

# z/VM 6.4: Preparation & Use

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## Abstract

z/VM 6.4 was generally available on November 11, 2016 and brought a lot of new capability to the z/VM environment. This presentation reviews some of the key changes in the release. First we'll look at your existing system and discuss what will be different when you go to z/VM 6.4. Next we'll look at what you should change prior to IPLing z/VM 6.4, things like expanded storage or changes for HyperPAV paging. We'll wrap things up with a discussion of how you exploit some of the new features after you are running z/VM 6.4.

# Agenda

- z/VM 6.4 Release Notes
- Things you need to look at or do while on older system for a smooth transition and to avoid problems
- Things to do as you bring up z/VM 6.4
- Things you need to look at to get the most out of z/VM 6.4 after it is up and running

# Release Status and Information

## z/VM Release Status Summary

z/VM Level	GA	End of Service	End of Marketing	Minimum Processor Level	Maximum Processor Level	Security Level
6.4	11/2016			IBM System z196 & z114 <sup>®</sup>	-	In progress
6.3	7/2013	12/2017 <sup>[1]</sup>	11/2016	IBM System z10 <sup>®</sup>	z14, z13s <sup>4</sup>	EAL 4+ OSPP-LS
6.2	12/2011	6/2017 <sup>[2]</sup>	7/2013	IBM System z10 <sup>®</sup>	z13	-
5.4	9/2008	12/2017 <sup>[3]</sup>	3/2012	IBM eServer zSeries 800& 900	zEC12	-

<sup>[1]</sup> Announced February 3, 2015

<sup>[2]</sup> Announced February 2, 2016

<sup>[3]</sup> Announced August 2, 2016

<sup>[4]</sup> Also LinuxONE corresponding machines

## z/VM 6.4

- General Availability November 11, 2016
- A release born from customer feedback
- Key components:
  - Enhanced technology for improved scaling and total cost of ownership
  - Increased system programmer and management capabilities
- New Architecture Level Set (ALS) of z196 and higher





## z/VM 6.4 Supported Hardware

- You can run z/VM 6.4 on the following servers:
  - IBM z14
  - IBM z13
  - IBM z13s
  - IBM LinuxONE Emperor and Emperor II
  - IBM LinuxONE Rockhopper
  - IBM zEnterprise EC12
  - IBM zEnterprise BC12
  - IBM zEnterprise 196
  - IBM zEnterprise 114
  
- Electronic and DVD install
  - No tapes

## Upgrade In Place

- Enables a smoother upgrade of existing z/VM 6.2 and z/VM 6.3 systems to z/VM 6.4, especially in a Single System Image (SSI) environment, and avoids a full and fresh install
- Includes Processes to:
  - Apply vendor and customer modifications
  - Back out upgrade changes
- Requires appropriate service on the old z/VM level
- See the Install Guide for the complete list of pre-requisites
- Unlike z/VM 6.3, z/VM 6.4 requires TCP/IP machine to be shutdown at one point, so will need alternate method to get to z/VM
- See Live Virtual Class for session on Upgrade in Place May 31<sup>st</sup>, 2017
  - <http://www.vm.ibm.com/education/lvc/>

## Fresh Install Considerations

- Supports 3390 mod-27 DASD (32760 cylinders)
- Default location for components is now SFS instead of minidisks
  - Minimizes future disruption for increasing minidisks
  - Can select to use minidisks instead
  - Different component names (e.g. dirmsfs instead of dirm)
- Install must be done to **full pack** minidisks (***cannot*** define as n-1 cylinders)
  - Minimum install sizes:
    - 3390 mod-3            - 3339 cylinders (changed from 3338)
    - 3390 mod-9           - 10017 cylinders (changed from 10016)
    - 3390 mod-27         - 32760 cylinders
  - Refreshed install image allows n-1 cylinders for 3390 mod-9 and mod-27
    - (available August 25, 2017)

## Installing z/VM on a z14

### ▪ z/VM 6.4

– *New install image required*

- Available August 25, 2017
- Refreshed DVD (-01 level)
- VM65942 must be applied immediately after install
  - Prior to doing any configuration of new system
  - PE fix for VM65942 is VM66071 in test; problem limited to Crypto Express 2 & 3

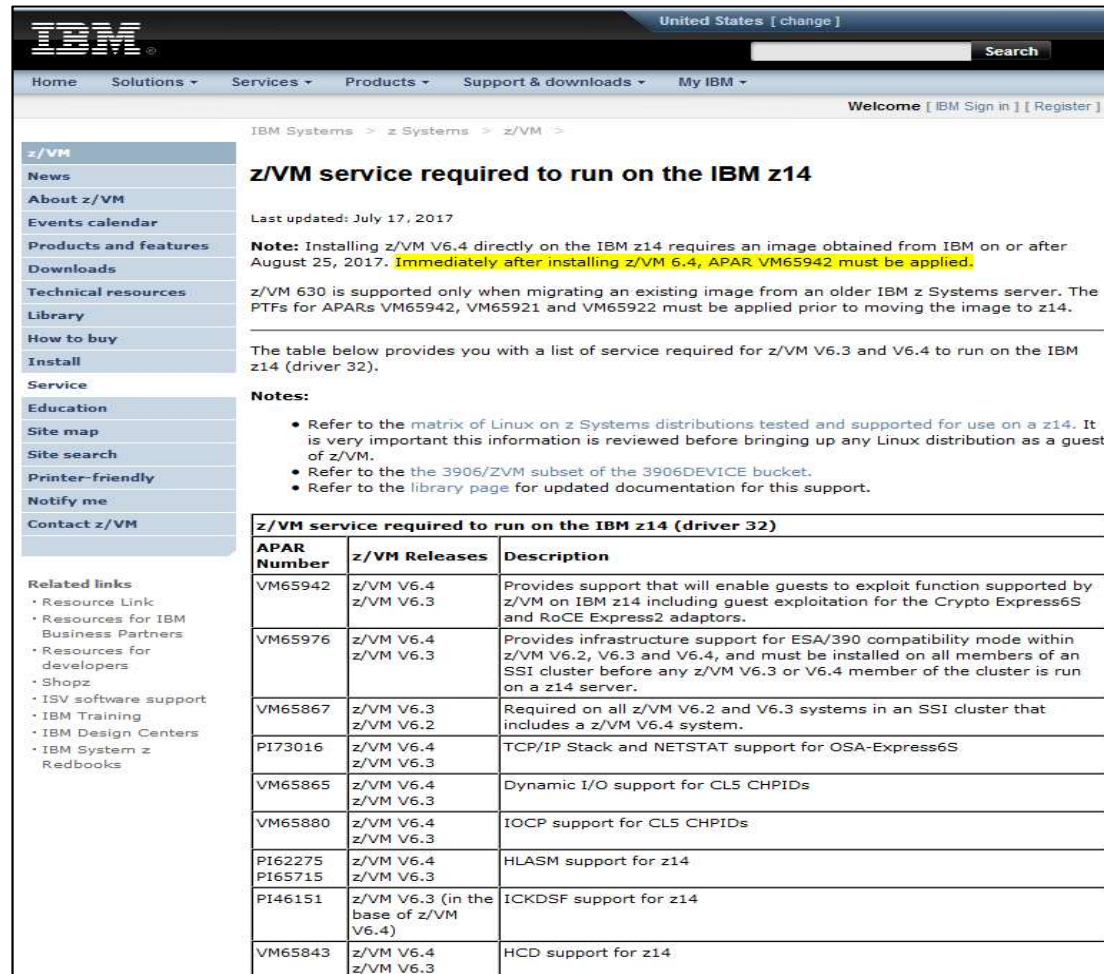
### ▪ z/VM 6.3

– *Must be migrated from prior server after required service is applied*

- Cannot be installed directly on a z14
- *Must build and install **new SAPL** (Stand-alone loader) before IPLing on z14*
  - New SALIPL MODULE provided with APAR VM65856
- Use SDINST utility to re-install the stand-alone dump program after applying VM65921 and VM65922

# Installing z/VM on a z14

- Required service information at <http://www.vm.ibm.com/service/vmreqz14.html>



**z/VM service required to run on the IBM z14**

Last updated: July 17, 2017

**Note:** Installing z/VM V6.4 directly on the IBM z14 requires an image obtained from IBM on or after August 25, 2017. **Immediately after installing z/VM 6.4, APAR VM65942 must be applied.**

z/VM 630 is supported only when migrating an existing image from an older IBM z Systems server. The PTFs for APARs VM65942, VM65921 and VM65922 must be applied prior to moving the image to z14.

The table below provides you with a list of service required for z/VM V6.3 and V6.4 to run on the IBM z14 (driver 32).

**Notes:**

- Refer to the matrix of Linux on z Systems distributions tested and supported for use on a z14. It is very important this information is reviewed before bringing up any Linux distribution as a guest of z/VM.
- Refer to the the 3906/ZVM subset of the 3906DEVICE bucket.
- Refer to the library page for updated documentation for this support.

APAR Number	z/VM Releases	Description
VM65942	z/VM V6.4 z/VM V6.3	Provides support that will enable guests to exploit function supported by z/VM on IBM z14 including guest exploitation for the Crypto Express6S and RoCE Express2 adaptors.
VM65976	z/VM V6.4 z/VM V6.3	Provides infrastructure support for ESA/390 compatibility mode within z/VM V6.2, V6.3 and V6.4, and must be installed on all members of an SSI cluster before any z/VM V6.3 or V6.4 member of the cluster is run on a z14 server.
VM65867	z/VM V6.3 z/VM V6.2	Required on all z/VM V6.2 and V6.3 systems in an SSI cluster that includes a z/VM V6.4 system.
PI73016	z/VM V6.4 z/VM V6.3	TCP/IP Stack and NETSTAT support for OSA-Express6S
VM65865	z/VM V6.4 z/VM V6.3	Dynamic I/O support for CL5 CHPIDs
VM65880	z/VM V6.4 z/VM V6.3	IOCP support for CL5 CHPIDs
PI62275 PI65715	z/VM V6.4 z/VM V6.3	HLASM support for z14
PI46151	z/VM V6.3 (in the base of z/VM V6.4)	ICKDSF support for z14
VM65843	z/VM V6.4 z/VM V6.3	HCD support for z14

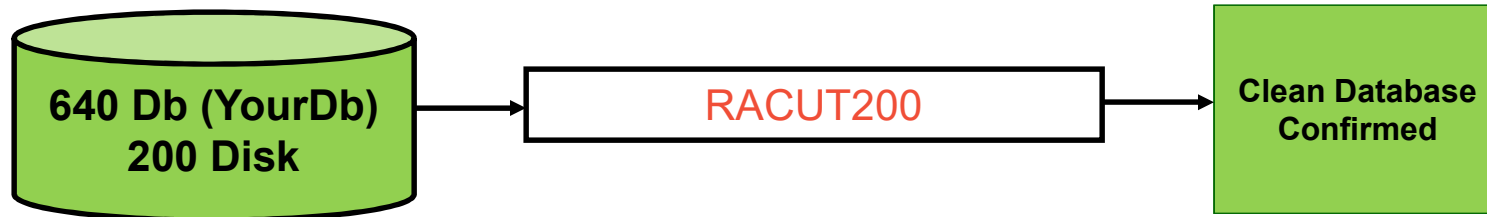
# Single System Image Considerations

- If running a mixed-release SSI cluster that includes z/VM 6.4 members
  - Apply VM65867 to z/VM 6.3 members
    - Correctly indicates supported architectures to guests
  
- Install VM65976 on **all** members of an SSI cluster before **any** member is run on a z14
  - z/VM 6.3 and 6.4
  - Allows live guest relocation between members on pre-z14 and members on z14 servers

# RACF Considerations

- **Validate the database before up-leveling RACF database template**

- RACUT200 utility checks database integrity
- Always run RACUT200 before issuing RACFCONV



- **Database best practices**

- Have a procedure for database backups
- Integrity-check your back-up databases
- Automate around RACF initialization

- **Whitepaper - Validating and Repairing RACF Database Integrity on z/VM**

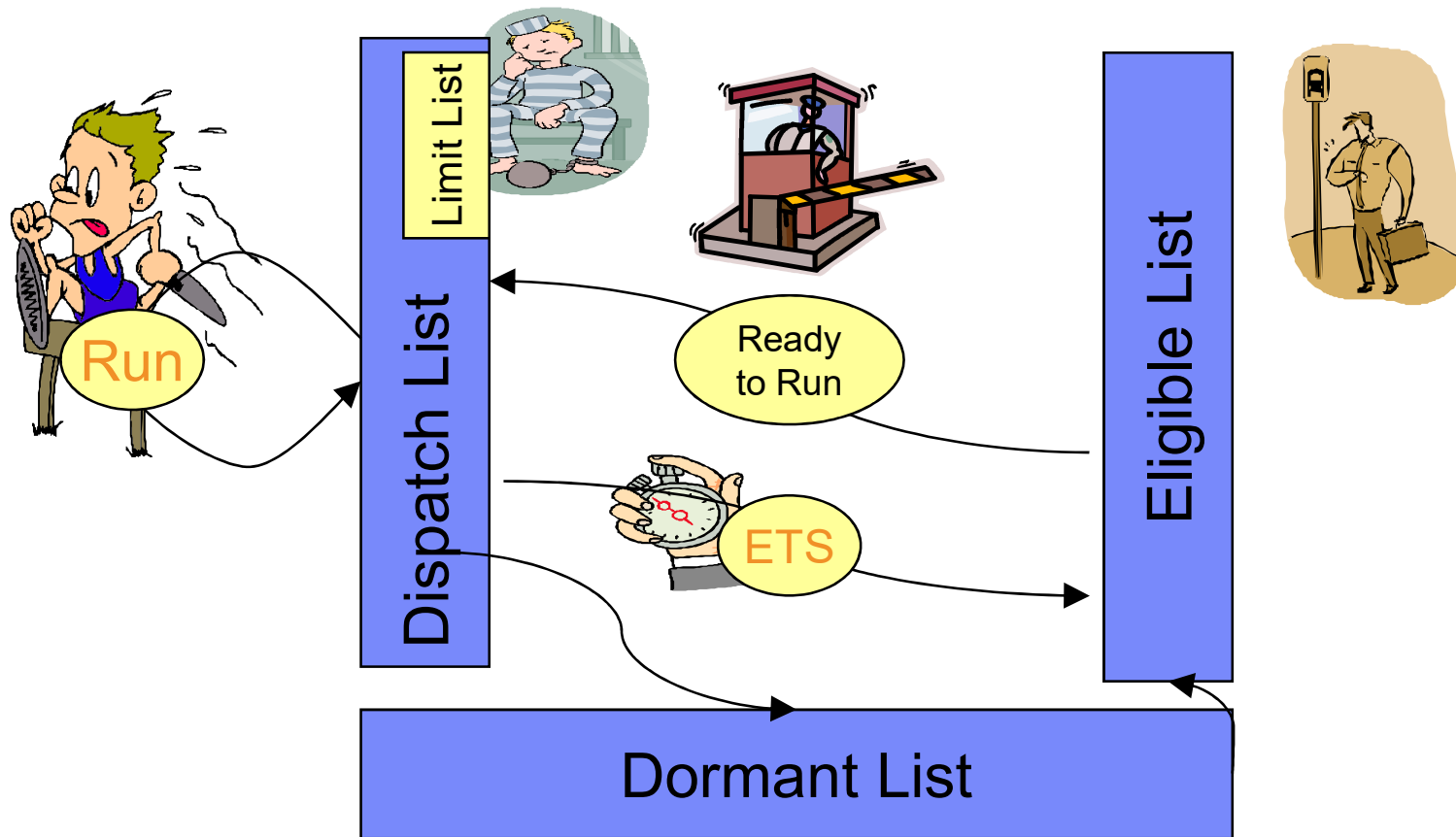
- <https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=ZSW03366USEN&>
  - *Brian W. Hugenbruch, CISSP - IBM Z Virtualization Security*
- More information available at <http://www.vm.ibm.com/security/>

## Expanded Storage

- z/VM 6.4 fulfills Statement of Direction to drop support for all use of Expanded Storage
- Convert any expanded storage to central storage (real memory) when bringing up z/VM 6.4 or 6.3
- The memory management changes made in z/VM 6.3 made expanded storage obsolete



# Scheduler Lists



## Eligible List

- z/VM 6.4 no longer places virtual machines into the eligible list. The eligible list is still defined and is displayed in various commands.
  - In the past, the wrong virtual machines went into the eligible list for too long
  - No longer need to worry about SET SRM STORBUF and LDUBUF settings
  - Need to ensure that you have sufficient system resources to avoid thrashing scenarios
  
- Check to see if you have had eligible lists forming in a case where they were needed.
  - Performance Toolkit SCHEDLOG report can show this
  - If you have had these scenarios, contact IBM to discuss options
  
- The QUICKDSP option on a virtual machine was used in past to ensure critical virtual machines always bypassed the eligible list.
  - Current recommendation is to not remove this option from machines where it is currently set.

# Scheduler Changes

- z/VM 6.4 improves the accuracy in the distribution of processor power
  - Existing problem where surplus 'share' is not distributed appropriately has been addressed
  
- The algorithms were changed to help accommodate this fix resulting in share values being normalized differently
  - All virtual machines are factored into the normalization, not just virtual machines in the dispatch and eligible lists.

## Surplus Share Distribution: Background

- Shares are relative to other virtual machines that want to run (in dispatch and eligible lists)
- Example:
  - Four compute-bound virtual machines on a real 1-way:
    - LINUX01 Relative 100 = 17%
    - LINUX02 Relative 100 = 17%
    - LINUX03 Relative 200 = 33%
    - LINUX04 Relative 200 = 33%
  - Total Shares = 600
  - What happens if LINUX04 wants to use only **3%**?

# Excess Share Distribution Problem

z/VM 6.4  
z/VM  
Prior

User ID	Share	Normalize	Correct Distribution	Problem Scenario
LINUX01	100	17%	24.5%	17%
LINUX02	100	17%	24.5%	17%
LINUX03	200	33%	48%	63%
LINUX04	200	33%	3%	3%

## Normalization Change

- z/VM 6.3 and earlier normalization
  - z/VM kept accumulated share values for virtual machines in the dispatch and eligible lists; one for absolute shares and one for relative shares
  - For absolute share:
    - If sum of absolute shares of virtual machines > 99%, prorate to 99%
    - Else absolute share → normalized share
  - For relative share:
    - Determine what is left over from absolute shares (always at least 1%)

$$\text{normalized share} = (100 - \sum \text{absolute\_share\_disp\_list}) \times \frac{\text{relative\_share}}{\sum \text{relative\_share\_disp\_list}}$$

- In z/VM 6.4 the sums include *all* users, not just those in the dispatch and eligible lists
  - Watch for systems where:

$$\sum \text{relative\_share} \gg \sum \text{relative\_share\_disp\_list}$$

- The sum of absolute and relative shares is provided in the SCHEDLOG Performance Toolkit report
- This is done for each processor type in all releases

## Security Changes

- z/VM SSL Server
  - Default in z/VM 6.4 is TLS 1.2, with TLS 1.0 disabled
- System Config file
  - Passwords\_on\_cmds feature now defaults to “No”
- Logon error message
  - If an incorrect password is given for a valid userid, the error message no longer indicates that the userid was valid
  - If invalid userid is entered without password, we still prompt for password
  - Meant to prevent phishing

```
HCPLGA050E LOGON unsuccessful - incorrect userid and/or password
```

## TCP/IP IPWIZARD Utility

- Need to circumvent a problem before running IPWIZARD on a newly-installed z/VM 6.4 system
  - TCPIP DATA file needs to be created
- See <http://www.vm.ibm.com/related/tcpip/tcpipwiz.html> for details



## Using FlashSystems for z/VM system volumes

- Prior to z/VM 6.4, you needed a San Volume Controller (SVC) to use FlashSystems for z/VM volumes
  - Could be connected to Linux guests without the SVC
- New device attribute (driver) for **EDEVICE** statement or **SET EDEVICE** command
- System configuration file:

**EDEVICE** *edev* **TYPE FBA ATTRIBUTES** **FLASH** **FCP\_DEVICE** *rdev* **WWPN** *wwpn* **LUN** *lun*

## New Query Info for Disk Devices

- Extended Information on QUERY commands
  - [Query EDEV nnnn details](#) – added LUN serial number
  - [Query DASD nnnn details](#) – added serial number

### Query edev 1111 details

EDEV 1111 TYPE FBA ATTRIBUTES 2105

VENDOR: IBM                      PRODUCT: 2105F20                      REVISION: .293

BLOCKSIZE:                      512      NUMBER OF BLOCKS: 390656

PATHS:

FCP\_DEV: B908      WWPN: 5005076300CD04DA      LUN: 5144000000000000

CONNECTION TYPE: POINT\_TO\_POINT STATUS: ONLINE

EQID: ABCDEFGH

SERIAL NUMBER: 2146561344562

## New Query Info for Disk Devices

- Extended Information on [QUERY EDEVICE](#)
  - New [inquiry](#) option to provide data from the device: Standard Inquiry Info and Vital Product Data

```
q edev 111 inquiry
```

```
- Begin - EDEV 0111 - Standard Inquiry Page -
```

```
00000532 9F101002 49424D20 20202020 32313037 39303020 20202020 20202020
2E323034 37353034 31393131 34303020 20202020 20202020 00600DA0 0A000300
03200000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00323037 35003236 34303400 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00080000
```

```
- End - EDEV 0111 - Standard Inquiry Page -
```

```
q edev 111 inquiry page 83
```

```
- Begin - EDEV 0111 - Vital Product Data Page 83 -
```

```
00830024 01030010 60050763 03FFC09C 00000000 00001400 01140004 00000032
01150004 00000000
```

```
- End - EDEV 0111 - Vital Product Data Page 83 -
```

## Additional Information on DASD

- For ECKD disks get Read Device Characteristics (RDC) and Read Configuration Data (RCD)
  - **QUERY DASD** with **CHARACTERISTICS** option

```
q dasd char 521d
- Begin - RDEV 521D - Read Configuration Data -
DC010100 F0F0F2F1 F0F7F9F0 F0C9C2D4 F7F5F0F0 F0F0F0F0 F0E8F5F8 F1F1071D
D4020000 F0F0F2F1 F0F7F9F3 F2C9C2D4 F7F5F0F0 F0F0F0F0 F0E8F5F8 F1F10700
D0000000 F0F0F2F1 F0F7F9F3 F2C9C2D4 F7F5F0F0 F0F0F0F0 F0E8F5F8 F1F00700
F0000001 F0F0F2F1 F0F7F9F0 F0C9C2D4 F7F5F0F0 F0F0F0F0 F0E8F5F8 F1F10700
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
80000310 2D001E00 05070013 62131325 000CC01D 3905FADB 03100000 0000F200
- End - RDEV 521D - Read Configuration Data -
- Begin - RDEV 521D - Read Device Characteristics -
2107E833 900A5F8C 5FF72024 01F4000F E000E5A2 05940222 13090674 00000000
00000000 00000000 24241F02 DFEE0001 0677080F 007F4A00 003C0000 000001F4
- End - RDEV 521D - Read Device Characteristics -
```

## IOEXPLOR Exec – FCP Example

- Used to format new output.

### IOEXPLOR 7FFF CHAR

-Begin: Characteristics Data for device 7FFF

Serial Number \_\_\_\_\_ 052a62e2052a-0000002a-00002c

#### Standard Inquiry Data

Peripheral Qualifier/Peripheral Device Type \_\_\_\_\_ 000b/00h

Vendor Identification \_\_\_\_\_ IBM

Product Identification \_\_\_\_\_ FlashSystem-9840

Product Revision Level \_\_\_\_\_ 1217

Version Descriptor \_\_\_\_\_ SAM-3 (no version)

Version Descriptor \_\_\_\_\_ FC-PH-3 (no version)

Version Descriptor \_\_\_\_\_ FC-AL-2 (no version)

Version Descriptor \_\_\_\_\_ FCP-3 (no version)

Version Descriptor \_\_\_\_\_ SPC-3 (no version)

Version Descriptor \_\_\_\_\_ SBC-2 (no version) (cont'd....)

## IOEXPLOR Exec – FCP Example

```
Device Identification
Cluster Identification _____ 052a62e2052a
IO Group _____ 0000
Vdisk Number _____ 002a
LUN Identification _____ 00002c
IEEE Company Identification _____ 005076
Cluster Alias _____ 12A62E2052A
Slot Number _____ 0C
Channel Number _____ 01

Device Characteristics
Device class code _____ 21
Unit type _____ 11
Bytes per track _____ 56832
Bytes per cylinder _____ 397824
Bytes per block _____ 512
Device size _____ 2097152 blocks
-End: Characteristics Data for device 7FFF
Ready; T=0.01/0.01 21:20:09
```

## IOEXPLOR Exec – FICON Example

### IOEXPLOR 19E CHAR

-Begin: Characteristics Data for device 19E

#### I/O Device Information

Device type-model _____	2107-900
Device manufacturer _____	IBM
Serial number (plant-seq#) _____	75-Y5811
Logical Volume Number _____	1040

#### Control Unit Information

Device type-model _____	2107-932
Serial number (plant-seq#) _____	75-Y5811
Logical Subsystem Number _____	10

#### Additional Device Information

Device manufacturer _____	IBM
Device type-model _____	2107-932
Serial number (plant-seq#) _____	75-Y5810
Logical Subsystem Number _____	10

#### Additional Device Information

Device manufacturer _____	IBM
Device type-model _____	2107-900
Serial number (plant-seq#) _____	75-Y5811
Logical Subsystem Number _____	10

(cont'd...)

## IOEXPLOR Exec – FICON Example

General NEQ		
Interface id _____	0230	
Missing Interrupt Timer Interval _____	30 seconds	
Secondary Missing Interrupt Timer Interval _____	0 seconds	
Controller System Adapter ID (SAID) _____	0230	
Logical paths supported _____	61952	
Device		
Host CU type-model _____	2107-E8	
Device type-model _____	3390-0A	
Storage Directory Facilities		
VM non-full pack minidisk _____	Yes	
MIDAW Capability supported _____	No	
Parallel Access Vol. state _____	HyperPAV Enabled	
XRC Functions _____	Enabled	
Peer-to-Peer Remote Copy _____	Not Enabled	
Striping and Compaction _____	Supported	
Locate Record Erase _____	Supported	
Cache Fast Write _____	Supported	
Multi-Path Lock _____	Supported	
Track Cache _____	Supported	(cont'd...)



## IOEXPLOR Exec – FICON Example

DASD Fast Write _____	Supported	
24 Byte Compatibility sense _____	Yes	
Device class code _____	20	
Device type code _____	24	
Primary cylinders _____	500	
Tracks per cylinder _____	15	
Number of Sectors _____	224	
Track length _____	58786	
HA + R0 length _____	1428	
Capacity formula _____	2	
Capacity factors F1-F6 _____	34 19 9 6 116 6	
MDR Record ID _____	24	
OBR Record ID _____	24	
Storage director Type _____	1F	
Read Trackset length _____	2	
Max Record zero length _____	57326	(cont'd...)

## IOEXPLOR Exec – FICON Example

Storage Class	
Data Encrypted device _____	No
Solid State drive _____	No
Enterprise Disk _____	No
SATA Disk _____	No
Flash Storage _____	No
Tiered Storage Pool _____	No
Track Set Size _____	1
Concurrent Copy Lower _____	0F
Concurrent Copy Upper _____	7F
Generic Device / CU functions	
Mirrored Device _____	No
RAID Device _____	Yes
Transparent subsystem cache _____	No
Split CE/DE _____	Yes
Device capable of Mirroring _____	No
XRC Device Management enabled _____	Yes
RVA Snapshot supported _____	No
Real Control Unit code _____	00
Real Device Code _____	3C
-End: Characteristics Data for device 19E	

# FCP Problem Determination

- New CP Command **EXPLORE FCP** allows for testing
  - **ADD**: adds FCP subchannel and WWPN to list of devices to be tested
    - (can also **REMOVE**)
  - **START**: activates FCP subchannels and opens WWPN ports in list of SCSI devices to be tested
    - (can also **STOP**)
  - **QUERY**: displays the FCP subchannels and WWPN ports in the list of SCSI devices to be tested and their current activation status

## Performance Toolkit

- Performance Toolkit for z/VM now runs in a **z/CMS** virtual machine
  - Allows exploitation of
    - more memory for processing large amounts of data
    - z/Architecture instructions for performance benefits
- Ensure virtual machines that utilize Performance Toolkit can run in **z/CMS**
  - z/CMS and XC mode virtual machines are incompatible
  - No exploitation of z/VM data spaces
    - SFS dircontrol file directories

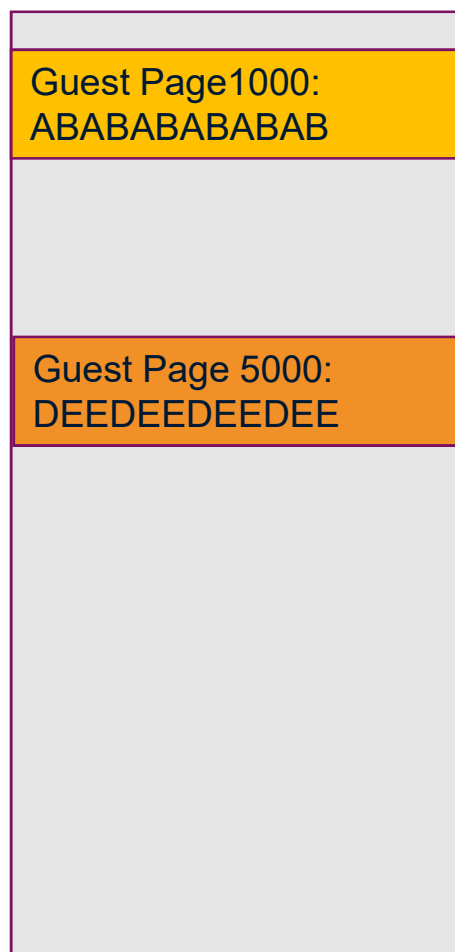
## 2 TB Real Memory Support

- z/VM 6.4 increases supported real memory from 1 TB to 2 TB
- Virtual machine limit remains at 1TB
- If exploiting, ensure
  - Sufficient dump space
  - Sufficient paging space
- Even if not increasing memory used, a good time to double check space guidelines

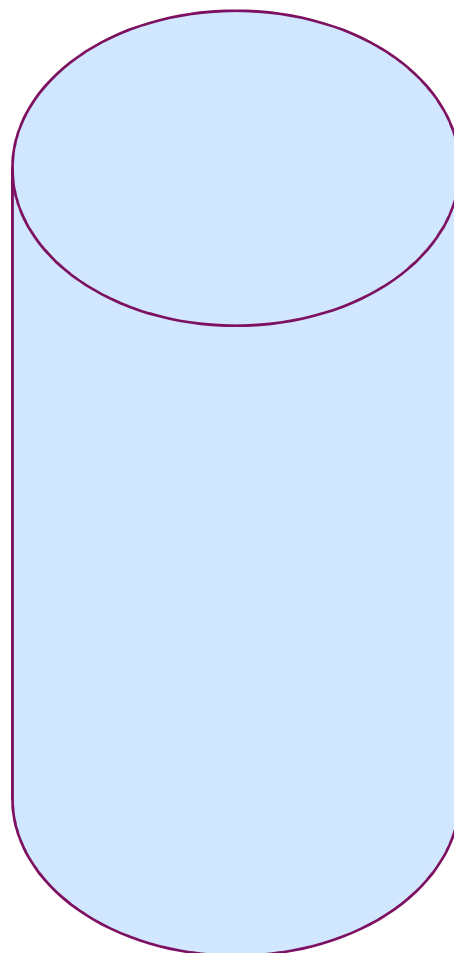
## Guest Large Page

- z/VM 6.4 adds guest support for Enhanced DAT, providing 1 MB pages for guest.
  - Continue to be managed as 4 KB pages at the z/VM host level
  - Reduces memory requirements for guest
- To use this from Linux:
  - Build a kernel containing large page exploitation (this is the default build)
  - Add hugepages=<n> kernel parameter (number of large pages to be allocated at boot time)
  - If desired, set sysctl variable to enable allocating large pages from moveable memory

## KEEPSLOT - Background



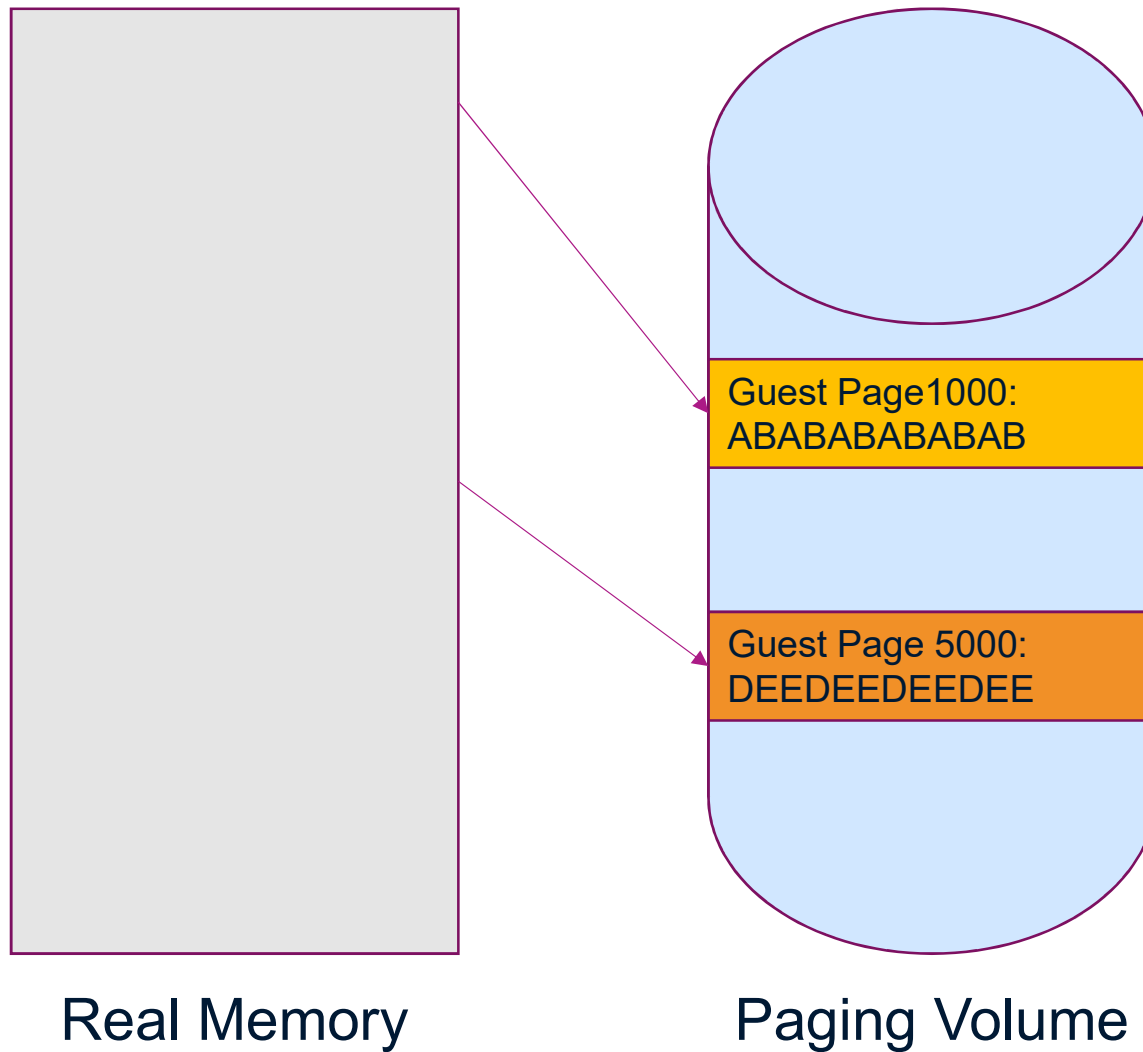
Real Memory



Paging Volume

z/VM determines  
it needs to page  
out Guest Pages  
1000 and 5000

## KEEPSLOT - Background

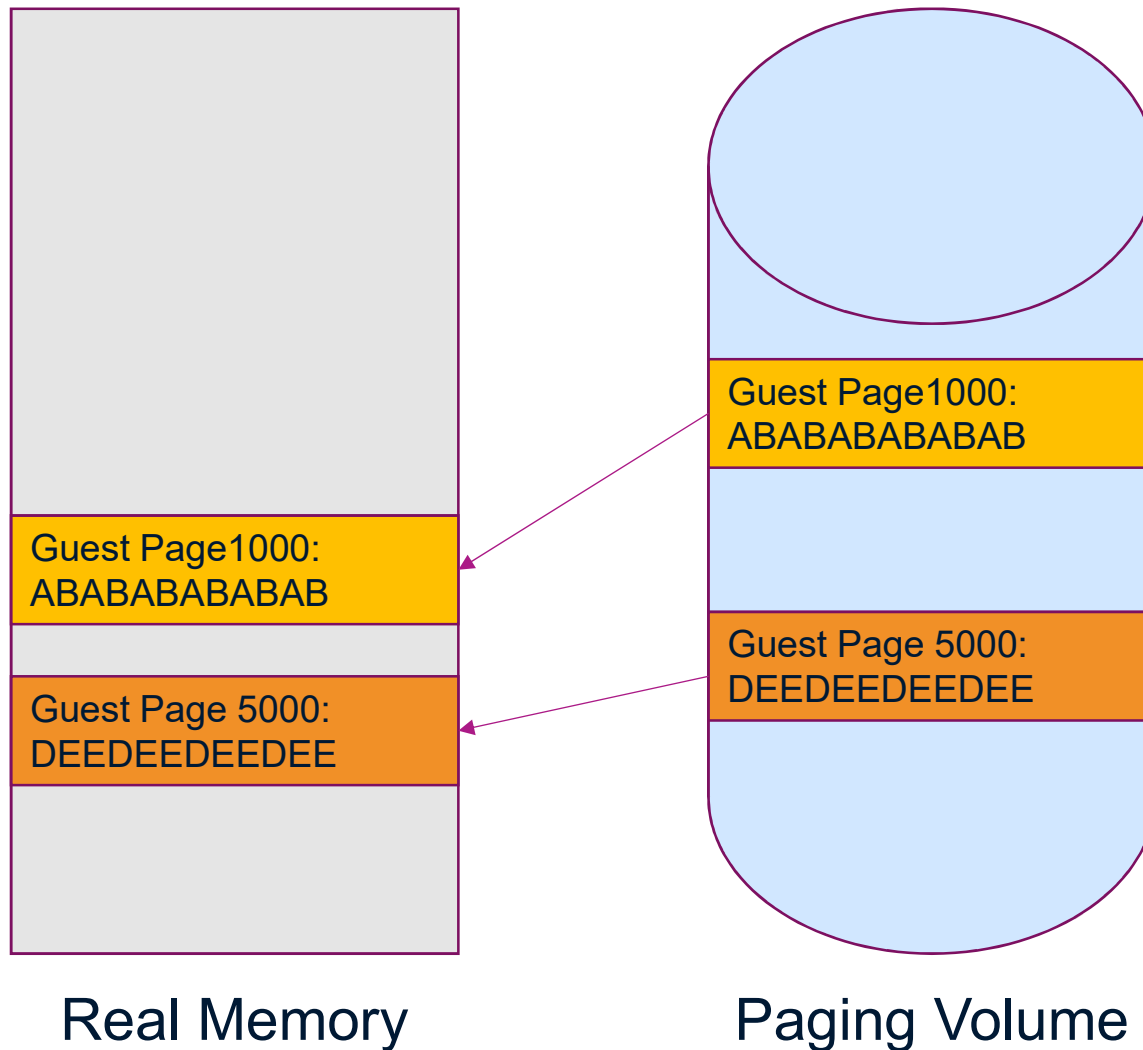


z/VM will select slots on a paging volume and write out the page.

(Actually it writes out a “set” of pages with this I/O).



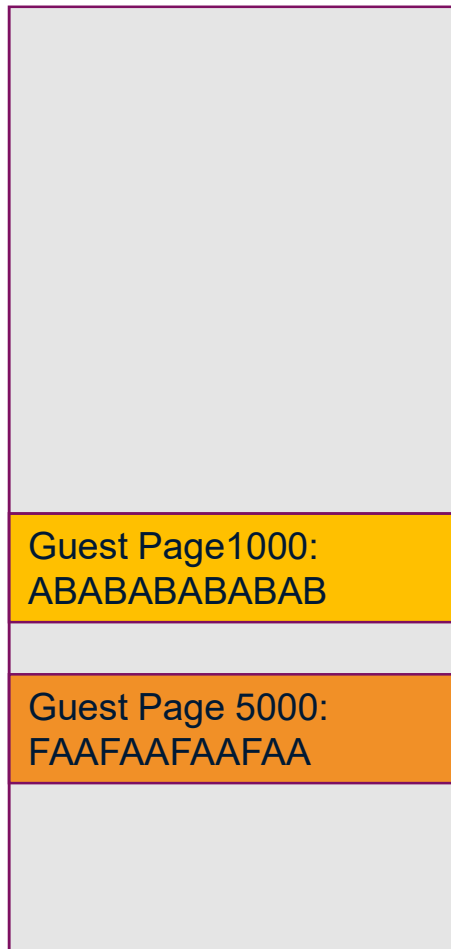
## KEEPSLOT - Background



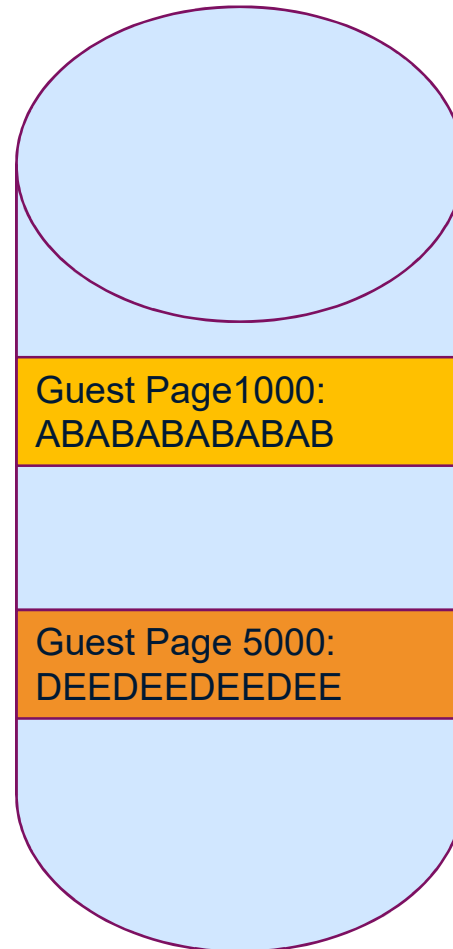
At some future time, the guest may reference the page that was paged out and z/VM page it back into real memory. But we leave the page in the disk slot as well.

This means we actually have two copies of the guest pages at this time.

## KEEPSLOT - Background



Real Memory

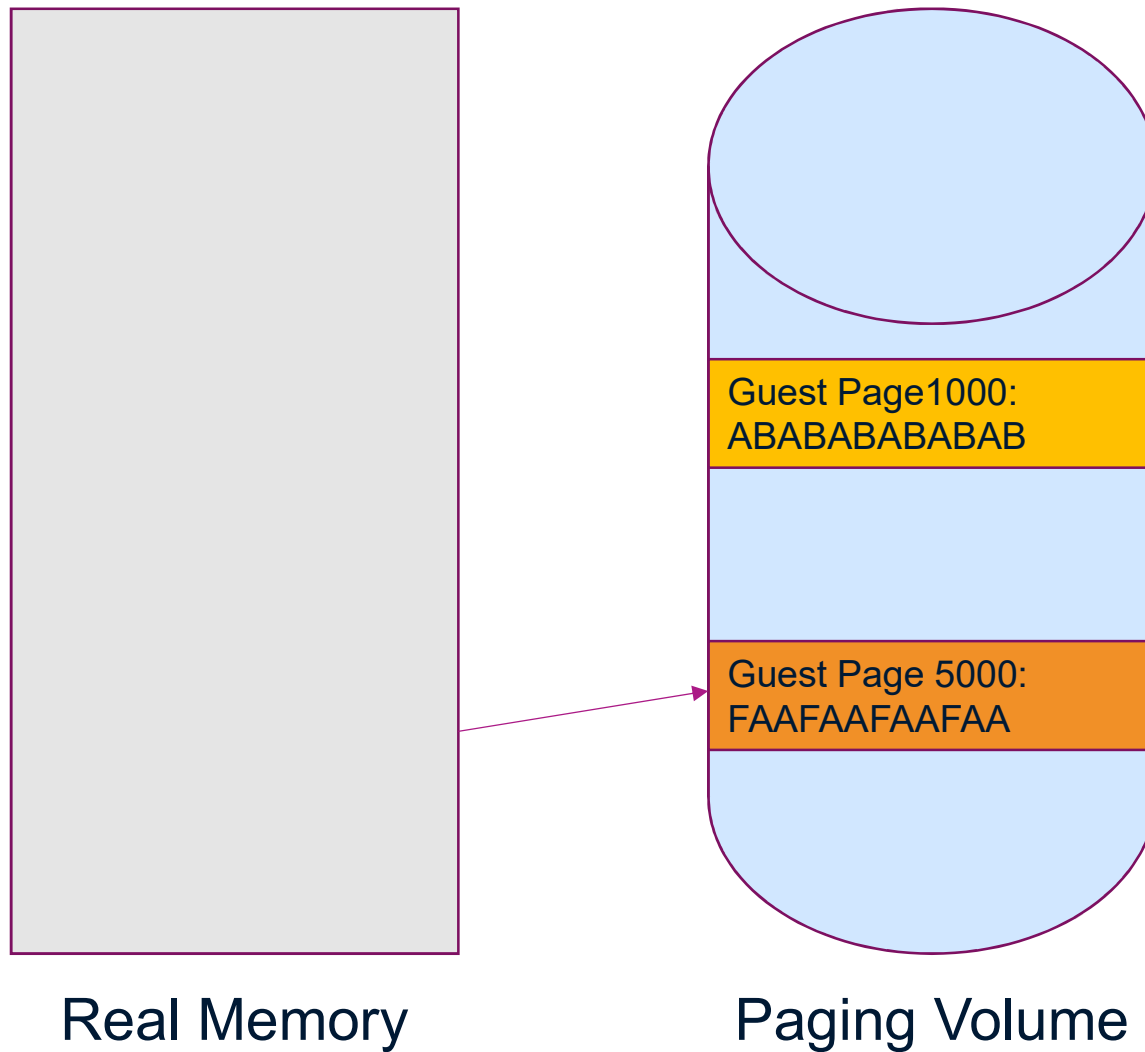


Paging Volume

Over time, lets assume that Page 5000 is changed.

Now the copy on disk doesn't match what's in memory.

## KEEPSLOT - Background



When we have to steal frames again, we do not need to write out page 1000 because that has not changed.

Page 5000 will be re-written because it changed since it was paged in.

# KEEPSLOT

- z/VM does not remove guest pages from disk when they are paged in (*"keeps the slots"*)
  - Avoids the need to re-write pages that have not changed
- Downside - this can result in larger paging space requirements
  - Especially after z/VM 6.3, where early writes were introduced
- z/VM 6.4 introduces a new **AGELIST** option to disable this
  - For environments where the overcommit level is low and large amounts of real memory are being used, you will want to consider disabling early writes and keeping disk slots
    - Command  
**SET AGELIST EARLYWRITES NO KEEPSLOT NO**
    - System configuration file:  
**STORAGE AGELIST EARLYWRITES NO KEEPSLOT NO**

## Paging Use of HyperPAV

- Applies to paging I/O to ECKD volumes on storage servers that support HyperPAV
  - Allows a pool of alias volumes to be associated with base volumes, allowing z/VM to start more than one I/O at a time.
- On existing systems check for queuing on z/VM paging volumes
  - Performance Toolkit FCX109 DEVICE CPOWN report
  - Page queues not reflected on the FCX108 DEVICE report
- On existing systems check for impact to virtual machines of queuing
  - Performance Toolkit FCX114 User State Sampling report shows page wait in %PGW and %PGA columns
- Set up HyperPAV paging
  - Recommend enabling via command and if no surprises, update system configuration file
    - Command: **SET PAGING ALIAS ON**
    - Configuration file: **FEATURES ENABLE PAGING\_ALIAS**
  - Can also be controlled at control unit level

## Paging Use of HyperPAV

- Recommend using a single logical control unit (LCU) for paging and other z/VM system volumes
- If you mix user volumes and paging volumes that exploit HyperPAV in the same LCU there can be contention
- Controls added to help influence bias for alias use between minidisk and paging usage
  - Configuration file:  
**CU HYPERPAV *ssid* ALIAS MDISK\_SHARE *nnnnn* PAGING\_SHARE *nnnnn***
  - Command:  
**SET CU ALIAS MDISK\_SHARE *nnnnn* PAGING\_SHARE *nnnnn* *ssid***
- Exploitation of HyperPAV makes use of larger paging volumes more feasible
- Still recommend having at least as many paging volumes as you have logical processors for the z/VM system

## Paging Use of High Performance FICON (zHPF)

- z/VM 6.4 introduced use of zHPF, transport mode, for z/VM system I/O (paging) for ECKD devices on storage servers that support zHPF
  
- Set up paging with zHPF
  - Recommend enabling via command and if no surprises, update system configuration file
    - Command: **SET PAGING HPF ON**
    - Configuration file: **FEATURES ENABLE PAGING\_HP**

## Dynamic SMT

- z/VM 6.4 allows one to dynamically change the number of active threads per core when SMT has been enabled in the system configuration file.
- Requires z14, z13, z13s, LinuxONE Emperor or LinuxONE Rockhopper
- Decide if more than 32 cores are required, if so cannot use SMT even with one active thread per core
- System configuration file statement enables SMT-1 (1 thread per core)

### MULTITHREADING ENABLE TYPE ALL 1

- Once z/VM has started, toggle between 1 and 2 threads via CP command:

### SET MT TYPE ALL 2

- May take a few seconds to transition.



## Dynamic SMT

- With SMT-1, the real processor addresses will all be even, skipping the 2<sup>nd</sup> processor that would be shown with SMT-2
  - SMT-1

```
Query processor
PROCESSOR 00 MASTER IFL
PROCESSOR 02 ALTERNATE IFL
PROCESSOR 04 ALTERNATE IFL
```

– SMT-2

```
Query processor
PROCESSOR 00 MASTER IFL
PROCESSOR 01 ALTERNATE IFL
PROCESSOR 02 ALTERNATE IFL
PROCESSOR 03 ALTERNATE IFL
PROCESSOR 04 ALTERNATE IFL
PROCESSOR 05 ALTERNATE IFL
```

# Live Guest Relocation

- Live Guest Relocation (LGR) supports relocation domains
  - Which allows for relocation across SSI cluster members which do not have identical configurations/capabilities.
  
- z/VM 6.4 introduces two additional scenarios where architectures, from the guest perspective, may appear incompatible when the cluster includes z/VM 6.4 and 6.3 systems:
  - Enhanced DAT (large page)
  - Transactional Execution Facility
  
- If guests are in relocation domains that span members with z/VM 6.4 and older z/VM releases, realize the guests will not see the new capabilities.
  - **SET VMRELOCATE USER** *userid* **DOMAIN** *ssi\_member\_name*

## CP Environment Variables

- z/VM 6.4 introduces a framework to handle meta data
  - Limit of 1000 variables
  - Variables starting with 'CP.' are reserved for IBM use
- System programmers with class B privilege can set variables
  - Additionally, one can be passed in via IPLPARMS on the SAPL screen
    - IPLVAR=variable on SAPL screen
    - CP.IPLPARMS.IPLVAR is the environment variable
  - Command or system configuration file statement:

**SET VARIABLE SYSTEM *name string***

- Read the fields via query command from any class G virtual machine:

**QUERY VARIABLE ALL**  
**QUERY VARIABLE NAME *variable\_name***

# Setting the IPLVAR Environment Variable

STAND ALONE PROGRAM LOADER: z/VM VERSION 6 RELEASE 4.0

DEVICE NUMBER: 018B MINIDISK OFFSET: 35 EXTENT: -

MODULE NAME: CPLOAD LOAD ORIGIN: 2000

-----IPL PARAMETERS-----

cons=0080 iplvar=PRODUCTION

-----COMMENTS-----

9= FILELIST 10= LOAD 11= TOGGLE EXTENT/OFFSET

iplvar=PRODUCTION

cp.iplparms.iplvar ← PRODUCTION

## Query CP Service

- Very simple **QUERY CPSERVICE**
  - Options to limit output to local mods, PTFs, APARs
  - Option to ask for a particular update
  - Wildcards with '\*'
- Shows service for the CPLOAD module that is currently running.
  - Does not show service for standalone utilities and other CP parts
- May want to use with CMS Pipelines if you use the default "ALL" option
  - **PIPE CP QUERY SERVICE | > cpservice output a**
- Checking for a specific APAR

**QUERY CPSERVICE APAR VM65371**

APAR	PTF
VM65371	UM34046

## Orderly Shut Down of Guests

- Guests can be enabled to receive a signal to shut down
  - For Linux guests, put the following in the *etc/inittab* file:

```
# z/VM or LPAR is shutting down
ca:12345:ctrlaltdel:/sbin/shutdown -h now
```

(make sure you issue **-h** instead of **-r**)

- Specify time interval allowed for guests that receive the signal to shut themselves down
  - In your system configuration file:

```
Set ,
Signal ShutdownTime 500,
ShutdownTime 30 /* amount of time reserved for z/VM shutdown
```

- Can also be set or changed with **SET SIGNAL** and **SET SHUTDOWNTIME** commands
- z/VM does not shut down until either:
  - All signaled guests indicate that they have shut down
  - The specified time interval expires

# Shutdown Enhancements

- New **QUERY SHUTDOWN** command
  - Provides information about shutdown time and status of a pending shutdown
  - Class G guests and service virtual machines can obtain shutdown status information
  - Can help automate an orderly shutdown of the z/VM system and guests

```
query shutdown
System shutdown time: 30 seconds; previous shutdown duration: 9 seconds
SHUTDOWN initiated at 2017-02-27 14:58:33 by MAINT
Signaled users have 490 seconds left to shut down
```

- **SHUTDOWN** sends a message to the operator console when shutdown is started or cancelled

```
HCPSHU2116I SHUTDOWN issued at 2017-02-27 14:43:54 by MAINT
```

- **SIGNAL SHUTDOWN ALL** or **SIGNAL SHUTDOWN <userid>** sends a message to the operator console

```
HCPSIG2118I SIGNAL SHUTDOWN ALL issued at 2017-02-27 14:51:50 by MAINT
```

- **FORCE** sends a message to the operator console when the forced-off user is enabled for signals

```
HCP2118I Shutdown signal sent to USER1 because a FORCE was issued at
2017-02-27 15:05:40 by MAINT
```

## IBM Tape Manager for z/VM

- Tape Manager for z/VM V1.3 supports z/VM 6.4
- In shared catalog environment that mixes z/VM 6.3 and z/VM 6.4
  - Communications error possible
  - Apply PTF UI45318 for Tape Manager V1.3
    - APAR PI77465 fixes the problem with Pipelines stage conflicts



## How do you know what to expect in z/VM 6.4?

- New VMREVIEW utility on z/VM download page
  - Run on existing z/VM 5.4, 6.1, 6.2, or 6.3 systems
  - Will highlight:
    - Things that should be changed prior to going to z/VM 6.4
    - Value that could be gained by going to z/VM 6.4
    - Other interesting things in regard to this environment being on z/VM 6.4
  - Envision this being a work in progress
    - Interested in feedback for other things it should do
- Started as an extra project by some of the newer members of the z/VM team
- <http://www.vm.ibm.com/perf/tips/vmreview.html>

# VMREVIEW Output

```

C - GDLMV7 - [40 x 132]
File Edit View Communication Actions Window Help

***** Lines 1 - 35 of 61 Columns 1 - 129 of 132 *****
*          VMREVIEW Version 1.0          *
*                                         *
*          (c) Copyright International Business Machines Corporation      *
*          2016. All Rights Reserved.                                         *
*                                         *
*          This is a migration check of what could affect you by moving to 6.4.0 *
*****

This check performed on: 4 Jan 2017 at 15:08:07 by BITNER @ GDLMV7
System Level: 6.4.0
Output file will be: VMREVIEW LISTING A

For more information on the changes in 6.4.0 and resources to aid in
migration go to: http://www.vm.ibm.com/perf/tips/vmreview.html

No XSTORE found. This is going away in 6.4.0

Most of your virtual machines are not staying in the dispatch list.

Total:      0340
Dispatched: 0032
Percent:    0.09%

In 6.4.0 there are scheduler changes to include share settings of all
virtual machines.

It appears you have no active users on the Eligible list. The Eligible
list is going away in 6.4.0

It appears you have a lot of small volumes for paging:

-----
Press PF7 to scroll up and PF8 to scroll down.
Any other PFkey will exit

====>
15:11:39                                     Enter a command or press a PF or PA ke

M0 C 39/008
Connected to remote server/host GDLMV7.endicott.ibm.com using port 23

```

# VMREVIEW highlights considerations

```
C - GDLMV7 - [40 x 132]
File Edit View Communication Actions Window Help

It appears you have a lot of small volumes for paging:
  2722, 2721, 2720, 271F, 271E, 271D, 271C, 271B, 271A, 2719, 2718,
  2717, 2716, 2715, 2714, 2713, 2712, 2711, 2710, 270F, 270E, 270D,
  270C, 270B, 270A, 2709, 2708, 2707, 2706, 2705, 2704, 2703, 2702,
  2701, 2700, are all less than 18000
Lines 35 - 61 of 61
Columns 1 - 129 of 132

With HyperPAV support for paging which is added in 6.4.0 you will not need so many small paging volumes

It does not appear that you have SCSI EDEVS. In 6.4.0 there are new SCSI
Management Queries.

It appears you are not currently using tapes. Just as a note:
In 6.4.0 tapes can no longer be used for installation and service.

Your machine is capable of multi-threading yet it appears to
be disabled.
6.4.0 supports dynamic SMT. You should consider enabling it.

It appears you have at least one VSwitch. A new feature of 6.4.0 is the
addition of a reset_counters function.

Your system currently has 40G of storage configured.
Please be aware that 6.4.0 increases the storage limit to 2TB.

-----
Press PF7 to scroll up and PF8 to scroll down.
Any other PFkey will exit

====>
15:13:02
Enter a command or press a PF or PA key

MÁ C 39/008
```

# Summary

## Summary - Checklist

- Before you go to z/VM 6.4
  - ☐ Check service for z/VM Upgrade in Place if you plan to use it
  - ☐ Check for formation of eligible list
  - ☐ If planning to use additional memory, plan for additional dump and paging space
  - ☐ Acquire a z196, z114 or newer machine
  - ☐ Check for queues on paging devices
  - ☐ Download and run VMREVIEW utility
  - ☐ Validate RACF DB before and after uplevel
  - ☐ Collect Monwrite performance data
- When you bring up z/VM 6.4
  - ☐ Configure expanded storage as central storage
  - ☐ To prepare for Dynamic SMT, enable multithreading with 1 thread per core
  - ☐ Check Relocation Domain considerations
  - ☐ Collect Monwrite performance data
- To exploit capabilities with z/VM 6.4
  - ☐ Ensure guest configured to use large page as appropriate
  - ☐ If memory rich, consider using KEEPSLOT
  - ☐ Enable HyperPAV for paging if appropriate
  - ☐ Enable zHPF for paging
  - ☐ Investigate uses for environment variables
  - ☐ Collect Monwrite performance data