



L12

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

Jim Elliott



September 19 - 23, 2005

San Francisco, CA



| Linux @ IBM

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



Jim Elliott

Advocate – Infrastructure Solutions

Manager – System z9 and zSeries Operating Systems

IBM Canada Ltd.

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.



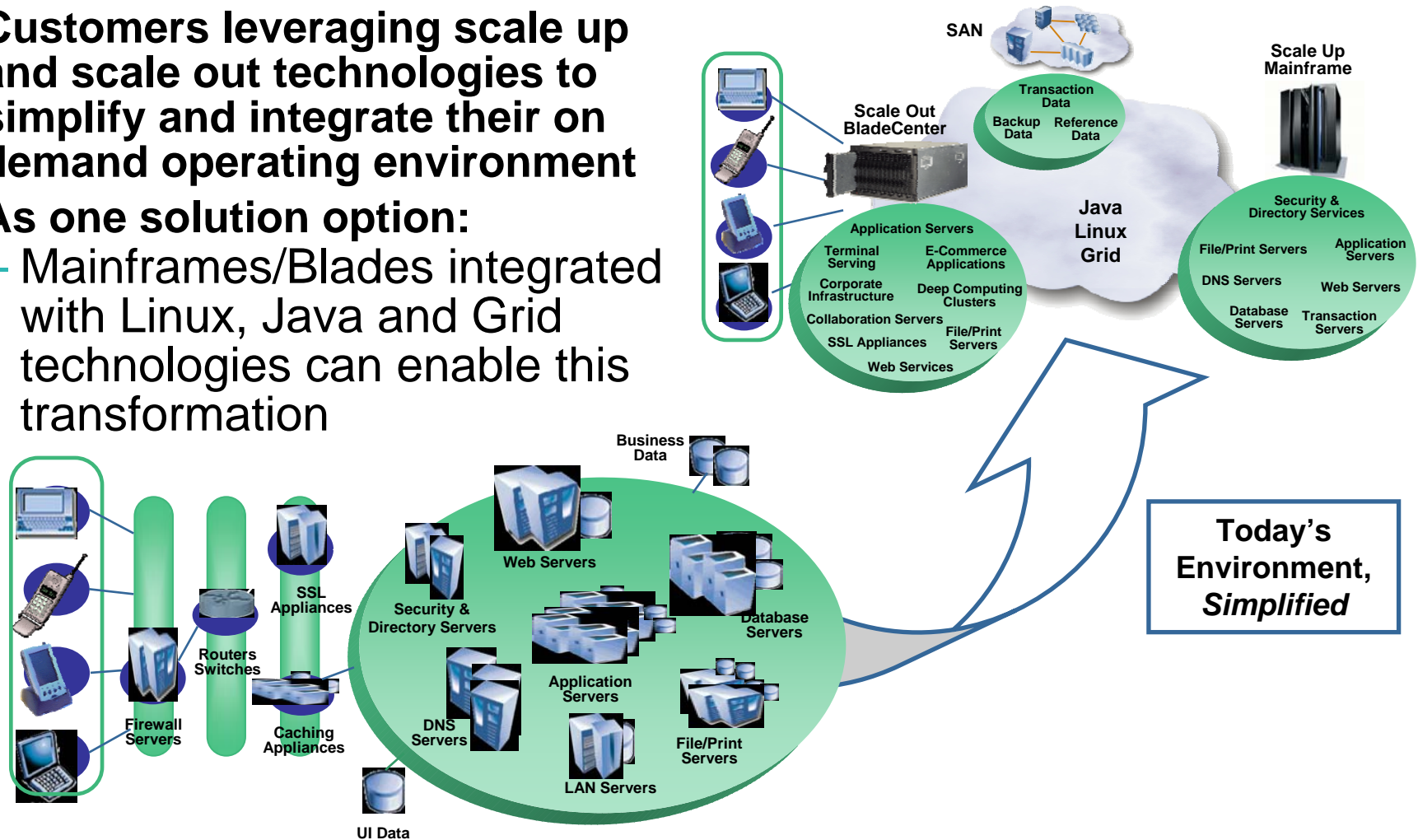
| Linux @ IBM

Scale-Up, Scale-Out, Virtualization

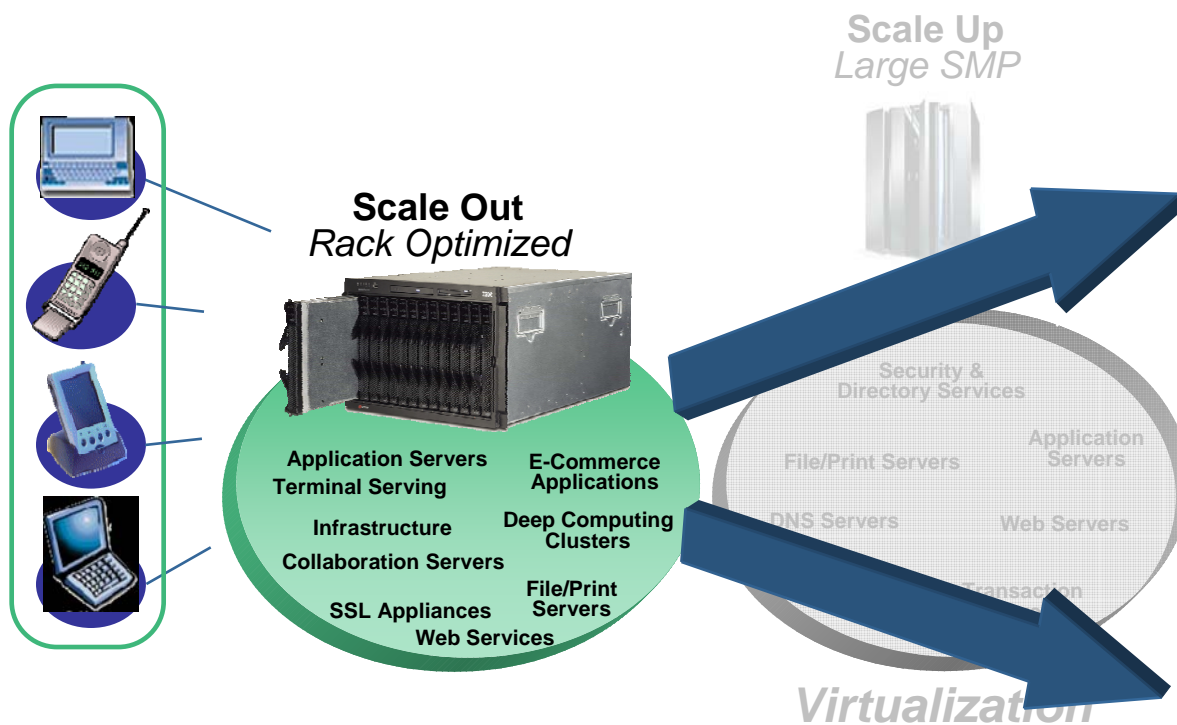


Infrastructure Simplification

- 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

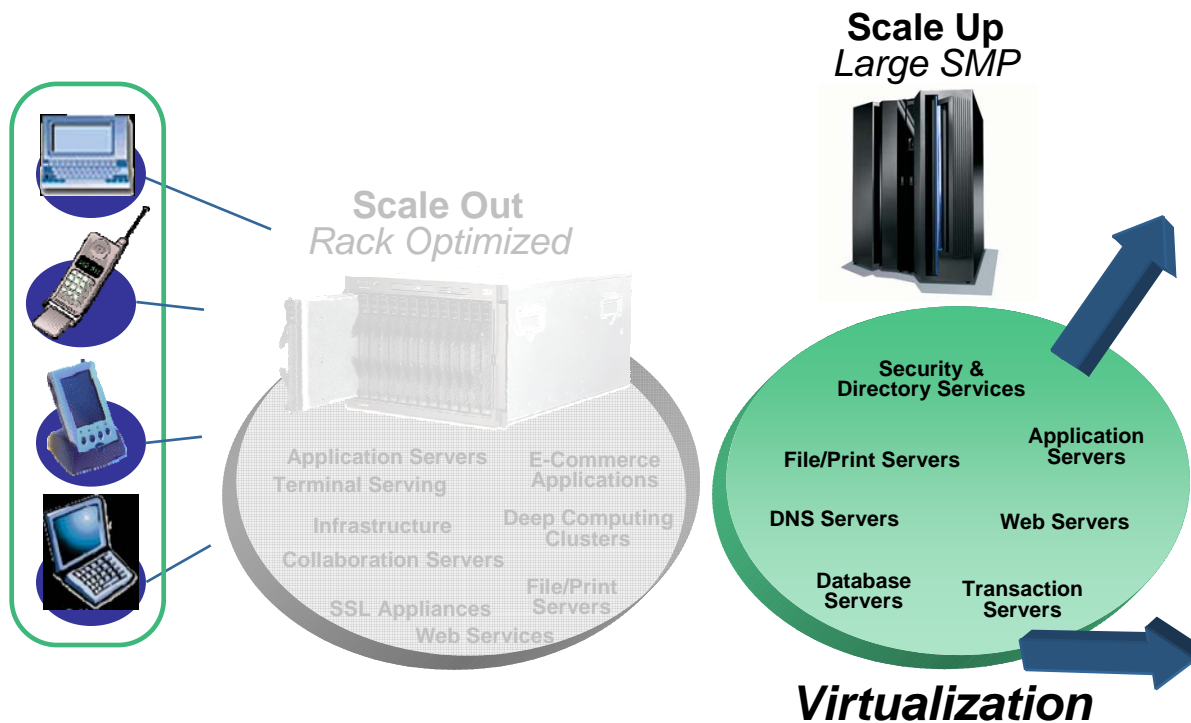


Ideal rack optimized implementations



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

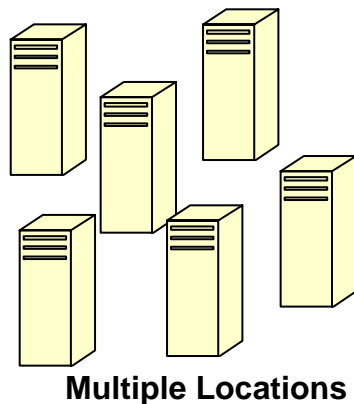
Ideal large SMP implementations



- 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

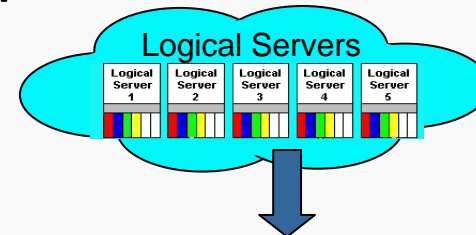


Workload/Hardware Consolidation

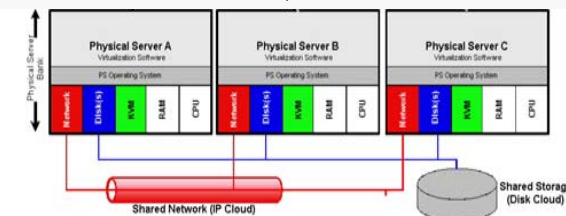


Single Multiprocessor System

Operations Consolidation



Solution engine provisions server resources as needed





Workload vs. Operations Consolidation

■ Workload consolidation

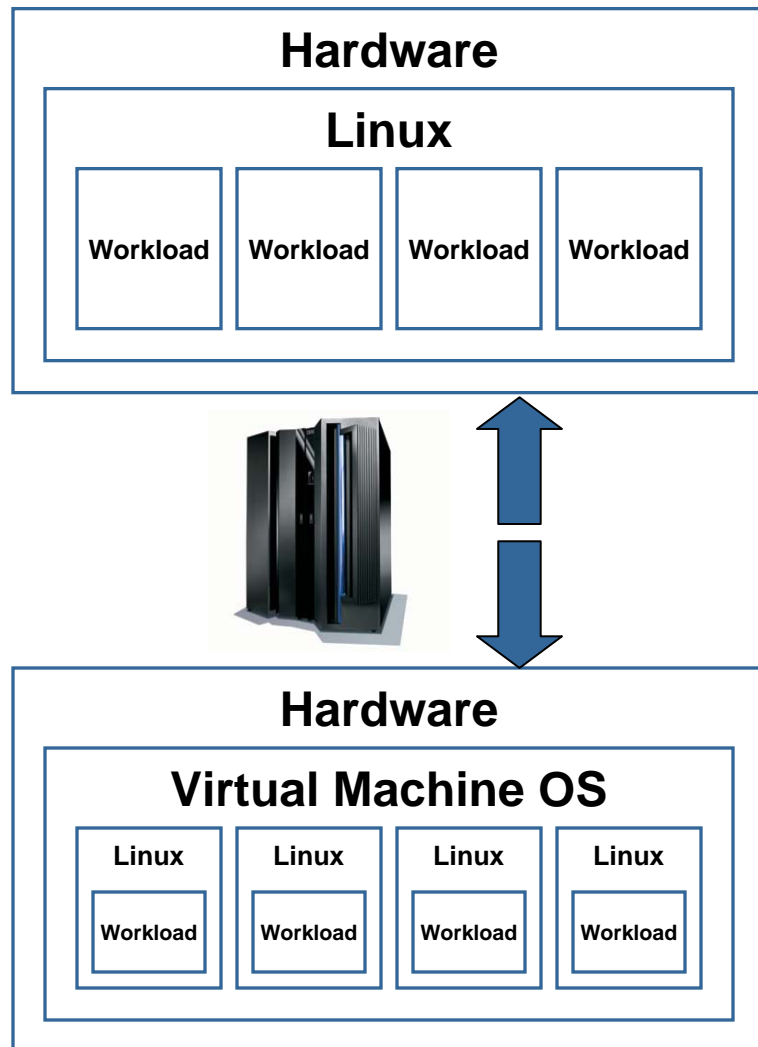
- Focus on hardware cost savings
- Operating system-level approach
- Needs single operating system
- No application changes
- Simpler, potentially more robust
- Shorter timescales

■ 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



| Linux @ IBM

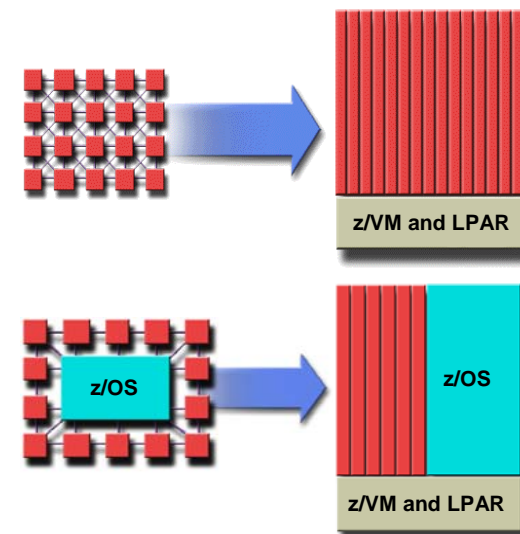


Linux on System z9 and zSeries



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

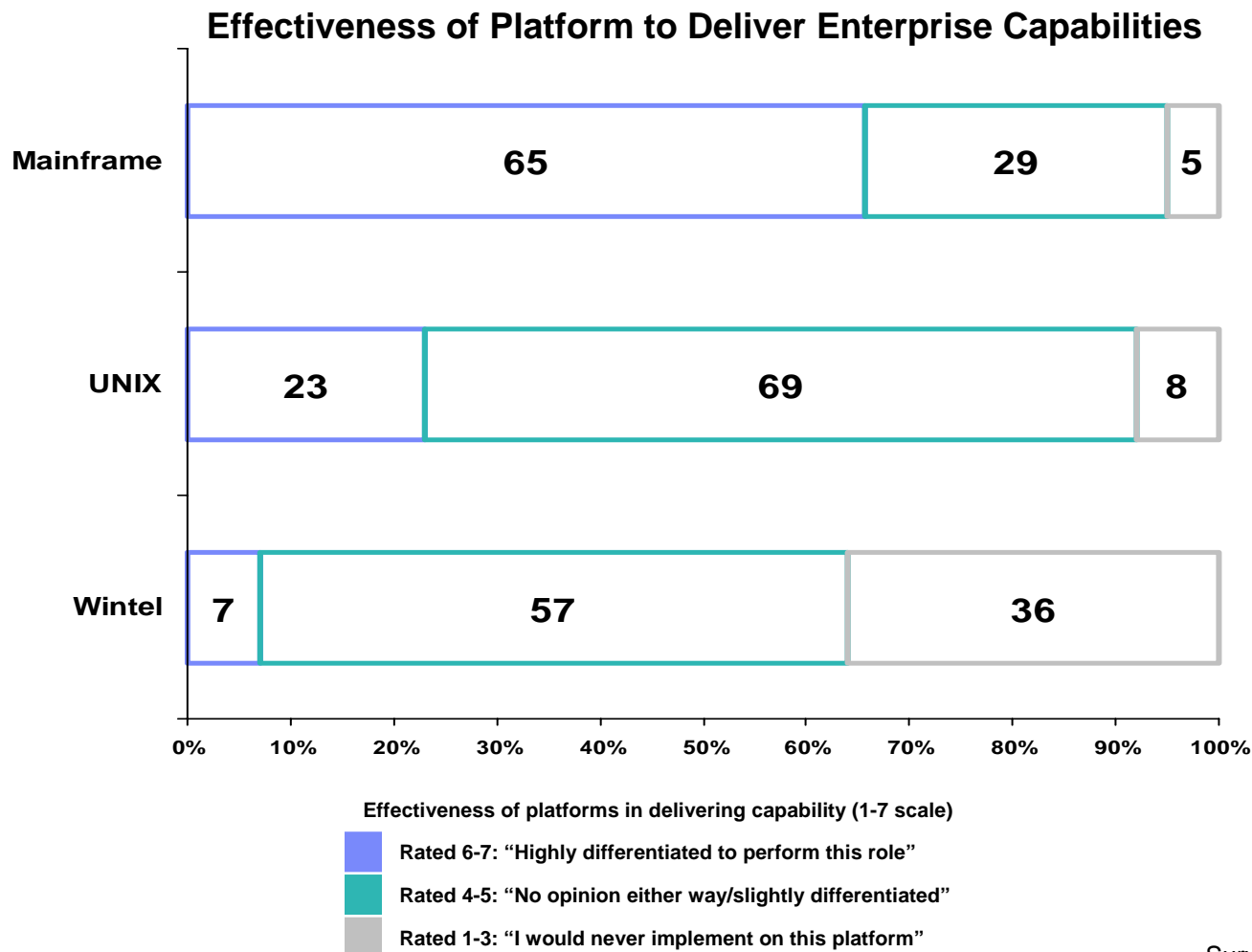
Attribute	Rating by Platform		
	Mainframe	UNIX	“Wintel”
Availability	4.81	3.59	2.64
System Integrity / Security Controls	4.65	3.30	2.27
Backup and Recovery (Including Disaster Recovery)	4.54	3.35	2.70
Workload Management	4.49	3.07	2.23
Average Response Time	4.15	3.60	2.96
Data and Transaction Processing	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



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**

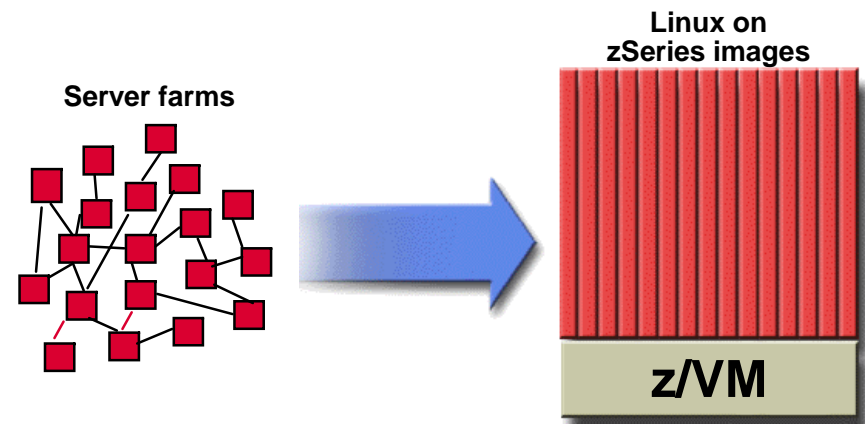
- Server consolidation enables horizontal growth
- N-tier architecture on two tiers of hardware
- Extensive support for sharing resources
- Virtual networking
- Effective isolation of Linux images, if required

- **Increased productivity**

- Development and testing
- Production support

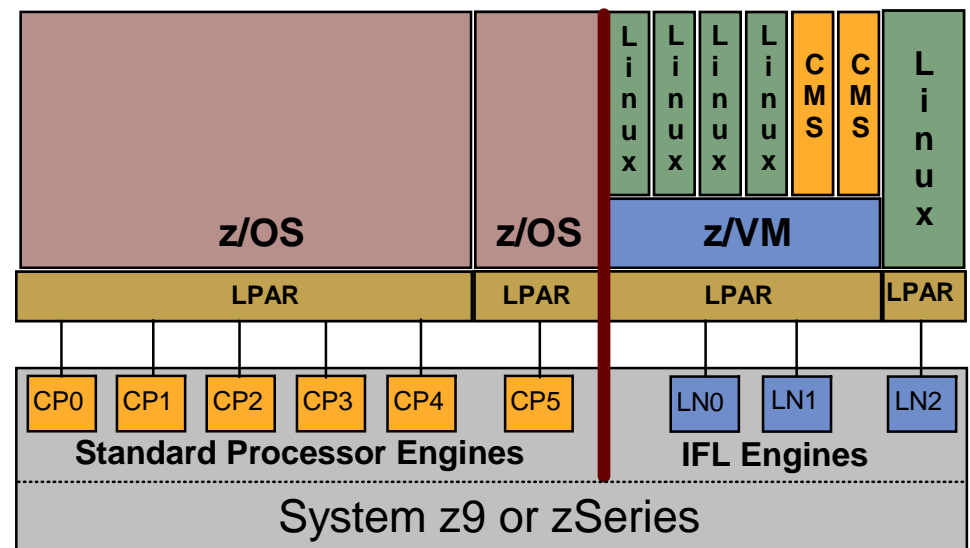
- **Improved operations**

- 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**



Red Hat Enterprise Linux and IFL Offering

- **Customers can now purchase a Red Hat Enterprise Linux subscription via PRPQ 5799-LRH with each purchase of an IFL from IBM, all at an attractive price**

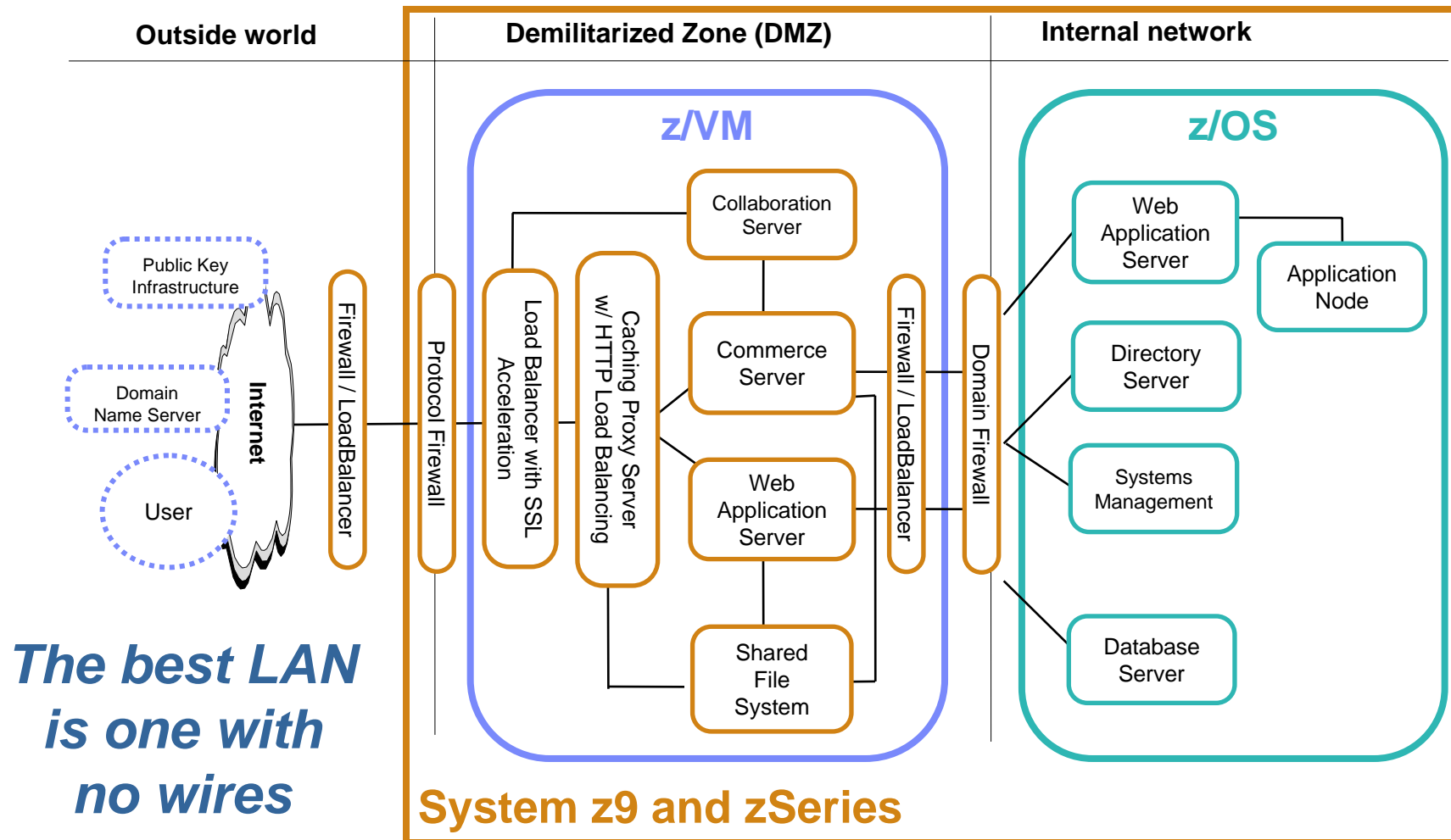
- 1st year only, customer must negotiate subscription for additional years with Red Hat

- **The supplied Linux code will include Red Hat's standard level 1 through 3 support during normal business hours for one year**

- **This offering will make obtaining Linux on zSeries more convenient, and is designed to help speed implementation, and lower Linux transaction cost**

Product	IBM List	Offering
IFL	\$125,000	\$62,500
RHEL	\$15,000	\$7,500
Total	\$140,000	\$70,000

Application serving with Linux on System z9 and zSeries



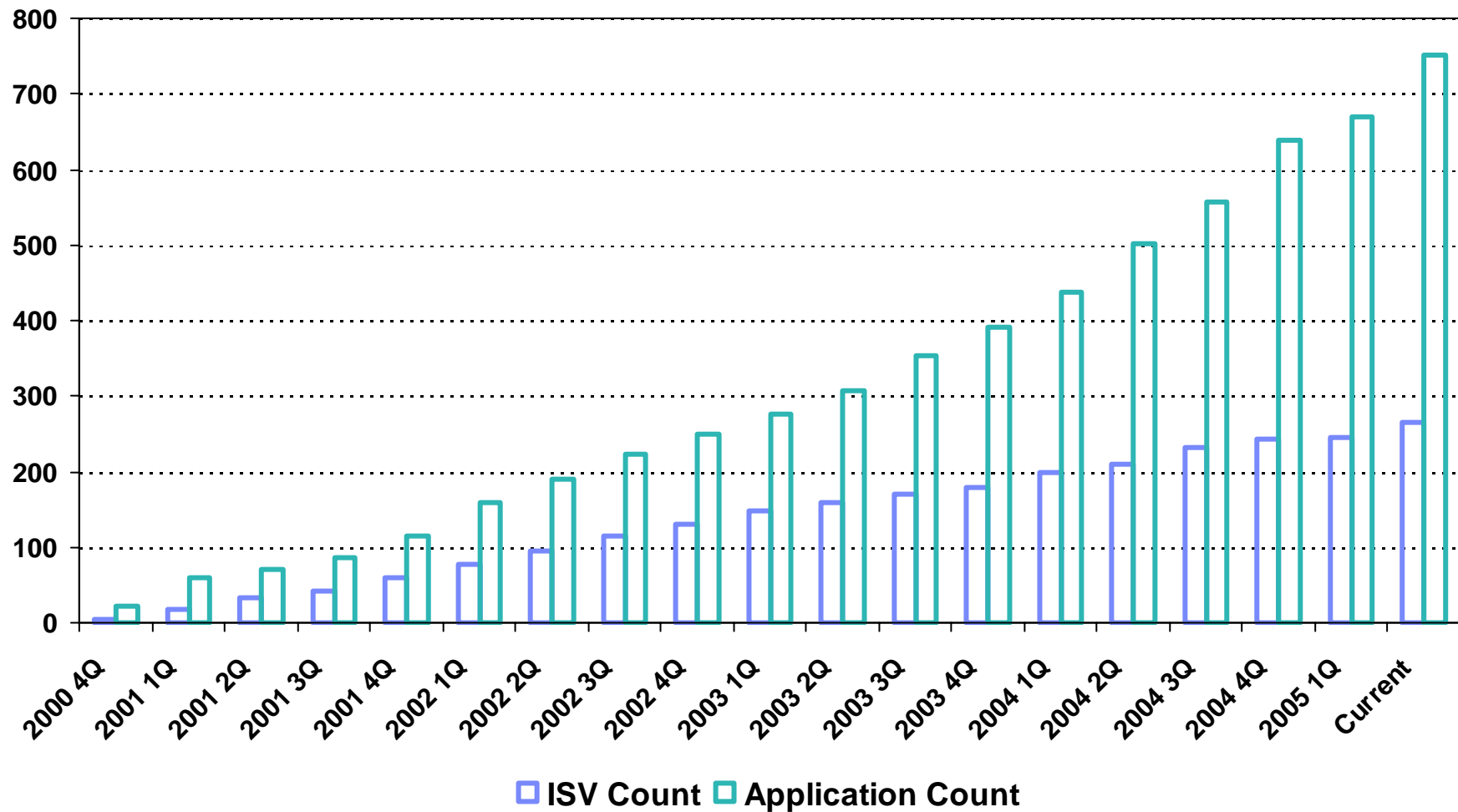
IBM Software for Linux on System z9 and zSeries

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

ibm.com/zseries/linux



The screenshot shows the IBM website for Linux on System z9 and zSeries. The header includes the IBM logo, a search bar, and navigation links for Home, Products, Services & solutions, Support & downloads, and My account. The main content area features a sidebar with links to Linux on System z9 & zSeries, About Linux on System z9 & zSeries, Solutions, Software, Success stories, Services, Technical support, Library, and Education. The main content area has a breadcrumb trail: Servers > Mainframe servers > Linux on System z9 and zSeries. The title is "Linux on System z9 and zSeries". The main text describes the foundation for on-demand operating environments, highlighting the scalability and reliability of IBM mainframe servers combined with the flexibility and open standards of Linux. It includes a link to "Get started with Linux on System z9 and zSeries". Below this is a "Featured topics" section with a link to "IBM and Red Hat expand relationship to help customers accelerate Linux adoption", which describes a solution including IBM's Integrated Facility for Linux engine (IFL) and a subscription of Red Hat Linux Enterprise v.4 for zSeries systems. Another featured topic is "Poughkeepsie Spring [1.06MB]", a paper by Bob Djurdjevic of Annex Research, which brings a fresh perspective on the IBM mainframe resurgence. A "Teleconference replay available: Security applications from ISVs" is also mentioned, with a link to "Listen now". On the right side, there is a "Request a quote" section with a form and a "Request a quote" button. Below that is a section titled "Effective infrastructure simplification" with an image of server racks and a "View PDF [92KB]" link. At the bottom right, there is an "on demand demo" section with a video thumbnail.

Country/region [select] | Terms of use

IBM®

Home | Products | Services & solutions | Support & downloads | My account

Servers > Mainframe servers >

IBM® e server®

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.

Teleconference replay available: Security applications from ISVs
Learn by listening about an antivirus and firewall application to protect and enhance existing investments.
Recorded: Thursday, April 27
Listen now

Request a quote
Tell us what you need, and we will contact you with a custom quote.
→ Request a quote


Effective infrastructure simplification

View PDF [92KB]

on demand demo


z/VM Web Site

ibm.com/vm



Country/region [select] | Terms of use

Search

[Home](#) | [Products](#) | [Services & solutions](#) | [Support & downloads](#) | [My account](#)

Servers > Mainframe servers > z/VM >


IBM @server®

[z/VM](#)
[News](#)
[About z/VM](#)
[Events calendar](#)
[Products and features](#)
[Downloads](#)
[Technical resources](#)
[Library](#)
[How to buy](#)
[Service](#)
[Education](#)
[Site map](#)
[Site search](#)
[Printer-friendly](#)
[Notify me](#)
[Contact z/VM](#)

z/VM®

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



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

The screenshot shows the IBM developerWorks website. At the top, there's a navigation bar with the IBM logo, a search bar, and links for Country/region, Terms of use, and a dropdown menu showing 'All of dW'. Below this is a secondary navigation bar with links for Home, Products, Services & solutions, Support & downloads, and My account. The main content area is titled 'Linux on zSeries Developer resources and downloads'. It includes a sidebar with a list of categories like DB2, eServer, Lotus, Rational, Tivoli, WebSphere, Autonomic computing, Grid computing, Java™ technology, Linux, Open source, Power Architecture™, SOA and Web services, Web architecture, Wireless technology, XML, and Feedback. The main content area has tabs for Overview, Developer resources, Downloads, and Training and support. The 'Overview' tab is selected, showing a paragraph about developing solutions for Linux on IBM eServer zSeries servers, mentioning no-charge software downloads, training, and other developer resources. Below this is a 'Getting started' section with a paragraph about complementing the flexibility and openness of Linux with IBM eServer zSeries servers, and another paragraph about getting started on IA32 with a no-charge Software Evaluation Kit. On the right side, there are three yellow boxes: 'Page options' with a link to 'e-mail this page', 'Technical resources' with links to 'Tech support forum' and 'Technical briefings', and 'Contact us' with links to 'Contact the Linux Speed-start team' and 'Get sales support'. At the bottom, there's an 'Additional resources' box with links to 'developerWorks Linux zone' and 'Speed-start your Linux app (on xSeries)'.

Country/region [select] | Terms of use

IBM® All of dW Search

Home | Products | Services & solutions | Support & downloads | My account

developerWorks > Linux > Speed-start your Linux app >

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

- [e-mail this page](#)

Technical resources

- [Tech support forum](#)
- [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*
- View and search the current list and archives:
 - <http://listserv.uark.edu/archives/vmesa-l.html>

■ LINUX-390 discusses Linux on System z9 and zSeries

- To subscribe, send a note to listserv@vm.marist.edu. In the body of the note, write only the following line:
 - **SUBSCRIBE LINUX-390** *firstname lastname*
- View and search the current list and archives:
 - <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

Jim Elliott

Advocate – Infrastructure Solutions

Manager – IBM System z9 and zSeries Operating Systems

IBM Canada Ltd.

jim_elliott@ca.ibm.com

ibm.com/vm/devpages/jelliott



Notices

© Copyright IBM Corporation 2000, 2005. All rights reserved.

This document contains words and/or phrases that are trademarks or registered trademarks of the International Business Machines Corporation in the United States and/or other countries. For information on IBM trademarks go to <http://www.ibm.com/legal/copytrade.shtml>.

The following are trademarks or registered trademarks of other companies.

Java and all Java-related trademarks and logos are trademarks of Sun Microsystems, Inc., in the United States and other countries.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Microsoft, Windows and Windows NT are registered trademarks of Microsoft Corporation.

Red Hat, the Red Hat "Shadow Man" logo, and all Red Hat-based trademarks and logos are trademarks or registered trademarks of Red Hat, Inc., in the United States and other countries.

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.

All other products may be trademarks or registered trademarks of their respective companies.

Notes:

This publication was produced in Canada. IBM may not offer the products, services or features discussed in this document in other countries, and the information may be subject to change without notice. Consult your local IBM business contact for information on the product or services available in your area.

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Information about non-IBM products is obtained from the manufacturers of those products or their published announcements. IBM has not tested those products and cannot confirm the performance, compatibility, or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Prices subject to change without notice. Contact your IBM representative or Business Partner for the most current pricing in your geography.