G02

zMainframe Concepts Part 2

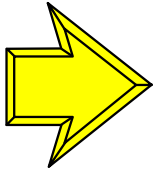### Brian Hatfield

zSeries Expo	Nov. 1 - 5, 2004

Miami, FL

Mainframe Environment, Physical/Logical Partitioning, CPC Initialization and CHPIDs

Mainframe Environment, Physical/Logical Partitioning, CPC Initialization and CHPIDs

Operational Environment, I/O Configuration and HCD Overview

zSeries platform functions, Capacity on Demand and other zSeries exclusives enabling Autonomic Computing

Today's Mainframe Environment

Logical Partitioning mode
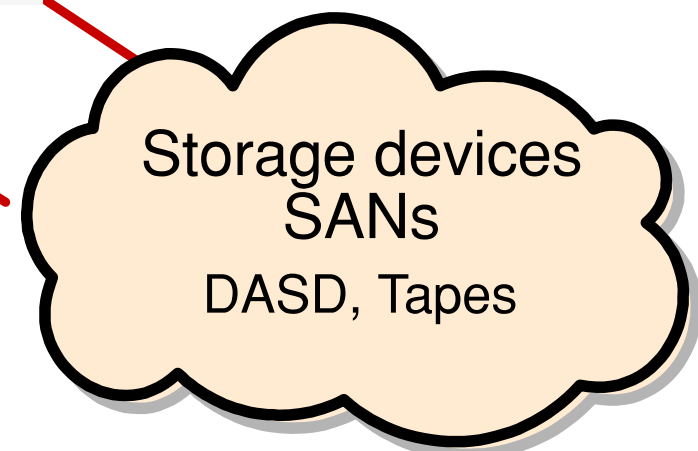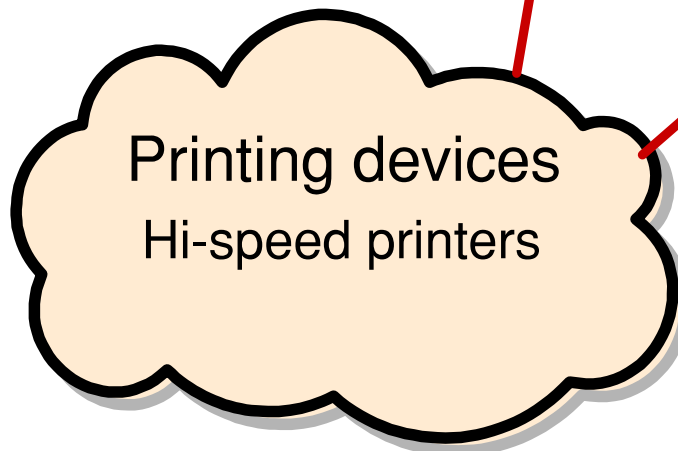
NATIVE mode

Network

LANs, WANs
various network devices

Many types of channels, switches, directors, and cabling exist to provide connectivity to an ever increasing complex I/O environment
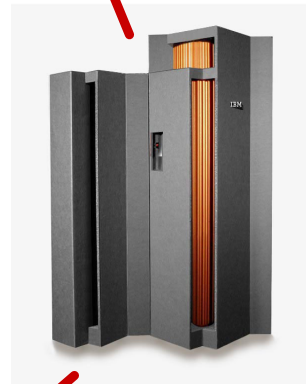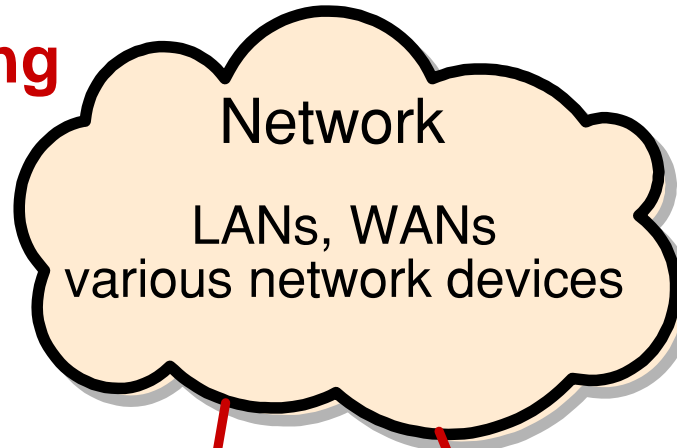
Operator console used to control/monitor environment, typically directly channel attached to CPC

Printing devices
Hi-speed printers

Storage devices
SANs

DASD, Tapes

Physical Partitioning (yesterday)

Physical partitioning, available in the 1980s is the capability of taking one physical CPC and dividing it into two separate CPCs with no sharing of resources.

- Supported on bipolar CPCs such as the 308x, 3090-x, and ES/9000 required certain CPC model configurations
  - These CPCs (model dependent) could operate in one physical Single Image (SI) or two physically partitioned (PP) images
- Physical partitioning was optionally enabled via H/W definition panels and required a POR
- Each physical partition required its own IOCDS
- Initially the two physically partitioned images could IPL only one operating system each in its architectural mode
  - Starting in the 1980s the operational architectural supported modes on various CPC H/W was 370-XA, ESA/370 and then ESA/390 which is supported on the ES/9000 through zSeries CPCs

Logical Partitioning (today)

Logical Partitioning (LPAR mode) available with PR/SM in the late1980s is the capability of taking one physical CPC and dividing it into many logical partitions, sharing and/or dedicating resources from the physical CPC.

- Supported on CPCs such as the Bipolar 3090-x, ES/9000, CMOS 9672 and zSeries
    - All zSeries CPCs supports 15 LPs in LPAR mode
    - zSeries 990 supports greater than 15 LPs and only operates in LPAR mode
- IOCDS must support LPAR mode
- Setup is done via H/W panels or activation profiles on CMOS CPCs
    - The operational architectural supported mode that is initially available to every LP is ESA/390, (supported on the 3090-x through zSeries CPCs)
    - A special mode, ICF (Internal Coupling Facility) is also supported on LPs

NOTE: zSeries supports z/Architecture,
z/Architecture support is provided by the OS and switches from ESA/390 to z/Architecture at IPL

Today's CPCs (9672s and zSeries) may be defined via activation profiles to operate in one of two modes at POR time
- LPAR mode - Resources shared and/or dedicated
- ESA/390 mode - Resources dedicated to a single image
    - This mode is typically called *NATIVE* or *BASIC* mode

Modes of Operation

Basic Mode

POR in Basic Mode

- One Operating System
- All processor resources available to the operating system
  - CPs, Storage, CHPIDs
- ESA/390 or ESA/390 TPF modes supported
- Coupling Facility mode is NOT supported - requires LPAR mode

LPAR Mode

POR in LPAR Mode

- Up to 15 partitions (z990 > 15)
- One operating system/partition
- A partition may be defined to operate in either ESA/390 or as a Coupling Facility
- CPs may be shared or dedicated to a partition
- Storage allocated to the partition at LP activation
- LP owns assigned storage
- CHPIDs may be dedicated, reconfigurable, shared or spanned
- ESA/370 mode is not supported on the G4, G5,G6 or zSeries

CPC Activation Overview

- CPC Activation is initiated and monitored at the Hardware Management Console (HMC).

- Activation is controlled by activation profiles that reside on the Support Element (SE).

- Three types of activation profiles exist on the SE.
  - Reset type Profile
    - Controls mode of operation (Basic or LPAR), supported I/O configurations and POR process.
  - Image type Profile
    - Defines LP options and resources (LPAR mode only).
  - Load type Profile
    - Defines IPL options, load address, and parameters.

Basic Mode Initialization Overview

Power on Reset (POR) in Basic mode to initialize the CPC

- Initialize CPs, storage, and channel subsystem
  - Load selected IOCDS into the Hardware System Area
  - POR complete - CPC status is Not Operating

- Initial Program Load (IPL)
  - IPL the operating system
    - Additional steps required for zSeries
    - Determine architecture mode (z/Architecture or ESA/390)
    - Determine storage assignments (ignore expanded storage assignments in z/Architecture)
  - Initialize the software
  - Initialization complete
  - CPC status is Operating
  - Image status is Operating

Note: CPC and Image status as determined from HMC details panel

zSeries CPC in Basic Mode

Reset Profile defines mode of operation at POR

One of three operational modes may be defined by the Reset Profile
- LPAR
- ESA/390 (Basic Mode)
- ESA/390 TPF (Basic Mode)

When **LPAR** is **not selected** on the Reset Profile the CPC is considered to be operating in **BASIC mode**

***BASIC** mode not supported on z990

RESET PROFILE
(BASIC MODE)

ESA/390 or ESA/390 TPF

★ Only one operating system can be activated (IPL'd)
All resources assigned to one OS, CPs, Storage, CHPIDs

ESA/390

★ z/OS (64-bit only)
★ OS/390 R10
★ z/VM

★ OS/390 pre R10
★ VM/ESA
★ VSE/ESA
★ Linux
★ VIF for Linux

ESA/390 TPF

★ TPF

z/Architecture
64-bit

ESA/390 Architecture
(31-bit)

ESA/390 Architecture
(31-bit)
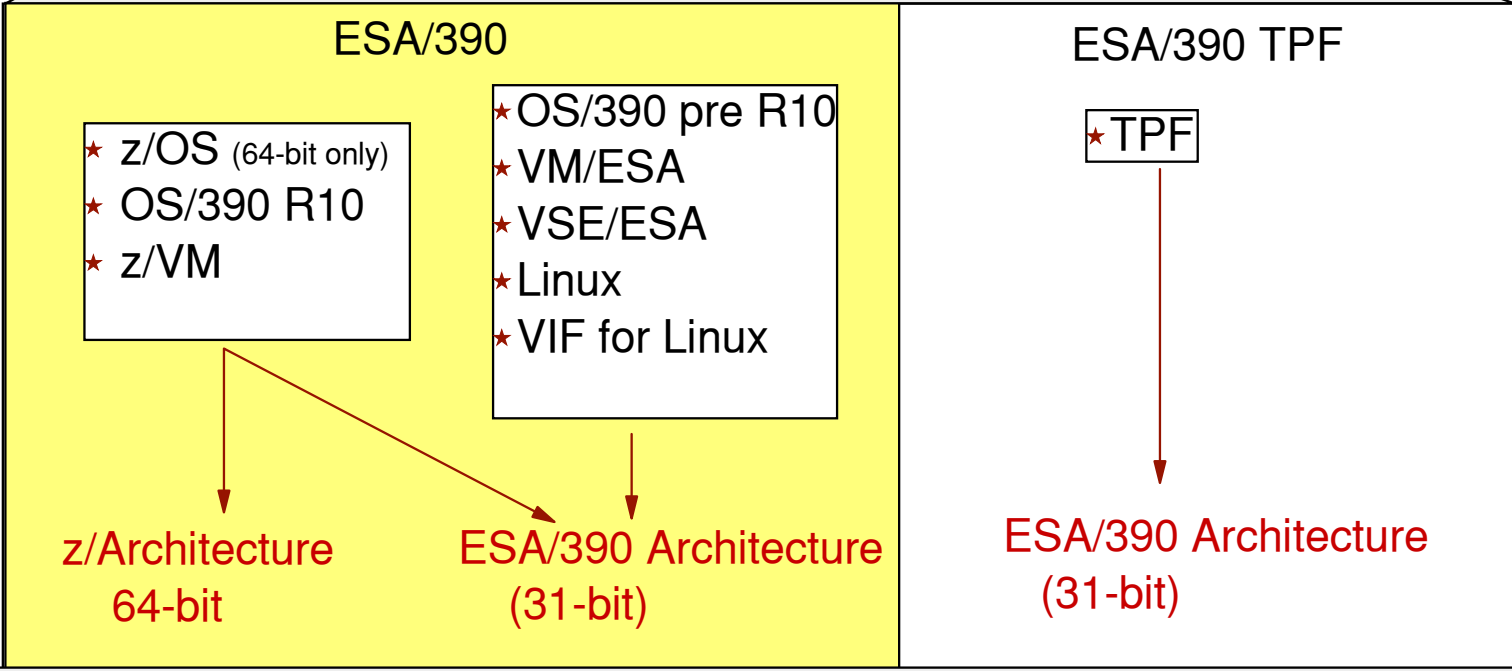
Only the zSeries is capable of running in the z/Architecture mode

LPAR Mode Initialization Overview

Power on Reset (POR) in LPAR mode to initialize CPC

- Initialize CPs, storage, and channel subsystem (CSS)
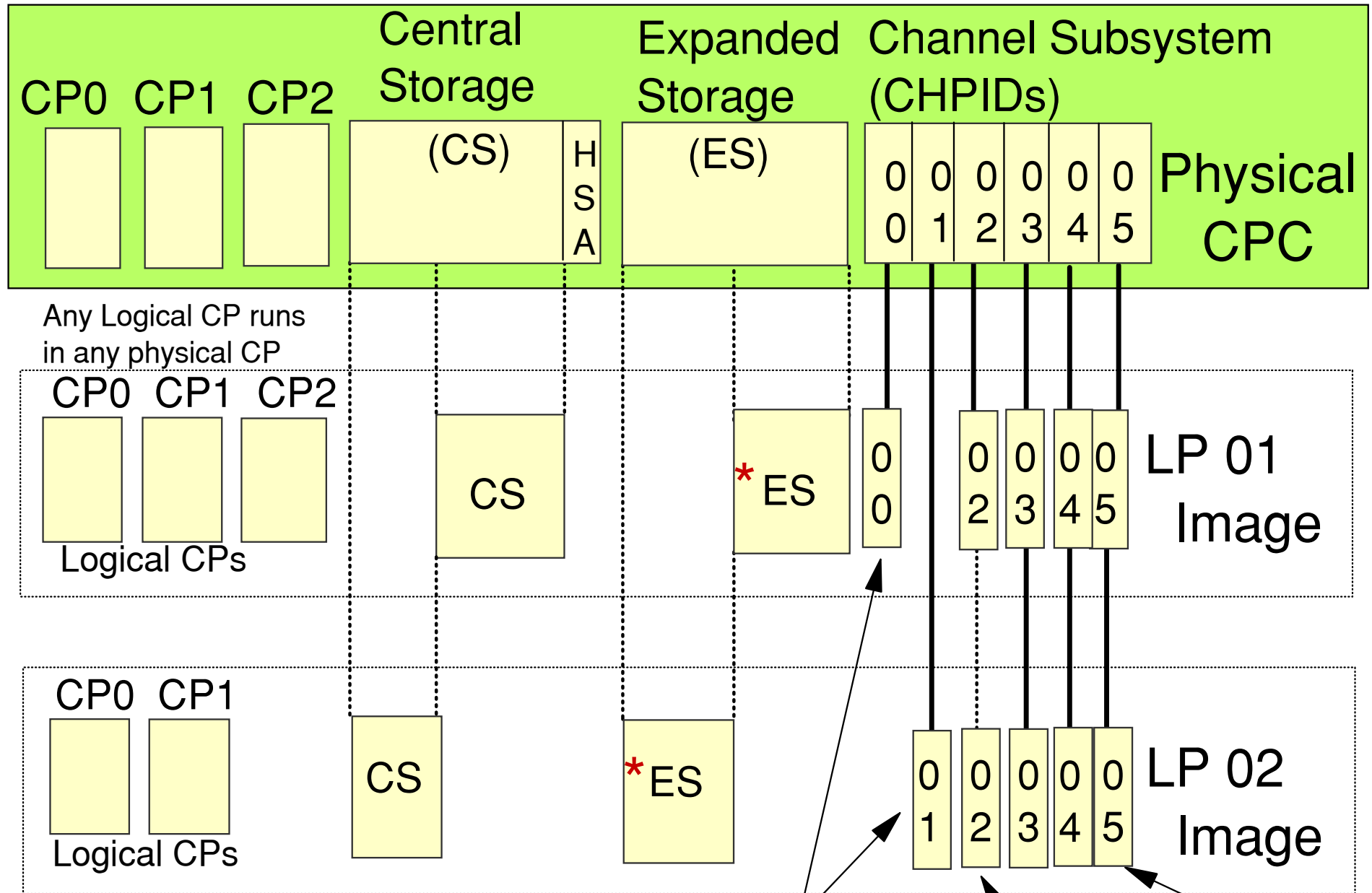 - Load selected IOCDS into the Hardware System Area (HSA)
  - Load LPAR LIC code into HSA
  - POR complete - CPC status is Operating
  - Image status is Not Activated

- Activate LPAR partitions
  - Initialize each Image defined in the selected IOCDS as per each image's image profile
  - Assign CPs, central and expanded storage, and CHPIDs
  - Activate complete (OS Image) - Image status is Not Operating
  - Activate complete (CF Image) - Image status is Operating

- Initial Program Load (IPL)
  - IPL the operating system
    - Additional steps required for zSeries
    - Determine architecture mode (z/Architecture or ESA/390)
    - Determine storage assignments (ignore expanded storage in z/Architecture mode)
    - Initialize the software
    - OS Initialization complete - Image status is Operating

LPAR Overview (Physical to Logical)

Physical CPC: CP0, CP1, CP2, Central Storage (CS), HSA, Expanded Storage (ES), Channel Subsystem (CHPIDs): 00 01 02 03 04 05

Any Logical CP runs in any physical CP

LP 01 Image: CP0, CP1, CP2 — Logical CPs; CS; *ES; CHPIDs: 00 02 03 04 05

LP 02 Image: CP0, CP1 — Logical CPs; CS; *ES; CHPIDs: 01 02 03 04 05

Dedicated
Reconfigurable
Shared (MIF)

*ES not used in z/Architecture
z800 / z990 does not support Parallel Channels

Central and Expanded Storage in LPAR Mode

Central or Real Storage

Hardware System Area	1024 MB
LPAR LIC 48 MB	
UCWs (subchannels)	
LPAR 01	976 MB
MVS, TPF or a CF	
776 MB	
LPAR 02	200 MB
MVS, TPF or a CF	
200 MB	0 M

*Expanded Storage

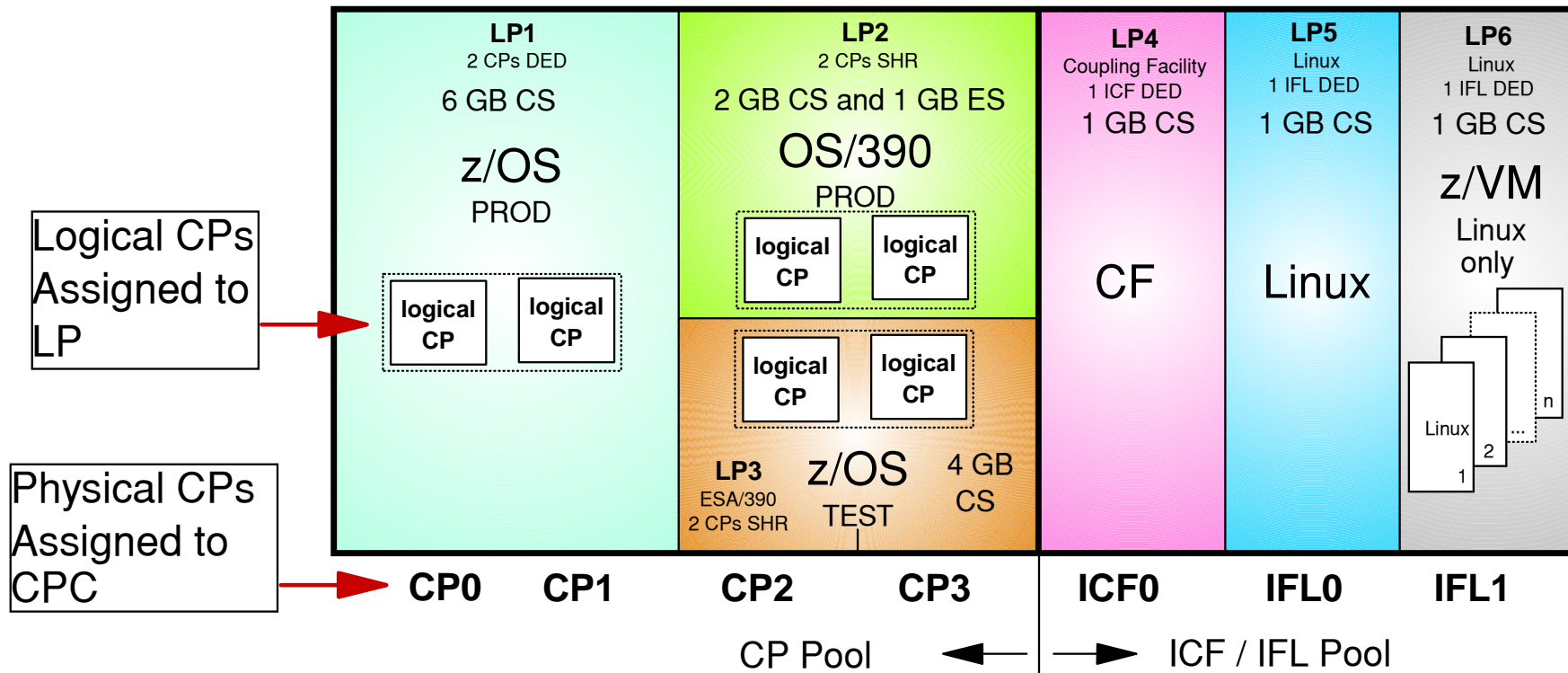|	
LPAR 01	1024 MB
768 MB	
LPAR 02	256 MB
256 MB	0 M
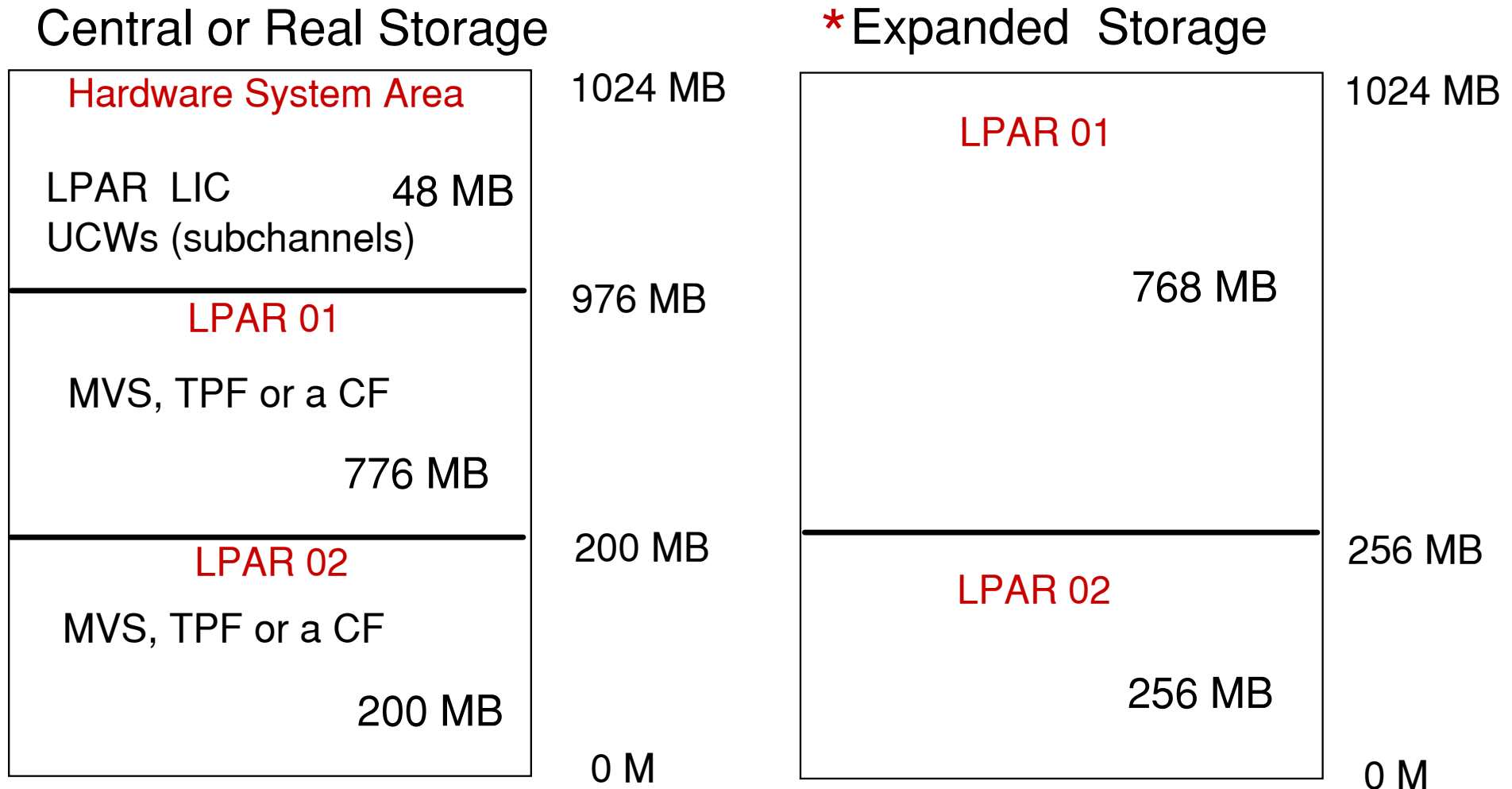
* ES not used in z/Architecture, all storage is assigned to CS (64-bit is H/W and OS dependent)

Memory is assigned exclusively to the owning partition, not shared. Exception: HSA which has common code and data.

LPAR Configuration Example

z900 model 104 16 GB of storage

LP1
2 CPs DED

6 GB CS

z/OS
PROD

logical CP   logical CP

Logical CPs Assigned to LP →

LP2
2 CPs SHR

2 GB CS and 1 GB ES

OS/390
PROD

logical CP   logical CP

LP3
ESA/390
2 CPs SHR

logical CP   logical CP

z/OS
TEST

4 GB CS

LP4
Coupling Facility
1 ICF DED

1 GB CS

CF

LP5
Linux
1 IFL DED

1 GB CS

Linux

LP6
Linux
1 IFL DED

1 GB CS

z/VM

Linux only

Linux
n ... 2
1

Physical CPs Assigned to CPC →

CP0   CP1   CP2   CP3   ICF0   IFL0   IFL1

CP Pool   ←   →   ICF / IFL Pool

- This Model 104 assigns the PUs as 4 CPs, 1 ICF, 2IFLs 2SAPs and has up to 3 spare PUs.
- Spare PUs may be assigned to the ICF/IFL Pool via feature codes through IBM.
- Above configuration example only, Some storage would have to be taken into consideration for HSA use.

zSeries CPC in LPAR Mode

Reset Profile defines mode of operation at POR
IMAGE Profile (*LPAR mode*) defines mode of operation at LP activation

One of three operational modes may
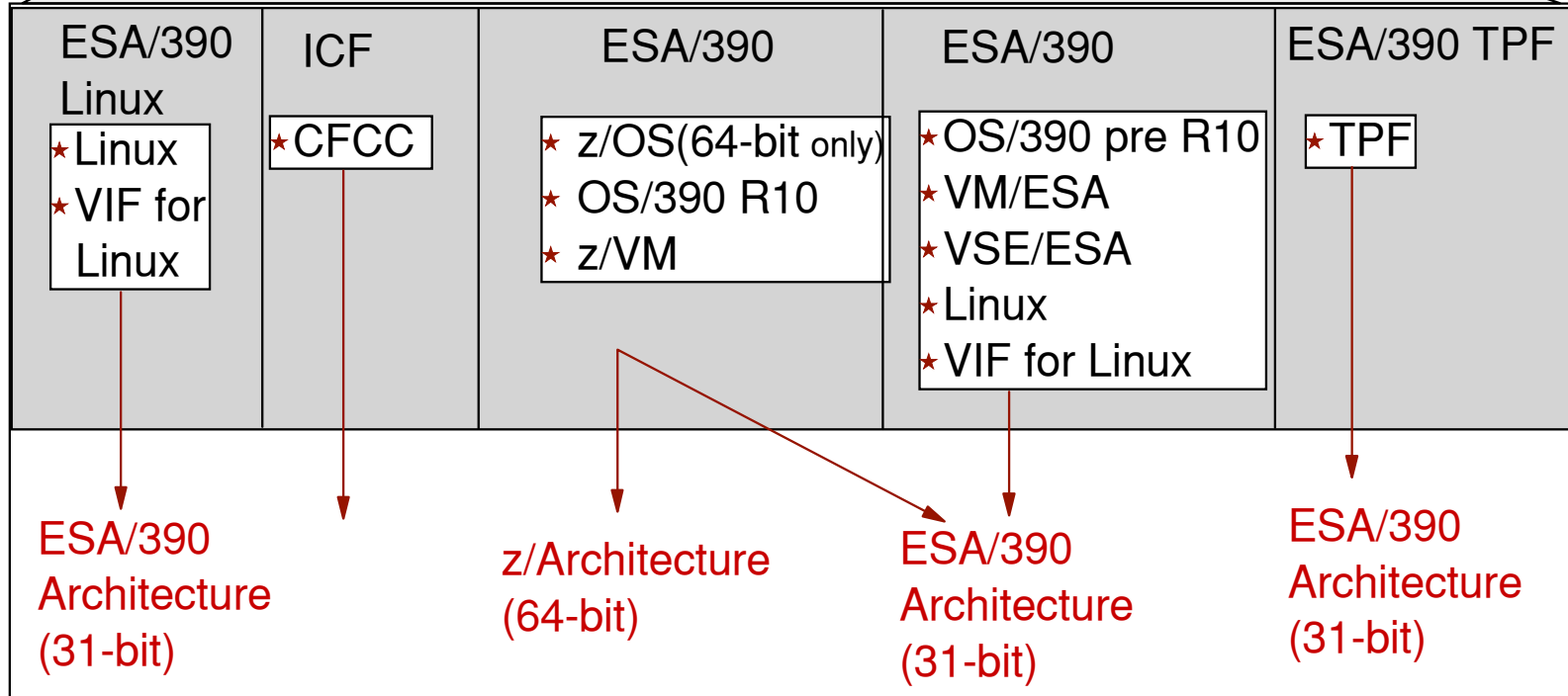be defined by the Reset Profile
- LPAR
- ESA/390
- ESA/390 TPF

IMAGE profiles defines / assigns
- Operational mode
- Security Options
- Resources
  - CPs (shared or dedicated)
 - Storage (Central / Expanded)

__LPAR mode only__
__supported on__
__z990__

RESET PROFILE
One IMAGE PROFILE per LP

◄———— 1 to 15 (or more) LPs can be defined ————►

★ One operating system can be activated (IPL'd) in each LP

ESA/390 Linux	ICF	ESA/390	ESA/390	ESA/390 TPF
★Linux ★VIF for Linux	★CFCC	★ z/OS(64-bit only) ★ OS/390 R10 ★ z/VM	★OS/390 pre R10 ★VM/ESA ★VSE/ESA ★Linux ★VIF for Linux	★TPF

ESA/390
Architecture
(31-bit)

z/Architecture
(64-bit)

ESA/390
Architecture
(31-bit)

ESA/390
Architecture
(31-bit)

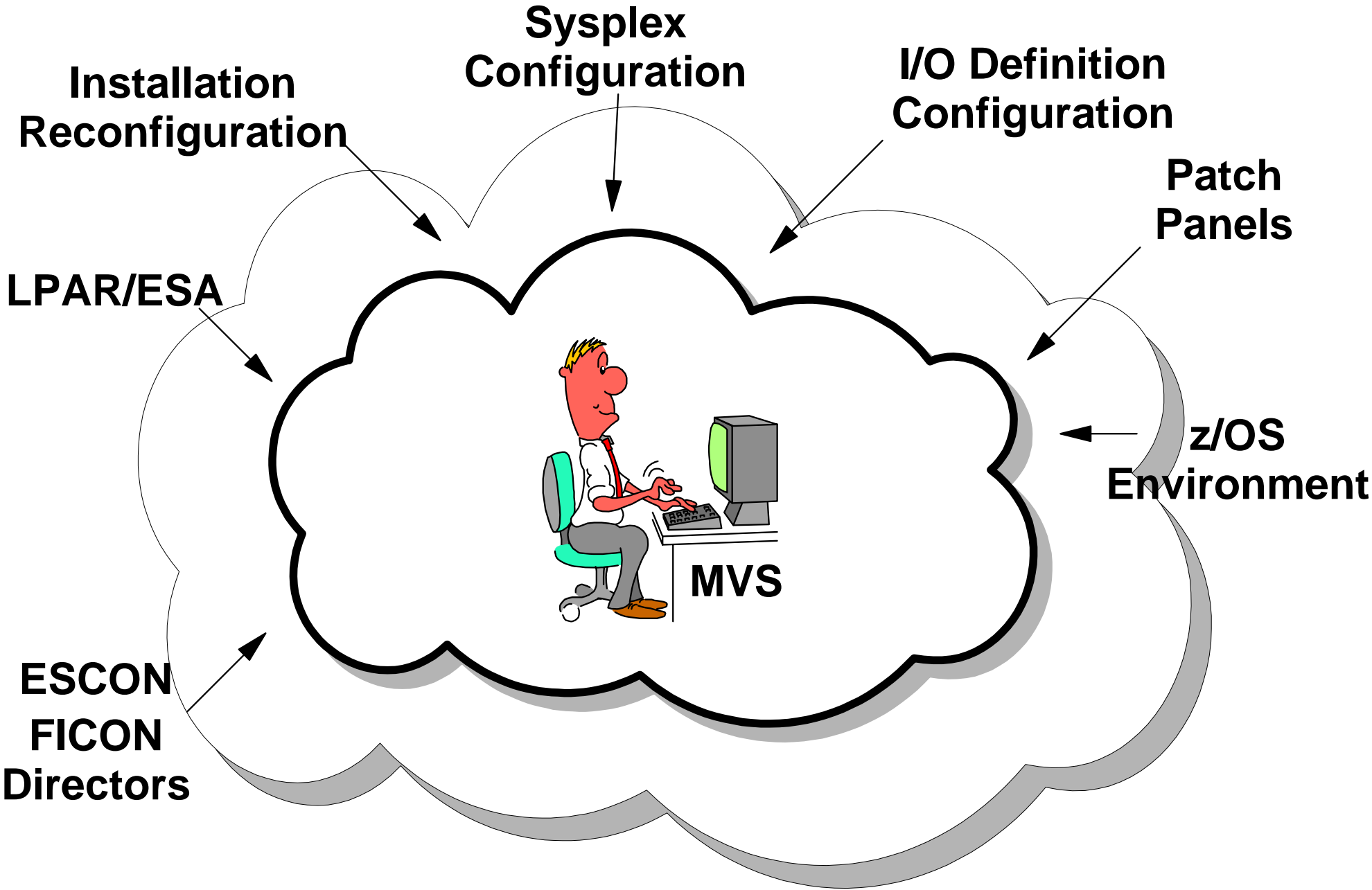# Operational Environment, I/O Configuration and HCD Overview

Mainframe Environment, Physical/Logical Partitioning, CPC Initialization and CHPIDs
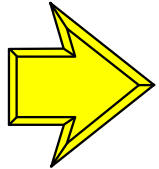
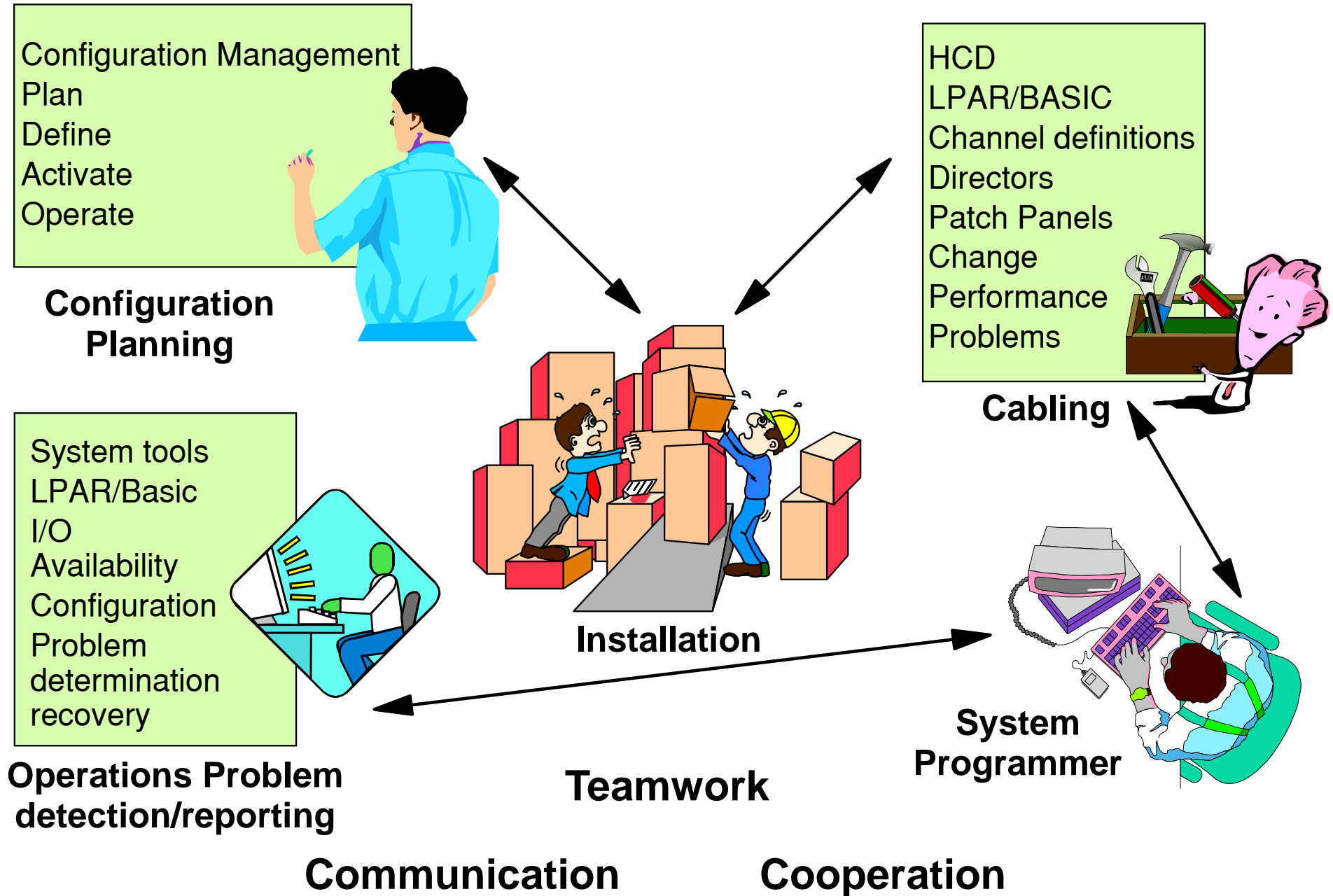Operational Environment, I/O Configuration and HCD Overview

zSeries platform functions, Capacity on Demand and other zSeries exclusives enabling Autonomic Computing

Operational Environment

Sysplex Configuration

Installation Reconfiguration

I/O Definition Configuration

Patch Panels

LPAR/ESA

z/OS Environment

MVS

ESCON FICON Directors

Complexity 24 x 7 Availability

I/O Configuration Management - The People

Configuration Management
Plan
Define
Activate
Operate

Configuration Planning

HCD
LPAR/BASIC
Channel definitions
Directors
Patch Panels
Change
Performance
Problems

Cabling

System tools
LPAR/Basic
I/O
Availability
Configuration
Problem determination recovery

Operations Problem detection/reporting

Installation

System Programmer

Teamwork

Communication

Cooperation

HCD Introduction

Today's System environments use HCD to define both OS and CSS configurations.

- MVSCP was used previous to MVS release 5
  - MVSCP configuration program used to define I/O to Operating system
- Since MVS release 5 HCD must be used to define I/O to the Operating system
  - HCD may and typically is used to define CSS

IOCP Statements

- ID
  - Specifies ID (machine characteristics) of CPC
- RESOURCE
  - Specifies partitions, type, and number
- CHPID
  - Specifies channel paths, type, mode, and accessibility from LPARs
- CNTLUNIT
  - Specifies control unit, type, and connections to Proc/CHP/ESCD
- IODEVICE
  - Specifies devices, type, connections to CUs, and accessibility from LPARs
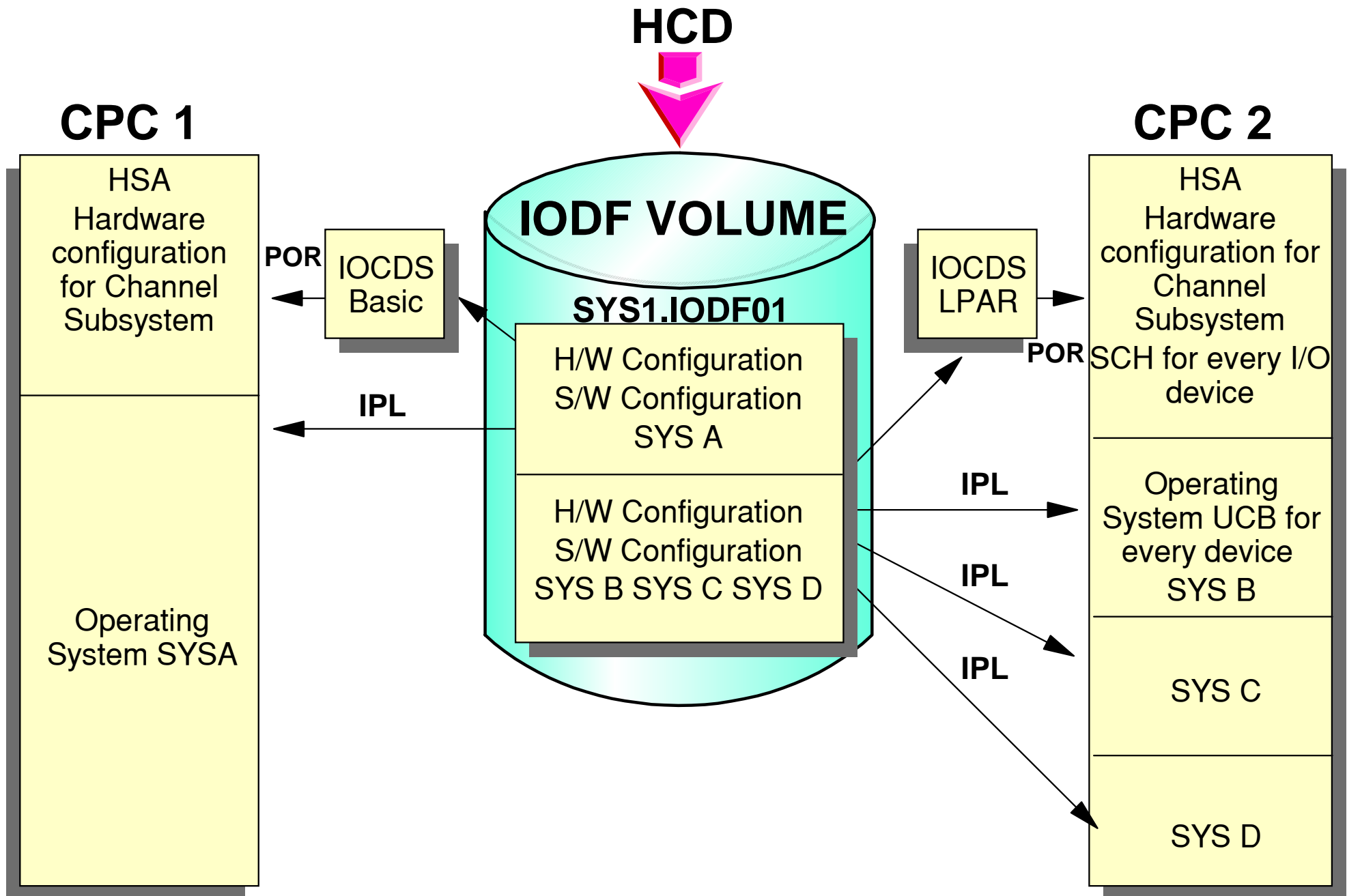
MVSCP Statements

- IOCONFIG ID
  - Specifies the numerical identifier of the OS (mandatory).

- EDT
  - An Eligible Device Table is specified with the EDT statement.

- NIPCON
  - Specifies a list of device numbers to be used as NIP consoles (mandatory).

- UNITNAME
  - Esoteric and generic device groups is specified with the UNITNAME statement.

- IODEVICE
  - Defines device parameters.

Hardware Configuration Definition Concept

- HCD provides a Dialog to maintain the configuration description in an I/O Definition File (IODF)

- The IODF can contain multiple hardware and software I/O configurations

- LOAD Members are used at IPL time to
  - Select the IODF to be read
  - Choose the desired software configuration
  - Select the master catalog to be used
  - Set other IPL parameters

- The activate function of HCD or the MVS ACTIVATE command is used to manage dynamic hardware and software changes.

Hardware Configuration Definition Overview

HCD

IODF VOLUME

SYS1.IODF01

CPC 1

HSA
Hardware
configuration
for Channel
Subsystem

POR IOCDS Basic

H/W Configuration
S/W Configuration
SYS A

IPL

H/W Configuration
S/W Configuration
SYS B SYS C SYS D

Operating
System SYSA

CPC 2

HSA
Hardware
configuration for
Channel
Subsystem

IOCDS LPAR

POR SCH for every I/O device

IPL

Operating
System UCB for
every device
SYS B

IPL

SYS C

IPL

SYS D

HCD Dynamic Activation

```
D IOS, CONFIG

IOS5061 16.00.01 I/O CONFIG DATA 313
ACTIVE IODF DATA SET = ATLRX3.IODF00
CONFIGURATION ID = MVS7     EDT ID = S7
TOKEN:  PROCESSOR DATE  TIME DESCRIPTION
SOURCE: ATLRX3 00-02-17 11:27:54 ATLRX3 IODF00
```

Processor token information that is currently in HSA

Indicates that both the hardware and software
definitions match using typical naming conventions

zSeries platform functions, Capacity on Demand and other zSeries exclusives

Mainframe Environment, Physical/Logical Partitioning, CPC Initialization and CHPIDs

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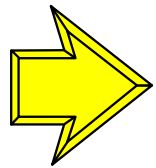
zSeries platform functions, Capacity on Demand and other zSeries exclusives enabling Autonomic Computing

zSeries Platform For On Demand Capacity

zSeries provides platform function (zPlatform) for On Demand Capacity for the On Demand e-business world

On demand capacity for nondisruptive:
- Planned Outages
- Unplanned Outages

Autonomic Computing - combining zPlatform and z/OS functions for self-management capabilities

zSeries Nondisruptive Planned Upgrades

Capacity Upgrade on Demand (CUoD)

- Standard machine capability for concurrent upgrades
- Nondisruptive permanent addition of CP/ICF/IFL/zAAPs, memory, I/O ports and channel cards
    - CIU, CBU and IBM field upgrades use this process

Customer Initiated Upgrade (CIU)

- Customer capability to order and install CUoD-capable upgrades
- CIU feature ordered to initiate contract and administrative setup
- Customer orders and installs upgrade via the WEB using IBM Resource Link and RSF

On / Off Capacity on Demand (On/Off CoD) z990/z890 only

- Temporarily activation of unowned CP/ICF/IFL/zAAPs within model
- Requires CIU contract with IBM and uses CIU process
- Billed on a monthly basis

zSeries Nondisruptive Unplanned Upgrades

Capacity BackUp (CBU)

- Nondisruptive temporary addition of CPs only in an emergency or disaster recovery situation
- CBU contract required to order CBU features and CBU LIC-CC
- CBU cannot be used for peak and workload management
- CBU activation can last up to 90 days
- One CBU feature for each stand-by CP
- Spare characterizable PUs must be available for each CBU feature
- Downgrade (Nondisruptive) required after test or recovery is complete
- Both CBU and On/Off CoD LIC-CC can be installed
  - Activation of CBU and activation On/Off CoD are mutually exclusive.
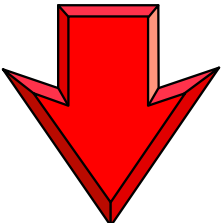 - Deactivation of one is required to activate the other

zSeries Capacity Upgrade Functions Summary
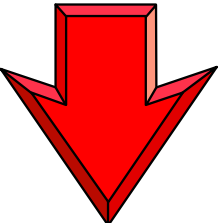
On demand capacity for on demand e-business

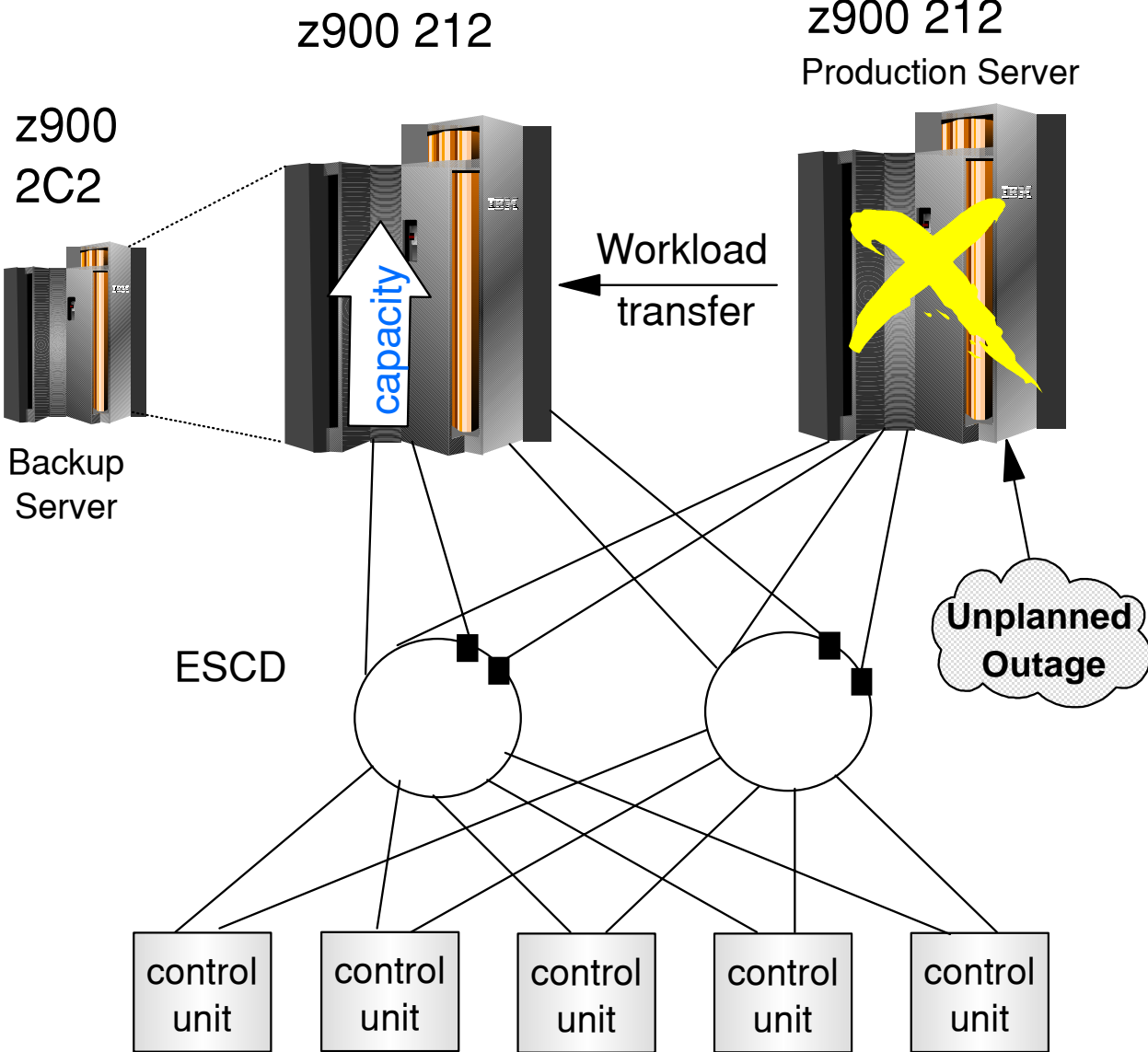| Function	Upgrades	Via	Type	Process
CUoD	CPs,IFLs,ICFs Memory I/O	LIC or Hardware Installation	Concurrent and permanent	Ordered as an normal upgrade and activated by IBM
CIU	CPs,IFLs,ICFs, zAAPs Memory	LIC-only (cannot add book)	Concurrent and permanent	Initiated via web and activated by customer
On/Off CoD z990/z890	CPs,IFLs,ICFs, zAAPs	LIC-only (cannot add book)	Concurrent and temporary (no time limit)	Initiated via web and activated by customer
CBU	CPs	LIC-only (cannot add book)	Concurrent and temporary (up to 90 days)	Ordered for backup/recovery only and activated by customer

z900 CBU Operation Example

z900 2C2
Current model with
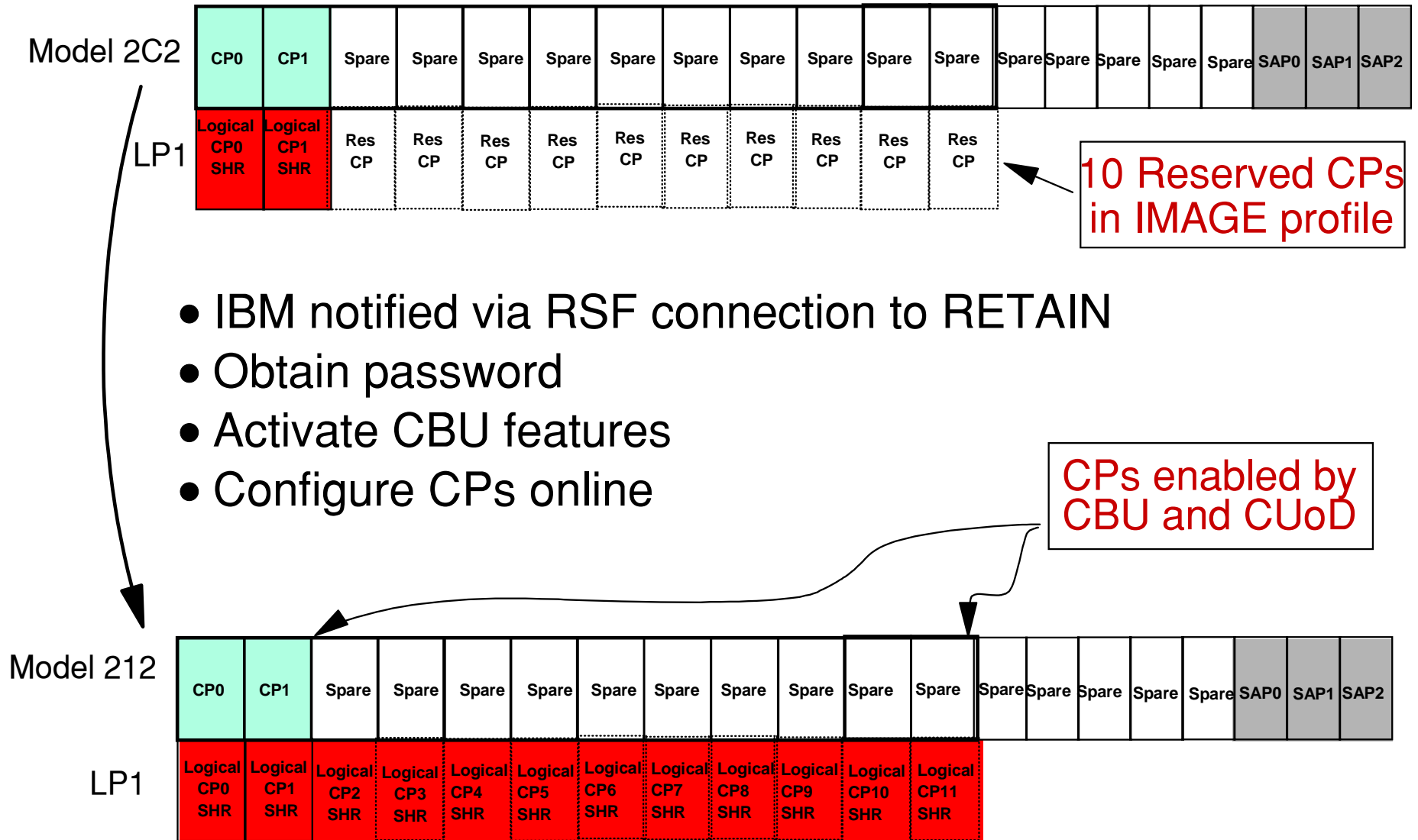10 CBU features

Emergency
processor upgrade

z900 212
target model

z900 2C2

z900 212
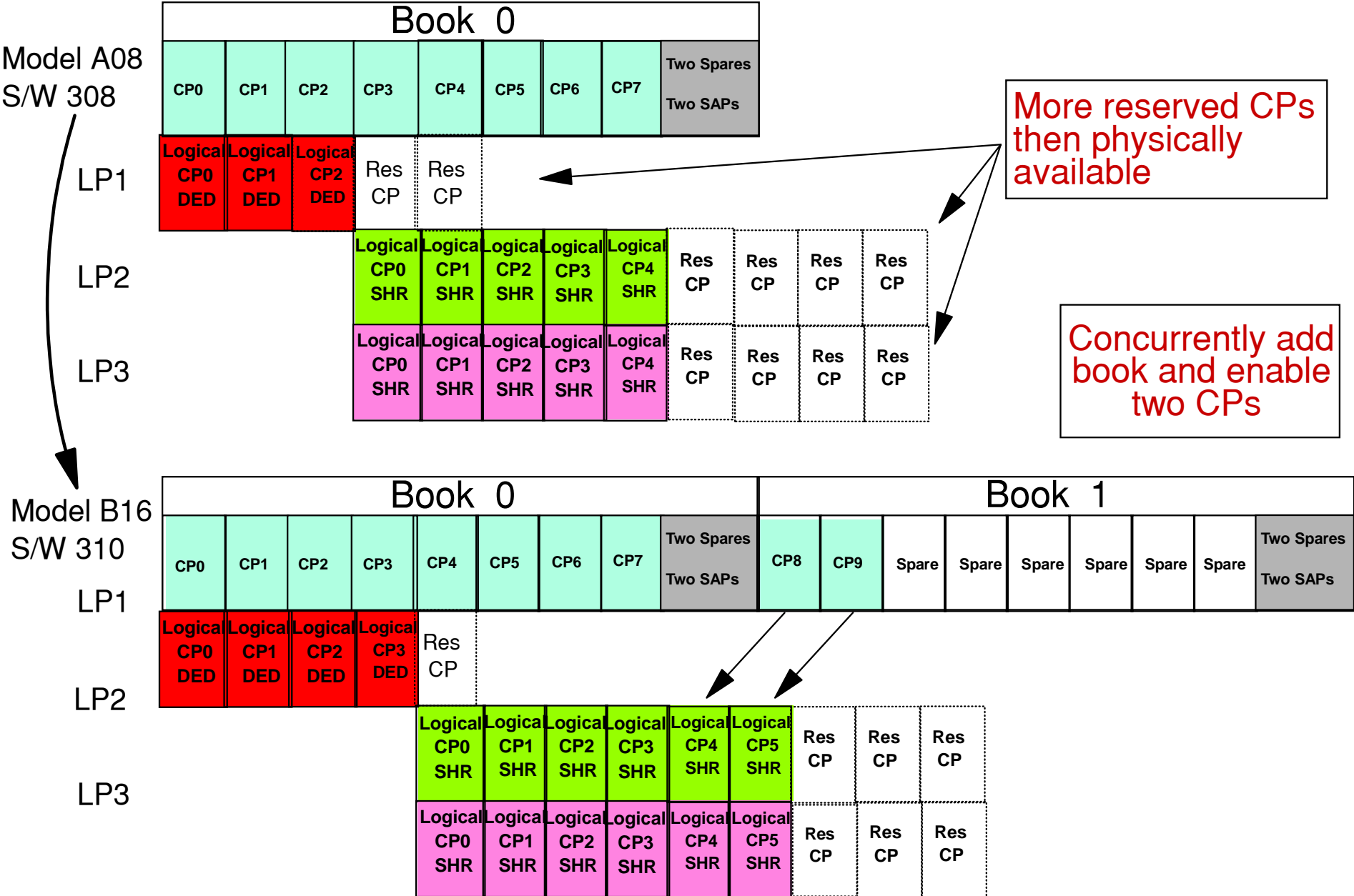
z900 212
Production Server

z900
2C2

Backup
Server

capacity

Workload
transfer

Unplanned
Outage

ESCD

control unit | control unit | control unit | control unit | control unit

CBU available on all zSeries CPCs, depending on CPC configuration

z900 2C2 to 212 Capacity Upgrade (CBU) Example

Model 2C2

| CP0 | CP1 | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | SAP0 | SAP1 | SAP2 |

LP1

| Logical CP0 SHR | Logical CP1 SHR | Res CP | Res CP | Res CP | Res CP | Res CP | Res CP | Res CP | Res CP | Res CP | Res CP |

10 Reserved CPs in IMAGE profile

- IBM notified via RSF connection to RETAIN
- Obtain password
- Activate CBU features
- Configure CPs online

CPs enabled by CBU and CUoD

Model 212

| CP0 | CP1 | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | Spare | SAP0 | SAP1 | SAP2 |

LP1

| Logical CP0 SHR | Logical CP1 SHR | Logical CP2 SHR | Logical CP3 SHR | Logical CP4 SHR | Logical CP5 SHR | Logical CP6 SHR | Logical CP7 SHR | Logical CP8 SHR | Logical CP9 SHR | Logical CP10 SHR | Logical CP11 SHR |

Concurrent upgrade within MCM hardware with reserved CPs and CUoD

z990 Concurrent Book add With CUoD

Model A08 S/W 308

Book 0

| CP0 | CP1 | CP2 | CP3 | CP4 | CP5 | CP6 | CP7 | Two Spares Two SAPs |

LP1

| Logical CP0 DED | Logical CP1 DED | Logical CP2 DED | Res CP | Res CP |

LP2

| Logical CP0 SHR | Logical CP1 SHR | Logical CP2 SHR | Logical CP3 SHR | Logical CP4 SHR | Res CP | Res CP | Res CP | Res CP |

LP3

| Logical CP0 SHR | Logical CP1 SHR | Logical CP2 SHR | Logical CP3 SHR | Logical CP4 SHR | Res CP | Res CP | Res CP | Res CP |

More reserved CPs then physically available

Concurrently add book and enable two CPs

Model B16 S/W 310

Book 0 **Book 1**

| CP0 | CP1 | CP2 | CP3 | CP4 | CP5 | CP6 | CP7 | Two Spares Two SAPs | CP8 | CP9 | Spare | Spare | Spare | Spare | Spare | Spare | Two Spares Two SAPs |

LP1

| Logical CP0 DED | Logical CP1 DED | Logical CP2 DED | Logical CP3 DED | Res CP |

LP2

| Logical CP0 SHR | Logical CP1 SHR | Logical CP2 SHR | Logical CP3 SHR | Logical CP4 SHR | Logical CP5 SHR | Res CP | Res CP | Res CP |

LP3

| Logical CP0 SHR | Logical CP1 SHR | Logical CP2 SHR | Logical CP3 SHR | Logical CP4 SHR | Logical CP5 SHR | Res CP | Res CP | Res CP |

Concurrent upgrade - model A08 to B16, Book add and enable two CPs (CUoD)

Web Based CIU and On/Off CoD

- **What is it?**
  - IBM Resource Link Web-based solution
  - Enables customers to configure, order and download microcode for vertical upgrade of processor and/or memory
  - Permanent upgrades (CIU)
  - Temporary upgrades of CPs, IFLs, ICFs and zAAPs (On/Off CoD)

Optional customer secondary order approval

http://www.ibm.com/servers/resourcelink

Internet

Places order

Customer

CIU order

zSeries

Remote Support Facility
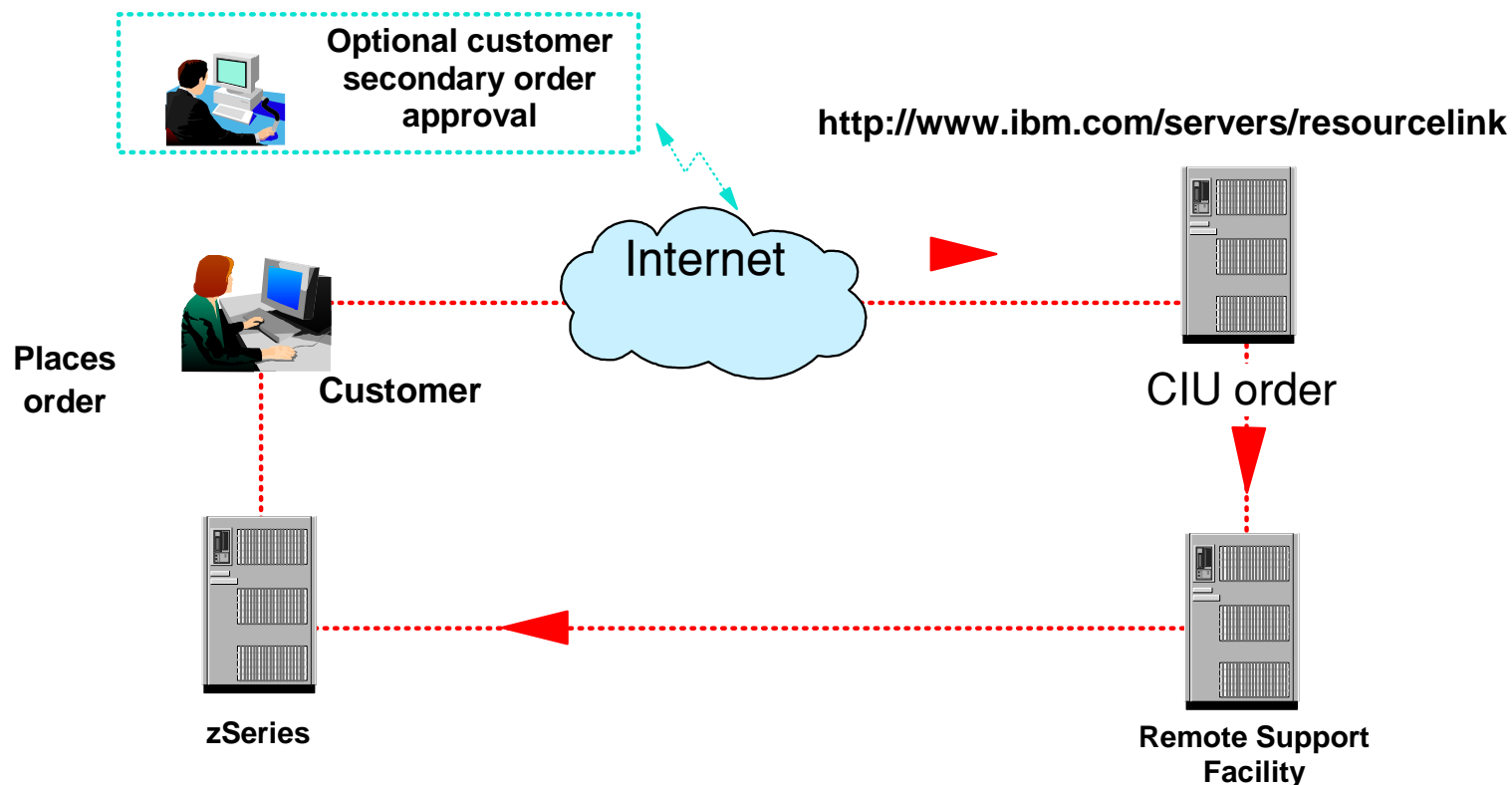
Note: Assumes spare PUs available (zSeries memory can also use CIU if H/W configuration supports)

zSeries zAAP (z980/z890) Exclusive

zAAP is a z890 and z990 exclusive

- zAAPs are designed for z/OS Java code execution

- z/OS JAVA Virtual Machine (JVM) assists with the execution of code from standard CPs to zAAPs and back to the standard CPs

- JVM executes Java code on zAAPs
  - JVM is the only authorized user

- When configured with general purpose engines within logical partitions running z/OS, zAAPs may help increase general purpose processors productivity
  - Requires z/OS 1.6 or z/OS.e 1.6 (z/OS.e for z890)

z/Architecture, zPlatform and z/OS

z/Architecture provides new platform function (zPlatform)
z/OS enables these functions plus other z/OS components

zPlatform Features:
- ★ 64-bit Architecture
- ★ Intelligent Resource Director (IRD)
- ★ HiperSockets
- ★ Workload License Charges (WLC) and zSeries Entry License Charges (zELC)
- ★ Integrated Facility for Linux
- ★ Project eLiza

z/OS new systems management components
- ★ msys for Setup
- ★ msys for Operations

Autonomic Computing - combining zPlatform and z/OS functions for self-management capabilities

z/OS Enables 64-bit Real Storage Support

z/OS in combination with zSeries hardware

Real Storage

64-bit
addressing

z/OS

LPAR 1

2 GB — DB2

2 GB — IMS,CICS

2 GB — WebSphere

31-bit
Appl.

Address and
data spaces
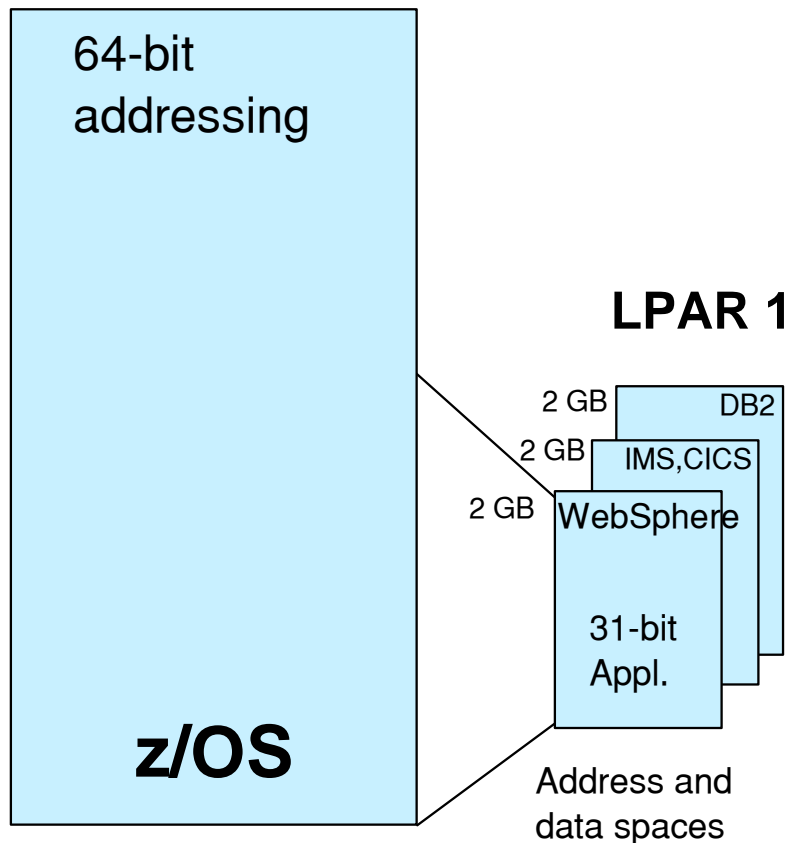
- Constraint relief

- Improved performance
  - Expanded storage paging overhead is eliminated
  - All memory is configured as real storage

- Ease of migration
  - Application transparency, 24-bit and 31-bit applications run unchanged
  - Minimal actions to take
  - Flexible migration paths

64-bit addressing on zSeries Hardware

Intelligent Resource Director (IRD)

Available only with z/OS on zSeries hardware

- Goal-oriented management of logical partition resources:
  - Processors
  - Channels

- Integration of PR/SM, Workload Manager, Channel Subsystem, and Parallel Sysplex

- IRD Functions:
  - LPAR CPU management
  - Dynamic channel path management
  - Channel subsystem priority queuing

LPAR Cluster

dynamic

z/OS   z/OS   z/OS

CEC
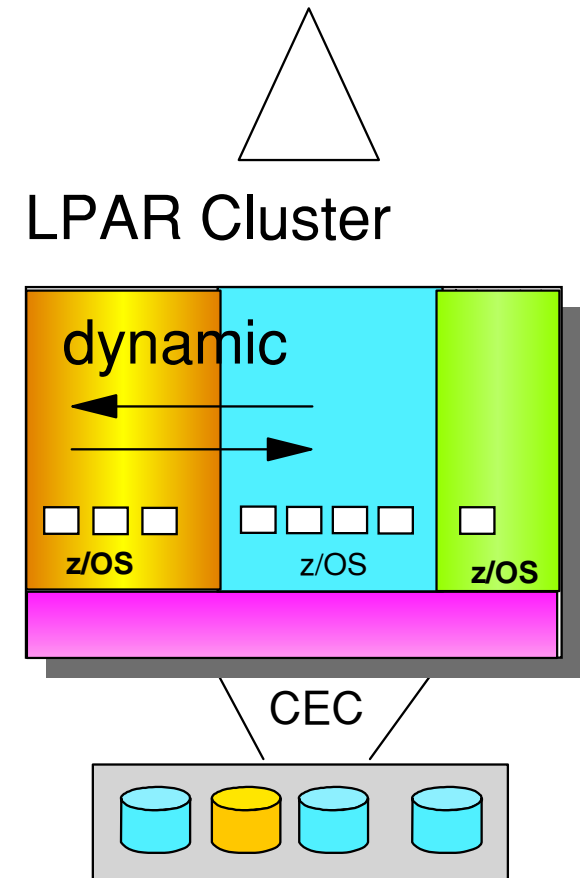
★ Directing resources to the priority work

HiperSockets: Network in the Box

16 HiperSockets available for z990 / z890

4 HiperSockets available for z800 / z900
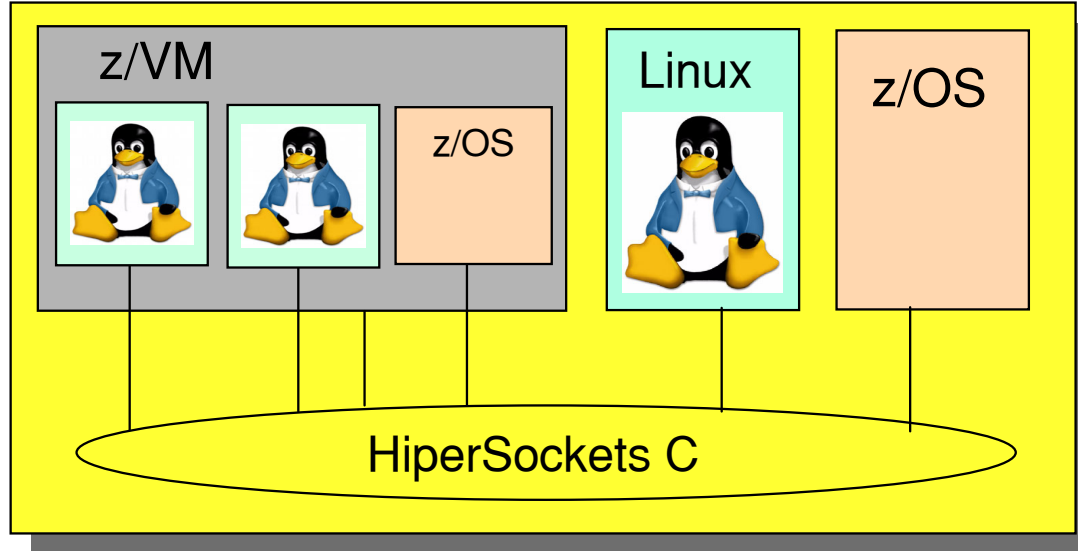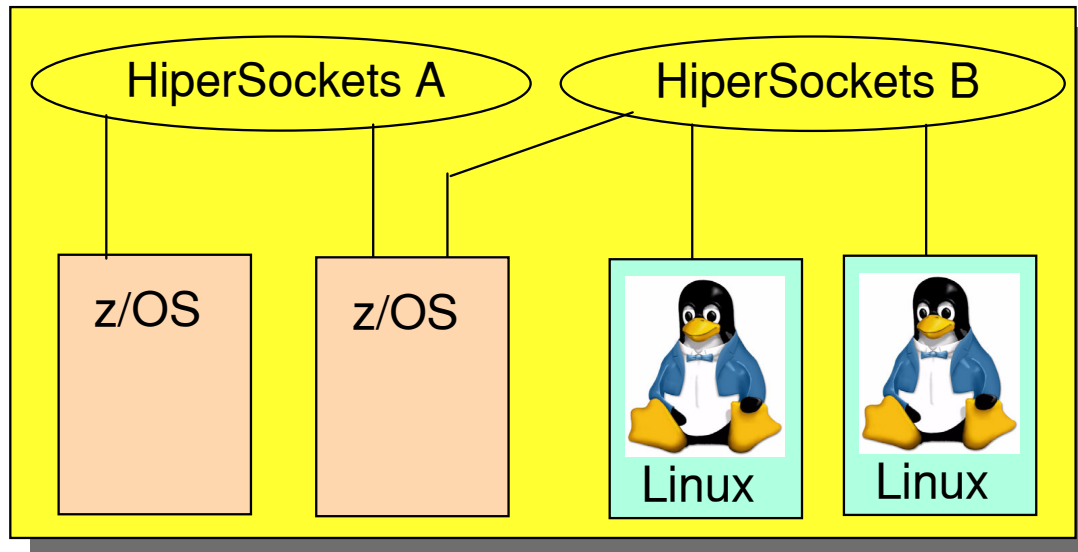
HiperSockets Accelerator

16 HiperSockets available for z990 / z890

4 HiperSockets available for z800 / z900
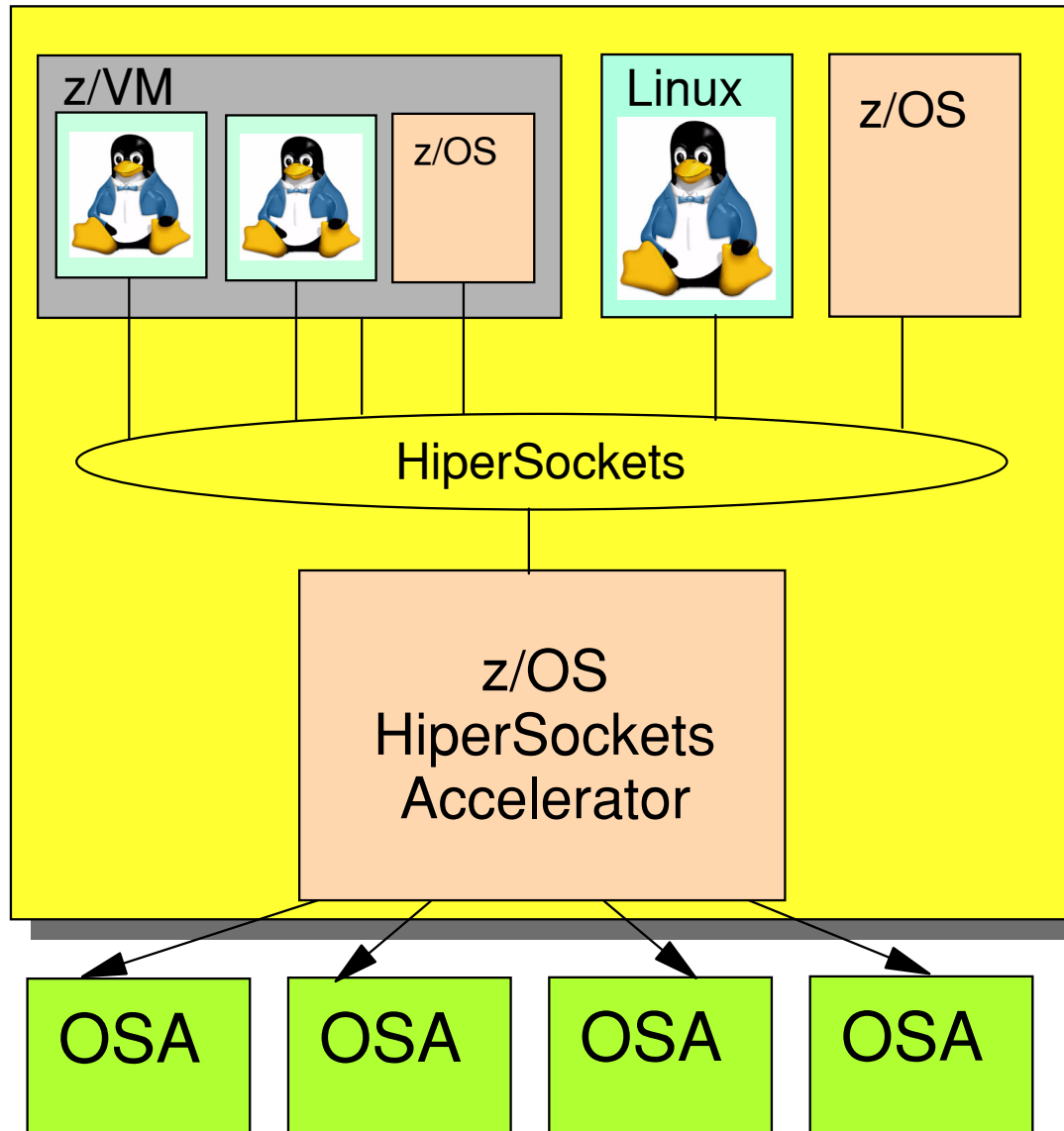
Workload License Charges Overview

Pricing model for zSeries: Workload License Charges (**WLC**) is IBM's newest software pricing model.

With WLC, customers pay only for the software capacity that they need.

Available on zSeries Machines running z/OS

Variable Charge Products:	**Flat Charge Products:**
• **Product LPAR utilization capacity** • **$/MSU decreases as capacity increases** • **Priced via Monthly License Charge** • **Aggregation across a Qualified Sysplex** • **Applies to z/OS, DB2, IMS, CICS, MQSeries, System Automation, NetView and others**	• **Single Price per Machine** • **Priced via Monthly License Charge** • **Applies to Other Current Products, VM, VSE and legacy S/390 products**
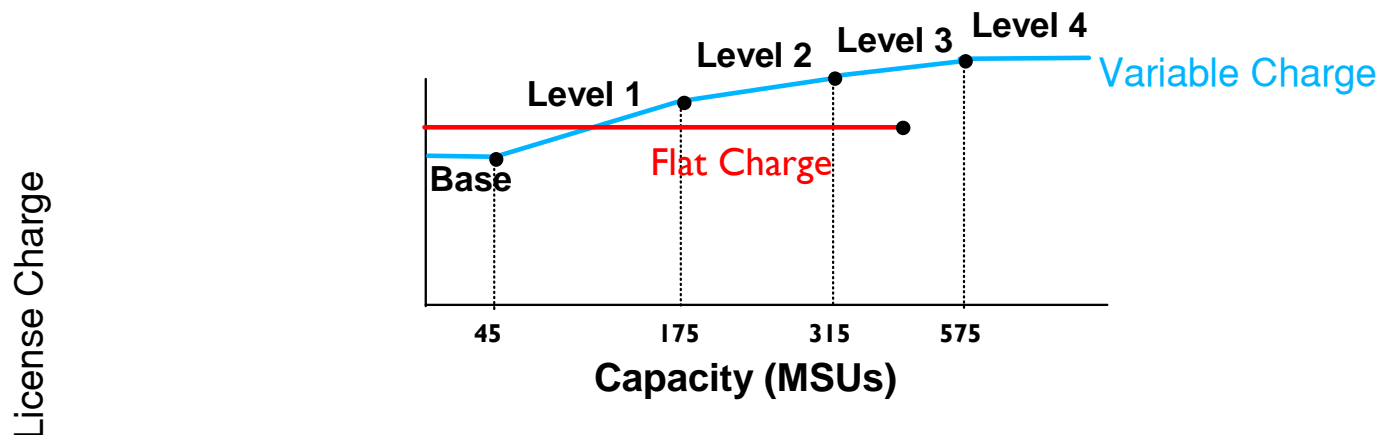
msys for Setup

New z/OS technology for product setup
- Increased productivity
- Lower skill requirements
- z/OS Management Directory

Used for setup of:
- Parallel Sysplex
- Base Sysplex
- TCP/IP
- ISPF
- UNIX System Services
- Language Environment Run-time
- LDAP

msys for Operations

New z/OS base element (R2)
- Increase availability of systems and applications
  - Improve system recoverability
  - Reduce outages due to operations errors
- Decrease total cost of ownership
  - Reduce operations complexity
  - Greater operational awareness
- Manage:
  - Systems in a Parallel Sysplex environment
  - Coupling Facilities, couple data sets and structures

Automate
- WTO(R) buffer shortage
- System log problems
- Relieve ENQ contention or auxiliary storage shortages
- Clear "pending" conditions of CF structures

IBM Eserver and Autonomic computing

– Intelligent Resource Director
– Parallel Sysplex extensions - Cisco distributors
– z/OS Workload Manager
– TCP/IP BIND9 Domain Named Server

– z/OS msys for Setup
– z/OS wizardry
– Capacity Upgrade (CPs, I/O, memory)
– Automatic hardware detection/configuration
– Automatic communication configuration

– z/OS msys for Operations and System
    Automation for OS/390
– Concurrent memory upgrade (CUoD)
– Capacity backup
– CPU, memory (ECC), I/O, network
– Sysplex coupling facility duplexing
– Concurrent maintenance
– Virtual IP takeover
– Electronic service agent (call-home support)

– Intrusion detection (IDS)
– Cryptographic enhancements (PCI accelerator)
– Digital certificates
– SSL
– LDAP
– Tivoli Policy Director

Self-Optimizing

Self-Configuring

Self-Protecting

Self-Healing

Formerly know as Project eLiza (Self-Configured)

zSeries Educational Offerings

Sysplex / zSeries course offerings

- H4016 (2 days) HMC Class
- H4041 (3) Plex Ops & Recovery (sysplex only)
- H4057 (5) Plex Ops & Recovery (H4016 & H4041)
- ES902 (5) Advanced Plex Recovery
- ES420 (5) Plex Implementation
- ES830 (5) CSAR (Complex Systems Availability & Recovery)
- ES820 (2) zSeries Mainframe Environment (A Technical Overview)
- OZ09 (2) z/Architecture for z900
- OZ05 (2) z990 Technical Update & Configuration Requirements
- ES321 (2) FICON Environment (Native & Brigde)
- ES960 (4) HCD and Dynamic I/O
- ES270 (3) z/OS and OS/390 System Operations