Hitchhiker's Guide to upgrade to Oracle Database 12c

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Senior Principal Technologist
Database Upgrades
Oracle Corporation

Updated: 3-APR-2014
Hitchhiker's Guide to Oracle Database Upgrades

- Introduction
- When?
- Why?
- How?
- News?
- The Real World
- Wrap Up
$> whoami

Mike Dietrich

6 years
RDBMS Core & Mission Critical Support

6 years
Technology Presales for DataGuard, Upgrades

6 years
ST Upgrade Development Team

50% Reference Projects
50% Workshops Worldwide
+ x% Development Work
Reference Involvement

Customer Success
Your success is our aim!

Non-binding Reference Proposal
for

Oracle Database Upgrade Development: Customer Reference Program

Company Name and Logo
You agree that your company name (where necessary including your logo) will be called “customer” or “reference customer” for relevant products and projects. Typically we will then use your company name during internal and external presentations or events.

Agree: [ ] Yes [ ] No
Comments:

Customer Quote
The quote is a brief statement about how your company has achieved a technological head start or has benefited economically from using Oracle products. Example: “Since we have been using Oracle iProcurement our acquisition costs have fallen by around 20%” – John Doe, CIO, IT Company Inc.
With your agreement we will use your quote, for instance, in product brochures.

Agree: [ ] Yes [ ] No
Comments:
Reference Involvement: Results

“The new parallel upgrade script promises to drastically reduce downtime due to planned maintenance. We saw a 37% improvement over the previous upgrade process in our environment.”

Harald Stefan
Lutter Deternfahnen
Payback GmbH

>16000 Downloads since June 2013
Slides and Dates?

- Download slides from:
  - blogs.oracle.com/UPGRADE

Upgrade your Database - NOW!
Further material?

- 90 Minute Webcast: Upgrade, Migrate & Consolidate to Oracle Database 12c
  - [http://event.on24.com/r.htm?e=750382&s=1&k=4F42244E75402FC0D8DEBBD12F134906](http://event.on24.com/r.htm?e=750382&s=1&k=4F42244E75402FC0D8DEBBD12F134906)

- OTN Page:
  - [http://otn.oracle.com/goto/upgrade](http://otn.oracle.com/goto/upgrade)
Hitchhiker's Guide to Oracle Database Upgrades

- Introduction
- When?
- Why?
- How?
- News?
- The Real World
- Wrap Up
When does Oracle Database 11.2 run out of Premier Support?

303 days < 10 months!
Upgrade, Migrate and Consolidate to Oracle 12c

- Introduction
- When?
- Why? Or why not?
- How?
- News?
- The Real World
- Wrap Up
Why customers don't upgrade

"You need to upgrade now as your release is going out of support soon!!!"

"Upgrading just costs a lot!"

"I don't see any benefits by upgrading to a newer release"

"I'm happy with the features of Oracle 8i"

"It will just introduce new bugs and issues"
Examination

"Size of the database(s)?"
"Number of databases?"
"Downtime?"
"Fallback?"
"Testing?"
"Exact source versions?"
"New hardware?"
"OS Migration?"
...
Are you maintaining a Zoo?

<table>
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<th>7.3</th>
<th>8.1</th>
<th>9.2</th>
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3 different OS families ⇔ 7 different major Oracle releases

6 of 8 OS desupported ⇔ 77 of 80 databases out of Support
Maintaining a Zoo is **EXPENSIVE**

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</tbody>
</table>

- **Maintenance Costs**
- **Upgrade/Migration Costs**
Another example from the Real World

--- Original Message ---

Subject: Re: Windows & Oracle - Data replication follow up
Date: Tue, 21 Jan 2014 16:06:30 -0600
From: [Redacted]
To: [Redacted]

Hi,

Thanks for the assistance and connections.
What would be an estimate for migrating to an Oracle 11g or Unix environment?

Downtime Requirements:
RTO 20 minutes
RPO as close to zero as possible (CEO did not state specifically zero however)

Size: unknown, these are WMS type applications for inventory, orders, etc

How Many: Estimated 10-15 instances based on conversation,

OS change
Application change
Client change
HW change

No upgrade done for ~17 years!!!

10-15 databases
Minimal Downtime between Oracle 7.3 and Oracle 11.2
Upgrade, Migrate and Consolidate to Oracle 12c

- Introduction
- When?
- Why?
- How?
- News?
- The Real World
- Wrap Up
Upgrade/Migration Strategies?

Step-by-Step Strategy
- In pieces over time
- Risk mitigating

Big-Bang Strategy
- All in one downtime window
- Sometimes necessary due to dependencies

Least Critical First
- Learn more with every step

Most Critical First
- Learn about almost all from the beginning
Project Approach?

- Plan your upgrades as early as possible
- Application testing is important
- Have valid test systems
- Think about the fallback ... before you start!
- Try to streamline
- Talk to us (Oracle) to avoid pitfalls
  - Get our Best Practice slides 😊
Project Phases

1. Data Gathering Phase
   - The more you know the better it is!

2. Test Phase

3. Upgrade/Migration Phase
   - Application:
     - Owner?
     - Version?
     - Dependencies?
     - Certification?
     - Timeframe?
     - Test budget?
   - Database:
     - Owner?
     - Exact version and patches?
     - Size?
     - Downtime?
     - Dependencies?
     - Gateways?
     - Operating system version?

4. Go-Live Phase

5. Future Phase
Project Phases

1. Data Gathering Phase
2. Test Phase
   - Test, test, test ... and test!!
3. Upgrade/Migration Phase
   - 1:1 test systems?
   - Documentation?
   - Network bandwidth?
   - Performance data from PROD?
   - Testing tools: RAT?
   - Batches, long-ops?
   - Multiple successful test runs?
   - Performance protection?
   - Be open to late patches/PSUs!
   - Fallback strategy tested?
4. Go-Live Phase
5. Future Phase
# Network Bandwidth

<table>
<thead>
<tr>
<th>Interface</th>
<th>Netto Data Volume</th>
<th>Theoretical Transfer Throughput</th>
<th>Real World Transfer Throughput</th>
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<tr>
<td>100 Mbit Ethernet</td>
<td>11 MB/sec</td>
<td>40 GB/hour</td>
<td>&lt;30 GB/hour</td>
</tr>
<tr>
<td>1 Gbit Ethernet</td>
<td>110 MB/sec</td>
<td>400 GB/hour</td>
<td>&lt;300 GB/hour</td>
</tr>
<tr>
<td>10 Gbit Ethernet</td>
<td>1100 MB/sec</td>
<td>4000 GB/hour</td>
<td>&lt;3000 GB/hour</td>
</tr>
<tr>
<td>Infiniband IB 4xQDR</td>
<td>4000 MB/sec</td>
<td>14400 GB/hour</td>
<td>&lt;11000 GB/hour</td>
</tr>
</tbody>
</table>
Database Replay

**IBM AIX**
10.2.0.4

Capture Workload

Migrate

SOLARIS
11.2.0.4

Replay Workload

Preprocess Workload

Compare – then restore and run again with changes

Database Replay

Capture Workload

Replay Workload

Preprocess Workload

Migrate
SQL Performance Analyzer

Capture SQLs into a STS

IBM AIX 10.2.0.4

Migrate

SOLARIS 12.1.0.1

Load STS

Evaluate, compare and tune – over and over again!

SQL Performance Analyzer
Testing Effort

- Relation between test completeness and costs
Project Phases

1. Data Gathering Phase
2. Test Phase
3. Upgrade/Migration Phase
   • Relax ...
4. Go-Live Phase
5. Future Phase

- Is everybody informed?
- Relax and lean back!
- Don't overtestosteronize!!
Upgrade/Migrate Older Oracle Releases

- Oracle 5/6/7/8
- Oracle 8i
- Oracle 9i
- Oracle 9.2
- Oracle 10.1

exp/imp

Less Downtime?

Transportable Tablespaces
Same platform only

Near-Zero Downtime?

Golden Gate
Upgrade Options to Oracle Database 12c

Oracle 10.2
expdp/impdp

Oracle 11.1
DBUA

Oracle 11.2.0.1/2

Oracle 11.2.0.3/4

Less Downtime?

Oracle 11.1

Oracle 11.2.0.1/2

Oracle 11.2.0.3/4

Near-Zero Downtime?

Translucent Standby

Golden Gate

Full Transportable Export/Import

RMAN Inc Bck
Migration Options to Oracle Database 12c

- Oracle 10.2
  - expdp/impdp
  - CTAS, COPY
  - SQL*Loader
  - TDB
  - Only same Endianness

- Oracle 11.1
  - Golden Gate

- Oracle 11.2.0.1/2
  - Near-Zero Downtime?
  - Transportable Tablespaces
  - Full Transportable Export/Import

- Oracle 11.2.0.3/4
  - RMAN Inc Bck

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Project Phases

1. Data Gathering Phase
2. Test Phase
3. Upgrade/Migration Phase
4. Go-Live Phase
   - Keep an extra eye on performance
5. Future Phase

- Monitor performance behaviour
- Any issues?
  - Use collected data from pre-upgrade to fix issues
  - Open an SR with Support
SPM – Plan Stability using **Plan Capture**

1. Load plans from a SQL Tuning Set
2. Load plans from the Cursor Cache
3. Load plans from a snapshot
4. Load plans from a snapshot

**Plan History**

- GB
- HJ

**2 Plans will be taken from STS and added to the SQL Plan Baseline**

```
DBMS_SPM.LOAD_PLANS_FROM_SQLSET
```
Project Phases

1. Data Gathering Phase
2. Test Phase
3. Upgrade/Migration Phase
4. Go-Live Phase
5. Future Phase
   - It's not over now ... It just started!!!

- Don't lean back – it just started!
- Patching strategy?
  - Next available PSU?
  - Next available patch set?
  - When will be the next upgrade?
- Adopt useful new features
  - Many features come for free
Waiting for next Patch Set?

- Release Schedule of Current Database Releases [Note.742060.1]
**Recommended Patches: PSUs**

- **Always install the latest PSU as soon as possible**
  - Most important Notes:
    - Note:854428.1: Introduction to Database PSU
    - Note:1227443.1: PSU Known Issues
  
- PSU contents:
  
- PSU characteristics:
  
- PSU schedule – 4x:
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# Upgrade to Oracle Database 12c

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</table>

Please note: This graph will apply to database upgrades only!
Upgrade SQL Automation

New Pre-Upgrade Script

- preupgrd.sql
- Executes pre-upgrade checks
- Runs in source environment
- Generates fixup scripts
  - preupgrade_fixups.sql
  - postupgrade_fixups.sql
- MOS Note:884522.1

Fixup: PURGE_RECYCLEBIN
Description: Check that recycle bin is empty
******************************************************************************
Fixup Succeeded
******************************************************************************

******************************************************************************
[Pre-Upgrade Recommendations]
******************************************************************************

******************************************************************************
** Dictionary Statistics ********
******************************************************************************

Please gather dictionary statistics 24 hours prior to upgrading the database.
To gather dictionary statistics execute the following command while connected as SYSDBA:
EXECUTE dbms_stats.gather_dictionary_stats;
Faster Upgrade – Less Downtime

New Parallel Upgrade

- `catctl.pl`
- Runs database upgrade in parallel
- Up to 40% faster upgrade
- Used and proven by selected Oracle Database 11g customers
Faster Upgrade – Less Downtime

New Parallel Upgrade

$> \$ORACLE_HOME/perl/bin/perl catctl.pl -n 8 catupgrd.sql

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<th># of Files</th>
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<td>313s</td>
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<tr>
<td>Grand Total Time</td>
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</table>
“The new parallel upgrade script promises to drastically reduce downtime due to planned maintenance. We saw a 37% improvement over the previous upgrade process in our environment.”

Harald Stefan
Leiter Datenbanken
Payback GmbH
Simplified Upgrade

Database Upgrade Assistant

- Pre-Upgrade Automation
- Parallel Upgrade
- RMAN Integration
- Guaranteed Restore Points
- Activity and Alert Log
Enterprise Manager **Mass and RAC Upgrades**

**EM Cloud Control**

- Mass Upgrades
- Grid Infrastructure Upgrades
- RAC Database Upgrades
- Standby Database Upgrades
Upgrade and Plug Into Oracle Multitenant

Upgrade into Multitenant

- Database upgrade
- Create XML description file
- Shutdown and Plugin
- Sanity operations
Combining:
- Transportable Tablespaces with
- Data Pump taking care of all meta information with optional
- RMAN incremental backups to decrease downtime

This works:
- Cross platform
- With or without Oracle Multitenant
- Source can be Oracle 11.2.0.3/4
- Target must be at least Oracle 12.1.0.1
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Real World Customer Experience

- @Oracle – Production Environment
Real World Customer Experience

"A bit more work regarding monitoring but a lot of improvements"

"It is very stable"

"Issues may get to you now at once"

"If we talk about whether a DBA life is much easier I think it's a mixed bag"

"If seen as 15 different databases I don't think I would have configured them on this cluster. But as deployment of 15 PDBs within one container it has been made possible"

"I am definitely impressed with the quality and stability side"
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Resources

- Download slides as PDF from:  

- Full Day Upgrade Workshop in Oslo:  
  - Registration:  
    - http://eventreg.oracle.com/profile/web/index.cfm?PKWebID=0x705481765&source=EMEAFM13033369MPP059  
  - May 20, 2014
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