Database Systems

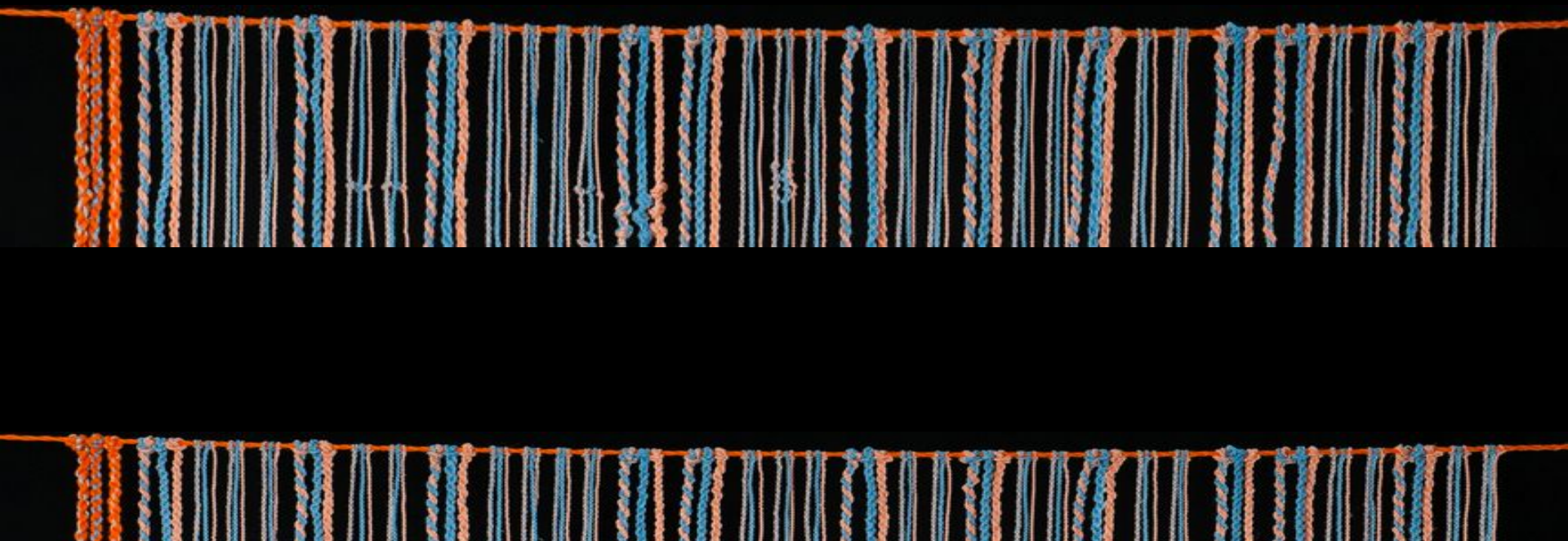
Achievements and Opportunities

Arin Ghosh
CMPT 843

Database Systems

Achievements and Opportunities

Quipu



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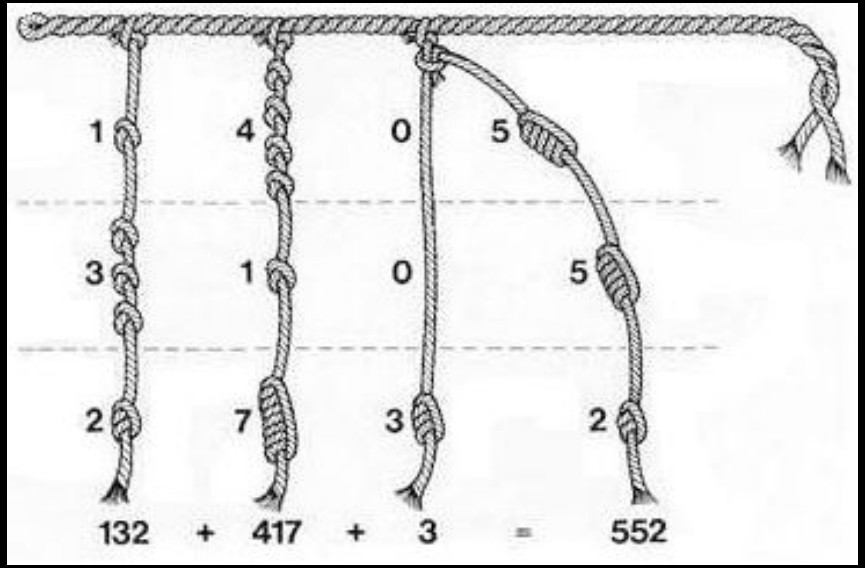
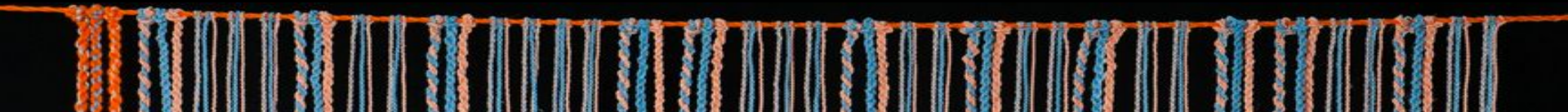
Achievements and Opportunities

Quipu

method used by the Incas and other ancient Andean cultures to keep records and communicate information





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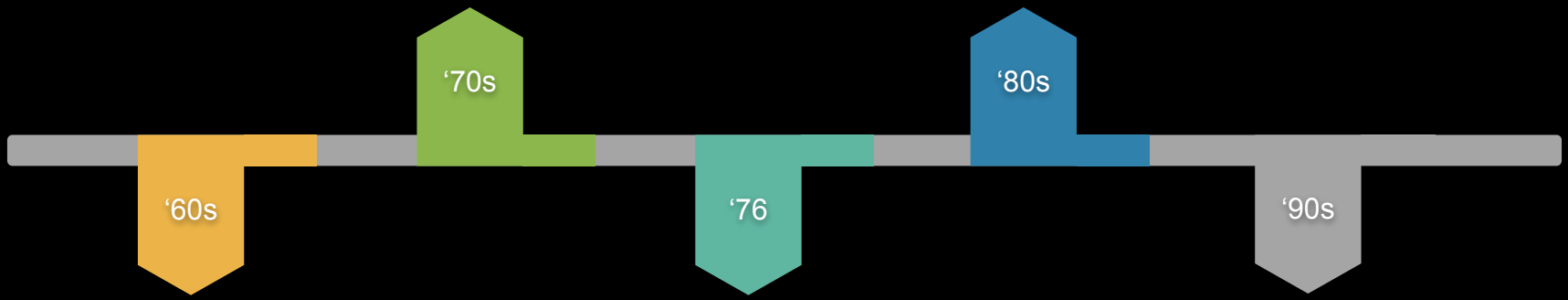
Achievements and Opportunities



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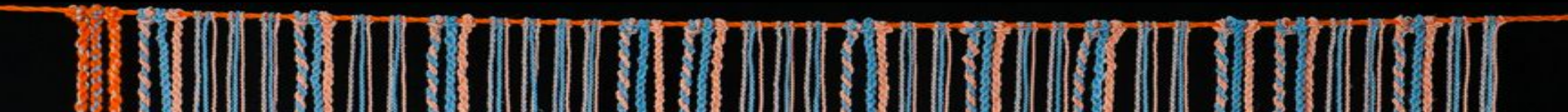
Achievements and Opportunities of the last decade

Relational Database

Transaction Management

Distributed Database



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Achievements and Opportunities

Relational Database

IMS / CODASYL - The existing systems

- Complex Implem
- Including new information changes structure

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Achievements and Opportunities

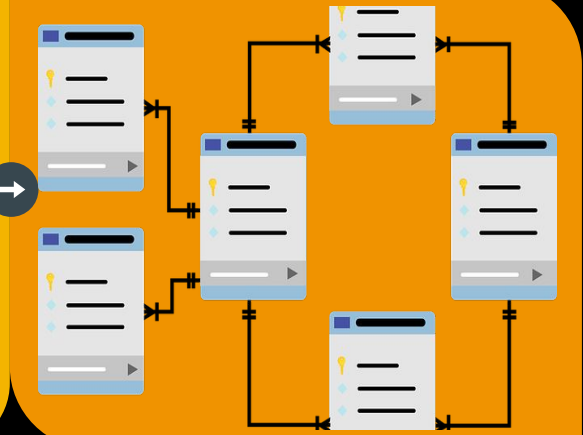
Relational Database

End User/ DB Application Programmer

Access data through a high-level non procedural query language

Query Optimizer

Translate the predicate specification to optimum algorithm for accessing database



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Achievements and Opportunities

Relational Database

Other Research Includes

- High level relational query
- Algorithm optimization
- Normalization
- Buffer management & Indexing technique

...All these led to radical simplification of current system

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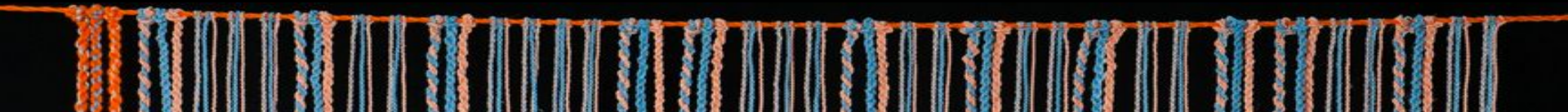
Achievements and Opportunities

Relational Database

Transaction Management

Distributed Database



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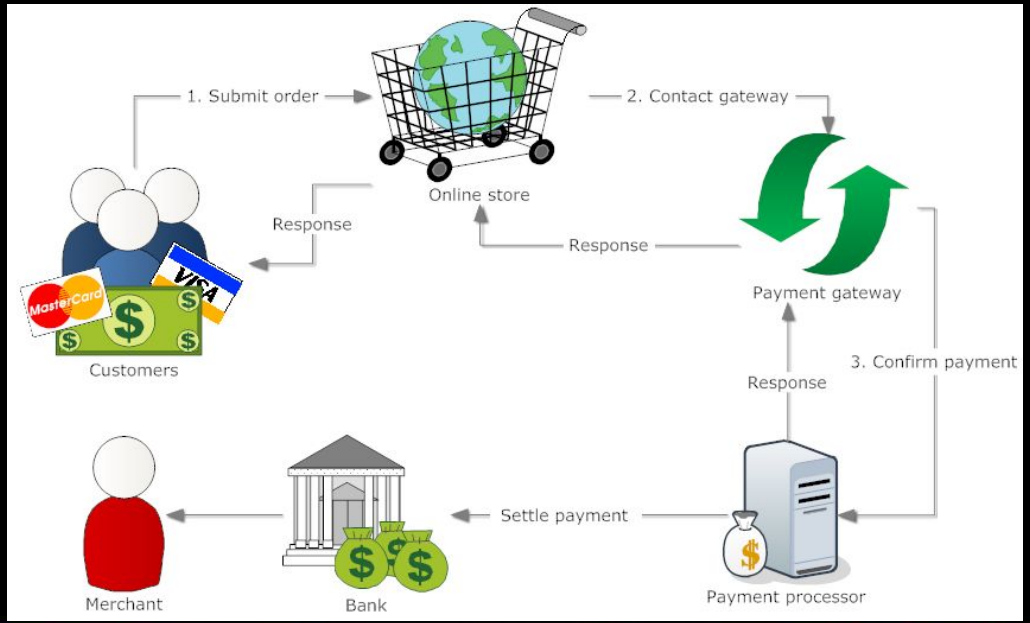
Achievements and Opportunities

Transaction Management

Transaction:: Individual, Indestructible operation that is either true or false



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Achievements and Opportunities

Transaction Management

Transactions Need to Be:

- Atomic in nature
  - handle concurrent transaction
  - handle system failure

Serializability Techniques: (1/2)

- Two-phase lock
- Timestamping
- Multiple versions of data *obj*.

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Achievements and Opportunities

Transaction Management

Transaction Recovery (2/2)

- Recovery
  - Making sure system survives crashes and other unforeseen events
- Recovery Techniques
  - Write ahead logging
  - Shadow file techniques

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Achievements and Opportunities

Relational Database

Transaction Management

Distributed Database

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Achievements and Opportunities

Distributed Databases

Distributed Database:

- Need for a distributed system
  - Decentralized business
  - System reliability in event of a crash
  - Location transparency for customer

… Two Phase Commit (2PC) Protocol

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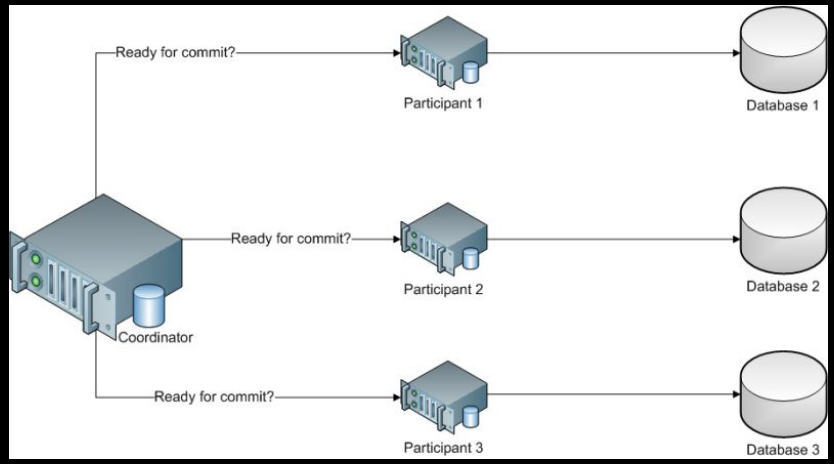
Achievements and Opportunities

Distributed Databases

2PC Protocol




```
Coordinator                                          Cohort
                        QUERY TO COMMIT
                  ---------------------------------->
                        VOTE YES/NO                  prepare*/abort*
                  <----------------------------------
commit*/abort*          COMMIT/ROLLBACK
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                        ACKNOWLEDGMENT               commit*/abort*
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end
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Credits:
https://bikashshaw.wordpress.com/2011/01/03/two-phase-commit-protocol

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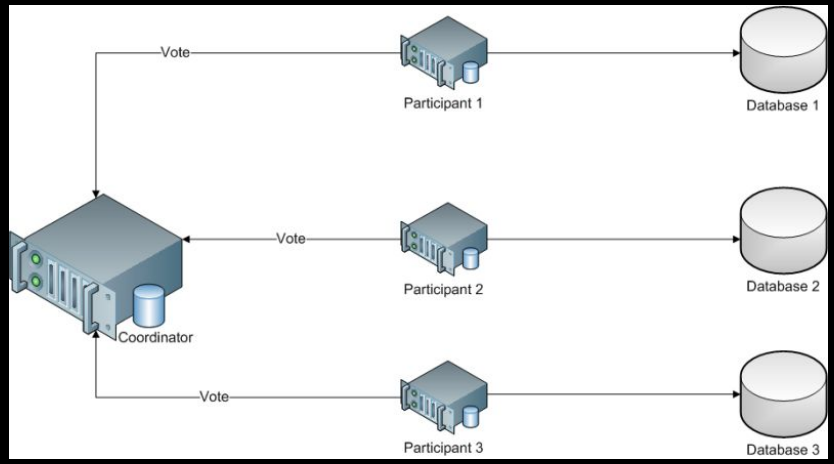
Achievements and Opportunities

Distributed Databases

2PC Protocol

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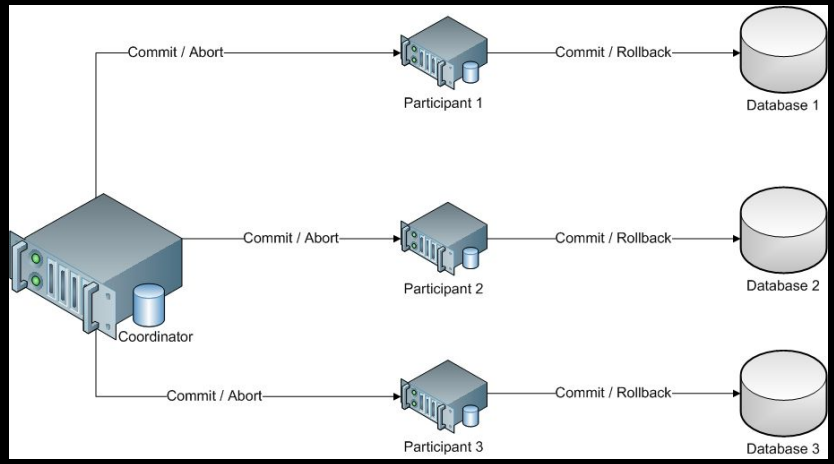


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Achievements and Opportunities

Relational Database

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Database Systems

Achievements and Opportunities that lie ahead

Should we carry on?

- *Tremendous achievements in the past in terms of database management philosophy*
- *Commercialization is on the right path*
- *Hardware cost is coming down*

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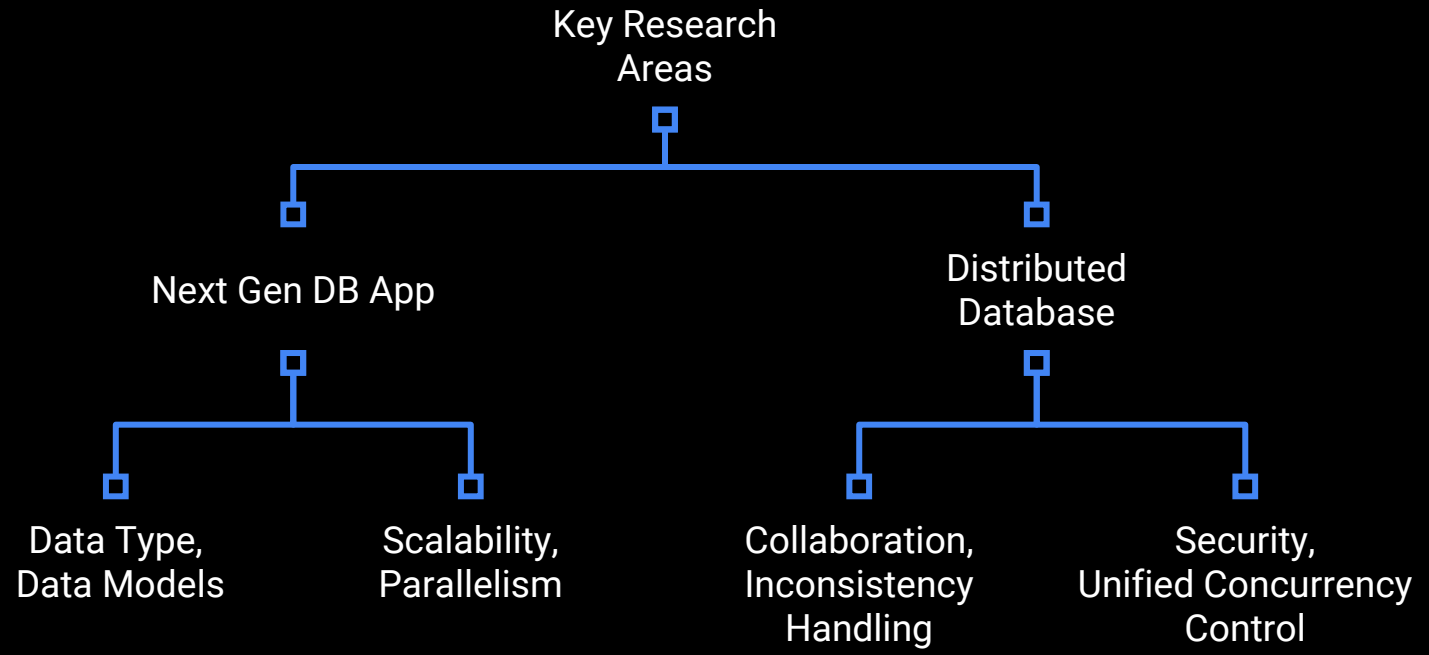
Achievements and Opportunities



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Achievements and Opportunities : Next Generation Applications

Motivations

- *Petabytes of data generation (e.g. NASA)*
- *Complex relationship of data with one another (e.g. Modern CAD systems)*
- *Introduction of multimedia in the last decade*

Conventional DBMS will FAIL to incorporate them

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Achievements and Opportunities : Next Generation Applications

New Faces of Data

Size

Next generation DBMS should treat big amount of data into smaller chunks in order to handle large volume of data

Type

The new DBMS should start supporting new emerging data types by handling errors at compile time not run time.

Rule

We need newer tools to validate and debug complex rules written on top of large volumes of data.

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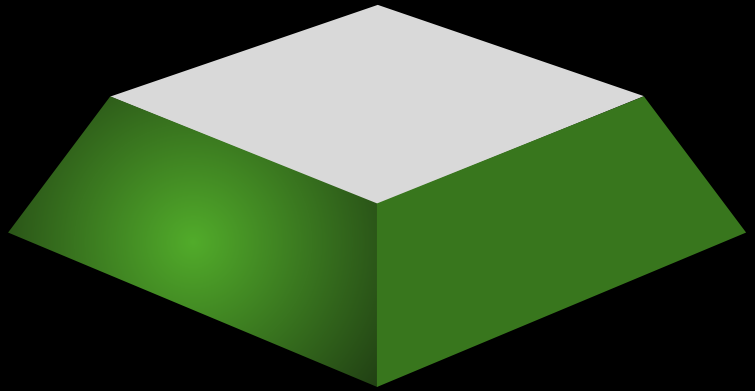
Achievements and Opportunities : Next Generation Applications

New Faces of Data



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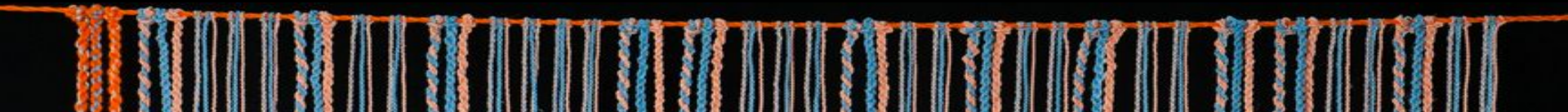

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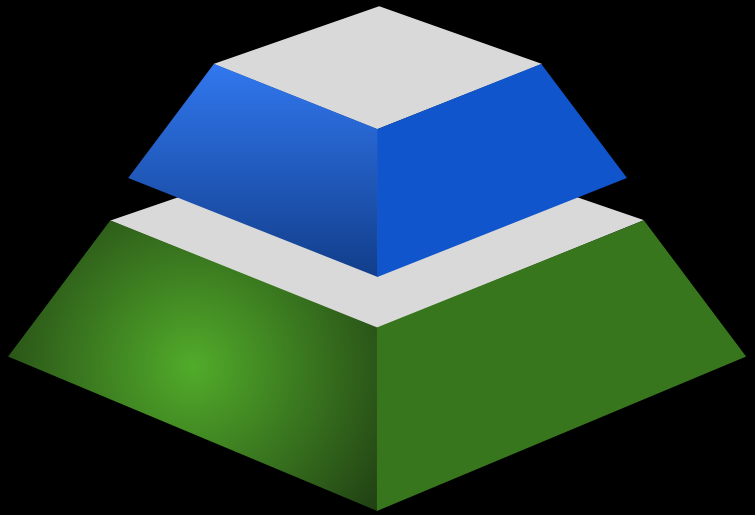
Achievements and Opportunities : Next Generation Applications

New Faces of Data

2 Time: Different use cases will require different concepts of time. For example a fiscal year for a tax consultant may not be the same as the business she is serving



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Achievements and Opportunities : Next Generation Applications

New Faces of Data

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3 Uncertainty: Some of the challenges of the AI community involves results in terms of probability. Research is essential to include massive amount of data of *limited reliability*.

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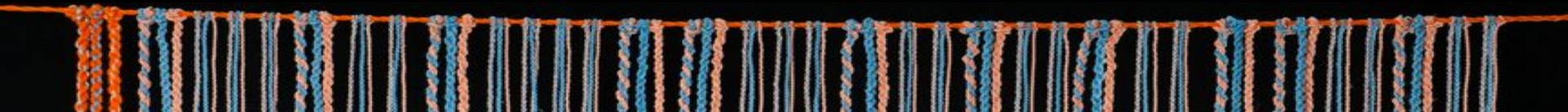

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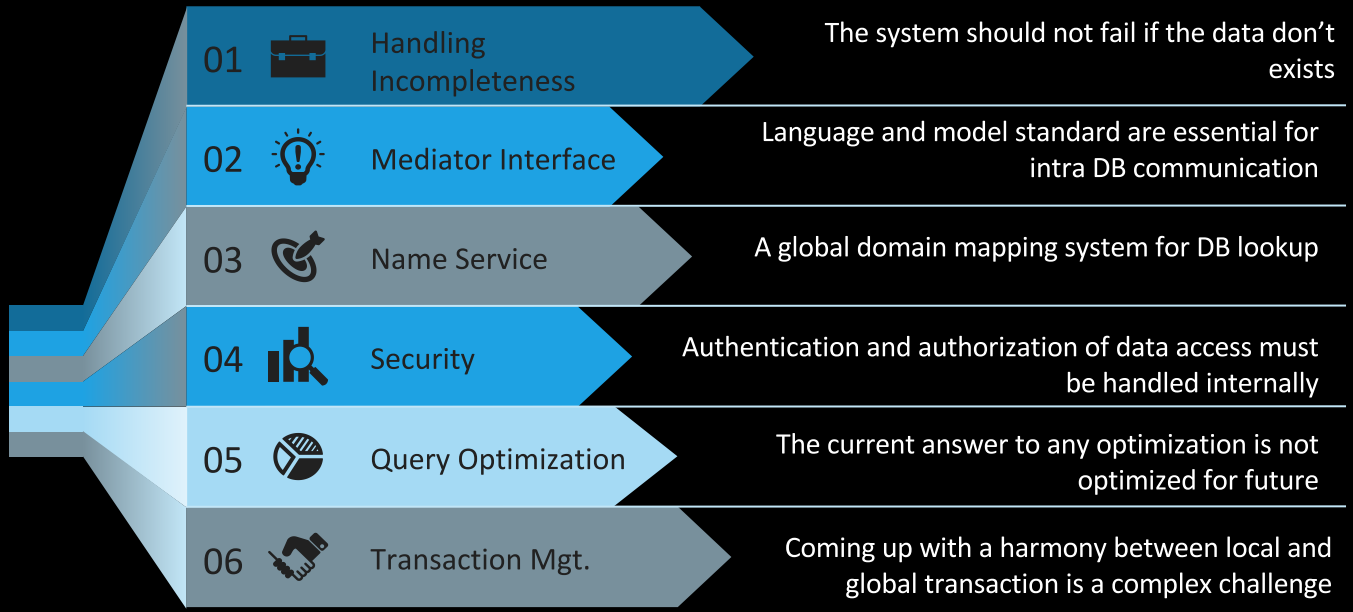
Achievements and Opportunities : Distributed Database Challenges

Heterogeneous DB

Logically integrating multiple databases across different organizations has its own challenges



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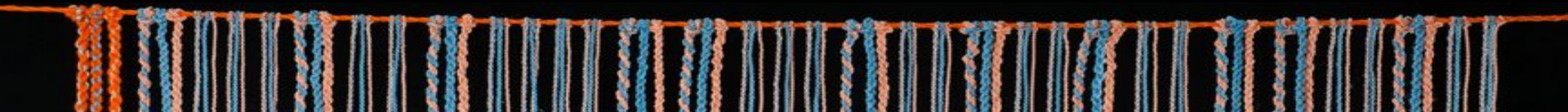
Achievements and Opportunities

Questions



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Achievements and Opportunities : Next Generation Applications

Data Model

1. Scaling Up
2. Parallelism
3. Long Duration Transaction