Oracle 12c: Gee Whiz Features

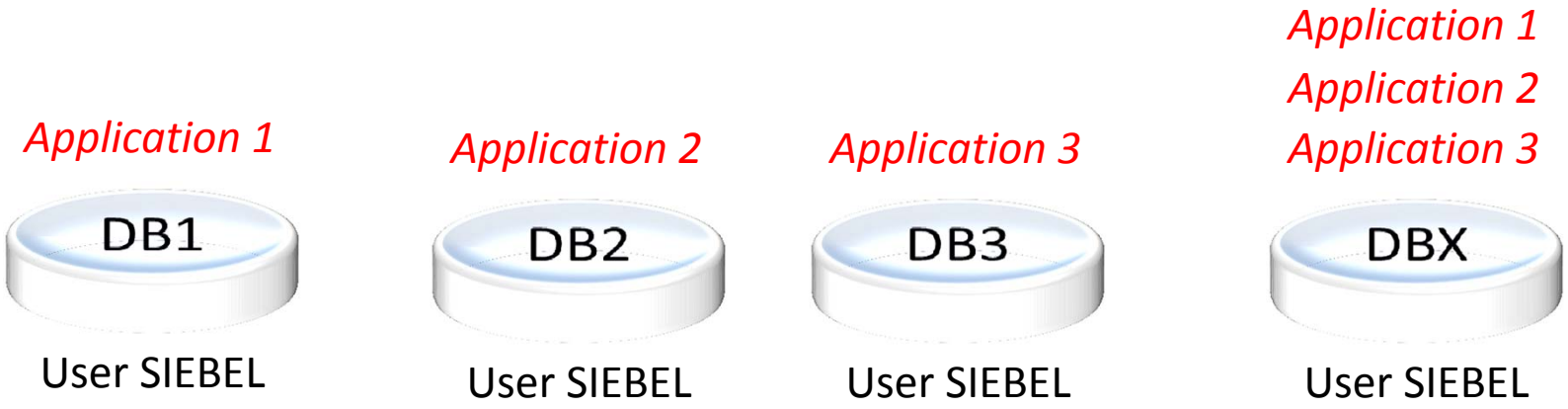
Arup Nanda

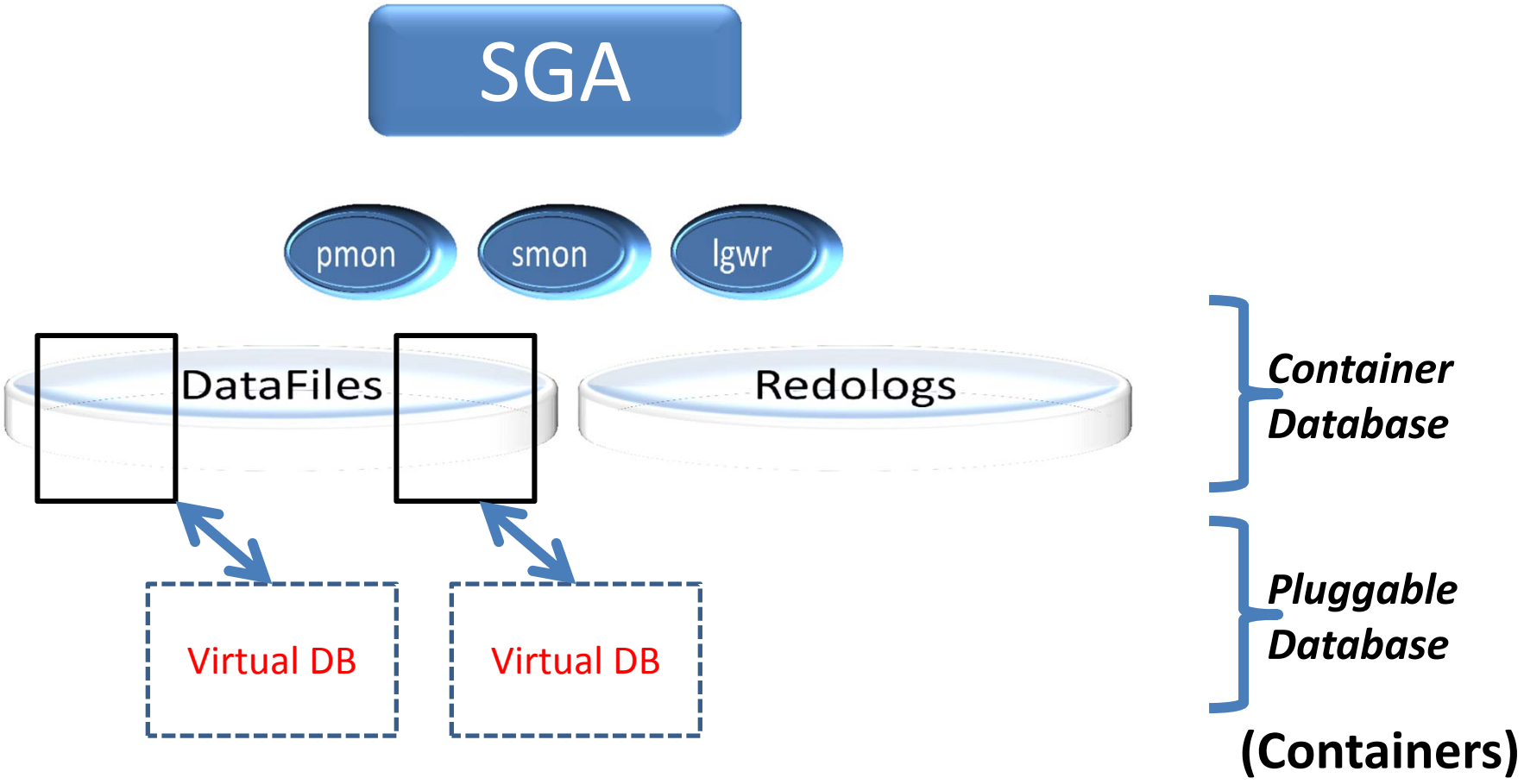
Longtime Oracle DBA

Agenda

- 12 Features
- Key *useful* features; not all.
- Not necessarily well advertised
- Some demo

1. Pluggable Database




SGA
pmon
smon
lgwr
DataFiles
Redologs
Virtual DB
Virtual DB
Container Database
Pluggable Database
(Containers)

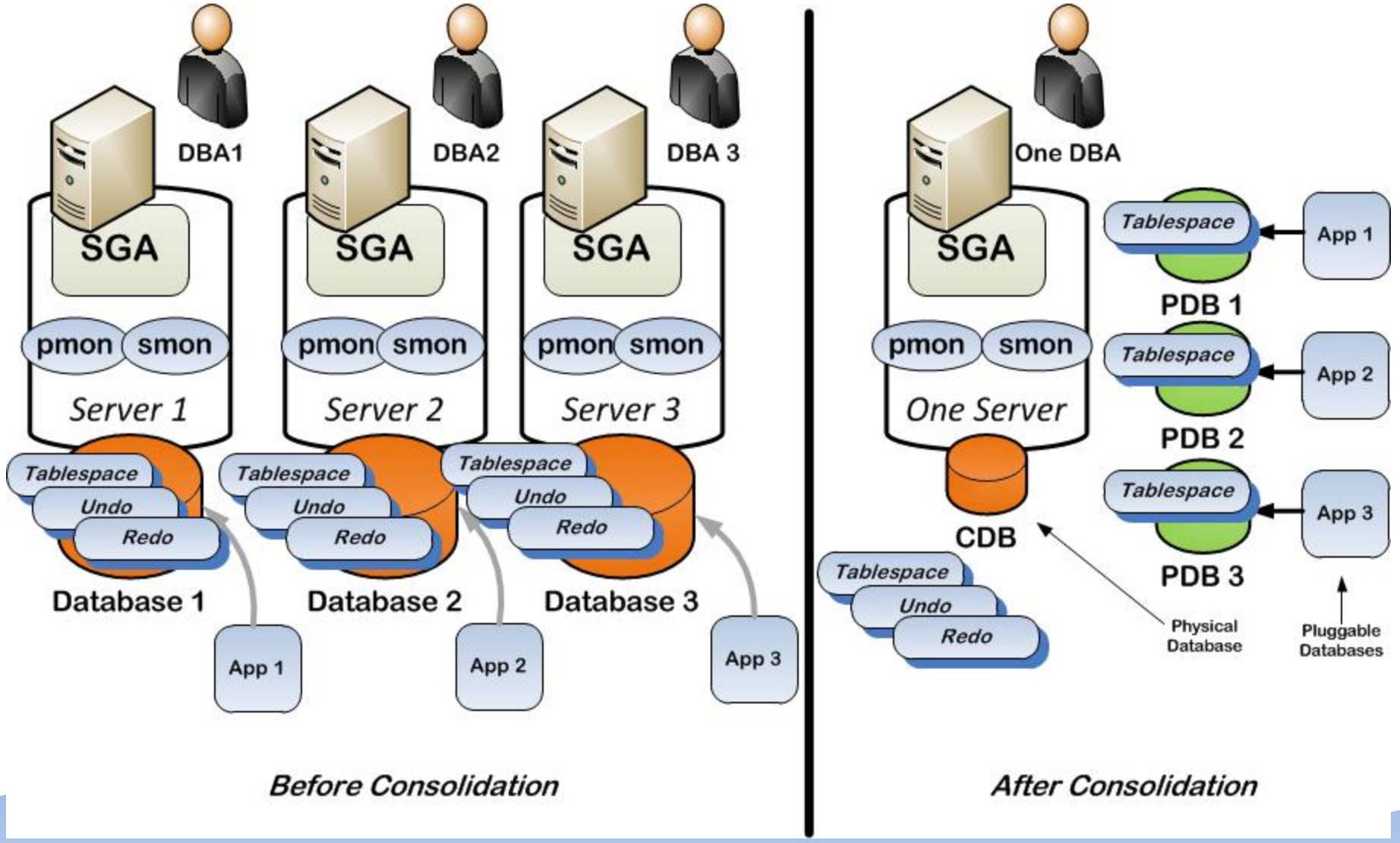
DBA_USERS

```
SELECT NAME
FROM USER$
WHERE CON_ID = ...
```

PDB1
CON_ID=2

PDB2
CON_ID=3

PDB3
CON_ID=4


DBA1
DBA2
DBA 3
SGA
SGA
SGA
pmon
smon
pmon
smon
pmon
smon
Server 1
Server 2
Server 3
Tablespace
Undo
Redo
Tablespace
Undo
Redo
Tablespace
Undo
Redo
Database 1
Database 2
Database 3
App 1
App 2
App 3
Before Consolidation
One DBA
SGA
pmon
smon
One Server
CDB
Tablespace
Undo
Redo
Tablespace
App 1
PDB 1
Tablespace
App 2
PDB 2
Tablespace
App 3
PDB 3
Physical Database
Pluggable Databases
After Consolidation

2. RMAN

- Sysbackup role
  - `grant sysbackup to rmanuser identified by rmanuser;`
  - `rman target='rmanuser/rmanuser as sysbackup'`
- SQL in RMAN
  - No need to put SQL 'command'
  - Select, even describe
- Recovering over the network
  - Great for data guard environments

Table Recovery

```
RMAN> recover table scott.accounts:p1
2> until scn 123456
3> auxiliary destination '+DG1';
```

- Creates a table called ACCOUNTS_P1
- Remap Table Name

```
4> remap table arup.accounts:p1:newaccs;
```

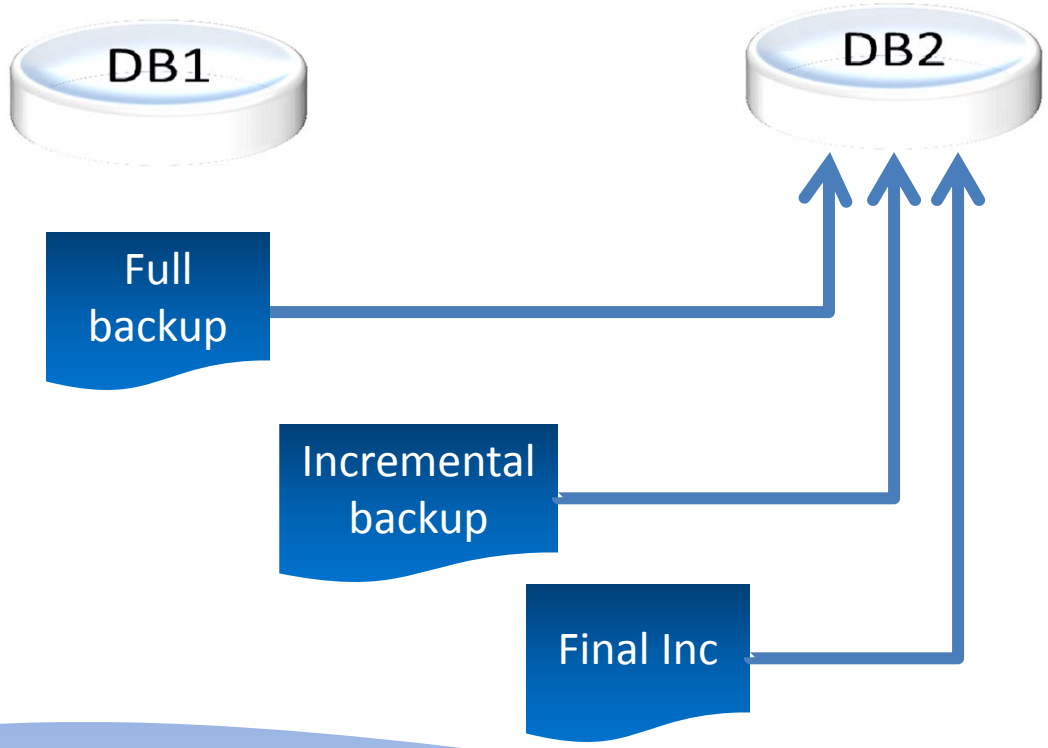
- Remap Tablespace

```
4> remap tablespace users:accdata;
```

- Datapump Dump

```
4> datapump destination '/tmp' dump file 'acc.dmp'
5> notableimport;
```

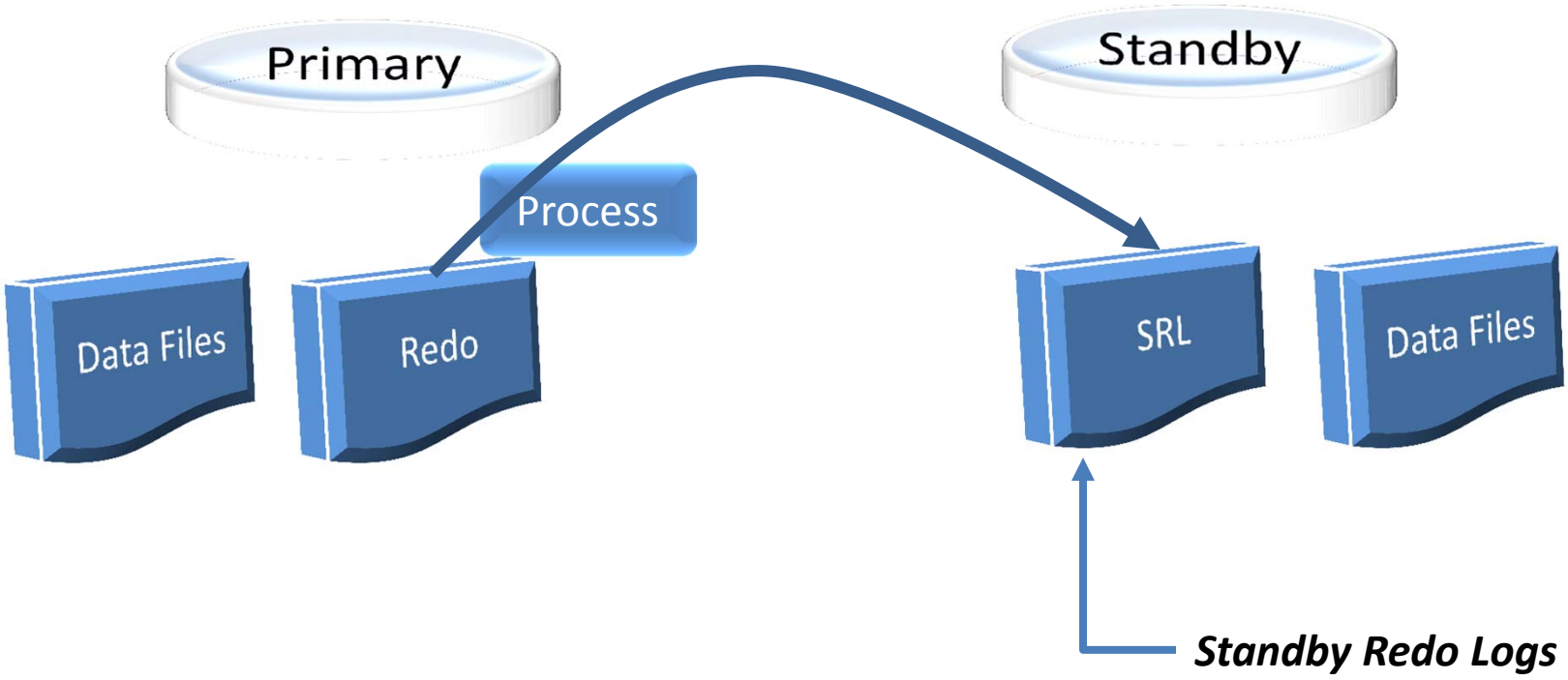
Cross-patform Database Migration

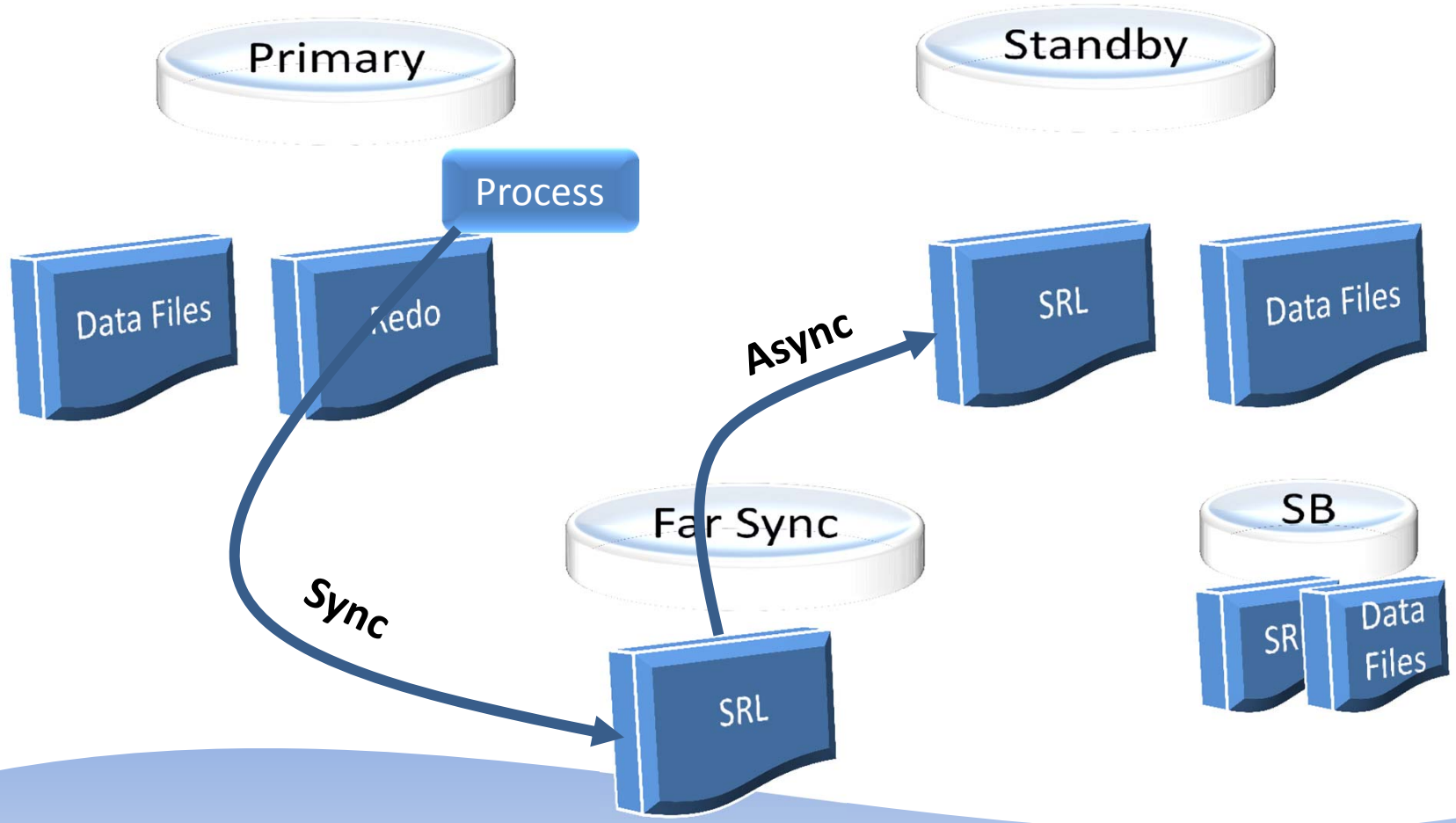


3. Data Guard

- Global Temporary Tables in ADG
  - You can use DML on GTTs
  - Uses temporary undo (in temp tablespace)
- Sequences in ADG
  - `select x.nextval from dual`
  - Pulls the <cache> amount of numbers for SGA
- Realtime cascade
- Data Guard Broker
  - One command role transition
  - Resumable switchover

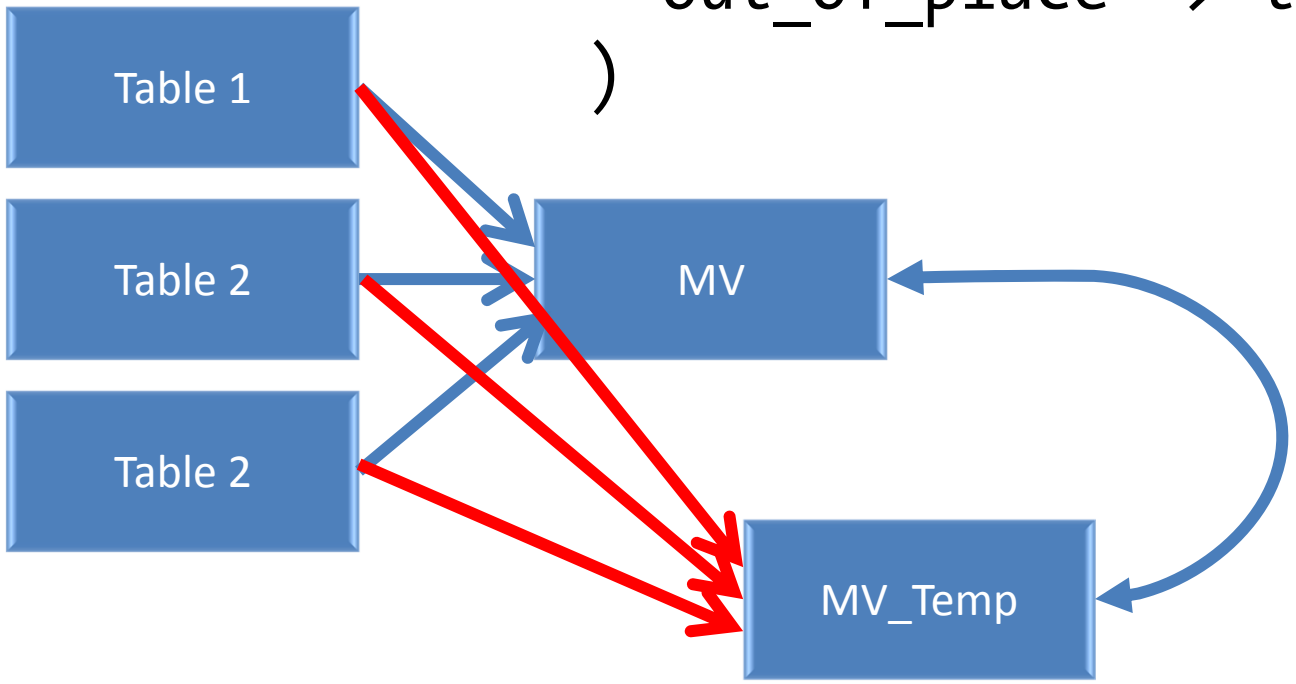
Far Sync Standby



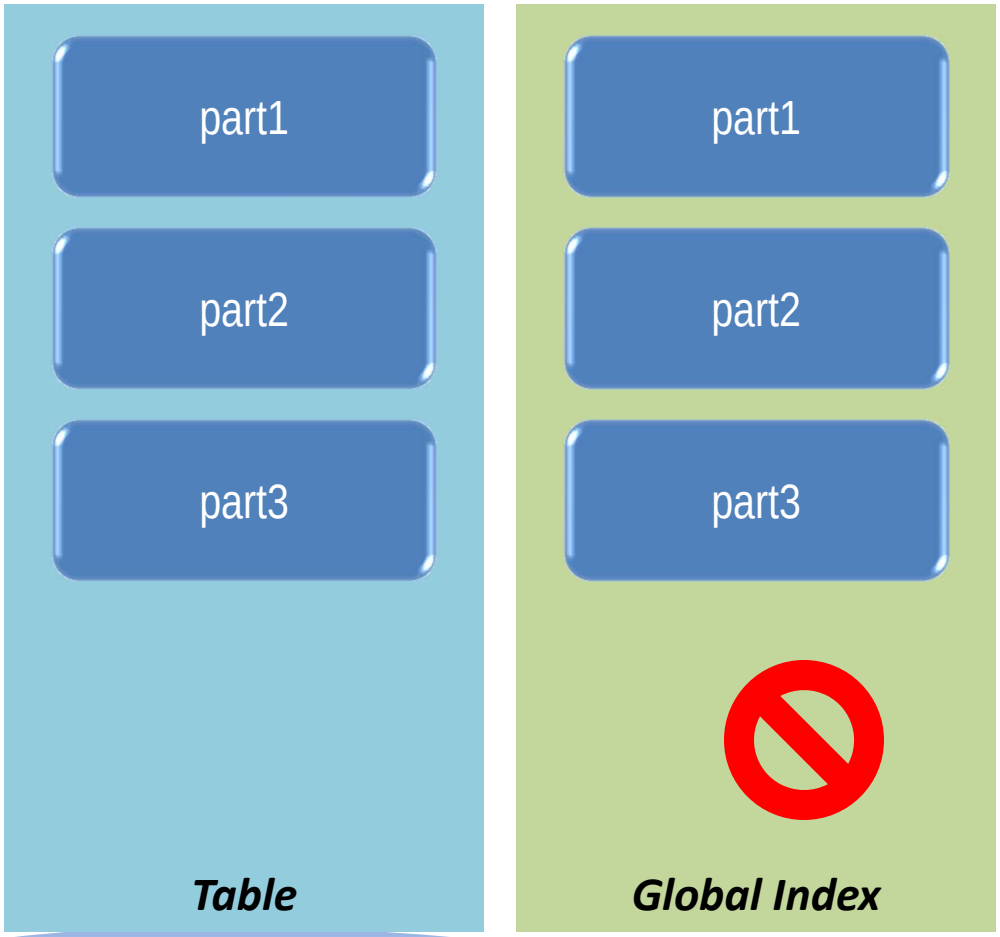

Primary
Standby
Process
Data Files
Redo
Async
SRL
Data Files
Far Sync
SB
Sync
SRL
SR
Data Files

4. MV Refresh

```
dbms_mview.refresh (
   …
   out_of_place => true
)
```



5. Partitioning: Asynch Global Index

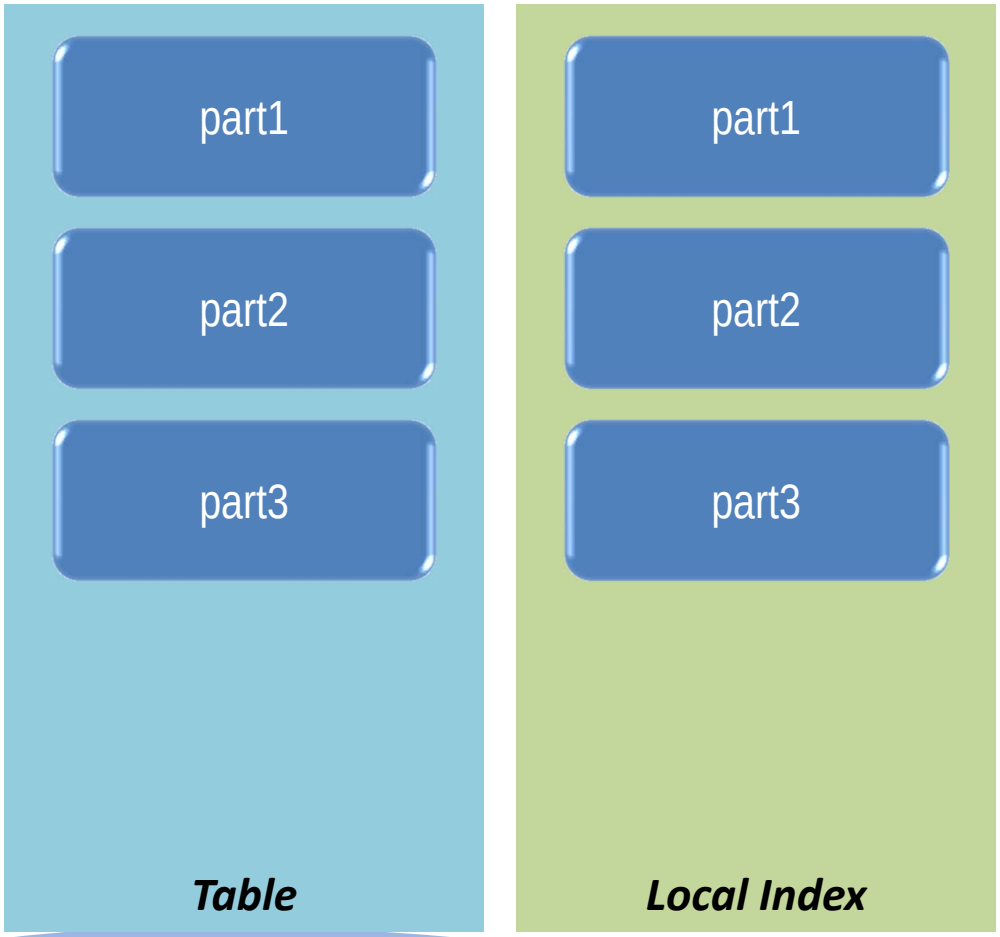



```
alter table drop t
partition part3
update global
indexes;
```

A scheduler job pmo_deferred_gidx _maint_job cleans up

Column ORPHANED_ENTRIES in USER_INDEXES view

5. Partitioning: Partial Index




```
SQL> alter table ptab1
modify partition p1
indexing on;

SQL> alter table ptab1
modify partition p2
indexing off;

SQL> create index
in_g2_ptab1 on ptab1
(c1) global indexing
partial;
```

6. Automatic Data Optimization

- Enable Heat Map

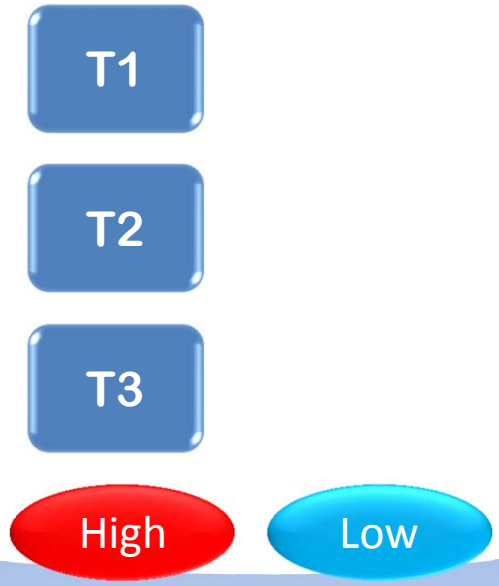
```
alter system set heat_map = on scope=both;
```

- Add Data Movement Policy

```
alter table exchange_rate ilm add policy tier to midterm_ts;
```

- Add Compression Policy

```
alter table exchange_rate
ilm add policy row store
compress advanced segment
after 7 days
of no modification;
```



7. Schema Management

- DDL Logging
  - Enable `alter system set enable_ddl_logging=true;`
  - The logs are written in `C:\oracle\diag\rdbms\anl2\anl2\log\ddl`
  - In XML format

```
<msg time='2013-08-30T20:29:36.635-04:00' org_id='oracle' comp_id='rdbms'
 msg_id='opiexe:4181:2946163730' type='UNKNOWN' group='diag_adl'
 level='16' host_id='STARUPNANT420B' host_addr='fe80::58b8:d0b2:f7c9:3147%27'
 version='1'>
 <txt> create table t11 (col1 number)
 </txt>
</msg>
<msg time='2013-08-30T20:32:56.719-04:00' org_id='oracle' comp_id='rdbms'
 msg_id='opiexe:4181:2946163730' type='UNKNOWN' group='diag_adl'
 level='16' host_id='STARUPNANT420B' host_addr='fe80::58b8:d0b2:f7c9:3147%27'>
 <txt>drop table t11
 </txt>
</msg>
```

Multiple Indexes

```
SQL> create table t3 (col1 number, col2 number);

Table created.

SQL> create index in_t3 on t3(col1);

Index created.

SQL> create index in_t3_02 on t3(col1);
create index in_t3_02 on t3(col1)
                          *
ERROR at line 1:
ORA-01408: such column list already indexed

SQL> create bitmap index in_t3_02 on t3(col1) invisible;

Index created.
```

Rules

- Different types: b-tree/bitmap
- Unique/nonUnique
- Only one is visible at a time

Invisible Column

```
SQL> create table t4 (col1 number, col2 number invisible);
SQL> desc t4
Name  Null? Type
----- ----- -----
COL1      NUMBER
SQL> insert into t4 values (1);
1 row created.
SQL> select * from t4;
      COL1
----------
         1
SQL> select col1, col2 from t4;
      COL1       COL2
---------- ----------
         1
SQL> insert into t4 (col1,col2) values (2,2);
1 row created.
```

```
SQL> set colinvisible on
SQL> desc t4
 Name                 Null?    Type
 ----------------- -------- ----------
--
 COL1                          NUMBER
 COL2 (INVISIBLE)              NUMBER

SQL> create index in_t4 on t4(col2);
Index created.
```

Default Values

```
SQL> create table t5 (col1 number,
col2 number default on null 0);
Table created.

SQL> desc t5
 Name                  Null?    Type
 ----------------- -------- ------
 COL1                           NUMBER
 COL2                  NOT NULL NUMBER

SQL> insert into t5 values (1,
null);
SQL> insert into t5 values (2,2);

SQL> select * from t5;
      COL1       COL2
---------- ----------
         1          0
         2          2
```

```
SQL> create table t6 (col1 number generated
always as identity);

SQL> create table t7 (col1 number generated
always as identity (start with 1000 increment
by 10));

SQL> insert into t6 values (1);
insert into t6 values (1)
*
ERROR at line 1:
ORA-32795: cannot insert into a generated always
identity column

SQL> create table t9 (col1 number, col2 number
generated by default as identity);
SQL> insert into t9 values (9,9);
SQL> insert into t9 values (10,default);
SQL> insert into t9 (col1) values (11);
SQL> select * from t9;
      COL1       COL2
---------- ----------
         9          9
        10          2
        11          3
```

8. SQL and PL/SQL

- Repetitive operations
- Stored Function and Procedure

```
CALC_INT (
    p_principal
    p_int_rate
    )
 returns number
 as
 begin
    ...
 end;
```

```
select accno,
       calc_int(bal, int_rate)
from accounts;
```

SQL WITH Functions

Not a stored function

```
with function calc_int (
   p_principal     in number,
   p_int_rate      in number
)
return number
as
begin
   return p_principal * (1+p_int_rate/100);
end;
select
   accno,
   balance,
   calc_int(balance,10) int
from accounts;
```

Just SELECT; not UPDATE or DELETE

Sqlf.sql

Top-N Query

- First 10, second 10 rows, etc.

```
select … from (select … from … order by …) where rownum <= 10
```

- 12c way:

```
select *
from sales_fact
order by year, week, country, region, product
fetch first 10 rows only;
```

- Next 10 rows
  - offset 10 rows fetch first 10 rows only
  - offset 10 rows fetch first 0.1 percent rows only
  - offset 10 rows fetch first 0.1 percent rows with ties

Fetch10.sql

- Session Sequences
  - Values visible only in the session
  - Not persistent

```
SQL> create sequence sessseq session;
SQL> create sequence globseq global;
SQL> select globseq.nextval from dual;
3
SQL> select sessseq.nextval from dual;
1
```

Seqg.sql sqqs.sql

View Expansion

```
create view v1 as select * from t1;

select * from v1;

SQL> var o clob
SQL> begin
  2     dbms_utility.expand_sql_text (
  3               'select * from v1',:o);
  4  end;
  5  /

SQL> print o

SELECT "A1"."COL2" "COL2" FROM  (SELECT "A2"."COL2"
"COL2" FROM ARUP."T1" "A2")
```

Exp1.sql

9. Administration

- PGA Size Limit
  - `pga_aggregate_target` is merely a target
  - `pga_aggregate_limit` limits PGA memory consumption
  - Greater of
    - 2 GB
    - 2 X pga_aggregate_target
    - 3 MB X processes
- Error:

```
ORA-00028: your session has been killed
ORA-04036: PGA memory used by the instance exceeds
PGA_AGGREGATE_LIMIT
PGA memory used by the instance exceeds PGA_AGGREGATE_LIMIT of
4000 MB
```

- Want Old Behavior?
  - Set `pga_aggregate_limit` to 0

- Adaptive Execution Plans
  - Estimate can change mid-execution
- Incremental Stats
  - Stats of partitions

Adapt1.sql

10. Online Activities

- Online Datafile Move
  - No need to put tablespace to read only

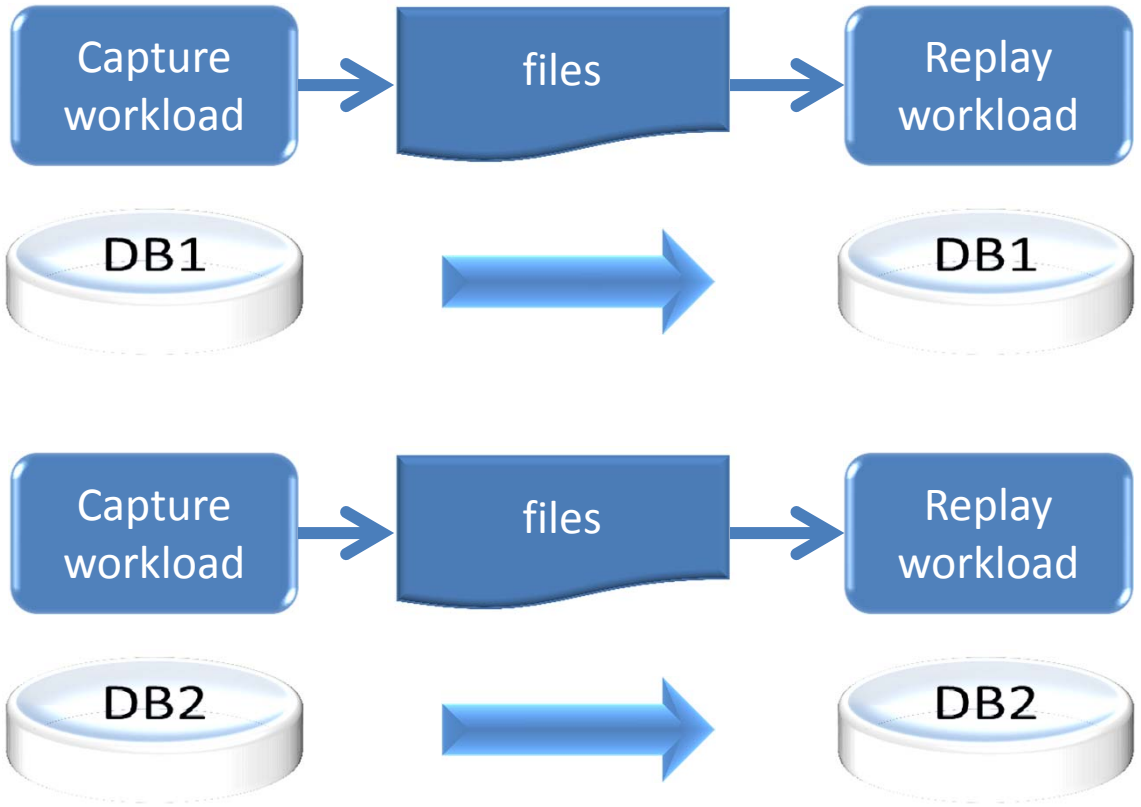
```
ALTER DATABASE MOVE DATAFILE ‘old1.dbf' TO
‘new1.dbf';
```

  - Queries and DML can continue
  - Great for ASM conversions
  - Use REUSE at the end, if you want to overwrite
  - If you want to keep the old one, use KEEP at the end

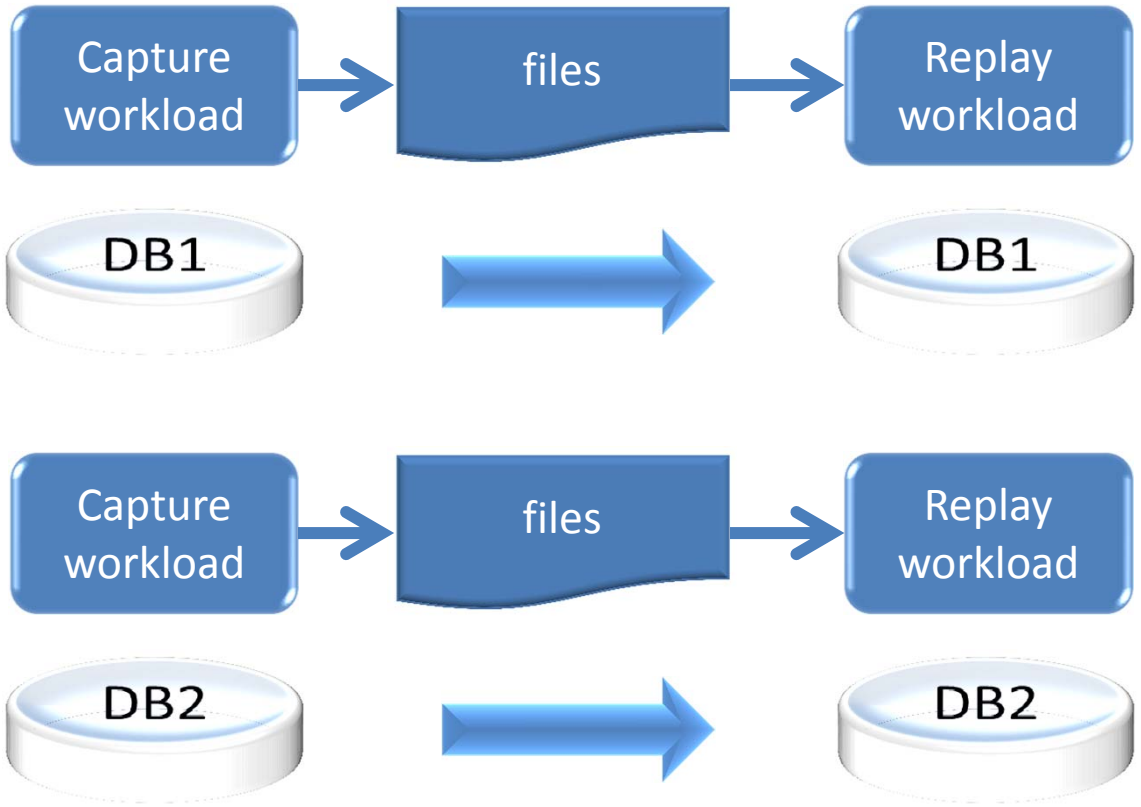
- Move partitions online
  - `alter table t1  move p1 to tablespace ts1 update indexes online`
  - DML allowed as usual
- Online DDLs

```
drop index i1 online;
alter table t1 drop constraint c1 online;
alter table t1 set unused column col1 online;
alter index i1 unusable online;
alter index i1 [in]visible;
```

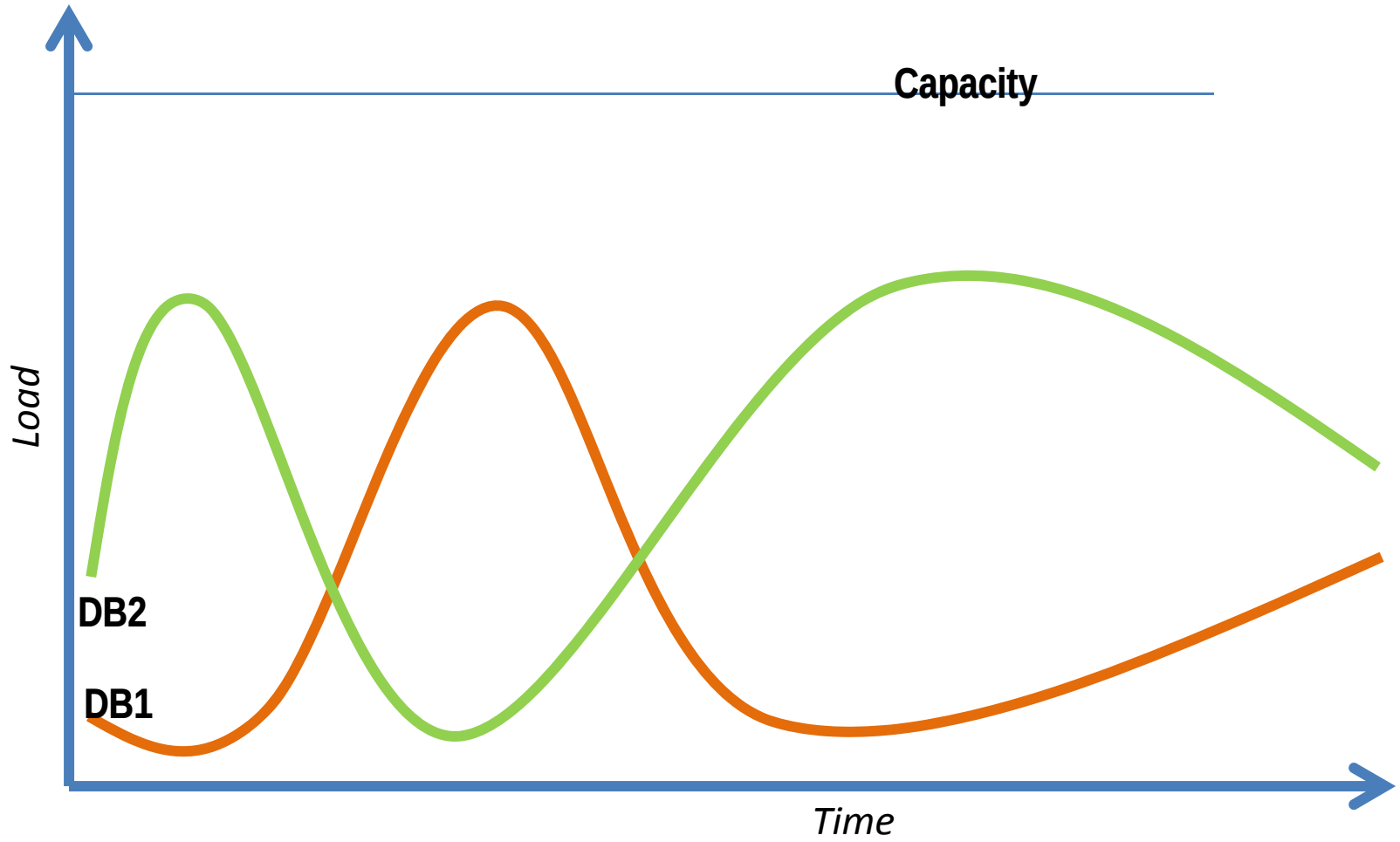
11. Replay Consolidation



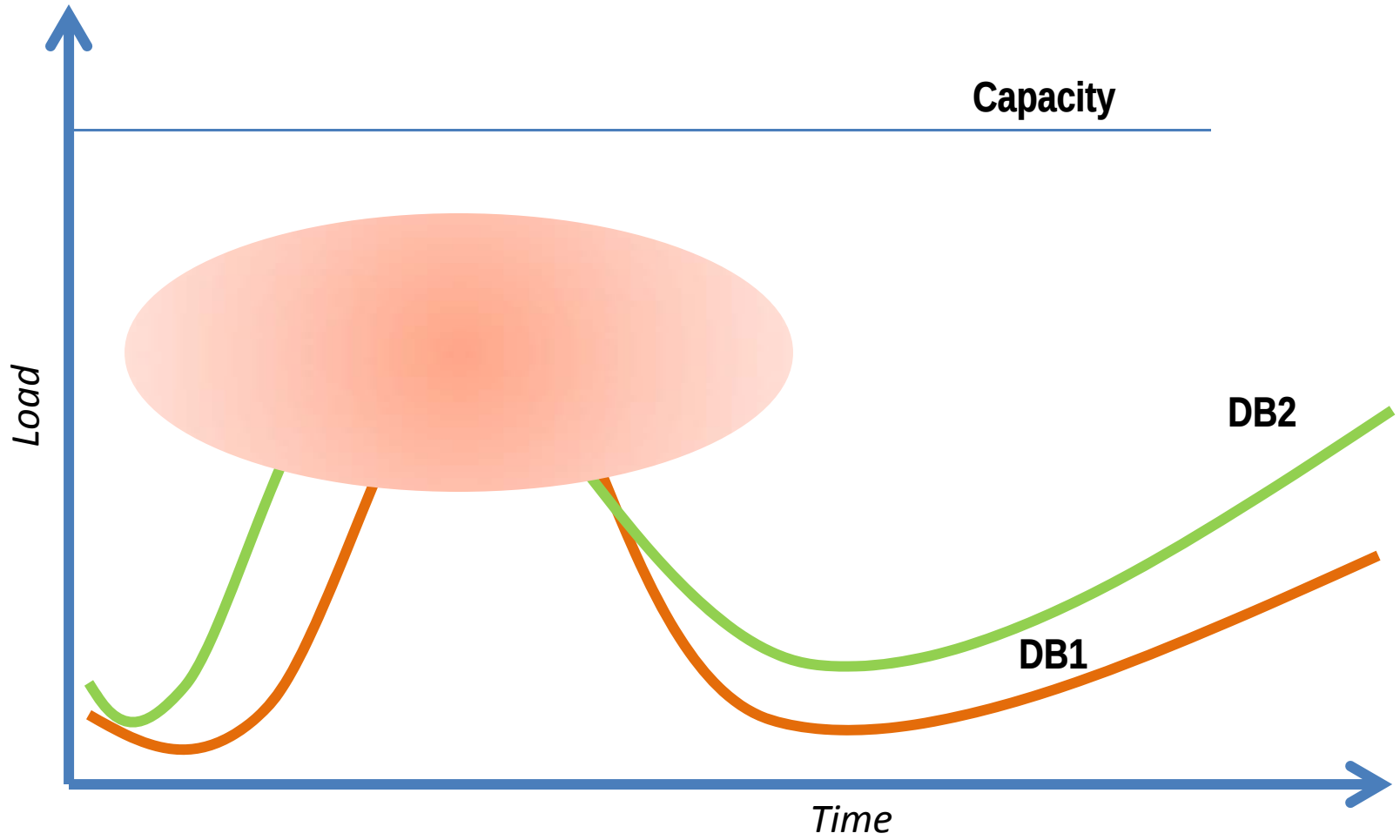
11. Replay Consolidation



Workload Characteristics #1

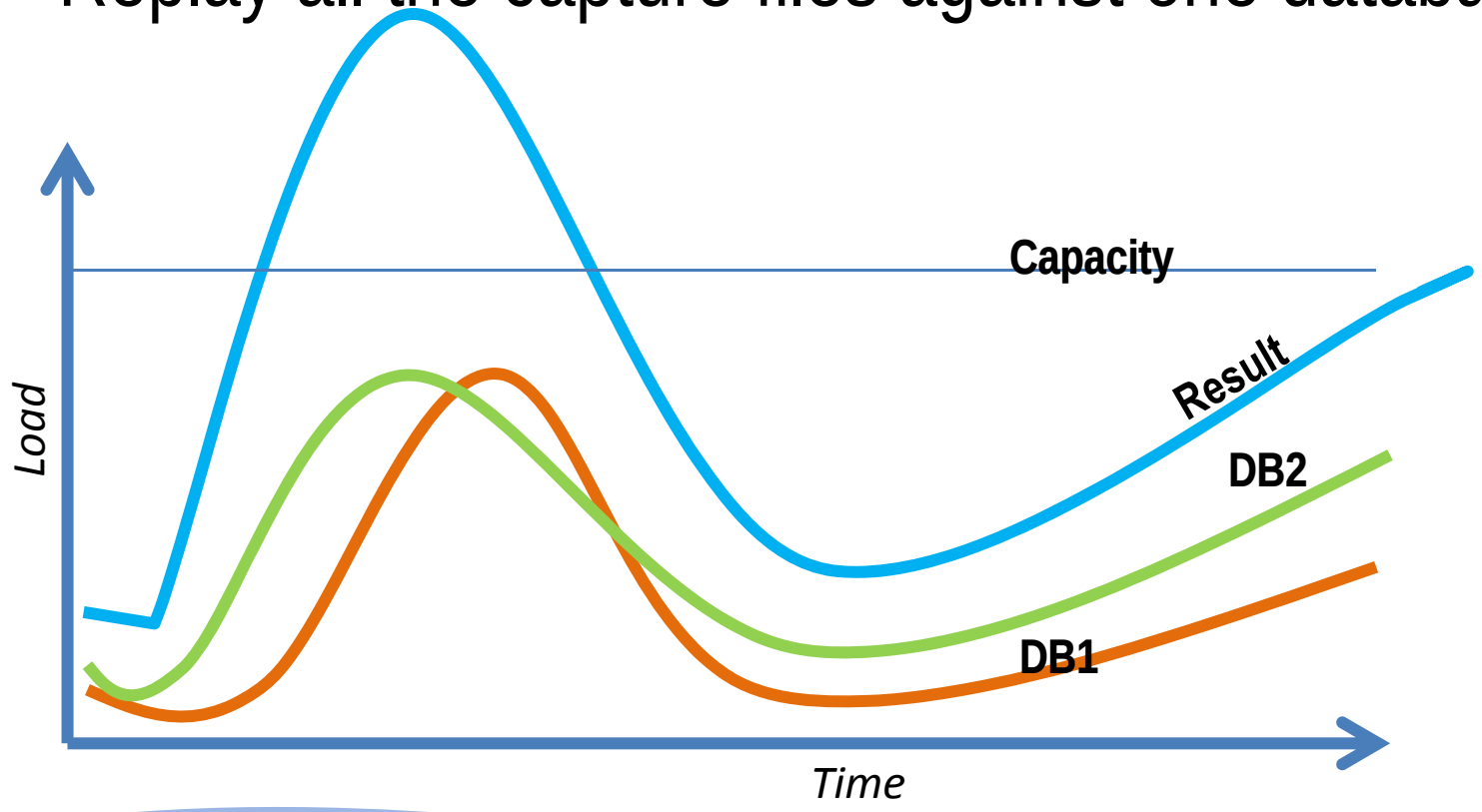


Workload Characteristics #2



Database Replay Consolidation

- Capture from multiple databases
- Replay all the capture files against one database



12. Miscellaneous

- Temporary Undo
  - Put the undo information in TEMP tablespace
  - alter session set temp_undo_enabled=true;
  - V$TEMPUNDOSTAT view gives the details
- VARCHAR2 is now 32676 bytes
  - Param MAX_STRING_SIZE should be set to EXTENDED
  - DB must be in upgrade mode
  - Irreversible
- Inline Stats Collection
  - CTAS, Insert Into Select From will collect stats

Thank You!

My Blog: **arup.blogspot.com**
My Tweeter: **arupnanda**