Deep dive into Query Performance

Peter Zaitsev,
Founder at Percona
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PERCONA UNIVERSITY

PERCONA

Database is a Black Box

You can connect to the Database Service Point, Quickly

Run Queries you need to run

Meaning

Queries

1

Run them without errors

2

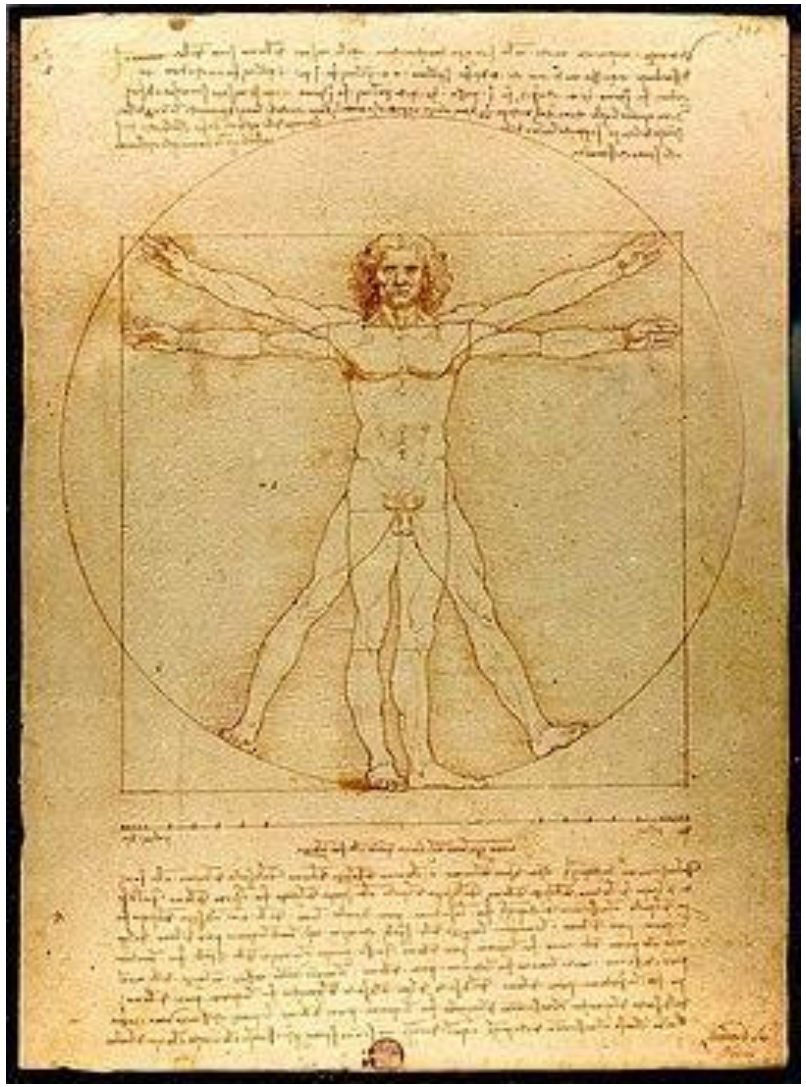
Run them with correct results

3

Run them with required response time

Performance

Performance is about Response Time you get for your Queries



Great design is not only about Performance

- **Security**
- **Availability**
- **Costs**
- **Maintability**
- **Impact on other users**

Response Time – Database View

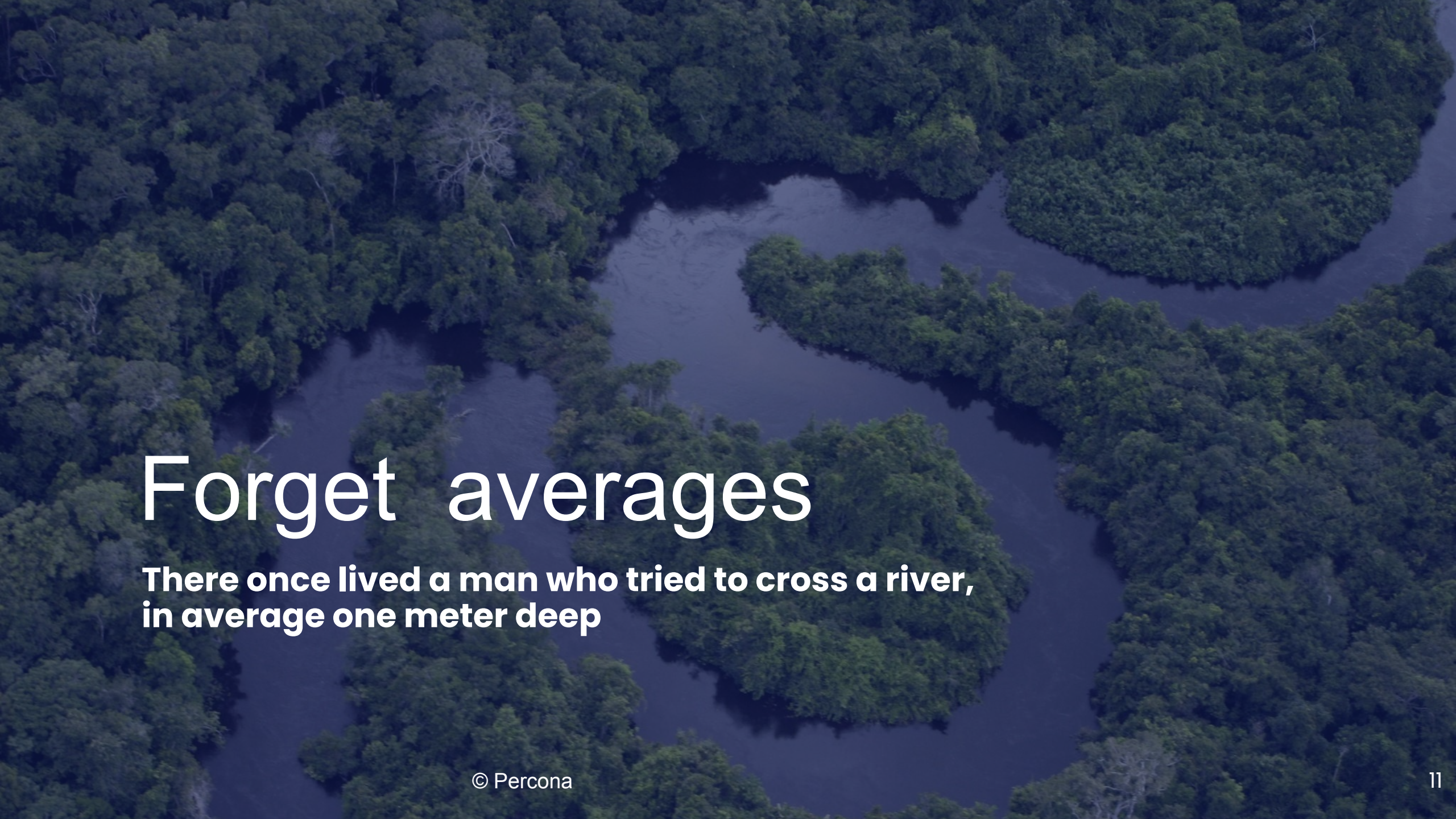
“I see database responds to queries in 5ms in average”

Response Time – Business View

All Users have outstanding performance experience with all their application interactions

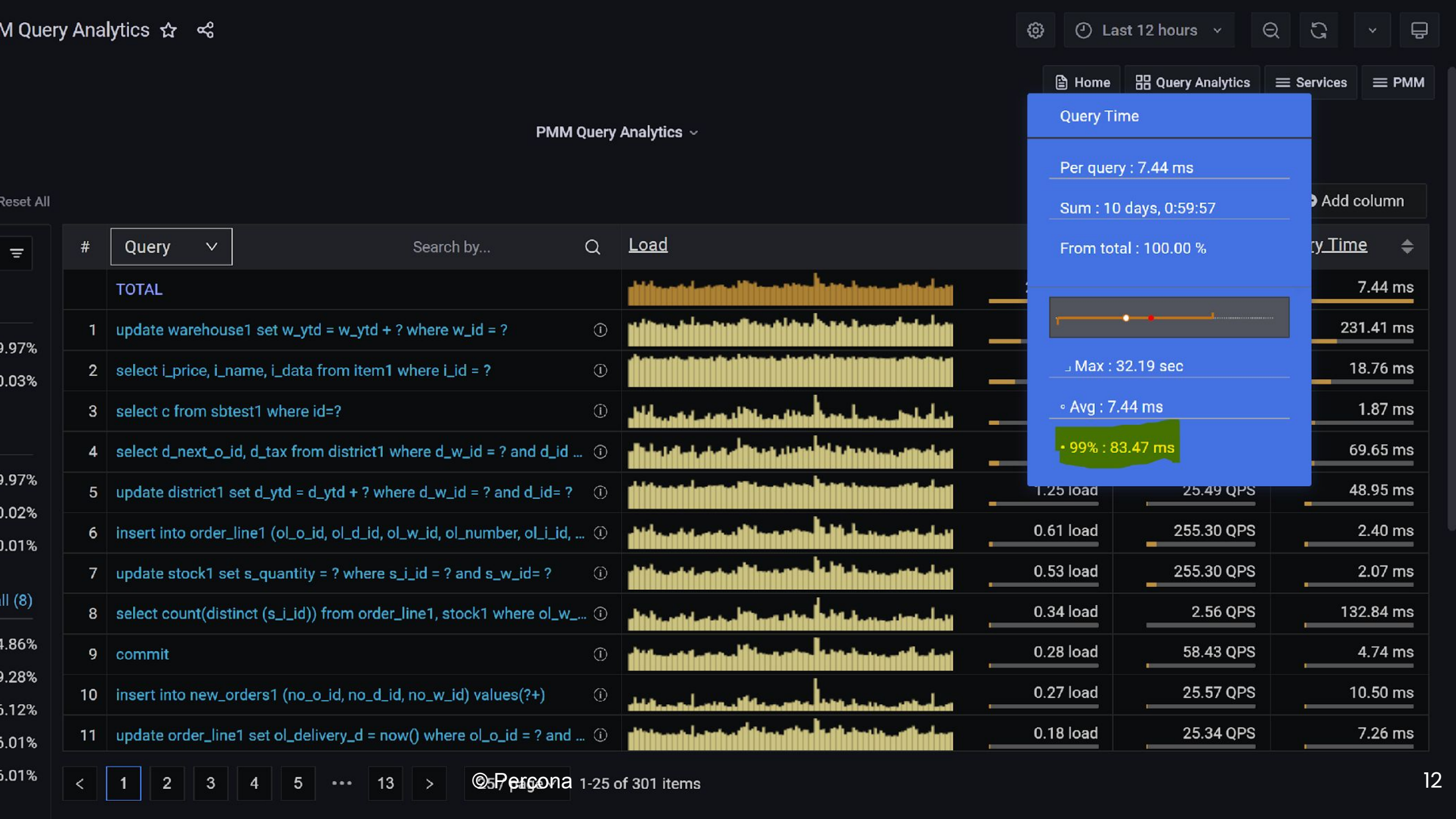
Downtime

Very Bad Performance is indistinguishable from downtime



Forget averages

There once lived a man who tried to cross a river, in average one meter deep


M Query Analytics
Last 12 hours
Home
Query Analytics
Services
PMM
PMM Query Analytics
Reset All
Add column
Query Time
Per query : 7.44 ms
Sum : 10 days, 0:59:57
From total : 100.00 %
Max : 32.19 sec
Avg : 7.44 ms
99% : 83.47 ms
Query Search by... Load
TOTAL 7.44 ms
1 update warehouse1 set w_ytd = w_ytd + ? where w_id = ? 231.41 ms
2 select i_price, i_name, i_data from item1 where i_id = ? 18.76 ms
3 select c from sbtest1 where id=? 1.87 ms
4 select d_next_o_id, d_tax from district1 where d_w_id = ? and d_id ... 69.65 ms
5 update district1 set d_ytd = d_ytd + ? where d_w_id = ? and d_id= ? 1.25 load 25.49 QPS 48.95 ms
6 insert into order_line1 (ol_o_id, ol_d_id, ol_w_id, ol_number, ol_i_id, ... 0.61 load 255.30 QPS 2.40 ms
7 update stock1 set s_quantity = ? where s_i_id = ? and s_w_id= ? 0.53 load 255.30 QPS 2.07 ms
8 select count(distinct (s_i_id)) from order_line1, stock1 where ol_w_... 0.34 load 2.56 QPS 132.84 ms
9 commit 0.28 load 58.43 QPS 4.74 ms
10 insert into new_orders1 (no_o_id, no_d_id, no_w_id) values(?+) 0.27 load 25.57 QPS 10.50 ms
11 update order_line1 set ol_delivery_d = now() where ol_o_id = ? and ... 0.18 load 25.34 QPS 7.26 ms
1 2 3 4 5 ... 13
1-25 of 301 items

99 percentile does not translate in 99% users having great performance

If every user interaction has 10 database queries

User in average has 10 interactions

Roughly 50% of session will have query with p99 response time

Percentile

Errors

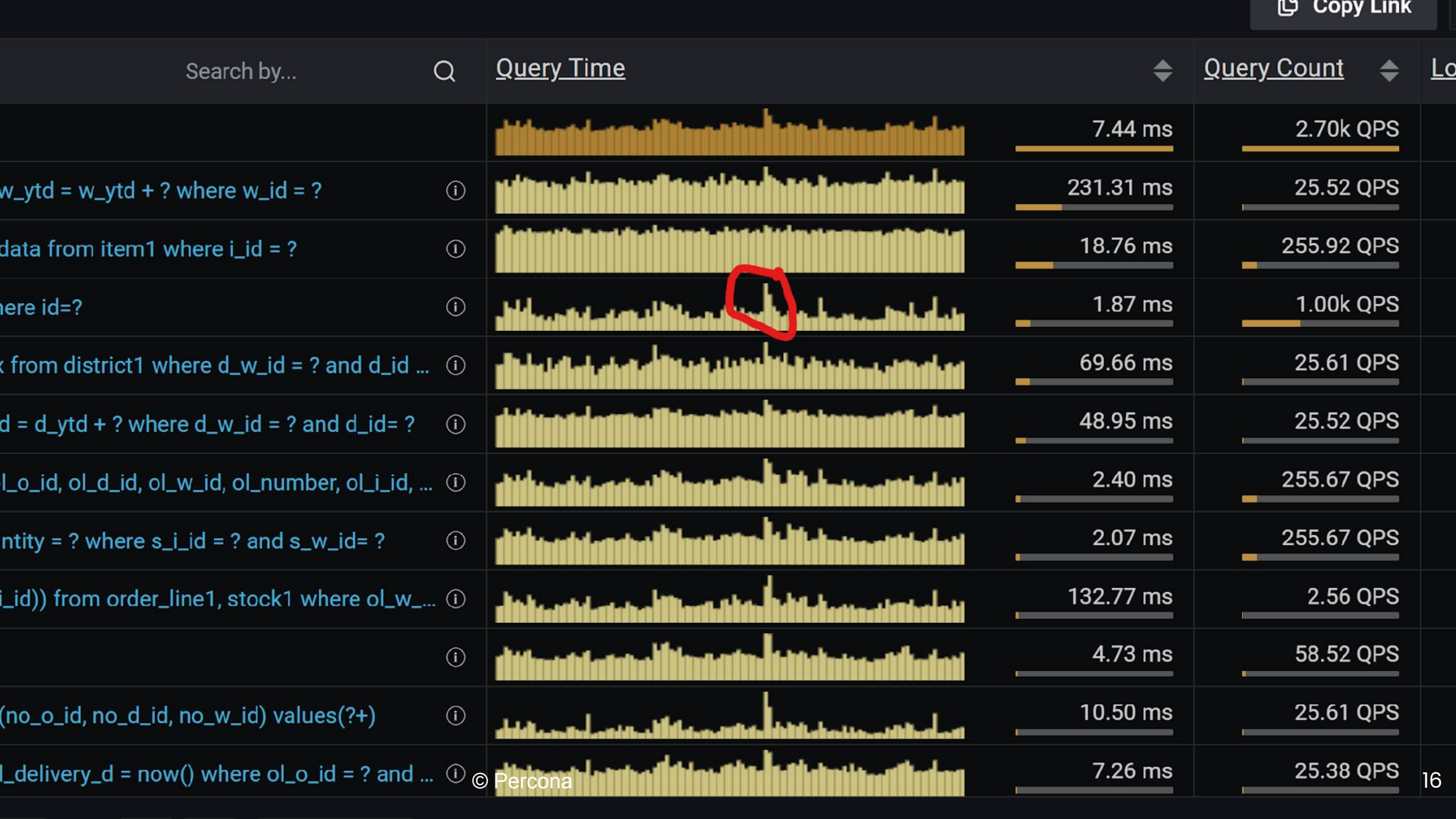
- Look at Response time of Successful Queries, do not let “fast errors” to screw up your data
- Measure response time of “slow errors” as it contributes to user experience

Over Time

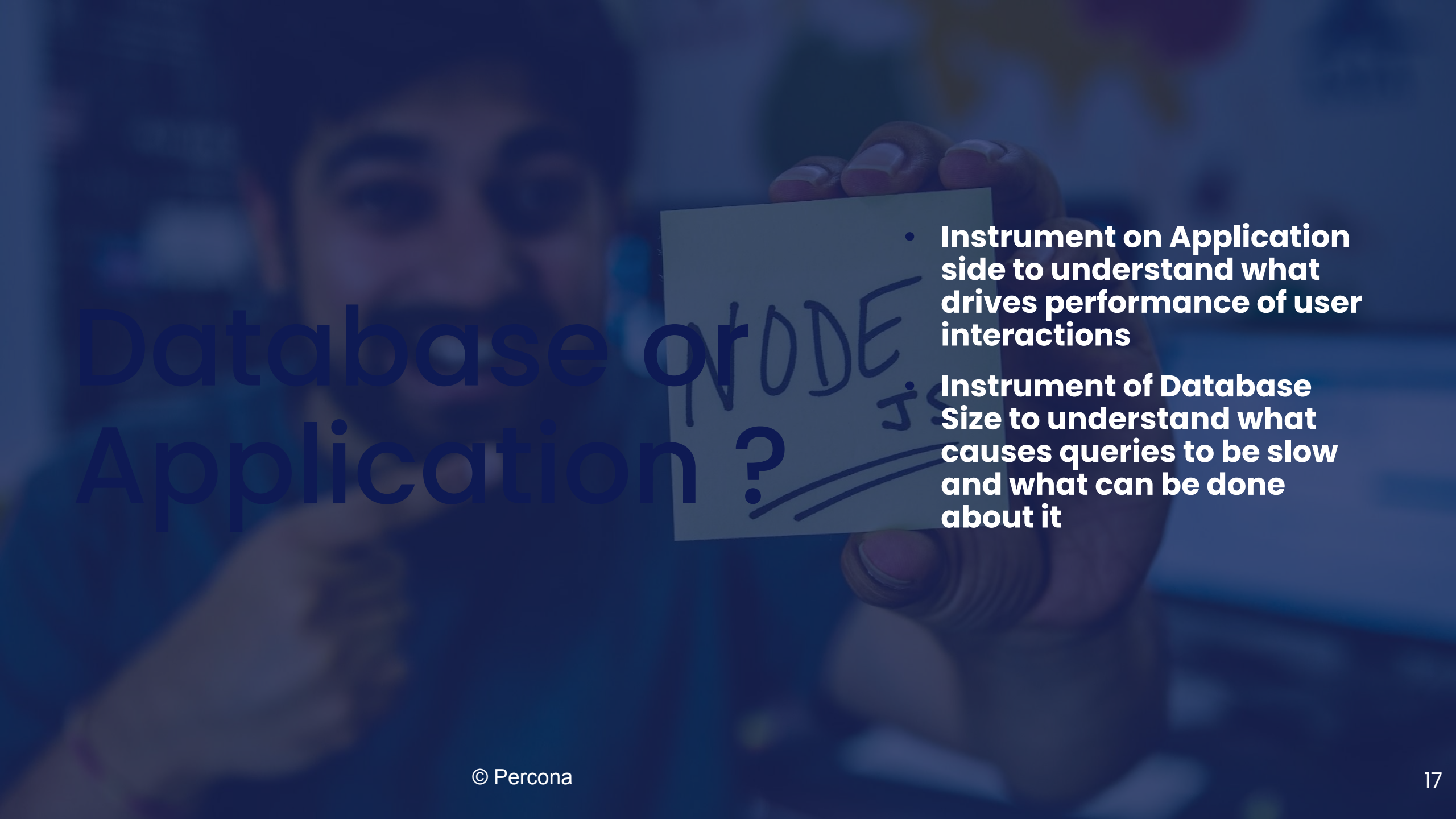
LOOK AT RESPONSE TIME TRENDS OVER TIME

MINOR SLOWDOWN OFTEN HAPPENS BEFORE POOR PERFORMANCE “DOWNTIME”

PERFORMANCE CAN BE WORSE AT CERTAIN TIMES – BACKUPS, BATCH JOBS, MAINTENANCE


Copy Link
Search by...
Query Time
Query Count
7.44 ms
2.70k QPS
w_ytd = w_ytd + ? where w_id = ?
231.31 ms
25.52 QPS
data from item1 where i_id = ?
18.76 ms
255.92 QPS
here id=?
1.87 ms
1.00k QPS
x from district1 where d_w_id = ? and d_id ...
69.66 ms
25.61 QPS
d = d_ytd + ? where d_w_id = ? and d_id= ?
48.95 ms
25.52 QPS
l_o_id, ol_d_id, ol_w_id, ol_number, ol_i_id, ...
2.40 ms
255.67 QPS
ntity = ? where s_i_id = ? and s_w_id= ?
2.07 ms
255.67 QPS
i_id)) from order_line1, stock1 where ol_w_...
132.77 ms
2.56 QPS
4.73 ms
58.52 QPS
(no_o_id, no_d_id, no_w_id) values(?+)
10.50 ms
25.61 QPS
l_delivery_d = now() where ol_o_id = ? and ...
7.26 ms
25.38 QPS

Database or Application ?



- Instrument on Application side to understand what drives performance of user interactions
- Instrument of Database Size to understand what causes queries to be slow and what can be done about it

Response Time – Business View

All Users have outstanding performance experience with all their application interactions

Enhancing Query Meta Data

SQL Commenter project by Google

https://per.co.na/SQLcommenter

Query Meta Data Possibilities

Actual User/Tenant

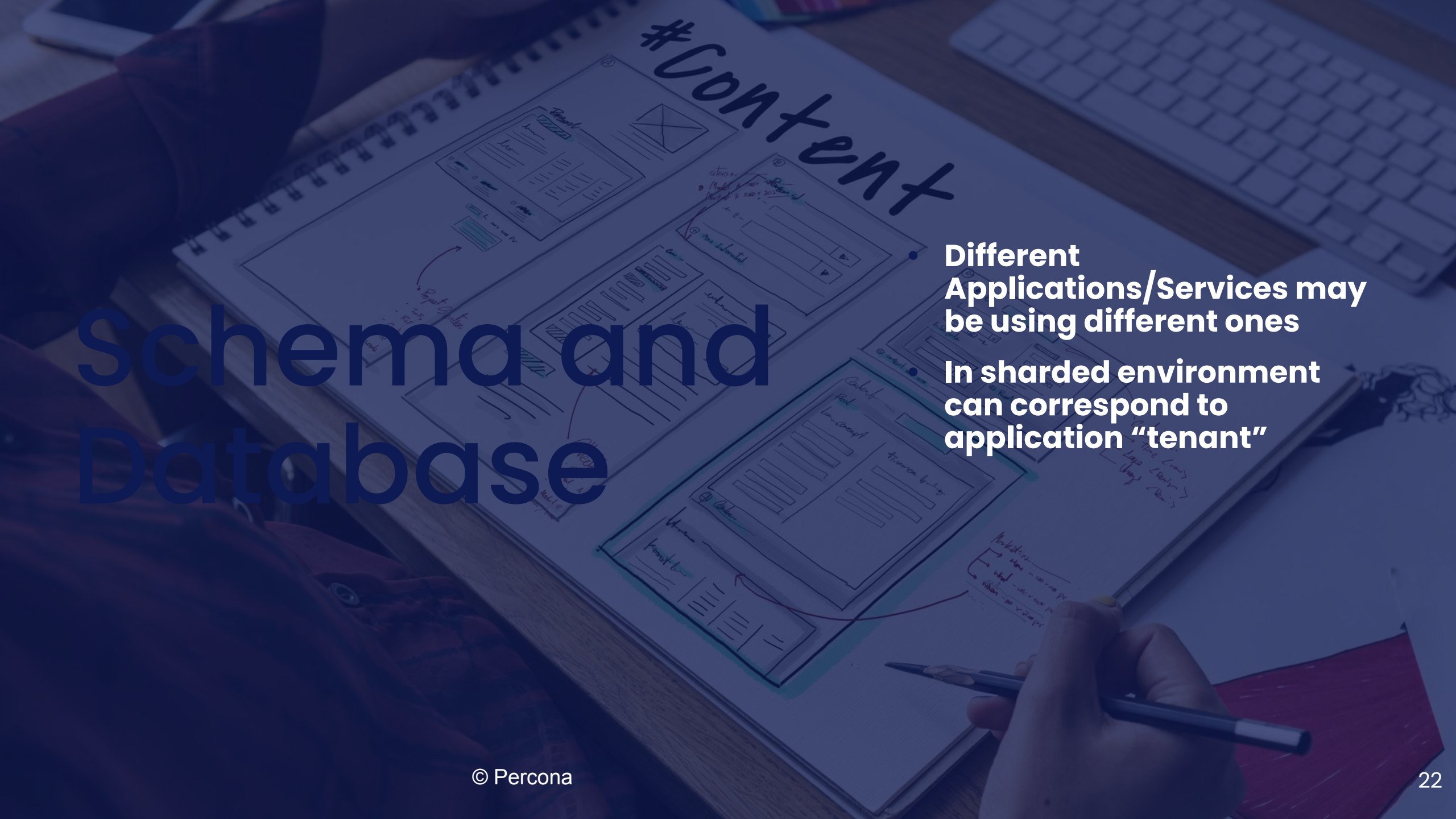
Application/Functionality

Version Information (A/B Testing)

Responsible Engineer/Team

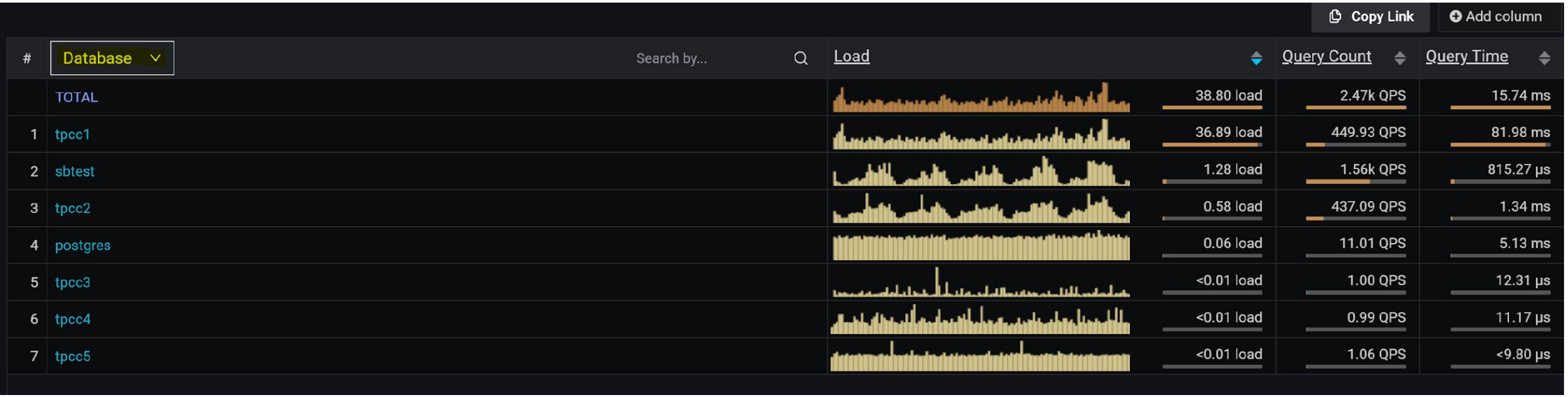
Query

- Different Queries have different performance profile
- They also correspond to different “user actions”
- And may have different acceptable level of Performance



Schema and Database

- **Different Applications/Services may be using different ones**
- **In sharded environment can correspond to application “tenant”**



Database view in Percona Monitoring and Management

Table/ Collection

- Can help identify “problematic data”
- Indexing changes impact queries hitting object
- Maintenance often impacts specific table

IDENTIFY SERVICE/APPLICATION

FIND HUMAN TROUBLE MAKERS WITH INTERACTIVE ACCESS

Database User

Copy Link | Add column

#	User Name	Search by...	Load	Query Count	Query Time
	TOTAL		38.83 load	2.47k QPS	15.73 ms
1	app1		36.92 load	450.62 QPS	81.92 ms
2	app3		1.28 load	1.57k QPS	815.02 µs
3	app2		0.59 load	437.34 QPS	1.34 ms
4	pmm		0.06 load	14.64 QPS	3.86 ms

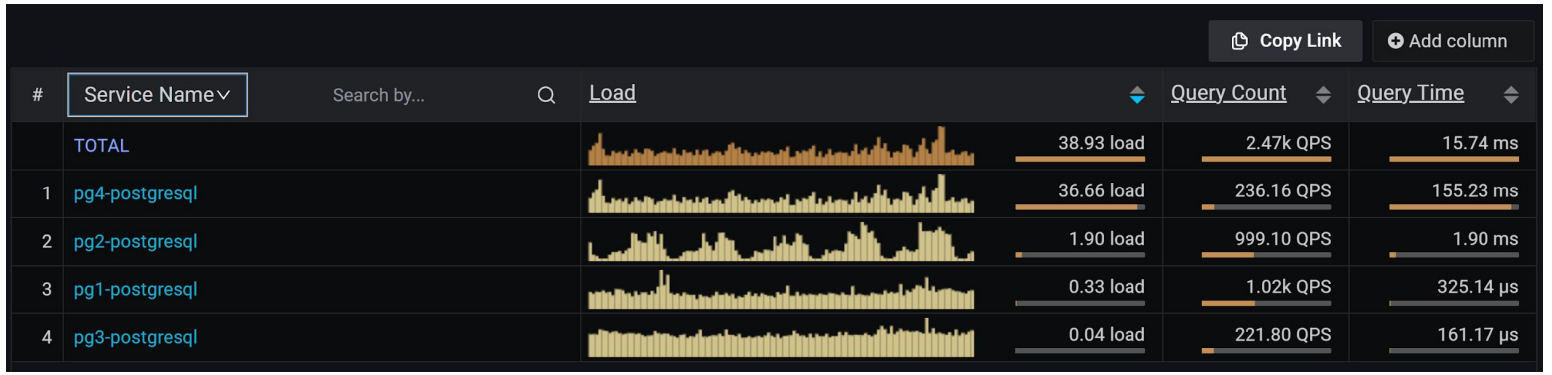
Database Host

Sharded environments often have multiple hosts handling the same traffic

Yet Problems often can be limited to some hosts

Data/Traffic Balance, configuration, invisible differences

Database Instances



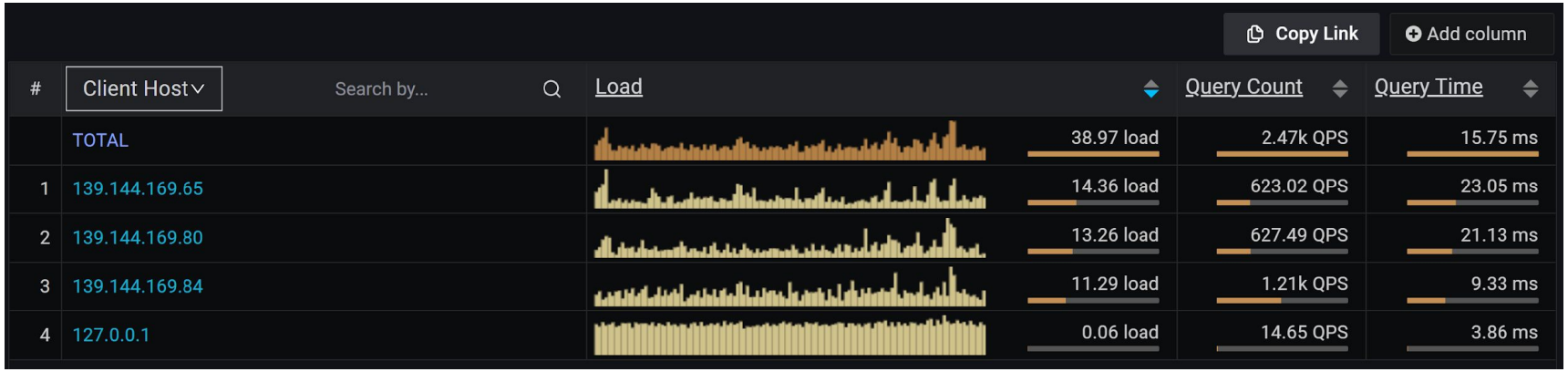
App Server/ Web Server/ Service Instance

You may expect all instances of the same type causing same even load

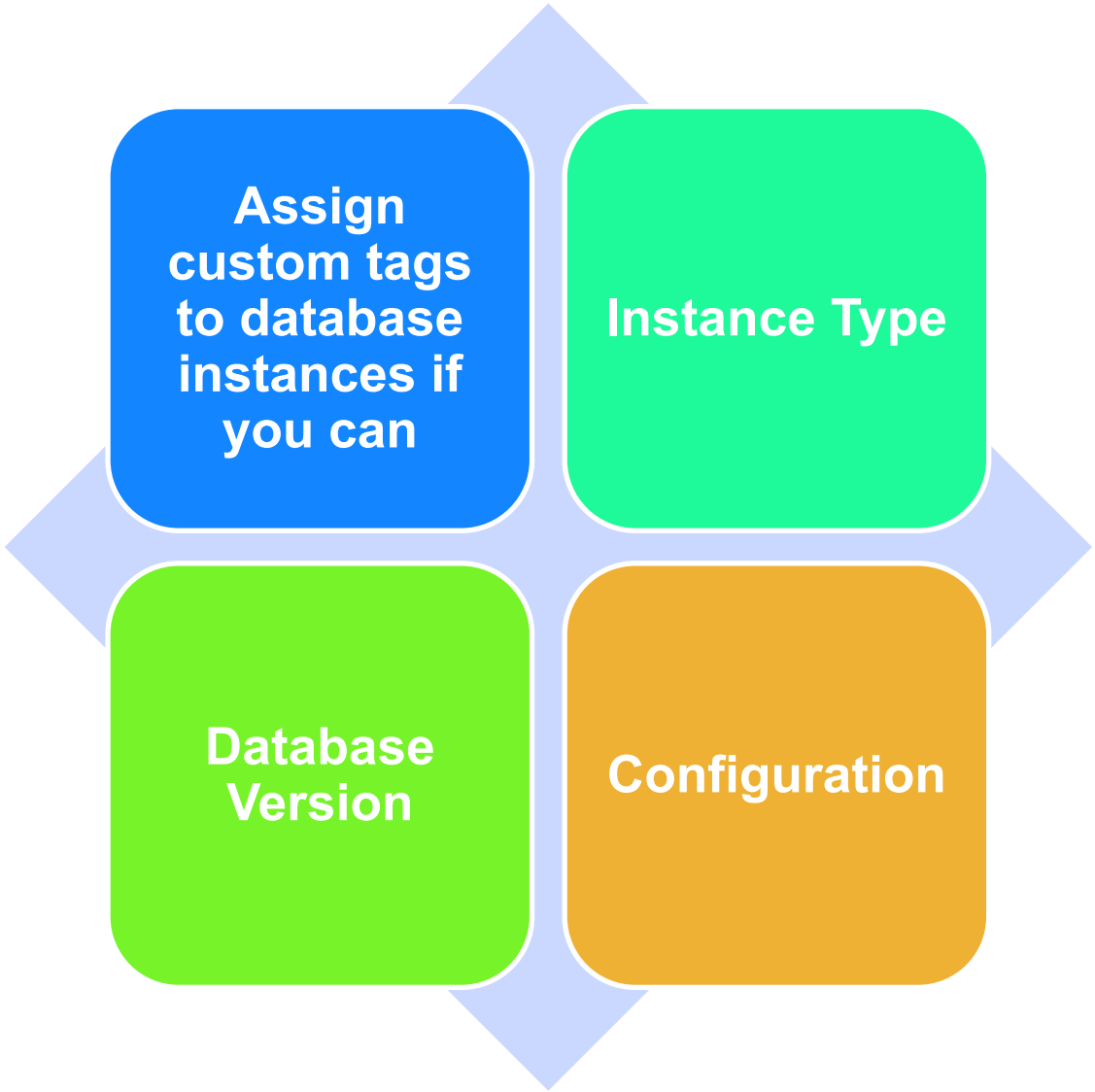
It may not be the case

Code versions, configuration, load balancer behavior, security incidents

Client Hosts

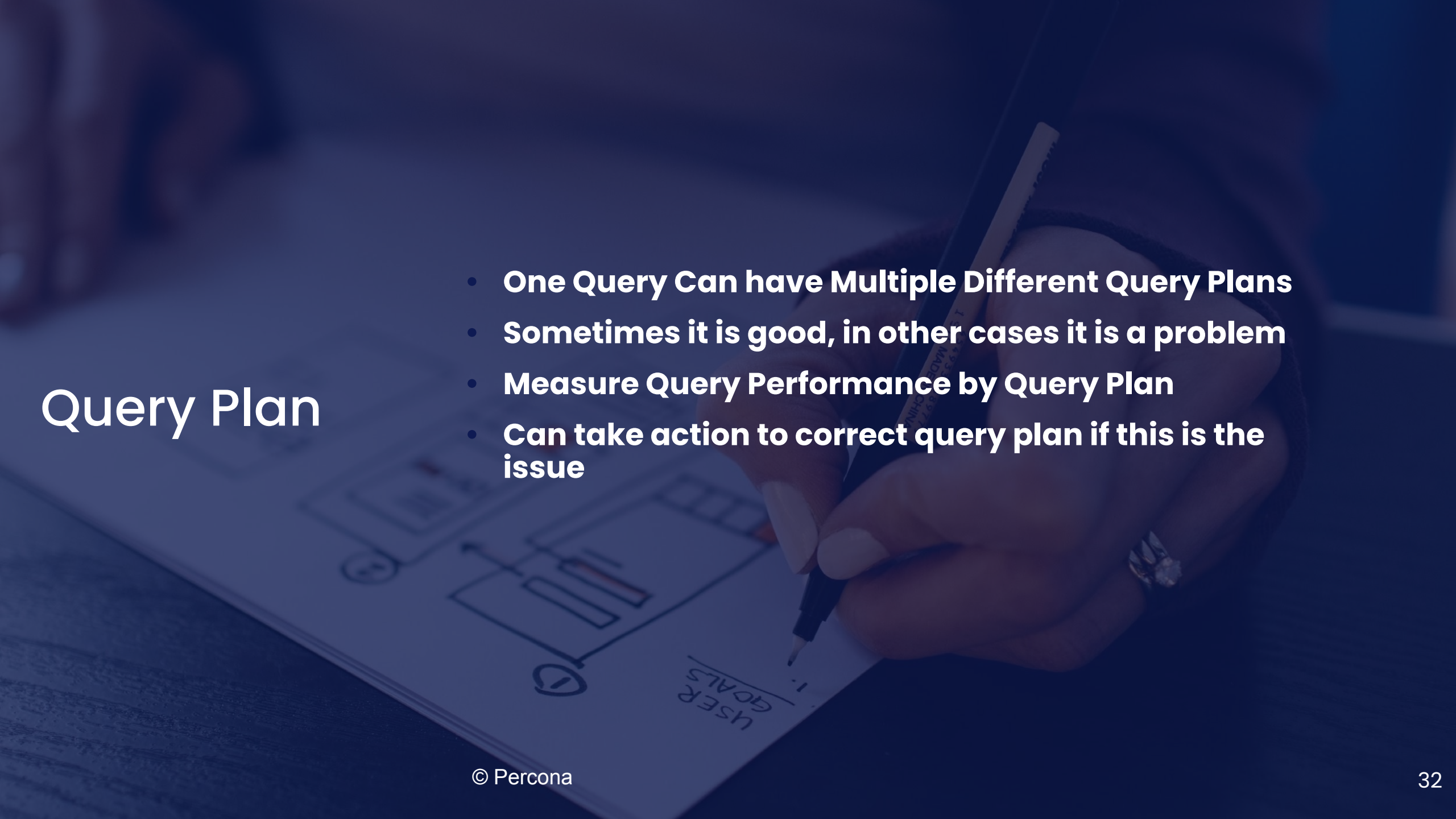


Custom Tags



Query Plan

- One Query Can have Multiple Different Query Plans
- Sometimes it is good, in other cases it is a problem
- Measure Query Performance by Query Plan
- Can take action to correct query plan if this is the issue



Where Response Time Comes From ?

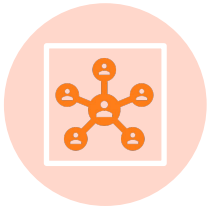
Data Crunching/CPU

Waits on CPU Availability

Disk IO

Row Locks

Contention



Network

Other Things to Consider

“Bad Queries” vs Victims

- **Query might be slow because it is heavy on its own**
- **Or it might be victim of other queries or their volume**

Do not forget currently running queries

- **Response time is measured when query completes**
- **You can write queries which “never” complete**
- **Consider killing runaway queries and whitelisting queries which need to run long**

Do not Ignore “Invisible”

- **Database Background Activities**
- **Maintenance Operations**
- **Cloud Noise**

Avoid Biased Sampling

"Let's Look only on slow queries"

Focus on Outliers

Likely to ignore queries causing most load, typical impact

Good Luck

Get your query performance under control

Do not over-do scaling by Credit Card


Thank you, Let's Connect!
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