RED HAT
ON THE MAINFRAME
THE REASONS ARE COMPELLING

Get the Hype on System z

Current & Future Linux on System z Technology

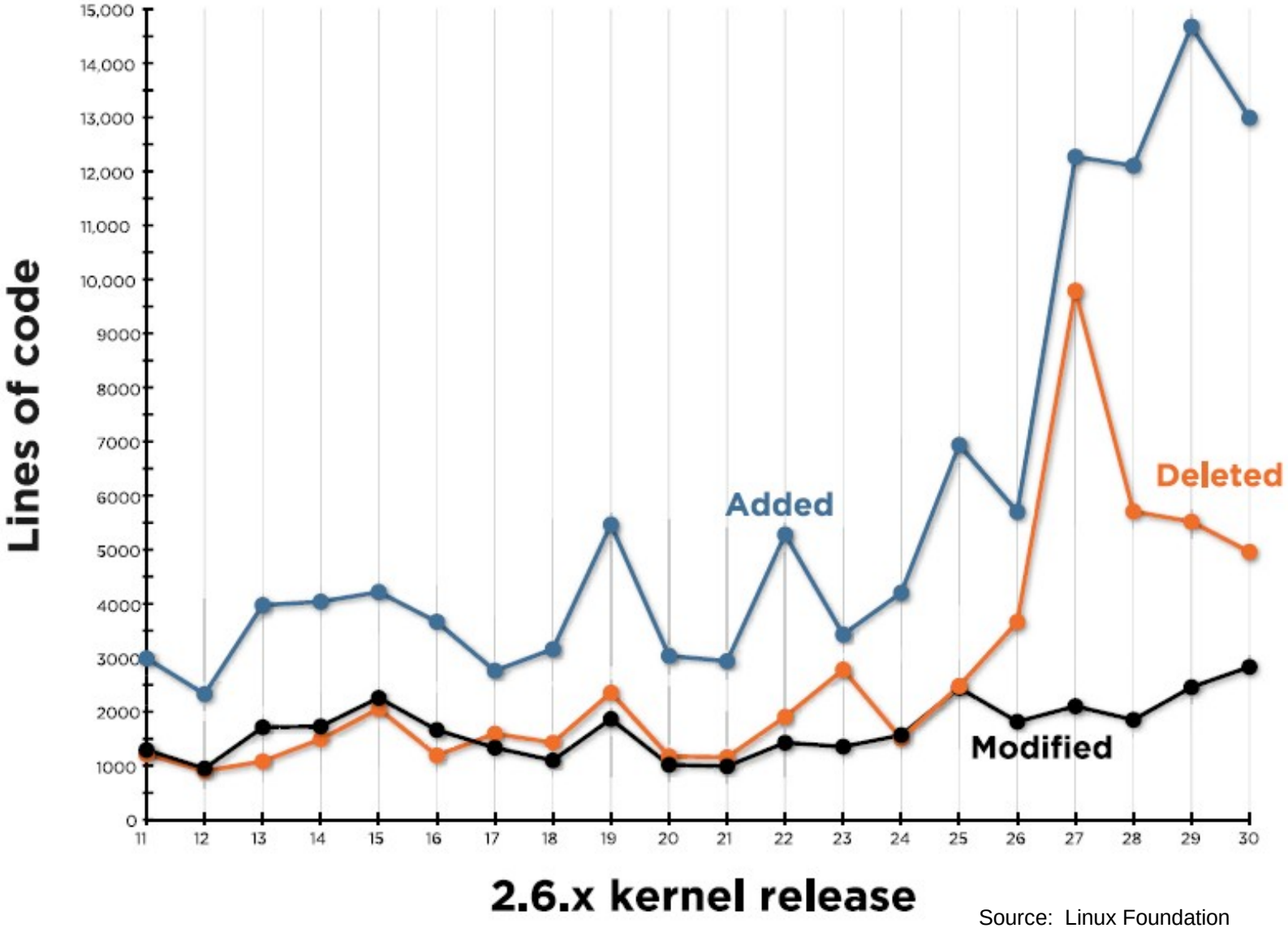
Thursday September 24th 2009

Agenda

- **Part 1: Current Technology**
  - Review of RHEL 5.4, released Tuesday 2-SEPT
    - Inclusion of Named Saved Segments (NSS)
    - Updated fiber channel drivers & utilities
    - Rebasing of s390utils to version 1.8.1
  - Tentative roadmap for RHEL 6 for System z
  - An update on CMM2 (i.e. CMMA) development activities via the CMM-Lite technology
- **Part 2: Future Technology**
  - What technologies are the joint IBM and Red Hat Linux on System z teams working on?
    - Storage
    - Networking
    - Usability
    - Crypto
    - Misc

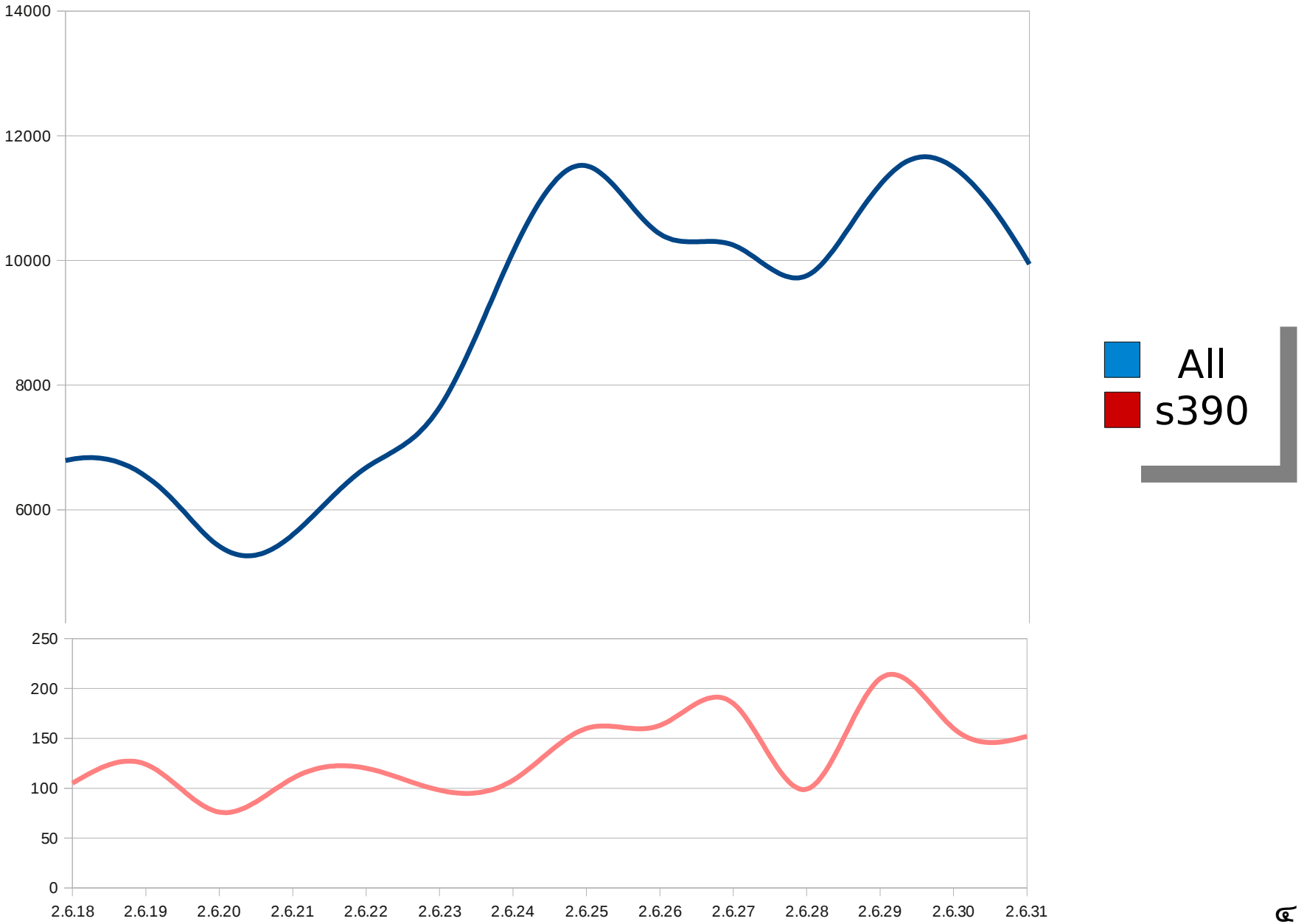
Linux Kernel Development: Rate of Change

Average: 6,422 lines added, 3,285 lines removed, and 1,687 lines changed every day for the past 4 1/2 years.

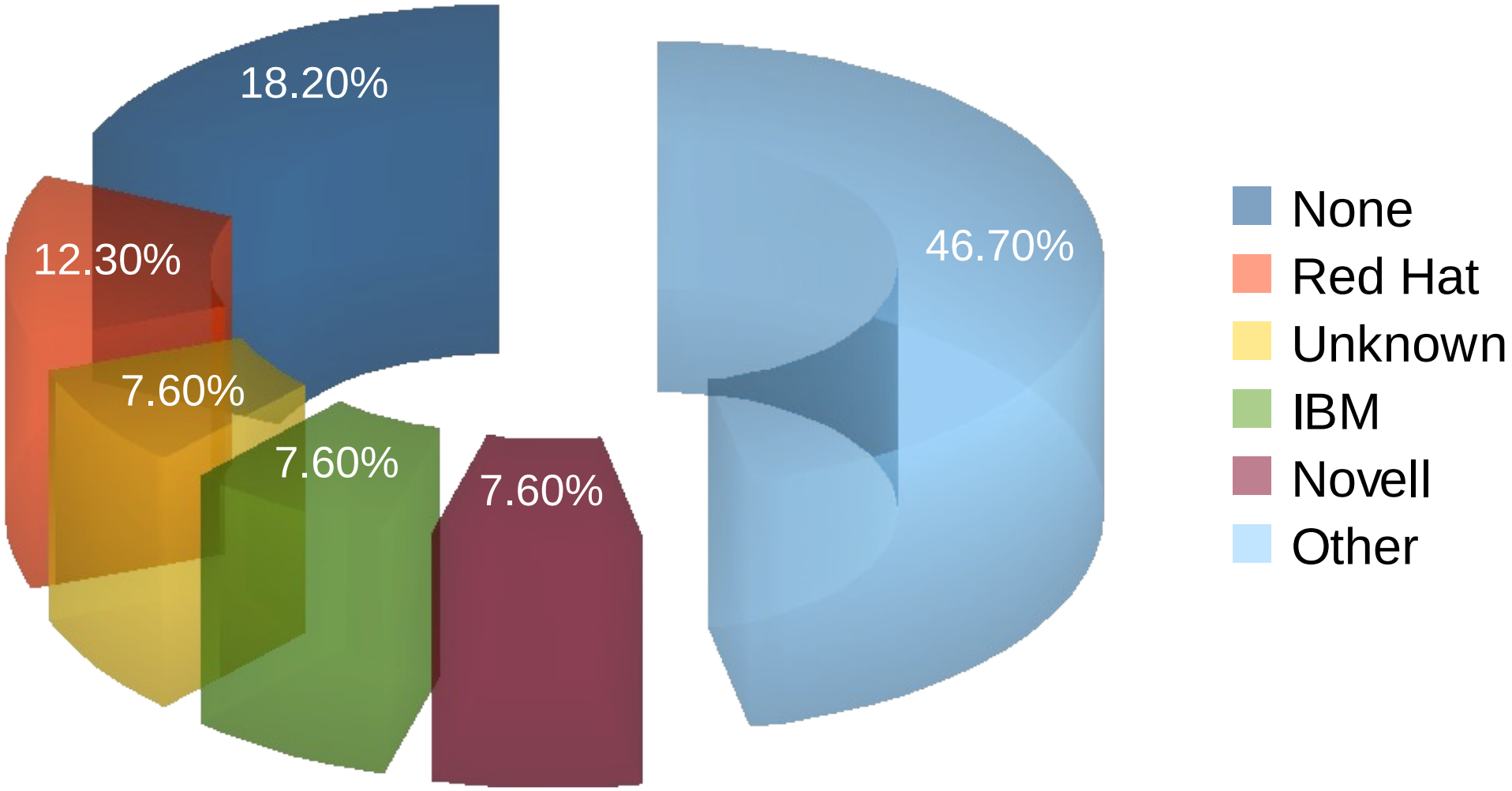


Source: Linux Foundation

Linux on System z specific Kernel Extensions



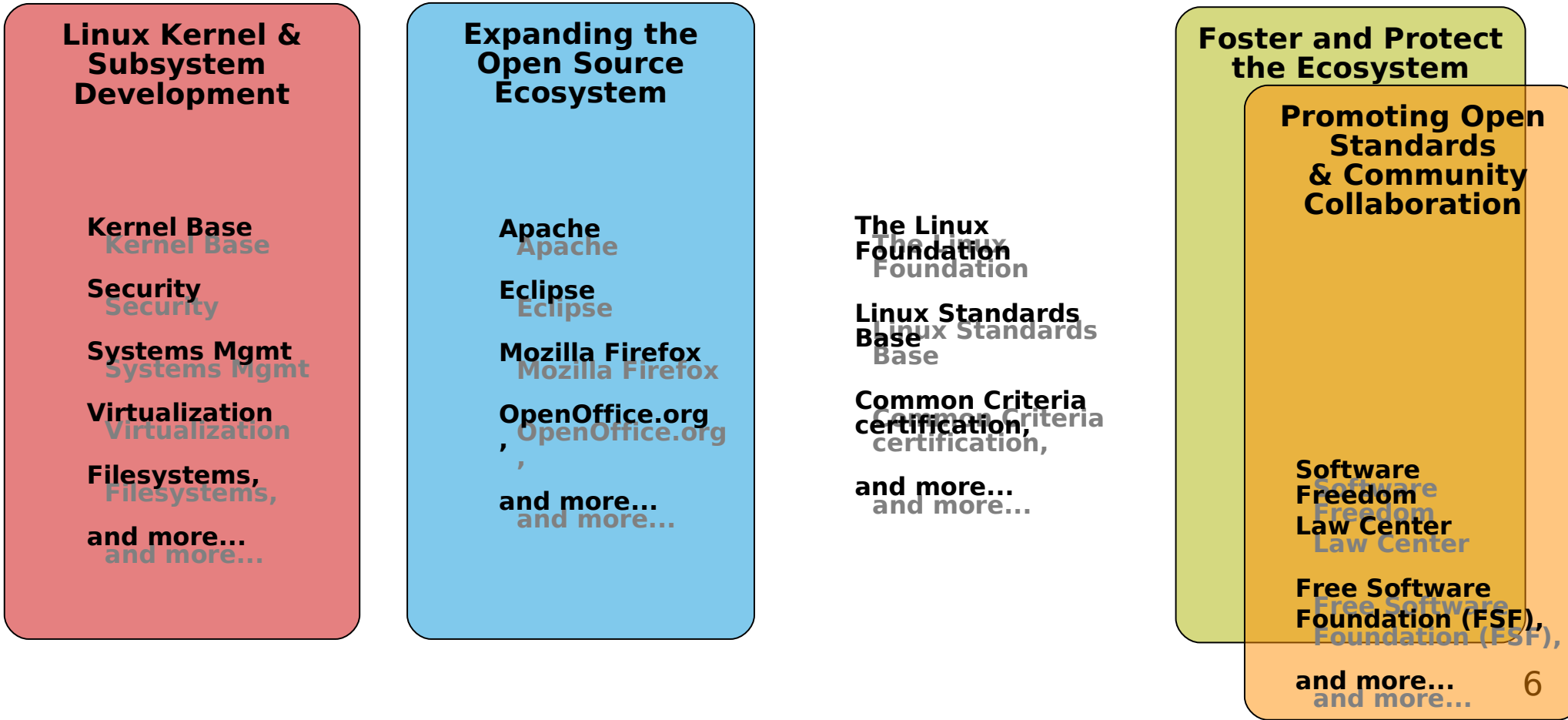
Top Linux Contributors



Source: Linux Foundation

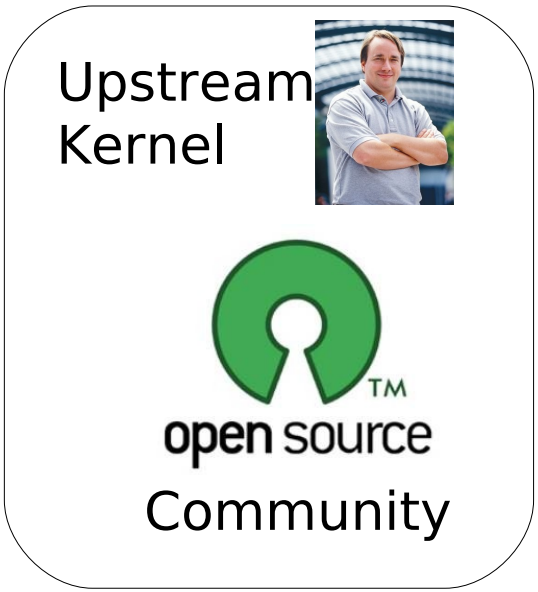
IBM collaborates with the Linux community

- ...has been an active participant since 1999
- ...is one of the leading commercial contributors to Linux
- ...has over 600 full-time developers working with Linux and open source



The IBM Linux Development Process

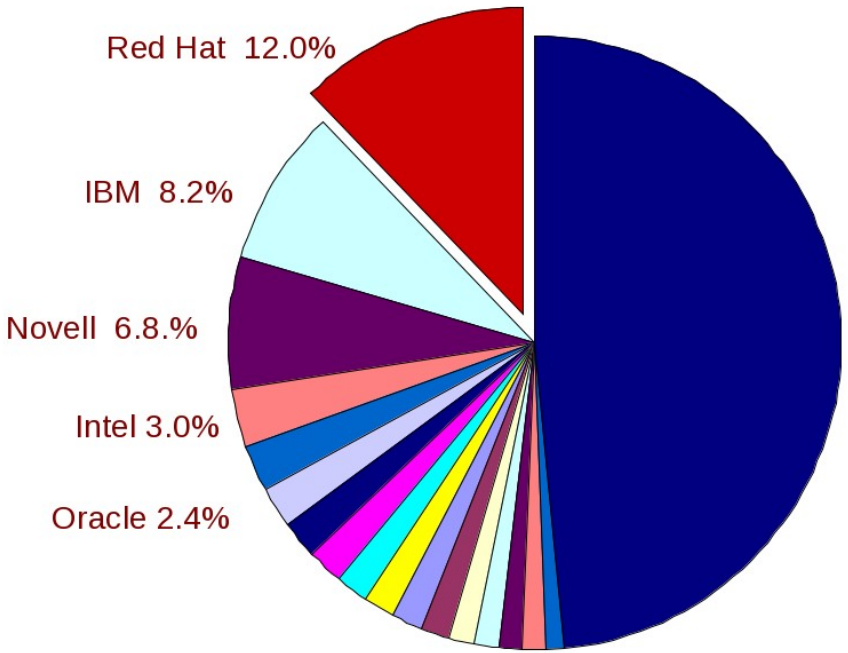
- IBM Linux on System z Development contributes in the following areas
  - Kernel
  - s390-tools
  - Open Source Tools (e.g. eclipse, ooprofile)
  - GCC, GLIBC, Binutils

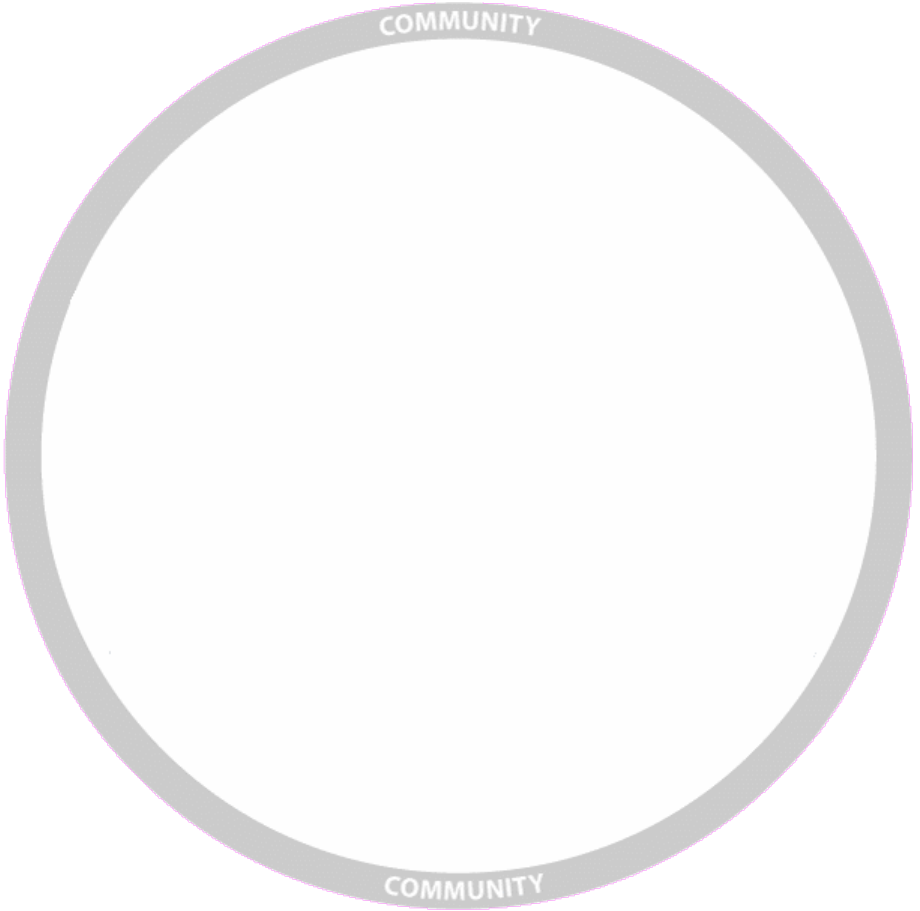


Red Hat Development Model

Community

- Development with “upstream” communities
- Kernel, glibc, etc
- Collaboration with partners, IBM, open source contributors

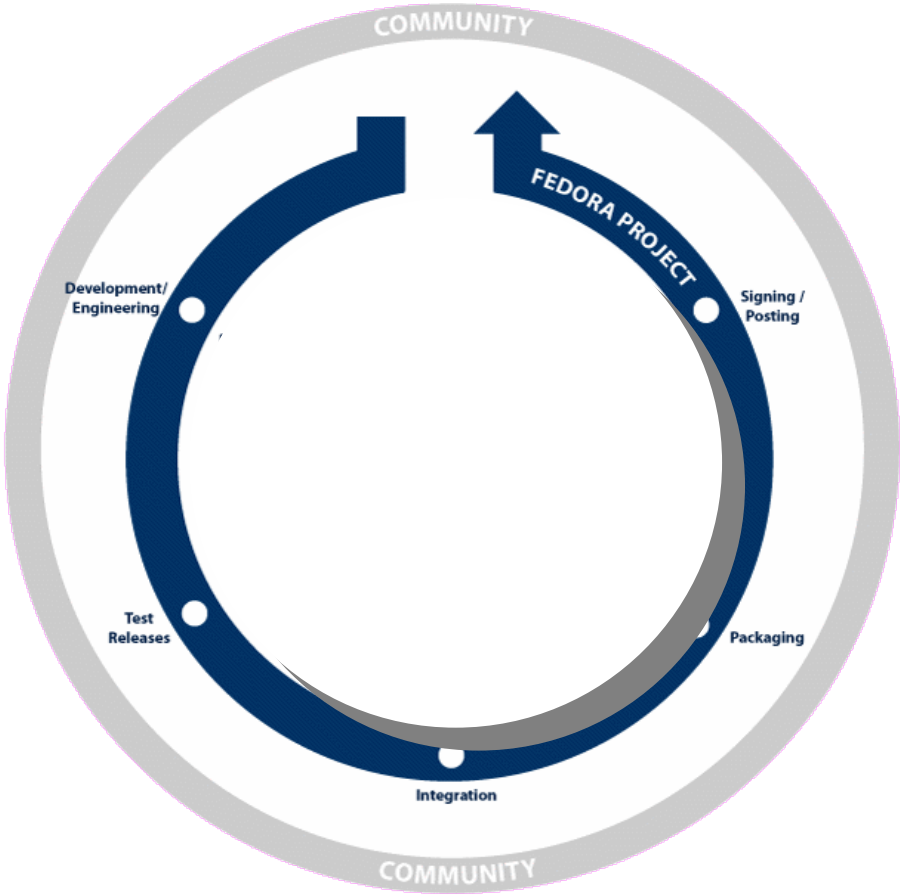




Red Hat Development Model

Fedora

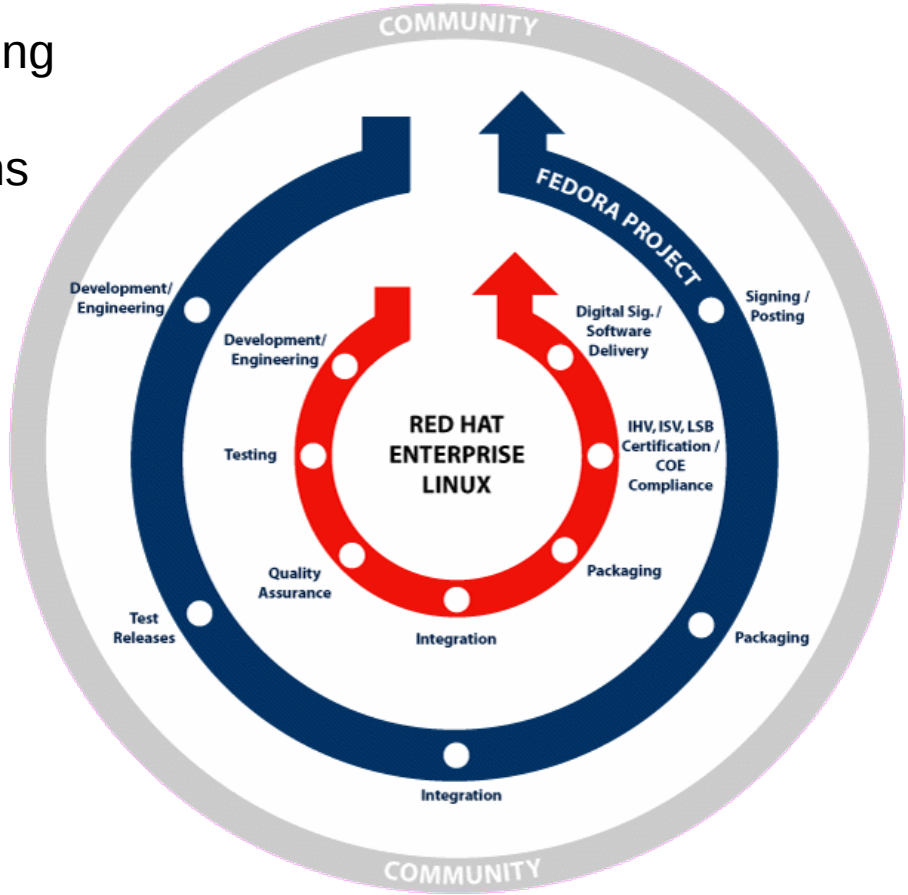
- Rapid innovation
- Latest technologies
- Community Supported
- Released ~6mo cycles



Red Hat Development Model

Red Hat Enterprise Linux

- Stable, mature, commercial product
- Extensive Q&A, performance testing
- Hardware & Software Certifications
- 7-10 year maintenance
- Core ABI compatibility guarantee
- Major releases 2-3yr cycle



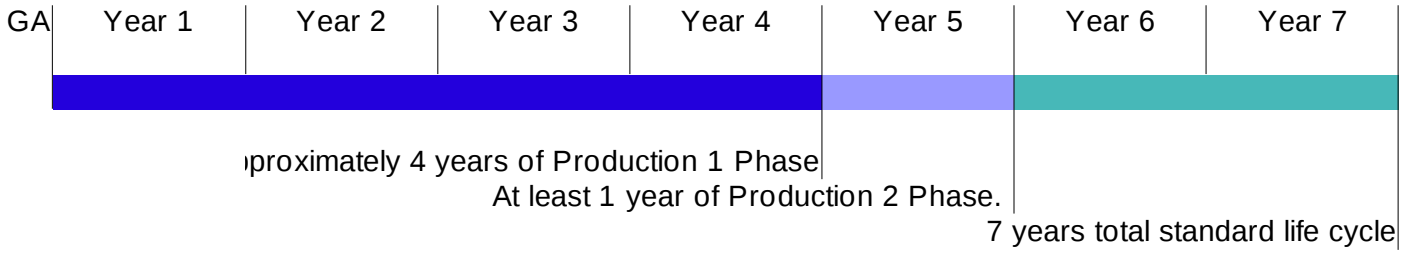
Fedora for System z

Opens Linux on System z development to entire Open Source community, not just IBM, Red Hat, and Novell.

Linux for System z now follows same development process as every other platform, allowing for faster Q&A, faster feature inclusion, and increased stability

http://fedoraproject.org/wiki/Architectures/s390x

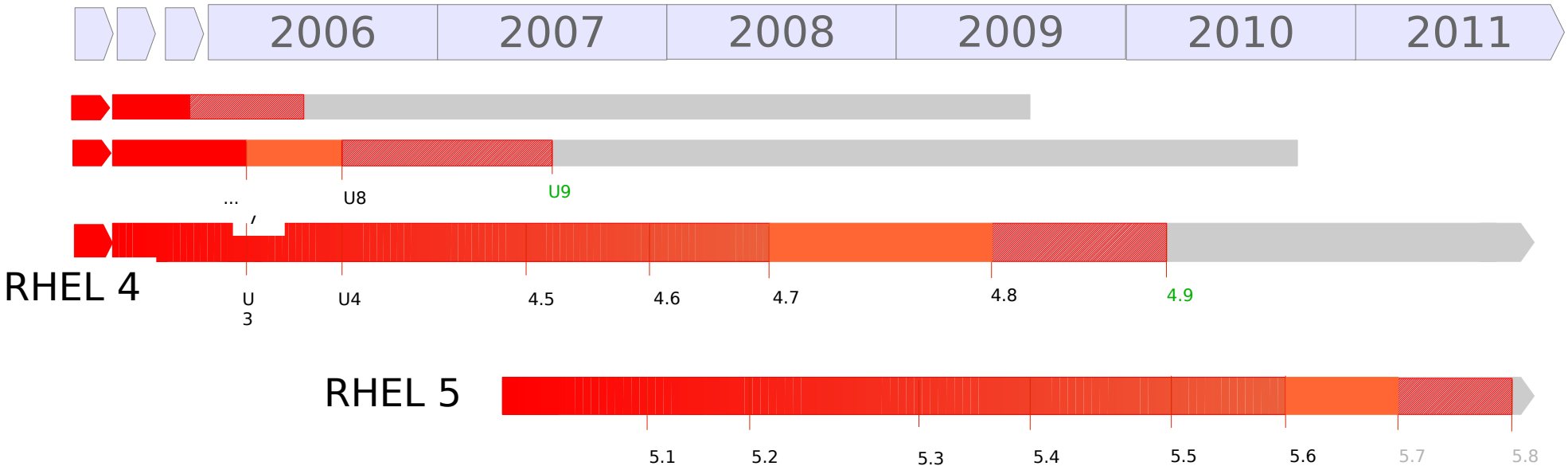
Red Hat Enterprise Linux Life Cycle



- Fully supported through standard life cycle of 7 years from GA.
- Async bug, enhancement, and security fixes depending on importance of the issue (e.g. Critical Impact security).
- **Production 1 Phase**
  - Minor releases, approx. 2 per year, roughly a 6-month cycle, stretching out at the end:
    - Hardware enablement.
    - General bugfixing based on priority.
    - General features if strong justification (generally Major releases are the release vehicle for new Features).
    - ISO images & media kits.
  - 4 years of Production 1 for RHEL 4, 5 and later
  - One year overlap between the Production 1 Phase of two subsequent major releases.
- **Production 2 Phase**
  - Transition from Production 1 to Production 3
  - Concluded by final, bugfix-only minor release on flexible schedule after 2nd subsequent major release (minimal HW enablement: PCI-IDs).
  - Scope: defects reported during Production 1
- **Production 3 Phase**
  - Time between the final update release and the end of the 7-year standard life cycle.
  - Critical bug and security fixes only...
- Planning based on customer requirements, hardware life cycles and upstream development.
- This schedule is only a schematic view and will be adapted over time.
- Customers can contact Red Hat sales regarding details for an optional extension beyond the regular 7 years.

Red Hat Enterprise Linux Life Cycle

Current planning snapshot. Exact schedule dates are subject to change.



- RHEL 2.1 at end of regular 7 year life cycle on May 31, 2009
- RHEL 3 in Production 3 phase until October 31, 2010
- RHEL 4 entering Production 2 phase by end of May 2009, after the GA of RHEL 4.8
- RHEL 5 development slowing down
- Development focus shifting from RHEL5 to RHEL 6

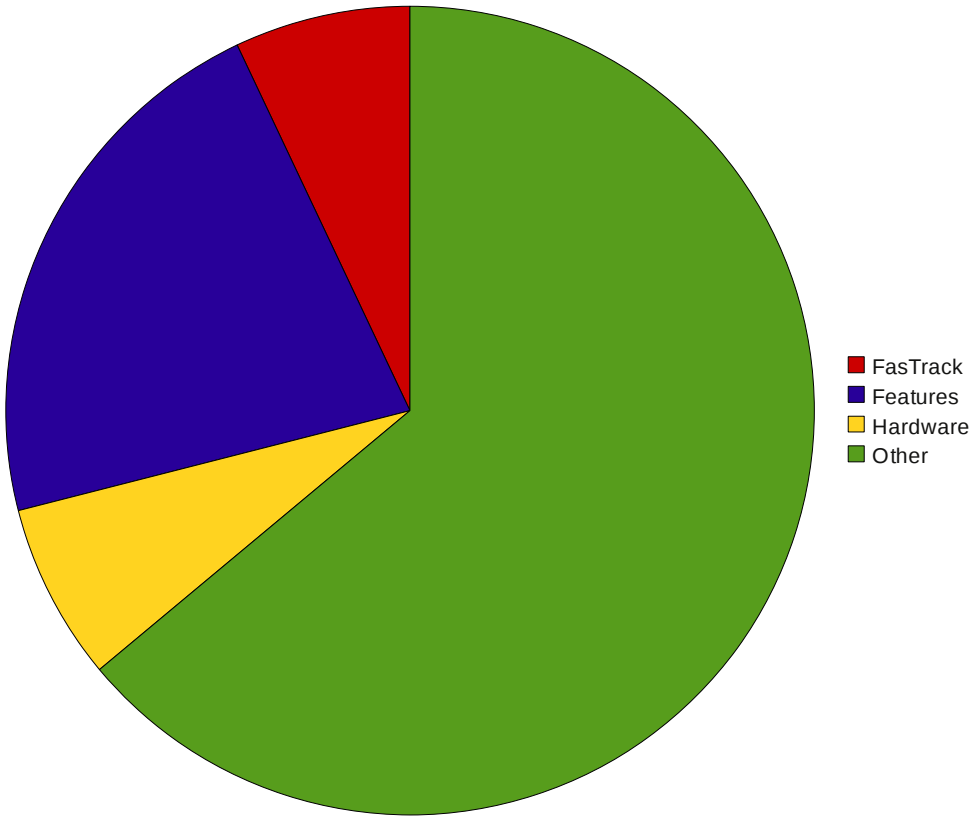
RHEL 6

RHEL 5.3

Current Technology

RHEL 5.3: Overview

- GA on January 20, 2009
- ~150 additions, ~3,400 BugZillas



- FasTrack 7%
  - Early release of low impact fixes
- Hardware Enablement - 7%
  - New chipsets and processor feature support
- New Features - 21%
  - Feature requests from customers and partners
- Other - 65%
  - Bugfixes
  - Documentation

RHEL 5.3: Networking

- Provision of several selectable TCP congestion modules (2.6.13)
  - Ref: http://lwn.net/Articles/128681/
- IPV6 - Support several new sockopt / ancillary data in Advanced API (2.6.14)
- IPv4/IPv6: UFO (UDP Fragmentation Offload) (2.6.15)
  - Offloads IP fragmentation functionality of large UDP datagram to hardware
  - Improves performance
- Add nf_conntrack subsystem: (2.6.15)
  - Common IPv4/IPv6 generic connection tracking subsystem
  - Allows IPv6 to have a stateful firewall capability (not previously possible)
    - Increased security
    - Enables analysis of whole streams of packets, rather than only checking the headers of individual packets

RHEL 5.3: Networking

- IPv6
  - RFC 3484 compliant source address selection (2.6.15)
  - Add support for Router Preference (RFC4191) (2.6.17)
  - Add Router Reachability Probing (RFC4191) (2.6.17)
- Generic segmentation offload (GSO) (2.6.18)
  - Available in place of TSO (TCP Segmentation Offload)
  - Performance improvements for large packet transfers without hardware assistance
- SELinux per-packet access controls
  - Replaces old packet controls
  - Add Secmark support to core networking
    - Allows security subsystems to place security markings on network packets (2.6.18)
- Inclusion of DCCPv6 – Datagram Congestion Control Protocol (2.6.16)

RHEL 5.3: Storage Management

- RAID 4/5/10 support added to dm-raid.
- Full support for software iSCSI target.
- Full support for LVM cluster mirror (cmirror).
- Add the ability to prioritize paths on HP MSA/HSV active/passive storage controllers.
- Reduce boot time by improving lvmcache, to reduce the amount of device scanning.
- Enhanced disk partition statistics

RHEL 5.3: File System / Storage Mgmt

- Block device encryption support, including support for /root partition, including configuration in anaconda installer.
- ext4 tech preview
- samba: rebased from 3.0.28 to 3.0.32 for bugfixes
  - Now supports Windows Vista and 2008
  - fixes for DC functionality (interoperability with Citrix and Domain trusts)
- Ecryptfs fixes (tech preview)

RHEL 5.3: System Services

- Rebased version of CUPS print server, now fully Kerberized
- dhcpv6 support
- ktune, a service that sets several kernel tuning parameters to values suitable for specific system profiles. Currently, ktune provides a profile for large-memory systems running disk-intensive and network-intensive applications. New package, tech preview.
- Package upstream rebases to the following utilities:
  - ksh, lm-sensors, lftp, net-snmp, openIPMI-tool, openldap, openmotif, python-urlgrabber, openPegasus, VNC
  - RPM to Fedora 9 version, which includes numerous bugfixes
  - yum and yum-utils primarily for speed improvements
  - totem, rb, and gstreamer rebased to enable modular codecs addition
- Numerous wireshark security fixes

RHEL 5.3: Security Enhancements

- pkinit clients can now be configured to use keys for client certificates which may not contain Kerberos-specific extensions & interoperability fixes
- nss_ldap now configured with support for paged results extension
- SELinux: enablement of New NetworkManager and Audit functionality.
- SELinux: Hundreds of AVC denial fixes.
- Improved Audit and Logging
  - TTY input audit support
  - Remote audit logging via unencrypted connection

RHEL 5.3: System z Specifics

BugZilla ID	Summary
46327	stage1: sshd error loading shared lib: libfipscheck.so.1
184770	LTC18425-62140: (big) xDR system Initialization for LPAR Clients
472788	rhel 5.3 snapshot3 scsi mpath install failed on z9bc lpar
439479	LTC:5.3:201474:Include gcc 4.3 as Add-On for latest z10 instruction set support
439440	LTC:5.3:201160:Long Random Numbers Generation
439441	LTC:5.3:201158:Selective Logging of ECKD DASD devices
439482	LTC:5.3:201542:FCP - Enhanced Trace Facility
447379	LTC:5.3:200994:Linux CPU Node Affinity
463917	unable to find DASD drives to install
439484	LTC:5.3:201490:Libica Library: Integration of Icainfo
43946	LTC:5.3:201360:OSA 2 Ports per CHPID Support - Installer Enhancements
466474	[RHEL5.3] *** glibc detected *** /usr/bin/python: double free or corruption (!prev): 0x000 0000080d55e90 ***
466305	cosmetic error message: failure in nl_set_device_mtu
466291	anaconda silently omits uninitialized disk

RHE 5.4

RHEL 5.4 : Overview

- The official GA release of Red Hat Enterprise Linux 5.4 (*kernel-2.6.18-164.el5*) was released on 02-Sep-2009

- Generic (not s390 specific) updates include
  - **Virtualization**: full support for the Kernel-based Virtual Machine (KVM) hypervisor only on x86_64 while Xen only x86 & Power based virtualization is still available & supported
  - **Network:** Kernel & Userspace update to support Generic Receive Offload (GRO) which increases the performance of inbound network connections by reducing the amount of processing done by the CPU. Furthermore Netfilter Framework & Bind Updates
  - **Storage:** Support for the XFS file system has also been added to the kernel as a Technology Preview.
  - **Tools:** SystemTap is now fully supported, and has been re-based to the latest upstream version.

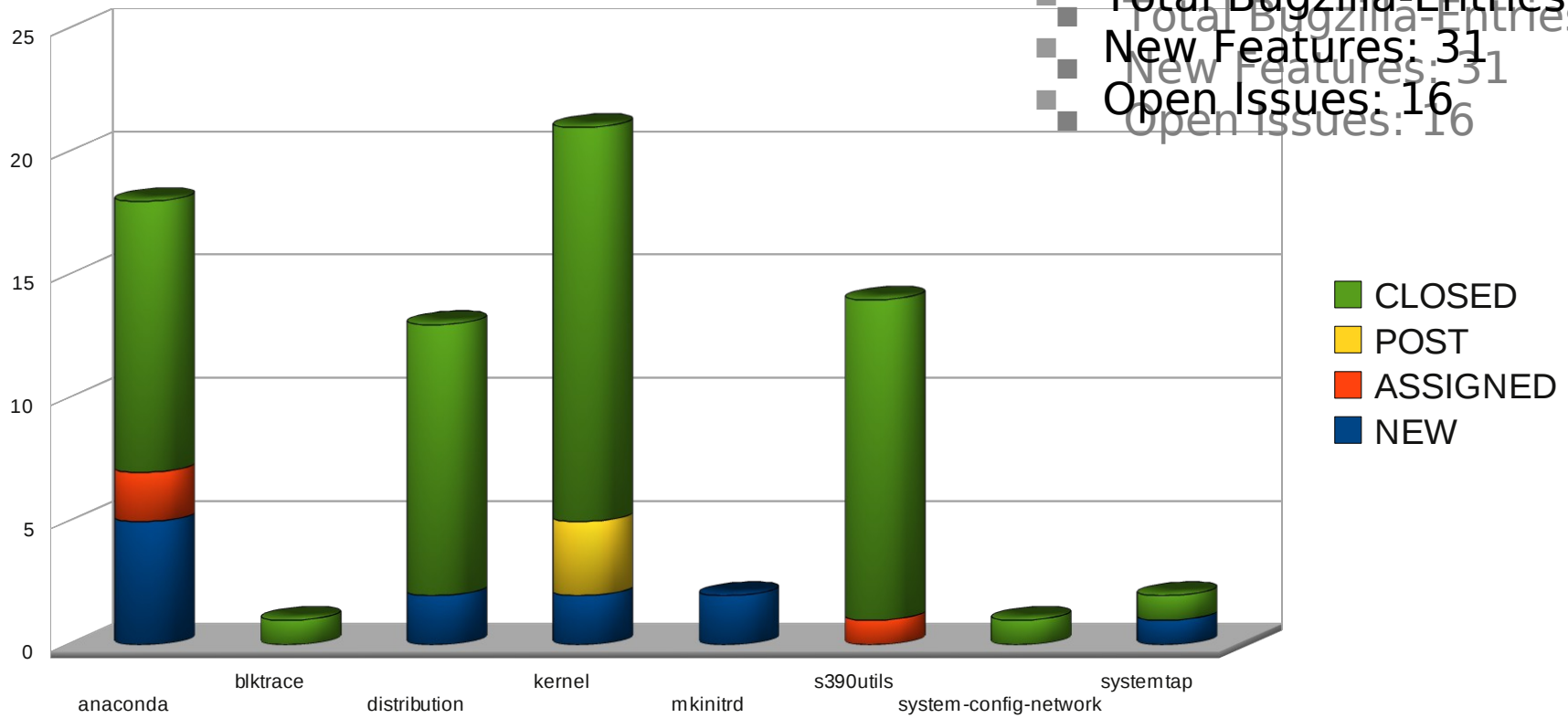
RHEL 5.4: File System / Storage Mgmt

- Add integrity check to cryptsetup-luks, in order to meet FIPS-140 requirements.
- Ext4 - refreshed the backport for our tech preview to bring in bug fixes and support for delayed allocation.
- File system freeze/quiesce interface added to support hardware snapshots for file systems.
- **Full support for FUSE and libfuse to allow end users to more easily install and use their own user space FUSE file systems.**

RHEL 5.4: System z Specifics
Other Included Features

- For a complete list & current status, please visit http://bugzilla.redhat.com/
- Alternatively, this link will bring you to the Red Hat Enterprise Linux 5.4 release notes

- Total Bugzilla-Entries: 71
- New Features: 31
- Open Issues: 16



RHEL 5.4: System z Specifics

BugZilla ID	Summary
475556	[LTC 5.4 FEAT] DS8000 support: Large volume support (userspace) [201738]
475569	[LTC 5.4 FEAT] Shutdown actions tools [201755]
461288	[EMC 5.4 feat] Require kernel support to issue Control I/O to CKD dasd on EMC Symmetrix arrays
474688	[LTC 5.4 FEAT] Automatic IPL after dump (kernel) [201169]
475346	[LTC 5.4 FEAT] Improve checking mechanisms and workflow of Linux on System z Anaconda install process [201676]
475670	[LTC 5.4 FEAT] Program directed IPL support - no XML in system dumper [200782]
475552	[LTC 5.4 FEAT] FCP - Performance data reports [201730]
488496	[LTC 5.4 FEAT] 201173:Crypto Hardware Enablement Device Driver Support - toleration
475564	[LTC 5.4 FEAT] Shutdown actions interface (userspace) [201748]
474679	[LTC 5.4 FEAT] Dynamic CPU hotplug daemon for System z [201132]
475345	[LTC 5.4 FEAT] Change list of Anaconda network alternatives to indicate supported devices on System z [201679]
475551	[LTC 5.4 FEAT] TTY terminal server over IUCV (kernel) [201734]

RHEL 5.4: System z Specifics

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475345	[LTC 5.4 FEAT] Change list of Anaconda network alternatives to indicate supported devices on System z [201679]
475551	[LTC 5.4 FEAT] TTY terminal server over IUCV (kernel) [201734]

475563	[LTC 5.4 FEAT] Shutdown actions interface (kernel) [201747]
474664	[LTC 5.4 FEAT] System z support for processor degradation [200975]
475334	[LTC 5.4 FEAT] FCP - Performance Data collection (kernel) [201590]
475572	[LTC 5.4 FEAT] HiperSockets Layer3 support for IPv6 [201751]
475548	[LTC 5.4 FEAT] FCP - Performance data collection (blktrace) [201729]
477189	[LTC 5.4 FEAT] Pick up latest version of s390-tools
475558	[LTC 5.4 FEAT] TTY terminal server over IUCV (userspace) [201735]
474646	[LTC 5.4 FEAT] Kernel NSS support - kernel part [200790]
475333	[LTC 5.4 FEAT] FCP - Performance Data collection & analysis (userspace) [201591]
475571	[LTC 5.4 FEAT] Large image dump on DASD [201752]

BugZi
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475530	[LTC 5.4 FEAT] Extra kernel parameter via VMPARM [201726]
475557	[LTC 5.4 FEAT] DS8000 Disk Encryption [201740]
474942	[LTC 5.4 FEAT] Add vmconvert option to vmur tool [201758]
475570	[LTC 5.4 FEAT] Provide service levels of HW & Hypervisor in Linux [201753]
468172	FEAT: 201085: cio_ignore entry in generic.prm for LPARs
474700	[LTC 5.4 FEAT] Crypto Device Driver use of Thin Interrupts [201174]
475350	[LTC 5.4 FEAT] Dialog defaults for Linux on System z specific Anaconda [201677]
475820	[LTC 5.4 FEAT] Linux to add Call Home data [201167]
484296	[LTC 5.4 FEAT] Automatic IPL after dump (userspace) [201757]

474646	[LTC 5.4 FEAT] Kernel NSS support - kernel part [200790]
475333	[LTC 5.4 FEAT] FCP - Performance Data collection & analysis (userspace) [201591]
475571	[LTC 5.4 FEAT] Large image dump on DASD [201752]

[LTC 5.4 FEAT] Change list of Anaconda network alternatives to indicate supported devices on System z [201679]

[LTC 5.4 FEAT] TTY terminal server over IUCV (kernel) [201734]

S390-tools package rebased to Version 1.8.1

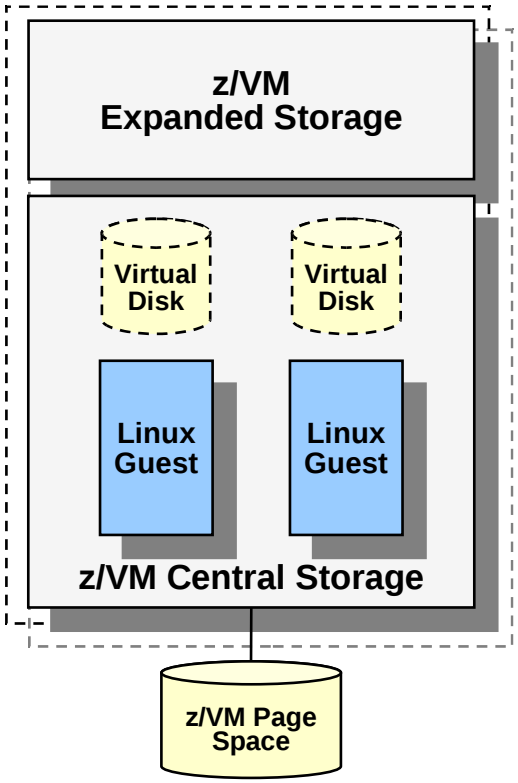
- The s390utils package has been rebased to version 1.8.1.
- This package provides **the** essential tool chain for Linux on System z. It contains everything from the boot loader to dump related tools for a system crash analysis .
- News Features (excerpt)
  - DASD related tools: Add Large Volume Support for ECKD DASDs
  - Ipl_tools: Can be used to change the reipl & shutdown behaviour
  - ziomon tools: Set of tools to collect data for zfcp performance analysis.
  - lsluns: List available SCSI LUNs depending on adapter or port.
  - lszcrypt: Show information about zcrypt devices and configuration.
  - chzcrypt: Modify zcrypt configuration.
  - cpuplugd: Daemon that manages CPU- and memory-resources based on a set of rules. Depending on the workload CPUs can be enabled or disabled. The amount of memory can be increased or decreased exploiting the Cooperative Memory Management (CMM1) feature.
  - chchp: Tool to modify channel-path states
  - lschp: Tool to list information about available channel-paths.
  - mon_procd: Daemon that writes process information data to the z/VM monitor stream.
  - vmur: Tool to work with z/VM spool file queues (reader, punch, printer).
  - zfcpdump_v2: Version 2 of the zfcpdump tool. Now based on the upstream Linux kernel 2.6.23.
- Plus various bug fixes

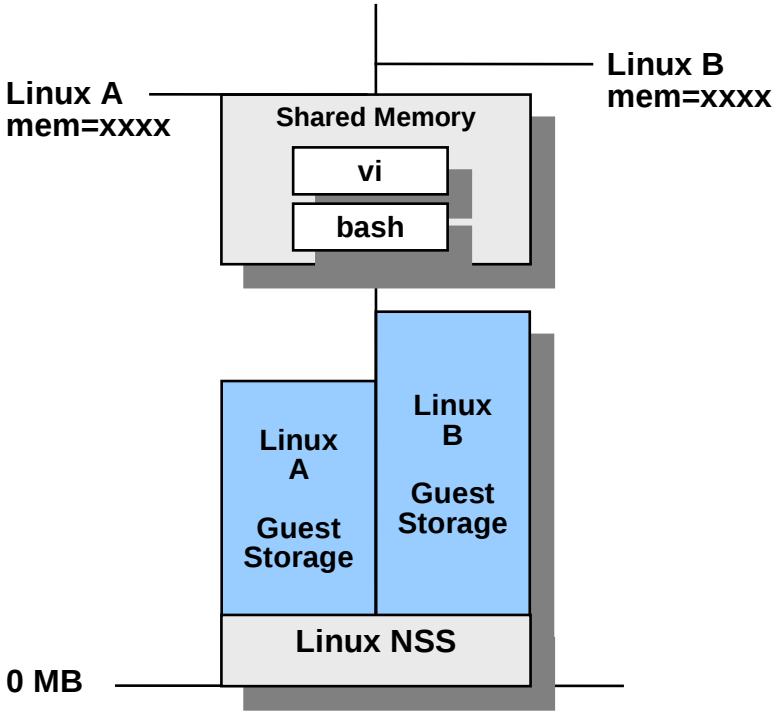
Kernel

- **Control Program Identification (CPI)**
  - If your RHEL5.4 Linux instance runs in LPAR mode, you can now use the extended control program identification (CPI) module, sclp_cpi and the sysfs interface */sys/firmware/cp*i to assign names to your Linux instance
  - The names are used, for example, to identify the Linux instance on the HMC.
  - *This feature is only available while running in LPAR*
- **Extra kernel parameter via VMPARM**
  - Modify the IPL records to append extra parameters specified with the z/VM VMPARM option to the kernel command line.
- **Support for processor degradation**
  - Adds support for processor degradation, which allows processor speed to be reduced in some circumstances (i.e. system overheating). This new feature allows automation software to observe the machine state.
- **TTY terminal server over IUCV**
  - Provide central access to the Linux console for the different guests of a z/VM.
  - The terminal server connects to the different guests over IUCV.
  - The IUCV based console is ASCII based.
  - Fullscreen applications like *vi* are usable on the console.

Virtual Server

- **Named Saved Segments (NSS)**
  - Using NSS the z/VM hypervisior makes operating system code in shared real memory pages available to z/VM guest virtual machines.
  - With this update, Linux guest operating systems using z/VM can boot from the NSS and be run from a single copy of the Linux kernel in memory.





Networking

- **HiperSockets Layer3 Support for IPv6**
  - How IPv6 support for HiperSockets devices running in layer 3 mode is available
  - IPv6 is supported on:
    - Ethernet interfaces of the OSA-Express adapter running in QDIO mode.
    - HiperSockets layer 2 and layer 3 interfaces
    - z/VM guest LAN interfaces running in QDIO mode.
  - IPv6 is not supported on the OSA-Express Token Ring and ATM features.

RAS

- **Multi volume dump support for DASDs**
  - Added the ability to dump on multiple ECKD DASD devices, which can be necessary, if the system memory size is larger than the size of a single DASD device.
- **Service Levels of Hardware & Hypervisor**
  - A new Interface which provides service levels of hardware and z/VM service-levels to the Linux userspace. Interface: */proc/service_levels*
- **Lstape support for SCSI Tapes**
  - With this feature it is now possible to list installed FCP-attached tape devices (SCSI tapes) besides channel attached tapes using the *lstape* command
- **Shutdown Actions Interface**
  - The new shutdown actions interface allows to specify for each shutdown trigger (halt, power off, reboot, panic) one of the five available shutdown actions (stop, ipl, reipl, dump, vmcmd).
  - A sysfs interface under /sys/firmware is provided for that purpose.
  - Possible use cases are e.g. to specify that a vmdump should be automatically triggered in case of a kernel panic or the z/VM logoff command should be executed on halt.
- Automatic IPL after dump
  - The new shutdown action dump_reipl is introduced. It combines the actions dump and re-ipl, first a dump is taken, then a re-ipl of the system is triggered

Storage

- **FCP performance data collection & reports:**
  - Fibre Channel Protocol (FCP) performance data can now be measured. Metrics that are collected and reported on include:
  - Performance relevant data on stack components such as Linux devices, Small Computer System Interface (SCSI) Logical Unit Numbers (LUNs) and Host Bus Adapter (HBA) storage controller information.
  - Per stack component: current values of relevant measurements such as throughput, utilization and other applicable measurements.
  - Statistical aggregations (minimum, maximum, averages and histogram) of data associated with I/O requests including size, latency per component and totals.
- **DS8K Encryption Support**
  - This feature enhances s390-tools to be able to display if the Storage has its disk encrypted or not.
- **Kernel support to issue Control I/O to dasd on EMC Symmetrix arrays**
  - Support has been added to the kernel to issue EMC Symmetrix Control I/O. This update provides the ability to manage EMC Symmetrix storage arrays.

Future Linux on System z Technology

Advanced Virtualization

- **Dynamic Memory Add/Remove** (kernel 2.6.27)
  - Enable to attach and use standby memory that is configured for a logical partition or z/VM guest.
  - Memory Attach & Detach requires running Linux on System z as a VM-guest requires z/VM 5.4 plus the PTF for APAR VM64524.
- **Standby CPU activation/deactivation** (kernel 2.6.25)
  - Allow standby CPUs to be activated / deactivated
- **Suspend / Resume** (kernel 2.6.31)
  - With suspend and resume support, you can stop a running Linux on System z instance and later continue operations.
  - When Linux is suspended, data is written to a swap partition. The resume process uses this data to make Linux continue from where it left off when it was suspended.
  - A suspended Linux instance does not require memory or processor cycles.

Storage Support

- **HyperPav** (kernel 2.6.25)
  - HyperPav is addressing the need to access more data with good performance and high availability!
  - This feature, which required a IBM DS8000™ disk storage system in average leads to a higher utilization, resulting in I/O transfer rates.
  - Activated automatically when the necessary prerequisites are there (DS8000 with HyperPAV LIC, z/VM 5.3). Transparent for the Linux on System z guest
- **DASD Large Volume Support** (> kernel 2.6.29)
  - Large Volume Support is a feature that allows to use ECKD devices with more than 65520 cylinders. This features is available with DS8000 R4.0
- **High Performance FICON (HPF)** (kernel 2.6.29)
  - Added HPF support to the DASD Device Driver
  - HPF is an extension to the FICON architecture and is designed to improve the execution of small block I/O requests.
  - HPF streamlines the FICON architecture and reduces the overhead on the channel processors, control unit ports, switch ports, and links by improving the way channel programs are written and processed.

Usability & Serviceability

- **Automatic IPL After Dump** (kernel 2.6.30)
  - Extension to the shutdown action interface which combines the actions dump and re-ipl, first a dump is taken, then a re-ipl of the system is triggered
- **Compiler Improvements** (gcc 4.3/4.4)
  - The latest compiler enhancements allow a customer to recompile existing applications which can be optimized for the latest hardware generation without any changes to the source code.
  - This can lead up to a > 10 % performance improvement.
- **Large Page Support (**kernel 2.6.25)
  - Support for a new access method to allocate larger chunks of memory, resulting in performance improvements, especially in Java based environments
  - This feature exploits z10 hardware features and provides a software emulation for older systems.

Miscellaneous

- **STP/ETR Support** (kernel 2.6.27)
  - Support for clock synchronization using the server time protocol (STP) or an external time reference (ETR).
- **Kernel vdso support** (kernel 2.6.29)
  - Kernel provided shared library to speed up a few system calls (gettimeofday, clock_getres, clock_gettime)

Q & A

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