IBM GLOBAL SERVICES

Session G03

IBM zSeries 990 Update 2004: Processor, Memory and System Structure

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IBM eServer™

IBM @server zSeries 990 Update 2004: Processor, Memory and System Structure

ON DEMAND BUSINESS™

zSeries Expo Session G03
November, 2004
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

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)

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

Terminology

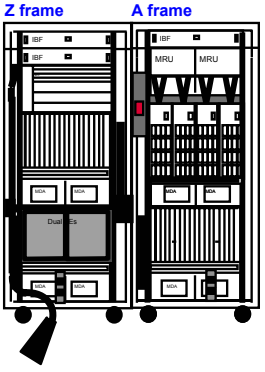
- OSA - Open Systems Adapter
- OSA/SF - OSA/Support Facility
- PCI - Peripheral Component Interconnect
- PCICA - PCI Cryptographic Accelerator
- PCIXCC - PCI-X Cryptographic Coprocessor
- PR/SM™ - Processor Resource/Systems Manager (logical partitioning hipervisor)
- PU - Processor Unit
- QDIO - Queued 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® 990 Model Structure
- IBM zSeries 990 PU Specifics
- IBM zSeries 990 Model and Capacity Upgrades and Processor Feature Conversions
- IBM zSeries 990 Memory and Memory Upgrades
- IBM zSeries 990 Cryptography
- IBM zSeries 990 Logical Partitioning
- IBM zSeries 990 I/O Introduction

z990 Model Structure

IBM eServer zSeries 990 (z990) Overview



Two Frame System

New function for z990.
Updates for GA3 on 5/28/04

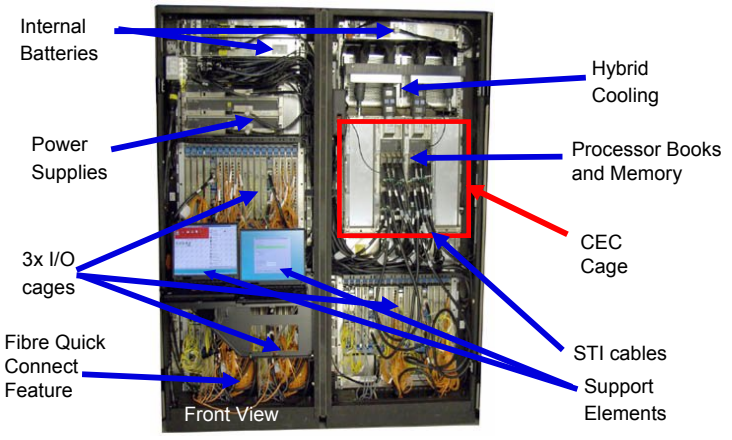
- Processor
  - *4 flexible models*
  - *Unified SMP structure of up to 4 books*
    - *Concurrent model (book) upgrade*
  - 64-bit z/Architecture™
  - Logical Partition Mode *Only*
    - *More than 16 logical PUs in an LPAR*
    - ***Dynamic LPAR name***
    - *Up to 30 LPARs active*
  - *Up to 48 PUs (12 per book), , SuperScalar*
  - *CMOS9S-SOI Technology*
  - *Up to 32 PUs characterizable*
    - *CP, zAAP (6/30/04), ICF, IFL, oSAP*
  - *Concurrent PU Conversion*
  - *Crypto assist for DES and SHA in every PU*
  - Capacity Upgrade on Demand
  - *On/Off Capacity on Demand*
    - *For CPs and IFLs*
    - *For ICFs (5/28/04) and zAAPs (6/30/04)*
    - *Activation coexistence with CBU*
  - Capacity Backup (CBU)
  - Customer Initiated Upgrade (CIU)
  - *Hybrid Cooling (Air/Liquid)* Optional ETR attachment
- Memory
  - *Maximum system memory 256 GB (D32)*
    - *Minimum system memory 16 GB*
  - *Card sizes 8, 16, 32 GB (2 cards per book)*
  - *Bi-directional redundant ring memory interconnect among books*

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

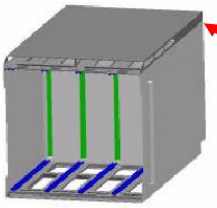
    Note: Some infrequent LIC updates may not be concurrent
  - OSA-Express functional improvements
    - Layer 2 Support
    - Improved TCP/IP stack utilization
- SAN
  - Preview of FCP LUN access control (Future)
  - FICON™ purge path extended
- Security
  - New Crypto Express2 (January 2005)
  - New Cryptographic 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
  - PR/SM™ EAL5 Certification
- Availability and Clustering
  - GDPS/PPRC Multiplatform Resiliency for zSeries
  - Coupling Facility dispatcher improvements

z990 - Under the Covers

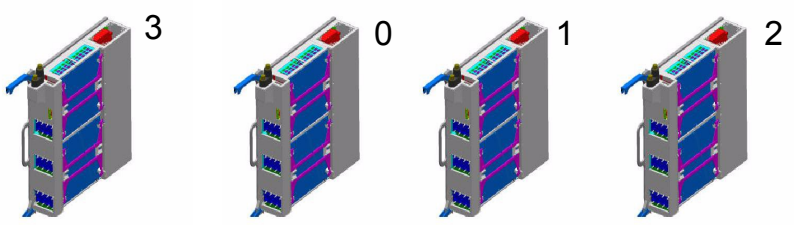


z990 CEC Cage

- Accepts one to four processor books
- Model determines the number of books
  - Model A08 - Book 0
  - Model B16 - Books 0 and 1
  - Model C24 - Books 0, 1, and 2
  - Model D32 - Books 0, 1, 2, and 3

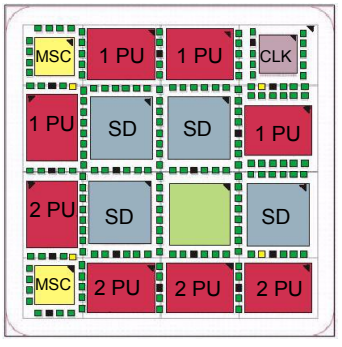


Power DCAs, OSC and ETR slots in the rear



z990 12 Processor Unit (PU) MCM

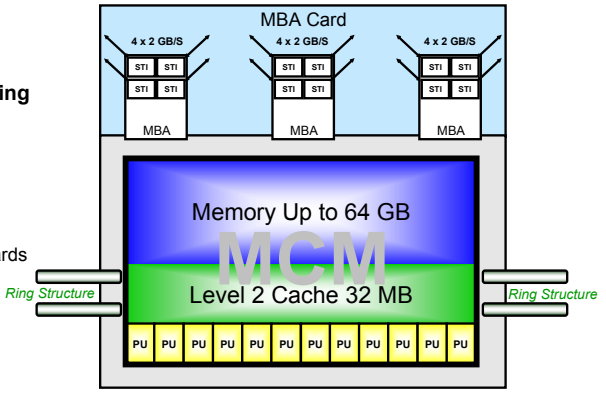
- Advanced 93mm x 93mm MCM
  - 16 chip sites, 185 capacitors
  - 100 Glass Ceramic layers
  - 1.3 Volts, 713 Watts
  - 46% smaller than z900



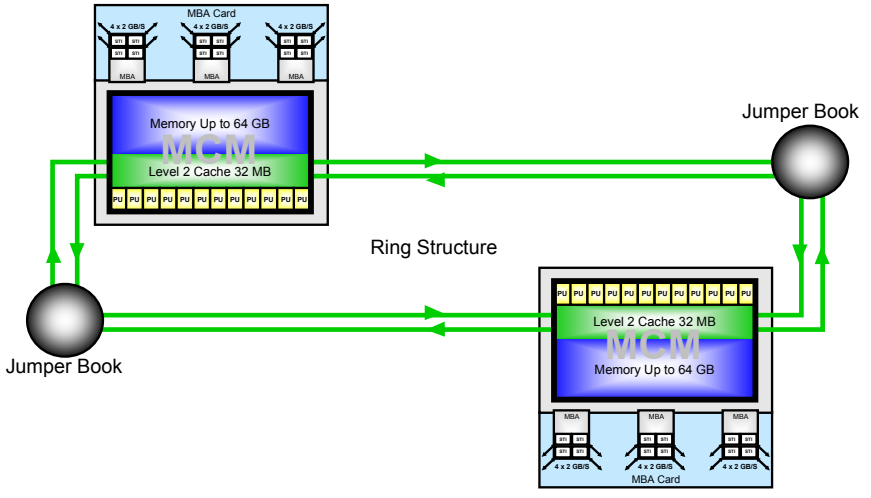
- CMOS 9S - SOI chip technology
  - .83 nsec cycle time
  - PU, SC, SD and MSC chips
  - Copper interconnections, 8 copper layers
- 4 Dual PU, 4 Single PU Chips per MCM
  - 14.1 mm x 18.9 mm
  - 122 million transistors/Chip
  - L1 cache/PU
    - 256 KB I-cache
    - 256 KB D-cache
- 4 System Data (SD) cache chips per MCM
  - 521 million transistors/chip
  - 8 MB L2 cache per chip
  - Single 32 MB L2 cache per MCM
- 1 Storage Control (SC) chip
  - L2 cache crosspoint switch
  - L2 access rings to/from other MCMs
  - L2 access to/from MBAs (off MCM)
- 2 Storage Control (MSC) chips
  - Memory cards (L3) interface to L2
- 1 Clock (CLK-ETR) chip
  - CMOS 8SF, 7 copper layers
  - Clock and ETR Receiver

z990 Model A08 Overview

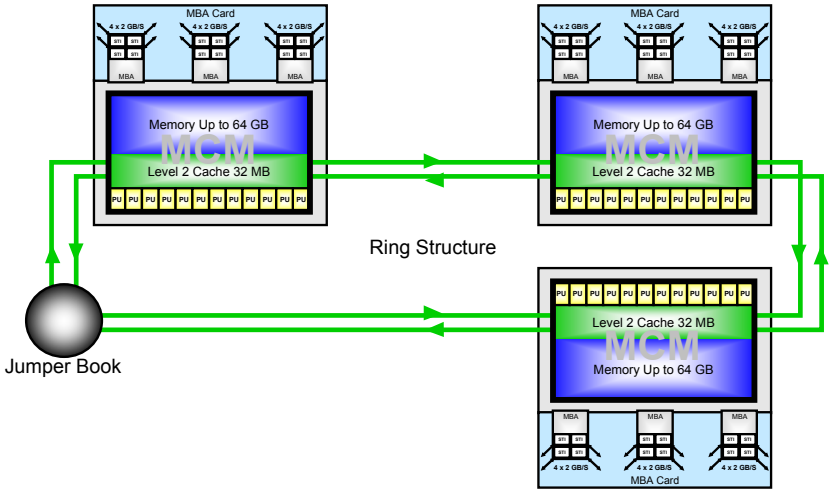
- **12 Processor Units**
  - 8 characterizable
  - 2 SAPs
  - 2 Spare
- **Up to 64 GB Memory**
- **L2 Cache 32 MB**
- **Memory subsystem dual ring to other books (if any)**
- **3 MBAs with 12 STIs**
- **An STI can support an:**
  - I/O Cages Domain
    - –4 I/O slots
      - I/O & Networking Cards
      - Crypto Cards
  - ICB Extender Card
    - –ICB -2 Extender
    - –ICB -3 Extender
  - ICB-4 Connection



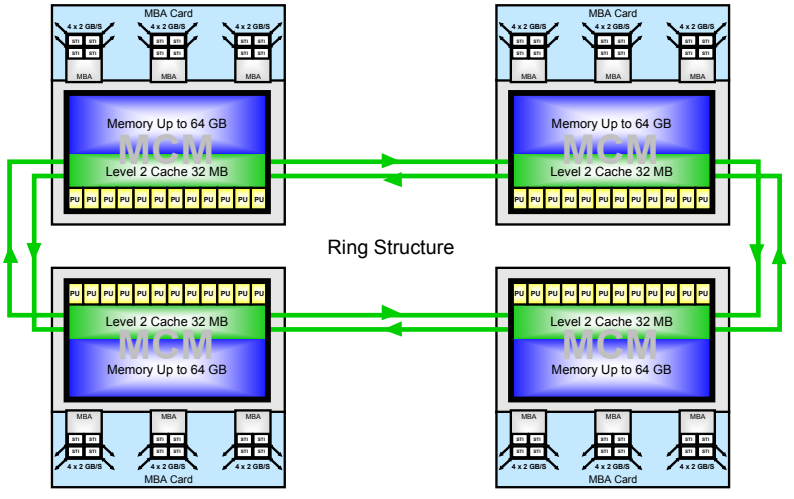
z990 Model B16



z990 Model C24



z990 Model D32



IBM eServer zSeries 990 PU Specifics

z990/890 PU Types and Characterization Features

- **Central Processor (CP) and on z990 Unassigned CP (Paid for, turned off) – Feature**
  - Speed and Number: z800 and z900 by Model, z990 by CP Features, z890 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 Processors (SAPs)** - (**Optional SAPs z990 only)**
  - 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

z990 MSU and ITR Comparisons

z990 STSI "MCI"	CPs	Base	ITR Ratio
301	1	z900 2C1	1.54 - 1.61
308	8	z900 2C8	1.52 - 1.56
316	16	z900 216	1.51 - 1.55
332	32	z900 216	2.46 - 2.98

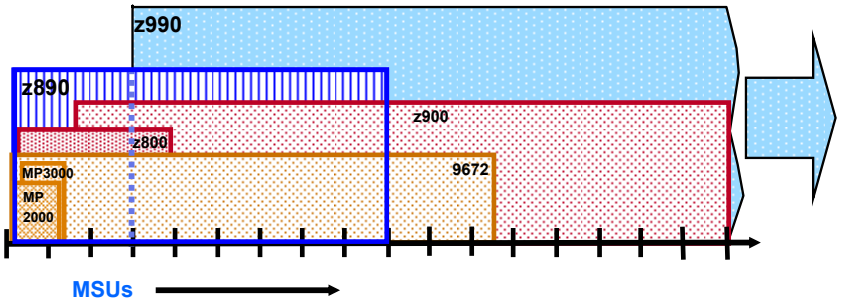
MCI = Model Capacity Indicator. For z990, this is "3nn", where "nn" is the number of CPs.

See: http://www.ibm.com/servers/eserver/zseries/library/swpriceinfo/pdf/swp_ibm.pdf

for exact MSU values represented by the height of each bar.

Notes: MSU values originally announced with z990 were reduced 10% by the IBM Mainframe Charter as a way of reducing software license charges. Capacity and ITR ratios did NOT change. STSI is the "Store System Information" instruction, which returns configuration information.

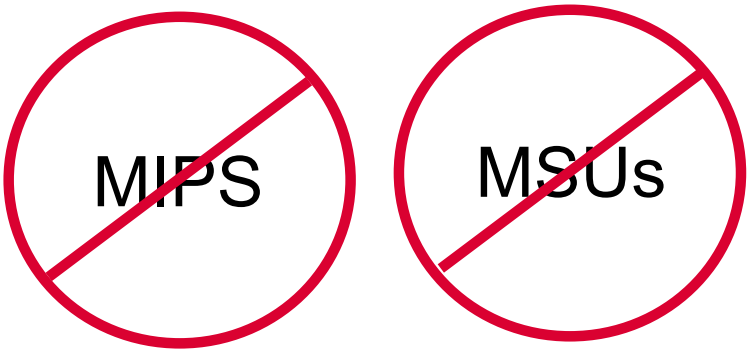
Positioning CP MSU Ranges for zSeries and S/390



- 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.

z990 Capacity Planning in a nutshell

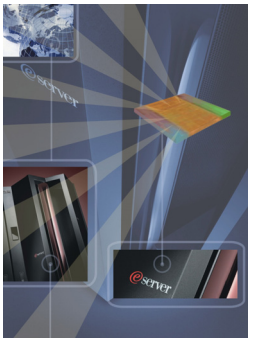


Work with IBM technical support for capacity planning!

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

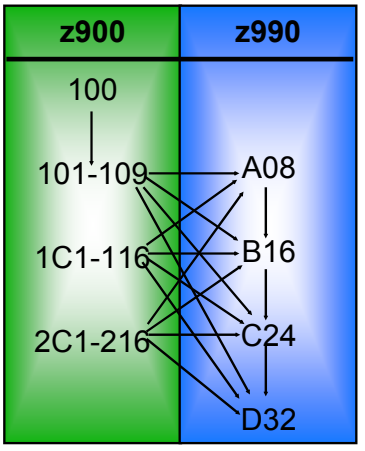


z990 - zAAP Characteristics

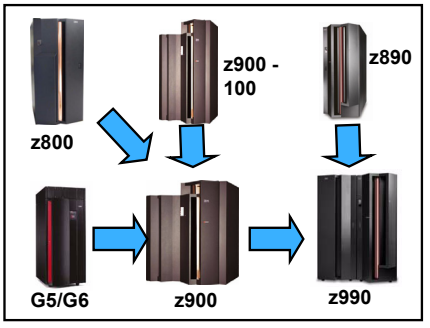
- z990 zAAP feature code 0520 characterizes one PU as a zAAP
  - One zAAP feature may be ordered for each CP and Unassigned CP feature ordered
  - zAAPs do not affect the overall MSU rating of a CEC or an LPAR
- Supporting level of z/OS and JVM (planned)
  - z/OS 1.6 and later
  - JVM 1.4.1 - SDK 1.4.1 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 z990 Model Upgrades and Processor Feature Conversions

Upgrade paths to z990



- No direct upgrade from G5/G6 or z800
- No direct upgrade from z900 Model 100
- Upgrade to z990-A08 from z890-A04
  170 (1-way), 240 (2-way), 330 (3-way), 430 (4-way) and larger only



z990 Concurrent PU Feature Conversions

- The z990 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

z990 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

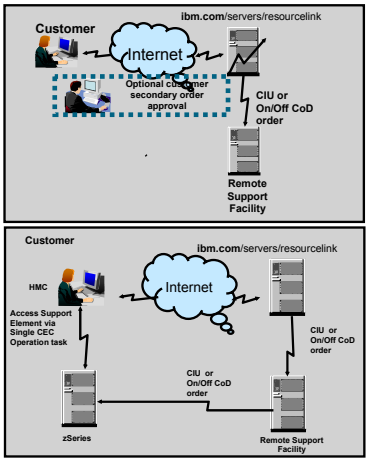
- **CIU** – Customer Initiated Upgrade - Express - Permanent upgrade
  - Customer capability to order and install permanent upgrade
  - CUoD capabilities NOT included:
    - Upgrades requiring parts (e.g. A08 to B16 upgrade)
    - Channel upgrades by LIC enable of existing ports
  - CIU feature - MES 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. A08 to B16 upgrade) 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

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 2 CPs to 4, 1 IFL to 2,or do both in the same order
    (Note: CIU upgrades and CBU for CPs do NOT have the 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.

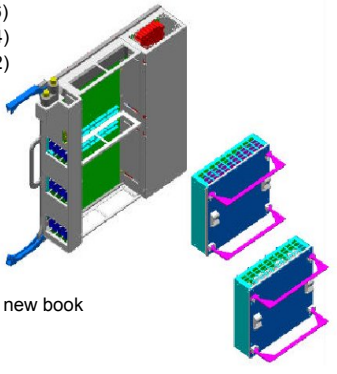
z990 Capacity Backup

- 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**.
  - 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

IBM eServer zSeries Memory

z990 Memory

- Memory is purchased in 8 GB increments
- Memory card sizes - 8, 16, or 32 GB/card = 16, 32 or 64 GB/book
- Offered memory sizes - all multiples of 8 GB:
  - Model A08 - 16 to 64 GB (FC#2602, ... FC#2608)
  - Model B16 - 16 to 128 GB (FC#2602, ... FC#2616)
  - Model C24 - 16 to 192 GB (FC#2602, ... FC#2624)
  - Model D32 - 16 to 256 GB (FC#2602, ... FC#2632)
- Memory Planning considerations:
  - HSA is LARGE up to 2.5 GBytes
  - Granularity at least 64 MB
- New build memory configuration
  - Use the smallest possible memory cards
- MES memory add
  - Concurrent
    - LIC enable increments on installed cards
    - LIC enable increments on cards added with a new book
  - Disruptive - Memory card change



z990 Memory Examples for New Build

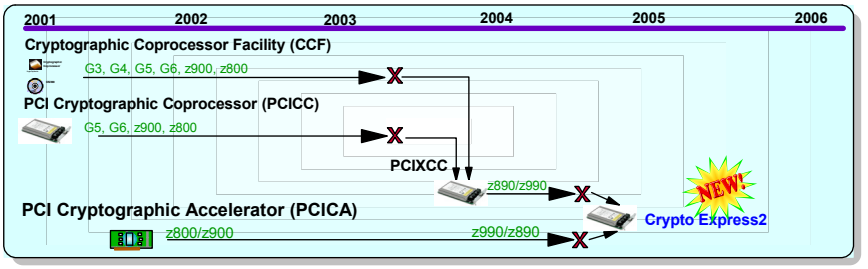
- Prerequisites for concurrent add
  - Must have spare memory capacity on installed cards (Rows and boxes in the table)
  - Or add memory with a new book
  - Increment size change not a concern!
- Concurrent Add to partition
  - Must predefine additional memory to partition as "Reserved Storage"
  - Add to z/OS® partition using Dynamic Storage Reconfiguration (DSR/2)
- Notes:
  - All combinations NOT shown
  - Cards shown are for new build only.
  - Cards added by MES may differ.
  - No CBU for memory

Memory Card Size and Number of Cards

Purchased Memory (GB)	Model A08	Model B16	Model C24 (GA2)	Model D32 (GA2)
16	8 GB x 2	8 GB x 4	8 GB x 6	8 GB x 8
24 32	16 GB x 2	8 GB x 4	8 GB x 6	8 GB x 8
40	32 GB x 2	16 GB x 2 8 GB x 2	8 GB x 6	8 GB x 8
48	32 GB x 2	16 GB x 2 8 GB x 2	8 GB x 6	8 GB x 8
56 64	32 GB x 2	16 GB x 4	16 GB x 2 8 GB x 4	8 GB x 8
---	---.	---	---	---
128	N/A	32 GB x4	32 GB x 2 16 GB x 4	16 GB x 8
---	---	---	---	---
256 (GA2)	N/A	N/A	N/A	32 GB x 8

IBM eServer z990/z890 Cryptography

z890/z990 Crypto Roadmap to Crypto Express2



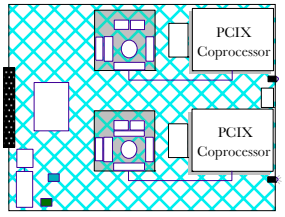
- **z990/890 includes NO standard cryptographic function**
- CP Assist for Cryptographic Function (message security assist) Feature #3863
  - Allows access to crypto functions from any CP (Limited to CP0 and CP1 on z900)
  - Supports limited clear key processing **running on the CP** – Compute intensive!
  - **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)

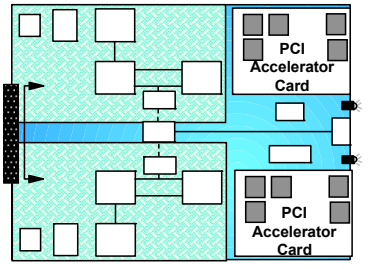
All z990/z890 cryptographic features are seamlessly managed by ICSF for optimum performance!

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

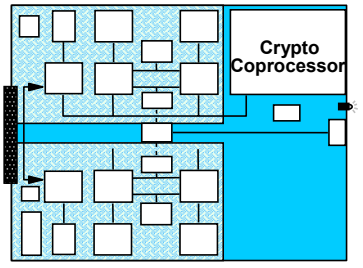
zSeries PCICA Feature

- 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**



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**

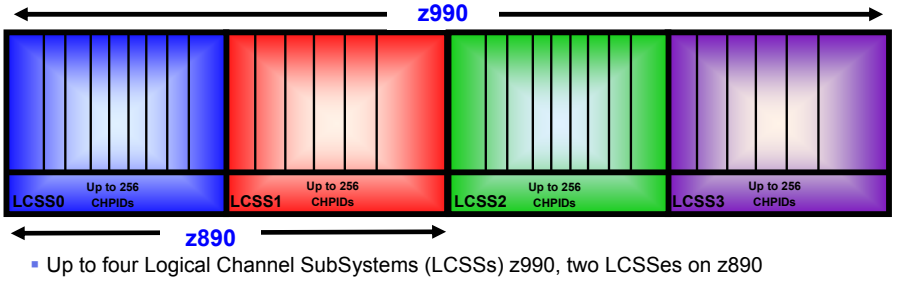


z990 Security Certifications

- **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+

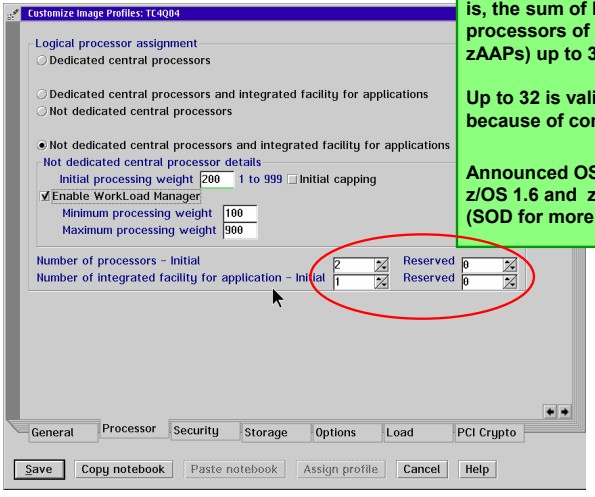
IBM eServer zSeries 990 and 890 Logical Partitioning

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)

z990 LPAR – More than 16 Processors in an LPAR

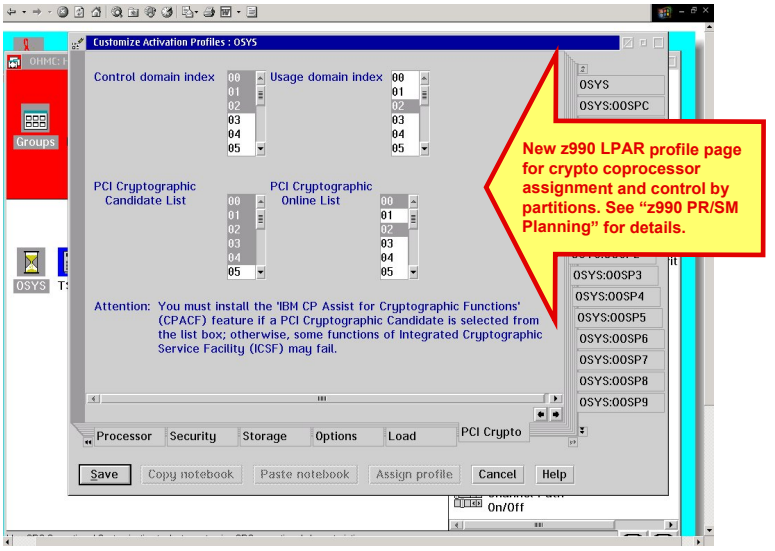


z990 allows up to 32 processors total. That is, the sum of Initial and Reserved processors of all types (e.g. CPs plus zAAPs) up to 32.

Up to 32 is valid even on an A08 or B16 because of concurrent book add support.

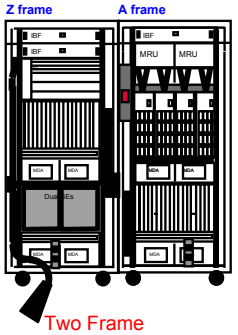
Announced OS support for more than 16: z/OS 1.6 and z/VM 5.1 – Both up to 24. (SOD for more. Watch this space!)

z990 LPAR configuration for cryptographic coprocessors



IBM eServer zSeries I/O Introduction

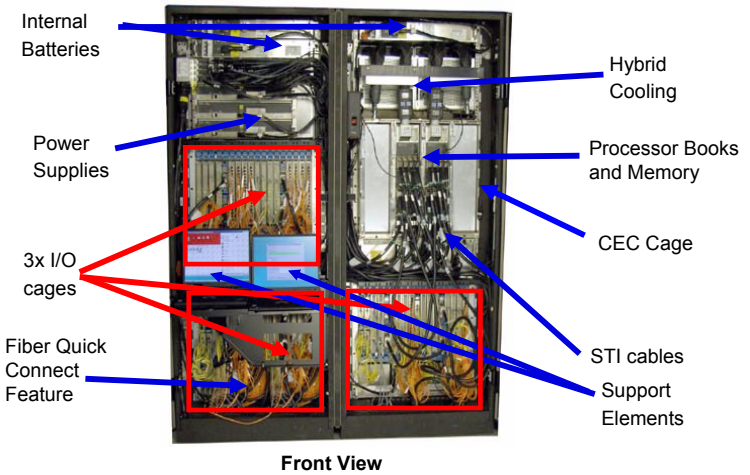
z990 System Overview - I/O



New function for z990.

- I/O
  - 64-bit Architecture (42/48-bit I/O addressing in hardware)
  - *Up to 48 x 2 GB/s Self-Timed Interconnects (STIs)*
  - I/O cage with *enhanced power* (1 to 3)
  - *Up to 4 Logical Channel SubSystems (LCSS)*
    - *Up to 256 channels per LCSS, 1024 total*
    - *Internal and external channels spanned among LCSSes*
    - *Dynamic I/O support for 4 LCSSes*
  - Up to *48* OSA-Express *or OSA-Express2* network connectors
    - *QDIO portname relief, VLAN (all zSeries)*
    - *OSA-Express ICC Channel*
  - Up to *120* FICON™ Express Channels
    - *Up to 15% more I/Os per second per channel*
  - SCSI over Fibre Channel (FCP for Linux)
    - *IPL from FCP disk for Linux and SA dump*
    - *SAN Management - CHBA API*
    - *FCP Channel Concurrent MCL*
  - Up to *16* HiperSockets™
- Crypto function
  - *CPACF in every PU*
  - PCICA, *PCIXCC, Crypto Express2*
  - *Additional Cryptographic APIs*
  - *TKE 4.2- Operational Key Entry, Smart Card Reader*
  - *No CHPID numbers required*
- Parallel Sysplex®
  - *ICB-4 (2 GB/s)*, ICB-3, ICB-2, ISC-3, IC
  - *CFCC Level 14 with DB2 and dispatching enhancements*
  - *CFCC Concurrent MCL*
  - *Up to 48 ISC-3 Peer Mode Links*
  - CF Duplexing
  - *Up to 100 km distance between sites (RPQ)*

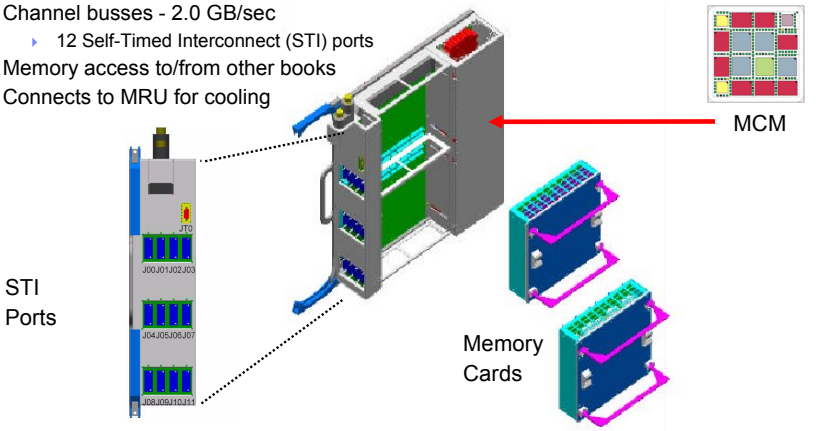
z990 - Under the Covers



Front View

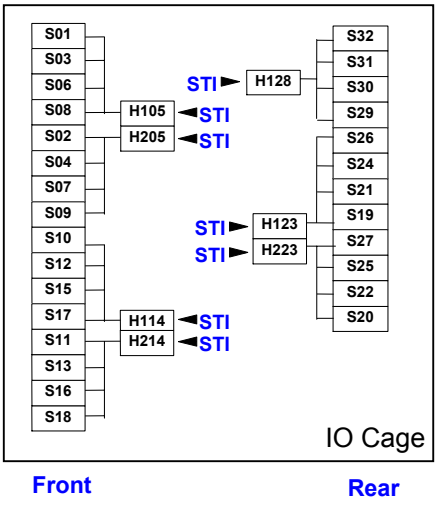
z990 Processor Book

- Multichip module with 12 processor units
- Two memory cards - 8, 16 or 32 GB each
- Channel busses - 2.0 GB/sec
  - 12 Self-Timed Interconnect (STI) ports
- Memory access to/from other books
- Connects to MRU for cooling



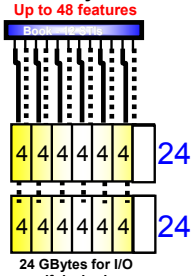
zSeries I/O Cage - z890, z990 (also z900)

- 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



z990 - STI and I/O Cage Structure

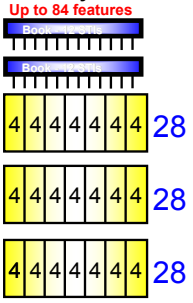
Model A08
12 STIs
24 GBytes
Up to 48 features



24 GBytes for I/O if desired

6 Domains in each I/O cage 12 STIs for I/O

Model B16
24 STIs
48 GBytes
Up to 84 features

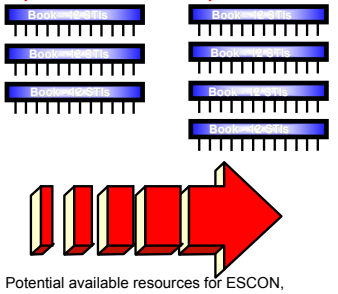


42 GBytes for I/O if desired

7 Domains in each I/O cage
21 STIs for I/O

Model C24
36 STIs
72 GBytes
Up to 84 features

Model D32
48 STIs
96 GBytes
Up to 84 features



Potential available resources for ESCON, FICON Express, ISC-3, OSA-Express as well as ICB, PCICA, and PCIXCC.

z990 and z890 Connectivity Overview

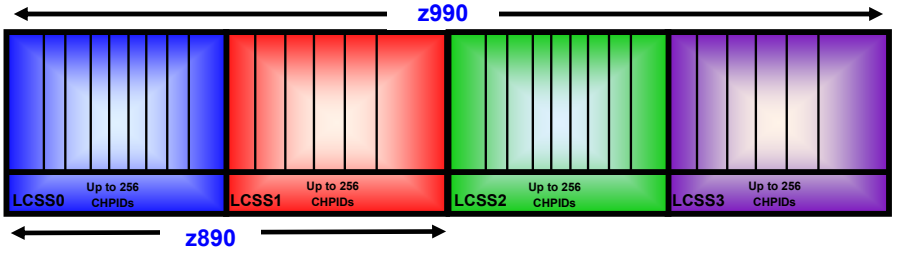
- ESCON
- FICON Express
  - FC and FCP
- Networking
  - OSA-Express
    - Gigabit Ethernet
    - 1000BASE-T Ethernet
    - Token-Ring
  - OSA-Express2
    - Gigabit Ethernet
    - 10 Gigabit Ethernet
  - HiperSockets
- Coupling Links
  - ISC-3
  - ICB-3, ICB-4, IC
  - ICB-2 - **z990 ONLY**
- Crypto
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

z990 and z890 Logical Channel Subsystems (LCSSes)



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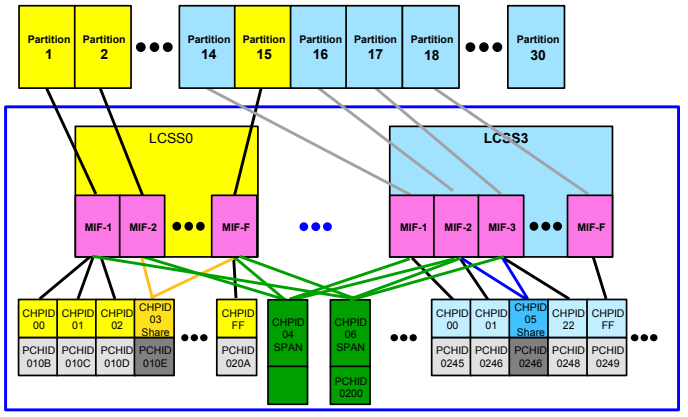
- Some channels may be assigned to multiple LCSSes - "**Spanned Channels**"
  - ICP, IQD, FC, FCP, OSE, OSD, OSC, CBP, CBS, CFP, CFS
  - But not ESCON, FICON Conversion, Coupling Receiver (CBR, CFR)

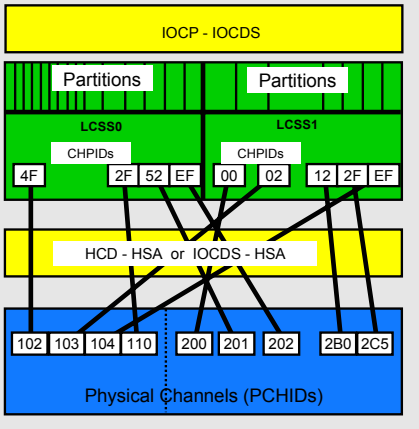
z990 Four LCSSes and External Spanned Channels



- **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)**

z990 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



zSeries CHPID Mapping Tool (CMT)

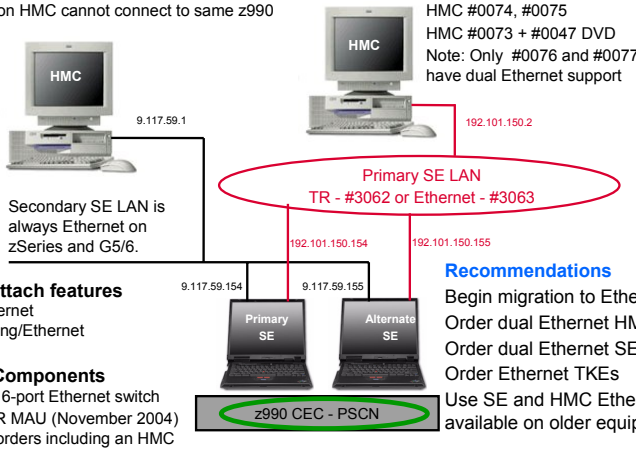
- Why do you need a CHPID Mapping tool?
  - **z890/z990** - Aid **REQUIRED** mapping of Physical Channels (PCHIDs) to CHPIDs in IOCDS
  - **z800/z900** - Enable **OPTIONAL** reassignment of default CHPIDs on the CEC.
- Changes to the Mapping Tool for z890 and z990
  - Three digit Physical Channel Identifiers (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**

IBM eServer zSeries HMC

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



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

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

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

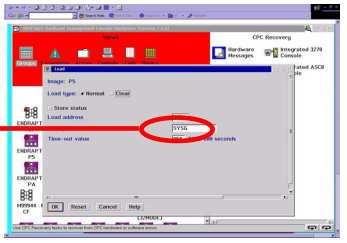
New HMC, TKE, Flat Panels and T/R MAU

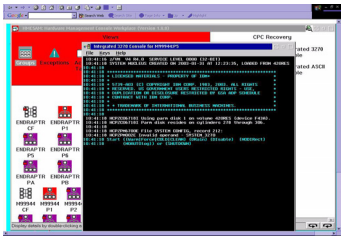
- New Hardware Management Console (HMC) features **(November 2004)**
  - **FC0079** HMC with DVD-RAM drive and dual Ethernet
  - **FC0080** HMC with DVD-RAM drive and both Token-Ring and Ethernet
- New Trusted Key Entry workstation and Smart Card Reader
  - **FC0846** TKE with DVD-RAM drive and Token-Ring (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
- New T/R MAU **FC0088** **(November 2004)**
  - 8 ports Token-Ring
  - Previously shipped automatically, now orderable
- 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.

z990 HMC integrated 3270 console support for z/VM

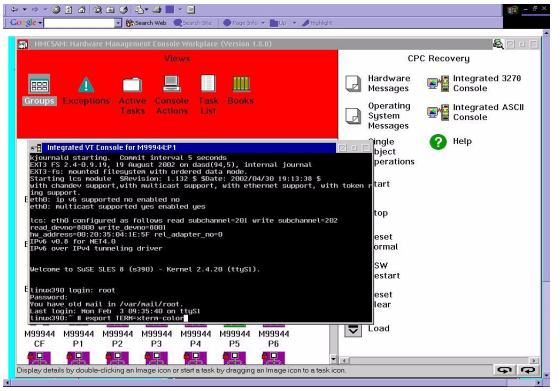
- **Supported in z/VM V4.4 and higher – IPLs to SYSG**
  - Communicates with a z/VM LPAR via the SE
  - Highly customizable keyboard mapping
  - Can be used from one HMC per CEC at a time, switching supported
  - Supports one console session per z/VM LPAR
- **Supports z/VM 4.4 and later on:**
  - On 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**





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.

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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.

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 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

End of Presentation

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