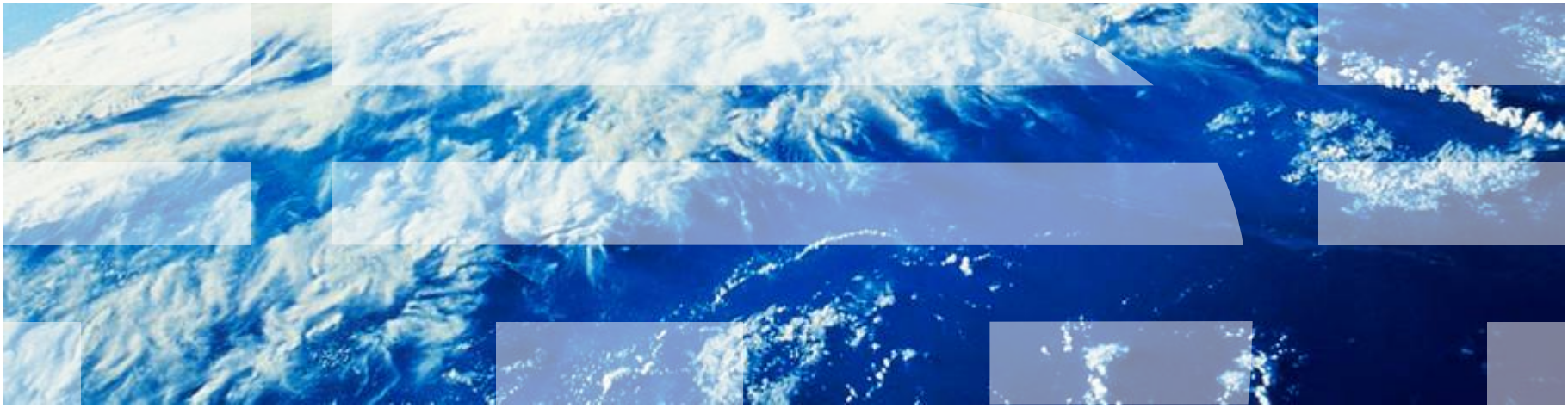
Server Time Protocol Implementation Considerations for Single CPC configurations



Michael Großmann

STG Lab Services - Global Client Center, IBM Germany R&D

Senior IT Specialist - System z

Disclaimer

- In this presentation the author has put together some information, when single CPC configurations implement STP
- This presentation is a for single CPC configurations
- Additional Reading – Server Time Protocol Overview Presentation
  - **ibm.com**/support/techdocs/atsmastr.nsf/WebIndex/PRS2398
- Additional Reading – Server Time Protocol Implementation Considerations
  - **ibm.com**/support/techdocs/atsmastr.nsf/WebIndex/PRS3845

Agenda

- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID
  - Initialize the time
  - Assign CTN Roles
- Additional Information

STP Overview

- Designed to provide the capability for multiple servers to maintain time synchronization with each other and form a Coordinated Timing Network (CTN)
  - CTN: a collection of servers that are time synchronized to a time value called Coordinated Server Time (CST)

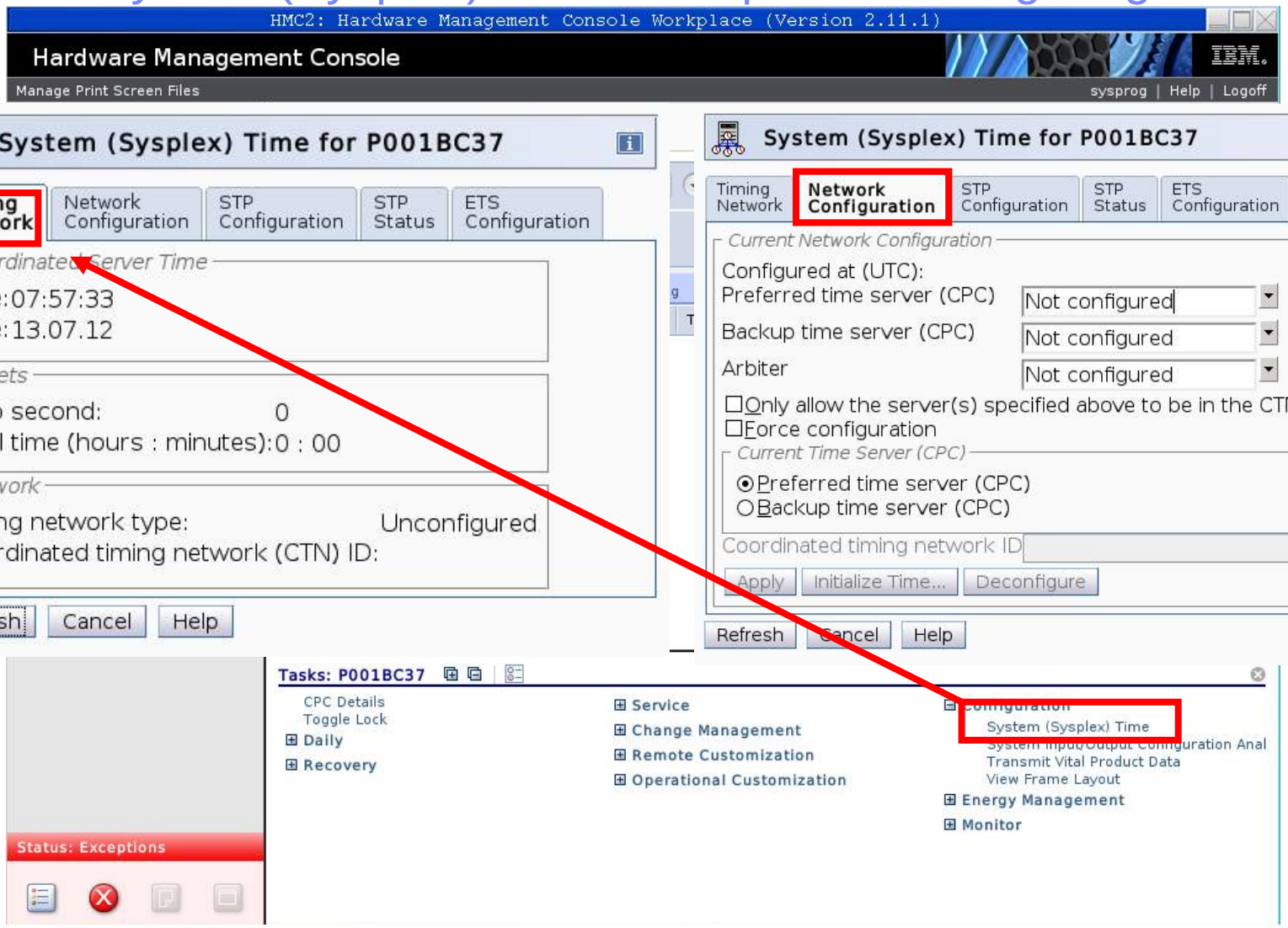
- IBM Server-wide facility implemented in IBM® zEnterprise™ EC12 (zEC12), IBM® zEnterprise™ 196 (z196), IBM® zEnterprise™ 114 (z114), IBM System z10™, IBM System z9™, IBM eServer™ zSeries® 990 (z990), zSeries 890 (z890) Licensed Internal Code (LIC)
  - Single view of “time” to PR/SM™
  - PR/SM can virtualize this view of time to the individual logical partitions (LPARs)

- Message based time synchronization protocol
  - Similar to Network Time Protocol (NTP) – an industry standard
  - Timekeeping information transmitted over Coupling Links supported by machine type.
    - ISC-3 links (Peer mode), ICB-3, ICB-4 and PSIFB links
  - NOT standard NTP

Agenda

- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID
  - Initialize the time
  - Assign CTN Roles
- Additional Information

HMC – System (Sysplex) Time Task prior to configuring STP



Agenda

- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID
  - Initialize the time
  - Assign CTN Roles
- Additional Information

External Time Source Options

- Dial-out from HMC to time services (available on z196, z114, z10, z9, z990, z890)
  - NIST Automated Computer Time Service (ACTS)
  - NRC Canadian Time Service (CTS)
  - IEN Telephone Date Code (CTD)
  - Scheduling of periodic dial-outs to time services so that CST can be gradually steered to time provided by dial-out time service
  - Time accuracy +/- 100 ms of time provided by dial-out time service
  - Modem support not available on the zEC12 (Driver 12 HMC)

- NTP server (available on zEC12, z196, z114, z10 and z9)
  - Addresses the requirements of customers who want time accuracy across heterogeneous platforms (System z and non-System z)
  - Time accuracy +/- 100 ms of time provided by NTP server

- NTP server with Pulse per second (PPS) output (available on zEC12, z196, z114, z10 and z9)
  - Pulse per second (PPS) provides enhanced accuracy
    - ✓ 10 microseconds vs 100 milliseconds

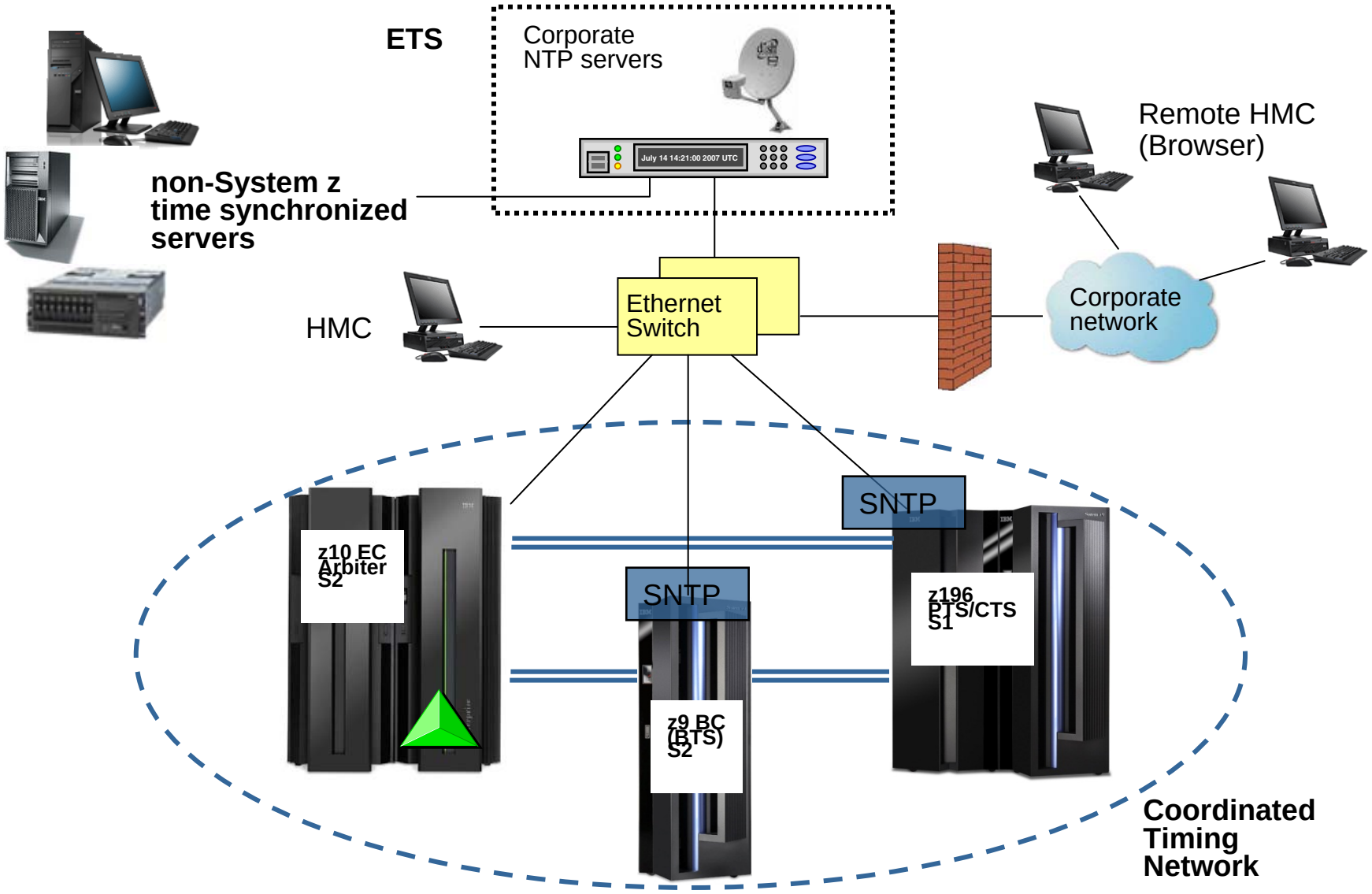
Network Time Protocol (NTP) client support

- **Purpose of this function is to allow the same accurate time across an enterprise comprised of heterogeneous platforms**
- Simple Network Time Protocol (SNTP) client support added to Support Element (SE) code of zEC12, z196, z114, z10 and z9 servers/CFs to enable interfacing with Network Time Protocol (NTP) servers
- NTP server becomes the single time source (External Time Source (ETS)) for STP, as well as other non-System z servers (UNIX®, Windows NT®, other) that have NTP clients
- Time reference for NTP server can be GPS, dial-out, DCF-77 etc.
- Accuracy is within +/- 100 ms of the time provided by an NTP Server
  - Actual time accuracy, relative to UTC, is dependent on how accurate the NTP server time is with respect to UTC.
- Only the Current Time Server (CTS) steers the time based on:
  - Timing information sent by Support Element (SE) code

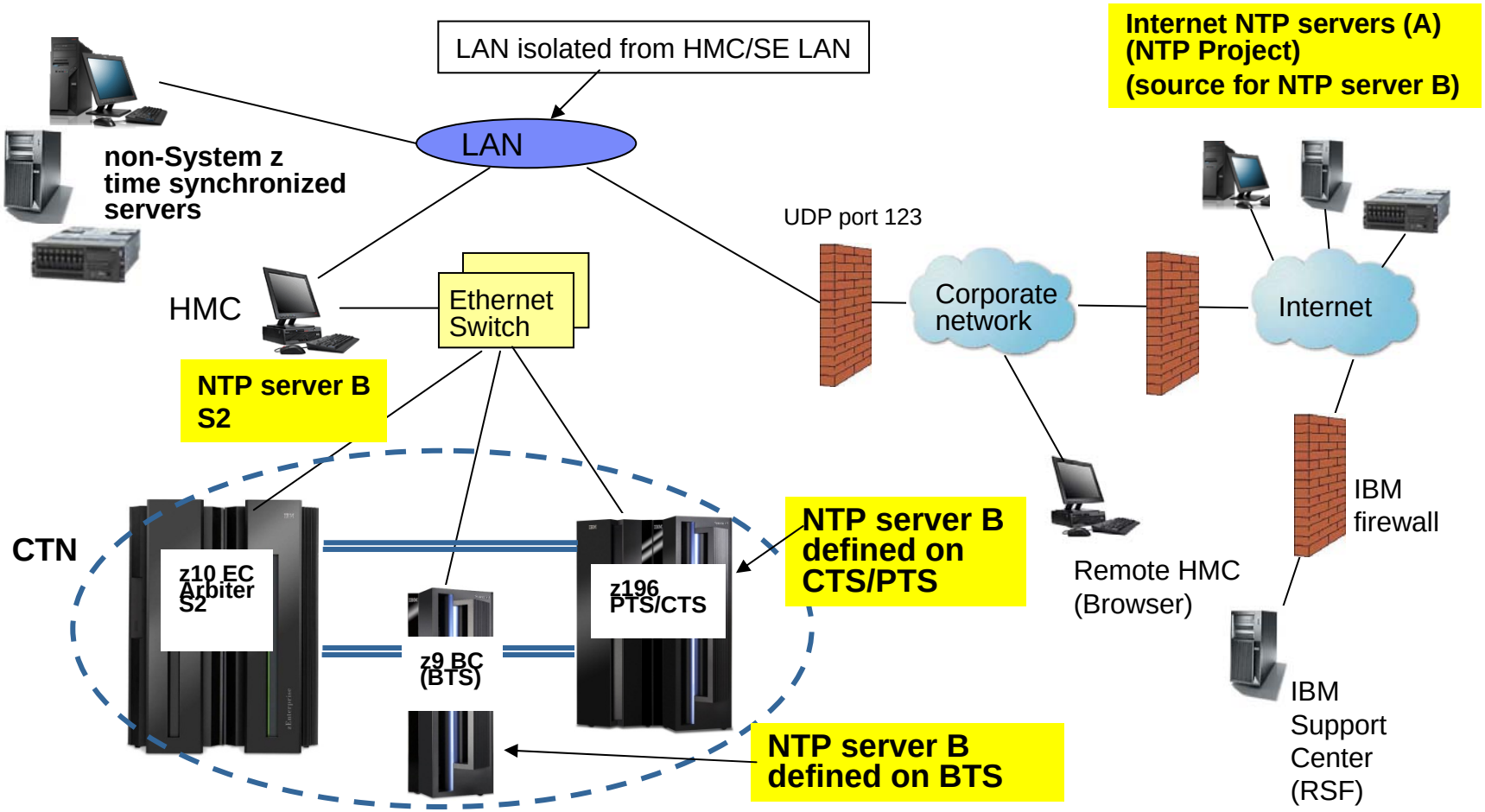
NTP Server Planning

- NTP/SNTP server can be :
  - An external device available from several vendors
  - NTP server on the HMC
  - A local workstation (example, UNIX, Linux, Windows) running the NTP/SNTP server code
    - HMC or workstation may use an internet NTP server for its time source
- NTP server should be directly connected to the SE LAN
  - SE LAN considered to be a private dedicated LAN
    - Isolated from the corporate and public networks
- NTP server on HMC addresses security concerns
  - Provides LAN isolation for SE NTP Client
  - The HMC has two LAN ports, physically isolated:
    - HMC/SE LAN used by NTP client code
    - Second LAN used by HMC to access an NTP time server to set its time

LAN Example 1 (NTP server available from vendors)



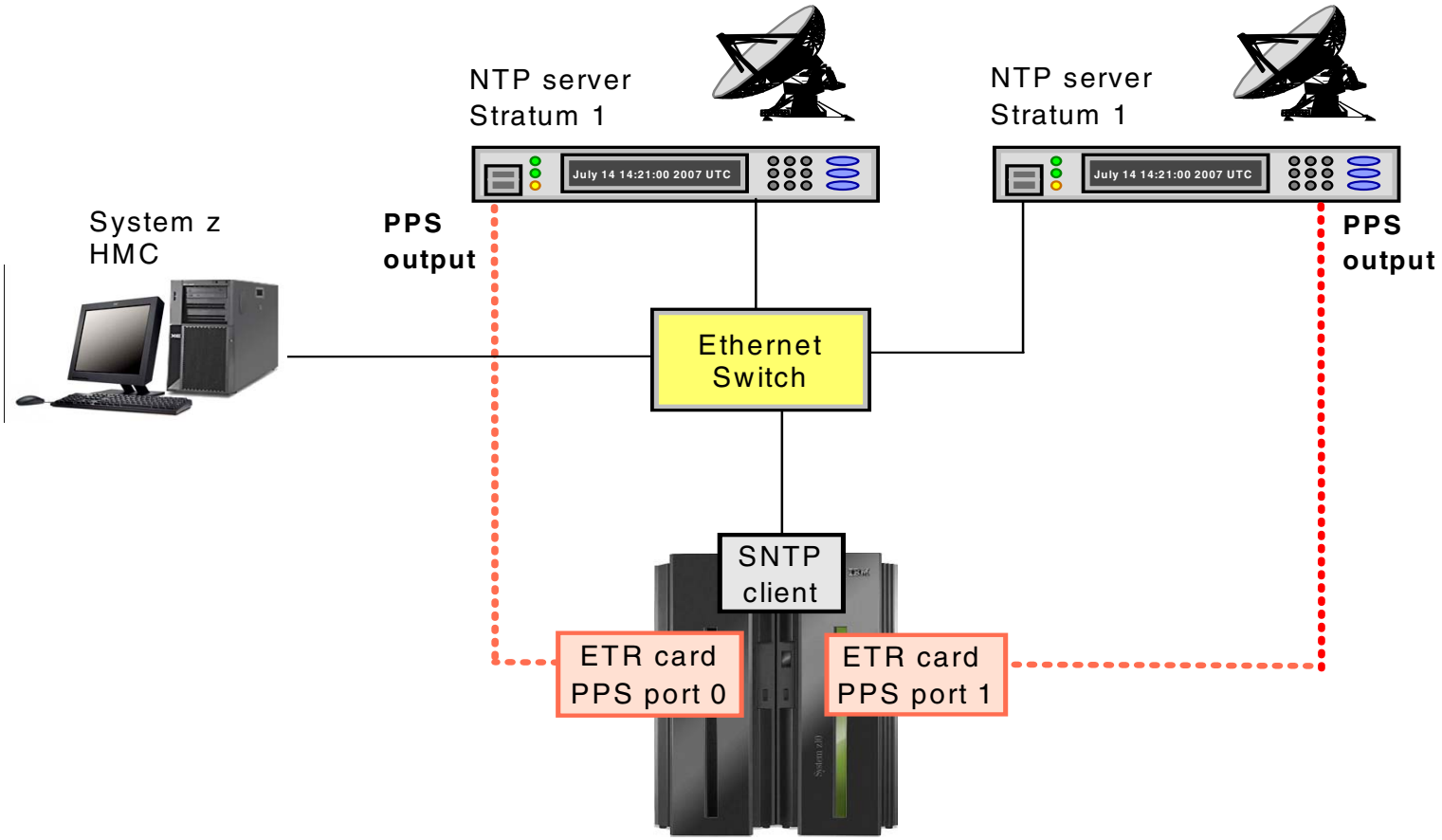
NTP Server as ETS (example 2 – HMC)



Enhanced Accuracy to an External Time Source (ETS)

- Some NTP servers also provide a highly stable, accurate “Pulse per second” (PPS) output
  - ETR card of z10 EC, z10 BC, z9 EC and z9 BC has additional PPS input
  - PPS capability exists on the zEC12, z196 or z114 on the FSP/STP card
  - Each System z has 2 ETR or FSP/STP cards providing capability of attaching to two NTP Servers with PPS output for redundancy
- STP utilizes the PPS signal to provide additional accuracy
  - Accuracy to PPS – 10 microseconds
- Only the Current Time Server (CTS) steers the time based on:
  - Timing information sent by Support Element (SE) code
  - PPS signal received by PPS port on ETR card

Enhanced Accuracy to an External Time Source (ETS) - ETS redundancy on same server (PTS/CTS) example

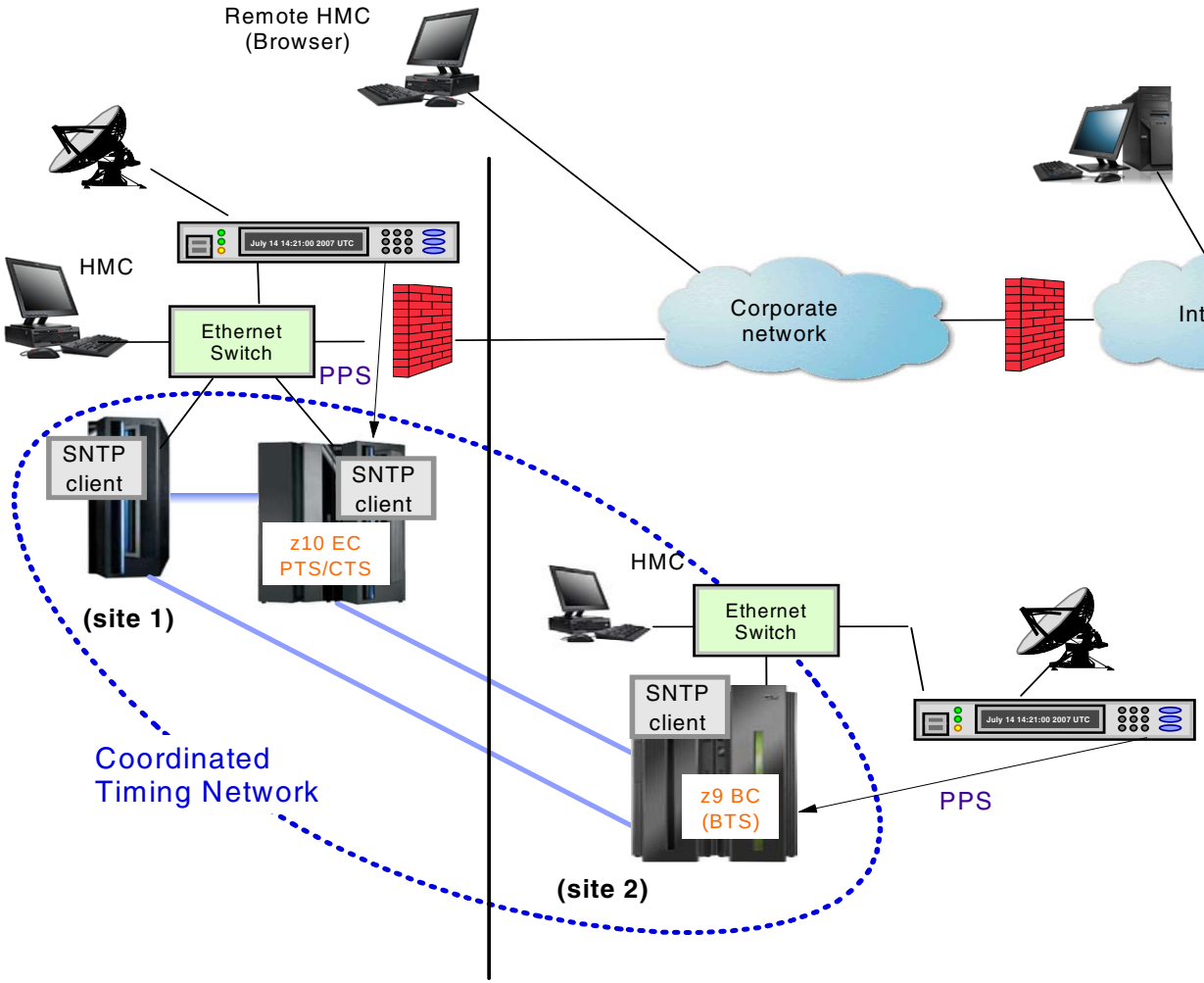


NTP Server Redundancy Recommendations

- At least one NTP server must be configured on the PTS/CTS
  - Only the Current Time Server (CTS) makes time adjustments based on information from the NTP Server
- Also recommended to configure at least one NTP server on the BTS
  - Allows continuous NTP server access when BTS becomes the CTS
  - Time adjustments to the STP-only CTN when the PTS/CTS cannot access any of its NTP servers
- STP allows two NTP servers to be configured for every System z server in the STP-only CTN
  - When two NTP servers are configured on the server that has the PTS/CTS role, STP will automatically access the second NTP server configured on the PTS/CTS if the selected NTP server fails.
  - For best availability, configure two NTP servers for both the PTS and the BTS
- NTP servers can also be configured for all servers in the STP-only CTN
  - Provides access to NTP servers if server roles reassigned

Recommendations apply when using NTP servers with or without PPS

Continuous Availability of ETS - two site example



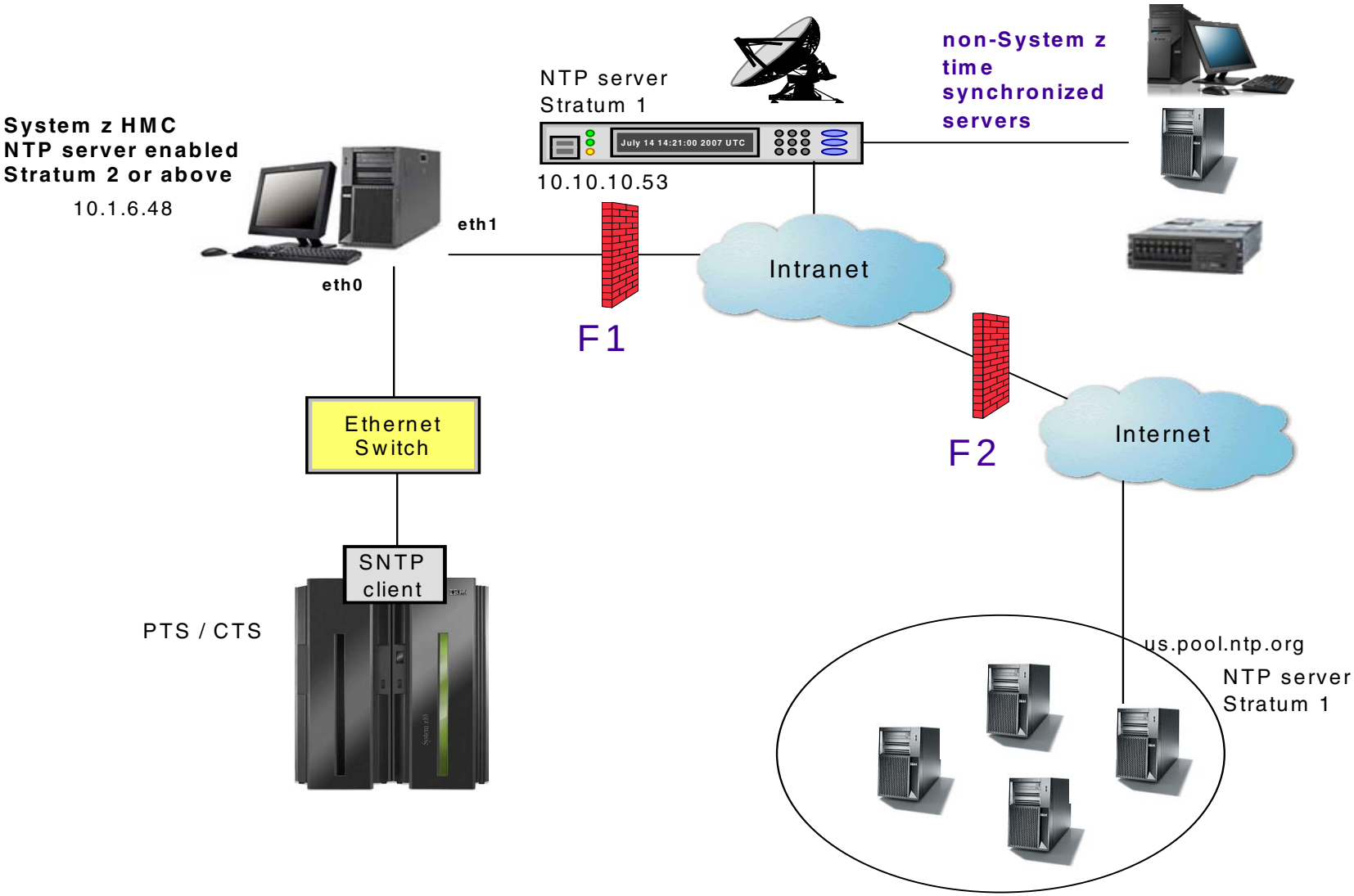
- BTS transmits adjustment information to PTS/CTS based on its NTP/PPS data
- When PTS/CTS detects failures associated with its NTP/PPS data
- PTS/CTS switches to using NTP/PPS data from BTS
- CTS role DOES NOT switch to BTS

Applicable when using NTP servers with or without PPS

Agenda

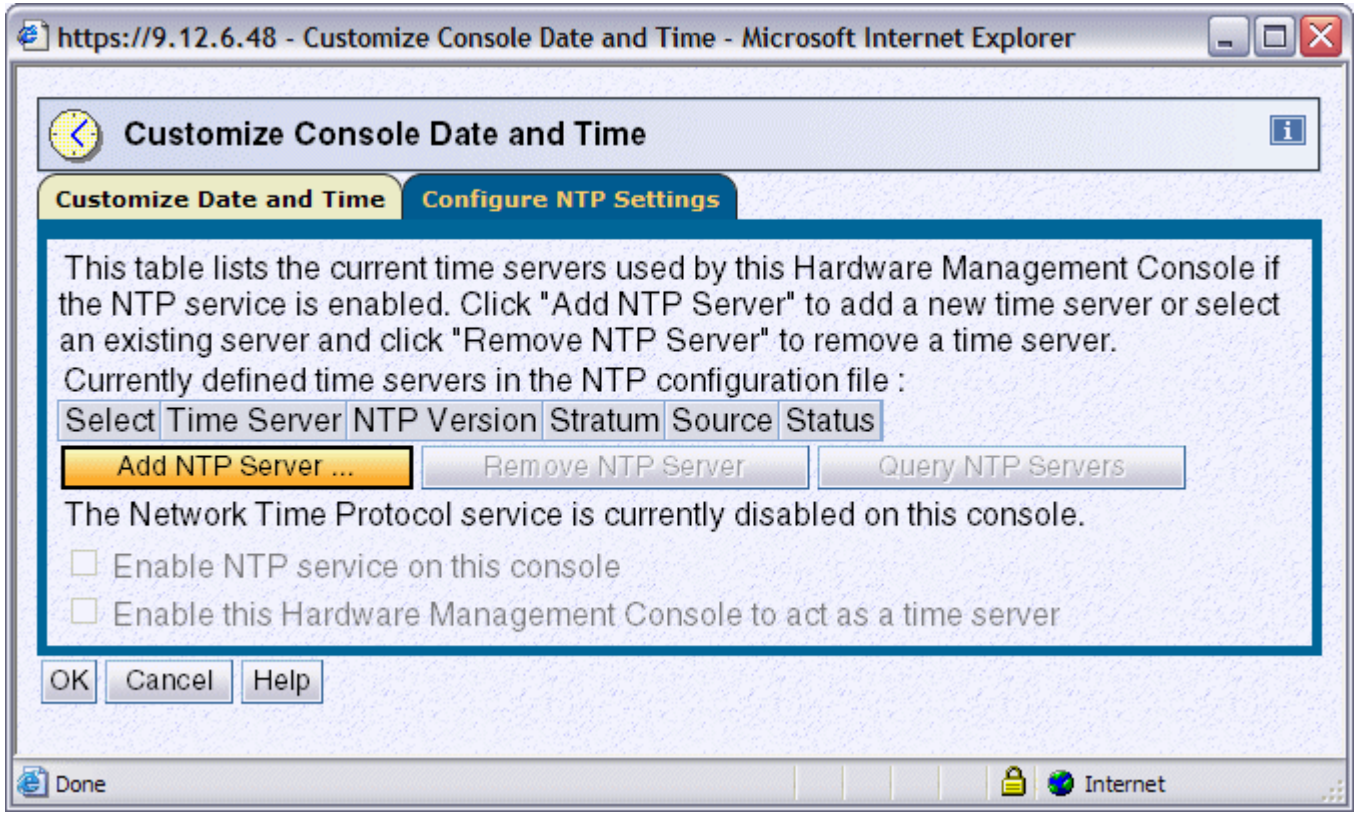
- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID
  - Initialize the time
  - Assign CTN Roles
- Additional Information

NTP Server on HMC as ETS



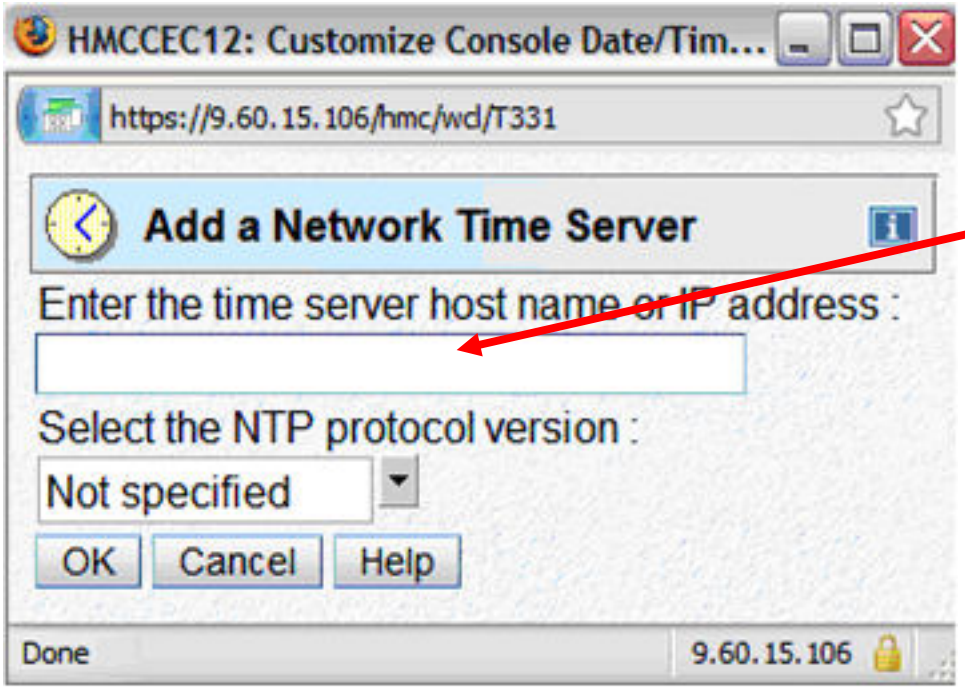
Configuring an NTP Server on HMC

Customize Console Date and Time – initial view



Configuring an NTP Server on HMC

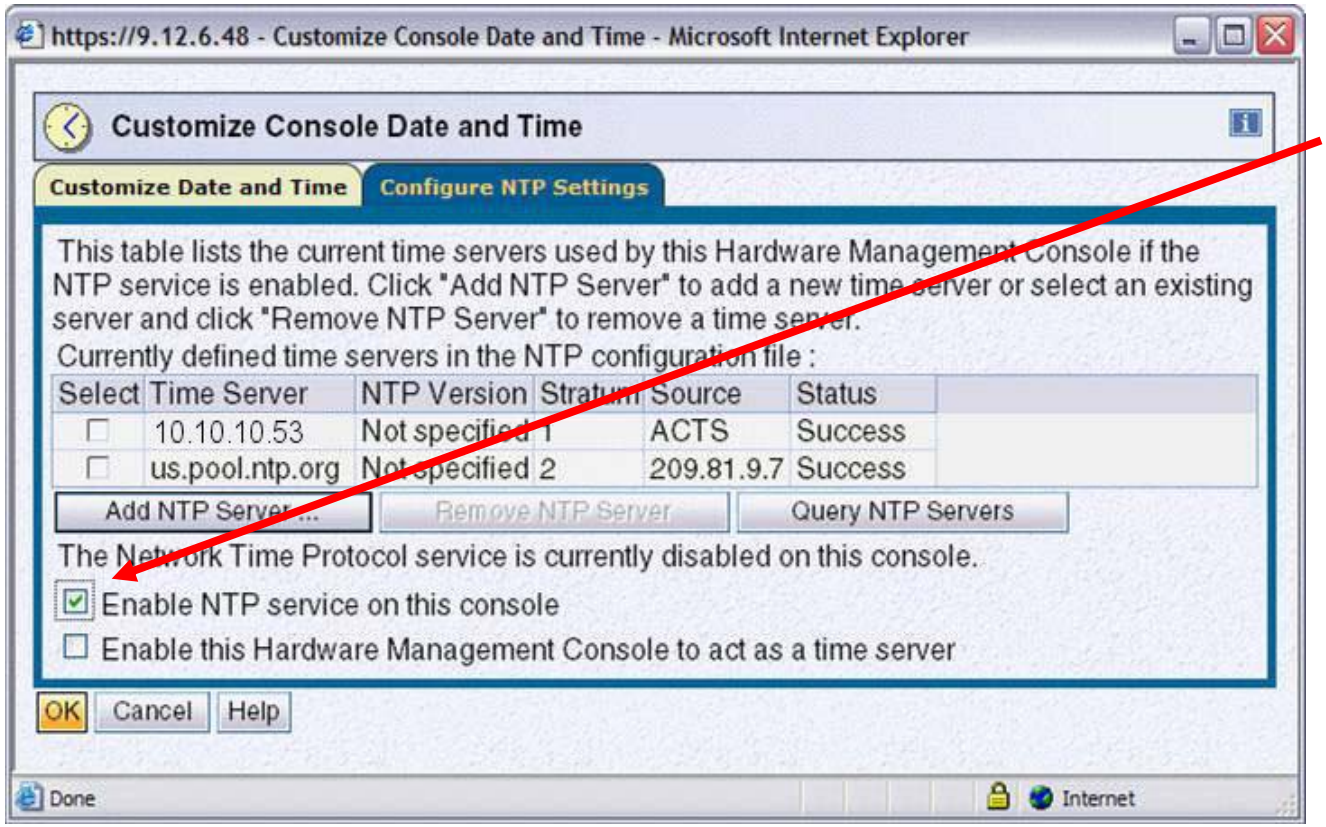
Add a corporate NTP server



- The server host name or the IP address of a known NTP server must be entered in this window.

Configuring an NTP Server on HMC

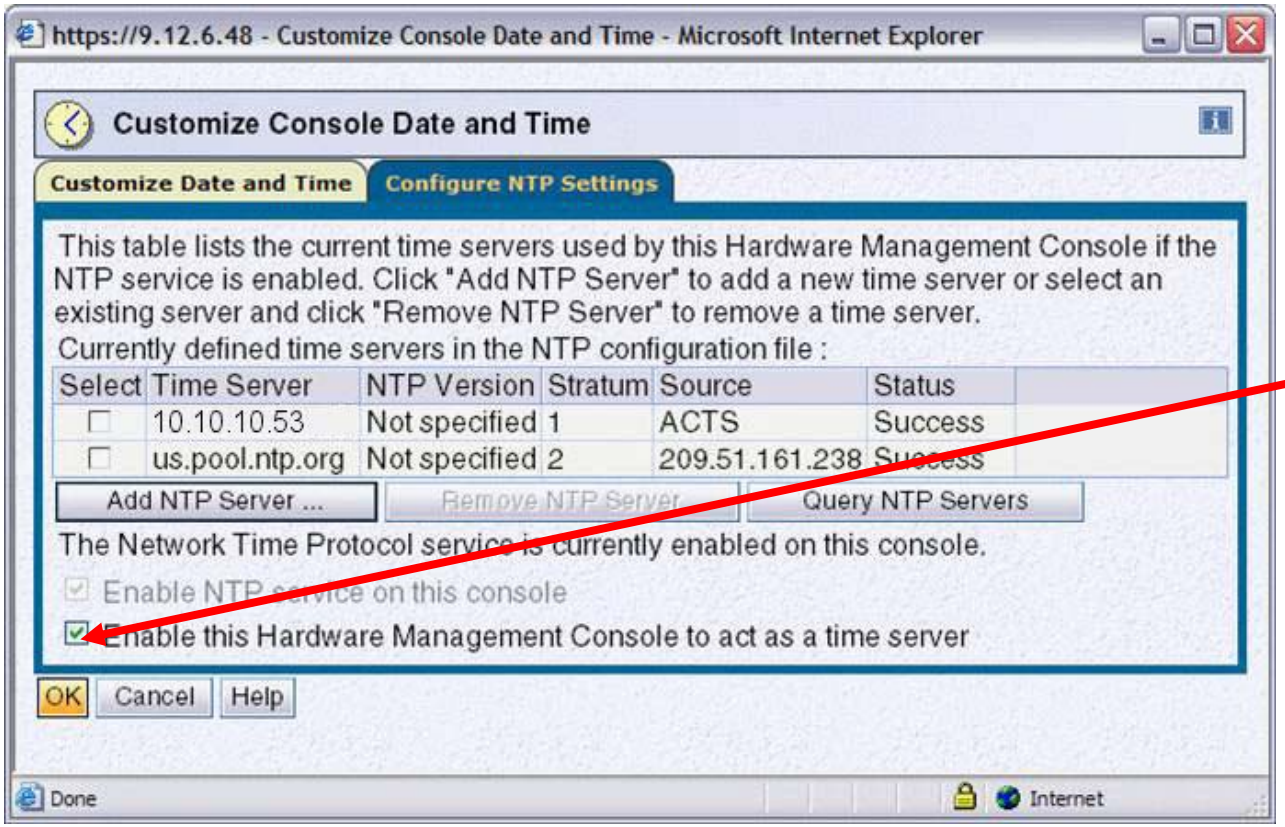
Enable NTP service on this console



- To turn on the NTP service, check the "**Enable NTP service on this console**" checkbox and click OK.
- When you click OK, you should be able to see the console clock at the bottom right corner get updated to the server's time.
- Even though the time change is instantaneous, it still takes time for the console's NTP code to ensure that the HMC's NTP server has started properly.

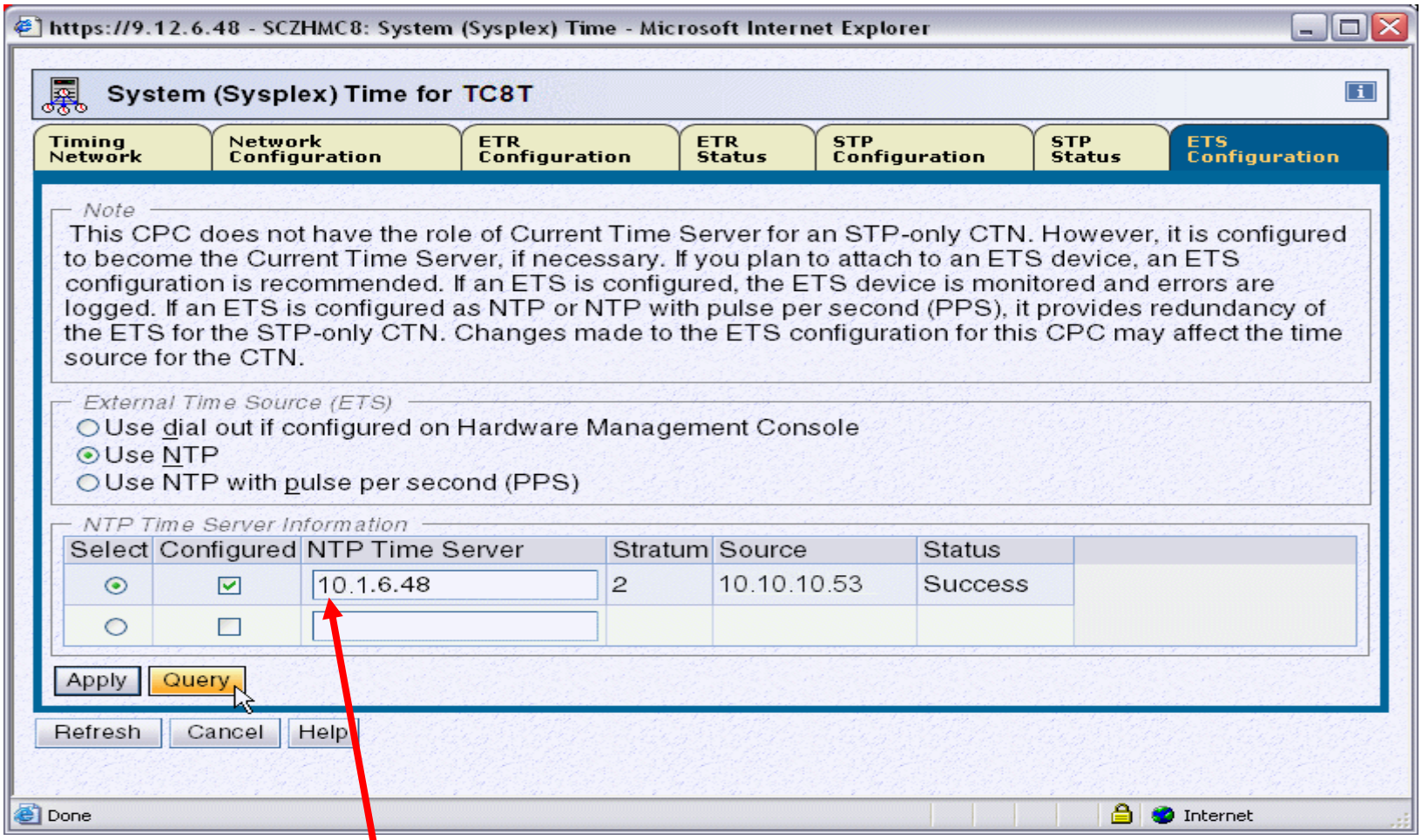
Configuring an NTP Server on HMC

Enable this Hardware Management Console to act as a time server



- To allow another HMC console, TKE console, or an STP-only CTN to use the HMC as a NTP server, check the "**Enable this Hardware Management Console to act as a time server**" checkbox and click the OK button.

Configuring an NTP server on the PTS/CTS



- **This is the IP address of the HMC NTP Server residing on the *private* network.**
- **It is different from the IP address of the NTP server on the corporate network.**

Agenda

- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID
  - Initialize the time
  - Assign CTN Roles
- Additional Information

Preparatory Work

- General Pre-Implementation Tasks
  - Hardware
    - Install FC 1021 to STP-enable the processor
    - Check hardware and HMC driver levels
  - Software
    - All systems at a STP-supported z/OS release with latest RSUs applied.
    - z/OS → CLOCKxx was updated (Note: These are the default values)
      - ✓ STPMODE=YES
      - ✓ STPZONE=YES
    - IPL all systems*.

*** Images must be IPL'ed after installing new STP maintenance and STP FC 1021.**

As we have only one zCPC in this configuration, setting the STP mode is a **disruptive** action

z/OS → Update CLOCKxx statements

- OPERATOR PROMPT|NOPROMPT
- TIMEZONE W|E hh.mm.ss
- ETRMODE YES|NO
- ETRZONE YES|NO
- SIMETRID nn
  - nn = 0 – 31
- STPMODE* YES|NO
  - Specifies whether z/OS is using STP timing mode
  - STPMODE YES default
- STPZONE* YES|NO
  - Specifies whether the system is to get the time zone constant from STP
- ETRDELTA ss
  - ss = 0 – 99 seconds
- TIMEDELTA* ss
  - ss = 0 – 99 seconds

Example:

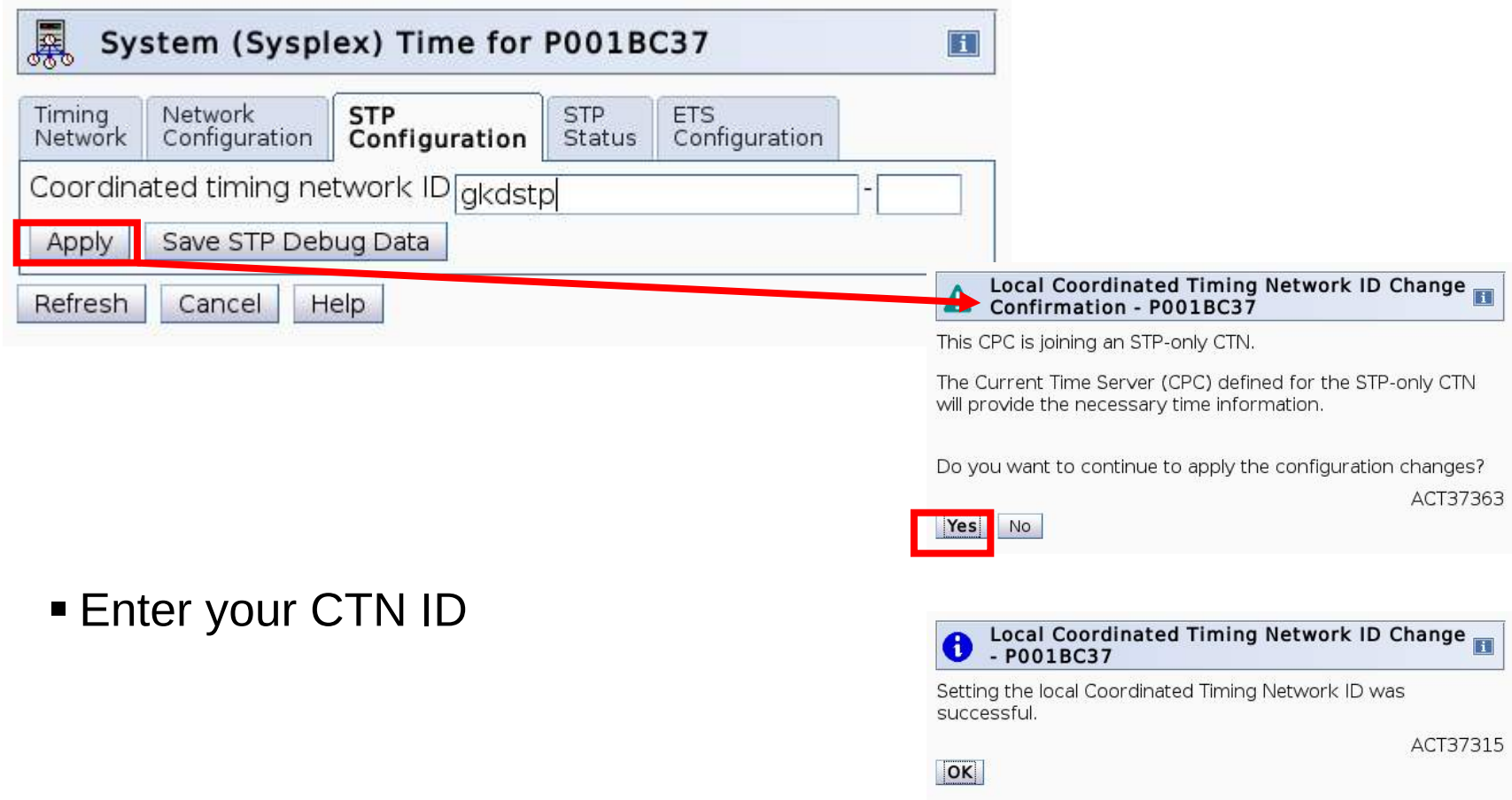
```
OPERATOR NOPROMPT
ETRMODE  NO
ETRZONE  NO
STPMODE  YES
STPZONE  YES
```

* New statements for STP

Agenda

- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID
  - Initialize the time
  - Assign CTN Roles
- Additional Information

Set CTN ID



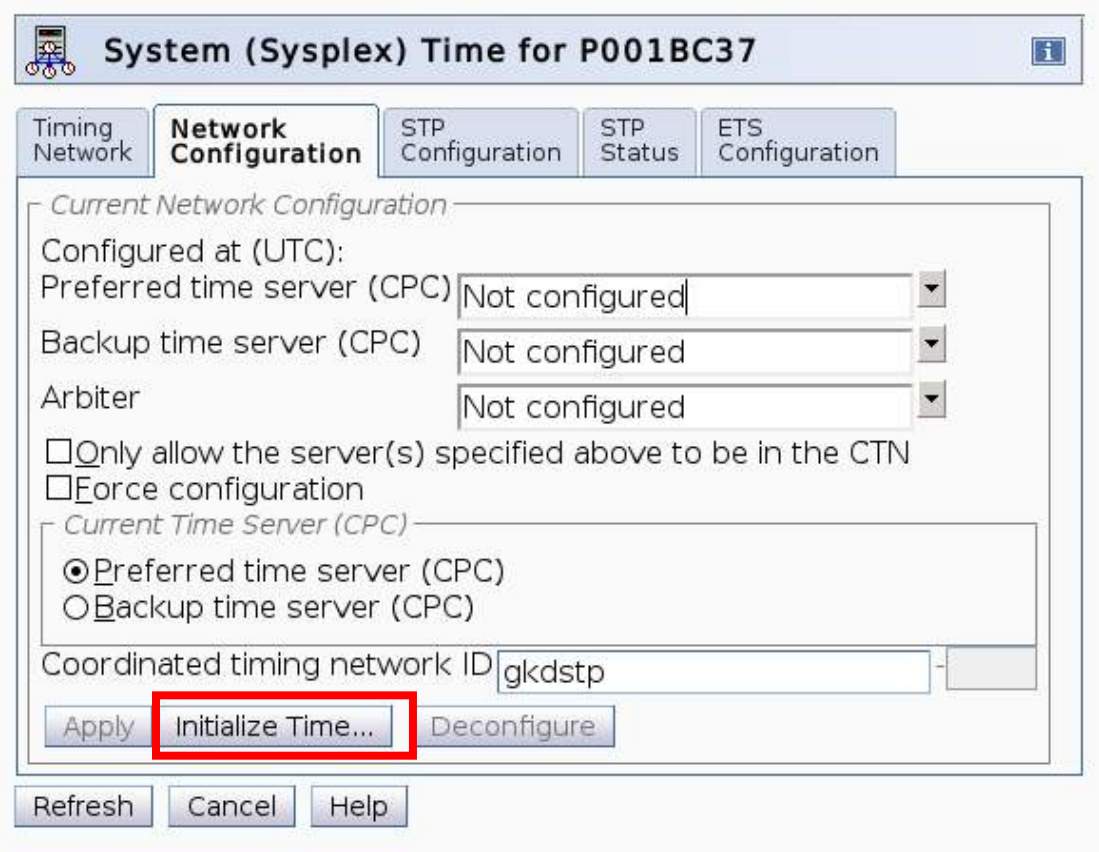
- Enter your CTN ID

Agenda

- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID ✓
  - Initialize the time
  - Assign CTN Roles
- Additional Information

Initialize time

Initialize Time button is accessed from the Network Configuration tab

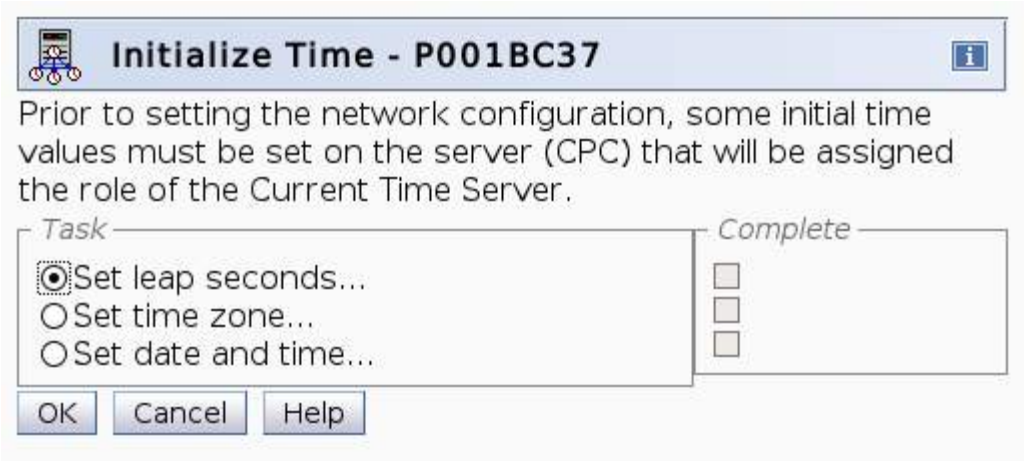


Initialize Time button enabled ONLY IF

- CTS and PTS roles have not been assigned
- Do not assign roles prior to initializing time

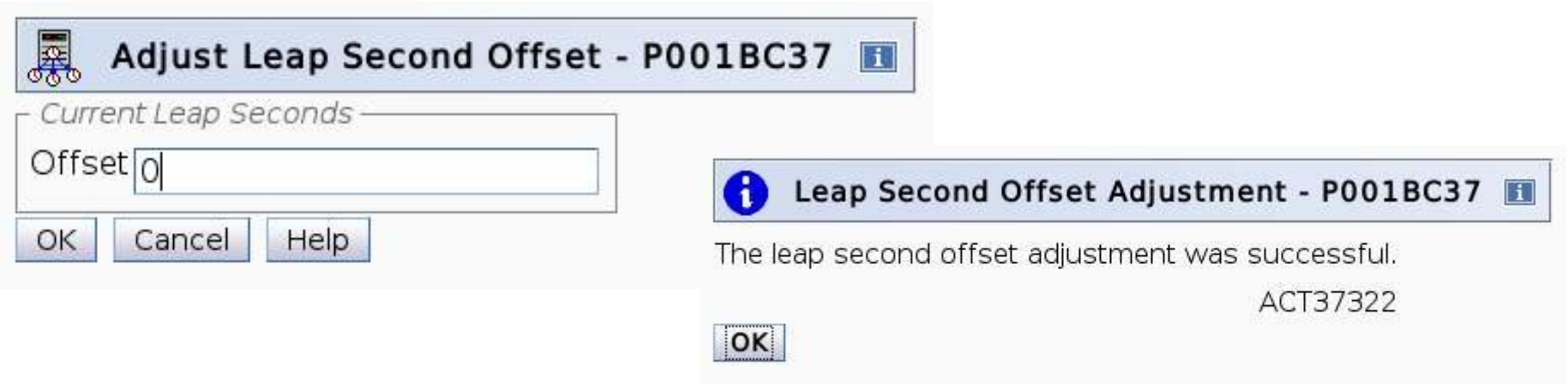
Important: Initializing the time must be done on the server that will become the Current Time Server for the STP-only CTN.

Initialize time



- Clicking *Initialize Time* on the Network Configuration tab displays the Initialize Time window
- 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.

Set Leap Seconds



- Although the installation may 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 zero value.

Set Time Zone

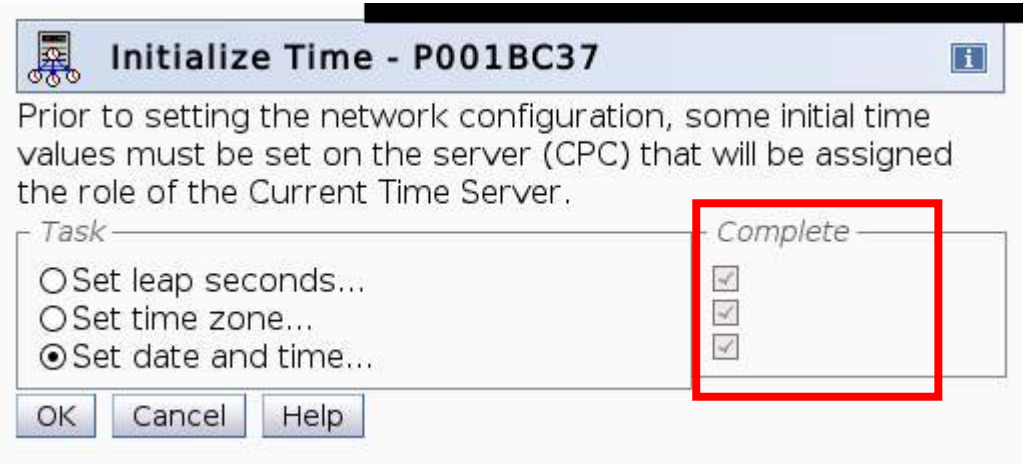
- **Automatically adjust** is selected by default when the time zone selected supports automatic adjustment of daylight saving time. Otherwise, this button is disabled.
- Even if automatic adjustment is supported, the user still has the option of selecting **Set standard time** or **Set daylight saving time**.

Set date and time

- If the local date and time are to be set to specific values, click the **Set date and time** button.
- If an ETS is configured, the date and time should be initialized by selecting the option **Use External Time Source to set date and time**

Regardless of the method chosen, STP uses the information to calculate the Coordinated Server Time and set the servers' TOD clock when the OK button is clicked.

Initialize Time - completed

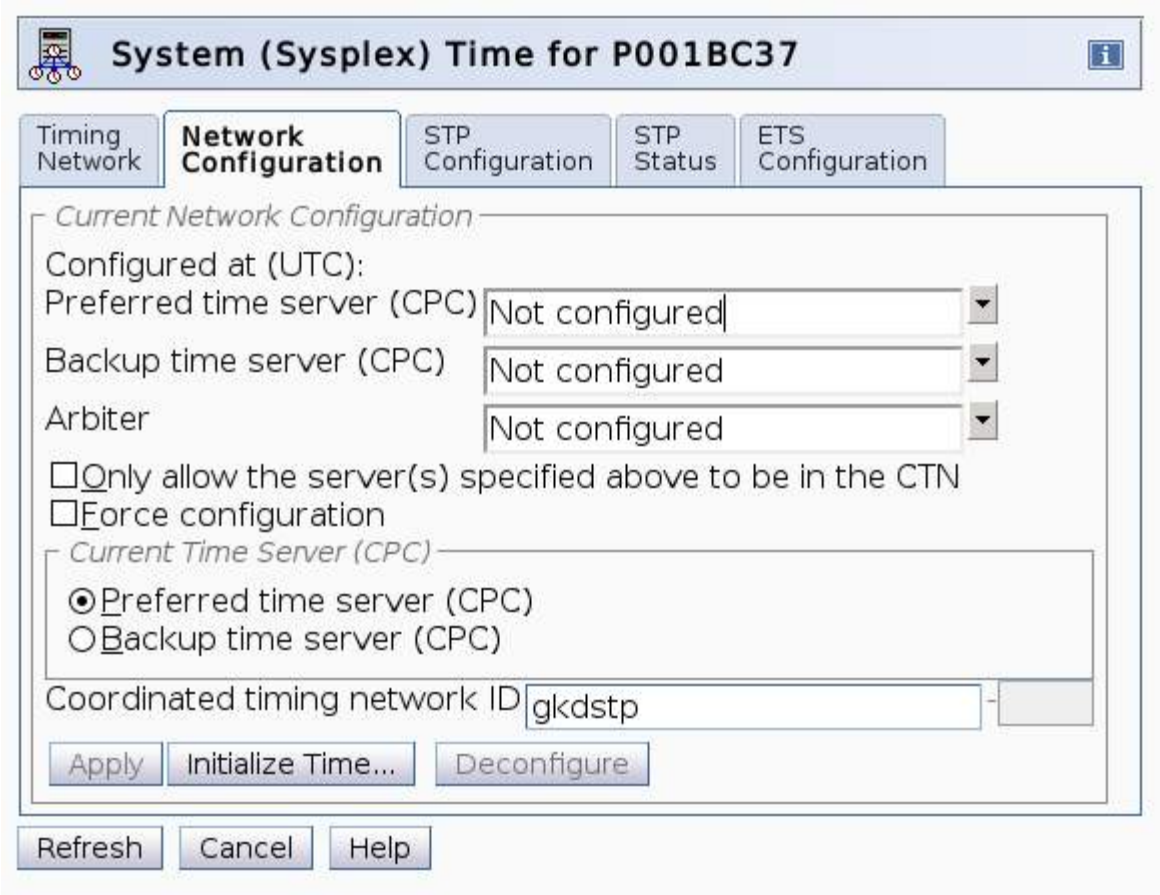


- At this point, the three tasks on the Initialize Time window have a check mark in the Complete column
- The user needs to click Cancel to exit the Initialize Time task and return to the Network Configuration tab.

Agenda

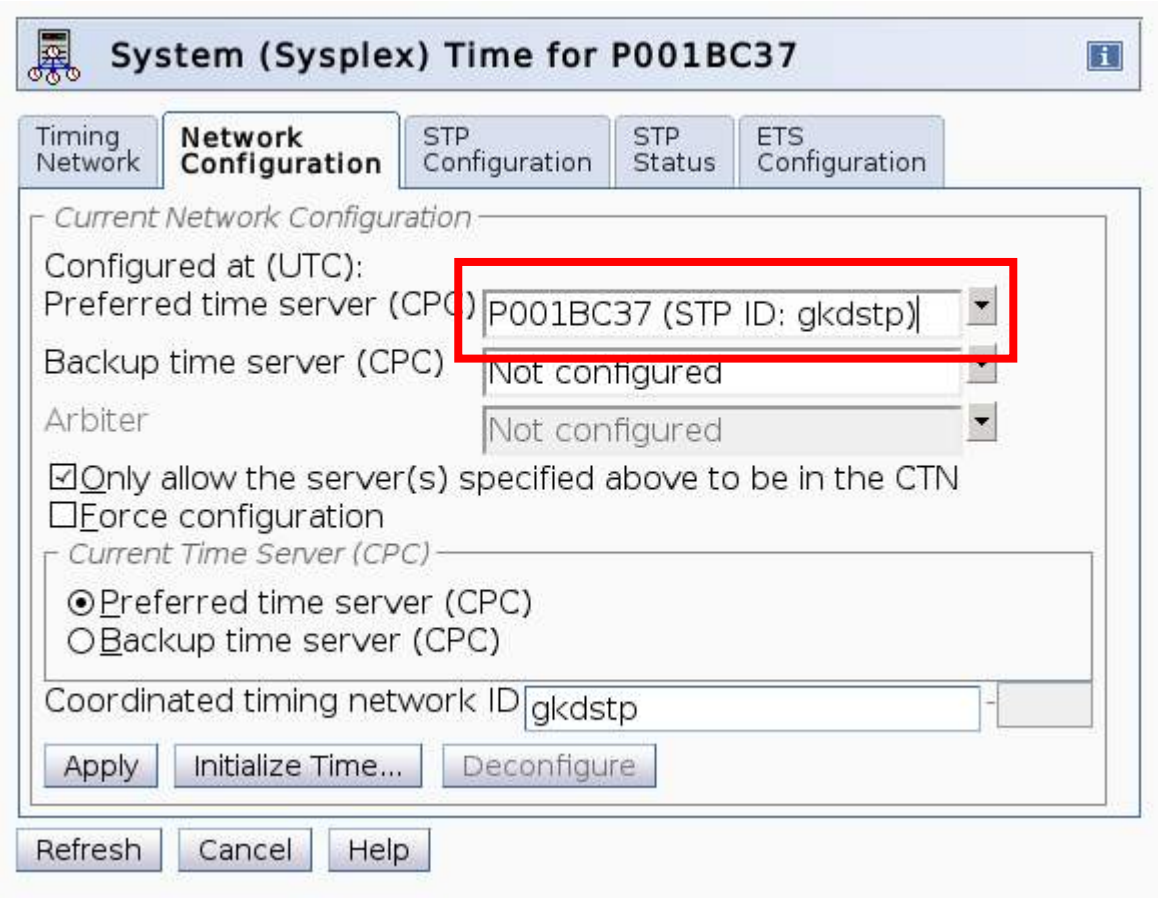
- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID ✓
  - Initialize the time ✓
  - Assign CTN Roles
- Additional Information

Assign Server Roles



- ✓ Initialize Time task is complete
- ✓ Apply button is enabled
- Server roles can now be assigned

Assign PTS/CTS



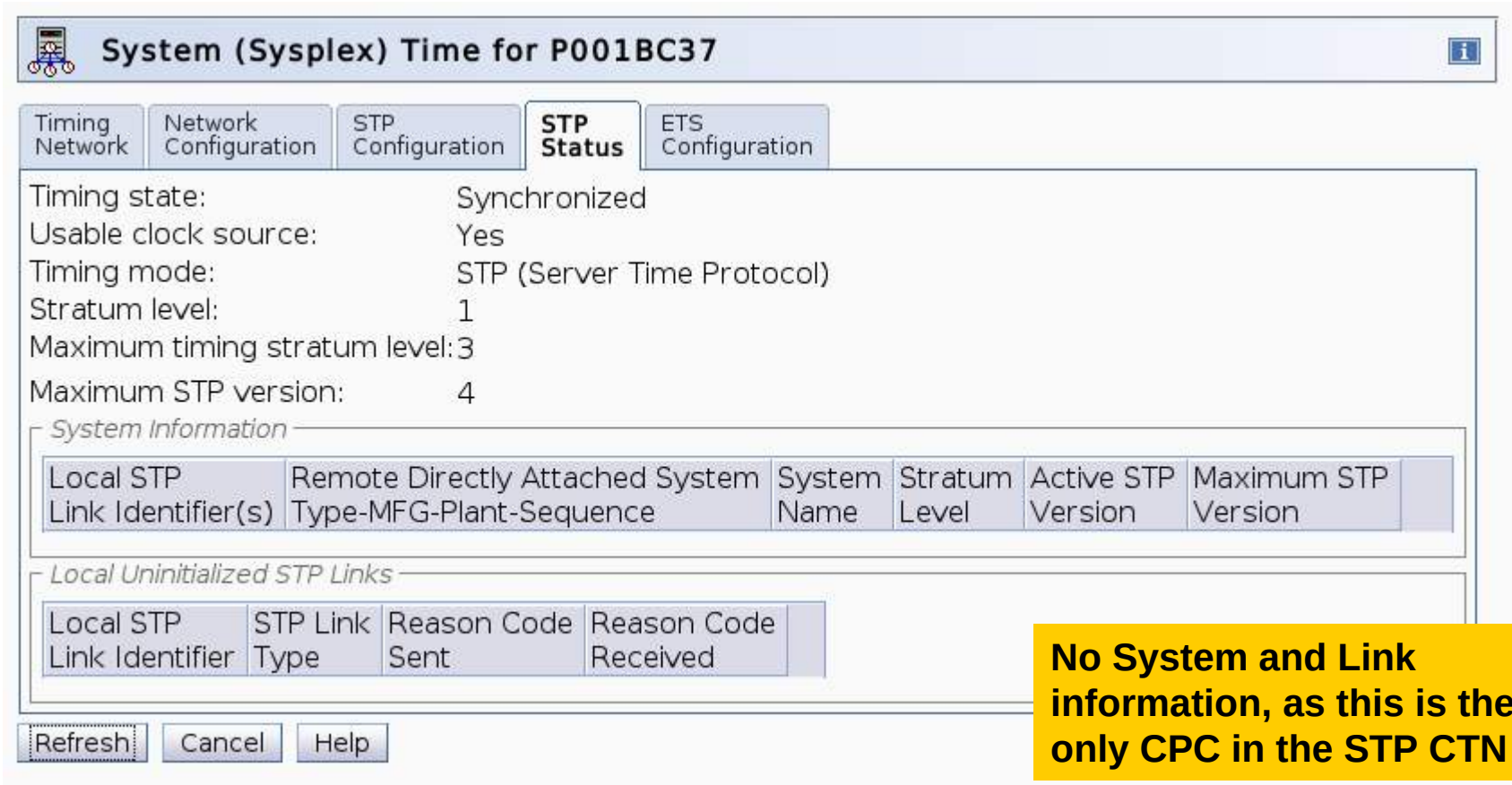
- Because the PTS will be the only server assigned, it has to be the CTS
- Only allow the server(s) specified above to be in the CTN to save STP configuration and time information across Power on Resets or power outages (http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD105103)
- Force configuration box must be specified when configuring a new STP-only CTN for the first time in order to bypass connectivity verification, as a Current Time Server does not yet exist.

Verify on HMC – Timing Network tab

Time field of the *Coordinated Server Time* section identifies the current time on the server.

Verify on HMC- STP Status tab

STP Timing Mode – Stratum 1



No System and Link information, as this is the only CPC in the STP CTN

z/OS Verification – DISPLAY ETR / D XCF,S,ALL

```
-           d etr
            IEA386I 13.14.10 TIMING STATUS 417                          C
  SYNCHRONIZATION MODE = STP
    THIS SERVER IS A STRATUM 1
    CTN ID = gkdstp
    THE STRATUM 1 NODE ID = 002818.M10.IBM.84.00000001BC37
    THIS IS THE PREFERRED TIME SERVER
    THIS STP NETWORK HAS NO BACKUP TIME SERVER
    THIS STP NETWORK HAS NO SERVER TO ACT AS ARBITER
-           d xcf,s,all
            IXC335I  13.14.46  DISPLAY XCF 420                           C
  SYSPLEX ZOST
  SYSTEM   TYPE SERIAL LPAR STATUS TIME         SYSTEM STATUS
  ZOST     2818 BC37   04   07/19/2012 13:14:46 MONOPLEX MODE  TM=STP

  SYSTEM STATUS DETECTION PARTITIONING PROTOCOL CONNECTION EXCEPTIONS:
    PROTOCOL NOT APPLICABLE IN MONOPLEX MODE
00-         d t
            IEE136I LOCAL: TIME=13.15.03 DATE=2012.201  UTC: TIME=11.15.03
   DATE=2012.201
```

Synchronization mode

Stratum level

Node ID

Timing Mode STP

Agenda

- STP – General Overview
- Sysplex Time Task prior to configuring STP
- Planning and Configuring an External Time Source
  - Planning an ETS
  - Configure a NTP Server
- Configuring a STP-only CTN for Single CPC usage
  - Set CTN ID ✓
  - Initialize the time ✓
  - Assign CTN Roles ✓
- Additional Information

DONE!

Additional Information

- Redbooks®
  - Server Time Protocol Planning Guide SG24-7280
  - Server Time Protocol Implementation Guide SG24-7281
  - Server Time Protocol Recovery Guide, SG24-7380
- Education
  - Introduction to Server Time Protocol (STP)
    - Available on Resource Link™
    - www.ibm.com/servers/resourcelink/hom03010.nsf?OpenDatabase
- STP Web site
  - www.ibm.com/systems/z/advantages/pso/stp/hardware.html
- Systems Assurance
  - The IBM team is required to complete a Systems Assurance Review (SAPR Guide SA06-012) and to complete the Systems Assurance Confirmation Form via Resource Link

Trademarks

- For a complete list of IBM Trademarks, see **ibm.com**/legal/copytrade.shtml