

Red Hat Enterprise Linux 101

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Agenda

- 10 things everyone should know about RHEL
- The Basics
- Device Management
- Disk Management
- Configuring Services
- RPM & YUM
- Kernel Basics
- Networking
- Compiling Software
- Tips & Tricks

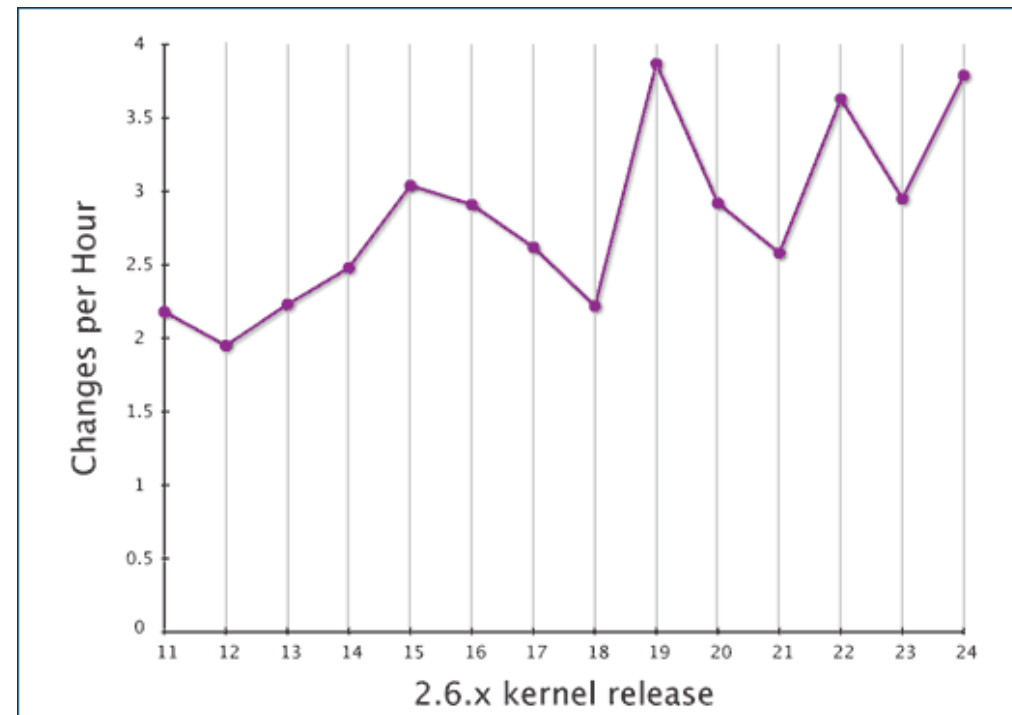
10. In Linux (like Unix):

“Everything is a file”

Everything is a file descriptor or a process

9. Fun Facts about Linux

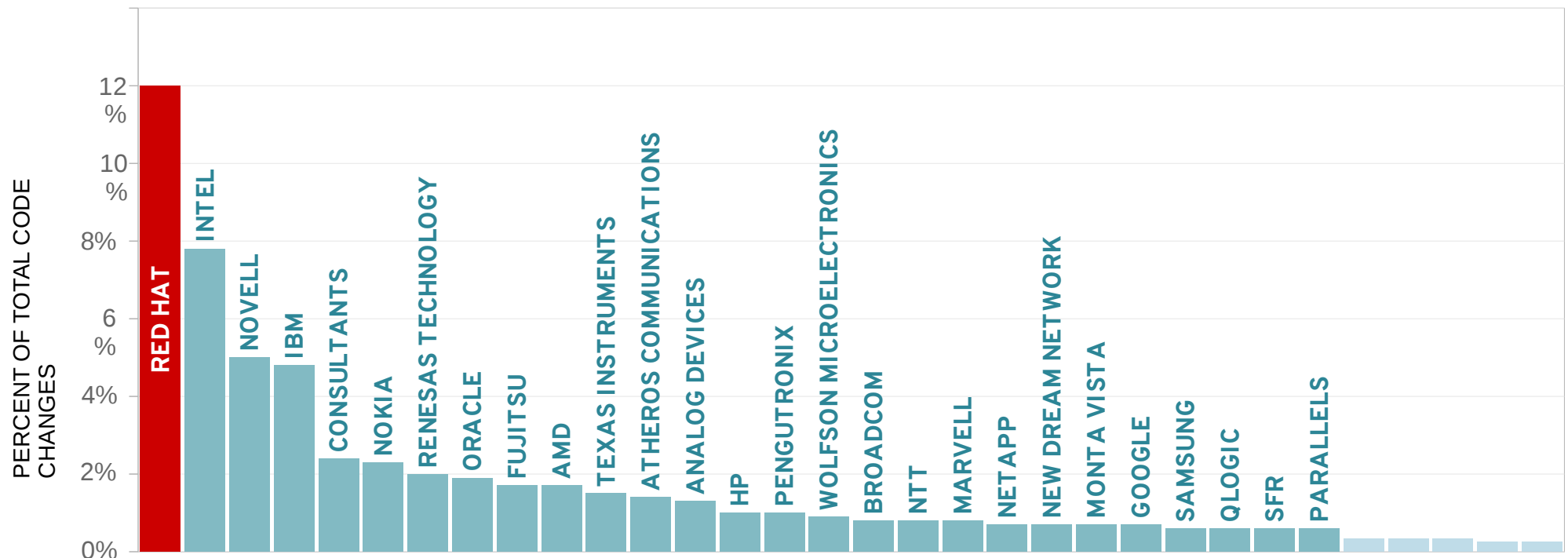
- In development for over twenty years
- A new version is released every ~3 months
- ~3.5 commits every hour to the upstream kernel
- ~15 million lines of code



8. Red Hat is a Development Powerhouse

Red Hat is consistently the largest contributor to the Linux kernel

Corporate Contributions to Linux KERNEL 2.6.30-2.6.35 (DEC 2010)



Source:
The Linux Foundation Linux Kernel Development 2010
December 2010 (Pages 14-15)

7. Red Hat Enterprise Linux Lifecycle

A major release is supported for:

- A) a couple years
- B) 7 years
- C) 10 years
- D) 13 years

7. Red Hat Enterprise Linux Lifecycle

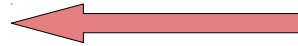
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RHEL 2, 3, 4

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RHEL 5, 6,

7. Red Hat Enterprise Linux Lifecycle

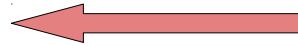
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Extended Life Support

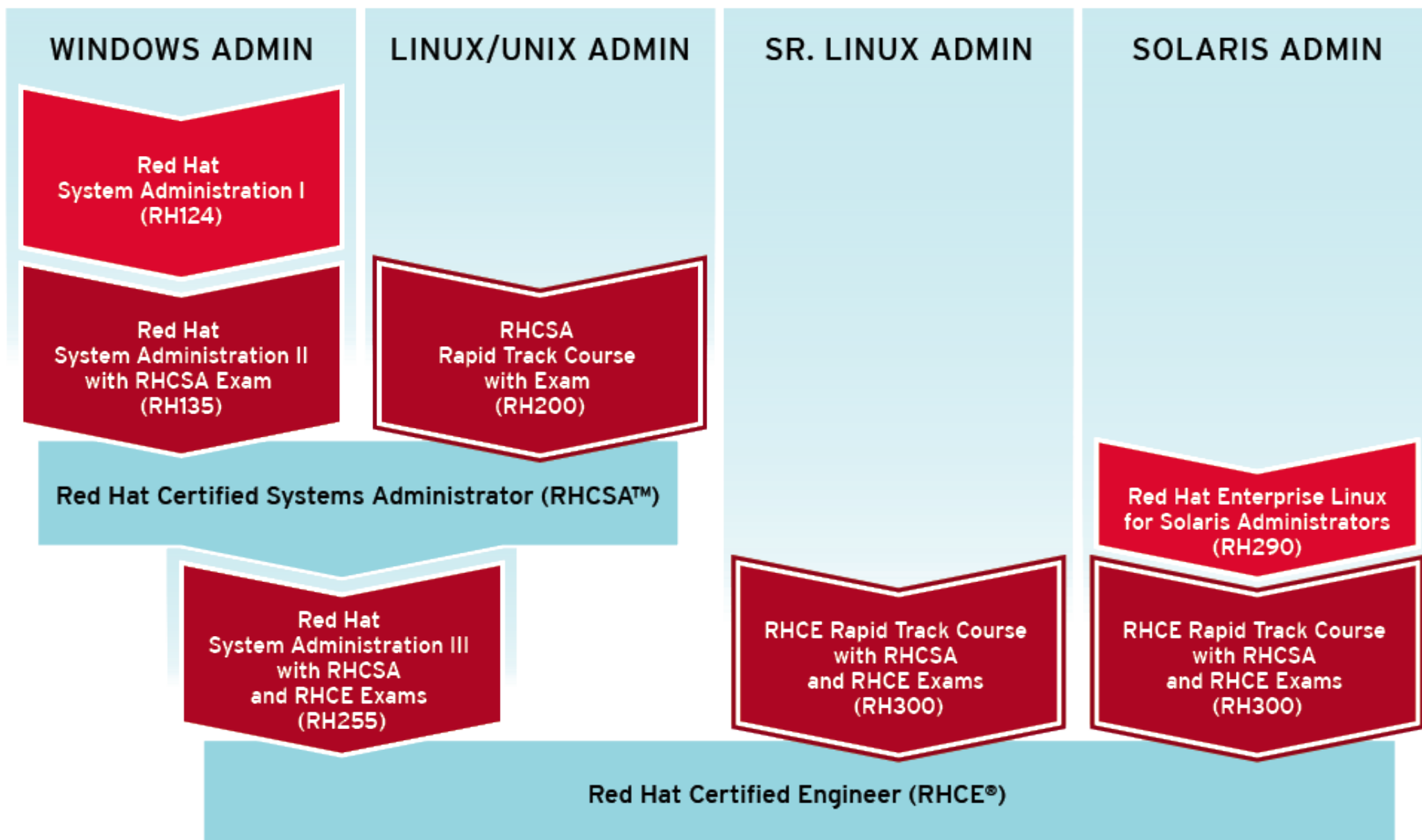
6. API/ABI Compatibility

The API / ABI Compatibility Commitment defines stable, public, system interfaces for the full ten-year life cycle of Red Hat Enterprise Linux 6. During that time, applications will not be affected by security errata or service packs, and will not require re-certification. Backward compatibility for the core ABI is maintained across major releases, allowing applications to span subsequent releases.

5. WHERE TO GO FOR HELP

- Customer Portal: <http://access.redhat.com>
 - Knowledge base, forums, reference arch
 - Support cases (now including chat)
 - Downloads & Documentation
- Via phone: 888-GO-REDHAT
- Documentation: <http://docs.redhat.com>

4. Flexible Training Options



3. Virtualization is built-in

Operating System

- Memory management
- Power management
- CPU Scheduling
- TCP/IP stack
- Security
- Fibre channel
- Clustering
- File system
- Volume Management
- Disk drivers
- Network Drivers

.....



Linux 99.5%

Hypervisor

- Memory management
- Power management
- CPU Scheduling
- TCP/IP stack
- Security
- Fibre channel
- Clustering
- File system
- Volume Management
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- Network Drivers

.....

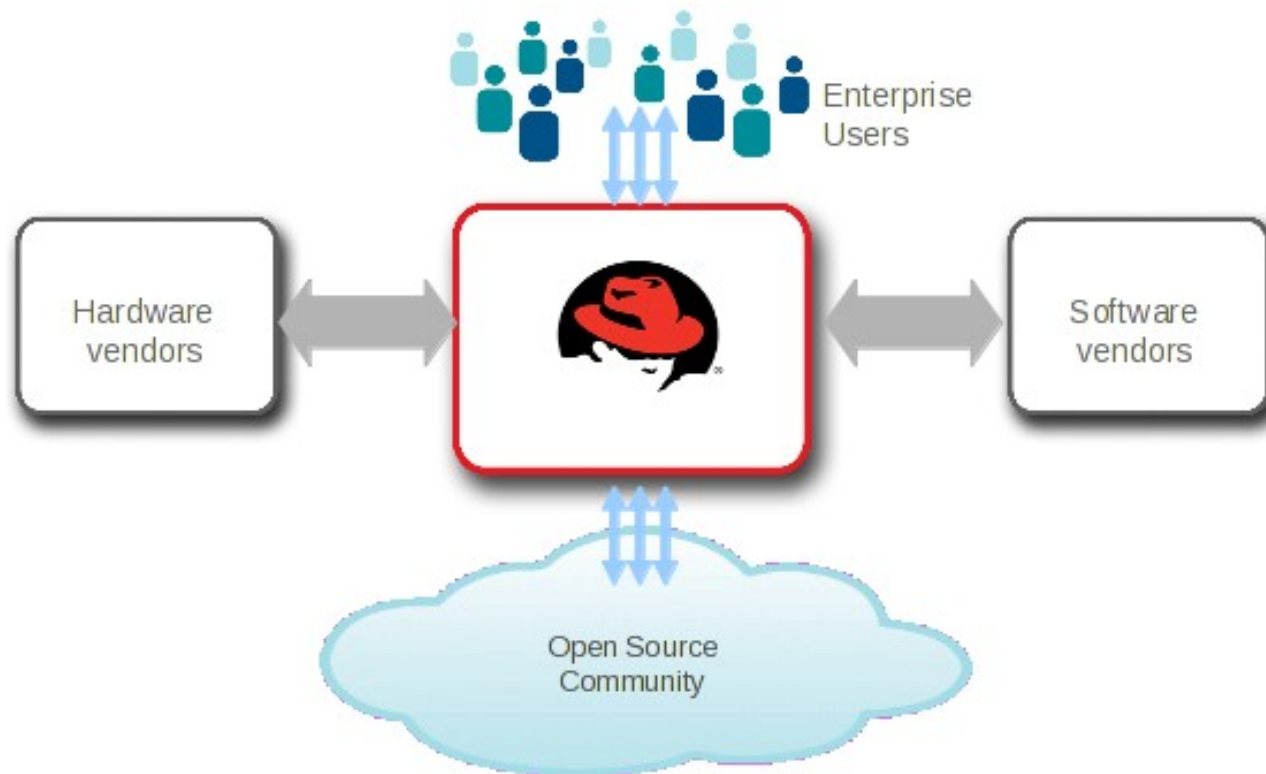
- Driver for Intel VT, AMD-V



KVM 0.5%

2. Customers help us drive change

Red Hat Enterprise Linux 6 includes 1,821 customer and partner requested features



1. The most important thing to remember is

Linux is Fun

.....and if you disagree, you haven't used it enough.

The Basics

Red Hat Enterprise Linux

- Supported architectures: x86, x86_64, PPC64, s390x
- Simple and straight forward to install
 - Deployments can be automated using kickstart
- RPM package based distribution
- Identify the version via ``cat /etc/redhat-release``
- `/etc/sysconfig/` contains many system settings
- `system-config` utilities provide simple configuration utilities
- Register to RHN or Satellite for updates

Boot Process

- GRUB – GRand Unified Bootloader
 - Default bootloader for Linux.
 - Can *chain load* other operating systems.
- Stage 1 – Small image, 446 bytes, in the MBR.
 - Simply loads stage 2.
- Stage 2 – Loaded from /boot
 - Configure via /boot/grub/grub.conf
 - Loads the kernel (vmlinuz) and initial RAM disk (initrd.img)

File System Hierarchy Standard (FHS)

/	/proc
/bin	/media
/boot	/mnt
/dev	/root
/etc	/sbin
/home	/tmp
/lib	/usr
/opt	/var

Command Comparison

Command Purpose	MS-DOS	Linux
Copies files	copy	cp
Move files	move	mv
List files	dir	ls
Delete files	del	rm
Compare files	fc	diff
Display help	[command] /?	man, -h, --help
Create directory	mkdir	mkdir
Rename files	ren	mv
Display location	chdir	pwd
Change dir	chdir	cd
RAM in use	mem	free
Process IDs	TASKLIST	top

User Management

- Local accounts: useradd, userdel
 - /etc/passwd, /etc/group, /etc/shadow
- Set password: passwd [username]
- SSSD – LDAP, Kerberos, Active Directory, IdM
- su – switch user
- sudo
 - /etc/sudoers
 - visudo to configure

File Permissions

- `-rw-r--r--. 1 root root 200 Oct 15 01:37 rsyslog`
- (r)ead=4, (w)rite=2, e(x)ecute = 1
- Useful commands `chmod`, `chown`, `chgrp`
 - `-R` for recursive, `-v` verbose
 - Ex: `chmod 600 myfile.txt`
 - Ex: `chmod u+x myfile.sh`
 - Ex: `chown owner:group myfile.txt`

Text Editors

- vi – **v**isual editor
 - Always installed
 - Very fast for tweaking configuration files
 - vim – vi enhanced
 - Learn vi with `vimtutor`
- Emacs – Powerful and extendable editor
- nano – A user friendly editor
- Graphical editors: gedit, kwrite

OpenSSH

- Provides the **Secure Shell** protocol
 - Replaces insecure legacy applications like telnet
 - Can tunnel insecure protocols using port forwarding
 - Includes scp (secure copy) and sftp (secure ftp)
- Configuration file: /etc/ssh/sshd_config
 - PermitRootLogin, Port, Protocol
- Forward X via `ssh -X user@hostname`
- Passwordless authentication
 - `ssh-keygen -t rsa`
 - `ssh-copy-id -i ~/.ssh/id_rsa user@hostname`
- Execute remote commands: `ssh user@hostname uptime`

[Openssh-intro](#)

Managing Devices

Device Naming Convention

- **Device type** followed by **device number**
 - ttyS0 <- 1st serial device
- Storage devices use name prefix, device letter, partition number
 - sdb3 <- 2nd disk 3rd partition
- MAKEDEV
- mknode

Devices under /dev

- sd – scsi/sata disk
- vd – virtio disk
- dm – device mapper
- mapper/vg_name-lv_name
- tty – terminals (switch via ctrl+alt+F{1..6})
- ttyS – serial ports

Viewing File Systems & Block Devices

- mount – use to display and mount file systems
- findmnt – provides a tree view of mount points
- /etc/fstab – Configure persistent mounts
 - Device mount point fs-type options dump-freq pass#
 - /dev/VolGroup00/LogVol00 / ext4 defaults 0 0
- df -h – disk free, view file system usage
- du -sh – disk usage, view file and directory size
- lsblk – list block devices
- blkid – Identify the UUID for a device

Viewing File Systems

Pop Quiz

What does this command do?

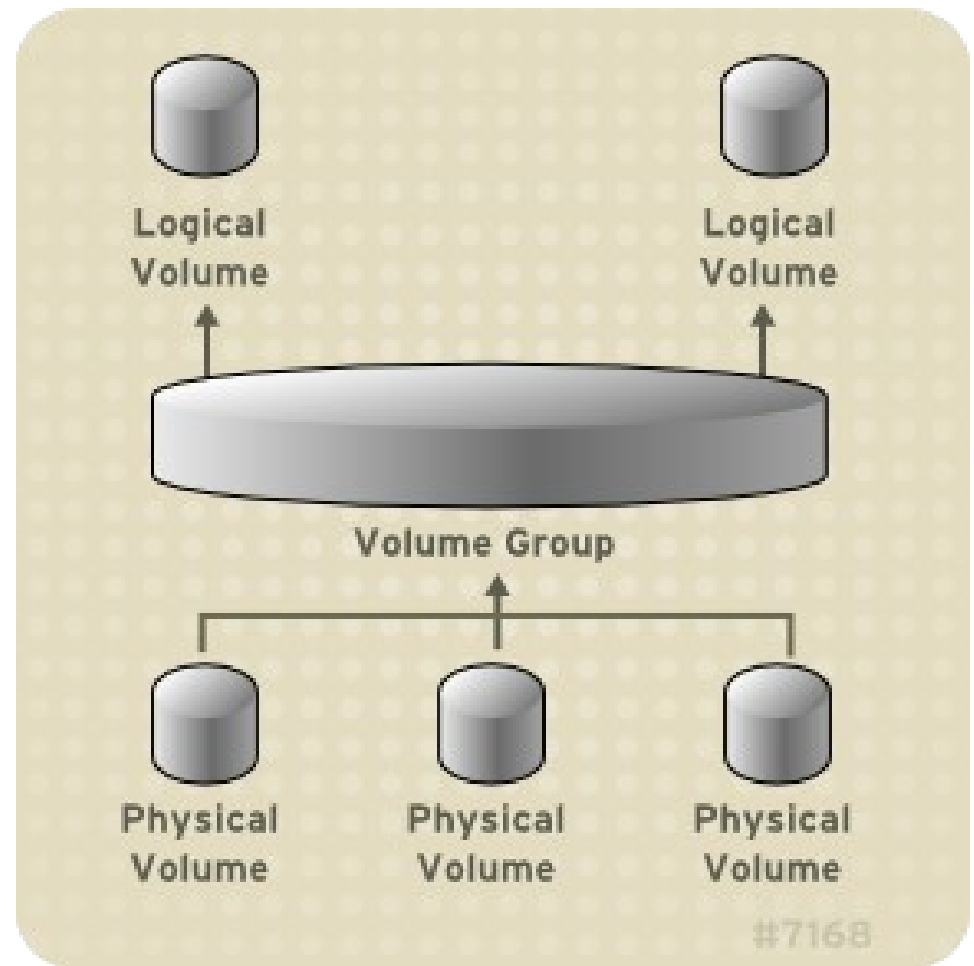
- `du -h | sort -rn | less`

Partitioning

- fdisk or parted
 - fdisk /dev/sdb
 - m for menu
 - n for new
 - Follow the prompts
 - W for write
 - Run `partprobe` to inform the OS of partition table changes.

LVM

- **Remember the order of operations**
 - **pv, vg, lv**
- {pv,vg,lv}display
- {pv,vg,lv}create
- {pv,vg,lv}remove
- {pv,vg,lv}resize
- {pv,vg,lv}s



Create File Systems

- mke2fs
- mkfs [tab] [tab]
 - mkfs.ext4 [device]

DM RAID

- `mdadm --create /dev/md0 --level=1 --raid-devices=2 /dev/sda1 /dev/sdb1`
- ``cat /proc/mdstat`` for status
- Use a bitmap when possible for faster recovery
 - `mdadm --grow /dev/md0 --bitmap=internal`
- Configure `/etc/mdadm.conf` for email alerts
 - MAILADDR
 - MAILFROM

```
$ mdadm --detail /dev/md0
```

```
/dev/md3:
```

```
Version : 0.90
```

```
Creation Time : Tue Jun 28 16:05:49 2011
```

```
Raid Level : raid1
```

```
Array Size : 128384 (125.40 MiB 131.47 MB)
```

```
Used Dev Size : 128384 (125.40 MiB 131.47 MB)
```

```
Raid Devices : 2
```

```
Total Devices : 2
```

```
Preferred Minor : 0
```

```
Persistence : Superblock is persistent
```

```
Update Time : Thu Jun 30 17:06:34 2011
```

```
State : clean
```

```
Active Devices : 2
```

```
Working Devices : 2
```

```
Failed Devices : 0
```

```
Spare Devices : 0
```

```
UUID : 49c5ac74:c2b79501:5c28cb9c:16a6dd9f
```

```
Events : 0.6
```

```
Number  Major  Minor  RaidDevice State
```

```
0       3      1      0    active sync  /dev/sda1
```

```
1       3     65      1    active sync  /dev/sdb1
```

Configuring Services

Init / Upstart

- Short for initialization
- Always PID 1
- Init scripts are located in /etc/init.d/
- Default runlevel set in /etc/inittab
 - id:3:initdefault:
- Change runlevel via `init X`
- Runlevels execute scripts under /etc/rc.d/rc[X].d/
- Use /etc/rc.local for commands on startup

Init / Upstart

```
root@bbreard:/etc/rc.d/rc3.d
File Edit View Search Terminal Help
[root@bbreard ~]# cd /etc/rc.d/rc3.d
[root@bbreard rc3.d]# ls
K00spiceusbsrzd  K60nfs  S05cgconfig  S26acpid
K01numad  K69rpcsvcgssd  S08ip6tables  S26haldaemon
K01smarzd  K73winbind  S08iptables  S26udev-post
K02oddjobd  K73ypbind  S10network  S27ktune
K03rhnsd  K75ntpdate  S11auditd  S27pcscd
K05wdaemon  K75quota_nld  S11portreserve  S28autofs
K10psacct  K76openvpn  S12rsyslog  S55sshd
K10sasauthd  K80kdump  S13cpuspeed  S56xinetd
K15htcacheclean  K83bluetooth  S13irqbalance  S58ntpd
K15svnserve  K84wpa_supplicant  S13rpcbind  S80postfix
K16abrt-ccpp  K85ebtables  S15mdmonitor  S84ksm
K16abrtzd  K86cgred  S22messagebus  S85httpd
K16abrt-oops  K87restorecond  S23NetworkManager  S85ksmtuned
K30spice-vdagentd  K88iscsi  S24avahi-daemon  S86tuned
K36mysqld  K88sssd  S24nfslock  S90crond
K36postgresql  K89iscsid  S24openct  S95atd
K46radvd  K89rdisc  S24rpcgssd  S97libvirtd
K50dnsmasq  K95firstboot  S24rpcidmapd  S97rhsmcertd
K50netconsole  K99rngd  S25blk-availability  S99certmonger
K50snmpd  K99sysstat  S25cups  S99libvirt-guests
K50snmptrapd  S02lvm2-monitor  S25netfs  S99local
[root@bbreard rc3.d]#
```

{K,S}, Order, Daemon -> sym link to ../init.d/daemon

Start, Stop, Onboot

- `/etc/init.d/[daemon]`
- `service {start, stop, restart, status} daemon`
 - Ex: `service httpd restart`
- To see available actions only enter ``service daemon``
`service dhcpd`

Usage: `/etc/init.d/dhcpd {start|stop|restart|force-reload|condrestart|try-restart|configtest|status}`

- `chkconfig daemon {on, off}`
- View: `chkconfig --list daemon`

RPM & YUM

RPM Package Manager

- Upgradability – Configuration files persist upgrades
- Powerful Querying – Identify which files belong to which packages
- System Verification – Integrity of binaries
- Pristine Sources – Original tgzs are included in srpms



**RPM PACKAGE
MANAGEMENT**

RPM Commands

- Install a package: `rpm -ivh [package name]`
- Upgrade a package: `rpm -Uvh [package name]`
- Remove a package: `rpm -e [package name]`
- View installed packages: `rpm -qa`
- Filter for package: `rpm -qa |grep [package name]`
- Verify package: `rpm -V [package name]`
- Query file: `rpm -qf /path-to-file`
- Locate documentation: `rpm -qdf /path-to-file`



RPM PACKAGE
MANAGEMENT

YUM Yellowdog Updater, Modified

- Package manager or “frontend” for RPM
- Whenever possible use YUM for installing/removing/upgrading packages
- Dependency resolution – avoid “dependency hell”
- Easily pull from repositories
- Add repositories to `/etc/yum.repos.d/`

YUM Commands

- Update system: `yum update`
- Update package: `yum update [package]`
- Install package: `yum install [package]`
- Install group: `yum groupinstall [group]`
- Install local rpm: `yum localinstall /path-to-rpm`
- Remove package: `yum remove [package]`
- Search for package: `yum search [package]`
- List package groups: `yum grouplist`
- Search based on file: `yum provides /path-to-file`
- Clear cached packages & headers: `yum clean all`

Kernel Basics

Kernel

- The “heart” of the operating system
- Handles process scheduling, input/output, memory management
- Drivers for system components are handled as kernel modules
- Red Hat attempts to ship as many modules as possible (so that only the minimal components are “hard-coded”)
- Each module has its own parameters, many of which are used for tuning

Kernel

- Check the current version via ``uname -r``
 - 2.6.32-358.2.1.el6.x86_64
- View installed kernels using ``rpm -q kernel``
- View parameters passed to the kernel at boot time
 - `cat /proc/cmdline`
- Kernel modules:
 - List: `lsmod`
 - Add: `modprobe`
 - Remove: `rmmod`

Kernel Tunables

- Exposed under `/etc/sysctl.conf`
- `/proc`
- `/sys`
- `tuned-adm`
- `/usr/share/doc/kernel-*/Documentation`
- `modinfo`

Networking

Networking

- View network info via:
 - `ip ad sh`
 - `Ifconfig`
- Restart networking: `service network restart`
- Bounce an interface: `ifdown eth0 && ifup eth0`
- Interactive TUI run ``setup``
- Configure hostname, gateway, gatewaydev in `/etc/sysconfig/network`
- Configure interface: `/etc/sysconfig/network-scripts/ifcfg-eth0`
- DNS is set in `/etc/resolv.conf`

Network Interface Scripts

```
cat /etc/sysconfig/network-scripts/ifcfg-eth0
```

```
DEVICE="eth0"
```

```
BOOTPROTO="dhcp"
```

```
NM_CONTROLLED="no"
```

```
ONBOOT=yes
```

```
TYPE="Ethernet"
```

```
HWADDR=F0:DE:F1:9A:5E:E8
```

Network Interface Scripts

```
cat /etc/sysconfig/network-scripts/ifcfg-eth0
```

```
DEVICE="eth0"
```

```
BOOTPROTO="static"
```

```
NM_CONTROLLED="no"
```

```
ONBOOT=yes
```

```
TYPE="Ethernet"
```

```
HWADDR=F0:DE:F1:9A:5E:E8
```

```
IPADDR=10.10.10.1
```

```
NETMASK=255.255.255.0   (for CIDR use PREFIX=24)
```

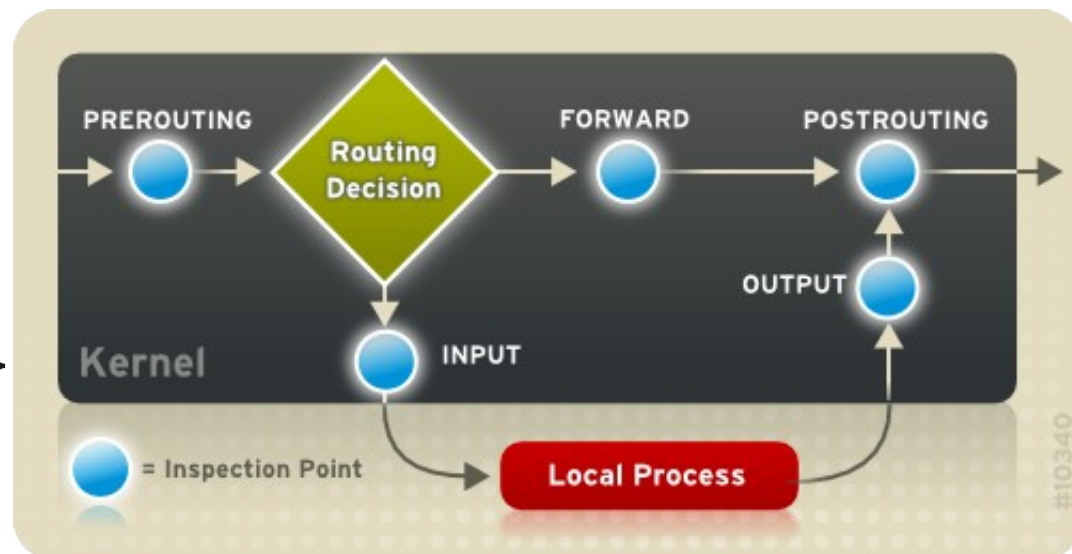
```
GATEWAY=10.10.10.254
```

```
DNS1=4.2.2.2
```

Firewall - iptables

- Stateless and stateful packet inspection (IPv4 & IPv6)
- Network address and port translation, e.g. NAT/NAPT (IPv4 and IPv6)
- Rules are persisted in /etc/sysconfig/iptables
- Tweak config file for easy edits & restart iptables
- System-config-firewall-tui
- lokkit --service=http
- lokkit --port=3129:tcp
- service iptables {start/stop}
- chkconfig iptables on/off

[iptables guide](#)



Compiling Software

STOP!

Consider the following:

1. Is this already packaged and available as an RPM?
 - RPMs are easier to manage, update, uninstall, etc.
 - Most ISVs ship RPMs and/or have yum repositories.
 - Check trusted 3rd party repositories (EPEL, Atrpms, etc)
2. If it's not available in an RPM, should you role one?
 - There is a learning curve to creating RPMs
 - Once a SPEC file is written, updating is easy

Developer Tools

- gcc - GNU Compiler Collection includes front ends for C, C++, Objective-C, Fortran, Java, and others.
- make – Automatically builds compiled code using a makefile
- automake – Tool for automatically generating makefiles
- Eclipse – Open source IDE

The Quick and Dirty

- Install these package groups: development-tools & development-libraries
- Extract the tarball
 - `tar -zxvf some.tar.gz`
 - `cd some`
 - `./configure`
 - `make`
 - `make install`

Tips & Tricks

Misc

- The best way to learn is by immersion.
 - Consider taking a class
 - Installing RHEL or Fedora on a personal laptop
- When troubleshooting always consider selinux & iptables
- SELinux Intro: <https://access.redhat.com/site/articles/217213>
- SELinux for Mere Mortals
- Configure static routes: <https://access.redhat.com/site/solutions/8023>
- Jumbo frames: add MTU=9000 to the interface config file

Misc

- Find files with `locate`
- Terminal tips:
 - Use tab completion
 - Shift+PgUp to backscroll (not an issue w/ putty)
 - Ctrl+I will clear the terminal
 - Ctrl+r searches history
 - sudo !! - rerun last command w/ escalated privileges
- Use `screen` for long SSH sessions
- Use a tuned profile

Creating a Virtual Template

- Delete ssh keys: ``rm -rf /etc/ssh/ssh_host_*``
- Comment or delete HWADDR from the network config
- Remove UDEV rules from `/etc/udev/rules.d/70-persistent-net.rules`
- ****optional**** `touch /.unconfigured`
 - Edit `/etc/rc.sysinit` to make it non-interactive

