Red Hat Enterprise Linux for zSeries, S/390:

Extending Linux throughout the Datacenter

SHARE August 2004
Session 9283

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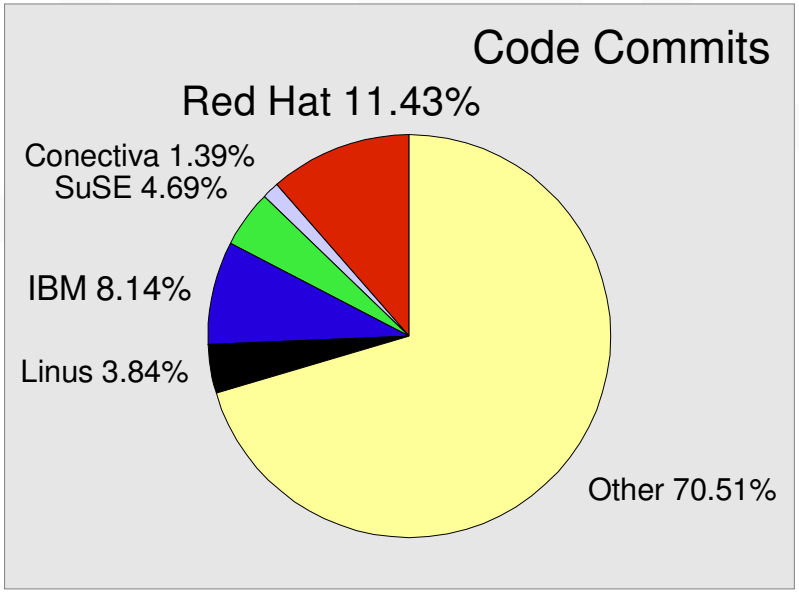
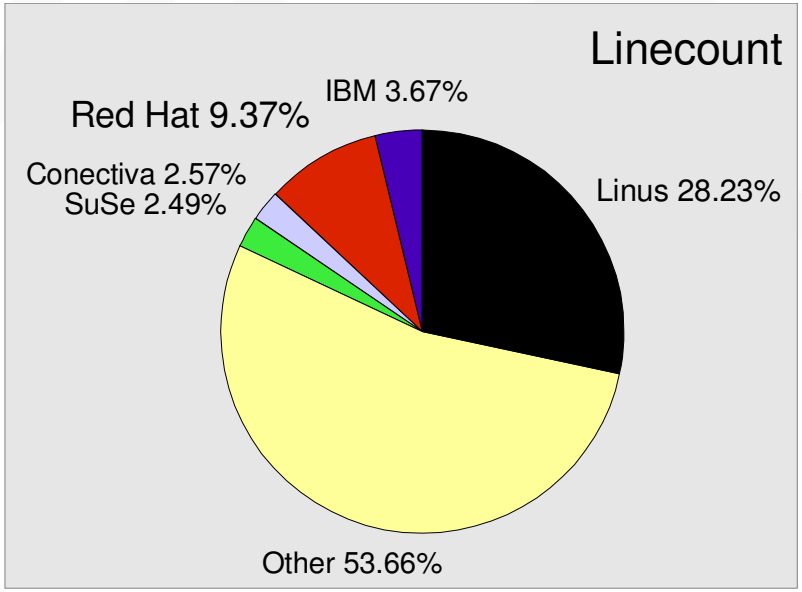
What Does Red Hat Do?

- **From an engineering standpoint:**
  - Works with the community, partners, and customers
  - Develops/incorporates new features
  - Integrates open source packages, new features, drivers, bug fixes, & security updates
  - Tests, certifies, productizes, and supports the result
- **From a business standpoint:**
  - Engineers and sustains the platform
  - Provides services—training, consulting, support
  - But leverages the open source development model

Leading with the Community

- The strength of Linux is based on having a large, vigorous, development community
  - Not overpowered by a single commercial entity
- Code Contribution Analysis:





Linux kernel BitKeeper tree analysis, May 2004

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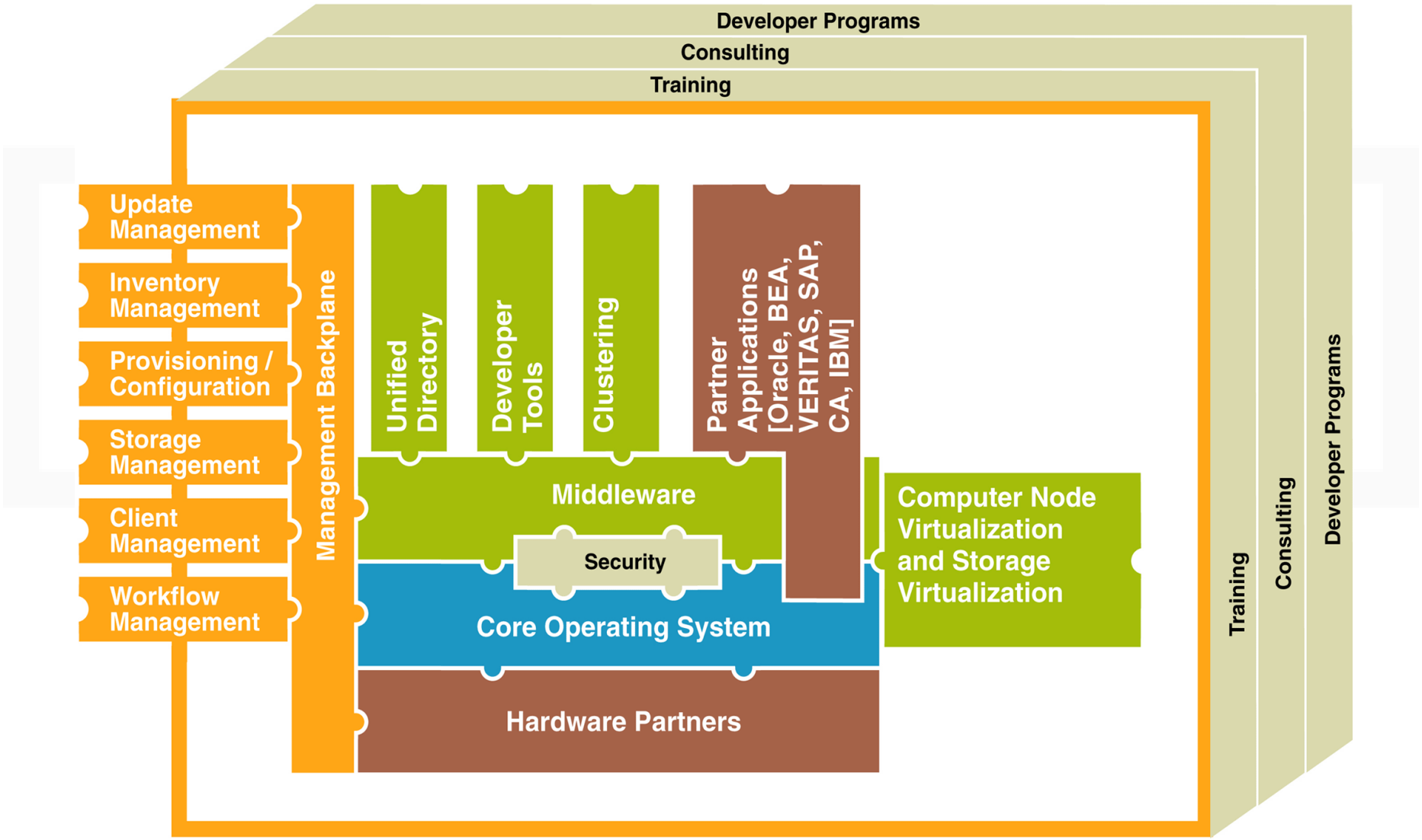
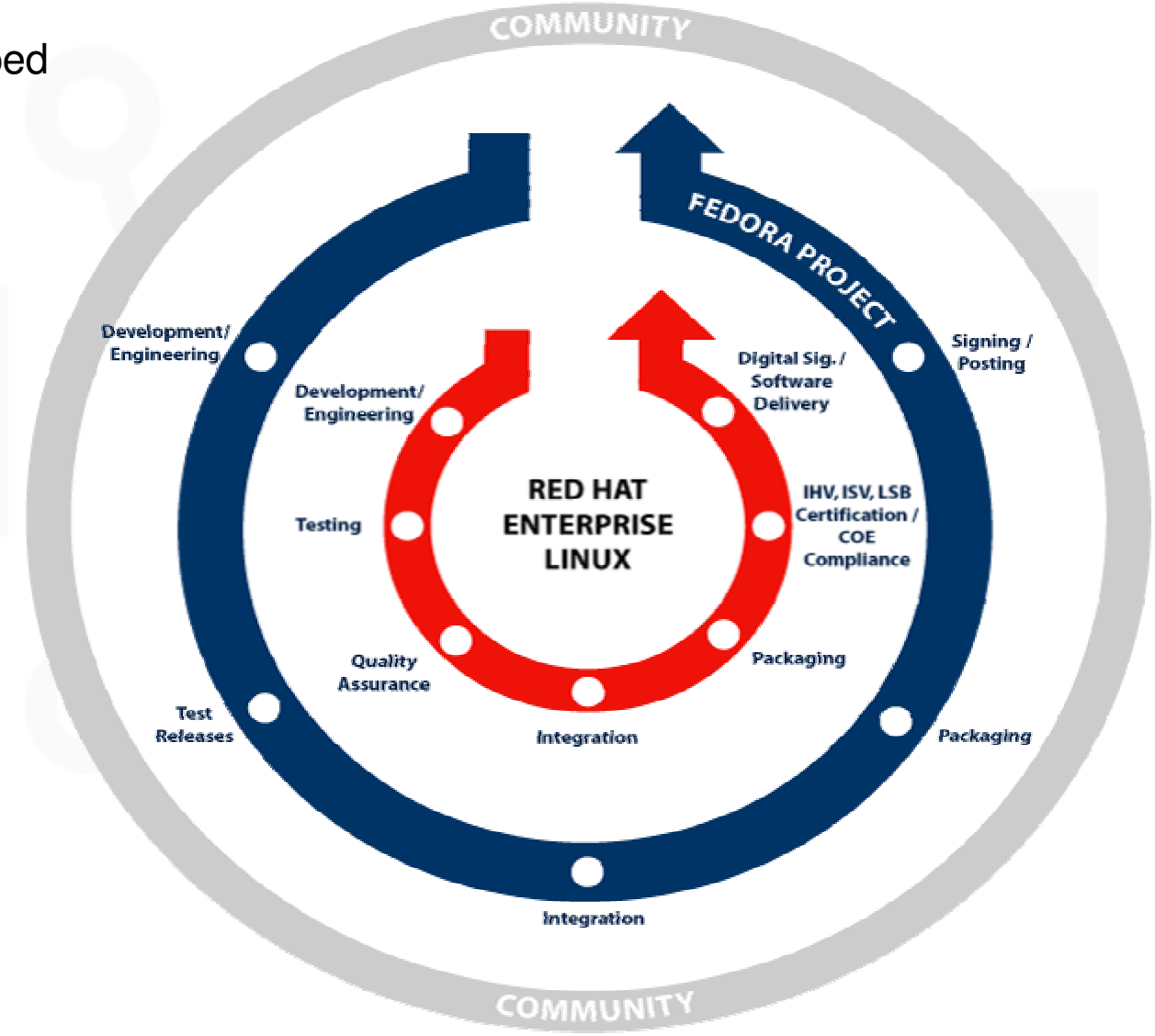
Open Source Architecture (OSA) Structural Overview



Development at Red Hat

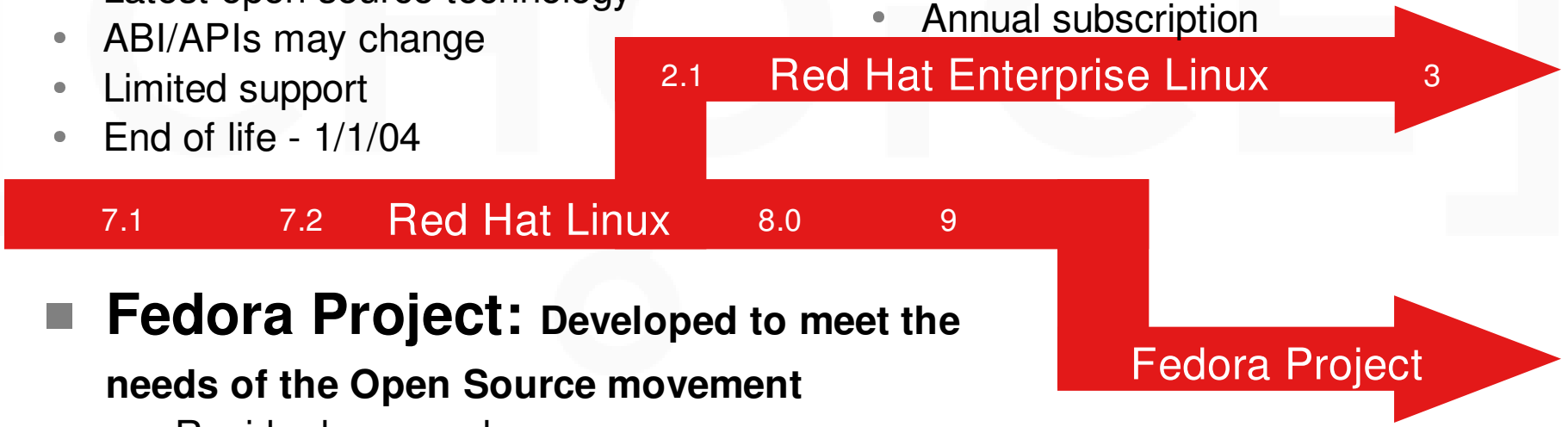
- Construction of S/W developed with the community
  - Additional development
  - Integration
  - Hardening
  - QA testing
  - Delivery
  - Benchmarking
  - Certifications
- Risk mitigation through long-term maintenance & support



Red Hat Product Lineage

- **Red Hat Linux: Developed to meet the needs of the Open Source movement and early technology adopters**
  - 4-6 month release cycle
  - Latest open source technology
  - ABI/APIs may change
  - Limited support
  - End of life - 1/1/04

- **Red Hat Enterprise Linux: Developed to meet the needs of enterprise/commercial customers**
  - 12-18 month release cycle
  - Stable/mature open source technology
  - ABI/APIs held stable
  - Bundled support – up to 5 years
  - Annual subscription



- **Fedora Project: Developed to meet the needs of the Open Source movement**
  - Rapid release cycle
  - Latest open source technology
  - ABI/APIs may change
  - No support; free download

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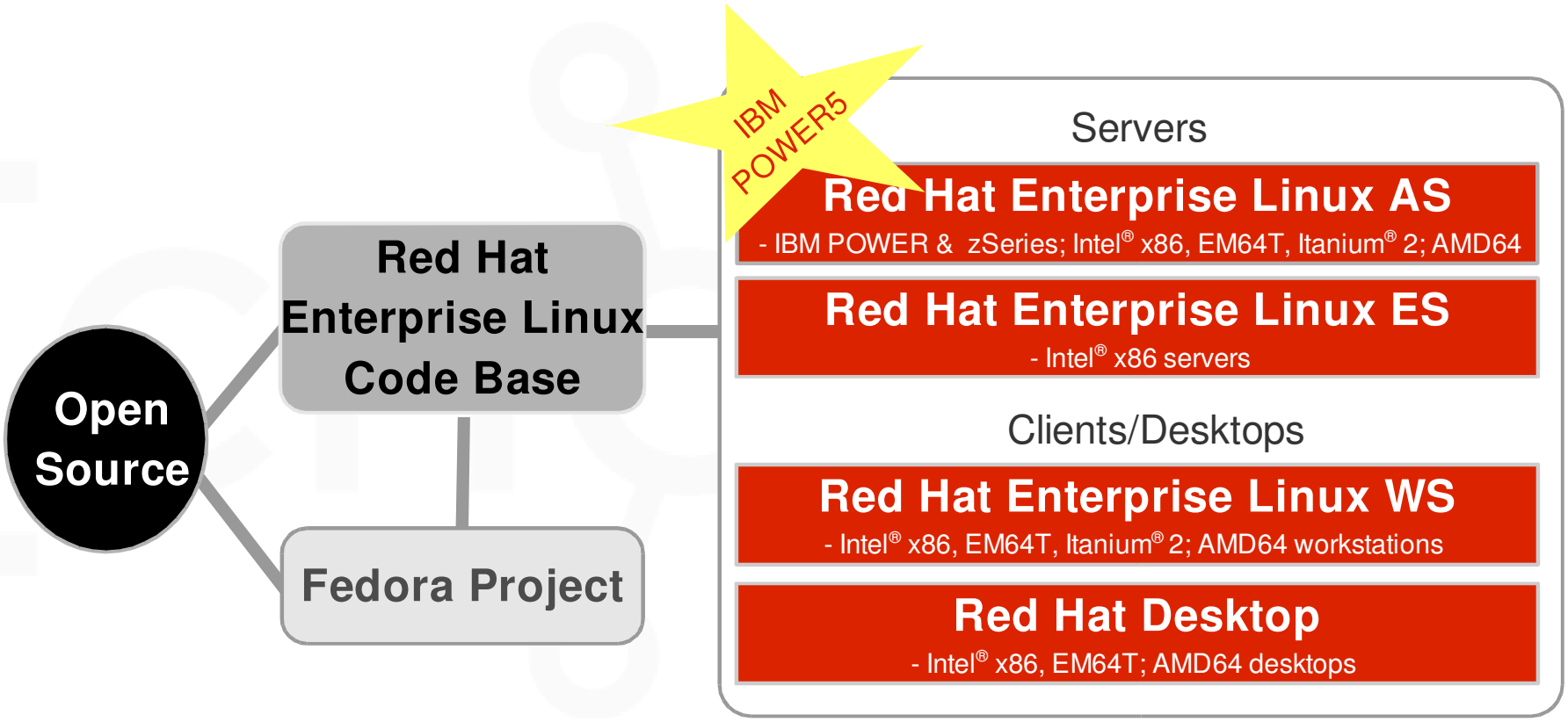
Operating Platforms



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Platform Segmentation

- Segmentation is primarily by CPU & Memory limits and support offerings
  - For different markets – offered with different pricing, packaging, support

	Max CPUs	Max mem	Target Market	Architectures
Red Hat Enterprise Linux AS "Advanced Server"	-	-	Large servers; Database; corporate apps	IBM POWER & zSeries Intel® x86, EM64T, Itanium® 2 AMD64
Red Hat Enterprise Linux ES "Entry/Mid Server"	2	8GB	Entry-mid servers; file/print; web; email	Intel® x86
Red Hat Enterprise Linux WS "Workstation"	2	-	Technical workstation; CAD/CAM apps; HPC; power user	Intel® x86, EM64T, Itanium® 2 AMD64
Red Hat Desktop	1	4GB	Standard corporate productivity desktop; volume deployments	Intel® x86, EM64T; AMD64

Hyperthreaded & multi-cored processor chips are counted as a single CPU

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Red Hat Enterprise Linux 3

- **Red Hat Enterprise Linux 3 product family shipped in October 2003**
  - Over 100 Prio1 features; over 350 general enhancements
  - Back-ported features from the Linux 2.5/2.6 kernel trees
  - Requests from OEM and ISV partners, and customers
- **A single source code base is used for all architectures**
  - Greatly improves code stability and maintainability
  - 5 new architectures; 64-bit clean implementation
  - Eliminates feature skew; simplifies ISV application support
  - Available in 10 languages
- **Key Features for zSeries and S/390**
  - Graphical installation
  - Kick Start support
  - Logical Volume Manager
  - LCS and QETH drivers are part of distribution
  - Single code base for all architectures

Red Hat zSeries/390 Development

- **Z990 + Shark Lab in Raleigh, NC**
  - 2 Books, 1TB
  - Z900 just replaced, new Shark to be installed (2 TB)
- **Fedora**
  - z/390 not targets for Fedora Core releases
  - Development Branch Packages are released for z/390
    - Available daily
- **Red Hat Enterprise Linux**
  - Integrated with all architectures:
    - Source
    - Build
    - Maintenance

Red Hat zSeries/390 Development

- Red Hat develops Red Hat Enterprise Linux to be **"architecture blind"**
  - Common source code pool used for all architectures
    - Very minor differences at the lowest hardware level
  - Common feature set and capabilities across all architectures
  - Single development and qualification process
  - Common kernel, toolchain, utilities, libraries, applications, etc.
  - Benefits:
    - Feature compatibility for applications from desktop to mainframe
    - Single management skillset required (common tools, etc)
    - Enhancements/fixes aggregate across the entire architecture set
      - Provides service-level consistency
- Red Hat Enterprise Linux solutions span the complete IT infrastructure
  - Single source for sales & services

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Red Hat Enterprise Linux & z/390

- Red Hat Enterprise Linux v.3 supports all currently shipping, and several previously available, mainframe systems, including:
  - z990, z900, z800, G5/G6
  - Including all I/O infrastructure (storage, LAN)
    - Drivers open sourced by IBM
    - Red Hat distributes the drivers as part of the core Enterprise Linux distribution
- 31-bit kernel for G5/G6, 64-bit kernel for z990, z900 & z800
  - Support for 31-bit OS on 64-bit platforms (consistent with other platforms)
- 64-bit OS runs on the z900, z990, z800
- Application Support:
  - Core Utilities/Applications provided with Red Hat Enterprise Linux
    - Apache, Samba, NFS, FTP, sendmail
  - WebSphere
  - DB2
  - Working with Oracle/IBM for certification

Red Hat Enterprise Linux & z/390

- Sys_epoll() will be provided in Red Hat Enterprise Linux 4
  - Stability requirement for RHEL 4 - defined interface to kernel (ABI) – changing sys_epoll without modifying our interface was too difficult
  - Sys_epoll() (David Libenzi) provides a mechanism identifying changes to (numerous)network connections/file descriptors
    - Specific applicability to threaded Domino implementation
      - File description means a network connection to Domino logical connection
  - Investigation into earlier delivery is currently underway

Partnerships Create Solutions

- Red Hat has the strongest partnership links in the Linux market:
  - Partnerships with all the leading OEMs has resulted in over 400 certified hardware systems
    - Servers, workstations, desktops, laptops, peripherals
  - More than 300 ISV partners have certified over 1000 applications
  - Global Distributor Partners allow Red Hat Enterprise technology to be procured world-wide
  - Developer Connection
  - Training partners
  - Hosting partners
  - Runtime partners
  - Business partners

Over 400 certified systems

Over 1000 certified applications

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Support Sustains Solutions

- Red Hat Enterprise Linux is supported for a full 5 years from product release
- Support delivered by Red Hat selected partners
  - IBM (and others)
- Three phases of support:
  - Full support: Includes hardware updates, bug fixes, security
  - Deployment: Includes security & bug fixes
  - Maintenance: Includes security & selected bug fixes

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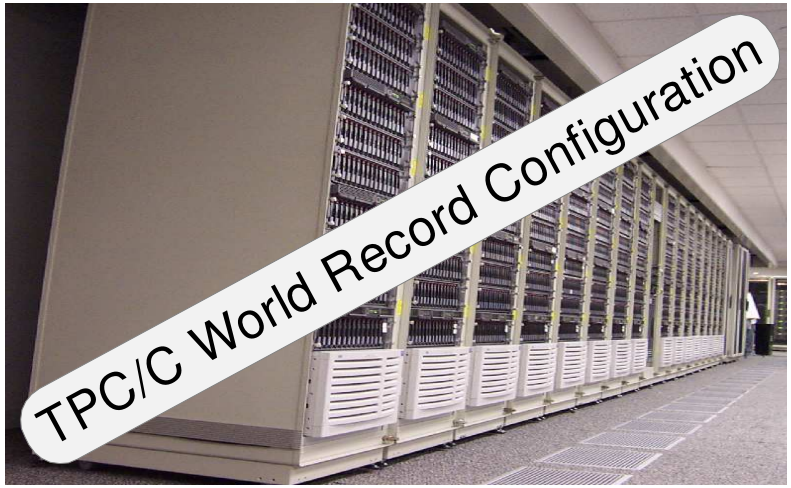
Red Hat Enterprise Linux Kernel Features

- Red Hat Enterprise Linux is based on a Linux 2.4.21 kernel, with numerous enterprise-focused Linux 2.6 kernel features included
  - Provides a solid combination of stability and performance

Feature	Included in Linux 2.6 kernel	Included in Enterprise Linux 3 products	Provides:
Native Posix Thread Library (NPTL)	Yes	Yes	High performance POSIX compliant multi-threading
Kernel IPSec	Yes	Yes	IPSec layer for use by kernel modules
Asynchronous I/O (AIO)	Yes	Yes	Improved application performance
O(1) Scheduler	Yes	Yes	Highly scalable SMP scheduler
Oprofile	Yes	Yes	CPU-hardware-based performance monitoring
Kksymoops	Yes	Yes	Improved kernel bug reporting
Reverse Map Virtual Memory (rmap VM)	Yes	Yes	Performance improvement in memory constrained systems
HugeTLBFS	Yes	Yes	Performance improvement for large virtual memory applications (e.g. Databases)
Remap_file_pages	Yes	Yes	Kernel memory optimization for shared memory applications
2.6 network stack features (IGMPv3, Ipv6...)	Yes	Yes	Improved network capabilities (performance, messaging, standards)
Ipvs	Yes	Yes	Network load balancing
Access Control Lists (ACLs)	Yes	Yes	Improved file system security management
4GB-4GB memory split	No	Yes	Greatly increased x86 physical memory support and larger application address space
Scheduler support for hyperthreaded CPUs	No	Yes	Improved hyperthreaded CPU performance (2.6 implementation not yet comparable)
Block I/O (BIO) layer	Yes	No	Major rewrite of the I/O subsystem (stabilization and driver support in progress)
Support for >2 TB file system	Yes	No	Support for very large volumes. Red Hat Enterprise Linux 3 supports up to 1 TB
New I/O elevators	Yes	No	Fine tuning for I/O subsystem performance (stabilization in progress)
XFS filesystem	Yes	No	High performance file system
Interactive scheduler response tuning	Yes	No	Scheduler improvements for interactive tasks (stabilization in progress)

Red Hat Enterprise Linux Benchmarks

- Red Hat Enterprise Linux performance & scalability is demonstrated by multiple world record benchmark results
  - Performance:
    - #1 – TPC/C, overall world record, cluster configuration
    - #1 – SPECjAppServer2002, dual-node world record
  - Price/performance
    - #1 – TPC/H, first under $100/QpH @ 3000 GB



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Ships later this month!

Red Hat Enterprise Linux v.3 Update 3

- Support for the new IBM POWER5 series systems
- Security: Position Independent Executables (PIE) support
  - Application section load addresses are randomly assigned every time an application is started, making address-based exploits much harder
- For non-S/390/z architectures
  - Inclusion of Evolution Exchange Connector
  - Support for local disk kernel crash dumps (extension of network dump feature)
  - Security: Exec Shield and No eXecute (NX) support
  - Extensive new driver support (esp. SATA, Fibre Channel, RAID, Network)
  - Misc. security updates & bug fixes; service call auditing; additional 32-bit libraries for 64-bit systems
    - Intel/AMD hardware architecture capability

Note: Features are subject to change prior to release

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Due Q1 2005 !

The Future: Red Hat Enterprise Linux v.4

- Red Hat Enterprise Linux v.4 will be a large release with many new features
  - Red Hat partners have had Alphas for several months
  - Betas Q3/Q4 CY04 – Final release target Q1 CY05
- Primary features include:
  - Linux 2.6 kernel base; GCC 3.4 toolchain
  - Enhanced Security with SELinux
  - Development focus on performance and scalability
  - Forward compatibility for applications (via compatibility libraries)
  - Enhanced storage and device-support subsystems
    - Improved Global File System, Virtualization & Storage Management
    - Device Mapper features – cluster-wide, snapshot, multi-path
  - Distributed Management and Provisioning enhancements (via RHN)
  - Also:
    - Improved Desktop Capabilities
    - Extensive partner hardware support (more laptops, etc.)

Note: Features are subject to change prior to product release

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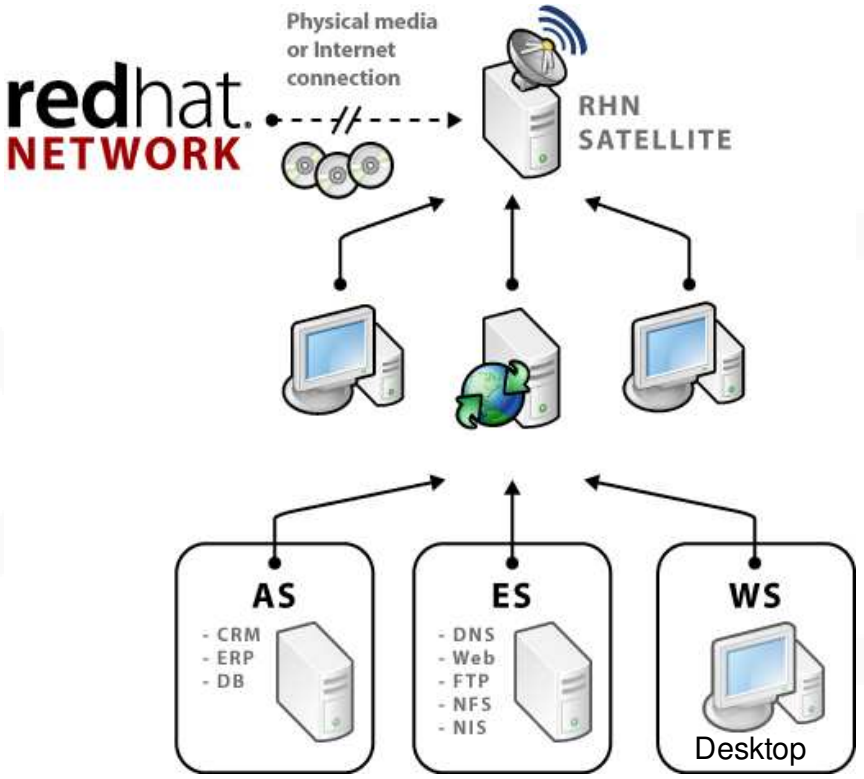
Red Hat Layered Products & Mainframes

- Red Hat has been rolling out a family of layered products for the Red Hat Enterprise Linux platform:
  - Red Hat Global File System (June 2004)
    - Provides cluster file system with shared, concurrent, read-write access
    - Announced June 2004
    - zSeries GFS support being evaluated (announced prior to acquisition)
  - Red Hat Application Server (July 2004)
    - Standards complaint Web and EJB container environment, based on Apache, Tomcat, JOnAS, Struts
    - Announced August 2004
  - Red Hat Developer Suite
    - IDE based on Eclipse
    - Announced late 2003
- These products are currently not available for mainframe systems
  - We are soliciting feedback from the mainframe community on the need for these products.

Red Hat Network

- Red Hat's modular, Web-based Linux management platform
  - Built for distributed systems
  - Integrates with existing platforms
- Simple value proposition
  - Save time and money
  - Increase productivity
  - Enhance security
- Modular approach
  - Updates
  - Management
  - Provisioning



Runs entirely on local network
(hosted version available)

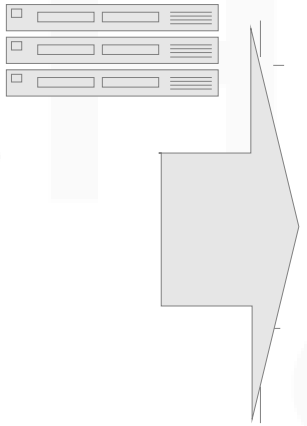
Red Hat Global Support

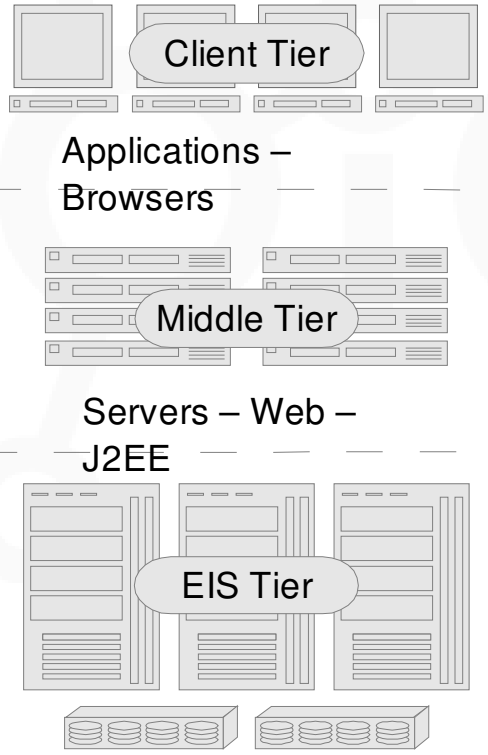
- 24x7 Production Support
  - Support centers on 4 continents
  - 100% RHCE staffed
  - Services in 8 languages
- Technical Account Management
  - Single point of contact, liaison to RH
  - 2x/year on-site implementation review
  - Includes technology roadmap briefings
- Developer support services
  - Service optimization for implementation
  - Performance tuning
  - Application porting and migration

Red Hat Solution Summary

Management & Support Infrastructure

- http://rhn.redhat.com
- Red Hat Network Server
  - Modules
- Red Hat Global Support Services
- Red Hat Global Professional Services
- Red Hat Global Learning Services





Development & Deployment Infrastructure

- Red Hat Developer Suite
- Red Hat Enterprise Linux WS
  Red Hat Desktop
- Red Hat Application Server
  - EJB container
  - Web container
- Red Hat Enterprise Linux AS/ES
- Red Hat Global File System
  Red Hat Cluster Suite
- Red Hat Enterprise Linux AS/ES

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Questions?