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Oracle Database Gateways

Thomas Niewel
Leitender Systemberater



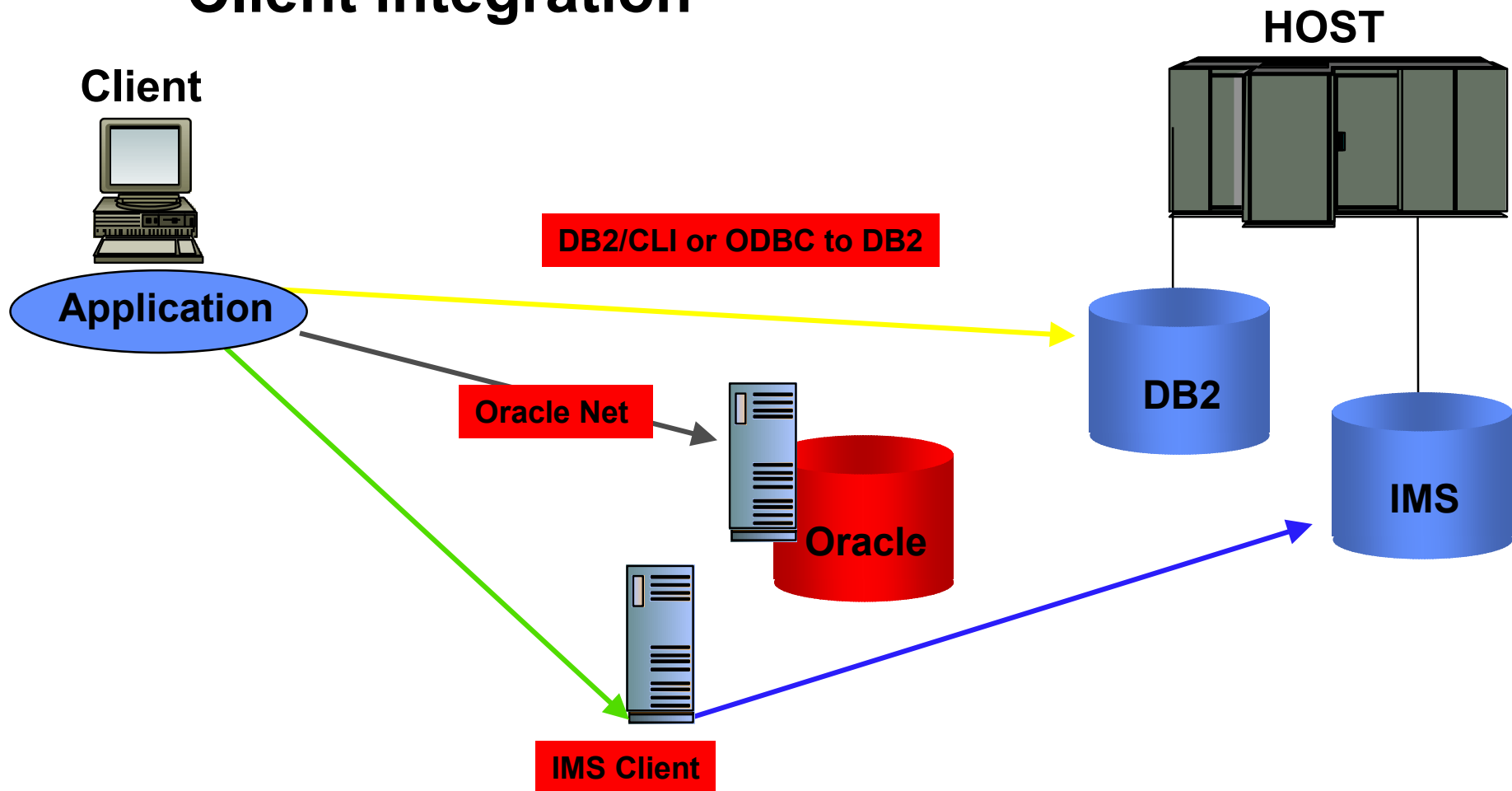
Agenda



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

Typical Middleware Architecture

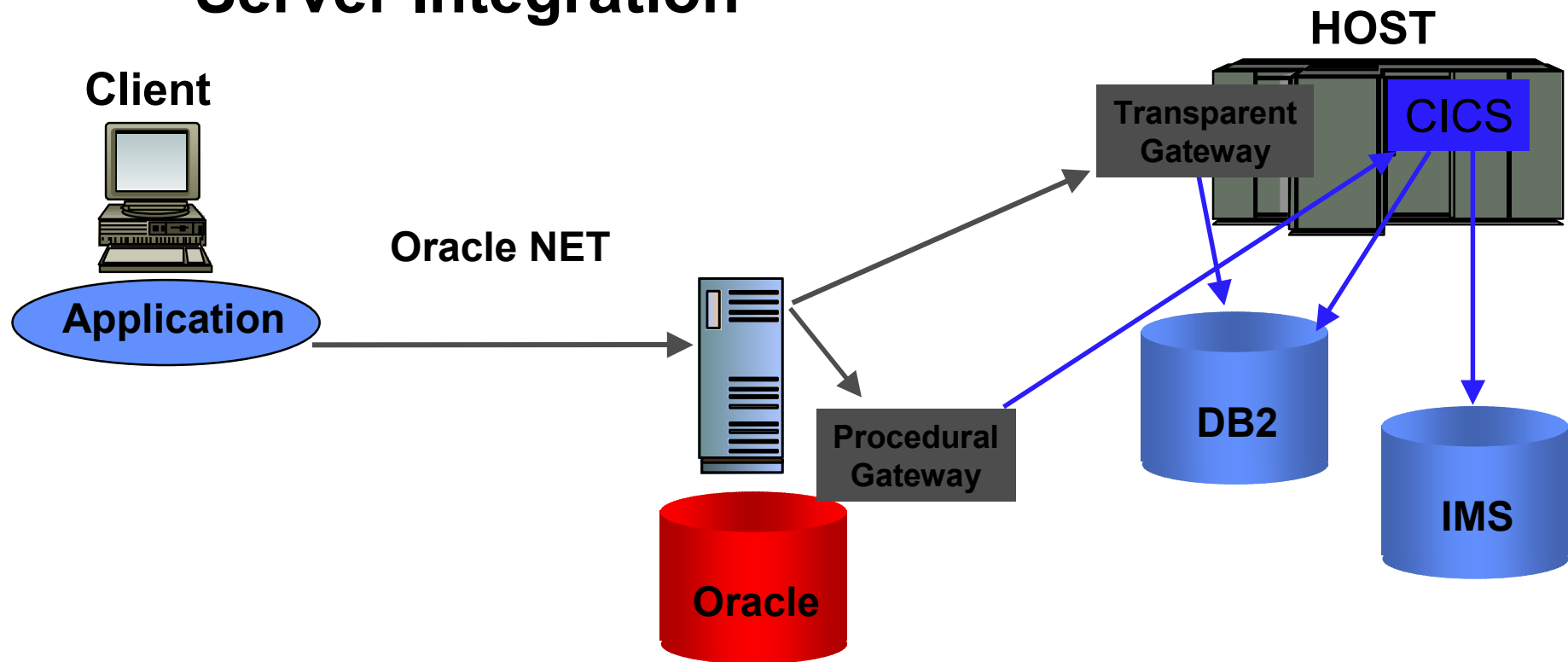
Client integration



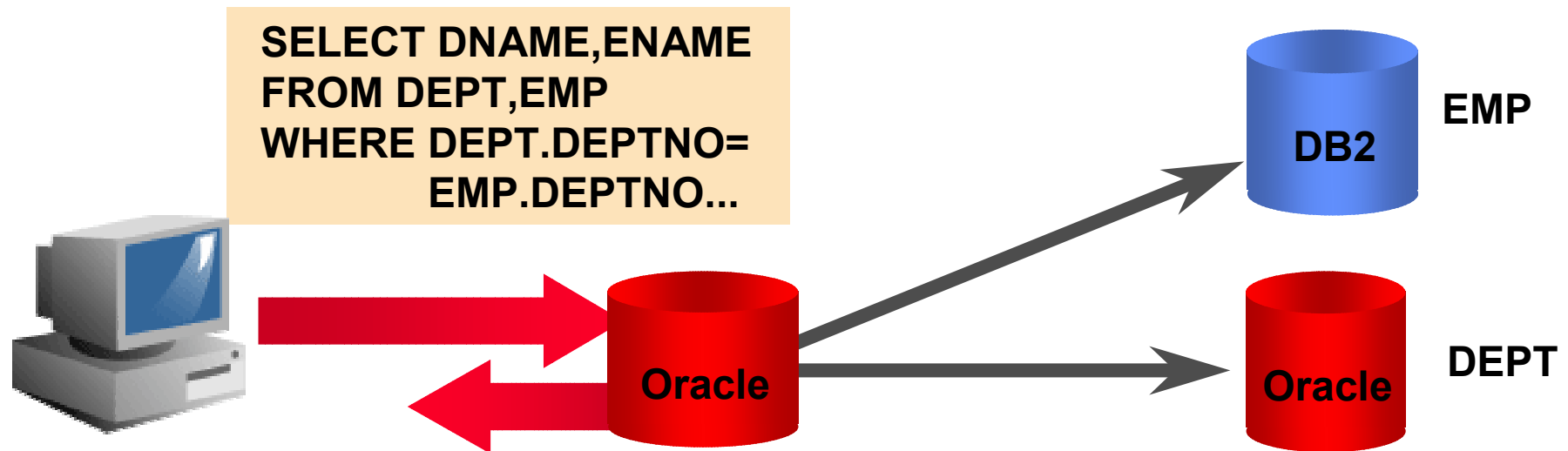
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Oracle Gateway Architecture

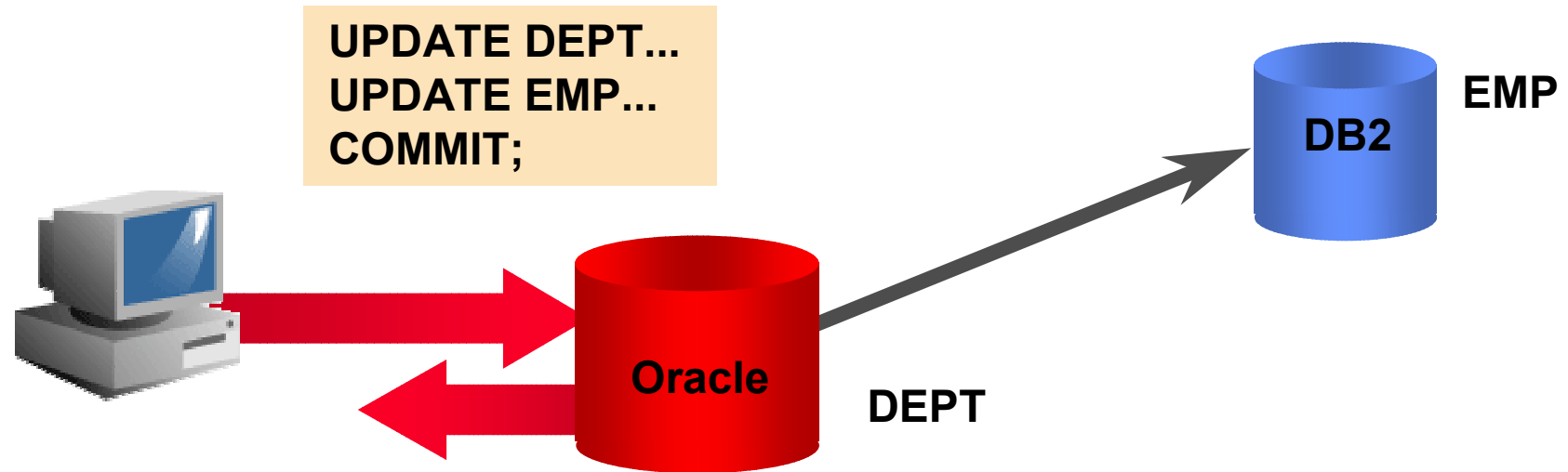
Server Integration



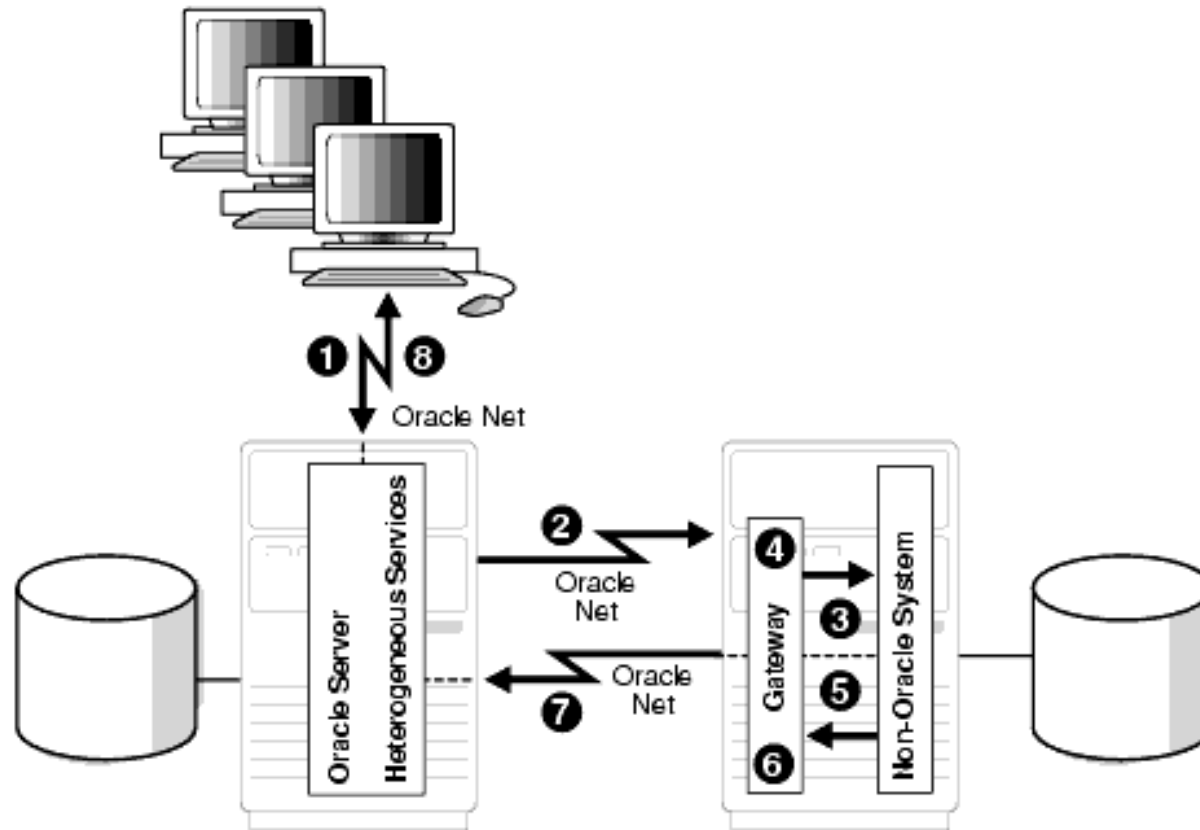
Oracle Database Gateways Distributed Joins



Oracle Database Gateways Two-Phase Commit



Oracle Database Gateways Architecture





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-Agents
 - are the Gateway Component
 - Communicate with non-Oracle Systems
 - “Capabilities” are part of HS-Agents



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







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



Agenda



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



- Oracle Products

- Oracle Database Gateways

- Open Systems Gateways

- Mainframe Gateways

- Legacy Gateways



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





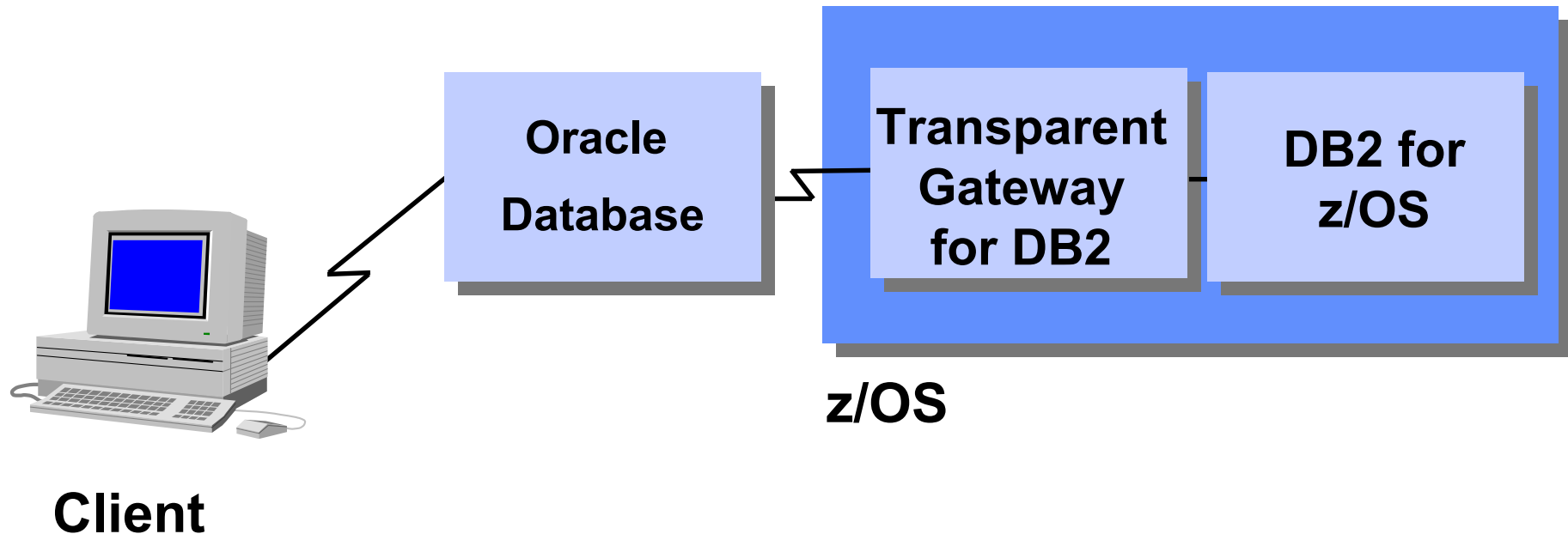
Oracle Database Gateways



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

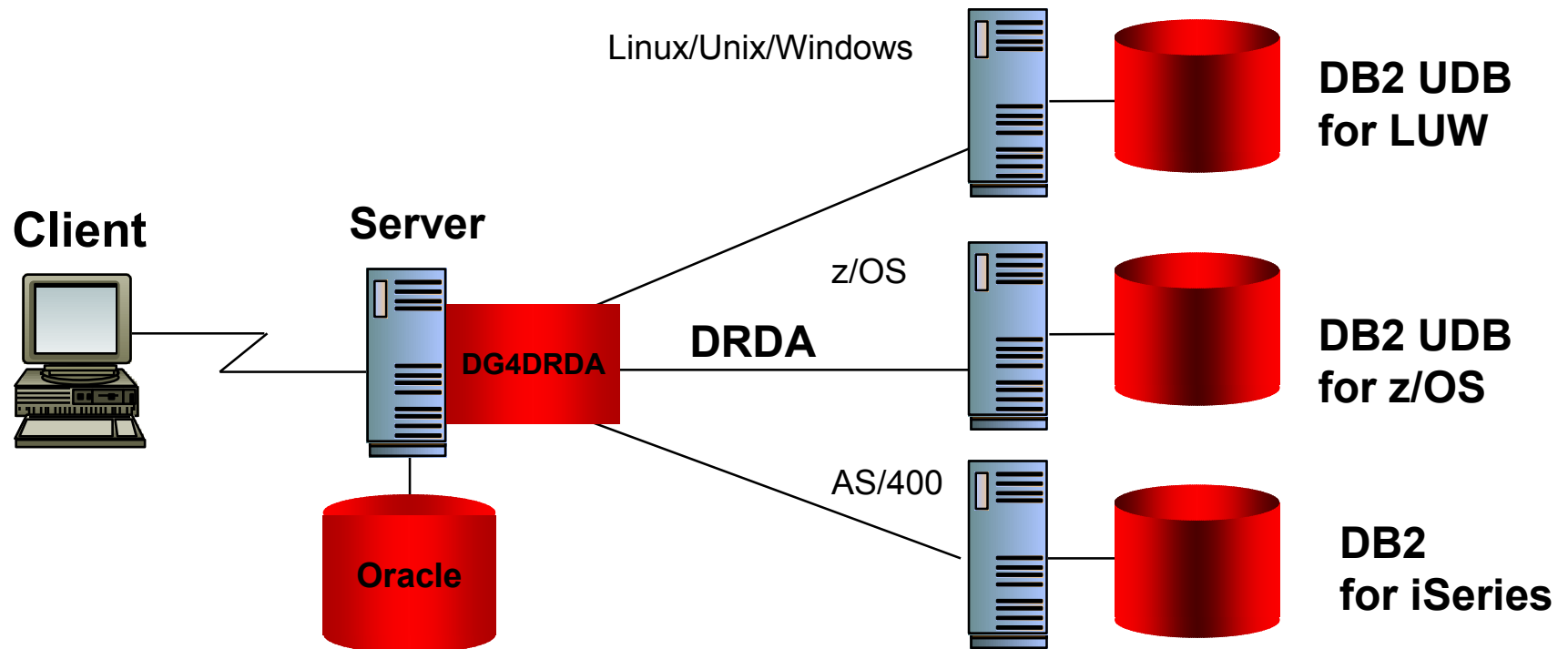
Mainframe Integration Gateways

Oracle Transparent Gateway for DB2



Architecture

- Database Gateway for DRDA



A solid red square.

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

Oracle Legacy Gateways

The screenshot displays the Oracle Control for Legacy Gateways Query Test interface. The main window is titled "Design - Query Test - Oracle Control for Legacy Gateways". The interface is divided into several panes:

- Configuration:** A tree view on the left showing the database structure. Under "Data sources", there is a "NAVDEMO (nav509NAV)" data source. Under "Tables", the "CUSTOMER" table is selected.
- Query Test:** The main area shows the selected table "NAVDEMO: CUSTOMER" in a table view. The "Query Type" is set to "select". Below this, there are tabs for "Tables", "Columns", "Where", "Group", "Having", and "Sort".
- SQL Editor:** A text area at the bottom contains the following SQL query:

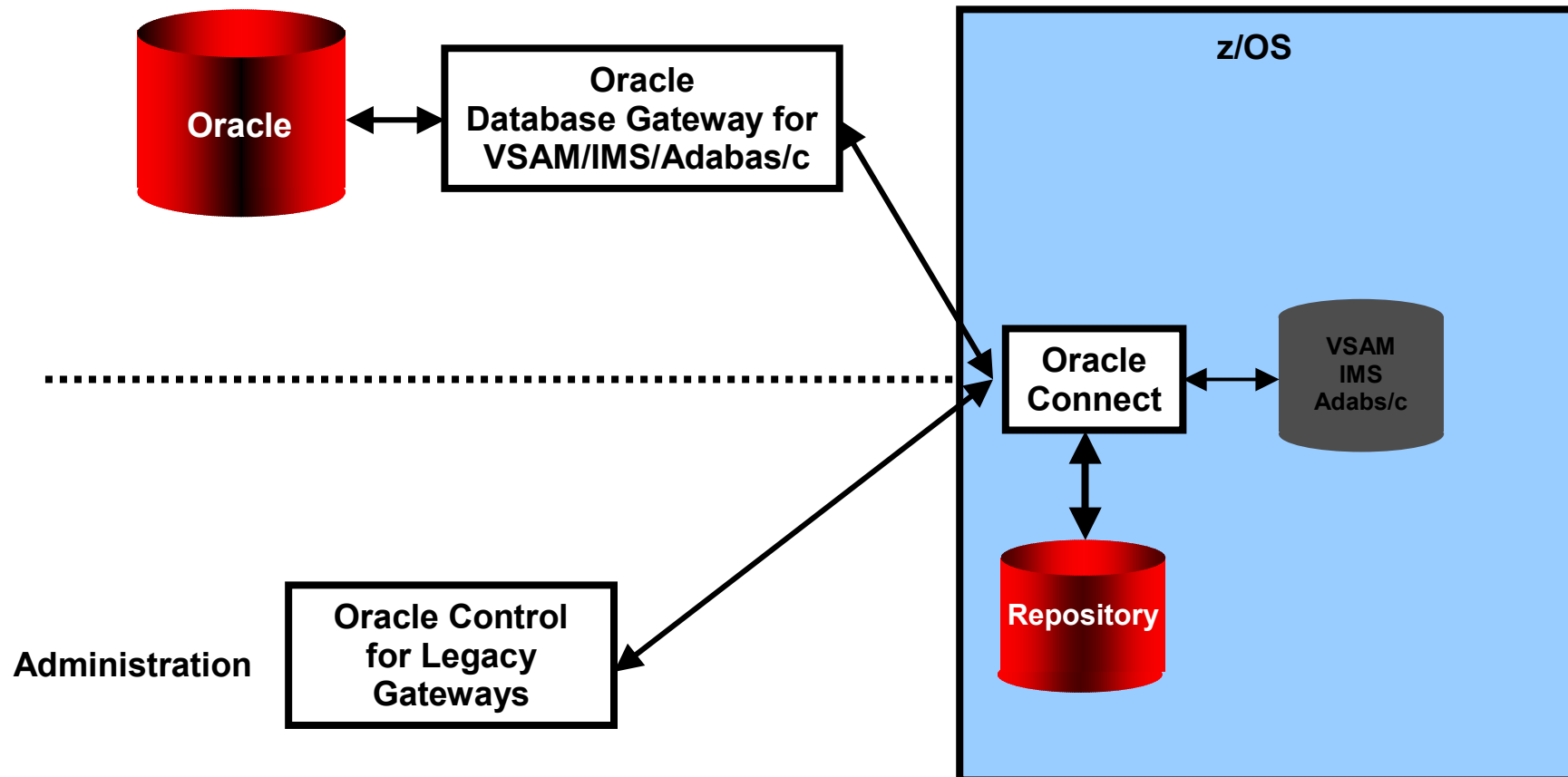
```
SELECT *  
FROM NAVDEMO: CUSTOMER  
LIMIT TO 100 ROWS
```
- Properties:** A small table at the bottom left shows the properties of the selected table:

Property	Value
Name	CUSTOMER
Path	nav509(bindings)/NAV/da...

The interface also includes a "Build Query" button and "Execute" and "Cancel" buttons at the bottom right.

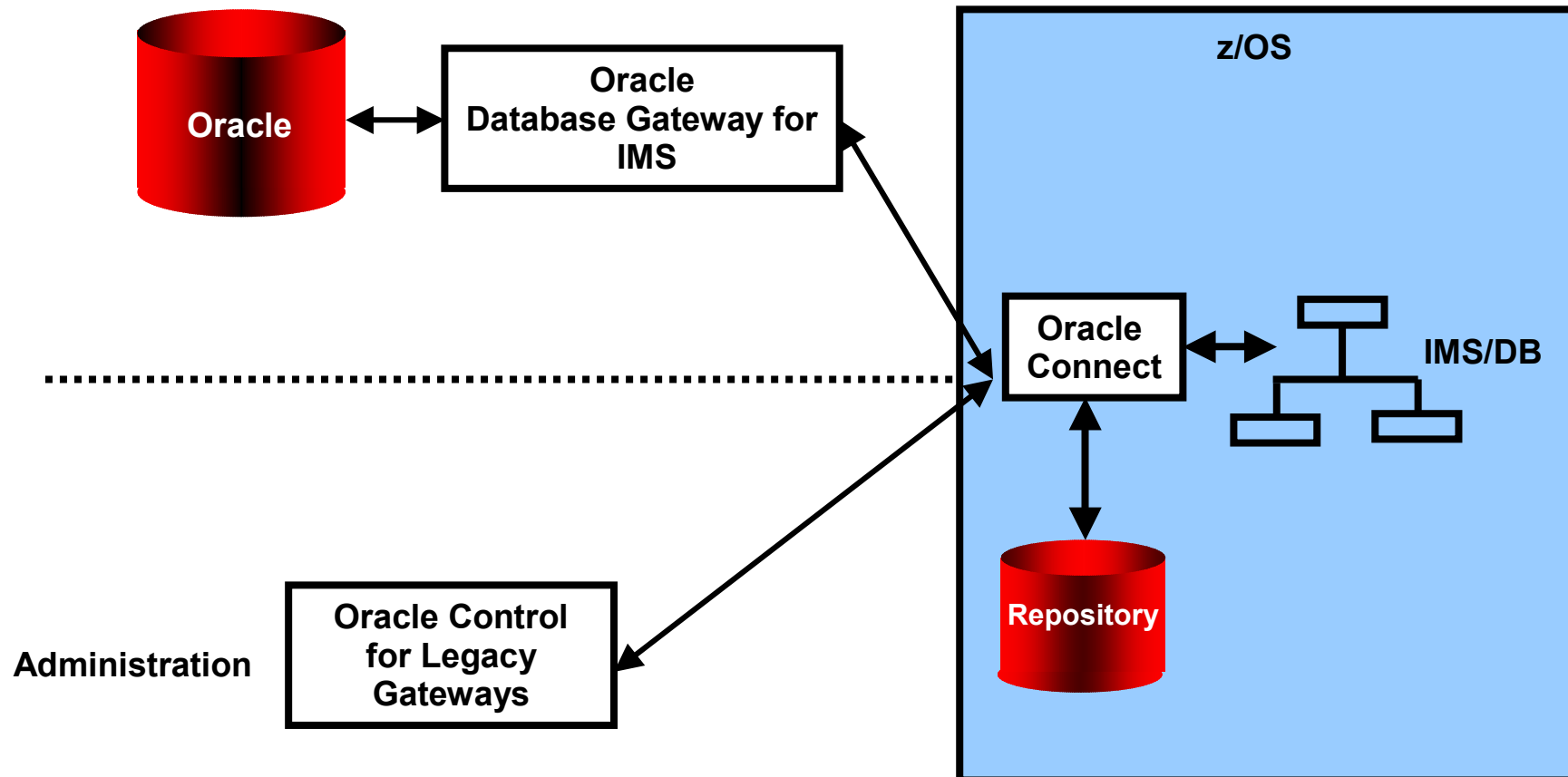
Architecture

- Database Gateway for VSAM



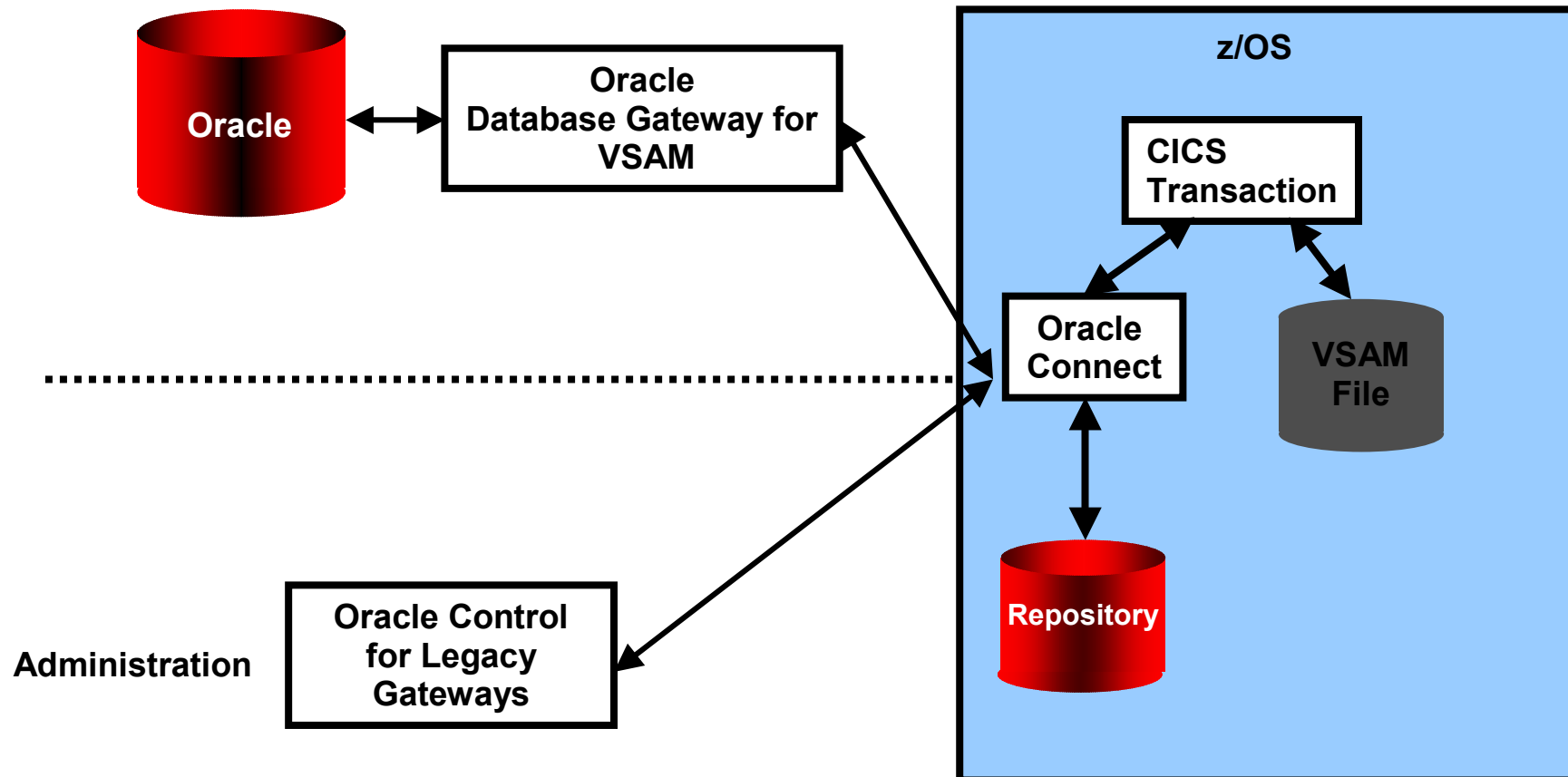
Architektur

- Database Gateway for IMS – DLI Access



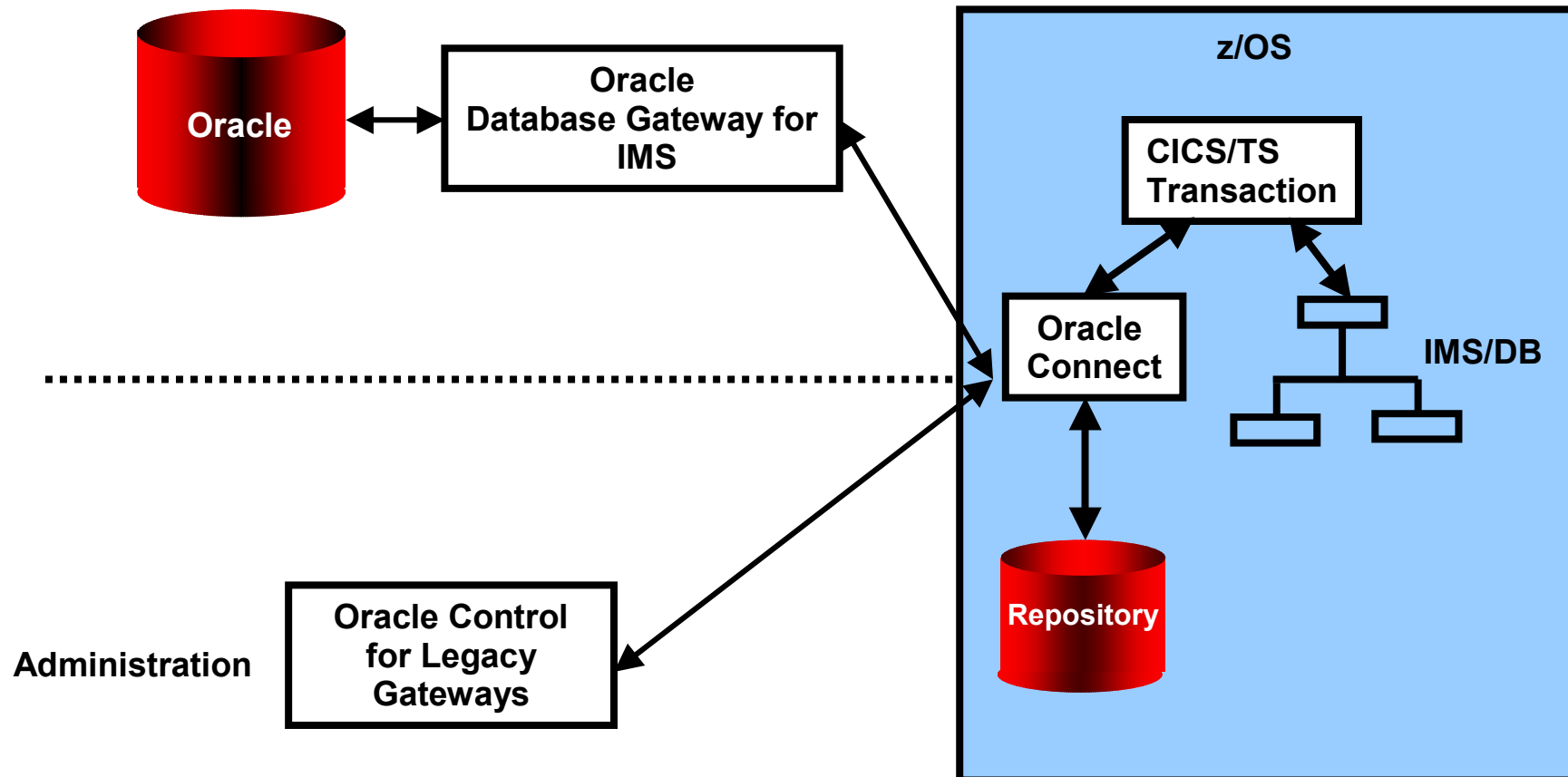
Architektur

- Database Gateway for VSAM



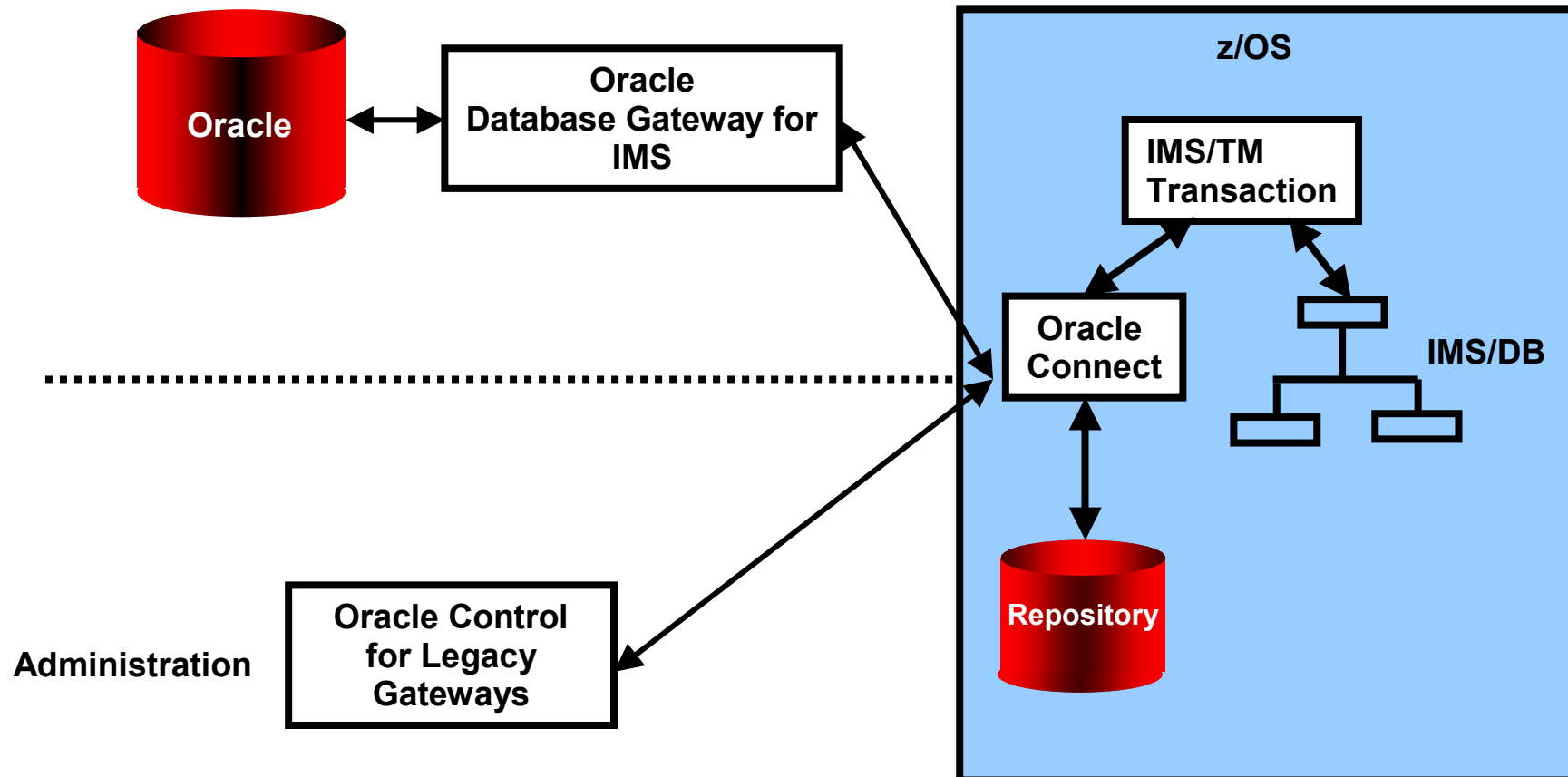
Architektur

- Database Gateway for IMS - DBCTL Access



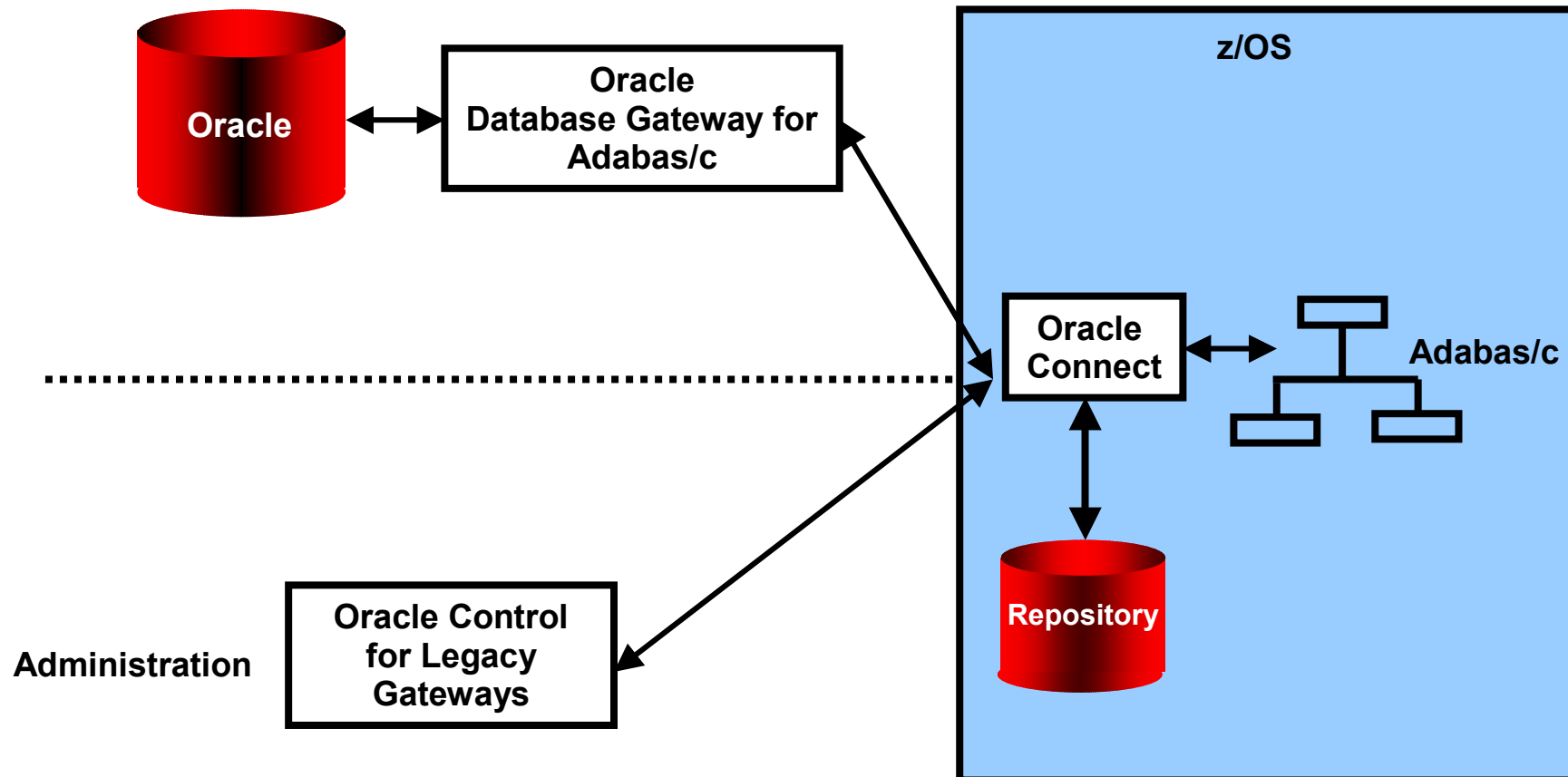
Architektur

- Database Gateway for IMS – DBDC Access



Architektur





- Database Gateway for Adabas/c





Agenda



-  Overview
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-  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

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

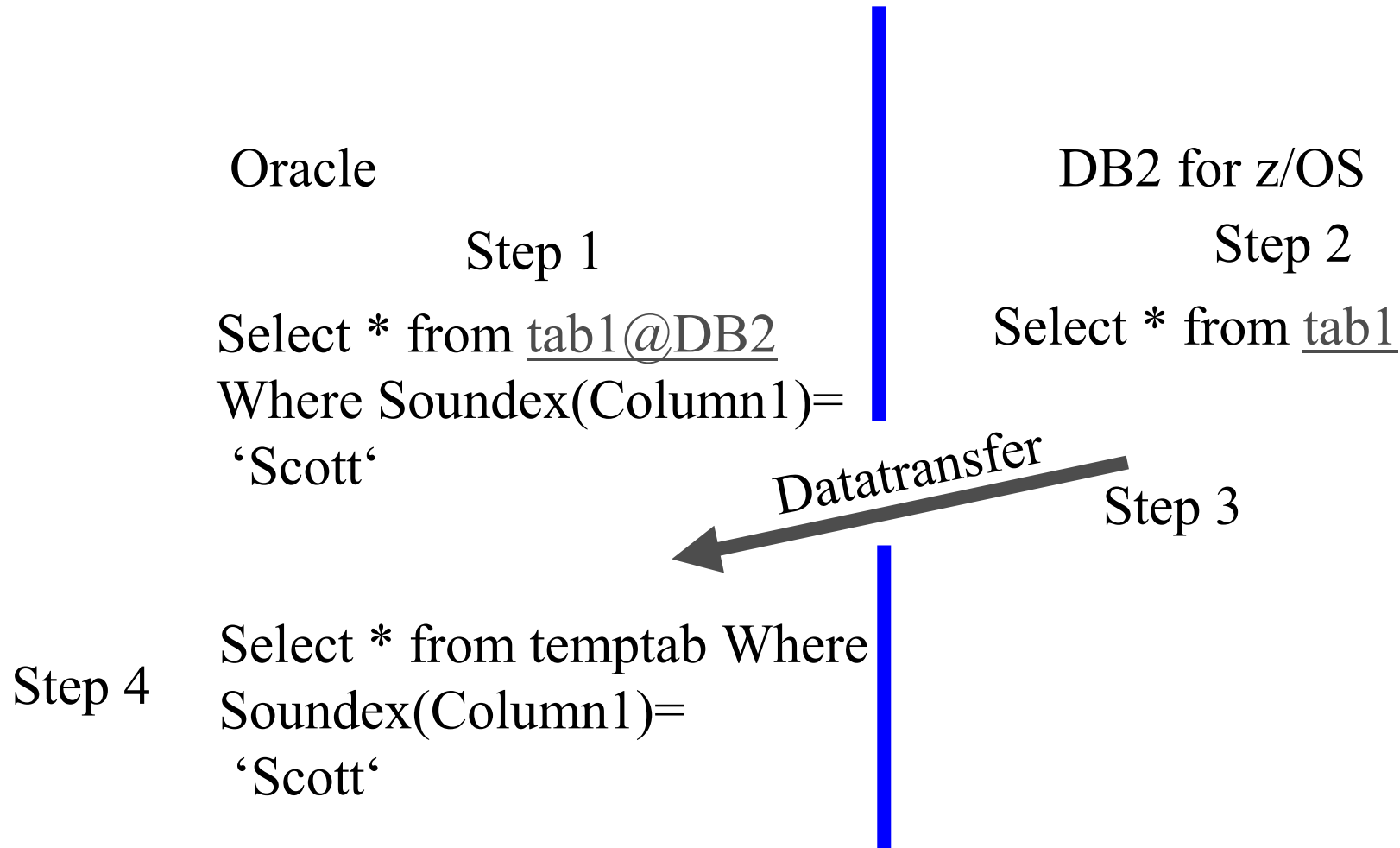
Select Name,age from
tab1 Where
Value(Age,18)= 18

← Datatransfer

Step 3

How does a Gateway work ?

Compensated Functions



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}}`

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



How can Post-Processing be determined

- Bad response time (SQL Trace)
- Gateway Trace
- Explain Plan
 - UTLXPLAN
 - UTLXPLS
 - Queries on PLAN_TABLE



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  
soundex(a.ename)='MAIER'
```

/

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            |               |     1 |    40 |    1 |     |        |            |  
| 3 | REMOTE            |               |     1 |    40 |    1 |     | E.,OM | SERIAL    |  
| 4 | REMOTE            |               |     1 |    20 |    1 |     | E.,OM | SERIAL    |  
-----
```

Predicate Information (identified by operation id):

- ```

1 - access("A2"."EMPNO"="A1"."EMPNO")
2 - filter(SOUNDEX("A2"."ENAME")='MAIER')
```

Slave SQL Information (identified by operation id):

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

Note: cpu costing is off



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'
```

/



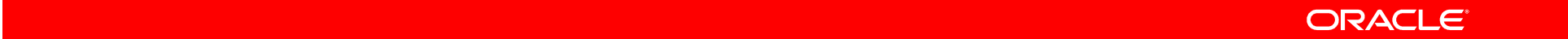
Without Post-Processing

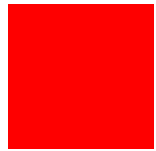
```
-----
| Id | Operation          | Name          | Rows | Bytes | Cost | TQ  | IN-OUT | PQ Distrib |
-----
|  0 | SELECT STATEMENT   |               |      |      |      |     |        |             |
|  1 | REMOTE             |               |      |      |      |     | E.,OM | SERIAL     |
-----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

Slave SQL Information (identified by operation id):

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

Note: rule based optimization





Distributed Join

explain plan for

select a.ename from

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

where

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

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 "TNIEWEL"."EMP"
```



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);

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."ENAM  
E"
```

Note: cpu costing is off

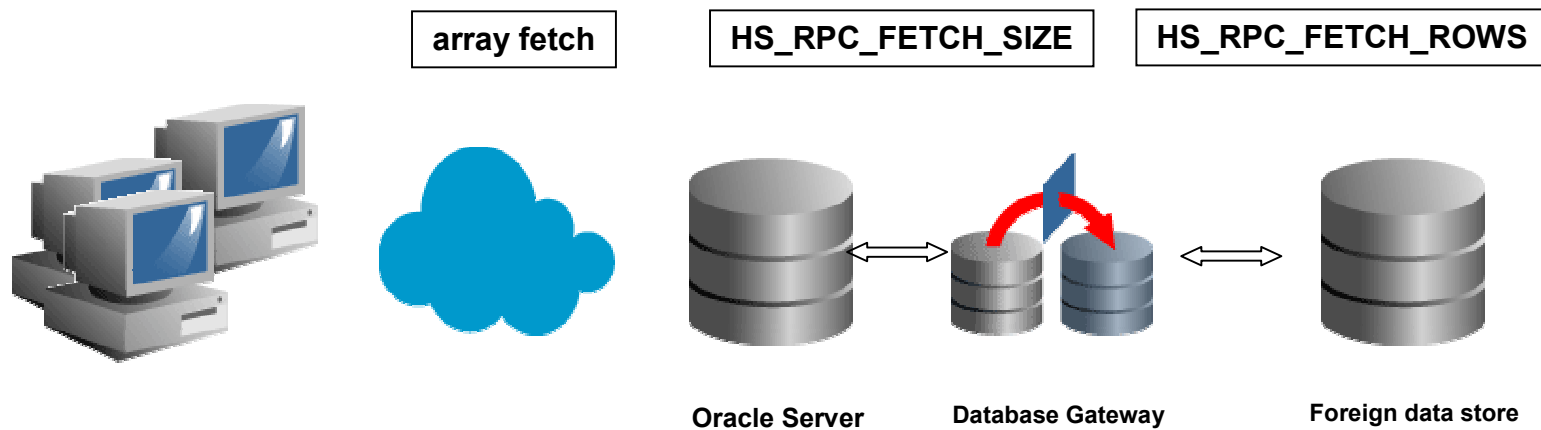
22 Zeilen ausgewählt.



Optimizing Distributed Joins

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

DG4DRDA - Parameters



Best Practices

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



DB2 Catalog Statistics

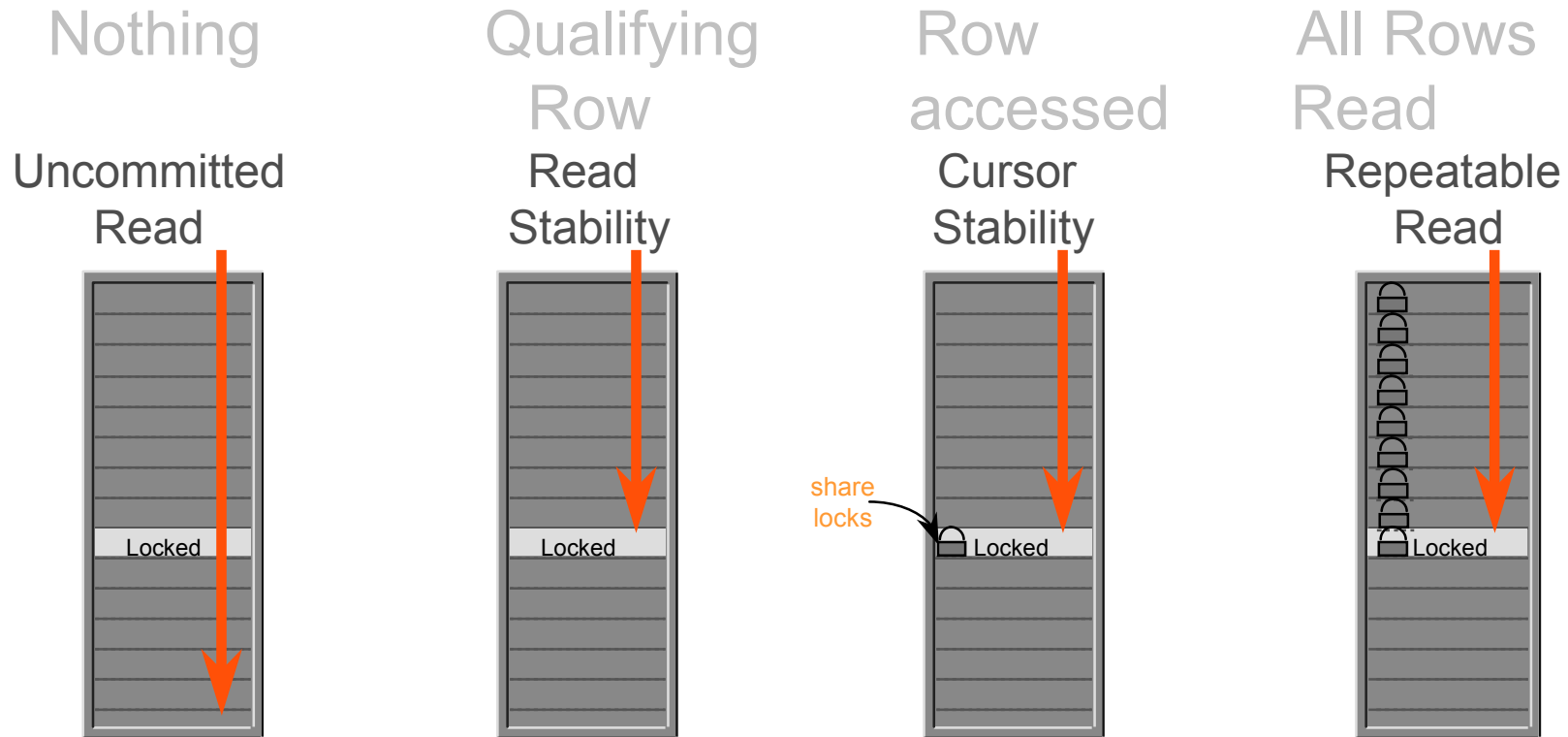
- Consideration of DB2 Catalog statistics
 - DG4DRDA
 - DRDA_OPTIMIZE_QUERY=TRUE
 - Table Cardinality
 - Key Column Cardinality
- Effects
 - Join sequence
 - Transfer of remote tables



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

DB2 Concurrency Model





DB2 Concurrency Model

Timeout in case of DB2 Lock situations

- `SQLCODE - 911`

Solution of the Problem

- Commit frequently



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)



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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- Performance considerations
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Datatransfer with Database Gateway for DRDA

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



Datatransfer 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;`



Datentransfer – 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;
```



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*

Bulk Loads

- 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`

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

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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.

Best Practices

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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

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	stusunmuc1	g4drsrvD71E@stu sunmuc1	D71E	13075
TNIEWEL	stadf16	tg4db2tg4db2p@s	D71F	28979

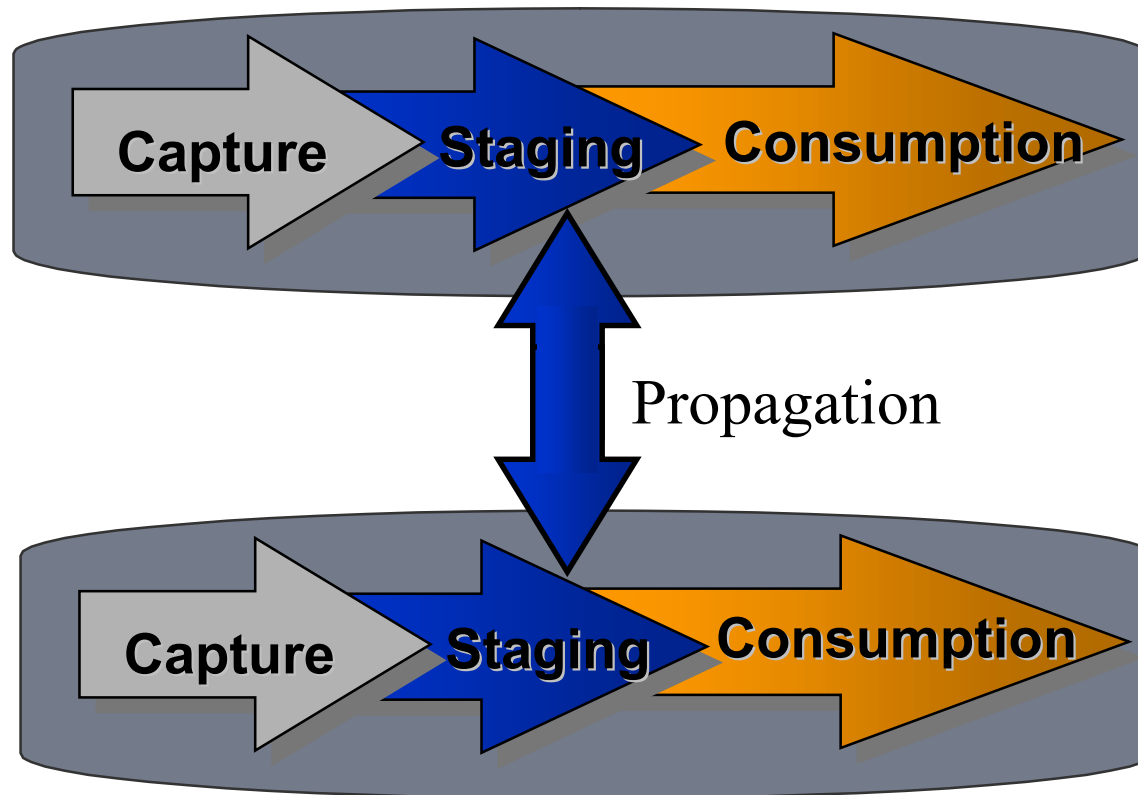


Agenda

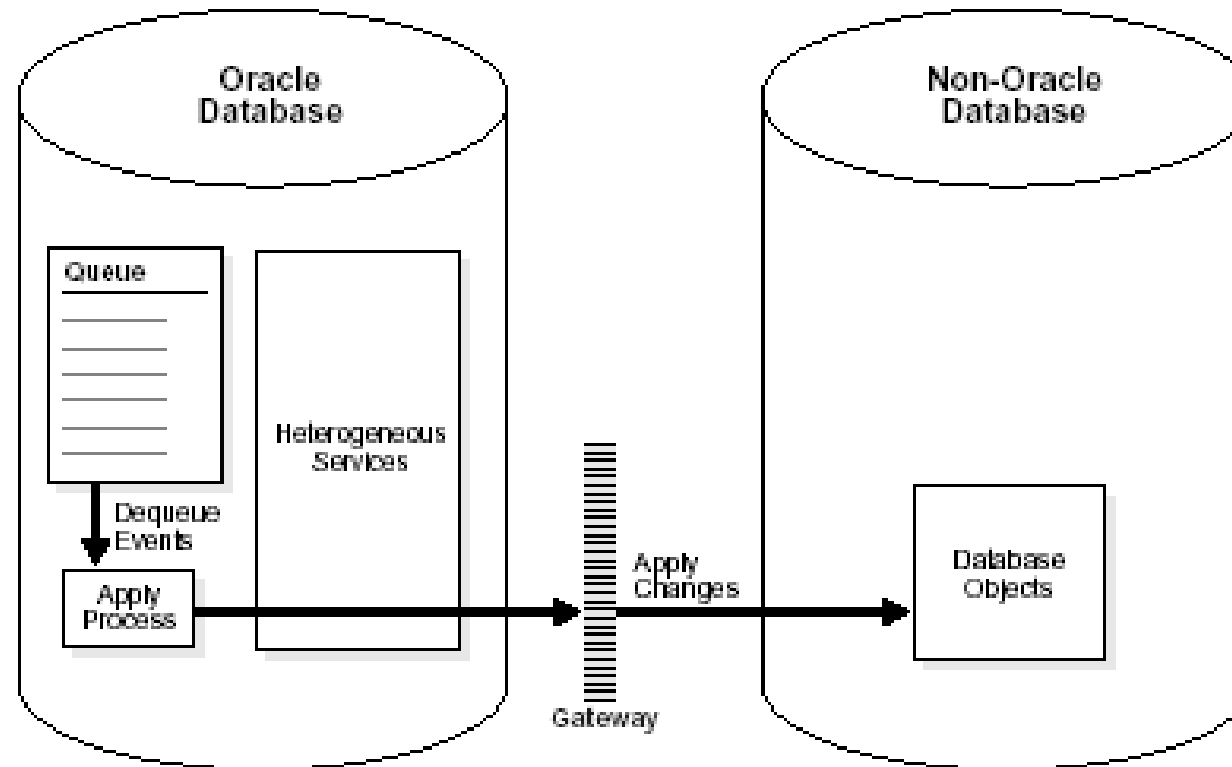


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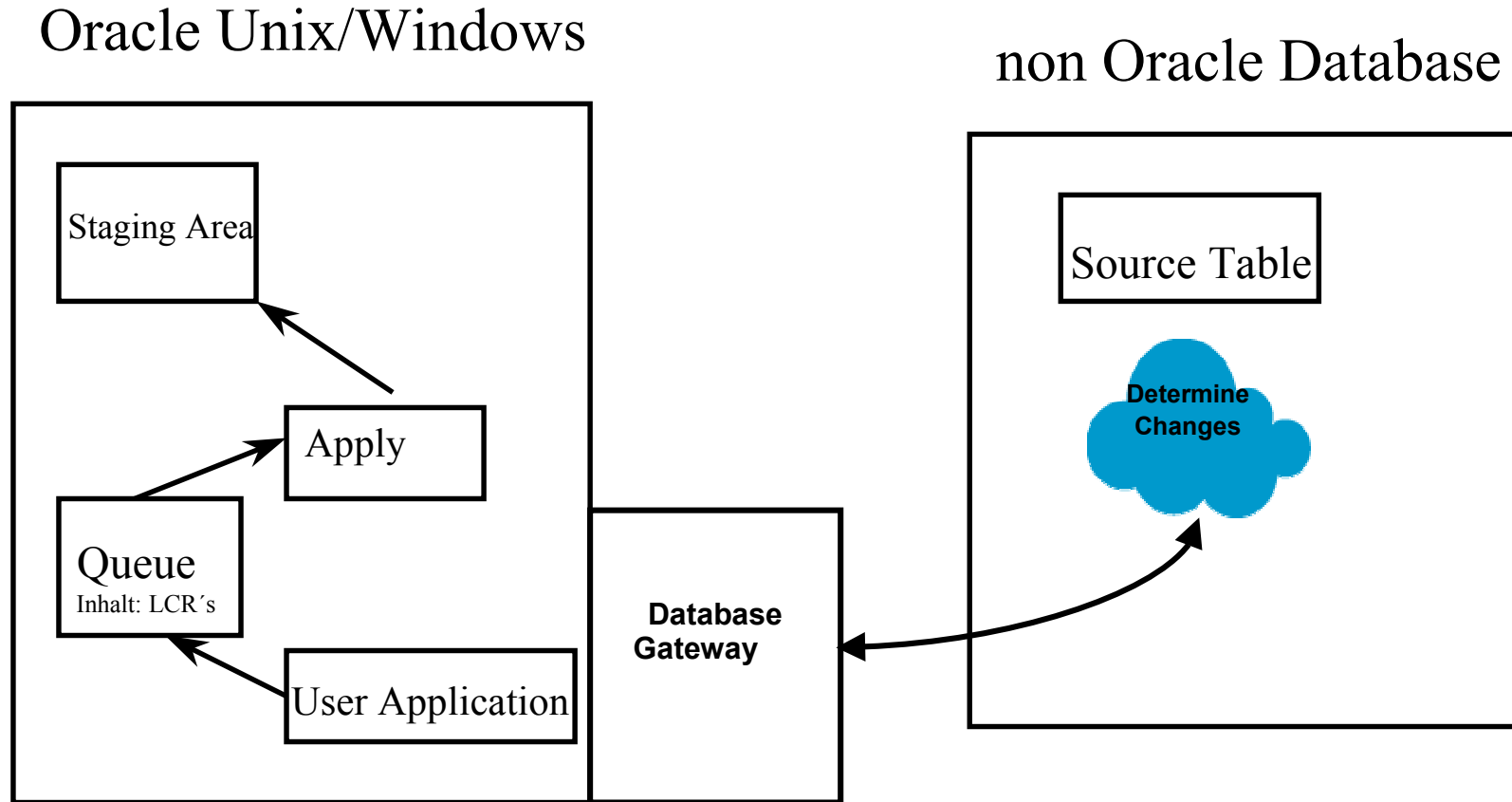
Oracle Streams



Oracle -> non Oracle Replication



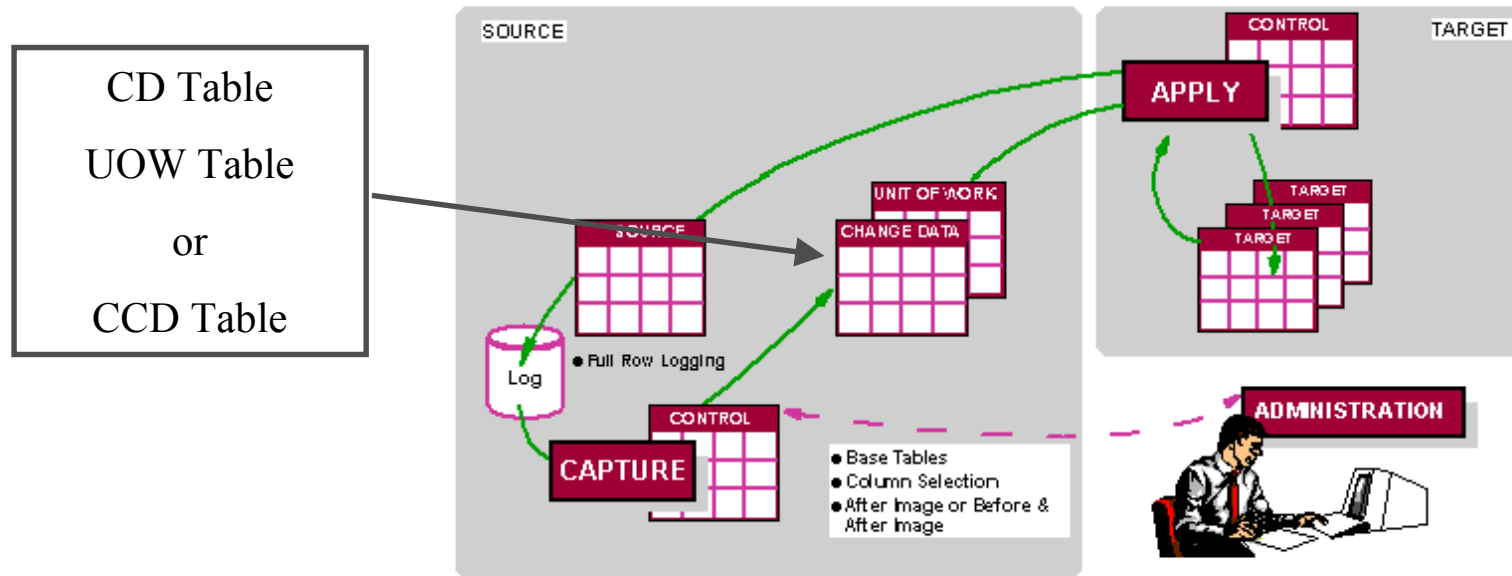
Replication non Oracle -> Oracle



Architecture Datapropagator Relational

IBM Relational Replication

- Captures base table changes from log
- Capture runs locally to the source
- Maintains transaction consistency
- Automatically maintains staging tables

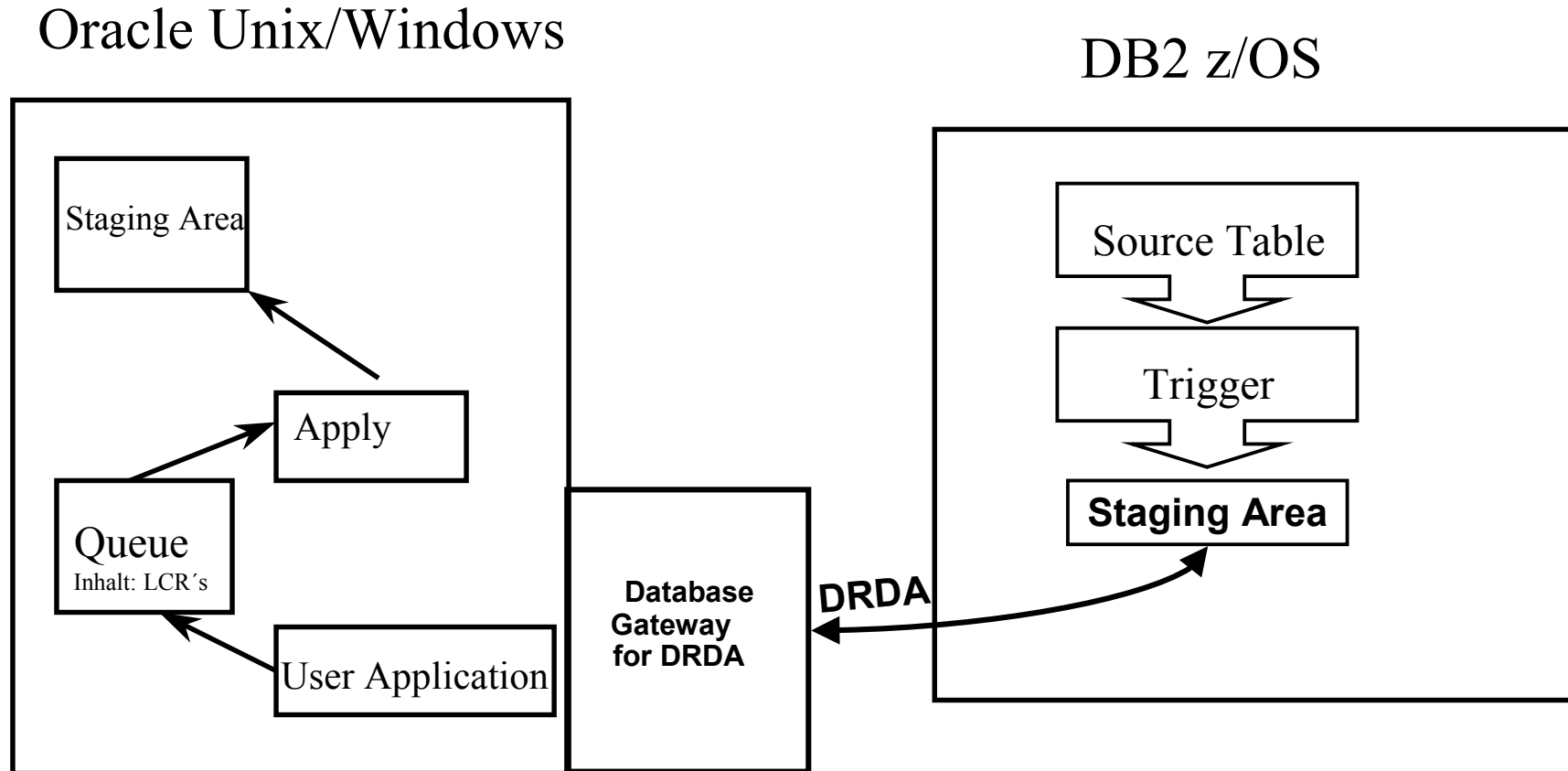




Content DPROP CD/UOW Tables

- IBMSNAP_UOWID
Foreign Key der UOW Tabelle
- IBMSNAP_INTENTSEQ
Globale Sequence Nummer.
- IBMSNAP_OPERATION
DML Operation 'I', 'U' oder 'D'
- AFTER-IMAGE
- BEFORE-IMAGE

Replication DB2 -> Oracle - Example





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