How to analyze trillions data with ClickHouse

虎牙信息 HUYA
李本旺 sundy-li
Github: http://github.com/sundy-li
Mail: libenw1992@gmail.com

APM

覆盖全公司上报数据

- 主播端 带宽，卡顿，PCU
- 客户端 卡顿，API 请求，信令通道
- TAF 调用
- 基础监控 Open-Falcon
- CDN,P2P,UDB …

3000亿 +
日均增量

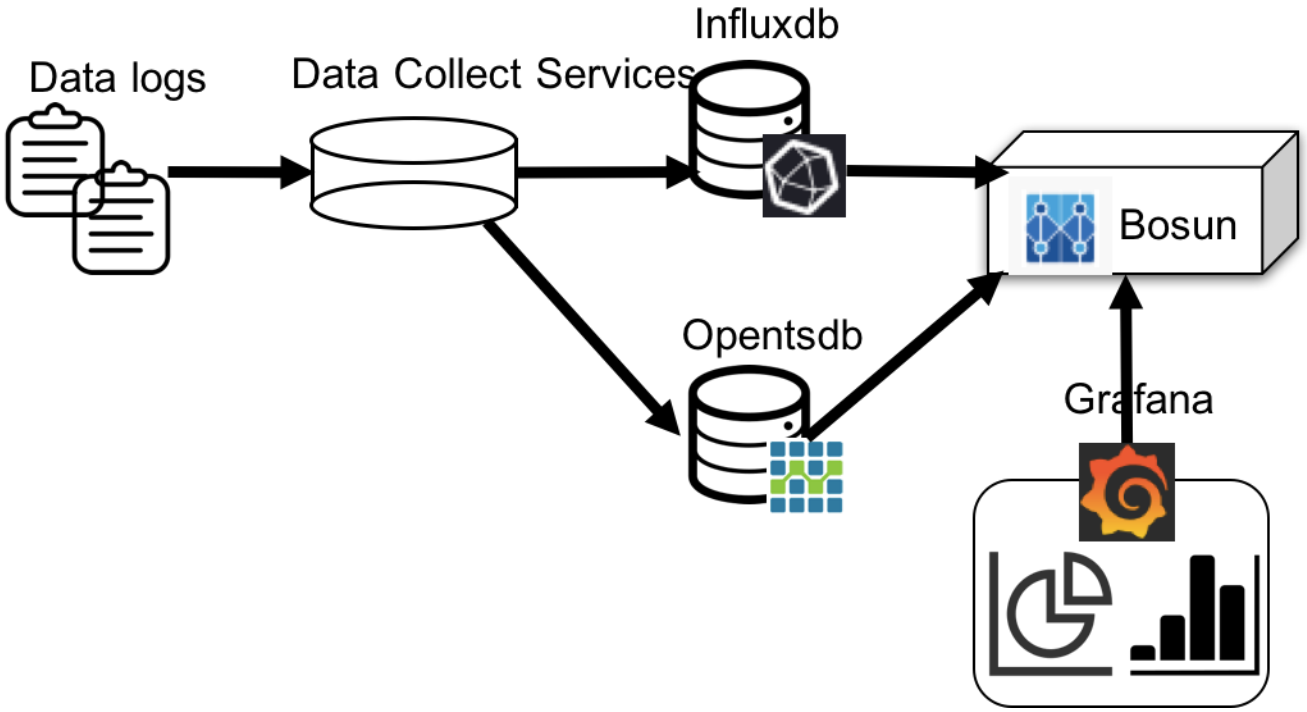
400+
业务指标

实时监控
秒级响应

500w +
每秒新增

3个集群，近百节点部署
覆盖海内外服务

Previous architecture



Features:

- Real-time pre-calculation
- Opentsdb Seriously dependent on hbase
- Opentsdb poor aggregation ability
- Influxdb is not clustered
- Not friendly with OLAP
- Poor performance
- Not flexible
- …

Why ClickHouse

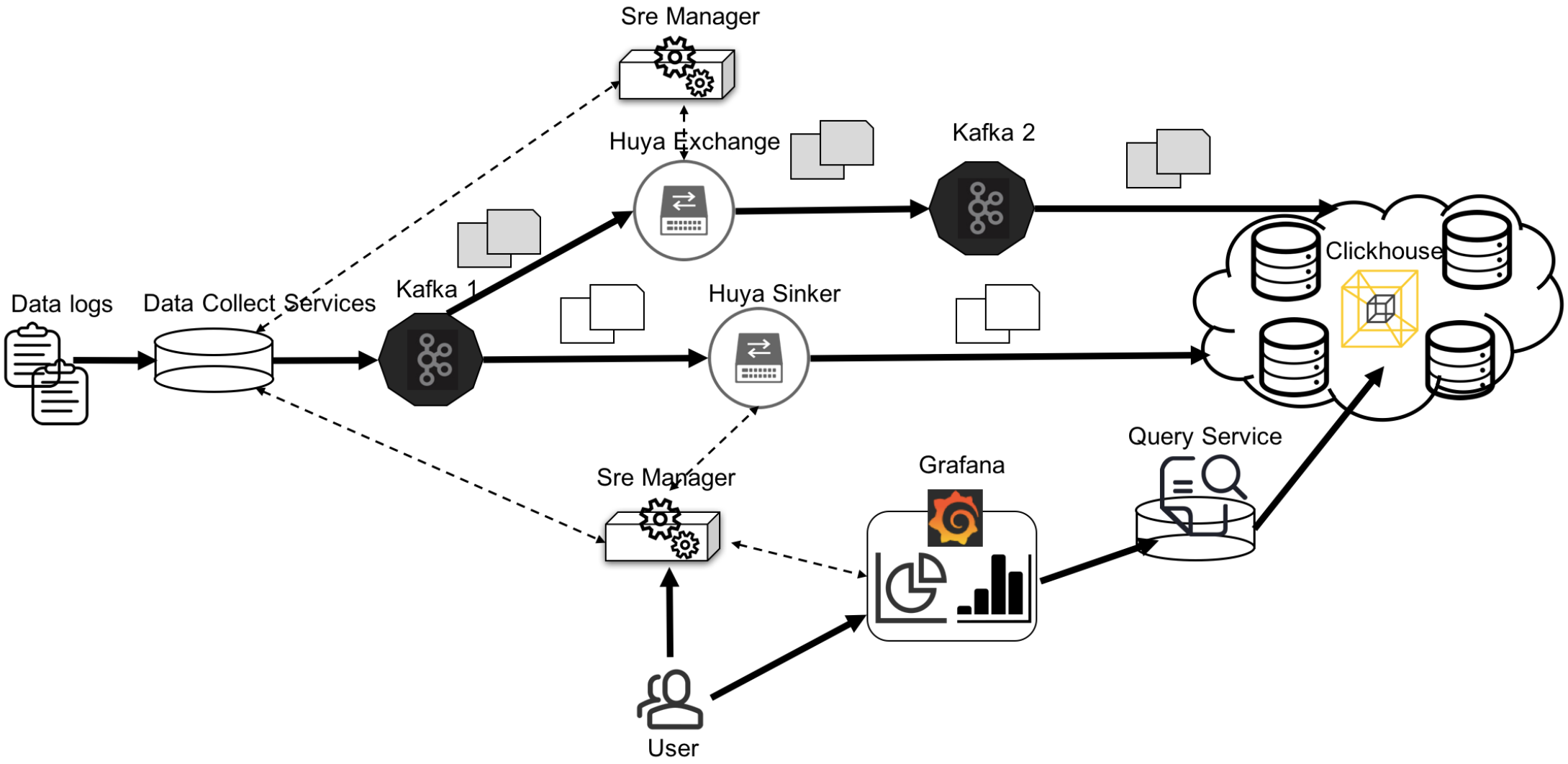
- Column Oriented
- Super Fast
- OLAP
- SQL supported
- Linearly Scalable
- Simple

ClickHouse as time-series database

Get the average value group by line, interval 20s

```
SELECT
    intDiv(its, 20) * 20 AS _timestamp,
    sum(value) / sum(_cnt) AS `卡比`,
    line AS `线路`
FROM view.[redacted]
WHERE
    (day >= toDate(1540278823)) AND (day <= toDate(1540279123))
AND
    (its >= 1540278823) AND (its <= 1540279123) AND (line IN (1, 3, 5)) AND (platform = 'adr')
GROUP BY
    line,
    _timestamp
ORDER BY _timestamp ASC
LIMIT 50000
FORMAT JSONCompact
```

Current architecture



Best practice start

Realtime ingestion

- Kafka Engine(×)

Not Recommended

```
Kafka SETTINGS
  kafka_broker_list = 'localhost:9092',
  kafka_topic_list = 'topic1,topic2',
  kafka_group_name = 'group1',
  kafka_format = 'JSONEachRow',
  kafka_row_delimiter = '\n'
  kafka_schema = '',
  kafka_num_consumers = 2
```

Because

- Error handling
- Kafka partition && consumer auto-rebalance
- ClickHouse is shared-nothing architecture
- Bad control of data sharding

Realtime ingestion

- How ?

huya_sinker

- Golang implemented
- Auto rebalance, easy to deploy as a container
- Dynamic awareness tables and columns configuration (etcd)
- Batch insert (interval, batch_size)
- Custom parser support

- Message JSON format
- Use Go tcp client, use gjson parser
- Random write Strategy
- On parallel
- High rate 10 Million rows/s

Realtime ingestion

- How to avoid data loss
  - Back pressure
  - Connection auto rebuild
  - Write backup data to backup kafka
  - Alarm monitor
  - …

Realtime ingestion

Write to single shard table or distributed table ?

Single Shard

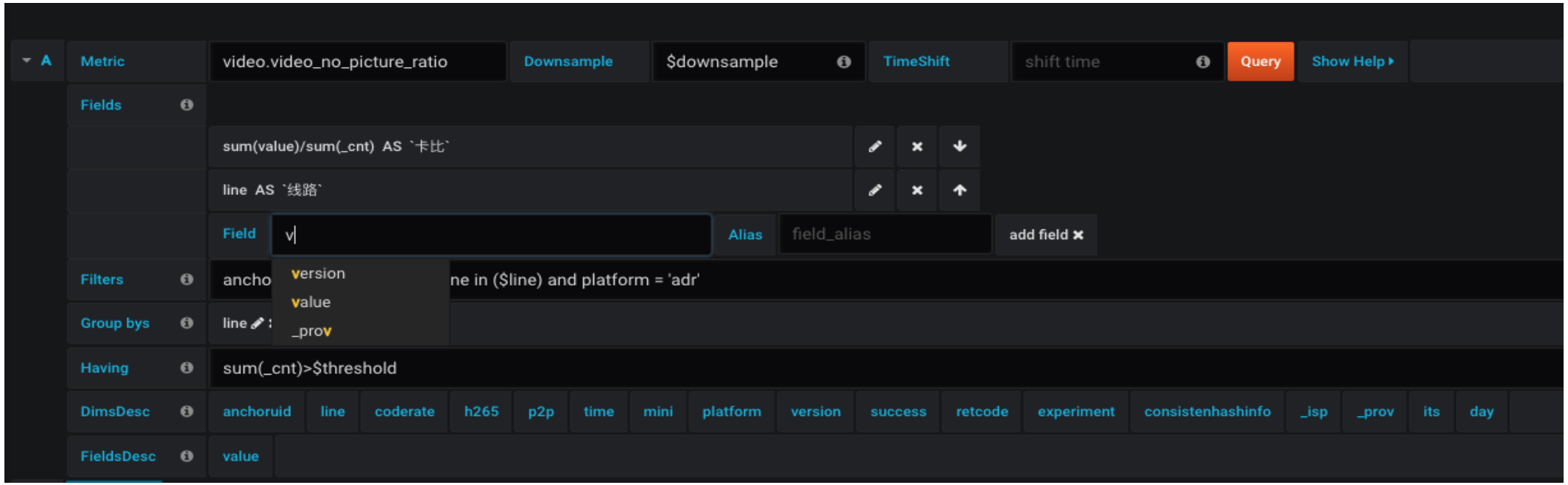
Consider about

I. Number of Sinker processors
II. Number of Connections
III. Number of Tables
IV. Number of shards

I. Good control of read or write split
II. Good control data transfer

Query

TSDB styles Grafana plugin



Query

- Rewrite Query
    - SQL Parser
    - Custom function support
    - Custom query statement

Query

- Rewrite Query

```
SELECT   intDiv(its, 20) * 20 AS _timestamp, sum(value) / sum(_cnt) as v, dict(device_id) as device_name
    FROM metric_name WHERE (its >= 1540178823) AND (its <= 1540279123) AND platform = * and line in (1,2,3)
GROUP BY line, _timestamp
```

```
SQLParser =>
time granularity :  20 seconds
time start to end:  [1540178823, 1540279123]
replace `*` filter:   platform = *
matched_columns :  [its, value, _cnt, device_id, platform, line]
```

```
SELECT   intDiv(its, 20) * 20 AS _timestamp, sum(value) / sum(_cnt) as v, dictGetString('device', 'name', toUInt64(device_id)) as device_name
    FROM real_table WHERE (its >= 1540178823) AND (its <= 1540279123)  and line in (1,2,3)
GROUP BY line, _timestamp
```

Query

- Custom query statement

```
ck_tags(metric_name, sVersion, now()-300,  platform in ($platfom) ,100)
```

```
Parser =>
```

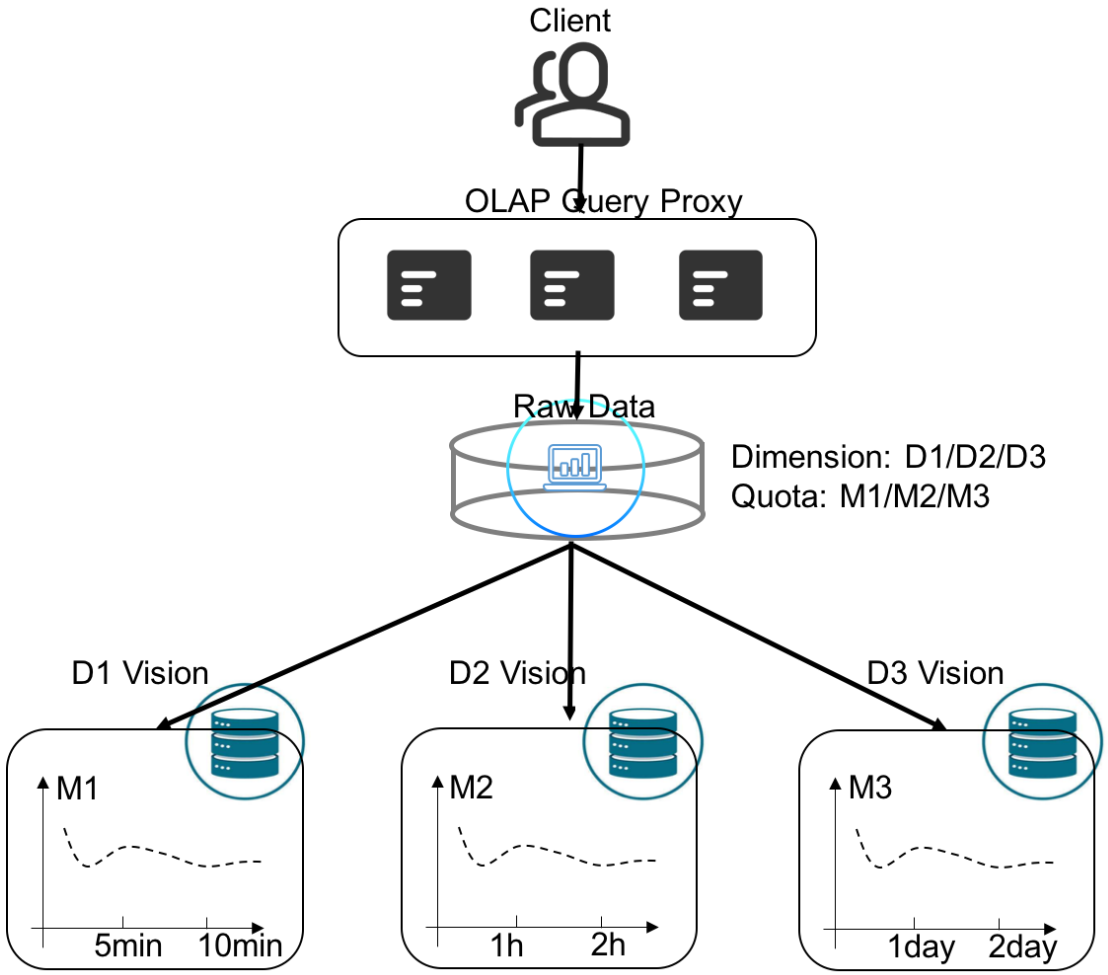
```
select sVersion from (select sVersion, count() as c
    from real_table  where its >= now()-300 AND  platform in ('android', 'ios') group by sVersion order by c limit 100)
```

Query

- Query rewrite to view

```
Matching Rules:

time granularity :  20 seconds
time start to end:  [1540178823, 1540279123]
columns :  [its, value, _cnt, device_id, platform, line]
...
```



Data Monitor

Flink CEP ?
Flink SQL ?

ClickHouse

appname	ip	connections_num
vhuya-transcode	58[redacted]	6
vhuya-transcode	58[redacted]	6
vhuya-transcode	58[redacted]	6
vhuya-transcode	58.[redacted]	6
vhuya-transcode	58[redacted]	6
vhuya-transcode	221[redacted]	6
vhuya-transcode	58[redacted]	6
vhuya-transcode	58.[redacted]	10
vhuya-transcode	58.[redacted]	6
vhuya-transcode	58.[redacted]	6

```
[
    {"appname":"vhuya-transcode","ip":"...","connections_num":6},
    ...
]
```

Source Table => SQL => View

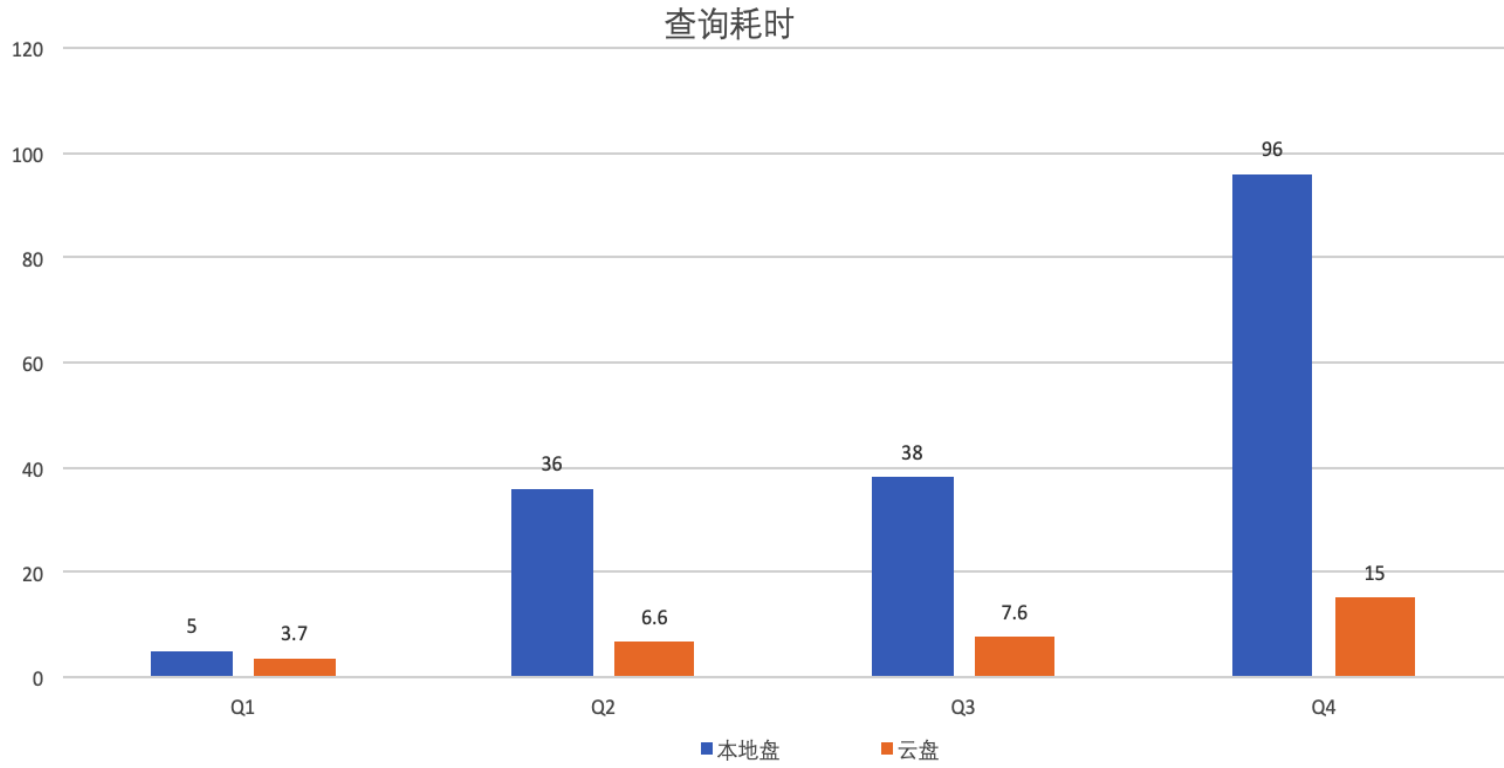
Interval Query => Rule Parser => Alarm

```
ckview="v_metric_app_monitor" AND connections_num > 500
```

Cloud

- IO
  - Sequence Read
    Sequence Write

IOPS Cloud >> local



More about cloud

- Distributed file systems (Considering)
  - Moosefs
  - Aws efs(Pinterest Goku)
  - Aliyun nas

- Data store separation (Working on it)
  - 90% query data is about last month
  - SSD for hot data, SATA for history data.

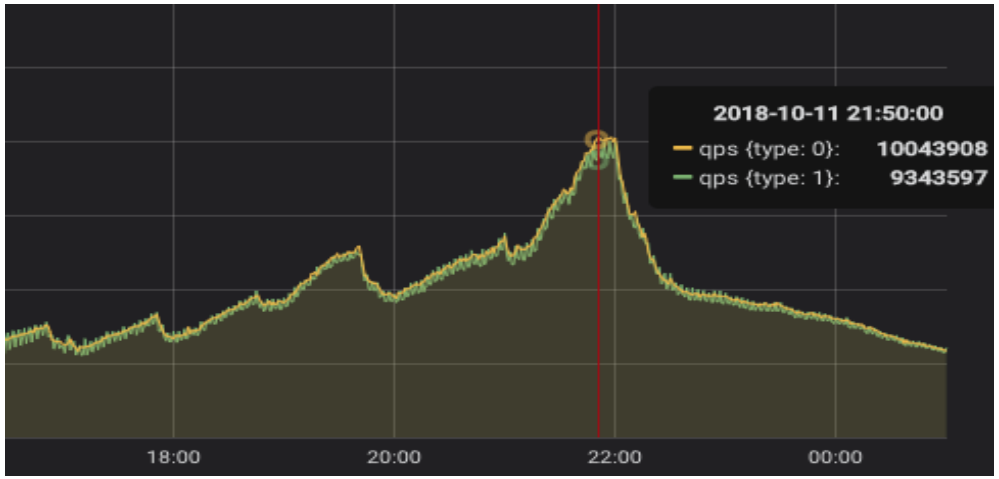
Operations

- Deploy platform
- Ansible
- Golang Template

```
<logs>
        {{range $index, $shards := .In.shards}}
         <shard>
             <weight>1</weight>
             <internal_replication>false</internal_replication>
             {{range $index2, $shard := $shards}}
             <replica>
                     <host>{{$shard.ip}}</host>
                     <port>{{$shard.port}}</port>
                     <user>{{$shard.user}}</user>
                     <password>{{$shard.pwd}}</password>
             </replica>
             {{end}}
        </shard>
        {{end}}
</logs>
```

Performance

- Data insert up to 10 Million rows/second, 300 Billion rows per day.
- 18 trillion total rows
- Query average costs < 1s (yet still contains little long queries)




```
SELECT sum(rows)
FROM cluster('logs', 'system', 'parts')
WHERE active = 1

┌─sum(rows)─┐
│ 18345366782968 │
└──────────┘

1 rows in set. Elapsed: 1.610 sec. Processed 535.27 thousand rows, 1
```

To community

- Tools
  - JDBC https://github.com/housepower/ClickHouse-Native-JDBC
  - Clickhouse_sinker https://github.com/housepower/clickhouse_sinker
- Features
  - windowFunnel
  - retention

Thank You

Hiring,we want you!

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监控 质量分析平台开发工程师
欢迎各路人才加入