

VM/CMS Survival Guide

Original Idea


LivingComputers.Org is shutdown due to the pandemic. So without them, we'll just copy the idea here and make things available more broadly - and in a different way.

Introduction

This is a brief introduction to basic concepts and commands for using a virtual IBM 4381 midrange computer system.

The virtual 4381 runs the VM/370 virtual machine operating system.

VM is basically two components:

- The Control Program (CP) which controls the real hardware and provides a virtual machine (VM) for each user, and
- The single user  [Conversational Monitor System](#) (CMS) is an operating system itself, which runs in a virtual machine (VM) to provide the user environment (this is the equivalent of a shell to you UNIX/Linux users or the Command Line to VMS and Windows users).

And Now, a Word From the Vendor




IBM has published an introductory document, [The Basics of Using z/VM](#).¹⁾ This gives a short overview of VM in general. But it's not useful from a hobbyist perspective.

[A far more useful document is one written by Melinda Varian:](#)

"What Mother Never Told You About VM Service - A Tutorial"

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The VM user environment has not changed extensively between VM/SP 5 and z/VM (the hobbyist version of it is VM/370), but there are few differences to point out between the Virtual 4381 and the environment described in the document:

- The Virtual 4381 is a 32-bit machine with a 24-bit (16 megabyte) address space.
 - MVS/XA, MVS/ESA, and z/OS guests (all descendants of  [MVS](#)) cannot run under VM/SP.
 - No supported version of  [Linux](#) or  [Unix](#) guests can run under VM/SP.
 - VM/SP does not have a POSIX shell or related utilities
- You cannot switch between sessions at the LOGON screen.
- VM/370 only supports minidisks for storage; it does not support:
 - SFS (Shared File System)
 - BFS (Byte File System)
 - NFS (Network File System)
- VM/370 supports the CP TRACE command, but not as documented in the presentation. (Enter HELP CP TRACE.)

- VM/SP does not support the CP TERM MORE command.

Connecting to the 4381

Secure Shell (ssh)

You can connect to LCM+L's 4361 with Secure Shell (ssh).


```
ssh ibm4361@tty.livingcomputers.org
```

Once you have connected to the 4361, you can follow the instructions on this page starting with the section “Log-on Procedure”.

The PA2 3270 terminal key (for clearing the screen) is mapped to **Ctrl-A 2** (Control-A followed the number 2) when connecting with ssh.

(ssh is available as part of the OpenSSH package for MacOS, *BSD and Linux operating systems, or PuTTY for Microsoft Windows.)

3270 Terminal Emulator

The VM/CMS system was originally designed to be accessed from a  3270-compatible terminal. Today, since 3270 hardware is rare, you will probably use 3270 emulator software.

[x3270](#) is a free open source software suite of 3270 terminal emulator tools by Paul Mattes and others. It includes clients for X11 (x3270; for Unix, Linux, *BSD, etc.), MS Windows console (wc3270), and others.

[Download](#) an appropriate package and follow the instructions to install it on your system.

Session set-up

Where to connect

Host Name	tty.livingcomputers.org
TCP Port	24

Terminal Sizes

On most platforms you can specific the model of terminal emulator if you start the program from the command line. The model is composed of two parts:

1. The model number:
 1. 3278 are monochrome terminals. These were the most common type when real 3270 terminals roamed the land.
 2. 3279 are color terminals. VM/SP has good support for them, and are generally preferred

when using modern terminal emulators.

2. The model suffix, which specifies the screen size:
 1. 2 is the classic 80 columns by 24 lines.
 2. 3 is 80 columns by 32 lines.
 3. 4 is 80 columns by 43 lines. This is useful for editing.
 4. 5 is 132 columns by 27 lines. This is useful for reviewing listings.

Thus for a color terminal sized 80×43, the full model is specified as 3279-4.

Unix (Linux, *BSD, Mac, ...)

You can login via x3270 from via a terminal window the X-Windows menus:

1. Using a xterm or other terminal window:
 1. run `x3270 -model 3279-4 tty.livingcomputers.org 24`
2. Using X Windows menus:
 1. In your X session, run x3270.
 2. From the **Connect** menu click **Other...**
 3. In the “x3270 Connect” window, enter the following Hostname:
`tty.livingcomputers.org:24`
 4. Click **Connect**. (The host will automatically be added to the **Connect** menu for future sessions.)

You can also install and use the more limited text window version, c3270; this will be limited by the size of the window it runs in:

1. `c3270 -model 3279-4 tty.livingcomputers.org 24`

MS Windows

1. Run the wc3270 Session Wizard.
2. On the Overview menu, select “1. Create new session (new)”.
3. Enter the configuration parameters from the table below.
4. Answer “y” to “Create session file '...'?”.
5. Optionally, answer “y” to “Create desktop shortcut?”.
6. Return to the Overview menu and select “8. Quit (quit)”.

Log-on Procedure

If We Tell You Nothing Else ...

First things first:


- Figure how your terminal emulator sends PA2 to the host. For example, the default x3270 mapping is `Alt-2`. This is because ...
- ... Once connected to VM, to clear the screen, use host key PA2. This clears all but the input area at the bottom of the screen.

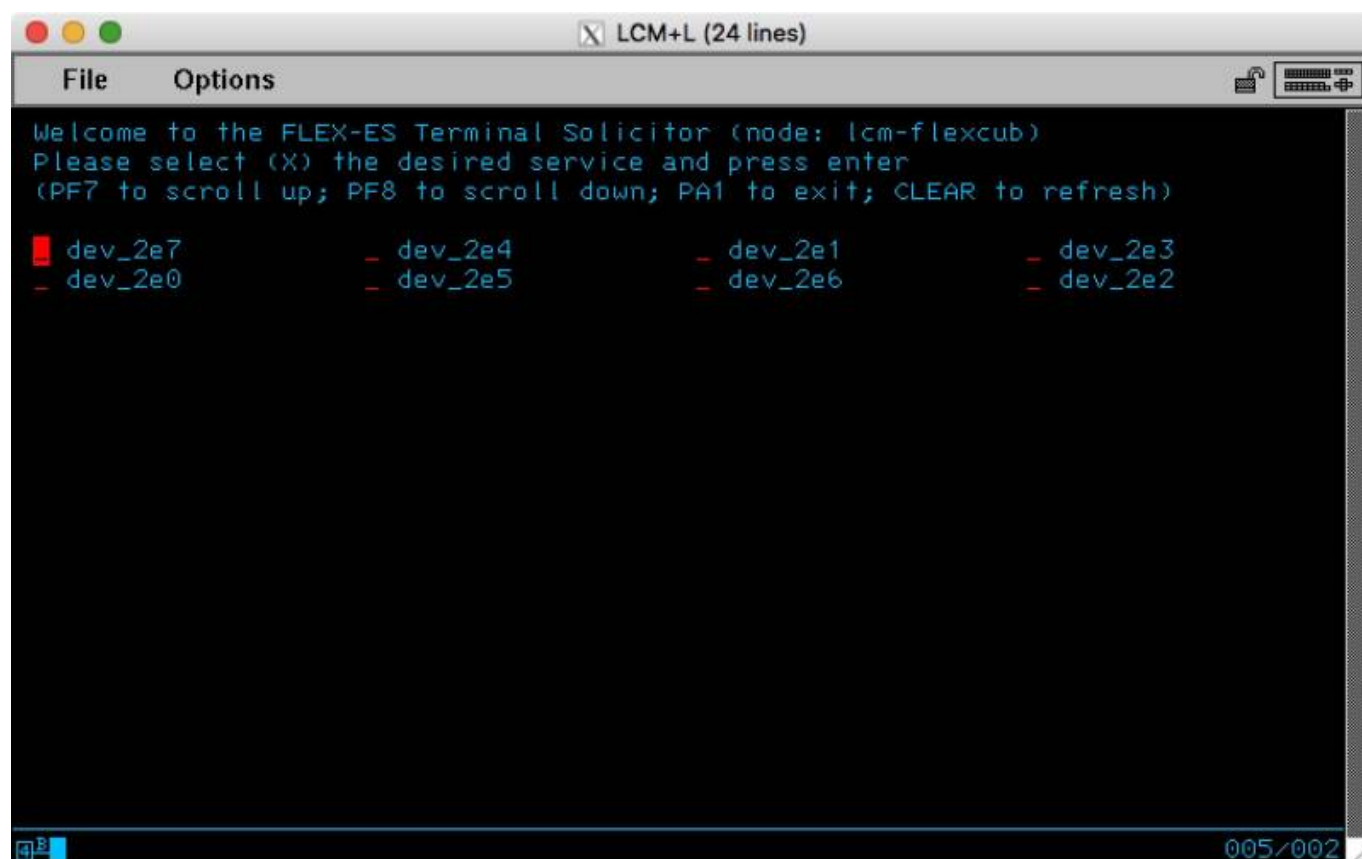
You'll also need to know how your emulator sends:

- ENTER (usually your ENTER or RETURN key)
- PA2
- PF1 through PF12
- RESET (often Alt-R)
- ^ (Insert Mode) (by default, 3270 terminals overwrite)


Connect and Log-on

Start your 3270 terminal emulator and connect to the LCM+L's 4361.

You'll be rewarded with a screen like the one below, which is the front end  [terminal controller](#) emulator for the 4361.



Put an X on any device, and press ENTER. You'll be rewarded with the VM Login screen:

Note: If this icon, , on the bottom line of your terminal, it means you tried to input data when the cursor was not located in an input field on the terminal screen. Press TAB to move the cursor to the next input field.

```

LCM+L (24 lines)
File Options
VIRTUAL MACHINE/SYSTEM PRODUCT

                Living Computers: Museum + Labs

      LL      CCCCCC  MM      MM      LL
      LL      CCCCCCCC MMM      MMM      ++      LL
      LL      CC      CC  MMMM  MMMM      ++      LL
      LL      CC      CC      MM  MMMM  MM  ++++++++ LL
      LL      CC      CC      MM      MM  ++++++++ LL
      LL      CC      CC      MM      MM      ++      LL
      LLLLLLLLLL CCCCCCCC MM      MM      ++      LLLLLLLLLL
      LLLLLLLLLL CCCCCC   MM      MM      ++      LLLLLLLLLL

      Be sure to logoff. Simply closing the terminal does not logoff,
      so the next user to use this address may be logged in as YOU.

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

      COMMAND ==>

                                     RUNNING  LCML4361
020/016

```

Enter your Userid & Password (use TAB to move the cursor to the next input field), press ENTER and you're off to the races.

Your CMS Session

After you log-in, your terminal will look something like this:

```
LOGON PAPA
LOGMSG - 21:57:43 PDT FRIDAY 06/22/18
*
* Enter QUERY LOG to see previous log messages.
*
* FLIST and BROWSE now exploit larger terminal sizes gracefully.
* Thanks to Bob Polmanter (again!)
*
* SMART has now idle checking enabled. If you are idle for two
* hours, it will warn you and then FORCE you off. Running any
* periodically waking program like VMCSTART will prevent this action.
FILES: 002 RDR, NO PRT, NO PUN
LOGON AT 02:40:56 PDT SATURDAY 06/23/18
VM/SP REL 5 05/07/18 15:45
D (192) R/O
PAPA 404 not linked; not in CP directory
I (402) R/O
DMSACP113S C(193) not attached
DMSACP113S M(591) not attached
R (222) R/O
DMSACP113S Q(392) not attached
Ready; T=0.21/0.38 02:40:57

■ (B) (D) RUNNING LML4361 (C)
qB 031/001
```

The terminal screen is divided into four areas:

A: System output. Commands you input to CMS are echoed here, and all system output is printed.

B: User input. This is the only input area on the default CMS screen.

C: System status

D: Terminal status

When you see the ready prompt (Ready; T=0.21/0.38 02:40:57 in the screen shot above, but yours can be customized), type commands into the user input area followed by ENTER, and CMS will try to fulfill your every desire.

System status


The system status area indicates the state of your CMS session and what kind of input the system is expecting from you. The following messages may be displayed:

RUNNING	CMS is waiting for you to type a command. This is the most common message.
---------	--

MORE...	The system is pausing in the middle of multi-screen output to give you a chance to read. After one minute the next screenful of output will be displayed. If you are ready for the next screen of output before then, press PA2. If you need more than one minute to read the current screen, press ENTER to go to HOLDING state. To discard the rest of the output, enter the command HT (for Halt Type).
HOLDING	The system is waiting for you to read the current screen of output. Press PA2 to continue.
VM READ	CMS or another VM program has requested input from you and is waiting for your answer.
CP READ	CP (the virtual machine hypervisor running underneath CMS) is waiting for a command. If you were previously working in CMS or a program you ran from CMS and got interrupted accidentally, try entering the command BEGIN and you may be able to restore your session. If that doesn't work, #CP IPL CMS will restart CMS, but you may lose the work you were doing before the interruption.
NOT ACCEPTED	You entered a command when the system wasn't ready. Press Reset

File System

Resources, including disk, are allocated by CP among users as disks and links defined by the user directory, a file maintained by the system administrator. Disks can be dedicated in their entirety to a single user²⁾, or divided into disks for smaller users. Such smaller disks are called minidisks. Common minidisks are listed below.

Common Name	Device Address	Detailed Description
System Disk (S-Disk)	190	The  CMS operating system and basic system programs are located on this disk.
User A-disk	191	The personal writable disk of the user.
D-Disk	192	A work disk which is automatically formatted if it is writable and unformatted.
G-Disk	19C	On the LCM+L 4361, it is read only and contains games.
Y-Disk	19E	An extension of the S-Disk, this contains utilities which are not part of the base system. For example, on the 4361 it contains compilers, IND\$FILE ³⁾ , the client interface for the real-time monitor SMART ⁴⁾ , useful editor macros, and other utilities.
Help Disk	19D	The location for system help files. This is automatically accessed, usually at file mode Z, when needed by the Help system.

As noted above, access to others' disks are done by link definitions in the system directory. Each disk in the directory may have one or more link passwords. If a disk is that is not defined as attached to your VM has a password for a mode, you may link it via a user command.

Mode ⁵⁾	Abbreviation	Detailed Description
RR	Read/Read	Attach to the disk read/only (R/O) if no one is linked to it, else attach to the disk R/O.
WR	Write/Read	Attach to the disk writable if no one is linked to it, else attach to the disk R/O. Generally, not used in favor of MR.
MR	Multi-write/Read	Attach to the disk writable if no one is writing to it, else attach to the disk R/O.

Mode ⁵⁾	Abbreviation	Detailed Description
MW	Multi-write/Write	Attach to the disk writable if no one is writing to it, else attach to the disk writable anyway. Using this mode will destroy a CMS-formatted disk. So forget you were told this option exists.

Files

File Names





Overview


A file on a CMS file system is described in three parts, separated by spaces. All three parts are required.

Component	Abbreviation	Description
file name	fn	The one to eight character name of the file. ⁶⁾
file type	ft	The one to eight character type of the file. See below for a list of important types.
file mode	fm	The two-character mode of the file. The first character is the alphabetic letter of the disk, the second character a number between 0 and 6, described below.

Type

Like Windows, the function of a file on CMS is defined by its type. Common types are listed below.

File Type (Executable files are in <i>italics</i>)	Description
ASSEMBLE BASIC C COBOL FORTRAN PLI	Source files for programs
EXEC	An executable (human readable) script. The language may be  EXEC ,  EXEC 2 , or  REXX
LISTING	The printable output from a compiler or other program.
MACLIB	Multiple source files organized into a single file, used as source includes for source programs.
MODULE	An executable binary program.
SYNONYM	A list of user command synonyms and acceptable abbreviations.
SCRIPT	A source file for the  SCRIPT Markup language used for formatting text.
TEXT	Object code. They are linked into runnable MODULES. ⁷⁾
TXTLIB	Multiple text (object) files organized into a single file, used as object code includes for compiled programs.

File Type (Executable files are in <i>italics</i>)	Description
VMARC	Like a ZIP or TAR files on other platforms, this is file an archive for files on VM. It is specifically formatted to a standard format of 80 byte records to allow binary transfer via foreign systems, VM readers, RSCS, and IND\$FILE without corrupting the data.
<i>XEDIT</i>	An executable (human readable) script executed by the  XEDIT editor. Supports the same languages as EXEC.

Mode Number

As noted above, file modes consist of the letter of the disk the file resides on, and number further defining a file.

Number	Definition	
0	Private	The file is only visible to the current user with write access.
1	Normal	The file is visible to all users. This is the default mode for most files created.
2	Public	The file is visible when accessed with a filter, such as ACCESS 19E Y/S * * Y2. System disks are generally automatically accessed this way.
3	Temporary	The file is deleted after open for reading. Useful for things like intermediate steps in compile procedures.
4	OS specific	The file is written according to special rules for OS emulation.
5	Normal (alternative)	The file is the same as file mode 1, but visually set apart by their number. Often used for generated LISTING files.
6	Update in-place	Normally, an update to a file occurs by allocating a new block on the disk and writing it. With mode 6, the original block is rewritten. ⁸⁾

Useful Commands

Enter `HELP command` at the command prompt on most of the commands below. Most commands can be abbreviated, and CP can usually be omitted.

Name	Description
DIRMAINT	Change your password and set other account parameters. Use <code>DIRM ?</code> for the complete list of DIRMAINT subcommands.
COPYFILE	Copy files
ERASE	Delete files
FILELIST⁹⁾	Display files in a scrollable display
FLIST¹⁰⁾	Display files in a scrollable display
GAME	Display games menu. This command has no help topic.
HELP	With no operands, lists a a top-level menu of topic areas.
LISTFILE	List files at the terminal
CP LOGOFF	Terminate your session
NAMES	Edit your address book, which is used by TELL, NOTE and SENDFILE
NOTE	Send an email to another user on the local machine.

Name	Description
CP QUERY NAMES ¹¹⁾	Display list of currently connected users.
CP QUERY VIRTUAL ¹²⁾	Display configuration of your virtual machine
RDRLIST	Display the contents of your virtual reader
RENAME	Rename files on a disk (will not move between disks)
SENDFILE	Send a file to another user
TELL	Send a message to another user
XEDIT	Edit a file

In addition, compilers for the following languages are available: Assembler (ASSEMBLE), BASIC, C, COBOL, FORTRAN, PL/I (PLI). (Where not otherwise noted, the compilers are invoked by their language name.) Not all of those have HELP files.

XEDIT Text Editor

For its environment, XEDIT is both an easy to use and powerful editor. It's primary lack is no cut-and-paste, but modern terminal emulators can do client-side pasting which is not visible to the mainframe.

However, this power does require a good explanation, so this humble author defers to IBM on the topic; see [XEDIT Users Guide for z/VM](#) for a proper overview of XEDIT.

Note: Most XEDIT examples show a prefix area with equal signs to the left of the screen, a scale across the middle of the screen, and the current line in the middle of the screen as well. The LCML4361 profile, which resides on the Y-Disk, changes this appearance to reduce the fixed “chrome”; it also moves the current line up, and provides line numbers in a *right* hand prefix area out of the way.

You can move current line back to the middle and turn on the left prefix area and scale by entering the following commands in XEDIT:


```
SET CURLINE ON M
SET PREFIX ON
SET SCALE ON
```





You can permanently customize the appearance by creating your own PROFILE XEDIT A, or simply editing the file on the Y-DISK and changing the file mode to A (SET FMODE A) before you save it.

EXEC Scripts

Types of Scripts

File of type EXEC or XEDIT can be one of three languages:

-  **Rexx** (Restructured Extended Executor), released with VM/SP 3 in 1982, is a block structured, high-level programming language. The first line of a Rexx program on CMS must begin with a C-style comment (`/* */`).

-  [EXEC 2](#), released with VM/SP 1981, is an enhanced version of EXEC, with longer tokens, ability to communicate with commands such as GLOBALV and EXECIO, and other enhancements. The first line of an EXEC2 program must start with &TRACE.
-  [EXEC](#) dates back to 1966 and the original  [CP-67](#) System, and based on even older facility for  [CTSS](#). It's famous for truncating tokens in strings to eight characters, which is rather annoying if your last name is "Cowlshaw". All EXEC and XEDIT files which are not flagged by their first line as Rexx or EXEC2 programs are processed as EXEC programs.

Rexx Help

See [For Further Reading](#) below for the primary IBM references and other resources on Rexx. The addition information on Rexx on the 4361 itself:

- Enter `HELP REXX` to get a basic feel of the language
- Browse the `KENDRA XEDIT Y` to see a sample of the code.

EXEC and EXEC2 help

For help on the earlier scripting languages, enter:

- `HELP EXEC MENU`
- `HELP EXEC2`

The MENU is needed for EXEC but not the other languages because there is an EXEC command which, not surprisingly, runs EXEC files.

Compilers & Interpreters

Modern Compilers

As of this writing, two modern (to the 1980's) compilers are installed on the 4361:

- C (GCC) NOTE, be sure to `HELP GCC` for details on increasing VM STORAGE
- VS FORTRAN Version 2 (FORTVS2)
- PL/I Optimizing Compiler (PLIOPT)

Not-so Modern Compilers

Older compilers, most dating to the original OS/360 era, are also installed:

- COBOL
- FORTRAN G (FORTRAN G)
- FORTRAN H (FORTRAN H)
- PL/F (PLIF)

Linkers

All the compilers run TEXT (object) files, which need to be combined with run-time libraries and saved as executable MODULE files. Various sample scripts will do this for simple programs:

- GENCOBOL
- GENFORTG
- GENFORTH
- GENFORTV
- GENGCC
- GENPLIF
- GENPLIOP

For a more detailed example of linking a program and running it, see [vm_cms_fortran](#)

Interpreters

Rounding out the language processors are interpreters, which were primarily oriented towards educational environments:

- BASIC
- FORTH
- PL/C for CMS (PLCT)
- SNOBOL4
- WATFIV FORTRAN (WATFIV)

These do not generate TEXT files with object code, but instead run the translated programs immediately.

For Further Reading

Introduction

Most the links in section are PDF files, many cases scanned copies of the original IBM manuals loaded to the site <http://bitsavers.org/>.

Core VM/SP Specific Manuals

Note: Where VM/SP Release 5 manuals are not available, other releases are used as listed. For release 6, most differences are minor and/or obvious, for example the new for release 6 Shared File System was supported. Usually, an appendix in each newer manual lists the differences from release 5.

Title	Retrieved	Description / Comments
VM/SP CMS User's Guide Release 3	18-07-2018	CMS User Guide, release 3 . Note: This describes how to use CMSBATCH, which is <u>not</u> covered in the Command Reference.
VM/SP CMS Command Reference Release 5	18-07-2018	The command reference for CMS commands. Note: Does not include CP commands; for that, see below.
VM/SP CP General User Command Reference Release 6	18-07-2018	The command reference for CP commands, release 6 .
VM/SP System Product Editor User's Guide Release 6	18-07-2018	User guide for XEDIT, release 6 .
VM/SP System Product Editor Command and Macro Reference Release 6	18-07-2018	Command Reference for XEDIT, release 6 .
VM/SP System Product Interpreter User's Guide Release 6	18-07-2018	Rexx User Guide, release 6 .
VM/SP System Product Interpreter Reference Release 6	18-07-2018	Rexx Reference, release 6 .
VM/SP EXEC2 Reference Release 5	18-07-2018	Reference for the older EXEC 2 language.
VM/SP CMS Command and Macro Reference	16-12-2018	Early version of the CMS Command Reference above, but also includes CMS Assembler Macros for programming. release 1 .
VM/SP CMS for Systems Programming Release 5	18-07-2018	A guide to CMS for heavy hitting IBM Assembler Programmers. It will bring out your inner CMS geek or send you screaming. (Or both.)
VM/SP System Facilities for Programming Release	18-07-2018	Like the guide to CMS above, a guide to CP for heavy hitting IBM Assembler Programmers. It will bring out your inner CP geek or send you screaming. (Or both.)

Other VM related documents

Title	Retrieved	Comments
Bitsavers VM/SP manual archive	07-18-2018	Index to All VM files collected by the archive. If looking for a particular manual and it's not found under Release 5 Dec86 , look to the newer and older releases for a near match.
CALL/360: BASIC Reference Handbook	12-14-2018	
VS FORTRAN Version 2 Programming Guide for CMS and MVS	07-18-2018	
The Basics of Using z/VM	07-18-2018	Introduction referenced at the top of this guide.

Title	Retrieved	Comments
Rexx Programmer's Reference	07-18-2018	Third party Rexx reference from the The Rexx Language Association
VM/CMS. Fake Your Way Through Minis and Mainframes.	07-18-2018	Third party tutorial on CMS
VM/CMS User Guide and Reference Manual	07-18-2018	Another (less useful) third party tutorial on CMS
VM/SP General Information Release 4	18-07-2018	General overview, not very useful in the LCML environment. For Release 4 .

1)

🐉 **z/VM** is a later edition of the VM family, updated for a 64-Bit 🐉 **POSIX** world.

2)

A disk or other device might be dedicated for a complex multiple users guest system like 🐉 **MVS**, 🐉 **MUSIC/SP** 🐉 **MTS**, or a VM running under VM.

3)

IND\$FILE performs transfers via a 3270 terminal emulator

4)

SMART shows system activity, similar to **top** on UNIX or Task Manager on Windows. It is invoked by the user command **VMC**, or more easily via the **VMCSMART EXEC**.

5)

If the second letter is omitted, and the primary link mode is rejected because others linked to the disk, the link will fail.

6)

Files with a single unique instance for each user on their A-Disk often use the user id as the name, such as **SNOWHITE NAMES A1** and **SNOWHITE NETLOG A1**.

7)

Files of type **TEXT** are not human readable text and not directly executable – if not compiling programs, pretend you didn't see them.

8)

Use with care. This mode can corrupt the file or the entire disk if CMS crashes before the file is closed.

9)

FILELIST uses **XEDIT**, which makes it slower than **FLIST**. However, **XEDIT** never gets confused by terminal sizes which don't match what the system was originally configured for.

10)

FLIST is a compiled program, which makes it faster **FILELIST**. However, **FLIST** can be confused by non-standard terminal sizes.

11)

For help on this, enter **HELP CPQUERY NAMES**.

12)

For help on this, enter **HELP CPQUERY VIRTUAL**

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