IBM GLOBAL SERVICES

Session G24

LPAR Advanced Topics

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IBM eServer™

LPAR Advanced Topics

ON DEMAND BUSINESS™

zSeries Expo Session G24
November, 2004
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Notes:

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

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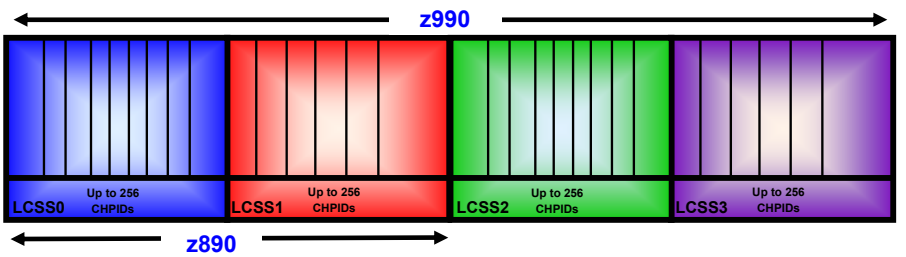
LPAR Advanced Topics

- Introduction to IBM eServer™ zSeries® 890 and 990 (z890 and z990)
  - Logical Channel Subsystems
  - HCD Definition
  - LPAR Enhancements – More than 16 logical processors, zAAPs, etc.
- z990 Activation Profile Changes
- Changing Running Partitions
- Memory Addressability, Configuration and Reconfiguration
  - Concurrent Memory Upgrades
  - Dynamic Storage Reconfiguration
  - HSA Size and Estimation Tool
- References: https://www.ibm.com/servers/resourcelink
  - **zSeries 890 and 990 PR/SM Planning**, SB10-7036-03 (October, 2004)
  - **zSeries (z800, z900) PR/SM Planning**, SB10-7033-06a (August, 2004)

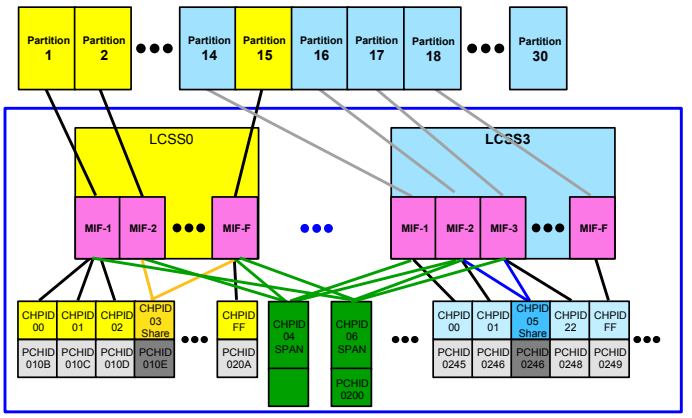
Introduction to z890 and z990

z990 and z890 Logical Channel Subsystems (LCSSes)



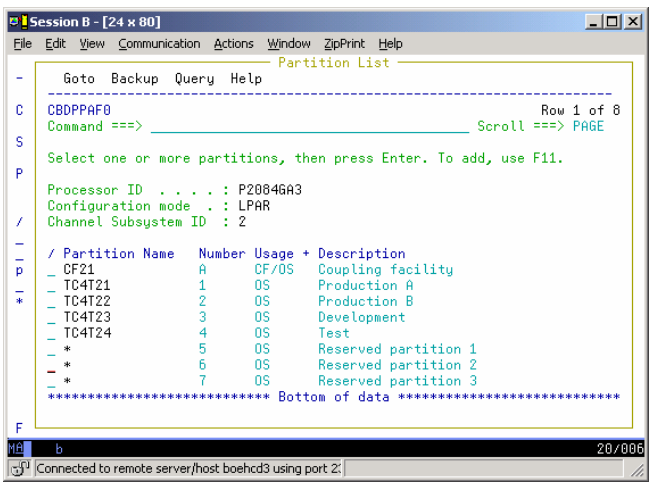
- Up to four Logical Channel SubSystems (LCSSs) z990, two LCSSes on z890
  - Up to 15 LPARs per LCSS
  - Up to 256 channels per LCSS
- Multiple LCSSes Enable
  - Up to 30 Logical Partitions per CEC (Even with three or four LCSSes on z990)
  - Up to 1024 external channels on z990, Up to 421 external channels 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)

Multiple 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)

Dynamic LPAR Name (Reserved LPAR) z890 and z990
(z990 at GA3 – May, 2004 level)



- **A dynamic partition must be reserved in the IOCDS used for POR.**
- **A reserved partition is defined with partition name placeholder ' * '.**
- **It has a MIF ID (partition number) and a usage type assigned. It may contain a description.**
- **Reserved partitions can not be assigned to access or candidate lists of channel paths or devices.**
- **z/OS 1.6 dynamic I/O can name a reserved LPAR or change a named LPAR to ' * '.**

HCD – Definition Sequence without Migration
(Reference: z/OS 1.4 HCD even for lower releases!)

- Define processor **(Can't clone old and change type!)**
  - Only LPAR mode allowed
  - Number of channel subsystems
- ► Define channel subsystems
  - CSS id (0-3), description, MAXDEV
- – Define partitions
  - Partition names may not be duplicated across CSSs
  - Partition number = MIF image id in range of 1-F, unique within LCSS
- – Define channel paths
  - CHPIDs unique only within a LCSS
  - Spanned channels - access and candidate lists are by LCSS and partition
  - Physical channel id must be specified to map logical CHPID to physical hardware
- Define control units
  - CHPID.link combinations must be specified for each LCSS
- Define devices
  - Channel subsystem data - preferred path and candidate lists must be specified for each LCSS

HCD – Definition Sequence with Migration
(Reference: z/OS 1.4 HCD even for lower releases!)

- **Define z890 processor**
  - Only LPAR mode allowed
  - Number of channel subsystems
- ► **Define channel subsystems**
  - CSS id (0-1), description, MAXDEV
- **Modify existing Definitions (if needed)**
  - Delete or change unsupported channel types Example: Parallel channels from existing z900
- **Migrate into z890 definition**
  - Select target processor
  - Specify target LCSS
  - Resolve duplicate partition names
- **Migrate other definitions as needed**

z890 and z990 LPAR Enhancements

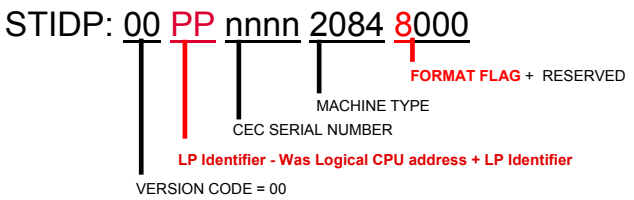
- Up to 32 physical processors can be managed
  - **z990 PR/SM** – Up to 32 logical processors per partition (z990 GA3 – May, 2004)
  - **z/OS 1.6 and z/VM 5.1 –** Both allow up to 24.
  - Caution – Don't exceed 16 for older releases
- New zSeries Application Assist Processors (z890 and z990 - 3Q 2004)
  - Java processing under z/OS 1.6 only (3Q 2004)
- New Reserved LPAR Definition (z890 and z990 - 3Q 2004)
  - Dynamic Name/Rename z/OS 1.6 only (3Q 2004)
- z990/z890 Implementation = massive **internal** changes to PR/SM
  - Awareness of z990 book structure
    - Efficient resource allocation to logical partitions at activation
    - Efficient dispatching decisions
  - Logical Channel Subsystems and up to 30 partitions
  - Large storage / large concurrent memory upgrade
    - Partition virtualization of storage increment size for memory allocation and reconfiguration
    - Massive increase in available central memory addressability
- Limited but important **external** change
  - "**Partition Identifier**" now two hex digits
  - Change to Store CPU ID (STIDP) instruction

zSeries Partition ID, MIF ID, and Partition Number

	Partition Identifier	MIF ID	Partition (Zone) Number
Defined	By systems programmer in the LPAR image profile on HMC	By systems programmer: HCD "Partition Number" IOCP RESOURCE statement	z800/z900 = MIF ID else assigned at POR by PR/SM z890/z990 assigned at POR by PR/SM
Range (Hex)	z800/z900 - 0-F z890/z990 - 00-3F	1-F	z800/z900 - 1 to F z890/z990 - 1 to 1E
Size	z800/z900 - 4 bits z890/z990 - 8 bits	4 bits	4 bits z800/z900 8 bits z890/z990
Usage	Messages, Store CPUID, PGID z890/z990: CFRM Policy to identify a CF LPAR	MIF Channel Sharing z800/z900: CFRM policy to identify a CF LPAR	Internal usage, not externalized.
Aliases	LP ID, User logical Partition ID (UPID)	Image ID (IID), EMIF ID	None
Notes	Unique on the CEC. LPAR deactivate/activate to change.	z800/z900: Unique on CEC z890/z990: Unique in LCSS POR to change.	Unique on the CEC.

Note: z990 compatibility support for the OSes is required to support changes to Partition Identifier "Size" and "Usage" running on z990 or z890 and often on other images in a Sysplex with an OS image on z990. ICKDSF R17 is required on any image sharing disk with an OS on z990 for the same reasons, especially the path group ID (PGID) change.

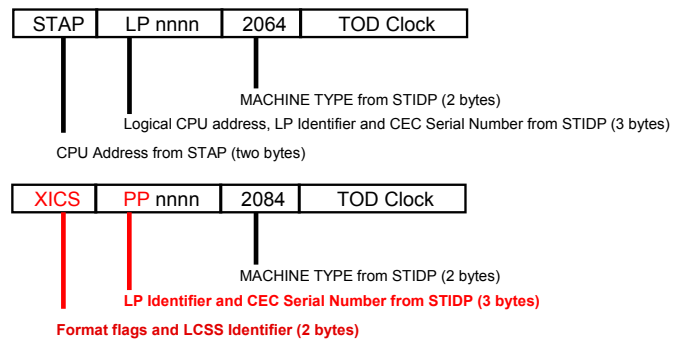
New z990 STIDP Result Format



Programs that use this must change

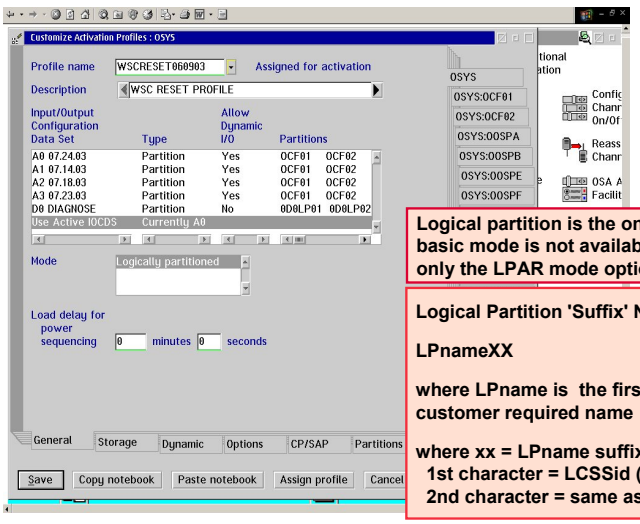
- PGID (OS/390®, VM/ESA®, VSE/ESA™, Linux/390, ICKDSF)
- XES and CFRM (CF identification)
- RMF™
- ISV software (should use STSI instruction, not STIDP)

Path Group Identifier (PGID) Before z990 and New Format



z990 Activation Profile Changes

z990 - Reset Profile - General (CEC OSYS)



Logical partition is the only mode supported, basic mode is not available (HCD also provides only the LPAR mode option)

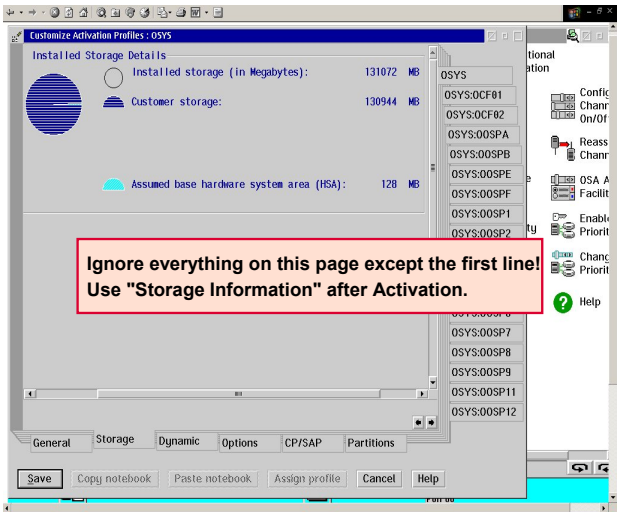
Logical Partition 'Suffix' Naming Convention

LPnameXX

where LPname is the first 6 characters of the customer required name

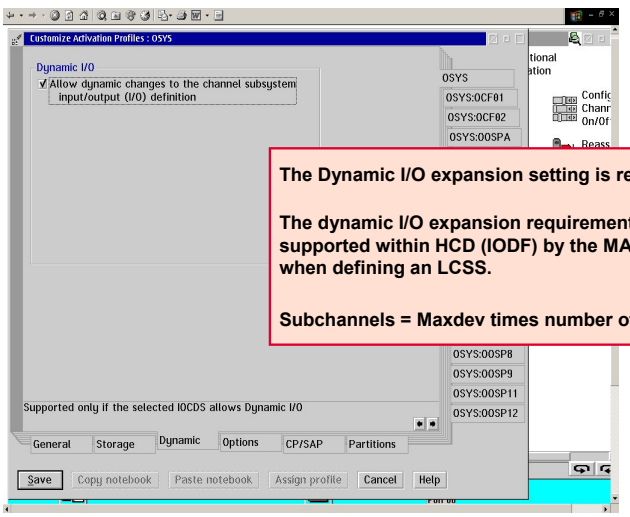
where xx = LPname suffix
1st character = LCSSid (0 = LCSS.0, 1 = LCSS.1)
2nd character = same as MIFid of 1 to F

z990 - Reset Profile - Storage



Ignore everything on this page except the first line!
Use "Storage Information" after Activation.

z990 Reset Profile - Dynamic

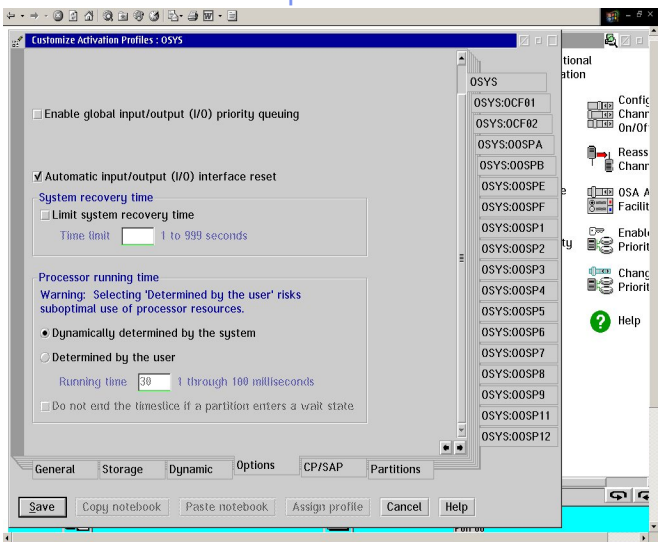


The Dynamic I/O expansion setting is removed.

The dynamic I/O expansion requirement is now supported within HCD (IODF) by the MAXDEV option when defining an LCSS.

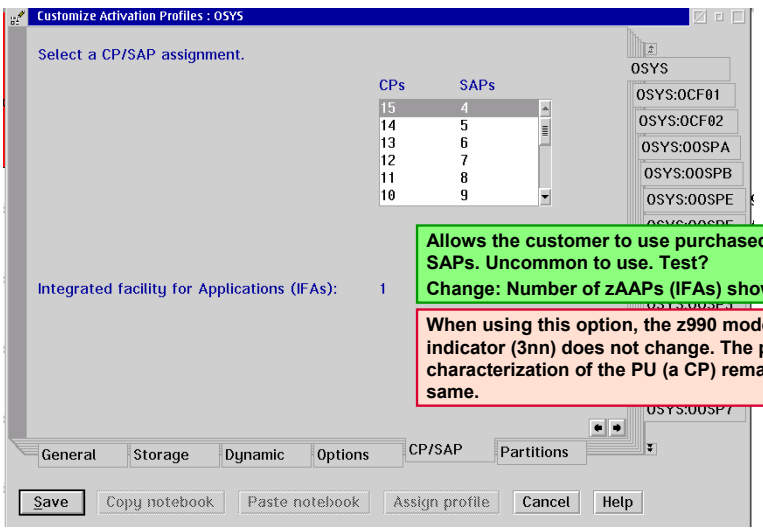
Subchannels = Maxdev times number of LPARs in LCSS

z990 Reset Profile - Options



No change

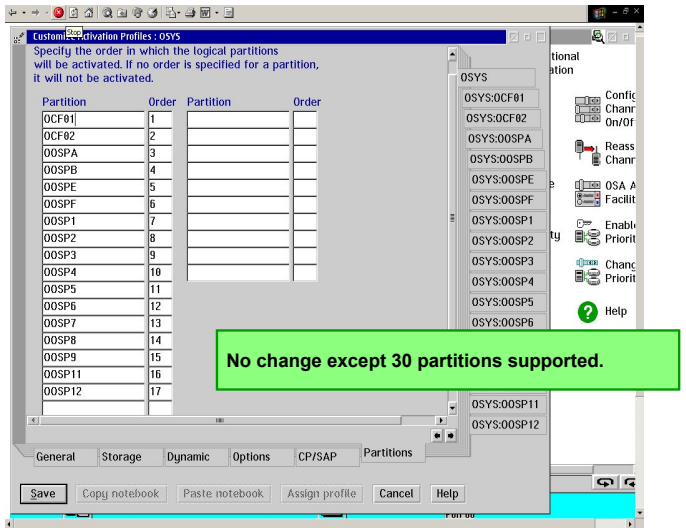
z990 Reset Profile - CP/SAP



Allows the customer to use purchased CPs as SAPs. Uncommon to use. Test?
Change: Number of zAAPs (IFAs) shown.

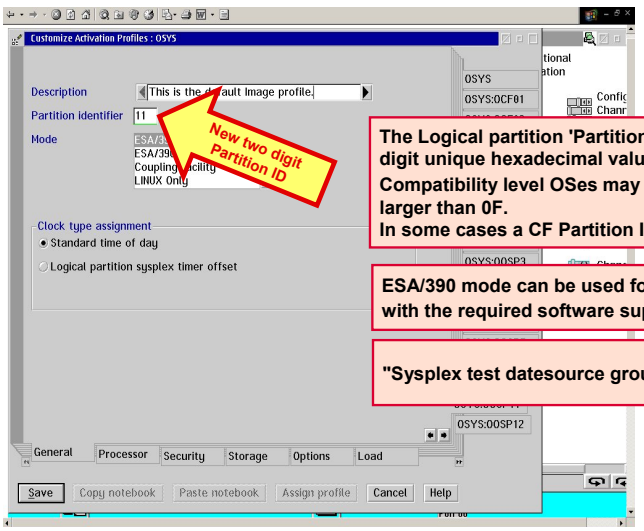
When using this option, the z990 model capacity indicator (3nn) does not change. The purchased characterization of the PU (a CP) remains the same.

z990 Reset Profile - Partitions



No change except 30 partitions supported.

z990 Image Profile - General (Partition OOSP11)

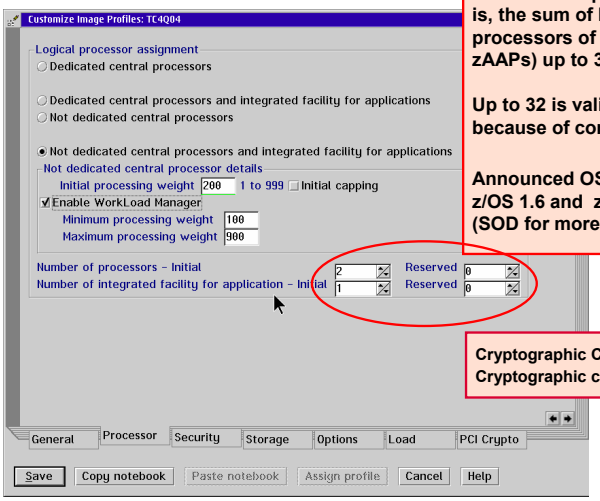


The Logical partition 'Partition Identifier' is a 1 or 2 digit unique hexadecimal value from 0 to 3F
Compatibility level OSes may not support a Partition ID larger than 0F.
In some cases a CF Partition ID cannot exceed 0F.

ESA/390 mode can be used for OS/390® z/OS® - z/VM® with the required software support for the z990

"Sysplex test datesource group" time removed.

z990 LPAR – More than 16 Processors in an LPAR ESA/390 Mode – CPs and zAAPs



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.

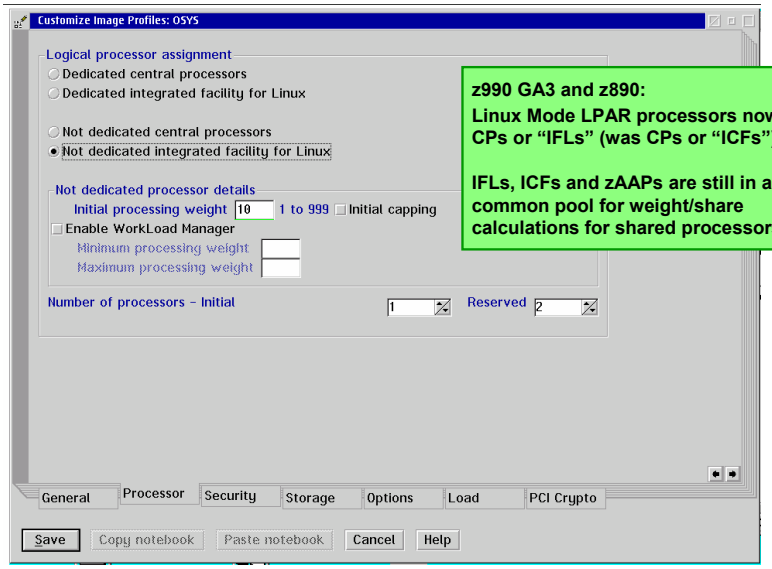
Announced OS support for more than 16: z/OS 1.6 and z/VM 5.1 – Both up to 24. (SOD for more. Watch this space!)

Cryptographic Coprocessor Selection removed. Cryptographic controls now in "PCI Crypto" page

z990/890 - zAAP Characteristics

- **z990 zAAP feature code 0520 characterizes one PU as a zAAP**
  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**
    (SOD: to be 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**

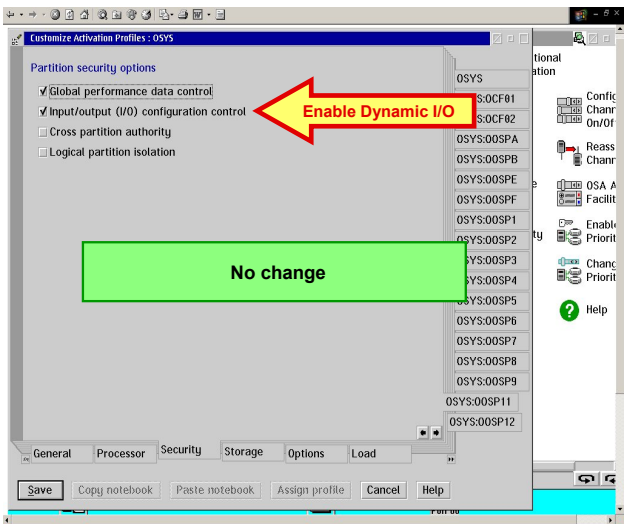
"LINUX ONLY" Mode – CPs or IFLs



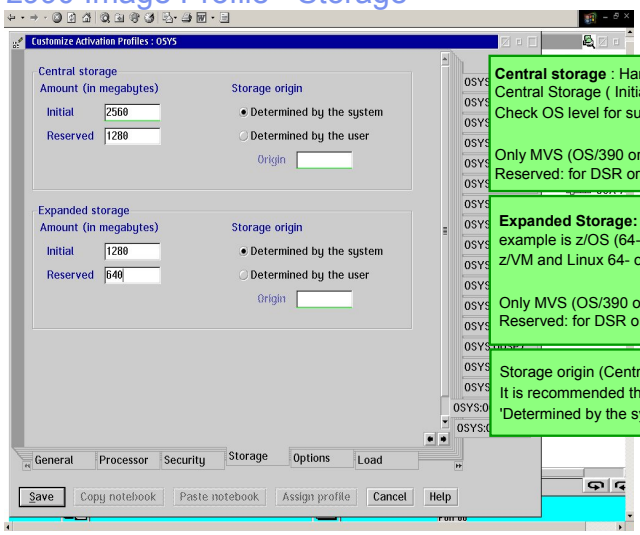
z990 GA3 and z890:
Linux Mode LPAR processors now CPs or "IFLs" (was CPs or "ICFs")

IFLs, ICFs and zAAPs are still in a common pool for weight/share calculations for shared processors.

z990 Image Profile - Security



z990 Image Profile - Storage



Central storage : Hardware supports up to 128 GB Central Storage (Initial + Reserved)
Check OS level for supported amounts.

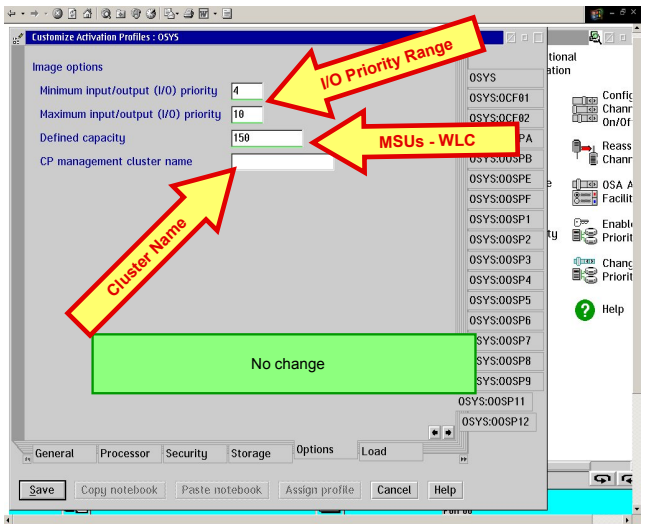
Only MVS (OS/390 or z/OS) supports Reserved.
Reserved: for DSR or storage added by CUoD

Expanded Storage: Some OSs do not support. One example is z/OS (64-bit) running on a z990.
z/VM and Linux 64- or 31-bit do support.

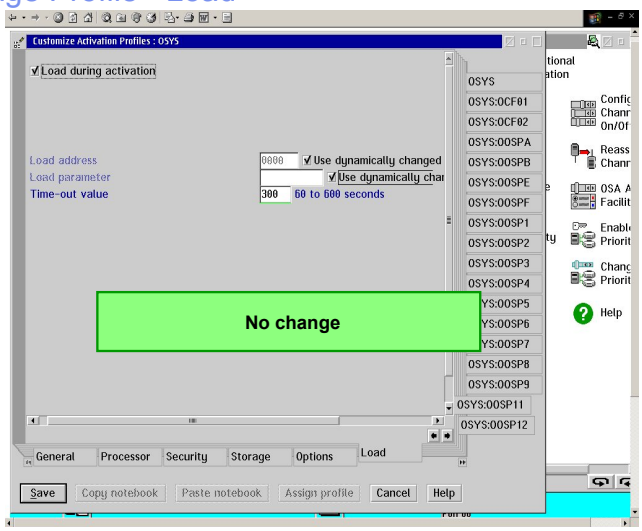
Only MVS (OS/390 or z/OS) supports Reserved.
Reserved: for DSR or storage added by CUoD

Storage origin (Central and Expanded storage)
It is recommended that you use the
'Determined by the system' option

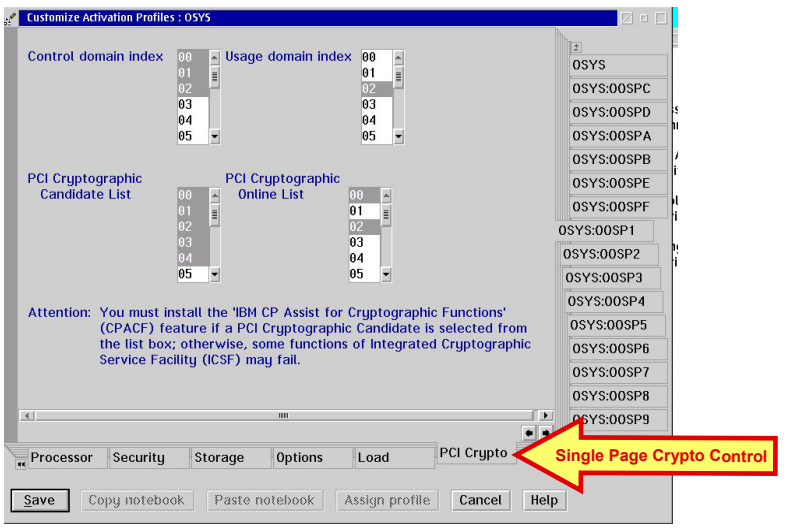
z990 Image Profile - Options



z990 Image Profile - Load

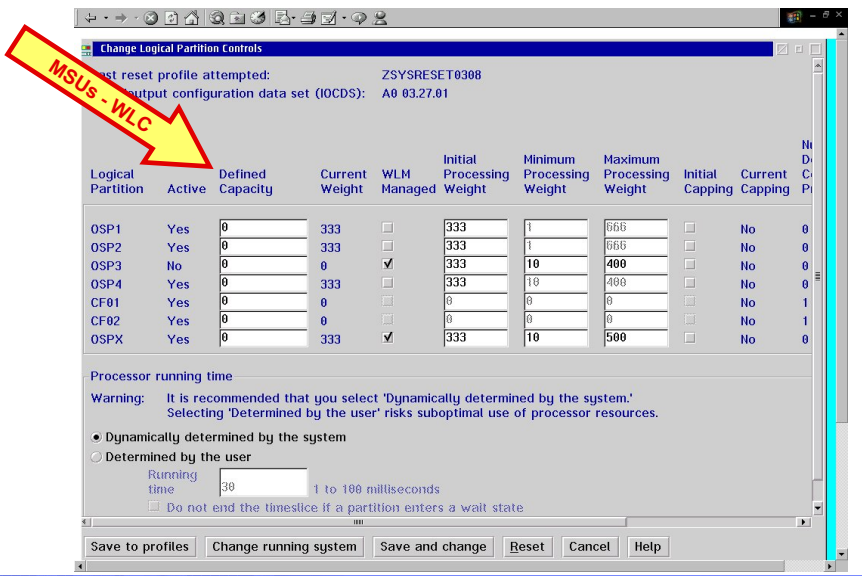


z990 Image Profile - PCI Crypto for PCICA and PCIXCC

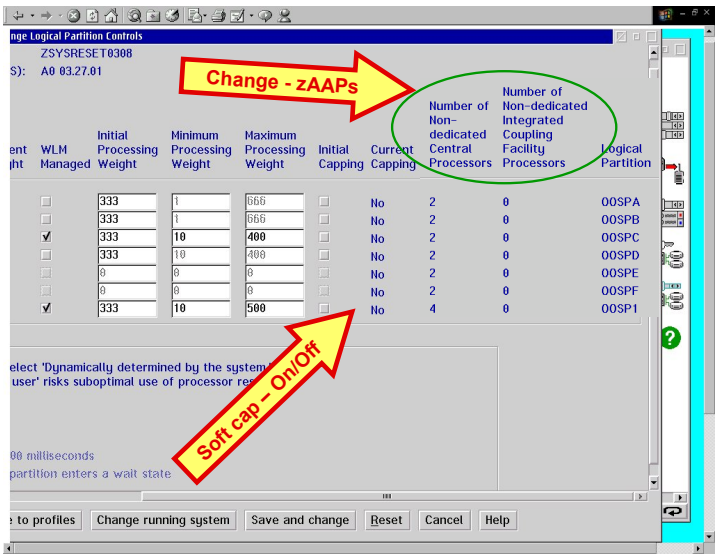


Changing Running Partitions

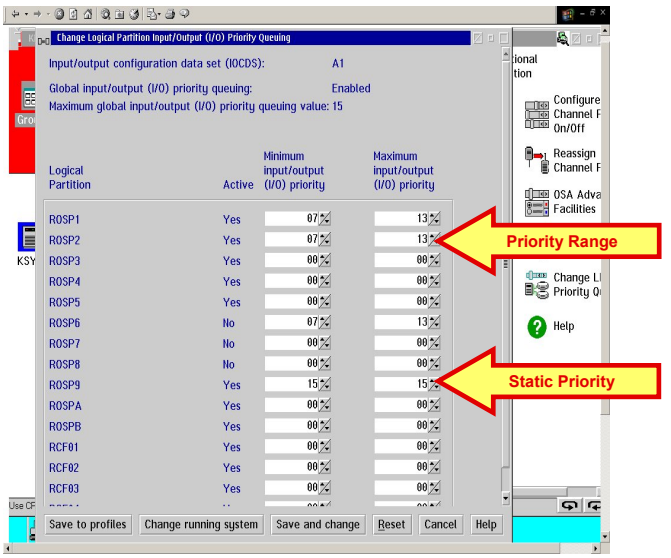
HMC/SE Change LPAR Controls (Left)



HMC/SE LPAR Change Controls (Right)



zSeries Change Logical Partition, CSS I/O Priority Queuing



zSeries Memory and Addressability

z900 and z800 Memory Granularity

- Memory Granularity = Increment Size
  - Storage assignments/reconfiguration and HSA must be an even multiple
  - Varies depending on installed memory size
    - LPAR Mode ONLY, 1 MB in BASIC mode for HSA)
    - Was 1 MB prior to G3 Dr 88 for LPAR, too
- Single Storage Pool - All central storage
  - ES configured as needed from CS - No POR needed
  - zSeries and G5/6 (Dr 22e and later)
- Machines without Single Storage Pool support
  - POR required to change CS/ES split

Total Storage G5/6 or zSeries	Granularity CS & ES
5 - 8 GB	16 MB
10 - 16 GB	32 MB
18 - 32 GB	64 MB
40 - 64 GB	128 MB

RSU Increment Size!!!

z990 Memory Granularity

- Memory Granularity = Increment Size
  - Storage assignments/reconfiguration and HSA must be an even multiple
  - **Physical increment size fixed at 64 MB**
  - **Expanded memory granularity always 64 MB**
  - **Central memory granularity is virtualized for each LP**
    - LP central memory increment is determined according to the size of the larger of the two central memory elements defined in the activation profile: Initial central memory or Reserved central memory
- Single Storage Pool - All central storage
  - ES configured as needed from CS - No POR needed
- **Review MVS™ RSU parameter**. Large z990 increment size may result in too much memory being reserved for reconfiguration after migration unless the new RSU options introduced in OS/390 2.10 are used.

Large Element Size	Granularity
64 MB to 32 GB	64 MB
>32 GB to 64 GB	128 MB
>64 GB to 128 GB	256 MB
>128 GB to 256 GB	512 MB

Rare to exceed today

z/OS Limit = 128 GB

MVS RSU Parameter

- In IEASYSxx. Specifies the number of central storage increments to be made available for central storage reconfiguration
  MVS attempts to keep this area free of long term fixed pages

$$\text{RSU} = \frac{\text{CS amount to be reconfigured}}{\text{storage increment size}}$$

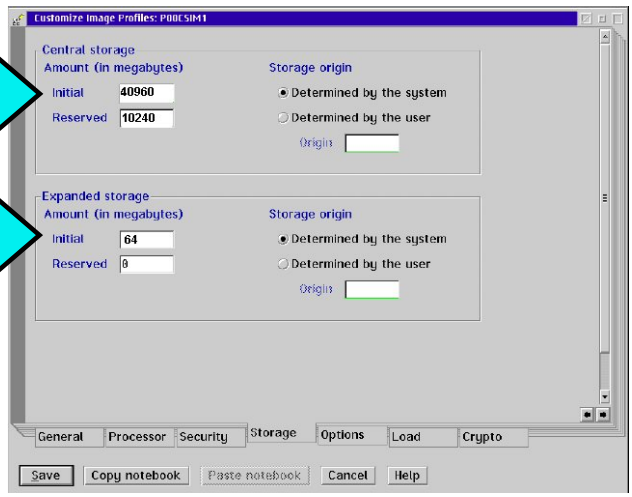
- Or: Storage to be kept free = RSU * increment
  If memory is upgraded, check the RSU parameter!

- OS/390 V2.10 and z/OS - Better RSU Options
  All OFFLINE storage (Reserved Storage)
  An amount (%, MB or GB) - System calculates increments

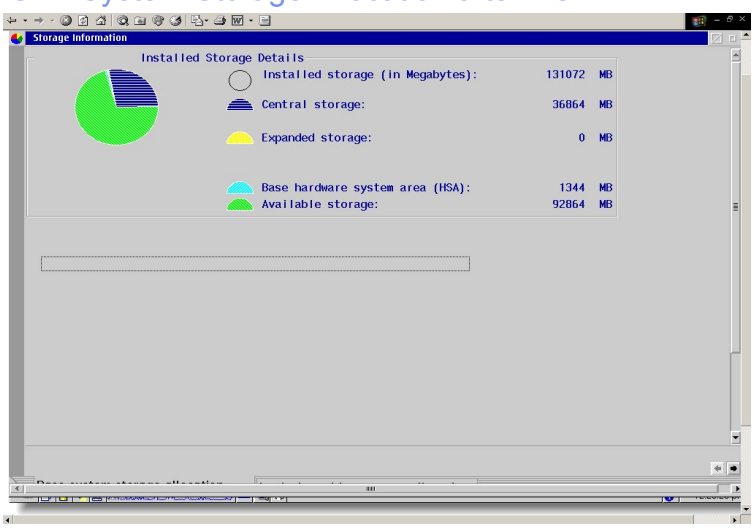
z990 Image "Storage" Page Increment Example

40 GB initial Element =128 MB Increment.

Valid at 64 even with 128 MB increment.

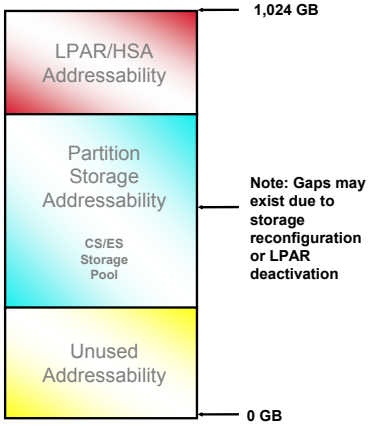


z990 SE - System Storage Allocation after POR

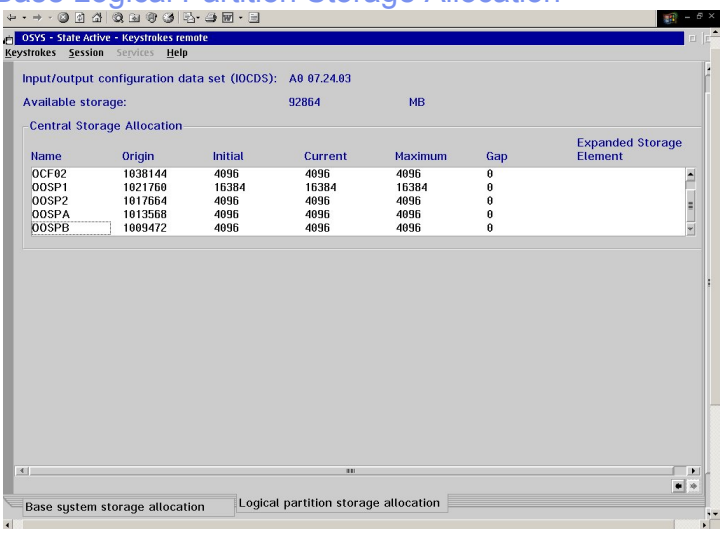


z990 and z990 Absolute Address Assignment

- Storage Addressability for LPAR/HSA is allocated top down from highest supported address
  - z800, z900 - Highest address based on installed memory
  - z990/890 – Highest address = 1,024 GB (1 TB), HUGE!
- Partition Storage Addressability for OS, applications, and I/O is assigned below HSA at LPAR activation
  - **OS, Application, I/O operations**
  - **Origin address is assigned top/down by default but a specific origin can be requested**
  - **All Initial and Reserved CS and ES takes addressability at LPAR activation**
  - **Addressability is contiguous**
- In Book/Memory Physical Storage
  - **LPAR/HSA starts at book/memory physical address 0 (in book 0)**
  - **LPAR/HSA size can exceed 2 GB**
  - **Physical storage assigned to LPARs is above this**
  - **No requirement to be contiguous**

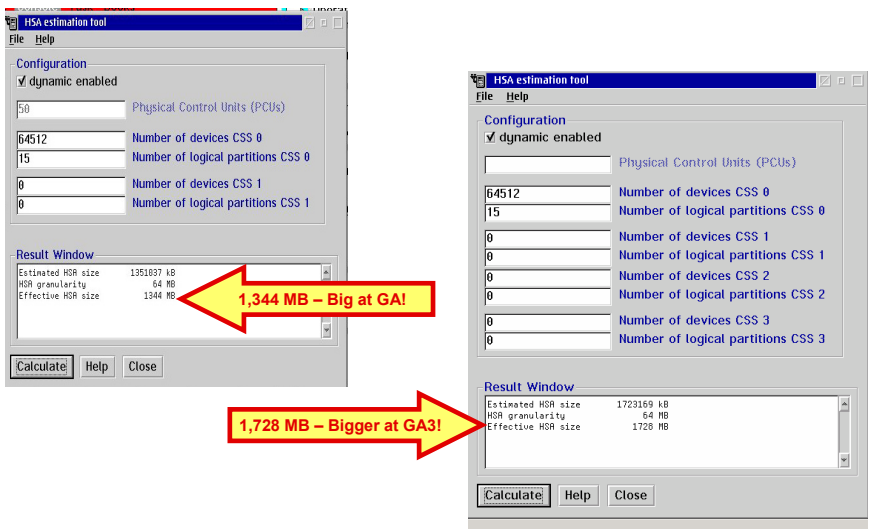


z990 Base Logical Partition Storage Allocation



z990 Hardware System Area (HSA)

z990 HSA Estimation Tool



End of Presentation