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Z Linux User Group – Sept 2009 – London

**Oracle on IBM System z running Linux**  
**Achieve Maximum Availability Architecture**

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## Agenda

- Oracle/IBM Joint Solutions Center
- Linux on IBM System z: What, Why
- Oracle Maximum Availability Architecture
  - Oracle Clusterware
  - Oracle Automated Storage Manager
  - Oracle Real Application Cluster
  - Oracle Dataguard
  - Oracle Enterprise Manager
- MAA Reference Architecture

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## IBM/Oracle Joint Solutions Center: The team

### Managers

Christophe  
MaldyMatthew  
Puccini

Christophe Menichetti



Didier Wojciechowski

### Oracle Applications AIA



Marc Connolly

### Architects



Alain Cyr



Paul Bramy

### Oracle Middleware/SOA Infrastructure



Frédéric Michiara



Fabienne Lepetit



Daniel Freneuil

### Oracle Grid / MAA Database Infrastructure & Performances

### Project Management



Carla Gamba



Nicolas Marescaux - System z



François Martin – Power System



Frédéric Dubois - System x


### Technical foundations



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## Oracle/IBM Integrated Solutions Centers

- ✓ Design Workshops
- ✓ Best Practices
- ✓ Reference Architectures
- ✓ Proof of Concept
- ✓ Benchmarks
- ✓ Technical Training
- ✓ Demonstrations
- ✓ Light Benchmark for Oracle


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**Oracle Maximum Availability Architecture  
Design Workshop**  
Oracle/IBM Integrated Solutions



Your business needs to be online 24x7, 365 days a year. If critical applications, servers or data become unavailable then it may damage your business. Oracle's Maximum Availability Architecture (MAA) provides clear and concise guidance for building high availability and disaster recovery solutions with Oracle software with IBM server technologies.

The Oracle MAA Design Workshop is designed to guide customers who are developing their architecture strategy by leveraging Oracle and IBM best practices.

**Best Practices Developed by Oracle and IBM Architects**  
A dedicated and integrated team of IBM and Oracle architects developed the Oracle/IBM Integrated Solutions Design Workshop. For over 10 years solution specialists have worked together with hundreds of clients from around the world to design and prototype advanced IT infrastructure solutions.

**Objectives**

- Facilitate alignment between the customer, Oracle and IBM
- Document customer's environment and objectives
- Design the integrated Oracle/IBM architecture
- Define the project plan and the next steps
- Define the Oracle/IBM support team

**Participants**

- Customer systems architects
- Customer Oracle database administrators
- Customer IT or business managers
- IBM architects
- Oracle architects

**Benefits**  
Design Workshops help customers reduce the time required to implement new IT infrastructures. This is accomplished by coordinating Oracle and IBM teams and resources and leveraging Oracle/IBM best practices.



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## IBM Light Benchmark for Oracle on System z

### Purpose: Proof of Concept

- Validation of new System z solutions
- Validation of new Oracle releases
- Validation of new System z features usage
- Validation of customer applications

## Terms

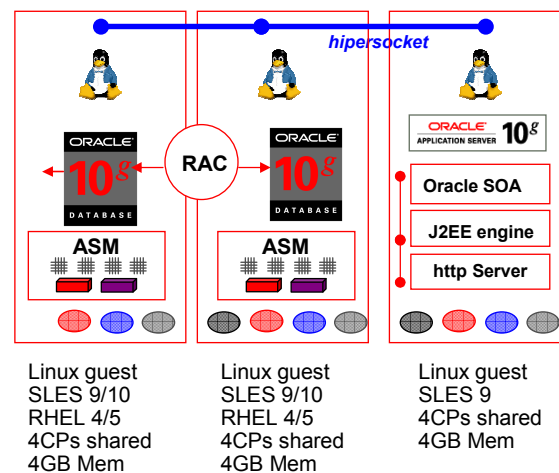
- Ask your IBM rep to contact us
- Duration: 1 to 4 weeks
- Platform accessible remotely through Open VPN
- Oracle AS on one Linux guest + Oracle RAC on 2 guest Linux (cluster), 4GB and 4CP per guest

## Support

- First level support provided by IBM tech center staff
- Second level support from System z Benchmark Center and the Oracle/IBM Joint Solution Center

## Contacts

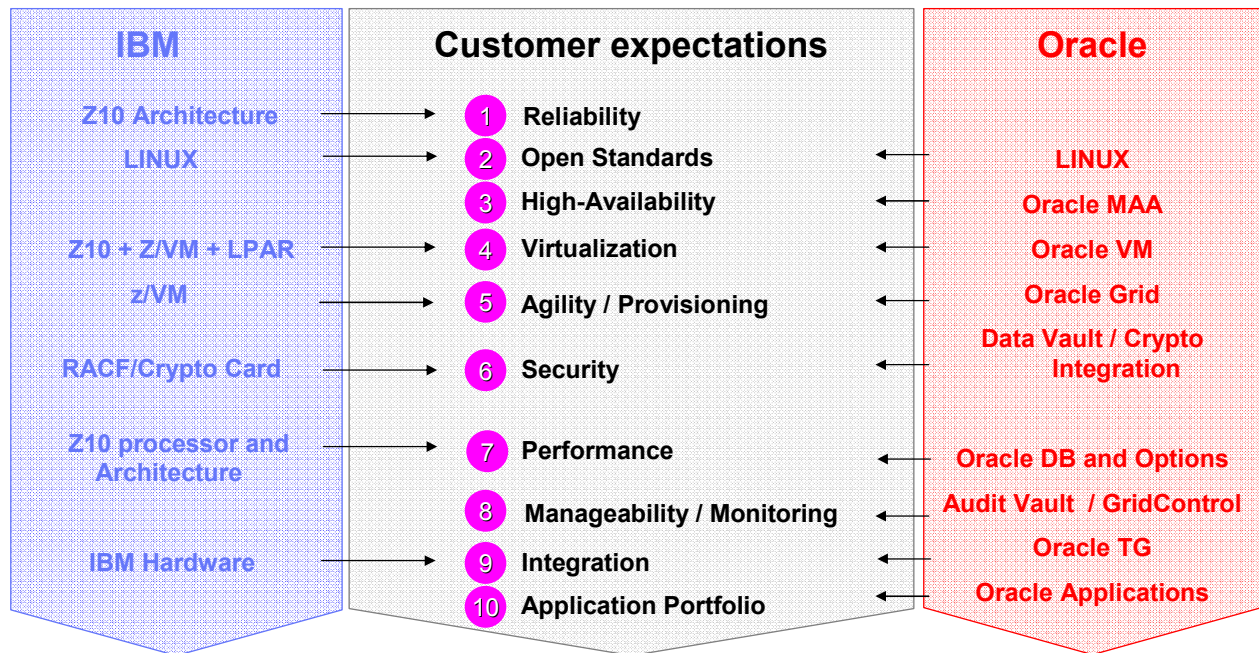
- Didier Cazier (Business Contact).
- H  l  ne Quillaud (System z Benchmark Center Manager).





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## Learned from customer projects





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## Customers are already « Building Up »...

### Infrastructure Simplification

#### Simplify global infrastructure on IBM System z with Oracle Solutions

- Infrastructure Simplification to reduce Complexity & increase resources utilization.
- Standardize your Database pool, Oracle & MS SQL, to simplify management.

### New Workloads on System z - Linux

#### Increase footprint with System z

- Application based on Oracle 10g Database & 10g AS + SOA can be fully implemented on System z running Linux
- More & more ISVs evaluate their applications on System z running Linux

### Applications on System z Linux

#### Leverage technology expertise for their core Applications

- Oracle iFlex : Full System z architecture
- Oracle EBS, PeopleSoft, Siebel : Split Tier

### Oracle Solutions integrated to z/OS

#### Business Logic Protection

- Integrate existing z/OS applications through Oracle Integration tools (OAM for CICS)
- Middleware integration
- Infrastructure Modernization





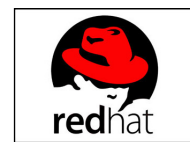


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## Oracle on IBM System z running Linux

➤ **Oracle Database EE 10gR2 64bits**

- ✓ Red Hat Enterprise AS/ES 4
- ✓ Red Hat Enterprise 5
- ✓ Novell SLES 9
- ✓ Novell SLES10



➤ **Oracle Database SE 10gR2 64bits**

- ✓ Red Hat Enterprise AS/ES 4
- ✓ Red Hat Enterprise 5
- ✓ Novell SLES 9
- ✓ Novell SLES10

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➤ **For more details, see the certification matrix:**

<http://www.oracle.com/technology/support/metalink/index.html>



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## Oracle on IBM System z running Linux

### • Data Solutions

- ✓ Oracle Database EE & SE 10gR2 64bits
- ✓ Oracle Application Express 3.2 with server 10gR2 64bits
- ✓ Oracle Business Intelligence EE (Split tier)
- ✓ Oracle Warehouse builder 10gR2 with server 10gR2 64bits

### • Middleware Solutions

- ✓ Oracle Application Server 10g
- ✓ Oracle Containers for J2EE (OC4J) 10g
- ✓ Oracle /BEA Weblogic Application server

### • Management Solutions

- ✓ Oracle Clusterware 10gR2 64bits
- ✓ Oracle Grid Control Agent 10gR2 64bits
- ✓ Oracle Database Vault 10.2 with server 10gR2 64bits

### • Integration Solutions

- ✓ Oracle Transparent Gateway for DRDA 10gR2 with server 10gR2 64bits

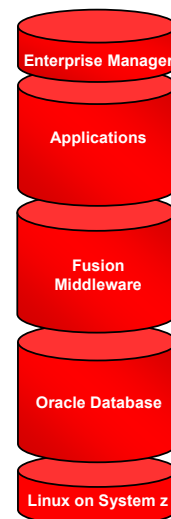
### • Applications

- ✓ Peoplesoft Enterprise V8.4 – Database tier
- ✓ Siebel V8 – Database tier
- ✓ eBusiness Suite 12.1 – Database tier

### • Industry Solutions

- ✓ iFlex Flexcube

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## What is Linux?

- **Support of Linux on all processor architectures**
  - ✓ Intel, AMD
  - ✓ PA-RISC, SPARC
  - ✓ z/Architecture
- **Many Linux distributions editors**
  - ✓ Novell
  - ✓ Red Hat
  - ✓ Debian
  - ✓ and many others...
- ✓ **Lot of Linux skills all over the world**
  - ✓ Easy to find Linux specialists
  - ✓ Easy to find technical documentation
- ✓ **Linux is an Open Source system**
  - ✓ Users can see the source code
  - ✓ Users can modify/customize their Linux distribution





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## Why Linux on IBM System z?

- **Designed to provide the highest quality of service**
  - ✓ Redundancy: n+1 components
  - ✓ Availability: 99,999%
  - ✓ Serviceability (concurrent upgrade capabilities)
  - ✓ Error detection and correction, Remote Support Facility (RSF)
  - ✓ Security (cryptographic co-processors, RACF): EAL5
- **Designed to support mixed workloads**
  - ✓ Virtualization and IT simplification
  - ✓ Resources sharing, Workload management
  - ✓ Complete workload isolation
  - ✓ High-speed inter-server communication
  - ✓ Dynamic resources adjustment
- ✓ **Scalability**
  - ✓ Horizontal & vertical scalability
  - ✓ Add more PU as needed
  - ✓ z10 EC scales to 64 application processors





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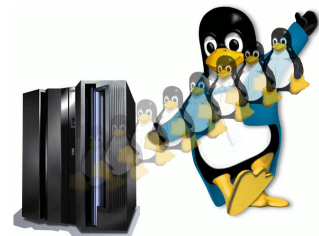
## Virtualization on IBM System z

### ➤ PR/SM (direct hardware virtualization)

- ✓ Hardware & Firmware functions
- ✓ Define Logical Partitions (LPAR) – dedicated or shared resources
- ✓ Fine grained time-sharing of all resources
- ✓ Internal in-memory network for inter-LPAR communication

### ➤ z/VM Hypervisor (direct hardware virtualization)

- ✓ Hardware, Firmware & Software functions
- ✓ Define thousands of Virtual Machines
- ✓ Share or dedicate everything (even memory)
- ✓ Complete workload isolation
- ✓ Define fully virtual networks
- ✓ Dynamic resources adjustment (VMRM)
- ✓ Collaborative Memory Management Assist (CMMA)

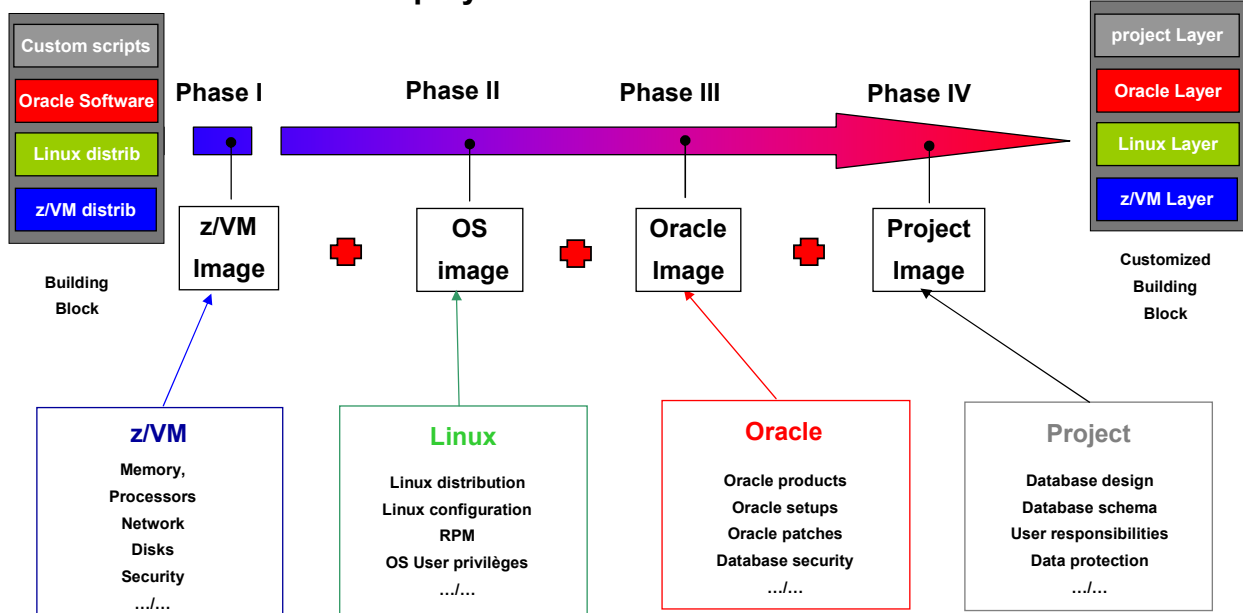




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## Linux provisioning on IBM System z

### ➤ Deploy Oracle Solutions On-Demand





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## Oracle Maximum Availability Architecture (MAA)

Oracle Maximum Availability Architecture (MAA) is Oracle's best practices blueprint based on proven Oracle high availability technologies and recommendations.

The goal of MAA is to achieve the optimal high availability architecture at the lowest cost and complexity.

- ✓ MAA best practices span Oracle Database, Oracle Application Server, Oracle Applications and Grid
- ✓ MAA leverages lower-cost servers and storage.
- ✓ MAA is hardware and OS independent.



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## Oracle Clusterware (CRS)

Oracle Clusterware (CRS) is a software cluster technology that allows clustering of single servers so that they cooperate as a single system.

- ✓ Enables the protection of any application (Oracle Database, Siebel Gateway, Web Server, ...) within a cluster
- ✓ Provides an easy way to manage applications (start/stop/check)

Oracle Clusterware CRS is a flexible and low cost solution

- ✓ No need to purchase additional software
- ✓ Easy to install & to manage
- ✓ Supports 100 nodes on all OS' certified for Oracle RAC
- ✓ Single-vendor support



### **Oracle MAA best practice**

Protect any mission-critical system within a CRS cluster



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## Oracle CRS in practice

### Implementing Oracle CRS

- ✓ Each node has a network interface on a dedicated network called *private interconnect*
- ✓ Each node has an additional IP address used by CRS to create node Virtual IP (node VIP)
- ✓ Each node has R/W access to a set of disks used for cluster registry (*OCR disk(s)*) and nodes heartbeat (*Voting disk(s)*)

### Protect applications with CRS

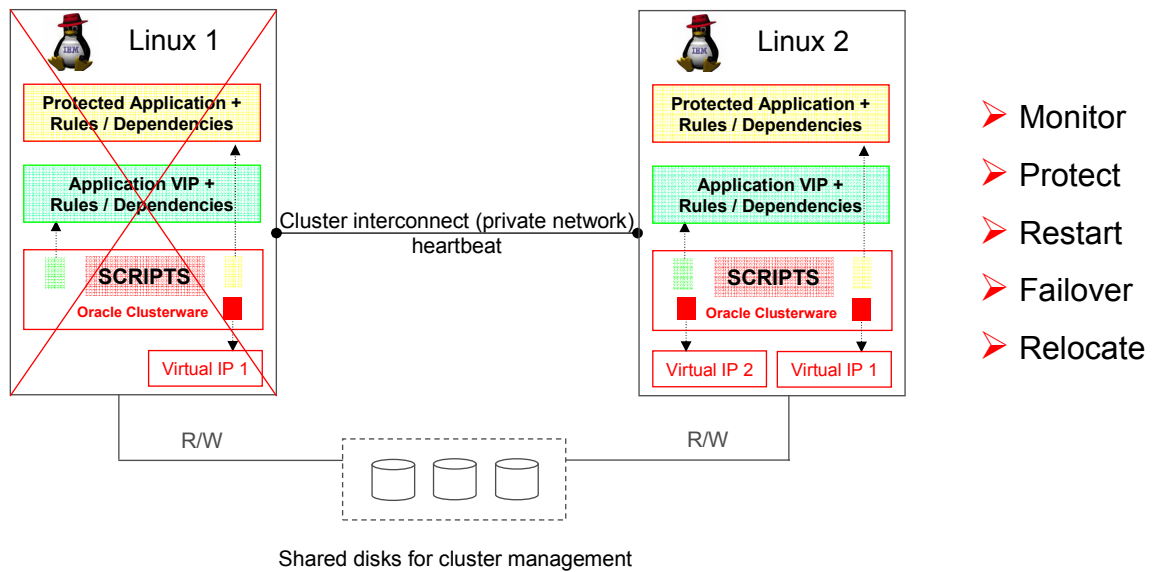
- ✓ Install CRS software on each Linux servers that will be part of the cluster
- ✓ Register applications as CRS services
- ✓ Define rules and dependencies for your CRS services
- ✓ Manage (start/stop/monitor, failover, relocate, ...) your application thru CRS interface



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## Oracle CRS in practice

➤ Improve the availability of your applications thru CRS services





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## Oracle CRS and IBM System z

Oracle CRS allows protection of Linux images running on IBM System z and located on

- ✓ different physical boxes
- ✓ different LPAR
- ✓ different Virtual Machines
- ✓ a mix of each above

Oracle CRS leverages IBM System z key capabilities

- ✓ Achieve ultra fast and ultra secure inter-node communications by using System z virtual networks
- ✓ Add/remove nodes from a cluster using System z provisioning capabilities and release dynamically unused resources
- ✓ Dynamically adjust cluster members resources (add/remove memory or CPU)
- ✓ Dynamically adjust cluster members priorities depending on workload constraints



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## Oracle Automatic Storage Management (ASM)

Oracle Automatic Storage Management (ASM) is a Logical Volume Manager (LVM) that provides the database administrator with a simple storage management interface.

- ✓ Eliminates need for conventional file system and 3rd party volume manager
- ✓ Extends SAME (Stripe And Mirror Everything)
- ✓ Improves performance, scalability, and reliability

When integrated within CRS, ASM becomes a Cluster Logical Volume Manager



### Oracle MAA best practice

Use ASM to simplify your storage management





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## Oracle ASM in practice

### Implementing Oracle ASM

- ✓ ASM is installed and managed as a specific Database instance
- ✓ Install ASM as a CRS service (cluster mode) and share data across cluster nodes
- ✓ Any device managed by ASM has to be accessible as a raw device (deprecated) or a block device
- ✓ Before 11gR2, only Datafiles can be stored on ASM-managed devices

### Manage storage devices with ASM

- ✓ Add/remove devices to ASM pool (set owner and permissions)
- ✓ Manage your storage dynamically (create/delete Diskgroups, add/remove disks in Diskgroups, ...)

### Achieve Capacity on Demand

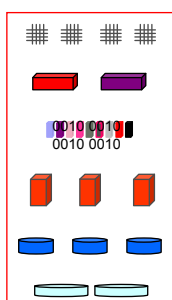
- ✓ Add/drop disks online
- ✓ Rebalance data across disks (dynamic striping)
- ✓ Automatic I/O load balancing



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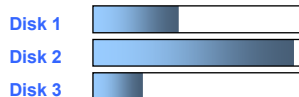
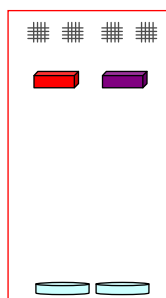
## Oracle ASM in practice

### Without ASM



← Tables →  
← Tablespace →  
← Files →  
← FileSystems →  
← LVs →  
← Devices →

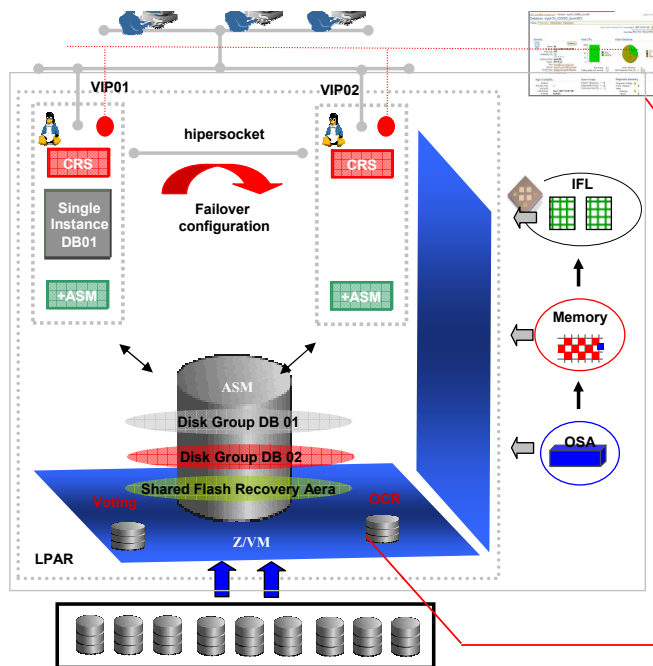
### With ASM





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## Oracle ASM in practice



Manage your Disk Groups from a central point of administration: the Grid Control (Oracle Enterprise Manager)

Share ASM Disks Groups across CRS members and ensure data availability



## Oracle ASM and IBM System z

Oracle ASM supports all type of storage available on Linux on IBM System z

- ✓ Traditional DASD devices (ECKD) with FICON attachments
- ✓ Open standard SCSI devices within a SAN infrastructure with FCP attachments
- ✓ z/VM Virtual Disks (Dedicated devices, Virtual Minidisks, FBA-emulated Devices)

IBM System z leverages ASM flexibility

- ✓ Take advantage of the System z I/O subsystem reliability (redundancy, error detection/correction, ...)
- ✓ Use z/VM virtualization & resource sharing capabilities to dynamically provision new shared storage



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## Oracle Real Application Cluster (RAC)

Oracle Real Application Cluster (RAC) is an option to the Oracle Database Enterprise Edition. Oracle RAC is a cluster database with a shared cache architecture that provides highly scalable and available database solutions for all your business-critical applications.

- ✓ Active/Active cluster Databases
- ✓ Provides a Database service management allowing Instances segregation and Workload isolation
- ✓ No need to purchase additional software
- ✓ Easy to install & to manage
- ✓ Support for third-party Cluster Filesystem
- ✓ Oracle RAC is a key component of Oracle enterprise grid architecture



### **Oracle MAA best practice**

Implement RAC Databases for mission-critical applications



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## Oracle RAC in practice

### Implementing Oracle RAC

- ✓ Oracle RAC is based on CRS infrastructure
- ✓ Requires a Cluster File System (ASM) for data storage

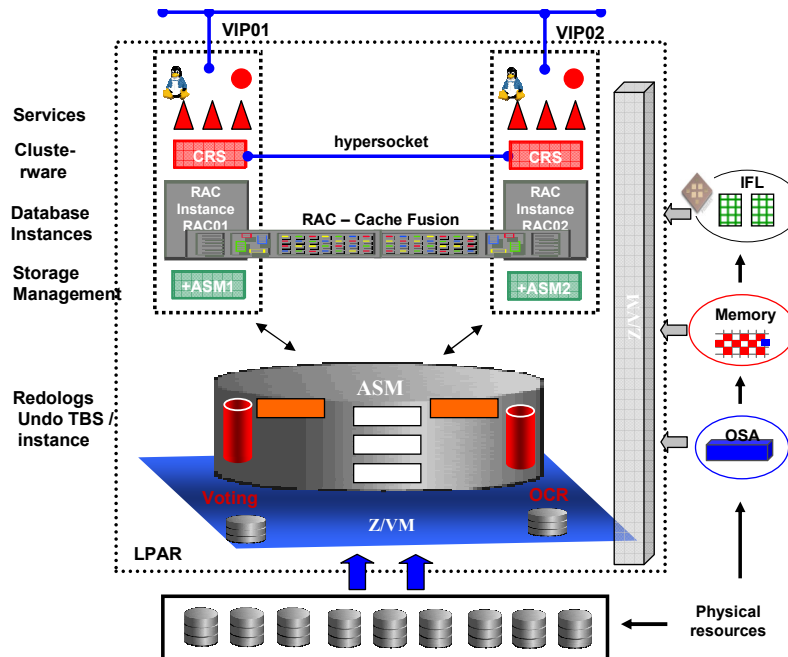
### Achieve Database High Availability

- ✓ Install Database software in cluster mode on top of CRS
- ✓ Create cluster Database having RAC instances on 1 or many cluster nodes
- ✓ Create RAC services to define Workload management strategy (load-balancing, spare instances, ...)
- ✓ Add/remove instances as your workload is growing/reducing
- ✓ Perform rolling upgrades and avoid/reduce database downtime during maintenance tasks



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## Oracle RAC in practice



### Availability

- ✓ Active-Active solution
- ✓ Only fractional capacity lost when a node in the cluster fails

### Scalability

- ✓ Add additional Instance as your workload grows

### Performance

- ✓ Query parallelization across nodes in the cluster

### Workload Distribution

- ✓ Automatic servers-side load balancing

### Manageability

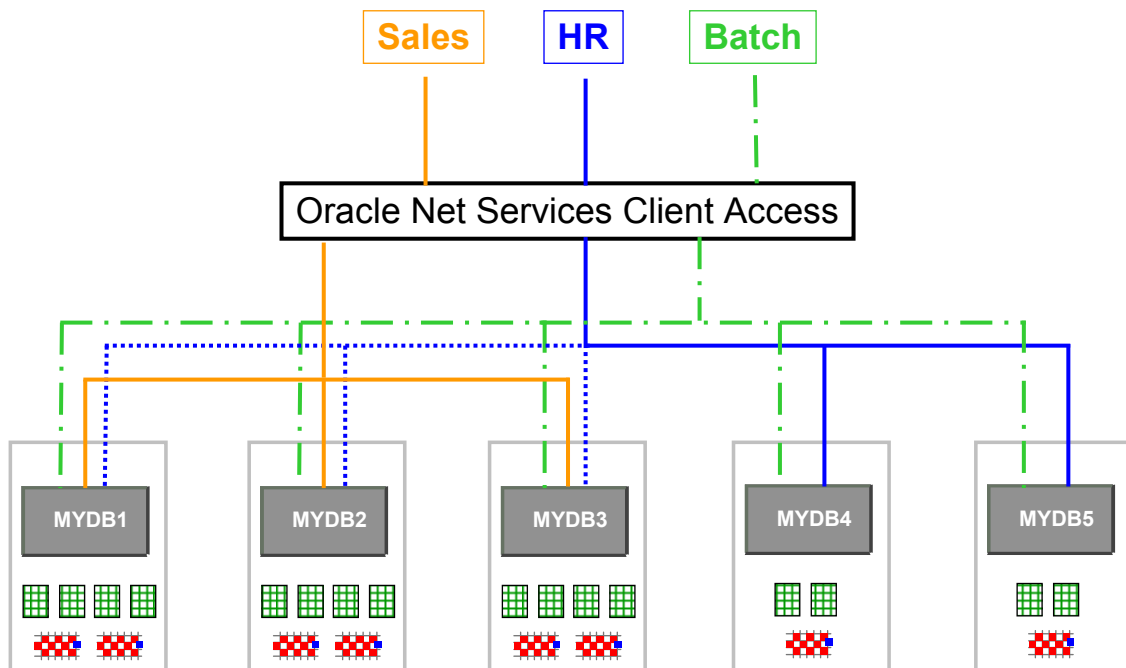
- ✓ Reduce Database downtime during maintenance phases





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## Oracle RAC Services





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## Oracle RAC and IBM System z

Achieve High Availability by associating the most reliable hardware with Oracle's HA technology

IBM System z leverages RAC scalability

- ✓ Take advantage of the System z dynamic resources management and add/remove resources as your workload growth/decrease: CoD, CBU, dynamic resources allocation... (vertical scalability)
- ✓ Use System z Logical Partitioning or z/VM virtualization to add/remove RAC instances (horizontal scalability)

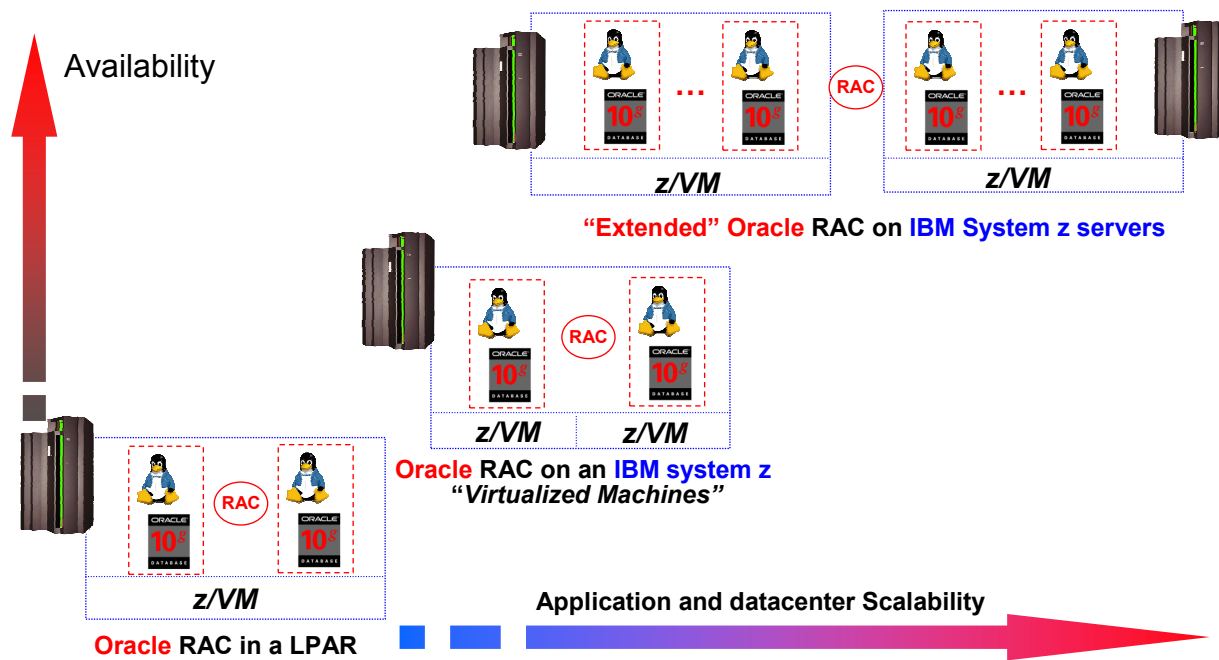
Use z/VM virtualization to achieve maximum infrastructure flexibility (server provisioning, virtual networking)

Use System z Hipersocket to enhance the performances of your RAC cluster



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## Oracle RAC and IBM System z: scalability





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## Oracle Data Guard

Oracle *Data Guard* provides the management, monitoring, and automation software to create and maintain one or more *standby databases* to protect Oracle data from failures, disasters, human error, and data corruptions. Data Guard provides optimal data protection and availability, minimizing downtime for both planned and unplanned outages

- ✓ A standby database can be used to perform planned maintenance in a rolling fashion, minimizing downtime and eliminating the risks inherent with introducing change to production environments.
- ✓ Oracle corruption detection checks insure that data is logically and physically consistent before it is applied to a standby database.
- ✓ Oracle provides both *logical* and *physical* standby databases



### Oracle MAA best practice

Use Data Guard to protect your mission-critical Databases from failure or data corruption



## Oracle Data Guard in practice

### Implementing Oracle Data Guard

- ✓ Add DR site: other LPAR, other physical machine, remote room or remote site
- ✓ Add storage for standby databases

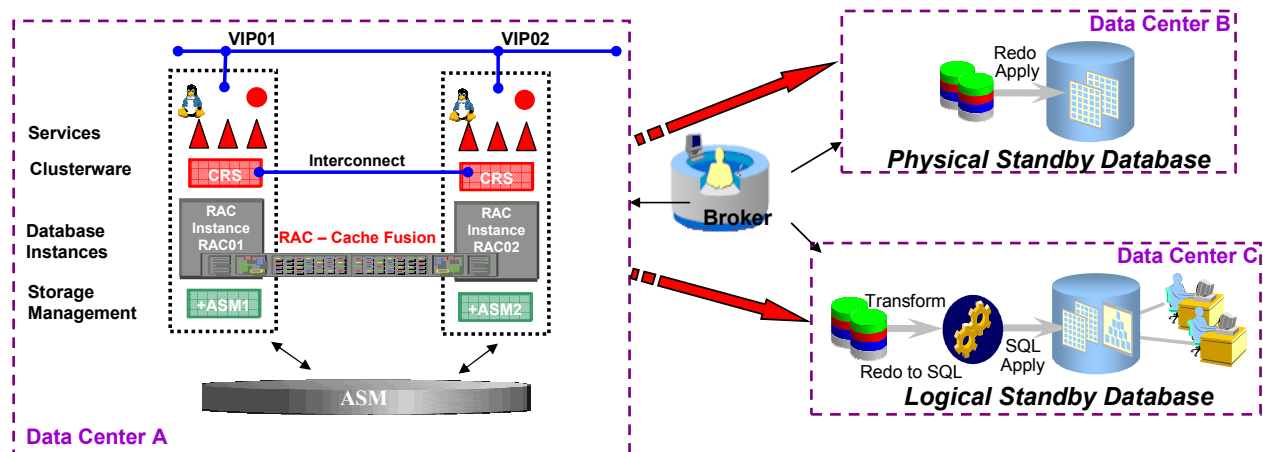
### Protect you mission-critical databases from HW failure or data corruption

- ✓ Create Logical and/or Physical Standby databases on DR site(s)
- ✓ Perform Data Guard *Switchover* to perform planned maintenance on primary site or solve data failures (primary site still available)
- ✓ Use Data Guard *Failover* to achieve Disaster Recovery in case of primary site loss or logical/data failures



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## Oracle Data Guard in practice



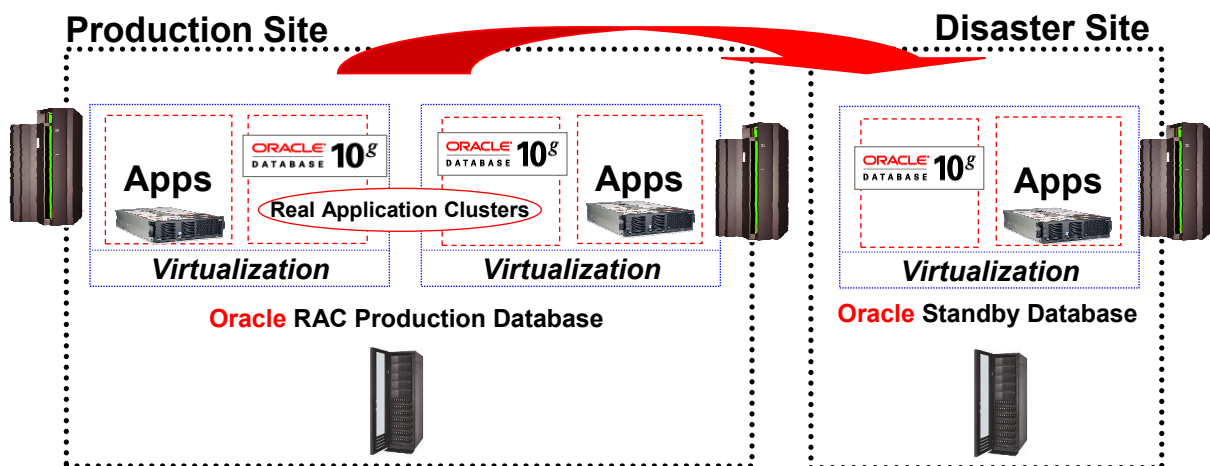


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## Oracle Data Guard and IBM System z

Oracle Data Guard can be implemented on:

- ✓ Another LPAR/VM on the same physical machine
- ✓ Another LPAR/VM on another machine in the same location
- ✓ Another LPAR/Virtual Machine on a remote site







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## Oracle Enterprise Manager (OEM)

Oracle Enterprise Manager with Oracle Grid Control provides a single, integrated interface for the top down administration and monitoring of applications and systems in an Oracle Grid.

- ✓ Monitor resource allocations and utilization
- ✓ Provides alerts and takes corrective action
- ✓ Deploy components, patches and agents
- ✓ Automate repetitive tasks

Oracle OEM supports the wider Oracle ecosystem and 3rd party technologies and software.

Install OEM anywhere and monitor any type of supported platforms and software



### **Oracle MAA best practice**

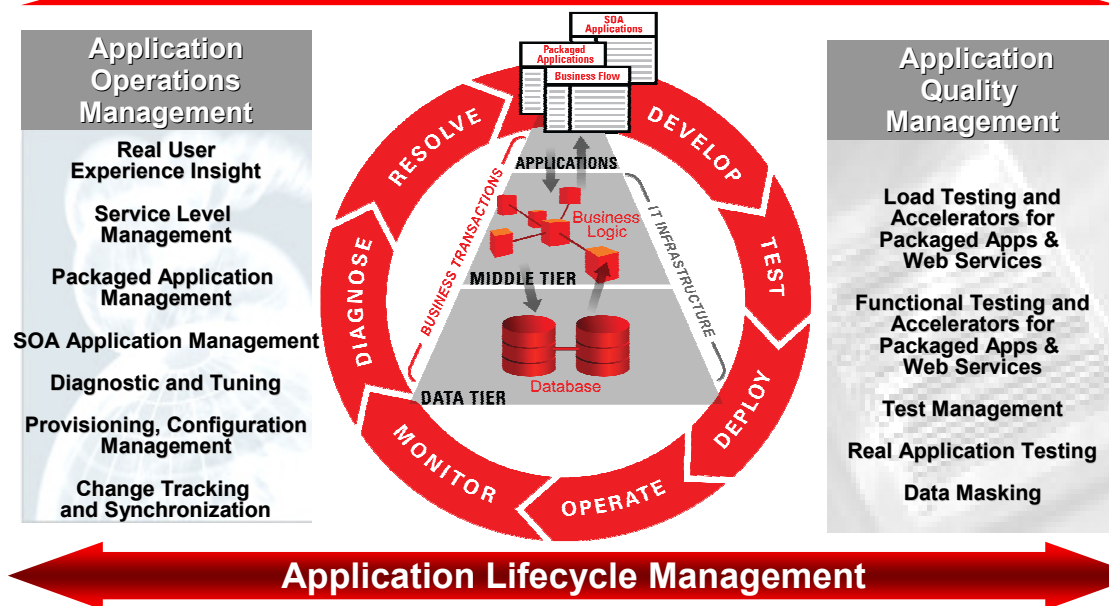
Enable Oracle Grid and use OEM to monitor and manage your Grid infrastructure



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## Oracle Enterprise Manager (OEM)

### Top-Down Application Management





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## Oracle OEM in practice

### Implementing Oracle EM

- ✓ Install Oracle Grid Control and create Management Repository
- ✓ Deploy maintenance packages, agent installation packages on OEM server

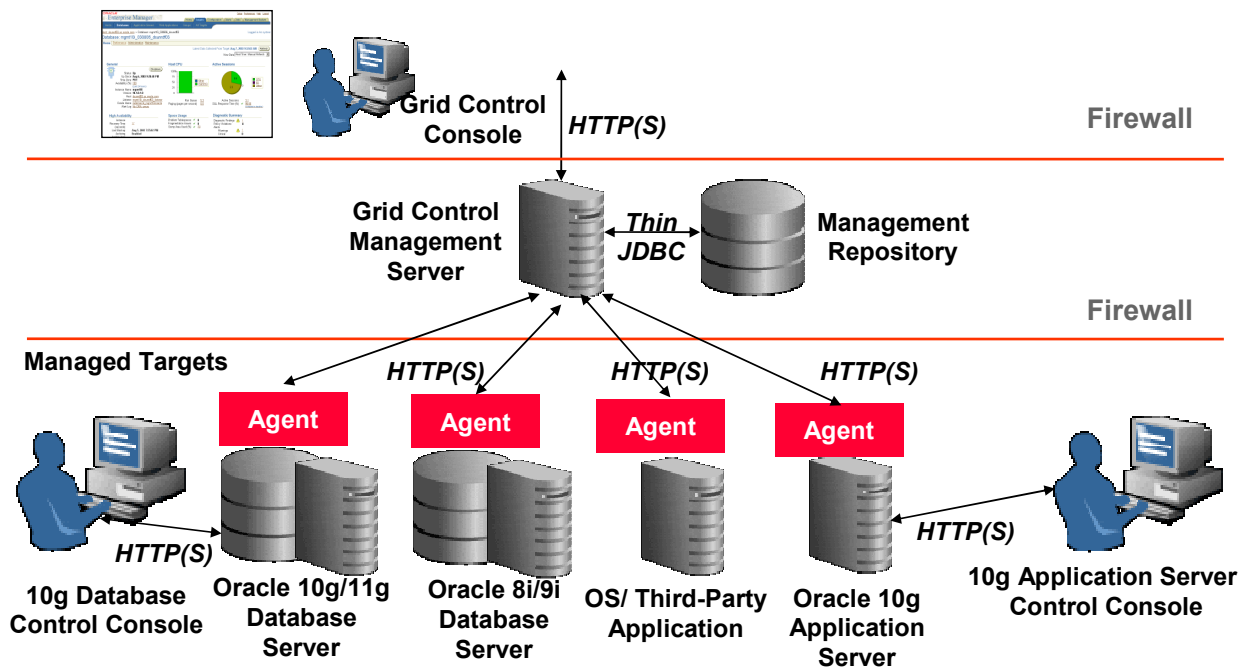
### Manage your Grid infrastructure from OEM and save time and money

- ✓ Deploy agents on target hosts: Database servers, clusters, Fusion Middleware...
- ✓ Monitor target systems activity (SW) and resource utilization (OS)
- ✓ Manage target systems (start/stop services or Database instances, configure ASM instances, perform tuning...)
- ✓ Deploy maintenance package to target systems from OEM
- ✓ Create custom scripts and schedule jobs
- ✓ Start thinking Cloud Computing



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## Oracle OEM in practice





## Oracle EM and IBM System z

Leverage System z resources optimization

- ✓ Deploy what you need when you need it
- ✓ Share IT resources and make systems cooperating

Simplify your infrastructure management

- ✓ Manage consolidated and distributed servers from a single point of administration
- ✓ Manage heterogeneous IT resources (servers, storage, ...) as a pool of resources



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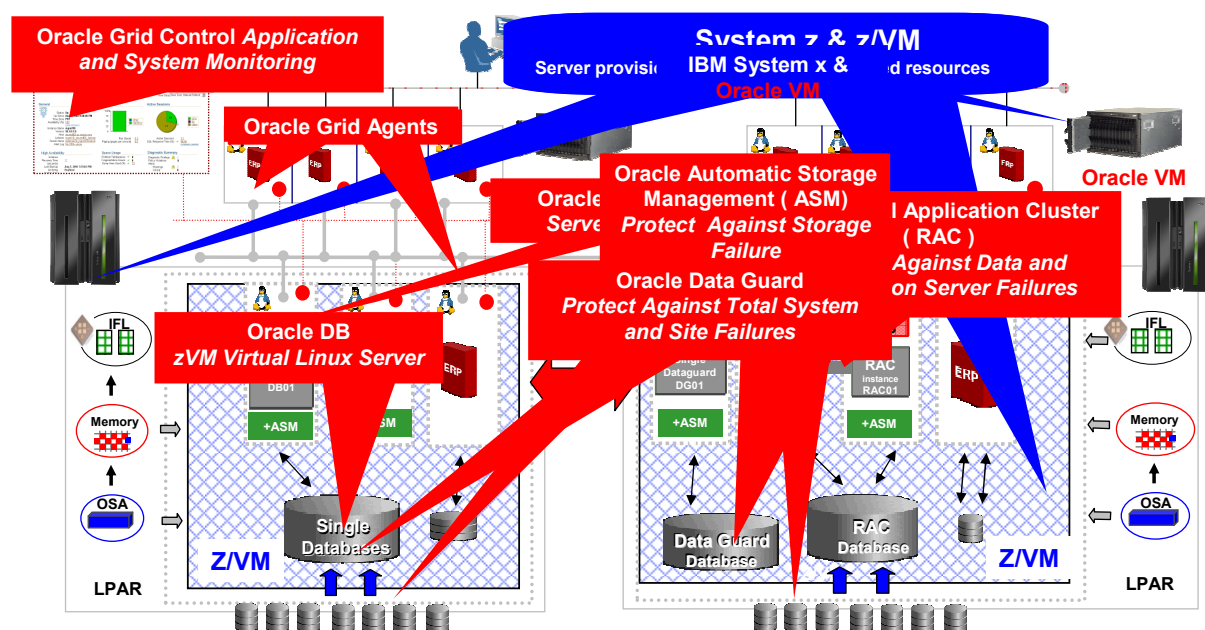




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## Maximum Availability Architecture (MAA)

### IBM/Oracle Integrated Architecture







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    - ✓ <https://metalink.oracle.com/CSP/ui/index.html>

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## Questions



Thank you.