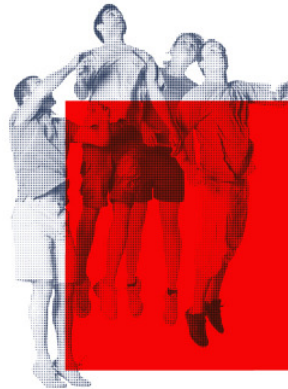


Database-Upgrade and -Migration using Oracle Streams



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Basel · Baden · Bern · Lausanne · Zurich · Düsseldorf · Frankfurt/M. · Freiburg i. Br. · Hamburg · Munich · Stuttgart · Vienna

Agenda



- The background of the project
- Streams – the functionality
- Setup
- Monitoring
- Switchover & Fallback
- Advantages & Disadvantages



Data are always
part of the game.

The background of the project (1)



- Large databases (about 3 – 5 TB)
- Large transaction volume (about 1 TB redolog/day)
- Platform change: HP-UX → Linux
- Oracle Upgrade: 10.2 → 11.2
- From single instance to RAC
- From file system to ASM
- Change of storage hardware
- Limited downtime (max. 5 hours)

The background of the project (2) – which method?



- Exp/imp or Datapump → Performance?
- Data Guard SQL Apply (Logical Standby)
 → Not applicable due to platform change from HP-UX → Linux
- Self-made methods had bad performance
- Tools like „Golden Gate“ or „Quest Shareplex“ → License costs?
- Transportable Tablespaces?
- Streams?

Agenda



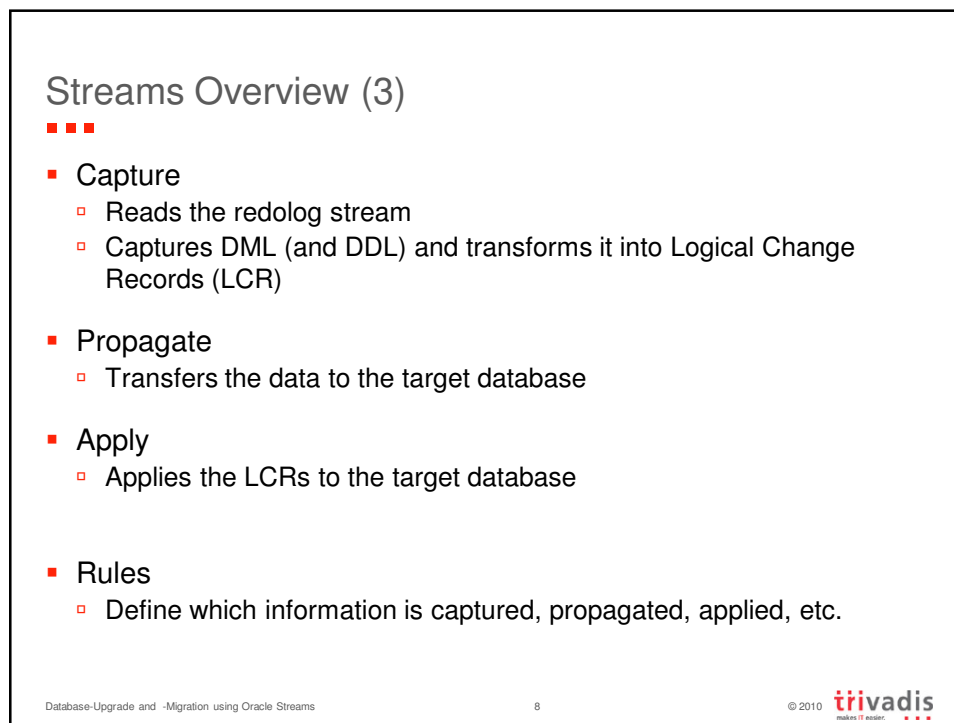
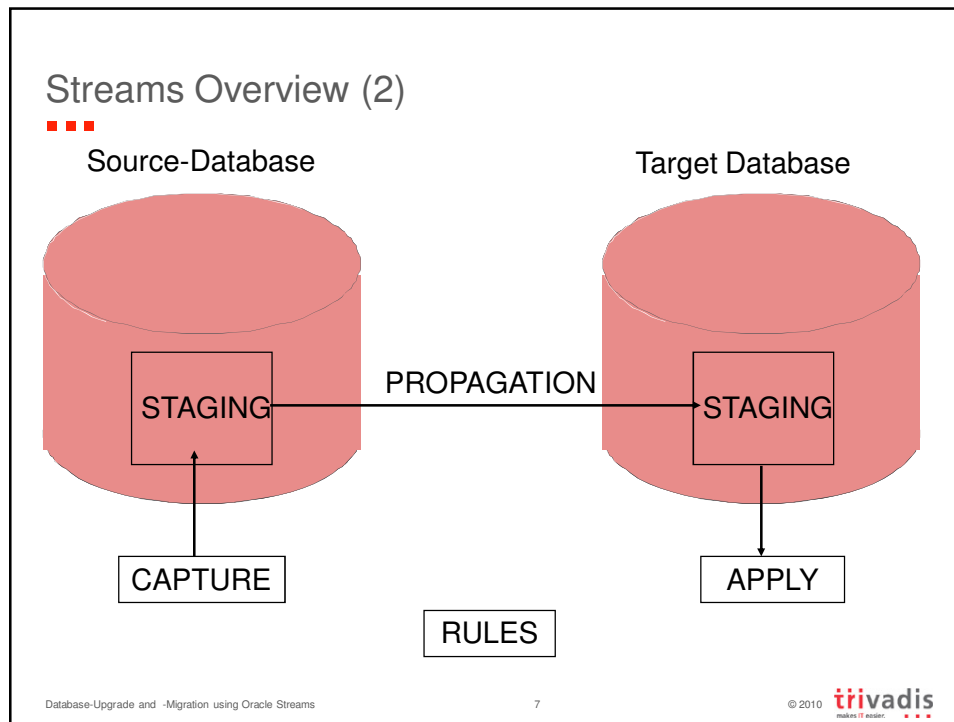
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Streams Overview (1)



- Functionality available since Oracle 9.2
- Setup and administration simplified with Oracle 10g ☺
- Exchange of data (messages) within a database or between databases
- Based on LogMiner- and Advanced Queueing technology
- Used for
 - Replication
 - Data Load
 - Migration & Upgrade



Streams Overview (4)



- Local Capture
 - Capture process runs on the source database
- Downstream Capture
 - Redologs are transferred to the target database (like with DataGuard)
 - Capture runs on target database
- “Capture Database”
 - You can add a 3rd database to the process, which does the capture
 - Necessary if you change the platform and you don't want to work with local capture (e.g. for performance reasons).
Source DB → Capture DB (same OS) → Target DB (different OS)
- Streams can work in both directions => simplifies fallback

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Setup (1) – Database



- ARCHIVELOG-Mode & Supplemental Logging

```
ALTER DATABASE ADD SUPPLEMENTAL LOG DATA
(PRIMARY KEY, UNIQUE INDEX, FOREIGN KEY) COLUMNS
```

- Tablespace for Streams Queues

```
CREATE TABLESPACE STREAMSDATA DATAFILE
'/u01/oradata/SOURCE/streamsdata01.dbf' SIZE 100M;
```

- A directory

```
CREATE OR REPLACE DIRECTORY STREAMS_DIR
AS '/u00/app/oracle/admin/SOURCE/streams_dir';
```

Setup (2) – Parameter



Parameter	Value	Comment
STREAMS_POOL_SIZE	>=256 M	For streams processes and queues, see v\$streams_pool_advice
GLOBAL_NAMES	TRUE	
JOB_QUEUE_PROCESSES	>=4	For Propagation and Apply-Jobs
UNDO_RETENTION	(depends)	Important for the instantiation using DataPump
OPEN_LINKS	>= 4	
PROCESSES		Don't forget the additional sessions for capture, propagate and apply

Setup (3) –STREAMSADMIN User



- A Streams environment needs a database user as a “Streams Administrator”
 - Owner of the Streams-AQ-Tables and Queues
- Don't use SYS or SYSTEM for this task!

```
CREATE USER STREAMSADMIN IDENTIFIED BY STREAMSADMIN
DEFAULT TABLESPACE STREAMSDATA TEMPORARY TABLESPACE
TEMP;
```

```
GRANT connect, resource, dba, select_catalog_role TO
STREAMSADMIN;
```

```
execute
DBMS_STREAMS_AUTH.GRANT_ADMIN_PRIVILEGE (' STREAMSADMIN' );
```

Setup (4) – DBMS_STREAMS_ADM Package



Procedure	Function
MAINTAIN_GLOBAL	Configures streams replication for the complete database
MAINTAIN_SCHEMAS	Configures streams replication for the specified schemas
MAINTAIN_TABLES	Configures streams replication for the specified tables
PRE_INSTANTIATION_SETUP	Configures capture and propagate
POST_INSTANTIATION_SETUP	Configures apply
CLEANUP_INSTANTIATION_SETUP	Removes a streams configuration set up by PRE_INSTANTIATION_SETUP
RECOVER_OPERATION	Deals with a failed streams setup
REMOVE_STREAMS_CONFIGURATION	Removal of a streams configuration

Setup (5) – the easy case



```

BEGIN
DBMS_STREAMS_ADM.MAINTAIN_GLOBAL(
  source_directory_object    => 'STREAMS_DIR',
  destination_directory_object => 'STREAMS_DIR',
  source_database            => null,
  destination_database       => 'target.markusflechtner.fma',
  perform_actions            => FALSE,
  script_name                => 'streams_setup.sql',
  script_directory_object    => 'STREAMS_DIR',
  dump_file_name             => 'exp_database.dmp',
  capture_name               => 'CAP_DB',
  capture_queue_table        => 'CAP_Q_T_DB',
  capture_queue_name         => 'CAP_Q_DB',
  propagation_name          => 'PROP_DB',
  apply_name                 => 'APP_DB',
  apply_queue_table          => 'APP_Q_T',
  apply_queue_name           => 'APP_Q',
  log_file                   => 'exp_database.log',
  bi_directional             => false,
  include_ddl                => false,
  instantiation              => DBMS_STREAMS_ADM.INSTANTIATION_FULL);
END;
/

```

Setup (6) – the easy case



- The procedure `DBMS_STREAMS_ADM.MAINTAIN_GLOBAL` creates a script `streams_setup.sql`
- The script can be modified (e.g. to add parallelism for DataPump)
- This script will
 - Configure capture and propagate on the source system
 - Instantiate the data (copy the initial data from source to target) using DataPump
 - Configure apply on the target system
- That's it 😊

streams_setup.sql

Setup (7) – Instantiation



- Instantiation = copying the “initial” data from the source database to the target database
- Methods
 - DBMS_STREAMS_ADM.MAINTAIN_GLOBAL|SCHEMAS|TABLES
 - Datapump
 - rman: Duplicate Database (same platform)
 - rman: Convert database (across platforms)
- When using DBMS_STREAMS_ADM or Datapump the tablespaces and users must be created before starting the instantiation

Setup (8) – „complex“ example



- Execute PRE_INSTANTIATION_SETUP
 - Capture and propagate will be configured
- Retrieve current SCN from v\$database


```
SQL> select current_scn from v$database;
CURRENT_SCN
-----
       7185879
SQL> alter system archive log current;
```
- Create the new database e.g. by using rman:


```
DUPLICATE DATABASE „(until scn“)
```
- Execute POST_INSTANTIATION_SETUP
 - Apply will be configured

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- **Monitoring**
- Switchover & Fallback
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Monitoring (1) – Oracle Enterprise Manager



ORACLE Enterprise Manager 10g Database Control

Database Instance: SOURCE.markusflechtner.fma >

Streams

Overview Capture Propagation Apply Messaging

Capture

Capture Processes 1
Capture Processes Having Errors ✓ 0

Propagation

Propagation Jobs 1
Propagations Having Errors ✓ 0

Apply

Apply Processes 0
Apply Processes Having Errors ✓ 0

Messaging

Queue Tables 14
Queues 27
Total Propagation Errors ✓ 0

Related Links

- [Streams Global, Schema, Table and Subset Replication Wizard](#)
- [Streams Tablespace Replication Wizard](#)
- [Remove Streams Configuration](#)

Monitoring (2) – Data Dictionary Views



DBA_STREAMS_UNSUPPORTED	Tables which are not supported by streams
DBA_RECOVERABLE_SCRIPT_ERRORS	Lists errors during setup
DBA_QUEUE_SCHEDULES	Propagation Schedules
DBA_CAPTURE	Information on capture process incl. errors
DBA_PROPAGATION	Information on propagate process incl. errors
DBA_APPLY	Information on apply process incl. errors
V\$STREAMS_POOL_ADVICE	Advice on sizing the streams pool

Monitoring (3)



- Healthcheck-scripts from My Oracle Support (MOS 273674.1)
 - Verification of the streams setup
 - Monitoring the replication
- Oracle “Streams Monitor” - STRMMON (MOS 296605.1)
- Oracle Streams Performance Advisor (11g)
 - Package DBMS_STREAMS_ADVISOR_ADM
- “Heartbeat-Table”
 - On the source database a database job periodically inserts a new record

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Switchover & Fallback



- **Switchover**
 - Shutdown the application
 - Wait for replication to complete (e.g. By checking heartbeat table)
 - Change connection data for the clients (tnsnames.ora etc.)
 - Startup the application
- **Fallback** (in case of bi-directional replication)
 - The other way round ...
- **Cleanup** (if migration resp. Upgrade was successful)
 - DBMS_STREAMS_ADM.REMOVE_STREAMS_CONFIGURATION
 - DROP USER STREAMSADMIN;
 - DROP TABLESPACE STREAMSDATA;

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Advantages & Disadvantages



- + Very flexible
- + Easy fallback
- + Very short downtime
- + Change of database character set possible
- Setup can be complex
- Overhead (supplemental logging, capture process etc.)
- Not all datatypes supported (DBA_STREAMS_UNSUPPORTED shows unsupported objects)
- High transaction load may cause problems

References – Whitepapers & Presentations



- Oracle 11.2 Dokumentation „Streams Concepts and Administration“ Appendix D „Online Database Upgrade and Maintenance with Oracle Streams“
- Oracle Streams Configuration Best Practices
http://www.oracle.com/technology/deploy/availability/pdf/maa_10gr2_streams_configuration.pdf
- Oracle Streams Performance Tuning Best Practices
http://www.oracle.com/technology/deploy/availability/pdf/maa_wp_10gr2_streams_performance.pdf
- Avoiding Downtime during Platform Migration
<http://www.e-dba.com/i/e-dba-website/resources/oracle/presentations/e-DBA%20UNIX%20SIG%20090120.pdf>

References – MOS-Notes



- 752871.1 - Streams Complete Reference FAQ
- 733205.1 - Migration of Oracle Database Instances Across OS Platforms
- 782444.1 - Upgrading Database Version Online Using Streams and RMAN
- 413586.1 - How To Use RMAN CONVERT DATABASE on Source Host for Cross Platform Migration
- 296605.1 - Oracle Streams Monitoring Utility STRMMON
- 273674.1 - Streams Configuration Report and Health Check Script
- 782541.1 - Streams Replication Supplemental Logging Requirements
- 556742.1 - Extended Datatype Support for Streams
- 732644.1 - Oracle Streams Performance Advisor

■ ■ ■ Thanks for your attention!
.. any questions?



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