Partitioning *Beyond* the Basics

Arup Nanda
Starwood Hotels & Resorts
White Plains, NY

Dynamic

Bread

Artist

What's It

- Divide and Conquer
- The Best Thing Since **Sliced Bread**

Partition

- Partition Elimination
- Parallel Execution
- Partition Exchange
- Deletion
- Archiving

Partition Views

View Created as

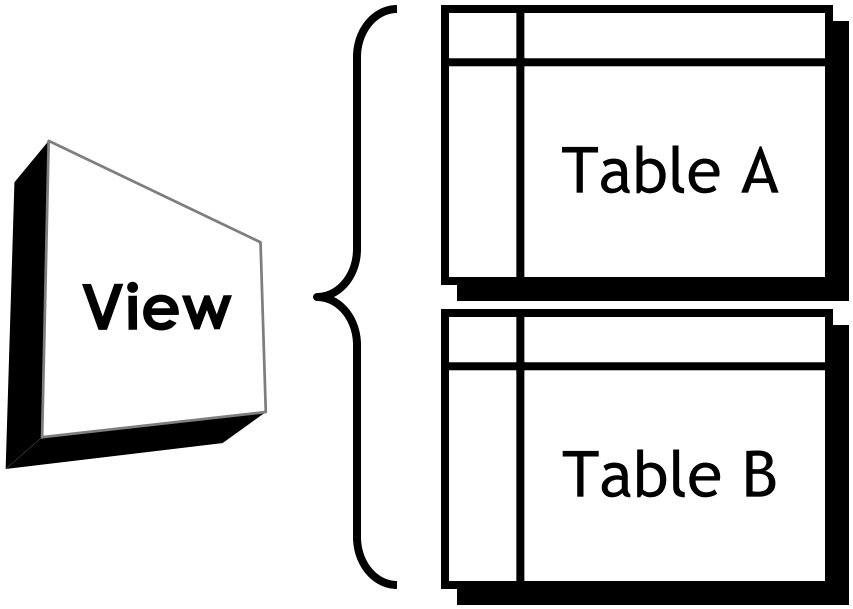
SELECT *some fields*

FROM Table1

UNION ALL

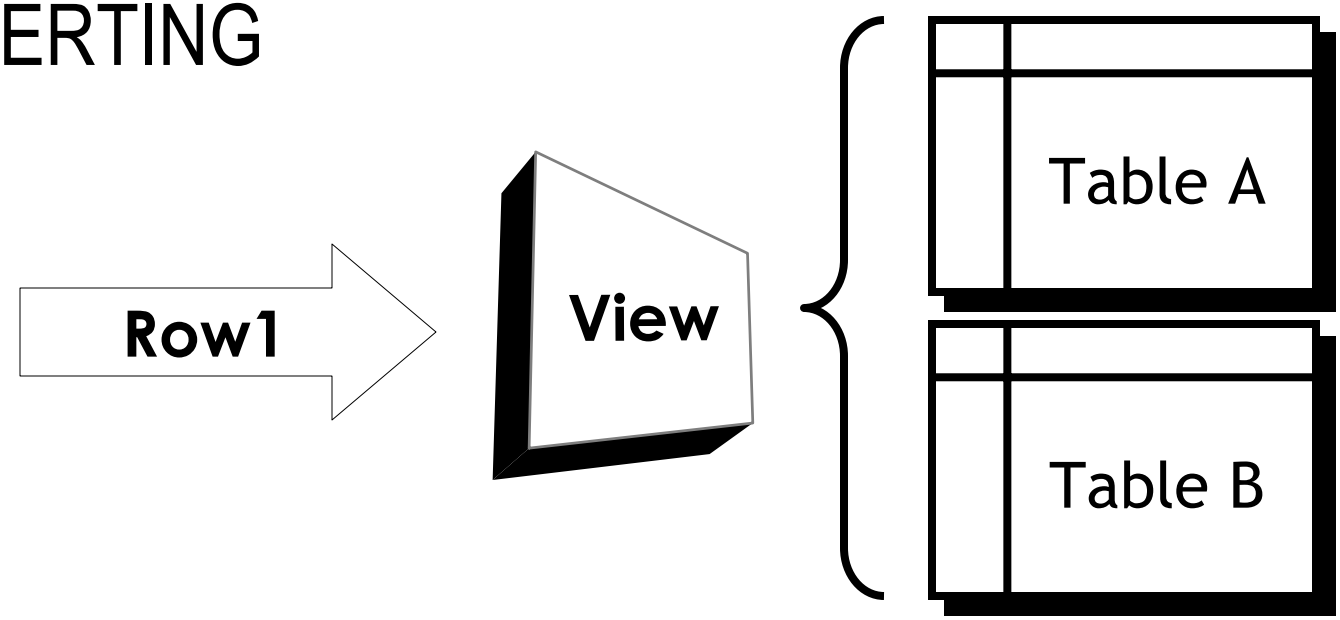
SELECT *same fields*

FROM Table2



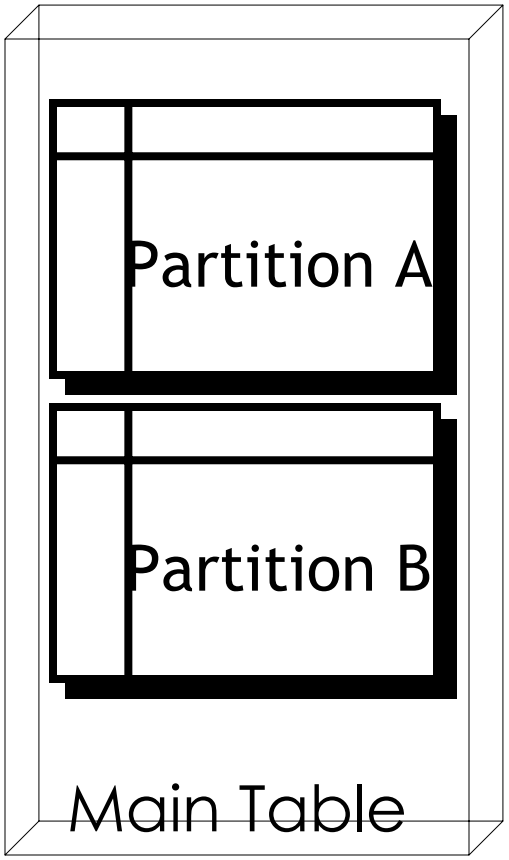
Problem

While INSERTING



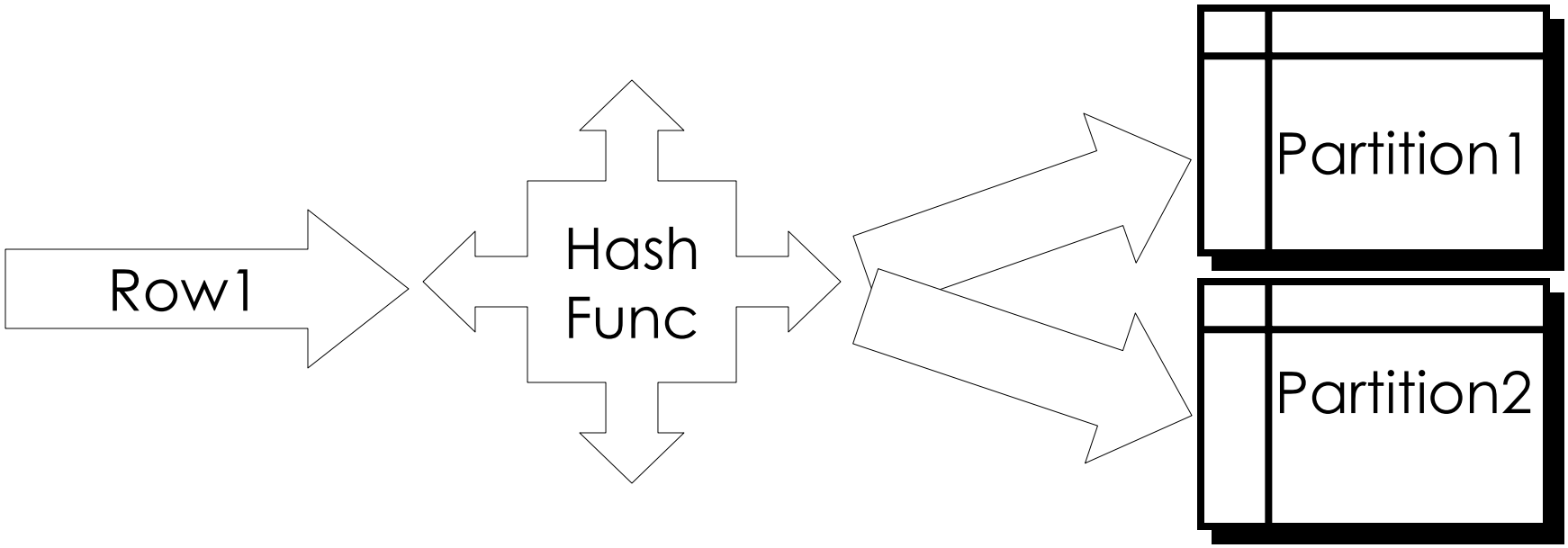
Real Partitions

- Came Out with Oracle 8.0
- Range Partitioned Only
- Partition Key Column
  - VALUES LESS THAN (CONSTANT)



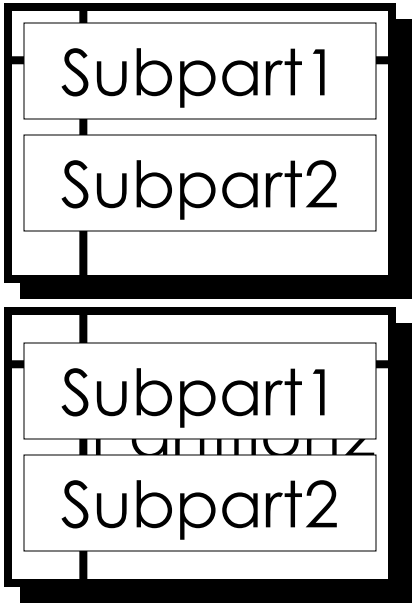
Hash Partitions

- Where Range is Not Practical
- Performance



Composite Partitioning

- Partitions are subdivided
- Range-Hash
- Range-List



More Techie

In V$SESSION_WAIT: ‘latch wait’

Latch: “cache buffer chain latch”

More Accesses to a Segment = Need More Latches

Partitioning ➔ More Segments per Object

➔ Less Accesses per Segment

➔ Less “cache buffer chain latch” contention

List Partitioning

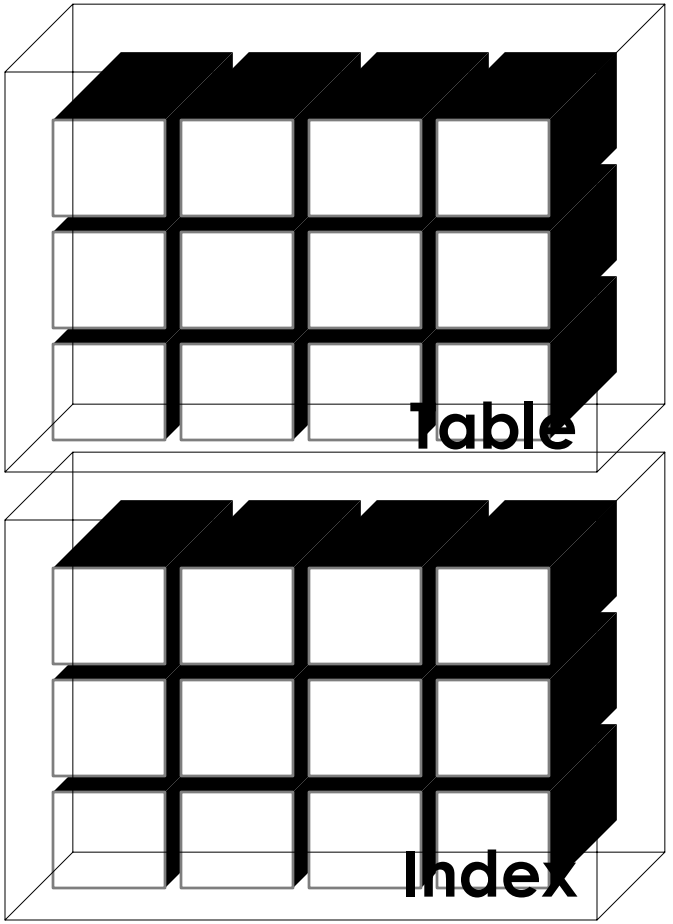
Similar to Range but Values are Discrete

```
PARTITION BY LIST (STATE_CODE)
(
   PARTITION P1 VALUES ('CT','NY'),
   PARTITION P2 VALUES ('NJ'),
   PARTITION PM VALUES (DEFAULT)
)
```

Multi-column not supported

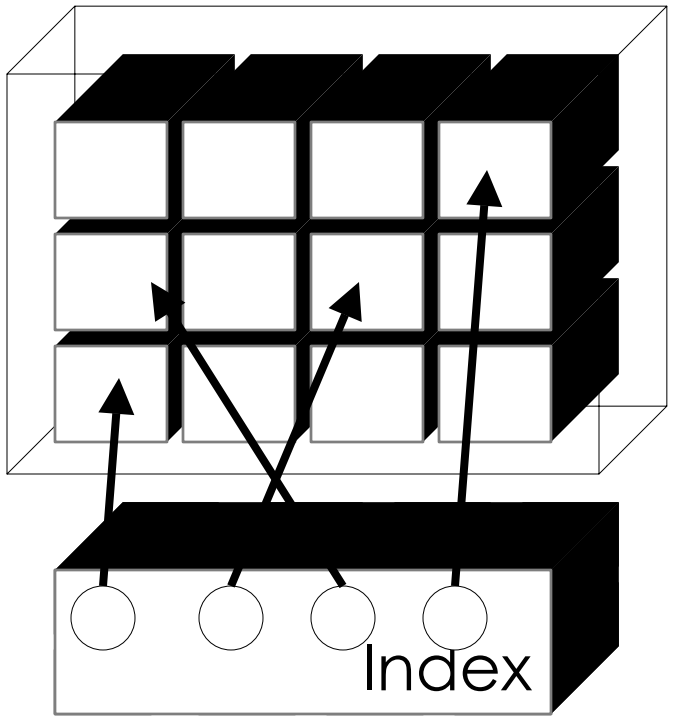
Local Index

- Partitioning Schemes of Index and Table are Same
- Easy to Administer
- REBUILD part by part



Global Indexes

- Indexes That Span Across All Rows of All Partitions
- Typically Used to Enforce Primary Keys



Oracle 10g: Global Index can be Hash Partitioned

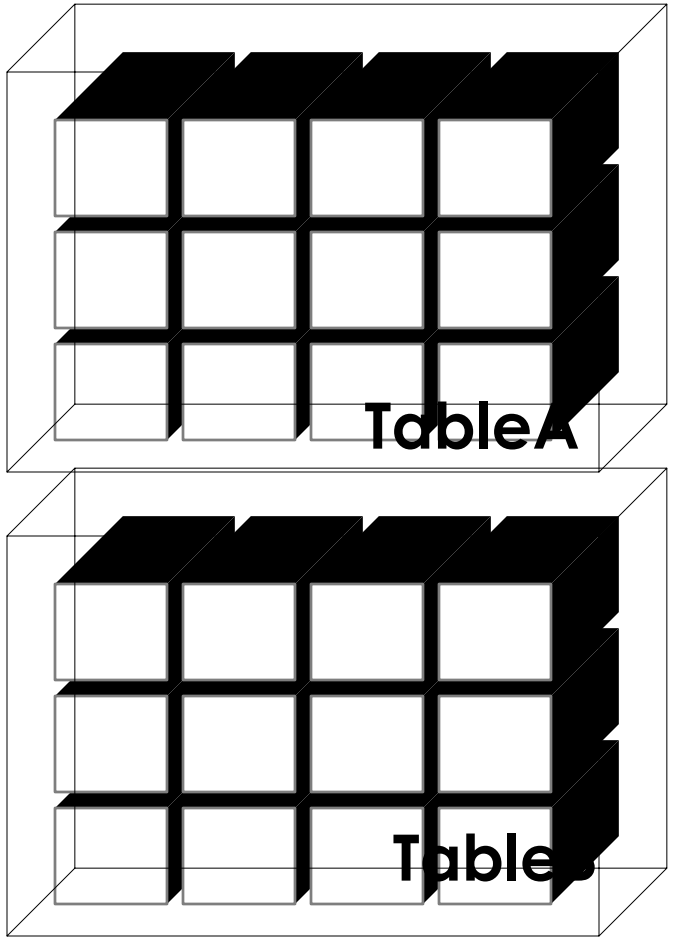
Equi-Partitioning

If a Table and another Table are partitioned in exactly same way with the same Partitioning Key

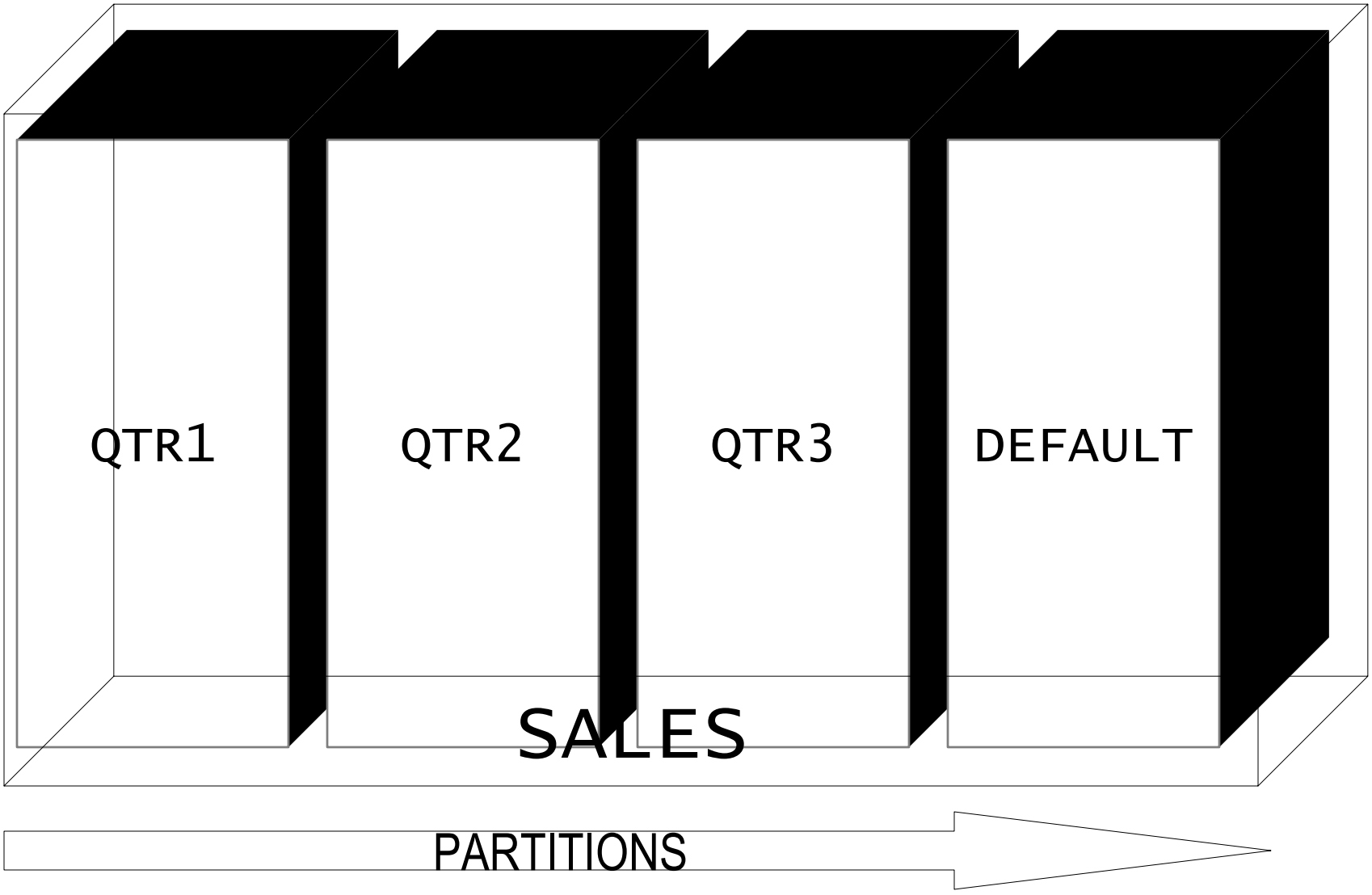
E.g.

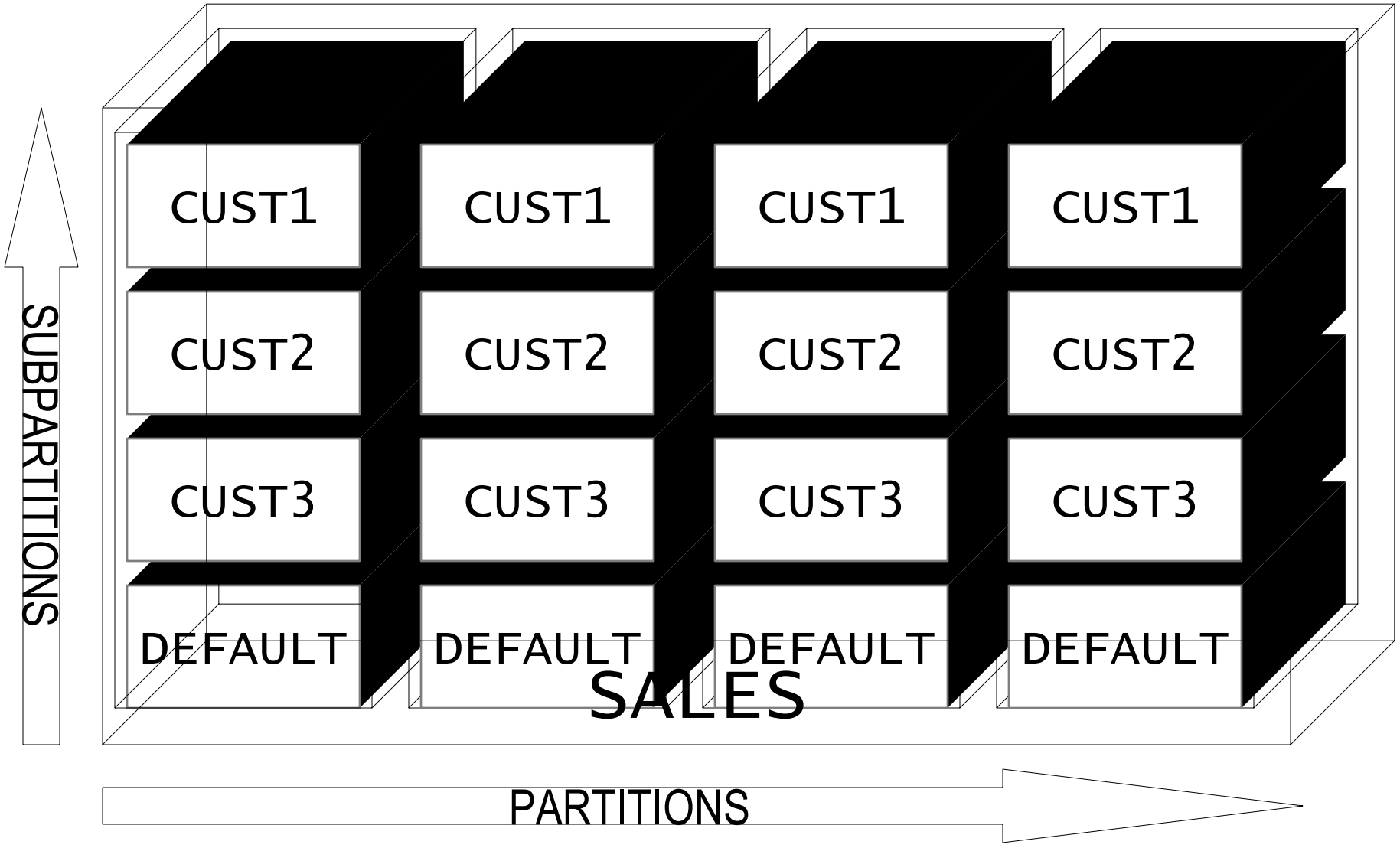
SALES on ORDER_DATE

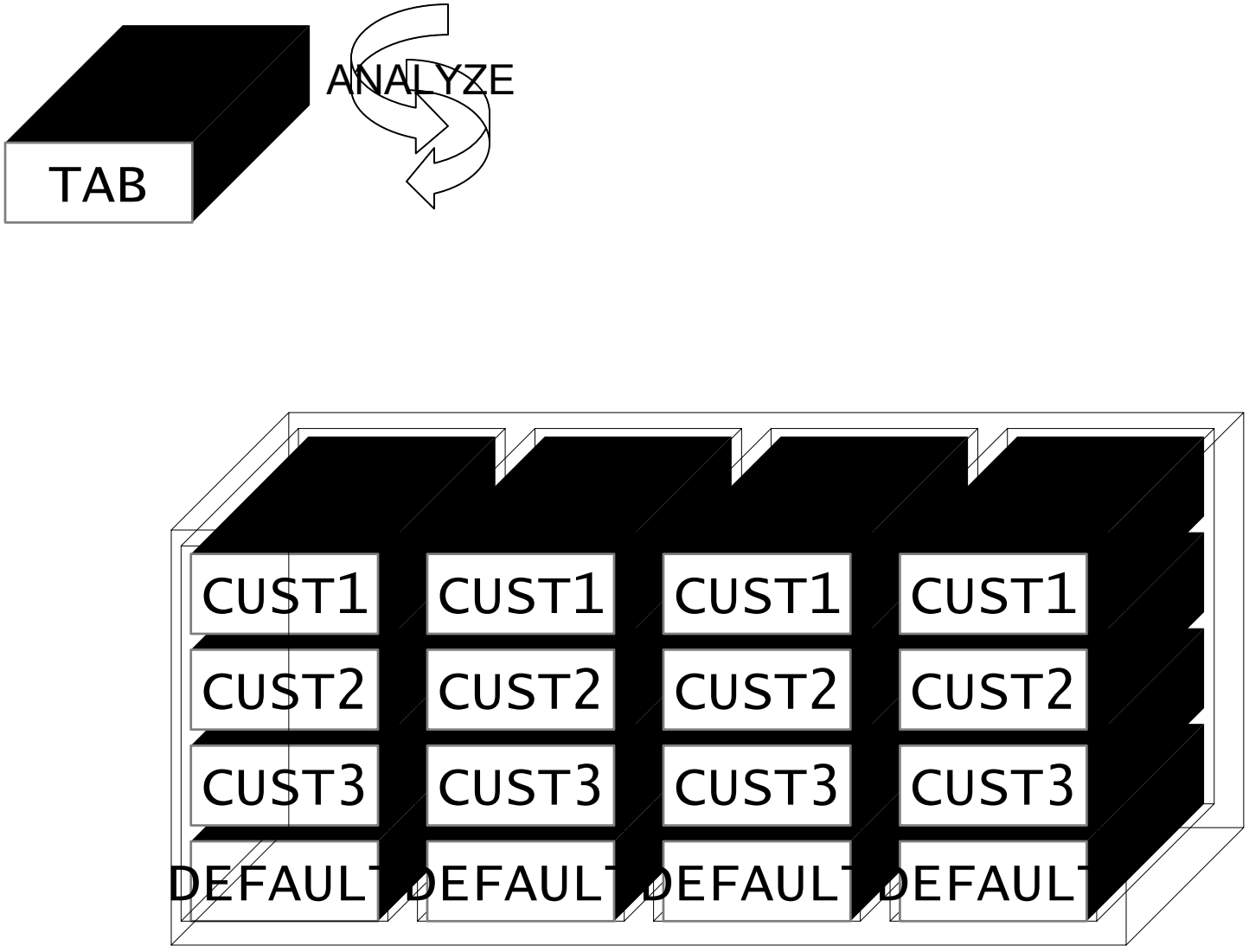
ORDERS on ORDER_DATE

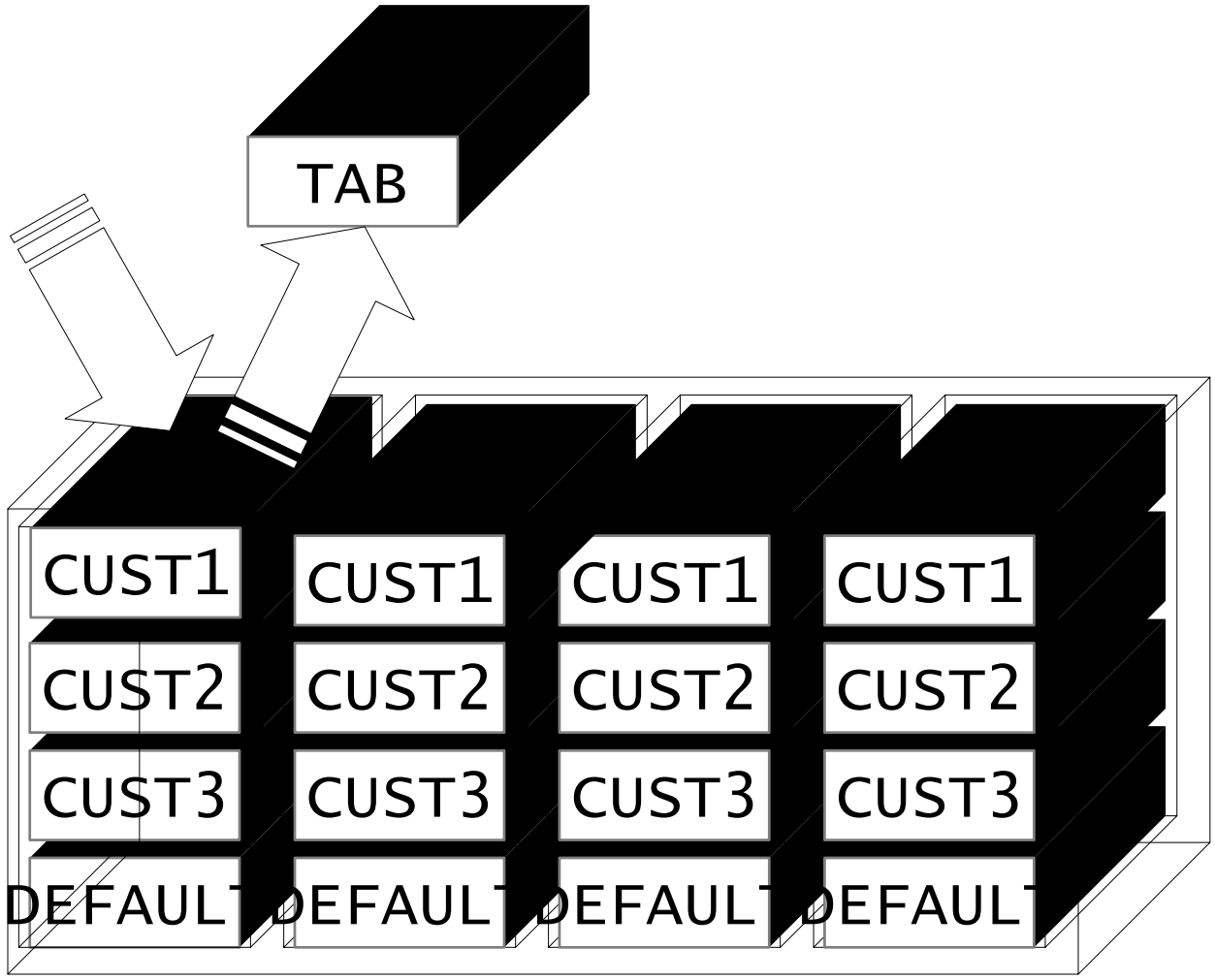


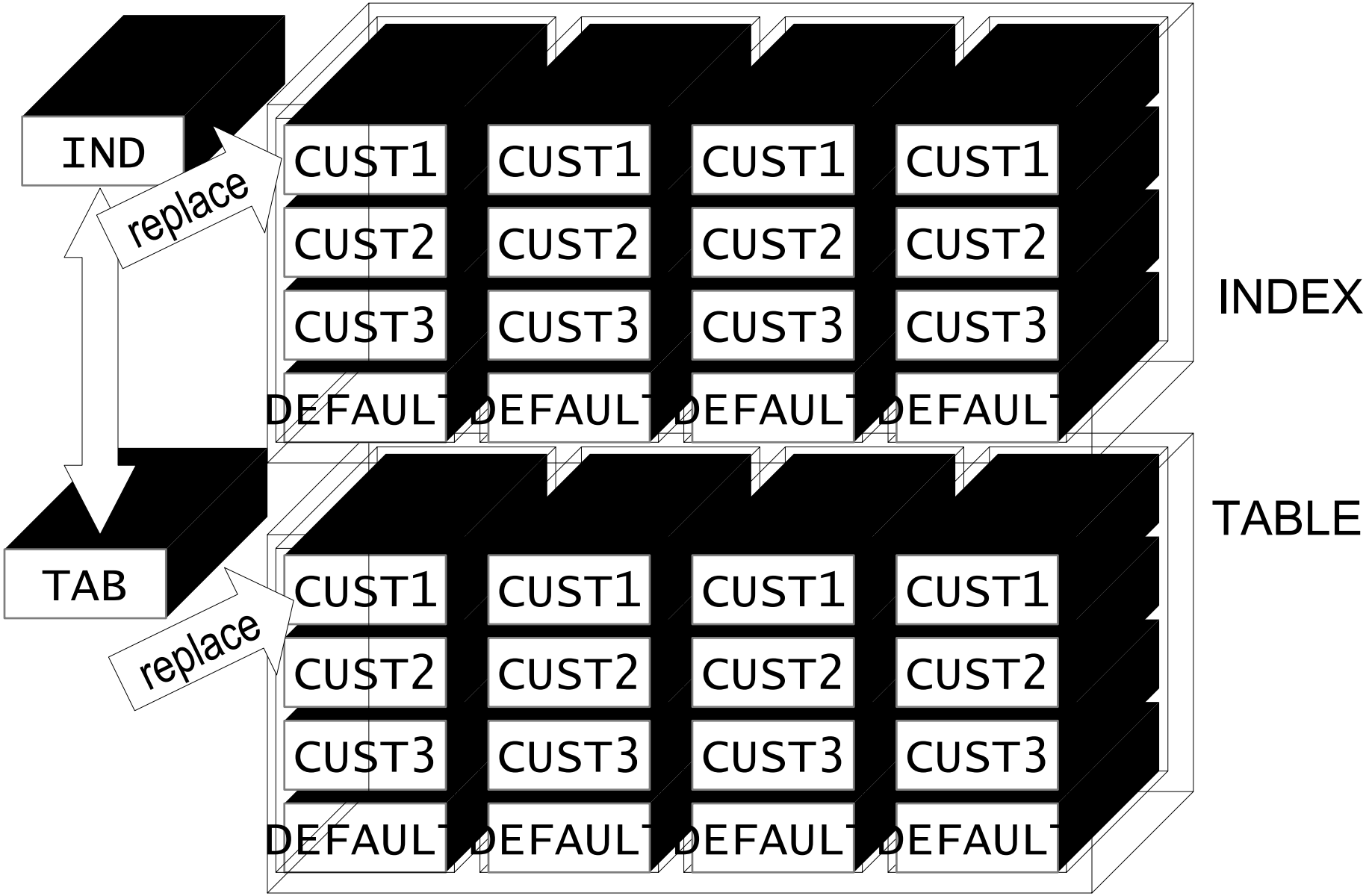

SALES

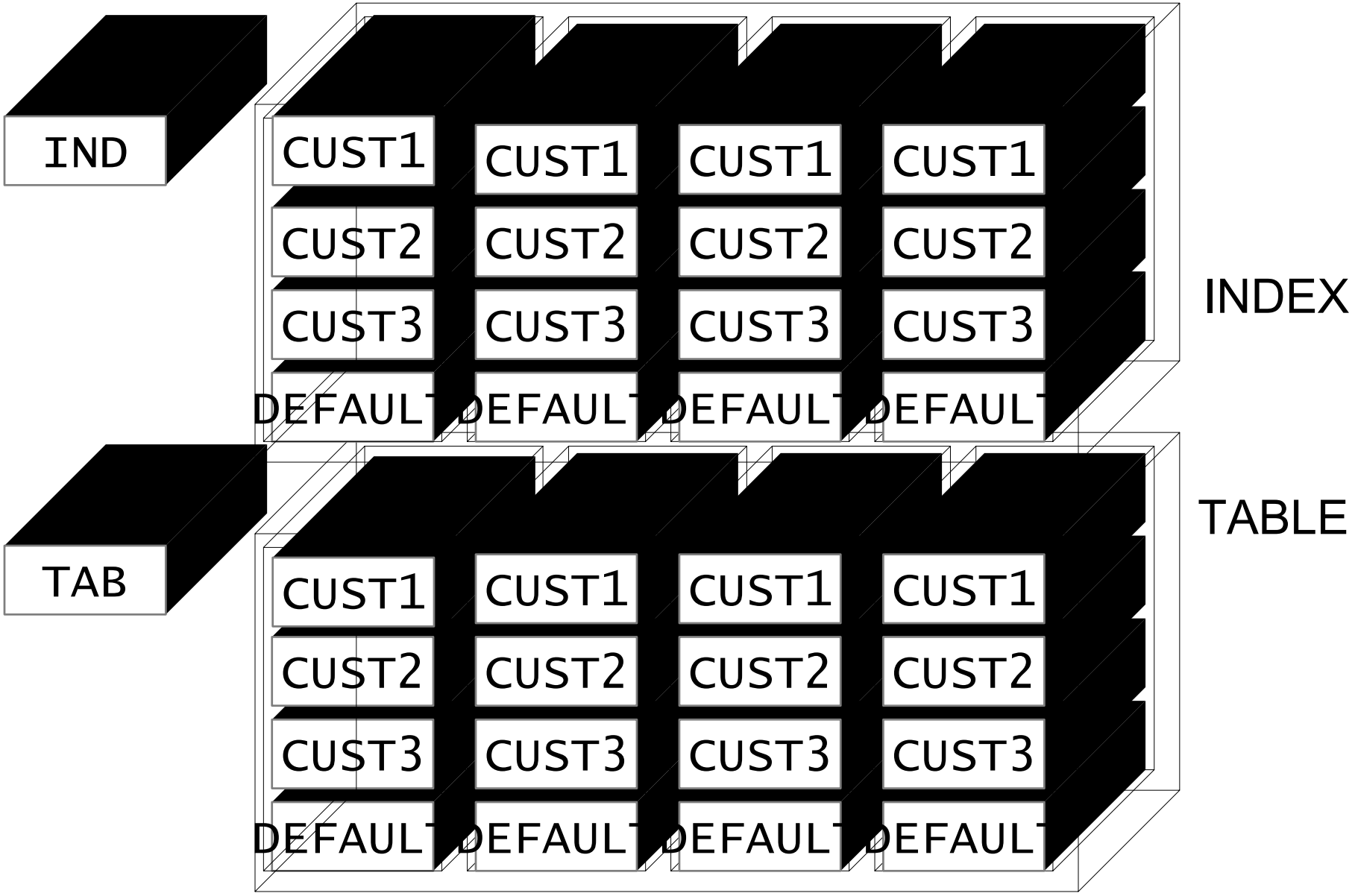

QTR1
QTR2
QTR3
DEFAULT
SALES
PARTITIONS


CUST1
CUST1
CUST1
CUST1
CUST2
CUST2
CUST2
CUST2
CUST3
CUST3
CUST3
CUST3
DEFAULT
DEFAULT
DEFAULT
DEFAULT
SALES
SUBPARTITIONS
PARTITIONS


TAB
ANALYZE
CUST1
CUST1
CUST1
CUST1
CUST2
CUST2
CUST2
CUST2
CUST3
CUST3
CUST3
CUST3
DEFAULT
DEFAULT
DEFAULT
DEFAULT


TAB
CUST1
CUST1
CUST1
CUST1
CUST2
CUST2
CUST2
CUST2
CUST3
CUST3
CUST3
CUST3
DEFAULT
DEFAULT
DEFAULT
DEFAULT


IND
replace
CUST1
CUST1
CUST1
CUST1
CUST2
CUST2
CUST2
CUST2
CUST3
CUST3
CUST3
CUST3
DEFAULT
DEFAULT
DEFAULT
DEFAULT
INDEX
TABLE
TAB
replace
CUST1
CUST1
CUST1
CUST1
CUST2
CUST2
CUST2
CUST2
CUST3
CUST3
CUST3
CUST3
DEFAULT
DEFAULT
DEFAULT
DEFAULT


IND
CUST1
CUST1
CUST1
CUST1
CUST2
CUST2
CUST2
CUST2
CUST3
CUST3
CUST3
CUST3
DEFAULT
DEFAULT
DEFAULT
DEFAULT
INDEX
TAB
CUST1
CUST1
CUST1
CUST1
CUST2
CUST2
CUST2
CUST2
CUST3
CUST3
CUST3
CUST3
DEFAULT
DEFAULT
DEFAULT
DEFAULT
TABLE

Subpartitioning

Select from a partition by

```
SELECT … FROM TAB1 PARTITION (P1);
```

Select from a subpartition by

```
SELECT … FROM TAB1 SUBPARTITION (SP1);
```

Works for Insert/Update/Delete, SQL*Loader

```
INTO TABLE TAB1 SUBPARTITION (SP1)
```

And Export, too `TABLE=MYTAB1:SP1`

Subpartitioning …

DBA_SEGMENTS

```
SELECT * FROM DBA_SEGMENTS
WHERE TABLE_NAME = 'TAB1'
AND PARTITION_NAME = 'SP1'
/
```

SEGMENT_TYPE

PARTITION_ID

Subpartitions

Subpartition Templates

```
PARTITION BY RANGE (COL1)
SUBPARTITION BY HASH (COL2)
SUBAPARTITION TEMPLATE
(
    SUBPARTITION SP1 TABLESPACE T1,
    SUBPARTITION SP2 TABLESPACE T2
)
(
    PARTITION P1 VALUES LESS THAN (101),
    PARTITION P2 VALUES LESS THAN (201),
…
```

P1_SP1, P1_SP2, P2_SP1, P2_SP2

Can't Specify Storage (8i)

Can specify Storage (9i) **DBA_SUBPARTITION_TEMPLATES**

Partition Pruning

Partition Based on Date – 1 partition per quarter

```
SELECT … FROM SALES
WHERE ORDER_DATE = ‘1/1/2003’
```

Will search only the 2003 Q1 partition

Plan_Table Revisited

Relvant Columns

- PARTITION_START
- PARTITION_STOP
- PARTITION_ID
  - *The step id that decided the partition start and stop*
- FILTER_PREDICATES
  - *The exact condition used to evaluate partitions*

Dbms_xplan

```
select * from
  table (
    dbms_xplan.display (
      /* plan table name */   'plan_table',
       /* statement id */      NULL,
        /* format */           'BASIC,ALL,SERIAL')
    )
```

Partition Wise Joins

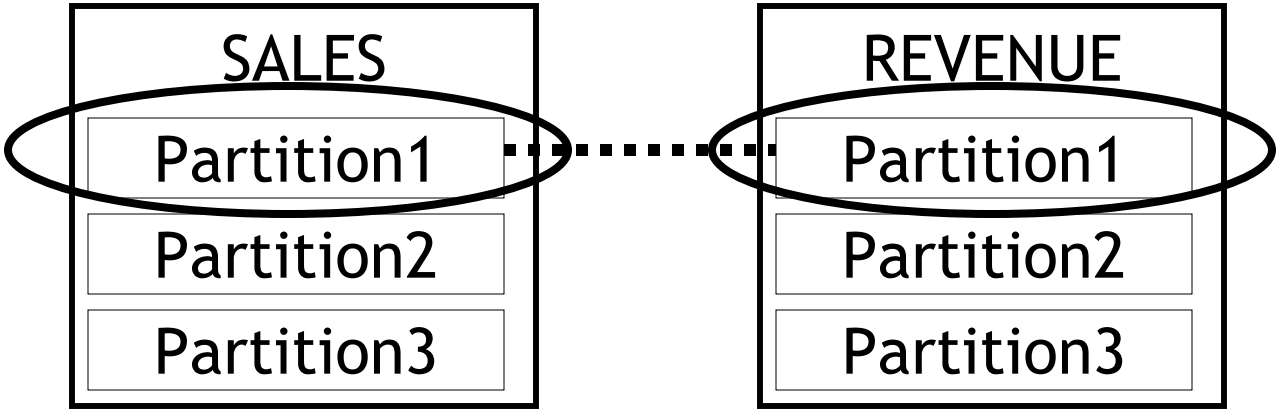
Equi-partioned tables

SALES partitioned on SALES_DATE

REVENUE partitioned on BOOKED_DATE

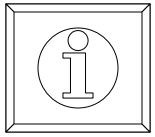
SELECT … FROM SALES S, REVENUE R

WHERE S.SALES_DATE = R.BOOKED_DATE



•Ptest3a ptest3b

Partitionwise Join

- Hash Partitioned Tables
- Elimination will occur in Equality only, not in range. 

Ptest3ha ptest3hb

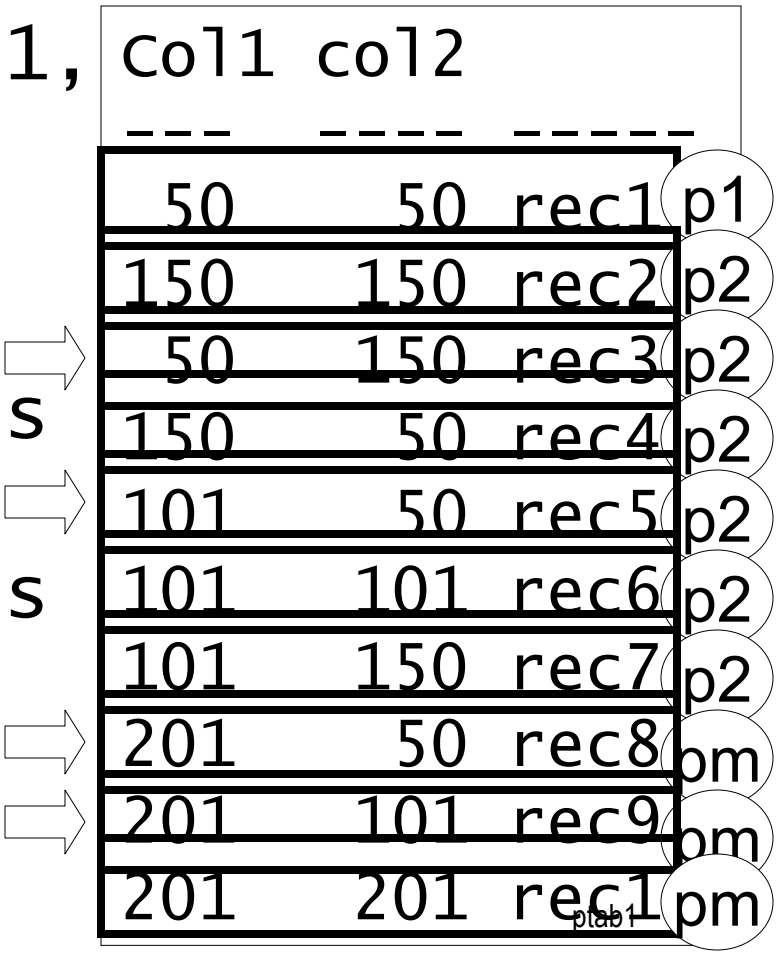
Character Values in Range

```
CREATE TABLE EMPLOYEE (……)
PARTITION BY RANGE (LAST_NAME)
(
PARTITION P1 VALUES LESS THAN ('D%'),
PARTITION P2 VALUES LESS THAN ('M%'),
PARTITION P3 VALUES LESS THAN ('T%'),
PARTITION PM VALUES LESS THAN (MAXVALUE)
)
```

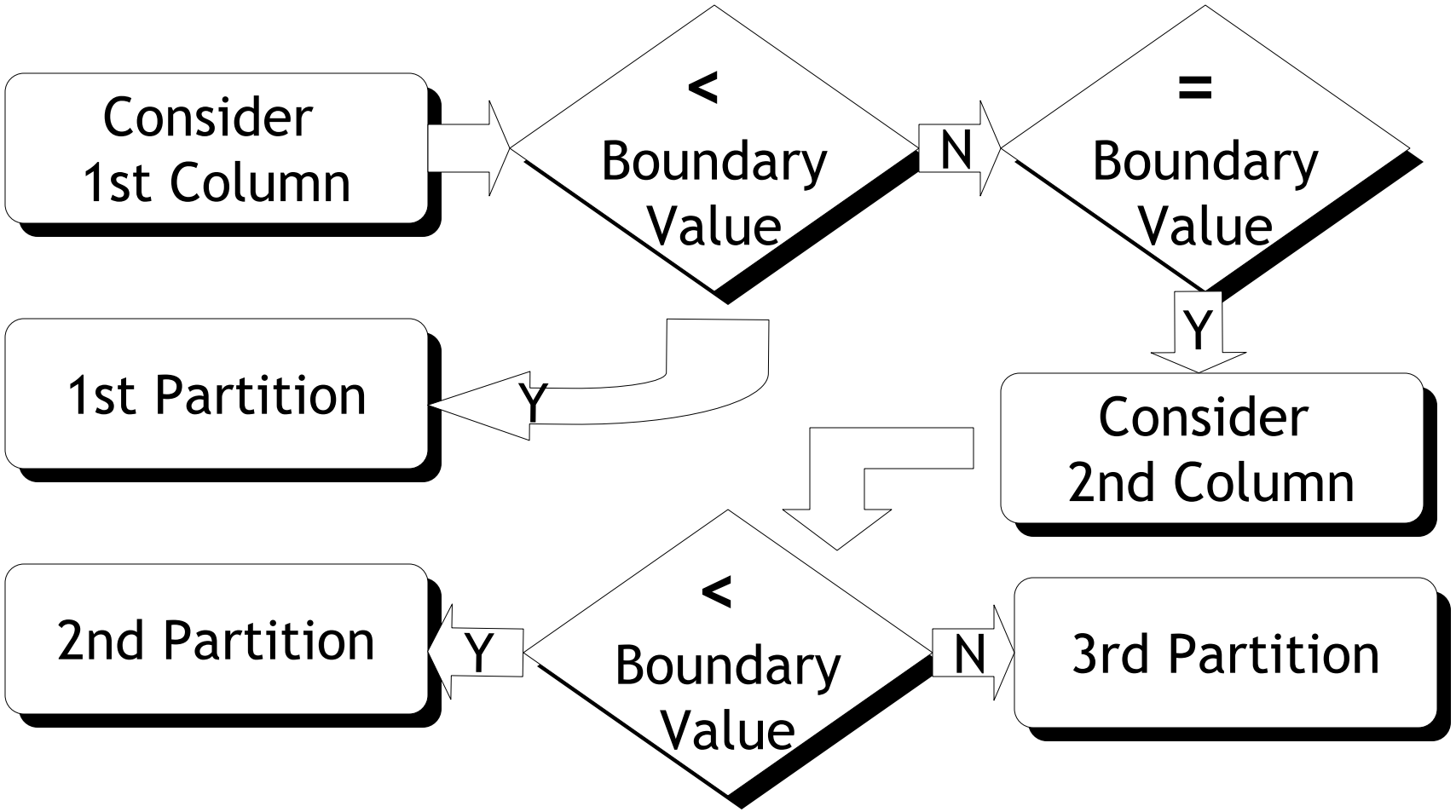
ptest4a, ptest4b, ins_ptest4

Multi-column Keys

```
partition by range (col1,
  col2)
(partition p1 values
  less than (101, 101),
partition p2 values less
  than (201, 201),
partition pm values less
  than
  (maxvalue, maxvalue))
```



Multi-Column Decision



Deciding Partition Key

- Performance – Elimination/Join, etc.
- Backup
- Other Manageability

Converting to Partitioning

Oracle Recommended (MetaLink Note 1070693.6)

- Create the partitoned table and Insert
- Create Table As Select (CTAS)
- Create Small Tables and Exchange Partitions
- **PROBLEM**: Space Requirement and Time

Alternatives

- Oracle 9i Online Redefinition
  - Small Downtime
  - Space Needed
  - Oracle 9i
- Materialized View Method
  - CREATE MATERIALIZED VIEW MV1 ON PREBUILT TABLE ….
  - DROP MATERIALIZED VIEW

Split-Split Method

- Create partitioned table exactly same as source table with one partition with MAXVALUE
- Exchange source table with this partition
- Split this partition at the lowest boundary
- Split the maximum partition at the next boundary
- Repeat till all partitions are created

Example

Table NOPART

- COL1 NUMBER
- COL2 VARCHAR2(10)
- COL3 CHAR(2)

Index IN_NOPART

- (COL2)

Constraint CK_NOPART

- (COL3 IS NOT NULL)

Partitioned BY RANGE (COL1)

- P1 LESS THAN (101)
- P2 LESS THAN (201)
- P3 LESS THAN (301)
- P4 LESS THAN (401)
- PM … (MAXVALUE)

Table PART

Table, Index, Constraint

- Name Change

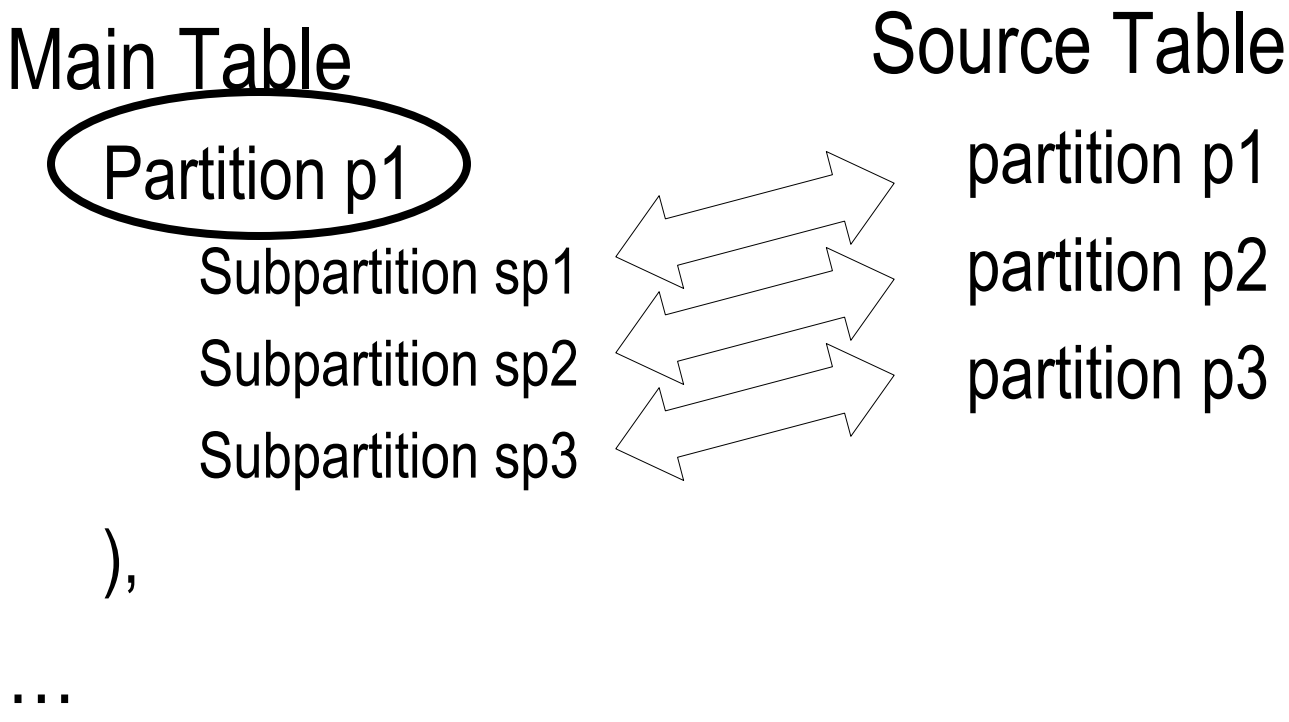
Summary

- Create table part …
- Exchange partition pMAX with table NOPART
- Split partition pMAX repeatedly
- Drop original table nopart
- Rename part to no part
- Rename index to in_nopart
- Rename constraint to ck_nopart

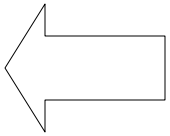
Pros & Cons

- Space Needs – Less
- Redo Log Generation – Minimized
- Time – Less
- Concurrency – Higher
- Time – Still High
- Concurency – Still Low

Exchanging Partitions



Subpartition Statistics

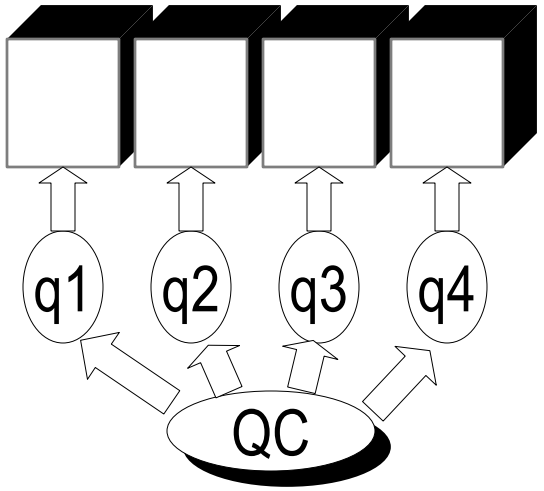
- DBMS_STATS.GATHER_TABLE_STATS
  - tabname => ‘MYTABLE’
  - partname => ‘P1’
  - **granularity** =>
    - DEFAULT
    - GLOBAL
    - PARTITION
    - SUBPARTITION 
    - ALL

Spart1.sql

Statistics Collection

Granularity	Table Global	Partition Global	Partition Stats	Subpart Stats
GLOBAL	YES	NO	NO	NO
PARTITION	NO	YES	YES	NO
DEFAULT	YES	YES	YES	NO
SUBPARTITION	NO	NO	YES	YES
ALL	YES	YES	YES	YES

Parallel Index Rebuilding



- One Query Server per Partition
- Slows down processing
- Can’t exploit the Parallel Processing Capabilities

Parallel Index Rebuilding

DBMS_PCLXUTIL.BUILD_PART_INDEX

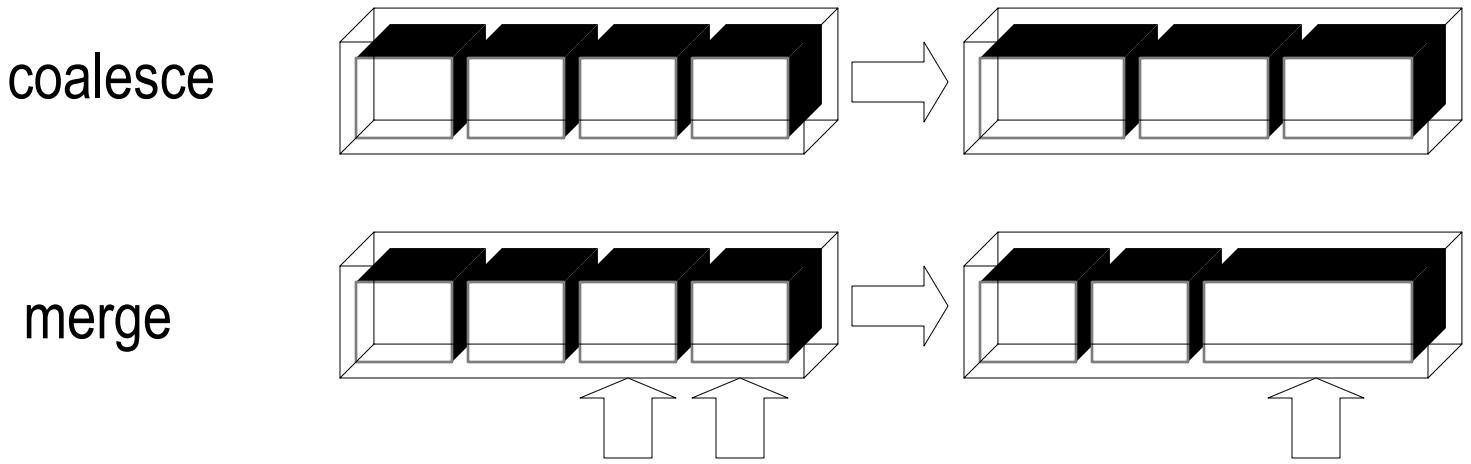
jobs_per_batch	NUMBER	DEFAULT 1
procs_per_job	NUMBER	DEFAULT 1
tab_name	VARCHAR2	
idx_name	VARCHAR2	
force_opt	BOOLEAN	DEFAULT FALSE

The Rule Based Optimizer

- Invokes CBO
- Makes Up Statistics
- Don’t Use Partitioning if RBO is Used

Coalesce –vs- Merge

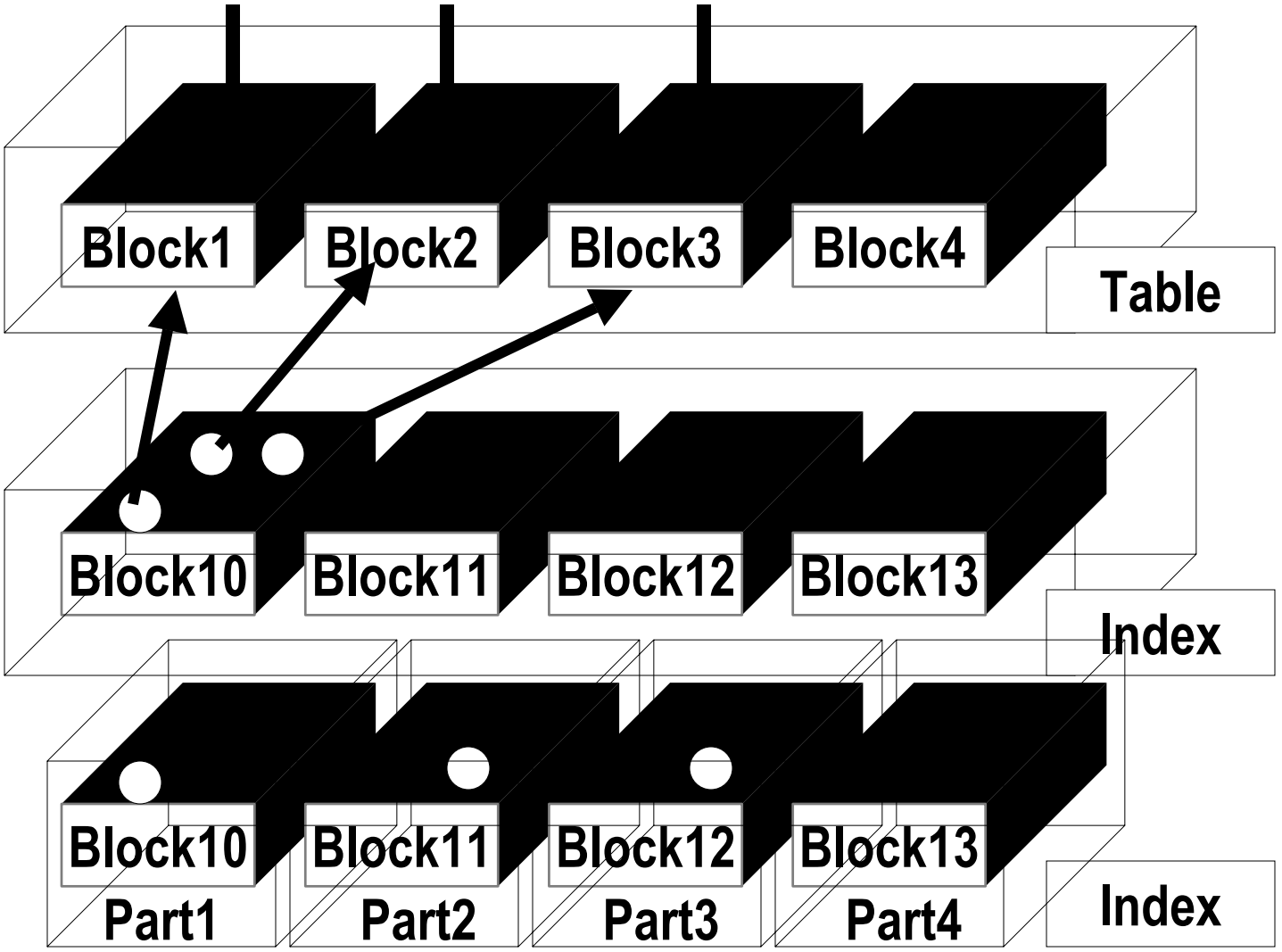
- Coalesce – Hash Partitions
- Merge – Range and List



Oracle 10g Enhancements

- Partitioned Index Organized Tables (IOT)
  - List Partitioning Possible
  - Bitmap Index Support
  - Global Index Maintenance
- Hash Partitioning of Indexes
  - On Partitioned Tables
  - On Index Organized Tables
  - On *Regular* Tables

Hash Partitioned Index



Thank You

Questions?

More Resources:

www.proligence.com