Exadata Software Maintenance

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Exadata and MAA Best Practices, Oracle Development
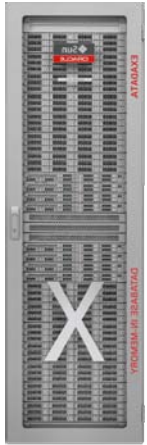November, 2015

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Patching and Upgrading Oracle Exadata

1 ▶ Software Architecture Overview

2 ▶ Software Maintenance Planning
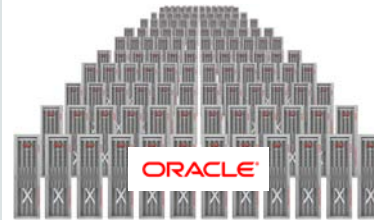
3 ▶ Updating Exadata Software

Patching and Upgrading Oracle Exadata

1 Software Architecture Overview

2 Software Maintenance Planning

3 Updating Exadata Software

Q: Why Exadata? A: Engineered Systems Value

Oracle Engineered Systems are the only fully tested full-stack configuration

Exadata Community Effect

Oracle Public Cloud
Oracle Development & Support
1000s of Customer and Partners

100%

Simplified Maintenance

Full Stack Patching
Full Stack Health Checks

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PLATINUM SERVICES

Platinum Services

Oracle engineers perform remote patch installation at no additional cost

Exadata Database Machine

Software Architecture Review (Bare Metal / Physical)

Database Grid

- Oracle Database and Grid Infrastructure
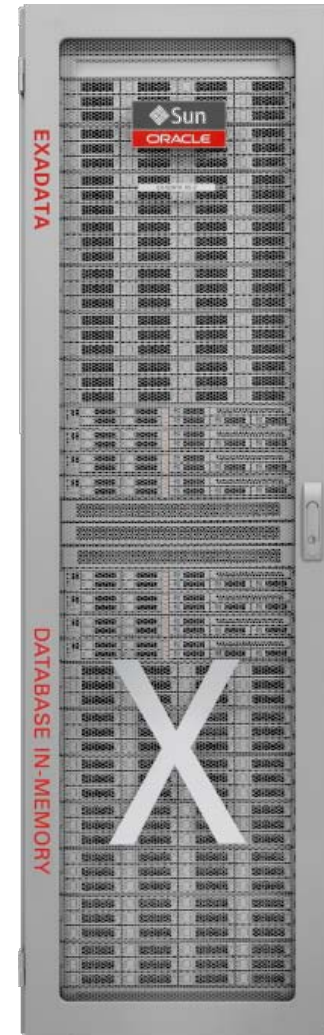- Exadata (firmware, Linux, Exadata)

Storage Grid

- Exadata (firmware, Linux, Exadata)

Networking

- Exadata (InfiniBand switch software)

Other: Ethernet switch, PDU

Software Architecture Comparison

Database Server: Bare Metal / Physical versus OVM

Bare Metal / Physical Database Server

Oracle GI/DB homes

Exadata (Linux, fw)

OVM Database Server

dom0

Exadata (Linux, Xen, fw)

domU-1

Oracle GI/DB homes

Exadata (Linux)

domU-2

/DB

nux)

domU-3

/DB

nux)

No change to **Storage Grid**, **Networking**, or **Other**

Patching and Upgrading Oracle Exadata

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2 ▸ Software Maintenance Planning

3 ▸ Updating Exadata Software

Exachk for Planning Software Maintenance

Automated Exadata Health Check – MOS 1070954.1

Simplify software planning

1. **Version recommendations**

2. **Critical Issue exposure report**

Oracle Exadata Assessment Report
Table of Contents

- Findings Needing Attention
  - On Database Server
  - On Storage Server
  - On InfiniBand Switch
  - Cluster Wide
- Maximum Availability Architecture (MAA) Scorecard
- Infrastructure Software and Configuration Summary
- Findings needing further review
- Platinum Certification
- Findings Passed
  - On Database Server
  - On Storage Server
  - On InfiniBand Switch
  - Cluster Wide
- Systemwide Automatic Service Request (ASR) healthchec
- Skipped Checks
- Top 10 Time Consuming Checks
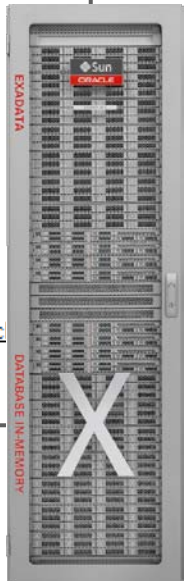
Exachk Critical Issue Exposure Report

Maximum Availability Architecture (MAA) Scorecard

FAIL	Patch Check	System is exposed to Exadata Critical Issue DB20	All Homes	View
FAIL	Patch Check	System is exposed to Exadata Critical Issue DB31	All Homes	View
FAIL	Patch Check	System is exposed to Exadata Critical Issue DB20	All Homes	View

★ **Exadata Critical Issues (Doc ID 1270094.1)**

DB31	ASM 12.1.0.2	Bug 21281532 - ASM rebalance interrupted with errors ORA-600 [kfdAtbUpdate_11_02] and ORA-600 [kfdAtUnlock00].	Fixed in 12.1.0.2.11. See Document 2031709.1 for additional details.

Late-breaking issues - MOS Alerts for Hot Topics

Exachk Version Recommendation

Component		Host/Location	Found version	Recommended versions	Status
DATABASE SERVER	Database Home	dm01db01,dm01db02: /u01/.../11.2.0.3/dbhome_1	11.2.0.3.28	11.2.0.3.28	**11.2.0.3 Error Correction Support ended Aug 2015.**
		dm01db01,dm01db02: /u01/.../11.2.0.4/dbhome_1	11.2.0.4.10	11.2.0.4.20	**11.2.0.4 BP is older than recommended.**
		dm01db01,dm01db02: /u01/.../12.1.0.2/dbhome_1	12.1.0.2.7	12.1.0.2.13	**Version within recommended range.**
	Grid Infrastructure	dm01db01,dm01db02: /u01/app/12.1.0.2/grid	12.1.0.2.7	12.1.0.2.13	**Version within recommended range.**
	Exadata	dm01db01,dm01db02	12.1.2.1.2	12.1.2.1.3	**Version within recommended range.**
STORAGE SERVER	Exadata	dm01cel01,dm01cel02	12.1.2.1.2	12.1.2.1.3	**Version within recommended range.**
		dm01cel03	11.2.3.3.1	12.1.2.1.3	**Older than recommended version. Exception: Version is different from peers.**
IB SWITCH	Firmware	dm01sw-iba0,dm01sw-ibb0	2.1.6-2	2.1.3-4 or higher	**Version within recommended range.**

Software Maintenance

Recommended Update Schedule

Frequency	Database / Grid Infrastructure	Exadata
3-12 months	Quarterly Update	Quarterly Update
1-2 years	Patch Set	New Release
2-4 years	New Release	

Patching End Date	11.2.0.3	11.2.0.4	12.1.0.1	12.1.0.2
	2015-Aug	**2020-Dec**	2016-Aug	?

All software for Exadata
MOS 888828.1

Responses to **security scan** findings
MOS 1405320.1

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Zero Downtime Software Maintenance

Rolling Software Update Support

Component to Update	Rolling Update
Database / Grid Infrastructure	Yes
Exadata Database Server	Yes
Exadata Storage Server	Yes
Exadata InfiniBand switch	Yes

Mitigate impact and risk

– Automatic client failover

– ASM high redundancy

– Out-of-place apply

– Test system

– Data Guard

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Reduce Risk and Downtime with Data Guard

Data Guard Standby First Patching (MOS 1265700.1)

Data Guard

Site A - **Primary**

Site B - **Standby**

Standby First Patching Steps

1. Update software on Standby

2. Test new software

3. Switchover

4. Update software on Standby

5. Run SQL portion of BP on Primary

Data Guard Standby First Patching

Site A - **Primary**

Site B - **Standby**

Data Guard

DB Dictionary
GI/DB Home
Exa Dbnode
Exa Storage
Exa Switches

Standby First Patching Steps

1. **Update software on Standby**

2. **Test new software**

3. Switchover

4. Update software on Standby

5. Run SQL portion of BP on Primary

Data Guard Standby First Patching

Data Guard

DB Dictionary

GI/DB Home

Exa Dbnode

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Exa Switches

Site A - **Standby**

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Standby First Patching Steps

1. Update software on Standby

2. Test new software

3. **Switchover**

4. Update software on Standby
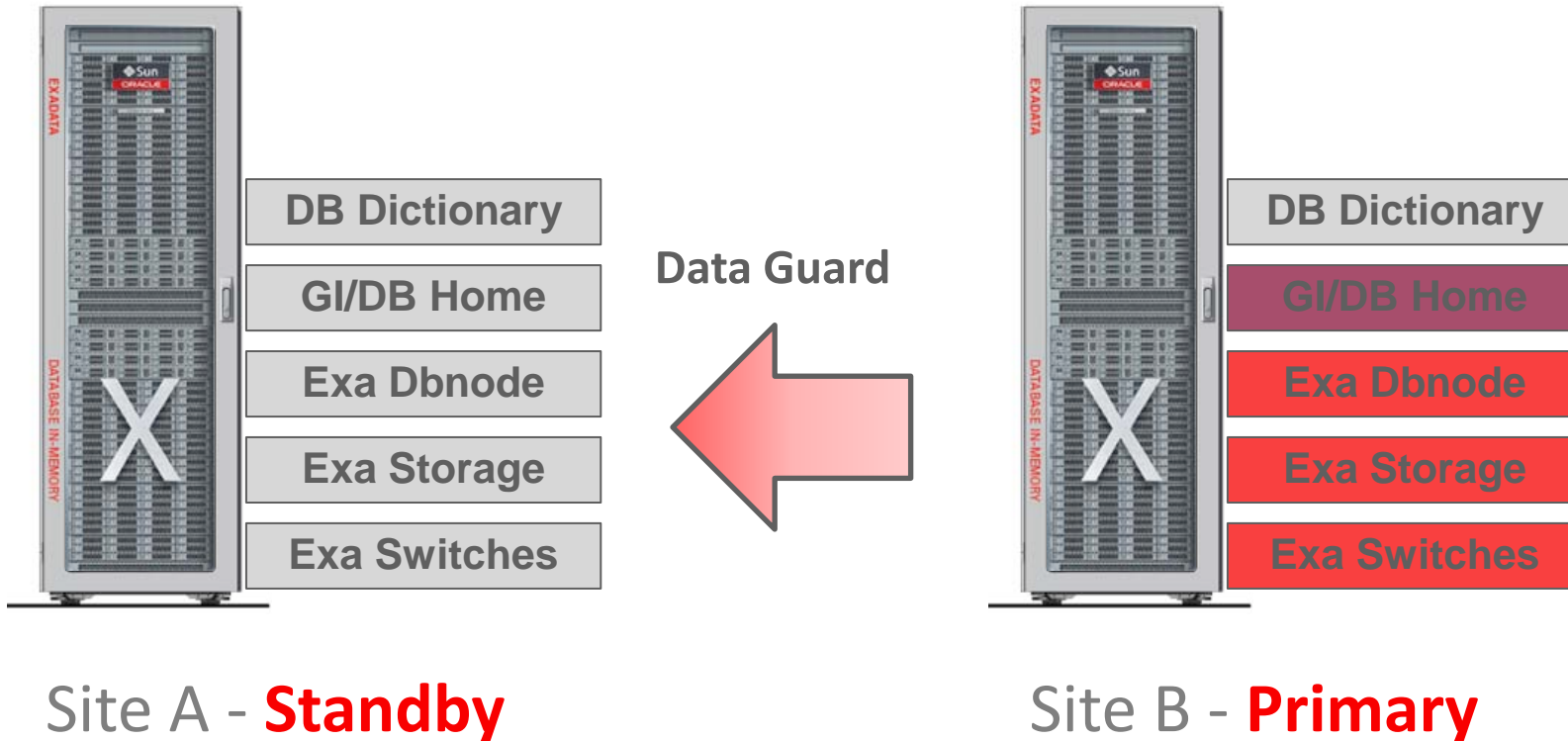
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Data Guard Standby First Patching

DB Dictionary

GI/DB Home

Exa Dbnode

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Exa Switches

Data Guard

DB Dictionary

GI/DB Home

Exa Dbnode

Exa Storage

Exa Switches

Site A - **Standby**

Site B - **Primary**

Standby First Patching Steps

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5. Run SQL portion of BP on Primary
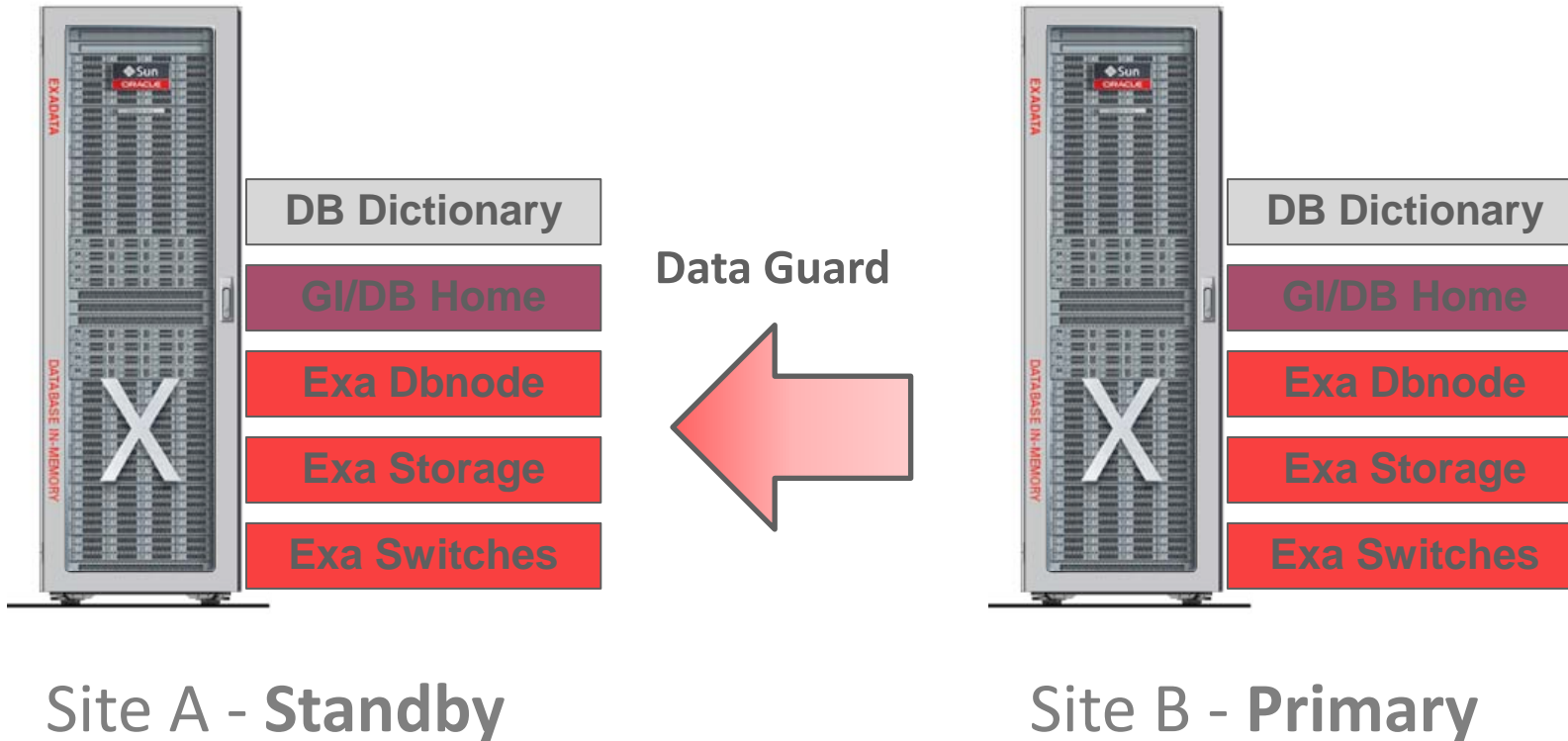
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Data Guard Standby First Patching

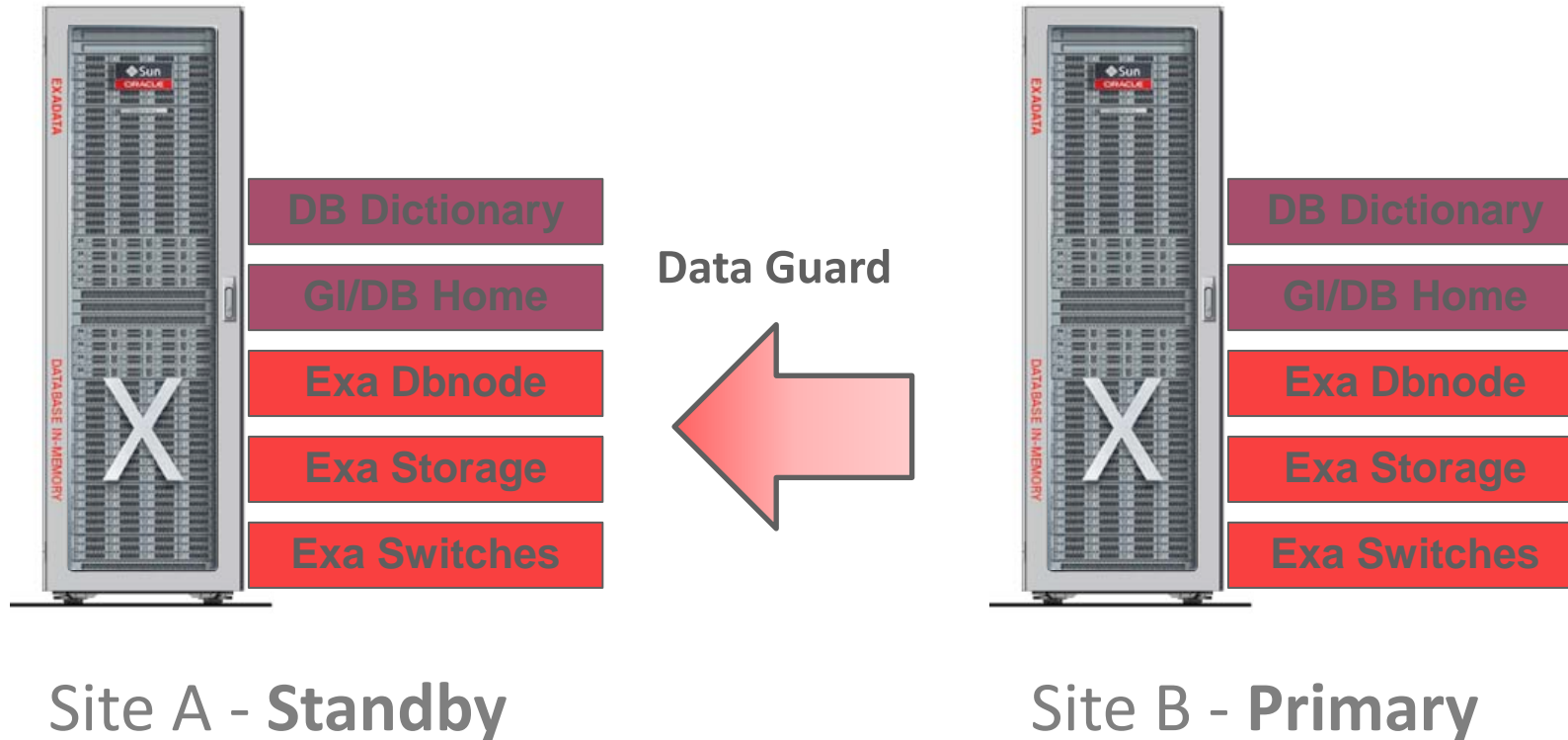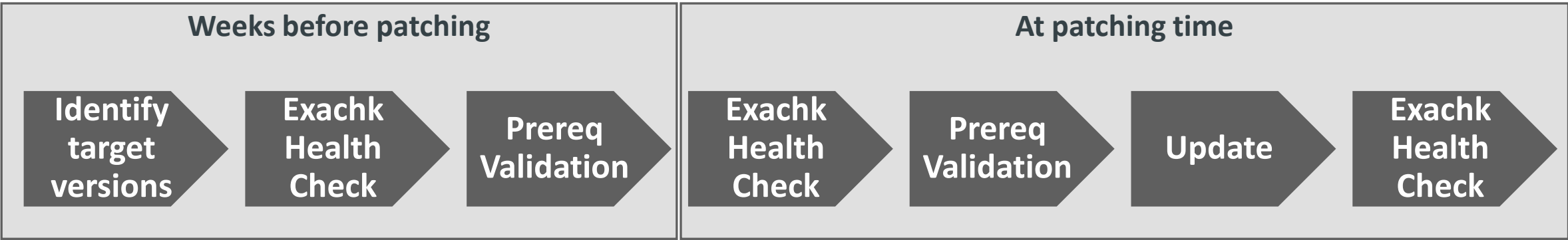**Data Guard**

Site A - **Standby**

Site B - **Primary**

Standby First Patching Steps

1. Update software on Standby

2. Test new software

3. Switchover

4. Update software on Standby

5. **Run SQL portion of BP on Primary**

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High Level Software Maintenance Flow

Weeks before patching			At patching time			
Identify target versions →	Exachk Health Check →	Prereq Validation →	Exachk Health Check →	Prereq Validation →	Update →	Exachk Health Check →

Inputs
- Exachk
- Issue resolution
- Application compatibility

Applies to
- **Oracle Database and Grid Infrastructure**
- **Exadata for Database Grid, Storage Grid, and Networking**

Grid Infrastructure and Database Software

- Tools and Methods the same as non-Exadata systems

Tools	Methods
OPatch / Opatchauto Oplan OUI, DBUA, ASMCA Enterprise Manager	Rolling or Non-Rolling Out-of-Place or In-Place

- Exadata-specific Quarterly Updates
  - Superset of generic PSU
    (**Do not use generic PSU** on Exadata)
  - Permitted on non-Exadata systems only when supporting Exadata system (DR, test)

Exadata Database Server

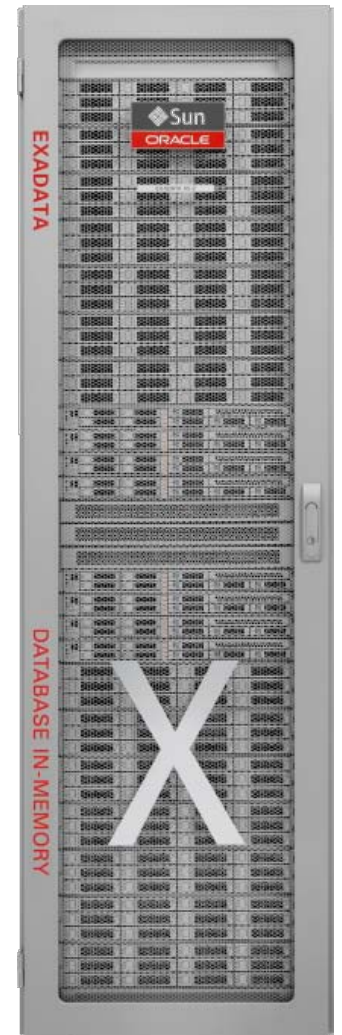## Simple dbnode upgrade steps

1. Exachk Health Check

2. Prereq validation

   ```
   # patchmgr -dbnode -dbnode_precheck
   ```

3. Update database servers

   ```
   # patchmgr -dbnode -dbnode_upgrade [-rolling]
   ```

Database Server - Standard vs. Custom Configuration

- **Standard Configuration**
  - Best practice configuration to run Oracle Database and Grid Infrastructure
  - Minimal by design
  - Full pre-release testing coverage
    - **Predictable, low risk update**

Exadata Standard Configuration for Database Server	
Software	Exact list of Oracle Linux packages and their versions, and firmware versions
Configuration	Best practice configuration (e.g. sysctl, network, ssh, pam, modules, drivers, etc.)
Disk	RAID, Logical volume (LVM), and file system configuration

- **Custom Configuration**
  - Customer-specific changes made to database servers <u>after</u> deployment
    - Allowed (sometimes required for given environment), but resist, test, track, and automate
  - Limited / minimal pre-release testing coverage
  - Increases admin cost and risk

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Database Server Custom Configuration

Customization Examples and Impact to Update

	Impact to Update	
	Regular Upd.	OL5 ➜ OL6
Exadata Standard Configuration (i.e. not customized)	**None**	**None**
Using all free space in VGExaDb	Low	Low
Customized file system – different mount points	Low	Low
Updating packages shipped with the current Exadata Image	Low	Low
Installation of additional (non-Exadata) rpm packages	Low	High
Customizing configuration files, removing / changing basic O.S. functionality	Medium	High
Installation of additional (non-Exadata) non-rpm packages	Medium	High
Setting up interactive shell profile / menus	High	High
Changing LVM layout	High	High

Database Server Upgrade Keys to Success

Database Server Software Maintenance Rules

- **Customization allowed, but resist**

- **Test** previous configuration **changes** to avoid latent patching failures

- Closely track customizations, automate build-up and teardown

- Qualify maintenance readiness - Upgrade only when **exachk and prereq check are clean**

- Always **use latest patching tools** (Doc ID 1553103.1)

Exadata Storage Server

Simple cell upgrade steps

1. Exachk Health Check

2. Prereq validation

   ```
   # patchmgr -cells -patch_check_prereq
   ```
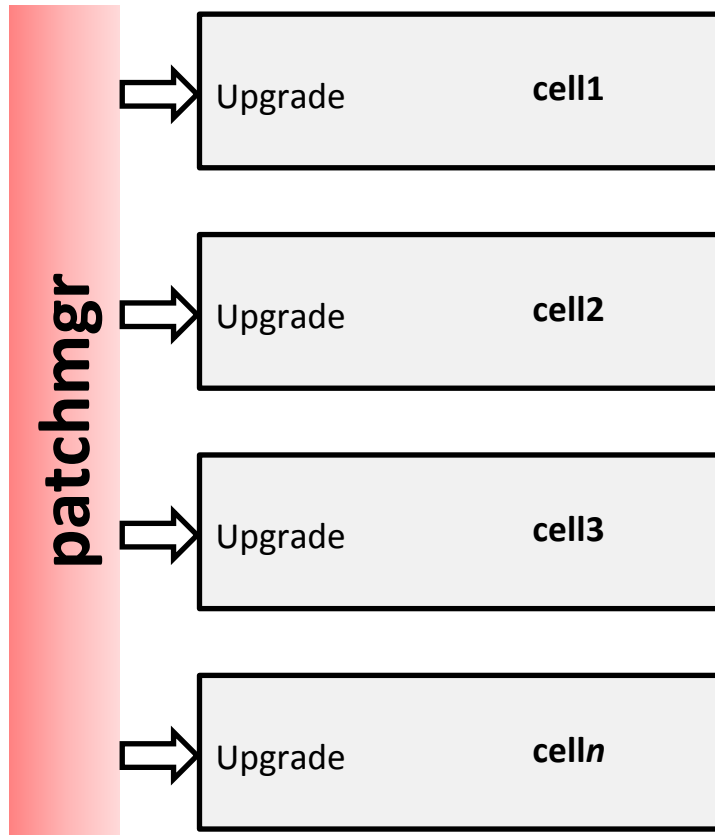
3. Update all storage servers

   ```
   # patchmgr -cells -patch [-rolling]
   ```

Storage Server Upgrade

Non-Rolling and Rolling

patchmgr

Upgrade	**cell1**

Upgrade	**cell2**

Upgrade	**cell3**

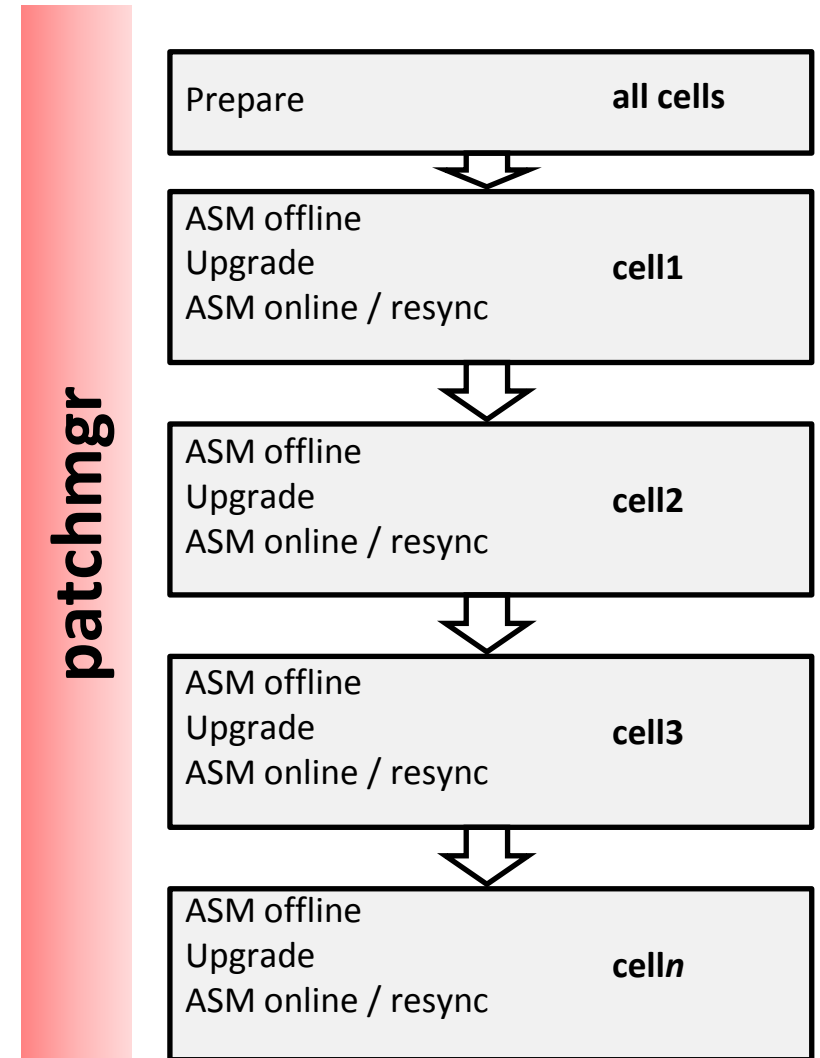| Upgrade	**cell*n***

Non-Rolling

- Databases down
- All cells upgraded in parallel

Rolling

- Databases up
- One cell upgraded at a time
- patchmgr manages ASM offline / online

patchmgr

Prepare	**all cells**

ASM offline Upgrade ASM online / resync	**cell1**

ASM offline Upgrade ASM online / resync	**cell2**

ASM offline Upgrade ASM online / resync	**cell3**

ASM offline Upgrade ASM online / resync	**cell*n***

Storage Server Upgrade Monitoring

Patchmgr Progress Email Notification

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Patchmgr: Patch State of cell05 Changed from Waiting to Patching
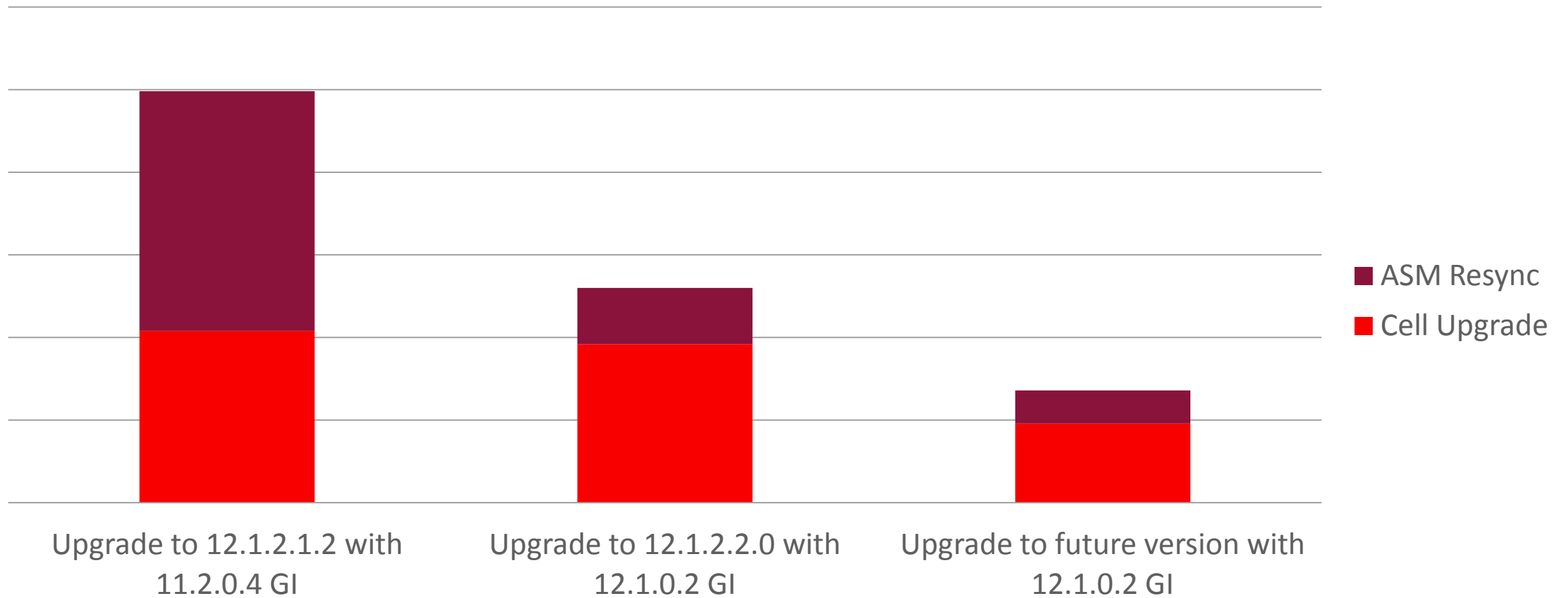
Event Time 2015-09-01 11:35:08-0700

Description Patch state of cell05 changed from Waiting to Patching.
Patchmgr launched from db03 is performing rolling patch on following cell(s).
1 out of 3 cell(s) completed.

Cell	Patch State	From Version	To Version	Time
cell04	Succeeded	11.2.3.3.1.140708	12.1.2.1.2.150617.1	2015-09-01 11:35:08-0700
cell05	**Patching**	**11.2.3.3.1.140708**	**12.1.2.1.2.150617.1**	**2015-09-01 11:35:08-0700**
cell06	Waiting	11.2.3.3.1.140708	12.1.2.1.2.150617.1	2015-09-01 10:08:42-0700

Recommended Action No action is needed.

Storage Server Rolling Upgrade Time Improvement

Legend:
- ASM Resync
- Cell Upgrade

Categories:
- Upgrade to 12.1.2.1.2 with 11.2.0.4 GI
- Upgrade to 12.1.2.2.0 with 12.1.0.2 GI
- Upgrade to future version with 12.1.0.2 GI

Storage Server Upgrade Keys to Success

Storage Server Software Maintenance Rules

- Do NOT make **unsupported** configuration changes

- Qualify maintenance readiness - Upgrade only when **exachk is clean**

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

Exadata InfiniBand Switch

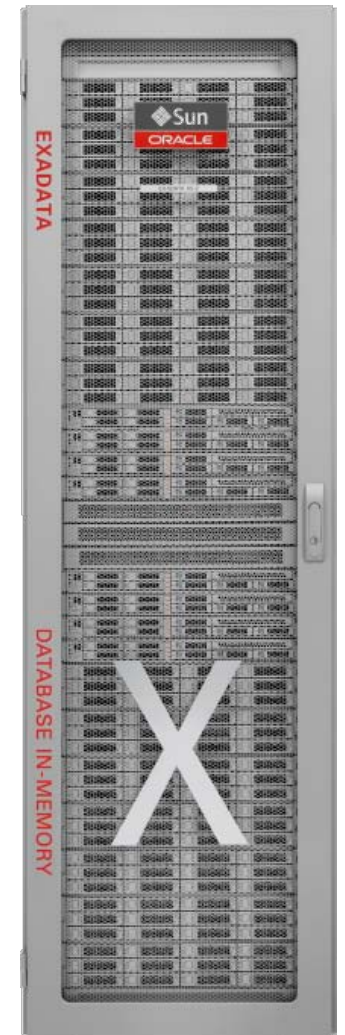## Simple switch upgrade steps

1. Exachk Health Check

2. Prereq validation

   ```
   # patchmgr -ibswitch -ibswitch_precheck
   ```

3. Update all InfiniBand switches

   ```
   # patchmgr -ibswitch -upgrade
   ```

| Method	Patchmgr Orchestration	Database Downtime
Rolling	One switch patched at a time, 15 min per switch	None

InfiniBand Switch Upgrade Keys to Success

InfiniBand Switch Software Maintenance Rules

- Do NOT make **unsupported** configuration changes

- Qualify maintenance readiness - Upgrade only when **exachk is clean**

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Summary

Best Practices for Exadata Planned Maintenance

- Leverage Exachk for simple software planning

- Configure for zero downtime software maintenance

- Reduce risk with Standby First Updating

- Leverage Lights Out Patching with notification function

- Take advantage of Exadata Engineered defaults
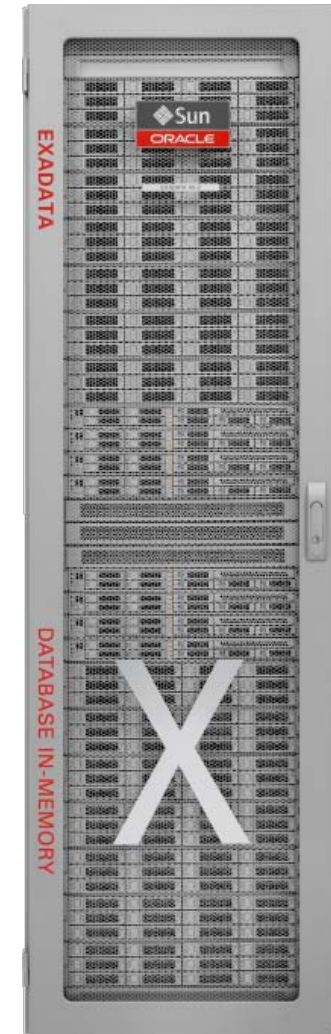
Exadata Software Maintenance

MOS References

- **MOS 888828.1 - Supported and Recommended Versions**

- MOS 1270094.1 - Critical Issues

- MOS 1405320.1 - Responses to Common Security Scan Findings

- MOS 1553103.1 - Database Server Update Tool

- MOS 1070954.1 - Exachk

- MOS 1262380.1 - Software Maintenance Overview and Guidelines