Server Time Protocol
Time Synchronization – The Next Generation

Overview and Planning

IBM Systems

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Agenda

- **Introduction (not included)**

- **Hardware & Software Planning**

- **Configuration Planning**

- **Migration Scenarios**

- **Reference Material**
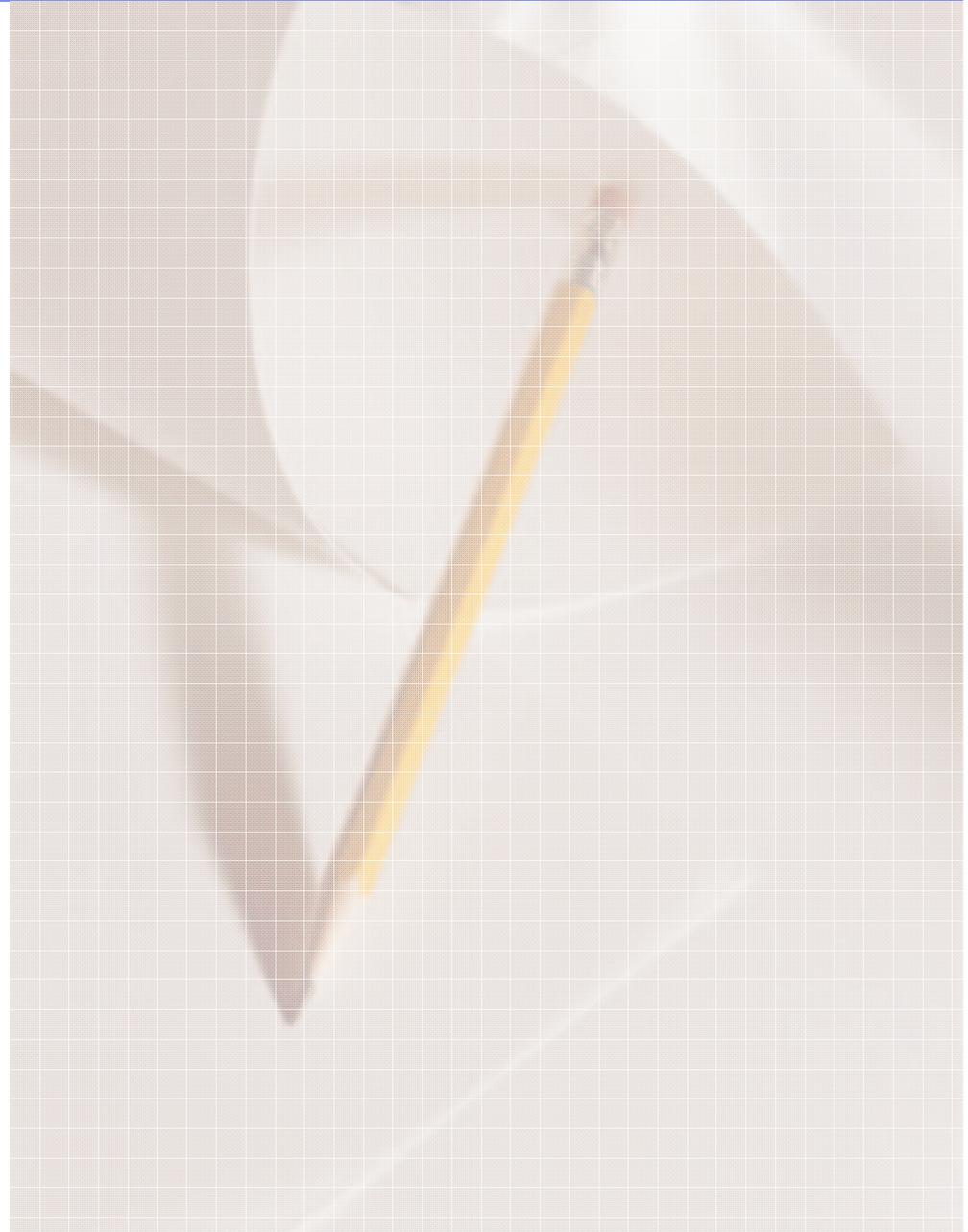
Agenda

- Introduction

- **Hardware & Software Planning**

- Configuration Planning

- Migration Scenarios

- Reference Material

Hardware & Software Planning

- **Servers and Coupling Facilities**
  - ► EC Drivers and STP Feature Code
- **Hardware Management Console**
- **Coupling Links and Timing-only Links**
- **Multi-Site**
  - ► Dense Wave Division Multiplexer (DWDM)
- **Operating Systems**
  - ► Preventative Service Planning (PSP)
  - ► IPLs
  - ► CLOCKxx

Servers and CFs

- **Prerequisite MCLs → STP-Capable**
  - ▶ IBM System z9 Enterprise Class (Driver 63J)
  - ▶ IBM System z9 Business Class (Driver 63J)
  - ▶ IBM eServer zSeries 990 (Driver 55K)
  - ▶ IBM eServer zSeries 890 (Driver 55K)

- **Feature Code 1021 → STP-Enabled**
  - ▶ Required on each STP capable Server or Coupling Facility
    - ● Chargeable feature on each

- **IBM Sysplex Timer 9037-002**
  - ▶ 9037-002 Licensed Internal Code (LIC) upgrade required
    - ● When migrating from an ETR network
    - ● LIC Upgrade is delivered with FC1021
    - ● Concurrent if 9037 Expanded Availability configuration and planned correctly

- **Parallel Sysplex® Coexistence in a Mixed CTN**
  - ▶ IBM eServer zSeries 900
  - ▶ IBM eServer zSeries 800

Hardware Management Console

- **HMC v2.9.1 (EC Driver level 64) or higher**
  - ► Can upgrade previously installed HMCs to v2.9.1 HMC code level
    - If existing HMC being upgraded, attached z990, z890, z900, z800 servers/CFs need to be at specific driver levels and specific MCLs need to be installed.
  - ► No HMC support for 9037 Console or ESCON® Director Console

- **To update a FC0075 or higher HMC to v2.9.1, the SSR must order and install ECA 241 (D76136).**
  - ► The HMC will <u>NOT</u> be supported on: G1, G2, G3, G4, Multiprise® 2k/3k
  - ► Support Element Prerequisites
    - z990 & z890 (Driver 55)
      - – MCL 132 for EC J13486
    - z900 & z800 (Driver 3Gf)
      - – MCL 194 for EC J11213
    - 9672 G5 and G6 (Driver 26)
      - – MCL 174 for EC F99918

Non-disruptive

Coupling Links

- **ICB-3 (FC0993)**

- **ICB-4 (FC3993) – preferred versus ICB-3**

- **ISC-3 (FC0217, FC0218, FC0219)**

  - ▶ FC0217 - ISC-M (ISC Mother Card)

  - ▶ FC0218 - ISC-D (ISC Daughter Cards)

  - ▶ FC0219 - ISC-3 Port (4 ports per card, LIC enabled)

    - ● ISC-3 links are supported exclusively in <u>peer mode</u> (CHPID type CFP) when using STP.

Connectivity Planning – multi-site sysplex

- **If CTN across multiple sites:**
  - ► Maximum fiber distance of ISC-3 Peer links without repeaters is 10 km
    - ● 20 km with RPQ 8P2197, 1 Gb/sec
  - ► If fiber distance greater than 10 km, need to plan for Dense Wavelength Division Multiplexers (DWDM)
- **IBM supports only those DWDM products qualified by IBM for use in multi-site sysplex applications, such as GDPS®**
- **At STP GA several DWDM products are planned to be qualified for Sysplex Timer and ISC-3 links (transporting CF and STP messages)**
- **The latest list of qualified DWDM vendor products can be found on the Resource Link™ Web site at:**
  - ► https://www.**ibm.com**/servers/resourcelink/hom03010.nsf?OpenDatabase
    - ● 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**

Operating Systems

- **z/OS® 1.7 and higher**
  - ► Various prerequisite APARs
  - ► IPL Required

- **z/OS 1.4 – 1.6**
  - ► STP Toleration support
    - Mixed CTN Configurations
    - Ensures server has Message Time Ordering Facility (MTOF)
    - Various prerequisite APARs
  - ► IPL Required

http://www14.software.**ibm.com**/webapp/set2/psp/srchBroker

z/OS – Timing Modes in a Mixed CTN (example)

Sysplex Timer
Console

Sysplex Timer
ETR Network ID = 31

HMC

Ethernet
Switch

P1

P2

P3

P4

P1 and P4 may be z/OS 1.7 systems enabled for STP or z/OS 1.4, 1.5, 1.6 systems with STP toleration code .

P2 and P3 must be z/OS 1.7 systems enabled for STP
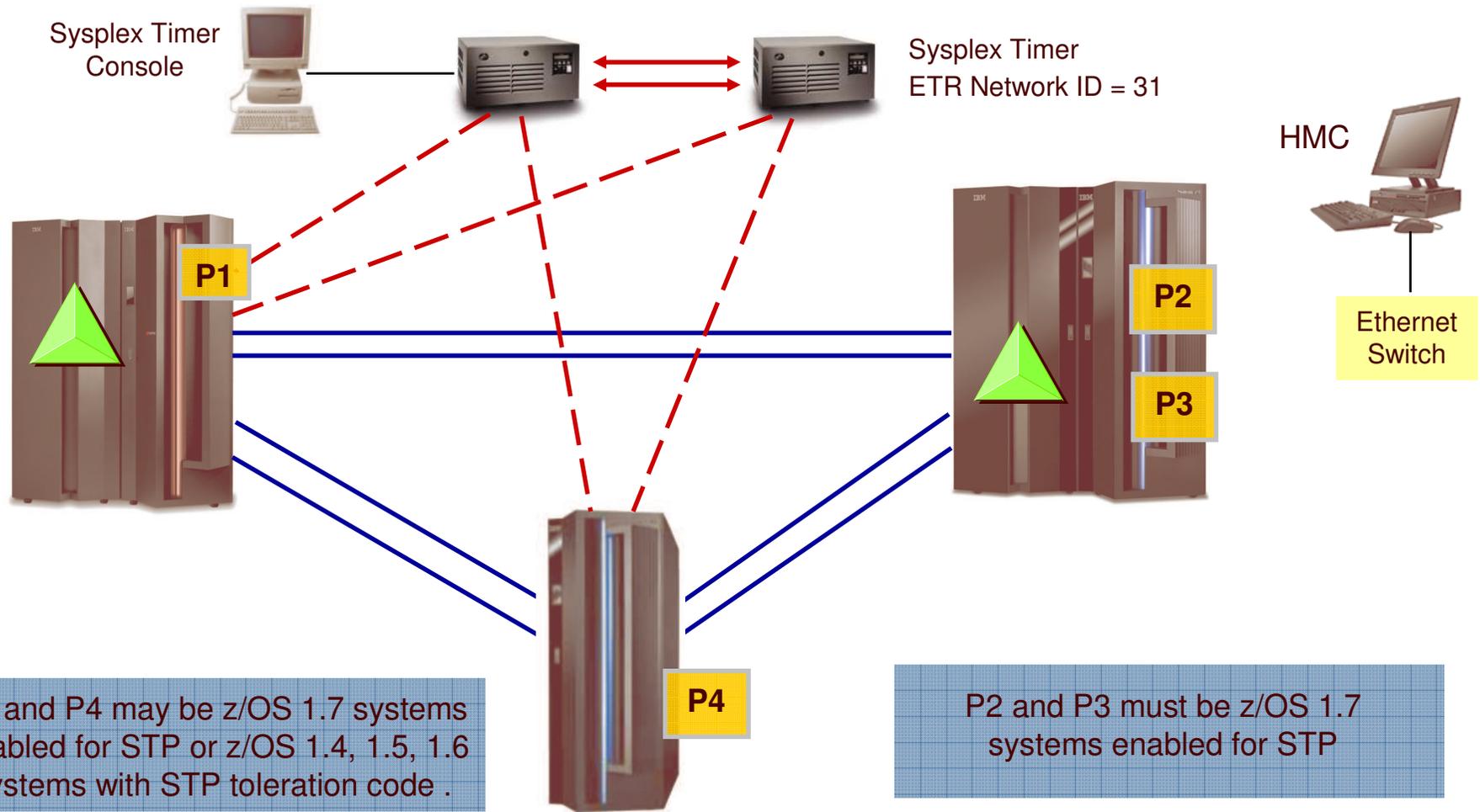
z/OS – Timing Mode in an STP-only CTN (example)

P1, P2, P3 and P4 must be z/OS
1.7 systems enabled for STP
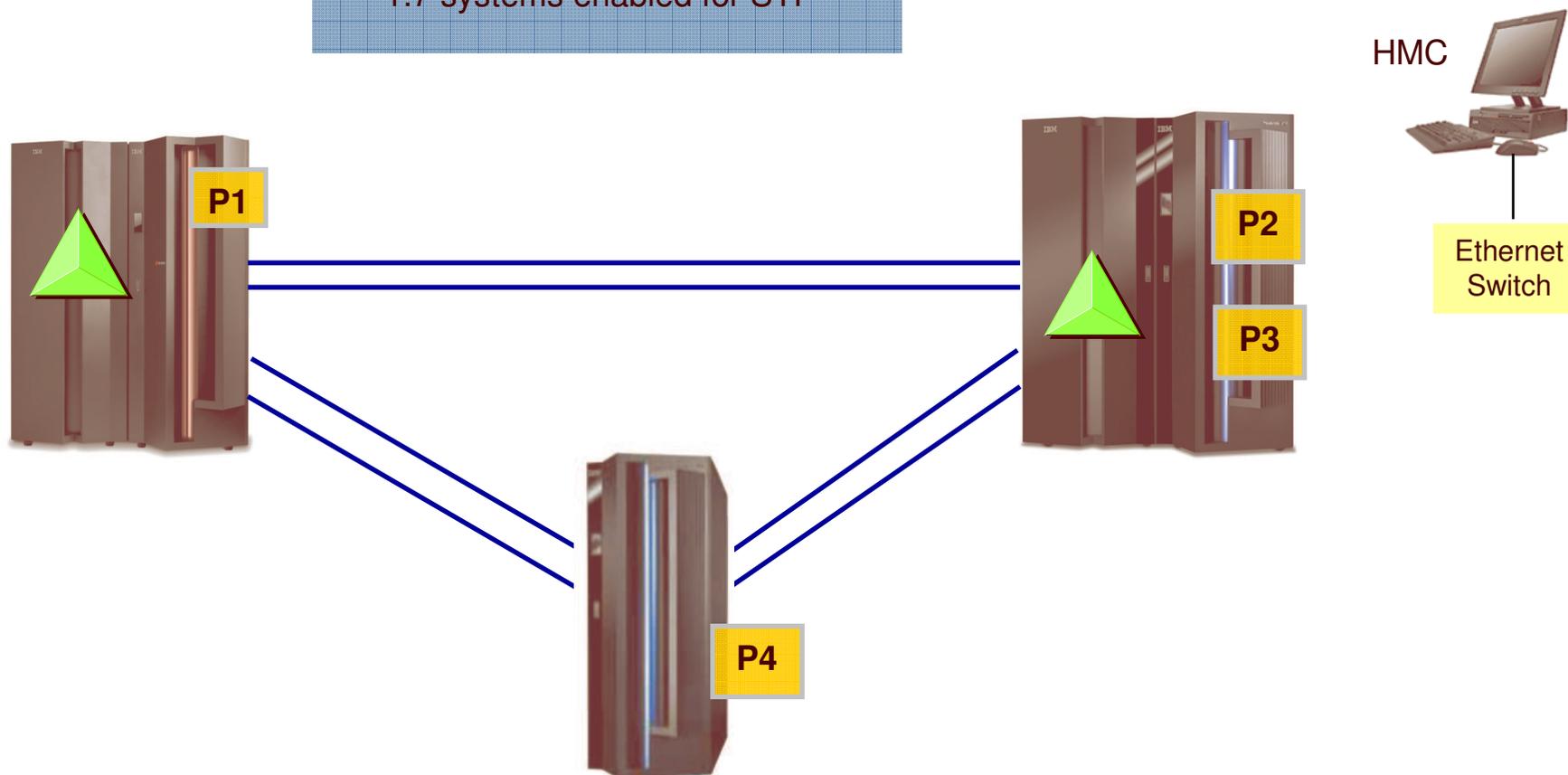
HMC

P1

P2

P3

P4

Ethernet
Switch

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- **Introduction**

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Configuration Planning

- **Hardware Management Console**

- **Sysplex Timer Ports**

- **Additional CF Links**

- **Timing-only Links**

- **Operating System Support**

- **CTN ID and Roles**

HMC configuration v2.9.1 – Driver 64 required

Planning Considerations

1. Use HMC for dial-out to External Time Source

2. HMC Connectivity to all servers if possible. Useful when defining roles from a single HMC.

3. Use IBM Ethernet Switch for local private HMC/SE network (supplied with server)

4. FC0075 or higher

5. Required for HMC Assisted Recovery

Customer Network

Do not connect the server Support Element directly to the network

IBM supplied switch

IBM supplied switch

IBM supplied switch

CPC
CPC
CPC
CPC
CPC
CPC
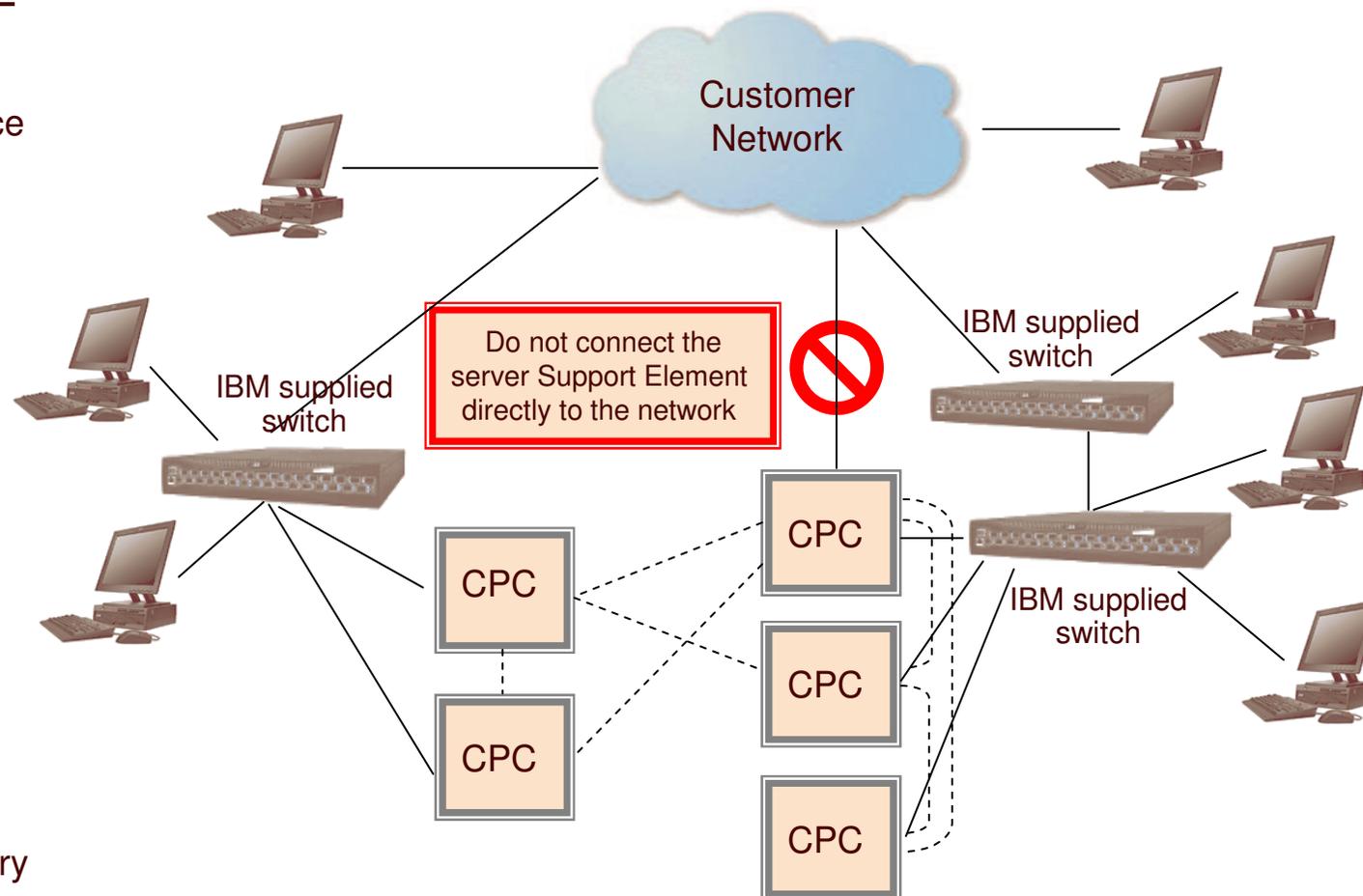
Sysplex Timer Ports

- **Mixed CTN may require additional Sysplex Timer Ports**
  - ► For non-STP-Capable servers or Coupling Facilities
    - z800 and z900 (1xx or 2xx) qualify
    - 9672 does not qualify
  - ► Requires a connection to the 9037-002 if MTOF capable server or CF in a Parallel Sysplex environment
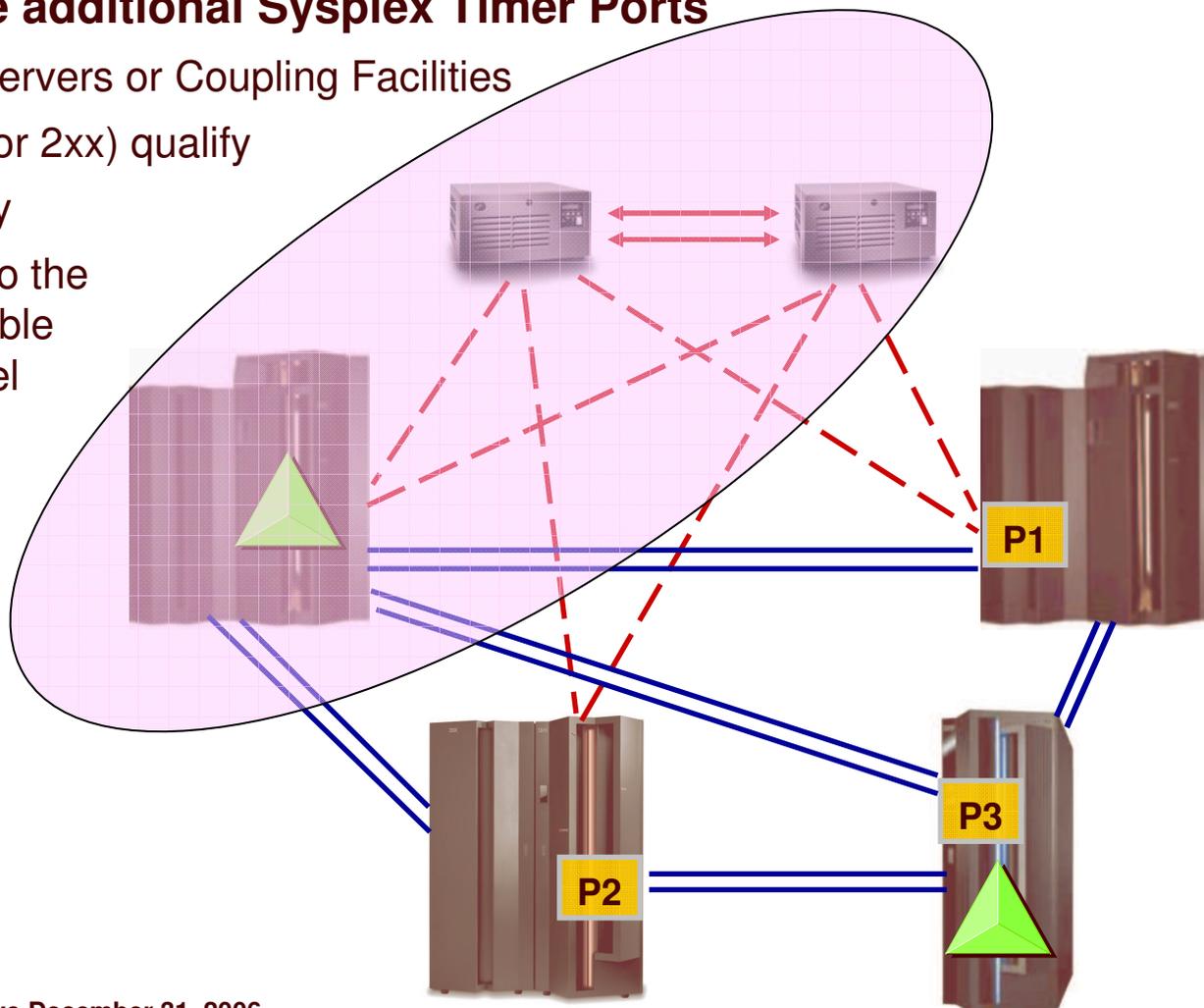
9037-002 Withdrawn from marketing, effective December 31, 2006

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
```
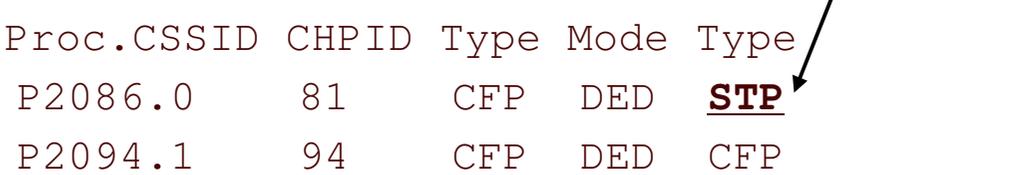
Timing-only Links

```
                 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
```

UNIT=STP

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

```
            DEFAULT

OPERATOR NOPROMPT
TIMEZONE W.00.00.00
ETRMODE YES
ETRZONE YES
STPMODE YES
STPZONE YES
TIMEDELTA 10
```

* New statements for STP

System (Sysplex) Time
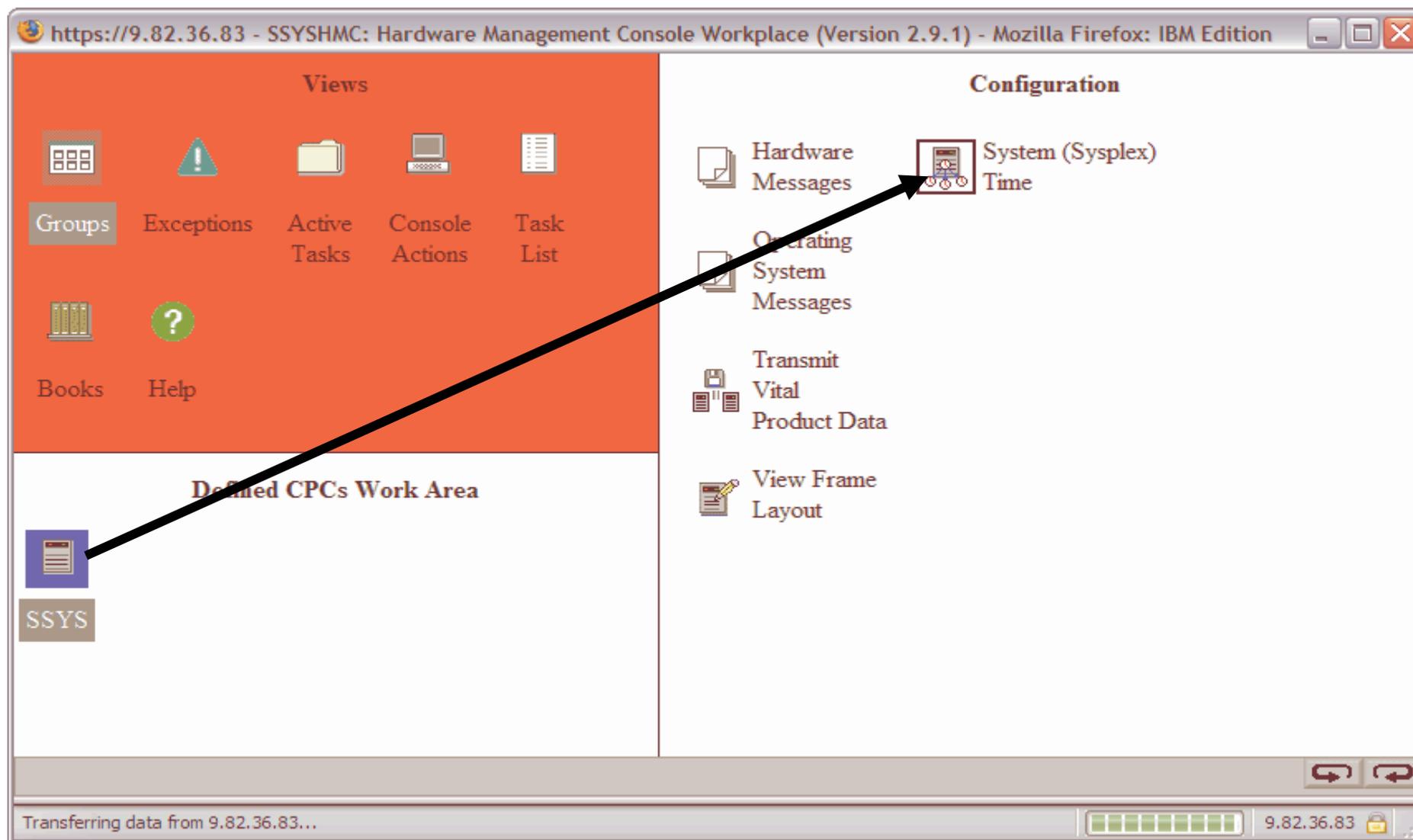
CTN ID

- **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 <u>STP Network ID</u>.
    - ● Eight characters (A-Z, a-z, 0-9, '-', and '_')
  - ► A field that defines the <u>ETR Network ID</u>.
    - ● 00-31
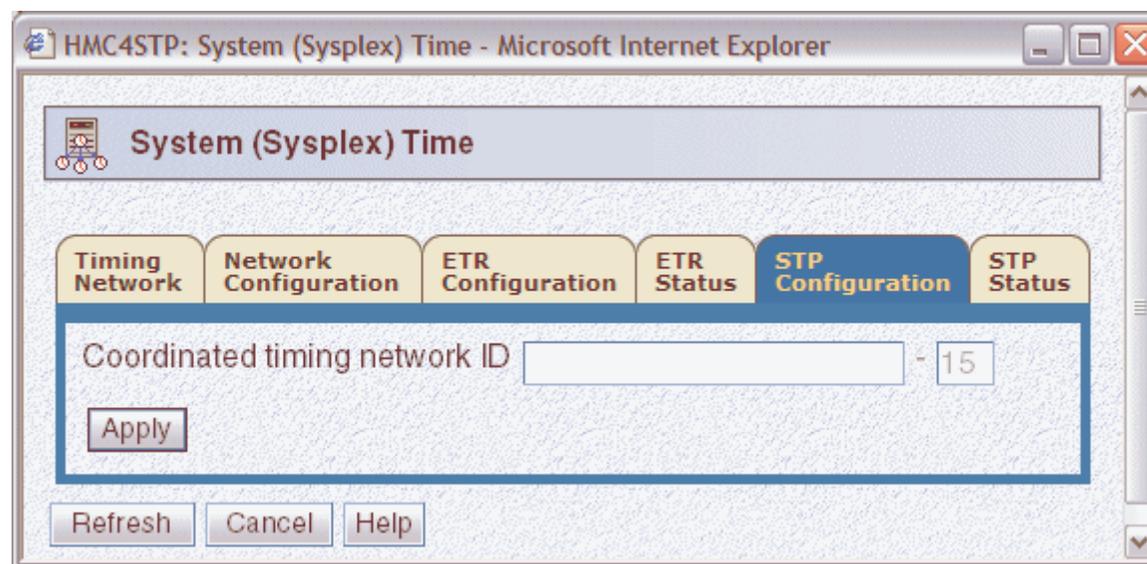
STP-only CTN Roles

- **All servers in STP-only CTN have to be STP capable**
  - ► 9037s no longer required and not part of STP-only CTN

- **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 Roles
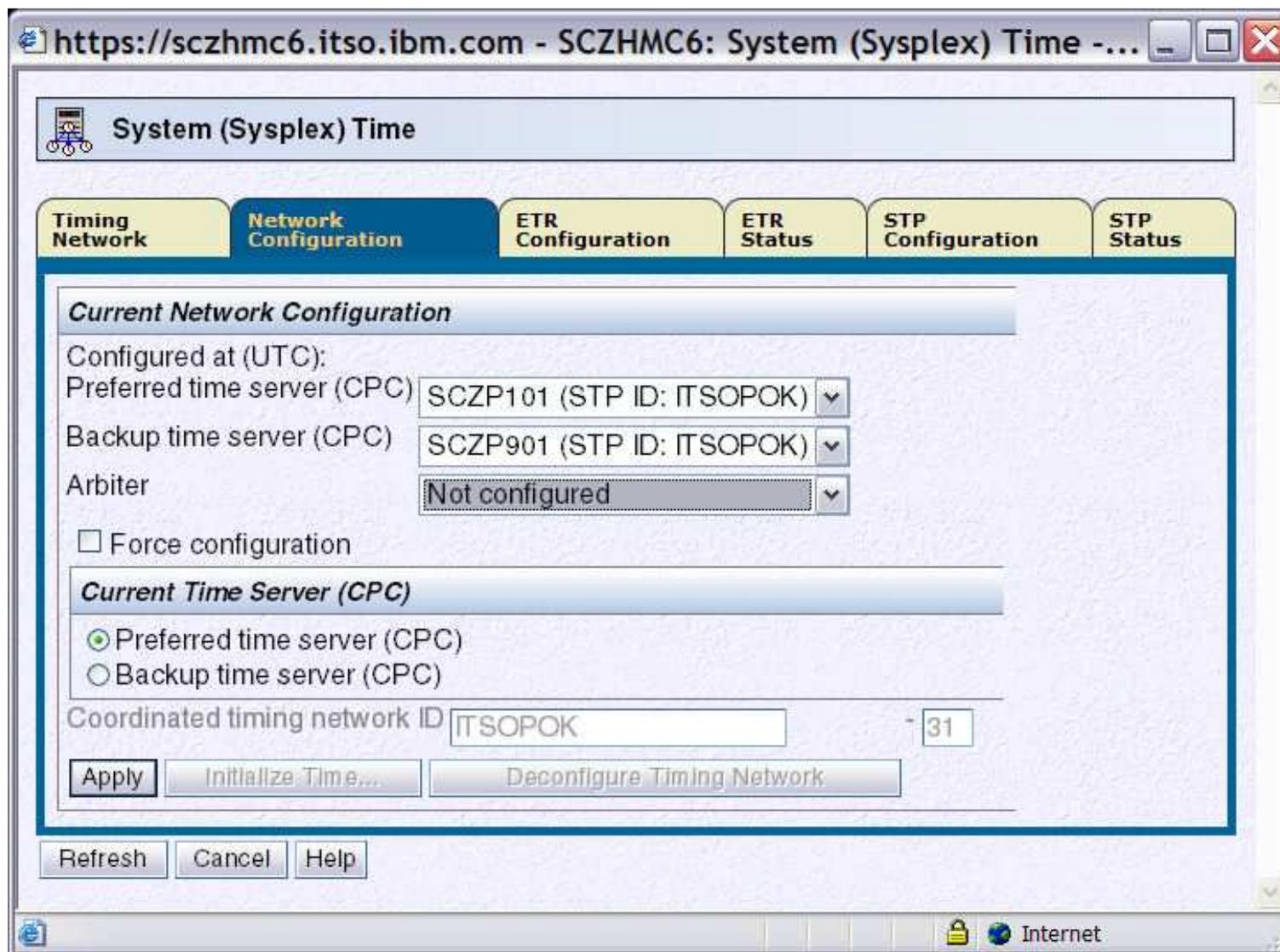
Agenda

- **Introduction**

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- **Configuration Planning**

- **Migration Scenarios**

- **Reference Material**

Migration Scenarios

1. **ETR to a Mixed CTN**

2. **Mixed CTN to STP-only CTN**

3. **STP-only CTN**

ETR to Mixed CTN – Start

- **Hardware Management Console**
- **Sysplex Timer Ports**
- **Additional CF Links**
- **Timing-only Links**
- **Operating System Support**
- **CTN ID**

HMC

9037 Console

CLO links

9037s
ETR Network ID = 15

ETR links

WHAT'S NEEDED ??

z900, Not STP-capable
Standalone Coupling
Facility

P2, P3
z/OS 1.4

z9 EC, STP-capable
ETR Network ID = 15

P1
z/OS 1.4

z990, STP-capable
ETR Network ID = 15

P4
z/OS 1.5

z890, STP-capable
ETR Network ID = 15
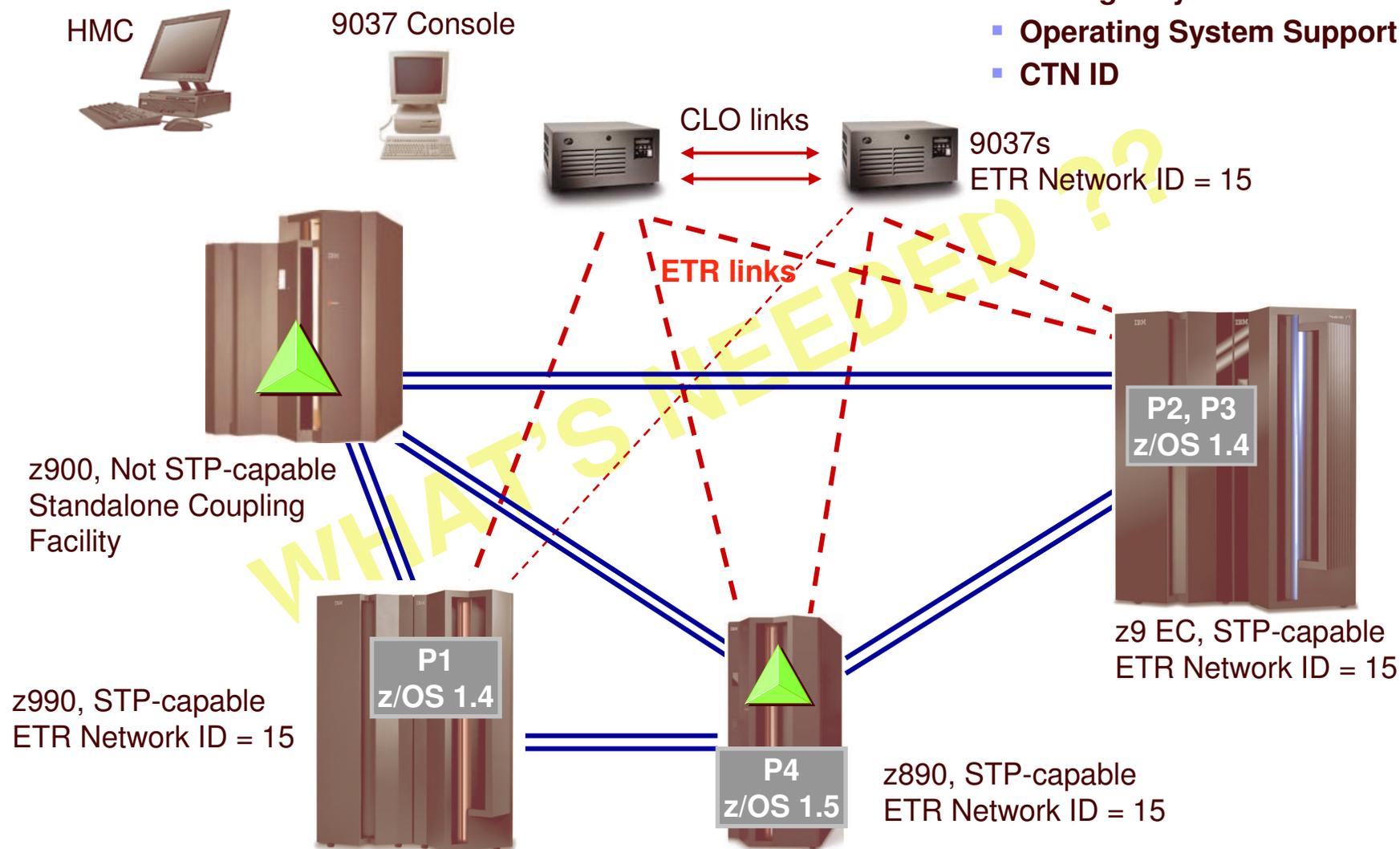
ETR to Mixed CTN – Target

- **Hardware Management Console**
- **Sysplex Timer Ports**
- **Additional CF Links**
- **Timing-only Links**
- **Operating System Support**
- **CTN ID**

HMC

9037 Console

CLO links

HMC Upgrade

9037s
ETR Network ID = 15

ETR links

Added ETR Links

Disabled ETR Ports

Upgraded z/OS

z900, Not STP capable
Standalone Coupling
Facility

P2, P3
z/OS 1.7

Added Timing-only CF Links

P1
z/OS 1.4

z9 EC, Stratum 2
CTNID = STPpart - 15

z990, Stratum 1
CTNID = STPpart - 15

P4
z/OS 1.5

z890, Stratum 1
CTNID = STPpart - 15

**Added STP ID to CTN ID
of all STP-enabled
Servers**

Toleration for z/OS
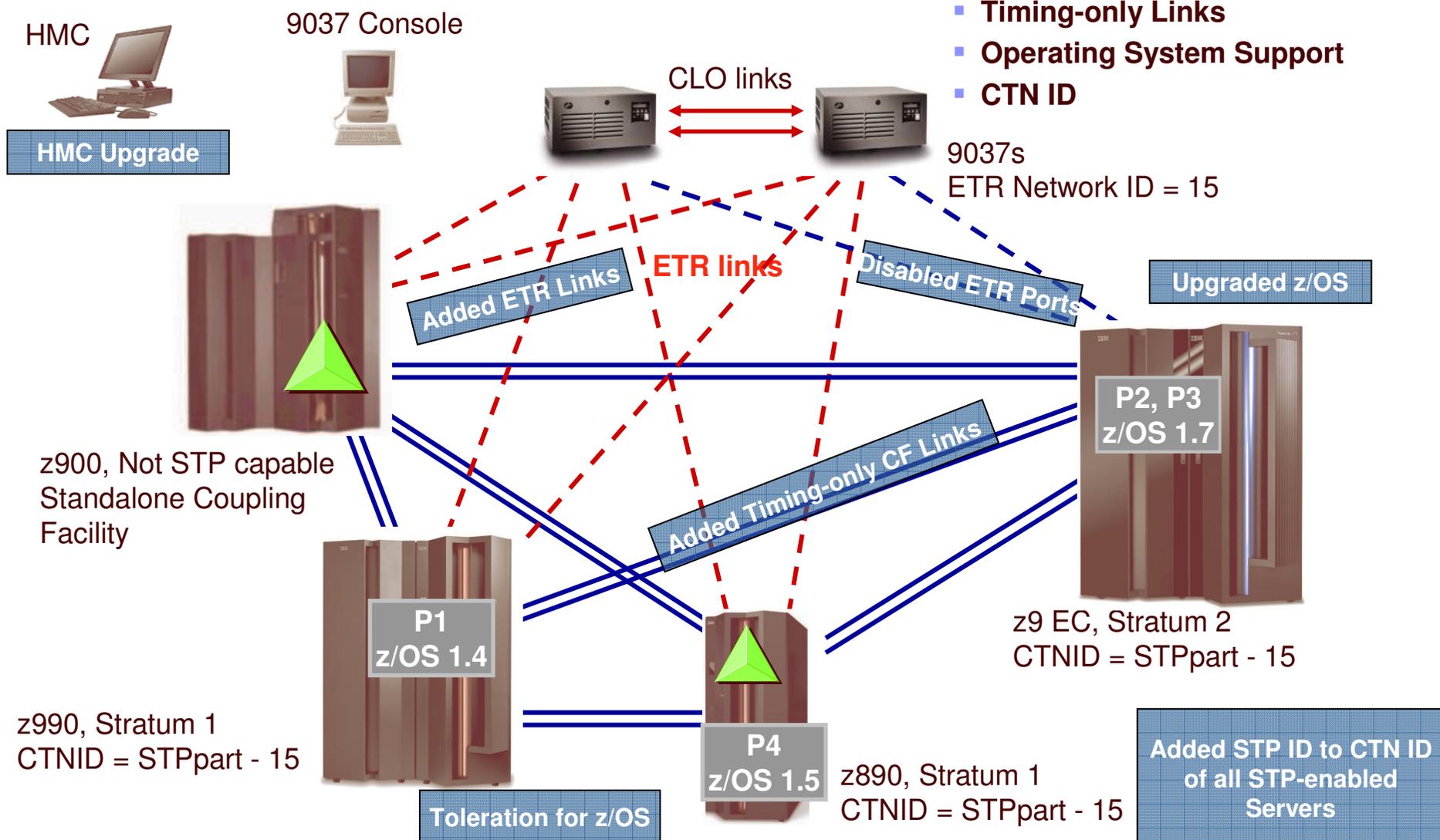
Mixed CTN to STP-only CTN – Start

- **Hardware Management Console**
- **Sysplex Timer Ports**
- **Additional CF Links**
- **Timing-only Links**
- **Operating System Support**
- **CTN ID and Roles**

HMC

9037 Console

CLO links

9037s
ETR Network ID = 15

ETR links

WHAT'S NEEDED ??

z900, Not STP capable
Standalone Coupling
Facility

P2, P3
z/OS 1.7

z9 EC, Stratum 2
CTNID = STPpart - 15

P1
z/OS 1.4

P4
z/OS 1.5

z990, Stratum 1
CTNID = STPpart - 15

z890, Stratum 1
CTNID = STPpart - 15
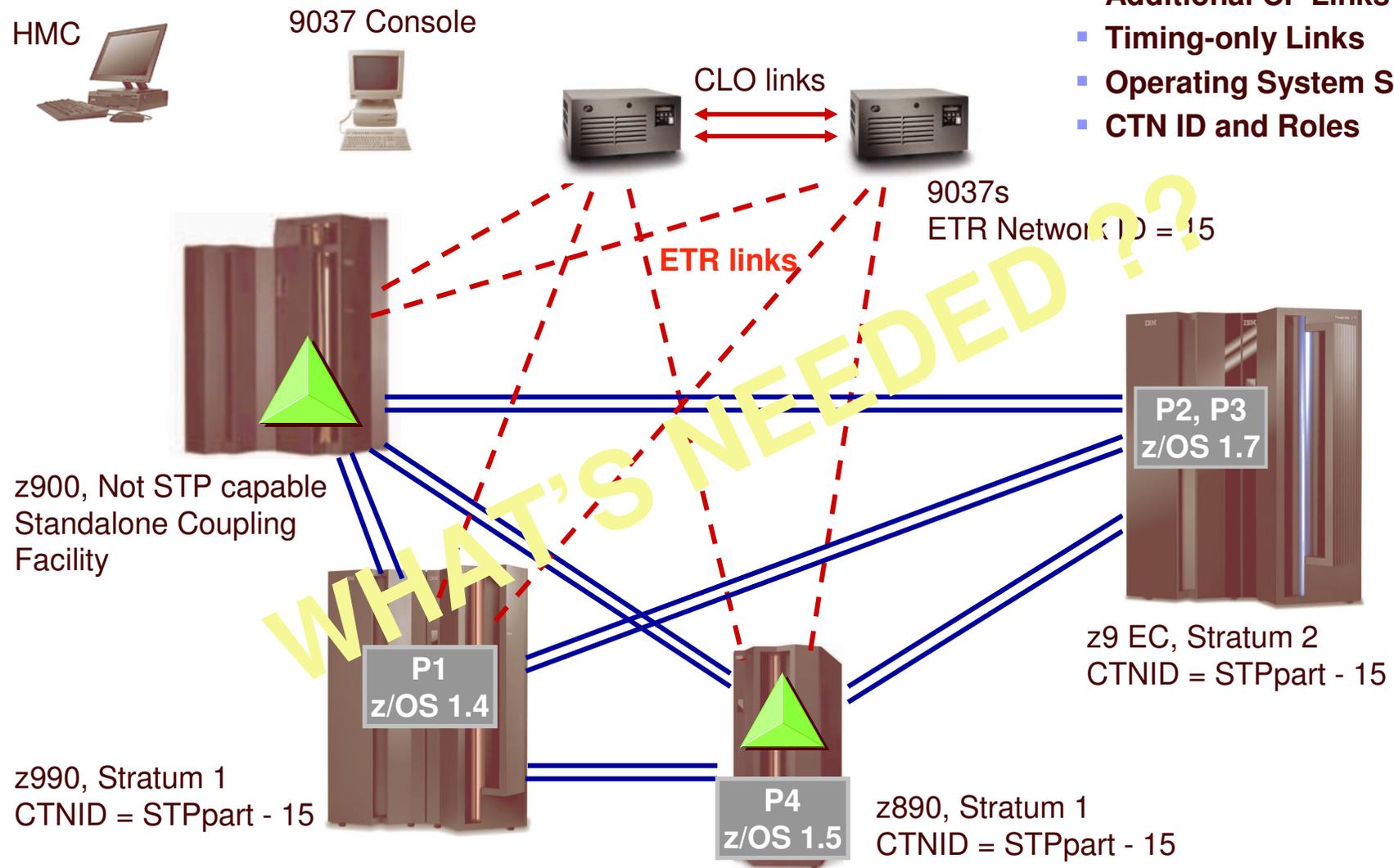
Mixed CTN to STP-only CTN – Target

- **Hardware Management Console**
- **Redefined CF Links**
- **Operating System Support**
- **CTN ID and Roles**

HMC

9037 Console

CLO links

ETR links

9037s Not being used

Ethernet Switch

z900 Removed or CF moved

Redefine (not Timing-only)

P2, P3 z/OS 1.7

P1 z/OS 1.7

z9 EC, Stratum 2
Backup Time Server
CTNID = STPpart

z990, Stratum 1
Preferred Time Server
Current Time Server
CTNID = STPpart

P4 z/OS 1.7

z890, Stratum 2
Arbiter
CTNID = STPpart

Upgraded z/OS on all servers

Assigned Roles PTS, BTS, Arbiter

No timing network to STP-only – Start

HMC

z/OS 1.4

z990

z/OS 1.5

z890

WHAT'S NEEDED ??

z/OS 1.7

z9 EC

- Hardware Management Console
- Additional CF Links
- Timing-only Links
- Operating System Support
- CTN ID and Roles

No timing network to STP-only – Target

HMC
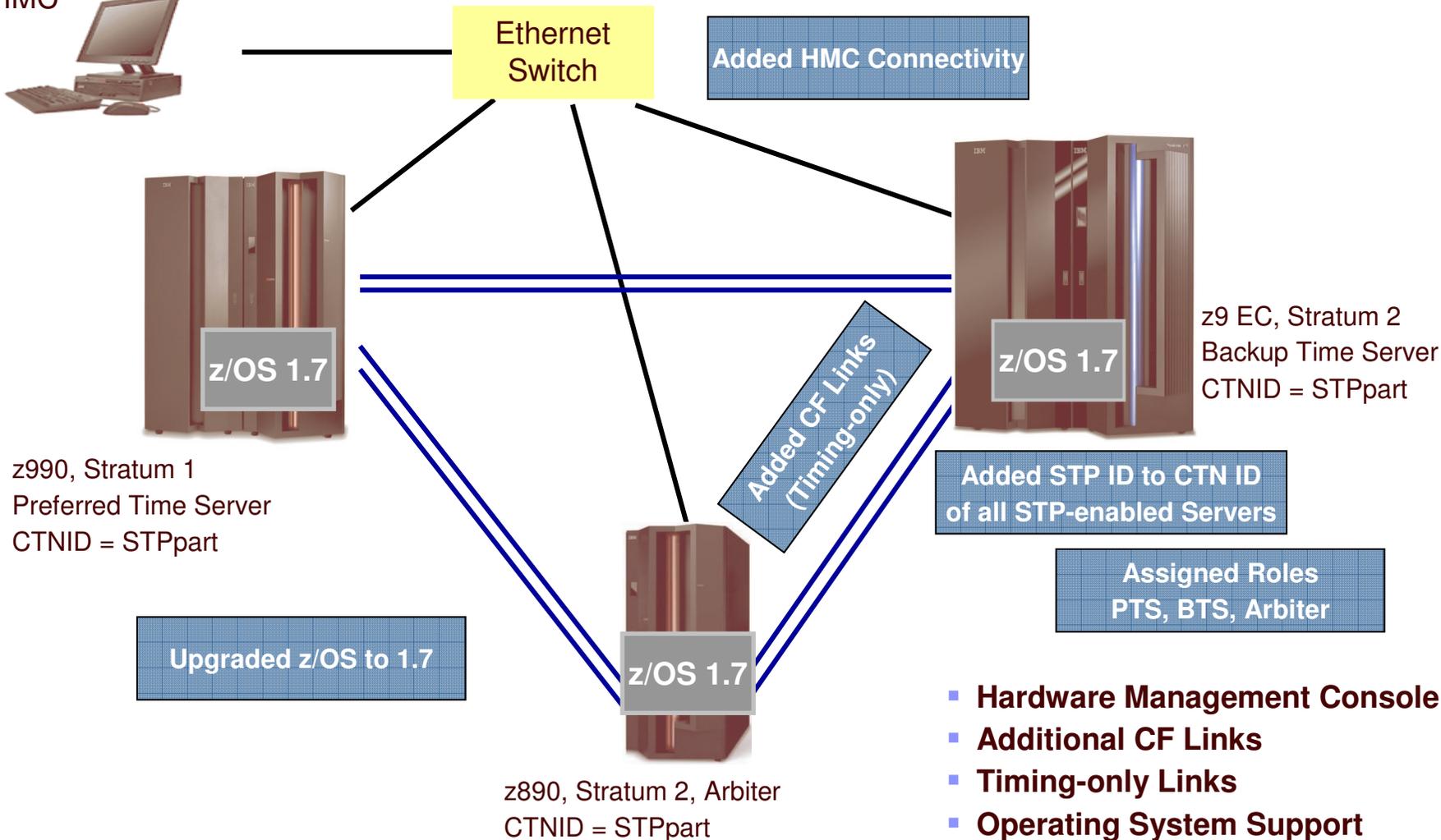
Ethernet
Switch

Added HMC Connectivity

z/OS 1.7

z/OS 1.7

z9 EC, Stratum 2
Backup Time Server
CTNID = STPpart

Added CF Links
(Timing-only)

z990, Stratum 1
Preferred Time Server
CTNID = STPpart

Added STP ID to CTN ID
of all STP-enabled Servers

Assigned Roles
PTS, BTS, Arbiter

Upgraded z/OS to 1.7

z/OS 1.7

z890, Stratum 2, Arbiter
CTNID = STPpart

- **Hardware Management Console**
- **Additional CF Links**
- **Timing-only Links**
- **Operating System Support**
- **CTN ID and Roles**

Agenda

- **Introduction**

- **Hardware & Software Planning**

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- **Migration Scenarios**

- **Reference Material**

Publications

- **Redbook™**
  - ► Server Time Protocol Planning Guide, SG24-7280 (available now)
  - ► Server Time Protocol Implementation Guide, SG24-7281 (available at GA)
  - ► S/390 Time Management and IBM 9037 Sysplex Timer, SG24-2070

- **Resource Link**
  - ► Introduction to STP Education Module (availble at GA)
  - ► SAPR Guide, SA06-012 – Confirmation Form required prior to shipment of FC1021

- **STP WEB site** (www.**ibm.com**/systems/z/pso/stp.html)

- **Server Installation Planning**
  - ► System z9 EC Installation Manual for Physical Planning, GC28-6844
  - ► System z9 BC Installation Manual for Physical Planning, GC28-6855
  - ► zSeries 990 Installation Manual for Physical Planning, GC28-6824
  - ► zSeries 890 Installation Manual for Physical Planning, GC28-6828

- **Hardware Management Console User's Guide**
- **Support Element User's Guide**
- **Server Installation Manual**
- **System Overview manuals**
- **PR/SM Planning Guide**
- **Server Service Guide**
- **Online Help**

Terminology

- **APAR**   Authorized Program Analysis Report
- **CBP**   Coupling Facility Peer Channel (copper)
- **CBR**   Coupling Facility Receiver Channel (ICB)
- **CBS**   Coupling Facility Sender Channel (ICB)
- **CEC**   Central Electronics Complex
- **CF**   Coupling Facility
- **CFCC**   Coupling Facility Control Code
- **CFP**   Coupling Facility Peer Channel (fiber)
- **CFR**   Coupling Facility Receiver Channel (ISC-3 definition)
- **CFS**   Coupling Facility Sender Channel (ISC-3)

- **CHPID**   Channel Path Identifier
- **CP**   Central Processor
- **ETR**   External Time Reference (Sysplex Timer)
- **ETS**   External Time Source
- **G4**   IBM 9672 Generation 4 eServer
- **G5**   IBM 9672 Generation 5 eServer
- **HCD**   Hardware Configuration Definition
- **IC**   Internal Coupling
- **ICB**   Integrated Cluster Bus
- **ICF**   Internal Coupling Facility
- **ICP**   Internal Coupling Peer Channel
- **IFL**   Integrated Facility for Linux

Terminology

IMPP	Installation Manual – Physical Planning		**SAP**	System Assist Processor
IOCP	Input Output Control Program		**STI**	Self Timed Interconnect
IPL	Initial Program Load		**STSI**	Store System Information
ISC	InterSystem Coupling Channel		**SW**	Software (programs and operating systems)
LAN	Local Area Network		**TCA**	Total Cost of Acquisition
LIC	Licensed Internal Code		**TPF**	Operating System
LICCC	Licensed Internal Code Configuration Code		**VM/ESA**	Operating System
LPAR	Logically Partition		**VSE/ESA**	Operating System
MES	Miscellaneous Equipment Specification		**WAN**	Wide Area Network
MTOF	Message Time Ordering Facility		**zIIP**	z9 Integrated Information Processor
OSC	Oscillator		**zAAP**	zSeries Application Assist Processor
PCHID	Physical Channel Identifier		**z/OS**	Operating System
PR/SM	Processor Resource / Systems Manager		**z/VM**	Operating System
PTF	Temporary Program Fix			
RPQ	Request for Price Quotation			

Backup Slides

Operating System – STP Maintenance

http://www14.software.**ibm.com**/webapp/set2/psp/srchBroker

Mixed CTN –> back to ETR

- **Hardware Management Console**
- **Sysplex Timer Ports**
- **Additional CF Links**
- **Timing-only Links**
- **Operating System Support**
- **CTN ID**

HMC

9037 Console

CLO links

9037s
ETR Network ID = 15

ETR links

**Enable
ETR Ports**

**P2, P3
z/OS 1.7**

z900, Not STP capable
Standalone Coupling
Facility

**P1
z/OS 1.4**

z9 EC
ETR Network ID = 15

z990
ETR Network ID = 15

**P4
z/OS 1.5**

z890
ETR Network ID = 15

**Null out the STP ID of all
STP-enabled Servers**

ETR to Mixed CTN – Two Sites – Start

Site 1

Site 2

HMC

9037 Console

9037s
ETR Network ID = 15

CLO links

HMC

z9 EC, STP capable

ETR links

WHAT'S NEEDED ??

P5, P6
z/OS 1.4

Coupling links

P2, P3
z/OS
1.4

z900
Not STP capable
Standalone CF

P7
z/OS 1.5

z9 EC, STP capable
ETR Network ID = 15

z9 BC, STP capable

P1
z/OS
1.4

P4
z/OS
1.5

z990, STP capable
ETR Network ID = 15

z890, STP capable
ETR Network ID = 15

- **Hardware Management Console**
- **Sysplex Timer Ports**
- **Additional CF Links**
- **Timing-only Links**
- **Operating System Support**
- **CTN ID**

ETR to Mixed CTN – Two Sites

HMC

9037 Console

CLO links

Ethernet Switch

Added HMC Connectivity

9037s
ETR Network ID = 15

HMC

ETR links

z900
Not STP capable
Standalone CF

P2, P3
z/OS 1.7

Upgraded z/OS

P5, P6
z/OS 1.7

DWDM — DWDM

P1
z/OS 1.4

P4
z/OS 1.5

z9 EC, STP capable
CTN ID = STPpart - 15
Stratum 2

z9 EC, STP capable
CTN ID = STPpart – 15
Stratum 2

P7
z/OS 1.7

z890, STP capable
CTN ID = STPpart - 15
Stratum 1

z990, STP capable
CTN ID = STPpart - 15
Stratum 1

z9 BC, STP capable
CTN ID = STPpart – 15
Stratum 2

Added CF Links

Added CF Links, ETR Ports,
Upgraded z/OS, Added z/OS
Toleration

Added DWDMs

Added STP ID to CTN ID
of all STP-enabled Servers

- **Hardware Management Console**
- **Sysplex Timer Ports**
- **Additional CF Links**
- **Timing-only Links**
- **Operating System Support**
- **CTN ID**

STP-only –> Back to Mixed

- Hardware Management Console
- Sysplex Timer Ports
- Additional CF Links
- Timing-only Links
- Operating System Support
- CTN ID and Roles

HMC

9037 Console

CLO links

9037s

ETR links

Enter the ETR ID from the Current Time Server. The CTS is steered to 9037 time.

Ethernet Switch

P2, P3 z/OS 1.7

P1 z/OS 1.7

z9 EC, Stratum 2
CTNID = STPpart -15

P4 z/OS 1.7

z990, Stratum 1
CTNID = STPpart -15

z890, Stratum 1
CTNID = STPpart -15