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z9 2007 Hardware Update

www.ibm.com/redbooks | STP Review and Enhancements

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Notices

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Slide 1

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Slide 2

Server Time Protocol Technical Overview - Agenda

- Description

- Key Attributes Summary

- Value

- Terminology

- Mixed Coordinated Timing Network

- STP-only Coordinated Timing Network

- Prerequisites

- Summary

- Backup

What is Server Time Protocol (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 EC, z9 BC, IBM eServer™ zSeries® 990 and 890 (z990, z890) Licensed Internal Code (LIC)
  - Single view of "time" to PR/SM™
  - PR/SM can virtualize this view of time to the individual partitions (LPARs)
  - STP not available on z900, z800 or 9672 Gx servers
- Message-based time synchronization protocol
  - Similar to Network Time Protocol (NTP) industry standard
  - Timekeeping information transmitted over Coupling Links
    - ISC-3 links (Peer mode), ICB-3 and ICB-4 links
  - NOT standard NTP

STP 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 100 km over fiber optic cabling
  - Allows a Parallel Sysplex® cluster to span up to 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

Key Attributes Continued …

- Allows
  - Use of dial-out time services to initialize Coordinated Server Time (CST) to within +/- 100 ms of time provided by the external time source
    - 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 an international time standard (UTC)
  - Attachment to a NTP server (S.O.D.)
    - Statement of Directions made October 2006

    S.O.D.

  - 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

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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

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Terminology Continued …

- Two types of CTN configurations possible:

  - Mixed CTN
    - Allows servers/CFs that are 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 …

- Sysplex Timer transmits timekeeping information to attached servers in a star pattern

- STP transmits timekeeping information in layers or Stratums:

- 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
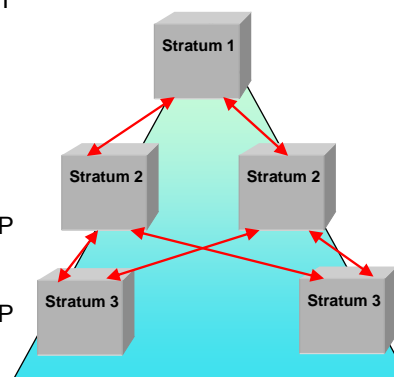
Time message will find a new path if needed

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 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 seconds
- Hardware Management Console (HMC) must be used for Mixed CTN ID initialization and modification

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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

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Example: Coexistence with non STP-capable server

HMC

Sysplex Timer Console

Sysplex Timer
ETR Network ID =31

ETR Network

Mixed Coordinated Timing Network

Ethernet Switch

z9 BC, Stratum 1
CTN ID = HMCTEST - 31

z900, Non STP capable

z990(1), Stratum 1
CTN ID = HMCTEST - 31

z990(2), Stratum 2
CTN ID = HMCTEST - 31

- z9 BC, z990(1), z900 synchronized to Sysplex Timer
- z9 BC, z990(1) are Stratum 1 servers
  - Two Stratum 1 servers recommended to avoid single point of failure

- z990(2) synchronized to either z9 BC or z990(1) via STP is a Stratum 2 server
  - z990(2) does not need ETR link connections
  - z990(2) can be located up to 100 km away from z9 BC, z990(1)

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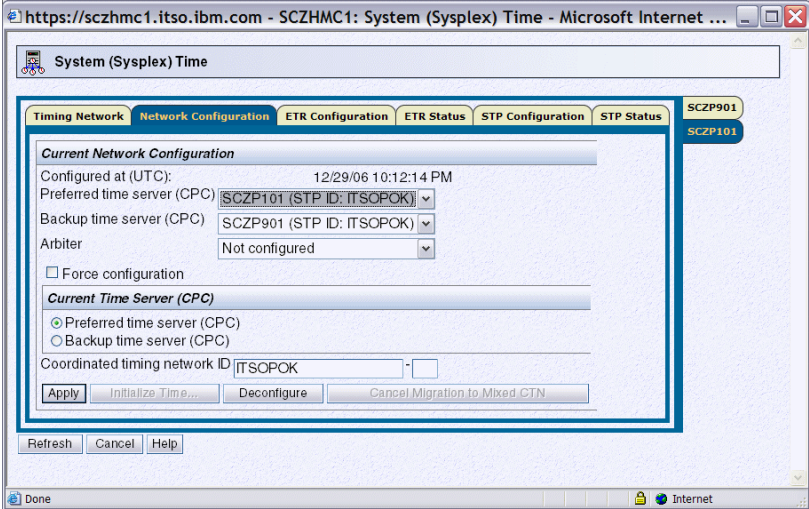
STP-only CTN

- 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

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STP-only CTN Roles

https://sczhmc1.itso.ibm.com - SCZHMC1: System (Sysplex) Time - Microsoft Internet ...

System (Sysplex) Time

| Timing Network | Network Configuration | ETR Configuration | ETR Status | STP Configuration | STP Status |

SCZP901
SCZP101

Current Network Configuration

Configured at (UTC):   12/29/06 10:12:14 PM
Preferred time server (CPC)   SCZP101 (STP ID: ITSOPOK)
Backup time server (CPC)   SCZP901 (STP ID: ITSOPOK)
Arbiter   Not configured

☐ Force configuration

Current Time Server (CPC)

⦿ Preferred time server (CPC)
○ Backup time server (CPC)

Coordinated timing network ID ITSOPOK   -

| Apply | Initialize Time... | Deconfigure | Cancel Migration to Mixed CTN |

| Refresh | Cancel | Help |

Done   🔒 Internet

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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 ETS
  - 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 (with proper planning)
  - 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.

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Slide 16: System (Sysplex) Time

Slide 17: CTN ID
- Coordinated Timing Network 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:
  - A field that defines the STP Network ID.
    - Eight characters (A-Z, a-z, 0-9, '-', and '_')
  - A field that defines the ETR Network ID.
    - 00-31

Example of STP-only CTN

- 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

STP can use existing Coupling links

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Network Time Protocol (NTP) client support – S.O.D.

- IBM intends to enhance the STP design to provide Network Time Protocol (NTP) client capability, so that Coordinated Server Time may be initialized and maintained to time provided by an NTP server.
  - The purpose of this function is to allow the same time across an enterprise comprised of heterogeneous platforms.

- Simple Network Time Protocol (SNTP) client support added to Support Element (SE) code of z9 to interface to Network Time Protocol (NTP) servers
  - Not available on z990 and z890 servers

- NTP server becomes the single time source (External Time Source (ETS)) for IBM System z servers, as well as other servers that have NTP clients (Unix, NT, etc)
  - NTP servers can be V3, V4, or SNTP
  - IPv4 support
  - Not available on z990 and z890 servers

- Time reference for NTP server can be GPS, dial-out, DCF-77, etc

- NTP servers have various options for stable oscillators used in case of loss of GPS or other input signal
  - Temperature Compensated (TCXO) – 21 milliseconds per day drift (typical)
  - Oven Compensated (OCXO) – 1 millisecond per day drift (typical)
  - Rubidium – 6 microseconds per day drift (typical)

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NTP Client Support – S.O.D.   (Continued …)

System (Sysplex) Time for SCZP101

| Timing Network | Network Configuration | ETR Configuration | ETR Status | STP Configuration | STP Status | ETS Configuration |

Note —
This CPC has the role of Current Time Server for an STP-only CTN. If you plan to attach to an ETS device, an ETS configuration is required. Changes made to the ETS configuration have an immediate effect on the time source for the CTN.

External Time Source (ETS)
○ Use dial out if configured on Hardware Management Console
◉ Use NTP

NTP Time Server Information

Configured	NTP Time Server	Stratum	Dispersion (microseconds)	Source	Status
☑	ntpsrv1.itso.ibm.com	2	30503	209.51.161.238	Success
☑	9.56.192.87	1	760	GPS	Success

Apply | Query

Refresh | Cancel | Help

- Only the STP facility in the Current Time Server (active Stratum 1) makes time adjustments
- NTP server can be defined to multiple servers in Coordinated Timing Network (CTN)
  – For redundancy it is recommended to configure NTP server for the Backup Time Server (BTS)
- Accuracy to External Time Source (ETS)
  – + / - 100 milliseconds

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Slide 2

NTP Client support for STP – S.O.D.

ETS

non-System z time synchronized servers

Remote HMC (Browser)

HMC

Ethernet Switch

Corporate network

SNTP

z9 EC CTS/PTS

z990 Arbiter

SNTP

z9 BC BTS

Coordinated Timing Network

S.O.D.

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Redundant NTP Server example using Internet NTP Servers – S.O.D.

non-System z time synchronized servers

NTP server Stratum 1

NTP server(s) Stratum 1

Internet NTP Servers (NTP Project)

NTP server (Unix, Linux) Stratum 2

System z HMC

Ethernet Switch

Corporate network

Internet

SNTP client

SNTP client

Remote HMC (Browser)

IBM firewall

IBM Support Center (RSF)

S.O.D.

IBM System z

Coordinated Timing Network

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Timing-only Links

HMC

z9 EC, S2 (BTS)

z990(1), S1 (PTS)

P1

P2

P3

P4

z990(2)

z9 BC, S2 (Arbiter)

Timing-only Links

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 synchronization needed not in a Parallel Sysplex configuration (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

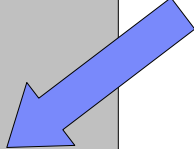System z Hw Update | © 2007 IBM Corporation. All rights reserved. | 23

Timing-only Links

- Permits Server-to-Server CF links when no CF is defined at either end of the definition.
  - CNTLUNIT=STP (no devices)
- May require the purchase of additional CF Links
- APARs – For z/OS 1.7 and z/VM 5.2

```
Select one or more channel paths, then press Enter.
Source processor ID . . . . . : P2084
Source channel subsystem ID . : 0
Source partition name . . . . : *
-------Source-------- ----------Destination---- -CU-
/ CHPID Type Mode Occ Proc.CSSID CHPID Type Mode Type
_ 80    CFP  DED  N   P2086.0    81    CFP  DED  STP
_ 81    CFP  SHR  N   P2094.1    94    CFP  DED  CFP
```

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Timing-only Links

```
--------------- Connect to CF Channel Path -----------------

Specify the following values.

Source processor ID . . . . . : SCZP101
Source channel subsystem ID . : 2
Source channel path ID . . . . : C0
Source channel path type . . . : CBP

Destination processor ID . . . . . . SCZP901   +
Destination channel subsystem ID . . 1   +
Destination channel path ID . . . . C5   +

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

UNIT=STP

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Prerequisites

- **Hardware**

  - 9037-002 concurrent LIC upgrade (if migrating from ETR network)
    - 9037 code changes to support STP Mixed CTN
      - 9037 LIC version 3.0 (concurrent)
  - System z9 server must be at EC Driver level 67L
    - 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 63) or higher
    - Can upgrade z890/z990 HMC to new HMC code level
  - Concurrently install STP Enablement MCL (FC 1021)

  S.O.D.
  - For NTP Client support function (optional)
    - NTP server at NTP v3 or v4 or SNTP with IPv4 support
    - z9 Requires HMC version 2.9.2 and SE Driver 67 or higher

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Prerequisites Continued …

- **Software**

  - z/OS 1.7 or higher
  - Additional software maintenance required for z/OS 1.7, 1.8 and 1.9
    - Includes STP enablement APAR
    - Maintenance can be applied using "rolling IPL" process
  - 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)
    - www14.software.ibm.com/webapp/set2/psp/srchBroker
  - 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 1.6 EOS 9/07

Operating System Support

▪New web site:
- ▪Technical help database for mainframe Preventive Service Planning (PSP) buckets
- – http://www14.software.ibm.com/webapp/set2/psp/srchBroker

Find the bucket by Type, Category and Release:

This functionality is currently available only for the base components of supported OS/390 and Z/OS releases, latest hardware buckets supported by the OS/390 and Z/OS releases, and several z/OS Cross Function buckets (for example, SYSPLEXDS).

Type: Function

Category: STP

-- ALL RELEASES --

Release:

● All Content
○ Exclude extract files
○ Extract files only

Go

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z/OS CLOCKxx statements

- ▪ OPERATOR PROMPT|NOPROMPT
- ▪ TIMEZONE W|E hh.mm.ss
- ▪ ETRMODE YES|NO
- ▪ ETRZONE YES|NO
- ▪ SIMETRID nn

- ▪ 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
  - – Indicates the greatest difference, after IPL, between the system image's TOD and the Coordinated Server Time (CST), by which the system image will adjust its TOD, when necessary, to match CST.
    - • Value Range: 0 to 99 seconds
    - • Default = 10 seconds

> **CLOCKxx**
>
> OPERATOR NOPROMPT
> TIMEZONE W.00.00.00
> ETRMODE YES
> ETRZONE YES
> STPMODE YES
> STPZONE YES
> TIMEDELTA 10

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Summary

- Server Time Protocol:
  - Allows Parallel Sysplex distances to extend beyond the current 40 km limit
    - Limits set by coupling protocol and links
  - Can help meet more stringent time synchronization requirements
  - Expected to Scale with technology as processors and messaging technology improve
  - Does not require dedicated Timer links
    - Uses same hardware and protocols as data
  - Allows concurrent migration from an ETR network with proper planning
  - Allows coexistence with ETR network
  - Allows time to be set to a dialup service to within 100 ms of UTC

Additional Information

IBM System z

Server Time Protocol (STP)

- **Redbooks™**
  - Server Time Protocol Planning Guide SG24-7280
  - Server Time Protocol Implementation Guide SG24-7281
- **Education**
  - Introduction to Server Time Protocol (STP)
    - Available on Resource Link™ at General Availability (GA)
    - www.ibm.com/servers/resourcelink/hom03010.nsf?OpenDatabase
- **STP Web site**
  - 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

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Questions ?

Thank You !

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