

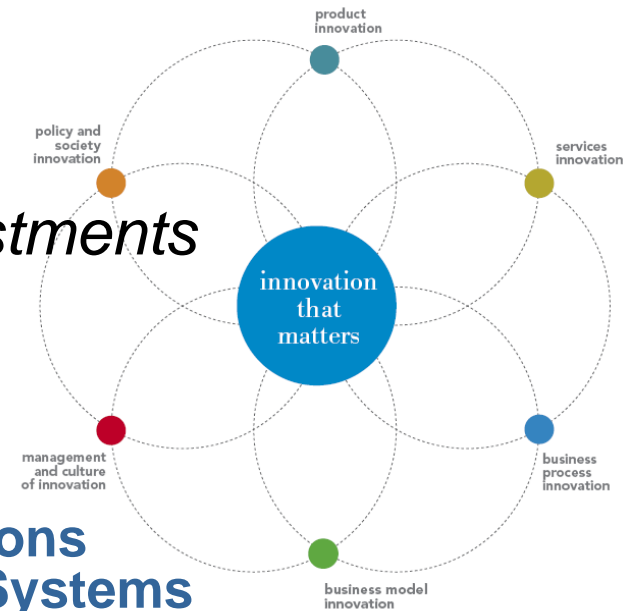


Open Computing @ IBM



# IBM System z and Linux

*Enhancing the value of mainframe investments*



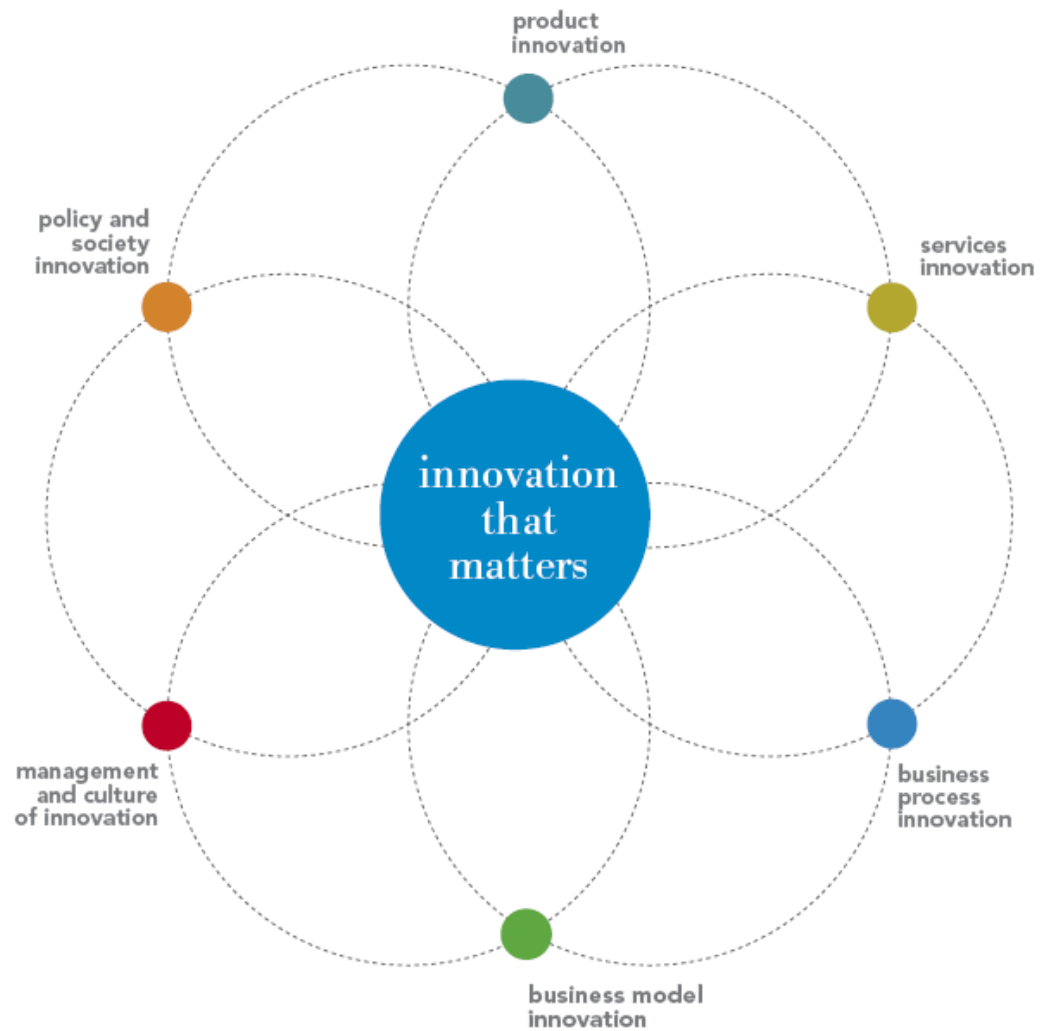
**Jim Elliott**  
Advocate – Infrastructure Solutions  
Manager – System z Operating Systems  
IBM Canada Ltd.





# Agenda

- Virtualization
- Linux on Mainframes





## First, a few words about product naming ...

Long Form			
IBM	@server <sup>®</sup>	zSeries	990
IBM	System	z9	109

Short Form
z990
z9-109

- **System z<sup>™</sup> = System z9<sup>™</sup> + eServer<sup>™</sup> zSeries<sup>™</sup>**
- **Notes:**
  - Hardware **does not** have a slash
  - Software **does** have a slash
    - z/OS<sup>®</sup>
    - z/VM<sup>®</sup>
    - z/VSE<sup>™</sup>
    - z/TPF<sup>™</sup>
    - z/Architecture<sup>®</sup> ( “considered” software)



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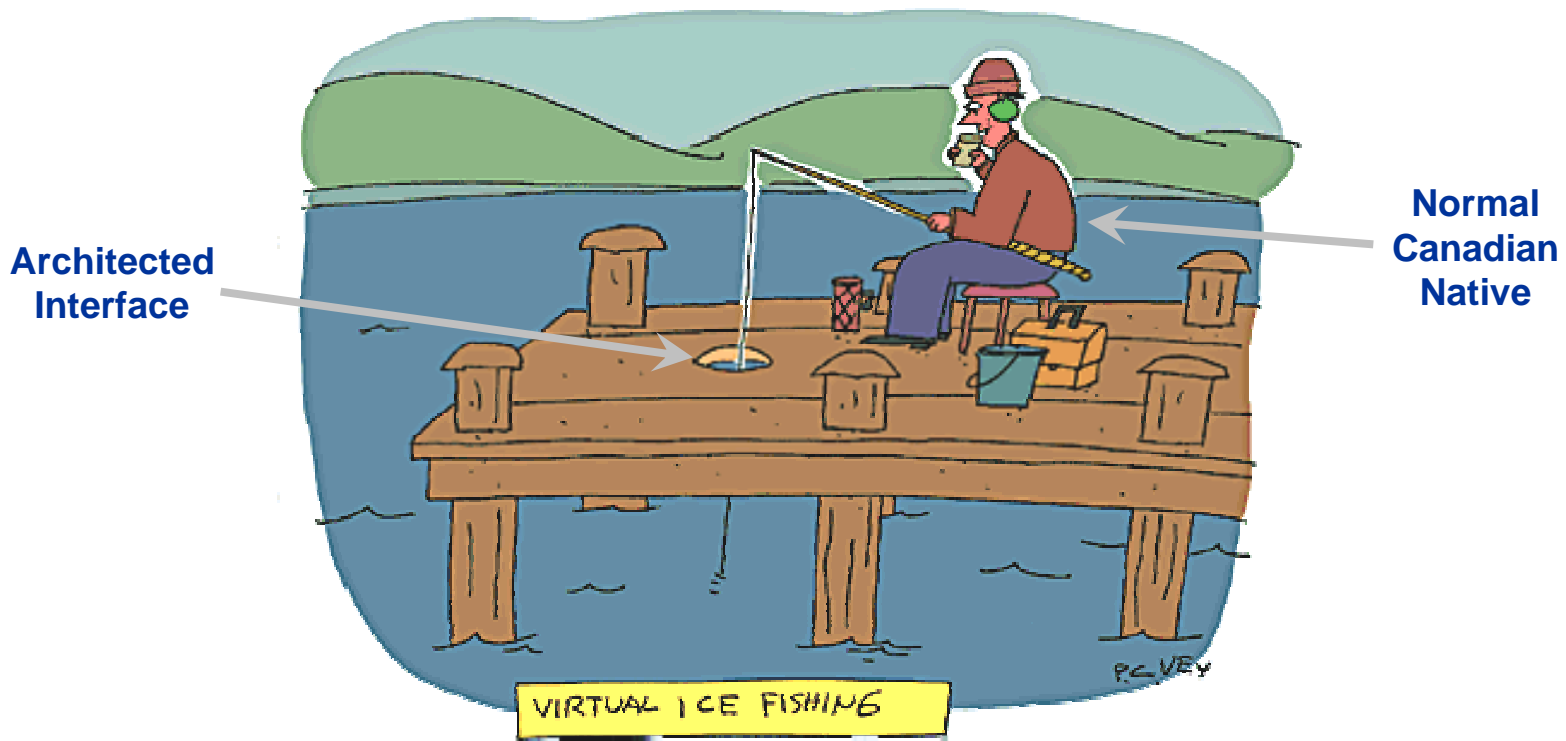


# Virtualization





## Virtualization users see idealized resources



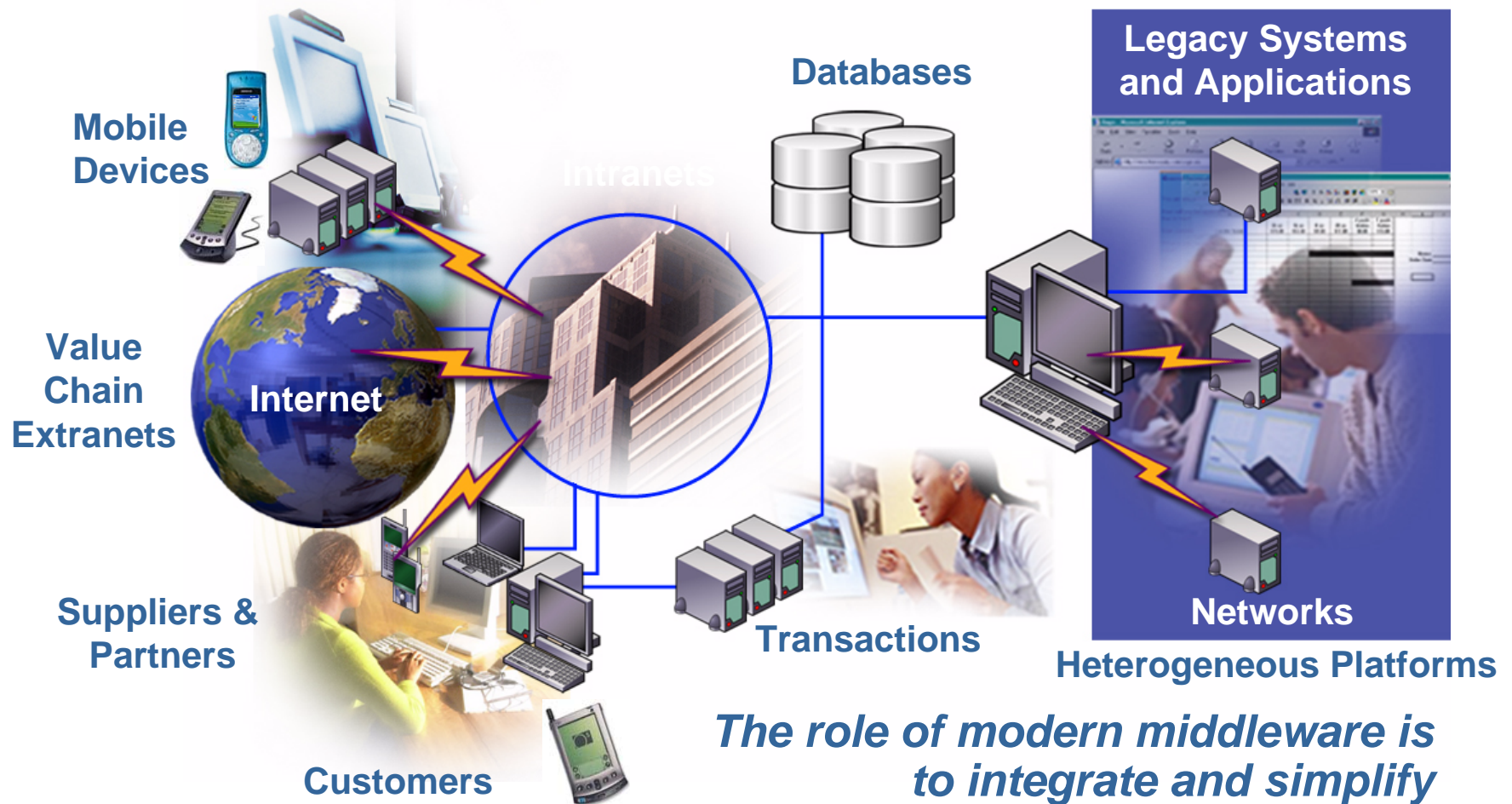
© 1997 P.C. Vey from The Cartoon Bank. All rights reserved.

- **From the Merriam-Webster Online Dictionary:**
  - Main entry: vir·tu·al
  - Function: adjective
  - Etymology: Middle English, possessed of certain physical virtues, from Medieval Latin virtualis, from Latin virtus strength, virtue



# Today's IT environment

*IT environments are increasingly heterogeneous and complex*



*The role of modern middleware is to integrate and simplify*



# IT complexity drives many hidden costs

*That may place the future success of your enterprise at risk*

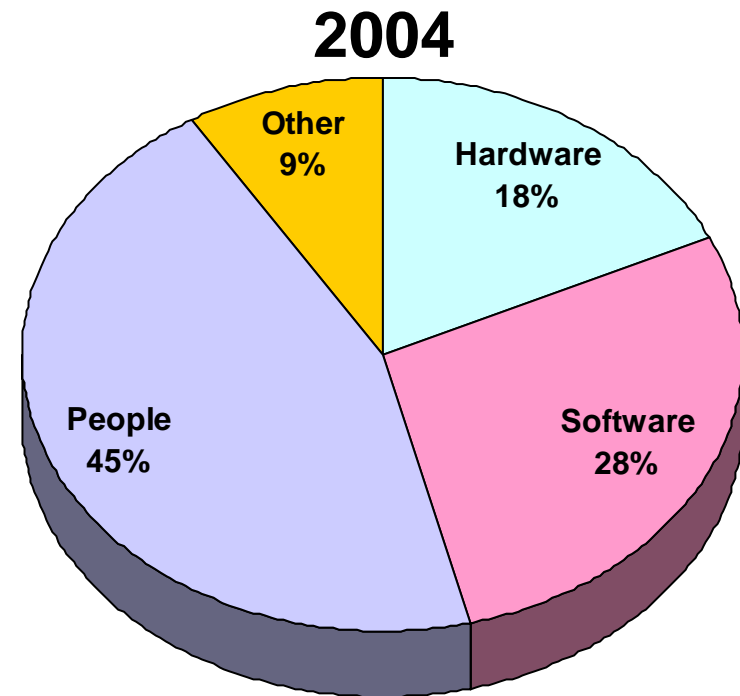
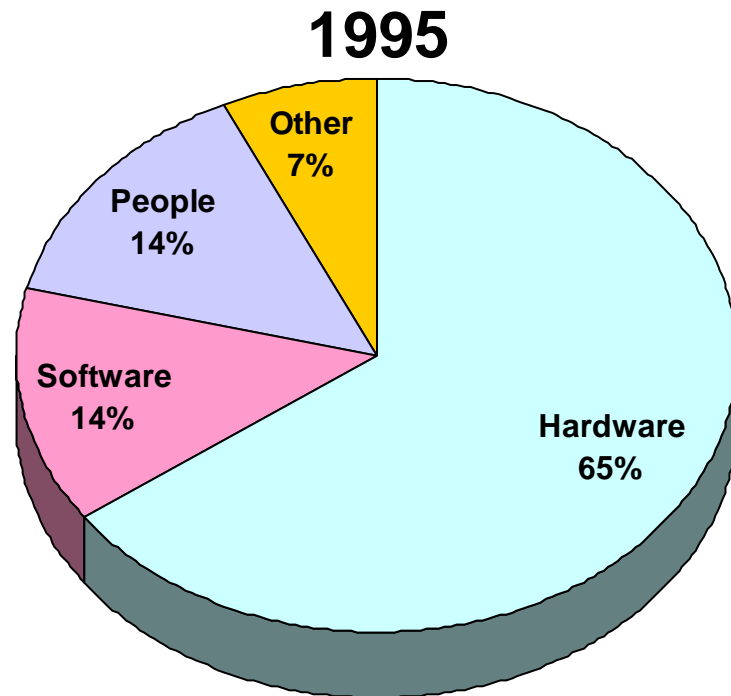
- **Managing today's mixed IT platform environments can be complex and costly**
  - Thousands of servers
  - Underutilized assets
  - Hundreds of applications
  - Thousands of software licenses
  - Thousands of distributed control points
  - Ineffective costing methodologies
- **The Result**
  - Massive complexity
  - Spiraling people costs
  - Increased availability and downtime costs
  - Increased security breach costs
  - Sub-optimal investment choices





# The changing expense profile

*Total Cost of Ownership across all platforms*



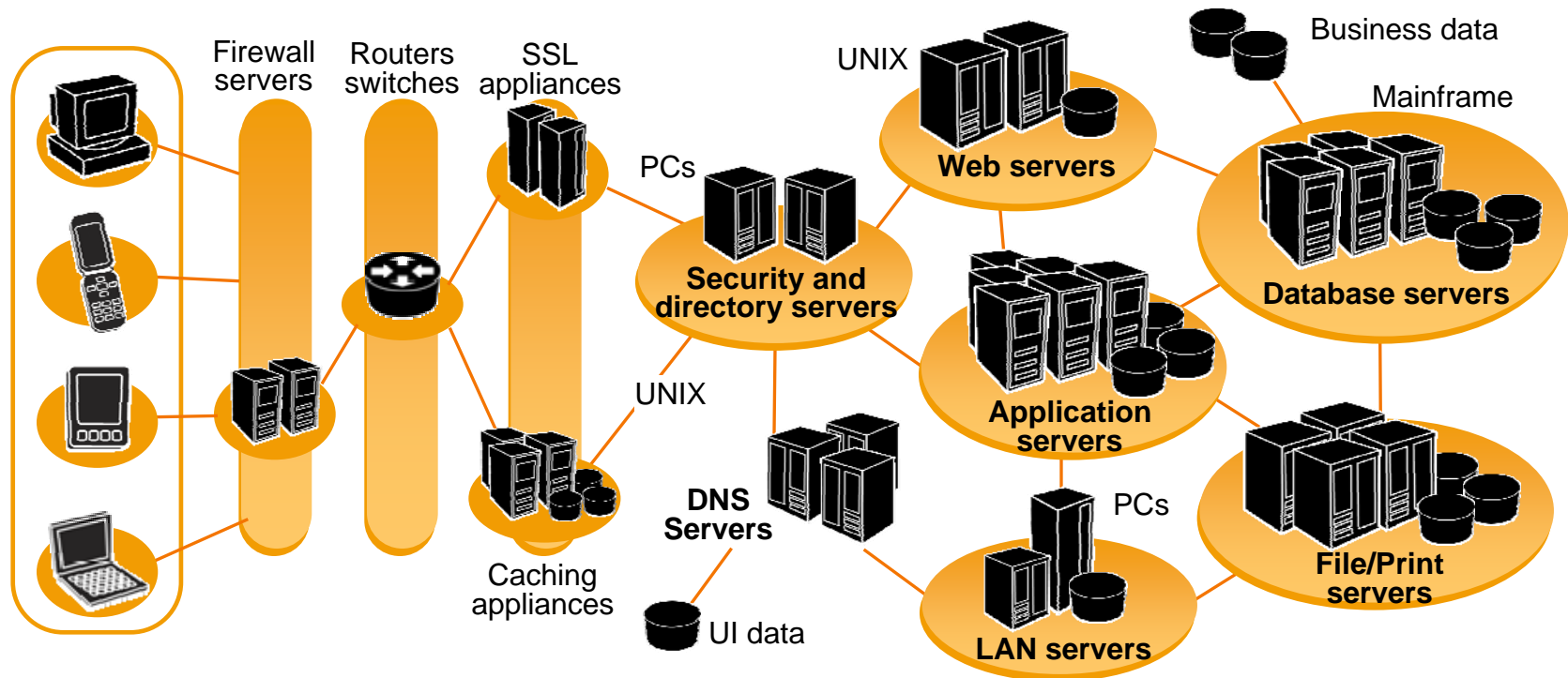
- **People expense has tripled as a %**
- **Software expense has doubled as a %**
- **Hardware is less than 1/3 of its original %**

Source: IBM Customer studies 1999-2004





# Complex infrastructures create challenges



- Management of complex, heterogeneous environments too hard
- IT asset utilization is too low
- Privacy, security and business continuity
- Swamped by the proliferation of technology and platforms to support
- Operational speed is too slow; IT flexibility too limited
- Inability to manage the infrastructure seamlessly



## Virtualization is a fundamental imperative

- ***“Virtualization is the process of presenting computing resources in ways that users and applications can easily get value out of them, rather than presenting them in a way dictated by their implementation, geographic location, or physical packaging. In other words, it provides a logical rather than physical view of data, computing power, storage capacity, and other resources.”***
  - Jonathan Eunice, Illuminata Inc.



***Virtualization is far more than just partitioning or single products***



## IBM's long term focus on virtualization

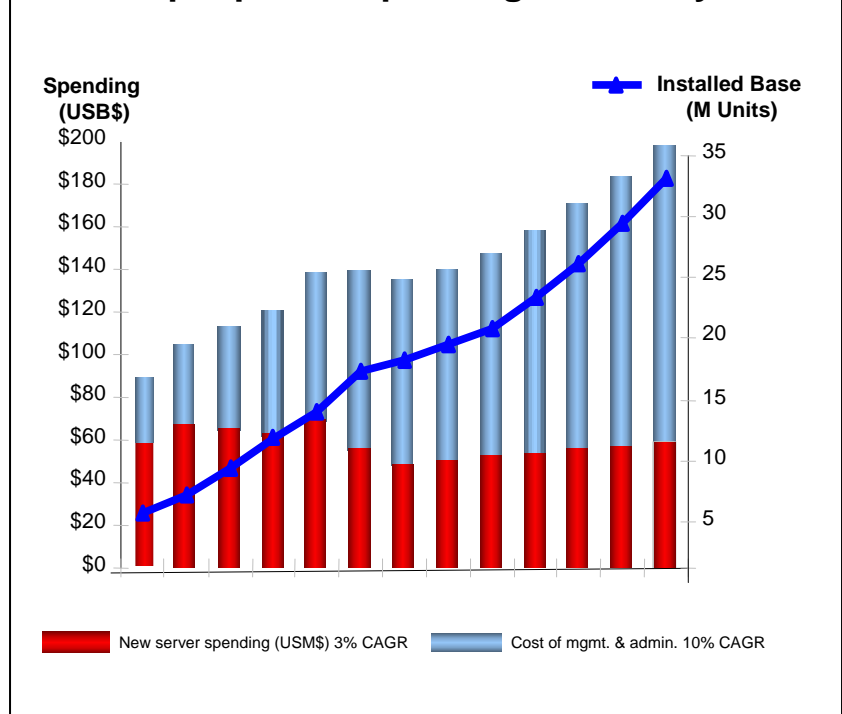
- **While virtualization sounds complex, it's really a simple idea – IBM systems can provide virtualization capabilities that are unique in the marketplace**
  - IBM mainframe virtualization - 40-yr history of world class hardware and software innovation
  - Open development leveraged across all servers and storage systems
  - All IBM systems can run multiple operating systems concurrently
  - Can manage non-IBM server and storage infrastructures
  - Does not require “rip and replace” hardware and software upgrades
  - Builds on existing infrastructure to help manage heterogeneous environments



# Why IT optimization is important

- **Fuel growth by managing costs:**
  - 80% of CEOs view growth as a key focus area
  - Operational costs far exceed the budgets for new hardware, they are growing at approximately 2½ times the compound annual growth rate\*
- **Complexity is growing:**
  - Existing computing capacity is highly underutilized
  - Gartner predicts that enterprises that don't leverage virtualization technologies will spend as much as 25% more for their x86 servers
- **Business Flexibility:**
  - Agility has been made a high priority across the organization ... [however] only 13% of the CEOs rate their organization's ability to respond to changing business conditions as very responsive \*\*

Cost of people vs. spending on new systems



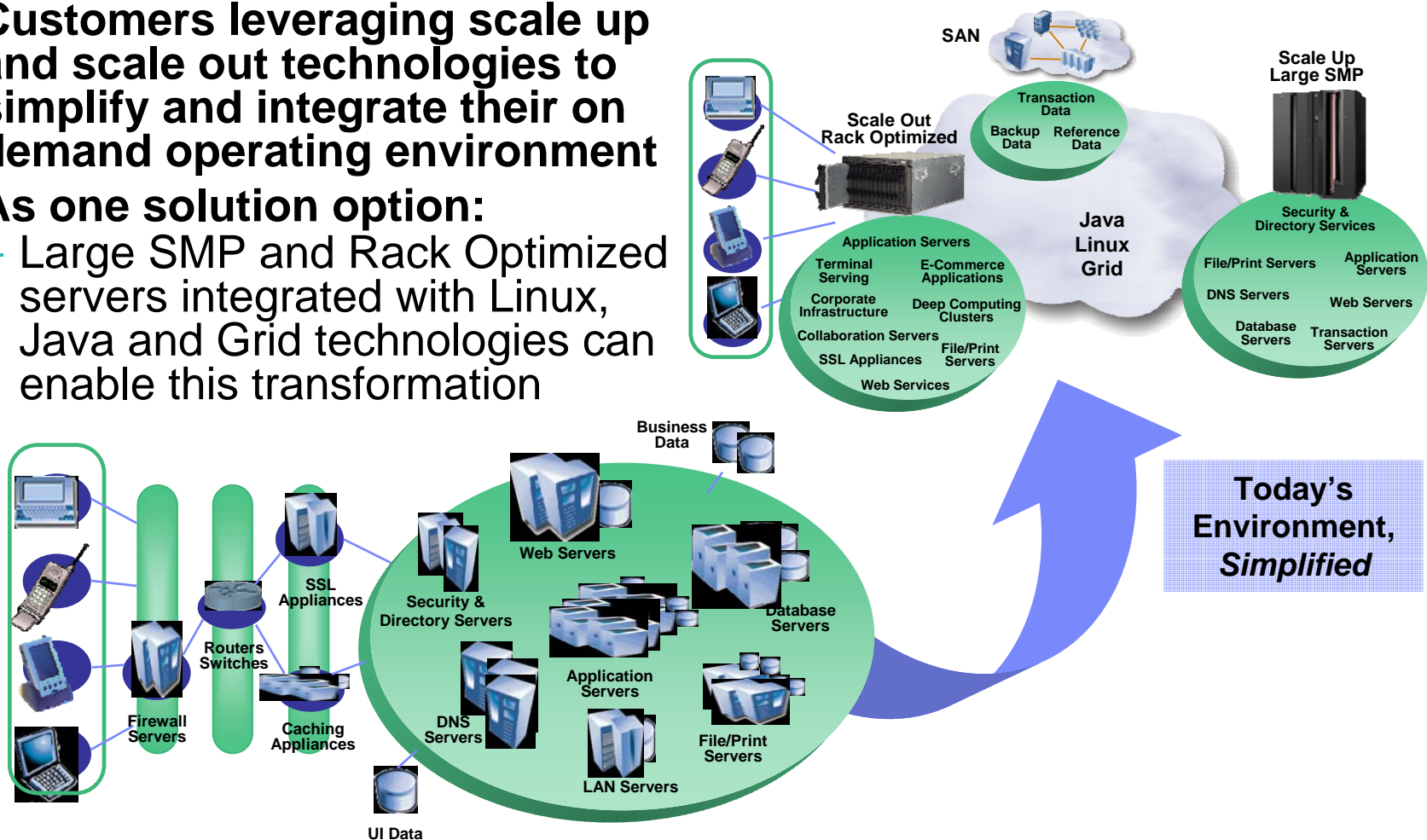
**Optimize IT assets now to fuel growth, improve ROI, increase staff productivity and improve quality of service**

\*IDC, 2004 \*\*CEO Study of 456 WW CEOs IBM Corporation, 2-04; Graphic: IDC Directions 4-7-04 Customer Adoption of On-Demand Enterprises.



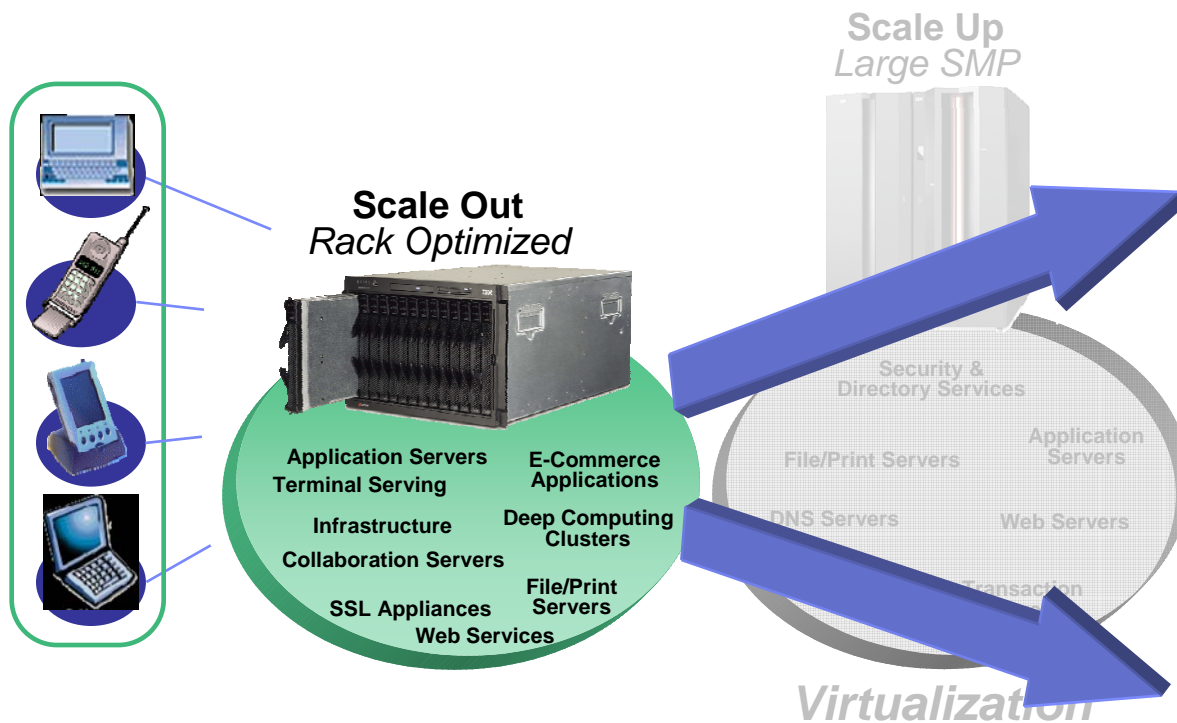
# IT optimization

- Customers leveraging scale up and scale out technologies to simplify and integrate their on demand operating environment
- As one solution option:
  - Large SMP and Rack Optimized servers integrated with Linux, Java and Grid technologies can enable this transformation





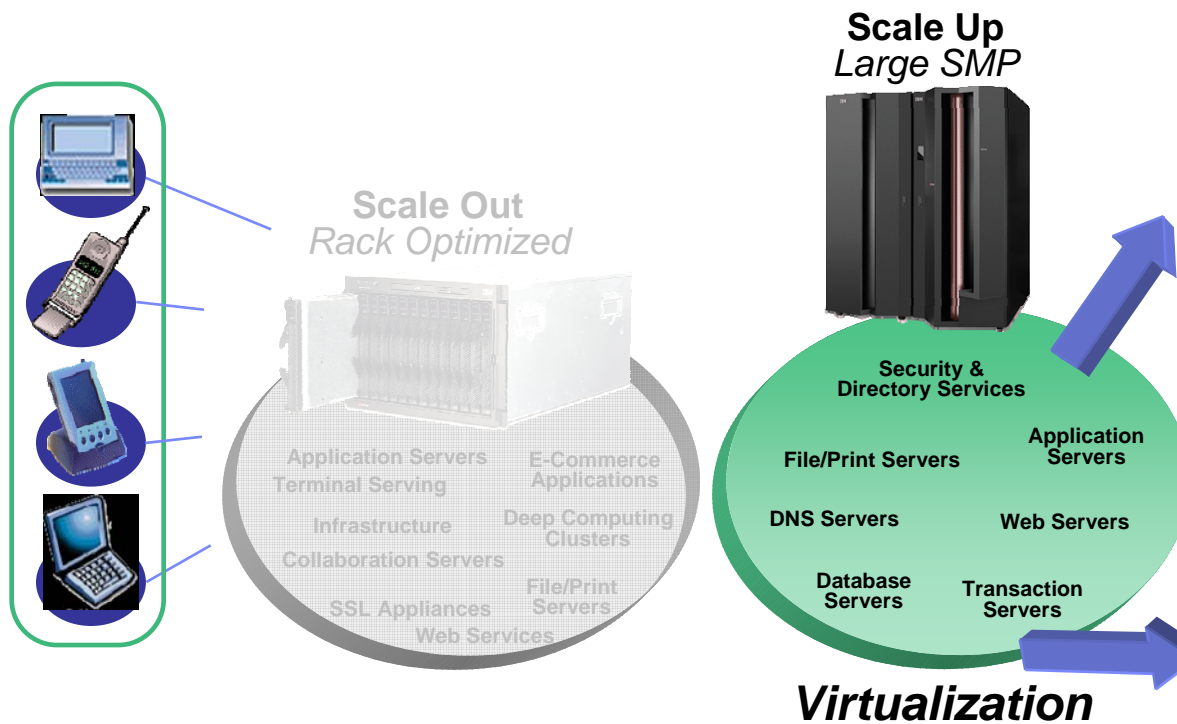
# Ideal blade implementations



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



# Ideal mainframe 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



## Design / architect continuum – A general “ROT”

### ■ x86

- Few servers
- Moderate to high average CPU % busy
- Low I/O requirements

### ■ RISC (POWER)

- CPU intensive
- Large memory
- LPAR benefits
- Moderate I/O

### ■ Mainframe

- Many servers
- Low to moderate average CPU % busy
- Virtual servers on demand
- High I/O requirements
- Integration with “legacy” systems





## 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 – eServer xSeries, BladeCenter**
  - Tolerates x86 software, limited exploitation
- **IBM POWER – System p, System i, BladeCenter JS**
  - 750+ commercial applications available
- **IBM Mainframe – System z**
  - 750+ commercial applications available



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# Linux on Mainframes

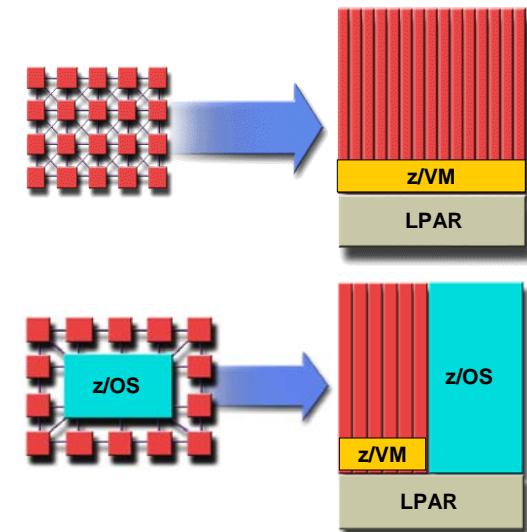
*[ibm.com/zseries/linux](http://ibm.com/zseries/linux)*





## What is Linux on System z?

- **A native mainframe operating environment**
  - Exploits IBM System z hardware
  - Not a unique version of Linux
- **Application sourcing strategy**
  - The IBM commitment to z/OS, z/TPF and z/VSE 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 z?

- 1. Increased solutions through Linux application portfolio**
- 2. Large number of highly skilled programmers familiar with Linux**
- 3. Integrated business solutions**
  - Data richness from System z
  - Wide range of Linux applications
- 4. Industrial strength environment**
  - Flexibility and openness of Linux
  - Qualities of service of System z
- 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**

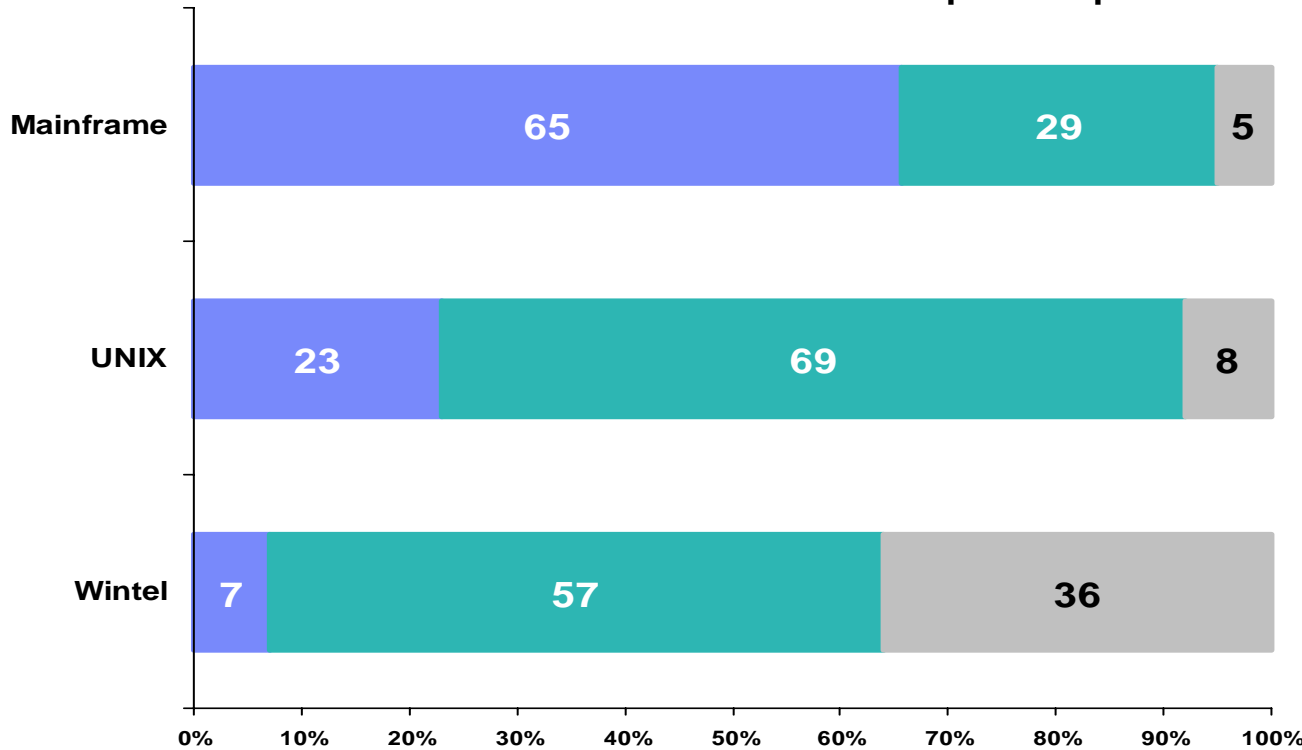
**Compared to market research in 2000, mainframe lead over Wintel has increased, gap over UNIX maintained**

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 z 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**
- **Designed to support mixed work loads**
  - Allows consolidation while maintaining one server per application
  - Complete work load isolation
  - High speed inter-server connectivity
- **Scalability**
  - System z9 109 scales to 54 application processors
  - eServer zSeries 990 scales to 32 application processors
  - eServer zSeries 890 scales to 4 application processors
  - Up to 8 dedicated I/O processors (SAPs)
  - Hundreds of Linux virtual servers



## What is different about Linux on System z?

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





## Value of Linux on System z

- **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 System z hardware and z/VM software
  - High performance integration with z/OS
- **Speed to market**
  - Capacity-on-demand capability on System z
  - Dynamic allocation of on-line users, less than 10 seconds to add a new Linux server image using z/VM and IBM DS8000



## Roadblocks to Linux adoption on System z

- **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**



# System z multidimensional virtualization

*Virtualization is built in, not added on*

- **Application support dimension (open, stable)**
  - Open, stable operating system
  - Virtual server awareness infrastructure
  - Enterprise applications
- **Hypervisor dimension (powerful, flexible)**
  - Shared-memory based virtualization model
  - Granular resource sharing and simulation
  - Flexible virtual networking
  - Resource control and accounting
  - Server operation continuity (failover)
  - Server maintenance tools and utilities
- **Hardware dimension (robust, reliable foundation)**
  - Legendary reliability, scalability, availability, security
  - Logical partitioning (LPAR)
  - Processor and peripheral sharing
  - Inter-partition communication
  - Virtualization support at the hardware instruction level

Application Support

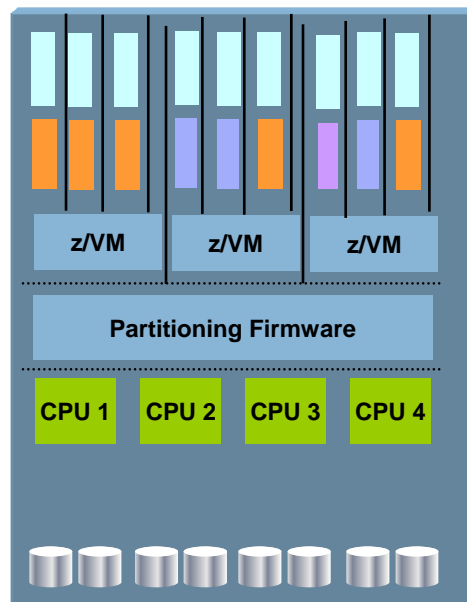
Hypervisor

Hardware



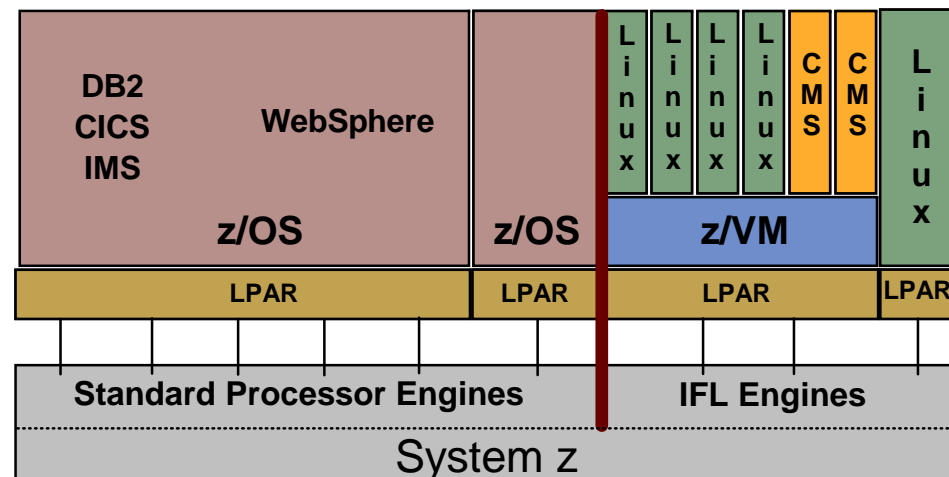
# System z – A closer look at the ultimate virtualization resource

IBM Mainframe



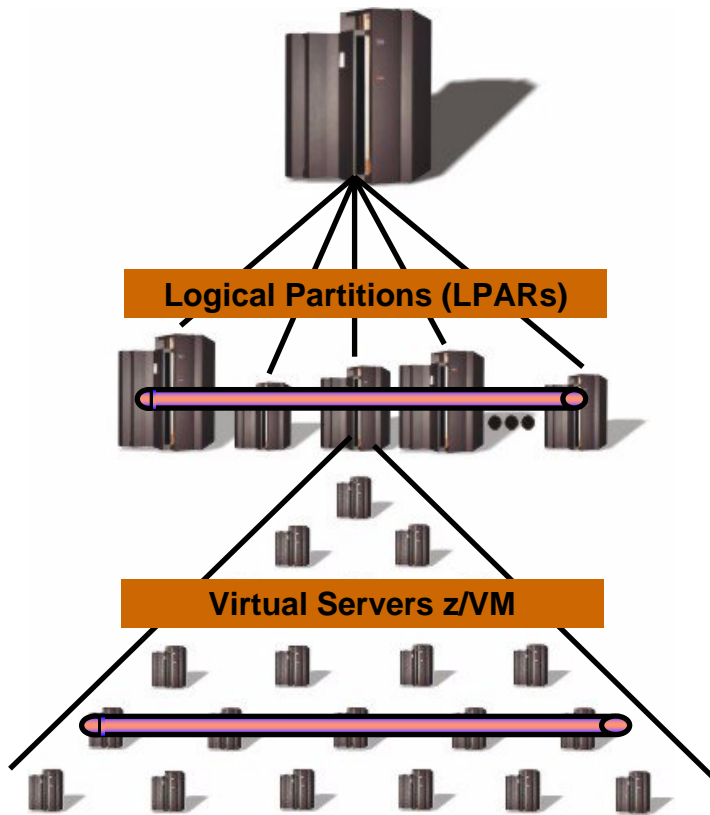
- **Utilization often exceeds 80%**
  - Handles peak workload utilization of 100% without service level degradation

- **Massive consolidation platform**
  - 60 logical partitions, 100s to 1000s of virtual servers under z/VM
  - Virtualization is built-in, not added-on
  - HiperSockets for memory-speed communication
  - Most sophisticated and complete hypervisor function available
- **Intelligent and autonomic management of diverse workloads and system resources based on business policies and workload performance objectives**





# z/VM – unlimited virtualization



**z/VM 5.2** – 64-bit support –  
real and virtual

- **Mature technology** – z/VM introduced in 1967
- **Software Hypervisor integrated in hardware**
  - Sharing of CPU, memory and I/O resources
  - Virtual network – virtual switches/routers
  - Virtual I/O (mini-disks, virtual cache, ...)
  - Virtual appliances (SNA/NCP, etc.)
- **Easy management**
  - Rapid install of new servers – cloning or IBM Director task z/VM Center
  - Self-optimizing workload management
  - Excellent automation and system management facilities
  - Flexible solution for test and development systems



# IBM Director with the z/VM Center

**IBM Director Console**

Console Tasks Associations View Options Window Help

**Groups**

- All Groups
  - All Systems and Devices
  - Chassis and Chassis Mem
  - Clusters and Cluster Memb
  - Hardware Status Critical
  - Hardware Status Informatio
  - Hardware Status Warning
  - IBM Director Systems
  - Platforms and Platform Men
  - Systems with Linux
  - z/VM Server Complexes
  - z/VM Systems

**All Systems and Devices : Server Complexes Me...**

Status and Name	TCP/IP
0000000000005152402.K4.OFERVM1	
Free guests	
LXEUI	9.60.60.67
scfM016	9.60.60.35
Production	
Print Servers	
scfM009	9.60.60.69
Web Servers	
scfM006	9.60.60.70
scfM007	9.60.60.68
Test	
T1	
scfM011	9.60.60.71
scfM012	9.60.60.72
Not Associated	
rhel4a.endicott.ibm.com	9.60.60.78

**Tasks**

- Event Action Plans
- Event Log
- External application launch
- File Transfer
- Hardware Status
- Inventory
- Microsoft Cluster Browser
- Network Configuration
- Process Management
- Remote Control
- Remote Session
- Resource Monitors
- Scheduler
- SNMP Browser
- Software Distribution
- All Software Distribution Packag
- System Accounts
- z/VM Center
- z/VM Server Complexes
- z/VM Virtual Server Deployment

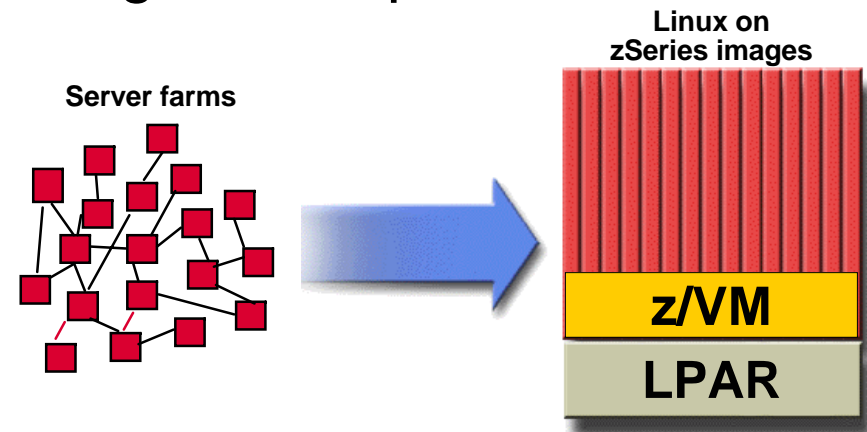
**IBM Director 5.1 with the z/VM Center simplifies deployment of guest images**

Host: ps-biran User ID: PS-BIRAN\biran 11:00 AM GMT



## The value of z/VM for Linux

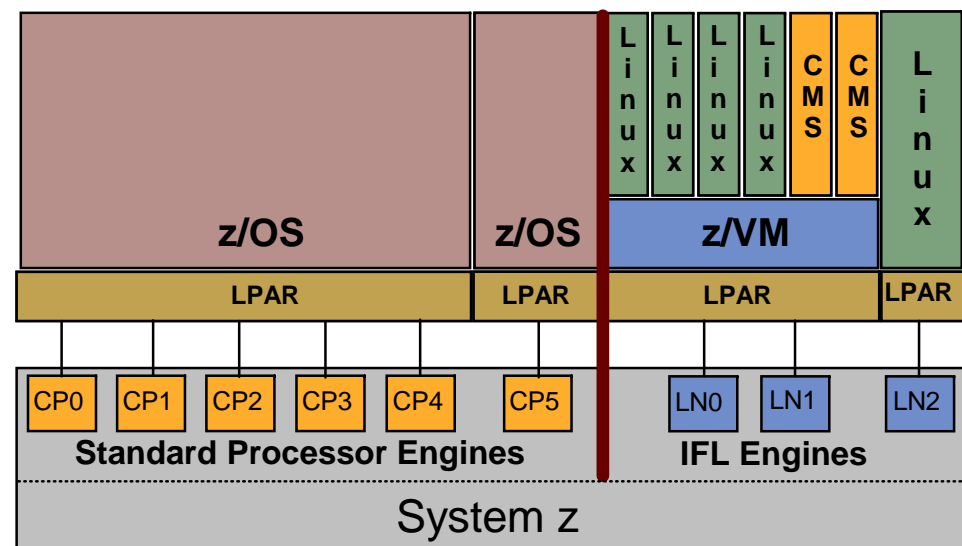
- **Enhanced performance, growth and scalability**
  - Server consolidation enables horizontal growth
  - N-tier architecture on two tiers of hardware
  - Extensive support for sharing resources
  - Virtual networking
  - Effective isolation of Linux images, if required
- **Increased productivity**
  - 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 zSeries
  - IFLs on “sub-uni” systems run at “full speed”
    - e.g z800, z890
- **Traditional mainframe software charges unaffected**
  - IBM mainframe software
  - Independent Software Vendor products
- **Linux and z/VM charged only against the IFLs**







## Current workload share on utilized IFLs

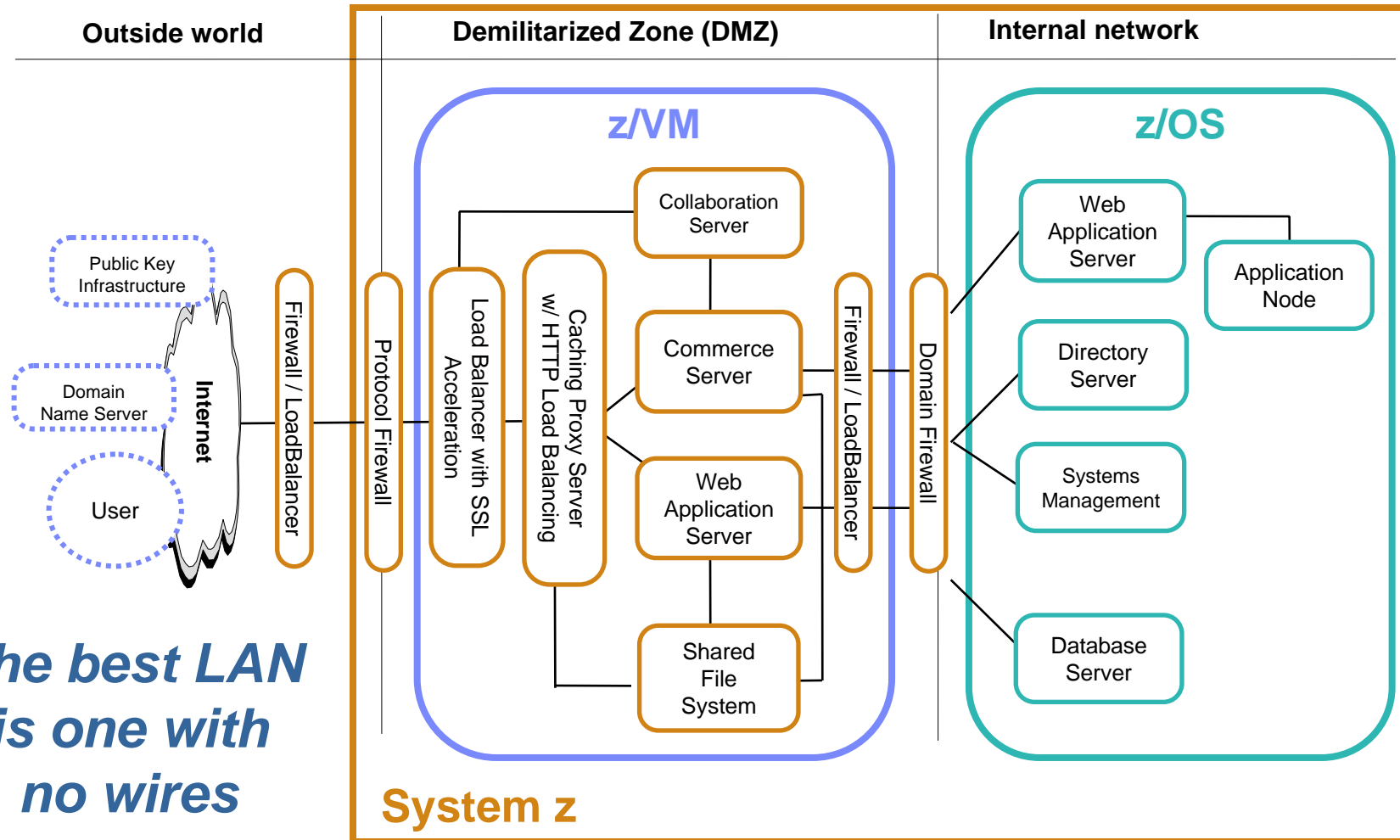
*Year-end 2005*

<b>70%</b>	<b>Application serving for z/OS</b> e.g. WebSphere, SAP, CICS TG, DB2 Connect
<b>20%</b>	<b>Data serving</b> e.g. Oracle DB, DB2 UDB
<b>4%</b>	<b>Workplace serving</b> e.g. Domino, other e-mail
<b>4%</b>	<b>Infrastructure serving</b> e.g. Apache, Samba
<b>2%</b>	<b>Linux application development/deployment</b>

Notes: extrapolation based on analyzing 1/3 of inventory, excludes all IBM



# Application serving with Linux on System z

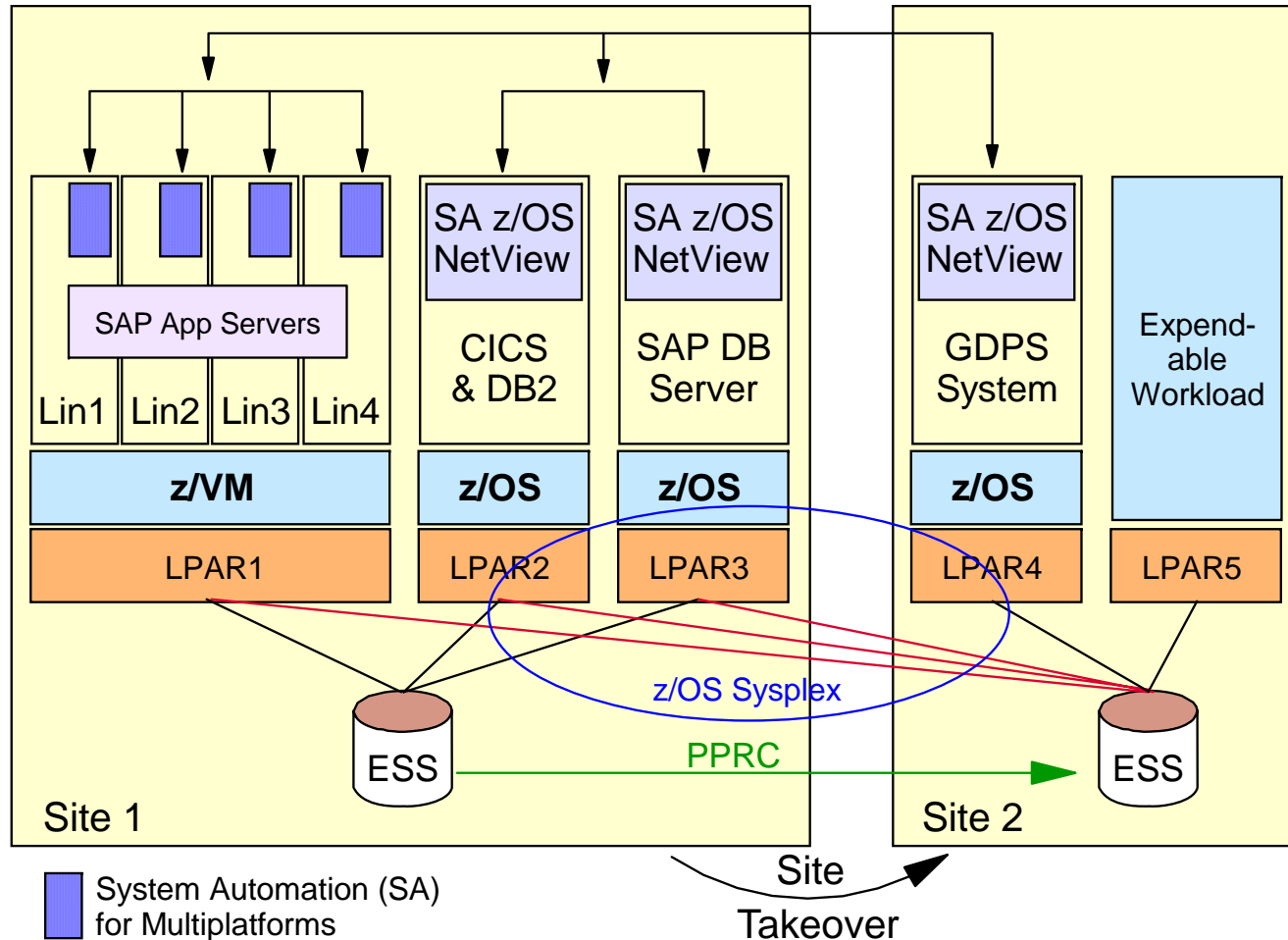


*The best LAN  
is one with  
no wires*

**System z**



# GDPS multiplatform resiliency for System z



- Designed for use with distributed applications
- SAP application server running on Linux for zSeries, SAP DB server running on z/OS
- Coordinated near-continuous availability and DR solution for z/OS, z/VM and Linux guests
- Uses z/VM HyperSwap function to switch to secondary disks
- Sysplex support allows for site recovery



# Where to deploy on System z – z/OS or Linux?

## Technical Considerations

---

Linux → z/OS

Quality of Service

---

Linux ← z/OS

Speed of deployment

---

Linux ← z/OS

Degree of portability

## Other Considerations

---

- Application availability
- Workload Management function and granularity
- File sharing across a Sysplex
- Manageability and scaling characteristics
- Availability of skill



# Platform selection for Linux applications

## Technical Considerations

System z ← Other architecture  
Quality of Service

System z ← Other architecture  
Speed of deployment  
Instances 2 - n

System z ← Other architecture  
Data Intensity

System z → Other architecture  
Compute Intensity

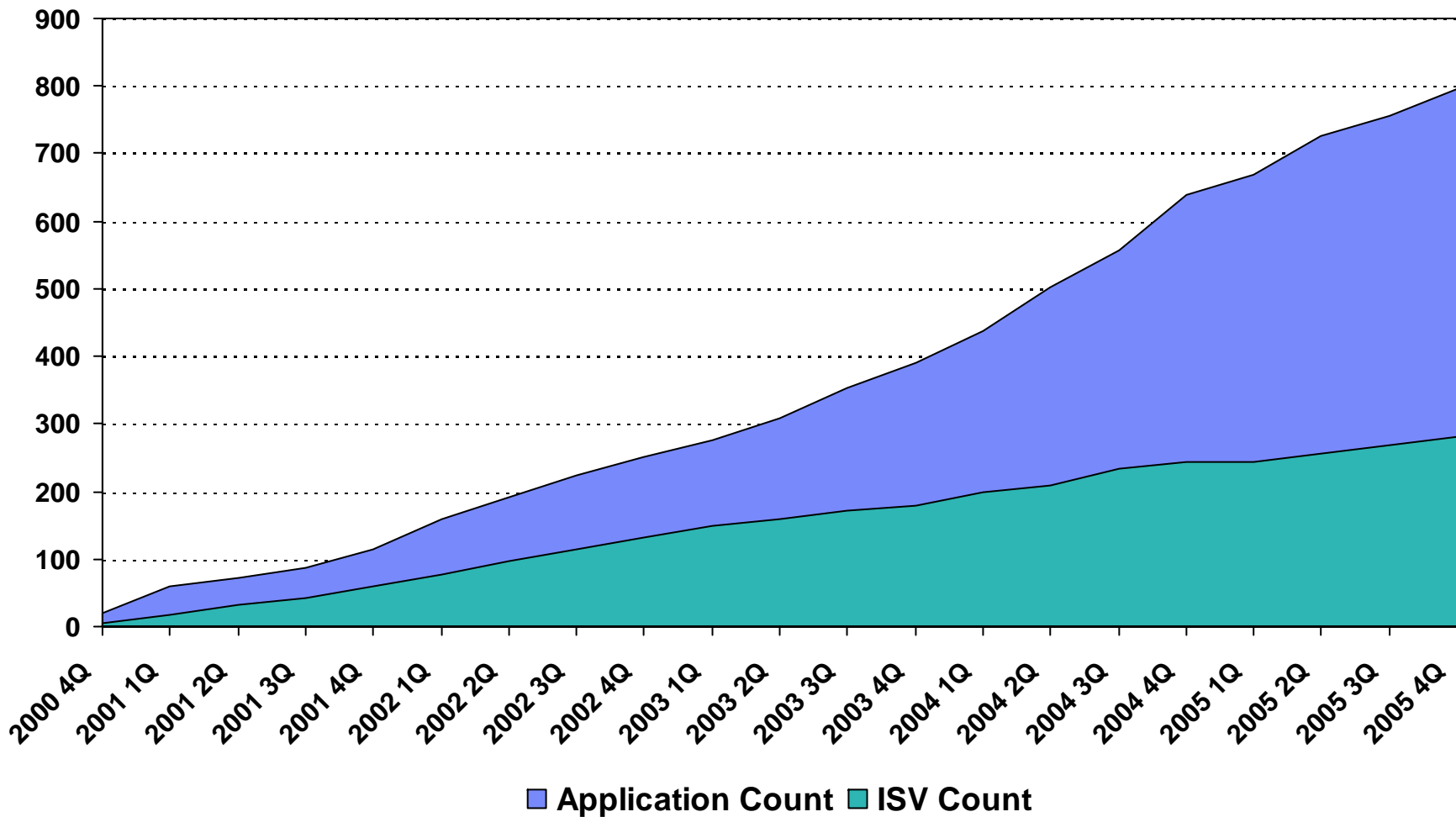
## Other Considerations

- **Application availability**
  - Certification of solution on hardware/software platform
- **Workload Management**
- **Manageability and scaling characteristics**
  - Especially DB2 on z/OS
  - Proximity of data to application
  - The best network is an internal network!



# Linux on System z ISV status

[ibm.com/zseries/os/linux/apps/all.html](http://ibm.com/zseries/os/linux/apps/all.html)





# Linux on System z Web site

*ibm.com/zseries/linux*

Country/region [select] | Terms of use

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

Servers > Mainframe servers >

## Linux on IBM System z™

**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 IBM System z

**Featured topics**

→ **Migrating Linux production servers from 2.4 to 2.6 kernel**  
 The recently published edition of the zSeries Test Report has added a new chapter on migrating Linux production environments with lots of middleware from Linux distributions based on the 2.4 kernel (SLES8 and RHEL3) to those based on the 2.6 kernel (SLES9 and RHEL4). The complete test report with all Linux and z/OS chapters is available from the zSeries Platform Test Web page.

→ **New product announcement: IBM Virtualization Engine and Infrastructure Services for Linux on System z9 and zSeries**  
 IBM Virtualization Services for Linux on System z9 and zSeries makes infrastructure simplification real by transforming integrated technologies, and extending the leading edge mainframe virtualization and management functions. With the product components, virtualization "best practices" can be extended into distributed environments, allowing to unify your heterogeneous IT infrastructure management consistently and open standards-based.

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

**Announcing**  
 IBM Virtualization Engine and Infrastructure Services  
 Effective infrastructure simplification



# 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 >

- 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<sup>®</sup>

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

### Currently marketed releases of z/VM



Now available: [z/VM V5.2](#)  
 Also available: [z/VM V5.1](#)  
[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, z/VSE, CMS, or Linux on System z9 and zSeries. [Read more about z/VM.](#)

### Summary of News and Updates

**View 02 Feb. 2006 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 / product links below)

- Dec. 16, 2005    [z/VM V5.2 Generally Available](#)
- Nov. 08, 2005    [IBM Virtualization Engine, V2.1](#)
- Nov. 01, 2005    [Revised transferability T's and C's for IBM z/VM V5.2](#)

Mainframe history

**40 years and counting**

Explore IBM mainframe innovation →

Is your VM current ?

Thinking about migration?

Technical Conference

**March 20-24 - Düsseldorf, Germany**

**IBM System z9 and zSeries Technical Conference**





## Internet list server discussions

### ■ VMESA-L discusses z/VM

- To subscribe, send a note to [listserv@listserv.uark.edu](mailto: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 z

- To subscribe, send a note to [listserv@vm.marist.edu](mailto: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>



Open Computing @ IBM



# Summary





## Three pillars of a successful Linux solution

### ■ On Demand Business

- Responsive
- Variable
- Focused
- Resilient

### ■ IBM

- End-to-end
- Hardware, software and services
- Value-net of partners



### ■ Linux

- Freedom of choice
- Cost effective
- Secure
- Innovative





## What next?

- **Familiarize yourself with the facts**
- **Establish an Open Policy**
  - It should be inclusive, not exclusive!
- **Align to Open Standards**
  - Insist on them!
- **View Open Source and Linux as valid alternatives for IT systems**
- **Make decisions based on business value; not hype and hope!**
  - Be pragmatic
- **Be prepared for change!**



# Thank you

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