Managing Large Scale Transactional Data in The Cloud

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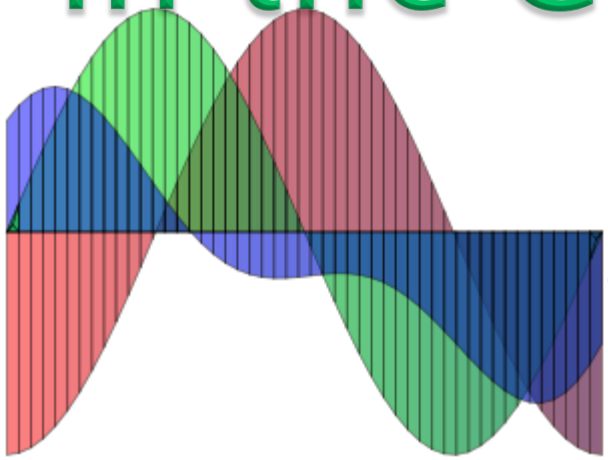
The Big Data Eco-System in the Cloud



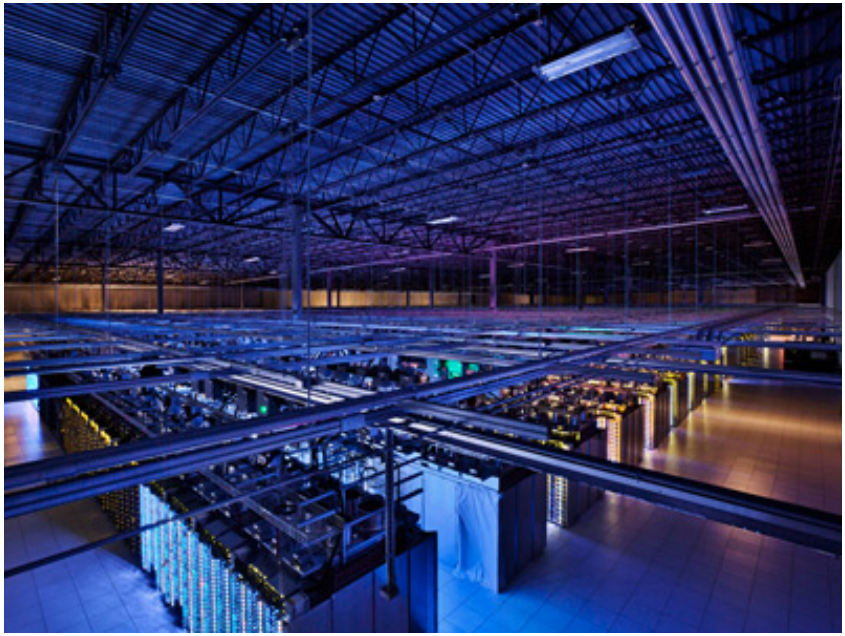
Analysis & Quality

Infrastructure

inter-data center

Inter-data center

Inside a Data Center



MaaT: Distributed Transaction Processing

Pessimistic locking

Less aborts compared to OCC

Blocking limits throughput

Optimistic Concurrency Control (OCC)

High Throughput

More aborts with contention

Maat Design Principles

High Throughput

Conflict resolution at fine granularity

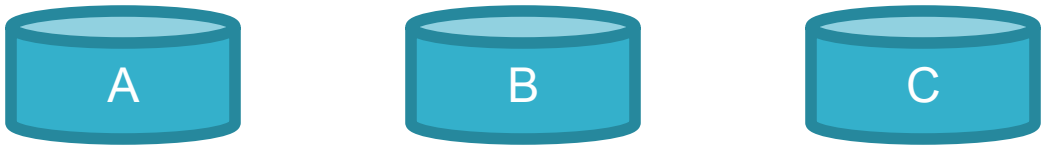
Avoid blocking transactions

Resolve conflict with less aborts

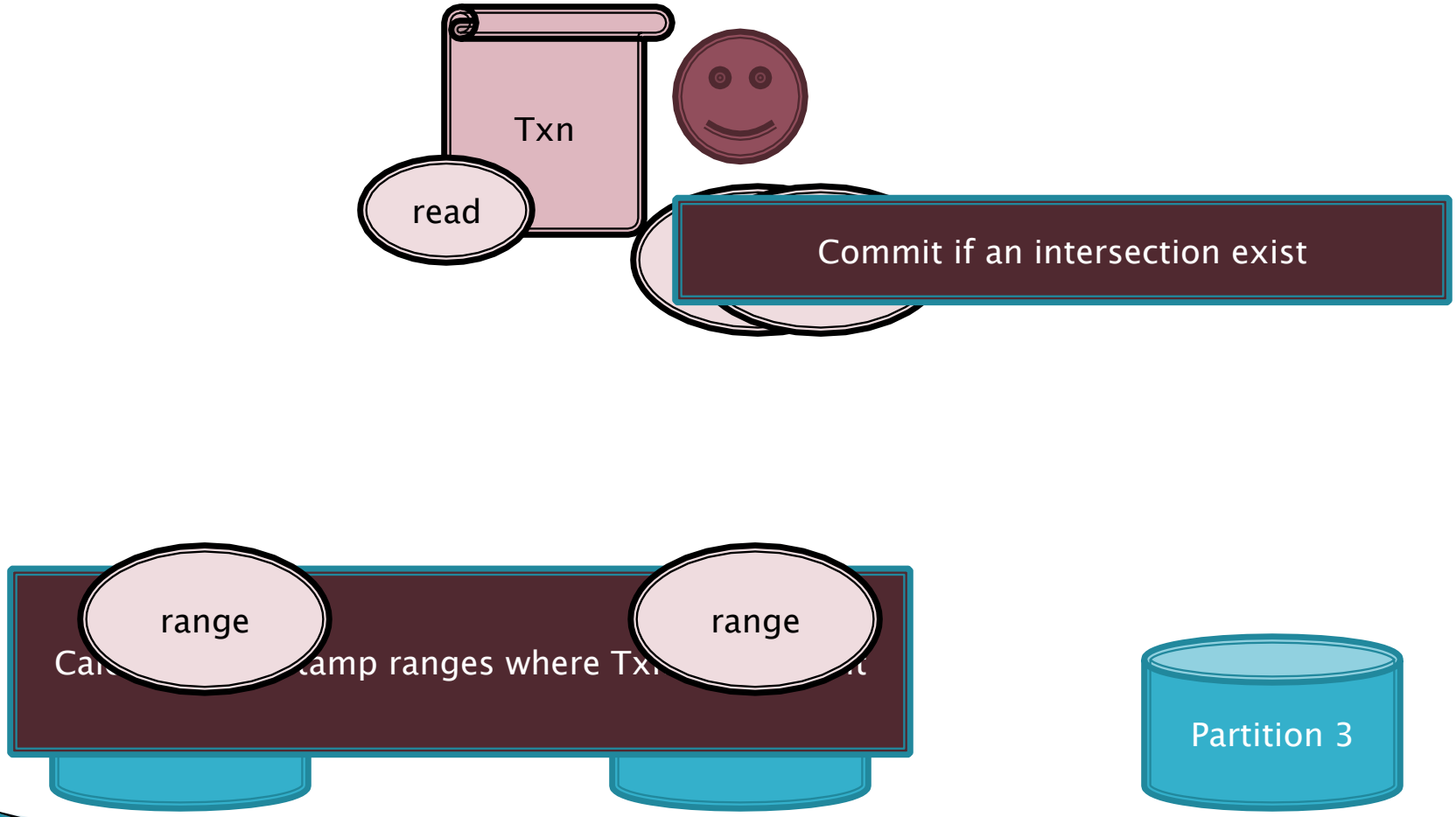
Scalability

Distributed verification

Only involve the nodes accessed



Data Center Data Management: MaaT

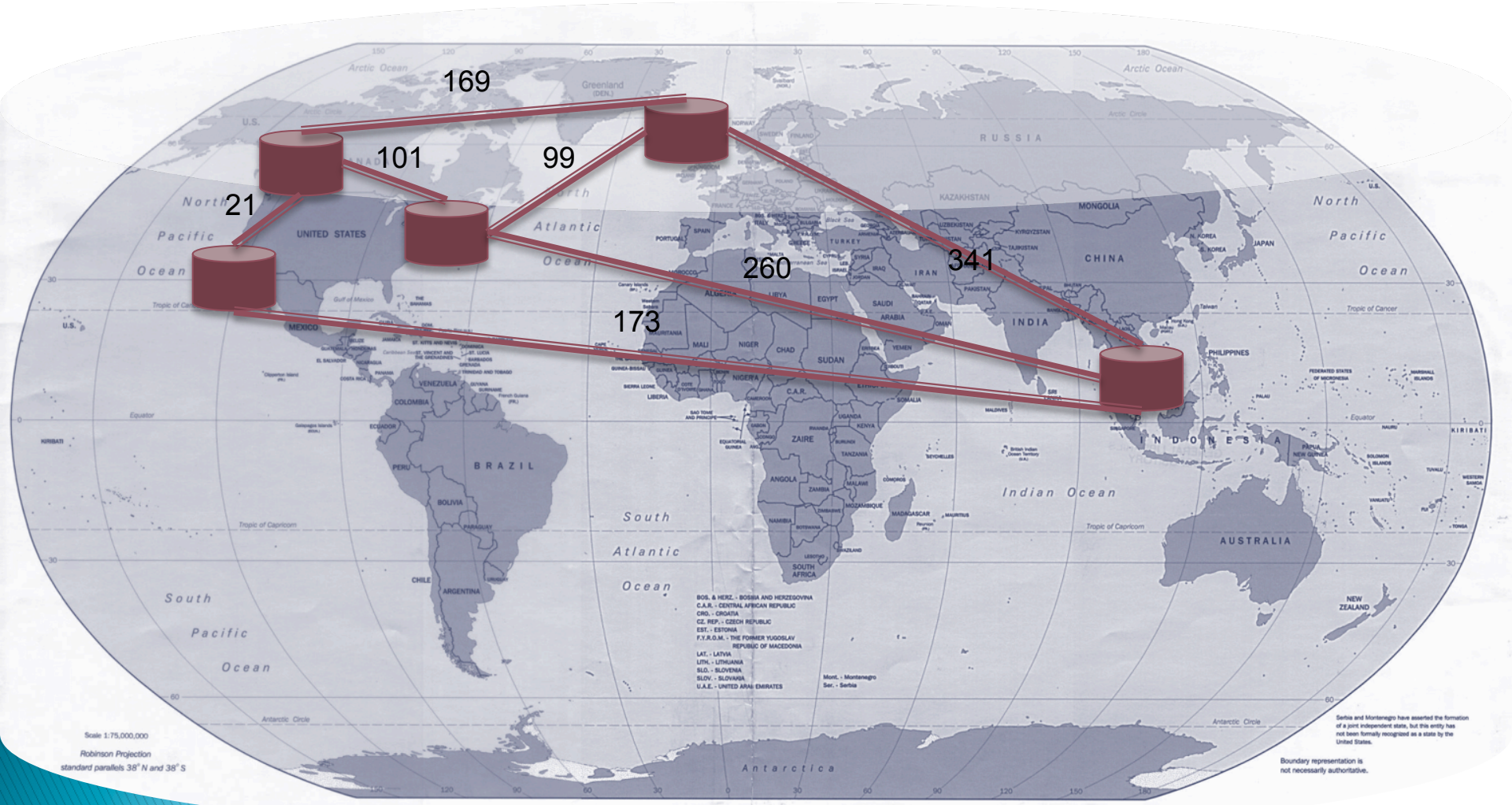


Catastrophic Failures: Geo-Replication

Google Spanner

- Global-scale data infrastructure
- Data is partitioned within data center
- Replication across data centers using Paxos
- Transactions execute on data using 2-phase commit

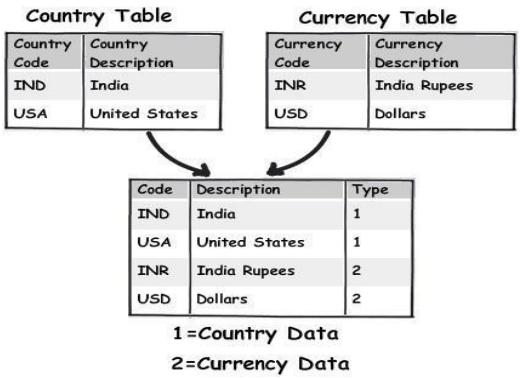
Communication Overhead

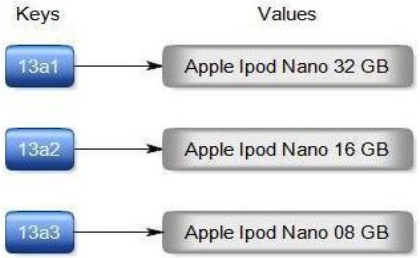


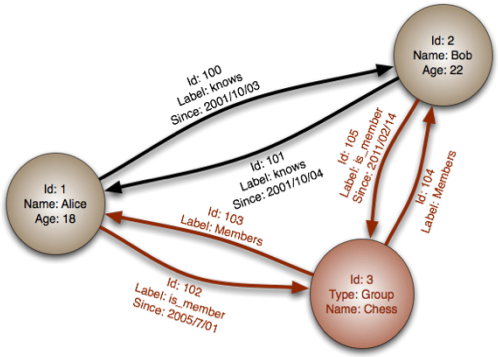
Replicated commit (VLDB 2013)

- Execute communication expensive transactions within a data center.
- Fault-tolerance across data centers using Paxos
- Consistency within data center using 2PC
- Significant reduction in communication costs.

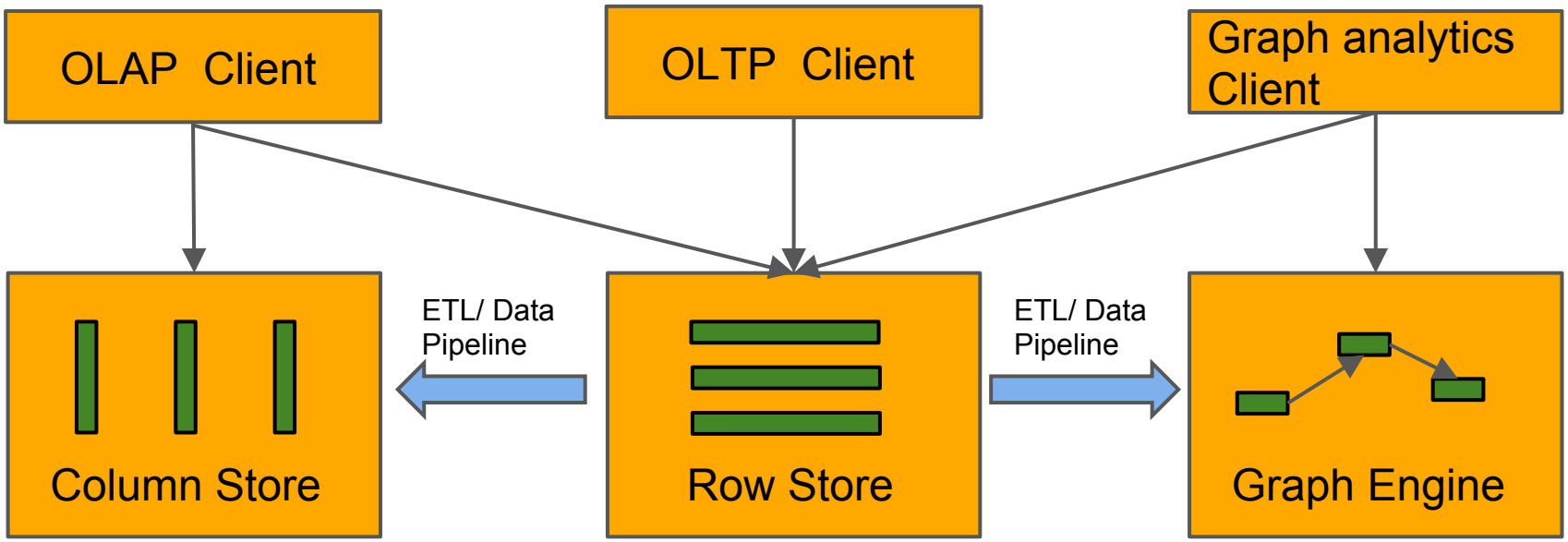
Data Variety



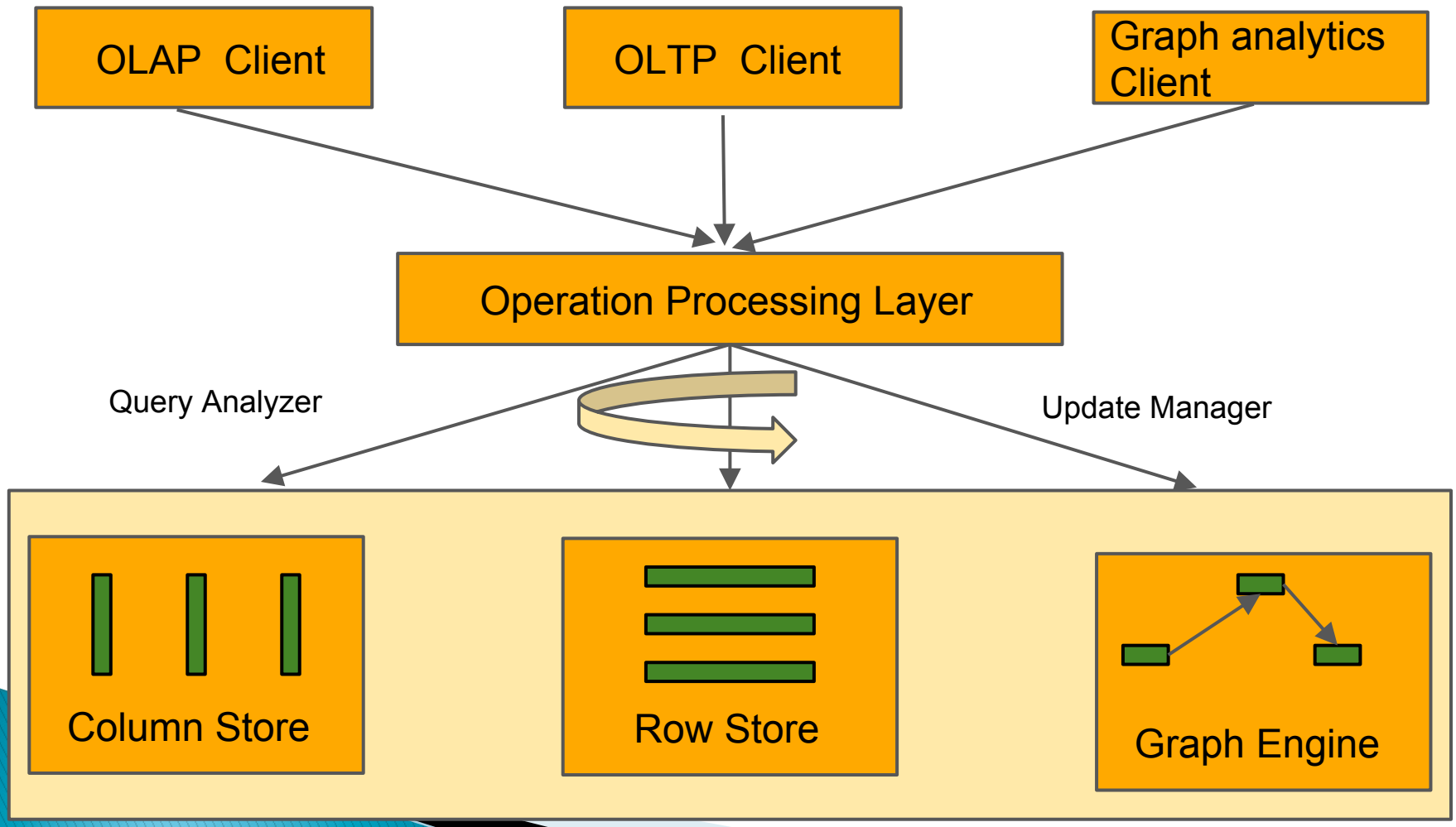




System Architecture



Replication Driven Solution

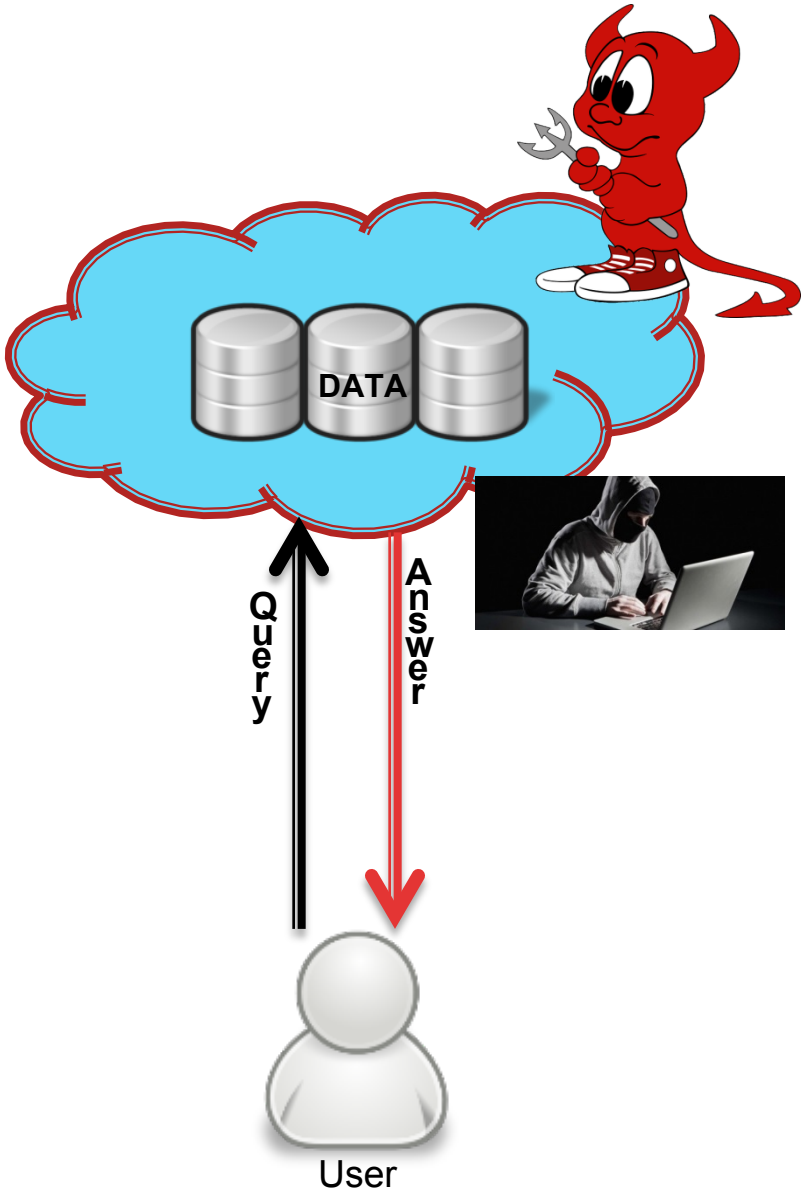



Privacy

Privacy-Preserving Data Services In the Cloud

- Data security and privacy in the cloud vulnerable to:
  - Curious/Snooping system administrators
  - Hackers with illegal access

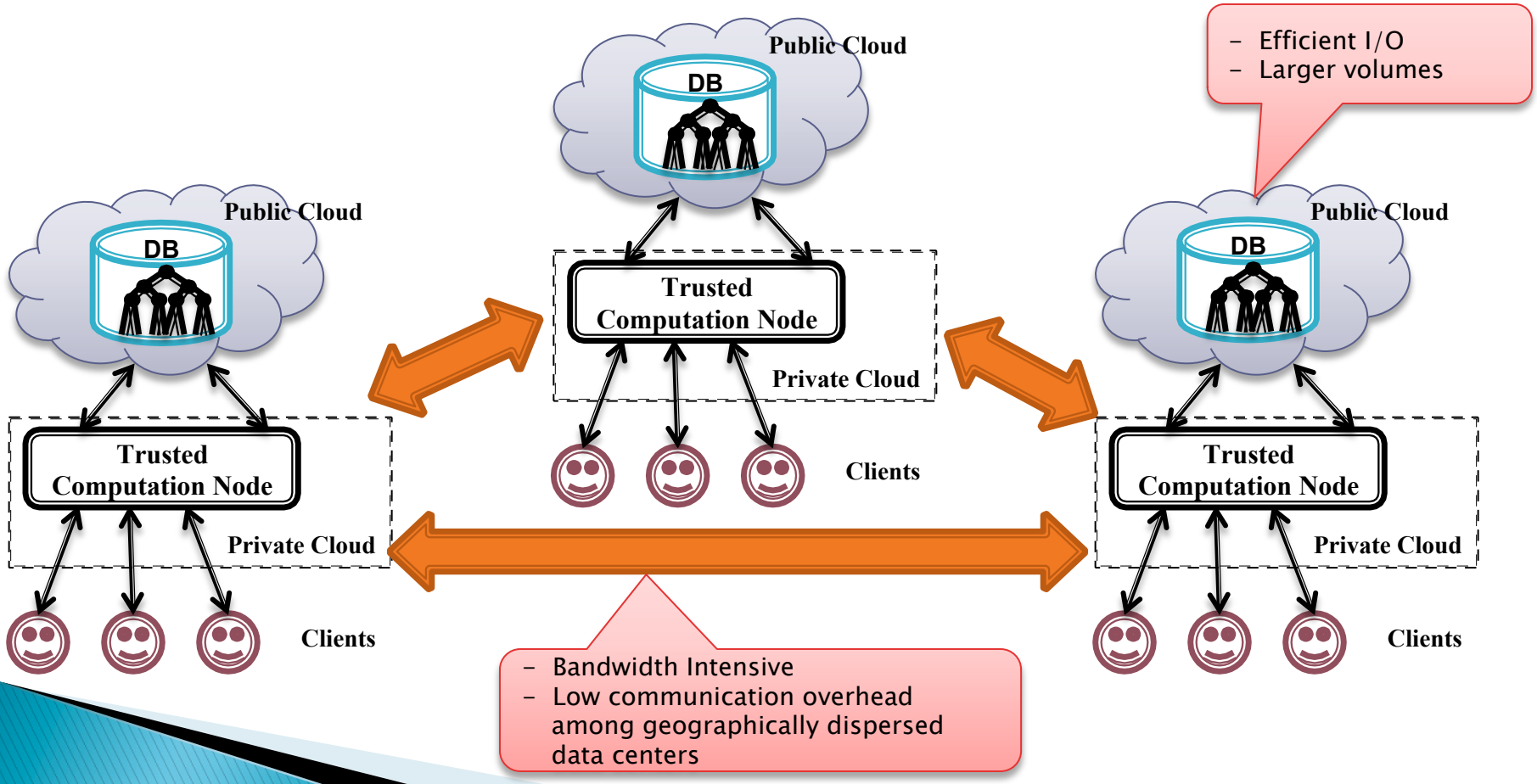
- GOAL: Functionality and performance of database systems while preserving data privacy and security.



Cloud for Privacy-Preserving Data Storage

Secure data storage requires **encryption** before outsourcing the data

- More **space** is required to store
- Data is **transferred** encrypted



Experimental Setup

- **Single DataCenter**
  - Servers, Racks and Clusters
  - Different Compute, Memory and Network configs
- **Multi DataCenter**
  - Datacenters in physically different locations
- Virtual Machine Access as given by Amazon EC2, Microsoft Azure

Evaluation Workloads

- **TPC-C** : Evaluating Single partitions and distributed Transactional Processing
- **Transactional YCSB** : Geo-Replication
- **TPC-H** and **Graph Workloads** - Variety

Evaluation Scenarios

- Contention
- Throughput Evaluation
- Scale-Out
- Handling Failures - Node and Data Centers

Wish List

- VM Placement Control
- Beyond the Virtual Machine Statistics:
  - NW Utilization
  - Physical Machine Utilization
  - Disc Utilization
- Infrastructure for Benchmark Generation

- Overall, EC2 + more control and statistics.