



Linux @ IBM

Linux Platform Options – Selecting Linux on IBM System z9 and zSeries



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Manager – System z9 and zSeries Operating Systems

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ibm.com/vm/devpages/jelliott





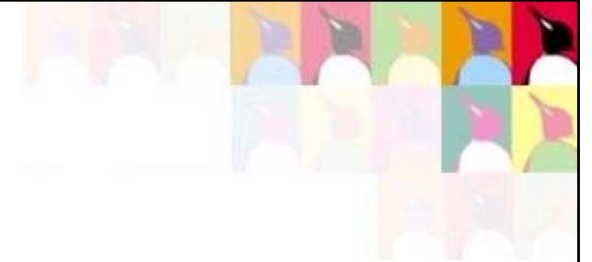
Selecting Linux on System z9 and zSeries

Session 9202

- **Datacenters planning to adopt Linux have a key architectural choice to make in designing large-scale implementations.**
- **Is the best approach to running Linux scale-out with rack-optimized servers, to scale-up with large SMP servers, or use virtualization facilities to run many images on a single server?**
- **In this session, Jim will examine the different options and their respective advantages and disadvantages and discuss some guidelines for making this critical choice based on workload and application requirements.**
- **For many users, Linux on System z9 and zSeries may be the optimal choice.**
- **Jim will describe how Linux on System z9 and zSeries, in combination with z/VM, will provide a robust Linux environment which integrates well with z/OS.**



Linux @ IBM



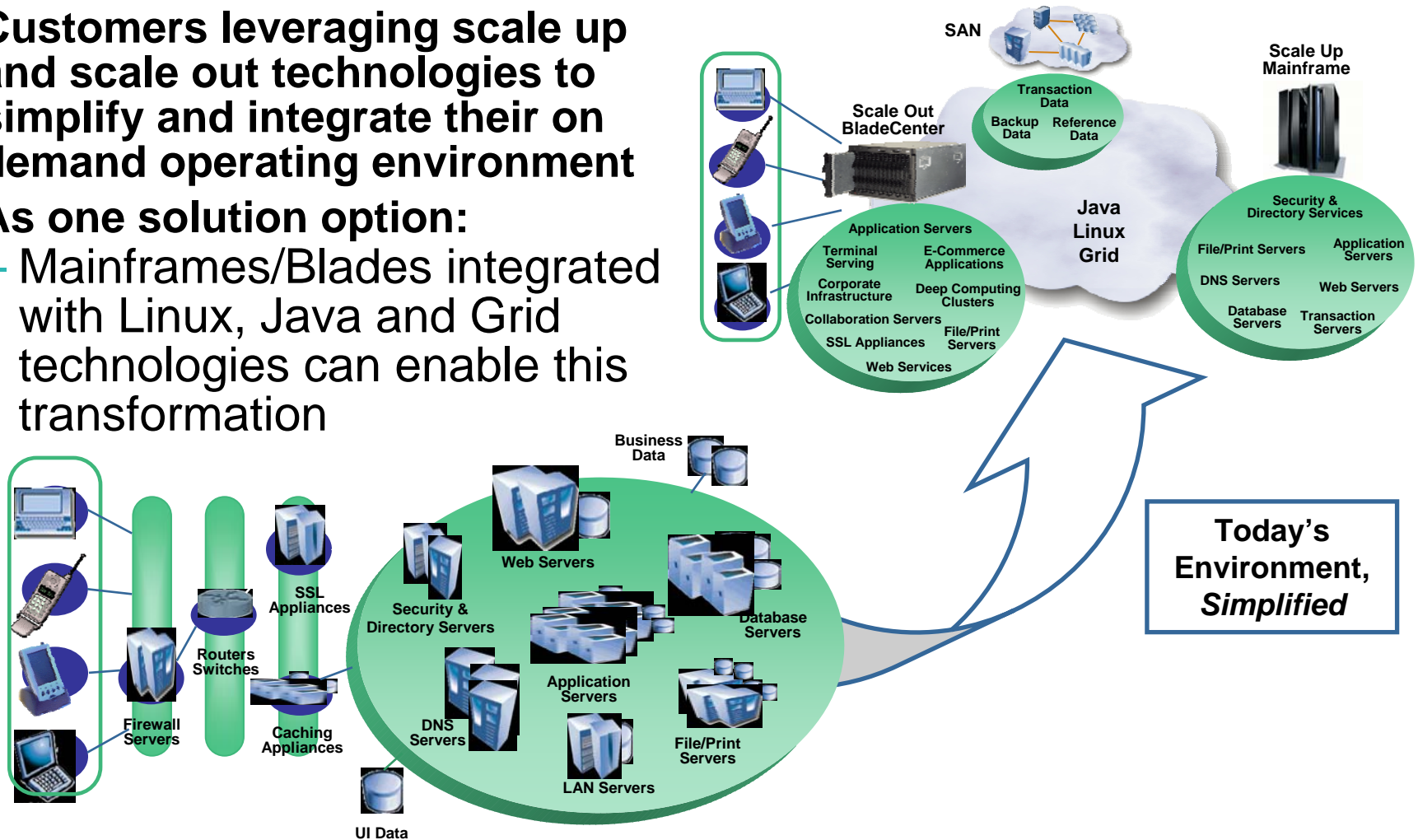
Scale-Up, Scale-Out, Virtualization



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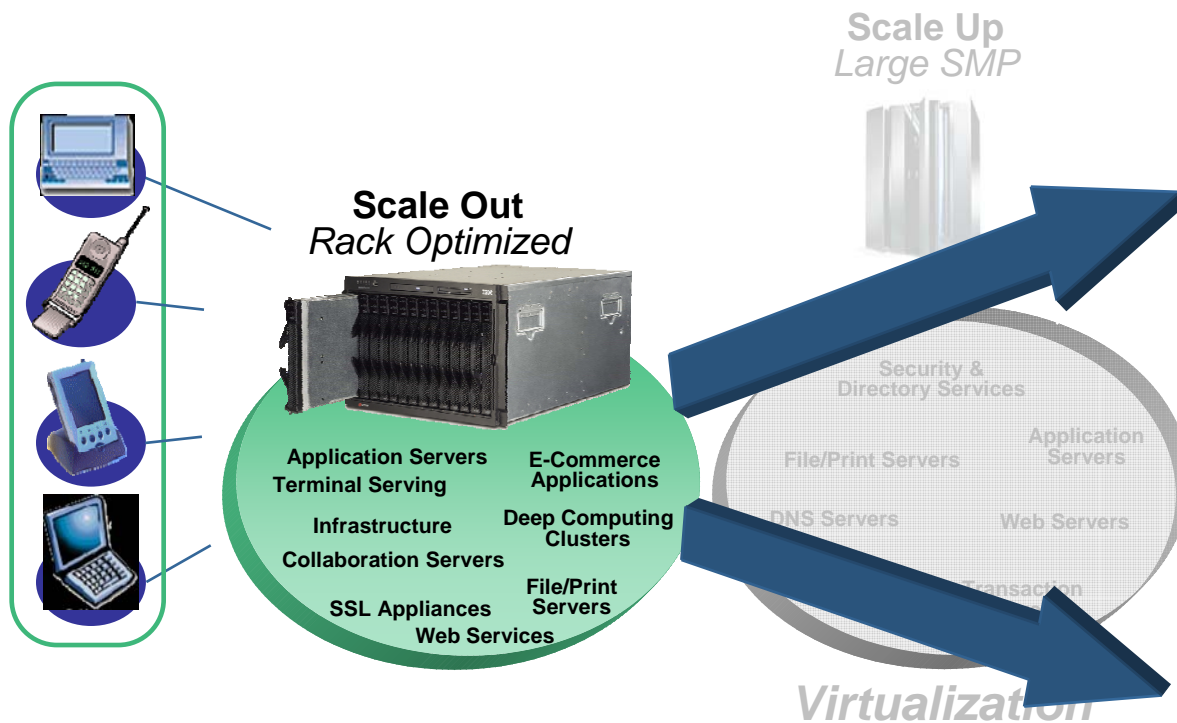
Infrastructure Simplification

- Customers leveraging scale up and scale out technologies to simplify and integrate their on demand operating environment
- As one solution option:
 - Mainframes/Blades integrated with Linux, Java and Grid technologies can enable this transformation





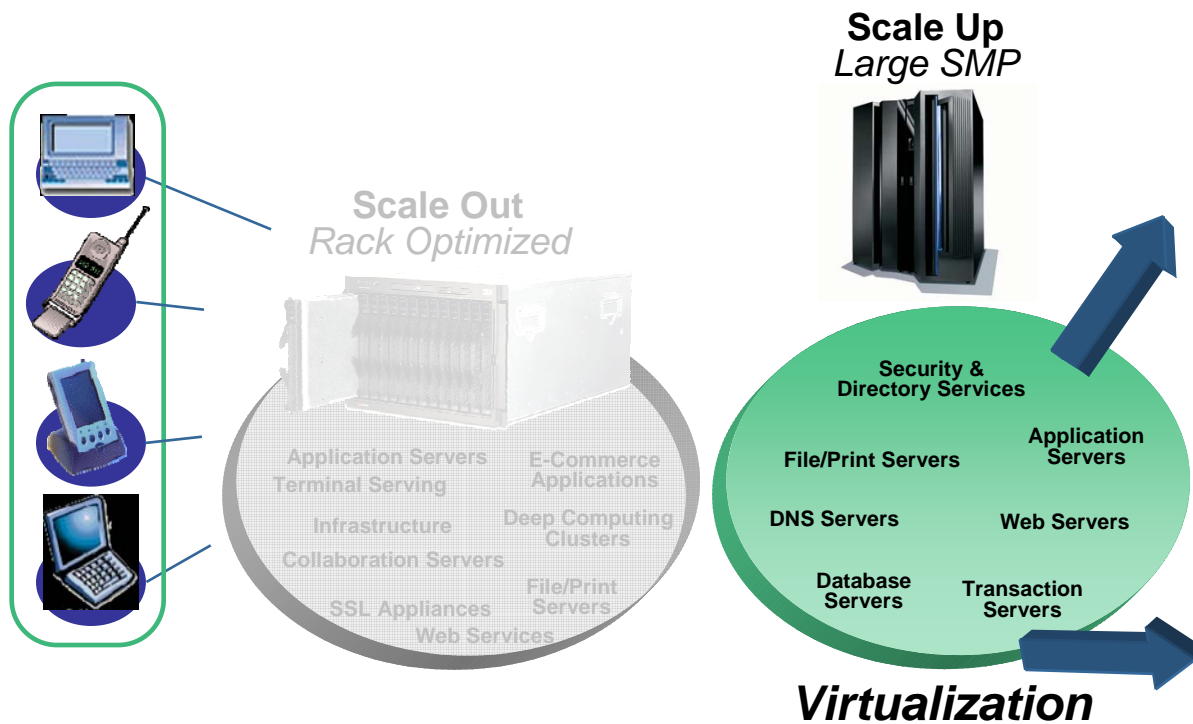
Ideal rack optimized implementations



- **Clustered workloads**
- **Distributed computing applications**
- **Infrastructure applications**
- **Small database**
- **Processor and memory intensive workloads**
- **Centralized storage solutions**



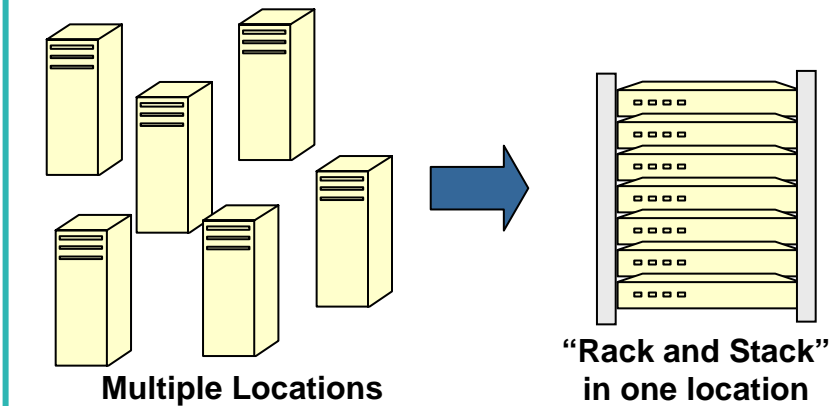
Ideal large SMP implementations



- High performance transaction processing
- I/O Intensive workloads
- Large database serving
- High resiliency and security
- Unpredictable and highly variable workload spikes
- Low utilization infrastructure applications
- Rapid provisioning and re-provisioning

Server Consolidation: Cost Savings and Operational Efficiency

Physical Consolidation

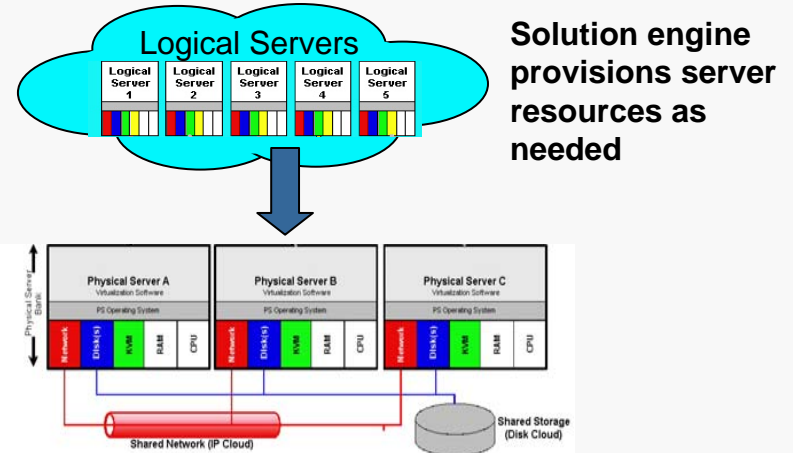


Workload/Hardware Consolidation



Single Multiprocessor System

Operations Consolidation





Workload vs. Operations Consolidation

■ Workload consolidation

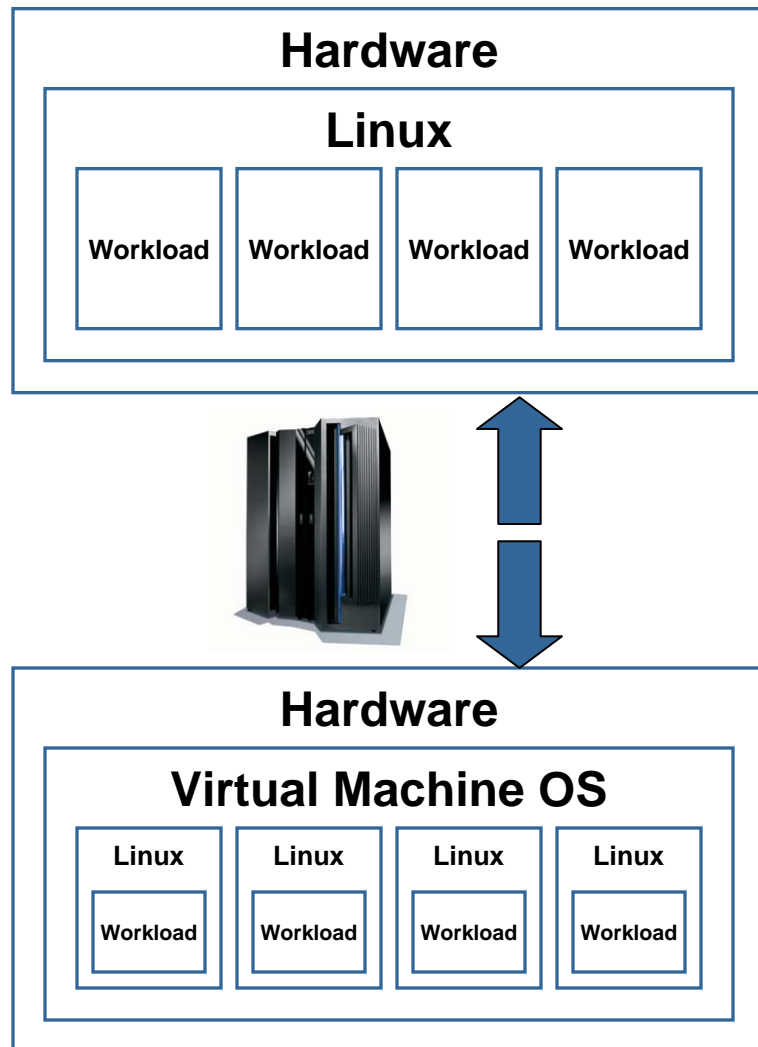
- Focus on hardware cost savings
- Operating system-level approach
- Needs single operating system
- No application changes
- Simpler, potentially more robust
- Shorter timescales

■ Operations consolidation

- Focus on operational effectiveness
- Application-level approach
- Can support multiple operating systems
- May need application (server) changes
- Potentially more functional
- Longer timescales

Bottom line: Both are valid approaches with overlapping but distinct benefits.

Workload Consolidation vs. Workload Scalability



■ Issues

- Which is best? Native Linux or VM?
- If native Linux, will it scale?
- If native Linux, will it handle multiple workloads?
- If VM, who does what?

■ Rule of Thumb

- If you have one very large workload, use Linux natively
- Sweet spot for VM is server consolidation



Consolidation Factors

- **Hardware costs**
 - CPU, storage, network (cables, routers, etc.), maintenance support
- **Software costs**
 - Product, service and support
- **System occupancy costs**
 - Space, power, special environment requirements
- **People, services, etc.**
 - FTEs, financing, etc.
- **Hidden factors**
 - RAS
 - Vendor choice
 - Time to market, new business opportunities



Design / Architect Continuum – A General “ROT”

- **x86**
 - Few servers
 - Moderate to high average CPU % busy
 - Low I/O requirements
- **IBM POWER – OpenPower, p5/pSeries, i5/iSeries**
 - CPU intensive
 - Large memory
 - LPAR benefits
 - Moderate I/O
- **IBM System z9 and zSeries**
 - Many servers
 - Low to moderate average CPU % busy
 - Virtual servers on demand
 - High I/O requirements



Software for Linux on various platforms

- **Most Open Source server software will run on any architecture**
- **Intel x86**
 - Largest volume of commercial software
- **Intel Itanium**
 - Limited commercial software – primarily databases, compute intensive, and ERP
- **AMD 64, Intel EM64T**
 - Tolerates x86 software, limited exploitation
- **IBM POWER – OpenPower, i5/iSeries, p5/pSeries, JS20**
 - 1000+ commercial applications available
- **IBM System z9 and zSeries**
 - 800+ commercial applications available



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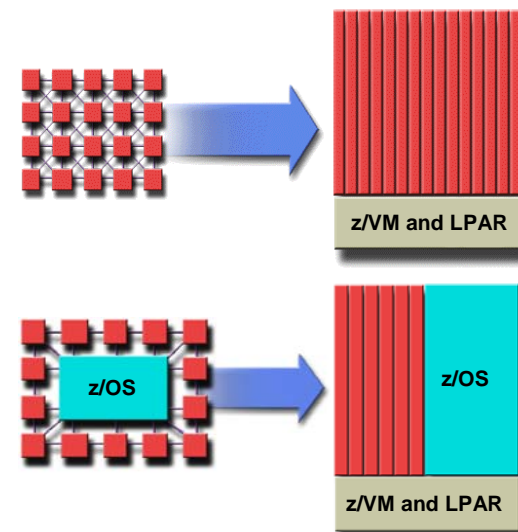
Linux on System z9 and zSeries



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What is Linux on System z9 and zSeries?

- **A native mainframe operating environment**
 - Exploits IBM System z9 and zSeries hardware
 - Not a unique version of Linux
- **Application sourcing strategy**
 - The IBM commitment to z/OS, z/VSE, and z/TPF is not affected by this Linux strategy
 - Customers are offered additional opportunities to leverage their investments through Linux
 - New doors are opening for customers to bring Linux-centric workloads to the platform





Why Linux on System z9 and zSeries?

- 1. Increased solutions through Linux application portfolio**
- 2. Large number of highly skilled programmers familiar with Linux**
- 3. Integrated business solutions**
 - Data richness from mainframe
 - Wide range of Linux applications
- 4. Industrial strength environment**
 - Flexibility and openness of Linux
 - Qualities of service of mainframe
- 5. Unique ability to easily consolidate large number of servers**



Customers Perceive a Distinct Gap Between Mainframe Capabilities and Other Platforms

Server Platform Perceptions – Ratings on a Scale of 1-5

Attribute	Rating by Platform		
	Mainframe	UNIX	“Wintel”
Availability	4.81	3.59	2.64
System Integrity / Security Controls	4.65	3.30	2.27
Backup and Recovery (Including Disaster Recovery)	4.54	3.35	2.70
Workload Management	4.49	3.07	2.23
Average Response Time	4.15	3.60	2.96
Data and Transaction Processing	4.49	3.61	2.75
Integration of data, applications across business processes	3.59	3.47	3.09
Average	4.39	3.43	2.66

Respondents consistently view the mainframe as differentiated in its capabilities

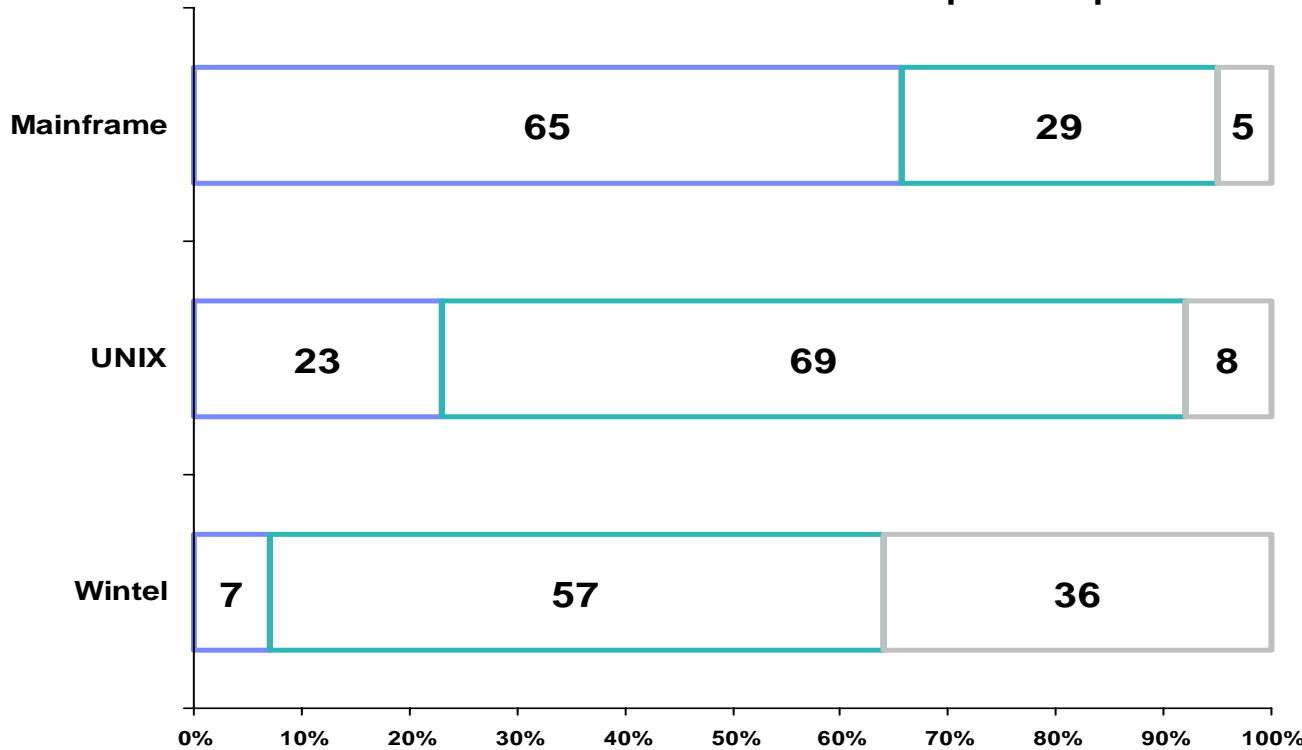
Compared to market research in 2000, mainframe lead over Wintel has increased, gap over UNIX maintained

Survey of over 700 existing zSeries customers. Question: For each attribute shown below, please rate each platform based on your experience / perceptions. (Note that you may rate different platforms as having equivalent levels). 0 = Not sure; 1 = Poor, 2, 3 = Average, 4, 5 = Best-in-class



Customers Viewed the Mainframe as Best Suited to Deliver Enterprise Wide Capabilities

Effectiveness of Platform to Deliver Enterprise Capabilities



Effectiveness of platforms in delivering capability (1-7 scale)

- Rated 6-7: "Highly differentiated to perform this role"
- Rated 4-5: "No opinion either way/slightly differentiated"
- Rated 1-3: "I would never implement on this platform"

The mainframe is seen as substantially better suited to perform all Enterprise Roles, compared to other platforms

It is seen as most differentiated in its ability to deliver enterprise workload management

CIOs/CTOs belief in the mainframe's ability to deliver Enterprise Roles equivalent to that of other decision makers

Survey of over 700 existing zSeries customers.



What System z9 and zSeries brings to Linux

- **The most reliable hardware platform available**
 - Redundant processors and memory
 - Error detection and correction
 - Remote Support Facility (RSF)
- **Centralized Linux systems are easier to manage**
- **Scalability**
 - eServer zSeries 990 scales to 32 application processors
 - System z9 109 scales to 54 application processors
 - Up to 8 dedicated I/O processors
- **Hundreds of Linux virtual servers**
- **Designed to support mixed work loads**
 - Allows consolidation while maintaining one server per application
 - Complete work load isolation
 - High speed inter-server connectivity



What is different about Linux on System z9 and zSeries?

- **Access to zSeries specific hardware**
 - Crypto support – PCICA, CPA, PCIXCC, Crypto2
 - Traditional and Open I/O subsystems
 - Disk (ECKD or SCSI) and tape
 - OSA-Express and OSA-Express2 for very high speed communication between z/OS, z/VSE, z/TPF and Linux
 - HiperSockets for ultra-high speed communication between z/OS, z/VSE and Linux
- **z/VM aware**
 - Enhanced performance
 - System management tools



Value of Linux on System z9 and zSeries

- **Reduced Total Cost of Ownership (TCO)**
 - Environmental savings – single footprint vs. hundreds of servers
 - Consolidation savings – less storage, less servers, less software licenses, less server management/support
- **Improved service level**
 - Systems management (single point of control)
 - Reliability, availability, security of mainframe hardware and z/VM software
 - High performance integration with z/OS, z/VSE and z/TPF
- **Speed to market**
 - Capacity-on-demand capability
 - Dynamic allocation of on-line users, less than 10 seconds to add a new Linux server image using z/VM and DS8000



Roadblocks to Linux Adoption on System z9 and zSeries

- **Wide acceptance of Linux as an enterprise-class environment, but still skepticism outside Intel platform and certain applications**
- **Be prepared to answer some tough questions:**
 - *“Why should we use Linux in the first place?”*
 - *“Why should I run a ‘free’ operating system on such an expensive platform?”*
 - *“What if we don’t know anything about VM? Or Linux?”*
 - *“What if our end users don’t like it?”*
 - *“Nobody else is doing it, right?”*
- **Be willing to accept your own answers; sometimes a different approach may be better**



How Expensive are System z9 and zSeries?

Some general considerations

- IFL processor costs – how does this compare to 20, 50 or 100 x86 or Power systems?
- If you can't utilize >50 percent of an IFL, think hard
- If current server utilization is >50 percent, think very hard
- Much more than CPUs – with z/VM, we can share memory, disk, I/O, network resources
- Virtualization has its (physical) limits – z/VM can't get 200 percent out of a processor, but it can help you get close to 100
- For critical workloads, over committing resources will typically degrade more gracefully in z/VM
- Think in terms of workload and reliability, not just processor capacity
- Plan, test, benchmark



When Do You Need More than “Good Enough”? *Making the Case for System z9 and zSeries Virtualization*

- **When workload growth and decline is difficult to predict (be it production, development, or test/assurance systems)**
- **When customer demand does not match your IT resources and business results suffer**
- **When your IT staff wants to optimize their productivity for deploying and managing virtual servers**
- **When innovation is stifled because your staff cannot experiment or develop new solutions using existing resources**
- **When speed to market affects your business results**
- **When your server applications need fast and flexible access to z/OS data and applications**
- **When business resiliency is a high priority**
- **When you want more control over your environmental expenses (e.g. floor space, cooling)**

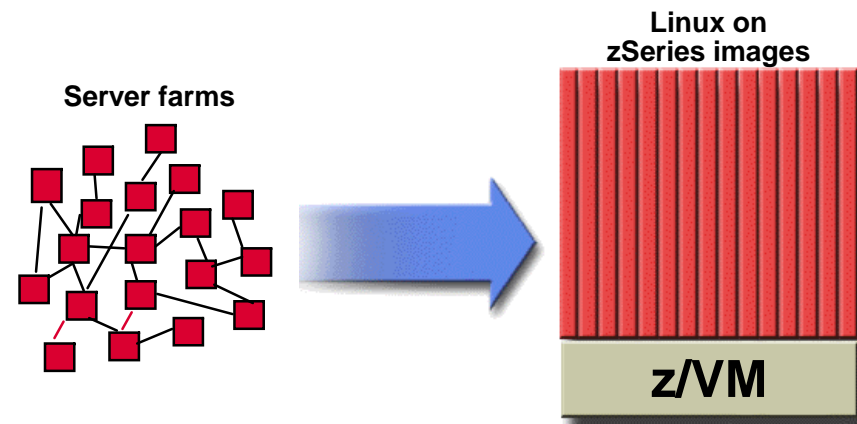


System z9 and zSeries LPAR and z/VM: World-class Server Virtualization

- **Logical Partitions (LPAR)**
 - Mainframe Logical Partitioning (LPAR), introduced in 1988, has provided years of business-critical, high-performance server partitioning for the world's largest corporations
 - Hardware partitioning enabling up to 60 “logical partitions” each of which runs a separate operating system – traditional operating systems and Linux
- **Virtual Partitions (z/VM)**
 - z/VM, commercially available since 1972, has supported mixed workloads that require minimal hypervisor overhead, massive scalability, and exceptional levels of availability
 - Support for large numbers of Linux images with rich system management capabilities
- **Both LPAR and z/VM employ hardware and firmware innovations developed over the years that make virtualization part of the basic fabric of the System z9 and zSeries platforms**

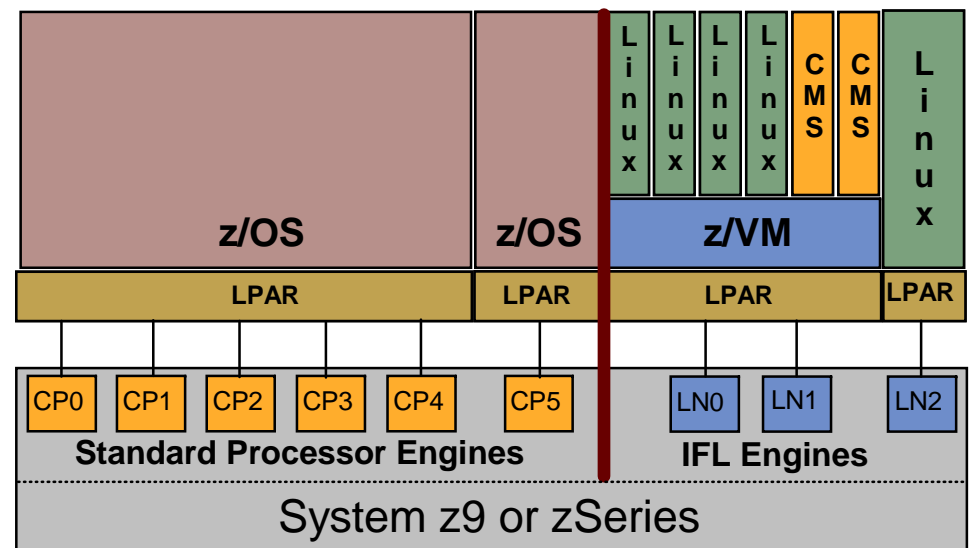
The value of z/VM for Linux

- **Enhanced performance, growth and scalability**
 - Server consolidation enables horizontal growth
 - N-tier architecture on two tiers of hardware
 - Extensive support for sharing resources
 - Virtual networking
 - Effective isolation of Linux images, if required
- **Increased productivity**
 - Development and testing
 - Production support
- **Improved operations**
 - Backup and recovery
 - Command and control

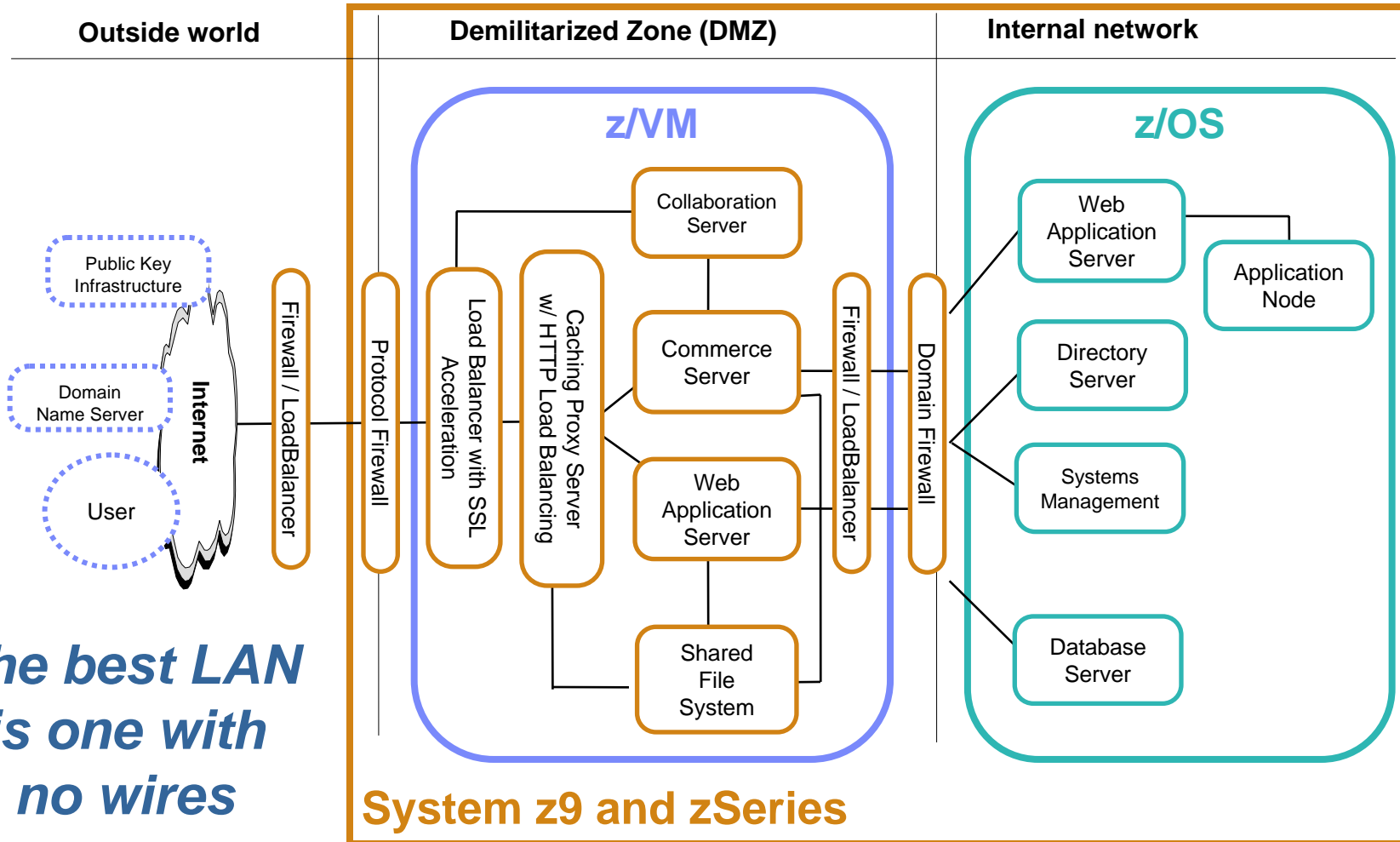


Integrated Facility for Linux

- **Additional engines dedicated to Linux workloads**
 - Supports z/VM and Linux on System z9 and zSeries
 - IFLs on “sub-uni” z890 and z800 systems run at “full speed”
- **Traditional mainframe software charges unaffected**
 - IBM mainframe software
 - Independent Software Vendor products
- **Linux and z/VM charged only against the IFLs**



Application serving with Linux on System z9 and zSeries



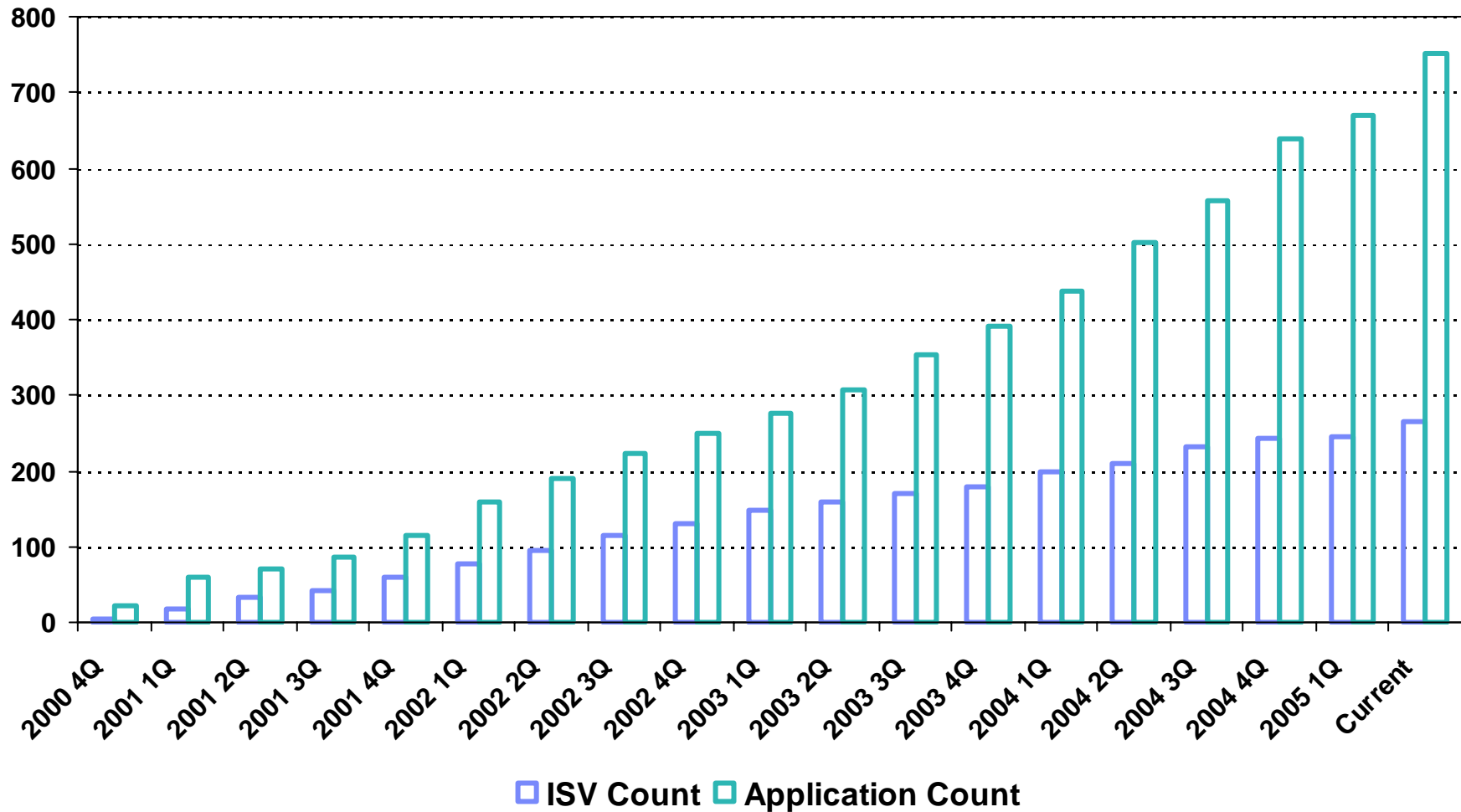
IBM Software for Linux on System z9 and zSeries

ibm.com/linux/matrix

Core Products	SLES	RHEL
DB2 Universal Database Enterprise Server Edition	X	X
Lotus Domino Server	X	X
Rational ClearCase	X	
Tivoli Access Manager for e-business	X	X
Tivoli Configuration Manager	X	X
Tivoli Directory Server	X	X
Tivoli Enterprise Console	X	X
Tivoli Monitoring	X	X
Tivoli Storage Manager	X	
WebSphere Application Server	X	X
WebSphere Business Integration Server Foundation	X	X
WebSphere Commerce Business Edition for Linux	X	X
WebSphere Portal for Multiplatforms Enable	X	X
IBM Developer Kit for Linux , Java 2 Technology Edition Java Technology development environment	X	X

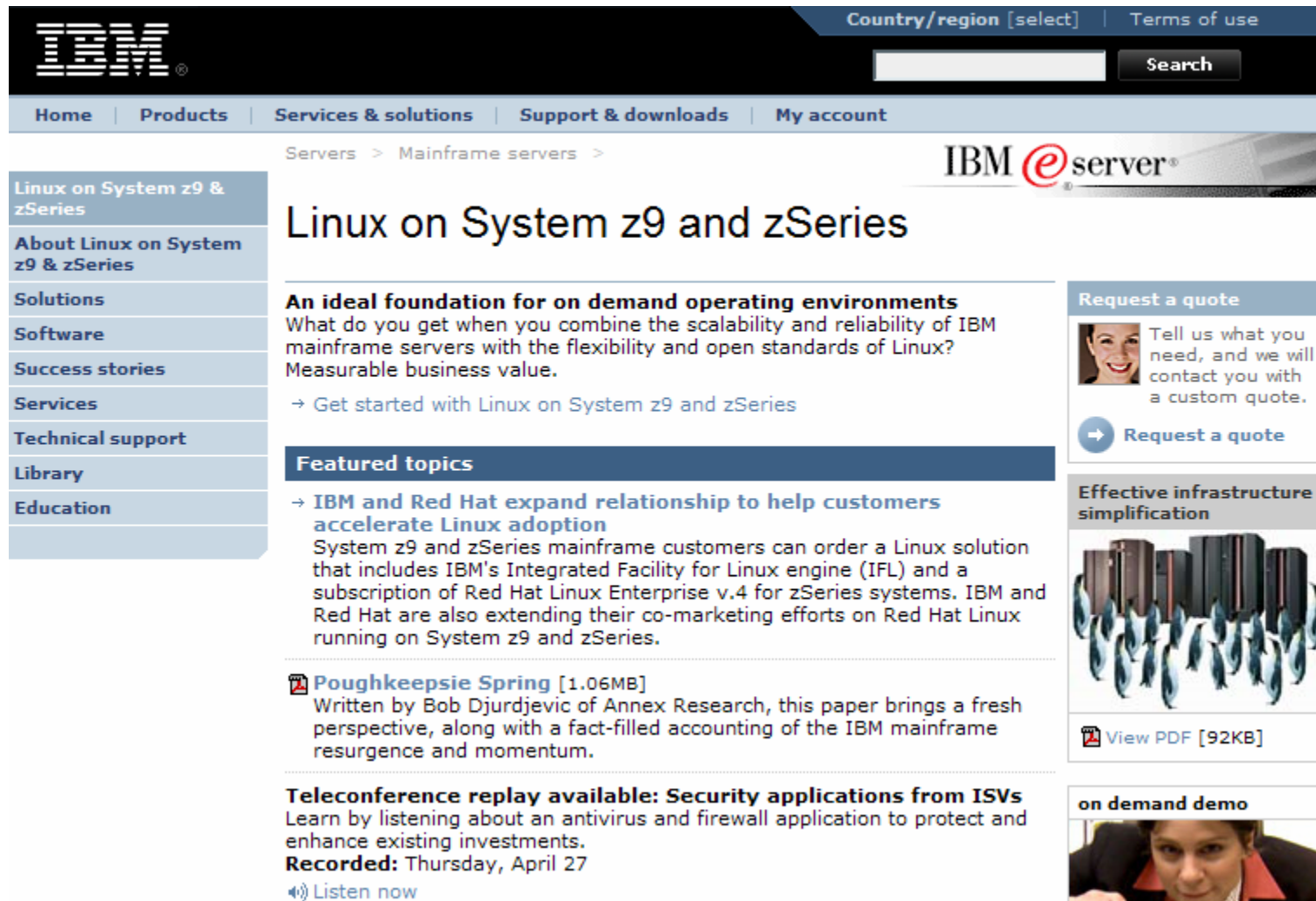


Linux on System z9 and zSeries ISV Status



Linux on System z9 and zSeries Web Site

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Linux on System z9 and zSeries

An ideal foundation for on demand operating environments
What do you get when you combine the scalability and reliability of IBM mainframe servers with the flexibility and open standards of Linux? Measurable business value.

→ Get started with Linux on System z9 and zSeries


Featured topics


→ **IBM and Red Hat expand relationship to help customers accelerate Linux adoption**
System z9 and zSeries mainframe customers can order a Linux solution that includes IBM's Integrated Facility for Linux engine (IFL) and a subscription of Red Hat Linux Enterprise v.4 for zSeries systems. IBM and Red Hat are also extending their co-marketing efforts on Red Hat Linux running on System z9 and zSeries.

 **Poughkeepsie Spring** [1.06MB]
Written by Bob Djurdjevic of Annex Research, this paper brings a fresh perspective, along with a fact-filled accounting of the IBM mainframe resurgence and momentum.

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the newest VM operating system based on 64-bit z/Architecture.

Currently marketed releases of z/VM

Announced: **z/VM V5.2**

Now available: **z/VM V5.1**

Also available: **z/VM V4.4**

z/VM provides a highly flexible test and production environment for enterprises deploying on demand business solutions. Built upon the solid VM/ESA base, z/VM exploits the z/Architecture and helps enterprises meet their growing demands for multi-user server solutions with a broad range of support for operating system environments such as z/OS, OS/390, TPF, VSE/ESA, CMS, or Linux on zSeries. Read more about z/VM.

Summary of News and Updates

View 05 Aug. 2005 updates.

Read the [z/VM and VM Site News and Changes](#) for a summary of VM-related news, announcements, pointers, new classes, and places to hear about z/VM virtualization technology.

Worldwide announcement letters(US letters or product links)

→ July 26, 2005 [z/VM V5.2 announced](#)

→ July 26, 2005 [IBM System z9 announced](#)

Mainframe history

1964 2004

40 years and counting

Explore IBM mainframe innovation →

Is your VM current ?

Thinking about migration?

Mark Your Calendar!

August 21-26, 2005

Boston, MA

[SHARE User Group](#)

zSeries[®] Expo

Featuring z/OS, z/VM, z/VSE & Linux on zSeries

Linux on zSeries Developer Resources

ibm.com/developerworks/offers/linux-speed-start/download-z.html

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Linux on zSeries
Developer resources and downloads

Overview | Developer resources | Downloads | Training and support

Developing solutions for Linux on IBM eServer zSeries (mainframe) servers? No-charge IBM software [downloads](#), as well as [training](#) and other [developer resources](#) are available here for customers, ISVs, and IBM Business Partners who are evaluating or including IBM middleware in Linux solutions on IBM eServer zSeries servers.

Getting started

Complementing the flexibility and openness of Linux, IBM eServer [zSeries servers](#) deliver an industrial-strength environment for Linux applications. In addition, zSeries enables massive scalability within a single server. Hundreds of Linux images can run simultaneously, providing unique server consolidation capabilities and reducing both cost and complexity.

Don't have a zSeries machine? No problem. Get started on IA32 with our **no-charge Software Evaluation Kit** and then use our porting centers to test your application on zSeries.

Page options

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Technical resources

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- Technical briefings

Contact us

- Contact the Linux Speed-start team
- Get sales support

Additional resources

- developerWorks Linux zone
- Speed-start your Linux app (on xSeries)



List Server Discussions

■ VMESA-L discusses z/VM

- To subscribe, send a note to listserv@listserv.uark.edu. In the body of the note, write only the following line:
 - `SUBSCRIBE VMESA-L firstname lastname`
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■ LINUX-390 discusses Linux on System z9 and zSeries

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 - <http://www.marist.edu/htbin/wlvindex?linux-390>



Next Steps



- Familiarize yourself with Linux, System z9 and zSeries
- View Linux as a valid alternative for IT systems
- Incorporate open source software development into IT strategies
- Look at Linux on System z9 and zSeries to see how it can lower costs, increase reliability and security, and improve service

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