

# ■ ■ ■ Database-Upgrade and -Migration using Oracle Streams



Markus Flechtner

markus.flechtner@trivadis.com  
DOAG-Regionaltreffen  
20. Oktober 2010

**trivadis**  
makes **IT** easier. ■ ■ ■

# Agenda



Data are always  
part of the game.

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

# 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



Data are always  
part of of the  
game.

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

# Streams Overview (1)



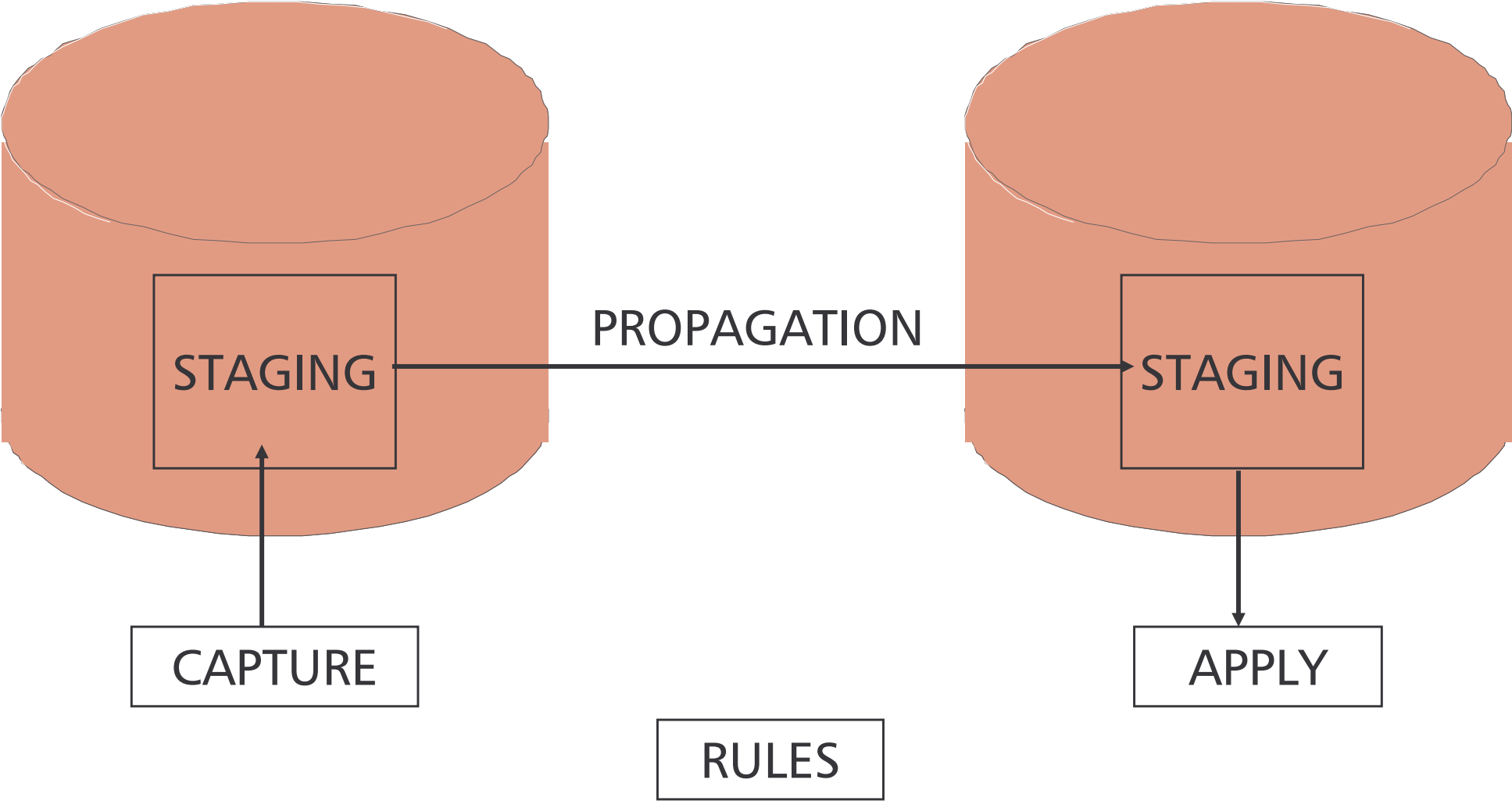
- Functionality available since Oracle 9.2
- Setup and administration simplified with Oracle 10g ☺
- Exchange of data (messages) within a database or between databases
- Based on LogMiner- and Advanced Queueing technology
- Used for
  - Replication
  - Data Load
  - Migration & Upgrade

# Streams Overview (2)



Source-Database

Target Database



# Streams Overview (3)



- Capture
  - Reads the redolog stream
  - Captures DML (and DDL) and transforms it into Logical Change Records (LCR)
  
- Propagate
  - Transfers the data to the target database
  
- Apply
  - Applies the LCRs to the target database
  
- Rules
  - Define which information is captured, propagated, applied, etc.



# 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 3<sup>rd</sup> 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

# Agenda



Data are always  
part of of the  
game.

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

# 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

`streams_setup.sql`

- That's it 😊



# 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

# Setup (9) – Attention!



- By default, the apply process stops on error!
- Errors are listed in DBA\_APPLY\_ERRORS
- DBMS\_APPLY\_ADM.EXECUTE\_ERROR can be used to retry a transaction (or EXECUTE\_ALL\_ERRORS)
- Or you configure the process to „ignore all errors“

```
EXECUTE
DBMS_APPLY_ADM.SET_PARAMETER
(
  '<<apply_name>>',
  'disable_on_error',
  'N'
);
```

# Agenda



Data are always  
part of the game.

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

# 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, e.g. IOTs, user-defined-datatypes
DBA_RECOVERABLE_SCRIPT_ERRORS	Lists errors during setup
DBA_QUEUE_SCHEDULES	Propagation Schedules (check for failures)
DBA_CAPTURE	Information on capture process incl. errors
DBA_PROPAGATION	Information on propagate process incl. errors
DBA_APPLY	Information on apply process incl. errors
DBA_APPLY_PROGRESS	Displays apply progress resp. latency
DBA_APPLY_ERROR	Transactions which could not be applied
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

# Agenda



Data are always  
part of the game.

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



# 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;`

# Agenda



Data are always part of the game.

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

# 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

# When to consider Streams for migration or upgrade?



- You may consider streams, if ..
  - Operating systems or character sets are different
  - Your database is „small“
  - Minimum downtime during an upgrade is important
  - Streams replication of all (or most) of your tables is supported
  - Amount of transactions is low
  
- Streams is not an option, if ...
  - you are running the database in NOARCHIVELOG-mode
  - you've got a lot of NOLOGGING transactions
  - You've got a „high“ transaction load on the system
  - You are afraid of the performance implications on the source system (supplemental logging, capturing resp. redolog transfer )

# 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](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](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
- 418755.1 – 10gR2 – Streams Recommended Configuration
- 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?



**trivadis**  
makes **IT** easier. ■ ■ ■

