IBM GLOBAL SERVICES

Session G19, Nov. 3, 2004

zSeries Connectivity Snapshots: EI, EI, O

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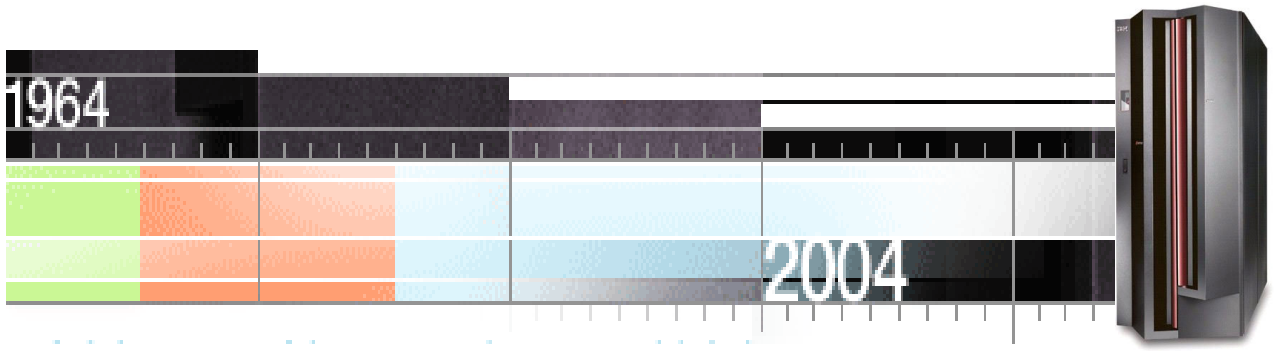
zSeries Expo | Nov. 1 - 5, 2004

Miami, FL



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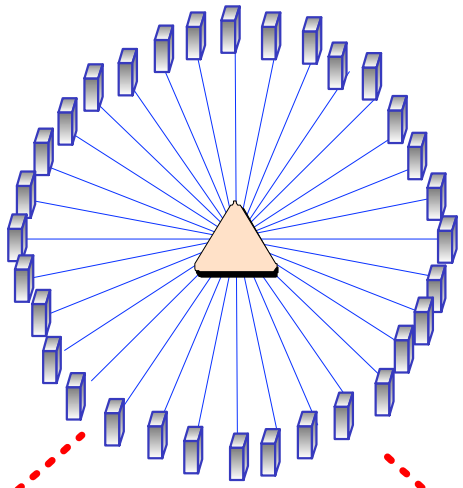
Glossary

Acronym	Full name	Use
CFCC	Coupling Facility Control Code	Parallel Sysplex
CP	Central Processor	PU for Operating systems
CPACF	CP Assist for Cryptographic Function	Cryptography
ESCON	Enterprise Systems Connection	Storage, Printers
ETR	External Time Reference	Sysplex Timer
FCP	Fibre Channel Protocol	SCSI devices (Linux only)
FICON	Fibre Connection	Storage, Printers
IC	Internal Coupling Channel	Parallel Sysplex
ICB	Integrated Cluster Bus	Parallel Sysplex
ICF	Internal Coupling Facility	PU for Coupling Facility Control Code
IFL	Integrated Facility for Linux	PU for Linux for zSeries operating system
ISC-3	InterSystem Channel-3	Parallel Sysplex
MBA	Memory Bus Adapter	Part of Central Electronic Complex
MCM	Multichip Module	Part of Central Electronic Complex
OSA	Open Systems Adapter	Local Area Networks
PCI	Peripheral Component Interconnect	Intel Bus standard
PCICA	PCI Cryptographic Accelerator	Cryptography
PCIXCC	PCIX Cryptographic Coprocessor	Cryptography
PU	Processor Unit	becomes a CP, ICF, IFL, zAAP
SCSI	Small Computer System Interface	Storage - fixed block devices
STI	Self-Timed Interconnect	Internal host bus
TKE	Trusted Key Entry	Cryptography - key management system
zAAP	zSeries Application Assist Processor	PU for specialized Java execution environment

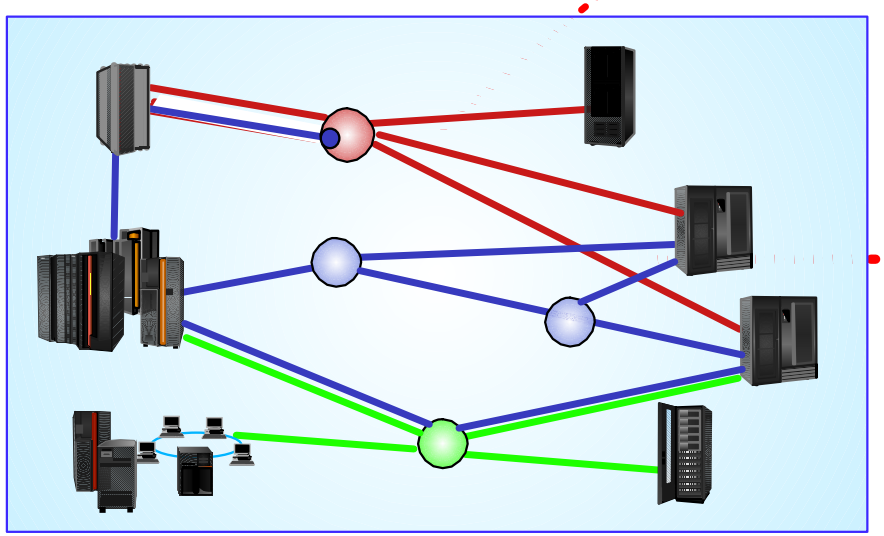
Three environments . . .

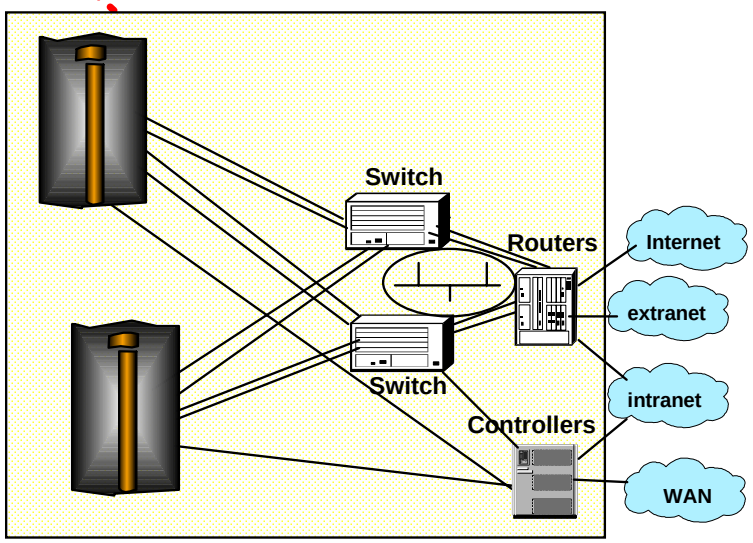


Storage Area Network

Parallel Sysplex

Local Area Network





. . . . . multiple protocols

IC
ICB
ISC
ETR

Parallel Sysplex

Storage Area Network

FICON

ESCON

Parallel

Local Area Network

Token Ring
Fast Ethernet
1000BASE-T Ethernet
Gigabit Ethernet

Connectivity agenda

Coupling

- **ICs**
- **ICB-4**
  - **2 GB link data rate**
- **ISC-3 =** Up to 48 links (peer)
- Up to 64 ICs, ICBs, ISC-3s per server

Cryptography

- **CPACF on every CP**
- **PCIXCC**
- **PCICA**
- **Crypto Express2**

Storage

- **ESCON**
  - Up to **512** channels - z890
  - Up to **1024** channels - z990
- **FICON Express**
  - Up to **120** channels

Switched fabric

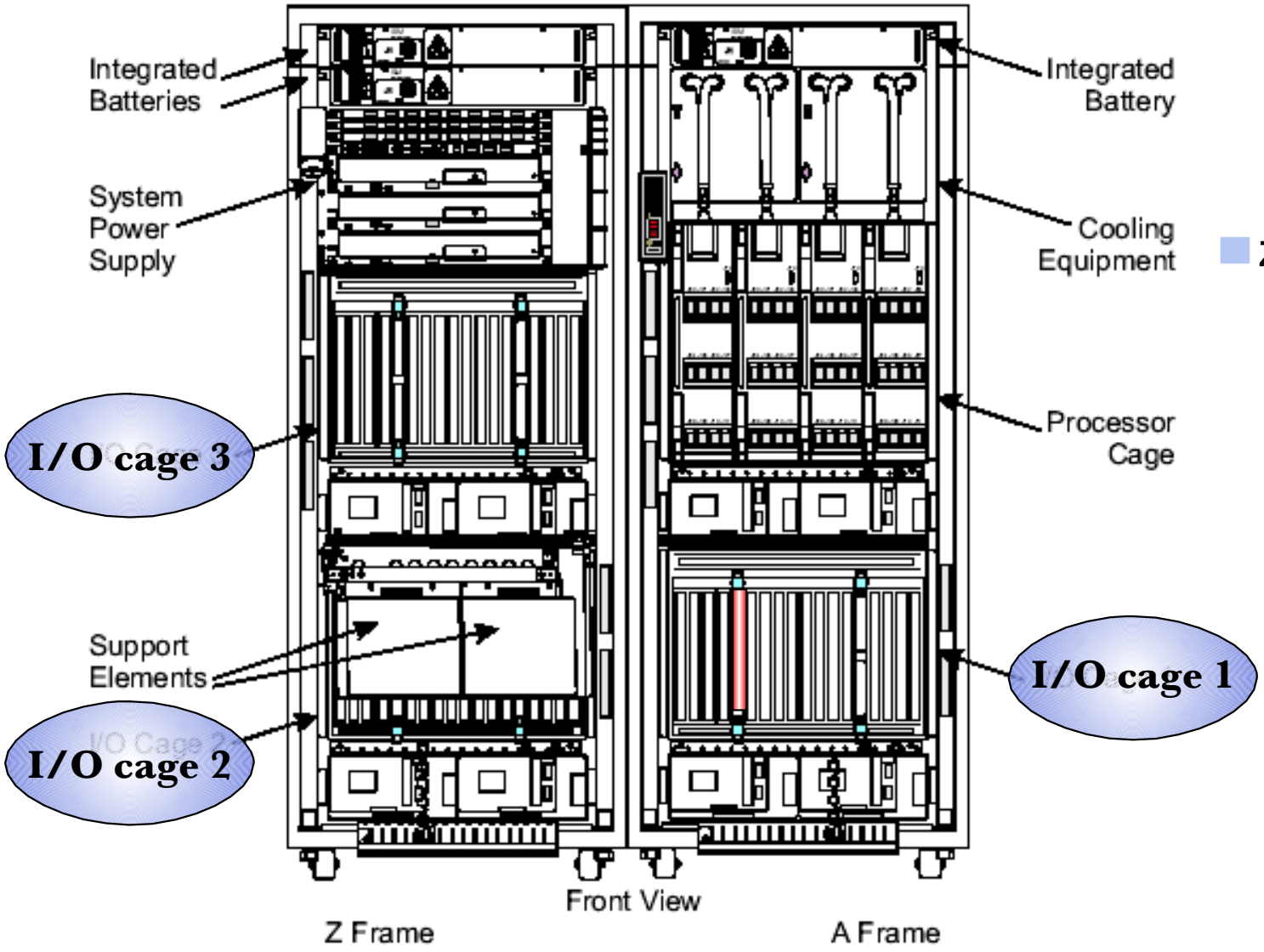
- **Fibre channel directors**
  - FICON high integrity fabric
  - FCP full fabric
- **Cascaded Directors**
- **Intermix of FICON/FCP**

Network

- **OSA-Express**
  - Up to **48** network connections
    - 1000BASE-T Ethernet
      - OSA-ICC
- **OSA-Express2 GbE, 10 GbE**

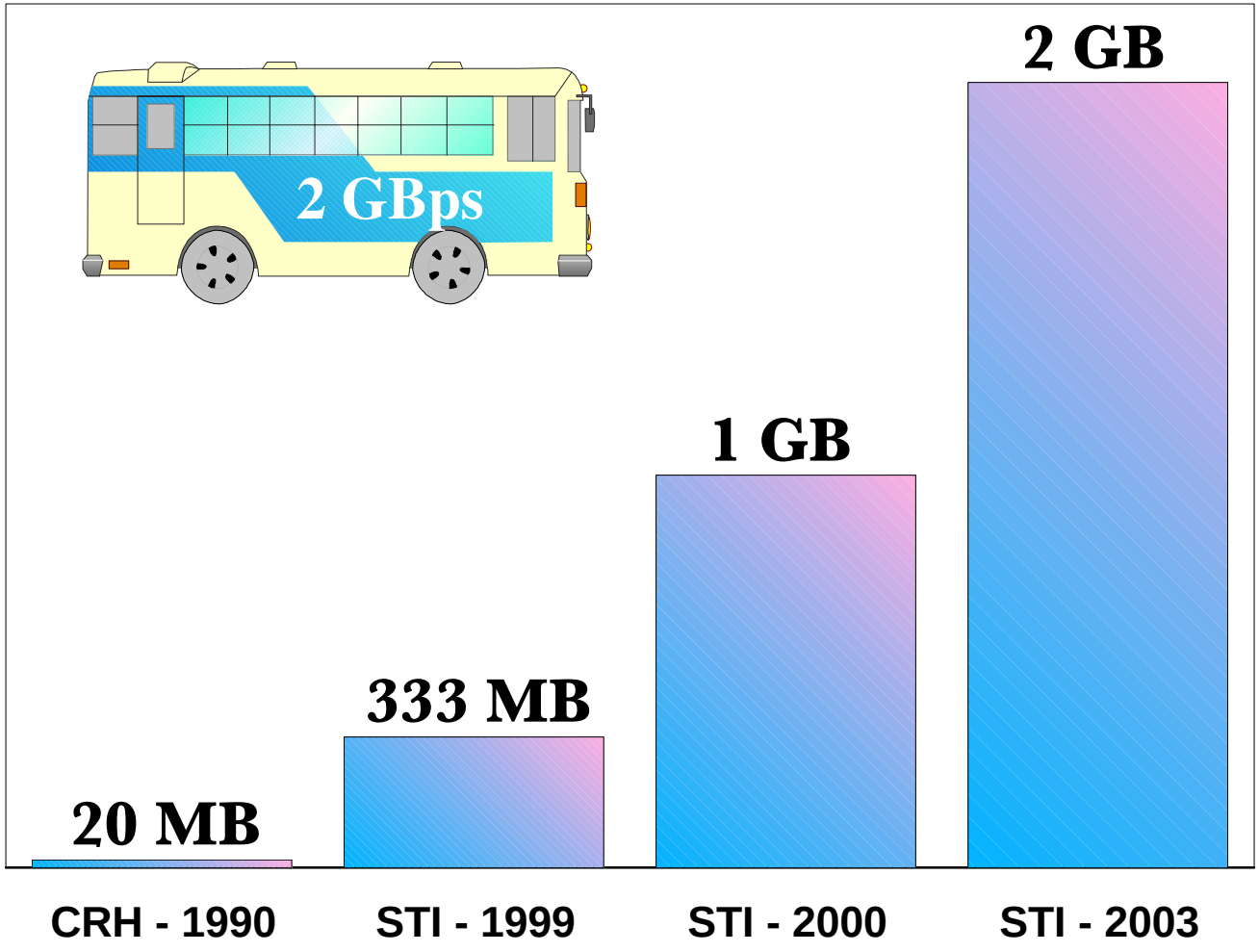
Where is the I/O?

z990 - 2 Frames



- z990
  - Two frames
  - Up to 3 I/O cages
    - 28 I/O slots each
  - Up to 84 I/O slots
- z890
  - One frame
  - One I/O cage
  - Up to 28 I/O slots

I/O subsystem bus



- Channel Request Handler bus
- Self-Timed Interconnect bus

I/O subsystem bus

★ **1990 - CRH bus = 20 MegaByte**
(Channel Request Handler)

Shared by up to 8 features

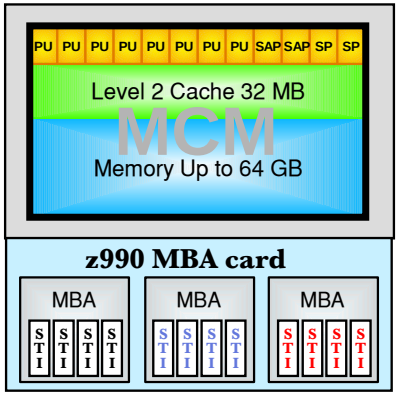
★ **1999 - STI bus = 333 MegaByte**
(Self-Timed Interconnect)
- **G5 - Up to 12 STIs for I/O**
- **G6 - Up to 24 STIs for I/O**

★ **2000 - STI bus = 1 GigaByte**
- **zSeries 900 - Up to 21 STIs for I/O**
- **zSeries 800 - Up to 4 STIs**

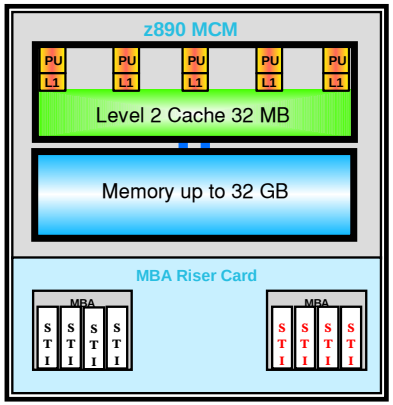
Shared by 4 features

★ **2003 - STI bus = 2 GigaByte**
- **zSeries 990 - Up to 21 STIs for I/O**
- **zSeries 890 - Up to 7 STIs for I/O**

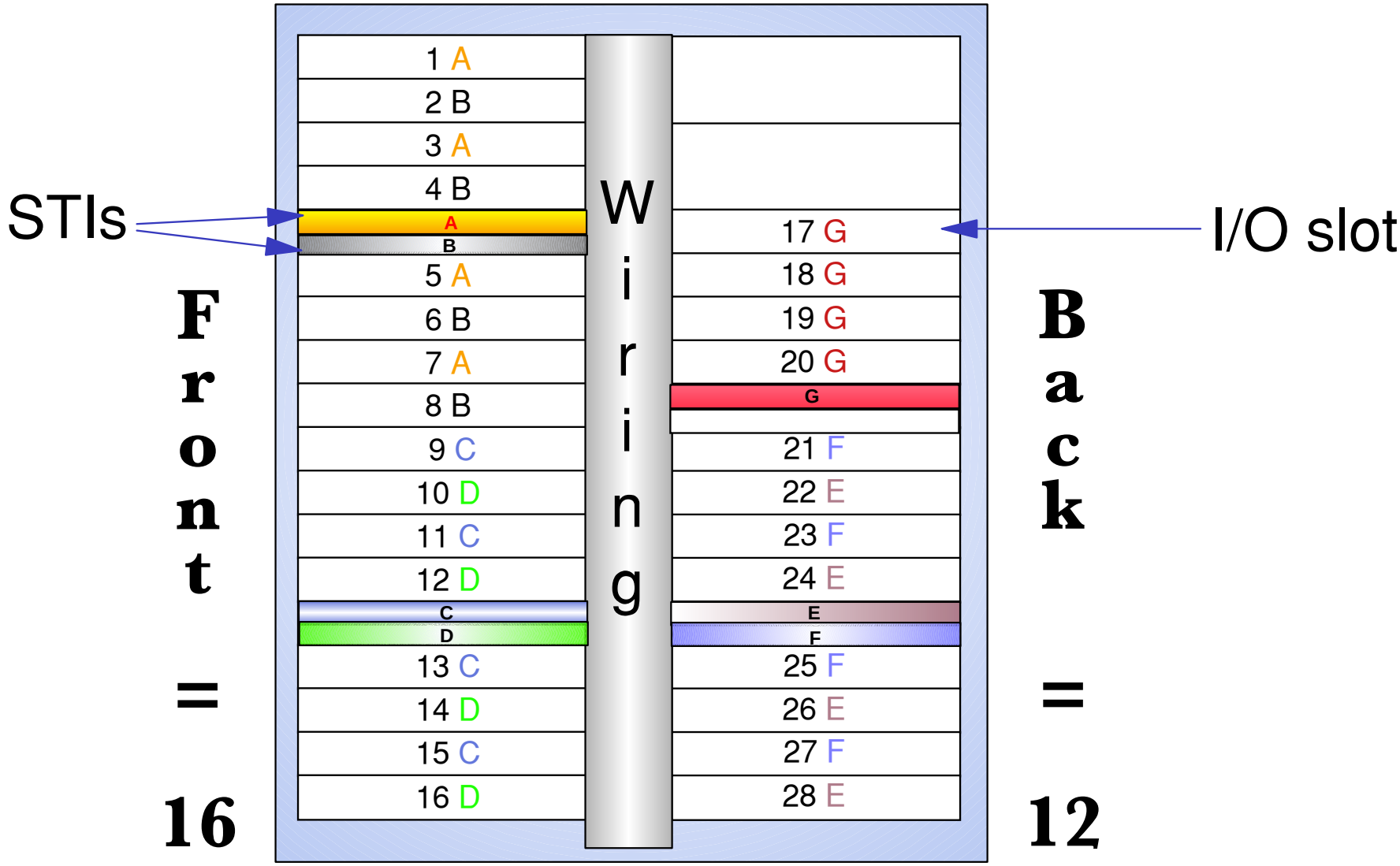
z990 1 - 4 MCMs



z890 1 MCM

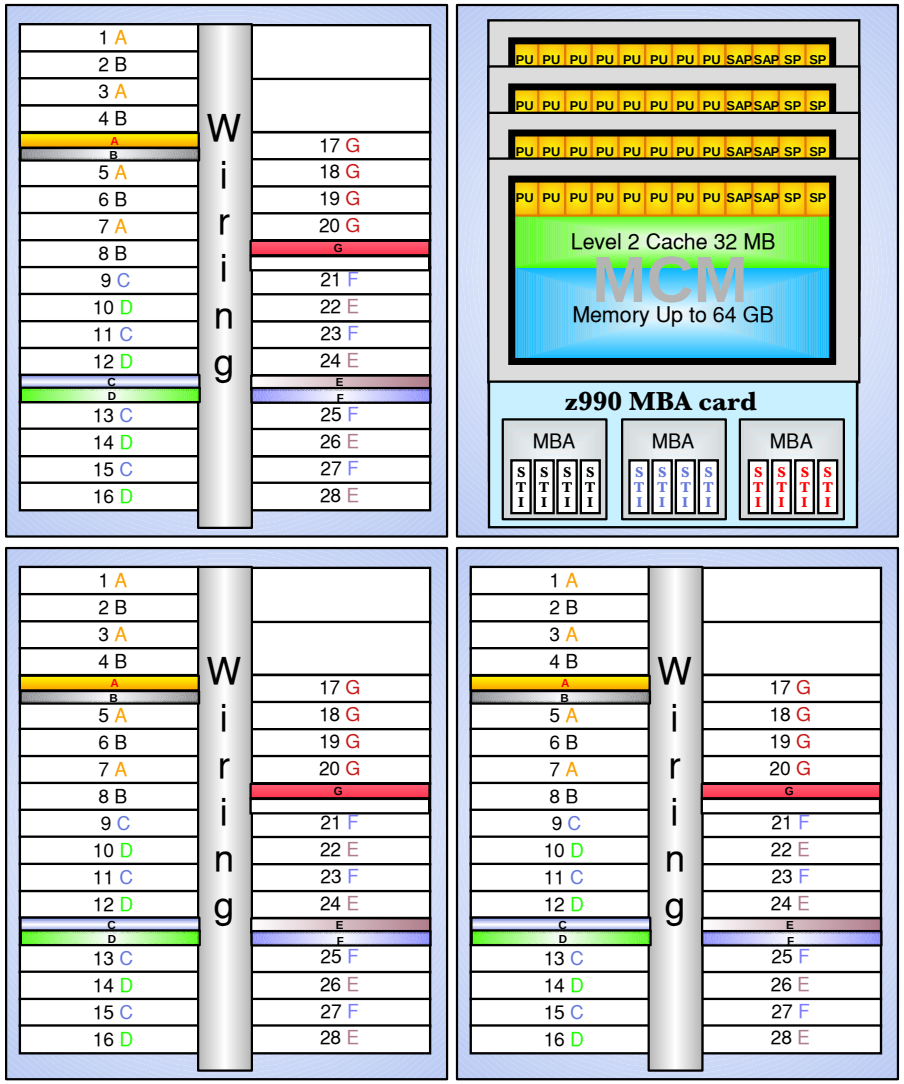


Top View of I/O cage with 28 I/O slots and 7 STIs



z990 and z890 building blocks

z990 - 2 Frames



Each I/O cage

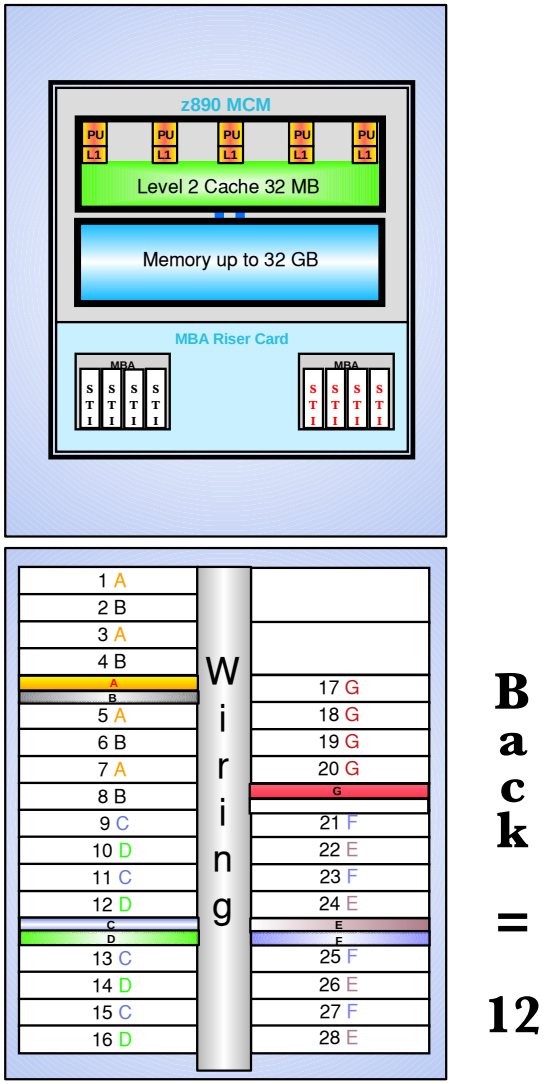
=

7 STIs

7 I/O domains

28 I/O slots

z890 - 1 Frame



Front = 16

Back = 12

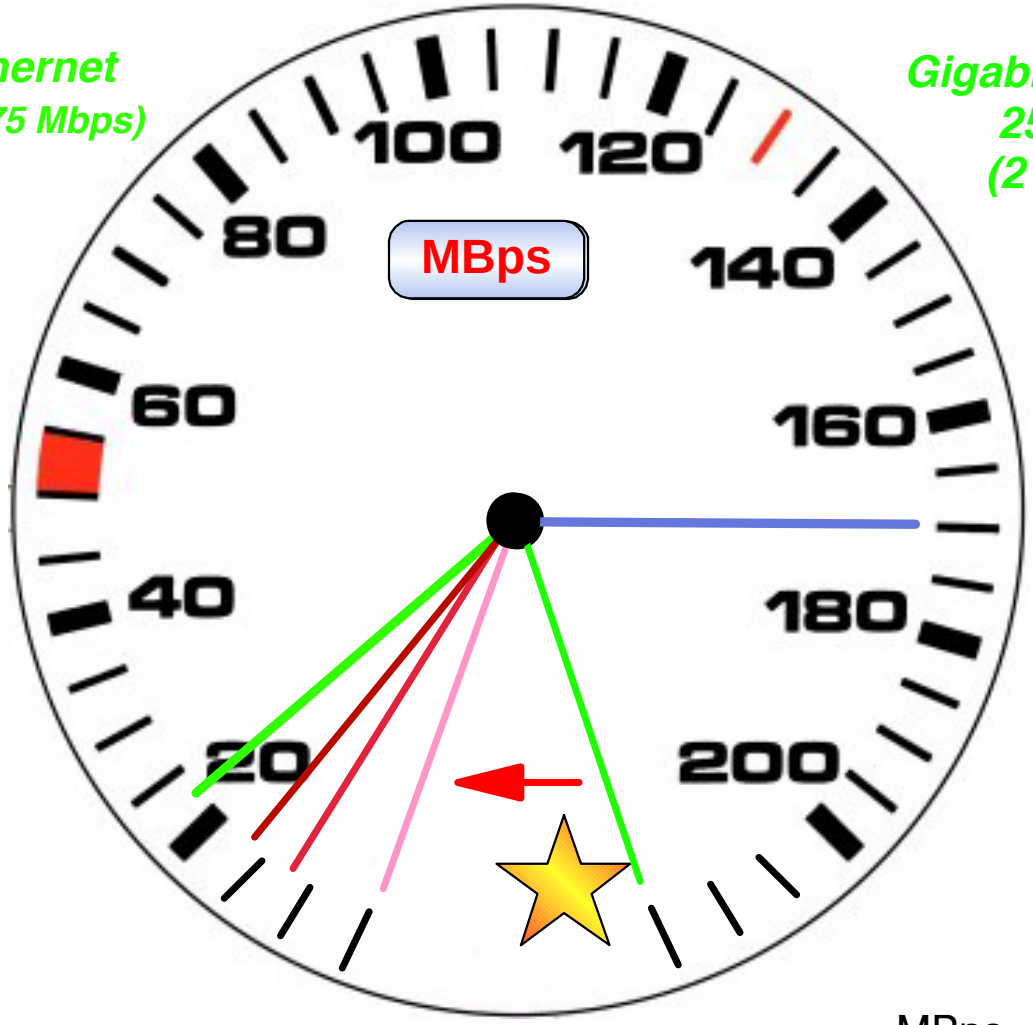
Speed zones on the information highway

Fast E Speed Zone 100 Mbps

Fast Ethernet 22 MB (175 Mbps)

Gigabit Ethernet 256 MB (2 Gbps)

GbE Speed Zone 2 Gbps



ESCON Speed Zone 17 MBps

ESCON Tape 17 MB

ESCON Disk 12 MB

ESCON Disk 5 MB

FICON 170 MB

FICON Speed Zone 200 MBps

MBps = MegaBytes per second
Gbps = Gigabits per second
Mbps = Megabits per second

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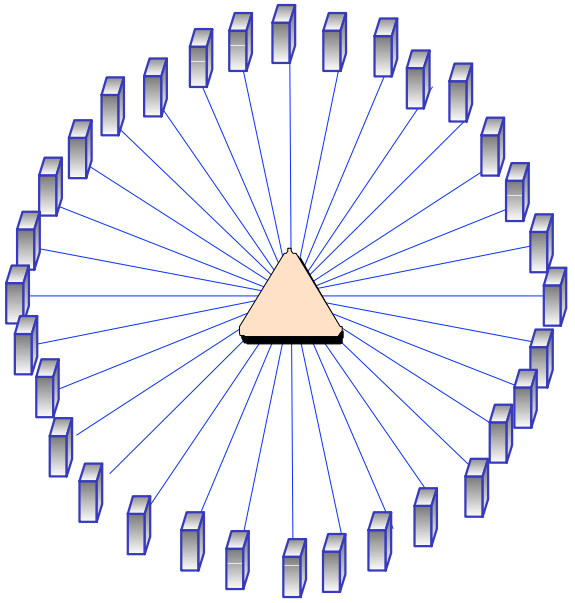
Parallel Sysplex Coupling Connectivity

ICs, ICBs, ISCs, ETR

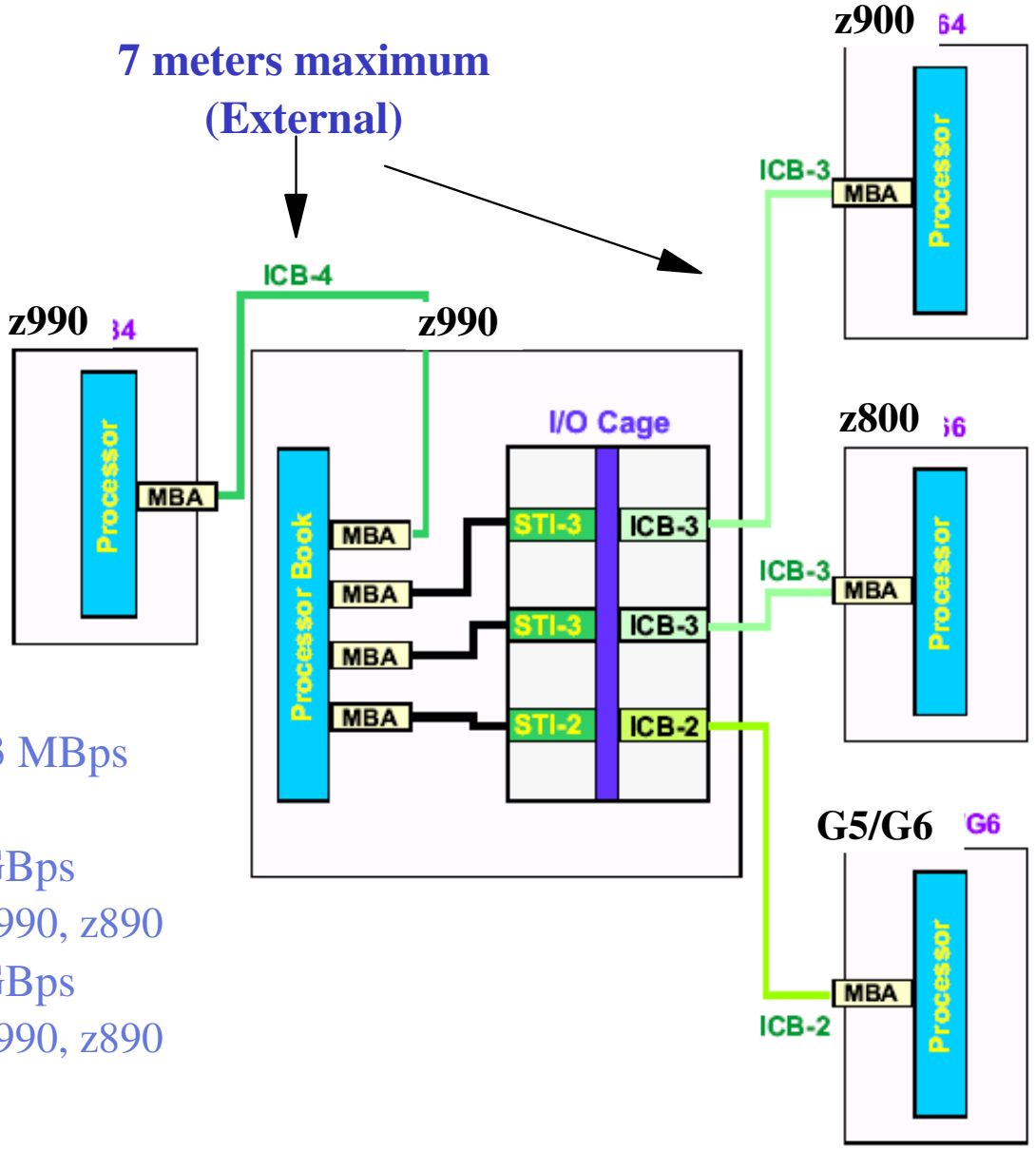


z990 and z890 Coupling Links

Link type	Name	Communication use	Link data rate	Distance	z990 maximum	z890 maximum
IC	Internal Coupling channel	Internal between CFs and z/OS, z/OS.e LPARs	Internal speeds	N / A	32	32
ICB-2	Integrated Cluster Bus-2	Server-to-Server z990s to G5/G6 Servers	333 MBps	7 meters	8	N/A
ICB-3	Integrated Cluster Bus-3	Server-to-Server z890s, z990s to z800s and z900s	1 GBps	7 meters	16	16
ICB-4	Integrated Cluster Bus-4	Server-to-Server z890s and z990s to z890s and z990s	2 GBps *	7 meters	16	8
ISC-3	InterSystem Channel-3	Server-to Server	2 Gbps **	10 km #	48	48 ##

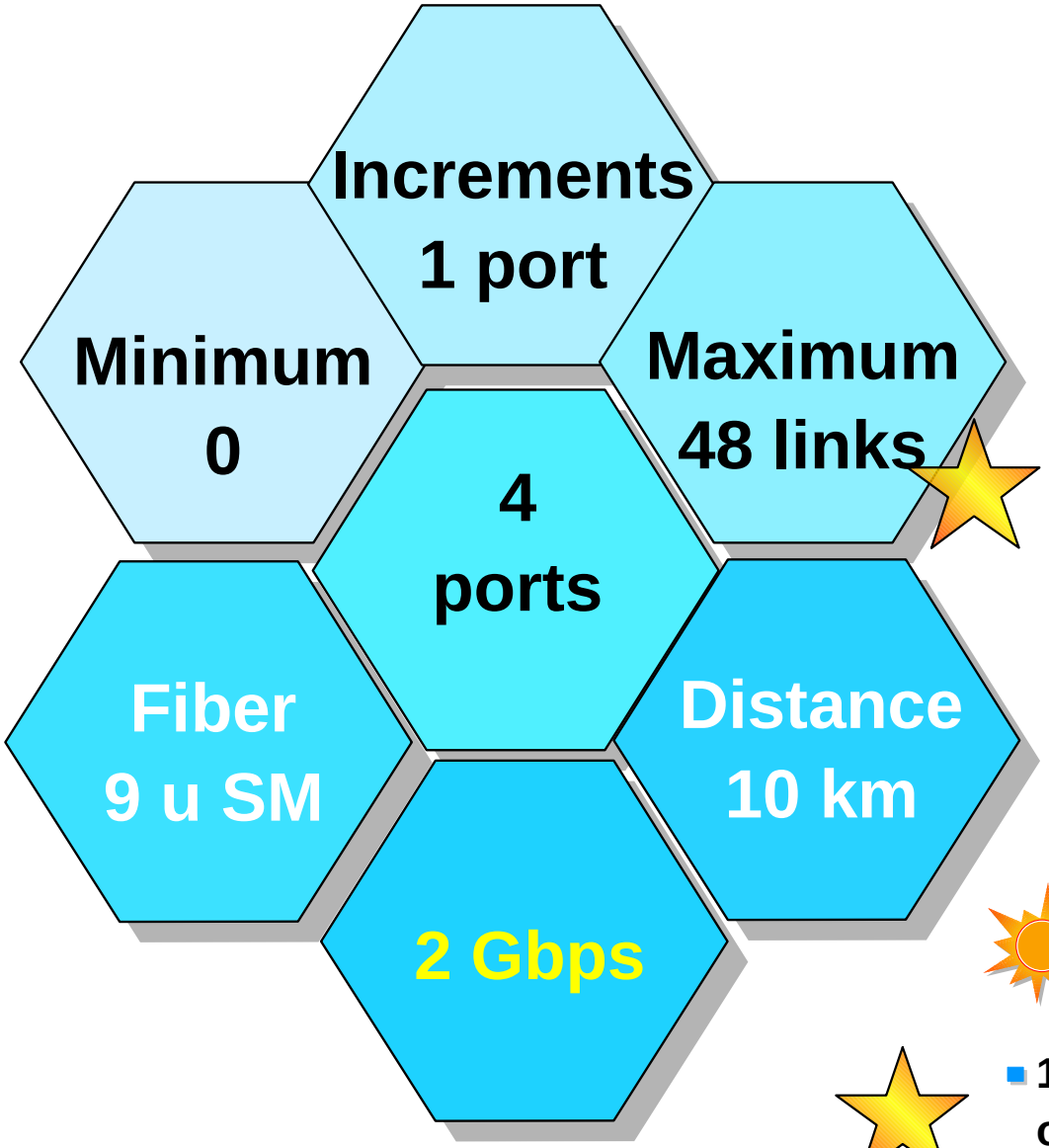
- * ICB-4 throughput is up to two times faster than ICB-3
- ** I Gbps when attached to a G5/G6 Server
- # Unrepeated distance of 20 km via RPQ (speed limited to 1 Gbps)
- ## Maximum of 24 ISC-3 links on z890 capacity setting 110
- ICB-2 will not be supported after z990. ICB-2 is not supported on z890.
- The maximum number of Coupling Links combined (ICs, ICBs, and active ISC-3 links) cannot exceed 64 per server.
- A maximum of 48 ISC-3s can be defined in peer mode (operating at 2 Gbps) and a maximum of 32 ISC-3s can be defined in compatibility mode (operating at 1 Gbps).
- An ISC-3 feature on a z890 or z990 can be connected to another zSeries server in peer mode (CHPID type CFP) operating at 2 Gbps or to a HiPerLink (ISC-2) on a G5/G6 in compatibility mode (CHPID types CFS/CFR) operating at 1 Gbps.

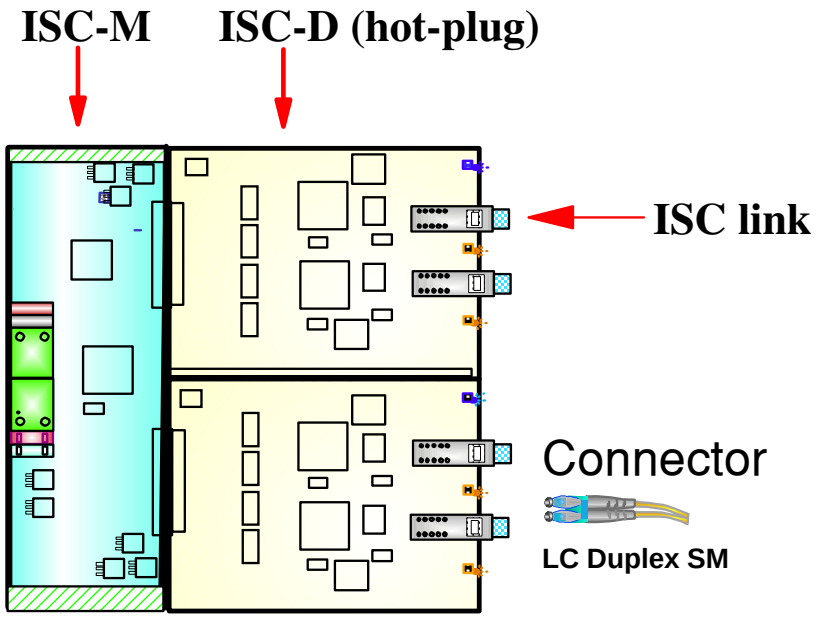
Integrated Cluster Bus connectivity



- ✓ ICB-2 links = 333 MBps
  - ► z990 to G5/G6
- ✓ ICB-3 links = 1 GBps
  - ► z900, z800 to z990, z890
- ✓ ICB-4 links = 2 GBps
  - ► z990, z890 to z990, z890

z990, z890 InterSystem Channel-3 (ISC-3)





zSeries ISC-3

ISC-M = Mother card
ISC-D = Daughter card

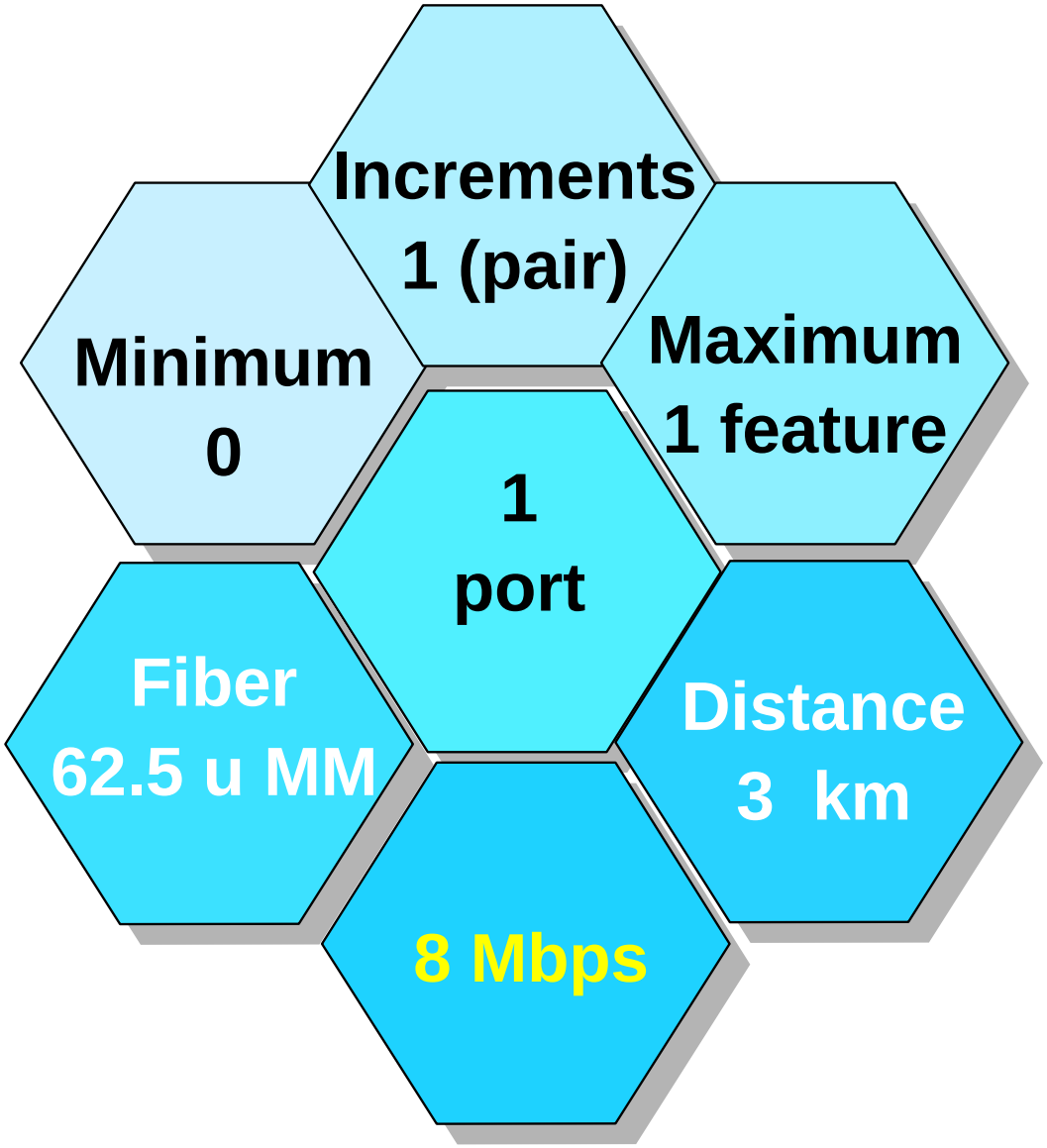
- **Two modes of operation**
  - Peer Mode (2 Gigabits per second - Gbps)
  - Compatibility Mode (1 Gbps)
- **100% increase in connectivity over z800, z900**
- **z890 capacity setting 110 maximum = 24 links**

Sysplex Timer - End of marketing 12/03

- z990 will attach to 9037-001 or 9037-002
  - Service for 9037-001 was discontinued year-end 2003
- Sysplex Timer® 9037-002
  - Hot-pluggable port cards
  - Maximum of 24 ports
    - 16 ports maximum - Sysplex Timer Model 1
  - Sysplex Timers can be separated by up to 40 km using a DWDM
    - Was 2.2 meters with Sysplex Timer Model 1
  - Provides for an active and standby console
    - Sysplex Timer Model 1 supports one active console
  - Allows a preferred and backup ETS
    - Sysplex Timer Model 1 allows for one ETS source
  - Replacement of 9037-001 to 9037-002 is disruptive
    - Procedure for minimizing outage available from IBM Representative
  - Detailed planning info:
    - "Planning for the 9037 Model 2 Sysplex Timer SA22-7233"
- MTO (Message Time Ordering)
  - May require additional ports on Sysplex Timers

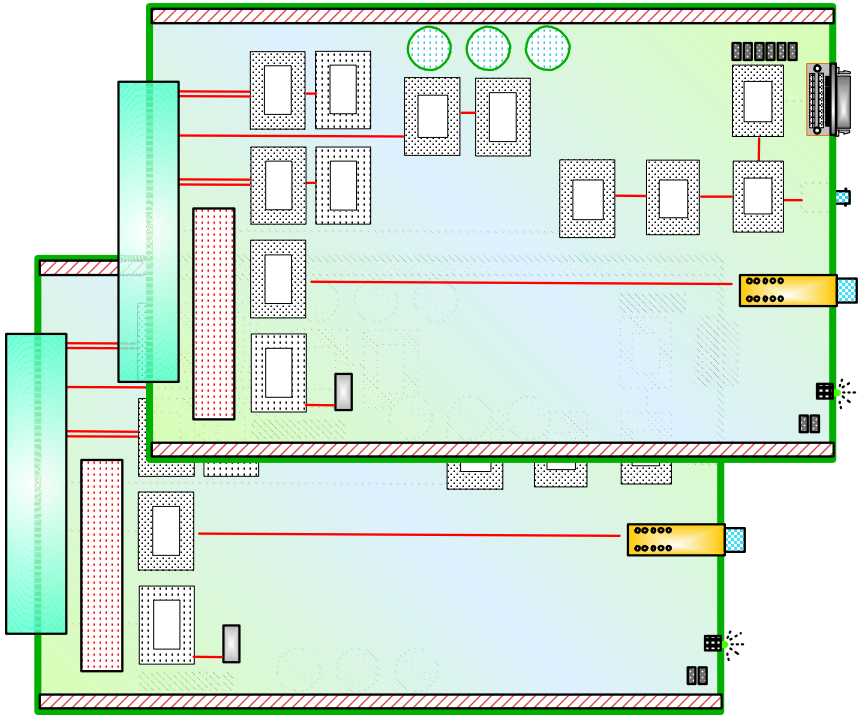
Replace 9037-001 with 9037-002!

z990, z890 ETR feature for attachment to Sysplex Timer



Connector

MTRJ MM



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Cryptographic options

CPACF, PCIXCC, PCICA, Crypto Express2

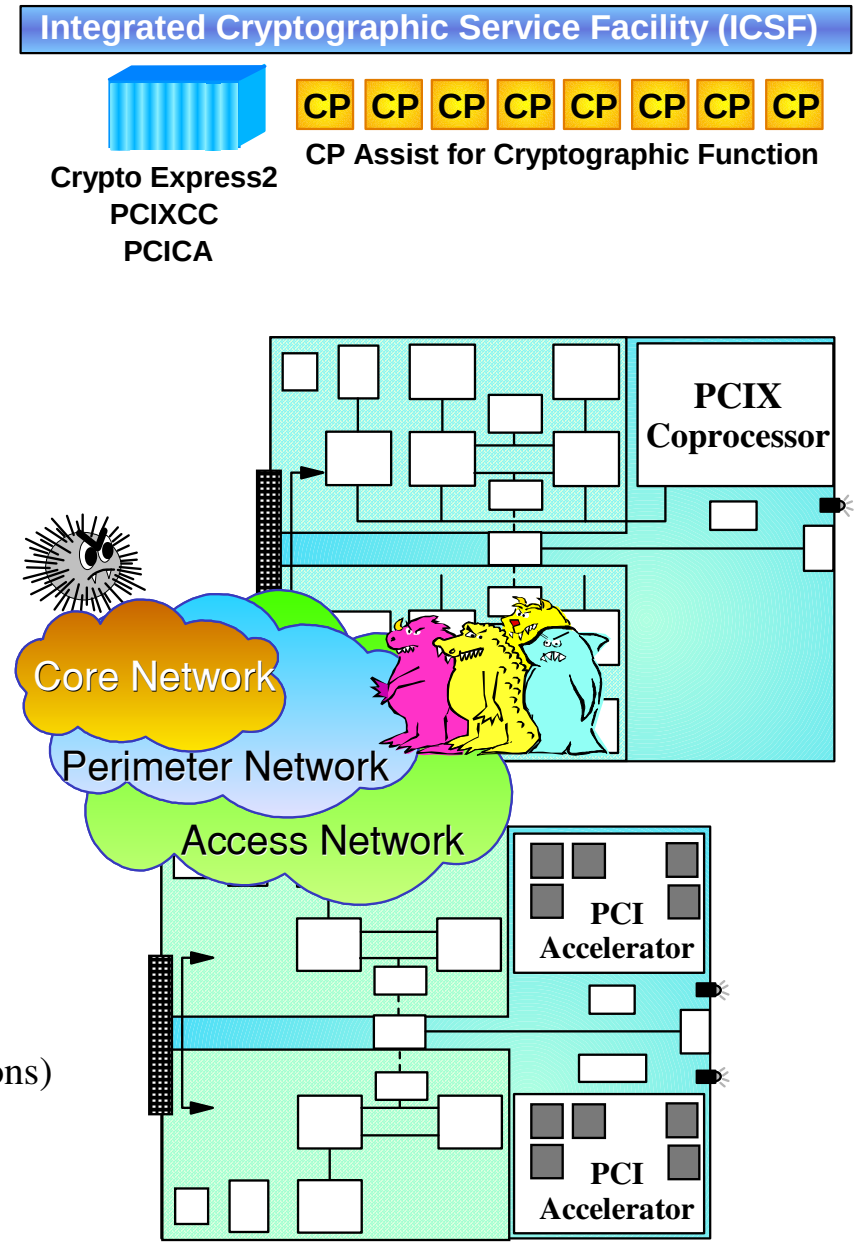
z990, z890 Cryptographic support

- **CP Assist for Cryptographic Function (CPACF)**
  - **On every CP**
  - High performance clear key symmetric encryption
  - DES and TDES encryption/decryption, SHA-1 support
    - DES/TDES require no charge enablement feature
  - 2X or more the performance of the predecessor CMOS Cryptographic Coprocessor Facility (CCF)

- **PCIX Cryptographic Coprocessor (PCIXCC)**
  - Single integrated coprocessor
    - Full CCF and PCICC functionality (as with z800 and z900)
  - Improved cost/performance over the PCICC
  - Current applications will run without change
  - Connection to STI interface; no external cables
  - Fully programmable, User Defined Extensions (UDX) support
  - Designed for FIPS 140-2 Level 4 Certification

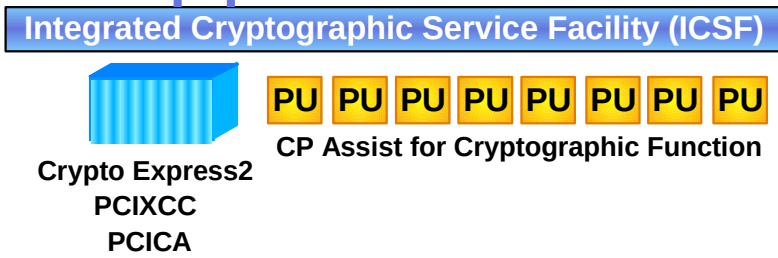
- **PCI Cryptographic Accelerator (PCICA)**
  - Two PCI accelerators per feature
  - Hardware acceleration for Secure Sockets Layer (SSL transactions)
  - High performance public key (RSA) acceleration
  - Connection to STI interface; no external cables
  - Can be carried forward on an upgrade from z800 and z900

- **Refer to Appendix for minimums and maximums**

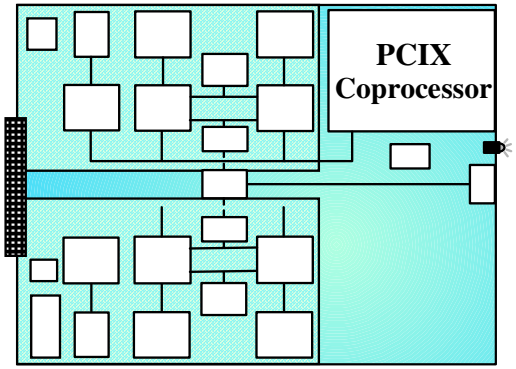


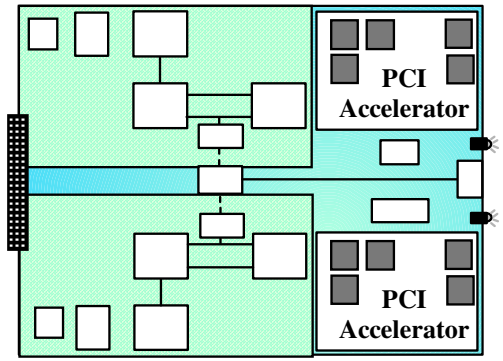
z990, z890 Cryptographic Support

May 2004 LIC



- **PCIX Cryptographic Coprocessor (PCIXCC)**
  - Derived Unique Key Per Transaction (DUKPT)
    - Added triple DES support (double length keys)
  - Europay Mastercard and VISA (EMV) 2000 standard support
    - Diversified key generate enhancements
      - Session keys for secure messaging for PINs
      - Session keys for secure messaging for keys using SESS-XOR scheme
      - Session keys for all applicable EMV key types using the EMV 2000 Annex A1.3.1 derivation scheme
    - New PIN_Change_Unblock service to handle VISA 1.4 PIN Change/Unblock command
  - Trusted Key Entry (TKE) enablement
    - Default setting is disabled

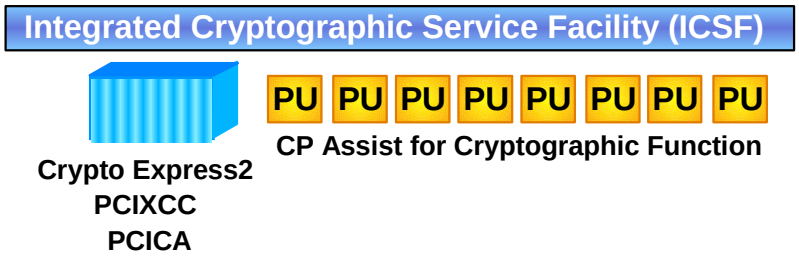




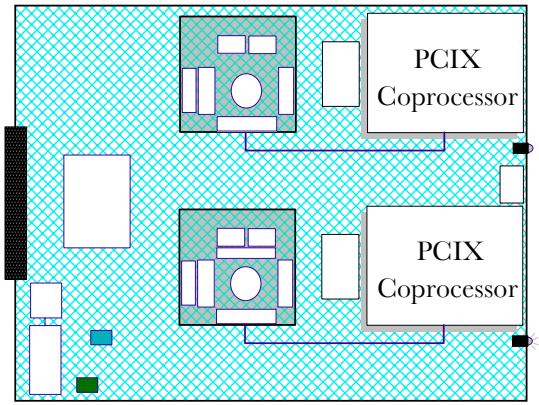
- **PCIXCC and PCI Cryptographic Accelerator (PCICA)**
  - Public Key Decript/Public Key Encrypt (PKD/PKE) enhancements
    - PKE Mod Raised to Power (MRP) support
    - PKD zero pad support
- **All of the above functions are supported by the new Crypto Express2 feature**

z990, z890 Cryptographic Support

- **Crypto Express2**



  - Dual ntegrated cryptographic coprocessors
    - Provides PCIXCC and PCICA functionality
  - Improved throughput over the PCIXCC
    - Realized with multitasking applications
  - Scalable (no CP affinity) - 0 to 8 features
    - The total number of Crypto Express2, PCICA and PCIXCC features cannot exceed 8 features per server
    - All 8 Crypto Express2 features can plug in a single I/O cage without restrictions
    - Minimum purchase increment is two (Crypto Express2 and/or PCIXCC)
  - Current applications expected to run without change
  - Connection to STI interface; no external cables
  - Fully programmable, User Defined Extensions (UDX) support
  - Designed for FIPS 140-2 Level 4 Certification
  - Trusted Key Entry (TKE) 4.X support
    - Secure operational and master key loading
    - Smart Card Reader support (TKE 4.2 only)



All z990/z890 cryptographic features are seamlessly managed by ICSF for optimum performance!

Cryptographic options announced October 7, 2004

- **19-digit Personal Account Numbers (PANs) - PCIXCC, Crypto Express2**
  - Designed to meeting the industry standard for Card Validation Value (CVV)
  - Designed to increase antifraud security
  - Previously supported 13-digit and 16-digit PANs, now 19-digit PAN
  - Exclusive to z890 and z990
- **Less than 512-bit clear key RSA operations - PCIXCC, Crypto Express2**
  - Designed to allow ***clear key*** RSA operations using keys less than 512-bits
    - Digital Signature Verify (CSNDDSV), Public Key Encrypt (CSNDPKE), and Public Key Decrypt (CSNDPKD).
  - Allows the migration of some additional cryptographic applications without rewriting the applications
  - Available on all zSeries servers
- **2048-bit key (clear and secure) RSA operations - PCICC, PCIXCC, Crypto Express2**
  - New for PCICC on z800, z900 (Previously supported up to 1024-bit keys)
    - The 2048-bit functional control vector will support four ICSF services:
      - Public Key Decrypt, Symmetric Key Import, Export, and Generate
  - Standard for PCIXCC (as of 9/2003) and Crypto Express2 on z890, z990
  - Supports new Automated Teller Machine (ATM) standards
  - Designed to increase antifraud security
  - Now available on all zSeries servers
- **TKE 4.2 workstation with smart card reader support**
  - Optional feature providing support for generating and storing key parts and key pairs
  - Trusted Key Entry (TKE) 4.2 workstation is used by: CCF, PCICC, PCIXCC, and Crypto Express2
  - TKE 4.2 support does not have a server hardware dependency.
  - Available on S/390 G6 servers and all zSeries servers
  - Available October 29, 2004

Availability - Cryptographic offerings

Announced October 7, 2004	Available PCICC z900, z800	Available PCIXCC z990, z890	Available Crypto Express2 z990, z890	Description
Crypto Express2	- - -	- - -	Jan. 28, 2005	Combines functions of PCICA and PCIXCC in one feature
19-digit PANs	Not applicable	Oct. 29, 2004	Jan. 28, 2005	Instead of 13 or 16-digit Personal Account Numbers (PANs) Card Validation Value (CVV) generation and verification services
Less than 512-bit clear key RSA operations	Currently available	Oct. 29, 2004	Jan. 28, 2005	Before only supported applications above 511 bits
2048-bit key (clear and secure) RSA operations	Oct. 29, 2004	Currently available	Jan. 28, 2005	New feature #0867 on PCICC. Integrated in PCIXCC and Crypto Express2 at introduction.

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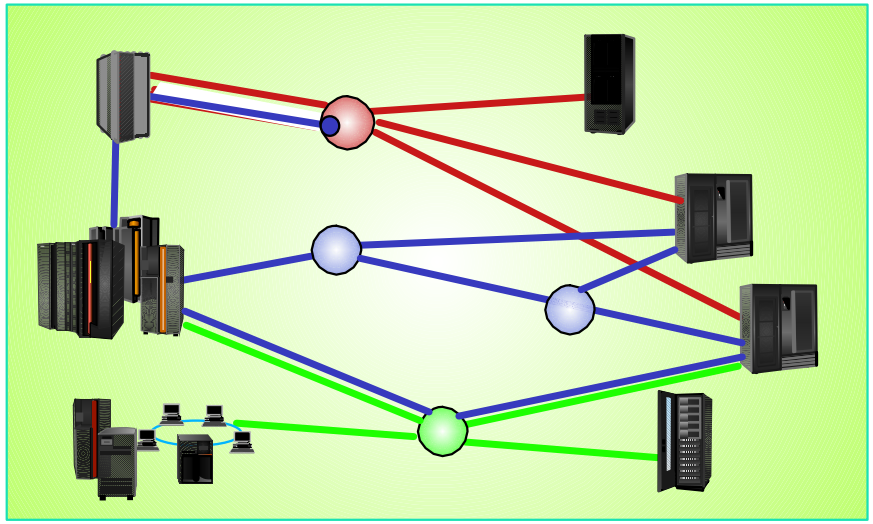
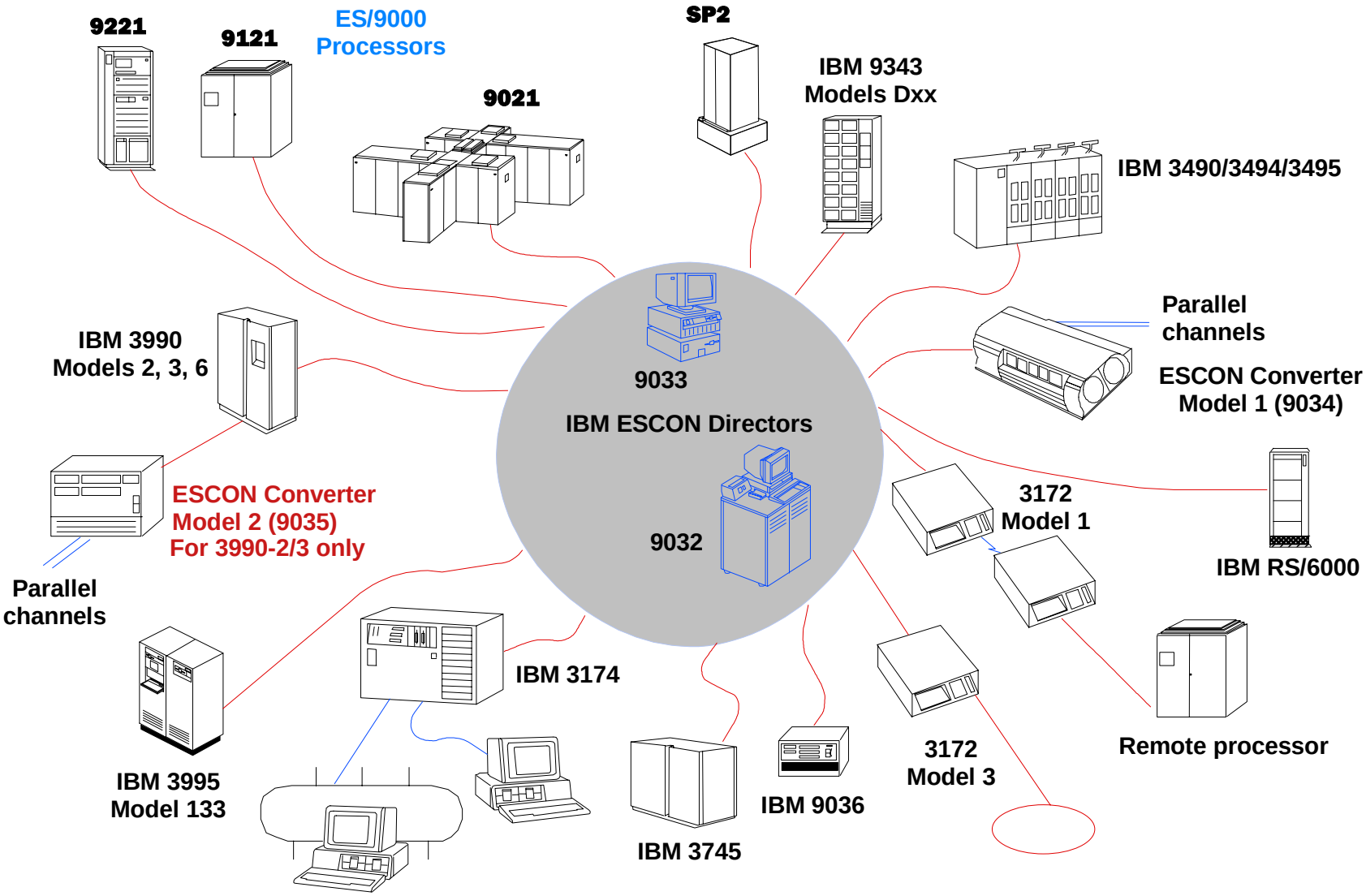
Storage Area Network Connectivity

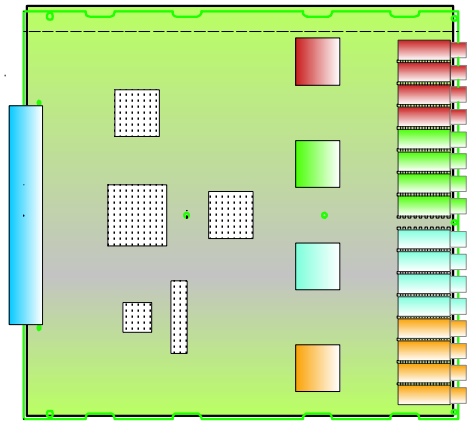
ESCON, FICON / FCP



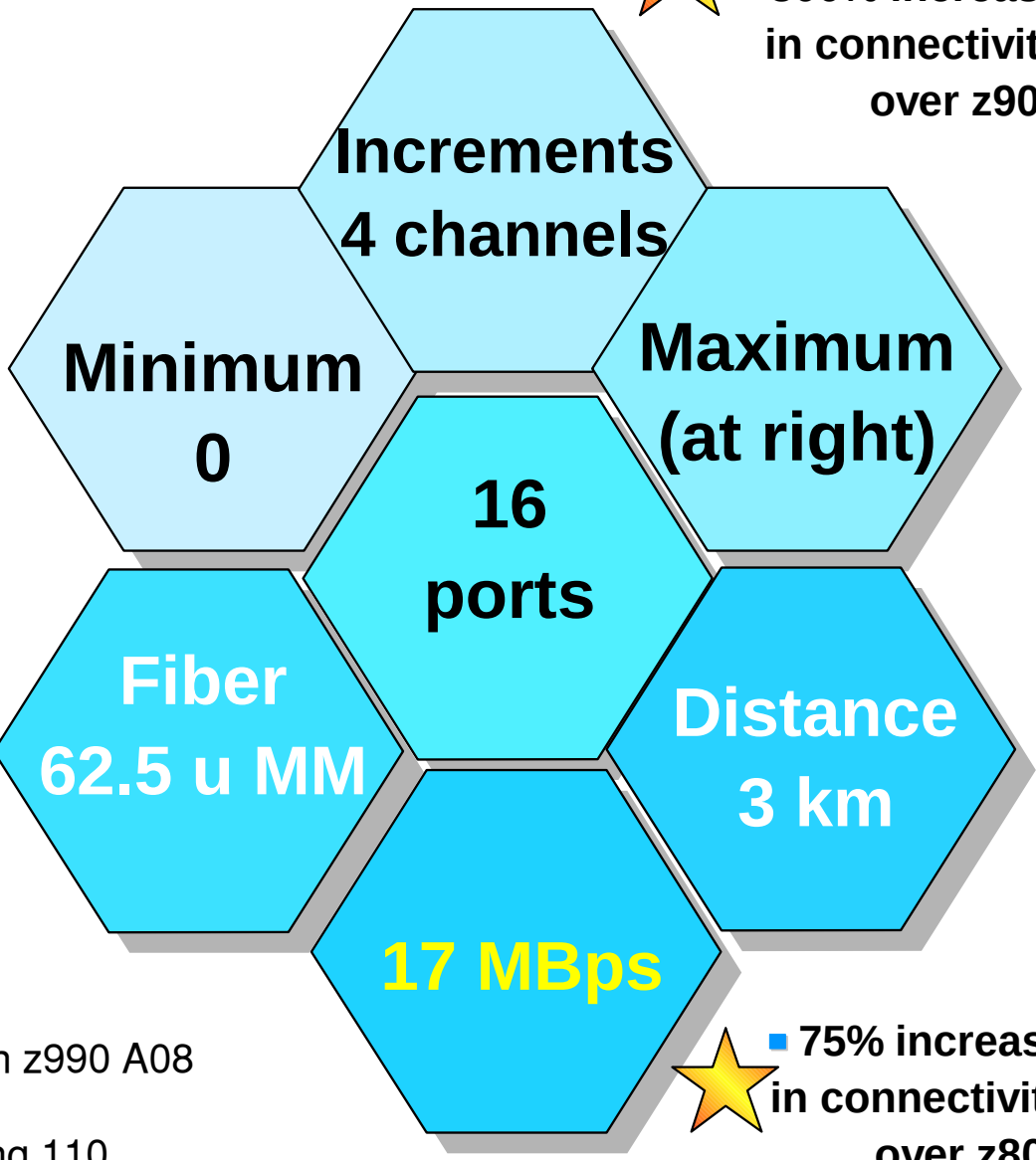
First Generation SAN: 1990 - 1993



16-port ESCON



MTRJ MM



- 300% increase in connectivity over z900

z990

Channels	Cards
4 - 28	2
32 - 44	3
48 - 60	4
. . .	. . .
244 - 268	18
. . .	. . .
508	34
- - -	- - -
1024 *	69

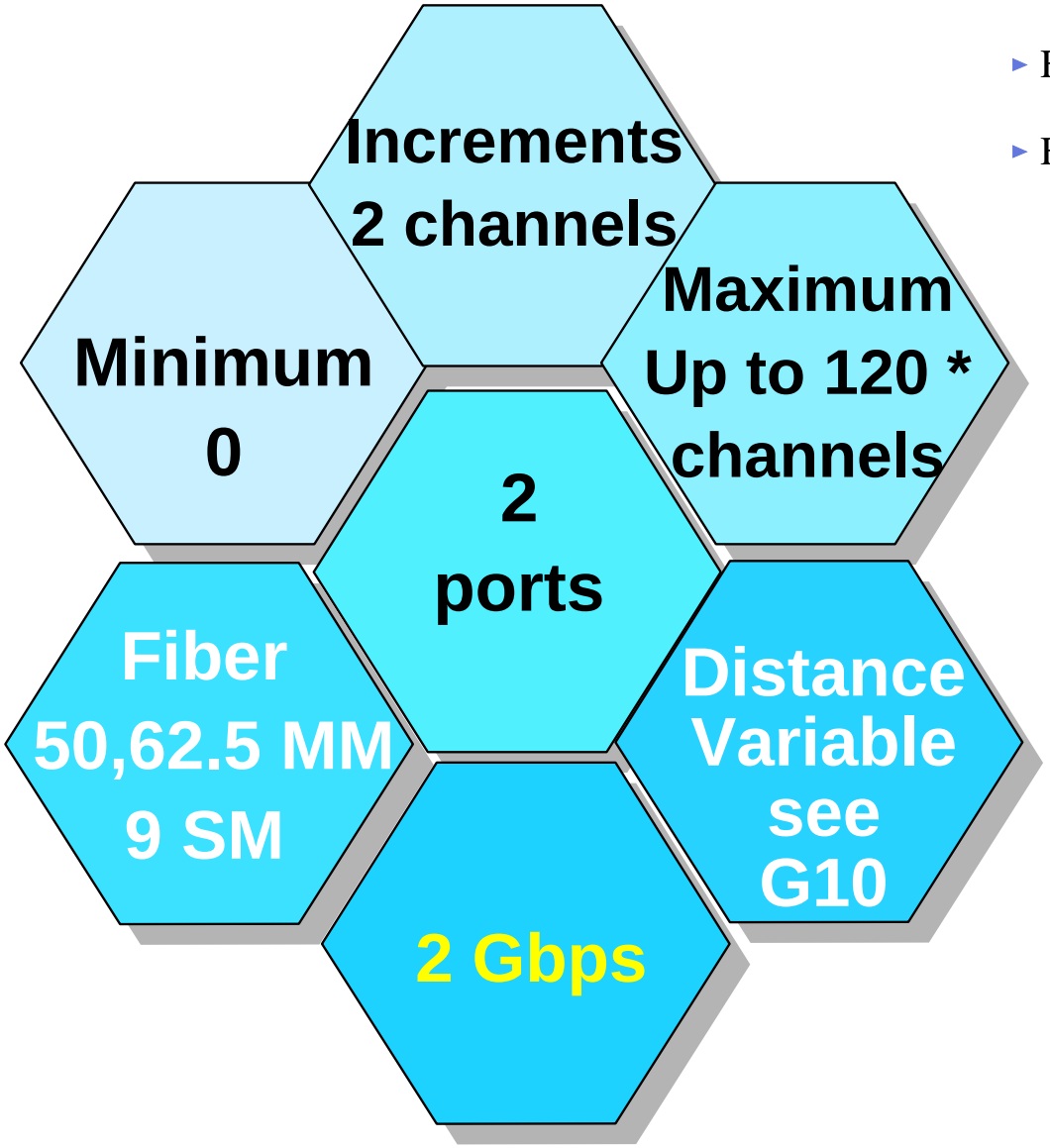
z890

Channels	Cards
4 - 28	2
32 - 44	3
48 - 60	4
. . .	. . .
244 - 268	18
. . .	. . .
420 **	28

- 75% increase in connectivity over z800

* Maximum of 720/48 on z990 A08
** Maximum of 240/16
on z890 capacity setting 110

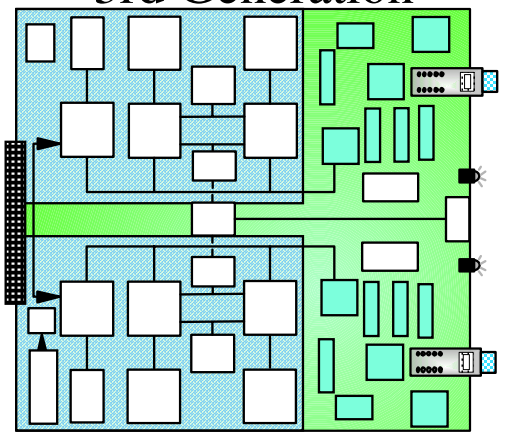
FICON Express



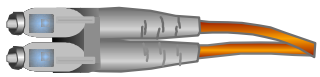
- **Modes of Operation: applicable by port**
  - FCV (FICON Bridge Converted)
    - LX feature only for communicating with ESCON devices
  - FC (Fibre Channel)
    - Native FICON, Channel-To-Channel (CTC)
  - FCP (Fibre Channel Protocol)
    - Support of SCSI devices in Linux environments

- **25% increase in connectivity over z800, z900**

FICON Express
3rd Generation



Feature code 2319 (LX), 2320 (SX)



LC Duplex MM

LC Duplex SM

24 → 36 → 96 → 120 channels (* model dependent)

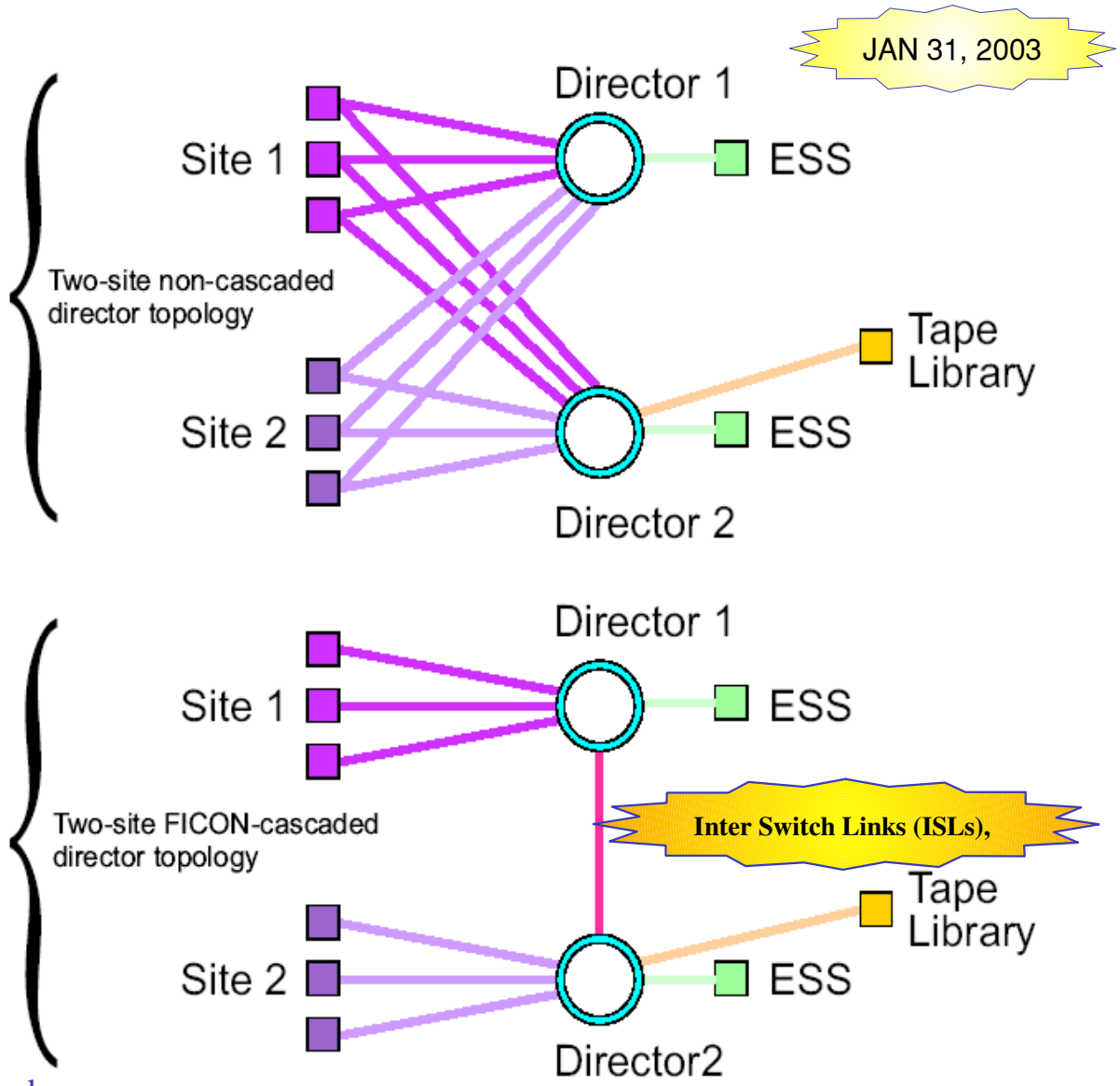
Cascaded Directors Cross-Site Connectivity

Two site non-cascaded director topology.
Each CEC connects to directors in both sites.

- **Fewer cross-site connections**
- **Reduces implementation costs for disaster recovery applications and remote copy**
- **Require single vendor high integrity fabric**
- **Software support**
  - OS/390 V2.10
    - z/OS V1.3 or V1.3 with enabling PTFs is required in an LPAR to dynamically define a cascaded director, for dynamic I/O changes, and to use the enhanced display functions.
  - z/VM V4.4
  - VSE/ESA V2.5
  - Linux Kernel V2.4
  - TPF V4.1 at PUT 16

Two Site cascaded director topology.
Each CEC connects to local directors only.

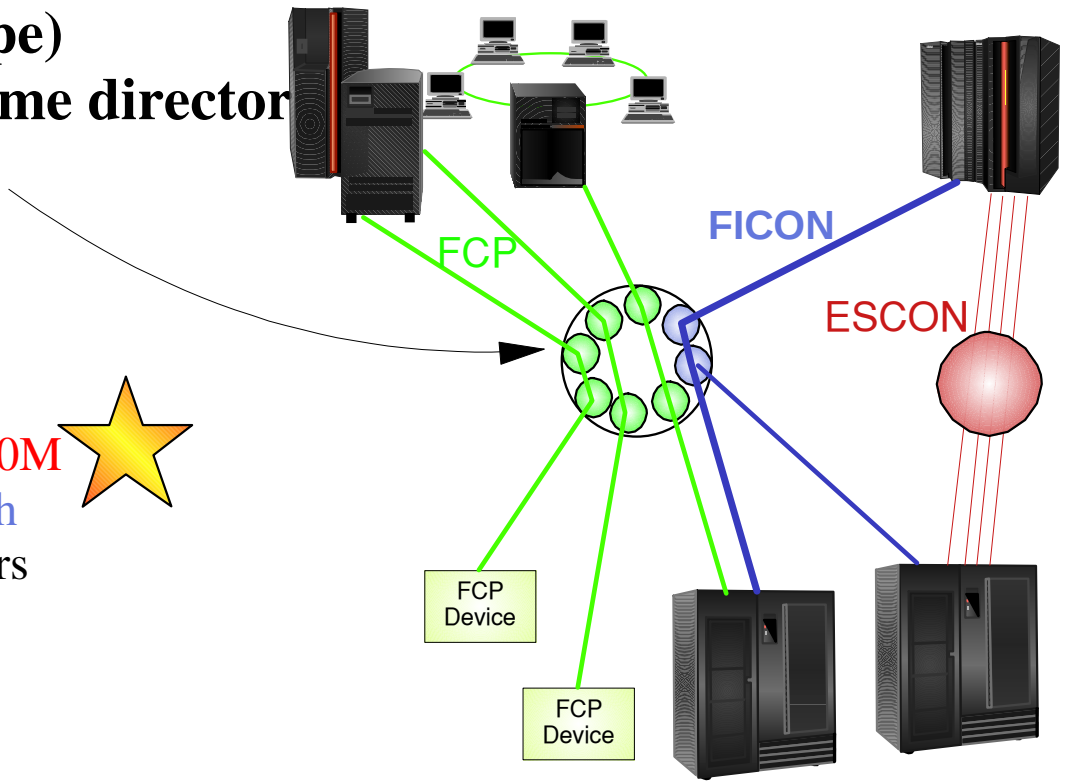
- **For maximum unrepeated distance between directors refer to:**
  - http://www.storage.ibm.com/products/index.html



FICON and FCP Intermix

March 2003

- **FICON (FC CHPID type) and Fibre Channel (FCP CHPID type) can now be intermixed in the same director**



- **Supported by**
  - Cisco MDS 9000 - 9216, 9506, 9509
  - CNT FC/9000 Directors
  - IBM TotatlStorage SAN Switch M12
  - IBM TotalStorage SAN32M-1, SAN140M
  - McDATA Sphereon 3232 Fabric Switch
  - McDATA Intrepid 6000 Series Directors

- **Shared on a port-by-port basis**

- **Refer to FICON/FCP Intermix White Papers**
  - http://www.cnt.com/literature/documents/PL673.pdf
  - http://www.mcdata.com/downloads/mkt/wpaper/ficon_intermix.pdf

- **For Linux on zSeries support of FCP**
  - http://www10.software.ibm.com/developerworks/opensource/linux390/index.shtml

New for FICON on z990 and z890

- **Previewing - FCP LUN access control (CHPID type FCP)**
  - Designed to allow:
    - Host-based control of operating system image access to SCSI devices as identified by their logical unit numbers (LUNs) on shared FCP channels.
  - Read-only sharing of LUNs among multiple operating system images
  - z/VM V4.4 and Linux on zSeries
  - Looking for Early Support Program customers
    - Inquires should be received by 11/15/2004 (see Oct. 7 announcement letter for more information)

- **FICON purge path extended (CHPID type FC)**
  - Designed to provide enhanced FICON Express problem determination and error-recovery by providing end-to-end error-related information to the host operating system.
  - z/OS and z/OS.e V1.4, and later, with PTFs
  - Available October, 29 2004.

- **For more information on FICON refer to Session G10 on your CD.**

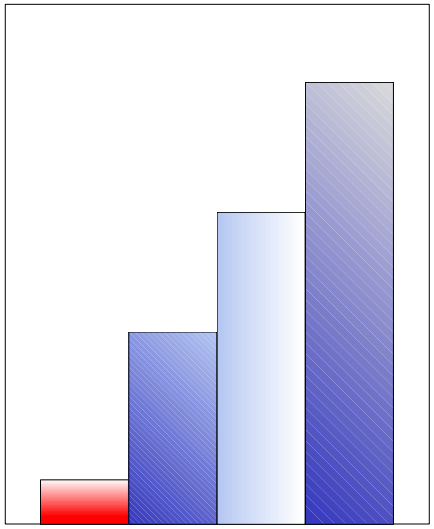
FICON Express Connectivity
Refer to session G10 on your CD

Distance - ESCON (3 km)

Distance - FICON (10 km)

Droop - ESCON (9 km)

Droop - FICON (100 km)



Performance

Function

FICON / CTC

1 Gbps or 2 Gbps links

Cascaded FICON

FCP

FICON/ FCP Intermix

IBM GLOBAL SERVICES

zSeries Expo | Nov. 1 - 5, 2004

Miami, FL

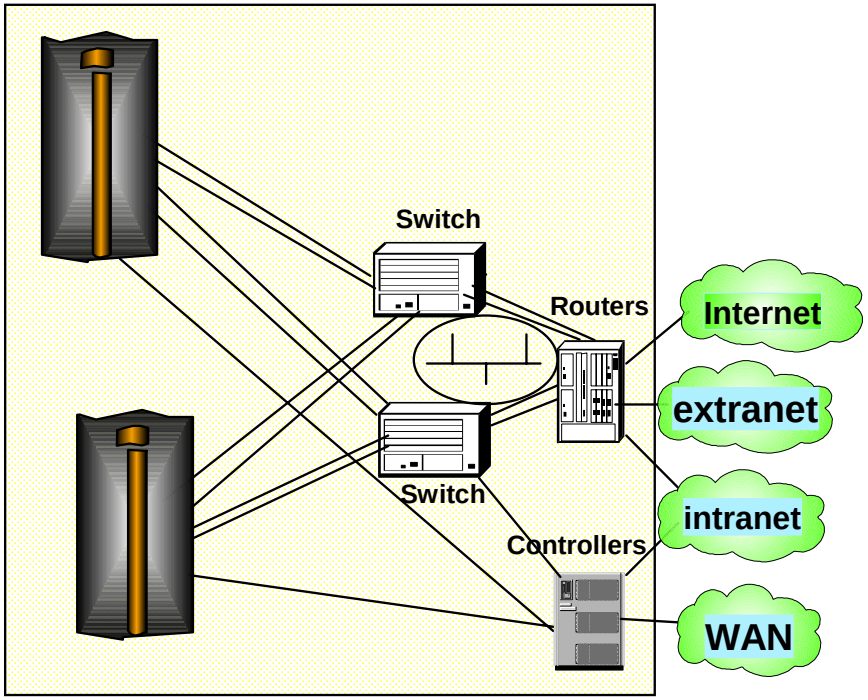
Local Area Network Connectivity

Token Ring, Fast Ethernet

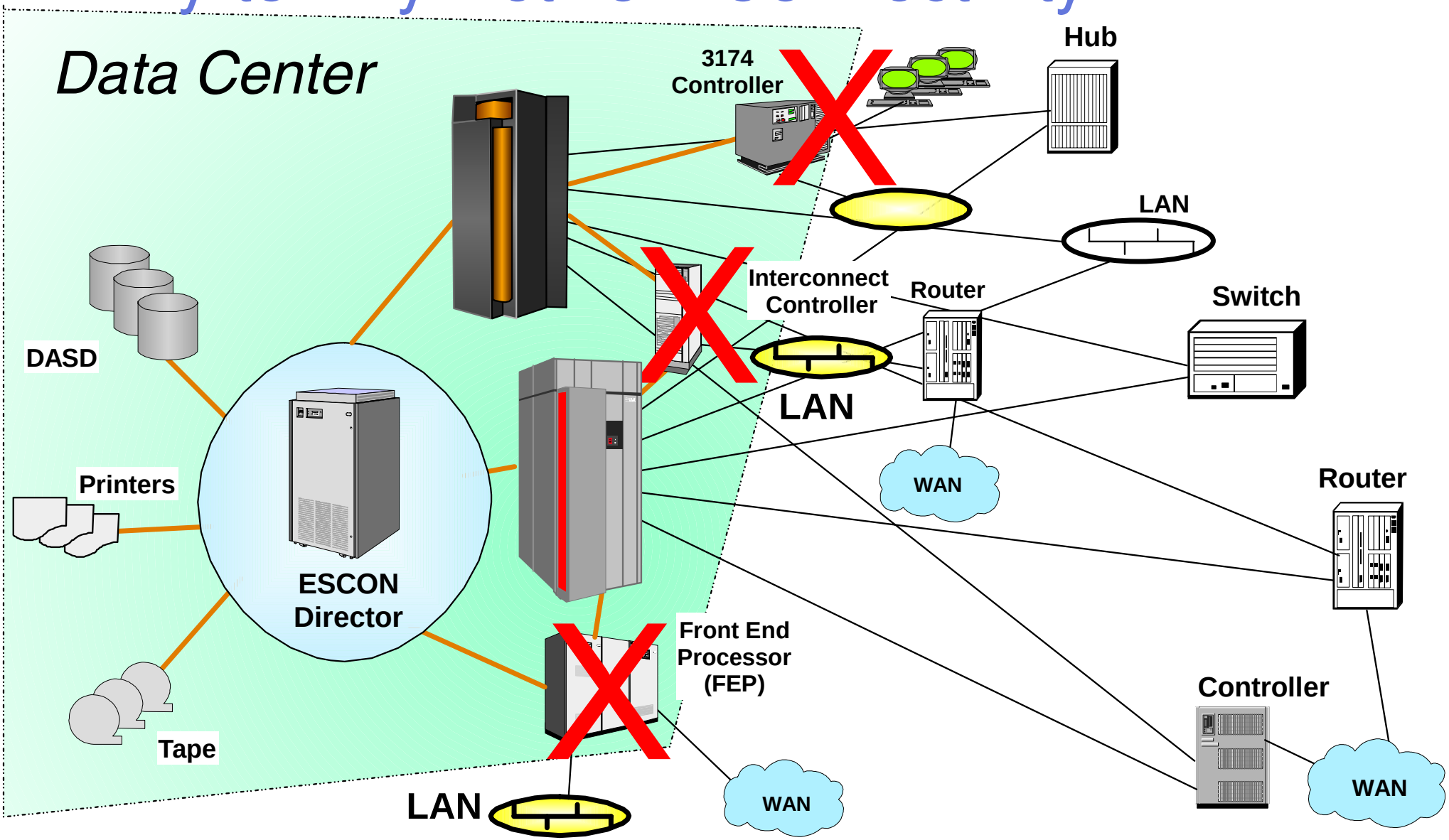
1000BASE-T Ethernet

Gigabit Ethernet

10 Gigabit Ethernet

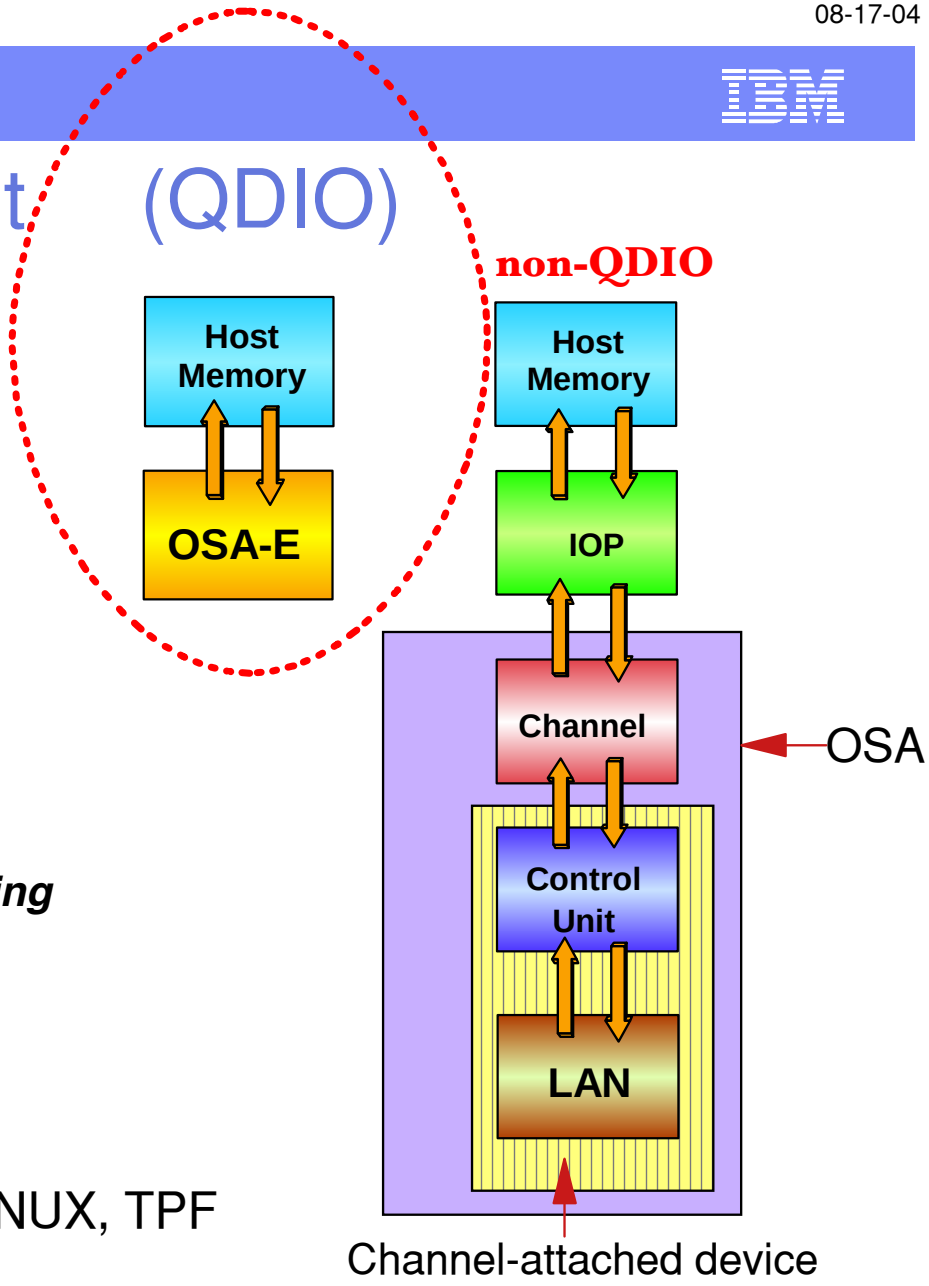


Any-to-Any Network Connectivity



Queued Direct Input/Output (QDIO)

- For TCP/IP traffic only
  - For SNA/APPN/HPR traffic with QDIO use TN3270, Enterprise Extender
- Designed for high speed communication
  - ***Reduced TCP/IP path length***
  1. ***QDIO IP Processing Assist***
  2. ***LPAR-to-LPAR Communication with port sharing***
  3. ***Direct Memory Access (DMA) Protocol***
     - Memory-to-memory communication
       - I/O interrupts minimized
       - Continuous direct data exchanges
  4. ***Dynamic customization***
- z/OS, OS/390, z/VM, VM/ESA, VSE/ESA, LINUX, TPF
- Gigabit Ethernet, 1000BASE-T Ethernet, Fast Ethernet, Token Ring



z990 and z890 OSA-Express2

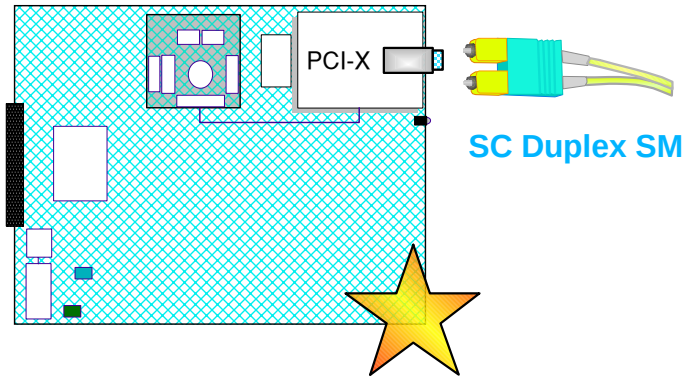
- **Newest member -** 10 Gigabit Ethernet LR (long reach)
  - One port per feature
  - 9 micron single mode fiber, SC Duplex connector

- **New** - Gigabit Ethernet features
  - Gigabit Ethernet LX (Long wavelength)
    - 9 micron single mode fiber, LC Duplex connector
  - Gigabit Ethernet SX (Short wavelength)
    - 50 or 62.5 micron multimode fiber, LC Duplex connector
  - Designed to achieve line speed - 1 Gbps in each direction

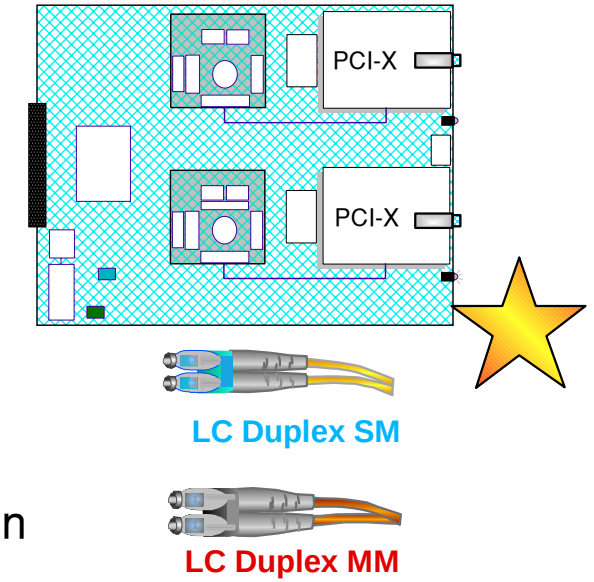
- Support offered by both 10 GbE and GbE:
  - Queued Direct Input/Output (QDIO) for TCP/IP traffic only
    - Use TN3270 or Enterprise Extender for SNA traffic
  - **Layer 2 support** for flexible and efficient data transfer
  - **640 TCP/IP stacks** for improved virtualization
  - **Large send** for CPU efficiency
  - **Concurrent LIC update** to minimize network traffic disruption

- CHPID type for all features and functions listed is OSD

10 Gigabit Ethernet Feature 3368



Gigabit Ethernet Features 3364 (LX), 3365 (SX)



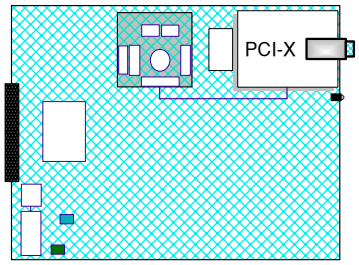
OSA-Express2/OSA-Express

- **Up to 48 network connections - z990**
- **Up to 40 network connections - z890**
  - 24 on z890 capacity settting 110
- **Choose from 5 features**
- OSA-Express2 GbE LX and SX, 10 GbE
- OSA-Express
  - 1000BASE-T Ethernet (10/100/1000 Mbps)
    - Same Category 5 **copper** as Fast Ethernet
  - Token Ring (4/16/100 Mbps)
    - Category 5 **copper**

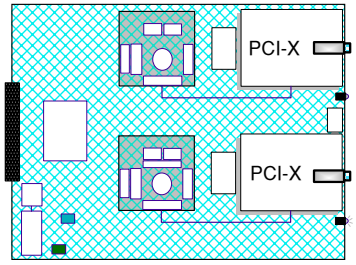
- Modes of Operation for 1000BASE-T Ethernet, Token Ring
  - QDIO = TCP/IP traffic only
    - TN3270 or Enterprise Extender for SNA traffic
  - Non-QDIO = TCP/IP and/or SNA/APPN/HPR

- **SOD - z990/z890 are the last zSeries servers to support Token Ring - new build, upgrade, MES, or carry forward**

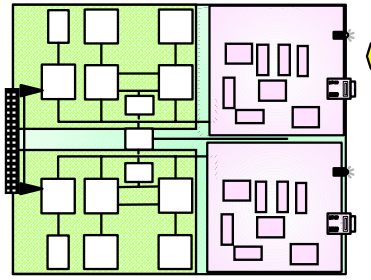
10 Gigabit Ethernet Feature 3368 1



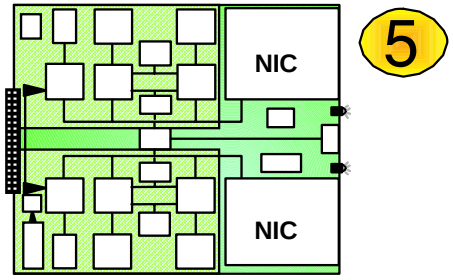
Gigabit Ethernet Features 3364 (LX), 3365 (SX) 2 3



Ethernet (1000BASE-T) Feature 1366



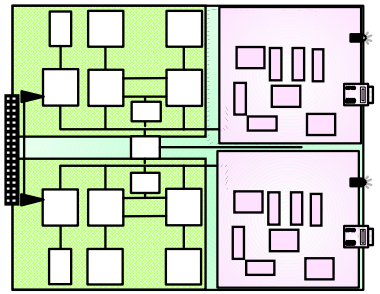
Token Ring Feature 2367



z990, z890 OSA-Express 1000BASE-T Ethernet

- **Supports auto-negotiation: 10, 100, 1000 Mbps**
- **QDIO and a non-QDIO (CHPID types OSD, OSE)**
- **TCP/IP and SNA/APPN/HPR environments at up to gigabit speeds**
- **Checksum Offload when in QDIO mode (OSD CHPID type)**
  - Supported by z/OS V1.5, Linux

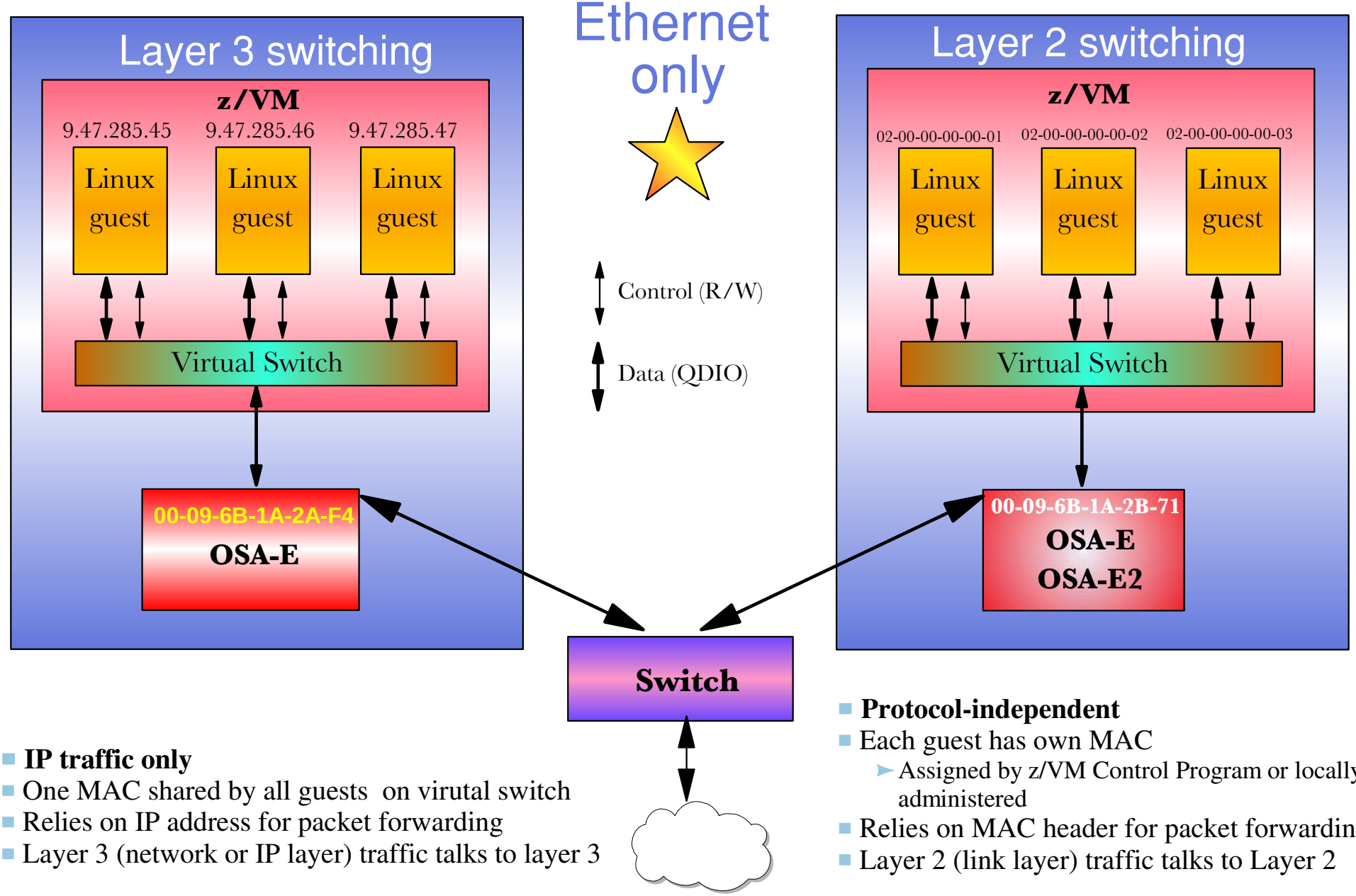
Ethernet (1000BASE-T) Feature 1366



- **When configured at 1 Gbps**
  - Operates in full-duplex mode only
  - Operates in QDIO mode or non-QDIO mode
  - Can carry SNA/APPN/HPR traffic (non-QDIO mode)
  - Can carry TCP/IP packets (QDIO or non-QDIO mode)
  - Supports jumbo frames in QDIO mode

- **OSA-ICC (CHPID type OSC), May 2004**
  - OSA-Express Integrated Console Controller
  - Supports TN3270E (RFC 2355) and non-SNA DFT 3270 emulation
  - 120 console sessions per port

Link layer transport for protocol-independent data transfer



- **IP traffic only**
- One MAC shared by all guests on virutal switch
- Relies on IP address for packet forwarding
- Layer 3 (network or IP layer) traffic talks to layer 3

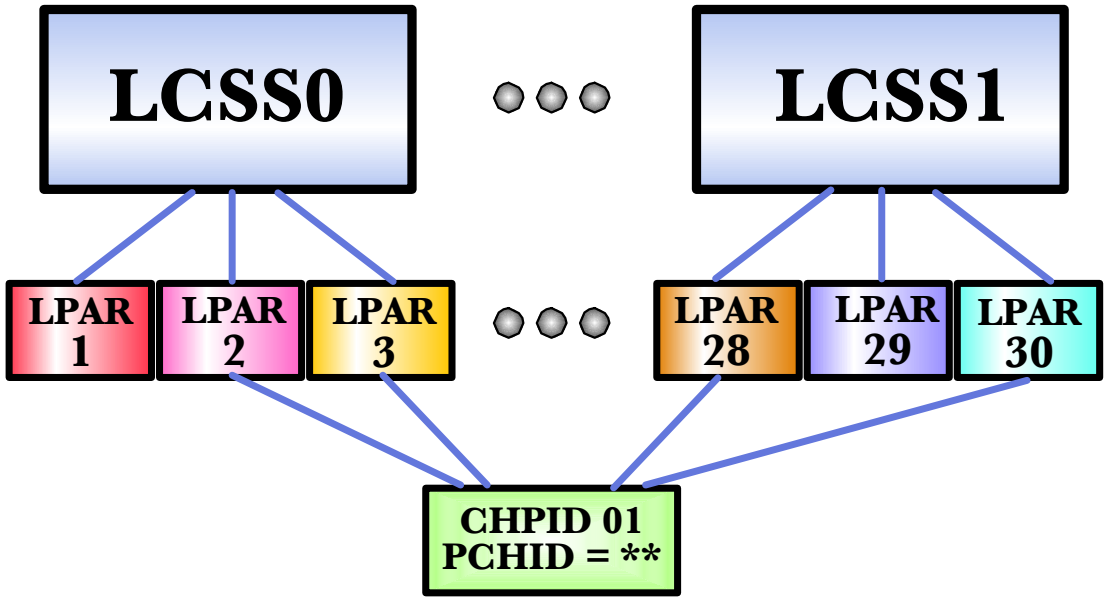
- **Protocol-independent**
- Each guest has own MAC
  - Assigned by z/VM Control Program or locally administered
- Relies on MAC header for packet forwarding
- Layer 2 (link layer) traffic talks to Layer 2

Availability - OSA offerings
Refer also to session G13 on your CD

Announced October 7, 2004	CHPID type	Available 2004 OSA-Express Ethernet	Available 2005 OSA-Express2 Ethernet	Description
OSA-Express2 GbE	OSD	- - -	January 28	New generation of GbE
OSA-Express2 10 GbE LR	OSD	- - -	January 28	New member of OSA family
Layer 2 support	OSD	October 29	January 28	IP and non-IP workloads. Simplifies network configuration
640 TCP/IP stacks	OSD	- - -	January 28	More TCP/IP stacks Hosting more Linux images
Large send	OSD	- - -	January 28	Sends 640 Kilobyte blocks to OSA. Saves CPU cycles
Concurrent LIC update	OSD	- - -	January 28	LIC updates without configuration off/on
Stack improvement	OSD	October 29	- - -	Now 160 stacks per LPAR instead of 84 per LPAR

Spanned channels
Share channels among LPARs across LCSSs

- **Internal spanned channels**
  - **HiperSockets and Internal Coupling links**
- **External spanned channels**
  - **FICON Express**
  - **ICBs, ISC-3**
  - **OSA-Express**



** No PCHID for HiperSockets and Internal Coupling links. PCHID required for FICON, ICs, ICBs, ISC-3, OSA
Spanning reduces the number of channels that can be defined for all LCSSs on server
Worst case - 256 if all channels are spanned between all LCSSs

A balanced system

* z890 capacity setting 110 has unique maximums
* z990 Model A08 has unique maximums

	z990	z890
Frames	Three *	One
STIs in I/O cage	7 per I/O cage	7
I/O cages	One - Three	One
I/O slots *	3 x 28 = 84 *	28 *
LCSSs	Four	Two
CHPIDs	1024	512
Type	z990 increase over 900	z890 increase over z800
ESCON *	300%	75%
FICON Express *	25%	25%
ISC-3 *	100%	100%
OSA-Express *	100%	67%

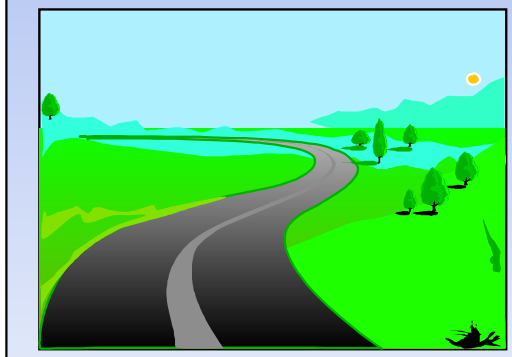
Announced May 13, 2003

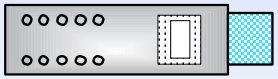
Available - June 16, 2003	Available - October 31, 2003
Models A08, B16	Models C24, D32
Up to 16 Processor Units (PUs)	Up to 32 Processor Units (PUs)
Up to 128 GigaBytes of memory	Up to 256 GigaBytes of memory
96 GigaBytes for I/O subsystem	Concurrent Model Upgrade
Two Logical Channel Subsystems (LCSSs)	GDPS/PPRC, Cross-site Parallel Sysplex up to 100 km
512 CHPIDs per System (256 per LCSS)	
15 Logical Partitions (LPARs)	30 Logical Partitions
ICB-4 up to two times faster than ICB-3	Trusted Key Entry (TKE) 4.0 Workstation
CP Assist for Cryptographic Function (CPACF)	Internal Spanned Channels (IC, HiperSockets)
PCI Cryptographic Accelerator (PCICA)	PCIXCC (delivered September 2003)
Up to 16 HiperSockets (Internal LANs)	HiperSockets Network Concentrator
Up to 512 ESCON Channels	
Up to 120 FICON Express Channels	FCP for SCSI disks
Up to 48 OSA-Express Network Connections	

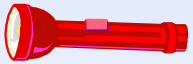
Announced

April 7, 2004, available May 2004	October 7, 2004
z890 Model A04 + z990 Enhancements	EAL5 certification for z990
z890 up to 5 PUs and 28 capacity settings	Crypto Express2
z890 up to 32 GigaBytes of memory	19-digit PANs, less than 512-bit keys
z890 - 16 GigaBytes for I/O subsystem	2048-bit key RSA operations
z990 - 4 LCSSs, z890 - 2 LCSSs	TKE 4.2 + Smart card reader support
z990 - 1024 CHPIDs, z890 - 512 CHPIDs	Preview - FCP LUN access control
z990 - 24 CPs in a single LPAR	FICON purge path extended
zAAP (Java execution environment)	OSA-Express2 GbE SX and LX
External Spanned Channels	OSA-Express2 10 GbE LR
	OSA Layer 2, 640 TCP/IP stacks
Up to 48 ISC-3 links	OSA large send, concurrent LIC update
Up to 1024 ESCON channels (z990)	CFCC level 14 w/Dispatcher Modifications
	On/Off CoD test
OSA-Express Integrated Console Controller	Extended staging - CIU, On/Off CoD orders

Sum it Up!

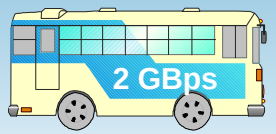






Speed Zone

? MBps



Coupling Links

CPACF
PCIXCC
PCICA

1024 ESCON

Crypto Express2

120 FICON

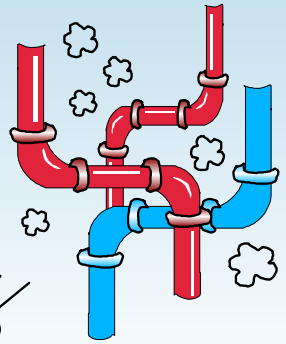
1000BASE-T Ethernet

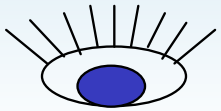
GbE
10 GbE

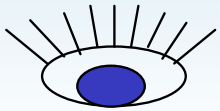
48 NICs

Token Ring

Fiber Cabling



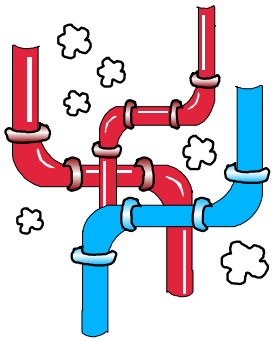




The STAIR STEPS: Infrastructure impacts x 1024

These stair steps represent the introduction of features requiring a cabling infrastructure (the parallel channel is not included). A data center may include multiple generations of products (ES/9000, S/390, zSeries).

1024 CHPIDs (z990), 512 CHPIDs (z890)
The possible combinations are tremendous and can include copper and fiber, a multitude of devices, differing connectors, and cabling.



Can you select the right connectivity?

2	3	5	8	10	11	12	15	18	21	22	25	28
1990	1991	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED	ESCON LED
ETR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	ETR
	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF	ESCON XDF
		ISC SM	ISC LX	ISC LX	ISC LX	ISC LX	ISC LX	ISC LX	ISC LX	ISC LX	ISC LX	ISC LX
		ISC MM	ISC SX	ISC SX	ISC SX	ISC SX	ISC SX	ISC SX	ISC SX	ISC SX	ISC SX	ISC SX
			FDDI	FDDI	FDDI	FDDI	FDDI	FDDI	FDDI	FDDI	FDDI	FDDI
			Ethernet	Ethernet	Ethernet	Ethernet	Ethernet	Ethernet	Ethernet	Ethernet	Ethernet	Ethernet
			Token Ring	Token Ring	Token Ring	Token Ring	Token Ring	Token Ring	Token Ring	Token Ring	Token Ring	Token Ring
				ATM SM	ATM SM	ATM SM	ATM SM	ATM SM	ATM SM	ATM SM	ATM SM	ATM SM
				ATM MM	ATM MM	ATM MM	ATM MM	ATM MM	ATM MM	ATM MM	ATM MM	ATM MM
					HiPerLinks LX	HiPerLinks LX	HiPerLinks LX	HiPerLinks LX	HiPerLinks LX	HiPerLinks LX	HiPerLinks LX	HiPerLinks LX
						Fast Ethernet	Fast Ethernet	Fast Ethernet	Fast Ethernet	Fast Ethernet	Fast Ethernet	Fast Ethernet
							GbE LX	GbE LX	GbE LX	GbE LX	GbE LX	GbE LX
							GbE SX	GbE SX	GbE SX	GbE SX	GbE SX	GbE SX
							FICON LX	FICON LX	FICON LX	FICON LX	FICON LX	FICON LX
								16-port ESCON	16-port ESCON	16-port ESCON	16-port ESCON	16-port ESCON
								ISC-3	ISC-3	ISC-3	ISC-3	ISC-3
								New ETR	New ETR	New ETR	New ETR	New ETR
									FICON SX	FICON SX	FICON SX	FICON SX
									FICON Express LX	FICON Express LX	FICON Express LX	FICON Express LX
									FICON Express SX	FICON Express SX	FCP	FCP
										FCP	*GbE LX*	*GbE LX*
											GbE SX	*GbE SX*
											1000BASE-T	*1000BASE-T*
												GbE LX
												GbE SX
												10 GbE LR

- For more on the fiber optic infrastructure refer to:

- Session G27 The Plumbing for Gigabit and Beyond
- Date: Wednesday, November 3rd
- Time: 2:50 PM
- Location: Same as today

- **Thank You!**

- Please fill out your evaluation.

- This is Session G19.

IBM eServer z990 Connectivity Summary

Maximum of 1024 CHPIDs, three I/O cages, 28 I/O slots per I/O cage, total of 84 I/O slots

z990 Feature	Per Server Minimum Features	Per Server Maximum I/O Slots used by Features	Per Server Maximum Connections	Ports/channels/ Increments per Feature	Purchase Increments
16-port ESCON	0 (1)	69 (2)	1024 channels (2)	16 channels (3)	4 channels
FICON Express	0 (1)	60 (2) (4)	120 channels	2 channels	1 feature
STI-2 (5) ICB-2 link	0 0 (1)	4 N/A	N/A 8 links (6)	2 outputs N/A	N/A 1 link
STI-3 (5) ICB-3 link	0 0 (1)	8 N/A	N/A 16 links (6)	2 outputs N/A	N/A 1 link
ICB-4 link	0 (1)	N/A (7)	16 links (6)	N/A	1 link
ISC-3	0 (1)	12	48 links (6) (8)	4 links	1 link
OSA-Express2 GbE, 10 GbE	0	24 (4) (9)	48 ports	2 or 1 (10 GbE has 1)	1 feature
OSA-Express *	0	24 (4) (9)	48 ports	2 ports	1 feature
Crypto Express2	0	8 (4) (10)	16 coprocessors	2 coprocessors	1 feature (12)
PCICA **	0	6 (4) (10) (11)	12 accelerator cards	2 accelerators	1 feature
PCIXCC **	0	4 (4) (10)	4 coprocessors	1 coprocessor	1 feature (12)

1. A minimum of one I/O feature (ESCON, FICON Express) or one Coupling Link (ICB, ISC-3) is required.
2. Maximum of 48 ESCON features (720 active channels) on Model A08, 48 FICON Express features on A08
3. Each ESCON feature has 16 channels of which 15 channels may be activated. One channel is always reserved as a spare.
4. The maximum quantity of FICON Express, OSA-Express2, OSA-Express, Crypto Express2, PCICA, and PCIXCC features in combination cannot exceed 20 features per I/O cage and 60 features per server.
5. The STI distribution cards, which support ICB-2 and ICB-3, reside in the I/O cage. Each STI distribution card occupies one I/O slot.
6. The maximum number of Coupling Links combined (ICs, ICB-2s, ICB-3s, ICB-4s, and active ISC-3 links) cannot exceed 64 per server.
7. ICB-4s do not require connectivity to a card in the I/O cage. ICB-4s are not included in the maximum feature count for I/O slots.
8. A maximum of 32 ISC-3s can be defined in compatibility mode (operating at 1 Gbps, instead of 2 Gbps).
9. The maximum quantity of OSA-Express2 and OSA-Express features cannot exceed 24 features per server.
10. The maximum quantity of Crypto Express2, PCICA, and PCIXCC features cannot exceed eight features per server.
11. The maximum quantity of PCICA features cannot exceed two features per I/O cage.
12. Crypto Express2 and/or PCIXCC feature minimum is 0 or 2.

* When OSA-Express2 GbE becomes available the OSA-Express GbE features are no longer orderable.

** No longer orderable when new features become available.

IBM eServer z890 Connectivity Summary

Maximum of 512 CHPIDs, 28 I/O slots in a single I/O cage (16 I/O slots on Capacity Setting 110)

z890 Feature	Per Server Minimum Features	Per Server Maximum I/O Slots used by Features	Per Server Maximum Connections	Ports/channels/ Increments per Feature	Purchase Increments
16-port ESCON	0 (1)	28 (2)	420 channels	16 channels (3)	4 channels
FICON Express	0 (1)	20 (2) (4)	40 channels	2 channels	1 feature
STI-3 (5) ICB-3 link	0 0 (1)	8 N/A	N/A 16 links (6)	2 outputs N/A	N/A 1 link
ICB-4 link	0 (1)	N/A (7)	8 links (6)	N/A	1 link
ISC-3	0 (1)	12 (2)	48 links (6) (8)	4 links	1 link
OSA-Express2	0	20 (2) (4)	40 ports	2 or 1 (10 GbE has 1)	1 feature
OSA-Express *	0	20 (2) (4)	40 ports	2 ports	1 feature
Crypto Express2	0	8 (4) (10)	16 coprocessors	2 coprocessors	1 feature (9)
PCICA *	0	2 (4) (10)	4 accelerator cards	2 accelerator cards	1 feature
PCIXCC *	0	4 (4) (10)	4 coprocessors	1 coprocessor	1 feature (9)

1. A minimum of one I/O feature (ESCON, FICON Express) or one Coupling Link (ICB, ISC-3) is required.
2. The capacity setting 110 has the following maximums: ESCON - 16 features (240 channels), FICON Express - 16 features, ISC-3 = 6 features (24 links), OSA-Express2/OSA-Express - 12 features (all features combined cannot exceed 16 features)
3. Each ESCON feature has 16 channels of which 15 channels may be activated. One channel is always reserved as a spare.
4. The maximum quantity of FICON Express, OSA-Express2, OSA-Express, Crypto Express2, PCICA, and PCIXCC features in combination cannot exceed 20 features per server (16 features for capacity setting 110).
5. Each STI-3 distribution card, which supports the ICB-3s, resides in the I/O cage, occupying one I/O slot.
6. The maximum number of Coupling Links combined (ICs, ICB-3s, ICB-4s, and active ISC-3 links) cannot exceed 64 per server.
7. ICB-4s do not require connectivity to a card in the I/O cage. ICB-4s are not included in the maximum feature count for I/O slots.
8. A maximum of 32 ISC-3s can be defined in compatibility mode (operating at 1 Gbps, instead of 2 Gbps).
9. Crypto Express2 and/or PCIXCC feature minimum is 0 or 2.
10. The maximum quantity of Crypto Express2, PCICA, and PCIXCC features cannot exceed eight features per server.

* When OSA-Express2 GbE becomes available the OSA-Express GbE features are no longer orderable.

** No longer orderable when new features become available.

Publications: ESCON/FICON

- **SA24-7172** **S/390 (FICON) I/O Interface Physical Layer**
- **GA23-0367-07b** **Planning for Fiber Optic Links**
  (ESCON, FICON, Coupling Links, and Open Systems Adapters)
- **SG24-5176** **Introduction to IBM S/390 FICON (*Redbook*)**
- **SG24-5444** **IBM eServer zSeries I/O Connectivity Handbook (*Redbook*)**
- **SG24-5445** **S/390 FICON Planning Guide (*Redbook*)**
- **SG24-5169** **S/390 FICON Implementation Guide (*Redbook*)**
- **SG24-2005** **ESCON Director 9032-005 Presentation (*Redbook*)**
  (includes FICON Bridge card installation and use)

FCP documentation

- Linux Device Drivers and Installation Commands (LNUX-1103-07)
  - www.ibm.com/developerworks/opensource/linux390/docu/lzsdd08.pdf
- Getting Started with zSeries Fibre Channel Protocol (Redbook)
  - www.redbooks.ibm.com/redpapers/pdfs/redp0205.pdf
- Linux 2.4 SCSI How To (White paper)
  - www.ibiblio.org/pub/Linux/docs/HOWTO/other-formats/pdf/SCSI-2.4-HOWTO.pdf
- Enterprise Storage Server, Fibre Channel Attachment (White paper)
  - www.storage.ibm.com/disk/ess/support/ess-fibrev60.pdf
- SCSI on Linux for zSeries - Early Experiences (Presentation)
  - www.vm.ibm.com:2003/pdfs/L622up.pdf
- The zfcp device driver - SCSI over Fibre Channel support for Linux on zSeries (Presentation)
  - www.vm.ibm.com:2003/pdfs/L992up.pdf

- Connectivity: ibm.com/servers/eserver/zseries/ connectivity

Publications: OSA

SA22-7935	z990 Open Systems Adapter-Express Customer's Guide and Reference
SA22-7476	z800, z900 Open Systems Adapter-Express Customer's Guide and Reference
SA22-7403	S/390 OSA-Express Customer's Guide and Reference (G5/G6)
GA22-7477	Planning for the Open Systems Adapter-2 for zSeries
SG24-5948	S/390 OSA-Express Implementation Guide (Redbook)
SG24-5444	IBM eServer zSeries Connectivity Handbook (Redbook)
SG24-5443	S/390 OSA-Express Gigabit Ethernet Implementation Guide (Redbook)
GX28-8002-10	Network and e-business Products Reference booklet (Redbook)
SG24-4770	Open Systems Adapter 2 Implementation Guide (Redbook)
SC28-1950-04	OS/390 Resource Measurement Facility Report Analysis
G221-0110	OSA-Express for IBM eServer zSeries 900 and S/390 Specification Sheet
GA23-0367-07b	Planning for Fiber Optic Links (ESCON, FICON, Coupling Links, and Open Systems Adapters)

On the Internet

- IBM Resource Link, Web-based tool
  - www.ibm.com/servers/resourcelink/
    - Services section: zSeries Fiber Cabling Service
    - Planning section/Physical Planning
      - Physical Planning manuals, GIM
    - Education section: zSeries courses (z800, z900)
      - General Information for Planning a Physical Site (GIM)

Check these out!

- http://www.ibm.com/services/networking/
  - Product and Enterprise cabling offerings
- http://www.redbooks.ibm.com
  - IBM Redbooks

- http://www.ibm.com/servers/eserver/zseries/networking
  - The network connectivity home page
- http://www.ibm.com/servers/eserver/zseries/connectivity
  - The I/O connectivity home page
  - Go to this location for a list of FICON/FCP supported devices
- http://www.ibm.com/wwoi
  - Announcement Letters

On the Internet

- IBM Resource Link
  - www.ibm.com/servers/resourcelink/
  - A fiber optic cabling presentation with narrative is available
  - Covers ISCs, ETR, ESCON, FICON/FCP, OSA
  - Overview of each feature with fiber optic cabling requirements
  - FQC, Conversion kits, MCP cables
  - Extended distance implications
  - IBM Networking Services
    - zSeries fiber cabling services
    - Enterprise fiber cabling services
  - You can locate the Fiber Optic Cabling presentation on Resource Link and subscribe to receive updates.
    - After logging in click on Education in the blue on the left.
    - Under zSeries Courses click on z990.
    - Click on Fiber Optic Cabling.

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