Red Hat Enterprise Linux on System z

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Agenda

- RHEL Lifecycle
- RHEL 6.0: Overview, Quick recap
- RHEL 6.1: Feature Highlights
- RHEL 5.7: Work in Progress
- Appendix: uPDT Mainframe Development System
Red Hat Enterprise Linux Life Cycle Overview

- Fully supported through standard life cycle of 7 years from GA plus 3-year optional extension.

- Asynchronous bug fix, enhancement, and security Errata Advisories for critical issues as needed.

- All Errata Advisories and Service Packs are incremental on a single stream.

- ABI stability is guaranteed for the full life cycle.

- Production 1 Phase
  - Non-critical Errata Advisories aggregated in Service Packs (aka Minor Releases), approx. 2 per year, may stretch out later in the life cycle; includes Feature enhancements and new Hardware support. Typically 4 years.

- Production 2 Phase
  - Transition from Production 1 to Production 3, Bug fixes and minor hardware enablement

- Production 3 Phase
  - Time between the final Service Pack and the end of the regular 7-year life cycle.
Red Hat Enterprise Linux High Level Roadmap

- **RHEL 6 GA on Nov 10 2010**
  - Major refresh of the RHEL platform with thousands of improvements and new features.
  - New Life Cycle model with EUS for every Service Pack.

- **RHEL 5.6 on Jan 13**
  - Selected backports of new application stacks – e.g. PHP, Bind refresh, IPA client.
  - General bug fixing and hardware enablement.
  - Target for Common Criteria Virt (KVM) Certification.
  - Updated QETH network driver for System z

- **RHEL 6 Service Pack 1**
  - Released May 19, 2011
  - In total ~ 600 enhancements and hardware enablement backports, as well as ~2700 bugfixes planned.
  - Target for Common Criteria and Ipv6 certifications.

- **RHEL NEXT**
  - Planning started based on major Red Hat initiatives.
  - All schedule and details TBD.

Note: This is a current planning snapshot. Dates and details subject to change.
Extended Update Support (EUS)

- Optional add-on to regular RHEL Subscription, that provides independent life cycles for the individual Service Packs during Production I phase.
- The overlap is 18 months leading to a ~ 2 year life cycle for each SP.
- Selective backports of fixes into the respective Service Pack
  - Provides Critical Impact security errata independent of customer requests.
  - Selected urgent priority defect fixes to address production blocking problems reported by EUS customers.
  - Does not provide incremental features or hardware enablement
- Inherits support SLA from underlying RHEL subscription (requires Standard or Premium support).
RHEL 6.0 Overview
RHEL 6: Key Features

- **Power Management**
  - Improvements through the application stack to reduce wake ups
  - Power consumption measurement by Powertop
  - Power Management and adaptive system tuning by Tuned

- **Next Generation Networking**
  - Comprehensive IPv6 support (NFS 4, CIFS, ISATAP support)
  - Redesigned QETH network driver with support for OSA data connection isolation

- **Reliability, Availability, and Serviceability**
  - System level enhancements from industry collaborations to make the most of hardware RAS capabilities.
RHEL 6: Run Leaner
Lower Power Consumption

![Bar chart showing power consumption reduction from RHEL 5.4 to RHEL 6.](chart.png)

- RHEL 5.4: 160 Watts
- RHEL 5.5: 120 Watts (20% Reduction)
- RHEL 6: 100 Watts (20% Reduction)

Idle power consumption (Watts)
RHEL 6: Key Features

- **Scalable File systems**
  - New file systems btrfs and ext4 (now the default) offer robustness, scalability, and high-performance.

- **Disk Storage Subsystem**
  - FCP automated port discovery and lsluns utility to automatically activate all available target ports
  - Support for High Performance FICON to reduce I/O overhead
  - Dynamically adjustable queue depth
  - I/O configuration support when running in LPAR

- **Fine-grained Control and Management**
  - Improved scheduler and better resource management in the kernel via Completely Fair Scheduler (CFS) and Control Groups (CG).
Performance Test: Application Scheduler

Scheduler Benchmark

Concurrent Thread Test

Test completion time (seconds)

Number of Processes

RHEL 5.5
RHEL 6.0
Problem: “I want to implement a chargeback model.”
Solution: Control Groups (cgroups)

- Cgroups are “process containers”. Lets you transform groups of applications into workloads
In Depth: Cloud Enablement with Control Groups

- **Resource Limiting**
  Specify limits on CPU, memory, and even file system usage

- **Prioritization**
  Give mission critical workloads higher priority than others

- **Accounting**
  Run report on resource utilization, i.e. for billing purposes

- **Isolation**
  Separate namespaces for groups, so they don't see each other's processes, network connections or files

- **Control**
  Freeze groups for checkpointing or restarting workloads
RHEL 6: Key Features

- **Virtualization**
  - Tighter integration with z/VM for extended functionality like dynamic memory resizing, better CPU utilization, HyperPAV, and suspend/resume support.

- **Enterprise Security Enhancement**
  - SELinux includes improved ease of use, application sandboxing, and significantly increased coverage of system services
  - SSSD provides unified access to identity and authentication services as well as caching for off-line use.
  - Support for the latest Crypto Express3 accelerator and coprocessor for offloading the processing of secure data.

- **Development and Runtime Support**
  - SystemTap (allows instrumentation of a running kernel without recompilation) and ABRT (simple collection of bug information)
  - Improvements to glibc (version 2.12), GDB (version 7.1), and the GCC compiler (version 4.4), which can lead to greater than 10% performance improvement.
RHEL 6: Filesystems

- Ext4 replaces Ext3 as default filesystem
  - Faster, more robust, and scales to 16 TB
  - Support for thin provisioning. You can create a 16 TB file system on a single mod-3 DASD! Just add more when needed.

- NFS version 4 for network file system
  - Clustered file system with support for read/write access from multiple guests simultaneously.
  - Use VSWITCH for fast “network” access, or Hipersockets for memory-speed transfers.

- Fuse
  - Allows filesystems to run in user space, allowing testing and development of fused-based filesystems.
  - For example, use Fuse to create a cloud filesystem.
RHEL 6.1: Feature Highlights
Released May 19, 2011
Performance and Application Scheduling

- CPU scheduling algorithms optimized
  - Results in 3 to 5% performance gain.
- Better concurrent processing by making use of RCU locking in the scheduler.
  - Read-Copy Update: Access to shared data without traditional locks. Designed for today's faster CPUs.
- Improvements to tickless timer algorithm.
- Performance improvements since 6.0
  - Java workload improved from 1% to 3%.
  - Transaction Processing workload improved from 6% to 8%.
File Systems and I/O

- CIFS improvements for access to Windows Shares
  - Multi-user mounts for more secure access
  - Support for Unix-style symbolic links on CIFS (mfsymlink)

- Quota management
  - Consolidation of quota management tools for file systems
File Systems and I/O

- **I/O Barriers**
  - Implementation reworked for improved disk performance

- **LVM**
  - Improved recovery times by skipping scans on failed devices.
  - Snapshot of mirrors
  - Support for mirror devices whose constituent devices are striped (RAID 0+1)
Networking

- Significant optimization in the way network traffic is processed in single and multi-CPU environments.

- Reduced latency for re-transmission of lost packets in time sensitive applications.

- Transparent proxy (TProxy) support.

- DHCP support for IPv6.

- Active-Active bonding for load sharing.
Networking Benchmark

- Greatly improved message throughput as a result of network packet flow/steering.

Impact of RPS/RFS on total transactions / sec

e1000e driver - (Single queue)

Note little difference when going from 1 to 2 drivers w/o steering

Graph showing impact of RPS/RFS on total transactions/sec for 1 driver and 2 drivers, with and without steering. Each driver running 100 concurrent netperf TCP_RR tests.
Resource Management with Control Groups

- Block I/O throttling
  - Limit I/O rate for device based on cgroup membership.

- Balance of throughput and fairness between groups
  - via new tunable “group_idle”.

- Reduce latency for interactive tasks running under CPU intensive workloads via autogroup.
  - Prevents single process from monopolizing the system.
Software Development

- **SystemTap**
  - Remote scripting capabilities, numerous performance optimizations.
- **GDB**
  - C++ debugging enhancements and Python support.
- **Valgrind**
  - Handle CPUs with three levels of cache
- **GCC Compiler**
  - Bug fixes and optimizations.
- **Eclipse**
  - Update to the platform (Helios) and plugins
Security and Audit

- Multiple updates to System Security Service Daemon (SSSD)
  - SSSD Integration with identity management services
  - Better DNS-based discovery
  - Auto renewal of Kerberos tickets, plus support for Kerberos FAST protocol
  - Password obfuscation (LDAP)
- Centralized management of SSH keys using LDAP
- Identity Management
  - Password policy management for users and groups
System z Specific Updates

- 49 z-specific features, 56 z-specific bug fixes for RHEL 6.1

- Here are some highlights...
System z Specific Updates

- Fix and recompile openSSH to enable HW Crypto
  - Performance improvement. Enable openSSH to offload secure processing to Crypto card.

- zEnterprise support for 4096-bit RSA FastPath
  - This feature extends the support for current hardware acceleration of RSA encryption and decryption to handle the zEnterprise Crypto Express3 card.

- Installer: /boot partition on LVM
  - zipl bootloader supports device-mapper (LVM & multipath) devices. Installer now allows /boot these devices

- Installer: /boot on ext4 partition
  - zipl bootloader supports ext4 partition. Installer now allows this.
System z Specific Updates

- Dynamic memory resize tools: lsmem/chmem

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Memory device size : 256 MB
Memory block size : 256 MB
Total online memory : 1792 MB
Total offline memory: 2304 MB
System z Specific Updates

- CMSFS write support
  - Support for writing to CMS file system. You can now your PROFILE EXEC with vi!

- Exploitation of z10 prefetching instructions
  - This is a toolchain enhancement from IBM. Prefetching instructions have been introduced to enhance memory access.

- Exploitation of z196 out-of-order instruction scheduling
  - Generate faster code sequences, and use CPU facilities to allow better instruction scheduling.
  - Recompile programs with --march=z196 and/or –mtune=z196

- Apply System z optimized sysctl settings by default
  - Apply kernel tuning settings to /etc/sysctl.conf optimized specifically for System z
**System z Specific Updates**

- **hyptop**: Hypervisor “top” - Show IFL usage across LPARs

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RHEL 5.7
Beta available now for download
Target GA: Q2 2011
New Feature: SCAP

- Security Content Automation Protocol (SCAP)
  - Open source framework for maintaining security of enterprise systems
  - Verify presence of patches, check system security settings, examine system for signs of compromise
- Includes a library and a set of utilities
- Allows security managers to use OVAL and XCCDF to verify security configuration and vulnerability status
- Backported from RHEL 6
New Feature: Developer Tools

- **CMake**
  - Cross-platform build system
  - Generates native makefiles and compiler independent configuration files
  - Supports developers with targets across multiple operating systems.
  - Backported from RHEL6

- **Buildsys-macros**
  - Support for dist tags for developers building RPMs
  - Backported from RHEL6
Feature: Remote Sync (rsync)

- Rsync has been updated to version 3.0.7
  - Improved replication speed
  - Replication starts while file list is still being compiled
- Companies requiring global data set replication should see major benefits
Features: Remote File Systems and Storage

• Updated Automounter (autofs)
  • Support for localityName attribute in LDAP maps
  • Encrypted secret for LDAP authentication

• iSCSI initiator
  • Support for s390x architecture
Documentation Links

- Documentation/Getting Started
  - Redbook, “z/VM and Linux on IBM System z: The Virtualization Cookbook for Red Hat Enterprise Linux 6.0”
    - Covers RHEL 6 and z/VM 6.1
  - DeveloperWorks:
  - Knowledgebase:
    - [http://kbase.redhat.com/](http://kbase.redhat.com/)
    - Search “s390”
  - [http://www.redhat.com/z](http://www.redhat.com/z)
Appendix
uPDT: Mainframe Development System

- Mainframe emulated environment on x86 hardware (laptop, desktop)
  - Develop and port applications to RHEL on System z without purchasing a mainframe

- Define IFLs, zIIP, zAAP, even preinstalled z/OS, z/VM

Thank You