Managing Linux Using 'Hidden' Tools in z/VM

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Over the years, IBM has added a lot of utility functions to what is now z/VM and its features.

For most people, these utilities remain a hidden secret as they are buried in the large library of z/VM's documentation.

Topics will include the using the FCON tool; the z/VM Real Time Monitor (RTM) feature; and the AUDITOR, ACCOUNT and PROP utility functions of CMS, among many others!

The speaker will bring to light these utilities and provide an overview of how they can be used to make your life easier in managing and monitoring your Linux for zSeries and Linux for S/390 images.
Sources of information

- z/VM library on the web
  - www.vm.ibm.com/library
- Help command
- Message lookup
Help!
**CMS User’s Guide, SC24-6009**

<table>
<thead>
<tr>
<th>HELPINFO</th>
<th>HELP Facility topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENUS</td>
<td>z/VM Help menus</td>
</tr>
<tr>
<td>TASKS</td>
<td>Basic z/VM tasks - good choice for beginners</td>
</tr>
<tr>
<td>COMMANDS</td>
<td>z/VM commands available to general users</td>
</tr>
<tr>
<td>CMS</td>
<td>CMS commands</td>
</tr>
<tr>
<td>CP</td>
<td>CP commands</td>
</tr>
<tr>
<td>QUERYSET</td>
<td>QUERY and SET commands and subcommands</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>TCP/IP commands</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>TCP/IP tasks</td>
</tr>
<tr>
<td>AVS</td>
<td>AVS commands</td>
</tr>
<tr>
<td>DUMPS</td>
<td>Dump commands, subcommands, and utilities</td>
</tr>
<tr>
<td>DYNIO</td>
<td>Dynamic I/O tasks</td>
</tr>
<tr>
<td>FEATURES</td>
<td>z/VM optional features</td>
</tr>
<tr>
<td>GLOSSARY</td>
<td>Definitions of terms</td>
</tr>
<tr>
<td>LE</td>
<td>Language Environment commands</td>
</tr>
<tr>
<td>LIBRARY</td>
<td>z/VM bibliography</td>
</tr>
<tr>
<td>MACROS</td>
<td>CMS assembler macros (menu)</td>
</tr>
<tr>
<td>MACROS</td>
<td>Assembler macros and functions (types)</td>
</tr>
<tr>
<td>MESSAGES</td>
<td>Messages and codes</td>
</tr>
<tr>
<td>OPEN</td>
<td>OpenExtensions services and APIs</td>
</tr>
<tr>
<td>PIPE</td>
<td>CMS Pipelines stages and subcommands</td>
</tr>
<tr>
<td>PIPE</td>
<td>CMS Pipelines tasks</td>
</tr>
<tr>
<td>PRODUCTS</td>
<td>Other products running under z/VM</td>
</tr>
<tr>
<td>Routines</td>
<td>CMS callable services (menu)</td>
</tr>
<tr>
<td>Routines</td>
<td>CMS routines (types)</td>
</tr>
<tr>
<td>STATMENTS</td>
<td>REXX, EXEC 2, and EXEC statements</td>
</tr>
<tr>
<td>SUBCMDS</td>
<td>Subcommand groups, such as XEDIT</td>
</tr>
<tr>
<td>TSAF</td>
<td>TSAF commands</td>
</tr>
<tr>
<td>VMSES</td>
<td>VMSES/E commands</td>
</tr>
</tbody>
</table>
# LookAt: Message lookup facility

www.ibm.com/zseries/zos/bkserv/lookat

<table>
<thead>
<tr>
<th>1. Enter Message ID</th>
<th>2. Select a platform for LookAt!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message ID:</td>
<td>Note: Platform selections below also include any IBM application software messages enabled for LookAt.</td>
</tr>
<tr>
<td>$messageid$</td>
<td>- OS/390™ and z/OS.e™</td>
</tr>
<tr>
<td></td>
<td>- z/OS™ V1R4</td>
</tr>
<tr>
<td></td>
<td>- z/OS™ V1R3</td>
</tr>
<tr>
<td></td>
<td>- z/OS™ only</td>
</tr>
<tr>
<td></td>
<td>- V4R3</td>
</tr>
<tr>
<td></td>
<td>- V4R1</td>
</tr>
<tr>
<td></td>
<td>- V2R10</td>
</tr>
<tr>
<td></td>
<td>- V2R3</td>
</tr>
<tr>
<td></td>
<td>- V4R2</td>
</tr>
<tr>
<td></td>
<td>- V4R5</td>
</tr>
<tr>
<td></td>
<td>- V2R8</td>
</tr>
<tr>
<td></td>
<td>- V2R5</td>
</tr>
<tr>
<td></td>
<td>- V2R1</td>
</tr>
</tbody>
</table>

On the web page, to view messages in IBM books that have not been enabled for LookAt, select an area to search using BookManager for APAR and ++HOLD Docs.

- z/OS™ All releases
- OS/390™ All releases
System utilities

CMS Command and Utility Reference, SC24-6010

- ACCOUNT - Provides basic processing of z/VM accounting records
- AUDITOR - Monitors virtual machine status
- DIRMAP - Creates a map of all minidisk and link statements in the user directory
- QSYSOWN - Maps system disk space
- SFPURGER - Manages spool space and spool files
ACCOUNT
System utilities

- Processes accounting records collected using the CP RETRIEVE command from the *ACCOUNT system service
- Only basic accounting records are processed
  - Virtual machine resource use, Dedicated device use and temporary disk space use (codes 01, 02 and 03)
  - User written application required for processing of all accounting records (defined in HCPACOBK)
    - REXX exec or use DTRYACC ASSEMBLE on MAINT 393 as a base
- Selective processing possible by userid, account number and project number
- Use VMSERVE to issue CP ACNT CLOSE command at end of shift to enable shift reporting
  - VMSERVE can also be used to initiate automatic processing of accounting records
AUDITOR

System utilities

- Monitors status of selected virtual machines
  - Running properly
  - Logged off
  - Disabled wait state
  - Failed user tests

- Restart virtual machines which fail test

- Automated tool with operator command support

************************************************************************
* AUDITOR CONTROL
************************************************************************
* MACHINE TEST AUTO FORCE TEST MAX NOTIFY
* ID INTERVAL LOG &AUTO EXIT ERRS USER ID
************************************************************************
APACHE 00:01:00 1 1 WEBTEST 10 OPERATOR
LINUX1 00:30:00 1 1 NONE 10 OPERATOR
SMBSRV 00:01:00 1 1 SMBTEST 10 OPERATOR
DIRMAP

System utilities

- MDISK/LINK mapping utility
- Processes the USER DIRECT file
- Output files
  - MDISKMAP - Map of all MDISKs
  - LINKMAP - Cross reference of all LINK statements
  - GAPFILE - List of all available "gaps"

See also the DISKMAP command in the CP Command and Utility Reference, SC24-6008
## QSYSOWN

### System utilities

- **Reports availability and use of system disk space**
  - Page and spool space
  - Number of pages available and in use
  - Percent of pages in use

- **CP QUERY ALLOC command for detailed information**

```
** Summary Information:  
Total-Pages
Type    Allocd   In-Use   %-Used
------------------------------         SPOL    428040   169905     39.7
PAGE    744120    10278      1.4
** Detail Information:
Volser  Addr  Device  Type   Allocd   In-Use   %-Used
--------------------------------------  SPOL    20700    20698    100.0
SPOL    11340    11338    100.0                      PAGE    15120     4554     30.1
PAGE     9000        0      0.0
ITSW01  9205  3390    SPOL    396000   137869     34.8
PAGE        0        0      0.0
```
SFPURGER

System utilities

- Manage spool space and spool files
- Purge, ignore or place holds on a spool file
- User-written action routines supported

******************************************************
* Sample SFPURGER CONTROL File                      *
******************************************************
* Ignore any spool files found in the NSS queue (privilege class E)   ACTION IGNORE
  QUEUE NSS
* Purge any spool files found in class 0                     ACTION PURGE
  CLASS 0
* Keep spool files owned by maintenance user IDs             ACTION IGNORE
  USERID MAINT*
* Purge dump files after 4 weeks. Ignore the rest           ACTION PURGE
  TYPE DMP      DAYS 29
* Change console logs to system hold after 1 week            ACTION SYSHOLD
  TYPE CON      DAYS 8
* Purge any reader files in USERHOLD after 4 weeks. Ignore the rest
  QUEUE RDR    DAYS 28
  HOLD USER    ACTION PURGE
  ACTION IGNORE
  TYPE DMP
* Purge any other print files after 2 weeks. Change the rest
  QUEUE PRT    DAYS 15
  ACTION PURGE
* to USERHOLD
  QUEUE PRT
  ACTION USERHOLD
CMS utilities

- CMS Pipelines - programmer productivity tool
- Programmable Operator (PROP)
- Fullscreen CMS
CMS Pipelines
www.vm.ibm.com/pipelines

- Programmer productivity tool for simple creation of powerful, reusable programs
- Lets you solve a complex problem by breaking it up into a series of smaller, less complex programs, called stages, that can then be hooked together to get the results you want
- Many built-in stages, but if you need a function that is not provided by CMS Pipelines, you can write your own stage, as many in the VM community already have done
- Began with John Hartmann of IBM Denmark who offered Pipelines to an enthusiastic VM community
- Shipped with z/VM but an enhanced level is distributed at vm.marist.edu/~pipeline
CMS Pipelines
HELP PIPE TASK

- Get information about CMS Pipelines
- Read or write records
- Get information about files
- Select or discard records
- Work with multiple records
- Manipulate data in records
- Reformat records
- Issue messages

- Interface with external environments
- Work with multiple streams
- Control the flow of records through the pipeline
- Buffer records to prevent stalls
- Write your own stage command
- Issue pipelines
- Build a filter package
CMS Pipelines
HELP PIPE MENU

< CASEI FILESLow Locate PIPEPVR SEVER SYNChron
*CMS CHANGE FILEUPDA LOOKUP PIPESTOP SHORT TAKE
> CHOP FIND MACLIB PIPIFMod SNAKE TAPE
>> CMS FMTFST MAXSTRea PIPIGFTXT SOCKA2IP TCPCLIENT
? COLLATE FRLAbel MCTOASA PIPIPInPut SORT TCPDATA
:PIPE COMBINE FRTPARGet MDISKBLK PIPILOCAT SPECs TCPLISTEn
ADDPIPE COMMAND FULLScrE MEMBERS PIPIOUTP SPILL TIMEstam
ADDSTREA COMMIT FULLScrQ MERGe PIPISEL SPLIT TOKENIZE
AFTFST CONFIGure FULLSCRs MESSAGE PIPISEVER SQL TOLAbe1
AHELP CONSoLe GATE NFIND PIPISHORT SQLCODES TOlARGet
ALL COPI GATHER NINSIDE PIPISTRO STACK UDP
APLDECod COUNT GETfiLes NLOCATE PIPISTRO STAGENUM UNIQUE
APLENcod CP GETRANGe NOCOMMIT PREDSele STARMOni UNPACK
APPEND CRC HELP NOT PREFACE STARMSG UNTAB
ASATOMIC CI4T038 HOLE NUCEXT PIPISTRO SQLCODES TOlARGet
ASMCOUNT DATES NATed HOBByNATed OUTPUT QSAM STATEW VAR
ASMNFINd DEBLOCK HOSTID OUTSIDE Query STEM VARLOAD
ASMXPNd DELAY HOBNAME OUTSTORE READER STORAGE VCHAR
BEgOutpu DROP IEBCOPY OVERlay READTO STRASM Fi VMC
BEtWEEN DUPlicat IMMCMd OVERSTRe RESOLVE STRASMFi WHILELAB
BFS ELASTIC INSIDE PACK REVERSE STREAMNU XAB
BFSDIREC EMSG INSTORE PAD REXX STREAMST XEDIT
BFSQUERy ESCHAPE IP2SCKA PAUSE REXXCMd STRFIND XLATE
BFSLREPLA FANIN ISPFI PDStDirec RXEXVARS STRFRLAB XMSG
BFSSTATE FANINANy JOIN PEEKTO RUMPipe STRIP XPNDHI
BFSEXECUT FANOUT JOINCONT PICK SCANRANGE STRLTer XRANGE
BLOCK FBlOCK JUXTAPOSt PIPOCMd SCANSTRIn STRFIND ZONE
BUFFER FILEBACK LDRTBLs PIPOCMd SCM STRTOLAB 3270BFRA
BUILDSRC FILEfast LISTPDs PIPOCMMT SECT SELECT STRWHILE 3270ENC
CALLPIPE FILERANd LITERAL PIPODESC SETRC SUBCOM

Programmable Operator Facility

**CMS Planning and Administration, SC24-6042**

- PROP is designed to increase the efficiency of system operation by intercepting all messages and requests directed to its virtual machine and by handling them according to preprogrammed actions.

- The tasks that can be performed by the programmable operator facility include:
  - Logging messages
  - Suppressing message display and routing messages to a logical (real) operator
  - Executing commands
  - Responding with preprogrammed message responses
Fullscreen CMS
CMS User’s Guide, SC24-6009

000D 2540 NOEOF CLOSED NOKEEP NOMSG NONAME
000D SUBCHANNEL = 0003
PRT 000E CL A NOCONT NOHOLD COPY 001 READY FORM STDN
000E TO JELLIOTT PRT DIST JELLIOTT FLASHC 000 DEST OFF
000E FLASH CHAR MDFY 0 FCB LPP OFF
000E 1403 NOEOF CLOSED NOKEEP NOMSG NONAME
000E SUBCHANNEL = 0004
DASD 0120 3390 SYE711 R/O 250 CYL ON DASD 7035 SUBCHANNEL = 000C
DASD 0121 3390 USE70C R/O 84 CYL ON DASD 7001 SUBCHANNEL = 000D
DASD 0190 3390 RSE702 R/O 130 CYL ON DASD 8081 SUBCHANNEL = 0005
DASD 0191 3390 USP746 R/W 20 CYL ON DASD 73CE SUBCHANNEL = 0000
DASD 019A 3390 SYE7CM R/O 400 CYL ON DASD 730C SUBCHANNEL = 0008
DASD 019D 3390 US7E0K R/O 250 CYL ON DASD 801C SUBCHANNEL = 0007
DASD 019E 3390 SYE7CM R/O 400 CYL ON DASD 730C SUBCHANNEL = 0006
DASD 019F 3390 SYE7MD R/O 100 CYL ON DASD 73D6 SUBCHANNEL = 0009
DASD 01A1 3390 USC071 R/O 100 CYL ON DASD 330E SUBCHANNEL = 000B
DASD 0399 3390 USP749 R/O 30 CYL ON DASD 73E0 SUBCHANNEL = 000A

PF1=Help  2=Pop_Msg  3=Quit  4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward  9=Rdrlist  10=Left  11=Right  12=Cmdline

09:41:01 Enter a command or press a PF or PA key
Operating a Linux virtual machine

Running Guest Operating Systems, SC24-5997

- **Problem determination**
  - Application documentation
  - Linux console messages
  - `/var/log`
  - Linux distributor or service organization

- **Automatically booting Linux**
  - CP XAUTOLOG command
  - AUTOLOG1 userid

- **Analyzing performance**

- **CP commands to know at the Linux operator's console**
Analyzing Performance
www.vm.ibm.com/perf

- **VM Performance Toolkit**
  - Provides enhanced capabilities for a z/VM systems programmer, system operator, or performance analyst to monitor and report performance data
  - Functions provided include:
    - Operation of the system operator console in full-screen mode
    - Management of multiple z/VM systems (local or remote)
    - Post-processing of Performance Toolkit for VM history files and VM monitor data captured by the MONWRITE utility
    - Viewing of performance monitor data using either Web browsers or PC-based 3270 emulator graphics
    - TCP/IP performance reporting
  - Also processes Linux performance data obtained from the Resource Management Facility (RMF) Linux performance gatherer, rmfpms
Analyzing Performance ...
Operating a Linux virtual machine

- **CP commands to enhance performance**
  - **INDICATE** - Broad overview of how system resources are being used
  - **LOCK** - Lock in real storage selected pages
  - **SET SHARE** - Control percentage of system resources a guest receives
  - **SET QUICKDSP** - Designate guests that don't wait in the eligible list
  - **SET RESERVED** - Set number of pages resident in real storage
  - **DEDICATE** - Allocate a processor to a guest
CP commands to know at the Linux operator's console

Operating a Linux virtual machine

- **COUPLE**
  - Connect a virtual channel-to-channel adapter (CTCA) to a compatible virtual CTCA
  - Connect a virtual adapter (NIC) to a compatible virtual LAN segment
- **DEFINE**
  - Change the configuration of your virtual machine
  - Change the configuration of your operating system
  - Add a new VM LAN to your system
- **DETACH**
  - Virtual processors from your virtual machine
  - Real and logical devices from the host system
  - Real, logical and virtual devices from your virtual machine
  - A VM LAN segment from the host system
CP commands to know at the Linux operator's console

*Operating a Linux virtual machine*

- **ATTACH**
  - Real or logical device to a virtual machine
  - Disk to the host system

- **DISPLAY**
  - The contents of first-level storage
    - The real storage of the processor
  - The contents of second-level storage
    - The storage that appears real to the operating system running in your virtual machine
  - The contents of third-level storage
    - The storage that appears virtual to the operating system running in your virtual machine
  - The old and new PSWs, interrupt information and registers
CP commands to know at the Linux operator's console

*Operating a Linux virtual machine*

- **TERMINAL HOLD**
  - Control whether CP displays the HOLDING status when the terminal screen is full

- **TERMINAL MORE**
  - Change the number of seconds that elapse between the time when CP issues the MORE... state and sounds the terminal alarm before CP clears the screen

- **TRACE**
  - Monitor events that occur in your virtual machine

- **VMDUMP**
  - Dump all or selected pages from second-level storage

*CP Command and Utility Reference, SC24-6008*
VM download site packages

*ibm.com/vm/download*

- CMSDDR - Enhanced DDR program to simulate DDR tapes via CMS files
- SMARTX - An XEDIT-based front-end for RTM
- SPOOLCHN - System programmer and system operator extended spool query commands
- VMSERVE - A service virtual machine manager that handles reader files, messages and time-of-day events
- LEIXX - Live Parsing Editor
CMSDDR
VM download site packages

- From Gerhard Widmayer, IBM Germany
- This package provides you with a kind of I/O redirection for DDR tapes into CMS files via a modified DDR Module
- It comes with a sample EXEC to perform DDR DUMP and RESTORE for minidisks
- A help file explaining the additional features is included
SMARTX
VM download packages

- From Kris Buelens, IBM Belgium
- The purpose of SMARTX is twofold:
  - Help the occasional users of RTM to find and execute the available RTM commands
  - Keep the data returned by RTM in an XEDITed CMS file.
- When in the XEDIT file, PFkeys are available for various functions:
  - Obtain description of the RTM keywords
  - Plot data using GDDM/REXX
  - Automatically repeat an RTM command
- The PROFSMRT XEDIT macro can be very useful when viewing saved SMART reports
- Of course, not necessary with the VM Performance Toolkit
SPOOLCHN
VM download site packages

- From Richard Ross, IBM US
- SPOOLCHN is a VM system programmer utility (class C or E) which will display files in the spool system
- SPOOLCHN has the following advantages over the standard spool Query commands:
  - Can show spool usage (blocks of spool data)
  - Shows more information than the spool Query commands
  - Output can be directed to terminal, stack, disk, or variables in REXX
  - Output can include an exec for manipulating the spool files
  - More search criteria than spool Query, such as number of records, age of file, etc.
  - Wildcard searches allowed
  - Does not tie up system resources like Q RDR ALL
VMSERVE
VM download site packages

- From Les Koehler, IBM US

- VMSERVE is a general purpose Disconnected Virtual Machine (DVM) manager for VM which will handle incoming reader files, messages, and time-of-day events

- VMSERVE has options to: Define the application name, Initiate extended console spooling, Turn internal tracing on, Perform a check of the run-time definitions, Override the internal interrupt priority scheme, Override the internal Reader and Message security checking sequence

- Although VMSERVE provides the facilities to accomplish the above, it is up to the application developer to properly implement the facilities necessary to meet their business needs
LEXX Live Parsing Editor
VM download site packages

- From Mike Cowlishaw, IBM UK
- LEXX lets you manipulate the structure and the appearance of the data you are editing, whether it be a text document, a program, or any other suitable material
- The routines that control the appearance of the data being edited are called Live Parsers
- Included are:
  - A parser for Generalized Markup Language (GML) documents (SCRIPT files)
  - A parser for REXX programs, such as Execs and Editor Macros
LEXX Live Parsing Editor - screen image
VM download site packages

Friends, Romans, countrymen, lend me your ears;
I come to bury Caesar, not to praise him.
The evil that men do lives after them,
The good is oft interred with their bones;
So let it be with Caesar. The noble Brutus
Hath told you Caesar was ambitious;
If it were so, it was a grievous fault;
And grievously hath Caesar answer’d it.
Here, under leave of Brutus and the rest, --
For Brutus is an honourable man;
So are they all, all honourable men, --
Come I to speak in Caesar's funeral.

Julius Caesar, III.i.79
**.LEXX Live Parsing Editor - additional packages**  
*VM download site packages*

<table>
<thead>
<tr>
<th>Package name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEXXPLXX</td>
<td>Parsers for PL/I, PL/X, Modula-2 and Pascal</td>
</tr>
<tr>
<td>LEXXASM$</td>
<td>Parser for Assembler</td>
</tr>
<tr>
<td>LEXXC$$</td>
<td>Parser for C</td>
</tr>
<tr>
<td>LEXXCFDA</td>
<td>&quot;Commands From Data Area&quot; facility</td>
</tr>
<tr>
<td>LEXXCOB$</td>
<td>Parser for COBOL</td>
</tr>
<tr>
<td>LEXXFOR$</td>
<td>Parser for FORTRAN</td>
</tr>
<tr>
<td>LEXXRX$$</td>
<td>Alternate parser for REXX</td>
</tr>
<tr>
<td>LEXXTEX$</td>
<td>Parser for LaTeX/TeX Parser</td>
</tr>
<tr>
<td>LXFINDT</td>
<td>FIND Token command</td>
</tr>
<tr>
<td>LXJCL$</td>
<td>Parser for MVS JCL</td>
</tr>
<tr>
<td>LXPRMPT</td>
<td>Prompt command</td>
</tr>
</tbody>
</table>
Tools/information on the Internet

- TXT2PDF - Convert a text file to a PDF
- Internet discussion lists
The TXT2PDF utility is used to convert a text file into a Portable Document Format (PDF) file.

It has many options to control the conversion, output appearance, and final presentation. Some of the features include:

- Annotations
- Outline generation
- Color control
- Several background options
- Viewer control
Internet discussion lists
www.vm.ibm.com/techinfo/listserv.html

- **VMESA-L**
  - The VM Discussion list is an ideal place to ask a question of your VM peers
  - To subscribe, send a note to listserv@listserv.uark.edu
    - SUBSCRIBE VMESA-L your name
  - listserv.uark.edu/archives/vmesa-l.html

- **LINUX-390 discusses Linux on IBM Mainframe**
  - Linux on zSeries, Linux for S/390 and Linux running as a VM guest
  - To subscribe, send a note to listserv@vm.marist.edu
    - SUBSCRIBE LINUX-390 your name
  - www.marist.edu/htbin/wlvindex?linux-390
Managing Linux Using 'Hidden' Tools in z/VM

- There are a great many tools and sources of information available to z/VM users
- They may be hard to find, but they are out there
- Use the VMESA-L list to ask questions

*Don't be afraid to ask for help!*

Jim Elliott, Advocate
IBM Corporate Linux

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www.vm.ibm.com/devpages/jelliott
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