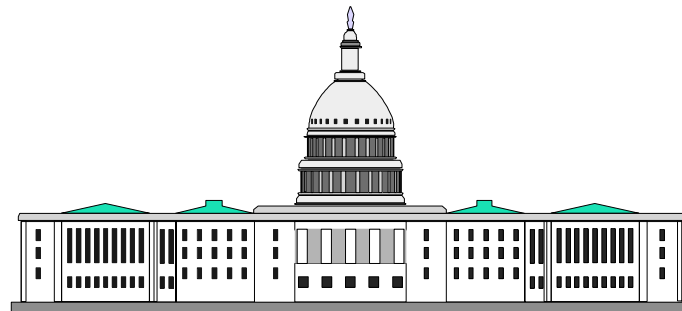# IBM zSeries 900 Processor Update

IBM z/OS and OS/390 Expo
October 7 - 11, 2002
Session T01

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emeryh@us.ibm.com

Washington Systems Center

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Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

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z900 - 2000 and 2001 Announcements

- **64-bit z/Architecture with tri-modal addressing**
- **25 General Purpose models and Coupling Facility Model**
- **Up to 16-way (20 PUs), up to 64 GB memory**
- **Enhanced Parallel Sysplex**
  - ► ISC-3, ICB-3, IC-3 Peer Mode Links
  - ► Intelligent Resource Director (IRD)
  - ► System Managed CF Structure Duplexing
- **Enhanced Security**
  - ► Cryptographic Coprocessors
  - ► PCICC
  - ► PCICA
- **Enhanced I/O and Connectivity**
  - ► FICON Express
  - ► FICON CTC
  - ► OSA-Express
  - ► HiperSockets
- **Availability Enhancements**
  - ► Capacity Upgrade on Demand (CUoD)
  - ► Concurrent memory upgrade
  - ► Concurrent I/O Upgrade/Repair
  - ► Capacity Backup (CBU) Upgrade with Concurrent Downgrade

z900 Design Improvements

- **64-bit z/Architecture™ Implemented**
  - ► 64/31/24-bit Addressing
  - ► 64-bit General Purpose Registers
  - ► Arithmetic and logical operations
  - ► I/O and channel subsystem
  - ► PR/SM™, SIE, QDIO, Crypto...

- **Enhanced branch prediction**

- **Compression engine in hardware**

- **Improved decimal performance**

- **Improved IEEE Floating Point**

- **Improved storage organization**
  - ► 512 kB L1 cache split - I/D (instructions/data)
  - ► 32 MB L2 Cache (16 MB 10x Models)
  - ► Doubled processor storage capability
  - ► Increased storage bandwidth

- **Improved I/O subsystem**
  - ► 24 STIs, 24 GB/sec bandwidth
  - ► CHPID mapping
  - ► IRD I/O priority queuing
  - ► IRD managed channels

- **Improved PR/SM hypervisor**
  - ► Defined capacity for IBM WLC
  - ► IRD weight management
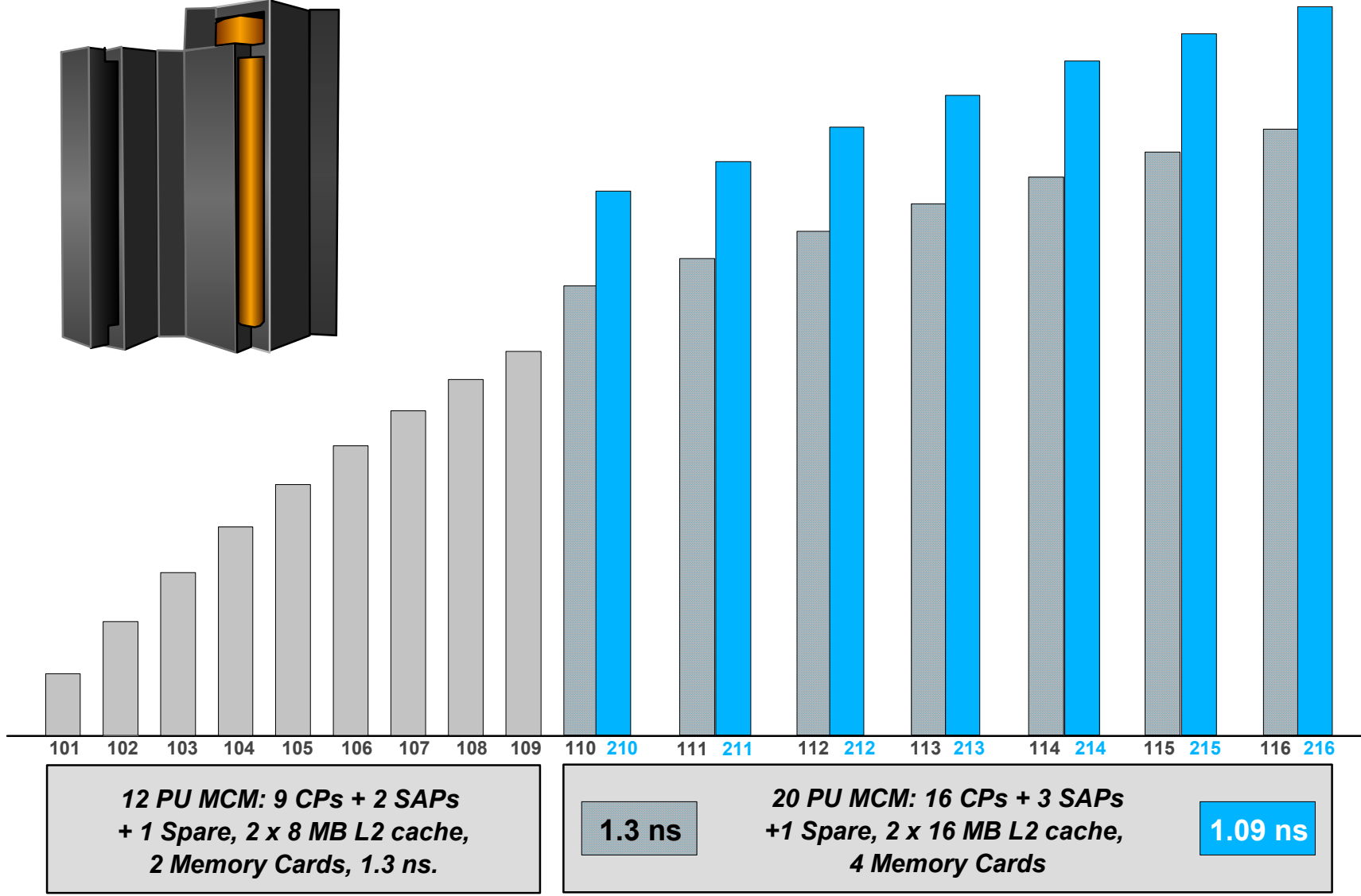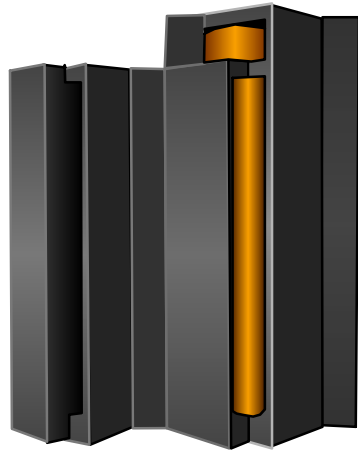
2002 - What's New with z900?

- **16 New z900 Models (2C1 - 216)**
  - ► Approximately 20% more performance
  - ► Double digit price performance improvement

- **Networking Enhancements**
  - ► OSA-Express Enhancements

- **I/O Enhancements**
  - ► FICON Express - 2 Gbit links
  - ► FICON Cascaded Directors (GA January 31, 2003)
    - – Two director cascade
  - ► FCP for Linux (LA June 15, 2002)
    - – Full Fabric Support

- **Parallel Sysplex Enhancements**
  - ► CFCC Level 12
    - – 64-bit, 48 tasks
    - – Structure duplexing
  - ► Message Time Ordering

- **Availability**
  - ► Customer Initiated Upgrade (CIU)

- **Linux Security Enhancements**
  - ► IFL support of PCICA

- **New "Stealth Black" HMC, TKE**

IBM z/OS and OS/390 Expo, 2002   T01:5

z900 Models 101 - 216 Relative Performance

12 PU MCM: 9 CPs + 2 SAPs + 1 Spare, 2 x 8 MB L2 cache, 2 Memory Cards, 1.3 ns.

1.3 ns

20 PU MCM: 16 CPs + 3 SAPs +1 Spare, 2 x 16 MB L2 cache, 4 Memory Cards

1.09 ns

Models: 101 102 103 104 105 106 107 108 109 110 210 111 211 112 212 113 213 114 214 115 215 116 216

IBM z/OS and OS/390 Expo, 2002

T01:6

z900 Capacity Models 1C1 - 2C9

1C1 2C1 1C2 2C2 1C3 2C3 1C4 2C4 1C5 2C5 1C6 2C6 1C7 2C7 1C8 2C8 1C9 2C9

1.3 ns *20 PU MCM: 16 CPs + 3 SAPs + 1 Spare,*
2 x 16 MB L2 cache, 4 Memory Cards **1.09 ns**

IBM z/OS and OS/390 Expo, 2002   T01:7
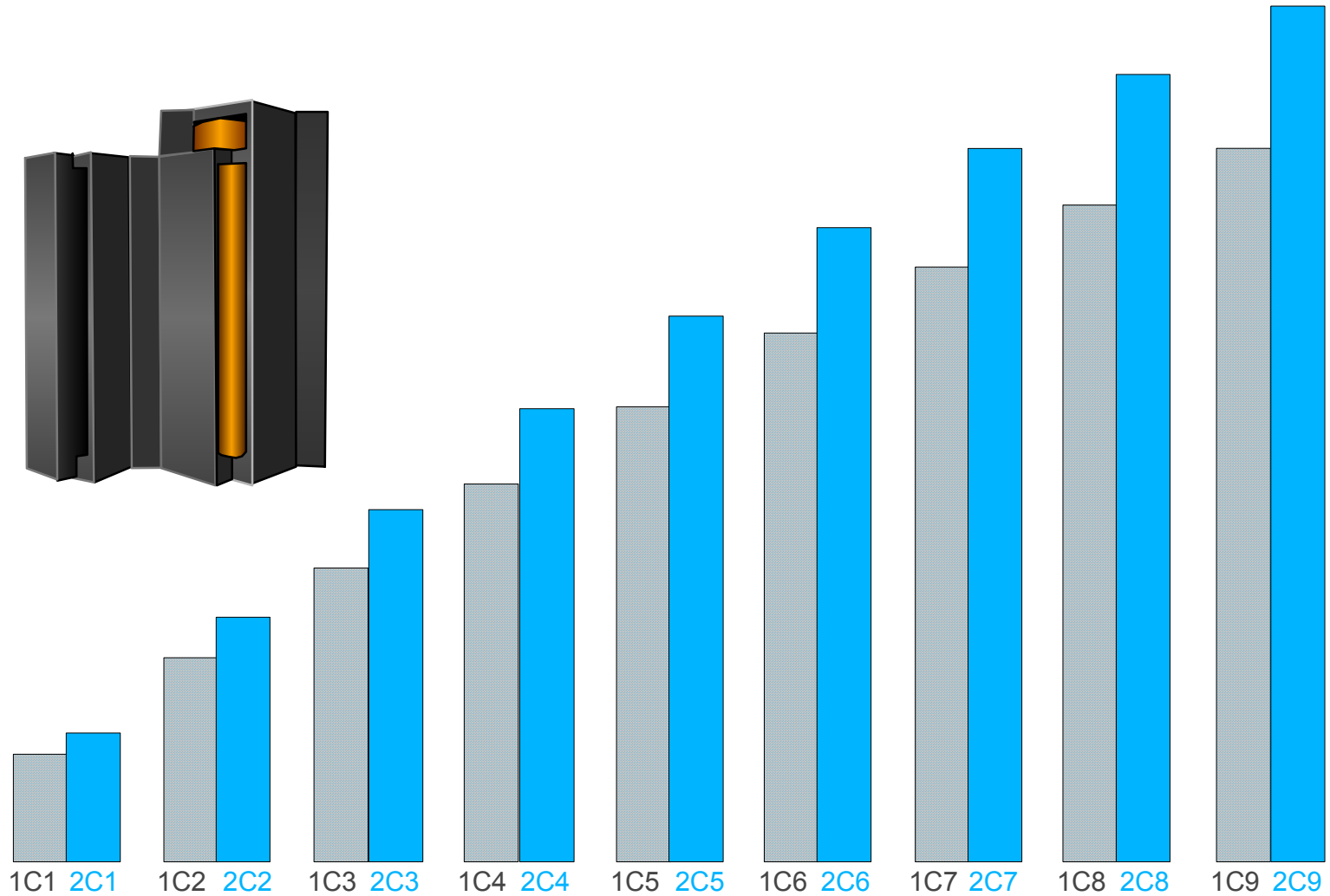
z900 MSUs per Hour (for pricing)

| 2002 Models 20 PU		2000 Models 20 PU		2000 Models 12 PU	
Model	MSUs	Model	MSUs	Model	MSUs
2C1	52	1C1	43	101	41
2C2	100	1C2	83	102	78
2C3	144	1C3	119	103	112
2C4	184	1C4	153	104	143
2C5	224	1C5	187	105	173
2C6	260	1C6	217	106	199
2C7	296	1C7	247	107	225
2C8	330	1C8	276	108	245
2C9	362	1C9	302	109	265
210	392	110	327		
211	420	111	350		
212	445	112	372		
213	475	113	392		
214	497	114	410		
215	517	115	426		
216	535	116	441		

Caution: Don't use MSUs or MIPs for capacity planning.

@server

z900 20-PU MultiChip Module (MCM)

Models 110 - 116 and 1C1 - 1C9
Models 210 - 216 and 2C1 - 2C9
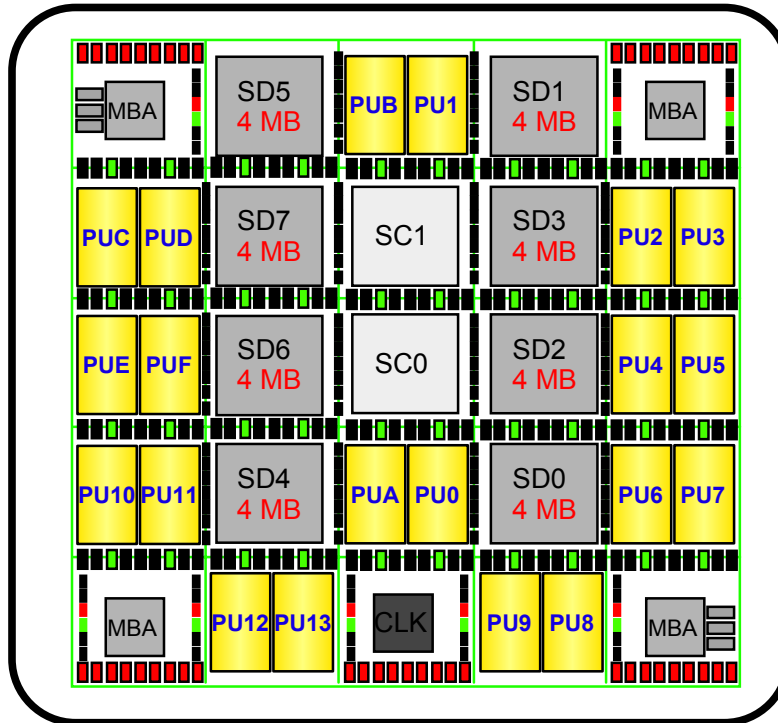
Technology Excellence
World's Densest Logic Package

- **CMOS Technology**
  - ► 1xx - CMOS 8S - copper
  - ► 2xx - CMOS 8SE - copper

- **35 Chips**
  - ► 30 chips CMOS 8SE or 8S

- **MCM Packaging**
  - ► 127.5 mm x 127.5 mm
  - ► Over 2.5 billion transistors
  - ► 20 Processor Units (PUs)
    - – 17.9 mm x 9.9 mm
    - – 47 million transistors
    - – L1 cache/CP
      - • 256 KB I-cache
      - • 256 KB D-cache
    - – 1.3 (1xx) and 1.09 ns (2xx) Cycle Time
  - ► 8 System Data (SD) cache chips
    - – L2 cache
      - • 234 million transistors
      - • 4 MB/chip
      - • 2 x 16 MB/cluster per MCM
  - ► 2 Storage Control (SC) chips
  - ► 4 Memory Bus Adapter (MBA) chips
  - ► 1 Clock (CLK) chip
  - ► 101 Glass Ceramic and 6 Thin Film layers
    - – 1 km of wire

Processor Options z900

	PUs	CPs	SAPs		IFLs*/ ICFs*	Spare PUs*	CUoD* / CIU* / CBU* Engines Available
			STD	OPT*			
100	12	0	2	0	1 - 9* (ICFs)	9	8
101	12	1	2	3	8	9	8
102	12	2	2	3	7	8	7
103	12	3	2	3	6	7	6
104	12	4	2	3	5	6	5
104	12	5	2	3	4	5	4
106	12	6	2	3	3	4	3
107	12	7	2	2	2	3	2
108	12	8	2	1	1	2	1
109	12	9	2	0	0	1	0
1C1 / 2C1	20	1	3	5	15	16	15
1C2 / 2C2	20	2	3	5	14	15	14
1C3 / 2C3	20	3	3	5	13	14	13
1C4 / 2C4	20	4	3	5	12	13	12
1C5 / 2C5	20	5	3	5	11	12	11
1C6 / 2C6	20	6	3	5	10	11	10
1C7 / 2C7	20	7	3	5	9	10	9
1C8 / 2C8	20	8	3	5	8	9	8
1C9 / 2C9	20	9	3	5	7	8	7
110 / 210	20	10	3	5	6	7	6
111 / 211	20	11	3	5	5	6	5
112 / 212	20	12	3	4	4	5	4
113 / 213	20	13	3	3	3	4	3
114 / 214	20	14	3	2	2	3	2
115 / 215	20	15	3	1	1	2	1
116 / 216	20	16	3	0	0	1	0

* Note: Indicates maximum number. Sum of CPs, SAPs, ICFs, IFLs and spare PUs always equals total PUs.

z900 Concurrent Memory Upgrade

z/OS & OS/390 Expo

- **Concurrent Memory Upgrade**
  - ► LIC CC nondisruptive memory activation up to size supported by currently installed cards
  - ► Add to OS/390 or z/OS partition using Dynamic Storage Reconfiguration 2 (DSR/2)

- **Prerequisites**
  - ► z900 Server, LPAR mode
  - ► Must have spare memory capacity on installed cards, otherwise disruptive
  - ► Must predefine additional memory to partition as "Reserved Storage"

- **Note: No CBU for memory**

Memory Card Size and Number of Cards

Total Storage (GB)	Models 100-109	Models 110-116 210-216	Models 1C1-1C9 2C1-2C9
5 6 7 8	4 GB x 2	Not Offered	Not Offered
10 12 14 16	8 GB x 2	4 GB x 4	4 GB x 4
18 20 24 28 32	16 GB x 2	8 GB x 4	8 GB x 4
40 48 56 64	Not Offered	16 GB x 4	16 GB x 4

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zSeries CBU, CUoD and CIU Summary

- **CUoD - Capacity Upgrade on Demand**
  - ► Standard machine function (not ordered, no feature number)
  - ► Nondisruptive addition of CPs (model upgrade), ICF/IFL, and z900 memory
    - – Addition of CPs to z800 subuni or subdyadic models changes CP capacity. Requires z/OS or OS/390 IPL.
  - ► Exploited by CBU, CIU and IBM ordered/installed MES upgrades
  - ► No support for downgrade RPQs - always disruptive

- **CBU - Capacity Backup**
  - ► Nondisruptive temporary addition of CPs ONLY in an emergency situation
  - ► CBU contract required to order CBU features and CBU LIC CC
  - ► Customer (or IBM) activates upgrade for test or temporary emergency
  - ► Nondisruptive downgrade required after test or recovery completed

- **CIU - Customer Initiated Upgrade (New!)**
  - ► Customer capability to order and install upgrades
  - ► CIU feature ordered to initiate contract and administrative setup
  - ► Customer orders and installs upgrade via Resource Link and RSF
  - ► Permanent upgrades only
  - ► No support for downgrade RPQs

zSeries Capacity Backup

- **Who Needs It?**
  - ► Customers who have a requirement for robust Disaster Recovery

- **What Is It?**
  - ► Temporary, nondisruptive addition of one or more CPs
    - – Memory, ICFs, IFLs, and channels not included
  - ► Must plan ahead for memory and connectivity requirements
  - ► Contract between IBM and customer
  - ► Needs "spare" PUs and pre-positioned CBU configuration

- **Nondisruptive temporary upgrade or test process**
  - ► Execute CBU from HMC
  - ► Configure CP(s) online to partition
    - – Predefine as "Reserved" CP(s)

- **Nondisruptive downgrade process**
  - ► Required after recovery or test completed
  - ► Follow procedures to quiesce workload
  - ► Configure CBU CP(s) off-line
  - ► Execute downgrade from HMC

zSeries CIU

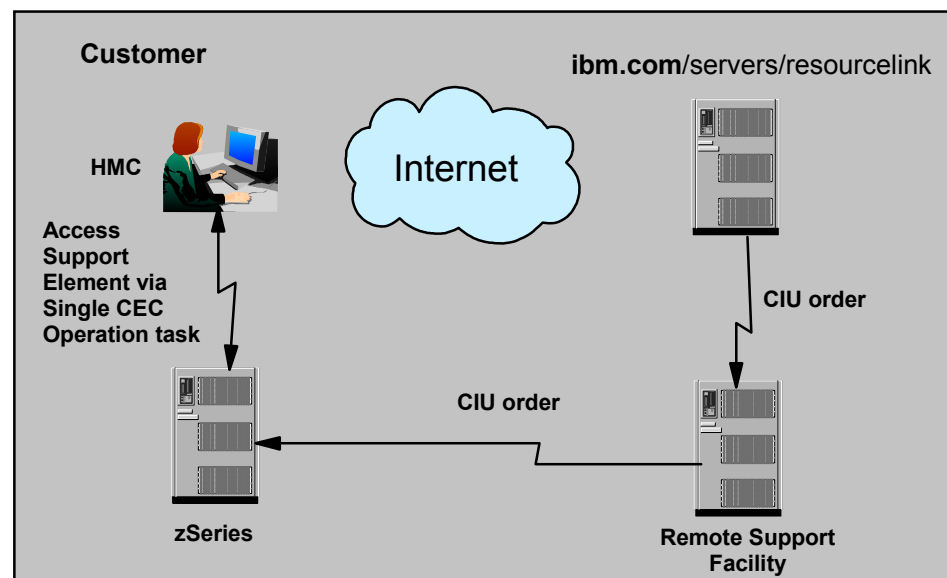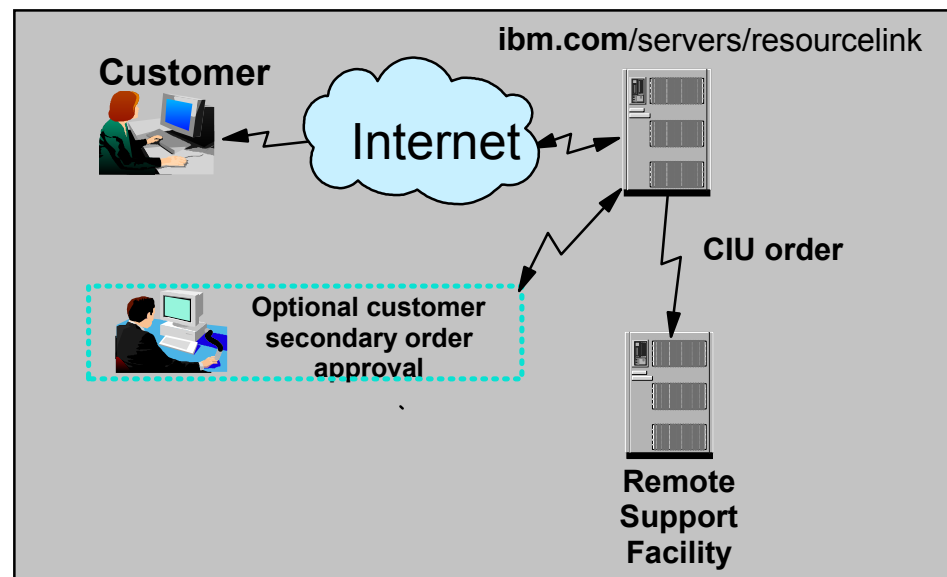- **Order CIU, Setup Process**
  - ▶ Qualification and pricing
  - ▶ ID Authorization

- **Customer Order**
  - ▶ Configure on Resource Link
  - ▶ CPs, ICFs, IFLs, Memory
  - ▶ Secondary Approval (Option)
  - ▶ Resource Link communicates with Remote Support Facility (RSF) to stage order and prepare download

- **Customer Install**
  - ▶ Customer notified order ready
  - ▶ Access Support Element (SE) via Hardware Management Console (HMC)
  - ▶ "Perform Model Upgrade"
  - ▶ Code obtained from RSF and installed on Target machine

Customer

ibm.com/servers/resourcelink

Internet

CIU order

Optional customer secondary order approval

Remote Support Facility

Customer

ibm.com/servers/resourcelink

HMC

Internet

Access Support Element via Single CEC Operation task

CIU order

CIU order

zSeries

Remote Support Facility

Example of a z900 CIU Order

Netscape

File   Edit   View   Go   Communicator   Help

IBM

Search

Home | Products & services | Support & downloads | My account

Enterprise Servers > Support > Resource Link > Customer Initiated Upgrade > Customer machines > IBM eserver zSeries 900 > Americas(US) > 8497001 >

41552 (TESTBED3)

Customer number:	8497001
Machine type:	2064
Machine serial:	41552
Machine name:	TESTBED3

	Current Configuration	Ordered Configuration
Model:	1C6	1C8
ICF:	1	3
Linux:	0	0
SAP:	3	3
Memory:	16	16
CBU:	N/A	

• A pre-negotiated price agreement exists for this machine.

Order History:

Order number	Order status	Date status updated
LD57HTWS	New order	02/19/2002 05:17:56 PM

Resource Link

Site search

User profiles

Planning

Education

Library

Technical support

Forums

Site feedback

Personal folders

Tools

Customer Initiated Upgrade

About IBM

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→ Select a country

Document: Done

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z900 I/O Frames and Cages

Z-Frame | **A-Frame**

2nd nI/O or 2nd cI/O cage	CEC
3rd nI/O or 1st CI/O cage	1st nI/O cage only
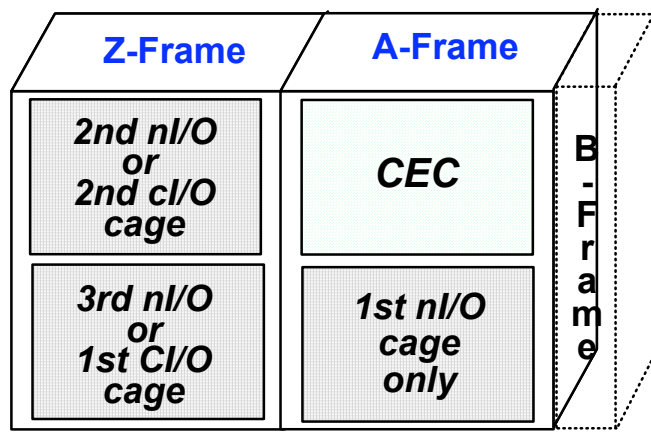
B-Frame

- **Channel CHPID Assignment**
  - ▶ Any port any CHPID
  - ▶ All 256 CHPIDs available (no blocked CHPIDs)
  - ▶ CHPID Availability Mapping Tool

- **zSeries nI/O Cages**
  - ▶ 7 times the I/O bandwidth of G5/6 I/O cage
  - ▶ A and/or Z-Frame
  - ▶ Slots for 28 new technology I/O cards
    - – Up to 15 ESCON channels per card
    - – Two Native FICON, FICON Bridge, or FCP channels per FICON/FICON Express card
    - – Up to 4 double-speed coupling links per card
    - – Two OSA-Express ports per card
    - – Two PCI CC/CA engines per card
    - – All hot plug, hot repair, hot swap
  - ▶ Up to 256 channels in one cage

- **Compatibility cI/O Cages**
  - ▶ New build or MES from G5/6
  - ▶ Z-Frame only
  - ▶ Investment protection
    - – Parallel channel cards
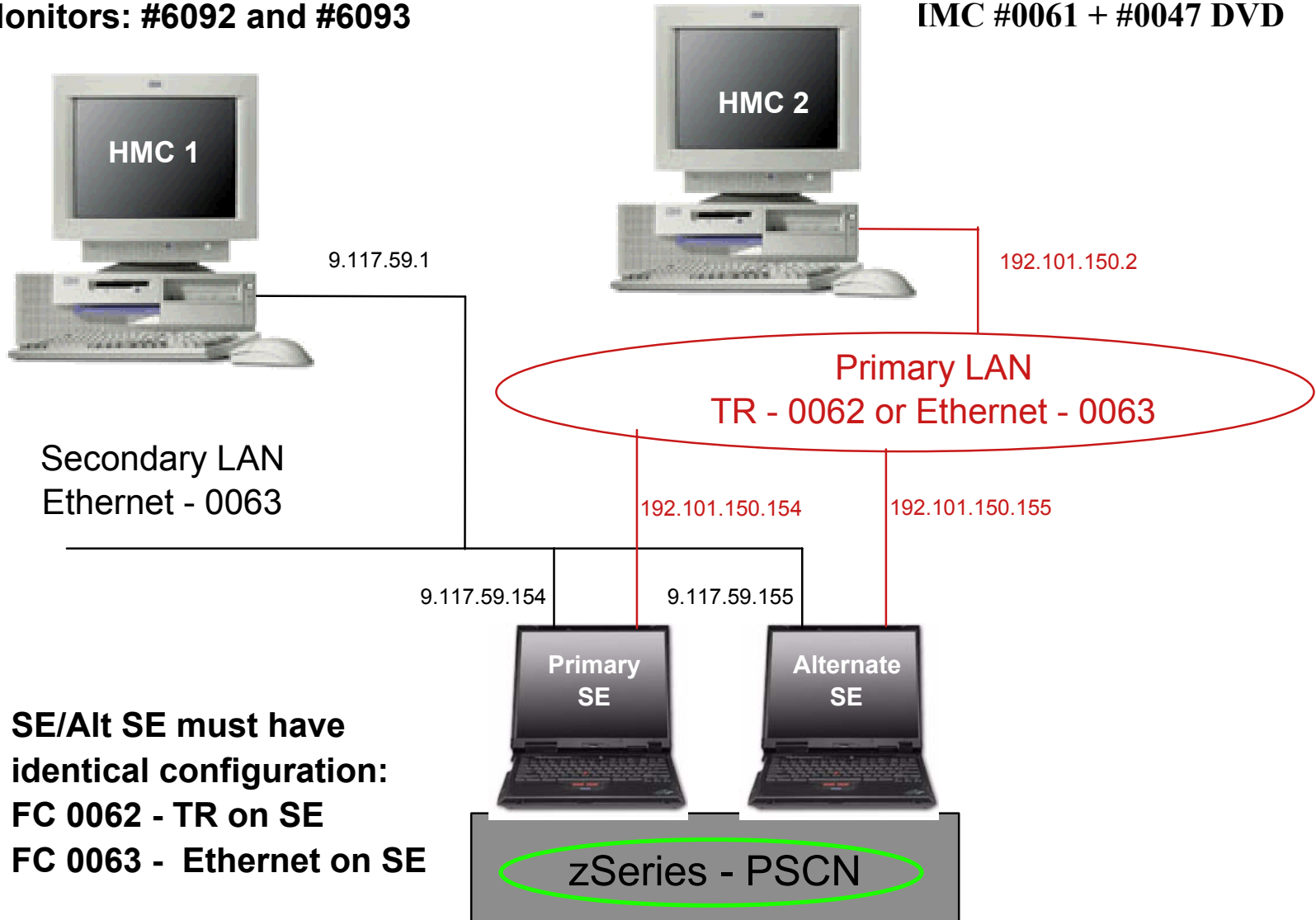   - – OSA-2 FDDI
    - – ESCON 4 port channel cards (MES only)

- **B-Frame**
  - ▶ Optional Internal Battery Feature
  - ▶ Local Uninterrupted Power Source
  - ▶ General Purpose Models: 3.5 to 20 minutes

@server

New "Stealth Black" HMC, TKE, and Monitors

z/OS & OS/390 Expo

HMC Feature #0074 includes DVD RAM, TR, Ethernet
Not available: WAC and 3270 Card
Monitors: #6092 and #6093

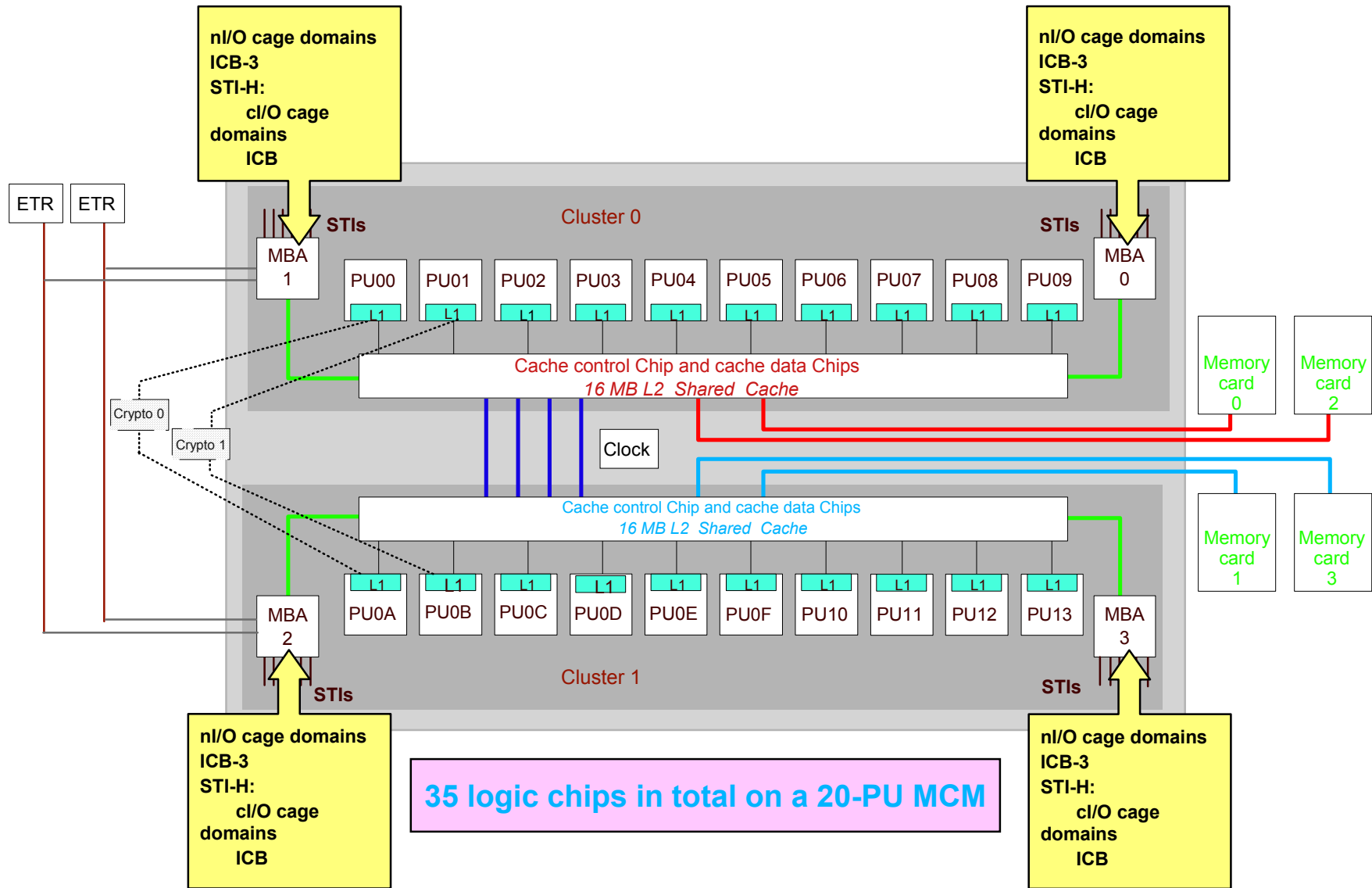Old HMCs OK - z800 or z900:
HMC #0073 + #0047 DVD
IMC #0061 + #0047 DVD

HMC 1

HMC 2

9.117.59.1

192.101.150.2

Primary LAN
TR - 0062 or Ethernet - 0063

Secondary LAN
Ethernet - 0063

192.101.150.154

192.101.150.155

9.117.59.154

9.117.59.155

Primary
SE

Alternate
SE

SE/Alt SE must have
identical configuration:
FC 0062 - TR on SE
FC 0063 - Ethernet on SE

zSeries - PSCN

e server

z900 20-PU Logical Structure

z/OS & OS/390 Expo

Cluster 0

nI/O cage domains
ICB-3
STI-H:
   cI/O cage domains
   ICB

nI/O cage domains
ICB-3
STI-H:
   cI/O cage domains
   ICB

ETR ETR

STIs   STIs

MBA 1   MBA 0

PU00 PU01 PU02 PU03 PU04 PU05 PU06 PU07 PU08 PU09
L1   L1   L1   L1   L1   L1   L1   L1   L1   L1

Crypto 0
Crypto 1

Cache control Chip and cache data Chips
16 MB L2 Shared Cache

Memory card 0   Memory card 2

Clock

Cache control Chip and cache data Chips
16 MB L2 Shared Cache

Memory card 1   Memory card 3

L1   L1   L1   L1   L1   L1   L1   L1   L1   L1
PU0A PU0B PU0C PU0D PU0E PU0F PU10 PU11 PU12 PU13

MBA 2   MBA 3

STIs   STIs

Cluster 1

nI/O cage domains
ICB-3
STI-H:
   cI/O cage domains
   ICB

nI/O cage domains
ICB-3
STI-H:
   cI/O cage domains
   ICB

35 logic chips in total on a 20-PU MCM

zSeries Security

- **Cryptographic Hardware**
  - Cryptographic Coprocessor(s) Facility (CCF)
  - PCI Cryptographic Coprocessors (PCICC)
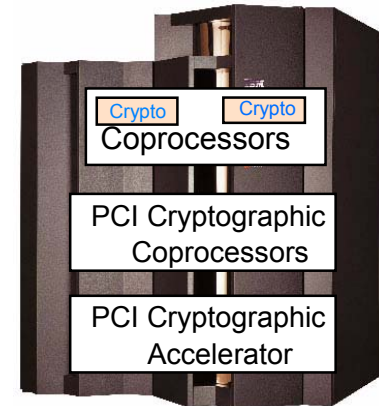 - PCI Cryptographic Accelerator (PCICA)

- **Enables End-to-End Security**
  - Tamper proof CCF and PCICC (FIPS 140-1 Level 4)
  - Traditional TDES Encryption/Decryption
  - Digital Signature function
  - Secure Sockets Layer (SSL)
  - User Defined Extensions (on PCICC)

- **z/OS ICSF**
  - Manages cryptographic hardware facilities
  - Routes requests for crypto services

- **Performance**
  - Up to 19 times over software for RSA Digital Signatures Generate
  - Up to **7000** SSL handshakes/sec on z900 Model 216 (**1300** SSL handshakes/sec on z800 Model 004)

Crypto | Crypto
Coprocessors

PCI Cryptographic Coprocessors

PCI Cryptographic Accelerator
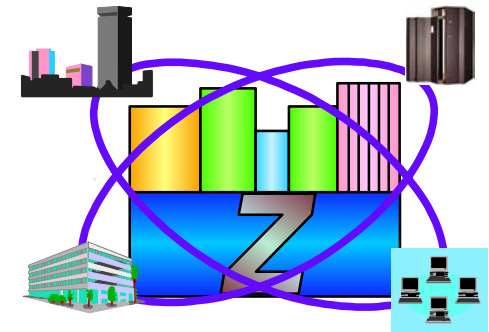
Industrial strength security with excellent performance for e-business applications

zSeries PCI Cryptographic Accelerator Card

PCI CA Feature #0862

- **Dual PCI Cryptographic Accelerator Card**
  - ▸ **Up to 6 features, 12 processors, total**
  - ▸ **Total of PCI CA and PCI CC features limited to 8**
  - ▸ **Provides increased SSL throughput and price performance (> 50%)**
  - ▸ **High performance asymmetric encryption (Public Key) accelerator**
  - ▸ **Up to 2,100 SSL handshakes/sec per feature**
  - ▸ **Up to 7000 SSL handshakes/sec on z900 Model 216 (1300 SSL handshakes/sec on z800 Model 004) Limit is based on CP capacity, not PCICA**
  - ▸ **Linux support on CP or IFL (New!)**
    - – **Via PKCS #11 API**
    - – **IFL support fulfills 10/01 SOD**

PCI Adapter

PCI Adapter
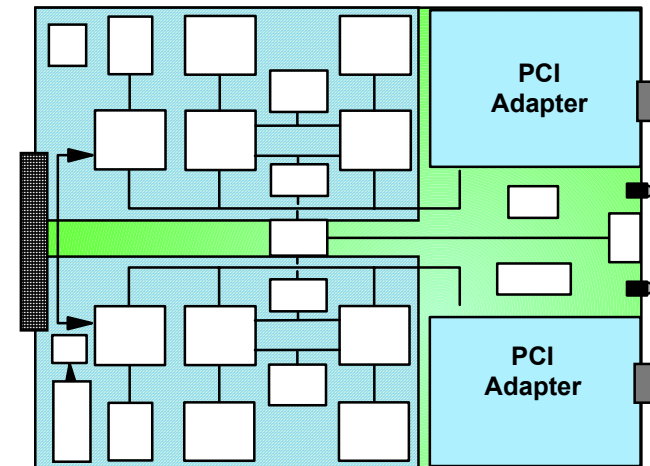
z900 PCI Cryptographic Coprocessor Card

- **Dual PCI Cryptographic Coprocessor Feature - 0861**
  - ▸ Up to 8 features, 16 processors total
  - ▸ High performance
  - ▸ Flexible - TDES, SSL, etc.
  - ▸ Tamperproof (FIPS 140-1 Level 4)
  - ▸ Encryption of Transactions
  - ▸ Network Encryption
  - ▸ Support of TDES and SSL
  - ▸ User Defined Extensions (UDX)
    - – Customize to user requirements
    - – Deploy new standard functions rapidly
    - – Enable migration from IBM 4753 channel attached crypto units

Open-System Connectivity

BUS

Up to 24 GB/sec

secure

Intranet Internet Extranet

PCI Cards

Crypto Coprocessor

@server

z/OS
&
OS/390
Expo
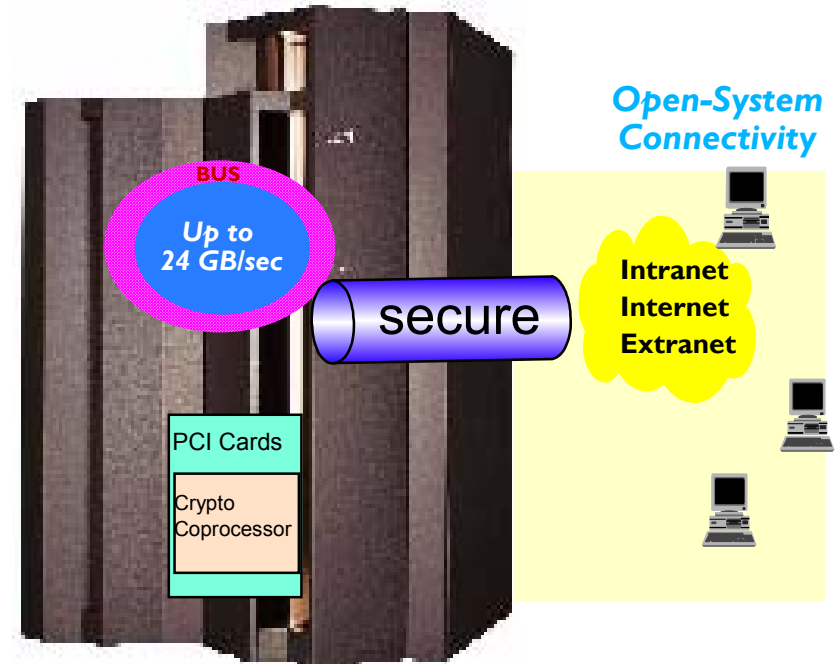
z900 Connectivity

Network Connectivity

- **Value based on**
  - ▸ Up to 24 media speed ports for end-user connectivity
    - – 12 OSA-Express Adapters
  - ▸ Any combination of
    - – Gigabit Ethernet
    - – Fast Ethernet
    - – ATM 155 Mbps
    - – Token-Ring 4/16/100 Mbps
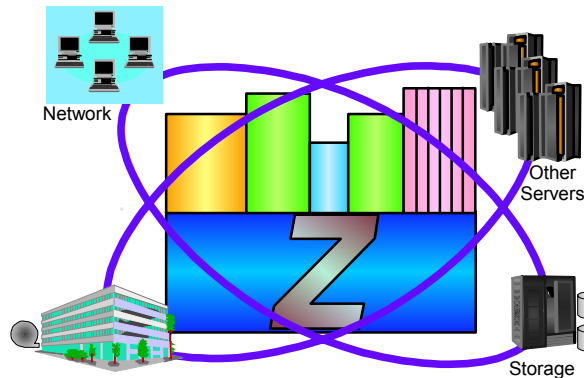 - ▸ HiperSockets
    - – Network within server

Storage Network Connectivity

- ▸ FICON Cascaded Directors
- ▸ FCP full fabric switch support

Parallel Sysplex Connectivity

- **Advanced zSeries connections**
  - ▸ ISC-3
  - ▸ ICB-3
  - ▸ IC-3
  - ▸ ISC-2
  - ▸ ICB-2

Channel Connectivity

Network

Other Servers

Storage

- ▸ FCP Channels
- ▸ Native FICON
- ▸ FICON Bridge
- ▸ ESCON
- ▸ Parallel

Very large end-to-end bandwidth

eserver

zSeries Network Connectivity

- **Open System Adapter (OSA) Express Card**
  - Gigabit Ethernet
  - Fast Ethernet
  - 155 ATM
  - Token-Ring (4/16/100 Mbit)
  - Up to 24 ports on 12 cards
  - Faster, more cost effective than channel attached control units
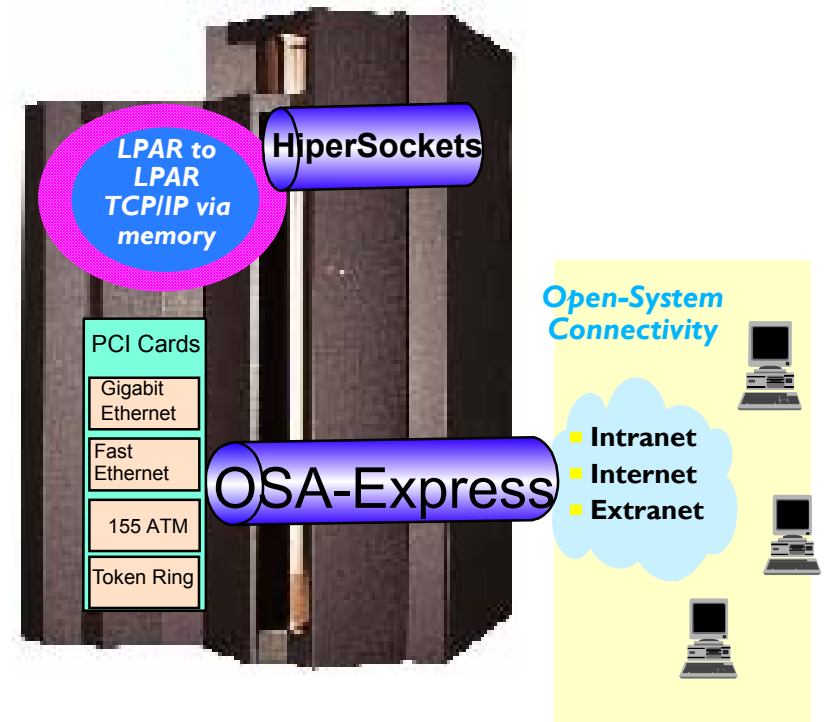
- **HiperSockets**
  - High speed "partition to partition" TCP/IP communications
  - No external network dependency
  - No hardware or cables required
  - Internal to server
  - Up to four internal networks
 - Faster, secure, no cost option

- **OSA-2 FDDI (z900 only)**

- **Statements of Direction**
  - **No ATM support beyond z800 and z900**
  - **No FDDI support beyond z900**

LPAR to LPAR TCP/IP via memory

HiperSockets

PCI Cards
Gigabit Ethernet
Fast Ethernet
155 ATM
Token Ring

OSA-Express

Open-System Connectivity

- Intranet
- Internet
- Extranet

z900 OSA-Express Features

- **Up to 12 cards (features), 24 channels per system**
  - ► z900 new I/O cage only
  - ► Two ports per card, One CHPID per port
  - ► Feature conversion on G5/6 upgrade to z900

- **Token-Ring (4/16/100 Mbps) - 2367**
  - ► 4/16/100 Mbps auto negotiation
  - ► QDIO (TCP/IP), non-QDIO (SNA/APPN/HPR and TCP/IP)
  - ► Replaces OSA-2 TR

- **Fast Ethernet - 2366**
  - ► 10/100 Mbps auto negotiation
  - ► QDIO (TCP/IP), non-QDIO (SNA/APPN/HPR and TCP/IP)

- **155 ATM - 2362, 2363 (SOD - No future support)**
  - ► SM (single mode) or MM (multimode) Fiber card
  - ► QDIO (TCP/IP), non-QDIO (SNA/APPN/HPR and TCP/IP)

- **Gigabit Ethernet - 2364, 2365**
  - ► LX (long wavelength) or SX (short wavelength)
  - ► LX with MCP - multimode fiber at reduced distances
  - ► QDIO (TCP/IP) - (use Enterprise Extender or TN3270 for SNA access over TCP/IP)
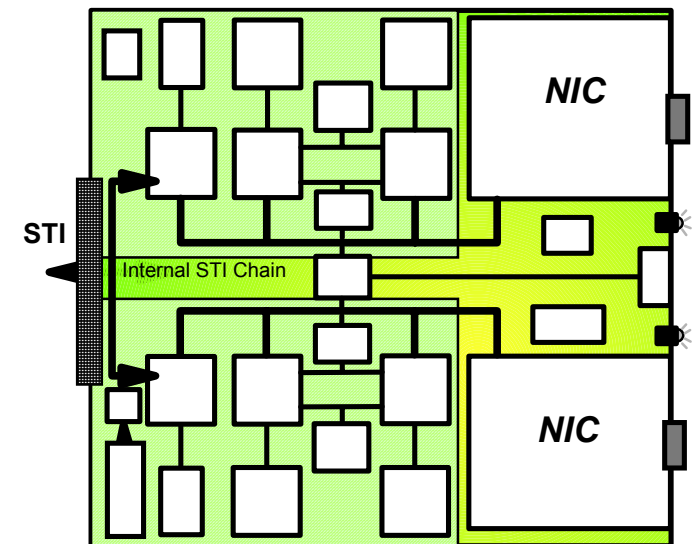
OSA-Express enhancements for QDIO mode

- **Multiple secondary router settings**
- **IPv6 support on Gigabit and Fast Ethernet for z/OS V1.4 and Linux**
  - ▶ Positions zSeries for explosive growth in IP device attachments
  - ▶ Minimizes need for Private Address spaces (Network Address Translation - NAT) to manage addressing limits
- **Full Virtual LAN (VLAN) support for Linux**
  - ▶ Separates a common physical network into a number of Logical LANs
  - ▶ Can reduce network overhead and traffic
  - ▶ Provides more secure isolation when multiple stacks share OSA-Express
- **Simple Network Management Protocol (SNMP) for z/OS V1.4 and Linux**
  - ▶ Onboard SNMP subagent and MIB minimizes management dependencies
    - – Eliminates OSA/SF to manage SNMP data for OSA-Express
    - – Operating systems have direct access to OSA-Express MIB
  - ▶ "GET" function retrieves real-time data
- **Address Resolution Protocol (ARP) cache management**
  - ▶ Linux: Query ARP table (IPv4)
  - ▶ Linux and z/OS V1.4: Purge APR table (IPv4)
  - ▶ Improved problem diagnosis and resolution for Linux and z/OS environments
- **Broadcast support for z/OS V1.4, Linux and z/VM™**
  - ▶ QDIO adapters can support e-mail, print/file server applications using broadcast

zSeries FICON Express - 2 Gigabit Support

FICON Express Card

- **FICON Express Characteristics**
  - 2 channels per feature
  - Up to 96 channels, 32 per zSeries I/O Cage
  - 2 or 1 Gigabit autonegotiated, full duplex
  - LC Duplex Connector (Reduced size, same as ISC-3)
  - Data Bus - 64 bits wide, 66 MHz
  - Channel Processor - 333 MHz

- **FICON Express LX - 2319**
  - 9 micron single mode fiber
    - Unrepeated Distance - 10 km
      (20 km RPQ at 1 Gbit, 12 km at 2 Gbit)
  - Multimode fiber with mode conditioning patch cable
    - Unrepeated Distance at 1 Gbit - 550 meters
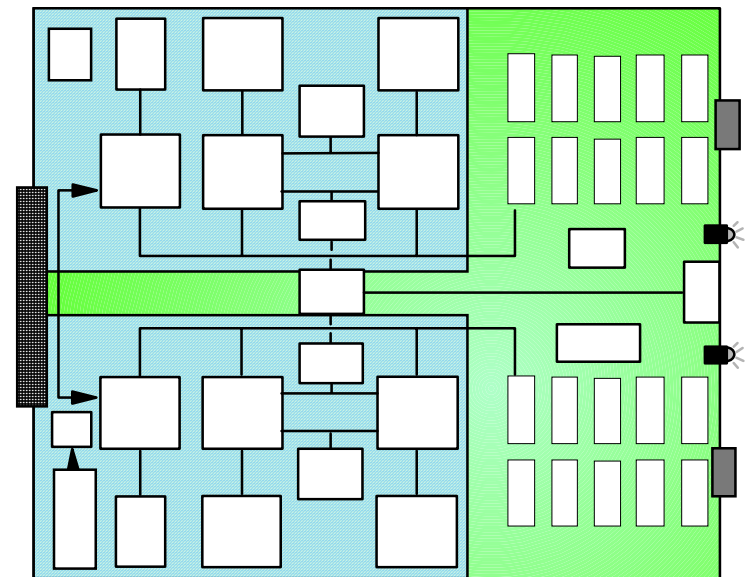   - Distance at 2 Gbit - NOT SUPPORTED

- **FICON Express SX - 2320**
  - 50 micron multimode fiber
    - Unrepeated Distance at 1 Gbit - 500 meters
    - Unrepeated Distance at 2 Gbit - 300 meters
  - 62.5 micron multimode fiber (ESCON standard fiber)
    - Unrepeated Distance at 1 Gbit - 250 meters
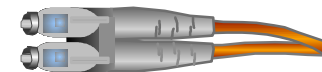   - Unrepeated Distance at 2 Gbit - 120 meters

- **Original zSeries FICON - 1 Gigabit ONLY**
  - Features: LX - 2315 and SX - 2318
  - Supported, no longer orderable
  - Larger SC Duplex Connectors
  - Bus - 32 bits wide, 33 MHz
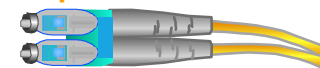 - Distance restrictions - Same as Express at 1 Gbit

LC Duplex MM

LC Duplex SM
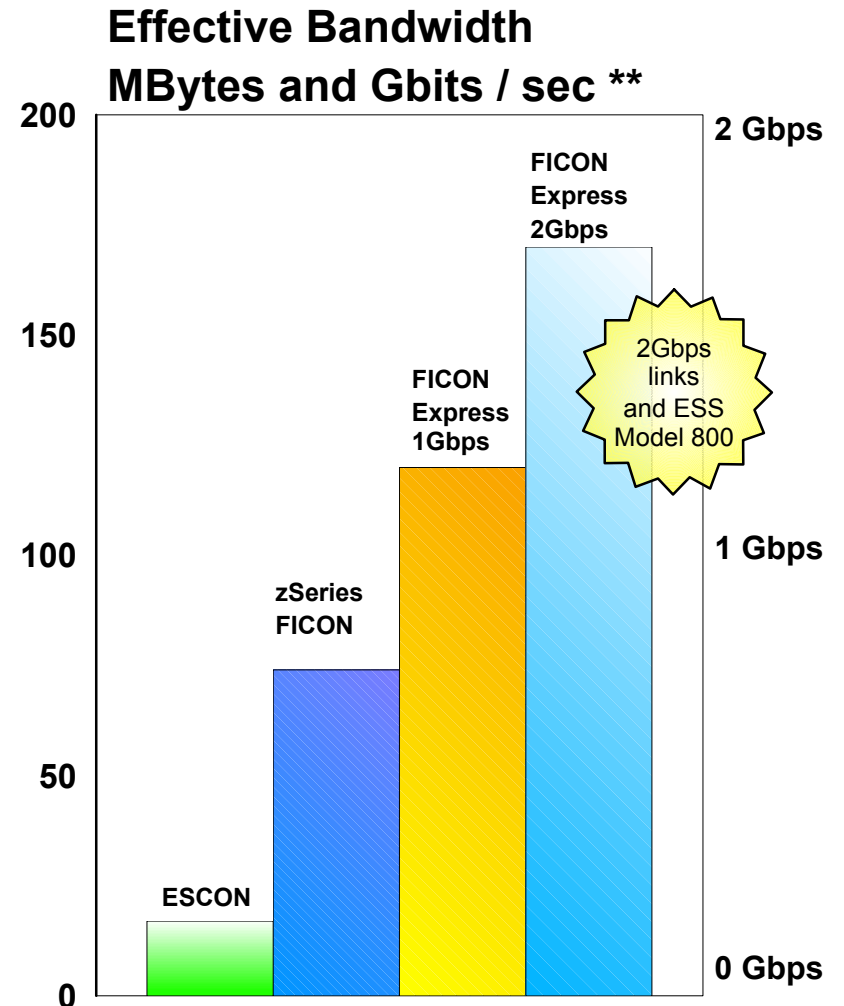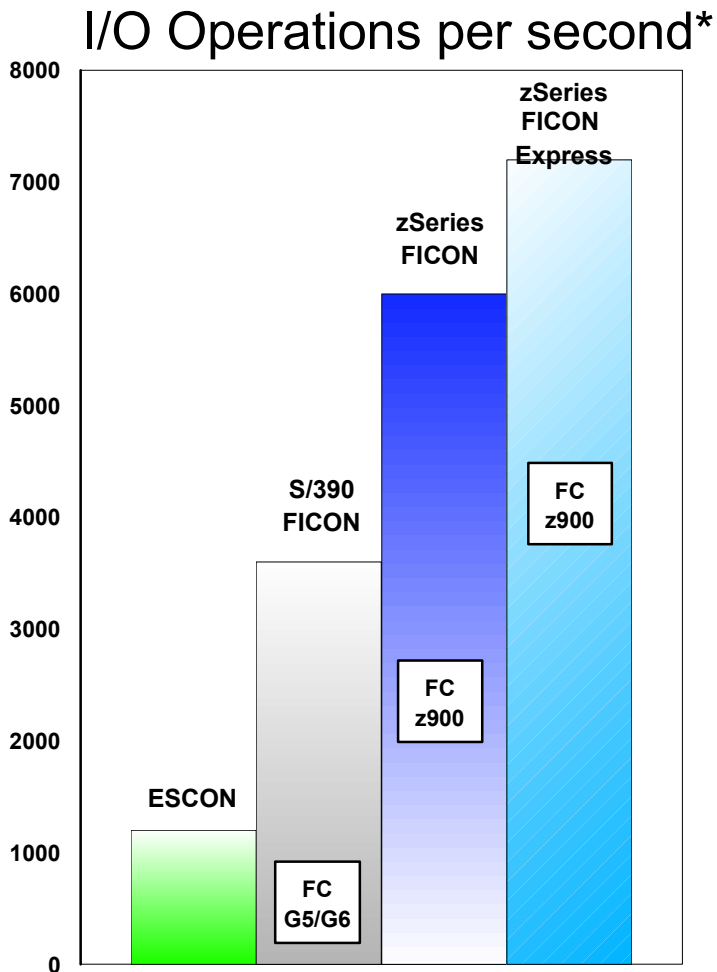
FICON Express - Breaking the Barrier

z/OS & OS/390 Expo

I/O Operations per second*

- ESCON
- FC G5/G6
- S/390 FICON
- zSeries FICON — FC z900
- zSeries FICON Express — FC z900

Effective Bandwidth
MBytes and Gbits / sec **

- ESCON
- zSeries FICON
- FICON Express 1Gbps
- FICON Express 2Gbps

2Gbps links and ESS Model 800
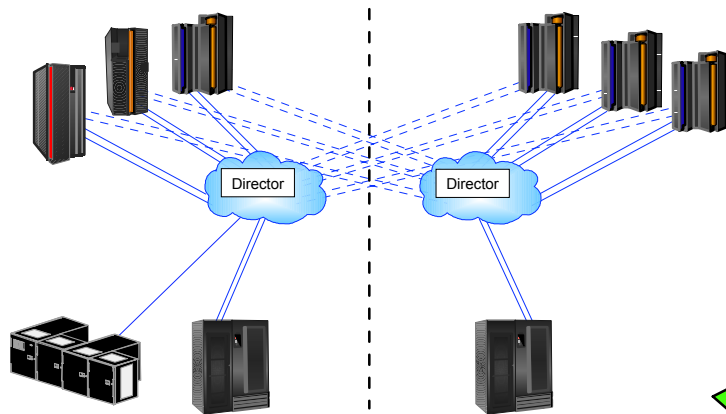
FICON Express Channel Card = Feature Code 2319 LX, and 2320 SX

* Channel 100% utilized, 4K block sizes, FC = Native, 1 or 2 GBit

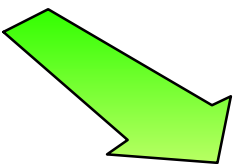** Using highly sequential 6x 27k block size, mixed reads and writes

@server

FICON Cascaded Directors (1/31/2003 GA)

- **Channel to CU: two directors with dynamic switching support in both**

- **Improved cross site connectivity**
  - ► Less fiber cabling required
  - ► More configuration flexibility

Two site non-cascaded director topology
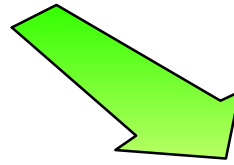
- **Requirements**
  - ► zSeries - Driver 3G + MCLs
  - ► Single vendor, high integrity fabric
  - ► z/OS V1.4, V1.3 + PTFs
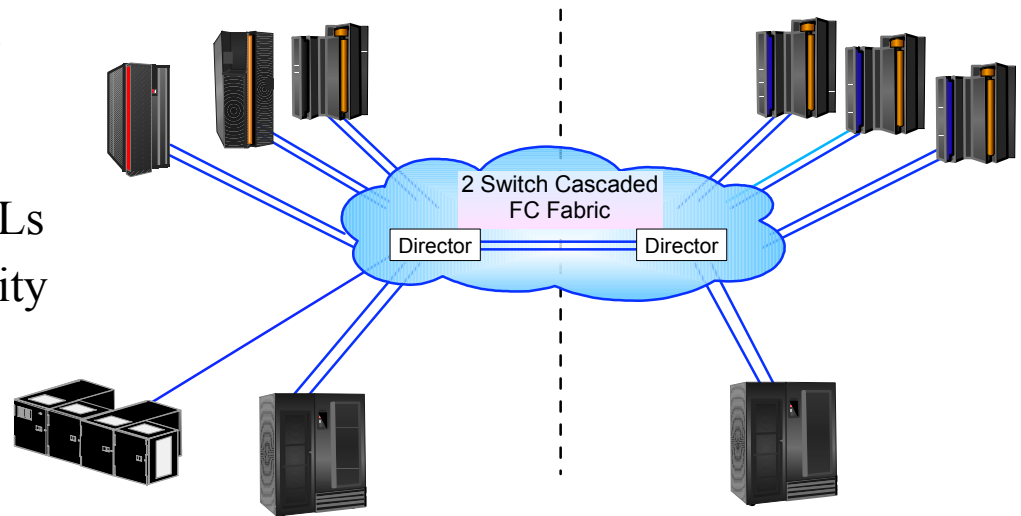
Two Site cascaded director topology

IBM z/OS and OS/390 Expo, 2002   T01:28

Configuring zSeries FICON and FICON Express

- **FICON Bridge - FCV (1 Gbit only)**
  - ► Exploit FICON channel with existing ESCON control units
  - ► FICON, FICON Express - **LX ONLY!**

- **Direct Attachment - FC**

- **FICON Switched - FC**
  - ► McDATA ED-5000 (IBM 2032-001)
  - ► Directors listed below

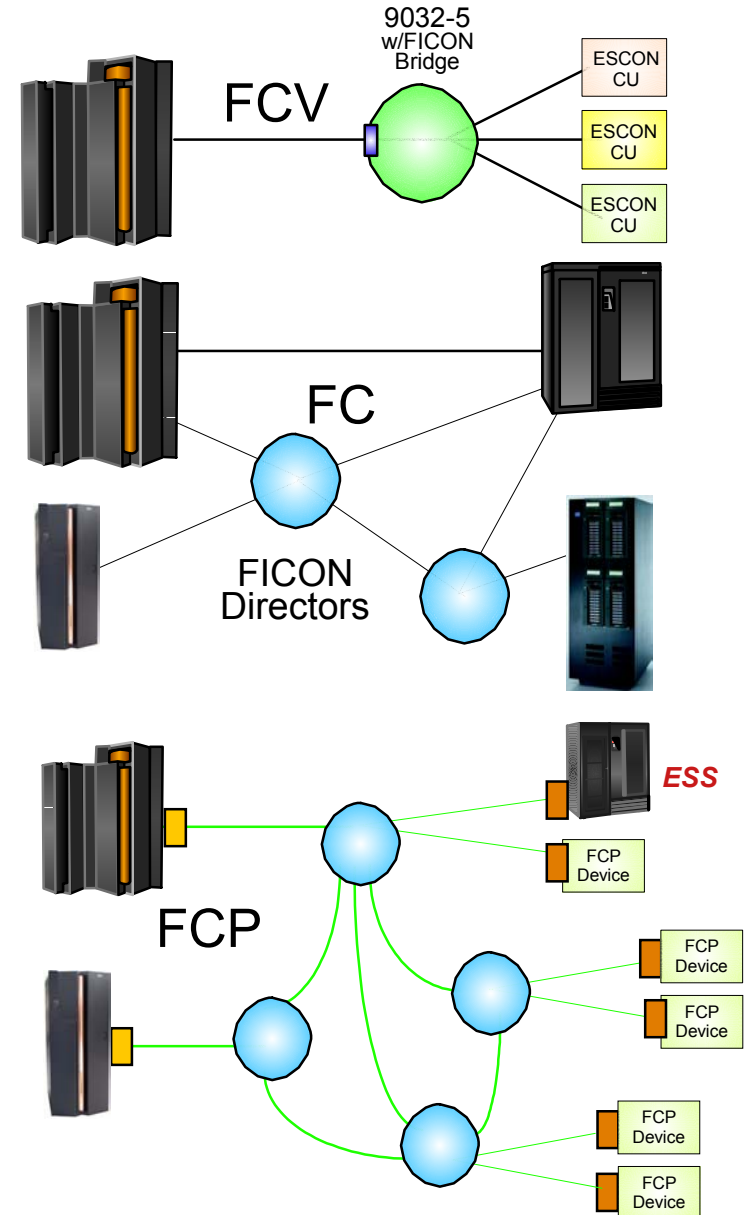- **FICON Switched, Cascaded - FC**
  - ► High integrity fabric features required
  - ► McDATA ED-6064 and ED-6140 IBM 2042-064 and -140
  - ► INRANGE FC/9000-001, -128, -256 IBM 2042-001, -128, and -256

- **Linux Open Fibre Channel Fabric - FCP**
  - ► SCSI on Fibre Channel
  - ► Homogeneous, single vendor fabric
  - ► Fibre channel switch support
    - – Ficon Directors listed above Plan carefully for protocol intermix especially with FICON Cascade
    - – IBM/Brocade Switches (FCP only)
  - ► FCP to SCSI Bridge
  - ► FCP to FC-AL Bridge

9032-5
w/FICON
Bridge

FCV

ESCON CU

ESCON CU

ESCON CU

FC

FICON Directors

ESS

FCP

FCP Device

FCP Device

FCP Device

FCP Device

FCP Device

FICON Express - 2 Gbit Links
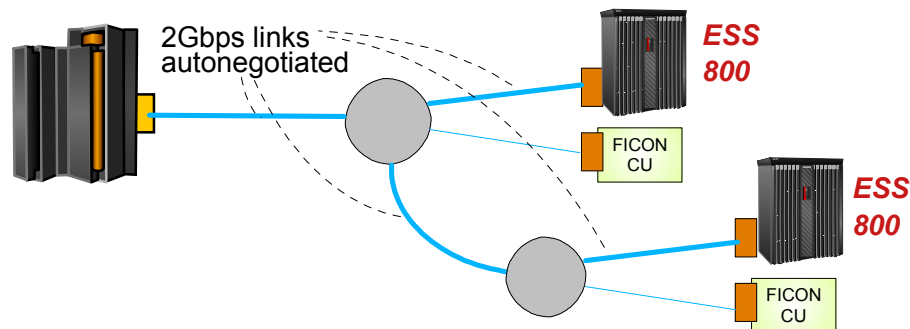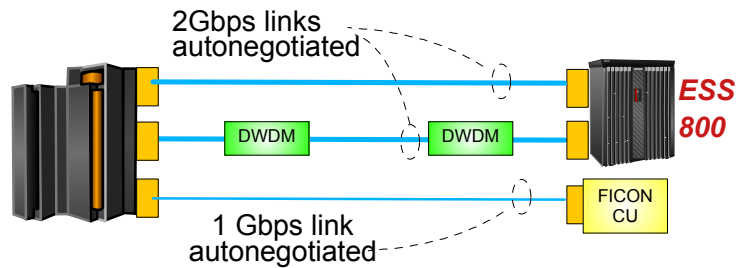
- **Direct Attachment**
  - ► IBM Enterprise Storage Server 800

- **Switched and Cascaded Connectivity**
  - ► Director upgrades may be needed
  - ► McDATA ED-6064 and ED-6140 IBM 2042-064 and -140
  - ► INRANGE FC/9000-001, -128, -256 IBM 2042-001, -128, and -256

- **DWDM and Optical Amplifiers**
  - ► Cisco ONS 15540 ESP (LX, SX) and optical amplifier (LX, SX)
  - ► Nortel Optera Metro 5200* and 5300E* and optical amplifier
  - ► IBM 2029 Fiber Saver*

  *2 Gbit support expected: LX - 4Q02, SX - 2H03

- **Transparent auto-negotiation between ports establishes link speed**

- **Compared to 1 Gbit, 2 Gbit links -**
  - ► Improve performance and/or effective bandwidth
  - ► Allow channel consolidation
  - ► With cascade, reduce fiber required between sites including GDPS

zSeries FCP Attachment Options for Linux LA Program - Web form on Resource Link

z/OS & OS/390 Expo

FCP support for limited availibility program
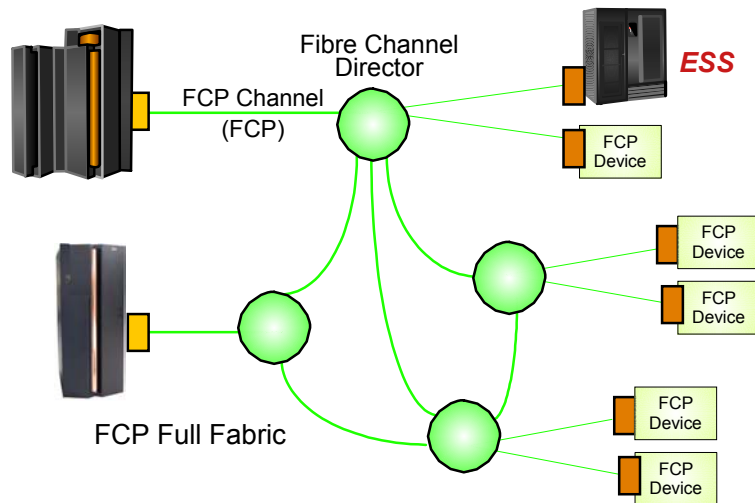
FCP Full Fabric Connectivity
- Homogeneous, single vendor fabric
- Fibre channel directors
  - INRANGE FC/9000 (IBM 2042)
  - McDATA ED-6064, -6140, -5000 (IBM 2032-064, -140, -001)
  - IBM 2109-F16/F08/S16/S08 (Brocade 3800/3200/2800/2400)
- IBM/Brocade Fibre channel swithches
- Devices
  - Enterprise Storage Server
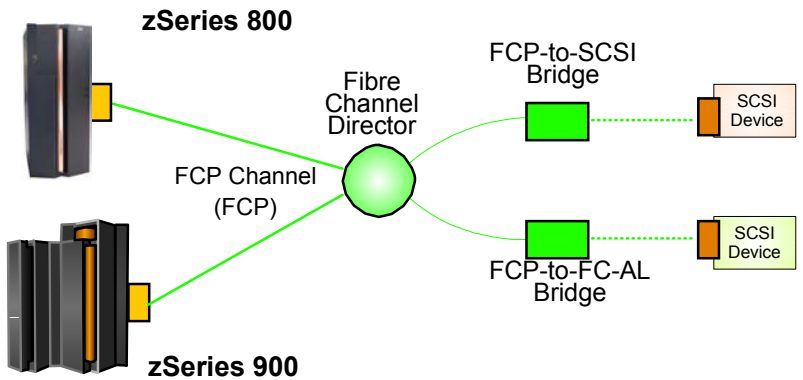
FCP to SCSI Bridge
- FCP-to-SCSI Bridges (via switch)
  - IBM 2108-G07 SAN Data Gateway
- FCP-to-FC-AL bridge (via switch)
  - McDATA ES-1000 Loop Switch (IBM ES-2031-L00)

Diagram labels:
- Fibre Channel Director
- FCP Channel (FCP)
- ESS
- FCP Device
- FCP Full Fabric
- zSeries 800
- Fibre Channel Director
- FCP-to-SCSI Bridge
- SCSI Device
- FCP-to-FC-AL Bridge
- zSeries 900

Initially, no direct attachment to device or bridge

eserver

zSeries FICON Channel To Channel (FCTC)

CTC

CNC

z900 or G5/G6

CNC

CTC

z900 or G5/G6

ESCON Director

ESCON CTC connectivity requires a pair of ESCON channels, one defined CTC and one defined CNC. The CTC defined channel is dedicated, no CNC function for I/O. max. 120 LCUs, max. 512 CTC unit addresses per channel

FCTC connectivity requires at least one FICON channel that supports FCTC CU function. If both support, location of FCTC CU is negotiated.

FICON FCTC CU function is provided with FICON FC definition on z900 at 10/01 LIC or later or on z800.

FICON FC channel on G5/6 or z900 at earlier LIC can connect to FICON FCTC CU if partner CEC supports it.

FICON FC channel supporting FCTC CU function also supports FC channel function for other I/O

max. 255 LCUs max. 16K CTC unit addresses per channel

zSeries 900 10/01 LIC

FC

zSeries 900 pre-10/01LIC

FC

FICON Director

FC Channels with FCTC CU function

FC Channels with NO FCTC CU function

FC

zSeries 800

ESS

FC

G5/G6 Server

z900 16-port ESCON Card

- **New technology, high-density package**
  - ➤ 16-port channel card (Up to 15 active, at least one spare)
  - ➤ Active ports - LIC controlled
  - ➤ ESCON channel increment - 4 channels
  - ➤ ESCON cards added in pairs as needed for availability
  - ➤ Only 18 cards needed for 256 channels

- **New, smaller MT-RJ connector**
  - ➤ 62.5 micron multimode fiber
  - ➤ Conversion kit needed to connect to existing ESCON duplex fiber optic cabling infrastructure
  - ➤ Wiring harness available (Fiber Quick Connect)

MTRJ MM
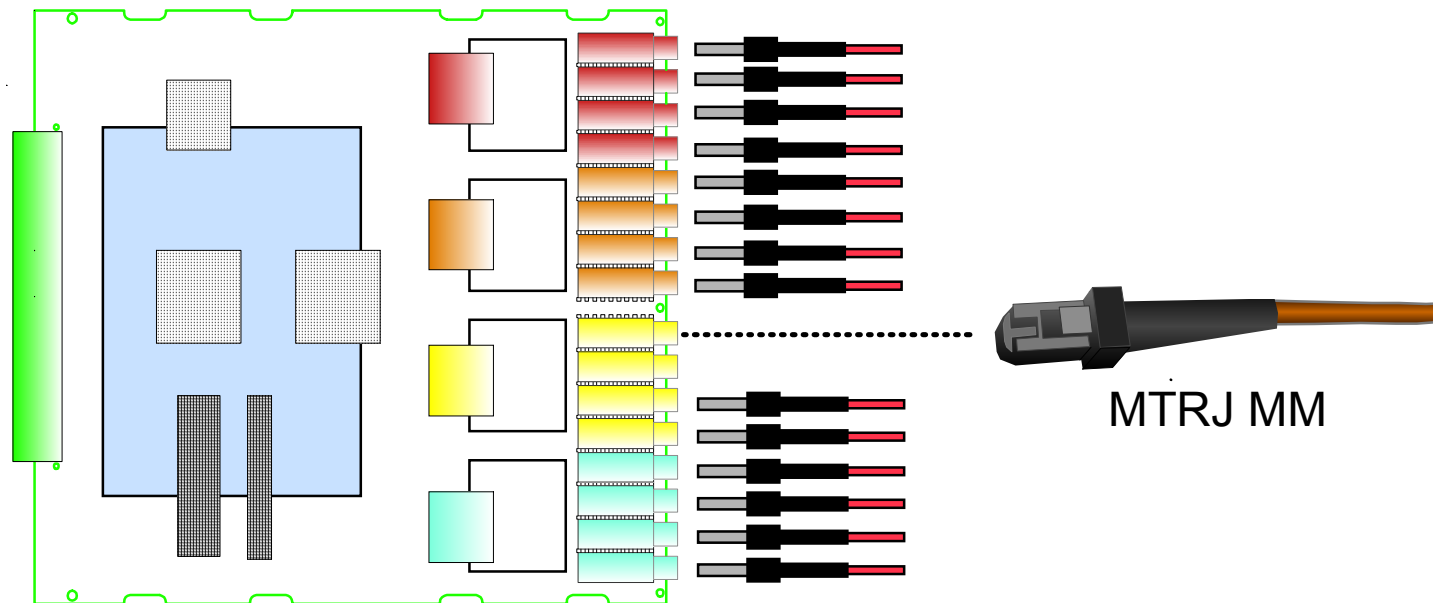
zSeries Sysplex

- **Peer Mode Links (zSeries to zSeries only)**
  - ISC-3 configured as CFP - 2 Gbit LX
  - ICB-3 configured as CBP - 1 GByte copper
  - Internal IC-3 configured as ICP
- **Compatibility Links (zSeries to 9672 G3 - G6)**
  - ISC-3 configured as CFS, CFR - 1 Gbit LX
  - ICB-2 configured as CBS, CBR (z900 to G5/6)
- **Coupling Facility Models**
  - Upgradeable to server models with CPs
  - z900 Model 100 (1 - 9 ICFs, 5 - 32 GB)
    - Links: Up to 42 ISC-3 (RPQ 8P2248),
      16 ICB-3, 16 ICB-2, 64 total external
  - z800 Model 0CF (1 - 4 ICFs, 8 - 32 GB)
    - Links: Up to 24 ISC-3, 6 ICB-3, 26 total external
- **zSeries Server with Internal CF**
  - Standard sysplex timer ports
  - Peer and Receiver - Dynamic I/O Definition
  - z900 (1- 15 ICFs, 5 - 64 GB, 32 external links)
  - z800 (1 - 3 ICFs, 8 - 32 GB, 26 external links)
    - ICFs on subunis run at full uniprocessor speed
- **All - CFCC Level 12 (*New!*)**
  - 64-bit - large structures in control store
  - 48 internal tasks
  - System managed structure duplexing

ICFs

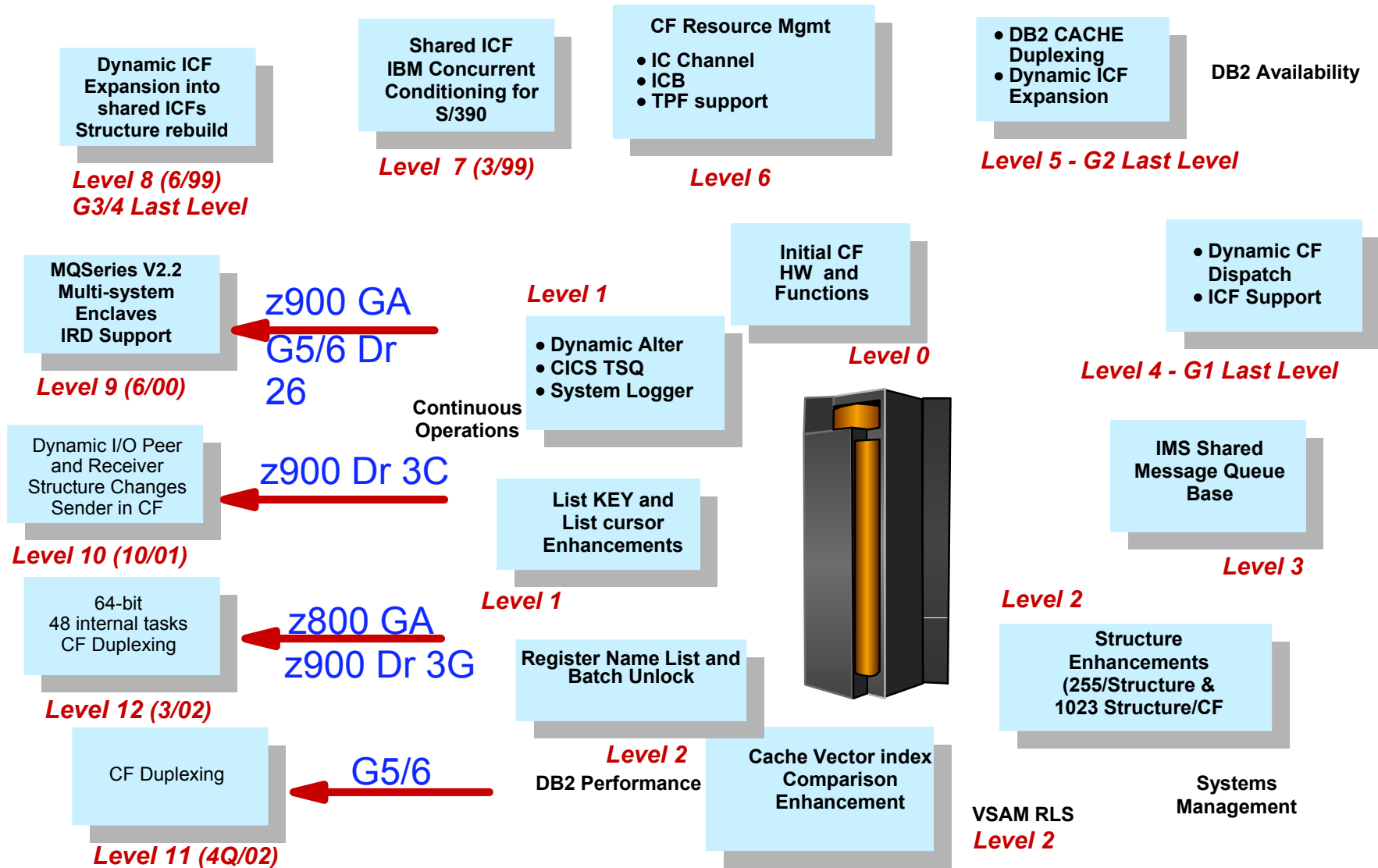**z800 Server**   **z800 Model 0CF**

ICFs

z900 Server   **z900 Model 100**

IBM Coupling Facility Control Code

z/OS & OS/390 Expo

Dynamic ICF Expansion into shared ICFs Structure rebuild

Level 8 (6/99)
G3/4 Last Level

Shared ICF IBM Concurrent Conditioning for S/390

Level 7 (3/99)

CF Resource Mgmt
- IC Channel
- ICB
- TPF support

Level 6

- DB2 CACHE Duplexing
- Dynamic ICF Expansion

DB2 Availability

Level 5 - G2 Last Level

MQSeries V2.2 Multi-system Enclaves IRD Support

Level 9 (6/00)

z900 GA
G5/6 Dr 26

Level 1

Initial CF HW and Functions

Level 0

- Dynamic Alter
- CICS TSQ
- System Logger

Continuous Operations

- Dynamic CF Dispatch
- ICF Support

Level 4 - G1 Last Level

Dynamic I/O Peer and Receiver Structure Changes Sender in CF

Level 10 (10/01)

z900 Dr 3C

List KEY and List cursor Enhancements

Level 1

IMS Shared Message Queue Base

Level 3

64-bit 48 internal tasks CF Duplexing

Level 12 (3/02)

z800 GA
z900 Dr 3G

Register Name List and Batch Unlock

Level 2
DB2 Performance

Cache Vector index Comparison Enhancement

Level 2

Structure Enhancements (255/Structure & 1023 Structure/CF)

Systems Management

CF Duplexing

Level 11 (4Q/02)

G5/6

VSAM RLS
Level 2

World's Leading and Unrivaled Coupling Technology

eserver

System Managed CF Structure Duplexing

z900 z/OS ICF

z800 ICF z/OS
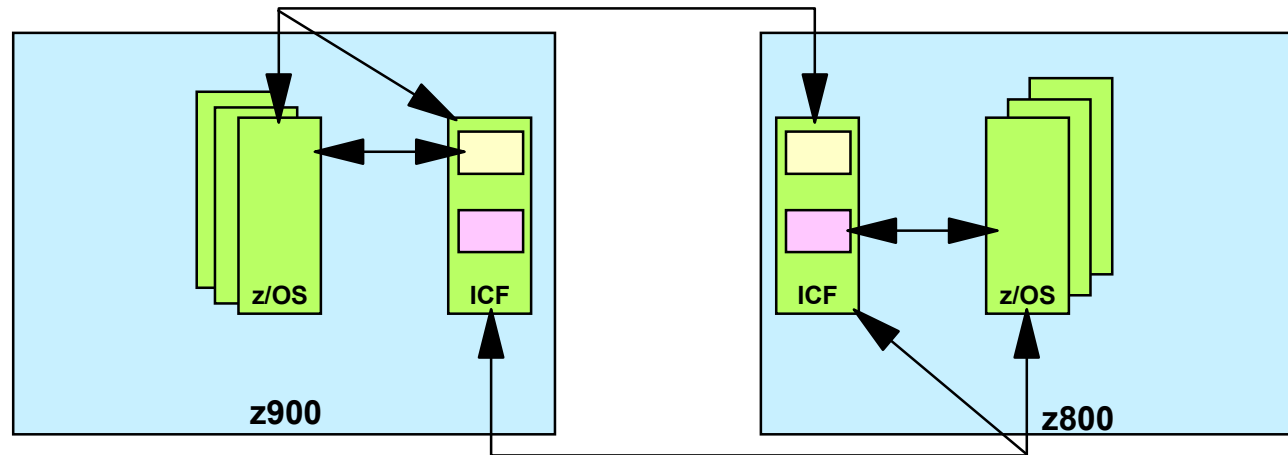
Robust, standard recovery capability
- Ease of use for middleware and ISVs
- Eliminates rebuild delay
- Reduces need for standalone CF

Considerations
- Not all structures supported
- Overhead to duplex
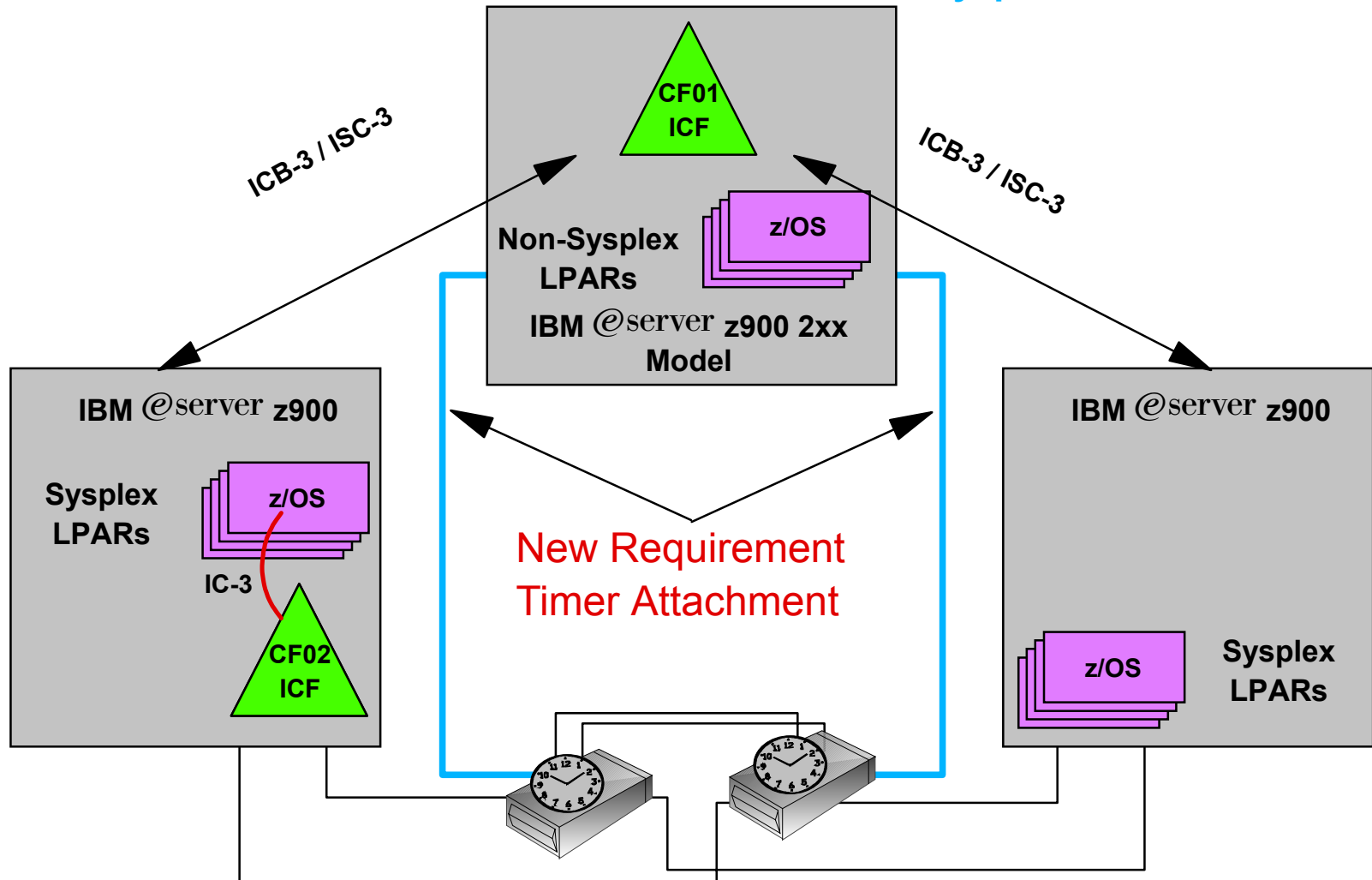- Storage required to duplex
- See Announcement 102-181 (06/02)

Requirements:
- Sysplex Images -
  - **z/OS v1.2 & up**
  - **APAR OW41617**
- Coupling Facilities -
  - ICF or standalone
  - **zSeries with CFCC Level 12**
  - **S/390 G5/6 with CFCC Level 11**
  - **CF - CF link connectivity**

Message Time Ordering - Fast CF Connection to Sysplex Timer

z/OS & OS/390 Expo

z900 New 2xx Model with ICF and non-Parallel Sysplex LPARS

ICB-3 / ISC-3

ICB-3 / ISC-3

CF01 ICF

Non-Sysplex LPARs

z/OS

IBM @server z900 2xx Model

IBM @server z900

Sysplex LPARs

z/OS

IC-3

CF02 ICF

New Requirement Timer Attachment

IBM @server z900

z/OS

Sysplex LPARs

■ **Required z/OS and OS/390 New Function APAR - OW53831**

@server

IBM Fiber Cabling Services for zSeries

- **Introduced with z800 and a new alternative for z900**
  - ► A scalable solution - 24 different standard solution packages
  - ► Fiber optic connectivity expertise deploying a proven methodology
  - ► Personalized services to effectively plan and install the fiber optic cabling needed for your zSeries with the future in mind

- **Addressing the requirements of**
  - ► The Data Center
  - ► Open Systems Environment
  - ► Storage Area Network (SAN)

- **Incorporating**
  - ► Current fiber optic cabling, connectors, transceivers
  - ► New industry-standard Small Form Factor (SFF) connectors and transceivers
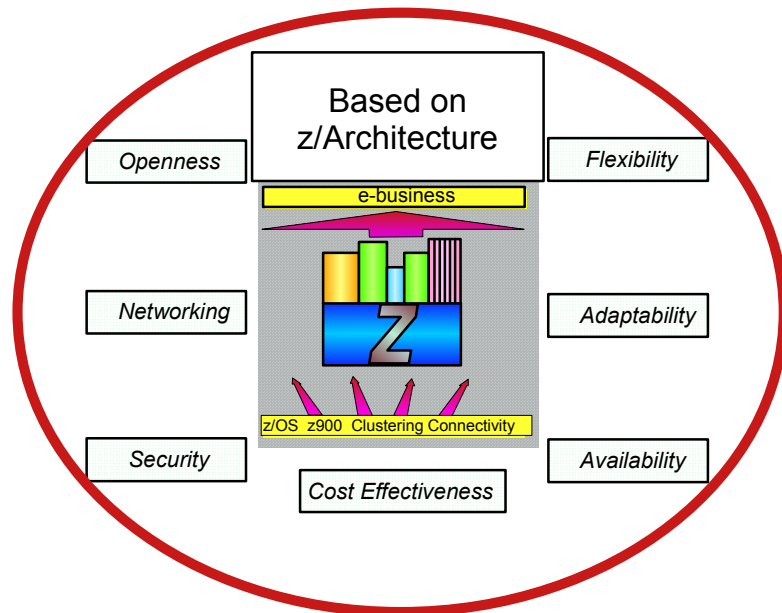
- **With**
  - ► A contracted service for your small, medium, or large enterprise
  - ► Analysis of the current fiber optic cabling and the zSeries configuration
  - ► Options customized for your system environment including jumper cables and specialty cables

A flexible, cost-effective, tailored cabling solution

zSeries Summary

Based on z/Architecture

Openness | Flexibility

e-business

Networking | Adaptability

z/OS z900 Clustering Connectivity

Security | Availability

Cost Effectiveness

64-bit architecture

- **Improved price/performance**

- **Interoperability with other 64-bit platforms**

- **Exploits large real memory**

- **Enhances application support**

Flexible Performance

- **Performance**
  - ► Uni-Processor improvements
  - ► 16-way (4-way on z800) SMP
  - ► Up to 15 (4 on z800)
    Linux (IFL) engines
  - ► More ERP and/or group users
  - ► Higher throughput for Web-based
    e-business transactions

I/O Connectivity

- **Significant connectivity improvements and configuration flexibility**
  - ► Up to 96 (32 on z800) 2 Gbit/sec
    FICON or FCP channels
  - ► FICON Cascaded Directors
  - ► OSA-Express
  - ► HiperSockets

Nondisruptive Growth

- **Dynamic and nondisruptive addition of capacity**
  - ► CP, ICF, IFL, I/O, Memory (z900)
  - ► CBU upgrades and downgrades
  - ► Customer Initiated Upgrades (CIU)