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

<table>
<thead>
<tr>
<th>z/VM Level</th>
<th>GA</th>
<th>End of Service</th>
<th>End of Marketing</th>
<th>Minimum Processor Level</th>
<th>Maximum Processor Level</th>
<th>Security Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.4</td>
<td>11/2016</td>
<td></td>
<td></td>
<td>IBM System z196 &amp; z114®</td>
<td>-</td>
<td>Statement of Direction</td>
</tr>
<tr>
<td>5.4</td>
<td>9/2008</td>
<td>12/2017[3]</td>
<td>3/2012</td>
<td>IBM eServer zSeries 800&amp; 900</td>
<td>zEC12</td>
<td>-</td>
</tr>
</tbody>
</table>

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

- Following z Systems servers:
  - z13
  - z13s
  - LinuxONE Emperor
  - 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 31st, 2017
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)

- Installing to almost full pack minidisks (n-1 cylinders) not possible
  - 3390 mod-3 minimum install size changed to 3339 cylinders from 3338
  - 3390 mod-9 minimum install size changed to 10017 cylinders from 10016
    - IBM may be able to change mod-9 back to 10016 at a later time.
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 factored into the normalization, not just virtual machines in the dispatch and eligible lists.
Surplus Share Distribution: Background

- Shares are relative to other users 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

<table>
<thead>
<tr>
<th>User ID</th>
<th>Share</th>
<th>Normalize</th>
<th>Correct Distribution</th>
<th>Problem Scenario</th>
<th>z/VM 6.4</th>
<th>z/VM Prior</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINUX01</td>
<td>100</td>
<td>17%</td>
<td>24.5%</td>
<td>17%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LINUX02</td>
<td>100</td>
<td>17%</td>
<td>24.5%</td>
<td>17%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LINUX03</td>
<td>200</td>
<td>33%</td>
<td>48%</td>
<td>63%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LINUX04</td>
<td>200</td>
<td>33%</td>
<td>3%</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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:
    \[
    \sum \text{relative share} \gg \sum \text{relative share disp list}
    \]

- In all releases, 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 FCPDEVICE 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

```plaintext
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 000C01D 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 7FFF CHAR

- **Begin: Characteristics Data for device 7FFF**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Number</td>
<td>052a62e2052a-0000002a-00002c</td>
</tr>
<tr>
<td>Standard Inquiry Data</td>
<td></td>
</tr>
<tr>
<td>Peripheral Qualifier/Peripheral Device Type</td>
<td>000b/00h</td>
</tr>
<tr>
<td>Vendor Identification</td>
<td>IBM</td>
</tr>
<tr>
<td>Product Identification</td>
<td>FlashSystem-9840</td>
</tr>
<tr>
<td>Product Revision Level</td>
<td>1217</td>
</tr>
<tr>
<td>Version Descriptor SAM-3</td>
<td>(no version)</td>
</tr>
<tr>
<td>Version Descriptor FC-PH-3</td>
<td>(no version)</td>
</tr>
<tr>
<td>Version Descriptor FC-AL-2</td>
<td>(no version)</td>
</tr>
<tr>
<td>Version Descriptor FCP-3</td>
<td>(no version)</td>
</tr>
<tr>
<td>Version Descriptor SPC-3</td>
<td>(no version)</td>
</tr>
<tr>
<td>Version Descriptor SBC-2</td>
<td>(no version)</td>
</tr>
</tbody>
</table>

(cont’d….)
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 19E CHAR

- **Begin:** Characteristics Data for device 19E

#### I/O Device Information

<table>
<thead>
<tr>
<th>Device type-model</th>
<th>2107-900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device manufacturer</td>
<td>IBM</td>
</tr>
<tr>
<td>Serial number (plant-seq#)</td>
<td>75-Y5811</td>
</tr>
<tr>
<td>Logical Volume Number</td>
<td>1040</td>
</tr>
</tbody>
</table>

#### Control Unit Information

<table>
<thead>
<tr>
<th>Device type-model</th>
<th>2107-932</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial number (plant-seq#)</td>
<td>75-Y5811</td>
</tr>
<tr>
<td>Logical Subsystem Number</td>
<td>10</td>
</tr>
</tbody>
</table>

#### Additional Device Information

<table>
<thead>
<tr>
<th>Device manufacturer</th>
<th>IBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device type-model</td>
<td>2107-932</td>
</tr>
<tr>
<td>Serial number (plant-seq#)</td>
<td>75-Y5810</td>
</tr>
<tr>
<td>Logical Subsystem Number</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device manufacturer</th>
<th>IBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device type-model</td>
<td>2107-900</td>
</tr>
<tr>
<td>Serial number (plant-seq#)</td>
<td>75-Y5811</td>
</tr>
<tr>
<td>Logical Subsystem Number</td>
<td>10</td>
</tr>
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</table>

(cont'd...)
## IOEXPLOR Exec – FICON Example

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

(cont'd...)

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### IOEXPLOR Exec – FICON Example

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DASD Fast Write</td>
<td>Supported</td>
</tr>
<tr>
<td>24 Byte Compatibility sense</td>
<td>Yes</td>
</tr>
<tr>
<td>Device class code</td>
<td>20</td>
</tr>
<tr>
<td>Device type code</td>
<td>24</td>
</tr>
<tr>
<td>Primary cylinders</td>
<td>500</td>
</tr>
<tr>
<td>Tracks per cylinder</td>
<td>15</td>
</tr>
<tr>
<td>Number of Sectors</td>
<td>224</td>
</tr>
<tr>
<td>Track length</td>
<td>58786</td>
</tr>
<tr>
<td>HA + R0 length</td>
<td>1428</td>
</tr>
<tr>
<td>Capacity formula</td>
<td>2</td>
</tr>
<tr>
<td>Capacity factors F1-F6</td>
<td>34 19 9 6 116 6</td>
</tr>
<tr>
<td>MDR Record ID</td>
<td>24</td>
</tr>
<tr>
<td>OBR Record ID</td>
<td>24</td>
</tr>
<tr>
<td>Storage director Type</td>
<td>1F</td>
</tr>
<tr>
<td>Read Trackset length</td>
<td>2</td>
</tr>
<tr>
<td>Max Record zero length</td>
<td>57326</td>
</tr>
</tbody>
</table>

(cont'd...)
### IOEXPLOROR Exec – FICON Example

<table>
<thead>
<tr>
<th>Storage Class</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Encrypted device</td>
<td>No</td>
</tr>
<tr>
<td>Solid State drive</td>
<td>No</td>
</tr>
<tr>
<td>Enterprise Disk</td>
<td>No</td>
</tr>
<tr>
<td>SATA Disk</td>
<td>No</td>
</tr>
<tr>
<td>Flash Storage</td>
<td>No</td>
</tr>
<tr>
<td>Tiered Storage Pool</td>
<td>No</td>
</tr>
<tr>
<td>Track Set Size</td>
<td>1</td>
</tr>
<tr>
<td>Concurrent Copy Lower</td>
<td>0F</td>
</tr>
<tr>
<td>Concurrent Copy Upper</td>
<td>7F</td>
</tr>
</tbody>
</table>

#### Generic Device / CU functions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mirrored Device</td>
<td>No</td>
</tr>
<tr>
<td>RAID Device</td>
<td>Yes</td>
</tr>
<tr>
<td>Transparent subsystem cache</td>
<td>No</td>
</tr>
<tr>
<td>Split CE/DE</td>
<td>Yes</td>
</tr>
<tr>
<td>Device capable of Mirroring</td>
<td>No</td>
</tr>
<tr>
<td>XRC Device Management enabled</td>
<td>Yes</td>
</tr>
<tr>
<td>RVA Snapshot supported</td>
<td>No</td>
</tr>
<tr>
<td>Real Control Unit code</td>
<td>00</td>
</tr>
<tr>
<td>Real Device Code</td>
<td>3C</td>
</tr>
</tbody>
</table>

-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
z/VM determines it needs to page out Guest Pages 1000 and 5000
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).
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.
Over time, let's assume that Page 5000 is changed.

Now the copy on disk doesn't match what's in memory.
When we have to steal frames again, we do not need to write out page 1000 because that has not change.

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_HPF
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 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\textsuperscript{nd} 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:

```bash
# 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:

```bash
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

VMREVIEW Output

VMREVIEW Version 1.0
(c) Copyright International Business Machines Corporation
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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 @ GDLVM7
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

Enter a command or press a PF or PA key.
VMREVIEW highlights considerations

It appears you have a lot of small volumes for paging:
2722, 2721, 2720, 271f, 271e, 271d, 271c, 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

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 SMI. 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

Enter a command or press a PF or PA key

-----
15:13:02

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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
  - 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