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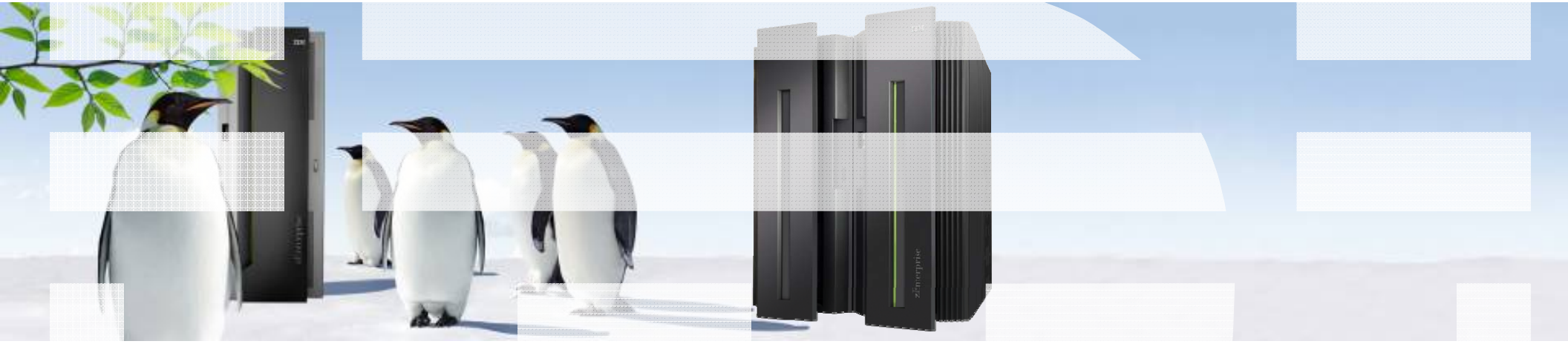
A Strategic View of Linux on System z from IBM



Abstract

- Linux became available for System/390 in December 1999
- In the 13 years since, 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, IBM Cognos, 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 provides for consolidation of distributed platforms

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
- **Simplified hosting for a private cloud**
- **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**

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
  - zEnterprise 114 scales to 10 configurable processors
  - Dedicated I/O processors
    - Up to 14 (z196) or 2 (z114)
  - 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 and OSA-Express4S for very high speed communication between systems
  - HiperSockets for ultra-high speed communication between images on the same machine (or between different machines via zBX)
- **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

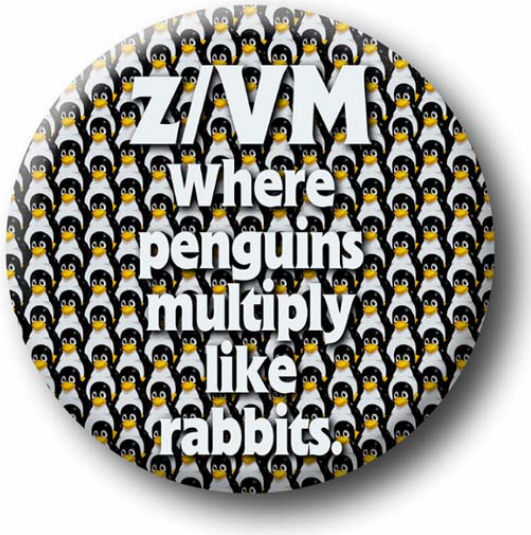
- **Utilization often (usually?) exceeds 90%**
  - Handles peak workload utilization of 100% without service level degradation
- **Massive consolidation platform**
  - Up to 60 logical partitions, 100s to 1000s of virtual servers under z/VM
  - Virtualization is built-in, not added-on
  - HiperSockets 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**

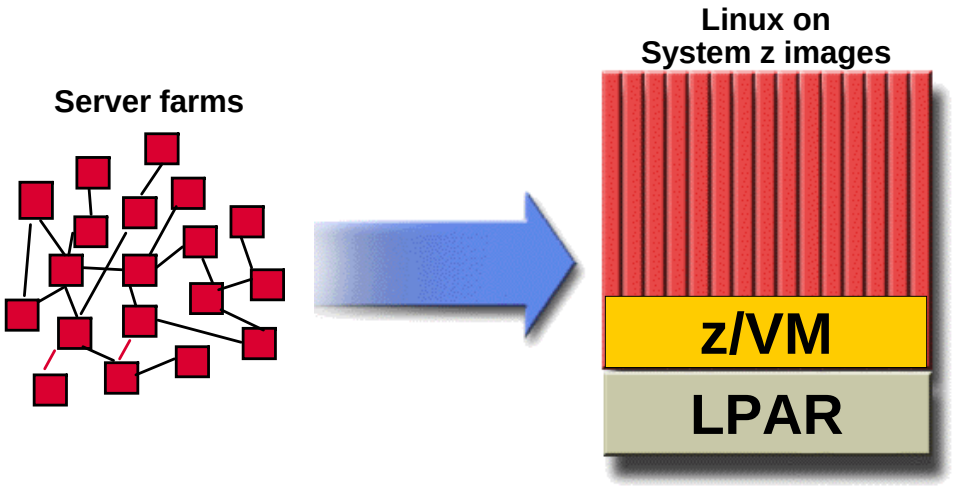
z/VM – Extreme virtualization

- **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

The value of z/VM for Linux

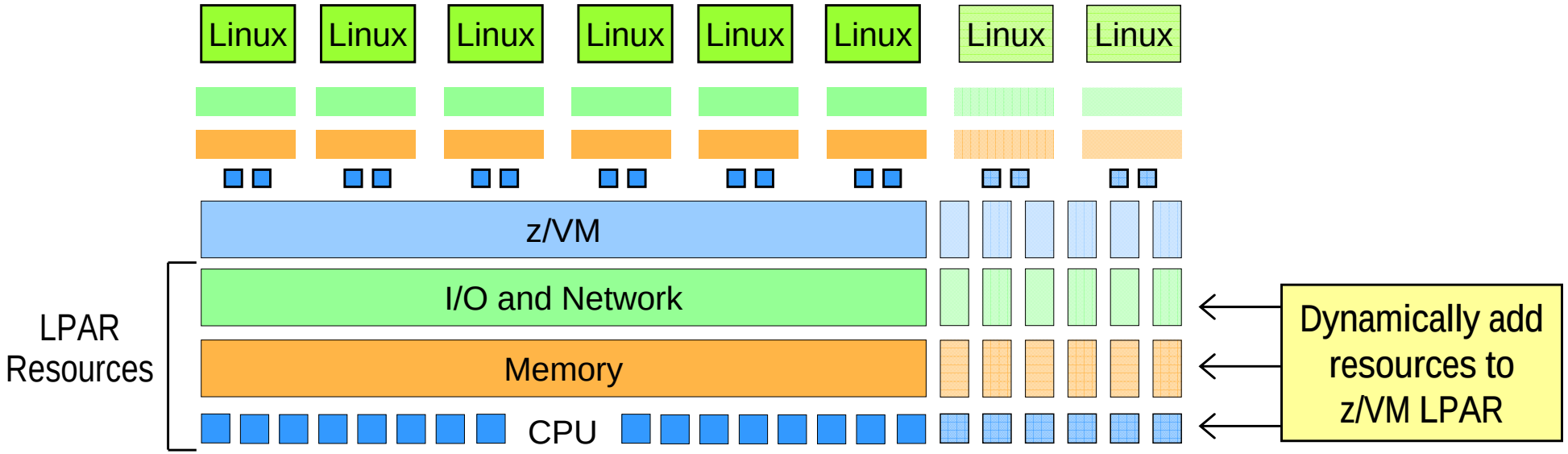
- **Enhanced performance, growth and scalability**
  - Server consolidation enables horizontal growth
  - N-tier architecture on two tiers of hardware
  - Extensive support for sharing resources
  - Virtual networking
  - Effective isolation of Linux images, if required
- **Increased productivity**
  - Development and testing
  - Production support
- **Improved operations**
  - Backup and recovery
  - Command and control





Linux on 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**

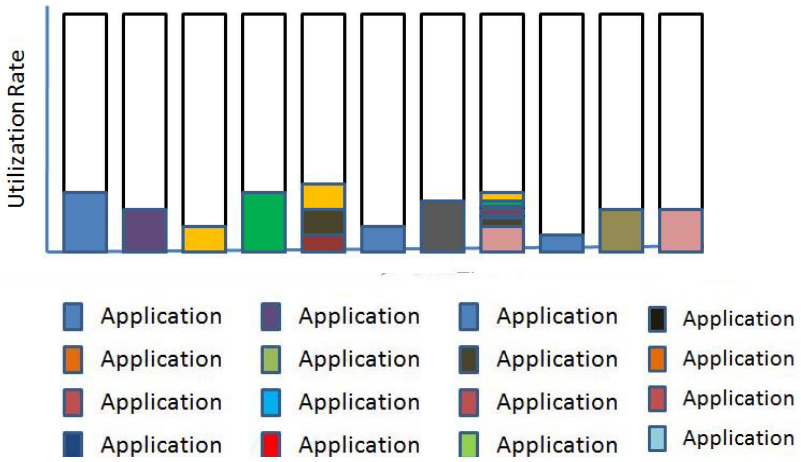


Smart economics: non-disruptively scale the z/VM environment by adding hardware assets that can be shared with *every* virtual server

Maximizing Utilization of Resources

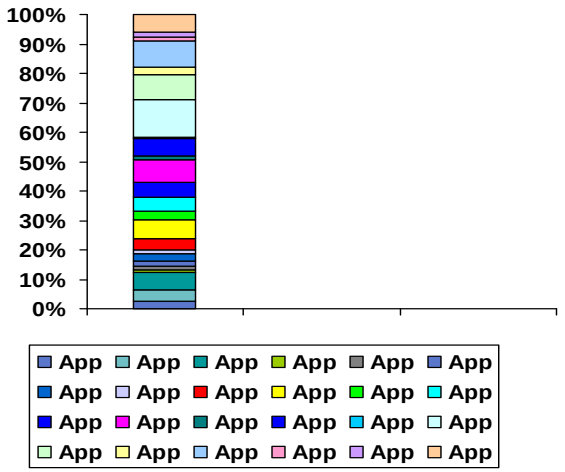
- **Up to 100% server utilization compared to 10-20% distributed server utilization[1]**
- **Shared everything infrastructure through hardware allows for maximum utilization of resources**
  - CPU, Memory, Network, Adapters, Cryptography, Devices

Moderate distributed servers



Typically single application per physical server

Up to 100% utilized System z server



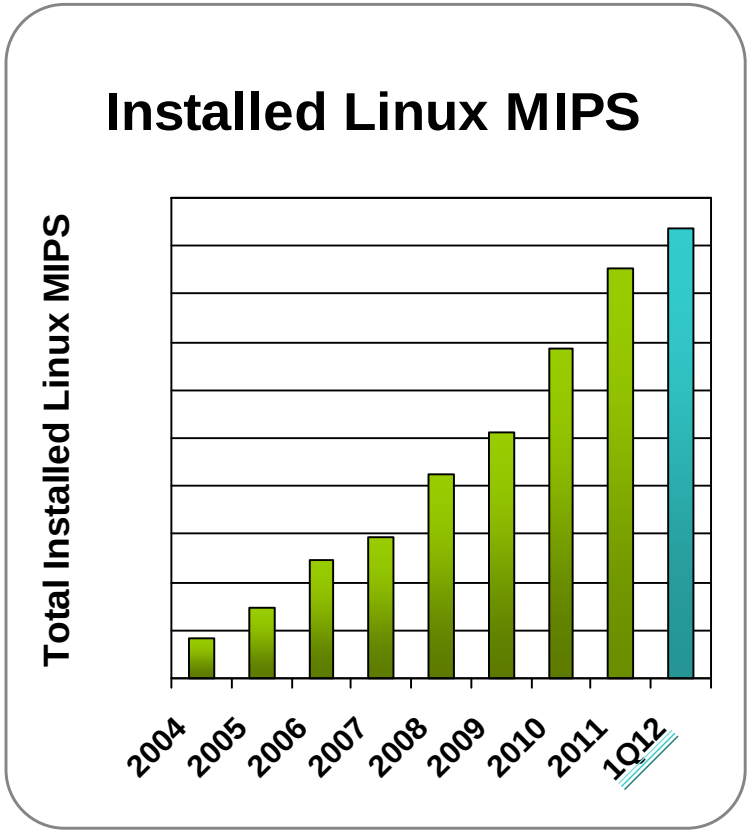
Multiple applications on one physical System z server

[1] Source: gomainframe.com Joe Clabby

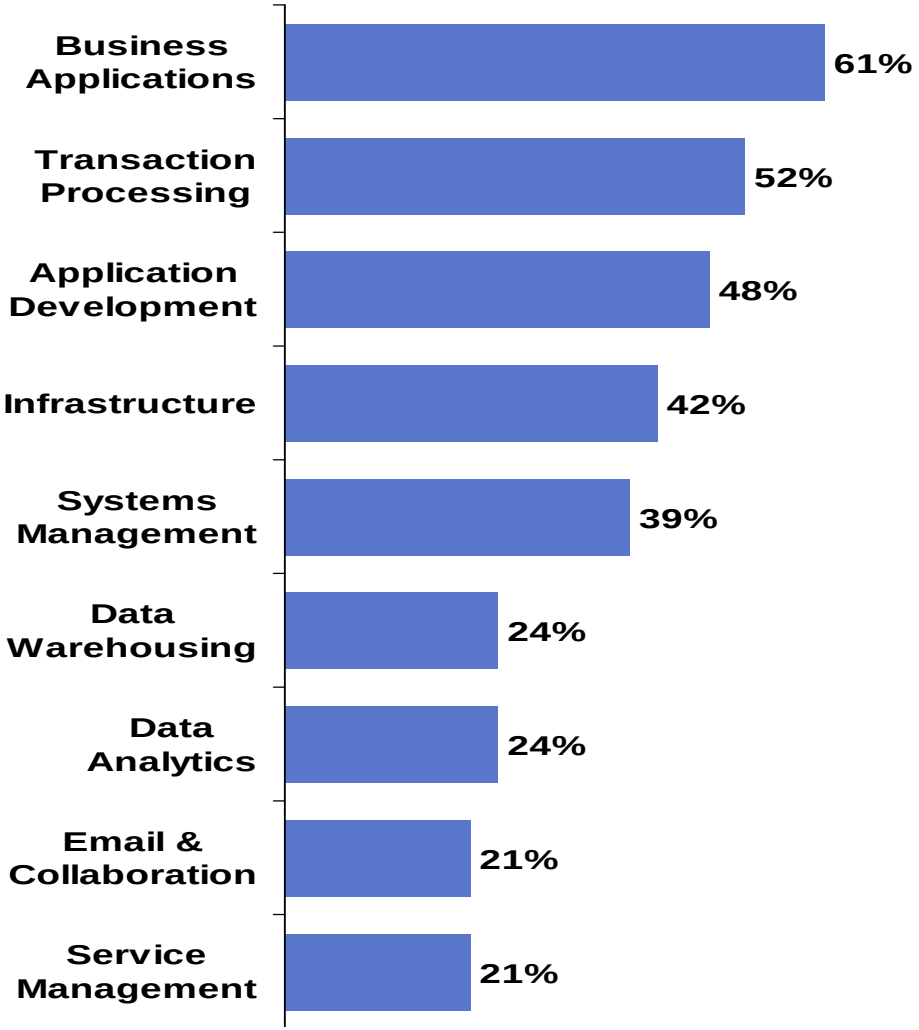
Linux on System z

Client adoption through 1Q2012

- **35% of System z customers have IFLs installed**
- **70 of the top 100 System z clients are running Linux on the mainframe**
- **20% increase in Linux only servers from 1Q11 to 1Q12**
- **Installed IFL MIPS increased 24% in 2011**
- **20% of Total installed MIPS run Linux in 4Q11**



Preferred workloads – Client feedback

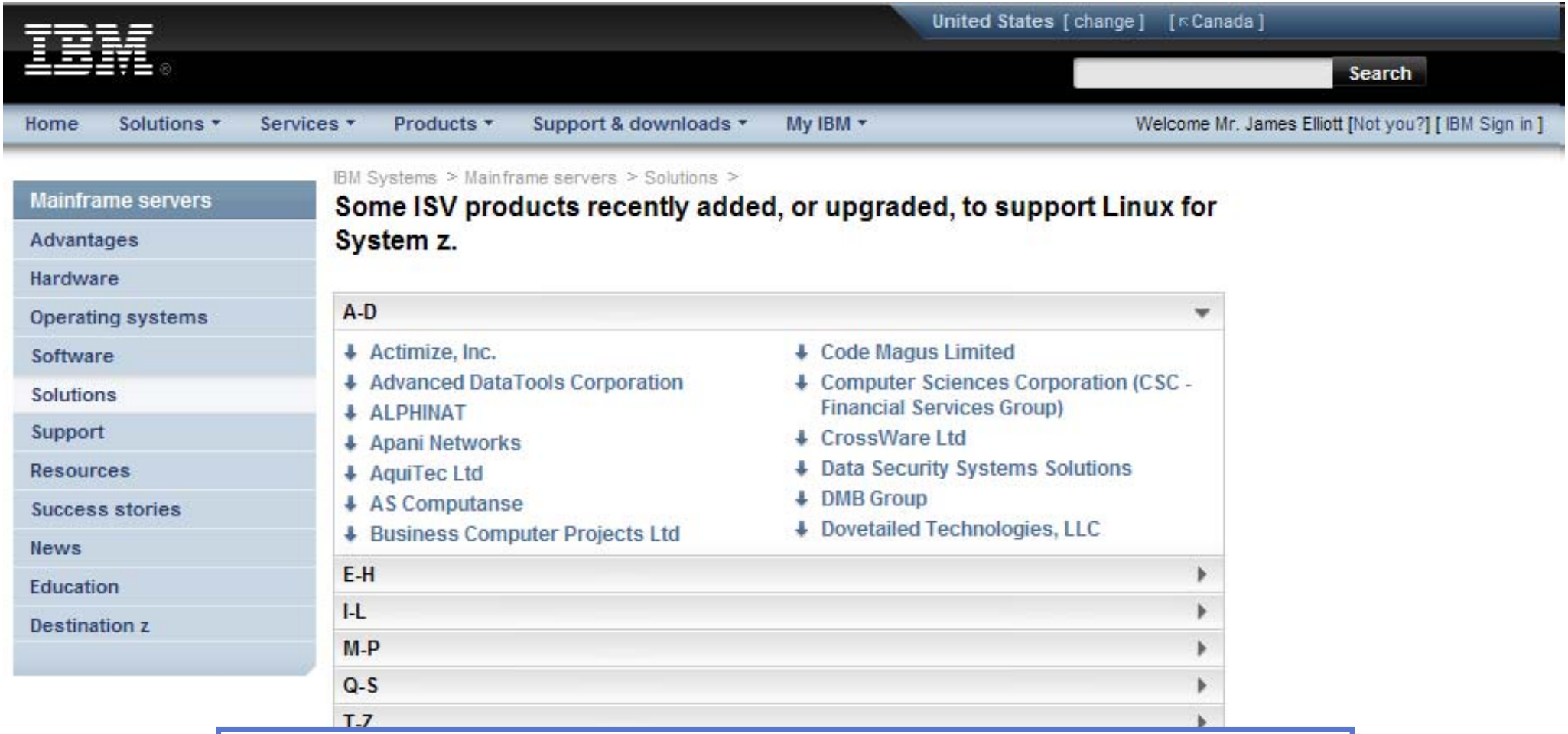


- **Survey indicates clients run:**
  - Business applications
  - Transaction processing
  - Data warehouse and data analytics
  - Application development
- **Recommended workloads for Linux on System z:**
  - Data services: Cognos, SPSS, DB2, InfoSphere, Informix, Oracle Database, Information Builders WebFOCUS, …
  - Business applications: WebSphere, SAP, …
  - Development and test: e.g. of WebSphere / Java applications, …
  - Email and collaboration: Lotus Domino, Lotus Collaboration products, …
  - Infrastructure services: FTP, NFS, DNS, Firewall, Proxy, WebSphere MQ, DB2 Connect, CICS Transaction Gateway, …
  - Cloud management: Infrastructure (IaaS) / Platform (PaaS) / Software (SaaS) / Business Process as a Service

Source: 2012 IBM Market Intelligence, Percentage of survey respondents

New ISV solutions on Linux on System z solutions

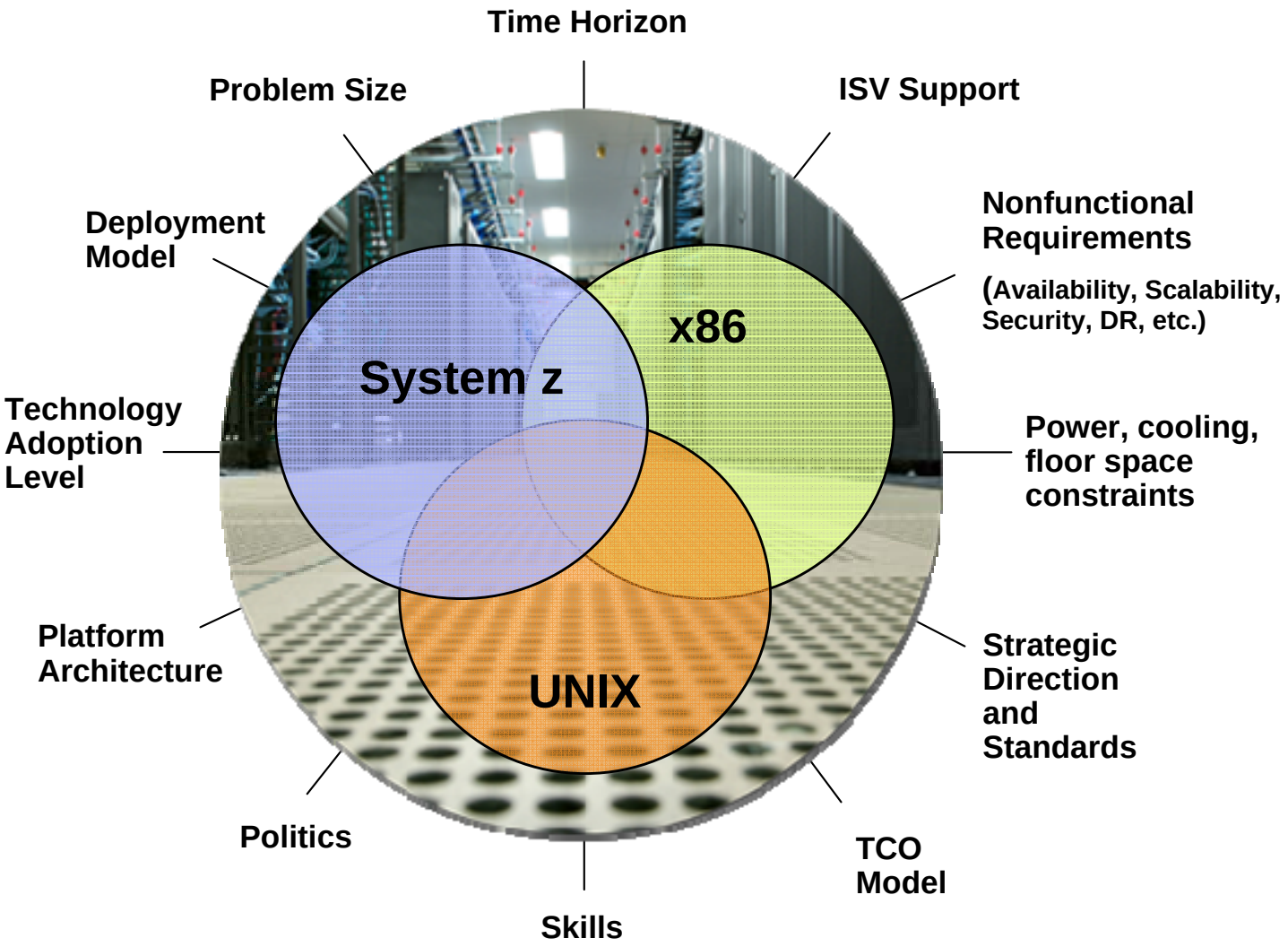
http://www.ibm.com/systems/z/solutions/isv/linuxproduct.html



In 2011, we had more than 1500 new / upgraded applications added for z/OS and Linux on System z

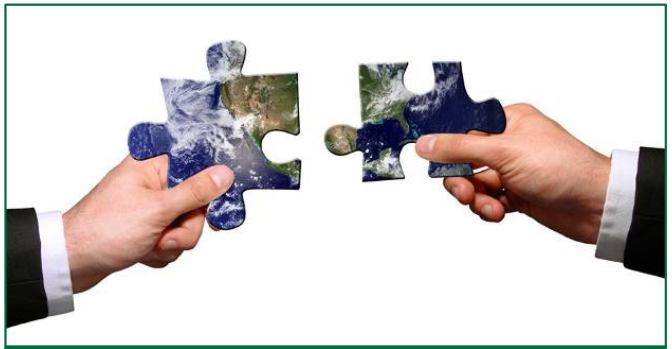
Platform choice – Fit for purpose, workload and situation

- 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



What makes the best fit?

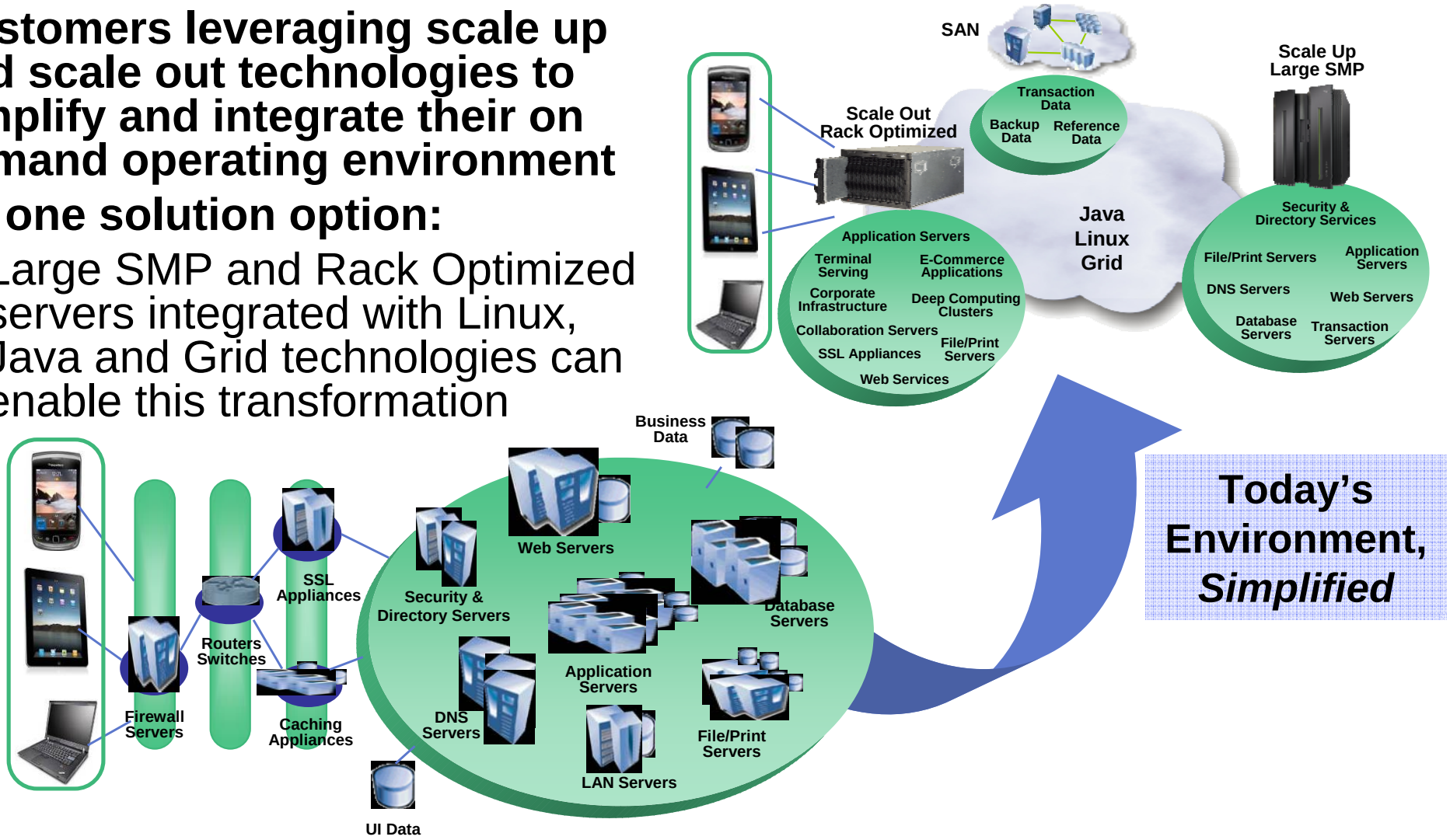
- **Leverage classic strengths of the System z**
  - High availability
  - High i/o bandwidth capabilities
  - Flexibility to run disparate workloads concurrently
  - Requirement for excellent disaster recovery capabilities
  - Security
- **Shortening end to end path length for applications**
  - Collocation of applications
  - Consolidation of applications from distributed servers
  - Reduction in network traffic
  - Simplification of support model
- **Consolidation effect**
  - Power requirements
  - Software costs
  - People Costs
  - Real Estate
  - Workloads requiring extreme Flexibility



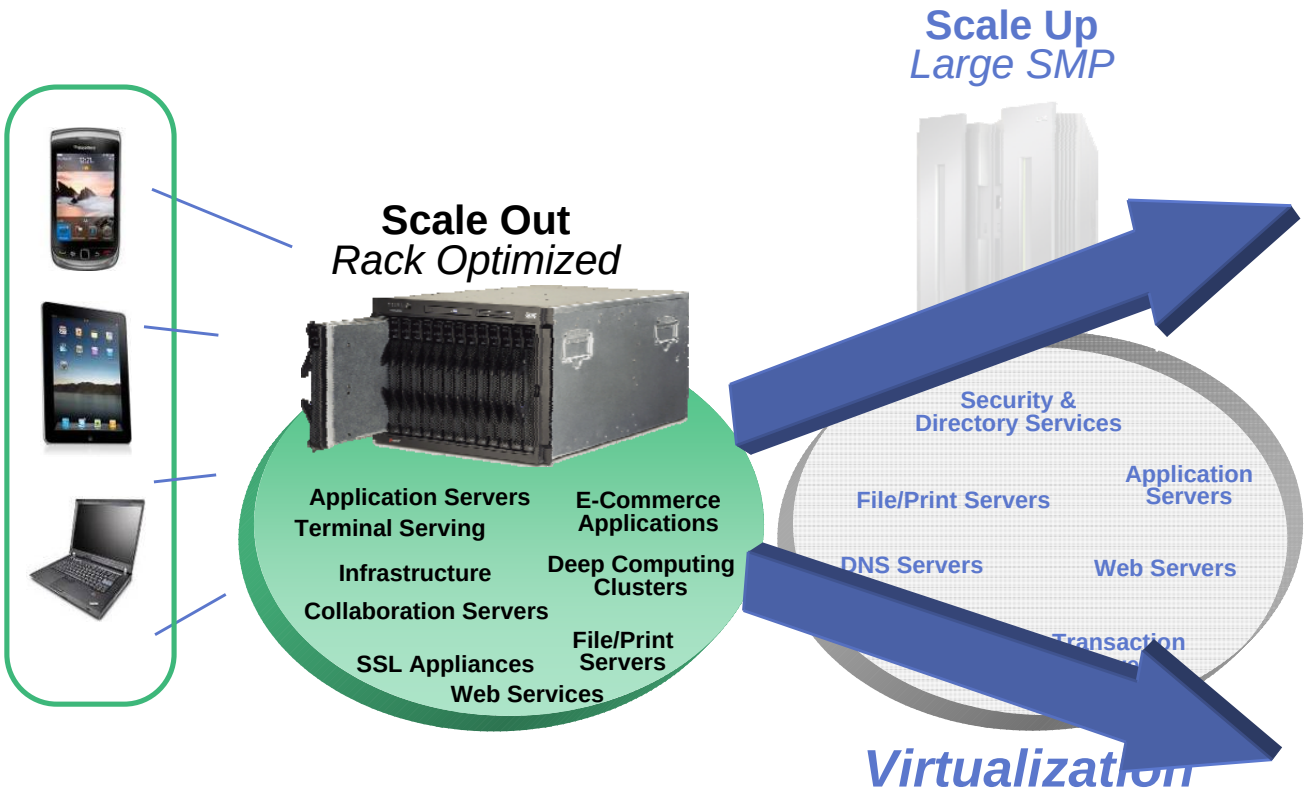
Best fit for Linux on IBM System z

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

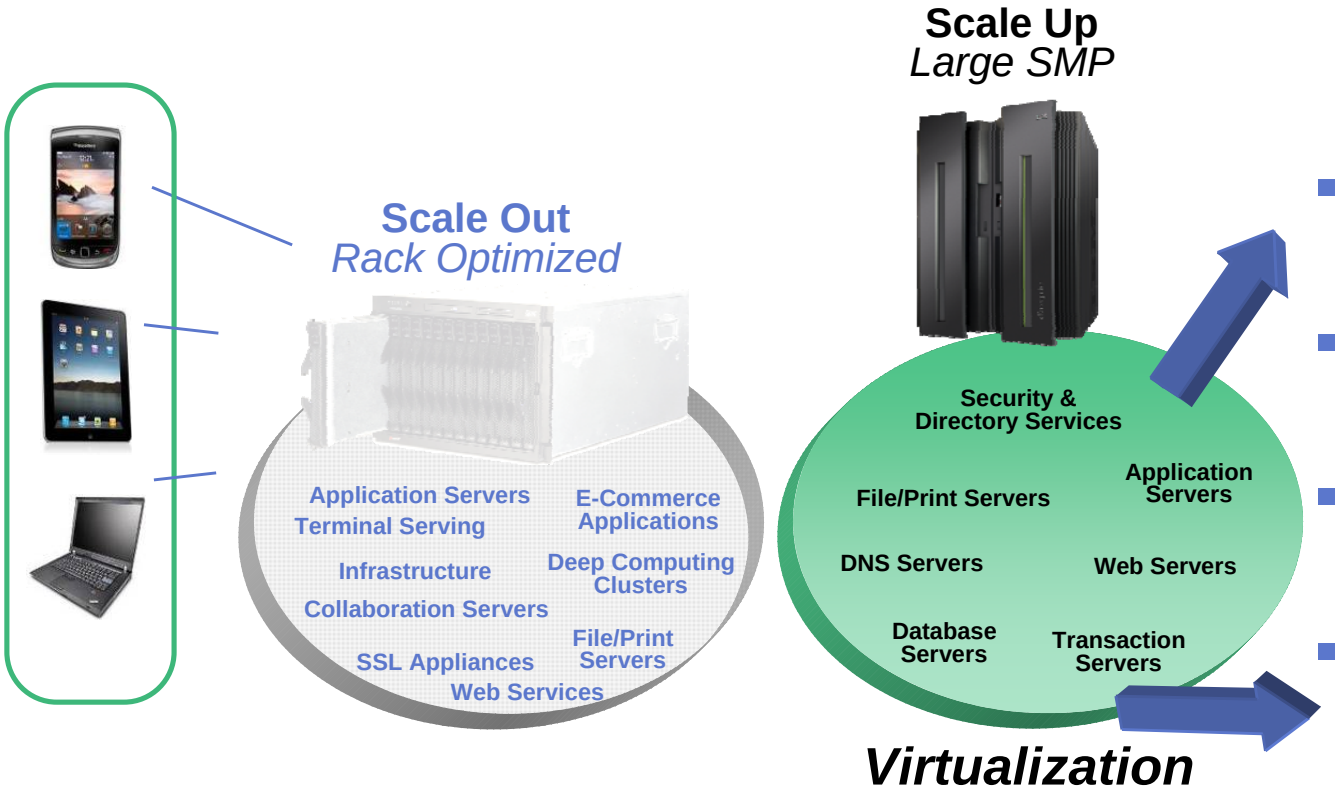


Ideal scale-out implementations



- **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**
- **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

- **SUSE Labs – SUSE Linux Enterprise Server**
  - http://www.suse.com/products/systemz/

- **Red Hat – Red Hat Enterprise Linux**
  - http://www.redhat.com/products/enterprise-linux/for-ibm-system-z/

Thanks!

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