IBM

Session G04

Introducing the IBM zSeries 890: Processor, Memory and System Structure

Harv Emery

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IBM

IBM eServer™

Introducing IBM @server zSeries 890: Processor, Memory and System Structure

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zSeries Expo Session G04
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Harv Emery, zSeries Hardware ATS

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Terminology

- ATM - Asynchronous Transfer Mode
- CBP - Cluster Bus Peer (coupling link, copper cable, zSeries)
- CBS - Cluster Bus Sender (coupling link, copper cable, S/390)
- CBR - Cluster Bus Receiver (coupling link, copper cable, S/390)
- CBU - Capacity Backup
- CBY - ESCON Conversion Channel (byte mode)
- CCF - Cryptographic Coprocessor Facility (S/390, z800, z900)
- CEC - Central Electronic Complex
- CF - Coupling Facility
- CFCC - Coupling Facility Control Code
- CFP - Coupling Facility Peer (coupling link, fiber optic, zSeries)
- CFR - Coupling Facility Receiver (coupling link, fiber optic, S/390)
- CFS - Coupling Facility Sender (coupling link, fiber optic, S/390)
- CHPID - Channel Path Identifier
- CIU - Customer Initiated Upgrade
- CMOS - Complementary metal oxide semiconductor
- CNC - ESCON Channel
- CP - Central Processor
- CTC - Channel to channel

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Terminology

- CU   - Control Unit
- ESCON - Enterprise Systems CONnection
- FCP   - Fibre Channel Protocol (Open SCSI on Fibre Channel)
- FDDI   - Fiber Distributed Data Interface
- FENET - Fast Ethernet (100 bps)
- FICON   - Fibre CONnection (S/390 protocol on Fibre Channel)
- FIPS   - Federal Information Processing Standard (USA)
- GbE   - Gigabit Ethernet
- GUI   - Graphical User Interface
- HCD   - Hardware Configuration Definition (part of z/OS)
- IC   - Internal Coupling
- ICB   - Integrated Cluster Bus
- ICF   - Internal Coupling Facility (coupling facility PU)
- ICP   - Internal Coupling Peer (internal coupling link, zSeries)
- ICR   - Internal Coupling Sender (internal coupling link, S/390)
- ICS   - Internal Coupling Receiver (internal coupling link, S/390)
- ICSF   - Integrated Cryptographic Service Facility (part of z/OS)

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Terminology

- IFL   - Integrated Facility for Linux (Linux PU)
- IGS   - IBM Global Services
- ISC   - Intersystem Coupling (fiber optic Parallel Sysplex coupling link)
- LAN   - Local Area Network
- LIC   - Licensed Internal Code
- LICCC   - Licensed Internal Code Configuration Code
- LPAR   - Logically Partitioned mode
- LSPR   - Large Systems Performance Reference
- LX   - Long Wave Fiber (single mode fiber)
- MBA   - Memory Bus Adapter (connects STIs to memory)
- MCM   - Multiple Chip Module
- MCP   - Mode Conditioning Patch
- MES   - Miscellaneous Equipment Specification
- MPCIPA - Multi-path Channel with IP Assist
- MSU   - Millions of Service Units per hour (CP capacity metric)
- MTU   - Maximum Transmission Unit
- OAT   - OSA Address Table

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Terminology

- OSA — Open Systems Adapter
- OSA/SF — OSA/Support Facility
- PCI — Peripheral Component Interconnect
- PCICA — PCI Cryptographic Accelerator
- PCIXCC — PCI-X Cryptographic Coprocessor
- PR/SM™ — Processor Resource/Systems Manager (logical partitioning hipervisor)
- PU — Processor Unit
- QDIO — Queued Direct Input and Output
- RPQ — Request for Price Quotation
- SAP — System Assist Processor
- SCSI — Small Computer System Interface
- SSL — Secure Sockets Layer
- STI — Self Timed Interconnect (bus for I/O between channels and MBA)
- SX — Short Wave Fiber (multimode fiber)
- TDES — Triple Data Encryption Standard
- TR — Token Ring
- TRLE — Transport Resource List Entry
- WAN — Wide Area Network

IBM @server® zSeries Processor Overview Agenda

- IBM zSeries® 890 Model Structure

- IBM zSeries 890 PU Specifics

- IBM zSeries 890 Model and Capacity Setting Upgrades and Processor Feature Conversions

- IBM zSeries 890 Memory and Memory Upgrades

- IBM zSeries 890 Cryptography

- IBM zSeries 890 Logical Partitioning

- IBM zSeries 890 I/O Introduction

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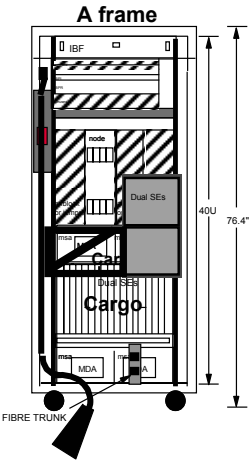
z890 Model Structure

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z890 System Overview

A frame

- IBF
- node
- Dual SEs
- mss
- CEC
- Dual SEs
- Cargo
- mss
- MDA
- A
- FIBRE TRUNK
- 40U
- 76.4"

z890 Front View

- **Processor**
  - ► Single Hardware model
  - ► 28 Capacity Settings
  - ► New to z890 - zAAPs
  - ► 64-bit z/Architecture
  - ► 5 PUs - One standard SAP and up to 4 PUs characterizable
  - ► CMOS 9S-SOI Technology
  - ► SuperScalar
  - ► Crypto assist for DES and SHA in every PU
  - ► Capacity Upgrade on Demand
  - ► On/Off Capacity on Demand
    - − For CPs
    - − For ICFs
    - − For IFLs
    - − For zAAPs
  - ► Capacity Backup (CBU) - To full size engines only
  - ► Customer Initiated Upgrade (CIU)
  - ► Up to 30 LPs active
  - ► Optional ETR attachment
  - ► Internal Battery Feature
- **Memory**
  - ► Maximum system memory 32 GB
    - − Minimum system memory 8 GB
  - ► Card sizes 8, 16, 32 GB (single card)

z990 Highlights for October 2004 (GA4)

- On Demand
  - On/Off Capacity on Demand test
  - Extended order staging for CIU-Express and On/Off CoD
- LAN
  - New OSA-Express2 Gb Ethernet and 10 Gb Ethernet LR (January 2005)
    - Concurrent LIC updates*
    - 640 TCP/IP Stacks
    - Large send for TCP/IP traffic
    - Layer 2 support
    - * Note: Some infrequent LIC updates may not be concurrent
  - OSA-Express functional improvements
    - Layer 2 Support
    - Improved TCP/IP stack utilization
- SAN
  - Preview of FCP LUN access control (Future)
  - FICON™ purge path extended
- Security
  - New Crypto Express2 (January 2005)
  - New Cryptographic Support
    - 19-digit Personal Account Numbers (December 2004)
    - 2048-bit clear and secure key RSA operations
    - Less than 512-bit clear key RSA operations
  - TKE 4.2 workstation with smart card reader
- Availability and Clustering
  - GDPS/PPRC Multiplatform Resiliency for zSeries
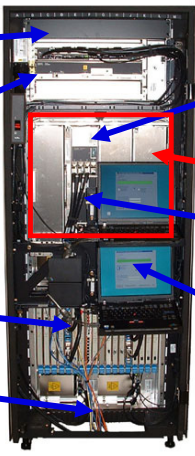 - Coupling Facility dispatcher improvements

NEW!

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z890 - Under the Covers

A Frame

Internal Batteries

Single Processor Book and Memory

Power Supplies

CEC Cage

MBA for STI Connectors

I/O Cage

Fiber Quick Connect Feature

Support Elements

Front View

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z890 5-way MCM

Advanced 93mm x 93mm MCM
- 101 Glass Ceramic layers
- 16 chip sites, 13 in use
- 0.4 km of internal wire
- 5,184 LGA connectors vs 1,849 pins for z800

MSC0	PU4	BLANK	MSC1
PU5	SD2	SD1	PU2
BLANK	SCC	SD0	PU1
BLANK	SD3	PU0	CLK

Note: MBAs not on MCM

CMOS 9S-SOI chip Technology
- PU, SC, SD and MSC chips
- Copper interconnections, 8 copper layers
- 5 PU chips/MCM
  - 14.1 mm x 18.9 mm
  - 122 million transistors/PU
  - L1 cache/PU
    - 256 KB I-cache
    - 256 KB D-cache
  - 1.0 ns Cycle Time
- 4 System Data (SD) cache chips/MCM
  - 17.5 mm x 17.5mm
  - L2 cache per Book
    - 521 million transistors/chip
    - 32 MB
- One Storage Control (SC) chip
  - 17.3mm x 17.3mm
  - 98 million transistors
  - 3692 Power Signal I/Os
  - L2 access to/from MBAs (off MCM)
- Two Memory Storage Control (MSC) chips
  - Memory cards (L3) interface to L2
- One Clock (CLK) chip - CMOS 8S
  - Clock and ETR Receiver

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z890 Model A04 Overview

5 Processor Units
- 4 characterizable
- 1 standard SAP
- No standard spare

Up to 32 GB Memory
- One memory card 8, 16 or 32 GB

L2 Cache 32 MB

Memory subsystem

2 MBAs with 8 STIs. Each STI can support:
- I/O Cages Domain
  - 4 I/O slots
    - I/O & Networking Cards
    - Crypto Cards
- ICB Extender Card
  - ICB-3 Extender
- ICB-4 Connection

z890 Processor Book

MCM

PU L1 | PU L1 | PU L1 | PU L1 | PU L1

Level 2 Cache 32 MB

Memory up to 32 GB

MBA Riser Card

MBA	MBA
STI STI STI STI	STI STI STI STI
4 x 2 GB/S	4 x 2 GB/S

- - - 8 x STI connections at 2 GB/s each - - -
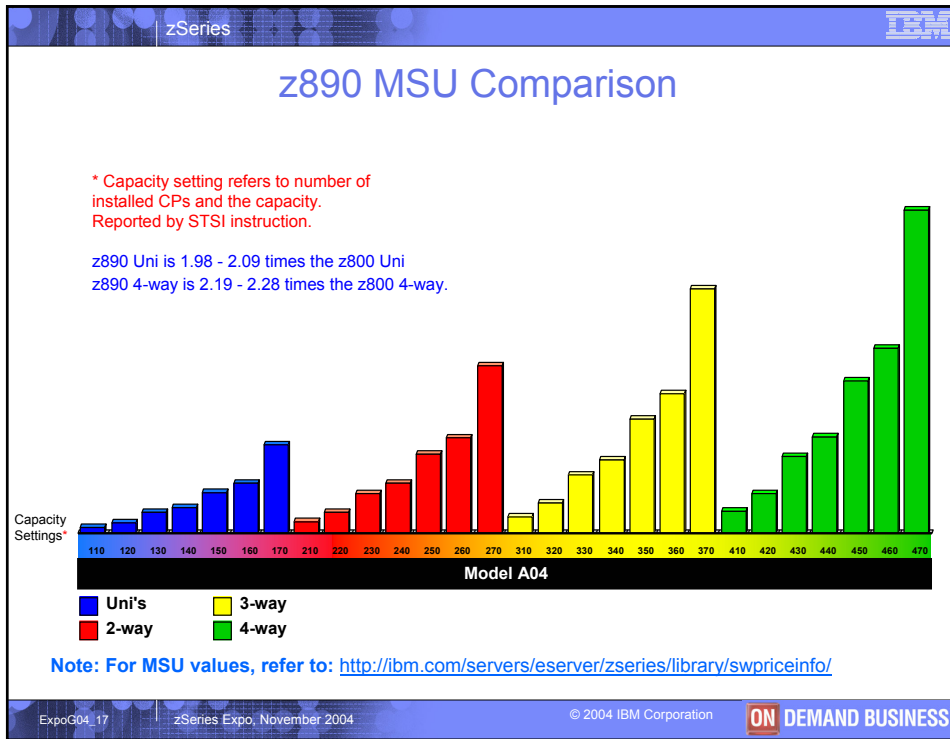
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IBM eServer zSeries 890 PU Specifics

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z890 PU Types and Characterization Features

- **Central Processors (CPs)**
  - Speed and Number by "Capacity Setting"
  - Provides processing capacity for z/Architecture and ESA/390 instruction sets
  - Runs z/OS, z/VM, VSE/ESA, TPF, Linux, and Coupling Facilities (Anything!)
- **IBM eServer zSeries Application Assist Processor (zAAP)** - **Feature**
  - Under z/OS only and only the Java Virtual Machine (JVM)
  - Requires z/OS 1.6 - available 09/2004
- **Integrated Facility for Linux (IFL) Unassigned IFL - Feature**
  - Provides additional processing capacity exclusively for Linux workloads
  - Runs Linux or Linux under z/VM Version 4 or Version 5
- **Internal Coupling Facility (ICF) - Feature**
  - Provides additional processing capacity exclusively for the execution of the Coupling Facility Control Code (CFCC) in a CF LPAR
- **System Assist Processor (SAP)**
  - Standard and Optional SAPs do I/O processing in the channel subsystem
  - Typically NOT needed except, sometimes for TPF
- **Spare PUs – Not orderable**
  - Available (unassigned) PUs on all zSeries, standard spares on z900 and z990 only
  - Support "Transparent Sparing" for other PU types on all zSeries

z890 MSU Comparison

* Capacity setting refers to number of installed CPs and the capacity. Reported by STSI instruction.

z890 Uni is 1.98 - 2.09 times the z800 Uni
z890 4-way is 2.19 - 2.28 times the z800 4-way.

Capacity Settings*

110 120 130 140 150 160 170 210 220 230 240 250 260 270 310 320 330 340 350 360 370 410 420 430 440 450 460 470

Model A04

- Uni's
- 2-way
- 3-way
- 4-way

Note: For MSU values, refer to: http://ibm.com/servers/eserver/zseries/library/swpriceinfo/

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z890 Capacity Setting CPs and MSUs

1-WAY	MSUs	2-WAY	MSUs	3-WAY	MSUs	4-WAY	MSUs
110	4	210	8	310	11	410	15
120	7	220	13	320	20	420	26
130	13	230	26	330	38	430	49
140	17	240	32	340	47	440	62
150	26	250	50	350	74	450	97
160	32	260	62	360	91	460	119
170 - Full 1-way	56	270 - Full 2-way	107	370 - Full 3-way	158	470 - Full 4-way	208

- **CPs** on the machine run at the speed determined by the capacity setting (No mixed CP speeds)
- The SAP, ICFs, IFLs, and zAAPs always run full speed (Setting "70").
- Capacity Setting 070 = z890 with IFL FC 6516 and/or ICF FC 6518 and no CPs
- The STSI instruction returns the z890 capacity setting as the "Model Capacity Indicator"

Positioning CP MSU Ranges for zSeries and S/390

z990

z890

z800

z900

MP3000

9672

MP 2000

MSUs →

- z990: 70 to 1365 Mainframe Charter MSUs
- z900: 41 to 535 MSUs
- z890: 4 to 208 Mainframe Charter MSUs
- z800: 7 to 108 MSUs
- 9672 G5/G6: 15 (RA6) to 285 (ZZ7) MSUs

Notes: **(1) Mainframe Charter MSUs are about 10% "bigger" than old MSUs.**
(2) Using MSUs or MIPs for capacity planning will not yield valid results.
(3) IBM technical support has tools to assist with capacity planning.

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z890 Capacity Planning in a nutshell

MIPS

MSUs

Work with IBM technical support for capacity planning!

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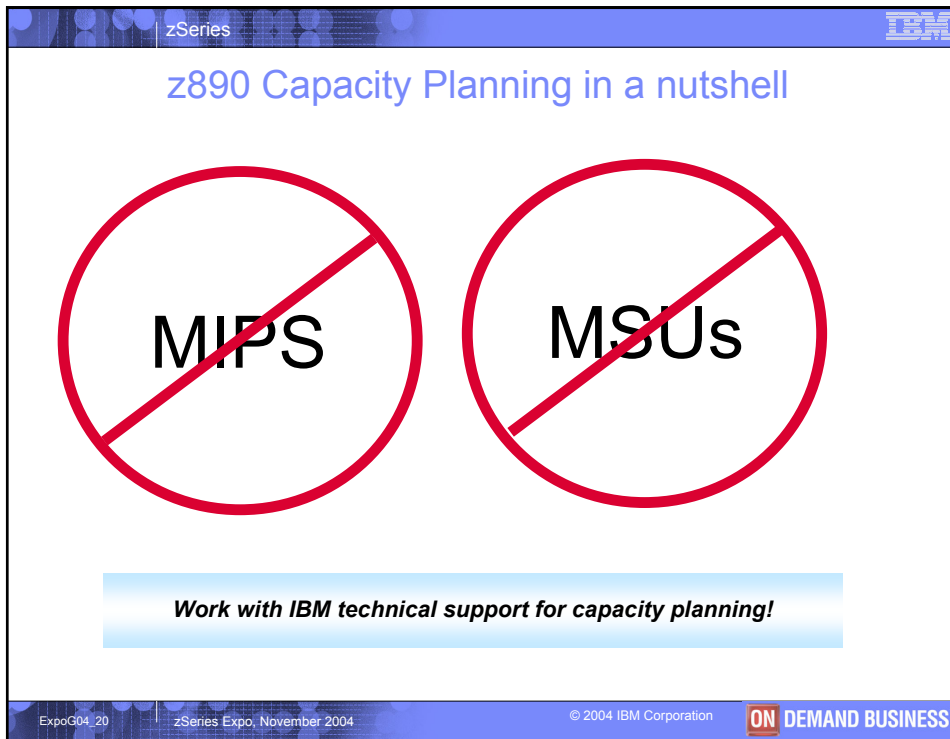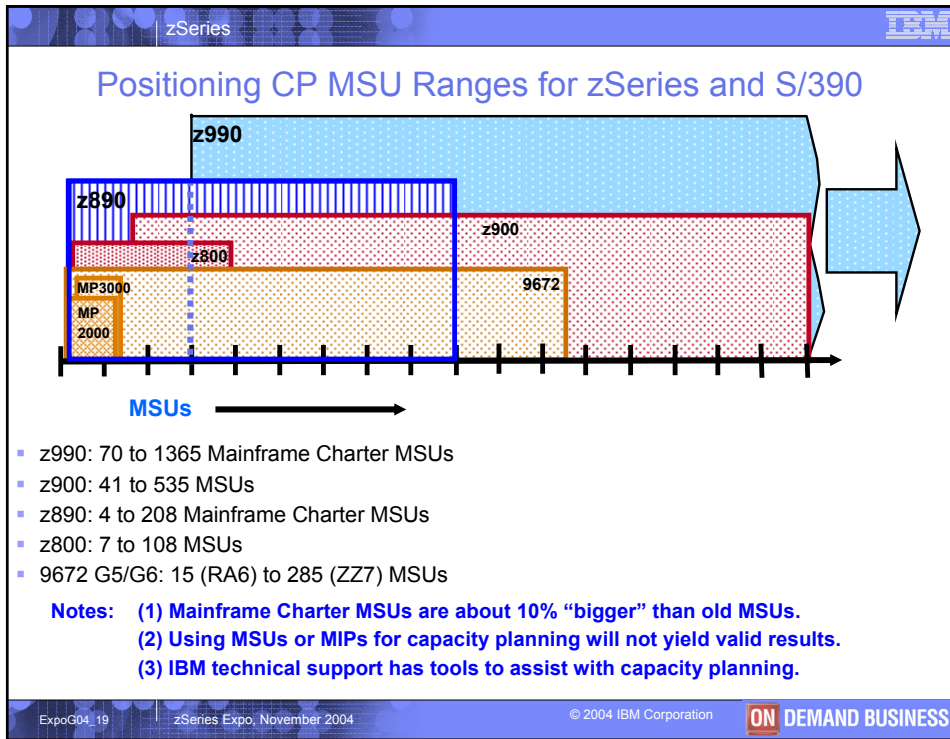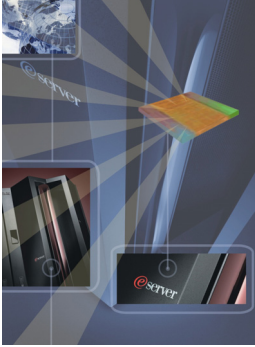
zSeries Application Assist Processor (zAAP) Overview

Specialty assist processor dedicated exclusively to execution of Java cycles under z/OS

- **zAAP for on demand business Integration & Infrastructure Simplification**
  - Leveraged by workloads with Java cycles e.g.: WebSphere, DB2®
  - Can help simplify and reduce server infrastructure and improve operational efficiencies.
  - Enables integration of e-business applications with mission critical database workloads
  - Potential operational advantages over distributed multi-tier solutions
- **Available on z990 and z890 and future zSeries servers only**
  - Executes Java cycles with no changes to applications
  - Enabled by IBM JVM, z/OS 1.6 and zSeries innovative PR/SM virtualization
  - Traditional IBM zSeries software charges unaffected
  - Sub-capacity eligible IBM software charges can be reduced

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z990/890 - zAAP Characteristics

- z890 zAAP feature code 6520 characterizes one PU as a zAAP
  - One zAAP feature may be ordered for each CP and Unassigned CP feature ordered
  - zAAPs do not affect the overall MSU rating of a CEC or an LPAR
- Supporting level of z/OS and JVM (planned)
  - z/OS 1.6 and later
  - JVM 1.4.1 - SDK 1.4.1 and later, 64-bit with the release of z/OS 1.6
- IBM, Vendor and Customer Java can exploit zAAPs if running on a supporting level of z/OS AND JVM.
  - This includes:
    – **WebSphere Application Server 5.1**
    – **CICS®/TS 2.3**
    – **DB2 V8**
    – **IMS™ V8**
    – **WebSphere WBI for z/OS**
  - Execution of Java on traditional CPs only, zAAPs only, or both is controlled by a z/OS system parameter when zAAPs are present in the LPAR

IBM z890 Model and Capacity Setting Upgrades
and Processor Feature Conversions

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z800 to z890 Upgrades – New Model Support

z800	z890

To ANY Capacity Setting

0X2
0A2
002
003
004

A04

e-Config will default to the next closest capacity setting models, but the user may change to <u>any</u> capacity setting desired.

z800   z890

New for GA2 – 0X2, 0A2, and 003 upgrades

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Concurrent PU Feature Conversions - z990 and z890

- The z990 and z890 concurrent conversion between different PU types
  - ► Flexibility to meet changing business environments
- Supported for CP, IFL and ICF conversions ordered by MES or CIU.
  - ➢ Example: From z990 A08 with eight CPs, convert one CP to an IFL
  - ➢ Note: z990 CP to zAAP support to be added later by RPQ
- New LICCC is shipped which can usually be installed without disruption
  - ➢ Disruptive example: A08 with eight CPs, convert all to IFLs.
  - ➢ Limited LPAR disruption might be needed to "free" PUs to be converted even in a non-disruptive case.

From/To	CP	Unassigned CP	IFL	Unassigned IFL	ICF
CP	x	Yes*	Yes*	No	Yes*
Unassigned CP	Yes	x	No	No	No
IFL	Yes*	No	x	Yes*+	Yes*
Unassigned IFL	No	No	Yes+	x	No
ICF	Yes*	No	Yes*	No	x

Notes: Conversions marked Yes* were disruptive prior to z990 GA3

z890 has no CP features. It supports only IFL conversions marked with +

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z990/z890 Capacity Upgrade on Demand

- **CUoD** is concurrent addition of CPs, IFLs, ICFs, zAAPs, and/or memory or concurrent PU type conversion (z990) among CPs, IFLs, and ICFs **without disruption to workloads** running on the machine - no power-off, power-on. Includes:
  - ▸ Addition of CP and IFL features includes turning on (assigning) "Unassigned" CP (z990) and IFL features
  - ▸ LIC enabling additional 8 GB memory increments
  - ▸ Concurrent z990 model upgrade (book add) to add active PUs, memory, and STI busses
- **All** CUoD capabilities can be exploited by **IBM ordered/installed** MES upgrade
- **Some** CUoD capabilities can be exploited by **customer controlled** upgrades:
  - ▸ Capacity Backup (CBU) – temporary emergency CP upgrades
  - ▸ Customer Initiated Upgrade (CIU) – permanent upgrades
  - ▸ On/Off Capacity on Demand (On/Off CoD) – temporary on-demand upgrades
- **Notes:**
  1. CUoD is built on a base of concurrent "hot-plug" maintenance
  2. I/O feature adds and removes are also nondisruptive but not really "CUoD"
  3. Permanent downgrades without PU conversion are DISRUPTIVE!

Concurrent Upgrade - Customer Controlled

- **CIU** – Customer Initiated Upgrade - Express - Permanent upgrade
    - ▸ Customer capability to order and install permanent upgrade
    - ▸ CUoD capabilities NOT included:
        - – Upgrades requiring parts (e.g. channel cards)
        - – Channel upgrades by LIC enable of existing ports
    - ▸ CIU feature - MES ordered to initiate contract and administrative setup
    - ▸ Customer orders and installs upgrade via Resource Link™ and IBM RSF
- **On/Off Capacity on Demand** - Temporary upgrade
    - ▸ Nondisruptive temporary addition of CPs, IFLs, ICFs, and zAAPs in any situation
    - ▸ Upgrades requiring parts (e.g. channel cards) not supported
    - ▸ "Right to use" feature - MES ordered to initiate contract and administrative setup
    - ▸ Customer orders and installs upgrade via Resource Link and IBM RSF
    - ▸ Nondisruptive removal when capacity is no longer wanted
- **CBU** – Capacity Backup - Temporary emergency capacity upgrade
    - ▸ 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

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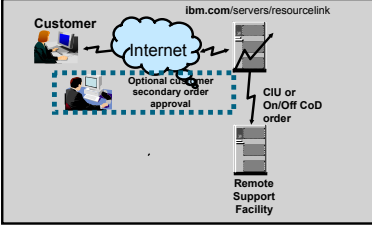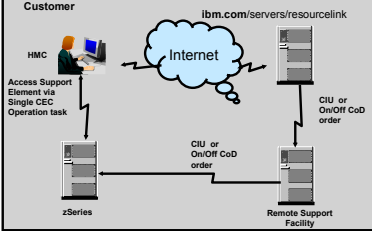## Ordering On/Off Capacity on Demand

- Prerequisite for use:
    - ▸ z990 or z890 server with at least one active CP, ICF or IFL
    - ▸ Signed CIU contract with specific Ts & Cs governing temporary capacity
    - ▸ Installed the Customer Initiated Upgrade (CIU FC 9898) and On/Off CoD "right-to-use feature" (FC 9896)
- Order temporary capacity - PUs up to machine model total
    - ▸ **Can at most add capacity equal to permanent capacity same type**
      For example – Go from 170 to 270, 1 IFL to 2, or do both in the same order
      (Note: CIU upgrades and CBU for CPs do NOT have this restriction)
- A LIC record is established and staged to RETAIN
    - ▸ **Can remain on RETAIN for an extended period (New October 2004 – was only 30 days)**
    - ▸ This record, once activated, has no expiration date
    - ▸ An individual record can only be activated once
    - ▸ Subsequent activations will require a new order to be generated producing a new LIC record for that specific order.
    - ▸ **On/Off CoD activation and CBU can coexist, but it is a requirement to deactivate one function to activate the other one.**
- Business Partners:
    - ▸ Business Partner administrator must log on and approve the order prior to a LIC record being staged in RETAIN.
    - ▸ Ensures that the customer and Business Partner have reached an agreement on price prior to the order being placed.

zSeries CIU and On/Off CoD

- **Order CIU and CoD "right to use" features**
  - Qualification, contracting, and pricing
  - Resource Link ID Authorization
- **Customer CIU or On/Off CoD order or**
  On/Off CoD test order (up to 24 hours)
  - Configure upgrade on Resource Link
  - Secondary Approval (Option)
  - Resource Link communicates with Remote Support
    Facility (RSF) to stage order and prepare download
- **Customer Order or Test Install**
  - Customer notified order ready
    - **Order can now remain on Retain for
      an extended period. (Was 30 days.)**
  - Access Support Element (SE) using Hardware
    Management Console (HMC)
  - "Perform Model Upgrade"
  - Code obtained using RSF and installed on target
    machine

On/Off Capacity on Demand billing and pricing

- Daily billing for On/Off CoD
  - Monitoring occurs through the machine call home facility.
  - A monthly bill will be generated which includes charges for each day that capacity was enabled for any part of a day. The monthly bills will then be accumulated into an invoice that will be sent to the customer quarterly.
  - Charge continues on a daily basis as long as the temporary upgrade is activated.
  - **One On/Off CoD test activation up to 24 hours is allowed with no IBM charges**
- Hardware daily billing
  - "Fixed fraction" of the bid purchase price: **90-day break even** with permanent capacity.
  - No additional maintenance charge for temporary capacity less than 12 months
- Software daily billing
  - IPLA products will be billed at the new daily rate. Letter 304-004 of January 13, 2004.
  - MLC products will be billed at the highest:
    - MSU rating for the month in the case of PSLC or full capacity WLC licenses OR
    - Four hour rolling average for sub-capacity WLC licenses.
- After deactivating the upgrade to the original machine state, the customer may choose to activate a new temporary upgrade, different from the previous upgrade.
- When customers dispose of the machine, or decides that they want to disable future On/Off CoD, the customers are required to remove the "right to use" feature.

z890 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 and channels are not included**.
    - **On z890, CBU activation results in all full-speed "70" CPs**
  - Must plan ahead for memory and connectivity requirements
  - Contract between IBM and customer
  - Count of CBU Features (FC #7800) is the number of active CPs to be added
  - Count of active PUs plus CBU features limited to available PUs
- Nondisruptive temporary upgrade or test process
  - Execute CBU from HMC
  - CBU features activate as CPs
  - Configure additional logical CPs ON to active partition
    - Predefine as "Reserved" CPs
- Nondisruptive downgrade process
  - Required after recovery or test completed
  - Follow procedures to quiesce workload
  - Configure CBU CPs OFF or deactivate the partition using them
  - Execute downgrade from HMC

ON DEMAND BUSINESS

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z890 Upgrades – Concurrent support for z/OS and z/VM

- **Single Machine: 2086 and a single Model: A04**

- **A dramatic new way to consider upgrading**

- **One MCM per model with 5 Processor Units (PUs)**

  - Four PUs available for characterization
    - CPs, IFLs, ICFs, or zAAPs
  - One PU standard as a SAP

- **Standard CPs –**

  - Four full capacity processors each with 7 capacity settings
    - Entry point is 65% less capacity than z800-0E1 and largest capacity setting is 110% more than z800-004
  - Upgrades can be horizontal, vertical, diagonal, or whatever way best fits your needs. All are concurrent to hardware (no POR).
  - Horizontal upgrades add same speed CP and are OS concurrent
  - **Vertical or diagonal upgrades change CP speed (Formerly – IPL required)**
    - **Designed to be concurrent: z/OS or z/OS.e 1.4 and higher with PTF for APAR OA07510**
    - **Designed to be concurrent: z/VM 5.1 for Linux guests and z/OS guests with OA07510**

1-WAY	2-WAY	3-WAY	4-WAY
110			
			470

* Note: No mixing of standard CP capacity sizes in multi-engine machines

> *Think of the possibilities:*
> *Define the processor the way your business requires!*

ON DEMAND BUSINESS

IBM eServer zSeries Memory

---

z890 Memory Upgrades

From	To	To	To
8 GB	16	24	32
16 GB	-	24	32
24 GB	-	-	32
32 GB	-	-	-

Red - Disruptive upgrade

Green - Concurrent upgrade

Card Sizes = 8 GB, 16 GB, 32 GB
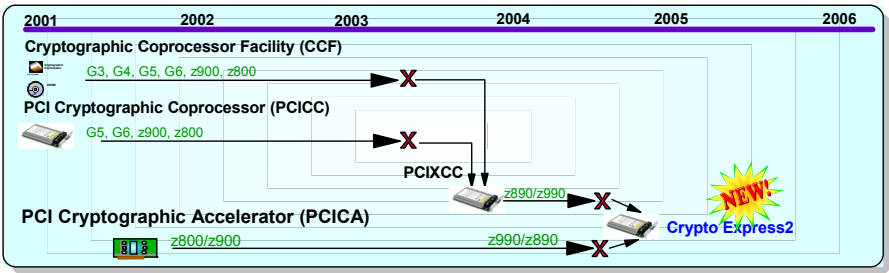
IBM eServer z990/z890
Cryptography

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z890/z990 Crypto Roadmap to Crypto Express2

2001	2002	2003	2004	2005	2006

Cryptographic Coprocessor Facility (CCF)
G3, G4, G5, G6, z900, z800 → X

PCI Cryptographic Coprocessor (PCICC)
G5, G6, z900, z800 → X

PCIXCC
z890/z990 → X

NEW!
Crypto Express2

PCI Cryptographic Accelerator (PCICA)
z800/z900   z990/z890 → X

- **z990/890 includes NO standard cryptographic function**
- CP Assist for Cryptographic Function (message security assist) Feature #3863
    - Allows access to crypto functions from any CP (Limited to CP0 and CP1 on z900)
    - Supports limited clear key processing **running on the CP** – Compute intensive!
    - **NOT equivalent to CCF on older machines in function or offload**
- PCIXCC Feature – Supports "Secure key" cryptographic processing
- PCICA Feature – Supports "Public key" SSL cryptographic processing
- Crypto Express2 – Combines function and performance of PCICA and PCICC
- **Migration to z990 when CCF, PCICC or PCICA is in use on an older machine usually requires Crypto Express2, PCIXCC and/or PCICA on z890/990.**

z990 Crypto – October 2004 announcement

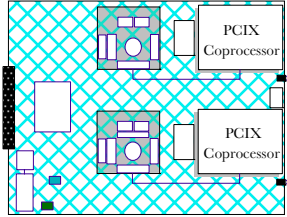| Hardware / z/OS Crypto Support	G5/G6	z800/z900	z990 GA1	z990-GA2/GA3	z890-GA2 z990-GA4
Hardware	**CCF PCICC**	**CCF PCICC PCICA**	**PCICA CPACF**	**PCIXCC PCICA CPACF**	**Crypto Express2 CPACF**
Crypto Function	**Clear key and Secure crypto**	**Clear key and Secure crypto**	**Clear key only**	**Clear key and Secure crypto**	**Clear key and Secure crypto**
OS Support	**OS/390 R10, z/OS 1.1+**	**CCF/PCICC: OS/390 R10, z/OS 1.1+ PCICA: z/OS 1.2+**	**z/OS 1.3 and higher**	**OS/390 2.10 and z/OS 1.2 to 1.6 Web deliverable**	**z/OS 1.3 to 1.6 Web deliverable**

- **CP Crypto Assist for Cryptographic Functions (CP Assist)**
  - High performance clear key DES and SHA-1 engine in every CP
  - Some DES, TDES applications may also require PCIXCC or Crypto Express2
- **Crypto Express2 (3rd Generation Crypto)**   **NEW!**
  - I/O Cage (STI) installable feature
  - Designed to add security-rich functions that previously required PCIXCC or PCICA
  - Designed provide the high performance SSL support that previously required PCICA

Crypto Express2

- Planned availability – January 28, 2005
- Dual Integrated Cryptographic Coprocessors
  - Provides PCIXCC and PCICA functionality
- Improved throughput over the PCIXCC
  - Multitasking required to use both coprocessors
- 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 – October 2004)

NEW!

PCIX Coprocessor

PCIX Coprocessor

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

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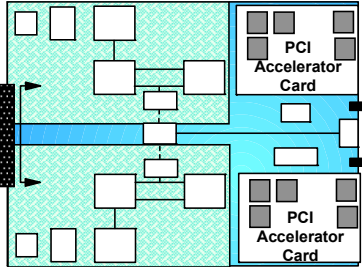# z890/z990 CP Assist for Cryptographic Function (CPACF)

- High performance crypto engine in every CP
  - Clear key DES and hashing
  - Optimized for low-latency SSL transactions

- Two algorithms:
  - DES (single, double, and triple)
    - Up to 2^{64} byte message, interruptible execution
    - Requires FC #3863 to enable (Export control)
  - SHA - Defined in FIPS PUB 180-1 publication
    - Always enabled

- 5 new problem state instructions:
  - KMAC - Compute Message Authentication Code
  - KM – Cipher Message
  - KMC – Cipher Message with Chaining
  - KIMD - Compute Intermediate Message Digest
  - KLMD - Compute Last Message Digest

---

zSeries PCICA Feature

- PCI Cryptographic Accelerator (PCICA)
  - High performance public key (RSA) acceleration (Clear Key)
  - Hardware acceleration for Secure Sockets Layer (SSL) transactions
    - 11,000/sec measured for z/OS 1.4 with access to 6 PCICAs and 16 CPs on a z990
    - 13,000/sec Linux on z990
    - 3,000/sec for z/OS 1.4 with access to 2 PCICAs and 4 CPs on a z890
    - 7, 000/sec on z900-216
    - 800/sec on z800-004

- Considerations
  - Scalable - 0 to 2 features for z890, 0 to 6 features for z990 (each feature has two Accelerator Cards)
  - Each feature occupies an I/O card slot
    - No CHPID number required
    - LPAR in any LCSS can access
  - Limitation: No more than 2 per I/O cage
  - Existing PCICA carried forward on MES upgrade from z800/z900 to z890/z990
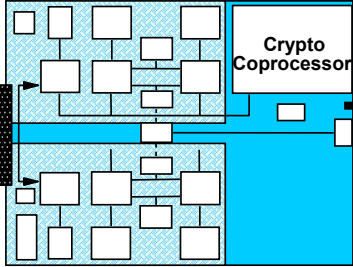 - **Being replaced by Crypto Express2**

PCI Accelerator Card

PCI Accelerator Card

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z890/z990 PCIXCC Feature

- New PCIX Cryptographic Coprocessor (PCIXCC)
  - ‣ Single Integrated Crypto coprocessor
    - − CCF and PCICC functionality
    - − Secure key capability
    - − The PCIXCC feature is designed to meet FIPS 140-2 level 4 certification
  - ‣ Current applications expected to run without change
  - ‣ Can improve cost/performance over PCICC
  - ‣ Hot pluggable, removal zeroization detection
  - ‣ Fully programmable User Defined Extensions (UDX)
    - − Support via a special contract with IBM
    - − Note: Existing UDX for PCICC require modification
- Considerations
  - ‣ Scalable - 0 to 4 Coprocessor features on z890/z990
  - ‣ Each feature occupies an I/O card slot
    - − No CHPID number required
    - − LPAR in any LCSS can access
    - − Plugs only in designated slots
    - − Minimum 2 cards (Note: PCIXCC feature can be ordered in quantities 0, 2, 3 or 4)
  - ‣ **Being replaced by Crypto Express2**

Crypto Coprocessor

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z990 Security Certifications

- **Cryptographic Security Certification**
  - ‣ Crypto Express2 – Designed to meet FIPS 140-2 Level 4
  - ‣ PCIXCC – Designed to meet FIPS 140-2 Level 4
  - ‣ TKE 4.2 Smart Cards – Certified to meet FIPS 140-2 Level 2
- **Common Criteria (ISO/IEC 15408) Evaluation Assurance Levels**
  Reference: http://niap.nist.gov/cc-scheme/
  - ‣ z990 PR/SM – EAL5 (With z800 and z900, the only server to receive EAL5)
  - ‣ z/OS 1.6 – Under evaluation for Controlled Access Protection Profile (CAPP) EAL3+ and Labeled Security Protection Profile (LSPP) EAL3+
  - ‣ z/VM V5.1 with the RACF® for z/VM – IBM has applied for Controlled Access Protection Profile (CAPP) EAL3+ and the Labeled Security Protection Profile (LSPP) EAL3+
  - ‣ SUSE LINUX SLES 8 – Controlled Access Protection Profile (CAPP) EAL3+

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IBM eServer zSeries 890
Logical Partitioning

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z990 and z890 Logical Channel Subsystems (LCSSes)

z990

LCSS0 Up to 256 CHPIDs	LCSS1 Up to 256 CHPIDs	LCSS2 Up to 256 CHPIDs	LCSS3 Up to 256 CHPIDs

z890

- Up to four Logical Channel SubSystems (LCSSs) z990, two LCSSes on z890
  - ▶ Up to 15 LPARs per LCSS
  - ▶ Up to 256 channels per LCSS
- Multiple LCSSes Enable
  - ▶ Up to 30 Logical Partitions per CEC (Even with three or four LCSSes on z990)
  - ▶ Up to 1024 external channels on z990, Up to 421 external channels on z890
- An LPAR can access channels ONLY in its assigned LCSS
- Some channels may be assigned to multiple LCSSes - "**Spanned Channels**"
  - ▶ ICP, IQD, FC, FCP, OSE, OSD, OSC, CBP, CBS, CFP, CFS
  - ▶ But not ESCON, FICON Conversion, Coupling Receiver (CBR, CFR)

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z890 LPAR configuration for cryptographic coprocessors

Customize Activation Profiles : OSYS

Control domain index 00 01 02 03 04 05   Usage domain index 00 01 02 03 04 05

PCI Cryptographic Candidate List 00 01 02 03 04 05   PCI Cryptographic Online List 00 01 02 03 04 05

New z890 LPAR profile page for crypto coprocessor assignment and control by partitions. See "z890 PR/SM Planning" for details.

Attention: You must install the 'IBM CP Assist for Cryptographic Functions' (CPACF) feature if a PCI Cryptographic Candidate is selected from the list box; otherwise, some functions of Integrated Cryptographic Service Facility (ICSF) may fail.

Processor Security Storage Options Load PCI Crypto

Save Copy notebook Paste notebook Assign profile Cancel Help

IBM eServer zSeries I/O Overview

z890 I/O Overview
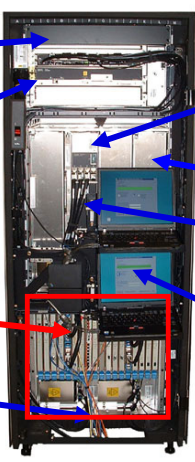
A frame

I/O Cage

z890 Rear View

- **I/O**
  - ► 64-bit Architecture (42/48-bit I/O addressing in hardware)
  - ► 8 x 2 GB/s Self-Timed Interconnects (STIs)
  - ► Single I/O cage with enhanced power
  - ► Up to 2 Logical Channel SubSystems (LCSS)
    - – Up to 256 CHPIDs per LCSS
    - – HiperSockets, Internal Coupling, OSA, FICON™, External Coupling channels spanned between LCSSs
    - – Dynamic I/O support for 2 LCSSs
  - ► Up to 40 OSA-Express or OSA-Express2 LAN connections
  - ► Up to 40 FICON Express Channels
  - ► SCSI over Fibre Channel (FCP for Linux)
  - ► Up to 16 HiperSockets
- **Crypto function**
  - – CPACF in every PU
  - – Crypto Express2
  - – PCICA
  - – PCIXCC
  - – TKE 4.2 with Operational Key Entry and Smart Card Reader
- **Parallel Sysplex**
  - ► Up to 8 ICB-4 (2 GB/s), 16 ICB-3, 48 ISC-3, 32 IC links
  - ► CFCC Level 14 with Duplexing, DB2 and dispatcher enhancements
  - ► Up to 100 km distance between sites (RPQ)
- Capacity Model 110 - maximum configuration:
  - ► 15 LPARs (zELC T & Cs)
  - ► 240 x ESCON®/32 x FICON
  - ► 24 x OSA-Express/16 x HiperSockets
  - ► Full Parallel Sysplex support

---

z890 - Under the Covers

A Frame

Internal Batteries

Power Supplies

I/O Cage

Fiber Quick Connect Feature

Single Processor Book and Memory

CEC Cage

MBA for STI Connectors

Support Elements

Front View

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zSeries I/O Cage - z890, z990 (also z900)

- Capacity
  - Up to 28 I/O Cards per cage
    - z900, z900 up 1, 2 or 3 cages
    - z890 one cage
- Seven I/O Domains
  - Up to 4 I/O Cards Each
  - One STI needed to drive
- Diagram Key:
  - Sxx
    - I/O card slot
    - xx=card slot number
  - H1xx
    - STI multiplex card
    - xx=slot number
    - half high card
    - top half
  - H2xx
    - STI multiplex card
    - xx=slot
    - half high card
    - bottom half

IO Cage

Front   **Rear**

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z890 Book (showing STI Connector, MBA Riser, Memory and MCM)

8 STI Connectors   2 MBAs   Single Memory Card and MCM
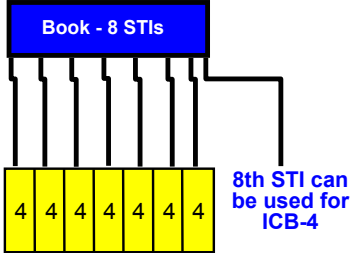
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z890 - STI and I/O Cage Structure

Model A04
8 STIs
16 GBytes/sec

Book - 8 STIs

4	4	4	4	4	4	4

8th STI can be used for ICB-4

7 Domains in the I/O cage using 7 STIs
Up to 28 features

---

z990 and z890 Connectivity Overview

- ESCON
- FICON Express
  - FC and FCP
- Networking
  - OSA-Express
    - Gigabit Ethernet
    - 1000BASE-T Ethernet
    - Token-Ring
  - OSA-Express2
    - Gigabit Ethernet
    - 10 Gigabit Ethernet
  - HiperSockets
- Coupling Links
  - ISC-3
  - ICB-3, ICB-4, IC
  - ICB-2 - **z990 ONLY**
- Crypto
  - Crypto Express2
  - PCICA
  - PCIXCC

Note: Only ICB cables orderable. All other cables have to be sourced separately. Consider IBM Cabling Services

Channels Not Supported: Parallel, OSA-2, OSA-Express ATM, and z900 FICON
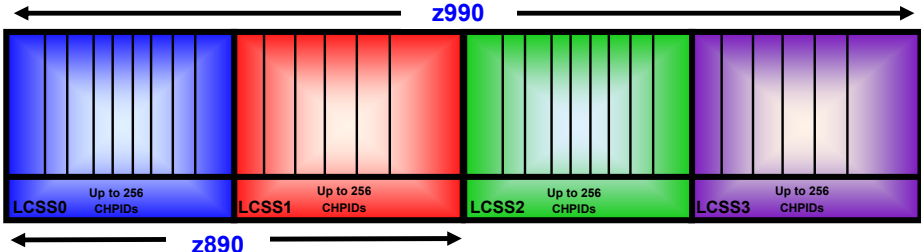
IBM eServer zSeries 890 and 990
Channel Subsystem and CHPID Mapping

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z990 and z890 Logical Channel Subsystems (LCSSes)

- Up to four Logical Channel SubSystems (LCSSs) z990, two LCSSes on z890
  - ► Up to 15 LPARs per LCSS
  - ► Up to 256 channels per LCSS
- Multiple LCSSes Enable
  - ► Up to 30 Logical Partitions per CEC (Even with three or four LCSSes on z990)
  - ► Up to 1024 external channels on z990, Up to 421 external channels on z890
- An LPAR can access channels ONLY in its assigned LCSS
- Some channels may be assigned to multiple LCSSes - "**Spanned Channels**"
  - ► ICP, IQD, FC, FCP, OSE, OSD, OSC, CBP, CBS, CFP, CFS
  - ► But not ESCON, FICON Conversion, Coupling Receiver (CBR, CFR)

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z890 Two LCSSes and External Spanned Channels

- **CHPID 04 Spanned Internal HiperSockets (IQD) or Internal Coupling Link (ICP)**
- **CHPID 06 Spanned external channel (FICON, OSA, or External Coupling Link) – New**
  - **Supported: FC, FCP, OSE, OSD, OSC, CBP, CBS, CFP, CFS**
  - **Not supported: ESCON, FICON Conversion, Coupling Receiver (CBR, CFR)**

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z890 Physical Channel IDs (PCHIDs)

- **CHPID numbers are no longer pre-assigned**
  - i.e. there are NO default CHPID numbers
- **Customer MUST assign CHPIDs to channels**
  - HCD/IOCP Process, and/or
  - CHPID Mapping Tool
- **CHPID assignment**
  - Define the channel to an LCSS(s)
  - Associate the CHPID number to a physical channel port location (PCHID)
  - CHPID numbers are still 00 - FF and must be unique within an LCSS
- **Physical channel location, known as the PCHID, is assigned by manufacturing and reported by eConfig in the PCHID report**
- **Except for ESCON sparing, a PCHID relates directly to a jack location on a channel card in a specific I/O slot, in a specific I/O cage**
  - Other exception
    - IC and HiperSockets - no PCHID
    - ICB-4 - assigned to CEC cage

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zSeries CHPID Mapping Tool (CMT)

- Why do you need a CHPID Mapping tool?
  - **z890/z990** - Aid **REQUIRED** mapping of Physical Channels (PCHIDs) to CHPIDs in IOCDS
  - **z800/z900** - Enable **OPTIONAL** reassignment of default CHPIDs on the CEC.
- Changes to the Mapping Tool for z890 and z990
  - Three digit Physical Channel Identifiers (PCHIDs) rather than two direct (CHPIDs)
  - A LCSS prefix qualifier is defined in the form LCSS.cc (1.A0 for LCSS 1. CHPID A0)
  - Logical CHPID numbers with their owning LCSS are associated with physical Channels in IOCDS
  - Full support for channels added to previously mapped for z990 or z890 (not z800 or z900)
- Inputs Required
  - Valid IOCP without PCHIDs from an HCD "Validated Work IODF"
  - Hardware Configuration (HWC) file from IBM or CFReport File from the IBM configurator
  - **Knowledge of the physical channel cabling infrastructure to be connected to channel ports**
- Using the CHPID Mapping Tool:
  - Two functions: Manual and Availability Mapping
  - Matches available channel ports/PCHIDs to IOCDS CHPID type
  - Offers an "availability" option designed to optimize the Channel assignments for RAS
  - Output:
    - **z800/z900**: Mapping diskette for CE
    - **z890/z990**: Provides updated IOCP statements with PCHIDs entered for each CHPID
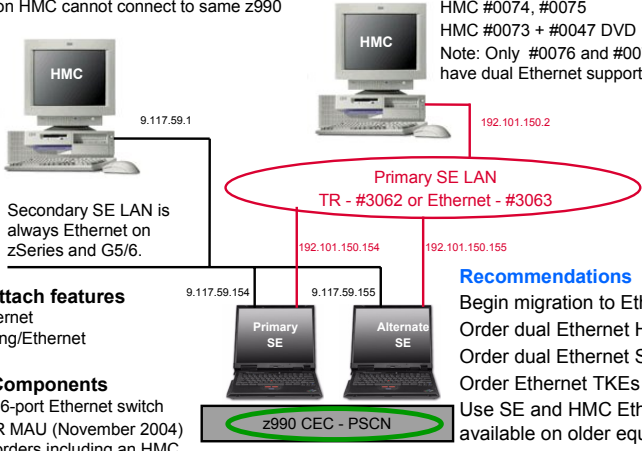   - All: **Configuration Reports to support installation activities**

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z990 HMC configuration and feature recommendations

Currently orderable HMCs (November 2004):
HMC #0079 – Dual Ethernet
HMC #0080 – Ethernet/Token-Ring
Note: Both LANs on HMC cannot connect to same z990

Old HMCs OK:
HMC #0077, #0078
HMC #0076 conversion of #0075
HMC #0074, #0075
HMC #0073 + #0047 DVD
Note: Only #0076 and #0077 have dual Ethernet support

9.117.59.1

192.101.150.2

Primary SE LAN
TR - #3062 or Ethernet - #3063

Secondary SE LAN is always Ethernet on zSeries and G5/6.

192.101.150.154   192.101.150.155

z990 SE LAN attach features
#3063 – Dual Ethernet
#3062 – Token-Ring/Ethernet

9.117.59.154   9.117.59.155

Primary SE   Alternate SE

Recommendations
Begin migration to Ethernet
Order dual Ethernet HMCs
Order dual Ethernet SEs
Order Ethernet TKEs
Use SE and HMC Ethernet available on older equipment

HMC/SE LAN Components
#0089 – 10/100, 16-port Ethernet switch
#0088 – 8 port T/R MAU (November 2004)
Note: Offered on orders including an HMC

z990 CEC - PSCN

New HMC, TKE, Flat Panels and T/R MAU

- New Hardware Management Console (HMC) features **(November 2004)**
  - ▸ **FC0079** HMC with DVD-RAM drive and dual Ethernet
  - ▸ **FC0080** HMC with DVD-RAM drive and both Token-Ring and Ethernet
- New Trusted Key Entry workstation and Smart Card Reader
  - ▸ **FC0846** TKE with DVD-RAM drive and Token-Ring (November 2004)
  - ▸ **FC0849** TKE with DVD-RAM drive and Ethernet (November 2004)
  - ▸ **FC0887** Smart Card Reader - Requires TKE 4.2 LIC (October 2004)
  - ▸ **FC0888** Additional Smart Cards (October 2004)
- New Flat Panel Displays **(November 2004)**
  - ▸ **FC6094** 17-inch flat panel display
  - ▸ **FC6095** 20-inch flat panel display
- Increased HMC feature support
  - ▸ Up to 10 HMCs with displays
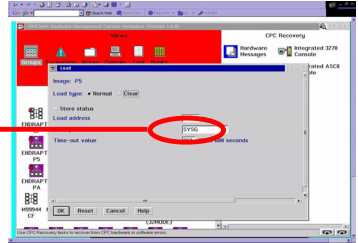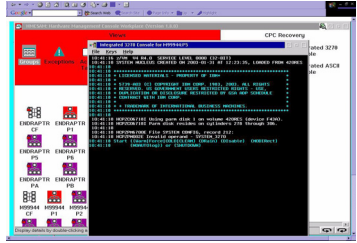 - ▸ Up to 10 T/R MAUs and Ethernet Switches

**Note: Ordering z990 SEs with dual Ethernet (FC3063) is recommended when
           dual Ethernet HMCs and Ethernet TKEs are selected.**

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z990 HMC integrated 3270 console support for z/VM

- **Supported in z/VM V4.4 and higher – IPLs to SYSG**
  - ► Communicates with a z/VM LPAR via the SE
  - ► Highly customizable keyboard mapping
  - ► Can be used from one HMC per CEC at a time, switching supported
  - ► Supports one console session per z/VM LPAR
- **Supports z/VM 4.4 and later on:**
  - ► On G5/G6 with driver level 26
  - ► On z800/z900 with driver level 3G
  - ► On z990
  - ► On z890
- **May remove need for an external 2074 Console Controller Unit for z/VM**
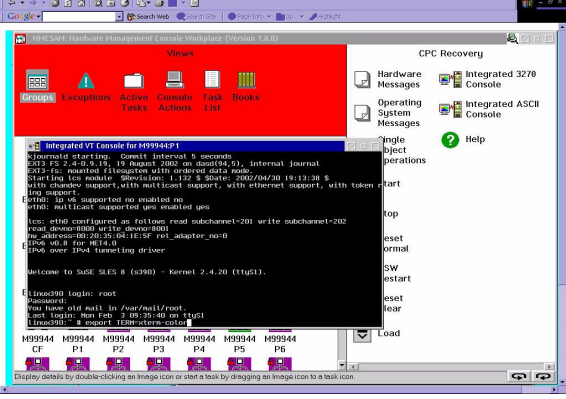
30

z990 HMC integrated ASCII console support for Linux

- **Requires Linux code using IBM's open source contribution of June 2003**
- **ASCII-to-ASCII**
  - ► VT220 emulation via /dev/ttyS1 logical device
- **Can be used from one HMC per CEC at a time**
  - ► Switching is supported
- **Communicates to the Linux LPAR via the SE**
- **Supports Linux on:**
  - ► G5/G6 with driver 26
  - ► z800/z900 with driver 3G
  - ► z990
  - ► z890

SNMP APIs for processor operations must be used on z990

- **Automation APIs on z990 Support Elements (SEs) allow automation of the CEC hardware operations (IPL, Activate/Deactivate, etc)**
  - ▸ SNA APIs present on S/390, z900 and z800 have been **removed** from the z990 SEs
  - ▸ SNMP APIs present on S/390, z900 and z800 remain available on the z990 SEs
  - ▸ Impact to automation software used to control hardware operations of z990
    - – System Automation for OS/390 (SA/390) ProcOps (previously TSCF)
    - – ISV or RYO software performing the same function

- Migration to automation software that uses z990 SE SNMP APIs is required
  - ▸ SA/390 2.2 can support ProcOps via either SNMP APIs or SNA APIs
    - – SA/390 2.2 software maintenance for SNMP:
      - • OW56342 enables SNMP support for synchronous processing
      - • OA02685 full SNMP support including asynchronous processing
    - – SA/390 2.2 continues to support SNA APIs on older CECs
  - ▸ SA/390 2.2 Internal Interface for z/OS
    - – OA02119 enables asynchronous processing
    - – BCP Internal Interface synchronous enabled in SA 2.2 base

- Migrate to SA/390 2.2 on systems that need to manage z990 via ProcOps
  - ▸ All required maintenance to SA/390 2.2 should be applied

IBM eServer zSeries 990 and 890
Statements of Direction (SODs)

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.

Statements of Direction for z990 and z890

- **October 2004: OSA-Express Token Ring not to be offered**: The zSeries 890 and 990 are expected to be the last zSeries servers to offer a Token Ring feature. It is intended that the OSA-Express Token Ring feature will not be available for ordering on a new build or upgraded server, or for carrying forward on an upgrade.
A migration from a Token Ring to an Ethernet environment should be a part of all strategic LAN planning.

- **April 2004: Token Ring on HMC, SE, TKE workstation, IBM 2074**: The z890 and z990 will be the last zSeries servers to offer Token Ring adapter features on the Hardware Management Consoles (HMCs), Support Element (SEs), and Trusted Key Entry (TKE) workstations. The IBM 2074 Model 3 Console Support Controller will be the last controller to offer Token Ring adapter features.
IBM zSeries is making these statements to allow enterprises sufficient opportunity to prepare for a migration to Ethernet environments.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

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Statements of Direction for z990 and z890

- **April 2004: Hardware Management Consoles (HMCs):** Beginning with the next zSeries server, after the IBM zSeries 890 and 990, all new HMCs on all currently marketed zSeries servers are intended to become closed platforms. They will support only the HMC application and not the installation of other applications such as the IBM ESCON Director and the IBM Sysplex Timer console applications.

  When available, the next-generation HMC is expected to communicate only with G5 Servers, and above (Multiprise 3000, G5/G6, z800, z900, z890, z990). TCP/IP is intended to be the only communications protocol supported.

- **April 2004: ISC-3s in compatibility mode**: IBM intends z890 and z990 to be the last family of zSeries servers to support:
  - ▶ Attachment of ISC-3 links to HiPerLinks (ISC-2) on G5/G6 servers
  - ▶ Compatibility mode (CHPID types CFS and CFR) definitions for ISC-3 links

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Statements of Direction for z990 and z890

- **April 2004: Greater than 24 CPs**: IBM intends to support greater than 24 CPs, or combined CPs and zAAPs, in a single LPAR in the future on the appropriate releases of z/OS and z/VM in combination with designated zSeries servers.

- **April 2004: Greater than 30 LPARs**: On May 13, 2003, IBM made the following statements of direction regarding the z990 and z/OS:
  - ▶ IBM intends to support up to 60 LPARs on the z990.
  - ▶ IBM intends to provide support for up to 60 LPARs running z/OS on a single z990 effective with z/OS V1.6.
  - ▶ IBM intends for z/VM V4.4 or later to provide support for up to 60 Logical Partitions (LPARs) with corresponding support on a z990 or future server.

  Based on additional evaluation of requirements, IBM now intends to support greater than 30 LPARs on a future zSeries server.

  This new SOD represents a modification to IBM's previously expressed direction "...to support up to 60 LPARs on z990..." which no longer represents IBM's intent.

  When support for greater than 30 LPARs is made available on a future zSeries server, it is IBM's intention to have support included in z/OS 1.6 and later, and z/VM 4.4 and later.

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Statements of Direction satisfied in GA2/4

- **May 2003: Smart Card Reader support by TKE Workstation**
  - ‣ October 2004 TKE 4.2 Workstation

- **April 2004: OSA-Express Layer 2 support**
  - ‣ Planned December 2004 – OSA-Express and z/VM 5.1
  - ‣ Planned January 2005 – OSA-Express2 and z/VM 5.1
  - ‣ Open Source code delivery for Linux on zSeries
    - – Planned October 2004 for kernel 2.4
    - – Planned early 2005 for kernel 2.6

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End of Presentation

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