An Introduction to HTAP

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Outline

• What is HTAP
• Why HTAP
• Different types of HTAP
• Design space
• Conclusion
What is HTAP

• OLTP
  • Single row insert/update
  • Key lookups (point query [with index])
  • High concurrency
  • High throughput
  • Low response time
What is HTAP

• OLAP
  • Complex queries with lots of joins
  • Scans lots of data
  • Low concurrency etc.
  • Ad hoc queries
What is HTAP

• Hybrid transactional and analytical processing
  • A single system for both transactions as well as reporting queries
  • Loosely defined vs. strictly defined
    • Most systems are solutions, using the loosely definition

• Gartner definition
  • An HTAP system can execute both I/U/D statements as well as analytical queries over all data, including the recently ingested in this transaction, within the same transaction
What is translytical?

• Forrester definition
  • A unified and integrated data platform that supports multi-workloads such as transactional, operational, and analytical simultaneously in real time, leveraging in-memory capabilities including support for SSD, flash, and DRAM and ensures full transactional integrity and data consistency.
Why HTAP

• Realtime analysis of transactional data
  • Analysis on fresh/real-time data
  • Increase business agility
  • Reduce business risks

• Traditional solutions

• Comparison with master/slave
Why HTAP

• The Evolution of products

- Oracle
- DB2
- SQL Server
- Teradata

- Vertica
- Netezza
- Greenplum
- DB2 BLU
- SAP HANA

- Hive
- Impala
- Presto
- Spark SQL
  (HBase etc.)

- MemSQL
- Hekaton
- Hyper
- VoltDB

Separate OLTP/OLAP systems
Purpose built OLAP systems
Big data era
In-memory OLTP
Different types of HTAP

• Most are loosely coupled systems
  • esp. the competitors in China
  • From pure Java OLAP to HTAP
  • From PostgreSQL OLAP to HTAP
  • From MySQL OLTP to HTAP
Different types of HTAP

• Loosely coupled systems
  • Separated OLTP and OLAP engines

• Tightly coupled systems
  • Separate engines but integrated

• A single system
  • A single engine for both workload
Design space

• Single engine vs. separated engines
  • For data ingestion and analytic queries
• Single storage option vs. different options
  • For transactional data and historical data
• Data format
  • Row format, columnar format or mixed format
• Data recency
• Transactional semantics
• Index support
Design space

• Data format leads to big difference
  • Row, columnar, mixed, or even dynamically organized

• Transactional semantic is the biggest difference
  • Play tricks with ACID
  • Single row vs. multiple row transactions
  • Weak TX consistency or use the misleading consistency of CAP

• Index support is hard for some systems
  • Traditional B+ index etc.
  • Secondary index
  • Local index vs. global index
Conclusion

• HTAP is strictly defined by Gartner
• Wildly used in the loosely speaking in industry
• Convergence of SQL database and Big Data
• The major use case is real-time data analysis