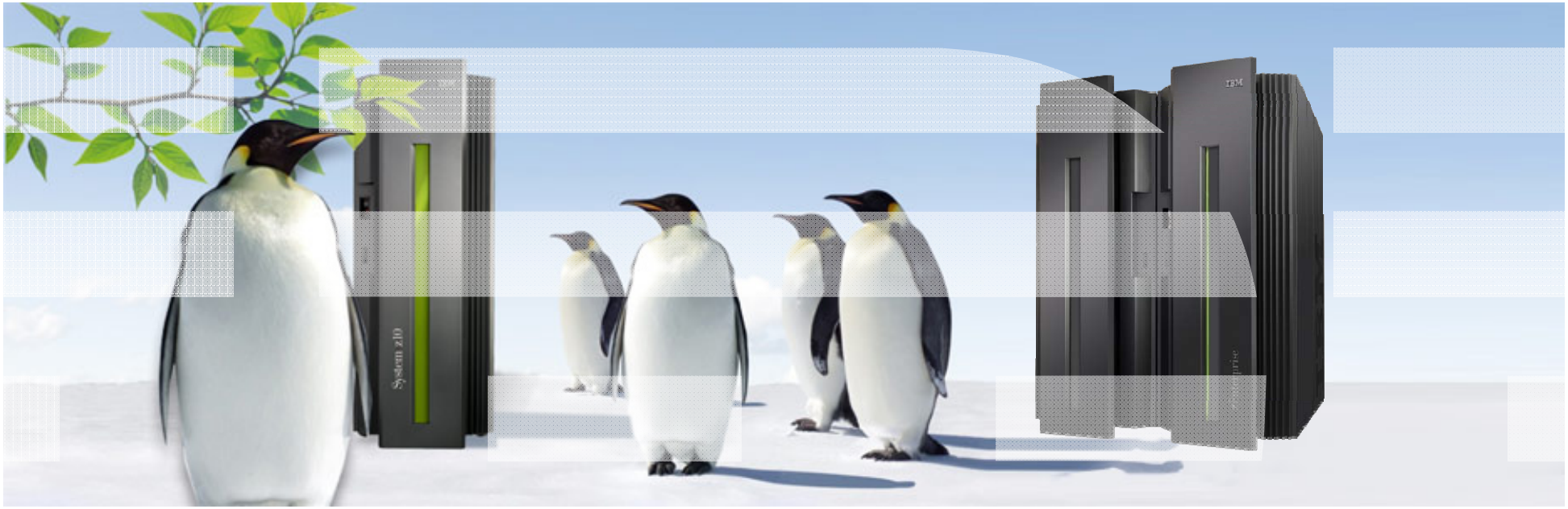
Jim Elliott
Consulting Sales Specialist – System z; zChampion; Linux Champion
IBM Canada Ltd.

A Strategic View of Linux on System z from IBM

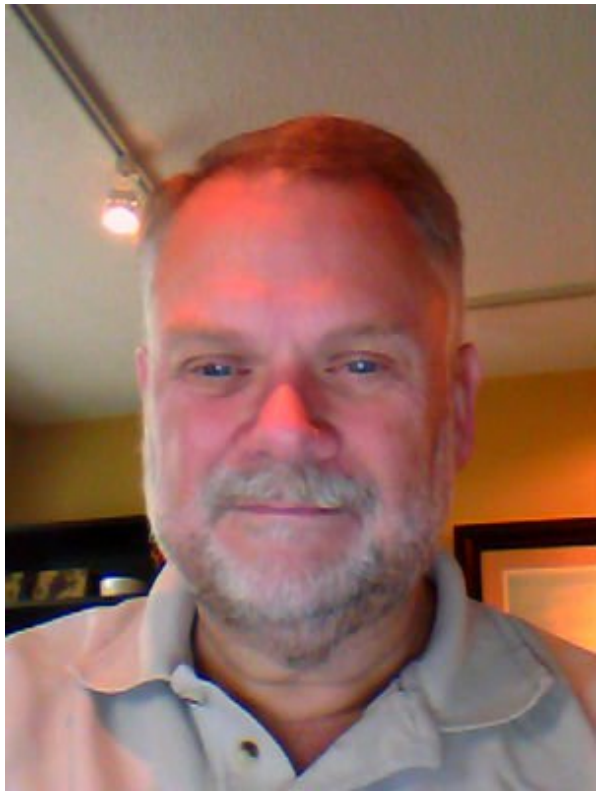


Abstract

- In the 11 years since Linux became available on mainframes, customers around the world have found novel ways to exploit this technology.
- From sites with a single IFL running just a few Linux images to sites with 100s of IFLs running 1000s of Linux images, the variety of implementations is dramatic.
- The early use was primarily “edge of network” where today usage is for mission-critical applications including SAP, IBM DB2 and Oracle DB, IBM WebSphere and Oracle Application Server, IBM Cognos, SGHE Banner and 100s of other applications.
- Users today have to decide on where to approach datacenter design as scale-out with rack-optimized servers, to scale up with large SMP servers, or a combination of the two using large SMP servers and virtualization to run many images on a single server.
- Jim will describe how Linux on System z, combination with z/VM, provides a robust and cost-effective Linux environment which integrates well with z/OS and z/VSE as well providing for consolidation of distributed platforms.

Jim Elliott – Consulting Sales Specialist, IBM Canada Ltd.

- **Jim is a Consulting Sales Specialist at IBM Canada and has worked at IBM for almost 38 years. He is the System z hardware sales specialist for General Business customers across Canada and the Caribbean and is a zChampion. He is also the Linux Champion for IBM Canada and in that role is the public spokesperson on Open Source and Linux issues.**
- **Jim has spent most of his career at IBM in technical roles and since 1992 has been the Product Manager for the mainframe operating systems in Canada. From May 1998 to December 2001 he was a mainframe Product Manager for IBM Americas where he led the launch of Linux on the mainframe. From January 2002 to May 2007 he was the Linux and Open Source leader for IBM Canada and then assumed his current role in May 2007.**
- **He is a graduate of the BC Institute of Technology, has co-authored over 20 IBM RedBooks, and is an active speaker on information technology across the US and Canada.**



Linux is continually evolving to meet strategic challenges

Linux continues to offer tremendous value
- Low acquisition costs/overall lower TCO

However – many customers and ISVs are now choosing Linux for strategic reasons first!
- Extensive hardware platform support
- ISV Support
- Security
- Skill set transfer
- Vendor diversity

"Linux has become a strategic data center operating system (OS) choice, not only for cost savings purposes."

Gartner Dataquest

Publication Date: 9 April 2009 ID Number: G00166909

User Survey Analysis: Are Linux Servers a Strategic Choice or TCO Reduction?

Kiyomi Yamada, George J. Weiss

Source: Gartner, User Survey Analysis, April 2009

Linux is a core component of the datacenter

***Linux** continues to enable new ways of doing business*

Edge and Web Infrastructure

- **Characteristics:**
  - Community Driven
  - Internet Enabled
  - Worldwide Volunteers
- **Typical applications:**
  - E-mail Servers
  - Apache, DNS, DHCP
  - Lightweight database
  - Network infrastructure

Application and Data Serving

- **Characteristics:**
  - Open Industry Driven
  - Open elements of IT industry join existing community
  - Linux adoption in the enterprise accelerates
- **Typical applications:**
  - e-Business, Web 2.0
  - Application servers
  - Broad HPC adoption
  - UNIX alternative

Business-Critical Workloads

- **Characteristics:**
  - Competition driven
  - Accepted as mature, open, lower-cost platform for DB, BI, ERP, CRM
  - Cornerstone of datacenter strategies
  - Steady adoption through downturn
- **Typical applications:**
  - Virtualization
  - Consolidation
  - Social networking
  - Embedded devices
  - Real-time

Next Generation Workloads

- **Characteristics:**
  - Accelerated adoption post-downturn
  - Workload allocation by platform capability
  - Utility billing models
  - Flexible resource allocation
  - IT-led cloud adoption
  - Fully established for business-critical use
- **Typical applications:**
  - Virtualization / Cloud
  - Consolidation
  - Analytics, BI, and HPC
  - Embedded devices
  - DB, ERP, CRM
  - Next-gen workloads

1991 – 2004 | **2005 – 2006** | **2007 – 2009** | **2010 +**

IBM provides complete Linux solutions

- Implementation support services
- Subscriptions

IBM Services

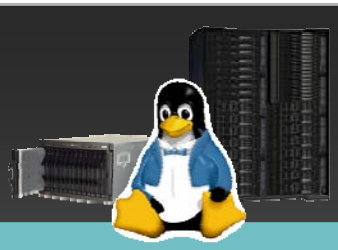
- Enterprise-ready Common across platforms

Information Management | **WebSphere®** | **Tivoli®** | **Lotus®** | **Rational®**

- Manage complex environments
- Simplification

IBM Systems Software

- Tier 1 Linux support for all IBM Systems
- Match workload needs to platform capabilities
- OS management skills common across platforms
- Increase flexibility
- Petabyte-scale storage solutions



IBM System x

IBM Power Systems

IBM System z

IBM Systems Storage

IBM Global Financing

Linux provides common benefits across all IBM platforms

Security
- Policy-based security
- Common criteria certification
- Very rapid time to fix if vulnerabilities are discovered

Supported platforms
- x86 to mainframes
- Broadest range of supported virtualization environments
- Can optimize by workload

Scalability
- Ongoing innovation in both scale out and scale up
- Platform support provides flexibility in consolidation

Skills
- Linux skills widespread
- OS management skills applicable across platforms

Innovative Linux solutions start with collaboration

- **IBM has been an active Linux community member since 1999**
- **IBM is the leading systems vendor contributing to Linux**
- **IBM has over 600 full-time developers working with Linux and open source**

- **Linux Kernel and Subsystem Development**
  - Kernel Base Architecture Support
  - GNU
  - Security
  - Systems Management
  - RAS
  - Virtualization
  - Special Projects
  - Filesystems, and more …
- **Foster and Protect the Ecosystem**
  - Software Freedom Law Center,
  - Free Software Foundation (FSF),
  - Open Invention Network, and more …
- **Expanding the Open Source Ecosystem**
  - Apache and Apache Projects
  - Eclipse
  - Mozilla Firefox
  - OpenOffice.org
  - PHP, Samba, and more …
- **Promoting Open Standards and Community Collaboration**
  - The Linux Foundation
  - Linux Standards Base
  - Common Criteria certification
  - Java Community Process
  - Open Software Initiative, and more …

Who has contributed to Linux?

Company Name	Number of Changes	Percent of Total
None	35663	18.9%
Red Hat	23356	12.4%
Novell	13120	7.0%
IBM	13026	6.9%
Unknown	12060	6.4%
Intel	11028	6.8%
Consultants	4817	2.6%
Oracle	4367	2.3%
Renesas Technology	2621	1.4%
The Linux Foundation	2488	1.3%
Academics	2464	1.3%
SGI	2450	1.3%
Fujitsu	2293	1.2%
Parallels	2226	1.2%
Analog Devices	1955	1.0%
Nokia	1896	1.0%
HP	1854	1.0%
MontaVista	1821	1.0%

http://www.linuxfoundation.org/docs/lf_linux_kernel_development_2010.pdf

IBM is committed to the growth of the Linux ecosystem

Focused on our Clients

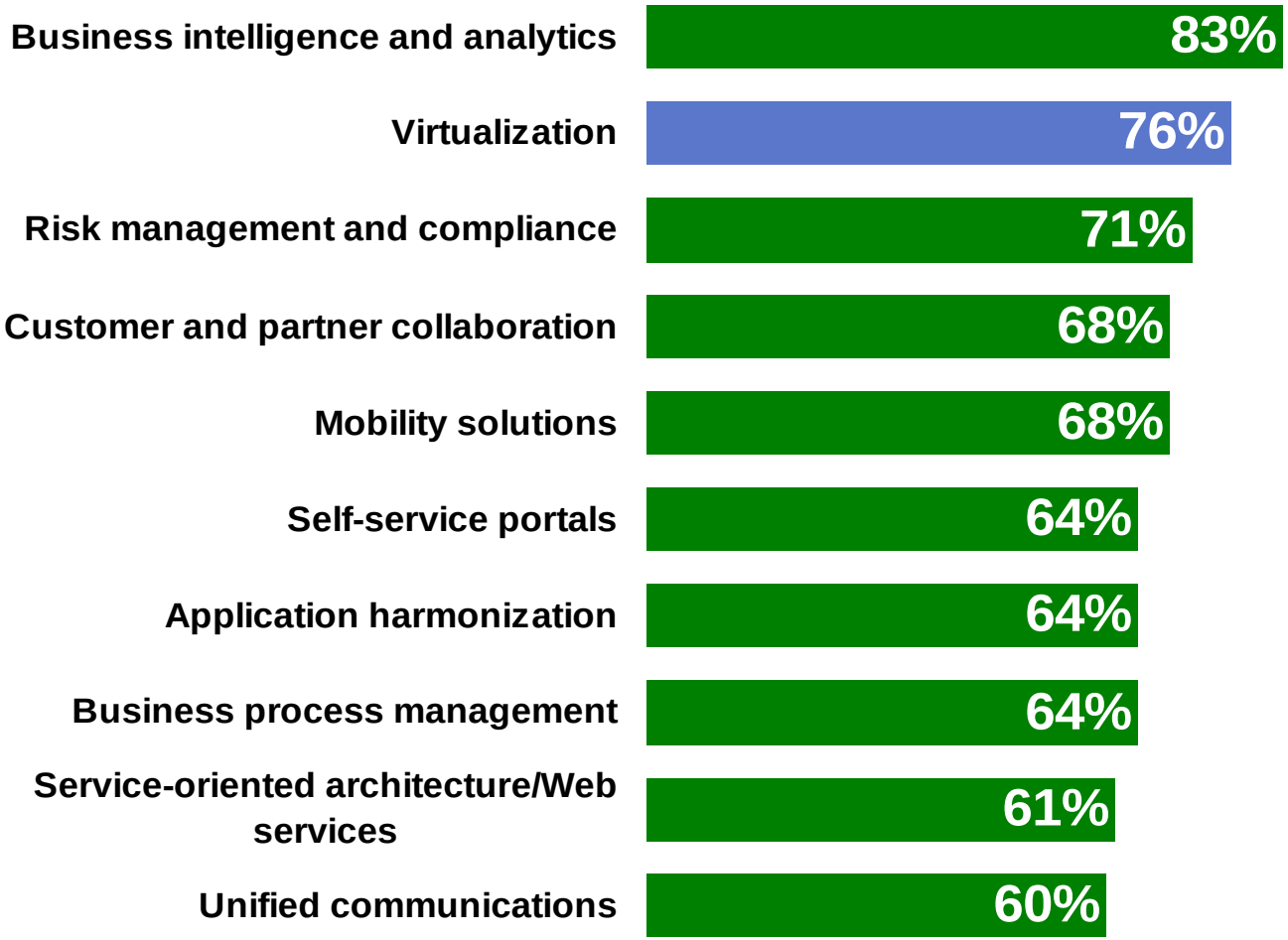
1. **Fully enable and support IBM's product suite on Linux**
2. **Accelerate the maturation of KVM capabilities**
3. **Drive capabilities for ever more workloads onto Linux**
4. **Ensure Linux is the premier guest operating system for cloud environments**
5. **Target Linux as the greenest of operating systems**
6. **Continue focus on simplification of the Linux environment**

Focused on Technology

IBM 2009 CIO survey results

CIOs select their 10 most important visionary plan elements

76% of CIOs cited *"implementing a virtualized computing environment"* as part of their visionary plans to enhance competitiveness.



Note: CIOs were asked to select all applicable answer to the question *"What kind of visionary plans to you have for enhanced competitiveness?"*

Linux on System z – take back control of your IT

A data center in a box – not a server farm

- **Potentially lower cost of operations**
  - Less servers
  - Fewer software licenses
  - Fewer resources to manage
  - Less energy, cooling and space
- **Central point of management**
- **Increased resource utilization**
- **Fewer intrusion points**
  - Tighter security
- **Fewer points of failure**
  - Greater availability

Linux on IBM System z

Linux + Virtualization + System z = SYNERGY

- **The legendary IBM mainframe – IBM System z**
  - Legendary dependability
  - Extremely security-rich, highly scalable
  - Designed for multiple diverse workloads executing concurrently
  - Proven high volume data acquisition and management
- **The IBM mainframe virtualization capabilities – z/VM**
  - Support for large real memory and 32 processors in a single partition
  - Enhanced security and LDAP server/client
  - Enhanced memory management for Linux guests
  - Enhanced management functions for Linux
- **Open standards operating system – Linux for System z**
  - Reliable, stable, security-rich
  - Available from multiple distributors
  - Plentiful availability of skills administrators and developers
  - Large selection of applications middleware and tooling from IBM, ISVs and Open Source

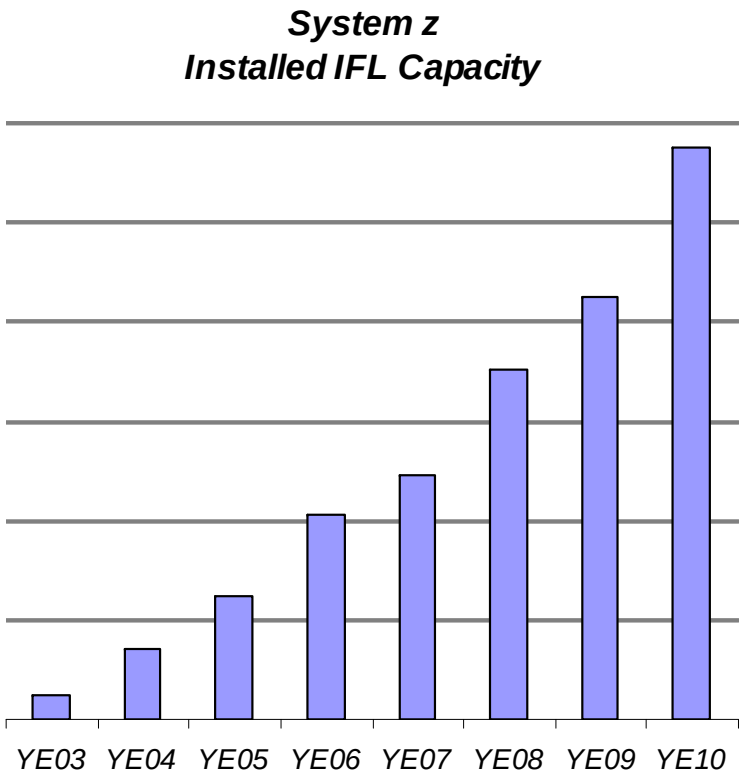
Why Linux on System z?

The reasons in 1999 are still valid today

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
   - Web capability of Linux applications
4. **Industrial strength environment**
   - Flexibility and openness of Linux
   - Qualities of service of System z
5. **Unique ability to easily consolidate a large number of servers**

System z Linux: The momentum continues

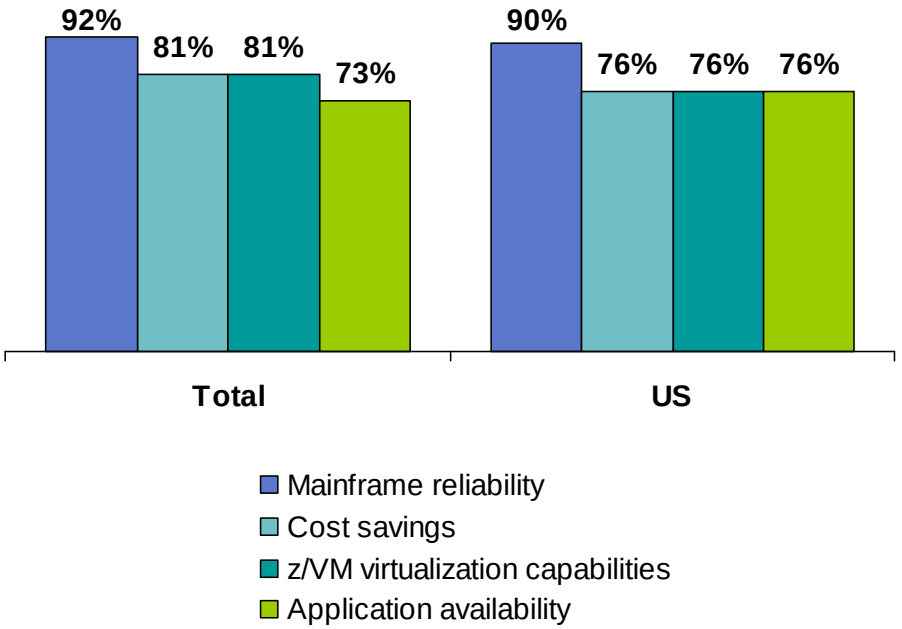
- **The momentum continues:**
  - Shipped IFL engine volumes increased 34% from YTD 4Q09 to YTD 4Q10
  - Installed IFL MIPS increased 6% from 3Q10 to 4Q10
  - Installed IFL MIPS increased 35% from 4Q09 to 4Q10
- **32% of System z customers have IFLs installed**
- **Linux represents 19% of the System z install base capacity (MIPS)**
- **64 of the top 100 System z clients are running Linux on the mainframe**
- **> 3,000 ISV applications are available for Linux on System z**



Reasons for running Linux on the mainframe

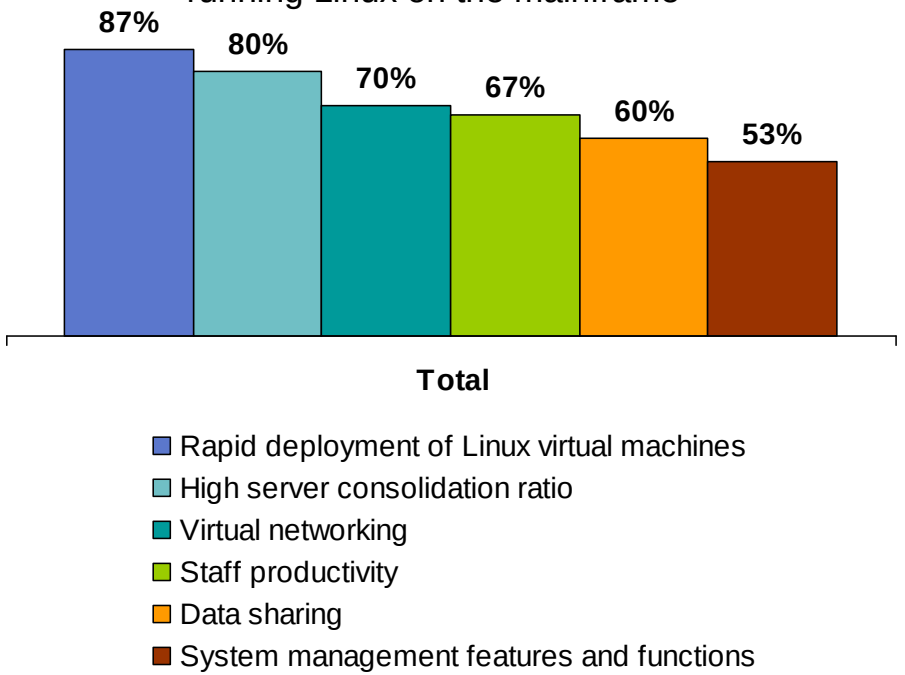
Key Factors in Running Linux on Mainframe

Base: Running Linux on the mainframe



z/VM Capabilities Valuable for Running Linux on Mainframe

Base: Those who consider z/VM capabilities a key factor in running Linux on the mainframe



- **Mainframe reliability is the top driver for running Linux on System z, followed by cost savings, z/VM® virtualization capabilities and application availability**
- **The most important z/VM capabilities are rapid deployment of Linux virtual machines and high server consolidation ratio**

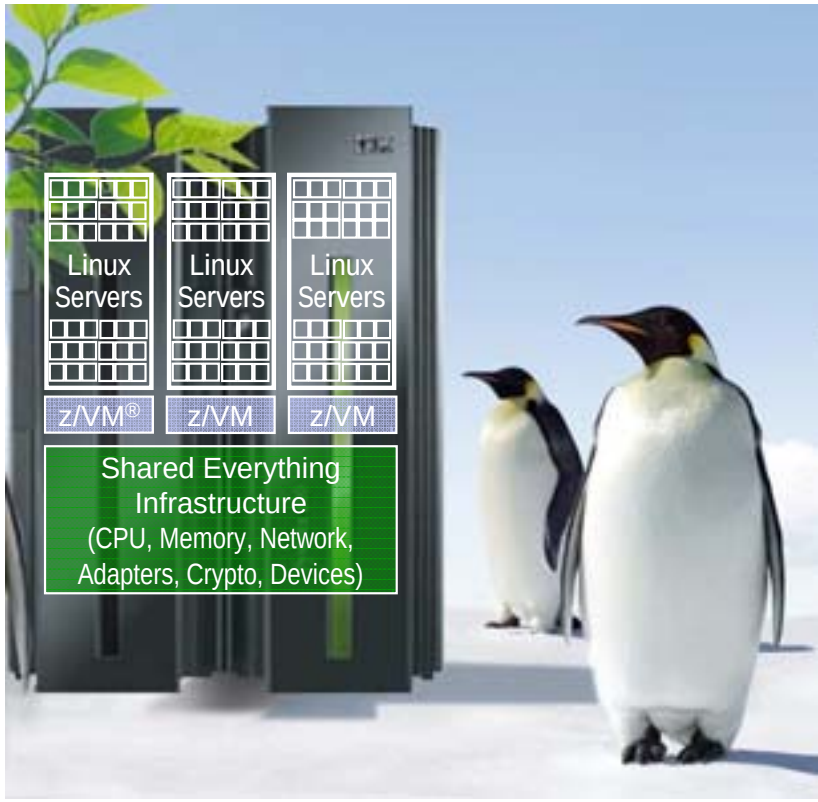
Source: 2009 IBM Market Intelligence

What System z brings to Linux

- **The most reliable hardware platform available**
- **Centralized Linux systems can be 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**
  - zEnterprise 196 scales to 80 IFLs
  - System z10 EC scales to 64 IFLs
  - System z10 BC scales to 10 IFLs
  - Dedicated I/O processors
    - Up to 14 (z196), up to 11 (z10 EC), or 2 (z10 BC)
  - Hundreds to thousands of Linux virtual servers

What is different about Linux on System z?

- **Access to System z specific hardware**
  - Crypto support – CPACF, CryptoExpress3
  - Traditional mainframe and Open I/O subsystems
    - IBM System Storage DS8000
    - IBM XIV Storage System
    - SAN Volume Controller for other storage
  - OSA-Express3 for very high speed communication between systems
  - HiperSockets for ultra-high speed communication between Linux images on the same machine
- **z/VM aware**
  - Enhanced performance
  - System management tools



Value of Linux on System z

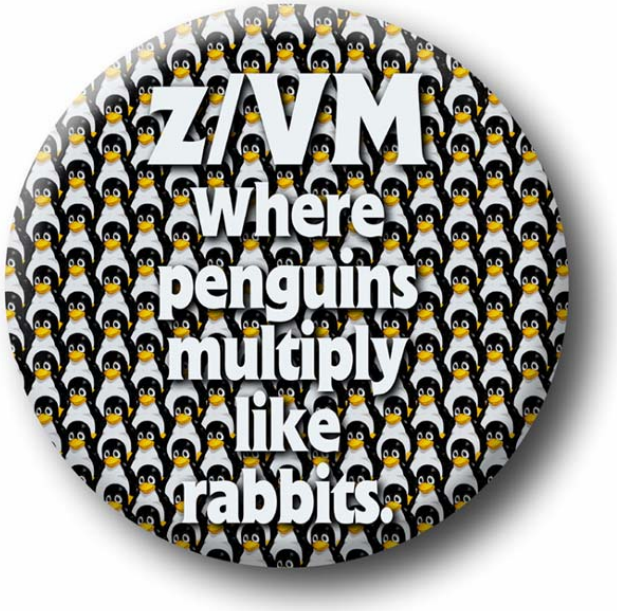
- **Reduced Total Cost of Ownership (TCO)**
  - Environmental savings – single footprint vs. hundreds of servers
  - Consolidation savings – less storage, less servers, less software licenses, less server management/support
- **Improved service level**
  - Systems management (single point of control)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

System z – The ultimate virtualization resource

- **Utilization often (usually?) exceeds 90%**
  - Handles peak workload utilization of 100% without service level degradation
- **Massive consolidation platform**
  - Up to 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**

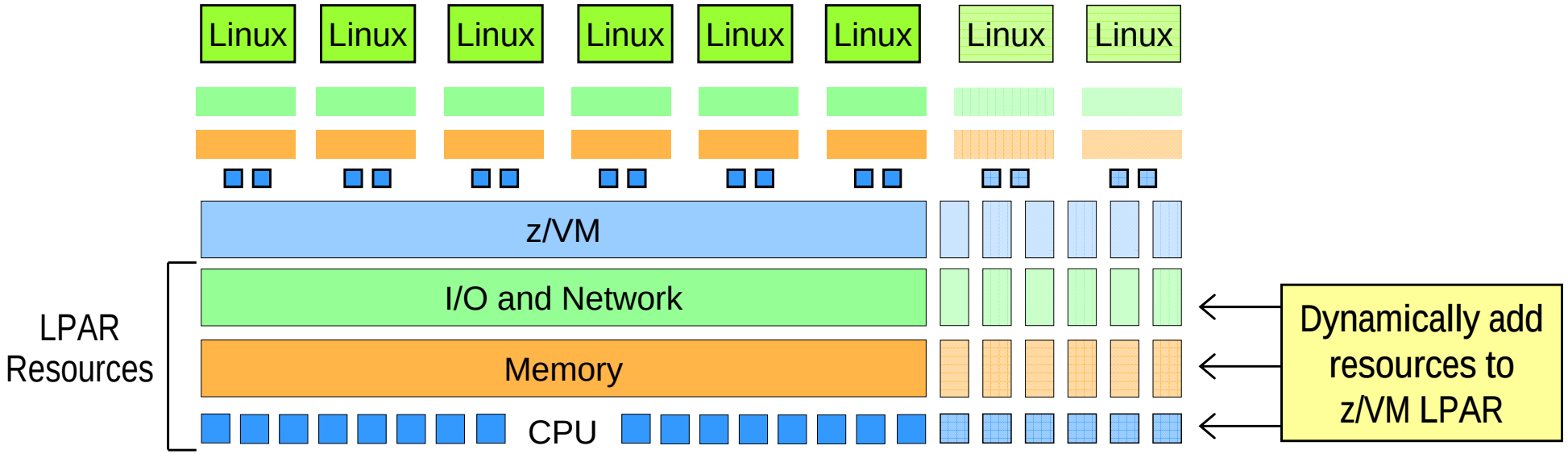
z/VM – Extreme virtualization

- **z/VM helps enterprises meet their growing demands for multi-system server solutions with a broad range of support for operating system environments**
- **Mature technology – VM/370 introduced in 1972**
- **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, …)
- **Easy management**
  - Self-optimizing workload management
  - Deploy virtual servers in seconds
  - Highly granular resource sharing (<1%)
  - Add physical resources without taking system down, scale out to 1000s of virtual servers
  - Do more with less: More virtual servers per core, Share more physical resources across servers
  - Extensive virtual server life-cycle management



Linux on z/VM: Flexible, efficient growth

- **Clients can start small with Linux on System z and non-disruptively grow their environment as business dictates**
- **Users can dynamically add CPUs, memory, I/O adapters, devices, and network cards to a running z/VM LPAR**
- **z/VM virtualizes this capability for guest machines**



Smart economics: non-disruptively scale the z/VM environment by adding hardware assets that can be shared with *every* virtual server

Built-in IBM System z security for distributed workloads

Reducing risk – protecting businesses

- **Protect from intrusion**
  - z/VM Integrity Statement
  - EAL4+ Common Criteria Certification for z/VM and Linux on System z
- **Protect data**
  - Built in encryption accelerators in every server
  - FIPS-140-20 Level 4 certified encryption co-processors for highly secure encryption
- **Ensure privacy**
  - Access to all resources is controlled by an integrated central security manager
- **Protect virtual servers**
  - The only servers with EAL5 Common Criteria Certification (for PR/SM)
- **Respond to compliance regulations**
  - Up to 70% in security audit savings

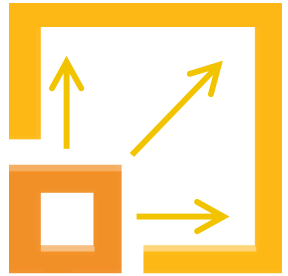
Smarter virtualization with the IBM Enterprise Linux Server

- **x86 virtualization solutions have some hidden and some not-so-hidden issues**
  - Physical server sprawl is needed to scale a virtualized x86 environment – typically with linear, per-machine pricing
  - x86 virtual machine sprawl can be difficult to manage, causing operational complexity
  - Ineffective capacity planning can result in failure to meet service level agreements
  - Limited core-to-core consolidation ratios and virtual machine mobility requirements can lead to costly software fees
  - x86 systems do not have a heritage of robust security support
  - Duplication of hardware and is needed for disaster recovery
- **Enterprise Linux Server provides a superior scale-up system architecture for scale-out x86 applications**
  - Dynamically expand your system “on demand” – add capacity when you need it, not any sooner, not any later
  - Enjoy superior operational capabilities for greater levels of command and control
  - Total Cost of Ownership economics favor server virtualization on an Enterprise Linux Server, especially when factoring in disaster recovery and server technology refreshes

Consolidate more and spend less with the Enterprise Linux Server

zEnterprise delivers impressive IFL scalability enhancements

Expanding the economic appeal of Linux-on-z/VM for server consolidation and workload optimization



- **25% more processor cores – up to 80 IFLs and 96 total system cores**
- **30-to-60% faster processing – larger cache memory structure for extreme virtualization; new instructions accelerate Java code**
- **100% more memory – up to 3 TBs for memory-hungry virtual servers**
- **Consolidate more virtual servers per core, per z/VM LPAR, per zEnterprise**
  - Require even fewer physical servers, fewer network devices, fewer switches, less disk space, less energy, and less floor space
  - Spend even less on software license fees with extreme levels of resource sharing and workload consolidation
  - Increase the productivity of your staff as they manage even more server images on a single zEnterprise system

zEnterprise blades complement Linux on z/VM consolidations

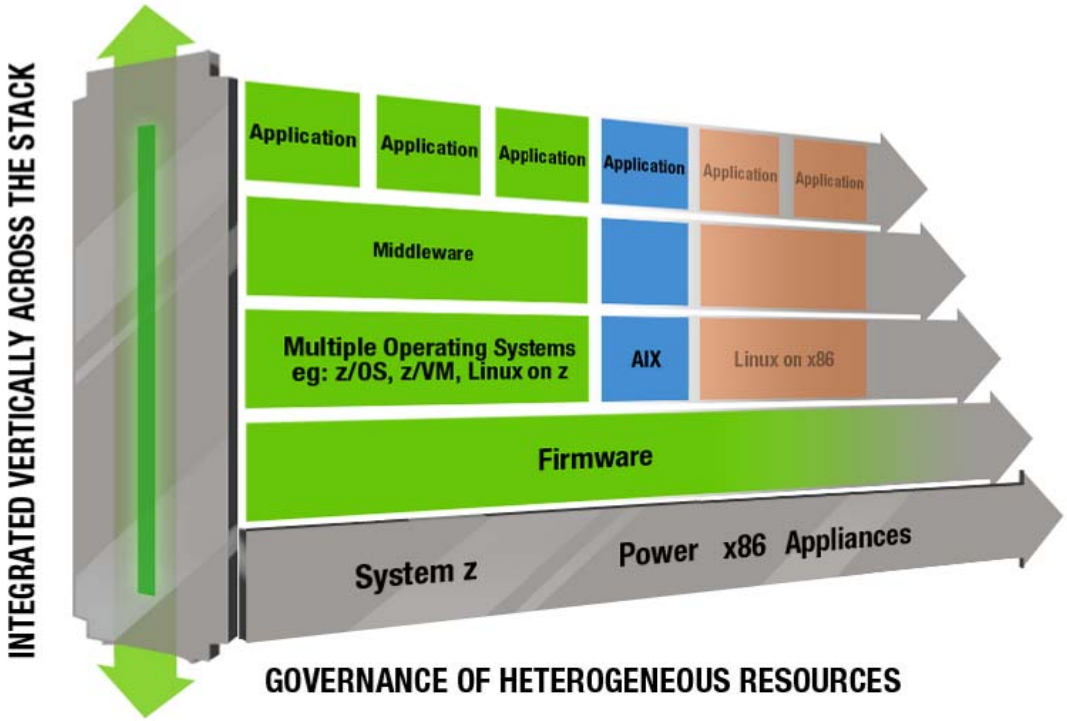
Use blade technology to increase application supply and further optimize workload placement

- **Server and application consolidation on System z using Linux and z/VM is the industry leader in large-scale, cost-efficient virtual server hosting**
- **Blades in zEnterprise BladeCenter Extension (zBX) offer clients ability to increase value of server consolidation on System z IFL specialty processors:**
  - Host a complete solution suite on zEnterprise by running “companion” apps on zEnterprise blades in conjunction with Linux applications running on z/VM
  - User Power and x86 blades for compute-intensive application logic that does not require z/VM and zEnterprise qualities of service
- **Use zEnterprise Unified Resource Manager as a common interface to manage virtual servers running on z/VM and zEnterprise blades**
  - This simplifies the effort to manage a “fit for purpose” solution deployment that runs applications on different architectures (e.g. IFLs, Power, x86)
  - This provides operational convenience when you want to re-host blade applications to Linux on z/VM as a result of application growth and/or a need for superior qualities of service

zEnterprise Unified Resource Manager

Building on classic System z strengths for workload management

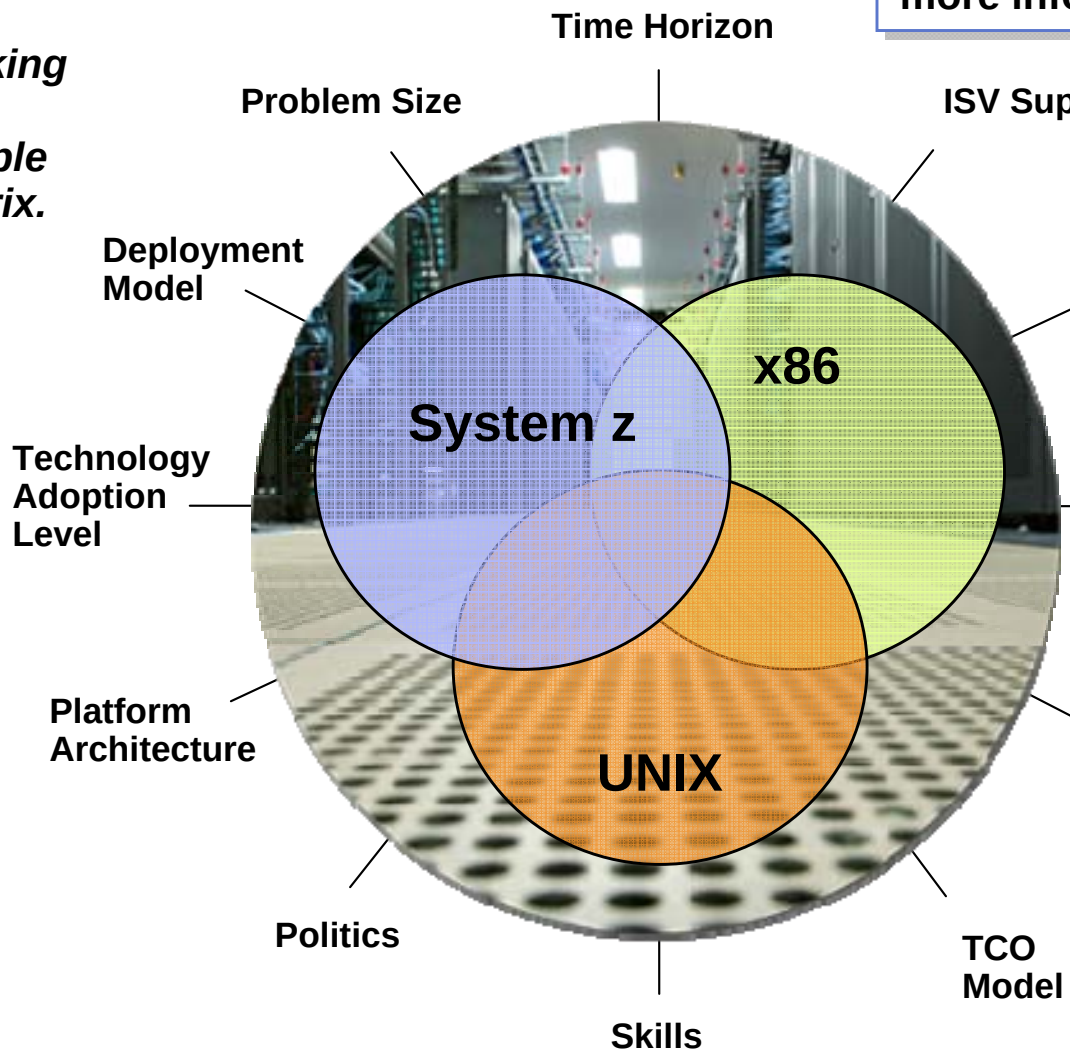
- **Introduces virtual server provisioning and management for Linux guests running on z/VM**
  - Use the Unified Resource Manager to create z/VM virtual machines
  - Simplify the skill level needed to manage a Linux on z/VM environment
- **Extends the comprehensive management of the System z technology stack to include blade resources**
- **Provides end-to-end governance and management that spans entire business processes**
- **Simplifies the effort to optimize workload placement across a mix of system architectures**
- **Modify your application landscape using a single user interface**
  - Eliminate multiple platform management consoles
  - Improve business responsiveness



Platform choice – Fit for purpose, workload and situation

Many factors influence a platform selection, making it difficult to present a simple selection matrix.

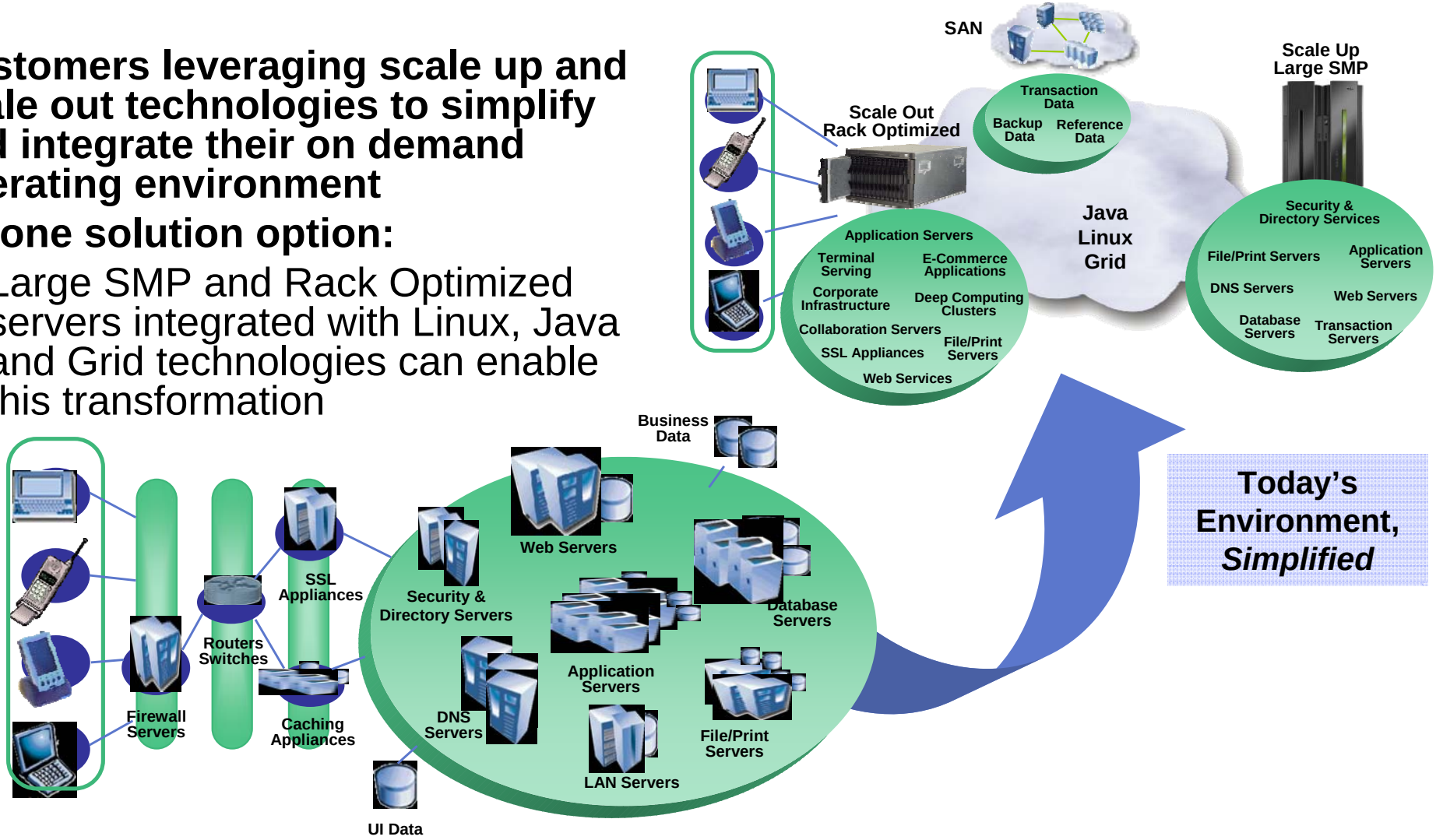
See Session 8937 "*Workload Thinking for zEnterprise - Fit for Purpose!*" for more information on this topic.



Some factors are specific to each business, others are common to all and can be generalized.

Infrastructure simplification and platform choice

- **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



Linux distributors

- **Novell SUSE Linux Enterprise**
  - http://novell.com/mainframe/
  - http://novell.com/products/systemz/

- **Red Hat Enterprise Linux**
  - http://redhat.com/rhel/server/mainframe/

Thank You!

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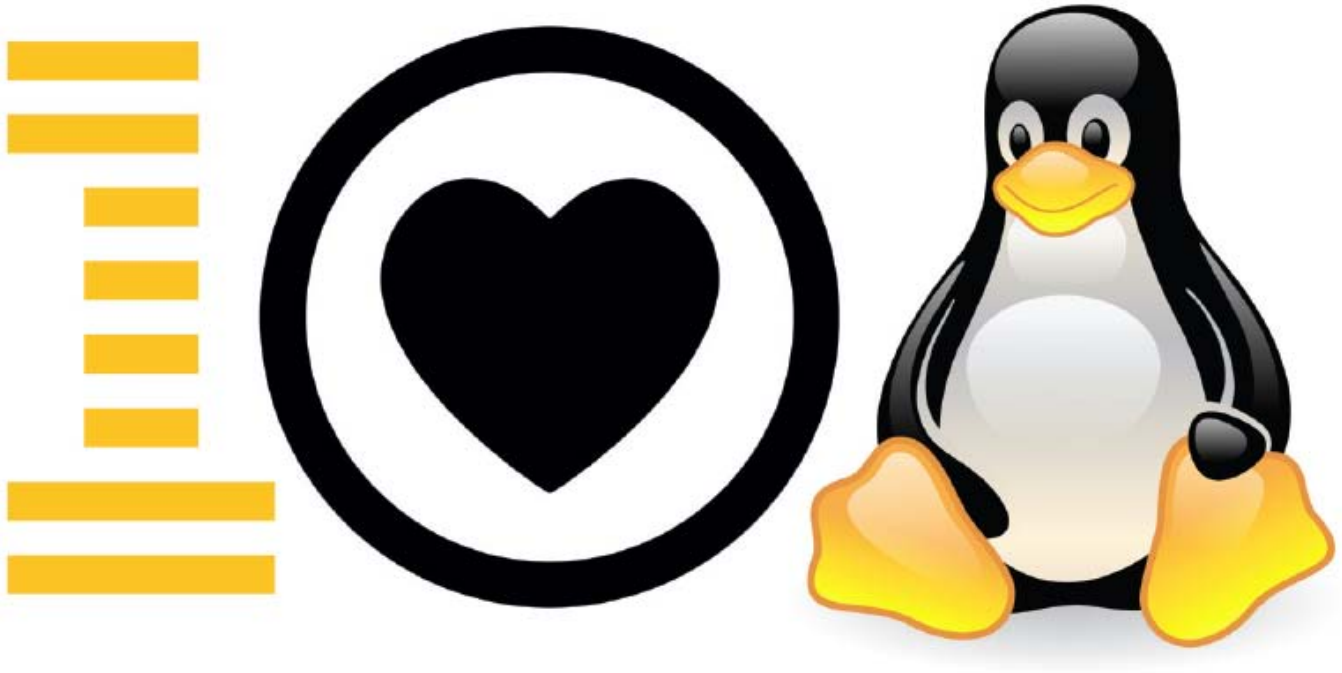

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