10 Things Developers should know about Databases

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Who Are you ?

More Developer ?

More OPS ?

Ops

Focused on Database Only

Generalist

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Programming Language

What Programming Languages does your team use ?

There is often Tension Devs vs Ops

DevOps suppose to have solved it but tension is still common between Devs and Ops

Especially with Databases which are often special snowflake

Especially with larger organizations

Large Organizations

Ops vs Ops have conflict too

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Devs vs Ops Conflict

Devs

- Why is this stupid database always the problem.
- Why can’t it just work and work fast

Ops

- Why do not learn schema design
- Why do not you write optimized queries
- Why do not you think about capacity planning

Database Responsibility

Shared Responsibility for Ultimate Success

Top Recommendations for Developers

Learn Database Basics

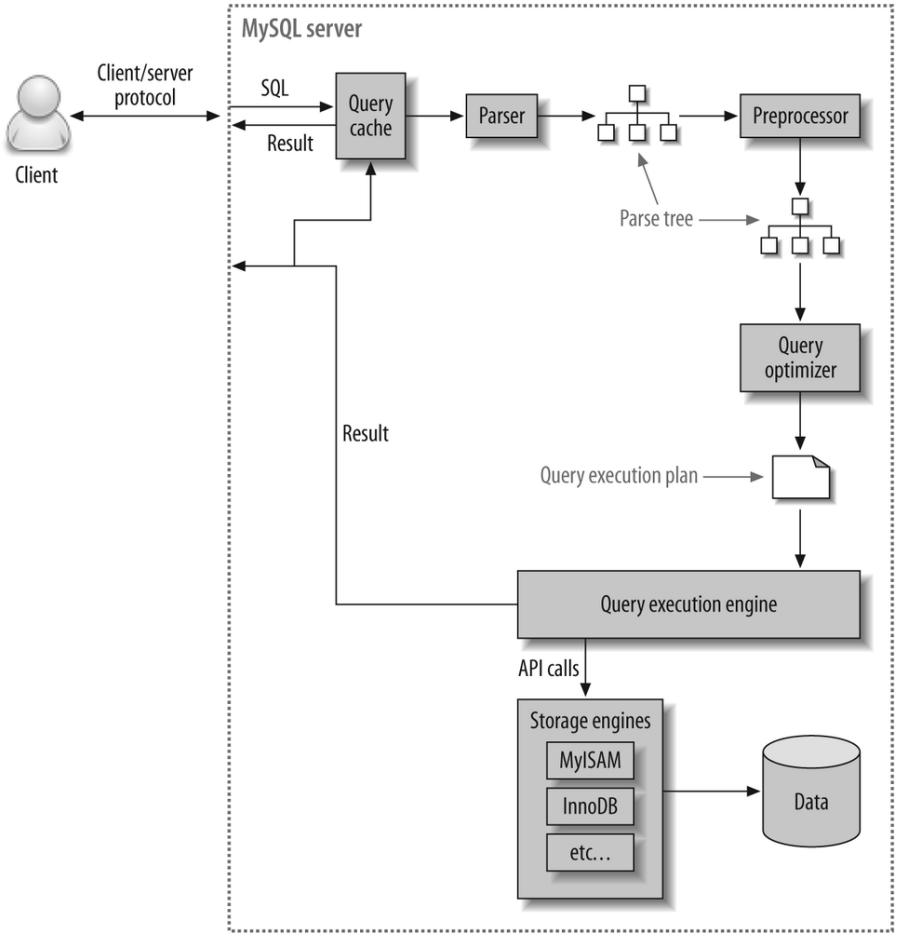
You can’t build great database powered applications if you do not understand how databases work

Schema Design

Power of the Database Language

How Database Executes the Query

Query Execution Diagram



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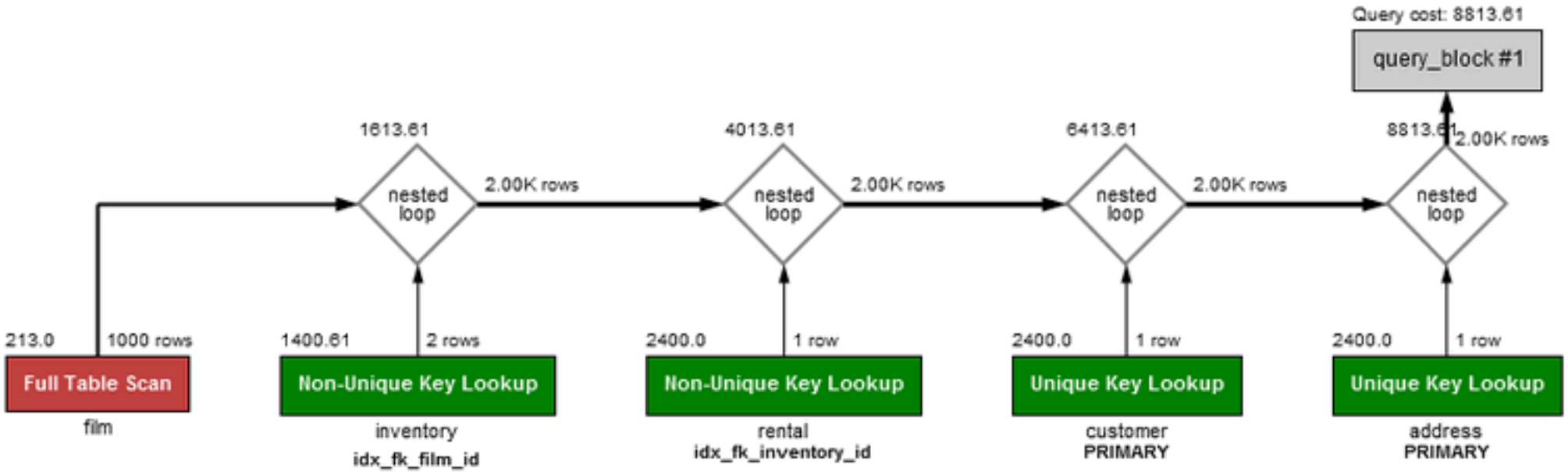
EXPLAIN



https://dev.mysql.com/doc/refman/8.0/en/execution-plan-information.html

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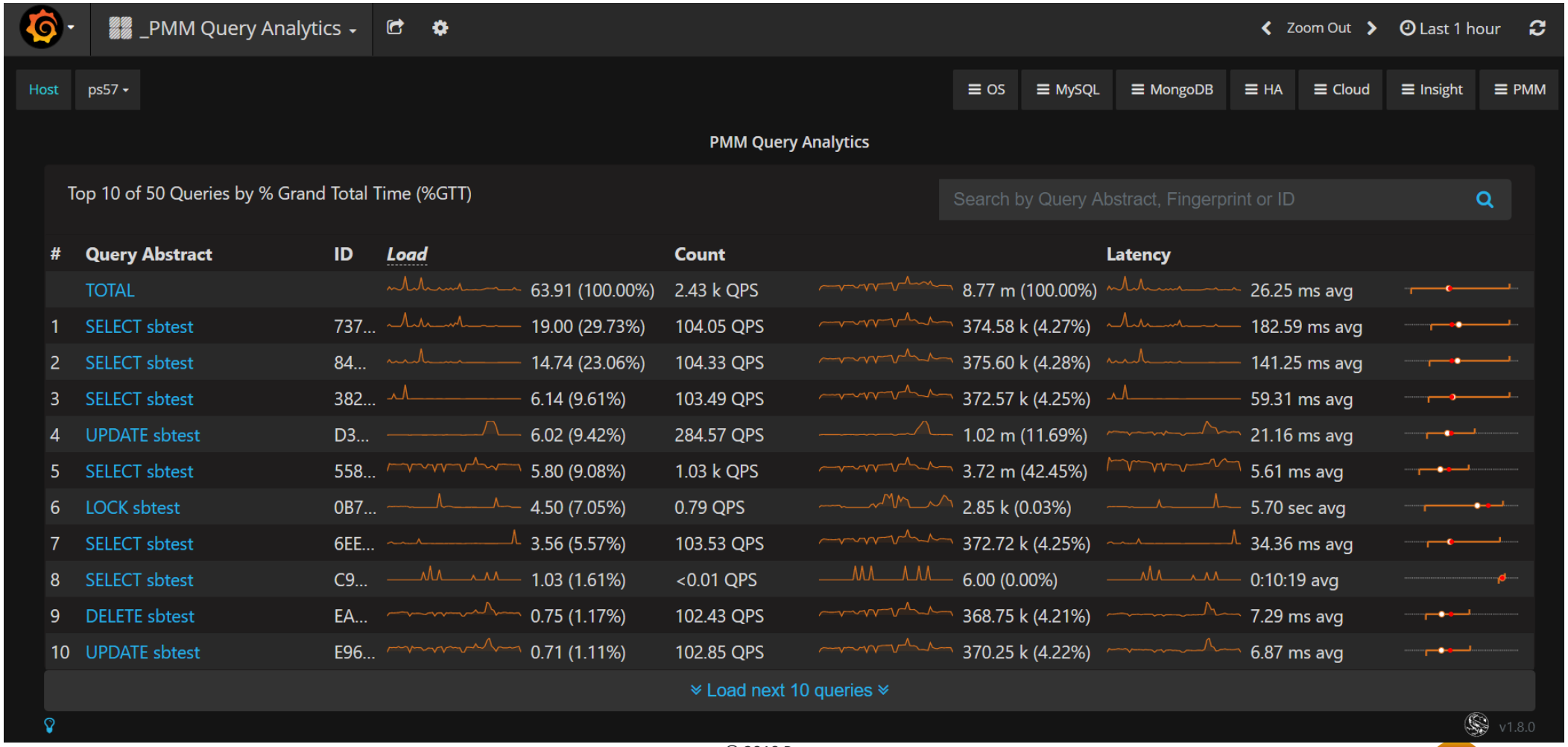
Which Queries are Causing the Load



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Why Are they Causing this Load

SELECT sbtest

737F39F04B198EF6

Metrics

Query first seen: Aug 3, 2017 1:55 PM ••• Last seen: Today at 9:46 AM

Metrics	Rate/Sec	Sum	Per Query Stats
Query Count	104.05 (per sec)	374.58 k 4.27% of total	
Query Time	19.00 load	18:59:56 29.73% of total	183.66 ms avg
Lock Time	0.11 (avg load)	0:06:42 1.35% of total 0.61% of query time	1.13 ms avg
Innodb IO Read Wait	0.61 (avg load)	0:36:44 9.10% of total 3.38% of query time	6.20 ms avg
Innodb Read Ops	52.35 (per sec)	188.45 k 7.62% of total	0.00 avg
Innodb Read Bytes	857.64 KB (per sec)	3.09 GB 7.62% of total 16.38 KB avg io size	8.22 KB avg
Innodb Distinct Pages	-	-	4.69 avg
Rows Sent	10.41 k (per sec)	37.46 m 30.52% of total	100.00 avg
Bytes Sent	1.30 MB (per sec)	4.67 GB 30.78% of total 124.71 Bytes bytes/row	12.47 KB avg
Rows Examined	1.14 m (per sec)	4.11 b 39.17% of total 109.79 per row sent	10.47 k avg
External Sorts (Filesort)	104.05 (per sec)	374.58 k 49.93% of total 100.00% of queries	-
Full Table Scans	0.01 (per sec)	40.00 0.17% of total 0.01% of queries	-
Queries Requiring Tmp Table In Memory	104.05 (per sec)	374.58 k 95.17% of total 100.00% of queries	-

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How to Improve their Performance

Example

```
SELECT DISTINCT c
FROM sbtest1
WHERE id
    BETWEEN 5559
        AND 5658
ORDER BY  c
```

CREATE

```
CREATE TABLE `sbtest1` (
  `id` int(10) unsigned NOT NULL AUTO_INCREMENT,
  `k` int(10) unsigned NOT NULL DEFAULT '0',
  `c` char(120) NOT NULL DEFAULT '',
  `pad` char(60) NOT NULL DEFAULT '',
  PRIMARY KEY (`id`),
  KEY `k_1` (`k`)
) ENGINE=InnoDB AUTO_INCREMENT=100000001 DEFAULT
```

JSON

Expand All

```
-{
   "query_block": -{
      "select_id": 1,
      "cost_info": +{...},
      "ordering_operation": -{
         "using_filesort": false,
         "duplicates_removal": -{
            "using_temporary_table": true,
            "using_filesort": true,
            "cost_info": +{...},
            "table": +{...}
```


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Check out PMM

http://pmmdemo.percona.com

PMM v 2 Beta 3 is now available

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How are Queries Executed ?

Single Threaded

Single Node

Distributed

Indexes

Indexes are Must

Indexes are Expensive

Capacity Planning

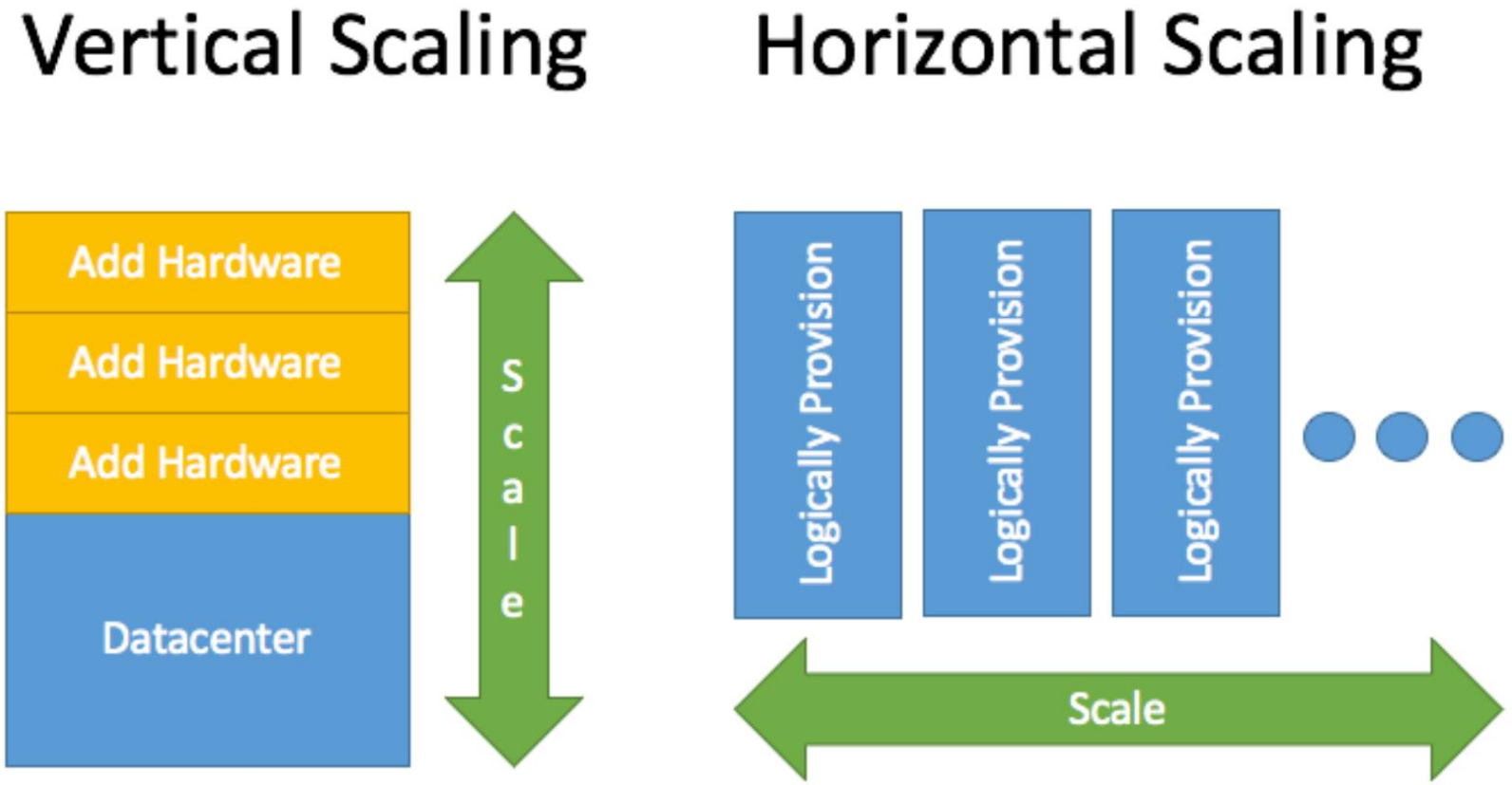
No Database can handle “unlimited scale”

Scalability is very application dependent

Trust Measurements more than Promises

Can be done or can be done Efficiently ?

Vertical and Horizontal Scaling



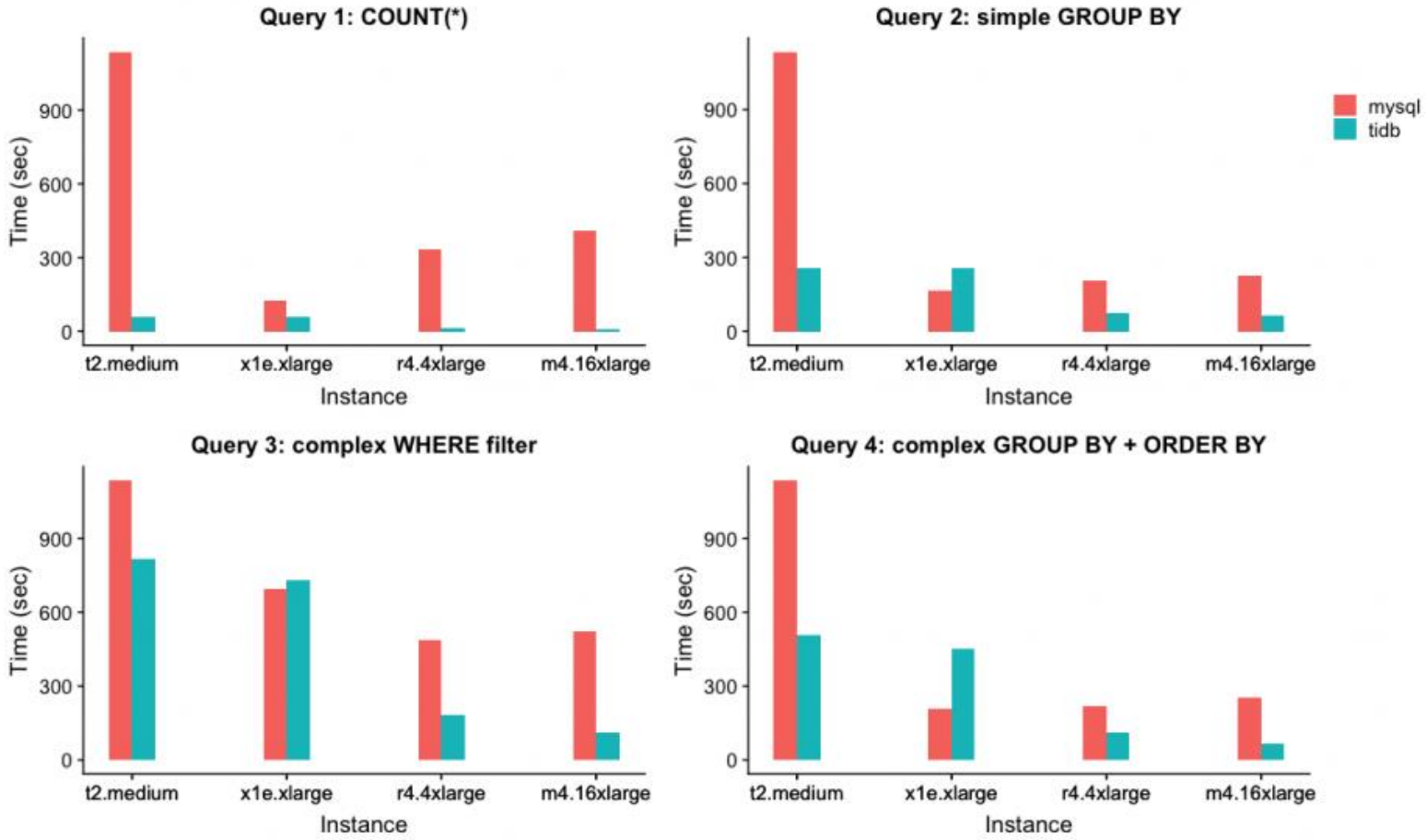
Scalable != Efficient

The Systems which promote a scalable can be less efficient

Hadoop, Cassandra, TiDB are great examples

By only the wrong thing you can get in trouble

TiDB Scalability (Single Node)



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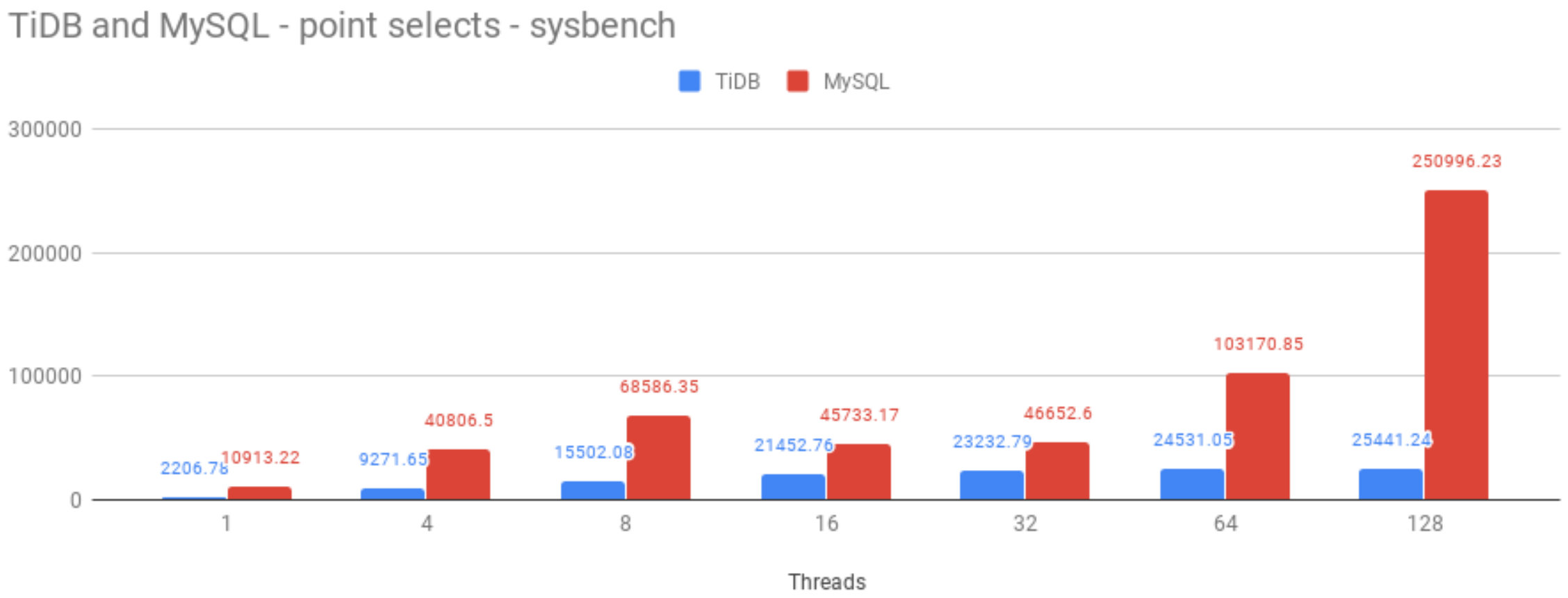
TiDB Efficiency



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Throughput != Latency

If I tell you system can do 100.000 queries/sec would you say it is fast ?

Speed of Light Limitations

High Availability Design Choices

You want instant durable replication over wide geography or Performance ?

Understanding Difference between High Availability and Disaster Recovery protocols

Network Bandwidth is not the same as Latency

Also Understand

Connections to the database are expensive

Especially if doing TLS Handshake

Query Latency Tends to Add Up

Especially on real network and not your laptop

Law of Gravity

Shitty Application at scale will bring down any Database

Scale Matters

Developing and Testing with Toy Database is risky

Queries Do not slow down linearly

The slowest query may slow down most rapidly

Memory or Disk

Data Accessed in memory is much faster than on disk

It is true even with modern SSDs

SSD accesses data in large blocks, memory does not

Fitting data in Working Set

Newer is not Always Faster

Upgrading to the new Software/Hardware is not always faster

Test it out

Defaults Change are often to blame

Upgrades are needed but not seamless

Major Database Upgrades often require application changes

Having Conversation on Application Lifecycle is a key

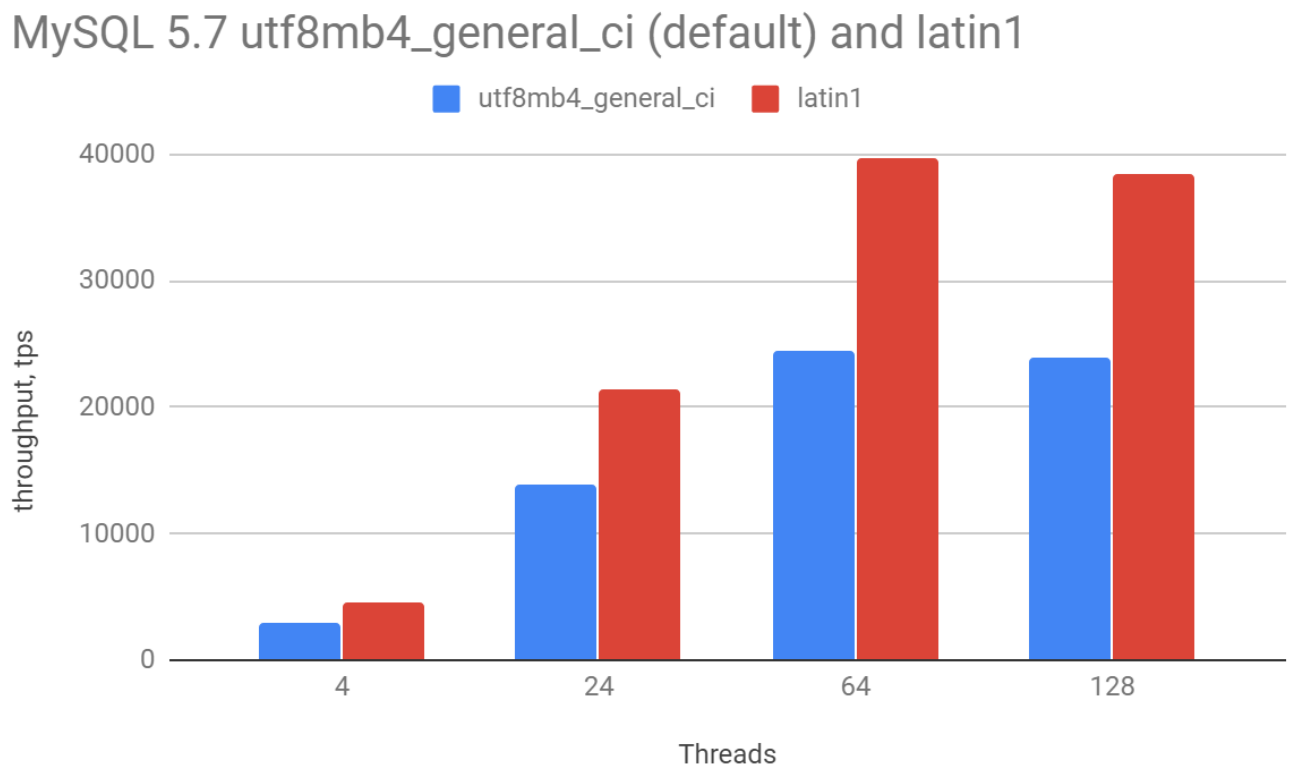
Character Sets

Performance Impact

Pain to Change

Wrong Character Set can cause Data Loss

Character Sets



https://per.co.na/MySQLCharsetImpact

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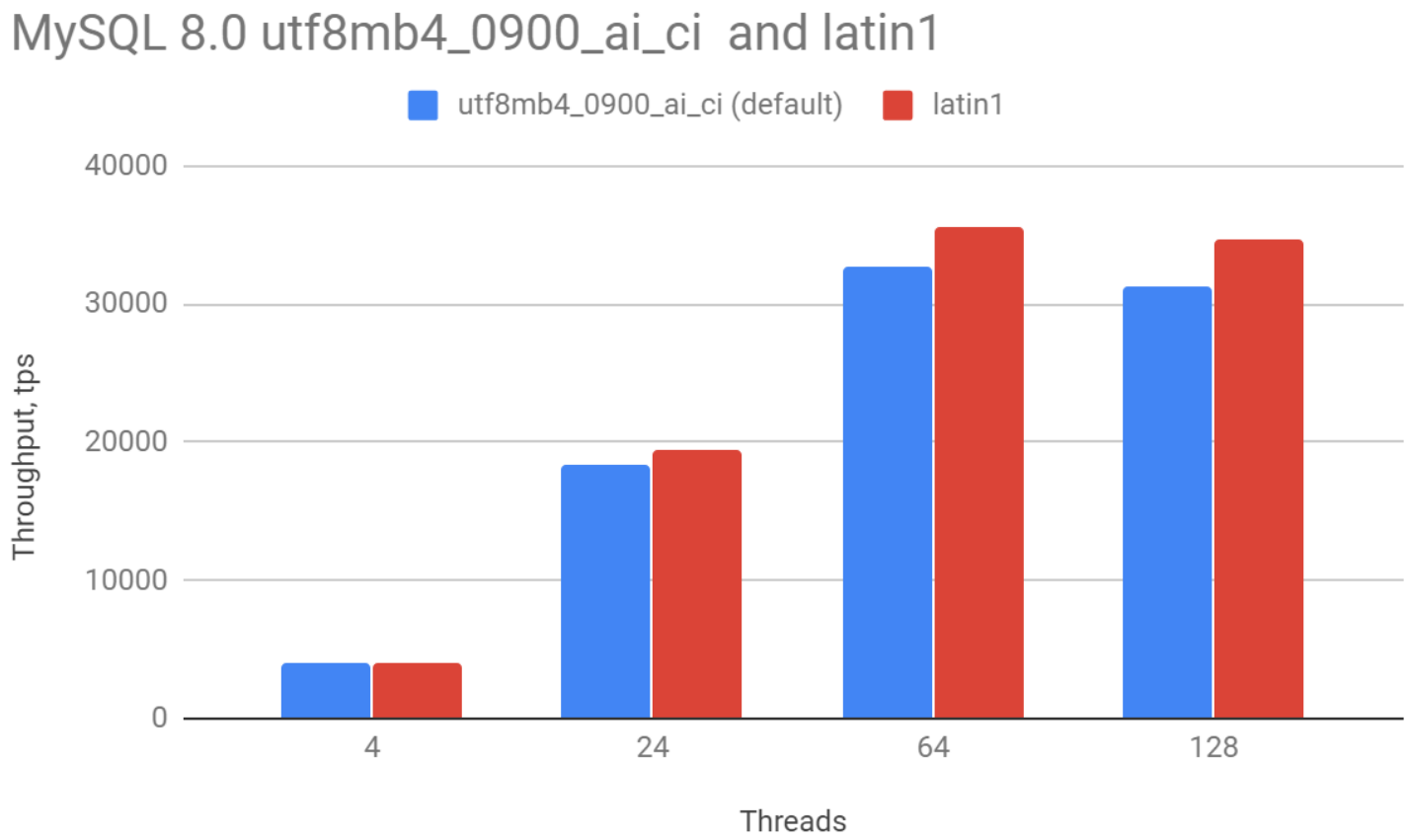
Less impact In MySQL 8



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Operational Overhead

Operations Take Time, Cost Money, Cause Overhead

10TB Database Backup ?

Adding The Index to Large Table ?

Distributed Systems

10x+ More Complicated

Better High Availability

Many Failure Scenarios

Test how application performs

Risks of Automation

Automation is Must

Mistakes can destroy database at scale

What Else

What Would you Add ?

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