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**Oracle Database Gateways**

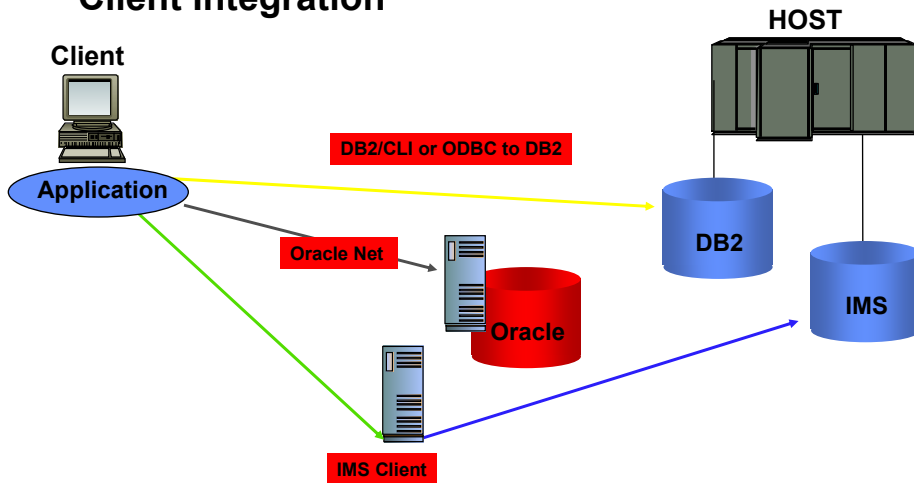
Thomas Niewel  
Leitender Systemberater

# Agenda

- Overview
- Which Systems can be integrated with Oracle Database Gateways
- Oracle Database Gateways – Best Practices
- Near Realtime Data Warehouse

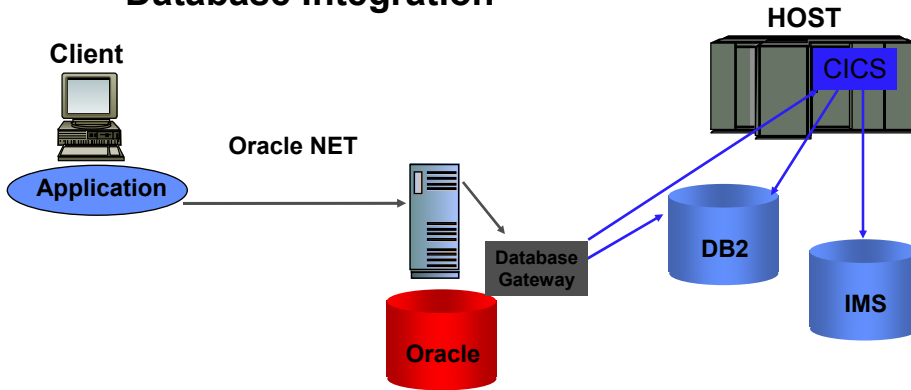
# Typical Architecture

## Client Integration



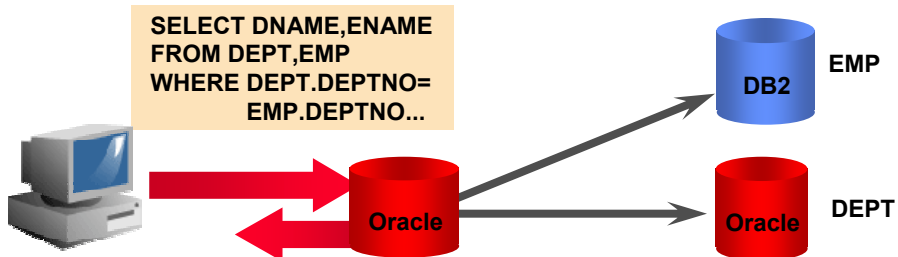
# Oracle Gateway Architecture

## Database Integration



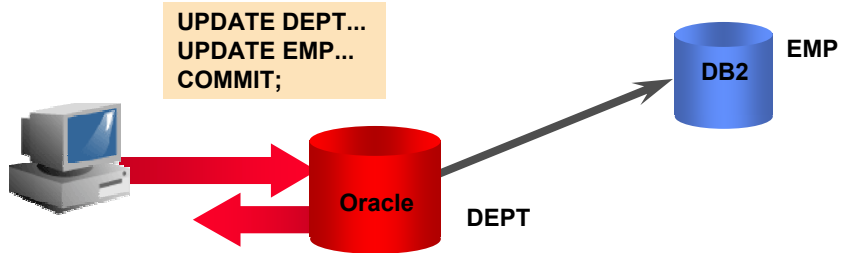
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# Oracle Database Gateways Distributed Joins



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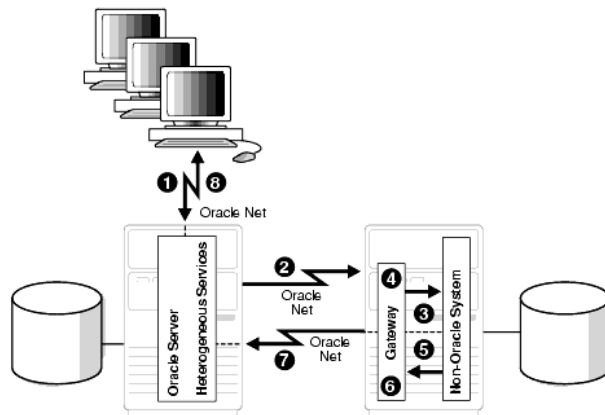
## Oracle Database Gateways Two-Phase Commit



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## Oracle Database Gateways Architecture



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## Architecture

- Heterogenous Services
  - Component of the Oracle Database
  - Intelligence of the gateways
  - Generic Functionality of the Gateways
  - Additional Components are needed to access Foreign data Stores(ODBC driver, Database Gateway)
- HS-Agent
  - is the Gateway Component
  - Communicates with non-Oracle Systems
  - “Capabilities” are part of the HS-Agent

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## Heterogenous Services

- Session Management
- Securing the Data integrity in distributed Transactions
- SQL Translation
- Data Dictionary Translation
- Provides Interface for fds-Stored Procedures Calls
- Pass-through SQL

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## Heterogeneous Services

View Name	Type	What it shows
• HS_BASE_CAPS	SQL service	All capabilities supported by Heterogeneous Services
• HS_BASE_DD	SQL service	All data dictionary translation table names supported by Heterogeneous Services
• HS_CLASS_CAPS	Transaction service, SQL service	Capabilities for each class
• HS_CLASS_DD	SQL service	Data dictionary translations for each class
• HS_CLASS_INIT	General	Initialization parameters for each class
• HS_FDS_CLASS	General	Classes accessible from this Oracle server
• HS_FDS_INST	General	Instances accessible from this Oracle8i server
• HS_INST_CAPS	transaction service, SQL service	Capabilities for each instance
• HS_INST_DD	SQL service	Data dictionary translations for each instance
• HS_INST_INIT	General	Initialization parameters for each instance
• V\$HS_SESSION		Sessions Running
• V\$HS_AGENT		Agents Running
• V\$HS_PARAMETER		Initialization Parameters

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## Agenda

- Overview
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- Gateways – Best Practices
- Near Realtime Data Warehouse

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## Oracle Database Gateways

- Open Systems Gateways
- Mainframe Gateways
- Legacy Gateways

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DATABASE 11g

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## Oracle Database Gateways

- Oracle Open Systems Gateways
  - Database Gateway for ODBC
  - Database Gateway for Sybase
  - Database Gateway for SQL Server
  - Database Gateway for Teradata
  - Database Gateway for Informix

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## Oracle Database Gateways

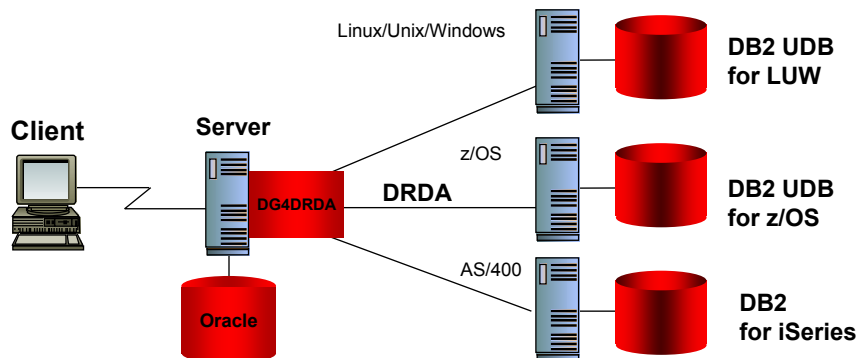
- Oracle Mainframe Gateways
  - Database Gateway for DRDA
    - Database Gateway for APPC
      - Procedural Gateway
    - Database Gateway for Websphere MQ
      - Procedural Gateway

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## Architecture

- Database Gateway for DRDA



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## Oracle Database Gateways

- Oracle Legacy Gateways
  - Database Gateway for IMS
  - Database Gateway for VSAM
  - Database Gateway for Adabas/c

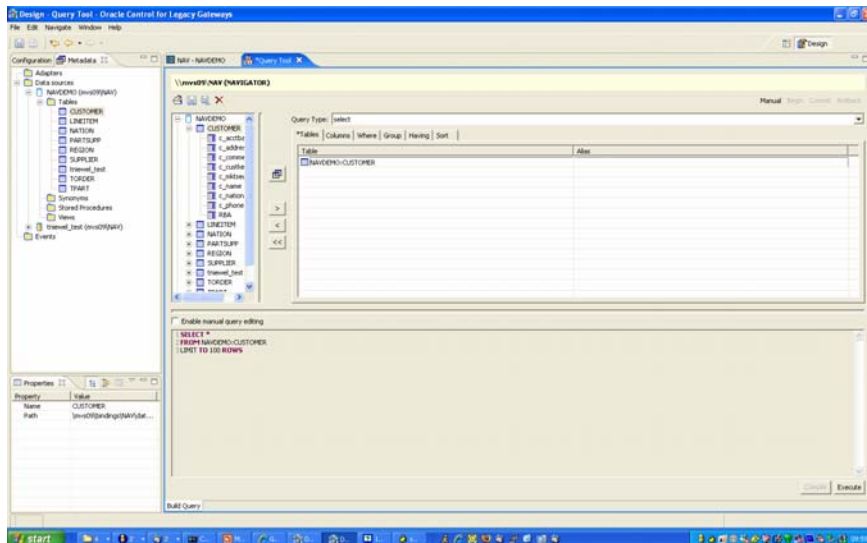
## Oracle Legacy Gateways

- Components
  - Oracle Connect
    - z/OS Listener
    - Connectivity to z/OS target system
    - Repository
  - Oracle Studio for IMS, VSAM and Adabas Gateways
    - Administrative GUI (Windows/Linux)
    - Processing of Cobol Copy Books (Mapping), PSB's, DBD's, Adabas Predict Metadata, Adabas DDM Files etc.

# Oracle Legacy Gateways

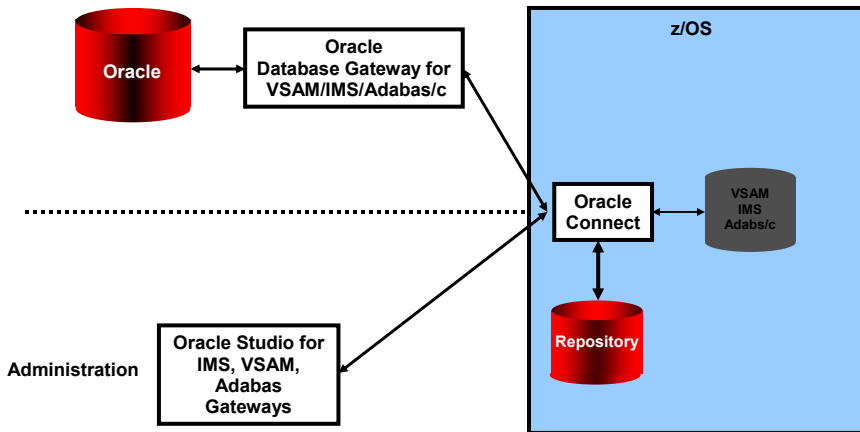
- Components
  - Oracle Database Gateway for IMS/VSAM/ADABAS
    - Gateway Software
    - Communicates with the Oracle Database and Oracle Connect
    - Conversion of SQL-Dialects, Datatypes etc.

# Oracle Legacy Gateways



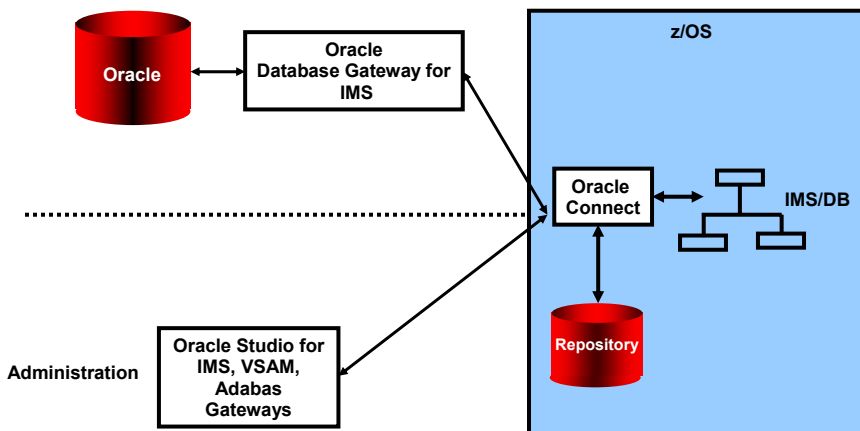
# Architecture

- Database Gateway for VSAM



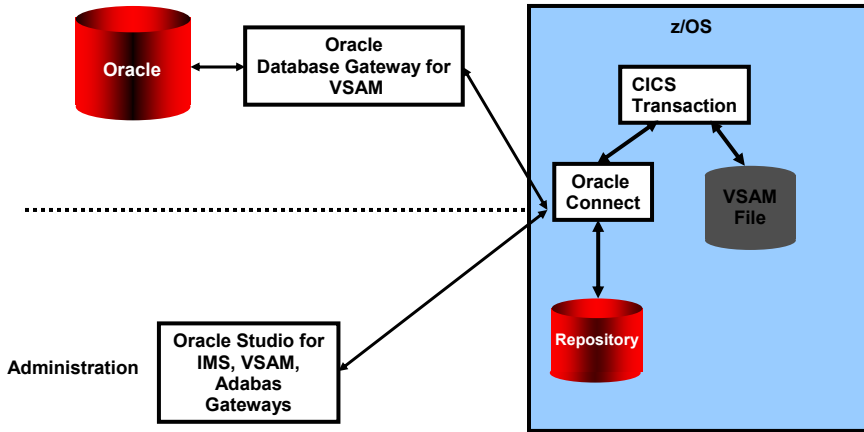
# Architecture

- Database Gateway for IMS – DLI Access



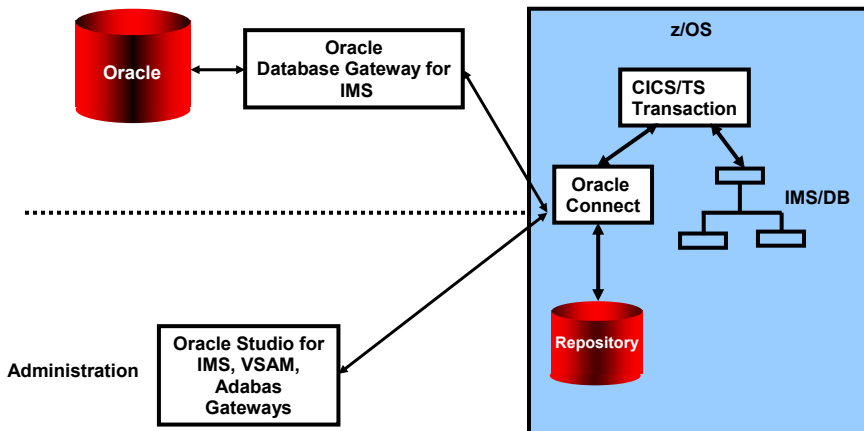
# Architecture

- Database Gateway for VSAM



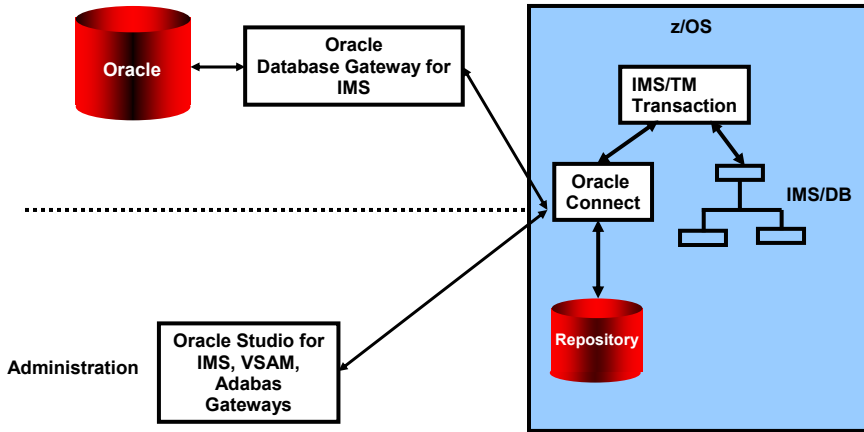
# Architecture

- Database Gateway for IMS - DBCTL Access



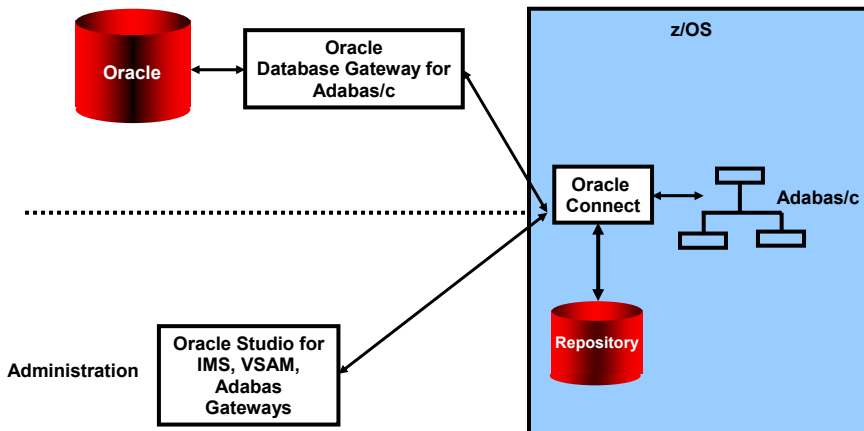
# Architecture

- Database Gateway for IMS – DBDC Access



# Architecture

- Database Gateway for Adabas/c



## Agenda

- Overview
- Which Systems can be integrated with Oracle Database Gateways
- Database Gateways – Best Practices
- Near Realtime Data Warehouse

## Best Practices

- How does a Gateway work - SQL Dialects
- Performance considerations
- Access to Foreign Datastores – Example DB2 for z/OS (via Database Gateway for DRDA)
- Optimization of a Load Process
- Security
- DB2 Threads – Oracle Sessions

## How does a Gateway work ? Compatible Functions

Oracle

Step 1

Select Max(Salary) from  
tab1@DB2 Where  
Name= 'MAIER'

DB2 for z/OS

Step 2

Select Max(Salary) from  
tab1 Where  
Name= 'MAIER'

Datatransfer  
Step 3

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## How does a Gateway work? Translated Functions

Oracle

Step 1

Select Name,age from  
tab1@DB2 Where  
NVL(Age,18)= 18

DB2 for z/OS

Step 2

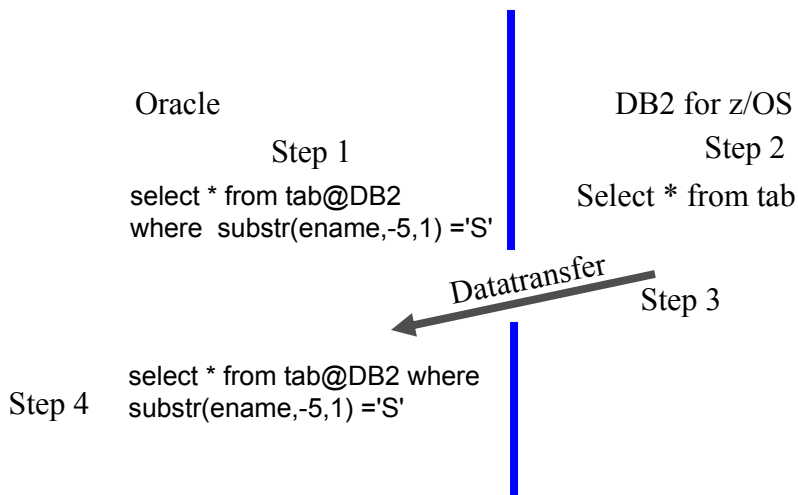
Select Name,age from  
tab1 Where  
Value(Age,18)= 18

Datatransfer  
Step 3

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## How does a Gateway work? Compensated Functions



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## Best Practices

- How does a Gateway work - SQL Dialects
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## Gateway Performance

- Compatible Functions
  - well performing
- Translated Functions
  - well performing
- Compensated Functions
  - Performance depending on the amount of data transferred
- Native Semantics
  - **DRDA\_CAPABILITY={FUNCTION}{ON|OFF}**

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## Gateway Performance

Table 14-1 DB2/OS390 SQL Compatibility, by Oracle SQL Function

Oracle SQL Function	Compatible	Translated	Compensated	Native Semantics Candidate
ABS			X	X
ACOS			X	
ADD_MONTHS			X	
ASCII			X	X
ASIN			X	
ATAN			X	
ATAN2			X	
AVG	X			
CEIL			X	X
CHARTOROWID			X	
CHR			X	X
CONCAT	X			
CONVERT			X	X
COS			X	X
COSH			X	X
COUNT(*)	X			
DECODE			X	X
DUMP			X	X
EXP			X	X
FLOOR			X	X
GREATEST			X	X

14-10 Oracle Transparent Gateway for IBM DRDA Installation and User's Guide

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## How can Post-Processing be determined

- Bad response time (SQL Trace)
- Gateway Trace
- Explain Plan
  - Visualize execution plan
    - SQL Developer, OEM
    - `SELECT * FROM table(DBMS_XPLAN.DISPLAY('plan_table', null, 'ALL'));`
    - `$ORACLE_HOME/rdbms/admin/utlxpls.sql`
    - Queries on `PLAN_TABLE`

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## Post-Processing - Example

explain plan for

```
select b.ename, b.empno from tniewel.emp@epg1 a,  
scott.emp@epg1 b where a.empno=b.empno and  
substr(a.ename,-5,1) = 'S'
```

/

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## Post-Processing - Example

Id	Operation	Name	Rows	Bytes	Cost	TQ	IN-OUT	PQ	Distrib
0	SELECT STATEMENT		1	40	1				
* 1	HASH JOIN		1	40	1				
* 2	FILTER								
3	REMOTE					E.,OM		SERIAL	
4	REMOTE		1	20		E.,OM		SERIAL	

Predicate Information (identified by operation id):

- 1 - access("A2"."EMPNO"="A1"."EMPNO")
- 2 - filter(SUBSTR("A2"."ENAME",-5,1)='S')

Slave SQL Information (identified by operation id):

- 3 - SELECT "EMPNO", "ENAME" FROM "TNIIEWEL"."EMP"
- 4 - SELECT "EMPNO", "ENAME" FROM "SCOTT"."EMP"

Note: cpu costing is off

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## Without Post-Processing

explain plan for

```
select b.ename, b.empno from tniewel.emp@epg1 a,  
scott.emp@epg1 b where a.empno=b.empno and  
a.ename='MAIER'
```

/

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## Without Post-Processing

Id	Operation	Name	Rows	Bytes	Cost	TQ	[IN-OUT]	PQ	Distrib
0	SELECT STATEMENT								
1	REMOTE					[E.,OM	[SERIAL]		

Slave SQL Information (identified by operation id):

```
1 - SELECT A1."ENAME", A1."EMPNO" FROM "TNIWEL"."EMP" A2, "SCOTT"."EMP" A1 WHERE A2."EMP
NO"=A1."EMPNO" AND A2."ENAME"='MAIER'
```

Note: rule based optimization

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## Distributed Join

explain plan for

select a.ename from

```
tniwel.emp a,  
tniwel.emp@epg1 b,  
scott.emp@epg1 c
```

where

```
a.ename=b.ename and b.ename=c.ename;
```

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## Distributed Joins – not optimized

```
-----  
| Id | Operation          | Name          | Rows | Bytes | Cost | TQ  | IN-OUT | PQ Distrib |  
-----  
| 0 | SELECT STATEMENT   |               | 1    | 21    | 3    |     |        |            |  
|* 1 | HASH JOIN          |               | 1    | 21    | 3    |     |        |            |  
| 2 | MERGE JOIN CARTESIAN|              | 1    | 14    | 2    |     |        |            |  
| 3 | REMOTE              |               | 1    | 7     |      |     | E.,OM | SERIAL    |  
| 4 | BUFFER SORT        |               | 82   | 574   | 2    |     |        |            |  
| 5 | TABLE ACCESS FULL| EMP           | 82   | 574   | 2    |     |        |            |  
| 6 | REMOTE              |               | 1    | 7     |      |     | E.,OM | SERIAL    |  
-----
```

Predicate Information (identified by operation id):

```
-----  
1 - access("A"."ENAME"="B"."ENAME" AND "B"."ENAME"="C"."ENAME")
```

Slave SQL Information (identified by operation id):

```
-----  
3 - SELECT "ENAME" FROM "SCOTT"."EMP"  
6 - SELECT "ENAME" FROM "TNEWEL"."EMP"
```

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## Distributed Join – optimized

explain plan for

select a.ename from

tniewel.emp a

where a.ename = (select b.ename

from

tniewel.emp@epg1 b,

scott.emp@epg1 c

where b.ename=c.ename);

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## Distributed Join – optimized

Id	Operation	Name	Rows	Bytes	Cost	TQ	IN-OUT	PQ Distrib
0	SELECT STATEMENT		1	7	2			
1	TABLE ACCESS FULL	EMP	1	7	2			
2	REMOTE					E.,OM	SERIAL	

Predicate Information (identified by operation id):

1 - filter("A"."ENAME"= (SELECT "A2"."ENAME" FROM "SCOTT"."EMP"@EPG1.DE.ORACLE.COM "A1"))

Slave SQL Information (identified by operation id):

2 - SELECT A2."ENAME" FROM "TNIEWEL"."EMP" A2, "SCOTT"."EMP" A1 WHERE A2."ENAME"=A1."ENAME"

Note: cpu costing is off

22 Zeilen ausgewählt.

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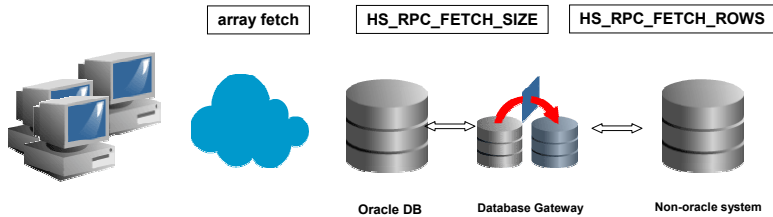
## Optimizing Distributed Joins

- Create Views in foreign data store
  - DB2: View Merge vs. View Materialization
  - Explain of view
  - Filter

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## Database Gateway for DRDA - Parameters



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## Best Practices

- How does a Gateway work - SQL Dialects
- Performance considerations
- Access to Foreign Datastores – Example DB2 for z/OS (via Database Gateway for DRDA)
- Optimization of a Load Process
- Security
- DB2 Threads – Oracle Sessions

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## DB2 Catalog Statistics

- Consideration of DB2 Catalog statistics
  - DG4DRDA
    - DRDA\_OPTIMIZE\_QUERY=TRUE
  - Table Cardinality
  - Key Column Cardinality
- Effects
  - Join sequence
  - Transfer of remote tables

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## DB2 Concurrency Model

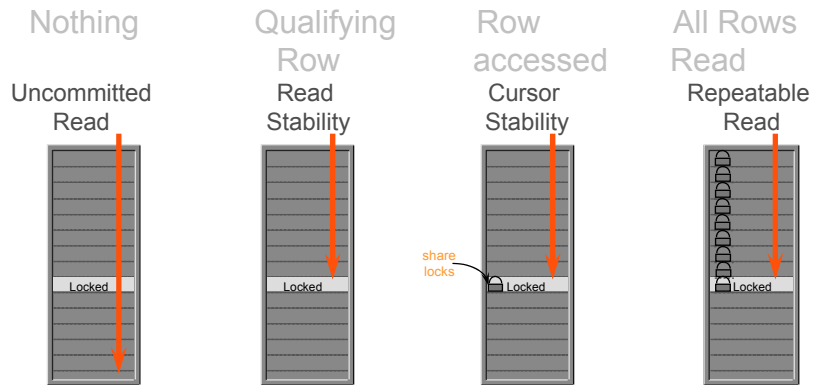
- DB2 Locking model
  - Bind attributes of the DG4DRDA Package
    - CS – Cursor Stability
    - RR – Repeatable Read
    - RS – Read Stability
    - NC – Uncommitted Read
  - Lock Escalation

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## DB2 Concurrency Model



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## DB2 Concurrency Model

Timeout in case of DB2 Lock situations

- SQLCODE - 911

Solution of the Problem

- Commit frequently

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## Best Practices - Summary

- Consider the way how DB2 works
  - If possible use functions which are not compensated
  - Commit frequently (even though read operations are performed)
  - DB2-Predicates
    - Indexable
      - Index can be used
    - Stage 1
      - Predicates, are carried out by the resource intensive DB2 component RDS(Relational Data System)

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## Gateway Passthrough

```
DECLARE
CRS binary_integer; RET binary_integer; VAL VARCHAR2(10);AGE Number
BEGIN
  CRS:=DBMS_HS_PASSTHROUGH.OPEN_CURSOR@gtwlink;
  DBMS_HS_PASSTHROUGH.PARSE@gtwlink(CRS,'SELECT NAME, AGE FROM PT_TABLE');
BEGIN
  RET:=0;
  WHILE (TRUE)
    LOOP
      RET:=DBMS_HS_PASSTHROUGH.FETCH_ROW@gtwlink (CRS,FALSE);
      DBMS_HS_PASSTHROUGH.GET_VALUES@gtwlink (CRS,1,VAL);
      DBMS_HS_PASSTHROUGH.GET_VALUES@gtwlink (CRS,2,AGE);
      INSERT INTO PT_TABLE_LOCAL VALUES (VAL);
    END LOOP;
  EXCEPTION
  WHEN NO_DATA_FOUND THEN
    BEGIN
      DBMS_OUTPUT.PUT_LINE('END OF FETCH');
      DBMS_HS_PASSTHROUGH.CLOSE_CURSOR@gtwlink(CRS) ;
    END;
END;
.....
```

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## Best Practices

- How does a Gateway work - SQL Dialects
- Performance considerations
- Access to Foreign Datastores – Example DB2 for z/OS (via Database Gateway for DRDA)
- Optimization of a Load Process
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## Data Transfer with Database Gateway for DRDA

- Can be done via
  - Create Table
  - Insert
  - Copy
  - Materialized Views
  - Streams (Near Realtime DWH)

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## Data Transfer with Database Gateway for DRDA

- Move data from DB2 to Oracle
  - CREATE TABLE EMP AS SELECT \* FROM SCOTT.EMP@gateway;
  - INSERT INTO EMP SELECT \* FROM SCOTT.EMP@gateway;
  - COPY FROM SCOTT/TIGER@gateway INSERT EMP  
USING SELECT \* FROM SCOTT.EMP@gateway;

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## Data Transfer – Database Gateway for DRDA

- Move data from DB2 to Oracle
  - Materialized Views

```
CREATE MATERIALIZED VIEW empdb2
  REFRESH COMPLETE NEXT SYSDATE + 1
  WITH ROWID
  AS
  SELECT * FROM SCOTT.EMP@gateway
  WHERE deptno=20;
```

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## Bulk Loads

- Parallelism
  - Oracle Database < 11g
    - Create DB2-Views to extract subsets of data
    - n Gateway Sessions executed in parallel
      - Insert into *localtable* Select \* from *RemoteView@Gateway*

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## Bulk Loads

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DATABASE

- Parallelism Oracle Database = 11g
  - Use of `dbms_hs_parallel`
    - `LOAD_TABLE`  
Parallel load of remote tables
    - `CREATE_TABLE_TEMPLATE`  
Create local table based on remote table
    - `CREATE_OR_REPLACE_VIEW`  
Create of a read only view to retrieve remote data in parallel
    - `DROP_VIEW`  
Drop of the object created with `CREATE_OR_REPLACE_VIEW`

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## Bulk Loads

- Example

Declare

```
remtab varchar2(36);  
dblink varchar2(36);  
oratab varchar2(36);  
rowcnt integer;
```

begin

```
remtab:='tniewel.emp';  
oratab:='tniewel.emp1';  
dblink:='D71E';  
/* Truncate=False */  
dbms_hs_parallel.load_table(remtab,dblink,oratab,False,4,rowcnt);  
dbms_output.put_line(,# of rows loaded ' ||rowcnt);
```

end;

## Bulk Loads

- One of the following is required for parallel processing:
  - The remote table is range partitioned
  - Histogram information for a numeric column is available
  - There is a numeric index or primary key

## Best Practices

- How does a Gateway work - SQL Dialects
- Performance considerations
- Access to Foreign Datastores – Example DB2 for z/OS (via Database Gateway for DRDA)
- Optimization of a Load Process
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- DB2 Threads – Oracle Sessions

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## Security

- Passwords in initSID.ora files
  - Can be encrypted with dg4pwd (10g: tg4pwd) utility
  - Encrypted password is stored in initSID.pwd
- Access to DB2 tables via Database Links
  - DB2 Userid/Password in Database Link
  - No Userid/Password in Database Link
    - If you do not specify a user ID and a password in the CONNECT TO clause, then the Oracle database user ID and password are used.

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## Best Practices

- How does a Gateway work - SQL Dialects
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- Optimization of a Load Process
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- DB2 Threads – Oracle Sessions

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## DB2 Threads – Oracle Sessions

- -DISPLAY THREAD(\*)

```
DSNV402I  <D71E ACTIVE THREADS -
NAME      ST A  REQ ID          AUTHID  PLAN      ASID TOKEN
SERVER    RA *  4020 G4003313      TNIEWEL DISTSERV 00A2  345
V445-GAA5F449.C3CD.C1CD54CA96AA=345 ACCESSING DATA FOR 10.165.2
TSO       T *   3 TNIEWEL      TNIEWEL      1007  346
DISPLAY ACTIVE REPORT COMPLETE
DSN9022I  <D71E DSNVDT '-DISPLAY THREAD' NORMAL COMPLETION
***
```

G4003313 → x'3313' = 13075

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## DB2 Threads – Oracle Sessions

```
SQL> set linesize 132
SQL> col username format a15
SQL> col machine format a15
SQL> col db_link format a20
SQL> col program format a15
SQL>
SQL> select a.username,
2         c.machine,
3         c.program,
4         b.db_link,
5         c.process from
6         v$session a,
8         v$hs_session b,
9         v$hs_agent c
10        where
11        a.sid=b.sid and
12        c.agent_id=b.agent_id
13
SQL> /
```

USERNAME	MACHINE	PROGRAM	DB_LINK	PROCESS
TNIEWEL	stusunmucl	g4drsrV71E@stu sunmucl	D71E	13075
TNIEWEL	stadf16	tg4db2tg4db2p@s	D71F	28979

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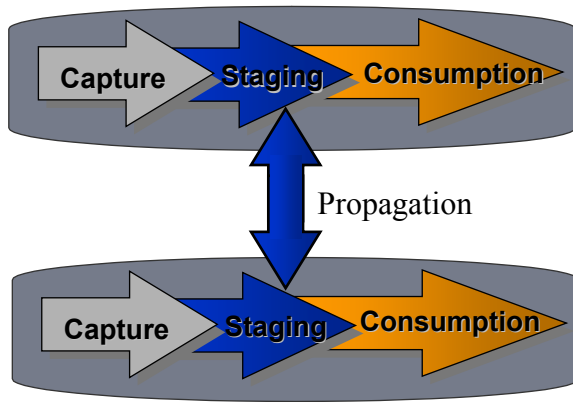
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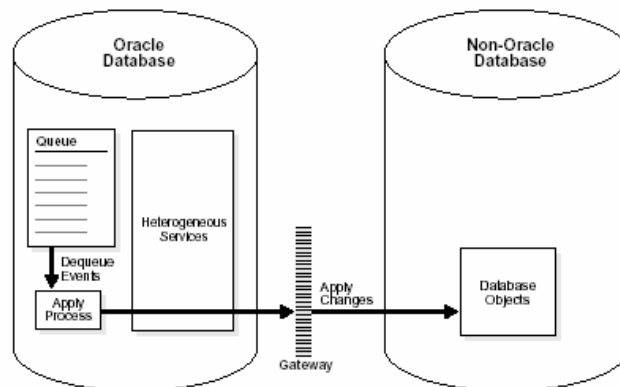
## Oracle Streams



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## Oracle -> non Oracle Replication



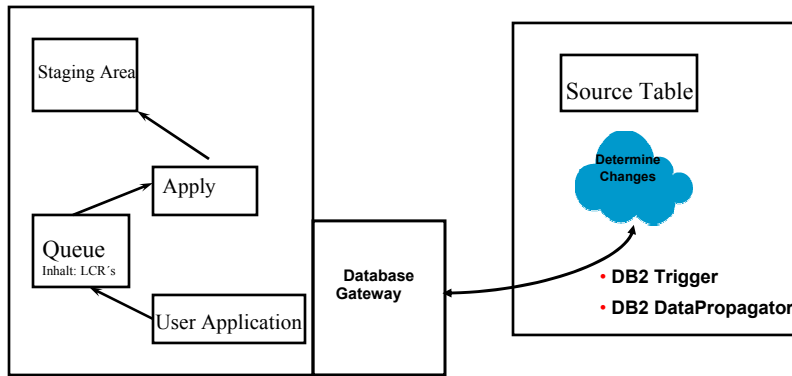
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# Replication non Oracle -> Oracle

Oracle Unix/Windows

non Oracle Database



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