

Server Time Protocol Overview and Planning Considerations

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SHARE in Boston

Introduction

- **Server Time Protocol (STP), a time synchronization facility for System z is designed to provide time synchronization for multiple IBM® zEnterprise™ 196 (z196), IBM System z10™, System z9™ and zSeries™ servers, and is the follow-on to the Sysplex Timer (9037-002).**
- **Customers with existing External Time Reference (ETR) networks can concurrently migrate to STP**
- **This session will describe the**
 - **Key functional capabilities of STP**
 - **Configurations STP is designed to support**
 - **Hardware and software planning considerations required for implementing STP**

Statement of Direction (April 28, 2009)

- **The System z10 will be the last server to support connections to the Sysplex Timer® (9037).**
 - Servers that require time synchronization, such as to support a base or Parallel Sysplex, will require Server Time Protocol (STP). STP has been available since January 2007 and is offered on the System z10, System z9, and zSeries® 990 and 890 servers.

Fulfilled

Statement of Direction (July 22, 2010)

- **The IBM zEnterprise 196 is planned to be the last high-end server to support dial-up modems for use with the Remote Support Facility (RSF), and the External Time Source (ETS) option of Server Time Protocol (STP).**
 - **The currently available Network Time Protocol (NTP) server option for ETS as well as Internet time services available using broadband connections can be used to provide the same degree of accuracy as dial-up time services.**
 - **Enterprises should begin migrating from dial-up modems to Broadband for RSF connections.**

Agenda

- STP Overview
- Hardware Planning
- External Time Source (ETS) Planning
- Software Planning Overview
- Server Role Planning
- Operational Safeguards
- 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™ 196 (z196), 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**

Key Attributes

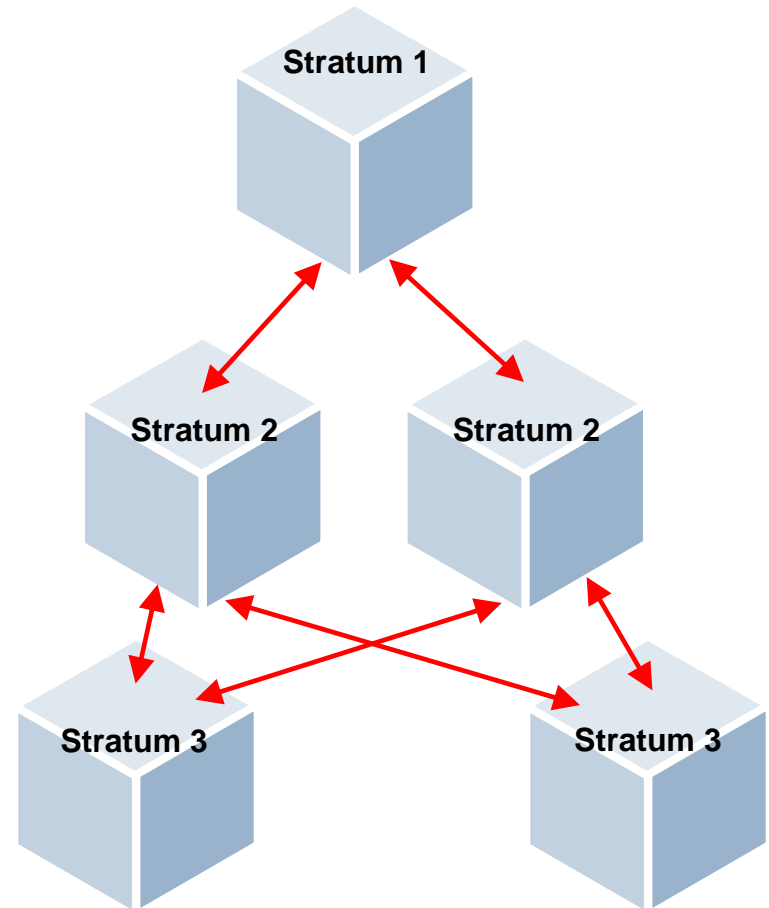
- Designed to provide improved time synchronization, compared to Sysplex Timer®, for servers in a Sysplex or non-Sysplex configuration
- Can scale with distance
 - Generally, servers exchanging data over fast short links require more stringent synchronization than servers exchanging data over long distances
- Supports a multi-site timing network of up to 200 km over fiber optic cabling
 - Parallel Sysplex® cluster can span up to 200 km
 - RPQ 8P2263 required for distances greater than 100 km
- Potentially reduces the cross-site connectivity required for a multi-site Parallel Sysplex cluster
 - Dedicated links not required to transmit timekeeping information
- With proper planning, allows concurrent migration from an existing External Time Reference (ETR) network
- Allows
 - Coexistence with ETR network
 - Automatic updates of DST offset based on time zone algorithm
 - Adjustment of CST up to +/- 60 seconds

Terminology

- **STP-capable server/CF**
 - z196, z10(EC or BC), z9(EC or BC), z990, z890 server/CF
with **STP LIC installed**
- **STP-enabled server/CF**
 - STP-capable server/CF with **STP Feature Code 1021 installed**
 - STP panels at the HMC/SE can now be used
- **STP-configured server/CF**
 - STP-enabled server/CF with a **CTN ID assigned**
 - STP message exchanges can take place
- **CTN**
 - Collection of servers that are **time synchronized** to a time value called Coordinated Server Time (CST)
- **CTN ID**
 - **Common identifier** assigned to Servers / Coupling Facilities (CFs) that make up the same CTN

Terminology (continued)

- STP transmits timekeeping information in layers or Stratum levels
 - Stratum 1 (S1)
 - Highest level in the hierarchy of timing network that uses STP to synchronize to Coordinated Server Time (CST)
 - Stratum 2 (S2)
 - Server/Coupling Facility (CF) that uses STP messages to synchronize to Stratum 1
 - Stratum 3 (S3)
 - Server/Coupling Facility (CF) that uses STP messages to synchronize to Stratum 2
- STP supports configurations up to Stratum 3

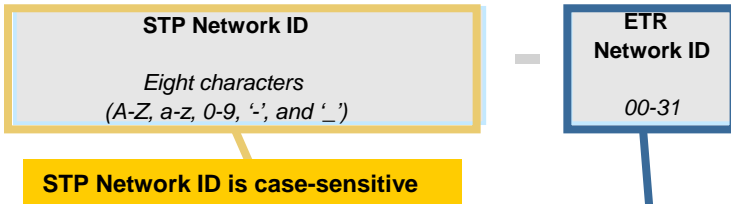


Configurations

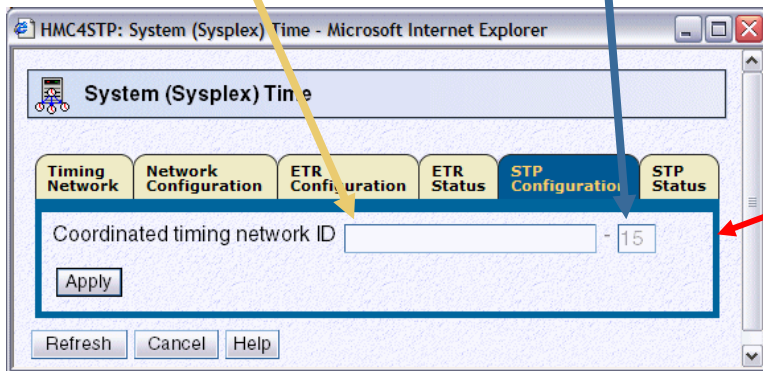
- Two types of CTN configurations possible:
 - **Mixed CTN**
 - Allows servers/CFs that can only be synchronized to a Sysplex Timer (ETR network) to coexist with servers/CFs that can be synchronized with CST in the “same” timing network
 - Sysplex Timer[®] provides timekeeping information
 - CTN ID format
 - *STP network ID concatenated with ETR network ID*
 - **STP-only CTN**
 - All servers/CFs synchronized with CST
 - Sysplex Timer is NOT required and not part of CTN
 - CTN ID format
 - *STP network ID only (ETR network ID field has to be null)*

Coordinated Timing Network ID (CTN ID)

- The CTN ID is an identifier that is used to indicate whether the server has been configured to be part of a CTN. It identifies the CTN.
- The CTN ID is made up of two fields



Timing Network	STP ID	ETR ID	CTN ID
None	Null	Null	
ETR	Null	ETR ID	15
Mixed	STP ID	ETR ID	HMCTEST-15
STP-Only	STP ID	Null	HMCTEST



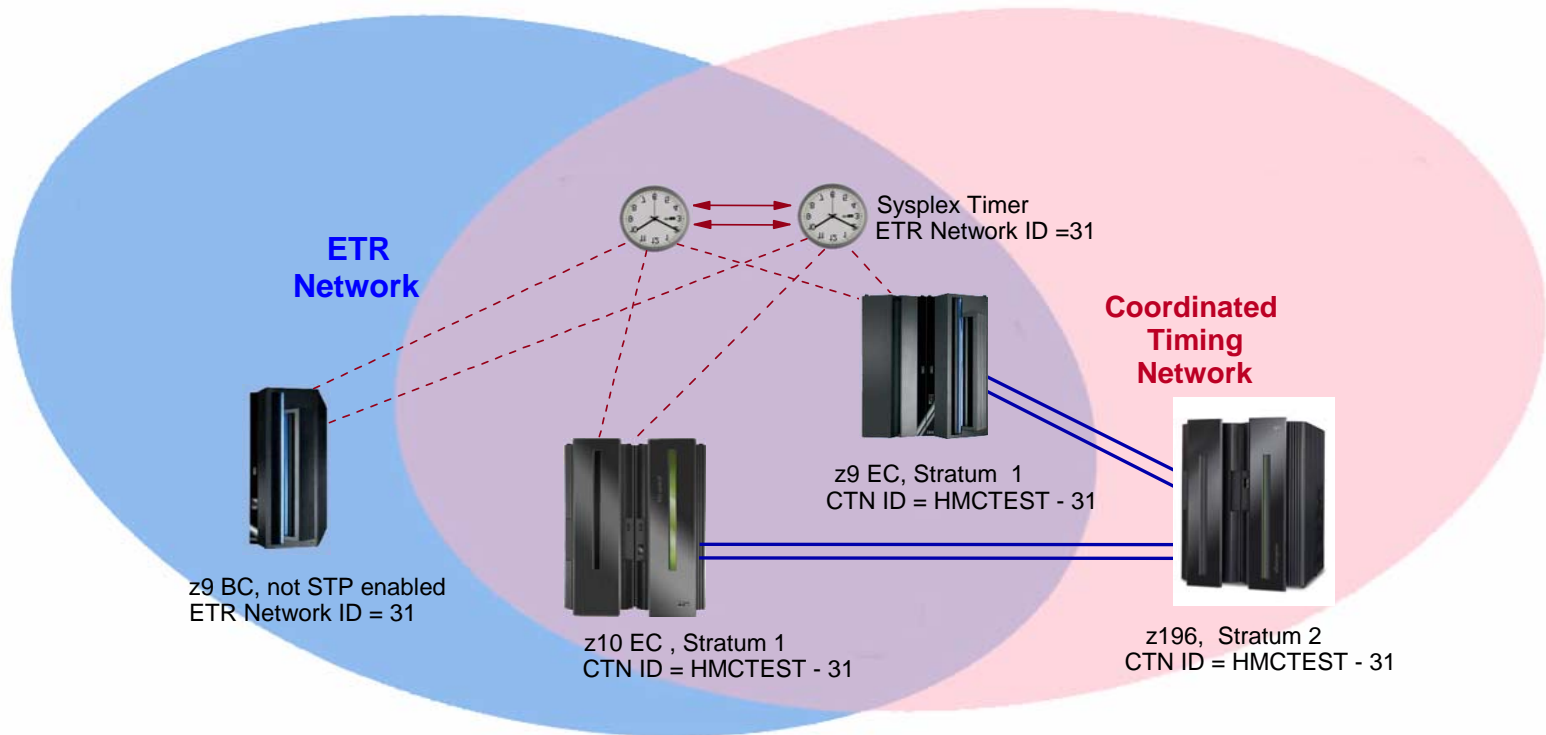
Mixed Coordinated Timing Network (CTN)

- **Need at least one STP-enabled server to configure Mixed CTN**
 - Selected STP-enabled server **MUST** also be synchronized to the Sysplex Timer
 - Automatically becomes a S1 server for the Mixed CTN
 - Can have multiple S1 servers in Mixed CTN
 - **Note: z196 does not support attachment to Sysplex Timer**
 - S2 server/CF uses S1 as clock source
 - S3 server/CF uses S2 as clock source
- **Sysplex Timer provides timekeeping information for Mixed CTN**
- **Sysplex Timer console continues to be used for all timing related functions of the Mixed CTN**
 - Initialize time; Set Time Zone, Daylight Saving Time (DST), Leap seconds offsets
 - Schedule DST and Leap seconds offset changes
 - Adjust time up to +/- 4.999 seconds
- **Hardware Management Console (HMC) must be used for Mixed CTN ID initialization and modification**

Mixed CTN (continued)

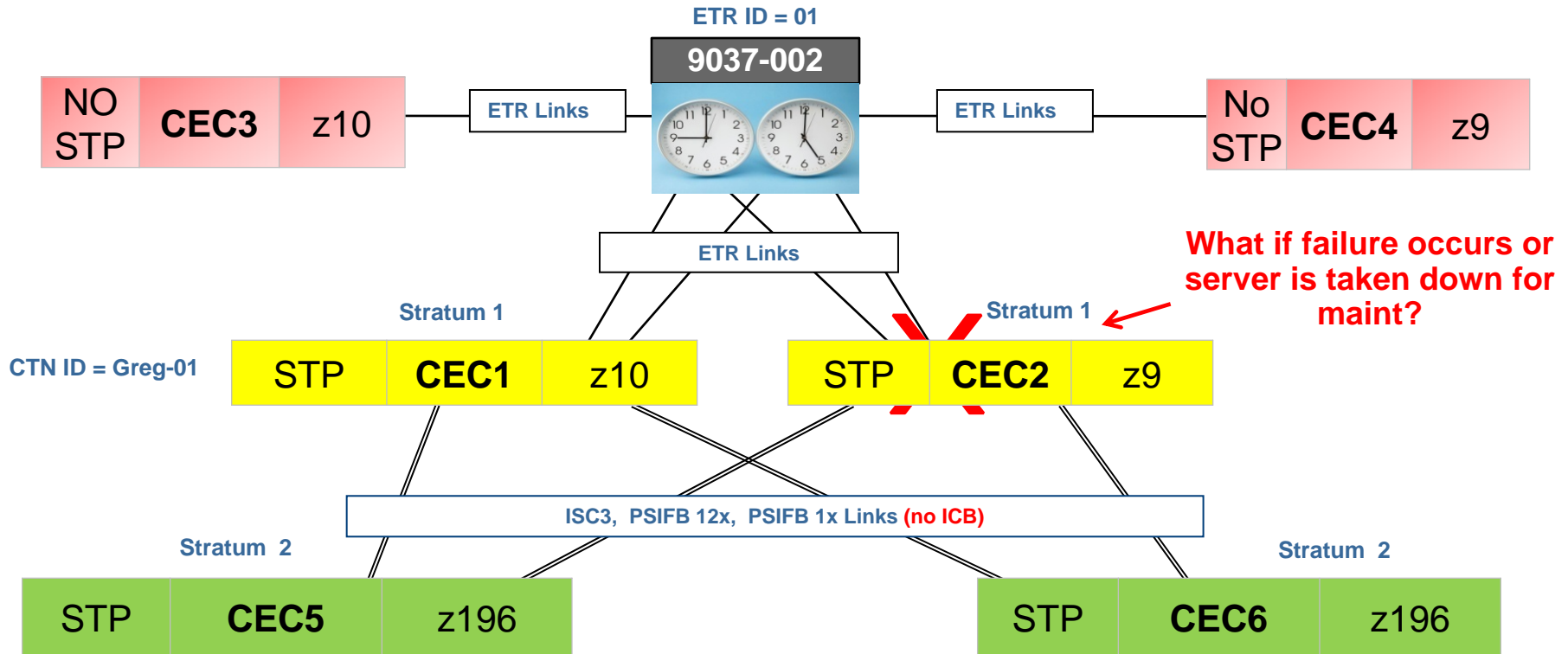
- **Concurrent migration from ETR network (with proper planning)**
 - Concurrently migrate from existing ETR network to Mixed CTN
 - Concurrently migrate from Mixed CTN to ETR Network
 - Allows testing Mixed CTN during change window and go back concurrently to
 - ETR network at start of production

Mixed CTN Example - S1 and S2 servers



- **z10 EC, z9 EC, z9 BC are synchronized to Sysplex Timer (S1 servers)**
- **z196 is S2 and is synchronized to either z10 EC or z9 EC via STP**
- **z196 does not need ETR link connections and can be located up to 200 km away from z10 EC or z9 EC**
- **Redundancy of S1 servers allows z196 S2 to stay within Mixed CTN if either S1 has a planned or unplanned outage**

No Support for ETR with z196



- It is possible to have a z196 server as a Stratum 2 server in a Mixed CTN as long as there are at least two z10s or z9s attached to the Sysplex Timer operating as Stratum 1 servers
- Two Stratum 1 servers are highly recommended to provide redundancy and avoid a single point of failure
- Suitable for a customer planning to migrate to an STP-only CTN.
- The z196 can not be in the same Mixed CTN as a z990 or z890 (n-2)

STP-only CTN

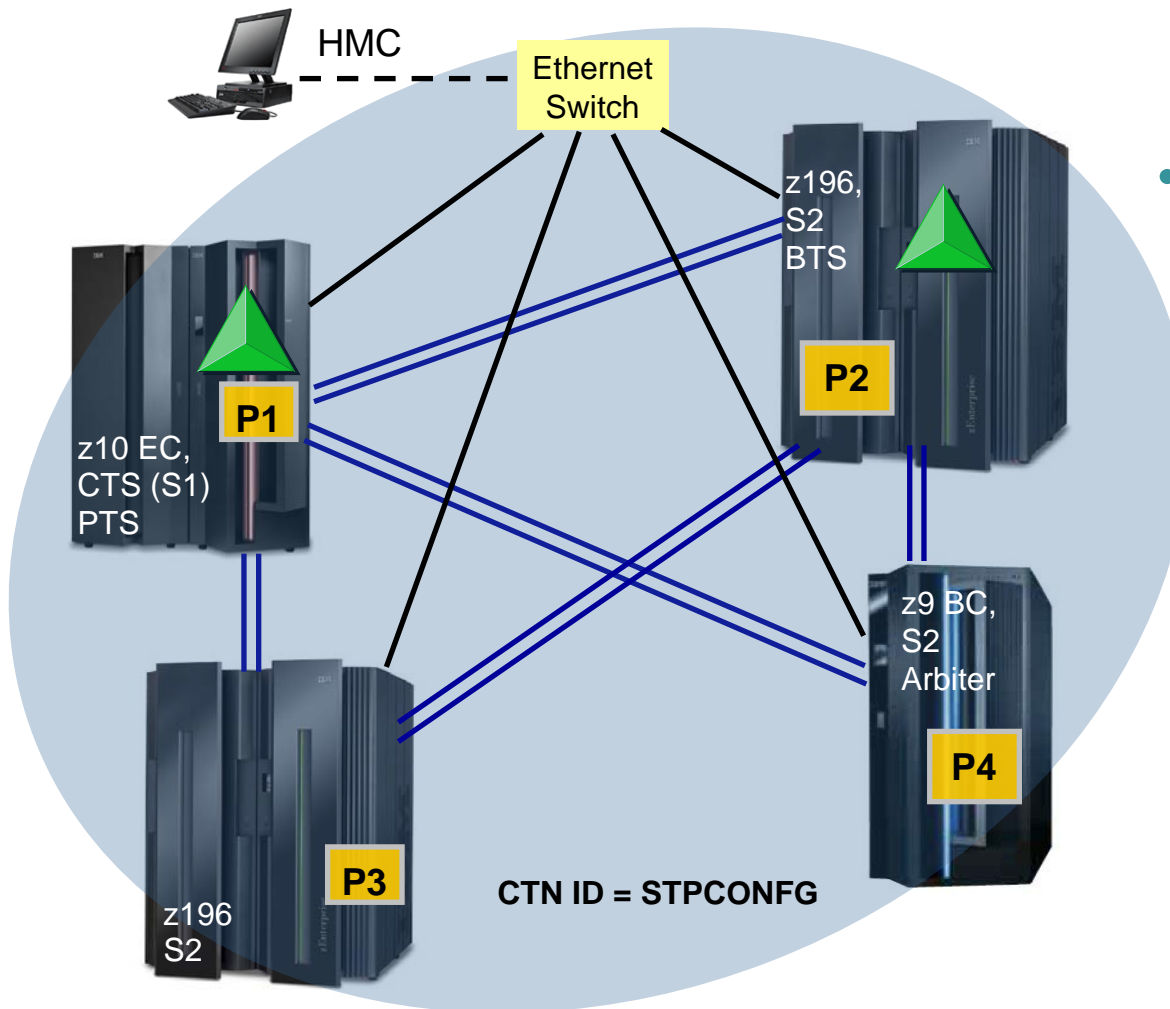
- All servers/CF's in STP-only CTN have to be STP configured
 - 9037s no longer required and not part of STP-only CTN
- Server/CF roles
 - **Preferred Time Server/CF (PTS)**
 - Server that is preferred to be the S1 server
 - **Backup Time Server/CF (BTS)**
 - Role is to take over as the S1 under planned or unplanned outages, without disrupting synchronization capability of STP-only CTN
 - **Current Time Server/CF(CTS)**
 - S1 Server/CF
 - *Only one S1 allowed*
 - *Only the PTS or BTS can be assigned as the CTS*
 - *Normally the PTS is assigned the role of CTS*
 - **Arbiter**
 - Provides additional means to determine if BTS should take over as the CTS under unplanned outages

STP-only CTN (continued)



- HMC must be used to provide the following functions:
 - Initialize Coordinated Server Time (CST) manually
 - Initialize CST to an External Time Source (ETS)
 - Configure an External Time Source (ETS) to set CST accurately
 - Set Time Zone Offset, Daylight Saving Time Offset, Leap seconds Offset
 - Schedule and change Offsets (Daylight Saving, Leap seconds)
 - Automatic scheduling of Daylight Savings Time based on algorithm
 - Adjust time by up to +/- 60 seconds (currently 9037 allows 4.999 seconds)
 - Define, modify, view the STP-only CTN ID
- Concurrent migration (with proper planning)
 - Forward migration (Existing ETR network to Mixed CTN to STP-only CTN)
 - Backward migration (STP-Only CTN to Mixed CTN to ETR network)
 - Allows testing STP-only CTN during change window and go back concurrently to Mixed CTN or ETR network at start of production.

STP-only CTN example



STP can use existing Coupling links

- Configuration has to be defined
 - Must assign PTS and CTS
 - Optionally assign BTS
 - Strongly recommended to allow near-continuous availability
 - Optionally assign Arbiter
 - Recommended for configurations of 3 or more servers/CFs
 - Can improve recovery

P1, P2, P3, P4 – systems in a Parallel Sysplex

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Server/CF Hardware planning



- Concurrently install all of the latest MCLs for each driver
 - IBM® zEnterprise™ 196 (z196) at Driver 86
 - System z10 server should be at EC Driver level 79
 - System z9 server must be at EC Driver level 67L
 - z990 and z890 must be at EC Driver level 55K
- 9037-002 concurrent LIC upgrade (if migrating from ETR network)
 - 9037 code changes to support STP Mixed CTN
- Concurrently install STP Enablement MCL (FC 1021)

Hardware Management Console (HMC) Planning

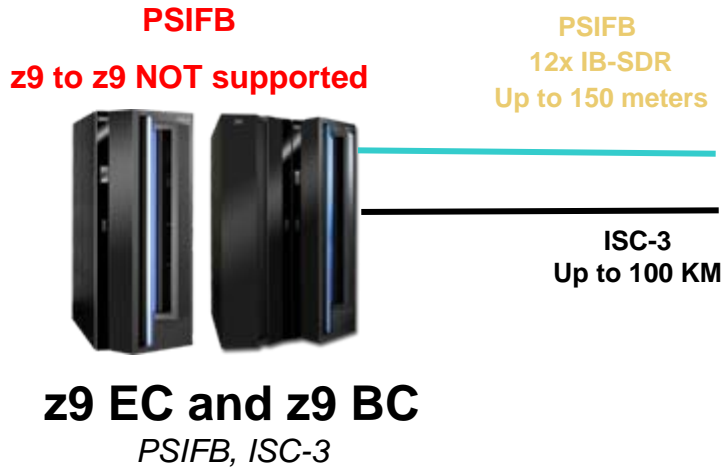


- HMC Application level must be equal or higher than the level of Support Element consoles it manages.
- All servers and CFs that need role assignment in the STP-only CTN be defined objects to any HMC used to manage the CTN.
- Strongly recommended that all servers and CFs in the STP-only CTN or Mixed CTN be defined objects to any HMC in order to have the capability for CTN reconfigurations
 - Useful after recovery
 - Even remote HMCs should define all servers and Coupling Facilities in the CTN.
- HMC used to
 - Dial out to External Time Source
 - Provide NTP server function

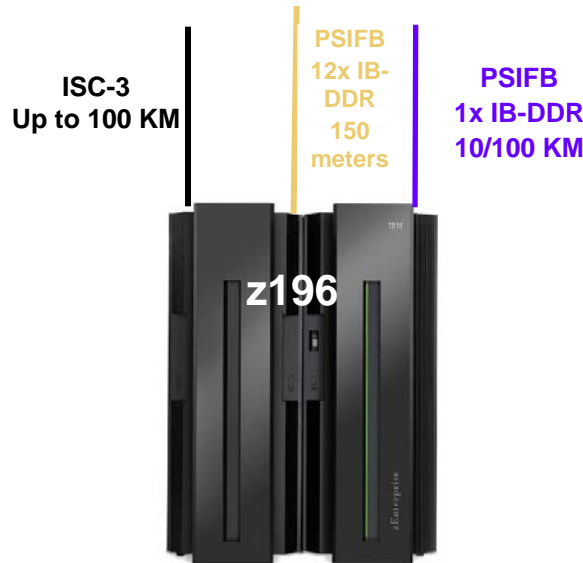
Coupling Link Planning

- **To transmit timing information, STP can choose any defined coupling link which is online between two System z servers.**
 - Transmit/receive Coupling Facility (CF) data
 - Transmit/receive Server Time Protocol (STP) timing information
- **Integrated Cluster Bus (ICB) copper links**
 - ICB-3 (FC 0993)
 - Link data rate of 1 Gigabyte per second (GBps)
 - Used to connect z9 EC, z9 BC, z990, z890, z900, z800 at a distance of 7 meters (m).
 - **Not supported on z196, z10 EC or z10 BC**
 - ICB-4 (FC 3393)
 - Link data rate of 2 GBps
 - Used to connect z10 EC, z10 BC, z9 EC, z9 BC, z990, and z890 at a distance of 7 m.
 - **Not supported on z196**
- **Inter System Channel (ISC) fiber optic links**
 - ISC-3 (FCs 0217, 0218, 0219)
 - Link data rate of 2 Gigabits per second (Gbps)
 - Used to connect z196, z10 EC, z10 BC, z9 EC, z9 BC, z990, and z890, z900, z800 at a distance of 10 kilometers (km) – unrepeated
- **Parallel Sysplex InfiniBand (PSIFB) fiber optic links**
 - 12x IB-DDR (z196 or z10 only FC 0163)
 - 12x IB-SDR (z9 to z196 or z10 FC 0167)
 - 1x IB-DDR (z196 or z10 to z196 or z10 only FC 0168) – for extended distances

z196 Parallel Sysplex[®] coexistence of Servers/CFs and coupling connectivity

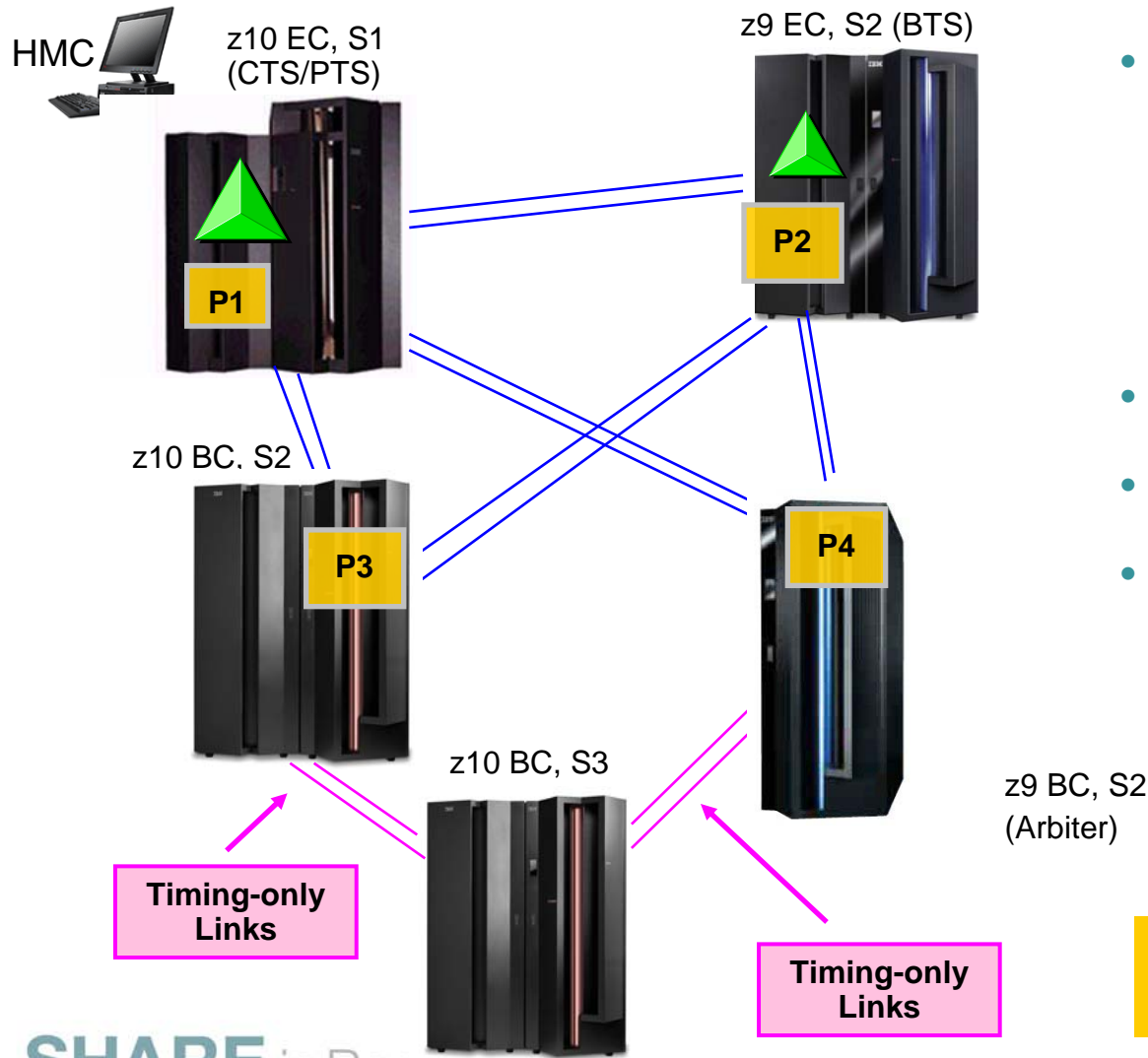


z800, z900
z890 and z990
Not supported!



Note: ICB-4s and ETR
NOT supported on z196

Timing-only Links



- Coupling links that allow two servers to be synchronized when a CF does not exist at either end of link
 - Typically required when servers requiring synchronization not in a Parallel Sysplex (for example XRC)
- HCD enhanced to define Timing-only links
- Can be defined in either Mixed CTN or STP-only CTN
- Timing-only links used to transmit STP messages only

May require purchase of additional CF links

P1, P2, P3, P4 – systems in a Parallel Sysplex

Hardware Configuration Dialog: Timing-only links

```
Connect to CF Channel Path

Specify the following values.

Source processor ID.. . . . : SCZP901
Source channel subsystem ID . : 0
Source channel path ID . . . . : 06
Source channel path type . . . : CFP

Destination processor ID . . . . . SCZP101 +
Destination channel subsystem ID . . 0 +
Destination channel path ID . . . . 02 +

Timing-only link . . . . . Yes
```

**Supported by
HCD and HCM**

- A timing-only link is established via HCD CF Channel Path Connectivity List panel
 - Like coupling links, timing-only links can be defined as dedicated, reconfigurable, shared, or spanned.
- The default for the **Timing-only link** field is **No**
 - If the user selects a timing-only link, HCD generates an STP control unit on each side of the connection, and no devices.

Note: The addition of timing-only links is fully supported by the Dynamic I/O Reconfiguration process so they can be added non-disruptively.

Hardware Configuration Dialog: Timing-only links

- For a timing-only link, HCD performs the following checks:
 - CHPIDs of a timing-only link must belong to different servers.
 - A timing-only link cannot be looped back into the same server.
 - If a CF connection already exists between two servers,
 - HCD does not allow defining a timing-only connection between these servers.
 - Also, if a timing-only link already exists between two servers, HCD will not allow defining a CF connection between these servers

Rule of thumb

- If there is an ICF or CF at either end of the definition, define a coupling link in HCD
- This will provide better positioning in case link needed for CF data in the future

Multi-Site Sysplex planning



- IBM supports only those DWDM products qualified by IBM for use in multi-site sysplex applications, such as GDPS®
- The latest list of qualified DWDM vendor products can be found on the Resource Link™ Web site at:
 - <https://www.ibm.com/servers/resourcelink/>
 - They are listed under the Hardware Products for Servers on the Library page
- Plan for redundant, diverse fiber routes between sites to help avoid a single point of failure of the fiber trunk
- Please ensure that the vendor qualification document is inspected carefully by a DWDM technical expert.
 - The document is written to be very specific (unit number, version number, applicable features that are qualified for STP). Time Division Multiplexing (TDM) may (or may not) be qualified, depending on the vendor.

Multi-Site Sysplex planning (continued)

- To transmit timing information, STP can choose any defined coupling link which is online between two System z servers.
- If coupling links are configured over DWDM equipment, **all** coupling links must use specific DWDM hardware (optical modules, transponders, TDM modules) with interface cards qualified by IBM for STP.
 - Cannot configure the links over a mixture of qualified and unqualified equipment,
 - STP may choose a coupling link configured over an unqualified connection.
 - May result in timing problems where servers may become unsynchronized without your knowledge.
- Only specific vendor models at specific releases have been qualified to TDM coupling links when used for STP message exchanges
 - **Example:** Cisco has a qualified 10G Muxponder module that is qualified for ISC-3 links when transferring CF data but **NOT QUALIFIED** for ISC-3 links when also exchanging STP messages

Selection of qualified DWDM

- **Selecting qualified WDM vendor does not mean that WDM model selected is qualified**
 - Vendors do not qualify all models
- **Selecting qualified WDM model does not mean that specific Release level is qualified**
 - Vendors do not qualify all release levels
- **Ensure that the vendor qualification letter is inspected carefully by a DWDM technical expert.**
 - Letter specifies model number, release level, interface modules qualified, protocols, application limitations, etc

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- STP Overview
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External Time Source Options

- **Dial-out from HMC to time services (available on z196, 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
 - **Statement of Direction (Modem support not available on the next high-end server)**
- **NTP server (available on z196, 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 z196, z10 and z9)**
 - Pulse per second (PPS) provides enhanced accuracy
 - *10 microseconds vs 100 milliseconds*

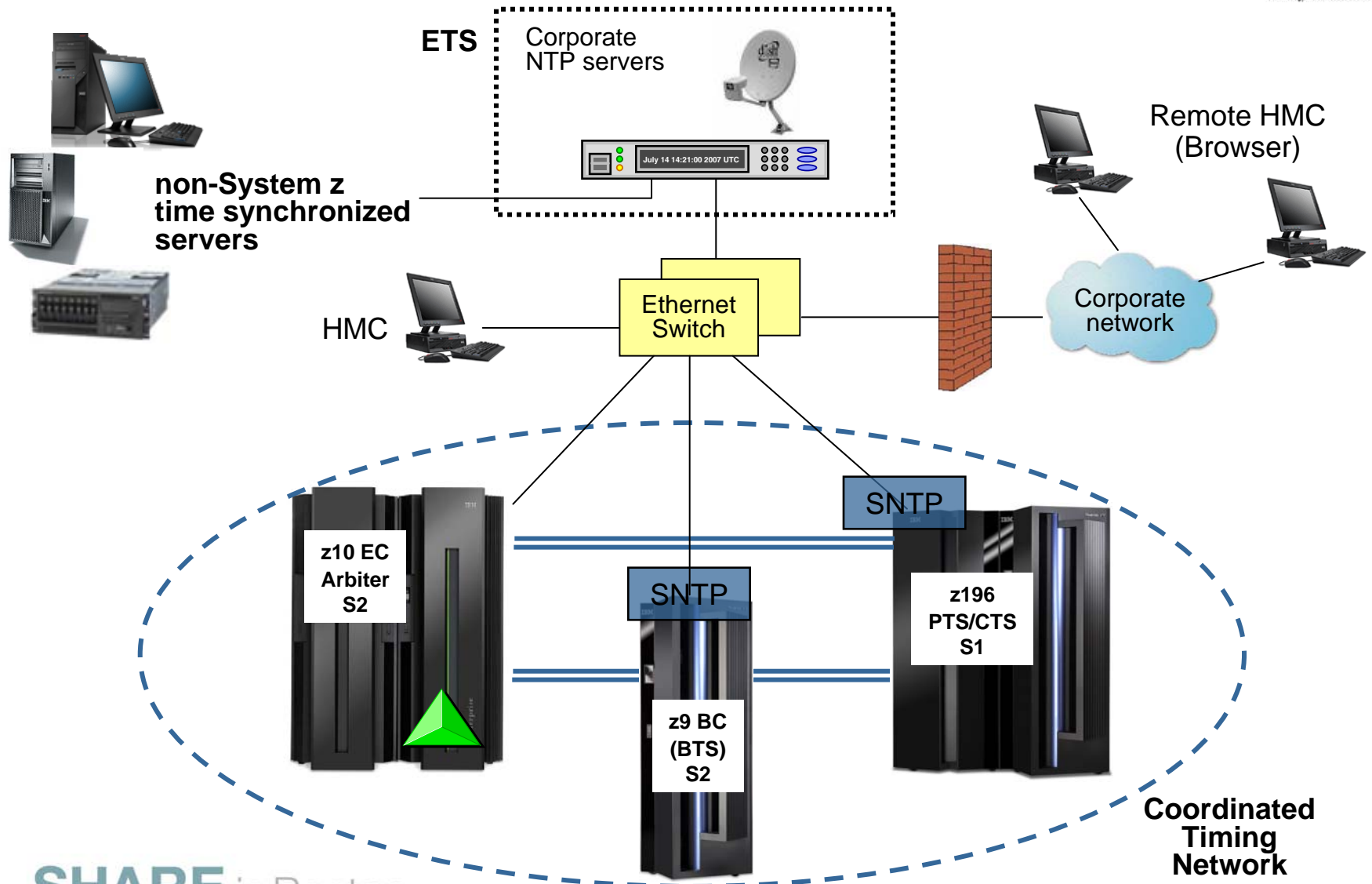
Network Time Protocol (NTP) client support

- **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 z196, 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

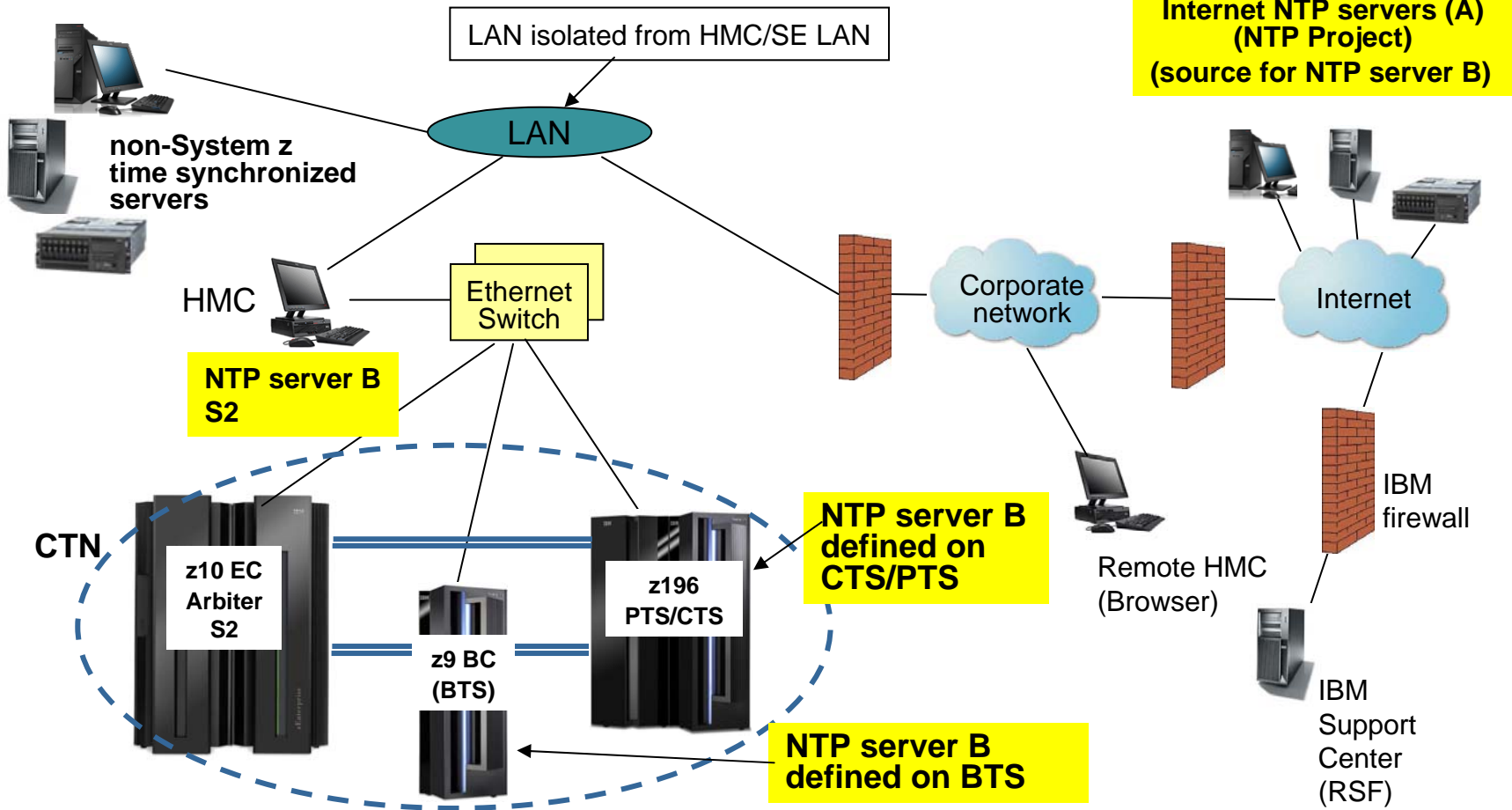
NTP Server Planning

- 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)

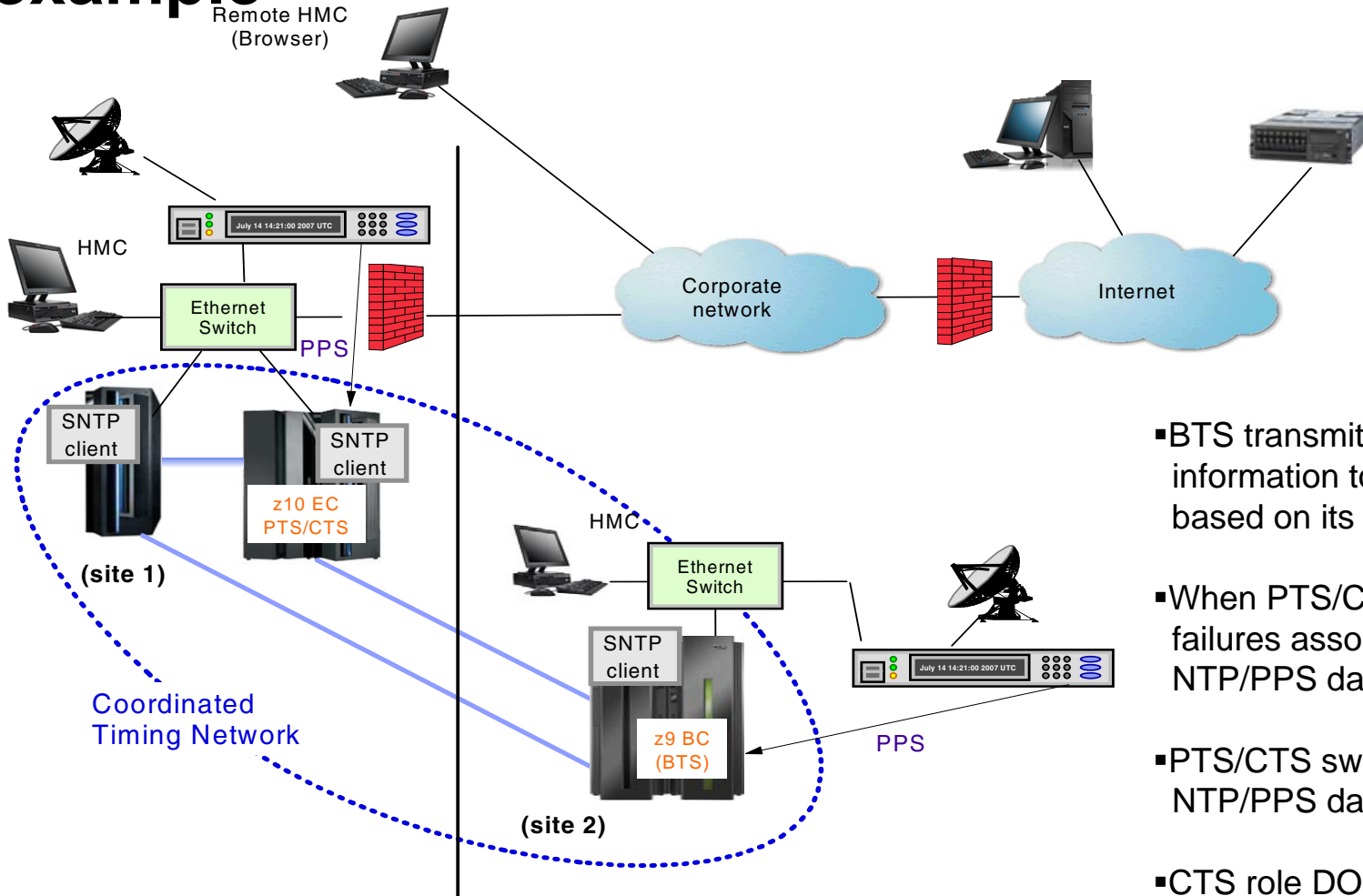


NTP Server Redundancy Recommendations

- **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

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Software Prerequisites

- **z/OS 1.7 or higher**
 - z/OS 1.7 - Lifecycle Extension for z/OS V1.7
 - z/OS 1.8 - Lifecycle Extension for z/OS V1.8
 - z/OS 1.9 - Lifecycle Extension for z/OS V1.9
- **Additional PTFs may be required**
 - Maintenance can be applied using “rolling IPL” process
- **Check Preventive Service Planning (PSP) buckets**
- **To simplify identification of PTFs for STP, functional PSP bucket created**
 - SMP-E 3.5
- **Coexistence with z/OS 1.4 through z/OS 1.6**
 - Mixed CTN can include pre-1.7 systems
 - PTFs required for toleration code
 - z/OS 1.4 through 1.6 – service has been discontinued

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 | **TIMEDELTA* ss**
 - ss = 0 – 99 seconds

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Server role planning

- Preferred Time Server (PTS) / Current Time Server (CTS)
 - **Location**
 - Most important site if multi-site configuration
 - Recovery considerations as to which site or server survives after outage
 - *Note: For a two site CTN, recommendation is to locate Arbiter in same site as PTS/CTS*
 - **Technology**
 - Enhancements may be available only on latest server technology
 - **Maintenance**
 - Server requiring frequent maintenance may not be best choice
 - STP will block disruptive actions on server assigned CTS
 - **Connectivity**
 - Must have connectivity to both the BTS and the Arbiter
 - Standalone CFs may provide best connectivity, but
 - *Will not produce z/OS messages for operations or interception by automation routines.*
 - *CTN information will be available from z/OS images on other servers*

Server role planning (continued

- **Backup Time Server (BTS)**
 - Must have connectivity to PTS and Arbiter
 - Should have at least the same connectivity to other servers as the PTS
 - BTS can become CTS (recovery)

- **Consider reassigning special roles when STP recovery results in one of the “normal” special role servers to be down (planned or unplanned)**
 - For example, if PTS/CTS down, and BTS has taken over as CTS
 - BTS is now a potential Single Point of Failure (SPOF)
 - No other server can now take over as CTS if second failure follows

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Operational Safeguards

- **To prevent against operational error, new safeguards have been added:**
 - **Execution of a disruptive task on a server that is configured as Current Time Server and has STP connectivity to S2 servers blocked**
 - Disruptive tasks such as: activate, deactivate, power off, power-on reset, disruptive switch to alternate SE are not permitted
 - CTS role has to be assigned to another server prior to disruptive action being allowed
 - **Accidental deconfiguration of the last timing link between any two servers rejected**
 - If last timing link condition is detected, explicit CHPID reconfiguration attempts on z/OS® V1R7 or higher servers are rejected
 - *CF CHP(xx), OFF*
 - *CF CHP(xx), OFF, FORCE*
 - Must now use either the HMC or the SE to reconfigure the Channel Path off for this “last timing link”

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Additional Information

- **Redbooks®**

- Server Time Protocol Planning Guide SG24-7280
- Server Time Protocol Implementation Guide SG24-7281
- **Server Time Protocol Recovery SG24-7380 (new)**

- **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/pso/stp.html

- **Systems Assurance**

- The IBM team required to complete a Systems Assurance Review (SAPR Guide SA06-012) and complete Systems Assurance Confirmation Form via Resource Link
 - <http://w3-03.ibm.com/support/assure/assur30i.nsf/WebIndex/SA779>

- **Techdocs and WSC Flashes**

- <http://www-03.ibm.com/support/techdocs/atmastr.nsf/Web/Techdocs>
 - Search on “STP”



IBM Implementation Services for System z – Server Time Protocol (6948-J56)



Offering Description	<ul style="list-style-type: none"> • This offering is designed to assist clients to quickly and safely implement Server Time Protocol within their existing environments. STP provides clients with the capability to efficiently manage time synchronization within their multi-server infrastructure. Following best practices and using detailed planning services, IBM helps clients identify various implementation models and engage in the appropriate configuration required to effectively support STP for driving a more responsive business and IT infrastructure.
Program, Play, Industry Alignment	<ul style="list-style-type: none"> • Infrastructure Improvement; Energy Efficiency; Better performance and lower operational cost
Client Value (<i>enables customers to...</i>)	<ul style="list-style-type: none"> • Swift and secure implementation of STP for improved availability, integrity and performance • Improves multi-server time synchronization without interrupting operations • Enables integration with next generation of System z infrastructure
Target Audience	<ul style="list-style-type: none"> • Primarily core, Large Enterprise customers. • Existing z midrange clients
Key Competitors	<ul style="list-style-type: none"> • In house staff
Competitive Differentiation	<ul style="list-style-type: none"> • Leverages best practices with secure implementation • Short implementation time – lower risk • Provides support and facilitates knowledge sharing through IBM's mainframe expertise
Proof Points & Claims for Client Value / Differentiation	<ul style="list-style-type: none"> • Need to safely implement a reliable replacement for Sysplex Timer® while maintaining continuous operations • Cost of providing and maintaining hardware, floor space and solution support for additional Sysplex Timer intermediate site • Lack of in-house expertise, skills and resources for implementing Server Time Protocol
Engagement Portfolio	<ul style="list-style-type: none"> • http://spimweb1.boulder.ibm.com/services/sosf/dyno.wss?oid=50423&loc=All&langcd=en-US#1
Offering Manager	<ul style="list-style-type: none"> • Anna Lee/Southbury/IBM, 512-590-8914, T/L: 268-9318

IBM Announces – IBM Implementation Services for System z – Server Time Protocol



Implementation of STP for improved availability and performance

Offering

Assist clients to quickly and safely implement Server Time Protocol within their existing environments. IBM helps clients identify various implementation models and engage in the appropriate configuration required to effectively support STP for driving a more responsive business and IT infrastructure

Customer Value:

- Improves multi-server time synchronization without interrupting operations***
- Enables integration with next generation of System z infrastructure***
- Swift and secure implementation of STP for improved availability, integrity, and performance***
- Reduces hardware maintenance and power costs while eliminating intermediate site requirements for Sysplex Timer***



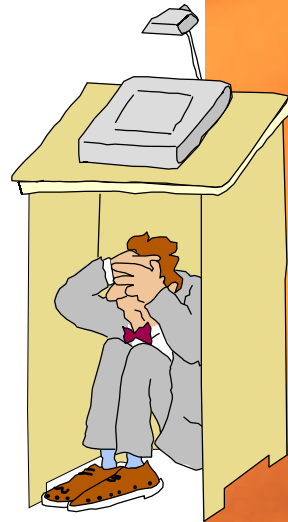
**Leverages IBM's
knowledge and best
practices to help
implementation of
Server Time Protocol**

Reference Material - Terminology

- | | | | |
|--------|------------------------------------|--------------|---------------------------------------|
| • APAR | Authorized Program Analysis Report | • NTP | Network Time Protocol |
| • ARB | Arbiter | • PR/SM | Processor Resource / Systems Manager |
| • BTS | Backup Time Server | • PSIFB | Parallel Sysplex |
| • CF | Coupling Facility | • Infiniband | |
| • CTS | Current Time Server | • PTF | Temporary Program Fix |
| • CTN | Coordinated Timing Network | • PTS | Preferred Time Server |
| • DWDM | Dense Wave Division Multiplexer | • SW and | Software (programs operating systems) |
| • | | • SE | Support Element |
| • ETR | External Time Reference | • TPF | Operating System |
| • ETS | External Time Source | • UTC | Coordinated Universal Time |
| • FC | Feature Code | • zVM | Operating System |
| • HMC | Hardware Management Console | • zVSE | Operating System |
| • | | • z/OS | Operating System |
| • HCA | Host Channel Adapter | • z/VM | Operating System |
| • ICB | Integrated Cluster Bus | | |
| • IPL | Initial Program Load | | |
| • ISC | InterSystem Coupling Channel | | |
| • LAN | Local Area Network | | |
| • LIC | Licensed Internal Code | | |
| • LPAR | Logically Partition | | |

Questions?

- **What are your questions?**



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BACKUP SLIDES

PTS/CTS role planning

- **Location**
 - Most important site if multi-site configuration
 - Recovery considerations as to which site or server survives after outage
 - Note: For a two site CTN, recommendation is to locate Arbiter in same site as PTS/CTS
- **Technology**
 - Enhancements may be available only on latest server technology
 - Examples of functions not available on z990, z890
 - NTP Client support
 - Restore STP configuration for two server CTN
- **Maintenance**
 - Server requiring frequent maintenance may not be best choice
 - STP will block disruptive actions on server assigned CTS

PTS/CTS role planning (continued)

- **Connectivity**

- Standalone CFs will typically provide best connectivity to other servers requiring time synchronization
- Existing coupling link connectivity can be used to exchange STP messages, but
 - What additional connectivity do you need to follow connectivity rules and best practices recommendations for reassigning roles?
- Standalone CFs will not produce z/OS messages for operations or interception by automation routines
 - Information messages at IPL or interrupt time may not be displayed
 - *IEA380I THIS SYSTEM IS NOW OPERATING IN STP TIMING MODE.*
 - *IEA381I THE STP FACILITY IS NOT USABLE. SYSTEM CONTINUES IN LOCAL TIMING MODE*
 - Warning messages identifying a condition being associated for a given server.
 - *If the condition being raised relates to connectivity between two servers, the information might be available to a z/OS system image at the other end of the link.*
 - *However, if both ends of the link are CF partitions, no warning message is available to the user.*

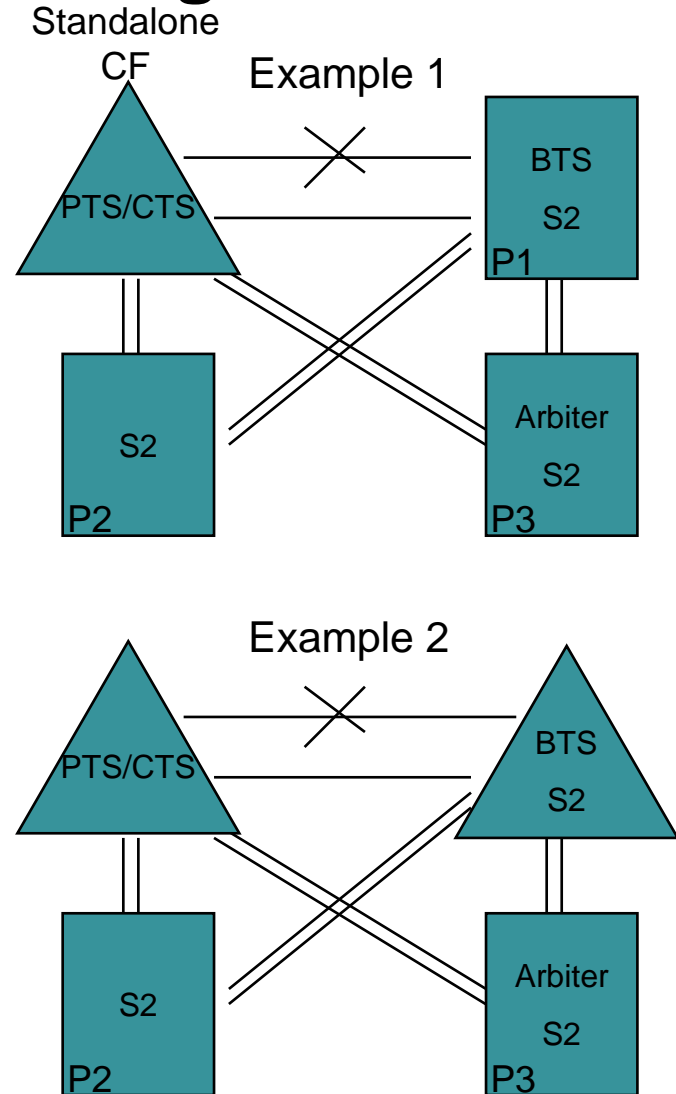
Examples of z/OS warning messages

- If the condition being raised relates to connectivity between two servers, the information might be available to a z/OS system image at the other end of the link.

- Example 1: If one of the two coupling links between PTS/CTS and BTS fails,
 - z/OS image P1 will still report
 - **IEA382I THIS SERVER HAS ONLY A SINGLE LINK AVAILABLE FOR TIMING PURPOSES**

- Example 2: If both ends of the link are CF partitions, no warning message is available to the user on the z/OS console
 - HMC will post a hardware message related to the link failure, but not a warning message that you have a potential SPOF

P1, P2, P3 – z/OS images in a Sysplex



PTS/CTS role planning - z/OS Messages

- There are many IEAxxx and IXCxxx messages which report current and changed timing status.
- As an example, the following reports the result of a successful migration from a mixed CTN to an STP-only CTN.
IXC438I COORDINATED TIMING INFORMATION HAS BEEN
UPDATED
FOR SYSTEM: sysname
PREVIOUS CTNID: IBM_NET1-15
CURRENT CTNID: IBM_NET1
- Question: Is it significant that these IEAxxx and IXCxxx messages are not displayed if the Standalone CF is assigned the role of PTS/CTS?

For a list of Supervisor, XCF/XES messages related to STP see Backup Slides

PTS/CTS role planning - z/OS Messages (contd)



- In general, there are no z/OS messages that are posted **only** on the PTS, BTS, or Arbiter.
- **Certain messages will not appear on the CTS since it is the time source**
 - IEA382I THIS SERVER HAS ONLY A SINGLE LINK AVAILABLE FOR TIMING PURPOSES.
 - IEA383I THIS SERVER RECEIVES TIMING SIGNALS FROM ONLY ONE OTHER NETWORK NODE.
 - IEA281I STP SYNC CHECK THRESHOLD EXCEEDED. CPC CONTINUES IN LOCAL MODE.
 - IEA390I TOD CLOCKS DYNAMICALLY ADJUSTED TO MAINTAIN STP SYNCHRONISM.
- **Following message may not appear on some special role servers**
 - IEA388I THIS SERVER HAS NO CONNECTION TO THE nnnnnnnnnn
 - Where nnnnnnnnnnn = 'PREFERRED '| 'BACKUP '| 'ARBITER '
 - For example,
 - IEA388I THIS SERVER HAS NO CONNECTION TO THE BACKUP will never appear on a z/OS system running on the BTS.

Need to examine complete list of STP z/OS messages before deciding significance of Standalone CF not displaying STP messages

Summary – Server role planning

- After deciding which server assigned PTS/CTS, similar review should be made for the BTS
 - If multi-site sysplex, Arbiter should be placed in same site as PTS/CTS
- Many considerations to evaluate before deciding which servers assigned special roles
 - Location, Technology, Maintenance
 - Connectivity
 - Stand alone CF
 - z/OS message automation
- Consider following best practices recommendations for reassignment of roles
- Every customer needs to do their own assessment
 - No single recommendation fits all configurations

STP ETR Messages - Supervisor

- **IEA031I** STP ALERT RECEIVED. STP ALERT CODE = nn
 - Alert code is x'01' to x'84'
- **IEA380I** THIS SYSTEM IS NOW OPERATING IN STP MODE.
- **IEA381I** THE STP FACILITY IS NOT USABLE. SYSTEM CONTINUES IN LOCAL MODE.
- **IEA382I** THIS SERVER HAS ONLY A SINGLE LINK AVAILABLE FOR TIMING PURPOSES.
- **IEA383I** THIS SERVER RECEIVES TIMING SIGNALS FROM ONLY ONE OTHER NETWORK NODE.
- **IEA384I** SETETR COMMAND IS NOT VALID IN STP TIMING MODE.
- **IEA385I** CLOCKxx ETRDELTA & TIMEDELTA BOTH SPECIFIED. yyyyyyy IGNORED.
- **IEA387I** STP DATA CANNOT BE ACCESSED. SYSTEM CONTINUES IN yyyyy TIMING MODE.
- **IEA388I** THIS SERVER HAS NO CONNECTION TO THE nnnnnnnnnn
- **IEA389I** THIS STP NETWORK HAS NO SERVER TO ACT AS nnnnnnnnnn
- **IEA392I** STP TIME OFFSET CHANGES HAVE OCCURRED.
- **IEA393I** ETR PORT n IS NOT OPERATIONAL. THIS MAY BE A CTN CONFIGURATION CHANGE.
- **IEA394A** THIS SERVER HAS LOST CONNECTION TO ITS SOURCE OF TIME.
- **IEA395I** THE CURRENT TIME SERVER HAS CHANGED TO THE cccccccccccc
 - (where ccccc is BACKUP or PREFERRED)

STP ETR Messages - XCF

- **IXC434I** SYSTEM sysname HAS TIMING DEFINITIONS THAT ARE NOT CONSISTENT WITH THE OTHER ACTIVE SYSTEMS IN SYSPLEX sysplex-name.
 - EFFECTIVE CLOCK VALUES ARE NOT CONSISTENT
 - SYSTEM: sysname IS RUNNING IN LOCAL MODE
 - SYSTEM: sysname IS USING ETR NET ID: xx
 - SYSTEM: sysname IS USING CTN ID: yyyyyyyy-xx
 - SYSTEM: sysname IS USING CTN ID: yyyyyyyy
 - where:
 - xx = ETR NET ID in use by system sysname
 - yyyyyyyy = CTN ID in use by system sysname
 - yyyyyyyy-xx = CTN ID in use by system sysname
- **IXC435I** ALL SYSTEMS IN SYSPLEX sysplexname ARE NOW SYNCHRONIZED TO THE SAME TIME REFERENCE.
 - SYSTEM: sysname IS USING ETR NETID: ee
 - SYSTEM: sysname IS USING CTNID sssssss-ee
 - SYSTEM: sysname IS USING CTNID sssssss

STP ETR Messages – XCF (continued)

- **IXC437I** - SYSTEMS CAN NOW ENTER THE SYSPLEX USING
 - COORDINATED SERVER TIME CTNID=ssssssss-ee
 - COORDINATED SERVER TIME CTNID=ssssssss

- **IXC438I** COORDINATED TIMING INFORMATION HAS BEEN UPDATED FOR SYSTEM: sysname
 - PREVIOUS ETR NETID: ee
 - PREVIOUS CTNID: ssssssss-ee
 - PREVIOUS CTNID: ssssssss

 - CURRENT ETR NETID: ee
 - CURRENT CTNID: ssssssss
 - CURRENT CTNID: ssssssss-ee
 - CURRENT TIMING: LOCAL

- **IXC439E** ALL SYSTEMS IN SYSPLEX sysplexname ARE NOT SYNCHRONIZED TO THE SAME TIME REFERENCE.
 - SYSTEM: sysname IS USING ETR NETID: ee
 - SYSTEM: sysname IS USING CTNID ssssssss-ee
 - SYSTEM: sysname IS USING CTNID ssssssss
 - SYSTEM: sysname IS RUNNING IN LOCAL MODE

- **IXC468W** XCF IS UNABLE TO ACCESS THE CTN AND HAS PLACED THIS SYSTEM INTO NON-RESTARTABLE
 - WAIT STATE CODE: 0A2 REASON CODE: 158

STP ETR Messages – XES

- **IXL160E** CF REQUEST TIME ORDERING: REQUIRED AND NOT-ENABLED
 - COUPLING FACILITY SIMDEV.IBM.EN.CF0100000000
 - PARTITION: 00 CPCID: 00
 - REASON: ETR NETID MISMATCH - CF ETR NETID: 0F
 - REASON: ETR NOT CONNECTED TO COUPLING FACILITY
 - REASON: MESSAGE TIME ORDERING FUNCTION FAILURE

 - REASON: TIME ORDERING FUNCTION NOT INSTALLED ON THE CF
 - REASON: TIME ORDERING FUNCTION NOT INSTALLED ON THIS SYSTEM
 - REASON: CF IS OUT OF SYNC WITH TIMING NETWORK
 - REASON: CTNID MISMATCH - CF CTNID: CTNNET01 0F

- **IXL162E** CF REQUEST TIME ORDERING: REQUIRED AND WILL NOT BE ENABLED
 - COUPLING FACILITY SIMDEV.IBM.EN.CF0100000000
 - PARTITION: 00 CPCID: 00
 - REASON: CTNID MISMATCH - CF CTNID: CTNNET01 0F