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

+ 🐧 >
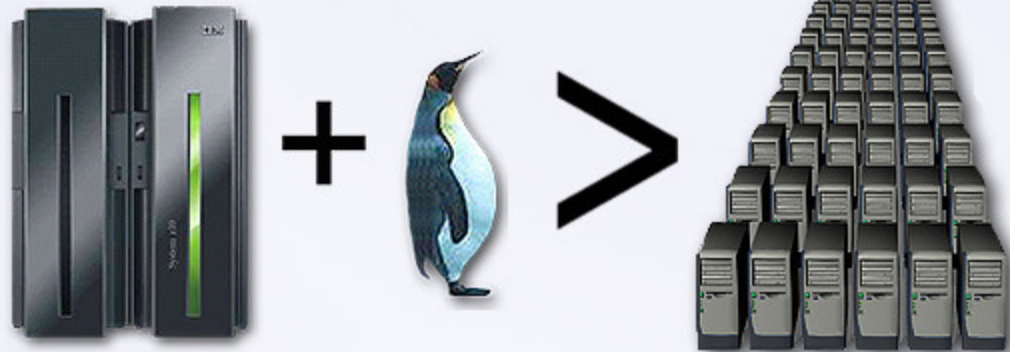
Linux on IBM System z
## *Linux + Virtualization + System z = SYNERGY*

- **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

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
    - 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
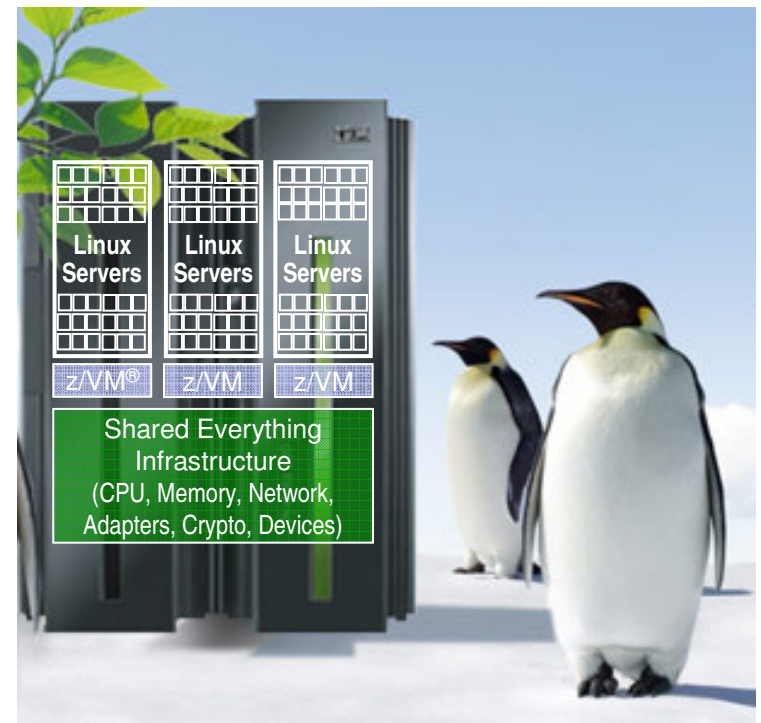
Value of Linux on System z

- **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
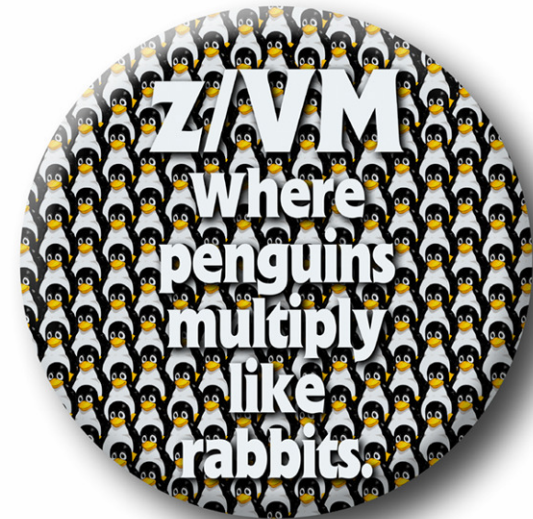
Linux on z/VM: Flexible, efficient growth

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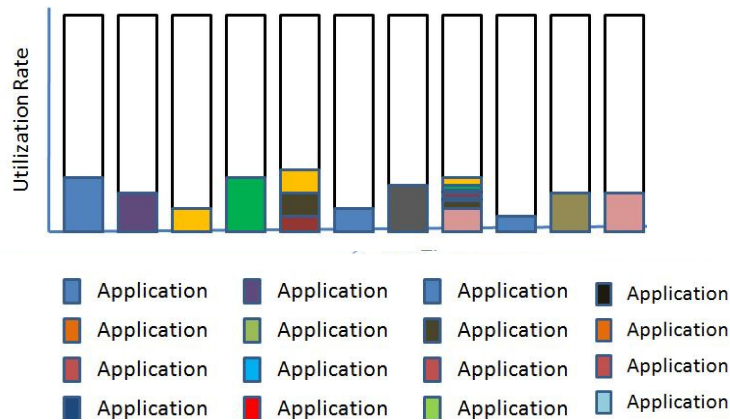- **z/VM virtualizes this capability for guest machines**
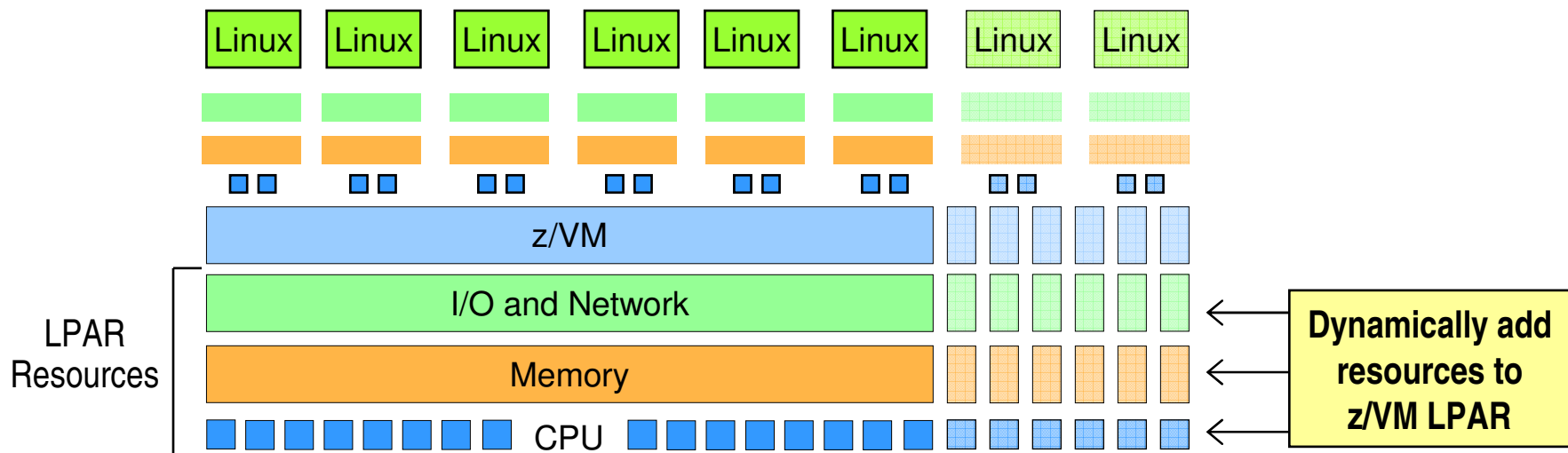
Smart economics: non-disruptively scale the z/VM environment by adding hardware assets that can be shared with *every* virtual server

Maximizing Utilization of Resources

- **Up to 100% server utilization compared to 10-20% distributed server utilization[1]**
- **Shared everything infrastructure through hardware allows for maximum utilization of resources**
  - CPU, Memory, Network, Adapters, Cryptography, Devices

Moderate distributed servers

Utilization Rate

Application	Application	Application	Application
Application	Application	Application	Application
Application	Application	Application	Application
Application	Application	Application	Application

Typically single application per physical server

Up to 100% utilized System z server

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

App	App	App	App	App	App
App	App	App	App	App	App
App	App	App	App	App	App
App	App	App	App	App	App
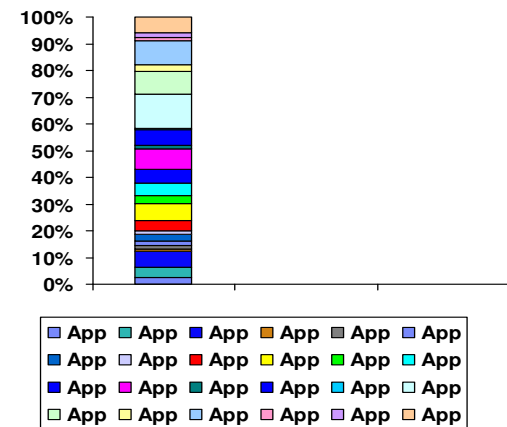
Multiple applications on one physical System z server

[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 images

Server farms

z/VM

LPAR
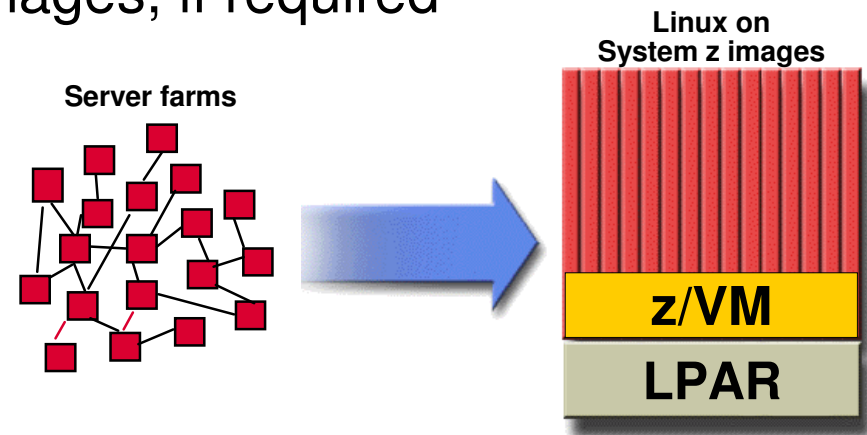
System z Linux: The momentum builds
*Installed Linux capacity at 43% CAGR**

- **The momentum continues:**
  - Shipped IFL engine volumes increased 35% from YE07 to YE09
  - Shipped IFL capacity increased 65% from YE07 to YE09
- **70% of the top 100 System z clients are running Linux on the mainframe**
  - Primary workloads are WebSphere, Oracle DB and DB2, Apache, collaboration, business intelligence
- **Linux is ~20% of the customer System z install base (capacity)**
- **Over 3,100 Linux applications are supported on System z**

Installed Linux capacity

2003 2004 2005 2006 2007 2008 2009
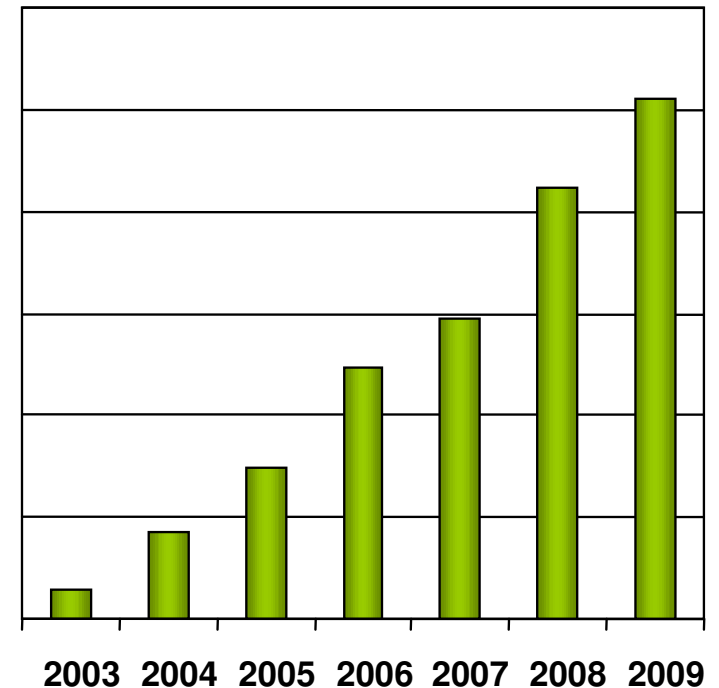
* Based on YE 2004 to YE 2009.

Platform choice – Fit for purpose

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

Time Horizon

Problem Size

ISV Support

Deployment Model

Nonfunctional Requirements

(Availability Scalability, Security, etc)

Technology Adoption Level

System z

x86 Linux / Windows

Power, cooling, floor space constraints

RISC / UNIX

Platform Architecture

Strategic Direction and Standards

Politics

Skills

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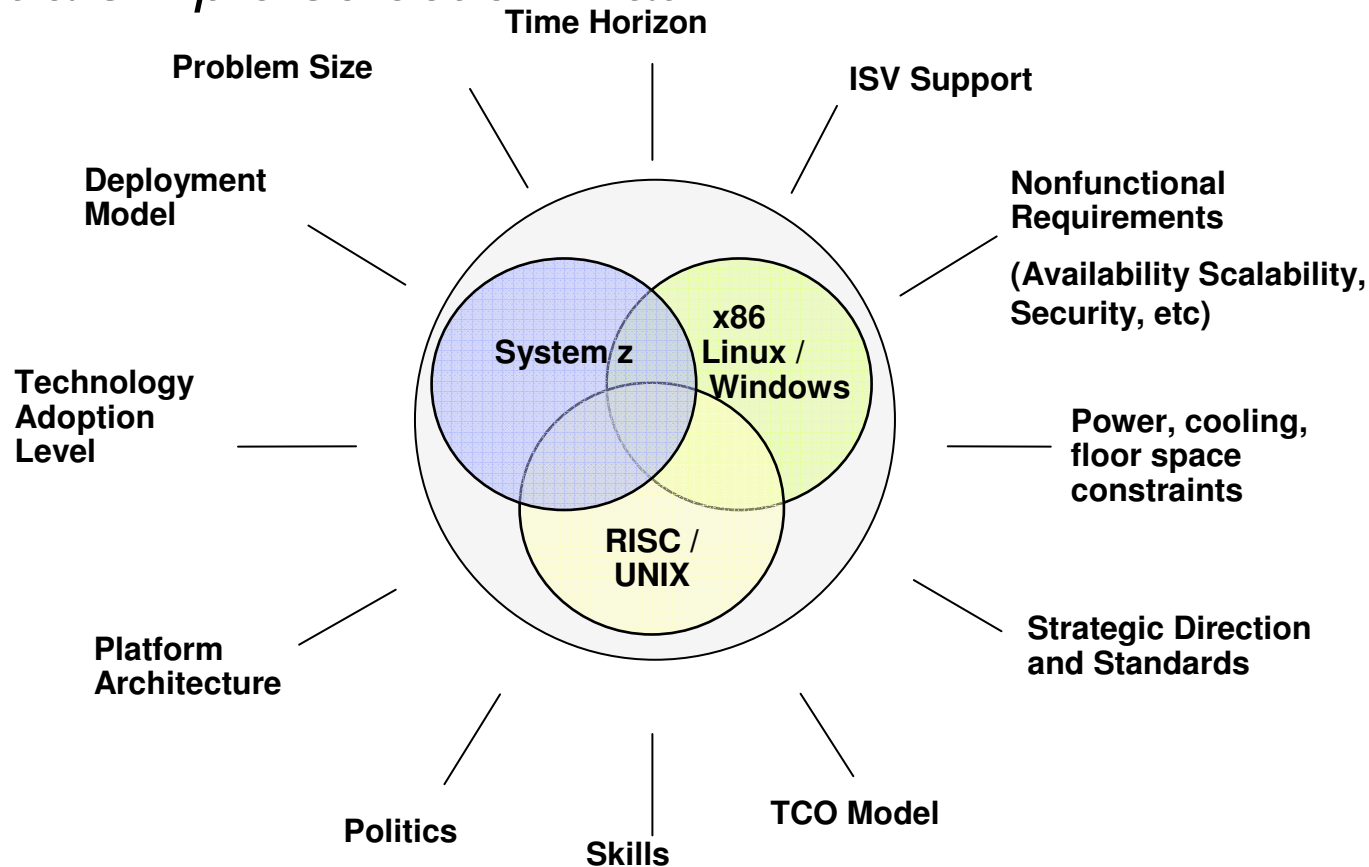
Some factors are specific to each business, others are common to all and can be generalized

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

SAN

Scale Up Large SMP

Scale Out Rack Optimized

Transaction Data
Backup Data   **Reference Data**

Java Linux Grid

Application Servers
Terminal Serving   **E-Commerce Applications**
Corporate Infrastructure   **Deep Computing Clusters**
Collaboration Servers   **File/Print Servers**
SSL Appliances
Web Services

Security & Directory Services
File/Print Servers   **Application Servers**
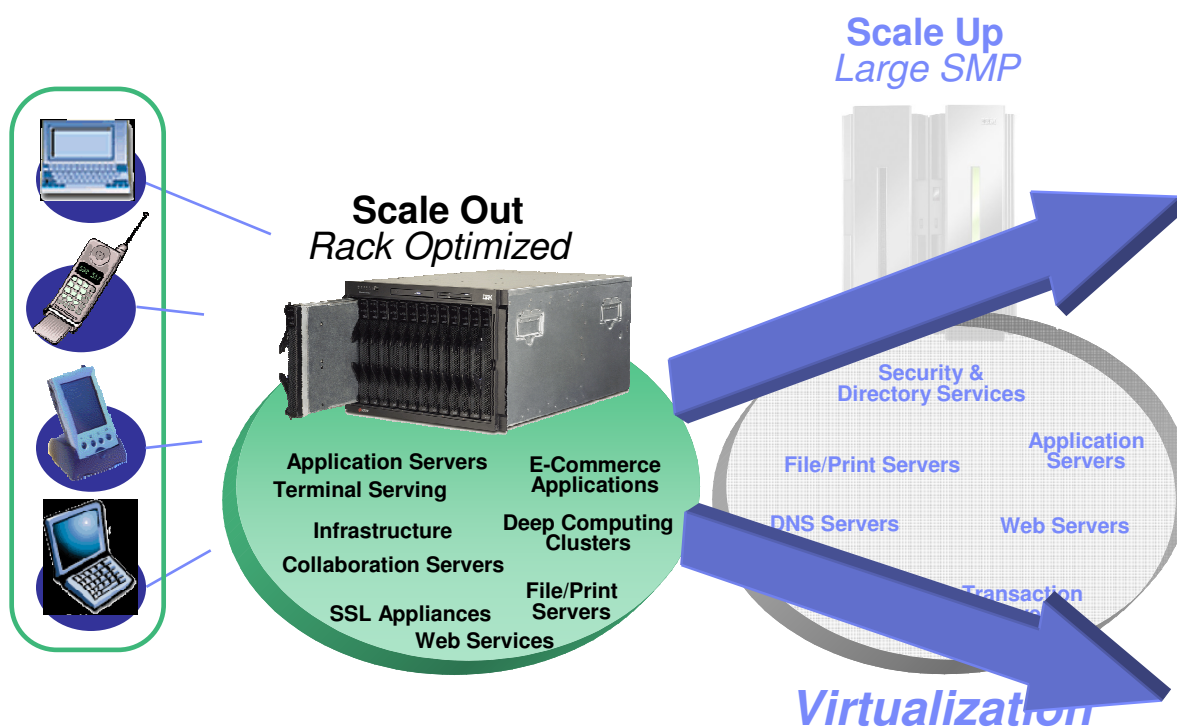**DNS Servers**   **Web Servers**
Database Servers   **Transaction Servers**

Today's Environment, *Simplified*

Business Data

Web Servers

SSL Appliances

Security & Directory Servers

Database Servers

Routers Switches

Application Servers

Firewall Servers

Caching Appliances

DNS Servers

File/Print Servers

LAN Servers

UI Data

Ideal scale-out implementations

Scale Up
Large SMP

Scale Out
Rack Optimized

Application Servers
Terminal Serving

E-Commerce
Applications

Infrastructure
Collaboration Servers

Deep Computing
Clusters

SSL Appliances

File/Print
Servers

Web Services

Security &
Directory Services

File/Print Servers

Application
Servers

DNS Servers

Web Servers

Transaction

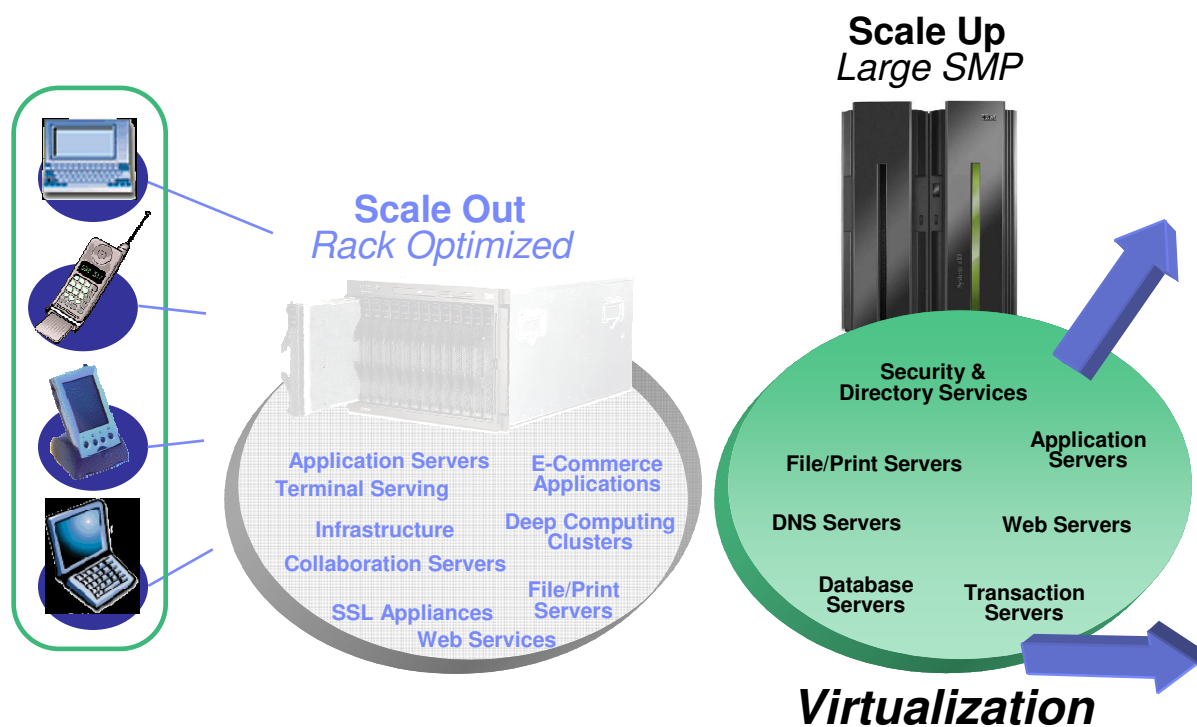*Virtualization*

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

Ideal scale-up implementations

Scale Out
Rack Optimized

Application Servers
Terminal Serving

E-Commerce
Applications

Infrastructure
Collaboration Servers

Deep Computing
Clusters

SSL Appliances

File/Print
Servers

Web Services

Scale Up
Large SMP

Security &
Directory Services

File/Print Servers

Application
Servers

DNS Servers

Web Servers

Database
Servers

Transaction
Servers

Virtualization

- **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/

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

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Thank You!

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