



Red Hat Enterprise Linux

Prepared for ExitCertified by
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An Established Global Leader

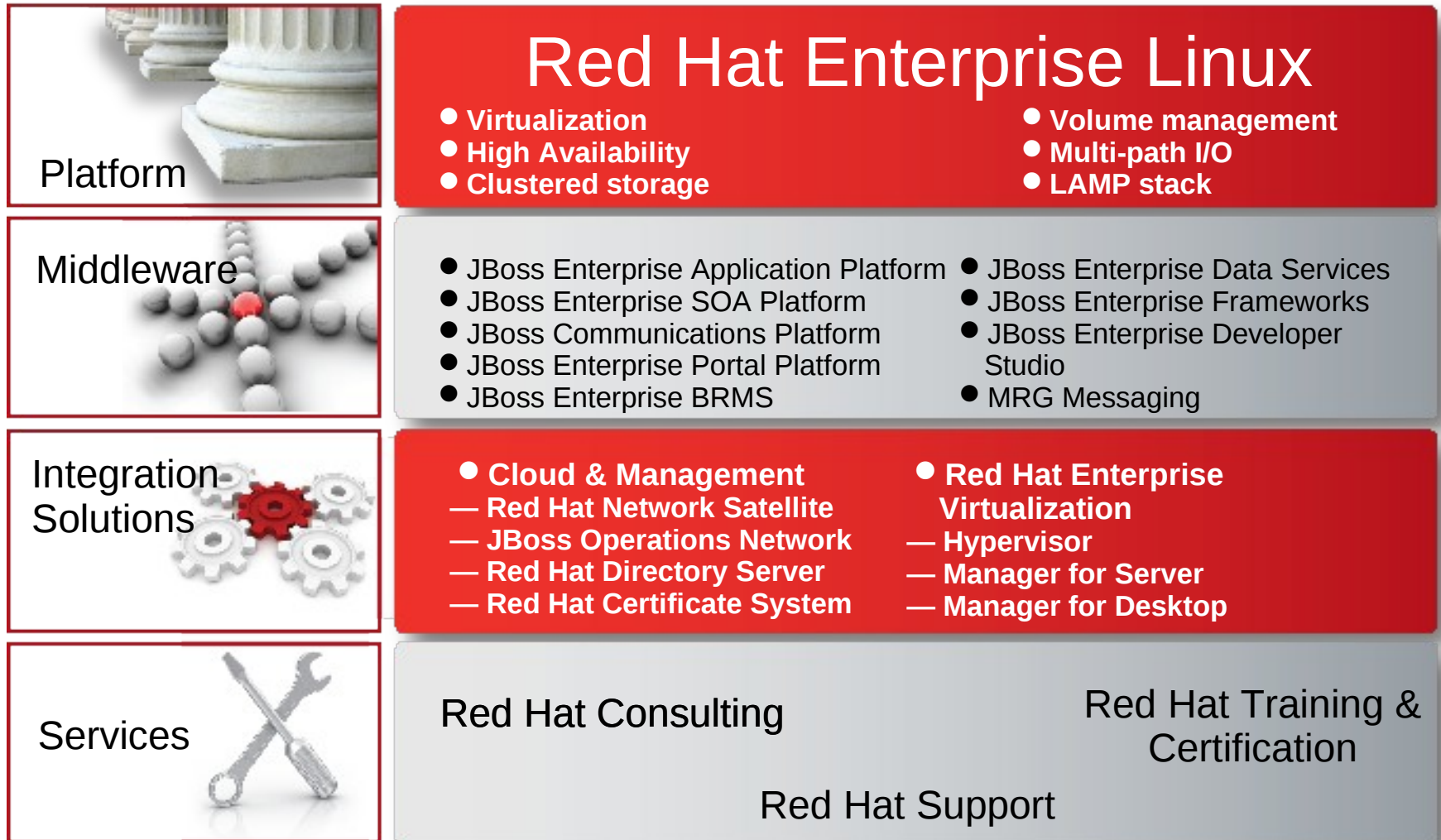


- Global development and support
- Listed on S&P 500
- 67 offices in 29 countries
- Extensive partnerships with leading enterprise hardware and software vendors
- Pioneered the open source subscription-based business model
- Comprehensive product portfolio for enterprise environments

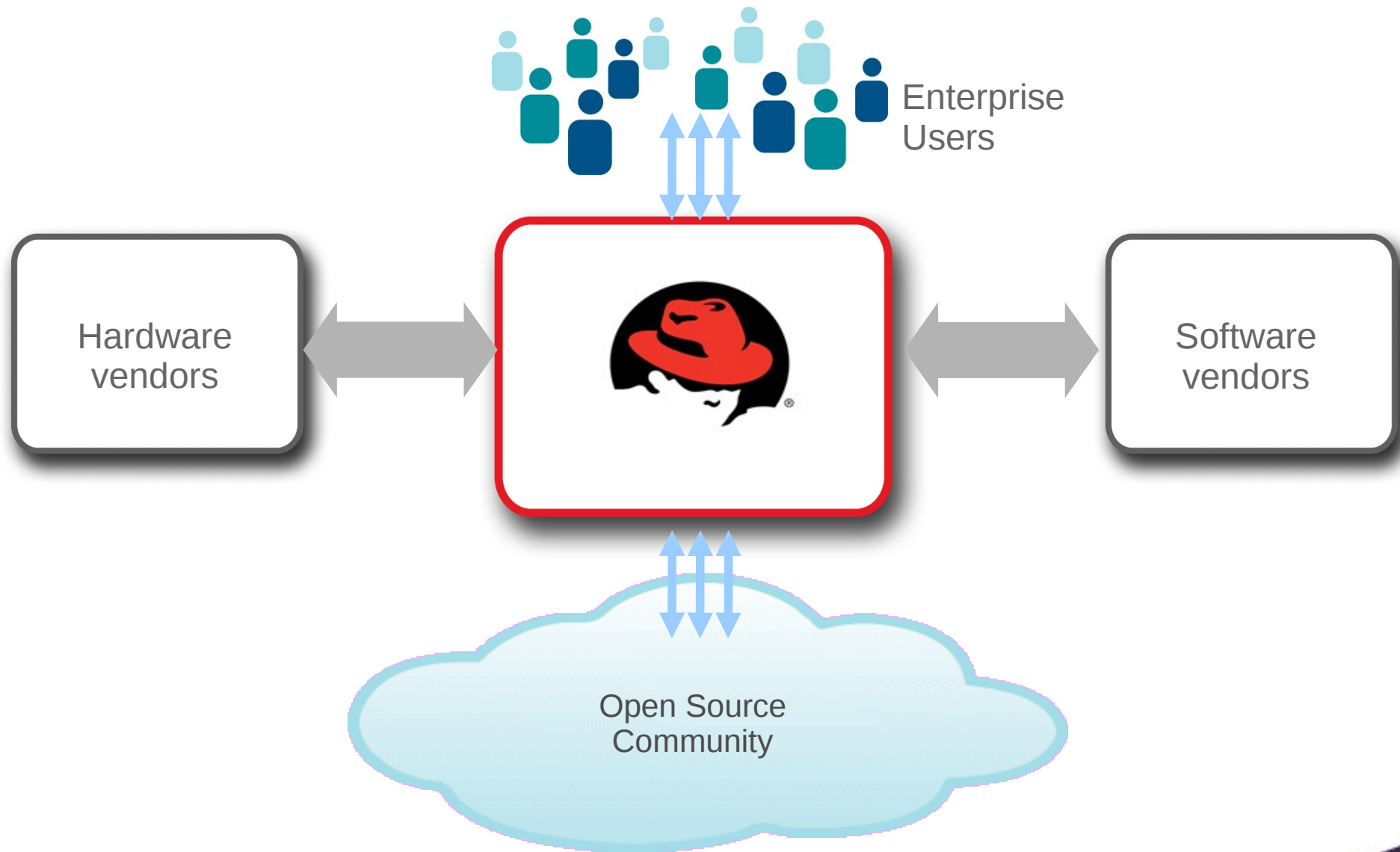


A Complete, Open Stack

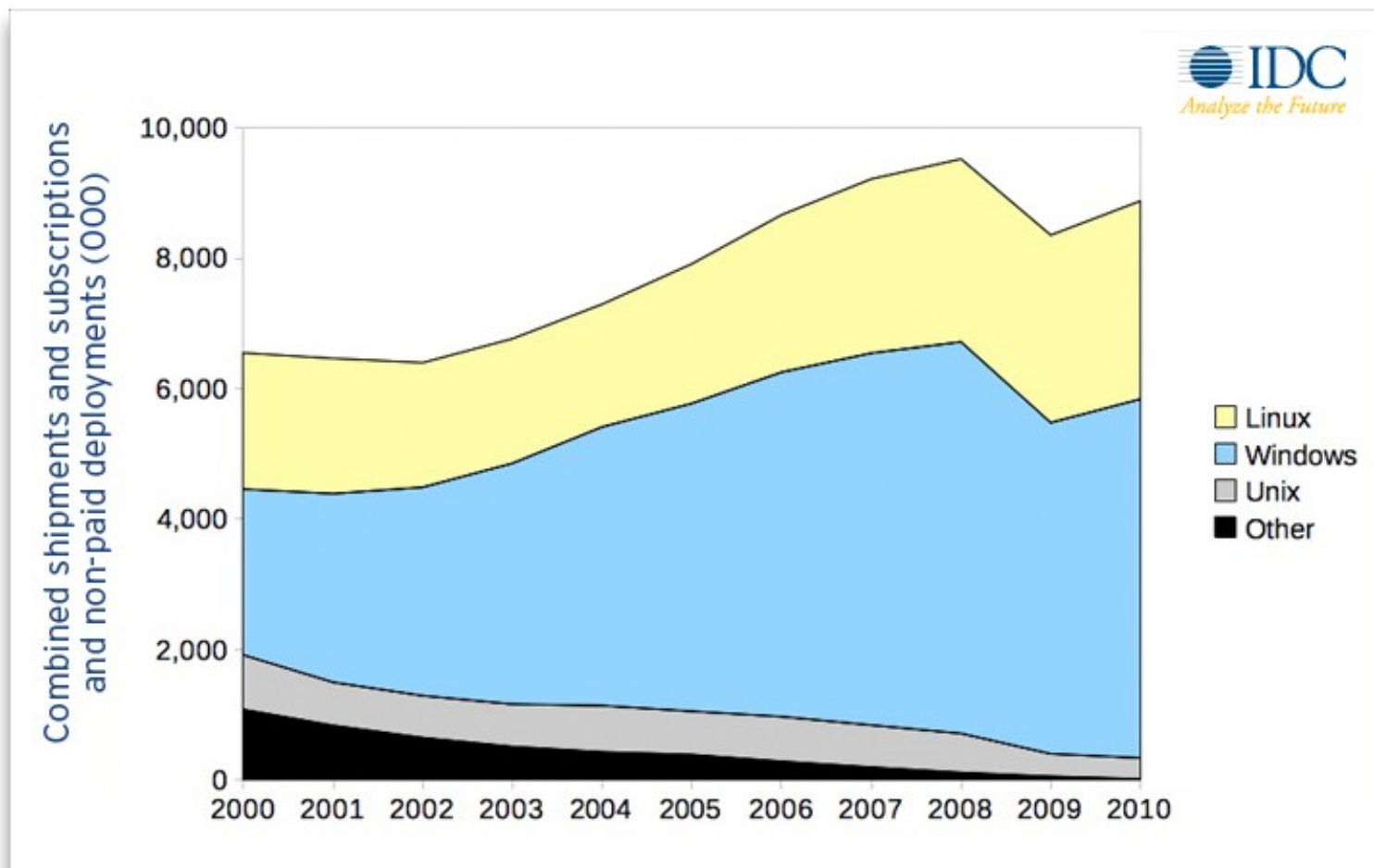
Products, Services, and Support for Enterprise-Class Applications



Bringing the Community, Vendors and Users Together



Only Two Server Operating Systems Will Remain



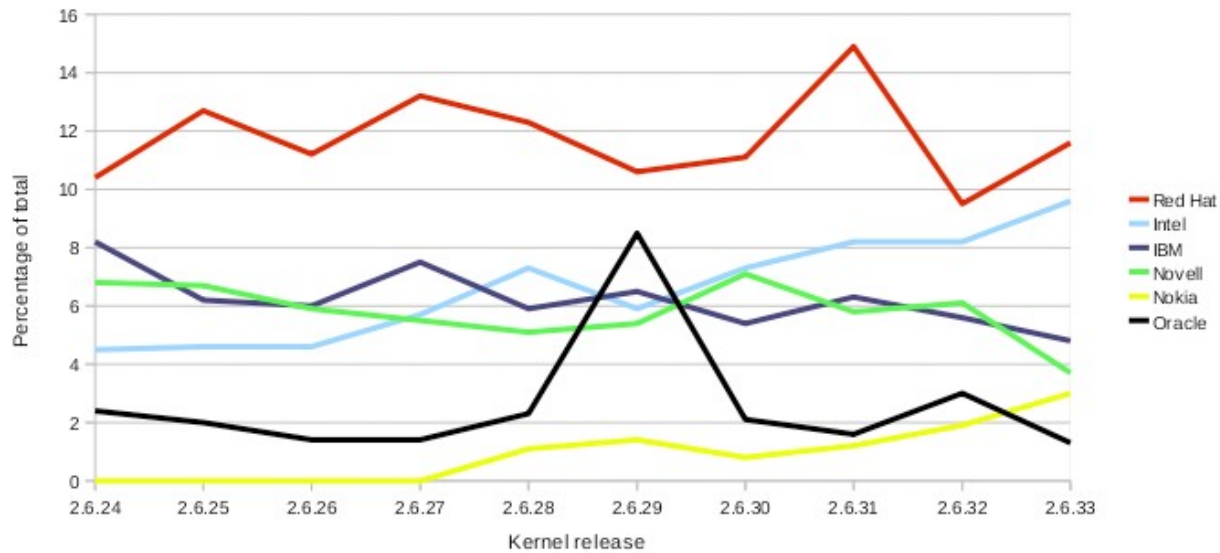
Source: IDC 2010



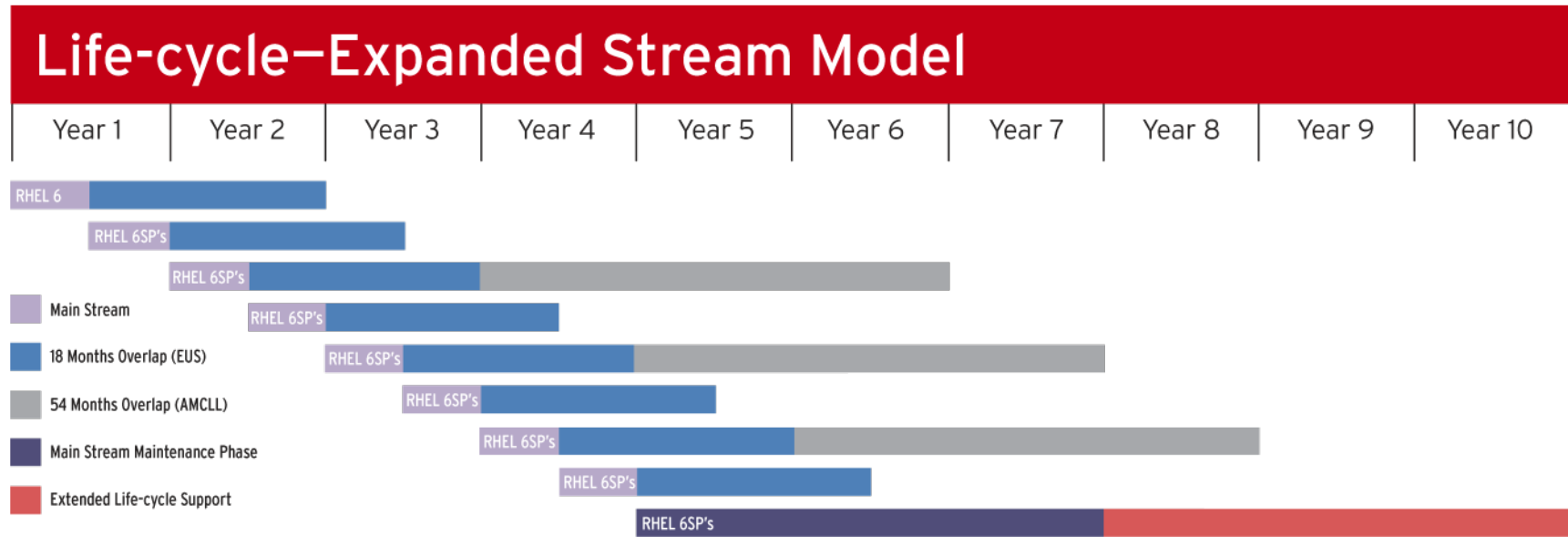
Leading Development



Changesets contributed by company



Red Hat Enterprise Linux Life-cycle



- Service Packs with hardware enablement during Production I phase of four years.
- Total of seven years for the regular life-cycle
- 3 years Extended Life-cycle Support (ELS) option
- 8 EUS streams with 18 month overlap each



Move Faster: Benchmark Results

- Scaling **Oracle 10g** in a Red Hat Enterprise Linux environment: scaled for horizontal and vertical scaling
- **Database 11g Release 2** with Oracle RAC on Linux over 1.1 million QphH@1000GB with a price of [\\$5.42/QphH@1000GB](http://www.tpc.org) (www.tpc.org)
- **SPECjbb 2005** Benchmarks using Red Hat Enterprise Linux 5.3 on an Intel Xeon based NEC server (2,150,260 BOPS) (March 2009) (www.spec.org)
- **SPECweb 2005** Benchmark using Red Hat Enterprise 5.3 on a HP Proliant DL380 G6 (71,045) (April 2009)
- **SPECWeb 2005** Red Hat Enterprise 5.3 on Fujitsu PRIMERGY TX300 S6 highest result ever (104,422)
- **SPECjAppServer 2004** Benchmark using Red Hat Enterprise 5.2 on an IBM BladeCenter HS21 (22,000 JOPS) (Feb 2009)
- First OS for Intel architecture to exceed 1M TPM (reaching 1.2M TM) in Aug. 2008 using Intel Xeon processor X7460 (TCP-C)



Be More Flexible

Across physical, virtual & cloud

Consistent operating environment

- Hardware and hypervisor independence
- Same execution environment (ABI/API) & support everywhere
- A portable, tunable, secure wrapper for all your apps

Improve IT operations with a common foundation

- Leverage skills, processes and operation technology
- Unified and comprehensive app & system security
- Manage to SLAs with unprecedented resource control (on x86)

Use integrated virtualization (KVM) to maximize options

- All RHEL features benefit the virtual environment
- Run RHEL or Windows guests confidently
- As physical or guest deployment





Next Generation Now: Overview of Red Hat Enterprise Linux 6

6 RED HAT®
ENTERPRISE LINUX®

Facts and Figures



Red Hat Enterprise Linux 6

Released November 10th, 2010

Represents more than 600 person years by Red Hat engineers

1,821 customer/partner requested features included

37 GB of content
2,957 binary RPMs

Red Hat engineers are based in 26 countries

85% more packages than Red Hat Enterprise Linux 5

14,631 resolved issues from partner, customer & community reports

847 features & fixes verified by partner QA teams

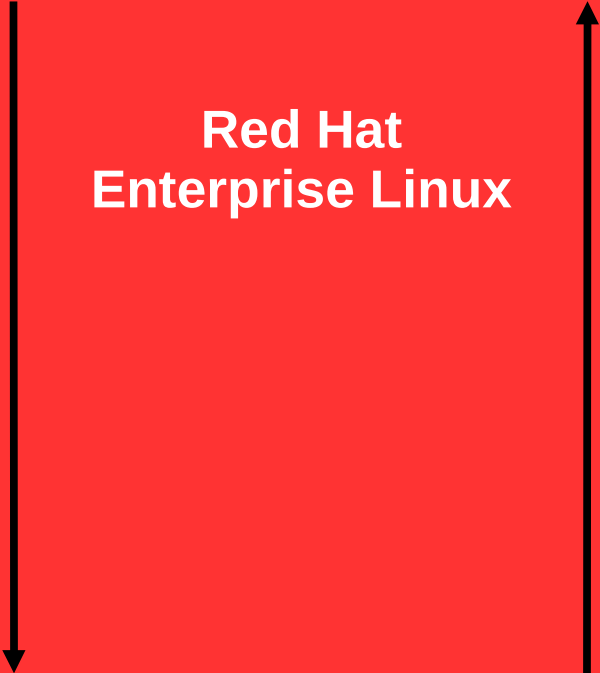
3,900 additional kernel enhancements to 2.6.32

Kernel based on 2.6.32 with many features from .33 & .34
Red Hat is the lead developer of kernel features
Red Hat Enterprise Linux design allows smooth integration of future features



Red Hat Enterprise Linux

A Comprehensive Platform

Features	Red Hat	Proprietary Alternatives
Operating system	<p>Red Hat Red Hat Enterprise Linux</p> 	Windows, AIX, HP-UX, Solaris
Multi-path I/O		EMC PowerPath
High availability		Veritas Cluster Suite
Systems management		HP OpenView/Opware, IBM Tivoli
Volume/storage Management		Symantec Storage Foundation Suite
High Performance Networking		Infiniband
Server virtualization		Vmware, Citrix



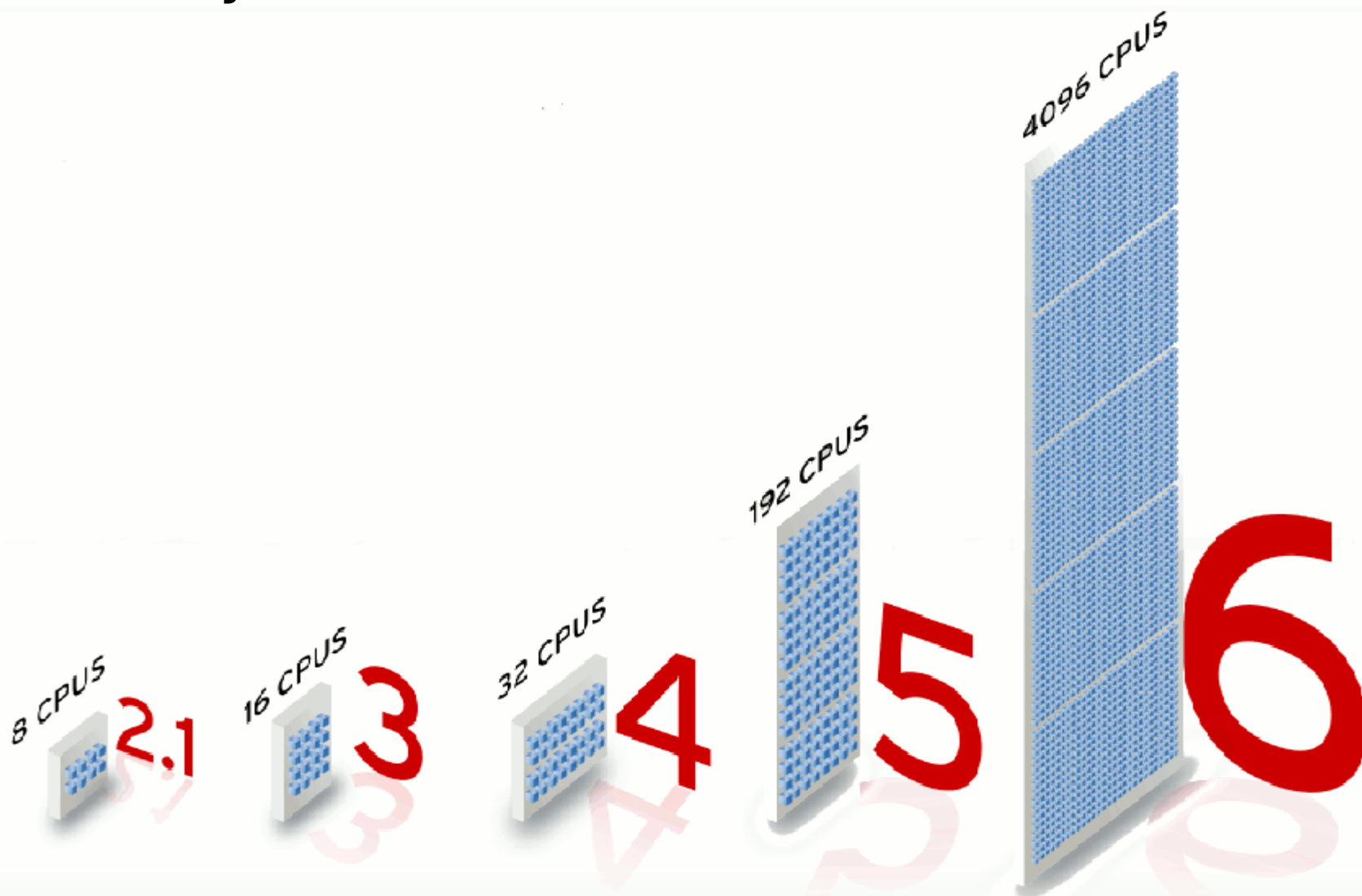
Efficiency, Scalability, Reliability.

Red Hat Enterprise Linux 6 evolves in concert with hardware advances

- Taking advantage of hardware with greater numbers of processing and memory resources
- Withstanding hardware failures better.



Scalability: CPUs

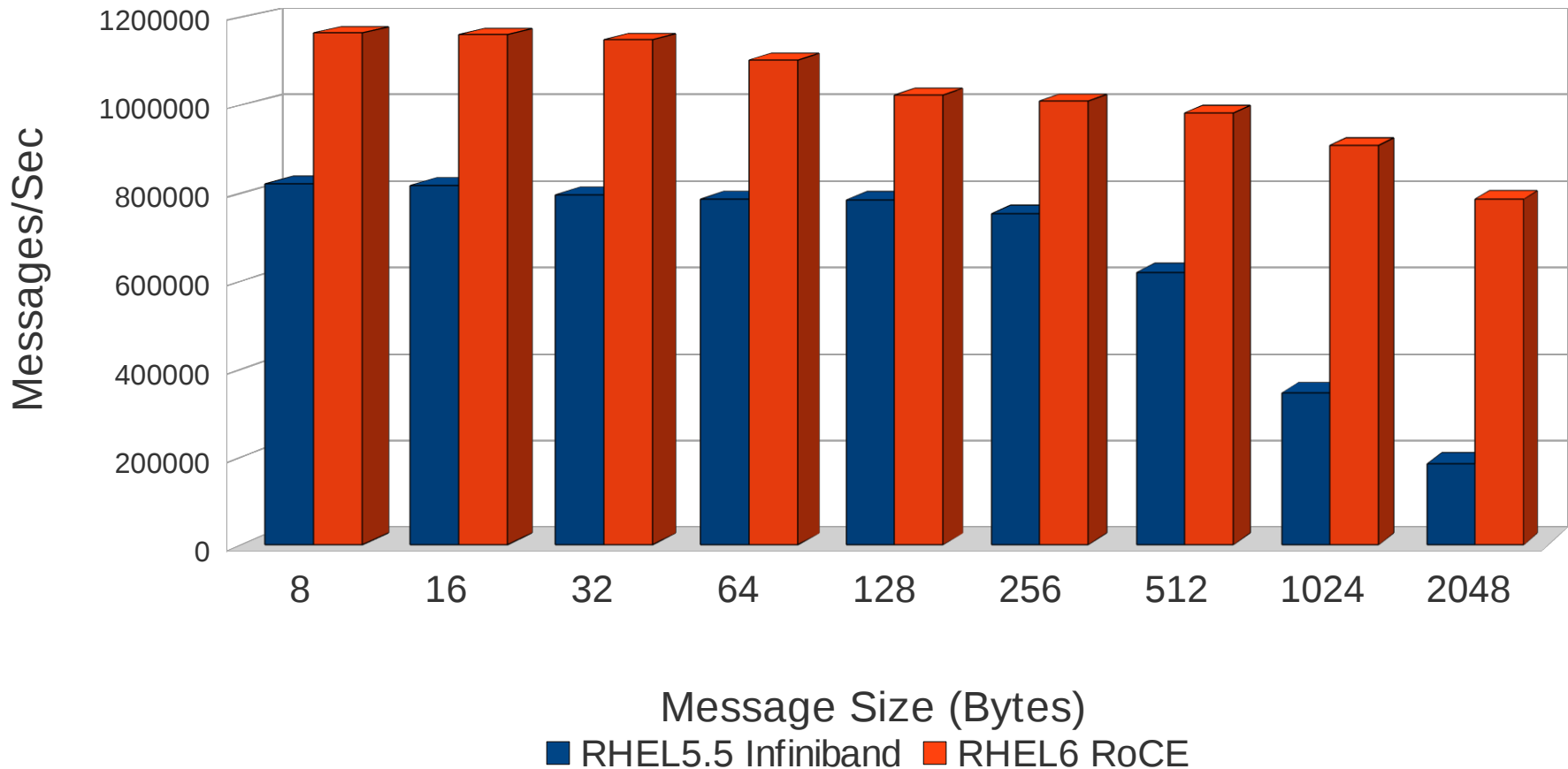


Scalability: Memory



Performance: Network

Comparing RHEL5.5 Infiniband with RHEL6 10Gb with RoCE



- **RoCE support is unique to Red Hat (RDMA over Converged Ethernet)**



Reliability, Availability, Serviceability (RAS)

Enables a new class of hardware/software capabilities

- **Advanced error recovery/reporting**
 - CPU and memory hot add
 - Machine Check Architecture
 - Intelligent recovery from CPU/memory errors
 - Enhanced error reporting for PCI devices (PCI-AER & APEI)
 - DIF/DIX: End-to-end data integrity checking
- **Rapid file system recovery (up to 10x faster than RHEL 5)**
 - E.G. Fsck for 1TB filesystem (45 million files)
 - *RHEL5 Ext3 = 1 hour, RHEL6 Ext4 = 6 minutes.*



Unprecedented Resource Management

Red Hat Enterprise Linux forges new ground in managing processing, memory, storage, and network resources.

- Policy driven Power Management
 - Automatically reduce system power consumption
 - Discover and optimize the system
- Dynamically allocate system resources
 - Manage processes via Control Groups (cgroup)
 - Meet application SLAs by reducing resource contention and increasing predictability in performance.



Cgroups Demo



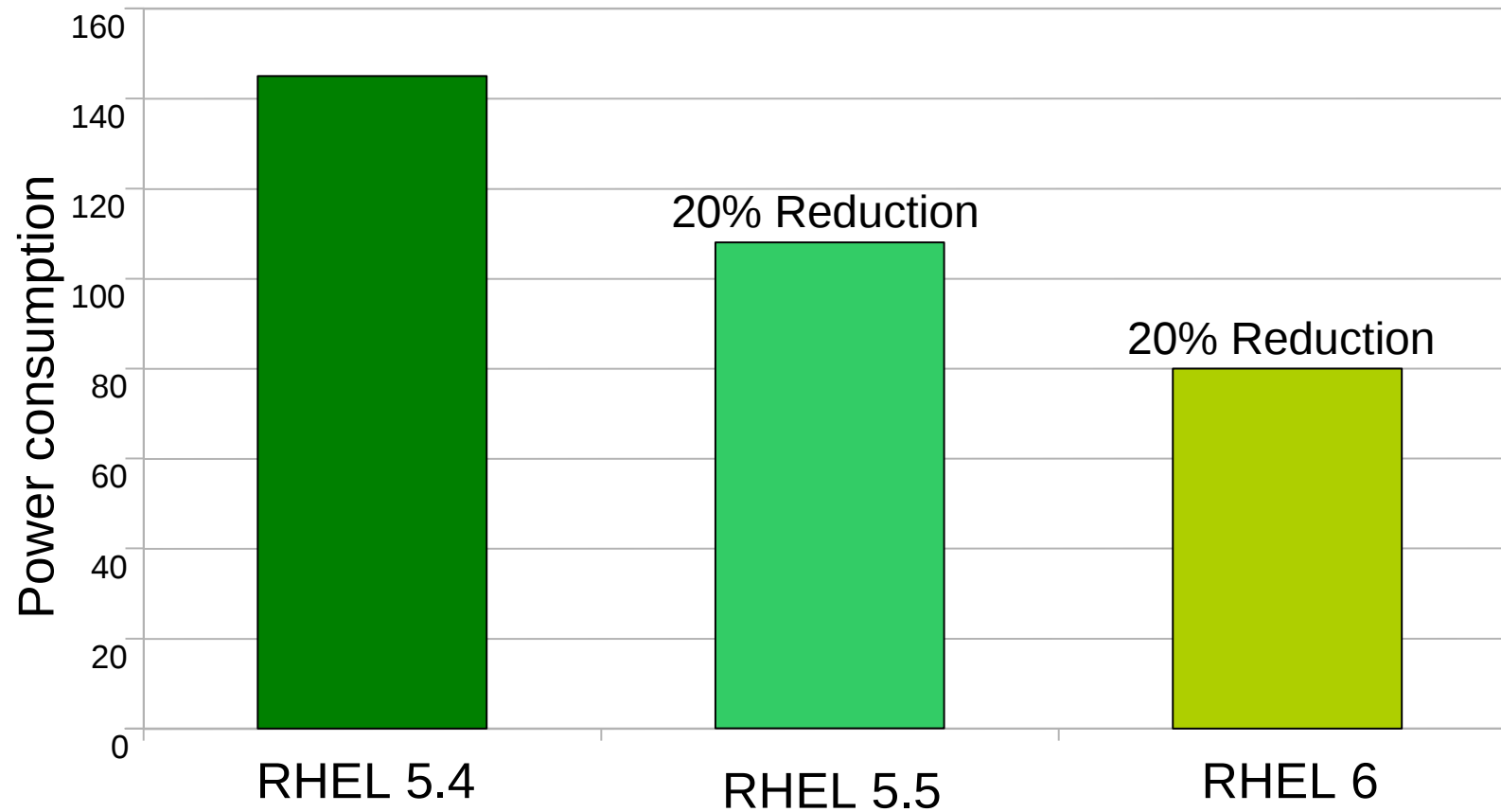
Policy driven power management



- **Advanced kernel and sub-systems**
 - Power savings from CPU, disk, network
 - Designed for minimal power with fewer interrupts
- **Tuned - adaptive tuning daemon**
 - Latency policy scripts
 - Provides a variety of power tuning profiles
- **Powertop**
 - Identifies power hungry applications and system services



Lower Power Consumption



Idle power consumption (W), measured on Nehalem-EP



Technical Details



- ***Reduces power consumption at multiple layers in the software stack***

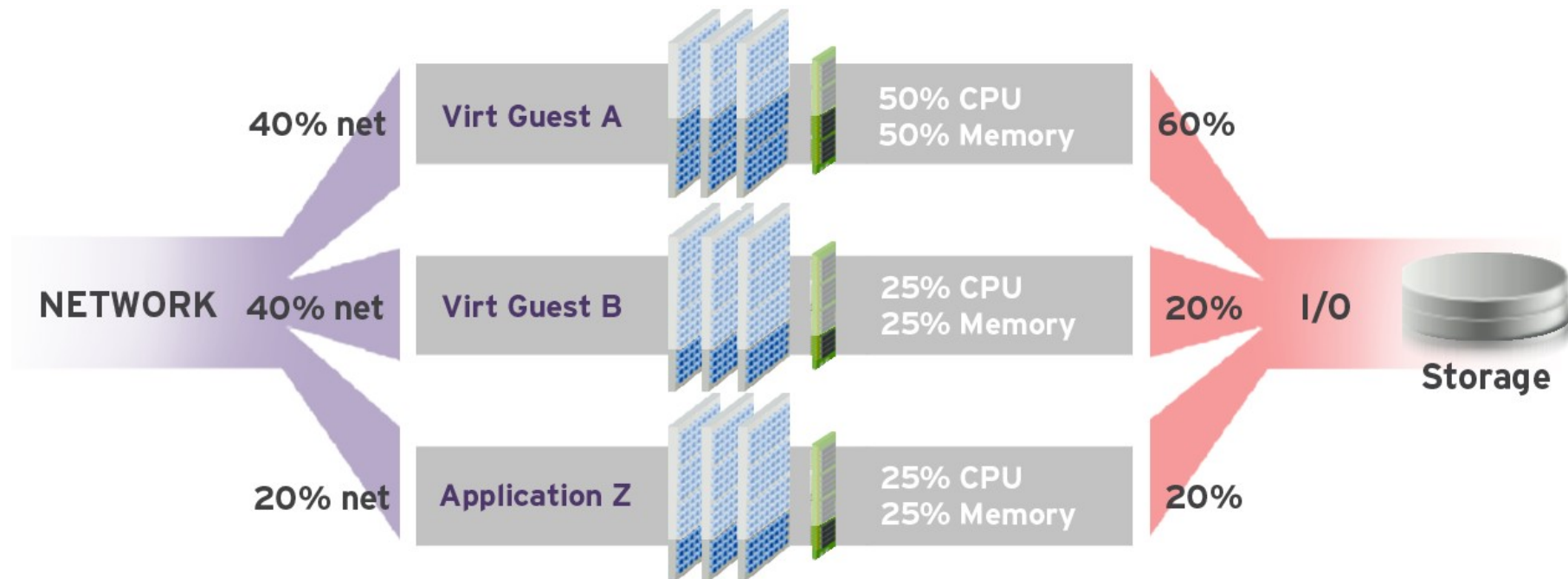
Component	Feature
Utilities	Power audit to reduce power consumption, E.G. convert utilities to event-based algorithms
File System	Intelligent drive spin-down File metadata I/O reduction: relatime mount option
Kernel	Tickless kernel enables extended low power states for idle systems
CPU	Core/CPU idling in lightly loaded SMP systems; applies for virtual guests
I/O	Dynamic power adjustment to PCIe & SATA links via ASPM & ALPM



Resource Management

Ability to manage large system resources effectively

- Control Group (Cgroups) for CPU/Memory/Network/Disk
- Benefit: guarantee Quality of Service & dynamic resource allocation
- Ideal for managing any multi-application environment
 - From back ups to the Cloud



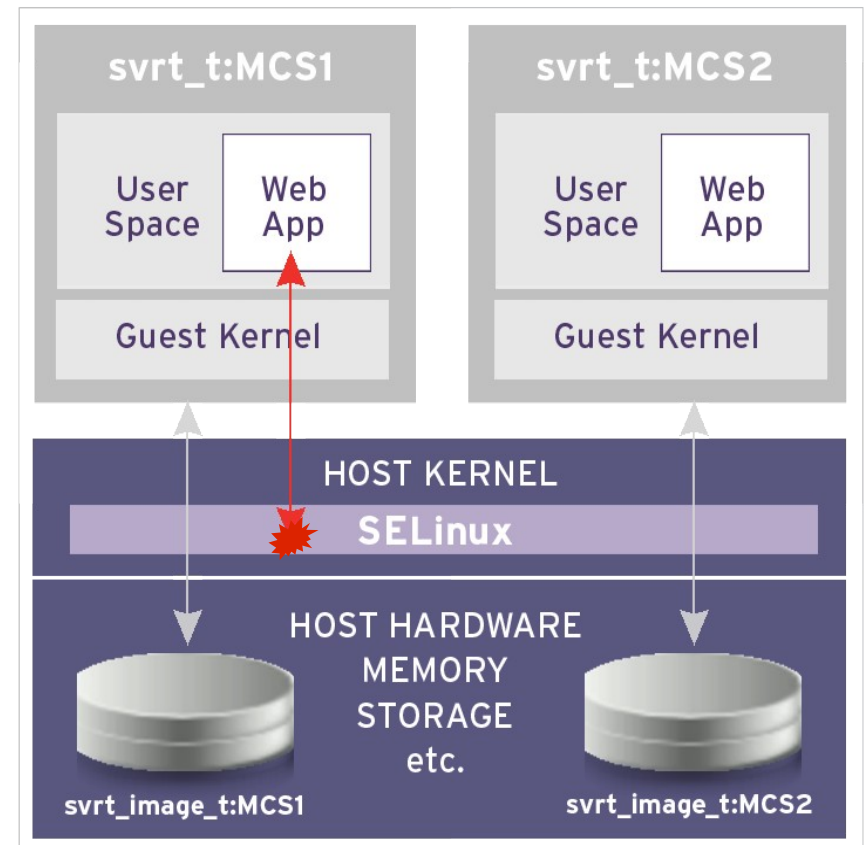
Designed-in Security

- **Making security comprehensive, consistent and portable**
 - Technologies across the stack including firewall, identity and fine grained access control
 - Tailoring your environment
 - Enhanced installation options, include minimal install
 - Update, audit & report with RHN Satellite
- **Power of SELinux applied to any application or guest**
 - Policy driven security
 - More control than whitelisting - Control what applications, process or guests can & can not access or execute
- **Security in the Operating Platform spans physical, virtual or cloud**



SELinux: From Applications to Guests

- ***Applying security labels to individual guest virtual machines and their resources***
 - Guest Isolation achieved with SELinux Mandatory Access Controls (MAC)
 - Protect against untrusted Guest VM
 - Protect against Host misconfiguration
 - Prevents unauthorized access of Guests/Host
 - Builds on existing, proven security mechanisms & controls



Integrated Virtualization

Red Hat Enterprise Linux 6 is the platform for enterprise virtualization.

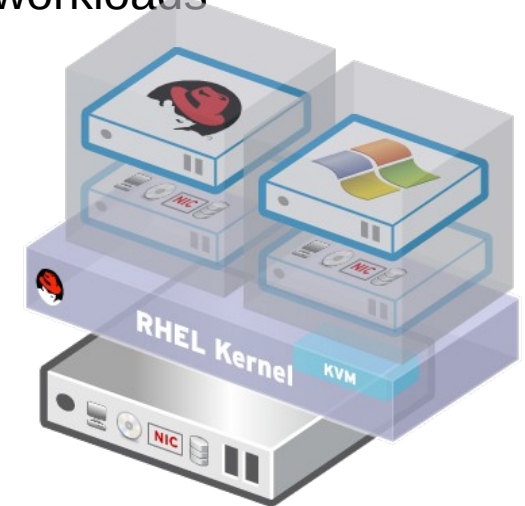
- Virtualization is a foundation for data center planning.
- Red Hat Enterprise Linux is an excellent virtualization host, and is designed to be a superior guest on any of the major hypervisors.
- Leverages built-in kernel features for networking storage related to guest acceleration.



Virtualization

Deliver enhancements to make virtualization ubiquitous

- **Performance:**
 - Commonly 85%-95% of bare metal, including I/O bound workloads
- **Scalability:**
 - Host: 4096 cores; 64 TB RAM
 - Guest: 64/4096 vCPU; 2 TB RAM
- **Advanced capabilities:**
 - Live Migration; CPU/Mem resource control
 - Memory page sharing (KSM); SR-IOV; VT-D; sVirt security
- **Hypervisor integrated into the Linux kernel**
 - All features accrue to Red Hat Enterprise Virtualization, which also provides sophisticated management capabilities



Deployment and Diagnostics

- **Tuned**
 - Adaptive system tuning daemon that provides common workload profiles.
- **SELinux**
 - Provide developers insight into application access to system resources and policy based application security
- **SystemTap**
 - Non-intrusive debugging of applications for kernel/user/Java
- **Performance counters for Linux (PCL)**
 - Profiling kernel code by tracking hardware events.



Enterprise Manageability.

Red Hat provides control for the data center operations to centralize and automate common management functions so your environment can scale

- Intelligent, flexible provisioning
- Integration with common directories
- Scaling up provisioning, auditing and reporting with Smart Management modules & RHN Satellite



Interoperability and Deployment

- **Installation using Workload Profiles/Personalities**

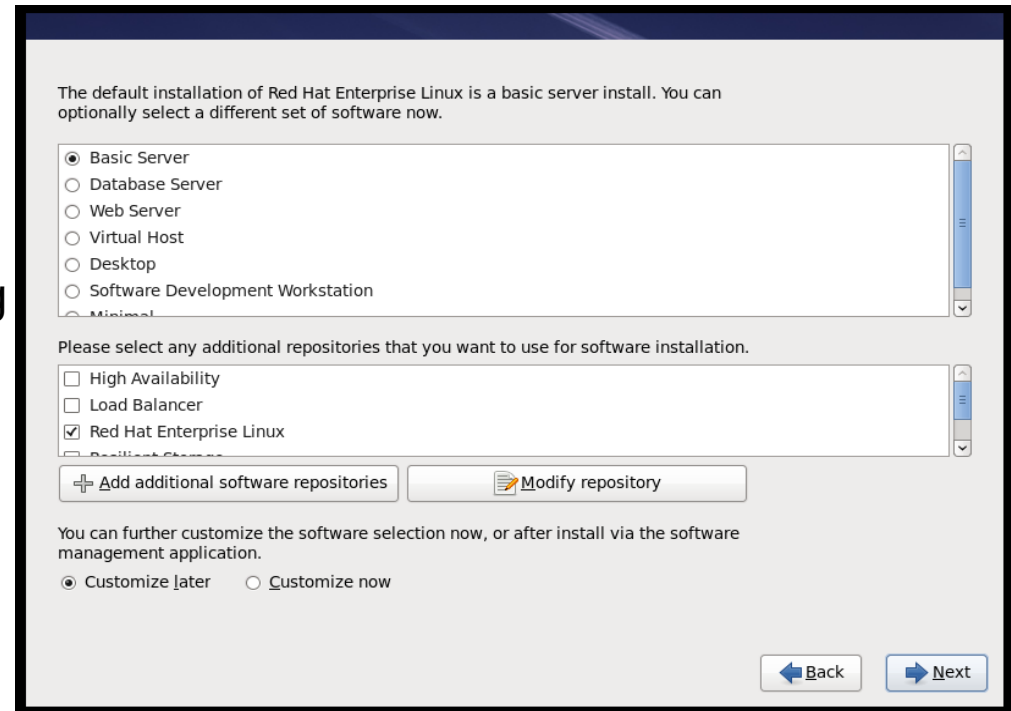
- Minimal install option provides minimal security attack surface

- **Microsoft Interoperability**

- Client support for Windows 2008 R2 active directory
- File/Print (Samba) file sharing
 - Ipv6 & Windows 7 domain support
- Encryption between client & server

- **Enterprise Management**

- Auditd for centralized reporting
- ABRT for centralized incident analysis
- Key Escrow: secure storage & recovery of encryption keys



Filesystems & Storage



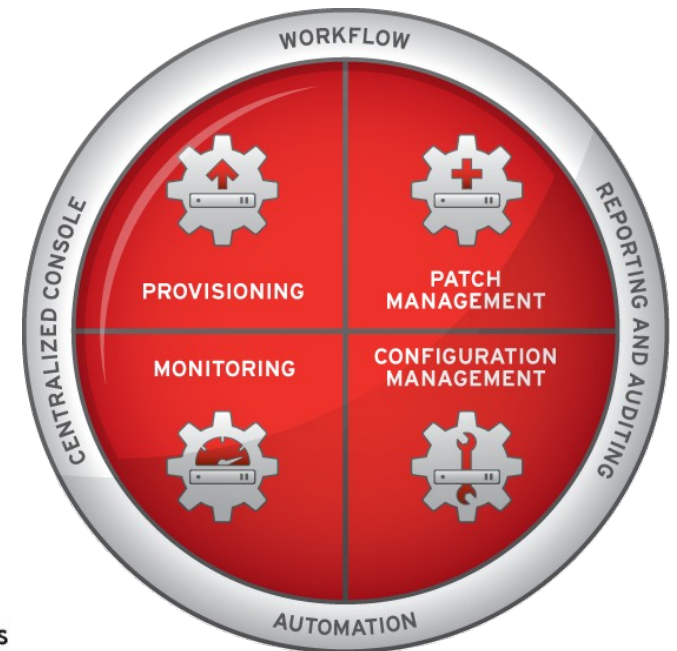
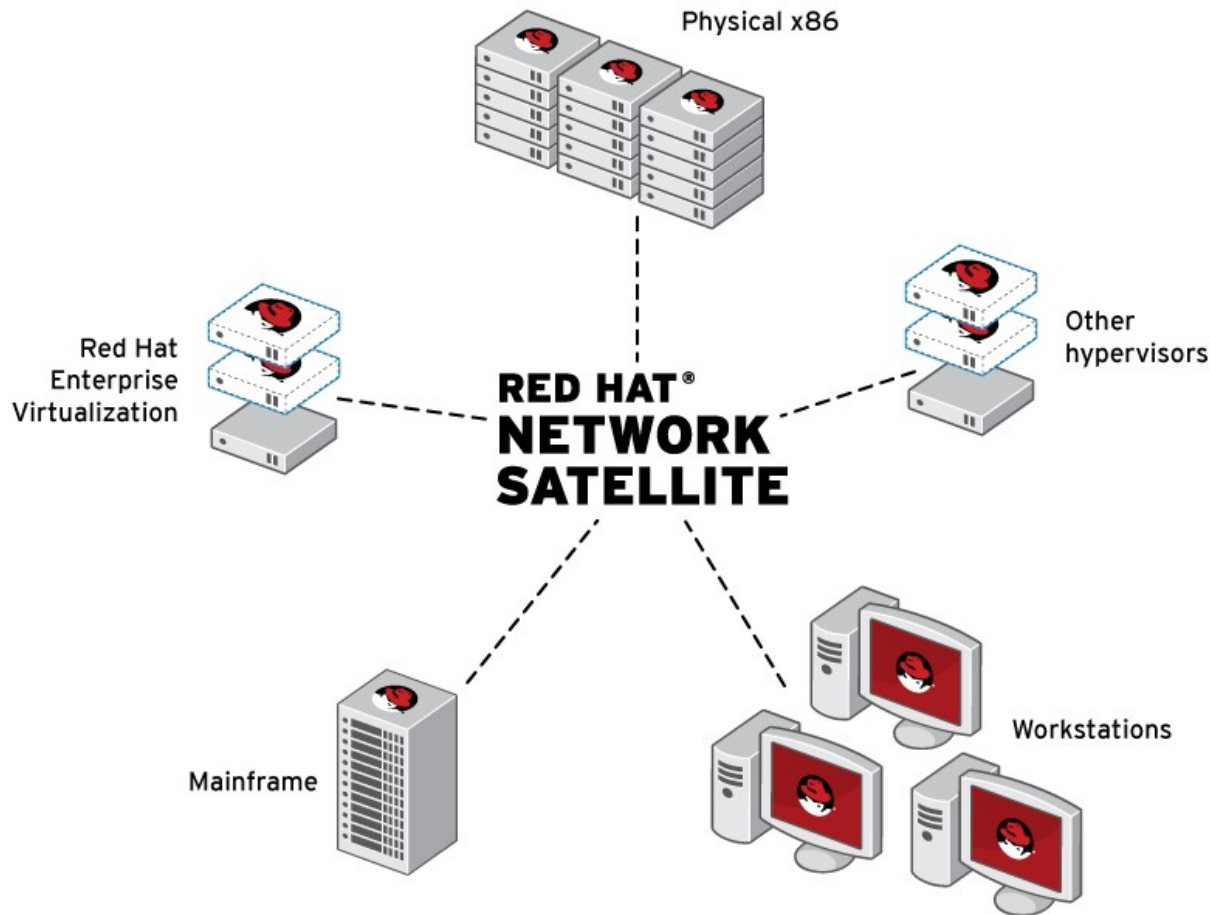
- ***Multiple file systems for different capabilities***
 - Ext4: new system default file system - faster, more scalable
 - XFS and GFS: options for very large storage, and clustered environments
 - NFS 4.0/1: enhanced encryption and IPv6
- ***Storage enhancements for data integrity, SSDs, Virtualization***
 - DIF/DIX: data checksumming from HBA <-> disk
 - Topology awareness: allows storage access optimizations
 - Virtual server storage optimizations: SR-IOV, NPIV, VSAN
 - Thin provisioning & Block discard: assist SSD wear leveling
 - Extensive LVM enhancements: online resize; multipathing; mirroring; snapshots; encryption





Satellite 5.4

Scaling Enterprise Manageability



RHEL 6 Support

- **Deploy and manage RHEL 6 optimally**
- **RHEL 6 client support**
 - Enhanced security with SHA256 checksum
- **Satellite 5.4 is required for RHEL 6 client support**
 - Older Satellites are not aware of RPM and yum repo SHA256 checksum
 - Older Satellites do not support RHEL 6 clients
 - RHEL 6 clients are not supported on older Satellites



Entitlements - Flex Guest Support

- Track & entitle your non-RHEL Hypervisor environment for your all your deployed RHEL
- Flex Guest Support aka Floating Virtualization Entitlement
- Before flex guest, a virt guest without a host took full entitlement (system and software)
- Specific Virtualization SKU's provide Flex Guest
- Specific virtualization technology guest types are recognized
- Satellite Cert now has a `flex=` field

```
<rhncert-field name="channel-families" flex="5"
  quantity="100" family="rhel-server" />
```



Yum Repository Syncing

- **Simplify importing of external yum repos into your Satellite channels! EPEL, HP & Dell repo's**
- **Define repository**
 - Associate one or more repos with channel
 - Import
 - Maintain
- **Schedule syncs per channel**
 - One time syncs
 - Scheduled syncs



Enhancements

Duplicate system detection/handling

spacewalk-create-channel

Staged deployment

Configuration management enhancements

Cross-org virtualization entitlements

Additional API calls

Additional reports

Yum repo generation

Support for External Oracle 11g DB





Unix Migration

Migrating Costs Less than Upgrading Unix

- **Server hardware costs**

- Commodity hardware — take advantage of competitive pricing

- **System management labor**

- Typical admin can manage > 200 systems using Red Hat tools, Red Hat Satellite
- Red Hat Network — automatically download updates
- Red Hat development community makes it easier to find answers
- Supply of Linux admins greater than Unix variants
- Linux will soon have an advantage in availability, cost, skill, and talent pool*

- **Power and facilities costs**

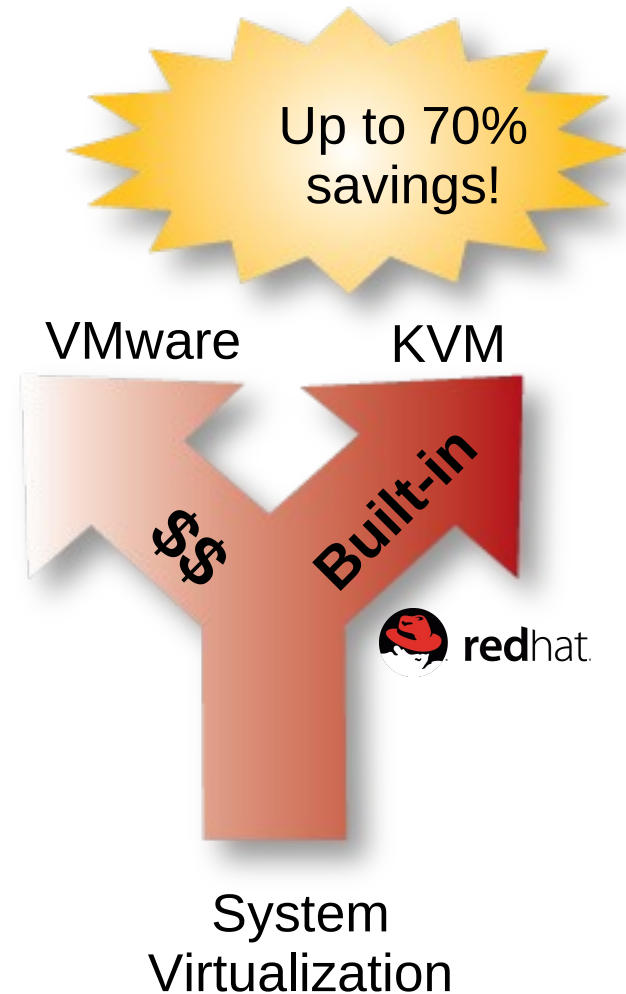
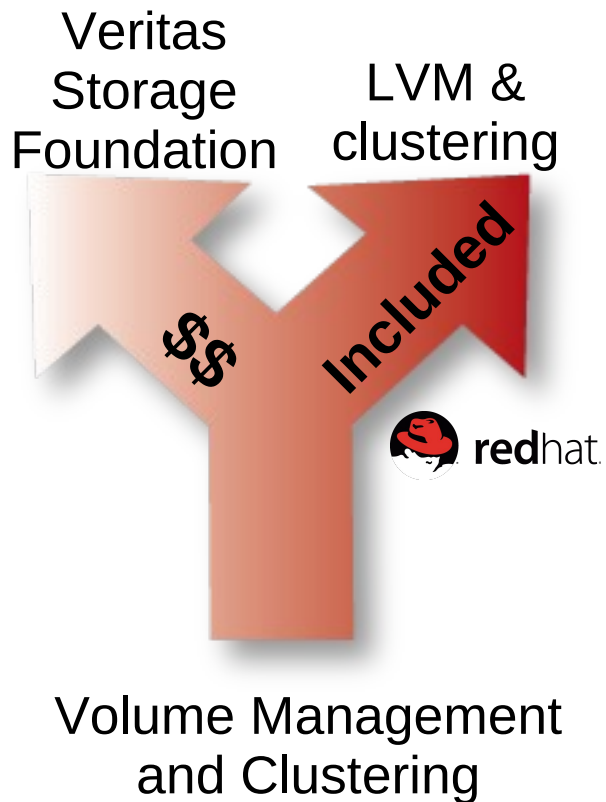
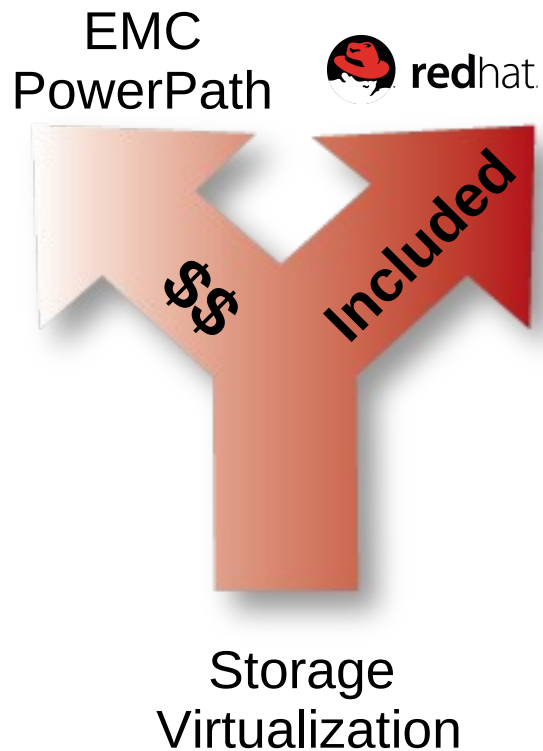
- Consolidating to greener, faster technologies/better workload management reduces requirements for power, cooling, and space



*Robert Francis Group

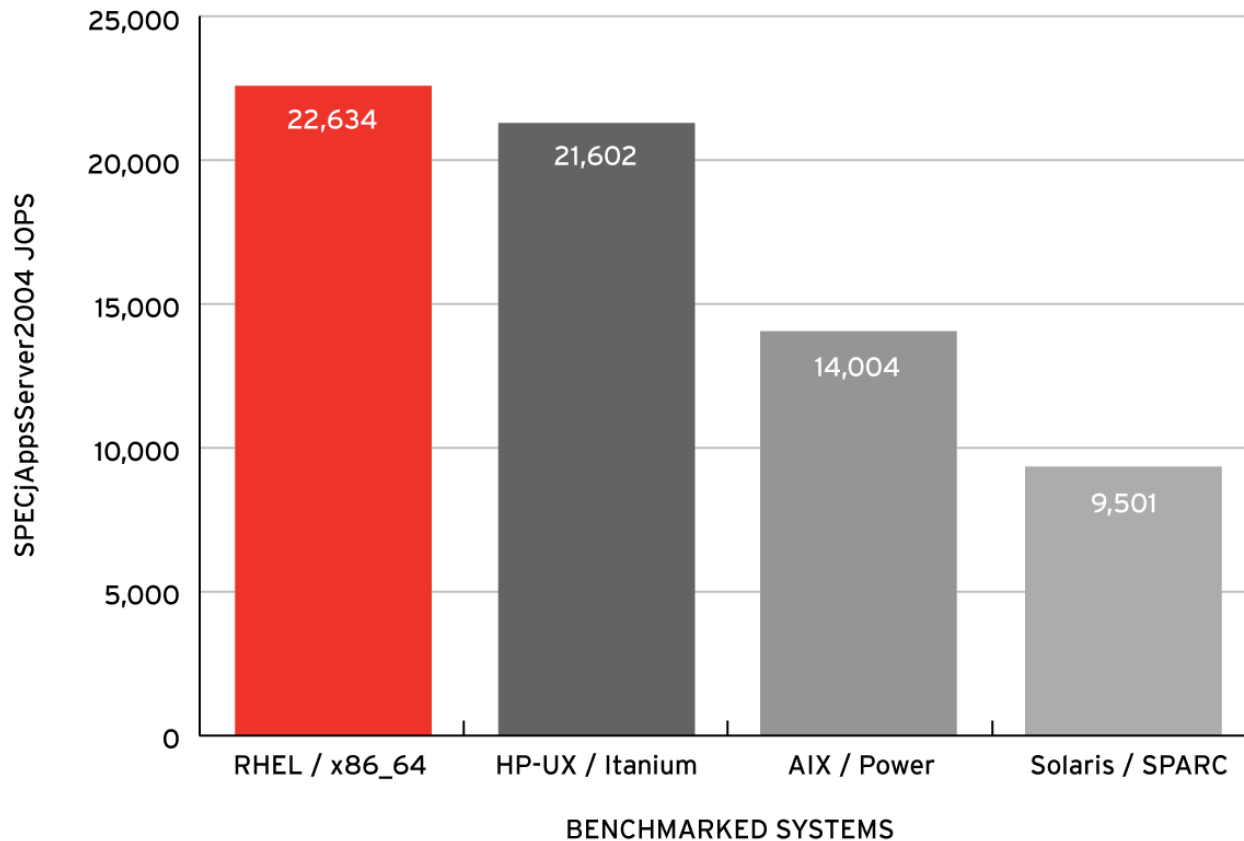


Migrating Costs Less than Upgrading



UNIX Migrations - RHEL Performance is Real

Best SPECjAppServer2004 (February 2009)



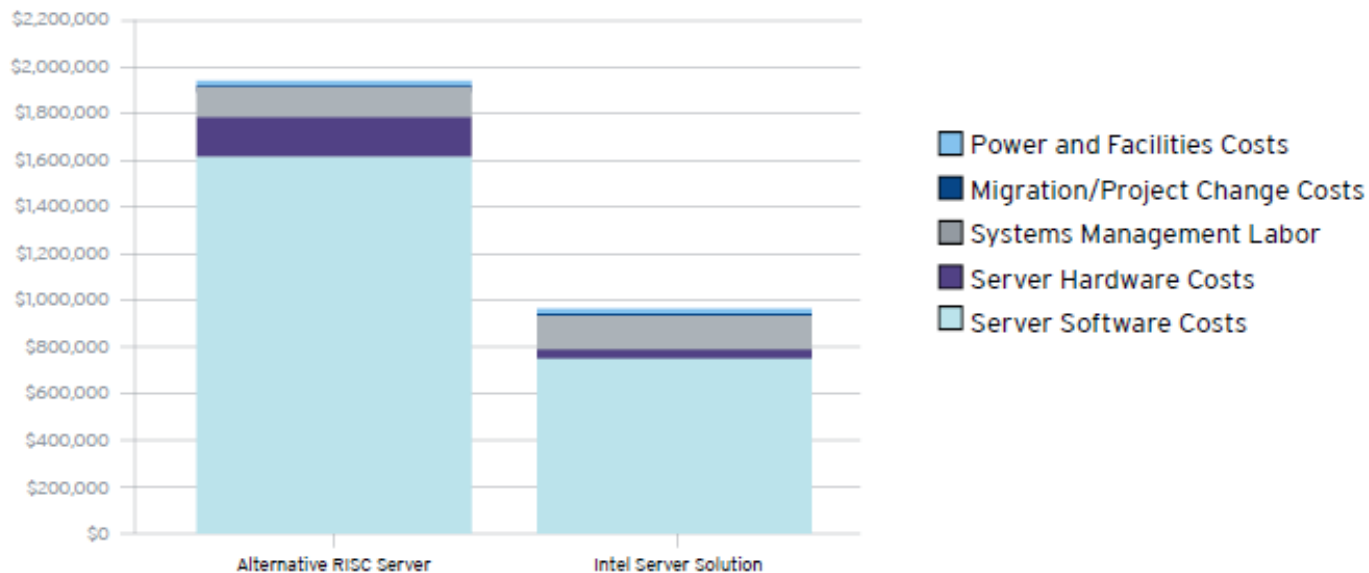
**Red Hat Enterprise Linux
best for Java EE application servers**



Save with Oracle on Linux & x86_64

- RISC to run large Oracle DB is 3x x86 (\$170K vs. \$46K)
- Total server software less than ½ of RISC/UNIX (\$780K vs. \$1.6M)
- Power and facilities cut by 1/3 (\$12K to \$8.5K)

FIGURE 1: COMPARABLE TCOS OF RISC/UNIX AND RED HAT-DELL-INTEL PLATFORM



*Oracle on Red Hat Enterprise Linux paper



Mission Critical Features

Component	Red Hat Enterprise Linux	Solaris	IBM AIX	HP-UX
Provisioning	Kickstart, Red Hat Network / Satellite	Jumpstart, Sun xVM Ops Center	Workload Partitions Manager	Ignite/UX, Hp Virtualization Manager
Systems Management & Monitoring	Red Hat Network / Satellite	Sun xVM Ops Center, Sun Management Center	IBM Tivoli Monitoring, IBM Systems Director	HP Systems Management, Insight Manager
Security	EAL4+	EAL4+	EAL4+	EAL4+
Identity Management	Red Hat Directory Server, Red Hat Certificate System	Sun Java System Directory Server, Identity Server	Tivoli Directory Server, Identity Manager	HP-UX Directory Server, no Identity man.
Virtualization	Red Hat Enterprise Linux Virtualization, KVM, Xen	Containers, Ldoms, Domains, xVM	WPAR, PowerVM	HP Insight Dynamics – VSE, npars
Clustering	Red Hat Cluster	Sun Cluster	PowerHA	Serviceguard
Tuning & Troubleshooting	Systemtap	DTrace	probevue	ktracer
Bare-Metal Recovery	Kickstart, Red Hat Network / Satellite	Flash Archive	Tivoli Storage Management	HP StorageWorks Data Protector

