



IBM System z

Linux on System z

ORACLE®
zSeries SIG

Jim Elliott
Consulting Sales Specialist –
System z New Workloads
IBM Canada Ltd.



The Future Runs on System z

IBM Systems

Topics

- **Linux on System z**
- **IBM Transformation**
- **Linux and Open Source on the Web at IBM**

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First, a few words about naming ...

Long Form				Short Form
IBM	eServer	zSeries	900/ 800 990 / 890	z900 / z800 z990 / z890
IBM	System	z9	EC / BC	z9 EC / z9 BC
IBM	System	z10	EC	z10 EC

- **System z = System z10 + System z9 + eServer zSeries**
- **Linux “naming” – *agreement with Linus Torvalds***
 - Linux on System z (or zSeries) refers to Linux on the mainframe
 - Linux for System z (or zSeries) refers to a 64-bit distro
 - Linux for S/390 refers to a 31-bit distro
- **To slash or not to slash**
 - Hardware **does not** (generally) have a slash
 - Software **does** (generally) have a slash
 - z/OS, z/VM, z/VSE, z/TPF
 - z/Architecture (“considered” software)



IBM System z

Linux on System z



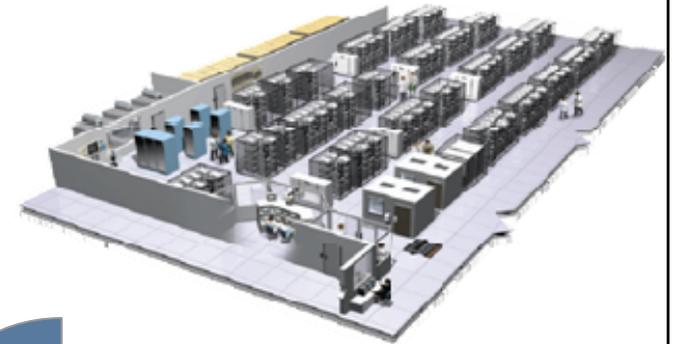
The Future Runs on System z

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Take back control of your IT infrastructure

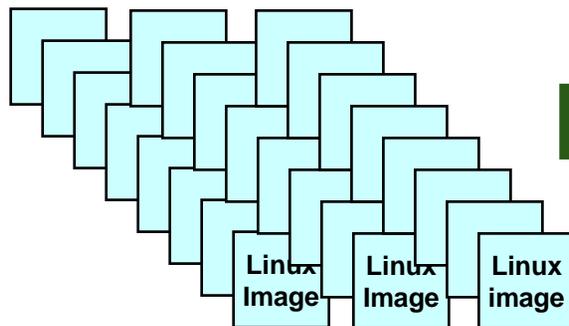
A data center in a box – not a server farm

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



The IT economics of becoming lean and green

- **Distributed servers often run at average utilization levels in the range of 5% to 20% ¹**
 - Production servers, development servers, test servers
- **Virtualization and workload management enable consolidation on the mainframe**
 - Run multiple images on fewer processors
 - Achieve utilization levels of 85% or more
- **Become lean and green through IT consolidation and simplification**



**5% to 20% average utilization
on 10-100 servers ¹**



Full utilization

1. Average Utilization includes Production, Development, and Test servers

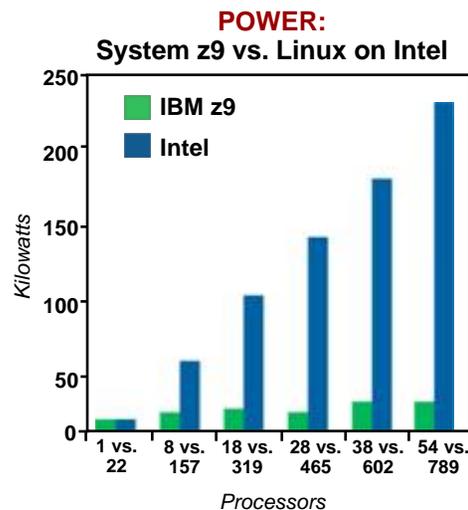
Clients are focused on energy, cooling and cost savings

- **Energy and cooling**
 - Gartner reports that 50% of poll respondents cited excessive heat or insufficient power as their key issue ¹
 - Most data centers are experiencing some sort of power/cooling problem
 - Data center power density is increasing by approximately 15% annually ³
 - Power draws per rack have grown 8x since 1996 ³
 - Over 40% of data center customers report power demand outstripping supply³
- **Cost savings**
 - 35% of CIO's report 'controlling IT costs' as a top IT management priority ⁴
 - 50% of data centers have server consolidation projects underway to reduce costs and better control systems ²
 - One third of CIO's have applied or plan to apply 'lean manufacturing principles' to data centers, to reduce waste and improve labor productivity ⁵
 - 56% of CEO's cite cost reduction benefits as the top benefit of business model innovators ⁶

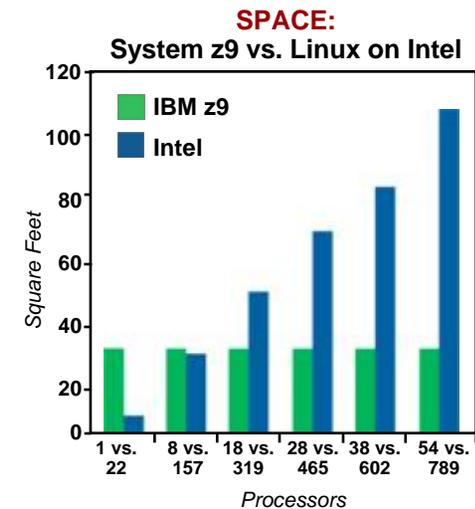
1. Gartner Data Center Conference, December 2005; 2.Gartner Data Center Conference, December 2006; 3. IDC, "The Impact of Power and Cooling on Data Center Infrastructure," 2007; 4.State of the CIO, CIO Magazine; 5.McKinsey Oct 20 2006: What's on CIO Agendas in 2007?; 6. The Global CEO Study, IBM 2006

Power and space consumption

- When consolidating low utilization Linux on x86 servers, the System z mainframe's ability to provide high utilization may help to reduce both power and facility costs



- In a consolidation, the z9 EC may provide up to **4 times the same work in the same space** and may provide up to **12 times the work for the same power consumption**



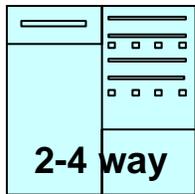
The Linux on Intel servers selected in this example are functionally eligible servers considered for consolidation to a System z running at low utilization such that the composite utilization is approximately 5%. The utilization rate assumed for System z EC is 90%. This is for illustration only actual power and space reductions, if any, will vary according to the actual servers selected for consolidation.

Linux on IBM System z

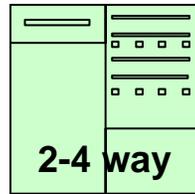
Linux + Virtualization + System z = SYNERGY

- **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
 - 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

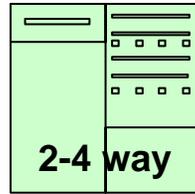
“Distributed” servers – complexity and cost



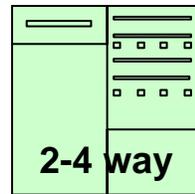
Web/App



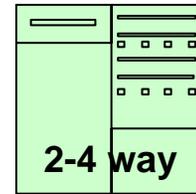
Web/App failover



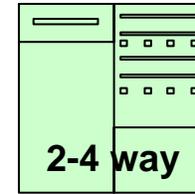
Development



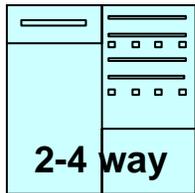
Test



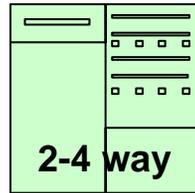
Web/App DR & QA



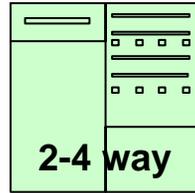
Web/APP DR failover



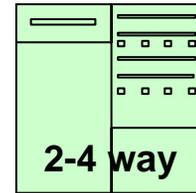
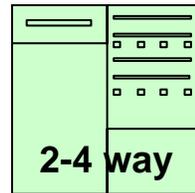
Messaging



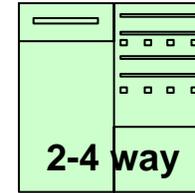
Messaging failover



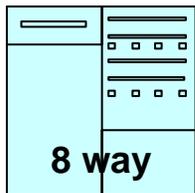
Test/Education Integration



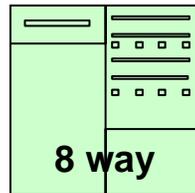
Messaging DR & QA



Messaging DR failover

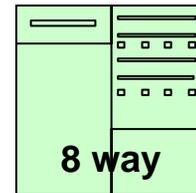


Database

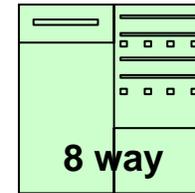


Database failover

- **Hardware**
 - 3 primary production servers
 - 16 total servers
 - 5:1 ratio
- **Software**
 - 32+ processors for database software
 - ~ \$1.8M over 3 years
 - 15+ processors for application software



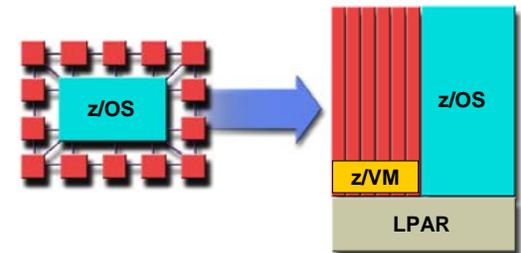
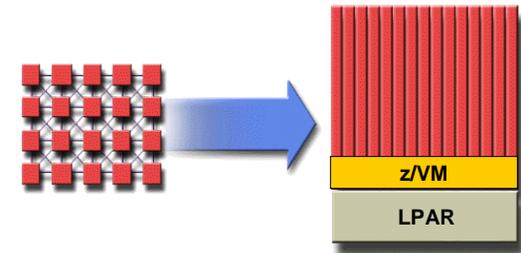
Database DR & QA



Database DR failover

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 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



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 z10 EC scales to 64 application processors
 - System z9 EC scales to 54 application processors
 - Up to 11 (z10 EC), 8 (z9 EC) dedicated I/O processors
 - Hundreds to thousands of Linux virtual servers

What is different about Linux on System z?

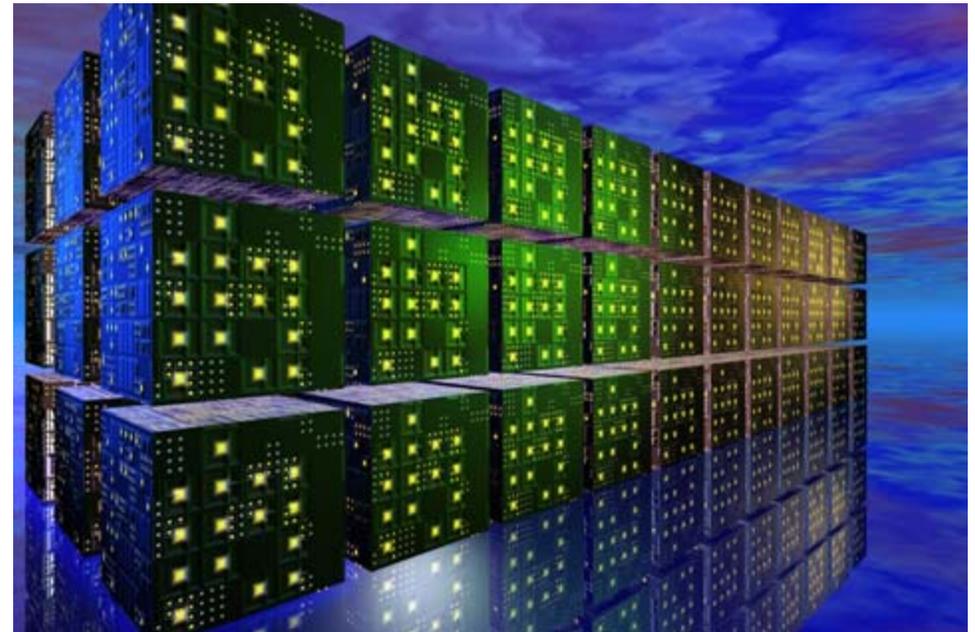
- **Access to System z specific hardware**
 - Crypto support – CPACF, Crypto2
 - Traditional and Open I/O subsystems
 - Disk (ECKD or SCSI) and tape
 - SAN Volume Controller
 - OSA-Express, OSA-Express2 and OSA-Express3 for very high speed communication between z/OS and Linux
 - HiperSockets for ultra-high speed communication between z/OS and Linux on the same machine
- **z/VM aware**
 - Enhanced performance
 - System management tools

Value of Linux on System z

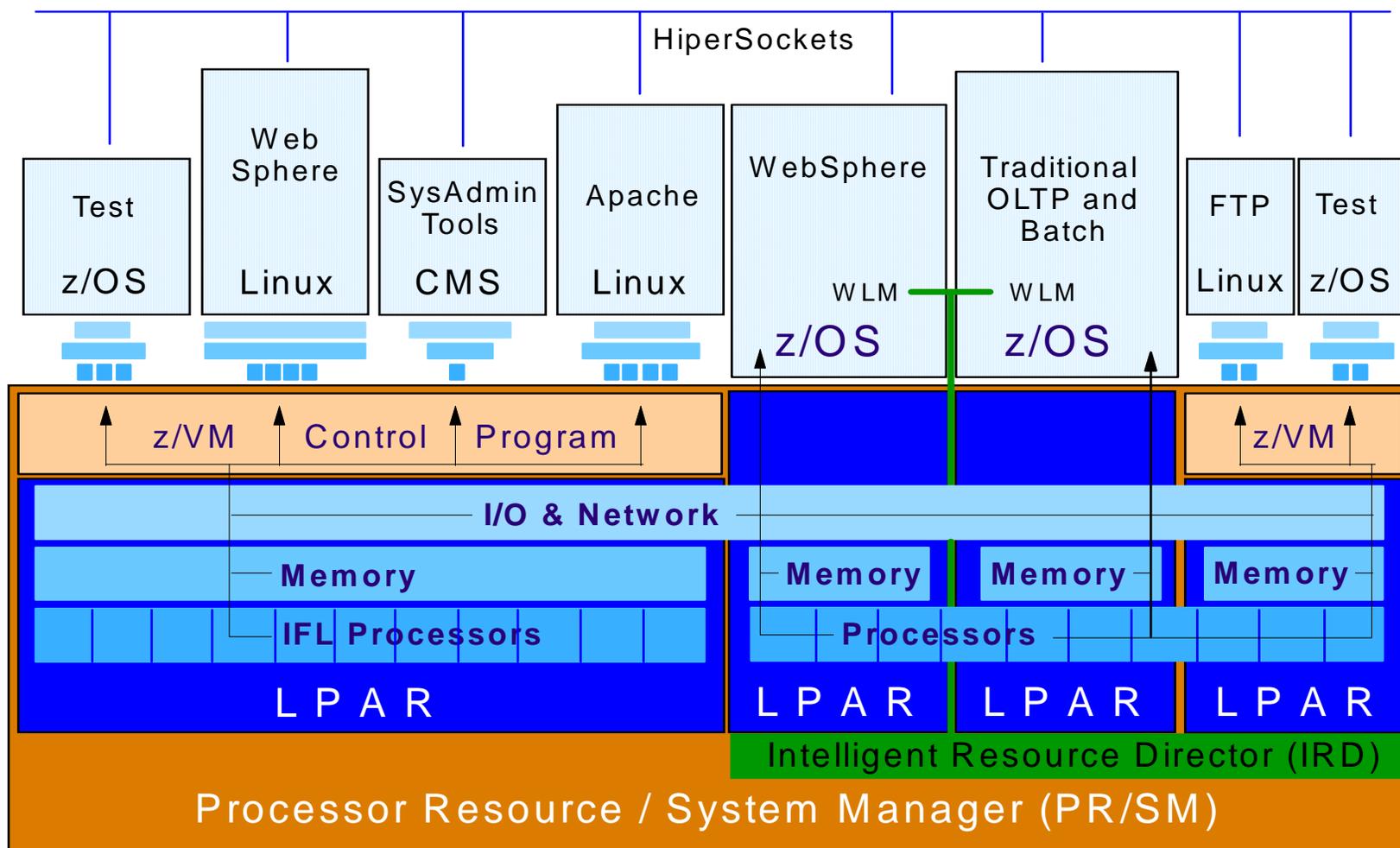
- **Reduced Total Cost of Ownership (TCO)**
 - Environmental savings – single footprint vs. hundreds of servers
 - Consolidation savings – less storage, less servers, less software licenses, less server management/support
- **Improved service level**
 - Systems management (single point of control)
 -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

System z – The ultimate virtualization resource

- **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
- **Utilization often exceeds 90%**
 - Handles peak workload utilization of 100% without service level degradation
- **Intelligent and autonomic management of diverse workloads**



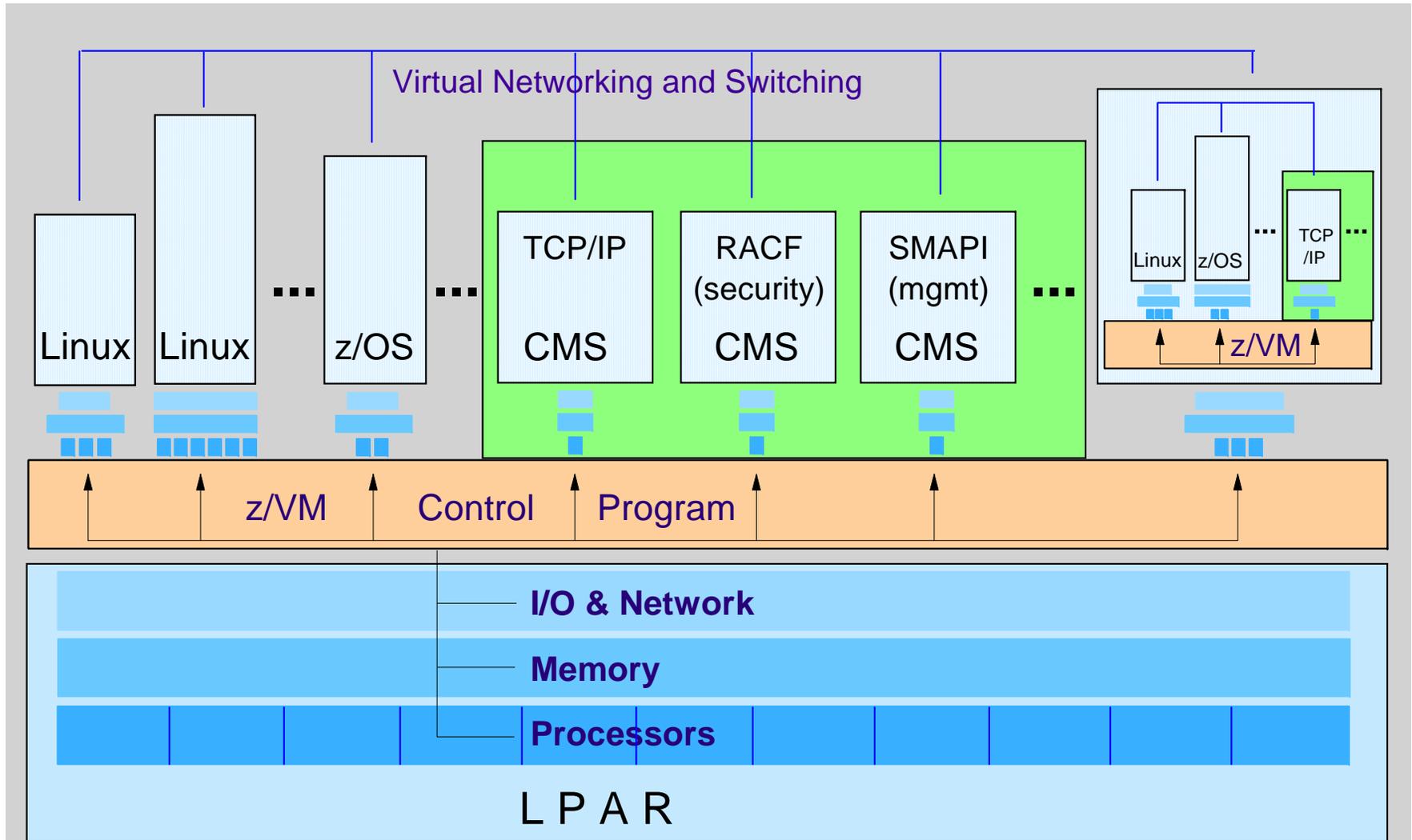
System z virtualization architecture



z/VM – Unlimited virtualization

- **z/VM provides a highly flexible test and production environment for enterprises deploying the latest e-business solutions**
- **z/VM helps enterprises meet their growing demands for multi-system server solutions with a broad range of support for operating system environments including z/OS and Linux on System z**
- **Mature technology**
 - CP/67 introduced in 1967 as a research tool
 - VM/370 introduced in 1972 to assist customers in migrating to OS/VS
- **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

z/VM architecture

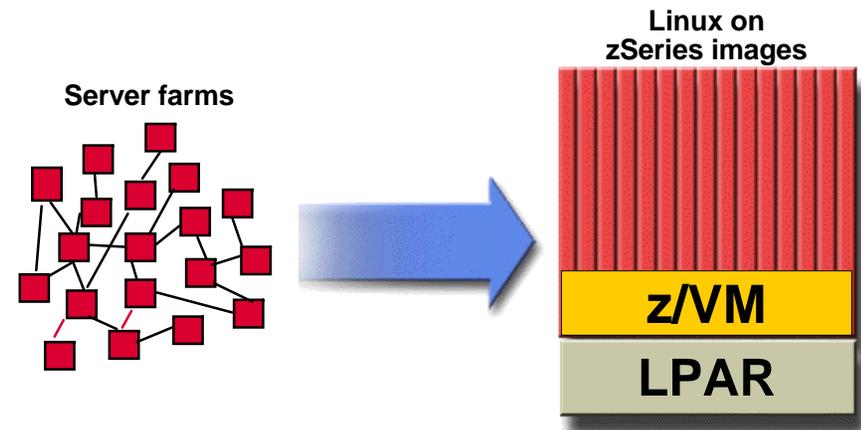


Potential TCO savings with z/VM

- Deploying virtual servers **can reduce hardware requirements**, which may result in savings when purchasing, installing and configuring new hardware
- Fewer hardware servers **occupy less space**, which may result in savings on raised floor requirements, heating, cooling and electricity
- Virtual servers can be **created in minutes**, which can help reduce cost and time associated with planning for new business opportunities
- Sharing operating systems and application code between virtual servers can **help you save** on software, systems management and staffing
- System management tools are delivered as part of the system which can help **avoid the cost of additional software** to perform these tasks
- Network **costs may be reduced** since virtual servers communicate using HiperSockets or VM guest LANs, Inter-User Communication Vehicle (IUCV), and virtual channel-to-channel adapters

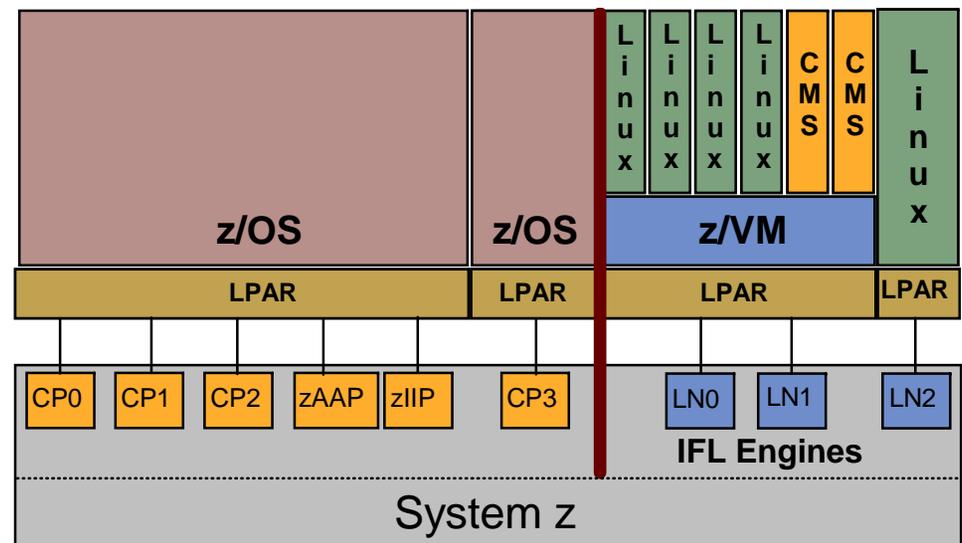
The value of z/VM for Linux

- **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 System z
 - IFLs on “sub-uni” systems run at “full speed”
 - z800, z890, z9 EC, z9 BC, **z10 EC**
- **Traditional mainframe software charges unaffected**
 - IBM mainframe software
 - Independent Software Vendor products
- **Linux and z/VM charged only against the IFLs**



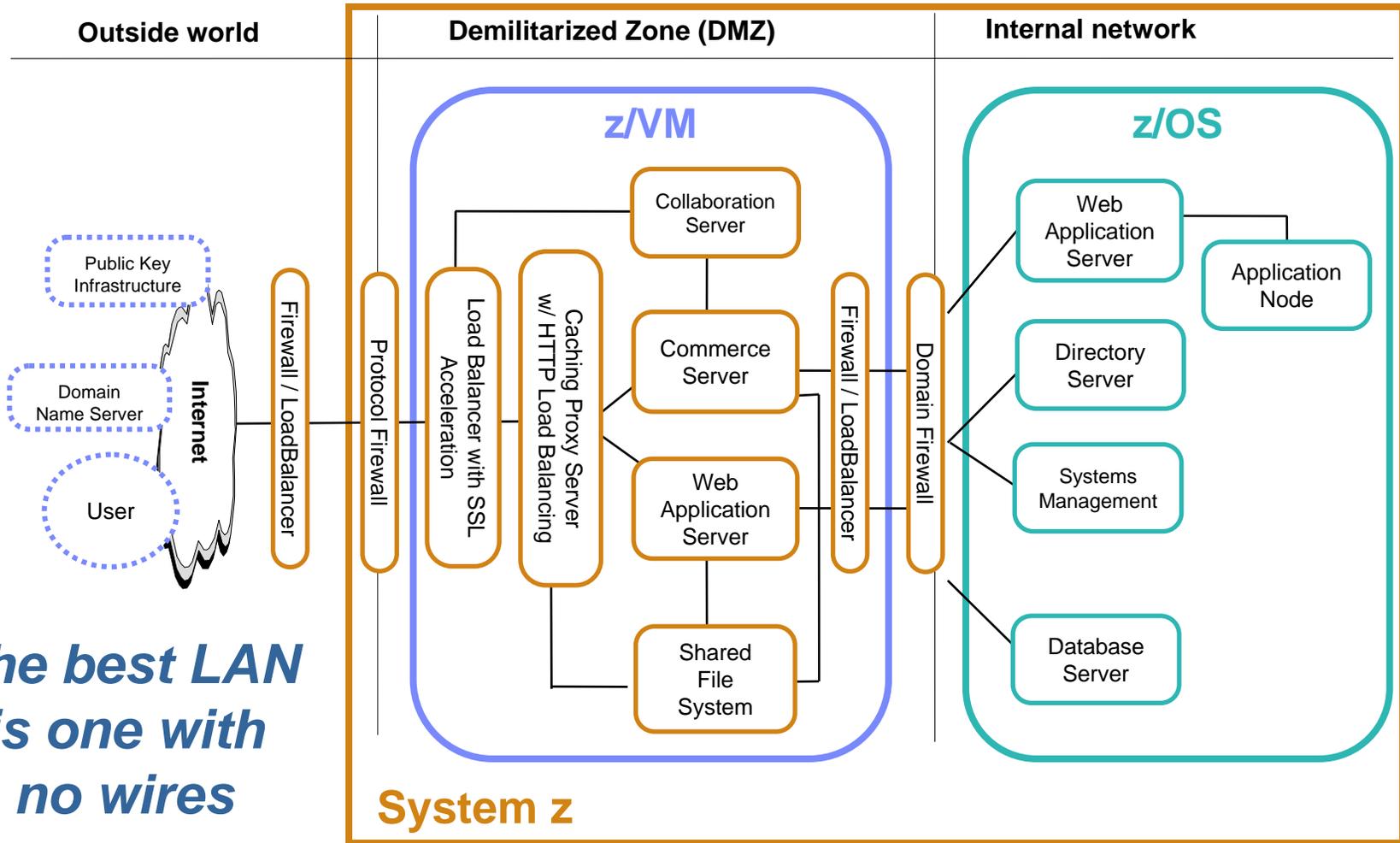
Workload share on utilized IFLs

Primary applications

60%	Application serving (z/OS front-end or consolidation) e.g. WebSphere family, Oracle Application Server, SAP, CICS TG, DB2 Connect, (<i>BEA WebLogic coming soon</i>), ...
30%	Data serving e.g. Oracle DB, DB2 UDB, MySQL, Informix, ...
5%	Workplace serving e.g. Domino, Communigate Pro, ...
5%	Infrastructure serving e.g. Apache, Samba, NFS, ...
<1%	Linux application development/deployment

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

Application serving with Linux on System z



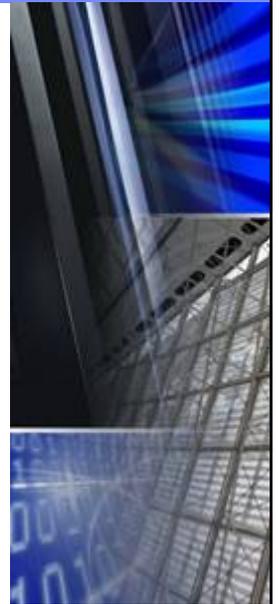
*The best LAN
is one with
no wires*

System z

Linux on IBM System z

Take back control of your IT infrastructure

- **Unify the infrastructure**
 - IT optimization and server consolidation based on virtualization technology and Linux
 - Linux can help to simplify systems management with today's heterogeneous IT environment
- **Leverage the mainframe data serving strengths**
 - Deploy in less time, accessing core data on z/OS
 - Reduced networking complexity and improved security network “inside the box”
- **A secure and flexible business environment**
 - Linux open standards support for easier application integration
 - Unparalleled scale up / scale out capabilities
 - Virtual growth instead of physical expansion on x86 or RISC servers
- **Leverage strengths across the infrastructure**
 - Superior performance, simplified management, security-rich environment
 - High-performance security-rich processing with Crypto2 cryptographic co-processors
 - Backup and restore processes





IBM System z

IBM Transformation



The Future Runs on System z

IBM Systems

IBM consolidation announcement highlights

- IBM will consolidate thousands of servers onto approximately 30 IBM System z™ mainframes
- We expect substantial savings in multiple dimensions: energy, software and system support costs
- Major proof point of IBM's 'Project Big Green' initiative
- The consolidated environment will use 80% less energy
- This transformation is enabled by the System z sophisticated virtualization capability



Think what we could do for you

IBM'S PROJECT BIG GREEN SPURS GLOBAL SHIFT TO LINUX ON MAINFRAME



Plan to shrink 3,900 computer servers to about 30 mainframes targets 80 percent energy reduction over five years

Optimized environment to increase business flexibility

ARMONK, NY, August 1, 2007 – In one of the most significant transformations of its worldwide data centers in a generation, IBM (NYSE: IBM) today announced that it will consolidate about 3,900 computer servers onto about 30 System z mainframes running the Linux operating system. The company anticipates that the new server environment will consume approximately 80 percent less energy than the current set up and expects significant savings over five years in energy, software and system support costs.

At the same time, the transformation will make IBM's IT infrastructure more flexible to evolving business needs. The initiative is part of Project Big Green, a broad commitment that IBM announced in May to sharply reduce data center energy consumption for IBM and its clients.

Project 'Big Green'

**Double compute capacity
with no increase in
consumption or impact**

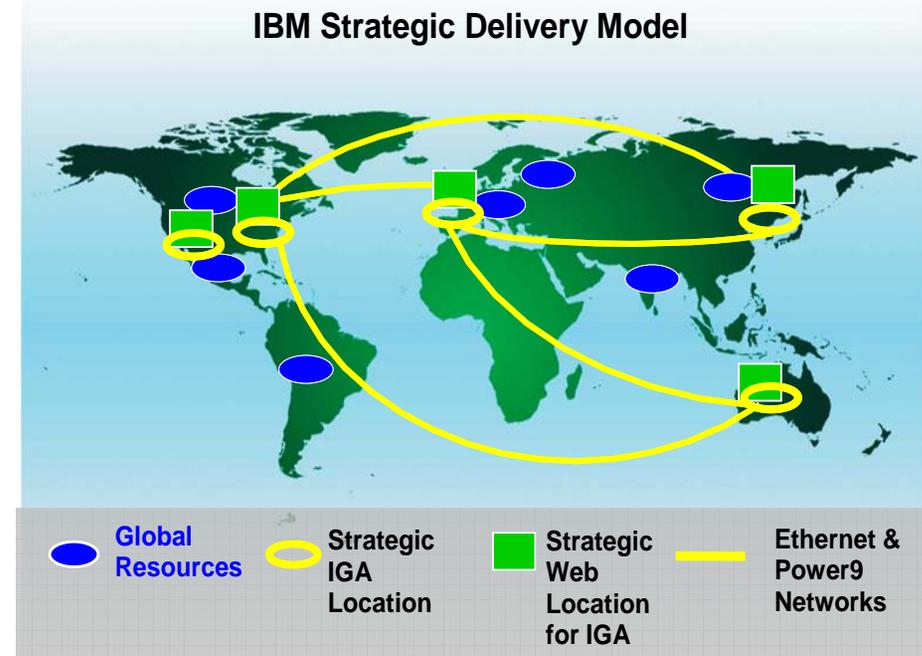


- **IBM to reallocate \$1 billion each year**
 - To accelerate “green” technologies and services
 - To offer a roadmap for clients to address the IT energy crisis while leveraging IBM hardware, software, services, research, and financing teams
 - To create a global “green” team of almost 1,000 energy efficiency specialists from across IBM
- **Re-affirming a long standing commitment at IBM:**
 - Energy conservation efforts from 1990 – 2005 have resulted in a 40% reduction in CO2 emissions and a quarter billion dollars of energy savings
 - Annually invest \$100M in infrastructure to support remanufacturing and recycling best practices

IBM infrastructure

Continued server growth brought physical space challenges

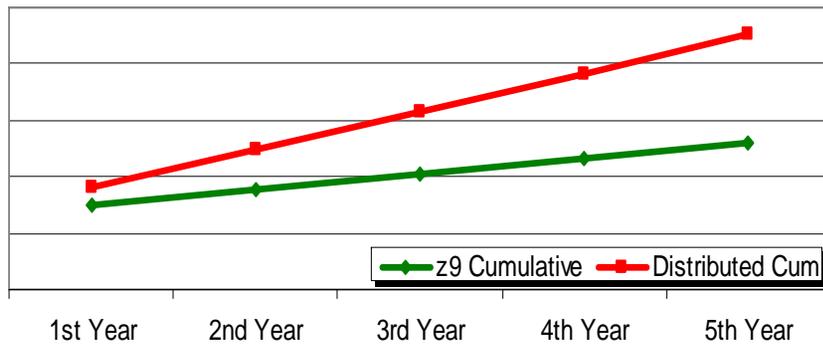
- **Data center efficiencies achieved**
 - Consolidation of infrastructure
 - Application consolidation/reduction
 - Enterprise architecture optimization
 - Global resource deployment
- **Next level of infrastructure challenge**
 - Floor space challenges in key facilities
 - Underutilized assets in outdated Web infrastructure
 - Continued infrastructure cost pressure



Early modeling identified significant potential for savings through virtualization on System z

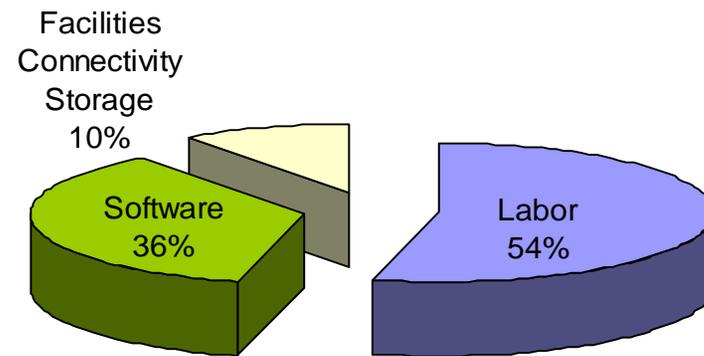
- **Performed TCO and consolidation assessment on IBM portfolio**
 - Cross-IBM effort: System z, Software Migration Services, TCO Academy, Migration Factory

Cumulative 5 Year Cost Comparison



Analysis models today's steady state operations cost with projected System z operations cost

Steady State Savings



Savings are net after hardware and migration investments

- **Identified substantial savings opportunity**
 - Annual Energy Usage reduced by 80%
 - Total floor space reduced by 85%



The anticipated facilities savings are substantial and contribute to IBM's green initiative

- 80% savings in annual energy usage

Comparison of Annual Energy Usage for Workloads				
	Distributed Solution		System z Solution	
	Kilowatts (K)	Cost* (\$K)	Kilowatts (K)	Cost* (\$K)
Power	24,000	\$2,400	4,796	\$479
Cooling**	14,400	\$1,440	2,877	\$287
Total Energy	38,400	\$3,840	7,673	\$767

* Electrical cost calculated at rate of .10 per kW

** Cooling is 60% of power cost

- 85% savings in total floor space

- 11,045 square feet for distributed solution
- 1,643 square feet for System z solution



This is a cornerstone initiative in the IBM quality of service imperative

- Leverages maturity of System z stack products for robust high availability
- Reduces complexity and increases stability
- Centralizes service level process management
- Potential for faster provisioning speed (months → days)
- Provides dynamic allocation of compute power
 - Capacity on demand; increase/reduce compute power
- Provides world class security



IBM virtualization progress

- **Established phased approach for quick wins**
- **Migrated initial servers from ‘early adopter’ teams**
 - Inventoried more than 4000 servers
 - Over 500 images deployed (migrated and new)
- **Comprehensive project plan and management system in place**
 - Integrated business priorities with transformational objectives
 - ‘Work in progress’ approach to maximize server migrations
 - Pipeline, process, technical, finance and communications support
- **Developed internal business case and cash flow analysis using specific server costs, detailed labor analysis, migration expense**
- **Technical solution, education plan and operational plan developed**
- **Highest level of support from IBM senior executive team**



Several factors are used in the analysis to determine which workloads to move



- **Servers delivering large saving**
 - Old technology: servers, storage, network
 - Servers with low utilization
 - Servers that free up contiguous space
 - Locations with high cost of energy and space



- **Lower cost migrations**
 - New deployments
 - Servers/applications with planned change
 - Associated servers
 - Lower complexity, fewer dependencies

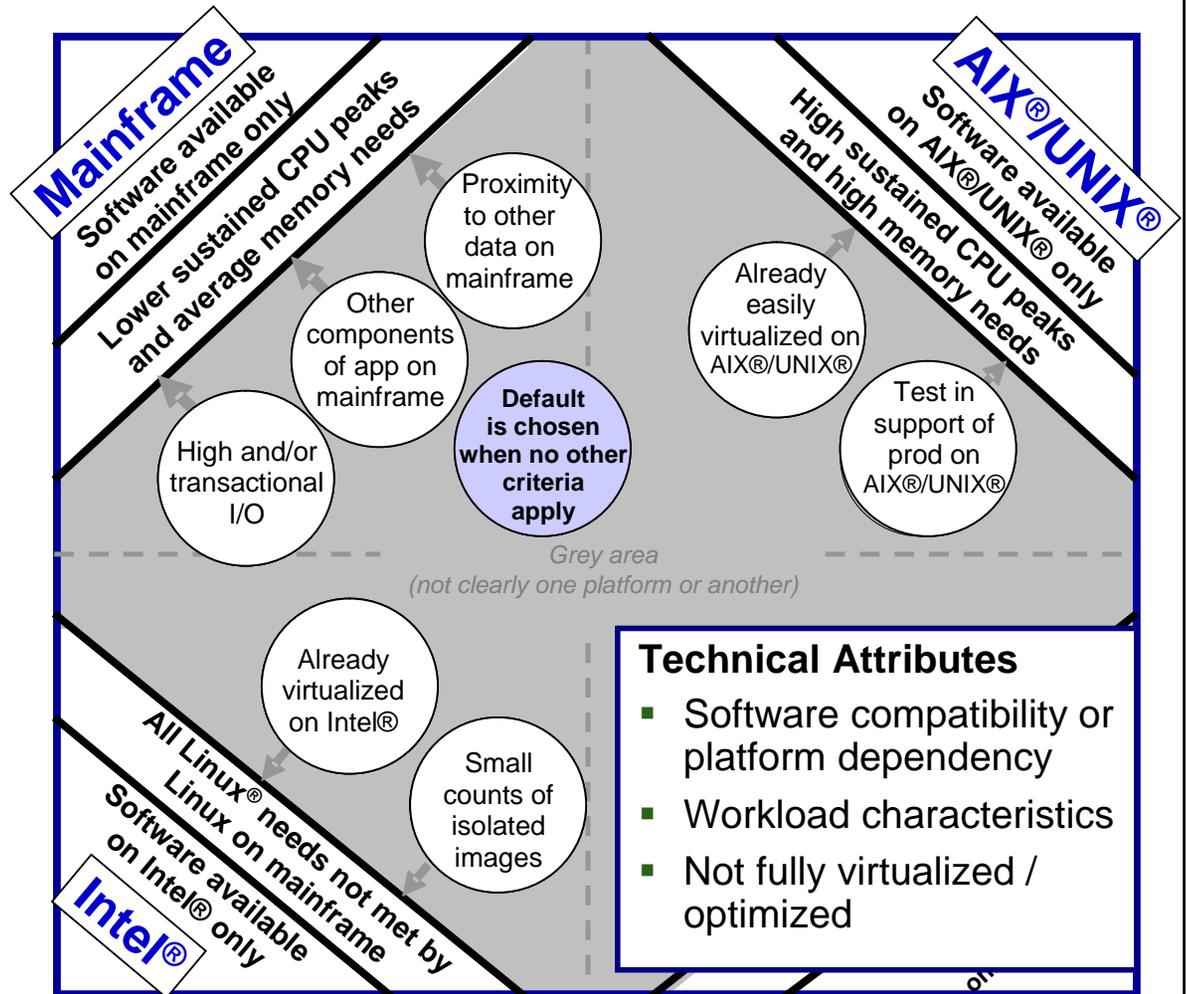


- **Business aspects**
 - Criticality and Impact to the business
 - Business cycles
 - SLA

Each workload is evaluated for suitability based on technical attributes

Priority workloads for consolidation:

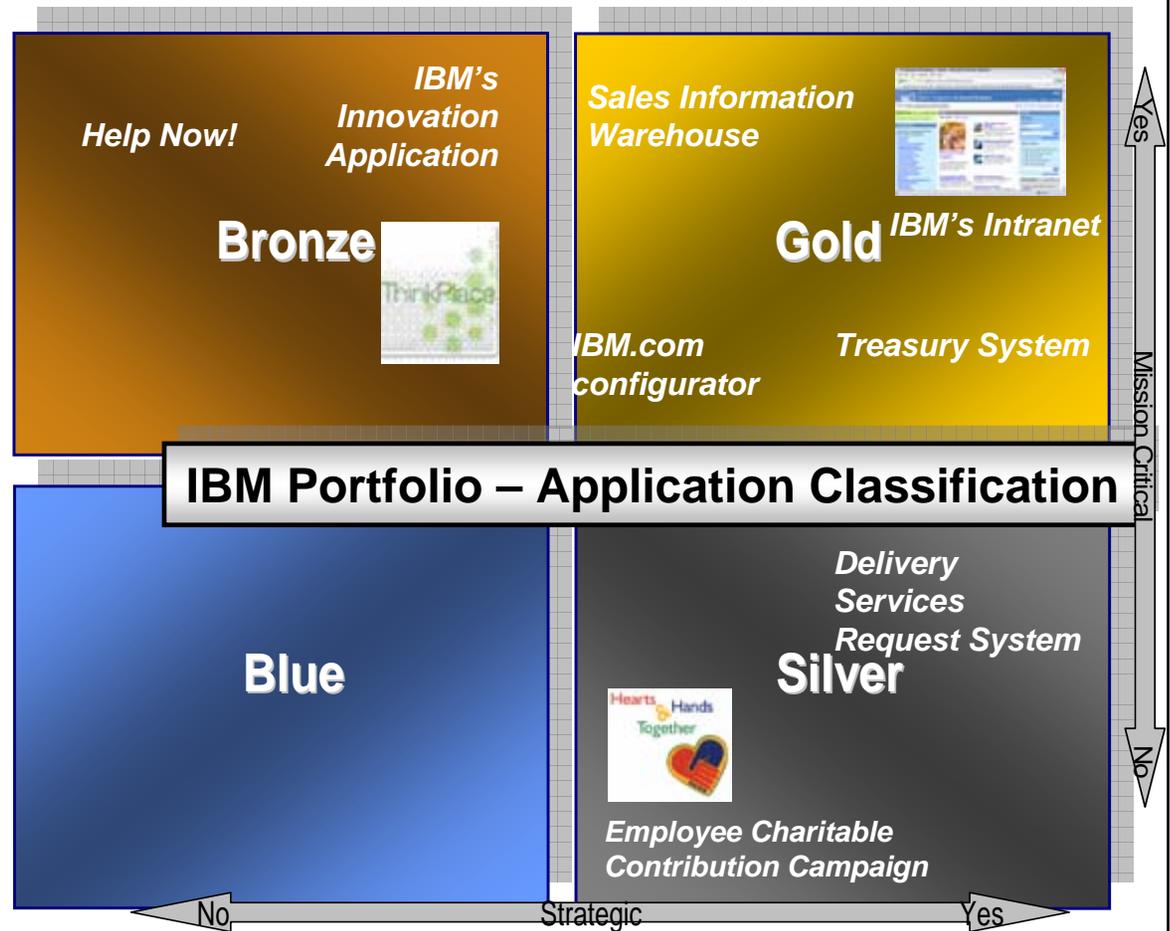
- WebSphere applications
- Domino applications
- Selected tools: Tivoli, WebSphere and internally developed
- WebSphere MQ
- DB2 Universal Database



Applications moving to System z tend to be strategic and mission critical

Application view

- Includes all business units, a cross-section of business functions
- Most are internally developed Web and Domino-based
- Tend to be complex with multiple servers and interfaces
- Almost 50% of initial applications are classified as "Gold"



Virtualization will leverage existing IBM System z boxes, increasing workloads with a measured approach

- Leveraging System z machines with Linux currently running in IBM's five major data centers worldwide
- Initially, machines are loaded to 50% utilization to allow for experience with the workloads
- A mix of high availability and non-high availability work ultimately enables capacity for automatic load spreading at 75% utilization, going to 90% on failover
- New capacity is being added together with backup for redundancy and high availability as needed



Operationally, the goal is to minimize change while leveraging the capability of System z

- **The distributed and mainframe support teams collaborated with IBM's Design Center to develop the operational approach and the basis for the reference architecture**
- **Approach:**
 - Adapt existing Unix team processes
 - Engage z team to operate System z and z/OS
 - Broaden the VM/mainframe knowledge of the mid-range team through training, to assist in support of VM Hypervisor (z/VM) and Linux
 - Use existing monitoring and operational tools, i.e.
 - Tivoli Monitoring and Enterprise Portal
 - VM Resource Manager
 - Monitor and Performance Toolkit
 - Administer capacity, operating system provisioning and software distribution tools

Training needs and classes for personnel involved in System z virtualization have been identified

- **IT Architects**
 - Broad based knowledge of Linux on System z solutions, VM and the underlying System z platform
- **Project Managers**
 - Sufficient knowledge of Linux on System z, VM, mainframe attributes, and migration scenarios to manage an ECM project
- **Server Build Personnel**
 - Understand the Linux on System z operating system; High level understanding of VM
- **Systems Administrators/Systems Operations Personnel**
 - Understand the unique attributes of Linux on System z and the VM/mainframe environment; Include Linux in base SA and systems operations education
- **A half day of general virtualization education for application owners and delivery personnel provides a high level view of virtualization, migration and Linux on System z**



Preparing for virtualization

Motivate business units

- **Enlist a Senior Executive Sponsor**
 - Sr. VP Linda Sanford, who manages Transformation for IBM is providing enterprise leadership, working with Business Unit Sr. VPs
- **Build an “incentive” rate**
 - Financial benefit provides good incentive for support and teaming in project execution. Reductions are being phased in during the project with differentiated rates.

Build the business case

- **Start with a high level planning estimate**
 - Initial estimates from zRACE model were validated by the CFO through a detailed analysis of a sample subset of 325 servers

Gather data

- **Augment inventories with network tools**
 - Local and central Configuration Management DB needed augmentation with network scans to gather configurations and application mapping

Project start-up

Start small

- **Migrate a small set of servers for a fast start**
 - An initial Phase to immediately migrate a small number of servers worked well to build early experience
-

Run operations while transforming

- **Use a dedicated team**
 - IBM's commercial migration practice is implementing most of the management and migration, minimizing the operational team's responsibility to Final Test, Environment Build and Cutover
-

Manage complexity

- **Engage strong project management**
 - A structured management approach and broad, sustained sponsorship from the business units are critical
-

Monitor progress and continuously improve

- **Use an end-to-end process approach**
 - A streamlined end-to-end process approach has been established with clear interfaces and handoffs. It will be monitored and improved with process flow metrics, yield metrics and automation

Business unit communication

- **The CIO Office is providing leadership and communication with the Business Units:**
 - Initial CIO communication shared business objectives and commitment
 - Exceptions scrutinized by CIO
 - Regular meetings and communication with business unit application owners during migration
 - Common concerns from business units and application owners being mitigated

Top 5 Concerns	Mitigation
Will my bill go up? How much will it be?	Implementing tiered rates: base cost plus variable usage. Rates will accurately reflect cost to the corporation
Have there been any successful pilots?	Accepting volunteer applications initially. CIO migrating most visible internal application: IBM's Intranet
Will my application run?	Focus on common middleware for initial migrations, communicating results to application teams
Will this impact my business priorities?	Migration process leverages planned changes and takes other business priorities into consideration
What about technical training?	Training to be delivered to application owners and development teams



Going forward, the IBM Virtualization team focus is:

- ***Process efficiency*** – increase throughput and reduce cycle time, leveraging process improvements and IBM Research innovations
- ***Operational metrics*** – manage the pipeline with key metrics
- ***Server / application selection criteria*** – validate effectiveness of screening and early decision making
- ***Savings tracking and analysis*** – validate transformation model and capture actual savings



IBM System z

Additional information about Linux on System z



The Future Runs on System z

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Linux offers a future-proof, long-term strategic platform. All major server and middleware vendors support the Linux platform.	IBM offers the broadest range of server and middleware products for Linux in the industry.

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The screenshot shows the IBM developerWorks website for Open Source. The main navigation bar includes links for Home, Business solutions, IT services, Products, Support & downloads, and My IBM. The left sidebar contains a list of categories, with 'Open source' highlighted and a red arrow pointing to it. The main content area features a 'Top story' titled 'Eclipse at eBay, Part 2' with a sub-headline 'Resources for open source development and implementation'. Below this, there are several articles with brief descriptions. The right sidebar contains sections for 'My developerWorks' (Welcome guest, Sign in, Register), 'Top project resources' (Apache Derby, Apache Geronimo, Eclipse, PHP), 'Spotlight' (alphaWorks Services, Apache Tuscany V1.1), and 'Editor's picks' (Eclipse Europa winter maintenance packages).



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IBM developerWorks for Linux

<http://ibm.com/developerworks/linux>

The screenshot shows the IBM developerWorks website for Linux. The top navigation bar includes 'Home', 'Business solutions', 'IT services', 'Products', 'Support & downloads', and 'My IBM'. A search bar is located on the right. The left sidebar contains a 'developerWorks' menu with categories like 'AIX and UNIX', 'Information Mgmt', 'Lotus', 'Rational', 'Tivoli', 'WebSphere', 'Architecture', 'Autonomic computing', 'Java™ technology', 'Linux', 'Multicore acceleration', 'Open source', 'SOA and Web services', 'Web development', 'XML', 'About dW', 'Submit content', and 'Feedback'. A red arrow points to the 'Linux' link in this menu. The main content area is titled 'Linux' and features a 'Top story' section with the article 'Linux development on the PlayStation 3, Part 1: More than a toy'. Below this are several other articles with brief descriptions. The right sidebar contains widgets for 'My developerWorks' (Welcome guest, Sign in, Register), 'developerWorks spaces', 'Spotlight' (PowerVM Lx86 for x86 Linux applications, Linux certification-prep tutorials, Top 10: Readers' favorite Linux articles), 'Editor's picks' (Explore Ubuntu Mobile and Embedded (UME), Role-based access control in SELinux), and 'Special offers' (Learn fast with free IBM Linux tutorials, LPI Exam 201 preparation: Linux filesystem, Trial download: Tivoli Provisioning Manager for OS Deployment).

IBM Redbooks

<http://ibm.com/redbooks/linux>

The screenshot shows the IBM Redbooks website interface. At the top, there's a navigation bar with 'Home', 'Solutions', 'Services', 'Products', 'Support & downloads', and 'My IBM'. A search bar is present with 'Redbooks' selected. The main content area is titled 'Linux at IBM' and features a large green banner for 'Linux and IBM Redbooks'. Below this, there are several sections: 'Linux Redbooks Domain', 'Latest Drafts ... show all' (listing articles like 'Using Oracle Solutions on Linux for System z'), 'New Technotes ... show all' (listing 'Installing Oracle 10gR2 on SLES10 Linux on System z'), 'Skills Development' (listing 'Residencies' and 'Workshops'), and 'What's New'. A prominent banner for 'NEW GUIDE FOR SYSTEMS ADMINISTRATORS' is displayed, along with a 'Download the IBM Redbook here' button. A red arrow points to the 'Residencies' link in the left navigation menu.

Linux on System z and z/VM Web sites

<http://ibm.com/systems/z/os/linux>

<http://ibm.com/vm>

Available:	z/VM V5.3
Also supported:	z/VM V5.2

Linux distributor web sites

- **Novell SUSE Linux Enterprise**

- <http://novell.com/mainframe>
- <http://novell.com/linux/mainframe/>

The Novell logo is displayed in a large, bold, red sans-serif font. A registered trademark symbol (®) is located at the end of the word.

- **Novell SLES Starter System for System z**

- <http://novell.com/partners/ibm/mainframe/starterpack.html>

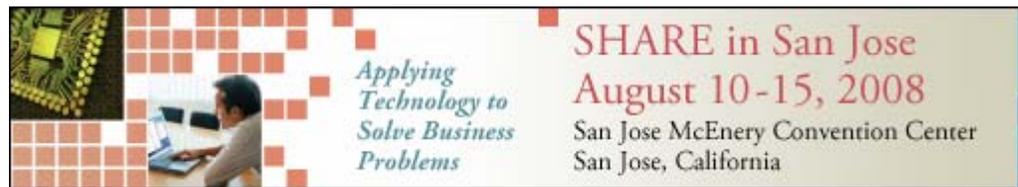
- **Red Hat Enterprise Linux**

- <http://redhat.com/rhel/server/mainframe/>



Education for System z

- **SHARE – “Not an acronym, it is what we do”**
 - August 10-15, 2008 in San Jose, California
 - www.share.org/events/sanjose/
 - March 1-6, 2009 in Austin, Texas



- **IBM System z Expo**
 - ibm.com/training/us/conf/systemz
 - October 13-17, 2008 in Las Vegas, Nevada
- **IBM Training**
 - ibm.com/training



Thank you

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Jim Elliott

Consulting Sales Specialist – System z New Workloads

IBM Canada Ltd.

jim_elliott@ca.ibm.com

905-316-5813

<http://ibm.com/linux>

<http://ibm.com/systems/z>

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