



Linux on System z and z/VM

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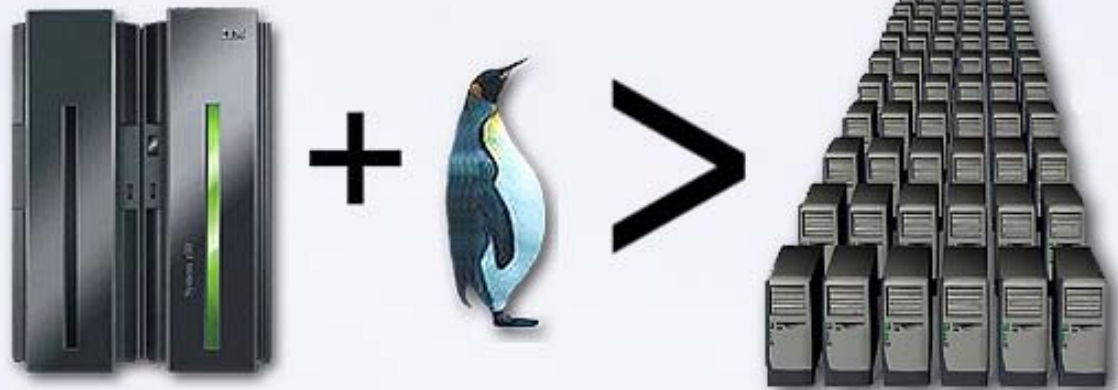
Linux on System z – take back control of your IT

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

It's simple

System z[®] and Linux provide a better, faster solution to IT complexity



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?

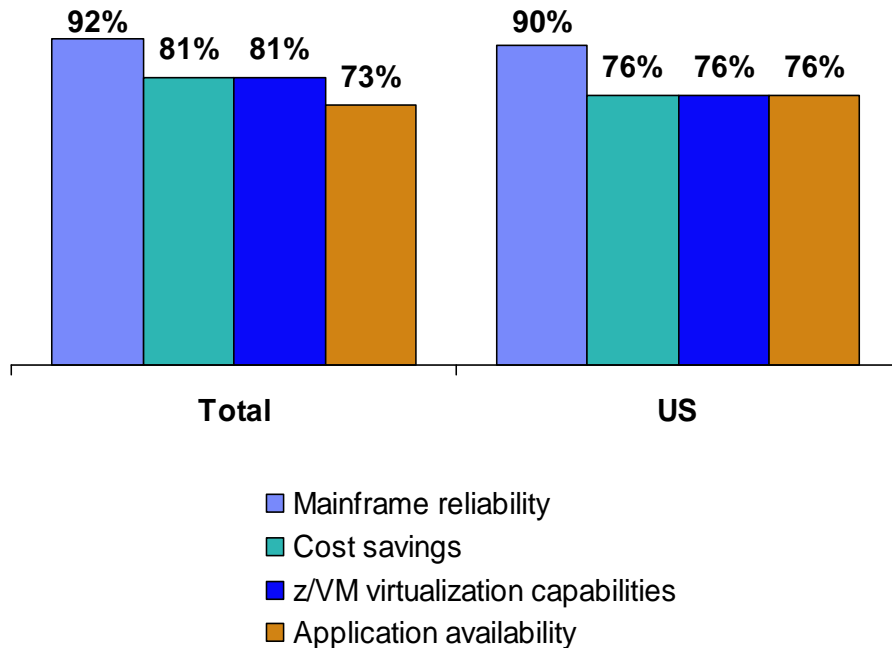
The reasons in 1999 are still valid today

- 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**

Reasons for running Linux on the mainframe

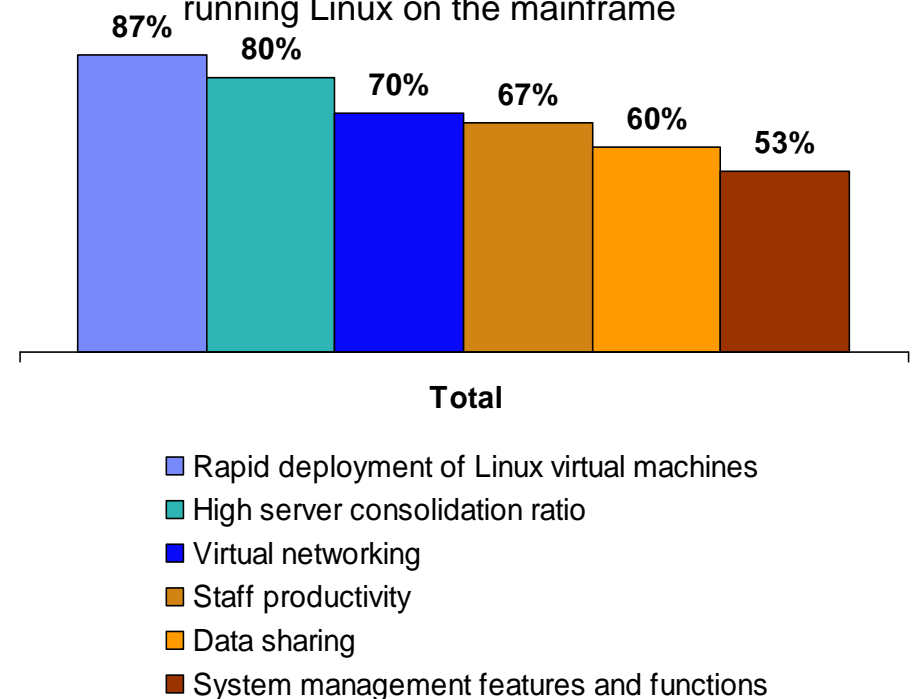
Key Factors in Running Linux on Mainframe

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 configurable processors
 - System z10 EC scales to 64 configurable processors
 - System z10 BC scales to 10 configurable processors
 - 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 DS8000 Enterprise Storage Systems
 - IBM XIV Storage System and Storwize V7000
 - 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

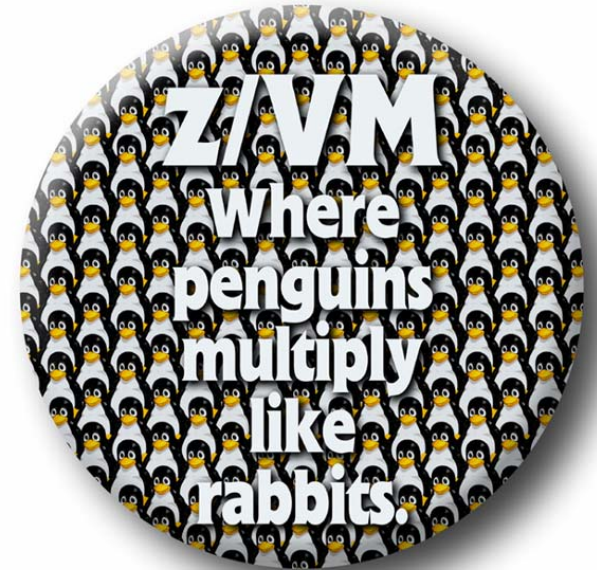
- **Reduced Total Cost of Ownership (TCO)**
 - Environmental savings – single footprint vs. hundreds of servers
 - Consolidation savings – less storage, less servers, less software licenses, less server management/support
- **Improved service level**
 - Systems management (single point of control)
 - Reliability, availability, security of System z
- **Speed to market**
 - Capacity-on-demand capability on System z
 - Dynamic allocation of on-line users, less than 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**

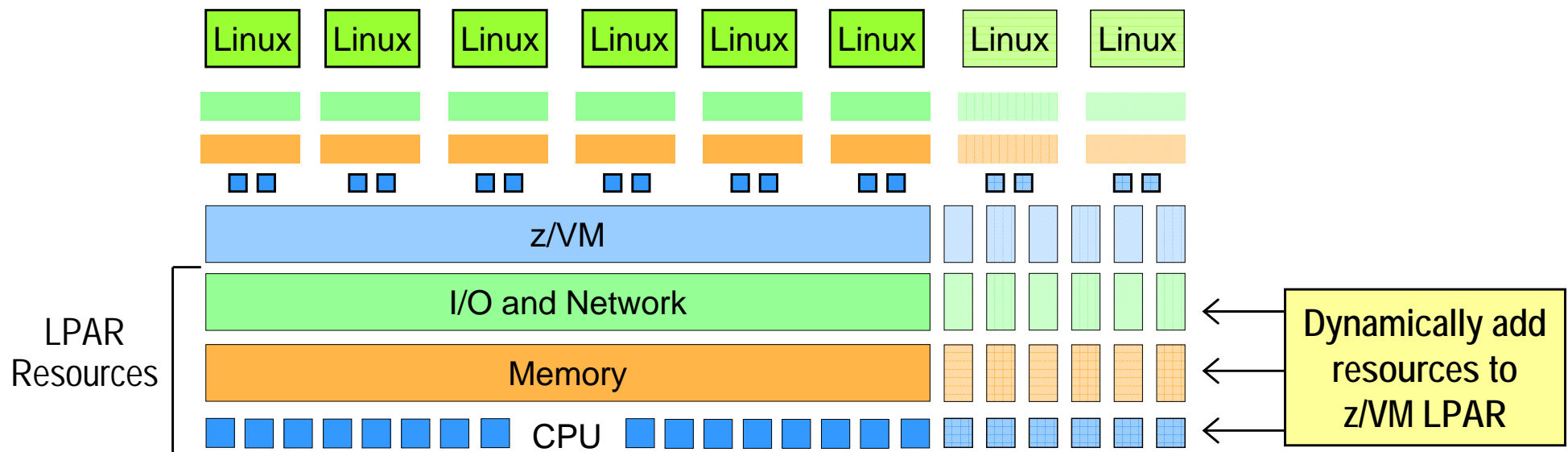
z/VM – Extreme virtualization

- **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

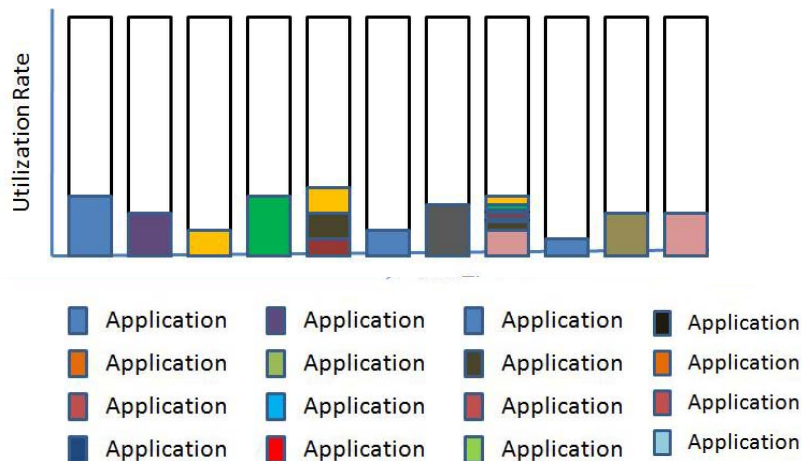


Smart economics: non-disruptively scale the z/VM environment by adding hardware assets that can be shared with every virtual server

Maximizing Utilization of Resources

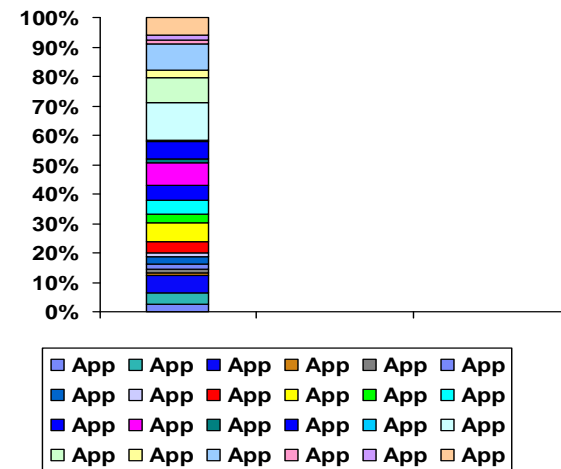
- **Up to 100% server utilization compared to 10-20% distributed server utilization¹**
- **Shared everything infrastructure through hardware allows for maximum utilization of resources**
 - CPU, Memory, Network, Adapters, Cryptography, Devices

Moderate distributed servers



Typically single application per physical server

Up to 100% utilized System z server



Multiple applications on one physical System z server

¹ Source: gomainframe.com Joe Clabby

Built-in IBM System z security for distributed workloads

Reducing risk – protecting businesses

- **Protect from intrusion**
 - z/VM Integrity Statement
- **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 partitioning
- **Respond to compliance regulations**
 - Up to 70% in security audit savings

IBM Enterprise Linux Server

Industry-leading virtualization



■ Overview

- The IBM® Enterprise Linux Server is a proven server consolidation platform that helps you control costs while improving virtual server availability, workload management, and energy efficiency
- With the virtualization capabilities of the Enterprise Linux Server, your business can consolidate applications and servers, share system resources at extreme levels of utilization, and provide a more flexible and dynamic IT infrastructure that will help you achieve superior levels of service and greater control in managing the growth of your business

IBM Enterprise Linux Server

Industry-leading virtualization



■ Highlights

- A highly scalable and flexible virtual infrastructure inside a single IBM server
- The ability to share all system resources with all virtual servers with unmatched levels of efficiency and security
- Business continuance and disaster recovery that help minimize your expenses
- The ability to grow your virtual server workload “on demand” by adding resources to a running environment without disruption
- A solution that helps you achieve a quick return on investment without sacrificing enterprise-class qualities of service
- The ability to deploy and manage a large scale-out virtual server environment on the industry’s best scale-up, share-everything system architecture

z/VM V6.1

Foundation for future virtualization growth



- **z/VM V6.1 is the base for all future z/VM enhancements**

- This release implements a new Architecture Level Set available only on the IBM System z10 and zEnterprise servers, and future generations of System z servers
- Includes several enhancements, plus support for the IBM Systems Director VMControl cloning tool

- **Statements of Direction**

- z/VM Single System Image
 - IBM intends to provide capabilities that permit multiple z/VM systems to collaborate in order to provide a single system image
- z/VM Live Guest Relocation
 - IBM intends to further strengthen single system image support by providing live guest relocation

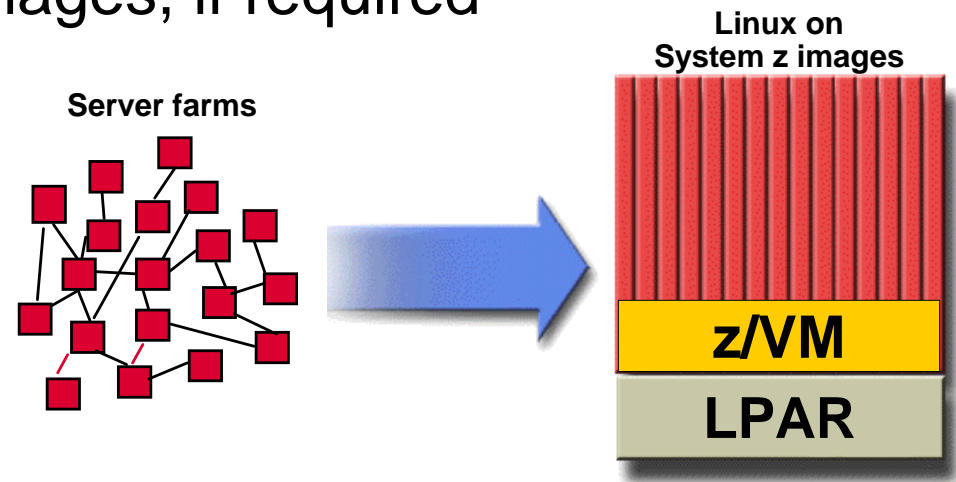
IBM Systems Director VMControl



- **IBM Systems Director VMControl can visualize, navigate, and manage virtual appliances and is designed to help you:**
 - Discover, import, and manage virtual appliances
 - Create new virtual appliances from existing fully-tested software stacks
 - Automate the creation of a virtual server and deployment of a virtual appliance into that virtual server
 - Decrease dependency management problems by deploying virtual appliances that contain setup and configuration requirements

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



Linux on System z

Client adoption continues to drive success

- **The momentum continues:**

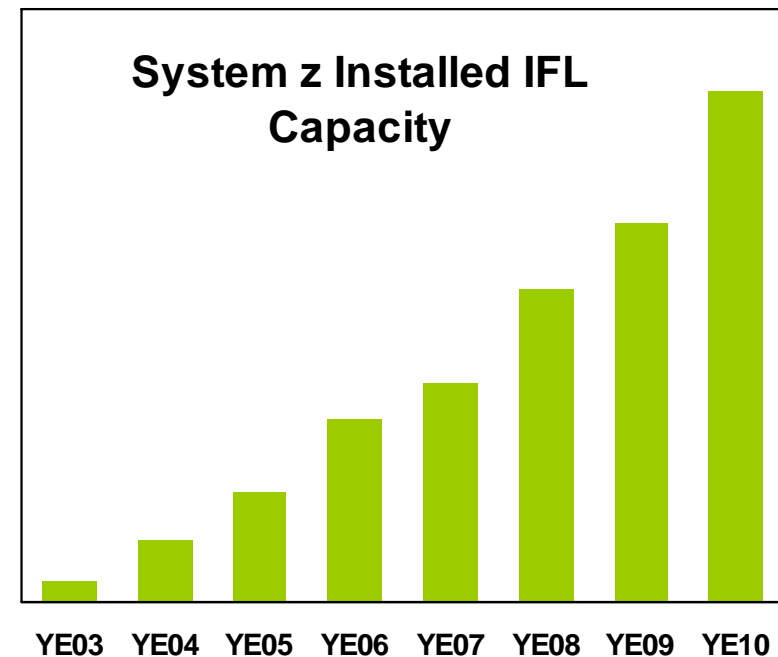
- Shipped IFL engine volumes increased 34% from YTD 4Q09 to YTD 4Q10
- Installed IFL MIPS increased 6% from 3Q10 to 4Q10
- Installed IFL MIPS increased 35% from 4Q09 to 4Q10

- **32% of System z customers have IFLs installed**

- **Linux represents 19% of the System z install base capacity (MIPS)**

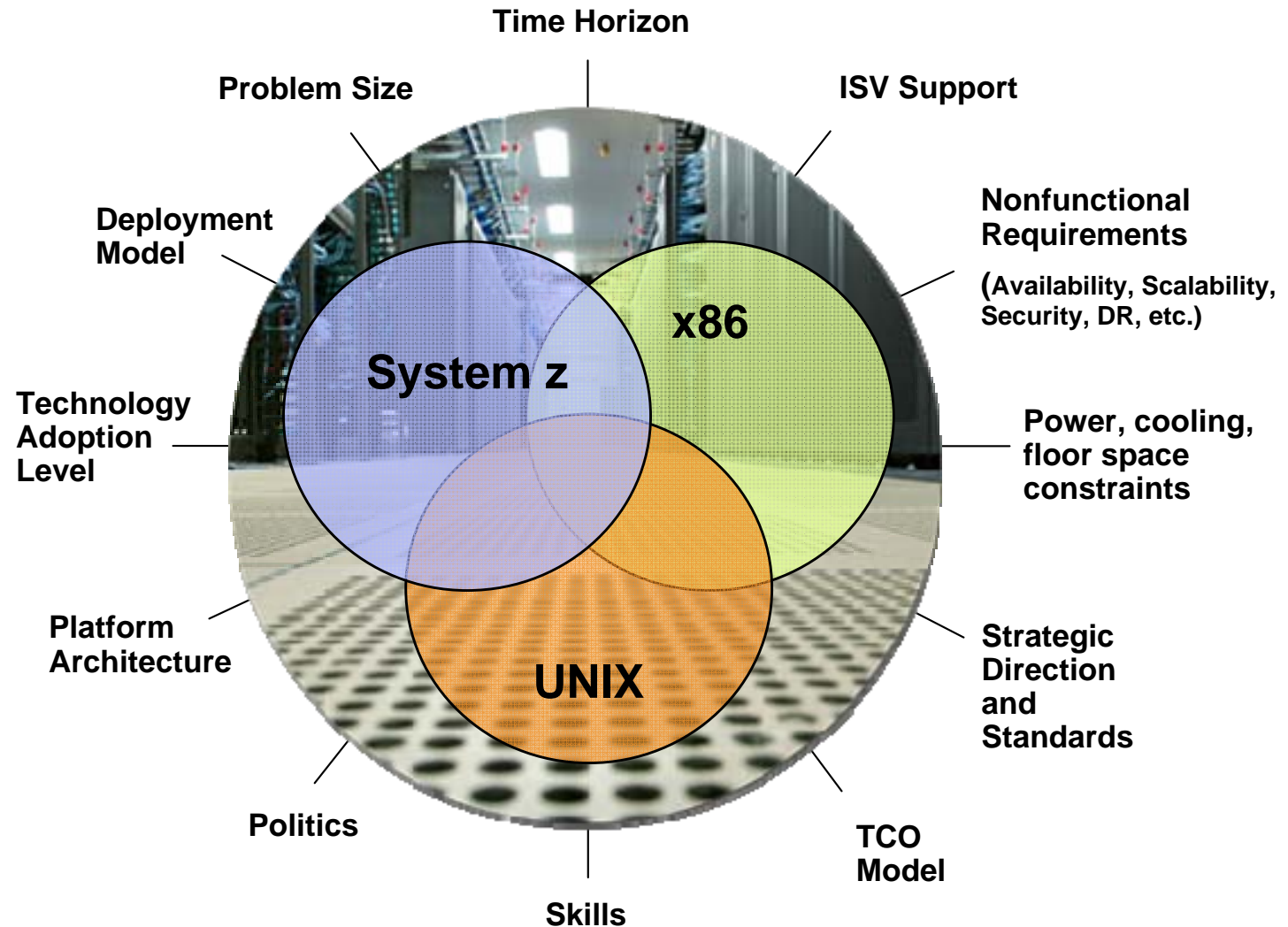
- **64 of the top 100 System z clients are running Linux on the mainframe**

- **> 3,000 applications are available for Linux on System z**



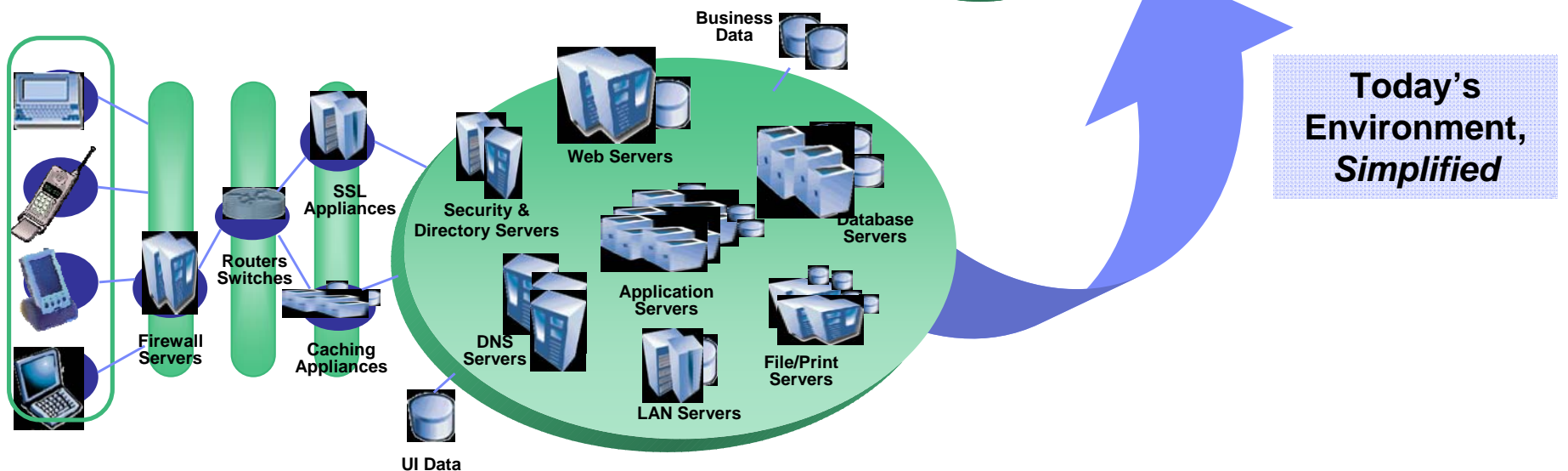
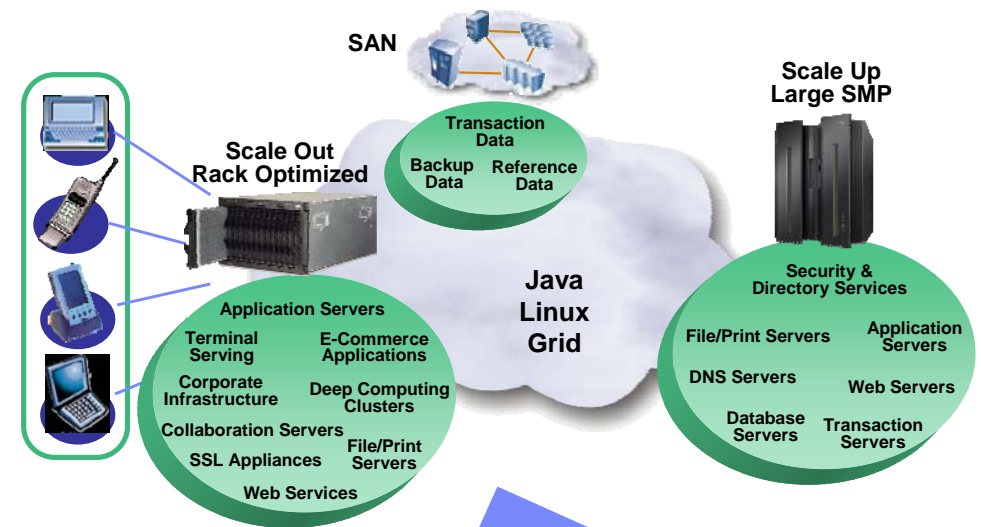
Platform choice – Fit for purpose, workload and situation

- Many factors influence platform selection, making it difficult to present a simple selection matrix
- Some factors are specific to each business, others are common to all and can be generalized

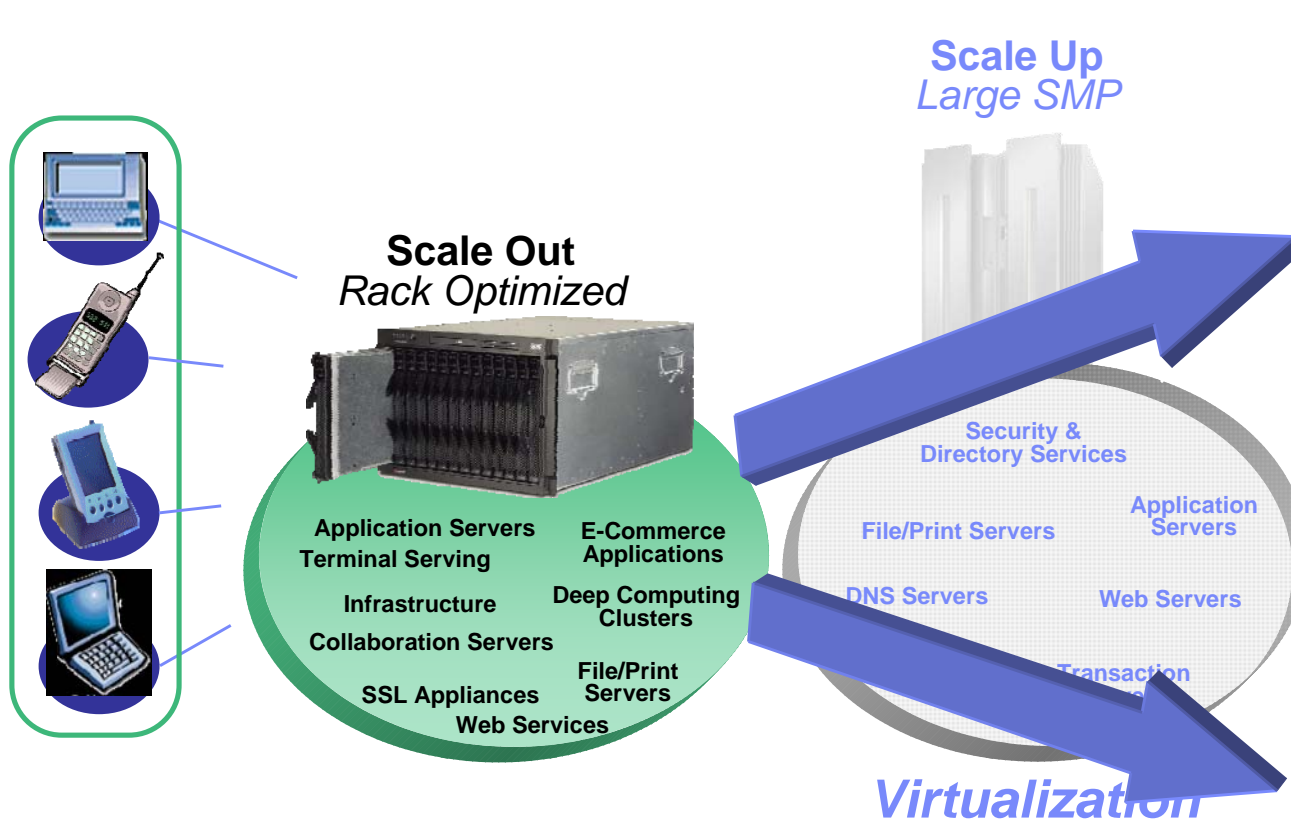


Infrastructure simplification and platform choice

- 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

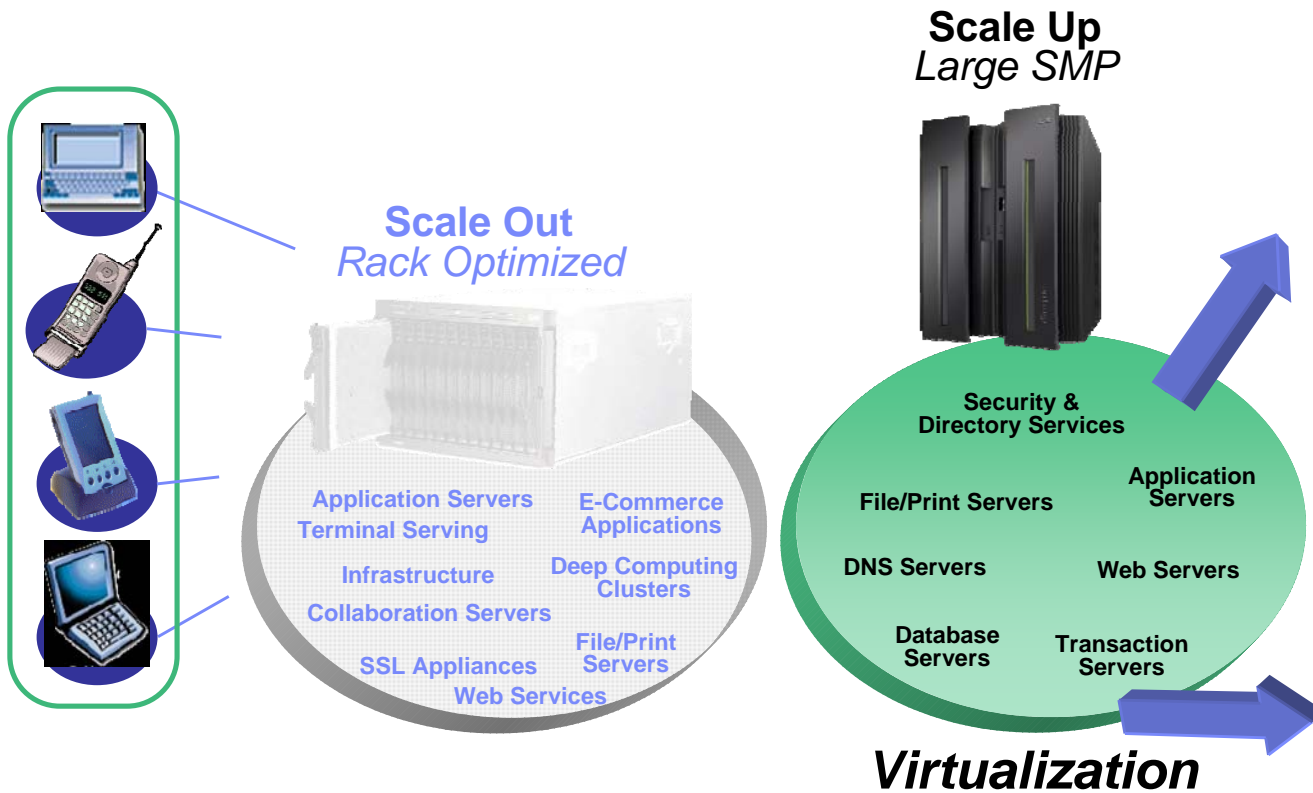


Ideal scale-out implementations



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

Ideal scale-up 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

Selecting an application

- **Performance on System z CPUs is comparable to CPUs on other platforms of similar speed**
 - CPU speed is not the entire story – it's in the architecture!
 - Architecture designed for multiple or consolidated workloads
 - System z has definite advantage with applications that have mixed CPU and I/O
- **System z and z/VM provide excellent virtualization capabilities**
 - Look for applications that are on lower utilized servers
 - Development and Test are good choices to start
- **Good planning is essential**
- **IBM can:**
 - Perform sizing estimates
 - Assist with planning and initial installation needs

Where to deploy – System z or “distributed”

Technical Considerations

System z ← “distributed”

Quality of Service

System z ← “distributed”

Speed of deployment
Instances 2 - n

System z ← “distributed”

Data Intensity

System z → “distributed”

Compute Intensity

Other Considerations

- **Application availability**
 - Certification of solution on hardware/software platform
- **Workload Management**
- **Manageability and scaling characteristics**
 - Especially database and web serving
 - Proximity of data to application
 - The best network is one with no wires!

Linux distributors

- **Novell SUSE Linux Enterprise**
 - <http://novell.com/mainframe/>
 - <http://novell.com/linux/mainframe/>

The Novell logo consists of the word "Novell" in a bold, red, sans-serif font, followed by a registered trademark symbol (®).

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



Thanks!

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