Virtualizing Oracle Servers with Linux on IBM System z™

Barry Perkins
Vice President: Global Sales support – Mainframe & Modernization, Oracle Corporation

Kathryn Arrell
IBM Oracle International Competency Center

Susan Adamovich
IBM STG - Oracle System z Business Development

Gaylan Braselton
IBM Sales Solution Consultant for Oracle

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Agenda

- Oracle Overview

- Oracle and IBM on Linux on System z today
  - Deploying Oracle in a virtual environment

- High availability Options for deploying Oracle on Linux on IBM System z

- Sizing, Scalability and Performance
  - Customer Successes
  - More information
Oracle Corporation

US $31B Ecosystem growing at 11% per year

- World’s largest enterprise software vendor
  - 49% of the DB Market
  - 79% of the Linux DB Market
- $22 Billion revenue, FY08
- 275,000 global customers
- 235,000 database customers
- 53,500 middleware customers
- 37,500 application customers
- 74,000 employees
- Operating in 145 Countries

1 Source: IBM STG
2 Source: Gartner 2007 Market Study

Our Mission

Making our software a source of continual competitive advantage for our customers.

Get Better Results
Oracle’s Product Families
Complete, Open and Integrated…

**Database**
- Database
- Real Application Clusters
- Partitioning
- OLAP / Data Mining
- Spatial
- Times Ten
- Database Vault
- Secure Enterprise Search
- ...

**Fusion Middleware**
- Java Application Server
- Development Tools
- Business Process Mgmt
- Identity Management
- Data Integration
- Content Management
- Business Intelligence
- User Interaction
- ...

**Applications**
- E-Business Suite
- PeopleSoft Enterprise
- Siebel CRM
- JD Edwards
- Oracle Retail
- i-flex Financial Services
- Communications
- Utilities
- ...

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**Acquisition Of Best-in-Class Companies**
- $30 Billion in Targeted Acquisitions

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- Cofax
- oblix
- PeopleSoft
- Retek
- 360Commerce
- i-flex
- InnoDB
- Net Col
- OCTETSTRING
- ProfitLogic
- Siebel
- THOR
- PiiPL
- Sunopsis
- TANGOSOL
- Amazon
- Fintura
- Interface Systems
- Moniforce
- Logical Apps
- Captivation
- Bharosin
- Annual
- NETCUBE
- Bridgewater

Note: Includes acquisitions of Covansys and Hexaware operations; acquisition of Mantas and Caster IP through majority-owned i-flex solutions company.
Oracle’s Leadership Position

- Database
- Supply Chain Management
- CRM
- Retail
- Communications
- Human Capital Management
- Financial Services
- Public Sector
- Professional Services
- Enterprise Performance Management

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Oracle and IBM: Continuous innovation
Sustained collaboration toward delivering joint solutions

Oracle and IBM have been working together to deliver joint solutions since 1983.

Virtualization on IBM mainframes has a history of software and hardware innovations dating back to the 1960s...and continuing today.

Oracle has been an innovator in enterprise applications, database, and middleware software for three decades.
Virtualization on IBM mainframes has a long history of software and hardware innovations.

IBM System z Virtualization
Continuous Innovation

Constant Evolution …
IBM System z & Oracle Together

Building Up new customer opportunities
With Oracle Grid on IBM System z
2008
Oracle solutions available on IBM System z for Linux

Data Solutions
- Oracle Database Enterprise Edition 10gR2 64-bit
- Oracle Database Standard Edition 10gR2 64-bit
- Oracle Warehouse Builder 10gR2 64-bit
- Oracle Business Intelligence EE (Split Tier) 10gR2 64-bit

Middleware Solutions
- Oracle Application Server 10g (10.1.3.1.0)
- Oracle Containers for J2EE (OC4J) 10g (10.1.2.0.2)
- Oracle Top Link 10g (10.1.3.1.0)
- Oracle AS Metadata Repository Creation Assistant 10g (10.1.2.0.3)

Management Solutions
- Oracle Clusterware (for Real Applications Clusters) 10gR2 64-bit
- Configuration Manager (OCM) 10.2.3.0.0

Integration Solutions
- Oracle Transparent Gateway for DRDA 10gR2 64-bit

Application Solutions
- Oracle Peeplesoft Enterprise* (Split Tier) 8.49
- Oracle Siebel* (Split Tier) 8
- Oracle eBusiness Suite (Split Tier) 11.12

Industry Solutions
- i-Flex* FlexCube

*also available for zOS or planned for zOS

Oracle and IBM System z Linux buzz

Strong interest in System z and Linux
- 64% of large companies and 46% of midsized companies use/plan to use in next 12 months
- 25% of all System z customers utilize zLinux today
- 50% of the top 100 System z customers utilize zLinux today
- 52% expect to use virtualization capabilities in the next two years
- 1,300 Linux ISV solutions enabled

“.. Linux-enabled Oracle workloads on the IFL strengthens the focus and commitment of both IBM and Oracle on enterprise Linux/IBM System z...” – IDC

“FLEXCUBE solution for core banking on IBM system z mainframes runs on Linux with Oracle infrastructure...”

- CXOtoday.com
The data center: What it is and what it can be. Imagine an IT environment where…

- Any server can run any application or database
- All applications enjoy high availability
- All servers can access all data
- Servers assigned to applications and databases as needed
- Provisioning new environments takes minutes
- Average utilization exceeds 90 percent
- More capacity can be delivered on demand

Problem: Today’s IT infrastructure is weak

- **Inflexibility**: Siloed infrastructures mean inflexibility in the face of continuous business change.
- **Complexity**: Managing heterogeneous environments is increasingly complex (HW, OS, SW, versions, application stacks…).
- **Productivity**: Manual or semi-automated processes tend to be error-prone.
- **Alignment**: Business and IT are not directly linked, inhibiting effective execution.
The negative impact of technology sprawl

- **Information Technology**
  - Complexity: Maintenance, patches, upgrades, skills
  - Efficiency: Can’t optimize resources and administration costs
  - Availability: Increased downtime (scheduled or unscheduled)
  - Security: Complex security for applications and data
  - Speed: Difficulty responding to business mandate

- **Business**
  - Cost: Growing management and environmental costs
  - Quality: Fragmented/redundant/inaccurate data
  - Efficiency: Lack of business process standards
  - Speed: Slows planning/implementing processes
  - Productivity: Difficult to find and access data
  - Planning: Difficult to forecast accurately

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Virtualization is the key

Virtualization helps meet customers’ business objectives

- **Increased** security
- **Simplified** management
- **Improved** business agility
- **Improved** business continuity
- **Higher** economic efficiency

“System infrastructure software is being impacted by game-changing forces, such as new use cases for virtualization…. Winners will be those who are best able to harness these game-changing technologies to lower operational costs or increase corporate agility.”

— Tim Grieser, Vice President, IDC
Oracle Grid Computing

Fusion Middleware

Real Application Clusters

Automatic Storage Management

Grid Control

Oracle Grid-Based Virtualization

Storage
- Provides a single pool of clustered storage to increase utilization and agility
- Simplifies and automates database storage management

Database and Middleware
- Dynamic clusters grow/shrink based on needs with high availability
- Server provisioning on demand with unlimited scaling

Systems Management
- Top-down applications management in a virtualized environment
- Centralized end-to-end policy-driven management
- Discover, monitor & manage virtual resources
- Dynamically grow & shrink resources
IBM System z Server Virtualization – A Proven Platform

Virtualize everything
- Up to 100% utilization rates
- CPU, memory, network, I/O, cryptography...

Scale massively on a single mainframe
- The Linux-on-z/VM record is 97,943 virtual machines
- Each virtual machine on z/VM can access up to 24,576 devices
- 54x CPU scalability per mainframe, 32x CPU scalability per z/VM LPAR
- z/VM is designed to support more than 1 TB of active virtual memory

Security
- Highest security classification for general purpose servers in the world
- System z LPAR technology is Evaluation Assurance Level 5 certified

System z virtualization is fully supported by Oracle
- Database, Real Application Clusters, Fusion middleware

Global leadership
- 71% of Global Fortune 500 are System z customers
- Nine of top 10 health and life insurance providers, top 25 banks in the world
- Ranked #1 in Gartner and IDC Server Tracker Results Q207
Virtualized data center summary

Agile, scalable, secure and automated
Full data center virtualization strategy
- Applications
- Data
- Servers
- Storage

Combines
- Proven Oracle Grid capabilities
- Proven System z server virtualization

System z virtualization extends Oracle Grid
- Maximizes consolidation
- Saves on power, cooling and space
- Easier maintenance and management
- Virtualize within and across clustered servers
- Enhance resource provisioning and workload balancing

Enterprise Manager

Virtualized Applications

System z
System p
Application Servers
Warehouse Application Application Application Split Tier

Mid-Tier Clusters
Real Application Clusters
Automatic Storage Management
Oracle & IBM Add System z to the Oracle Grid

“Our customers are rapidly adopting server virtualization and grid computing as a way to save space, energy and other costs. Oracle sees a growing number who are incorporating Oracle software on System z Linux virtual servers as part of that strategy,” says Robert Shimp, Oracle vice president, Global Technology Business Unit. “With this announcement the IBM System z10 becomes an even more attractive platform for deploying Oracle Database, Oracle Fusion Middleware and the Oracle E-Business Suite.”

Joint Solution Center

Oracle solutions with System z Linux

- Oracle and IBM System z experts
- Assess your infrastructure
- Design and test your solution
- Test complex configurations on robust, customized proof-of-concept hardware, software and middleware platforms
- Benchmark testing of Oracle infrastructure configurations
- System z, System x™ and System p™ resources
Solution: “Virtualize the Data Center”
With Oracle & Linux on System z

- **Standardize**
  - Data, application & OS platforms

- **Virtualize**
  - Data, applications, servers & storage

- **Consolidate**
  - Fragmented data, application and server platforms

- **Automate**
  - Systems management

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Oracle Maximum Availability Architecture

- Oracle's best practices blueprint based on proven Oracle high availability technologies and recommendations
  - Technology + Configuration + Operational Practices
  - Applications, Enterprise Manager, Application Server, Collaboration Suite and Database
    - Constantly validated and enhanced as new products and features become available
    - Focused on reducing unplanned and planned downtime

- Papers published to the Oracle Technology Network (OTN)

Oracle Maximum Availability Architecture Components

Oracle Clusterware (CRS)
- RAC’s clusterware
- Multiple clusterware (Single Oracle DB instance protection & other uses)

Oracle Automatic Storage Management (ASM)
- Kernel integrated file system and volume manager

Oracle Real Application Clusters (RAC)
- Multiple instances of Oracle database kernel on separate nodes acting in unison
  - Each node can participate in node failure restart and workload resumption

Oracle Data Guard
- Services to create, maintain, manage and monitor remote standby databases

Oracle Flashback Database
- Oracle database point in time recovery without requiring initial database restore

Oracle Recovery Manager/Secure Backup
- Oracle database backup/recovery services

Oracle Enterprise Manager Grid Control
- Database & Application Server/Component monitoring, configuration, management, security
  - Historical statistical, event, alert repository
IBM High Availability System Components

IBM z/VM
System z Logical Partition (LPAR)
IBM System z Directory Maintenance (DirMaint)
IBM Integrated Facility for Linux (IFL)
IBM System z HiperSockets
IBM Storage Flash Copy
IBM System z Servers (Spare processors etc)
IBM Storage Area Network (SAN)
Linux Components
IBM Geographically Dispersed Parallel Systems (GDPS)

Use Oracle and IBM components for your high availability infrastructure

Oracle 10g Real Application Clusters (RAC) overview

- Two main objectives
  - Scalability and performance
  - High availability
- Easy to implement on z
Scenario 1

- In this example, an Oracle instance is installed on a single Linux server that runs under z/VM. The SPoFs for the application are:
  - System z (entire system as redundancy is built in)
  - LPAR
  - z/VM
  - Linux
  - Oracle DB and Application

Can use:
- ASM, CRS for single instance

Scenario 2

- In this example, the Oracle RAC nodes are installed on multiple Linux servers that run under z/VM. The SPoFs for the application are reduced to:
  - System z hardware
  - LPAR
  - z/VM
Scenario 3

- In this example the Oracle RAC nodes are installed on multiple Linux servers that run under multiple z/VM systems on multiple LPARs. The SPOFs for the application are reduced to:
  - System z hardware

**System z – A**

- z/VM LPAR 1 running Linux
  - Oracle RAC 11
  - Linux Guest 11
- Oracle RAC 21
  - Linux Guest 21

**z/VM LPAR 2 running Linux**

- Oracle RAC 12
  - Linux Guest 12
- Oracle RAC 22
  - Linux Guest 22

Scenario 4

- In this example, the Oracle RAC nodes are installed on multiple Linux servers that run under multiple z/VM systems on multiple LPARs on multiple System z servers. No SPOFs for the Oracle environment remain.

**System z – A**

- z/VM LPAR 1 running Linux
  - Oracle RAC 11
    - Linux Guest 11
  - Oracle RAC 21
    - Linux Guest 21

**System z – B**

- z/VM LPAR 2 running Linux
  - Oracle RAC 12
    - Linux Guest 12
  - Oracle RAC 22
    - Linux Guest 22

RAC, CRS

RAC, Data Guard
Scenario 5 - Disaster Recovery needed

- In this extension of Scenario 3, a backup site is considered. The Oracle RAC nodes are installed on multiple Linux servers that run under multiple z/VM systems on multiple LPARs on multiple System z servers. No SPoFs for the Oracle environment remain.

IBM GDPS Offering, Oracle Streams, Oracle Data Guard, DR Site (CBU)
High Availability

- Understand the true availability needs for the application
  - Plan and implement appropriately
  - What advantages does System z bring to those applications.
  - What advantages does Oracle MAA bring to those applications.
  - Combine the components to achieve your availability needs

- Oracle is continually enhancing its database server to provide better HA and DR implementations
- IBM System z has always been the HA and DR leading platform
- zVM and System z hardware continue to be enhanced to compliment Linux

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Sizing, Scalability, and Performance

- Oracle Database has been running on the mainframe for over 25 years, and on Linux for over 6 years.
- Continuous internal testing, and improvement has occurred over the last six years on Linux to:
  - Identify bottlenecks,
  - Ensure scalability
  - Document best practices
- Monitoring and tests with Oracle products has been completed at:
  - Oracle HQ (Stress, Destructive)
  - IBM Labs in Boeblingen, Montpellier, Gaithersburg, and China
- Linux and VM have evolved to minimize overhead and to improve (virtualization capabilities) throughput

Sizing, Scalability and Performance

- Key is to have a sizing methodology to predict CPU and memory resources when moving workloads to Linux on IBM System Z
  - Our sizing methodologies have been repeatedly confirmed in tests completed by IBM and Oracle
- Scaling can be achieved with
  - Scaling up with single instance under VM
  - Scaling up in an LPAR (no VM)
  - Scaling out with RAC in one LPAR, or on two LPARs or on two System zs
- Performance expectations will be met with the proper planning, sizing and database selection.
- Customer experiences have confirmed our expectations
Successful Customer Experiences

- High availability mission critical database
  - Customer A - In production for 4 years with no unplanned outages
- Large databases for OLTP
  - Customer B – Large 5 TB database on 50 IFLS
- Large databases for Data Warehouse
  - Customer C - 2 to 3 TB DW database
- Many small Databases with simplified infrastructure
  - Customer D – 300 Databases on 5 z9 IFLS
  - Customer E – 400 Virtual servers on 14 z9 IFLS
  - Customer F – 85 Virtual servers on 10 z9 IFLS
- Several customers running Oracle RAC for availability and scalability
  - Customer G – RAC with Websphere portal on 2 z9s
  - Customer H – 4 node RAC for 25TB DB for DW on z9

Sample of Customers Who Have Chosen IBM System z running Linux with Oracle Database

- FEDERAL POLICE (BRAZIL)
- TIVIT (BRAZIL)
- TELEMAR (BRAZIL)
- DGTIC (CANADA)
- UNIVERSITY OF MARYLAND (USA)
- LOT FINANCIAL SERVICES AG (LIECHTENSTEIN)
- ADAM MCKEOWN UNIVERSITY (POLAND)
- TELEMAR (BRAZIL)
- TVIT (BRAZIL)
- DOUX FRANGOSUL (BRAZIL)

Large Japanese Financial Customer
"IBM System z9 and Oracle Real Application Clusters... 1,000 transactions/sec."
Managing Director, Group IT Strategy
LinuxWorld Japan 2006
Sizing, Scalability and Performance Conclusions

- History has demonstrated that Linux on System z is an excellent platform for Oracle for infrastructure simplification
  - Oracle scales well both vertically and horizontally
  - Excellent availability characteristics
  - Scalability and performance should not be a concern
- Choose your application carefully
- Size the resources needed
- Implement a pilot project using actual workload

Information Sources

- [IBM and Oracle Virtualize the Data Center Executive Brief](http://www-03preview.ibm.com/solutions/businesssolutions/oracle/doc/content/landingdtw/3065120128.html)
- [IBM System z10 Enterprise Class (z10 EC) Reference Guide](http://www.redbooks.ibm.com)
- [Oracle, Linux and System z Redbooks – SG24-7573, SG24-7191, SG24-6462](http://www.oracle.com/ibm)
- [Oracle/IBM platform information](http://otn.oracle.com)
  - (Select "download code and documentation")
- [IBM technical documentation](http://www.vm.ibm.com/perf/index.html)
- [Linux Disk I/O Alternatives](http://www.ibm.com/developerworks/oas/linux/linux98/index.shtml)
- [Lot’s of information on open source and IBM products](http://www-124.ibm.com/developerworks/oas/linux98/index.shtml)
- [Hints and Tips for Selecting and Tuning I/O options](http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebsTechDocs)
- [Special Interest Group of Oracle users on the mainframe (z/OS and Linux)](http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebsTechDocs)
- [Linux Disk I/O Alternatives](http://www.vm.ibm.com/perf/reports/zvm/html/520lxd.html)
Questions