Linux on System z – A Strategic View

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Advocate – Linux, Open Source, and Virtualization and Manager – System z Operating Systems
IBM Canada Ltd.

9202 – Linux on System z – A Strategic View

- **Datacenters planning to adopt Linux have a key architectural choice to make in designing large-scale implementations**
- **Is the best approach to running Linux scale-out with rack-optimized servers, to scale-up with large SMP servers using virtualization facilities to run many images on a single server?**
- **For many users, Linux on IBM System z may be the optimal choice**
- **Jim will describe how Linux on System z, in combination with z/VM, will provide a robust Linux environment which integrates well with z/OS, z/TPF and z/VSE**
- **In addition, Jim will provide an overview of running Oracle/DB on Linux on System z**

Agenda

- Linux on System z overview
- Linux on System z deployment criteria
- Consolidating Oracle/DB to Linux on System z
- Users of Linux on System z
- Additional information about Linux on System z

First, a few words about naming …

Long Form				Short Form
IBM	eServer	zSeries	990 / 890	z990 / z890
IBM	System	z9	EC / BC	z9 EC / z9 BC

- **System z = System z9 + eServer zSeries**
- **Linux "naming"**
  - 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 have a slash
  - Software does have a slash
    - z/OS, z/VM, z/VSE, z/TPF
    - z/Architecture ("considered" software)

User presentations at SHARE

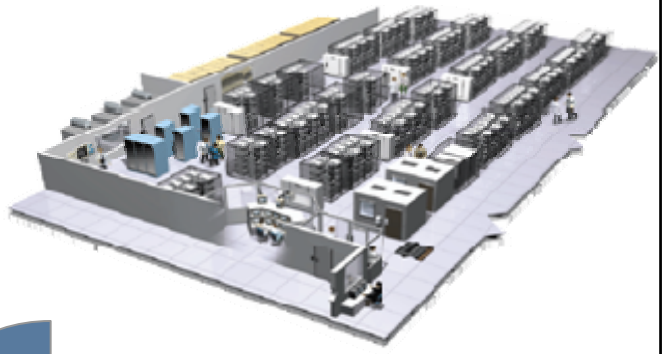
- **9206** ***From A (AIX) to Z (Linux on System z), A Customer Experience at NCCI***
  - Tue, 4:30pm, 4th Floor, Room 37
- **9212** ***Linux for System z at Nationwide - From Woe to Whoa! How did We Get Here, Toto?***
  - Tue, 3:00pm, 1st Floor, Room 24
- **9213** ***Linux for System z at Nationwide - From Woe to Whoa! Where do we go now?***
  - Tue, 4:30pm, 1st Floor, Room 24
- **9230** ***How to Rise Above the Challenges of Deploying z/VM and Linux on the Mainframe and Thrive at CSPQ***
  - Wed, 1:30pm, 1st Floor, Room 24
- **9231** ***Building a Strong z/VM and Linux Architecture on the Mainframe at CSPQ***
  - Wed, 3:00pm, 1st Floor, Room 24
- **9249** ***Putting Linux on System z into Production: True Stories***
  - Wed, 11:00am, 1st Floor, Room 24

Linux on System z overview

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



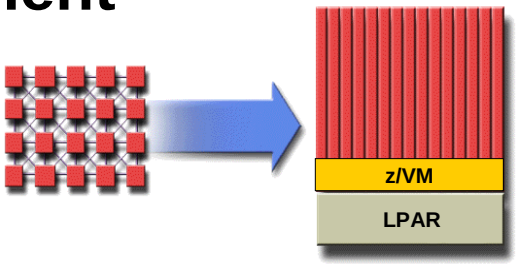
Linux on IBM System z

Linux + Virtualization + System z = SYNERGY

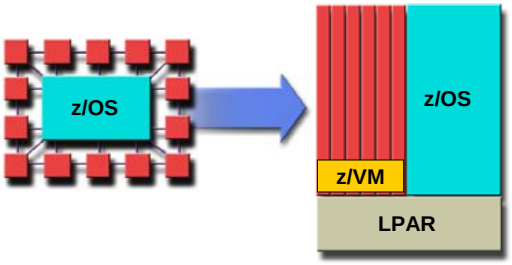
- **The legendary IBM mainframe – IBM System z**
  - Legendary dependability
  - Extremely security-rich, highly scalable
  - Designed for multiple diverse workloads executing concurrently
  - Proven high volume data acquisition and management
- **The IBM mainframe virtualization capabilities – z/VM 5.2**
  - Improved scalability for applications with large memory requirements
  - Increased number of virtual guests possible with dedicated devices
  - … and improved performance and enhanced SCSI disk support
- **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 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, z/VSE and z/TPF 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 z9 EC scales to 54 application processors
  - System z9 BC scales to 7 application processors
  - eServer zSeries 990 scales to 32 application processors
  - eServer zSeries 890 scales to 4 application processors
  - Up to 8 dedicated I/O processors
  - Hundreds of Linux virtual servers

What is different about Linux on System z?

- **Access to System z specific hardware**
  - Crypto support – CPA, Crypto2
  - Traditional and Open I/O subsystems
    - Disk (ECKD or SCSI) and tape
    - SAN Volume Controller
  - OSA-Express and OSA-Express2 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

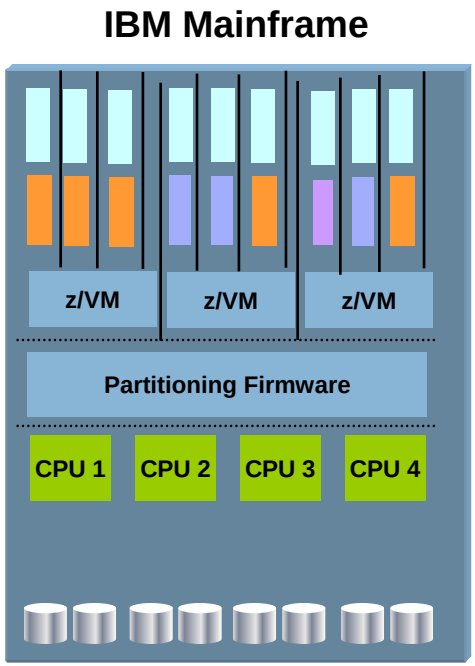
Business Case for Linux on System z

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

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, 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 exceeds 90%**
  - Handles peak workload utilization of 100% without service level degradation

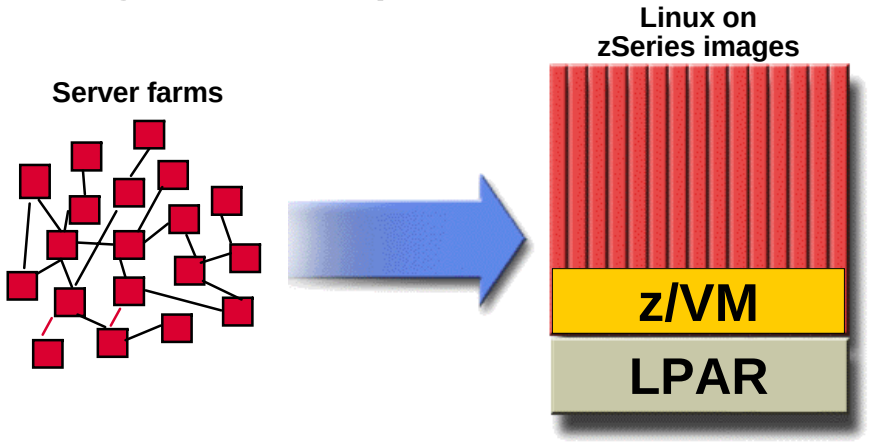
- **Massive consolidation platform**
  - 60 logical partitions, 100s to 1000s of virtual servers under z/VM
  - Virtualization is built-in, not added-on
  - HiperSockets for memory-speed communication
  - Most sophisticated and complete hypervisor function available
- **Intelligent and autonomic management of diverse workloads and system resources based on business policies and workload performance objectives**

z/VM – 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**
- **Mature technology – z/VM introduced in 1967**
- **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

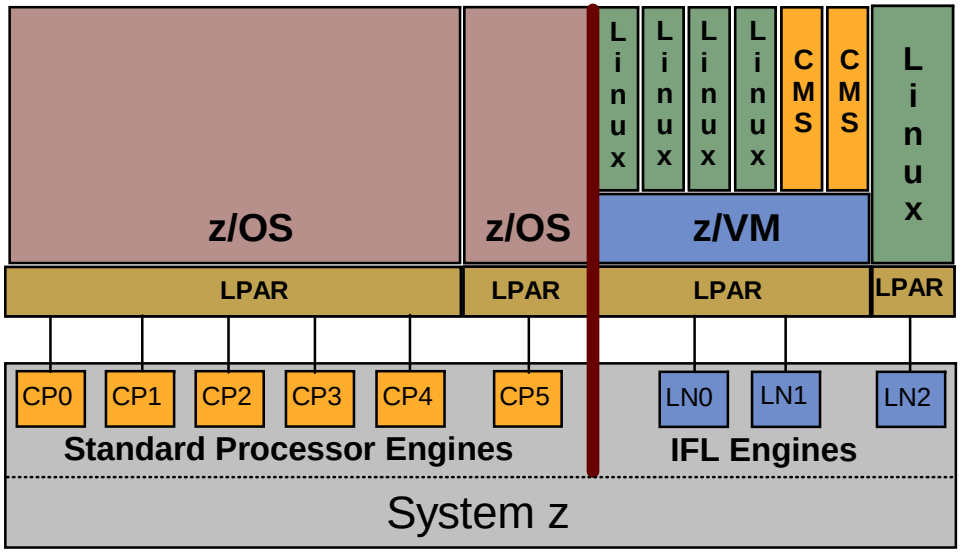
The value of z/VM for Linux

- **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

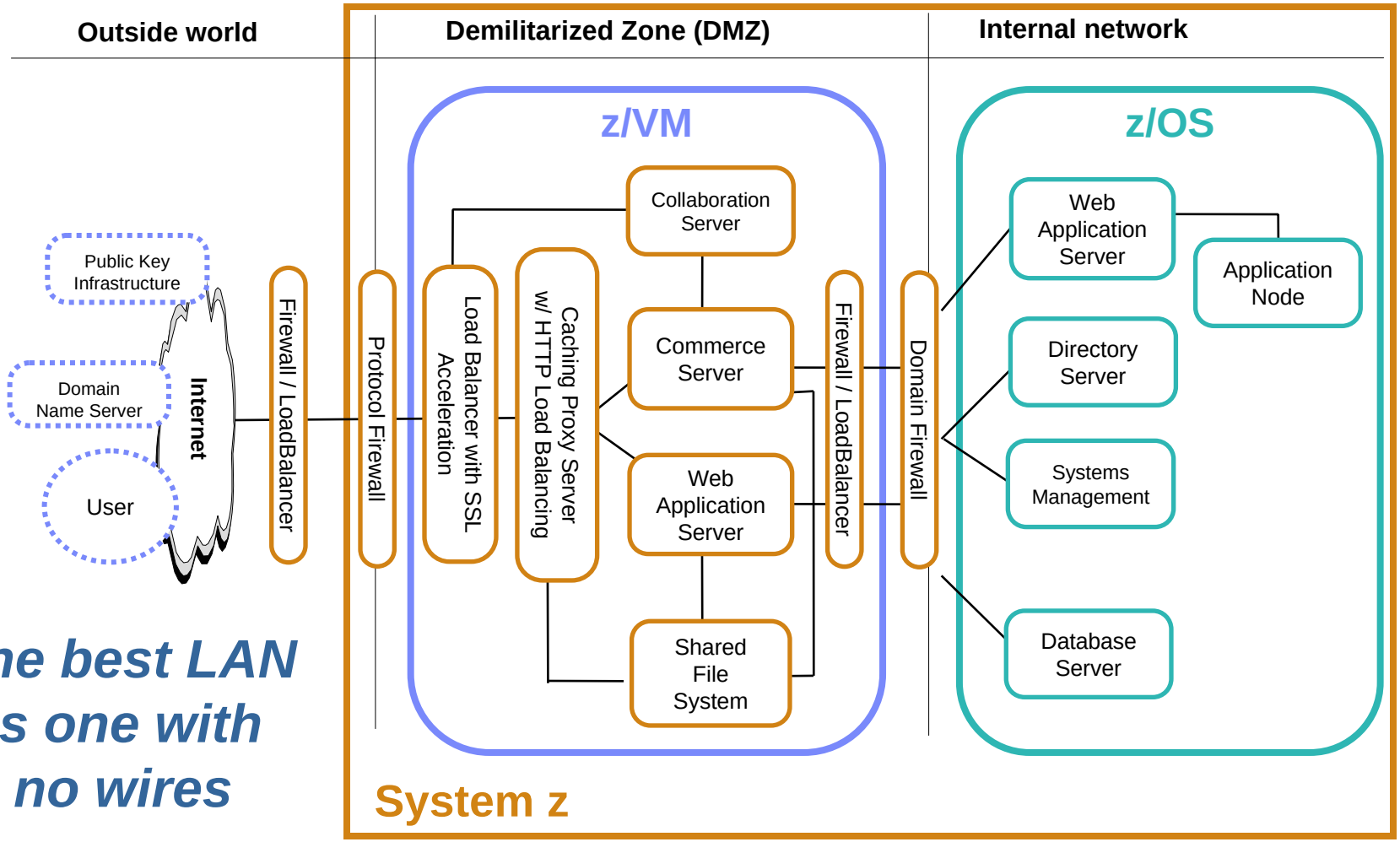


Integrated Facility for Linux

- **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**
- **Traditional mainframe software charges unaffected**
  - IBM mainframe software
  - Independent Software Vendor products
- **Linux and z/VM charged only against the IFLs**



Application serving with Linux on System z

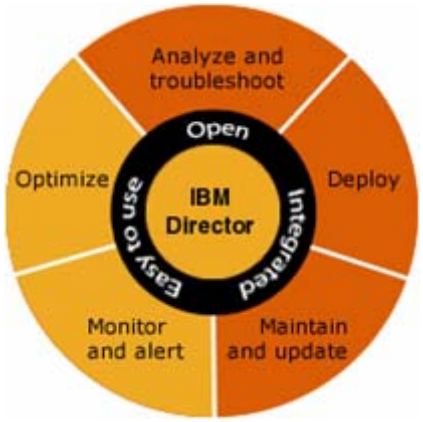


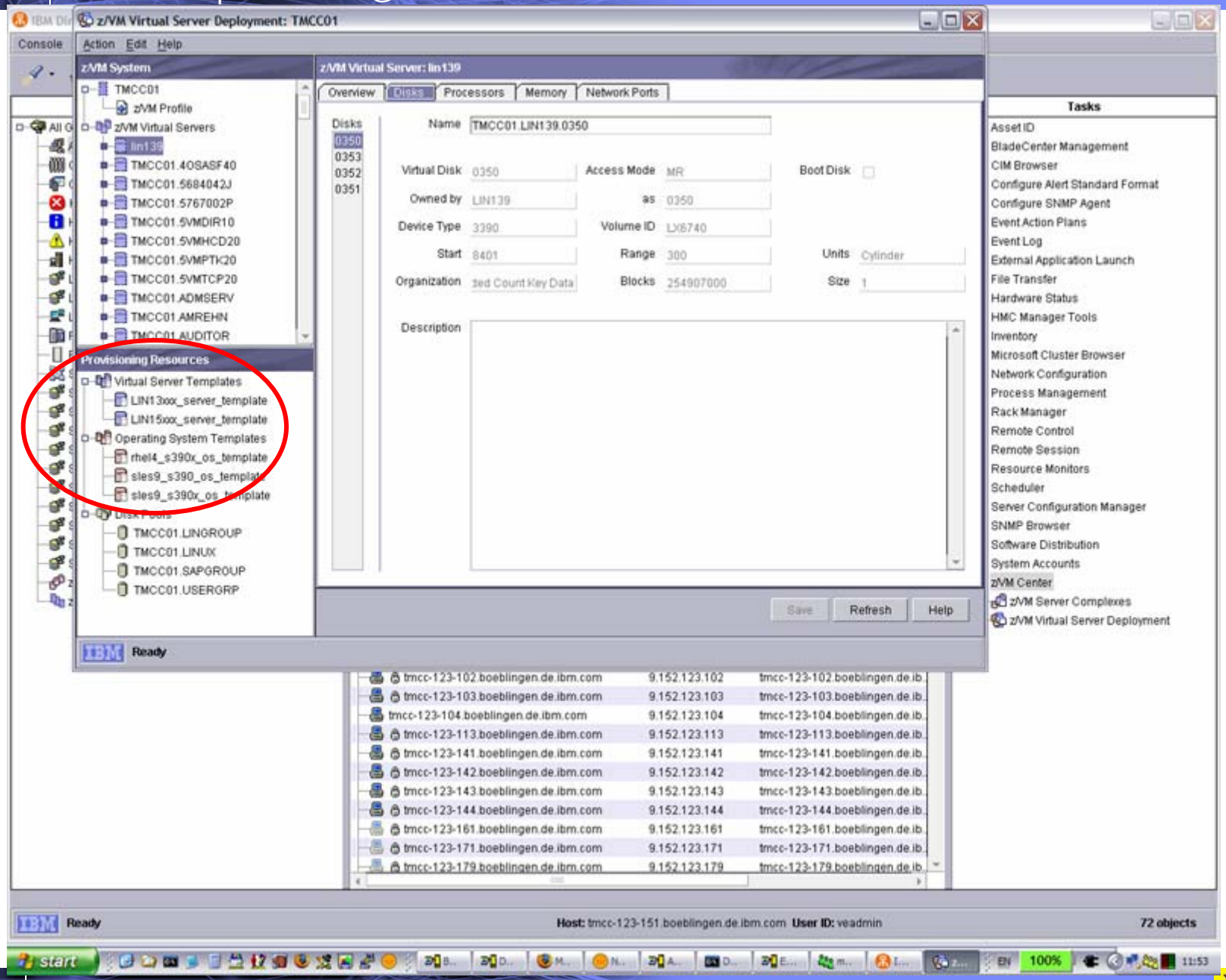
The best LAN is one with no wires

IBM Director V5.20 for Linux on System z

z/VM Center – Linux provisioning on z/VM

- **Virtual Server Deployment (VSD) – Easy deployment of Linux virtual servers on z/VM**
  - Creation of templates for virtual server and Linux operating system provisioning
  - Creation of virtual server from template
  - Applying Linux into a virtual server from template
- **Server Complexes – One-step provisioning of multiple Linux virtual servers**
  - Exploits Virtual Server Deployment task
  - Manages configuration settings of z/VM Linux virtual servers
  - Manages configuration consistency




z/VM Virtual Server Deployment: TMCC01
Console
Action Edit Help
z/VM System
TMCC01
z/VM Profile
z/VM Virtual Servers
lin139
TMCC01.40SASF40
TMCC01.5684042J
TMCC01.5767002P
TMCC01.5VMDIR10
TMCC01.5VMHCD20
TMCC01.5VMPTK20
TMCC01.5VMTCP20
TMCC01.ADMSERV
TMCC01.AMREHN
TMCC01.AUDITOR
Provisioning Resources
Virtual Server Templates
LIN13xxx_server_template
LIN15xxx_server_template
Operating System Templates
rhel4_s390x_os_template
sles9_s390_os_template
sles9_s390x_os_template
TMCC01.LINGROUP
TMCC01.LINUX
TMCC01.SAPGROUP
TMCC01.USERGRP
z/VM Virtual Server: lin139
Overview
Disks
Processors
Memory
Network Ports
Disks
0350
0353
0352
0351
Name TMCC01.LIN139.0350
Virtual Disk 0350
Access Mode MR
Boot Disk
Owned by LIN139
as 0350
Device Type 3390
Volume ID LX6740
Start 8401
Range 300
Units Cylinder
Organization 3ed Count Key Data
Blocks 254907000
Size 1
Description
Save
Refresh
Help
Ready
Tasks
Asset ID
BladeCenter Management
CIM Browser
Configure Alert Standard Format
Configure SNMP Agent
Event Action Plans
Event Log
External Application Launch
File Transfer
Hardware Status
HMC Manager Tools
Inventory
Microsoft Cluster Browser
Network Configuration
Process Management
Rack Manager
Remote Control
Remote Session
Resource Monitors
Scheduler
Server Configuration Manager
SNMP Browser
Software Distribution
System Accounts
zVM Center
z/VM Server Complexes
z/VM Virtual Server Deployment
tmcc-123-102.boeblingen.de.ibm.com 9.152.123.102
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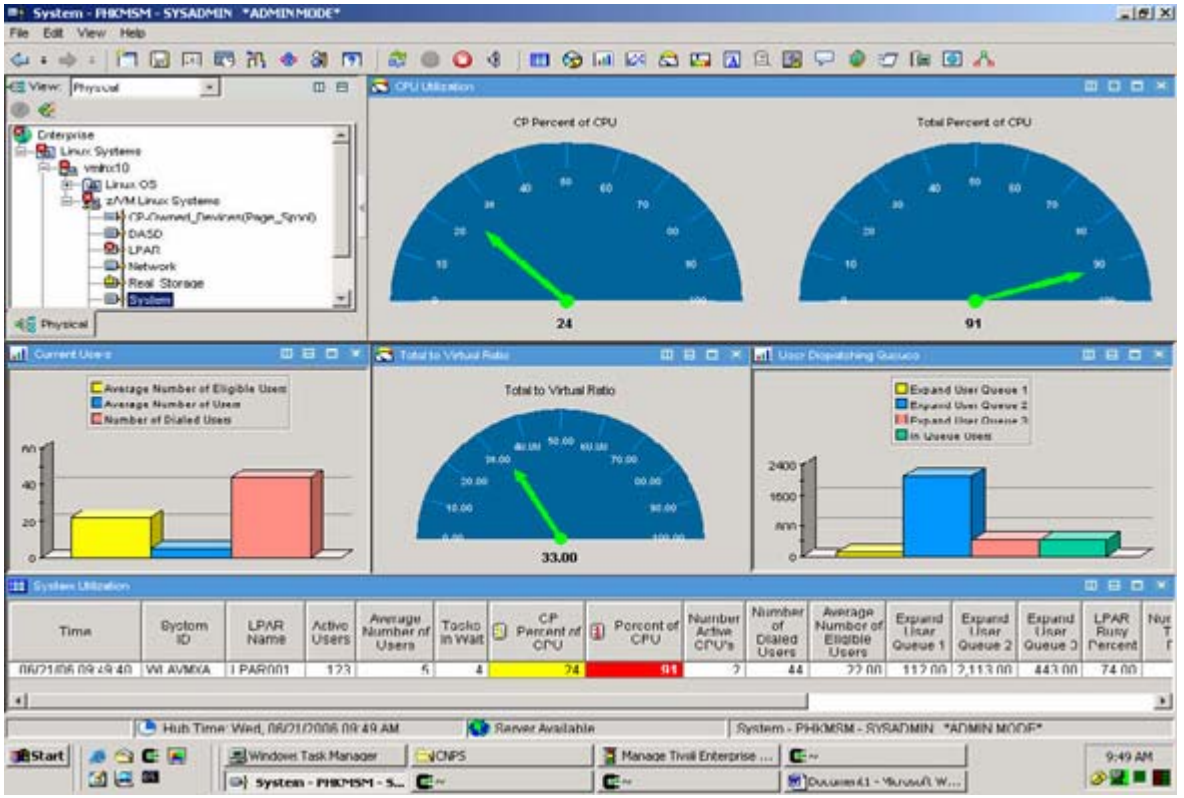
tmcc-123-171.boeblingen.de.ibm.com 9.152.123.171
tmcc-123-179.boeblingen.de.ibm.com 9.152.123.179
Ready
Host: tmcc-123-151.boeblingen.de.ibm.com User ID: veadmin
72 objects
start
100%
11:53

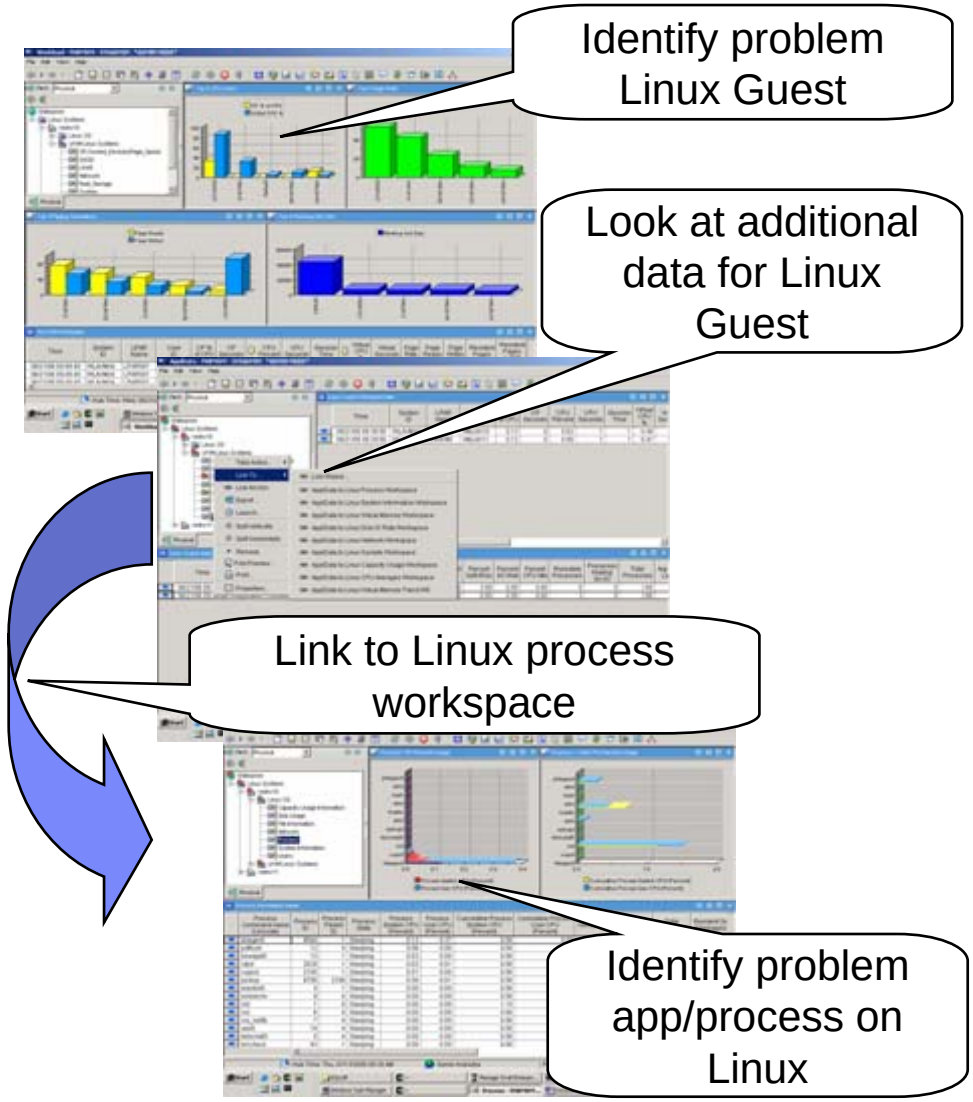
Tivoli OMEGAMON XE on z/VM and Linux

- **Single product offering for Linux on System z and z/VM**
- **Integrated OMEGAMON XE operations console for z/VM**
- **Platform support**
  - z/VM 5.2, Novell SLES 9 initially
  - Others as function is available



Tivoli OMEGAMON XE on z/VM and Linux

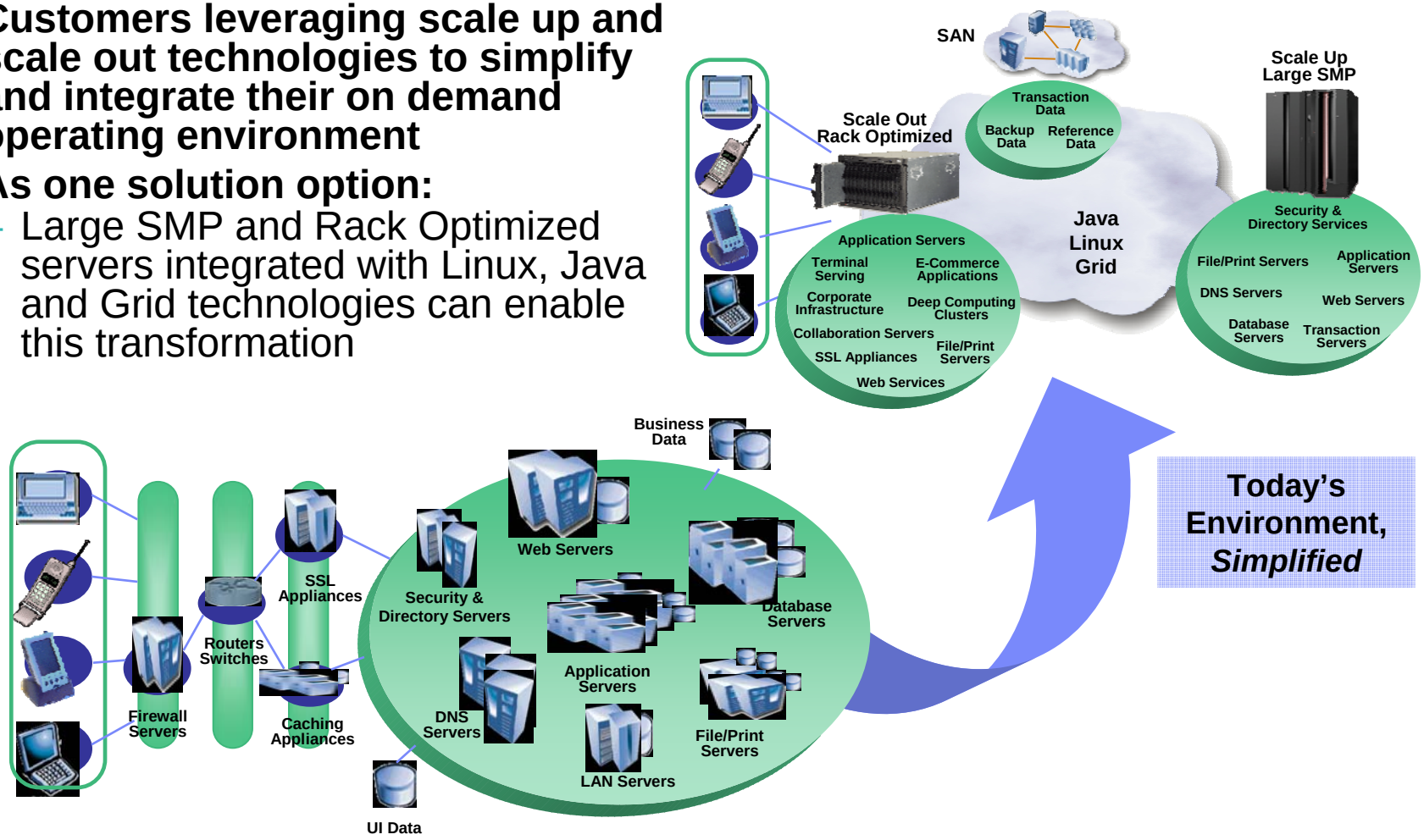
- **Problem**
  - Uneven Linux Guest CPU consumption
- **Solution**
  - Use Linux Guest Workload workspace to identify problem Linux guest
  - Link to Linux workload/process workspace to identify problem app/process
  - Notify application owner of application performance problem
- **Potential Benefits**
  - Quicker identification of base problem
  - Can manage z/VM and Linux from a single point of control



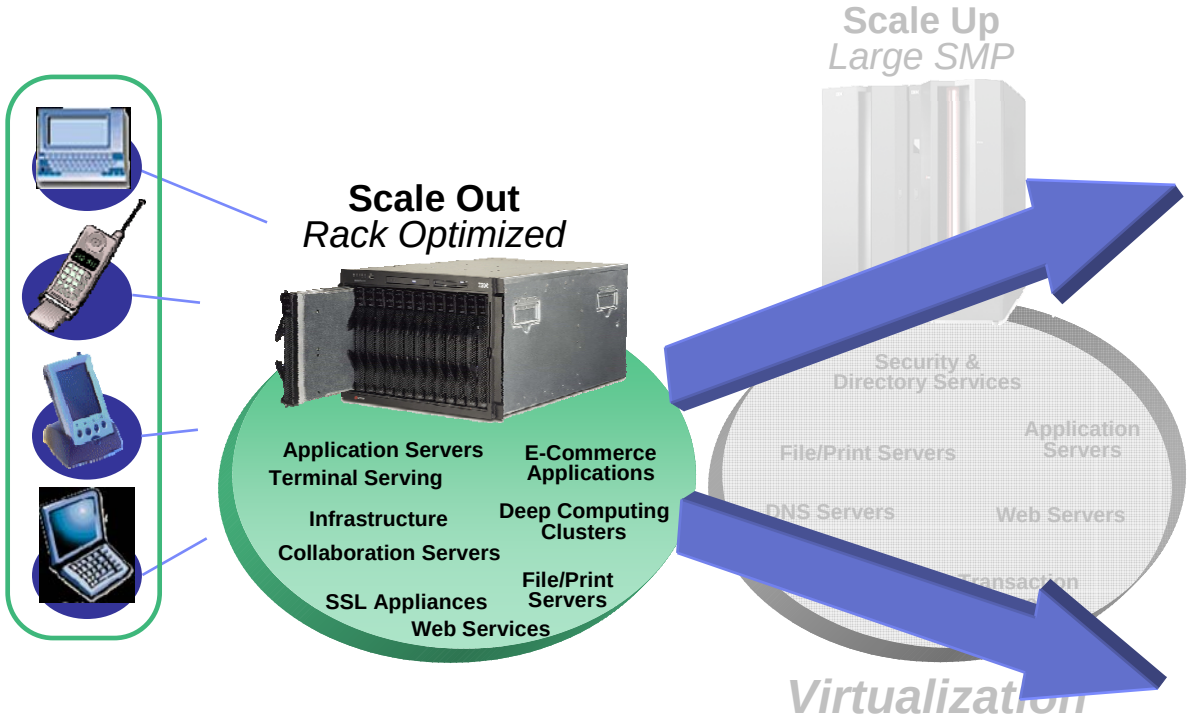
Linux on System z deployment criteria

Infrastructure simplification

- **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

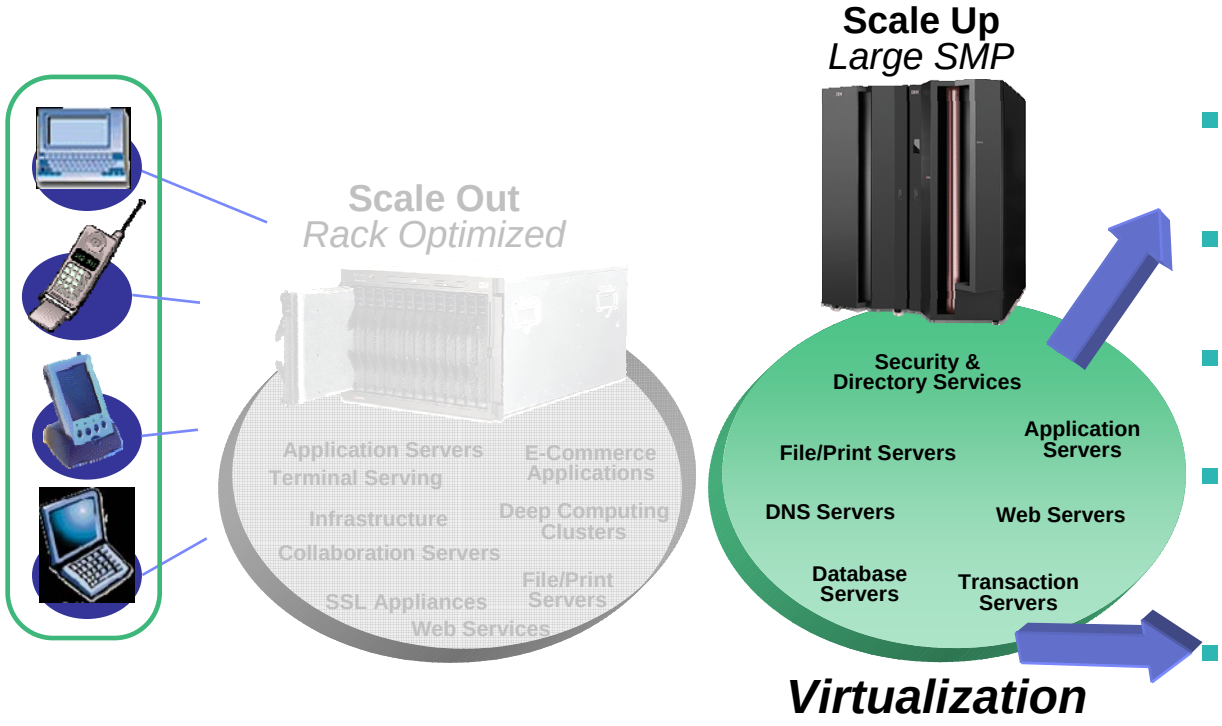


Ideal blade implementations



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

Ideal mainframe 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 on System z – z/OS or Linux?

Technical Considerations

Linux → **z/OS**

Quality of Service

Linux ← **z/OS**

Speed of deployment

Linux ← **z/OS**

Degree of portability

Other Considerations

- **Application availability**
- **Workload Management function and granularity**
- **File sharing across a Sysplex**
- **Manageability and scaling characteristics**
- **Availability of skill**

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"**

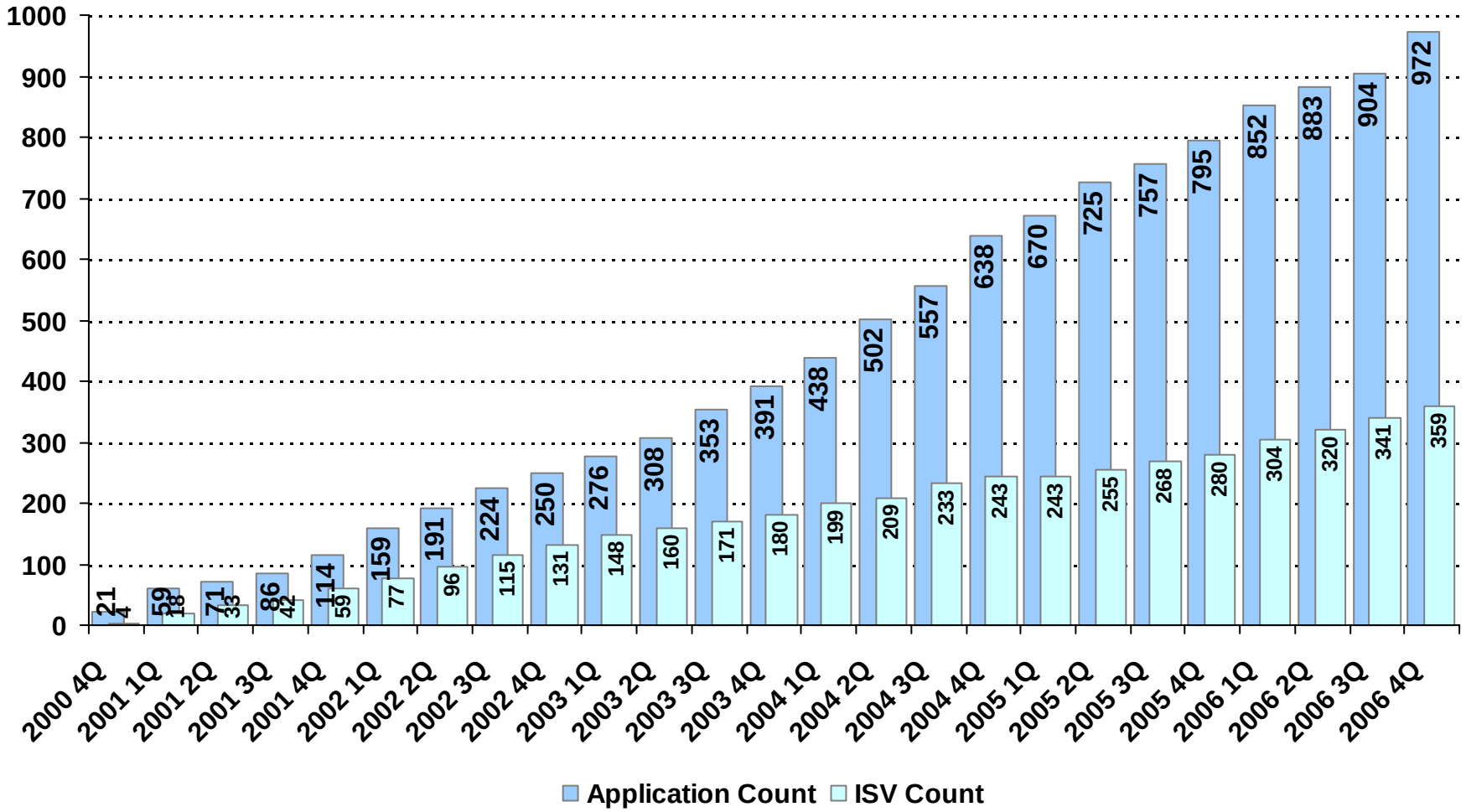
Compute Intensity

Other Considerations

- **Application availability**
  - Certification of solution on hardware/software platform
- **Workload Management**
- **Manageability and scaling characteristics**
  - Especially DB2 on z/OS
  - Proximity of data to application
  - The best network is an internal network!

Linux on System z ISV status

ibm.com/systems/z/solutions/isv/linuxproduct.html



Recent Linux on System z ISV solutions

AcademicedgeOnline	AcademicEdge – Open Source Java/JEE Solution for Colleges/Universities
Acelet	SuperDashboard, SuperLogging ,SuperMessaging , SuperPeekPoke, SuperScheduler,SuperTracer,SuperWatchdog, SuperWebservice
Adobe Systems	Flex Data Services
Alaric Systems	Authentic
Beta Systems	Beta Web Enabler
Borland	Visibroker 7.0
Clear C2	C2 CRM Relationship Management, C2 CRM Sales Management, C2 CRM Customer Service, C2 CRM Marketing Management, C2 CRM Content Management, C2 CRM Project Management
HiTSoftware	Allora
Interwoven	OpenDeploy
NRG Global	TaskWatch, SNMPwatch, SystemWatch , AppsWatch , BizWatch, LogWatch
Seagull Software	LegaSuite Workflow Version 5, LegaSuite Integration Version 5
Software AG	Adabas V6 for Open Systems, Applin V5

Workload share on utilized IFLs

Primary application

60%	**Application serving for "legacy" systems** e.g. WebSphere, SAP, CICS TG, DB2 Connect
30%	**Data serving** e.g. Oracle DB
5%	**Workplace serving** e.g. Domino, Scalix, other e-mail
5%	**Infrastructure serving** e.g. Apache, Samba, NFS, etc.
<1%	**Linux application development/deployment**

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

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

Consolidating Oracle/DB to Linux on System z

Linux and Oracle

- **Linux will pass Sun Solaris as the leading Oracle deployment platforms according to a groundbreaking study**
  - This survey of more than 800 enterprises using Oracle database technology revealed that while 49 percent of the respondents currently run Oracle on a Solaris platform, that number should slip to 43 percent next year
  - At the same time, 39 percent of the respondents currently run Oracle on Linux, a figure that should climb to 44 percent by next year, making Linux the top Oracle deployment platform

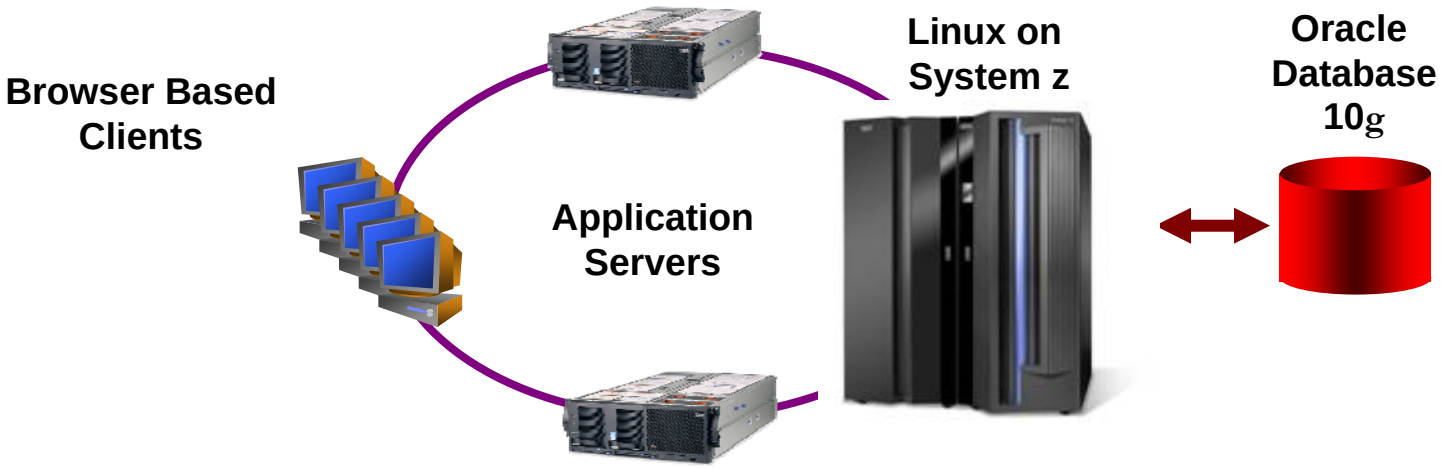
March 2, 2006 – Full report located at http://www.ioug.org/Research.pdf

Oracle products available for Linux on System z

- **The Technology Stack**
  - Oracle9i Release 2 Enterprise Edition
  - Oracle Database 10g Release 1 EE
  - Oracle Database 10g Release 2 EE
  - Oracle Application Server AS 10g
    - AS 10g 10.1.2 Base
    - AS 10g 10.1.3 (J2EE)
    - AS 10g 10.1.4 (Identity Manager)
  - Oracle Clustered File System V2 (OCFS2)
    - http://oss.oracle.com/projects/ocfs2/
- **Linux Distributions used for Oracle in Linux for System z**
  - Novell SLES8/9 and Red Hat RHEL4
    - Oracle9i is SLES8 and SLES9 only
  - Novell and Red Hat will continue to be the distributions for Oracle certifications on Linux on System z

Oracle applications available for Linux on System z

- **Oracle Applications**
  - PeopleSoft Enterprise 8.9
  - Siebel CRM 7.3
  - Oracle E-Business Suite 11i (11.5.10.2)
- **All the applications are *split configuration* architectures**
  - Only Oracle Database 10gR2 certified for above applications with Linux on System z
  - The middle tier, regardless of application server, must be implemented on a platform other than System z



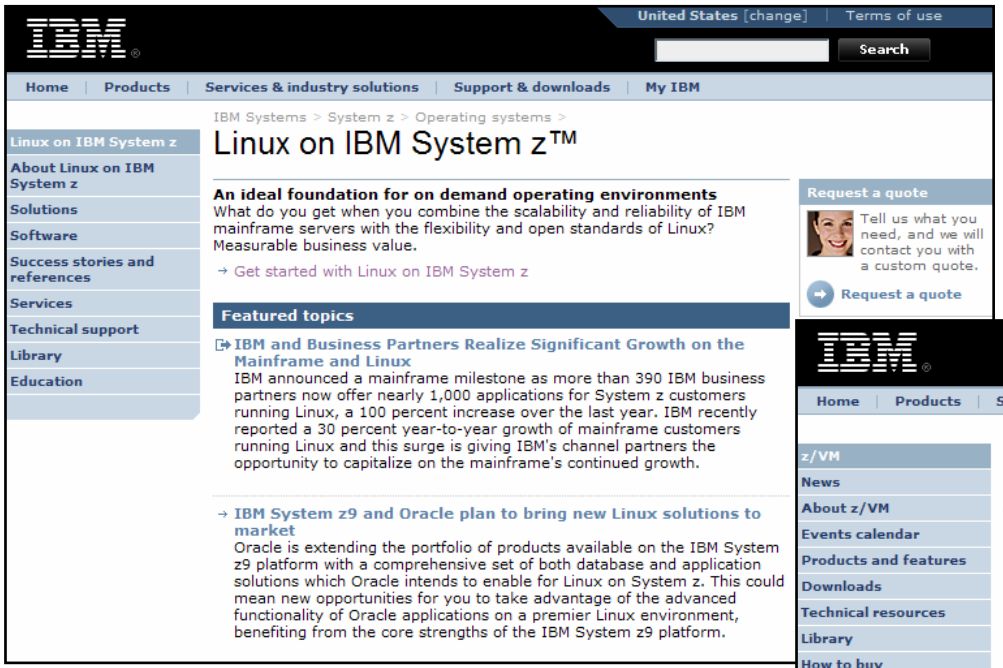
Additional information sources

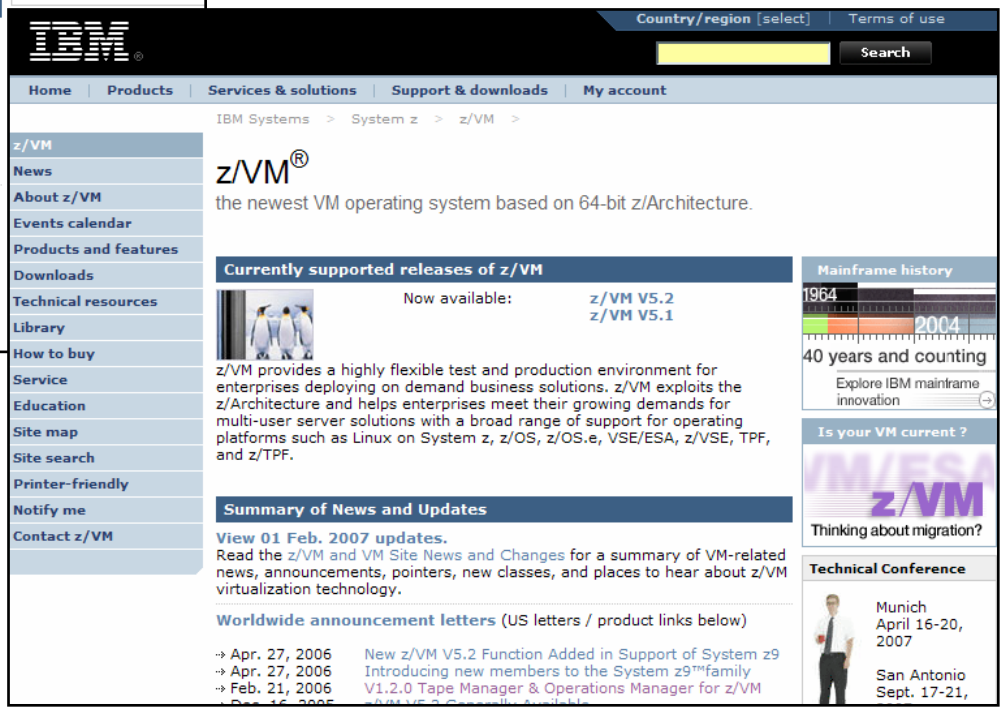
- **SG24-7191 Experiences with Oracle 10gR2 Solutions on Linux for IBM System z**
  - **ibm.com**/redbooks
- **LGT Group reference**
  - ibm.com/software/success/cssdb.nsf/CS/STRD-6QBLH3
- **Idaho Power reference**
  - novell.com/success/idaho_power.html?sourceidint=ic_nb100506_idaho
- **Special Interest Group of Oracle users on the mainframe (z/OS and Linux)**
  - www.zseriesoraclesig.org
  - The 2007 conference will be held April 15-18 at the Hilton Clearwater Beach Resort in Clearwater, Florida

Additional information about Linux on System z

Linux on System z and z/VM Web sites

ibm.com/systems/z/linux *ibm.com/vm*





Internet list server discussions

- **IBMVM discusses z/VM**
  - To subscribe, send a note to listserv@listserv.uark.edu. In the body of the note, write only the following line:
    - **SUBSCRIBE IBMVM** *firstname lastname*
  - View and search the current list and archives:
    - http://listserv.uark.edu/archives/ibmvm.html
- **LINUX-390 discusses Linux on System z**
  - To subscribe, send a note to listserv@vm.marist.edu. In the body of the note, write only the following line:
    - **SUBSCRIBE LINUX-390** *firstname lastname*
  - View and search the current list and archives:
    - http://www.marist.edu/htbin/wlvindex?linux-390

Mark Post's Linux for Big Iron site

linuxvm.org

Last updated on:
Saturday February 3, 2007

Software

- Linux/390 Distributions
- Linux/390 Patches
- Hercules - An S/390 Hardware Emulator

Linux for S/390 Linux for Big Iron

Linux for S/390 and zSeries, also known as Linux/390, is the native port of Linux to the S/390 and zSeries hardware platforms. It runs on the bare hardware, in an LPAR and as a VM, or z/VM guest.

LinuxVM.org is the official home of the Linux/390 project. The purpose of the project is to provide a central source of Linux/390 information and software, and to explore the possibilities of Linux and CP integration or interoperation.

The list of Linux/390 Redbooks was getting a little too unweildy to remain on the front page, so it has been moved to its own page.

01/26/2007 - A new Linux Kernel mailing list has been set up at vger.kernel.org for anyone that is interested in following or participating in mainframe Linux development. The traffic will consist mostly of technical discussions about kernel development for the mainframe platform. You can subscribe at the link below.
http://vger.kernel.org/vger-lists.html#linux-s390
http://www2.marist.edu/htbin/wlvtype?LINUX-VM.64285

Additional web sites

- **z/VM resources for Linux on IBM System z**
  - **ibm.com**/vm/linux
- **Wikipedia**
  - wikipedia.org/wiki/Linux_on_zSeries
- **General z/VM tuning tips**
  - **ibm.com**/vm/perf/tips
- **Information on open source patches**
  - **ibm.com**/developerworks/linux/linux390
- **Hints and tips for selecting and tuning I/O options**
  - **ibm.com**/developerworks/linux/linux390/perf
- **Linux distributions for System z**
  - Novell SUSE Linux Enterprise at novell.com/products/server/
  - Red Hat Enterprise Linux at redhat.com/rhel/details/servers/

Summary

What next?

- **Familiarize yourself with Linux and IBM System z**
- **View Linux as a valid alternative for IT systems**
- **Incorporate open source software development into IT strategies**
- **Look at Linux on System z to see how it can lower costs, increase reliability and security, and improve service**

Thank you

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