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RED HAT ENTERPRISE LINUX ROADMAP HIGHLIGHTS

Tim Burke
Vice President, Linux Development
and Engineering Team Leaders
Red Hat, Inc.
May 4, 2011

Objectives for this talk

- To show you how Red Hat Enterprise Linux 6:
  - Helps you run leaner and more efficiently
  - Incorporates flexibility into your infrastructure
- To give you ideas for how you can apply RHEL 6 to your business
- To give you a roadmap to other resources and talks at the Red Hat Summit and beyond

Agenda

- RHEL 6 major themes and initiatives overview (10 min)
  - A deployment scenario that incorporates typical customer problems
- Solutions for each of the feature areas (45 min)
- Break near the hour (10 min)
- Solutions, part two (35 min)
- Summary and Q&A (15 min)

RHEL Mission

- Stable and efficient infrastructure platform
- Productized access to the best of open source collaborative development – superior integration
- Driving innovation in data center operational efficiency by leading open source contribution
- Providing customer choice
- Customer relationships

RHEL Release Lifecycles

RHEL 3

- Extended lifecycle available through Oct 2013

RHEL 4

- RHEL 4.9 shipped Feb 2011
- High priority only bug fixes through Feb 2012
- Extended lifecycle available through Oct 2015

RHEL 5

- RHEL 5.6 shipped Jan 2011
- Minor features and additional hardware enablement through 2012
- High priority only bug fixes through Mar 2014
- Extended lifecycle available through Mar 2017

RHEL 6 Major Themes

OPTIMIZATION FOR TODAY'S IT DEPLOYMENTS

Scale - Performance
Security - Resource Control
Manageability - Reliability

VIRTUALIZATION

Secure optimization
for hosts and guests
Cloud foundation

GREEN IT

Power management
and efficiency

RUNTIME

Application development
Monitoring
Runtime ecosystem

RHEL 6.1 Innovation

- Ongoing subscription value
- Latest hardware enablement and scalability
- Performance improvements
- Updated development and debugging tools
- Interoperability enhancements
- New identity management capabilities
- Redesigned entitlement system to boost the value of your RHEL subscription
- Preserves application compatibility to RHEL 6.0

Deployment scenario: Greenhouse Professional Software*

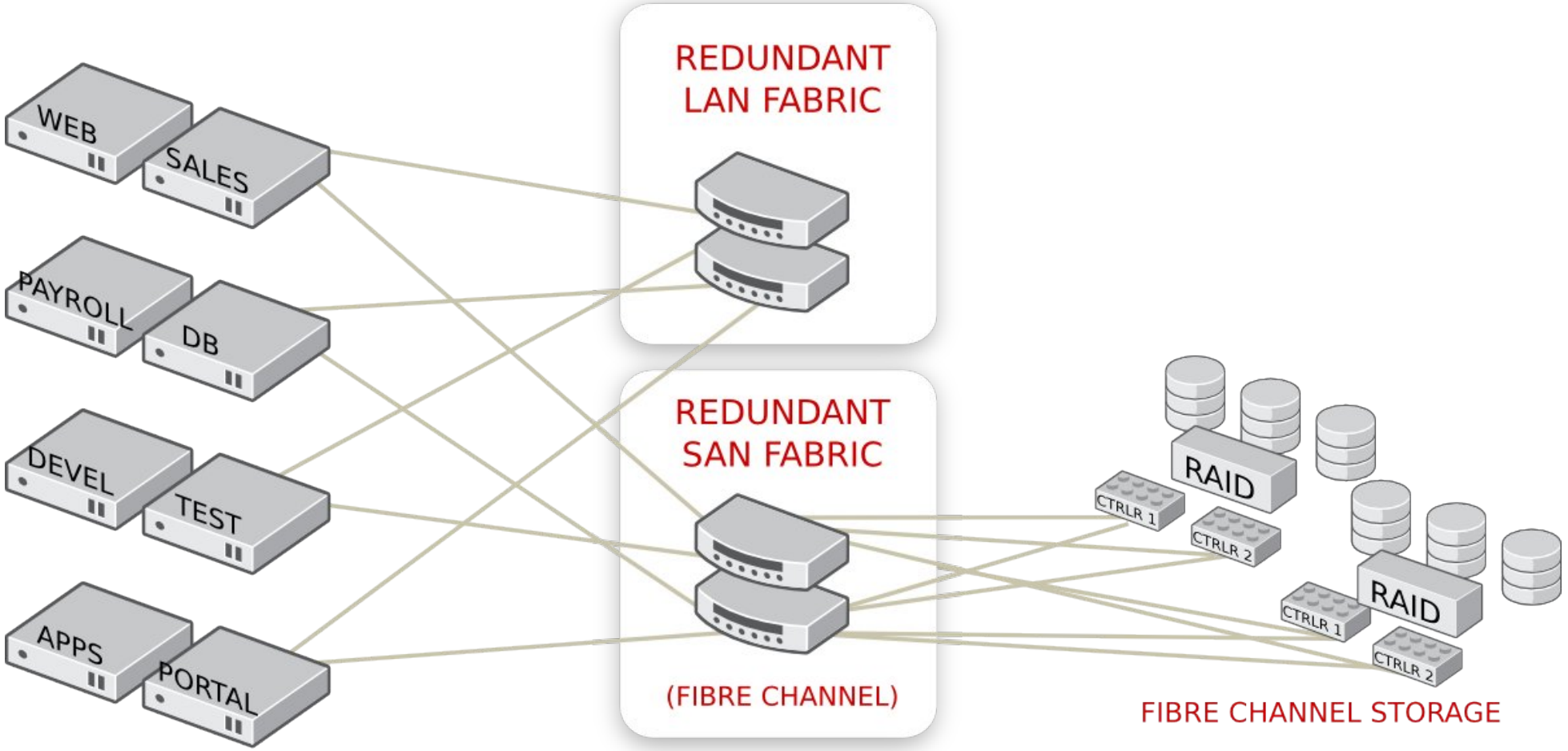
- For-hire application development firm
- Often delivers on tight schedule-based, fixed contract
- Maintains a suite of custom applications in-house

** The company depicted herein is fictitious and used for example purposes only.*

Challenges at Greenhouse

- IT room is filling up, monthly power bill is increasing
- Company has added remote employees, window for maintenance time has shrunk
- Management of IT resources has grown too complex
- Hardware support contract and license costs too high
- Old servers starting to fail – their OS doesn't support desired newer hardware, and 3rd party apps don't support new OSes
- Need to add capacity, cut costs, maintain performance

Today's IT situation at Greenhouse



The solution...

How Greenhouse can own the new now

DATA CENTER CONSOLIDATION AND EFFICIENCY


Migrate storage


Virtualize hosts

MANAGE AND OPTIMIZE SYSTEM RESOURCES


Establish resource use policies


Optimize file systems


Deploy virtualized guest security containment


Measure and minimize power consumption

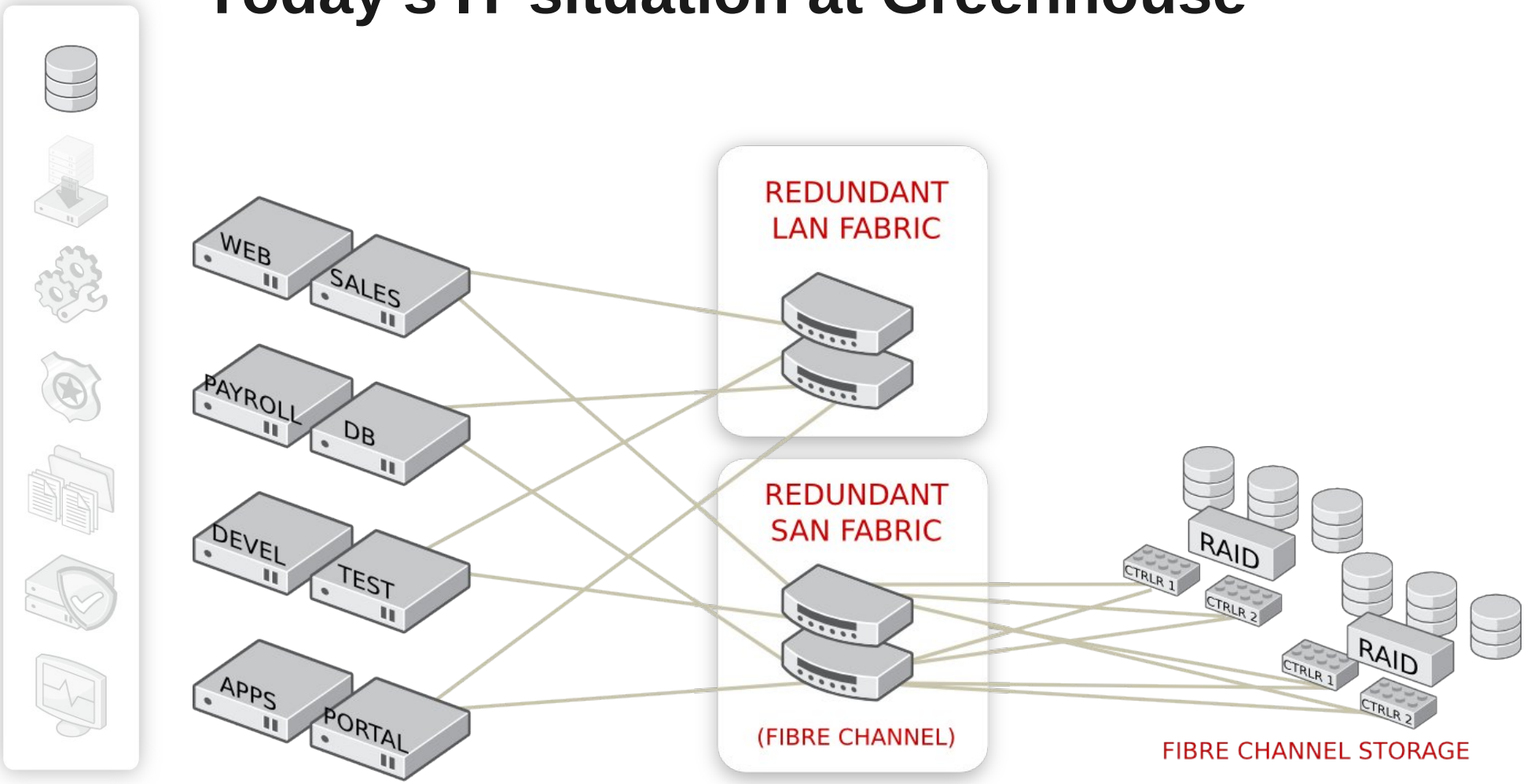

Collect and act on application crash data


Monitor, observe, and tune application performance

STORAGE

Tom Coughlan
Senior Engineering Manager, Kernel Storage
Red Hat, Inc.

Today's IT situation at Greenhouse



Greenhouse's problems

All associated with maintaining two fabrics – network and storage

- Space
- Cost
- Complexity
- Power

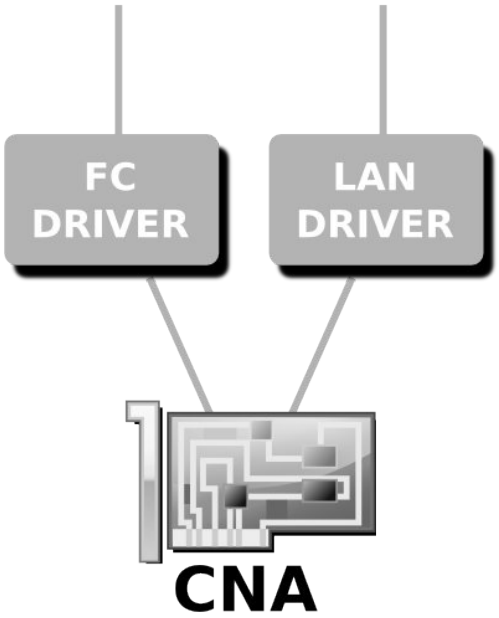
What is FCoE?

Fibre Channel over Ethernet

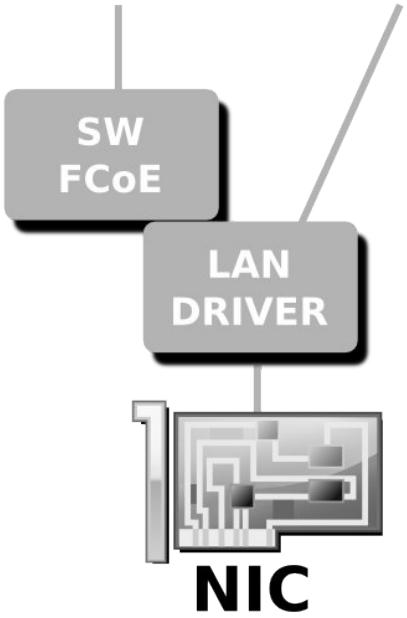
- Encapsulates FC frames in Ethernet packets
- No TCP/IP – simple, more predictable performance
- Uses Data Center Bridging (DCB) Ethernet extensions
  - Lossless frame delivery
  - Priority Groups (QoS)

FCoE in Red Hat Enterprise Linux

- Converged Network Adapter (CNA)



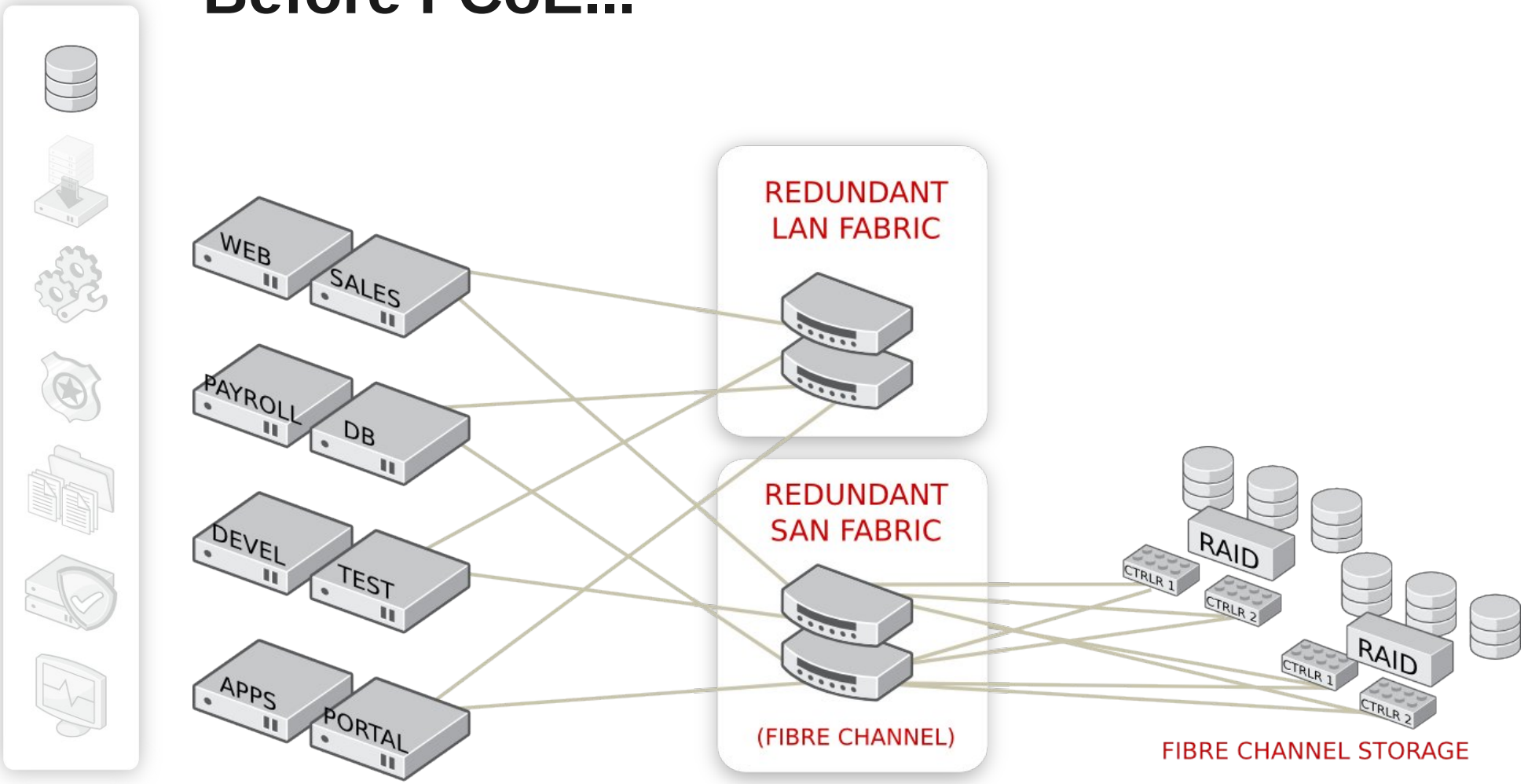
- Software FCoE on a standard NIC



Greenhouse's approach

- Move to 10Gbit Ethernet
- Keep their FC storage (for now)
  - Connect to a FC line-card on the 10GbE switch
  - Access to all the LUNs and data is unchanged
    - Device-mapper-multipath for high availability (HA)
    - Familiar storage management methods and tools remain

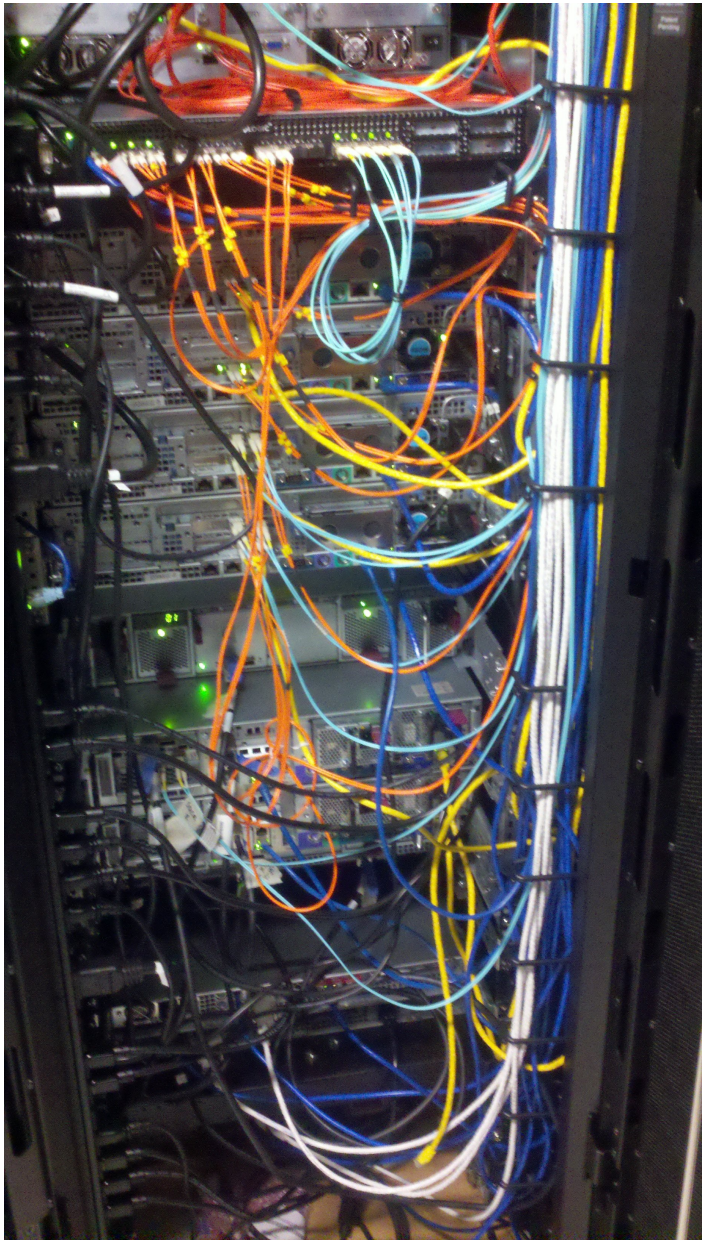
Before FCoE...


WEB
SALES
PAYROLL
DB
DEVEL
TEST
APPS
PORTAL
REDUNDANT
LAN FABRIC
REDUNDANT
SAN FABRIC
(FIBRE CHANNEL)
RAID
CTRLR 1
CTRLR 2
RAID
CTRLR 1
CTRLR 2
FIBRE CHANNEL STORAGE

Before FCoE...

FC Switch

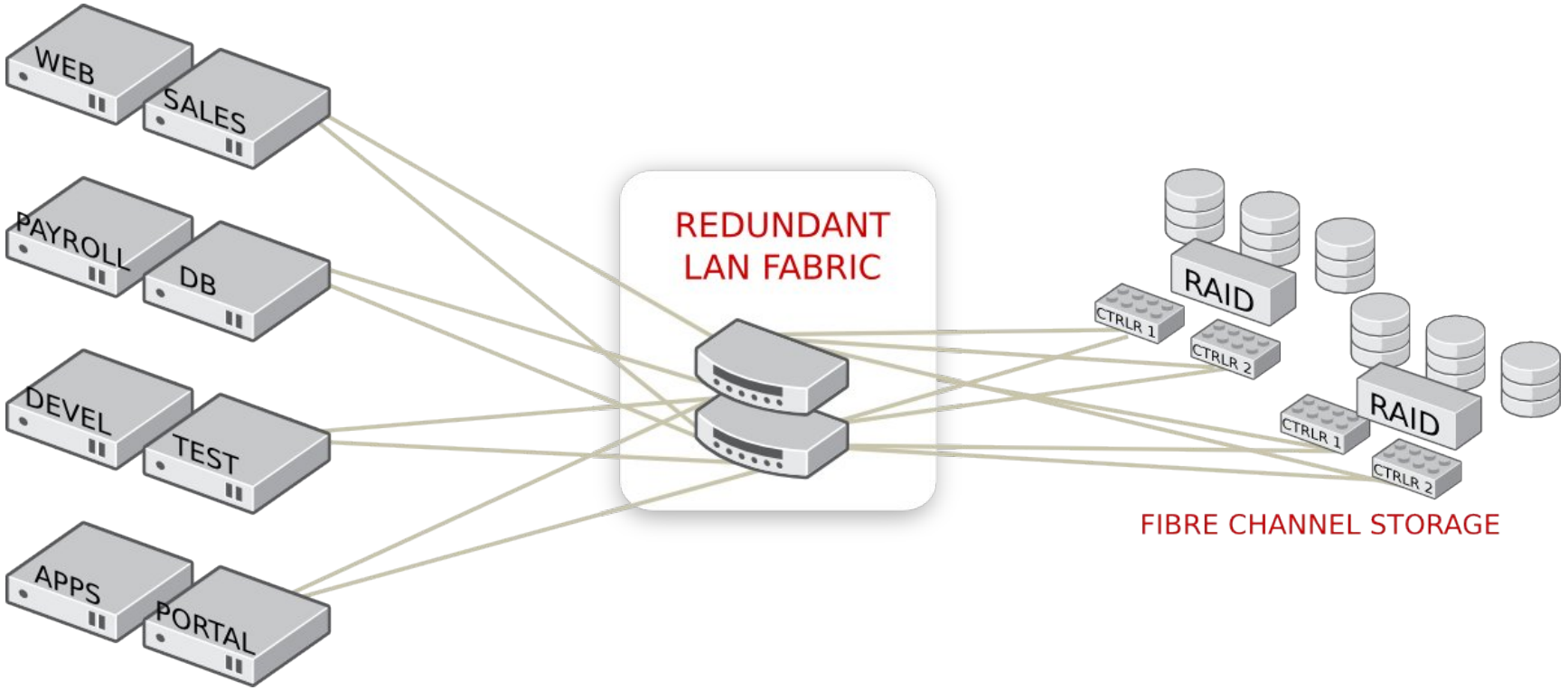
Three servers, each with two FC connections and two LAN connections



LAN Cables

Get rid of all those orange cables!

After FCoE


WEB
SALES
PAYROLL
DB
DEVEL
TEST
APPS
PORTAL
REDUNDANT
LAN FABRIC
RAID
CTRLR 1
CTRLR 2
RAID
CTRLR 1
CTRLR 2
FIBRE CHANNEL STORAGE

Greenhouse problems solved

- Reduce cost and complexity of data center by moving to FCoE in RHEL 6
- Preserve access to storage, unchanged – allows incremental change

When you are ready...

...Update your storage.

RHEL 6 supports several new SCSI features currently making their way to the market:

- I/O Discard – to optimize hardware thin provisioning, and flash storage
- Automatic data alignment and I/O size
- 4K sector size
- Protection Information (PI, *aka* DIF/DIX)

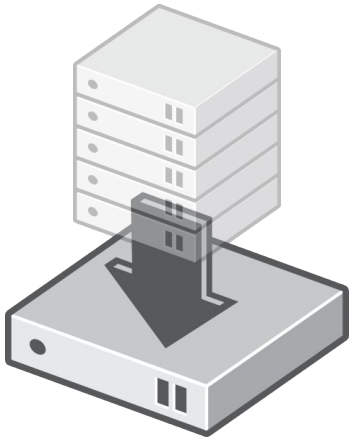
Related sessions

Wed. 3:10pm, Thu. 10:20am: Protecting Information Using On-Disk Encryption – Bowe Strickland

Wed: 4:20pm: Clustered Applications with RHEL 6 – Thomas Cameron and Lon Hohberger

Thu. 11:30am: High Availability in the Cloud – Perry Myers, Steven Dake, and Sayan Saha

Fri. 9:45am: Enabling RHEV with NetApp Storage – Geert Jansen, Jon Benedict, and Henry Vail



VIRTUALIZATION

Rik van Riel
Senior Software Engineer
Red Hat, Inc.

Virtualization benefits

- Reduces hardware requirements
- Reduces power requirements
- Reduces space requirements
- Increases reliability
- Hardware breaks? Run the VM elsewhere
- In use at many companies

Scary situation at Greenhouse

- Old servers are OLD
  - Business depends on old fragile hardware
  - Not enough budget to upgrade them all
- Business is growing, IT budget is not
  - No space for many additional servers
  - No power for many additional servers
  - No money for many additional servers
- Reliability requirements becoming stricter

...Virt is the answer to scary.

Virtualization options

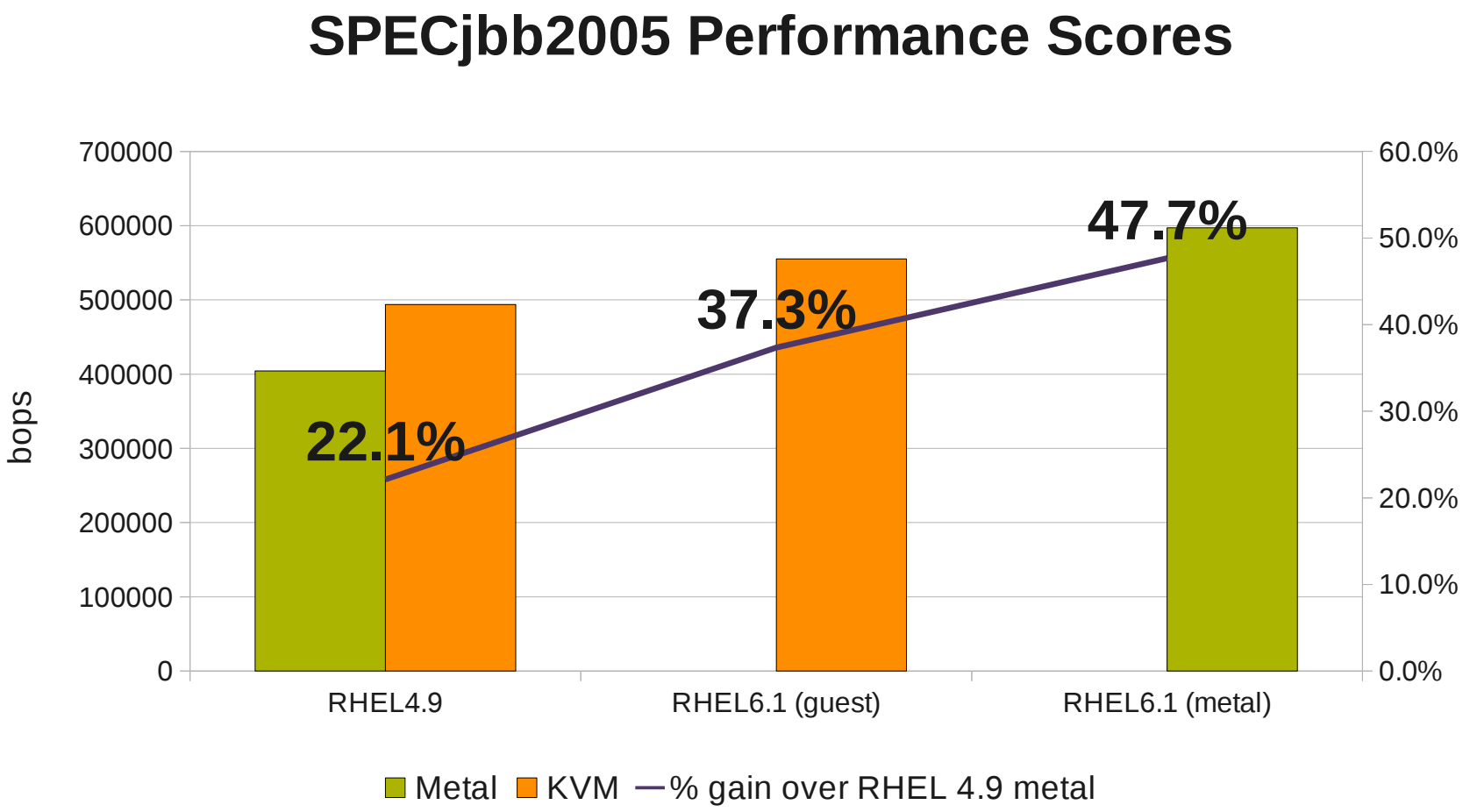
- KVM (Kernel Virtual Machine)
  - Part of Linux kernel
  - Hardware support and scalability from Linux
  - Top performing SPECvirt
- RHEL – Basic virt management
- RHEV – Complete data center virtualization

Physical to virtual migration

- Take disk image of physical system to LUN on SAN, or file on virt host
- Run *v2v* conversion tool
- Virtual machines managed with:
  - GUI: *virt-manager*
  - CLI: *virsh*
  - libvirt using scripts and cluster suite

Demonstration...

KVM performance



KVM performance

- Builds on Linux performance and scalability
- Many improvements in RHEL 6.1
  - vhost-net and SR-IOV for faster networking
  - Kernel Shared Memory (KSM) with transparent hugepages (THP)
  - Various CPU and other optimizations

Wed. 4:20pm: KVM Performance Numbers – Mark Wagner

Thu. 4:20pm: KVM Performance – How We Did It – Rik van Riel

KVM performance overview

- Overhead 3-15% on complex enterprise workloads
- Red Hat KVM holds 3 of top 5 SPECvirt scores, including #1
- Easy to manage with RHEL or RHEV

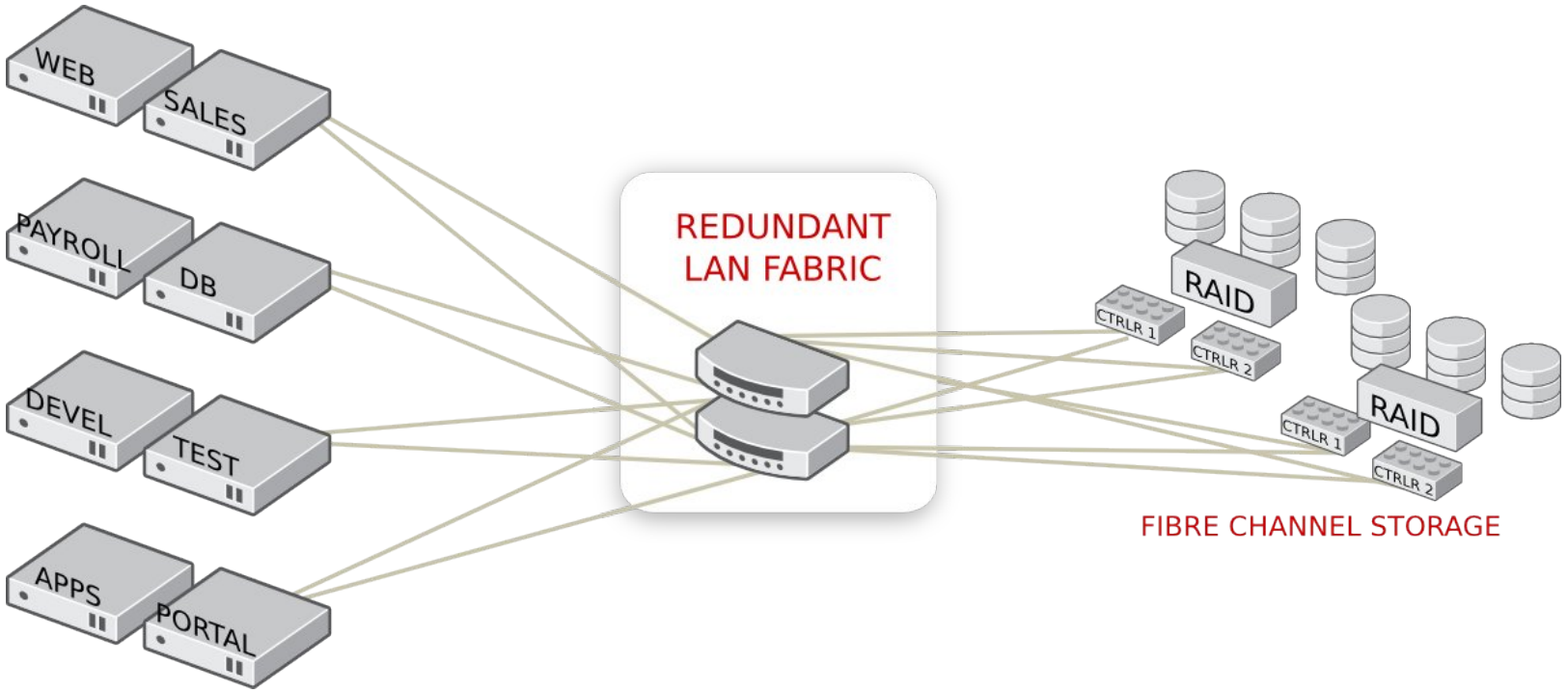
Wed. 2:00pm: RHEV Overview – Chuck Dubuque

Wed. 3:10pm: Virt in RHEL Overview – Chris Wright

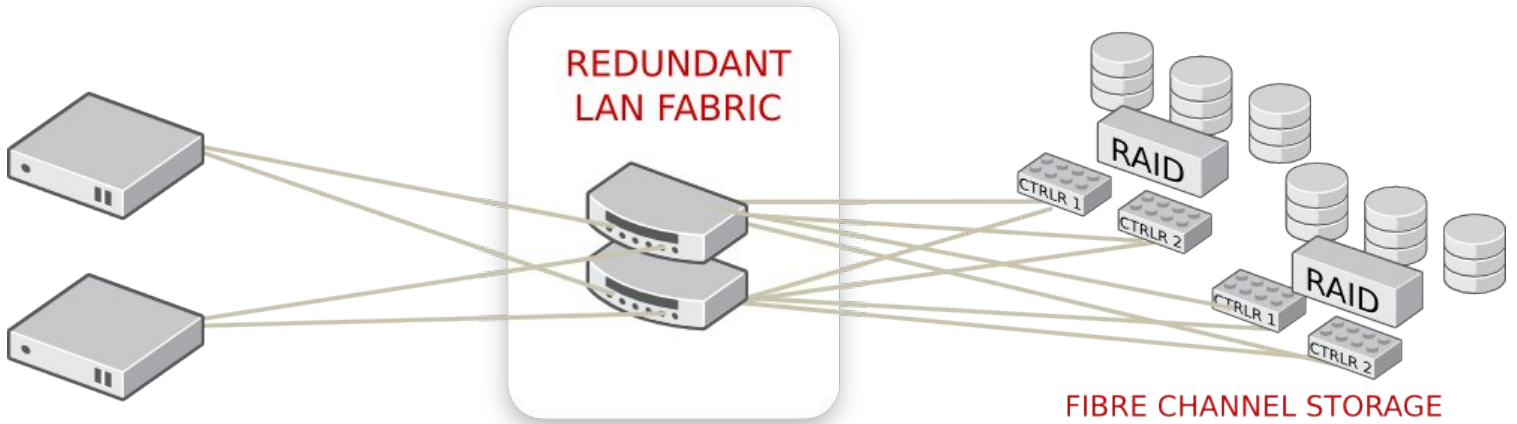
KVM is powerful and flexible

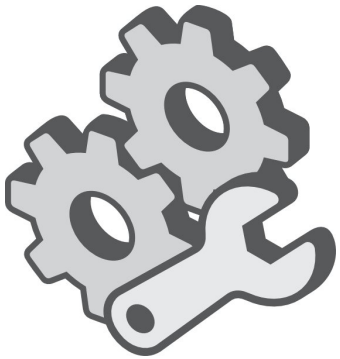
- Linux and Windows guests supported, with virtio drivers for maximum performance in both
- 64 CPUs and 1 TB memory supported in guest, an industry record
- Host limits same as bare metal RHEL 6

Greenhouse IT before virtualization...



Greenhouse IT after virtualization



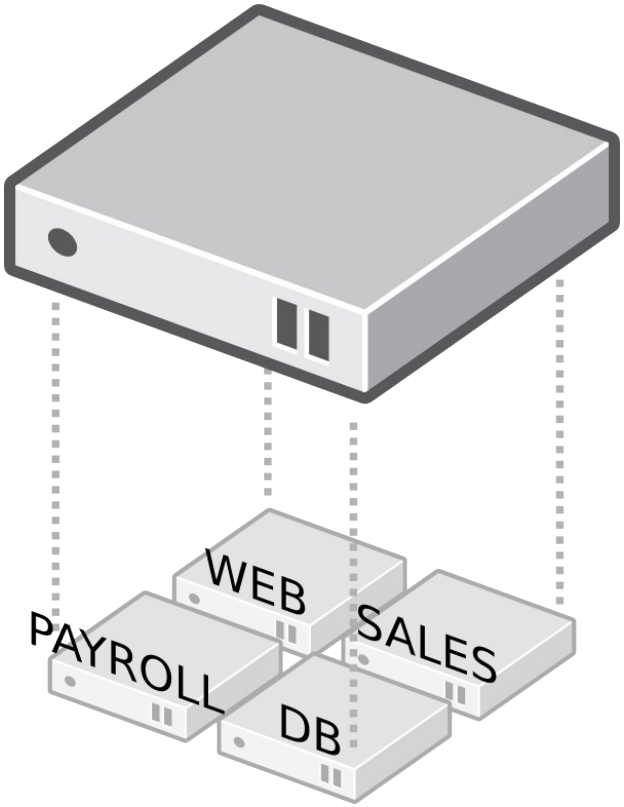


KERNEL

Linda Wang
Senior Engineering Manager, Core Kernel
Red Hat, Inc.

Now to tackle the OS

- We've covered how to solve Greenhouse's problems with hardware related changes
- Now we'll explore how you can tune and optimize at the operating system level with RHEL 6



Resource management

- System resources can be partitioned and bandwidth controlled
- Provide the ability to manage large system resources effectively
- Allocate resources to high priority tasks, and keep low priority resource hog tasks in check
- With RHEL 6.1, we also added a few enhancement features

Greenhouse problems

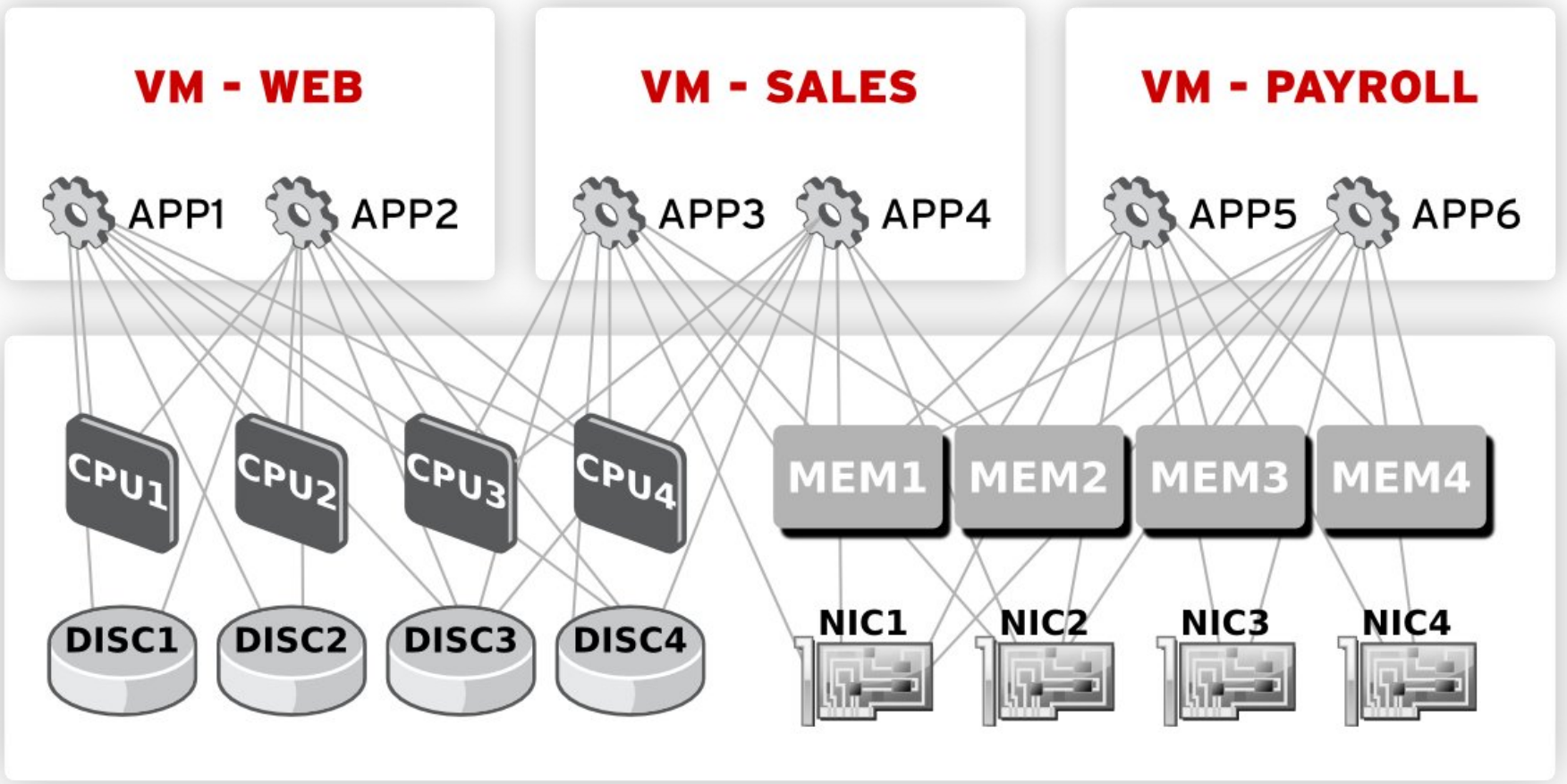
- Sales VM vs. Web VM
  - Near end of quarter, sales department application consumes too much CPU and bandwidth
  - VM Web guest on same host is being negatively impacted, causing some customer complaints
- Developers vs. Development VM
  - Developers want responsiveness at the console even while they're compiling code and chewing up CPU

Control groups supported in RHEL 6

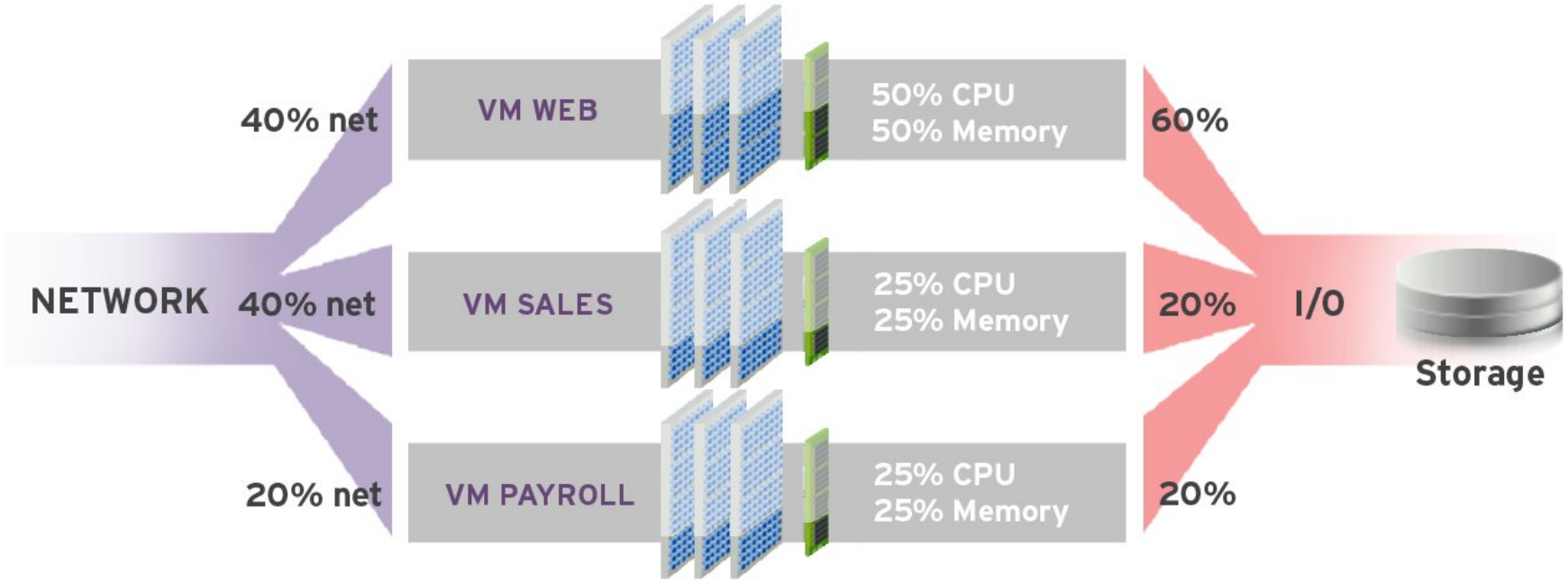
Several types of controllers available, including:

- CPU, CPU set
- Memory
- Storage bandwidth
- Network bandwidth
- Configuration and utilities
  - Non-persistent and persistent configuration

System without control groups



System with control groups



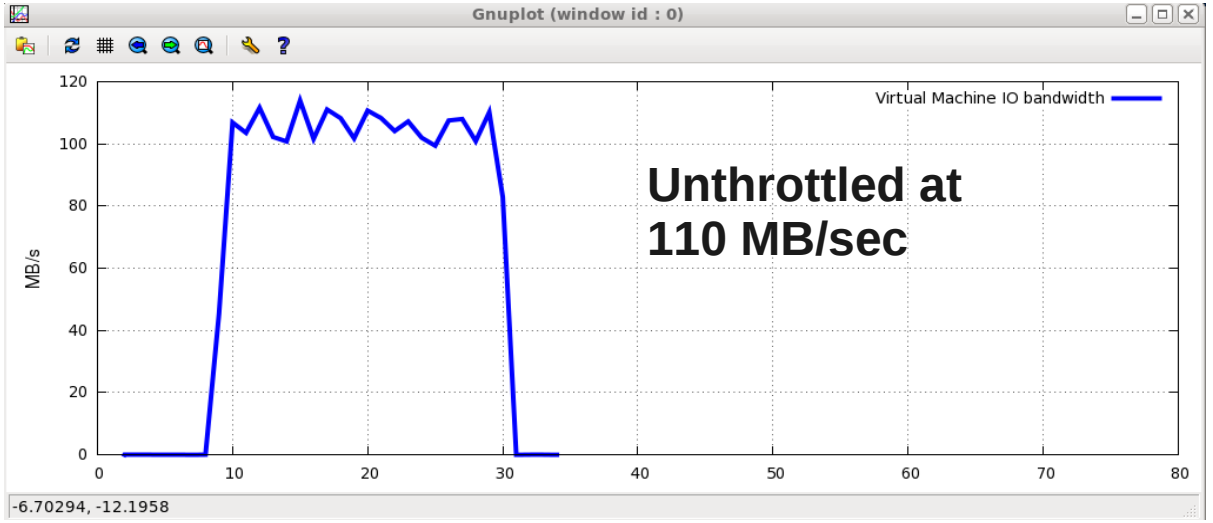
Control groups improvements in RHEL 6.1

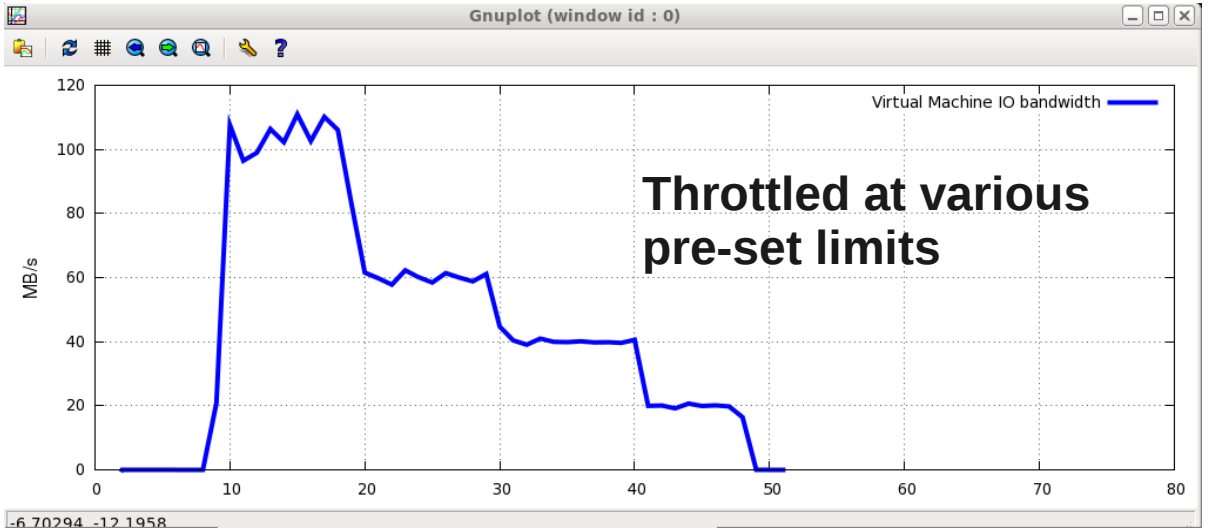
- Memory controller – reduces per-page memcg memory overhead by 20%
- Block I/O controller – throttling feature allows more fine-grained control of I/O bandwidth
- Autogroup – improves interactive tasks on a per-tty basis

Thu. 4:20pm: I/O tuning and I/O cGroup – Jeff Moyer and Vivek Goyal

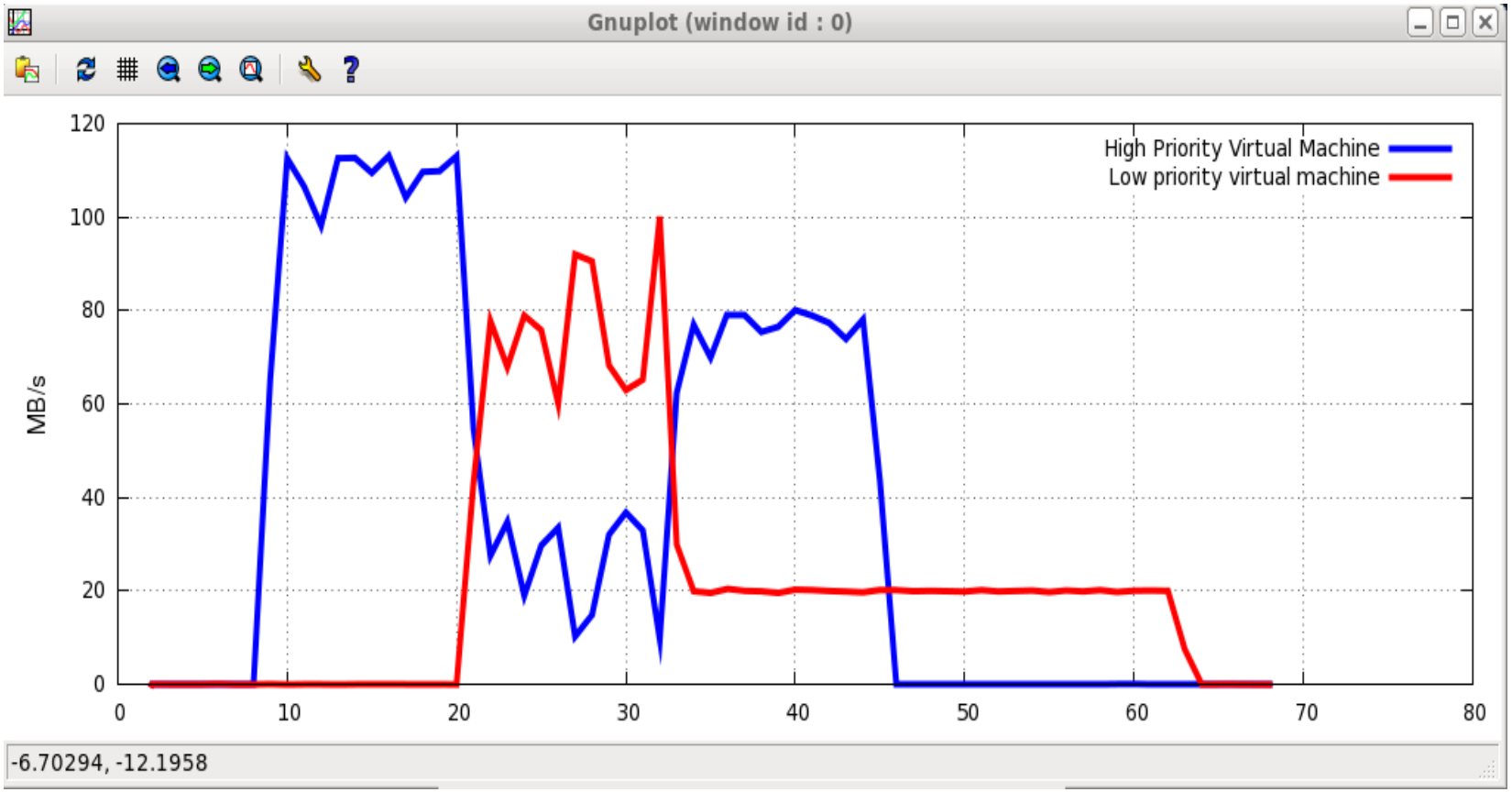
Fri. 11:00am: Managing System Resources – Linda Wang and Bob Kozdemba

Unthrottled vs. throttled VM





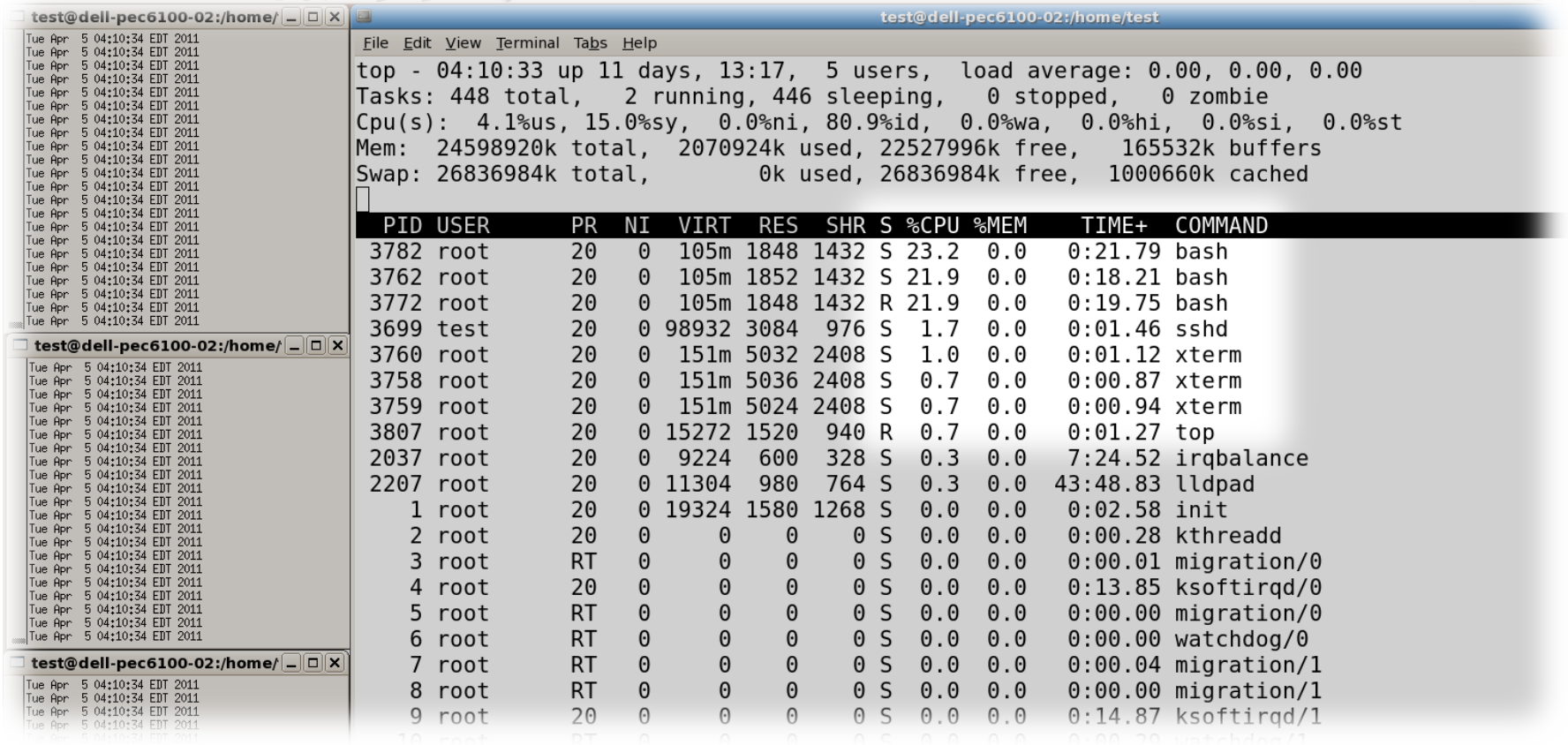
Throttling rough virtual machines



Without throttling **With throttling**

Control group: autogroup

```
echo 1 > /proc/sys/kernel/sched_autogroup_enable
```



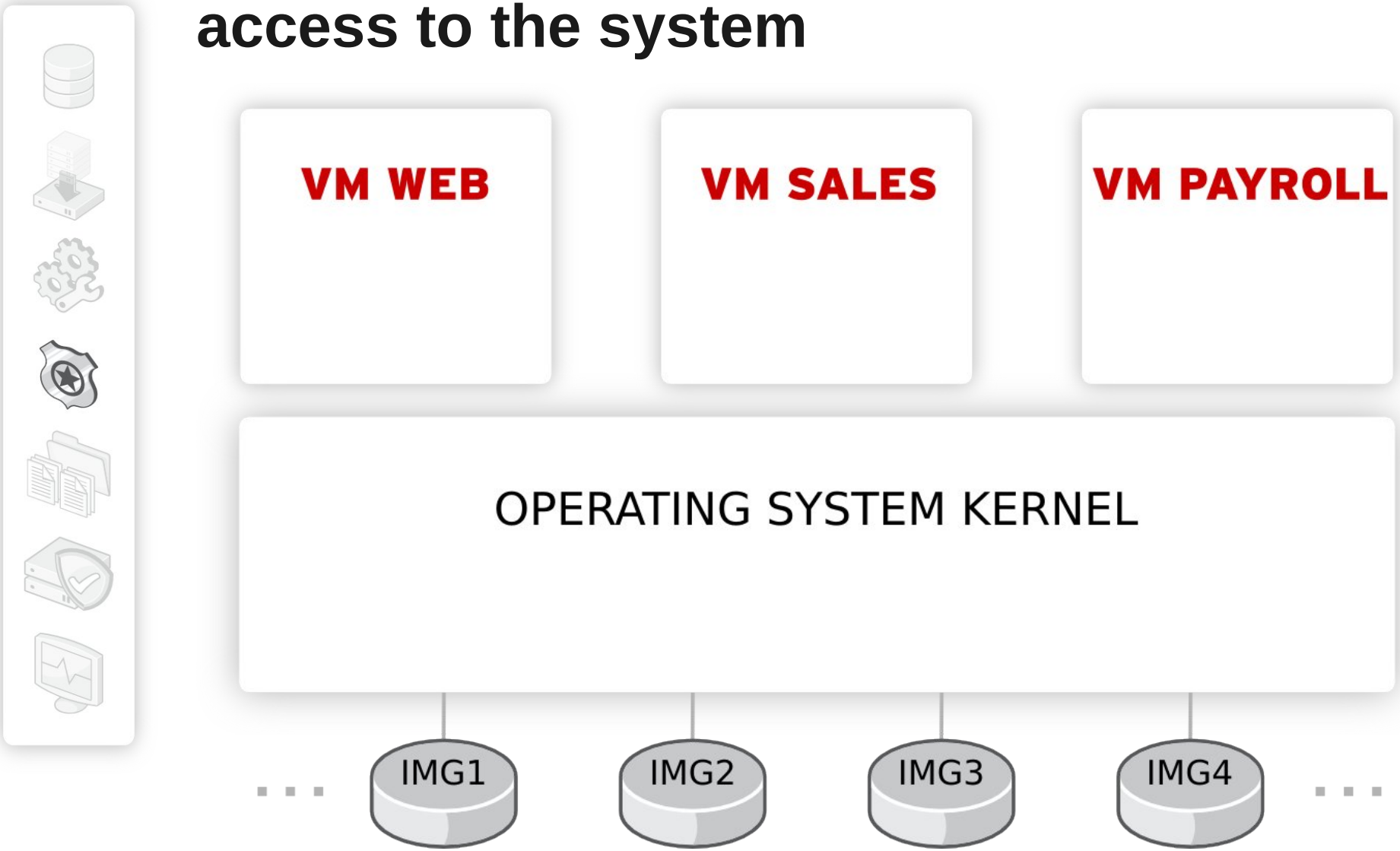
Greenhouse problems solved

- Sales VM is now constrained
  - Public facing web server performance meets customer (and potential customer) expectations
  - Immediate crisis averted, now sales app problem could be investigated – more on this later
- Developers can carry on email, web, and other desktop productivity tasks while compiling code in background

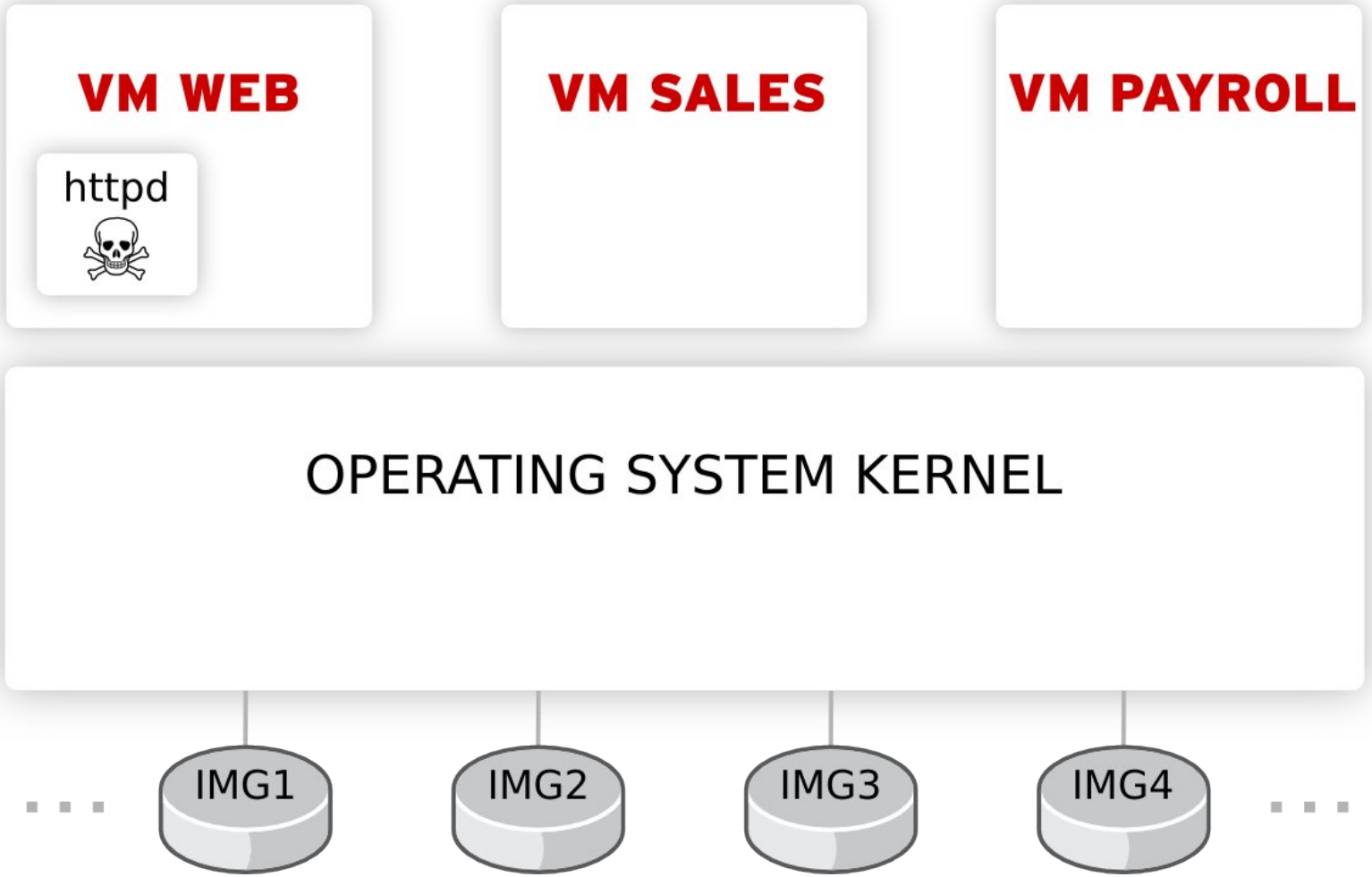
SECURITY

Dan Walsh
Senior Principal Software Engineer
Red Hat, Inc.

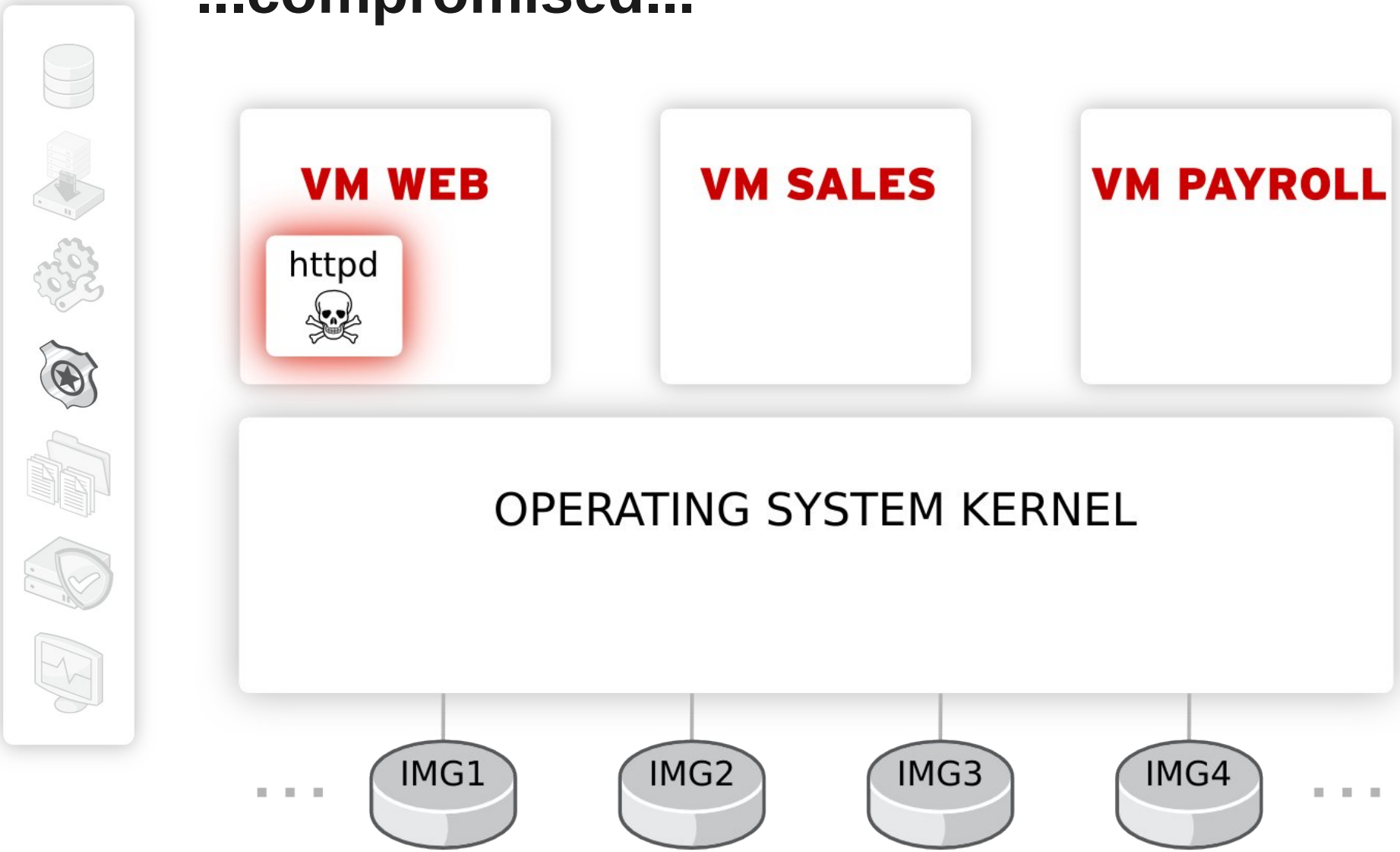
Virtual machine processes all have equal access to the system



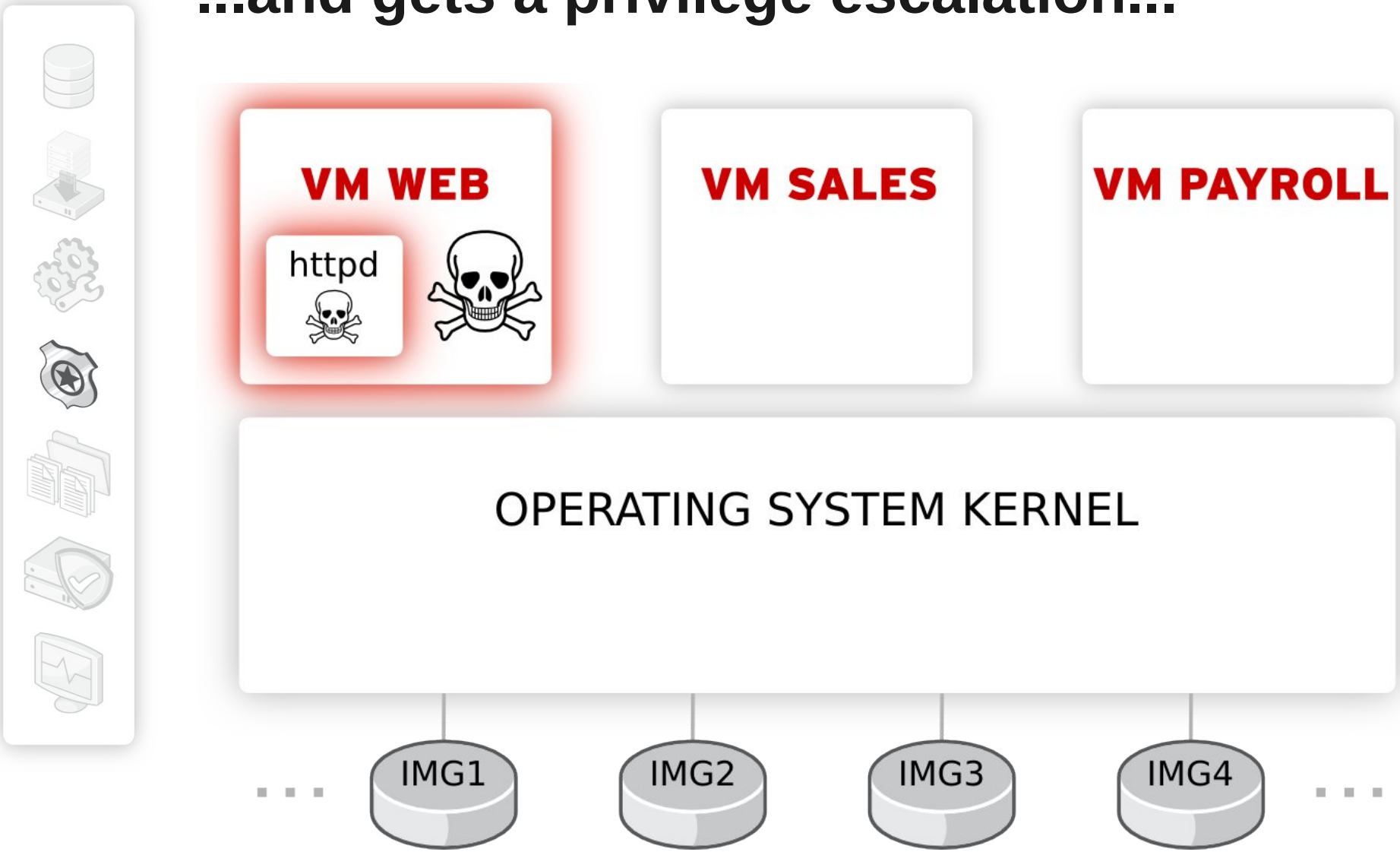
If an application on one virtual guest is attacked...



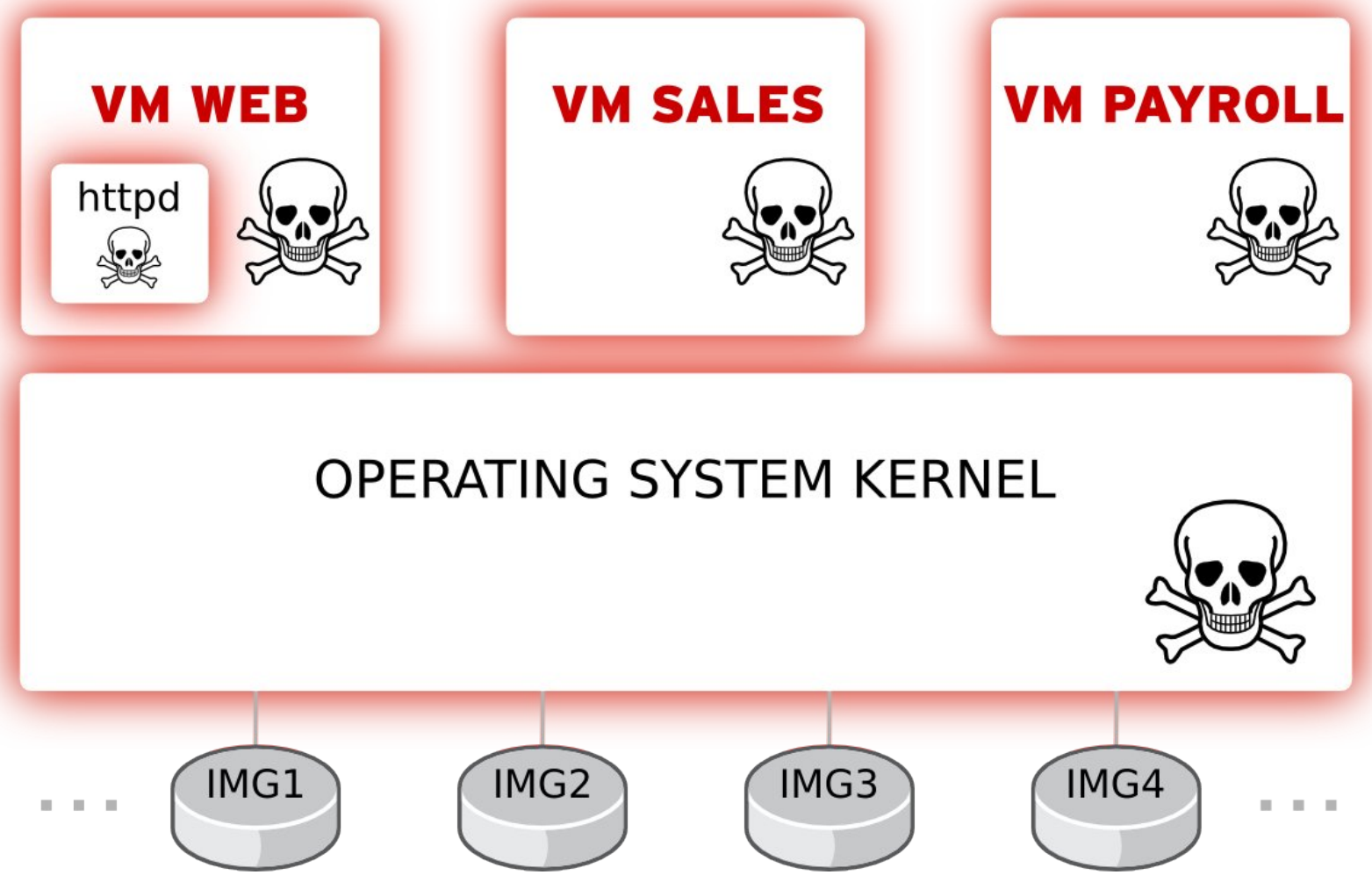
...compromised...



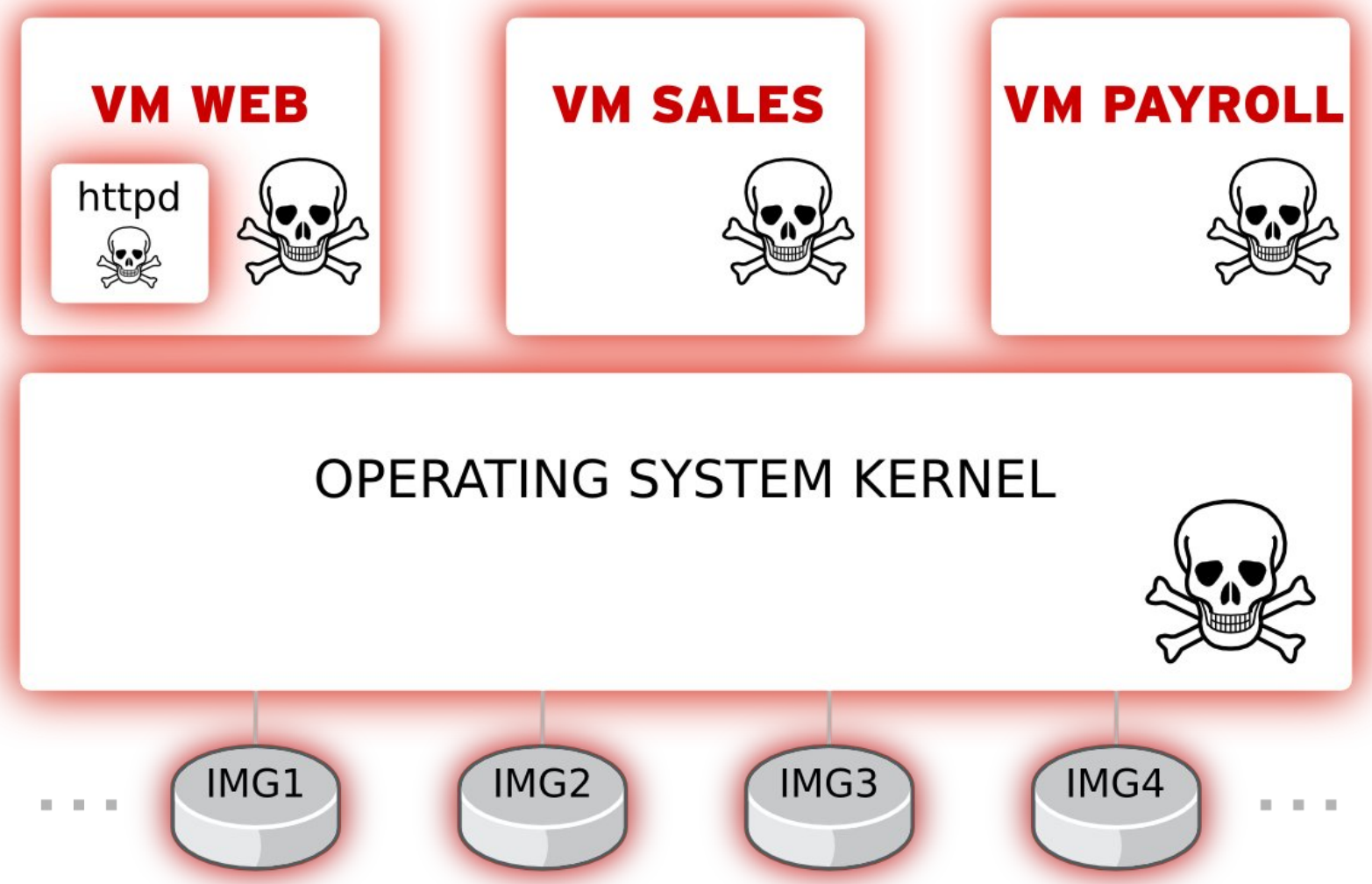
...and gets a privilege escalation...



...and your machine has a hypervisor vulnerability...



...everything's suspect

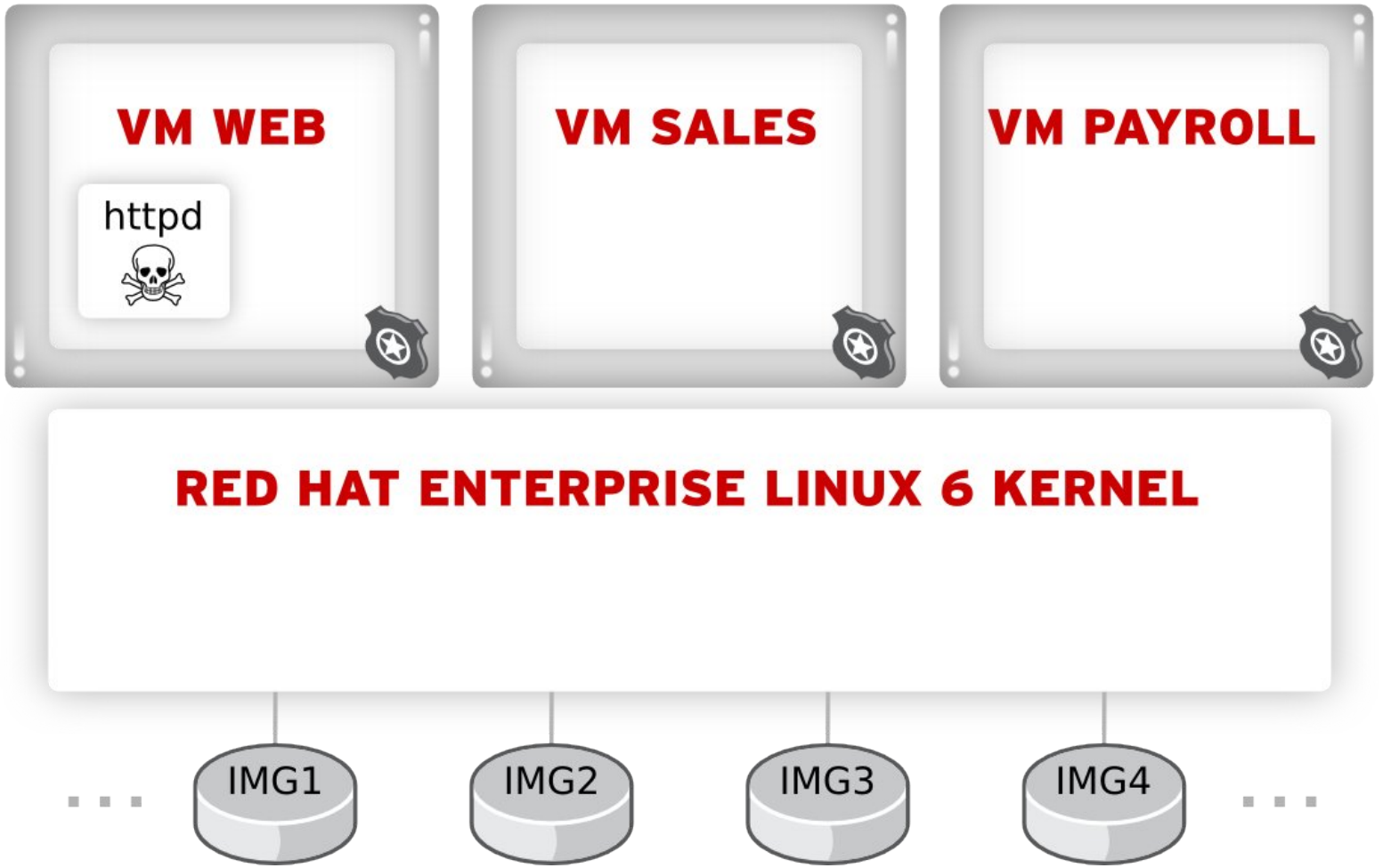


SELinux to the rescue

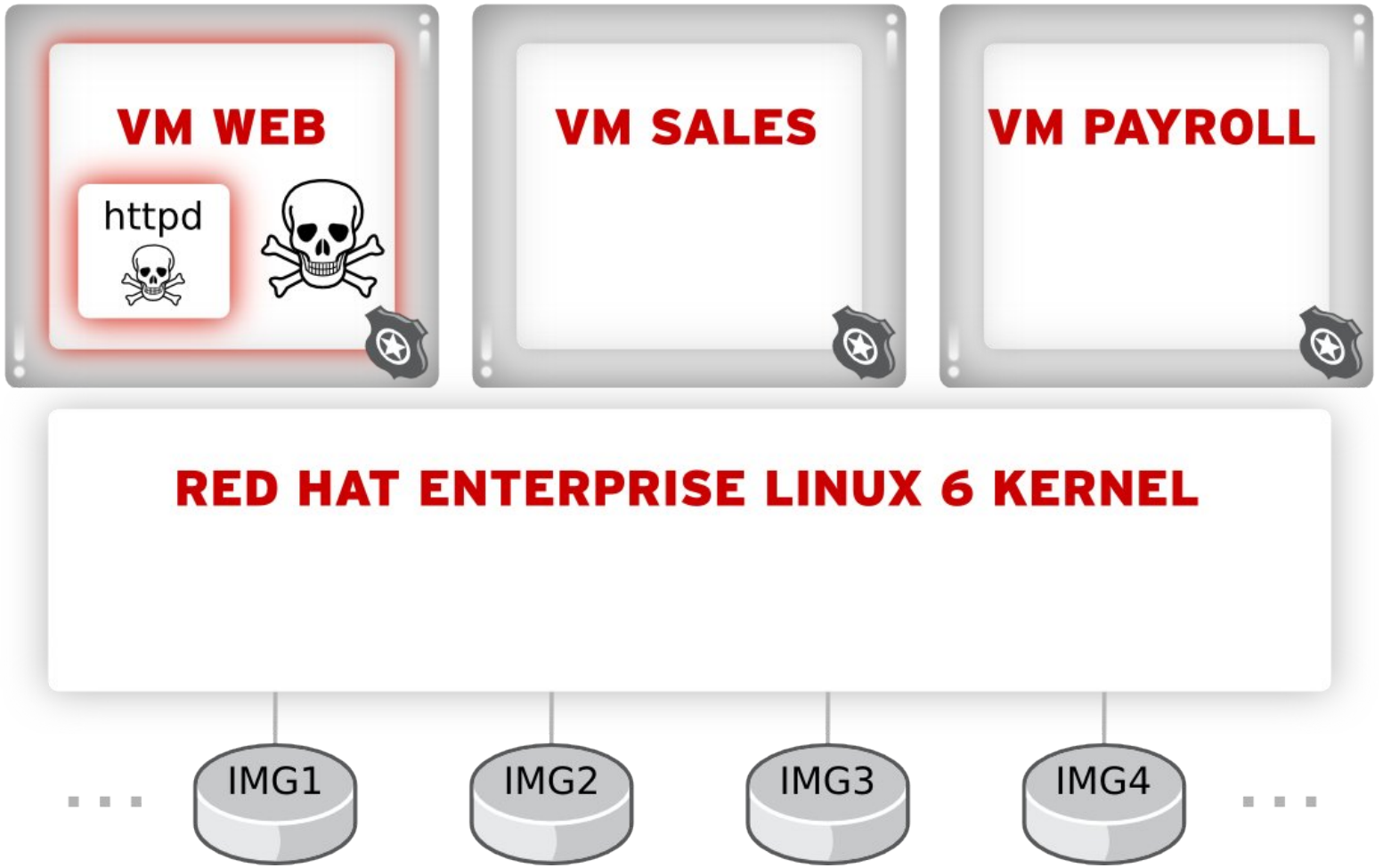
SELinux is all about labeling

- Processes get labels – virtual machines with KVM are processes
- Files and devices get labels – virtual images are stored on files and devices
- Rules control how process labels interact with file labels and other process labels
- The kernel enforces these rules

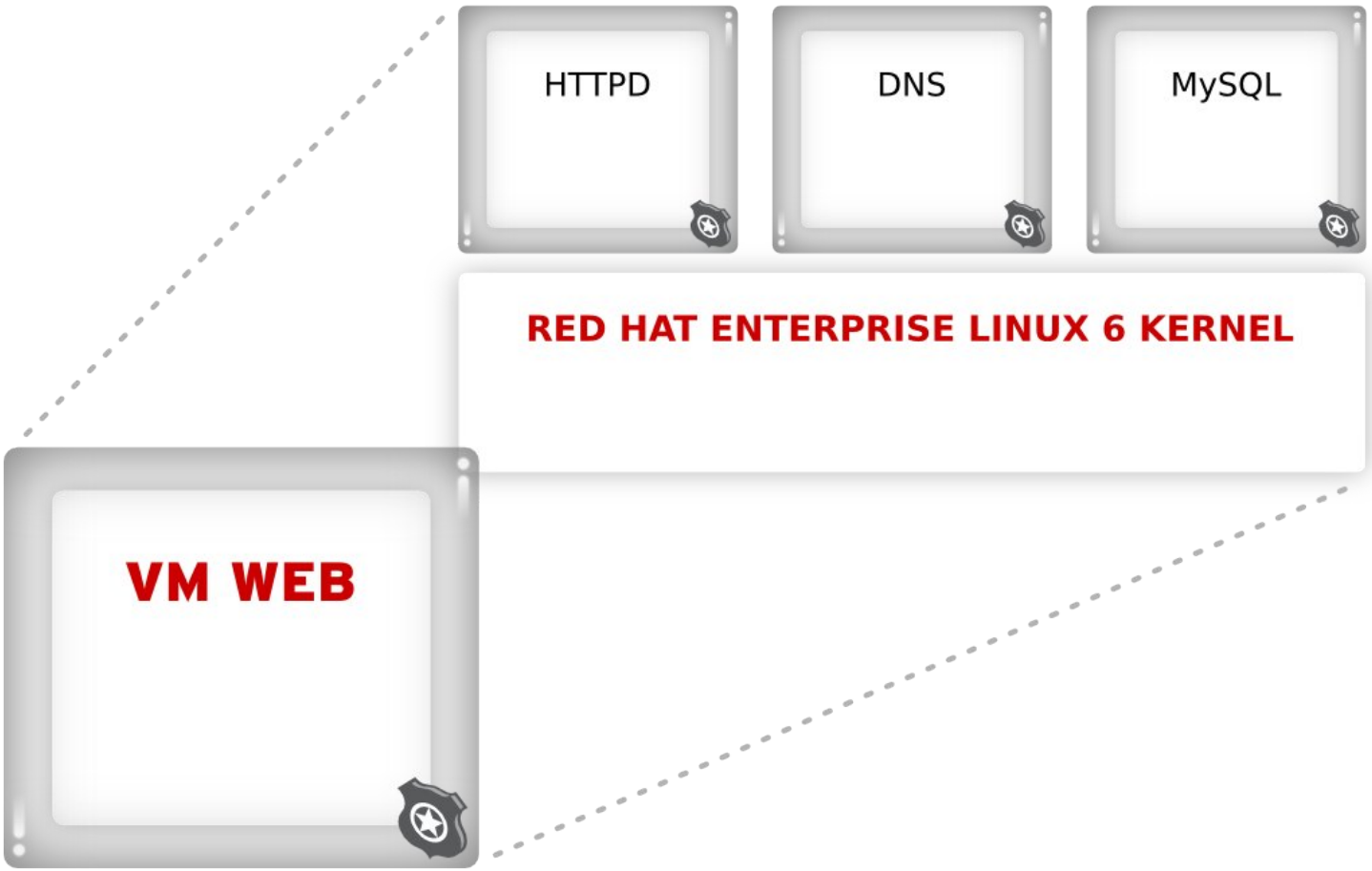
KVM guests are processes, so we can confine them like processes



Compromised virtual machine guest confined, despite hypervisor vulnerability



And of course, the guest operating system can also run SELinux



Related talks

Wed. 4:20pm: SELinux for Mere Mortals – Thomas Cameron

Thu. 11:30am: RHEL 6 Security Overview – Peter Vrabec, Jack Rieden, Dan Walsh

Labs and training

Wed. 2:00pm: How to Write SELinux Policies – Dan Walsh

Wed. 3:10pm, Thu. 10:20am: SELinux Management – Forrest Taylor

INTERMISSION

We'll return in 10 minutes with even more information on RHEL 6. See you then!

FILE SYSTEMS

Ric Wheeler
Architect and Manager, File System Team
Red Hat, Inc.

Upgrading to ext4

- ext4 is the next generation of ext3
  - Same commands and familiar look
  - Faster in many ways
  - New support for SSDs
- Continuing to use ext3 is supported and reasonable for many users

Ext4 speed enhancements

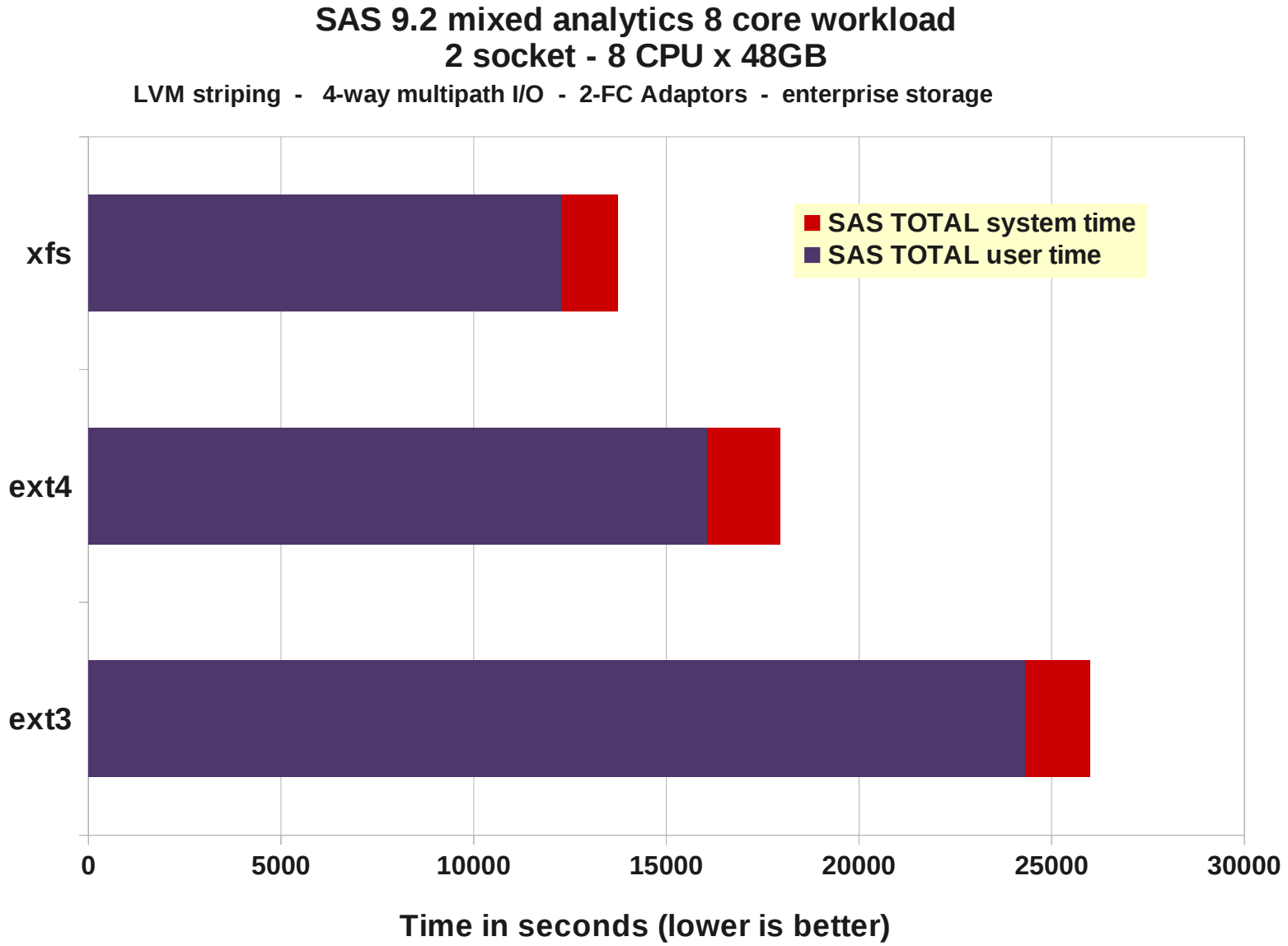
- Streaming writes are significantly faster
- File system repair times up to 10x faster

Getting to ext4

- Red Hat does not support migration in place from ext3 to ext4
  - Backup your old ext3 data
  - Create a new ext4 file system
  - Restore the data
- You can run servers with many different file systems
  - Keep existing SAN file systems on ext3
  - Create new ext4 ones as you add new LUNs or new servers

Why do some people use XFS?

- XFS is included in the Scalable File System Add-on for RHEL
  - Supports very large storage (over 16TB)
  - Has some of the highest performance with extreme workloads
- Very fast file system creation and repair


SAS 9.2 mixed analytics 8 core workload
2 socket - 8 CPU x 48GB
LVM striping - 4-way multipath I/O - 2-FC Adaptors - enterprise storage
xfs
ext4
ext3
SAS TOTAL system time
SAS TOTAL user time
0
5000
10000
15000
20000
25000
30000
Time in seconds (lower is better)

Greenhouse's approach

- Greenhouse can keep its existing storage area network LUNs on ext3
- New LUNs should be created with the new RHEL 6 default ext4 file system
- Greenhouse should evaluate XFS based on their specific needs and workload

Other resources

- Red Hat videos (search for “ext4” or “XFS”) https://access.redhat.com/knowledge/videos
- Community mailing lists include linux-ext4@vger.kernel.org, xfs@oss.sgi.com, linux-btrfs@vger.kernel.org
- Excellent coverage of storage and file systems at http://lwn.net

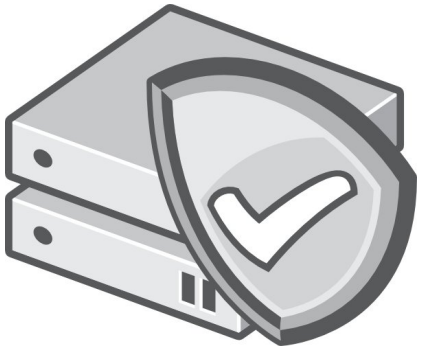
Related Summit talks

Wed. 2:00pm: NFS: the Next Generation – Steve Dickson

Wed. 4:20pm: Building a Cloud Filesystem – Jeff Darcy and Mark Wagner

Wed. 5:30pm: File System Performance – John Shakshober

Thu. 3:10pm: File System Scalability – Ric Wheeler



POWER MANAGEMENT

Phil Knirsch
Engineering Supervisor, Core Services
Red Hat, Inc.

The Greenhouse problem

- Power consumption of old servers is too high
- Overall power usage for all 8 old servers: 8 x 150W @ idle, 8 x 280W @ load
- Single machines often idle around, unnecessarily wasting power
- Want to reduce power consumption as part of migration

Concept for a solution

- Distribute all 8 old systems between the 2 new systems evenly, based on power measurement prior to migration
- Take into account performance and power peaks at different times
- Analyze and optimize host systems after migration, following the Power Management Guide for RHEL 6
- Goal is to balance between performance and power saving

Analysis

- Use new tools and features in RHEL 6 to determine application activity on the system
- Rely on powertop as the analysis tool of choice: *powertop -d -t 60*
- Save results for later review and use in optimizing the setup

Pre-optimization: CPU states

```
Cn                  Avg residency
C0 (cpu running)          (14.7%)
polling           0.5ms ( 0.0%)
C1 mwait          0.1ms ( 0.0%)
C2 mwait          1.1ms (25.6%)
C3 mwait          2.5ms (59.6%)
P-states (frequencies)
  2.40 Ghz     0.1%
  2.27 Ghz     0.0%
  2.14 Ghz     0.0%
  2.00 Ghz     0.0%
  1.87 Ghz     0.0%
  1.74 Ghz     0.0%
  1.60 Ghz    99.9%
```


Pre-optimization: Wakeups

```
Wakeups-from-idle per second : 467.6    interval: 60.0s
no ACPI power usage estimate available
Top causes for wakeups:
  58.8% (5464.9)        middleware : hrtimer_start_range_ns (hrtimer_wakeup)
  23.9% (2219.6)     <kernel core> : hrtimer_start_range_ns (tick_sched_timer)
  14.5% (1349.5)       <interrupt> : extra timer interrupt
   1.1% (100.1)            lldpad : hrtimer_start_range_ns (hrtimer_wakeup)
   0.3% ( 27.5)     <kernel core> : hrtimer_start (tick_sched_timer)
   0.2% ( 20.2)     <kernel core> : garp_join_timer_arm (garp_join_timer)
   0.1% ( 13.1)       <interrupt> : eth0-TxRx-0
   0.1% ( 12.6)        postmaster : hrtimer_start_range_ns (hrtimer_wakeup)
   0.1% ( 11.4)       <interrupt> : eth0-TxRx-5
   0.1% ( 10.4)       <interrupt> : eth2-TxRx-0
```


Pre-optimization: *powertop* suggestions

```
Suggestion: increase the VM dirty writeback time from 5.00 to 15 seconds with:
  echo 1500 > /proc/sys/vm/dirty_writeback_centisecs
This wakes the disk up less frequently for background VM activity

Suggestion: enable the power aware CPU scheduler with the following command:
  echo 1 > /sys/devices/system/cpu/sched_mc_power_savings
or by pressing the C key.

Suggestion: Enable SATA ALPM link power management via:
  echo min_power > /sys/class/scsi_host/host0/link_power_management_policy
or press the S key.
```

Optimization

- Choice is to either select specific suggestions from *powertop*, or use one of several predefined *tuned* profiles for power saving
- Greenhouse goes with creating a custom user-defined profile for *tuned*
- Evaluate performance vs. additional power saving for each setting suggested
- Found their internal *middleware* app to be very inefficient but easily fixable

Post-optimization: CPU states

```
Cn                    Avg residency
C0 (cpu running)          ( 0.1%)
polling                0.0ms ( 0.0%)
C1 mwait               1.5ms ( 0.0%)
C2 mwait               2.0ms ( 0.1%)
C3 mwait              39.4ms (99.8%)
P-states (frequencies)
  2.40 Ghz     0.0%
  2.27 Ghz     0.0%
```

Post-optimization: Wakeups

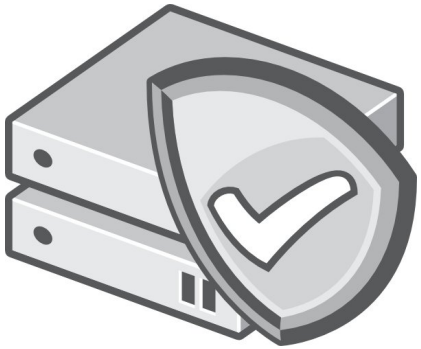
```
Top causes for wakeups:
  86.9% (1879.1)       <interrupt> : extra timer interrupt
   4.6% ( 99.8)           lldpad : hrtimer_start_range_ns (hrtimer
   1.9% ( 40.9)     <kernel core> : hrtimer_start (tick_sched_timer
   1.2% ( 26.1)     <kernel core> : hrtimer_start_range_ns (tick_s
   0.9% ( 20.1)     <kernel core> : garp_join_timer_arm (garp_join
     ⋮                    ⋮
   0.0% (  1.0)     <kernel core> : ipmi_timeout (ipmi_timeout)
   0.0% (  1.0)             ntpd : hrtimer_start_range_ns (hrtimer
   0.0% (  1.0)     <kernel core> : ixgbe_watchdog (ixgbe_watchdog)
   0.0% (  0.9)       <interrupt> : ahci
   0.0% (  0.8)        middleware : hrtimer_start_range_ns (hrtimer
```


The solution

- New system power usage: 2x185W @ idle, 2x560W @ load
  - Virtualization alone saved 70% @ idle and 50% @ load!
- Specific host and software optimization saved another 44W:
  - ALPM to min_power: 10W
  - Power aware CPU scheduler: 4W
  - Middleware inefficiency: 30W

Additional resources

- RHEL 6 Power Management Guide
- Less Watts website: http://www.lesswatts.org/
- Fedora special interest group: http://fedoraproject.org/wiki/SIGs/PowerManagement



BUG REPORTING

Denise Dumas
Director of Base OS Software Engineering
Red Hat, Inc.

Problem reporting, with special help for critical applications

- Greenhouse wants to capture all crashes to their IT staff for review.
- For their database server, they want to include additional information

Reporting flow

Automated Bug Reporting Tool (ABRT)

- Default RHEL 6.1 Server installs abrt daemon
- Config file and plug-in configuration determine actions taken on crashes – out of box, logs locally
- Extra plug-ins available on Optional channel include *filetransfer, bugzilla, reportuploader*

ABRT customization for Greenhouse

- Greenhouse needs to add additional information to local logs, copy to central site, email IT
- IT reviews and consolidates, and opens Red Hat problem ticket where needed

Configuring Greenhouse's servers

- Install extra plugin: *yum install abrt-plugin-filetransfer*
- Modify */etc/abrt/abrt.conf* to:
  - Check that the crashing application was their database instance
  - Copy the desired extra files into the crash folder
  - Send mail to IT with a specific subject line

Server configuration, cont'd.

- Modify plug-in configuration file with central URL to which to send crash information
- Modify plug-in configuration file to send mail with sender and recipient email addresses
- Restart the *abrtd* daemon

Configuring Greenhouse's IT admin server

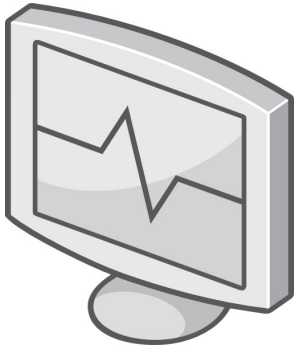
- Install *abrt* (CLI and/or GUI)
- ABRT configuration file updated to automate creation of Red Hat problem ticket

When email arrives reporting a problem

- Use the CLI or GUI to examine the crash information copied from remote systems
- ABRT detects and downloads any missing *debuginfo* packages
- ABRT analyzes crash and creates report
- Edit the report if needed (remove passwords, add steps to reproduce, additional data, special config options)
- Report problem to Red Hat via Logger

More information

For an in-depth look at ABRT, configuration, plug-ins, and the CLI and GUI tools, visit:
Red Hat Enterprise Linux 6 Deployment Guide



PERFORMANCE TOOLS

Will Cohen
Performance Tools Engineer
Red Hat, Inc.

Greenhouse performance concerns

- KVM overhead due to frequent timeout wakeups
  - *powertop* very useful, but only in RHEL 6
  - Need to examine older RHEL 5 guest VMs
- PostgreSQL database efficiency

Addressing Greenhouse's concerns

- SystemTap ready-to-run script to monitor syscall timeouts
- SystemTap userspace probes for PostgreSQL

Process polling example

- System calls return due to data OR timeout
- SystemTap script monitors system calls that timeout
- Useful for finding processes that keep waking:
  - Eliminate useless overhead due to polling
  - Reduce power usage
  - Allow more virtual guests on the same physical machine
- Find polling processes with:
  stap timeout.stp -c “sleep 10”

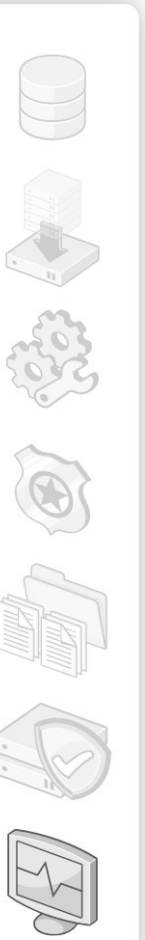
Timeout output (before)

```
  pid |    poll  select    epoll  itimer    futex nanosle  signal| process
28742 |       0    6888        0        0        0        0       0| middleware
 4404 |       0      50        0        0        0        0       0| postmaster
 4403 |       0      49        0        0        0        0       0| postmaster
28748 |       0       0        0        0        0       39       0| stapio
 1431 |       1       0        0        0        0        9       0| multipathd
 4405 |       0       9        0        0        0        0       0| postmaster
 4401 |       0       9        0        0        0        0       0| postmaster
23534 |       0       9        0        0        0        0       0| ntpd
 4406 |       4       0        0        0        0        0       0| postmaster
 2508 |       0       1        0        0        0        0       0| sendmail
[root@dell-pec6100-02 ~]#
```


Timeout cause (before)

```
while(1) {
   FD_SET(listen_fd, &rfds);
   tv.tv_sec = 0;
   tv.tv_usec = 1000;
   retval = select(listen_fd+1, &rfds, NULL, NULL,
      &tv);
   do_something();
}
```

Timeout cause (after)



```
while(1) {
   FD_SET(listen_fd, &rfds);
   tv.tv_sec = 10;
   tv.tv_usec = 0;
   retval = select(listen_fd+1, &rfds, NULL, NULL,
      &tv);
   do_something();
}
```


Timeout output (after)

```
  pid |   poll  select   epoll  itimer   futex nanosle  signal| process
 4404 |      0      49       0       0       0       0       0| postmaster
 4403 |      0      49       0       0       0       0       0| postmaster
28783 |      0       0       0       0       0      39       0| stapio
 1431 |      1       0       0       0       0       9       0| multipathd
 4405 |      0       9       0       0       0       0       0| postmaster
23534 |      0       9       0       0       0       0       0| ntpd
 4401 |      0       9       0       0       0       0       0| postmaster
 4406 |      4       0       0       0       0       0       0| postmaster
 2535 |      0       1       0       0       0       0       0| crond
 2508 |      0       1       0       0       0       0       0| sendmail
[root@dell-pec6100-02 ~]#
```


Applications with SystemTap support

- SystemTap allows probing both kernel- and user-space
- Application provides more symbolic probe points
- Applications in RHEL 6 with probe points:
  - PostgreSQL database
  - OpenJDK Java run-time environment
  - Python interpreter
- Additional information at: http://sourceware.org/systemtap/wiki

Greenhouse IT's PostgreSQL issue

- Greenhouse IT wants to understand PostgreSQL performance
- Use scripts and information from: http://sourceware.org/systemtap/wiki/PostgresqlMarkers
- Find queries taking more than 0.25 seconds (250,000µs):
  stap postgresql-slowq.stp 250000
- Exercise with PostgreSQL regression tests:
  gmake installcheck

PostgreSQL Queries

```
[root@dell-pec6100-02 postgresql]# stap postgresql-slowq.stp 250000
^Ctid time string
19584 1001150 SELECT pg_sleep(1.0);
19584 2001138 SELECT pg_sleep(2.0);
19513 2016421 select blockme();
19568 263319 INSERT INTO foochild VALUES(123,'child',999,-123);
19467 259331 CLUSTER clstr_tst_c ON clstr_tst;
19333 771376 VACUUM;
19480 329155 INSERT INTO bmscantest
  SELECT (r%53), (r%59), 'fooooooooooooooooooooooooooooooooooooooooooooooooooo
ooooooooooooooooooooooooooooooooooooooooooo'
  FROM generate_series(1,70000) r;
19077 5816654 CREATE DATABASE "regression" TEMPLATE=template0 ENCODING='SQL_ASCI
I'
19385 424950 analyze tt3;
[root@dell-pec6100-02 postgresql]#
```


Results with SystemTap

- Eliminated excessive wakeup in middleware application
- Improved PostgreSQL database performance:
  - Restructured the slow queries
  - Eliminate useless and unneeded queries

Wed. 4:30pm: Adopting Next-generation Profiling and Tracing – James Leddy

Thu. 3:10pm: Developer Tooling in RHEL 6 – Will Cohen

SUMMARY

Tim Burke
Vice President – Linux Development
Red Hat, Inc.

Summary of improvements

- Reduced hardware, cost and complexity
- Lower power usage
- Higher usage of fewer resources = more efficiency
- Improved security profile and isolation
- Optimized performance
- Better capture of application problems
- More resources to spend on business innovation

Scratching the surface

The hypothetical scenario only captures a subset of RHEL 6 features.

For more information, refer to the handout for this presentation, and additional materials available at:

http://redhat.com/summit/

http://access.redhat.com

http://www.redhat.com/rhel/resource_center/

Q&A

Submit questions in advance for our Expert Forum through Twitter using the **#rhforum** hashtag, or using the question drop boxes on the Plaza level.

Then attend the audience-driven Expert Forum on Friday, May 6 from 9:45-10:45am.

Thank you for attending, and enjoy the rest of the Red Hat Summit and JBossWorld!

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