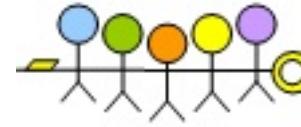
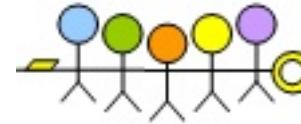


TiDB 原理与实战

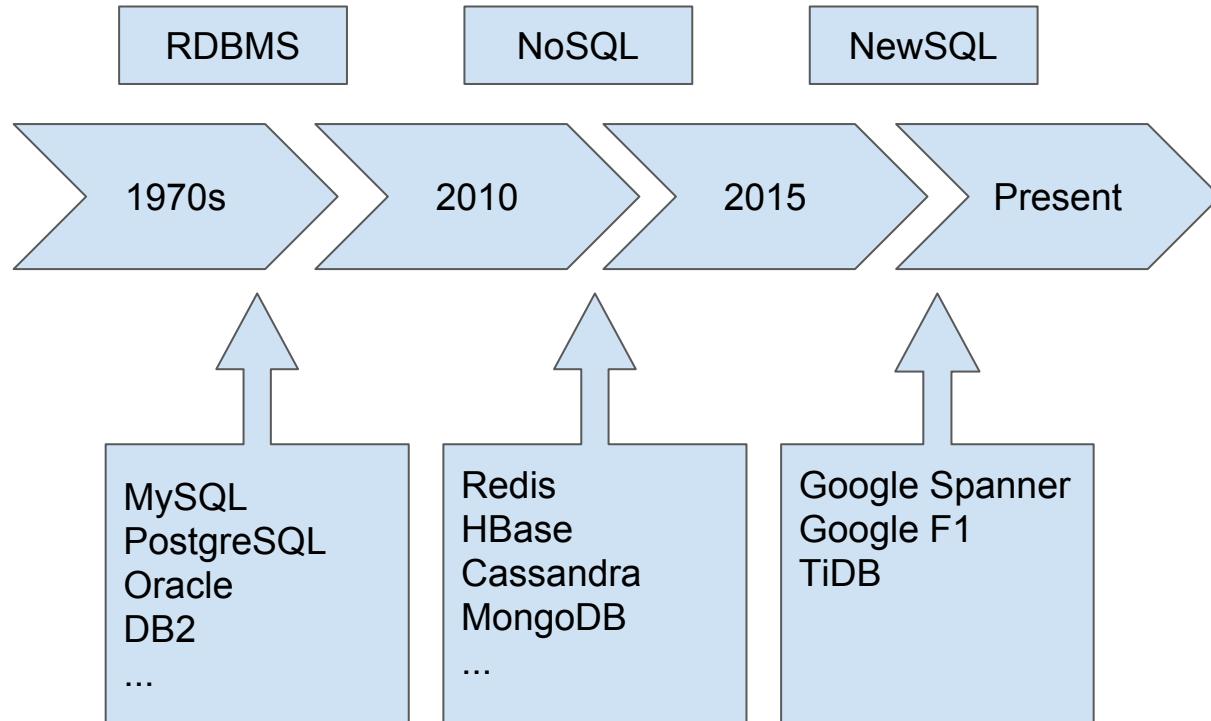


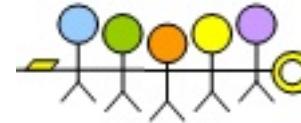
Agenda

- A brief introduction of NewSQL
- TiDB
- Plan optimization
- Dist SQL
- Online DDL
- TiKV
- Feelings
- Q & A

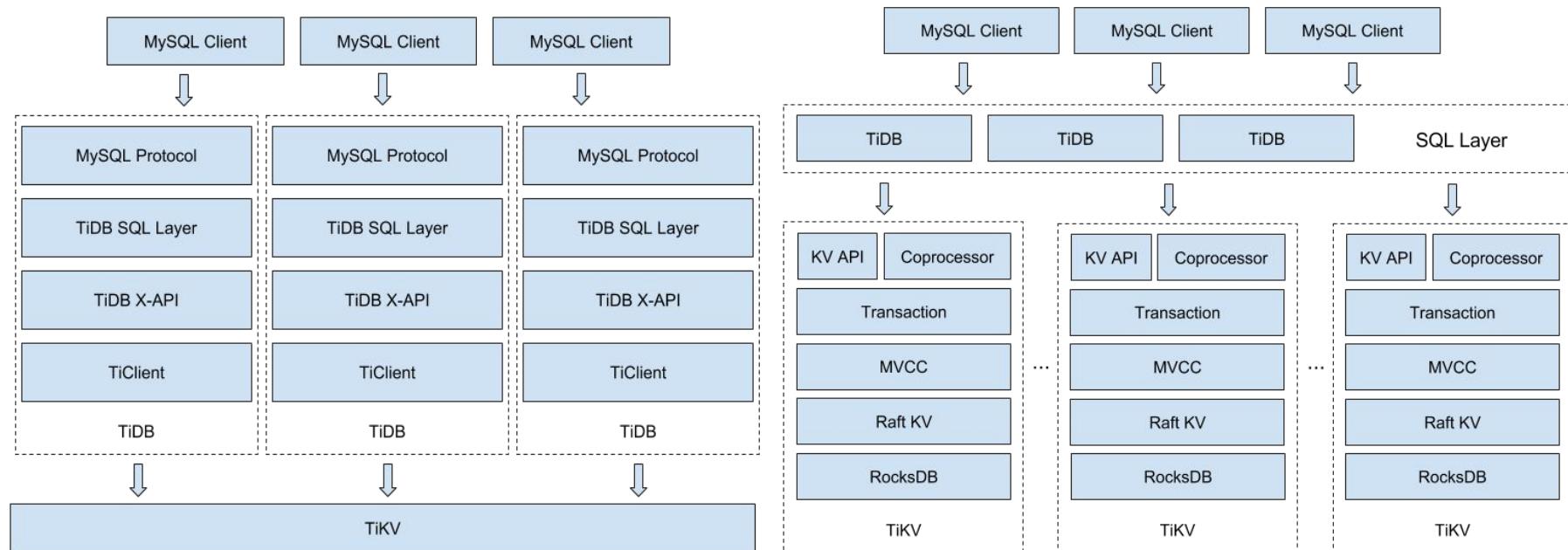


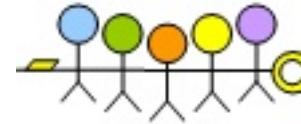
A brief introduction of NewSQL





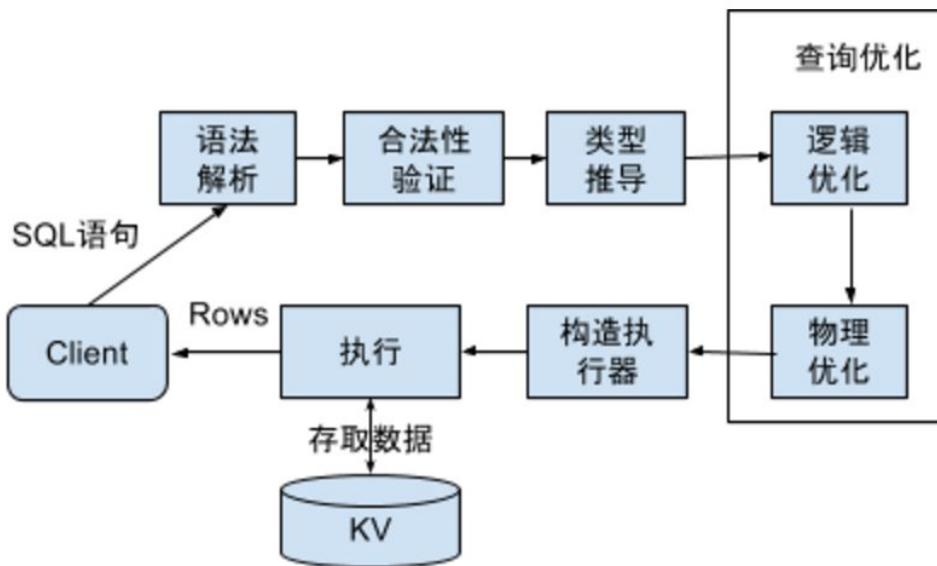
TiDB and TiKV





TiDB

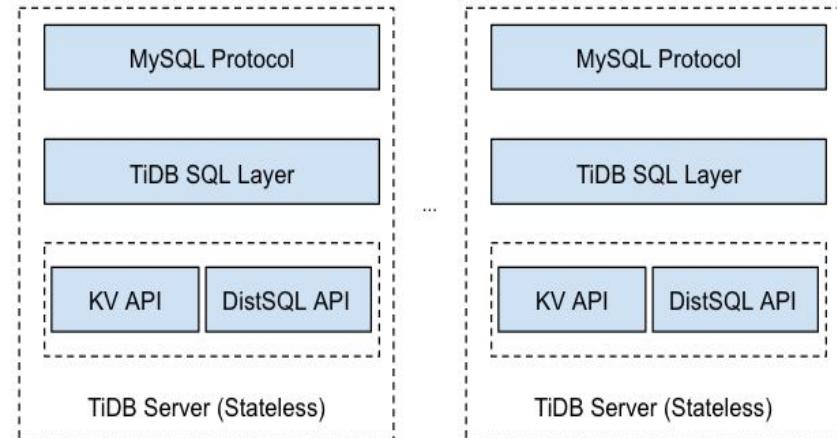
执行流程:

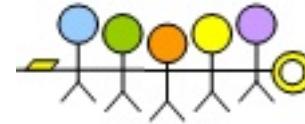


TiDB

支持 MySQL 协议

- 用户从 MySQL 的相关解决方案迁移过来时几乎没迁移成本。
- 目前还有少量函数或功能未实现





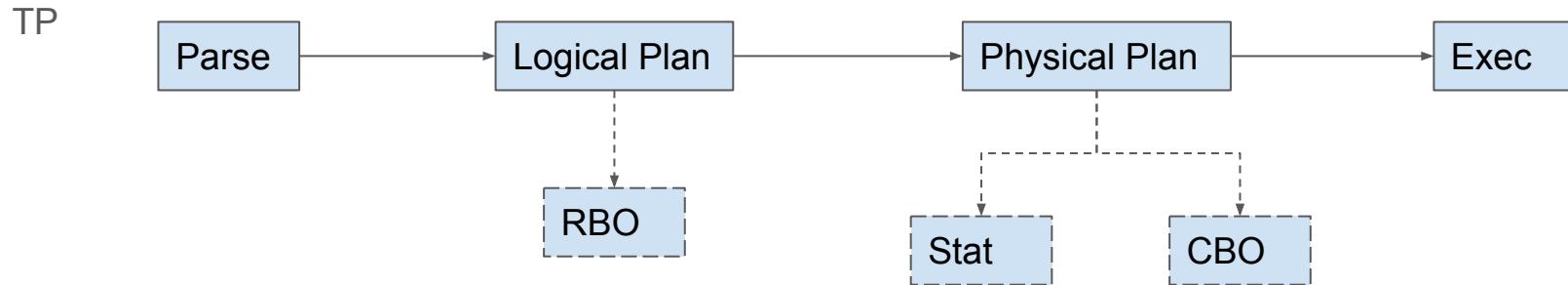
Plan optimization

逻辑优化

- 主要依据关系代数的等价交换做一些逻辑变换

物理优化

- 主要依据数据读取、表连接方式、表连接顺序、排序等技术对查询进行优化。



Plan optimization

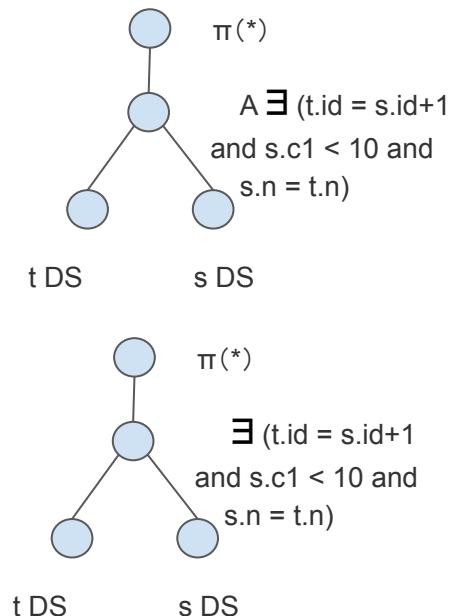
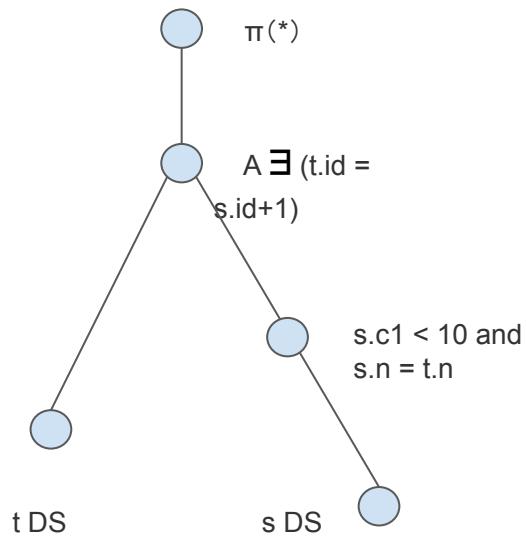
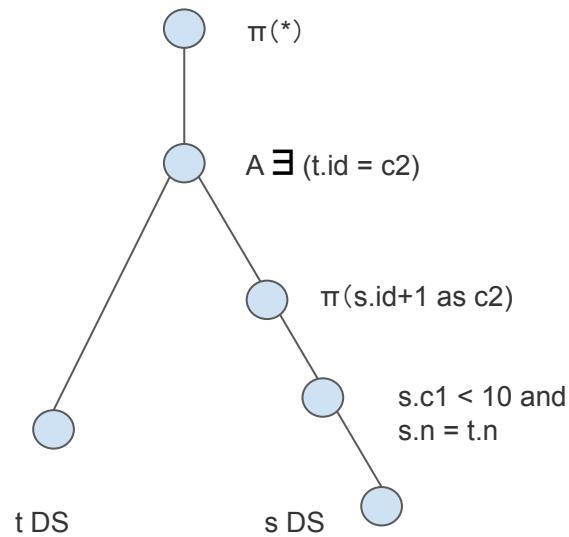
Logical plan

- Prune column
 - $\text{select } * \text{ from } s \text{ where } 0 = (\text{select count(*) from } t \text{ group by } s.id) \rightarrow \text{select } * \text{ from } s \text{ where } 0 = (\text{select count(*) from } t \text{ group by } 1)$
- Decorrelation
- Predicate push down
- Eliminate aggregation
 - $\text{select min(b) from } t \text{ group by id} \rightarrow \text{select b from } t$ id is unique index
 - $\text{select count(*) from } t \text{ group by id} \rightarrow \text{select 1 from } t$ id is unique index
- Aggregation push down

Plan optimization

Decorrelation

`select * from t where t.id in (select id+1 as c2 from s where s.c1 < 10 and s.n = t.n)`

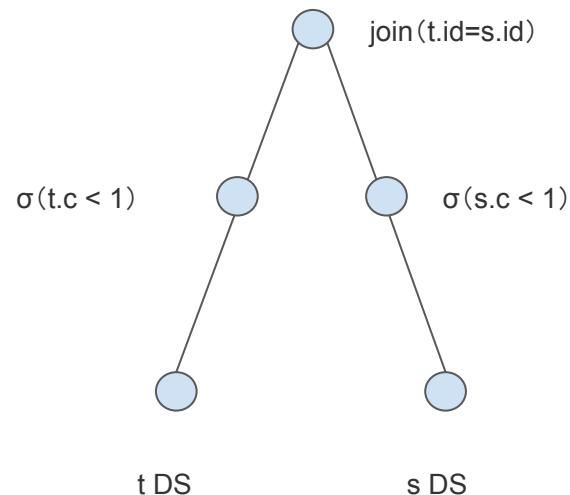
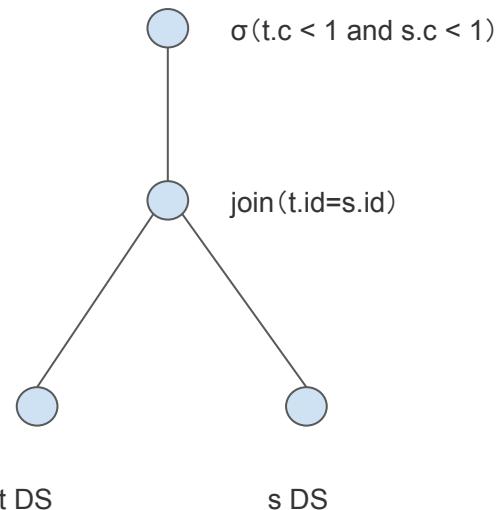


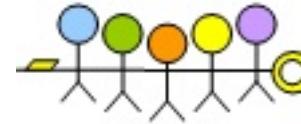
Plan optimization

Predicate push down

select * from t join s on t.id = s.id where t.c < 1 and s.c < 1

如若改成 left out join 则只能下推 $\sigma(t.c < 1)$

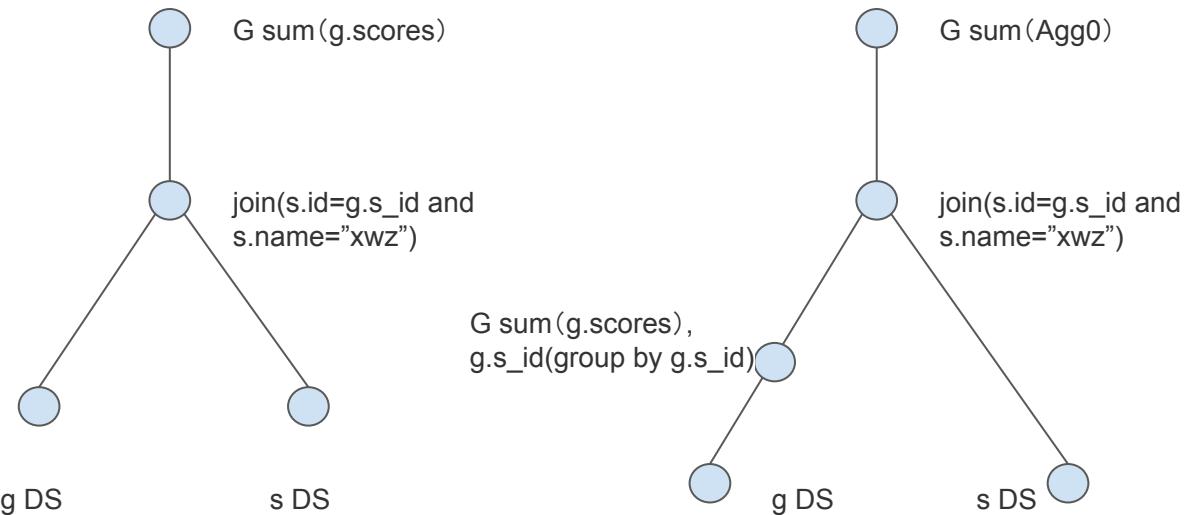


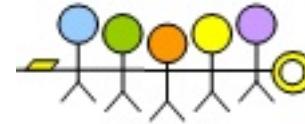


Plan optimization

Aggregation push down

```
select sum(grade.scores) from stu join grade on stu.id = grade.stu_id and stu.name="xwz"
```





Plan optimization

Physical plan

- Statistics, 例子: select * from t where c1 < 10 and c2 < 10 (c1 is PK, c2 is index)

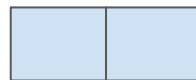
等深直方图, bucket count 128-256

bucket size: 1



12 89 120 200

...



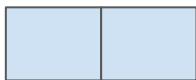
809 990 999

bucket size: 2



12 120 200 280

...



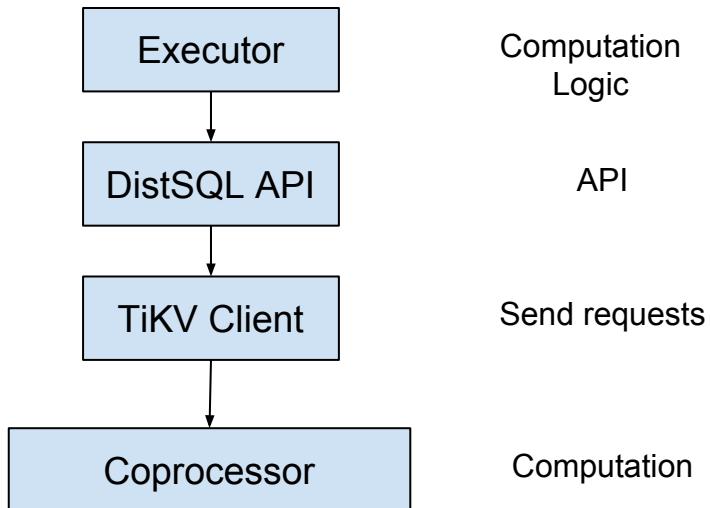
789 809 999

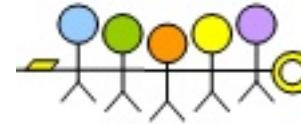


Dist SQL

分布式计算

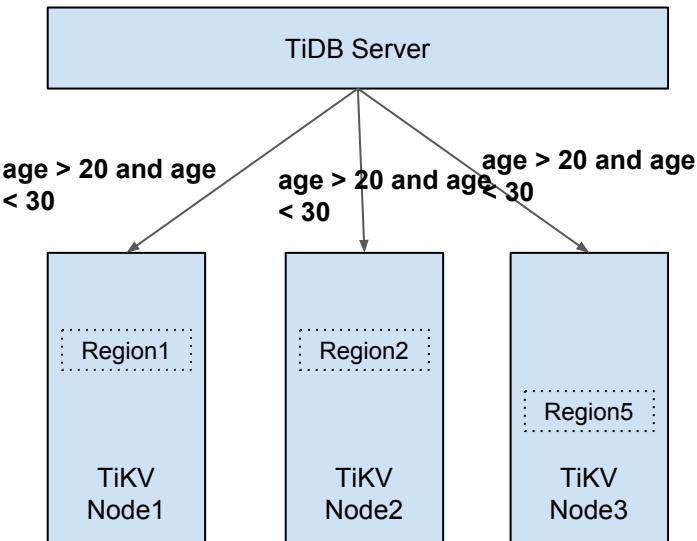
- 减少计算成本
- 减少网络开销

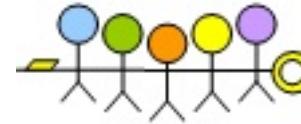




Dist SQL

- select * from t where age > 20 and age < 30;
- select count(id) from t where age > 20 and age < 30;
- select * from t order by age limit 10;

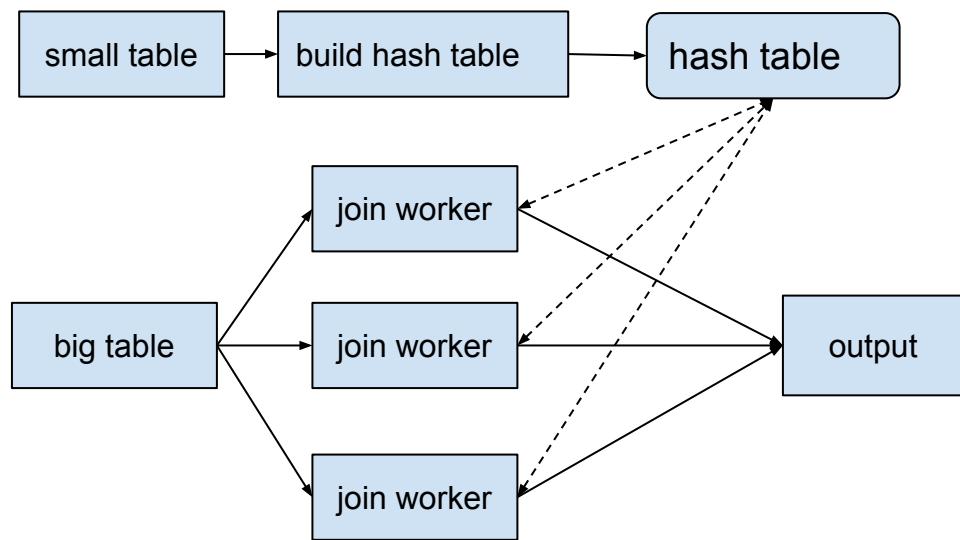




Hash join

并行优化, 支持 hash join

- 小表放到内存, 等值 key 建立哈希表
- 大表是用 goroutine 分批取值, 匹配哈希表
- 之后会支持 merge sort join 等常用算法



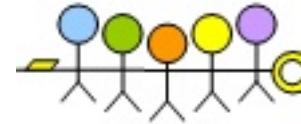
Online DDL

现状, 锁表(有些数据支持读操作, 但是也以消耗大量内存为代价)

- 架构师们在设计整个系统的时候都会很慎重的考虑表结构
- DBA 在做此类操作前要做足准备

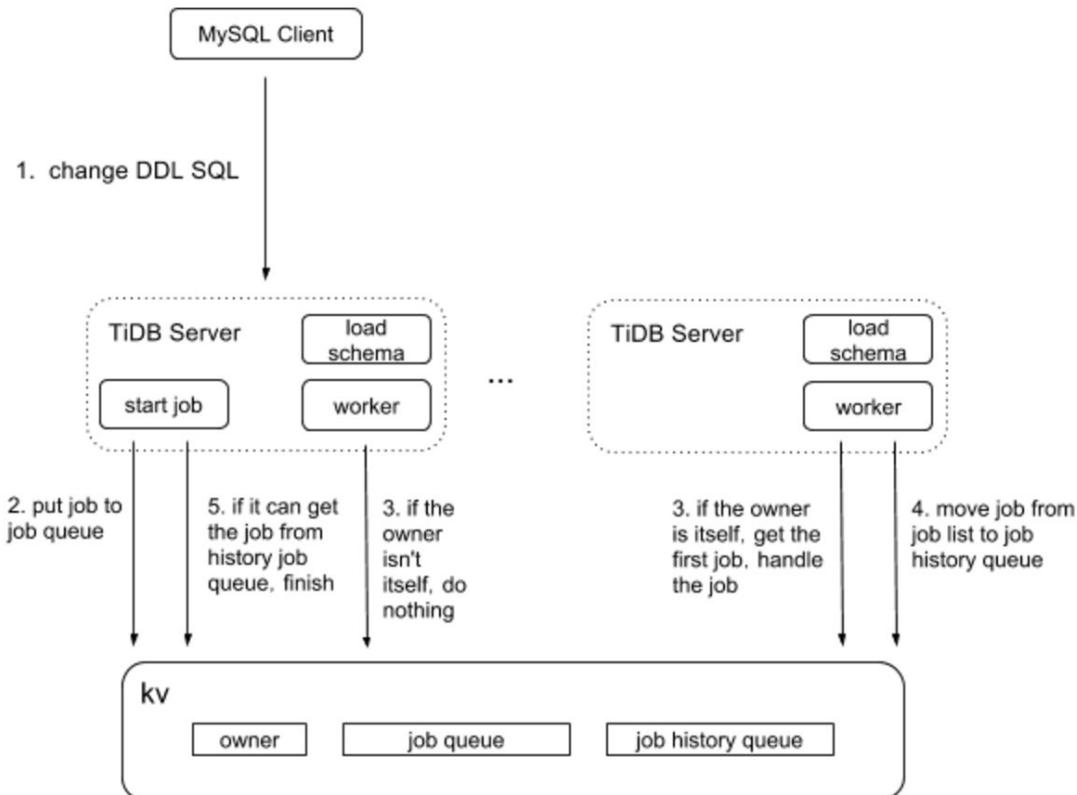
TiDB解决方案, 参考 Google 动态变更 schema 的论文

absent --> delete only --> write only -- reorg --> public



Online DDL

- 一般 DDL 实现
- 特殊 DDL 实现
 - drop table/database



Online DDL

Add index 优化

同时并发地处理 defaultBatches(16) 个任务. 每个任务分别处理一个 handle 区间的 index 记录. 虽然每个 handle 区间的长度可控, 但是这个区间的 handle 值不可预计(handle 虽然是递增的, 但是里面的记录可能被删除过), 所以需要串行地获取 handle 区间. 即真正的并发处理需要在获取完 handle 区间之后执行.

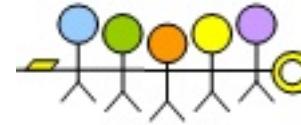
Add column 优化

1. The default value is nil and the not nul flag is false
2. The default value isn't nil

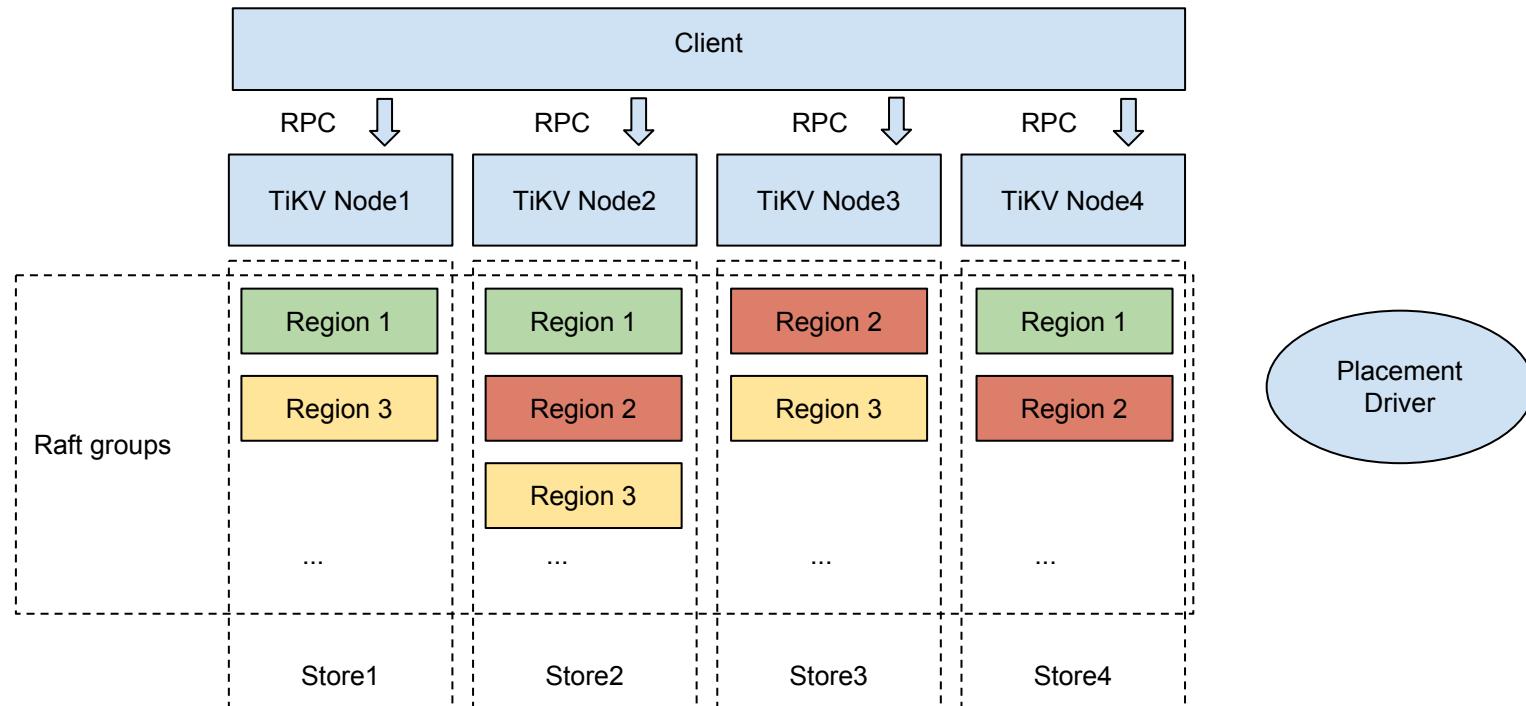
TiDB

通过 TiKV 支持的特性：

- 分布式事务
 - 2PC(二阶段提交), 参考 Google percolator 的论文
 - MVCC
 - 隔离级别 (SI + 乐观锁)
 - 引擎 RocksDB
- 水平扩容/缩容
 - raft 协议 + PlacementDriver
- 容错



TiKV



Feelings

- 代码风格
 - 对于原先的我更多的是代码命名方面的问题，一步一步的修改
 - 参照 Go 源码或者 GitHub 上一些知名项目
 - 注释有时候是必要
- 测试
- 在这个团队里，让我的感受是没有挺好，你可以更好

Q & A

- 项目地址
- TiDB: <http://github.com/pingcap/tidb> (7000+ stars)
- TiKV: <https://github.com/pingcap/tikv> (1600+ stars)