SDCC
中国软件开发者大会
SOFTWARE DEVELOPER CONFERENCE CHINA

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TiDB: HBase分布式事务与SQL实现

About me

- TiDB & Codis founder
- Golang expert
- Distributed database developer
- Currentlly, CEO and co-founder of PingCAP

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Agenda

- HBase introduction
- TiDB features
- Google percolator and omid
- Internals of TiDB over HBase

Features of HBase

- Linear and modular scalability.
- Strictly consistent reads and writes.
- Automatic failover support between RegionServers.
- Block cache and Bloom Filters for real-time queries.
- Query predicate push down via server side Filters
- MVCC

What did they say ?

“Nothing is hotter than SQL-on-Hadoop, and now SQL-on-HBase is fast approaching equal hotness status”

Form **HBaseCon 2015**

We want more !

SQL + Transaction(ACID)

TiDB Features

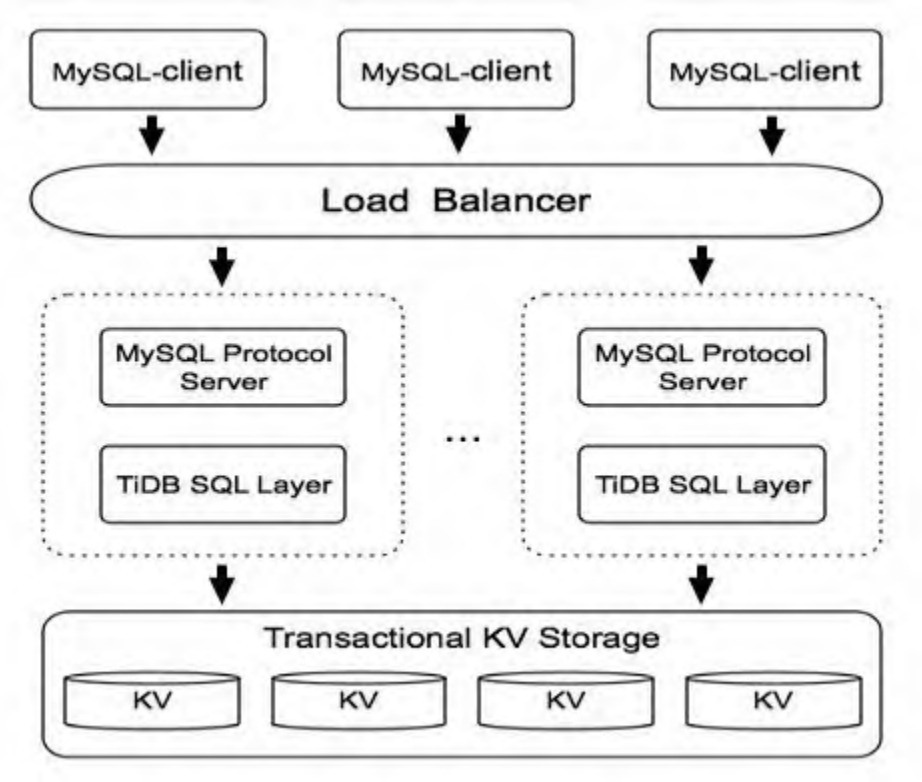
- **Consistent distributed transactions**
  - TiDB makes your application code simple and robust.
- **Compatible with MySQL protocol**
  - Use TiDB as distributed MySQL.
  - Replace MySQL with TiDB to power your application without changing a single line of code in most cases.
- **Focus on OLTP**
  - There are lots of OLAP system(Spark, Presto, Impala…)

TiDB Features

- **Multiple storage engine support**
  - TiDB supports most of the popular storage engines in single-machine mode. You can choose from goleveldb, LevelDB, RocksDB, LMDB, BoltDB and even more to come.
- **Written in Go**
  - Faster develop
  - Run fast

Why called TiDB ?

TiDB Architecture



AH. HBase

- First things first
  - Need to build a transactional layer over HBase

Google percolator

- Design
  - BigTable
  - Transactions
  - Timestamps

Percolator

- **Three components**
  - Percolator worker
  - BigTable tablet server
  - GFS chunkserver

Percolator

- **Transactions**
  - ACID semantics
  - **Snapshot-Isolation** (too weak for RDBMS)
  - must maintain locks explicitly

Percolator's Transactions

Bob wants to transfer 4$ to Joe

Key	Bal: Data	Bal: Lock	Bal: Write
Bob	6: 5: $10	6: 5:	6: data @ 5 5:
Joe	6: 5: $2	6: 5:	6: data @ 5 5:

Percolator's Transactions

Key	Bal: Data	Bal: Lock	Bal: Write
Bob	7: $6 6: 5: $10	7: I am Primary 6: 5:	7: 6: data @ 5 5:
Joe	6: 5: $2	6: 5:	6: data @ 5 5:

Percolator's Transactions

Key	Bal: Data	Bal: Lock	Bal: Write
Bob	7: $6 6: 5: $10	7: I am Primary 6: 5:	7: 6: data @ 5 5:
Joe	7: $6 6: 5: $2	7:Primary@Bob.bal 6: 5:	7: 6: data @ 5 5:

Percolator's Transactions

Key	Bal: Data	Bal: Lock	Bal: Write
Bob	8: 7: $6 6: 5: $10	8: 7: ~~I am Primary~~ 6: 5:	8: data @ 7 7: 6: data @ 5 5:
Joe	8: 7: $6 6: 5: $2	8: 7:Primary@Bob.bal 6: 5:	8: data @ 7 7: 6: data @ 5 5:

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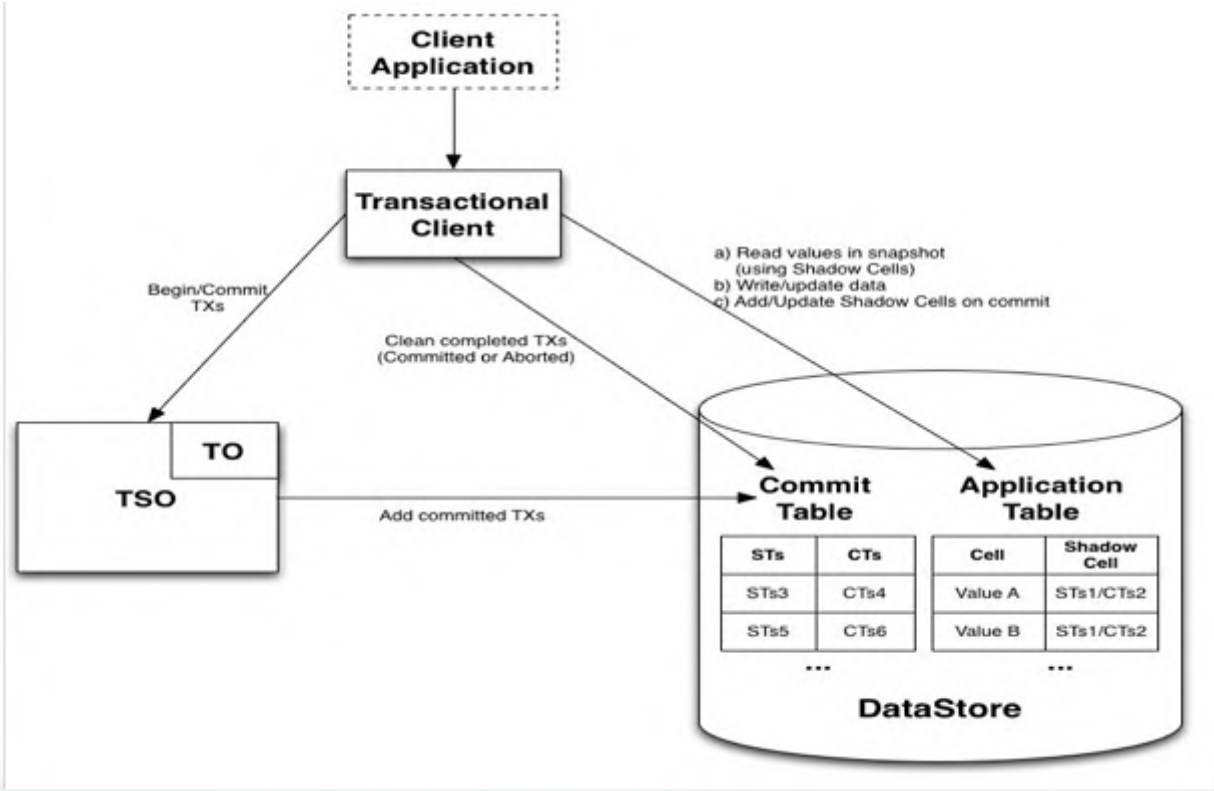
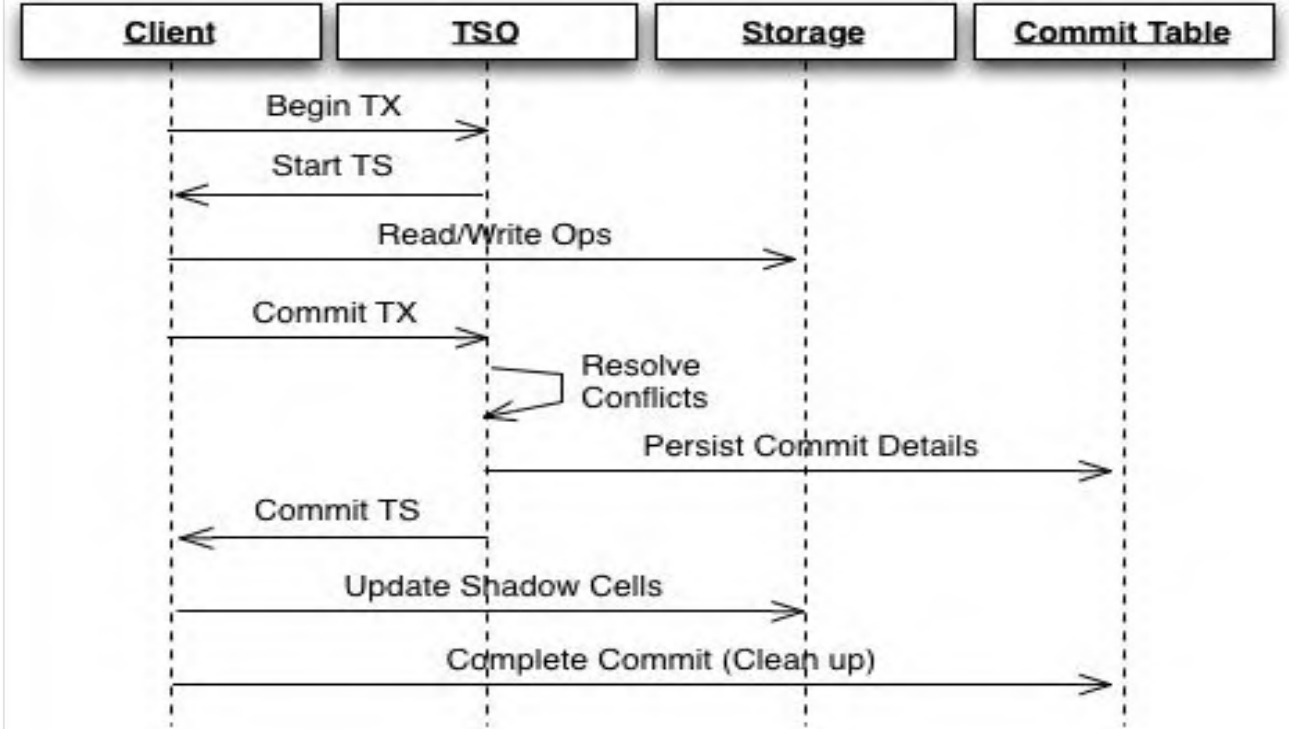
Timestamp

- Timestamps in strictly increasing order.
- For efficiency, it batches writes, and "pre-allocates" a whole block of timestamps.
- How many timestamps do you think Google’s timestamp oracle serves per second from 1 machine?
  - 2,000,000 / s

Yahoo's OMID


Client Application
Transactional Client
Begin/Commit TXs
a) Read values in snapshot (using Shadow Cells)
b) Write/update data
c) Add/Update Shadow Cells on commit
Clean completed TXs (Committed or Aborted)
TO
TSO
Add committed TXs
Commit Table
Application Table
STs
CTs
STs3
CTs4
STs5
CTs6
Cell
Shadow Cell
Value A
STs1/CTs2
Value B
STs1/CTs2
DataStore

Yahoo's OMID


Client
TSO
Storage
Commit Table
Begin TX
Start TS
Read/Write Ops
Commit TX
Resolve Conflicts
Persist Commit Details
Commit TS
Update Shadow Cells
Complete Commit (Clean up)

Google Spanner

- ‘We wanted something that we were confident in. It’s a time reference that’s owned by Google.’
  - — Andrew Fikes

Google Spanner

- With Spanner, Google discarded the NTP in favor of its own time-keeping mechanism

- TrueTime API
  - Atomic clocks
  - GPS (global positioning system) receivers

Google F1

- Architecture
  - Sharded Spanner servers
  - data on GFS and in memory
  - Stateless F1 server
  - Pool of workers for query execution
- Features
  - Relational schema
  - Extensions for hierarchy and rich data types
  - **Non-blocking schema changes**
  - Consistent indexes
  - Parallel reads with SQL or Map-Reduce

Let’s talk about SQL

How does TiDB map SQL to KV

User table

RowID(hidden column)	name	email
1	bob	bob@gmail.com

Inside TiDB, each table, column has an unique ID

How to map SQL to KV

Let assume ID of user table is 1，ID of name is 2，ID of email is 3

key (TableID : RowID : ColumnID)	value
1 : 1 : 1	nil
1 : 1 : 2	bob
1 : 1 : 3	bob@email.com

How to map SQL to KV

Example SQL:

```
select name, email from user;
```

Map to Key-Value (TableID : RowID : ColumnID)**:**

```
name := kv.Get( " 1 : 1 : 2 " )
email := kv.Get( " 1 : 1 : 3 " )
```

How to map SQL to HBase

Example:

Key	列族:标识符	Value	列族:标识符	Value	列族:标识符	Value
row_1	cf:q	value	L:cf#q	lock_info	P:cf#q	startTs
row_2	cf:q	value			P:cf#q	startTs

```
lock_info {
        startTS(version)
        primary lock or secondary lock
        pointer to primary lock (for secondary lock)
}
```

MySQL protocol support

- Why does TiDB support MySQL protocol?
  - Testing
  - Community
  - Plenty of tools, easy to use

Current status

- **Able to run many famous applications**
  - WordPress, phpMyAdmin
  - ORM: Hibernate, SQLAlchemy …
- **Asynchronous schema changes**
- **Active and growing community**
  - ~2800 star, 21 contributors within two month

Thank you

Q&A

https://github.com/pingcap/tidb

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We are hiring