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Operational Best Practices for Oracle Exadata

Lawrence To
Senior Director, Oracle ST Development

Program Agenda

- Exadata MAA for Maximum Availability and Stability
- Essential Exadata Operational Practices

Oracle Exadata Database Machine

EXTREME PERFORMANCE

One architecture for…

- Data Warehousing
- OLTP
- Database Consolidation

Exadata is Oracle's strategic database platform for ALL Oracle Database workloads

Maximum Availability Architecture

Experience from Thousands of Deployments, Validated in Oracle Labs

- HA best practices for:
  - Exadata Database Machine
  - Oracle Database
  - Oracle Fusion Middleware
  - Oracle Applications
  - Cloud Control
  - Partner solutions

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 the Exadata Database Machine, Oracle Database, Oracle Fusion Middleware, Oracle Applications, Grid Control and Oracle Partners.
- MAA accommodates a range of business requirements to make these best practices as widely applicable as possible.
- MAA leverages lower-cost servers and storage.
- MAA evolves with new Oracle versions and features.
- MAA is hardware and OS independent.

This Maximum Availability Architecture Overview describes how MAA is used to maximize systems availability and meet the most aggressive Service Level Agreements (SLAs) for system availability, quality of service, and data protection.

For MAA Best Practices and other technical information see:

MAA Best Practices	Case Studies	Documentation	Demonstrations	Articles Presentations

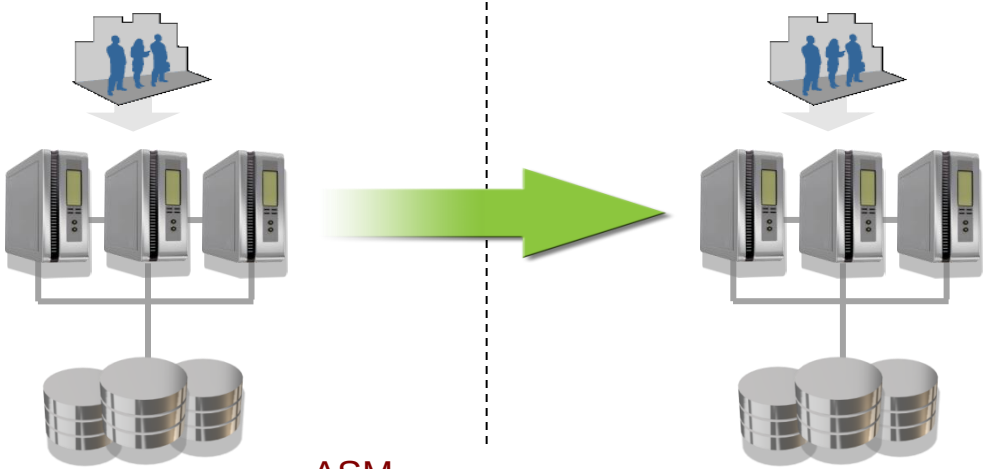
Ref. http://www.oracle.com/goto/maa

Maximum Availability Architecture (MAA)

Low-Cost, Integrated, Fully Active, High ROI

Production Site

Active Replica



RAC
– *Scalability*
– *Server HA*

Flashback
– *Human error correction*

Online Redefinition,
Edition-based Redefinition,
Data Guard, GoldenGate
– *Minimal downtime maintenance, upgrades, and migrations*

ASM
– *Volume Management*

RMAN & Fast Recovery Area
– *On-disk backups*

Active Data Guard
– *Data Protection, DR*
– *Query Offload*

GoldenGate
– *Active-active*
– *Heterogeneous*

Oracle Secure Backup
– *Backup to tape / cloud*

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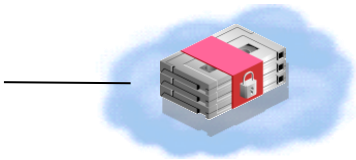
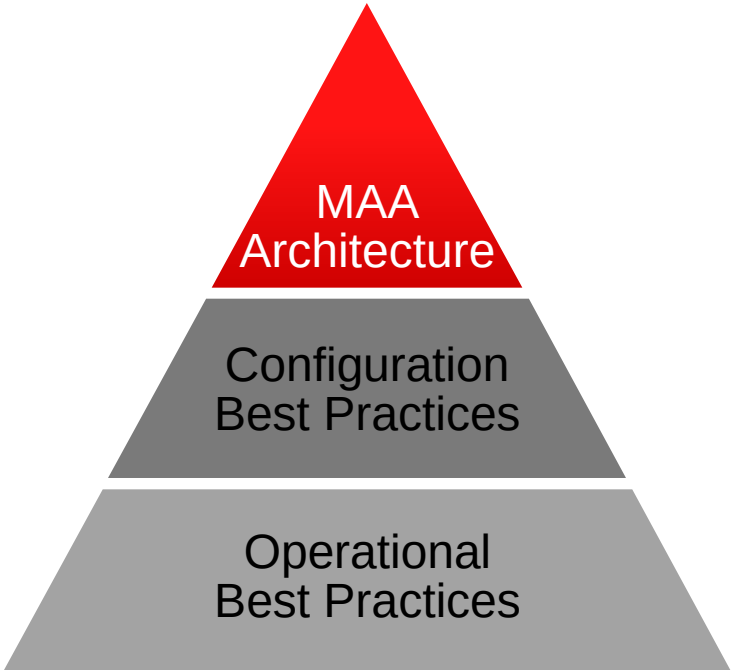


Oracle Secure Backup
– *Backup to tape / cloud*

Building Blocks of MAA

Operational Best Practices for Maximum Stability and Availability



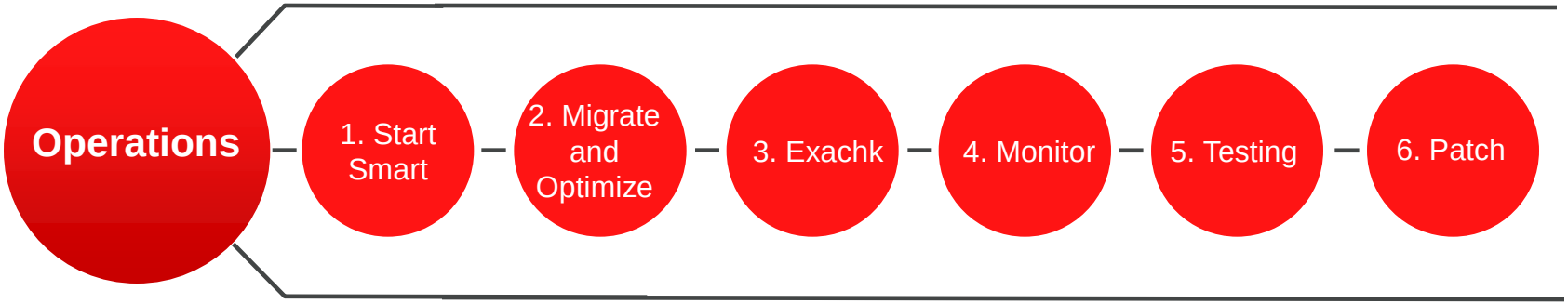
CON8392:Oracle Maximum Availability Architecture Best Practices for Oracle Exadata
Tuesday 5:00pm, Room 303
Moscone South

This presentation

Exadata Essential Operational Practices

Essential Exadata Operational Practices

Goal: Maximum Stability and Availability



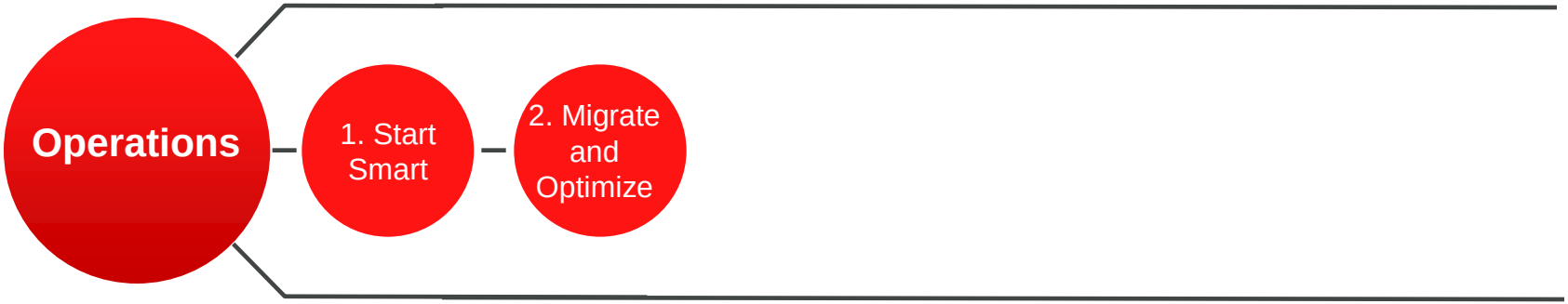
1. Start Smart

Proper sizing, Configuration, Deployment for Big Benefits

Sizing	Configuration	Deployment
• Evaluate Peak • Evaluate Growth • Redundancy/HA • Translation • Wiggle Room	• Java Deployment Assistant • High redundancy • Bonded client networks • Enable Monitoring	• OneCommand • MAA Settings • Exachk • Software updates • Monitoring

Essential Exadata Operational Practices

Goal: Maximum Stability and Availability



2. Migrate and Optimize

Simplify and Optimize

For Exadata

- **Index re-evaluation for Data Warehouse**
- **Hybrid Columnar Compression (HCC)**

For Best Practice (MOS 757552.1)

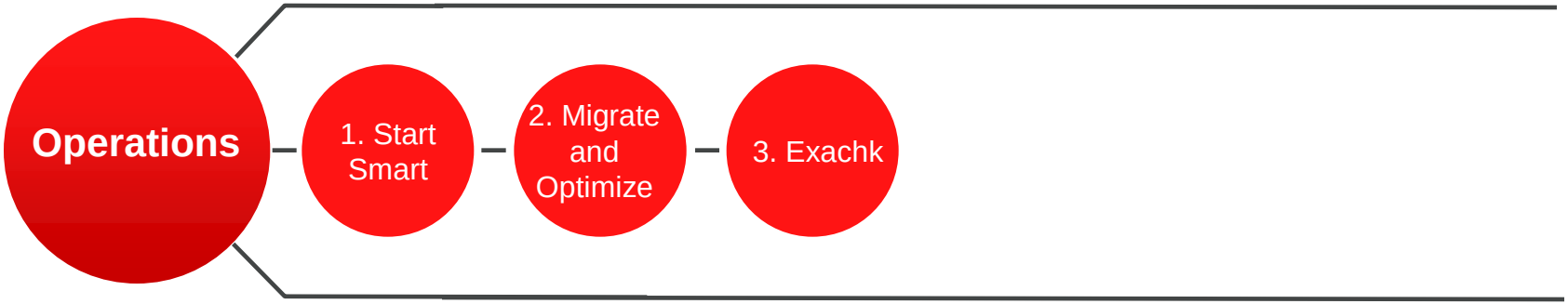
- **Default init.ora. Remove underscores**
- **Remove hints from SQL**
- **Improved schema object layout**
- **Fewer tablespaces and data files**
- **Large database object extent size**
- **Character set (MOS 123670.1)**

Migration Techniques

	Migration Method	Downtime factor
Physical •Block for block copy •Whole tablespace or database •Typically best for OLTP	Physical Standby	Switchover (11.2) Change rate + upgrade (11.1)
	Transportable Tablespaces	Data size
	Transportable Database	Data size
Logical •Unload, reload with SQL •Easy to subset •Typically best for DW	Data Pump	Data size
	Insert as Select	Data size
Low Downtime Options •Use in conjunction with other method to reduce downtime	Cross Platform Incremental Backups (w/ TTS)	< 1 hour (small metadata)
	Oracle GoldenGate	Seconds
	Physical Standby and Transient Logical Standby	Seconds

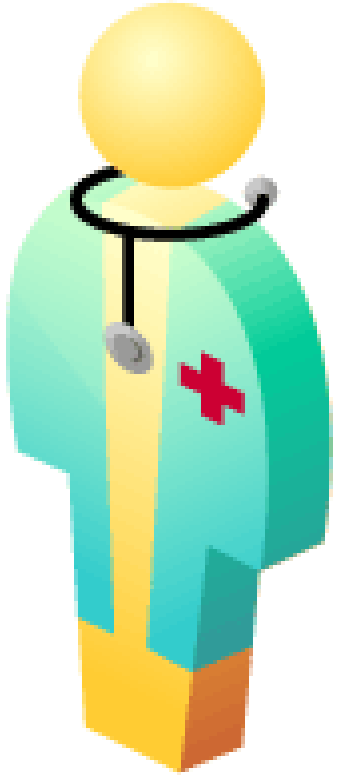
Essential Exadata Operational Practices

Goal: Maximum Stability and Availability



3. Use Exachk Regularly

Contains Critical Alerts and MAA configuration checks



- Exadata MAA exachk – MOS 1070954.1
  - Hardware, Software and MAA checks
  - Validated Exadata MAA configuration best practices
  - MAA score card and review
  - Critical software and patches updates
  - Pre/Post 11.2.0.3 Oracle upgrade checks
  - Support V2, X2-2s, X2-8s, X3 Exadata families
- Download latest and run monthly or pre/post maintenance

Exachk Health Score and Summary

Oracle Exadata Assessment Report

System Health Score is 85 out of 100 (detail)

Cluster Summary

Cluster Name	EBS-cluster
OS Version	LINUX X86-64 OELRHEL 5 2.6.32-300.7.3.el5uek
CRS Home - Version	/u01/app/11.2.0.3/grid - 11.2.0.3.0
DB Home - Version - Names	/u01/app/oracle/product/11.2.0.3/proddb1 - 11.2.0.3.0 – u550 /u01/app/oracle/product/11.2.0.3/proddb2 - 11.2.0.3.0 – t550 /u01/app/oracle/product/11.2.0.3/proddb3 - 11.2.0.3.0 – t592
Exadata Version	11.2.3.1.1
Number of nodes	19
Database Servers	2
Storage Servers	14
IB Switches	3
exachk Version	2.1.6_20120817
Collection	exachk_u550_082712_131532.zip
Collection Date	27-Aug-2012 13:34:59

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DB Home - Version - Names	/u01/app/oracle/product/11.2.0.3/proddb1 - 11.2.0.3.0 – u550 /u01/app/oracle/product/11.2.0.3/proddb2 - 11.2.0.3.0 – t550 /u01/app/oracle/product/11.2.0.3/proddb3 - 11.2.0.3.0 – t592
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Exadata X2-8

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- Findings Needing Attention
  - On Database Server
  - On Storage Server
- MAA Scorecard
- Findings Passed
  - On Database Server
  - On Storage Server
  - On Infiniband Switch
  - Cluster Wide
- Systemwide firmware and software versions
- Killed Processes
- Skipped Checks

Findings Needing Attention and MAA Scorecard

Top Failures per Component

Alerts and Problem Avoidance

Findings Needing Attention

FAIL, WARNING, ERROR and INFO findings should be evaluated. INFO status is considered a significant finding and details for those should be reviewed in light of your environment.

Database Server

Status	Type	Message	Status On	Details
FAIL	SQL Parameter Check	Database parameter USE_LARGE_PAGES is NOT set to recommended value	All Instances	View

Storage Server

Status	Type	Message	Status On	Details
FAIL	Storage Server Check	one or storage server has open critical alerts.	All Storage Servers	View

Cluster Wide

Status	Type	Message	Status On	Details
WARNING	Cluster Wide Check	Time zone does not match for Grid Infrastructure software owner across cluster	Cluster Wide	View

Top

Recommendation and Direction

Check for parameter use_large_pages

Success Factor	DBMACHINE X2-2 AND X2-8 AUDIT CHECKS
Recommendation	Critical Benefit / Impact: Memory savings and reduce paging and swapping. Experience and testing has shown that certain database initialization parameters should be set at specific values. These are the best practice values set at deployment time. By setting these database initialization parameters as recommended, known problems may be avoided and performance maximized. The parameters are common to all database instances. The impact of setting these parameters is minimal. The performance related settings provide guidance to maintain highest stability without sacrificing performance. Changing the default performance settings can be done after careful performance evaluation and clear understanding of the performance impact. Risk: If the database initialization parameters are not set as recommended, a variety of issues may be encountered, depending upon which initialization parameter is not set as recommended, and the actual set value. Action / Repair: USE_LARGE_PAGES = ONLY ensures the entire SGA is stored in hugepage for Linux based systems only. Prequisites: Operating system hugepages setting need to be correctly configured and need to be adjusted when another instance is added or dropped or whenever sga sizes change. See referenced MOS Notes to configure HugePages.
Links	• Note: 401749.1 - Shell Script to Calculate Values Recommended Linux HugePages / HugeTLB - • Note: 361323.1 - HugePages on Linux: What It Is... and What It Is Not... -
Needs attention on	u550a, u550b
Passed on	t550a, t592a, t550b, t592b

Recommendation and Direction

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Recommendation +
Risk Analysis +
Direction/Steps

Critical software patch alerts

Database Server

Status	Type	Message	Status On	Details
FAIL	ORACLE_HOME Check	System is exposed to Exadata Critical Issue DB14	All ORACLE_HOME's	View
FAIL	OS Check	System is exposed to Exadata Critical Issue DB13	All Database Servers	View
FAIL	Patch Check	System may be exposed to Exadata Critical Issue DB11	All Homes	View
FAIL	SQL Parameter Check	Database parameter USE_LARGE_PAGES is NOT set to recommended value	u550a, u550b	View

Critical issue DB14

Success Factor	DBMACHINE X2-2 AND X2-8 AUDIT CHECKS
Recommendation	Issue:- Bug 14054411 - Database may hang if it is configured to use Direct NFS with the /etc/mtab
Links	• Note: 1274318.1 - Oracle Sun Database Machine X2-2 Setup/Configuration Best Practices (Doc ID 1274318.1) - • Note: 1460787.1) - DB Hangs When DNFS is Enabled on UEK kernel - • Note: 762374.1 - Step by Step - Configure Direct NFS Client (DNFS) on Linux (11g) -
Needs attention on	a01db01p:/eb_rda0_t/orabin/t592db/11.2.0.3, a01db01p:/eb_rdo0_t/orabin/t550db/11.2.0.3, a01db01p:/eb_rdo1_u/orabin/u550db/11.2.0.3, a01db02p:/eb_rda0_t/orabin/t592db/11.2.0.3, a01db02p:/eb_rdo0_t/orabin/t550db/11.2.0.3, a01db02p:/eb_rdo1_u/orabin/u550db/11.2.0.3
Passed on	-

Critical software patch alerts

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Passed on	-

Alert Notification
Recommendation
Apply if applicable

MAA Scorecard helps identify additional gaps

MAA Scorecard

Outage Type	Status	Type	Message	Status On	Details
COMPUTER FAILURE PREVENTION BEST PRACTICES	FAIL	Description Oracle RAC and Oracle Clusterware allow Oracle Database to run any packaged or custom application across a set of clustered servers. This capability provides server side high availability and scalability. If a clustered server fails, then Oracle Database continues running on the surviving servers. When more processing power is needed, you can add another server without interrupting access to data. Key HA Benefits: Zero database downtime for node and instance failure. Oracle RAC and Oracle Clusterware rolling upgrade for most hardware and software changes excluding Oracle RDBMS patch sets and new database releases. Links: • MAAP: Chapter 6: Configuring Oracle Database with Oracle Clusterware • MAAP: Chapter 7: Configuring Oracle Database with Oracle RAC • MAAP: Chapter 8: Configuring Oracle Database contains Generic HA practices			
	WARNING	SQL Check	Redo log file size should be >= 4GB	t592	View
	WARNING	SQL Parameter Check	fast_start_mttr_target has NOT been changed from default	All Instances	View
	PASS	SQL Check	Redo log file size is >= 4Gb	t550, u550	View
	PASS	SQL Check	Database Archivelog Mode is set to ARCHIVELOG	All Databases	View
	PASS	SQL Parameter Check	Database parameter LOG_BUFFER is set to recommended value	All Instances	View
STORAGE FAILURES PREVENTION BEST PRACTICES	PASS	Description The Oracle Storage Grid is implemented using either Oracle Automatic Storage Management (ASM) and Oracle Exadata Storage Server Software or ASM and third-party storage. The Oracle Storage Grid with Exadata seamlessly supports HAA-related technology, improves performance, provides unlimited I/O scalability, is easy to use and manage, and delivers mission-critical availability and reliability to your enterprise. A properly configured storage grid eliminates single point of failure for storage components, including disk, disk controller, network connections or switches. The Exadata Database Machine default configuration is an example of a properly configured storage grid. Key HA Benefits: Zero database downtime for storage related failures. Oracle Grid Infrastructure and ASM rolling upgrade. Other References: Oracle® Exadata Storage Server Software User's Guide: Chapter 1: Section: About Oracle ASM for Maximum Availability Links: • Oracle Exadata Database Machine • MAAP Chapter 4: Configuring Storage			
	PASS	SQL Check	At least one high redundancy diskgroup configured	All Databases	View
DATA CORRUPTION PREVENTION BEST PRACTICES	FAIL	Description The MAA recommended way to achieve the most comprehensive data corruption prevention and detection is to use Oracle Data Guard and configure the DB_BLOCK_CHECKING, DB_BLOCK_CHECKSUM, and DB_LOST_WRITE_PROTECT database initialization parameters on the Data Guard primary and standby databases. Links: • Note: 1302539.1 - Best Practices for Corruption Detection, Prevention, and Automatic Repair - in a Data Guard Configuration - • MAAP: Chapter 5.1.6: Protect Against Data Corruption • Note: 1265884.1 - Resolving ORA-752 or ORA-600 [3020] During Standby Recovery - • MAAP: Chapter 13.2.6:			
	FAIL	SQL Parameter Check	Database parameter DB_LOST_WRITE_PROTECT is NOT set to recommended value	t550a, u550a, t550b, u550b	View
	FAIL	SQL Parameter Check	Database parameter DB_BLOCK_CHECKSUM is NOT set to recommended value	All Instances	View
	WARNING	SQL Check	There should be no reported block corruptions in V$DATABASE_BLOCK_CORRUPTIONS	t592	View
	WARNING	Database Check	Database parameter DB_BLOCK_CHECKING on PRIMARY is NOT set to the recommended value.	All Databases	View
	PASS	SQL Check	No reported block corruptions in V$DATABASE_BLOCK_CORRUPTIONS	t550, u550	View
	PASS	SQL Parameter Check	Database parameter DB_LOST_WRITE_PROTECT is set to recommended value	t592a, t592b	View
	PASS	OS Check	Shell limit soft nofile for DB is configured according to recommendation	All Database Servers	View

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- MAA review
- MAA Gap Analysis
- MAA Recommendations and Best Practices

Exachk has upgrade checks

Pre-Upgrade and Post-Upgrade to 11.2.0.3 check options available

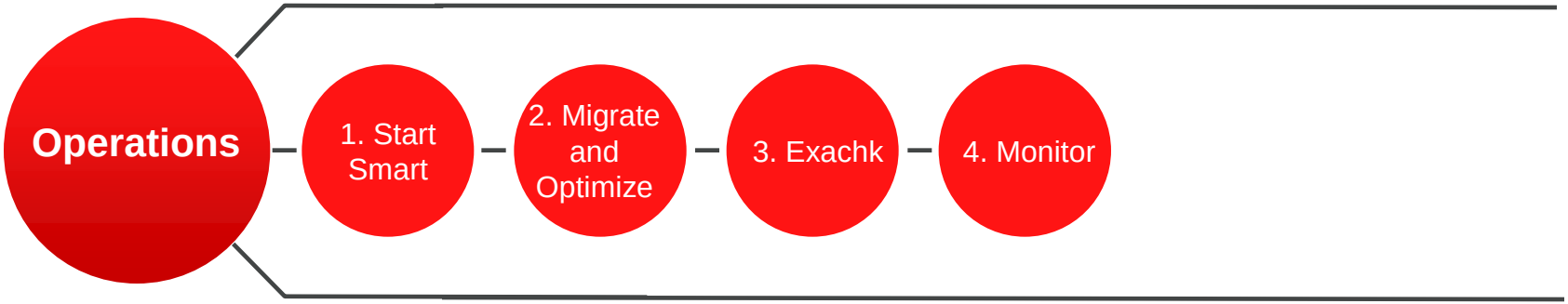
- Critical Pre and Post Upgrade checks
- Alerts and pointers to reference materials
- Same simple exachk format

Database Server

Status	Type	Message	Status On	Details
WARNING	OS Check	One or more UPGRADE ISSUES need attention. View details for more information	All Database Servers	View
INFO	OS Check	Capture performance baseline, backup important configuration files and batch, cron, DBMS_JOBS and DBMS_SCHEDULER jobs	All Database Servers	View
INFO	SQL Check	Prior to Upgrade Verify NO Materialized Views Being Refreshed (Automatically or Manually)	All Databases	View

Essential Exadata Operational Practices

Goal: Maximum Stability and Availability



4. Setup Real Time Monitoring and Alerting

Best Prevention, Detection and Proactive Repair Combination

1. Automatic Service Request
- HW failure alerts
- Service Request Creation

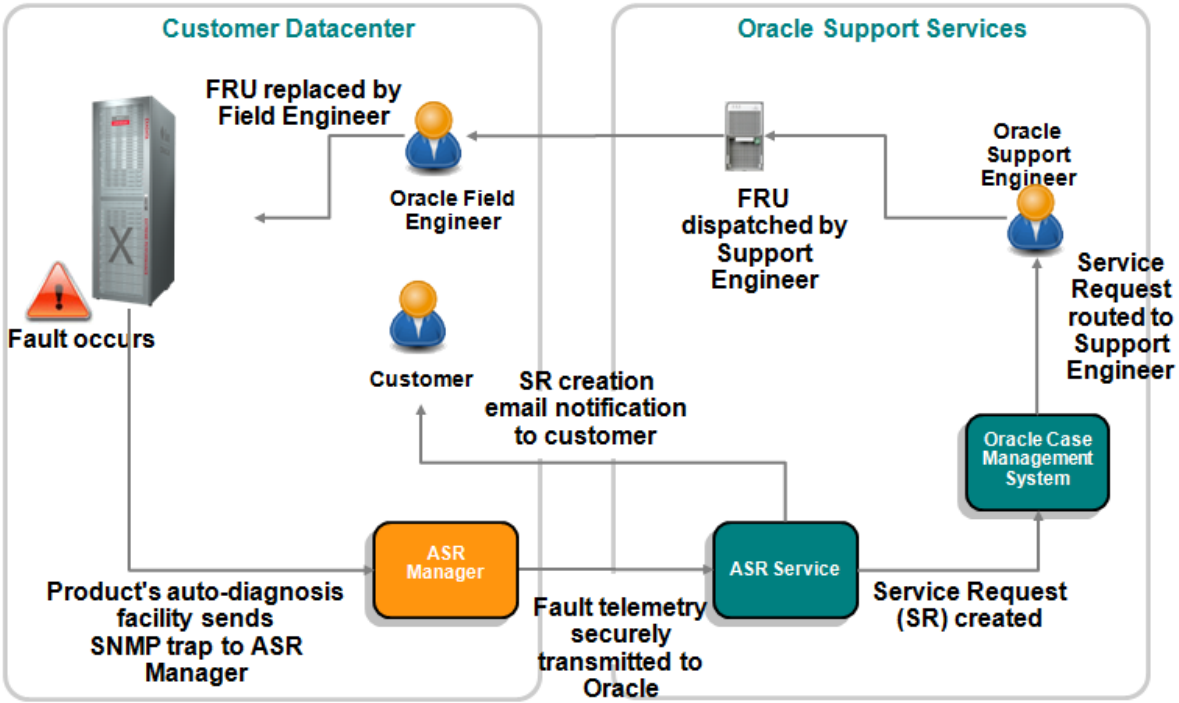
2. Oracle Configuration Manager
- Extract configuration changes
- Customized alerts and updates

3. Enterprise Manager 12c
- Real Time Monitoring
- Alerts and Troubleshooting

4. Oracle Platinum Services
- Monitoring
- Patching
- Restoration SLAs

Automatic Service Request (ASR)

Out-of-box Hardware Support



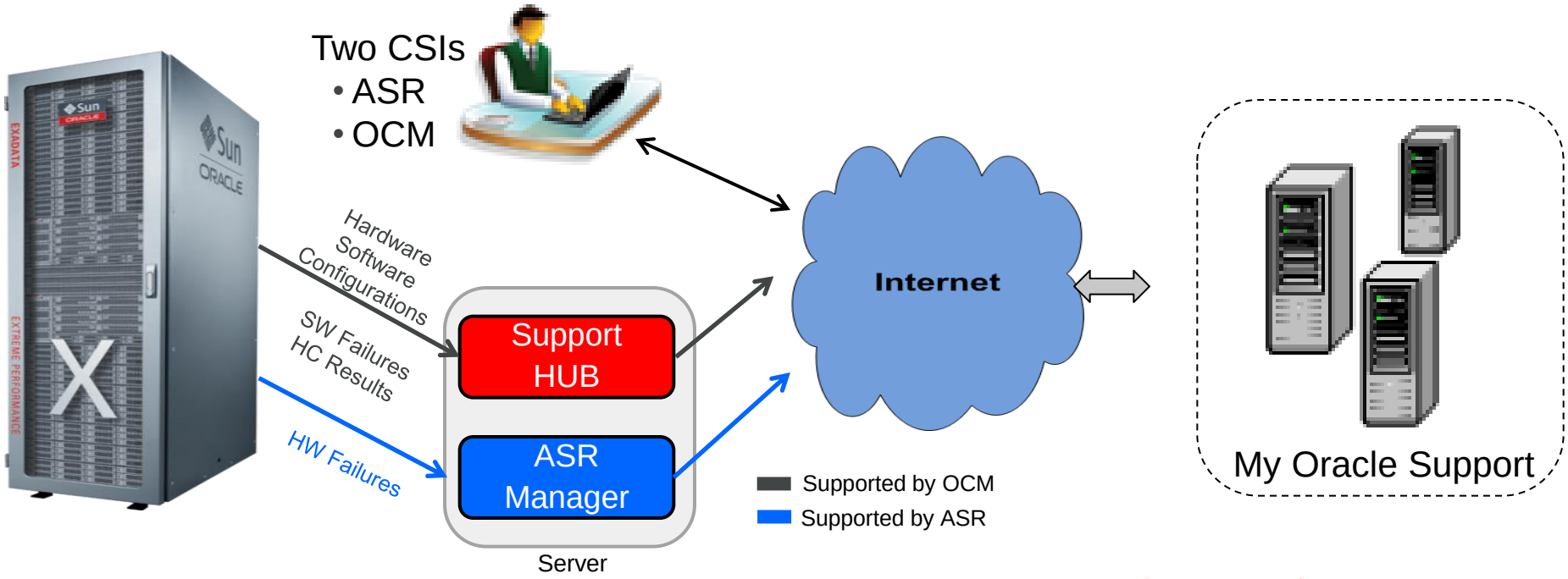
Comprehensive Fault Coverage

- CPU
- Disk controllers
- Disks
- Flash Cards
- Flash modules
- InfiniBand
- Memory
- System Board
- Power supplies
- Fans

Refer to My Oracle Support Note 1185493.1

Oracle Configuration Manager (OCM)

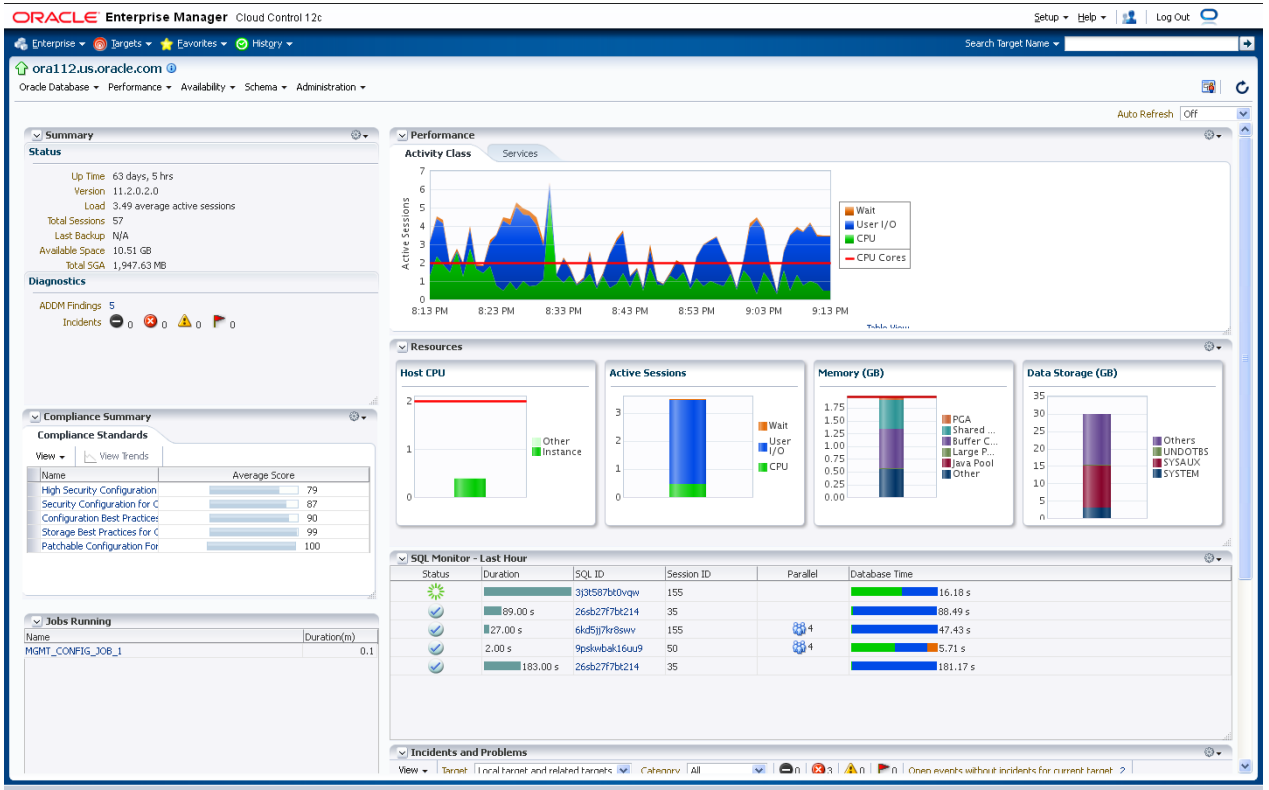
Out-of-Box Configuration Management



Refer to My Oracle Support Note1319476.1

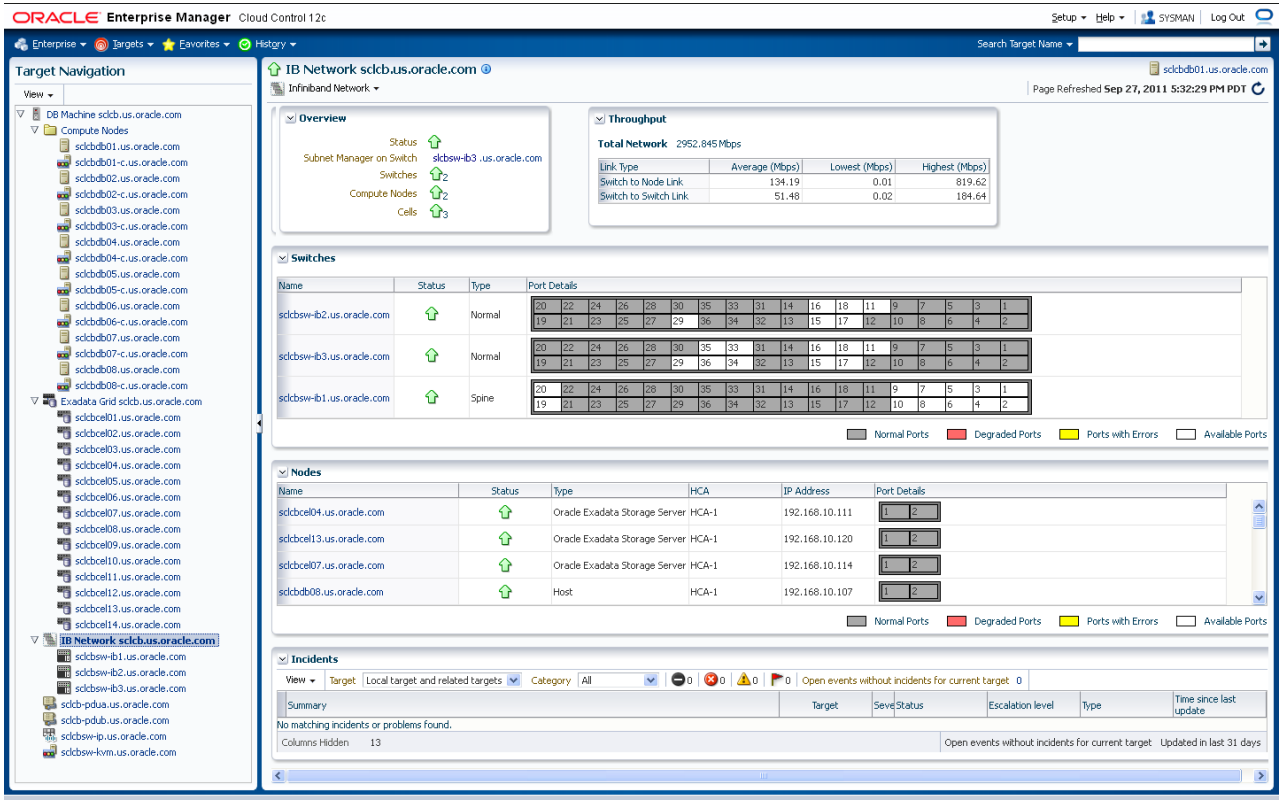
Exadata and Enterprise Manager 12c

Comprehensive monitoring and management for Exadata Database Machine



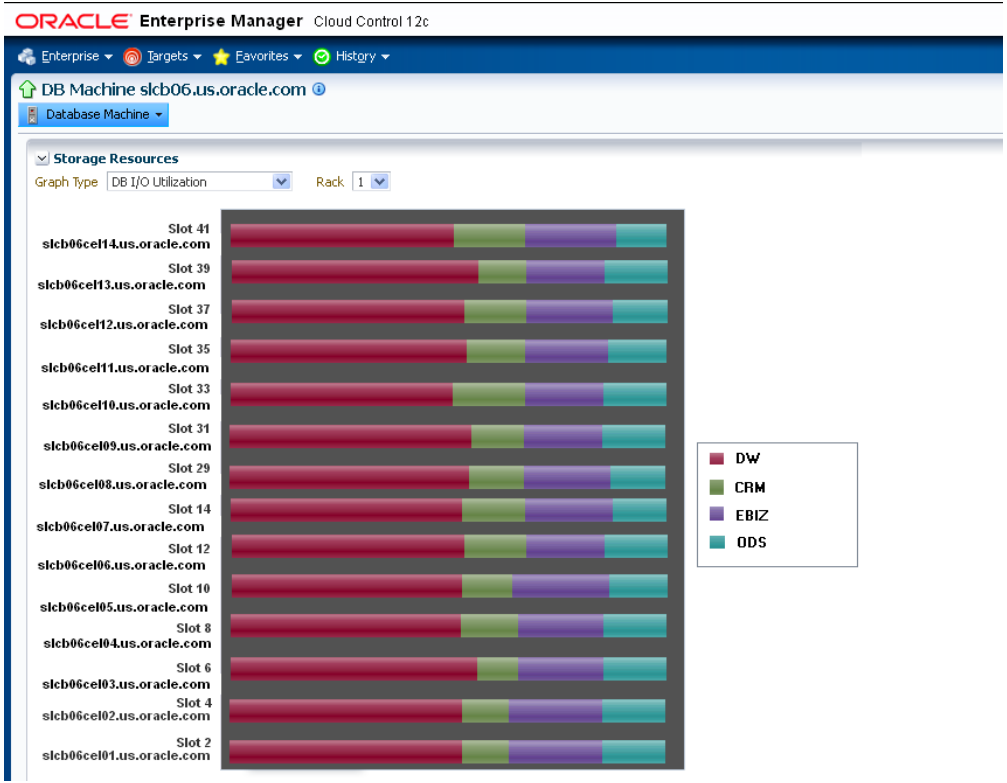
Enterprise Manager 12c

Monitor and manage individual system components



Enterprise Manager 12c

Monitor and manage system utilization by database in consolidated environments



Oracle Support for Exadata

ORACLE
PREMIER SUPPORT

Complete. Integrated. Proactive.

- **24/7 support**
- **Specialized Engineered Systems Support Team**
- **2-hour onsite response** to hardware issues[1]
- **New Updates and Upgrades for Database, Server, Storage, and OS software**
- **My Oracle Support** proactive support portal
- **"Phone home"** automated service requests (ASR)

ORACLE PLATINUM SERVICES

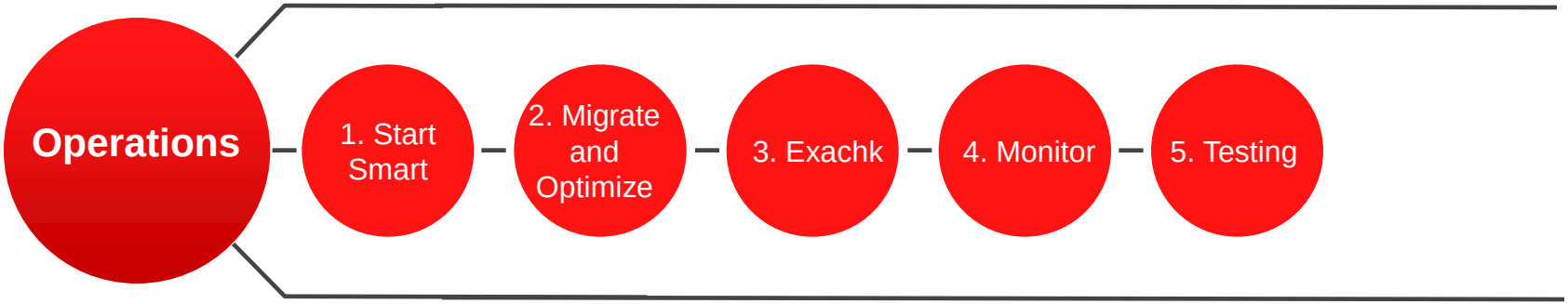
High Availability. No Additional Cost.

- **Higher support levels for the complete Oracle stack**
  - Includes higher support levels for Database software
- **Proactive remote monitoring for faults**
- **Industry leading service level response times:**
  - **5 Minute** Fault Notification
  - **15 Minute** Restoration or Escalation to Development
  - **30 Minute** Joint Debugging with Development
- **Oracle Engineers perform quarterly patching and updates**

Available for certified configurations on Exadata

Essential Exadata Operational Practices

Goal: Maximum Stability and Availability



5. Best Protection is a Strong Defense

Testing reduces risks and uncertainty

- Essential Test Requirements and Goals
  - Performance, HA and growth requirements understood
  - Every change needs to be tested and proven
  - Application functionality, behavior and impact understood
  - Repair and recovery needs to be validated
  - Backout plans desired
- Essential Test Resources
- Essential Test Approach

Essential Test Resources

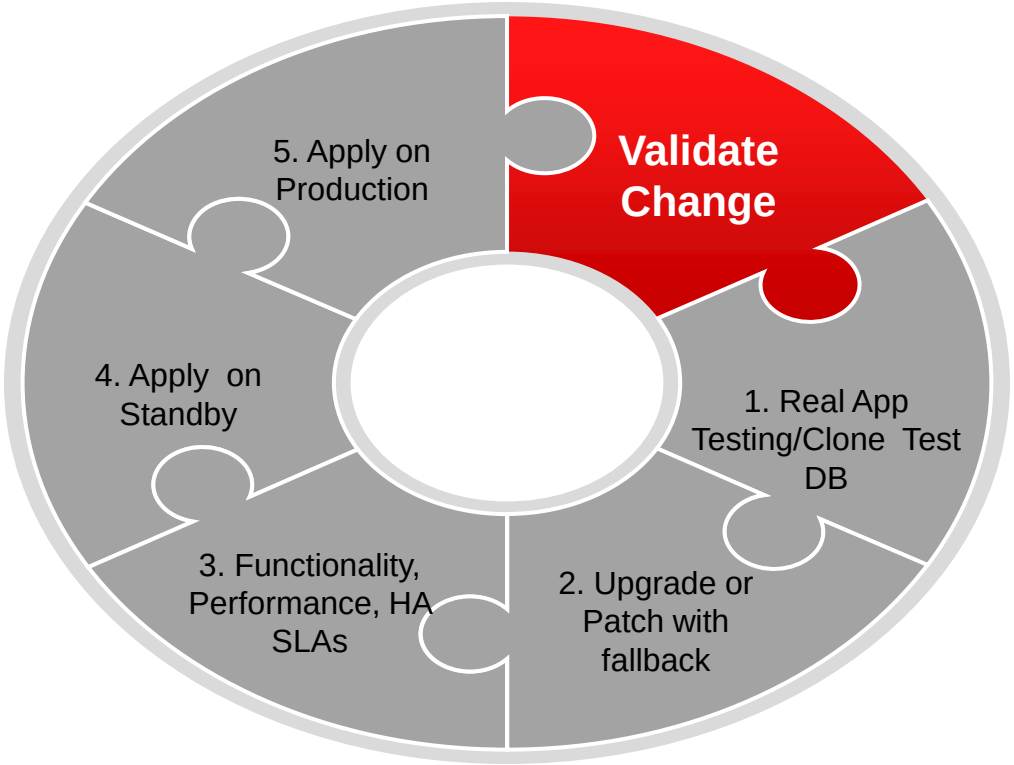
Best Practice – Deploy an Exadata Test System

- Dedicated system identical to production
- Full validation
- RMAN clone or Data Guard Snapshot Standby
- Real Application Testing

- Smaller Exadata system or Data Guard standby
- Partial validation
- RMAN clone or Data Guard Snapshot Standby
- Real Application Testing

- Non-Exadata System
- Patching and generic testing
- RMAN clone or Data Guard Snapshot Standby or ZFSSA snaps/clones (supports HCC)
- Real Application Testing

Essential Test Approach



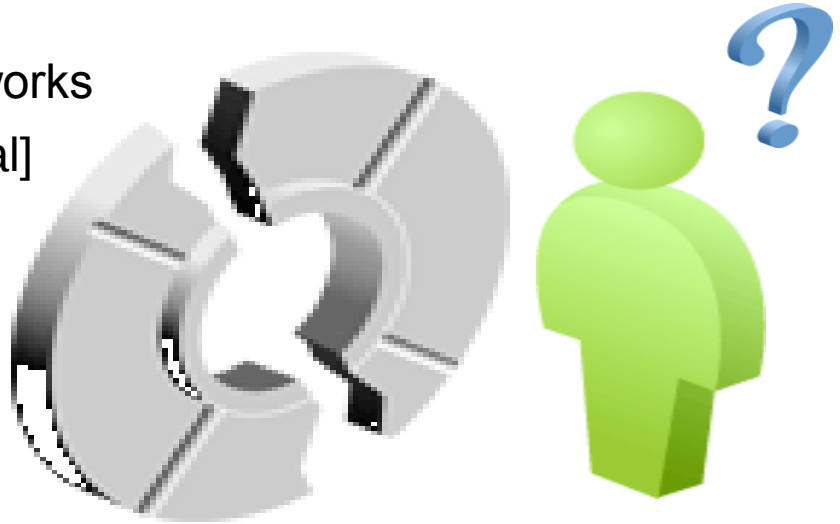
Test Plan
MOS 1262380.1

Standby-first
MOS 1265700.1

Validate and Automate HA practices

Know it Works

- Validate, automate, practice
  - Don’t wait for an outage to see if it works
  - RMAN backup validate [check logical]
- Use MAA outage matrix
  - Ensure application failover
  - Ensure restore/recovery
  - Ensure App and Data Guard role transition



http://www.oracle.com/technetwork/database/features/availability/exadata-maa-best-practices-155385.html
MAA Best Practices for Oracle Exadata Database Machine (technical white paper)

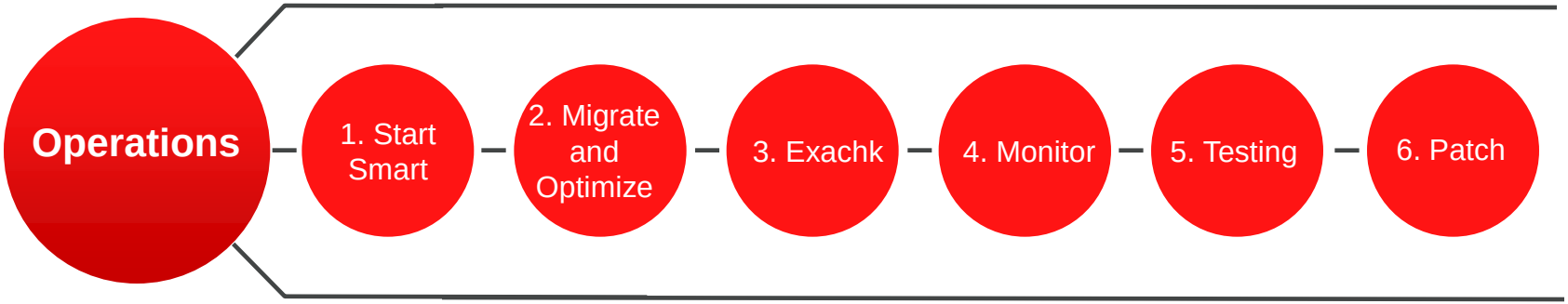
Data Guard required for maximum availability

Administrator must be ready and willing

- Execute Data Guard Role Transitions
  - Periodic full stack role transitions for planned and unplanned failures
  - Validate solution and eliminate unknown
  - Full readiness to leverage solution to maximize availability for any failure

Essential Exadata Operational Practices

Goal: Maximum Stability and Availability



6. Patching / Maintenance Best Practices

- Planning Guide - Support Note 1461240.1
  - Hardware / software, rolling and zero application downtime maintenance
- Software Patching - Support Note 888828.1
  - Minimal downtime: Data Guard database rolling upgrades
  - Zero downtime: Rolling patching for Database, Grid Infrastructure and Exadata Software
  - Zero downtime: GoldenGate Multi-master and Edition-Based Redefinition
- Critical Issues - Support Note 1270094.1
  - Timely notice, review monthly for insight into targeted upgrades
- Platinum Service
  - Quarterly software updates

Exadata Planned Maintenance Frequency

Schedule Updates for Stability: MOS 1461240.1

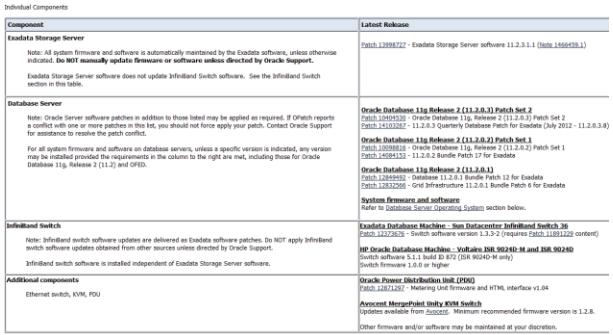
Frequency	Action	Application Downtime
3-6 months	Update Exadata Software (e.g. 11.2.2.4.2 to 11.2.3.1)	Zero downtime
	Update database quarterly database patch (QDPE)	Zero downtime
1-2 years	Update major database patch (e.g. 11.2.0.2 to 11.2.0.3)	Seconds to Minutes with Data Guard or GoldenGate
	Update infiniband switch software	Zero downtime
	Update additional components (if necessary)	Zero downtime
2 years	Replace battery in disk controllers of storage and database servers	Zero downtime
2-4 years	Update database major or maintenance release (e.g. 11.2 to 11.3 or 11 to 12)	Seconds to Minutes with Data Guard or GoldenGate
	Replace energy storage module in PCIe flash cards of storage servers	Zero downtime

Exadata Database Machine Software

Latest Patch/Release Information - MOS 888828.1

Latest Releases and Patching News

- New Exadata Storage Server release - Patch 14212264 - Exadata Storage Server software 11.2.3.2.0 (Note 1468877.1)
  Re-released OneCommand release - Patch 14617927 - Supports 11.2.0.3.10, 11.2.0.2 BP17. and Exadata X3 hardware
- New 11.2.0.3 Database release - Patch 14352236 - 11.2.0.3 Database Patch for Exadata Sep 2012 - 11.2.0.3.10
  - Patch 14103267 - 11.2.0.3 Quarterly Database Patch for Exadata (QDPE) Jul 2012 - 11.2.0.3.8 remains the recommended version for planned maintenance purposes.
- New 11.2.0.2 Database release - Patch 14084153 - 11.2.0.2 Bundle Patch 17 for Exadata
- New QFSDP release - Patch 14207418 - Quarterly Full Stack Download Patch (QFSDP) Jul 2012
- X2-8 Exadata Database Machine must use Oracle Linux on database servers.



Individual Components

Component	Latest Release
Exadata Storage Server Note: All system firmware and software is automatically maintained by the Exadata software, unless otherwise indicated. **Do NOT manually update firmware or software unless directed by Oracle Support.** Exadata Storage Server software does not update InfiniBand Switch software. See the InfiniBand Switch section in this table.	Patch 13998727 - Exadata Storage Server software 11.2.3.1.1 (Note 1466458.1)
Database Server Note: Oracle Server software patches in addition to those listed may be applied as required. If OPatch reports a conflict with one or more patches in this list, you should not force apply your patch. Contact Oracle Support for assistance to resolve the patch conflict. For all system firmware and software on database servers, unless a specific version is indicated, any version may be installed provided the requirements in the column to the right are met, including those for Oracle Database 11g, Release 2 (11.2) and OFED.	**Oracle Database 11g Release 2 (11.2.0.3) Patch Set 2** Patch 10404530 - Oracle Database 11g, Release 2 (11.2.0.3) Patch Set 2 Patch 14103267 - 11.2.0.3 Quarterly Database Patch for Exadata (July 2012 - 11.2.0.3.8) **Oracle Database 11g Release 2 (11.2.0.2) Patch Set 1** Patch 10098816 - Oracle Database 11g, Release 2 (11.2.0.2) Patch Set 1 Patch 14084153 - 11.2.0.2 Bundle Patch 17 for Exadata **Oracle Database 11g Release 2 (11.2.0.1)** Patch 12849492 - Database 11.2.0.1 Bundle Patch 12 for Exadata Patch 12832566 - Grid Infrastructure 11.2.0.1 Bundle Patch 6 for Exadata **System firmware and software** Refer to Database Server Operating System section below.
InfiniBand Switch Note: InfiniBand switch software updates are delivered as Exadata software patches. Do NOT apply InfiniBand switch software updates obtained from other sources unless directed by Oracle Support. InfiniBand switch software is installed independent of Exadata Storage Server software.	**Exadata Database Machine - Sun Datacenter InfiniBand Switch 36** Patch 12273676 - Switch software version 1.3.3-2 (requires Patch 11801229 content) **HP Oracle Database Machine - Voltaire ISR 9024D-M and ISR 9024D** Switch software 5.1.1 build ID 872 (ISR 9024D-M only) Switch firmware 1.0.0 or higher
Additional components Ethernet switch, KVM, PDU	**Oracle Power Distribution Unit (PDU)** Patch 12871287 - Metering Unit firmware and HTML interface v1.04 **Avocent MergePoint Unity KVM Switch** Updates available from Avocent. Minimum recommended firmware version is 1.2.8. Other firmware and/or software may be maintained at your discretion.

Supported releases per component on Exadata

Check for Relevant Critical Issues

Late Breaking Critical Issues - MOS 1270094.1

- Compare current versions with existing critical issues
  - InfiniBand Switch, Exadata Storage Server, Database Server
  - Check if relevant for your environment and application

InfiniBand Switch

#	Applies to	Issue	Fix or Workaround
IB3	Sun Datacenter InfiniBand Switch 36 software 1.3.3-1	Unpublished Bug 11682754 - A memory leak causes switches running for approximately 3 months to crash.	Fixed in Patch 12373676 - Switch software version 1.3.3-2

Exadata Storage Server

#	Applies to	Issue	Fix or Workaround
EX8	Exadata Storage Server 11.2.2.3.x to 11.2.2.4.1	Bug 13489445 - NTP service interruption can cause the system clock to drift backward which may cause the CELLSRV process to fail with error ORA-600 [ossmisc:ossmisc_timer_ticks]. If multiple cells are simultaneously affected, it may cause a database outage.	Fixed in Exadata Storage Server 11.2.2.4.2. All earlier releases apply Patch 13517481. See Document 13866 for details.

Database Server

#	Applies to	Issue	Fix or Workaround
DB14	Sun X4800 and X4800 M2 database servers (8-socket database servers on Exadata X2-8 systems) running Unbreakable Enterprise Kernel (UEK) 2.6.32-300.7.x (supplied with Exadata 11.2.3.1.x)	Bug 14054411 - Database may hang if it is configured to use Direct NFS with the /etc/mtab. See Document 1460787.1 for details.	Configure Direct NFS to use an oranfstab configuration file. Se Document 762374.1 for details.

Methods

Rolling versus Non-Rolling

	Rolling	Non-Rolling
Lowest Database Downtime	✓	
Lowest Installation Time		✓

- Patch Non-Rolling if maintenance window allows
- Patch Rolling during low workload
- Mix-and-match

Storage Server Rolling Patching

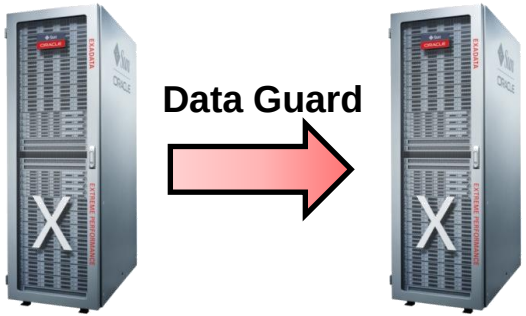
- Reduce disk failure risk w/ high redundancy (or DG)

Database Server Rolling Patching

- Use Automatic Workload Management

Reduce Risk and Downtime with Data Guard

- Reduce Planned Maintenance Risk and Downtime with **Data Guard**
  - Upgrade standby system and switchover



No Dependency between Primary and Standby (Upgrade with no impact to Primary)

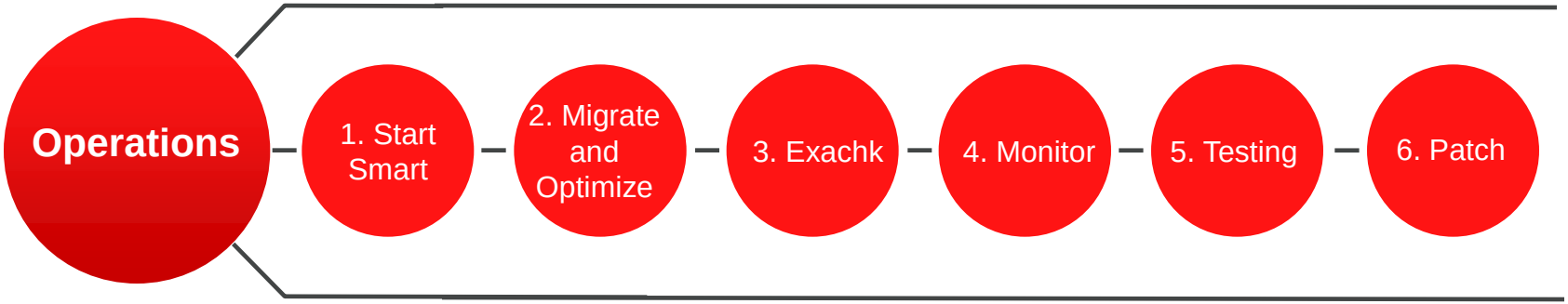
- Exadata Storage Server software
- InfiniBand Switch software
- Database Server Exadata OS and firmware
- Database Server Grid Infrastructure home

Dependent Components

- Database Server Database home (MOS 1265700.1)
  - Data Guard Standby-First Installable qualified patches only

Essential Exadata Operational Practices

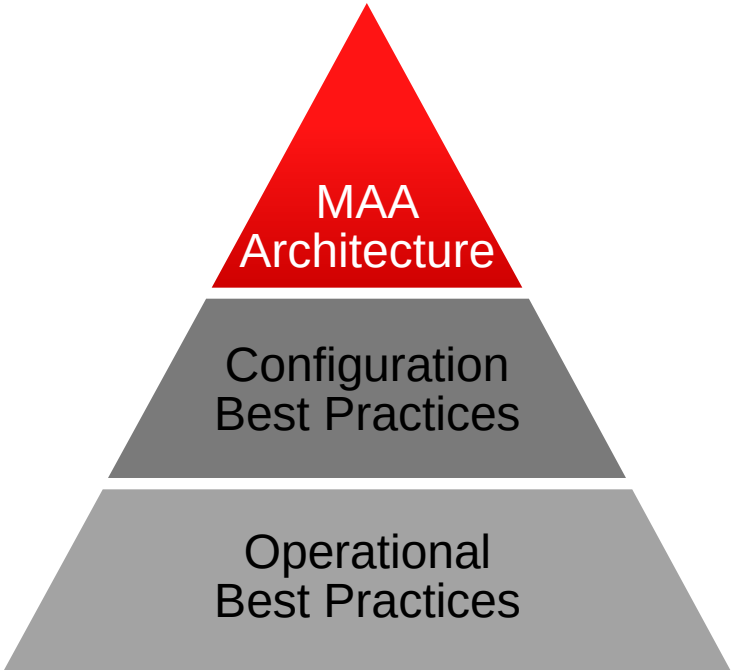
Goal: Maximum Stability and Availability



Conclusion & Resources

Building Blocks of MAA

Architecture, Configuration and Operational Practices = Maximize Availability



- Architecture – Enabler
- Configuration – Best Settings

- Operations –Maintenance for Stability and Availability

Resources

- **OTN HA Portal:**
  http://www.oracle.com/goto/availability
- **Maximum Availability Architecture (MAA):**
  http://www.oracle.com/goto/maa
- **MAA Blogs:**
  http://blogs.oracle.com/maa
- **Exadata on OTN:**
  http://www.oracle.com/technetwork/database/exadata/index.html
- **Oracle HA Customer Success Stories on OTN:**
  http://www.oracle.com/technetwork/database/features/ha-casestudies-098033.html

Key HA Sessions and Demos by Oracle Development

Monday, 1 October – Moscone South

12:30p Oracle Data Guard Zero-Data-Loss Protection at Any Distance, 300
12:30p Future of Exadata: OLTP, Warehousing, and Consolidation, 104
1:45p Automating ILM with the Latest Database Technology, 300
1:45p Extracting Data in Oracle GoldenGate Integrated Capture Mode, 102
3:15p Maximize Availability with the Latest Database Technology, 303
3:15p Maximize Enterprise Availability with the Latest DB Technology, 303
4:45p Mission-Critical Oracle Exadata OLTP Deployment at PayPal, 300
4:45p Temporal Database Capabilities with the Latest DB Technology, 300

Tuesday, 2 October – Moscone South

10:15a Database Tables to Storage Bits: Data Protection Best Practices, 300
10:15a GoldenGate & Data Guard: Working Together Seamlessly, 305
11:45a Active Data Guard Zero-Downtime Database Maintenance, 300
11:45a Using Automatic Storage Mgmt with the Latest DB Technology, 301
1:15p The Four Ts of RMAN: Tips, Tuning, Troubleshooting, and … ?, 102
5:00p Maximum Availability Architecture Best Practices for Exadata, 303

Wednesday, 3 October – Moscone South

10:15a Operational Best Practices for Oracle Exadata, 102
10:15a Maximize Availability by Minimizing Disruption for End Users and Application, 301
11:45a What's New in the Latest Generation of Oracle RAC, 301
11:45a Best Practices for HA w/ GoldenGate on Oracle Exadata, 102
1:15p Oracle Secure Backup: Integration Best Practices with Engineered Systems, 300
1:15p Application MAA Best Practices on Oracle Private Clouds, 200
5:00p Tuning &Troubleshooting Oracle GoldenGate on Oracle, 102

Thursday, 4 October – Moscone South

11:15a Integrate Your Globally Distributed Databases for Key Cloud Computing Benefits, 300
12:45p Backup and Recovery of Oracle Exadata: Experiences and Best Practices, 300

Demos – Mon 10:00a-6:00p - Tue 9:45a-6:00p - Wed 9:45a-4:00p

Oracle Maximum Availability Architecture, S-011
GoldenGate 11*g*R2: Real-Time, Transactional DB Replication, S-027
Oracle Database 12*c:* Global Data Services, S-010
Oracle Database 12c Application Continuity - S-009
Oracle Secure Backup, S-014
Oracle Active Data Guard, S-007
Oracle Recovery Manager and Oracle Flashback Technologies, S-019
Oracle Real Application Clusters and Oracle RAC One Node - S-008
Oracle Database 12c Xstream, Streams, Advanced Queing, S-018

After OpenWorld, visit ***oracle.com/goto/availability***

Hardware and Software
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APPENDIX

Essential MAA collateral

- Exadata MAA OTN website

- Essential My Oracle Support (MOS) Notes

Exadata Best Practices

Extensive Resource Library (search Exadata MAA)

MAA Best Practices - Exadata Database Machine

- MAA Best Practices for Oracle Exadata Database Machine (technical white paper)
- Best Practices For Database Consolidation On Oracle Exadata Database Machine
- Oracle Enterprise Manager 12c: Oracle Exadata Discovery Cookbook
- Oracle Exadata Database Machine Consolidation: Segregating Databases and Roles
- Oracle University MAA Best Practices Series (recorded presentations)
- Backup and Recovery Performance and Best Practices for Exadata Database Machine - Oracle Database 11.2.0.2
- Backup and Recovery Performance and Best Practices using Sun ZFS Storage Appliance with Oracle Exadata Database Machine *New!*
- Oracle Exadata Database Machine - Backup & Recovery Sizing: Tape Backups
- Backup and Recovery Performance and Best Practices for Exadata Database Machine - Oracle Database 11.2.0.1 and prior
- Monitoring Exadata Database Machine Using Enterprise Manager and Plugins - Oracle Support Note 1110675.1
- Oracle Data Guard: Disaster Recovery Best Practices for Exadata Database Machine
- Oracle GoldenGate on Exadata Database Machine
- Best Practices for Migrating to Exadata Database Machine *Updated!*
- PeopleSoft on Exadata
- Siebel on Exadata
- Oracle E-Business Suite on Exadata
- Migrating Oracle E-Business Suite to Exadata Database Machine Using Oracle Data Pump
- Migrating Oracle E-Business Suite to Exadata Database Machine Using Transportable Tablespaces
- Installing Oracle E-Business Suite Release 12 with Exadata Database Machine

- MAA Overall
- Consolidation
- MAA Videos
- Backup/Recovery
- Monitoring
- Data Guard/DR
- GoldenGate
- Migration
- PeopleSoft
- Siebel
- E-Business Suite

Exadata and MAA Best Practices

Exadata and MAA documentation and My Oracle Support Notes (MOS)

Exadata Database Machine Owner's Documentation
Exadata Storage Server Software User's Documentation
Best Practices for Migrating to Exadata Database Machine (MAA OTN)
MAA Best Practices for Oracle Exadata Database Machine (MAA OTN)
Oracle Enterprise Manager 12c: Oracle Exadata Discovery Cookbook
Best Practices For Database Consolidation On Oracle Exadata Database Machine
Oracle Database 11g Release 2 High Availability Documentation and Best Practices
Reduce Transportable Tablespace Downtime using Cross Platform Incremental Backups (MOS 1389592.1)

Exadata and MAA Best Practices

Exadata Operational Best Practices My Oracle Support Notes (MOS)

Information Center: Oracle Exadata Database Machine (MOS 1187674.1)
Exadata Best Practices (MOS 757552.1)
HealthCheck or Exachk (MOS 1070954.1)
Recommended EM12c Monitoring/ASR (MOS 1110675.1 and 330072.1)
Oracle Configuration Management (MOS 1185493.1)
Exadata Software and Hardware Maintenance Guide (MOS 1461240.1)
Exadata Recommended Software (MOS 888828.1)
Exadata Critical Issues Updates (MOS 1270094.1)
Testing and Patching (MOS 1262380.1)
Exadata Diagnostics and Data Gathering (MOS 201804.1, 1353073.1, 1059805.1)
11.2.0.3 Database Upgrade on Exadata (MOS 1373255.1)

Exadata and MAA Best Practices

Exadata Resource Management and MAA MOS Notes

Master Note for Oracle Database Resource Manager (MOS1339769.1)

Corruption Prevention and Repair (MOS 1302539.1)
Flashback Best Practices (MOS 565535.1)
Data Guard Standby-First Apply (MOS 1265700.1)
Schema Recovery in Exadata (MOS 1386048.1)
Instantiating or Duplicating a Database on Exadata (MOS 1206603.1)
Data Guard Transport on Exadata (MOS 960510.1)