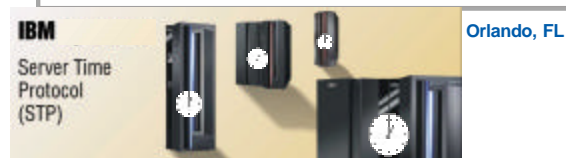


# Z15

## Introduction to Server Time Protocol

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**SYSTEM z9 AND zSERIES EXPO**  
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## Agenda

- Overview
  - Description
  - Key attributes
- Enhancements compared to External Time Reference (ETR) network
- Terminology
  - Coordinated Timing Network (CTN)
  - Stratum
- Mixed CTN
- STP-only CTN
- Timing-only links
- Hardware and Software Prerequisites
- Timing Modes
- Summary

## What is STP?

- Provides 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)
- Server-wide facility implemented in IBM System z9™ Enterprise Class, z9 Business Class, z990, 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)
    - (for example z/OS)
  - STP not available on z900, z800 or 9672 Gx servers
- Message based time synchronization protocol
  - Similar to Network Time Protocol (NTP) – an industry standard
  - Timekeeping information transmitted over Coupling Links
    - ISC-3 links (Peer mode), ICB-3 and ICB-4 links
  - **NOT standard NTP**

## Key Attributes

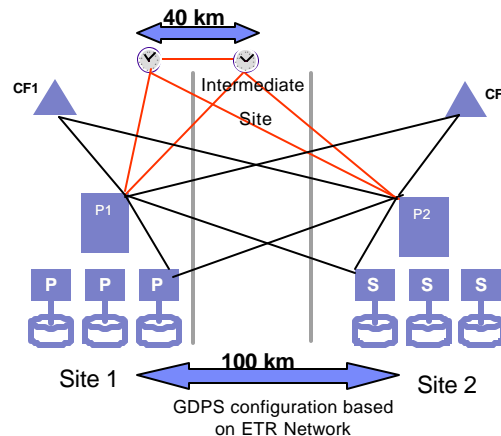
- Provides improved time synchronization, compared to Sysplex Timer, for servers in a Sysplex or non-Sysplex configuration
- Scales with distance
  - Servers exchanging data over fast short links require more stringent synchronization than servers exchanging data over long distances
- Supports a multi-site timing network of up to 100 km over fiber optic cabling
  - Allows a Parallel Sysplex to span 100 km
- Potentially reduces the cross-site connectivity required for a multi-site Parallel Sysplex
  - Dedicated links not required to transmit timekeeping information
- Allows concurrent migration from an existing External Time Reference (ETR) network
- Allows coexistence with ETR network

## Key Attributes (continued)

- Allows
  - Use of dial-out time services to initialize Coordinated Server Time (CST) to within +/- 100 ms of international time standard (UTC)
    - NIST Automated Computer Time Service (ACTS)
    - IEN Telephone Date Code (CTD)
    - NRC Canadian Time Service (CTS)
  - Scheduling of periodic dial-outs to time services, so that CST can be gradually steered to an international time standard (UTC)
  - Setting of local time parameters,
    - Time zone offset,
    - Daylight Saving Time (DST) offset,
    - Leap Seconds offset
  - Automatic updates of DST offset based on time zone algorithm
  - Adjustment of CST up to +/- 60 seconds

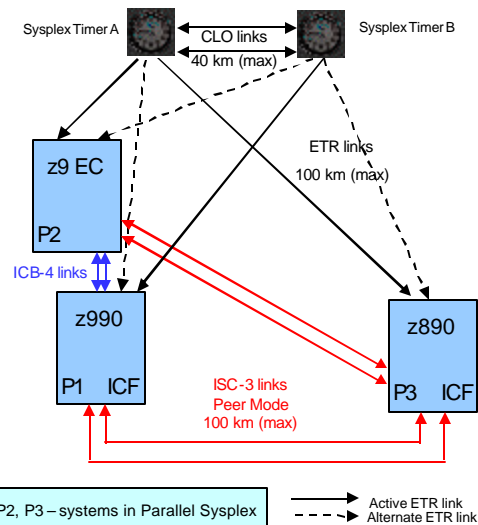
## STP Enhancements compared to ETR Network

- STP supports a multi-site timing network of up to 100 km without requiring an intermediate site
- Fiber distance between Sysplex Timers cannot exceed 40 km
  - Intermediate site to locate second timer recommended to avoid a single point of failure, if data centers more than 40 km apart



## STP Enhancements compared to ETR Network (continued)

- Time of Day (TOD) clocks of servers must be synchronized within the fastest messaging time between servers
- STP design allows more stringent synchronization between z9 EC and z990 (shortest messaging time in example) compared to between z990 and z890 (longer messaging time in example)
- ETR Network does not scale with distance
  - “Best case” messaging times over ICB links in Parallel Sysplex (8 us approx) approaching “Worst case” TOD synchronization between CECs stepping to Sysplex Timers 40 km apart (4 us approx)



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## STP Enhancements compared to ETR Network (continued)

STP also provides the following additional value:

- Allows automatic adjustment of Daylight Saving Time offset based on time zone algorithm
  - With ETR network you need to schedule DST offsets at least twice a year manually at the Sysplex Timer console
- Allows gradual time adjustment of up to +/- 60 secs
  - Sysplex Timer allows time adjustments of up to +/- 4.999 secs
- Eliminates
  - Infrastructure requirements (space, power) to support Sysplex Timers
  - Sysplex Timer maintenance costs
  - Dark fiber requirements for multi-site sysplex for ETR and CLO links
    - Reduces fiber optic infrastructure requirements for DWDM ports, patch/trunk cables

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## Terminology

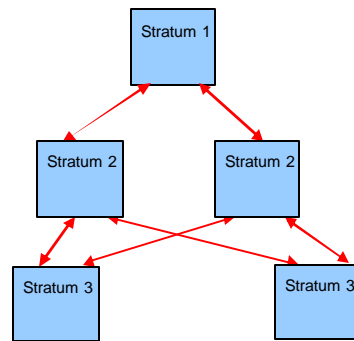
- STP-capable server/CF
  - z9 EC, z9 BC, z990, z890 server/CF with STP LIC installed
- STP-enabled server/CF
  - STP-capable server/CF with STP FC 1021 installed
  - STP panels at the HMC/SE can now be used
- STP-configured server/CF
  - STP-enabled server/CF with a CTN ID assigned
  - STP message exchanges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

## Terminology (continued)

- 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
    - CTN ID format
      - STP network ID only (ETR network ID field has to be null)

## Terminology (continued)

- STP transmits timekeeping information in layers or Stratum
  - Stratum 1 (S1)
    - Highest level in the hierarchy of timing network that uses STP to synchronize to 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 S3



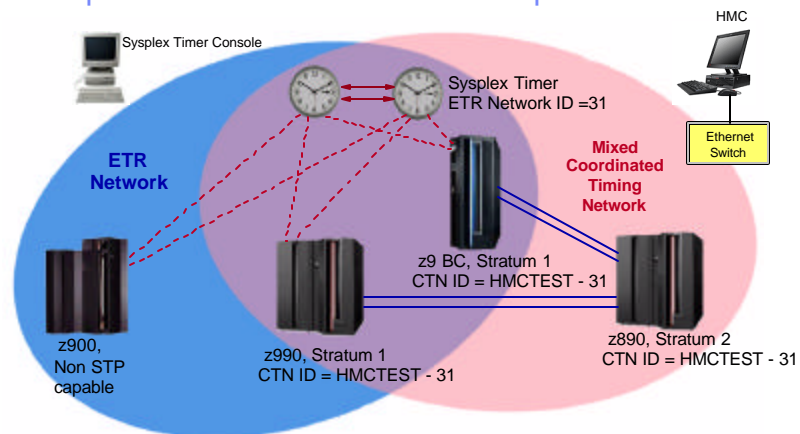
## Mixed Coordinated Timing Network (Mixed CTN)

- 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 Stratum 1 server for the Mixed CTN
  - Stratum 2 server/CF uses Stratum 1 as clock source
  - Stratum 3 server/CF uses Stratum 2 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 secs
- Hardware Management Console (HMC) must be used for Mixed CTN ID initialization and modification

## Mixed CTN (continued)

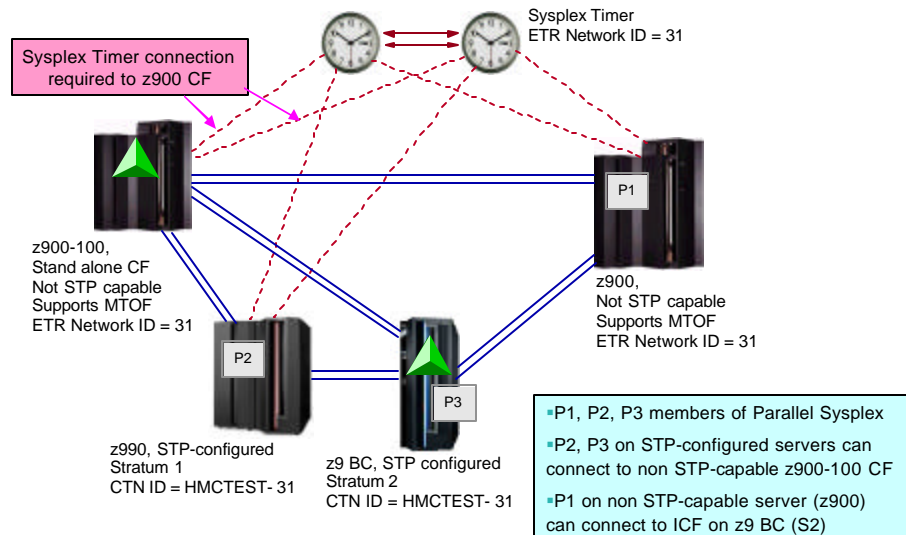
- Mixed CTN allows:
  - Concurrent migration from ETR network (with proper planning)
    - Concurrently migrate from existing ETR network to Mixed CTN
    - Concurrently migrate from Mixed CTN to ETR Network
      - Allows testing Mixed CTN during change window and go back concurrently to ETR network at start of production
  - Coexistence in the “same” timing network of
    - Servers/CFs that can only be synchronized to a Sysplex Timer (ETR network) and
    - Servers/CFs that can be synchronized with CST
    - In a Parallel Sysplex configuration, the only non STP-capable server and CF that can coexist are the z900 and z800 server and CF
      - Non STP-capable Server/CF MUST support Message Time Ordering Facility (MTOF)
      - Non STP-capable server/CF MUST be attached to Sysplex Timer

## Example: Coexistence of non STP-capable server



- z9 BC, z990, z900 synchronized to Sysplex Timer
- z9 BC, z990 are Stratum 1 servers
  - Two Stratum 1 servers recommended to avoid single point of failure
- z890 synchronized to either z9 BC or z990 via STP is a Stratum 2 server
  - z890 does not need ETR link connections
  - z890 can be located up to 100 km away from z9 BC, z990

## Example: Non STP-capable server and CF in a PS configuration



## STP-only CTN

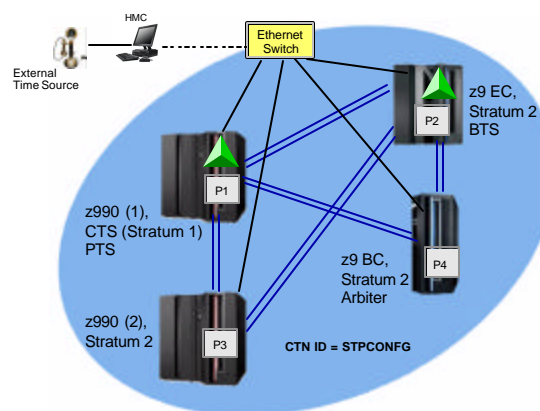
- All servers in STP-only CTN have to be STP-capable
  - 9037s no longer required
- Server roles
  - Preferred Time Server (PTS)
    - Server that is preferred to be the “active” Stratum 1 server
  - Backup Time Server (BTS)
    - Role is to take over as the Stratum 1 under planned or unplanned outages, without disrupting synchronization capability of STP-only CTN
  - Current Time Server (CTS)
    - “Active” Stratum 1 server
      - Only one “active” 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 international time standard (UTC)
    - Dial-out from HMC to set CST to within +/- 100 ms of UTC
  - Schedule periodic dial outs to maintain accurate time
  - 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
  - Concurrently migrate from Mixed CTN to STP-only CTN or
  - Concurrently migrate from existing ETR network to STP-only CTN
  - Concurrently migrate from STP-only CTN to Mixed CTN
    - Allows testing STP-only CTN during change window and go back concurrently to Mixed CTN or ETR network at start of production

## Example of STP-only CTN

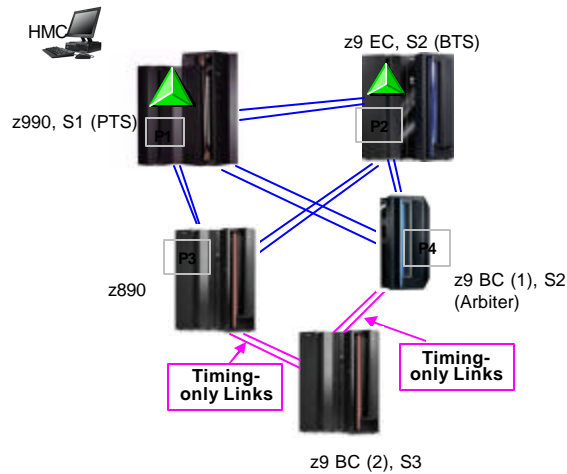


- Configuration has to be defined
  - Must assign PTS and CTS
  - Optionally assign BTS
    - Strongly recommended for continuous availability
  - Optionally assign Arbiter
    - Recommended for configurations of 3 or more servers/CFs
    - Improves recovery

STP can use existing Coupling links

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

## Timing-only Links



- Coupling links that allow 2 servers to be synchronized when a CF does not exist at either end of link
  - Typically required when synchronization needed in non Parallel Sysplex configurations
    - For example: Base sysplex; 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

## Prerequisites

### Hardware

- 9037-002 concurrent LIC upgrade
  - When migrating from ETR network
  - 9037 code changes to support STP Mixed CTN
- z9 server must be at EC Driver level 63J
  - Concurrently install all of the latest MCLs for this driver
  - STP prerequisite MCLs (LIC) will be installed
- z990 and z890 must be at EC Driver level 55K
  - Concurrently install all of the latest MCLs for this driver
  - STP prerequisite MCLs (LIC) will be installed
- HMC v2.9.1 (EC Driver level 64) or higher
  - Can upgrade z890/z990 HMC to new HMC code level
- Concurrently install STP Enablement MCL (FC 1021)

## Prerequisites

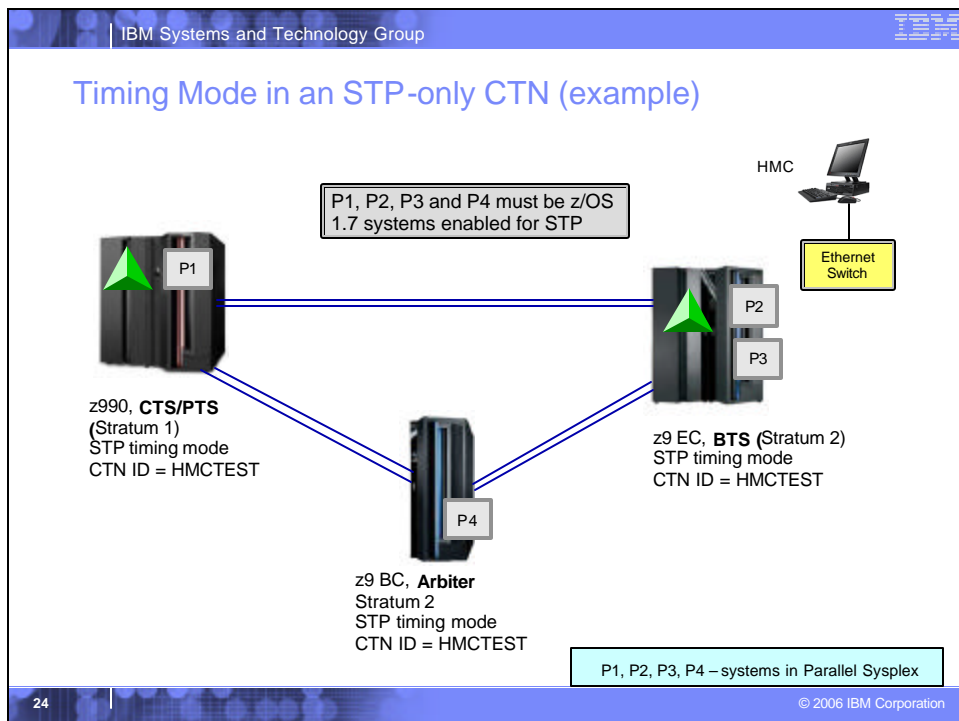
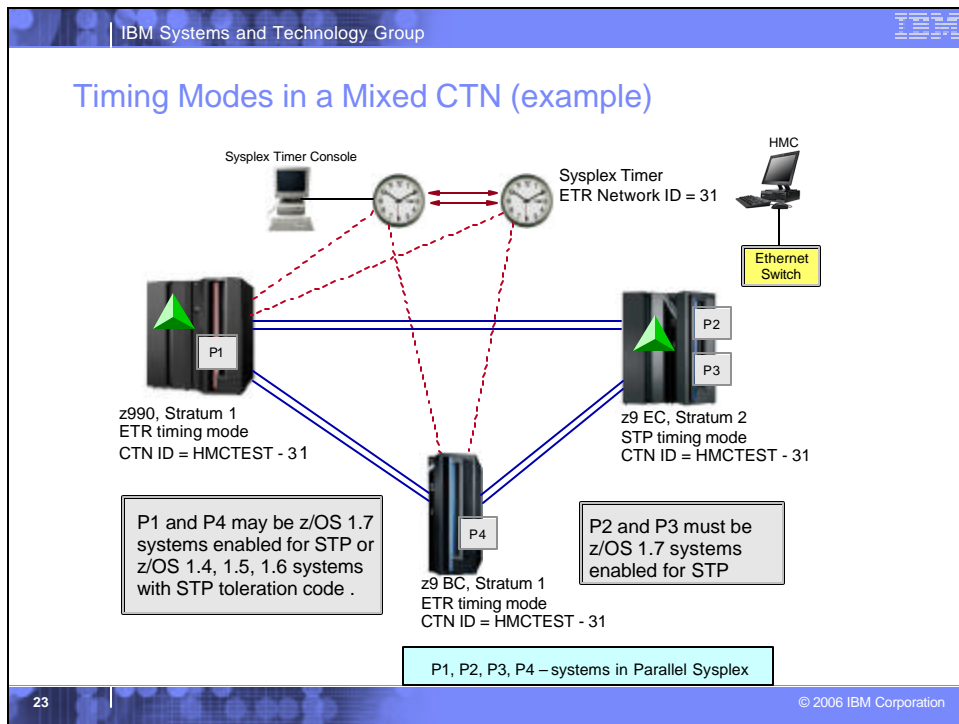
### ■ Software

- z/OS V1.7 or higher
- Additional software maintenance required for z/OS V1.7, V1.8
  - Includes STP enablement APAR
  - Maintenance can be applied using “rolling IPL” process
- Coexistence with z/OS V1.4 through z/OS V1.6
  - Mixed CTN can include pre-V1.7 systems
  - PTFs required for toleration code
- Check Preventive Service Planning (PSP) buckets
  - Listed in the 2084DEVICE, 2086DEVICE, 2094DEVICE and 2096DEVICE PSP buckets for the z990, z890, z9 EC and z9 BC respectively
- To simplify identification of PTFs for STP, functional PSP bucket created
  - Use the Enhanced Preventive Service Planning Tool (EPSPT)
  - <http://www14.software.ibm.com/webapp/set2/psp/srchBroker>

## CLOCKxx statements

- OPERATOR PROMPT|NOPROMPT
- TIMEZONE W|E hh.mm.ss
- ETRMODE YES|NO
- ETRZONE YES|NO
- SIMETRID nn
  - Where 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
  - Where ss = 0 - 99 seconds

\* New statements for STP



## Summary

- Server Time Protocol:
  - Allows multi-site sysplex distances to extend to 100 km without requiring an intermediate site
    - 100 km limit set by coupling protocol and links
  - Meets more stringent time synchronization requirements compared to ETR network
  - Scales with distance
  - Can share links used to exchange CF messages in a Parallel Sysplex to transmit STP messages
    - Does not require dedicated links to transmit timekeeping information
  - Allows concurrent migration from an ETR network
  - Allows coexistence with non-STP capable servers
  - Allows time to be set to a dialup service to within 100 ms
    - STP plans to improve this capability in 2007

## Additional Information

- Redbooks
  - Server Time Protocol Planning Guide SG247280
    - Available at announce time
  - Server Time Protocol Implementation Guide SG247281
    - Available at General Availability (GA)
- Education
  - Introduction to Server Time Protocol (STP)
    - Available on Resource Link
    - <https://www.ibm.com/servers/resourcelink>
- STP website
  - <http://www.ibm.com/systems/z/pso/stp.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