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

SHARE August 13, 2008
Session 9295

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**

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Oracle Corporation

US $31B Ecosystem growing at 11% per year [1]

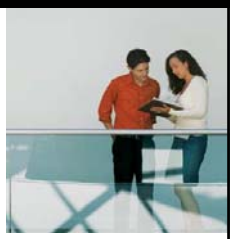
- World's largest enterprise software vendor
  - 49% of the DB Market [2]
  - 79% of the Linux DB Market [2]
- $22 Billion revenue, FY08
- 275,000 global customers
- 235,000 database customers
- 53,500 middleware customers
- 37,500 application customers
- 74,000 employees
- Operating in 145 Countries

ORACLE THIRTY YEARS 30

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

IBM ORACLE

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
- …

IBM ORACLE

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

Oracle FY 2005 — 4 Acquisitions: Collaxa, oblix, PeopleSoft, Retek

Oracle FY 2006 — 17 Acquisitions: 360Commerce, context media, G-Log, hotsip, i-flex, InnoDB, Net4Call, OctetString, ProfitLogic, Siebel, Sleepycat Software, TempoSoft, Thor Technologies, TimesTen, Triple Hop Technologies

Oracle FY 2007 — 14 Acquisitions: Hyperion, Demantra, agile, Lodestar, Mantas, MetaSolv Software, Portal, Sigma Dynamics, SPL, Stellent, Sunopsis, Tangosol, Castek, Interlace Systems (AppForge / Bridgestream)

Oracle FY 2008 — 8 Acquisitions: bea, Interlace Systems, Moniforce, LogicalApps, Captovation, Bharosa, Revenue Technologies, netsure, Bridgestream

Note: Includes acquisitions of Covansys and Hexaware operations; acquisition of Mantas and Castek 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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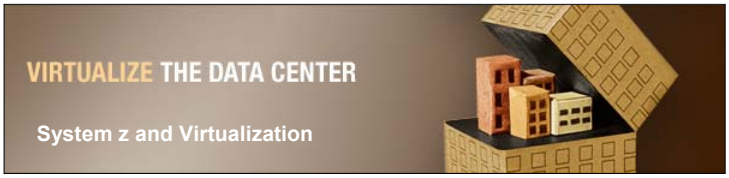

Oracle and IBM: Continuous innovation

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.

1980 2000 2005 2010

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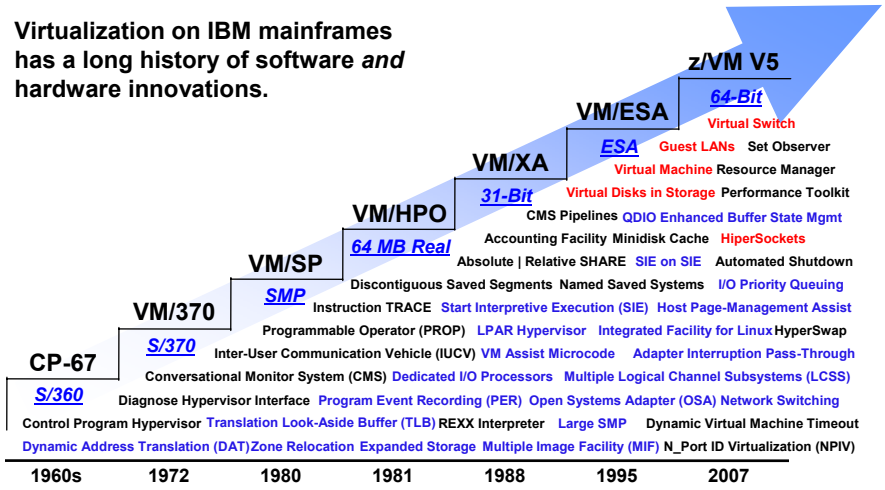
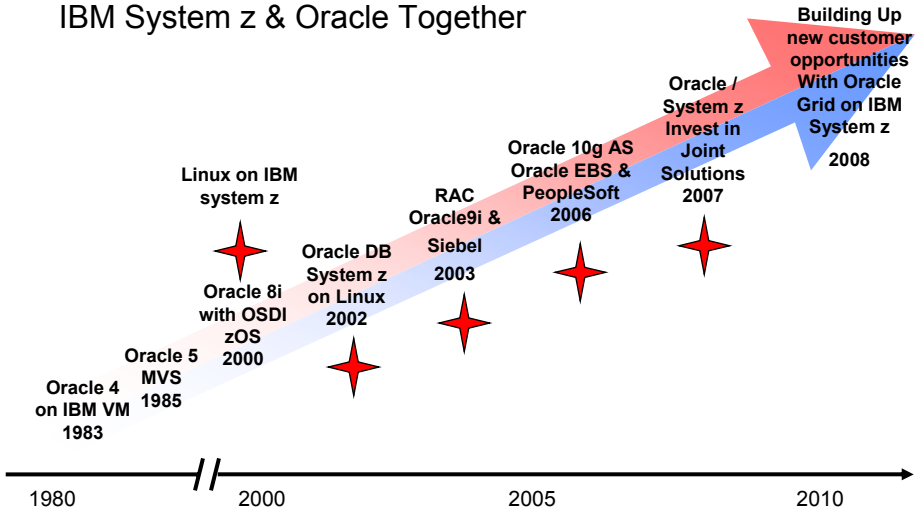
IBM System z Virtualization
Continuous Innovation

Virtualization on IBM mainframes has a long history of software *and* hardware innovations.

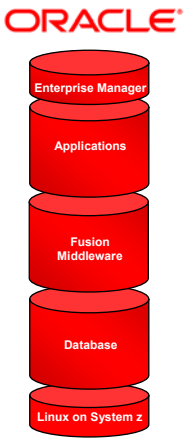


IBM ORACLE

Constant Evolution …
IBM System z & Oracle Together



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 Database Client	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)	10.2.6.0.0

Integration Solutions

Oracle Transparent Gateway for DRDA	10gR2 64-bit

Application Solutions

Oracle Peoplesoft 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

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

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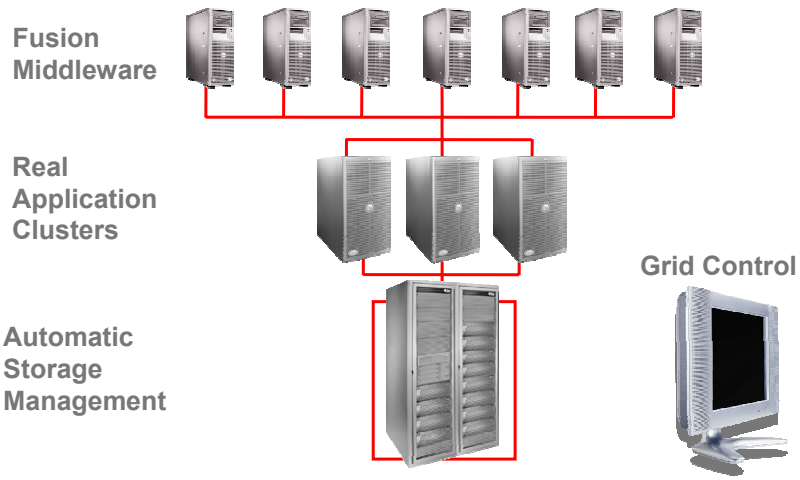
Oracle Grid Computing



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Oracle Grid-Based Virtualization

Storage

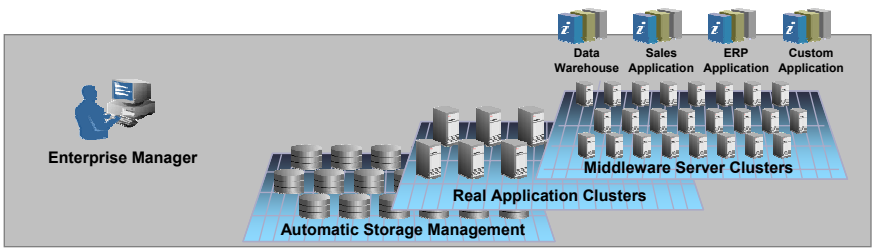
- Provides a single pool of clustered storage to increase utilization and agility
- Simplifies and automates database storage management

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



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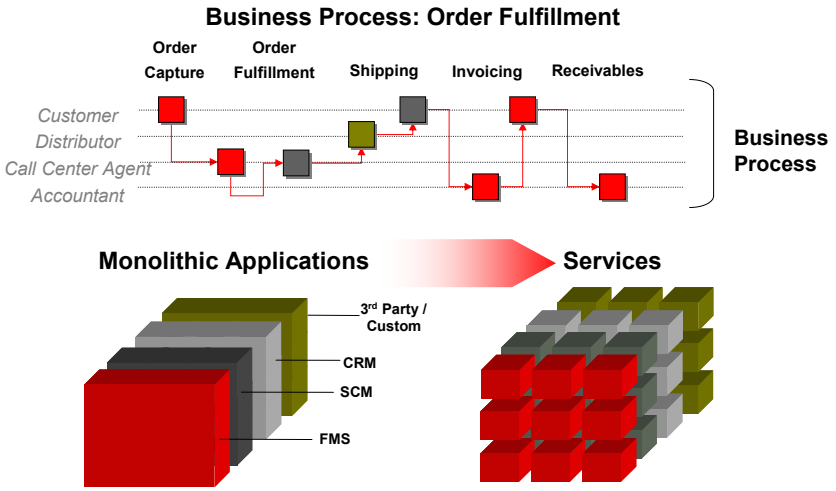
Oracle SOA-Based Virtualization



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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

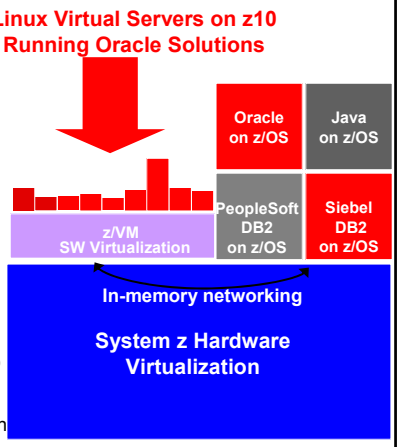
Global leadership
- 71% of Global Fortune 500 are System z customers
- Nine of top 10 health and life insurance providers, top 25 banks in the world
- Ranked #1 in Gartner and IDC Server Tracker Results Q207

z10 Supports Multiple Solutions Across The Enterprise

- Linux – Oracle Database, 3rd Party Applications, Java
- z/OS – Oracle Database, 3rd Applications, Java
- z/OS – Applications Unlimited on DB2
  - PeopleSoft and Siebel on DB2
- **z10 With z/VM Virtualization Provides Flexibility**
  - New Guests Can Be Added Quickly W/O Additional Capital Costs, Hardware Installation Delays
  - z/VM Can Create A New Virtual Image In 10 Seconds To Run A New Application

"Hipersockets" Provide "Internal" TCP/IP Networking

- In-memory LPAR-LPAR Communication (Logical Partition)
- Appears As Ordinary Network Interface
- Simplifies Network Configuration, Logistics, External Cablin



Virtualized data center summary

Agile, scaleable, secure and automated

Full data center virtualization strategy

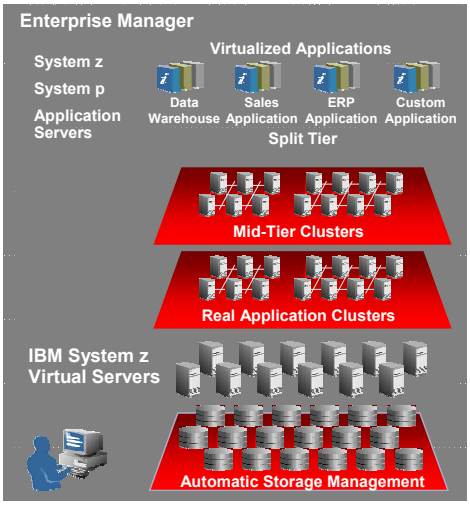
- Applications
- Data
- Servers
- Storage

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



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."

Data Center Virtualization with System z, zVM & Linux
Oracle Grid
Oracle Fusion Middleware

Oracle Applications with System z & Linux
Oracle E-Business Suite, Peoplesoft, Siebel and iFlex

High Availability with System z, zVM & Linux
Oracle Maximum Availability Architecture

Modernization with System z & Linux
Oracle Fusion SOA Services
Oracle Business Intelligence

Joint Solution Center

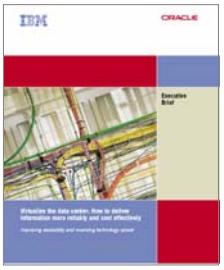
Oracle solutions with System z Linux

- 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

IBM ORACLE

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



Joint Executive Brief
Virtualize the Data Center

- http://www-03.ibm.com/solutions/businesssolutions/oracle/doc/content/resource/brochure/3127177128.html

IBM ORACLE

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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)**
  - http://www.oracle.com/technology/deploy/availability/htdocs/maa.htm

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

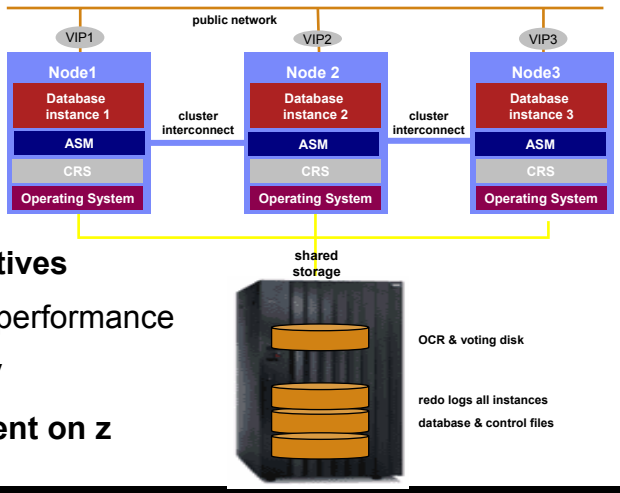
Oracle Enterprise Manager Grid Control
- Database & Application Server/Component monitoring, configuration, management, security
- Historical statistical, event, alert repository

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



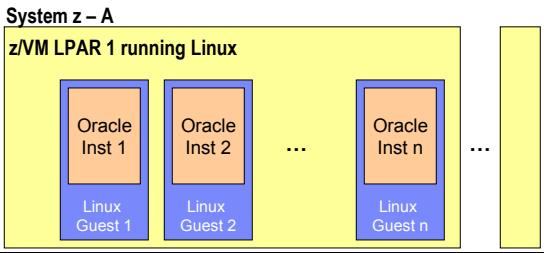
- **Two main objectives**
  - Scalability and performance
  - High availability
- **Easy to implement on z**

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

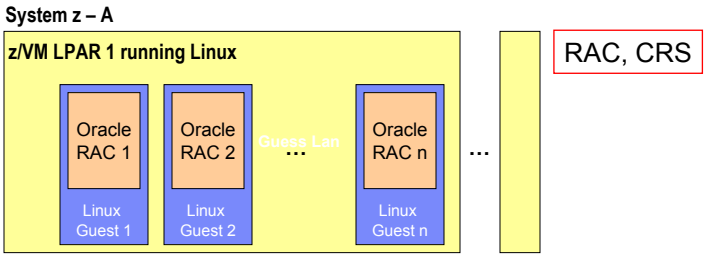
Can use:

ASM, CRS for single instance



Scenario 2

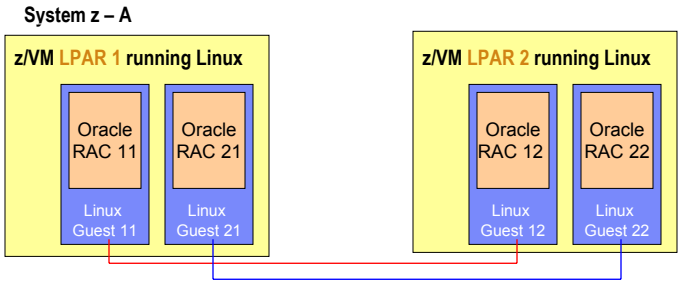
- In this example, the Oracle RAC nodes are installed on multiple Linux servers that run under z/VM. The SPoFs for the application are reduced to:
  - ✓ System z hardware
  - ✓ LPAR
  - ✓ z/VM



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

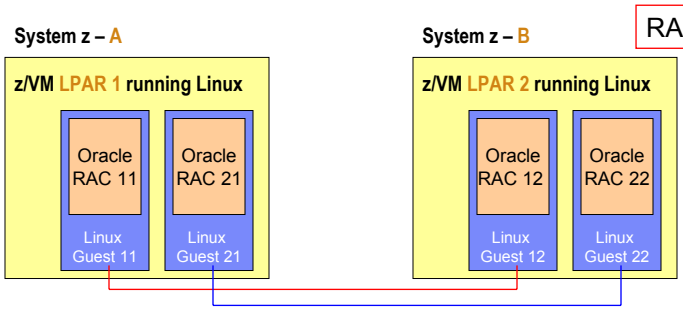
RAC, CRS



Scenario 4

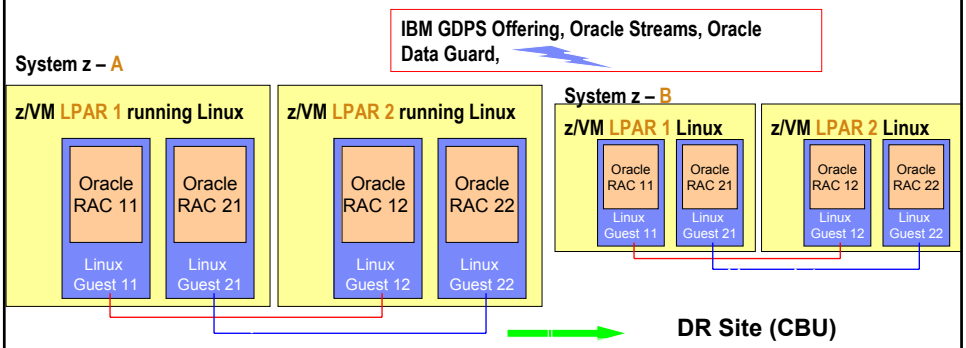
- In this example, the Oracle RAC nodes are installed on multiple Linux servers that run under multiple z/VM systems on multiple LPARs on multiple System z servers. No SPoFs for the Oracle environment remain.

RAC, Data Guard

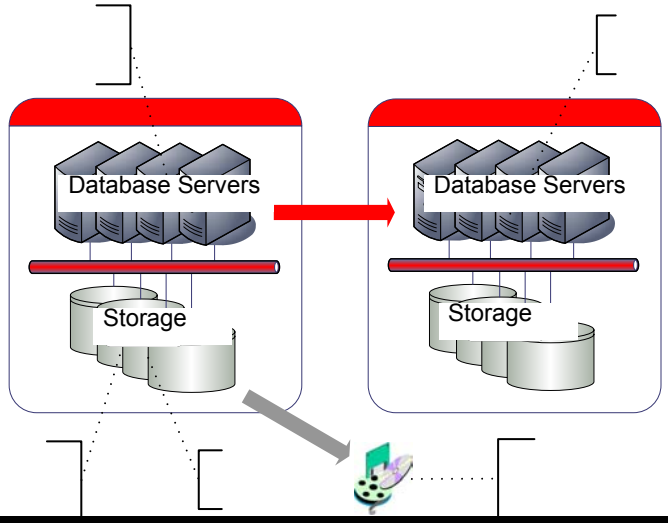


Scenario 5 - Disaster Recovery needed

- 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.



Oracle Maximum Availability Architecture - Database Features



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

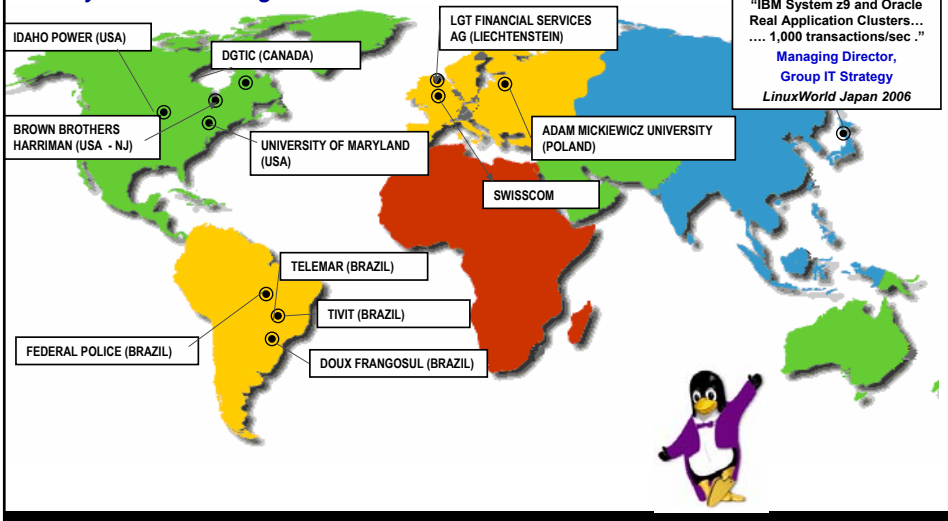
- Key is to have a sizing methodology to predict CPU and memory resources when moving workloads to Linux on IBM System Z
  - **Our sizing methodologies have been repeatedly confirmed in tests completed by IBM and Oracle**
- Scaling can be achieved with
  - **Scaling up with single instance under VM**
  - **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



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

- http://www-03preview.ibm.com/solutions/businesssolutions/oracle/doc/content/landingdtw/3065120128.html
  - IBM and Oracle Virtualize the Data Center Executive Brief
- http://www.ibm.com/systems/z/news/announcement/20080226_annc.html
  - IBM System z10™ Enterprise Class Announcement Landing Page
- http://www-03.ibm.com/systems/z/news/announcement/pdf/ZSO03018.pdf
  - IBM System z10 Enterprise Class (z10 EC) Reference Guide
- http://www.redbooks.ibm.com
  - Oracle, Linux and System z Redbooks – SG24-7573, SG24-7191, SG24-6482
- http://www.oracle.com/ibm
  - Oracle/IBM platform information
- http://otn.oracle.com
  - (Select “download code and documentation”)
- http://www.vm.ibm.com/perf/tips
  - General z/VM Tuning Tips
- http://www.vm.ibm.com/perf/reports/zvm/html/520lxd.html
  - Linux Disk I/O Alternatives
- http://www-124.ibm.com/developerworks/oss/linux390/index.shtml
  - Lot’s of information on open source and IBM products
- http://www-128.ibm.com/developerworks/linux/linux390/perf/index.html
  - Hints and Tips for Selecting and Tuning I/O options
- http://www.zseriesoraclesig.org
  - Special Interest Group of Oracle users on the mainframe (z/OS and Linux)
- http://www-03.ibm.com/support/techdocs/atsmastr.nsf/Web/TechDocs
  - IBM technical documentation

IBM ORACLE

Questions