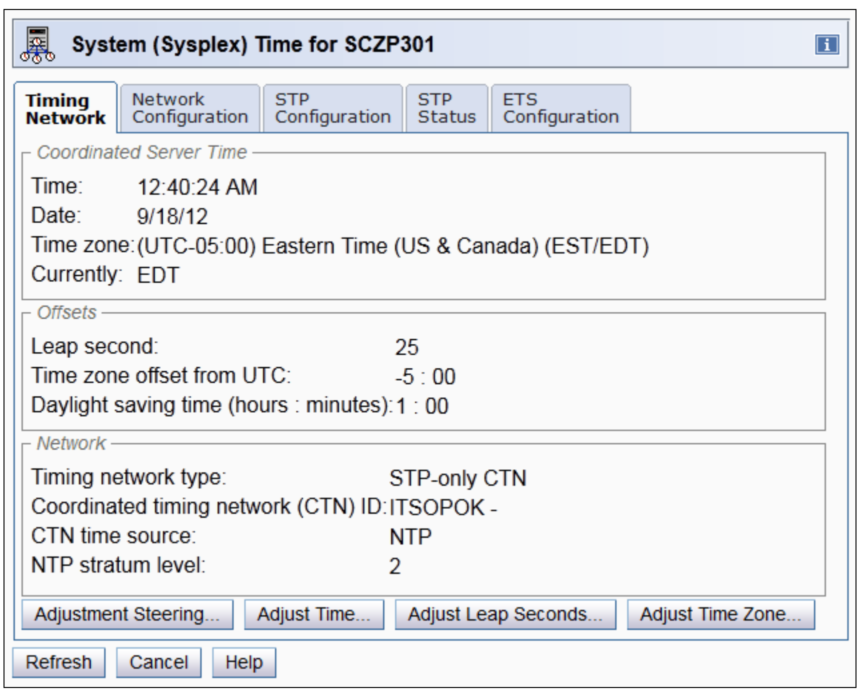


Figure 6-127 Timing Network tab - Leap seconds adjusted

Note: Leap seconds are automatically built into the UTC time obtained from an external time source. Any leap second offset that is defined is taken into account when calculating the delta between your Current Time Server and the time received from the ETS. This is required to prevent double accounting.

If you decide to rely on the ETS to incorporate an additional leap second into the Current Time Server TOD, then be aware that this is a breach of the requirement that leap second adjustments occur at the same time worldwide. This is because TOD adjustments through the ETS are implemented over a period of time through adjustment steering rather than immediately. For most sites, this is not a problem, but if your site is leap-second sensitive, then the Adjust Leap Seconds facility must be used to ensure that the new offset is applied as a single adjustment at the correct time.

Time-zone offset adjustment

The Offsets section of the Timing Network tab displays the current time zone offset information of the STP-only CTN.

As shown in Figure 6-128, if this tab displays the Total time (hours : minutes) field, then a time zone offset entry has not yet been set from the Adjust Time Zone Offset window, but has been inherited from a Sysplex Timer during a migration from a Mixed to STP-only CTN. In this instance, the time zone must be set.

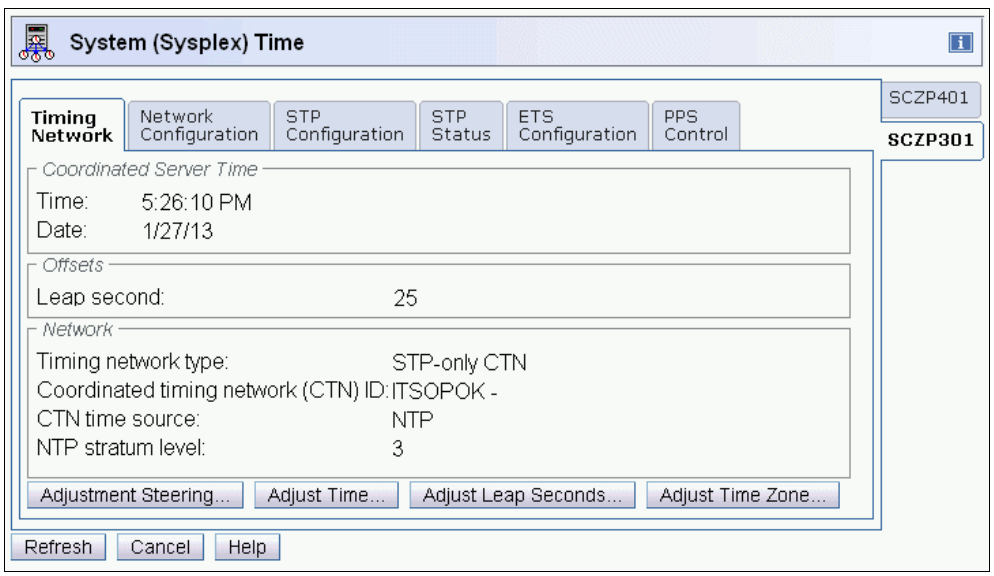


Figure 6-128 Timing Network tab - Time zone not set

To adjust the time zone:

1. Click **Adjust Time Zone** to display the Adjust Time Zone Offset window (Figure 6-129).

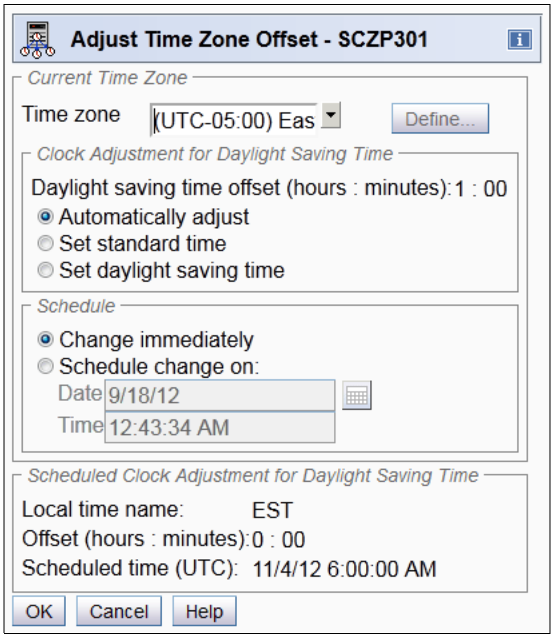


Figure 6-129 Adjust Time Zone Offset

2. From this window, select one of the supported time zones that is provided by default or use one of the five user-defined time zones to customize an entry to specifically meet your requirements.
3. There are three choices that must be made on the Adjust Time Zone Offset window:
   a. Select one of the values from the Time zone drop-down menu.

      Following a migration, the Time zone entry displays <Not initialized>. In the example shown in Figure 6-129 on page 235, “Time zone (UTC-05:00) Eastern Time (US & Canada) (EST/EDT)” has been selected from the drop-down menu.
   b. In the Clock Adjustment for Daylight Saving Time section, choose a daylight saving time offset.

      Automatically adjust is selected by default when the time zone selected supports automatic adjustment of daylight saving time. Otherwise, the button is disabled. If this option is selected, STP automatically selects the correct time zone offset based on the current date and time.

      If the selected time zone does not support automatic adjustment or if the user does not want to use automatic adjustment of daylight saving time, select **Set standard time** or **Set daylight saving time**, depending on what is in effect at the time that the change is made.
   c. In the Schedule section, click one of the radio buttons to choose when the time zone adjustment is to be initiated.

      Change Immediately indicates that the change will take place when **OK** is clicked. This is the best choice following a Mixed to STP-only migration.

      If the Schedule change on radio button is selected, the user enters the local date and time when the change is to occur. Then STP does the conversion and displays the results of when it is scheduled in UTC time.
4. Click **OK** to save the settings and return to the Timing Network tab.

As compared to the original state shown in Figure 6-128 on page 234, note that in the Offsets section shown in Figure 6-130:

- The Total time offset field is no longer displayed after a time zone offset has been set.
- The time zone offset from UTC value is set to -5:00 and the daylight saving time value is set to 1:00, reflecting the changes made in Figure 6-129 on page 235.

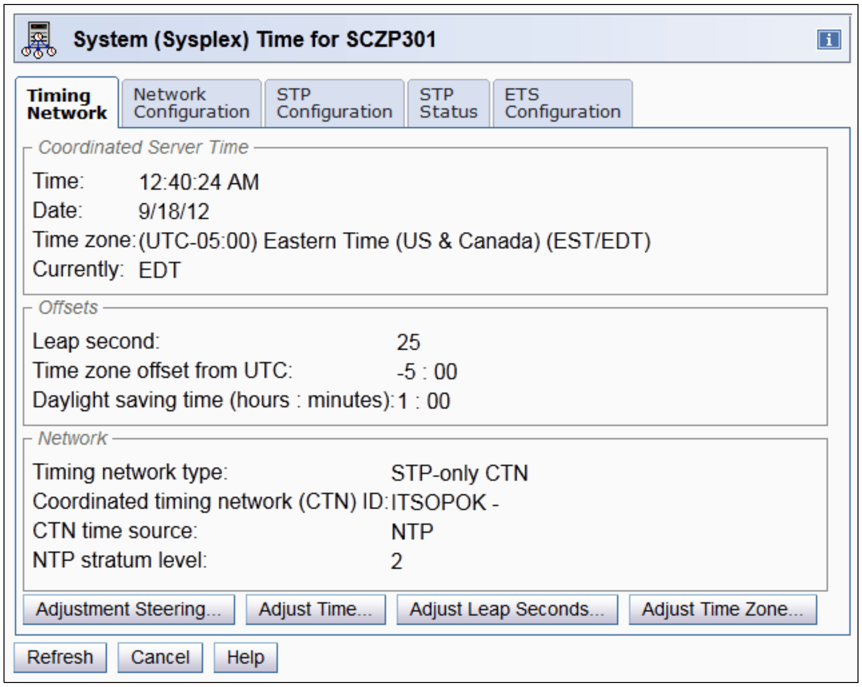


Figure 6-130 Timing Network tab - Time zone offset now showing

Supported time-zone offsets

A number of supported time zone offset entries are provided by default (Figure 6-131). Each of these entries has a defined offset from UTC, and an entry can be selected that is suitable for the time zone.

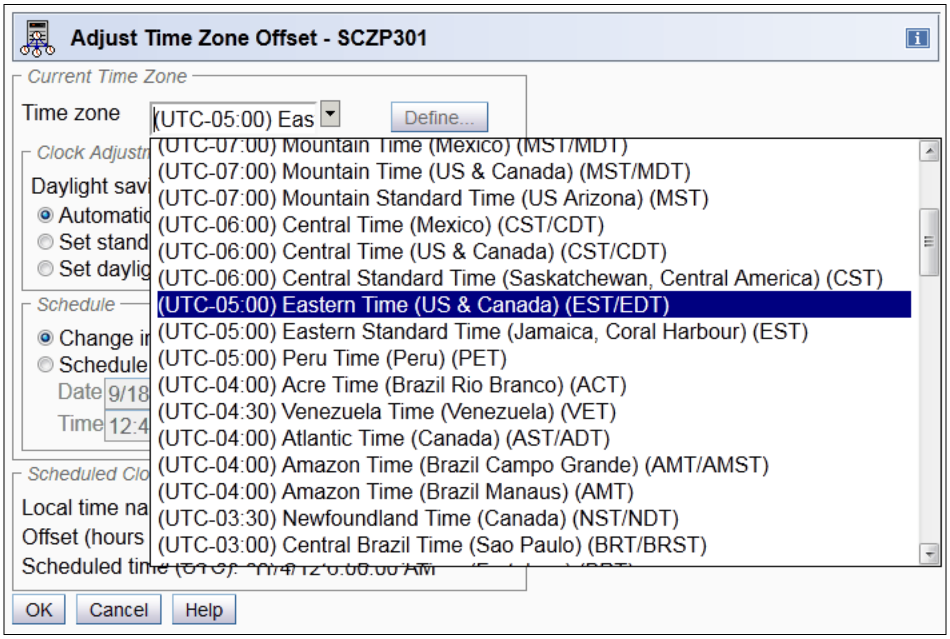


Figure 6-131 Adjust Time Zone Offset window - Predefined zones

In addition, these entries may optionally have a time zone algorithm defined that contains the following daylight saving time information:

- Daylight saving time offset
- Optional: Daylight saving time automatic adjustment information:
  - Daylight saving date and time start algorithm
  - Daylight saving date and time end algorithm

When the operation is complete, message ACT37328 displays (Figure 6-132).

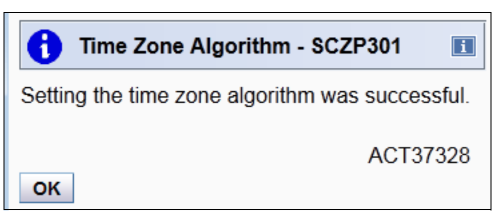


Figure 6-132 Setting time zone successful message

If the selected time zone offset supports automatic clock adjustment for daylight saving time by providing an algorithm with the necessary start and end information, then the Automatically adjust radio button can be used to activate automatic adjustment.

Alternatively, the time zone offset might not support automatic adjustment or the installation might prefer not to use automatic adjustment of daylight saving time. Two radio buttons, “Set standard time” and “Set daylight saving time,” provide the ability to set local time to either standard or daylight saving time.

Select either **Set standard time** or **Set daylight saving time**, depending on what is in effect at the time that the change is made. If the time zone does not have a daylight saving time offset, only the Set standard time button is enabled.

Selecting **Daylight Saving Time** and clicking **OK** displays message ACT37330 (Figure 6-133).

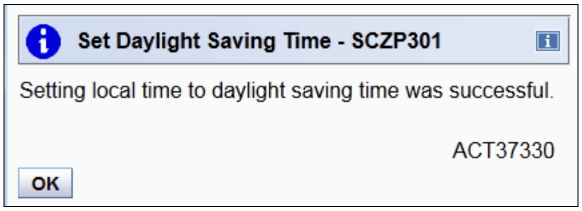


Figure 6-133 Setting DST was successful

As in Figure 6-134, selecting **Standard Time** and clicking **OK** displays message ACT39139.

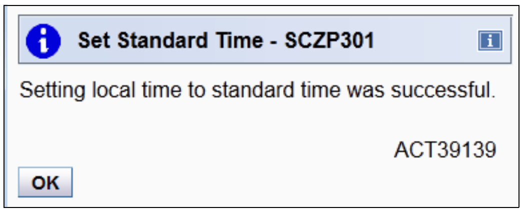


Figure 6-134 Setting standard time successful

User-defined time zone offsets

There are five user-defined time zone offset entries that may be customized and applied if none of the provided entries meet the requirements.

These entries are named UD1 to UD5, and when one of these is selected, the Define button on the Adjust Time Zone Offset window is enabled. It can then be used to modify the selected entry to meet the requirements. Figure 6-135 shows UD1 being defined with an offset of 3 hours and 30 minutes and a DST offset called DST1 of one hour.

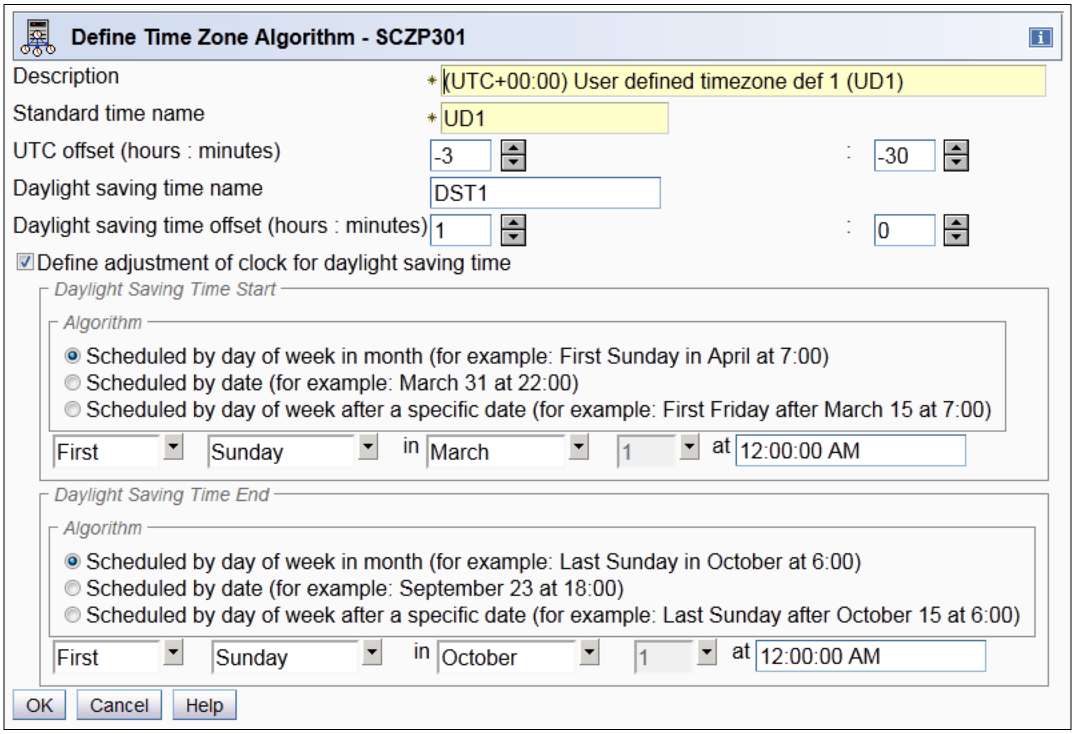


Figure 6-135 Define Time Zone Algorithm window

6.7 Local time changes

z/OS allows either STCK time, UTC time, or local time to be obtained depending on your requirements. The difference between UTC time and local time is usually the time zone offset under normal circumstances (that is, with no leap seconds offset defined).

The time zone offset is managed at the z/OS level by specifying the ETRZONE=NO and STPZONE=NO options in the CLOCKxx PARMLIB member, and the relevant option applies depending on whether the server is in ETR timing mode or STP timing mode.

When this is done, the TIMEZONE parameter in the CLOCKxx member is used to set the time-zone offset at IPL, and a number of z/OS SET commands can be used to dynamically adjust this offset if required. Similarly, the coupling facility supports the concept of time zone offset and allows dynamic modification of the time zone offset through a command.

z/OS commands

On a z/OS system, the local date and time my be modified dynamically. The ability to do this depends on what options have been specified in the CLOCKxx member at IPL (Table 6-6).

Table 6-6 z/OS time adjustment through command cross-reference

Option	Adjust time using z/OS command		
	Local time ZONE=LT	**UTC time ZONE=UTC**	**STCK time STCK**
ETRMODE=NO, ETRZONE=NO	Yes	Yes[a]	Yes[a]
ETRMODE=YES, ETRZONE=NO	Yes	No	No
ETRMODE=YES, ETRZONE=YES	No	No	No
STPMODE=NO, STPZONE=NO	Yes	Yes[a]	Yes[a]
STPMODE=YES, STPZONE=NO	Yes	No	No
STPMODE=YES, STPZONE=YES	No	No	No

a. If ETRMODE NO and STPMODE YES (the default) is specified, z/OS will issue IEA888A to prompt the operator to set the TOD clock during system initialization. This will occur regardless of whether OPERATOR PROMPT or NOPROMPT has been specified. IEA888A is issued because system initialization has detected that STPMODE YES was requested but STP is not available. The operator is prompted to notify that local server time is being used and allow the time to be adjusted if required. IEA888A is issued regardless of whether OPERATOR PROMPT or NOPROMPT is specified in CLOCKxx. For more information, go to the following website:
`http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/FLASH10576`

DISPLAY TIME

This command can be used to display the local time and date, and the UTC time and date (Figure 6-136).

```
DISPLAY TIME
IEE136I LOCAL: TIME=17.06.33 DATE=2006.290  UTC: TIME=21.06.33  DATE=2006.290
```

Figure 6-136 z/OS DISPLAY TIME command

Under normal circumstances, the difference between local time and UTC time is the time zone offset (incorporating daylight saving time offset, if any) applicable to the time zone.

SET DATE

This command is not permitted in an STP-only CTN. Any attempt to change the local time or date when the server is operating in STP mode and if STPZONE YES is specified, receives z/OS message IEA279I:

```
IEA279I ALL CLOCK RELATED SET COMMANDS ARE IGNORED WHEN IN STP MODE.
```

SET CLOCK

This command is not permitted in an STP-only CTN. Any attempt to change the local time or date when the server is operating in STP mode receives message IEA279I.

SET RESET

This command causes the time zone offset to be reset to the value that was read in from the CLOCKxx member during IPL, causing the local date and time to be changed accordingly. The syntax is:

```
SET RESET
```

This annuls all previous SET DATE, SET CLOCK, and SET TIMEZONE commands and reestablishes the relationship local date and time = UTC date and time + time zone offset.

SET TIMEZONE

This command can be used to change the time zone offset to a different value from that specified at IPL through the TIMEZONE parameter in CLOCKxx. This automatically adjusts the local date and time accordingly. The syntax is:

```
SET TIMEZONE={W|E}.hh[.mm]
```

The time zone offset direction is west (W) or east (E). West is the default if it not specified. The value for *hh* must be between 00 and 15, and the value for *mm* must be between 00 and 59.

The daylight saving time changes may be handled manually using the SET CLOCK command rather than having it done automatically by the STP facility or the Sysplex Timer.

Using this method there is always a degree of error, because the difference between the local time and UTC time does not exactly match the time zone offset that would have been achieved by updating the TIMEZONE statement in CLOCKxx and IPLing.

The z/OS SET TIMEZONE command overcomes this problem by applying the correct offset value in the CVTLDTO field, causing an exact time zone offset to be applied.

Tip: If the SET CLOCK command is used to change local time for daylight saving time offset purposes, then we advise using the SET TIMEZONE command instead for far greater accuracy.

Remember that if the time zone offset for daylight saving time purposes is changed dynamically using either the z/OS SET CLOCK command or the SET TIMEZONE command, the TIMEZONE statement in CLOCKxx must be updated so that the new offset is not regressed upon the next IPL.

7

Operational considerations

The loss of timing synchronization for servers in a Coordinated Timing Network (CTN) might have grave consequences for system images running in a Parallel Sysplex. New safeguards have been added to prevent the following actions:

- Execution of a disruptive task on a server that is configured as the Current Time Server and has Server Time Protocol (STP) connectivity to Stratum 2 servers
- Execution of a disruptive task on a server that is configured as the BTS or Arbiter
- Accidental deconfiguration of the last timing link between any two servers

With these new safeguards, the user must complete additional steps prior to executing the disruptive action. New messages draw the attention of the user when certain STP configuration conditions are not met. These conditions are described in the following sections.

> **Important:** In an STP environment, if you plan to change your cabling topology, make sure that you understand the CTN roles of the servers subject to re-cabling, and perform the following tasks prior to any disruptive action:
>
> - Update the IOCP for affected servers
> - Test the changed links by configuring the channels online

7.1 Disruptive actions on the Current Time Server

A disruptive action on the Current Time Server (CTS) can jeopardize the entire CTN. Protection has been added to *prevent* a disruptive task from being performed on a server in the following conditions:

- On a server that is configured as the Current Time Server. Checking is only performed for the Current Time Server in an STP-only CTN. It does not apply to other server roles.
- On a server that has initialized STP links to Stratum 2 servers.

Only the combination of CTS role and active STP links conditions is checked. The protection only applies if *both* conditions are met. There is no protection enforced for a CTS that consists of a single server, because the active STP links condition is not met. See *Server Time Protocol Planning Guide,* SG24-7280, for detailed information about single server considerations.

When both conditions are met, the server is locked for disruptive tasks such as activate, deactivate, power off, power-on reset, and disruptive switch to alternate Support Element (SE). The protection also prevents modification of the server STP ID, the External Timer Reference (ETR) Network ID on the STP Configuration tab, or the ETR Network ID on the ETR Configuration tab.

7.1.1 Example of a disruptive action on the CTS: DEACTIVATE

If an attempt is made to perform a disruptive task on a server that is currently the CTS while other servers are attached through initialized STP links (being Stratum 2), that disruptive task fails. In the following example, a deactivate request on a server that matches both criteria is shown:

1. When the deactivate request is clicked for server H40, the normal Secondary Object Notification for Disruptive task gets posted.
2. The normal Deactivate Task Confirmation message gets posted.

3. The Disruptive Task Confirmation window prompts for the current user’s password (Figure 7-1).

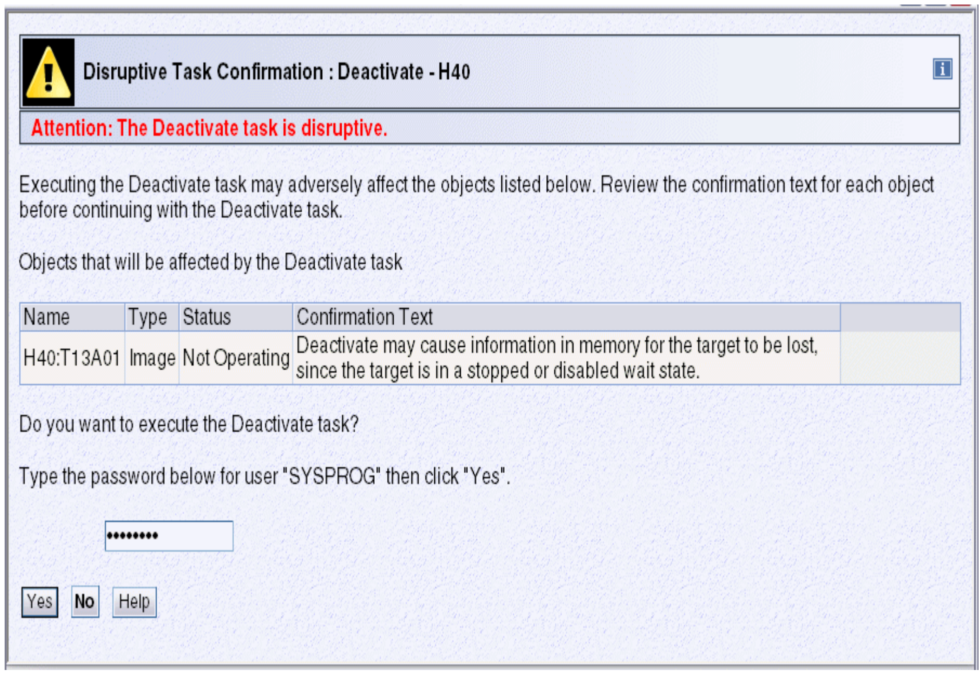


Figure 7-1 Disruptive Task Confirmation window

4. However, the Deactivate Progress window returns a failed status. Details are available (Figure 7-2).

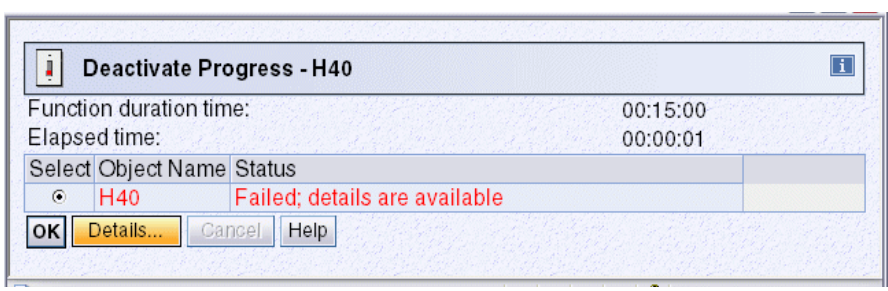


Figure 7-2 Deactivate Progress

5. Clicking **Details** displays message ACTZ01C7 (Figure 7-3). No alternative action is possible from this window. The user can only acknowledge that the request failed and click **OK**.

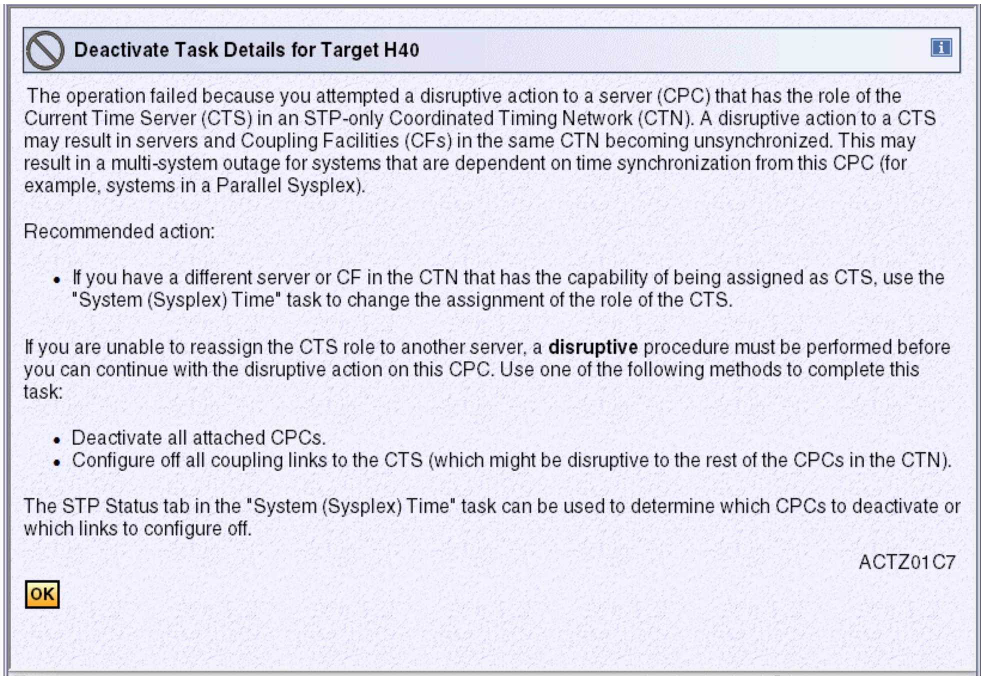


Figure 7-3 Message ACTZ01C7 - Deactivate Task details

If the request really must be pursued, the solution is to first change the STP configuration by reconfiguring the Current Time Server to another server from the Network Configuration window of the server that will become the new CTS. Only then can the deactivate request be accepted.

If the CTS *cannot* be reassigned, the alternatives will be disruptive to maintaining synchronization for other servers in the CTN. The alternatives are:

- Deactivate all the Stratum 2 and Stratum 3 servers in the CTN first. After that is done, the disruptive action on the CTS can be performed.
- Configure off all the coupling link CHPIDs from the CTS to all its attached servers. The special procedure that must be adhered to in order to configure off all, or more precisely, the last CHPID used for STP timing, is described in 7.3, “Last timing link validation” on page 248. The disruptive action on the CTS can be performed after this action is completed.

7.1.2 Protection of the CTS: CTN ID change

In a multisystem CTN environment, the Current Time Server is also protected from a local configuration change. This includes the following functions:

- ETR ID change from either the ETR configuration tab or the STP Configuration tab for servers without the ETR feature
- STP ID change from the STP configuration tab

A local CTN ID change basically removes the server from the current CTN to move to a separate CTN. Such a configuration change on a CTS is disruptive to the CTN.

Changing the CTN ID of a server that is not the CTS can also be globally disruptive. For example, consider the case of changing the CTN ID of a Stratum 2 server that is the sole time source for a Stratum 3 server that was supposed to remain in the original CTN. The modification of the ETR ID on the ETR Configuration tab or STP ID on the STP Configuration tab results in the message ACT39161 (Figure 7-4).

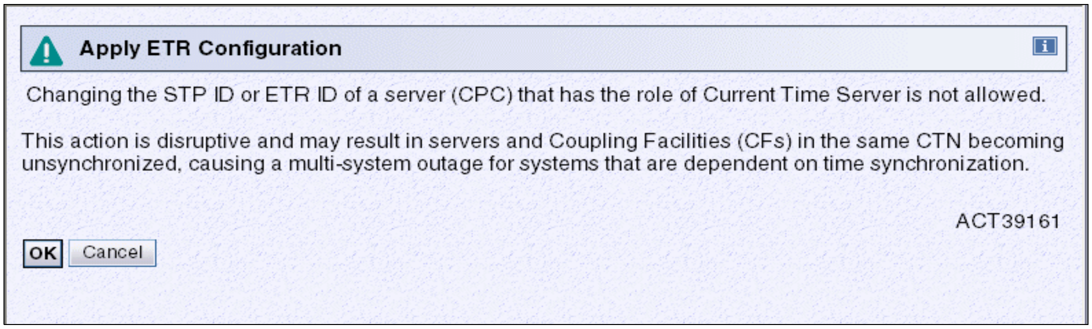


Figure 7-4 Message ACT39161

7.2 Disruptive actions on the BTS or Arbiter

Disruptive actions are now blocked for the BTS and Arbiter. This new function was introduced with the MCL levels listed in Table 7-1.

Table 7-1 MCL levels which introduced blocking of STP disruptive actions

Driver/Server	MCL	Bundle	Release date
D86E/z196	N29809.277	45	8 September 2011
D86E/z196	N29802.420	45	8 September 2011
D79F/z10	N24415.078	50	28 September 2011
D79F/z10	N24409.184	50	28 September 2011
D93G/z114 and z196 GA2	Integrated	N/A	9 September 2011

This provides the same safeguards for the BTS and Arbiter as described in “Disruptive actions on the Current Time Server”; it prevents a disruptive action causing the CTS to give up the S1 role and go S0. For example, if the PTS has the CTS role and then the Arbiter (or BTS) has a planned or unplanned outage, then a disruptive action on the BTS (or Arbiter) causes the CTS to give up the S1 role and go S0 as it loses communication to both the BTS and Arbiter.

Attention: This recent restriction that a disruptive action cannot be taken against the server assigned with the BTS role has changed how the “Only allow the server(s) specified above to be in the CTN” button is used, because it requires that a BTS is assigned in a two-server CTN.

This means that the BTS server has to be removed from the CTN when the BTS role is removed to allow the “Only allow the server(s) specified above to be in the CTN” button to be selected when the PTS is power-on reset.

7.3 Last timing link validation

The loss of a server's last coupling link might cause the loss of timing synchronization for all system images on the server that is being synchronized (Stratum 2 or Stratum 3). To prevent accidental misconfiguration of the last coupling link that is being used to deliver STP timing between any two servers, additional safeguards are provided to prevent operational errors.

The last coupling link that is being used to deliver STP timing between any two servers is also referred to as the *last timing link*. A last timing link condition occurs when the following conditions are true:

- To identify a physical channel, a physical channel identifier (PCHID) is assigned to each possible location that can support a channel card or that can provide I/O connectivity (for example, ESCON or FICON, networking, and coupling interfaces) or a logical interface, such as cryptographic attachments. PCHIDs represent the physical location of the I/O ports within the server. CHPIDs are then mapped to PCHIDs.

  The PCHID is initialized for STP timing messages, whether it is defined to HCD as a coupling link or as a timing-only link.

  The PCHID is listed in the Local STP Link Identifier(s) column of the System information section on the STP Status tab, and is the only remaining PCHID between any two servers in a Mixed or STP-only CTN.

- The CHPID status is online to only one logical partition. That is, the CHPID only has one partition remaining in its access list.

  Note that the status of the logical partitions defined in the CHPID access list is not used to determine whether a last timing link condition exists. STP messages will flow on any coupling link if CHPIDs at both ends of the link are online, regardless of whether the logical partition that the CHPIDs are defined to is active.

In the example configuration displayed in Figure 7-5, the PCHIDs are shown in such a way so that the reader can relate the STP Status information shown in this section to the CTN topology. In this example, the coupling link between the SCZP101 server and the H40 server is a potential last timing link. The coupling link between the SCZP201 server and the H40 server is also a potential last timing link.

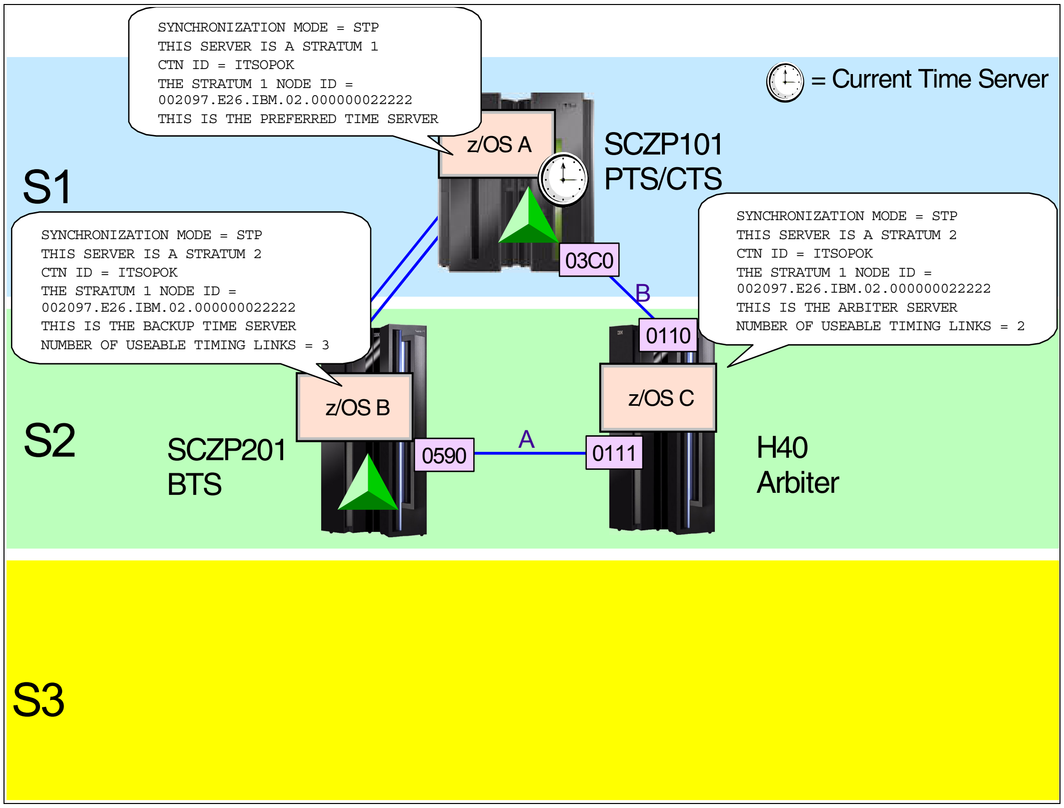


Figure 7-5 Example configuration - SCZP101, SCZP201, and H40 servers

This means that the SCZP101 and SCZP201 servers each have one potential last timing link, and whereas server H40 has two coupling links available for STP messages, each one can raise a last timing link condition because each of these links is the last link that is being used to deliver STP timing between two servers.

When a last timing link condition is detected, any attempt to remove the channel path from a z/OS image at either end of the link using the z/OS command CONFIG CHP(xx),OFF is rejected. In the example shown in Figure 7-5, an attempt to configure off from z/OS image z/OS C on H40 results in message IEE148I:

```
IEE148I CHP(xx) NOT RECONFIGURED - WOULD REMOVE A CPC-CRITICAL STP TIMING LINK
```

The CONFIG OFF request is also rejected if the FORCE option is specified on the z/OS or CFCC command.

When a last timing link condition exists, the configuration change must be completed on the HMC or Support Element. Also, a new confirmation message has been added to the configure Channel Path On/Off task to reflect this.

To demonstrate the last timing link safeguards, the following example steps through the process of configuring off a CHPID mapped on PCHID 0110 of H40. Figure 7-5 on page 249 shows the configuration.

1. From the HMC application, select the server H40, then from the task list select **Recovery** → **Single Object Operations** to access the Support Element Workplace.
2. On the Support Element Workplace, expand **System Management** and the appropriate server and click **Channels** to open the Channels Work Area where the PCHID can be selected. Then choose **CHPID Operations** → **Configure On/Off** from the task list.

   In our example, access the Channels Work area for H40 and select **PCHID 0110.** This is the PCHID between SCZP101 and H40 in our configuration.
3. The Configure Channel Path On/Off window displays the list of CHPIDs associated with the PCHID. In the example shown in Figure 7-6, PCHID 0110 has decades CHPIDs shared across logical partitions.

   Only one CHPID remains online, for logical partition T13A01. Notice that a `Not Allowed` message displays. The last timing link condition does exist.

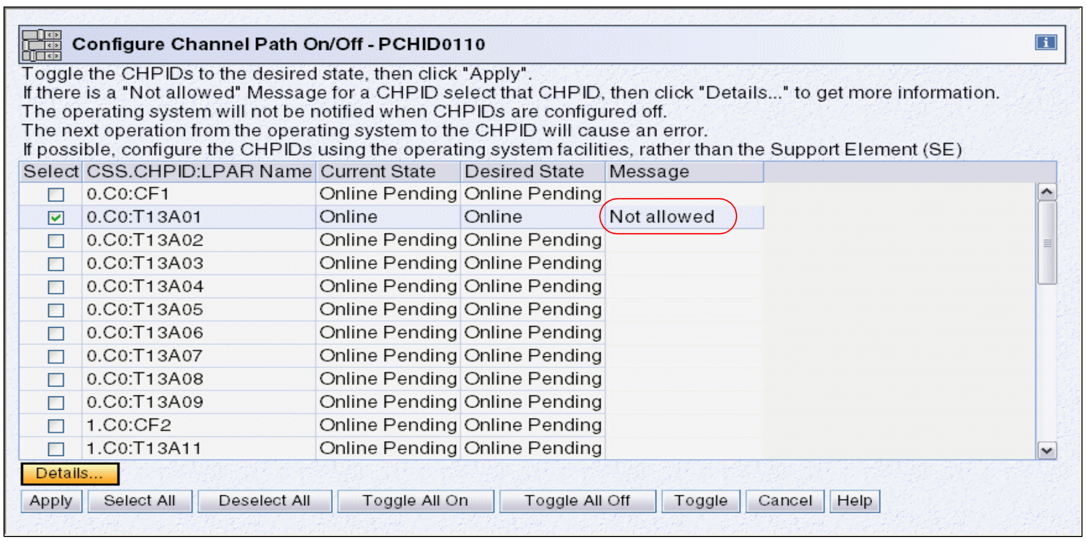


Figure 7-6 Configure Channel Path On/Off

In the CSS.CHPID:LPAR Name table, there is a `Not allowed` message for the last logical partition that has the timing link online. Click the check box for the partition and click **Details**. Message ACT20042 displays, which indicates the last timing link condition (Figure 7-7).

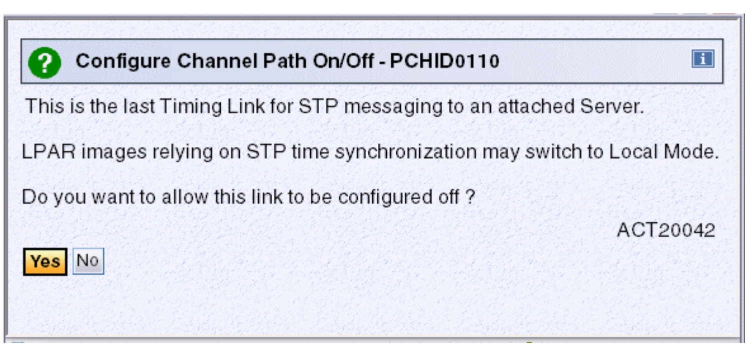


Figure 7-7 Message ACT20042 - Configure Channel Path On/Off

The message also gives the user the option to override.

4. Click **Yes** if the reconfiguration is to proceed. This removes the last timing link lock for the CHPID and returns control to the Configure Channel Path window. The Not Allowed message no longer displays in the Message column (Figure 7-8).

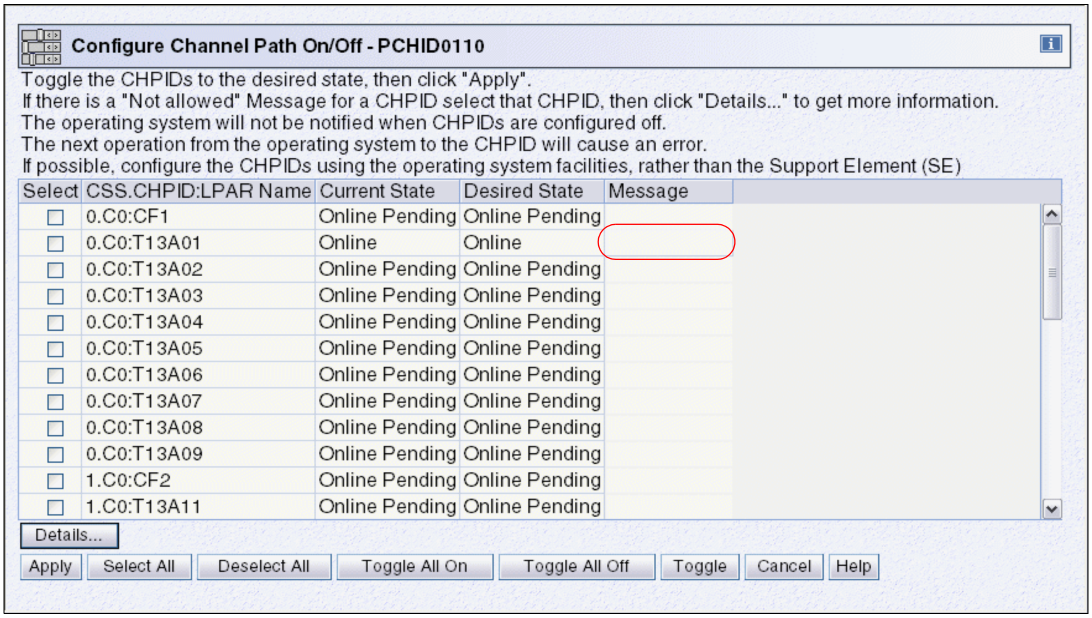


Figure 7-8 Configure Channel Path On/Off

It is now possible to proceed with the reconfiguration of the last online CHPID.

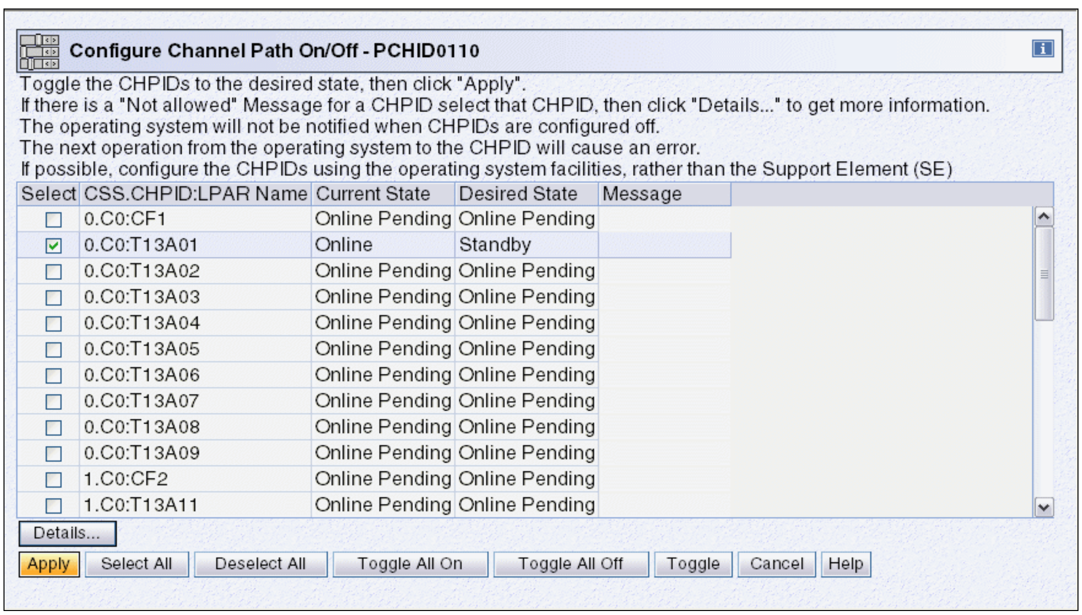


Figure 7-9 Configure Channel Path On/Off

5. Click the check box for the CHPID:LPAR name, 0.C0:T13A01, in the example. Click **Toggle** to switch the desired state to standby and click **Apply** (Figure 7-9 on page 251). Now that the last timing link security has been removed, the CHPID reconfiguration continues normally. The Configure Channel Path On/Off Progress window displays the completion of the operation (Figure 7-10).

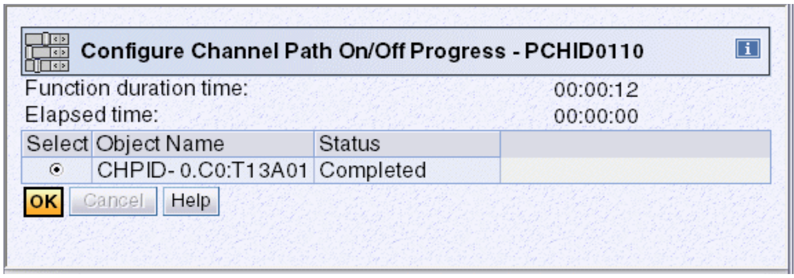


Figure 7-10 Configure Channel Path On/Off progress

When the removal of the last CHPID is complete, all traffic on the coupling link is stopped. The Channels Work Area on the server reflects the fact the PCHID is now in standby because all its CHPIDs are now configured off. See PCHID 0110 in Figure 7-11.

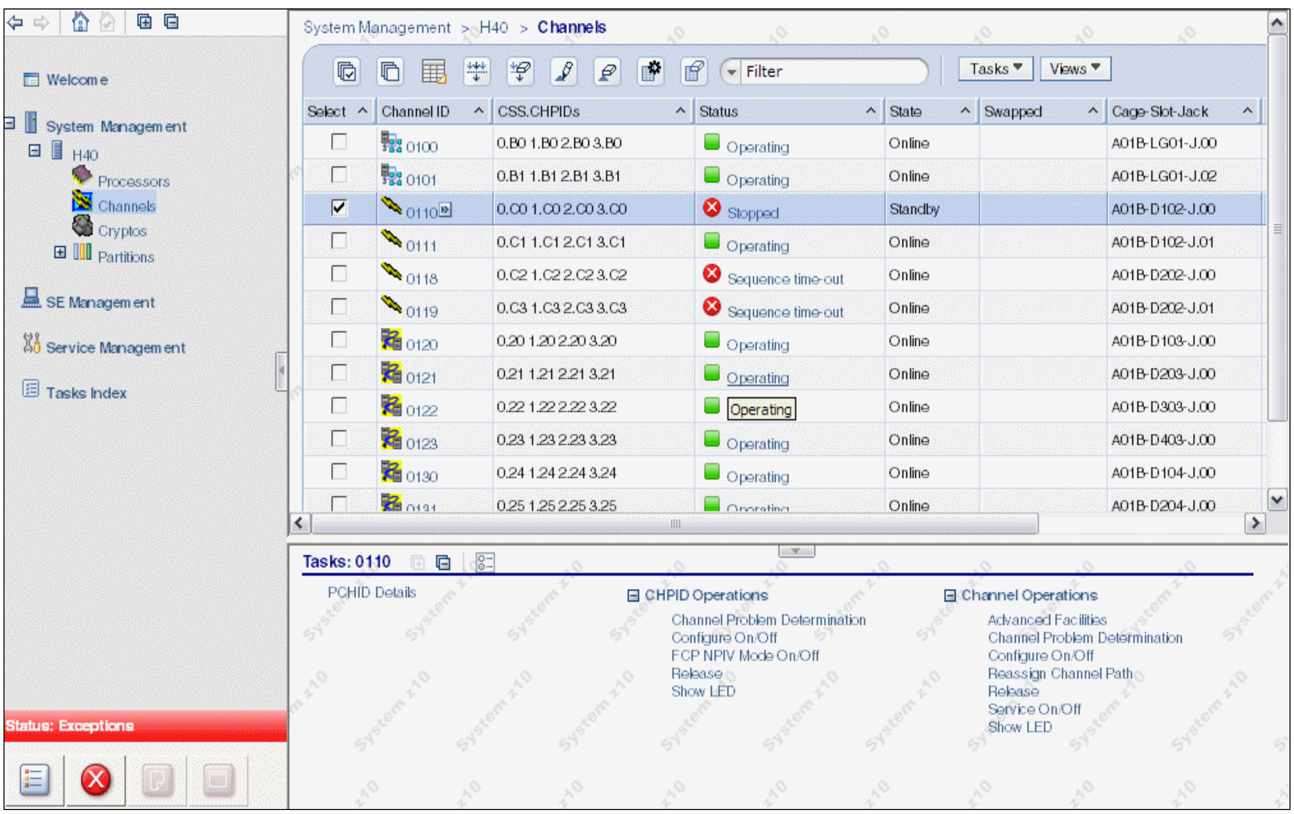


Figure 7-11 Channels Work Area: H40

The CHPID configuration change is reflected on the physical channel at the other end of the link. On SCZP101, although still online, PCHID 03C0 now reports an error condition, such as Loss of synchronization (Figure 7-12).

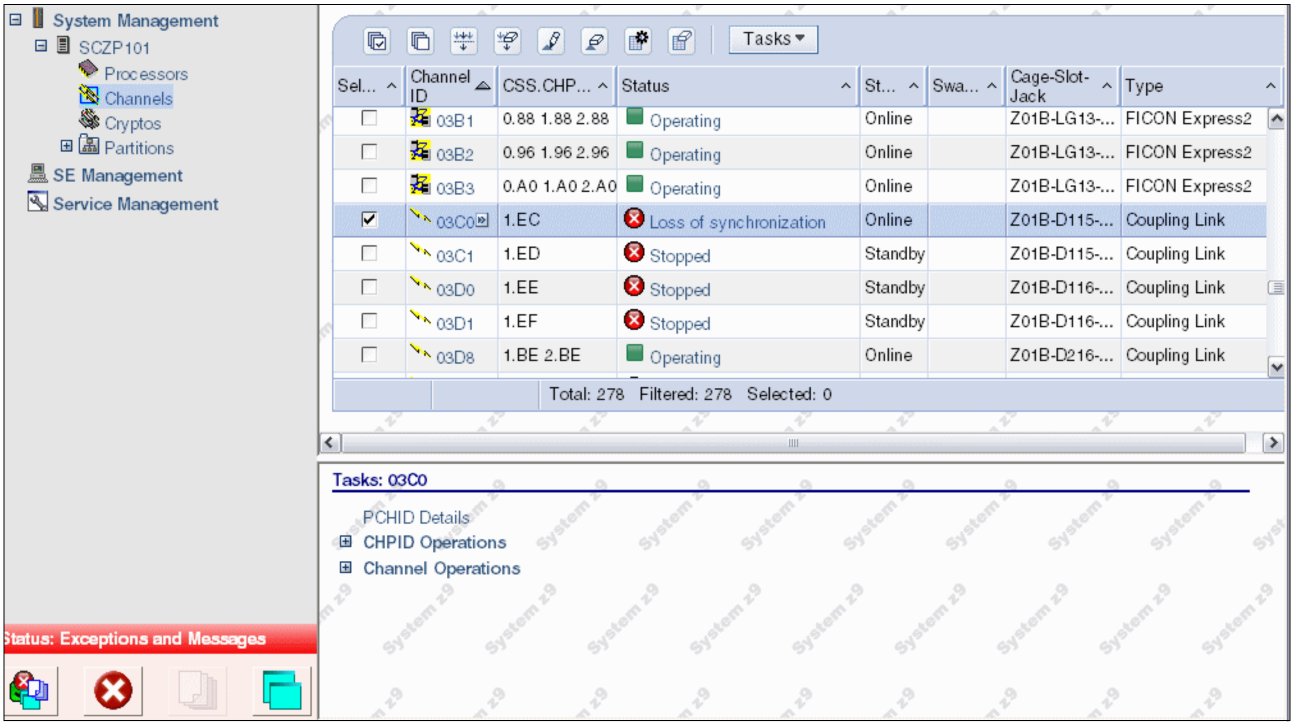


Figure 7-12 Channels Work Area - SCZP101

The same information is also reflected in the STP Status tab on each server. Figure 7-13 shows the STP Status information for server H40. Notice that PCHID 0110 has now been moved to the Local Uninitialized Link section and the uninitialized reason code indicates `Offline`.

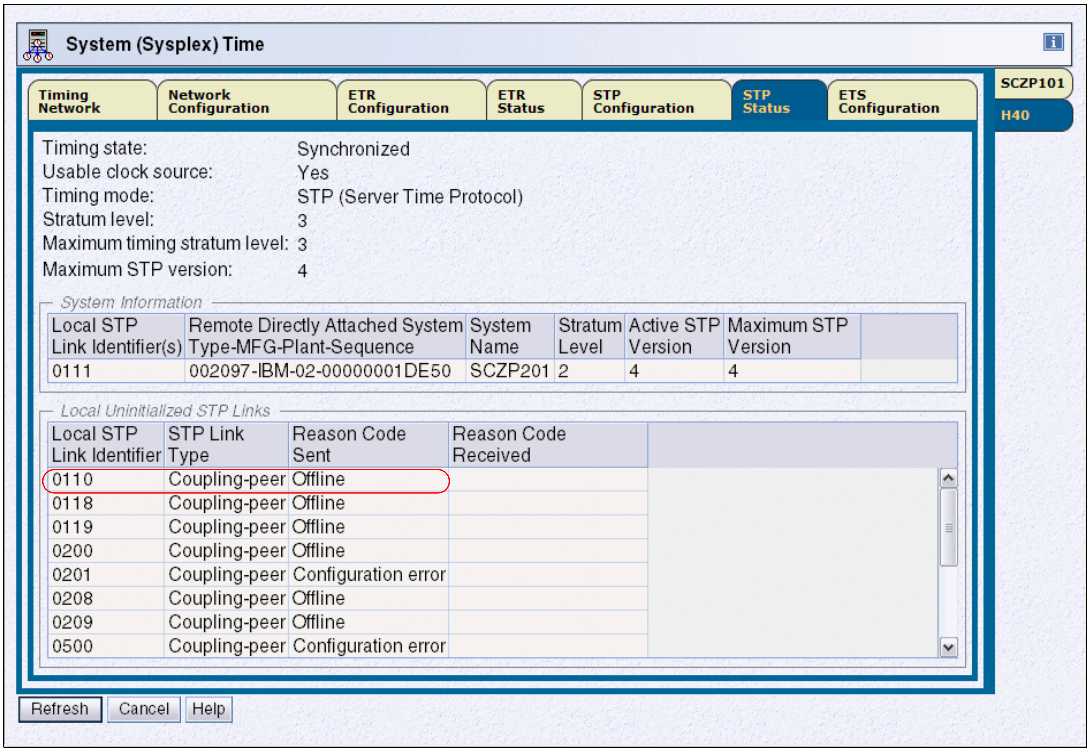


Figure 7-13 STP Status tab - H40

At the other end of the link, on SCZP101, the STP Status tab shows that PCHID 03C0 has also been moved to the Local Uninitialized Link section with a reason code that indicates link failure (Figure 7-14).

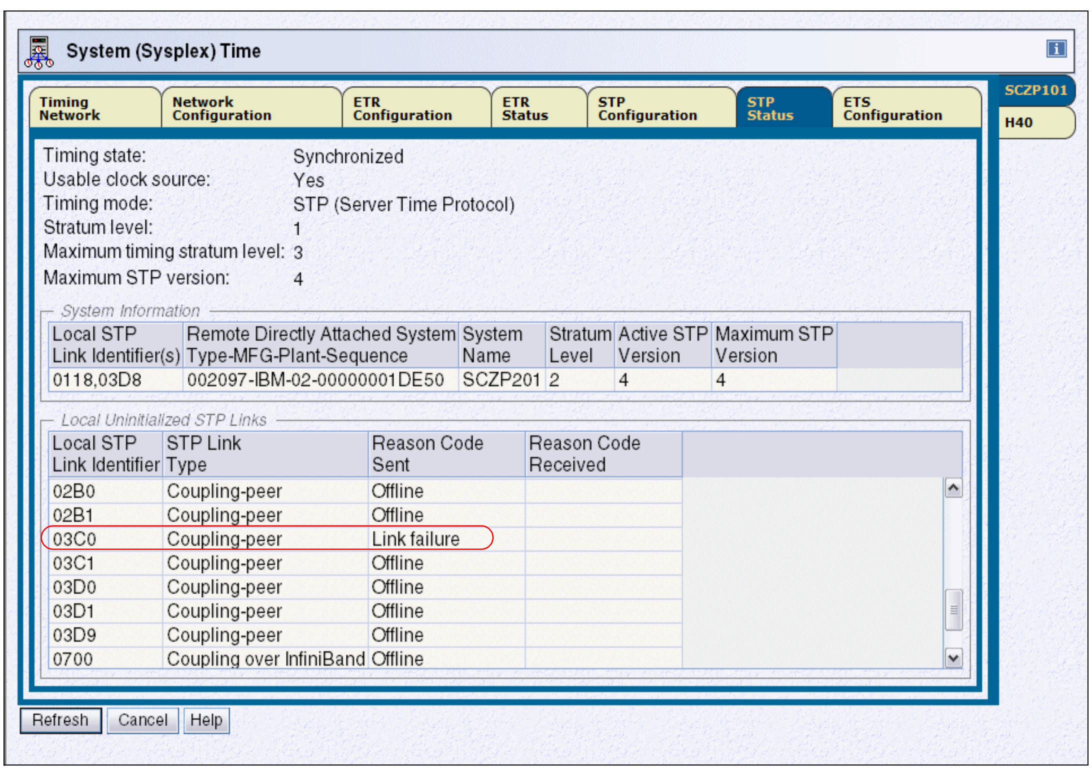


Figure 7-14 STP Status tab - SCZP101

Figure 7-15 shows the resulting configuration. Figure 7-15 also shows the output of a DISPLAY ETR command from a z/OS image on each server, following the CHPID reconfiguration.

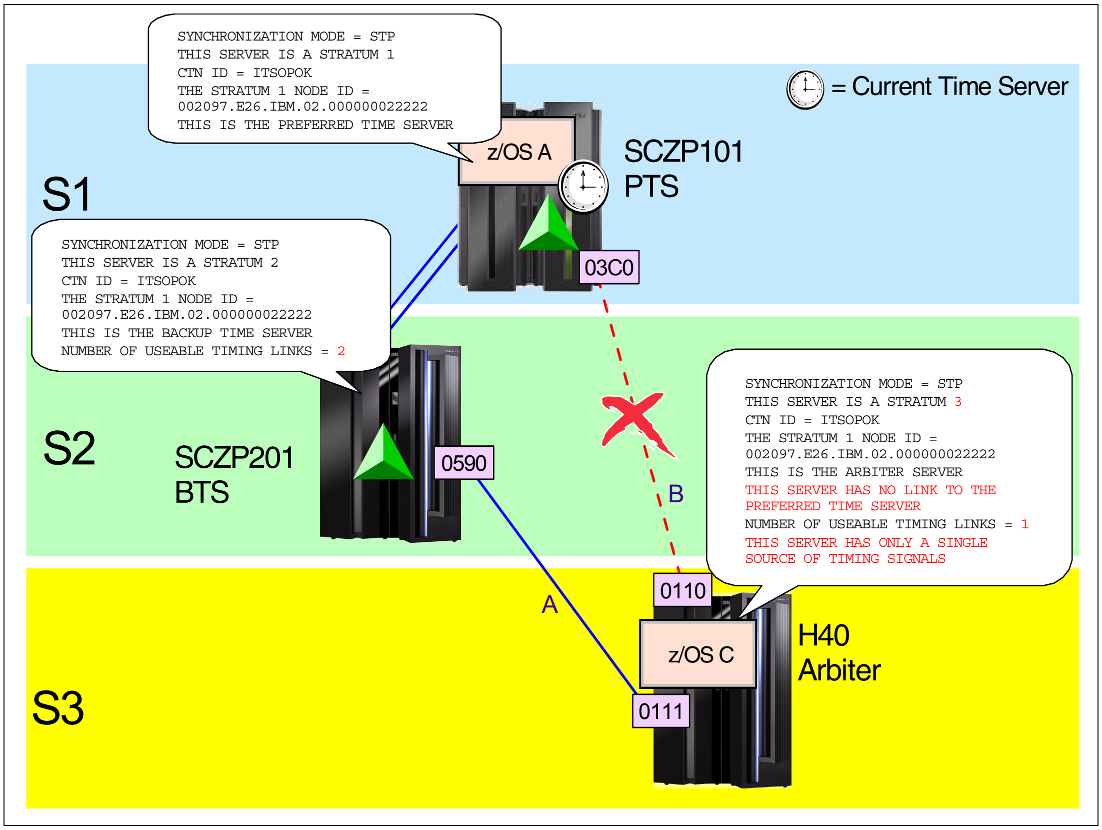


Figure 7-15 Example configuration - After removal of one link

In the example described above, there was no hard consequence because STP automatically adjusted to use alternate links. However, H40 is now a Stratum 3 and has only one single source and one single link remaining to receive STP messages, resulting in a configuration containing a single point of failure (SPOF). An IEA382I message is posted to indicate the SPOF:

```
IEA382I THIS SERVER HAS ONLY A SINGLE LINK AVAILABLE FOR TIMING PURPOSES.
```

The decision to reply yes to message ACT20042 and pursue a reconfiguration must be reviewed carefully. To assess the consequences of forcing a CHPID reconfiguration in a last timing link scenario requires the user to understand the CTN topology at that precise moment in time. Unfortunately, the CTN topology is not something readily available in one single place in the system. It has to be reconstructed from various HMC and z/OS sources.

STP messages flow from one server to another but are not directed to any logical partition. As a consequence, STP messaging requires the CHPIDs to be online at both ends of the link, but does not require any logical partition in the CHPID access list to be activated. A CF link is available for STP messaging as long as one CHPID is online to any logical partitions in its access list, whether the partition is activated or not.

Remember also that when a CHPID is configured OFF to an inactive logical partition, the effect is immediate. However, when it is configured ON to an inactive logical partition, the LPAR will queue the request and the CHPID will only be brought online the next time that the logical partition is activated.

The primary source of information for operations is z/OS messages. However, z/OS messages give no information about the last timing link condition because a DISPLAY ETR command on a z/OS system image has no visibility to CHPIDs defined to partitions other than its own.

The output of the z/OS DISPLAY ETR command identifies coupling links (PCHIDs), and only as viewed from the z/OS system image. Note that the number of usable timing links is only displayed for a Stratum 2 or a Stratum 3 server that is hosting the z/OS image. The z/OS image on the Stratum 1 server does not show the number of usable timing links because the server does not rely on external STP links. For a Stratum 2 or Stratum 3 server, only STP *initialized* links to a Stratum 1 or a Stratum 2 are included in the number of usable timing links.

- z/OS counts physical links (PCHIDs).
  - In the configuration shown in Figure 7-5 on page 249, on H40, the DISPLAY ETR command output on the z/OS image identifies no single point of failure:

    ```
    NUMBER OF USABLE TIMING LINKS =  2
    ```

    However, links 0590 to 0111 and 03C0 to 0110 might raise a last timing link condition if one online CHPID only remains mapped to the PCHID on each server.
  - In Figure 7-15 on page 255 on H40, the DISPLAY ETR information about the Z/OS image identifies a single point of failure:

    ```
    NUMBER OF USABLE TIMING LINKS =  1
    THIS SERVER HAS ONLY A SINGLE SOURCE OF TIMING SIGNALS
    ```

    The user needs to go to the STP Status tabs to map the link to PCHID 0590 to 0111. Again, this does not automatically imply a last timing link condition on H40 (or at the other end of the link, on SCZP201), because the last timing link condition depends on the contents of the CHPID access list.
- The DISPLAY ETR command output provides information only for PCHIDs that are input to the server hosting the z/OS image. It does not consider coupling links to dependent systems. For example, in the configuration shown in Figure 7-15 on page 255:
  - On SCZP101, which has the Current Time Server role, the *number of usable timing links* is not indicated. Because the CTS owns the Current Server Time and does not rely on external links, links are not considered a single point of failure for images on the server.
  - On SCZP201, the *number of usable timing links* at this point in time is now two, because z/OS only counts the number of PCHIDs from its host server to the Current Time Server, SCZP101.

    Notice the difference with the configuration in Figure 7-5 on page 249. Prior to the reconfiguration, the z/OS image running on SCZP201 recognized three usable timing links (PCHIDs) because at the time, H40 had connectivity to the Current Time Server and was a possible source of STP timing messages.
- The DISPLAY ETR information is not available for dedicated coupling facilities, because the CFCC has no DISPLAY ETR equivalent.

A CTN configuration diagram with PCHID and CHPID information is a useful starting point. It can be created manually or be derived from HCD or HCM if the installation uses a single IODF. However, given the real-life constraints of any IT installation, a diagram might not always reflect the status of the CHPID access lists at that precise moment in time.

Before attempting to override a last timing link condition, review and understand the DISPLAY ETR command output from z/OS system images on each server, and check the STP connectivity information using both the STP Status windows and the CHPID access list information from the Configure Channel Path On/Off windows.

7.4 Restarting a CTN after a site power outage or CTS power-on reset

A fundamental aspect of STP algorithms is to monitor the STP links and the state of the attached servers (preferred, backup, and Arbiter) and to make decisions based on the states of those entities.

An STP-configured server that is being powered on is unable to do that and must rely on information from other servers, if they exist. An individual server that is powered up does not know, when it returns, whether the entire data center has been shut down, whether there has been a physical or logical reconfiguration during the shutdown, whether the user might *not* want to reinstate the previous CTN, and so on.

As a consequence, an STP-only CTN is deconfigured in case of a power outage that affects all servers in the CTN. This can happen in the case of a site power outage, or even in a multisite configuration if the loss of power is caused by a failure in the regional or national electric grid.

The CTN may also be deconfigured for a single server CTN when a power-on reset or other disruptive action is made. Disruptive actions are not blocked on a single server CTN.

The server roles therefore need to be reassigned after these actions:

- The CTS in a single server CTN has been power-on reset or has gone through a power-off, power-on sequence and has not been specified to be the only member of the CTN.
- The PTS and BTS in a dual-server CTN have been power-on reset or have gone through a power-off, power-on sequence and have not been specified to be the only servers of the CTN.

> **Note:** If a single server CTN or a dual-server CTN is specified to be the only members of the CTN, it saves its time and configuration information across power-on reset and power outage scenarios. Otherwise, a single server CTN or a dual-server CTN still needs to go through the procedures outlined below.
>
> For planning information, see “Activating the STP-only CTN” in 3.2.2 “Configuring an STP-only CTN” of the *Server Time Protocol Planning Guide*, SG24-7280.

- Any STP-only CTN is deconfigured intentionally by the user.
- The PTS and the BTS, if assigned, experience a power outage (for example, a data center power outage).

When the site power is restored, the CTN remains deconfigured, with all participating servers being Stratum 0. The Network Configuration tab shows that the PTS, BTS, and Arbiter are not configured (Figure 7-16). Servers rely on explicit instructions from the console to reestablish a new time source and reconfigure the CTN. This is a change from the restart procedures used in a similar situation when using a Sysplex Timer configuration. Operating procedures must be modified accordingly.

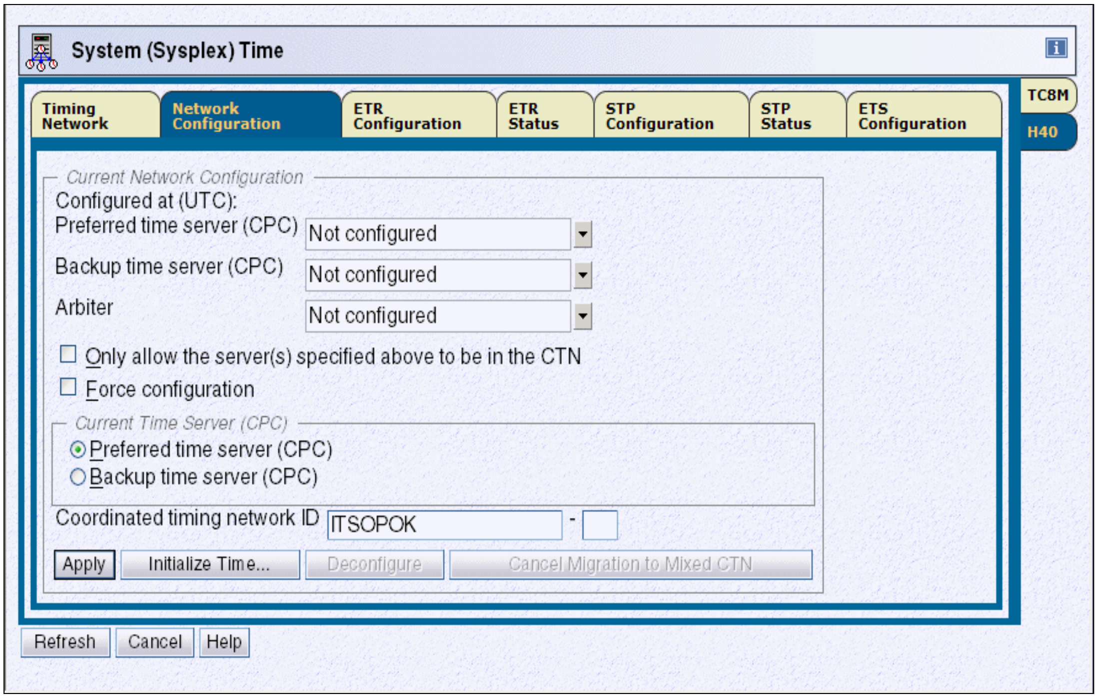


Figure 7-16 HMC workplace - System (Sysplex) Time Network Configuration

The sequence to restart an STP-only CTN is:

1. Set the time zone offset, leap seconds, and date and time.
2. Assign the CTN roles.

7.4.1 Initializing the time

The Initialize Time button is accessed from the Network Configuration tab (Figure 7-16 on page 258). The Initialize Time button becomes enabled when the CTN is deconfigured as a result of a site power failure or power-on reset of a single CEC CTN.

Clicking **Initialize Time** displays the Initialize Time window (Figure 7-17). The three tasks related to initializing the time are listed here:

- Set leap seconds.
- Set time zone.
- Set date and time.

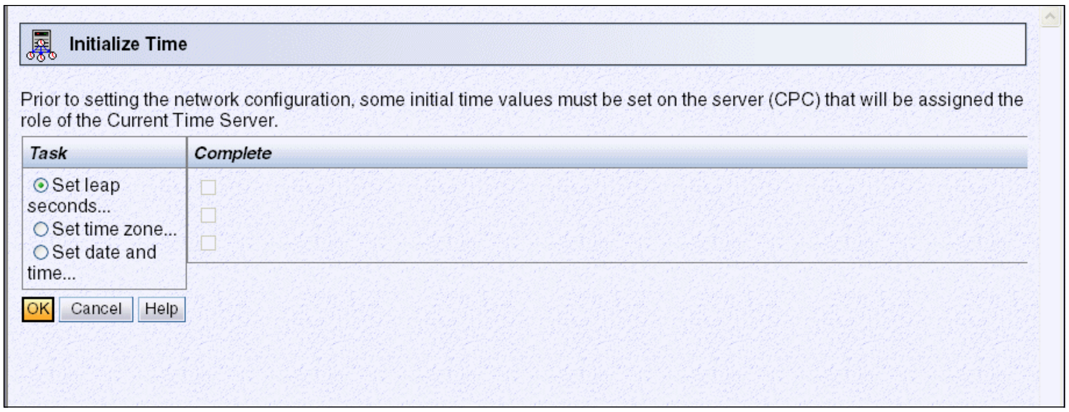


Figure 7-17 HMC workplace - Initialize Time

Set leap seconds and Set time zone are described in “Initialize time: Set leap seconds” on page 182 and “Initialize time: Set time zone” on page 183.

The final task is to initialize the date and time using the **Set date and time** button. The task is detailed in “Initialize Time: Set date and time” on page 186.

Following a power outage or power-on reset of the CTS, the date and time can be set, depending on the following items:

- If the ETS is configured and is already available at the time of the recovery, the preferred method is to use the Use External Time Source option.
- For customers who do *not* have an ETS, select **Modify time by delta to set date and time** and enter a delta value of zero (Figure 7-18).

STP uses the date and time from the server Support Element to calculate the Coordinated Server Time and set the server time of day (TOD) clock when you click **OK**.

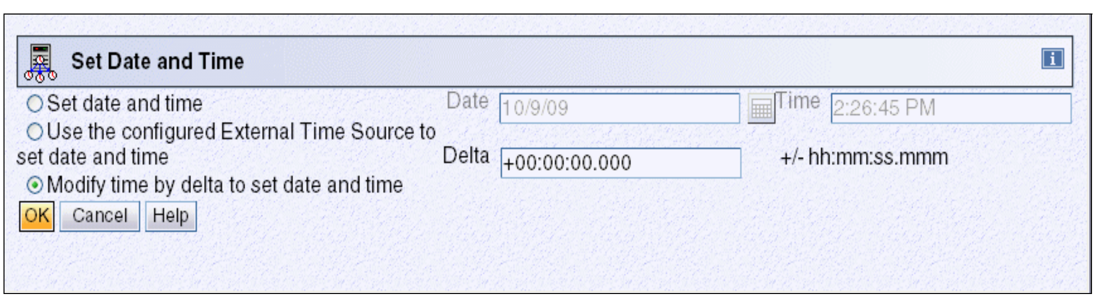


Figure 7-18 Set Date and Time

When all three tasks on the Initialize Time window have a check mark in the Complete column, the user needs to click **Cancel** to exit the Initialize Time task (Figure 7-19).

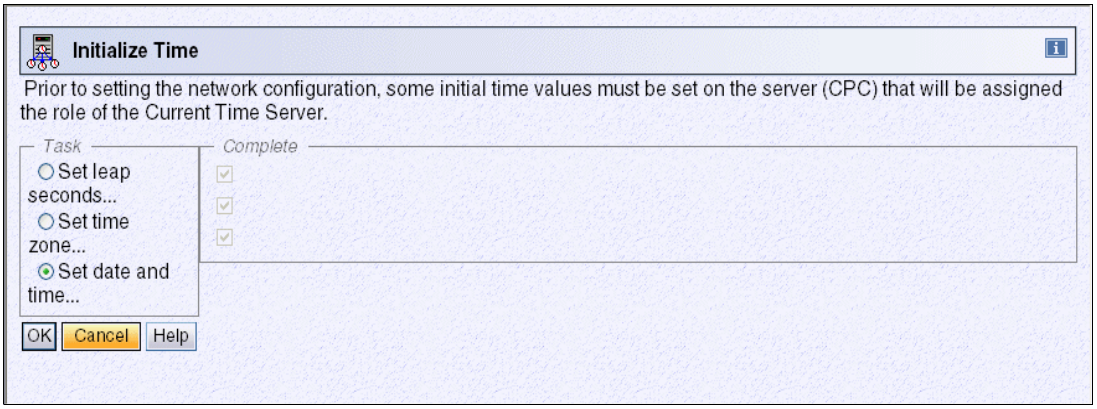


Figure 7-19 Initialize Time

7.4.2 Assigning the CTN roles

After the Initialize Time task has been completed, the Apply button on the Network Configuration tab becomes enabled. The server roles must be assigned. Under normal circumstances, perform this in two distinct steps. However, following a site power outage, it might be convenient to force the configuration in one step, because not all servers might be in a POR-complete state.

The CTN roles are assigned from the Network Configuration tab. The task must be done from the server that will become the Current Time Server. Take these steps:

1. Assign the PTS role.
2. Assign the BTS, applicable for two or more servers, and Arbiter if the CTN has three or more participating servers.
3. Assign the CTS role.
4. Click the **Force configuration** check box. This is necessary to configure a new STP-only CTN. Because this option bypasses a number of validity checks on server connectivity, it allows the configuration of servers that might not be in POR-complete state or that do not yet have coupling link connectivity to the designated CTS.
5. Click **Apply**.

For each of the Preferred Time Server (PTS), Backup Time Server (BTS), and Arbiter roles, there are drop-down boxes listing the servers currently available. Only STP-enabled servers with their Support Element visible to the HMC are selectable.

In a normal situation, when the HMC has connectivity to the server, the STP ID information (STP ID: xxxxx) is shown if there is an initialized STP link to the target server and the server participates to the same CTN. In the current recovery situation, certain server Support Elements can be visible to the HMC, but the STP ID is not available. Either the activation of this particular server is not complete, or coupling link connectivity to the CTS has not yet been reestablished.

In the example in Figure 7-20:

- H40 is selected as the PTS and CTS. The STP ID is (ITSOPOK).
- TC8M is selected as the BTS. The STP ID is (ITSOPOK).

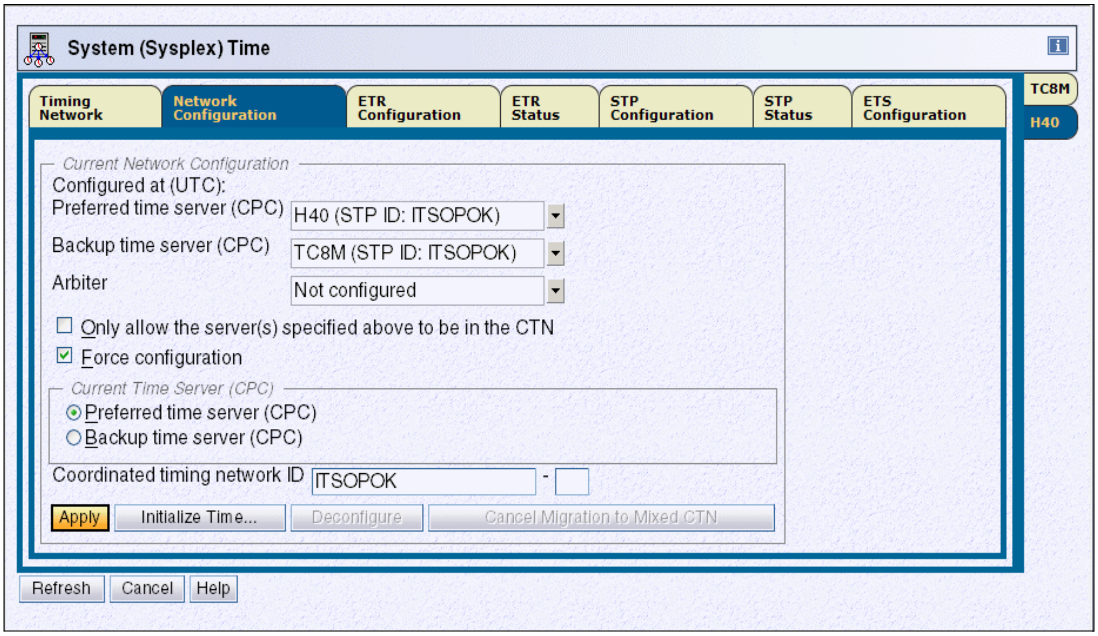


Figure 7-20 Network Configuration tab

Because the Force configuration option is checked, the Network Configuration Change Confirmation message ACT37348 displays. Click **Yes** to confirm. When the configuration is successful, message ACT37341 displays. Click **OK**.

The assignment of the CTS globally configures into the CTN all servers that meet the following conditions:

- They are already powered-on and in a POR-complete state.
- They have the same CTN ID as the CTS.
- They have coupling link connectivity to the CTS.

Other servers that are not yet in POR-complete state, or that have not yet reestablished connectivity to the CTS, automatically join the CTN and recognize their role assignments when their operating conditions return to normal. After all conditions have returned to normal, reconfigure the server roles in the CTN to the configuration that was in place before the outage.

Part 3

Migration scenarios

There are many potential implementation and migration scenarios for establishing a Mixed CTN or an STP-only CTN. The scenarios presented in this part discuss the most common situations. These scenarios are:

- ETR Network to Mixed CTN (ETR timing mode)
- Mixed CTN (ETR timing mode) to ETR Network
- Mixed CTN: Changing one server from ETR timing mode to STP timing mode
- Mixed CTN: Changing one server from STP timing mode to ETR timing mode
- Mixed CTN: Adding a server in STP timing mode
- Mixed CTN (two servers) to STP-only CTN
- Mixed CTN (three servers) to STP-only CTN
- STP-only to Mixed CTN (a.k.a "Reverse migration")

In this part each migration scenario is performed and then followed by a related scenario to return the CTN to the timing state that it had at the start of the previous migration. The scenarios involving the addition of new processors (to a Mixed CTN or to an STP-only CTN) do not have a related removal scenario, as these do not involve any changes to the existing STP environment. In addition, the successful migration endpoint of one scenario may become the starting point of the next scenario as we work our way through the chapter.

Prerequisites

All STP planning requirements have been completed. Check the *Server Time Protocol (STP) Solution Assurance Product Review (SAPR) Guide*, SA06-012, to ensure that you have a proper STP Migration checklist.

External Timer Reference (ETR)

All Sysplex Timers used in the migration scenarios have the ETR LIC installed.

STP feature installation

All servers used in each of the migration scenarios are STP capable and have been STP enabled. This implies that all prerequisite hardware tasks have been performed and that all resident z/OS images have been IPLed at z/OS V1.7 or later with maintenance.

CLOCKxx member

The CLOCKxx member used by all z/OS systems uses the defaults supplied with the z/OS maintenance, as shown in the following example:

```
OPERATOR NOPROMPT
TIMEZONE W.04.00.00
ETRMODE YES
ETRZONE YES
STPMODE YES
STPZONE YES
TIMEDELTA 10
```

Important: When two or more servers are selected in the System (Sysplex) Time task, it is necessary to click **Refresh** to update the displayed configuration information for *all* servers.

This part describes migration scenarios for a Mixed CTN or a STP-only CTN. The content in these examples must be referenced according to your own implementation requirements.

8

ETR Network to Mixed CTN (ETR timing mode)

In this scenario[1], all servers in our sample configuration are migrated from an External Timer Reference (ETR) Network to a Mixed Coordinated Timing Network (CTN) through updating the CTN ID on all servers to define the Server Time Protocol (STP) ID. In this chapter we work through the following sections:

A Mixed CTN might consist of servers in ETR timing mode only, or a combination of servers in ETR timing mode and STP timing mode. In both cases, the ETR is the time source for the CTN.

This scenario proceeds to the point that all servers have a CTN ID defined that includes both an STP ID and an ETR Network ID, but are still *in ETR timing mode*.

Migration of a server in a Mixed CTN to use STP timing mode is the subject of another migration scenario discussed in this chapter. See Chapter 10, "Mixed CTN: Changing one server from ETR timing mode to STP timing mode" on page 295.

[1] See "Prerequisites" on page 263.

8.1 Start point

The starting environment for this scenario is the ETR Network shown in Figure 8-1.

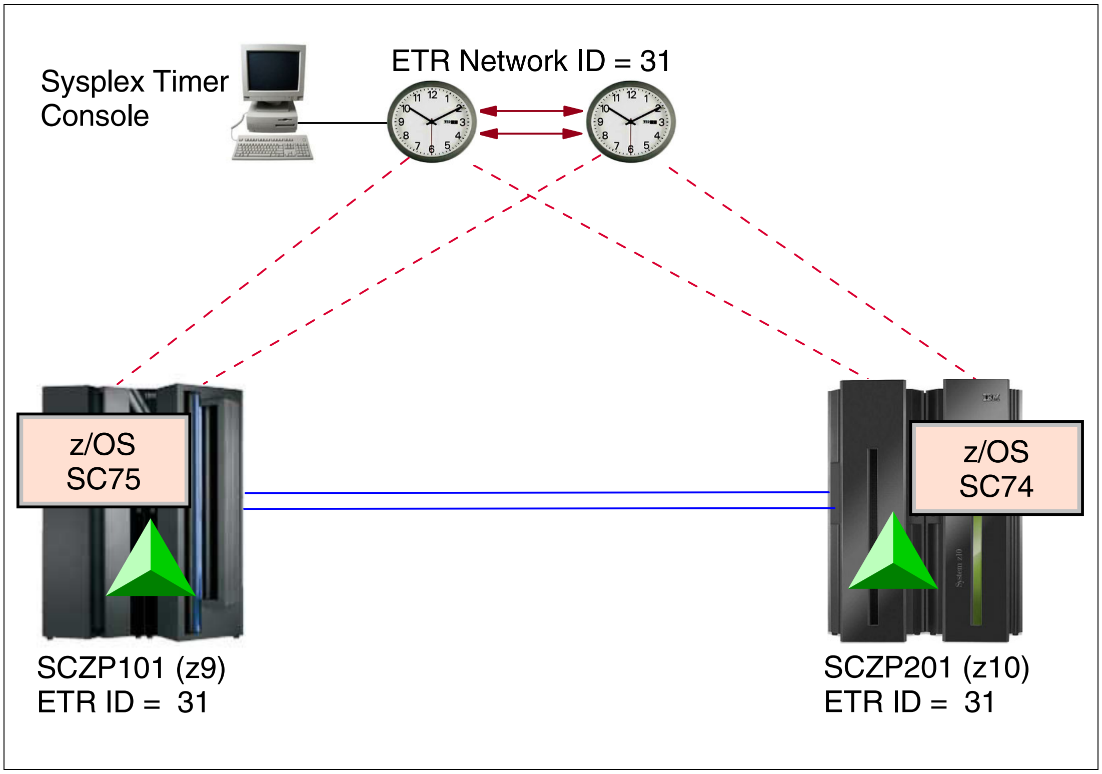


Figure 8-1 STP implementation environment - ETR network

This configuration consists of two STP-capable processors, each of which has connectivity to two Sysplex Timers in an Expanded Availability ETR configuration. Both of these servers are STP enabled. This means that all of the prerequisite tasks from the preparation and installation phases are complete. These servers are still in ETR timing mode, because the configuration and activation tasks have not been addressed.

Each server is connected to the other server in a redundant configuration using multiple coupling links, and each server has a z/OS image and a coupling facility defined. There are six coupling links between these servers, as evidenced by various Hardware Management Console (HMC) workplace displays. However, only two links are shown for clarity.

Because existing coupling links are already available, these may be used for STP timing messages. In instances where timing-only links are necessary, they must be defined using the Hardware Configuration Dialog (HCD) prior to the start of this migration.

8.1.1 z/OS DISPLAY ETR command

Figure 8-2 shows the output from the DISPLAY ETR command entered on the SC74 z/OS image, on SCZP201.

```
D ETR
IEA282I 13.12.05 TIMING STATUS 823
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=00                   ETR PORT=00
  ETR ID=00                     ETR ID=01
```

Figure 8-2 DISPLAY ETR display - SC74 image on SCZP201 ETR network

This display indicates that SC74 is using an ETR as its timing source. Server SCZP201 is connected to two Sysplex Timers in an ETR Network, which has an ETR Network ID of 31. The server ETR port that is currently being used to receive timing signals is port 0, connected to the Sysplex Timer with ETR ID of 00.

Note: There is no STP-related information shown, because this server (while *enabled* for STP) does not have an STP ID defined at this stage.

8.1.2 z/OS DISPLAY XCF command

Figure 8-3 shows the output from the DISPLAY XCF command entered on the SC74 z/OS image, on SCZP101.

```
D XCF,S,ALL
IXC335I  13.12.46  DISPLAY XCF 825
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/03/2009 13:12:46 ACTIVE         TM=ETR
SC75     2094 991E   1C   10/03/2009 13:12:42 ACTIVE         TM=ETR
```

Figure 8-3 DISPLAY XCF display - SC74 image on SCZP201 ETR network

This display shows that SC74 is a member of a sysplex that also includes image SC75, on a separate server, as evidenced by the different CPU serial number. Both SC74 and SC75 are in ETR timing mode.

8.1.3 System (Sysplex) Time tabs

After an STP-capable server or coupling facility has been STP enabled through installation of the STP feature, additional tabs become available for the server on both the Support Element and the HMC workplace.

The following tabs are available through the System (Sysplex) Time selection for each selected server and are discussed in turn to provide the starting basis for this scenario:

- Timing Network
- Network Configuration
- ETR Configuration (only shown if the server has ETR ports installed)
- ETR Status (only shown if the server has ETR ports installed)
- STP Configuration
- STP Status
- ETS Configuration

The following figures reference the detail behind the tabs in relation to an ETR Network.

Timing Network tab

Figure 8-4 shows the Timing Network tab for the SCZP201 server.

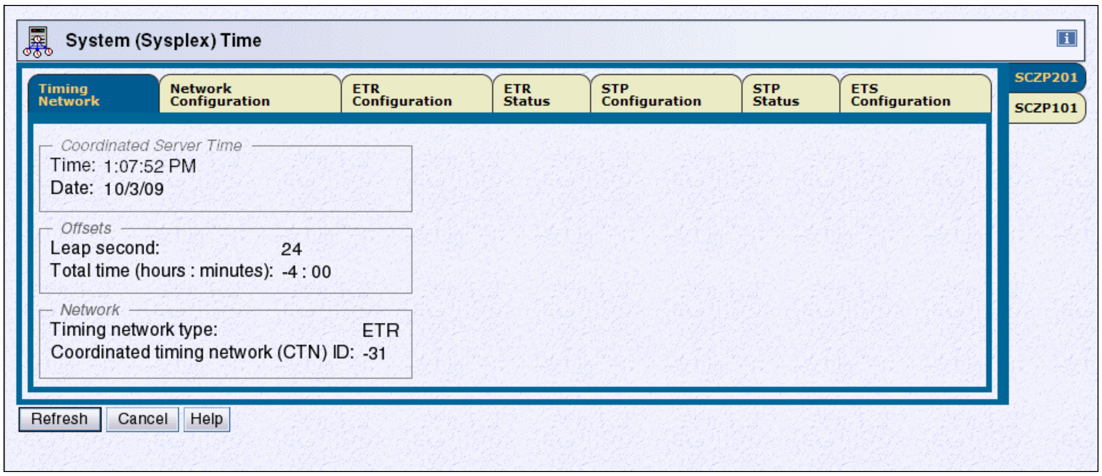


Figure 8-4 Timing Network tab (SCZP201)

The Coordinated Timing Network ID is shown on this tab as -31. From an STP point of view, this is represented as [ ] - [31], where:

- The STP ID component of the CTN ID is blank.
- The ETR Network ID component of the CTN ID is 31.

This indicates that only the ETR Network ID has been defined for the SCZP201 server.

Other fields on the Timing Network tab that are of interest include the leap second offset (set to 24) and the total time offset (set to -4). Because this server is in an ETR network, the values of these fields originate from the Sysplex Timer and are included in the timing signal from the ETR.

Network Configuration tab

Figure 8-5 shows the Network Configuration tab for the SCZP101 server.

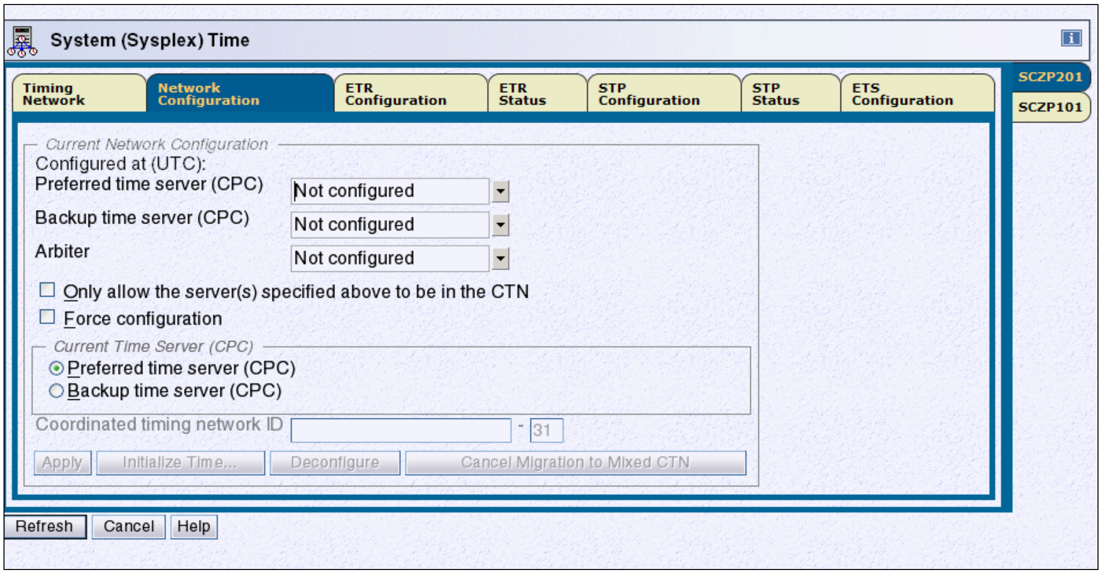


Figure 8-5 Network Configuration tab (SCZP201)

Because SCZP101 is in an ETR Network, the Preferred Time Server, Backup Time Server, and Arbiter fields are not applicable, and the Apply, Initialize Time, and Deconfigure buttons have been disabled.

The Coordinated Timing Network ID field has also been disabled. However, the contents of this field contain the current CTN ID in use by the SCZP101 server. In this case, it contains [ ] - [31], representing a blank STP ID and an ETR Network ID of 31.

ETR Configuration tab

Figure 8-6 shows the ETR Configuration tab for the SCZP101 server.

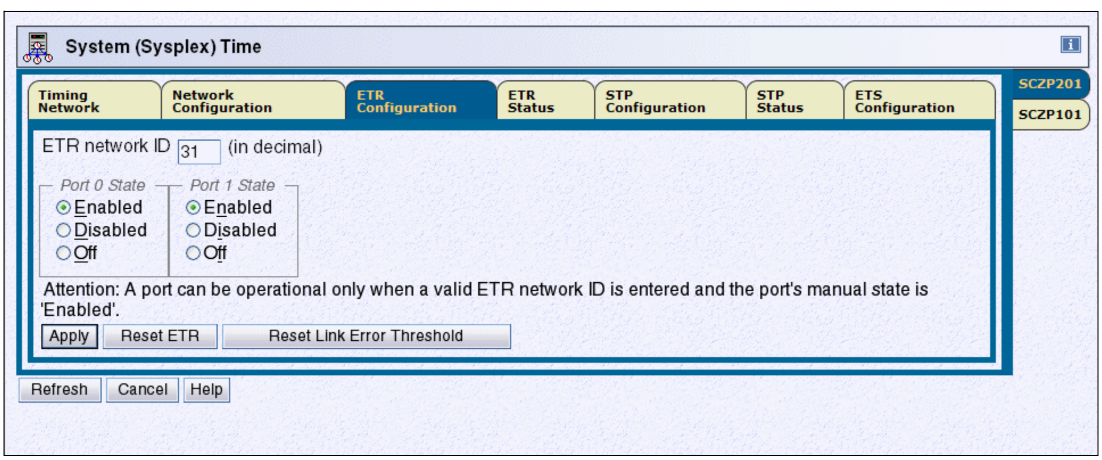


Figure 8-6 ETR Configuration tab (SCZP201)

This tab displays the current ETR Network ID of 31. It also shows the current state of the SCZP201 server ETR ports as enabled and allows these to be modified to another state if required.

Important: The ETR Network ID can be modified through the ETR Configuration tab. However, this is not necessary except in the specific circumstance where a new server is being added to an existing Mixed CTN. Changing this value to an incorrect or invalid value causes the server to lose the ability to use the connected ETR as the timing source and causes the server to enter local time of day (TOD) stepping mode. Resident z/OS images in a sysplex configuration that rely on the Sysplex Timer are impacted.

ETR Status tab

Figure 8-7 shows the ETR Status tab for the SCZP101 server.

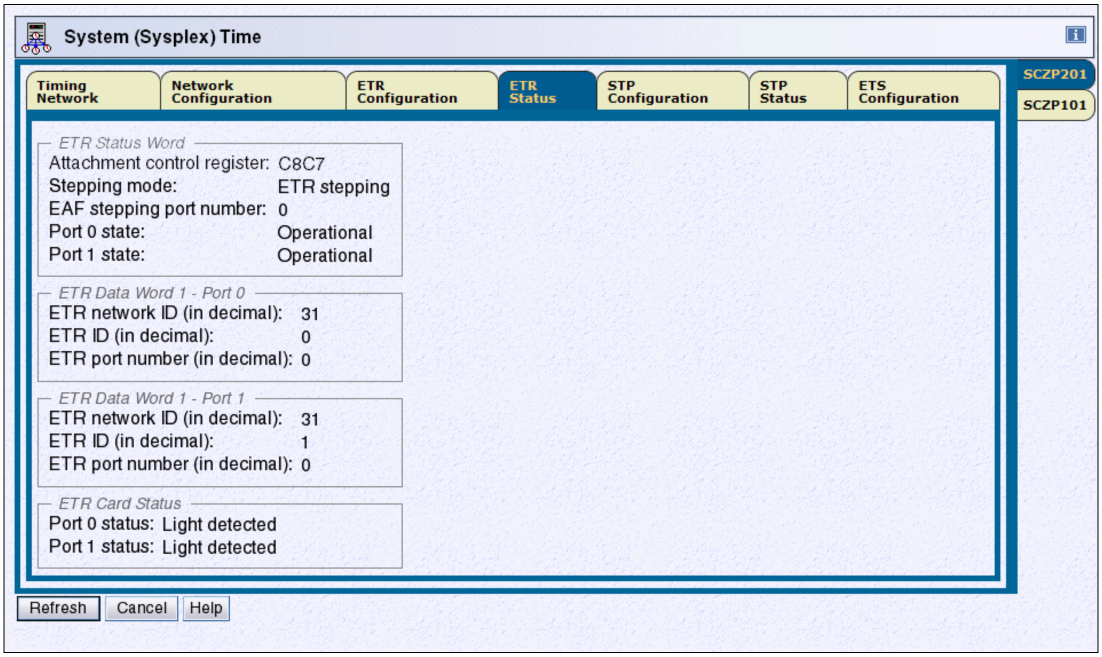


Figure 8-7 ETR Status tab (SCZP201)

This is a status display tab only, and no modifications to the configuration can be made from here. This provides ETR status information for the SCZP101 server ETR ports in line with what displays through the DISPLAY ETR command (Figure 8-2 on page 267).

STP Configuration tab

Figure 8-8 shows the STP Configuration tab for the SCZP201 server.

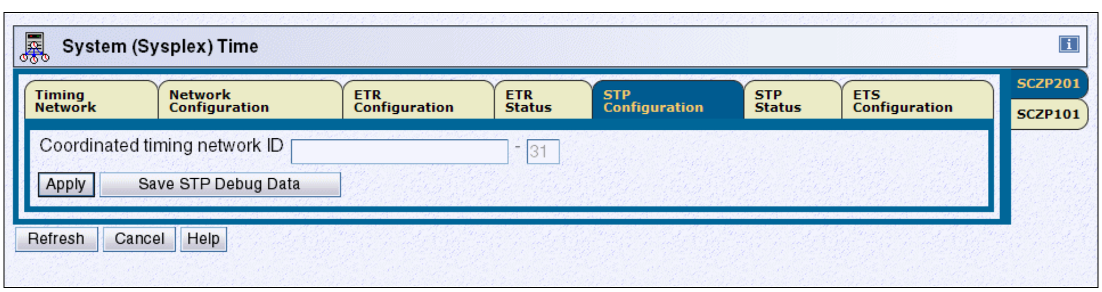


Figure 8-8 STP Configuration tab (SCZP201)

This tab is used to define the STP ID portion of the CTN ID. The ETR Network ID is also displayed. However, the field has been disabled to prevent modification.

As it currently stands, the CTN ID is defined as [ ] - [31], indicating that the SCZP201 server is in an ETR Network.

STP Status tab

Figure 8-9 shows the STP Status tab for the SCZP101 server.

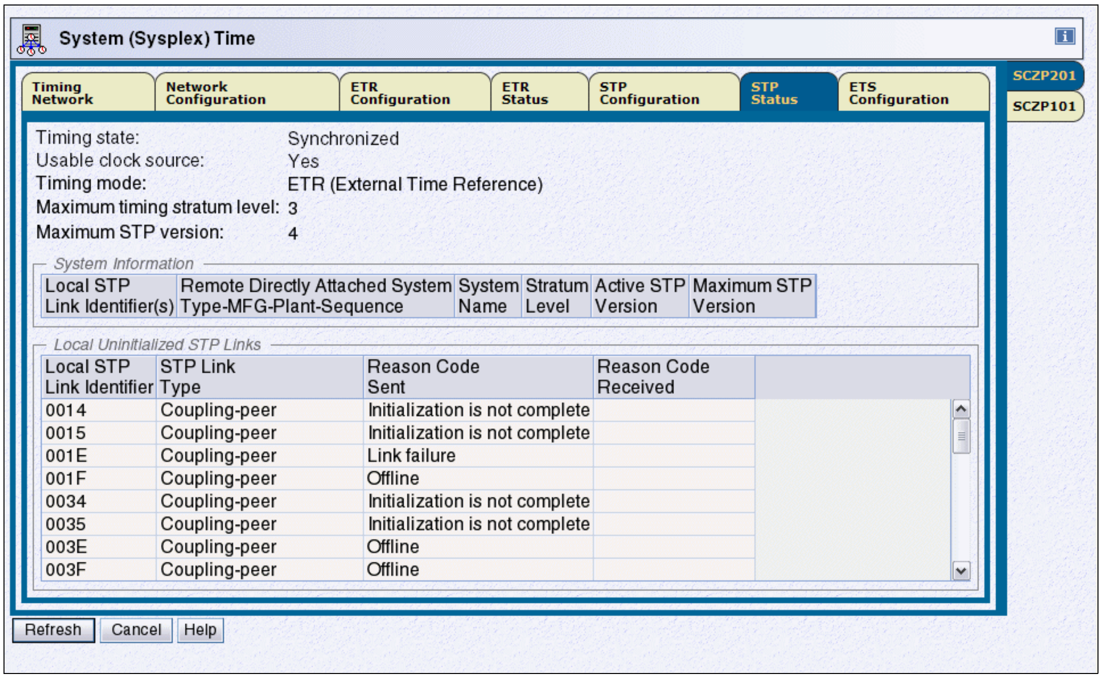


Figure 8-9 STP Status tab (SCZP201)

As shown on the ETR Status tab in Figure 8-7 on page 270, the STP Status tab contains status information only, and no modifications can be made from this location. As expected, no STP configuration details are shown, because the SCZP201 server is in ETR timing mode.

This tab displays the links defined in the IOCDS that are *eligible* for the exchange of STP messages. However, no links are initialized for STP until the STP ID is defined in the CTN ID as part of the migration to a Mixed CTN or an STP-only CTN.

Note: Each link remains in an *uninitialized* state until the servers at both ends of the link have a matching CTN ID defined that contains a valid STP ID.

ETS Configuration tab

Figure 8-9 on page 271 shows the ETS Configuration tab for the SCZP201 server.

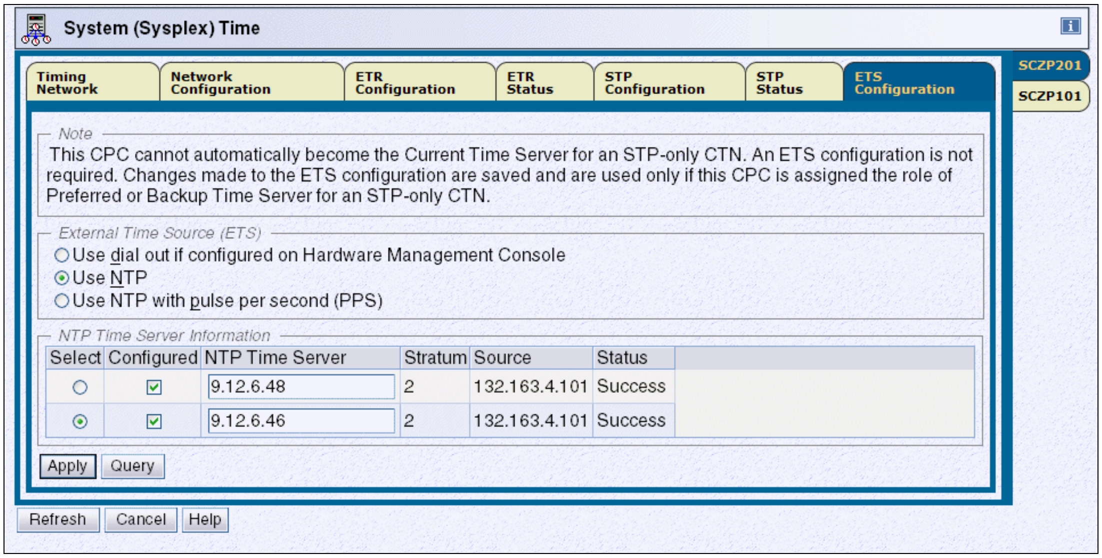


Figure 8-10 ETS Configuration tab (SCZP201)

This tab shows the configuration of the External Time Sources (ETS) that is used when the CPC is assigned the role of a Preferred or Backup Time Server for an STP-only CTN. However, we are still in an ETR network, so the entries are of no relevance at this point.

8.2 Migration

The migration from an ETR Network to a Mixed CTN requires one change per server and a stand-alone coupling facility. This change involves defining the STP ID portion of the CTN ID using the STP Configuration tab (Figure 8-8 on page 270).

For our migration, the CTN ID is set to [ITSOPOK] - [31] on both the SCZP101 server and the SCZP201 server, where ITSOPOK represents the STP ID, and 31 is the ETR Network ID that is in use by the existing ETR network.

Table 8-1 shows the before and after configuration details.

Table 8-1 Server configuration - ETR Network to Mixed CTN migration

	Server	CTN ID		Server role	Timing mode	Stratum level
		STP ID	ETR ID			
Before migration	SCZP101	Null	31	N/A	ETR	Not defined
	SCZP201	Null	31	N/A	ETR	Not defined
After migration	SCZP101	ITSOPOK	31	N/A	ETR	1
	SCZP201	ITSOPOK	31	N/A	ETR	1

8.2.1 Defining STP ID on SCZP201

At the HMC workplace, perform the following steps in order:

1. Highlight server **SCZP101** and select **System (Sysplex) Time**.
2. Click the **STP Configuration** tab.
3. Enter the required STP ID (in our case, ITSOPOK) in the Coordinated Timing Network ID fields (Figure 8-11).

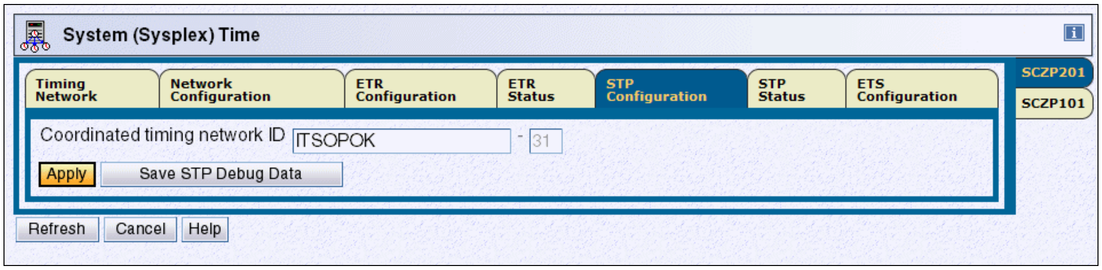


Figure 8-11 STP Configuration tab - Define STP ID (SCZP201)

4. Click **Apply**. This displays the Local Coordinated Timing Network ID Change Confirmation, message ACT37361 (Figure 8-12).

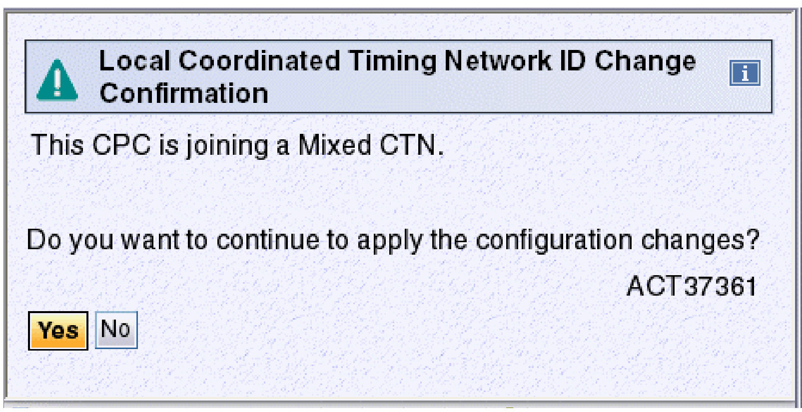


Figure 8-12 Message ACT37361 - Local Coordinated Timing Network ID Change Confirmation

Note: The word *local* is included in this window to indicate that this change only applies to the selected server. It is not a *global* change that will be propagated automatically throughout the CTN.

5. Confirm the configuration change by clicking **Yes**. This displays the Local Coordinated Timing Network ID Change, message ACT37315, indicating that the change was successful (Figure 8-13).

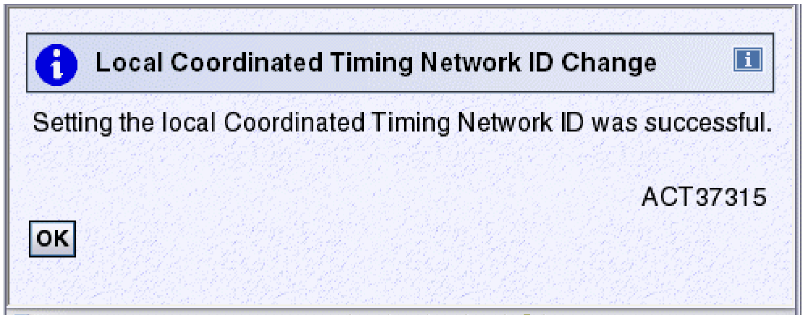


Figure 8-13 Message ACT37315 - Local Coordinated Timing Network ID Change (SCZP201)

The change to the CTN ID is also flagged by XCF with message IXC438I on the console and SYSLOG of z/OS images in a sysplex configuration resident on SCZP101 (Figure 8-14).

```
IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 842
        FOR SYSTEM: SC74
        PREVIOUS ETR NETID:   31
        CURRENT  CTNID:   ITSOPOK -31
```

Figure 8-14 SYSLOG messages - SC74 image on SCZP201 STP ID definition

This informational message confirms the success of the CTN ID change from an XCF perspective. It is only issued by z/OS images using the Sysplex Timer in a sysplex configuration.

8.2.2 Defining STP ID on SCZP101

At this stage, only one server has been switched from an ETR Network to a Mixed CTN.

This process now needs to be done for the remaining servers in the CTN using the same CTN ID of [ITSOPOK] - [31] in each case.

In our scenario, the CTN consists of one other server, so the process defined in step 1 needs to be repeated for SCZP101 only. In a large CTN, this process might need to be performed many times until all servers have the same CTN ID defined.

After this has been done for SCZP101, the migration is complete.

8.3 End point

At the completion of the scenario, the topology diagram changes to reflect the new definitions (Figure 8-15).

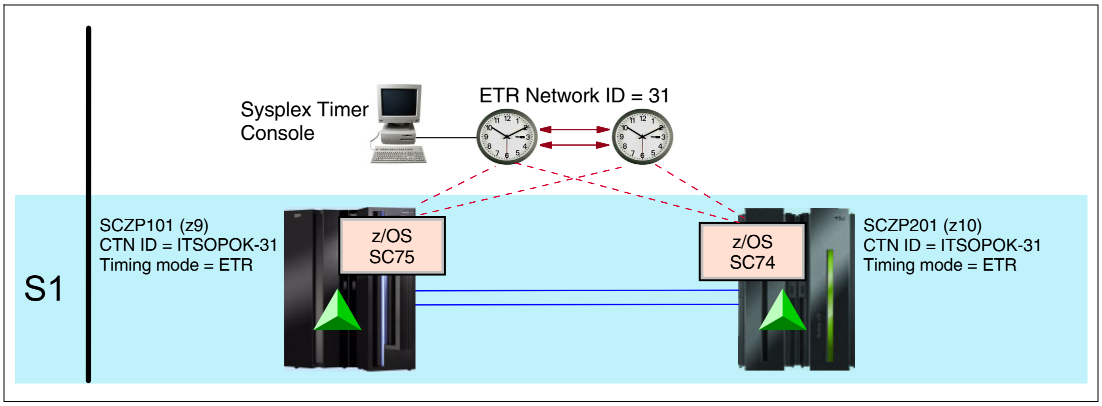


Figure 8-15 STP implementation environment - Mixed CTN with ETR timing mode only

Because the servers now have a valid STP ID defined, they are considered to be STP configured rather than STP enabled, and the CTN ID needs to be shown in full to reflect the importance of this value to the CTN.

In addition, the servers are now defined with valid Stratum levels, and these also need to be shown. Because both servers are still connected to the ETR network, they are defined as Stratum 1, as per the STP architecture specification.

It is also important to note that at this stage, STP timing messages will be flowing over the coupling links. However, the servers ignore these messages in favor of the Sysplex Timers as the selected timing source.

8.3.1 z/OS DISPLAY ETR command

Figure 8-16 shows the output from the DISPLAY ETR command entered on the SC74 z/OS image, on SCZP101.

```
D ETR
IEA282I 13.55.59 TIMING STATUS 844
SYNCHRONIZATION MODE = ETR
  CPC PORT 0    <== ACTIVE       CPC PORT 1
  OPERATIONAL                    OPERATIONAL
  ENABLED                        ENABLED
  ETR NET ID=31                  ETR NET ID=31
  ETR PORT=00                    ETR PORT=00
  ETR ID=00                      ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31     (1)
```

Figure 8-16 DISPLAY ETR display - SC74 image on SCZP201 Mixed CTN

Note that an extra line displays (see (1) in Figure 8-16) containing the CTN ID when the server is in a Mixed CTN with an STP ID defined.

All other information in the DISPLAY ETR output is the same as prior to the server change to a Mixed CTN. In particular, the timing mode (ETR) remains unchanged, indicating that the ETR is the time source for this server.

8.3.2 z/OS DISPLAY XCF command

Figure 8-17 shows the output from the z/OS DISPLAY XCF command entered on the SC74 z/OS image, on SCZP101.

```
D XCF,S,ALL
IXC335I  13.56.38  DISPLAY XCF 846
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/03/2009 13:56:38 ACTIVE         TM=ETR
SC75     2094 991E   1C   10/03/2009 13:56:36 ACTIVE         TM=ETR
```

Figure 8-17 DISPLAY XCF display - SC74 image on SCZP201 Mixed CTN

The z/OS DISPLAY XCF command output is unchanged by the migration. Whereas XCF is aware of the CTN ID change, the CTN ID is not displayed in the output of this command.

8.3.3 System (Sysplex) Time tabs

The System (Sysplex) Time tabs have also undergone minor changes as a result of the definition of an STP ID in the CTN ID.

Timing Network tab

Figure 8-18 shows that three changes occurred on the Timing Network tab.

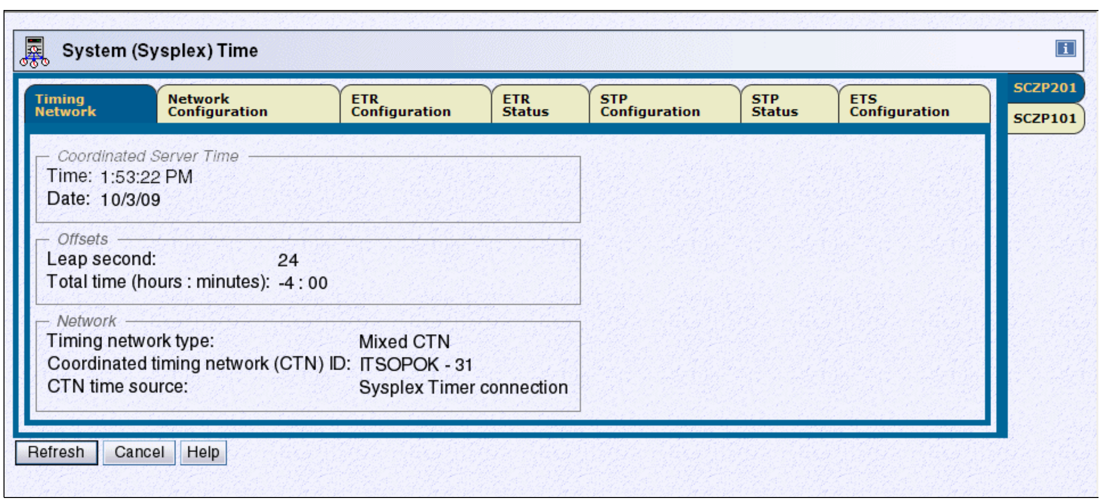


Figure 8-18 Timing Network tab (SCZP201)

The timing network type now indicates *Mixed*. The Coordinated Timing Network ID field has been updated to reflect the new CTN ID. In addition, an extra line has been added in the Network section indicating that the Sysplex Timer is the CTN time source.

Network Configuration tab

The Network Configuration tab is basically unchanged, except for the Coordinated Timing Network ID field now containing the new CTN ID that was specified during the migration.

Note: The Coordinated Timing Network ID field is disabled.

No modifications to either the STP ID or the ETR Network ID are possible from this location until this server is migrated to an STP-only CTN or joins an existing STP-only CTN.

However, the previously disabled Apply button has now been enabled, allowing a full STP conversion to proceed at this point (Figure 8-19).

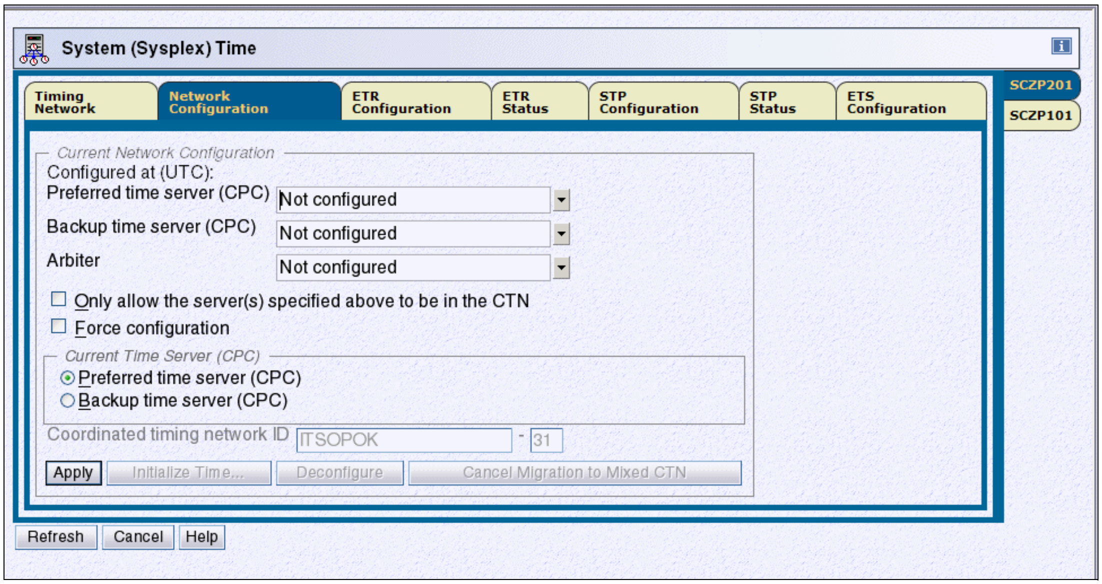


Figure 8-19 Network Configuration tab (SCZP201)

After all servers in the Mixed CTN have the same CTN ID, it is possible to transition into an STP-only CTN and remove the ETR as the time source. After the STP connectivity between servers has been verified, this is done by defining a Preferred Time Server and (optionally) a Backup Time Server and Arbiter. The server to become the Current Time Server must also be selected at this stage.

ETR Configuration and ETR Status tabs

These tabs remain unchanged, because no modifications have been performed to the ETR network or server ETR ports.

STP Configuration tab

The STP Configuration tab is much the same as when the STP ID was entered during migration (Figure 8-20).

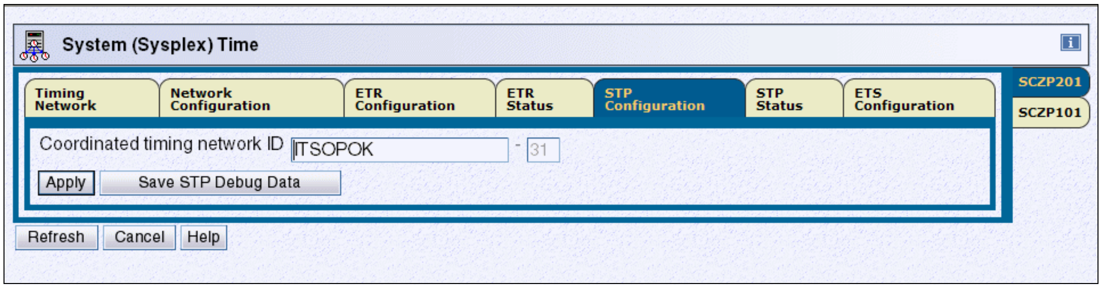


Figure 8-20 STP Configuration tab (SCZP201)

The STP ID portion of the CTN ID is *enabled*, allowing the STP ID to be removed for backout purposes or changed to another value to select a different Mixed CTN if required.

> **Note:** The ETR Network ID portion of the Coordinated Timing Network ID field is *disabled*, forcing all changes to this value to be done from the ETR Configuration tab only.

STP Status tab

The STP Status tab also has multiple changes as a result of conversion to Mixed CTN (Figure 8-21).

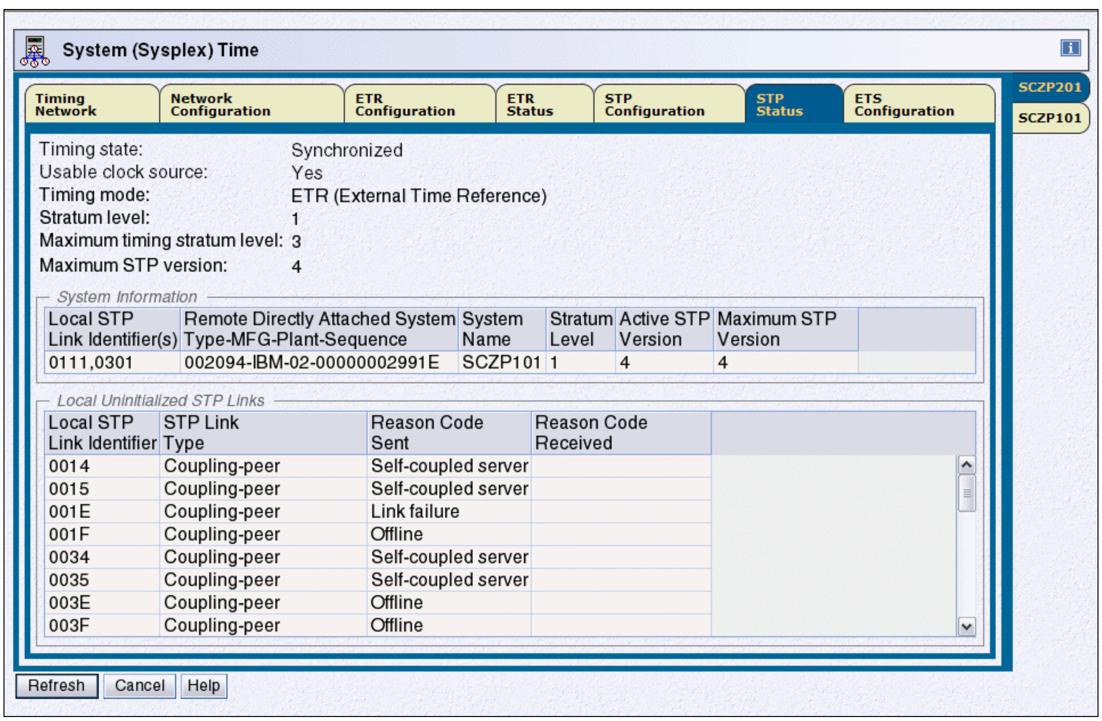


Figure 8-21 STP Status tab (SCZP201)

An extra line has been added, indicating the stratum level of the server. In our case, the SCZP201 server remains connected to the Sysplex Timer, so the stratum level must be Stratum 1, as per STP architectural requirements.

Also, the Remote Directly Attached Systems section now has an entry for the SCZP101 server, showing all the STP Link Identifiers over which STP timing messages are being passed.

Note: The equivalent display of the STP Status tab for the SCZP101 server also shows a Stratum level of 1, because SCZP101 also retains connectivity to the Sysplex Timers. However, the Remote Directly Attached Systems section displays information for the SCZP201 server and the associated STP Link Identifiers usable by SCZP101 for STP messages.

ETS Configuration tab

This tab also remains unchanged, because no modifications have been performed to the ETS configuration.

9

Mixed CTN (ETR timing mode) to ETR Network

In this scenario[1], all servers in our sample configuration are migrated from a Mixed Coordinated Timing Network (CTN) to an External Timer Reference (ETR) Network by updating the CTN ID on all servers in our Mixed CTN to remove the Server Time Protocol (STP) ID.

In this chapter we work through the following sections:

A Mixed CTN may consist of servers in ETR timing mode only or a combination of servers in ETR timing mode and STP timing mode. In both cases, the ETR is the time source for the CTN.

This scenario proceeds to the point that all servers have a CTN ID defined that includes only an ETR Network ID.

Note: At the completion of this scenario, the CTN is returned to the start point for the migration scenario described in Chapter 8, "ETR Network to Mixed CTN (ETR timing mode)" on page 265. This chapter can be considered a backout procedure for that scenario.

[1] See "Prerequisites" on page 263.

9.1 Start point

The starting environment for this scenario is a Mixed CTN with both servers operating in ETR timing mode (Figure 9-1).

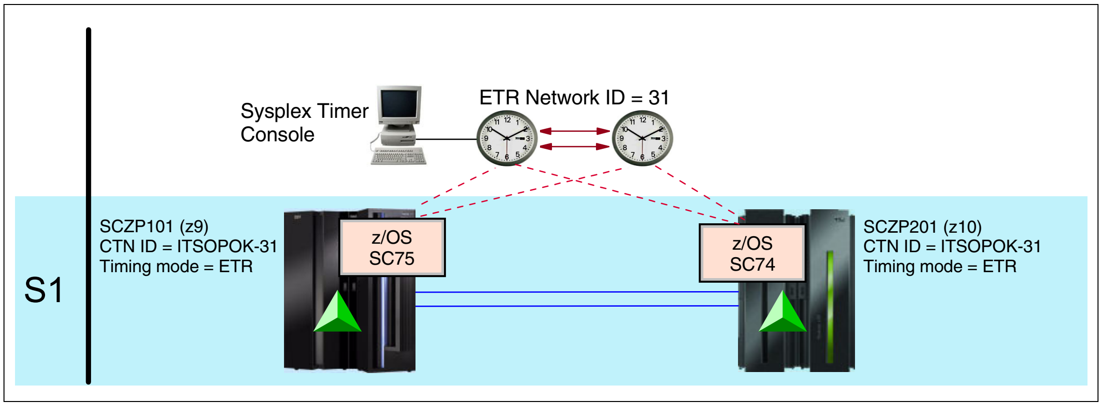


Figure 9-1 STP implementation environment - Mixed CTN with ETR timing mode only

The Mixed CTN consists of two servers:

- SCZP101
- SCZP901

Both servers are STP configured and are operating in ETR timing mode, meaning that they both have connectivity to the ETR network.

Each server is connected to the other server in a redundant configuration using multiple coupling links, and each server has a z/OS image and coupling facility defined. There are six coupling links between these servers, as evidenced by various HMC workplace displays. However, only two links have been shown for clarity.

This is the same configuration shown as the endpoint for the ETR Network to Mixed CTN scenario previously described. See Chapter 8, “ETR Network to Mixed CTN (ETR timing mode)” on page 265, for further details.

9.1.1 z/OS DISPLAY ETR command

Figure 9-2 shows the output from the DISPLAY ETR command entered on the SC74 image, on SCZP101.

```
D ETR
IEA282I 12.49.39 TIMING STATUS 816
SYNCHRONIZATION MODE = ETR
  CPC PORT 0    <== ACTIVE        CPC PORT 1
  OPERATIONAL                     OPERATIONAL
  ENABLED                         ENABLED
  ETR NET ID=31                   ETR NET ID=31
  ETR PORT=00                     ETR PORT=00
  ETR ID=00                       ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Figure 9-2 DISPLAY ETR display - SC74 image on SCZP201 Mixed CTN

This display shows that SC74 is using an ETR as its timing source. The active server ETR port is port 0, which is connected to an ETR with an ID of 00 in an ETR Network with an ID of 31. The server on which the SC74 image is resident is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31].

9.1.2 z/OS DISPLAY XCF command

Figure 9-3 shows the output from the z/OS DISPLAY XCF command output entered on the SC74 z/OS image, on SCZP101.

```
D XCF,S,ALL
IXC335I  12.51.42  DISPLAY XCF 818
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/03/2009 12:51:42 ACTIVE         TM=ETR
SC75     2094 991E   1C   10/03/2009 12:51:40 ACTIVE         TM=ETR
```

Figure 9-3 DISPLAY XCF display - SC74 image on SCZP101 Mixed CTN

This shows that both z/OS images SC74 and SC75 are operating in ETR timing mode. These z/OS images are resident on separate servers, as evidenced by the different serial numbers. However, there is no indication from this command output as to whether these servers have CTN IDs defined.

9.1.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) Time selection for each server. Only the tabs for the SCZP101 server are shown in this section.

Timing Network tab

Figure 9-4 shows the Timing Network tab for the SCZP101 server.

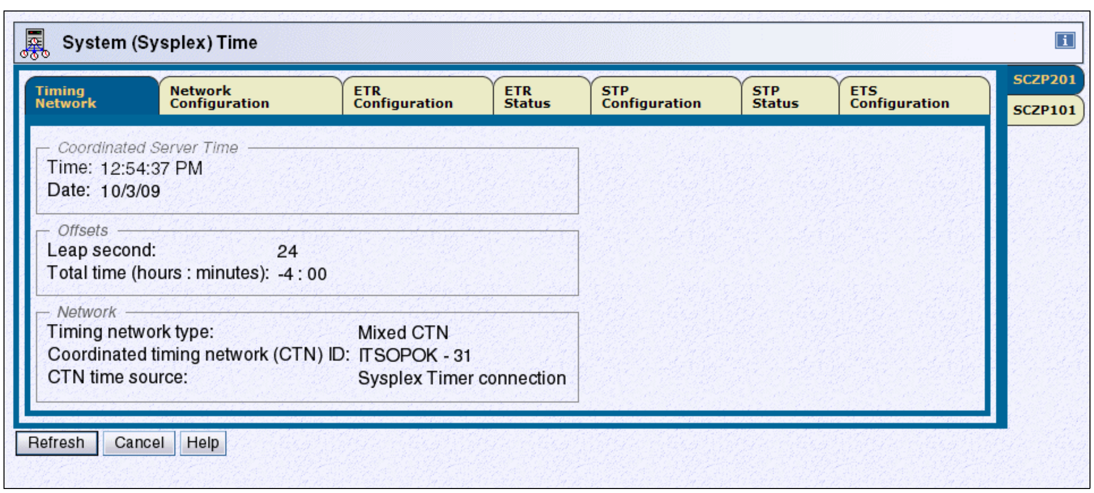


Figure 9-4 Timing Network tab (SCZP201)

This shows that the SCZP201 server is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31]. Because the ETR network is the CTN time source, the leap second offset (set to 24) and the total time offset (set to -4) originate from the Sysplex Timer as part of the timing signal.

Network Configuration tab

Figure 9-5 shows the Network Configuration tab for the SCZP201 server.

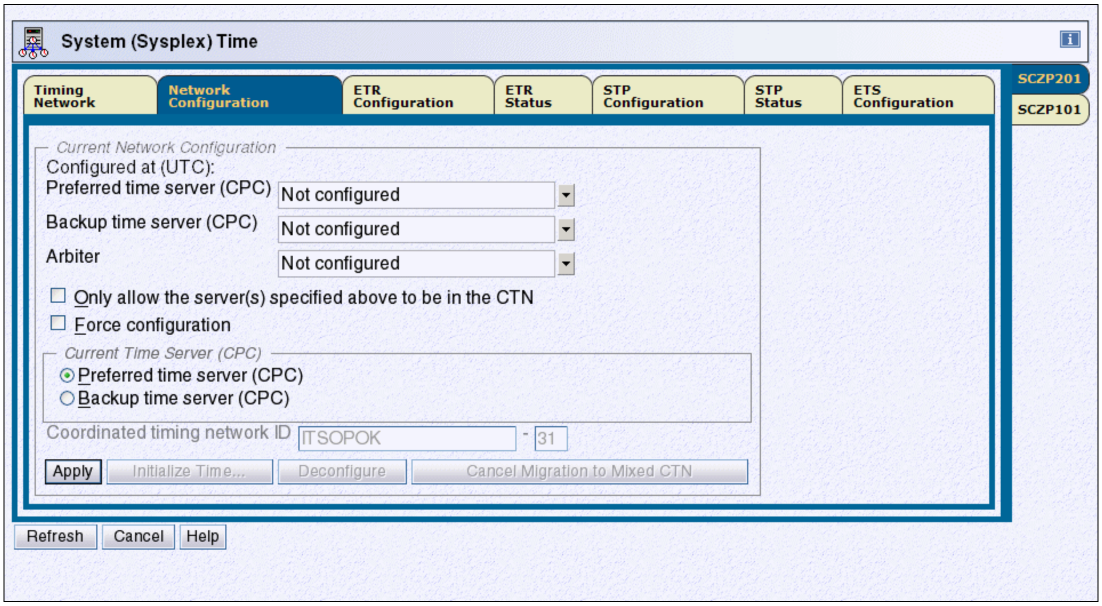


Figure 9-5 Network Configuration tab (SCZP201)

Because SCZP201 is in an ETR network, the Preferred Time Server, Backup Time Server, and Arbiter fields are not applicable. Only the Apply button is enabled to allow a full STP conversion to proceed. See Chapter 13, "Mixed CTN (two servers) to STP-only CTN" on page 335, for further details of this process.

ETR Configuration tab

Figure 9-6 shows the ETR Configuration tab for the SCZP201 server.

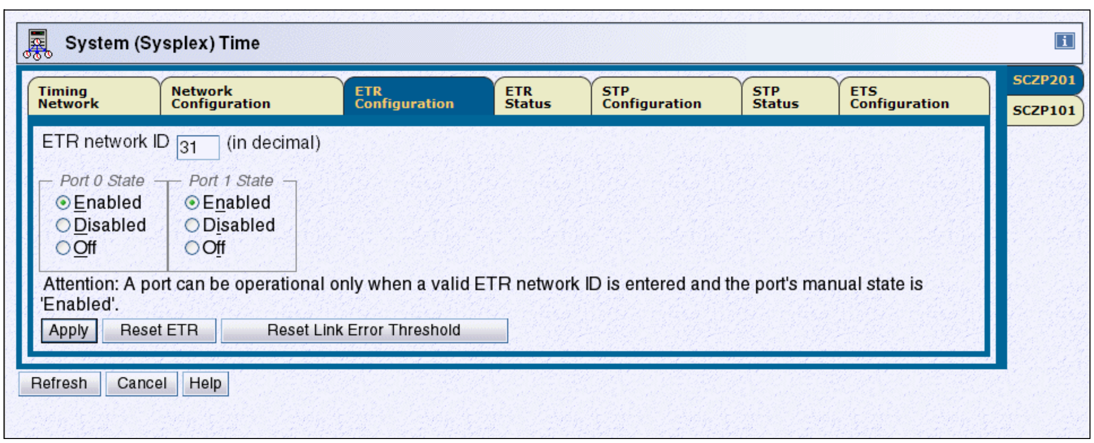


Figure 9-6 ETR Configuration tab (SCZP201)

This shows that server SCZP201 is connected to an ETR network with an ETR Network ID of 31. Both server ETR ports are enabled. This corresponds with the DISPLAY ETR command output shown in Figure 9-2 on page 282.

ETR Status tab

Figure 9-7 shows the ETR Status tab for the SCZP201 server.

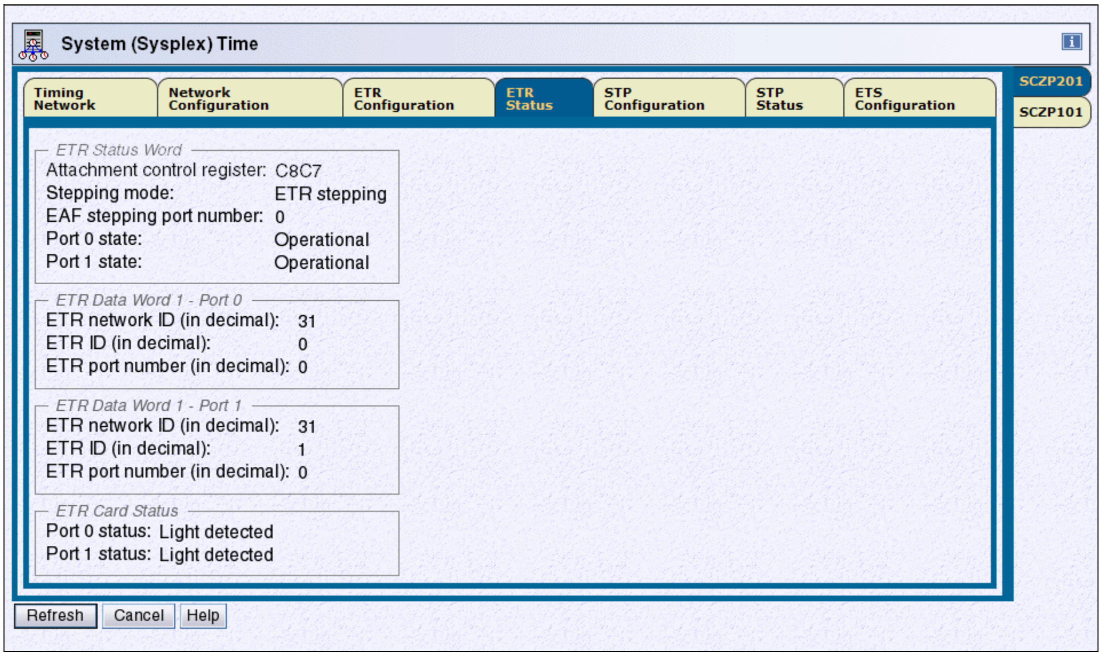


Figure 9-7 ETR Status tab (SCZP201)

This is a status tab only, and no modifications to the server ETR ports are possible from here. This tab shows that the TOD on the SCZP201 server is being stepped by the ETR connected to server ETR port 0.

The connected ETR has an ETR ID of 0 and is in ETR Network ID 31, and a second ETR is available on server ETR port 1, which has an ETR ID of 1. Both server ETR ports are operational. Again, this corresponds to the DISPLAY ETR command output shown in Figure 9-2 on page 282.

STP Configuration tab

Figure 9-8 shows the STP Configuration tab for the SCZP101 server.

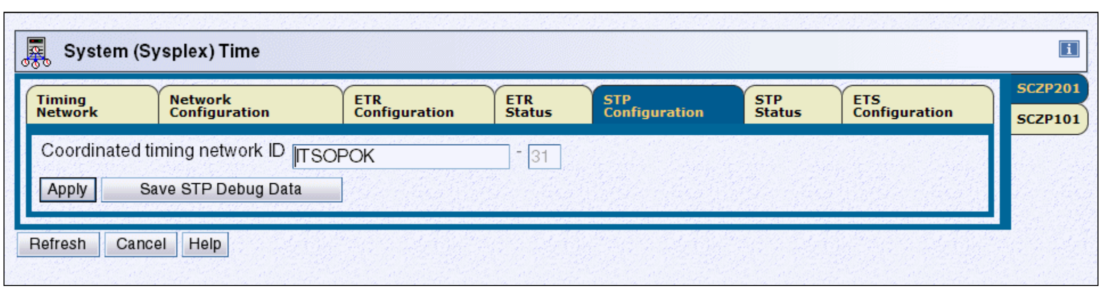


Figure 9-8 STP Configuration tab (SCZP201)

This shows that the SCZP201 server is in a mixed CTN with a CTN ID of [ITSOPOK] - [31], where ITSOPOK is the STP ID and 31 is the ETR Network ID.

The STP ID component of the CTN ID can be changed from this location. However, the ETR Network ID field is disabled, and all changes to this field must be done from the ETR Configuration tab.

Removing the STP ID migrates this server from the Mixed CTN to an ETR Network configuration.

Changing the STP ID from its existing value of ITSOPOK to another value causes the server to move from the current Mixed CTN to another Mixed CTN. This is rarely required and is disruptive to resident z/OS images in a sysplex configuration, because they will appear to have a different time source in comparison to the other z/OS images.

STP Status tab

Figure 9-9 shows the STP Status tab for the SCZP201 server.

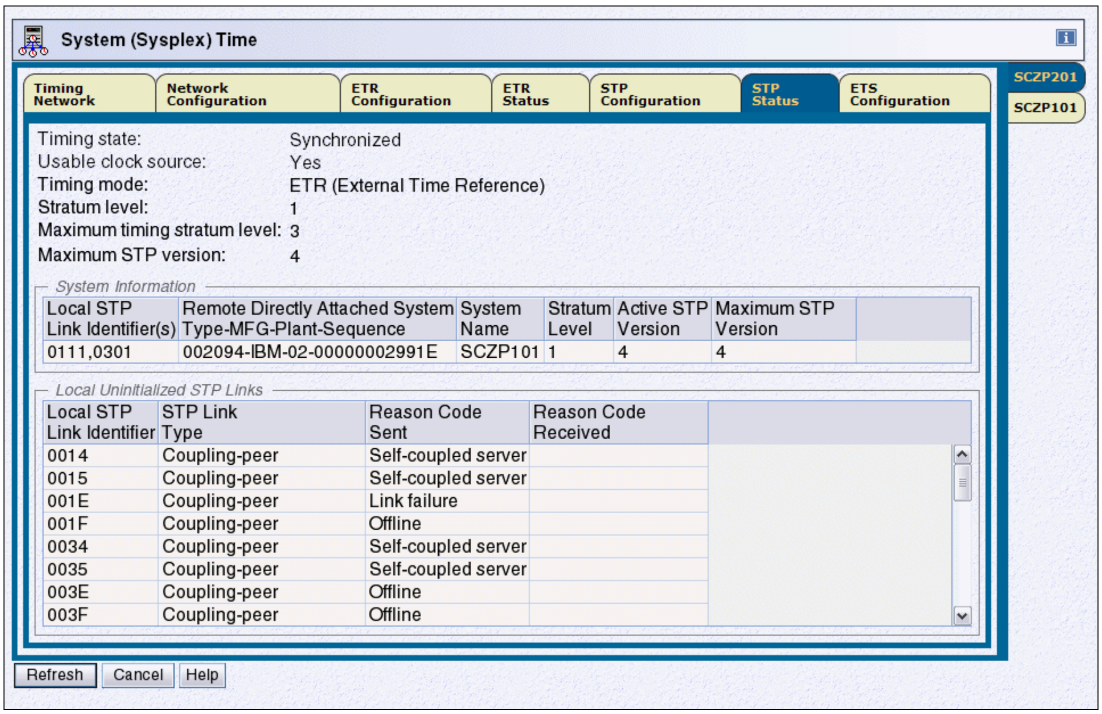


Figure 9-9 STP Status tab (SCZP201)

Figure 9-9 shows that the SCZP201server is in ETR timing mode and, because it is also a Stratum 1, it must have a CTN ID defined and be in a Mixed CTN. As a result, it is considered to be STP configured.

This server also has STP connectivity to the SCZP101 server over a number of links, as identified by the STP link identifiers. This implies that the SCZP101 server is also STP *configured*. Because SCZP101 is also a Stratum 1, it also must have connectivity to the ETR network and be in ETR timing mode.

ETS Configuration tab

The ETS Configuration tab is irrelevant for this scenario, because the time source for the mixed CTN is the ETR and, therefore, no ETS is used.

9.2 Migration

The migration process for a Mixed CTN to an ETR Network is similar to the migration of an ETR Network to a Mixed CTN, except that the STP ID is being *removed* from the CTN ID instead of being *defined*.

The CTN ID is currently defined as [ITSOPOK] - [31] on both SCZP101 and SCZP201, where ITSOPOK represents the STP ID, and 31 is the ETR Network ID that is already in use by the existing ETR network.

This migration requires one change per server to remove the STP ID portion of the CTN ID. This is done using the STP Configuration tab to set the CTN ID to [ ] - [31], which changes each server from being STP configured to STP enabled.

> **Note:** This is a *local* change that must be done on each server using the STP Configuration tab.
>
> The Network Configuration tab also shows the full CTN ID. However, the field is disabled, so removal of the STP ID is not possible from this location. This tab is used to perform *global* changes to the CTN in an STP-only CTN.

Table 9-1 lists the before and after configuration details.

Table 9-1 Server configuration - ETR Network to Mixed CTN migration

	Server	CTN ID		Server role	Timing mode	Stratum level
		STP ID	ETR ID			
Before migration	SCZP101	ITSOPOK	31		ETR	1
	SCZP201	ITSOPOK	31		ETR	1
After migration	SCZP101	Null	31		ETR	Not defined
	SCZP201	Null	31		ETR	Not defined

The order in which the servers are modified does not matter, because both servers retain connectivity to the Sysplex Timers throughout the scenario.

9.2.1 Removing the STP ID on SCZP201

At the HMC workplace, perform the following steps:

1. Highlight the **SCZP201** server and select **System (Sysplex) Time**.
2. Click the **STP Configuration** tab.

3. Remove the existing STP ID (in our case, ITSOPOK) from the Coordinated Timing Network ID field (Figure 9-10).

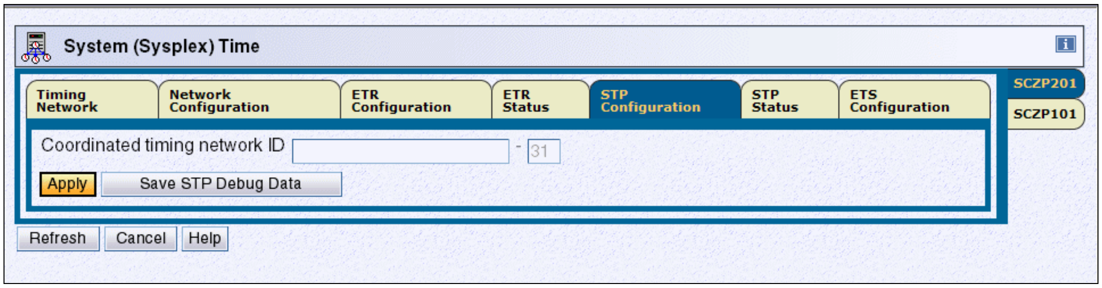


Figure 9-10 STP Configuration tab - Remove STP ID (SCZP201)

4. Click **Apply**. This displays the Local Coordinated Timing Network ID Change Confirmation, message ACT37360 (Figure 9-11).

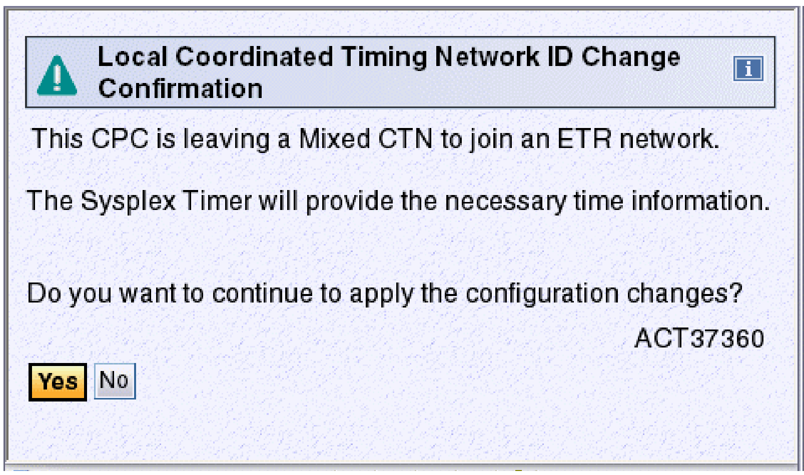


Figure 9-11 Message ACT37360 - Local Coordinated Timing Network ID Change Confirmation

> **Note:** The word *local* is included in this window to indicate that this change only applies to the selected server and must be performed on all other servers in the CTN. It is not a *global* change that will be propagated automatically throughout the CTN.

5. Confirm the configuration change by clicking **Yes**. This displays the Local Coordinated Timing Network ID Change, message ACT37315, indicating that the change was successful (Figure 9-12).

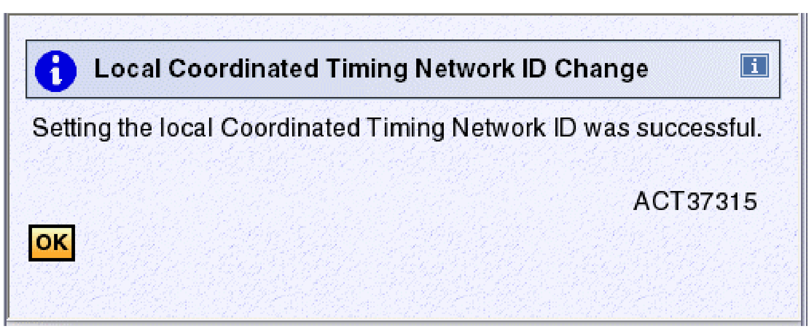


Figure 9-12 Message ACT37315 - Local Coordinated Timing Network ID Change

The change to the CTN ID is also flagged by XCF with message IXC438I on the console and SYSLOG of z/OS images in a sysplex configuration resident on SCZP901 (Figure 9-13).

```
IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 821
        FOR SYSTEM: SC74
        PREVIOUS CTNID:   ITSOPOK -31
        CURRENT  ETR NETID:   31
```

Figure 9-13 SYSLOG messages - SC74 image on SCZP901 STP ID removal

This information message confirms the success of the CTN ID change from an XCF perspective. It is only issued by z/OS images using the Sysplex Timer in a sysplex configuration. Non-sysplex images, monoplex images, and sysplex images using a simulated timer (through SIMETRID) are not aware of the CTN ID change.

9.2.2 Removing the STP ID on SCZP101

At this stage, only one server has been backed out from a Mixed CTN to an ETR Network. This process now needs to be done for the remaining servers in the CTN by setting the CTN ID to [ ] - [31] in each case.

In our scenario, the CTN consists of one other server, so the process defined in step 1 needs to be repeated for SCZP101 only.

9.3 End point

At the completion of the scenario, the network topology has changed (Figure 9-14).

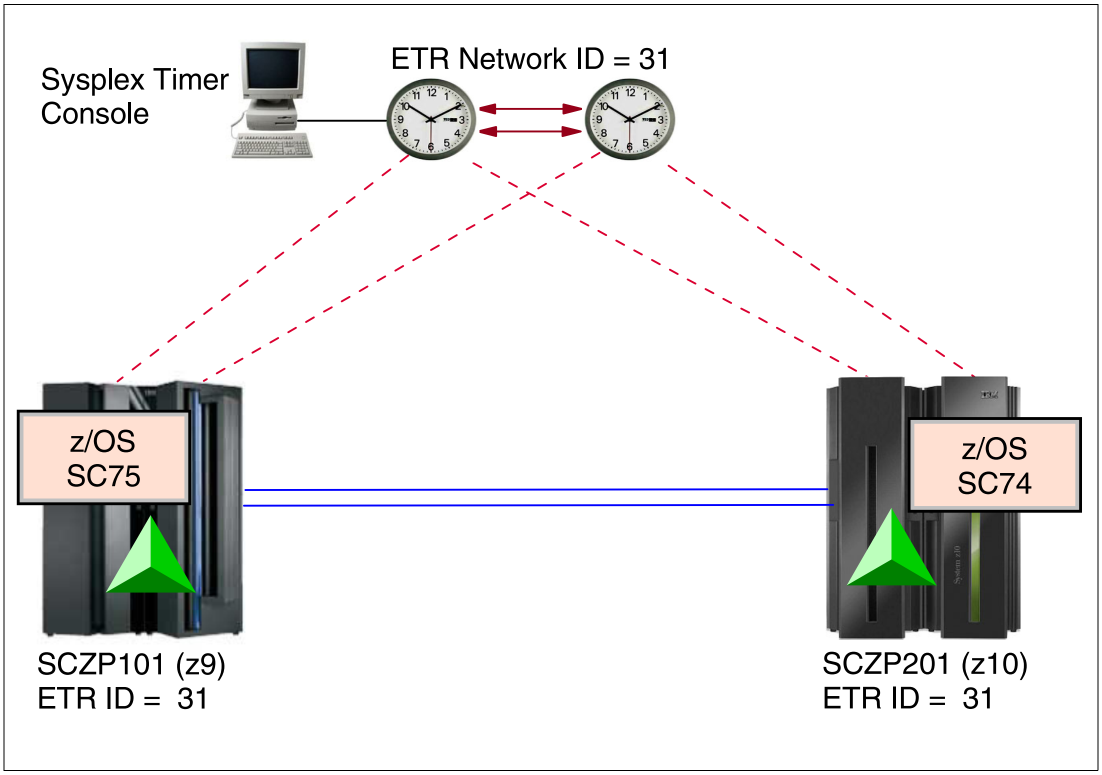


Figure 9-14 STP Implementation environment - ETR Network

Each of the servers has changed from STP configured to STP enabled, and the CTN ID is replaced by the ETR Network ID. The STP ID and stratum levels are no longer relevant.

9.3.1 z/OS DISPLAY ETR command

Figure 9-15 shows the output from the DISPLAY ETR command entered on the SC74 image, on SCZP201.

```
D ETR
IEA282I 13.12.05 TIMING STATUS 823
SYNCHRONIZATION MODE = ETR
  CPC PORT 0    <== ACTIVE       CPC PORT 1
  OPERATIONAL                    OPERATIONAL
  ENABLED                        ENABLED
  ETR NET ID=31                  ETR NET ID=31
  ETR PORT=00                    ETR PORT=00
  ETR ID=00                      ETR ID=01
```

Figure 9-15 DISPLAY ETR display - SC74 image on SCZP201 ETR Network

This display shows that SC74 is using an ETR as its timing source. Because the SCZP201 server no longer has a CTN ID defined, the extra line that previously appeared in the DISPLAY ETR command output prior to the migration (Figure 9-2 on page 282) is no longer apparent.

9.3.2 z/OS DISPLAY XCF command

Figure 9-16 shows the output from the z/OS DISPLAY XCF command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  13.12.46  DISPLAY XCF 825
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/03/2009 13:12:46 ACTIVE         TM=ETR
SC75     2094 991E   1C   10/03/2009 13:12:42 ACTIVE         TM=ETR
```

Figure 9-16 DISPLAY XCF display - SC74 image on SCZP201 ETR Network

This shows that both z/OS images SC74 and SC75 are operating in ETR timing mode. There is no indication from this command output that the CTN ID has changed.

9.3.3 System (Sysplex) Time tabs Sample numbered list

The System (Sysplex) Time tabs have undergone minor changes as a result of the removal of the STP ID from the CTN ID.

Timing Network tab

Figure 9-17 shows the Timing Network tab for the SCZP101 server.

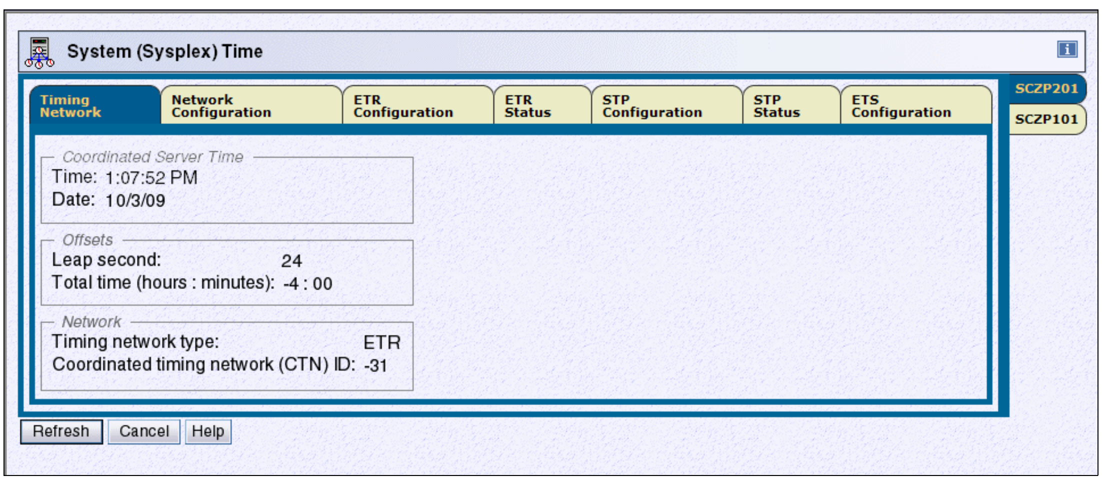


Figure 9-17 Timing Network tab (SCZP201)

The Coordinated Timing Network ID field has changed from [ITSOPOK] - [31] to [ ] - [31]. Also, the additional line in the Network section regarding the CTN time source is no longer shown.

Network Configuration tab

Figure 9-18 shows the Timing Network tab for SCZP101 (Figure 9-16 on page 291).

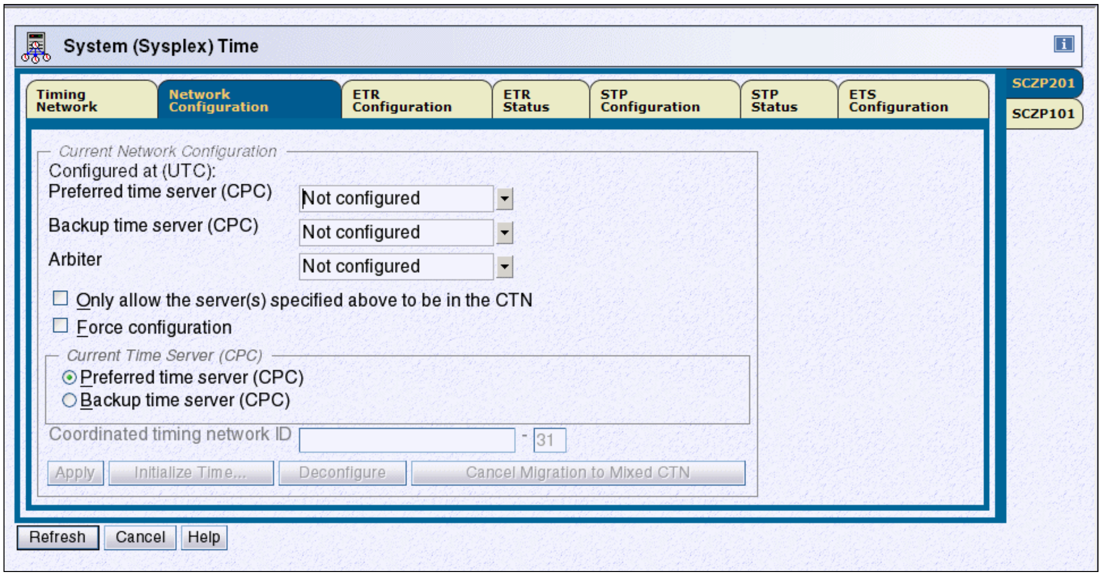


Figure 9-18 Network Configuration tab (SCZP201)

The Network Configuration tab no longer has the STP ID shown in the Coordinated Timing Network ID field. Only the ETR Network ID of 31 is shown. Also, the Apply, Initialize Time, and Deconfigure buttons have all been disabled, because these functions are STP related and this server is no longer STP configured.

ETR Configuration and ETR Status tabs

These tabs remain unchanged, because no modifications have been performed to the ETR network or ETR server ports.

STP Configuration tab

Figure 9-19 shows the STP Configuration tab for SCZP201 (Figure 9-16 on page 291).

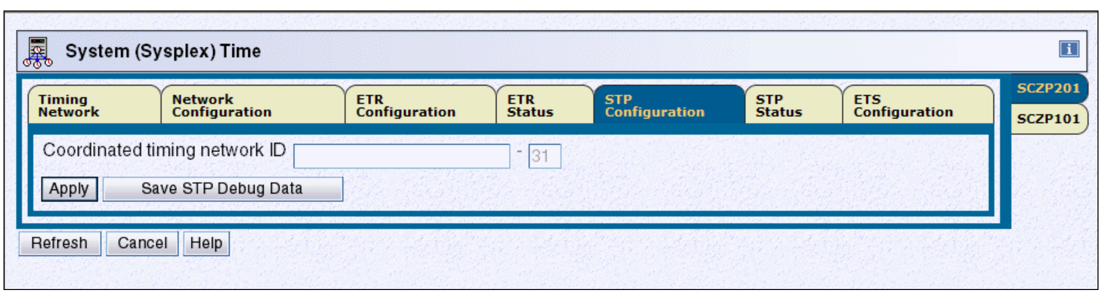


Figure 9-19 STP Configuration tab (SCZP201)

This shows that the STP ID component of the CTN ID is no longer defined. The ETR Network ID of 31 is shown. However, the field is disabled, thus forcing all changes to this value to be performed from the ETR Configuration tab.

STP Status tab

Figure 9-20 shows the STP Status tab for the SCZP101 server.

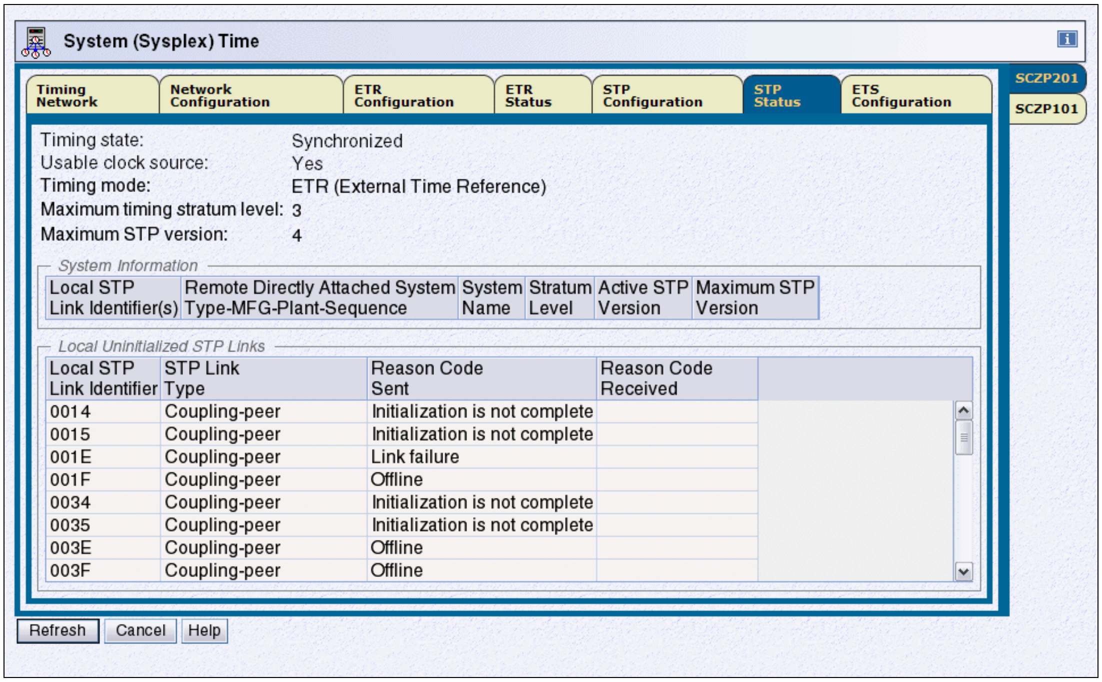


Figure 9-20 STP Status tab (SCZP201)

Because the SCZP201 server is no longer STP configured, this tab no longer shows a stratum level. Also, the Remote Directly Attached Systems section does not show any connected servers that are STP configured, because this server is unable to send or receive STP-related control or timing messages.

ETS Configuration tab

This tab also remains unchanged, because no modifications have been performed to the ETS configuration.

10

Mixed CTN: Changing one server from ETR timing mode to STP timing mode

In this example[1], one server in our sample configuration is converted from External Timer Reference (ETR) timing mode to Server Time Protocol (STP) timing mode by *disabling* connectivity of this server to the ETR timing network. The server then uses STP timing messages to remain synchronized in the Coordinated Timing Network (CTN).

In this chapter we work through the following sections:

A Mixed CTN may consist of servers in ETR timing mode only, or a combination of servers in ETR timing mode and STP timing mode. In both cases, the ETR is the time source for the CTN.

This scenario proceeds to the point where one server in the Mixed CTN is converted from ETR timing mode to STP timing mode.

[1] See "Prerequisites" on page 263.

10.1 Start point

The starting point for this scenario is the Mixed CTN with servers operating in ETR timing mode only (Figure 10-1).

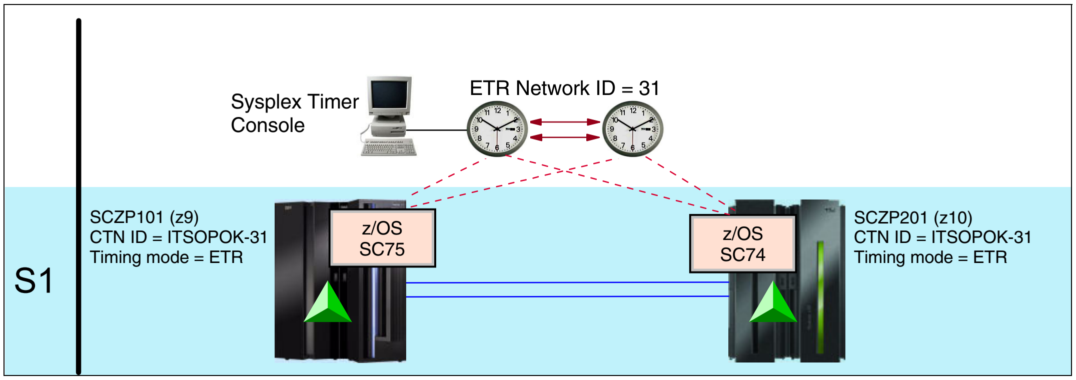


Figure 10-1 STP Implementation environment - Mixed CTN with ETR timing mode only

The Mixed CTN consists of two servers, SCZP101 and SCZP201. Both servers are STP configured and are operating in ETR timing mode, meaning that they both have connectivity to the ETR network.

Each server is connected to the other server in a redundant configuration using multiple coupling links, and each server has a z/OS image and coupling facility defined. There are actually two coupling links between these servers, as evidenced by various HMC workplace displays.

This is the same configuration shown as the endpoint for the ETR Network to Mixed CTN scenario previously described. See Chapter 9, “Mixed CTN (ETR timing mode) to ETR Network” on page 281, for further details.

10.1.1 z/OS DISPLAY ETR command

The output from the DISPLAY ETR command entered on the SC74 image, on SCZP201, is shown in Figure 10-2.

```
D ETR
IEA282I 09.10.19 TIMING STATUS 130
SYNCHRONIZATION MODE = ETR
  CPC PORT 0    <== ACTIVE       CPC PORT 1
  OPERATIONAL                    OPERATIONAL
  ENABLED                        ENABLED
  ETR NET ID=31                  ETR NET ID=31
  ETR PORT=00                    ETR PORT=00
  ETR ID=00                      ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Figure 10-2 DISPLAY ETR display - SC74 on SCZP201, Mixed CTN with ETR timing mode

This shows that SC74 is using an ETR as its timing source. The active server ETR port is port 0, which is connected to an ETR with an ID of 00 in an ETR Network with and ID of 31. The server on which the SC74 image is resident is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31].

10.1.2 z/OS DISPLAY XCF command

Figure 10-3 shows the output from the z/OS DISPLAY XCF command entered on the SC74 image, on SCZP901.

```
D XCF,S,ALL
IXC335I  09.14.59  DISPLAY XCF 132
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME          SYSTEM STATUS
SC75     2094 991E   1C   10/04/2009 09:14:56 ACTIVE         TM=ETR
SC74     2097 DE50   2C   10/04/2009 09:14:59 ACTIVE         TM=ETR
```

Figure 10-3 DISPLAY XCF display - SC74 on SCZP201, Mixed CTN with ETR timing mode

This shows that both z/OS images SC74 and SC75 are operating in ETR timing mode. These z/OS images are resident on different servers, as evidenced by the different serial numbers. However, there is no indication from this command output as to whether these servers have CTN IDs defined.

10.1.3 System (Sysplex) Time tabs

The following tabs are available on the System (Sysplex) Time window for each server. Only the tabs for server SCZP901 are shown in this section.

Timing Network tab

Figure 10-4 shows the Timing Network tab for server SCZP201.

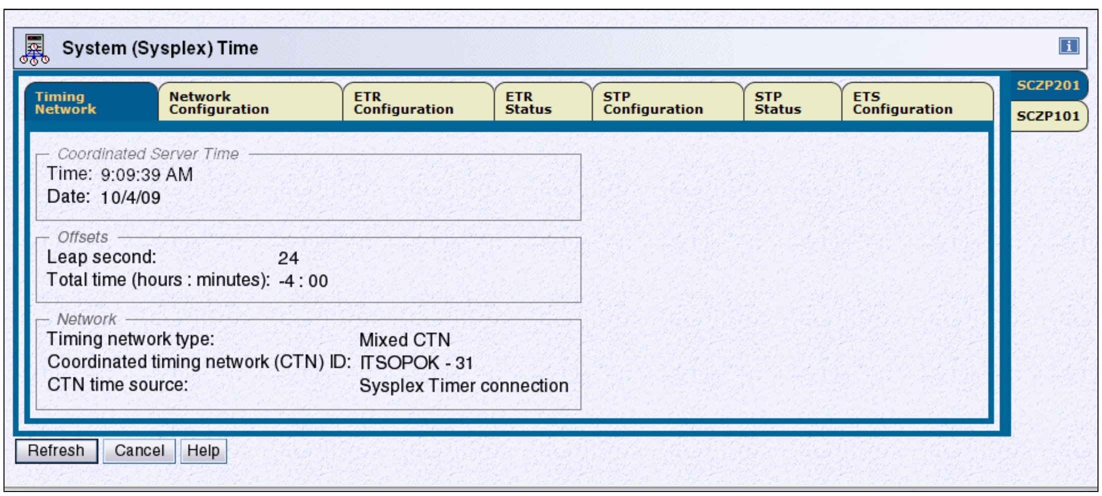


Figure 10-4 Timing Network tab (SCZP201)

This shows that server SCZP201 is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31]. Because the ETR network is the CTN time source, the leap second offset (set to 24) and the total time offset (set to -4) originate from the Sysplex Timer as part of the timing signal.

Network Configuration tab

Figure 10-5 shows the Network Configuration tab for server SCZP201.

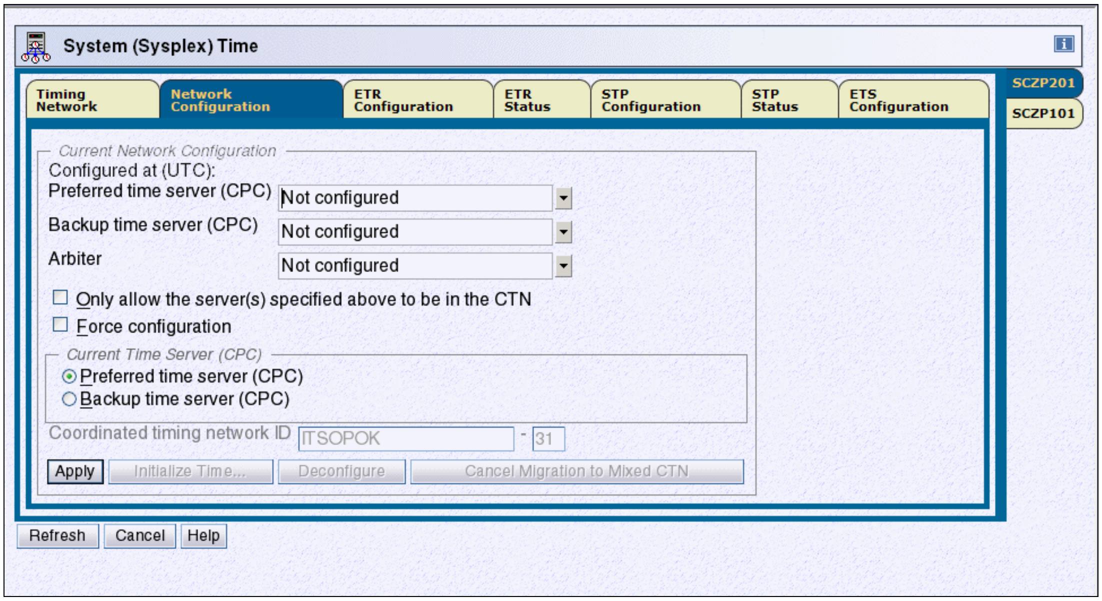


Figure 10-5 Network Configuration tab (SCZP201)

Because SCZP201 is in an ETR network, the Preferred Time Server, Backup Time Server, and Arbiter fields are not applicable. Only the **Apply** button is enabled to allow a full STP conversion to proceed. See Chapter 13, “Mixed CTN (two servers) to STP-only CTN” on page 335, for a detailed description of this process.

ETR Configuration tab

Figure 10-6 shows the ETR Configuration tab for server SCZP901.

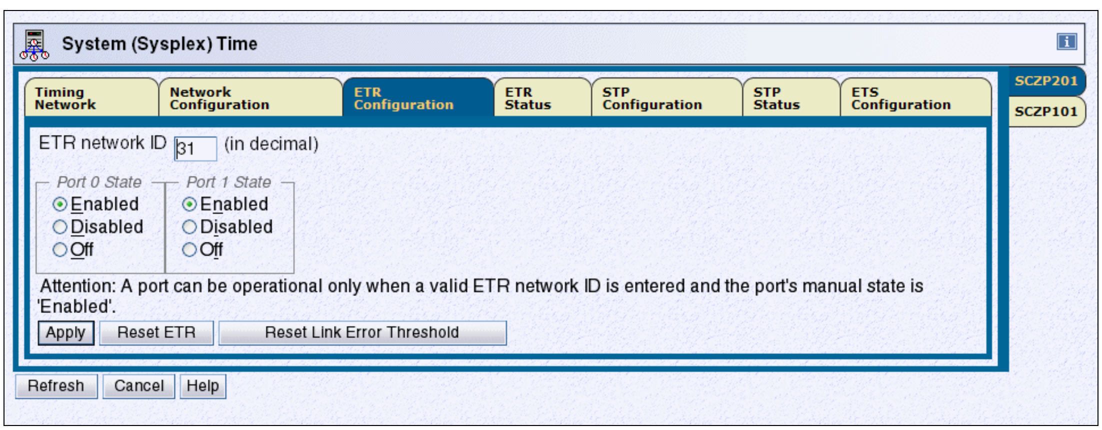


Figure 10-6 ETR Configuration tab (SCZP201)

This shows that server SCZP201 is connected to an ETR network with an ETR Network ID of 31. Both server ETR ports are enabled. This corresponds with the DISPLAY ETR command output shown in Figure 10-2 on page 296.

ETR Status tab

Figure 10-7 shows the ETR Status tab for server SCZP201.

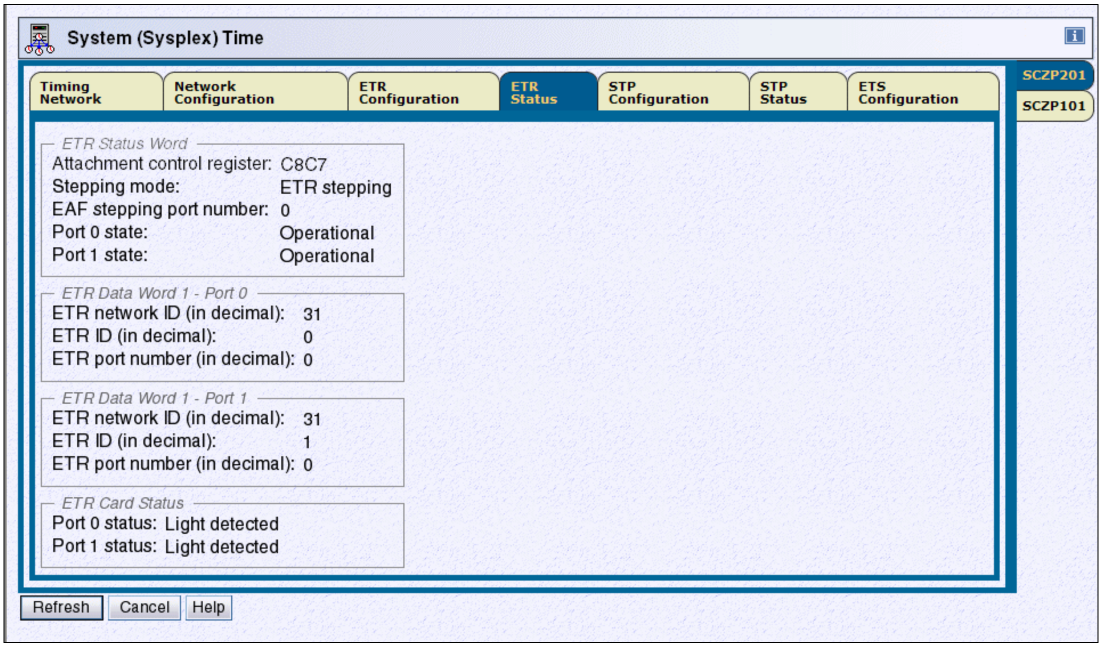


Figure 10-7 ETR Status tab (SCZP201)

This is a status tab only, and no modifications to the server ETR ports are possible from here. The ETR Attachment Feature (EAF) indicates that the TOD on server SCZP201 is being stepped by the ETR connected to server ETR port 0. Both Port 0 and Port 1 are operational.

The connected ETR has an ETR ID of 0 and is in ETR Network ID 31. A second ETR is available on server ETR port 1, which has an ETR ID of 1. Both server ETR ports are operational. Again, this corresponds to the DISPLAY ETR command output shown in Figure 10-2 on page 296.

STP Configuration tab

Figure 10-8 shows the STP Configuration tab for server SCZP201.

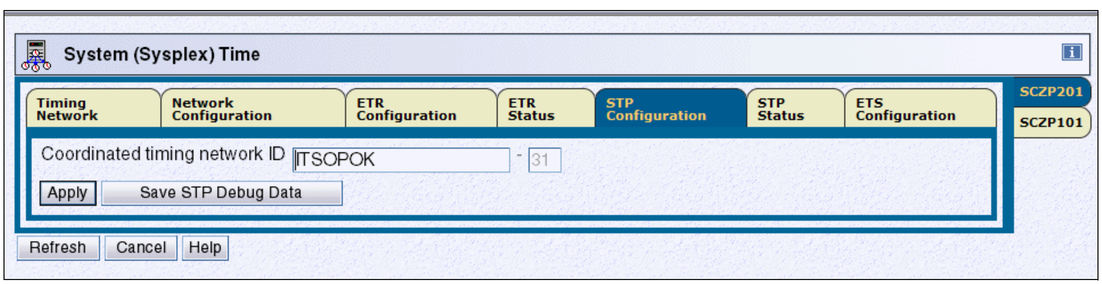


Figure 10-8 STP Configuration tab (SCZP201)

This shows that server SCZP201 is in a mixed CTN with a CTN ID of [ITSOPOK] - [31], where ITSOPOK is the STP ID, and 31 is the ETR Network ID.

The STP ID component of the CTN ID can be changed from this location. The ETR Network ID field is disabled, and all changes to this field must be done from the ETR Configuration tab.

Removing the STP ID will migrate this server from the Mixed CTN to an ETR Network configuration.

Changing the STP ID from its existing value of ITSOPOK to another value will cause the server to move from the current Mixed CTN to another Mixed CTN. This is rarely required and would be *disruptive* to any resident z/OS image in a sysplex configuration, because they would appear to have a different time source in comparison to the other z/OS images.

STP Status tab

Figure 10-9 shows the STP Status tab for server SCZP201.

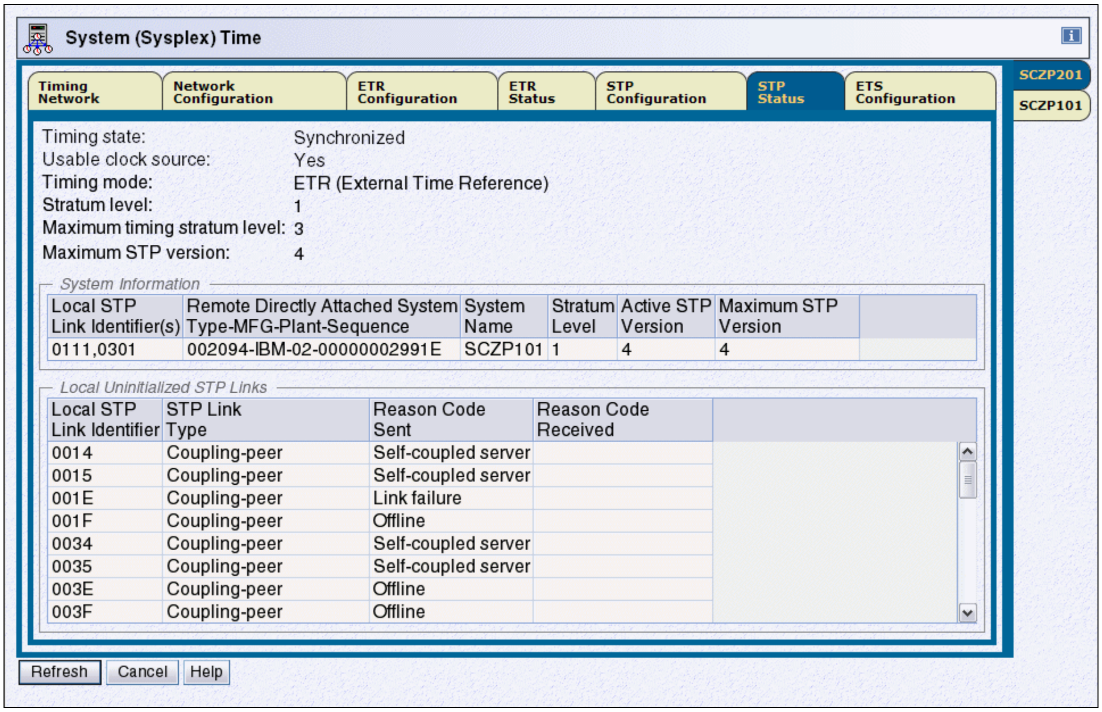


Figure 10-9 STP Status tab (SCZP201)

This shows that SCZP201 is in ETR timing mode. Also, because it is a Stratum 1, it must have a CTN ID defined and be in a Mixed CTN. As a result, it is considered to be STP configured.

SCZP201 also has STP connectivity to server SCZP101 over two links, as identified by the Local STP link identifiers. This implies that server SCZP101 is also STP configured. Because SCZP101 is also a Stratum 1, it must have connectivity to the ETR network and be in ETR timing mode.

The server's connectivity to another Stratum 1 or Stratum 2 server must be verified at this stage, because this will be necessary to maintain synchronization when disabling the ETR ports in the next step.

ETS Configuration tab

The ETS Configuration tab is irrelevant for this scenario, because the time source for the mixed CTN is the ETR and therefore no ETS is used.

10.2 Migration

This step can be considered as optional and should *not* be used for the last server in the Mixed CTN.

> **Important:** The user should *not* disable the ETR ports on the last Stratum 1 server, because this would remove the time source for the entire Mixed CTN.

The migration of a server in a Mixed CTN from ETR timing mode to STP timing mode involves a single change on that server. This change consists of disabling connectivity of the server to the ETR network. Because connectivity to the ETR network is no longer available, the server selects the STP timing messages that are being provided over the coupling links as the timing source.

> **Important:** This operation should always be performed from the ETR Configuration tab.
>
> ETR ports should *never* be disabled at the Sysplex Timer, or by removing ETR link cables, when migrating a server from ETR timing mode to STP timing mode.

Even though the server no longer has connectivity to the ETR network, no changes are made to the CTN ID, which remains set to [ITSOPOK] - [31] in our case.

This might appear confusing, because the CTN ID defined for this server contains the ETR Network ID, but the server will not be using the ETR network as its time source after migration to STP timing mode is complete.

Whenever a CTN ID includes a valid ETR Network ID, it implies that the time source for the CTN is being provided by the ETR Network, which is distinct from the time source for each individual server.

Table 10-1 lists the before and after configuration details.

Table 10-1 Server configuration - Mixed CTN, ETR timing mode to STP timing mode for SCZP201

	Server	CTN ID		Server role	Timing mode	Stratum level
		STP ID	ETR ID			
Before migration	SCZP101	ITSOPOK	31	N/A	ETR	1
	SCZP201	ITSOPOK	31	N/A	ETR	1
After migration	SCZP101	ITSOPOK	31	N/A	ETR	1
	SCZP201	ITSOPOK	31	N/A	STP	2

> **Important:** It is strongly *not recommended*, in a mixed CTN consisting of two servers, to migrate one server to STP timing mode, just as it is demonstrated in this scenario. This will produce a single point of failure for the sysplex. If the server that is connected to the ETR fails, then the other server in STP timing mode will also go down.
>
> Only consider migrating one server in a mixed CTN to STP timing mode, if at least two servers remaining in ETR timing mode are left.

Step 1: Disable ETR connectivity on SCZP901

At the HMC workplace, perform the following steps in this sequence:

1. Ensure that this CEC has established STP connectivity over the CF links to an attached Stratum 1, as shown in the System Information table in the STP Status tab shown in Figure 10-9 on page 300.
2. Highlight server SCZP201 and select **System (Sysplex) Time**.
3. Click the **ETR Configuration** tab.
4. Set both Port 0 and Port 1 states to Disabled (Figure 10-10).

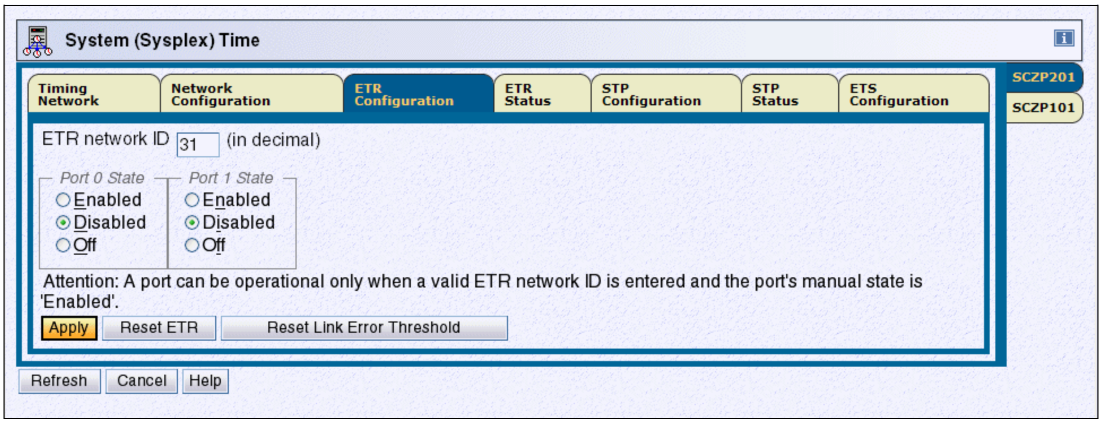


Figure 10-10 ETR Configuration tab - Disable ETR Ports (SCZP201)

> **Note:** Do not change or remove the ETR Network ID, because this would remove the server from the existing Mixed CTN.

5. Click **Apply**. This displays the Port State Change Confirmation, message ACT37388 (Figure 10-11).

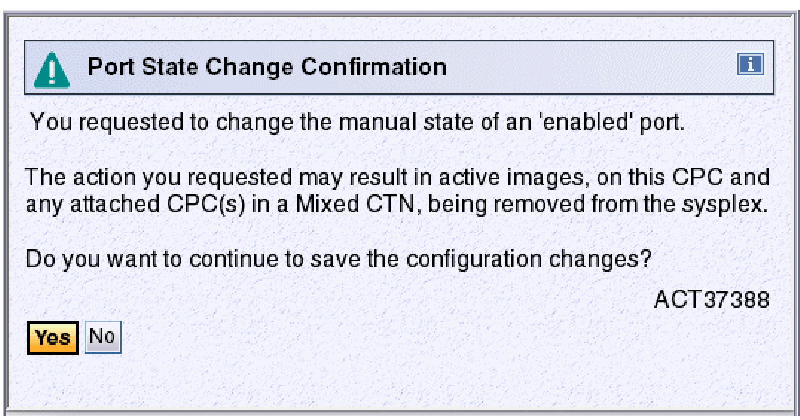


Figure 10-11 Message ACT37388 - Port State Change Confirmation (SCZP201)

6. Confirm the configuration change by clicking **Yes**. This will display the Apply ETR Configuration, message ACT37301, indicating that the change was successful (Figure 10-12).

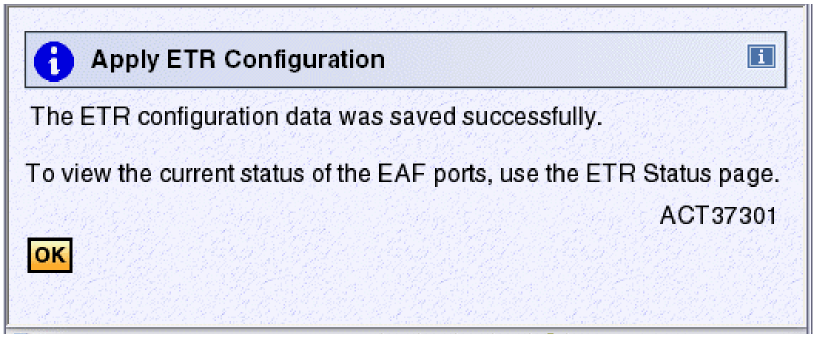


Figure 10-12 Message ACT37301: Apply ETR Configuration (SCZP201)

Messages will also appear on the console and a SYSLOG of z/OS images in a sysplex configuration resident on SCZP201 (Figure 10-13).

```
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.             (1)
*IEA393I ETR PORT 0 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.   (2)
*IEA393I ETR PORT 1 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.                         (3)
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 25                                 (4)
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 0B                                 (5)
```

Figure 10-13 SYSLOG messages: SC74 image on SZCP201, ETR ports disabled

Notes:

(1) IEA390I is issued on a server when conversion from ETR timing mode to STP timing mode is started.

(2) IEA393I is issued on a server in ETR timing mode as the server ETR ports are disabled.

(3) IEA380I is issued on a server when conversion from ETR timing mode to STP timing mode is complete.

(4) IEA031I is received when a change occurred with respect to the external time source for the CTN. STP Alert Code 25 indicates that the non-preferred NTP server is accessible. However, the NTP server is not used, the time source for the CTN still is the ETR.

(5) STP Alert Code 0B indicates that the NTP server switched to the preferred NTP server. However, the NTP server is not used, the time source for the CTN still is the ETR

Important: At this stage, the server ETR ports have been disabled, but the ETR link cabling between the server and the Sysplex Timers is still in place, allowing the ports to be enabled at a future time. Only remove the ETR link cabling when the server has no further requirement for ETR timing mode.

10.3 End point

The topology diagram of our sample configuration needs to be updated to cater to the migration of SCZP901 to STP timing mode (Figure 10-14).

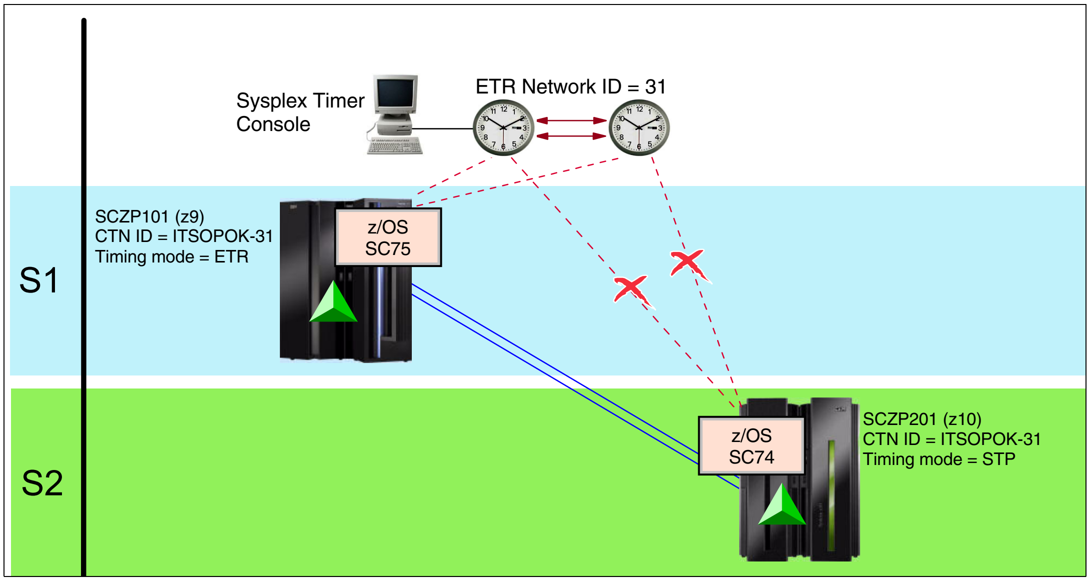


Figure 10-14 STP Implementation environment: Mixed CTN with STP timing mode (SCZP201)

The connectivity between SCZP201 and the ETR network has been disabled. SCZP201 is now shown as a Stratum 2, because it is receiving timing messages over coupling links from SCZP101, which is a Stratum 1. The timing mode of SCZP201 has also changed from ETR to STP.

If SCZP101 is removed from the Mixed CTN for any reason, the CTN will have lost its timing source because SCZP101 is the only server connected to the ETR network. The remaining server, SCZP201, will transition to Stratum 0 as a result. For this reason, we recommend that a Mixed CTN always have multiple servers with connectivity to the ETR network to avoid this single point of failure.

10.3.1 z/OS DISPLAY ETR command

Figure 10-15 shows the output from the DISPLAY ETR command entered on the SC75 image, on SCZP901.

```
D ETR
IEA386I 09.50.09 TIMING STATUS 663
SYNCHRONIZATION MODE = STP                                        (1)
  THIS SERVER IS A STRATUM 2                                      (2)
  CTN ID = ITSOPOK -31                                            (3)
  NUMBER OF USABLE TIMING LINKS =  2                              (4)
  THIS SERVER HAS ONLY A SINGLE SOURCE OF TIMING SIGNALS          (5)
```

Figure 10-15 DISPLAY ETR command - SC75 image on SCZP901, Mixed CTN with STP timing mode

The DISPLAY ETR command now contains only STP-related information, because connectivity to the ETR network has been disabled and is no longer relevant.

Notes:

(1) The timing mode has changed from ETR to STP, as shown by the Synchronization Mode field.

(2) The server has transitioned from Stratum 1 to Stratum 2, because it is receiving its timing signals from SCZP101 through the coupling links rather than directly from the ETR network.

(3) The CTN ID of the SCZP901 server is unchanged as a result of this migration and remains as [ITSOPOK] - [31].

(4) There are currently six usable coupling links between SCZP101 and SCZP201. The STP Link Identifiers on the STP Status tab identify the PCHIDs for these links.

(5) An optional line is included in the display output advising a single point of failure situation, because SCZP201 is receiving timing signals only from one other server. This is because our sample configuration consists of only two servers at this stage. A larger configuration would most likely implement a redundant configuration where each server is connected to multiple other servers by either coupling facility or timing-only links, in which case this message would not be displayed.

10.3.2 z/OS DISPLAY XCF command

Figure 10-16 shows the output from the z/OS DISPLAY XCF command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  09.51.15  DISPLAY XCF 665
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/04/2009 09:51:14 ACTIVE        TM=STP       (1)
SC75     2094 991E   1C   10/04/2009 09:51:11 ACTIVE        TM=ETR
```

Figure 10-16 D XCF display - SC74 image on SCZP201, Mixed CTN with STP timing mode

Notes:

(1) The timing mode of the SC74 image resident on server SCZP201 has changed from ETR to STP. This implies that SC74 must be resident on an STP-configured server. There is no indication from this command output as to whether SC75 is resident on an STP capable, STP-enabled, or STP-configured server.

XCF must ensure that all images in the sysplex are using the same timing source, to maintain timing integrity for resource sharing and data sharing purposes. XCF allows only certain CTN ID combinations to occur among the sysplex members within a sysplex configuration.

The migration from ETR timing mode to STP timing mode does not involve a change in the CTN ID, and no XCF-related messages are issued during this process.

10.3.3 System (Sysplex) Time tabs

The System (Sysplex) Time tabs have undergone minor changes as a result of the migration of SCZP201 from ETR timing mode to STP timing mode.

Timing Network and Network Configuration tabs

These tabs remain unchanged, because they make no reference to timing mode.

ETR Configuration tab

Figure 10-17 shows the ETR Configuration tab for server SCZP901.

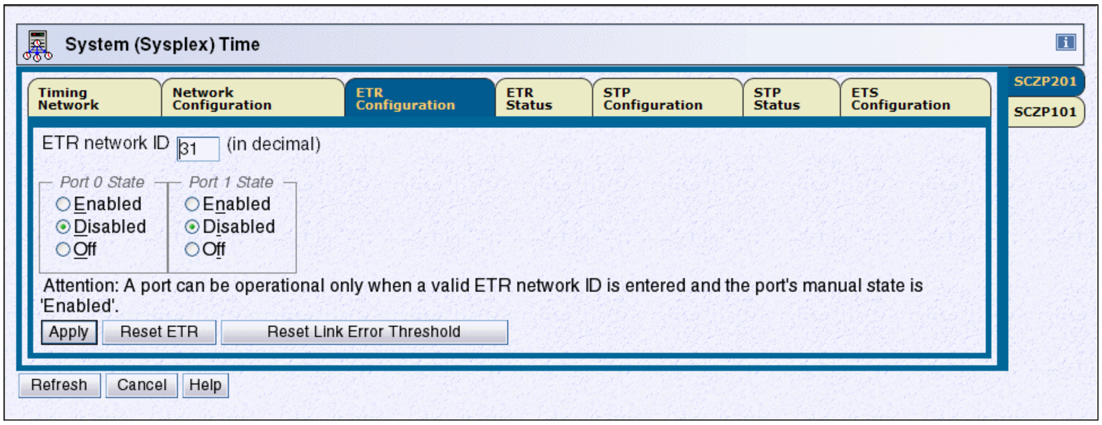


Figure 10-17 ETR Configuration tab (SCZP201)

Both server ETR ports are now shown as disabled. The ETR Network ID is still defined, allowing the ports to the ETR network to be enabled at a future time.

Note: Do not change or remove the ETR Network ID, because this would remove the server from the existing Mixed CTN.

ETR Status tab

Figure 10-18 shows the ETR Status tab for server SCZP201.

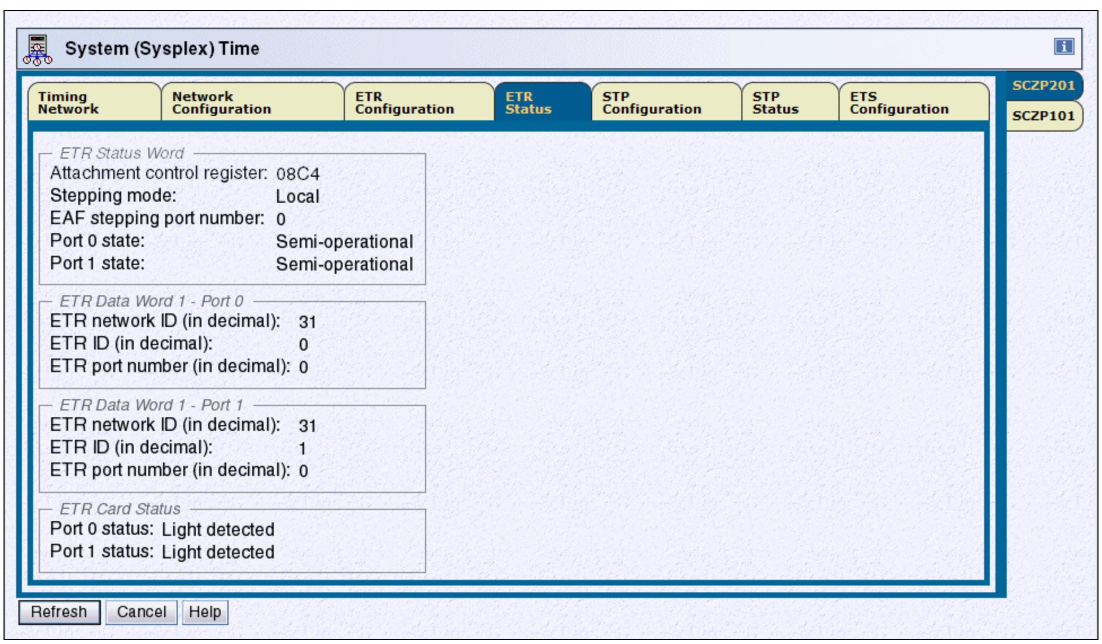


Figure 10-18 ETR Status tab (SCZP201)

This shows the server ETR port states as *semi-operational*, which indicates that connectivity exists between the server and the ETR network, but the server ETR ports have been disabled.

STP Configuration tab

This tab remains unchanged.

STP Status tab

Figure 10-19 shows the STP Status tab for server SCZP201.

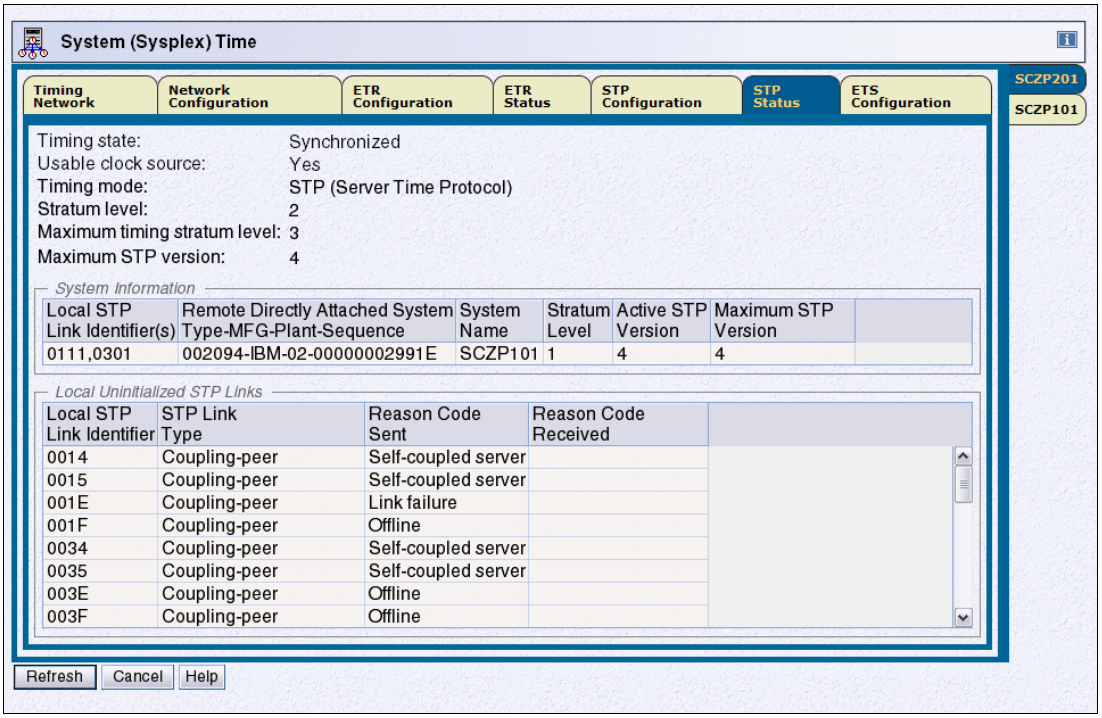


Figure 10-19 STP Status tab (SCZP201)

The SCZP201 server is now shown to be using STP timing mode and has transitioned to Stratum 2 to remain synchronized in the Mixed CTN.

The information for the connectivity to SCZP101 in the Remote Directly Attached Systems section remains unchanged, because no modifications were made to this server.

ETS Configuration tab

This tab also remains unchanged, because no modifications have been performed to the ETS configuration.

11

Mixed CTN: Changing one server from STP timing mode to ETR timing mode

In the example in this chapter[1], one server in our sample configuration is reverted from Server Time Protocol (STP) timing mode to External Timer Reference (ETR) timing mode by *enabling* connectivity of this server to the ETR network. The server then uses ETR timing messages to remain synchronized in the Coordinated Timing Network (CTN).

In this chapter we work through the following sections:

A Mixed CTN may consist of servers in ETR timing mode only, or a combination of servers in ETR timing mode and STP timing mode. In both cases, the ETR is the time source for the CTN.

This scenario proceeds to the point where one server in the Mixed CTN that is currently in STP timing mode will be converted to ETR timing mode.

> **Note:** At the completion of this scenario, the CTN is returned to the start point for the migration described in Chapter 10, "Mixed CTN: Changing one server from ETR timing mode to STP timing mode" on page 295. This section may be considered a back-out procedure for that scenario.

[1] See "Prerequisites" on page 263.

11.1 Start point

The starting environment for this scenario is a Mixed CTN, with one server operating in ETR timing mode and the other server operating in STP timing mode (Figure 11-1).

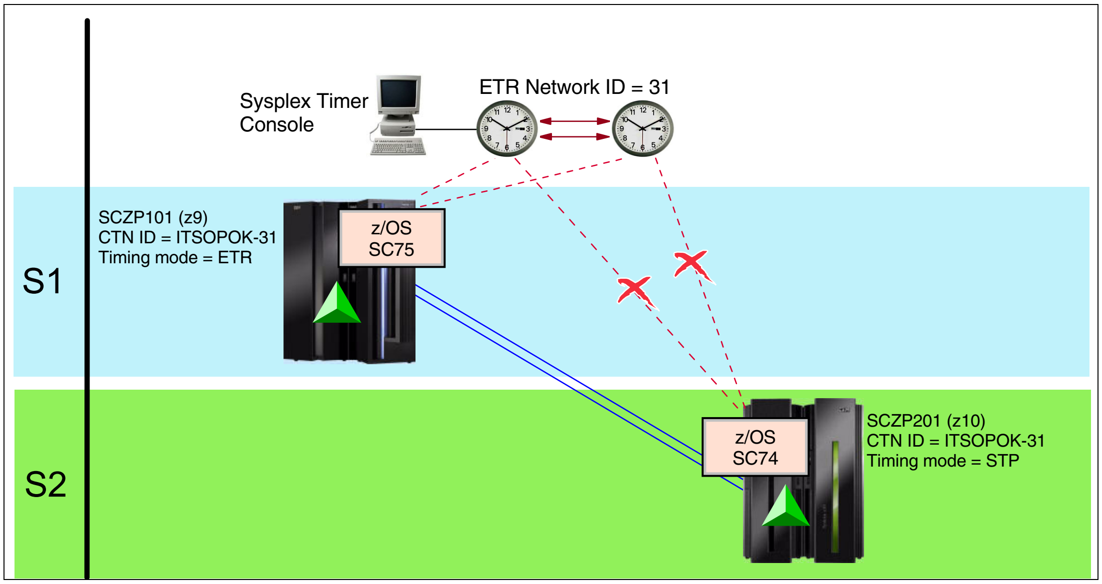


Figure 11-1 STP implementation environment - Mixed CTN with STP timing mode (SCZP201)

The Mixed CTN consists of two servers:

- SCZP101
- SCZP201

Both servers are *STP configured*, but are operating in different timing modes:

- SCZP101 retains connectivity to the ETR network and is in ETR timing mode.
- SCZP201 has had connectivity to the ETR network disabled and is in STP timing mode.

Each server is connected to the other server in a redundant configuration using multiple coupling links, and each server has a z/OS image and coupling facility defined. There are six coupling links between these servers, as evidenced by various HMC workplace displays. However, only two links have been shown for clarity.

This is the same configuration shown for the endpoint for the scenario described in Chapter 10, “Mixed CTN: Changing one server from ETR timing mode to STP timing mode” on page 295.

The ETR network connectivity is reinstated to return SCZP201 to ETR timing mode.

11.1.1 z/OS DISPLAY ETR command

Figure 11-2 shows the output from the DISPLAY ETR command entered on the SC74 image, on SCZP201.

```
D ETR
IEA386I 09.50.09 TIMING STATUS 663
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK -31
  NUMBER OF USABLE TIMING LINKS =  2
  THIS SERVER HAS ONLY A SINGLE SOURCE OF TIMING SIGNALS
```

Figure 11-2 DISPLAY ETR display - SC74 image on SZCP201, Mixed CTN with STP timing mode

This display shows that SC74 is resident on a server operating in STP timing mode as a Stratum 2 and is using STP messages as its timing source. Even though it is using STP messages, it is in a Mixed CTN, as evidenced by the CTN ID of [ISTOPOK] - [31], which indicates that the timing source for the CTN is an ETR Network with an ID of 31.

11.1.2 z/OS DISPLAY XCF command

Figure 11-3 shows the output from the z/OS DISPLAY XCF command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  09.51.15  DISPLAY XCF 665
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/04/2009 09:51:14 ACTIVE        TM=STP
SC75     2094 991E   1C   10/04/2009 09:51:11 ACTIVE        TM=ETR
```

Figure 11-3 DISPLAY XCF display - SC74 image on SZCP201, Mixed CTN

This display shows that SC75 is resident on a server operating in ETR timing mode and therefore must have connectivity to an ETR network. However, SC74 is resident on a server operating in STP timing mode.

11.1.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) Time selection for each server. Only the tabs for the SCZP201 server are shown in this section.

Timing Network tab

Figure 11-4 shows the Timing Network tab for the SCZP201 server.

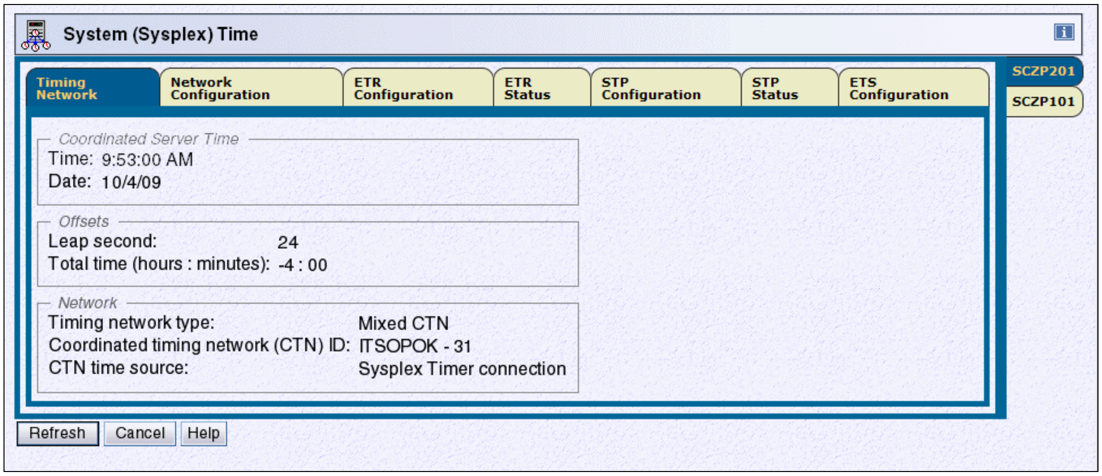


Figure 11-4 Timing Network tab (SCZP201)

This window shows that the SCZP201 server is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31]. Because the ETR network is the CTN time source, the leap second offset (set to 24) and the total time offset (set to -4) originate from the Sysplex Timer as part of the timing signal.

Network Configuration tab

Figure 11-5 shows the Network Configuration tab for the SCZP201 server.

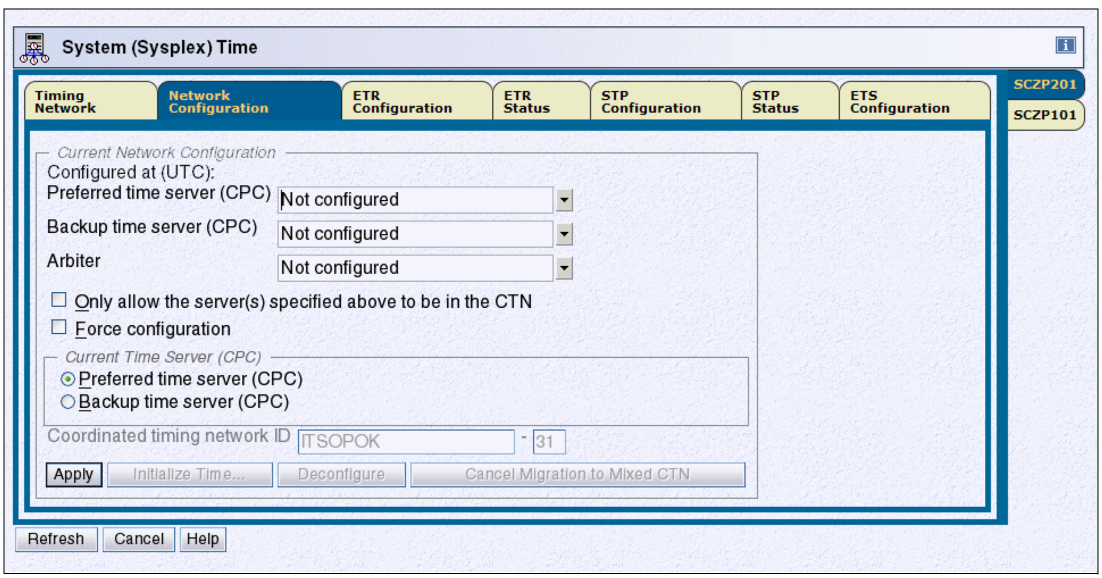


Figure 11-5 Network Configuration tab (SCZP201)

Because SCZP201 is in a Mixed CTN, the Preferred Time Server, Backup Time Server, and Arbiter fields are not applicable. Only the Apply button is enabled to allow a full STP conversion to proceed. See Chapter 13, “Mixed CTN (two servers) to STP-only CTN” on page 335, for a detailed description of this process.

ETR Configuration tab

Figure 11-6 shows the ETR Configuration tab for the SCZP201 server.

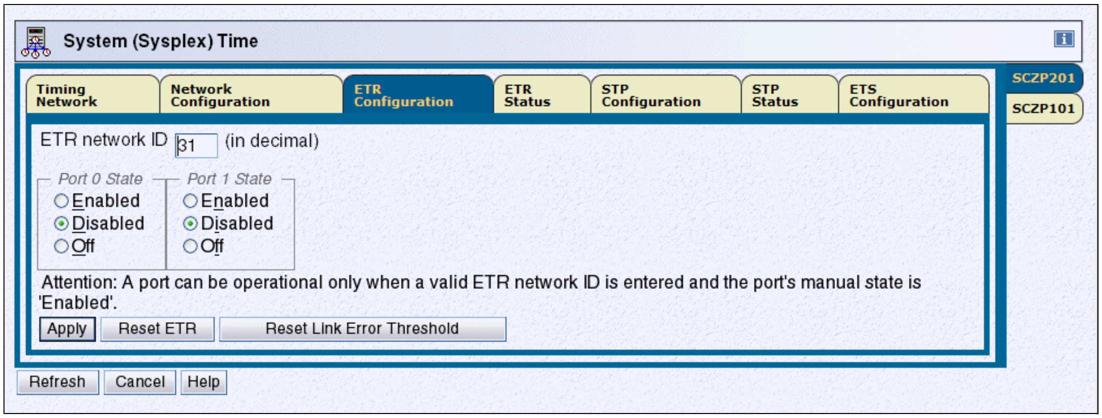


Figure 11-6 ETR Configuration tab (SCZP201)

This shows that the SCZP201 server is physically connected to an ETR network with the ETR Network ID of 31. However, connectivity is not currently available, because both server ETR ports are disabled. This corresponds with the DISPLAY ETR command output (Figure 11-2 on page 311).

ETR Status tab

Figure 11-7 shows the ETR Status tab for the SCZP201 server.

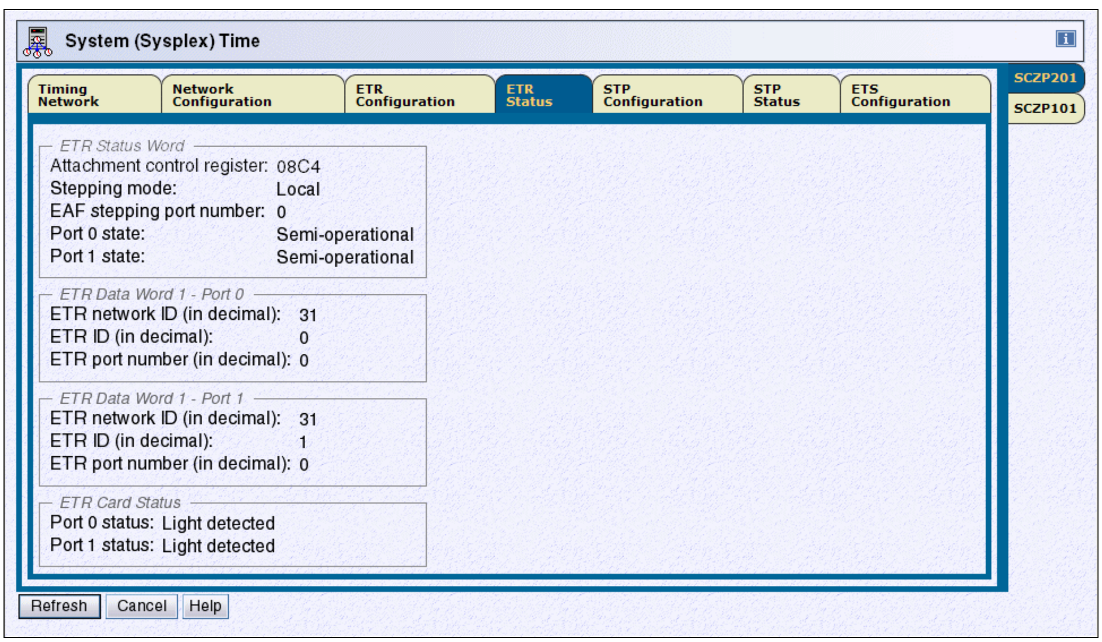


Figure 11-7 ETR Status tab (SCZP201)

This is a status tab only, and no modifications to the server ETR ports are possible from here. This tab shows the server ETR port states as *semi-operational*, which indicates that connectivity exists between the server and the ETR network, but that the server ETR ports have been disabled.

STP Configuration tab

Figure 11-8 shows the STP Configuration tab for the SCZP201 server.

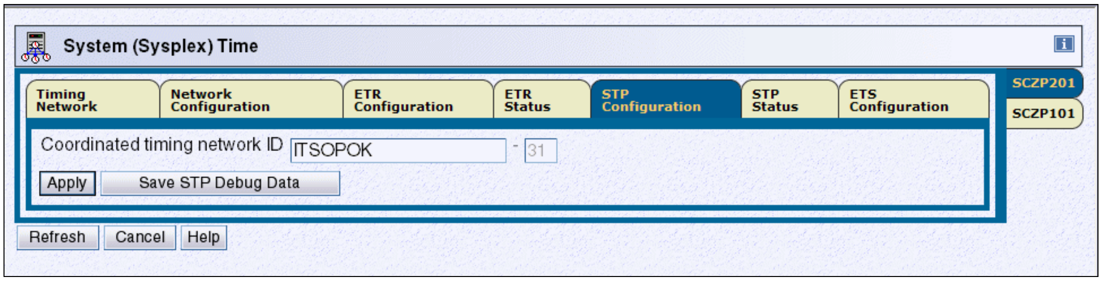


Figure 11-8 STP Configuration tab (SCZP201)

This shows that the SCZP201 server is in a mixed CTN with a CTN ID of [ITSOPOK] - [31], where ITSOPOK is the STP ID, and 31 is the ETR Network ID.

STP Status tab

Figure 11-9 shows the STP Status tab for the SCZP201 server.

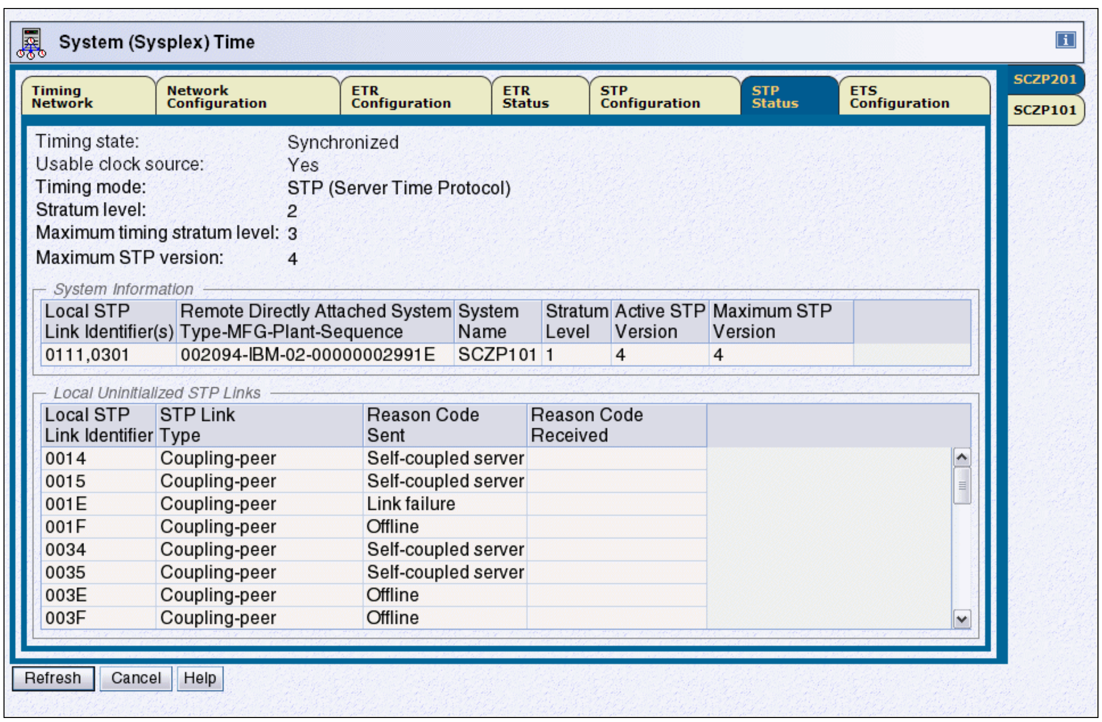


Figure 11-9 STP Status tab (SCZP201)

The SCZP201 server is in STP timing mode, is a Stratum 2, and is synchronized in the Mixed CTN.

This server also has STP connectivity to the SCZP101 server over two links, as identified by the STP link identifiers. Because SCZP101 is a Stratum 1, it must have connectivity to the ETR network and be in ETR timing mode.

ETS Configuration tab

The ETS Configuration tab is irrelevant for this scenario because the time source for the Mixed CTN is the ETR and therefore, no ETS is used.

11.2 Migration

The migration process for a Mixed CTN server in STP timing mode to ETR timing mode involves enabling the server ETR ports to establish connectivity to the ETR network.

Table 11-1 lists the before and after configuration details.

Table 11-1 Server configuration - Mixed CTN, STP timing mode to ETR timing mode for SCZP201

	Server	**CTN ID**		**Server role**	**Timing mode**	**Stratum level**
		STP ID	**ETR ID**			
Before migration	SCZP101	ITSOPOK	31	N/A	ETR	1
	SCZP201	ITSOPOK	31	N/A	STP	2
After migration	SCZP101	ITSOPOK	31	N/A	ETR	1
	SCZP201	ITSOPOK	31	N/A	ETR	1

In our sample configuration, only SCZP201 was previously converted to STP timing mode, so only this server needs to be migrated to ETR timing mode to return the CTN to full ETR timing mode.

For a larger configuration, this procedure needs to be repeated on all servers running in STP timing mode if a return to a Mixed CTN with full ETR timing mode is required.

Enable ETR connectivity on SCZP201

At the HMC workplace, perform the following steps:

1. Highlight the **SCZP201** server and select **System (Sysplex) Time**.
2. Click the **ETR Configuration** tab.
3. Ensure that the ETR Network ID is correct, and set both Port 0 and Port 1 states to Enabled (Figure 11-10).

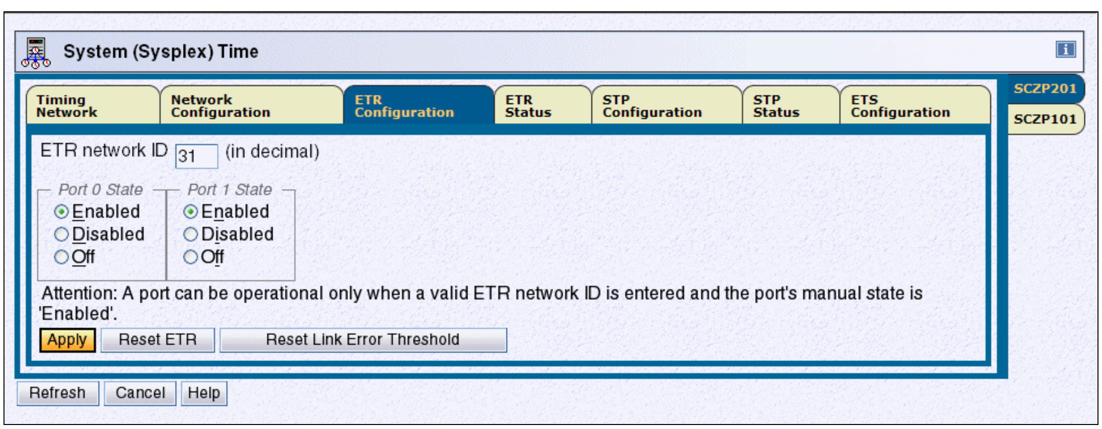


Figure 11-10 ETR Configuration tab - Enable ETR Ports (SCZP201)

4. Click **Apply**. This displays the Apply ETR Configuration, message ACT37301, indicating that the change was successful (Figure 11-11).

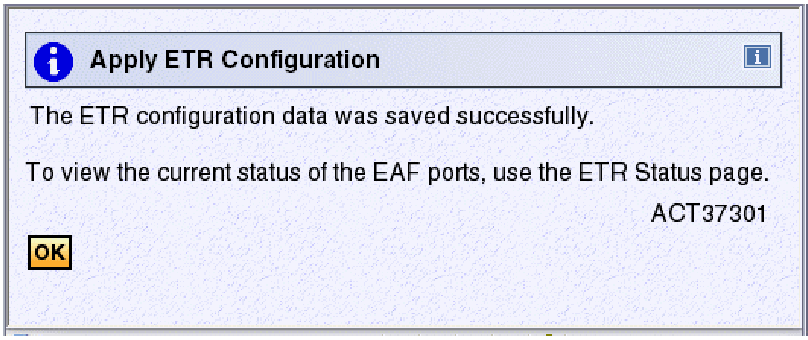


Figure 11-11 Message ACT37301 - ETR Configuration tab - Enable ETR Ports success (SCZP201)

Messages also display on the console and SYSLOG of z/OS images in a sysplex configuration resident on SCZP201 (Figure 11-12).

```
IEA267I ETR PORT 0 IS NOW AVAILABLE.                              (1)
IEA267I ETR PORT 1 IS NOW AVAILABLE.
IEA260I THE CPC IS NOW OPERATING IN ETR MODE.                     (2)
IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 25                  (3)
IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 0B                  (4)
```

Figure 11-12 SYSLOG messages for SC74 image - ETR ports enabled

The following notes apply to Figure 11-12:

(1) IEA267I is issued by each z/OS image as each server ETR port is enabled.

(2) IEA260I is issued by each z/OS image when conversion from STP timing mode to ETR timing mode is complete.

(4) IEA031I is received when a change occurred with respect to the external time source for the CTN. STP Alert Code 25 indicates that the non-preferred NTP server is accessible. However, the NTP server is not used, and the time source for the CTN still is the ETR.

(5) STP Alert Code 0B indicates that the NTP server switched to the preferred NTP server. However, the NTP server is not used, and the time source for the CTN still is the ETR.

11.3 End point

At the completion of the scenario, each server is operating in ETR timing mode due to the available connectivity with the ETR network (Figure 11-13).

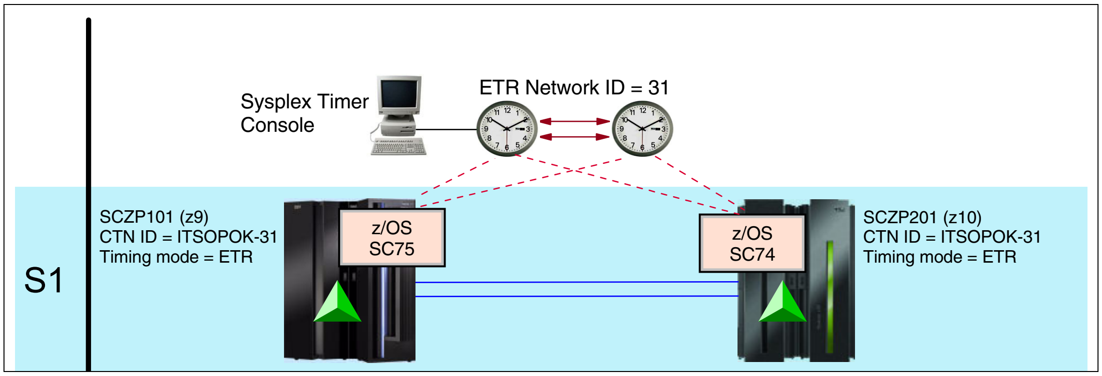


Figure 11-13 STP implementation environment - Mixed CTN with ETR timing mode only

Each server is defined as a Stratum 1 in the Mixed CTN, and the CTN ID of each server remains unchanged at [ITSOPOK] - [31]. Both servers are operating in ETR timing mode.

11.3.1 z/OS DISPLAY ETR command

Figure 11-14 shows the output from the DISPLAY ETR command entered on the SC74 image, on SCZP201.

```
D ETR
IEA282I 10.10.51 TIMING STATUS 677
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=00                   ETR PORT=00
  ETR ID=00                     ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Figure 11-14 DISPLAY ETR display - SC75 image on SCZP201 - Mixed CTN with ETR timing mode

This shows that SC74 is using an ETR as its timing source. The active server ETR port is port 0, which is connected to an ETR with an ID of 00 in an ETR Network with an ID of 31. The server on which the z/OS image SC74 resides is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31].

11.3.2 z/OS DISPLAY XCF command

Figure 11-15 shows the z/OS DISPLAY XCF command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  10.11.35  DISPLAY XCF 679
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME          SYSTEM STATUS
SC74     2097 DE50   2C   10/04/2009 10:11:35 ACTIVE        TM=ETR
SC75     2094 991E   1C   10/04/2009 10:11:34 ACTIVE        TM=ETR
```

Figure 11-15   DISPLAY XCF display - SC74 image on SCZP201 - Mixed CTN with ETR timing mode

This shows that both z/OS images SC74 and SC75 are operating in ETR timing mode. These z/OS images are resident on separate servers, as evidenced by the different serial numbers. However, there is no indication from this command output as to whether these servers have CTN IDs defined.

11.3.3 System (Sysplex) Time tabs

The System (Sysplex) Time tabs have undergone minor changes as a result of the migration of SCZP201 from STP timing mode to ETR timing mode.

Timing Network and Network Configuration tabs

These tabs remain unchanged, as these tabs make no reference to timing mode.

ETR Configuration tab

Figure 11-16 shows the ETR Configuration tab for the SCZP201 server.

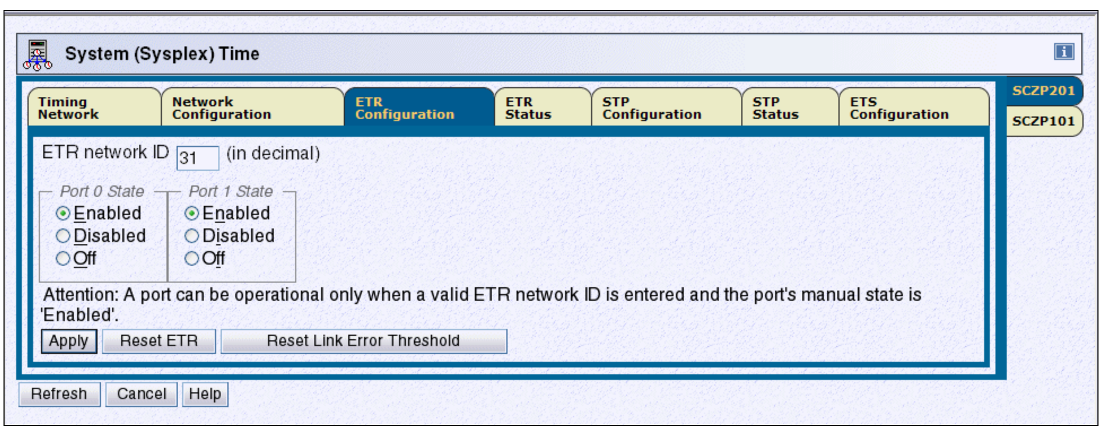


Figure 11-16   ETR Configuration tab (SCZP201)

Both server ETR ports are now shown as enabled.

ETR Status tab

Figure 11-17 shows the ETR Configuration tab for the SCZP201 server.

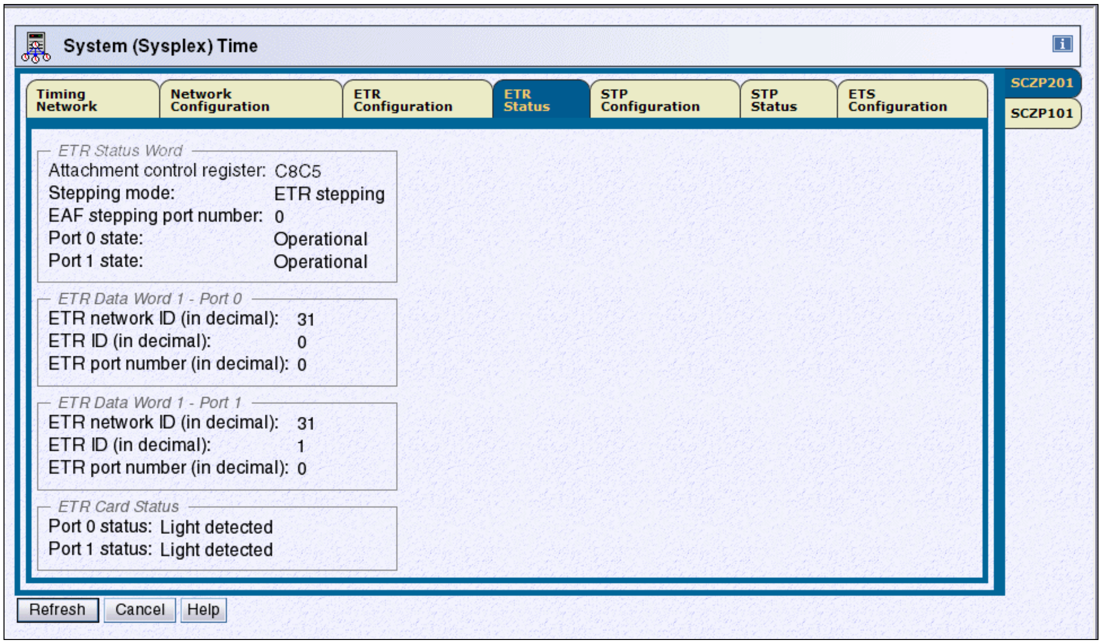


Figure 11-17 ETR Status tab (SCZP201)

Both server ETR ports are now operational.

STP Configuration tab

This tab remains unchanged.

STP Status tab

Figure 11-18 shows the STP Status tab for the SCZP901 server.

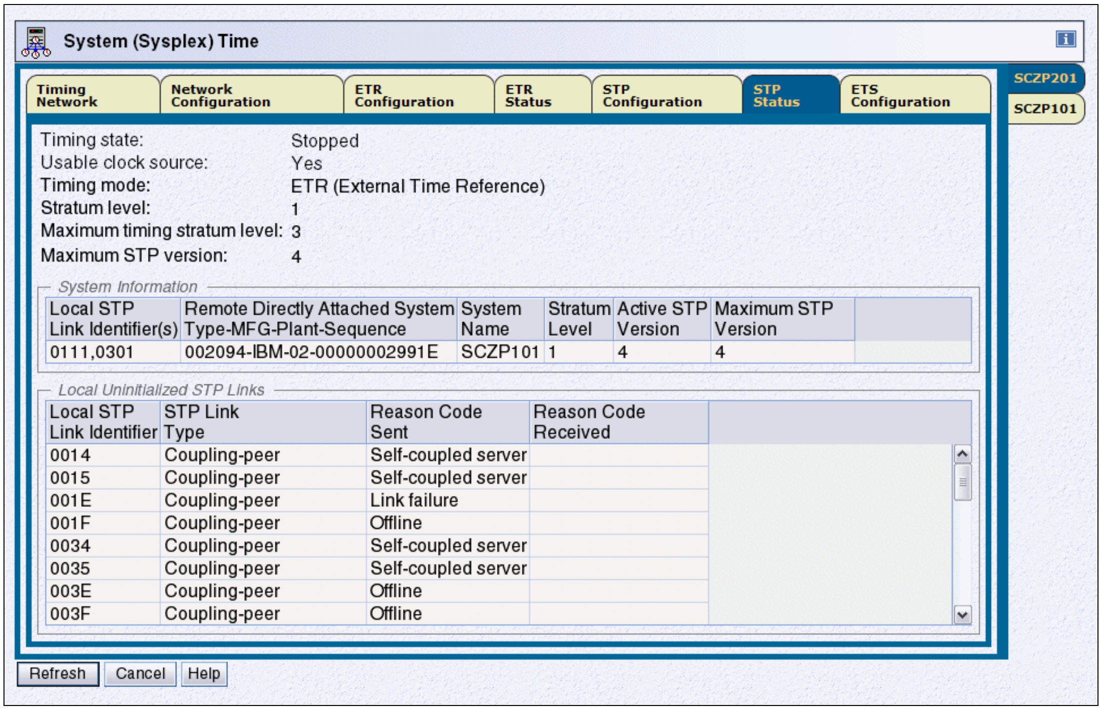


Figure 11-18 STP Status tab (SCZP201)

The SCZP201 server is now using ETR timing mode and has transitioned to Stratum 1, because it now has connectivity to the ETR network.

The information for the connectivity to SCZP101 in the Remote Directly Attached Systems section remains unchanged, because no modifications were done to this server.

ETS Configuration tab

This tab also remains unchanged, because no modifications have been performed to the ETS configuration.

12

Mixed CTN: Adding a server in STP timing mode

In the example in this chapter[1], one server is added to our sample Mixed Coordinated Timing Network (CTN) network. The new server has no connectivity to the External Timer Reference (ETR) network and can only participate in the Mixed CTN in Server Time Protocol (STP) timing mode.

In this chapter we work through the following sections:

A Mixed CTN can consist of servers in ETR timing mode only or a combination of servers in ETR timing mode and STP timing mode. In both cases, the ETR is the time source for the CTN.

This scenario proceeds to the point that all servers have a CTN ID defined that includes both an STP ID and an ETR Network ID. The servers with connectivity to the ETR network operate in ETR timing mode as a Stratum 1. The new server operates in STP timing mode as Stratum 2.

[1] See “Prerequisites” on page 263

12.1 Start point

The starting point for this scenario is a Mixed CTN (Figure 12-1).

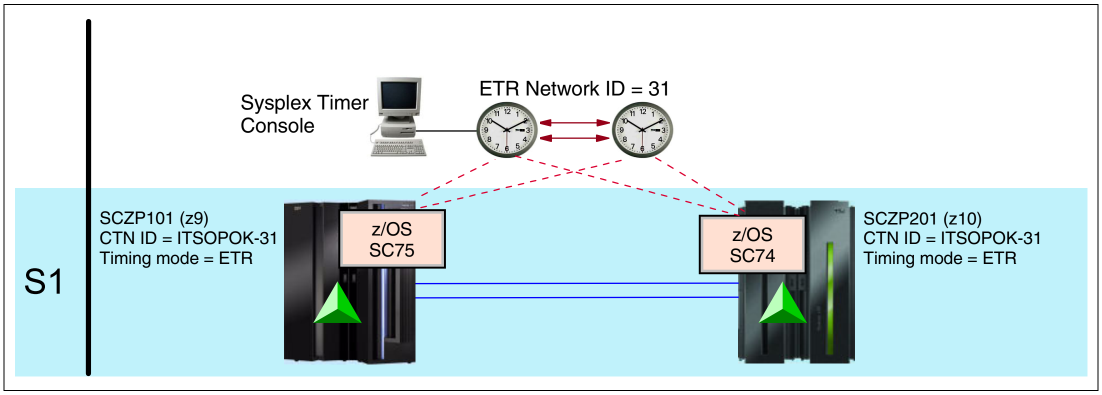


Figure 12-1 STP implementation environment - Mixed CTN with both servers in ETR timing mode

The Mixed CTN consists of two servers:

- SCZP101
- SCZP201

Both servers are STP configured, retain connectivity to the ETR network, and are in ETR timing mode (Stratum 1).

Each server is connected to the other server in a redundant configuration using two coupling links, and each server has a z/OS image and coupling facility defined.

This is the same configuration for the endpoint for the scenario described in Chapter 11, "Mixed CTN: Changing one server from STP timing mode to ETR timing mode" on page 309.

An extra server, H40, which does not have connectivity to the ETR network, will be added to the Mixed CTN in STP timing mode.

12.1.1 z/OS DISPLAY ETR command

Figure 12-2 shows the output from the **DISPLAY ETR** command entered on the SC74 image, on SCZP201.

```
IEE421I RO *ALL,D ETR 815
SC74     RESPONSES ---------------------------------------------------
IEA282I 09.13.16 TIMING STATUS 814
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=00                   ETR PORT=00
  ETR ID=00                     ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
SC75     RESPONSES ---------------------------------------------------
IEA282I 09.13.16 TIMING STATUS 612
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=01                   ETR PORT=01
  ETR ID=01                     ETR ID=00
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Figure 12-2 DISPLAY ETR display - SC74 image on SZCP201 - Mixed CTN

This display shows that SC74 and SC75 are resident on servers operating in ETR timing mode through connectivity to an ETR network. The CTN ID is [ISTOPOK] - [31], which indicates that the timing source for the CTN is an ETR Network with the ID of 31.

12.1.2 z/OS DISPLAY XCF command

Figure 12-3 shows the output from the z/OS **DISPLAY XCF** command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  09.15.01  DISPLAY XCF 817
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/10/2009 09:15:00 ACTIVE         TM=ETR
SC75     2094 991E   1C   10/10/2009 09:14:56 ACTIVE         TM=ETR
```

Figure 12-3 DISPLAY ETR display - SC74 image on SZCP201 - Mixed CTN

This shows that both images SC74 and SC75 are operating in ETR timing mode. These z/OS images are resident on separate servers, as evidenced by the different serial numbers.

12.1.3 System (Sysplex) Time tabs

The tabs discussed in this section are available in the System (Sysplex) Time window for each server. Only the tabs for the H40 server are shown in this section.

Timing Network tab

Figure 12-4 shows the Timing Network tab for the H40 server.

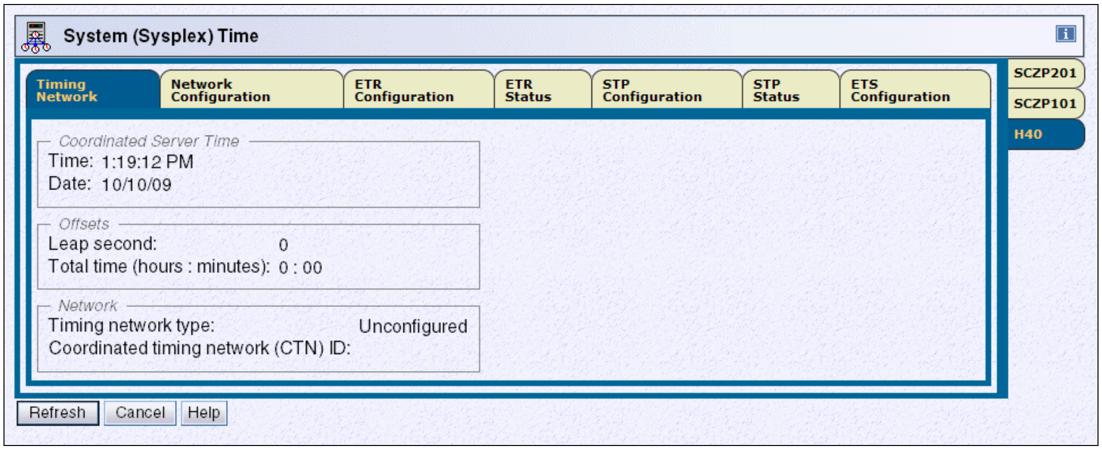


Figure 12-4 Timing Network tab (H40)

This shows that the H40 server is not configured in a CTN and, therefore, is running in local time-of-day (TOD) stepping mode.

Network Configuration tab

Figure 12-5 shows the Network Configuration tab for the H40 server.

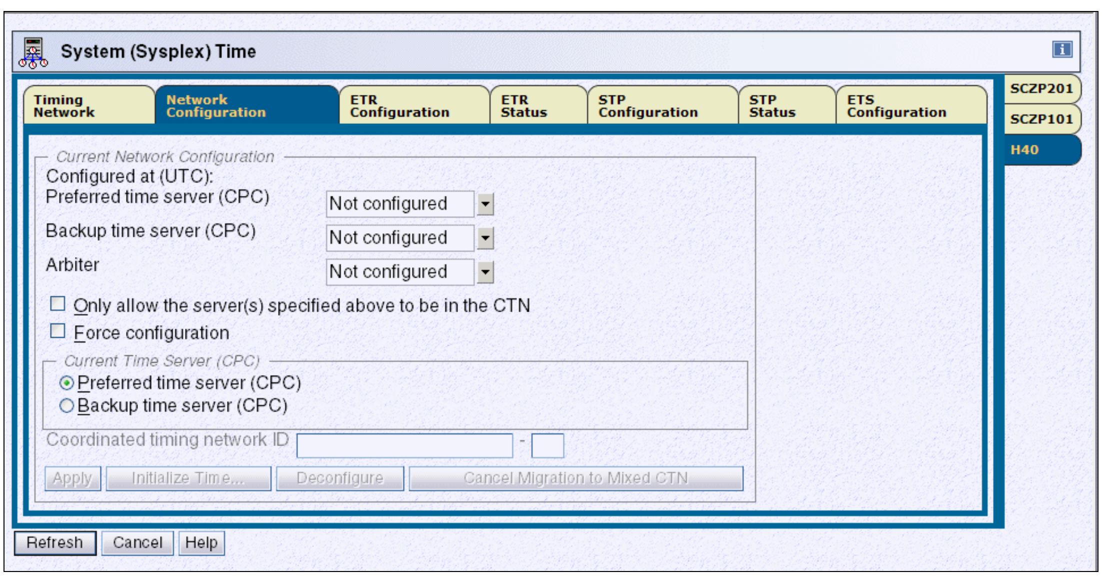


Figure 12-5 Network Configuration tab (H40)

Because H40 is not STP configured, the Preferred Time Server, Backup Time Server, and Arbiter fields are not applicable, and the Coordinated Timing Network ID is blank. Also, the Apply, Initialize Time, and Deconfigure buttons have been disabled.

ETR Configuration and ETR Status tabs

These tabs are not relevant to this scenario, because server H40 does not have connectivity to the ETR network.

STP Configuration tab

Figure 12-6 shows the STP Configuration tab for the H40 server.

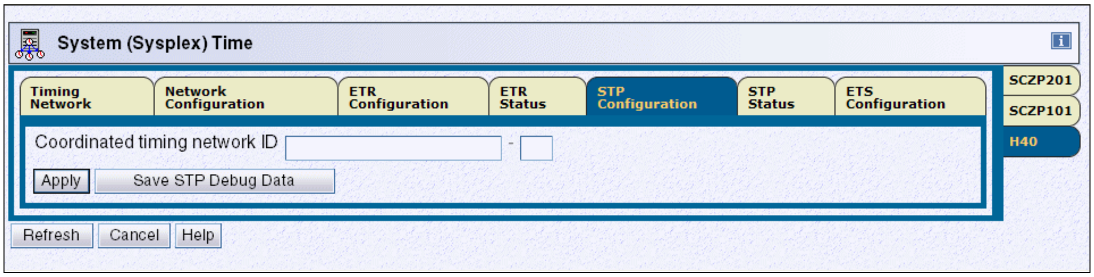


Figure 12-6 STP Configuration tab (H40)

Because the H40 server has not been configured for STP, this tab shows the CTN ID as blank.

STP Status tab

Figure 12-7 shows the STP Status tab for the H40 server.

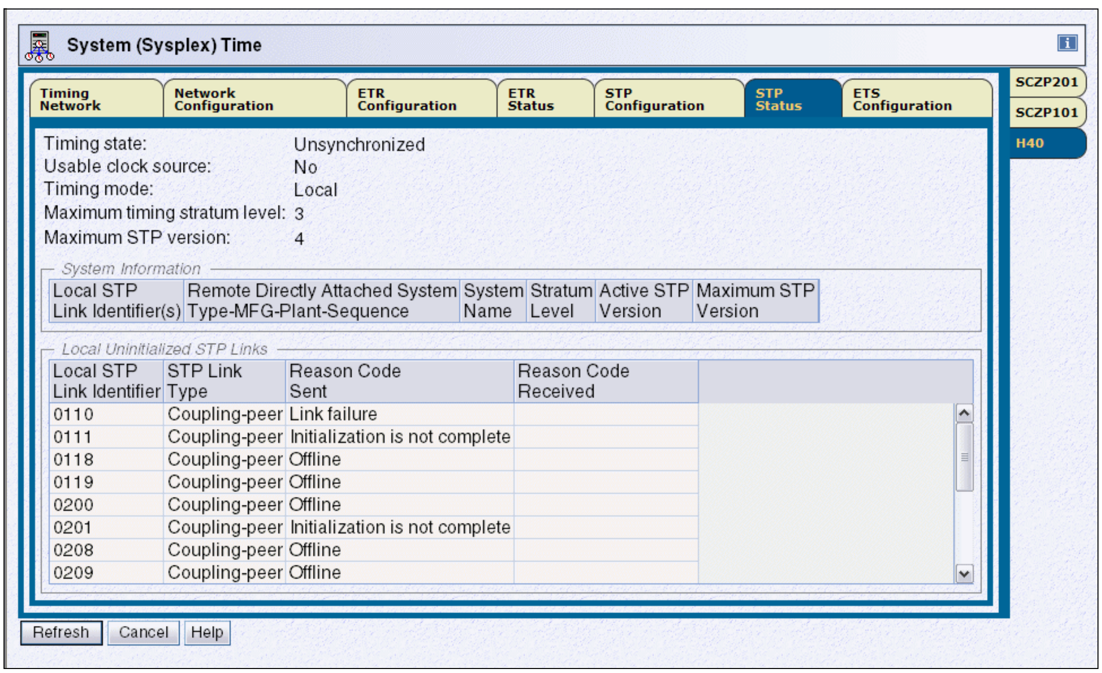


Figure 12-7 STP Status tab (H40)

The H40 server is shown as unsynchronized, because it has no usable clock source. It is running in local TOD stepping mode. No stratum level is shown.

Also, the H40 server does not have a CTN ID defined and is therefore not STP configured. So, no servers appear in the Remote Directly Attached Systems section, because H40 is unable to send or receive STP control and timing messages.

However, this tab displays the links defined in the IOCDS that are *eligible* for the exchange of STP messages after the STP ID portion of the CTN ID is defined.

Note: Each link remains in an *uninitialized* state until the servers at both ends of the link have a matching CTN ID defined that contains a valid STP ID.

ETS Configuration tab

The ETS Configuration tab is irrelevant for this scenario because the time source for the mixed CTN is the ETR and therefore, no ETS is used.

12.2 Migration

The addition of a new server to an existing Mixed CTN involves defining the CTN ID on the new server to match the value already in use by the Mixed CTN. In our sample configuration, the CTN ID in use is [ITSOPOK] - [31], so the new server must also have this value defined in line with the existing servers. This might seem confusing, because the CTN ID defined for this server contains an ETR Network ID. However, the server does not use the ETR network as its time source after migration to STP timing mode is complete.

Whenever a CTN ID includes a valid ETR Network ID, it implies that the time source for the CTN provided by the ETR Network is distinct from the time source for each individual server. Every server in the CTN must have a matching CTN ID to establish STP connectivity through the coupling links. The ETR Network ID must be specified on every server, even though certain servers might not have connectivity to the ETR network.

Important: Setting the CTN ID *must* be done using different methods, depending on whether the server has ETR ports installed, which in turn determines whether the ETR Configuration and ETR Status tabs are available within System (Sysplex) Time:

If the server has ETR ports installed, the CTN ID is defined in two steps:

1. Define the ETR Network ID on the ETR Configuration tab.
2. Define the STP ID on the STP Configuration tab.

If the server does not have ETR ports installed, the CTN ID is defined in a single step, which is to define the STP ID and the ETR Network ID on the STP Configuration tab.

Table 12-1 shows the before and after configuration details.

Table 12-1 Server configuration - Mixed CTN - ETR timing mode to STP timing mode for H40

	Server	CTN ID		Server role	Timing mode	Stratum level
		STP ID	ETR ID			
Before migration	SCZP101	ITSOPOK	31	N/A	ETR	1
	SCZP201	ITSOPOK	31	N/A	ETR	1
	H40	Null	Null	N/A	LOCAL	Not defined
After migration	SCZP101	ITSOPOK	31	N/A	ETR	1
	SCZP201	ITSOPOK	31	N/A	ETR	1
	H40	ITSOPOK	31	N/A	STP	2

The prerequisite STP preparation tasks are assumed to have been completed for this new server.

The new server also requires coupling link connectivity to the existing servers in the Mixed CTN. These links might be either coupling links or timing-only links, depending on the configuration. The sample configuration uses coupling links, because each existing server in the Mixed CTN contains a coupling facility.

12.2.1 Defining the ETR Network ID on H40

Because the new H40 server in our sample configuration has ETR ports installed, definition of the CTN ID must be done in two stages, with the ETR Network ID being defined first, followed by the STP ID. At the completion of this step, the CTN ID is [ ] - [31] for the new server, which is in line with the value defined for the existing servers.

At the HMC workplace, perform the following steps in order:

1. Highlight the **H40** server and select **System (Sysplex) Time**.
2. Click the **ETR Configuration** tab.
3. Enter an ETR Network ID of 31 and set both Port 0 and Port 1 states to Disabled (Figure 12-8).

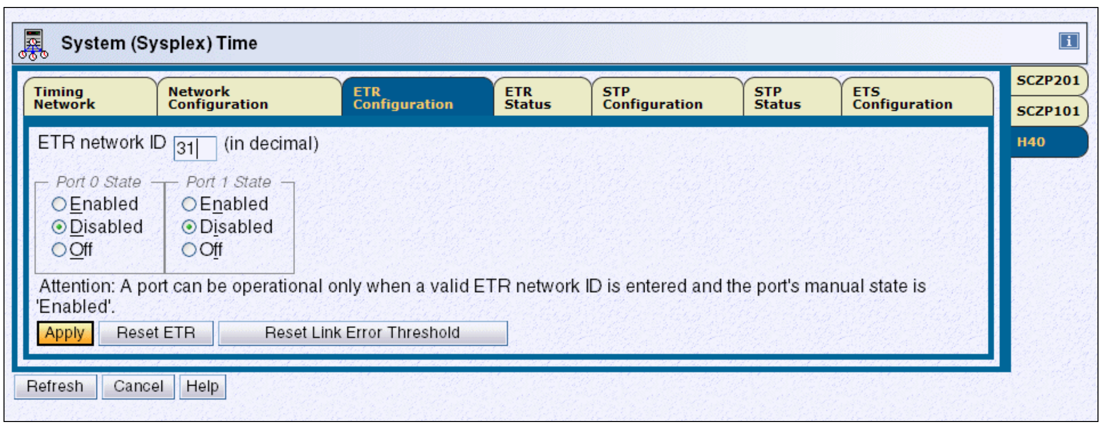


Figure 12-8 ETR Configuration tab - Define ETR Network ID (H40)

4. Click **Apply**. This displays the Local Coordinated Timing Network ID Change Confirmation, message ACT37359 (Figure 12-9).

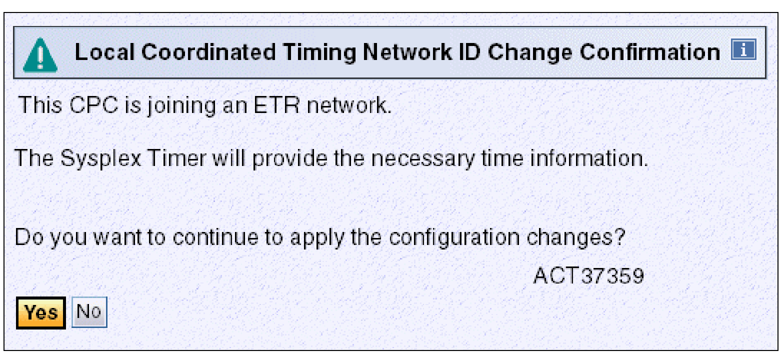


Figure 12-9 Message ACT37359 - Local Coordinated Timing Network ID Change (H40)

5. Confirm by clicking **Yes**. This displays the Apply ETR Configuration, message ACT37301, indicating that the change was successful (Figure 12-10).

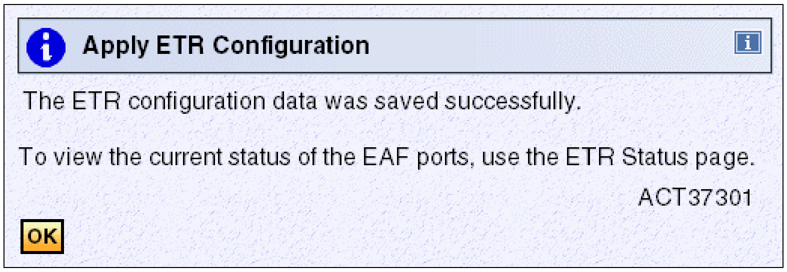


Figure 12-10 Message ACT37301 - Apply ETR Configuration (H40)

12.2.2 Defining the STP ID on H40

The second step of the definition involves defining the STP ID in the CTN ID. At the end of this step, the CTN ID defined for the new server will be [ITSOPOK] - [31], which matches the CTN ID already in use by the Mixed CTN.

At the HMC workplace, perform the following steps:

1. Highlight the **H40** server and select **System (Sysplex) Time**.
2. Click the **STP Configuration** tab.
3. Enter the required STP ID (in our case, `ITSOPOK`) in the Coordinated Timing Network ID field (Figure 12-11).

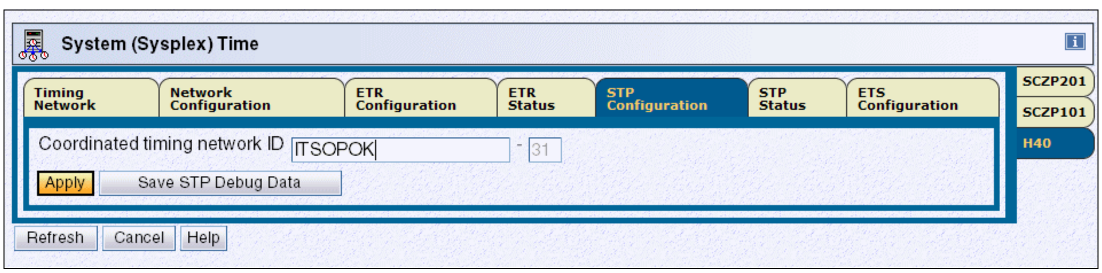


Figure 12-11 STP Configuration tab - Define STP ID (H40)

4. Click **Apply**. This displays the Local Coordinated Timing Network ID Change Confirmation, message ACT37361 (Figure 12-12).

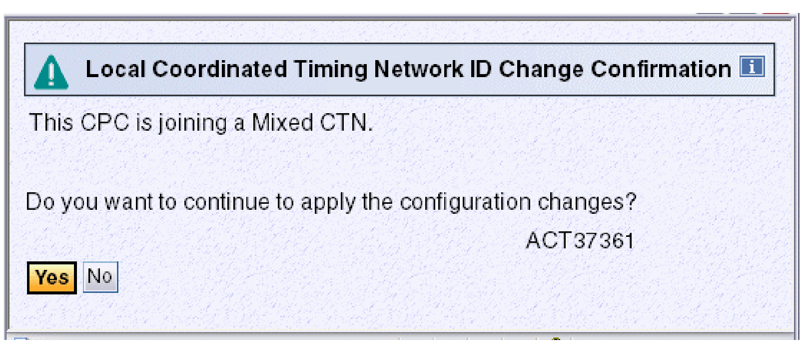


Figure 12-12 Message ACT37361 - Local Coordinated Timing Network ID Change (H40)

Note: The word *local* is included in this window to indicate that this change only applies to the selected server and might need to be performed on all other servers in the CTN. It is not a *global* change that will be propagated automatically throughout the CTN.

5. Confirm by clicking **Yes**. This displays the Local Coordinated Timing Network ID Change, message ACT37315, indicating that the change was successful (Figure 12-13).

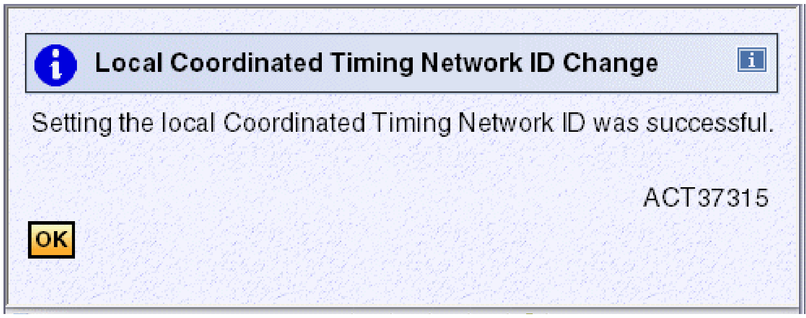


Figure 12-13 Message ACT37315 - Local Coordinated Timing Network ID Change (H40)

12.3 End point

The topology diagram of our sample configuration has been updated to include the addition of the H40 server operating in STP timing mode (Figure 12-14).

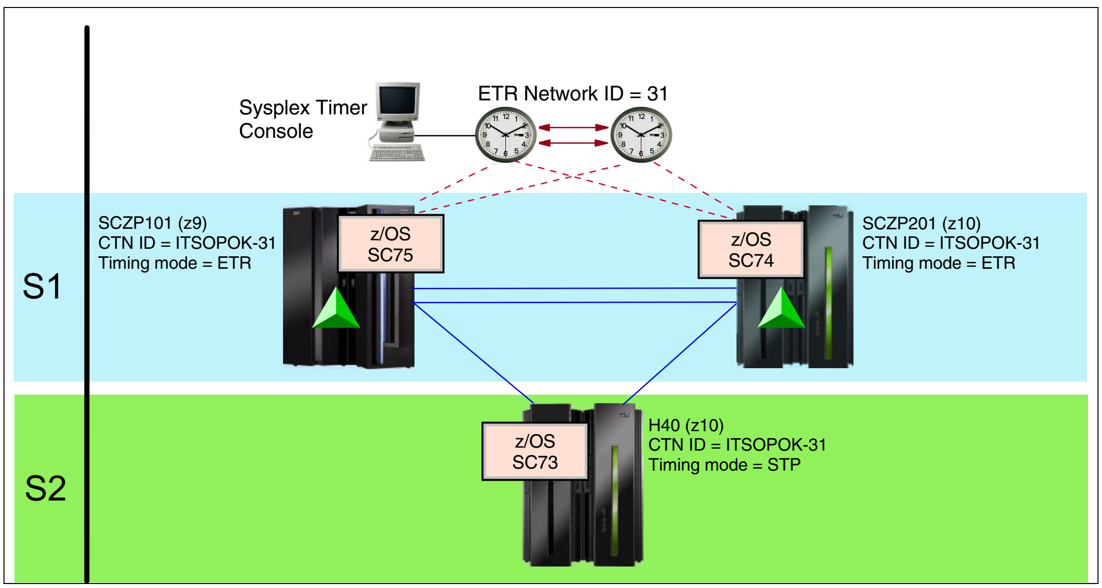


Figure 12-14 STP Implementation environment - Mixed CTN with new server (H40)

The new server H40 is receiving STP timing messages from both Stratum 1 servers SCZP101 and SCZP201 over the coupling links. Note that our sample configuration only has one coupling link available from H40 to each of the other servers in the Mixed CTN. This is *not* a recommended configuration.

If connectivity between one of the Stratum 1 servers SCZP101 or SCZP201and H40 is lost due to a coupling link failure, H40 remains synchronized in the Mixed CTN by automatically selecting the other Stratum 1 server as the time source.

It is useful for a Mixed CTN to always have multiple servers with connectivity to the ETR network to avoid a single point of failure. If there is only one server connected to the ETR and running in Stratum 1, and the other two servers have no ETR connection and are running in Stratum 2, then if this Stratum 1 server is removed from the Mixed CTN for any reason, the CTN will have lost its timing source. Both remaining servers transition to Stratum 0 as a result.

z/OS image SC73 is now IPLed on H40 to issue z/OS commands.

The Mixed CTN [ITSOPOK-31] cannot be migrated back to an ETR CTN [31] until H40 has an ETR connectivity established.

12.3.1 z/OS DISPLAY ETR command

Figure 12-15 shows the output from the **DISPLAY ETR** command entered on the SC73 image, on H40.

```
D ETR
IEA282I 09.34.27 TIMING STATUS 837
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK -31
  NUMBER OF USABLE TIMING LINKS =  2
```

Figure 12-15 DISPLAY ETR - SC73 image on H40 - Mixed CTN

This display shows that SC73 is resident on a server operating in STP timing mode as a Stratum 2. It is participating in a Mixed CTN with a CTN ID of [ITSOPOK] - [31] and has two links available for STP timing messages.

12.3.2 z/OS DISPLAY XCF command

Figure 12-16 shows the output from the z/OS **DISPLAY XCF** command entered on the SC73 image, on H40.

```
D XCF,S,ALL
IXC335I  09.36.58  DISPLAY XCF 839
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME        SYSTEM STATUS
SC74     2097 DE50   2C   10/10/2009 09:36:58 ACTIVE        TM=ETR
SC75     2094 991E   1C   10/10/2009 09:36:54 ACTIVE        TM=ETR
SC73     2097 961F   1A   10/10/2009 09:36:51 ACTIVE        TM=STP
```

Figure 12-16 DISPLAY XCF - SC73 image on H40 - Mixed CTN

This display shows that SC74 and SC75 are resident on separate servers operating in ETR timing mode and therefore must have connectivity to an ETR network. However, SC73 is resident on a server operating in STP timing mode.

12.3.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) Time selection for each server. Only the tabs for the P000STP2 server are shown in this section.

Timing Network tab

Figure 12-17 shows the Timing Network tab for the H40 server.

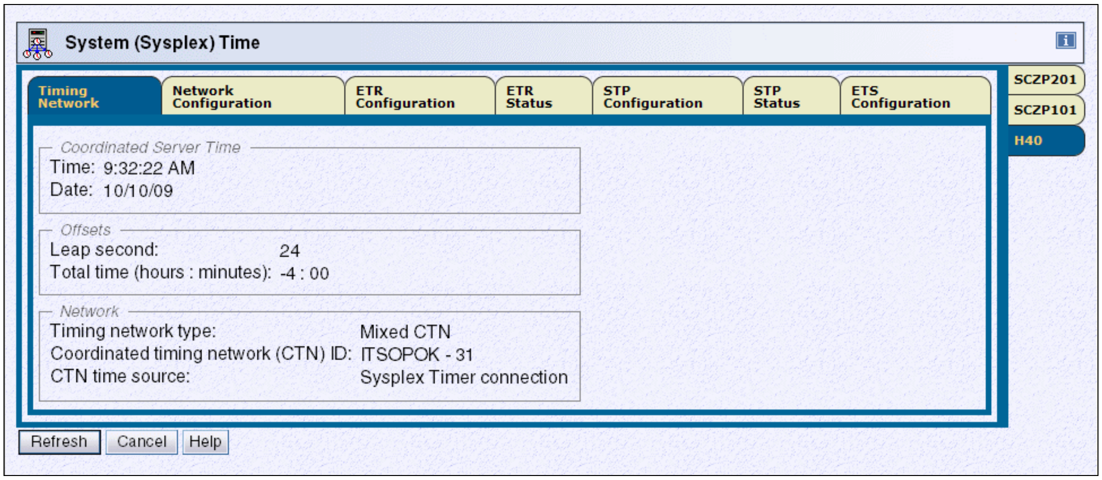


Figure 12-17 Timing Network tab (H40)

This shows that the H40 server is now in a Mixed CTN with a CTN ID of [ITSOPOK] - [31], and the CTN time source is the ETR network. This is the same information that will be displayed on the Timing Network tab for the other STP-configured servers in the Mixed CTN.

Network Configuration tab

Figure 12-18 shows the Network Configuration tab for the H40 server.

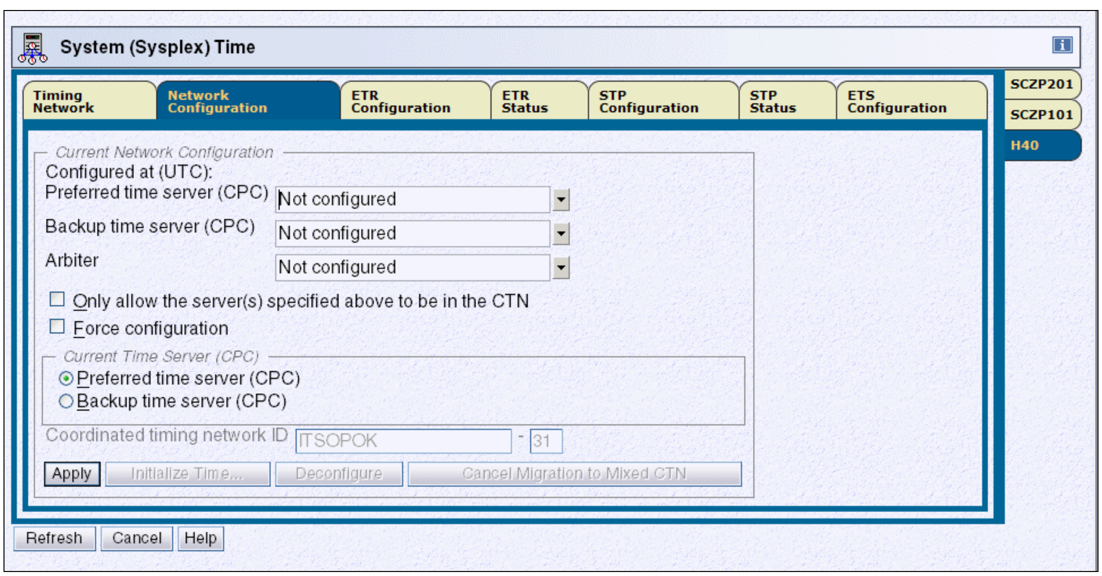


Figure 12-18 Network Configuration tab (H40)

Because the H40 server is in a Mixed CTN, the Preferred Time Server, Backup Time Server, and Arbiter fields are not applicable. Only the Apply button is enabled to allow a full STP conversion to proceed. See Chapter 13, "Mixed CTN (two servers) to STP-only CTN" on page 335, for a detailed description of this process.

ETR Configuration and ETR Status tabs

These tabs are only available if the new H40 server has ETR ports configured.

If that is the case, the ETR Configuration tab contains the ETR Network ID of 31 and shows the server ETR ports in a disabled state. The ETR Status tab is not relevant, because the server is not connected to the ETR in our sample configuration.

STP Configuration tab

Figure 12-19 shows the STP Configuration tab for the H40 server.

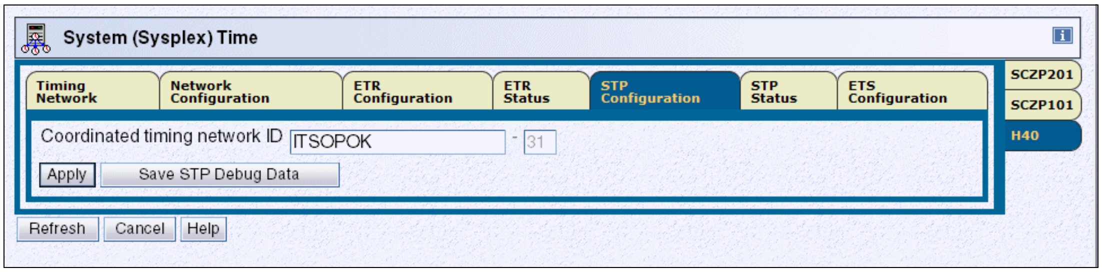


Figure 12-19 STP Configuration tab (H40)

This shows that the H40 server is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31], where ITSOPOK is the STP ID, and 31 is the ETR Network ID.

STP Status tab

Figure 12-20 shows the STP Status tab for the H40 server.

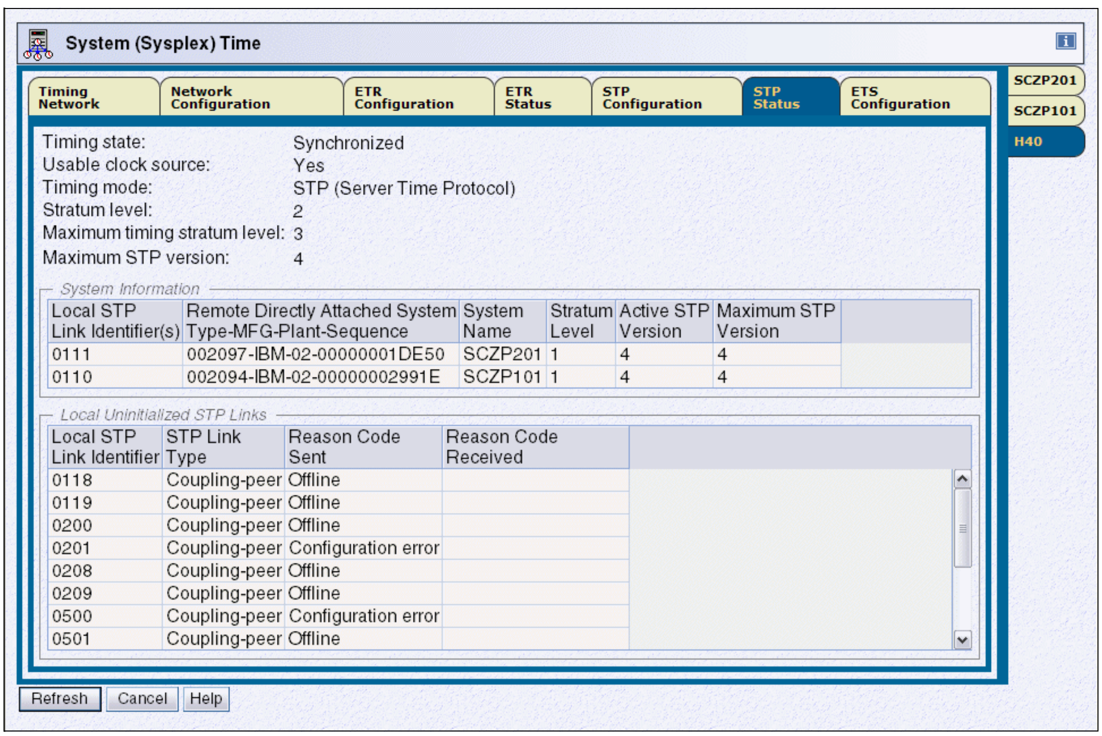


Figure 12-20 STP Status tab (H40)

The H40 server is shown to have joined the Mixed CTN as a Stratum 2 and is time synchronized. It has two Remote Directly Attached Systems, SCZP901and SCZP101, both a Stratum 1.

Connectivity to each of the Remote Directly Attached Systems is by one coupling link only, as evidenced by the single STP Link Identifier registered for each attached server. This is *not* a recommended configuration.

ETS Configuration tab

This tab also remains unchanged, because no modifications have been performed to the ETS configuration.

13

Mixed CTN (two servers) to STP-only CTN

In the scenario in this chapter[1], a sample configuration consisting of two servers is converted from a Mixed CTN to an STP-only CTN.

In this chapter we work through the following sections:

Once in an STP-only CTN, there is no further reliance on the External Timer Reference (ETR) network, because all servers previously operating in ETR timing mode have their ETR connectivity disabled as part of the migration process.

Important: After conversion to an STP-only CTN is complete, the timing source for the CTN is the Stratum 1 server, and no further timing signals are used from the ETR network. After this occurs, the respective time in the ETR Network and the Stratum 1 server might slowly drift apart, because they are no longer being kept aligned.

A subsequent migration from an STP-only CTN back to a Mixed CTN might be impacted by this time differential, and the potential for this to occur is proportionally related to the period during which the two timing sources are no longer being kept aligned.

When planning to perform a test migration from a Mixed CTN to an STP-only CTN, and then migrating back to a Mixed CTN, try to minimize the time spent in the STP-only CTN configuration to limit this potential impact.

[1] See "Prerequisites" on page 263.

13.1 Start point

The starting point for this scenario is a Mixed CTN consisting of two servers, with both servers in ETR timing mode (Figure 13-1). This configuration is the result of a previous migration step in which a timing mode change was done.

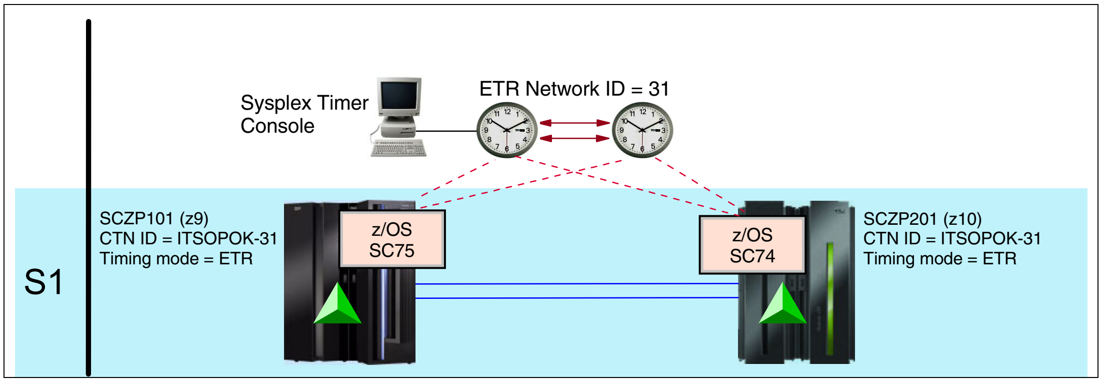


Figure 13-1 STP Implementation environment: Mixed CTN with two servers

The Mixed CTN consists of two servers:

- SCZP101
- SCZP201

Both servers are STP configured, and both servers are in ETR timing mode because they retain connectivity to the ETR network.

The SCZP101 and SCZP201 servers are connected to each other in a redundant configuration using two coupling links, and each of these servers has a z/OS image and coupling facility defined.

This is the same configuration that is the endpoint for the scenario for adding a new server to an existing Mixed CTN, as discussed in Chapter 8, “ETR Network to Mixed CTN (ETR timing mode)” on page 265, and Chapter 11, “Mixed CTN: Changing one server from STP timing mode to ETR timing mode” on page 309.

13.1.1 z/OS DISPLAY ETR command

Figure 13-2 shows the output from the DISPLAY ETR command entered on the SC74 image, on SCZP201.

```
IEE421I RO *ALL,D ETR
SC74     RESPONSES ---------------------------------------------------
IEA282I 18.48.27 TIMING STATUS 528
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=00                   ETR PORT=00
  ETR ID=00                     ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
SC75     RESPONSES ---------------------------------------------------
IEA282I 18.48.27 TIMING STATUS 953
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=01                   ETR PORT=01
  ETR ID=01                     ETR ID=00
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Figure 13-2 DISPLAY ETR display - SC74 image on SCZP201 - Mixed CTN

This display shows that SC74 and SC75 are resident on separate servers operating in ETR timing mode through connectivity to an ETR network.

All servers are in the same Mixed CTN with a CTN ID of [ITSOPOK] - [31], which indicates that the timing source for the CTN is an ETR network with an ETR Network ID of 31.

13.1.2 z/OS DISPLAY XCF command

Figure 13-3 shows the output from the z/OS DISPLAY XCF command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  18.49.36  DISPLAY XCF 531
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC75     2094 991E   1C   10/03/2009 18:49:33 ACTIVE         TM=ETR
SC74     2097 DE50   2C   10/03/2009 18:49:35 ACTIVE         TM=ETR
```

Figure 13-3 DISPLAY XCF display - SC74 image on SCZP201 - Mixed CTN

This display shows that SC74 and SC75 are resident on separate servers operating in ETR timing mode and therefore must have connectivity to an ETR network.

13.1.3 System (Sysplex) Time tabs

The following tabs are available on the System (Sysplex) Time selection for each server. Only the tabs for the SCZP201 server are shown in this section.

Timing Network tab

Figure 13-4 shows the Timing Network tab for the SCZP201 server.

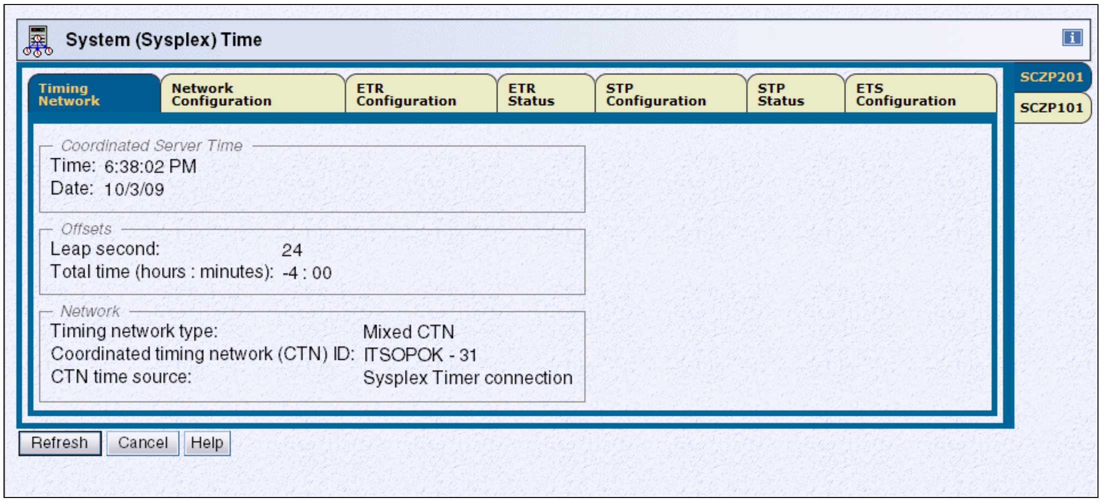


Figure 13-4 Timing Network tab (SCZP201)

This shows that the SCZP201 server is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31], and the CTN time source is the ETR network. This is the same information that is shown on the Timing Network tab for the other STP-configured server in the Mixed CTN.

Network Configuration tab

Figure 13-5 shows the Network Configuration tab for the SCZP201 server.

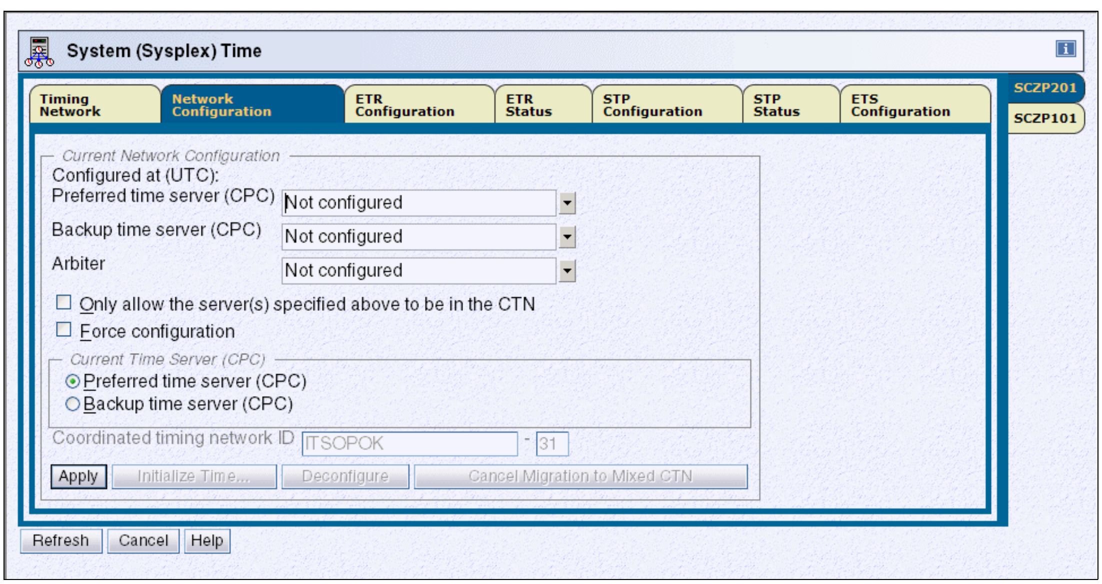


Figure 13-5 Network Configuration tab (SCZP201)

Because the SCZP201 server is in a Mixed CTN, the Preferred Time Server, Backup Time Server, and Arbiter fields are not applicable. Only the Apply button is enabled to allow a full STP conversion to proceed.

ETR Configuration tab

Figure 13-6 shows the ETR Configuration tab for the SCZP201 server.

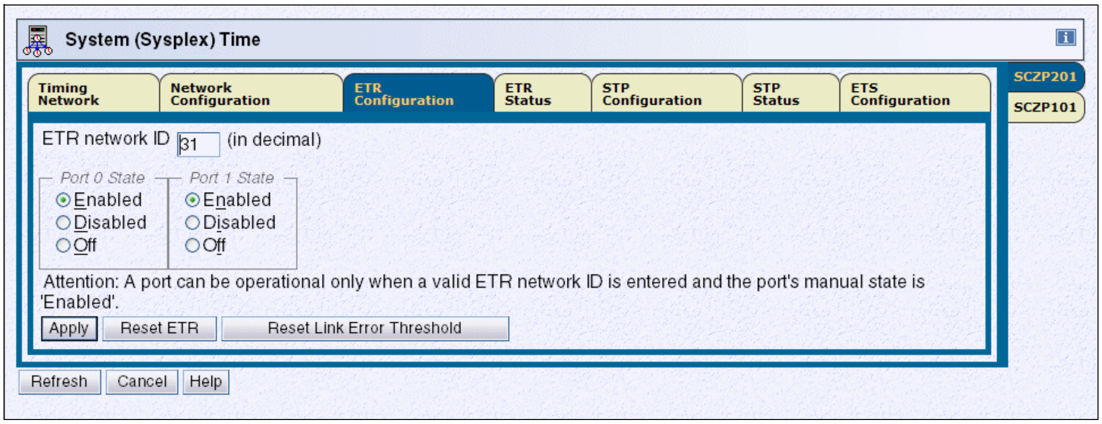


Figure 13-6 ETR Configuration tab (SCZP201)

Because the SCZP201 server is operating in ETR timing mode, both server ETR ports are shown as enabled.

ETR Status tab

Figure 13-7 shows the ETR Status tab for the SCZP201 server.

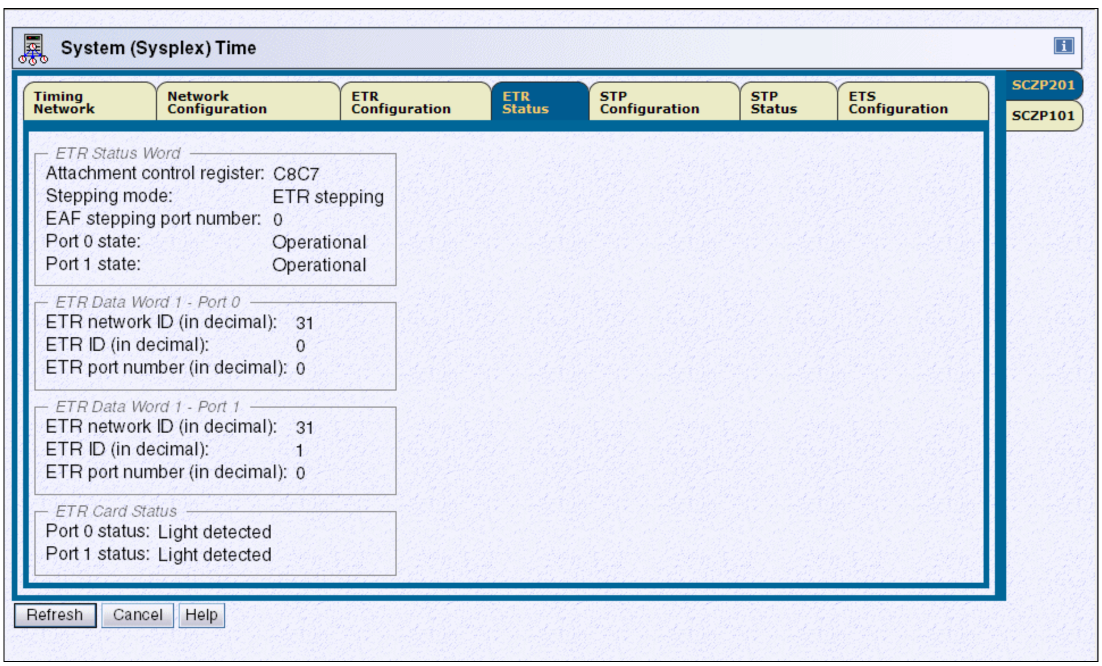


Figure 13-7 ETR Status tab (SCZP201)

This is a status tab only and no modifications to the server ETR ports are possible from here. This tab shows the server ETR port states as *operational*, which indicates that connectivity exists between the server and the ETR network, and that the server ETR ports have been enabled.

STP Configuration tab

Figure 13-8 shows the STP Configuration tab for the SCZP201 server.

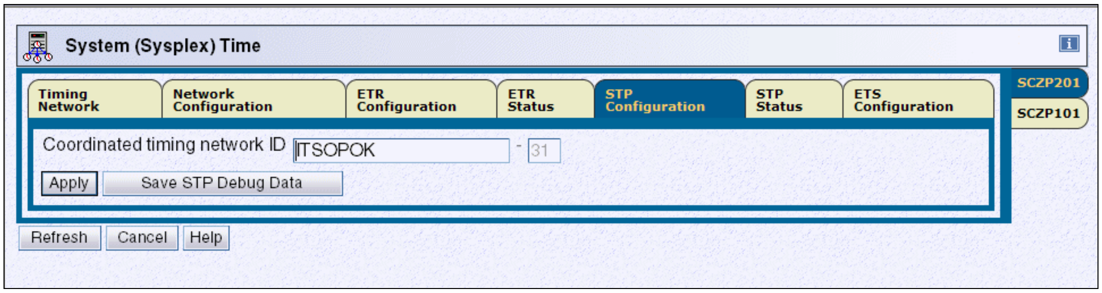


Figure 13-8 STP Configuration tab (SCZP201)

This shows that the SCZP201 server is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31], where ITSOPOK is the STP ID, and 31 is the ETR Network ID.

STP Status tab

Figure 13-9 shows the STP Status tab for the SCZP201 server.

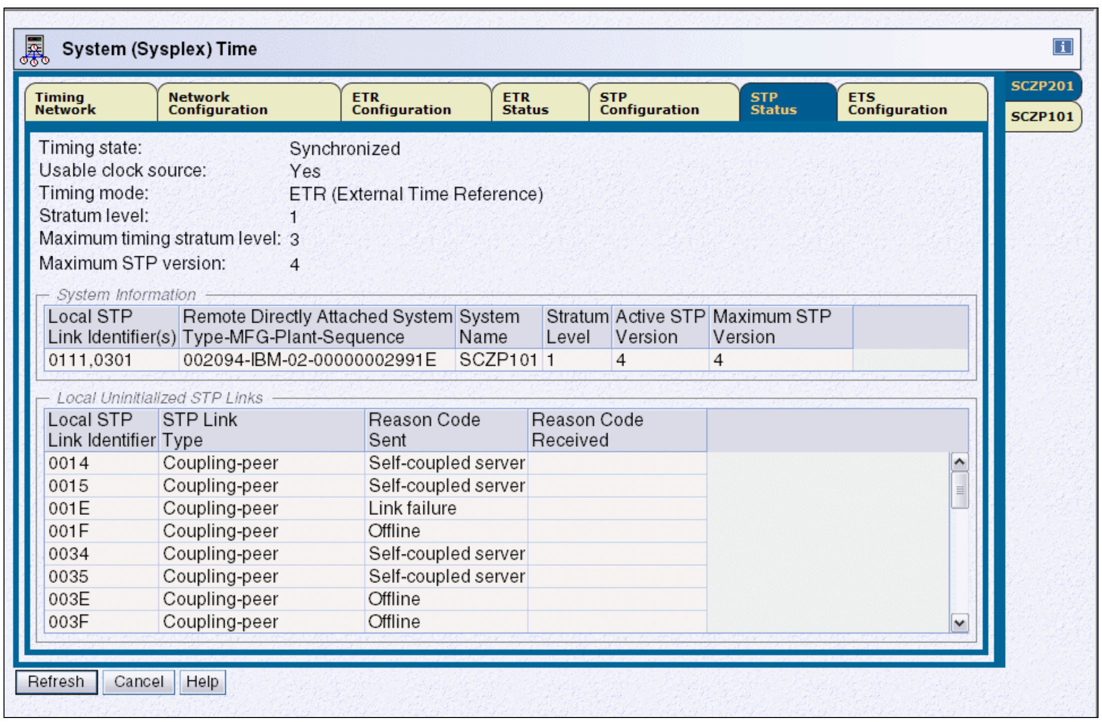


Figure 13-9 STP Status tab (SCZP201)

The SCZP201 server is shown as participating in the Mixed CTN as a Stratum 1 and is time synchronized. It has one Remote Directly Attached Systems, SCZP101, which is a Stratum 1.

Connectivity of SCZP901 to the other server is shown in the Remote Directly Attached Systems section, and the STP Link Identifiers show the PCHIDs of the coupling links or timing-only links that are used for STP control and timing messages.

ETS Configuration tab

Figure 13-10 shows the ETS Configuration for the SCZP201 server.

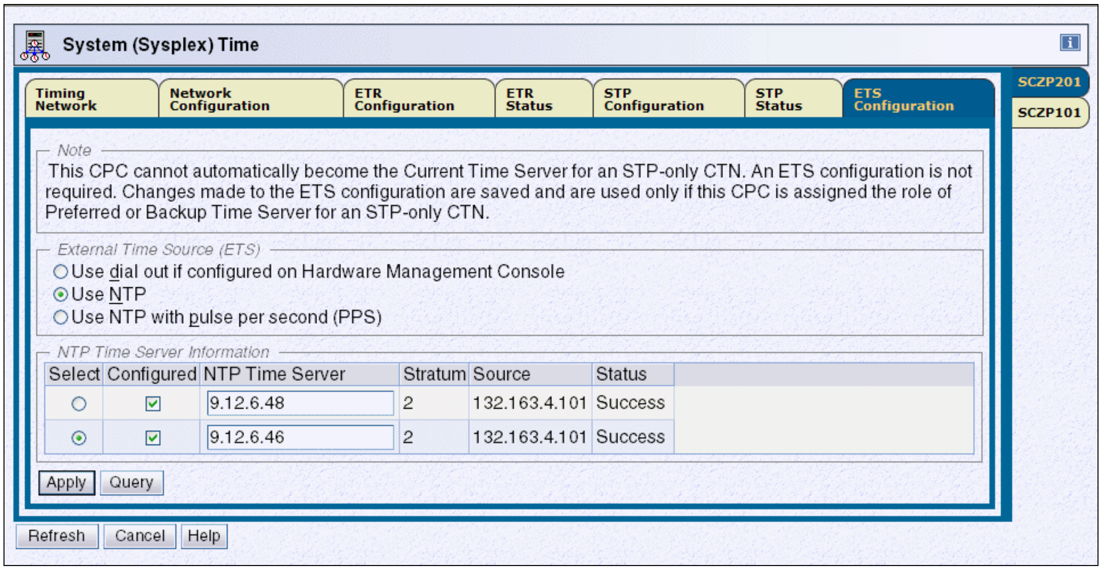


Figure 13-10 ETS Configuration tab (SCZP201)

Two NTP time servers have been defined as time sources, if SCZP201 will ever become the Current Time Server for an STP-only CTN. These are the two Hardware Management Consoles (HMCs) of the configuration. Both of them are Stratum 2 NTP servers connected to an external Stratum 1 NTP server and have been successfully contacted. However, SCZP201 now is not defined as a Preferred Time Server or as a Backup Time Server to the CTN, so the ETS configuration is not used. The time source of the CTN still is the ETR.

13.2 Migration

The migration to an STP-only CTN involves a single change that *must* be performed from the server that will become the Current Time Server (CTS).

Note: Migration to an STP-only CTN is a *global* change that only needs to be performed once within the CTN.

In most circumstances, the server assigned to be the Preferred Time Server (PTS) becomes the CTS.

The configuration of server roles is performed using the Network Configuration tab, within System (Sysplex) Time, at the HMC workplace. This tab may also be used to subsequently change the server roles in the STP-only CTN and to move the CTS function between the PTS and BTS servers, if this is required.

The servers that assume the PTS, BTS, and Arbiter roles must have connectivity to one another. Otherwise, the **Force configuration** check box must be selected.

Note: Any STP-configured server in the Mixed CTN can assume any of the server roles and change the stratum level during the migration accordingly.

In our case, the following changes in stratum levels occur during the migration:

- SCZP101 was previously a Stratum 1 and must transition to a Stratum 2, because it is being defined as the BTS.
- SCZP201 was previously a Stratum 1, and it remains a Stratum 1 to assume the CTS role as defined.

Table 13-1 shows the before and after configuration details.

Table 13-1 Server configuration - Mixed CTN to STP-only CTN migration

	Server	CTN ID		Server role	Timing mode	Stratum level
		STP ID	ETR ID			
Before migration	SCZP101	ITSOPOK	31		ETR	1
	SCZP201	ITSOPOK	31		ETR	1
After migration	SCZP101	ITSOPOK		BTS	STP	2
	SCZP201	ITSOPOK		PTS & CTS	STP	1

During the migration process, the CTN ID is updated by the *STP facility* to remove references to the ETR Network ID, and all remaining connectivity to the ETR network is disabled.

The CTN ID on all servers in the Mixed CTN prior to migration is [ITSOPOK] - [31]. At the completion of this scenario, the global change initiated from the Network Configuration tab causes the CTN ID on all servers in the CTN to become [ITSOPOK] - [ ].

It is the migration process that causes the ETR Network ID to be removed from the CTN ID. This is performed by the STP facility in a *coordinated* manner across all of the STP-configured servers in the CTN.

Defining the server roles on SCZP901

At a minimum, a PTS must be defined. If this is the only server defined, then by default it must assume the CTS role. If a BTS is also defined, the definition of an Arbiter becomes optional. Because this is a two-server scenario, there is no Arbiter.

In this scenario, the server roles are defined as follows:

- PTS and CTS = SCZP201
- BTS = SCZP101

Note: Because the CTS role is to be allocated to the SCZP201 server, we must perform the Mixed CTN to STP-only CTN migration from *this* server.

At the HMC workplace, perform the following steps:

1. Highlight the **SCZP201** server and select **System (Sysplex) Time**.
2. Click the **Network Configuration** tab.

3. Select the Preferred Time Server, Backup Time Server, and Arbiter from the drop-down boxes, which list all of the STP-configured servers in the Mixed CTN (Figure 13-11).

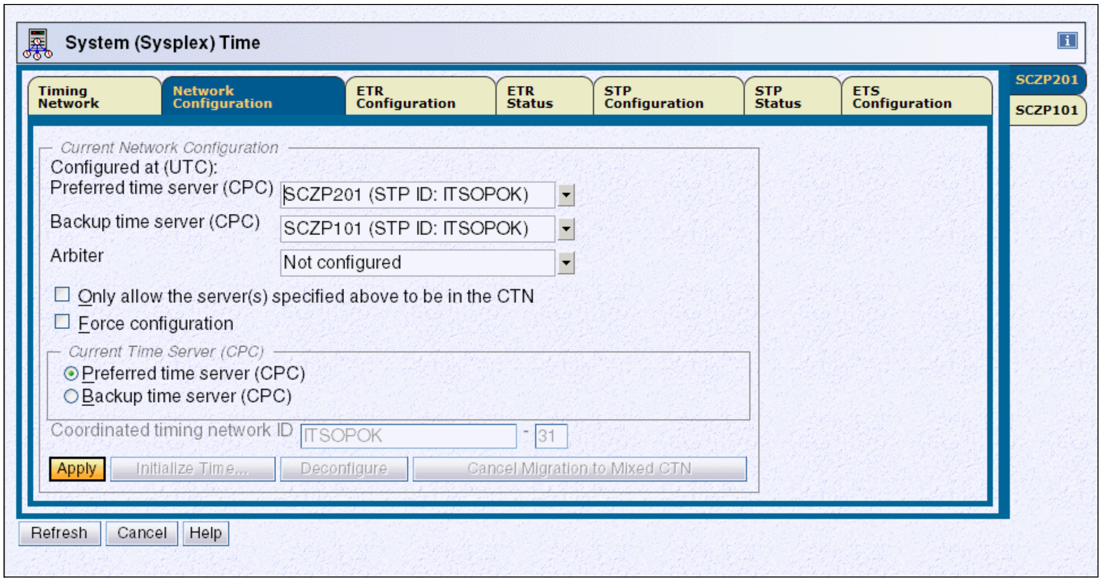


Figure 13-11 Network Configuration tab - Define roles (SCZP201)

4. Click **Apply**. This displays the Global Timing Network ID Change Confirmation, message ACT37355 (Figure 13-12).

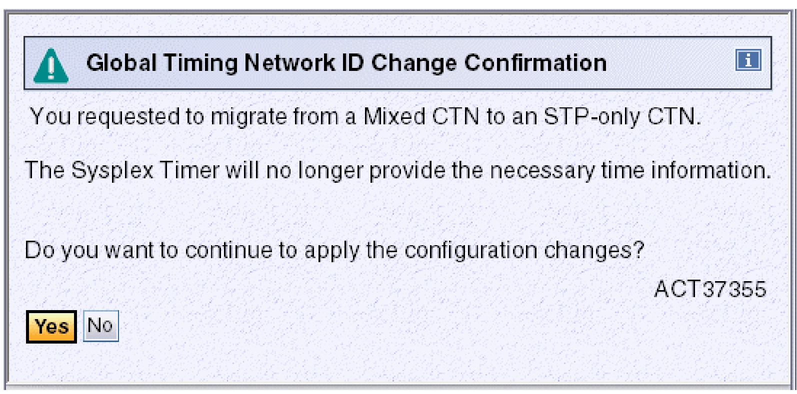


Figure 13-12 Message ACT37355 - Network Configuration tab (SCZP201)

Note: The word *global* is included in this window to indicate that this change is a global change that will affect all STP-configured servers in the Mixed CTN.

5. Confirm by clicking **Yes**. This displays the Modify Network Configuration, message Message ACT37341, indicating that the change was successful (Figure 13-13).

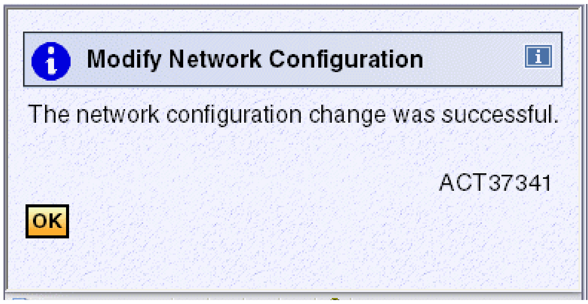


Figure 13-13 Network Configuration - Define roles success (SCZP201)

The STP facility propagates the CTN ID change from [ITSOPOK] - [31] to [ITSOPOK] - [ ] in a coordinated manner across all servers in the Mixed CTN. As this occurs, messages will be displayed on the console and the SYSLOG of z/OS images in a sysplex configuration resident on these servers.

In the interim, XCF notes that images in the sysplex use different time sources for synchronization, as evidenced by the different CTN ID. In normal circumstances, this is an invalid condition and z/OS images are partitioned out of the sysplex to maintain timing integrity for resource-sharing and data-sharing purposes.

To prevent this, XCF has been updated to recognize a global CTN ID change and tolerate the CTN ID mismatch for a short time. XCF reports the status so that the user can see each system in the sysplex transition to the new CTN ID over the course of multiple messages (Figure 13-14).

```
-> SC74
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
*IEA393I ETR PORT 0 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE. (2)
*IEA393I ETR PORT 1 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.                        (3)
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 84
 IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 226                     (1)
         FOR SYSTEM: SC74
         PREVIOUS CTNID:   ITSOPOK -31
         CURRENT  CTNID:   ITSOPOK

-> SC75
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
*IEA393I ETR PORT 0 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE. (2)
*IEA393I ETR PORT 1 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.                        (3)
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 83
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 84
 IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 066                     (1)
         FOR SYSTEM: SC75
         PREVIOUS CTNID:   ITSOPOK -31
         CURRENT  CTNID:   ITSOPOK
*IXC439E ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOT SYNCHRONIZED 067                  (4)
          TO THE SAME TIME REFERENCE.
         SYSTEM: SC74  IS USING CTNID: ITSOPOK -31
         SYSTEM: SC75  IS USING CTNID: ITSOPOK
 IXC435I ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOW SYNCHRONIZED 068                  (5)
          TO THE SAME TIME REFERENCE.
         SYSTEM: SC74  IS USING CTNID: ITSOPOK
         SYSTEM: SC75  IS USING CTNID: ITSOPOK
```

Figure 13-14 SYSLOG messages - Mixed CTN to STP-only CTN migration

The following information applies to Figure 13-14:

(1) IXC438I is issued on each z/OS image in the sysplex as the CTN ID changes.

(2) IEA393I is issued by each z/OS image in the sysplex on a server in ETR timing mode as the server ETR ports are disabled.

(3) IEA380I is issued by each z/OS image in the sysplex when conversion from ETR timing mode to STP timing mode is complete.

(4) IXC439E is issued by XCF once per second while z/OS images in the sysplex are not synchronized to the same time reference, as evidenced by the different CTN IDs shown.

(5) IXC435I is issued by XCF after the CTN ID mismatch has been resolved.

Attention: Disable the ETR ports to the CECs in STP Timing Mode on the Sysplex Timer after a successful migration. Otherwise, during a POR, the CEC initially adjusts its internal clock using the timing signals from the Sysplex Timer and later adjusts it to the CTN-time.

Depending on the discrepancy, this adjustment might take a significant amount of time. Remember to enable the ports on the Sysplex Timer again when you plan a reverse migration.

13.3 End point

The topology diagram of our sample configuration has been updated to account for the conversion of the Mixed CTN to an STP-only CTN (Figure 13-15).

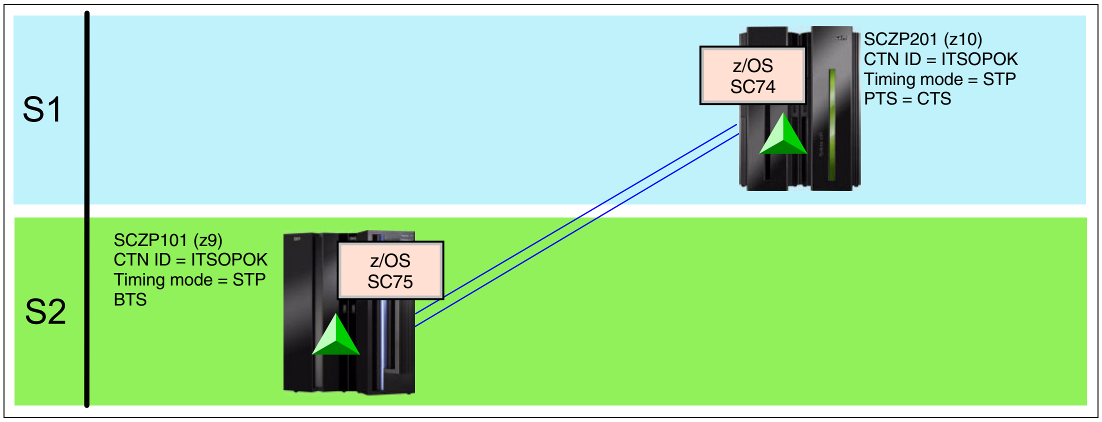


Figure 13-15 STP Implementation environment - STP-only CTN - two servers

All servers are now using STP timing mode. Each server has been allocated a role within the STP-only CTN, with the SCZP201 server being both the Preferred Time Server and the Current Time Server at the end of the migration. The SCZP101 server is the Backup Time Server.

The CTN ID of all servers is now [ITSOPOK] - [ ] with only an STP ID defined. The ETR Network ID has been removed and all server ETR ports have been disabled, so there is no longer any connectivity with the ETR network. This occurs on all servers within the Mixed CTN that had connectivity to the ETR network at the start of the migration.

All ETR ports on the servers are disabled. However, leave the ETR links in place for a certain period of time to allow for a back-out plan. Depending on individual change management constraints, the ETR links can be disconnected after a migration back to a Mixed CTN is no longer being considered.

Even when the ETR ports are disabled, the ETR signals of both links are still monitored to be able to perform a reverse migration. Furthermore, disconnecting the links is considered an ETR link failure, and z/OS message IEA393I is posted:

```
IEA393I ETR PORT n IS NOT OPERATIONAL. THIS MAY BE A CTN CONFIGURATION CHANGE.
```

13.3.1 z/OS DISPLAY ETR command

Figure 13-16 shows the output from the DISPLAY ETR command entered on the SC73 image, on P000STP2.

```
RO *ALL,D ETR
SC74     RESPONSES ---------------------------------------------------  (1)
IEA386I 19.40.38 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
SC75     RESPONSES ---------------------------------------------------  (2)
IEA386I 19.40.38 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE BACKUP TIME SERVER
  NUMBER OF USABLE TIMING LINKS =  3
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 13-16 DISPLAY ETR display - SC75 image on SCZP901 - STP-only CTN

The following notes refer to Figure 13-16:

(1) SC74 is resident on SCZP201, the PTS. It is a Stratum 1 because it currently is the CTS.

(2) SC75 is resident on SCZP101, the BTS. It is a Stratum 2 because the CTS function is currently on SCZP201, the PTS.

> **Note:** The DISPLAY ETR output contains additional lines depending on whether a BTS and Arbiter are configured as follows:
>
> ```
> THIS STP NETWORK HAS NO BACKUP TIME SERVER
> THIS STP NETWORK HAS NO SERVER TO ACT AS BACKUP
> ```
>
> Both messages are displayed if both the BTS and the Arbiter are not configured.

13.3.2 z/OS DISPLAY XCF command

Figure 13-17 shows the output from the z/OS DISPLAY XCF command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  19.41.28  DISPLAY XCF 161
 SYSPLEX PLEX75
 SYSTEM   TYPE SERIAL LPAR STATUS TIME        SYSTEM STATUS
 SC74     2097 DE50   2C   10/03/2009 16:43:47 ACTIVE        TM=STP
 SC75     2094 991E   1C   10/03/2009 16:43:46 ACTIVE        TM=STP
```

Figure 13-17 DISPLAY XCF display - SC75 image on SCZP901, STP-only CTN, two servers

All z/OS images are now shown to be resident on servers that are in STP timing mode. Each of these z/OS images is resident on a separate server, as evidenced by the different serial numbers.

13.3.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) Time selection for each server. Only the tabs for the SCZP901 server are shown in this section.

Timing Network tab

Figure 13-18 shows the Timing Network tab for the SCZP201 server.

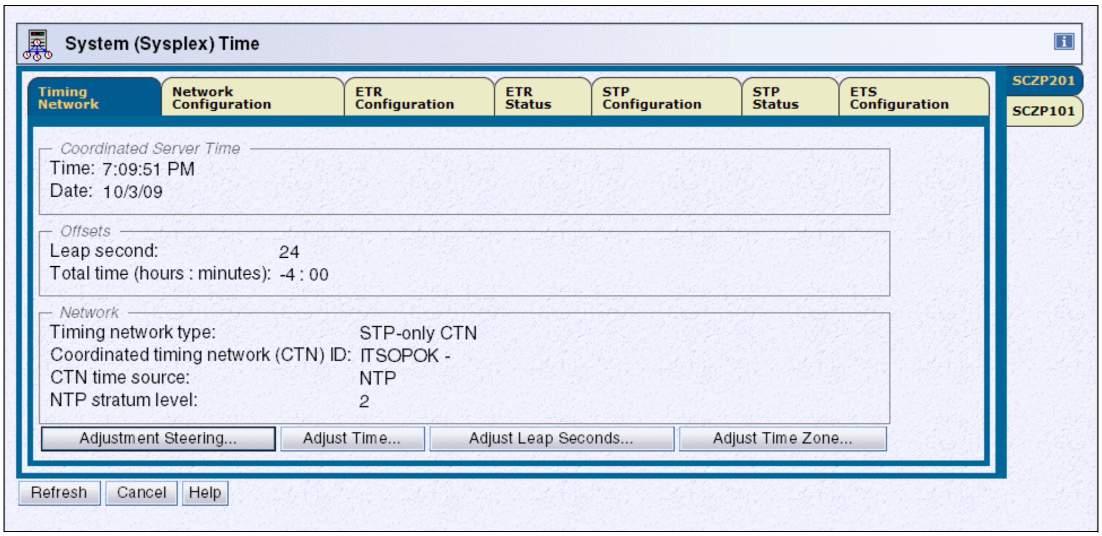


Figure 13-18 Timing Network tab (SCZP201)

This shows that the SCZP201 server is in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ].

The same information is shown on all servers in the STP-only CTN. However, only the Current Time Server has the Adjust Time, Adjust Leap Seconds, and Adjust Time Zone buttons enabled.

Adjustments of up to 60 seconds may be made to Coordinated Server Time using the steering facility within Adjust Time. See 6.6.2, “Time adjustment” on page 217, for further details.

The CTN time source field indicates that the time source is a Stratum 2 NTP server. This is specified in the ETS Configuration tab (Figure 13-24 on page 353).

Because the STP-only CTN no longer has connectivity to the ETR network, the leap second offset and the total time offset, set respectively to 0 and -5 in the example shown in Figure 13-18, are now maintained by the Current Time Server.

A migration from a Mixed CTN to an STP-only CTN inherits the time and the total offset from the Sysplex Timer. As shown in Figure 13-18, the Timing Network tab displays the total time (hours : minutes) for the offset. This only occurs when the time zone information (incorporating a daylight saving time offset, if any) has been inherited from a Sysplex Timer.

Note: For a reverse migration, the leap second offset and local time-of-day offset are taken from the Sysplex Timer. This means that any changes made after the migration to STP are lost on a reverse migration.

To finalize the Mixed to STP-only migration, a time zone offset entry *must* be set. Selection of the time zone algorithm must be initiated from SCZP201, because the Adjust Time Zone button is only enabled on the CTS. If a time zone algorithm is not defined following a migration from Mixed CTN to STP-only CTN, it is not possible to schedule the next daylight saving time adjustment. See 2.5.2, "Time-zone offset adjustment" on page 74, for further details.

Network Configuration tab

Figure 13-19 shows the Network Configuration tab for the SCZP201 server.

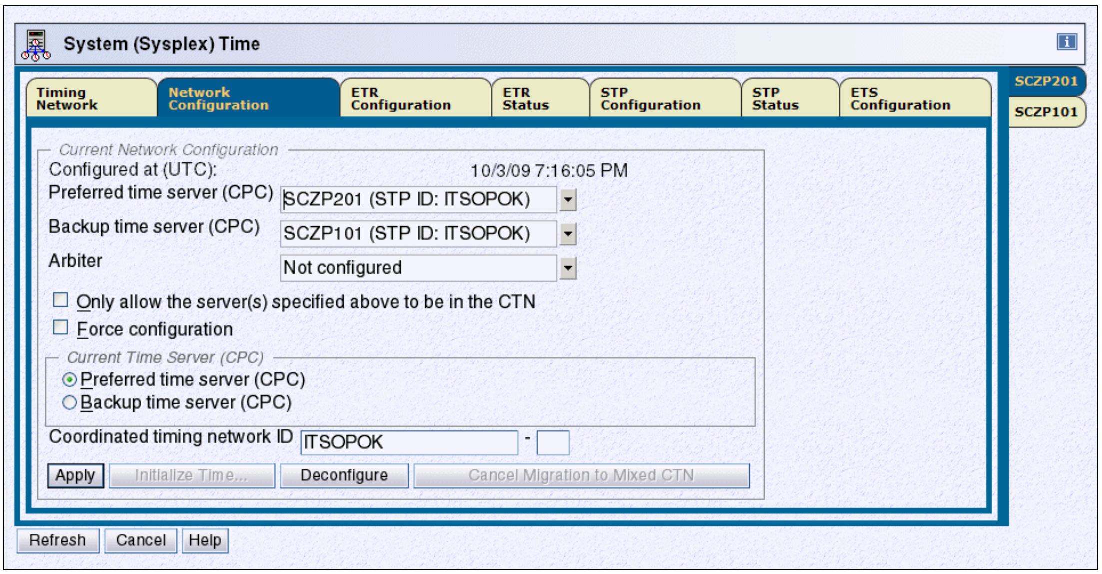


Figure 13-19 Network Configuration tab (SCZP201)

This tab now shows the server roles within the STP-only CTN and indicates which server is the Current Time Server. The CTN ID is also displayed. The same information is shown on all servers in the STP-only CTN.

The Preferred Time Server, Backup Time Server, Arbiter, Current Time Server, and CTN ID fields may all be modified from this tab. However, the modifications are accepted only if they are performed on the server that is *going to become* the CTS after the network reconfiguration is complete.

Modifications performed from the Network Configuration tab are *global* and, as such, are propagated throughout the STP-only CTN.

The CTN ID can be changed to either:

- Specify a separate STP ID for the STP-only CTN.
- Define an ETR Network ID that will migrate the STP-only CTN to a Mixed CTN.

The Deconfigure button removes all definitions in the STP-only CTN, causing all servers to become unsynchronized. This should never need to be used.

ETR Configuration tab

Figure 13-20 shows the ETR Configuration tab for the SCZP201 server.

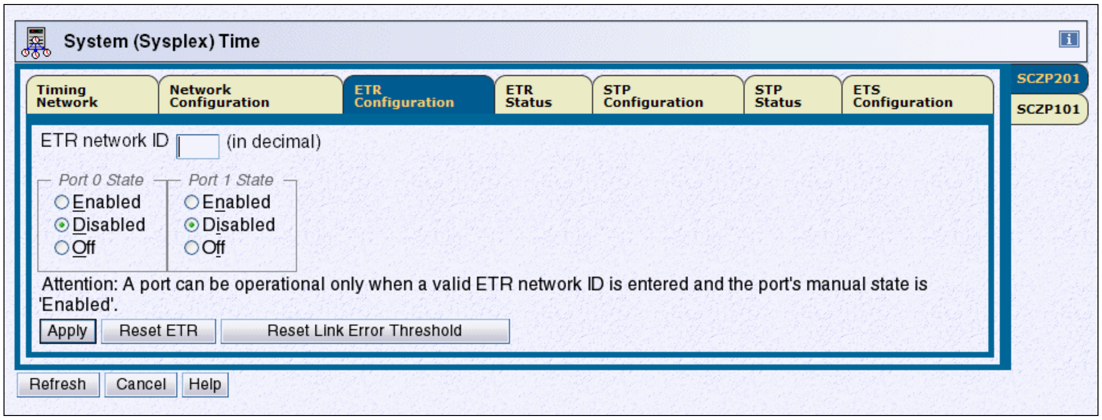


Figure 13-20 ETR Configuration tab (SCZP201)

Prior to migration, this tab specified an ETR Network ID of 31. The migration from a Mixed CTN to an STP-only CTN has disabled the ETR ports, and the ETR Network ID has been removed. The new CTN ID is now [ITSOPOK] - [ ], with only the STP ID part defined.

ETR Status tab

Figure 13-21 shows the ETR Status tab for the SCZP201 server.

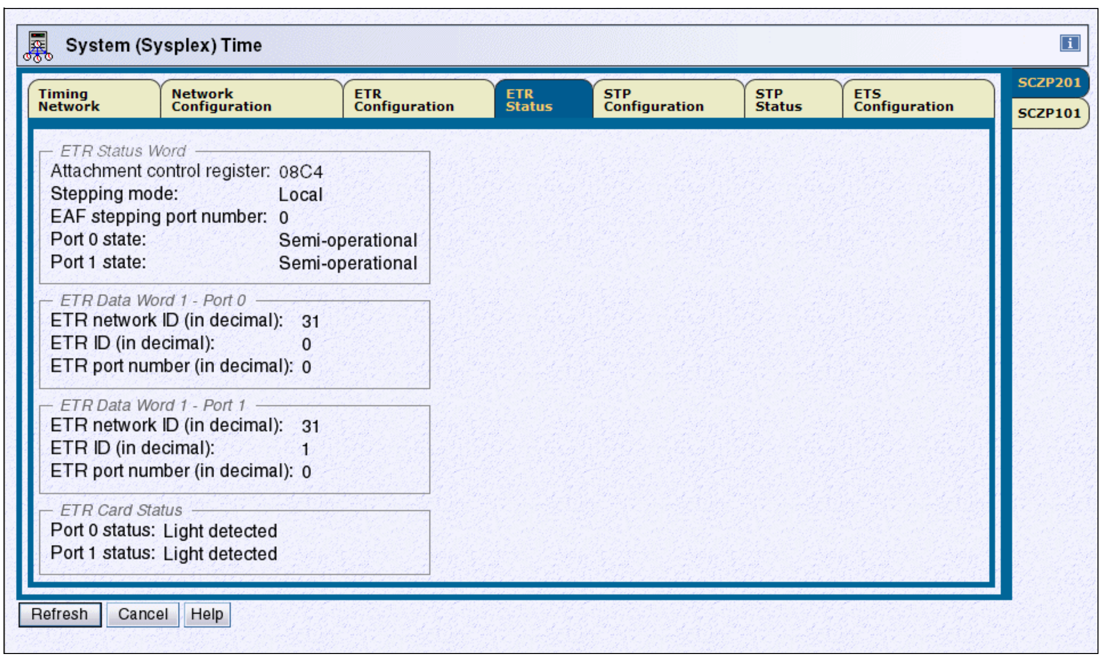


Figure 13-21 ETR Status tab (SCZP201)

Even though the SCZP201 server has disabled connectivity to the ETR network and has removed the ETR Network ID from the CTN ID, the ETR Status tab retains details of the connected Sysplex Timers until the ETR network is physically disconnected.

If an ETR link failure occurs while in STP-only mode, then z/OS message IEA393I appears (Example 13-1). The purpose is to be able to repair a failing link as long as a reverse migration to a Mixed CTN is scheduled.

Example 13-1 Message IEA393I

```
IEA393I ETR PORT n IS NOT OPERATIONAL. THIS MAY BE A CTN CONFIGURATION CHANGE.
```

STP Configuration tab

Figure 13-22 shows the STP Configuration tab for the SCZP201 server.

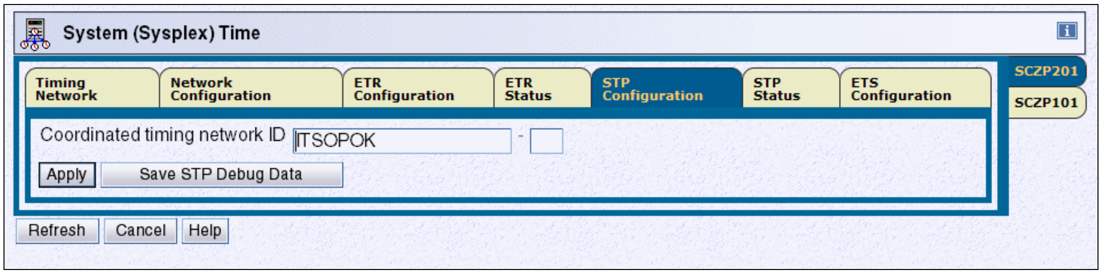


Figure 13-22 STP Configuration tab (SCZP201)

This shows that the SCZP201 server is in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ], where ITSOPOK is the STP ID. No ETR Network ID is defined, because connectivity to the ETR network has been fully disabled as a result of the migration.

Important: Modification of the STP ID (or the ETR ID) is not permitted on the STP Configuration tab for the Current Time Server.

On other servers in the CTN, the STP Configuration tab allows an STP ID to be modified. However, if performed from this location, it is a *local* change only, causing this server to transition from the existing STP-only CTN to another STP-only CTN with another CTN ID.

This is disruptive to z/OS images on this server if they are in a sysplex configuration with z/OS images remaining in the STP-only CTN. XCF would detect multiple time sources in the sysplex and begin to remove sysplex members until the situation was resolved.

Modification of the STP ID can only be done nondisruptively from the Network Configuration tab on the Current Time Server, where it is managed as a *global* change.

STP Status tab

Figure 13-23 shows the STP Status tab for the SCZP201 server.

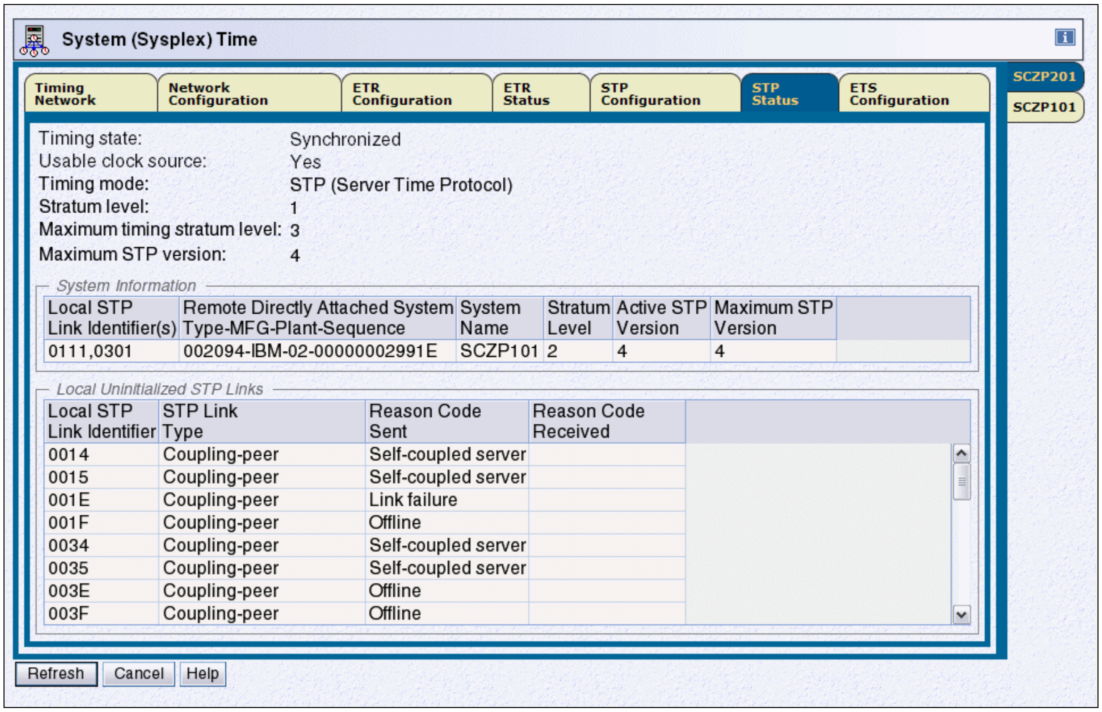


Figure 13-23 STP Status tab (SCZP201)

The SCZP201 server is shown to be synchronized in the STP-only CTN as the Stratum 1 server. There is one Stratum 2 server in the Remote Directly Attached Systems.

This server has connectivity to the SCZP201 server over the coupling facility or timing-only links, as identified by the STP Link Identifiers.

ETS Configuration tab

Figure 13-24 shows the ETS Configuration for the SCZP201 server.

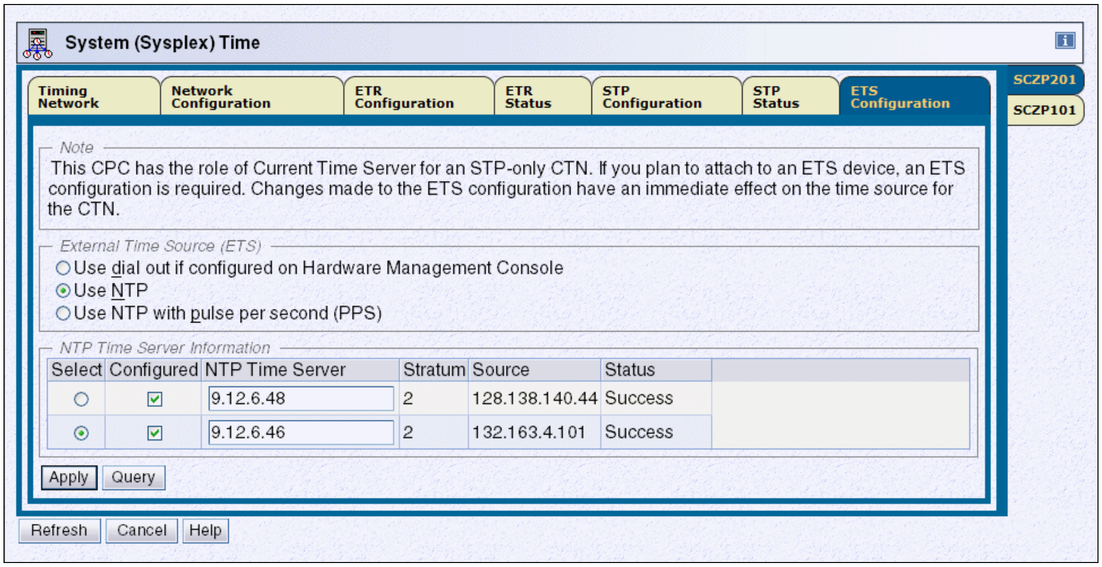


Figure 13-24 ETS Configuration tab (SCZP201)

Two NTP time servers have been defined as time sources. Because SCZP201 is the Current Time Server for the STP-only CTN, the selected NTP server is used as the time source for SCZP201.

14

Mixed CTN (three servers) to STP-only CTN

In the scenario in this chapter[1], a sample configuration consisting of three servers is converted from a Mixed CTN to an STP-only CTN.

In this chapter we work through the following sections:

Once in an STP-only CTN, there is no further reliance on the External Timer Reference (ETR) network, because all servers previously operating in ETR timing mode will have their ETR connectivity disabled as part of the migration process.

> **Important:** After the conversion to an STP-only CTN is complete, the timing source for the CTN is the Stratum 1 server, and no further timing signals are used from the ETR network. Once this occurs, the respective times in the ETR Network and the Stratum 1 server might slowly drift apart, because they are no longer being kept aligned.
>
> A subsequent migration from an STP-only CTN back to a Mixed CTN might be impacted by this time differential, and the potential for this to occur is proportionally related to the period of time that the two timing sources are no longer kept aligned.
>
> When planning to perform a test migration from a Mixed CTN to an STP-only CTN and then migrate back to a Mixed CTN, try to minimize the time spent in the STP-only CTN configuration to limit this potential impact.

[1] See "Prerequisites" on page 263.

14.1 Start point

The starting point for this scenario is a Mixed CTN with two servers in ETR timing mode, and one server in STP timing mode (Figure 14-1). This configuration is the result of a previous migration step in which a timing mode change was done. The H40 server has the ETR ports disabled and is therefore in STP timing mode.

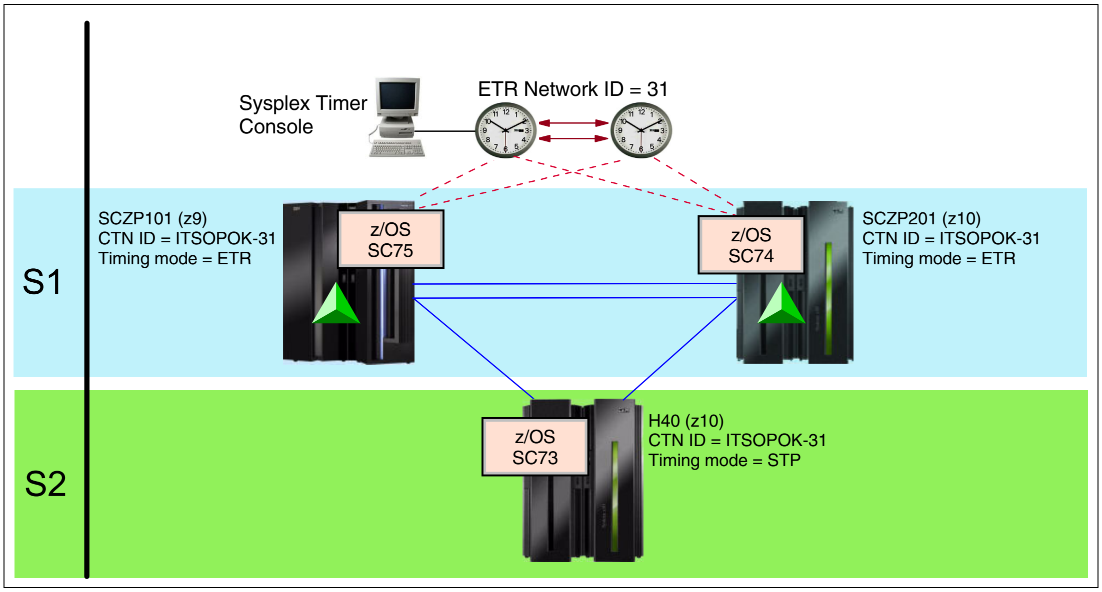


Figure 14-1 STP Implementation environment - Mixed CTN with three servers

The Mixed CTN consists of three servers:

- SCZP101
- SCZP201
- H40

All servers are STP configured, but SCZP101 and SCZP201 are in ETR timing mode because they retain connectivity to the Sysplex Timer, and H40 is in STP timing mode.

The SCZP101 and SCZP201 servers are connected to each other in a redundant configuration using two coupling links, and each of these servers has a z/OS image and coupling facility defined.

The H40 server contains a z/OS image only. It is connected to the SCZP101 and SCZP201 servers using only one coupling link in each case.

> **Note:** The configuration shown in Figure 14-1 is not a recommended configuration because the H40 server must have at least two coupling links to both SCZP101 and SCZP201 servers for redundancy. From a timing perspective, it is not a major problem if one of these links becomes unusable, because the H40 server can still use the remaining link for STP messages. However, loss of a coupling link also means the loss of access to the coupling facility, which might cause disruption within the Parallel Sysplex.

This is the same configuration that is the endpoint for the scenario for adding a new server to an existing Mixed CTN, as discussed in Chapter 12, “Mixed CTN: Adding a server in STP timing mode” on page 321.

14.1.1 z/OS DISPLAY ETR command

Figure 14-2 shows the output from the **DISPLAY ETR** command entered on the SC74 image, on SCZP201.

```
RO *ALL,D ETR
SC74     RESPONSES ---------------------------------------------------
IEA282I 09.58.25 TIMING STATUS
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE      CPC PORT 1
  OPERATIONAL                  OPERATIONAL
  ENABLED                      ENABLED
  ETR NET ID=31                ETR NET ID=31
  ETR PORT=00                  ETR PORT=00
  ETR ID=00                    ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
SC75     RESPONSES ---------------------------------------------------
IEA282I 09.58.25 TIMING STATUS
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE      CPC PORT 1
  OPERATIONAL                  OPERATIONAL
  ENABLED                      ENABLED
  ETR NET ID=31                ETR NET ID=31
  ETR PORT=01                  ETR PORT=01
  ETR ID=01                    ETR ID=00
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
SC73     RESPONSES ---------------------------------------------------
 IEA386I 09.58.25 TIMING STATUS
 SYNCHRONIZATION MODE = STP
   THIS SERVER IS A STRATUM 2
   CTN ID = ITSOPOK -31
  NUMBER OF USABLE TIMING LINKS =  2
```

Figure 14-2 DISPLAY ETR display - SC74 image on SCZP201 - Mixed CTN

This display shows that SC74 and SC75 are resident on two separate servers operating in ETR timing mode through connectivity to a Sysplex Timer. SC73 is resident on a server operating in STP timing mode, which is a Stratum 2 using STP messaging as its time source.

All servers are in the same Mixed CTN with a CTN ID of [ITSOPOK] - [31], which indicates that the timing source for the CTN is a Sysplex Timer with an ETR Network ID of 31.

14.1.2 z/OS DISPLAY XCF command

Figure 14-3 shows the output from the z/OS **DISPLAY XCF** command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  10.00.01  DISPLAY XCF 847
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/10/2009 10:00:01 ACTIVE         TM=ETR
SC75     2094 991E   1C   10/10/2009 09:59:59 ACTIVE         TM=ETR
SC73     2097 961F   1A   10/10/2009 09:59:56 ACTIVE         TM=STP
```

Figure 14-3 DISPLAY XCF display - SC74 image on SCZP201 - Mixed CTN

This display shows that SC74 and SC75 are resident on two separate servers operating in ETR timing mode and therefore must have connectivity to a Sysplex Timer. However, SC73 is resident on a separate server operating in STP timing mode.

14.1.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) time selection for each server. Only the tabs for the SCZP201 server are shown in this section.

Timing Network tab

Figure 14-4 shows the Timing Network tab for the SCZP201 server.

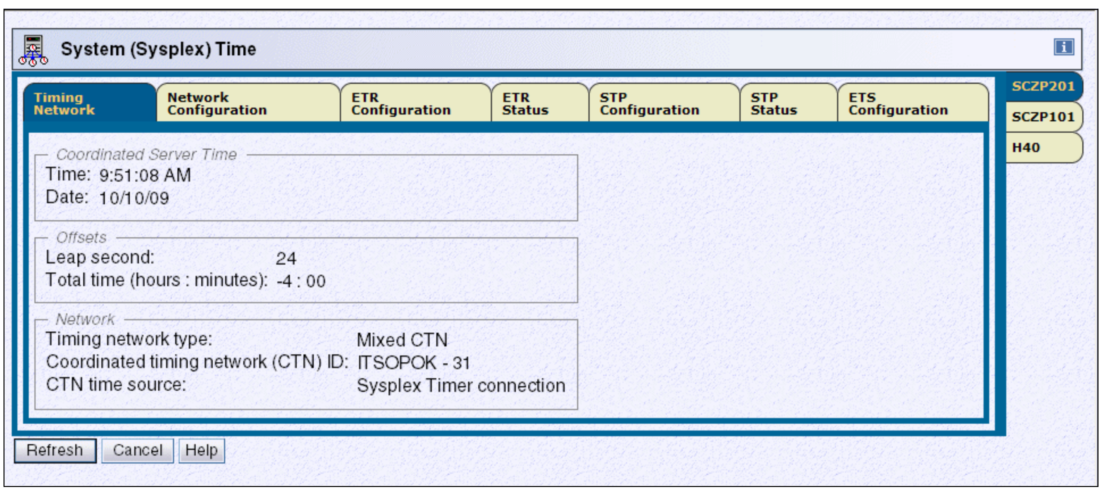


Figure 14-4 Timing Network tab (SCZP201)

This shows that the SCZP201 server is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31], and the CTN time source is the Sysplex Timer. This is the same information that is shown on the Timing Network tab for the other STP-configured servers in the Mixed CTN.

Network Configuration tab

Figure 14-5 shows the Network Configuration tab for the SCZP201 server.

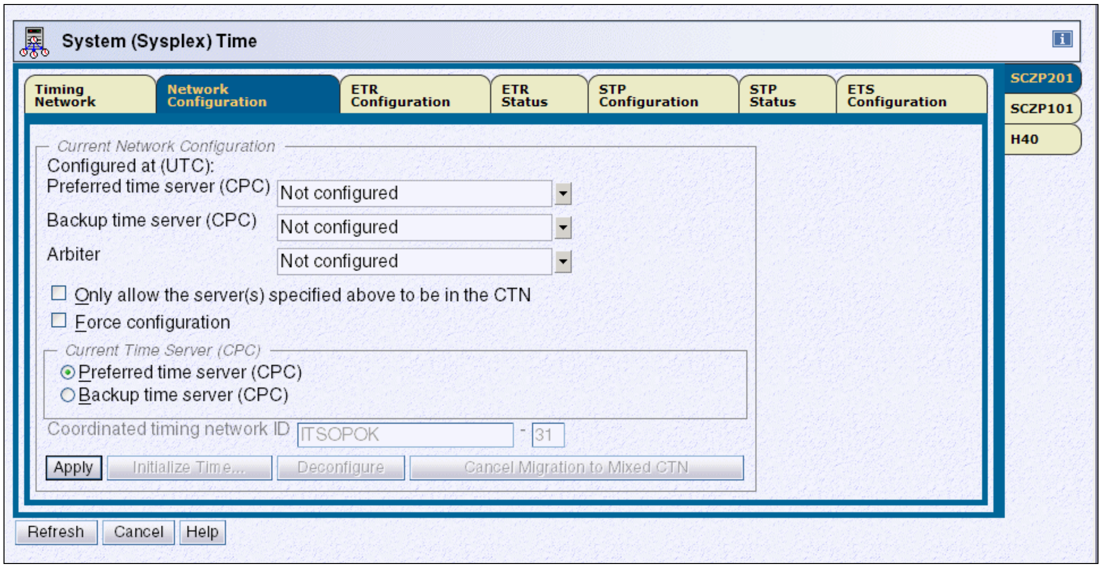


Figure 14-5 Network Configuration tab (SCZP201)

Because the SCZP201 server is in a Mixed CTN, the Preferred Time Server, Backup Time Server, and Arbiter fields are not configured. Only the Apply button is enabled to allow a full STP conversion to proceed.

ETR Configuration tab

Figure 14-6 shows the ETR Configuration tab for the SCZP201 server.

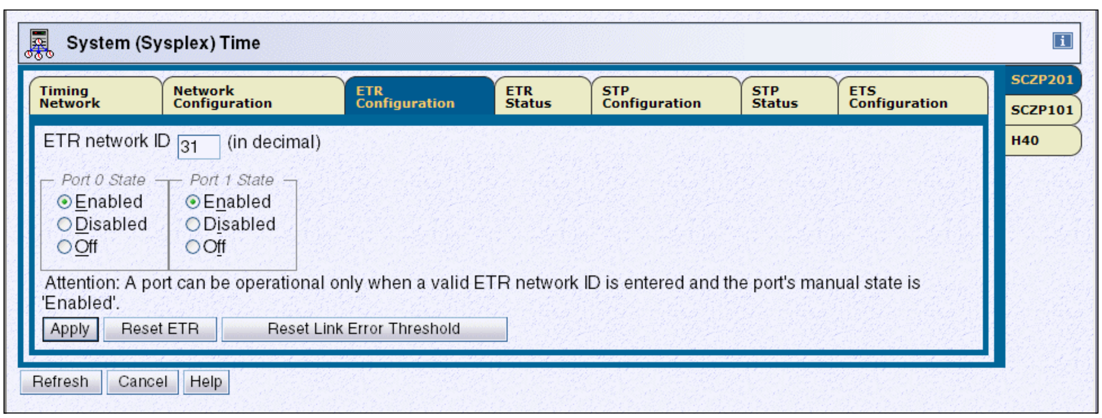


Figure 14-6 ETR Configuration tab (SCZP201)

Because the SCZP201 server is operating in ETR timing mode, both server ETR ports are shown as enabled.

ETR Status tab

Figure 14-7 shows the ETR Status tab for the SCZP201 server.

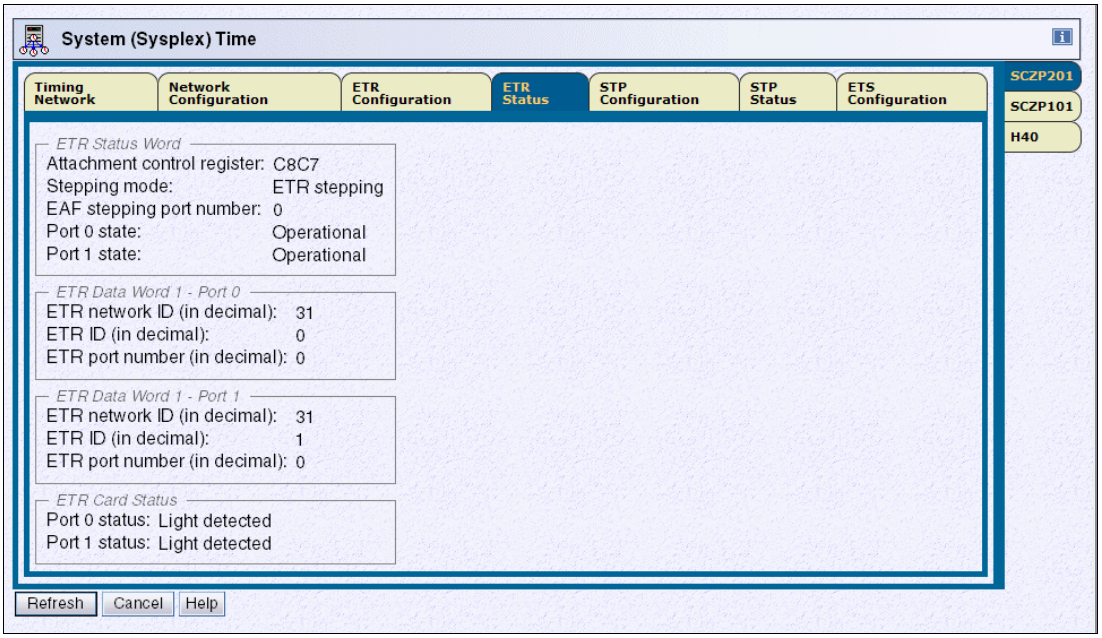


Figure 14-7 ETR Status tab (SCZP201)

This is a status tab only, and no modifications to the server ETR ports are possible from here. This tab shows the server ETR port states as `operational`, which indicates that connectivity exists between the server and the ETR network, and that the server ETR ports have been enabled.

STP Configuration tab

Figure 14-8 shows the STP Configuration tab for the SCZP201 server.

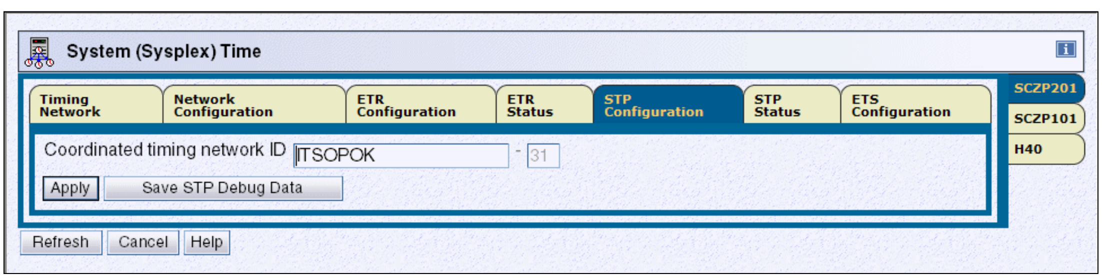


Figure 14-8 STP Configuration tab (SCZP201)

This shows that the SCZP201 server is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31], where ITSOPOK is the STP ID, and 31 is the ETR Network ID.

STP Status tab

Figure 14-9 shows the STP Status tab for the SCZP201 server.

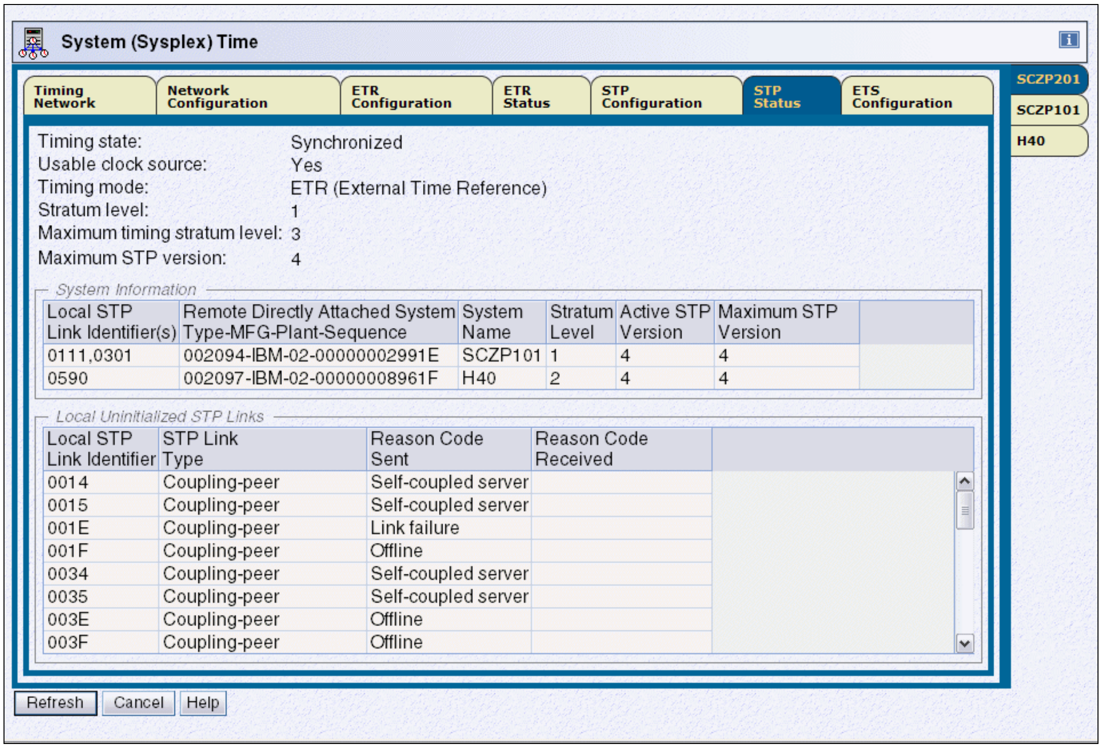


Figure 14-9 STP Status tab (SCZP201)

The SCZP201 server is shown as participating in the Mixed CTN as a Stratum 1 and is time synchronized. It has two Remote Directly Attached Systems:

- SCZP101 (a Stratum 1)
- H40 (a Stratum 2)

Connectivity of SCZP201 to the other servers is shown in the Remote Directly Attached Systems section, and the STP Link Identifiers show the PCHIDs of the coupling links or timing-only links that are used for STP control and timing messages.

ETS Configuration tab

Figure 14-10 shows the ETS Configuration for the SCZP201 server.

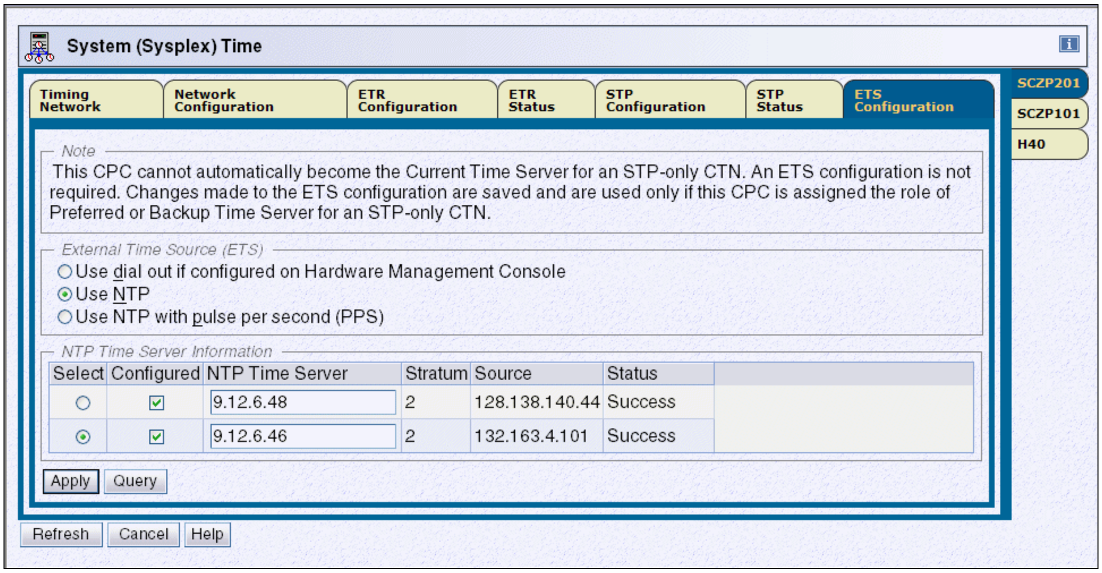


Figure 14-10 ETS Configuration tab (SCZP201)

Two NTP time servers have been defined as time sources, in case SCZP201 ever becomes the Current Time Server for an STP-only CTN. These are the two Hardware Management Consoles (HMCs) of the configuration. Both of them are Stratum 2 NTP servers connected to an external Stratum 1 NTP server, and both of them have been successfully contacted.

However, SCZP201 now is not defined as a Preferred or as a Backup Time Server to the CTN, so the ETS configuration is not used. The time source of the CTN still is the Sysplex Timer.

14.2 Migration

The migration to an STP-only CTN involves a single change that *must* be performed from the server that will become the Current Time Server (CTS).

Note: Migration to an STP-only CTN is a *global* change that only needs to be performed once within the CTN.

In most circumstances, the server assigned to be the Preferred Time Server (PTS) is also assigned the CTS.

The configuration of server roles is done using the Network Configuration tab, within System (Sysplex) Time, at the HMC workplace. This tab may also be used to subsequently change the server roles in the STP-only CTN and to move the CTS function between the PTS and BTS servers, if this is required.

The servers that assume the PTS, BTS, and Arbiter roles must have connectivity to one another. Otherwise, the **Force configuration** check box must be selected.

Note: Any STP-configured server in the Mixed CTN can assume any of the server roles, and can change stratum level during the migration accordingly.

In our case, the following changes in stratum levels occur during the migration:

- SCZP101 was previously a Stratum 1 and must transition to a Stratum 2, as it is being defined as the BTS.
- SCZP201 was previously a Stratum 1, and it remains a Stratum 1 to assume the CTS role as defined.
- H40 remains a Stratum 2.

Table 14-1 shows the before and after configuration details.

Table 14-1 Server configuration - Mixed CTN to STP-only CTN migration

	Server	CTN ID		Server role	Timing mode	Stratum level
		STP ID	ETR ID			
Before migration	SCZP101	ITSOPOK	31		ETR	1
	SCZP201	ITSOPOK	31		ETR	1
	H40	ITSOPOK	31		STP	2
After migration	SCZP101	ITSOPOK		BTS	STP	2
	SCZP201	ITSOPOK		PTS & CTS	STP	1
	H40	ITSOPOK		Arbiter	STP	2

During the migration process, the CTN ID is updated by the *STP* facility to null out the ETR Network ID, and all remaining connectivity to the Sysplex Timer is disabled.

The CTN ID on all servers in the Mixed CTN prior to migration is [ITSOPOK] - [31]. At the completion of this scenario, the global change initiated from the Network Configuration tab causes the CTN ID on all servers in the CTN to become [ITSOPOK] - [ ].

It is the migration process that causes the ETR Network ID to be removed from the CTN ID. This is performed by the STP facility in a *coordinated* manner across all of the STP-configured servers in the CTN.

Defining the server roles on SCZP901

At a minimum, a PTS must be defined. If this is the only server defined, then by default it must assume the CTS role. If a BTS is also defined, the definition of an Arbiter becomes optional.

In this scenario, the server roles are defined as follows:

- PTS & CTS = SCZP201
- BTS = SCZP101
- Arbiter = H40

Note: Because the CTS role is to be allocated to the SCZP201 server, we must perform the Mixed CTN to STP-only CTN migration *from this server.*

At the HMC workplace, perform the following steps:

1. Highlight the **SCZP201** server and select **System (Sysplex) Time**.
2. Click the **Network Configuration** tab.
3. Select the Preferred Time Server, Backup Time Server, and Arbiter from the drop-down menus, which list all of the STP-configured servers in the Mixed CTN (Figure 14-11).

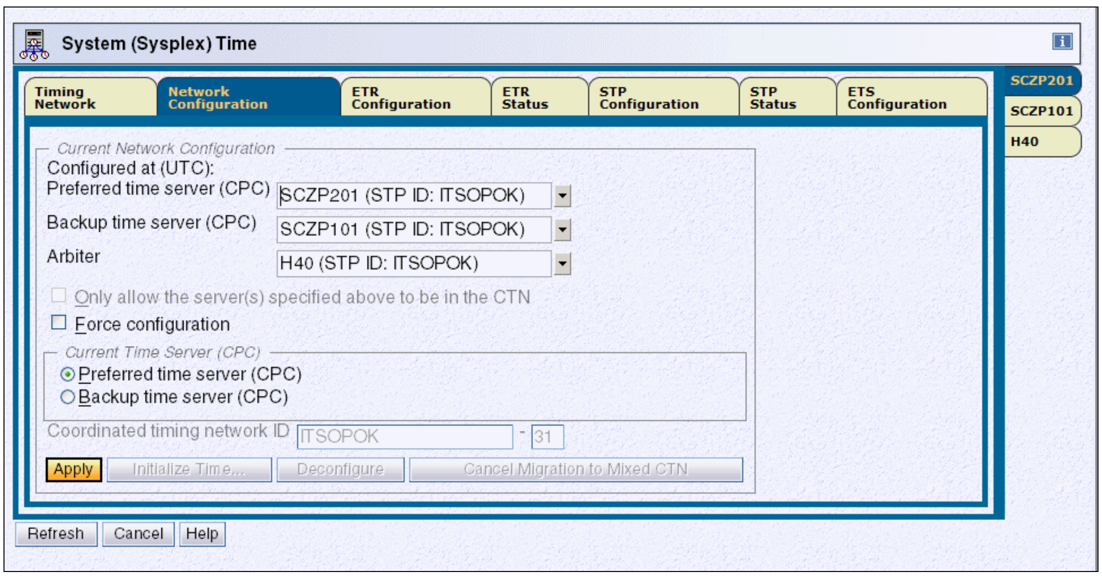


Figure 14-11 Network Configuration tab - Define roles (SCZP201)

4. Click **Apply**. This displays the Global Timing Network ID Change Confirmation, message ACT37355 (Figure 14-12).

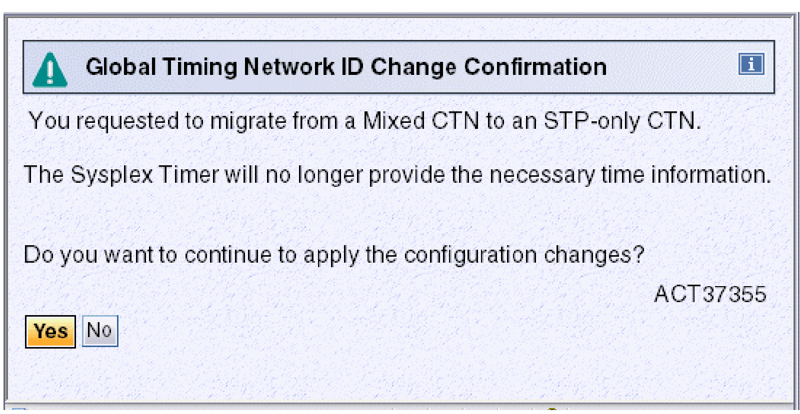


Figure 14-12 Message ACT37355 - Network Configuration tab (SCZP201)

Note: The word *global* is included in this window to indicated that this change is a global change that affects all STP-configured servers in the Mixed CTN.

5. Confirm by clicking **Yes**. This displays the Modify Network Configuration, message Message ACT37341, indicating that the change was successful (Figure 14-13).

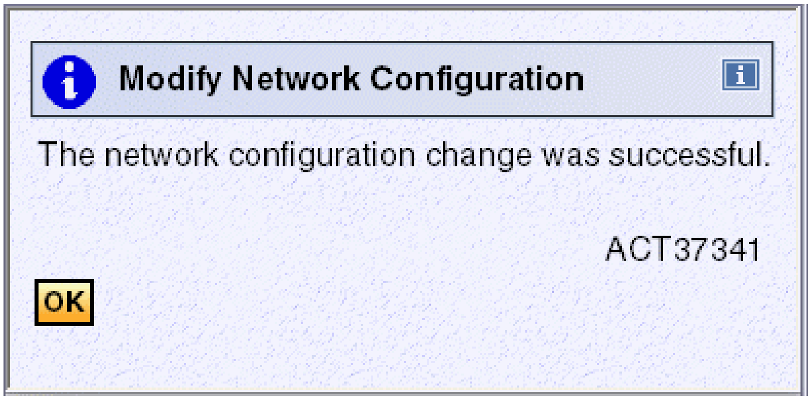


Figure 14-13 Network Configuration - Define roles success (SCZP201)

The STP facility propagates the CTN ID change from [ITSOPOK] - [31] to [ITSOPOK] - [ ] in a coordinated manner across all servers in the Mixed CTN. As this occurs, messages are displayed on the console and SYSLOG of z/OS images in a sysplex configuration resident on these servers.

In the interim, XCF notes that images in the sysplex use separate time sources for synchronization, as evidenced by the different CTN IDs. Under normal circumstances this is an invalid condition, and z/OS images would be partitioned out of the sysplex to maintain timing integrity for resource-sharing and data-sharing purposes.

To prevent this, XCF has been updated to recognize a global CTN ID change and tolerate the CTN ID mismatch for a short time. XCF reports the status so that the user can see each of the systems in the sysplex transition to the new CTN ID over the course of multiple messages (Figure 14-14).

```
-> SC74
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
*IEA393I ETR PORT 0 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE. (2)
*IEA393I ETR PORT 1 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.                        (3)
 IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 854                     (1)
         FOR SYSTEM: SC74
         PREVIOUS CTNID:   ITSOPOK -31
         CURRENT  CTNID:   ITSOPOK
*IXC439E ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOT SYNCHRONIZED 855                  (4)
         TO THE SAME TIME REFERENCE.
        SYSTEM: SC74  IS USING CTNID: ITSOPOK
        SYSTEM: SC75  IS USING CTNID: ITSOPOK -31
        SYSTEM: SC73  IS USING CTNID: ITSOPOK -31

-> SC75
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
*IEA393I ETR PORT 0 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE. (2)
*IEA393I ETR PORT 1 IS NOT OPERATIONAL.  THIS MAY BE A CTN CONFIGURATION CHANGE.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.                        (3)
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 25
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 0B
 IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 640                     (1)
         FOR SYSTEM: SC75
         PREVIOUS CTNID:   ITSOPOK -31
         CURRENT  CTNID:   ITSOPOK
*IXC439E ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOT SYNCHRONIZED 641                  (4)
         TO THE SAME TIME REFERENCE.
        SYSTEM: SC74  IS USING CTNID: ITSOPOK
        SYSTEM: SC75  IS USING CTNID: ITSOPOK
        SYSTEM: SC73  IS USING CTNID: ITSOPOK -31

-> SC73
 IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
 IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.                        (3)
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 25
 IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 0B
 IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 517                     (1)
         FOR SYSTEM: SC75
         PREVIOUS CTNID:   ITSOPOK -31
         CURRENT  CTNID:   ITSOPOK
 IXC435I ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOW SYNCHRONIZED 518                  (5)
         TO THE SAME TIME REFERENCE.
        SYSTEM: SC74  IS USING CTNID: ITSOPOK
        SYSTEM: SC75  IS USING CTNID: ITSOPOK
        SYSTEM: SC73  IS USING CTNID: ITSOPOK
```

Figure 14-14 SYSLOG messages - Mixed CTN to STP-only CTN migration

The following notes refer to Figure 14-14 on page 366:

(1) IXC438I is issued on each z/OS image in the sysplex as the CTN ID changes.

(2) IEA393I is issued by each z/OS image in the sysplex on a server in ETR timing mode as the server ETR ports are disabled.

(3) IEA380I is issued by each z/OS image in the sysplex when conversion from ETR timing mode to STP timing mode is complete.

(4) IXC439E is issued by XCF once per second while z/OS images in the sysplex are not synchronized to the same time reference, as evidenced by the different CTN IDs shown.

(5) IXC435I is issued by XCF after the CTN ID mismatch has been resolved.

Note: Disable the ETR ports to the CECs in STP Timing Mode on the sysplex timer after a successful migration. Otherwise, during a POR the CEC initially adjusts its internal clock using the timing signals from the Sysplex Timer and later adjusts it to the CTN time. Depending on the discrepancy, this adjustment might take a significant amount of time. Remember to enable the ports on the sysplex timer again when you plan a reverse migration.

14.3 End point

The topology diagram of our sample configuration has been updated to account for the conversion of the Mixed CTN to an STP-only CTN (Figure 14-15).

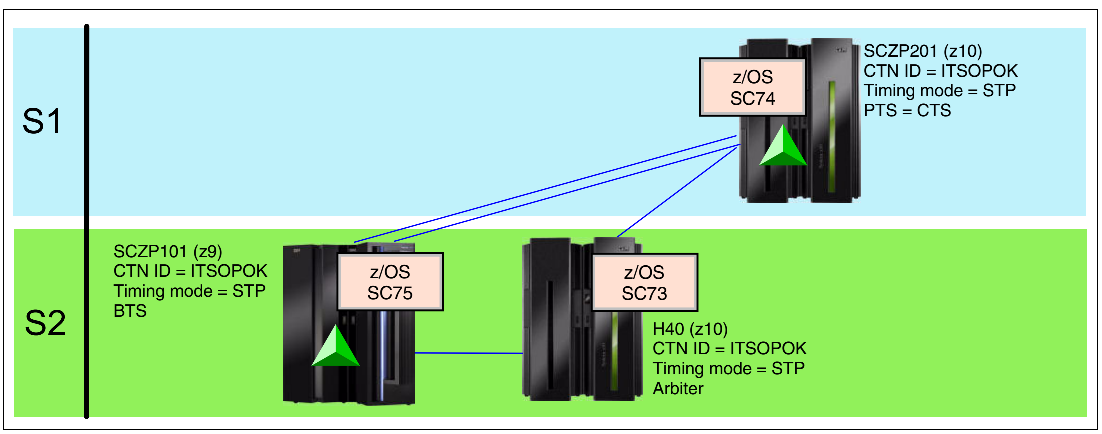


Figure 14-15 STP Implementation environment - STP-only CTN, three servers

All servers are now using STP timing mode. Each server has been allocated a role within the STP-only CTN, with the SCZP201 server being both the Preferred Time Server and the Current Time Server at the end of the migration. The SCZP101 server is the Backup Time Server and H40 is the Arbiter.

The CTN ID of all servers is now [ITSOPOK] - [ ] with only an STP ID defined. The ETR Network ID has been removed and all server ETR ports have been disabled, so there is no longer any connectivity to the Sysplex Timer. This occurs on all servers within the Mixed CTN that had connectivity to the Sysplex Timer at the start of the migration.

Even though all ETR ports on the servers are disabled, leave the ETR links in place for a certain period of time to allow for a back-out plan. Depending on individual change management constraints, the ETR links can be disconnected after a migration back to a Mixed CTN is no longer being considered.

Even when the ETR ports are disabled, the ETR signals of both links are still monitored to be able to perform a reverse migration. Furthermore, disconnecting the links is considered an ETR link failure, and z/OS message IEA393I is posted:

```
IEA393I ETR PORT n IS NOT OPERATIONAL. THIS MAY BE A CTN CONFIGURATION CHANGE.
```

14.3.1 z/OS DISPLAY ETR command

Figure 14-16 shows the output from the **DISPLAY ETR** command entered on the SC73 image, on P000STP2.

```
RO *ALL,D ETR
SC74     RESPONSES ---------------------------------------------------  (1)
IEA386I 10.34.34 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE PREFERRED TIME SERVER
SC75     RESPONSES ---------------------------------------------------  (2)
IEA386I 10.34.34 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE BACKUP TIME SERVER
  NUMBER OF USABLE TIMING LINKS =  3
SC73     RESPONSES ---------------------------------------------------  (3)
IEA386I 10.34.34 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE ARBITER SERVER
  NUMBER OF USABLE TIMING LINKS =  2
```

Figure 14-16 DISPLAY ETR display - SC75 image on SCZP901, STP-only CTN

Note the following information about Figure 14-16:

(1) SC74 is resident on SCZP201, the PTS. It is a Stratum 1 because it currently is the CTS.

(2) SC75 is resident on SCZP101, the BTS. It is a Stratum 2 because the CTS function is currently on SCZP201, the PTS.

(3) SC73 is resident on H40, the Arbiter. It is a Stratum 2.

Note: The **DISPLAY ETR** output contains additional lines, depending on whether a BTS and Arbiter are configured:

```
THIS STP NETWORK HAS NO BACKUP TIME SERVER
THIS STP NETWORK HAS NO SERVER TO ACT AS BACKUP
```

Both messages are displayed if both the BTS and the Arbiter are not configured.

14.3.2 z/OS DISPLAY XCF command

Figure 14-17 shows the output from the z/OS **DISPLAY XCF** command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  10.40.23  DISPLAY XCF 874
SYSPLEX PLEX75
SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
SC74     2097 DE50   2C   10/10/2009 10:40:22 ACTIVE        TM=STP
SC75     2094 991E   1C   10/10/2009 10:40:19 ACTIVE        TM=STP
SC73     2097 961F   1A   10/10/2009 10:40:17 ACTIVE        TM=STP
```

Figure 14-17 DISPLAY XCF display - SC74 image on SCZP201, STP-only CTN, three servers

All z/OS images are now shown to be resident on servers that are in STP timing mode. Each of these z/OS images is resident on a separate server, as evidenced by the different serial numbers.

14.3.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) time selection for each server. Only the tabs for the SCZP201 server are shown in this section.

Timing Network tab

Figure 14-18 shows the Timing Network tab for the SCZP201 server.

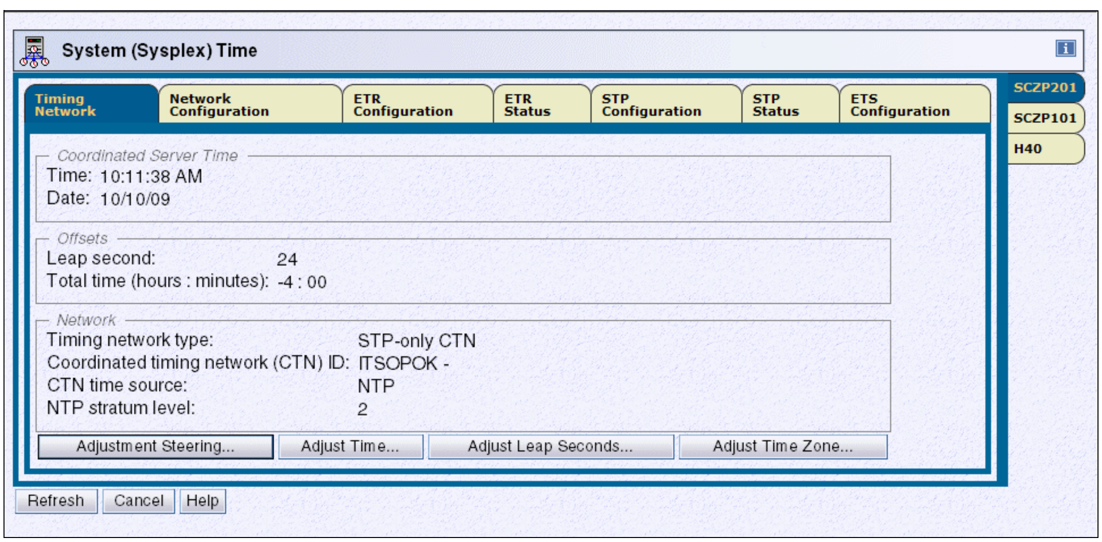


Figure 14-18 Timing Network tab (SCZP201)

This shows that the SCZP201 server is in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ].

The same information is shown on all servers in the STP-only CTN. However, only the Current Time Server has the Adjust Time, Adjust Leap Seconds, and Adjust Time Zone buttons enabled.

Adjustments of up to 60 seconds may be made to Coordinated Server Time using the steering facility within Adjust Time. See 6.6.2, “Time adjustment” on page 217, for further details.

The CTN time source field indicates that the time source is a Stratum 2 NTP server. This is specified in the ETS Configuration tab (Figure 14-24 on page 374).

Because the STP-only CTN no longer has connectivity to the Sysplex Timer, the leap second offset and the total time offset, set to 24 and -4, respectively, in the example shown in Figure 14-18 on page 369, are now maintained by the Current Time Server.

A migration from a Mixed CTN to an STP-only CTN inherits the time and the total offset from the Sysplex Timer. As shown in Figure 14-18 on page 369, the Timing Network tab displays the total time (hours : minutes) for the offset. This is the time zone information (incorporating a daylight saving time offset, if any) that has been inherited from a Sysplex Timer.

Note: For a reverse migration, the leap second offset and local time of day offset are taken from the Sysplex Timer. This means that any changes made after the migration to STP are lost on a reverse migration.

To finalize the Mixed to STP-only migration, a time-zone offset entry *must* be set. Selection of the time zone algorithm must be initiated from SCZP201, because the Adjust Time Zone button is only enabled on the CTS. If a time zone algorithm is not defined following a migration from Mixed CTN to STP-only CTN, it is not possible to schedule the next daylight saving time adjustment. See 2.5.2, “Time-zone offset adjustment” on page 74, for further details.

Network Configuration tab

Figure 14-19 shows the Network Configuration tab for the SCZP201 server.

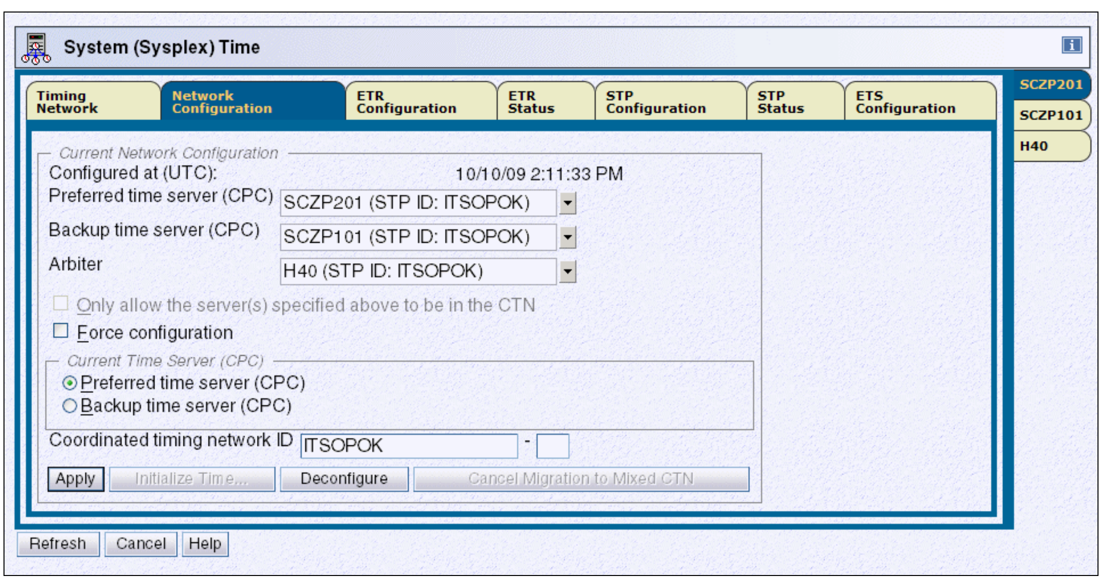


Figure 14-19 Network Configuration tab (SCZP201)

This tab now shows the server roles within the STP-only CTN and indicates which server is the Current Time Server. The CTN ID is also displayed. The same information is shown on all servers in the STP-only CTN.

The Preferred Time Server, Backup Time Server, Arbiter, Current Time Server, and CTN ID fields can all be modified from this tab. However, the modifications are only accepted if they are performed on the server that *is going to become* the CTS after the network reconfiguration is complete.

Modifications performed from the Network Configuration tab are *global* and, as such, are propagated throughout the STP-only CTN.

The CTN ID can be changed to either:

- Specify a different STP ID for the STP-only CTN.
- Define an ETR Network ID that will migrate the STP-only CTN to a Mixed CTN.

Important: The Deconfigure button removes all definitions in the STP-only CTN, causing all servers to become unsynchronized. This should be used with extreme caution, and only if absolutely required.

ETR Configuration tab

Figure 14-20 shows the ETR Configuration tab for the SCZP201 server.

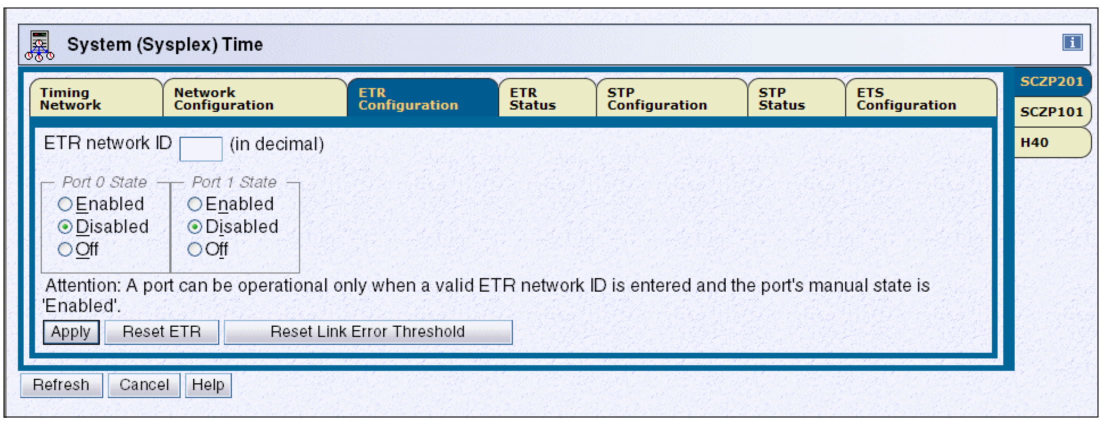


Figure 14-20 ETR Configuration tab (SCZP201)

Prior to migration, this tab specified an ETR Network ID of 31. The migration from a Mixed CTN to an STP-only CTN has disabled the ETR ports, and the ETR Network ID has been removed. The new CTN ID is now [ITSOPOK] - [ ] with only the STP ID part defined.

ETR Status tab

Figure 14-21 shows the ETR Status tab for the SCZP201 server.

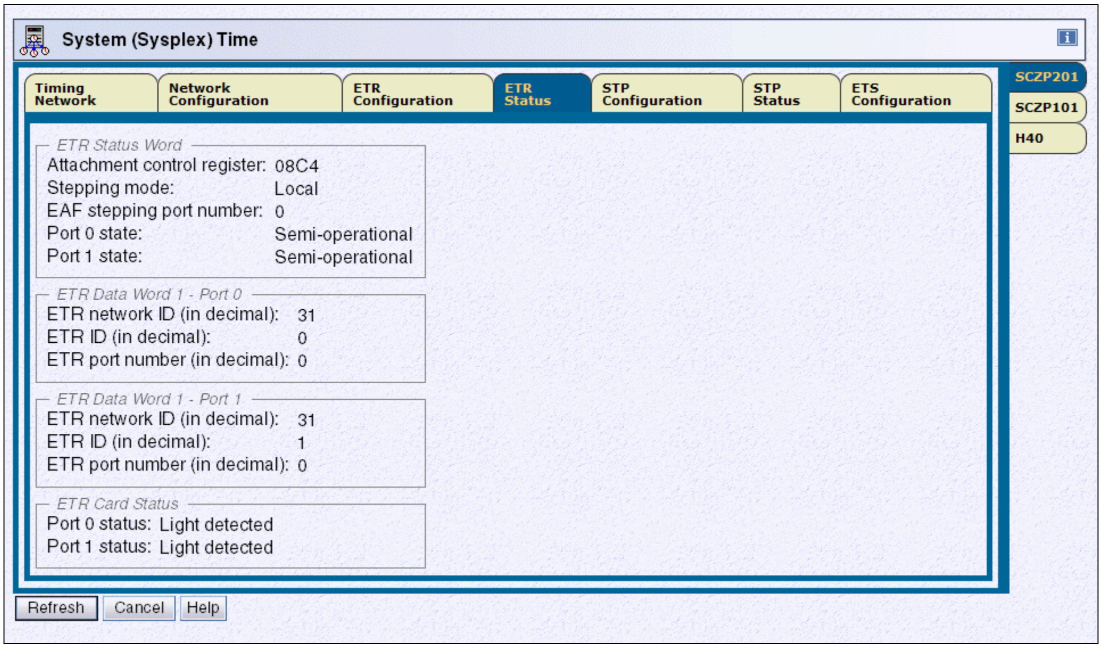


Figure 14-21 ETR Status tab (SCZP201)

Even though the SCZP201 server has disabled connectivity to the ETR network and has removed the ETR Network ID from the CTN ID, the ETR Status tab retains details of the connected Sysplex Timers until the ETR network is physically disconnected.

If an ETR link failure occurs while in STP-only mode, then z/OS message IEA393I appears (Example 14-1). The purpose is to be able to repair a failing link in case a reverse migration to a Mixed CTN is scheduled.

Example 14-1 Message IEA393I

```
IEA393I ETR PORT n IS NOT OPERATIONAL. THIS MAY BE A CTN CONFIGURATION CHANGE.
```

STP Configuration tab

Figure 14-22 shows the STP Configuration tab for the SCZP201 server.

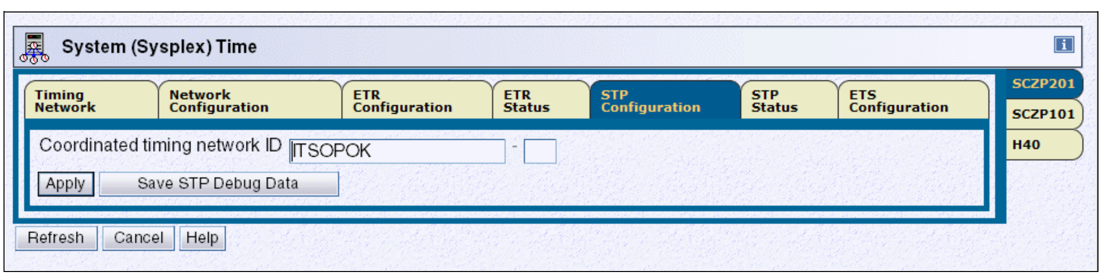


Figure 14-22 STP Configuration tab (SCZP201)

This shows that the SCZP201 server is in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ], where ITSOPOK is the STP ID. No ETR Network ID is defined, because connectivity to the ETR network has been fully disabled as a result of the migration.

Important: Modification of the STP ID (or the ETR ID) is not permitted on the STP Configuration tab for the Current Time Server.

On other servers in the CTN, the STP Configuration tab allows an STP ID to be modified, but if done from this location, it is a *local* change only, causing this server to transition from the existing STP-only CTN to another STP-only CTN with a different CTN ID.

This is disruptive to z/OS images on this server if they are in a sysplex configuration with z/OS images remaining in the STP-only CTN. XCF detects multiple time sources in the sysplex and begins to remove sysplex members until the situation is resolved.

Modification of the STP ID can only be done nondisruptively from the Network Configuration tab on the Current Time Server, where it is managed as a *global* change.

STP Status tab

Figure 14-23 shows the STP Status tab for the SCZP201 server.

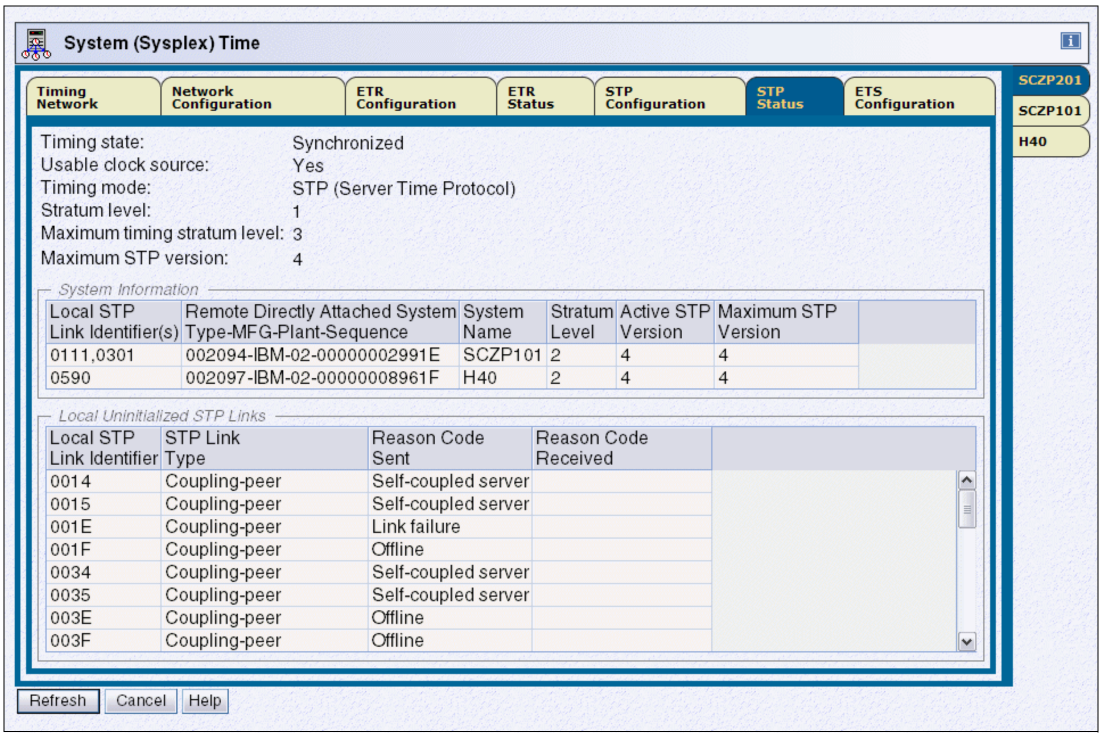


Figure 14-23 STP Status tab (SCZP201)

The SCZP201 server is shown to be synchronized in the STP-only CTN as the Stratum 1 server. There are two Stratum 2 servers in the Remote Directly Attached Systems. Each of these servers is Stratum 2 and has connectivity to the SCZP201 server over the coupling facility or timing-only links, as identified by the STP Link Identifiers.

ETS Configuration tab

Figure 14-24 shows the ETS Configuration for the SCZP201 server.

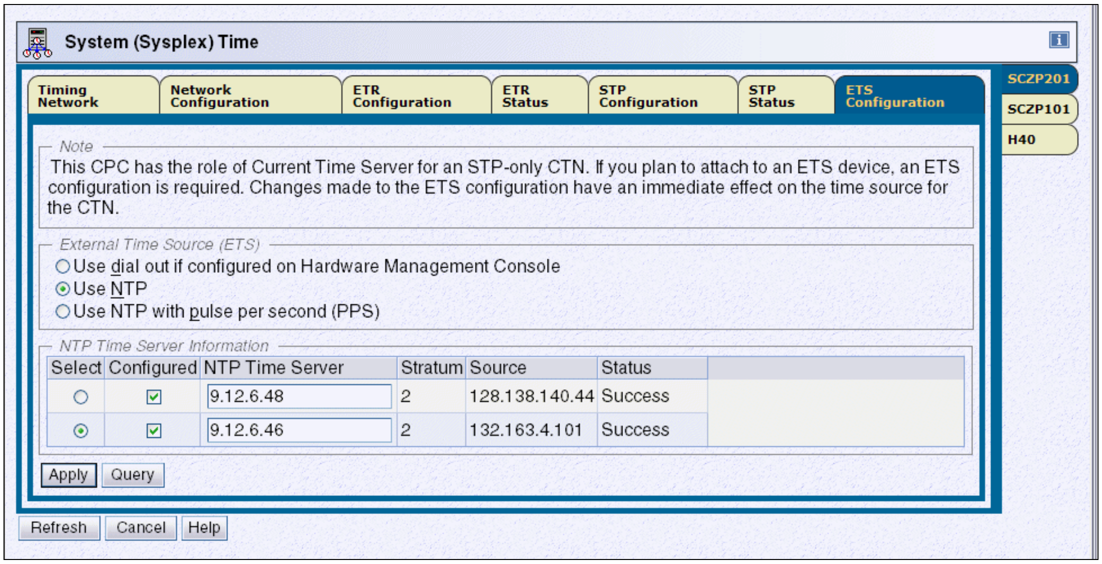


Figure 14-24 ETS Configuration tab (SCZP201)

Two NTP time servers have been defined as time sources. Because SCZP201 is the Current Time Server for the STP-only CTN, the selected NTP server is used as the time source for SCZP201.

15

STP-only to Mixed CTN

In the scenario in this chapter[1], our sample configuration is converted from an STP-only CTN to a Mixed CTN by defining the External Timer Reference (ETR) Network ID in the CTN ID.

This is done as a single *global* change, distinct from the scenario described in Chapter 9, “Mixed CTN (ETR timing mode) to ETR Network” on page 281, where the ETR Network ID is defined in the CTN ID of each server as a *local* change.

In this chapter we work through the following sections:

An STP-only CTN can consist of several servers in STP timing mode.

This scenario proceeds to the point that all servers have a CTN ID defined that includes both an STP ID and an ETR Network ID.

The timing mode of each server at the end of the migration depends its their role within the STP-only CTN:

- The Preferred Time Server (PTS) and Backup Time Server (BTS), if defined, have their server ETR ports enabled, and transition to ETR timing mode and become Stratum 1.
- The remaining servers do not have their server ETR ports enabled, and remain in STP timing mode and are either Stratum 2 or Stratum 3, depending on available coupling link connectivity.

[1] See “Prerequisites” on page 263.

A migration from an STP-only CTN to a Mixed CTN might take considerable time due to the potential difference in time between the Current Time Server and the Sysplex Timer at the start of the migration. After the migration is selected, the STP facility must steer the Coordinated Server Time (CST) toward the time provided by the Sysplex Timer.

An estimate of how long this steering process will take is provided in a confirmation window. If this time is excessive, the user may decide not to proceed with the migration process at this time. After the migration has started, it can be cancelled at any time. Any steering adjustment to the Current Time Server that has occurred in the interim is retained.

15.1 Start point

The starting environment for this scenario is an STP-only CTN with all servers operating in STP timing mode (Figure 15-1).

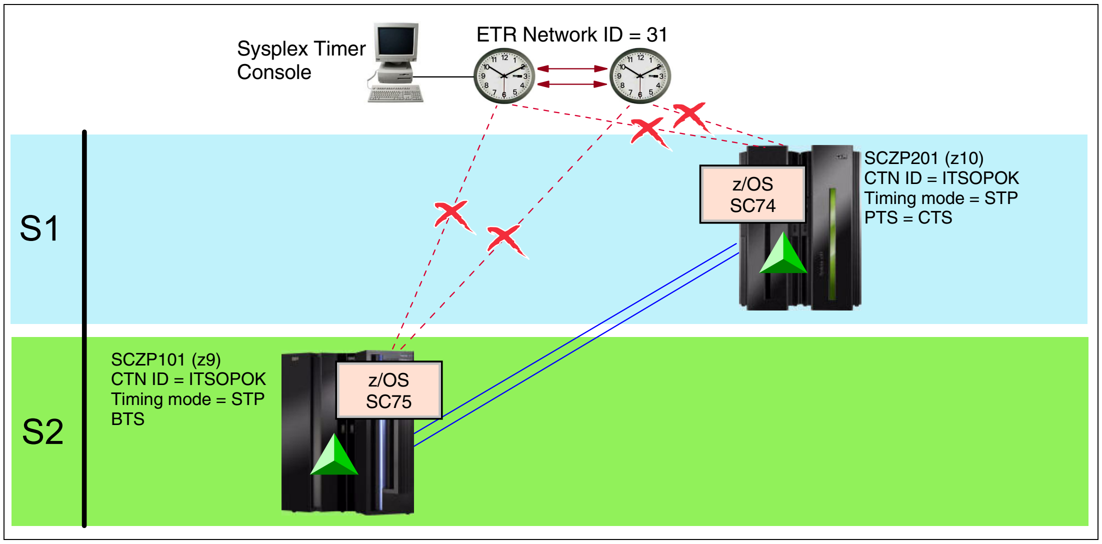


Figure 15-1 STP Implementation environment - STP-only CTN

The STP-only CTN consists of two servers:

- SCZP201 is the Current Time Server.
- SCZP101 is the Backup Time Server.

There is no Arbiter defined.

Each server is connected to the other server in a redundant configuration using multiple coupling links, and each server has a z/OS image and coupling facility defined. There are two coupling links between these servers, as evidenced by the various HMC workplace displays.

This configuration is migrated to a Mixed CTN operating in ETR timing mode.

15.1.1 z/OS DISPLAY ETR command

Figure 15-2 shows the output from the **DISPLAY ETR** command entered on the SC74 image, on SCZP201.

```
RO *ALL,D ETR
SC74     RESPONSES ---------------------------------------------------
IEA386I 16.42.46 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 1
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE PREFERRED TIME SERVER
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
SC75     RESPONSES ---------------------------------------------------
IEA386I 16.42.46 TIMING STATUS
SYNCHRONIZATION MODE = STP
  THIS SERVER IS A STRATUM 2
  CTN ID = ITSOPOK
  THE STRATUM 1 NODE ID = 002097.E26.IBM.02.00000001DE50
  THIS IS THE BACKUP TIME SERVER
  NUMBER OF USABLE TIMING LINKS =  2
  THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
```

Figure 15-2 DISPLAY ETR display - SC74 on SCZP201, STP-only CTN

This display shows that z/OS image SC74 is resident on a processor that is both the Preferred Time Server and the Current Time Server, and that z/OS image SC75 is resident on the Backup Time Server. There is no Arbiter in this STP-only CTN.

15.1.2 z/OS DISPLAY XCF command

Figure 15-3 shows the output from the z/OS **DISPLAY XCF** command entered on the SC74 image, on SCZP201.

```
D XCF,S,ALL
IXC335I  16.43.48  DISPLAY XCF 161
 SYSPLEX PLEX75
 SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
 SC74     2097 DE50   2C   10/03/2009 16:43:47 ACTIVE         TM=STP
 SC75     2094 991E   1C   10/03/2009 16:43:46 ACTIVE         TM=STP
```

Figure 15-3 DISPLAY XCF display - SC74 image on SCZP201, STP-only CTN

This display shows that both z/OS images SC74 and SC75 are operating in STP timing mode. They are resident on separate servers, as evidenced by the different serial numbers.

15.1.3 System (Sysplex) Time tabs

The tabs discussed in this section are available on the System (Sysplex) time selection for each server. Only the tabs for the SCZP201 server are shown in this section.

Timing Network

Figure 15-4 shows the Timing Network tab for the SCZP201 server. As shown in the Offsets section, the Total time (hours : minutes) field indicates that a time zone offset entry has not yet been set from the Adjust Time Zone Offset window, but has been inherited from a Sysplex Timer during a migration from a Mixed to STP-only CTN. In this instance, the time zone must be set. See 2.5.2, “Time-zone offset adjustment” on page 74 for details.

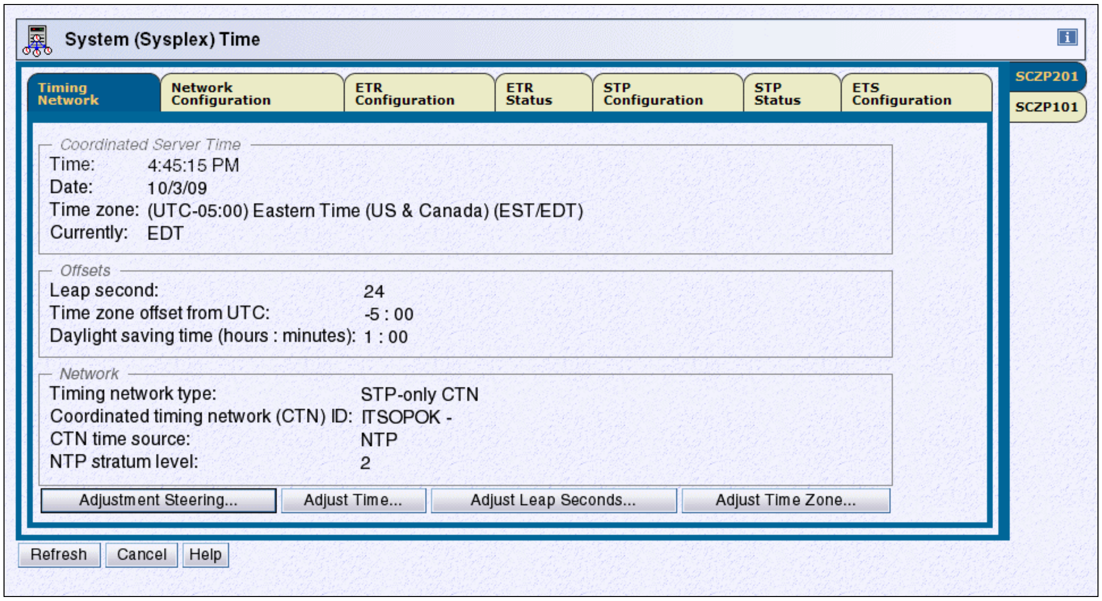


Figure 15-4 Timing Network tab (SCZP201)

This shows that the SCZP201 server is in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ]. The same information is shown on all servers in the STP-only CTN. However, only the Current Time Server has the Adjust Time, Adjust Leap Seconds, and Adjust Time Zone buttons enabled.

The CTN time source field indicates that the time initialization of this CTN is through an NTP server.

Because the STP-only CTN no longer has connectivity to the ETR network, the leap second offset (set to 24) and the total time offset (set to -5) are now maintained by the Current Time Server. These can be modified using the Adjust Leap Seconds and Adjust Time Zone buttons accordingly.

Network Configuration tab

Figure 15-5 shows the Network Configuration tab for the SCZP201 server.

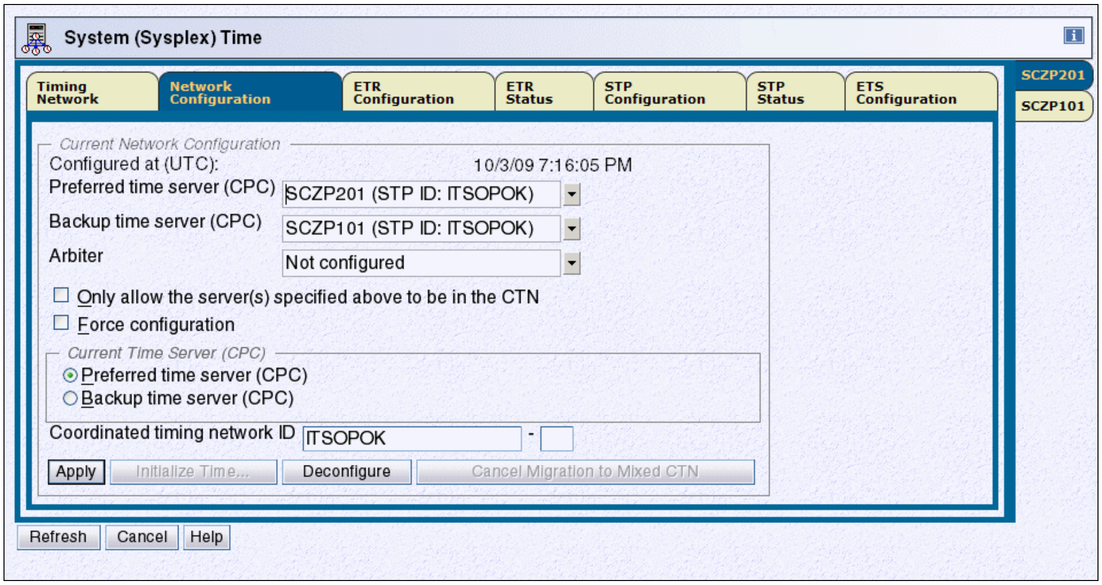


Figure 15-5 Network Configuration tab (SCZP201)

This tab shows the server roles with the STP-only CTN and indicates which server is the Current Time Server. The CTN ID is also displayed. The same information is shown on all servers in the STP-only CTN.

The Preferred Time Server, Backup Time Server, Arbiter, Current Time Server, and CTN ID fields can all be modified from this tab. However, the modifications are accepted only if they are performed on the server that is *going to become* the CTS after the network reconfiguration is complete.

Modifications performed from the Network Configuration tab are *global* and, as such, are propagated throughout the entire STP-only CTN.

The CTN ID can be changed to either:

- Specify a different STP ID for the STP-only CTN.
- Define an ETR Network ID that will migrate the STP-only CTN to a Mixed CTN.

The Deconfigure button removes all definitions in the STP-only CTN, causing all servers to become unsynchronized.

ETR Configuration tab

Figure 15-6 shows the ETR Configuration tab for the SCZP201 server.

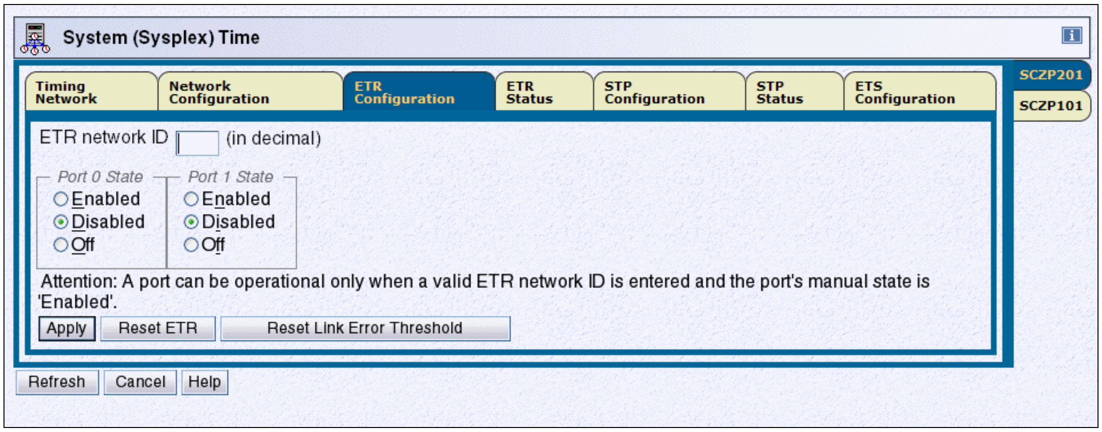


Figure 15-6 ETR Configuration tab (SCZP201)

As the SCZP201 only is in an STP-only CTN, there is no connectivity to the ETR network, so the ETR Network ID is not defined, and the server ETR ports are disabled.

Important: The STP facility does not allow the ETR Network ID to be specified on the ETR Configuration tab of the Current Time Server. Definition of an ETR Network ID to migrate the STP-only CTN to a Mixed CTN can only be done nondisruptively from the Network Configuration tab where it is managed as a *global* change.

ETR Status tab

Figure 15-7 shows the ETR Status tab for the SCZP201 server.

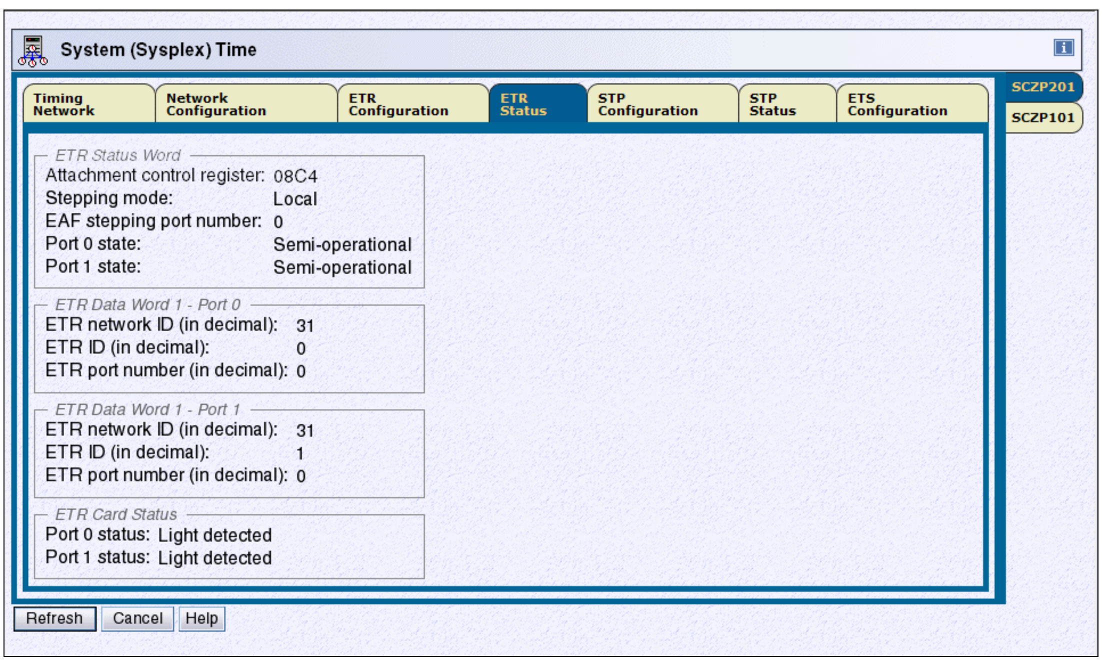


Figure 15-7 ETR Status tab (SCZP201)

Even though the SCZP201 server has disabled connectivity to the ETR network and has removed the ETR Network ID from the CTN ID, the ETR Status tab retains details of the connected Sysplex Timers until the ETR network is physically disconnected.

STP Configuration tab

Figure 15-8 shows the STP Configuration tab for the SCZP201 server.

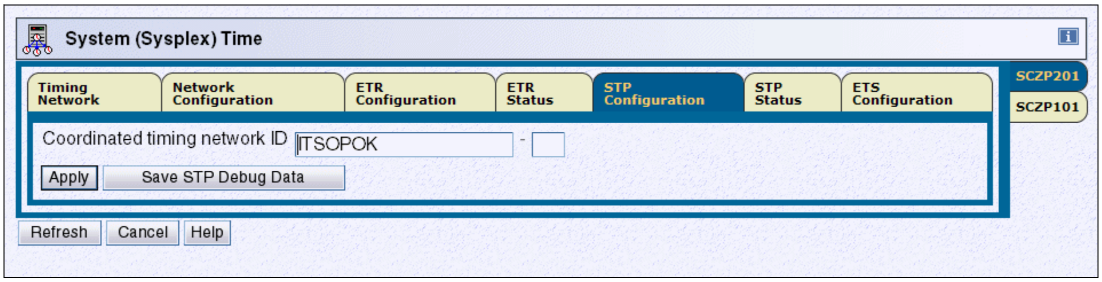


Figure 15-8 STP Configuration tab (SCZP201)

This shows that the SCZP201 server is in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ], where ITSOPOK is the STP ID. No ETR Network ID is defined, as connectivity to the ETR network has been disabled.

STP Status tab

Figure 15-9 shows the STP Status tab for the SCZP201 server.

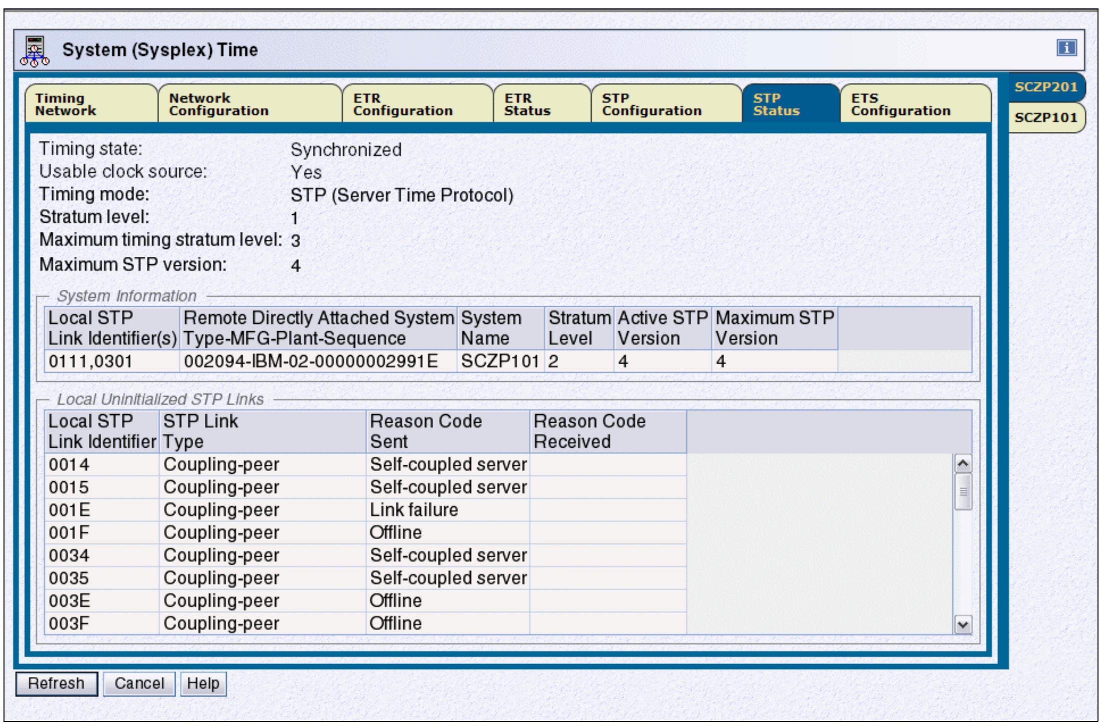


Figure 15-9 STP Status tab (SCZP201)

This tab shows that the SCZP201 server is synchronized in the STP-only CTN as the Stratum 1 server. There is a single Stratum 2 server, SCZP101, shown in the Remote Directly Attached Systems. Connectivity from SCZP201 to SCZP101 is over the coupling links, as identified by the STP link identifiers.

ETS Configuration tab

Figure 15-10 shows the ETS Configuration for the SCZP201 server.

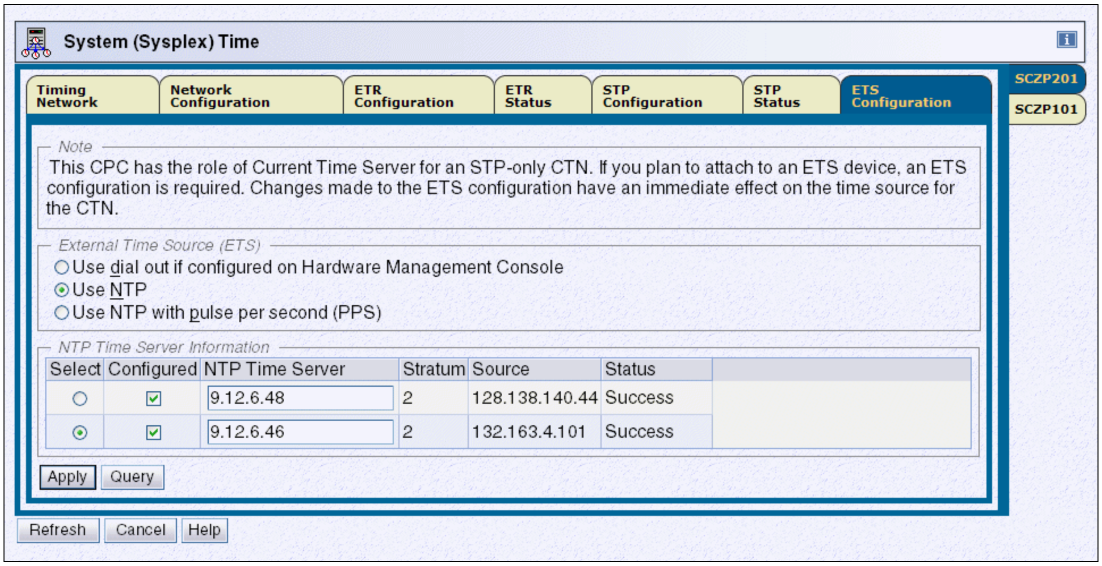


Figure 15-10 ETS Configuration tab (SCZP201)

Two NTP time servers have been defined as time sources. These are the two Hardware Management Consoles (HMCs) of the configuration. Both are Stratum 2 NTP servers connected to an external Stratum 1 NTP server, and both have been successfully contacted. Because SCZP201 is the Current Time Server for the STP-only CTN, the selected NTP server is used as the time source for SCZP201.

15.2 Migration

The migration process for an STP-only CTN to a Mixed CTN involves defining the ETR Network ID in the CTN ID. In this case, the CTN ID changes from [ITSOPOK] - [ ] to [ITSOPOK] - [31] to match the ETR Network ID transmitted by the Sysplex Timers and displayed in the ETR Status tab (Figure 15-7 on page 381).

Because this is a *global* change affecting the entire CTN, it needs to be done from the Network Configuration tab on the Current Time Server. In the configuration being used, the SCZP201 server is the CTS.

Table 15-1 shows the before and after configuration details.

Table 15-1 Server configuration - STP-only CTN to Mixed CTN migration

	Server	CTN ID		Server role	Timing mode	Stratum level
		STP ID	ETR ID			
Before migration	SCZP101	ITSOPOK		BTS	STP	2
	SCZP201	ITSOPOK		PTS & CTS	STP	1
After migration	SCZP101	ITSOPOK	31	Not defined	ETR	1
	SCZP201	ITSOPOK	31	Not defined	ETR	1

During the migration process, the STP facility steers the Coordinated Server Time (CST) to the time of the ETR network, and this might take a while. See the *Server Time Protocol Planning Guide*, SG24-7280, for more information about the implications of the ETRDELTA setting.

After the times are aligned, the STP facility adds the ETR Network ID to the CTN ID on all servers and enables the server ETR ports on both the Current Time Server and the Backup Time Server, converting them to ETR timing mode. Both servers transition to Stratum 1. Other servers in the CTN, if any, remain in STP timing mode as either Stratum 2 or Stratum 3, depending on available connectivity.

Important: In a migration from an STP-only CTN to a Mixed CTN, only the Preferred Time Server and the Backup Time Server (if defined) have their ETR ports enabled and transition to ETR timing mode.

The Arbiter (if defined) and any other servers in the CTN remain in STP timing mode, because their server ETR ports are not enabled as part of the migration process.

15.2.1 Defining the ETR Network ID on SCZP201

Note that because the CTS role is currently allocated to SCZP201, the migration must be performed from this server.

Important: Check whether the ETR ports are enabled and if they are receiving valid time data.

At the HMC workplace, perform the following steps:

1. Highlight the **SCZP201** server and select **System (Sysplex) Time**.
2. Click the **Network Configuration** tab.
3. Enter the ETR Network ID in the Coordinated Timing Network ID field (Figure 15-11).

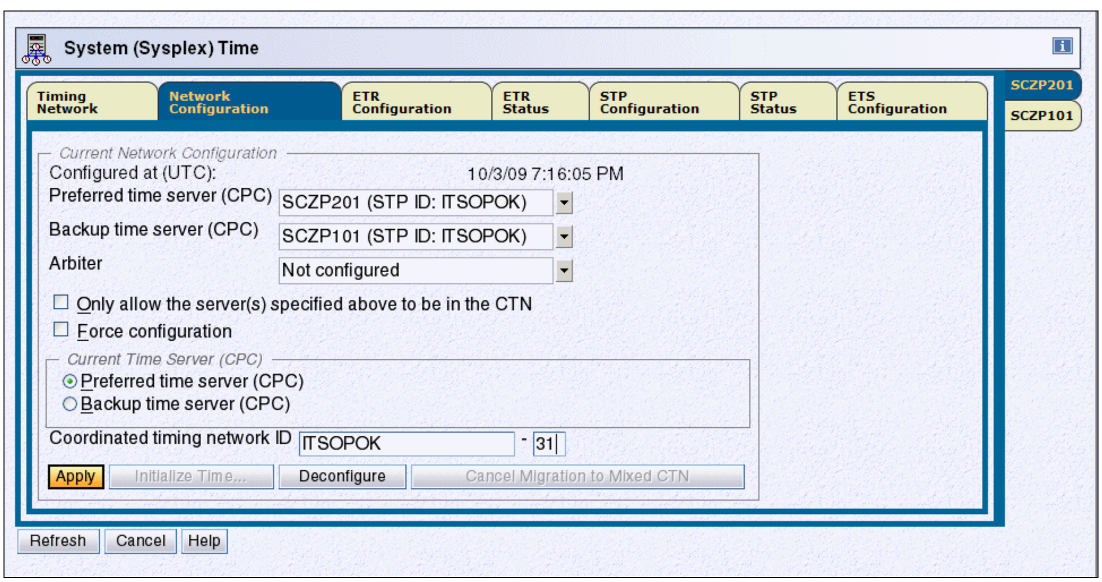


Figure 15-11 Network Configuration tab (SCZP201)

4. Click **Apply**. This displays the Migration to Mixed CTN Confirmation, message ACT37354 (Figure 15-12).

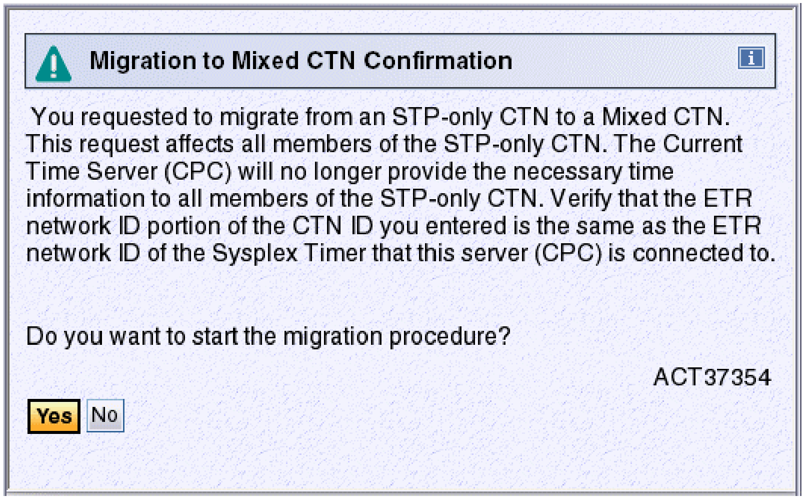


Figure 15-12 Message ACT37354 - Migration to Mixed CTN confirmation

5. Click **Yes** to confirm. This displays the Migration to Mixed CTN Confirmation, message ACT39128 (Figure 15-13). This is a second confirmation window that provides an estimate of how long the migration process will take.

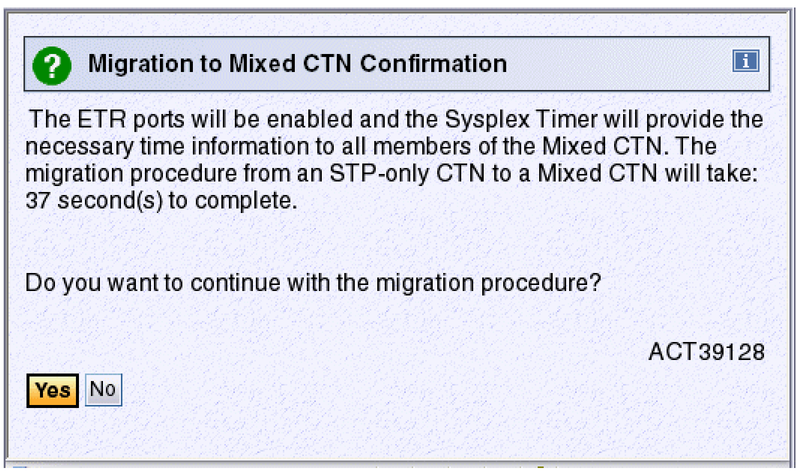


Figure 15-13 Message ACT39128 - Migration to Mixed CTN confirmation

6. Confirm the migration by clicking **Yes**. This displays the Migration to Mixed CTN, message ACT39136 (Figure 15-14).

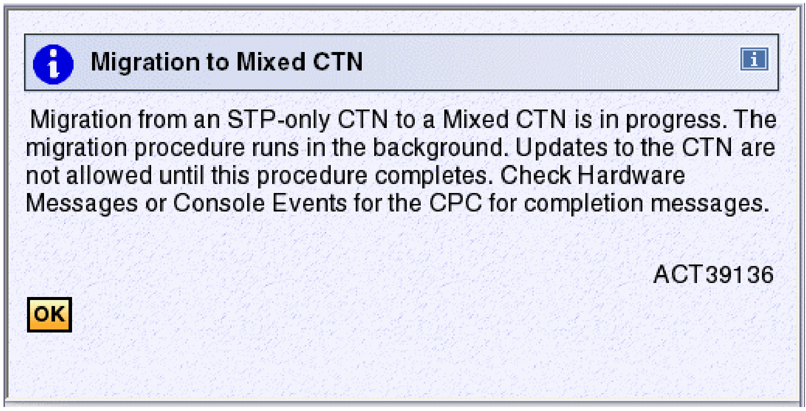


Figure 15-14 Message ACT39136 - Migration to Mixed CTN in progress

15.2.2 STP-only CTN to Mixed CTN migration in progress

During the migration process, the STP facility steers the Current Time Server to the time of the ETR network, and this might take some time. While the migration is in progress, the Current Time Server continues to provide the time information. Although certain functions are disabled, the CTN still is an STP-only CTN.

The tabs discussed in this section are available on the System (Sysplex) time selection for each server. Only the tabs for SCZP201 are shown.

Timing Network tab

Figure 15-15 shows the Timing Network tab for the SCZP201 server.

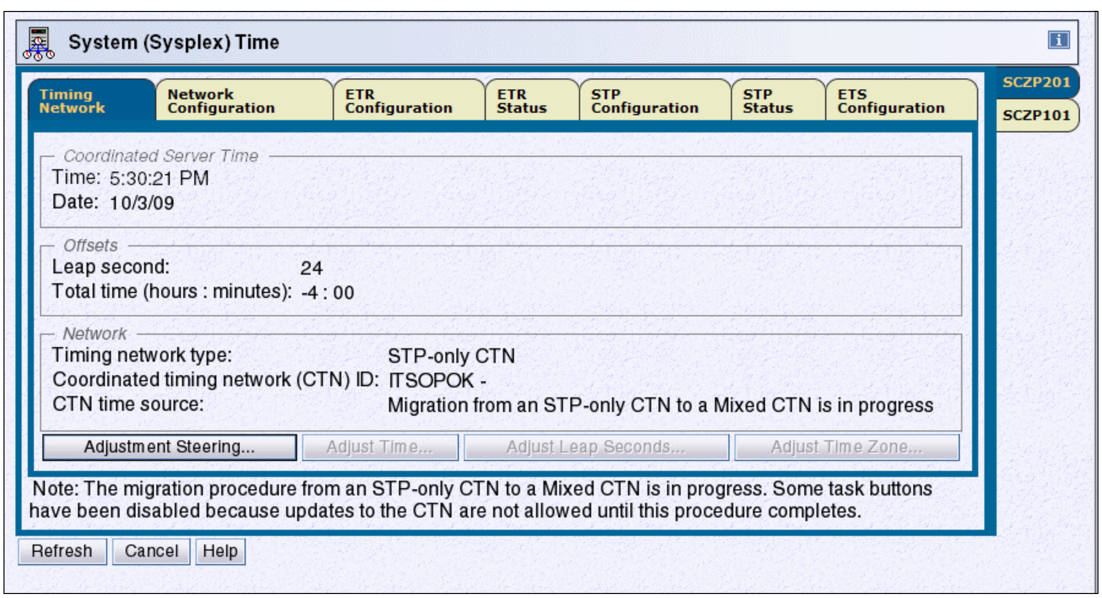


Figure 15-15 Timing Network tab (SCZP201)

The Adjust Time, Adjust Leap Seconds, and Adjust Time Zone buttons are no longer enabled. Only the Adjustment Steering button is available. The Adjustment Steering Information window (Figure 15-16) displays the amount of time (seconds) to steer and the estimated finish time for the migration.

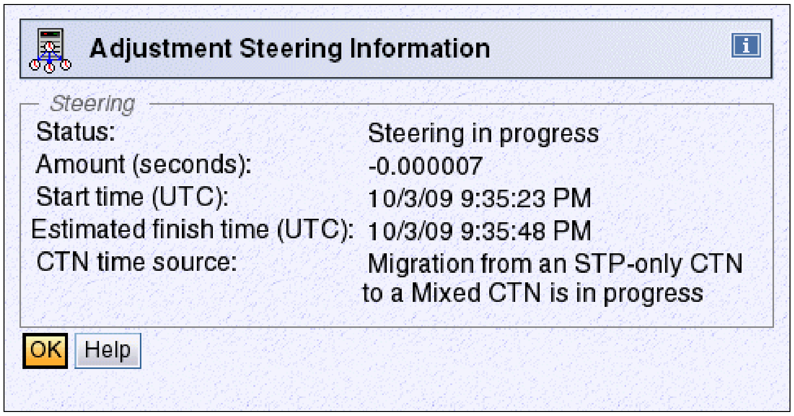


Figure 15-16 Adjustment Steering Information

The amount of time to steer represents the difference between the time at the Sysplex Timer and the Coordinated Server Time at the CTS.

Network Configuration tab

Figure 15-17 shows the Network Configuration tab for the SCZP201 server.

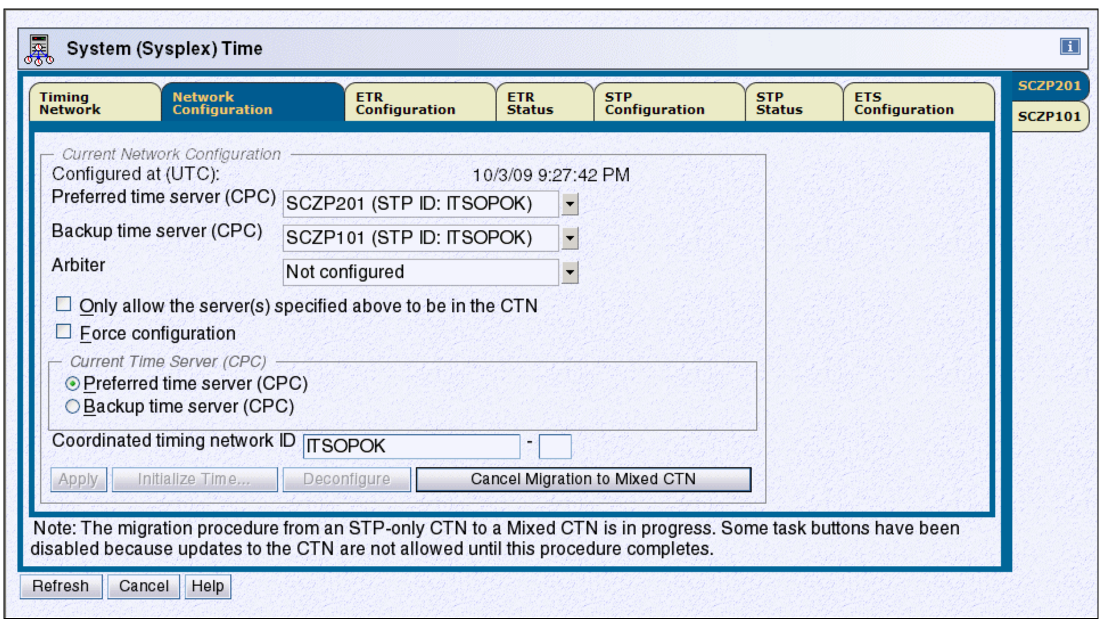


Figure 15-17 Network Configuration tab (SCZP201)

During the migration, only the Cancel Migration to Mixed CTN is enabled. The tab reflects an STP-only CTN, because the switch to Mixed CTN only occurs at the end of the migration.

ETR Configuration tab

Figure 15-18 shows the ETR Configuration tab for the SCZP201 server.

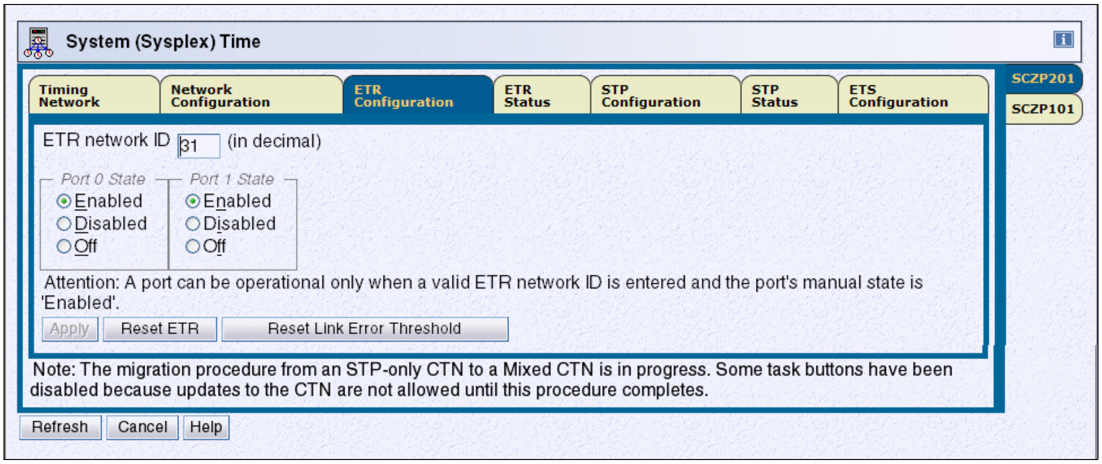


Figure 15-18 ETR Configuration tab (SCZP201)

This tab shows that the SCZP201 server is connected to an ETR network with an ETR Network ID of 16. Both server ETR ports are enabled. A note indicates that a migration procedure from an STP-only CTN to a Mixed CTN in currently in progress.

ETR Status tab

Figure 15-19 shows the ETR Status tab for the SCZP201 server.

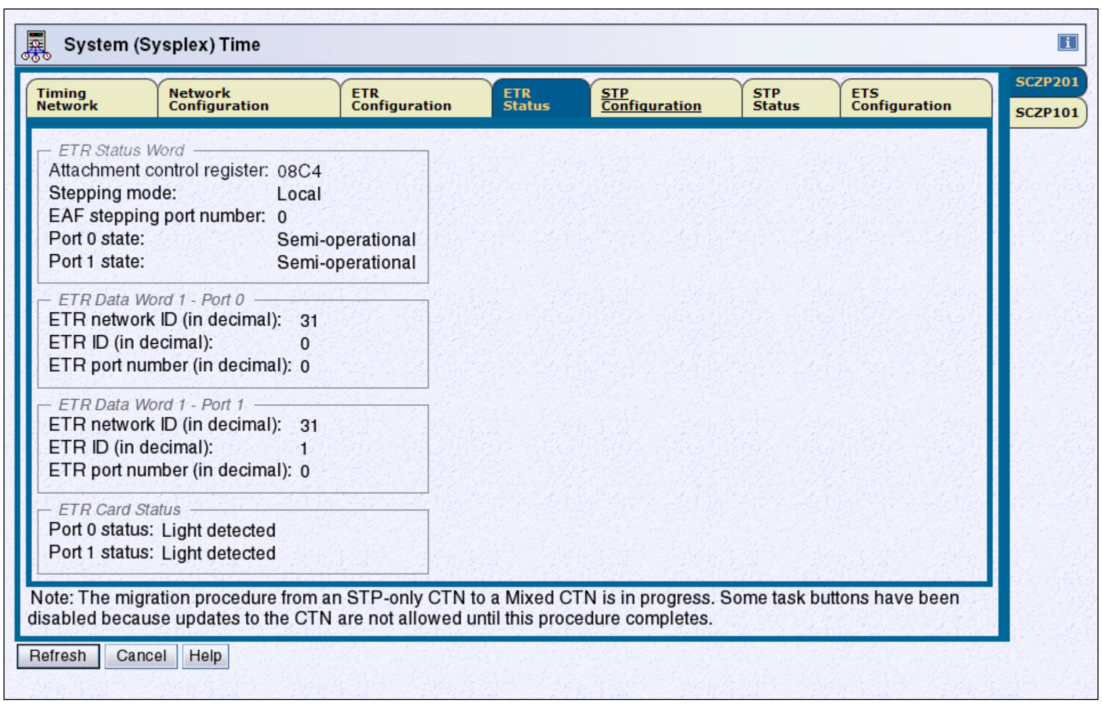


Figure 15-19 ETR Status tab (SCZP201)

This tab shows that the server ETR port states are operational and the ETR Attachment facility is stepping to port 0. The ETR ID is 0 and the ETR Network ID is 31.

As for the ETR Configuration tab, a note indicates that a migration procedure from an STP-only CTN to a Mixed CTN is currently in progress.

STP Configuration tab

Figure 15-20 shows the STP Configuration tab for SCZP201. It shows that SCZP201 is still in an STP-only CTN with a CTN ID of [ITSOPOK] - [ ].

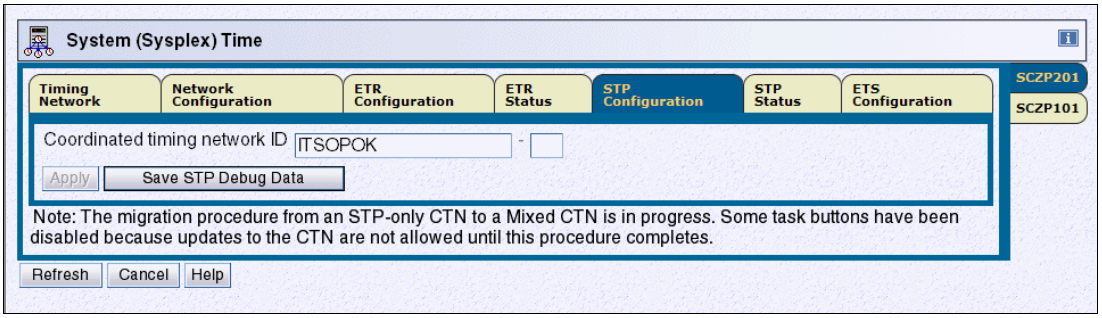


Figure 15-20 STP Configuration tab (SCZP201)

When the STP facility completes steering of the Current Time Server so that it is aligned with the time at the Sysplex Timer, the CTN switches from STP-only to Mixed, and the CTN ID change from [ITSOPOK] - [ ] to [ITSOPOK] - [31] is propagated in a coordinated manner across all servers. As this occurs, messages are displayed on the console and SYSLOG of z/OS images in a sysplex configuration resident on these servers.

When the CTN ID change occurs, XCF notes that images in the sysplex are using different time sources for synchronization, as evidenced by the different CTN IDs.

In normal circumstances, this is an invalid condition, and z/OS images would be partitioned out of the sysplex to maintain timing integrity for resource sharing and data sharing purposes. To prevent this, XCF has been updated to recognize a global CTN ID change and tolerate the CTN ID mismatch for a short period of time. XCF reports the status so that the user can see each of the systems in the sysplex transition to the new CTN ID (Figure 15-21).

```
IEA267I ETR PORT 0 IS NOW AVAILABLE.                                 (1)
IEA267I ETR PORT 1 IS NOW AVAILABLE.
IEA260I THE CPC IS NOW OPERATING IN ETR MODE.
IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 25
IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 0B
IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 514          (2)
        FOR SYSTEM: SC74
        PREVIOUS CTNID:   ITSOPOK
        CURRENT  CTNID:   ITSOPOK -31
IXC439E ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOT SYNCHRONIZED 517       (3)
        TO THE SAME TIME REFERENCE.
       SYSTEM: SC75  IS USING CTNID: ITSOPOK
       SYSTEM: SC74  IS USING CTNID: ITSOPOK -31
IEA267I ETR PORT 0 IS NOW AVAILABLE.
IEA267I ETR PORT 1 IS NOW AVAILABLE.
IEA260I THE CPC IS NOW OPERATING IN ETR MODE.                        (4)
IEA273I TOD CLOCKS DYNAMICALLY ADVANCED TO MAINTAIN ETR SYNCHRONISM.  (5)
IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 25
IEA031I STP ALERT RECEIVED.  STP ALERT CODE = 0B
IXC438I COORDINATED TIMING INFORMATION HAS BEEN UPDATED 946
        FOR SYSTEM: SC75
        PREVIOUS CTNID:   ITSOPOK
        CURRENT  CTNID:   ITSOPOK -31
IXC435I ALL SYSTEMS IN SYSPLEX PLEX75 ARE NOW SYNCHRONIZED 518       (6)
        TO THE SAME TIME REFERENCE.
       SYSTEM: SC75  IS USING CTNID: ITSOPOK -31
       SYSTEM: SC74  IS USING CTNID: ITSOPOK -31
```

Figure 15-21 SYSLOG messages - S14 image on SCZP201, STP-only to Mixed CTN migration

The following information refers to Figure 15-21:

(1) IEA267I is issued by each z/OS image in the sysplex on a server in ETR timing mode as the server ETR ports are enabled.

(2) IXC438I is issued on each z/OS image in the sysplex as the CTN ID changes.

(3) IXC439E is issued by XCF once per second, whereas z/OS images in the sysplex are not synchronized to the same time reference, as evidenced by the different CTN IDs shown.

(4) IEA260 is issued by each z/OS image in the sysplex when conversion from STP timing mode to ETR timing mode is complete.

(5) IEA273I is issued when the server's TOD is aligned to the ETR.

(6) IXC435I is issued by XCF after the CTN ID mismatch is resolved.

15.3 End point

The topology diagram of our sample configuration has been updated to account for the conversion of the STP-only CTN to a Mixed CTN (Figure 15-22).

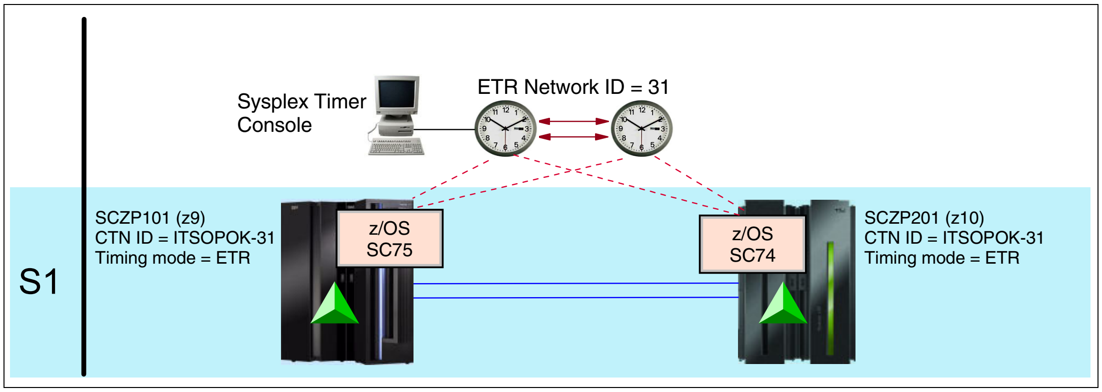


Figure 15-22 STP Implementation environment - Mixed CTN

Both servers are now running in ETR timing mode, because connectivity to the ETR network has been reinstated and server ETR ports enabled. As a result, the SCZP101 server has transitioned to a Stratum 1.

Also, none of the servers have STP roles defined, because these are available only to an STP-only CTN. The CTN ID on all servers has changed from [ITSOPOK] - [ ] to [ITSOPOK] - [16] with the definition of the ETR Network ID.

15.3.1 z/OS DISPLAY ETR command

Figure 15-23 shows the output from the **DISPLAY ETR** command entered on the S14 image, on SCZP201.

```
RO *ALL,D ETR
SC74     RESPONSES ---------------------------------------------------
IEA282I 18.48.27 TIMING STATUS 528
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=00                   ETR PORT=00
  ETR ID=00                     ETR ID=01
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
SC75     RESPONSES ---------------------------------------------------
IEA282I 18.48.27 TIMING STATUS 953
SYNCHRONIZATION MODE = ETR
  CPC PORT 0   <== ACTIVE       CPC PORT 1
  OPERATIONAL                   OPERATIONAL
  ENABLED                       ENABLED
  ETR NET ID=31                 ETR NET ID=31
  ETR PORT=01                   ETR PORT=01
  ETR ID=01                     ETR ID=00
  THIS SERVER IS PART OF TIMING NETWORK ITSOPOK -31
```

Figure 15-23 DISPLAY ETR display - S14 on SCZP201, Mixed CTN in ETR timing mode

This display shows that both z/OS images SC74 and SC75 are now running in ETR timing mode connected to an ETR network with an ETR Network ID of 31. They are also shown to be part of a Mixed CTN through display of the CTN ID of [ITSOPOK] - [31].

15.3.2 z/OS DISPLAY XCF command

Figure 15-24 shows the output from the z/OS **DISPLAY XCF** command entered on the S14 image, on SCZP201.

```
D XCF,S,ALL
 IXC335I  18.49.36  DISPLAY XCF 531
 SYSPLEX PLEX75
 SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
 SC75     2094 991E   1C   10/03/2009 18:49:33 ACTIVE         TM=ETR
 SC74     2097 DE50   2C   10/03/2009 18:49:35 ACTIVE         TM=ETR
```

Figure 15-24 DISPLAY XCF display - S14 on SCZP201, Mixed CTN

Both z/OS images are now shown to be resident on servers that are in ETR timing mode. Each of these z/OS images is resident on a separate server, as evidenced by the different serial number.

15.3.3 System (Sysplex) Time tabs

When the migration is finished, the System (Sysplex) Time task tabs reflect information applicable to a Mixed CTN. Only the tabs for the SCZP201 server are shown.

Timing Network tab

Figure 15-25 shows the Timing Network tab for the SCZP201 server.

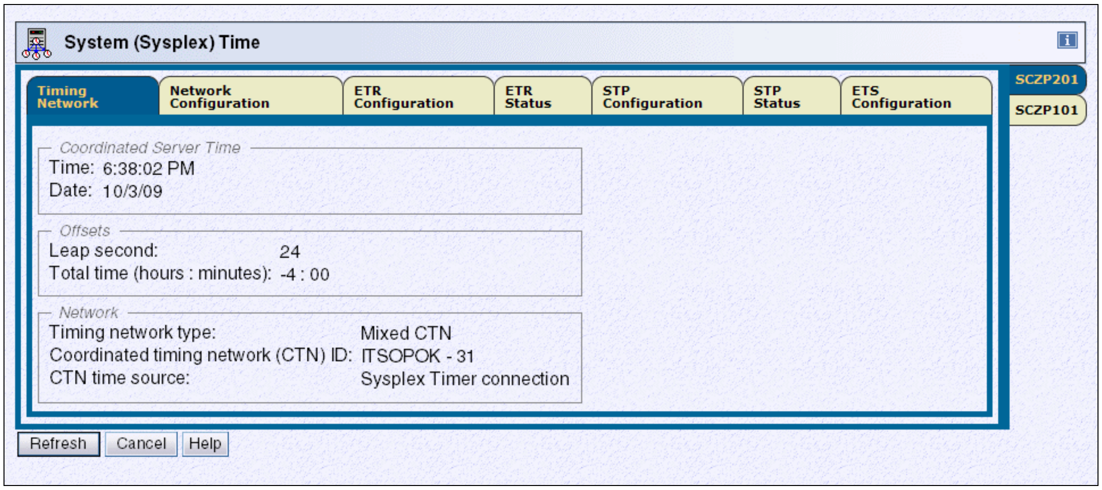


Figure 15-25 Timing Network tab (SCZP201)

The timing network type is Mixed CTN and the Coordinated Timing Network (CTN) ID is [ITSOPOK] - [31]. The CTN time source is a Sysplex Timer connection. The Adjustment buttons are no longer displayed.

Note: The leap second offset and local time of day settings are not propagated from the STP setting. The values specified on the Sysplex Timer are used.

Network Configuration tab

Figure 15-26 shows the Network Configuration tab for the SCZP201 server. When the migration is complete, SCZP201 is in a Mixed CTN. Server roles are not configured. Only the Apply button is enabled to allow a future conversion to STP-only CTN to proceed.

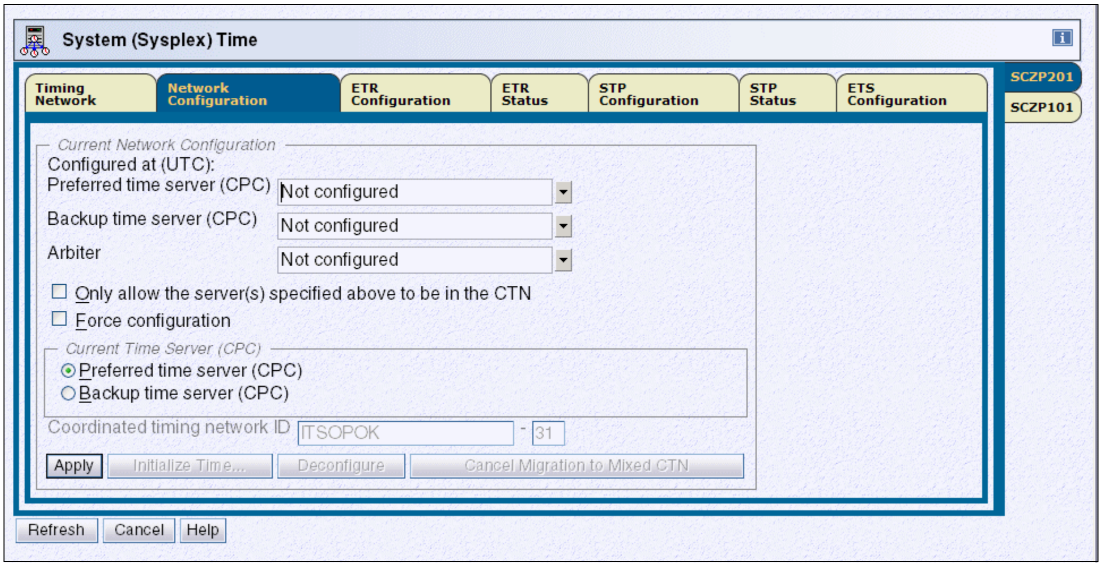


Figure 15-26 Network Configuration tab (SCZP201)

ETR Configuration tab

Figure 15-27 shows the ETR Configuration tab for the SCZP201 server.

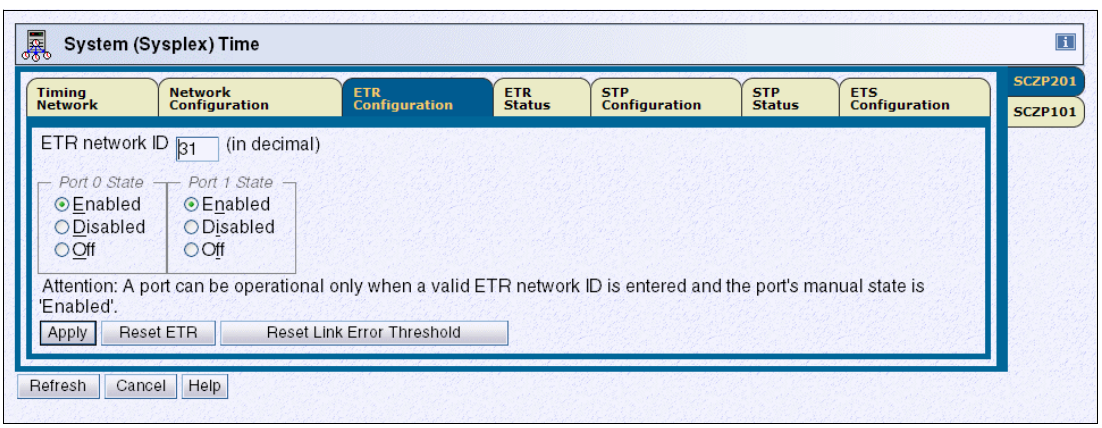


Figure 15-27 ETR Configuration tab (SCZP201)

This tab shows that the SCZP201 server is connected to an ETR network with an ETR Network ID of 31. Both server ETR ports are enabled.

ETR Status tab

Figure 15-28 shows the ETR Status tab for the SCZP201 server.

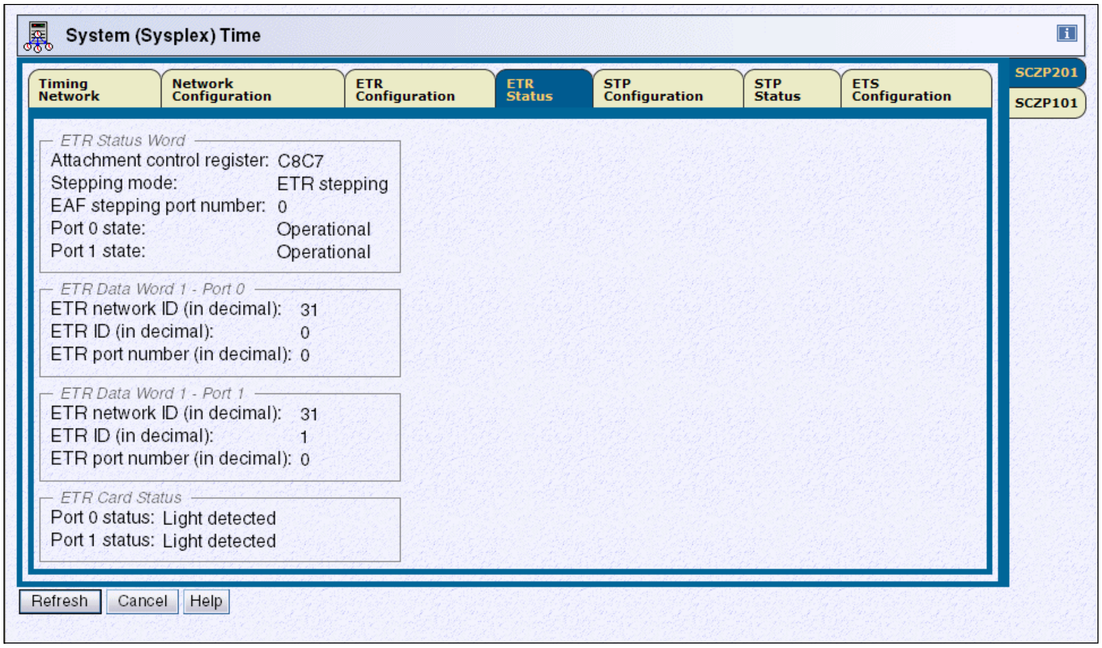


Figure 15-28 ETR Status tab (SCZP201)

This tab shows that the server ETR port states are operational and the server is synchronized to the ETR attached to server ETR port 0. This ETR has an ETR ID of 0 and is in an ETR network with an ETR Network ID of 31.

STP Configuration tab

Figure 15-29 shows the STP Configuration tab for the SCZP201 server.

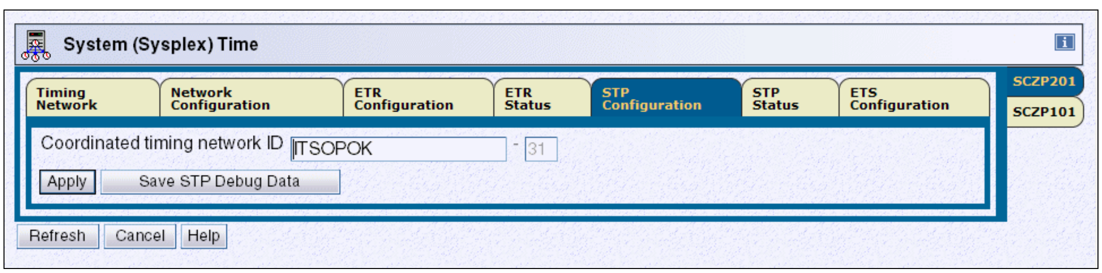


Figure 15-29 STP Configuration tab (SCZP201)

This shows that SCZP201 is in a Mixed CTN with a CTN ID of [ITSOPOK] - [31], where ITSOPOK is the STP ID, and 31 is the ETR Network ID.

STP Status tab

Figure 15-30 shows the STP Status tab for the SCZP201 server.

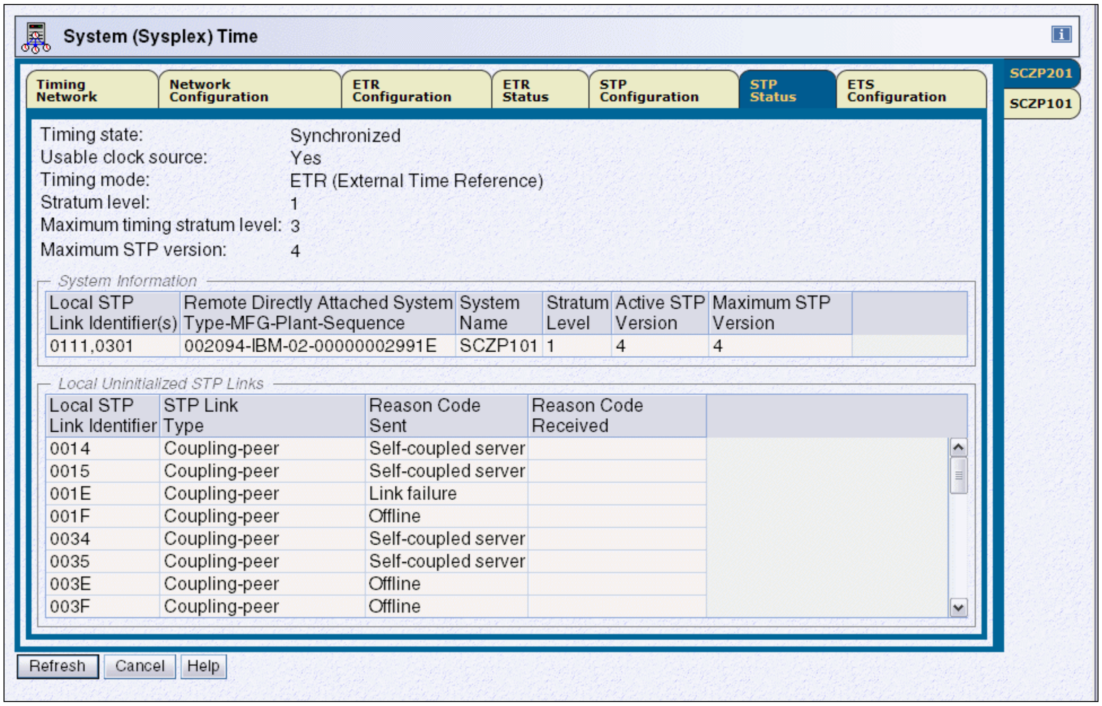


Figure 15-30 STP Status tab (SCZP201)

This tab shows that the SCZP201 server is in a Mixed CTN and is time synchronized. It is operating in ETR timing mode and is therefore a Stratum 1, because it has connectivity to the ETR network.

SCZP201 has a single Remote Directly Attached System, SCZP101, which is also a Stratum 1, and therefore is also in ETR timing mode. Connectivity of SCZP201 to SCZP101 is through the coupling links identified in the Local STP Link Identifiers column.

ETS Configuration tab

Figure 15-31 shows the ETS Configuration for the SCZP201 server.

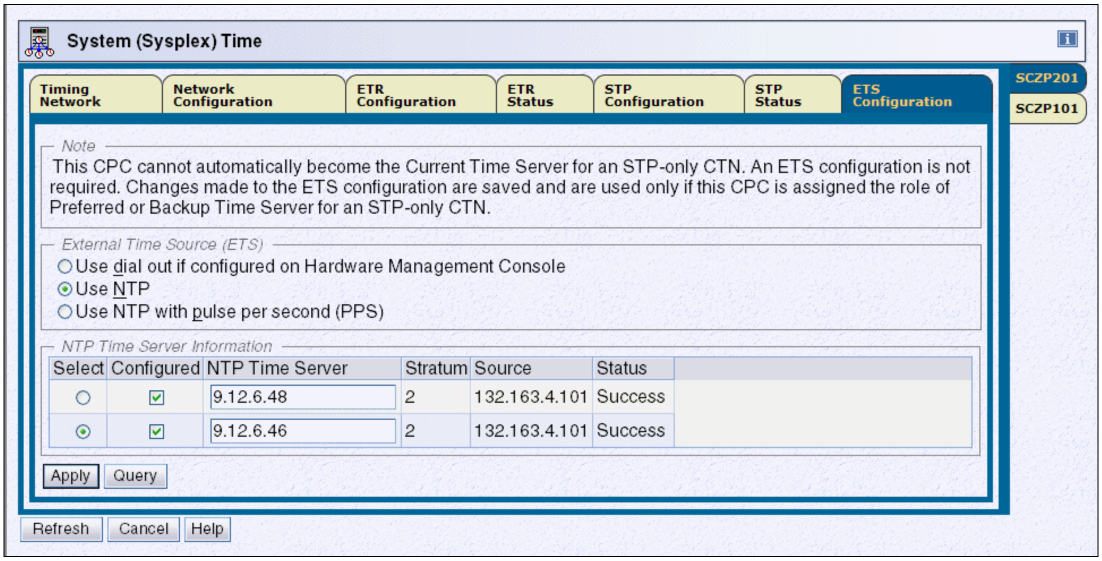


Figure 15-31 ETS Configuration tab (SCZP201)

Two NTP time servers have been defined as time sources, in case SCZP201 ever becomes the Current Time Server for an STP-only CTN. These are the two HMCs of the configuration. Both are Stratum 2 NTP servers connected to an external Stratum 1 NTP server, and both have been successfully contacted. However, SCZP201 now is not defined as a Preferred Time Server or as a Backup Time Server to the CTN, so the ETS configuration is not used. The time source of the CTN now is the ETR.

Part 4

Appendixes

A

POR of a server in an STP-only CTN

This appendix documents IBM-recommended best practices for the power-on-reset (POR) of a server in an STP-only CTN. Following these recommendations ensures that the impact for systems running on the other servers is kept to a minimum and the optimum level STP recovery capability is maintained.

When there are four or more servers, STP recovery functionality should not be impacted because the STP role of the server being POR'ed can be reassigned, provided the required connectivity exists via coupling or timing only links.

If the STP-only CTN consists of exactly three servers, STP recovery functionality will be impacted by the temporary removal of one of the servers. In this case the recommended STP-only configuration that has a PTS, BTS and Arbiter cannot be maintained. As the Arbiter role must be removed, Arbiter-assisted recovery will not be available while one of the servers is down.

In a two-server CTN there will be no BTS available to take over if the PTS/CTS fails. However, in this case all systems will fail because the only remaining server has failed.

The steps for the POR of a server in an STP-only CTN make the following assumptions:

- The server has at least one CF LPAR. If this is not the case for your planned server maintenance, the CF-related steps are not required.
- There was no change to the CF definition in the CFRM policy and the same links and control units are to be used to access the CFs. This means the logical state of the paths after the POR will be OFFLINE.
- The BTS role has been assigned in a two-server STP-only CTN. However, the actions for the BTS remain valid when performed on the non-PTS server.
- The BTS and Arbiter roles have been assigned in a three-or-more server STP-only CTN.
- The STP configuration will be saved across the POR by selecting **Only allow the server(s) specified above to be in the CTN** on the Network Configuration panel. This is only allowed for one- or two-server CTNs but is incorporated in the POR procedures for three-or-more server CTNs.

> **Note:** When the first server in an STP-only CTN is activated after a site shutdown, the STP configuration is restored and the STP time is taken from the support element (SE). This means it is critical to ensure that the SE time is correct before activating the first server when all servers are being POR'ed.

The suggested steps for server POR actions for the followng procedures will be shown in the following sections:

- Procedure 1: POR of the server in a single-server STP-only CTN
- Procedure 2: POR of a server in a two-server STP-only CTN
- Procedure 3: POR of a server in a three-or-more server STP-only CTN
- Procedure 4: POR of all servers in a two-server STP-only CTN
- Procedure 5: POR of all servers in a three-or-more server STP-only CTN

> **Restriction:** New safeguards for STP role servers that prevent a disruptive action being taken for PTS, BTS or Arbiter change how the "Only allow the server(s) specified above to be in the CTN" button is used because it requires that a BTS is assigned in a two-server CTN. This means that the BTS server has to be removed from the CTN when the BTS role is removed to allow the "Only allow the server(s) specified above to be in the CTN" button to be selected when the PTS is POR'ed.

Procedure 1: POR of the server in a single-server STP-only CTN

The following steps document the suggested procedure to POR the server in a single-server STP-only CTN. The steps taken assume that the "Only allow the server(s) specified above to be in the CTN" button on the Network Configuration panel is selected.

1. Shut down z/OS systems and deactivate all z/OS and CF LPARs.
2. Select the "Only allow the server(s) specified above to be in the CTN" button on the Network Configuration panel should be selected.To cause the STP configuration to be saved across the POR.
3. Ensure that the time on the SE is accurate.The SE time will be used to initialize the STP time when the PTS server is activated.
4. Perform the POR.
5. Check the server status via the STP status pane to ensure that the server timing state is synchronized.
6. Reactivate all z/OS and CF LPARs.
7. IPL the z/OS systems.

Procedure 2: POR of a server in a two-server STP-only CTN

The following steps document the suggested procedure to POR a server in a two-server STP-only CTN.

1. Quiesce all work on z/OS images that reside on the CPC being POR'ed. Remove z/OS images from the sysplex using V XCF,sysname,OFFLINE. Ensure that all systems on the server being POR'ed are not active in the sysplex.

2. If there is a CF LPAR on the server being POR'ed, move the CF structures to a CF on the other server. This ensures that systems running on the other server are not impacted. The CF structures are moved via the XCF MAINTMODE and REALLOCATE commands. The following commands are used to move the CF structures from CFA:
   a. SETXCF START,MAINTMODE,CFNAME=CFA
   b. D XCF,REALLOCATE,TEST
   c. SETXCF START,REALLOCATE
   d. D XCF,CF,CFNAME=CFA and check for structures that did not move
      - D XCF,REALLOCATE,REPORT
      - SETXCF START,REBUILD,STRNAME=strname,LOC=OTHER
3. Vary paths to the CFs on the server being POR'ed offline from all systems in the sysplex:

   V PATH(CFA,xx,CFA,yy),OFFLINE,UNCOND

   The paths used by the CF are part of the D XCF,CF,CFNAME=CFA output. Taking the paths offline causes the z/OS systems to take the CHPIDs connected to the CFs logically offline.
4. Issue the SHUTDOWN command via the CF OPERMSG console and deactivate the CF LPARs. Issuing the SHUTDOWN command ensures that all CF structures have been moved so that the CF LPARs can be deactivated safely.
5. If the PTS/CTS is being POR'ed, perform the following steps via the Network configuration panel on the server that is the current BTS:
   – Unselect the “Only allow the server(s) specified above to be in the CTN" button.
   – Assign the PTS role to the server that is the current BTS.
   – Remove the BTS role.
6. If the BTS is being POR'ed, perform the following steps via the Network configuration panel on the server that is the PTS:
   – Unselect the “Only allow the server(s) specified above to be in the CTN” button.
   – Remove the BTS role.
7. Perform the POR.
8. Confirm that the STP link status for links from this server are initialized. Verify that there are at least two initialized STP links between the two servers.
9. Use the Network configuration panel to revert back to the original assignments for PTS/CTS and BTS and to select the “Only allow the server(s) specified above to be in the CTN" button.
10. Reactivate all z/OS and CF LPARs.
11. Vary the paths to the CFs online from all systems in the sysplex. Because there were no link configuration changes, the paths will be offline for the z/OS systems on the other server that remained active.
12. Move the CF structures back to the CFs on the POR'ed server. This is done via the XCF MAINTMODE and REALLOCATE commands:
   – SETXCF STOPT,MAINTMODE,CFNAME=CF7A
   – SETXCF START,REALLOCATE
   – D XCF,REALLOCATE,REPORT
13. IPL the z/OS systems.

Procedure 3: POR of a server in a three or more-server STP-only CTN

The following steps document the suggested procedure to POR a server in a three or more-server STP-only CTN.

1. Quiesce all work on z/OS images that reside on the CPC being POR'ed. Remove z/OS images from the sysplex using V XCF,sysname,OFFLINE. Ensure that all systems on the server being POR'ed are not active in the sysplex.
2. If there is a CF LPAR on the server being POR'ed, move the CF structures to a CF on another server. This ensures that systems running on the other server are not impacted. The CF structures are moved via the XCF MAINTMODE and REALLOCATE commands. The following commands are used to move the CF structures from CFA:
   a. SETXCF START,MAINTMODE,CFNAME=CFA
   b. D XCF,REALLOCATE,TEST
   c. SETXCF START,REALLOCATE
   d. D XCF,CF,CFNAME=CFA and check for structures that did not move
      - D XCF,REALLOCATE,REPORT
      - SETXCF START,REBUILD,STRNAME=strname,LOC=OTHER
3. Vary paths to the CFs on the server being POR'ed offline from all systems in the sysplex:

   V PATH(CFA,xx,CFA,yy),OFFLINE,UNCOND

   The paths used by the CF are part of the D XCF,CF,CFNAME=CFA output. Taking the paths offline causes the z/OS systems to take the CHPIDs connected to the CFs logically offline.
4. Issue the SHUTDOWN command via the CF OPERMSG console and deactivate the CF LPARs. Issuing the SHUTDOWN command ensures that all CF structures have been moved so that the CF LPARs can be deactivated safely.
5. If the server has an STP special role assigned (PTS, BTS, or Arbiter) the role should be either reassigned or removed.
6. Perform the POR.
7. Confirm that the STP link status for links from this server is initialized and the server has the expected stratum level via the STP status panel. We suggest the following best practices for STP connectivity:
   – There are at least two initialized STP links between the two servers.
   – There should be at least two attached servers.
   – If the server will become an STP special role server in step 8, ensure that the STP links to the other two servers that will have STP special roles are initialized.
   – If the server is a Stratum 2, ensure that it has at least two links to the server that will become the BTS in step 8.
8. Use the Network configuration panel to revert back to the original assignments for PTS/CTS and BTS.
9. Reactivate all z/OS and CF LPARs.
10. Vary the paths to the CFs online from all systems in the sysplex. Because there were no link configuration changes, the paths will be offline for the z/OS systems on the other server that remained active.

11. Move the CF structures back to the CFs on the POR'ed server. This is done via the XCF MAINTMODE and REALLOCATE commands:
    - SETXCF STOPT,MAINTMODE,CFNAME=CF7A
    - SETXCF START,REALLOCATE
    - D XCF,REALLOCATE,REPORT
12. IPL the z/OS systems.

Procedure 4: POR of both servers in a two-server STP-only CTN

The following steps document the suggested procedure to POR both servers in a two-server STP-only CTN.

1. Shut down z/OS systems and deactivate all z/OS and CF LPARs.
2. Unselect the "Only allow the server(s) specified above to be in the CTN" button via the Network Configuration panel. This needs to be done so that the BTS role can be removed and must be performed via the server that is the PTS/CTS.
3. Remove the BTS role because a server with a special role cannot be deactivated.
4. Deactivate the server that had the BTS role. This will allow the PTS/CTS to be POR'ed because it will not have any initialized STP links.
5. Select **Only allow the server(s) specified above to be in the CTN** via the Network Configuration panel. This causes the single-server STP configuration to be saved across the POR.
6. Ensure that the time on the SE is accurate. The SE time will be used to initialize the STP time when the PTS server is activated.
7. Perform the POR of the PTS server. This server must be activated first because it is assigned as the PTS/CTS in the saved STP configuration.
8. Check the server status via the STP status panel to verify that the server timing state is synchronized.
9. Unselect the "Only allow the server(s) specified above to be in the CTN" button via the Network Configuration panel.This will allow the server that had the BTS role to join the CTN.
10. Activate the server that had the BTS role. An Activate is required since the server was Deactivated in Step 4.
11. Verify that there are at least two initialized STP links between the two servers.
12. Assign the BTS role. The IBM recommendation is to always assign a BTS to avoid a single point of failure.
13. Select **Only allow the server(s) specified above to be in the CTN** via the Network Configuration panel.
14. Reactivate all z/OS and CF LPARs.
15. IPL the z/OS systems.

Procedure 5: POR of all servers in a three or more-server STP-only CTN

The following steps document the suggested procedure to POR all servers in a three or more-server STP-only CTN. The steps taken use the “Only allow the server(s) specified above to be in the CTN” button via the Network Configuration panel so that the STP configuration is saved when the last server is POR’ed.

1. Shut down z/OS systems and deactivate all z/OS and CF LPARs.
2. Remove the BTS and Arbiter roles via the Network Configuration panel.
3. Deactivate all servers except the PTS. This will allow the “Only allow the server(s) specified above to be in the CTN" button on the Network Configuration panel to be selected.
4. Select **Only allow the server(s) specified above to be in the CTN** on the Network Configuration panel .This causes the single-server STP configuration to be saved across the POR.
5. Ensure that the time on the SE is accurate. The SE time will be used to initialize the STP time when the PTS server is activated.
6. Perform the POR of the PTS server. This server must be activated first because it is assigned as the PTS/CTS in the saved STP configuration.
7. Check the server status via the STP status panel to verify that the server timing state is synchronized.
8. Unselect the “Only allow the server(s) specified above to be in the CTN” button on the Network Configuration panel. This will allow the other servers to join the CTN.
9. Activate the other servers. An Activate is required because the servers were Deactivated in Step 2.
10. Confirm that the STP link status for each server is initialized and the server has the expected stratum level via the STP status panel. IBM recommends the following best practices for STP connectivity:
    - There are at least two initialized STP links between the two servers.
    - There should be at least two attached servers.
    - If the server will become an STP special role server in Step 11, ensure that the STP links to the other two servers that will have STP special roles are initialized.
    - If the server is a Stratum 2, ensure that it has at least two links to the server that will become the BTS in Step 10.
11. Assign the BTS role and Arbiter roles. The IBM recommendation is to always assign a BTS to avoid a single point of failure and to assign an Arbiter for STP recovery.
12. Reactivate all z/OS and CF LPARs.
13. IPL the z/OS systems.

B

How to draw a CTN topology

As part of the planning process, it is important that a graphic depiction of the Coordinated Timing Network (CTN) topology be drawn up and made available to systems programmers and operations staff who are responsible for Parallel Sysplex time-related tasks.

Having an understanding and image of the CTN topology at the channel path identifier (CHPID) level is useful not only for informational purposes, but also for recovery and last path validation, for example.

This appendix provides general instructions about how to compile the information necessary to draw up a basic diagram for a given CTN topology. We assume that the diagram will be updated periodically because the CTN configuration (what Central Processor Complexes (CPCs) participate in the CTN) and link information (coupling links or timing links) change over time.

Introduction

The process to draw a CTN topology comprises the following steps:

1. Identifying the CPCs that will participate in the CTN.
2. Compiling the CHPID and physical channel identifier (PCHID) information from Hardware Configuration Definition (HCD).
3. Sketching the CTN topology diagram.

The logical flow of this process is described in detail in Figure B-1.

```
Identify CECs
Identify active IODF and enter HCD

FOR each processor
. .FOR each channel subsystem
. . . .FOR each CHPID of interest
. . . . . .Gather PCHID and connectivity information
. . . .ENDFOR
. .ENDFOR
ENDFOR

Sketch CTN diagram
```

Figure B-1 Basic logic flow to draw a CTN topology diagram

Figure B-2 on page 409 shows a completed topology diagram for a sample CTN configuration. This diagram is referenced in the following sections to describe the steps involved in compiling the information necessary to arrive at the final diagram shown.

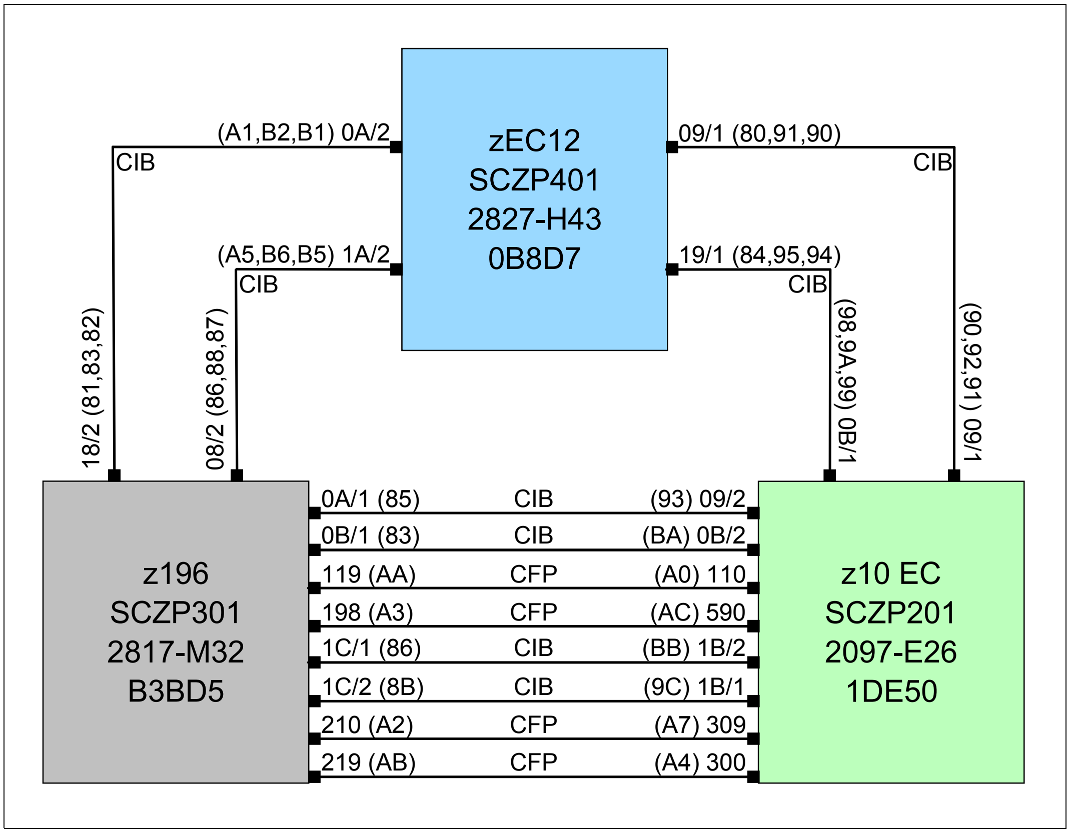


Figure B-2 Sample completed CTN topology diagram

Step 1: Identifying CPCs participating in CTN

As part of the planning process, it is necessary to determine all the CPCs that will participate in the CTN configuration. As shown in Table B-1, there are three CPCs in the sample CTN configuration.

Table B-1 CPC Information for Sample CTN

CEC	Model type
SCZP201	z10 EC
SCZP301	z196
SCZP401	zEC12

Step 2: Identifying an active IODF

Once the participating CPCs have been identified, the next step is to gather the CHPID and PCHID from the HCD. However, the input provided to HCD is an Input/Output Definition File (IODF), and the correct IODF file must be identified prior to entering HCD.

Note: A production IODF defines one or more valid I/O configurations, which can be activated dynamically or selected during IPL. Although you can build multiple production IODFs, only the one that is selected during IPL or activated during dynamic configuration is the *active* production IODF.

z/OS commands

z/OS provides several commands to assist in identifying the IODF that is in effect. Use the DISPLAY IOS,CONFIG command to display IOS-related configuration information.

As shown in Figure B-3, the second line indicates that IODF file SYS6.IODF06 is active on this system. If it is necessary to identify the volume upon which the IODF exists, issue DISPLAY IPLINFO.

```
IOS506I 15.35.17 I/O CONFIG DATA 762
ACTIVE IODF DATA SET = SYS6.IODF06
CONFIGURATION ID = L06RMVS1       EDT ID = 01
TOKEN:  PROCESSOR DATE     TIME     DESCRIPTION
 SOURCE: SCZP401  12-09-05 17:56:49 SYS6     IODF06
ACTIVE CSS:  0    SUBCHANNEL SETS CONFIGURED: 0, 1, 2
CHANNEL MEASUREMENT BLOCK FACILITY IS ACTIVE
```

Figure B-3 z/OS DISPLAY IOS,CONFIG command

As shown in Figure B-4, the next-to-last line indicates that the IODF resides on a device with a unit address of C730. Run the following command:

```
DISPLAY U,,,C730,1
```

```
IEE254I  15.37.54 IPLINFO DISPLAY 765
 SYSTEM IPLED AT 15.24.36 ON 09/16/2012
 RELEASE z/OS 01.13.00    LICENSE = z/OS
 USED LOAD01 IN SYS0.IPLPARM ON 0C730
 ARCHLVL = 2   MTLSHARE = N
 IEASYM LIST = XX
 IEASYS LIST = (00) (OP)
 IODF DEVICE: ORIGINAL(0C730) CURRENT(0C730)
 IPL DEVICE: ORIGINAL(09602) CURRENT(09602) VOLUME(Z1DRE1)
```

Figure B-4 z/OS DISPLAY IPLINFO command

As shown in Figure B-5, and using the information from Figure B-3, it can be determined that IODF file SYS6.IODF06 resides on 3390 DASD with a volume serial of IODFPK.

```
IEE457I 15.40.03 UNIT STATUS 767
UNIT TYPE STATUS       VOLSER    VOLSTATE
C730 3390 A            IODFPK    PRIV/RSDNT
```

Figure B-5 z/OS DISPLAY U,,,C730,1 command

Note: Each CPC can possibly be defined to separate IODFs (for example, this is plausible in a multisite CPC configuration). In that event, it may be necessary to repeat the z/OS commands on each CPC to ensure that the correct IODF information is gathered.

To obtain CPC-related information, issue the DISPLAY M=CPU command on each CEC that will participate in the CTN configuration.

As shown in Figure B-6, note that the CPC ND informational line identifies the processor type (2827), model (H43), and serial number (00000000B8D7).

```
IEE174I 15.42.10 DISPLAY M 769
PROCESSOR STATUS
ID  CPU                 SERIAL
00  +                    01B8D72827
01  +                    01B8D72827
02  +A                   01B8D72827
03  +A                   01B8D72827
04  +I                   01B8D72827
05  +I                   01B8D72827
06  -
07  -

CPC ND = 002827.H43.IBM.02.00000000B8D7
CPC SI = 2827.719.IBM.02.000000000000B8D7
         Model: H43
CPC ID = 00
CPC NAME = SCZP401
LP NAME = A01       LP ID =  1
CSS ID  = 0
MIF ID  = 1
```

Figure B-6 z/OS DISPLAY M=CPU command

Step 3: HCD - Specifying IODF file

In the sample CTN configuration (Table B-1 on page 409), three CPCs are defined. This section describes the sequence of HCD panels to navigate for a single CPC, SCZP301, and for a single CHPID. To obtain the information for the other CPCs, repeat the steps once per CPC (and per IODF, if there is more than one IODF that must be explored).

1. With the IODF file information known, enter HCD, which displays the panel shown in Figure B-7.

```
z/OS V1.13 HCD
Command ===> ____________________________________________________________

                           Hardware Configuration

Select one of the following.

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

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

I/O definition file . . . 'SYS6.IODF06'                    +
```

Figure B-7 HCD: main screen

2. Specify the IODF file name in the I/O definition file field (as shown in Figure B-3 on page 410, this is `SYS6.IODF06`).

3. Select option 1 to define, view, or modify configuration data and press Enter to display another selection panel (Figure B-8).

```
z/OS V1.13 HCD
+------------- Define, Modify, or View Configuration Data --------------+
|                                                                       |
|     Select type of objects to define, modify, or view data.           |
|                                                                       |
|      3_ 1. Operating system configurations                            |
|                consoles                                               |
|                system-defined generics                                |
|                EDTs                                                   |
|                  esoterics                                            |
|                  user-modified generics                               |
|         2. Switches                                                   |
|                ports                                                  |
|                switch configurations                                  |
|                  port matrix                                          |
|         3. Processors                                                 |
|                channel subsystems                                     |
|                  partitions                                           |
|                  channel paths                                        |
|         4. Control units                                              |
|         5. I/O devices                                                |
|         6. Discovered new and changed control units and I/O devices   |
|                                                                       |
+-----------------------------------------------------------------------+
```

Figure B-8 HCD - Define, modify, or view configuration data

Step 4: Selecting a processor

To do this task, take these steps:

1. As shown in Figure B-8, select 3 for Processors and press Enter to display the Processor List screen (Figure B-9).

```
 Goto  Filter  Backup  Query  Help
------------------------------------------------------------------------------
                                Processor List       Row 1 of 6 More:       >
Command ===> _______________________________________________ Scroll ===> PAGE

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


/ Proc. ID Type +   Model +  Mode+ Serial-# + Description
_ ISGSYN   2064     1C7      LPAR  __________ ________________________________
_ ISGS11   2064     1C7      LPAR  __________ ________________________________
_ SCZP101  2094     S18      LPAR  02991E2094 Danu
_ SCZP201  2097     E26      LPAR  01DE502097 Eclipse
/ SCZP301  2817     M32      LPAR  0B3BD52817 Gryphon
_ SCZP401  2827     H43      LPAR  00B8D72827 Helix
******************************* Bottom of data ********************************
```

Figure B-9 HCD - Processor List view

2. As shown in Figure B-9 on page 414, type a slash (/) next to the SCZP301 processor and press Enter to display a panel that allows actions to be performed against a processor's configuration data.

Note: As shown in Figure B-10, HCD provides shortcut action codes (for example, a, r, c, and i) for experienced users. For the purposes of this appendix, the *long way* of selecting actions by number is used throughout this example.

```
 Goto  Filter  Backup  Query  Help
------------- +-------------- Actions on selected processors ---------------+
              |                                                             |
Command ===>  |                                                             |
              | Select by number or action code and press Enter.            |
Select one or |                                                             |
              | 9_  1.  Add like . . . . . . . . . . . . . . . . (a)        |
              |     2.  Repeat (Copy) processor configurations (r)          |
/ Proc. ID Ty |     3.  Change . . . . . . . . . . . . . . . . . (c)        |
_ ISGSYN   20 |     4.  *Prime serial number . . . . . . . . . . (i)        |
_ ISGS11   20 |     5.  Delete . . . . . . . . . . . . . . . . . (d)        |
_ SCZP101  20 |     6.  View processor definition  . . . . . . . (v)        |
_ SCZP201  20 |     7.  View related CTC connections . . . . . . (k)        |
/ SCZP301  28 |     8.  Work with partitions . . . . . . . (SMP) (p)        |
_ SCZP401  28 |     9.  Work with attached channel paths (SMP) (s)          |
************* |     10. Work with attached devices . . . (SMP) (u)          |
              |     11. Copy to channel subsystem  . . . (SMP) (y)          |
              |     12. Work with channel subsystems . . (XMP) (p,s)        |
              |                                                             |
              | * = requires TSA I/O Operations                             |
              |                                                             |
              |                                                             |
              +-------------------------------------------------------------+
```

Figure B-10 HCD - Actions on selected processors

Step 5: Selecting a channel subsystem

To do this task, take these steps:

1. As shown in Figure B-10 on page 415, select 9 to work with the currently attached channel paths and press Enter. A list of channel subsystems displays.
2. As shown in Figure B-11, type a slash (/) next to CSS 0 and press Enter to display a screen that allows actions to be performed against the selected channel subsystem.

```
 Goto  Backup  Query  Help
------------------------------------------------------------------------------
                            Channel Subsystem List    Row 1 of 4 More:       >
Command ===> _______________________________________________ Scroll ===> PAGE

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

Processor ID . . . : SCZP301      Gryphon

  CSS Devices in SS0    Devices in SS1    Devices in SS2
/ ID  Maximum + Actual  Maximum + Actual  Maximum + Actual
/ 0   65280     8253    65535     13031   65535     0
_ 1   65280     8573    65535     13031   65535     0
_ 2   65280     7950    65535     11559   65535     0
_ 3   65280     7907    65535     13031   65535     0
******************************* Bottom of data ********************************
```

Figure B-11 HCD - Channel Subsystem List

Note: This step may need to be repeated once for each channel subsystem (CSS) in the list (Figure B-11 on page 416) to ensure that all CHPID/PCHID has been gathered properly.

```
 Goto  Backup  Query  Help
------------- +---------- Actions on selected channel subsystems -----------+
              |                                                             |
Command ===>  |                                                             |
              | Select by number or action code and press Enter.            |
Select one or |                                                             |
              | 7_  1.  Add like . . . . . . . . . . . . . . . . (a)        |
Processor ID  |     2.  Repeat (Copy) channel subsystem  . . . (r)         |
              |     3.  Copy to processor  . . . . . . . . . . (y)         |
  CSS Devices |     4.  Change . . . . . . . . . . . . . . . . . (c)        |
/ ID  Maximum |     5.  Delete . . . . . . . . . . . . . . . . . (d)        |
/ 0   65280   |     6.  Work with partitions . . . . . . . . . . (p)        |
_ 1   65280   |     7.  Work with attached channel paths . . . (s)         |
_ 2   65280   |     8.  Work with attached devices . . . . . . (u)         |
_ 3   65280   |                                                             |
************* |                                                             |
              |                                                             |
              |                                                             |
              +-------------------------------------------------------------+
```

Figure B-12 HCD - Actions on selected Channel Subsystem (CSS)

Step 6: Displaying the master list of CHPIDs

To display the master list of CHPIDs (Figure B-12 on page 417), select 7 to work with the channel paths attached in CSS 0 and press Enter. A list of channel path IDs (CHPIDs) displays (Figure B-13).

```
 Goto  Filter  Backup  Query  Help
------------------------------------------------------------------------------
                              Channel Path List     Filter Mode. More:       >
Command ===> ______________________________________________ Scroll ===> PAGE

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

Processor ID . . . . : SCZP301      Gryphon
Configuration mode . : LPAR
Channel Subsystem ID : 0

        PCHID             Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
/ A2    210   CFP   SHR   __  __ __   Y   No  ISC-3 TESTPLEX to P201
_ A3    198   CFP   SHR   __  __ __   Y   No  ISC-3 TESTPLEX to P201
_ 83    18/2  CIB   SHR   __  __ __   Y   No  12x-3 TESTPLEX to P401
_ 88    08/2  CIB   SHR   __  __ __   Y   No  12x-3 TESTPLEX to P401
_ 8B    1C/2  CIB   SHR   __  __ __   Y   No  12x (parked) to P201
_ 90    08/1  CIB   SHR   __  __ __   Y   No  12x-3 Trainer loop
****************************** Bottom of data *******************************
```

Figure B-13 HCD: Channel path ID (CHPID) List

> **Note:** It is possible to filter the CHPIDs that are displayed using the Filter menu, in the action bar, or using the **FILTER** command in the command line.

In this list it you can gather the CHPIDs, together with their PCHIDs (or HCA ID and Port for Infiniband) and Types. If you require more details, for example gather the LPARs that are in the access list of CHPID A2, do the following:

1. As shown in Figure B-13, type a slash (/) next to CHPID A2 and press Enter to display a panel that allows actions to be performed against the selected CHPID.
2. As shown in Figure B-14, select 7 to view the CHPID definition for CHPID A2 and press Enter. The definition for CHPID A2 displays.

```
 Goto  Filter  Backup  Query  Help
------------- +------------- Actions on selected channel paths -------------+
              |                                                             |
Command ===>  |                                                             |
              | Select by number or action code and press Enter.            |
Select one or |                                                             |
              | 7_  1.  Add like . . . . . . . . . . . . . . . (a)          |
Processor ID  |     2.  Change . . . . . . . . . . . . . . . . (c)          |
Configuration |     3.  Connect CF channel paths . . . . . . . (f)          |
Channel Subsy |     4.  Aggregate channel paths  . . . . . . . (g)          |
              |     5.  Delete . . . . . . . . . . . . . . . . (d)          |
        PCHID |     6.  Work with attached control units . . (s)            |
/ CHPID AID/P |     7.  View channel path definition . . . . (v)            |
/ A2    210   |     8.  View connected switches  . . . . . . (w)            |
_ A3    198   |     9.  View related CTC connections . . . . (k)            |
************* |     10. *View graphically  . . . . . . . . . (h)            |
              |     11. View unused resources  . . . . . . . (u)            |
              |                                                             |
              | * = requires GDDM                                           |
              |                                                             |
              +-------------------------------------------------------------+
```

Figure B-14 HCD - Actions on selected CHPIDs, view CHPID A2 definition

3. As shown in Figure B-15, further details are displayed for CHPID A2, to see LPARs in the access list press Enter.

```
 Goto  Filter  Backup  Query  Help
- +-------------------- View Channel Path Definition ---------------------+
  |                                                                       |
C |                                                                       |
  | Processor ID . . . . : SCZP301      Gryphon                           |
S | Configuration mode . : LPAR                                           |
  | Channel Subsystem ID : 0                                              |
P |                                                                       |
C | Channel path ID  . . . . : A2   PCHID  . . . . . : 210                |
C | Channel path type  . . . : CFP                                        |
  | Operation mode . . . . . : SHR                                        |
  | Managed  . . . . . . . . : No   I/O Cluster  . . :                    |
/ |                                                                       |
/ | Description  . . . . . . : ISC-3 TESTPLEX to P201                     |
_ |                                                                       |
* | Dynamic entry switch ID  :                                            |
  | Entry switch ID  . . . . :                                            |
  | Entry port . . . . . . . :                                            |
  |                                                                       |
  | ENTER to continue.                                                    |
  |                                                                       |
  +-----------------------------------------------------------------------+
```

Figure B-15 HCD - View CHPID definition of CHPID A2 to obtain details

4. The View Access List panel opens and displays the LPARs in the access list, as seen in Figure B-16.

```
 Goto  Filter  Backup  Query  Help
- +--------------------------- View Access List ----------------------------+
  |                                                             Row 1 of 2 |
C | Command ===> _______________________________________ Scroll ===> PAGE  |
  |                                                                         |
S | The following partitions are in the access list.                       |
  |                                                                         |
P | Channel Subsystem ID : 0                                                |
C | Channel path ID  . . : A2     Channel path type . . : CFP               |
C | Operation mode . . . : SHR                                              |
  |                                                                         |
  | ENTER to continue.                                                      |
/ |                                                                         |
/ | CSS ID Partition Name    Number Usage Description                       |
_ | 0      A0D               D      CF    TESTPLEX CF7A                     |
* | 0      A05               5      OS    TESTPLEX SC74                     |
  | *************************** Bottom of data **************************** |
  |                                                                         |
  +-------------------------------------------------------------------------+
```

Figure B-16 HCD - View LPARs in the access list

Step 7: Viewing CF CHPID connectivity information

To do this task, use these steps:

1. As shown in Figure B-17, type a slash (/) next to any CHPID and press Enter to display a panel that allows actions to be performed.

```
 Goto  Filter  Backup  Query  Help
------------------------------------------------------------------------------
                              Channel Path List     Filter Mode. More:       >
Command ===> _______________________________________________ Scroll ===> PAGE

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

Processor ID . . . . : SCZP301      Gryphon
Configuration mode . : LPAR
Channel Subsystem ID : 0

        PCHID            Dyn Entry +
/ CHPID AID/P Type+ Mode+ Sw+ Sw Port Con Mng Description
/ A2    210   CFP   SHR   __  __ __    Y   No  ISC-3 TESTPLEX to P201
_ A3    198   CFP   SHR   __  __ __    Y   No  ISC-3 TESTPLEX to P201
_ 83    18/2  CIB   SHR   __  __ __    Y   No  12x-3 TESTPLEX to P401
_ 88    08/2  CIB   SHR   __  __ __    Y   No  12x-3 TESTPLEX to P401
_ 8B    1C/2  CIB   SHR   __  __ __    Y   No  12x (parked) to P201
_ 90    08/1  CIB   SHR   __  __ __    Y   No  12x-3 Trainer loop
******************************* Bottom of data ********************************
```

Figure B-17 HCD - CHPID List screen

2. As shown in Figure B-18, select 3 to view a screen that displays a list of coupling facility (CF) CHPID connections and press Enter. The CF connectivity list displays.

```
 Goto  Filter  Backup  Query  Help
------------- +------------- Actions on selected channel paths -------------+
              |                                                             |
Command ===>  |                                                             |
              | Select by number or action code and press Enter.            |
Select one or |                                                             |
              | 3_  1.  Add like . . . . . . . . . . . . . . . (a)          |
Processor ID  |     2.  Change . . . . . . . . . . . . . . . . (c)          |
Configuration |     3.  Connect CF channel paths . . . . . . . (f)          |
Channel Subsy |     4.  Aggregate channel paths  . . . . . . . (g)          |
              |     5.  Delete . . . . . . . . . . . . . . . . (d)          |
        PCHID |     6.  Work with attached control units . . (s)            |
/ CHPID AID/P |     7.  View channel path definition . . . . (v)            |
/ A2    210   |     8.  View connected switches  . . . . . . (w)            |
_ A3    198   |     9.  View related CTC connections . . . . (k)            |
************* |     10. *View graphically  . . . . . . . . . (h)            |
              |     11. View unused resources  . . . . . . . (u)            |
              |                                                             |
              | * = requires GDDM                                           |
              |                                                             |
              +-------------------------------------------------------------+
```

Figure B-18 HCD - Actions on selected CHPIDs - Connect CF path option

3. As shown in Figure B-19, it can be determined that CHPID A2 of CPC SCZP301 connects to CHPID A7 of CPC SCZP201 (CSS 2).

   The PCHID that corresponds to CHPID A7 of CPC SCZP201 can be gathered later (Figure B-13 on page 417) when the configuration for SCZP201 is explored.

```
 Goto  Filter  Backup  Query  Help
--------------------------------------------------------------------------
                    CF Channel Path Connectivity List            Row 1 of 18
Command ===> ___________________________________________ Scroll ===> PAGE

Select one or more channel paths, then press Enter.

Source processor ID . . . . . : SCZP301   Gryphon
Source channel subsystem ID . : 0
Source partition name . . . . : *

  --------Source--------   ---------Destination---------   -CU-  -#-
/ CHPID CF Type Mode Occ   Proc.CSSID CHPID CF Type Mode   Type  Dev
_ 83    Y  CIB  SHR  N     SCZP401.0  B2    Y  CIB  SHR    CFP   7
_ 88    Y  CIB  SHR  N     SCZP401.0  B6    Y  CIB  SHR    CFP   7
_ 8B    N  CIB  SHR  N     SCZP201.0  9C    Y  CIB  SHR    CFP   7
_ 90    N  CIB  SHR  N     SCZP301.1  94    Y  CIB  SHR    CFP   7
_ A2    Y  CFP  SHR  N     SCZP201.2  A7    Y  CFP  SHR    CFP   7
_ A3    Y  CFP  SHR  N     SCZP201.2  AC    Y  CFP  SHR    CFP   7
_ C0    Y  ICP  SHR  N     SCZP301.0  C1    Y  ICP  SHR    CFP   7
_ C1    Y  ICP  SHR  N     SCZP301.0  C0    Y  ICP  SHR    CFP   7
_ C2    Y  ICP  SHR  N     SCZP301.0  C3    Y  ICP  SHR    CFP   7
_ C3    Y  ICP  SHR  N     SCZP301.0  C2    Y  ICP  SHR    CFP   7
_ C4    N  ICP  SHR  N     SCZP301.0  C5    Y  ICP  SHR    CFP   7
_ C5    Y  ICP  SHR  N     SCZP301.0  C4    N  ICP  SHR    CFP   7
_ C6    N  ICP  SHR  N     SCZP301.0  C7    Y  ICP  SHR    CFP   7
_ C7    Y  ICP  SHR  N     SCZP301.0  C6    N  ICP  SHR    CFP   7
_ C8    Y  ICP  SPAN N     SCZP301.0  CA    Y  ICP  SPAN   CFP   7
_ C9    Y  ICP  SPAN N     SCZP301.0  CB    Y  ICP  SPAN   CFP   7
_ CA    Y  ICP  SPAN N     SCZP301.0  C8    Y  ICP  SPAN   CFP   7
_ CB    Y  ICP  SPAN N     SCZP301.0  C9    Y  ICP  SPAN   CFP   7
******************************* Bottom of data ******************************
```

Figure B-19 HCD - View CF CHPID Connectivity List

4. Use the screen inFigure B-19 to identify CHPIDs of interest, by looking at which CPCs they connect to (remember we are interested in the CPCs listed in Table B-1 on page 409). Gather their connectivity information, their PCHID, and any other details you may want, as described in “Step 6: Displaying the master list of CHPIDs” on page 417. In our case we are interested in the CHPIDs 83, 88, 8B, A2 and A3. All the other CHPIDs are either virtual paths (ICP) or are connected to SCZP301 itself.

5. When all CHPID information within this particular channel subsystem has been gathered (in this example, SCZP301 CSS ID 0), return to “Step 5: Selecting a channel subsystem” on page 416, to examine the next channel subsystem of interest and repeat all steps through “Step 7: Viewing CF CHPID connectivity information” on page 420. For example, one might next explore CSS ID 1.

6. After exploring all channel subsystems defined within this particular processor, return to “Step 4: Selecting a processor” on page 414 and select another processor of interest. As shown in Table B-1 on page 409, the next processor of interest might be SCZP401.

Repeat all steps between this step and “Step 7: Viewing CF CHPID connectivity information” on page 420 as before.

Upon completion of this compilation process, all information necessary to draw the CTN diagram shown in Figure B-2 on page 409 should have been obtained, as shown in Table B-2. If not, repeat “Step 4: Selecting a processor” on page 414 through Step 8, “Step 7: Viewing CF CHPID connectivity information” on page 420, as necessary, or see the logic flow diagram in Figure B-1 on page 408.

Table B-2 CHPID mapping

Source				**Destination**			
Proc.CSSID	**PCHID**	**CHPID**	**Type**	**Proc.CSSID**	**PCHID**	**CHPID**	**Type**
SCZP401.0	09/1	80	CIB	SCZP201.0	09/1	90	CIB
SCZP401.0	09/1	91	CIB	SCZP201.2	09/1	92	CIB
SCZP401.1	09/1	90	CIB	SCZP201.0	09/1	91	CIB
SCZP401.0	0A/2	A1	CIB	SCZP301.3	18/2	81	CIB
SCZP401.0	0A/2	B2	CIB	SCZP301.0	18/2	83	CIB
SCZP401.1	0A/2	B1	CIB	SCZP301.2	18/2	82	CIB
SCZP401.0	19/1	84	CIB	SCZP201.0	0B/1	98	CIB
SCZP401.0	19/1	95	CIB	SCZP201.2	0B/1	9A	CIB
SCZP401.1	19/1	94	CIB	SCZP201.0	0B/1	99	CIB
SCZP401.0	1A/2	A5	CIB	SCZP301.3	08/2	86	CIB
SCZP401.0	1A/2	B6	CIB	SCZP301.0	08/2	88	CIB
SCZP401.1	1A/2	B5	CIB	SCZP301.2	08/2	87	CIB
SCZP301.2	0A/1	85	CIB	SCZP201.0	09/2	93	CIB
SCZP301.2	0B/1	83	CIB	SCZP201.0	0B/2	BA	CIB
SCZP301.3	119	AA	CFP	SCZP201.0	110	A0	CFP
SCZP301.0	198	A3	CFP	SCZP201.2	590	AC	CFP
SCZP301.2	1C/1	86	CIB	SCZP201.0	1B/2	BB	CIB
SCZP301.0	1C/2	8B	CIB	SCZP201.0	1B/1	9C	CIB
SCZP301.0	210	A2	CFP	SCZP201.2	309	A7	CFP
SCZP301.3	219	AB	CFP	SCZP201.0	300	A4	CFP

Sketching the diagram

Use any graphics tool, such as Microsoft Visio, to draw the final CTN diagram using the CHPID/PCHID connectivity information gathered. Figure B-2 on page 409 shows an example of a final CTN diagram.

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks publications

For information about ordering these publications, see “How to get Redbooks publications” on page 427. Note that certain documents referenced here may be available in softcopy only.

- *Server Time Protocol Implementation Guide*, SG24-7281
- *Server Time Protocol Recovery Guide*, SG25-7380
- *IBM zEnterprise EC12 Technical Guide*, SG24-8049
- *IBM zEnterprise EC12 Technical Introduction*, SG24-8050
- *IBM zEnterprise 196 Configuration Setup*, SG24-7834
- *IBM zEnterprise EC12 Configuration Setup*, SG24-8034
- *IBM zEnterprise 196 Technical Guide*, SG24-7833
- *IBM System z9 Enterprise Class Technical Guide*, SG24-7124
- *Getting Started with InfiniBand on System z10 and System z9,* SG24-7539
- *IBM System z9 Business Class Technical Introduction*, SG24-7241
- *IBM System z10 Enterprise Class Configuration Setup,* SG24-7571
- *IBM System z10 Enterprise Class Technical Guide,* SG24-7516
- *IBM System z10 Enterprise Class Technical Introduction,* SG24-7515
- *IBM System z10 Business Class Technical Overview,* SG24-7632
- *IBM System z Connectivity Handbook*, SG24-5444
- *S/390 Time Management and IBM 9037 Sysplex Timer*, SG24-2070

Other publications

These publications are also relevant as further information sources:

- *z/Architecture Principles of Operation*, SA22-7832
- *zEnterprise EC12 Installation Manual for Physical Planning*, GC28-6914
- *zEnterprise 196 Installation Manual for Physical Planning*, GC28-6897
- *zEnterprise 114 Installation Manual for Physical Planning*, GC28-6907
- *IBM System z10 Business Class Installation Manual for Physical Planning,* GC28-6875
- *System z10 Enterprise Class Installation Manual for Physical Planning,* GC28-6864
- *System z10 Processor Resource/Systems Manager Planning Guide,* SB10-7153
- *IBM System z10 Enterprise Class System Overview,* SA22-1084
- *IBM System z10 Business Class System Overview,* SA22-1085

- *IBM System z10 Enterprise Class Service Guide,* GC28-6866
- *System z9 Enterprise Class System Overview*, SA22-6833
- *System z9 Business Class System Overview*, SA22-1083
- *System z9 EC Installation Manual for Physical Planning*, GC28-6844
- *System z9 BC Installation Manual for Physical Planning*, GC28-6855
- *System z9 Processor Resource/Systems Manager Planning Guide,* SB10-7041
- *System z9 Support Element Operations Guide Version 2.9.1,* SC28-6858
- *zSeries 990 Installation Manual for Physical Planning*, GC28-6824
- *zSeries 890 Installation Manual for Physical Planning*, GC28-6828
- *zSeries 890 and 990 Processor Resource/Systems Manager Planning Guide*, SB10-7036
- *z890 and z990 Support Element Operations Guide Version 1.8.2,* SC28-6831
- *Hardware Management Console Operations Guide Version 2.12.0*, SC28-6919
- *zEnterprise System Support Element Operations Guide Version 2.12.0*, SC28-6920
- *System z CHPID Mapping Tool User's Guide*, GC28-6900
- *Hardware Management Console Operations Guide Version 2.10.1,* SC28-6873
- *Hardware Management Console Operations Guide Version 2.10.0,* SC28-6867
- *Support Element Operations Guide V2.10.1,* SC28-6879
- *Support Element Operations Guide V2.10.0,* SC28-6868
- *Planning for the 9037 Model 2*, SA22-7233
- *Model 5900 and 4900 ESCON Server Installation and User's Guide*, GA22-1082
- *z/OS MVS Setting Up a Sysplex*, SA22-7625
- *IOCP User's Guide,* SB10-7037
- *Stand-Alone Input/Output Configuration Program User's Guide,* SB10-7152
- *Planning for Fiber Optic Links,* GA23-0367
- *Common Information Model (CIM) Management Interfaces,* SB10-7154

Online resources

These websites and URLs are also relevant as further information sources:

- IBM Resource Link

  http://www.ibm.com/servers/resourcelink/

- Server Time protocol web page

  http://www-03.ibm.com/servers/eserver/zseries/pso/stp.html

- GDPS

  http://www.ibm.com/systems/z/gdps/

How to get Redbooks publications

You can search for, view, or download Redbooks publications, Redpapers publications, Technotes, draft publications and Additional materials, as well as order hardcopy Redbooks publications, at this website:

ibm.com/redbooks

Help from IBM

IBM Support and downloads

ibm.com/support

IBM Global Services

ibm.com/services

Index

T

U

X

Z

IBM

Redbooks

Server Time Protocol Implementation Guide

Server Time Protocol Implementation Guide

Coordinated Timing Network configuration

Administration and operations tasks

How to implement Server Time Protocol examples

Server Time Protocol (STP) is a server-wide facility that is implemented in the Licensed Internal Code (LIC) of IBM zEnterprise EC12 (zEC12), IBM zEnterprise 196 (z196), IBM zEnterprise 114 (z114), IBM System z10, and IBM System z9. It provides improved time synchronization in both a sysplex or non-sysplex configuration.

This IBM Redbooks publication will help you configure a Mixed or STP-only Coordinated Timing Network. It is intended for technical support personnel requiring information about:

- Installing and configuring a Coordinated Timing Network
- Using STP functions and operations
- Migrating to a Coordinated Timing Network from various timing environments

Readers are expected to be familiar with IBM System z technology and terminology. For planning, see our companion book, *Server Time Protocol Planning Guide,* SG24-7280. For information about how to recover your STP environment functionality, see *Server Time Protocol Recovery Guide*, SG24-7380.

INTERNATIONAL TECHNICAL SUPPORT ORGANIZATION

BUILDING TECHNICAL INFORMATION BASED ON PRACTICAL EXPERIENCE

IBM Redbooks are developed by the IBM International Technical Support Organization. Experts from IBM, Customers and Partners from around the world create timely technical information based on realistic scenarios. Specific recommendations are provided to help you implement IT solutions more effectively in your environment.

For more information:
ibm.com/redbooks

SG24-7281-03 ISBN 0738438111