



Linux/390 System Management for the Mainframe System Programmer

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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?
- What networking connections does Linux/390 support?

Agenda (2)

- 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
- Job scheduling

Agenda (3)

- 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 / VSM
- address space
- task (tcb)
- swap 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 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.
- The Linux man pages work without extra effort on OS/390 side.
- There’s no confusion about which TCP/IP parameters are put where.
- The Linux man pages work without extra effort on OS/390 side.
- There’s no confusion about which TCP/IP parameters are put where.

How does Linux/390 compare to...

- Unix System Services (cont.)
 - 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.
 - 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.
 - 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:
 - YaST2 (SuSE)
 - Nautilus (Red Hat, redhat-config-* tools)
 - Webmin (completely perl-based)
 - AdminUX (Green Light Advantage)
 - linuxconf (no longer recommended by RH)
 - Others

Linux/390 DASD management

- 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 and re-run "zipl" to make the change permanent.**
- For 2.2.x kernels, requires updating /boot/parmfile, re-running "silo," and rebooting.

Formatting DASD - 2.4.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 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 / 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.

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
 - rpm -e package.name
 - rpm -q package.name
 - 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
- Webmin is popular
- linuxconf is/was popular
- 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 kernel only)

Editors (Holy War fodder)

- vi / vim / elvis
- emacs / xemacs
- joe
- jed
- jove
- ed (sed)
- nano
- pico
- ne
- 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
- sed
- head
- tail
- silo / zipl
- wget
- export
- file
- insmod
- modprobe
- lsmod
- rmmod
- telinit
- top

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
- 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

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

MVS

- LISTC
- LISTD
- LIST
- COPY
- MOVE
- RENAME
- DELETE
- HELP
- ICKDSF

VM

- L
- L (L
- TYPE
- COPY
- MOVE
- RENAME
- ERASE
- HELP
- FORMAT

Linux

- ls / locate
- file
- cat
- cp
- mv
- mv
- rm
- man / info
- dasdfmt /
mke2fs

DOS

- dir
- attrib
- type
- copy
- move
- ren
- del
- help
- format

Command Comparison (2)

MVS

- SEND LISTB
- LOGOFF
- PRINTDS
- V ONLINE
- V OFFLINE
- D TS
- D TS,L
- D A,L

VM

- TELL / MSG / NOTE
- LOGOFF
- PRINT
- ATTACH
- DETACH
- Q U
- Q N
- Q N

Linux

- write / talk / wall
- /etc/motd
- exit
- lpr
- mount
- umount
- uptime
- users / w
- ps -ax

Command comparison (3)

Linux

- cd
- mkdir
- rmdir
- less / more
- ping
- traceroute

DOS

- cd
- mkdir
- rmdir
- more
- ping
- tracert

Linux

- host
- nslookup
- netstat
- route
- find
- set
- export

DOS

- nslookup
- nslookup
- netstat
- route print
- find
- set
- set

Questions?

