Horizontally Scale MySQL with TiDB

While avoiding Manual Sharding

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May 1st, 2019

Percona Technical Webinars

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In This Presentation

Scaling MySQL

Why and when Sharding is Needed

Problems to Consider

Solutions TiDB offers

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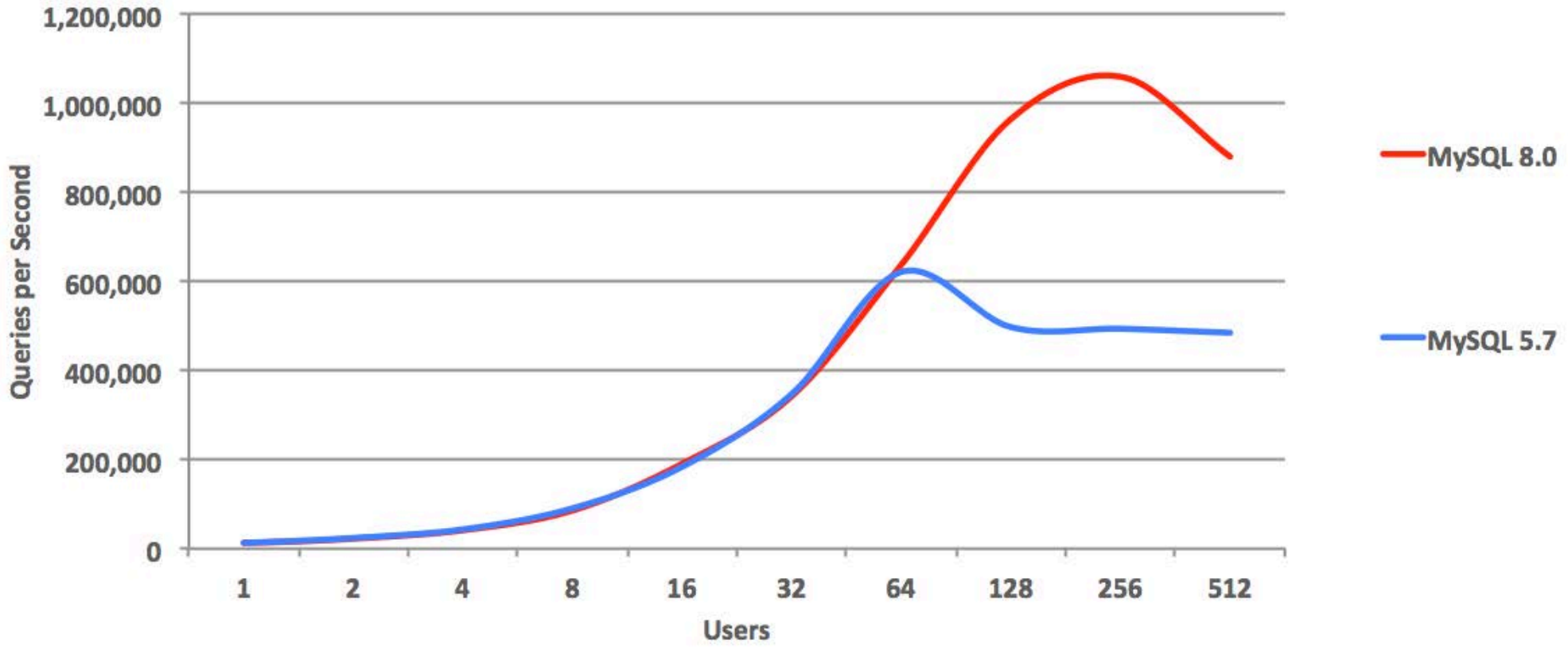
MySQL Scalability (Single Instance)



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Single MySQL Instance Can Do

Hundreds of Thousands of Queries/Sec

Tends of Thousands of Updates/Sec

Traverse Tens of Millions of Rows/Sec

Comfortably Handle Several TB Database size

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Lets Do Some Math

100.000 QPS

10 Queries per User Interaction

10.000 User Interactions/sec

864.000.000 User Interactions/Day

30 User Interactions/User Avg

28.000.000 Daily Active Users Possible

15M of Daily Active Users counting time of day skew

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Is it Enough ?

More than Enough for Small-Medium Size Applications

Not enough for next Uber or Facebook

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Additional Worries

Single Thread Query Execution means no scalability for complicated queries

Huge instances are painful especially in the age of Cloud, Containers, Kubernetes

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Solution

Sharding – Splitting the data across multiple instances by some criteria

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Approach to Sharding

Manual Sharding

- Application manually places data in right location

Automatic Sharding

- Sharding implemented on database engine level

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Sharding Pains

Manual Sharding

- Increases Application Complexity
- Reduces Development Velocity

Automated Sharding

- More Complicated Database Engine
- Danger of relying on Magic

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Sharding Problems to Consider

- Picking Right Sharding Key
- Query Routing
- Cross Shard Query Execution
- Schema Maintenance
- Consistent Backups
- Cluster Scaling and Shard Balancing

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Automating Sharding

Application Level

- Manual Sharding Done Right
- Custom API
- Pain for smaller group of backend Developers

Proxy

- Use Existing MySQL backend
- Easy Compatibility for Routed Queries
- Hard to handle distributed queries optimally

Custom Distributed Engine

- Can be designed to solve all the Sharding problems
- Compatibility with MySQL is harder

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Examples for MySQL

Application Level	• Hibernate Shards
Proxy	• ProxySQL • Vitess
Custom Engine	• TiDB

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Beyond MySQL

Have been moving certain workloads off MySQL

- Analytical Workloads to Spark, Hadoop, ClickHouse, RedShift
- Full Text Search workloads to Elastic and Solr
- Document and Key Value Workloads to MongoDB and Cassandra

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Polyglot Persistence

Great

- Allows to use the best tool for the job

Not So Great

- Increases complexity in development and operations

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TiDB

Allow to horizontally scale MySQL workloads and limit technology sprawl

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Thank You!

How to horizontally scale MySQL with TiDB while avoiding sharding issues

May 2019

Morgan Tocker, PingCAP (@morgo)

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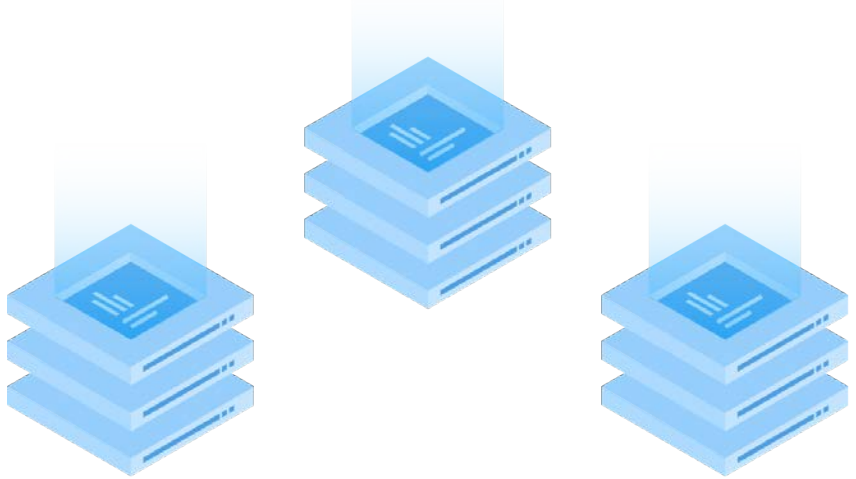


Agenda

- **History and Community**
- Technical Walkthrough
- Use Cases
- MySQL Compatibility
- Benchmarks

PingCAP TiDB

History and Community

Founded in 2015 in China

Ti = Titanium

Apache 2.0 Licensed

Storage layer (TiKV) a CNCF project since 2018

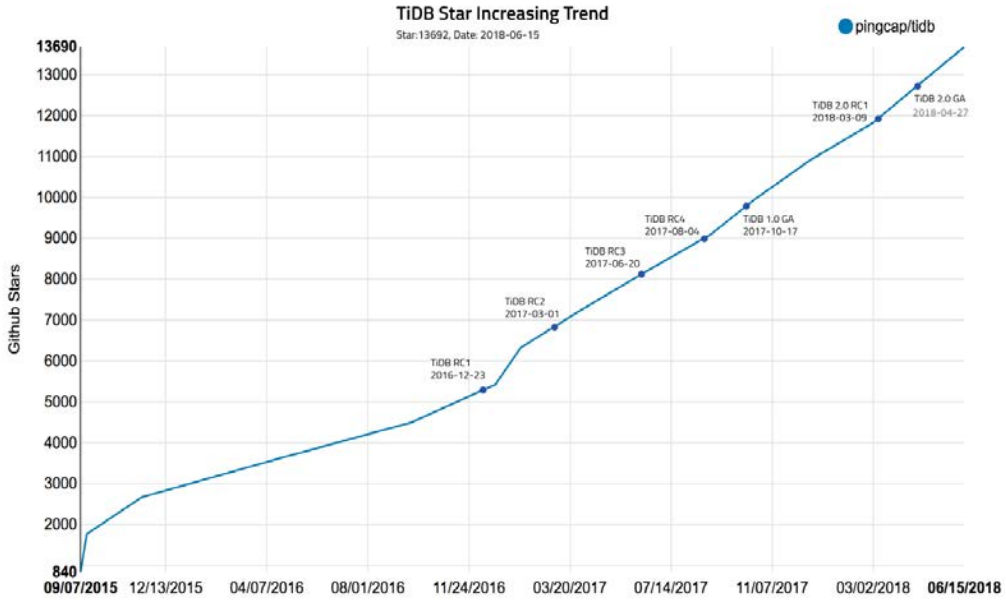
US Office since 2018

Quick Numbers:

700+ Annual Conference Attendees

300+ Production Deployments

250+ GitHub Contributors (the TiDB server alone)



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Introduction

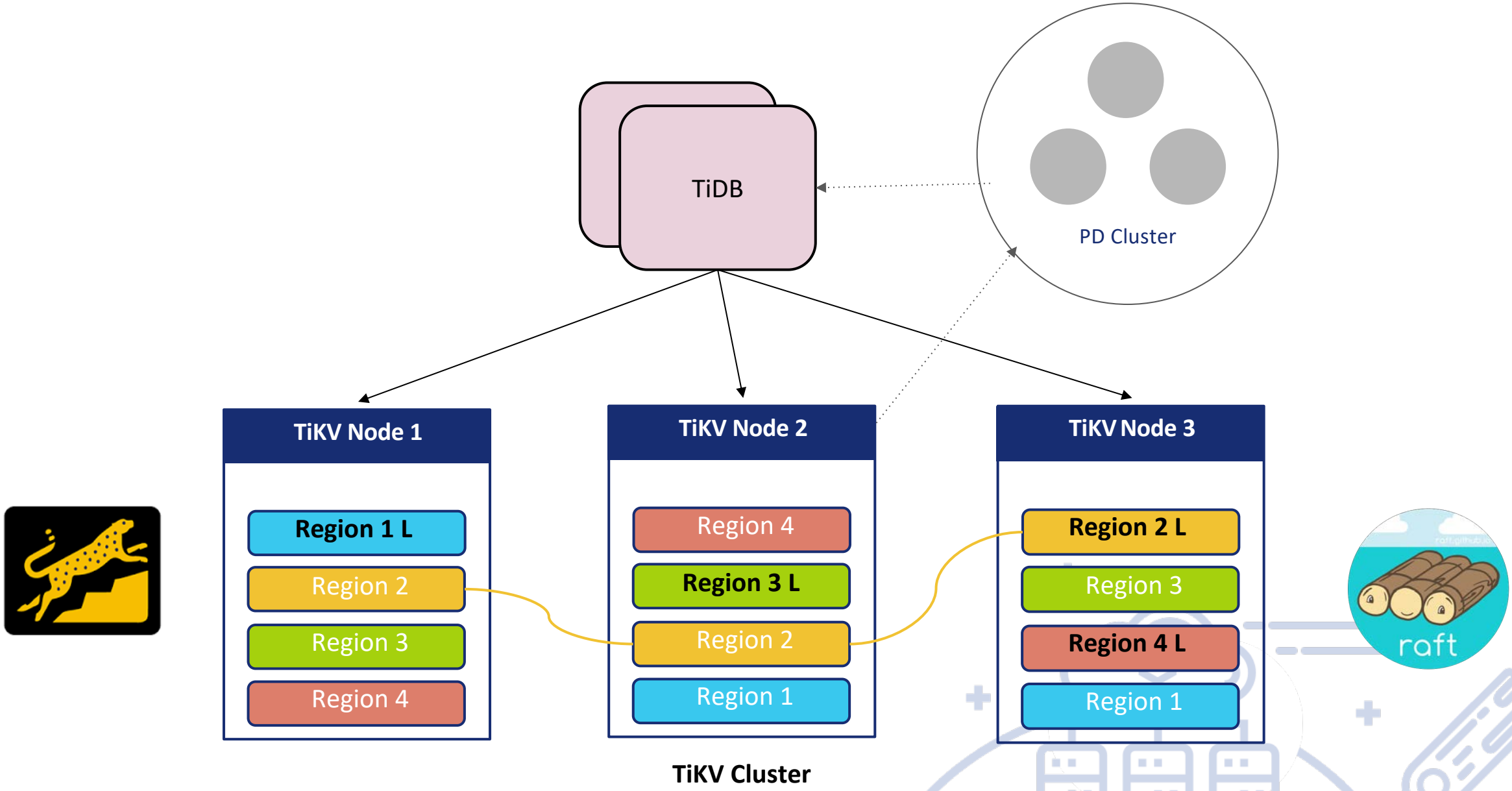
TiDB is a distributed database that speaks the MySQL protocol

- It is **not** based on the MySQL source code
- It **is** an ACID/strongly consistent database
- The inspiration is **Google Spanner/F1**

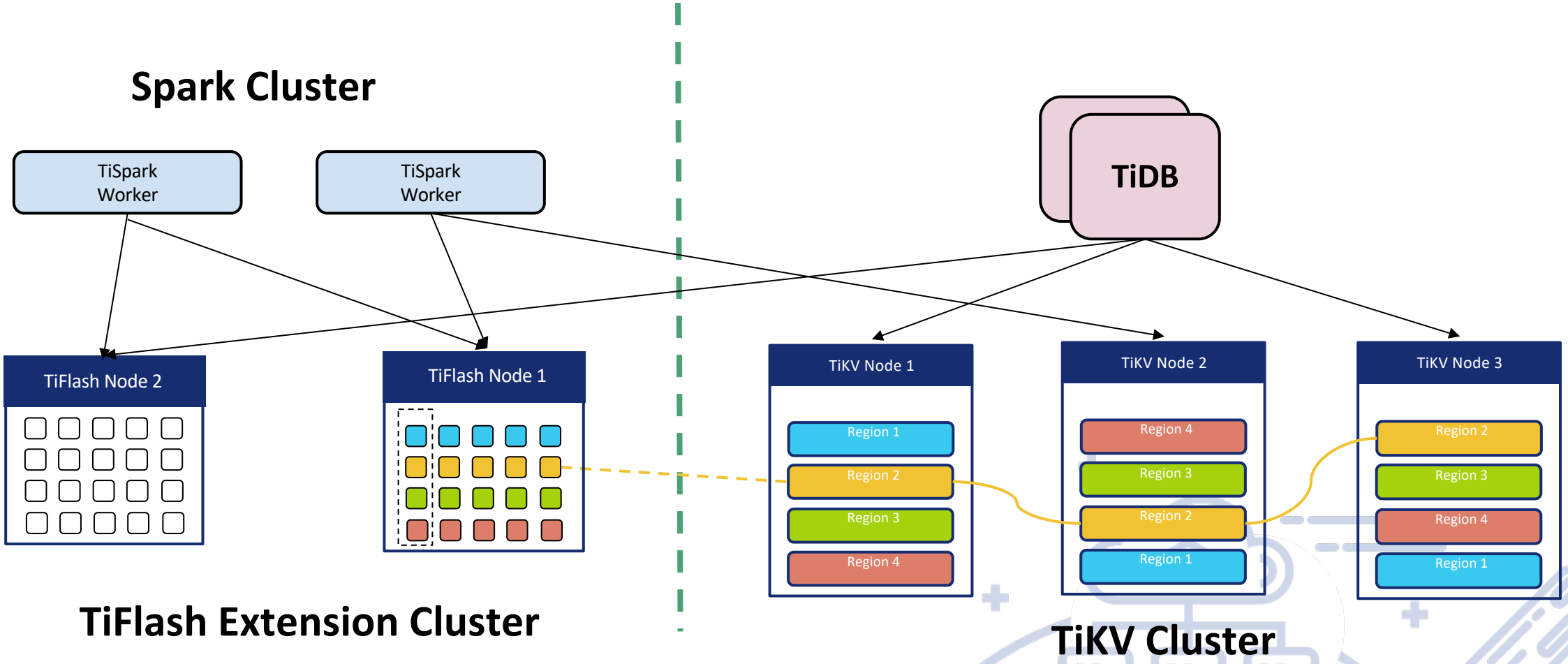
It **separates** SQL processing and Storage into separate components

- Both of them are **independently scalable**
  - The SQL processing layer is stateless

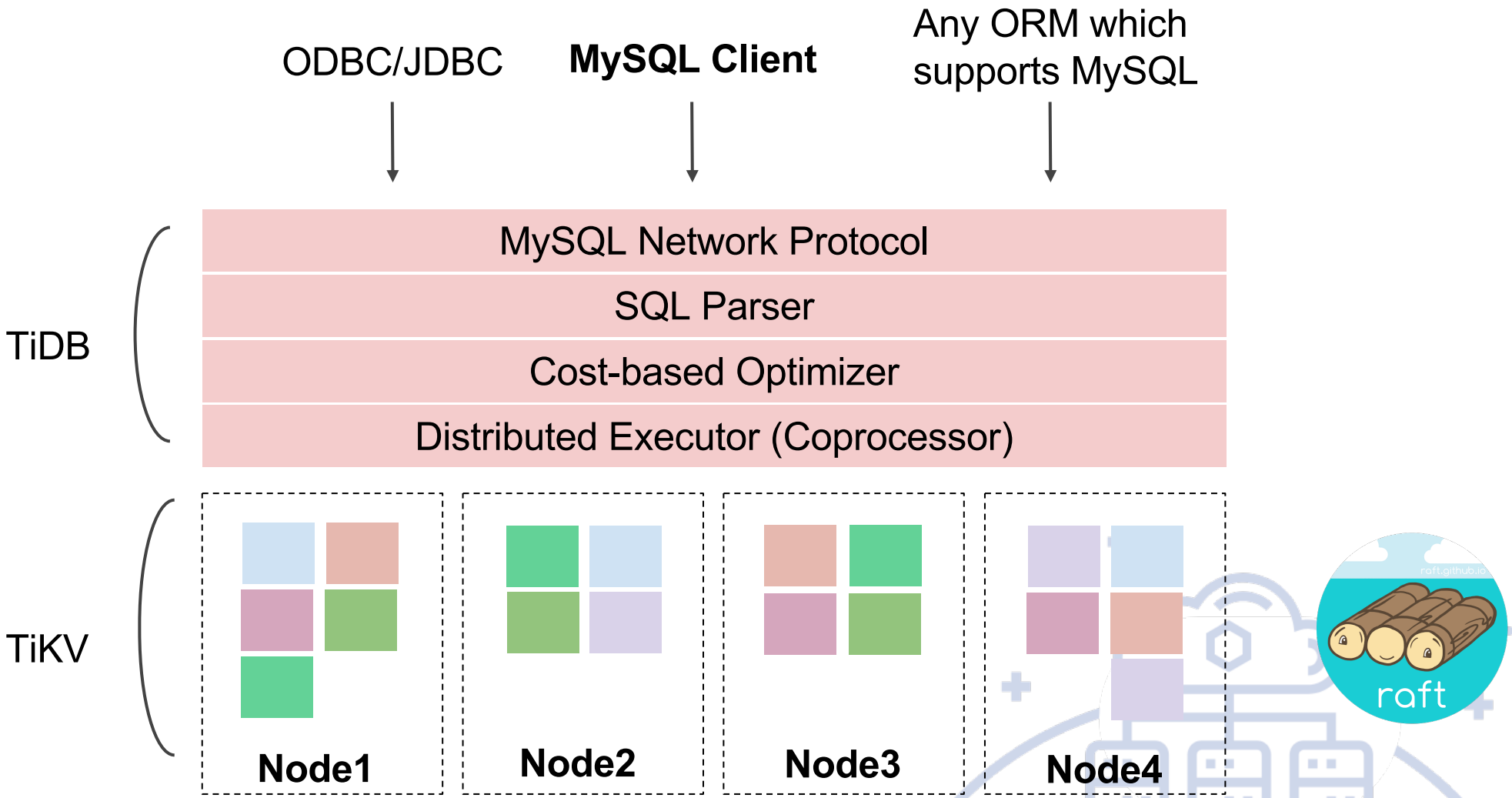
It is designed for both Transaction and Analytical Processing (HTAP)


TiDB
PD Cluster
TiKV Node 1
Region 1 L
Region 2
Region 3
Region 4
TiKV Node 2
Region 4
Region 3 L
Region 2
Region 1
TiKV Node 3
Region 2 L
Region 3
Region 4 L
Region 1
raft
TiKV Cluster

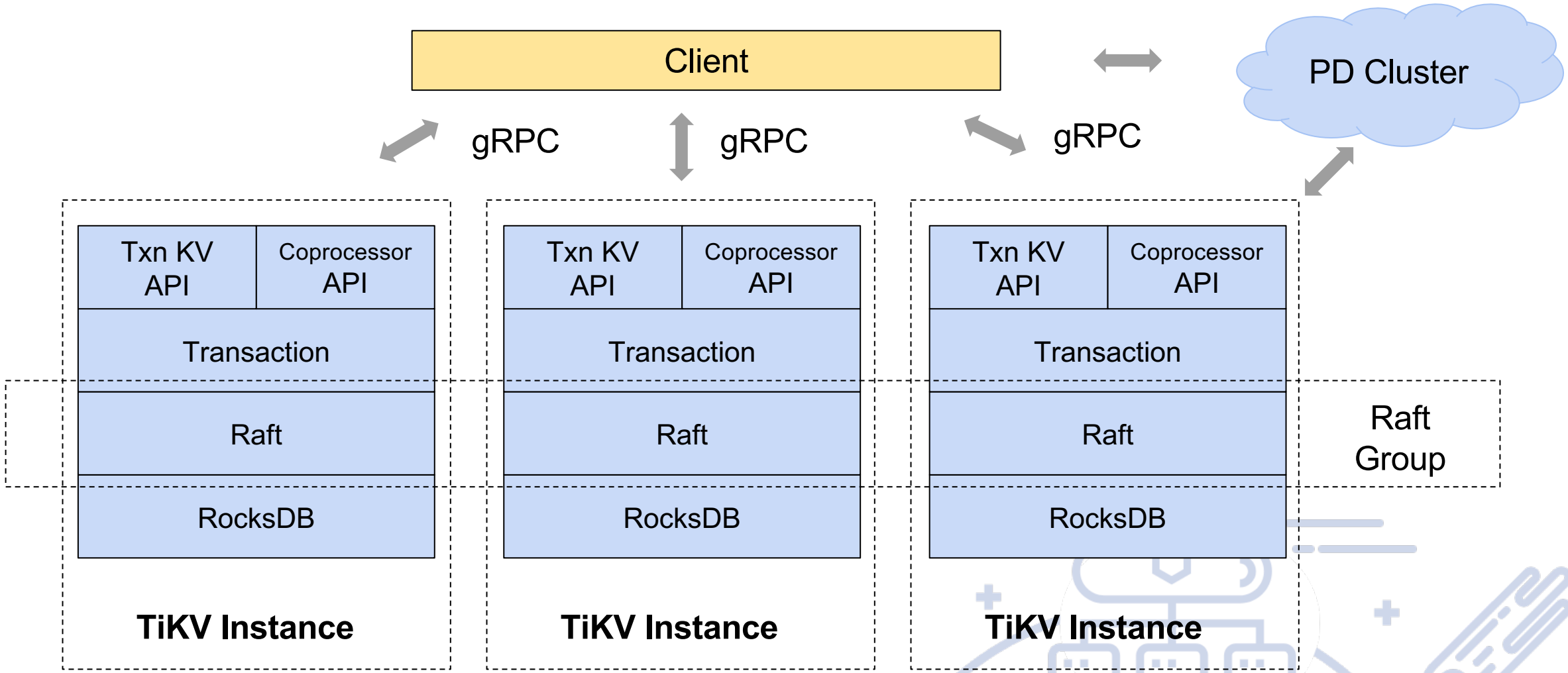
Row + Column Storage (Announced Jan 2019)



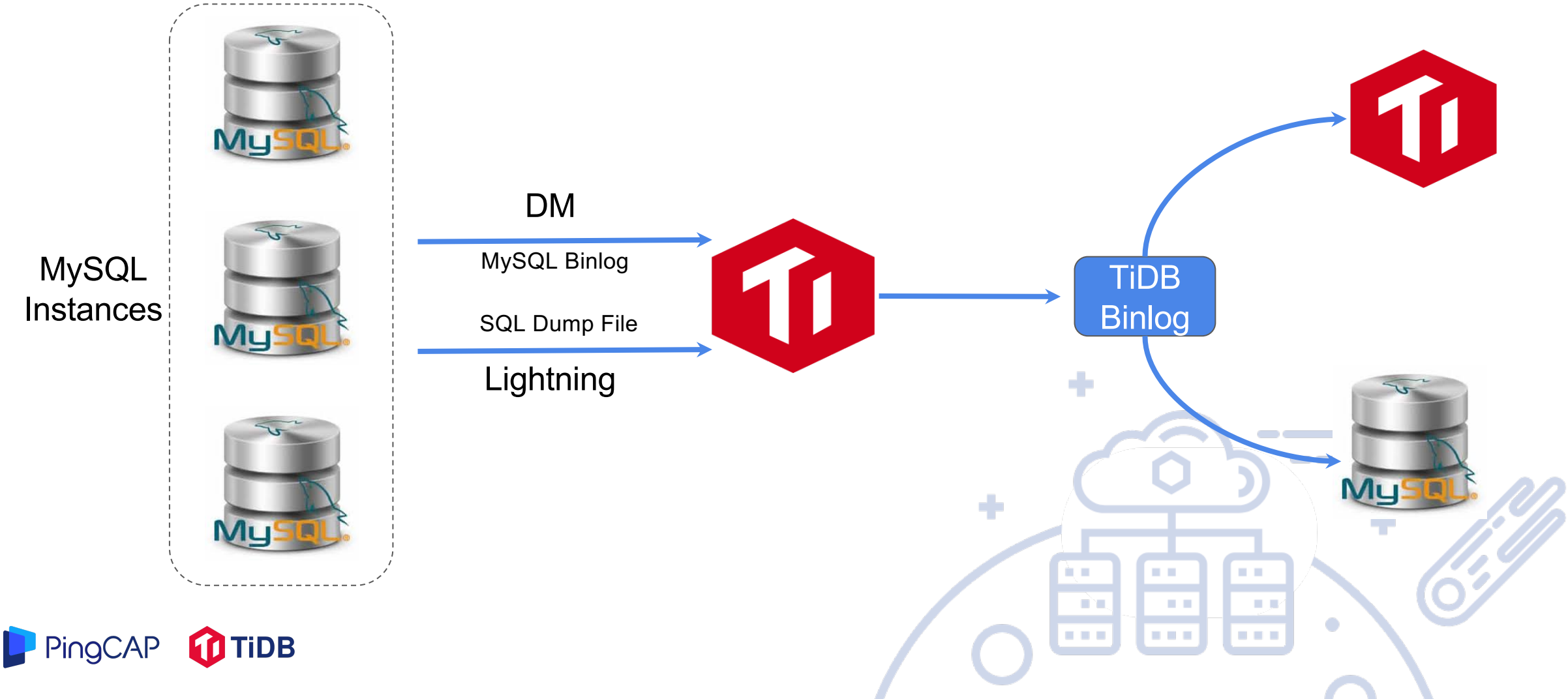
TiDB: The SQL Layer



TiKV: The Storage Foundation



Migration (in and out of TiDB)



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Use Cases

1. **Approaching the maximum size for MySQL** on a single server. Debating whether or not to shard.
2. **Already sharded MySQL**, but having a hard time doing analytics on up-to-date data.

Mobike + TiDB

- 200 million users
- 200 cities
- 9 million smart bikes
- **~30 TB / day**

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Agenda

- History and Community
- Technical Walkthrough
- Use Cases
- **MySQL Compatibility**
- Benchmarks

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pingcap.com
/docs/sql/mysql-compatibility/

Summary

- **Compatibility with MySQL 5.7:**
  - Joins, subqueries, DML, DDL etc.
  - All SQL Modes
- **On the 3.0 roadmap:**
  - Views, Window Functions
- **Not Planned:**
  - Stored Procedures, Triggers, Events, Fulltext

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Nuanced

- Some features work differently
  - Auto Increment
  - Optimistic Locking
- TiDB works better with smaller transactions
  - Recommended to batch updates, deletes, inserts to 5000 rows

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Tools

- Mydumper, ProxySQL **work**
  - We maintain a branch of mydumper
  - We are looking to push upstream
- Innotop.. **won't work**
- MySQL Workbench works!

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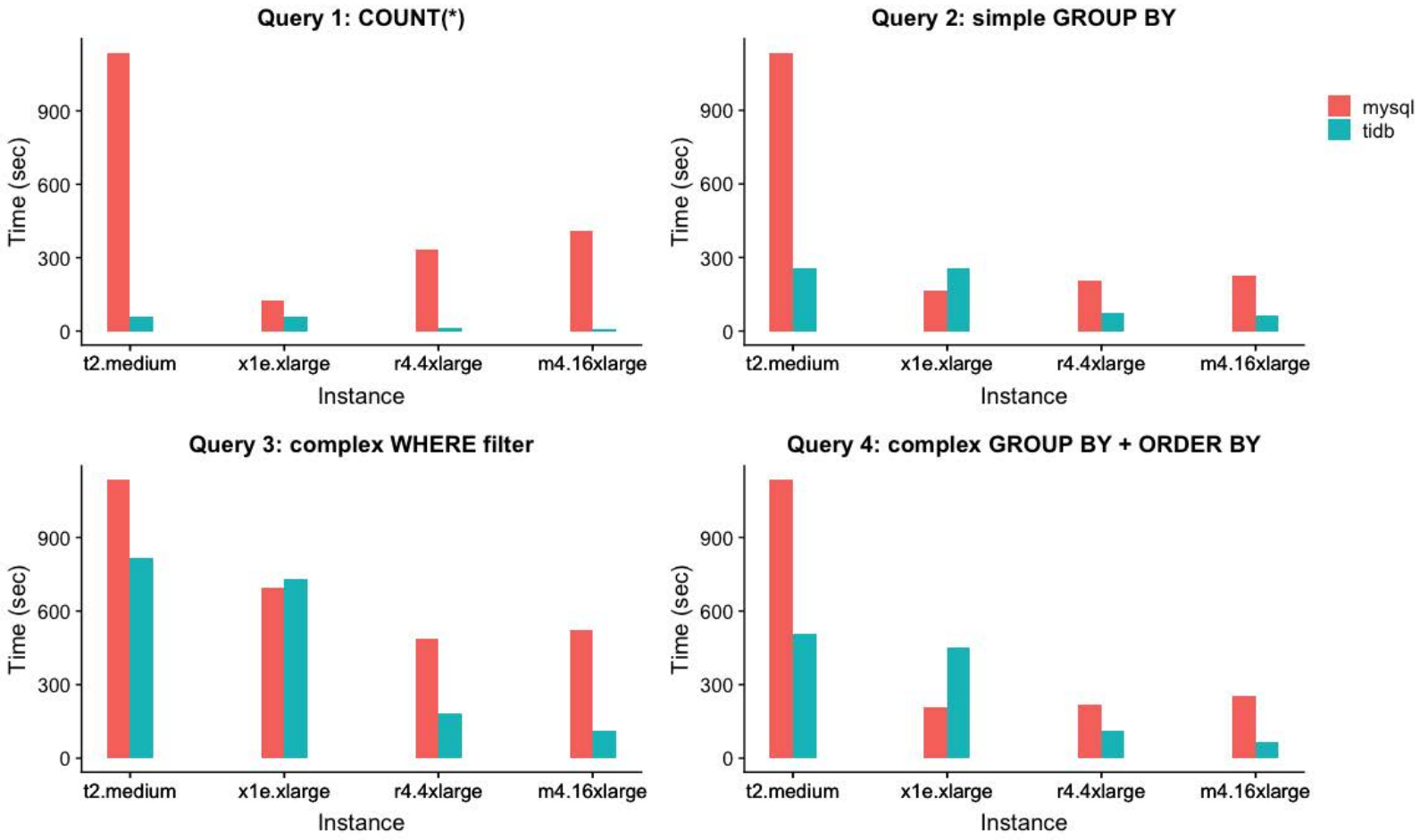
- **Benchmarks**

Benchmarks (TiDB 2.1)

Thank you Alexander Rubin!



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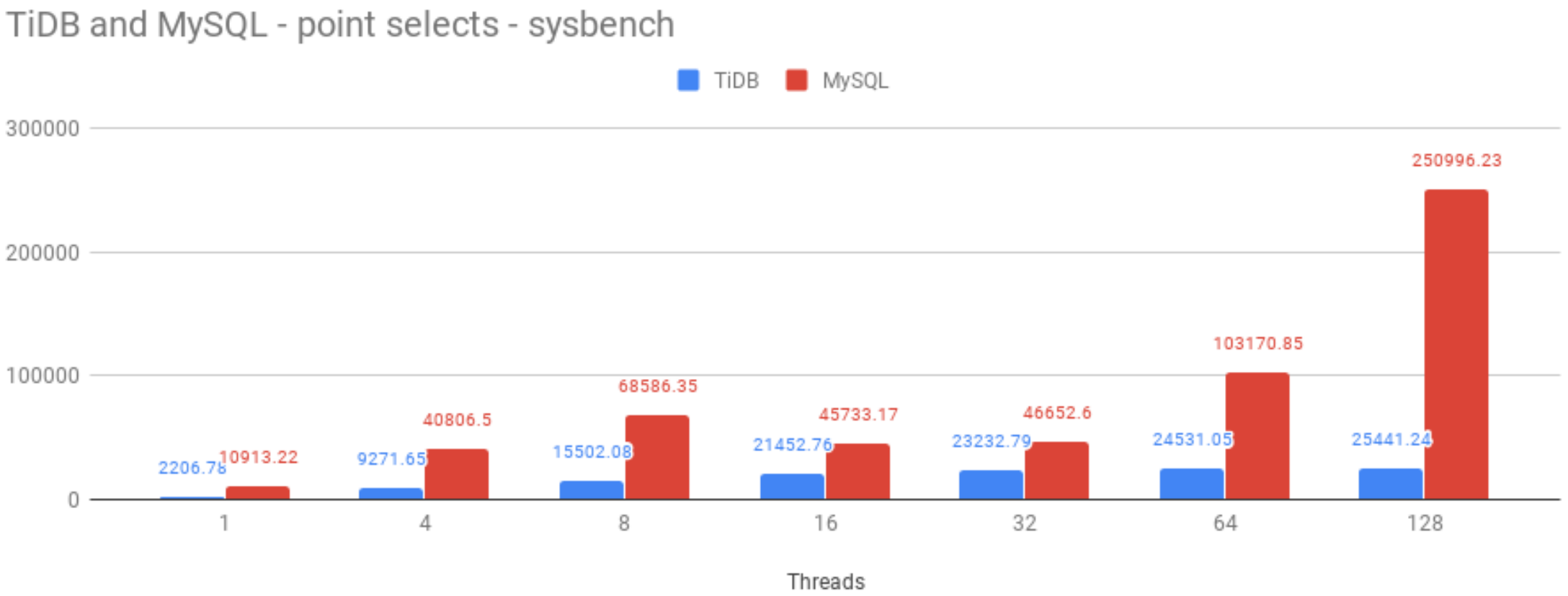

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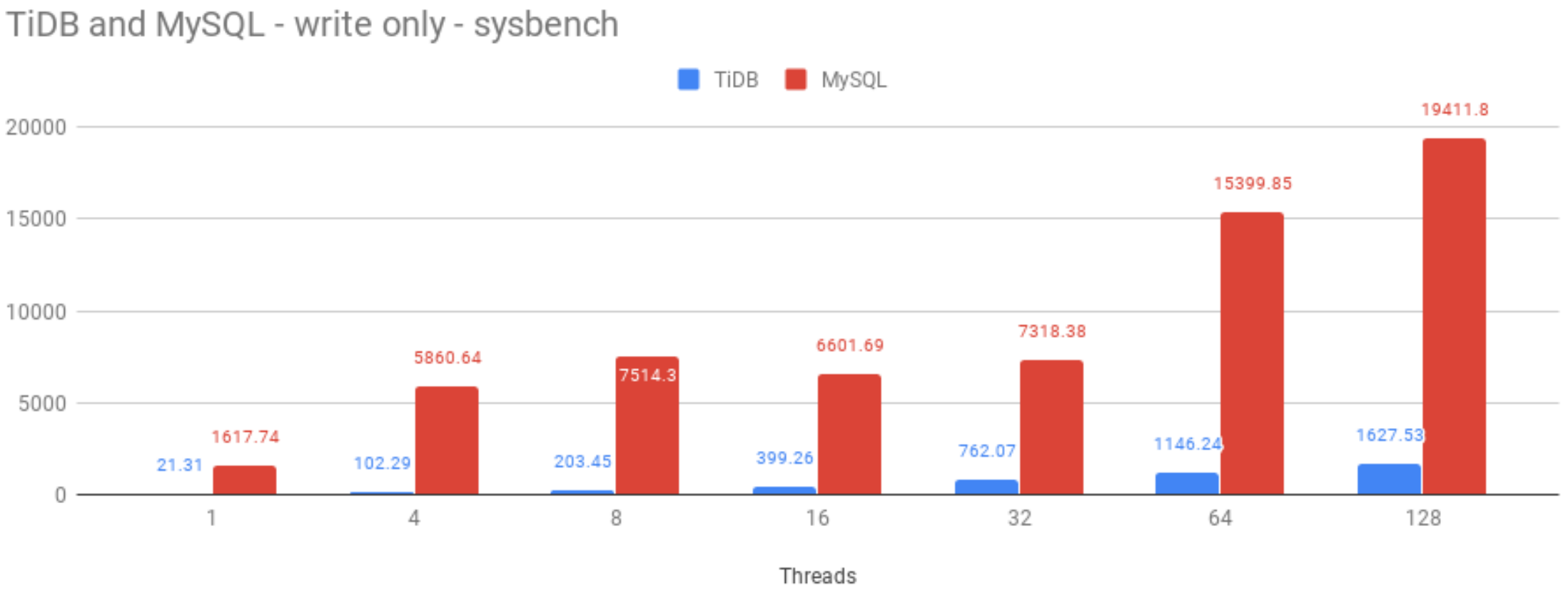

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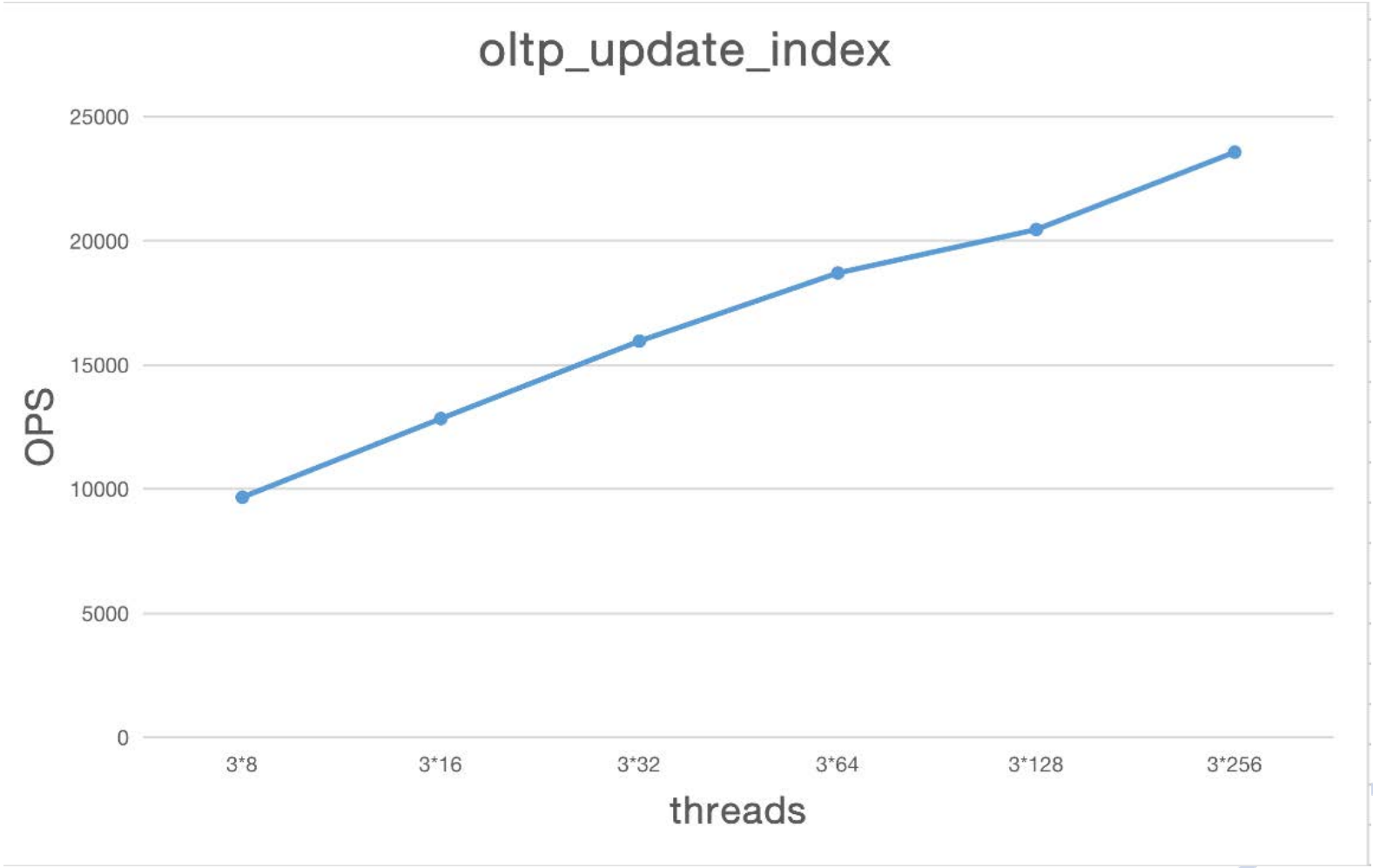
Benchmarks (3.0 Alpha)

February 2019, Internal Test



Same Benchmark

Different Test Conditions:
3 node cluster
Each node with 1 TiDB + 1 TiKV
Load balanced by HA Proxy
Higher thread counts

Different hardware:
Original = m4.16xlarge (64 CPU cores)
This Test = 40 vCPUs XEON E5-2630 v4 @ 2.20GHz

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https://github.com/pingcap/docs/blob/master/benchmark/sysbench-v4.md

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Thank you!

Full Day TiDB Track!