Linux/390 System Management for the Mainframe System Programmer

I know how to do "abc" with my usual OS.
How do I do that with Linux/390?

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About me

- Mark Post (mark.post@eds.com)

- Senior Infrastructure Specialist (Systems Programmer, "plus")

- EDS, Auburn Hills, Michigan

- Worked with IBM mainframes since entering college in 1973.

- Supported MVS and VM for GM and EDS

- Linux and Linux/390 Technical Lead since 01/2003

My Linux background

- First installed Slackware Linux on a PC at home in 1998.

- Involved with Linux/390 since May of 2000.

- Co-author of IBM Redbook:"Linux for zSeries and S/390: Distributions," SG24-6264

- Active in the Linux-390 mailing list hosted by Marist College.

- Webmaster for the linuxvm.org web site.

- Ported Slackware® Linux to the mainframe, released as Slack/390 in July of 2004.

Agenda

- Cultural differences & similarities

- Terminology

- How does Linux/390 compare to Unix System Services?

- How does Linux/390 compare to other Linux platforms?

- What is a distribution, and why doesn't IBM have one?

- What hardware does Linux/390 support?

Agenda (2)

- What networking connections does Linux/390 support?

- Where's SYS1.PARMLIB kept?

- Do I *really* have to know all this stuff?

- Linux/390 DASD management

- Backup and restore

- Software and maintenance management

- Data sharing with Linux/390 and other OS

Agenda (3)

- Job scheduling

- Security and user management

- Diagnostic information available (or not)

- Editors

- Basic vi concepts

- Scripting languages

- System logs

- Basic commands

Agenda (4)

- Advanced commands

- Kernel modules, insmod and modprobe

- System startup and shutdown

- Performance management

- Creating additional images

- Additional information resources
  - Web sites, Redbooks/pieces/tips, Usenet (news), O'Reilly Books

- Command comparisons

Cultural differences

- Open Source Community

- Expectations of self-reliance

- Open Source software

- Software quality

- Where and how you get support

- 3270 terminals vs. VTxxx.

- Install Linux on a PC and use it.

- Is rebooting unnecessarily a sin?

Terminology

- IPL
- nucleus
- PLPA / LINKLIST
- TSO / CMS
- OSA
- PTF / APAR
- IEBUPDTE
- IEBUPDTE input
- SuperC / COMPARE
- xedit update mode

- boot
- kernel
- kernel modules
- shell
- NIC
- patch
- patch
- diff
- diff
- diff

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Terminology (2)

- paging space
- multi-processor
- systems programmer
- GUI
- pattern matching
- help files
- STC / SVM
- address space
- task (tcb)

- swap partition/volume/file
- SMP
- system administrator
- X / X-Window
- regular expression
- man pages
- daemon
- process
- thread

Terminology (3)

- runlevel

- device driver

- tarball (tar - tape archive)
  - tar -cf backup.tar file1 file2 file3 file4
  - tar -xf backup.tar
  - tar -zcf backup.tar.gz file1 file2 file3 file4
    - Equivalent to tar command followed by gzip command
  - tar -zcf backup.tgz file1 file2 file3 file4
  - tar -zxf backup.tgz
  - tar -jcf backup.tar.bz2 file1 file2 file3 file4
    - Uses bzip2 instead of gzip for compression
  - tar –jxf backup.tar.bz2

How does Linux/390 compare to...

- ## Unix System Services
    - Linux/390 is "real" UNIX "under the covers." Things that run on most other Unix systems can be run on Linux/390, usually without change (assuming source is available).
    - There is no such thing as SMP/E or SES in UNIX / Linux. (Not that USS really uses it either, per se.)
    - Option "switches" on various commands are different, due to different shells, or compliance to different standards.

How does Linux/390 compare to...

- Unix System Services (cont.)
  - The Linux man pages work without extra effort on OS/390 side.
  - There's no confusion about which TCP/IP parameters are put where.
  - Things that you learn about other UNIX systems are generally easier to apply to Linux than USS.
  - There's no "other side" (OS/390) to help bail you out when things get messed up.
  - Native ASCII. No EBCDIC <=> ASCII conversions.

How does Linux/390 compare to...

- ## Unix System Services (cont.)
    - Source code is available.
    - Default shell is more often bash than (t)csh.
    - No 3270 interface/limitations to work around. Which also means no real ISPF. (You can buy a clone of it, though.)
    - PL/1, CLISTs are not available.
    - REXX is available, but called Regina.
    - OREXX is available, now in Open Source form.
    - HLASM is now available from Tachyon Software.

- ## Other Linux Platforms
    - Very similar, but it lacks a lot of common PC-type hardware
    - 3270 support included for consoles in LPAR mode
    - S/390 specific hardware

What are distributions?

- VARs

- System Integrators

- Packagers

- Maintainers

- Developers

- Support

- Why doesn't IBM have one?

Linux/390 hardware support

- Any processor that supports the "Halfword Immediate and Relative Branch Feature" instructions added with the G2.

- For decent performance, IEEE FPU is needed. (G5 and up, MP3000.)

- ECKD DASD

- FBA DASD

- 3480/3490/3590 Tapes

- SCSI over FCP now available

Linux/390 networking connections

- 3172

- OSA-2 (Token-Ring, Ethernet, Fast Ethernet)

- OSA-Express (Ethernet, Fast Ethernet)

- 2216 (Token Ring, Ethernet)

- QDIO OSA-Express (Gb Ethernet, Fast Ethernet)

- ESCON / CTC (native and under VM)

- IUCV (only under VM)

- HiperSockets (native and under VM)

- Guest LANs (only under VM)

- Cisco CLAW (CIP) - driver by UTS Global

Where's SYS1.PARMLIB kept?

- Just about everything you need is kept under /etc (at some level of hierarchy).

- Individual text files (or groups of them), since no concept of a PDS in Linux.

- Some *really* important ones:

  - /etc/passwd
  - /etc/shadow
  - /etc/group
  - /etc/gshadow
  - /etc/inittab

  - /etc/inetd.conf
  - /etc/modules.conf
  - /etc/fstab
  - /etc/hosts
  - /etc/resolv.conf

  - /etc/rc.d/...
  - /etc/httpd/...
  - /etc/sysconfig/…
  - /etc/samba/...
  - /etc/pam.d/...
  - /etc/ssh/…

Do I *really* have to know all this stuff?

- No, but shouldn't you?

- If you really don't want to know what's going on or have a large virtual farm:
  - YaST   (SuSE)
  - Nautilus   (Red Hat)
  - Webmin   (completely perl-based)
  - AdminUX   (Green Light Advantage)
  - linuxconf   (no longer recommended by RH)
  - Others

Linux/390 DASD management

Quick Overview:

- 2 kinds of DASD layouts, cdl and ldl.

- Adding/removing DASD

- Preparing DASD for use
    - Formatting
    - Partitioning (2.4.x & 2.6.x kernels only)
    - Creating file systems and Swap
    - File systems vs. directories

- Backing up your DASD

Adding/Removing DASD

- For 2.4.x kernels, can be dynamic:
  - Adding a device
  - **echo "add device range=*devno-range* " > /proc/dasd/devices**
  - Disabling a device
  - **echo "set device range=*devno-range* off " > /proc/dasd/devices**
  - Enabling a device
  - **echo "set device range=*devno-range* on " > /proc/dasd/devices**
  - Still want to update /boot/parmfile or /etc/zipl.conf and re-run "zipl" to make the change permanent. (mkinitrd may also be required.)

- For 2.2.x kernels, requires updating /boot/parmfile, re-running "silo," and rebooting.

Adding/Removing DASD in 2.6.x

- /sys/bus/ccw/devices/0.0.0601@

- /sys/bus/ccw/drivers/dasd-eckd/0.0.0601@

- /sys/bus/css/devices/0.0.0016@

- /sys/bus/css/drivers/io_subchannel/0.0.0016@

- /sys/devices/css0/0.0.0016/

  - 0.0.0601/
    bus@
    chpids
    driver@
    pimpampom

- /sys/devices/css0/0.0.0016/0.0.0601/

  - Availability
  - bus@
  - cmb_enable
  - cutype
  - devtype
  - discipline
  - driver@
  - online
  - readonly
  - use_diag

Use /sbin/chccwdev instead

chccwdev --online 0.0.0601

chccwdev --e 0.0.0601

Formatting DASD - 2.4.x, 2.6.x

- dasdfmt -b 4096 [-l volser] [-d layout]
    -f /dev/dasd?
    -n 0d18   (only if devfs is in use)
    - dasdfmt -b 4096   -d cdl -f /dev/dasda
    - dasdfmt -b 4096   -d ldl   -n 0cf3
    - dasdfmt -b 4096   -d cdl -n 0d2f

- fdasd /dev/dasd?
    - **Must** create one, two, or three partitions

Formatting DASD - 2.2.x

- dasdfmt -b 4096 [-l volser] -f /dev/dasd?

- dasdfmt -b 4096 [-l volser] -n fc23

Creating file systems and Swap

- ## 2.4.x, 2.6.x Kernels
  - mke2fs -b 4096 /dev/dasd?1,2,3
    - mke2fs -b 4096 /dev/dasda1
    - mke2fs -b 4096 /dev/dasda2
    - mke2fs -b 4096 /dev/dasda3

- ## 2.2.x Kernels
  - mke2fs -b 4096 /dev/dasd?1
    - mke2fs -b 4096 /dev/dasda1
    - mke2fs -b 4096 /dev/dasdb1

- ## mkswap /dev/dasd?1   (2.2 kernels)

- ## mkswap /dev/dasd?1,2,3   (2.4, 2.6 kernels)

File systems vs. directories

/   (root)

/bin

/boot *

/dev

/etc

/home

/lib

/mnt

/opt

/proc

/root (not to be confused
                    with / root)

/sbin

/tmp

/usr

/var

Backup and restore

- ## Native Linux facilities
  - afio/cpio/tar

- ## Software packages (Open Source and proprietary)
  - Amanda / offlindr
  - DFSMSdss / DDR
  - Tivoli TSM/ADSM
  - Innovation FDRINSTANT/UPSTREAM
  - CA BrightStor
  - SecureAgent SecureBackup
  - UTS Global TSS-BAR
  - Veritas NetBackup

Software & maintenance management

- Since there is no such thing as SMP/E or SES, you have to learn a new mindset.

- There are "binary" packages for several platforms, primarily Intel. Different distributions use different methods to manage those packages: RPM, dpkg.

- Source packages (RPM, tar.gz, etc.) are always available for Open Source software.

Software & maintenance management (2)

- In a number of cases, there is no binary available for Linux/390. Compiling from source is the only option. This can be **very** easy or **very** difficult, depending on the package.

- You will become very familiar with the 'tar,' 'gzip,' and 'make' commands. Most likely 'patch' and 'diff' as well.

- Once you start down that road, you are no longer a Linux user, but a Linux developer, with all the pain that can entail.

Software & maintenance management (3)

- Keeping track of security patches is **very** important, and people-intensive.

- Getting email notifications from security sources (CERT, etc.) is recommended.

- If you *have* to install a package from source, it probably won't be too difficult.
  - tar -zxf package.name.tar.gz
  - cd package-directory
  - ./configure
  - make, and then make install

Using RPM

- VERY high-level!
  - rpm -i package.name.rpm   (install)
  - rpm -e package.name   (remove)
  - rpm -q package.name   (query)
  - rpm -ql package.name
  - rpm -qlp package.name.rpm
  - rpm -qa
  - rpm -qf /path/to/file/name

- dpkg on Debian-based systems

Data sharing with Linux/390 and other OS

- No direct, hard-wired sharing

- z/OS and z/VM don't "know" ext2

- Linux doesn't "know" VTOCS, etc.
  - Except now it does. But, no security!

- Various network-based methods
  - NFS
  - GFS
  - AFS
  - Samba (SMB / CIFS / MS Networking)

- Under VM - sharing minidisks *read-only* between guests.

Job scheduling

- Linux native facilities
  - cron
  - at

- Open Source:
  - DQS
  - queue
  - OpenPBS
  - generic NQS

- Proprietary
  - CA-7 Agent
  - Jobtrac
  - CA Scheduler
  - PBSPro

Security and user management

- Security in an ongoing process, not a status. It must be constantly attended to for you to have any chance at all.

- Most successful security breaches come from employees of a company, not outsiders.

- In contrast to typical mainframe security, Linux security is more network oriented.

- If possible, have a UNIX security person handle your Linux security needs.

Security and user management (2)

- Turn off *ALL* unnecessary services: telnet, ftp, smtp, time, finger, http, pop3, imap, login, shell, printer, nfs, etc., etc.

- Use OpenSSH instead of telnet, ftp, rlogin, rsh, rexec, rlogin, etc..

- Use shadow password utilities.

- Use TCP Wrappers (/etc/hosts.allow, etc.)

- Review your system logs regularly.

- Monitor security alerts from your suppliers, and from various security organizations.

Security and user management (3)

- Don't lump all your users into one group (typically "users").

- Don't create a separate group for each user (Red Hat's approach).

- Try to have reasonable groups defined so that people can share data appropriately, and put the proper users into them.

- Don't give *anyone* a UID of zero unless it's absolutely necessary (and even then think about other ways to avoid it).

Security and user management (4)

- Various tools are available for adding, deleting and changing user and group definitions. All information about users and groups are in plain text files.

- SuSE has YaST

- Red Hat has Nautilus and redhat-config-* tools

- Webmin is popular

- linuxconf was popular, but should not be used

- useradd, userdel, usermod, groupadd, groupdel, groupmod are common

Security and user management (5)

- Protect the password of "root" very carefully.

- Login as "yourself" and su to root only when really needed.

- Consider using /etc/suauth to allow designated people to "su" using their own password.

- Consider using /etc/sudoers to grant some selected command authority to designated people.

Diagnostic information

- strace

- ulimit (to enable core dumps)

- gdb

- uptime

- top

- ksymoops

- netstat

- ping

- traceroute

- system logs

- dmesg

- standalone dump (2.4.x and 2.6.x kernels only)

Editors (Holy War fodder)

- vi / vim / elvis

- emacs / xemacs

- joe

- jed

- jove

- ed (sed)

- nano

- pico

- ne

- ned (3270 enabled)

- Nedit

- THE (The Hessling Editor)

No native free ISPF/PDF clones.
(2 proprietary ones)

Basic vi concepts

- Cursor keys work as expected (or h-j-k-l), as do Page up and Page Down, Delete and Backspace (when ssh client is properly configured.)

- Two important modes: command, insert.

- I'm pretty unfamiliar with vi, so I basically use insert mode and command mode.

- Insert button = insert mode (twice = replace)

- ESC = exit insert/command mode to visual mode.

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Basic vi concepts (2)

- :set smd   or :set showmode
  - gives visual indicator what mode you're in

- :d = delete a line

- :w = write updated file to disk

- :x = write updated file to disk and exit

- :q = quit if no updates have been made since the last save (:w)

- :q! = quit regardless

- :help = help me!

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Scripting languages (Holy War cont.)

- perl

- ash / bash / csh / tcsh / ksh / ksh93 / zsh

- Regina (REXX)

- OREXX

- Tcl

System logs

- Most of what you want will be in /var/log/, or in a subdirectory of it.

- Names and contents vary by distribution

- Reviewing them *frequently* is important

- Samples:

  - /var/log/messag es
  - /var/log/syslog
  - /var/log/debug
  - /var/log/boot.log
  -

  - /var/log/proftpd.log
  - /var/log/maillog
  - /var/log/warn
  - /var/log/httpd/...
  - /var/log/samba/...

Basic commands

- **rm -rf /***

- cd

- cp

- mv

- rm

- ls

- find

- grep

- cat

- less / more

- man

- info

- mount

- umount

- mkdir

- rmdir

- ps

- pushd

- popd

- which

Advanced commands

- ifconfig
- netstat
- route
- ping
- host / nslookup
- traceroute
- su
- sudo
- gzip / bzip2
- last

- chmod
- chown
- dmesg
- du
- df
- locate
- top
- sed
- head
- tail

- silo / zipl
- wget
- export
- file
- insmod
- modprobe
- lsmod
- rmmod
- telinit

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Kernel modules, insmod and modprobe

- The kernel contains all the code necessary to run as an operating system. This includes device drivers, file system drivers, networking code, etc.

- Kernel modules are parts of the kernel that don't have to be compiled into the kernel itself (but can be if you want to).

- This can allow you to update these components on the fly, without rebooting.

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Kernel modules, insmod and modprobe (2)

- Since modules are *not* in the kernel, how do they get loaded into kernel storage?
  - insmod
  - modprobe
  - dynamically by the kernel if /etc/modules.conf has the right data in it.

- How does the module get it's parameters?
  - provided on insmod command
  - read from /etc/modules.conf by modprobe and the kernel.

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Kernel modules, insmod and modprobe (3)

- How does the kernel find the module?
  - Usually in /lib/modules/kernelver/something...
  - depmod -a command creates a cross reference of the modules and where they are located, and writes it into /lib/modules/kernelver/modules.dep.
  - modprobe figures out the dependencies and loads the modules in the right order. insmod does not do this.

System startup and shutdown

- From the HMC, just like any other OS, except no loadparms are needed/used.

- From VM, there are usually some CMS/CP commands issued in PROFILE EXEC, followed by a 'CP IPL devno CLEAR'

- From VM, you can still IPL from the reader, if desired.

- snIPL (simple network IPL)

- How the rest of the system is brought up by init is a very complex process, beyond the scope of this talk.

System startup and shutdown (2)

- When shutting down, it is important to do it *properly*. File system corruption and data loss can result otherwise.

- Use the halt, reboot or shutdown command.

- You can use shutdown to warn any logged on users, and/or set the shutdown to some time in the future.

- The shutdown command has options to reboot, halt, or cancel a previous shutdown command.

Performance management

- Some "standalone" native Linux tools:
  - top, ntop, httperf, sar, iostat, gkrellm, pload, statnet, Big Brother, iptraf
  - Understand that in a shared environment, such as z/VM, these will *all* be lying to you in certain ways.

- Proprietary products
  - Velocity Software ESALPS (under z/VM)
  - BMC MAINVIEW
  - Candle OMEGAMON XE

Creating additional images

- Some commercial tools

- Can be done with home grown tools

- For large "penguin farms," knowing what to share between images and how is key.

- IBM Redbook "Linux on IBM zSeries and S/390: ISP/ASP Solutions," SG24-6299

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Questions?

Additional information - web sites

- http://linuxvm.org/
  (Largely Linux/390 specific)

- http://www.marist.edu/htbin/wlvindex?linux-390
  (Linux/390 mailing list)

- http://www.slack390.org/

- http://www.kernel.org/

- http://www.linux.org/

- http://www.tldp.org/
  (The Linux Documentation Project)

Additional information - Redbooks

- http://www.redbooks.ibm.com/

- Linux for S/390, SG24-4987

- Linux for zSeries and S/390: Distributions, SG24-6264

- Linux on zSeries and S/390: ISP/ASP Solutions, SG24-6299

- Linux on zSeries and S/390: Application Development, SG24-6807

- Linux on zSeries and S/390: System Management, SG24-6820

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Additional information – Redbooks (2)

- Linux on zSeries and S/390: Large Scale Linux Deployment, SG24-6824

- Linux on zSeries and S/390: Performance Measurement and Tuning, SG24-6926

- Linux with zSeries and ESS: Essentials, SG24-7025

- Experiences with Oracle for Linux on zSeries, SG24-6552

- SAP on DB2 UDB for OS/390 and z/OS: Implementing Application Servers on Linux for zSeries, SG24-6847

Additional information – Redbooks (3)

- e-Business Intelligence: Leveraging DB2 for Linux on S/390, SG24-5687

- e-Business Intelligence: Data Mart Solutions with DB2 for Linux on zSeries, SG24-6294

Additional information – Redpieces

- Implementing Linux in your Network using Samba, redp0023

- Building Linux Systems Under IBM VM, redp0120

- Linux on zSeries and S/390: High Availability for z/VM and Linux, redp0220

- Linux on zSeries and S/390: Securing Linux for zSeries with a Central z/OS LDAP Server (RACF), redp0221

- Linux on zSeries and S/390: Server Consolidation with Linux for zSeries, redp0222

- Linux on zSeries and S/390: Cloning Linux Images in z/VM, redp0301

Additional information – Redpieces (2)

- Linux on zSeries and S/390: TCP/IP Broadcast on z/VM Guest LAN, redp3596

- Linux on zSeries and S/390: Managing a Samba Server from z/VM, redp3604

- Linux on zSeries and S/390: Porting LEAF to Linux on zSeries, redp3627

- Linux on zSeries and S/390: Virtual Router Redundancy Protocol on VM Guest LANs, redp3657

- Linux on zSeries and S/390: z/VM Configuration for WebSphere Deployments, redp3661

Additional information – Redpieces (3)

- Linux on zSeries and S/390: Building SuSE SLES8 Systems under z/VM, redp3687

- Linux on zSeries and S/390: VSWITCH and VLAN Features of z/VM 4.4, redp3719

- e-commerce Patterns for Linux on zSeries Using WebSphere Commerce Suite V5.1 Patterns for e-business series, redp0411

- Getting Started with zSeries Fibre Channel Protocol, redp0205

Additional information – Redpieces (4)

- WebSphere Portal Installation on Linux for zSeries, redp3699

- Open Your Windows with Samba on Linux, redp3780

Additional information – Hints & Tips

- Linux on zSeries: Configuring gcc as a cross-compiler, tips0005

- Dynamic management of DASD devices in Linux running on zSeries, tips0023

- Formatting and Labeling a DASD Volume for Linux Guests Running Under z/VM, tips0275

- Partitioning DASD for Linux Guests Running under z/VM, tips0277

Additional information - Usenet ("news")

- alt.os.linux.dial-up
- alt.os.linux.redhat
- alt.os.linux.slackware
- alt.os.linux.suse
- alt.os.linux.turbolinux
- comp.os.linux.admin
- comp.os.linux.advocacy
- comp.os.linux.announce
- comp.os.linux.development.apps
- comp.os.linux.development.system
- comp.os.linux.hardware
- comp.os.linux.help
- comp.os.linux.misc
- comp.os.linux.networking

- comp.os.linux.questions
- comp.os.linux.redhat
- comp.os.linux.security
- comp.os.linux.setup
- comp.os.linux.x
- comp.protocols.smb (Samba, mainly)
- linux.debian.devel.mentors
- linux.debian.devel.qa
- linux.debian.devel.release
- linux.debian.ports.s390
- linux.debian.project
- linux.debian.project
- linux.debian.security

- linux.dev.c-programming
- linux.dev.kernel
- linux.dev.laptop
- linux.dev.newbie
- linux.help
- linux.kernel
- linux.net.masquerade
- linux.redhat.announce
- linux.redhat.devel
- linux.redhat.install
- linux.redhat.pam
- linux.redhat.rpm
- linux.samba
- linux.sources.kernel

Additional information - O'Reilly books

* Apache: The Definitive Guide, 2nd Edition
  Apache Pocket Reference
* Building Internet Firewalls, 2nd Ed
* DNS and BIND, 4th Edition
* Learning Perl, 3rd Edition
* Learning the bash Shell, 2nd Edition
* Learning the vi Editor, 6th Edition
  MySQL & mSQL
* Perl Cookbook
  Perl for System Administration
  Perl for Web Site Management
  Perl in a Nutshell

* Practical UNIX & Internet Security, 2nd Edition

* Programming Perl, 3rd Edition

* Running Linux, 3rd Edition

    Samba Pocket Reference

    sed & awk Pocket Reference

* sed & awk, 2nd Edition

* sendmail, 2nd Edition

    sendmail Desktop Reference

* SSH, The Secure Shell: The Definitive Guide

* TCP/IP Network Administration, 2nd Edition

* Using Samba - comes with the software

    vi Editor Pocket Reference

* Networking CD Bookshelf

      TCP/IP Network Administration, 2nd Edition

      sendmail, 2nd Edition

      sendmail Desktop Reference

      DNS and BIND, 3rd Edition

      Practical UNIX & Internet Security, 2nd Edition

      Building Internet Firewalls

* The Perl CD Bookshelf, Version 2.0

      Programming Perl, 3rd Edition

      Perl for System Administration

      Perl in a Nutshell

      Perl Cookbook

      Advanced Perl Programming

* The Linux Web Server CD Bookshelf

    Running Linux, 3rd Edition

    Linux in a Nutshell, 3rd Edition

    Apache: The Definitive Guide, 2nd Edition

    MySQL & mSQL

    Programming the Perl DBI

    CGI Programming with Perl, 2nd Edition

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Command comparison

MVS	VM	Linux	DOS
• LISTC	• L	• ls / locate	• dir
• LISTD	• L (L	• file	• attrib
• LIST	• TYPE	• cat	• type
• COPY	• COPY	• cp	• copy
• MOVE	• MOVE	• mv	• move
• RENAME	• RENAME	• mv	• ren
• DELETE	• ERASE	• rm	• del
• HELP	• HELP	• man / info	• help
• ICKDSF	• FORMAT	• dasdfmt / mke2fs	• format

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Command Comparison (2)

MVS	VM	Linux
SEND	TELL / MSG / NOTE	write / talk / wall
LISTB		/etc/motd
LOGOFF	LOGOFF	exit
PRINTDS	PRINT	lpr
V ONLINE	ATTACH	mount
V OFFLINE	DETACH	umount
D TS	Q U	uptime
D TS,L	Q N	users / w
D A,L	Q N	ps -ax

Command comparison (3)

Linux	DOS	Linux	DOS
• cd	• cd	• host	• nslookup
• mkdir	• mkdir	• nslookup	• nslookup
• rmdir	• rmdir	• netstat	• netstat
• less / more	• more	• route	• route print
• ping	• ping	• find	• find
• traceroute	• tracert	• set	• set
		• export	• set