Data Guard is Easy

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… about me

- Oracle Spezialist since 1992
  - 1992: Presales at Oracle in Dusseldorf
  - 1999: Projectmanager at Herrmann & Lenz Services GmbH
  - 2005: Technical Director ADM Presales at Quest Software GmbH
  - 2011: Executive Director at CarajanDB GmbH
- 2011 → Oracle ACE
- Author of the following books:
  - Oracle9i für den DBA, Oracle10g für den DBA, Oracle 11g Release 2 für den DBA
- DOAG Responsibility for Database Administration and Standard Edition
- Hobbys:
  - Kiting – esp. Indoor Kiting
  - Motorcykling
  - Singing in a Choir

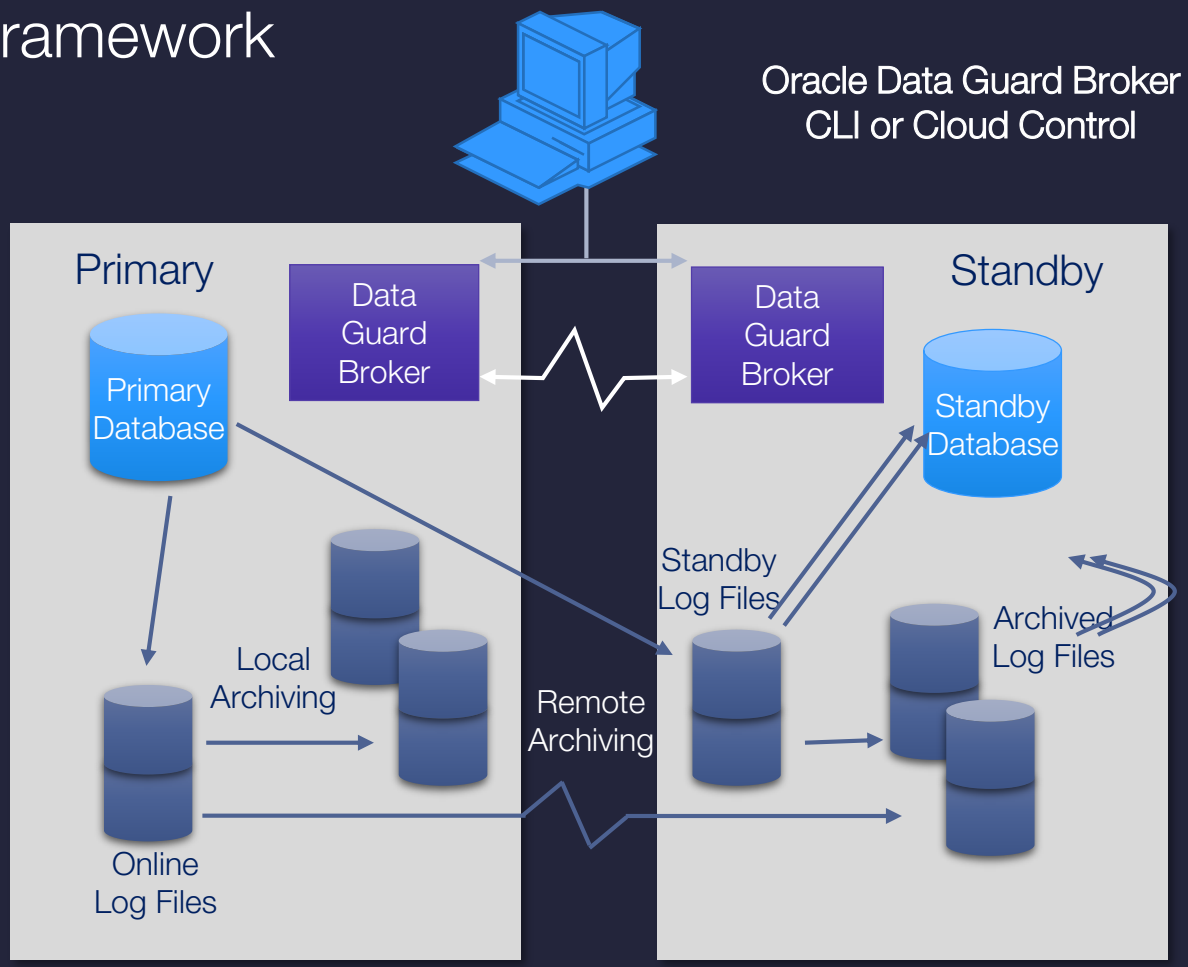
Data Guard Basics

Standby vs. Data Guard

- Standby
  - A Datenbank which is in Recovery Mode
- Data Guard
  - Configuration with at minimum two databases. Where one is the primary an the other(s) are the standby databases
- Data Guard Broker
  - Data Guard Configuration process
    - Management via Cloud Control or CLI
- DGMGRL
  - Command Line Interface for Data Guard Broker

Data Guard

- Data Guard Broker Framework



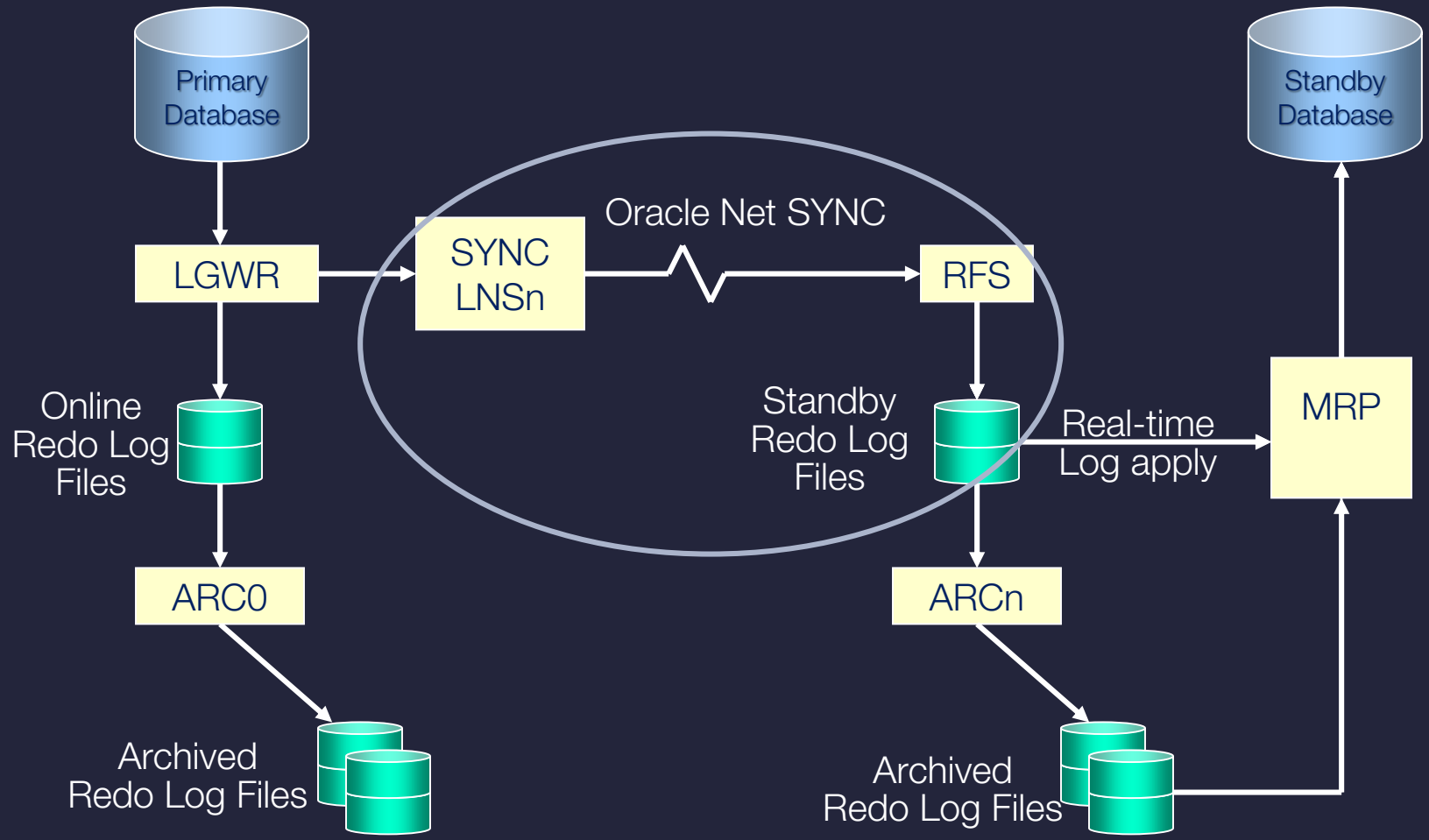
Data Guard Processes

- DMON: Data Guard Monitor on Primary and Standby
- MRP: Managed Recovery Prozess (Physical) on Standby
- LNS: LGWR Network Server
- RSM: Remote System Monitor monitoring the environment
- RFS: Remote File Server retrieves redo from primary
- NSV: Network Slave synchronizes the configuration

Protection Level

- Maximum Protection
  - No data loss
  - „Transaction completed“ retrieved only if the transaction has been written to minimum one standby redo log
  - RPO=0
- Maximum Performance
  - The primary database should not suffer from standby database activity
  - „Transaction Completed“, if data has been written to the primary redo logs
- Maximum Availability
  - Maximum Protection, as long as the standby is online
  - Maximum Performance, if standby is offline for more than <n> seconds

Maximum Availability Mode



Maximum Availability Mode

- Requirements:
  - Standby Redologs, reliable network

```
SQL> ALTER DATABASE ADD STANDBY LOGFILE GROUP 11
     ('/u02/oradata/FRAGILE/stbyredo11.log') size 200M;
```

  - Standby redo logs are created in addition to the online redo logs and only used on the standby database
    - Nevertheless the primary database should have standby redo logs as well to allow a role switch
  - Calculation: same size as the online redo logs and number of online redologs plus one per thread

Data Guard Konfiguration

CARAJAN DB

Setup

1. Database preparation (primary)
   - Database parameter
   - Force Logging
   - Standby Redologfiles
   - Oracle Net Parameter
   - Broker Files
2. Database duplication
   - Password file copy
   - RMAN duplicate
   - Activate Flashback Database
3. Data Guard Broker Configuration
   - Create configuration files
   - Choose protection level
   - Activate configuration

CARAJAN DB

Installation & Setup

- Primary database preparation
- Force Logging
  - You should always force logging for the database to prevent from unforseen outages

```
ALTER DATABASE FORCE LOGGING;
```

- DB_UNIQUE_NAME
  - Unique identifier for each database in the data guard configuration
  - Primary and standby databas will use the same DB_NAME
  - But DB_UNIQUE_NAME is unique for each of the databases
- DOMAIN_NAME
  - If used it should be identical for all databases

Tip 1: DB_UNIQUE_NAME

- DB_UNIQUE_NAME
  - Recommendation
    - DB_UNIQUE_NAME →DB_NAME + Location
    - e.g.
      - Database 1 (primary) → `<DBNAME>_S1`
      - Database 2 (standby) → `<DBNAME>_S2`
- Don‘t disqualify the standby database, e.g.
  - <DBNAME>_PROD vs. <DBNAME>_STBY
  - This has the risk that colleagues might stop your „standby“ database will it is production

Flashback Database

- Flashback Database
  - Without flashback database data guard reinstate is not possible. This leads into the problem that, whenever a failover occurs the standby database has to be recreated

```
SQL> ALTER DATABASE FLASHBACK ON;
```

  - There are some bugs while online activating flashback with RAC. So better activate flashback while the instances are in mount

Oracle Net

- listener.ora
  - Static database parameter in listener.ora to allow a remote startup (required for RMAN duplicate)
  - Additional entry for Data Guard Failover / Switchover Connect

```
…
SID_LIST_LISTENER =
   (SID_LIST =
      (SID_DESC =
         (GLOBAL_DBNAME = FRAGILE_S1.carajandb.intra)
         (ORACLE_HOME=/u01/app/oracle/product/12.2.0/dbhome_1)
         (SID_NAME = FRAGILE))
      (SID_DESC =
         (GLOBAL_DBNAME = FRAGILE_S1_DGMGRL.carajandb.intra)
         (ORACLE_HOME=/u01/app/oracle/product/12.2.0/dbhome_1)
         (SID_NAME = FRAGILE))
)
```

Oracle Net

- tnsnames.ora
  - Dedicated entry for each database for RMAN Duplicate

„Normal“ Connect

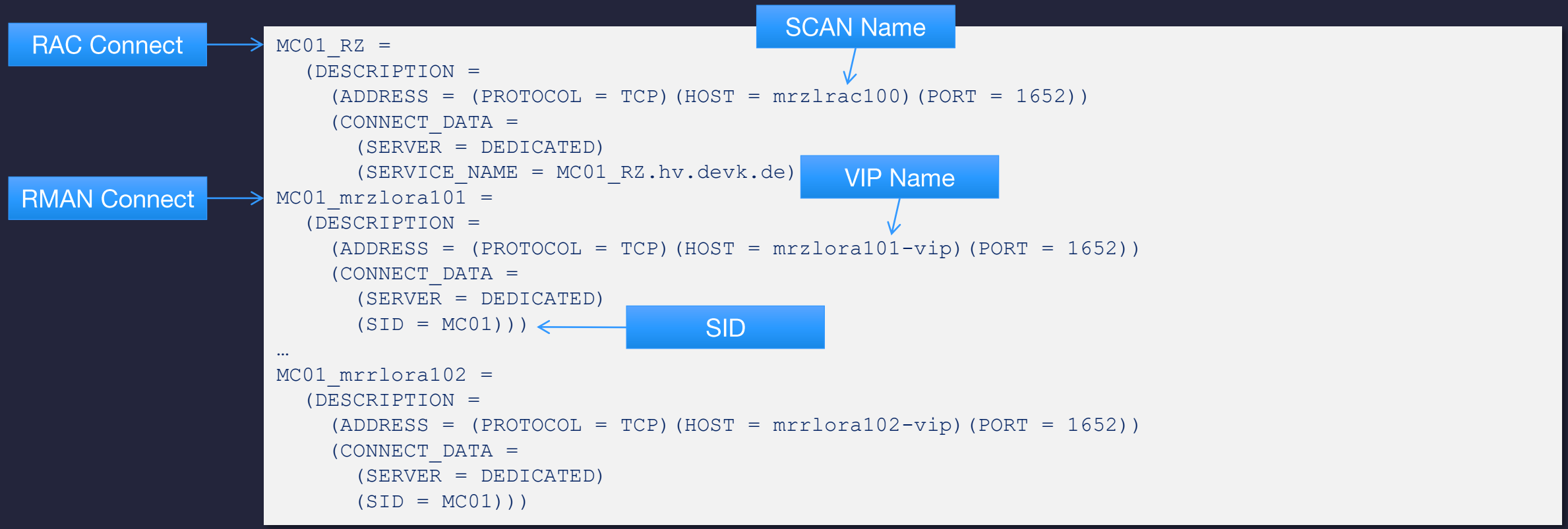
RMAN Duplicate Connect

```
FRAGILE_S1.carajandb.intra =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = sting)(PORT = 1521))
    (CONNECT_DATA =
      (SERVICE_NAME = FRAGILE_S1.carajandb.intra)))
FRAGILE_S2.carajandb.intra =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = simon)(PORT = 1521))
    (CONNECT_DATA =)
      (SERVICE_NAME = FRAGILE_S2.carajandb.intra)))

FRAGILE_sting.carajandb.intra =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = sting)(PORT = 1521))
    (CONNECT_DATA =
      (SID = FRAGILE)))
FRAGILE_simon.carajandb.intra =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = simon)(PORT = 1521))
    (CONNECT_DATA =
      (SID = FRAGILE)))
```

Oracle Net with RAC

- tnsnames.ora
  - Additional entry for RMAN duplication via VIP instead of scan



Important Parameter

- Important Server Parameter:

```
ALTER SYSTEM SET db_domain='carajandb.intra' scope=spfile;
ALTER SYSTEM SET db_unique_name=FRAGILE_S1 scope=spfile;
ALTER DATABASE FORCE LOGGING;
ALTER SYSTEM SET db_recovery_file_dest_size=25G;
ALTER SYSTEM SET dg_broker_config_file1='/u02/oradata/FRAGILE/dg_config1.cfg';
ALTER SYSTEM SET dg_broker_config_file2='/u03/orabackup/FRAGILE/dg_config2.cfg';
ALTER SYSTEM SET dg_broker_start=FALSE;
```

Tip 2: Query On Physical

- Real Time Apply means that the database is open for read activity while recovery is ongoing
- You need to have licensed Active Data Guard
- Grid Infrastructure will check if real time apply has been configured or not
  - But Single instance with SQL*Plus does not!
- Better set the following parameter:

```
ALTER SYSTEM SET "_query_on_physical"=false SCOPE=spfile;
```

- Warning: this parameter is not officially supported

Maximum Availability Mode

- “Activate” MaxAvailabaility Mode

```
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY 'LogXptMode'='SYNC';
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY 'LogXptMode'='SYNC';
EDIT CONFIGURATION SET PROTECTION MODE AS maxavailability;
```

- Timeout parameter

```
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY 'NetTimeout'=60;
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY 'NetTimeout'=60;
```

CARAJAN DB

Installation and Setup

- Create a dummy pfile for the standby database
  - It‘s only used for the first startup
  - RMAN dupicate will create a valid copy of the spfile
- Copy the password file to the standby database
  - Before 12.2 → whenever the password changes
  - Since Oracle 12.2 → automatic resynchonization
- IMPORTANT: While using RAC only use a single instance for duplicate
  - That means: <DBNAME>1 and not <DBNAME>

```
SQL> startup nomount
        pfile='/u01/app/oracle/admin/FRAGILE/pfile/initdup.ora'
```

Tip 3: init.ora

- Dummy init.ora for RMAN Duplicate on all hosts!

```
*.audit_trail='DB'
*.compatible='12.2.0.1.0'
*.db_block_size=8192
*.db_domain='carajandb.intra'
*.db_name='FRAGILE'
*.db_recovery_file_dest='/u03/orabackup/FRAGILE'
*.db_recovery_file_dest_size=20G
*.diagnostic_dest='/u01/app/oracle'
*.log_archive_format='%t_%s_%r.arc'
*.pga_aggregate_target=512M
*.processes=1000
*.remote_login_passwordfile='EXCLUSIVE'
*.sga_target=2000M
*.undo_tablespace='UNDOTBS1'
```

RMAN Duplicate

- Will create the standby database in one single step
  - Create spfiles
  - Create Standby Controlfiles
  - Change DB_UNIQUE_NAME
- IMPORTANT:
  - Check that you are able to connect to the primary and dummy instance from ALL servers via TNS alias
- Start RMAN duplicate from the standby dataa

```
rman @duplicate.rcv
```

Tip 4: Connect Test

- RMAN Duplicate Check
  - Primary Database
    - RMAN Connect TARGET
    - RMAN Connect AUXILIARY
  - Standby Database
    - RMAN Connect TARGET
    - RMAN Connect AUXILIARY

5. Tipp: RMAN Script

- Create an individual RMAN script for each side

„Normal“ Connect

RMAN Duplicate Connect

```
connect target sys/manager@FRAGILE_S1
connect auxiliary sys/manager@FRAGILE_simon
run{
allocate channel prmy1 type disk;
allocate auxiliary channel stby1 type disk;
DUPLICATE TARGET DATABASE
  FOR STANDBY
  FROM ACTIVE DATABASE
  DORECOVER
  SPFILE
  PARAMETER_VALUE_CONVERT 'FRAGILE_S1','FRAGILE_S2','sting','simon'
  SET "db_unique_name"="FRAGILE_S2"
  SET "instance_number"="1"
  NOFILENAMECHECK;
}
```

Data Guard Preparation

- Activate Flashback Database on standby

```
ALTER DATABASE FLASHBACK ON;
```

- Start Data Guard Broker (both databases)

```
ALTER SYSTEM SET dg_broker_start=true;
```

- … wait because broker process startup might take some minutes

Data Guard Configuration

- Data Guard configuration has to be made on the primary database
  - Choose a configuration name – will never been used again
  - Primary Datenbank using DESCRIPTION or TNS-Alias
  - Standby Datenbank using DESCRIPTION or TNS-Alias
  - Default: Maximum Performance Mode

```
CREATE CONFIGURATION 'FRAGILE_DG' AS
PRIMARY DATABASE IS 'FRAGILE_S1'
CONNECT IDENTIFIER IS 'FRAGILE_S1.carajandb.intra';

ADD DATABASE 'FRAGILE_S2' AS
CONNECT IDENTIFIER IS 'FRAGILE_S2.carajandb.intra'
MAINTAINED AS PHYSICAL;
```

Data Guard Configuration

- Data Guard Parameter

```
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY StandbyFileManagement='AUTO';
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY StandbyFileManagement='AUTO';
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY 'NetTimeout'=60;
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY 'NetTimeout'=60;
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY 'LogXptMode'='SYNC';
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY 'LogXptMode'='SYNC';
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY dbDisplayName = 'FRAGILE_S1.carajandb.intra';
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY dbDisplayName = 'FRAGILE_S2.carajandb.intra';
EDIT CONFIGURATION SET PROTECTION MODE AS MAXAVAILABILITY;
```

- Activate Data Guard

```
DGMGRL> ENABLE CONFIGURATION
```

Tip 5: Data Guard Skript

- One configuration file per side

```
cat > /u01/app/oracle/admin/FRAGILE/scripts/dgconfig.dgc <<EOCAT
CREATE CONFIGURATION 'FRAGILE_DG' AS
PRIMARY DATABASE IS 'FRAGILE_S1'
CONNECT IDENTIFIER IS 'FRAGILE_S1.carajandb.intra';
ADD DATABASE 'FRAGILE_S2' AS
CONNECT IDENTIFIER IS 'FRAGILE_S2.carajandb.intra'
MAINTAINED AS PHYSICAL;
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY StandbyFileManagement='AUTO';
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY StandbyFileManagement='AUTO';
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY 'NetTimeout'=60;
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY 'NetTimeout'=60;
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY 'LogXptMode'='SYNC';
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY 'LogXptMode'='SYNC';
EDIT DATABASE 'FRAGILE_S1' SET PROPERTY dbDisplayName = 'FRAGILE_S1.carajandb.intra';
EDIT DATABASE 'FRAGILE_S2' SET PROPERTY dbDisplayName = 'FRAGILE_S2.carajandb.intra';
EDIT CONFIGURATION SET PROTECTION MODE AS MAXAVAILABILITY;
ENABLE CONFIGURATION;
EOCAT
```

- Since 12.2

```
dgmgrl / @/u01/app/oracle/admin/FRAGILE/scripts/dgconfig.dgc
```

Changing parameters

- The following parameter are now managed through Data Guard (Don‘t change them manually, e.g. via ALTER SYSTEM)
  - `log_archive_dest_1`
  - `log_archive_dest_2 (only primary DB)`
  - `log_archive_dest_state_2`
  - `log_archive_config`
  - `standby_file_management`
  - `fal_server (only Standby DB)`

Tempfile Creation

- MOS Doc ID 1514588.1
  - Data Guard Physical Standby - Managing temporary tablespace tempfiles
  - Oracle Database - Enterprise Edition - Version 10.2.0.1 to 12.1.0.2 [Release 10.2 to 12.1]

Standby Site

The tempfile thats has been added to the Primary site file is not automatically replicated to the Standby site like regular datafiles.
There is still only one tempfile in the Standby database even though there are now 2 tempfiles in the Primary.
The parameter **standby_file_management=AUTO** *has no impact* on tempfile management in the environment.

Data Guard Wallet

Tip 6: Connect using TNS-Alias

- For failover, switchover and other operations the Data Guard connect musst be fully qualified including username and password
  - Might lead into problems with securty / scripting, etc.
  - Minimize security risk using SYSDG in Oracle 12.1

```
oracle@sting[FRAGILE]% dgmgrl sysdg/FragileDG1@FRAGILE_S1
DGMGRL for Linux: Release 12.2.0.1.0 - Production on Fri Jan 5 16:20:15 2018

Copyright (c) 1982, 2017, Oracle and/or its affiliates.  All rights reserved.

Welcome to DGMGRL, type "help" for information.
Connected to "FRAGILE_S1"
Connected as SYSDG.
```

Wallet Connecct

- SYSDG with Wallet and TNS alias authentication

```
oracle@sting[FRAGILE]% dgmgrl /@FRAGILE_S2_SYSDG
DGMGRL for Linux: Release 12.2.0.1.0 - Production on Fri Jan 5 16:21:44 2018

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Welcome to DGMGRL, type "help" for information.
Connected to "FRAGILE_S2"
Connected as SYSDG.
```

Walkthrouh

1. Create user with SYSDG privilege
2. Create TNS-Alias
3. Create Walletstore and Wallets for Data Guard
4. Modify sqlnet.ora
   - Be careful because if this entry is faulty noone might be able to connect to the database anymore
5. Modify Data Guard

1. Create or modify User

- Tip: don‘t use the default user!

```
sqlplus / as sysdba
SQL> ALTER USER sysdg IDENTIFIED BY FragileDG1;
SQL> GRANT sysdg TO sysdg;

scp $ORACLE_HOME/dbs/orapwFRAGILE simon:$ORACLE_HOME/dbs/orapwFRAGILE
```

2. Create TNS-alias

- Tip: Use an include file for all wallets

```
echo ifile=/u01/app/oracle/admin/wallet/tnsnames_wallet.ora >> $TNS_ADMIN/tnsnames.ora

cat /u01/app/oracle/admin/wallet/tnsnames_wallet.ora

FRAGILE_S1_SYSDG.carajandb.intra =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = sting)(PORT = 1521))
    (CONNECT_DATA =
      (SERVICE_NAME = FRAGILE_S1.carajandb.intra)))

FRAGILE_S2_SYSDG.carajandb.intra =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = simon)(PORT = 1521))
    (CONNECT_DATA =
      (SERVICE_NAME = FRAGILE_S2.carajandb.intra)))
EOCAT
```

3. Create Wallet

- Tip: separte directory and two wallets per database (with and without domain)

```
mkdir /u01/app/oracle/admin/wallet

mkstore -wrl /u01/app/oracle/admin/wallet -create

cd /u01/app/oracle/admin/wallet

mkstore -wrl /u01/app/oracle/admin/wallet -createCredential FRAGILE_S1_SYSDG SYSDG FragileDG1
mkstore -wrl /u01/app/oracle/admin/wallet -createCredential FRAGILE_S2_SYSDG SYSDG FragileDG1
mkstore -wrl /u01/app/oracle/admin/wallet -createCredential FRAGILE_S1_SYSDG.carajandb.intra
SYSDG FragileDG1
mkstore -wrl /u01/app/oracle/admin/wallet -createCredential FRAGILE_S1_SYSDG.carajandb.intra
SYSDG FragileDG1

cd  ..
scp -r wallet simon:`pwd`
```

4. Modify sqlnet.ora

```
cd $TNS_ADMIN
cat sqlnet.ora
NAMES.DEFAULT_DOMAIN=carajandb.intra
wallet_location =
   (SOURCE =
      (METHOD = FILE)
      (METHOD_DATA =
         (DIRECTORY = /u01/app/oracle/admin/wallet)
      )
   )
SQLNET.WALLET_OVERRIDE = TRUE
SSL_LCIENT_AUTHENTICATION = FALSE
SSL_VERSION = 0

scp tnsnames.ora sqlnet.ora simon:`pwd`
```

5. Modify Data Guard

- Modify the connect identifier and the static connect identifier to reflect the new TNS-alias

```
dgmgrl /
edit database "FRAGILE_S1" set property dgConnectIdentifier='FRAGILE_S1_SYSDG.carajandb.intra';
edit database "FRAGILE_S2" set property dgConnectIdentifier='FRAGILE_S2_SYSDG.carajandb.intra';
edit database "FRAGILE_S1" set property
StaticConnectIdentifier='FRAGILE_S1_SYSDG.carajandb.intra';
edit database "FRAGILE_S2" set property
StaticConnectIdentifier='FRAGILE_S2_SYSDG.carajandb.intra';
```

Use Data Guard Wallet

- Connect without Password

```
dgmgrl /@FRAGILE_S1_SYSDG
```

- Don‘t forget to modify your scripts!

Data Guard Reset

Reset Data Guard

- After Failover if fashback rentention has been exceeded
  - Unable to reinstate
- Alter faulty data guard broker configuration
  - e.g. Create Pluggable Database without script
  - …

1. Remove Standby Database

- Standby Database

```
sqlplus / AS SYSDBA

SQL> SHUTDOWN IMMEDIATE
SQL> STARTUP MOUNT RESTRICT
SQL> DROP DATABASE
SQL> !rm /u02/oradata/FRAGILE/dg_config1.cfg /u03/orabackup/FRAGILE/dg_config2.cfg
SQL> EXIT;
```

2. Reset Primary Database

- Primary Database

```
sqlplus / AS SYSDBA

SQL> ALTER SYSTEM SET dg_broker_start=false;
SQL> ALTER SYSTEM SET log_archive_dest_2='';
SQL> !rm /u02/oradata/FRAGILE/dg_config1.cfg /u03/orabackup/FRAGILE/dg_config2.cfg
SQL> EXIT;
```

3. Recreate Standby Database

- RMAN Duplicate

```
sqlplus / AS SYSDBA

SQL> startup nomount pfile='/u01/app/oracle/admin/FRAGILE/pfile/initdup.ora';
SQL> EXIT;

rman @/u01/app/oracle/admin/FRAGILE/scripts/duplicate.rcv

sqlplus / as sysdba
SQL> ALTER DATABASE FLASHBACK ON;
SQL> ALTER SYSTEM SET dg_broker_start=TRUE;
```

4. Activate Data Guard

- Primary Database

```
sqlplus / AS SYSDBA

SQL> ALTER SYSTEM SET dg_broker_start=true;
SQL> EXIT

dgmgrl / @/u01/app/oracle/admin/FRAGILE/scripts/dgconfig.dgc
```

CARAJAN DB

Tips

1. No disqualification of DB_UNIQUE_NAME (“STANDBY”)
2. Query On Physical Parameter → FALSE
3. Dummy init.ora
4. Connect Test to Primary and Standby from all servers
5. RMAN Script for duplication
6. Always Connect to Data Guard Broker using TNS-Alias
7. Data Guard Wallet instead of Password
8. Just wait and see …

CarajanDB

- More than 30 years experience in Database Administration
- Specialists for
  - Database Administration (Oracle and PostgreSQL)
  - High Availability (RAC, Data Guard, Replication, etc.)
  - Migration (Unicode, PostgreSQL)
  - Performance Tuning
  - Monitoring (OEM, Foglight, CheckMK, PEM)
- Remote Support
- Trainings and Workshops
  - PostgreSQL
  - Oracle
  - Toad

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Questions?