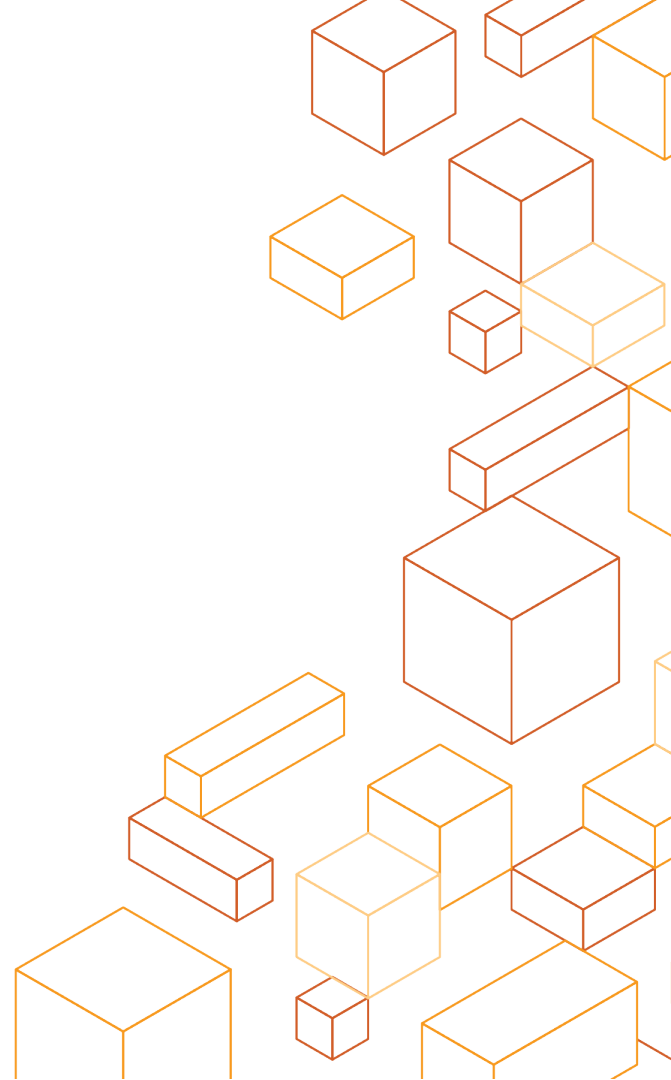
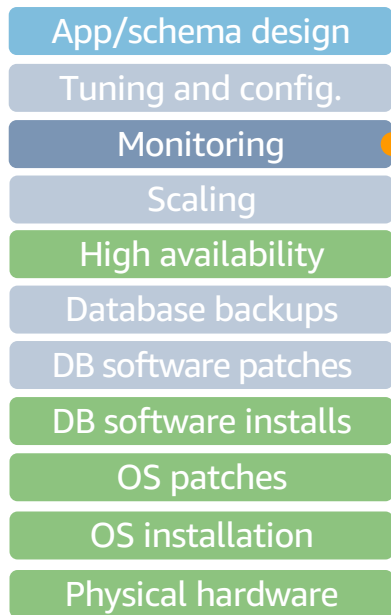


Amazon Aurora

Monitoring and Performance Insights



Monitoring capabilities



Amazon RDS

AWS provides:

- Built-in monitoring and health checks to operate service
- Tools to monitor database operational and performance metrics: CloudWatch, Enhanced Monitoring, Performance Insights
- Capabilities to alarm, notify based on monitoring metrics
- Log collection and publishing capabilities

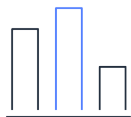
You are responsible for:

- Enabling relevant additional monitoring features
- Monitoring and alarming on relevant metrics and setting workload appropriate thresholds
- Enabling and configuring desired logs

Monitoring capabilities at a glance

Amazon RDS comes with comprehensive monitoring built-in

Amazon CloudWatch Metrics



Monitor core (CPU, memory) and transactional (throughput, latency) metrics

Amazon CloudWatch Logs



Publishing database logs (errors, audit, and slow queries) to a centralized log store

Enhanced Monitoring



Additional database-specific metrics at up to 1 second granularity

Performance Insights



Query- and wait-level performance data

Monitoring RDS databases



Instance

Amazon CloudWatch

- CPU/ Memory / IOPS / Network – Host level metrics
- Single platform across AWS
- Alarm and notify
- Per minute metric storage in Amazon CloudWatch
- Upload database logs to CloudWatch



Operating System

Amazon RDS Enhanced Monitoring

- Process / Thread list with host metrics
- View in AWS Console or push to monitoring systems
- Stored in Amazon CloudWatch Logs
- 1–60 second granularity
 - Start with 15s & Dial down to 1s when troubleshooting



Database Engine

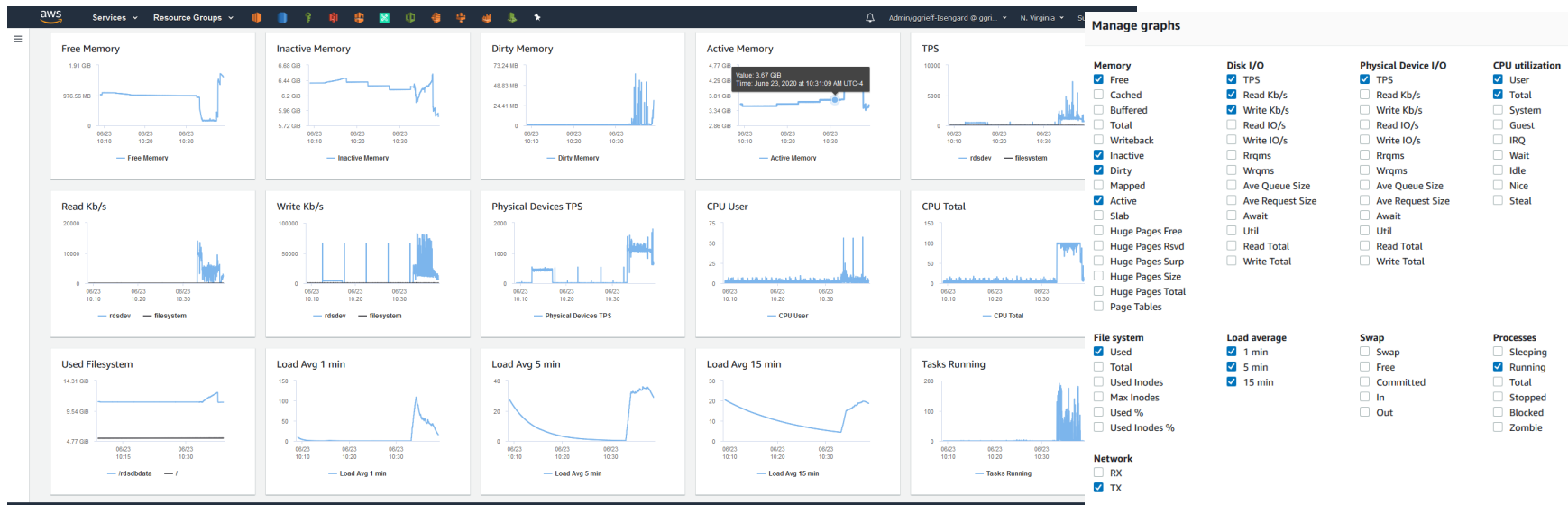
Amazon RDS Performance Insights

- Measure database load, average active sessions
- Per second granularity
- All Amazon RDS engines
- No licensing requirements
- View in AWS Console or push to monitoring systems

Enhanced Monitoring

Released on 2016, Enhanced Monitoring gathers finer grained OS metrics from an agent installed on the RDS host.

- By default metrics are stored for 30 days.
- Incurs additional CloudWatch costs based on granularity (from 1 to 60 seconds).



Monitoring RDS Environment

CloudWatch Alarms

RDS Event Notification

RDS Recommendations

Alarm details



Provide the details and threshold for your alarm. Use the graph to help set the appropriate threshold.

Name: rds-freestoragespace-below-1gib

Description: Alarm when free storage below 1 GiB

Whenever: FreeStorageSpace

is:

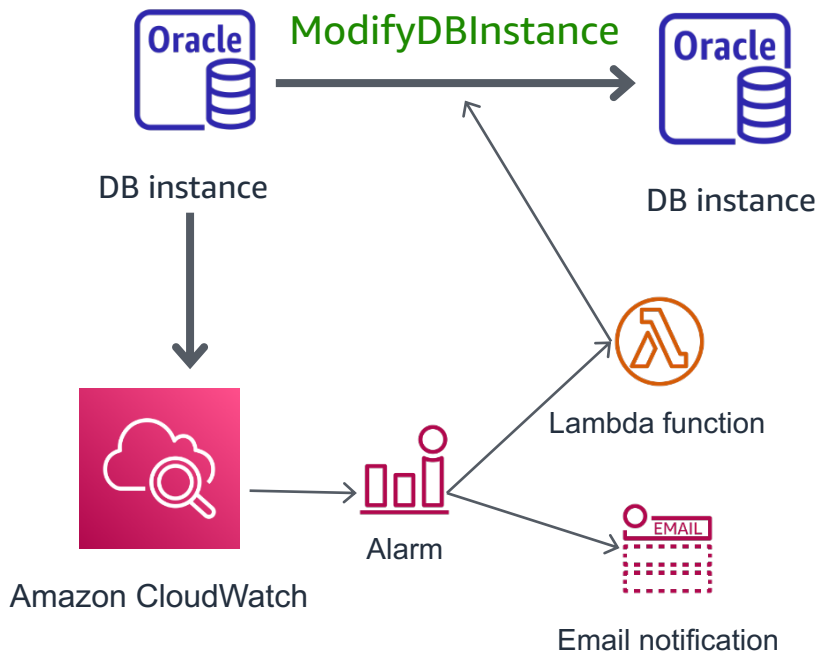
for: 5  out of datapoints 

Monitoring RDS Environment

CloudWatch Alarms

RDS Event Notification

RDS Recommendations



Monitoring RDS Environment

CloudWatch Alarms

Provide notifications when RDS events occur

Built-in API to list events (ad hoc delivery)

Leverage an Amazon SNS topic as the delivery target (push delivery)

RDS Event Notification

Create subscription for specific RDS resource types (DB instances, DB clusters, snapshots, parameter groups...) and event categories

Add desired RDS resources to subscription

RDS Recommendations

Near real-time notifications

Monitoring RDS Environment

CloudWatch Alarms

RDS Event Notification

RDS Recommendations

RDS > Recommendations

Recommendations

Active (5) | Dismissed (0) | Applied (0) | Scheduled (0)

► **Engine version outdated (2)**
DB instances that are not running the latest minor engine version. [Info](#)

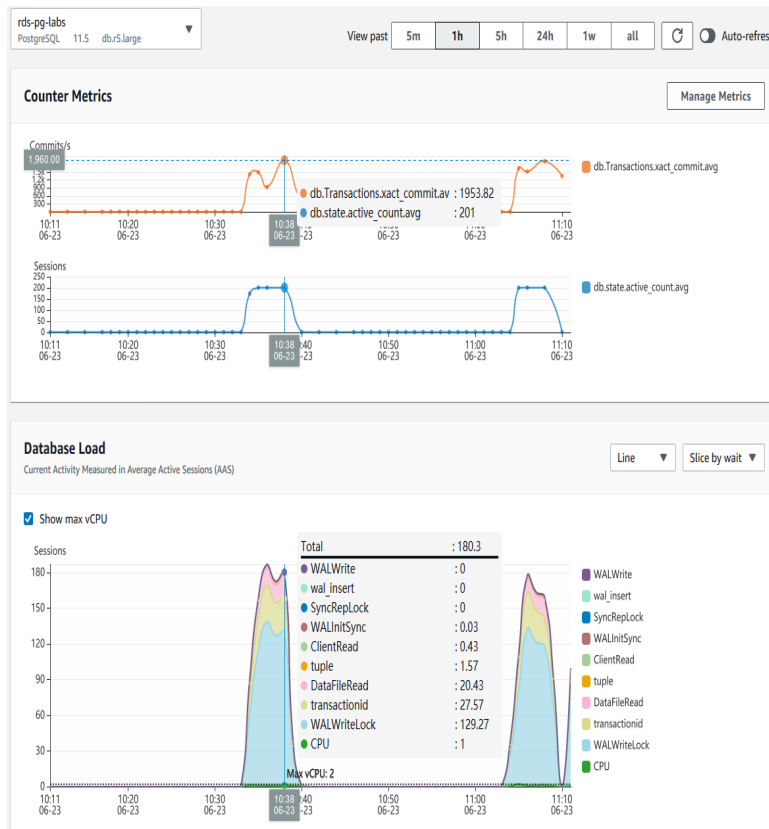
► **Encryption disabled (2)**
DB instances that do not have encryption enabled. [Info](#)

► **Enhanced monitoring disabled (1)**
DB instances that don't have Enhanced Monitoring enabled. [Info](#)

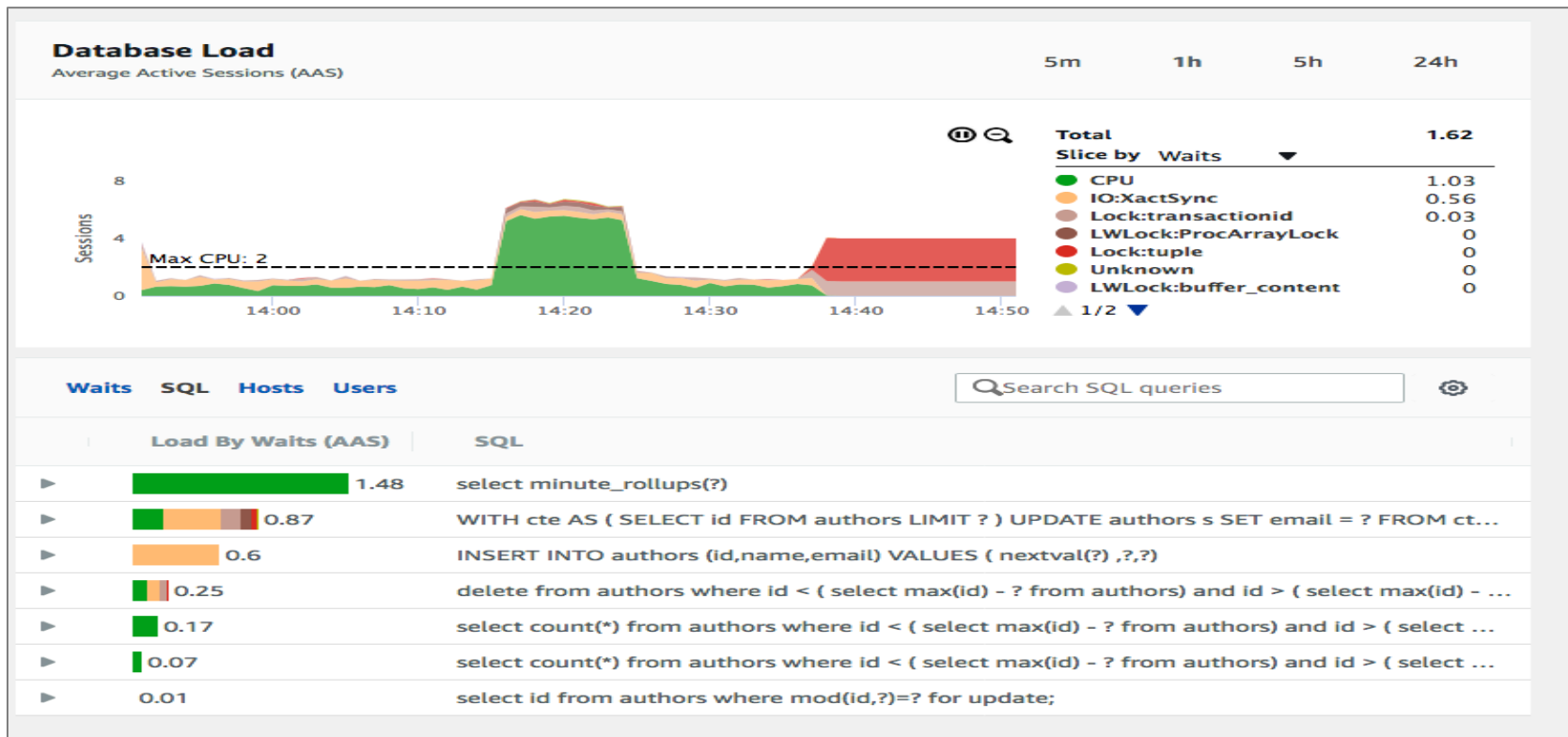
Performance Insights

Amazon RDS Performance Insights monitors your **Database Load**

- Visibility into performance of Amazon Relational Database Service (Amazon RDS) databases
- Adjustable timeframe
- Filter load by Waits, SQL Statements, Hosts, or Users
- Easily find SQLs causing load
- Change chart granularly from 5 minutes to 1+ weeks
- For beginners as well as experts



Performance Insights dashboard



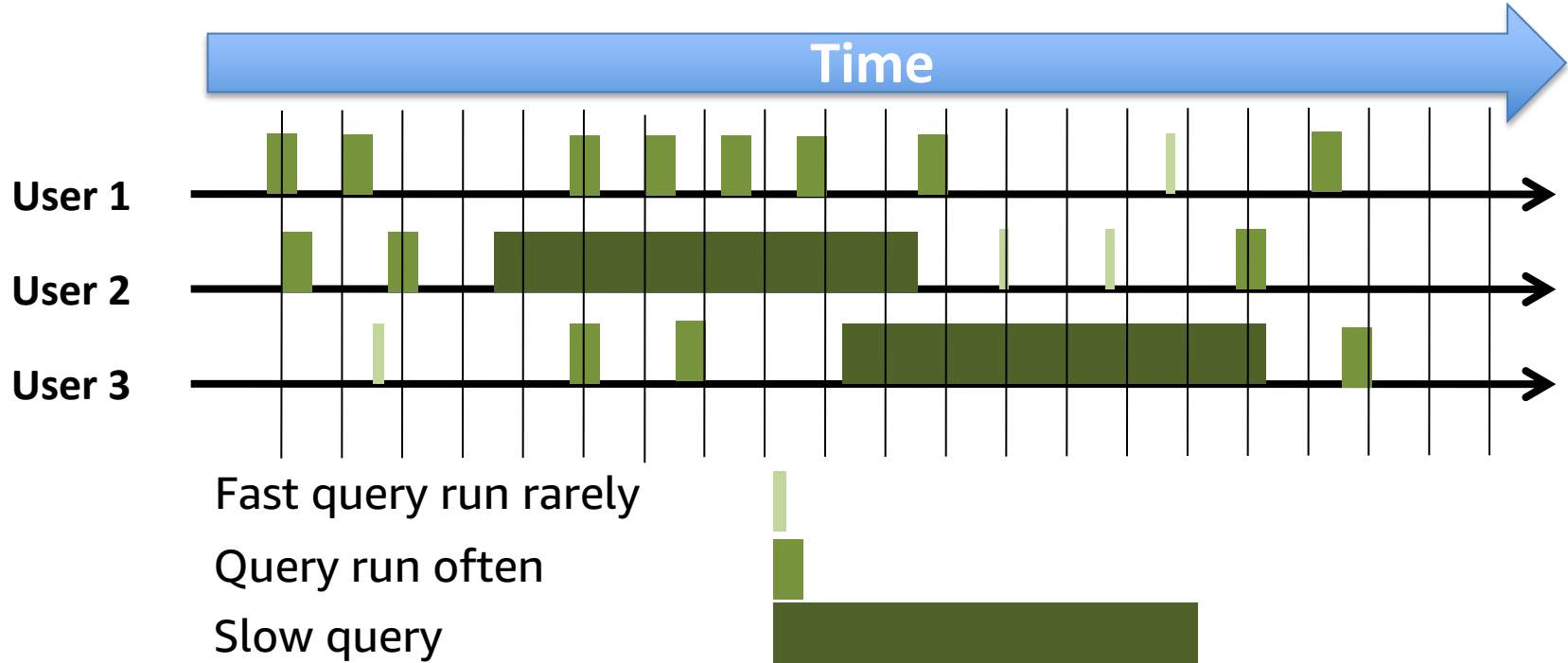
What is “Database Load”?

- All engines have a connections list showing
 - Active
 - Idle
- We sample every second
 - For each active session, collect
 - SQL
 - State: CPU, I/O, lock, commit log wait, and more
 - Host
 - User
- Expose as “average active sessions” (AAS)

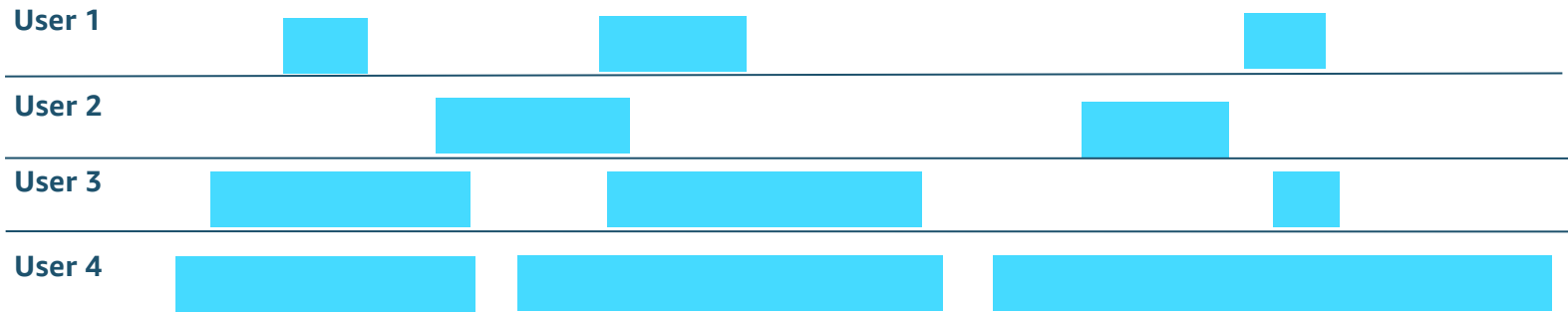


Performance Insights –Sampling

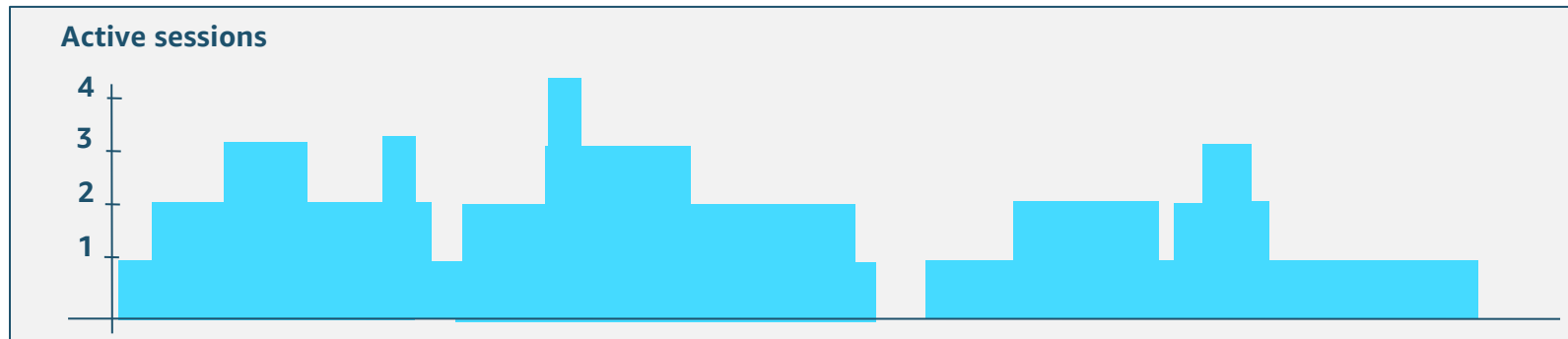
Sampling every second



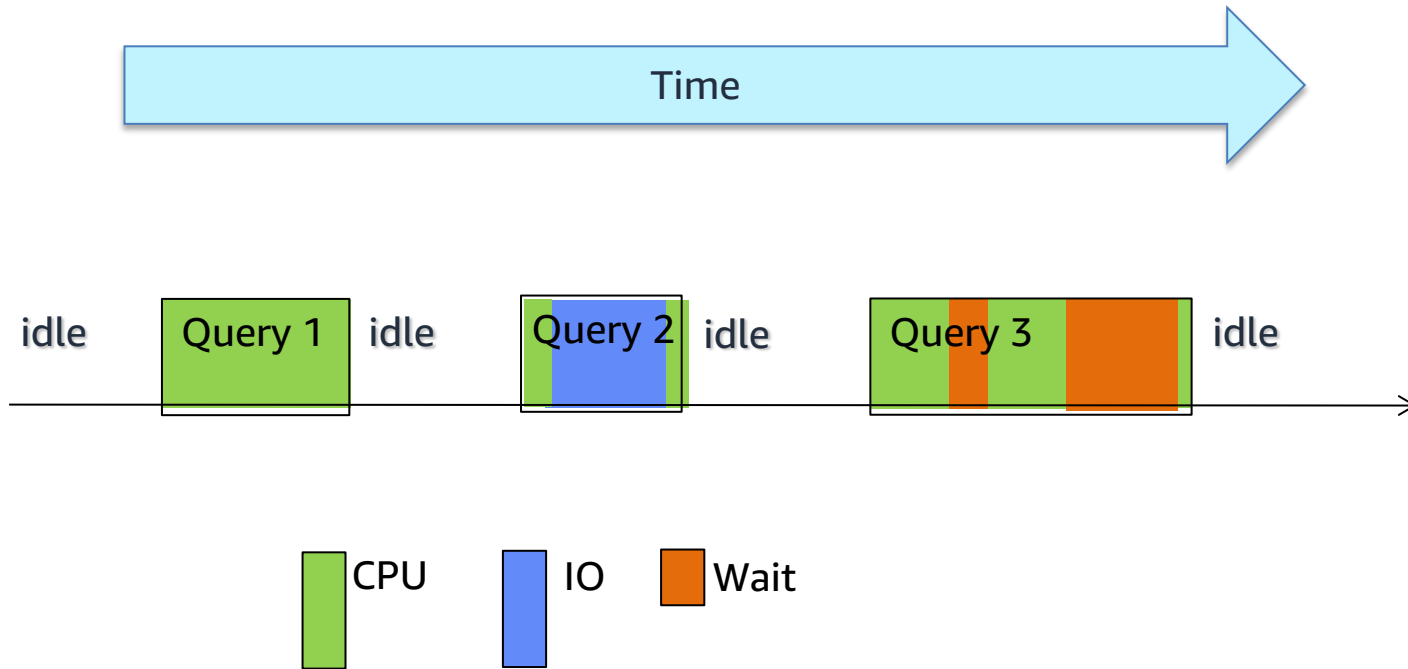
AAS load graph



=



Active session state



Performance Insights - Yardstick

$AAS < 1$

Database is not blocked

$AAS \approx 0$

Database basically idle. Problems are in the APP not DB

$AAS < \# \text{ of CPUs}$

CPU available

Are any single sessions 100% active?

$AAS > \# \text{ of CPUs}$

Could have performance problems

$AAS \gg \# \text{ of CPUs}$

There is a bottleneck

When users say the database is slow ...

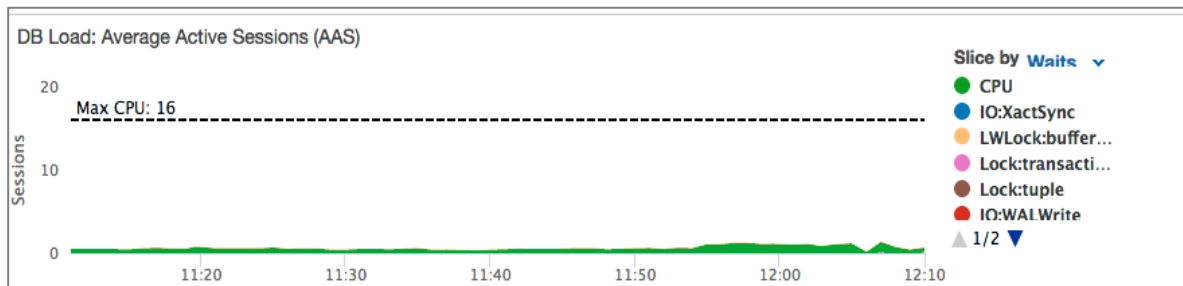


AAS = 0

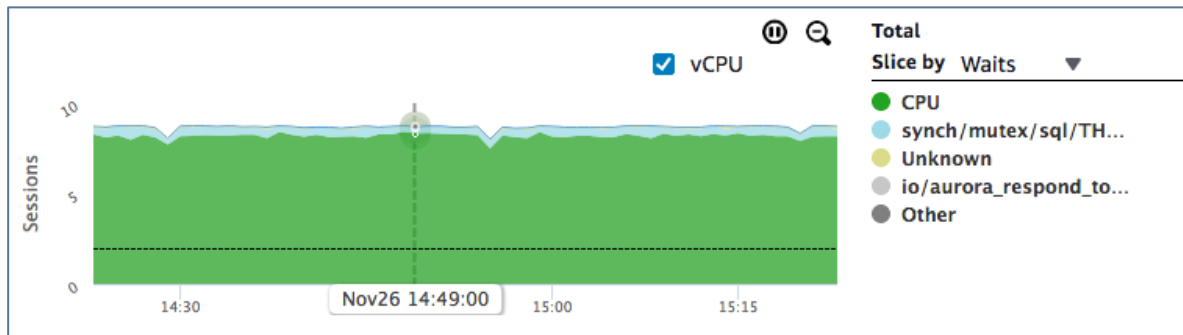
You prove that it's not the database

Also useful for sizing

- If CPU load significantly less than #vCPU then oversized



- If CPU load is > #vCPU undersized

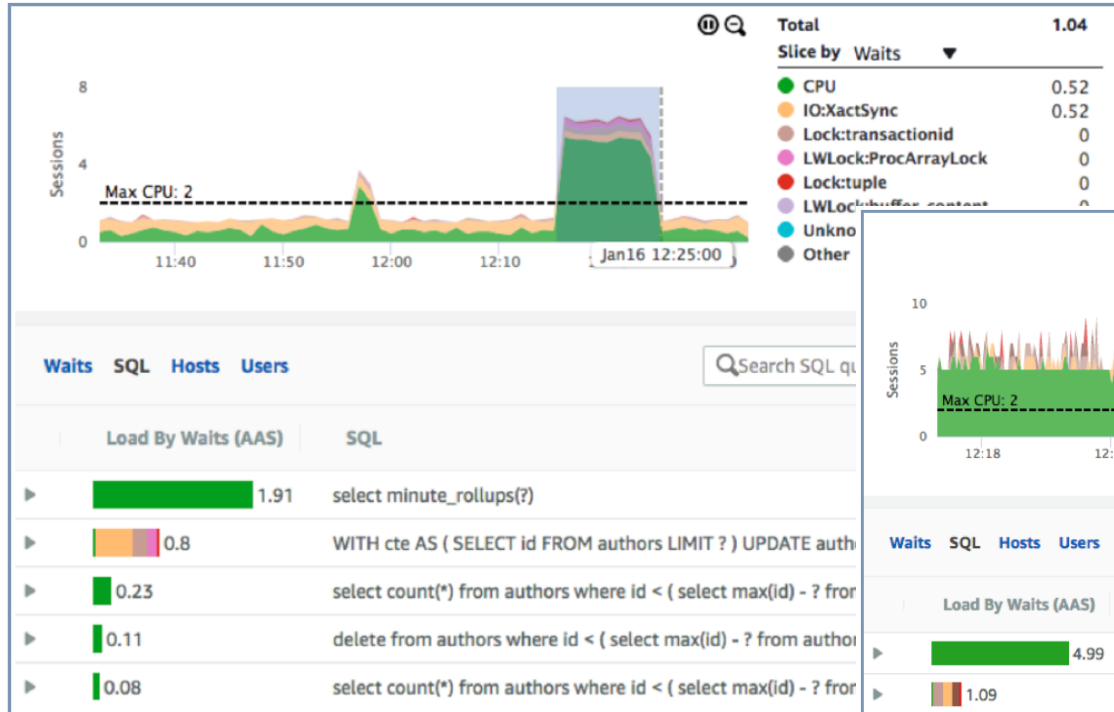


Performance Insights - Counters

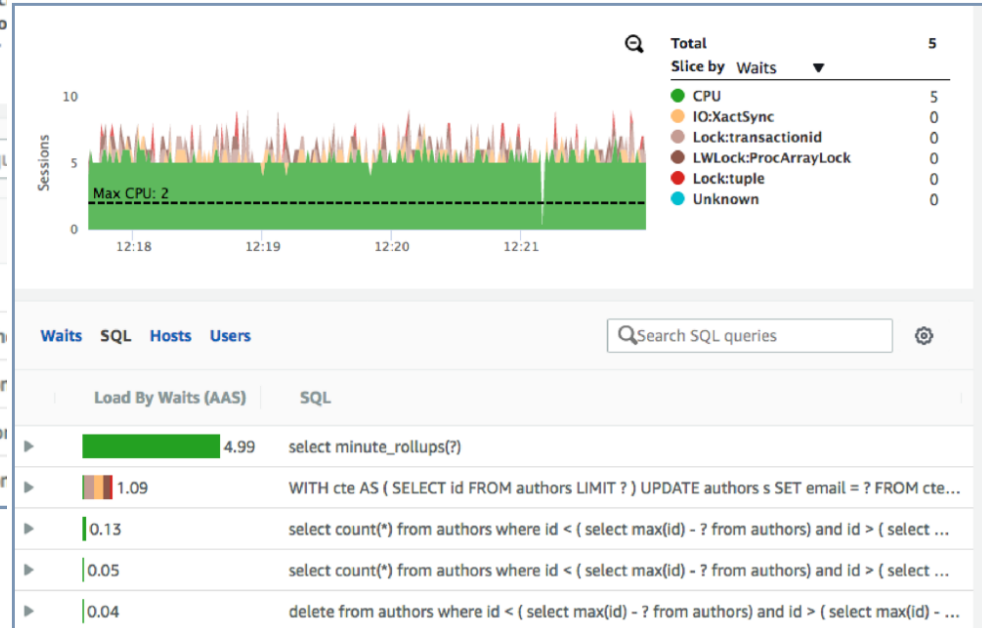
Customize the Performance Insights Dashboard with up to 10 additional graphs

Counter	Type	Unit	Metric
tup_deleted	SQL	Tuples per second	db.SQL.tup_deleted
tup_fetched	SQL	Tuples per second	db.SQL.tup_fetched
tup_inserted	SQL	Tuples per second	db.SQL.tup_inserted
tup_returned	SQL	Tuples per second	db.SQL.tup_returned
tup_updated	SQL	Tuples per second	db.SQL.tup_updated
buffers_checkpoint	Checkpoint	Blocks per second	db.Checkpoint.buffers_checkpoint
checkpoints_req	Checkpoint	Checkpoints per minute	db.Checkpoint.checkpoints_req
checkpoint_sync_time	Checkpoint	Milliseconds per checkpoint	db.Checkpoint.checkpoint_sync_time
checkpoints_timed	Checkpoint	Checkpoints per minute	db.Checkpoint.checkpoints_timed
checkpoint_write_time	Checkpoint	Milliseconds per checkpoint	db.Checkpoint.checkpoint_write_time
maxwritten_clean	Checkpoint	Bgwriter clean stops per minute	db.Checkpoint.maxwritten_clean
active_transactions	Transactions	Transactions	db.Transactions.active_transactions
blocked_transactions	Transactions	Transactions	db.Transactions.blocked_transactions
max_used_xact_ids	Transactions	Transactions	db.Transactions.max_used_xact_ids
xact_commit	Transactions	Commits per second	db.Transactions.xact_commit

Performance Insights Example: CPU Bottleneck

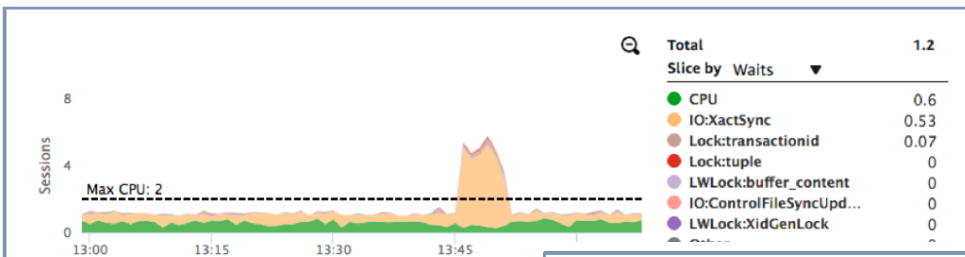


Zoom in by clicking and dragging along timeline



Identify problem statement

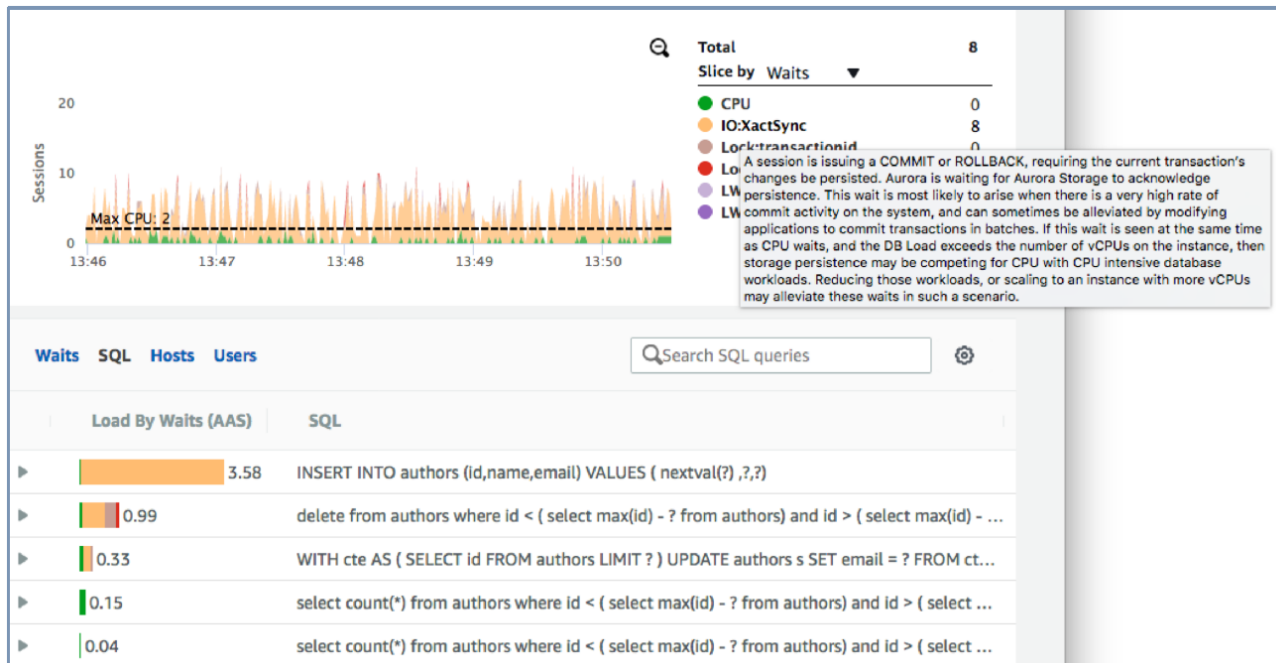
Performance Insights Example: Wait Bottleneck



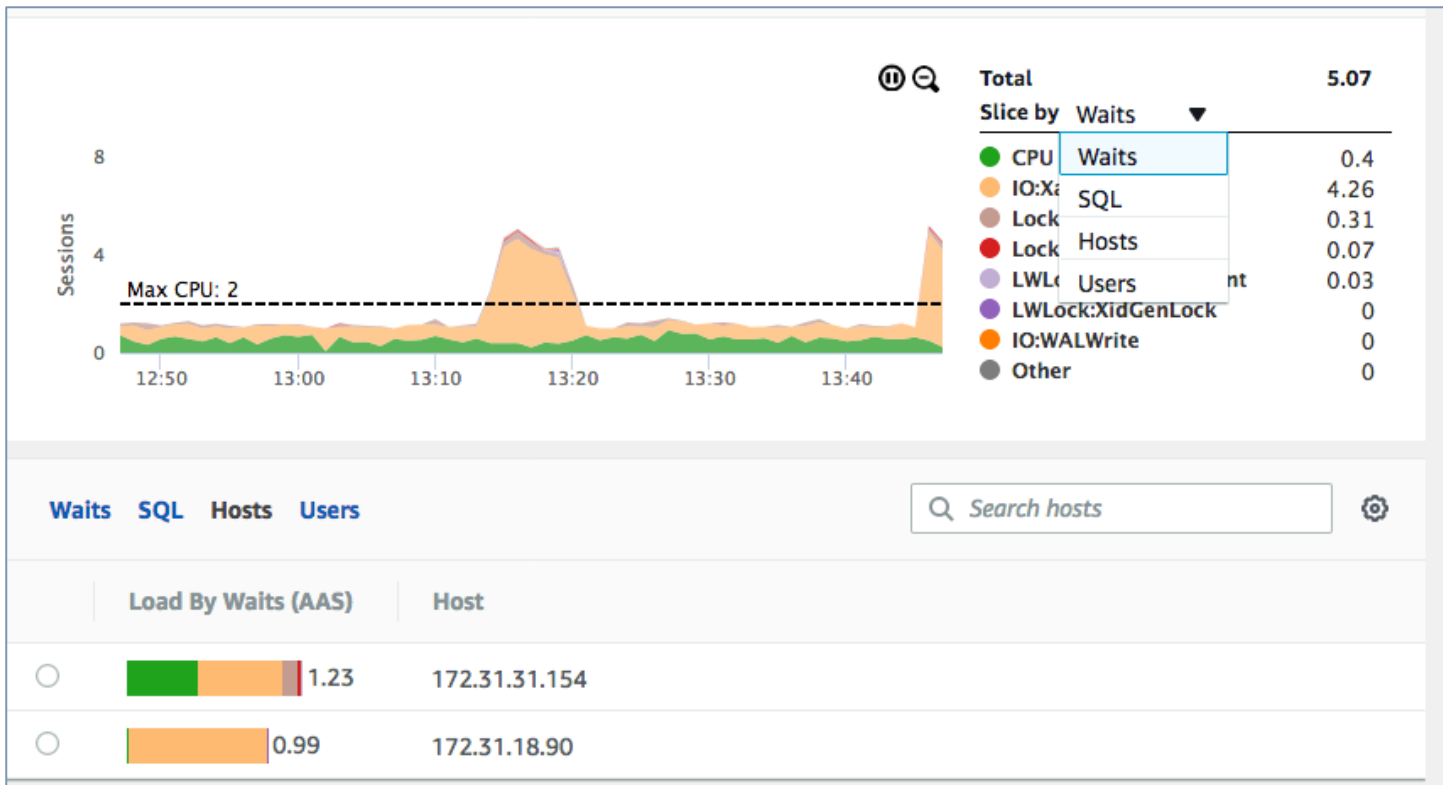
Get contextual help for wait events

Waits	SQL	Hosts	Users
Load By Waits (AAS)		SQL	
▶	0.74	INSERT INTO authors (id,name,em...	
▶	0.64	WITH cte AS (SELECT id FROM aut	
▶	0.3	delete from authors where id < (se	
▶	0.21	select count(*) from authors where	
▶	0.08	select count(*) from authors where	

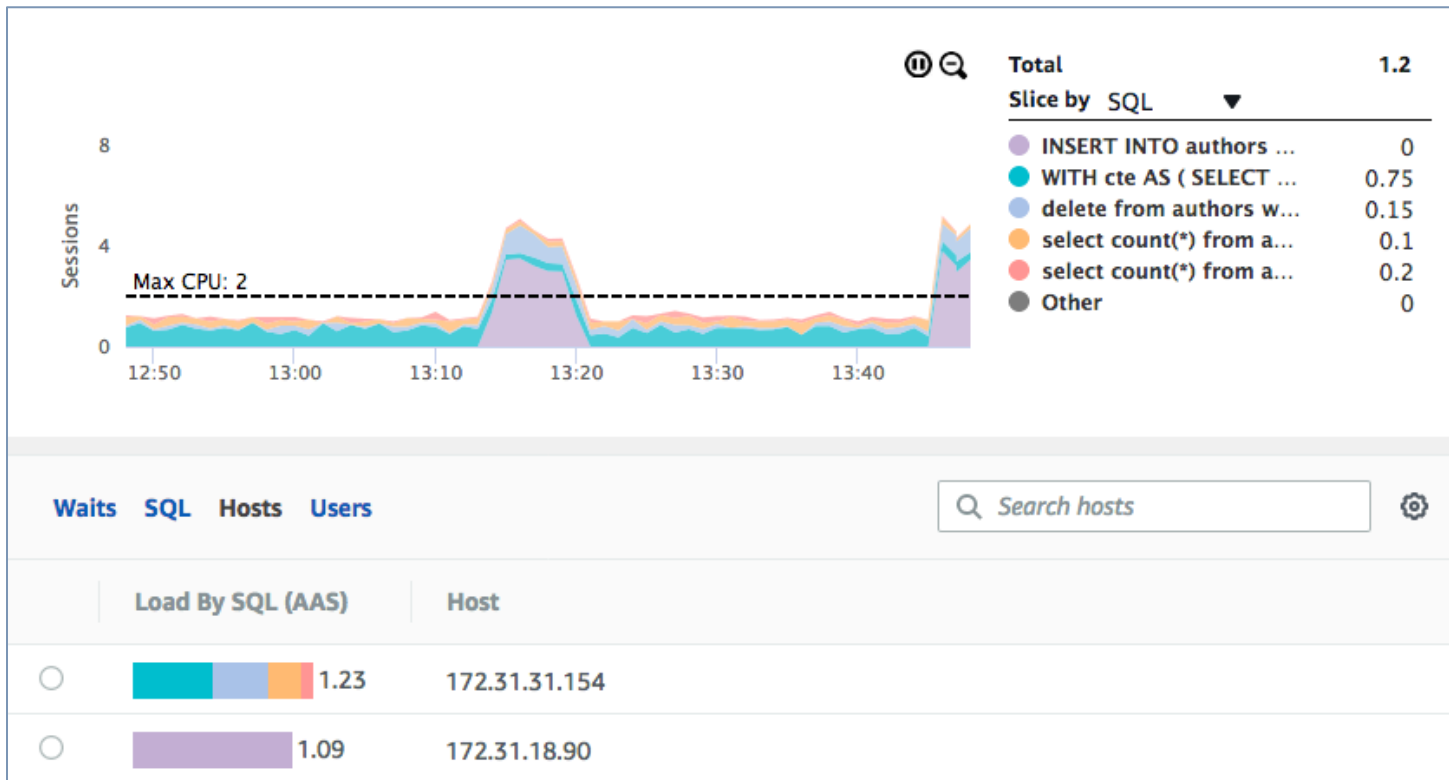
Identify problem statement



Other dimensions



Top host by SQL statement



Performance Insights – Access

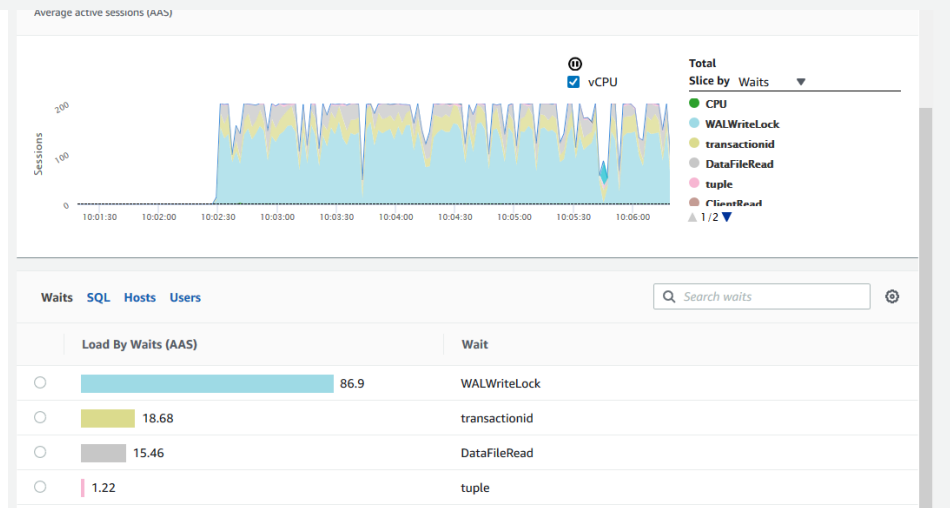
RDS > Databases

Databases Group resources Refresh Modify Actions Restore from S3 Create database

	DB identifier	Role	Engine	Region & AZ	Size	Status	CPU	Current activity
<input type="radio"/>	database-1	Instance	Oracle Enterprise Edition	us-east-1f	db.t3.small	Available	2.00%	0.02 Sessions
<input type="radio"/>	rds-pg-labs	Instance	PostgreSQL	us-east-1a	db.r5.large	Available	44.00%	160.71 Sessions

In the RDS console there are two bar graphs (CPU & Sessions)

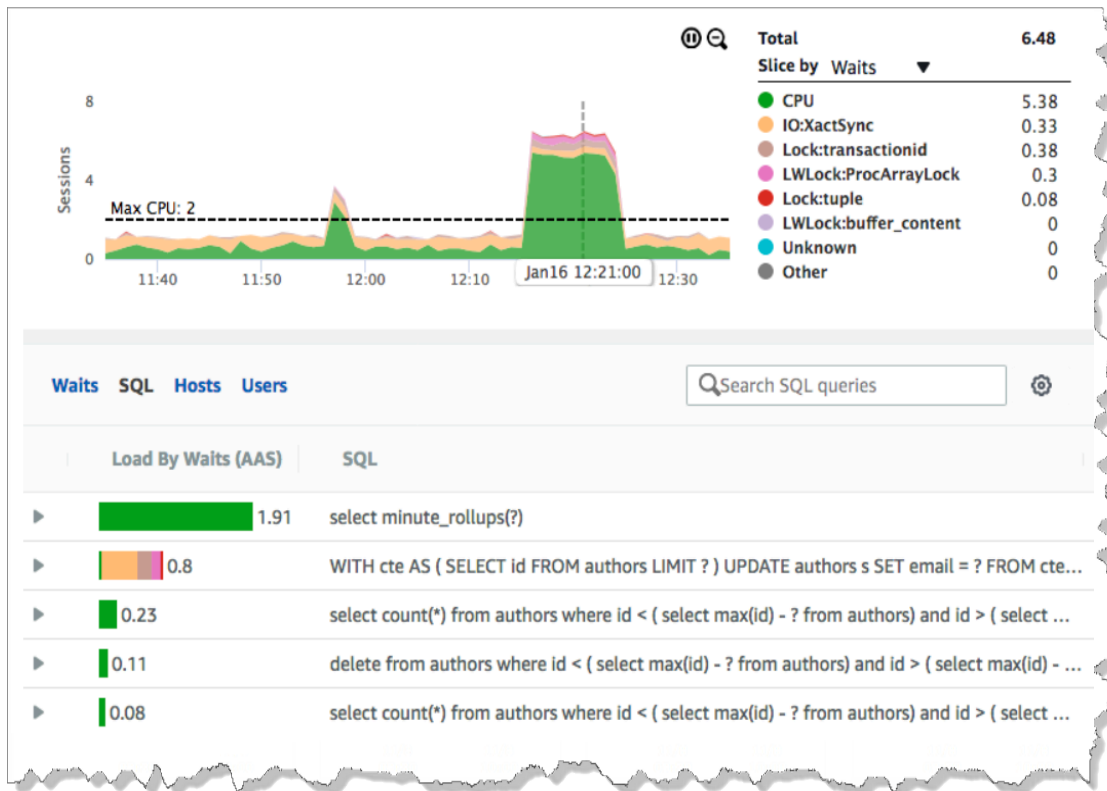
- These give a quick view of overall state of your RDS instance.
- Visible in the list of databases and details page
- Clicking on the link for Sessions brings you to Performance Insights



What is Coming

- SQL execution plan
- SQL stats

Summary: Amazon RDS Performance Insights



- DB load: Average active sessions
 - Identifies database bottlenecks
 - Easy
 - Powerful
- Top SQL
 - Identifies source of bottleneck
- Enables problem discovery
 - Adjustable time frame
 - Hour, day, week, and longer

Publishing Logs to Cloud Watch Logs

- You can configure your Amazon Aurora database engine to publish log data to a log group in Amazon CloudWatch Logs.
- With CloudWatch Logs, you can perform real-time analysis of the log data, and use CloudWatch to create alarms and view metrics.
- You can use CloudWatch Logs to store your log records in highly durable storage, which you can manage with the CloudWatch Logs Agent
- With CloudWatch Logs, you can analyze the log data, and use CloudWatch to create alarms and view metrics and store your log records in highly durable storage.

Thank you!

