Different Ways to Upgrade and Migrate to Oracle Database 12c

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Updated: 08-DEC-2014
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
- Oracle 11.1
- Oracle 11.2.0.1/2
- Oracle 11.2.0.3/4

Exdpd/impdp
DBUA
catctl.pl

Less Downtime?

- Transient Standby
- Transportable Tablespaces
- Full Transportable Export/Import

Near-Zero Downtime?

+ Golden Gate
+ RMAN Inc
+ Bck

Different Ways to Upgrade and Migrate to Oracle Database 12c
# Upgrade to Oracle Database 12c

<table>
<thead>
<tr>
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<td>Oracle 9.2.0.8</td>
<td>9.2.0.8</td>
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</tbody>
</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]

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** global customers
  – Telco billing
  – >100 SAP systems
  – Large DWH

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“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
### Faster Upgrade – Less Downtime

#### New Parallel Upgrade

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

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<td>1</td>
<td>3s</td>
</tr>
<tr>
<td>#50</td>
<td>1</td>
<td>313s</td>
</tr>
</tbody>
</table>

**Grand Total Time: 2468s**
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
  - Note: Requires Lifecycle Management Pack
Migration Options to Oracle Database 12c

- **Oracle 10.2**
  - expdp/impdp

- **Oracle 11.1**
  - CTAS, COPY

- **Oracle 11.2.0.1/2**
  - SQL*Loader
  - TDB Only same Endianness

- **Oracle 11.2.0.3/4**

- **Less Downtime?**
  - Transportable Tablespaces
  - Full Transportable Export/Import

- **Near-Zero Downtime?**
  - Golden Gate
  - RMAN Inc Bck

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Data Pump Migration
Cross Endianness Migration
• Example: Migration of a single instance database to Exadata

Example Facts & Description
1. Hardware migration to an Exadata Database Machine
2. Cross Endianness database migration from Oracle 9.2.0.8 to Oracle 11.2.0.4
3. Maximum tolerated downtime: 24 hours
4. Database size: 8TB
Cross Endianness Migration

- **Basic options** with Oracle 9i:
  - `exp` and `imp`
    - Import of all versions $\geq$ Oracle V5 possible
      - `exp` is *not supported* for general use since Oracle 11g
        - But the utility is still there and can be used
      - `imp` is still supported

---

![Diagram showing migration from Oracle 9.2.0.8 HP-UX to Oracle 11.2.0.4 OL5.8 64bit in 24 hours.](image)
Cross Endianness Migration

• **Better options** since Oracle 10g:
  
  – Data Pump `expdp` and `impdp`
    
    • Usually the first option to try
  
  – Cross platform Transportable Tablespaces (xTTS)
    
    • More complicated, more manual steps than pure Data Pump
Case 3: Cross Endianness Migration
• Migration of a single instance database to Exadata

- Prepare a new database on EXADATA
- Restore online backup to SWING
- Upgrade database on SWING
- Full database import via NETWORK_LINK
- Post Migration Actions

Oracle 9.2.0.8 HP-UX

24 hrs

Oracle 11.2.0.4 HP-UX

Oracle 11.2.0.4 OL5.8 64bit

8TB

8TB

8TB
Data Pump Best Practices

• For full exports:
  – Role `EXP_FULL_DATABASE` is required

• For export consistency use:
  – `FLASHBACK_TIME=SYSTIMESTAMP`
    alternative:
  – `CONSISTENT=Y` [since Oracle 11.2 – Legacy Interface]
    • This will increase UNDO requirements for the duration of the export

• Always set parameters:
  – `EXCLUDE=STATISTICS`
  – `METRICS=YES`
Data Pump Best Practices

• Speed up Data Pump:
  – PARALLEL=n
    • Typically \( n = 2 \times \text{number of CPU cores} \)
  – EXCLUDE=INDEXES on import
    1. Initial impdp with EXCLUDE=INDEXES
    2. Second impdp with INCLUDE=INDEXES SQLFILE=indexes.sql
    3. Split indexes.sql into multiple SQL files and run in multiple sessions
  – Set COMMIT_WAIT=NOWAIT and COMMIT_LOGGING=BATCH during full imports
Data Pump Best Practices

• Direct import via database link
  – Parameter: NETWORK_LINK
    • Run only impdp on the target system - no expdp necessary
    • No dump file written, no disk I/O, no file transfer needed

• Restrictions of database links apply:
  – Does not work with LONG/LONG RAW and certain object types

• Performance: Depends on network bandwidth and target's CPUs

$ impdp ...
NETWORK_LINK=dblink

$ expdp ...
Data Pump Best Practices

• **Real World Case:**
  Kaiser Permanente, Medicare (USA)
  – `impdp on NETWORK_LINK` with 8 vs 16 CPU cores
    • 10GBit connection leveraged up to 8 Gbit
    • 1 TB table copied in ~15 min ⇒ 4 TB/hour
  – Network bandwidth and CPU bound
Data Pump News in Oracle 12c

- Full transportable export/import for an entire database
- Support for multitenant container databases and pluggable databases
- New ...

- VIEWS_AS_TABLES parameter
  - Lets you export the contents of a view as a table

- TRANSFORM parameter options
  - TRANSFORM=DISABLE_ARCHIVE_LOGGING:Y
    - Will disable archive logging during import for tables and/or indexes
  - TRANSFORM=LOB_STORAGE:SECUREFILE
  - TRANSFORM=STORAGE:N
  - TRANSFORM=TABLE_COMPRESSION:<compression_clause>

- LOGTIME= [ NONE | STATUS | LOGFILE | ALL ] parameter
  - Will write timestamps on status and/or logfile messages
Transportable Tablespaces
Concept Transportable Tablespaces

- TTS feature available since Oracle 8i
- Cross platform support since Oracle 10g

```
expdp "sys"/"sys" as sysdba "..." ...
TRANSPORT_TABLESPACES=TS1, TS2 ...

impdp "sys"/"sys" as sysdba "..." ...
TRANSPORT_DATAFILES=...
```

Self Contained? Read Only

Read Write

Oracle 10.2.0.4
IBM AIX

Oracle 11.2.0.4
OL5.8 64bit

75TB

48 hrs
Concept: Transportable Tablespaces xTTS

- Cross platform support
  - V$TRANSPORTABLE_PLATFORM

LITTLE ENDIAN PLATFORMS
- HP IA Open VMS
- HP Open VMS
- HP Tru64 UNIX
- Linux IA (32-bit)
- Linux IA (64-bit)
- Linux x86 64-bit
- Microsoft Windows IA (64-bit)
- Microsoft Windows x86 64-bit
- Microsoft Windows IA (32-bit)
- Solaris Operating System (x86)
- Solaris Operating System (x86-64)

BIG ENDIAN PLATFORMS
- Apple Mac OS
- HP-UX (64-bit)
- HP-UX IA (64-bit)
- AIX-Based Systems (64-bit)
- IBM zSeries Based Linux
- IBM Power Based Linux
- Solaris[tm] OE (32-bit)
- Solaris[tm] OE (64-bit)
Upgrade/Migration: Transportable Tablespaces

Rebuild meta information
(views, synonyms, trigger, roles etc)

SOURCE Database 10.2.0.4
- USERS
  - SCOTT (Read Only)
  - HUGO
- SYSTEM
- SYSAUX
- UNDO
- TEMP

DESTINATION Database 11.2.0.4
- SYSTEM
- SYSAUX
- UNDO
- TEMP
- SCOTT
- HUGO
- VIEWS
- CODE
- PROS
Possible options

- **Moving meta information - 3 possible options**
  - The “brute force” approach
    - Data Pump
  - The “smart” approach
    - DBMS_METADATA
  - A “same OS” approach
    - RMAN duplicate
    - Does not work for platform changes

expdp/impdp CONTENT=METADATA_ONLY

SELECT DBMS_METADATA.GET_DDL('SYNONYM', SYNONYM_NAME, OWNER) FROM all_synonyms where owner='PUBLIC' and table_owner not in ('SYS');

RMAN> duplicate target database to 'NEW' skip tablespace DATA1, DATA2
Transportable Tablespaces

• **TTS might not be a good solution when ...**
  – Too many objects to rebuild
    • Views, synonyms, sequences ...
    • **Simple is better for fast TTS!!!**

  – Too many objects in tablespaces slow down meta expdp/impdp
    • (Sub)partitions, partitioned indexes ...
Speed Up Transportable Tablespaces

• Usually the biggest **pain points** with TTS
  – **Downtime** due to:
    • Duration to copy very large amounts of data
    • Duration to convert many tablespaces cross Endianness

• New technique: **Avoid the copy & convert phase**
  – RMAN can convert **incremental backups** cross platform
    • Available since Oracle 11.2.0.3 for Exadata only
    • Available for Linux x86-64 with Oracle 11.2.0.4
    • Available on all platforms starting with Oracle 12c
    • See [MOS Note:1389592.1](#) for description and Linux perl scripts
Transportable Tablespaces with **Incremental Backups**

**SOURCE Database 10.2.0.5**
- **IncSet 1**
- **Read Only**
  - SYSTEM
  - SYSAUX
  - UNDO
  - TEMP
- SCOTT
- HUGO

**DESTINATION Database 11.2.0.4**
- **Read Write**
  - SYSTEM
  - SYSAUX
  - UNDO
  - TEMP
- SCOTT
- HUGO

Data Pump

Convert and apply backups

Downtime!!!

`expdp "'sys/sys as sysdba'" ... TRANSPORT_TABLESPACES=TS1,TS2 ...

impdp "'sys/sys as sysdba'" ...

Downtime!!!

Different Ways to Upgrade and Migrate to Oracle Database 12c
Full Transportable Export/Import

• Combining:
  – Transportable Tablespaces with
  – Data Pump taking care of all meta information with optional
  – RMAN incremental backups to decrease downtime

• One Command Migration

  impdp ... VERSION=12 FULL=Y TRANSPORTABLE=ALWAYS ...

• This works:
  – Cross platform (with RMAN CONVERT)
  – With or without Oracle Multitenant
  – Source can be Oracle 11.2.0.3/4 or newer
  – Target must be at least Oracle 12.1.0.1
Full Transportable Export/Import with Copies

SOURCE Database 11.2.0.3
- USERS
  - SCOTT
  - HUGO
- SYSTEM
- SYSAUX
- UNDO
- TEMP

DESTINATION Database 12.1.0.1
- USERS
  - SCOTT
  - HUGO
- SYSTEM
- SYSAUX
- UNDO
- TEMP

Data Pump

DESTINATION Database 12.1.0.1

Different Ways to Upgrade and Migrate to Oracle Database 12c
Full Transportable Export/Import with Backups

SOURCE Database 11.2.0.3

DESTINATION Database 12.1.0.1

Convert and apply backups

Data Pump

Read Only

System
SySAUX
UND0
TEMP

VIEWS
CODE
PRIVS

SCOTT
HUGO

SCOTT
HUGO

SYSTEM
SySAUX
UND0
TEMP

VIEWS
CODE
PRIVS

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Full Transportable Export/Import in 3 Steps

1. Create a new database or PDB
   - SOURCE Database 11.2.0.3/4
   - DESTINATION Database 12.1.0.1/2

2. Copy the datafiles or Restore/Merge Inc Backups
   - SOURCE Database 11.2.0.3/4
   - DESTINATION Database 12.1.0.1/2

3. Data Pump "One Command Migration"
   - SOURCE Database 11.2.0.3/4
   - DESTINATION Database 12.1.0.1/2
Zero Downtime?
Introduction

• True ZERO Downtime is very hard to achieve
  – Only Oracle TimesTen In-Memory Database can do that
• Replication technologies are easier to handle and setup
  – A limited downtime will occur to switch clients/application
    • Active/active scenarios are possible depending on the application and usage scenario

• Technologies:
  – Oracle Golden Gate
    • NOTE: Oracle Streams is deprecated as of Oracle Database 12c
Oracle Golden Gate

• Paid option of the database
  – Migratable license for 1 year which includes Active Data Guard

• Works with many Oracle database versions
  – Golden Gate 12.1 supports Oracle ≥ 11.1.0.6
    • Golden Gate 11.2 supports Oracle ≥ 10.2.0.4
      – For earlier database versions (8i (DML only), 9i-11.1) use Golden Gate 10.4

• Oracle GoldenGate Installation and Setup Guide
• Also works with non-Oracle databases (DB2, Teradata ...)
• GoldenGate OTN page:
  http://www.oracle.com/technetwork/middleware/goldengate/overview/index.html
**Capture**: committed transactions are captured (and can be filtered) as they occur by reading the transaction logs.

- **Capture**
- **Oracle 10.2.0.3 HP-UX Itanium**
  - 10TB
  - <5 mins
- **Oracle 11.2.0.4 OL5.8 64bit**

Different Ways to Upgrade and Migrate to Oracle Database 12c
Start Capture Mechanism
Build Up Database Copy with Data Pump or TTS
Start Apply Mechanism

**Trail**: stages and queues data for routing

Capture

Trail

Oracle 10.2.0.3
HP-UX Itanium

<5 mins

10TB

Oracle 11.2.0.4
OL5.8 64bit

10TB
Different Ways to Upgrade and Migrate to Oracle Database 12c

- **Start Capture Mechanism**
- **Build Up Database Copy** with Data Pump or TTS
- **Start Apply Mechanism**

Build up the target database using:
- Transportable Tablespaces x-Platform
- Export/Import with Data Pump

Capture

Trail

Oracle 10.2.0.3
HP-UX Itanium
10TB

<5 mins

Oracle 11.2.0.4
OL5.8 64bit
10TB
Pump: distributes data for routing to target(s)

Capture Trail Pump

Oracle 10.2.0.3 HP-UX Itanium

<5 mins

Oracle 11.2.0.4 OL5.8 64bit

10TB

10TB
**Route:** data is compressed, encrypted for routing to target(s)

Capture Trail Pump Trail

Oracle 10.2.0.3 HP-UX Itanium

10TB

<5 mins

Oracle 11.2.0.4 OL5.8 64bit

10TB

Different Ways to Upgrade and Migrate to Oracle Database 12c

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Different Ways to Upgrade and Migrate to Oracle Database 12c

1. Start Capture Mechanism
2. Build Up Database Copy with Data Pump or TTS
3. Start Apply Mechanism

**Delivery**: applies data with transaction integrity, transforming the data as required

Capture Trail Pump Delivery

- **Capture**: Oracle 10.2.0.3 HP-UX Itanium
- **Trail**: 10TB
- **Pump**: <5 mins
- **Delivery**: Oracle 11.2.0.4 OL5.8 64bit

10TB
GoldenGate works **bidirectionally** - from higher to lower release as well!
Case 6: Real Rolling Upgrade
### Basic Facts and Information

<table>
<thead>
<tr>
<th>Physical Standby</th>
<th>Logical Standby</th>
<th>Transient Standby</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standby Type</strong></td>
<td>Block identical copy of PROD</td>
<td>Logical copy of PROD</td>
</tr>
<tr>
<td><strong>Apply Technique</strong></td>
<td>Redo Apply</td>
<td>SQL Apply</td>
</tr>
<tr>
<td><strong>Build Up</strong></td>
<td>RMAN DUPLICATE</td>
<td>Convert from Physical</td>
</tr>
<tr>
<td><strong>Switchover</strong></td>
<td>&lt; 1 min</td>
<td>Seconds</td>
</tr>
</tbody>
</table>
Transient Logical Standby - Workflow

1. Guaranteed Restore Point
2. Logminer Build
3. KEEP IDENTITY
4. New $OH + Upgrade
5. synchronize
6. SWITTOVER
7. FLASHBACK DATABASE TO ...
8. New $OH...
9. synchronize
10. SWITTOVER

Differernt Ways to Upgrade and Migrate to Oracle Database 12c
Transient Logical Standby – White Paper

• Transient Upgrade Concept:
  [Link](http://www.oracle.com/technetwork/database/features/availability/maa-wp-lingu-1-131927.pdf)

  Database Rolling Upgrade Using
  Transient Logical Standby:
  Oracle Data Guard 11g
  Oracle Maximum Availability Architecture White Paper
  September 2008

• Shell scripts in [Note:949322.1](http://www.oracle.com/technetwork/database/features/availability/maa-wp-2.pdf) for automation:
  [Link](http://www.oracle.com/technetwork/database/features/availability/maa-wp-2.pdf)

  Database Rolling Upgrades Made Easy by Using a Data Guard
  Physical Standby Database
  Oracle Maximum Availability Architecture White Paper
  October 2011
DBMS_ROLLING

- Data Guard **Simple** Rolling Upgrade
  - Semi-automation of Transient Logical Standby Rolling Upgrade
  - Works with Data Guard Broker
  - Procedure `DBMS_ROLLING`
    - `INIT_PLAN`
    - `DESTROY_PLAN`
    - `BUILD_PLAN`
    - `SET_PARAMETER`
    - `START_PLAN`
    - `SWITCHOVER`
    - `FINISH_PLAN`
    - `ROLLBACK_PLAN`

- Usable for maintenance tasks beginning with Oracle 12.1.0.1
- Usable for upgrades beginning with the first patch set of Oracle 12c (12.1.0.2)
  - `DBMS_ROLLING` usage requires a license for Active Data Guard
Migration with GoldenGate

amadeus
Your technology partner
Real World Checkpoint

- Amadeus is a leading transaction processor for the global travel and tourism industry

**DISTRIBUTION BUSINESS**
- 711 airlines
- 110,000+ hotel properties
- 30 car rental companies
- 50+ cruise and ferry lines
- 207 tour operators
- 24 insurance companies
- 95 railways

**IT SOLUTIONS**
- Inventory
- Departure Control
- e-Commerce
- Airlines
- Airports
- Hotels
- Rail

- 20,000+ tx/sec (peak)
- < 0.3 sec response time
- 10 Petabytes of storage
- 3+ million net bookings/day
- > 1 billion tx/day
Real World Checkpoint

- Migrate Oracle 10g production databases to Oracle 11g on new HW and/or OS platform

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle 10.2.0.3 RAC HPUX v2</td>
<td>Oracle 11.2.0.2/3 RAC HPUX v3</td>
</tr>
<tr>
<td>Oracle 10.2.0.3 RAC HPUX v2</td>
<td>Oracle 11.2.0.2/3 RAC RHE Linux</td>
</tr>
<tr>
<td>Oracle 10.2.0.3 Single Instance HPUX v2</td>
<td>Oracle 11.2.0.2/3 RAC One RHE Linux</td>
</tr>
</tbody>
</table>
Real World Checkpoint

- Fixed quarterly outage windows
- Maximum of 5 minutes database downtime
- No service impact outside the outage window
- Endian change: HP-UX $\Rightarrow$ to Linux (big $\Rightarrow$ little endian)
- Possibility of fallback during and after the outage
- High volume of DB changes (redo of up to 20MB/sec)
- Large database sizes (up to 14TB)
- Possibility for physical re-organization
  - Fresh data dictionary
  - Tablespace and partitioning redesign
Real World Checkpoint

- In-depth proof of concept (supported by Oracle)
  - Focusing on functional aspects
  - Focusing on data volume

- Standardized migration process model with timeline
- Home-made scripts and procedures to support setup, monitoring, tuning and switch over
- Training of in-house specialist supporting the DBAs
Real World Checkpoint

- Instantiation of new 11g database: expdp from Physical Standby
- Installation, configuration, tuning of GG replication

- Comparison of source/target DB content (Veridata)
- Rehearsals of switch over and fallback
- Switch over: Stop replication / Start reverse-replication
Real World Checkpoint

- 15 databases successfully migrated, so far (Oct 2012)

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
<th>Migrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle 10.2.0.3 RAC HPUX v2</td>
<td>Oracle 11.2.0.2/3 RAC HPUX v3</td>
<td>6</td>
</tr>
<tr>
<td>Oracle 10.2.0.3 Single Instance HPUX v2</td>
<td>Oracle 11.2.0.2/3 RAC RHE Linux</td>
<td>3</td>
</tr>
<tr>
<td>Oracle 10.2.0.3 RAC HPUX v2</td>
<td>Oracle 11.2.0.2/3 RAC One RHE Linux</td>
<td>6</td>
</tr>
</tbody>
</table>

- Switchover duration: 2-6 minutes
- No fallback performed
Real World Checkpoint

- The concept proved to handle a smooth and secure migration across different DB versions and HW/OS platforms

- To be considered ...
  - Instantiation of target database (incl. Plan Stability)
  - Customized GG setup per database
  - Handling of unsupported data types (e.g. ANYDATA)
  - Impact of supplemental logging on source DB
  - Effort of tuning GG for DBs with high DML rate (e.g. parallel replicate processes)
Real World Checkpoint

• Payback GmbH
  – Belongs to Loyalty Partner GmbH which belongs to American Express
  – HQ in Munich, Germany
  – Develops and operates professional customer loyalty programs based on customized IT solutions
    • Provider for Payback
    • Active in Germany, Poland, India, Italy and Mexico
Real World Checkpoint

- Migrate **7TB / 1.5TB** from HP-UX to Exadata V1
  - Cross platform, cross Endianness, cross version
    - Oracle 9.2.0.7 on HP-UX ↦ Oracle 11.1.0.7 on OL
  - 4 months planning and migration phase
    - August to November 2009
  - Proposed go-live date
    - 15-NOV-2009
Real World Checkpoint

- Move everything in **less than 24 hrs**
- Network bottleneck
  - Remedy: Install extra InfiniBand hardware into HP box ⇒ ~ 3GB/sec throughput!

## Constraints

<table>
<thead>
<tr>
<th>Customer</th>
<th>Project</th>
<th>Constraints</th>
<th>Preparation</th>
<th>Migration</th>
<th>Success?</th>
<th>Remarks</th>
</tr>
</thead>
</table>

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Real World Checkpoint

• Setup:

PROD
HP-UX PA-RISC
Prod Load

SWING
HP-UX PA-RISC
IB Hardware

Restore
Upgrade

Different Ways to Upgrade and Migrate to Oracle Database 12c
Real World Checkpoint

- Test migrations:

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<th>Project</th>
<th>Constraints</th>
<th>Preparation</th>
<th>Migration</th>
<th>Success?</th>
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<tr>
<td>PROD</td>
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<tr>
<td>Data Pump on NETWORK_LINK</td>
<td>INSERT APPEND on database links for tables &gt;100 GB</td>
<td>IB Hardware</td>
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</tbody>
</table>
Real World Checkpoint

• Parallel live loads: Performance tests

HP-UX PA-RISC  \( \rightarrow \) Prod Load

Redirect the production load by apps servers

HP-UX PA-RISC  \( \rightarrow \) Prod Load

OL 64bit
Real World Checkpoint

- **Final test** became **LIVE** migration
Real World Checkpoint

• Live? And alive?
  – Yes! Go-live in early November 2009
    • Two weeks earlier than proposed
  – Total upgrade and migration time: ~20 hours
    • ~ 8 hours: Restore and recovery
    • ~ 1 hour: Database upgrade to Oracle 11.1.0.7
    • ~10 hours: Data migration to Exadata V1
    • ~ 1 hour: Smoke testing and final verification
  – Dramatic performance improvements
    • Job runtimes decreased by 80%
    • User complaints about too fast performance ... really!!
Real World Checkpoint

• Not a single piece of SQL had to be changed!!!
  – Most critical job: runtime from 30 hrs to < 2hrs
Real World Checkpoint

- Same customer again ... Payback GmbH

TO BE CONTINUED
Real World Checkpoint

- Migrate **14TB from Exadata V1 to Exadata X2-2**
  - 2 months planning and migration phase
    - June to July 2012
  - Proposed go-live date
    - 22-JUL-2012

- **MOS Note: 1055938.1**
  - migrating from HP Oracle Database Machine to Sun Oracle Database Machine 11.2 using Data Guard
Real World Checkpoint

- Database has grown from 7TB to **14TB**
- Downtime: **less than 8 hrs**
- Network "bottleneck"
  - Remedy: Extra IB cabled connection from V1 to X2-2
Real World Checkpoint

- Restoring 14TB with RMAN
  - DUPLICATE FOR STANDBY FROM ACTIVE DATABASE
- Removed unused components from the source database
Real World Checkpoint

• Live upgrade/migration
  – RMAN Restore and Recovery: <3 hours
    • 64 parallel RMAN channels allocated: >4TB/hour
Real World Checkpoint

- Database upgrade 11.1.0.7 ⇒ 11.2.0.3
  - Using the **new PARALLEL UPGRADE** scripts
  - Total database upgrade time including recompilation and time zone change: 20 mins

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<td>Oracle 11.2.0.3</td>
<td>Oracle 11.2.0.3</td>
<td>Oracle 11.2.0.3</td>
<td>* Released for selected customers only</td>
</tr>
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</table>

*InfiniBand cable*
Real World Checkpoint

• Live? And alive?
  – Yes! Go-live on 3-JUL-2012
    • Almost three weeks earlier than proposed
  – Total migration and upgrade time: ~4 hours
    • < 3 hours: Restore for Standby and recovery
    • < 20 mins: Database upgrade to Oracle 11.2.0.3
    • ~ 40 mins: Extra tasks (crsctl etc.)
  – Significant performance improvements
    • Job runtimes decreased again by 30-60%
Real World Checkpoint

• A few plans did change – but we were prepared 😊
  – Had captured all plans from AWR into an SQL Tuning Set
  – Remedied failing plans with SQL Plan Management
Resources

• Download slides from:
  – http://blogs.oracle.com/UPGRADE
Hardware and Software
Engineered to Work Together