



# INFO20003 Database Systems

Assignment Project Exam Help

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Dr. Penata Borovica-Gajic  
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Lecture 22

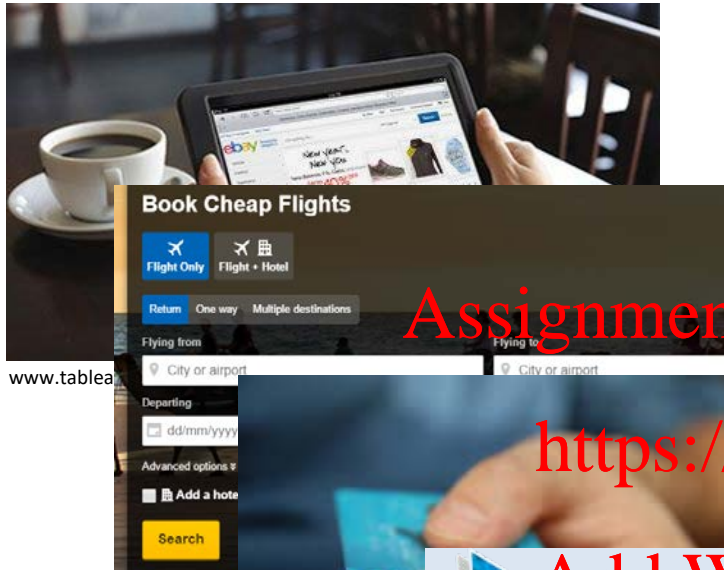
Adaptive databases for the future

Introducing research avenues (non-examinable)

Week 11

# Data, data everywhere...

[The Economist]



www.tablea

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<http://reportlogix.com/reporting.html>



**50-fold from 2010-2020\***

\* "The Digital Universe in 2020: Big Data, Bigger Digital Shadows, and Biggest Growth in the Far East", 2012, IDC

# And grows exponentially...

# Finding useful information



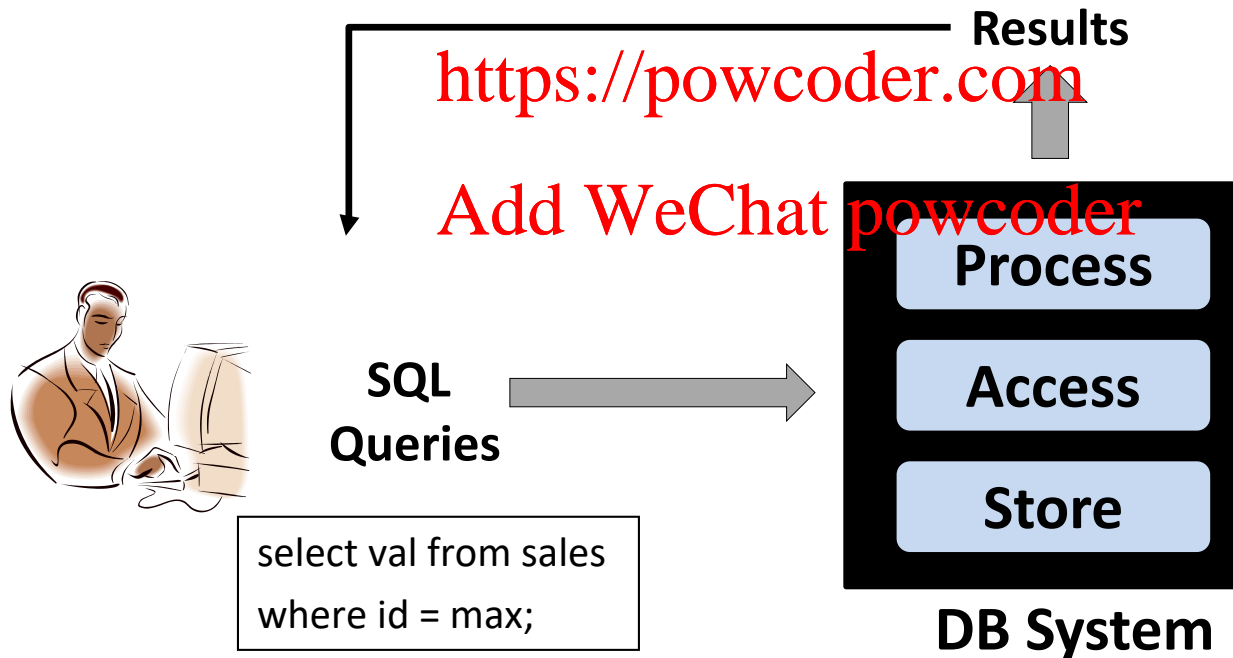
Equals to finding the needle in a haystack

# Data analysis with databases

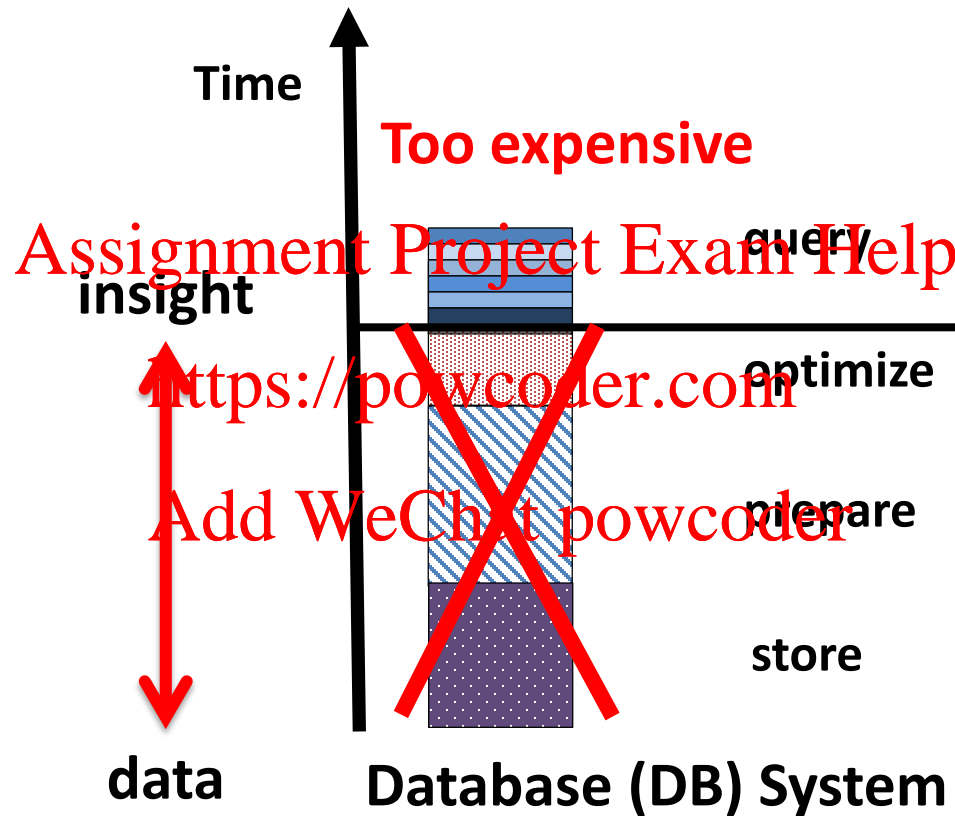
## Database systems (DB):

4 decades of research,  
predominant data analysis tool

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# From data to knowledge



The luxury is long gone

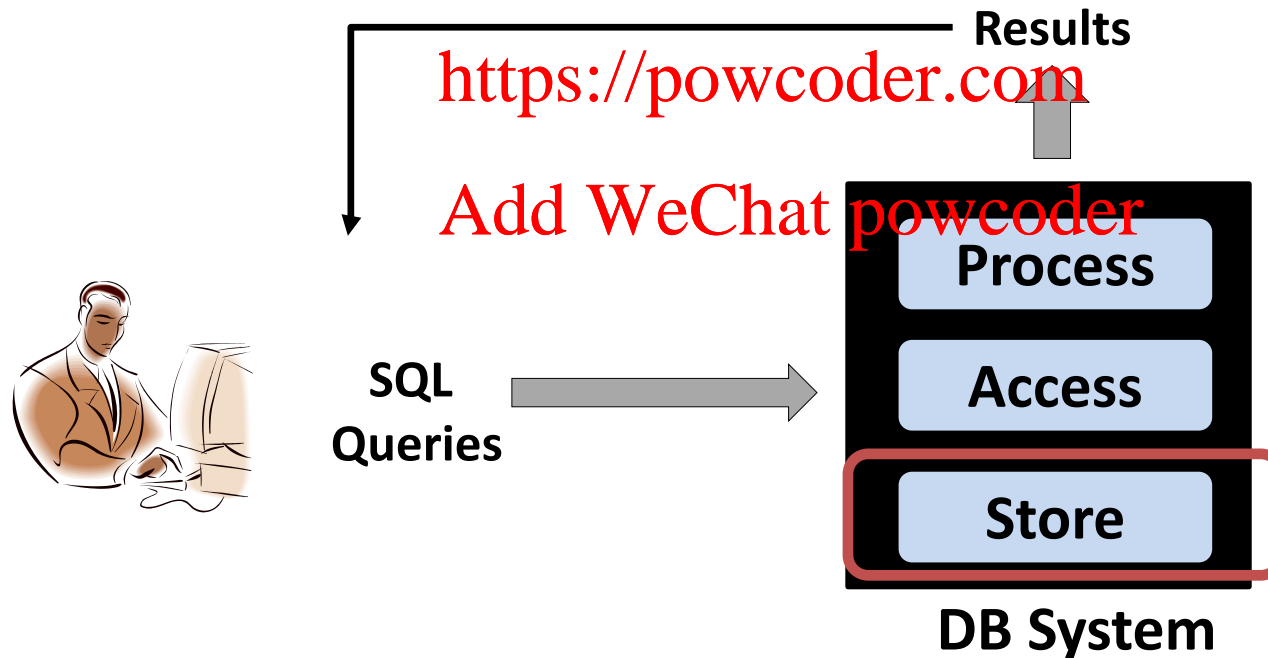
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**Unless.....**

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# Data analysis with databases

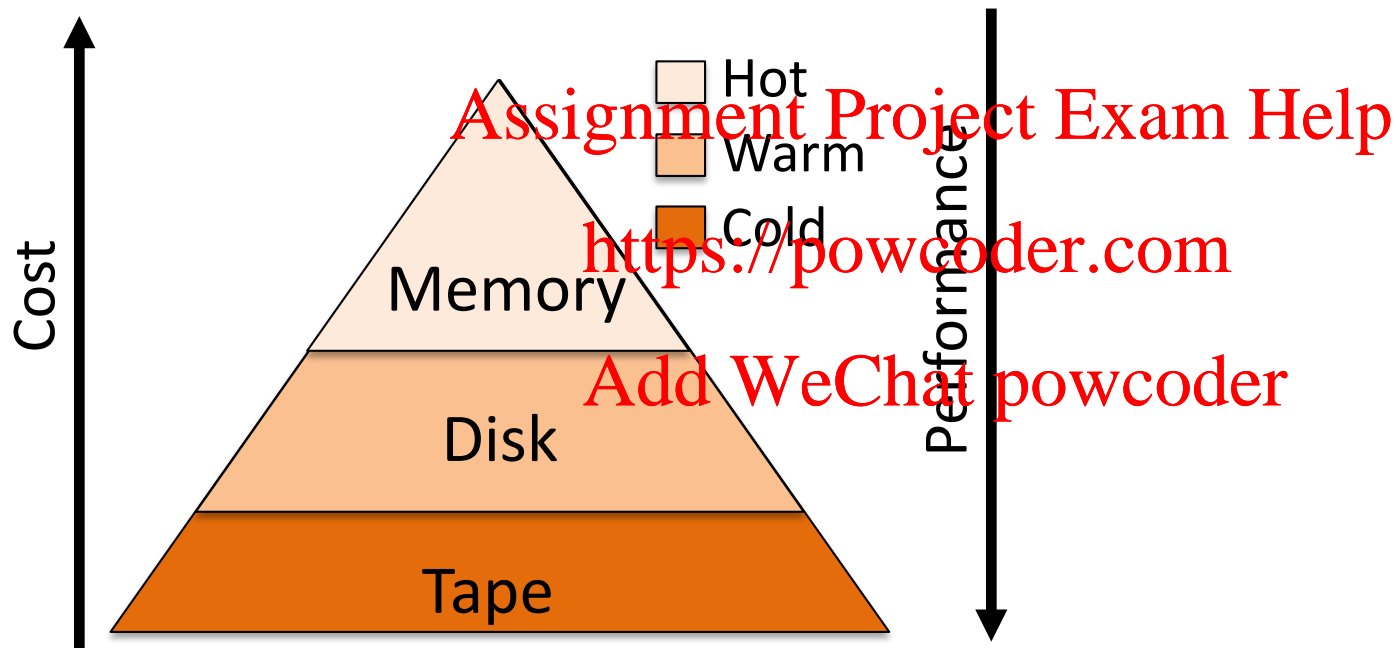
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# Store data carefully

[VLDB'16, ADMS'17]

Storage tiering in private and public clouds

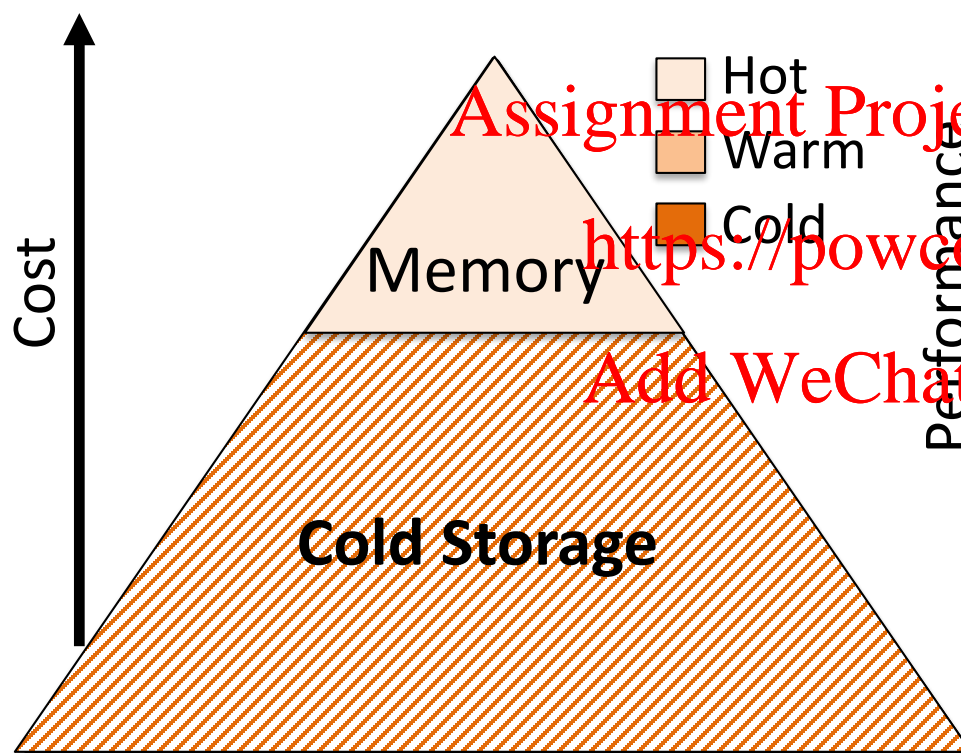




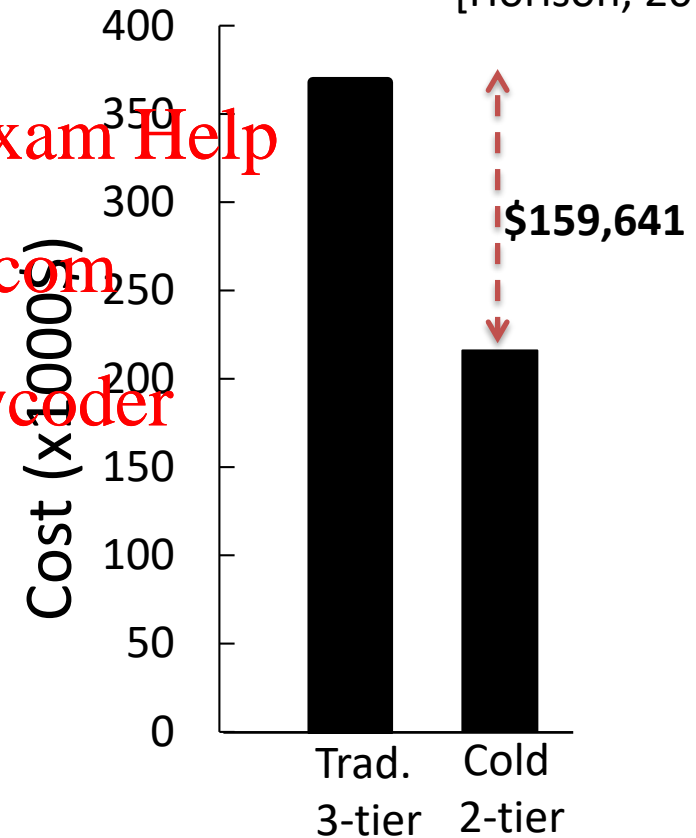
# Store data carefully

[VLDB'16, ADMS'17]

Storage tiering in private and public clouds



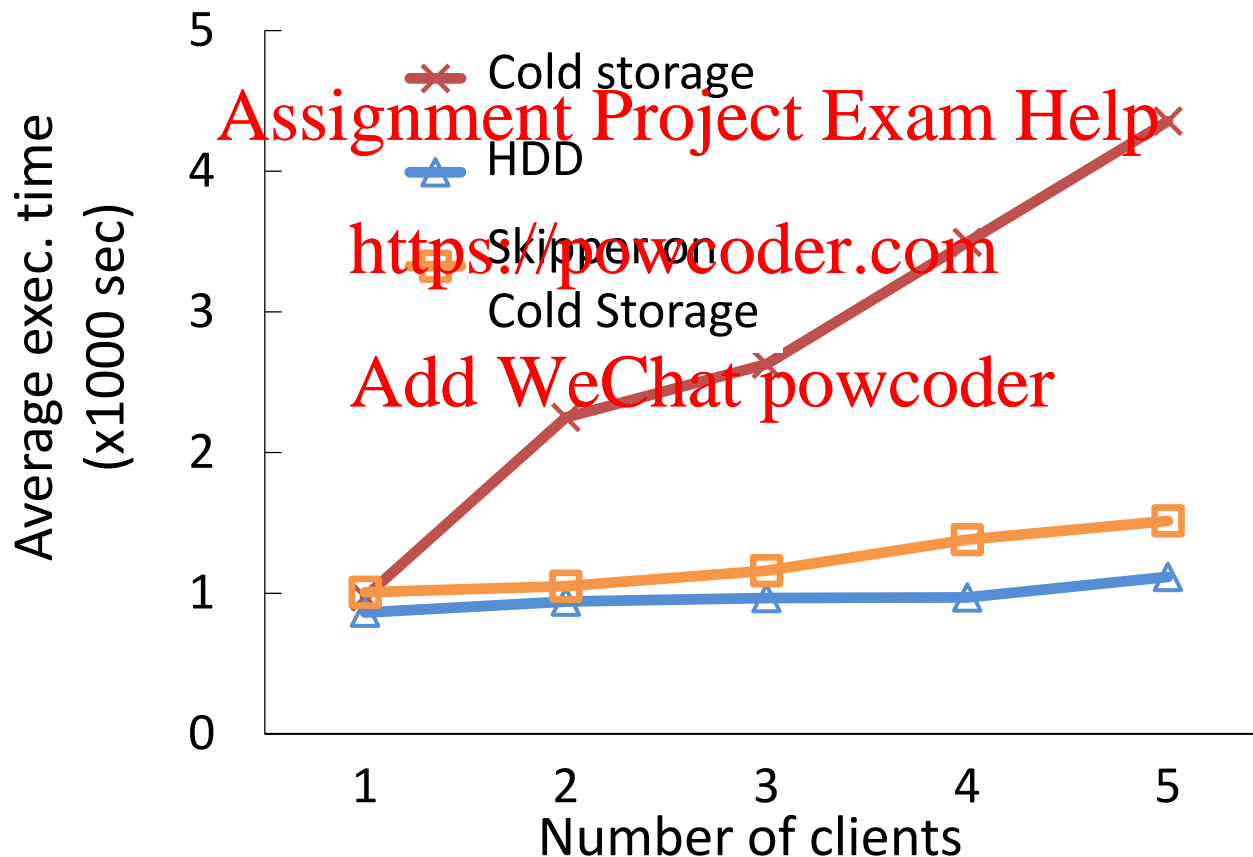
Storing 100TB of data  
[Horison, 2015]



Embrace new technology

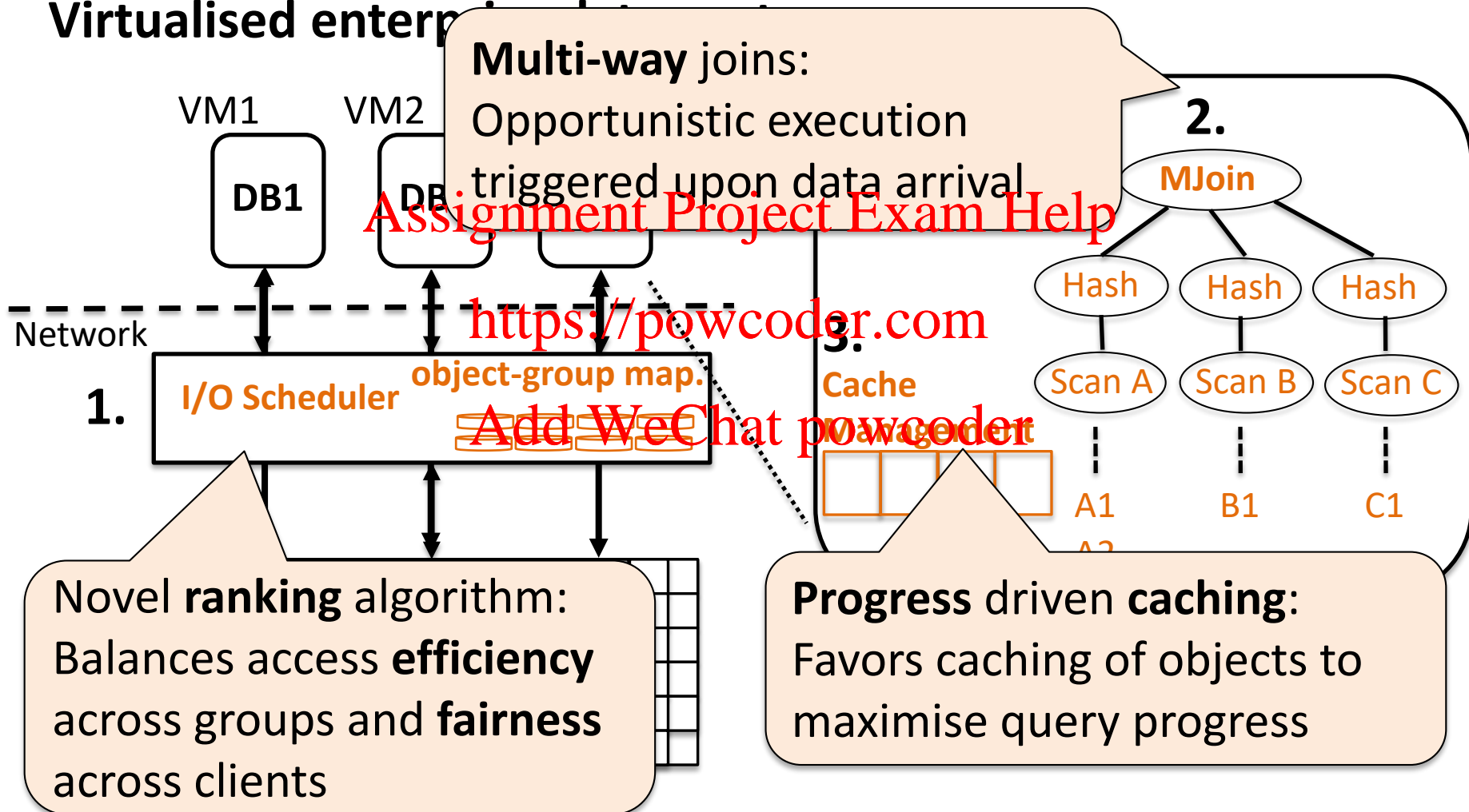
# Cost benefit without performance penalty

**Setting:** multitenant enterprise datacenter, clients: TPCH 50, Q12, CSD: shared, layout: one client per group



# Skipper to the rescue

## Virtualised enterprise data warehouse



# Lesson #1

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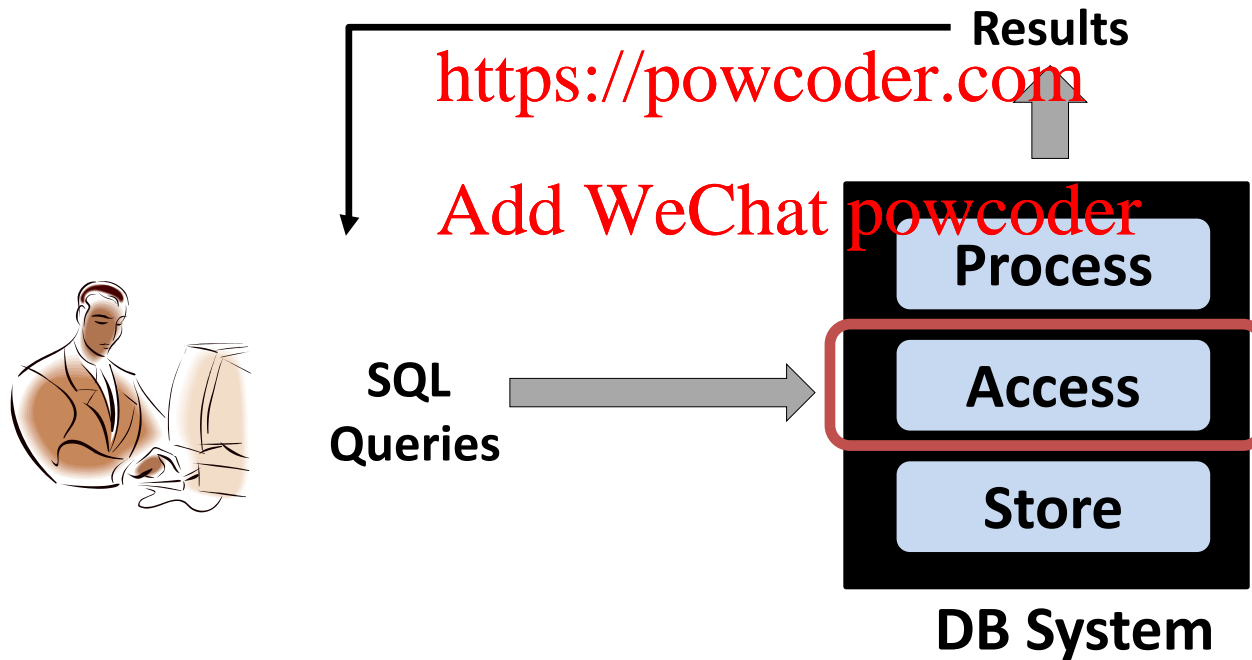
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**Embrace new HW technology**

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# Data analysis

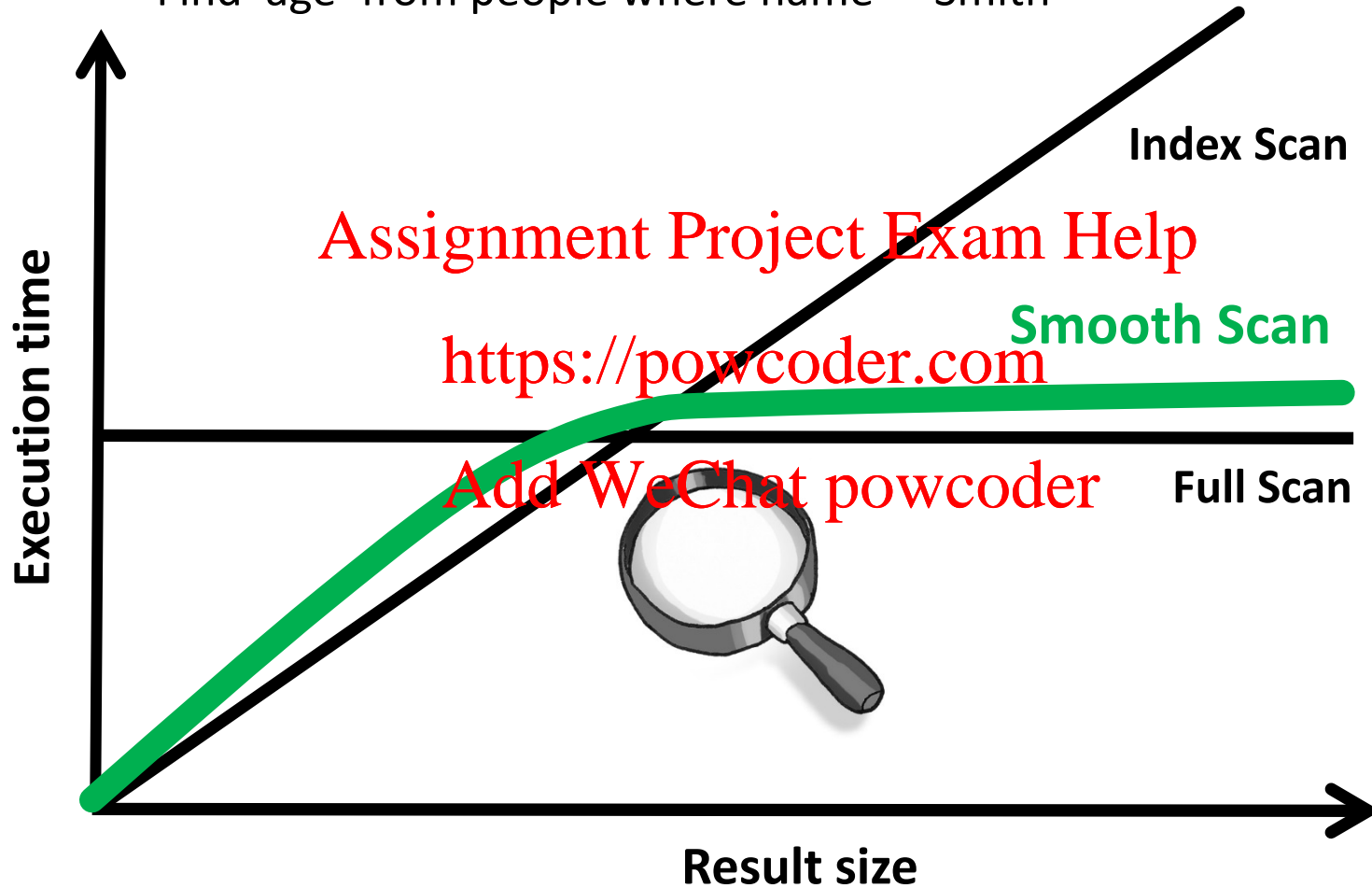
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# Choose access strategy on-the-fly

[DBTest'12, ICDE'15, VLDBJ'18]

Find 'age' from people where name = 'Smith'



Adapt to data

# Morphing mechanism

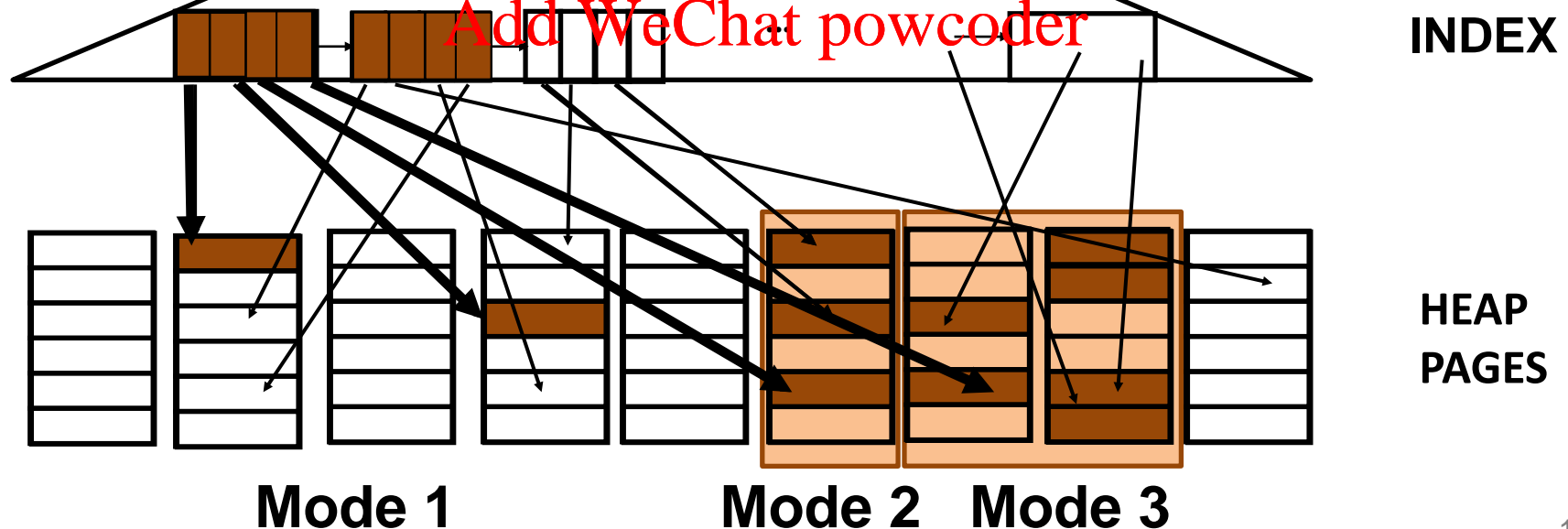
Modes:

1. **Index Access:** Traditional index access
2. **Entire Page Probe:** Index access probes entire page
3. **Gradual Flattening Access:** Probe adjacent region(s)

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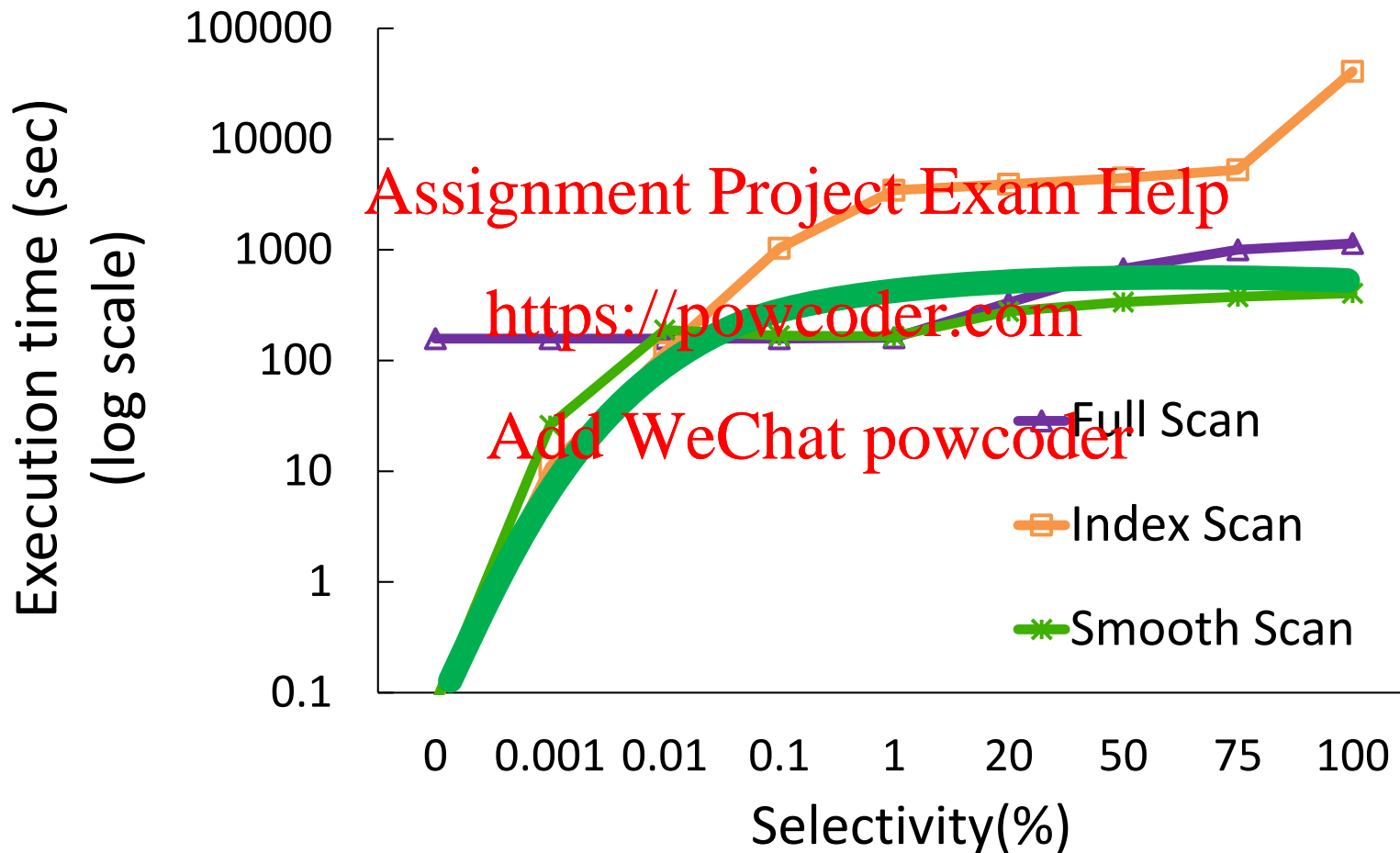
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# Smooth Scan in action

**Setting:** Micro-benchmark, 25GB table, Order by, Selectivity 0-100%



**Near-optimal over entire selectivity range**



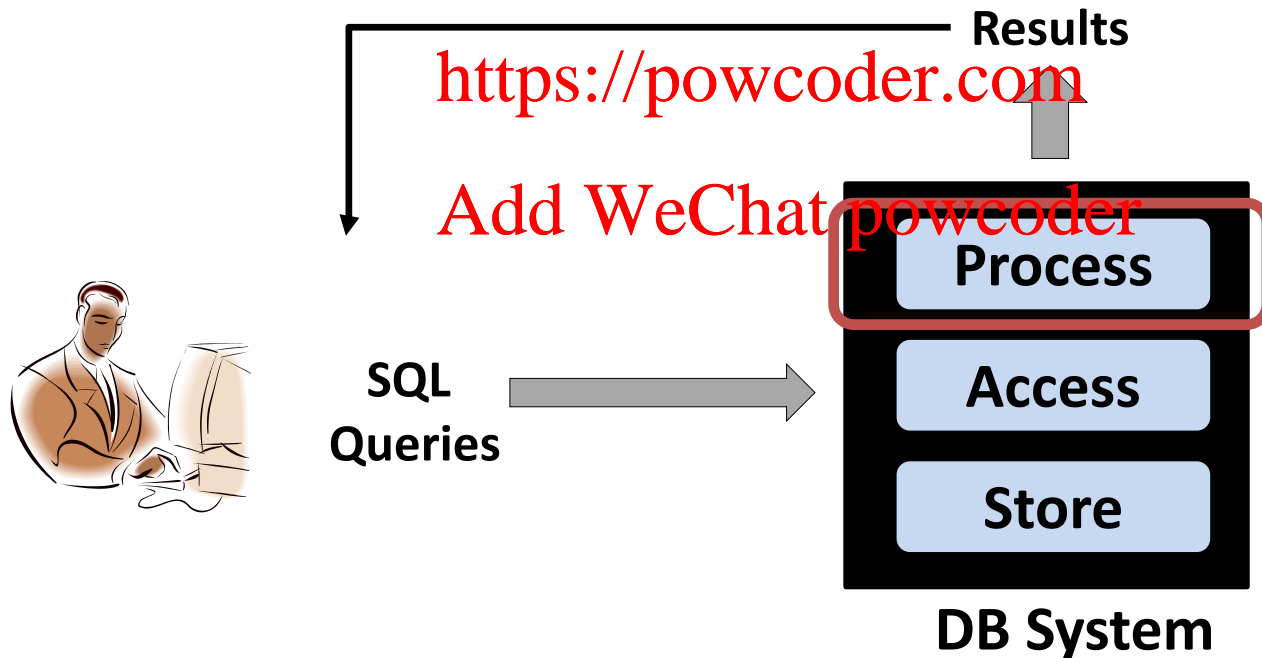
# Lesson #2

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**Learn from data**  
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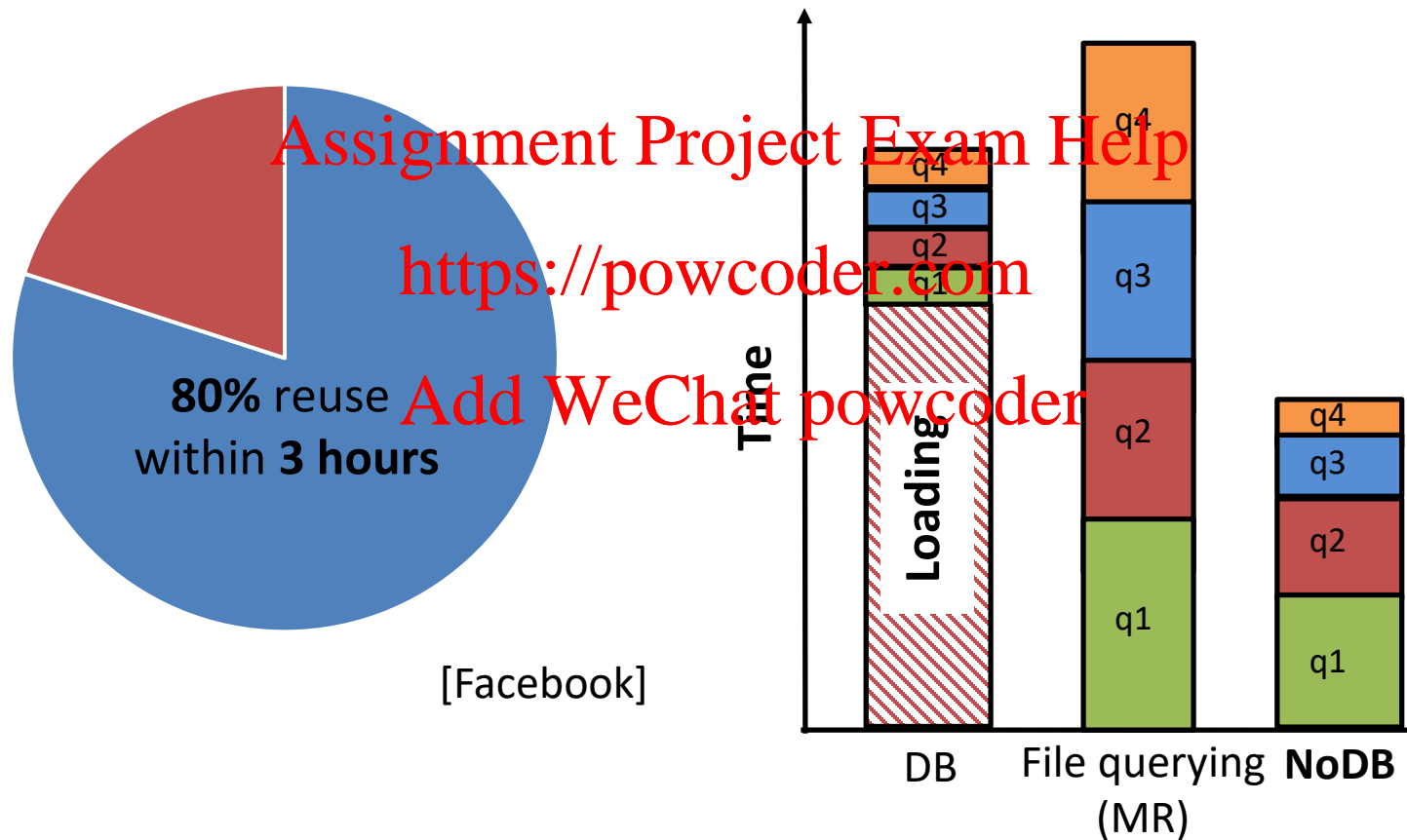
# Data analysis with databases

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# Process instantly

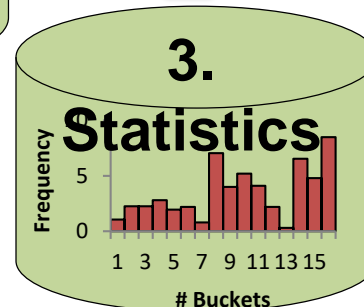
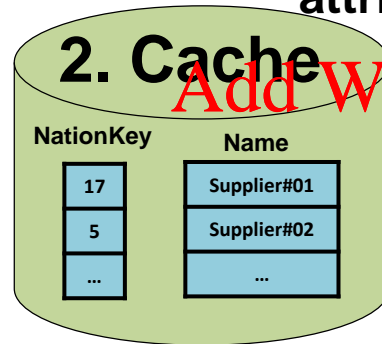
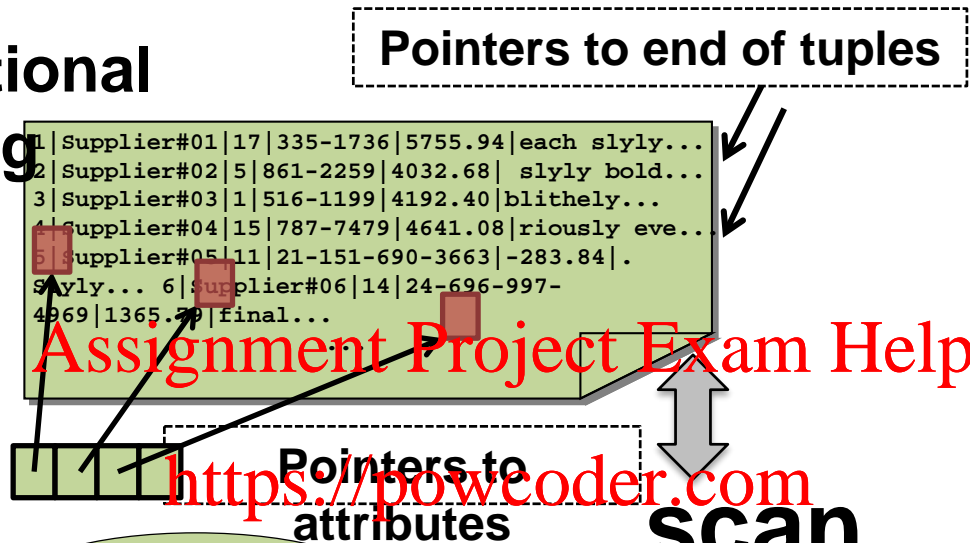
[SIGMOD'12, VLDB'12, CACM'15]



## Adapt to queries

# PostgresRaw: NoDB from idea to practice

## 1. Positional indexing

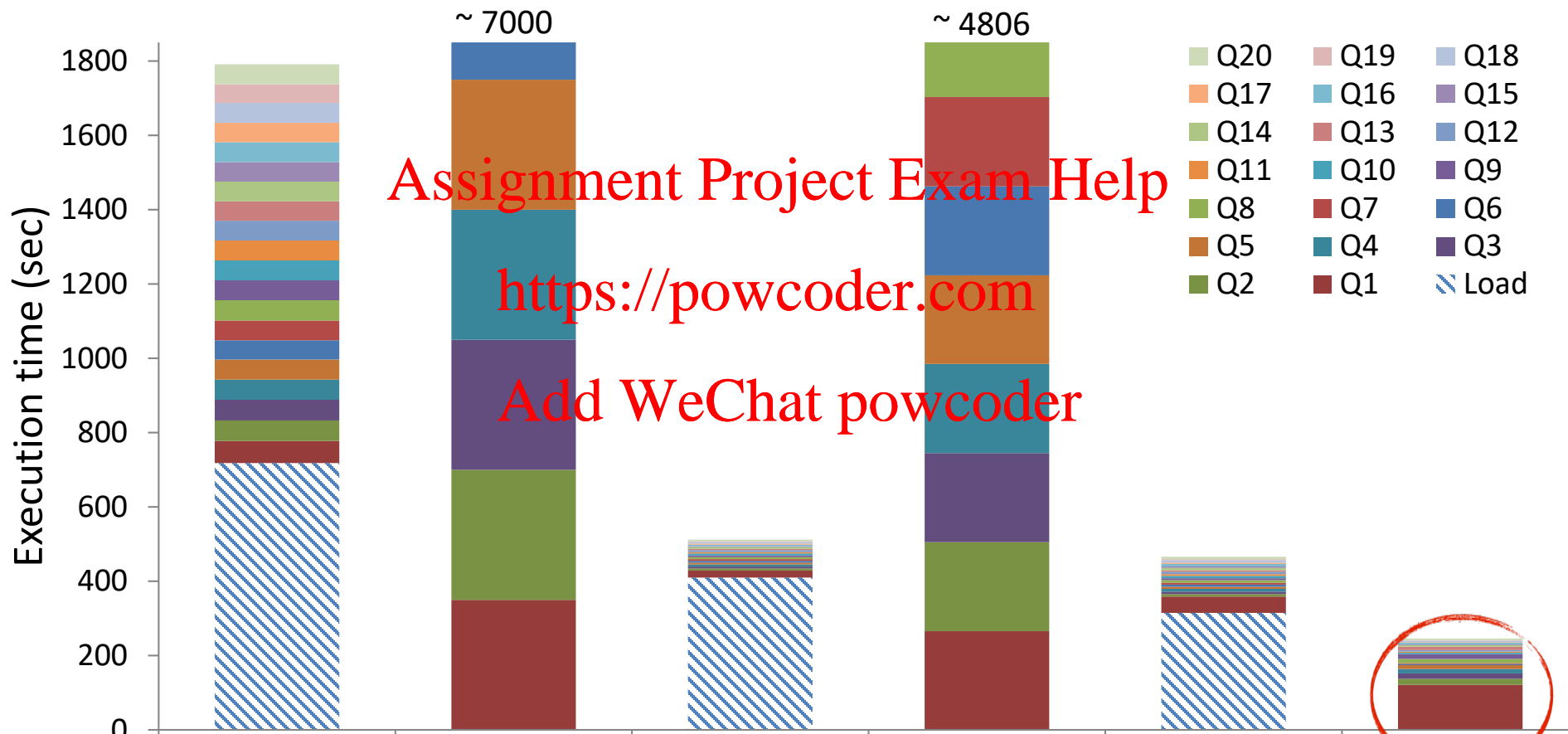


Adjust to queries = progressively cheaper 20

# PostgresRaw in action

**Setting:** 7.5M tuples, 150 attributes, 11GB file

**Queries:** 10 arbitrary attributes per query, vary selectivity



**Data-to-insight time halved with PostgresRaw**  
**Per query performance comparable to traditional DBMS**

# Lesson #3

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**Learn from queries**

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# Self-designing systems for data analysis

*"It is not the strongest species that survive, nor the most intelligent, but the ones most responsive to change." Charles Darwin*

## Queries

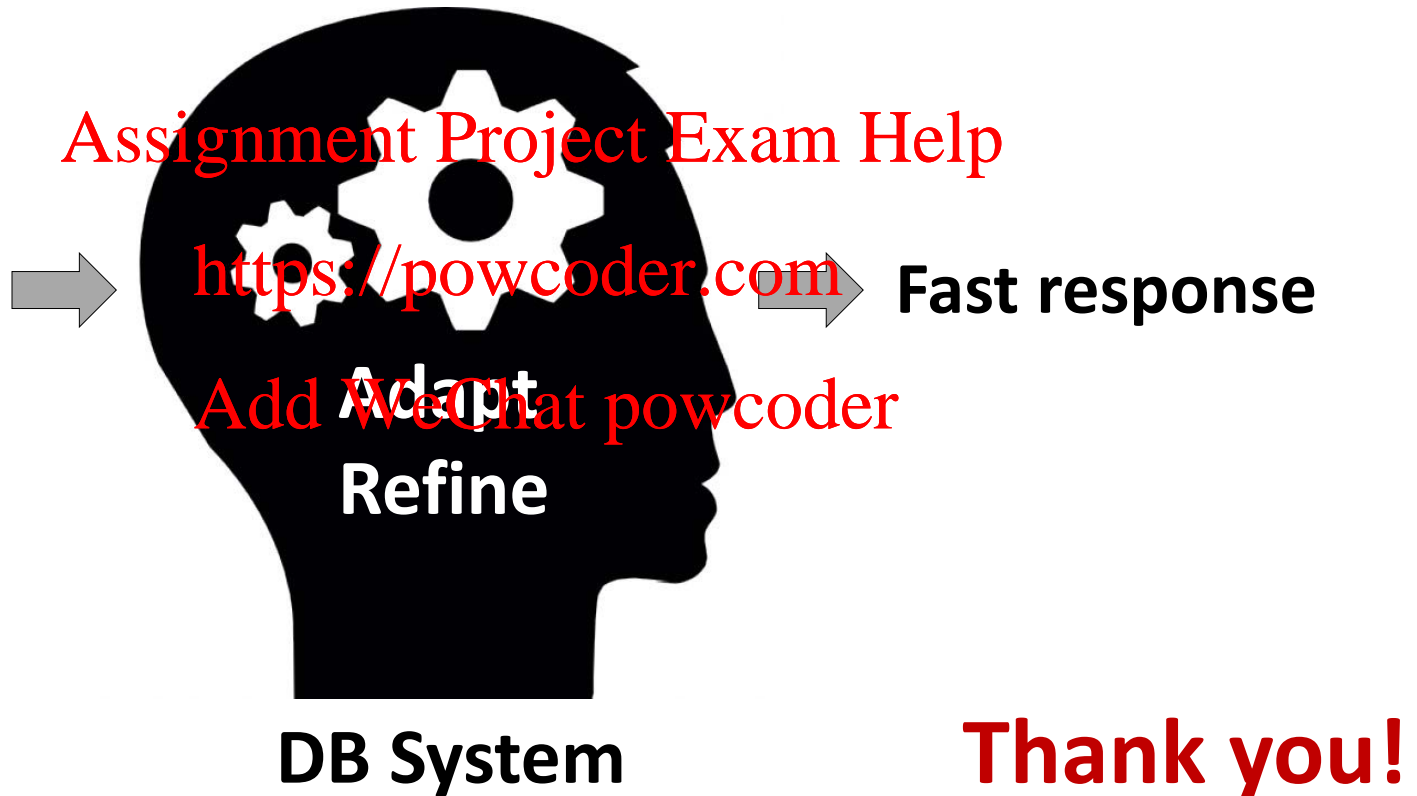
[SIGMOD'12]  
[VLDB'12]  
[CACM'15]

## Data

[DBTest'12]  
[ICDE'15]  
[VLDBJ'18]

## Hardware

[VLDB'16]  
[ADMS'17]



Anyone can be a data scientist with self-driving DB