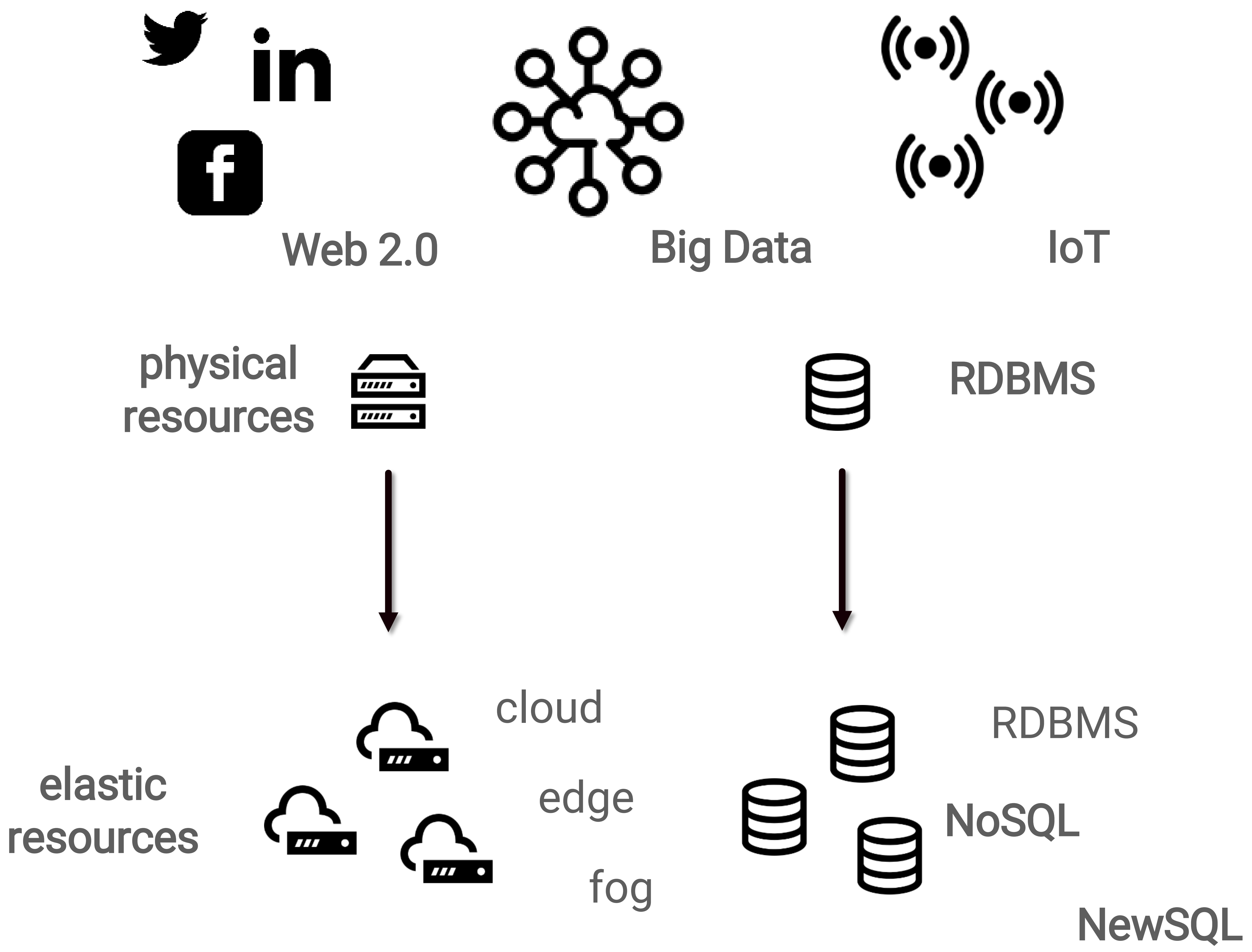
Automated Benchmarking of Cloud-hosted DBMS with benchANT

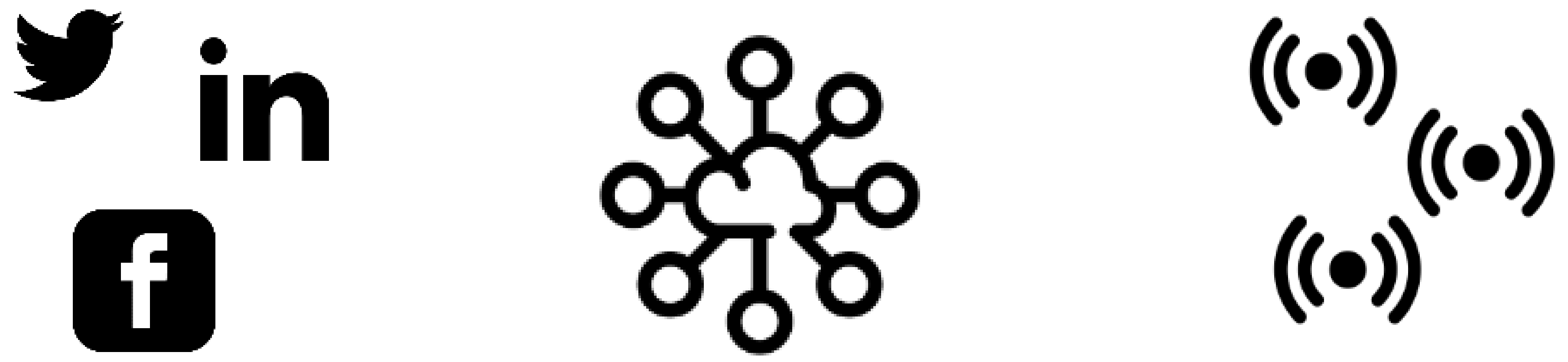
12th Symposium on Software Performance 2021

Daniel Seybold, Jörg Domaschka
benchANT | Ulm University

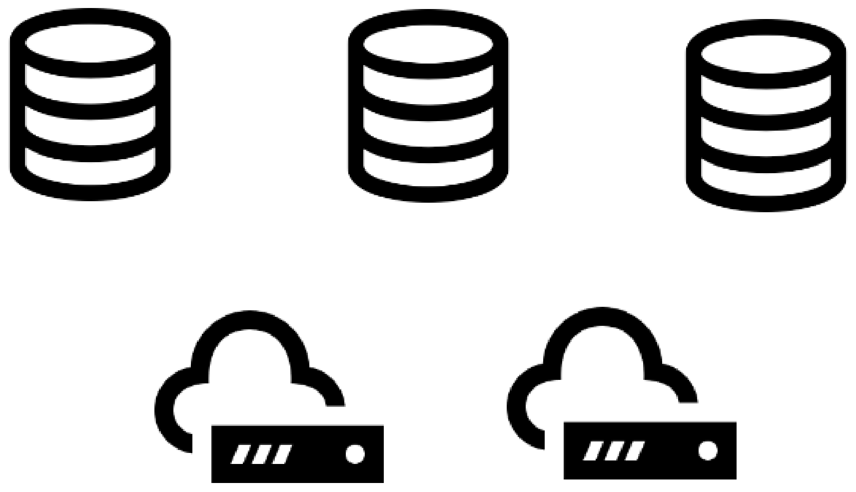
Advances of Data Management Technologies for Data-intensive Applications



Advances of Data Management Technologies for Data-intensive Applications



Web 2.0 Big Data IoT



cloud resources have become the preferred solution to operate DBMS [1]

the idea of "one-size-fits-all" is over [2]

[1] Abadi, Daniel, et al. "The seattle report on database research." ACM SIGMOD Record (2020)
[2] Stonebraker, Michael, and Uğur Çetintemel. "One size fits all" an idea whose time has come and gone." Making Databases Work: the Pragmatic Wisdom of Michael Stonebraker. 2018

Decision Making in the Cloud DBMS World

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Decision Making in the Cloud DBMS World

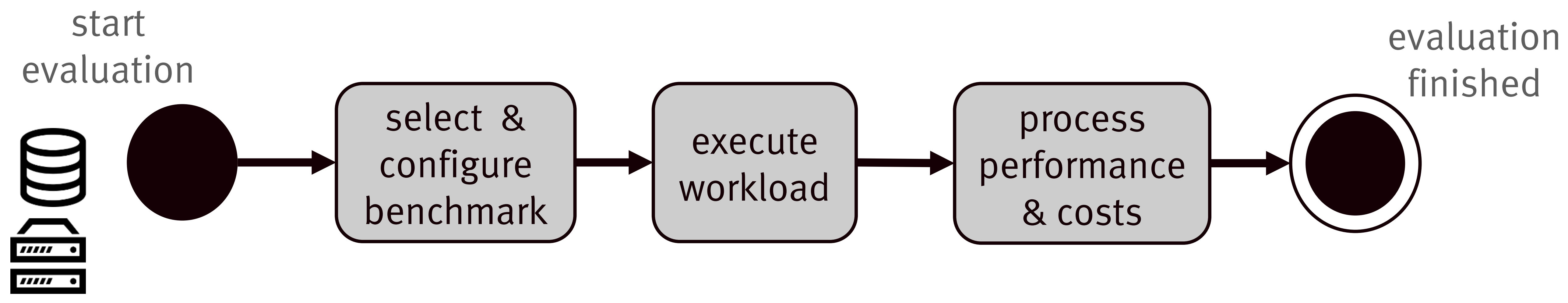
"… we recommend measuring the performance of applications to identify appropriate instance types … we also recommend rigorous load/scale testing …" – *AWS*

https://aws.amazon.com/ec2/instance-types/

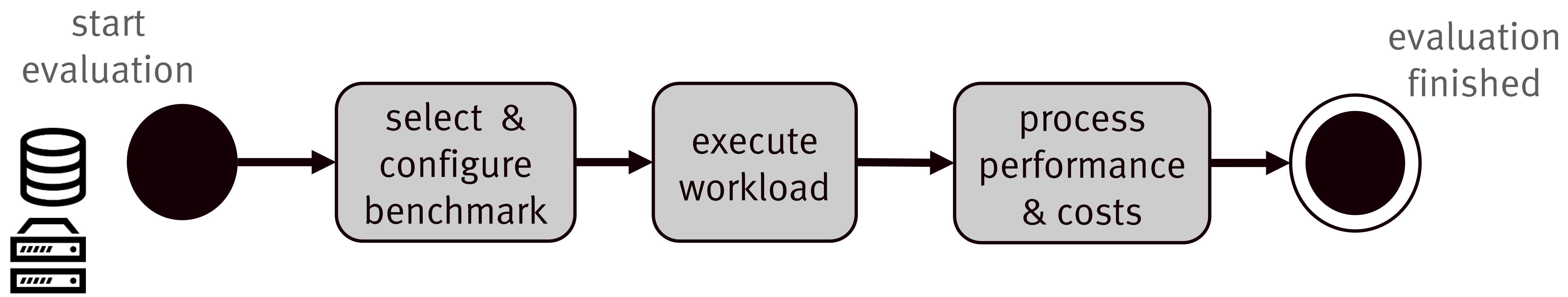
"… measure everything, assume nothing …" – *MongoDB*

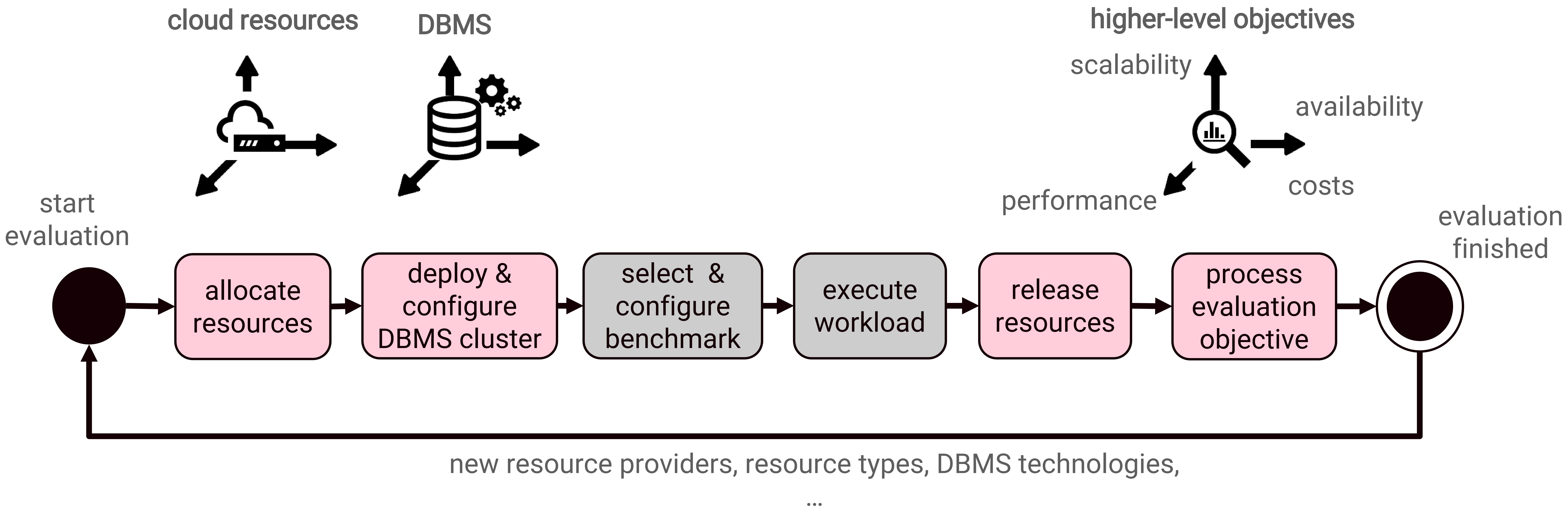
https://engineering.mongodb.com/post/repeatable-performance-tests-ec2-instances-are-neither-good-nor-bad

Benchmarking DBMS in the Pre-Cloud Era vs. Cloud Era

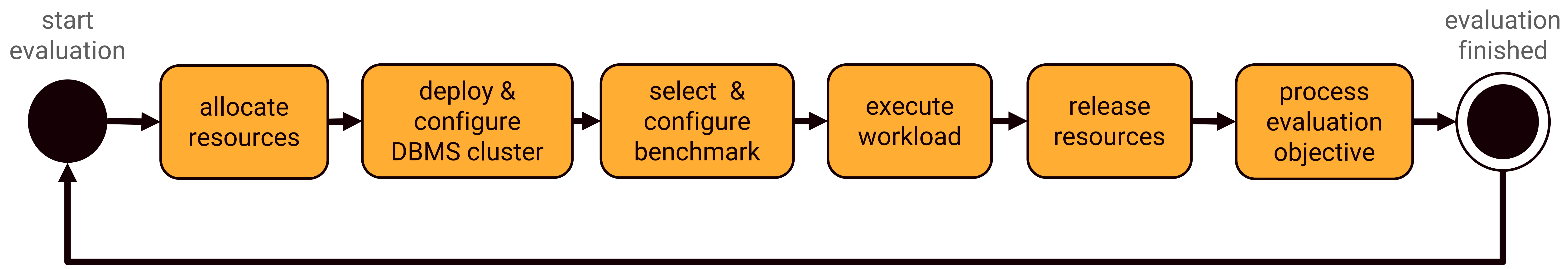


Benchmarking DBMS in the Pre-Cloud Era vs. Cloud Era

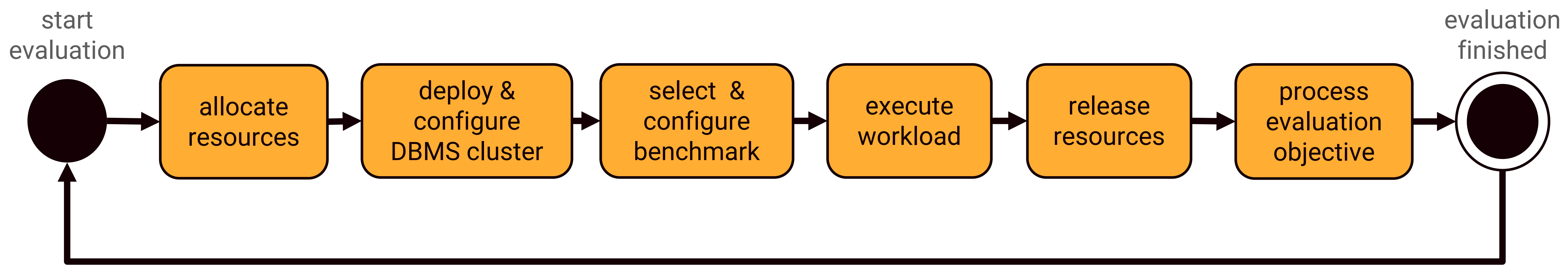




Benchmarking Cloud-hosted DBMS with benchANT



Benchmarking Cloud-hosted DBMS with benchANT



Mowgli, Kaa & King Louie[1,2]

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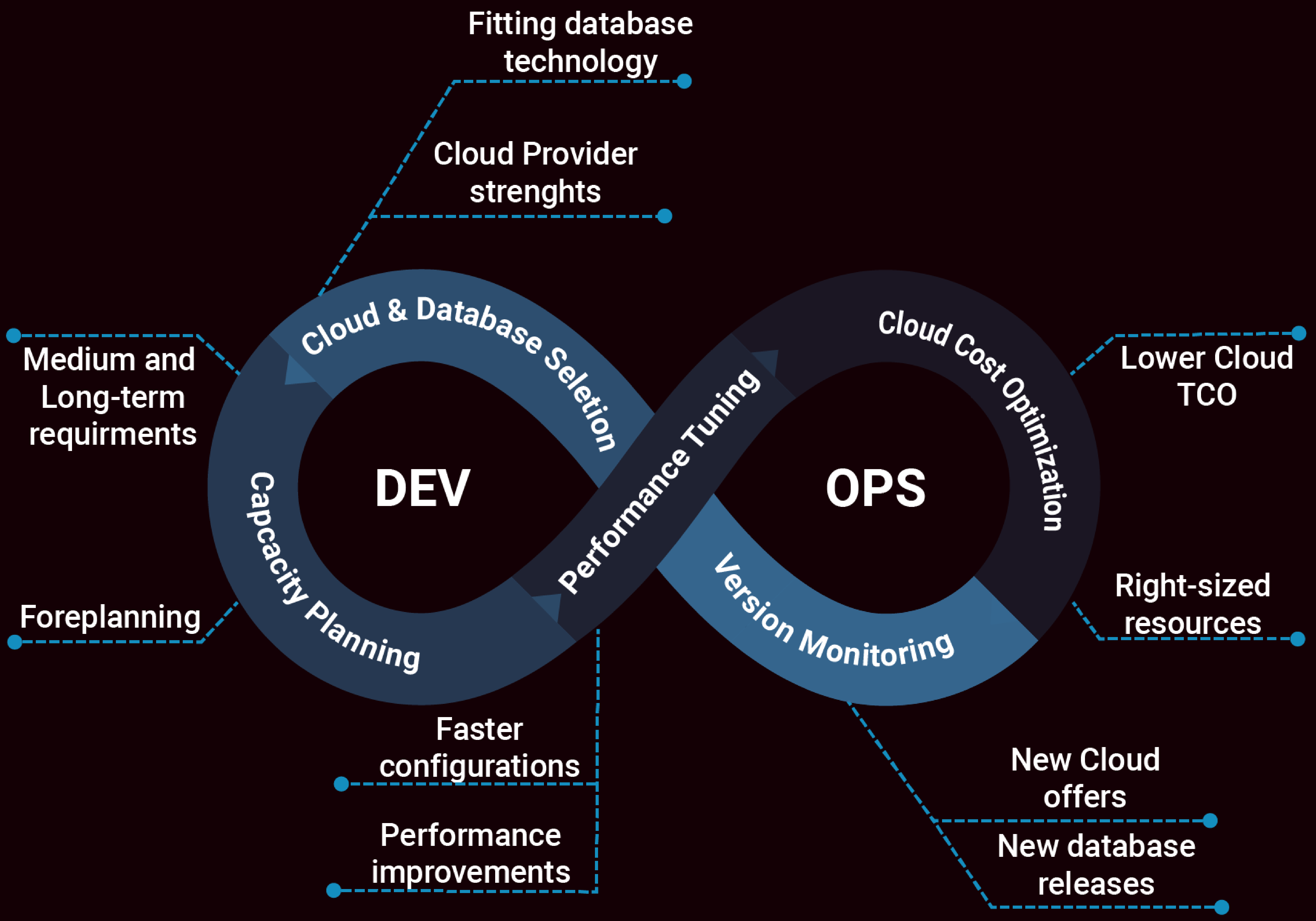
[1] https://research.spec.org/tools/overview/mowgli/

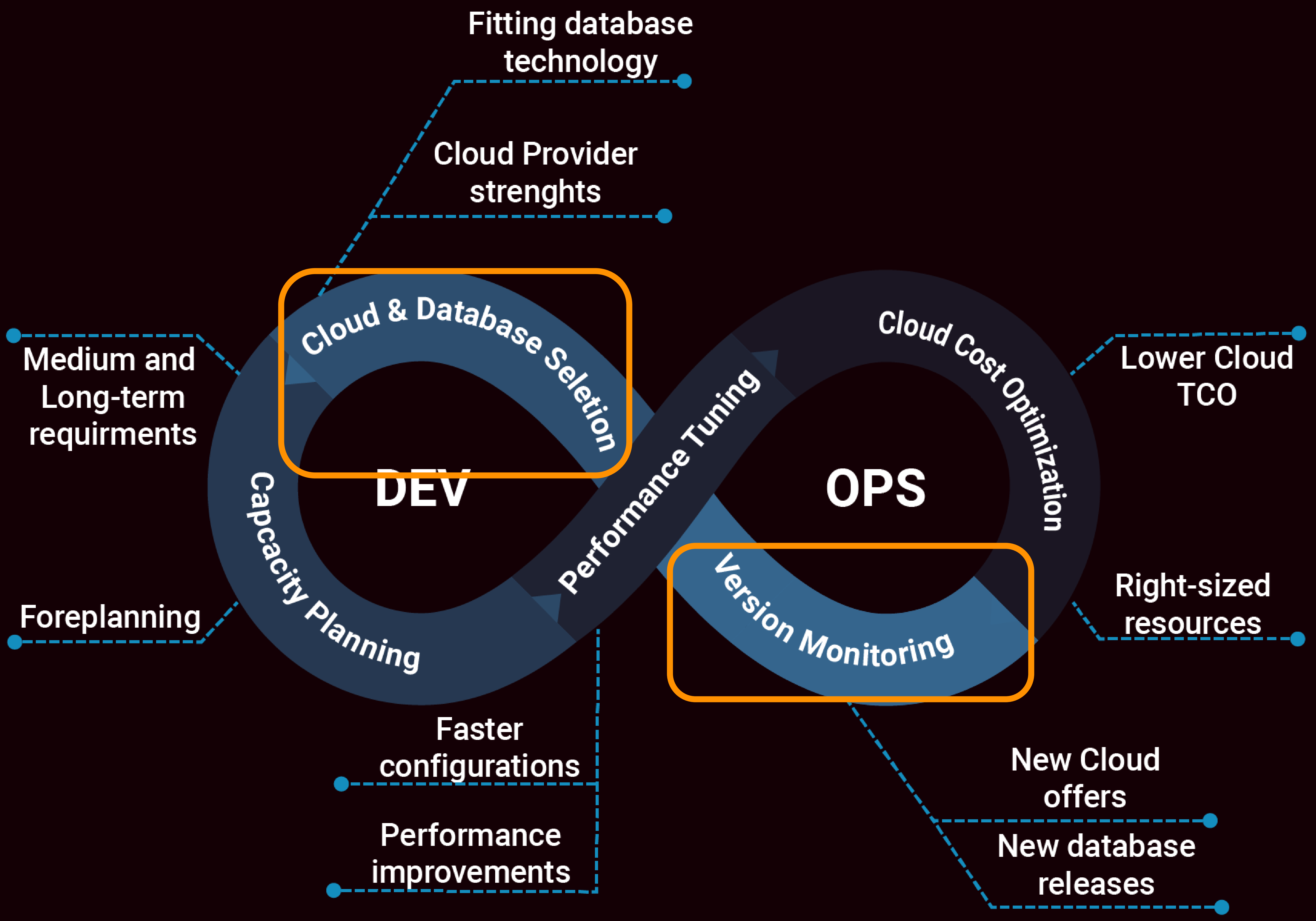
[2] Seybold, D. 2021. An automation-based approach for reproducible evaluations of distributed DBMS on elastic infrastructures. Universität Ulm

LIVE-DEMO

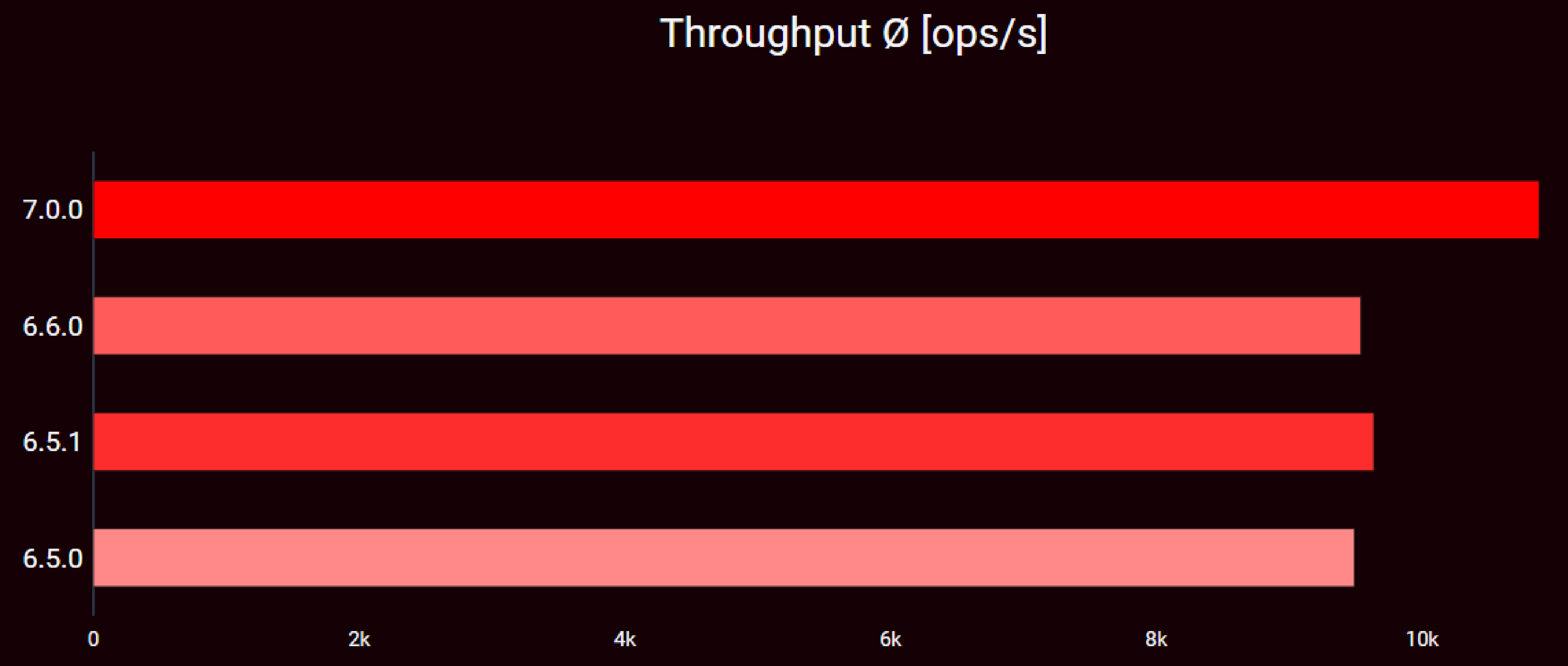
Continous Benchmarking with benchANT

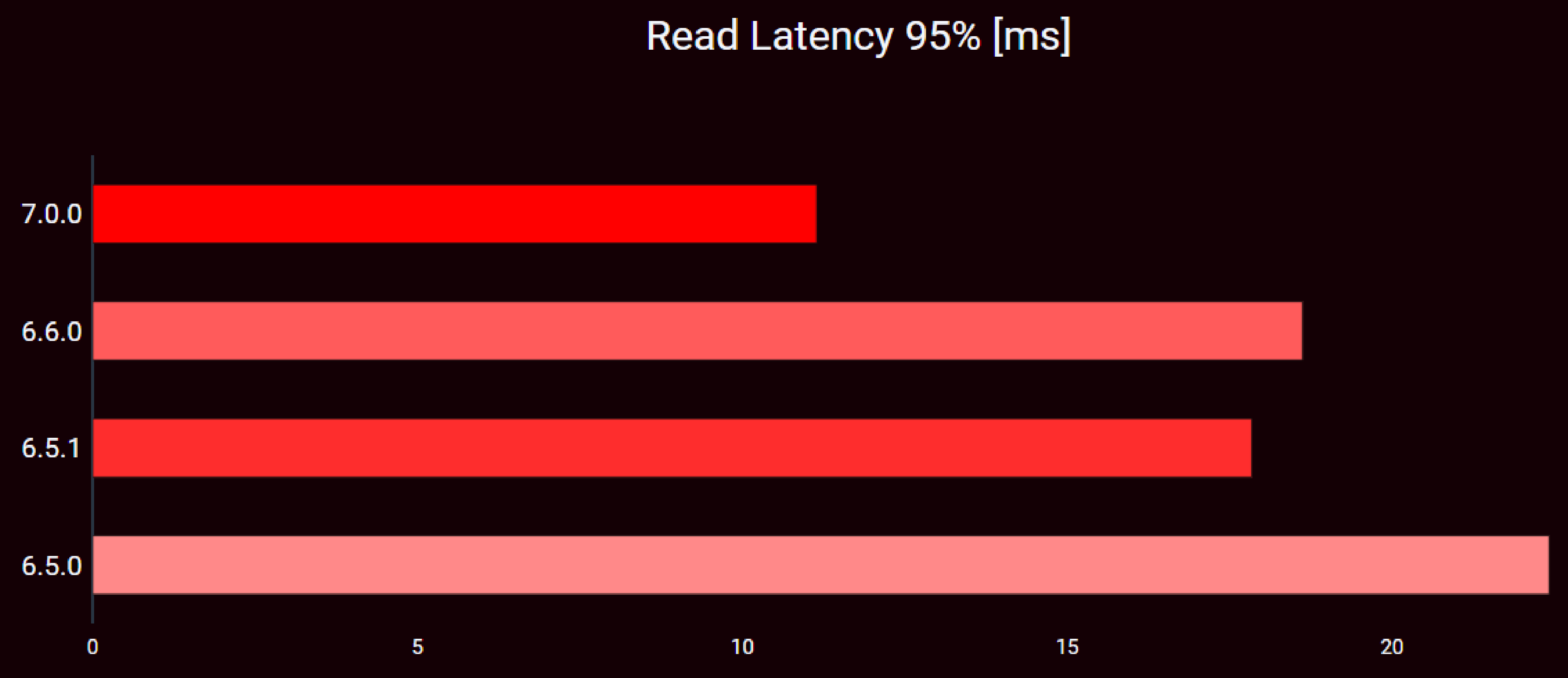


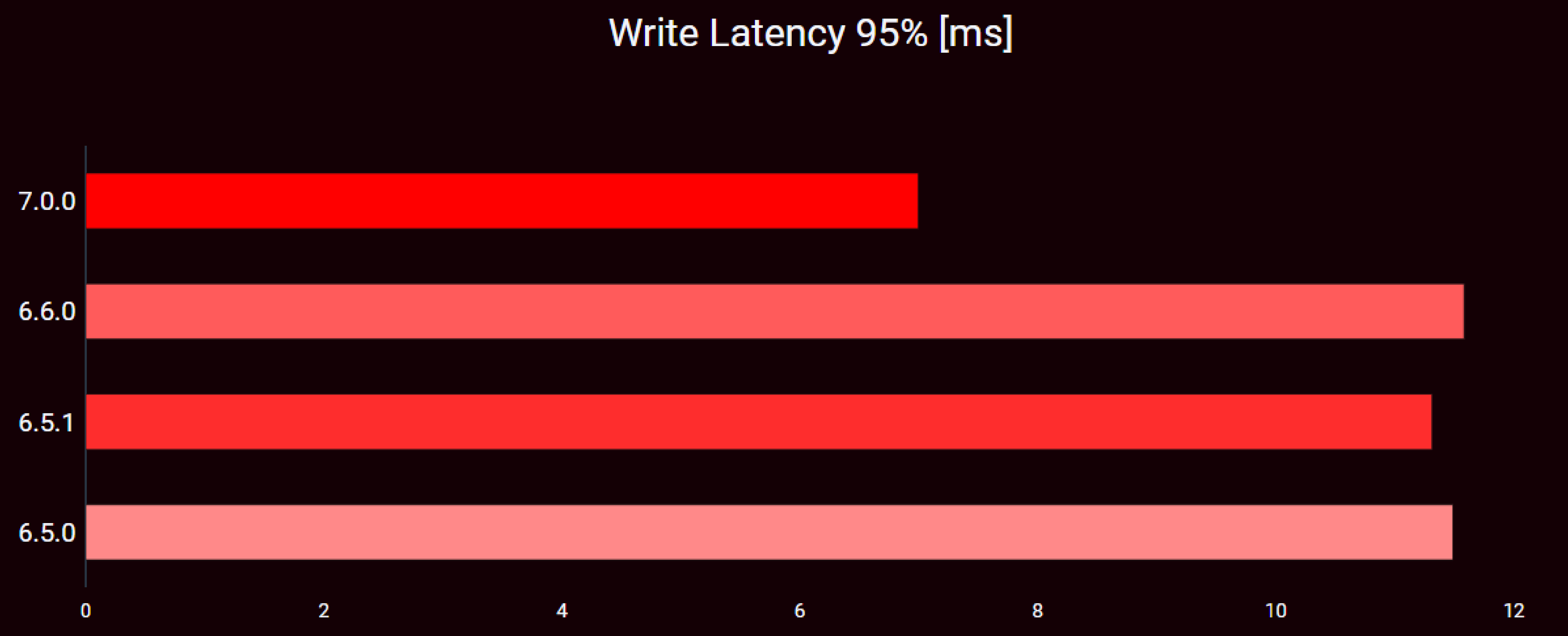
Continous Benchmarking with benchANT



Version Monitoring Insights:
New DBMS Release = Better Performance ?







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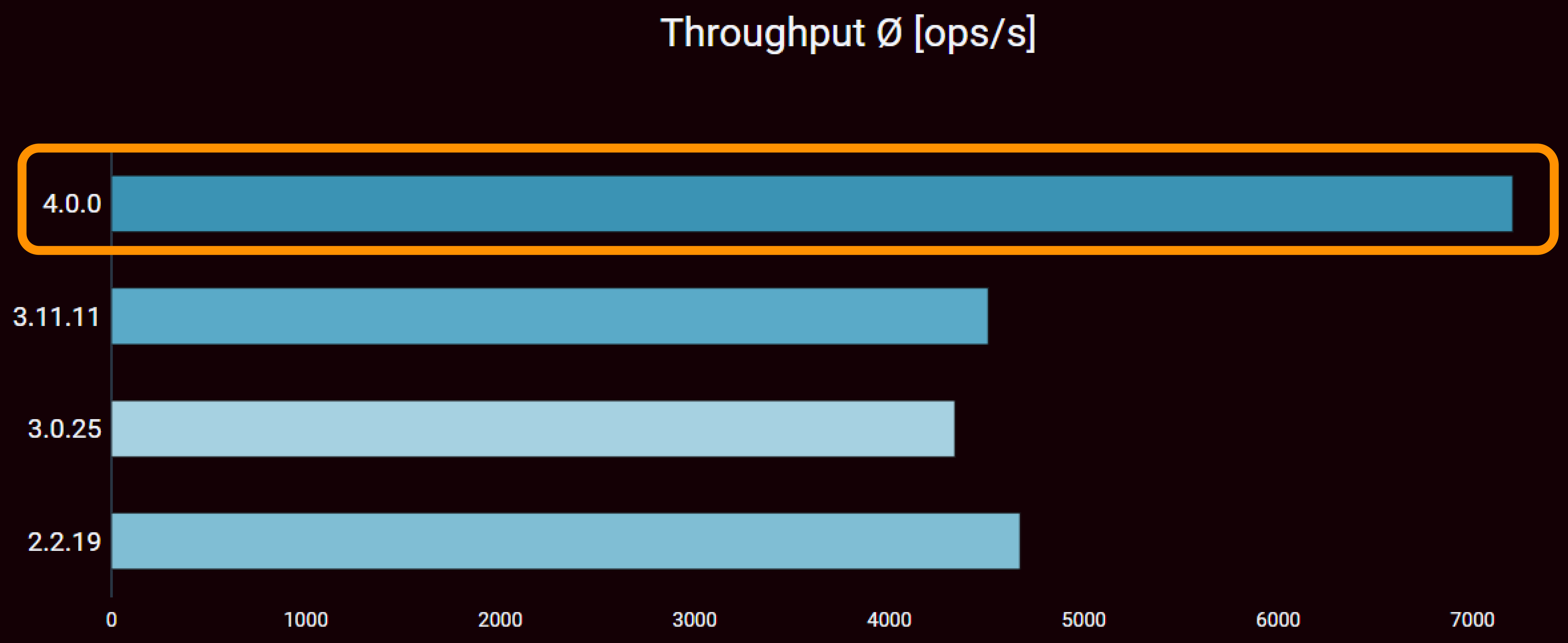

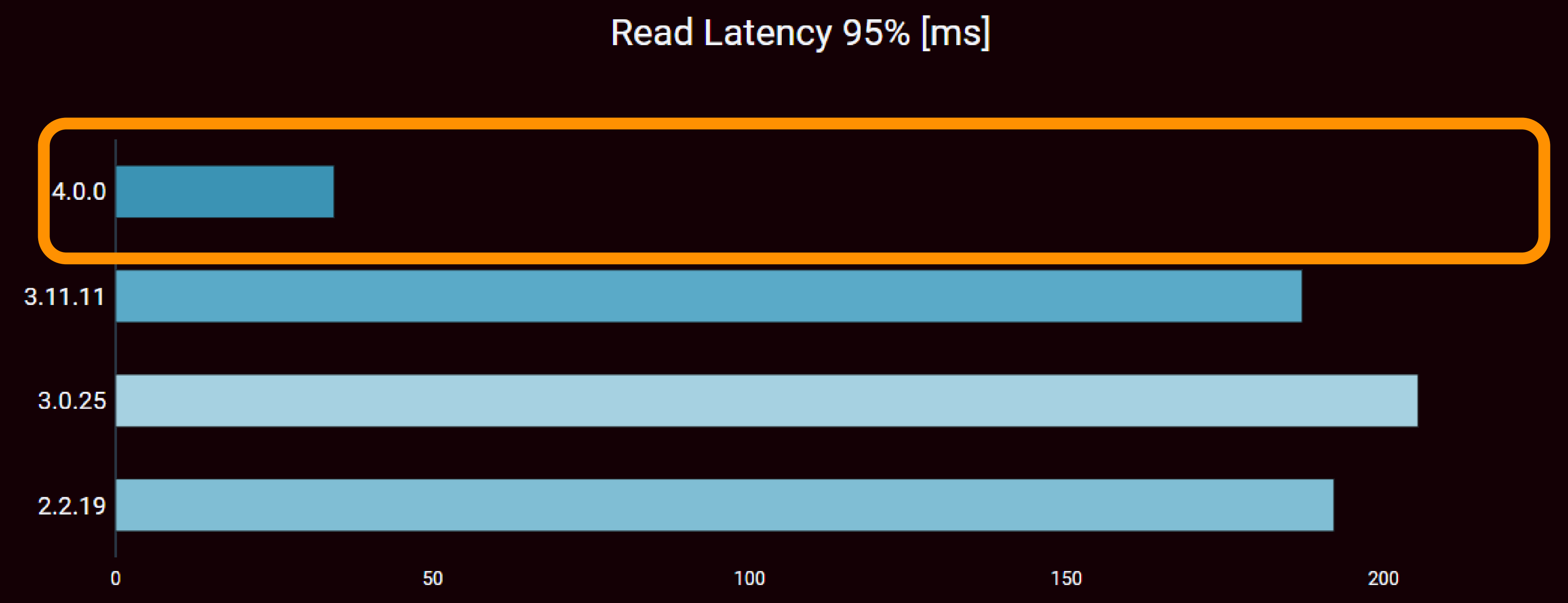

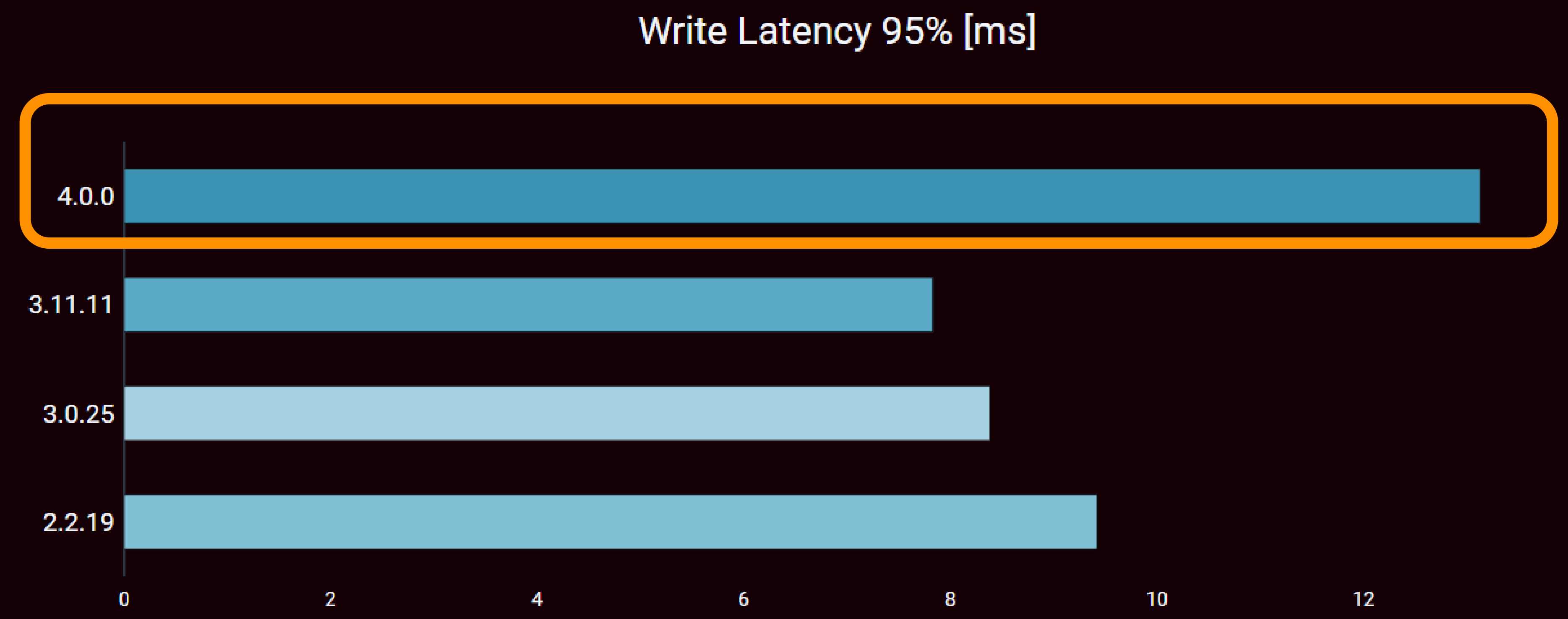

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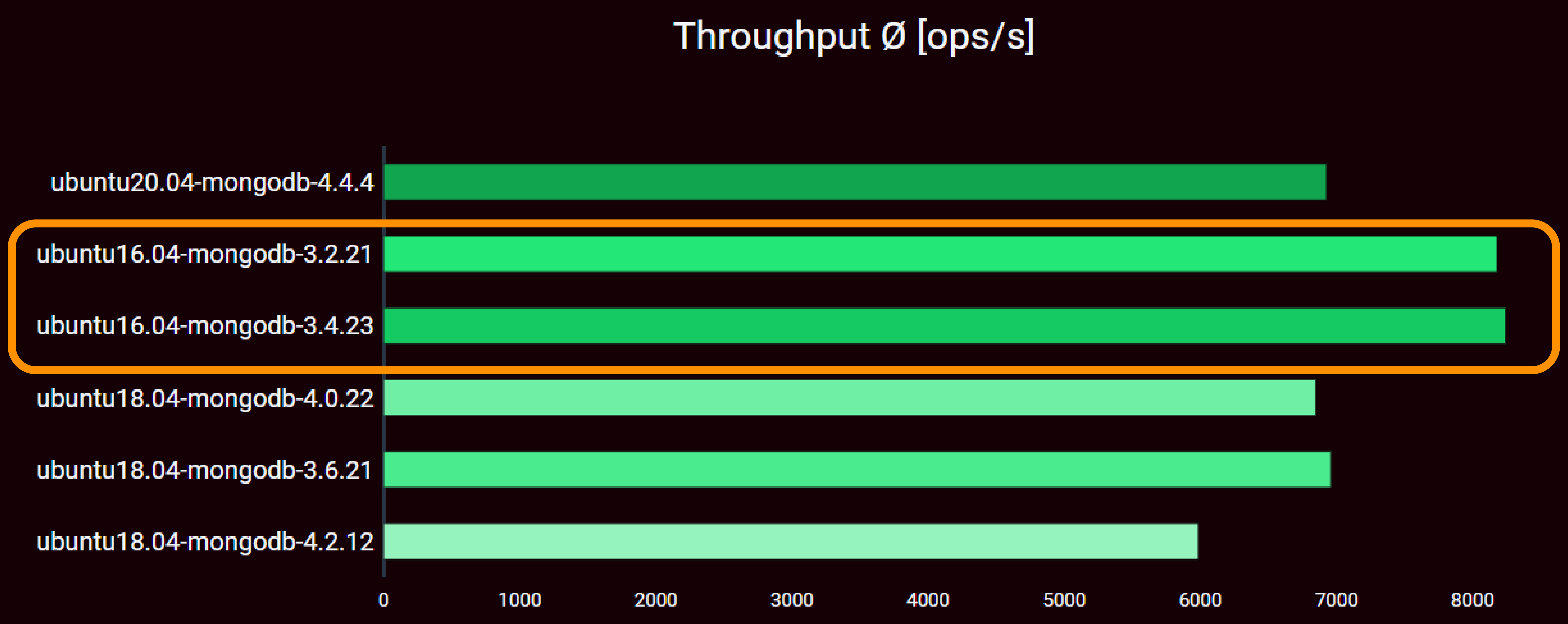
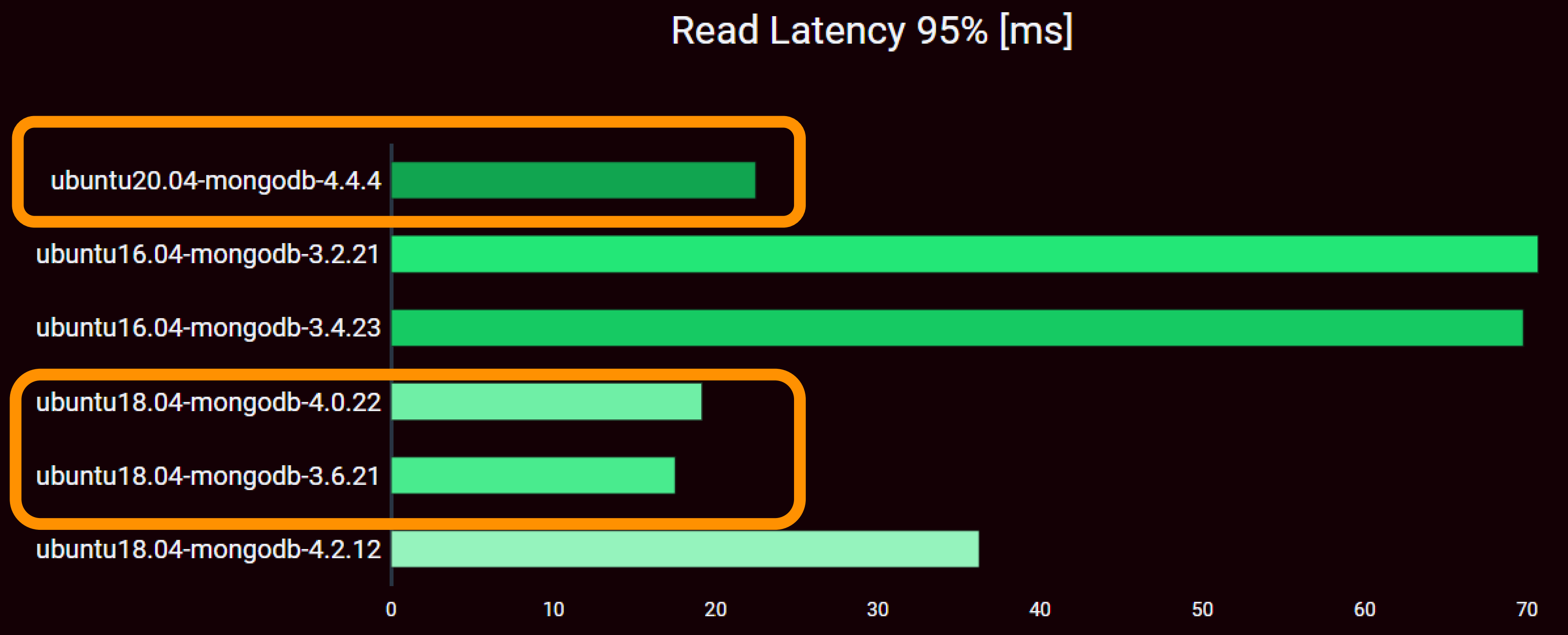
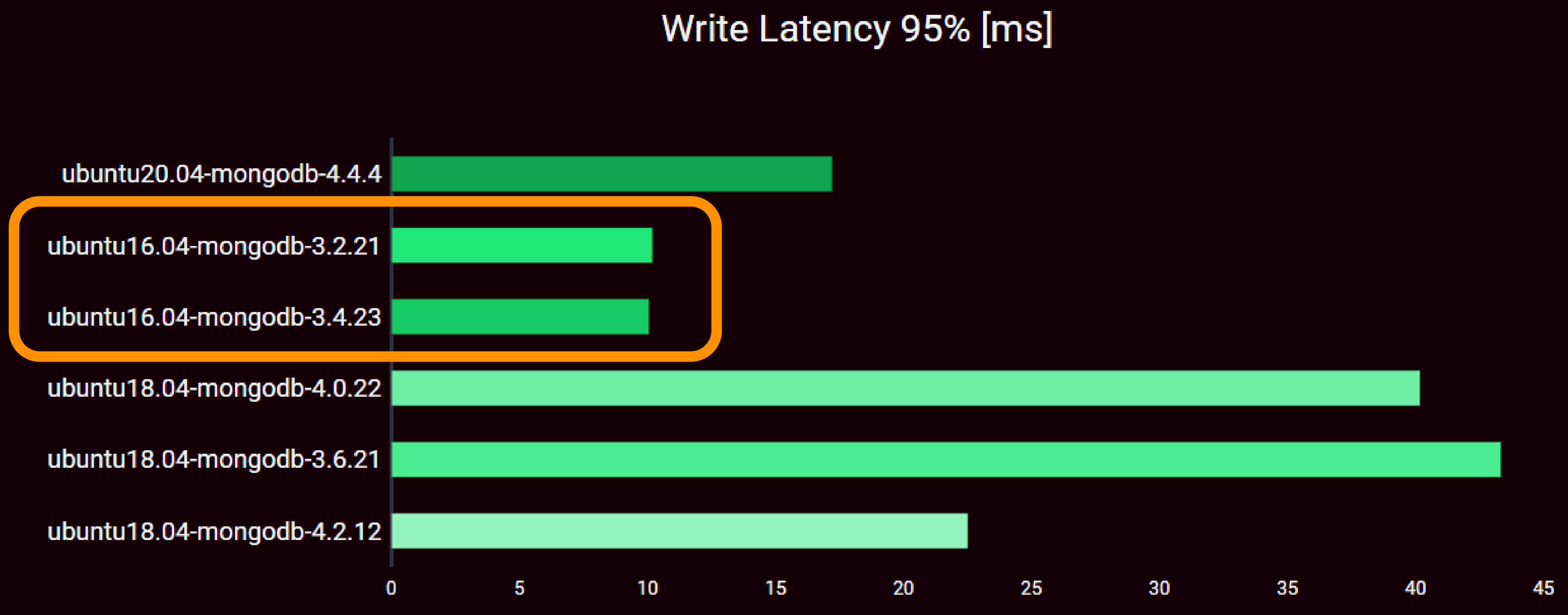
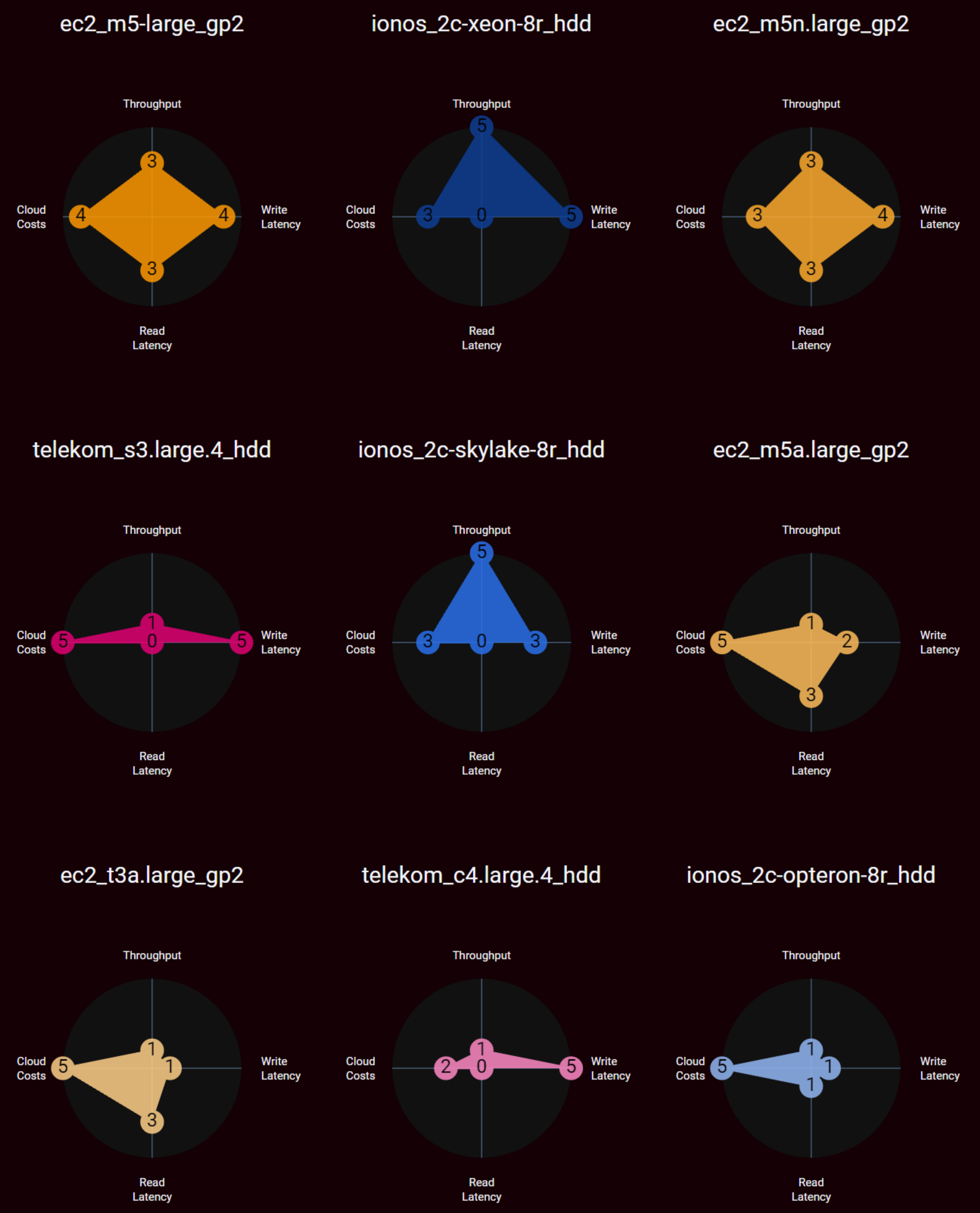






Cloud Provider Selection Insights:
Similar VM Flavours = Similar Performance ?

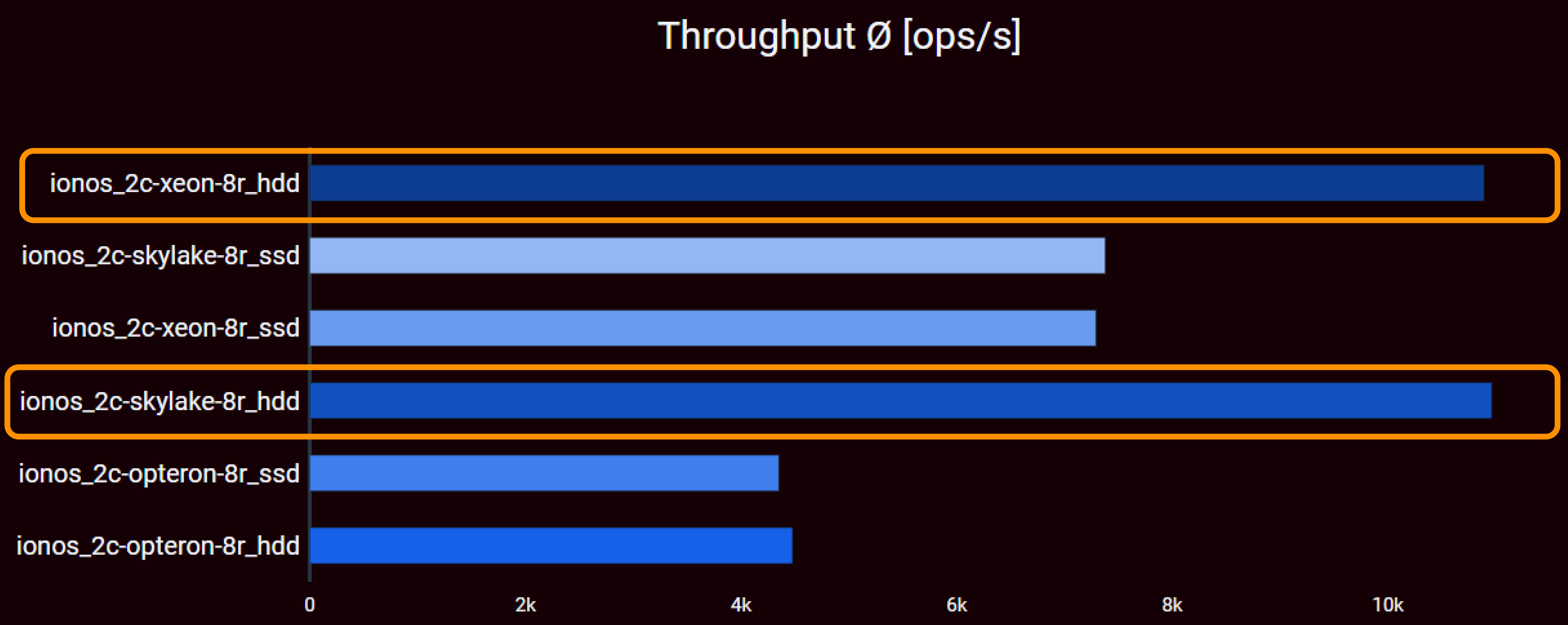


DBMS spec:
MongoDB
3 nodes

VM spec:
2 cores
8GB RAM
cheapest storage option

Workload Spec:
YCSB
80% writes
20 % reads

Cloud Provider Selection Insights:
Always choose SSD over HDD for Write Performance ?



benchANT Feature Set
ALPHA Release

DBMS	mongoDB, cassandra, Couchbase, PostgreSQL, MySQL, Cockroach DB
Cloud	aws, Azure, Open Telekom Cloud, IONOS by 1&1, openstack
Benchmark	Yahoo Cloud Serving Benchmark (YCSB)
KPIs	Throughput, Write Latency, Read Latency, Storage Allocation, Cloud Costs

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benchmarkingAnyNewTechnology

Trace-based DBMS workloads

AI-based recommender system

benchANTs Benchmarking-as-a-Service technology

ALPHA
DATABASES
On Public & Private Cloud

2022
STORAGE
On Public & Private Cloud

2023
AI
On Public & Private Cloud

2024
λ
SERVERLESS
On Public Cloud

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We are looking for pilot projects & research collaborations!

benchANT | info@benchant.com
Universität Ulm | Institut für Organisation und Management von Informationssystemen

APPENDIX

benchANT is built upon

1 PhD

> 15 years of research

> 10 scientic papers

scientific awards and results

Cloud Research

Hathi: An MCDM-based Approach to Capacity Planning for Cloud-hosted DBMS
(UCC 2020)

Kaa: Evaluating elasticity of cloud-hosted DBMS
(CloudCom 2019)

The impact of the storage tier: A baseline performance analysis of containerized DBMS
(Euro-Par 2017)

Performance Engineering Research

Baloo: Measuring and modeling the performance configurations of distributed DBMS
(MACOTS 2020)

Mowgli: Finding your way in the DBMS jungle
(ICPE 2019)

Towards Understanding the Performance of Distributed Database Management Systems in Volatile Environments
(SSP 2019)

DBMS Research

King Louie: Reproducible availability benchmarking of cloud-hosted DBMS
(SAC 2020)

Is distributed database evaluation cloud-ready?
(ADBIS 2017)

Is elasticity of scalable databases a myth?
(Big Data 2016)

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The team behind benchANT
Researchers & Innovators

Dr. Daniel Seybold
Technology & Development

PhD on Cloud Database Benchmarking
Cloud-Database Performance (6 years)

Jan Ocker
Operations, Finance & Market

Dipl. phys. oec. (Physics & Economy)
eCommerce experience
project manager & Business Development (7 years)

Dr. Jörg Domaschka
Consulting, Sales & HR

PhD Computer Science
Cloud-Research (16 years)
IT Consultant (2 years)

Funding

ESF European Social Fund for Germany
European Union
Designing. The Future. Together.

Supporters

universität ulm
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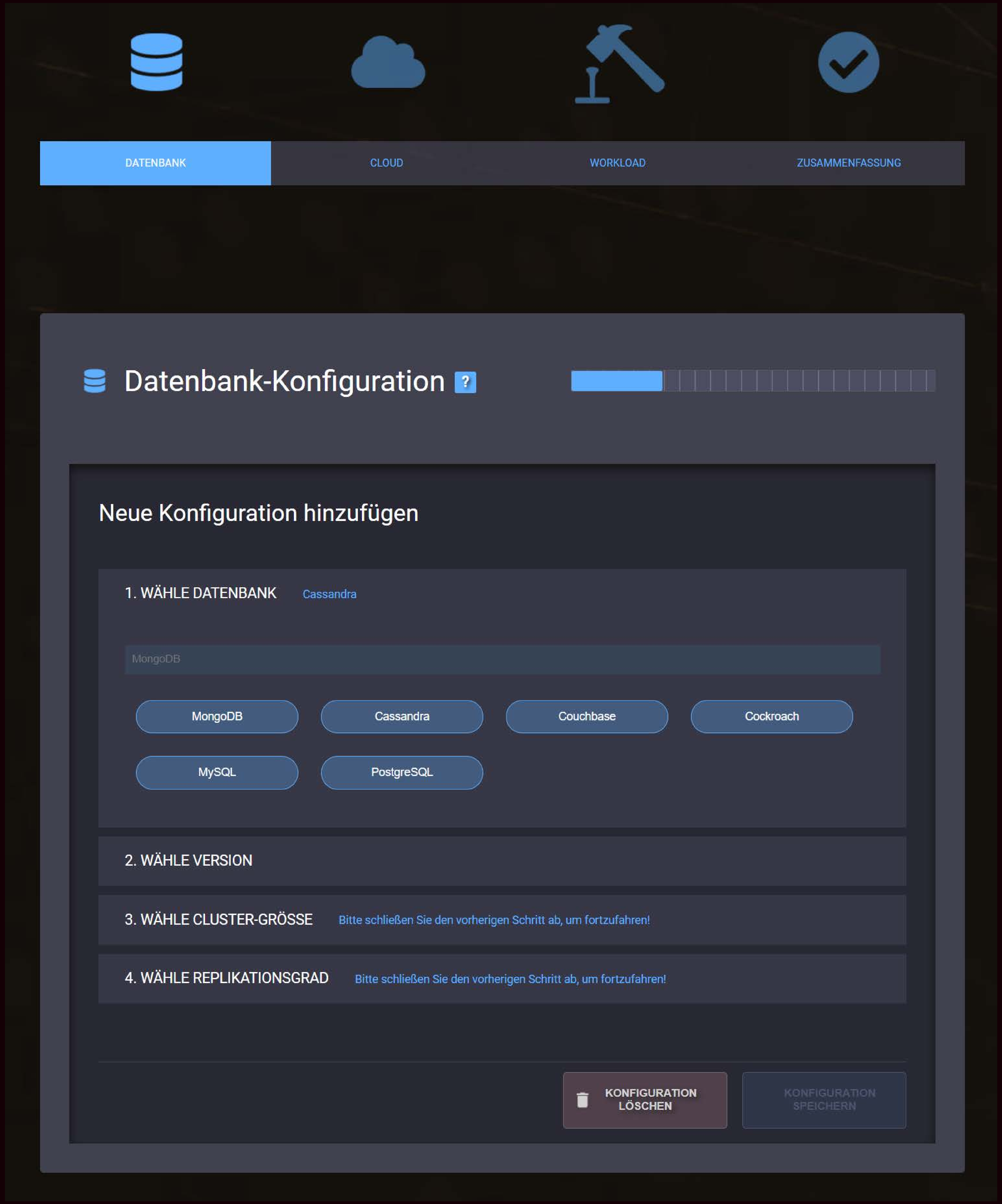
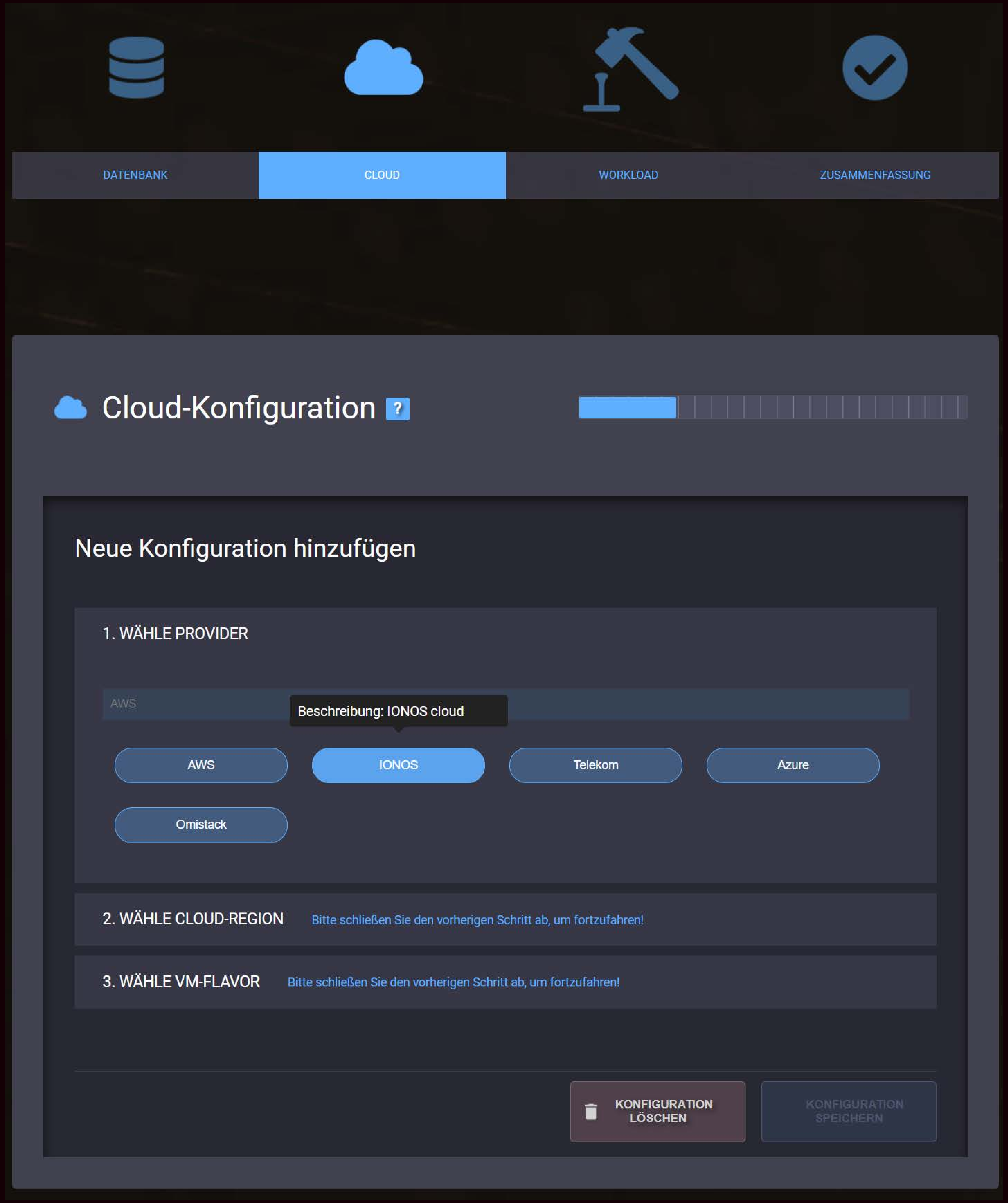
M.TECH ACCELERATOR
INNOVATION RWTH AACHEN UNIVERSITY
CYBER ONE DER HIGHTECH AWARD BADEN-WÜRTTEMBERG

Demo Backup

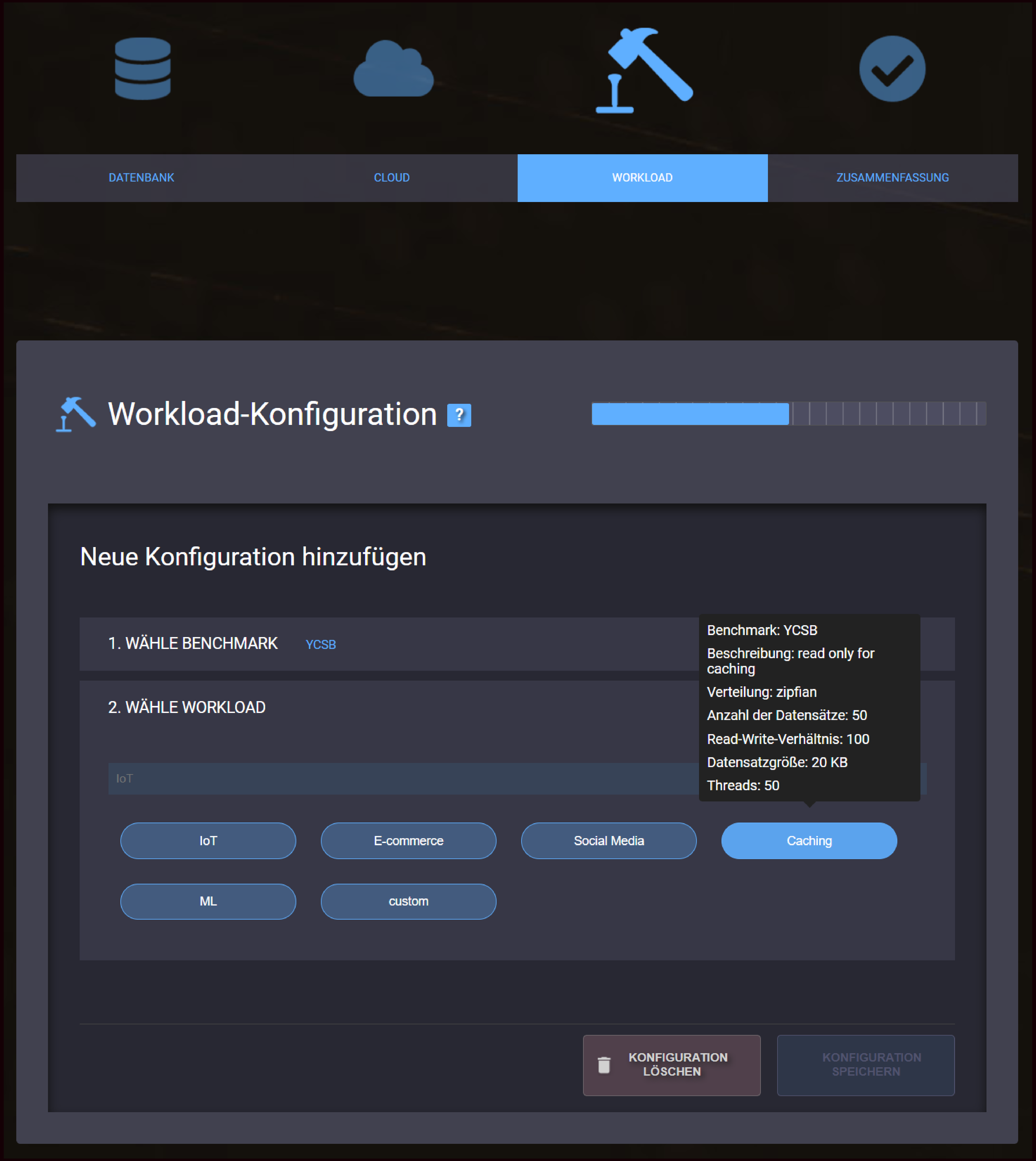
Demo
Configurator



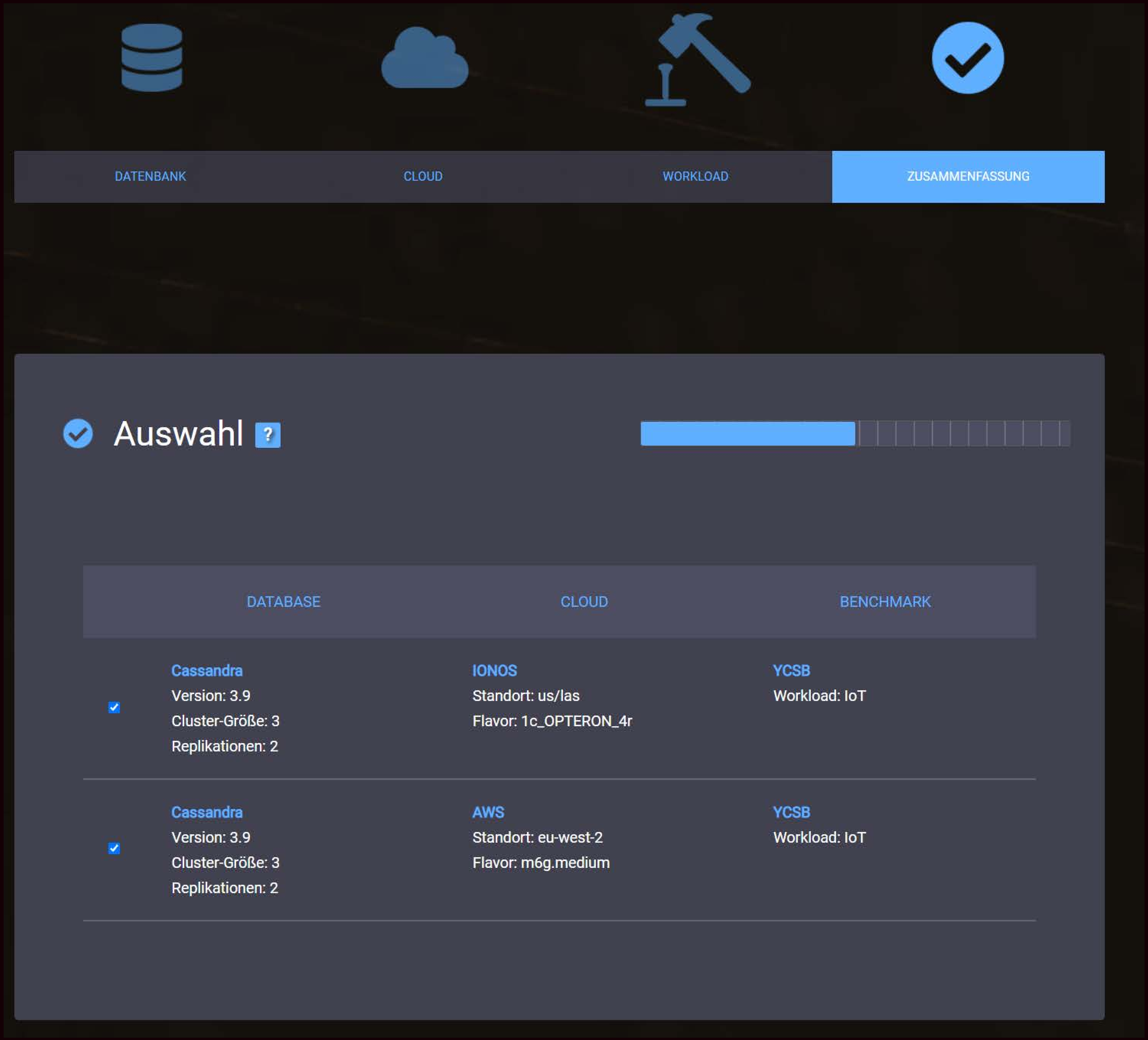
Demo Configurator



Demo
Configurator



Demo Configurator



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Demo
Dashboard

Ranking Overview

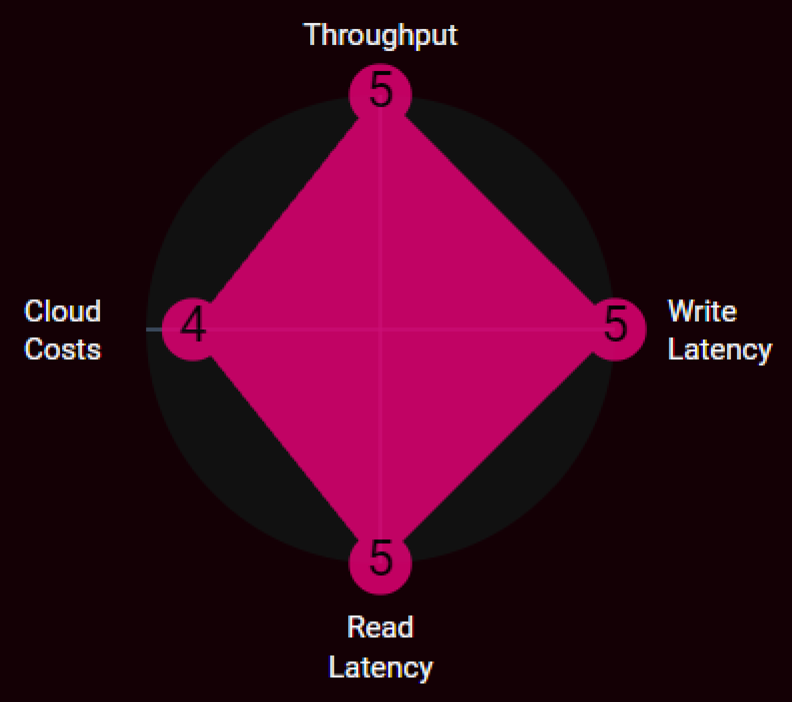
Select setups for performance details. Detailed charts are visualised interactively below the table. Hover over data points to get more information.
Setups are sorted by the benchANT-Score.

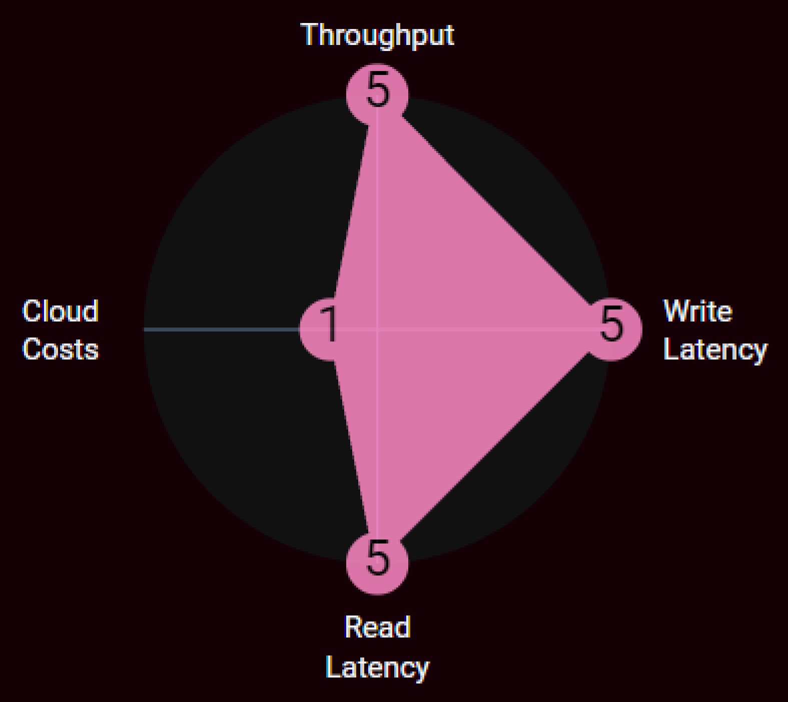
	benchANT SCORE	CONFIG ID	DBMS	CLOUD	BENCHMARK
		filter data...	filter data...	filter data...	filter data...
☑	19	telekom-mongodb-64-threads-s3.large.4-ssd	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: TELEKOM region: eu-de flavour: s3.large.4 storage: SSD	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☑	16	telekom-mongodb-64-threads-c4.large.4-ssd	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: TELEKOM region: eu-de flavour: c4.large.4 storage: SSD	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☑	14	ec2-m5.large-mongodb-64-threads	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: EC2 region: eu-west-1 flavour: m5.large storage: GP2	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☐	13	ionos_intel-xeon-mongodb-hdd	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: IONOS region: us/ewr flavour: 2c_XEON_8r storage: HDD	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☐	13	ionos_xeon-mongodb-SSD-200GB	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: IONOS region: us/ewr flavour: 2c_XEON_8r storage: SSD	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☐	13	ionos_xeon-mongodb-SSD-400GB	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: IONOS region: us/ewr flavour: 2c_XEON_8r storage: SSD	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☐	13	ec2-m5n.large-mongodb-64-threads	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: EC2 region: eu-west-1 flavour: m5n.large storage: GP2	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☐	12	ionos-intel-skylake-mongodb-64-threads	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: IONOS region: de/txl flavour: 2c_SKYLAKE_8r storage: SSD	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☐	12	ionos_intel-xeon-mongodb-64-threads	type: MONGODB version: 4.4.2 nodes: 3.0 replication factor: 3.0	provider: IONOS region: us/ewr flavour: 2c_XEON_8r storage: SSD	type: YCSB write proportion: 0.8 read proportion: 0.2 request distribution: ZIPFIAN
☐	11	telekom-mongodb-64-threads	type: MONGODB version: 4.4.2 nodes: 3.0	provider: TELEKOM region: eu-de flavour: s3.large.4	type: YCSB write proportion: 0.8 read proportion: 0.2

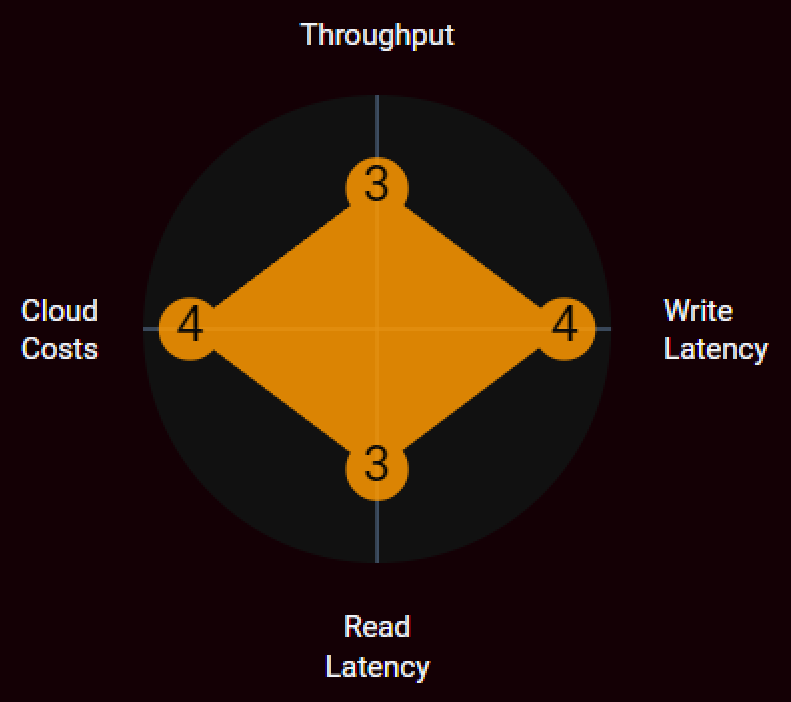
Demo Dashboard

benchAnt Score ×

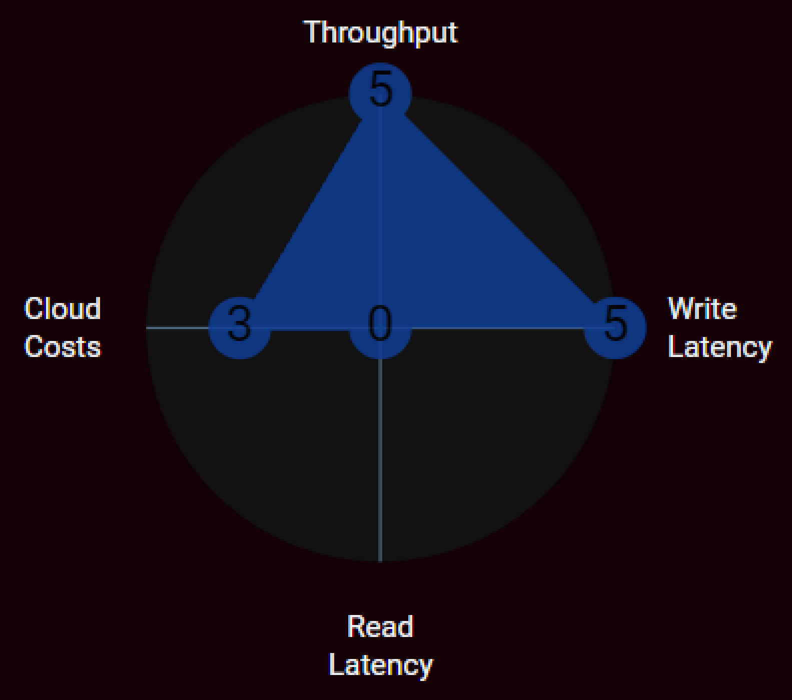
ım-mongodb-64-threads-s3.largeım-mongodb-64-threads-c4.largeıc2-m5.large-mongodb-64-thread

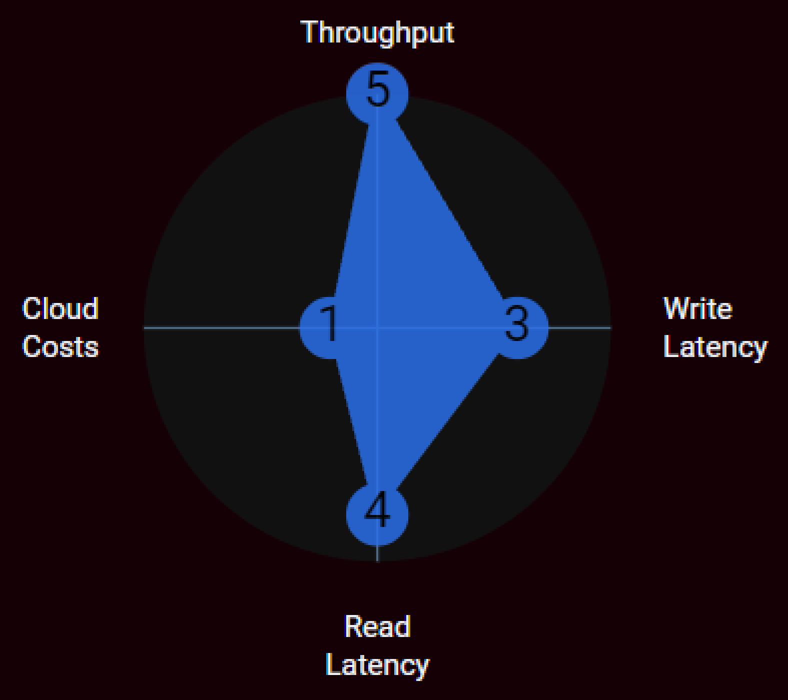


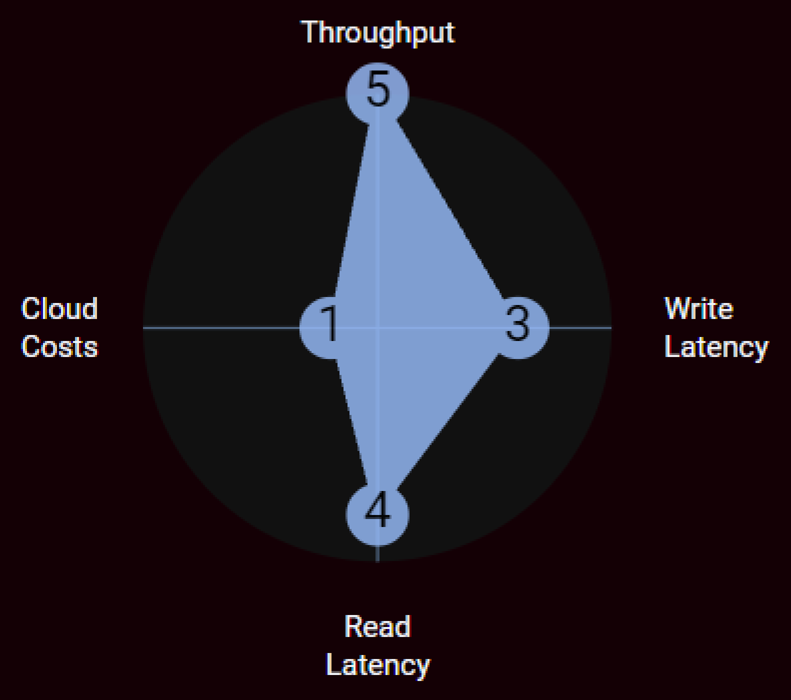




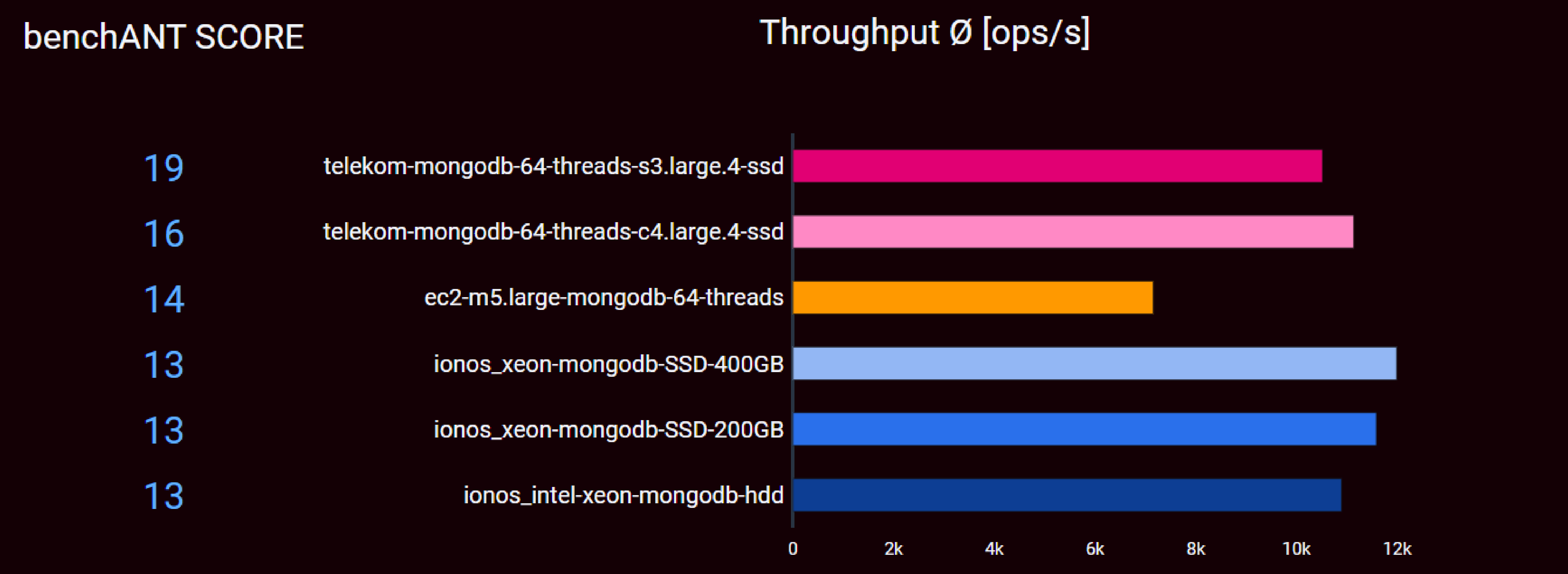
ionos_intel-xeon-mongodb-hdd onos_xeon-mongodb-SSD-200GEonos_xeon-mongodb-SSD-400GE



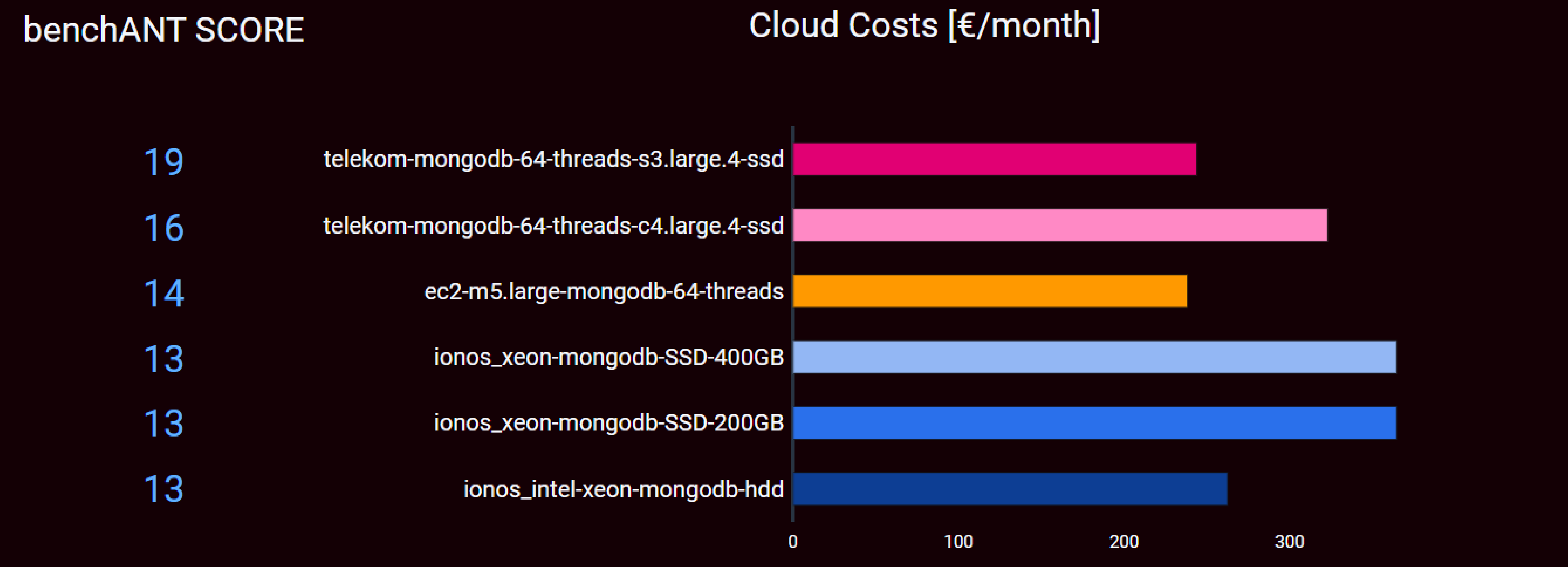




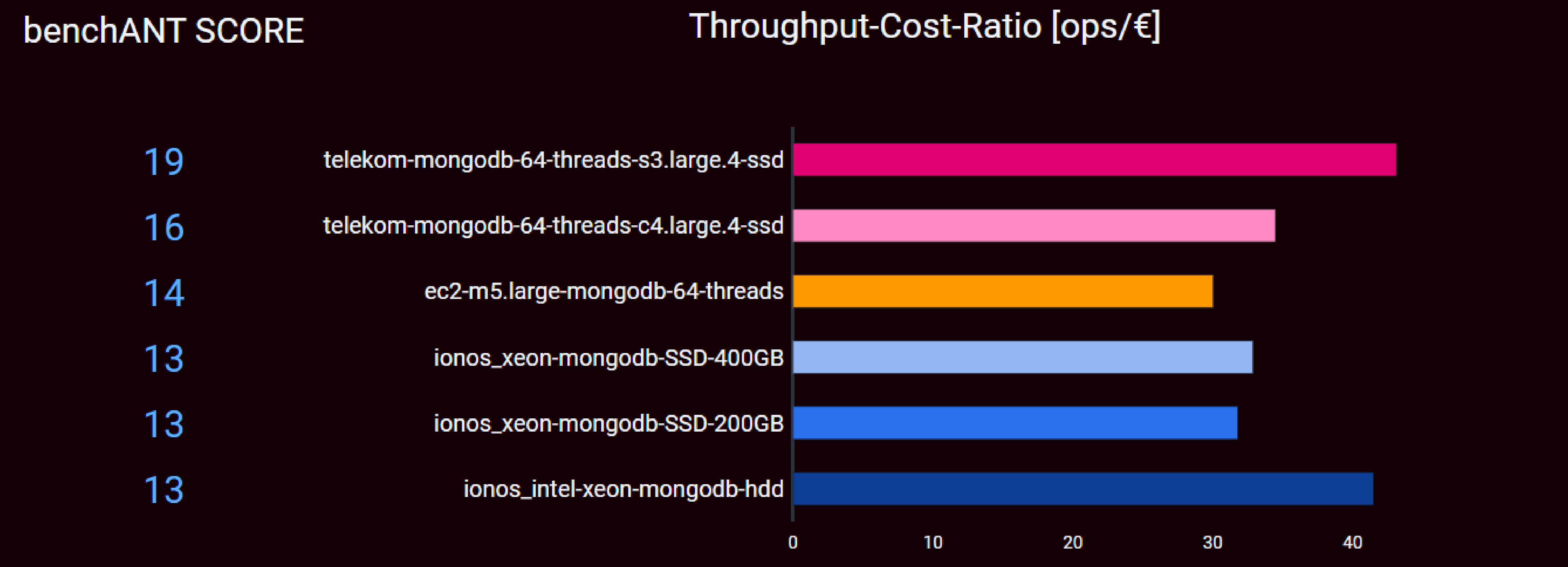
Demo Dashboard



show Cloud Costs [€/month]



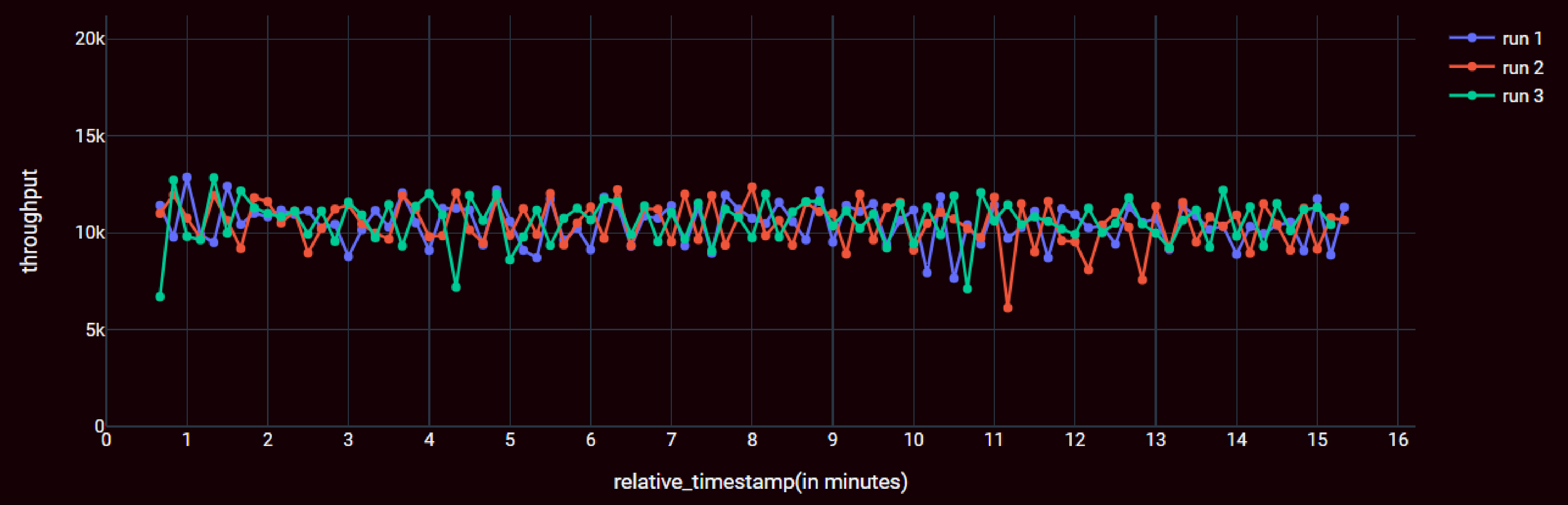
show Throughput-Cost-Ratio [ops/€]



Demo
Dashboard

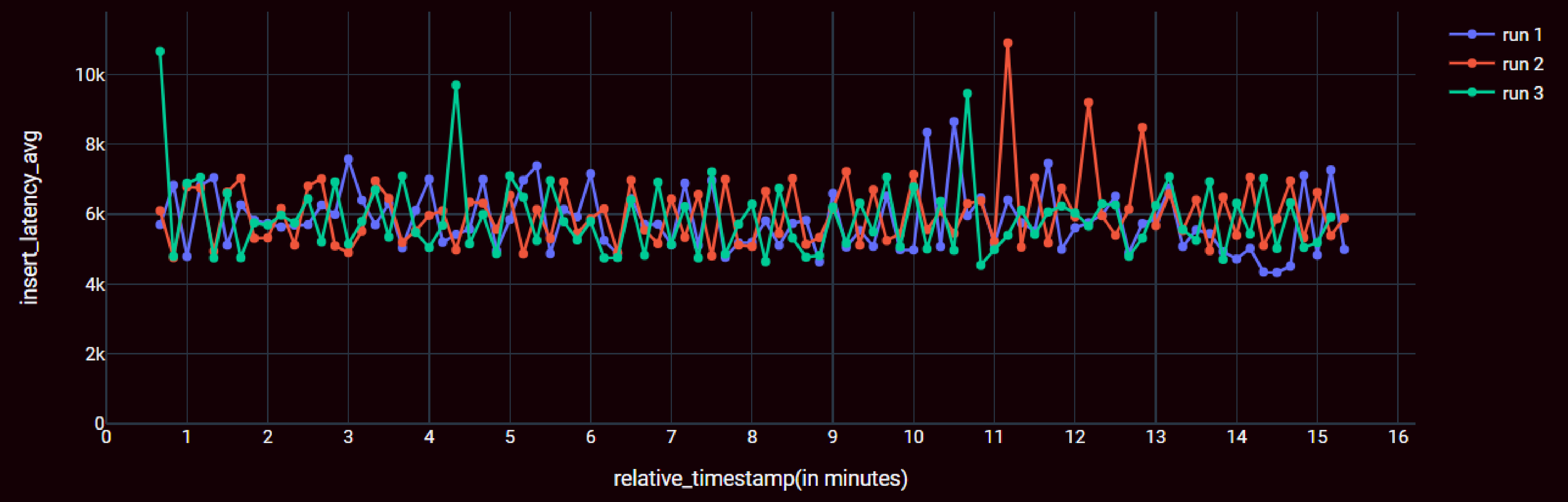
show throughput

throughput



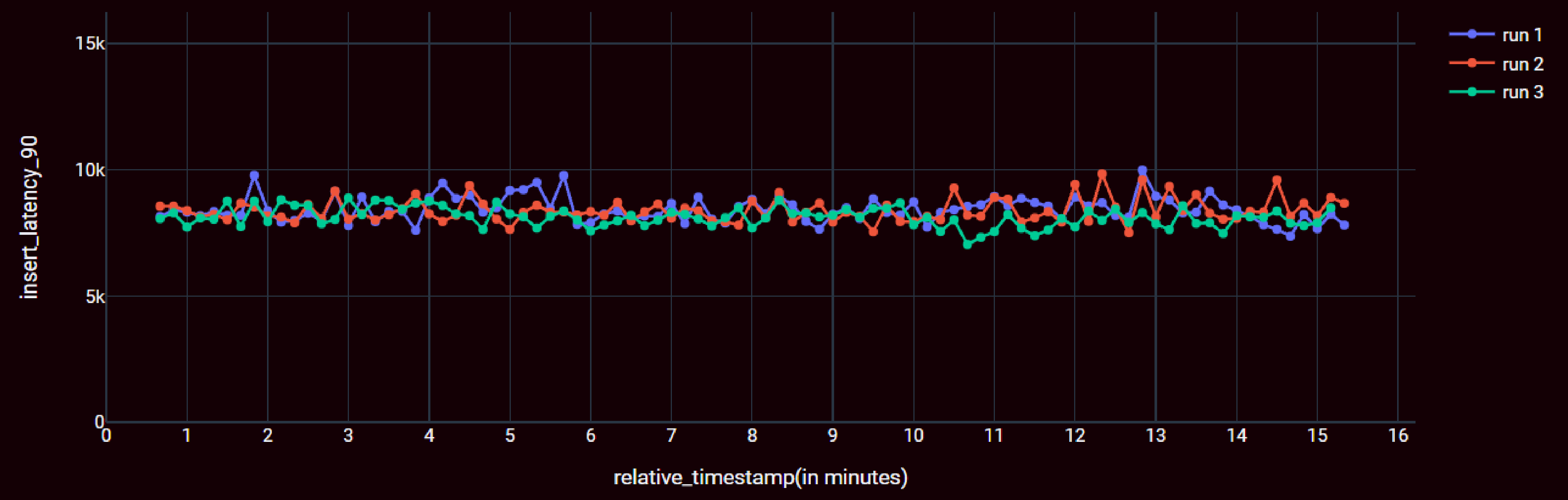
show insert_latency_avg

insert_latency_avg

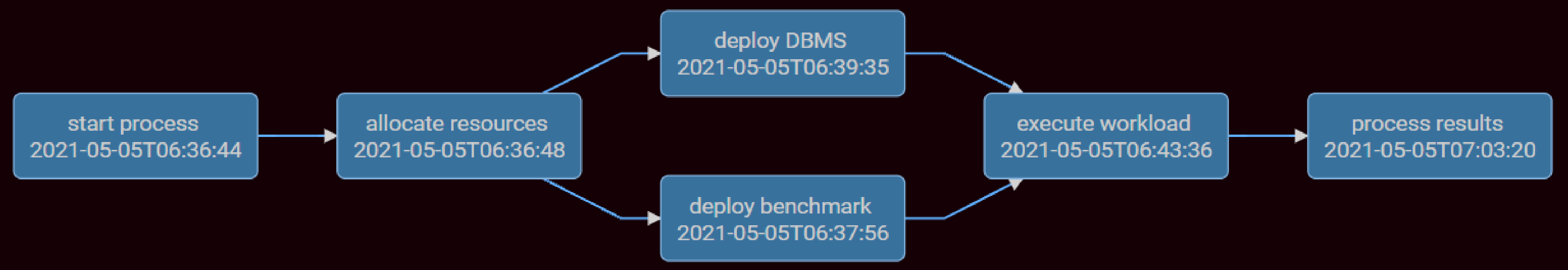


show insert_latency_90

insert_latency_90



Demo Dashboard



▼ Cloud Provider Metadata


```
"auth": {
    "auth_url": "VALUE_SPECIFIED_IN_NO_LOG_PARAMETER",
    "password": "VALUE_SPECIFIED_IN_NO_LOG_PARAMETER",
    "project_domain_name": "VALUE_SPECIFIED_IN_NO_LOG_PARAMETER",
    "project_id": "VALUE_SPECIFIED_IN_NO_LOG_PARAMETER",
    "project_name": "VALUE_SPECIFIED_IN_NO_LOG_PARAMETER",
    "user_domain_name": "VALUE_SPECIFIED_IN_NO_LOG_PARAMETER",
    "username": "VALUE_SPECIFIED_IN_NO_LOG_PARAMETER"
},
"auth_type": null,
"auto_ip": true,
"availability_zone": "********-01",
"boot_from_volume": false,
"boot_volume": "ab8b105f-69c8-4d80-b87e-d45a71c9706e",
"ca_cert": null,
"client_cert": null,
"client_key": null,
"config_drive": false,
"delete_fip": false,
"description": null,
"flavor": "s3.large.4",
"flavor_include": null,
"flavor_ram": null,
"floating_ip_pools": null,
```


▼ VM Metadata


```
{
    "_ansible_facts_gathered": true,
    "all_ipv4_addresses": [
        "192.168.0.122"
    ],
    "all_ipv6_addresses": [
        "fe80::f816:3eff:fedc:beaa"
    ],
    "ansible_local": {},
    "apparmor": {
        "status": "enabled"
    },
    "architecture": "x86_64",
    "bios_date": "04/01/2014",
    "bios_vendor": "SeaBIOS",
    "bios_version": "rel-1.10.2-0-g5f4c7b1-20181220_000000-szxrtosci10000",
    "board_asset_tag": "NA",
    "board_name": "NA",
    "board_serial": "NA",
    "board_vendor": "NA",
    "board_version": "NA",
    "chassis_asset_tag": "NA",
    "chassis_serial": "NA",
    "chassis_vendor": "QEMU",
```


▼ MONGODB Metadata


```
MongoDB shell version v4.4.2
connecting to: mongodb://192.168.0.122:27017/?compressors=disabled&gssapiServiceName=mongodb
Implicit session: session { "id" : UUID("4e554f69-c1da-4e7b-b665-f3e31df56f63") }
MongoDB server version: 4.4.2
{
        "set" : "rs0",
        "date" : ISODate("2021-05-05T06:42:35.690Z"),
        "myState" : 1,
        "term" : NumberLong(1),
        "syncSourceHost" : "",
        "syncSourceId" : -1,
```