Deep dive into Query Performance

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1 Feb 2023

800 PER BOX
RAW
ROLLING PAPERS
WEED SHOP COMPANY
WEED SHOP COMPANY
WEED SHOP COMPANY
WEED SHOP COMPANY
WEED SHOP COMPANY
THC
JUST DOOBIE IT.

#ghc15
CODE2040
I AM THE FUTURE
BLACK GIRLS CODE
GOD IS
Femgineer
technovation

Database is a Black Box

Meaning

You can connect to the Database Service Point, Quickly

Run Queries you need to run

Queries

1

Run them without errors

2

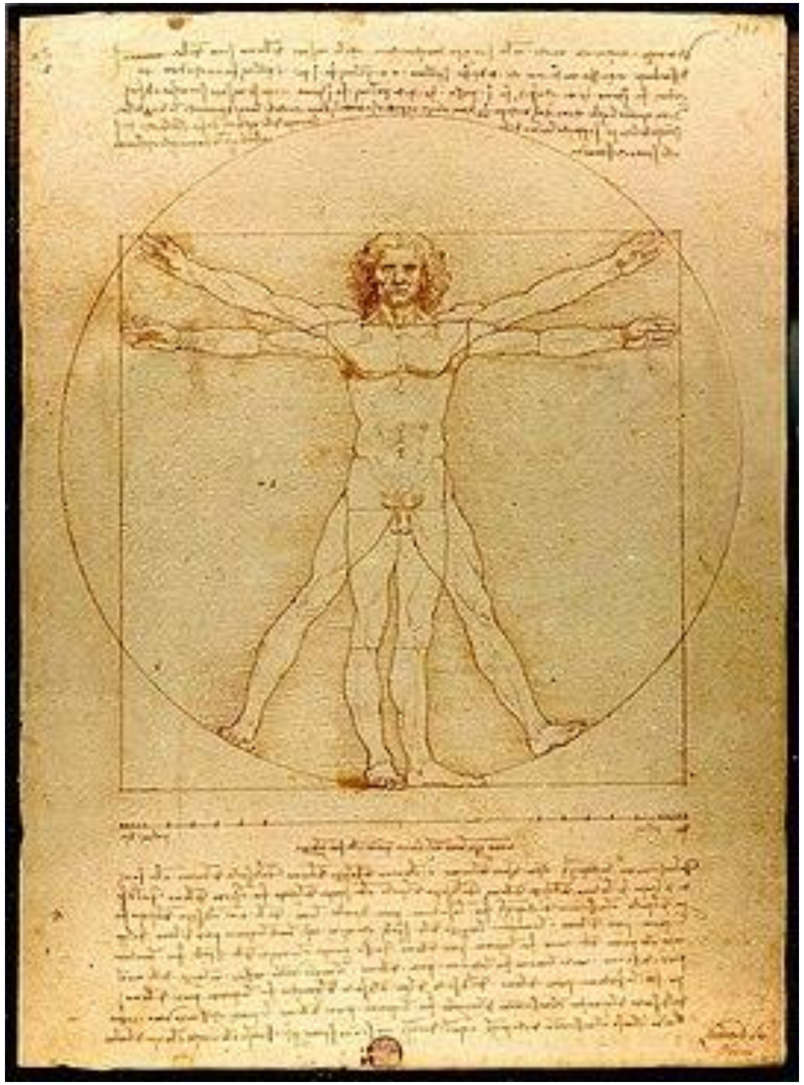
Run them with correct results

3

Run them with required response time

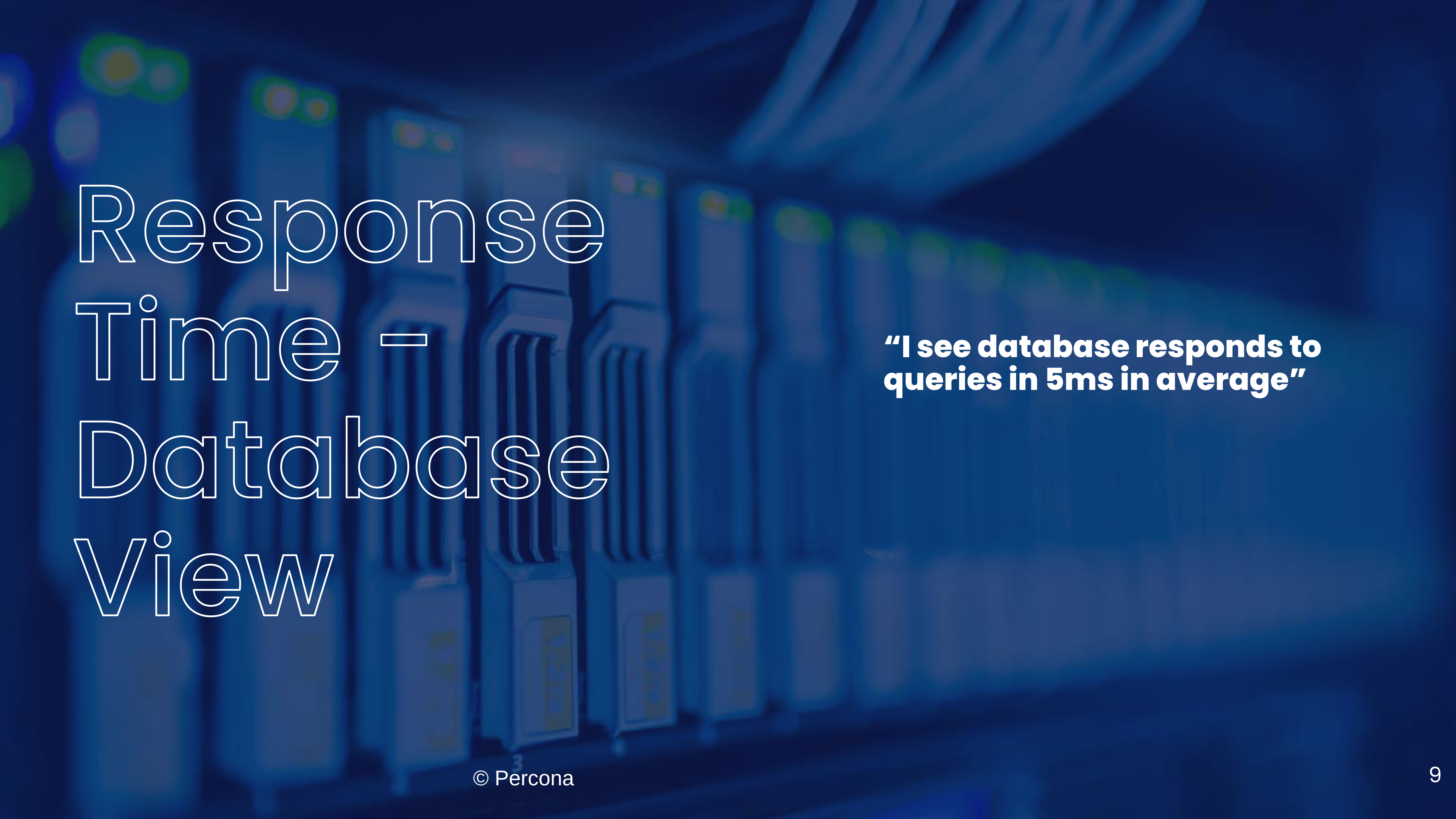
Performance

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

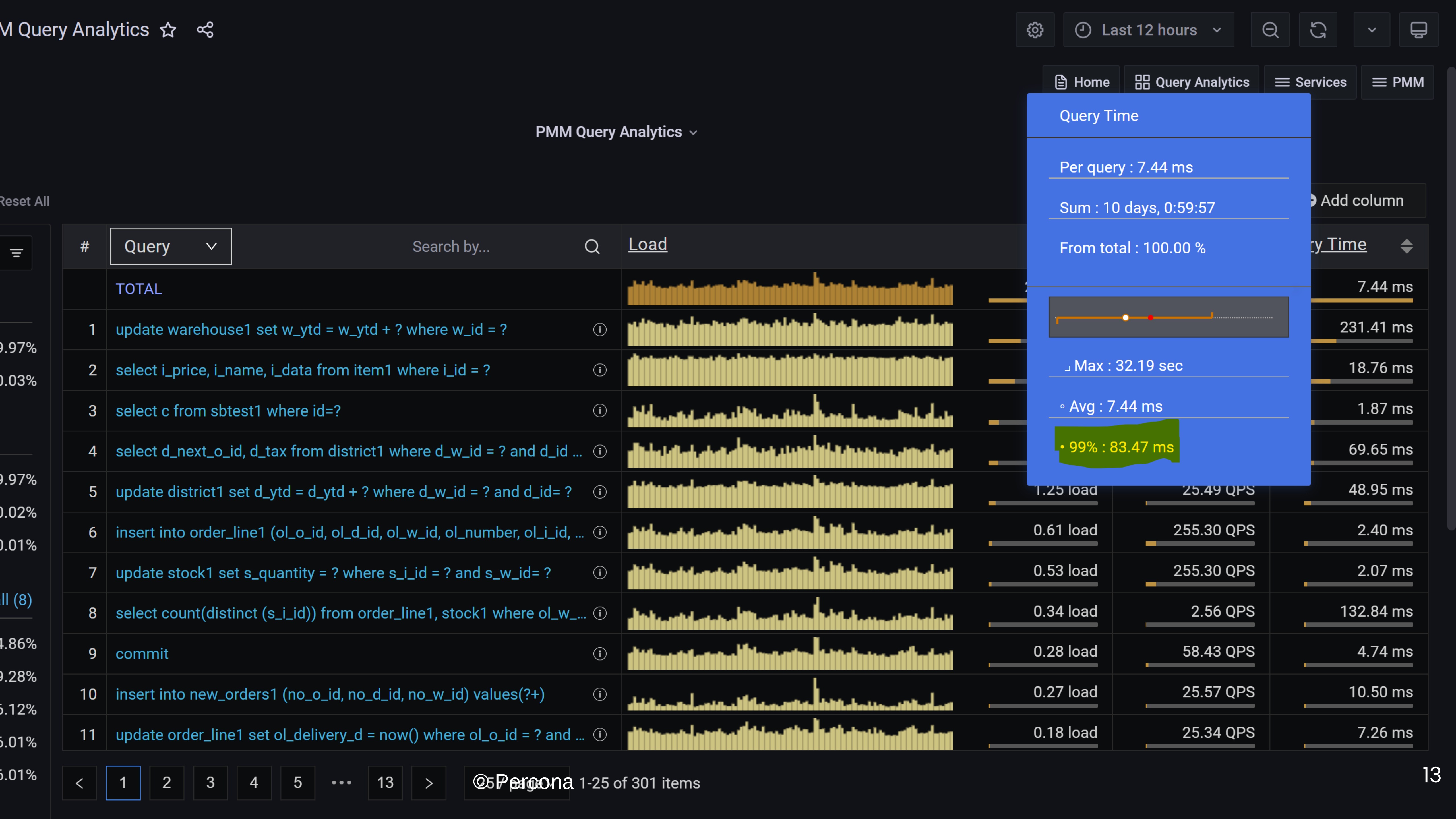
All Users have outstanding performance experience with all their application interactions

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	Load		ry Time
	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

1-25 of 301 items

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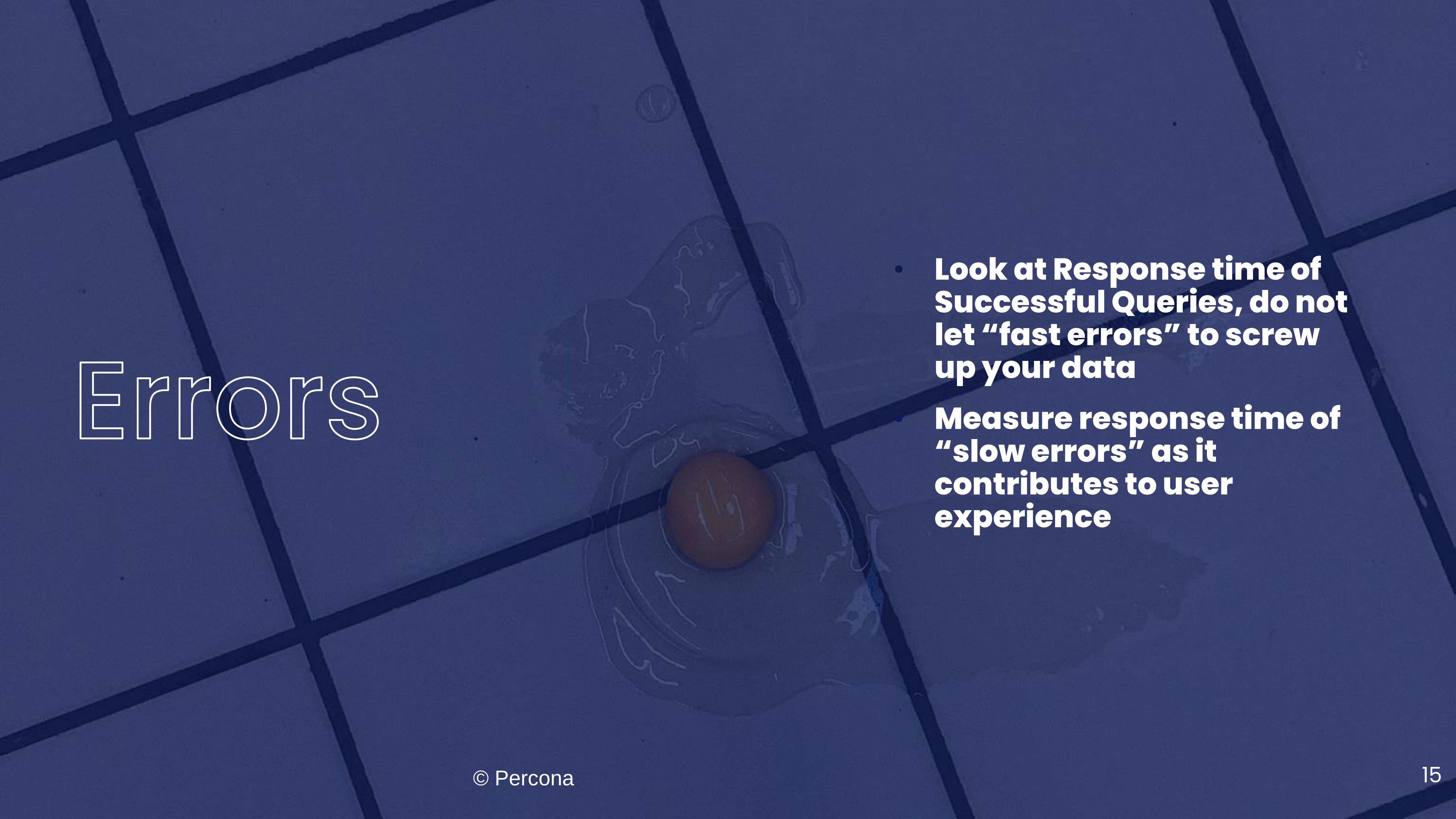
Percentile

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



Errors

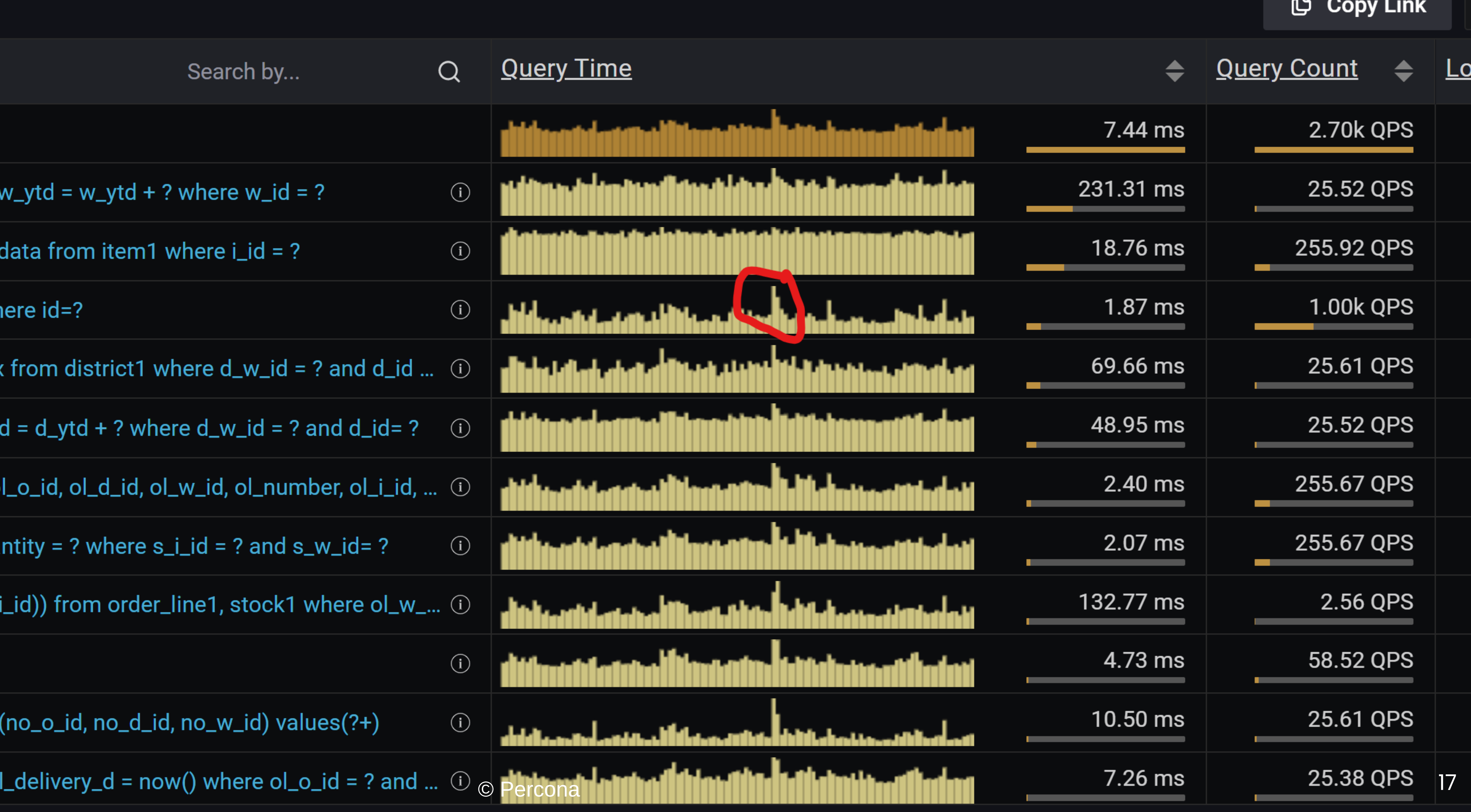
- **Look at Response time of Successful Queries, do not let “fast errors” to screw up your data**
- **Measure response time of “slow errors” as it contributes to user experience**

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



Search by...	Query Time		Query Count	Lo
		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	
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

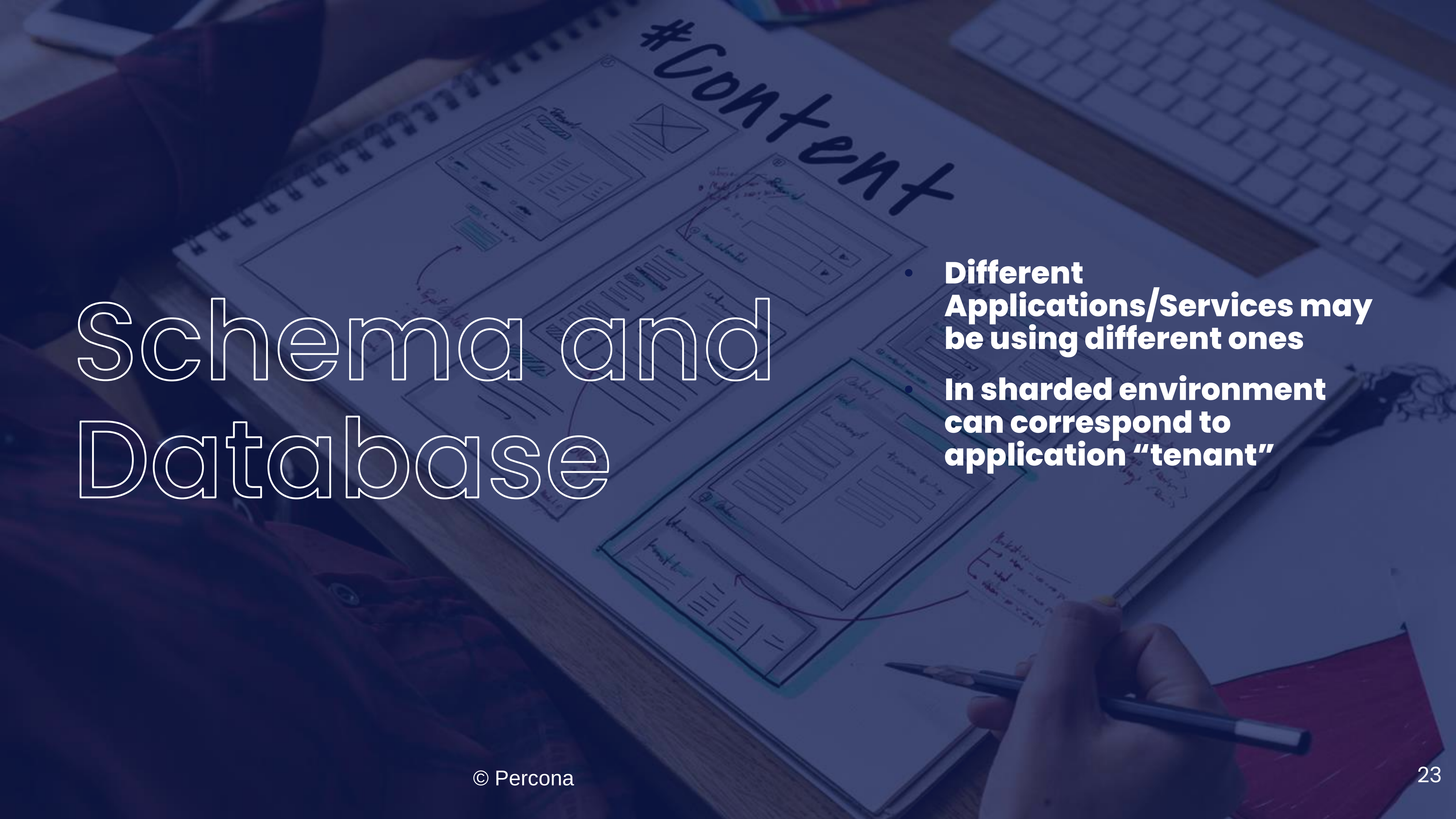
Application/Functionality

Version Information (A/B Testing)

Responsible Engineer/Team

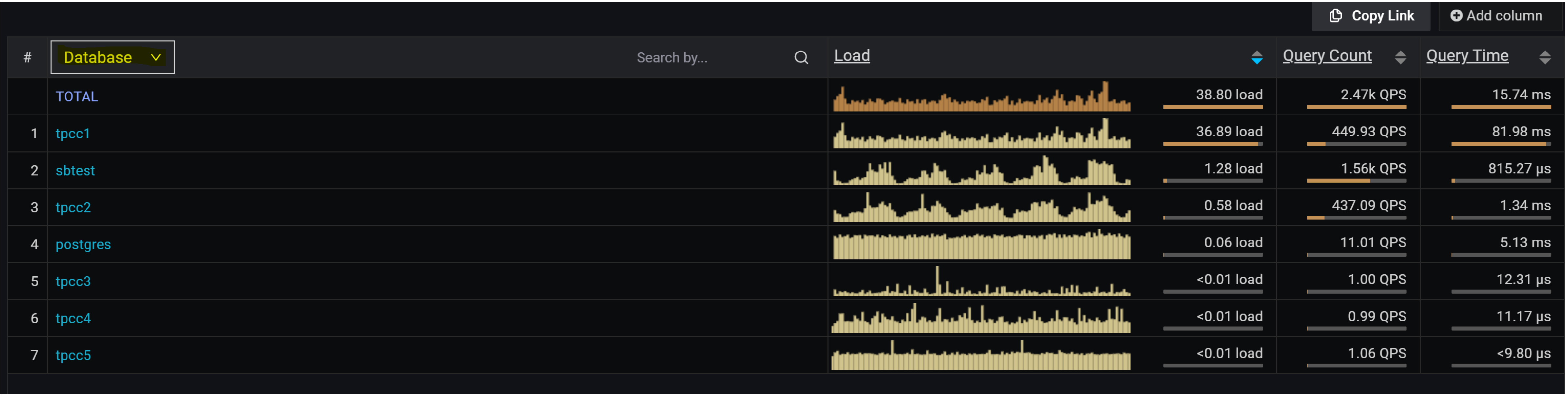
Query

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



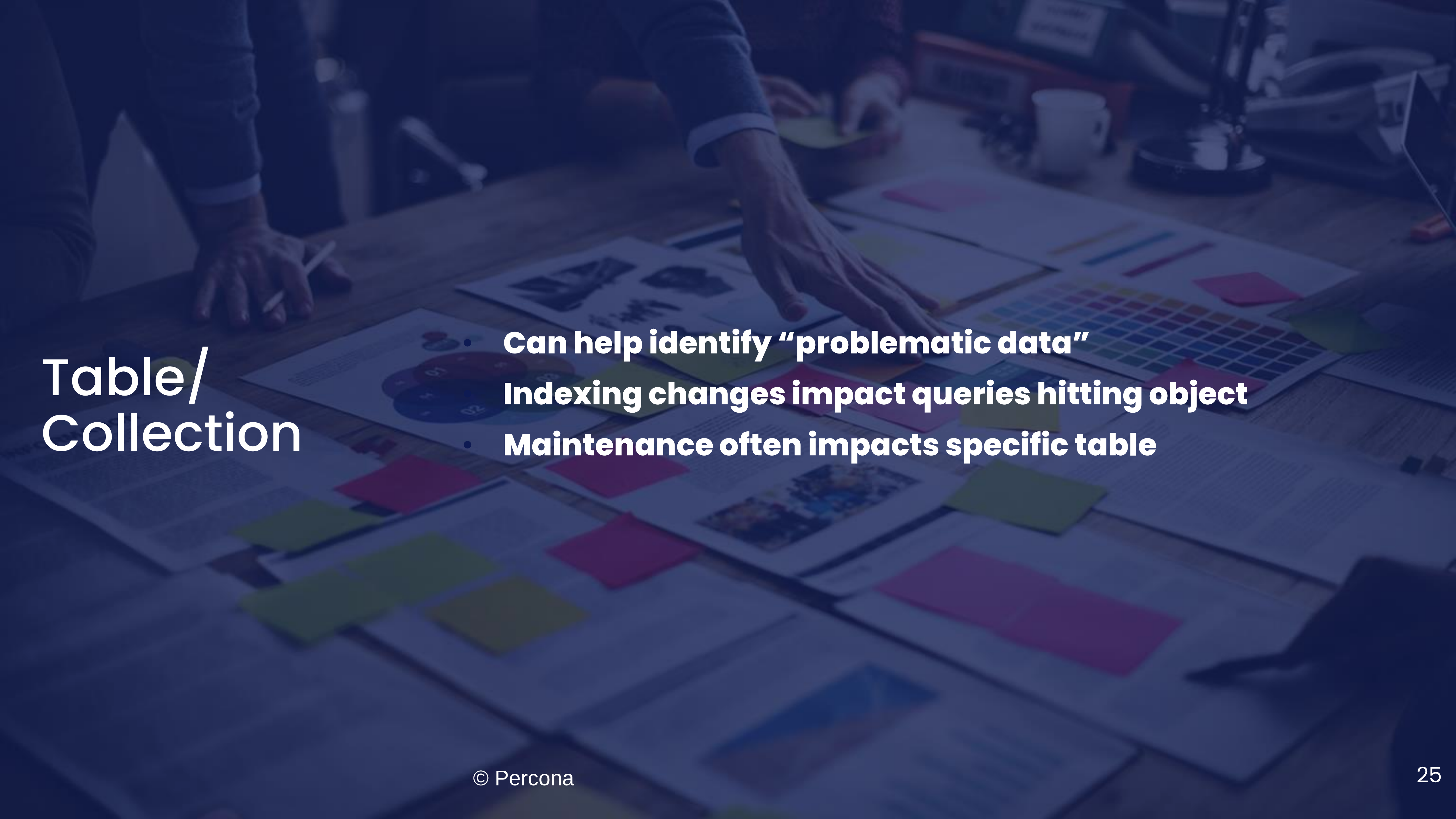
Schema and Database

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



#	Database	Load	Query Count	Query Time
	TOTAL	38.80 load	2.47k QPS	15.74 ms
1	tpcc1	36.89 load	449.93 QPS	81.98 ms
2	sbtest	1.28 load	1.56k QPS	815.27 µs
3	tpcc2	0.58 load	437.09 QPS	1.34 ms
4	postgres	0.06 load	11.01 QPS	5.13 ms
5	tpcc3	<0.01 load	1.00 QPS	12.31 µs
6	tpcc4	<0.01 load	0.99 QPS	11.17 µs
7	tpcc5	<0.01 load	1.06 QPS	<9.80 µs

Database view in Percona Monitoring and Management



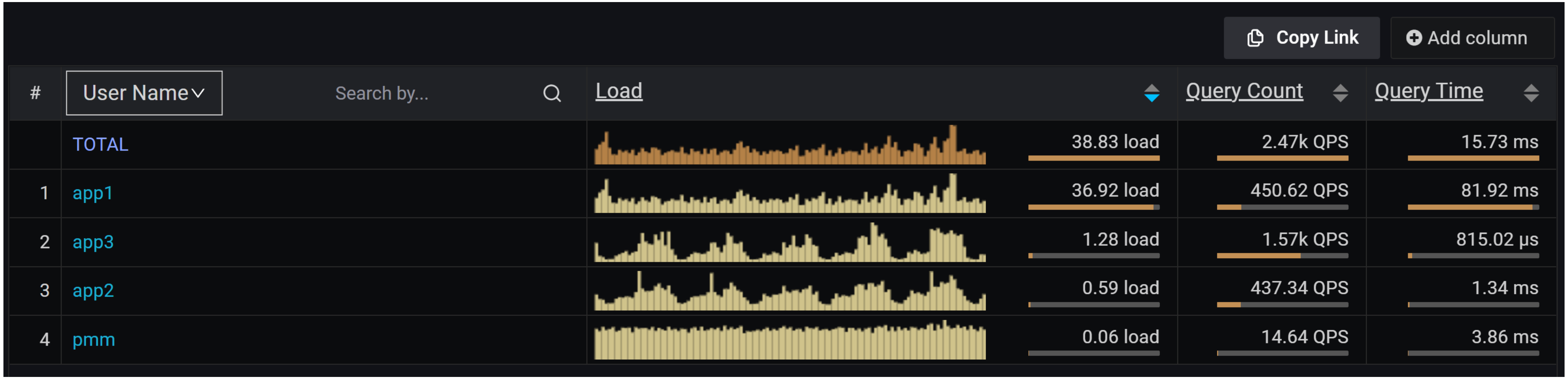
Table/ Collection

- 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



#	User Name	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

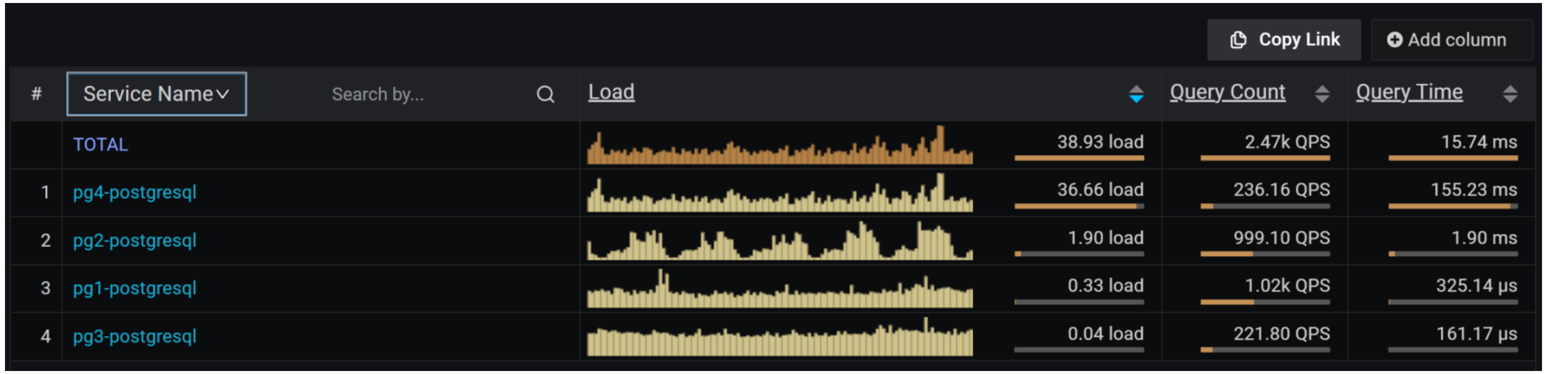
Database Host

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



#	Service Name	Load	Query Count	Query Time
	TOTAL	38.93 load	2.47k QPS	15.74 ms
1	pg4-postgresql	36.66 load	236.16 QPS	155.23 ms
2	pg2-postgresql	1.90 load	999.10 QPS	1.90 ms
3	pg1-postgresql	0.33 load	1.02k QPS	325.14 µs
4	pg3-postgresql	0.04 load	221.80 QPS	161.17 µs

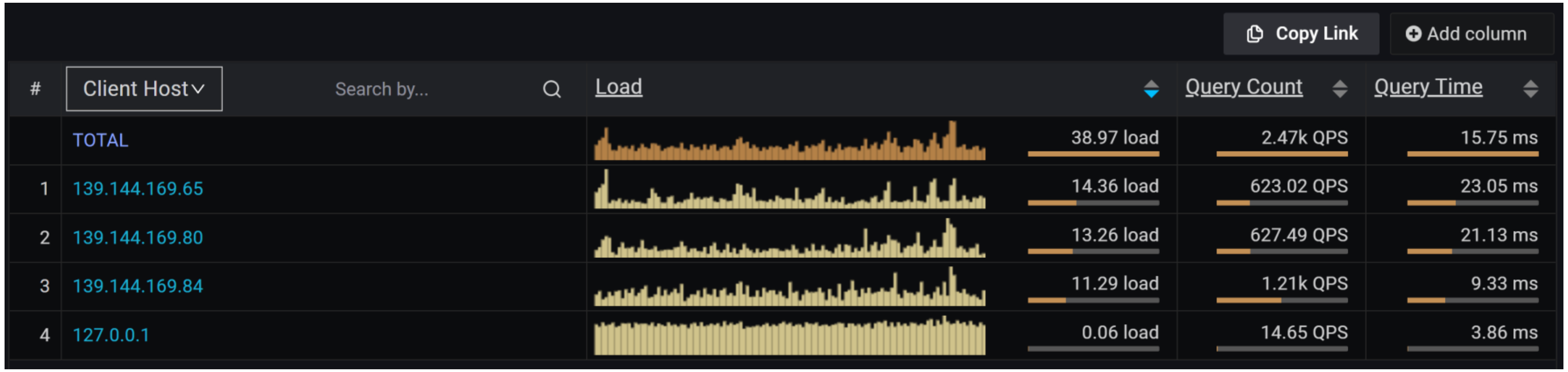
App Server/ Web Server/ Service Instance

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

It may not be the case

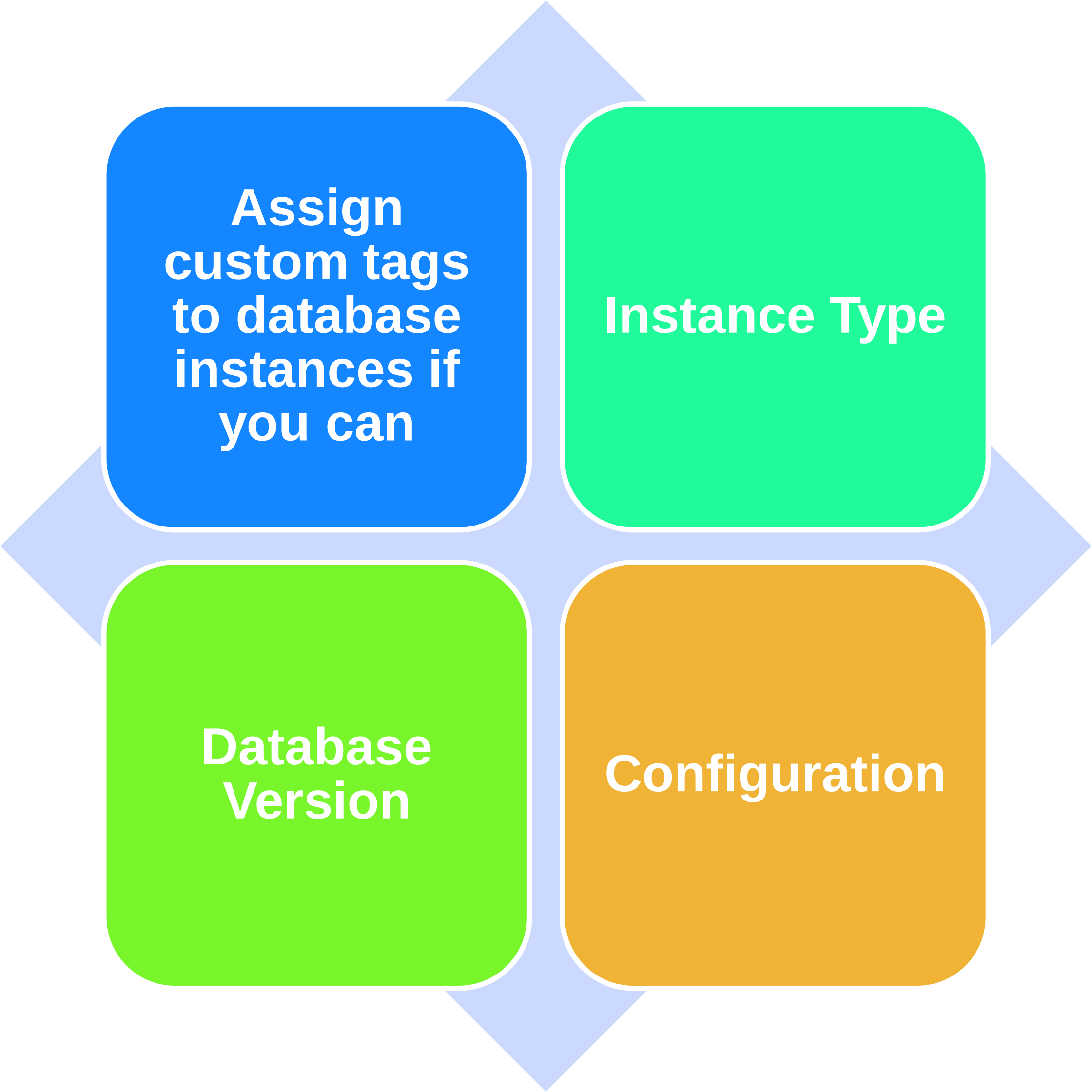
Code versions, configuration, load balancer behavior, security incidents

Client Hosts



#	Client Host	Load	Query Count	Query Time
	TOTAL	38.97 load	2.47k QPS	15.75 ms
1	139.144.169.65	14.36 load	623.02 QPS	23.05 ms
2	139.144.169.80	13.26 load	627.49 QPS	21.13 ms
3	139.144.169.84	11.29 load	1.21k QPS	9.33 ms
4	127.0.0.1	0.06 load	14.65 QPS	3.86 ms

Custom Tags

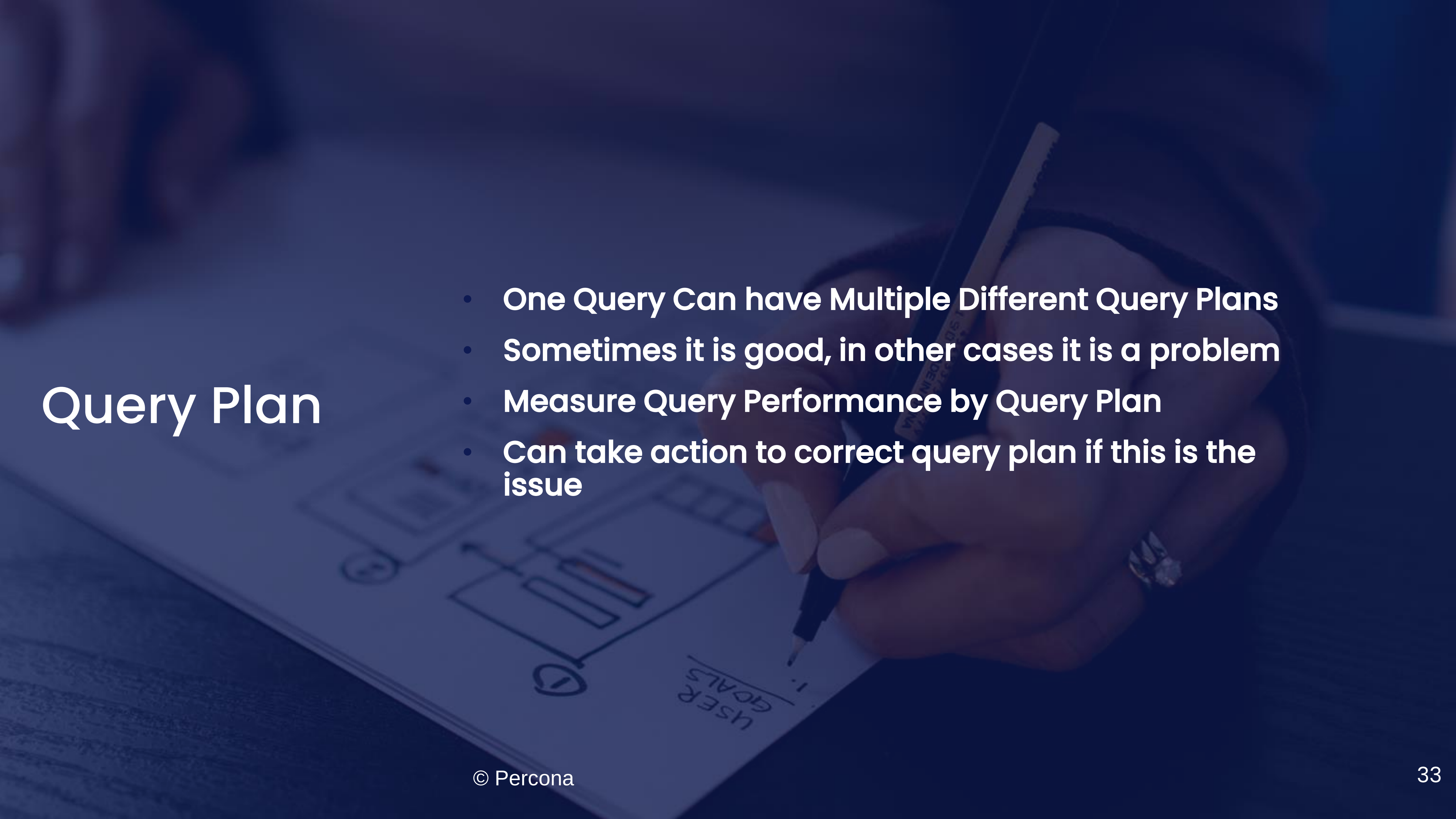


Assign custom tags to database instances if you can

Instance Type

Database Version

Configuration



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

pg_stat_monitor

Deep Query Performance Insights for PostgreSQL

https://github.com/percona/pg_stat_monitor

https://www.percona.com/blog/2020/10/14/announcing-pg_stat_monitor-tech-preview-get-better-insights-into-query-performance-in-postgresql/

Why not improve pg_stat_statements

- Move fast, experiment new approaches to data capture
- Focus on data being constantly consumed by monitoring system (hence held on the instance for short term)
- Focusing on change over time
- pg_stat_statements view provided for compatibility in v 2.0

Where Response Time Comes From ?

- Data Crunching/CPU
- Waits on CPU Availability
- Disk IO
- Row Locks
- Contention
- Network

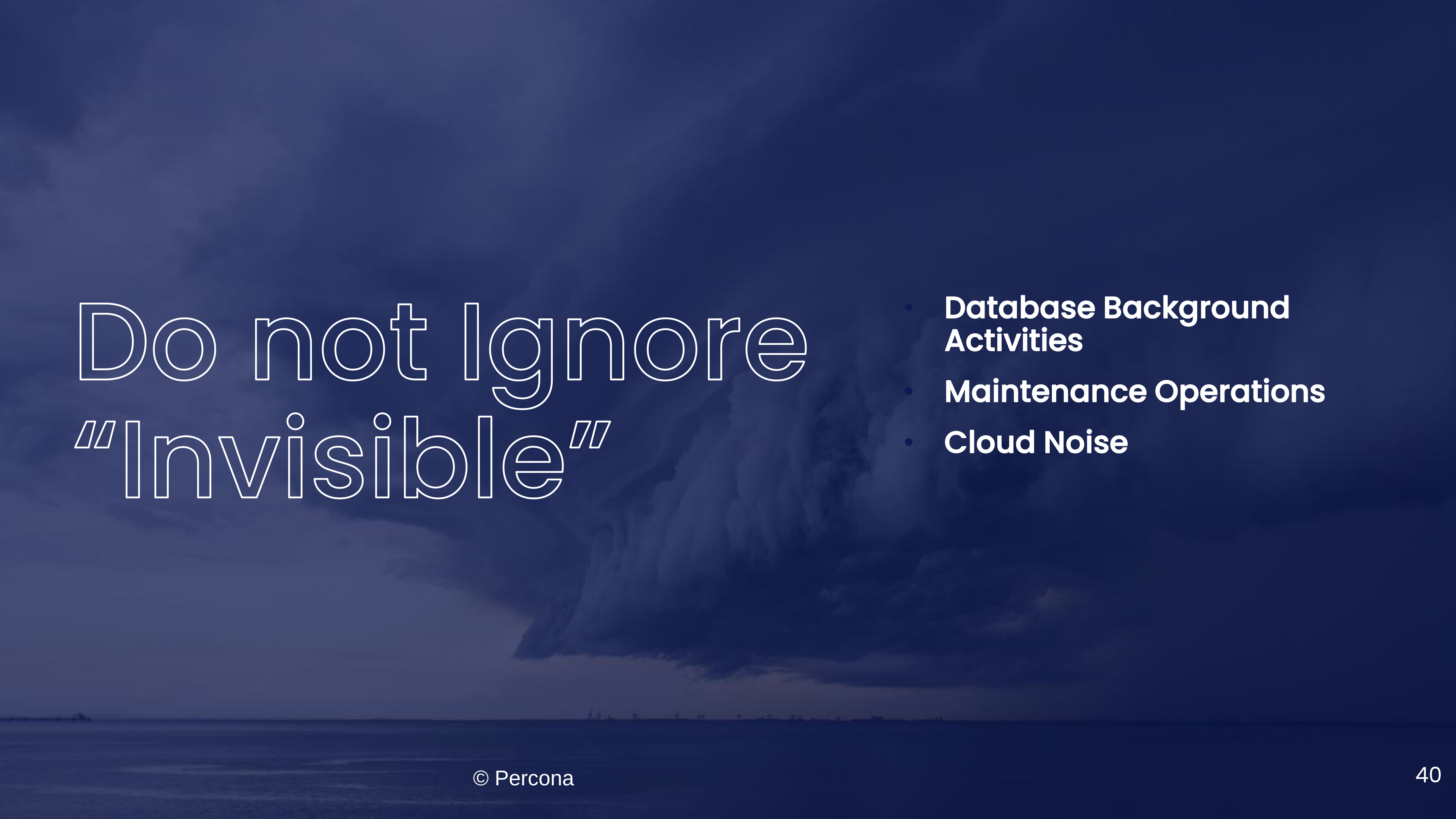
Other Things to Consider

“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”

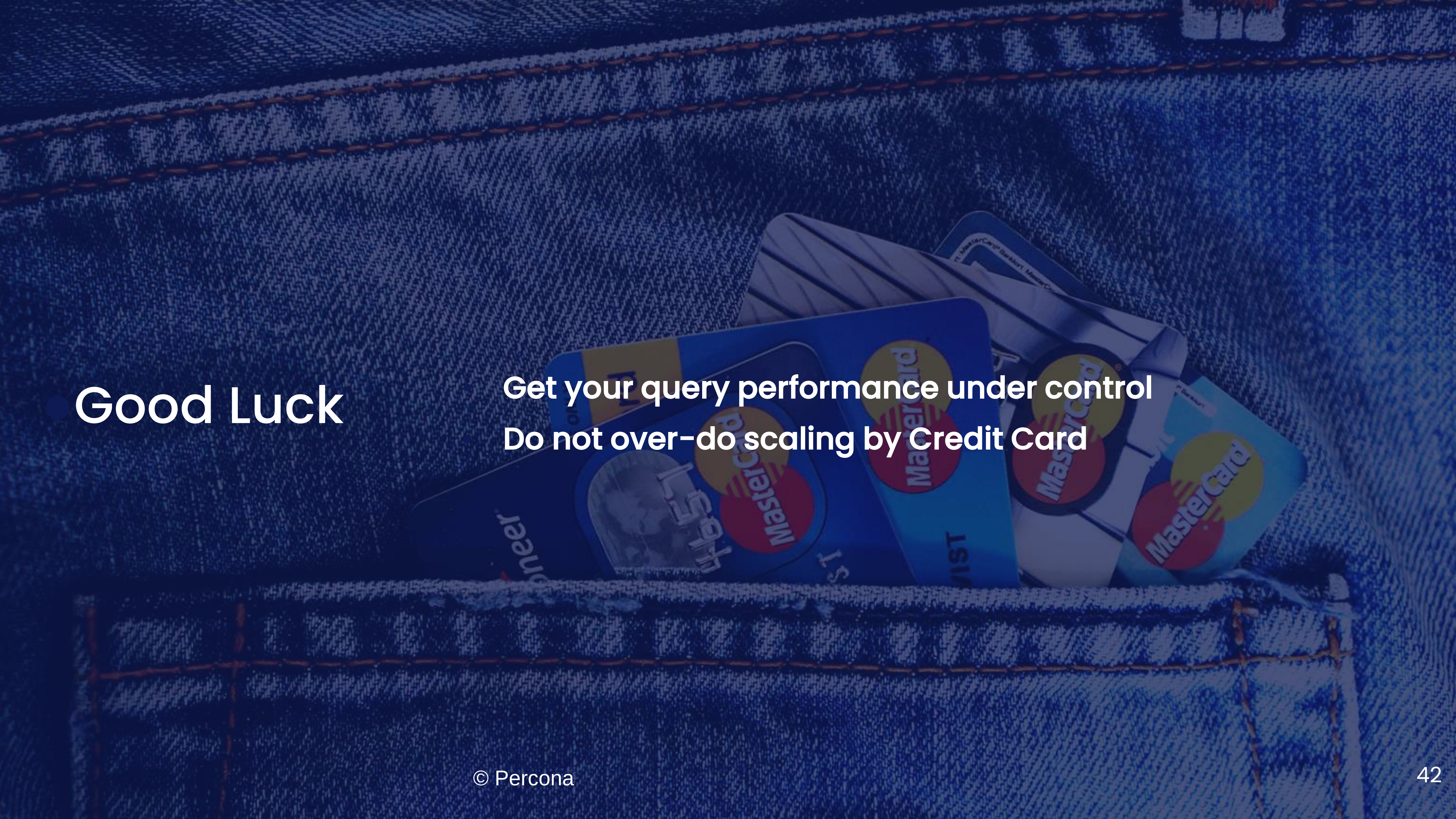
- Database Background Activities
- Maintenance Operations
- Cloud Noise

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

Let’s Connect!

https://www.linkedin.com/in/peterzaitsev/

https://twitter.com/PeterZaitsev

http://www.peterzaitsev.com

THANK YOU!

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