Should I Drop Indexes in Exadata?

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Quotes

"You don't need indexes on Exadata."

"*Drop all the indexes and reclaim space.*"

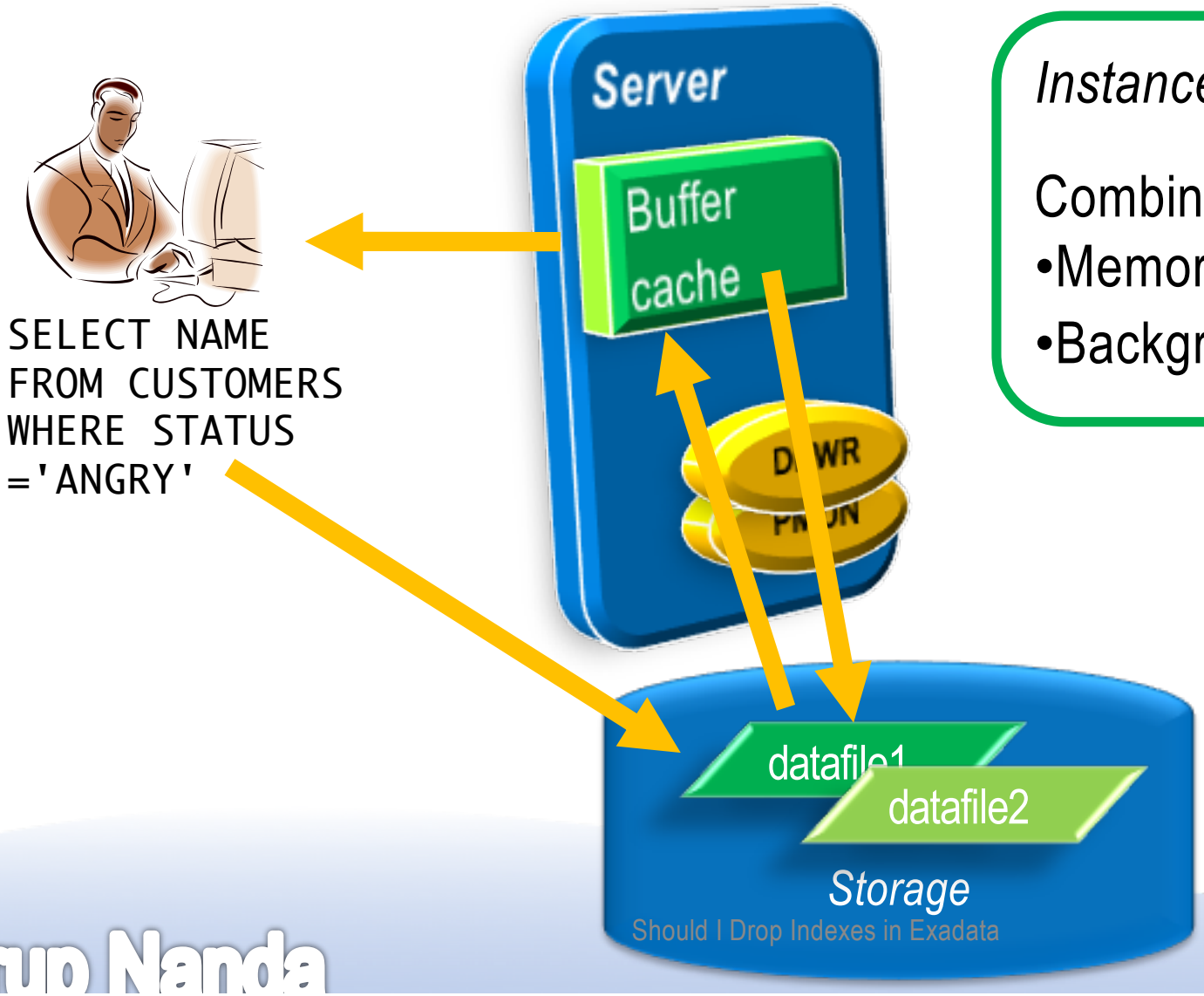
"*Why*? Because there is a storage index."

3 Questions for "Best Practices"

1. Why it is better than the rest?
2. What happens if it is *not* followed?
3. When are they *not* applicable?

Storage Index

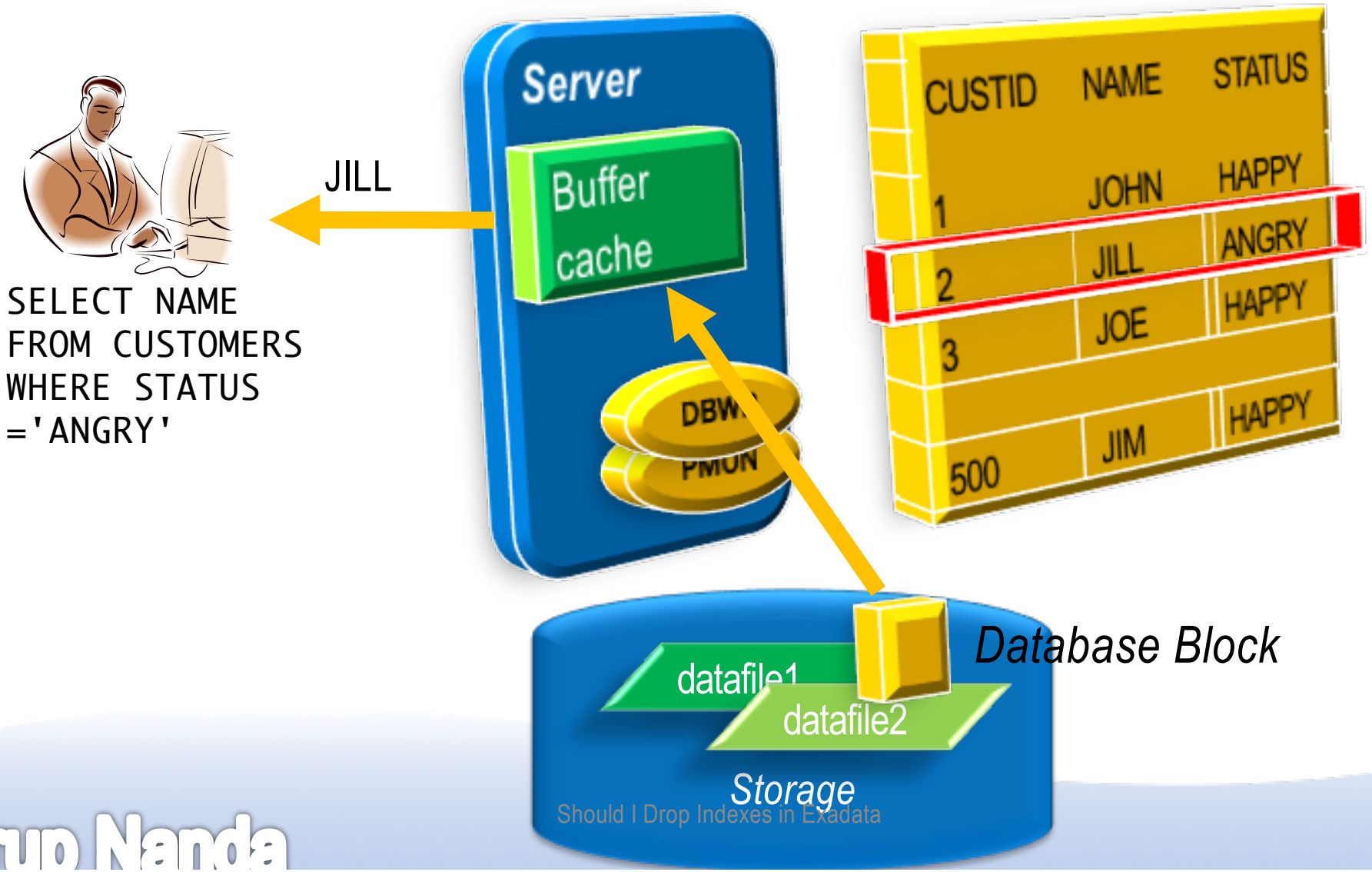
Instances and Databases

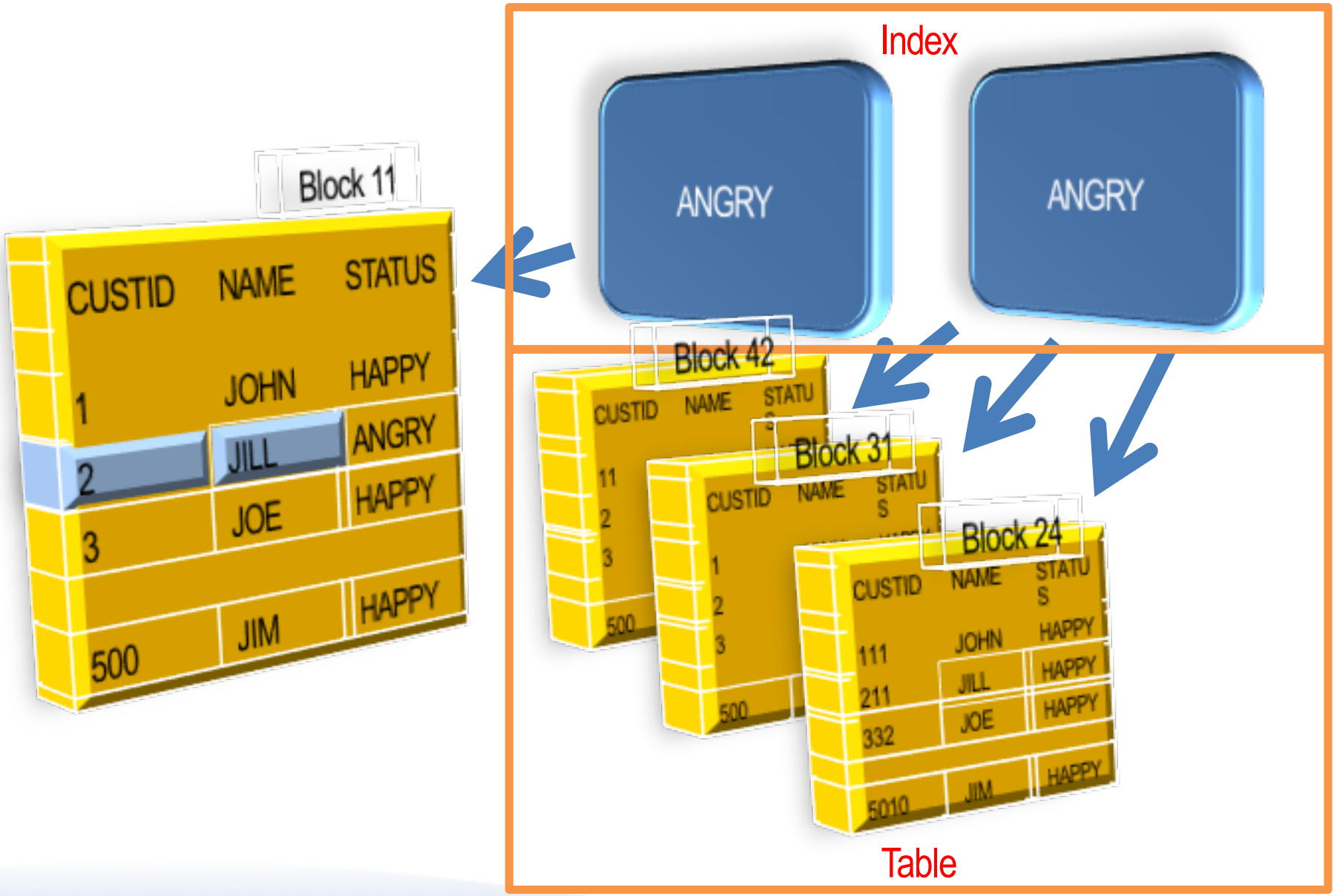


Instance

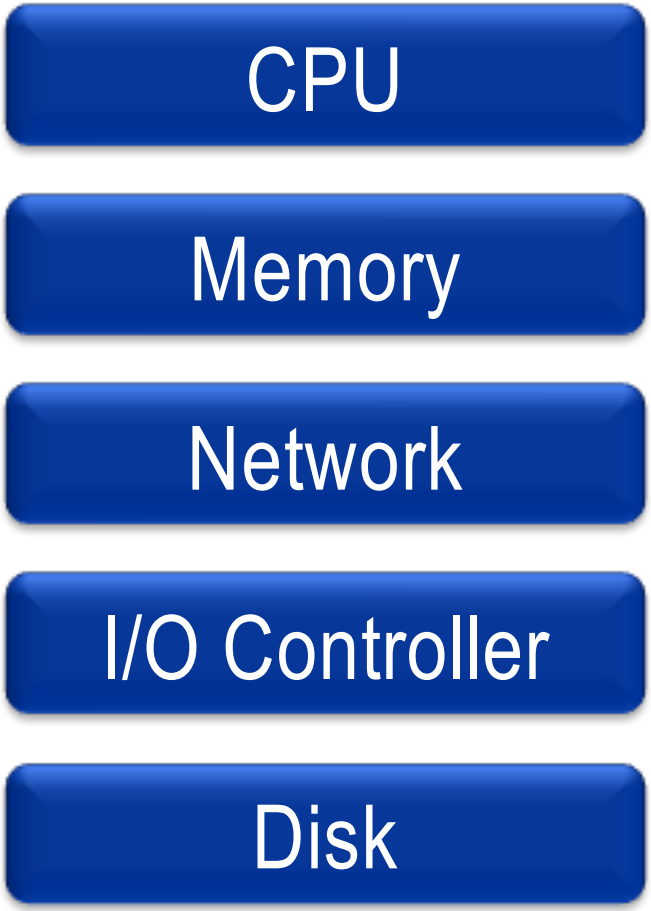
Combination of
- Memory Areas
- Background Processes

Query Processing




Index
ANGRY
ANGRY
Block 11
CUSTID
NAME
STATUS
1
JOHN
HAPPY
2
JILL
ANGRY
3
JOE
HAPPY
500
JIM
HAPPY
Block 42
Block 31
Block 24
111
211
332
5010
Table

Components for Performance



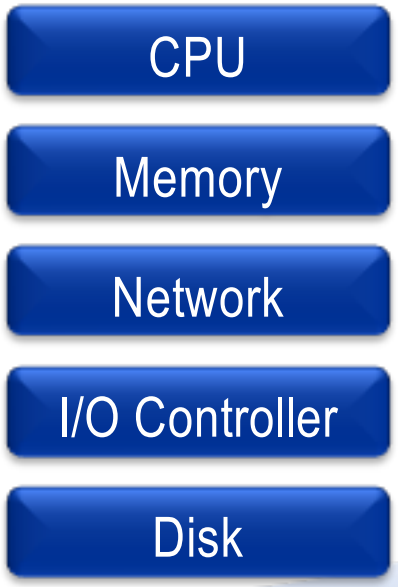
Less I/O = better performance

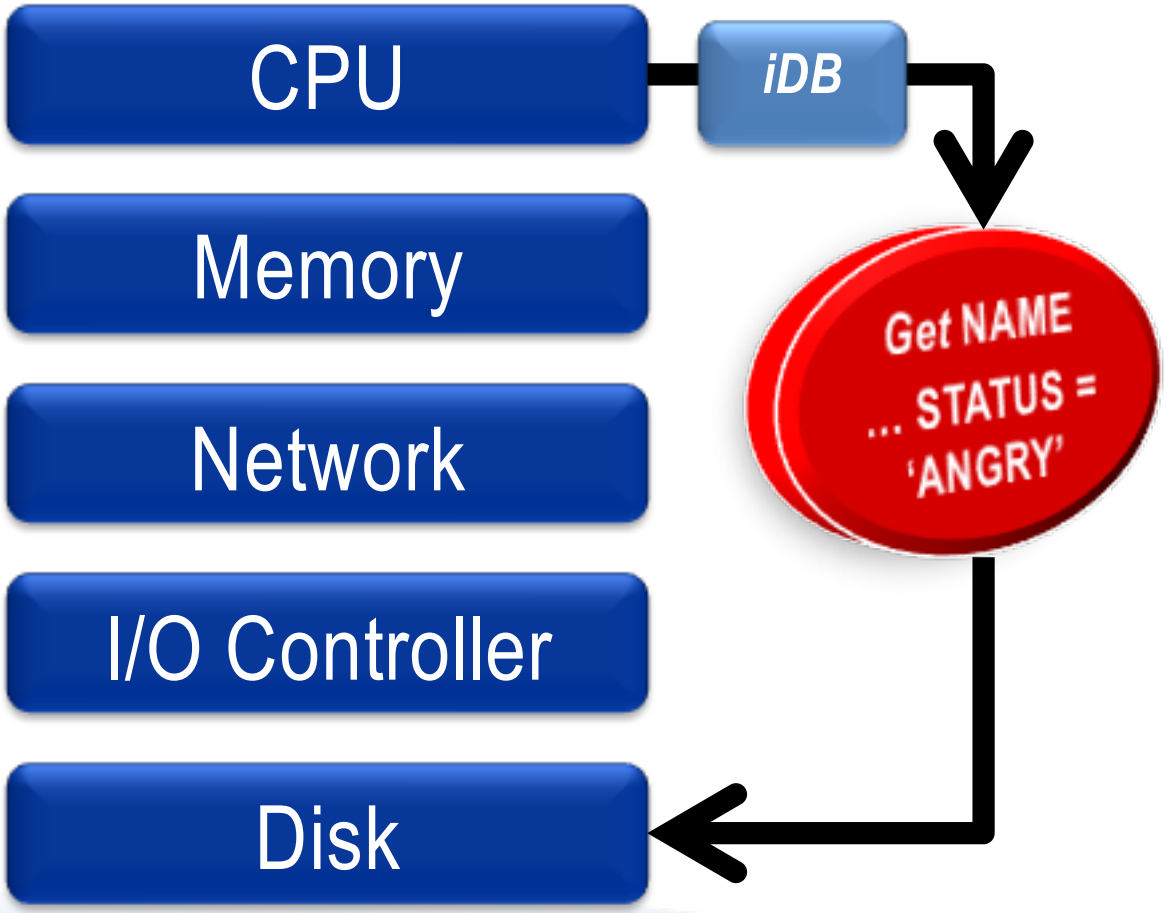
The Solution

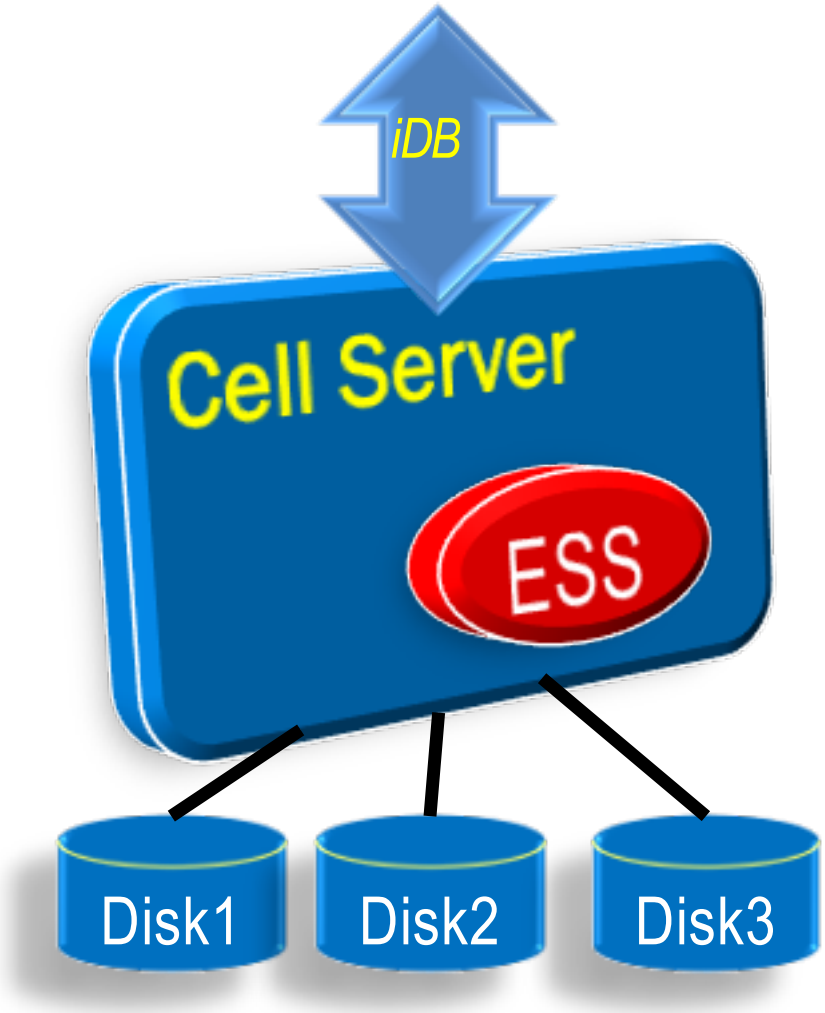
- A typical query may:
  - Select 10% of the entire storage
  - Use only 1% of the data it gets
- To gain performance, the DB needs to shed weight
- It has to get less from the storage
  - → Filtering at the storage level
  - → The storage must be cognizant of the data

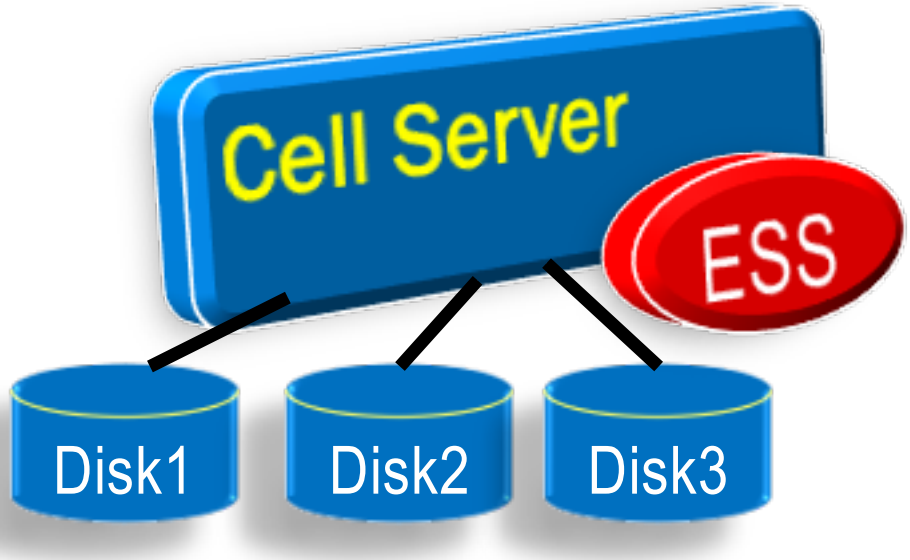
```
SELECT NAME
FROM CUSTOMERS
WHERE STATUS
='ANGRY'
```

Filtering should be Applied Here

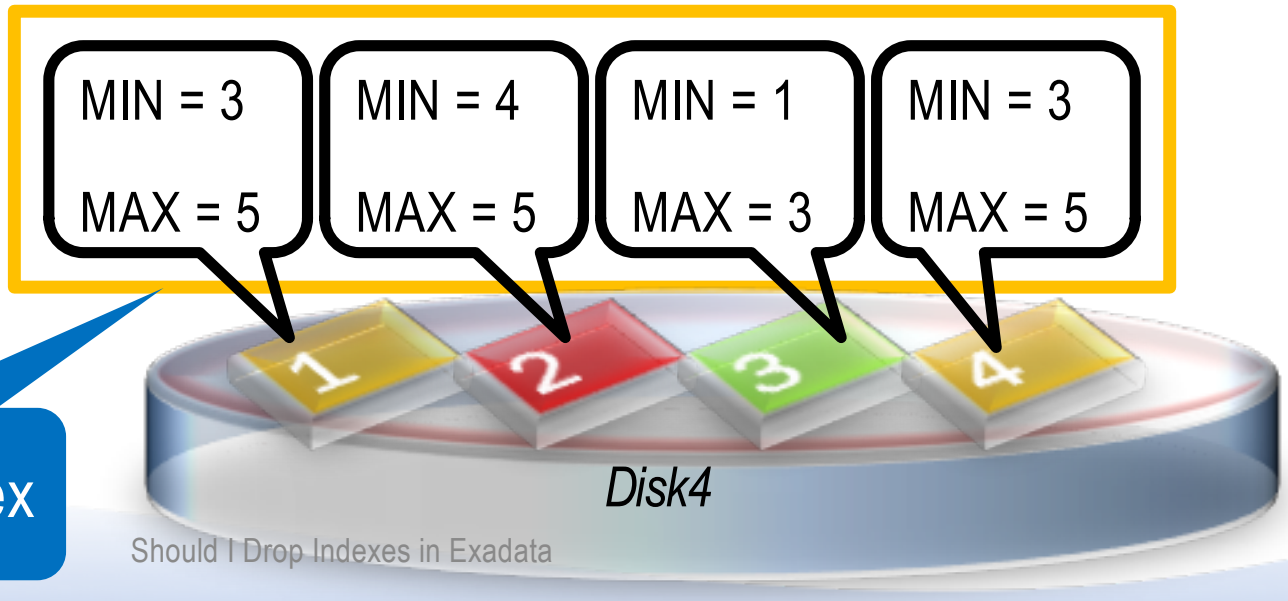



CPU
Memory
Network
I/O Controller
Disk
iDB
Get NAME
... STATUS =
'ANGRY'


iDB
Cell Server
ESS
Disk1
Disk2
Disk3




```
SELECT …
FROM TABLE
WHERE COL1 = 2
```



Storage Index

Storage Indexes

- Do not point to the database blocks
- Merely stores for a Storage "Unit"
  - Max/Min Values
  - Whether nulls are present
  - For some columns
- Is on Memory of Cells; not disk
  - Disappears when the cell is down

Checking Storage Index Use

```
select name, value/1024/1024 as stat_value
from v$mystat s, v$statname n
where s.statistic# = n.statistic#
and n.name in (
   'cell physical IO bytes saved by storage index',
   'cell physical IO interconnect bytes returned by smart scan')
```

Output

```
STAT_NAME   STAT_VALUE
---------- ----------
SI Savings    5120.45
Smart Scan    1034.00
```

Offloading and Smart Scan

Offloading

Processing to storage cells

Smart Scan

Reduction in I/O

Offloading

- Column Projection

```
select cust_id, sale_amt
from sales
```

- Predicate Filtering

```
where status = 'ANGRY'
```

- Function Offloading

```
select min(sale_amt)
```

- Virtual Columns

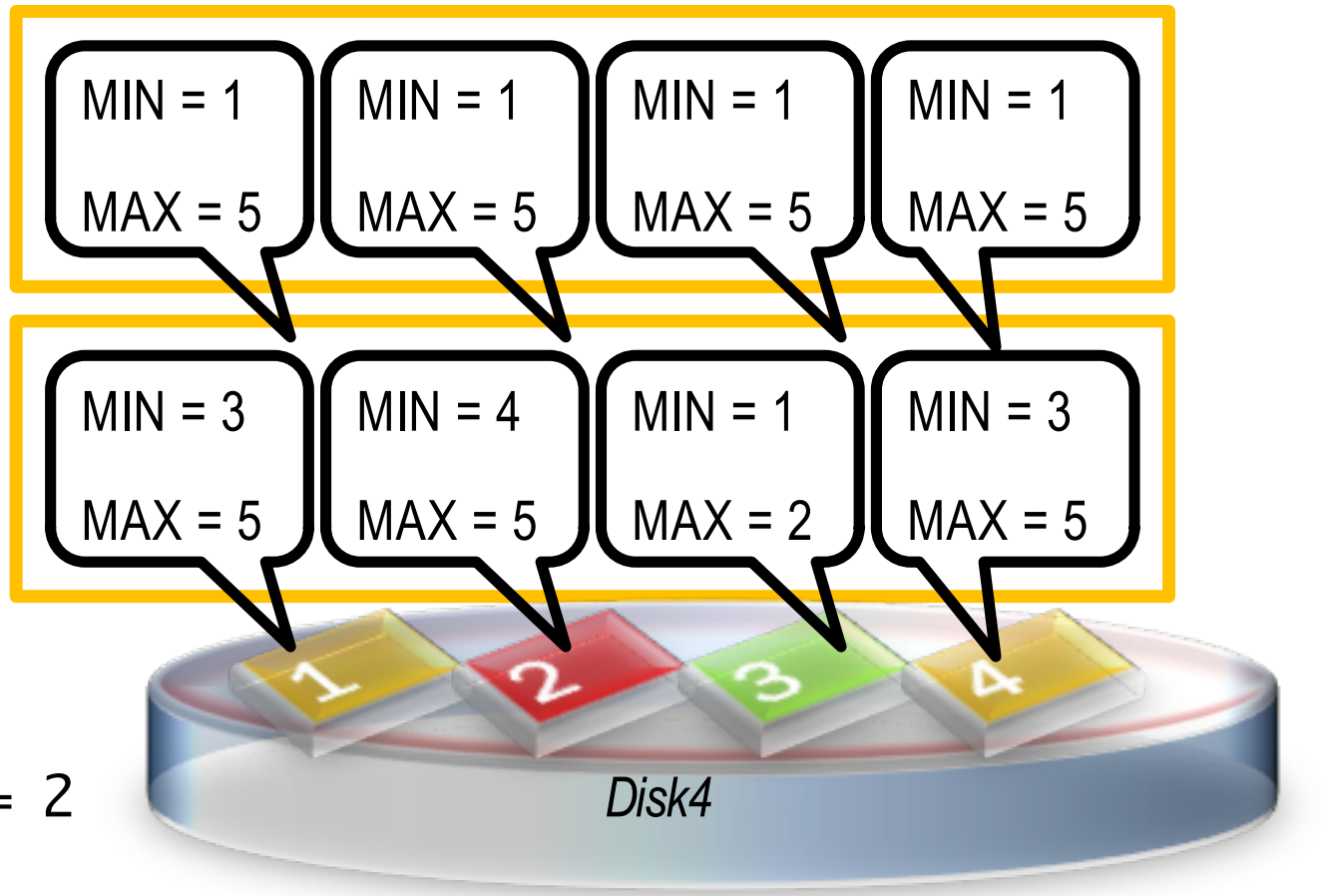
Smart Scan Benefits

- Less I/O means
  - Faster disk access time
  - Less data from storage to DB
  - Less buffers
  - Less CPU
  - Less data between compute nodes

Why Not?

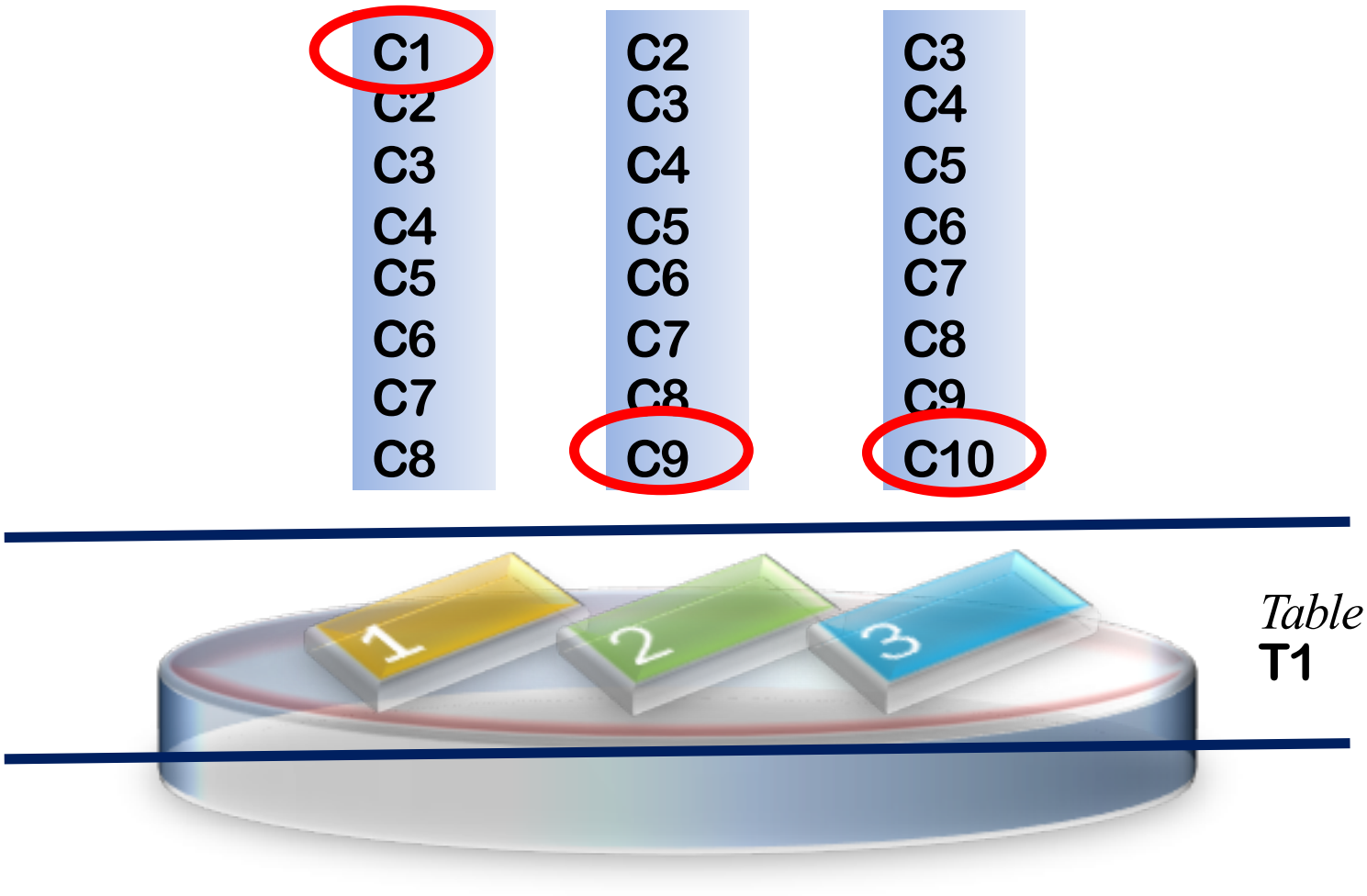
- Pre-requisite for Smart Scan
  - Direct Path
  - Full Table or Full Index Scan
  - > 0 Predicates
  - Simple Comparison Operators
- Other Reasons
  - Cell is not offload capable
    - The diskgroup attribute cell.smart_scan_capable set to FALSE;
  - Not on clustered tables, IOTs, etc.

Impact of Data Distribution




```
SELECT …
FROM TABLE
WHERE COL1 = 2
```

8 Columns


C1
C2
C3
C4
C5
C6
C7
C8
C2
C3
C4
C5
C6
C7
C8
C9
C3
C4
C5
C6
C7
C8
C9
C10
1
2
3
Table
T1

No Predicate

- Aggregations

```
select sum(sale_amt)
from sales
```

Index on SALE_AMT

- Sorting

```
select ...
from sales
order by sale_amt;
```

Function Based Indexes

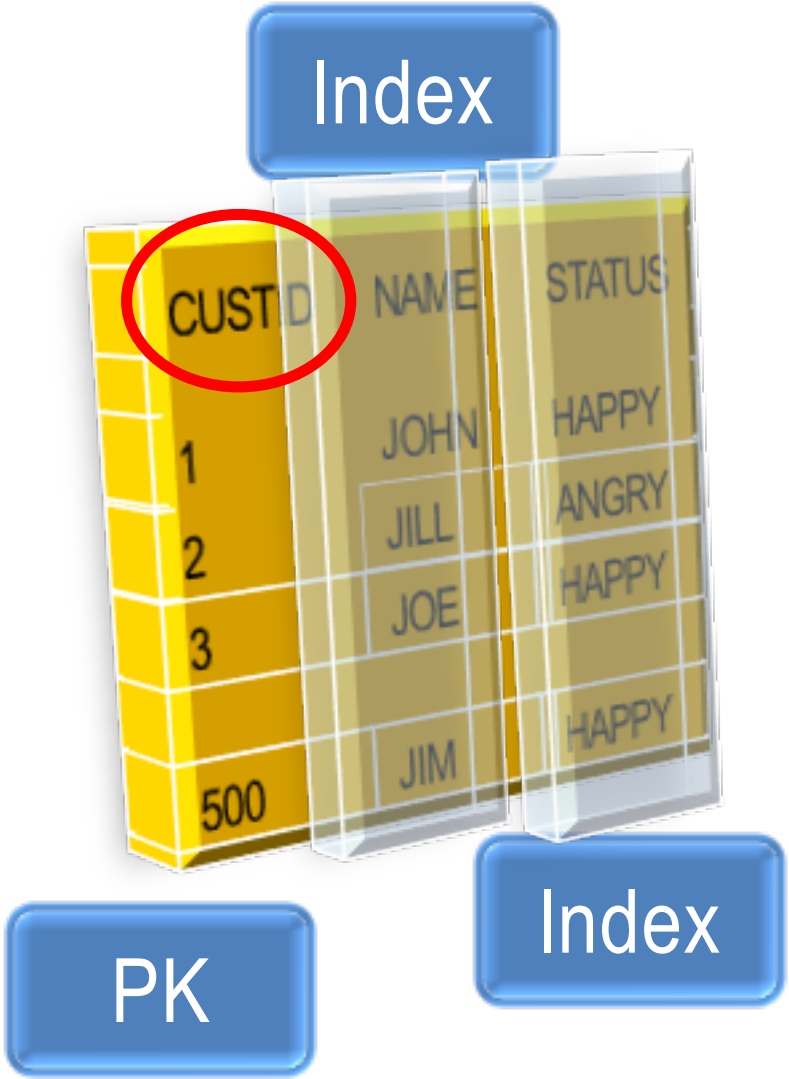
- Traditional Indexes can't work

```
select …
from sales
where to_char(sale_dt,'YY') = '13'
```

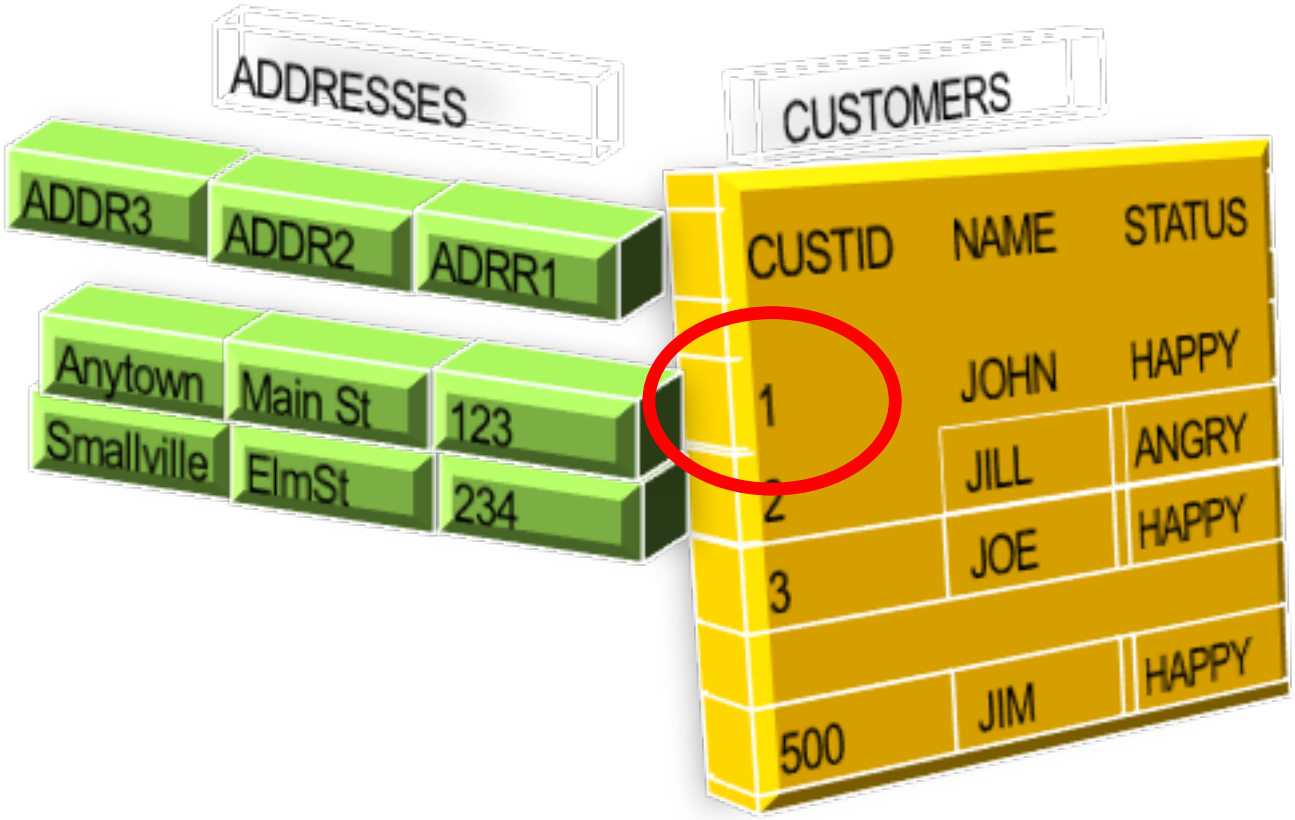
- Function Based Indexes help
- SI indexes will not be useful

IOTs

- Index Organized Tables
- PK-based rows
- Secondary Indexes built on the other columns



Clustered Tables



Exclusion for SIs

- Not for non-equality

```
select sale_amt
from sales
where status != 'SHIPPED'
```

- No Wildcards

```
select sale_amt
from sales
where city like 'NEW YORK%'
```

Virtual Columns

- Example

```
alter table EMP add (
  tot_sal number(13) generated always as
sal+comm)
)
```

- Implication
  - Do not actually exists in the table
  - Computed at runtime

Indexes on Small Tables

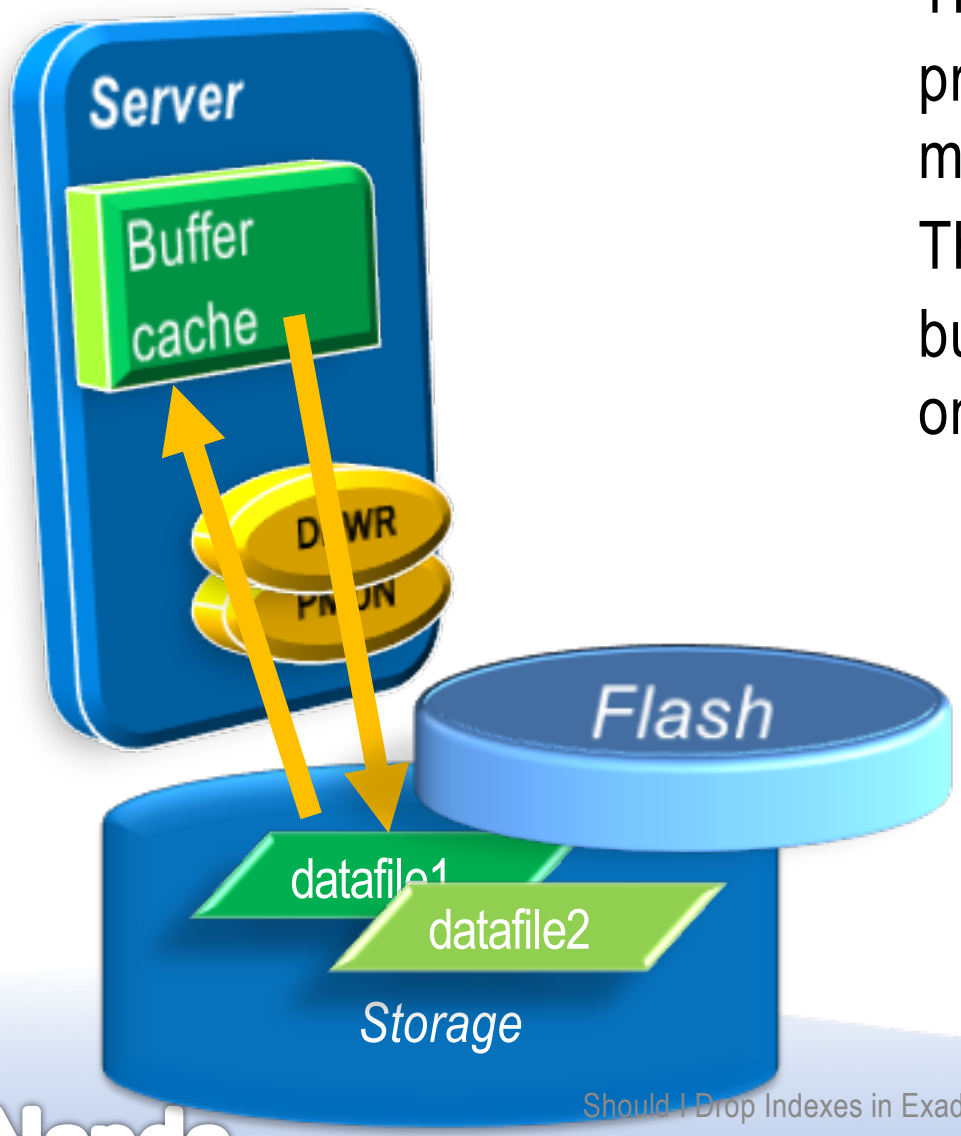
- Small table
  - Parameter _small_table_threshold
- Indexes still help small table

  http://richardfoote.wordpress.com/2009/04/16/indexes-on-small-tables-part-i-one-of-the-few/
  - Less latching

Summary of SI Limitations

- Direct Path not used
- No Predicate ► No SI
- No Inequality (!=)
- ≤ 8 columns
- No Virtual Columns
- No wildcard match (LIKE '..%')
- No IOT, Clustered Table
- Latching on small tables
- First-timer Penalty
  - Only subsequent queries benefit

Flash Cache



These are flash cards presented as disks; not memory to the Storage Cells.

They are similar to SAN cache; but Oracle controls what goes on there and how long it stays.

```
alter table person
storage
(cell_flash_cache
keep)
```

Flash Trick for Indexes

- Pin Oft-Used Objects in Flash

```
SQL> alter index in_t2 storage
(cell_flash_cache keep);
```

- Check flash

```
CellCLI> list flashcachecontent attributes –
>        cachedKeepSize, cachedSize, hitCount,
-
>         hoursToExpiration, missCount -
>         where objectnumber = 382380;
```

- Or, partitions

Drop the Index?

- Make the indexes invisible

```
SQL> alter index i1 invisible;
```

  – Maintains the index; but optimizer ignores it

- See the performance impact.
- Selectively see the impact

```
SQL> alter session set
optimizer_use_invisible_indexes = true;
```

- See the performance impact.

Disable

- Two parameters
  - Could be session level
- To disable offloading

```
cell_offload_processing = false;
```

- To disable storage indexes alone

```
_kcfis_storageidx_disabled = true;
```

In Conclusion

- Full table scans in Exadata
  - may be faster compared to non-Exadata
  - may not be faster than index scans in Exadata
  - may benefit from Storage Indexes
- Storage Indexes are not same as DB Indexes
- No DB Indexes helps in some cases
  - But not all
- Test by making DB Indexes invisible
- Force FTS in those cases where index hurts

Thank You!

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