L05
Linux/390 System Management for the Mainframe Systems Programmer
Mark Post
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

- Backup and restore
- Software and maintenance management
- Data sharing with Linux/390 and other OS
- Job scheduling
- Security and user management
- Diagnostic information available (or not)
- Editors
- Basic vi concepts
Agenda (2)

- Scripting languages
- System logs
- Basic commands
- Advanced commands
- Kernel modules, insmod and modprobe
- System startup and shutdown
- Performance management
- Creating additional images
Agenda (3)

- Questions?
- Additional information resources
  - Web sites, Redbooks/pieces/tips, Usenet (news), O'Reilly Books
- Command comparisons
## File systems vs. directories

<table>
<thead>
<tr>
<th>File System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>/</code> (root)</td>
<td></td>
</tr>
<tr>
<td><code>/bin</code></td>
<td></td>
</tr>
<tr>
<td><code>/boot</code></td>
<td></td>
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<tr>
<td><code>/dev</code></td>
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<tr>
<td><code>/etc</code></td>
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<tr>
<td><code>/home</code></td>
<td></td>
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<tr>
<td><code>/lib</code></td>
<td></td>
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<tr>
<td><code>/mnt</code></td>
<td></td>
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<tr>
<td><code>/opt</code></td>
<td></td>
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<tr>
<td><code>/proc</code></td>
<td></td>
</tr>
<tr>
<td><code>/root</code></td>
<td>(not to be confused with <code>/root</code>)</td>
</tr>
<tr>
<td><code>/sbin</code></td>
<td></td>
</tr>
<tr>
<td><code>/sys</code></td>
<td></td>
</tr>
<tr>
<td><code>/tmp</code></td>
<td></td>
</tr>
<tr>
<td><code>/usr</code></td>
<td></td>
</tr>
<tr>
<td><code>/var</code></td>
<td></td>
</tr>
</tbody>
</table>
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.
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 its 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, 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
Questions?
Additional information - web sites

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

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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.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 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
* 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
  MySQL & mSQL
  Programming the Perl DBI
  CGI Programming with Perl, 2nd Edition
# Command comparison

<table>
<thead>
<tr>
<th>MVS</th>
<th>VM</th>
<th>Linux</th>
<th>DOS</th>
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<tbody>
<tr>
<td>LISTC</td>
<td>L</td>
<td>ls / locate</td>
<td>dir</td>
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<td>LISTD</td>
<td>L (L</td>
<td>file</td>
<td>attrib</td>
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<tr>
<td>LIST</td>
<td>TYPE</td>
<td>cat</td>
<td>type</td>
</tr>
<tr>
<td>COPY</td>
<td>COPY</td>
<td>cp</td>
<td>copy</td>
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<tr>
<td>MOVE</td>
<td>MOVE</td>
<td>mv</td>
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<tr>
<td>RENAME</td>
<td>RENAME</td>
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<tr>
<td>DELETE</td>
<td>ERASE</td>
<td>rm</td>
<td>del</td>
</tr>
<tr>
<td>HELP</td>
<td>HELP</td>
<td>man / info</td>
<td>help</td>
</tr>
<tr>
<td>ICKDSF</td>
<td>FORMAT</td>
<td>dasdfmt / mke2fs</td>
<td>format</td>
</tr>
</tbody>
</table>

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## Command Comparison (2)

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

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## Command comparison (3)

<table>
<thead>
<tr>
<th>Linux</th>
<th>DOS</th>
<th>Linux</th>
<th>DOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• cd</td>
<td>• cd</td>
<td>• host</td>
<td>• nslookup</td>
</tr>
<tr>
<td>• mkdir</td>
<td>• mkdir</td>
<td>• nslookup</td>
<td>• nslookup</td>
</tr>
<tr>
<td>• rmdir</td>
<td>• rmdir</td>
<td>• netstat</td>
<td>• netstat</td>
</tr>
<tr>
<td>• less / more</td>
<td>• more</td>
<td>• route</td>
<td>• route print</td>
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<tr>
<td>• ping</td>
<td>• ping</td>
<td>• find</td>
<td>• find</td>
</tr>
<tr>
<td>• traceroute</td>
<td>• tracert</td>
<td>• set</td>
<td>• set</td>
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