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 …

### 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 workloads**
  - 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

- **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

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

- **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

System z
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
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?

<table>
<thead>
<tr>
<th>Technical Considerations</th>
<th>Other Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux → z/OS</td>
<td>Application availability</td>
</tr>
<tr>
<td>Quality of Service</td>
<td>Workload Management function and granularity</td>
</tr>
<tr>
<td>Linux ← z/OS</td>
<td>File sharing across a Sysplex</td>
</tr>
<tr>
<td>Speed of deployment</td>
<td>Manageability and scaling characteristics</td>
</tr>
<tr>
<td>Linux ← z/OS</td>
<td>Availability of skill</td>
</tr>
<tr>
<td>Degree of portability</td>
<td></td>
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## Where to deploy – System z or “distributed”

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<th>Technical Considerations</th>
<th>Other Considerations</th>
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<tr>
<td>System z ← “distributed”</td>
<td><strong>Application availability</strong></td>
</tr>
<tr>
<td>Quality of Service</td>
<td>– Certification of solution on hardware/software platform</td>
</tr>
<tr>
<td>System z ← “distributed”</td>
<td><strong>Workload Management</strong></td>
</tr>
<tr>
<td>Speed of deployment Instances 2 - n</td>
<td><strong>Manageability and scaling characteristics</strong></td>
</tr>
<tr>
<td>System z ← “distributed”</td>
<td>– Especially DB2 on z/OS</td>
</tr>
<tr>
<td>Data Intensity</td>
<td>– Proximity of data to application</td>
</tr>
<tr>
<td>System z ← “distributed”</td>
<td>– The best network is an internal network!</td>
</tr>
<tr>
<td>Compute Intensity</td>
<td></td>
</tr>
</tbody>
</table>

Where to deploy – System z or “distributed”
Linux on System z ISV status

ibm.com/systems/z/solutions/isv/linuxproduct.html
## Recent Linux on System z ISV solutions

<table>
<thead>
<tr>
<th>AcademicedgeOnline</th>
<th>AcademicEdge – Open Source Java/JEE Solution for Colleges/Universities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adobe Systems</td>
<td>Flex Data Services</td>
</tr>
<tr>
<td>Alaric Systems</td>
<td>Authentic</td>
</tr>
<tr>
<td>Beta Systems</td>
<td>Beta Web Enabler</td>
</tr>
<tr>
<td>Borland</td>
<td>Visibroker 7.0</td>
</tr>
<tr>
<td>HiTSoftware</td>
<td>Allora</td>
</tr>
<tr>
<td>Interwoven</td>
<td>OpenDeploy</td>
</tr>
<tr>
<td>NRG Global</td>
<td>TaskWatch, SNMPwatch, SystemWatch, AppsWatch, BizWatch, LogWatch</td>
</tr>
<tr>
<td>Seagull Software</td>
<td>LegaSuite Workflow Version 5, LegaSuite Integration Version 5</td>
</tr>
<tr>
<td>Software AG</td>
<td>Adabas V6 for Open Systems, Applin V5</td>
</tr>
</tbody>
</table>
### Workload share on utilized IFLs

*Primary application*

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Application Type</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>60%</td>
<td>Application serving for “legacy” systems</td>
<td>e.g. WebSphere, SAP, CICS TG, DB2 Connect</td>
</tr>
<tr>
<td>30%</td>
<td>Data serving</td>
<td>e.g. Oracle DB</td>
</tr>
<tr>
<td>5%</td>
<td>Workplace serving</td>
<td>e.g. Domino, Scalix, other e-mail</td>
</tr>
<tr>
<td>5%</td>
<td>Infrastructure serving</td>
<td>e.g. Apache, Samba, NFS, etc.</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>Linux application development/deployment</td>
<td></td>
</tr>
</tbody>
</table>

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

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)

- **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

An ideal foundation for on demand operating environments
What do you get when you combine the scalability and reliability of IBM mainframe servers with the flexibility and open standards of Linux? Measurable business value.
→ Get started with Linux on IBM System z

IBM System z and Oracle plan to bring new Linux solutions to market
Oracle is extending the portfolio of products available on the IBM System z9 platform with a comprehensive set of both database and application solutions which Oracle intends to enable for Linux on System z. This could mean new opportunities for you to take advantage of the advanced functionality of Oracle applications on a premier Linux environment, benefiting from the core strengths of the IBM System z9 platform.
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:
Linux and Open Source @ IBM

Mark Post’s Linux for Big Iron site

linuxvm.org

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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 unwieldy to remain on the front page, so it has been moved to its own page.

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Software

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

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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/wytype2?LINUX-VM.64285
Additional web sites

- **z/VM resources for Linux on IBM System z**
  - [ibm.com/vm/linux](http://ibm.com/vm/linux)

- **Wikipedia**
  - [wikipedia.org/wiki/Linux_on_zSeries](http://wikipedia.org/wiki/Linux_on_zSeries)

- **General z/VM tuning tips**
  - [ibm.com/vm/perf/tips](http://ibm.com/vm/perf/tips)

- **Information on open source patches**
  - [ibm.com/developerworks/linux/linux390](http://ibm.com/developerworks/linux/linux390)

- **Hints and tips for selecting and tuning I/O options**

- **Linux distributions for System z**
  - Novell SUSE Linux Enterprise at [novell.com/products/server/](http://novell.com/products/server/)
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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ibm.com/vm/devpages/jelliott
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