
AWS
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SESSION ID: DAT323

Performance monitoring with Amazon RDS and Aurora, featuring Autodesk

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Database Specialist Solutions Architect
AWS

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Software Architect
Autodesk

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What do these pictures have in common?







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Agenda

Overview of monitoring in Amazon RDS

SQL performance analysis demo using Amazon RDS Performance Insights

ML-powered diagnostics with Amazon DevOps Guru for Amazon RDS

Autodesk success story

Q&A

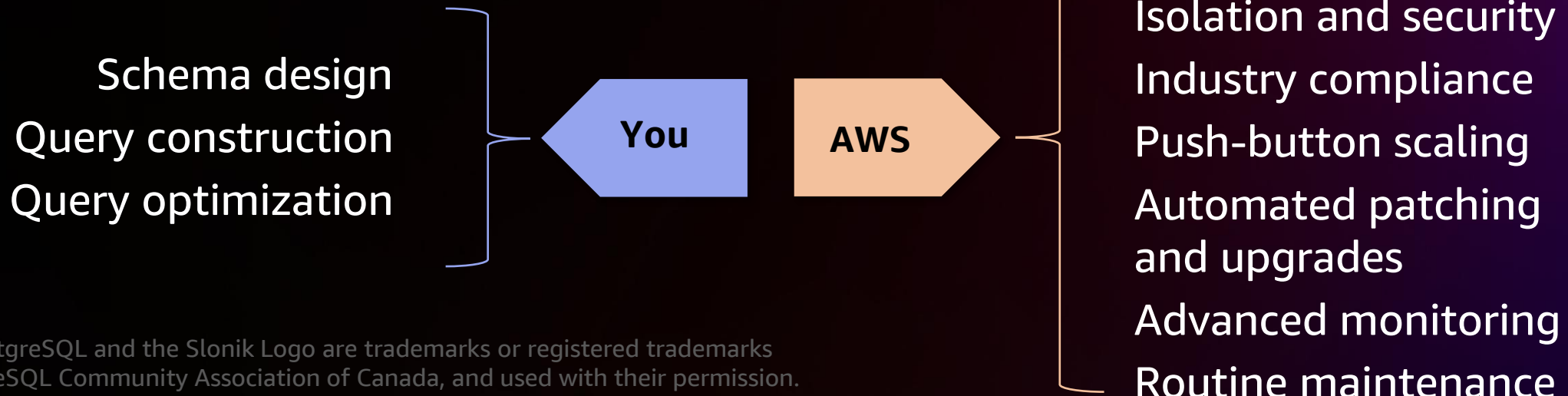
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Amazon Relational Database Service (RDS)

A FULLY MANAGED RELATIONAL DATABASE SERVICE

Amazon Aurora | MySQL | MariaDB | PostgreSQL | Microsoft SQL Server | ORACLE

Spend time innovating and building new apps, not managing infrastructure

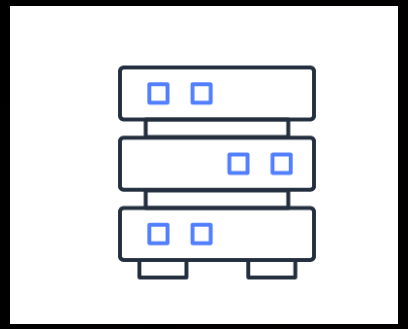


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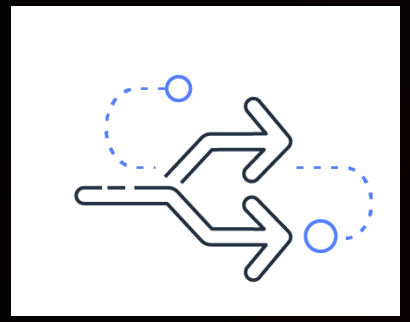
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Overview of monitoring in Amazon RDS



Instance

Amazon CloudWatch



Operating system

Amazon RDS Enhanced Monitoring



Database engine

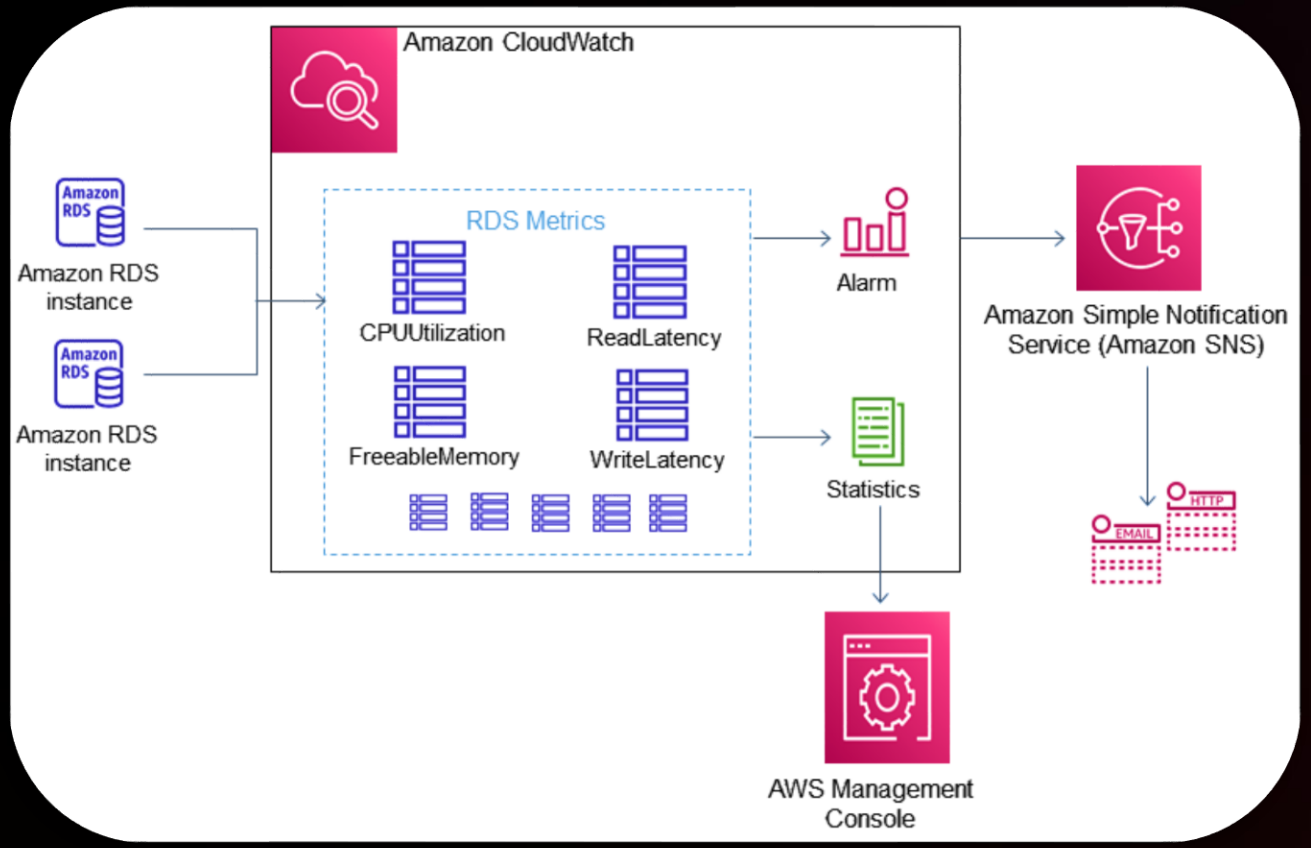
Amazon RDS Performance Insights

DevOps Guru for Amazon RDS

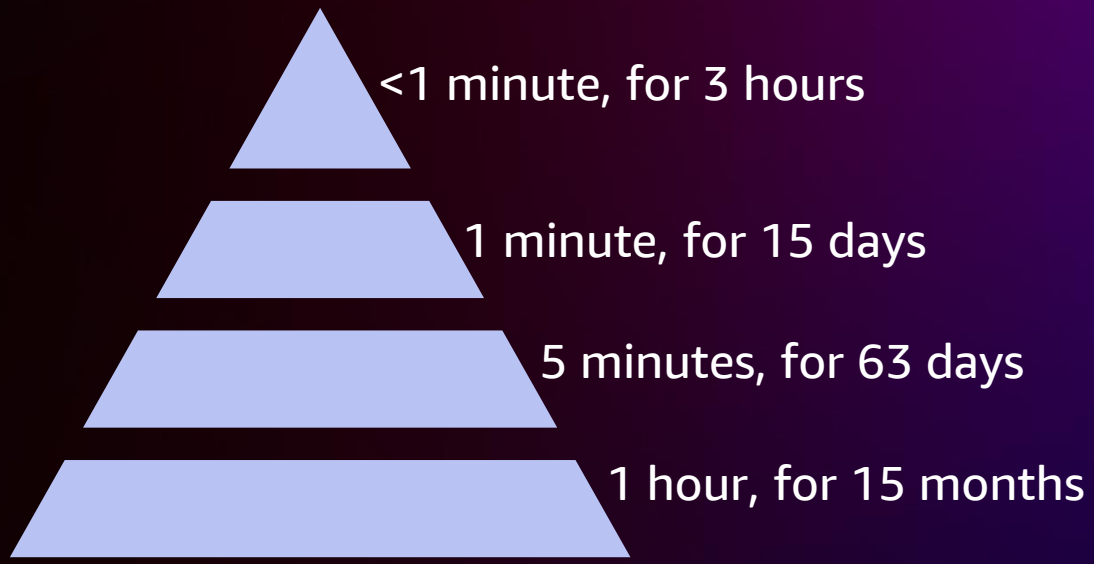
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Monitoring Amazon RDS metrics with CloudWatch



Metrics retention and resolution



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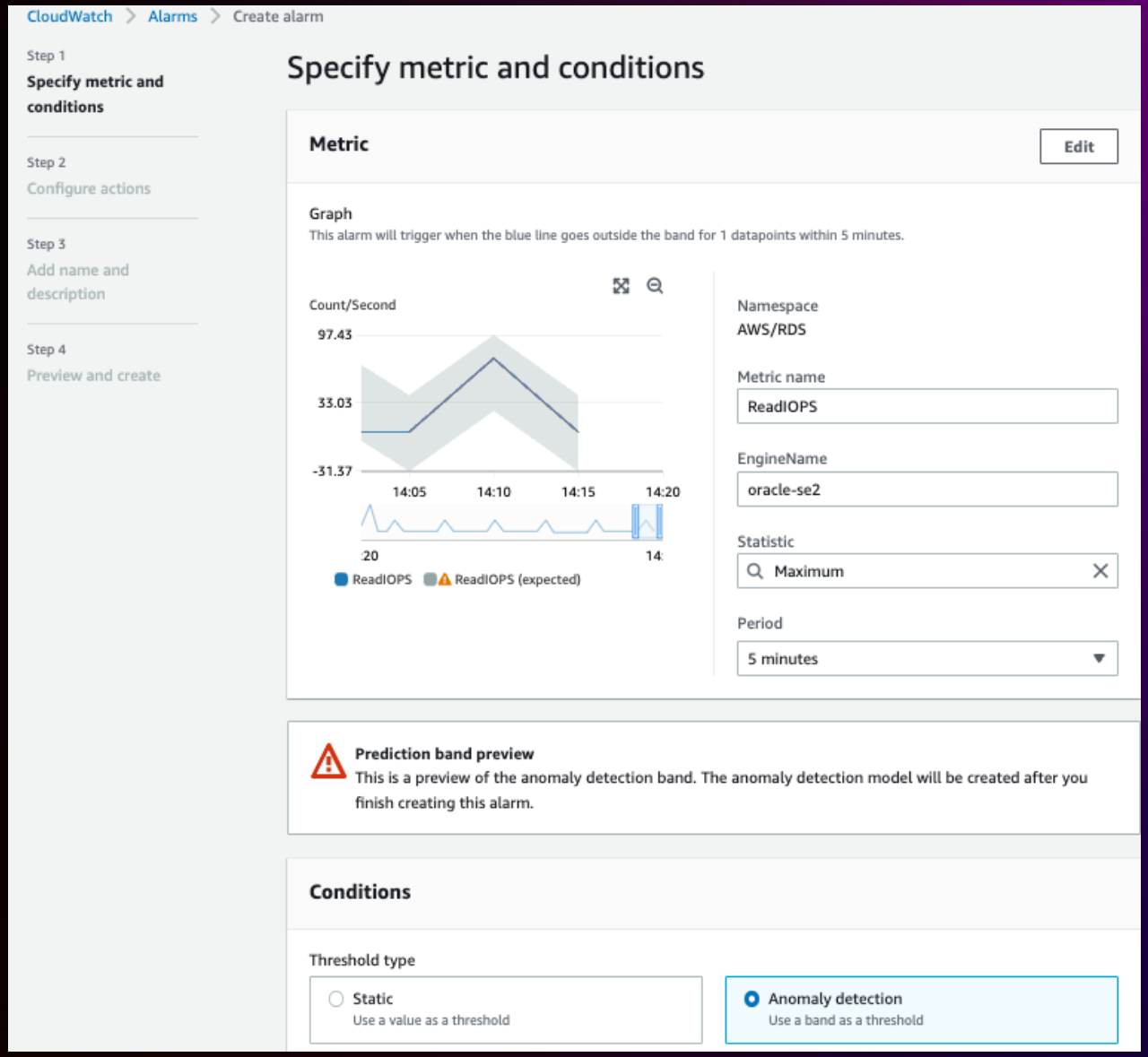
CloudWatch alarms

Can perform actions

Simple and intuitive wizard

Threshold types

- Static
- Dynamic (machine learning)



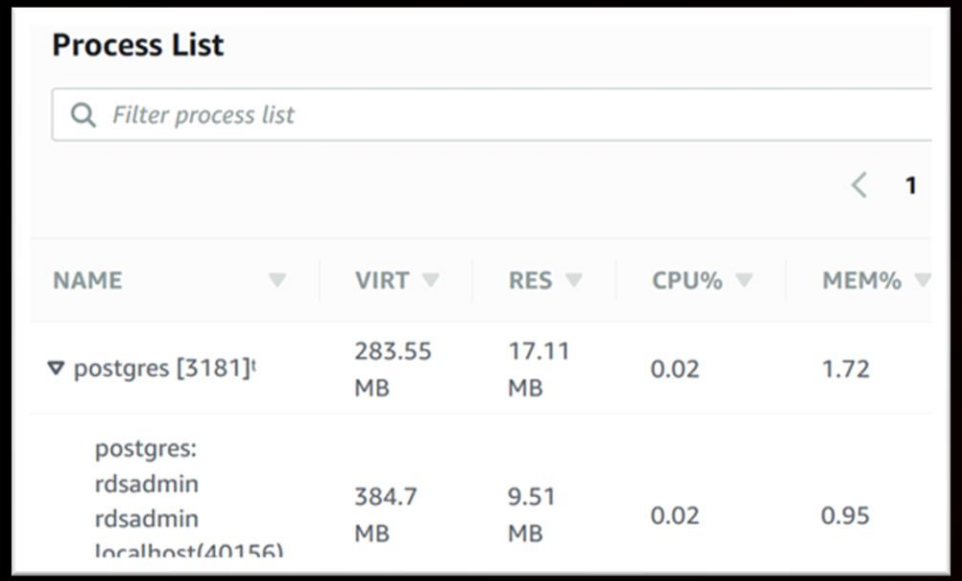
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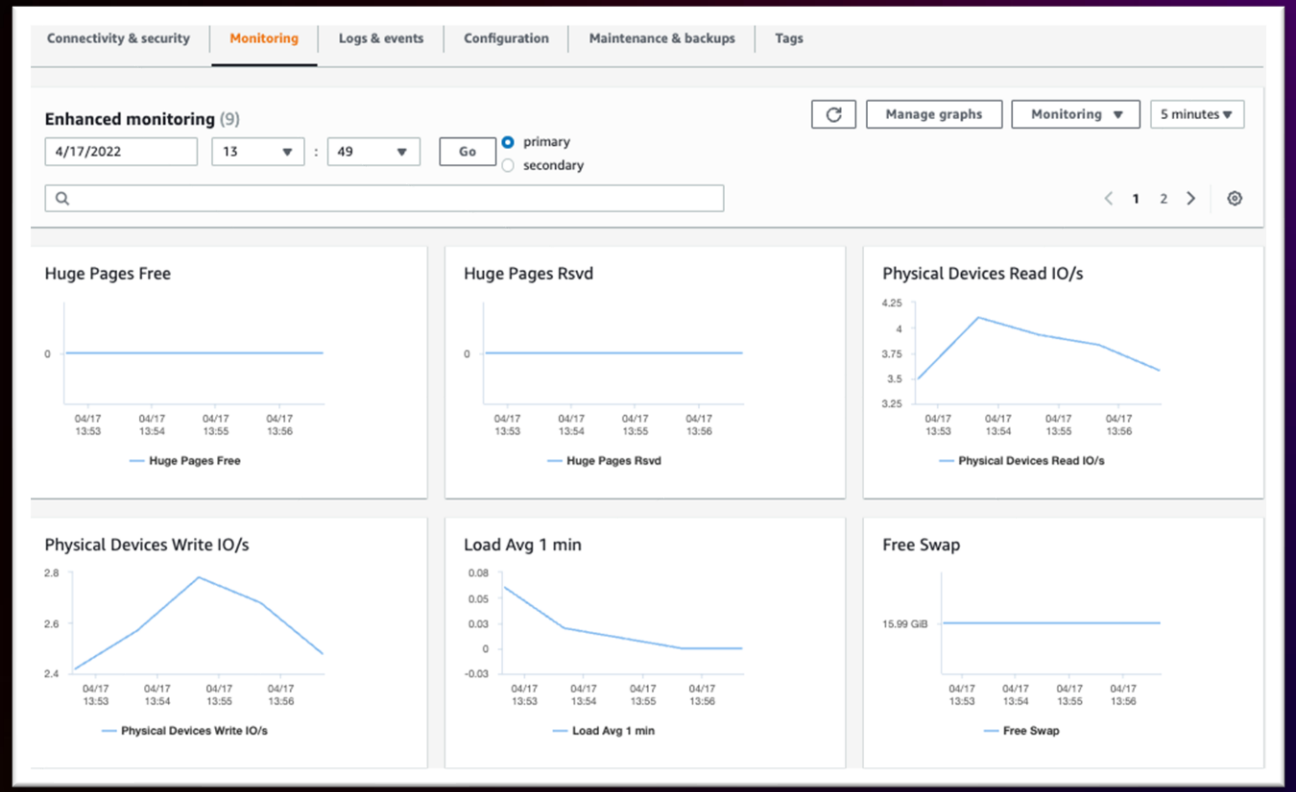
Monitoring the Amazon RDS OS with Enhanced Monitoring

Granular OS monitoring (e.g., process list, physical devices, swap activity)

Gathers data via a local agent on the DB instance

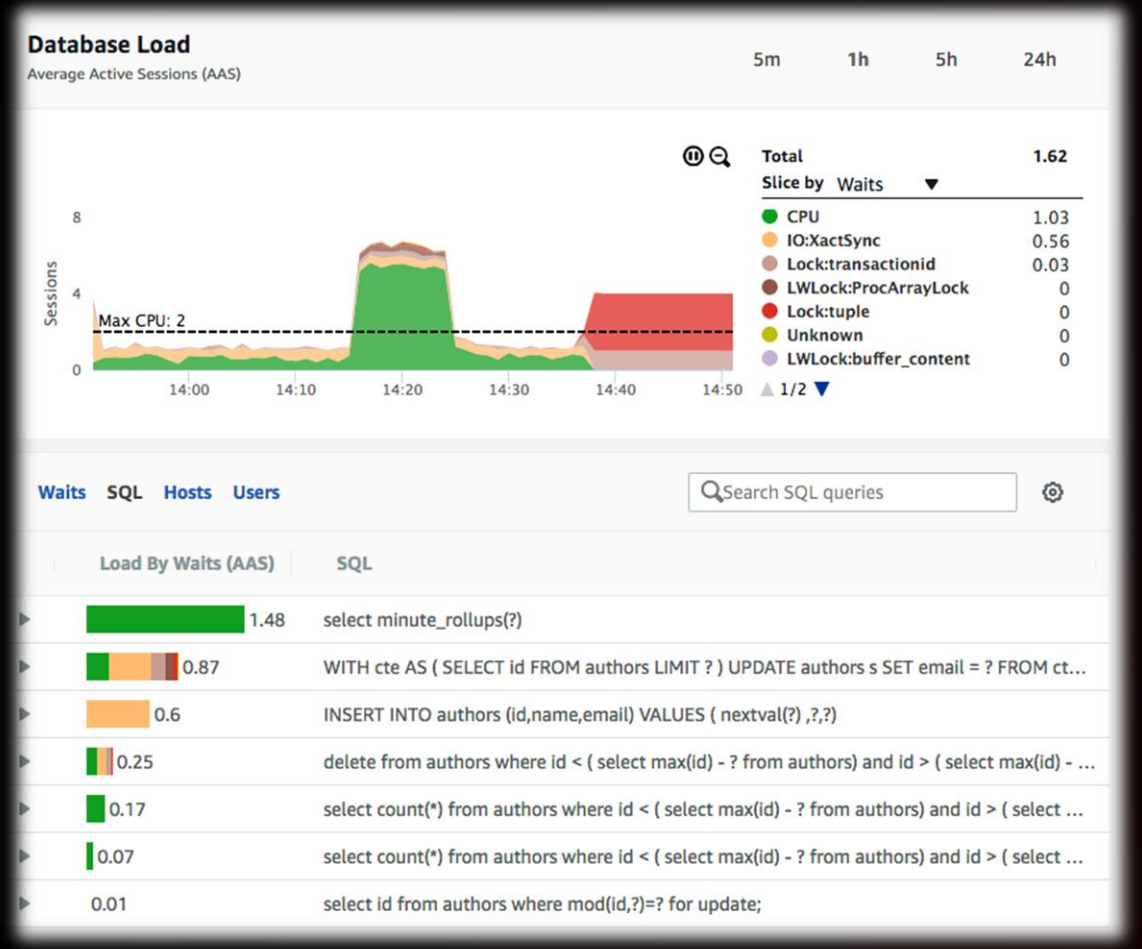
Default retention period: 30 days





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Amazon RDS Performance Insights increases productivity



- Measures database load over time
- Easy to identify database bottlenecks
- Available for all Amazon RDS database engines
- Integrated and fully managed

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What is database load?

Exposed as **average active sessions**

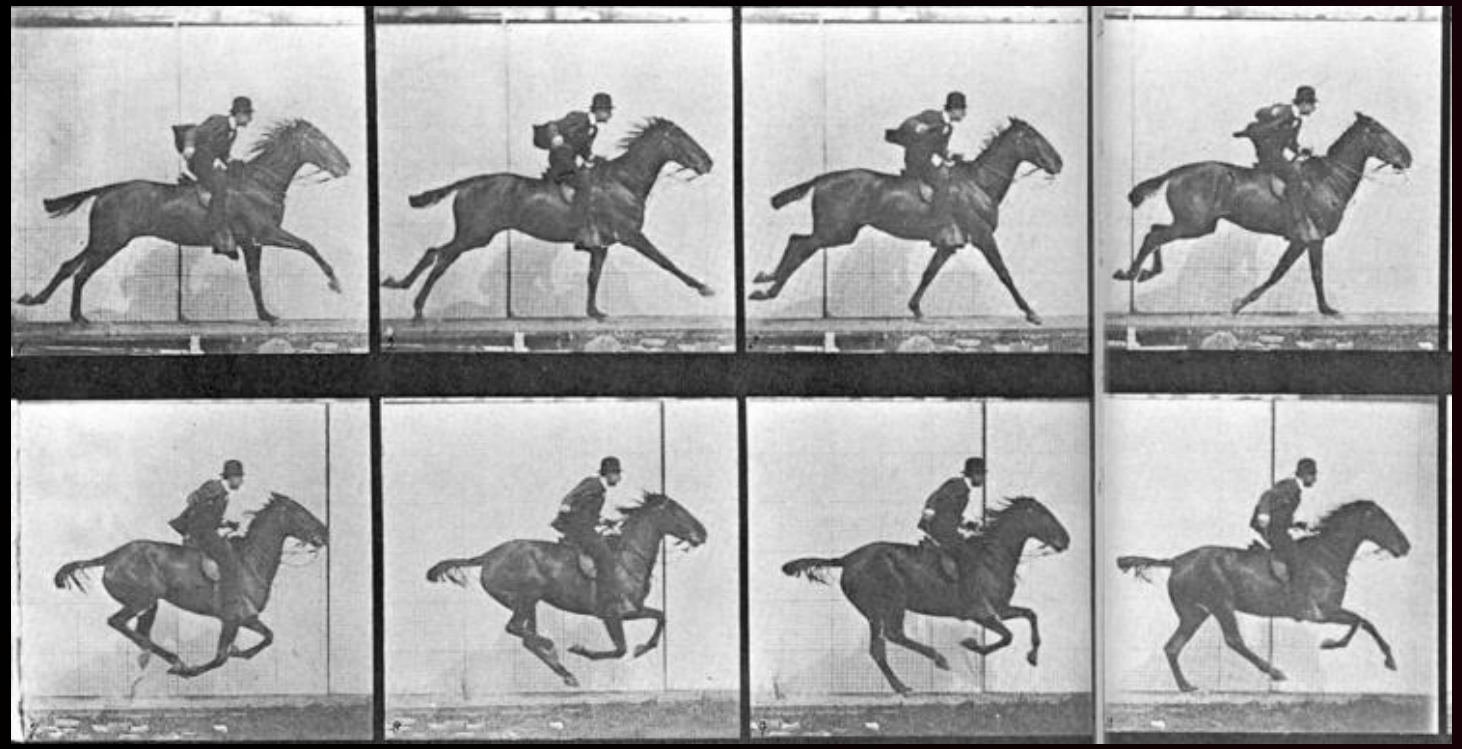
We sample every second; for each active session, we collect:

- SQL
- State: CPU, I/O, lock, commit log wait, and more
- Additional dimensions (e.g., hosts, users)

Central metric for Performance Insights

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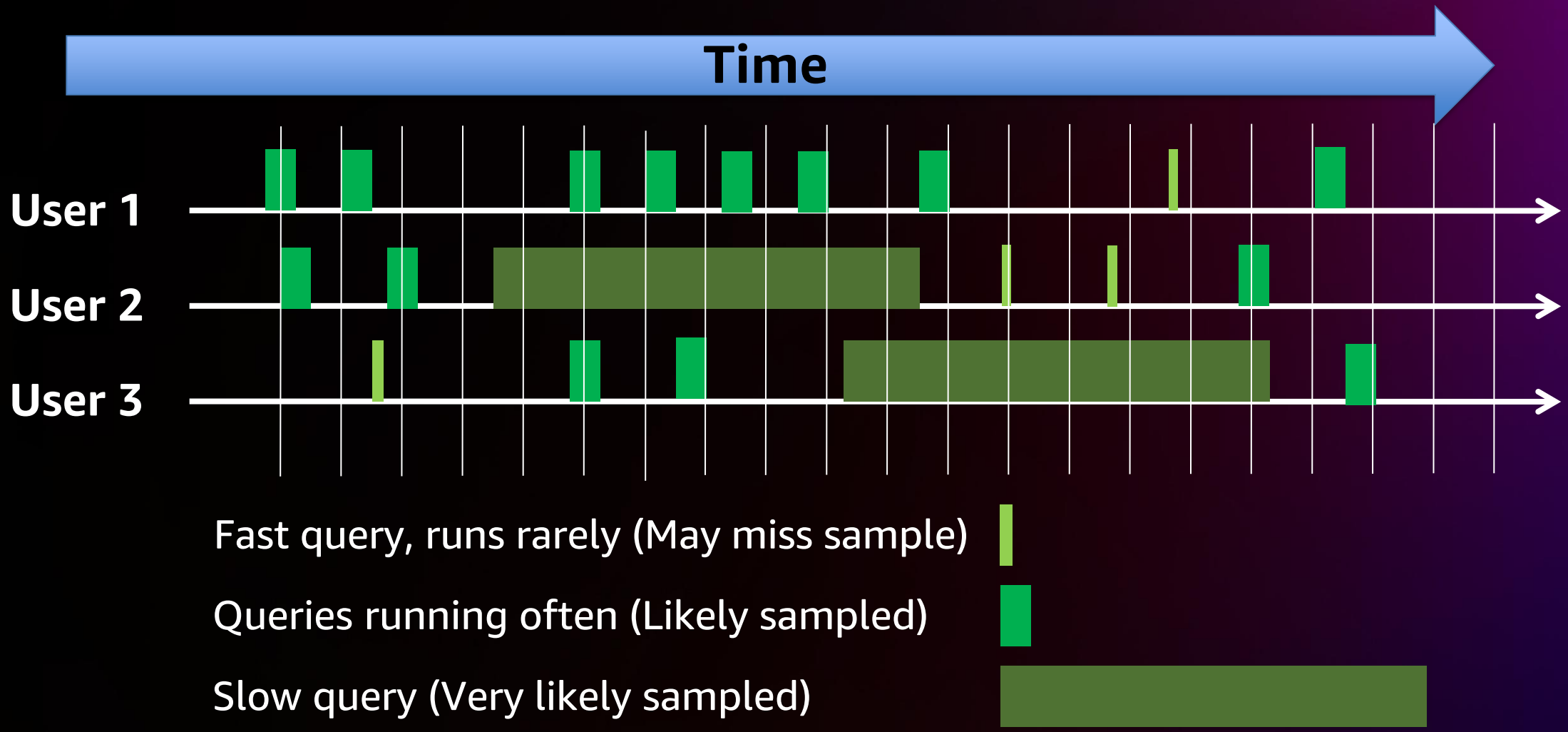
Performance Insights sampling is like a film





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Performance Insights sampling



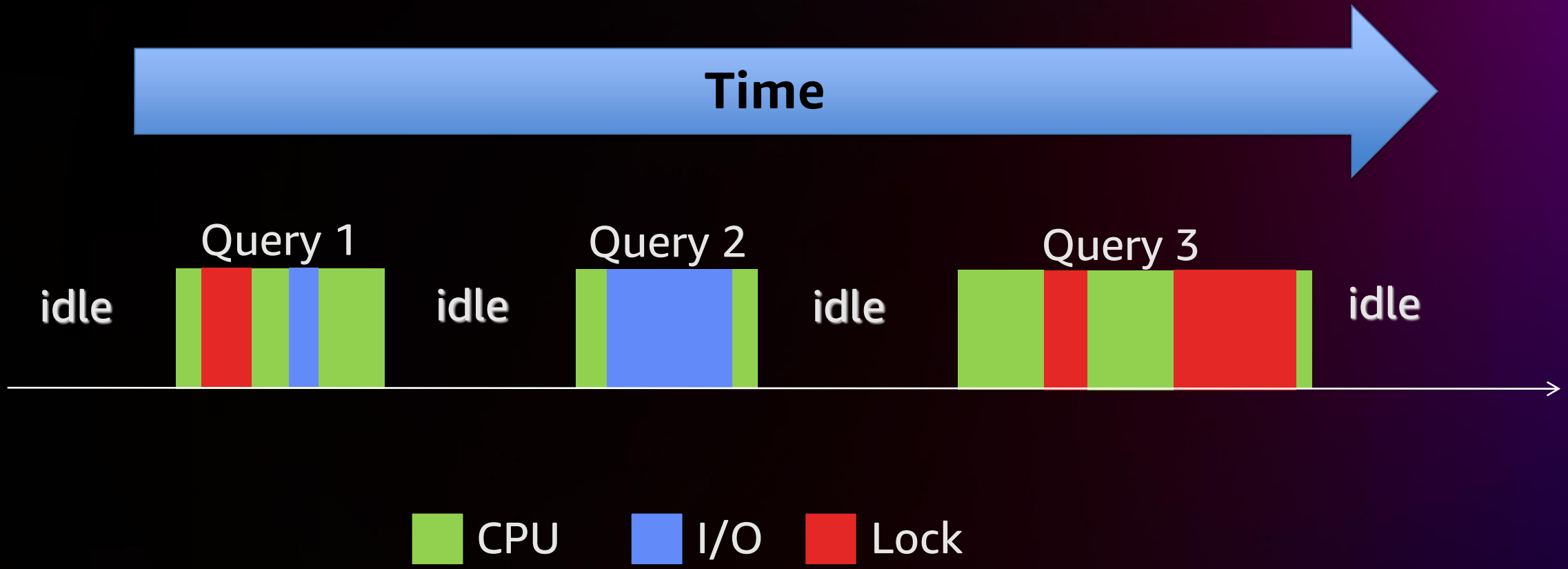
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Average active sessions load graph



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Active sessions state



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Interpreting average active sessions

Average active sessions ~= 0

Database idle

Average active sessions < 1

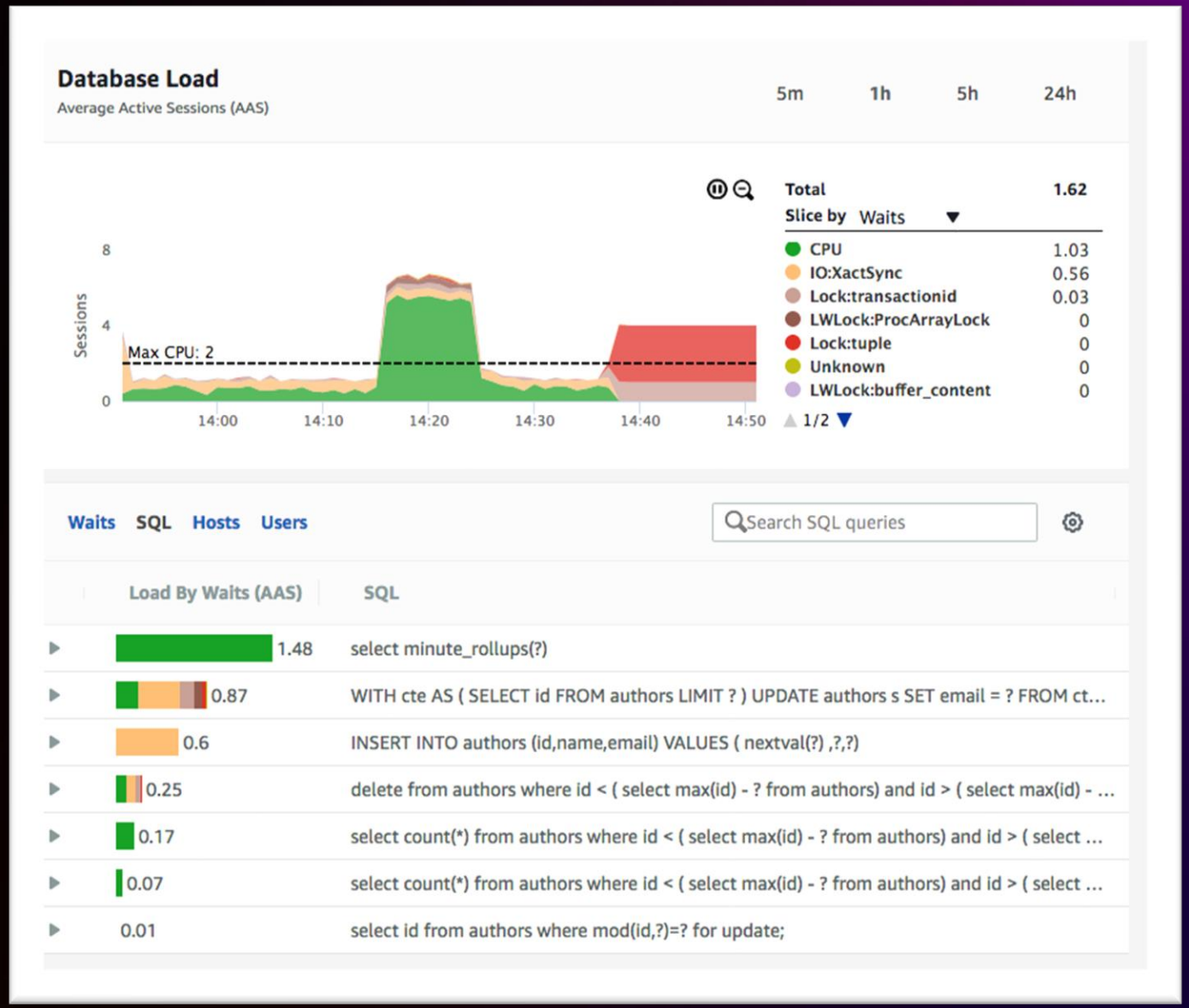
No major blocks

Average active sessions < # of CPUs

CPU available

Average active sessions > # of CPUs

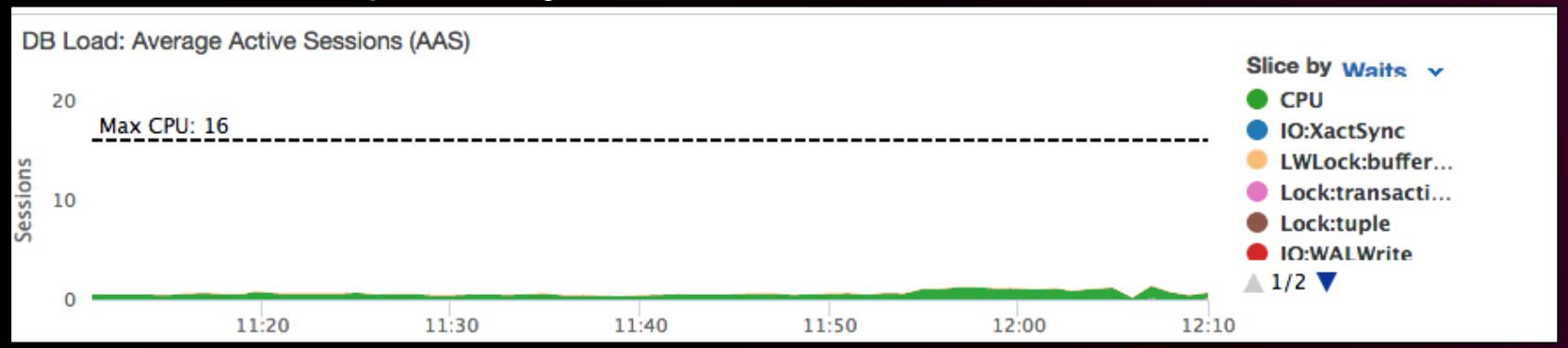
Possible bottlenecks



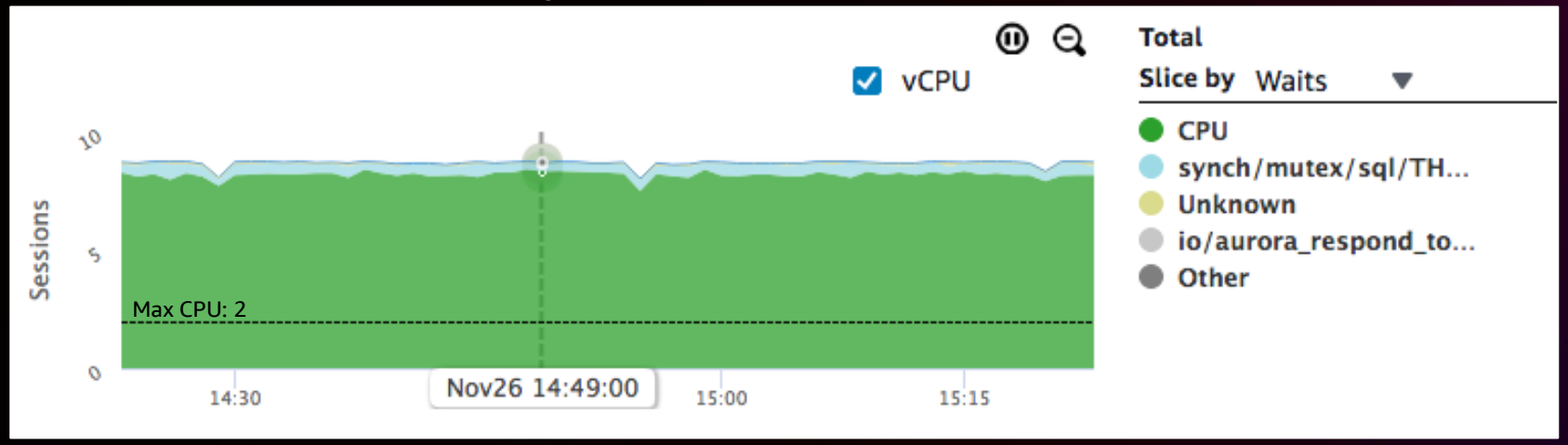
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Also useful for rightsizing

If CPU load < # of vCPUs ⟶ probably **oversized**

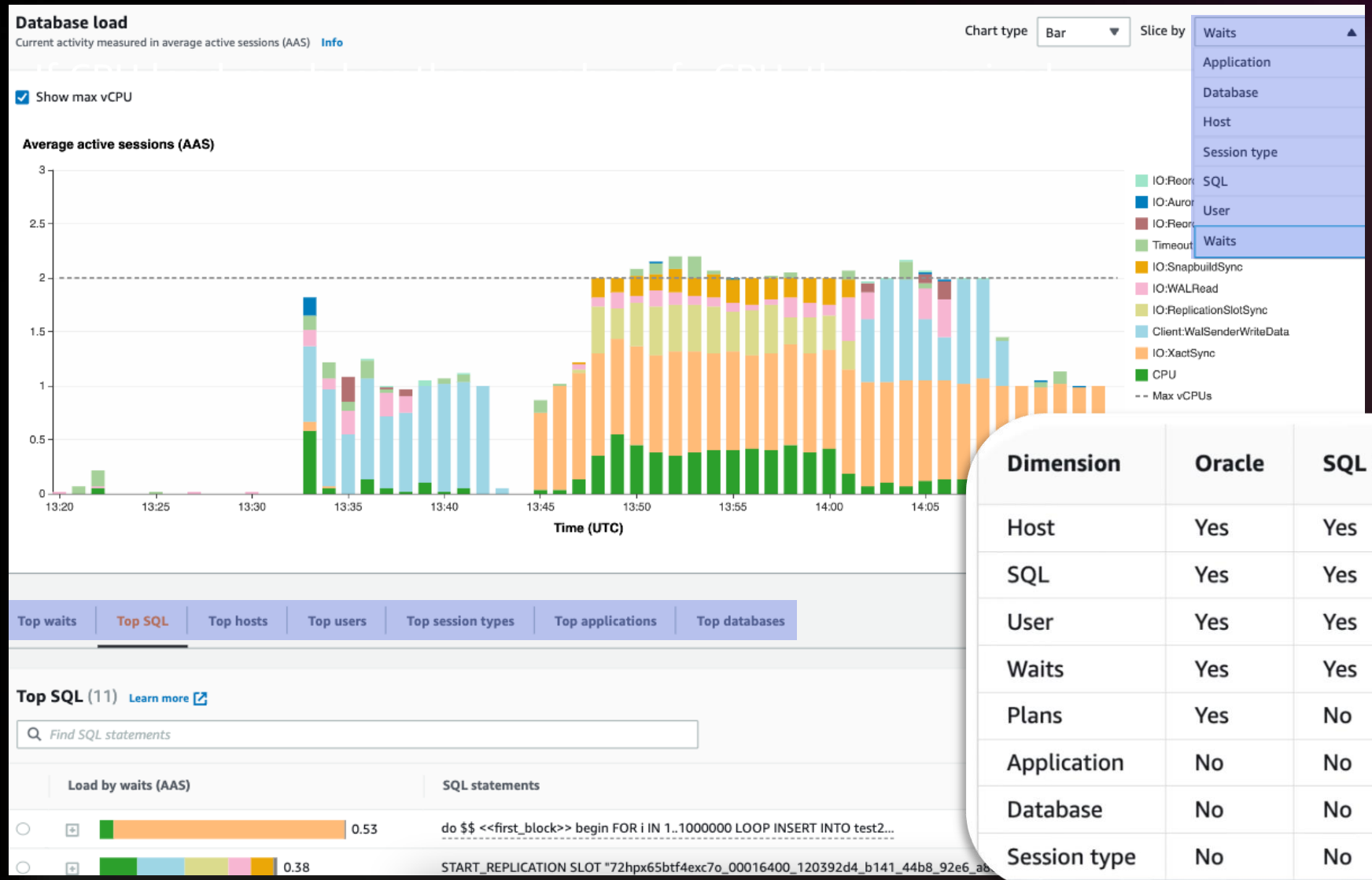


If CPU load > # of vCPUs ⟶ probably **undersized**



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Multi-dimensional analysis



Dimension	Oracle	SQL Server	PostgreSQL	MySQL
Host	Yes	Yes	Yes	Yes
SQL	Yes	Yes	Yes	Yes
User	Yes	Yes	Yes	Yes
Waits	Yes	Yes	Yes	Yes
Plans	Yes	No	No	No
Application	No	No	Yes	No
Database	No	No	Yes	Yes
Session type	No	No	Yes	No

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Demo steps

Precreated

Employees table with 1 million rows

Benchmark #1

Randomly select employees by “**name**” column and update salaries

Benchmark #2

Randomly select employees by “**id**” column and update salaries

Final step

Investigate database load in Performance Insights

aws

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Resource Groups & Tag Editor

Try the new Amazon RDS Multi-AZ deployment option for MySQL and PostgreSQL
For your Amazon RDS for MySQL and PostgreSQL workloads, improve transactional commit latencies by 2x, experience faster failover typically less than 35 seconds and, get read scalability with two readable standby DB instances by deploying the Multi-AZ DB cluster Learn more

Create database

Or, Restore Multi-AZ DB Cluster from Snapshot

Resources

Refresh

You are using the following Amazon RDS resources in the US East (Ohio) region (used/quota)

DB Instances (1/40)
- Allocated storage (0 TB/100 TB)
- Increase DB instance limit

DB Clusters (1/40)
Reserved instances (0/40)
Snapshots (1)
- Manual
  - DB Cluster (0/100)
  - DB Instance (0/100)
- Automated
  - DB Cluster (1)
  - DB Instance (0)

Recent events (12)
Event subscriptions (0/20)

Parameter groups (4)
- Default (2)
- Custom (2/100)

Option groups (1)
- Default (1)
- Custom (0/20)

Subnet groups (1/50)
Supported platforms VPC
Default network vpc-0717f231b115f089a

Create database

Amazon Relational Database Service (RDS) makes it easy to set up, operate, and scale a relational database in the cloud.

Restore from S3 | Create database

Note: your DB instances will launch in the US East (Ohio) region

Service health

View service health dashboard

Current status	Details
Amazon Relational Database Service (Ohio)	Service is operating normally

Recommended for you

Implementing Cross-Region DR
Learn how to set up Cross-Region disaster recovery (DR) for Aurora PostgreSQL using an Aurora global database spanning multiple Regions. Learn more

Migrate SSRS to RDS for SQL Server
Learn how you can migrate existing SSRS content to an Amazon RDS for SQL Server instance using a PowerShell module. Learn more

Test Your DR Strategy in Minutes
Amazon Aurora Global Database now supports planned managed failover, making disaster recovery drills a breeze. Learn more

Time-Series Tables in PostgreSQL
Step-by-step guide to design high-performance time series data tables on Amazon RDS for PostgreSQL. Learn more

Additional information

Getting started with RDS
Overview and features
Documentation
Articles and tutorials
Data migration guide for MySQL
Data migration guide for Oracle
Data migration guide for SQL Server
New RDS feature announcements
Pricing
Forums

Database Preview Environment

Get early access to new DB engine versions, before they're generally available. The RDS database preview environment lets you work with upcoming beta, release candidate, and early production versions of PostgreSQL engines. Preview environment instances are fully functional, so you can easily test new features and functionality with your applications

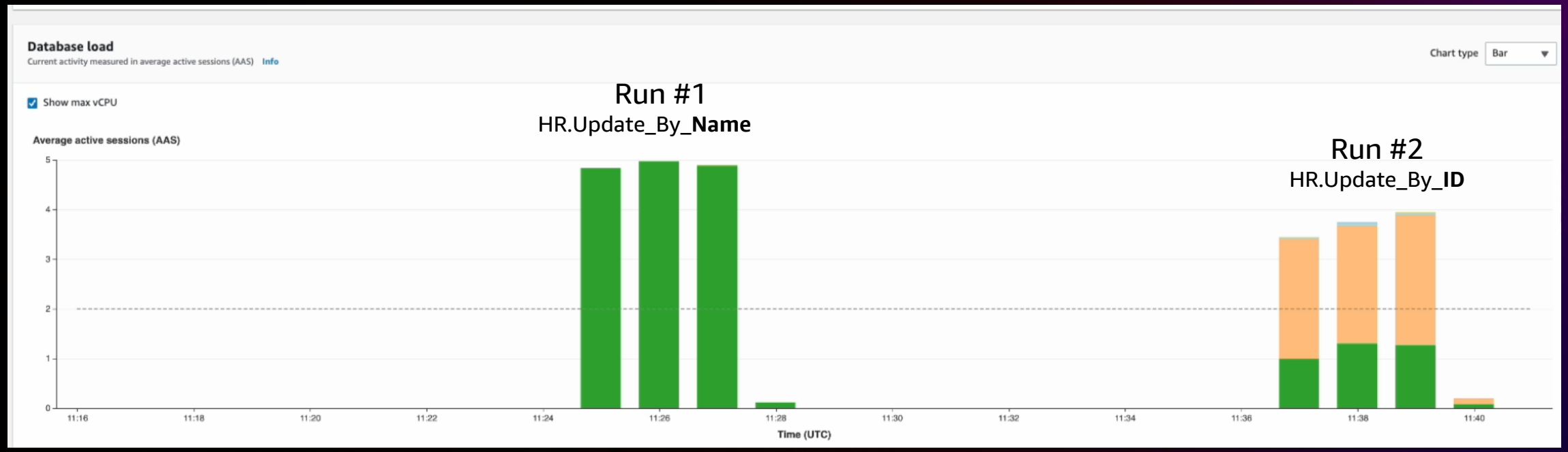
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Demo summary – What have we learned?

Run #1 – **100%** CPU utilization, **7** transactions per second

Run #2 – **90%** CPU utilization, **800+** transactions per second

Wait events – could indicate root cause of performance bottleneck



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DevOps Guru for RDS

A machine learning (ML)–powered capability for Amazon RDS that automatically detects and diagnoses database performance and operational issues so you can resolve bottlenecks in minutes rather than days





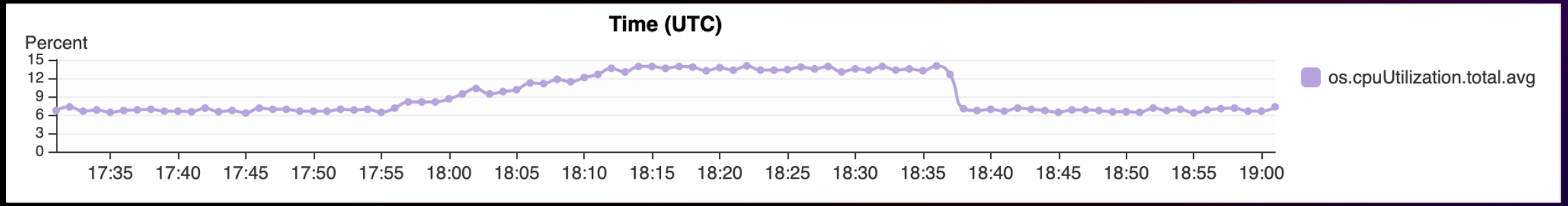
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Example: Table contention

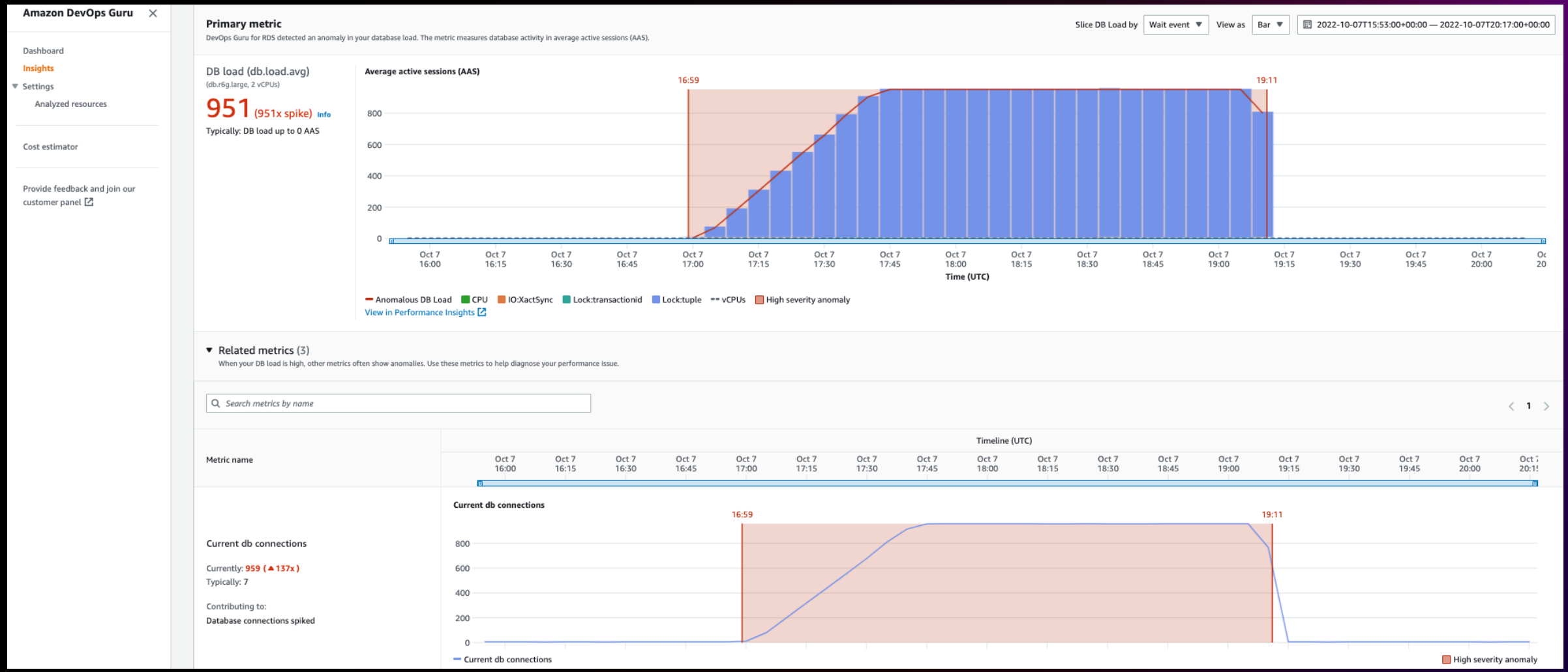
```
UPDATE inventory
SET available_items = available_items-1
WHERE item_id = :item;
```

When looking at CPU utilization in CloudWatch, everything looks fine …



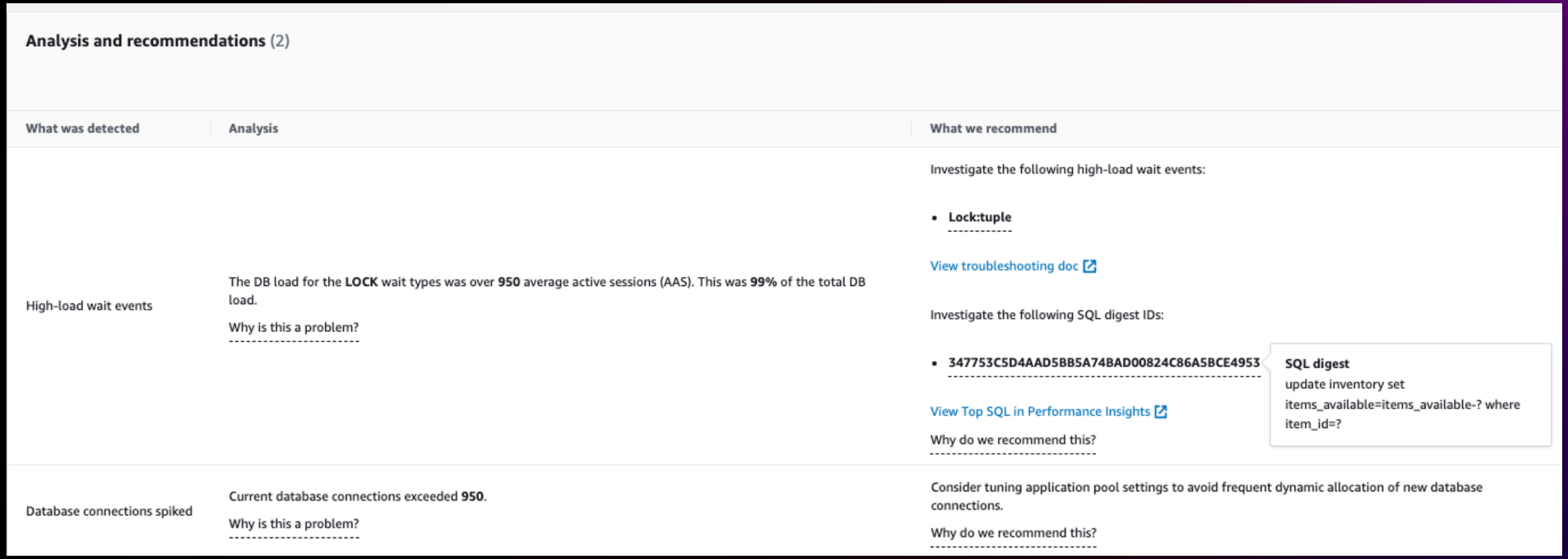
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DevOps Guru for RDS looks at the bigger picture



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DevOps Guru for RDS – Analysis and recommendations



Analysis and recommendations (2)

What was detected	Analysis	What we recommend
High-load wait events	The DB load for the **LOCK** wait types was over **950** average active sessions (AAS). This was **99%** of the total DB load. Why is this a problem?	Investigate the following high-load wait events: • **Lock:tuple** View troubleshooting doc Investigate the following SQL digest IDs: • **347753C5D4AAD5BB5A74BAD00824C86A5BCE4953** **SQL digest** update inventory set items_available=items_available-? where item_id=? View Top SQL in Performance Insights Why do we recommend this?
Database connections spiked	Current database connections exceeded **950**. Why is this a problem?	Consider tuning application pool settings to avoid frequent dynamic allocation of new database connections. Why do we recommend this?

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Our industries

Architecture, engineering, and construction

Manufacturing

Media and entertainment







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Greener buildings

Cleaner cars

Smarter factories

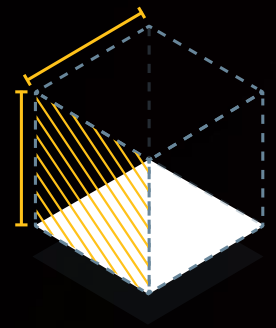
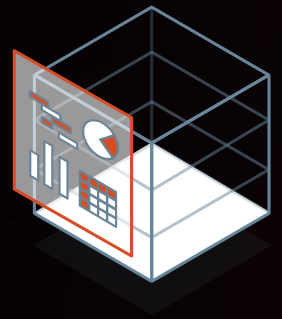
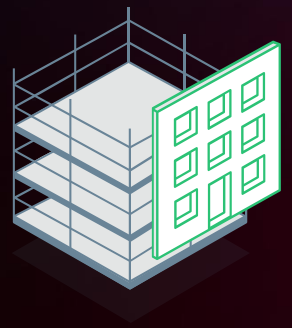
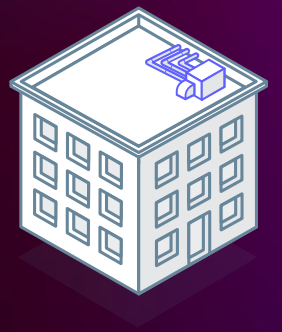
Bigger blockbusters

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AUTODESK Construction Cloud

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AUTODESK Construction Cloud

	Design	Plan	Build	Operate
Shared data	Models · Drawings · Issues · Specifications · RFIs · Cost · Assets · As-Builts · Photos · Video			
Insight	Dashboards · Reports · Construction IQ · Data Connector			
Network	Builders Network			

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AWS services used (20+)

Amazon VPC 

Amazon SQS 

Amazon RDS 

Amazon S3 

Elastic Load Balancing (ELB) 

Amazon SNS 

Amazon ElastiCache 

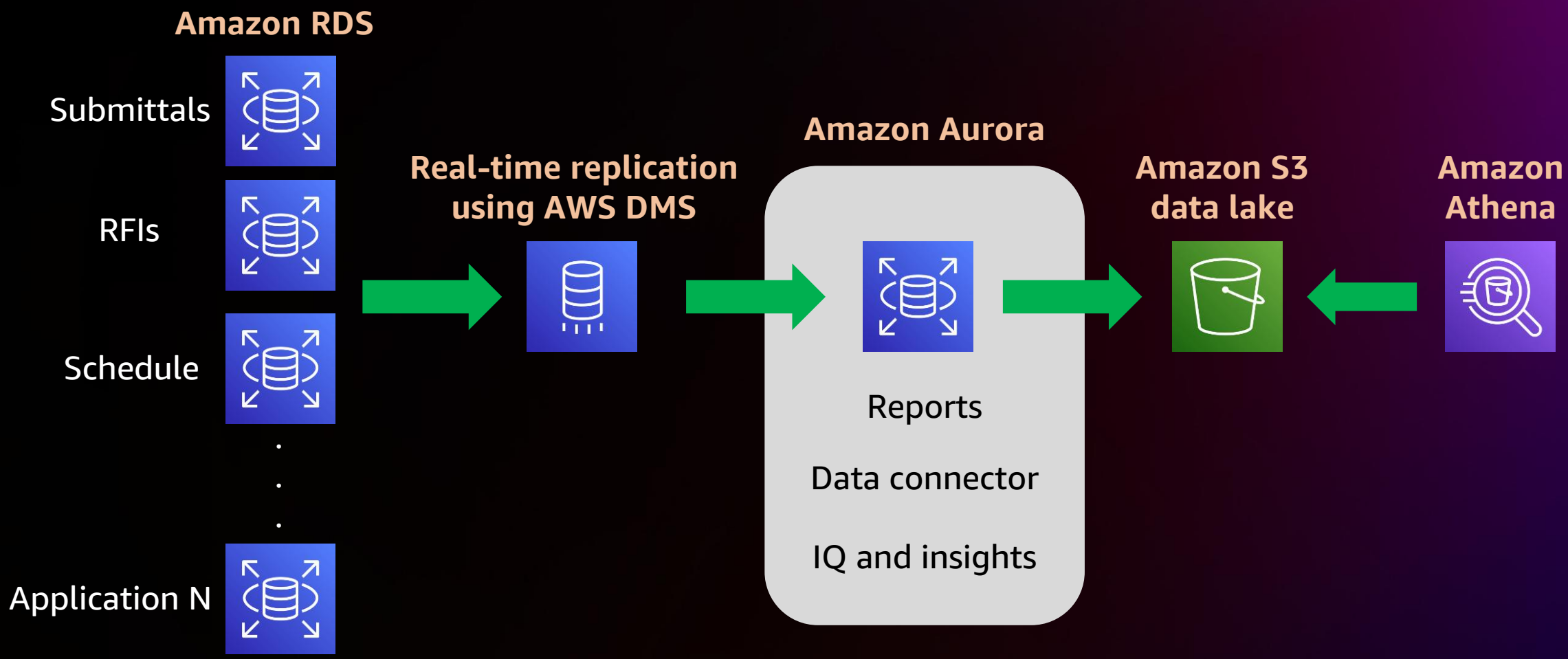
Amazon ECS 

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Digital transformation timeline



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Amazon RDS for PostgreSQL incident

Severity	Summary	Created	Service
Critical	BIM 360 Workflows Service Policy (bim360-workflows-prod-db_us-east-1 violated RDS free disk space below 100 GB) HIDE DETAILS	on Jul 28, 2022 at 9:15 AM	BIM 360 TLV Submittals-Workflows

Storage



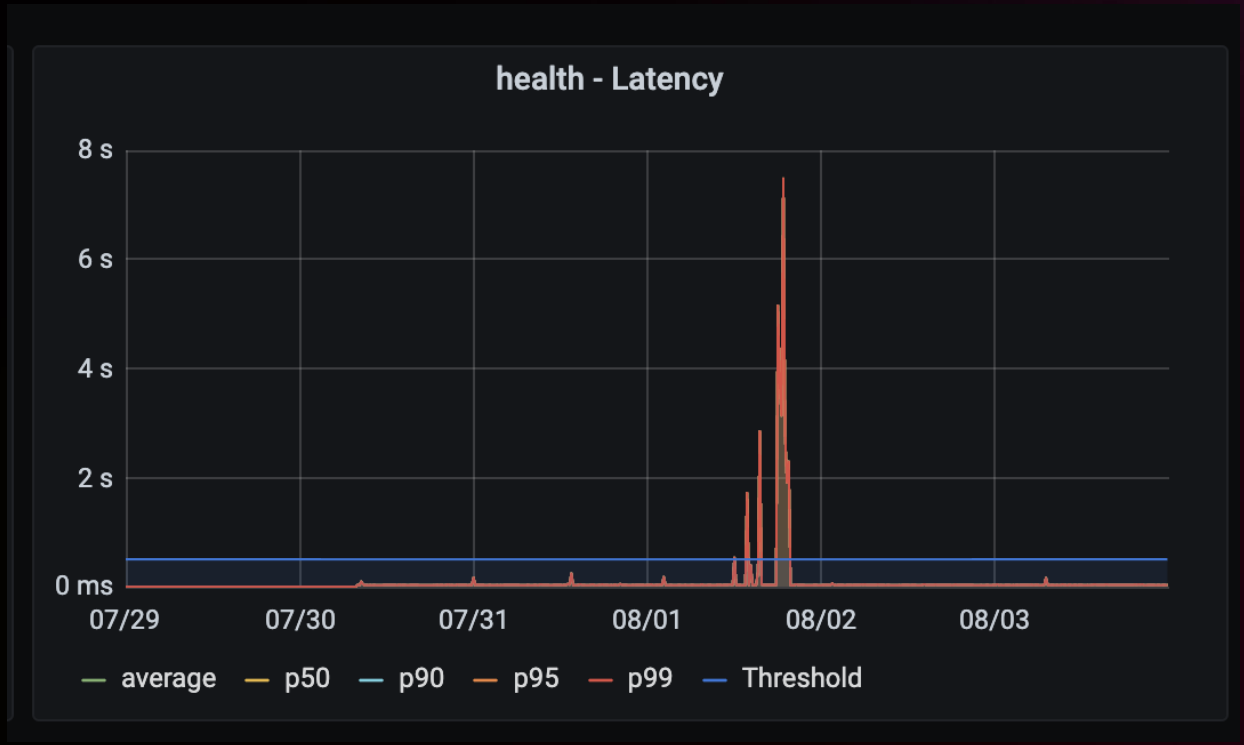
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Potential business impact

- Service degradation
- API outage
- Offline jobs failures

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Issue confirmed with additional data points



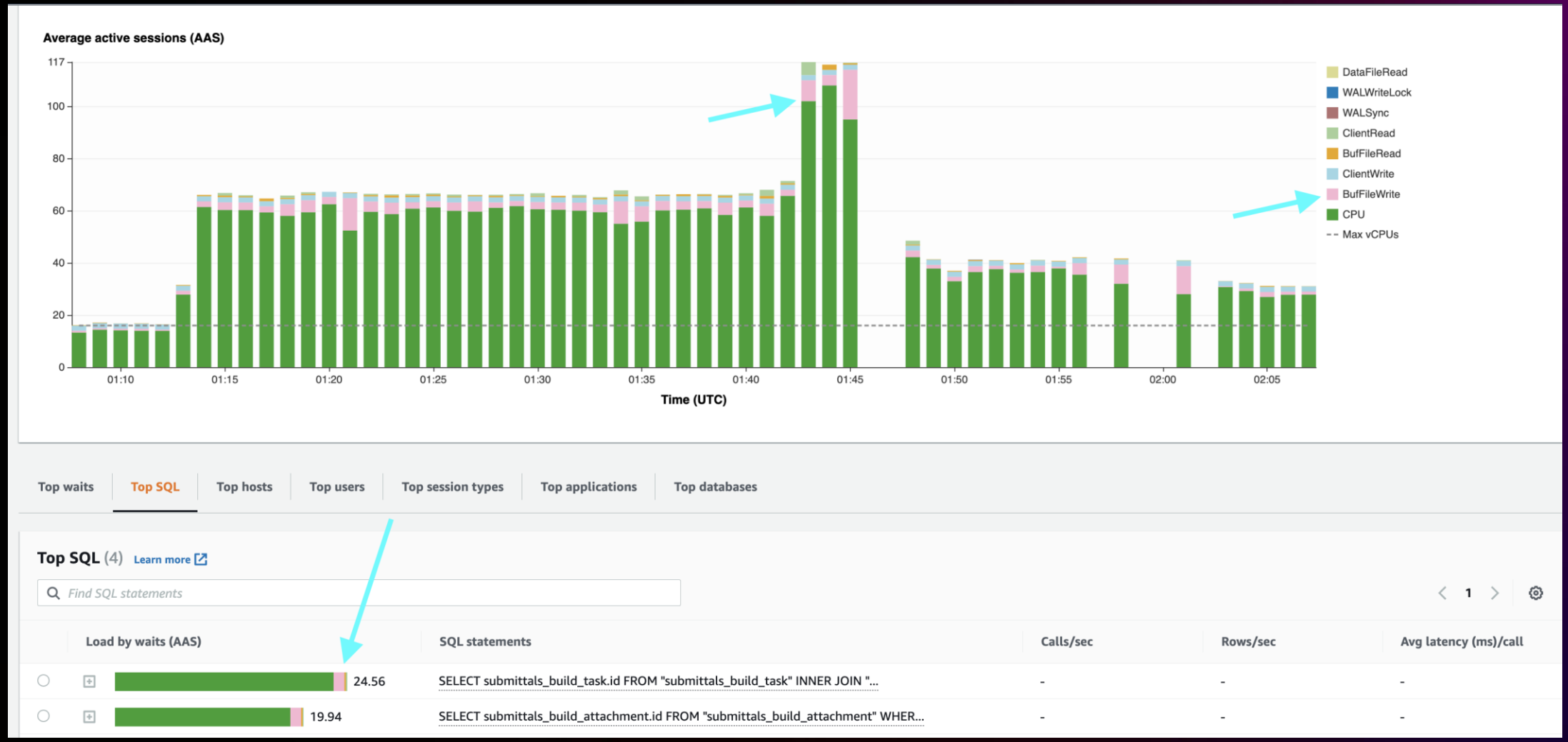
Health endpoint latency

System notes

The gp2 burst balance credits for the RDS database instance are low. To resolve this issue, reduce IOPS usage or modify your storage settings to enable higher performance.

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Remediation with Performance Insights



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AWS documentation to the rescue!

Context

`IO:BufFileRead` and `IO:BufFileWrite` relate to the work memory area and maintenance work memory area. For more information about these local memory areas, see Work memory area and Maintenance work memory area.

The default value for `work_mem` is 4 MB. If one session performs operations in parallel, each worker handling the parallelism uses 4 MB of memory. For this reason, set `work_mem` carefully. If you increase the value too much, a database running many sessions might consume too much memory. If you set the value too low, Aurora PostgreSQL creates temporary files in local storage. The disk I/O for these temporary files can reduce performance.

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work_mem parameter

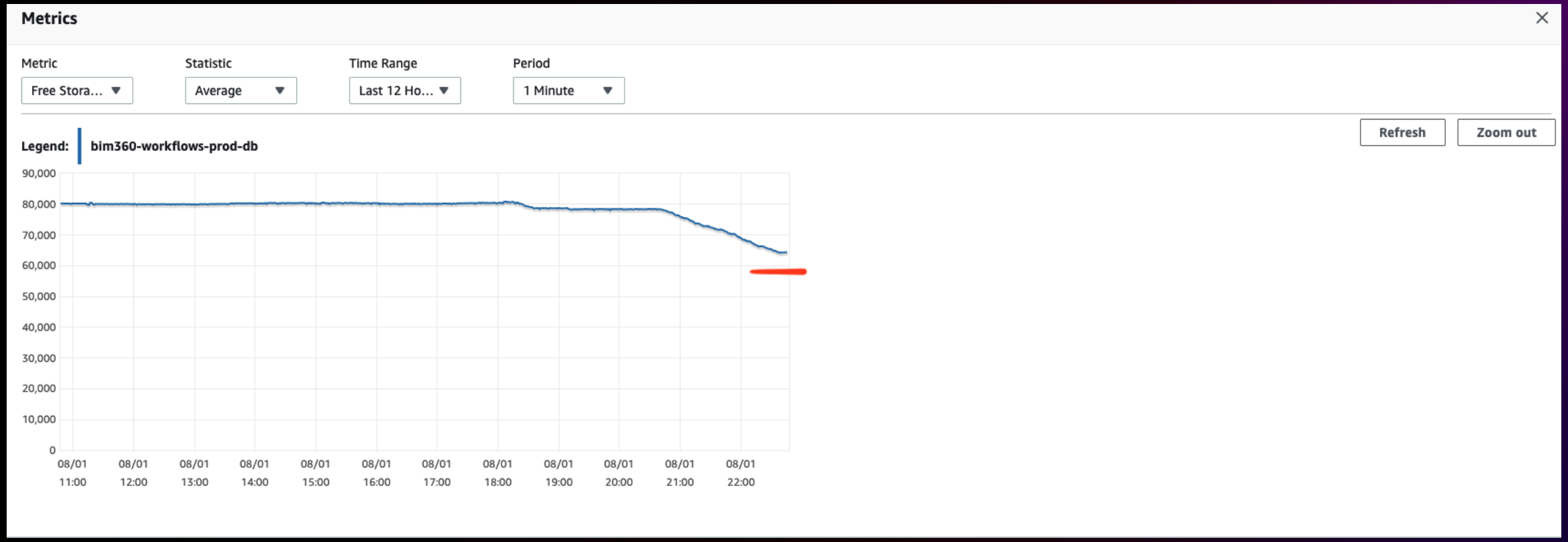
- Default size: **4 MB**
- Specifies the amount of memory that the PostgreSQL engine uses for internal sort operations and hash tables before it writes to temporary disk files
- In cases where we have large **JOIN** statements with **DISTINCT** and/or **ORDER BY**, consider modifying its value
- Dynamic parameter; instance reboot is not required
- We decided to set its value to **50 MB**

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Remediation using Performance Insights

SET work_mem = ‘50MB’ (via the Amazon RDS parameter group)

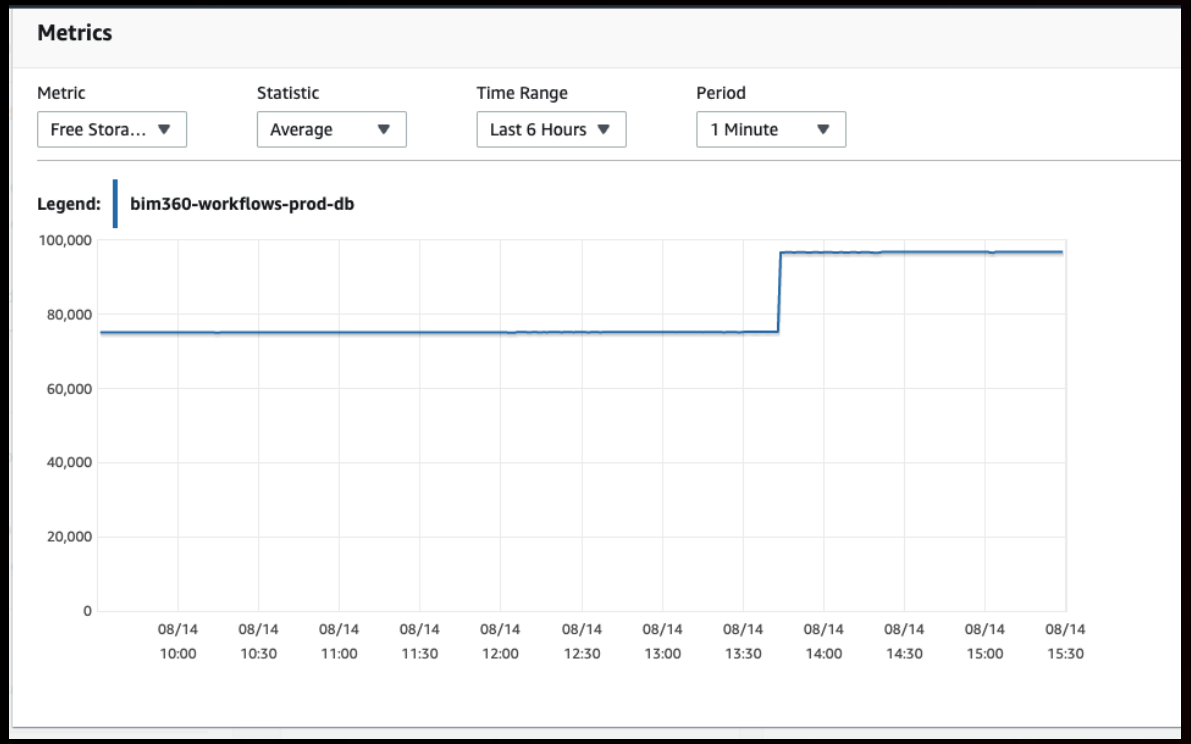
Storage drop stopped



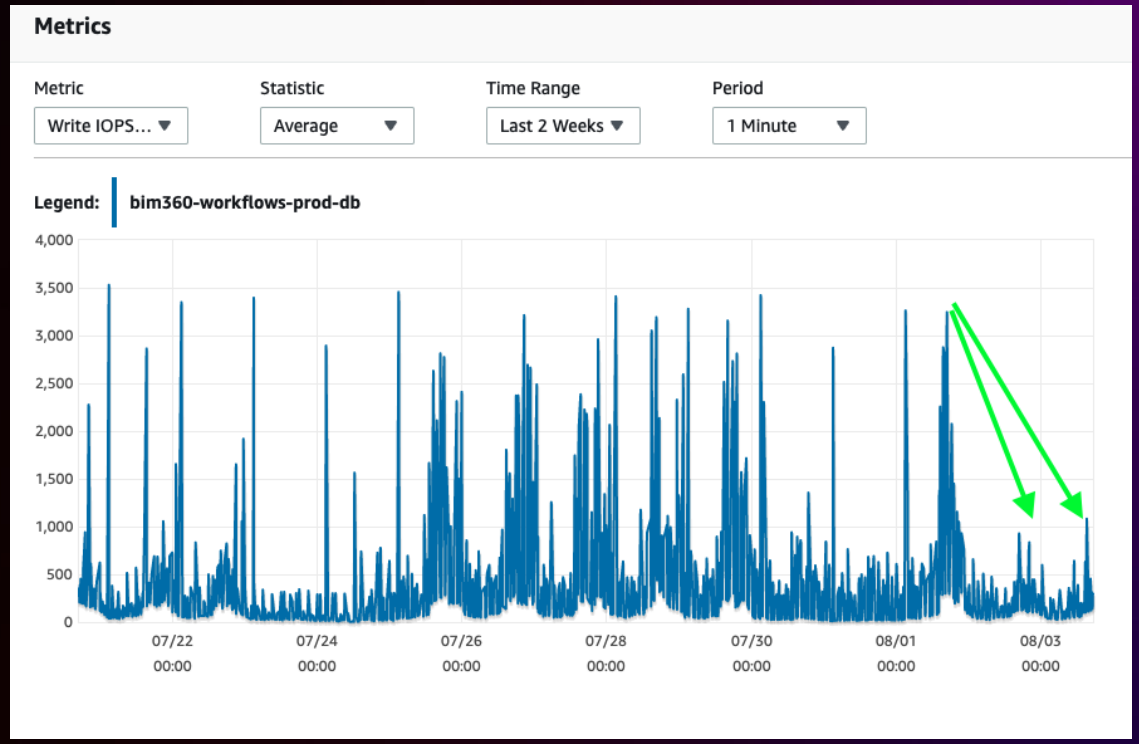
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Impact on key Amazon RDS metrics

Storage freed



Write IOPS decreased



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Alternative options

- Increase storage, which results in more IOPS
- Move to provisioned IOPS
- SQL optimization/code changes

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Conclusions and key takeaways

- Ownership changes
- You build it, you own it
- Business impact

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Summary

- You can’t fix a performance problem that you can’t see
- Use the right tool for the right job
- Be proactive rather than reactive







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AUTODESK

Thank you!

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Please complete the session survey in the **mobile app**

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