SUSE Linux Enterprise Server for System z

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Agenda

- Why are customers interested in Linux on the mainframe?
- The history of SLES and System z
- Differentiating SLES and RHEL for System z
- Whats new in SLES11 SP1
- What are customers saying about SLES for System z?

Why are customers interested in Linux on the mainframe?

Example #1: Server Consolidation
Basic Scenario

- A new client required us to build ~50 Linux systems on Intel-based server class equipment.
- A much smaller number of Windows and Solaris systems were also to be built.
- Due to the client's promises to others, we had 2 months to get everything installed and in production.
- The systems were all going to be remote from where any of the Linux system administrators were located.
- A number of other bidders on the contract refused to commit to the 2-month timeframe.
- The project had upper management “visibility.”

Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

Distributed Hardware Costs for 3 years

- 27 Production Systems
  - 27 additional GIGe NICs
  - 254GB RAM
  - 75 Processors (3.33 and 3.4 GHz)
  - 115 Internal 72GB SCSI disks
- 17 Development Systems
  - 17 additional GIGe NICs
  - 146GB RAM
  - 52 Processors (3.33 and 3.4 GHz)
  - 75 Internal 72GB SCSI disks
- 7 Test Systems
  - 7 additional GIGe NICs
  - 96GB RAM
  - 18 Processors (3.33 and 3.4 GHz)
  - 28 Internal 72GB SCSI disks

- HBAs for SAN storage – 56
- Fibre cables for SAN – 56
- RAM expansion boards – 37
- External 72GB disks for alternate boot drives – 37
- External disk enclosures – 19
- SCSI cards for external disk access – 37
- Mezzanine riser cards – 37
- Rack units (42u) – 13 (78 sq. ft. without service clearance)
- Power distribution units – 26
- Switch ports – 204
- Ethernet cables – 204
- SAN switch ports - 56
- Hardware support 24x7 – 27 (+10 for ext. storage)
- Hardware support 13x5 – 24 (+9 for ext. storage)

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Distributed Hardware Costs for 3 years = $1,212,130.55

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Distributed Software Licensing Costs for 3 years

- Test and Development
  - 29 Oracle database (licensed per processor)
  - Oracle maintenance 22% of purchase price per year
  - 24 (3-year) Linux, including 9x5 support

- Production
  - 44 Oracle database (licensed per processor)
  - Oracle maintenance 22% of purchase price per year
  - 27 (3-year) Linux, including 24x7 support
  - 2 clustering software

Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

Distributed Software Licensing Costs for 3 years = $5,077,789.74

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Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

Total Cost of Distributed for 3 years

Hardware	-	$1,212,130
Software	-	$5,077,789
Power and Cooling	-	$107,627
Floor Space	-	$150,064
Distributed Total	-	$6,547,610

Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

System z Hardware Costs for 3 years

- z9 EC (2094-S18)
  - 1 CP (Oddity due to IBM Pricing Policy)
  - 2 IFLs
  - 256GB RAM (16x16GB cards, requires 2 books)
  - 2 FICON Cards = 8 Ports/Channels
  - 2 FCP Cards = 8 Ports/Channels
  - 2 OSA-Express2 1000Base-T
- DASD (DS8100)
  - 4 TB ECKD
- Hardware support 24x7 – 2 (The z9 and DASD)
- Ethernet Switch Ports – 4
- Ethernet cables – 4
- Fiber cables for FICON DASD – 8
- Fiber cables for SCSI over FCP - 8

Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

System z Hardware Costs for 3 years = $3,575,096

- z9 EC (2094-S18)
  - 1 CP (Oddity due to IBM Pricing Policy)
  - 2 IFLs
  - 256GB RAM (16x16GB cards, requires 2 books)
  - 2 FICON Cards = 8 Ports/Channels
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System z Software Licensing Cost for 3 years

- Software licensing, including support and maintenance
  - 2 – z/VM
  - 2 – Linux
  - 2 - Oracle
  - 2 - Dirmaint
  - 2 - z/VM Performance Monitor

Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

System z Software Licensing Cost for 3 years = $309,080

- Software licensing, including support and maintenance
  - 2 – z/VM
  - 2 – Linux
  - 2 - Oracle
  - 2 - Dirmaint
  - 2 - z/VM Performance Monitor

Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

Mainframe versus Distributed Costs

Category	Unrealistic	More Realistic
Hardware	$5,295,092	$3,575,096
Software	$309,080	$309,080
Power and Cooling	$26,345	$26,345
Floor Space	$38,742	$38,742
Mainframe Total	$5,669,259	$3,949,263
Distributed Total		$6,547,610

Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

Cost Comparison Over 5 Years

Category	Unrealistic	More Realistic
Hardware	$5,555,492	$3,835,496
Software	$458,960	$458,960
Power and Cooling	$43,908	$43,908
Floor Space	$64,570	$64,570
Mainframe Total	$6,122,930	$4,402,934
Distributed Total		$8,204,091

Source: Linux on System z – Choose the right architecture and save millions, 2008 BrainShare Presentation, Mark Post

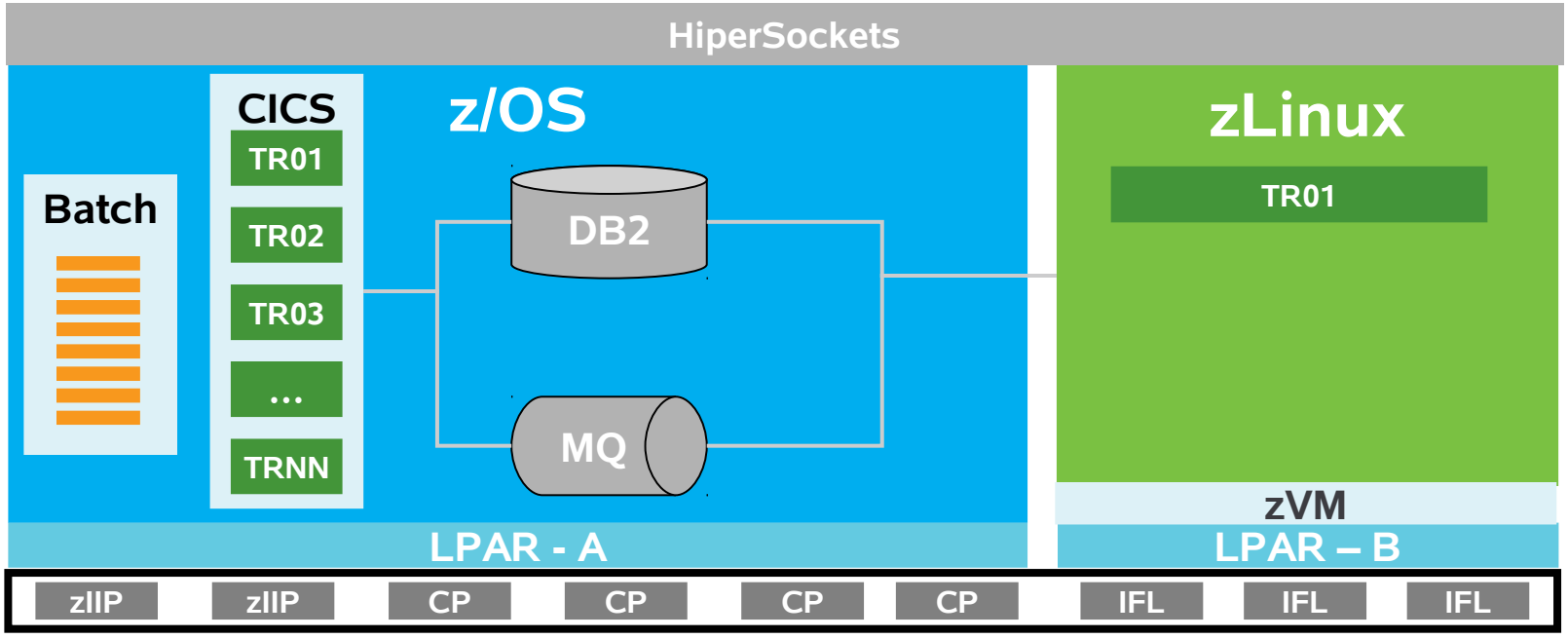
Example #2: Mainframe Optimization (MFO)

- MFO focuses on **Reducing Costs** while mitigating **Operational Risk**
- A typical mainframe (>2,000 MIPS) can start to **save millions** of dollars **annually**, and have savings in **under 6 months**
- Major savings come from transitioning z/OS-based processing (Java, CICS transactions, Batch COBOL, PL/1) to SUSE Linux running on IFL specialty engines
- Additional benefits can be attained by **consolidating** distributed workloads on to IFLs, including:
  - Databases (e.g., Oracle, DB2 UDB, Informix)
  - Application Servers
  - SAP
  - .NET applications (using MONO)

Migration Path Example

Keep the risk low – start by moving batch jobs or one CICS transaction at a time

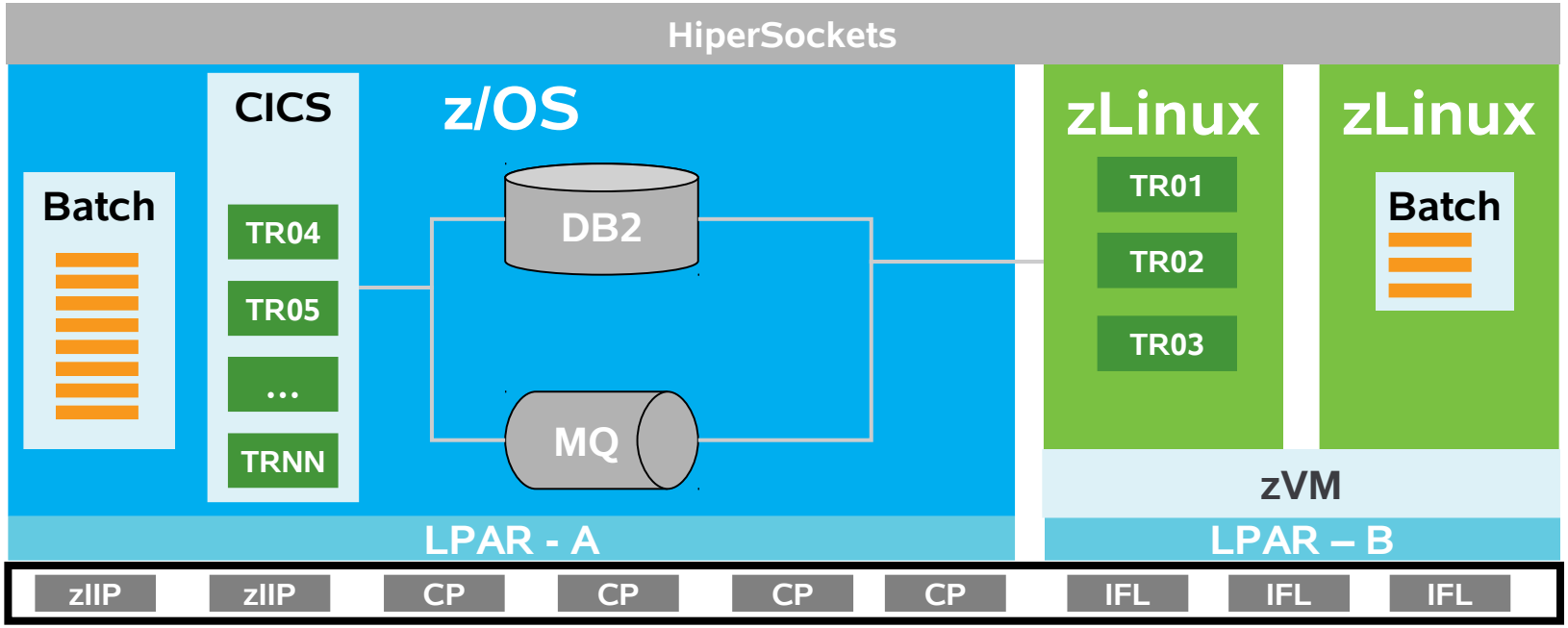
- Enable the work to be done in both the “new” and the “old” world – only process a fraction of the workload under Linux to start
- Test out the operations in the “new” world and build confidence that the new platform can handle the transaction and the load and meet service levels
- Add transactions and volume as experience grows



Future State

Migrate only the code with a good return on investment

- CICS and Batch code can be moved
- Some of the CICS transactions may remain (the cost of migration may be higher than the benefit). COBOL source code is identical, although some minor changes may be required to run under both z/OS and zLinux
- Other z/OS processing may be migrated. MQ can be readily migrated. DB2 can be migrated to DB2 UDB (with effort and some loss of functionality)



Where do the savings come from?

Real world IBM software costs

IBM (Z9 503) – 1103 MIPS

Areas	Total (annual)	Cost/MIP
• DB2	$324,000	$294
• IMS-DB	$285,228	$259
• IMS-DC	$324,576	$294
• z/OS / MVS	$775,440	$703
• Cobol	$30,000	$27
• Devel Tools	$175,000	$159
• CA-7&8	$450,000	$408
• Misc.	$420,000	$381
	$2,784,244	$2,525

Note: some software was not under software maintenance anymore

Easy metric:
Expect savings of ~$2-2.5K per MIP moved. z9 CP has 400 MIPS = $1M / yr savings

The history of SLES and System z

Five Years Ahead of Competition
System z Historic Milestones

1999	SUSE and IBM started engineering cooperation; since then IBM engineers and SUSE / Novell engineers cooperate very tightly on the basis of an excellent relationship.
2000	First SUSE Linux Enterprise Server launched for IBM Mainframes
2001	SUSE and IBM base their cooperation on a formal agreement for the delivery of SUSE Linux Enterprise Server for IBM's hardware architectures and worldwide support.
2002	SAP certified SUSE Linux Enterprise Server for System z; first customer deployments followed in the same year.
2003	SUSE Linux Enterprise Server achieved Common Criteria certification for all supported IBM architectures (upto EAL4+ level)
2004	From 2000 until 2004, IBM's Linux Impact Teams and SUSE's Linux experts joined forces in a joint project office, to counsel our customers with the maximum expertise for their Linux on Mainframe business
2005	
2006	Novell/SUSE and IBM entered into a formal global strategic alliance
2007 - 2008	Novell/SUSE launches our 5th generation (code 10) of SUSE Linux Enterprise Server for IBM system z, now including a Starter System that makes POCs and evaluations much easier
Today	With massive investments into ISV enablement, SUSE Linux Enterprise Server becomes the *Linux application leader*, with the broadest software support of any Linux distribution. In addition, IBM and Novell work together to bring new workloads to the mainframe, such as .NET based applications running on Novell's Mono runtime environment.
	With a share of 80%+, Novell/SUSE continues as the #1 Enterprise Linux for IBM Mainframes

SUSE® Linux Enterprise Server – Mainframe success

- **Starting in 1999,** SUSE GmbH started their cooperation with IBM and the Marist College to move the available Linux code into an Enterprise ready Linux distribution - Since then SUSE took over the responsibility for Linux on System z.
- **2010 is the 10 Year Anniversary of Linux on the Mainframe - Available since 2000:** SUSE Linux Enterprise Server for System z is available to customers since 2000, either through IBM or directly through SUSE.
- **100% market share in 2004:** Entering this new market SUSE Linux Enterprise Server was the only available enterprise-class Linux, which was maintained and supported and which delivered the Reliability, Availability and Scalability (RAS) as expected by IBM´s Mainframe customers.
- **80+% market share in 2009:** Although other enterprise-like Linux offerings entered the market, Novell with SUSE Linux Enterprise Server clearly leads the Linux Mainframe market with a share of more than 80%
- **SUSE Linux Enterprise Server is the best choice for running SAP on zLinux**
- **ISV application portfolio is strong for System z**

Client Adoption Drives Linux Success

*Installed Linux MIPS at 50% CAGR**

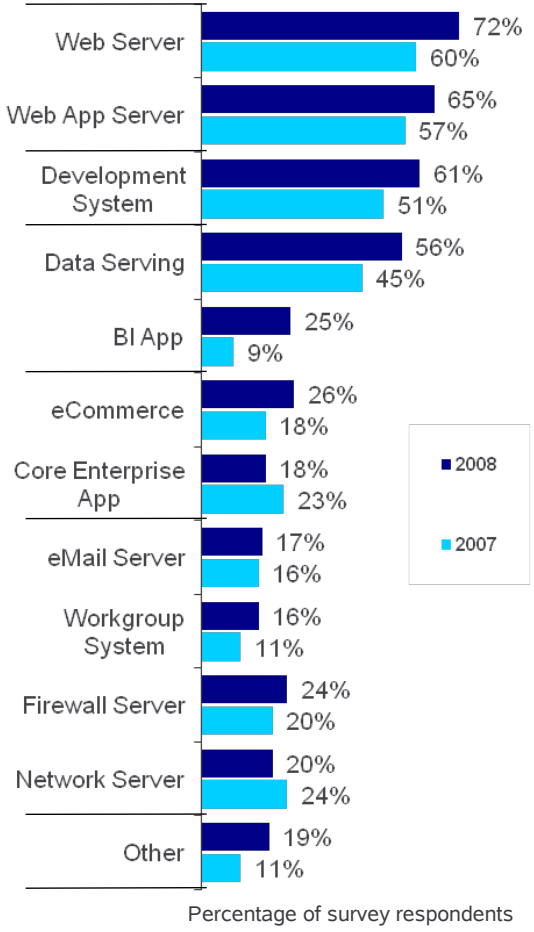
- **The momentum continues:**
  - Shipped IFL engine volumes increased 62% from 3Q07 to 3Q09
  - Shipped IFL MIPS increased 100% from 3Q07 to 3Q09
- **Linux is 16% of the System z customer install base (MIPS)**
- **70% of the top 100 System z clients are running Linux on the mainframe**
- **More than 3,000 applications available for Linux on System z**

Consolidation Ratios

- Consolidation benefits go beyond hardware costs
- Results vary based on workload and implementation

Customer	Distributed Servers	IFLs	Ratio
Nationwide	450+ (x86)	21	21:1
First National Bank of Omaha	40 (Sparc)	5	8:1
Government of Quebec	27 (x86) +22*	3	16:1

Consolidate What?



Surveys indicate IBM System z® customers use Linux for:

- Web Serving and Web Application Serving
- Data Serving
- Systems Development

"Best Fit" Workloads for Linux on System z:

- **Business connectors**: WebSphere® MQSeries®, DB2® Connect, CICS® Transaction Gateway, IMS™ Connect for Java™
- **Business critical applications**: e.g. SAP
- **Development and test** of WebSphere and Java applications
- **WebSphere Application Server** (WAS)
- **Email & collaboration**: Domino™, Web 2.0
- **Network Infrastructure**: FTP, NFS, DNS, etc. and Comm Server and Communications Controller for Linux, Communicate Pro (VoIP)
- **Data services**: Cognos®, Oracle, Informix®, Information Server, Builders WebFOCUS
- **Applications requiring top end disaster recovery model**
- **Virtualization and Security Services**

Source: IBM Market Intelligence

Consolidation Candidates

Best Fit Applications

Best fit applications are those that leverage the classic strengths of System z servers:

- High availability
- High I/O bandwidth capabilities
- Data exchange using shared memory or fast interconnects such as HiperSockets

Good Fit Applications

Good fit applications are applications which are optimized for SUSE® Linux Enterprise Server for System z, but also runs well on other architectures, such as x86 and POWER*.

- TCO
- Application availability on Linux
- Politics within the organization

Why SLES for System z

Why SUSE® Linux Enterprise Server for System z

- Market share leadership = 80+%
- Tools to easily deploy SUSE Linux Enterprise Server for System z on mainframes
- Strategic relationship with IBM—working with IBM on Linux for the mainframe since about 1999
- Many applications supported on System z
- Work closely with the IBM Chiphopper program
- First SAP certified solution stack on Linux for mainframe
- Many new capabilities included in major releases and SPs
- Virtualization pricing is very attractive to customers!!

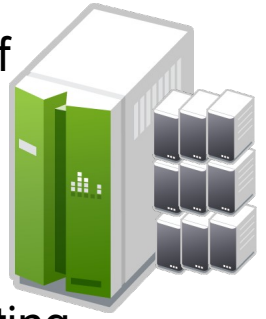
Service Pack 3 Features Summary
SUSE Enterprise Server 10 for System z

- Update s390-tools to version 1.8.1
- 2 OSA Ports per CHPID Support
- Selective Logging of ECKD DASD devices
- Large image dump on DASD (use multi-volume)
- DS8000: Large volume support and Disk Encryption
- Crypto Hardware Enablement Device Driver Support - toleration
- Long Random Numbers Generation
- AF_IUCV SOCK_SEQPACKET support
- HiperSocket Layer 3 support for Ipv6
- *... and many more ... (please consult release notes for details)*

SUSE® Linux Enterprise Server 11 for System z
New Features in GA Version

- **Dynamic add/remove of CPU and memory:** resources of a Linux guest under z/VM can be adjusted while running. A pool of CPUs are dynamically given to a Linux guest and used as needed

- **Vertical CPU management:** helps get the most performance out of System z10 servers by being aware of the server's NUMA characteristics



Linux CPU Node Affinity: improves performance by scheduling processes to the optimal node where the CPU is associated, exploiting the new System z10 CPU node topology

Enhanced HiperSocket support: Additional Layer 2 support for IPV4 and support for IPV6

- **Modularization of qdio and thin interrupts:** Make the thin interrupt layer independent from qdio and improve the code layering in the qdio module. This provides for additional performance enhancements.

= SLES unique feature

SUSE® Linux Enterprise Server 11 for System z
New Features in GA Version (c´d)

Higher performance analysis in the disk subsystem: gives performance analysts the same type of view into SCSI over Fibre Channel Protocol that they have with mainframe Direct Access Storage Devices (DASD)

Large page support: enables better performance with large memory footprints like in Java or database workloads by exploiting new System z10 large memory pages (1MB)

★ **Cross architecture debugging:** System z core dumps can be analyzed on x86 systems, negating the need for a duplicate System z server

★ **I/O configuration support:** (available only on LPAR) Adds the infrastructure to allow Linux system to change the I/O configuration of a System z system.Operations are addition, removal and reconfiguration/reassignment of I/O channels, control units and subchannels.

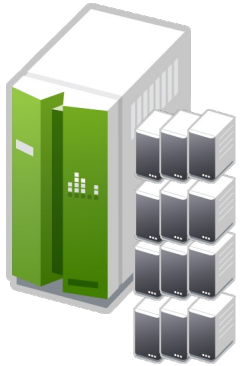
★ = SLES unique feature

SUSE® Linux Enterprise Server 11 for System z
New Features in Service Pack 1

Suspend / Resume support: stop a running instance and later continue operations. A suspended Linux instance does not require memory or processor cycles. gives you better performance, resource utilization, and power savings

Automatic IPL after dump: extension to the shutdown action interface which combines the actions dump and re-ipl, helps increase availabity and minimize downtime, as well as keep management and service costs low

DS8000 support- Large volume support architecture: use use one large volume, instead of multiple small volumes, for your large amount of data. You no longer need to combine and manage various small disks anymore. This gives you much better performance and data consolidation.



Support of HPF TCW command interface in DASD driver configuration support: increases performance for database serving

★ = SLES unique feature

SUSE® Linux Enterprise Server 11 for System z
New Features in Service Pack 1 (c´d)

Next generation crypto HW device driver exploitation: new System z crypto hardware features and performance improvements are exploited by SUSE Linux Enterprise Server for System z. Hardware-driven crypto acceleration functions help reduce operations and maintenance costs.

AF_IUCV SOCK_SEQPACKET support: improves close collaboration between SUSE Linux Enterprise Server for System z and z/VM in the networking area. This provides better performance for intra machine / VM communication.

TTY terminal server over IUCV: provides central access to the Linux console for the different guests of a z/VM. Fullscreen applications like *vi* are usable on the console.

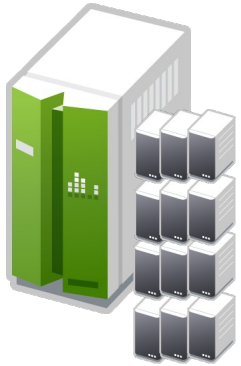
= SLES unique feature

SUSE® Linux Enterprise Server 11 for System z
New Features in Service Pack 1 (c´d)

s390-tools enhancements: package with a set of user space utilities. It is the essential tool chain for Linux on System z and contains everything from the boot loader to dump-related tools for a system crash analysis

★ **System z kernel features – message documentation:** Cleanup messages in System z related code, script to generate a man page for every kernel message

★ **FCP adjustable queue depth:** Customizable queue depth for SCSI commands in zfcp. In the past was at constant 32 queue entries. Improves performance

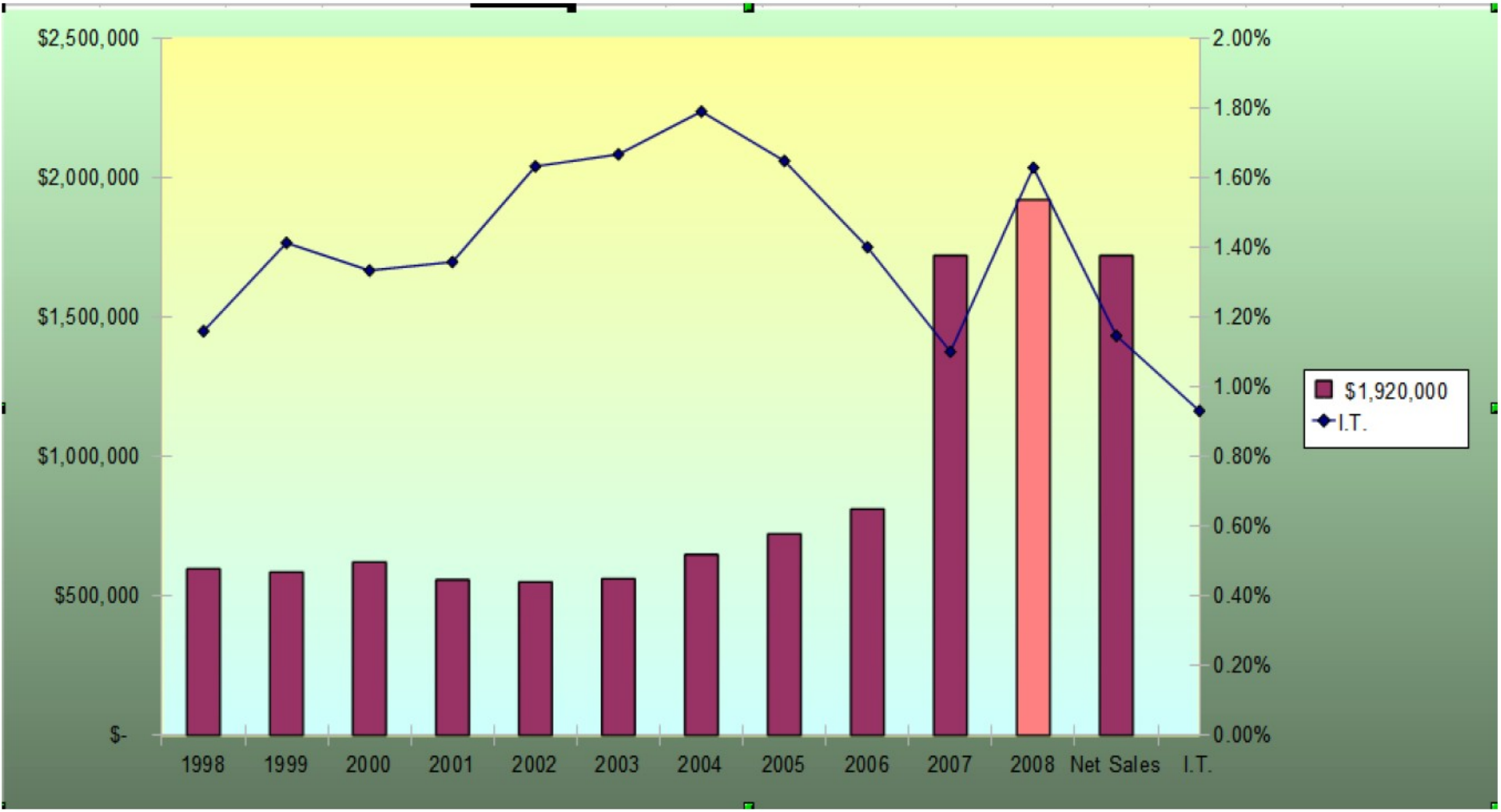


★ = SLES unique feature

What are customer saying about SLES for System z?

Baldor Electric

Net Sales vs. I.T. Percentage of Sales



Source: System Z – Linux at it's best, 2009 System z Expo, Mark Shackelford - Baldor

Baldor Electric

Industry View of a World Class Data Centers

Source: System Z – Linux at it's best, 2009 System z Expo, Mark Shackelford - Baldor

Baldor Electric's
World Class Data Center

Source: System Z – Linux at it's best, 2009 System z Expo, Mark Shackelford - Baldor

US Postal Service

CICS Migration

Workloads	•CICS transactions under z/OS
Business Issues	•Large growth in transaction volume (25% year-over-year) •High operating costs •Very “visible” application
Novell® Solution	•SUSE® Linux Enterprise Server •Accenture Mainframe Optimization Services •MicroFocus COBOL running on SUSE Linux Enterprise •IBM System z10 with IFLs
Results	•First year savings of more than $10M •Projected savings of $100+ million in the next five years •Continued use of DB2, Parallel Sysplex with z/OS •Better use of zIIP engines •Plans to move other components (Batch, MQ)


Novell®