RED HAT
ON THE MAINFRAME
THE REASONS ARE COMPELLING

IBM.

Current & Future State of Linux on System z

Updated 27-JAN-2009

Agenda & Introduction

- **Red Hat System z Business Update**
- **RHEL 5.3 Update (released 20-JAN 2009)**
  - What's new?
  - What's new specifically for System z?
- **Future Tech / Upstream Development Efforts**

Agenda & Introduction

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- Based in Washington, D.C.
- Global responsibility for Red Hat's System z activities

System z Business Update

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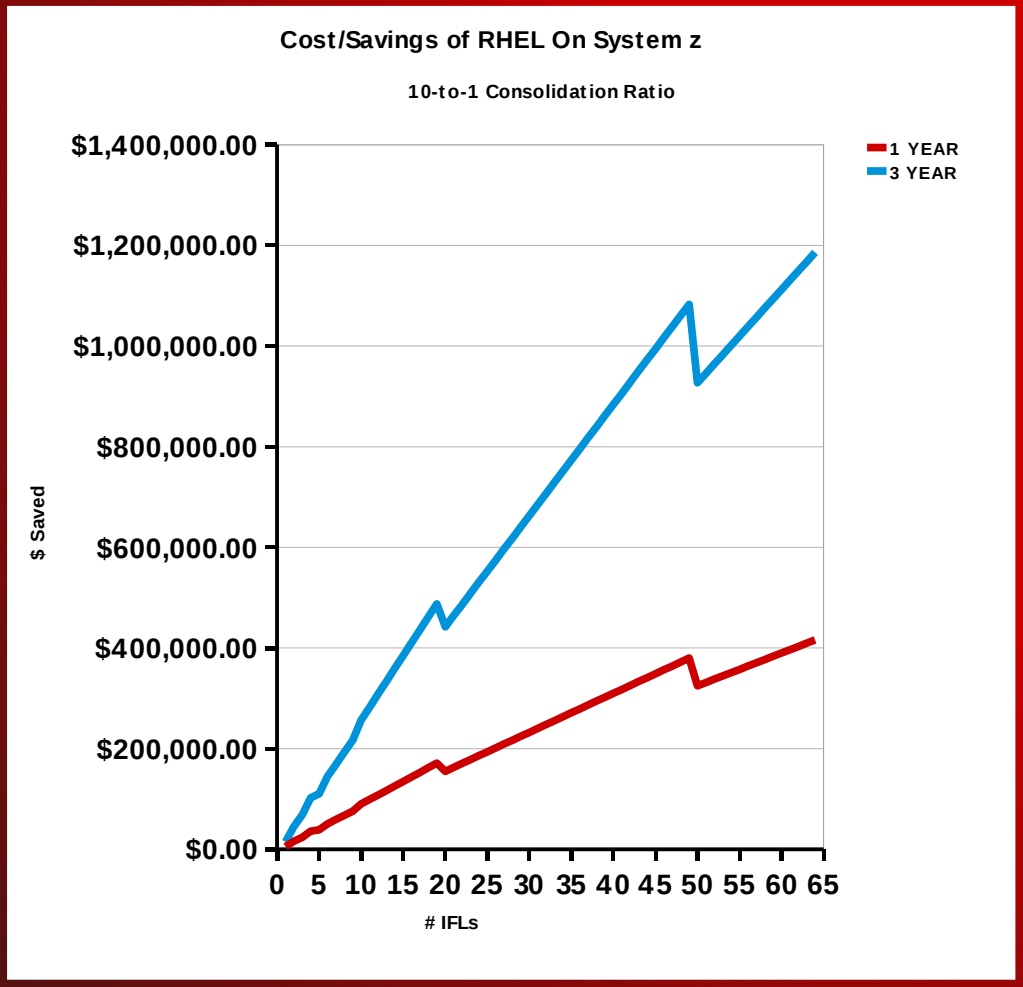
	Oracle/IBM Portal, Oracle BPM, ILOG JRules	JBoss Portal Platform, JBoss jBPM, Rules Frameworks	
	BEA WebLogic, IBM Websphere	JBoss Enterprise Application Platform	
	BEA AquaLogic, IBM ESB, IBM EII	JBoss Enterprise SOA Platform, MetaMatrix Enterprise Data Services Platform	JBoss Operations Network
eDirectory, SunDS	IBM Websphere MQ, Tibco EMS	Red Hat Enterprise MRG Messaging	Red Hat Directory Server, Virtual Directory, Certificate Services
Keon, PowerBroker, Active Directory	Data Synapse, Platform	Red Hat Enterprise MRG Grid	Red Hat Enterprise IPA
HP OpenView/Opsware, IBM Tivoli	EMC PowerPath	Multi-path I/O	Red Hat Network
	Veritas Storage Suite	LVM, CLVM, Global File System	
	VMware Virtualization	Red Hat Integrated Virtualization	
Citrix/VMware VDI	AIX, HP-UX, Solaris	Red Hat Enterprise Linux, Red Hat Enterprise MRG Realtime	Qumranet Solid ICE
	Veritas Cluster Suite	Red Hat Cluster Suite	

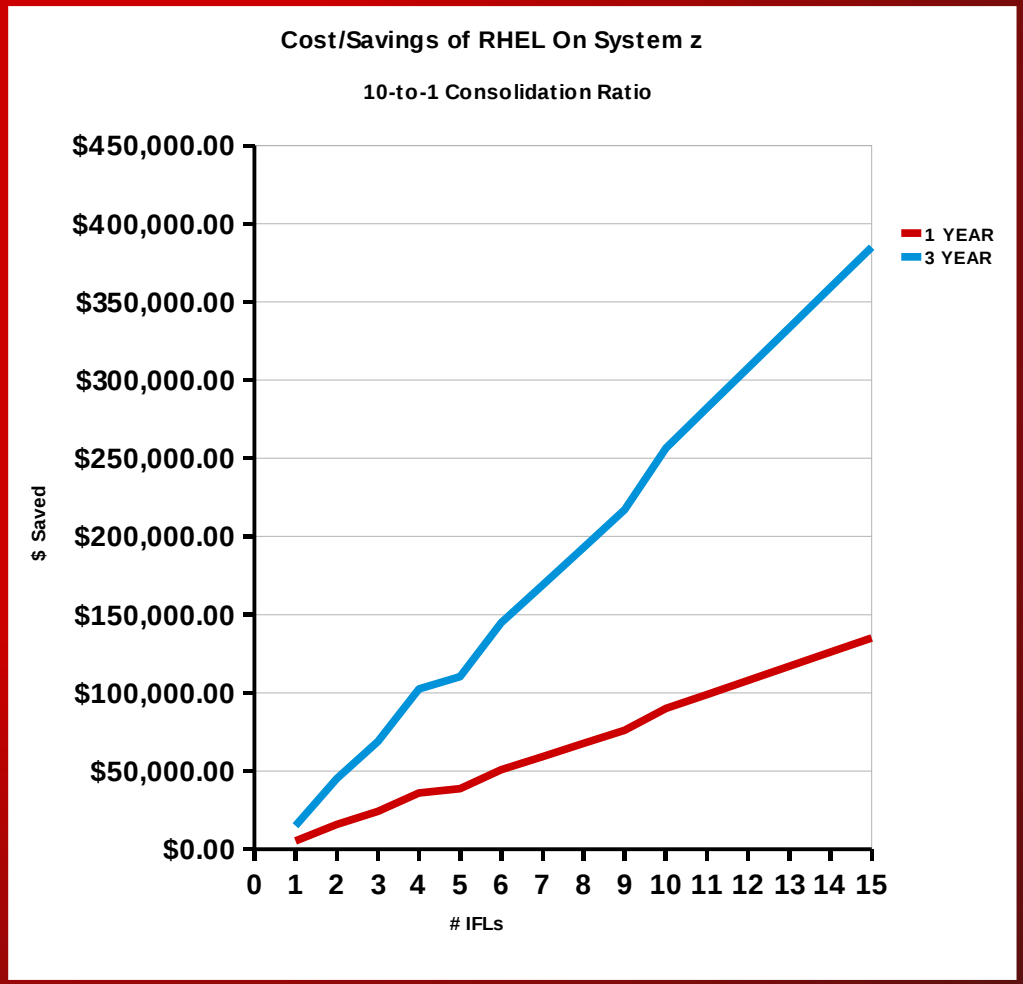
Red Hat / IBM Relationship

- Cross platform relationship founded in the late 90s (when Red Hat incorporated)
- Started releasing RHEL for s390 in 2001
- Formal Linux on System z agreement & announcement in 2007
  (http://www-03.ibm.com/press/us/en/pressrelease/21513.wss)
- Red Hat has dedicated staff to System z
  (we haven't done this for any other H/W platform)

Why move to System z?

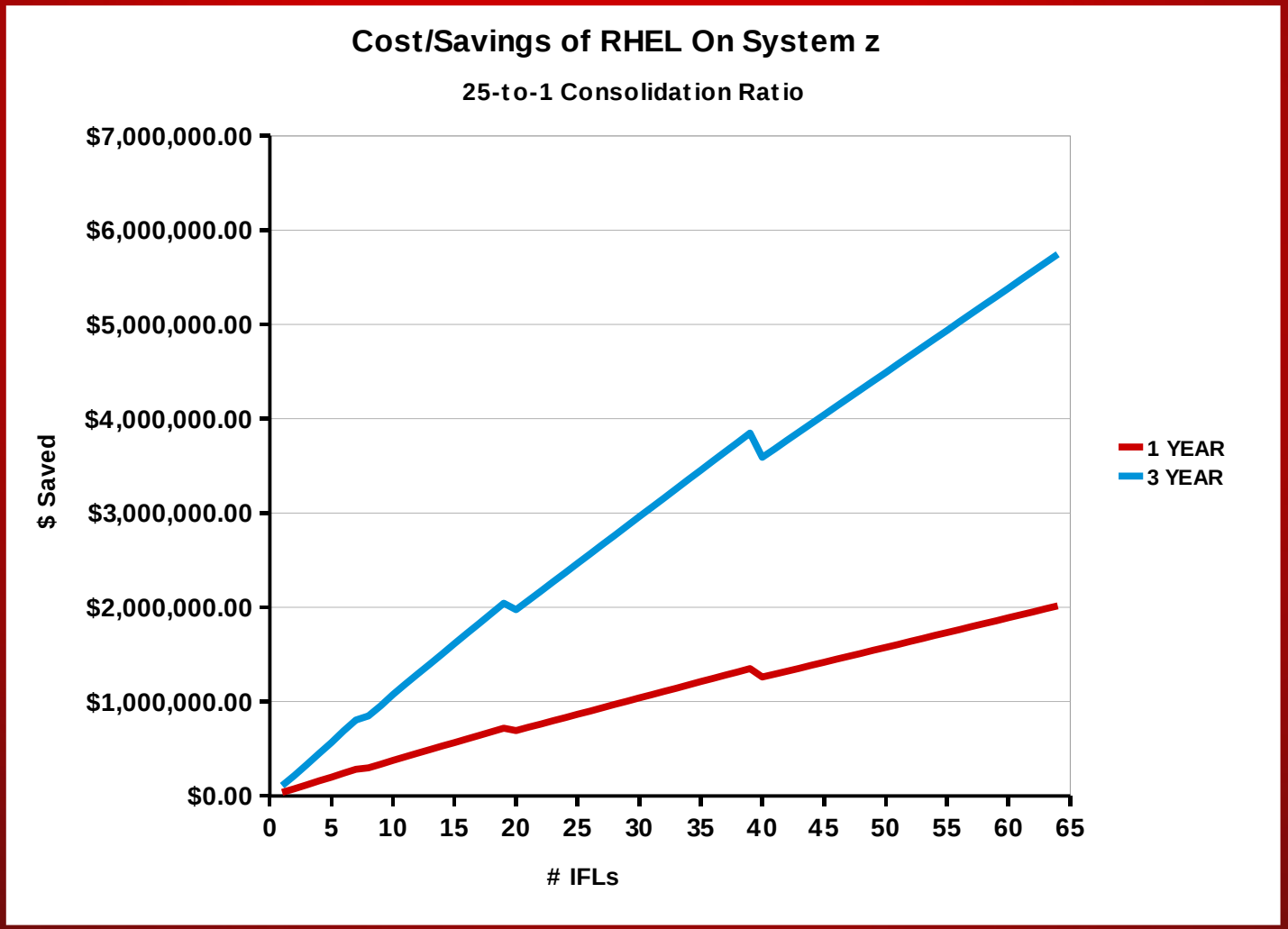
RHEL Subscription Cost Elimination/Prevention





Why move to System z?

RHEL Subscription Cost Elimination/Prevention



Why move to System z?

3rd Party ISV Costs

- **Oracle DB**
  - MSRP * #cores * CPU_Factor
  - SUN: $40,000 * 8 * 1.7 = **$544K**
  - z9 = $40,000 * 1 * 1 = **$40K**
  - z10 = $40,000 * 4 * 1 = **$160K**

Why move to System z?

Environmental “Go Green” Factors

- **Bank of New Zealand**
  - One of the top 50 largest banks in the world
  - Offices in 4 continents, 15 countries
  - Mainframe RHEL since September, 2008
    - SWIFT ($10B/day)
    - PCBB ($4M/day)
    - Teller Banking Applications
  - Carbon neutral by 2010

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Why move to System z?

Environmental "Go Green" Factors

- **Bank of New Zealand (cont)**
  - Consolidated 131 SUN servers to RHEL on z10
  - Mix of small, medium, large: 280Rs, V440s, E10Ks

	SUN	RHEL & z10	
Power (kW/hr)	36	22	38% less
Heat (kBTUs/hr)	110	74	33% less
Space (Racks)	6.5	4.5	31% less
Carbon Emissions	66	40	39% less

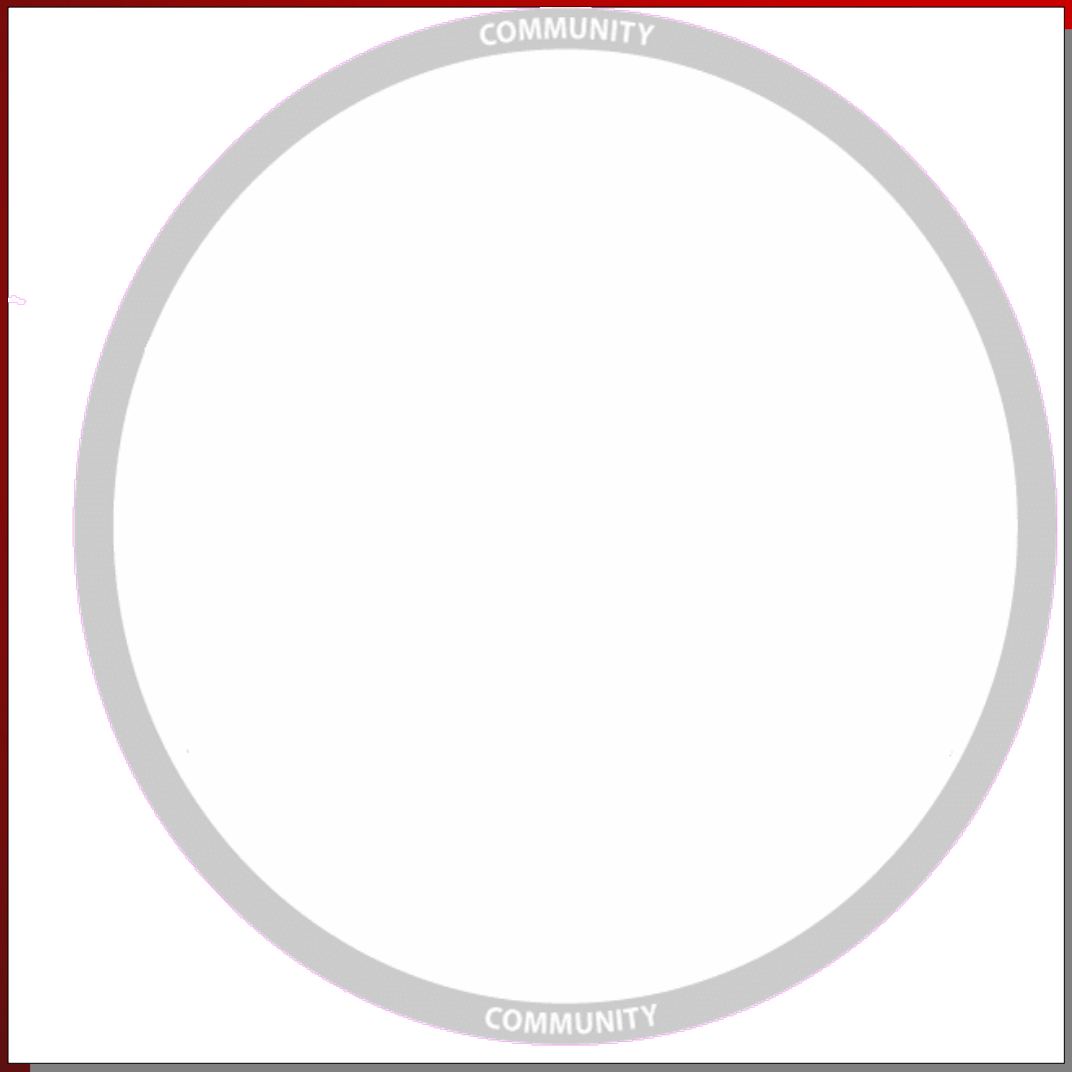
Why move to System z?

Performance

- **104 SUN cores to 7 z10 EC IFLs**
  - Large US Government customer
  - 700M+ rows in Oracle
  - 104 SUN cores, incl prod/dev/test,
    - **Processing time 3 days**
  - 7 z10 EC IFLs, incl prod/dev/test,
    - **Processing time < 15 minutes, peak utilization of 55%**

Red Hat Development & Subscription Model

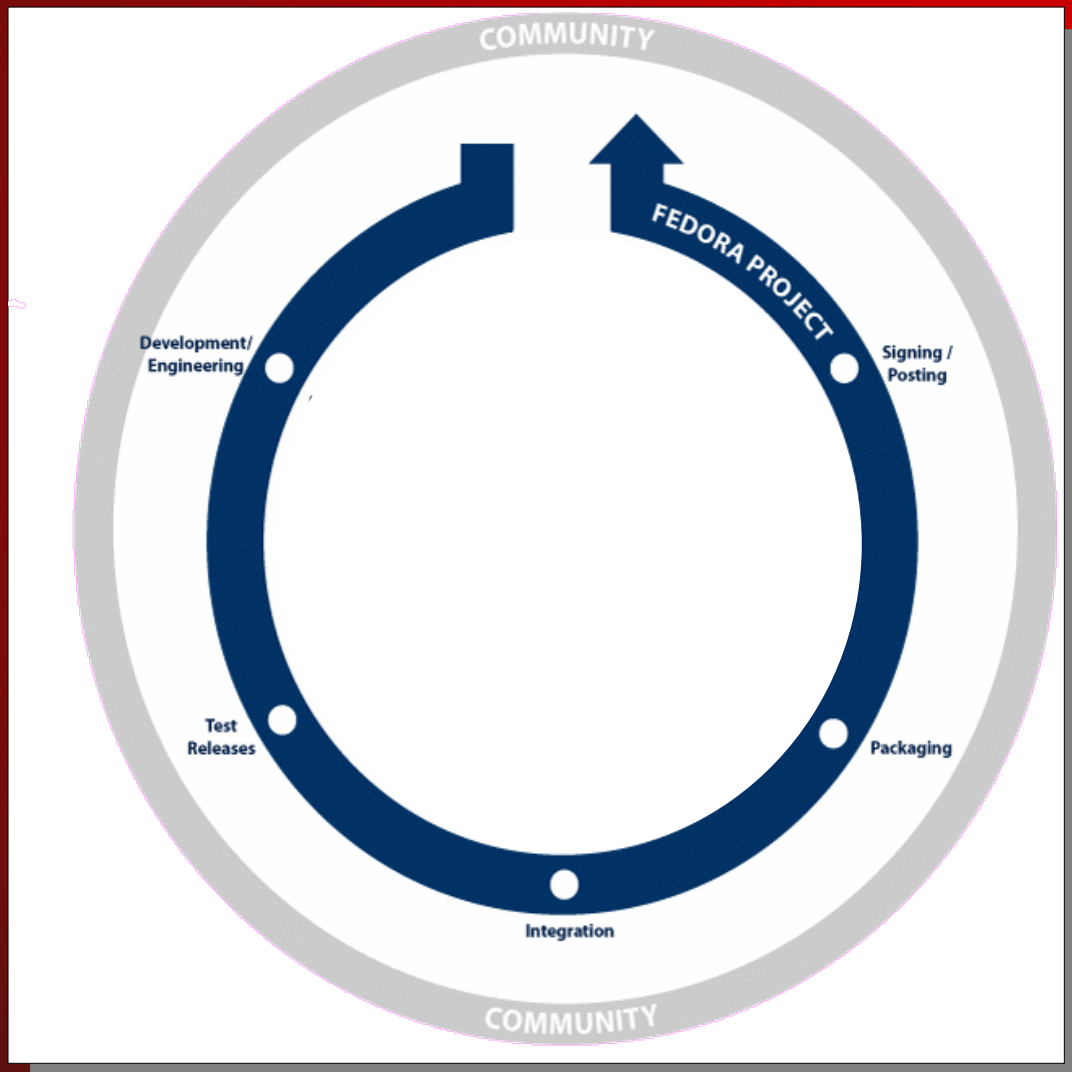
Red Hat Development Model



COMMUNITY

- Development with "upstream communities"
- Kernel, glibc, Apache, etc
- Collaboration with open source community; individuals, business partners, customers

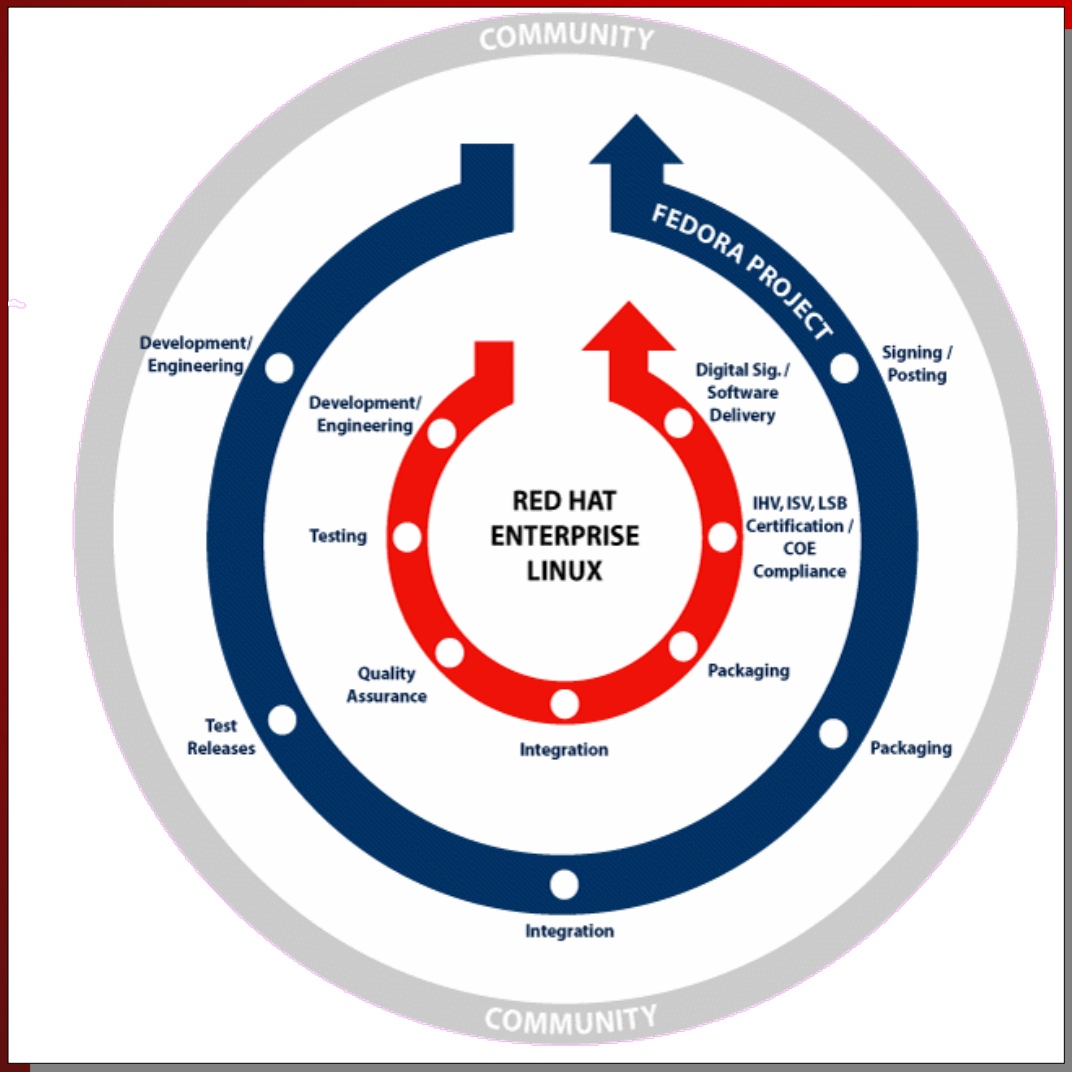
Red Hat Development Model



FEDORA

- Bleeding edge
- Sets technology direction for RHEL
- Community supported
- Released ~6mo cycles
- Fedora 8,9,10 = RHEL6

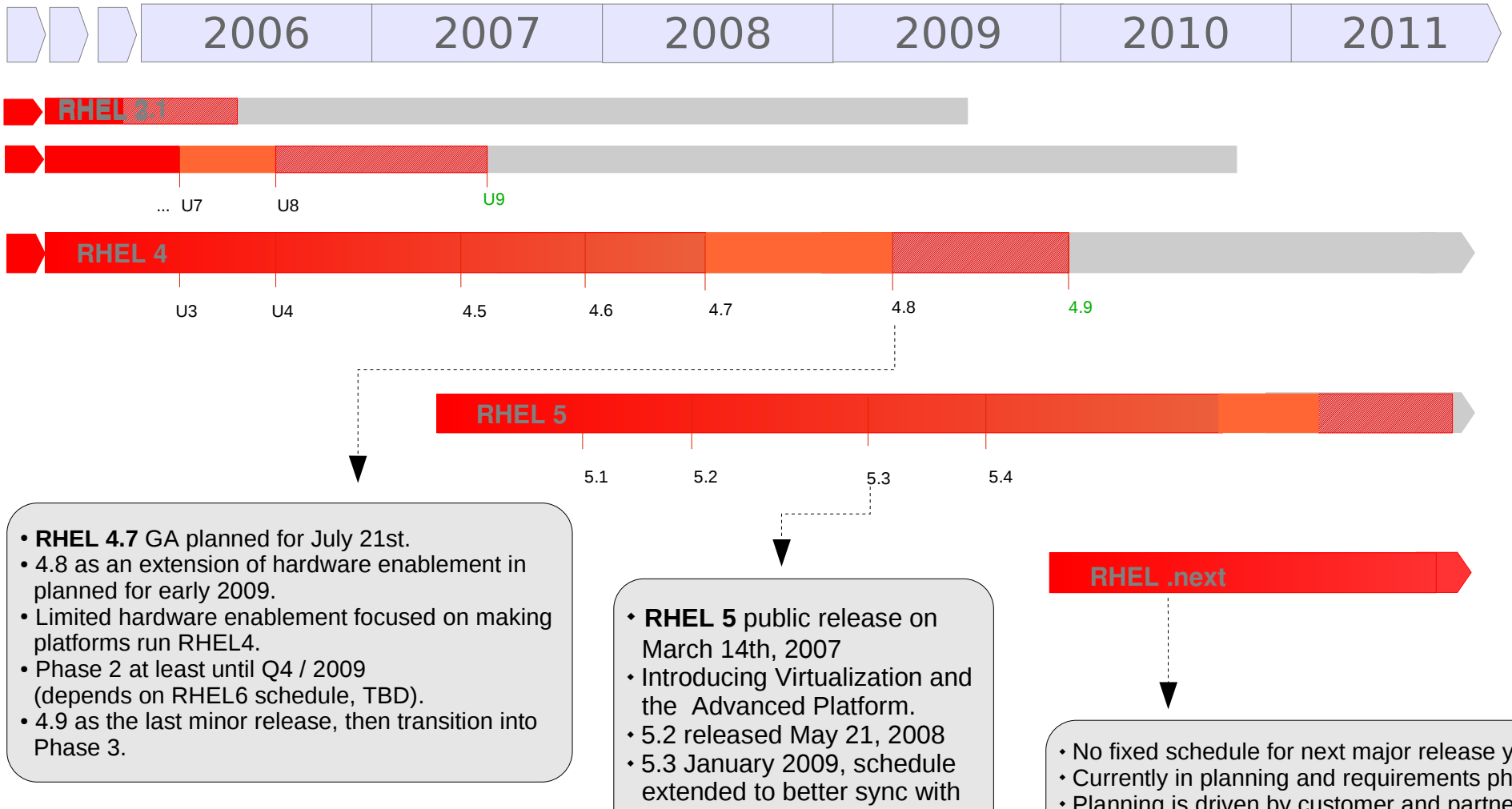
Red Hat Development Model



RHEL

- Stable, matured
- Q&A, testing
- H/W & S/W Certifications
- 7yr maintenance
- Core ABI compatibility
- Major releases 2-3yr cycle

Red Hat Development Model



- **RHEL 4.7** GA planned for July 21st.
- 4.8 as an extension of hardware enablement in planned for early 2009.
- Limited hardware enablement focused on making platforms run RHEL4.
- Phase 2 at least until Q4 / 2009 (depends on RHEL6 schedule, TBD).
- 4.9 as the last minor release, then transition into Phase 3.

- **RHEL 5** public release on March 14th, 2007
- Introducing Virtualization and the Advanced Platform.
- 5.2 released May 21, 2008
- 5.3 January 2009, schedule extended to better sync with hardware schedules.

- No fixed schedule for next major release yet.
- Currently in planning and requirements phase.
- Planning is driven by customer and partner requirements.
- Further announcements to come.

- **RHEL 3** in Maintenance phase (no new hardware, critical changes only).
- .New hardware still available through virtualization
- Improved para-virtualized drivers are released.

Current Lifecycle Milestones

Red Hat Enterprise Linux 2.1

- End of Maintenance Phase: May 31, 2009

Red Hat Enterprise Linux 3

- GA Date: October 23, 2003
- Full Support through: July 20, 2006
- Transition into Maintenance Phase: Jun 30, 2007
- End of Maintenance Phase: October 31, 2010

Red Hat Enterprise Linux 4

- GA Date: February 14, 2005
- Full Support through: Q1 / 2009
- Transition into Maintenance Phase: Not earlier than Q4 / 2009 (depends on further schedule for next major release).
- End of Maintenance Phase: February 29, 2012

Red Hat Enterprise Linux 5

- GA Date: March 14, 2007
- Full Support through: Through Q1 / 2011
- Transition into Maintenance Phase: Not earlier than Q1 / 2012
- End of Maintenance Phase: March 31, 2014

Linux on System z Support

CONSULTANTS

TECH ACCNT MGRS

Level 3: Special Engineering

Custom Patches, Code Re-writes,
Interim Patches, Application Redesign

Level 2: Advanced Support

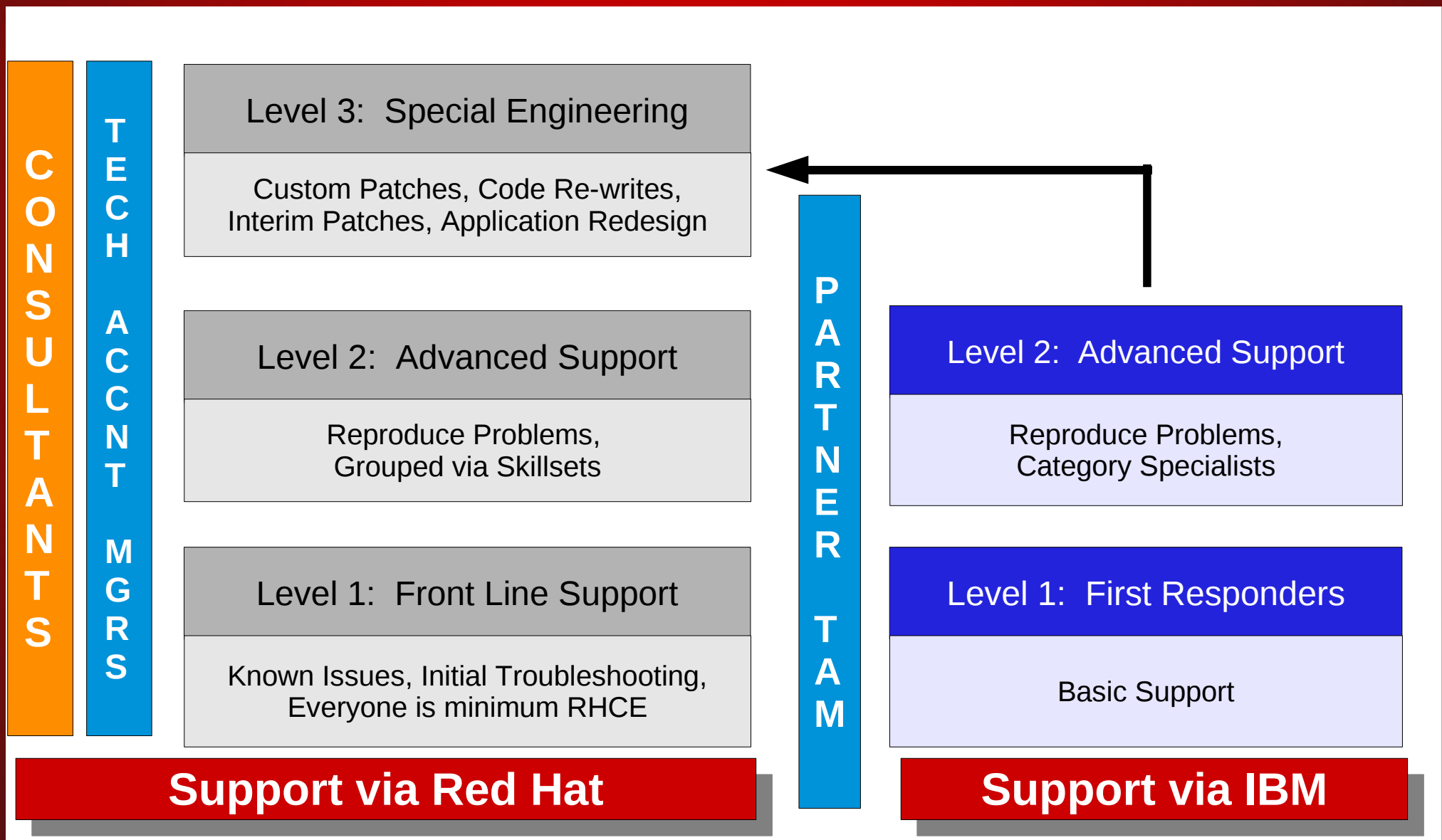
Reproduce Problems,
Grouped via Skillsets

Level 1: Front Line Support

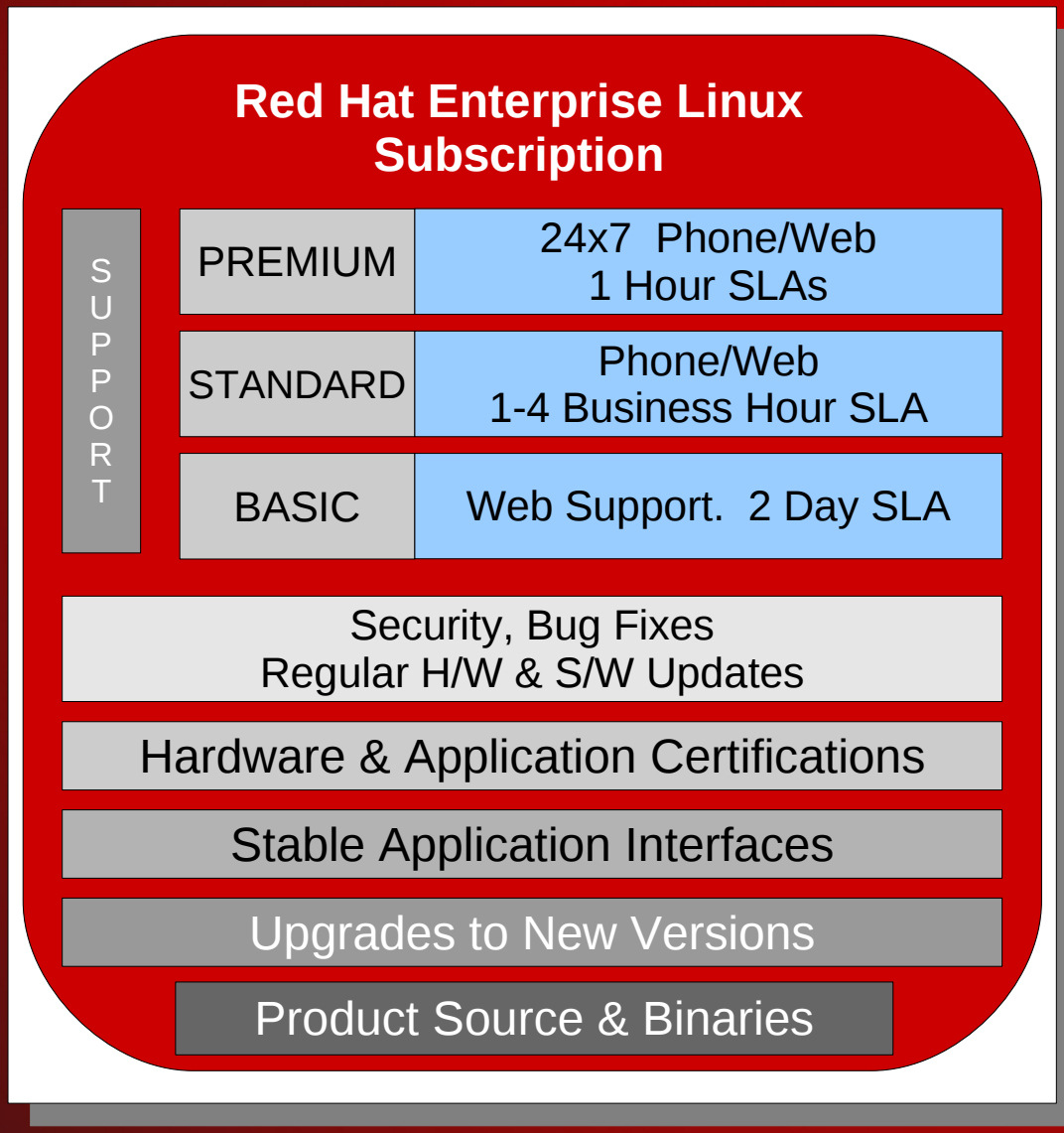
Known Issues, Initial Troubleshooting,
Everyone is minimum RHCE

Support via Red Hat

Linux on System z Support

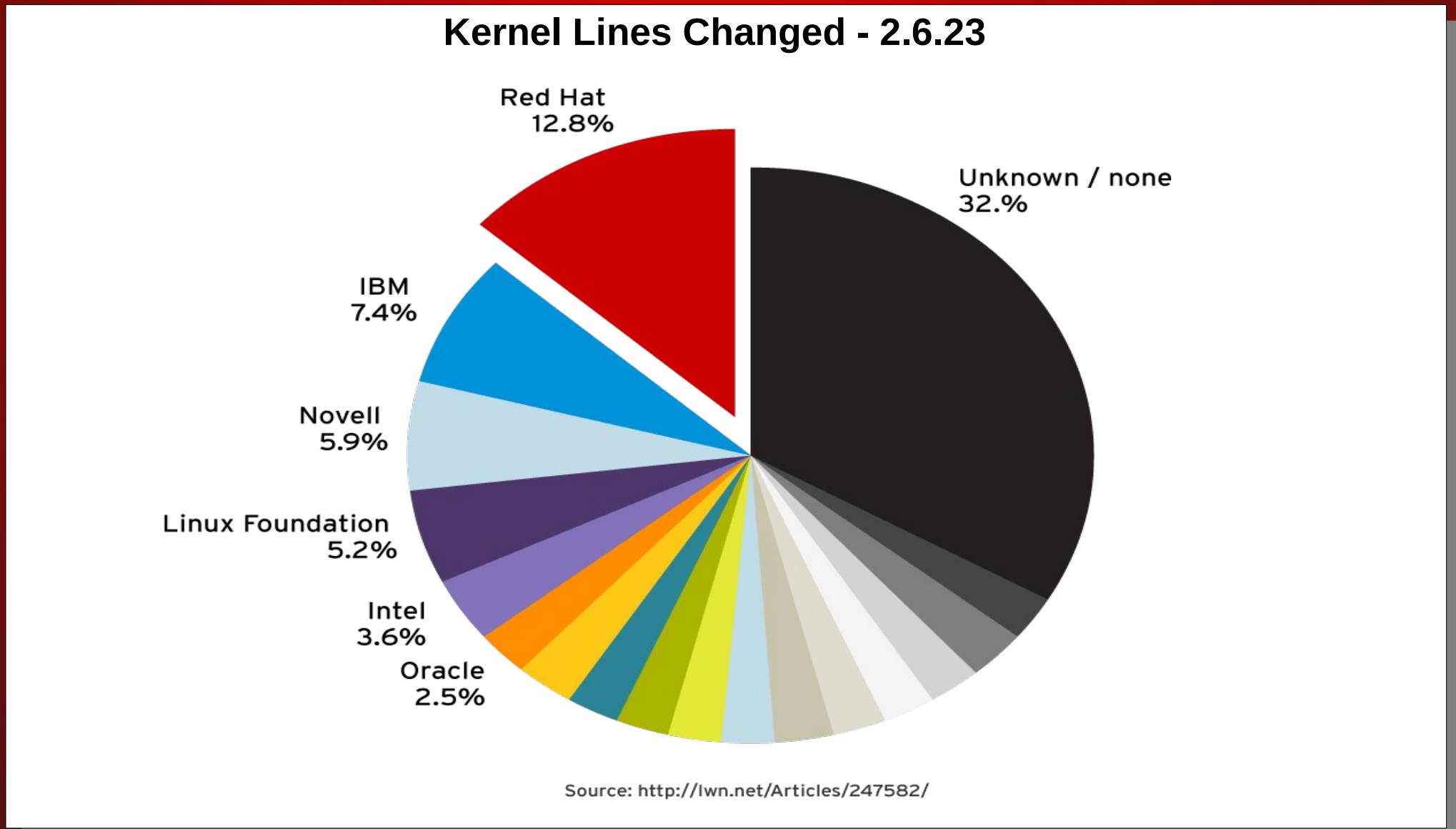


RHEL For System z Subscriptions



- No version upgrade cost
- No “client access” fee
- Unlimited support incidents
- Priced per IFL
- Possible to convert subscriptions to/from other platforms

Joint Red Hat / IBM Development

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RHEL 5.2 Tech
Deep Dive

the proof is in the pudding...

RHEL 5.2: Technical Review

- **Accelerated in-kernel Crypto**
  - Support for crypto algorithms of z10 (SHA-512, SHA-384, AES-192, AES-256)
- **Two OSA ports per CHPID; Four port exploitation**
  - Exploit next OSA adapter generation which offers two ports within one CHPID. The additional port number 1 can be specified with the qeth sysfs-attribute “portno”

Support is available only for OSA-Express3 GbE SX and LX on z10, running in LPAR or z/VM guest (PFT for z/VM APAR VM64277 required!)

RHEL 5.2: Technical Review

- **SELinux per-package access controls**
  - Replaces old packet controls
  - Adds secmark support to core networking
- **Add nf_conntrack subsystem**
  - Allows IPv6 to have stateful firewall capability
  - Enables analysis of whole streams of packets, rather than only checking the headers of individual packets

RHEL 5.2: Technical Review

- **Audit Subsystem**
  - Support for process-context based filtering
  - More filter rule comparators
- **Address Space Randomization**
  - Address randomization of multiple entities – including stack & mmap() region (used by shared libraries) (2.6.12; more complete implementation than in RHEL4)
  - Greatly complicates and slows down hacker attacks

RHEL 5.2: Technical Review

- **High Resolution Timers**
  - Provide fine resolution and accuracy depending on system configuration and capabilities - used for precise in-kernel timing


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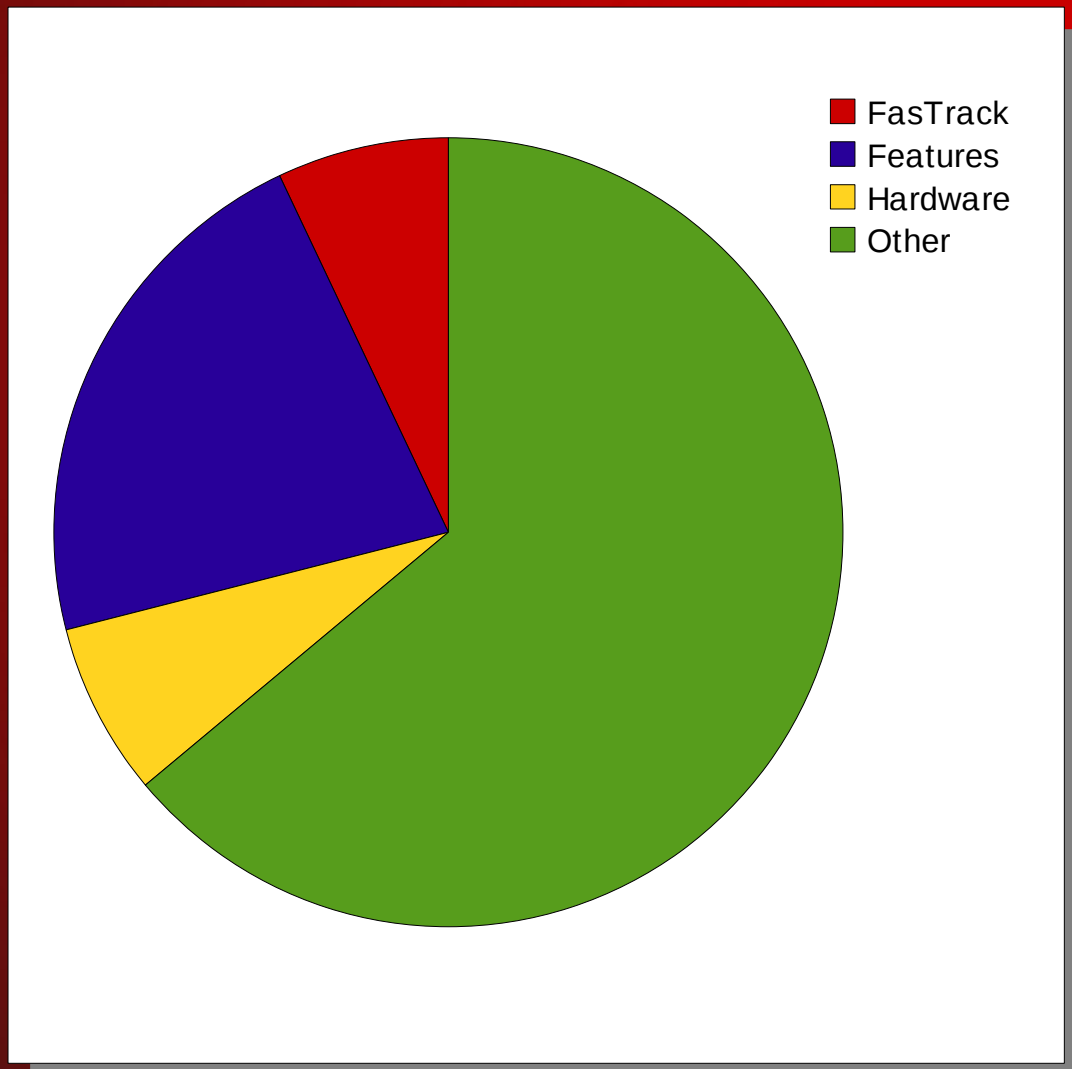
RHEL 5.3 Tech
Deep Dive

RHEL 5.3 Overview



~150 additions, ~3,400 BugZillas

- **7% FasTrack**
  Early release of low impact fixes
- **7% Hardware Enablement**
  New chipsets & processor feature support
- **21% New Features**
  Feature requests from customers & partners
- **65% “Other”**
  Feature enhancements, Bug fixes, Documentation

RHEL 5.3: Technical Review

- **Highlights**
  - Added RAID 4/5/10 in dm-raid
  - DHCPv6 Support
  - Inclusion of OpenJDK
    - Full open source JDK for Java 1.6 support
    - Tested with Java SE 1.0 Technical Compatibility Kit (TCK) ==> 100%
    - x86 and x86_64 architectures only!
  - Root (/) and SWAP encryption support in the installer

RHEL 5.3: Technical Review

- **Highlights, cont**
  - Improved Audit & Logging
    - TTY Input audit support

RHEL 5.3: System z Specific

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

RHEL 5.3: Technical Review

xDR System Initialization for LPAR Clients

(Red Hat BugZilla 184770, IBM BugZilla 37874)

- This requirement enables a new version of the "GDPS/PPRC Multiplatform Resiliency" disaster recovery solution.
- This new version will support site failover and Hyperswap (transparent storage subsystem failover) to Linux running in a zSeries LPAR
- (in a next step) non-zSeries Linux images attached to an ESS

RHEL 5.3: Technical Review

GCC 4.3 Inclusion (latest z10 instruction support)

(Red Hat BugZilla 439479, IBM BugZilla 43379)

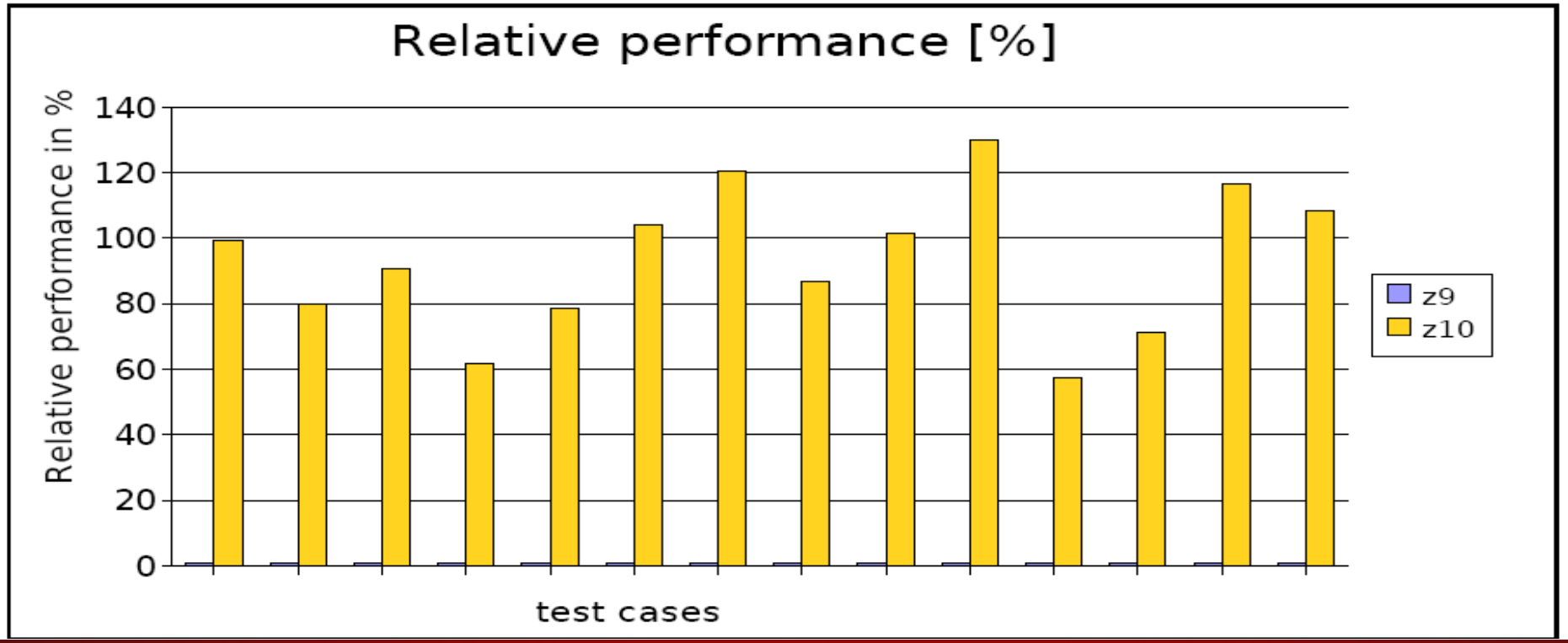
- Includes the following z10 specific patches to GCC
  - Introduce TARGET_MEM_CONSTRAINT macro
  - Introduce 'enabled' insn attribute
  - S/390: Exploit the 'enabled' insn attribute
  - S/390: Replace 'm' with 'RT' constraints
  - S/390: Add the -march=z10/-mtune=z10 options for z10
  - S/390: Support the new instructions introduced with z10
  - S/390: z10 pipeline description
  - PR36822 recog: Reorder extra memory constraint checks for inline assemblies
  - S/390: Fix -march=z9-ec -msoft-float

RHEL 5.3: Technical Review

GCC 4.3 Inclusion (latest z10 instruction support)

(Red Hat BugZilla 439479, IBM BugZilla 43379)

- Includes the following z10 specific patches to GCC
  - Overall improvement with z10 versus z9: 1.9x



Graph taken from Mustafa Mešanović's T3 Boeblingen presentation, 1-JULY 2008, "Linux on System z Performance Update"

RHEL 5.3: Technical Review

Long Numbers Generation

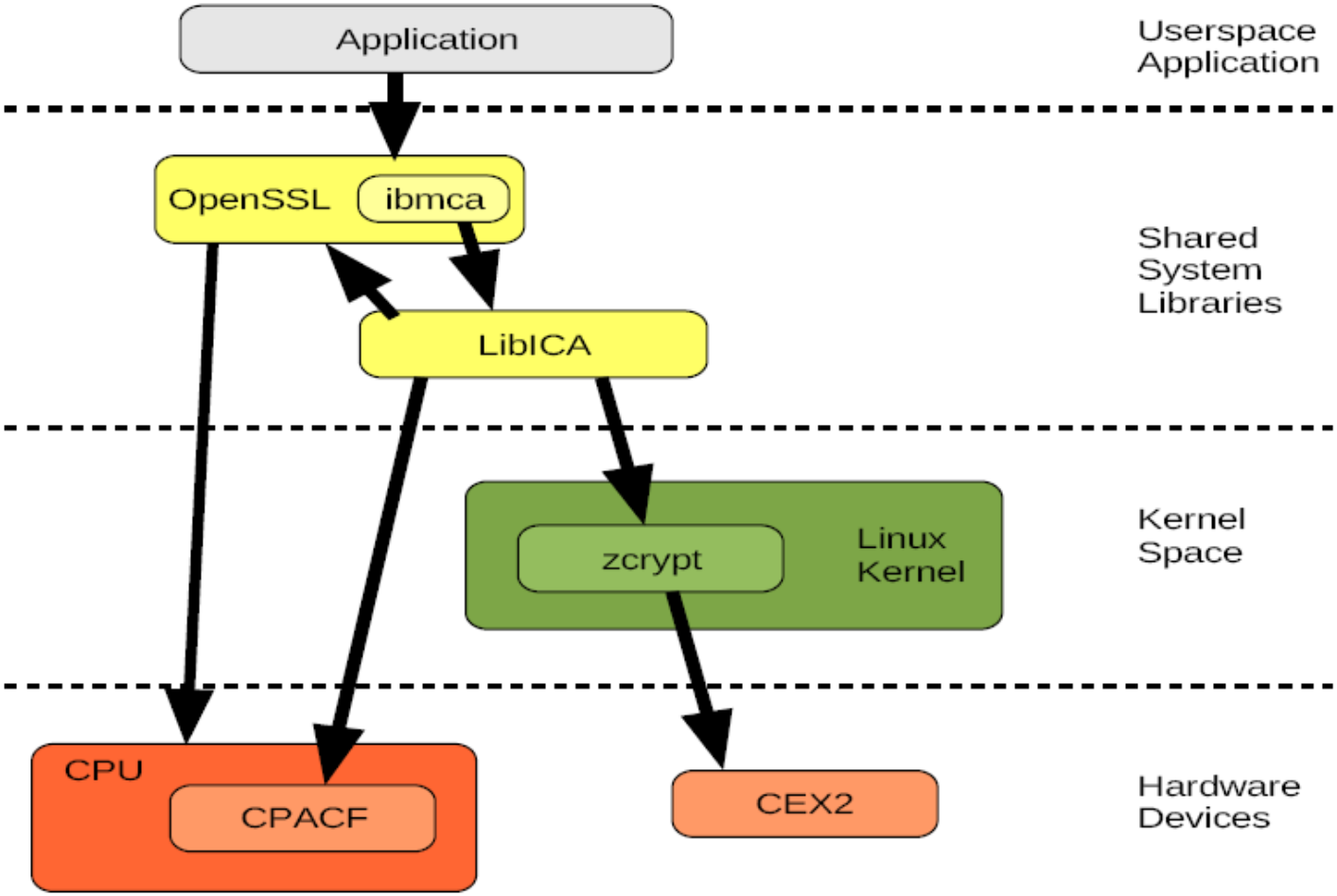
(Red Hat BugZilla 439440, IBM BugZilla 43340)

- Provides access to the random number generator on the crypto card in order to meet high volume random number requirements
- Frequently useful when high amount of SSL handshakes occur (JBoss, WebSphere, etc), or encryption/decryption (remember, encrypted memory is now supported!)
- Specific performance numbers not available at this time from Red Hat... but we do have IBMs.

RHEL 5.3: Technical Review

Long Numbers Generation

(Red Hat BugZilla 439440, IBM BugZilla 43340)

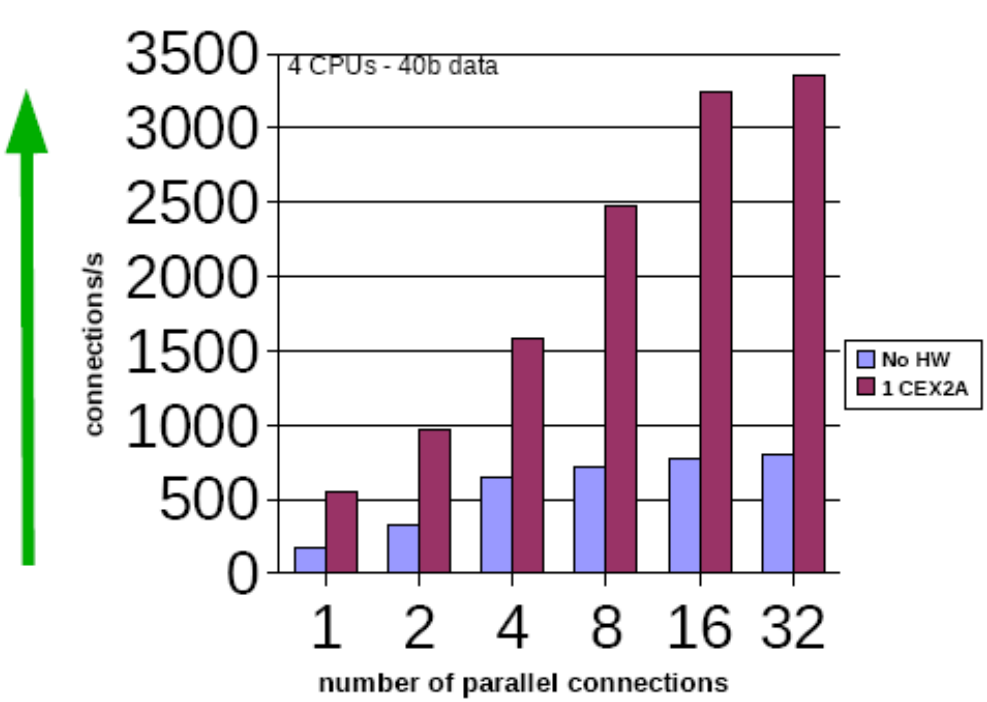


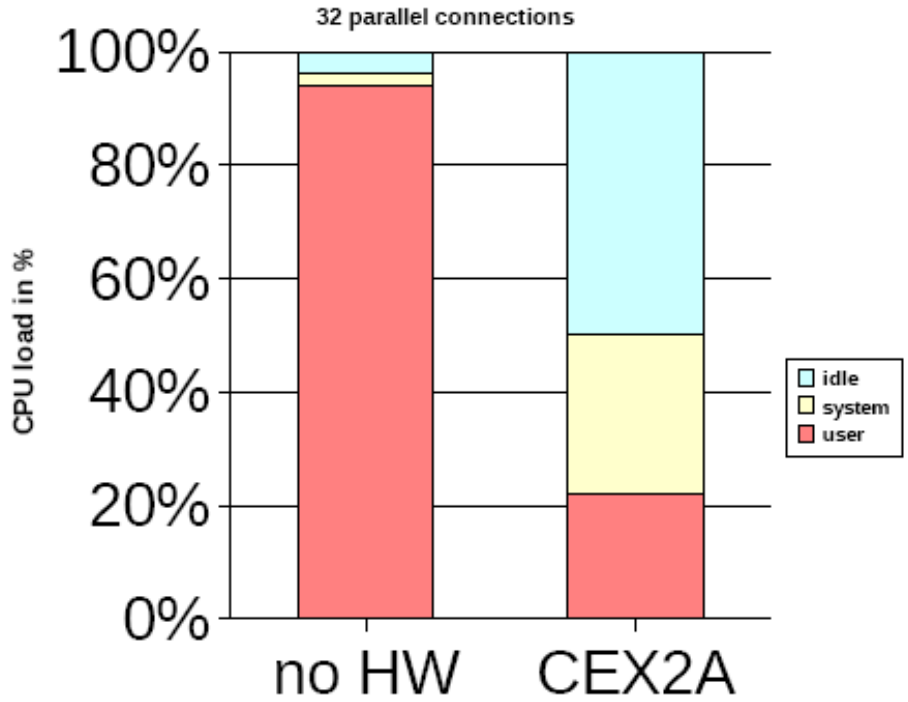
RHEL 5.3: Technical Review

Long Numbers Generation

(Red Hat BugZilla 439440, IBM BugZilla 43340)

- The number of handshakes is up to 4x higher with HW support.
- In the 32 connections case we save about 50% of the CPU resources





Graphs taken from Mustafa Mešanović's T3 Boeblingen presentation, 1-JULY 2008, "Linux on System z Performance Update"

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RHEL 5.3: Technical Review

Enablement of ECKD DASD Sense Data

(Red Hat BugZilla 439441, IBM BugZilla 43339)

Sense Key	Name	Description
0h	No Sense	Indicates there is no specific Sense Key information to be reported for the disc drive. This would be the case for a successful command or when the ILI bit is one.
1h	Recovered Error	Indicates the last command completed successfully with some recovery action performed by the disc drive. When multiple recovered errors occur, the last error that occurred is reported by the additional sense bytes. Note: For some Mode settings, the last command may have terminated before completing.
2h	Not Ready	Indicates the logical unit addressed cannot be accessed. Operator intervention may be required to correct this condition.
3h	Medium Error	Indicates the command terminated with a non-recovered error condition, probably caused by a flaw in the medium or an error in the recorded data.
4h	Hardware Error	Indicates the disc drive detected a nonrecoverable hardware failure while performing the command or during a self test.
5h	Illegal Request	Indicates an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands (Format Unit, Mode Select, and so forth). If the disc drive detects an invalid parameter in the Command Descriptor Block, it shall terminate the command without altering the medium. If the disc drive detects an invalid parameter in the additional parameters supplied as data, the disc drive may have already altered the medium. This sense key may also indicate that an invalid IDENTIFY message was received. This could also indicate an attempt to write past the last logical block.
6h	Unit Attention	Indicates the disc drive may have been reset.
7h	Data Protect	Indicates that a command that reads or writes the medium was attempted on a block that is protected from this operation. The read or write operation is not performed.
9h	Firmware Error	Vendor specific sense key.
h	Aborted Command	Indicates the disc drive aborted the command. The initiator may be able to recover by trying the command again.
Ch	Equal	Indicates a SEARCH DATA command has satisfied an equal comparison.
Dh	Volume Overflow	Indicates a buffered peripheral device has reached the end of medium partition and data remains in the buffer that has not been written to the medium.
Eh	Miscompare	Indicates that the source data did not match the data read from the medium.

RHEL 5.3: Technical Review

FCP – Enhanced Trace Facility

(Red Hat BugZilla 439482, IBM BugZilla 43384)

- Detailed troubleshooting information for LUNs

```
[root@h0530014 s390dbf]# ll zfcp_0.0.5914_rec
total 0
--w------- 1 root root 0 Sep 12 08:11  flush
-r-------- 1  root root 0 Sep 12 08:11  hex_ascii
-rw------- 1 root root 0 Sep 12 08:11  level
-rw------- 1 root root 0 Sep 12 08:11  pages
-r-------- 1  root root 0 Sep 12 08:11  structured

[root@h0530014 zfcp_0.0.5914_rec]# cat structured
timestamp       01221199894:240391062
cpu             01
tag             trigger
hint            online
id              85
reference       0x0000000000000000
erp_action      0x0000000019a0d9d8
requested       4
executed        4
wwpn            0x0000000000000000
fcp_lun         0x0000000000000000
adapter_status  0x41000124
port_status     0x00000000
unit_status     0x00000000
```

RHEL 5.3: Technical Review

CPU Node Affinity

(Red Hat BugZilla 447379, IBM BugZilla 44875)

- Newer hardware (System z10 EC) supports an interface which can be used to get information about the CPU topology of an LPAR.
  - This can be used to optimize the Linux scheduler which bases its decisions on which process gets scheduled to which CPU on the CPU topology.
  - This feature should increase cache hits and therefore overall performance as well.

English Version: You dedicate 2 z10 IFLs to a RHEL5 VM. We can then pin applications to specific cores, or to IFLs in their entirety.

RHEL 5.3: Technical Review

Integration of icainfo into libICA

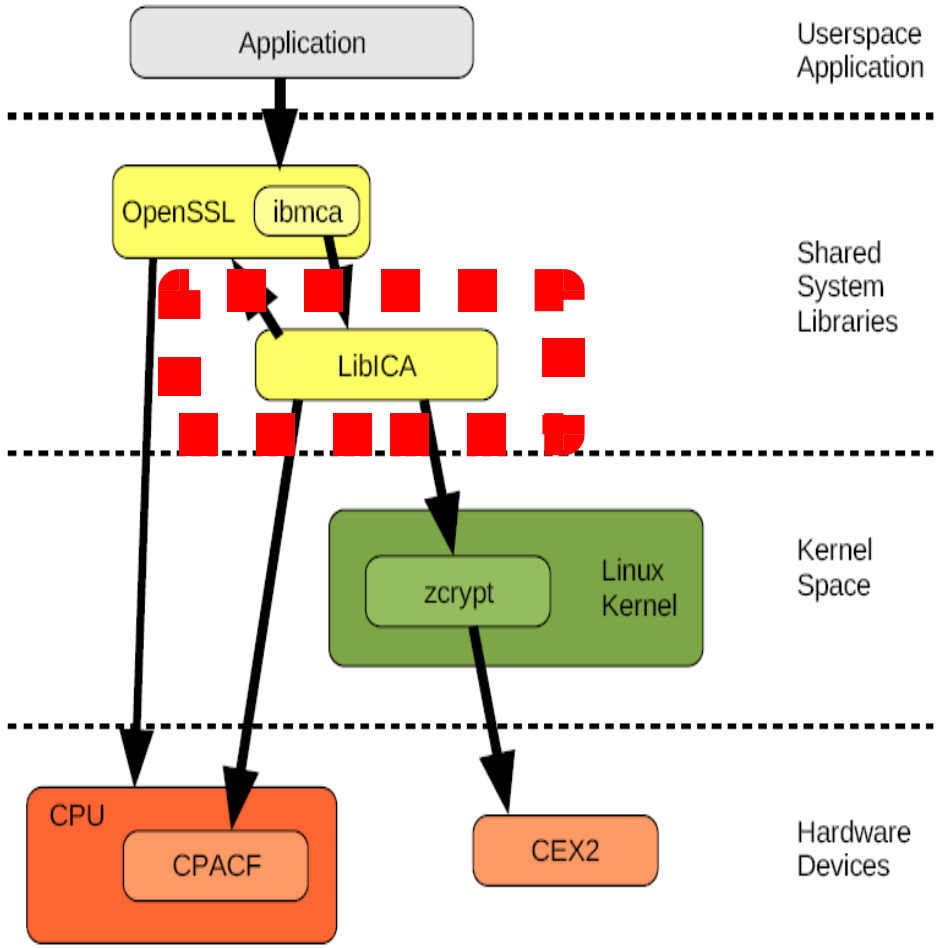
(Red Hat BugZilla 439484, IBM BugZilla 43383)

- icainfo is a part of the SHA & AES enhancements. It shows the customer which CPACF instructions are available in their system.

- libica allows customer applications to speed up cryptographic operations by using the CP Assist for Cryptographic Function (CPACF) facility.

- A new tool called 'icainfo' allows the customer to display a list of all CPACF operations supported by libica.

- This is helpful to verify that CPACF is correctly enabled on a particular system.

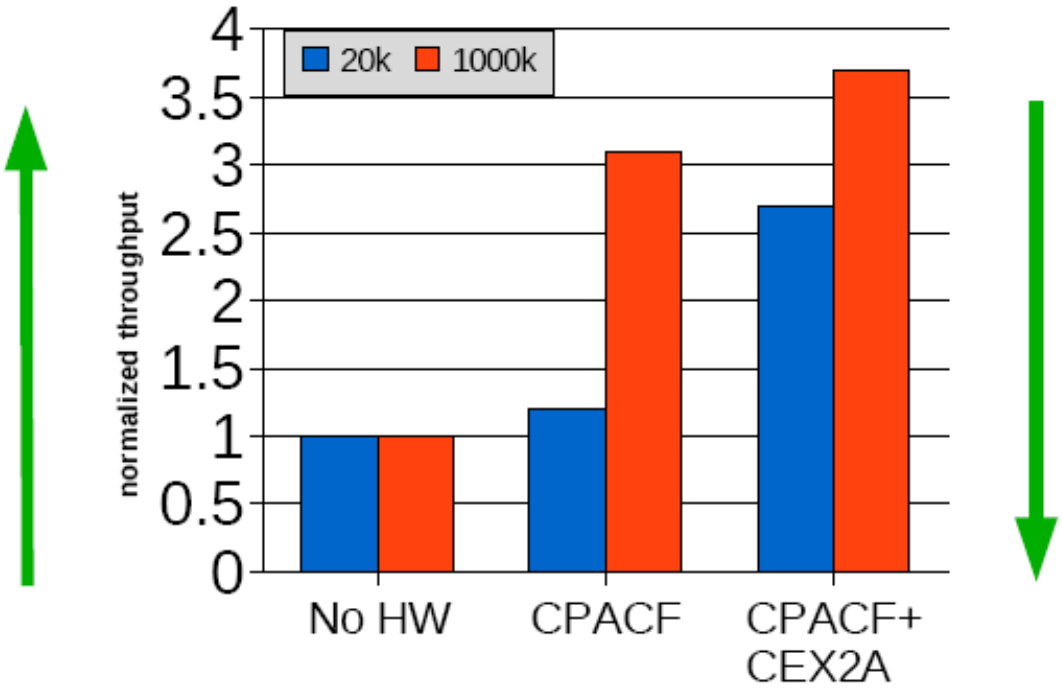


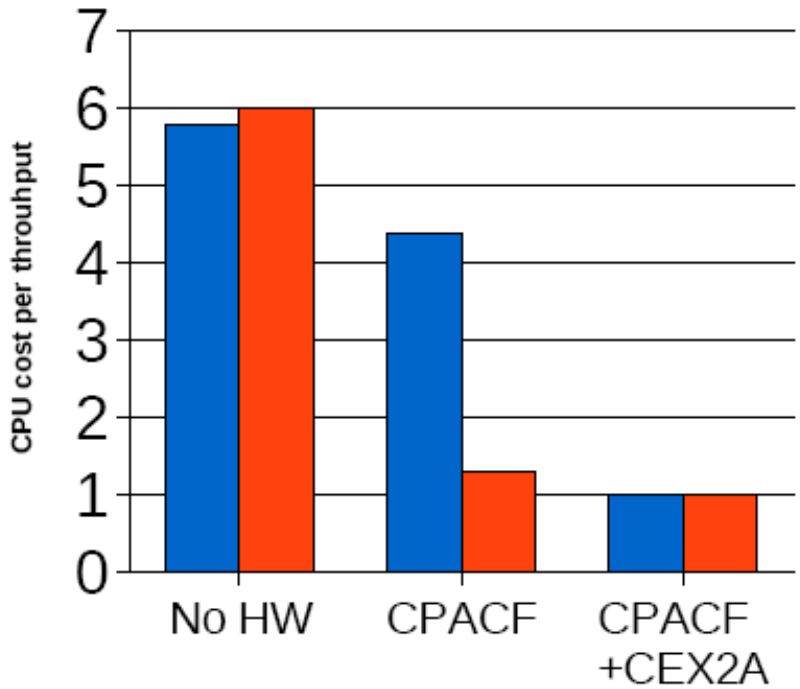
RHEL 5.3: Technical Review

Integration of icainfo into libICA

(Red Hat BugZilla 439484, IBM BugZilla 43383)

- The use of hardware features leads to 3.5x more throughput
- Using software encryption costs about 6x more CPU





Graphs taken from Mustafa Mešanović's T3 Boeblingen presentation, 1-JULY 2008, "Linux on System z Performance Update"

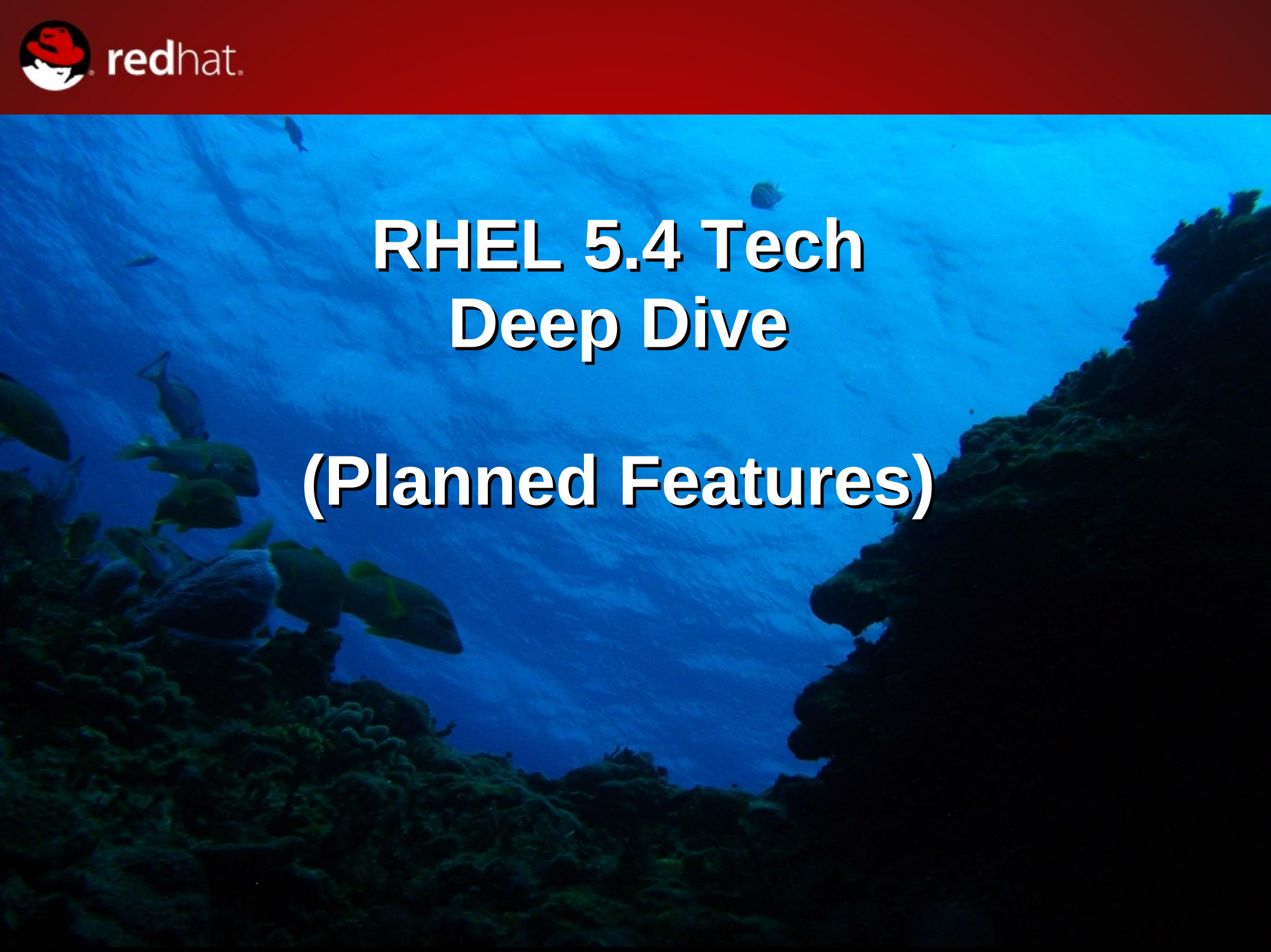
RHEL 5.3: Technical Review

OSA 2 Ports per CHPID Installer Support

(Red Hat BugZilla 439461, IBM BugZilla 43371)

- Anaconda now supports both ports on CHPID for OSA Express3 cards.
  - The installer will prompt for the port number in the initial stage of the installation.
  - The value provided for the port also affects installed network interface startup script. When port 1 is selected, the value "portno=1" is added to OPTIONS parameter of ifcfg-eth* file.

Note: When installing under z/VM, you can add either PORTNO=0 (to use port 0) or PORTNO=1 (to use port 1) to the CMS configuration file to avoid being prompted for the mode.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RHEL 5.4 Tech
Deep Dive
(Planned Features)

RHEL 5.4: Works In Progress

- This list includes items currently under development, and is **not** a commitment to include features.
  - Is there something you must have? Let us know! It only took two customer request to back-port NPIV into RHEL 4.8. Your feedback matters!
  - If you have a BugZilla account (it's free!), you can use this link to view latest information
  - Don't have an account? Sign up at http://bugzilla.redhat.com/
- **Expected ETA: Mid-Late 2009**

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RHEL 5.4: Works In Progress

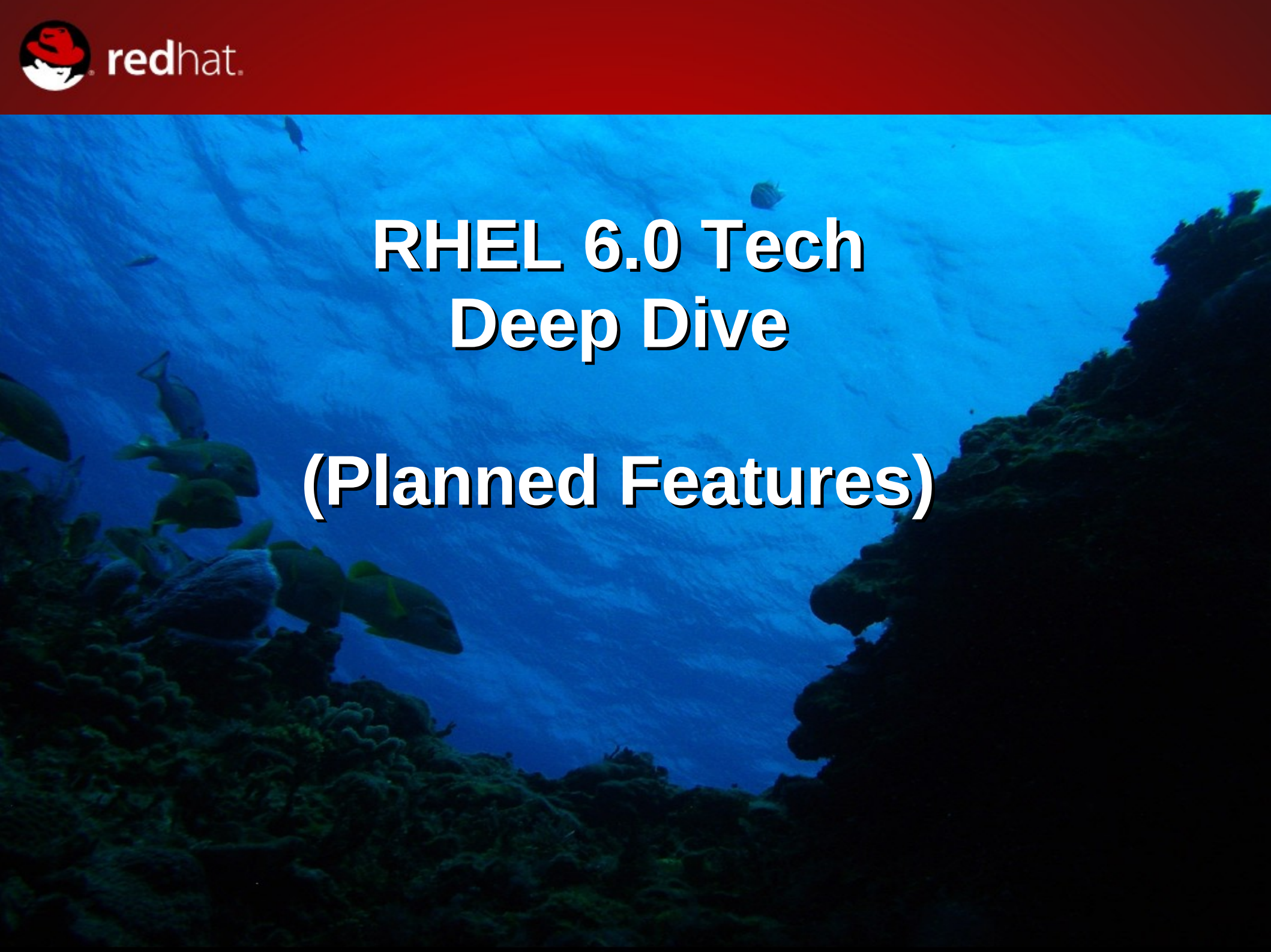
BugZilla	Feature Description
475345	[LTC 5.4 FEAT] Change list of Anaconda network alternatives to indicate supported devices on System z [201679]
475346	[LTC 5.4 FEAT] Improve checking mechanisms and workflow of Linux on System z Anaconda install process [201676]
475350	[LTC 5.4 FEAT] Dialog defaults for Linux on System z specific Anaconda [201677]
475358	[LTC 5.4 FEAT] Adjust Anaconda Swap recommendations to Linux on System z specifics [201680]
475520	[LTC 5.4 FEAT] Intuitive dump device configuration workflow and dialogue [201624]
475675	[LTC 5.4 FEAT] cio_ignore entry in generic.prm for LPARs [201085]
475677	[LTC 5.4 FEAT] Firstboot for System z [201092]
461288	[EMC 5.4 feat] Require kernel support to issue Control I/O to CKD dasd on EMC Symmetrix arrays
472936 [SEC]	extension of linuxrc.s390: improved workflow, dialog defaults, indicate supported network devices
474679	[LTC 5.4 FEAT] Dynamic CPU hotplug daemon for System z [201132]
474942	[LTC 5.4 FEAT] Add vmconvert option to vmur tool [201758]
475333	[LTC 5.4 FEAT] FCP - Performance Data collection & analysis (userspace) [201591]
475552	[LTC 5.4 FEAT] FCP - Performance data reports [201730]
475557 [SEC]	[LTC 5.4 FEAT] DS8000 Disk Encryption [201740]

RHEL 5.4: Works In Progress

BugZilla	Feature Description
475558	[LTC 5.4 FEAT] TTY terminal server over IUCV (userspace) [201735]
475564	[LTC 5.4 FEAT] Shutdown actions interface (userspace) [201748]
475569	[LTC 5.4 FEAT] Shutdown actions tools [201755]
475571	[LTC 5.4 FEAT] Large image dump on DASD [201752]
475670	[LTC 5.4 FEAT] Program directed IPL support - no XML in system dumper [200782]
477189	[LTC 5.4 FEAT] Pick up latest version of s390-tools
474646	[LTC 5.4 FEAT] Kernel NSS support - kernel part [200790]
474664	[LTC 5.4 FEAT] System z support for processor degradation [200975]
474688	[LTC 5.4 FEAT] Automatic IPL after dump (kernel) [201169]
475530	[LTC 5.4 FEAT] Extra kernel parameter via VMPARM [201726]
475551	[LTC 5.4 FEAT] TTY terminal server over IUCV (kernel) [201734]
475563	[LTC 5.4 FEAT] Shutdown actions interface (kernel) [201747]
475570	[LTC 5.4 FEAT] Provide service levels of HW & Hypervisor in Linux [201753]
475572	[LTC 5.4 FEAT] HiperSockets Layer3 support for IPv6 [201751]

RHEL 5.4: Works In Progress

475820	[LTC 5.4 FEAT] Linux to add Call Home data [201167]
477188	[LTC 5.4 FEAT] ETR support
475343	[LTC 5.4 FEAT] Provide CMS script for initial IPL under z/VM [201594]
475548	[LTC 5.4 FEAT] FCP - Performance data collection (blktrace) [201729]
475669	[LTC 5.4 FEAT] snIPL SCSI LOAD for LPAR [200787]
472764	let mkinitrd default to recreating the initrd for the currently running kernel
474912 [SEC]	[LTC 5.4 FEAT TRACKER] Web 2.0
474917	[LTC 5.4 FEAT] Web 2.0 - Inclusion of package 'mod_security' [201558]
474924	[LTC 5.4 FEAT] Web 2.0 - Inclusion of package memcached [201469]
474925	[LTC 5.4 FEAT] Web 2.0 - Inclusion of package Apache MyFaces Core
474926	[LTC 5.4 FEAT] Web 2.0 - Inclusion of package perl-CGI-Session [201471]
474927	[LTC 5.4 FEAT] Web 2.0 - Inclusion of package mysql-connector-java [201472]
474928	[LTC 5.4 FEAT] Web 2.0 - Inclusion of packages 'rubygems-actionwebservice' and 'rubygems-tzinfo' [201556]
474929	[LTC 5.4 FEAT] Web 2.0 - Inclusion of package 'rubygems-rake' [201554]
474930	[LTC 5.4 FEAT] Web 2.0 - Inclusion of packages 'rubygems-actionpack', 'rubygems-activerecord', 'rubygems-activesupport', 'rubygems-actionmailer' [201555]
474932	[LTC 5.4 FEAT] Web 2.0 - Inclusion of package rubygems [201465]
474933	[LTC 5.4 FEAT] Web 2.0 - Inclusion of package rubygem-rails [201466]
475334	[LTC 5.4 FEAT] FCP - Performance Data collection (kernel) [201590]
468172 [SEC]	FEAT: 201085: cio_ignore entry in generic.prm for LPARs


redhat.
RHEL 6.0 Tech
Deep Dive
(Planned Features)

RHEL 6.0: Works In Progress

- This list includes items currently under development, and is **not** a commitment to include features.
  - Is there something you must have? Let us know! It only took two customer request to back-port NPIV into RHEL 4.8. Your feedback matters!
  - If you have a BugZilla account (it's free!), you can use this link to view latest information
  - Don't have an account? Sign up at http://bugzilla.redhat.com/
- **Expected ETA: Early 2010**

RHEL 6.0: Works In Progress

462973	[LTC 6.0 FEAT] 201679:Change list of Anaconda network alternatives to indicate supported devices on System z
462974	[LTC 6.0 FEAT] 201677:Dialog defaults for Linux on System z specific Anaconda
462975	[LTC 6.0 FEAT] 201676:Improve checking mechanisms and workflow of Linux on System z Anaconda install process
463177	[LTC 6.0 FEAT] 201686:Installer - HiperSockets MAC Layer Routing Support
463180	[LTC 6.0 FEAT] 201687:Installer - QETH Componentization
463184	[LTC 6.0 FEAT] 201690:Installer - FCP LUN discovery tool
463187	[LTC 6.0 FEAT] 201688:Installer migration - Merge CTCMPC into CTC device driver
463831	[LTC 6.0 FEAT] 201764:Installer enhancement - FICON Hyper PAV enablement
463564	[LTC 6.0 FEAT] 201092:Firstboot for System z
462976	[LTC 6.0 FEAT] 201674:Pick up latest version of s390-tools
462977	[LTC 6.0 FEAT] 201675:Pick up latest version of libica
463208	[LTC 6.0 FEAT] 201730:FCP - Performance data reports
463560	[LTC 6.0 FEAT] 201132:Dynamic CPU hotplug daemon for System z
463688	[LTC 6.0 FEAT] 201591:FCP - Performance Data collection & analysis (userspace)
463707	[LTC 6.0 FEAT] 201735:TTY terminal server over IUCV (userspace)

RHEL 6.0: Works In Progress

463806	[LTC 6.0 FEAT] 201748:Shutdown actions interface (userspace)
463812	[LTC 6.0 FEAT] 201752:Large image dump on DASD
463822	[LTC 6.0 FEAT] 201757:Automatic IPL after dump (userspace)
463823	[LTC 6.0 FEAT] 201758:Add vmconvert option to vmur tool
463826	[LTC 6.0 FEAT] 201754:Extend lstape to support SCSI tapes
463650	[LTC 6.0 FEAT] 201303:Provide a utmp format that is compatible between 32 and 64 bit.
463795	[LTC 6.0 FEAT] 201184:Provide DFP hardware accelerated libgcc
463796	[LTC 6.0 FEAT] 201183:System z optimizations for gcc 2007
463830 [SEC]	[LTC 6.0 FEAT] 201765:Compiler- Architecture Level Set for IBM System z9 and newer
463541	[LTC 6.0 FEAT] 201066:QETH Componentization
463583	[LTC 6.0 FEAT] 201162:CMM2 Merge for Upstream Integration (Full version)
463601	[LTC 6.0 FEAT] 201171:FCP Automatic Port Discovery
463602	[LTC 6.0 FEAT] 201169:Automatic IPL after dump
463678	[LTC 6.0 FEAT] 201546:FCP - code cleanup stage 2
463679	[LTC 6.0 FEAT] 201545:FCP - code cleanup stage 1

RHEL 6.0: Works In Progress

463689	[LTC 6.0 FEAT] 201590:FCP - Performance Data collection (kernel)
463692	[LTC 6.0 FEAT] 201593:Sysplex Timer Protocol Support
463694	[LTC 6.0 FEAT] 201592:Exploitation of DCSSs above 2G
463695	[LTC 6.0 FEAT] 201723:Kernel Message Catalog autogeneration - Stage 1: infrastructure
463696	[LTC 6.0 FEAT] 201728:Secondary unicast addresses for qeth layer2 devices
463697	[LTC 6.0 FEAT] 201725:Pre-allocated headers for HiperSockets (qeth driver)
463698	[LTC 6.0 FEAT] 201727:Kernel Message Catalog autogeneration - Stage 3: DASD, tape, QETH and CIO
463699	[LTC 6.0 FEAT] 201726:Extra kernel parameter via VMPARM
463700	[LTC 6.0 FEAT] 201724:Kernel Message Catalog autogeneration - Stage 2: all s390 drivers and s390 arch. code except for DASD, tape, CIO and QETH
463706	[LTC 6.0 FEAT] 201736:Suport for HiperSockets Sniffer
463708	[LTC 6.0 FEAT] 201734:TTY terminal server over IUCV (kernel)
463710	[LTC 6.0 FEAT] 201743:FCP - SCSI error recovery hardening
463799	[LTC 6.0 FEAT] 201747:Shutdown actions interface (kernel)
463804	[LTC 6.0 FEAT] 201750:HiperSockets enhanced SIGA
463805	[LTC 6.0 FEAT] 201749:I/O dynamic configuration support
463811	[LTC 6.0 FEAT] 201753:Provide service levels of HW & Hypervisor in Linux
463825	[LTC 6.0 FEAT] 201756:Linux support for dynamic memory attach

RHEL 6.0: Works In Progress

463832	[LTC 6.0 FEAT] 201759:Extra kernel parameter for SCSI IPL
462957	[LTC 6.0 FEAT] 201598:FCP - HBA API followup for upstream
463282	[LTC 6.0 FEAT] 201167:Linux to add Call Home data
463665	[LTC 6.0 FEAT] 201472:Web 2.0 - Inclusion of package mysql-connector-java
463666	[LTC 6.0 FEAT] 201469:Web 2.0 - Inclusion of package memcached
463667	[LTC 6.0 FEAT] 201471:Web 2.0 - Inclusion of package perl-CGI-Session
464179	[LTC 6.0 FEAT] 201729:FCP - Performance data collection (blktrace)
464229	[LTC 6.0 FEAT] 201180:Inclusion of libdfp
463393	[LTC 6.0 FEAT] 200303:ADTools Oprofile Java Profiling Enhancements
463219	[LTC 6.0 FEAT] 201744:Cleanup of libICA Crypto library
462969	[LTC 6.0 FEAT] 201666:ZFCP Performance Statistics - blktrace (userspace part)
253776	[s390] boot from NSS support
463609	[LTC 6.0 FEAT] 201185:Iconv character Conversion Routines Speedup.
224414 [SEC]	HAL crashes on LPAR with thousands of devices
462953	[LTC 6.0 FEAT] 201594:Provide CMS script for initial IPL under z/VM
463616	[LTC 6.0 FEAT] 201187:Binutils: Decimal Floating Point support - PFPO
463617	[LTC 6.0 FEAT] 201186:Binutils: Decimal Floating Point support

RHEL 6.0: Works In Progress

463604	[LTC 6.0 FEAT] 201179:Decimal Floating Point support in gcc backend - PFPO
463605	[LTC 6.0 FEAT] 201178:Decimal floating point support in gcc backend (HW support)
463606	[LTC 6.0 FEAT] 201177:Decimal floating point support in gcc backend (SW support)
463455	[LTC 6.0 FEAT] 200785:Improved handling of dynamic subchannel mapping
463516	[LTC 6.0 FEAT] 200855:Linux on System z: Enhanced Linux System Layout
463518	[LTC 6.0 FEAT] 200789:ETR support
463532	[LTC 6.0 FEAT] 201000:FICON: Hyper PAV enablement
463535	[LTC 6.0 FEAT] 200975:System z support for processor degradation
463537	[LTC 6.0 FEAT] 200994:Linux CPU Node Affinity
463551	[LTC 6.0 FEAT] 201064:Standby cpu activation/deactivation.
463552	[LTC 6.0 FEAT] 201065:Modularization of qdio and thin interrupt layer
463553	[LTC 6.0 FEAT] 201067:In-kernel crypto generic algorithm fallback
463559	[LTC 6.0 FEAT] 201140:Standby memory add via SCLP
463584	[LTC 6.0 FEAT] 201159:System z ZFCP Performance Statistics
463603	[LTC 6.0 FEAT] 201168:Linux Support for Dynamic Memory Detach
463607	[LTC 6.0 FEAT] 201176:Merge CTCMPC into CTC device driver for upstream integration
463677	[LTC 6.0 FEAT] 201579:Linux struct page elimination

RHEL 6.0: Works In Progress

463681	[LTC 6.0 FEAT] 201542:FCP - Enhanced Trace Facility
463813	[LTC 6.0 FEAT] 201751:HiperSockets Layer3 support for IPv6
463608	[LTC 6.0 FEAT] 201175:Support for Eclipse IDE Plattform
463704	[LTC 6.0 FEAT] 201739:CMM2 Lite
463178	[LTC 6.0 FEAT] 201680:Adjust Anaconda Swap recommendations to Linux on System z specifics
463186	[LTC 6.0 FEAT] 201689:Installer - FCP automatic port discovery
463218	[LTC 6.0 FEAT] 200092:(big) Install from SCSI/FCP attached CD/DVD
463544	[LTC 6.0 FEAT] 201085:cio_ignore entry in generic.prm for LPARs
463824	[LTC 6.0 FEAT] 201755:Shutdown actions tools
464236	[LTC 6.0 FEAT] 201180:Decimal Floating Point Support in glibc
463575	[LTC 6.0 FEAT] 201157:ZFCP Performance Statistics - blktrace
463662	[LTC 6.0 FEAT] 201465:Web 2.0 - Inclusion of package rubygems
463668	[LTC 6.0 FEAT] 201470:Web 2.0 - Inclusion of package Apache MyFaces Core (JSR 252 - JSF implementation - recommended Version 1.1.x)
463669	[LTC 6.0 FEAT] 201466:Web 2.0 - Inclusion of package rubygem-rails

Upstream Kernel Development

Generic Kernel 1/4

- **Virtual Memory**
  - Scalability – 1TB ram, 1G page table support (AMD)
  - Scatter list IO support for large page sizes
  - Queued spinlocks – protects large non-numa configs from contention starvation (database stalls)
  - Replicated readonly page cache for NUMA (ie tetx for filesystem backend pages).... very experimental
  - IO throttling – scaling IO device speed to RAM sizes & speed
  - SLUB allocator to scale for large CPU counts
  - Transactional memory – charger member in Velox
- **CFS (completely fair scheduler)**
  - Realtime priority
  - Beneficial for high computer bound, large # of thread
  - Improved network latency
  - Group scheduling – process groups, constrained to cpu sets

Upstream Kernel Development

Generic Kernel 2/4

- **Scalability**
  - Private futexes – avoiding data structure contention (glibc & kernel)
  - Syslets – async syscalls

- **Realtime** – goal of consistency, low-latency determinism (incl in Red Hat MRG product)

- **Storage Enhancements**
  - Seamless SAN/NAS – ease of use / config – make as easy to use as local disks. Enhanced iSCSI config in installer/boot

  - LVM Layering – combinations
    - Striping (raid0) + mirroring (raid1) = raid10
    - Snapshot & mirroring
    - Remote replication – remote copy asynchronous, journaled resync (experimental, feedback welcome)

Upstream Kernel Development

Generic Kernel 3/4

- **Virtualization (distributed)**
  - KVM
  - Paravirt Ops
- **Power Management Work Areas**
  - Tickless kernel – avoid clock tick 1000/sec – allowing true idle
  - Kernel & user space APIs to align timers
  - PowerTOP – useful in identifying “hot” applications
    - Iterative process of cleaning up apps
  - Reworking system startup
    - Only start services / devices as needed
    - Stop idle services

Upstream Kernel Development

Generic Kernel 4/4

- **Ongoing Work Areas**
  - *Security*
    - Hardware drivers, fingerprint readers
    - Runtime tamper checks
    - SHA256 standardized encryption algorithm usage throughout all core services
    - SELinux usability enhancements
    - NFS v4 extended attribute support, allowing SELinux operation

Open Discussion / Q&A