Oracle 9i/10g Streams

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Agenda

- Available High Availability Solution
- What is Oracle 9i Streams
- Architecture of Oracle Streams
- Common terminology
- Oracle HA Features Comparison
- Pre-requisite for Streams Implementation
- Common Streams Element DD Views
- Questions & Answers

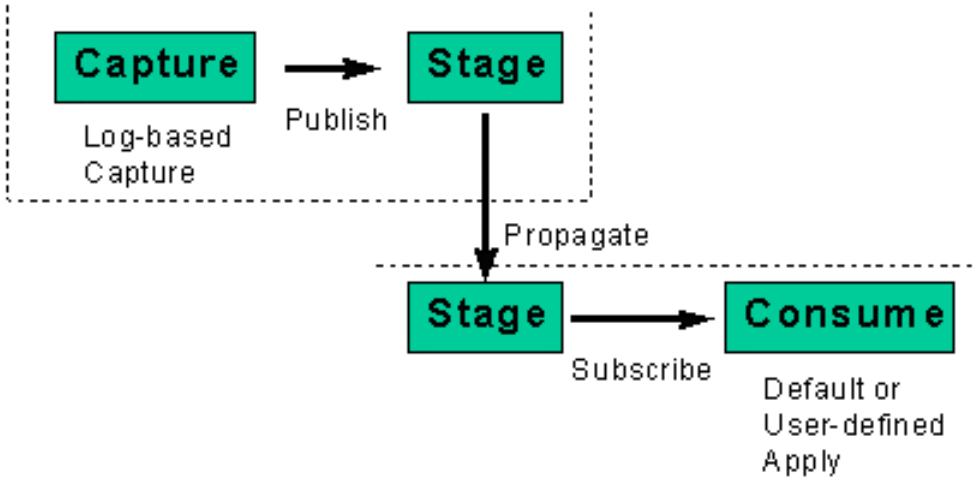
Available Oracle High Availability Solutions

- Real Application Cluster
- Oracle Advance Replication
- Oracle Data Guard [Physical/ Logical Standby]
- Oracle Failsafe
- Oracle 9i Streams

What is Oracle STREAMS

- New Oracle 9i feature to share information between Oracle as well as non-Oracle databases.
- Streams is a set of processes and database structures that allow sharing of data and messages in a data stream.
- The information placed in the data stream is called Event which can be
  - →DML/DDL changes Or
  - →User created messages
- Streams Uses Advanced Queues and Log Miner.

Architecture of Oracle STREAMS



Streams Contains 3 basic elements that enables you to control

- What Information is put into the stream
  [Capture]
- How the Stream Flow from node to Node
  [Stage & Propagate]
- What Happens to events as they flow into each node
  [Optional Transformation]
- How the Stream terminates
  [Apply]

Common Terminology

RULES

- A Rule is a database object that describes what information need to be share and where to share it.
- Rules are evaluated by Oracle9i's built-in *rules engine* and evaluate to a Boolean result (*TRUE or FALSE*)
- Rules can be used during capture, propagate and apply process
- Rules can be defined at different levels such as table level, schema level and database level.
- You can group related rules together into rule sets. A rule can be part of multiple rule set or no rule set.
- Use DBMS_RULE_ADM procedure

CREATE_RULE_SET / CREATE_RULE / ADD_RULE

Common Terminology

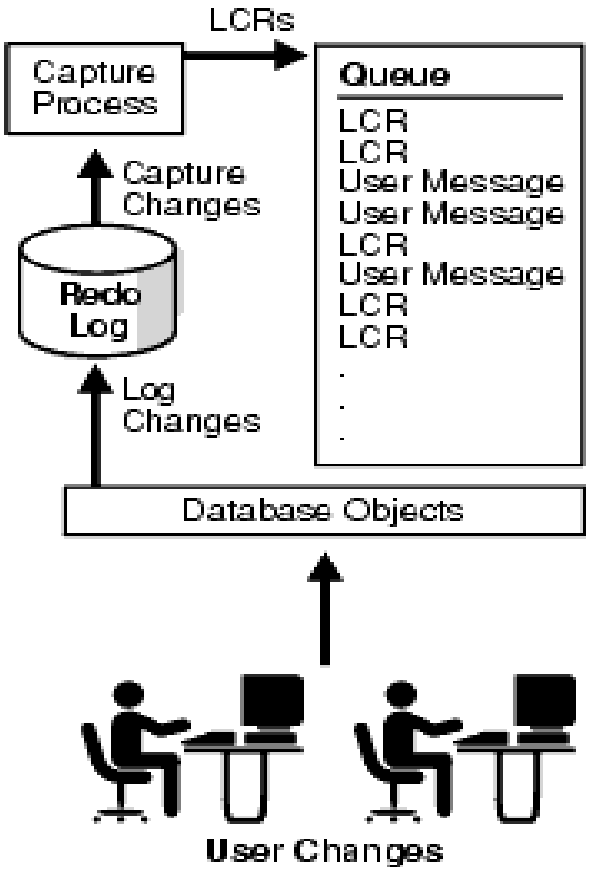
LCR → Logical Change Record

- An LCR is an object with a specific format that describes a database change. LCRs are of two types : row LCRs and DDL LCRs.
- A row LCR describes a change to the data in a single row or a change to a single LOB column in a row as a result of DML
- A DDL LCR describes a data definition language (DDL) change
- Each LCR [DDL or DML] Contain the following main information
  - The name of the source database where the DDL/DML change occurred
  - The type of DDL/DML statement like Insert/Update/Alter table
  - The schema name of the user
  - The name of the database object
  - The SCN when the change was written to the redo log

Elements of Streams

- **Capture Process**
- Staging Process
- Propagation
- Transformation
- Apply Process

CAPTURE PROCESS



- Reads the Redo logs
- Extracts the DDL/DML as per predefined set of **RULES** which define what changes to be captured
- Format the information into events also called **LCR**
- Place the information in the queue also called **Staging**

Capture Process - Log Miner

- A capture process use LogMiner Infrastructure to capture Database changes. Streams configures LogMiner automatically.
- By Default Logminer Tables are created to use SYSTEM tablespace and is not recommended.
- Re-create logminer tables in different tablespace before configuring stream setup

SQL> Execute DBMS_LOGMNR_D.SET_TABLESPACE('<TblSpNam>');

- If using OEM to configure Stream environment, then it will check and prompt your for different tablespace
- Oracle 10g contain SYSAUX tablespace to store all auxiliary metadata related to Oracle options like Streams.

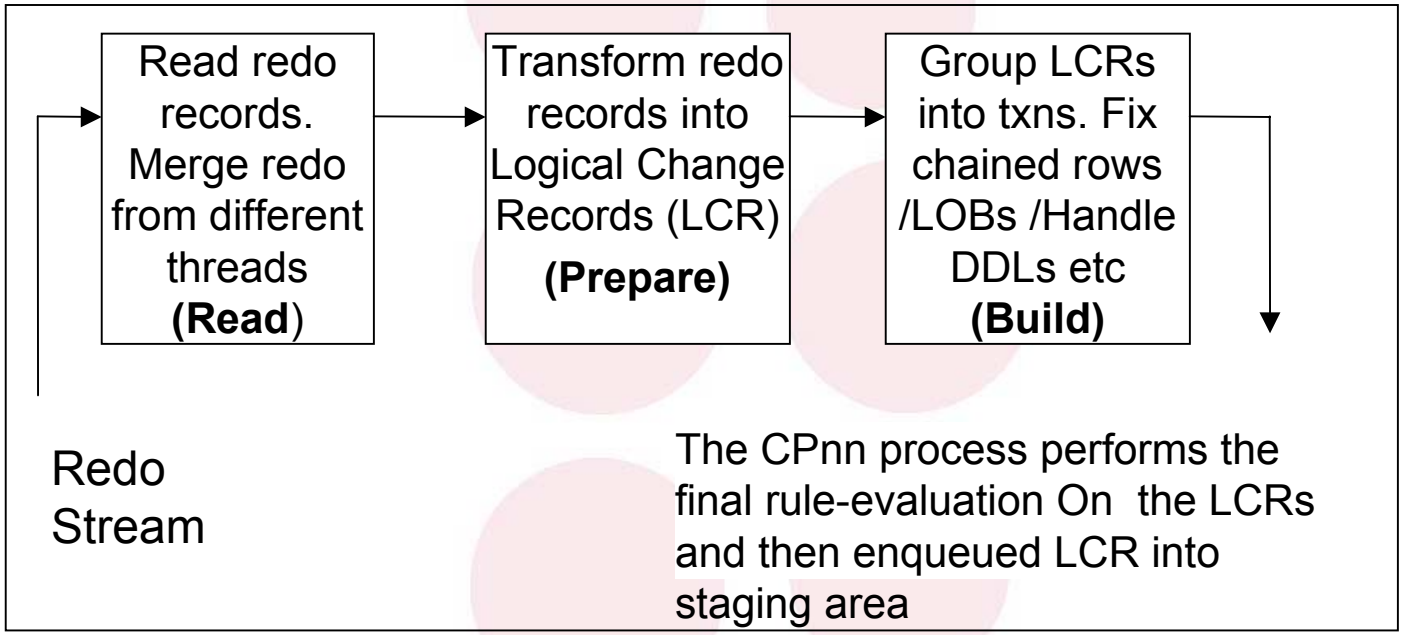
Capture Process – Redo Log

- Capture process Reads either online Redo log file or Archived redo log files
- Archived Files are Used in Oracle 9i RAC or at time when there is high DML activity on the Database
- Seamless transition from reading an online redo log to reading an archived redo log and vice versa
- Oracle 10g support Online Redo log capture for Oracle RAC
- Oracle 10g support mining the archived logs of the source database at an alternative database, assuming the alternative database is on a similar platform type and operating system

Capture Process - Creation

```
BEGIN
    DBMS_STREAMS_ADM.ADD_TABLE_RULES(
    table_name => 'hr.employees',
    streams_type => 'capture',
    streams_name => 'strm01_capture',
    queue_name => 'strm01_queue',
    include_dml => true,
    include_ddl => true,
    include_tagged_lcr => false);
END
```

Capture Process - Components



– It depend on **PARALLELISM** setting.

– If parallelism is set to a value of 3 or greater

– If **parallelism** = 5, then a capture process uses one reader server, three **Prepare** servers, and one builder server.

Capture Process - Parallelism

```
BEGIN
   DBMS_CAPTURE_ADM.SET_PARAMETER(
   capture_name => 'strm01_capture',
   parameter => 'parallelism',
   value => '3');
END;
```

- If parallelism is set to 2 or lower, then a capture process itself [cpnn (01-99)] performs all the work without using any parallel execution servers.

Capture Process Contd…

- A capture process never captures changes in the SYS and SYSTEM schemas
- A capture process does not capture DBMS_REDEFINITION package changes
- A capture process uses queue buffers available in shared pool area unlike queue tables on disk in AQ
- You can create, alter, start, stop, and drop a capture process

```
BEGIN
    DBMS_capture_ADM.Start_capture
    (Capture_name=>'capture_hr');
END
```

Capture Process Contd…

Supported Data types	Unsupported Data types
CHAR, NCHAR VARCHAR2, NVARCHAR2 NUMBER DATE CLOB,BLOB RAW TIMESTAMP TIMESTAMP WITH TIME ZONE TIMESTAAMP WITH LOCAL TIME ZONE INTERVAL YEAR TO MONTH INTERVAL DAY TO SECOND	NCLOB LONG LONG RAW BFILE ROWID UROWID User-defined types •Object types •REFS •Varrays •Nested tables

STREAMS Non-Supported DDL Operations

CREATE or ALTER DATABASE	ALTER SESSION
CREATE/ALTER/DROP ROLLBACK	ALTER SYSTEM
CREATE/ALTER/DROP TYPE	TRUNCATE
CREATE/ALTER/DROP PROFILE	SET ROLE
CREATE/ DROP LIBRARY	SET TRANSACTION
CREATE/ DROP DIRECTORY	SET CONSTRAINT
CREATE CONTROL FILE	ANALYZE
CREATE SPFILE	EXPLAIN
CREATE PFILE	CALL
LOCK TABLE	PL/SQL Procedural Calls

DDL Captured but Not applied

CREATE/ALTER/DROP MATERIALIZED VIEW LOG	CREATE SCHEMA AUTHORIZATION
CREATE , ALTER, or DROP MATERIALIZED VIEW	CREATE or DROP DATABASE LINK
CREATE or ALTER TABLE for Index-organized tables	RENAME (use ALTER TABLE instead)
CREATE TABLE AS SELECT for clustered tables	

Elements of Streams

- Capture Process
- **Staging Process**
- Propagation
- Transformation
- Apply Process

STAGING PROCESS

- It is a queue that provides a service to store and manage captured events.
- Message remain in staging area until consumed by all subscribers
- If the subscriber is another staging area, the event is propagated to the other staging area, either within the same database or in a remote database

STAGING PROCESS

- There are two types of events that can be staged in a Streams queue:
  - » logical change records (LCRs) and
  - » User messages.
- Your applications can enqueue/dequeue user messages using

  PL/SQL (DBMS_AQ package),JMS, OCI
- Staged events can be consumed or propagated, or both.

Elements of Streams

- Capture Process
- Staging Process
- **Propagation**
- Transformation
- Apply Process

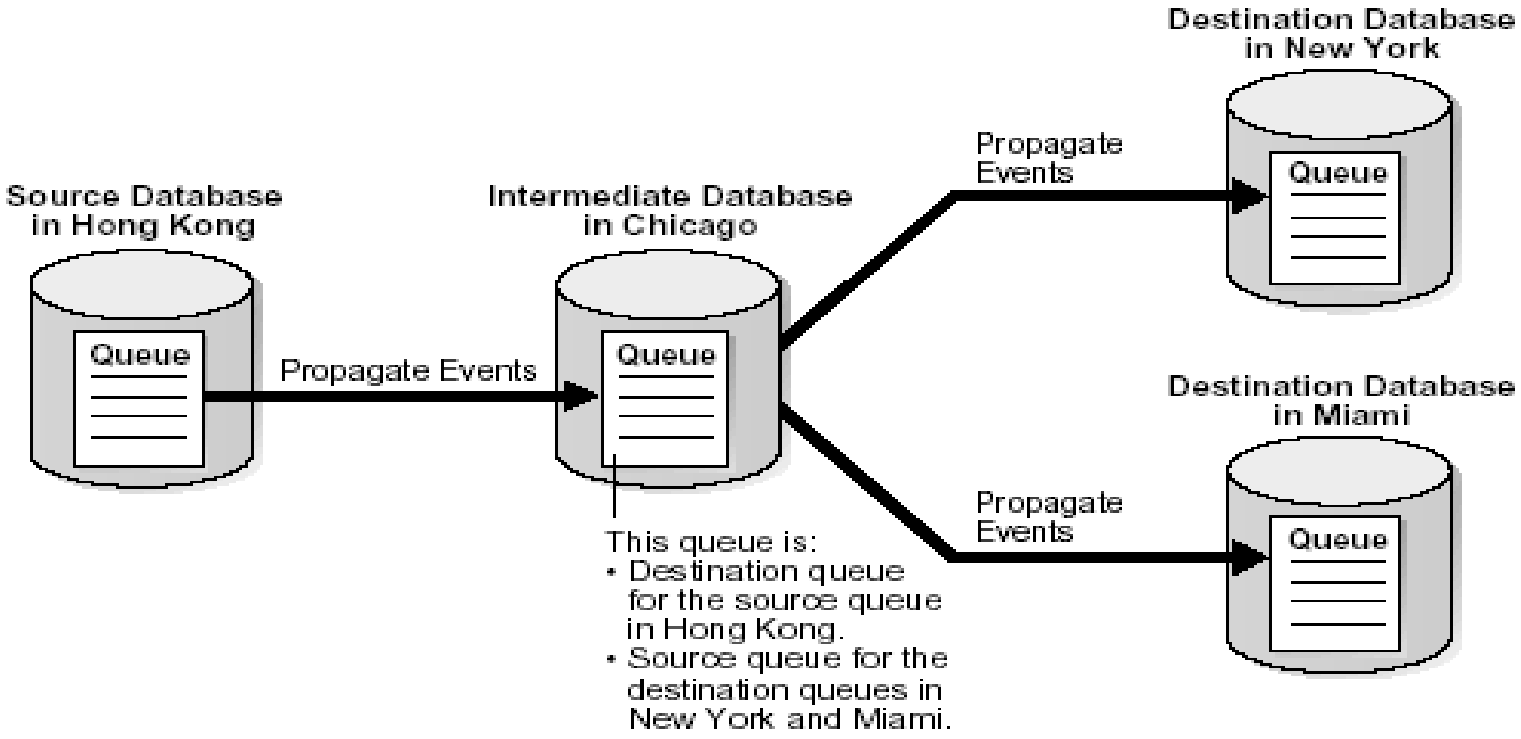
PROPAGATION

- Streams uses job queues to propagate events using job queue processes (J nnn)
- You can CREATE/DROP a propagation Using DBMS_STREAMS_ADM DBMS_PROPAGATION_ADM package
- The default schedule has the following properties:
  - The start time is SYSDATE().
  - The duration is NULL, which means infinite.
  - The next time is NULL
- You can alter the schedule for a propagation with ALTER_PROPAGATION_SCHEDULE procedure in the DBMS_AQADM package.

PROPAGATION - Creation

```
BEGIN
    Dbms_Streams_Adm.Add_Table_Propagation_Rules(
    table_name => 'hr.departments',
    streams_name => 'strm01_propagation',
    source_queue_name => 'strmadmin.strm01_queue',
    destination_queue_name =>
       'strmadmin.strm02_queue@dbs2.net',
    include_dml => true,
    include_ddl => true,
    include_tagged_lcr => false,
    source_database => 'dbs1.net' );
END;
```

Directed Network

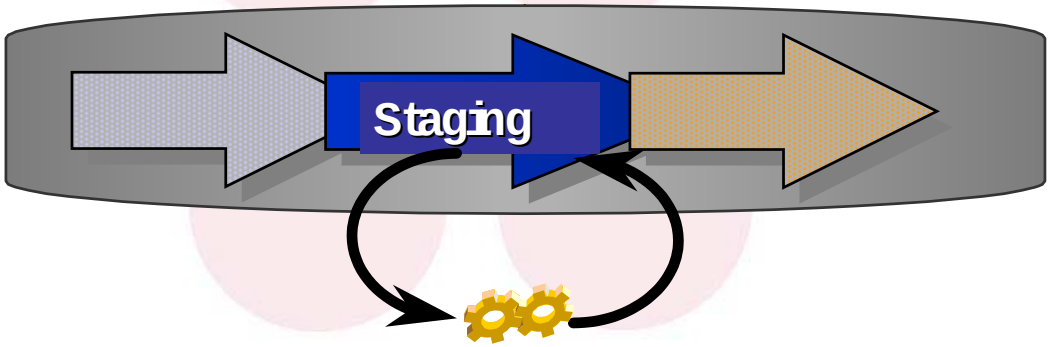


- Queue Forwarding and Apply Forwarding

Elements of Streams

- Capture Process
- Staging Process
- Propagation
- **Transformation**
- Apply Process

TRANSFORMATION



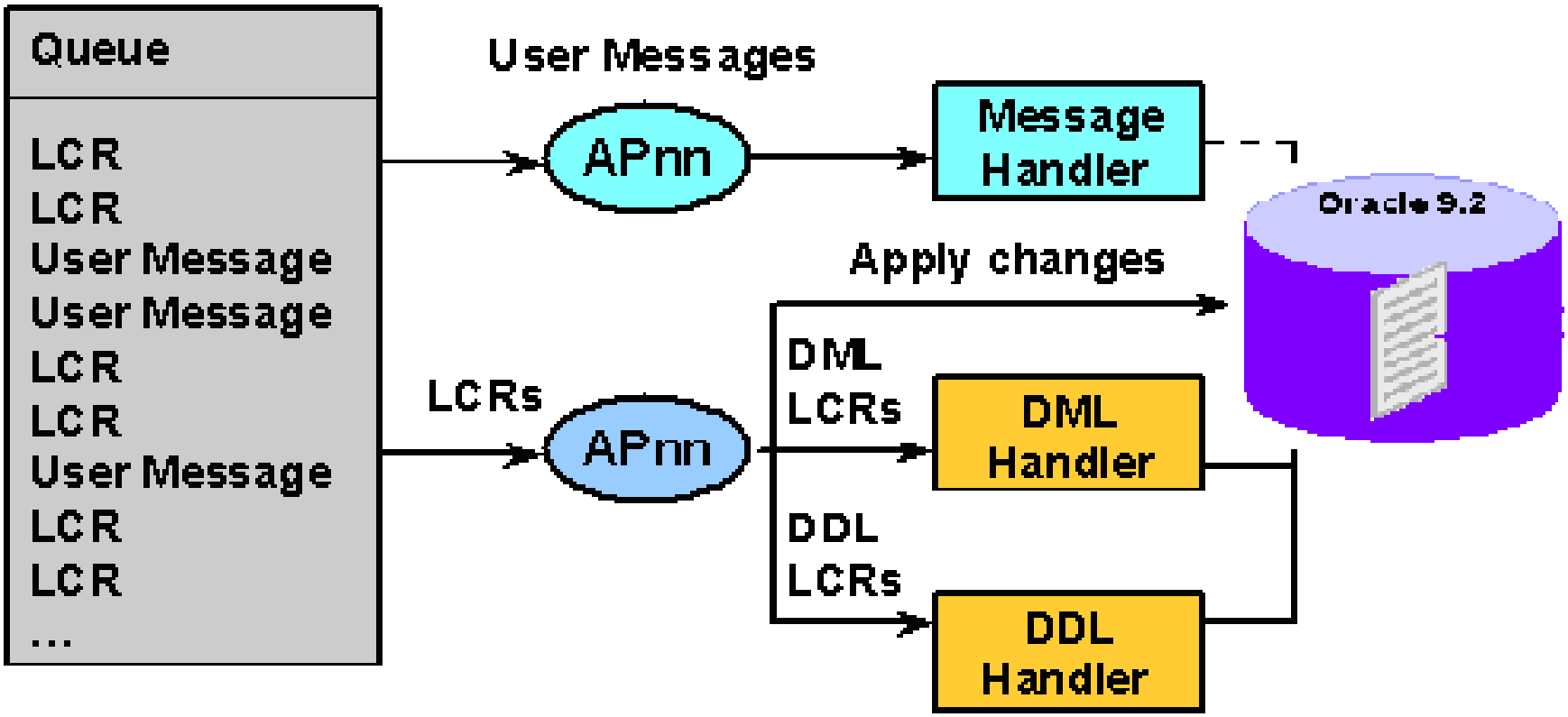
- Transformations can be performed
  - as events enter the staging area
  - as events leave the staging area
  - as events propagate between staging areas
- Transformation examples
  - change format, data type, column name, table name

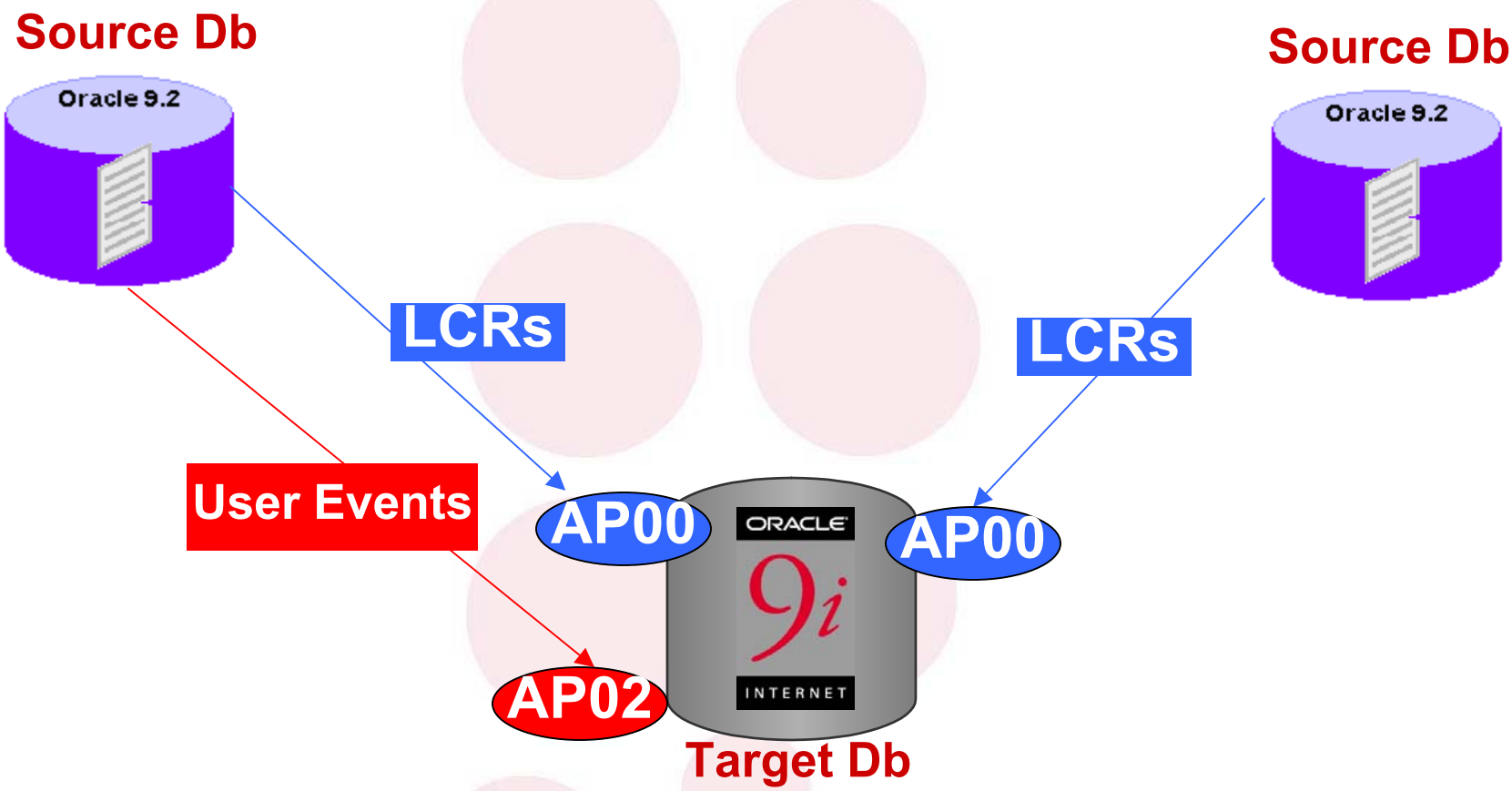
Elements of Streams

- Capture Process
- Staging Process
- Propagation
- Transformation
- **Apply Process**

APPLY PROCESS

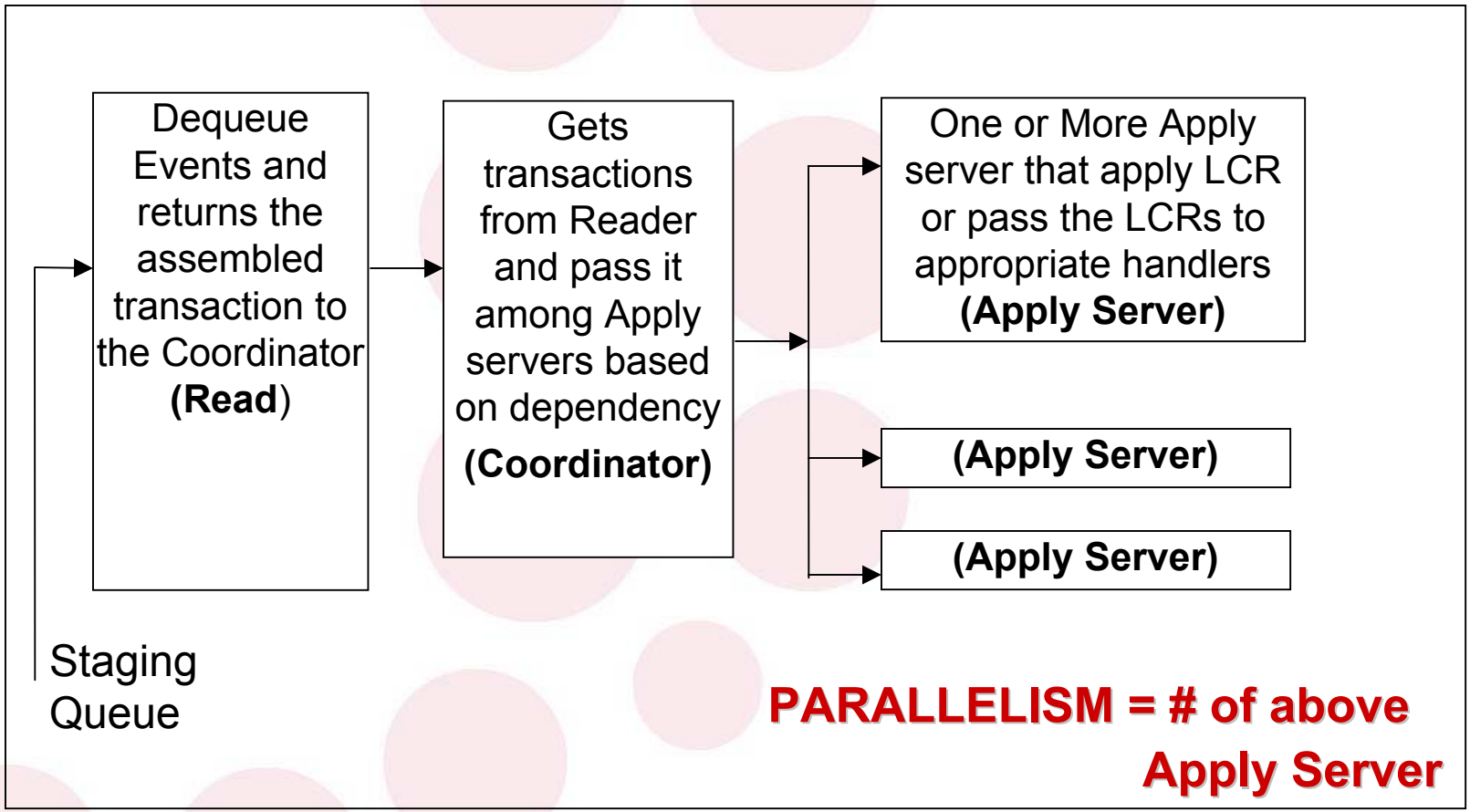
- Oracle background process [ap nn] that dequeue LCRs and user messages
- For non-LCR messages, the apply servers pass the events to the message handler.
- Automatic conflict detection with optional resolution →unresolved conflicts placed in exception queue





- Separate Apply process for each Capture Process
- Separate Apply Process for LCR and User Events

Apply Process - Components



APPLY PROCESS - Creation

```
BEGIN
    DBMS_STREAMS_ADM.ADD_TABLE_RULES(
    table_name => 'hr.employees',
    streams_type => 'apply',
    streams_name => 'apply_emp',
    queue_name => 'strmadmin.streams_queue',
    include_dml => true,
    include_ddl => false,
    source_database => 'cpap.net');
END;
```

APPLY PROCESS - Start

```
BEGIN
    DBMS_APPLY_ADM.SET_PARAMETER(
    apply_name => 'apply_emp',
    parameter => 'disable_on_error',
    value => 'n');
END;
/
BEGIN
    DBMS_APPLY_ADM.START_APPLY(
    apply_name => 'apply_emp');
END;
```

APPLY PROCESS - Commit

Apply servers may apply transactions at the destination in an order that is different from the commit order at the source

```
BEGIN
    DBMS_APPLY_ADM.SET_PARAMETER(
    apply_name => 'strm01_apply',
    parameter => 'commit_serialization',
    value => 'none');
END;
```

Commit Serialization has the following value:

- full: Default and order is same as at source database
- none: Commit transactions in any order. Performance is best if you specify this value.

More Facts

Missing Columns at the Destination Database

Apply process raises an error and moves the transaction into an exception queue.

Fix :- Creating a rule-based transformation or DML handler that eliminates the missing columns from the LCRs before they are applied.

Column Data type Mismatch

Apply process places transactions into an exception queue.

Fix :- Create a rule-based transformation or DML handler that converts the data type.

APPLY PROCESS - More Facts

Extra Columns at the Destination Database

- Apply process check for Dependency for the column and If the extra columns are not used for dependency computations, then applies changes to the destination table.
- If column defaults exist for the extra columns, then these defaults are used for these columns for all inserts.

Avoid System Generated Names

– For example, DDL statement at a source database:

CREATE TABLE EMP (n1 NUMBER NOT NULL);

– This results in a NOT NULL constraint with a system-generated name. For example, sys_001500.

– When DDL is applied at a destination , the system-generated name for this constraint may be sys_c1000.

– Again DDL statement at the source database:

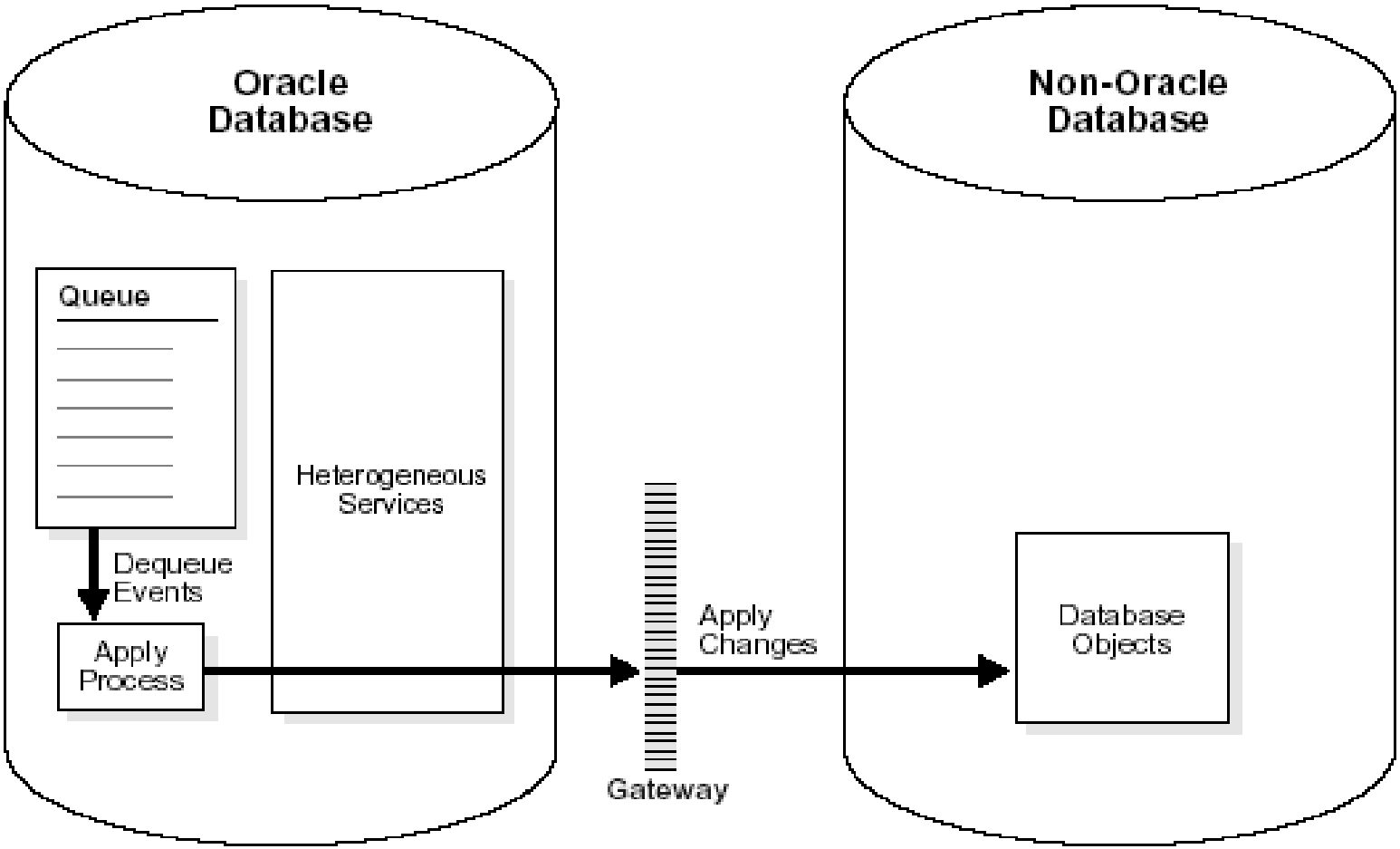
ALTER TABLE EMP DROP CONSTRAINT sys_001500;

– It fails at the destination database during the apply process and so Fix is

CREATE TABLE EMP

(n1 NUMBER CONSTRAINT emp_null_nn NOT NULL);

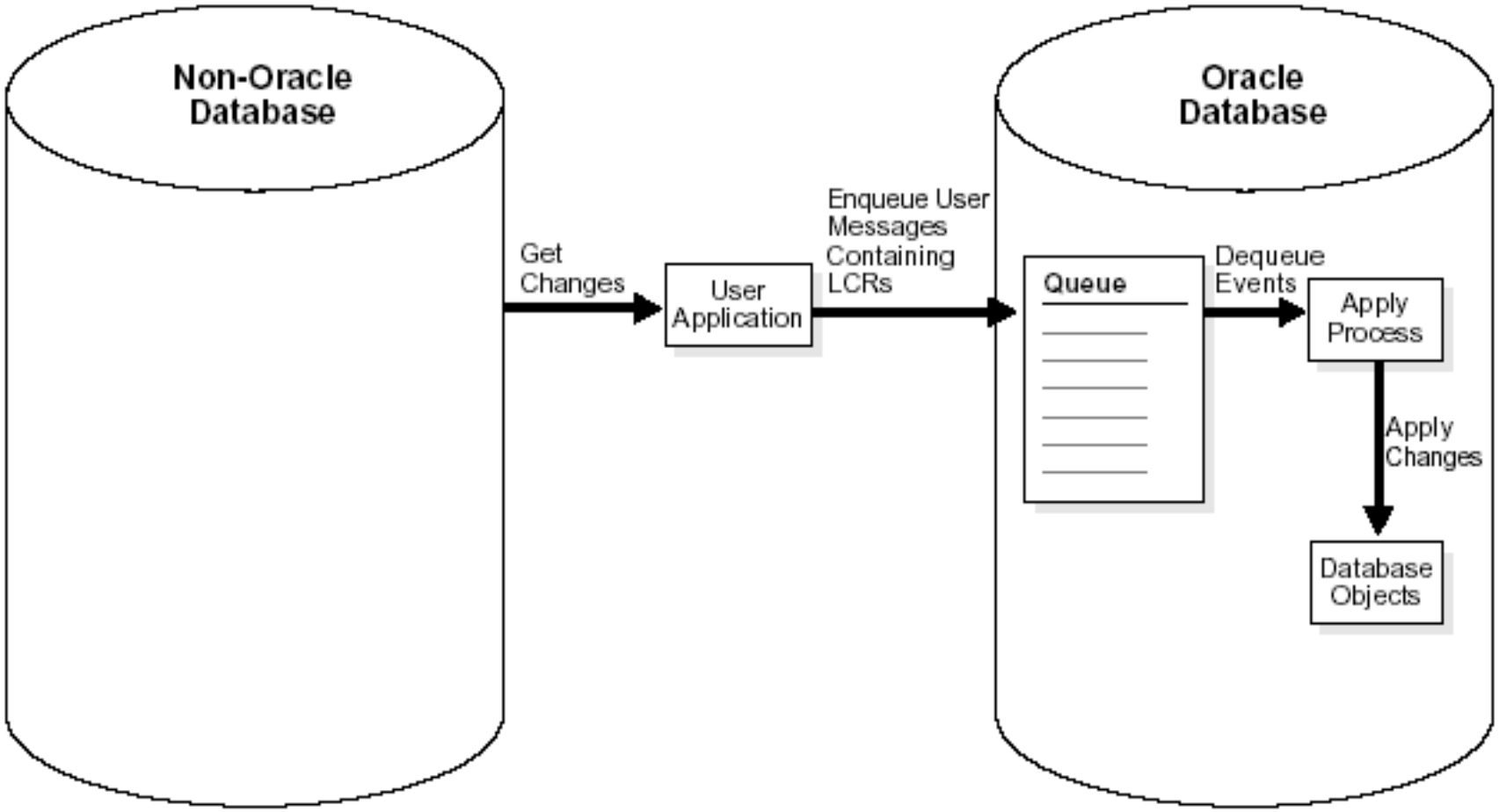
Oracle → Non Oracle Replication



Oracle → Non Oracle Replication

- Parallel apply to non-Oracle databases is not supported.
- Error handlers and conflict handlers are not supported
- If an apply error occurs, then the transaction moved into an exception queue in the Oracle database.
- The apply process detects data conflicts but automatic conflict resolution is not supported.Therefore, any data conflicts encountered are treated as apply errors.
- The apply process cannot apply DDL changes at non-Oracle databases.

Non-Oracle → Oracle Replication



Feature Comparison

	Advanced Replication	RAC	Data Guard	Streams
Entire Database Replication	YES	N/A	YES	YES
Schema Replication	YES	N/A	NO	YES
Table Replication	YES	N/A	NO	YES
DML/DDL Replication	YES	N/A	YES	YES
Instance Redundant	YES	YES	YES	YES
Database Redundant	YES	NO	YES	YES
Cluster Software	NO	YES	NO	NO
Failover	Manual	TAF	Manual	Manual
Load Balancing	YES	YES	YES	YES
Data type Support	SOME	ALL	SOME	SOME
Heterogeneous Db Support	YES	NO	NO	YES

Feature Comparison

	Advanced Replication	RAC	Data Guard	Streams
OS between Source & Target	Can be Different	Must be Same	Must be Same	Can be Different
Oracle S/w Version between Source and Target	Can be Different	Must be Same	Must be Same	Can be Different [at least 9.2]
Hardware Location	N/A	Same Place	N/A	N/A
Cost Factor for Licensing	Included	Extra Cost	Included	Included

Pre-requisite for Streams

- Oracle Software Version 9.2.0.3 or higher
- Database should be in ARCHIVELOG mode
- Override Nologging operations by using

  Alter Database/Tablespace Force Logging;

- Following init.ora parameter setting
  - AQ_TM_PROCESSES to be at least 1
  - COMPATIBLE to be 9.2.0 or higher
  - GLOBAL_NAMES=true for sharing information between databases
  - JOB_QUEUE_PROCESSES to be at least 2
  - SHARED_POOL_SIZE increase by 10Mb

Important DD Views - CAPTURE

DBA_CAPTURE

DBA_CAPTURE_PARAMETERS

DBA_CAPTURE_PREPARED_DATABASE

DBA_CAPTURE_PREPARED_SCHEMA

DBA_CAPTURE_PREPARED_TABLES

V$STREAMS_CAPTURE

Important DD Views - STAGE

DBA_QUEUES

DBA_QUEUE_PUBLISHERS

DBA_QUEUE_TABLES

AQ$<queueTableName> - Enqueue & Dequeue Information

Important DD Views - PROPAGATE

DBA_DB_LINKS

DBA_JOBS

DBA_JOBS_RUNNING

DBA_PROPAGATION

DBA_QUEUE_SCHEDULES

Important DD Views - APPLY

DBA_APPLY
DBA_APPLY_PROGRESS
DBA_APPLY_PARAMETERS
DBA_APPLY_CONFLICT_COLUMNS
DBA_APPLY_DML_HANDLERS
DBA_APPLY_ERROR
DBA_APPLY_INSTANTIATED_OBJECTS
DBA_APPLY_KEY_COLUMNS
V$STRAMS_APPLY_COORDINATOR
V$STRAMS_APPLY_READER
V$STRAMS_APPLY_SERVER

Questions
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Answers

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