



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
- 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
- Open Source software
- Software quality
- Where and how you get support
- Expectations of self-reliance
- 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



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 -jcf backup.tar.bz2 file1 file2 file3 file4
 - tar -zxf backup.tgz



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 $\Leftrightarrow$ 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.
 - HLASM is now available from Tachyon Software.



How does Linux/390 compare to...

- 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 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.)
- 2.6.x kernels use a completely different means.
- 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 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 / offlinr
 - 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.



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 is 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.



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!



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/messages
 - /var/log/syslog
 - /var/log/debug
 - /var/log/boot.log
 - /var/log/dmesg
 - /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



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.

⋮⋮ 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.



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, httpperf, 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



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



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



Additional information – Redpieces (2)

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



Additional information – Redpieces (3)

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



Additional information - O'Reilly books (2)

- * 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



Additional information - O'Reilly books (3)

- * 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



Additional information - O'Reilly books (4)

- * 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



Command comparison

<u>MVS</u>	<u>VM</u>	<u>Linux</u>	<u>DOS</u>
• 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



Command Comparison (2)

<u>MVS</u>	<u>VM</u>	<u>Linux</u>
• 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)

<u>Linux</u>	<u>DOS</u>	<u>Linux</u>	<u>DOS</u>
• 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