The Basics of Using z/VM and CMS

Or, a Day in the Life of an IBM z/VM Virtual Machine

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Agenda

- Exploring a z/VM Virtual Machine
  - What it is, and where it comes from
  - What defines it, and what it can do
  - How to log onto it

- Using CMS
  - Commands
  - CMS File System
  - XEDIT
  - Tailoring your environment

- Examples screens, "Virtual Demo" and Exercises

z/VM Control Program (CP)
Overview – Virtual Machines

- z/VM contains two basic parts:
  - CP - Control Program (the Hypervisor layer)
  - The guest running under z/VM
    - Resides in a distinct location inside the system
    - Isolated and separated from other virtual machines
Overview – Virtual Machines

- The virtual machine is:
  - A discrete object on the system, distinct from the hypervisor
  - Isolated from other guests
  - A place where workload runs
    - A guest can run workload, store data, or communicate with others
    - All a question of sysadmin policy
Overview – Virtual Machines

- **CMS: Conversational Monitor System**
  - An operating system that runs as a guest of VM
  - Provides “a place to stand while you’re configuring the hypervisor”
    - IBM-defined virtual machines with special authorities, for example
  - Can also create files, execute programs, or run workload.
## Overview – Hypervisor Parts 101

<table>
<thead>
<tr>
<th></th>
<th>z/VM</th>
<th>KVM</th>
<th>VMware</th>
<th>PowerVM</th>
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</thead>
<tbody>
<tr>
<td><strong>Hypervisor</strong></td>
<td>Control Program (CP)</td>
<td>KVM kernel</td>
<td>ESX or ESXi</td>
<td>POWER Hypervisor</td>
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<tr>
<td><strong>Interface</strong></td>
<td>CMS</td>
<td>Virsh or VMM</td>
<td>VirtualCenter</td>
<td>IVM or PowerVC</td>
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<tr>
<td><strong>Guests</strong></td>
<td>CMS, Linux, z/OS, z/VM ...</td>
<td>Linux</td>
<td>As advertised</td>
<td>As advertised</td>
</tr>
</tbody>
</table>

**Notes:**
- CMS is both an **interface to** managing z/VM and a **guest of** z/VM
- The CMS "shell" is not the only way to manage z/VM, but it is a vital one
Overview – Virtual Machines

- **Frequently Asked Question:** Is CMS the only way to control my z/VM system?
  - *Answer:* No. Software is available for the management of your systems
  - Managing is relative to your skills and scope of responsibility
  - What CMS shows is how z/VM works … no matter how you control it!
Overview – Virtual Machines

- CMS cooperates well with CP
  - Commands to exploit CP function and devices
  - Exploits virtual machine concepts
  - Commands entered in CMS can be passed directly to CP
  - Shared CMS Nucleus, DCSS (Discontiguous Saved Segment)

- Many productivity tools available
  - IBM-supplied tools
  - Vendor programs
  - REXX programming language – design your own
Where do virtual machines come from?

- How does a virtual machine come to be?

- What defines it? What can it do?

- The USER DIRECTORY is the answer for all of these
  - Maintained by the hypervisor layer
  - Defines all the virtual machines on a system
  - Controls access to minidisks
  - Controls what commands a user can issue

z/VM Control Program (CP) → CMS
Defining a Virtual Machine

Sample User Directory Entry

USER IBMUSER IBMUSER 32M 32M ABCDEG
ACCOUNT SYSTEMS
MACH ESA
IPL CMS

CONSOLE 009 3215
SPOOL 00C 2540 READER *
SPOOL 00D 2540 PUNCH A
SPOOL 00E 1403 A

LINK MAINT 0190 0190 RR * CMS system disk
LINK MAINT 019E 019E RR * Product code disk
LINK 7VMRAC20 29E 29E RR
LINK 7VMRAC20 505 305 RR
LINK 7VMRAC20 191 391 RR
MDISK 1191 3390 2078 001 72CRES MR READ WRITE MULTIPLE
MDISK 191 3390 0895 030 72CUSR MR READ WRITE MULTIPLE
Defining a Virtual Machine
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MDISK 191 3390 0895 030 72CUSR MR READ WRITE MULTIPLE
Overview – CMS

- To establish a z/VM session:

  - z/VM Logo Screen
    - One at a time - 3270 emulation (for example, PComm or x3270)
    - LOGON <userid> HERE -- move a signon to another terminal session
    - LOGON <userA> by <userB> -- signon using different credentials
Esc for 'Sys Attn'

Pause for 'Clear'

No brackets [ ] defined

Enter for 'Newline'

Ctrl for 'Enter'
x3270 Keyboard Profile

! x3270 profile
! File created Wed Mar 9 08:37:27 2011 by x3270 v3.3.10ga4 Thu May 13 10:00:03 UTC 2010 buildd
! This file overrides xrdb and .Xdefaults.
! To skip reading this file, set NOX3270PRO in the environment.
!
! emulator font (-efont)
x3270.emulatorFont: 3270-20
! model (-model)
x3270.model: 3
! oversize (-oversize)
x3270.oversize: 150x60
! Ignore prefix when pasting
x3270.marginedPaste: true
x3270.keymap: default
x3270.keymap.default: \n
<Key>Pause: PA(1)
<Key>Escape: Clear()
<Key>Insert: ToggleInsert()
<Key>Return: Enter()
<Key>Control_R: Enter()
Ctrl<Key>End: EraseEOF()
<Key>End: FieldEnd()
<Key>Home: BackTab()
Shift<Key>6: CircumNot()
Shift<Key>Prior: PF(19)
Shift<Key>Next: PF(20)
 BTN4Down: PF(7)
 BTN5Down: PF(8)
<Key>Prior: PF(7)
<Key>Next: PF(8)

#IBMz #zVM
built on IBM Virtualization Technology
IBM Washington System Center Gaithersburg, Maryland

Fill in your USERID and PASSWORD and press ENTER
(Your password will not appear when you type it)
USERID   ==> 
PASSWORD  ==> 
COMMAND   ==> 

RUNNING TOSP1B
Enter one of the following commands:

- LOGON userid (Example: LOGON VMUSER1)
- DIAL userid (Example: DIAL VMUSER2)
- MSG userid message (Example: MSG VMUSER2 GOOD MORNING)
- LOGOFF

CP READ T0SP1B
Overview – CMS Execution Modes

- Status appears at the bottom right of screen
  - CP Read (CP is waiting for a command)
  - VM Read (CMS is waiting for a command)
  - Running (Ready for cmds or working on some)
  - More... (More info than can fit on the screen)
    - 50 seconds then beep then 10 seconds
    - Determine setting: Query Term
    - Page without waiting: Term More 0 0
  - Holding (Waiting for you to clear the screen)
  - Not Accepted (Too many commands in buffer; wait for executing command to complete)
Enter one of the following commands:

LOGON userid            (Example: LOGON VMUSER1)
DIAL userid             (Example: DIAL VMUSER2)
LOGOFF
l hugen2

Enter your password,
or
To change your password, enter: ccc/nnn/nnn
   where ccc = current password, and nnn = new password

ICH70001I HUGEN2       LAST ACCESS AT 07:59:00 ON THURSDAY, JUNE 10, 2010
z/VM Version 5 Release 4.0, Service Level 1001 (64-bit).
built on IBM Virtualization Technology
There is no logmsg data
FILES: 0006 RDR,  NO PRT,  NO PUN
LOGON AT 10:03:16 EDT THURSDAY 06/17/10
z/VM V5.4.0      2010-04-07 15:56

*******************************************************************************
*    Data classified as IBM CONFIDENTIAL may be processed on this system.   *
*******************************************************************************

HOLDING GDLVM7  DOC  23/001
IBMz

z/VM Version 5 Release 4.0, service level 1001 (64-bit)
Generated at 04/14/10 15:11:35 EDT
IPL at 04/17/10 10:05:57 EDT
CMS LEVEL:
z/VM Version 5 Release 4.0
STORAGE = 32M
Adjunct Status: UNAVAILABLE
FILES: 0006 RDR, 0001 PRT, NO PUN
Ready: T=0.07/0.09 10:03:58

RUNNING

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Defining a Virtual Machine
Sample User Directory Entry

USER IBMUSER IBMUSER 32M 32M ABCDEG
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MACH ESA
IPL CMS

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Defending a Single Virtual Machine

There are seven IBM-defined Privilege Classes:

A: Commands for System Operators
B: Commands for System Resource Operators
C: Commands for System Programmers
D: Commands for Spooling Operators
E: Commands for System Analysts
F: Commands for Service Representatives
G: Commands for General CMS Users
ANY: Commands available to everyone

The capabilities of a virtual machine can therefore be defined based upon the role or roles it is expected to carry out (Role-Based Access Control). System administrators can define their own privilege classes.

- **QUERY PRIVCLASS**
  - Lists current privilege class for your virtual machine

- **QUERY COMMANDS**
  - Provides a list of all the commands to which your VM is authorized
  - **Note:** a security product may refine security policy on your VM system
Try for yourselves! (5-minute exercise)

- Change your PComm keyboard layouts to something you find useful
- LOGON <userid> /* Remember, CTRL is default Enter key */
  /* ... Until you change it, that is.   */
- QUERY PRIVCLASS /* Your security context ... */
- QUERY COMMANDS
q privclass

Privilege classes for user PIPUSR02

   Currently: GP
   Directory: GP

The privilege classes are not locked against changes.

Ready; T=0.01/0.01 14:06:05
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</table>
Defining a Virtual Machine

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Defining a Virtual Machine

Sample User Directory Entry

- CMS
- zCMS (the 64-bit version of CMS)
- Linux (often on its own separate disk)
- z/OS
- z/VSE
CMS Commands

- CMS commands control the virtual machine
  - Manipulate disks and files
  - Adjust the operating environment

- Commands are blank-delimited

- Commands are case-insensitive
  - CMS will automatically uppercase and pass to command parser

- General syntax:
  Command name [operand(s)...] [ (options.... [ ] ) ]

Examples:
- copy Profile Exec A = = C
- Rdrlist
- LISTFILE (Date
CMS Commands

- Command Search Order -- when a command is entered, CMS has to locate it
  - Search for an EXEC with the specified command name
    - EXECs in storage
    - Command name with Filetype EXEC on accessed disk or directory (A-Z)
  - Search for translation or synonym
  - Search for a module with the specified command name
    - Nucleus extension, transient area, nucleus resident, on accessed disk/directory
  - If Command not found in CMS, it will be passed to CP for execution
    - SET IMPCP (Implied CP) can enable or disable this behavior
CMS Commands and CP Commands

- CP (the hypervisor) and CMS (the guest) have their own sets of commands

- Commands can be passed directly to CP, rather than going through the CMS search order
  - Useful if CMS is "stuck" (e.g., NOT ACCEPTED)
  - `#CP <command> (options`

- `#CP IPL CMS` – restarts your entire CMS guest
  - "Reboot button" / "percussive maintenance"
  - Destroys any unsaved work
CMS Commands

- Immediate Commands
  - Can be entered while another command is running
  - Intermittently the running command and executes immediately
  - 10 system immediate commands:
    - HB, HI, HO, HT, HX, RT, RO, SO, TE, TS

  **Tip:** HX is the equivalent of ^C or ^X in other operating systems

  - Advanced users can define their own immediate commands (IMMCMD)
CMS File System

- Files are named using a file identifier (file ID) consisting of 3 fields:
  - File name (FN)
  - File type (FT)
  - File mode (FM) or Directory name (dirname) – a letter A through Z.

- Files can be stored in a few different ways:
  - On Minidisks (fn ft fm)
    - Standard file modes: A - user's disk, S - system disk
  - In an SFS (Shared File System) filespace: GPLSRV2:HUGENBRR.REXX.
  - On the BFS (Byte File System) /../home/userid/
    - hierarchical file structure
  - In NFS (Network File System)
Try for yourselves! (8-minute exercise)

- QUERY DISK                          /* Your resources ... */
- QUERY ACCESSED
- FILELIST * * A
- LISTFILE * * A
- SET FILEPOOL GPLSRV2               /* connect to an SFS */
- ACCESS GPLSRV2:HUGENBRU.NEWHIRE. D /* or another free filemode */
- FILELIST * * D                     /* see what's out there */
- QUERY AUTH .NEWHIRE                /* is this different from ... */
- QUERY AUTH GPLSRV2:HUGENBRU.NEWHIRE /* who has access? */
- LISTFILE FOREVER * *              /* and if file exists, then ... */
- EXEC FOREVER
- /* Now, break out of the EXEC ... */
- /* Question: are you in RUNNING state? If not ... */
- B
query disk

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<th>VDEV</th>
<th>M</th>
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<th>CYL</th>
<th>TYPE</th>
<th>BLKSZ</th>
<th>FILES</th>
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<th>BLKS LEFT</th>
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Ready; T=0.01/0.01 14:10:34

query accessed

Mode Stat Files Vdev      Label/Directory
A   R/W   6 DIR   VMPSFS:PIPSR02.
C   R/O   858 592 TCM592
S   R/O   704 190 MNT190
Y/S R/O   1124 19E MNT19E

Ready; T=0.01/0.01 14:10:36
Overview – CMS

- CMS supports multiple **internal** environments:

- **CMS**
  - IPL CMS or *Begin* will run **Profile Exec**
  - Linemode or Fullscreen mode

- **XEDIT Environment**
  - XEDIT *fn ft fm*,
  - Tailorable (**Profile Xedit**)  
  - CMS Subset mode

- **Extensions***
  - Open Extensions (Posix Shell & Utilities)
  - Byte File System, Network File System
  - z/OS and z/VSE simulation modes
Ready: T=0.01/0.01 10:07:41

forever
This exec will print the same line forever.
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This exec will print the same line forever.
This exec will print the same line forever.

hx

CMS
This exec will print the same line forever.

`hx
CMS
b`

Ready; T=0.01/0.01 10:08:18
Defining a Virtual Machine

Sample User Directory Entry

USER IBMUSER IBMUSER 32M 32M ABCDEG
ACCOUNT SYSTEMS
MACH ESA
IPL CMS

CONSOLE 009 3215
SPOOL 00C 2540 READER *
SPOOL 00D 2540 PUNCH A
SPOOL 00E 1403 A

LINK MAINT 0190 0190 RR * CMS system disk
LINK MAINT 019E 019E RR * Product code disk
LINK 7VMRAC20 29E 29E RR
LINK 7VMRAC20 505 305 RR
LINK 7VMRAC20 191 391 RR

MDISK 1191 3390 2078 001 72CRES MR READ WRITE MULTIPLE
MDISK 191 3390 0895 030 72CUSR MR READ WRITE MULTIPLE
Defining a Virtual Machine

Sample User Directory Entry

- Spool Devices:
  Virtualized Reader, Printer, and Punch
```
query files
FILES: 0034 RDR, NO PRT, NO PUN
Ready; T=0.01/0.01 21:12:34
query rdr all

<table>
<thead>
<tr>
<th>ORIGINID</th>
<th>FILE</th>
<th>CLASS</th>
<th>RECORDS</th>
<th>CPY</th>
<th>HOLD</th>
<th>DATE</th>
<th>TIME</th>
<th>NAME</th>
<th>TYPE</th>
<th>DIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUGENBRU</td>
<td>2615</td>
<td>A</td>
<td>000000008</td>
<td>001</td>
<td>NONE</td>
<td>02/05</td>
<td>17:31:40</td>
<td>DVHRLN</td>
<td>SRCCEXEC</td>
<td>HUGENBRU</td>
</tr>
<tr>
<td>HUGENBRU</td>
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<td>00000030</td>
<td>001</td>
<td>NONE</td>
<td>02/05</td>
<td>17:31:40</td>
<td>DVHPURGE</td>
<td>D1827DY0</td>
<td>HUGENBRU</td>
</tr>
<tr>
<td>HUGENBRU</td>
<td>2613</td>
<td>A</td>
<td>00000035</td>
<td>001</td>
<td>NONE</td>
<td>02/05</td>
<td>17:31:40</td>
<td>DVHCHADR</td>
<td>D1827DY0</td>
<td>HUGENBRU</td>
</tr>
<tr>
<td>HUGENBRU</td>
<td>2612</td>
<td>A</td>
<td>00000119</td>
<td>001</td>
<td>NONE</td>
<td>02/05</td>
<td>17:31:40</td>
<td>DVHCHGID</td>
<td>D1827DY0</td>
<td>HUGENBRU</td>
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<tr>
<td>HUGENBRU</td>
<td>2611</td>
<td>A</td>
<td>00000008</td>
<td>001</td>
<td>NONE</td>
<td>02/05</td>
<td>17:31:40</td>
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<td>SRCCREXX</td>
<td>HUGENBRU</td>
</tr>
<tr>
<td>HUGENBRU</td>
<td>2610</td>
<td>A</td>
<td>00000020</td>
<td>001</td>
<td>NONE</td>
<td>02/05</td>
<td>17:31:40</td>
<td>DVHBLDDP</td>
<td>D1827DY0</td>
<td>HUGENBRU</td>
</tr>
<tr>
<td>HUGENBRU</td>
<td>2609</td>
<td>A</td>
<td>00000062</td>
<td>001</td>
<td>NONE</td>
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<td>17:31:40</td>
<td>DVHLINK</td>
<td>D1827DY0</td>
<td>HUGENBRU</td>
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<tr>
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<td>2606</td>
<td>A</td>
<td>00000586</td>
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<td>NONE</td>
<td>02/05</td>
<td>17:31:40</td>
<td>DVHRLN</td>
<td>$EXEC</td>
<td>HUGENBRU</td>
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<tr>
<td>HUGENBRU</td>
<td>2605</td>
<td>A</td>
<td>00000312</td>
<td>001</td>
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<td>02/05</td>
<td>17:31:40</td>
<td>DVHGETMD</td>
<td>$REXX</td>
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<tr>
<td>HUGEN2</td>
<td>0115</td>
<td>T</td>
<td>00000027</td>
<td>001</td>
<td>NONE</td>
<td>06/04</td>
<td>08:16:28</td>
<td>HUGEN2</td>
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<td></td>
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<tr>
<td>HUGEN2</td>
<td>0103</td>
<td>T</td>
<td>00000027</td>
<td>001</td>
<td>NONE</td>
<td>03/05</td>
<td>09:24:31</td>
<td>HUGEN2</td>
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<td></td>
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<tr>
<td>HUGEN2</td>
<td>0242</td>
<td>T</td>
<td>00000143</td>
<td>001</td>
<td>NONE</td>
<td>05/06</td>
<td>14:01:45</td>
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<td></td>
</tr>
<tr>
<td>HUGENBRU</td>
<td>2608</td>
<td>A</td>
<td>00000183</td>
<td>001</td>
<td>NONE</td>
<td>02/05</td>
<td>17:31:40</td>
<td>DVHRLN</td>
<td>EXEC</td>
<td>HUGENBRU</td>
</tr>
<tr>
<td>HUGEN2</td>
<td>0104</td>
<td>T</td>
<td>00000176</td>
<td>001</td>
<td>NONE</td>
<td>03/21</td>
<td>09:22:35</td>
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<td></td>
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<td>DIRMAINT</td>
<td>0112</td>
<td>A</td>
<td>00000031</td>
<td>001</td>
<td>NONE</td>
<td>04/19</td>
<td>16:24:11</td>
<td>HUGEN2</td>
<td>DIRECT</td>
<td>REVIEW</td>
</tr>
<tr>
<td>HUGEN2</td>
<td>0220</td>
<td>T</td>
<td>00000045</td>
<td>001</td>
<td>NONE</td>
<td>06/10</td>
<td>08:28:28</td>
<td>HUGEN2</td>
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<tr>
<td>HUGENBRU</td>
<td>2391</td>
<td>A</td>
<td>00000607</td>
<td>001</td>
<td>NONE</td>
<td>10/17</td>
<td>14:40:51</td>
<td>QKDAR</td>
<td>LIST3270</td>
<td>HUGENBRU</td>
</tr>
</tbody>
</table>
```

MORE... GDLVM7
<table>
<thead>
<tr>
<th>Filename</th>
<th>Filetype</th>
<th>Class</th>
<th>User at Node</th>
<th>Hold</th>
<th>Records</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIRMAINT NEWMAIL</td>
<td>PUN</td>
<td>A HUGENBRU GDLVME</td>
<td>NONE</td>
<td>149</td>
<td>12/22</td>
<td>7:54:04</td>
<td></td>
</tr>
<tr>
<td>CLASVM2 NOTE</td>
<td>PUN</td>
<td>A CLASVM2 GDLVME</td>
<td>NONE</td>
<td>19</td>
<td>7/25</td>
<td>13:34:14</td>
<td></td>
</tr>
<tr>
<td>RETAIN CONLOG</td>
<td>CON</td>
<td>A PSFRET3 GDLVME</td>
<td>NONE</td>
<td>5</td>
<td>7/24</td>
<td>15:34:07</td>
<td></td>
</tr>
<tr>
<td>RETAIN CONLOG</td>
<td>CON</td>
<td>A PSFRET3 GDLVME</td>
<td>NONE</td>
<td>5</td>
<td>7/24</td>
<td>16:25:07</td>
<td></td>
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<tr>
<td>UIDSER 875996</td>
<td>PUN</td>
<td>A CLASRPT2 PKEDVM9</td>
<td>NONE</td>
<td>128</td>
<td>1/12</td>
<td>13:45:53</td>
<td></td>
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<tr>
<td>MDSER 875996</td>
<td>PUN</td>
<td>A CLASRPT2 PKEDVM9</td>
<td>NONE</td>
<td>117</td>
<td>1/12</td>
<td>13:47:20</td>
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<tr>
<td>HUGENBRU NOTIFY</td>
<td>PUN</td>
<td>A RACFVM GDLVME</td>
<td>NONE</td>
<td>9</td>
<td>2/02</td>
<td>5:41:24</td>
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<td>PI29130C PACKLIB</td>
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<td>A PBCHART GDLVME</td>
<td>NONE</td>
<td>33140</td>
<td>11/24</td>
<td>21:21:00</td>
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<tr>
<td>PI31202 INSPECT</td>
<td>PRT</td>
<td>A HUGENBRU GDLVME</td>
<td>NONE</td>
<td>1569</td>
<td>2/12</td>
<td>10:16:47</td>
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</tr>
<tr>
<td>PI31200 INSPECT</td>
<td>PRT</td>
<td>A HUGENBRU GDLVME</td>
<td>NONE</td>
<td>2895</td>
<td>2/12</td>
<td>10:23:52</td>
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</tr>
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<td>VM65580 INSPECT</td>
<td>PRT</td>
<td>A HUGENBRU GDLVME</td>
<td>NONE</td>
<td>16827</td>
<td>2/12</td>
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</tr>
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<td>PI31200 INSPECT</td>
<td>PRT</td>
<td>A HUGENBRU GDLVME</td>
<td>NONE</td>
<td>5953</td>
<td>2/13</td>
<td>16:41:33</td>
<td></td>
</tr>
</tbody>
</table>

1= Help  2= Refresh  3= Quit  4= Sort(type)  5= Sort(date)  6= Sort(user)  7= Backward  8= Forward  9= Receive  10=  11= Peek  12= Cursor
Defining a Virtual Machine
Sample User Directory Entry

USER IBMUSER IBMUSER 32M 32M ABCDEG
ACCOUNT SYSTEMS
MACH ESA
IPL CMS

CONSOLE 009 3215
SPOOL 00C 2540 READER *
SPOOL 00D 2540 PUNCH A
SPOOL 00E 1403 A

LINK MAINT 0190 0190 RR * CMS system disk
LINK MAINT 019E 019E RR * Product code disk
LINK 7VMRAC20 29E 29E RR
LINK 7VMRAC20 505 305 RR
LINK 7VMRAC20 191 391 RR
MDISK 1191 3390 2078 001 72CRES MR READ WRITE MULTIPLE
MDISK 191 3390 0895 030 72CUSR MR READ WRITE MULTIPLE
Our CMS guest is running under z/VM
The z/VM Control Program connects this minidisk to the guest at Address 191
191 is Accessed inside the guest at Filemode “A”
More About Minidisks

- A location on real DASD which has been allocated for storage of a user's files
- Three (3) types of minidisks:
  - **Permanent**
    - lasts across sessions (logons); defined in the User Directory
  - **Temporary** (T-disks)
    - Created inside a z/VM session
    - Destroyed at logoff!
    - use CP DEFINE command or ATTACH by operator
  - **Virtual disks in storage** (V-disks)
    - Temporary *simulation* of a minidisks in system storage
      - not allocated on real DASD (for example, on 3390 DASD)
    - Avoids I/O overhead
    - Good swap space for Linux guests
More About Minidisks – Commands

- CP DEFINE and FORMAT
  - Defines a virtual device or virtual disk in storage
    -- DEFINE T3390 as 815 cyl 10
  - Minidisks must be formatted before first time using!
    -- FORMAT 815 D

- CP LINK, CMS ACCESS
  - Link to other user's minidisks to share files
    -- LINK HUGENBRU 191 391 rr
  - Once linked, a disk can be accessed
    -- ACCESS 391 C
More About Minidisks – Commands

- **RELEASE, CP DETACH**
  - Release frees an accessed disk
    - -- Release C
  - Detach removes the device from your VM configuration
    - -- Detach 815 -OR- Release c (detach)

- **CP QUERY VIRTUAL DASD**
  - Shows what your machine has linked; displays status

- **Q ACCESSED, Q DISK, Q SEARCH**
  - Shows various status information for accessed disks/directories

- **LISTFILE, FILELIST**
  - Lists the files on an accessed minidisk or directory
define t3390 as 815 cyl 10
DASD 0815 DEFINED
Ready; T=0.01/0.01 14:36:40
format 815 d
DMSFOR603R FORMAT will erase all files on disk D(815). Do you wish to continue?
Enter 1 (YES) or 0 (NO).
1
DMSFOR605R Enter disk label:
PIP815
DMSFOR733I Formatting disk D
DMSFOR732I 10 cylinders formatted on D(815)
Ready; T=0.01/0.01 14:36:51
q disk
LABEL VDEV M STAT CYL TYPE BLKSZ FILES BLKS USED-% BLKS LEFT BLK TOTAL
- DIR A R/W - - 4096 6 - -
TCM592 592 C R/D 140 3390 4096 858 11818-47 13382 25200
PIP815 815 D R/W 10 3390 4096 0 7-00 1793 1800
MNT190 190 S R/D 207 3390 4096 704 18095-49 19165 37260
MNT19E 19E Y/S R/O 500 3390 4096 1124 30404-34 59596 90000
Ready; T=0.01/0.01 14:36:55

RUNNING TOSP1B
Developing Programs in a z/VM Environment

Creating and Compiling

- Filetype indicates name of programming language you are using
  - Assemble, Fortran, C, Cobol, PLI, Pascal, Rexx, etc.

- Invoke the compiler by typing compiler name followed by File name of the program

- LISTING and TEXT files are produced
  
  command: ASSEMBLE ASM1

  result: ASM1 LISTING
  ASM1 TEXT

- Use XEDIT to create the program like any other file
Developing Programs with XEDIT

- Command: `Xedit fn ft fm` TEST FILE A1 F 80 Trunc=80 Size=45 Line=0 Col=1 Alt=0
- Each line is a record
- Screen Layout:

```
===== * * * Top of File * * *
|...+.....1....+....2....+....3....+....4....+....5....+....6....+....7...
===== one
===== two
===== three
===== four
===== five
===== six
===== seven
===== eight
===== nine
===== ten
====>
```

`XEDIT 1 File`
Developing Programs with XEDIT

- Prefix Commands (subset)
  - m, mm..mm move, block move
  - c, cc..cc copy, block copy
  - f following
  - p preceding
  - a add
  - si sequential insert
  - d, dd..dd delete, block delete
  - "","" "" repeat previous command
Developing Programs with XEDIT

- Command-line commands
  - screen format
  - change /xxx/yyy/ * *
  - /zzz/ (find zzz in text)
  - all /zzz/ (find all zzz at once)

- Write your own XEDIT commands
  - Name: yourcmdn XEDIT
  - Write using REXX
  - Can use Pipelines

- Saving and Quitting your XEDIT Session
  - QQuit  - leave without saving changes
  - SAVE   - saves changes without exiting program
  - FILE   - leave and save changes
Developing Programs with XEDIT

- PROFILE XEDIT runs when XEDIT is invoked
- Sample: PROFILE XEDIT

```
/* PROFILE XEDIT */
'SET VERIFY OFF 1 72'
'SET NUMBER ON'
'SET PREFIX NULL'
'SET CASE MIXED IGNORE'
'SET CURLINE ON 4'
'SET SCALE OFF'
'SET AUTOSAVE 1'
```

- Note: Xedit is very tailorable!
Developing Programs with XEDIT

Current Line
Prefix Area
Command Line
Data Area
No Scale
Developing Programs with XEDIT – Synonyms

- ISPF prefixes - PROFILE XEDIT

/* to mimic ISPF */

'SET PREFIX SYNONYM B P '
'SET PREFIX SYNONYM A F '
'SET PREFIX SYNONYM R " '
'SET PREFIX SYNONYM RR "" '
A Note on Programming in Rexx

- Scripting language useful for writing productivity tools
  - Available on z/OS, Linux, Unix, Windows …

- Quick notes on REXX:
  - /* always starts with a comment */
  - Filetypes: EXEC (most common), EXEC2, REXX
  - Contains Variables and Stemmed Arrays
    - Stores Strings and Numbers as strings
  - Has 'flow control'
    - do and do…while
    - If…then, else, select
  - Allows Functions and Procedures
  - Allows for Pipelines
  - Issues CP/CMS commands (in quotes)
A Note on Programming in Rexx

- **PROFILE EXEC** runs when you sign on

- Contains all the tailoring and configuration desired for this virtual machine

- Can also issue commands at start-up
Try for yourselves! (5-minute exercise)

- LISTFILE PROFILE EXEC *
- XEDIT PROFILE EXEC A
PROFILE EXEC A2 V 130 Trunc=130 Size=33 Line=5 Col=1 Alt=2

0 ** Top of File **
1 /* profile exec for Brian's personal ID */
2
3 Signal on NOVALUE
4
5 'SYNONYM HUGENDRO SYNONYM A'
6
7 'EXEC VDISK' /* grab a V-disk */
8 'EXEC PFSET' /* SET PF keys. On my A-disk */
9 'EXEC PROJECT' /* prompt for today's work */
10
11 'CP SP PRF TD *
12 'CP SET LINEDIT ON'
13 'CP SET RETRIEVE MAX'
14 'CP TERM HILIGHT ON'
15
16 /* Set Brian's Ready message - Use DMSUME EXEC to change it */
17 'SET RDMSG LMSG'
18 'SET LANG AMENG ( ADD DMS USER '
19
20 'CP SET EMSG ON'
21 /* 'BATCH ADDRESS SQV BATCH GDLVM7' */
22 'globalv init'
23
24 /* colors */
25 'CP SCREEN CPOUT WHITE '
26 'CP SCREEN VMOUT BLUE'
27 'CP SCREEN INREDISP YELLOW'
28 'CP SCREEN STATAREA RED '
29
30 'CP QUERY CLEVEL'
31 'CP QUERY V STOR'
32 'CP QUERY FILES'
33 Exit
34 ** End of File **
```
0   *** Top of File ***
1  /* creates a tdisk */
2
3  'DEFINE T3390 AS 0292 CYL 1'
4
5  queue '1'
6  queue 'BWHDSK'
7  'FORMAT 0292 D'
8  *** End of File ***
```
Debugging A Virtual Machine

- Record your console
  - `spool console to * start` (to start recording)
  - `...` (do work here)
  - `spool console stop close` (punch console to reader)
  - `query reader all` (to get the spool id)
    - `rdrlist`
  - `peek {spool id} (for *` (to look at the console)
  - `receive {spool id} fn ft fm` (to save console in a file)
Debugging A Virtual Machine

- HELP Facility
  - HELP /* main menu */
  - HELP command /* for a specific command */
  - HELP msg DMSxxxE /* for a specific message */

- CP LINK MAINT 19D 19D RR
  - link for HELP disk

- Most virtual machines that IBM ships by default already have this disk linked
HELP TASKS
(c) Copyright IBM Corporation 1990, 2013

z/VM HELP, main panel

The help panels listed below provide information about various
z/VM functions, topics, and tasks.
To view a help panel, move the cursor to any character of the name
or description and press the ENTER key or the PF1 key.

HELP - z/VM HELP Facility topics
MENUS - z/VM help menus
TASKS - Basic z/VM tasks
AVS - AVS commands
CMS - CMS commands
CP - CP commands
DIRMAINT - DirMaint commands
DIRMAINT - DirMaint topics
DUMPS - Dump commands, subcommands, and utilities
DYNIO - Dynamic I/O tasks
GLOSSARY - Definitions of terms
LE - Language Environment commands
LIBRARY - z/VM bibliography
MACROS - CMS assembler macros (menu)
MACROS - Assembler macros and functions (types)
MESSAGES - Messages and codes
OPEN - OpenExtensions services and APIs
PERFKIT - Performance Toolkit topics
PIPE - CMS Pipelines stages and subcommands
PIPE - CMS Pipelines tasks and subcommands
QUERYSET - QUERY and SET commands and subcommands
ROUTINES - CMS callable services (menu)
ROUTINES - CMS routines (types)
RSCS - RSCS Networking commands and link parameters
PF7 = Help    2 = Top    3 = Quit   4 = Return   5 = Glocate   6 = ?
PF8 = Backward 8 = Forward  9 = PFkeys 10 = 11 =  12 = Cursor

$=> _
Note: the coloration of the help panels can be adapted for ease of reading.
21:49:50  * MSG FROM HUGENBRU: STOP SLACKING OFF AND TEACH YOUR CLASS
21:50:06  * MSG FROM HUGENBRU: TYPE 'MSG <USERID> <TEXT>'
21:50:21  * MSG FROM HUGENBRU:
21:50:28  * MSG FROM HUGENBRU: P.S. HI MOM
Logging Off of a Virtual Machine

- **CP LOGOFF**
  - Terminates activity inside the virtual machine
  - Temporary and virtual disks are erased
  - User returns to logon screen

- **CP DISCONNECT**
  - Virtual machine and programs inside of it continue to run
  - User returns to logon screen
Try for yourselves!

- SPOOL CONS TO * START
- QUERY ACCESSED
- QUERY LAN
- LISTFILE * EXEC *
- SPOOL CONS TO * STOP CLOSE
- QUERY RDR
- RDRLIST, then hit PF11 on the last file to view
- HELP LINK
  - Q ACCESSED
  - LINK MAINT 19D 19D RR
  - ACC 19D <filemode>
- HELP LINK
- LOGOFF
For more information …
z/VM Internet Library

- https://www.ibm.com/vm/library

Includes:
- z/VM Knowledge Center
  - Useful when unsure which book or for searching tasks
- z/VM Information Center (being replaced by z/VM Knowledge Center)
- z/VM PDF bookshelf
  - Useful for when you know the book you need and prefer PDFs
- z/VM Program Directories
- z/VM Education and Presentations
- z/VM data areas and control blocks
- z/VM monitor records
- Select IBM Redbooks®
- White papers and other documents
z/VM Library Overview

Last Updated: 17 December 2021

Update: Revised publications are now available for new or upcoming z/VM 7.2 New Function APARs released between September and December 2021. An updated collection kit containing all the updates is also available.

You can now get all IBM z/VM PDF files directly from the z/VM Library web site. All documentation pertaining to a specific supported version and release will be available regardless of the New Function APARs you have installed on your z/VM system. PDF files are available for z/VM 6.x and z/VM 7.1 releases as well as z/VM related publications.

The z/VM Library also offers complete PDF collections of the documentation on a near quarterly basis. These collections are indexed, meaning you can search for any terms and it will return all matches from any document within the collection. No more hunting for a specific manual to find exactly what you need.

z/VM product information

- z/VM 6.x PDFs
- z/VM 7.1 PDFs
- z/VM Related PDFs
z/VM CMS Primer

- Primer walks through getting started with CMS

- Key content:
  - Logging on and off of z/VM
  - CMS minidisk file system and SFS (Shared File System) background
  - Editing files using XEDIT
  - Managing files and several productivity aids included in CMS for this
    • Like other platforms, there is often more than one way to do things.

- Content you can probably skip when you read for first time:
  - Printing from CMS
  - NAMES files

For More Information …

- **Web sites:**
  - [https://www.vm.ibm.com/](https://www.vm.ibm.com/) -- zVM on the Web
  - [https://www.vm.ibm.com/library](https://www.vm.ibm.com/library) -- the online zVM Library
  - [https://www.vm.ibm.com/library/presentations/](https://www.vm.ibm.com/library/presentations/) -- links to presentations like this one!
  - [https://www.youtube.com/playlist?list=PL_4RxtD-BL5uGoq629H8IDxfuvAN3IpF](https://www.youtube.com/playlist?list=PL_4RxtD-BL5uGoq629H8IDxfuvAN3IpF) -- “z/VM How-To Guides” YouTube Channel

- **Via mailing lists:**
  - [IBMTCP-L@VM.MARIST.EDU](mailto:IBMTCP-L@VM.MARIST.EDU)
  - [IBMVM@LISTSERV.UARK.EDU](mailto:IBMVM@LISTSERV.UARK.EDU)
  - [LINUX-390@VM.MARIST.ED](mailto:LINUX-390@VM.MARIST.ED)

**Contact Information:**

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[@Bwhugen](https://twitter.com/Bwhugen)
Backup Slides
Debugging A Virtual Machine

- **Tracing**
  - trace i r12345.10
    - trace instructions @ location 12345 for x'10' bytes
  - display g  
    (display general registers)
  - d t12345.20
    (display translated storage for x20)
  - b
    (begin execution)
  - trace end
    (end tracing)

- **Dumps**
  - VMDUMP
  - VM Dump Tool
Try for yourselves!

- LOGON <userid> /* Remember, CTRL is your Enter key */
- SPOOL CONS TO * START
- QUERY PRIVCLASS /* Your security context ... */
- QUERY COMMANDS
- QUERY DISK /* Your resources ... */
- QUERY ACCESSED
- QUERY LAN
- SPOOL CONS TO * STOP CLOSE
- RDRLIST, then hit PF11 on the last file to view ... look familiar?
- PURGE RDR ALL
- QUERY RDR
- HELP LINK
- LINK MAINT 19D 19D RR
- HELP LINK
- LOGOFF

#IBMz  #zVM
FAQ: “What are those numbers on my filemode?”

- You may see a second character (0-6) appear in the filemode field when doing a FILELIST on your minidisk or SFS directory. It’s okay, it’s meant to be there.
  - The number is a functional marker. The default is ‘1’. CMS system disks are a special case and should be ‘2’.
  - Function sometimes differs depending on if it’s a minidisk or an SFS directory:

<table>
<thead>
<tr>
<th>Minidisk</th>
<th>SFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>File is private, unless a user has R/W access to the disk</td>
</tr>
<tr>
<td>1</td>
<td>Default: normal read and/or write access</td>
</tr>
<tr>
<td>2</td>
<td>Same Function as 1; conventionally used for files on shared disks.</td>
</tr>
<tr>
<td>3</td>
<td>File is erased after it is read (be careful with this one)</td>
</tr>
<tr>
<td>4</td>
<td>OS simulated data set format</td>
</tr>
<tr>
<td>5</td>
<td>Same Function as 1; conventionally used for filegroups.</td>
</tr>
<tr>
<td>6</td>
<td>Indicates “Update in place” is in effect.</td>
</tr>
</tbody>
</table>
# Brian's Cheat Sheet v1.2: "Where is it?"
## (z/VM 7.2 edition)

<table>
<thead>
<tr>
<th>File</th>
<th>Where It Is</th>
<th>What It Is</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOGO.CONFIG</td>
<td>PMAINT CF0</td>
<td>z/VM Logo Screen</td>
</tr>
<tr>
<td>SYSTEM.CONFIG</td>
<td>PMAINT CF0</td>
<td>z/VM System Configuration File</td>
</tr>
<tr>
<td>CPLOAD_MODULE</td>
<td>MAINT CF1</td>
<td>z/VM Control Program (the &quot;kernel&quot;)</td>
</tr>
<tr>
<td></td>
<td>MAINT CF3 (backup)</td>
<td></td>
</tr>
<tr>
<td>USER.DIRECT</td>
<td>PMAINT 2CC</td>
<td>All virtual machine definitions (Note: resides in different place if you're using a Directory Manager)</td>
</tr>
<tr>
<td>Help Files</td>
<td>MAINT 19D</td>
<td>Access to HELP command</td>
</tr>
<tr>
<td>Sample Utilities</td>
<td>MAINT720 2C2</td>
<td>Access to z/VM utilities</td>
</tr>
</tbody>
</table>