
AWS
re:Invent
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DAT326

Deep dive into Amazon Aurora and its innovations

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Senior Principal Engineer
AWS

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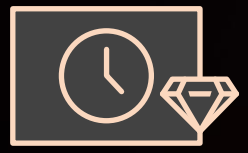
Amazon Aurora

Designed for unparalleled high performance and availability at global scale with full MySQL and PostgreSQL compatibility at 1/10th the cost of commercial databases



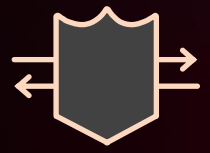
Performance & scalability

- 5x throughput of standard MySQL and 3x of standard PostgreSQL
- Scale out up to 15 read replicas
- Decoupled storage and compute enabling cost optimization
- Fast database cloning
- Distributed, dynamically scaling storage subsystem



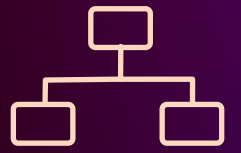
Availability & durability

- 6 copies of data across 3 AZs (customers pays for 1)
- Automatic, continuous, incremental backups with point-in-time recovery (PITR)
- Fault-tolerant, self-healing, auto-scaling storage
- Global Database for disaster recovery



Highly secure

- Network isolation
- Encryption at rest/in transit
- Supports multiple secure authentication mechanisms and audit controls



Fully managed

- Automates time-consuming management of administration tasks like hardware provisioning, database setup, patching, and backups
- Serverless configuration options

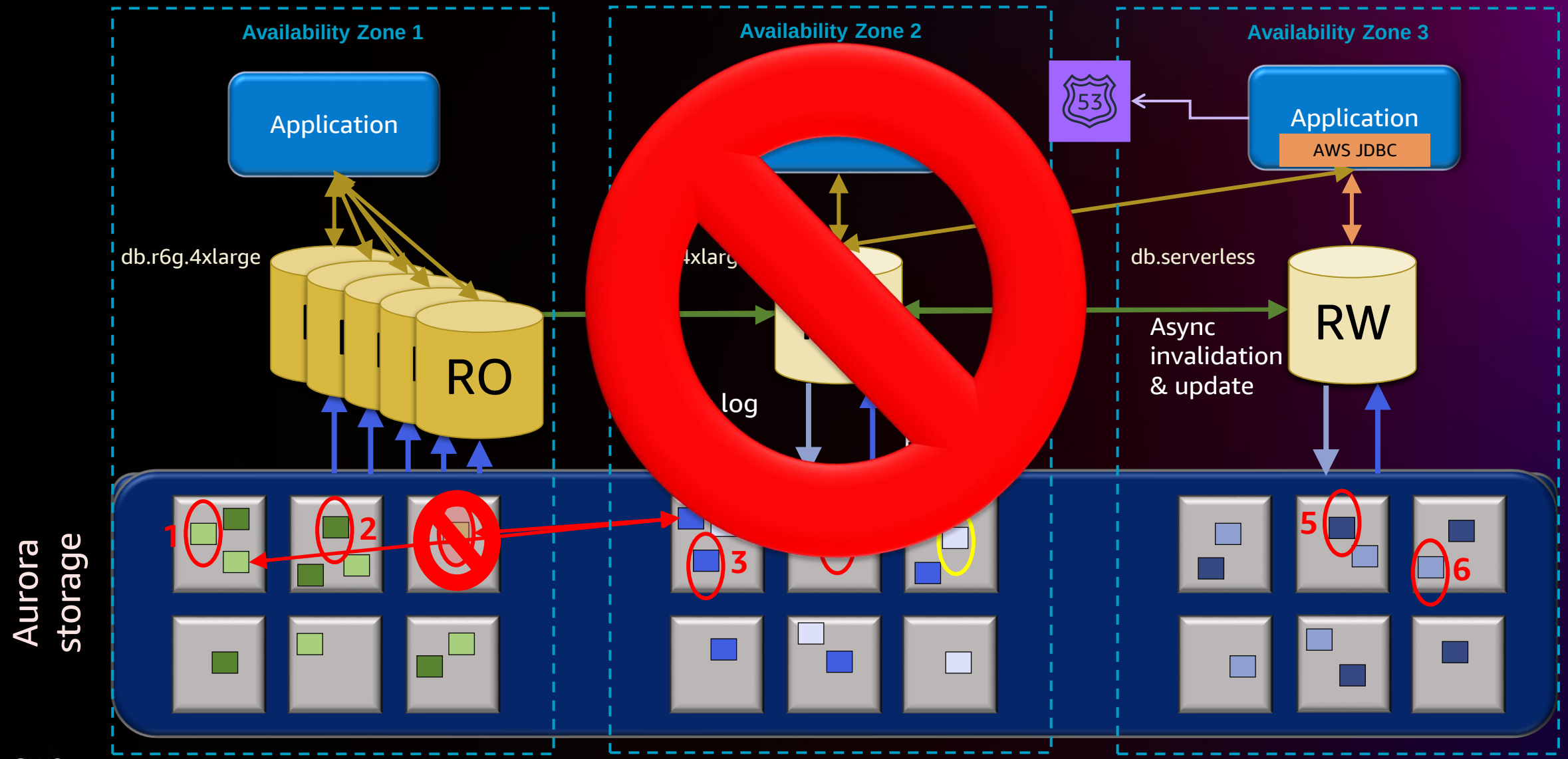
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Architecture

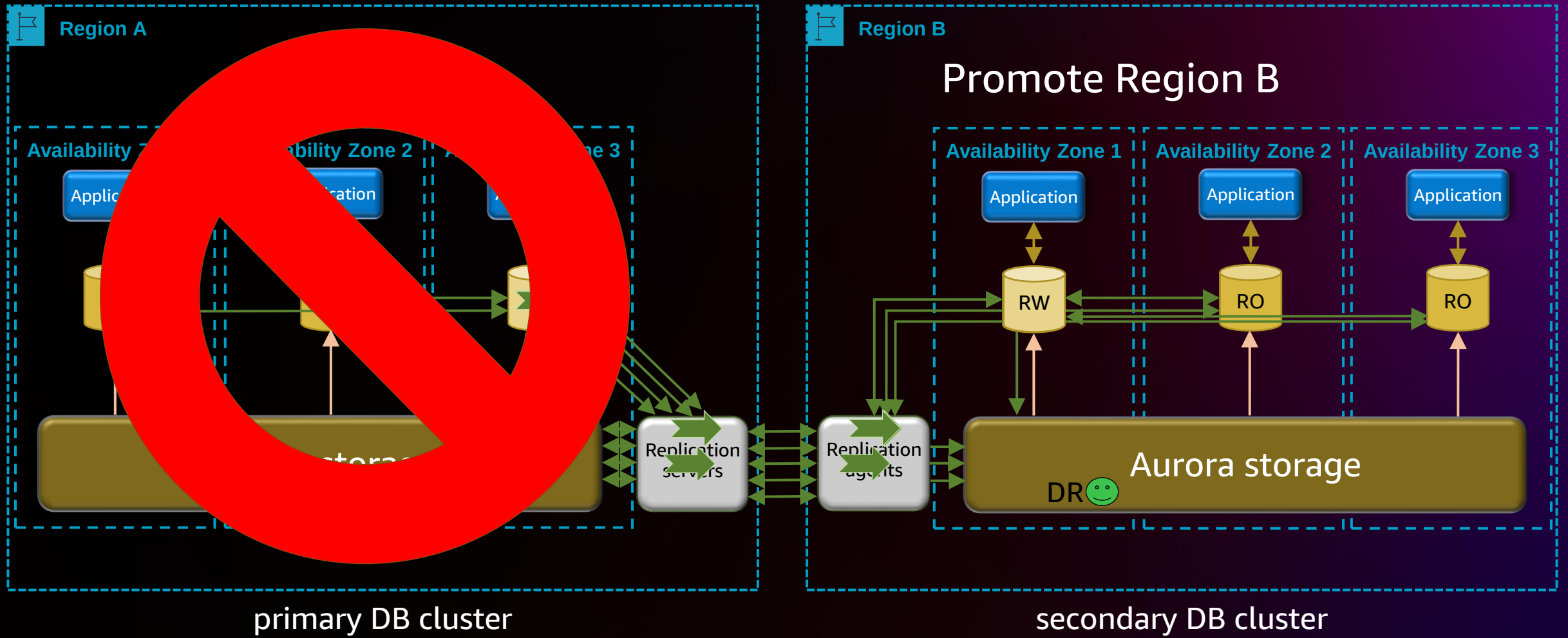
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Aurora storage and replicas



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Amazon Aurora Global Database



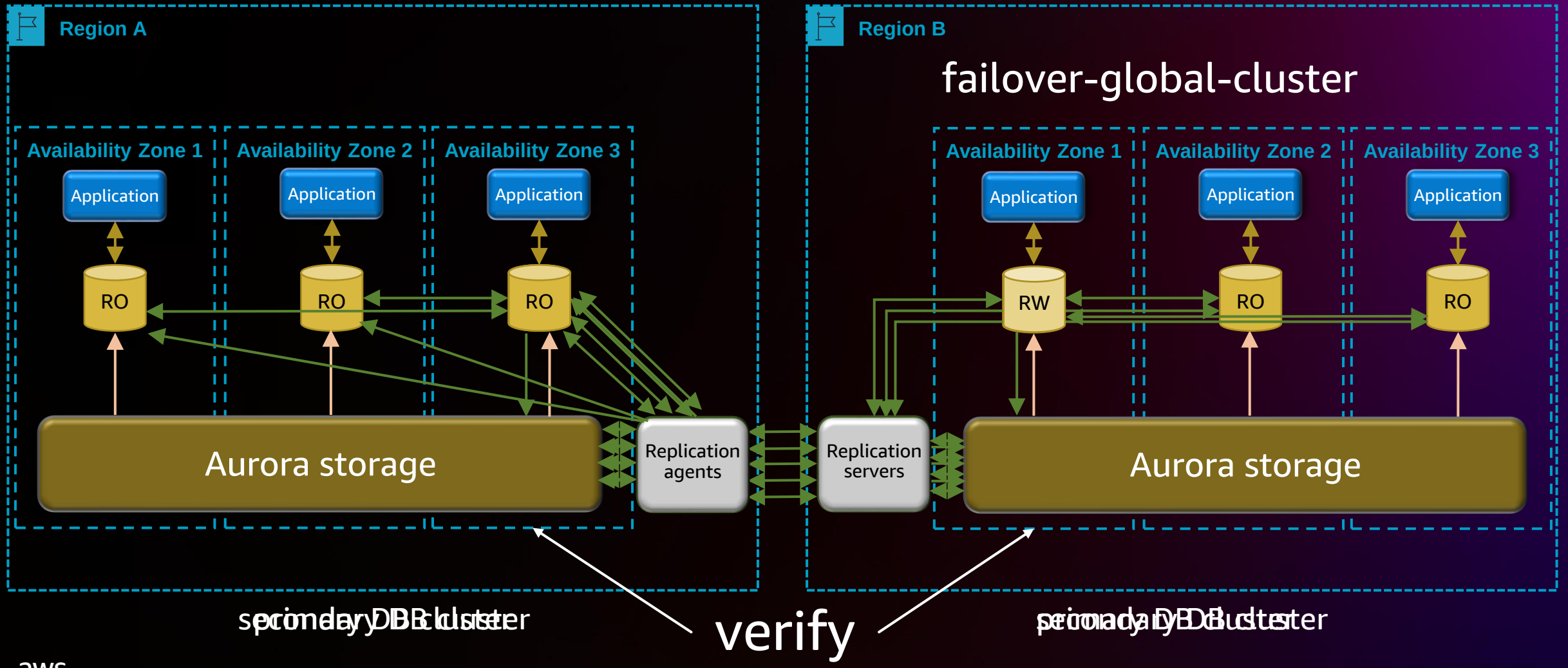
primary DB cluster

secondary DB cluster

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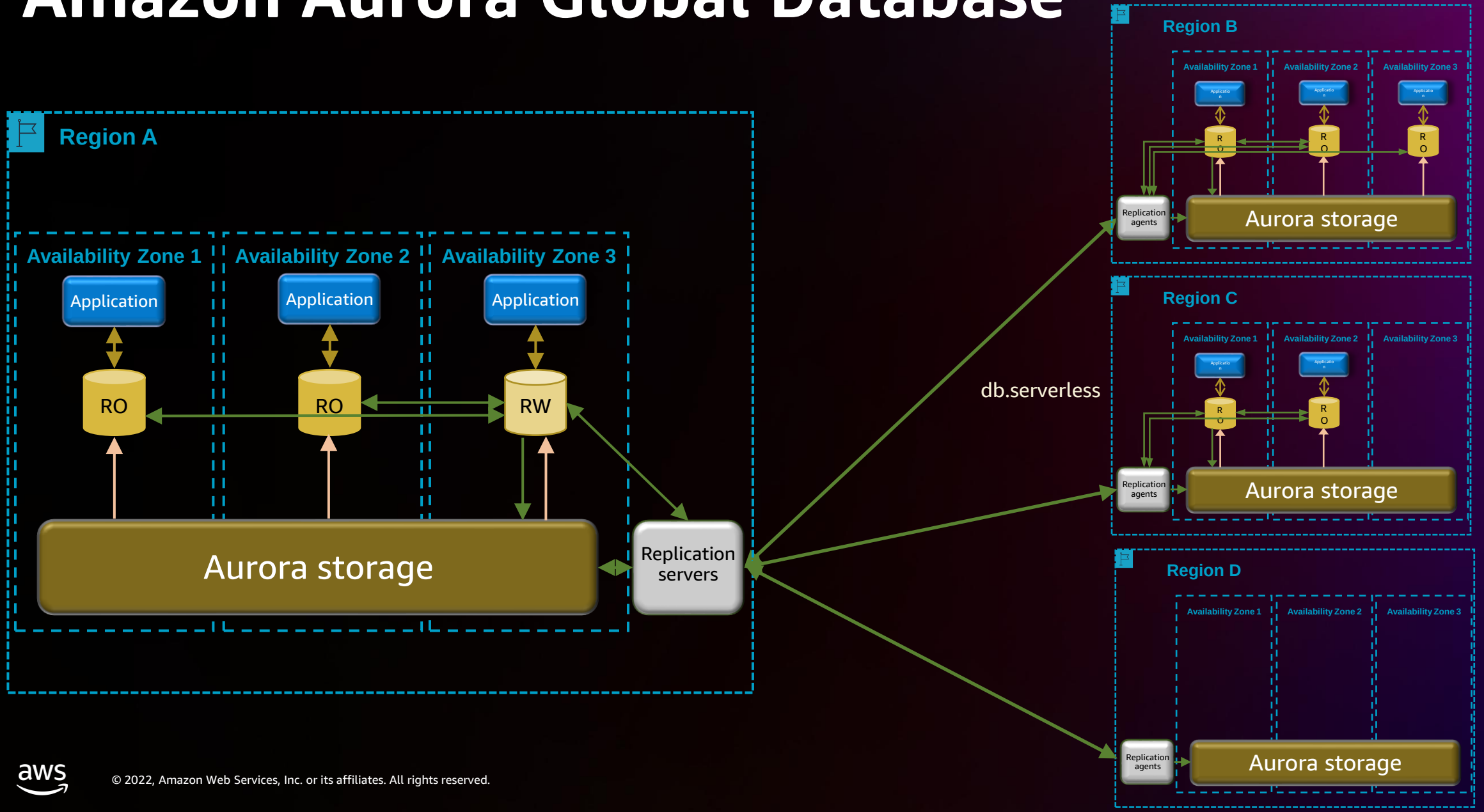
Amazon Aurora Global Database

Managed planned failover



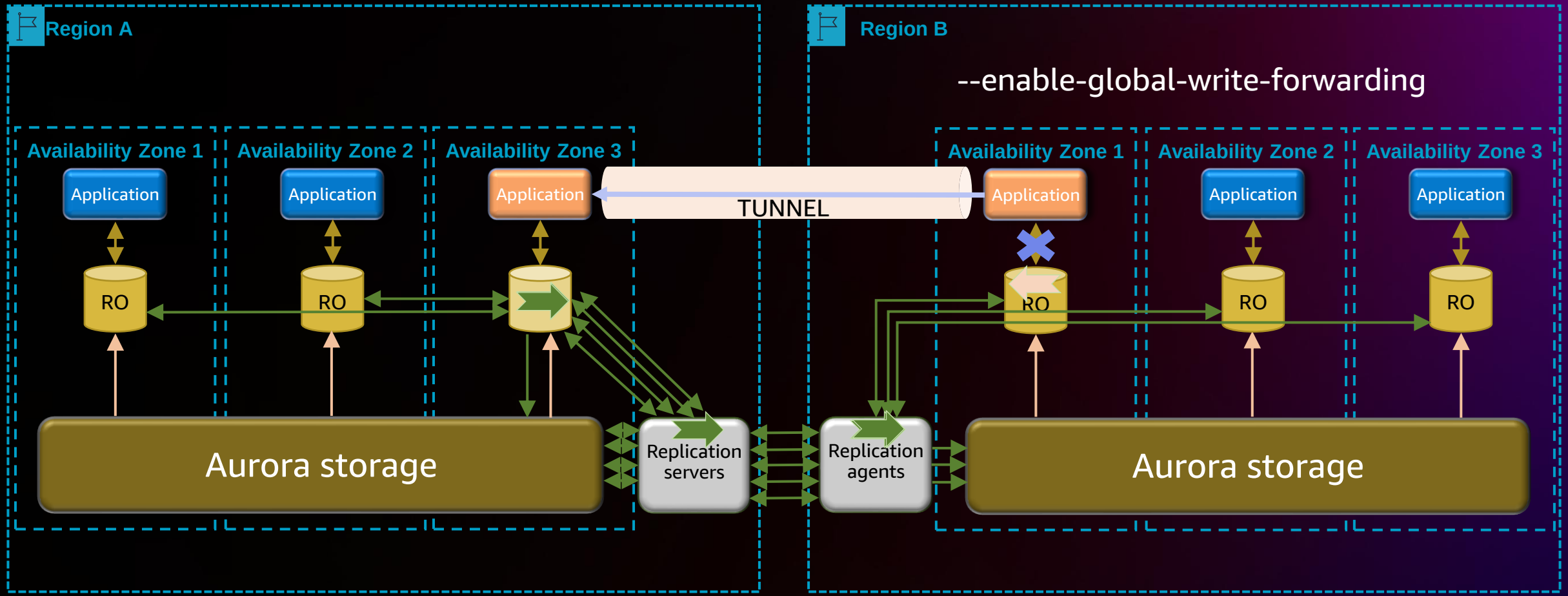
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Amazon Aurora Global Database



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Amazon Aurora Global Database
Write Forwarding

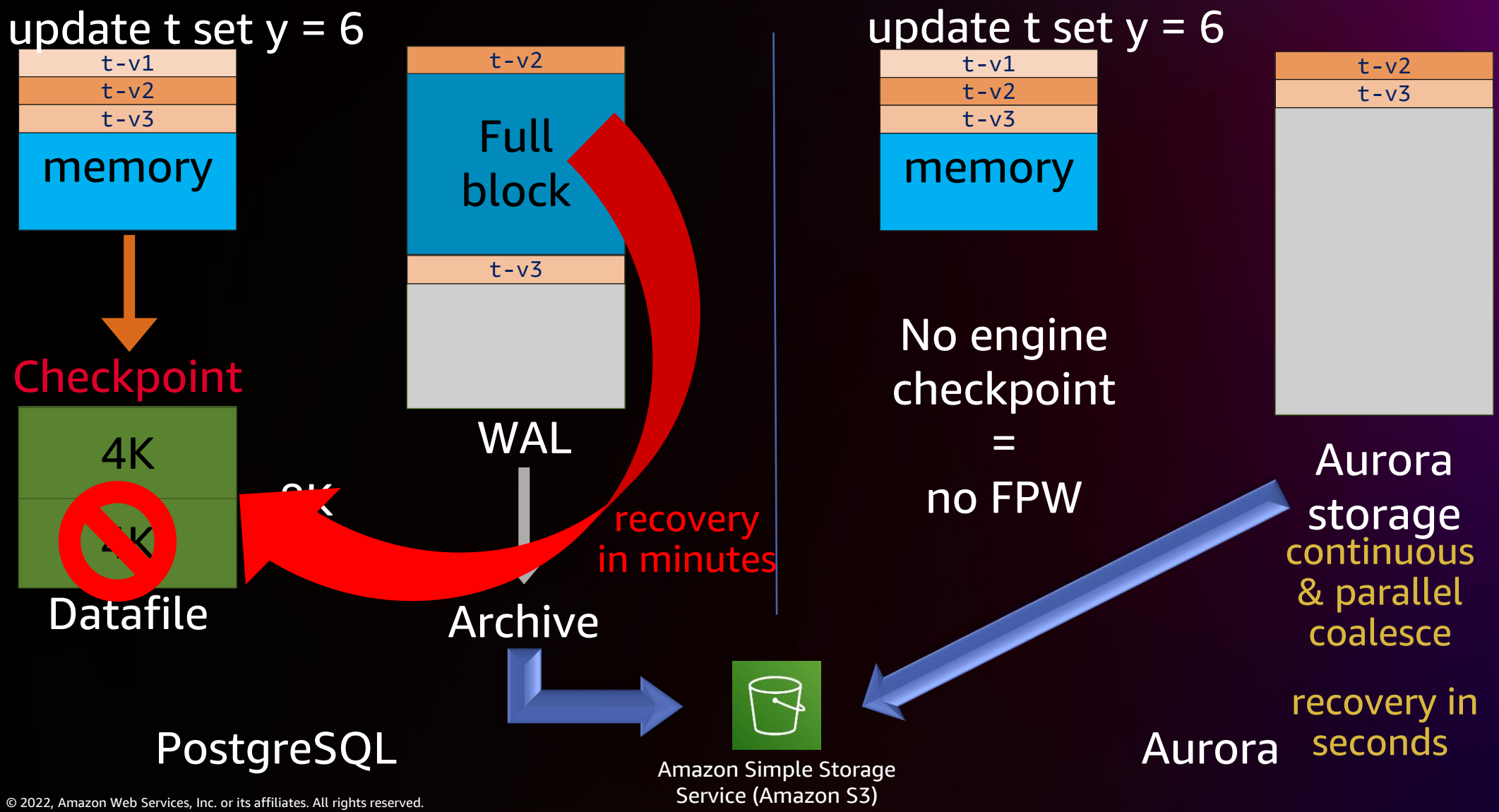


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Aurora Storage Internals

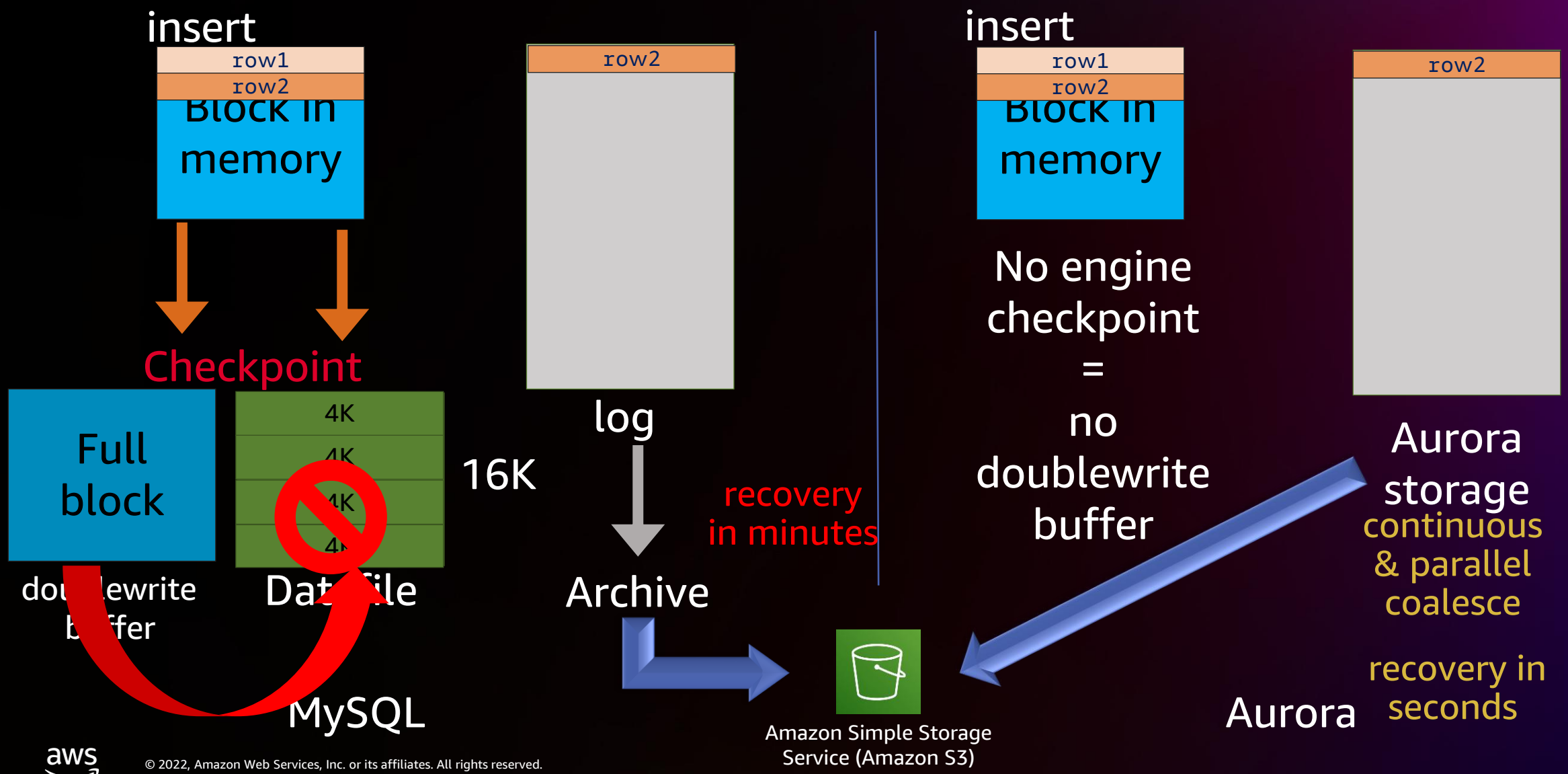
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Aurora PostgreSQL: Writing less



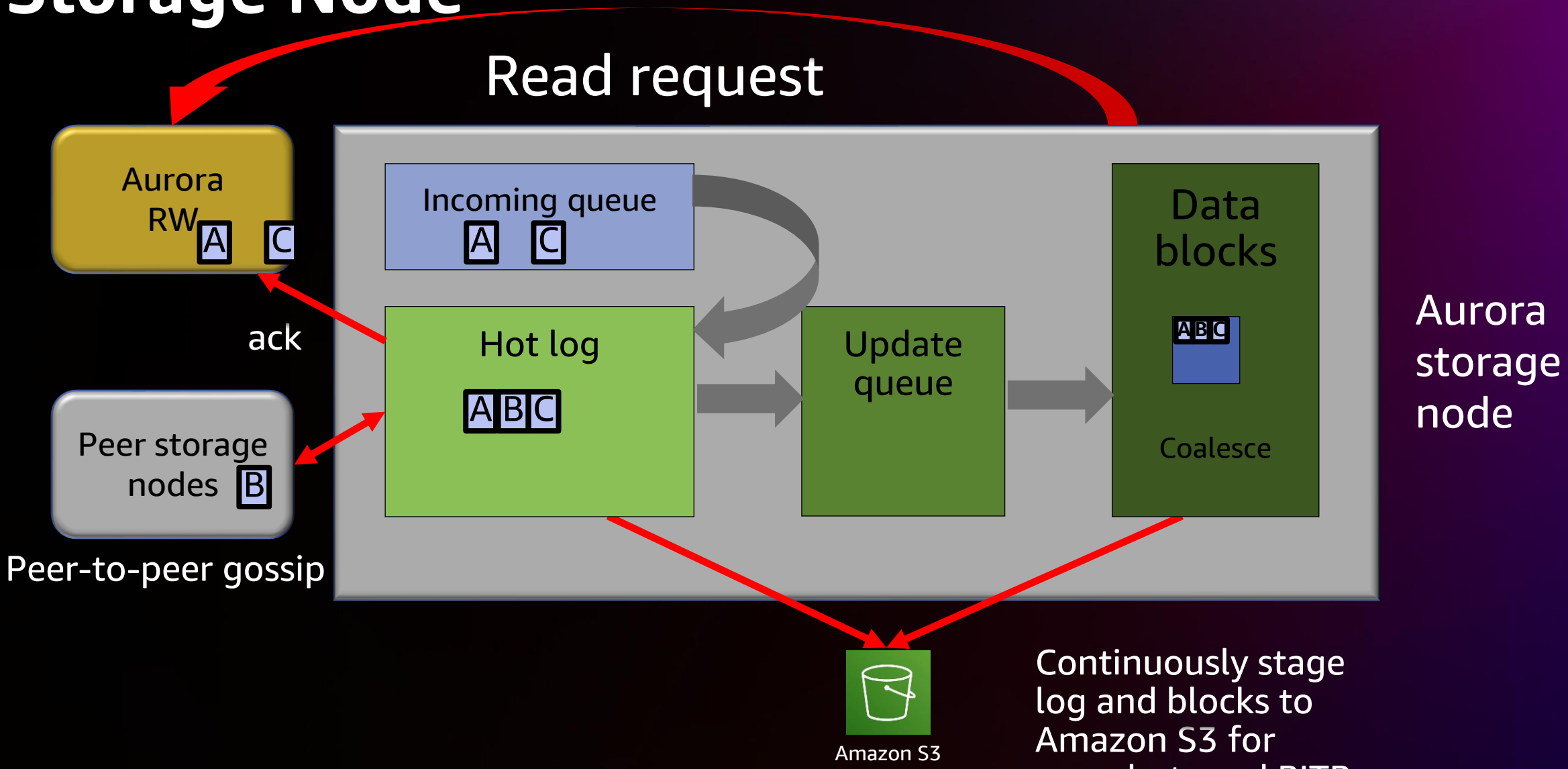
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Aurora MySQL: Writing less



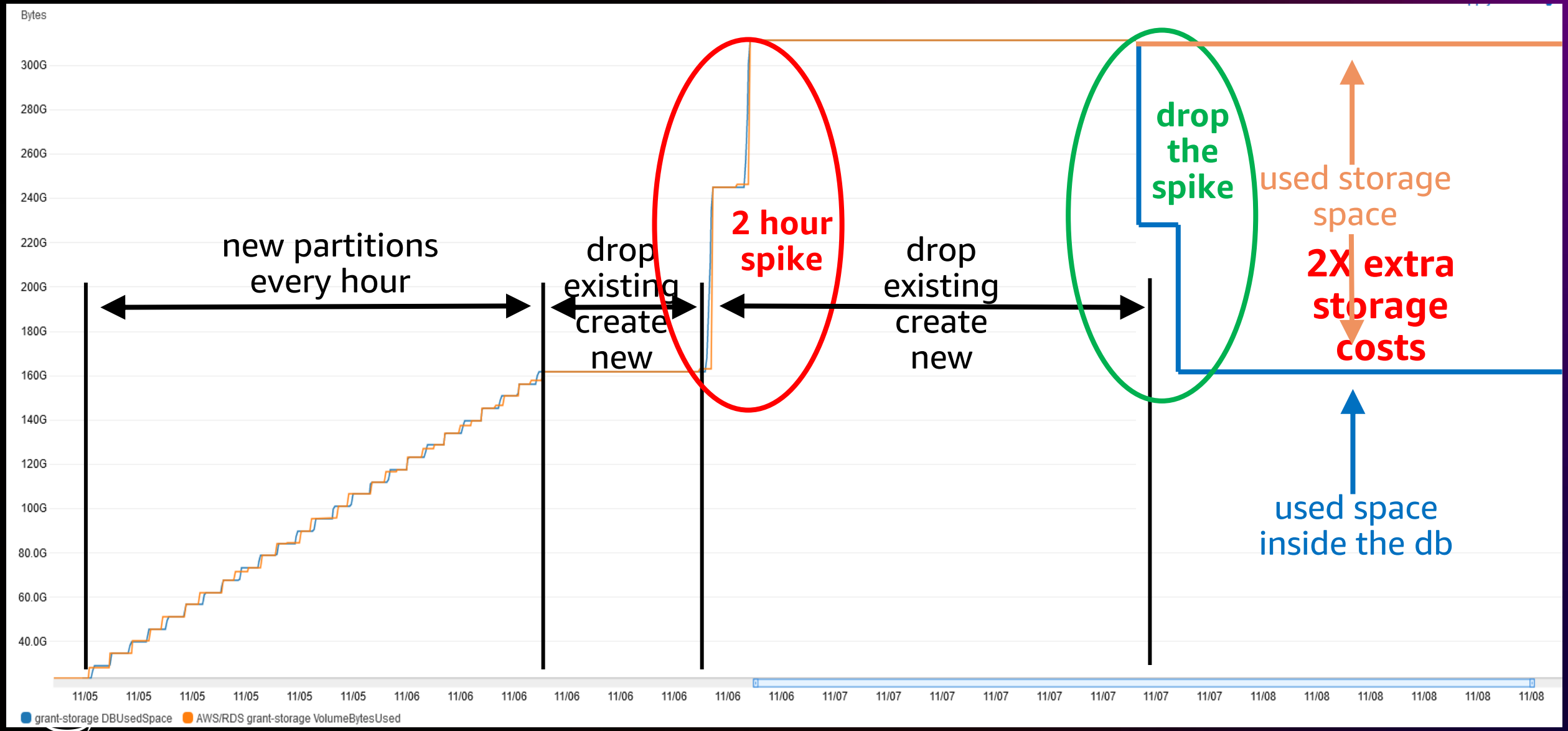
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Storage Node

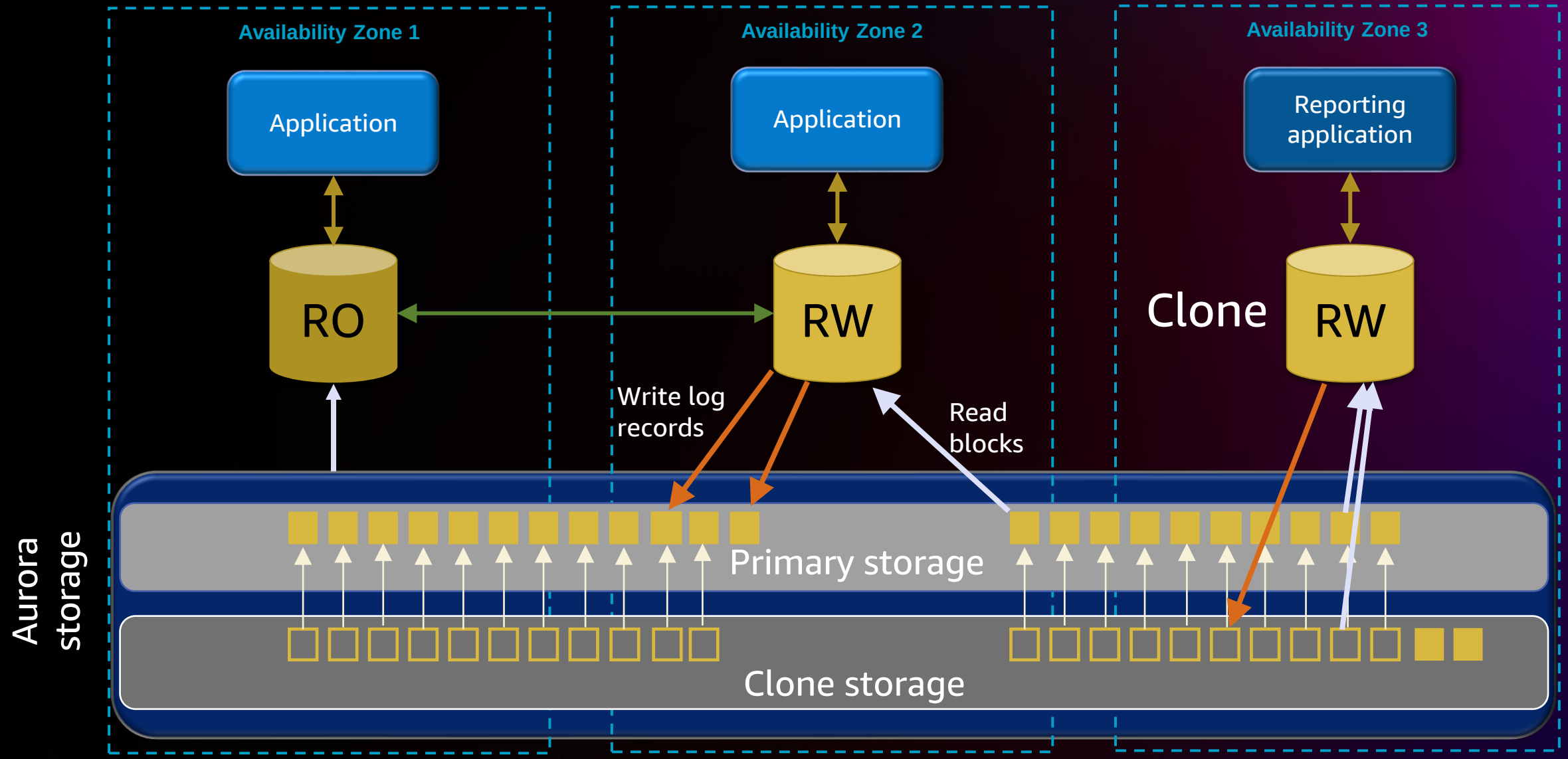


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Storage Management – Dynamic resizing

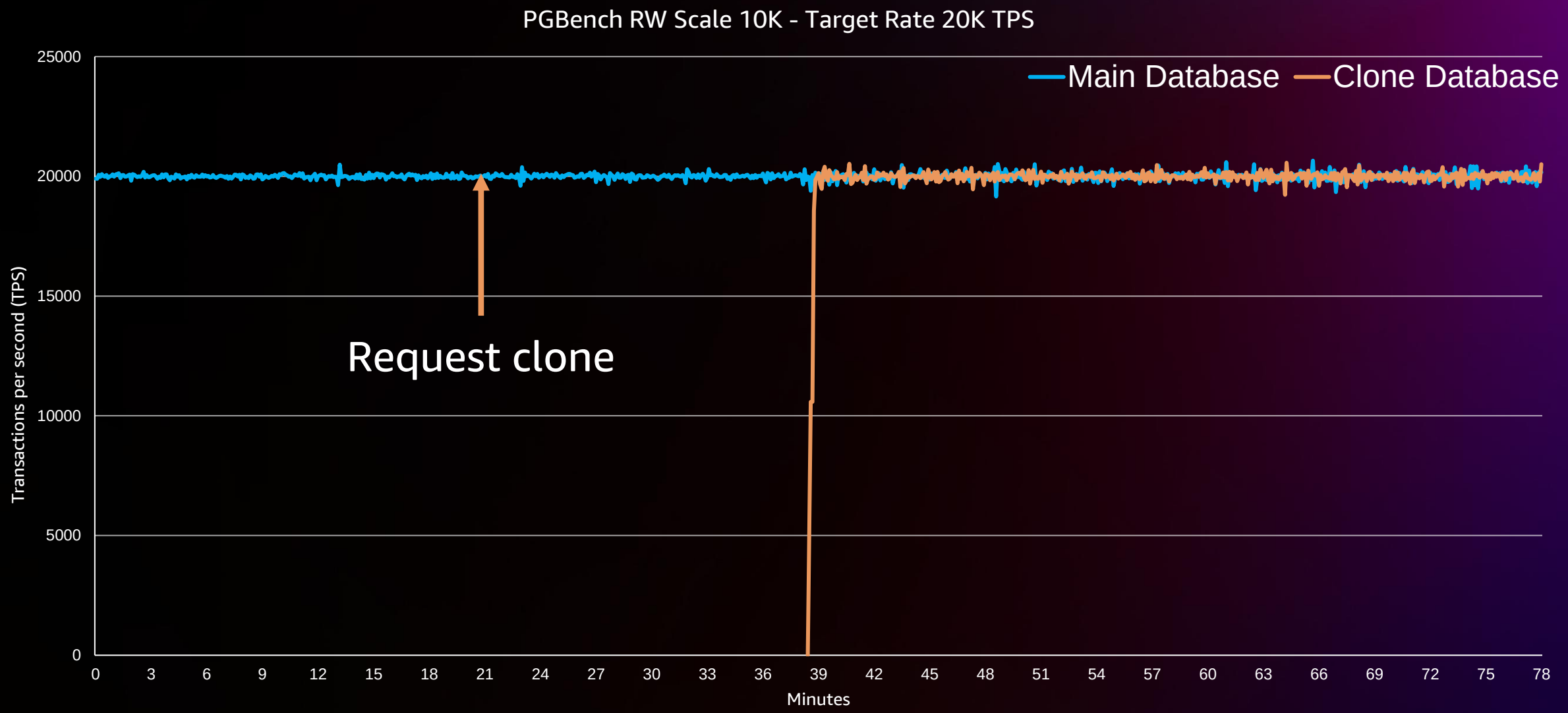


Fast clones



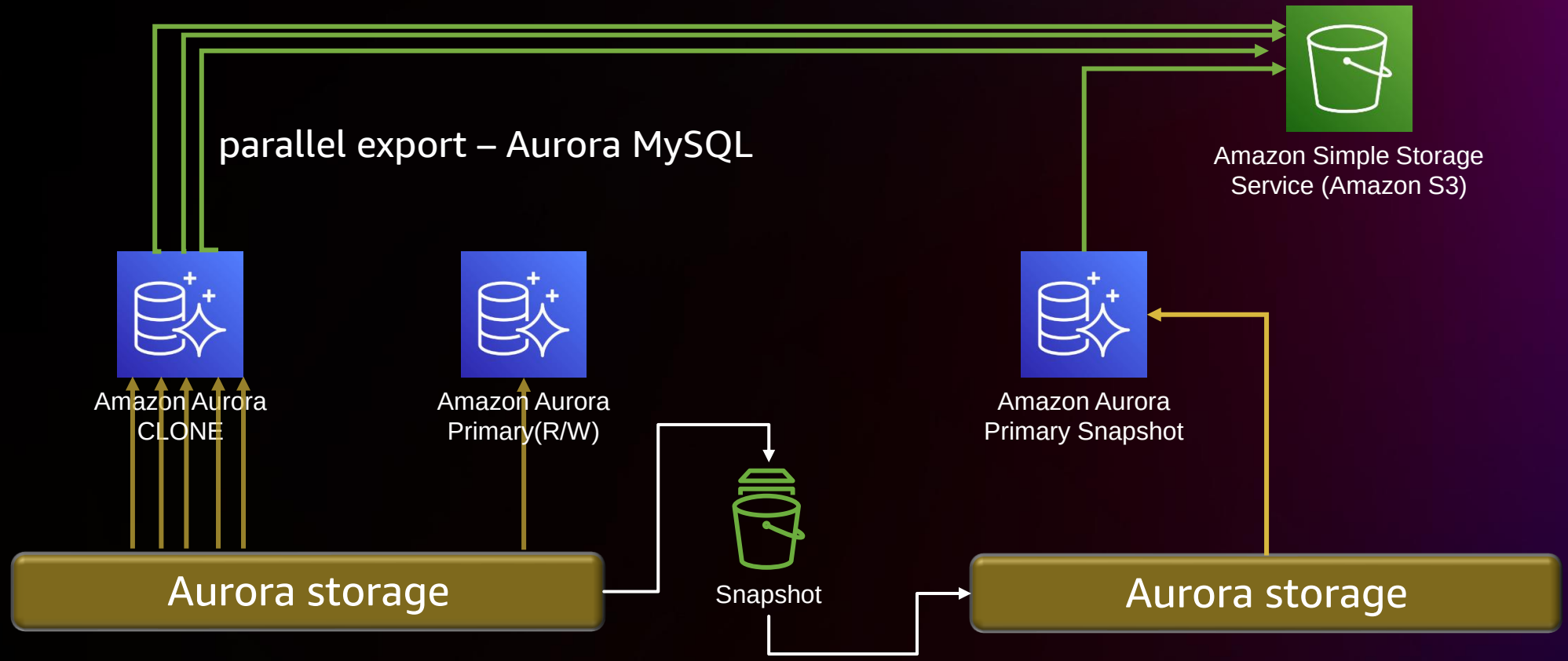
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Fast clone example



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Export to S3 via clone



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MySQL Updates

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Aurora MySQL Updates

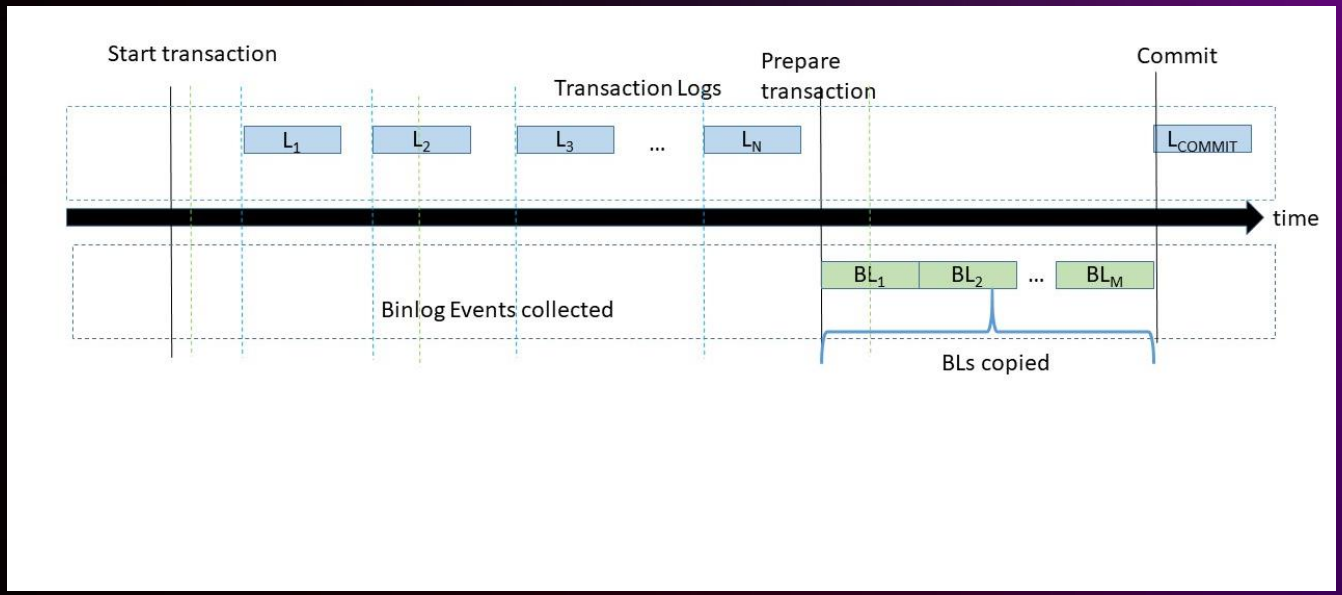
- Support for major version upgrade to MySQL 3 with MySQL 8.0 Compatibility
- IPv6 support
- Active Directory support
- Parallel Export to S3
- Enhanced binlog

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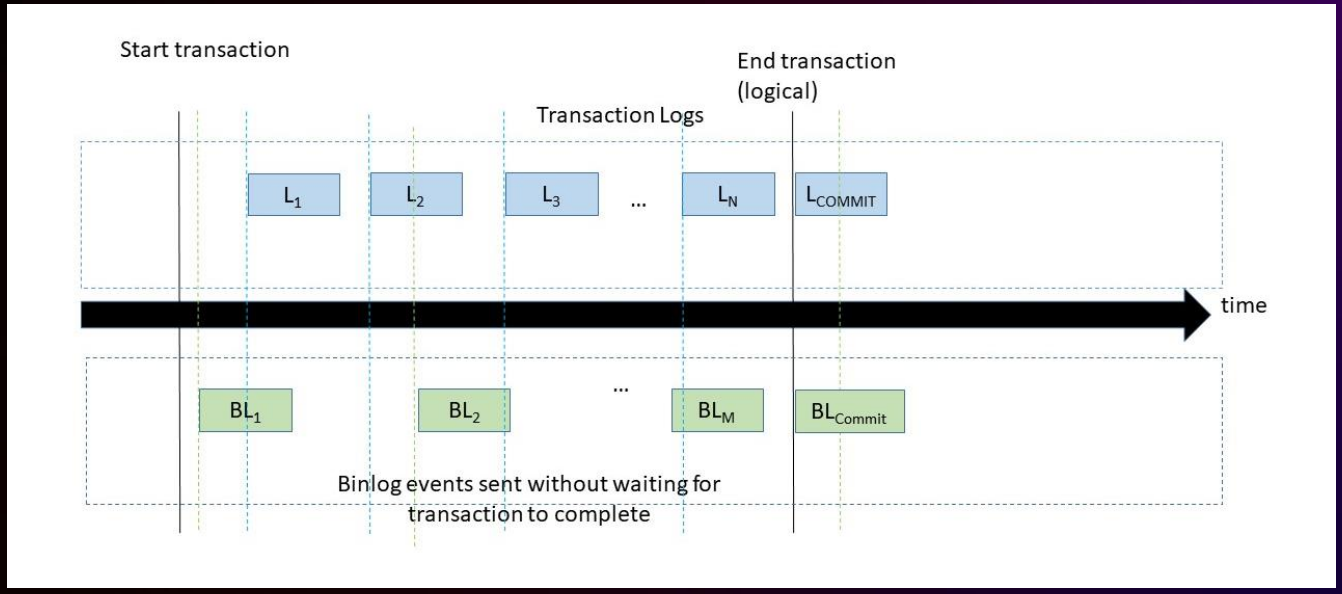
enhanced binlog

- **greatly reduced overhead for enabling binlog**
- **reduced cost to read binlogs for cdc**

Binlog



Enhanced Binlog



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PostgreSQL Updates

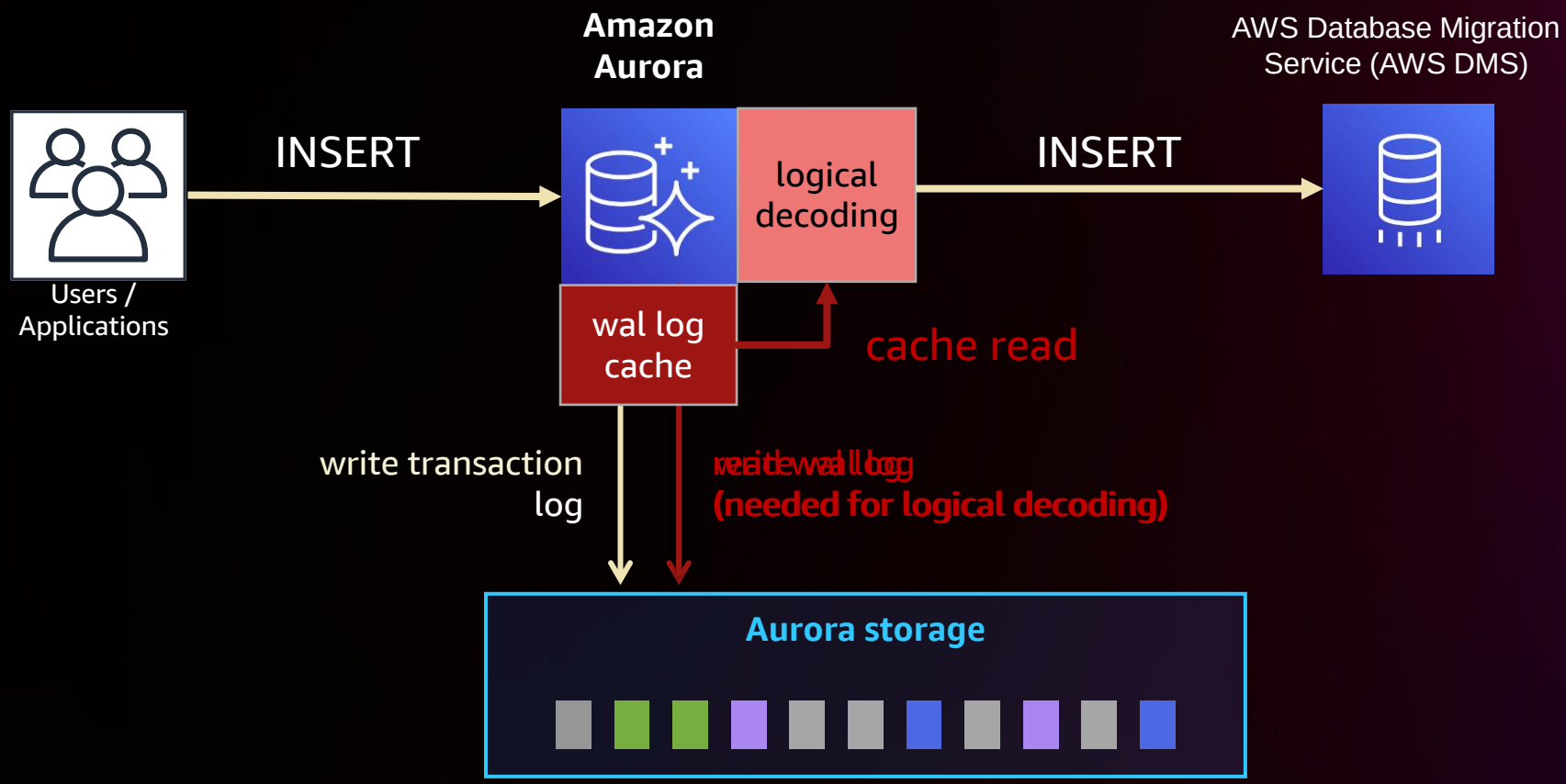
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Aurora PostgreSQL Updates

- Support for PostgreSQL14 – new extensions tds_fdw & lo
- Multi Major Version Upgrade
- SCRAM auth enforcement
- IPv6 support
- Improved consistency of minor version & patch upgrade times
- Improved availability of read replicas
- Logical Replication cache

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Aurora PostgreSQL – Logical replication cache



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PostgreSQL Trusted Language Extensions

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Trusted Language Extensions (TLE)

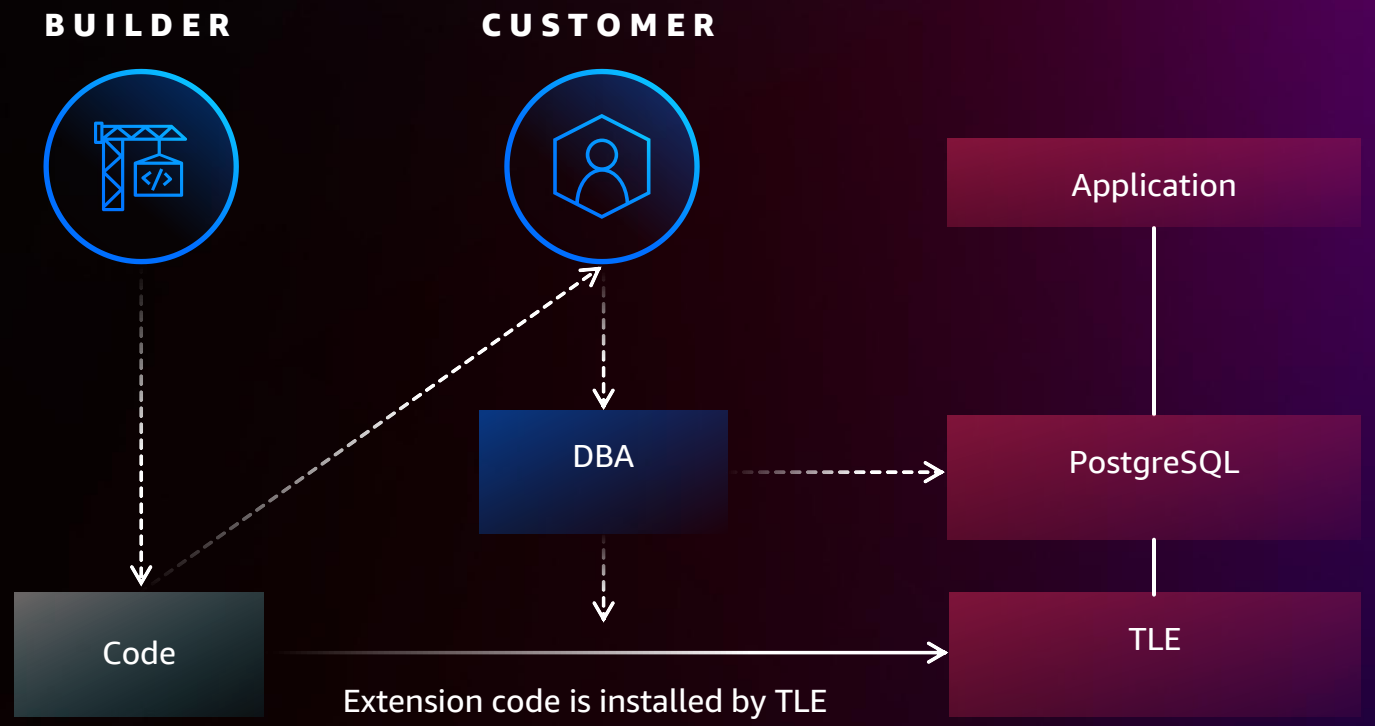
AMAZON AURORA WITH POSTGRESQL COMPATIBILITY, AMAZON RDS FOR POSTGRESQL

Available on Aurora and RDS PostgreSQL 14.5 and higher

Builders create new libraries using TLE framework

Customers choose TLE extensions for their apps

DBAs control who can install and manage TLE extensions



Open Source Project - Source code: https://github.com/aws/pg_tle - Apache 2.0 licensed

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Safely extend PostgreSQL capabilities

TLE PROVIDES SAFE OPERATION OF POSTGRESQL EXTENSIONS IN PRODUCTION

Improved Safety

Enforces use of PostgreSQL trusted languages

TLE API provides safe access to PostgreSQL internals

High Performance

Supports languages that have C-like performance

Removes need for C expertise to create a safe extension

More Flexibility

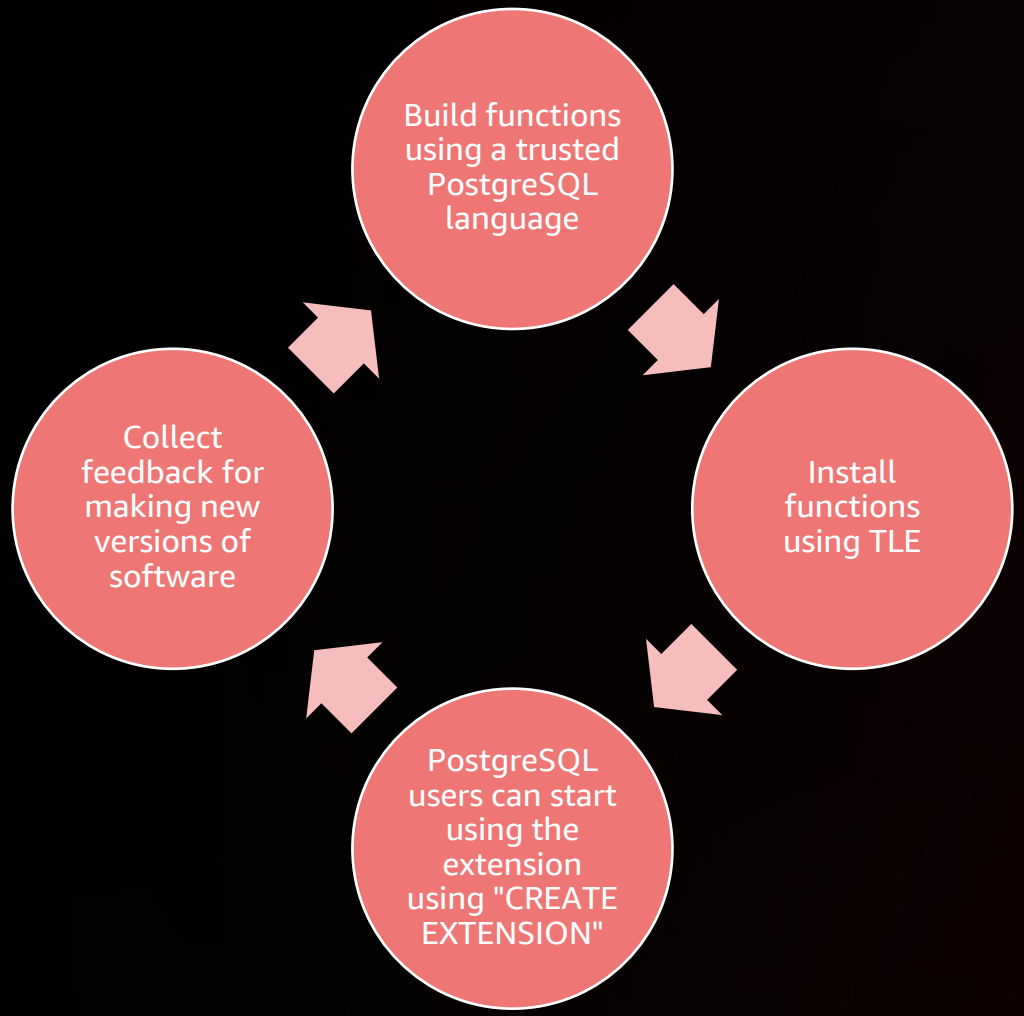
Build and use extensions on your timeline

Reduces DBA certification burden

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How it works



Any "trusted" PostgreSQL procedural language can be used in a TLE

- JavaScript
- Perl
- Tcl
- PL/pgSQL
- Coming soon: Rust

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Manageability – Aurora Serverless

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Amazon Aurora Serverless



On-demand and automatically scaling configuration

Automatically scales capacity based on application needs

Simple **pay-per-use** pricing per second

Scales instantly to support demanding applications

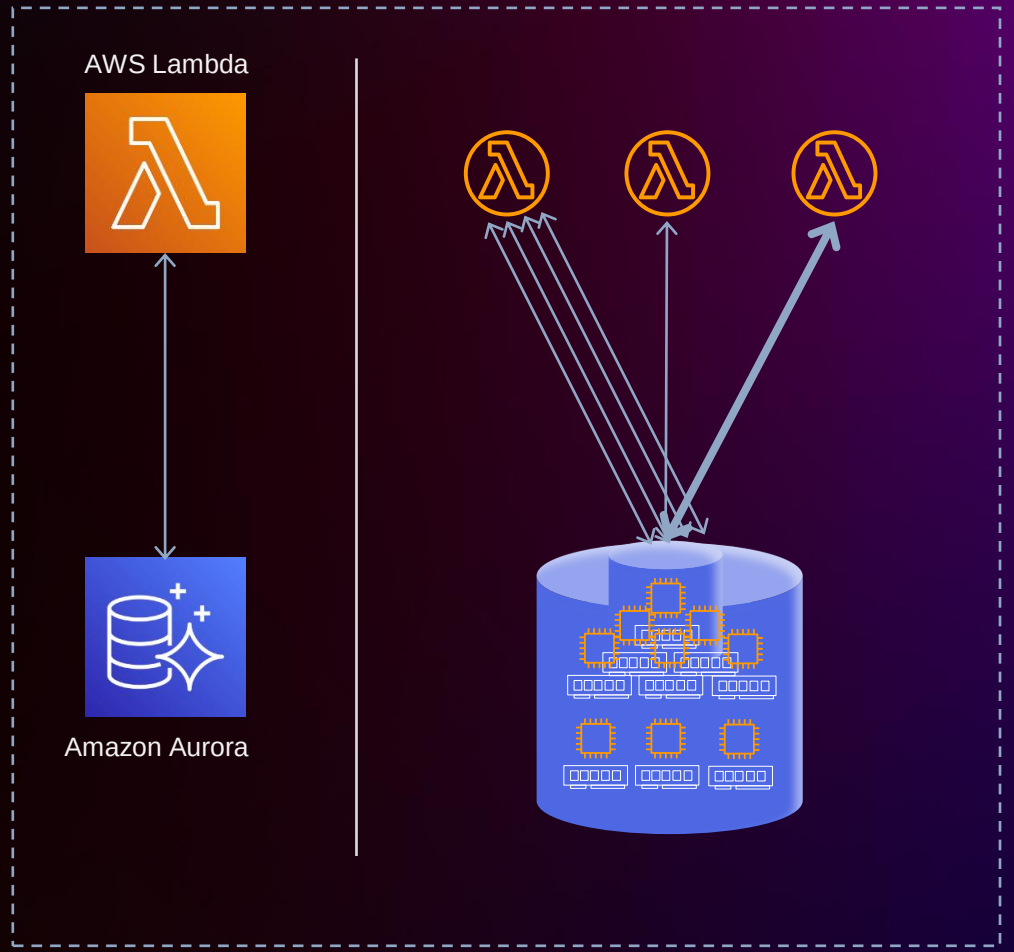
Worry-free database capacity management

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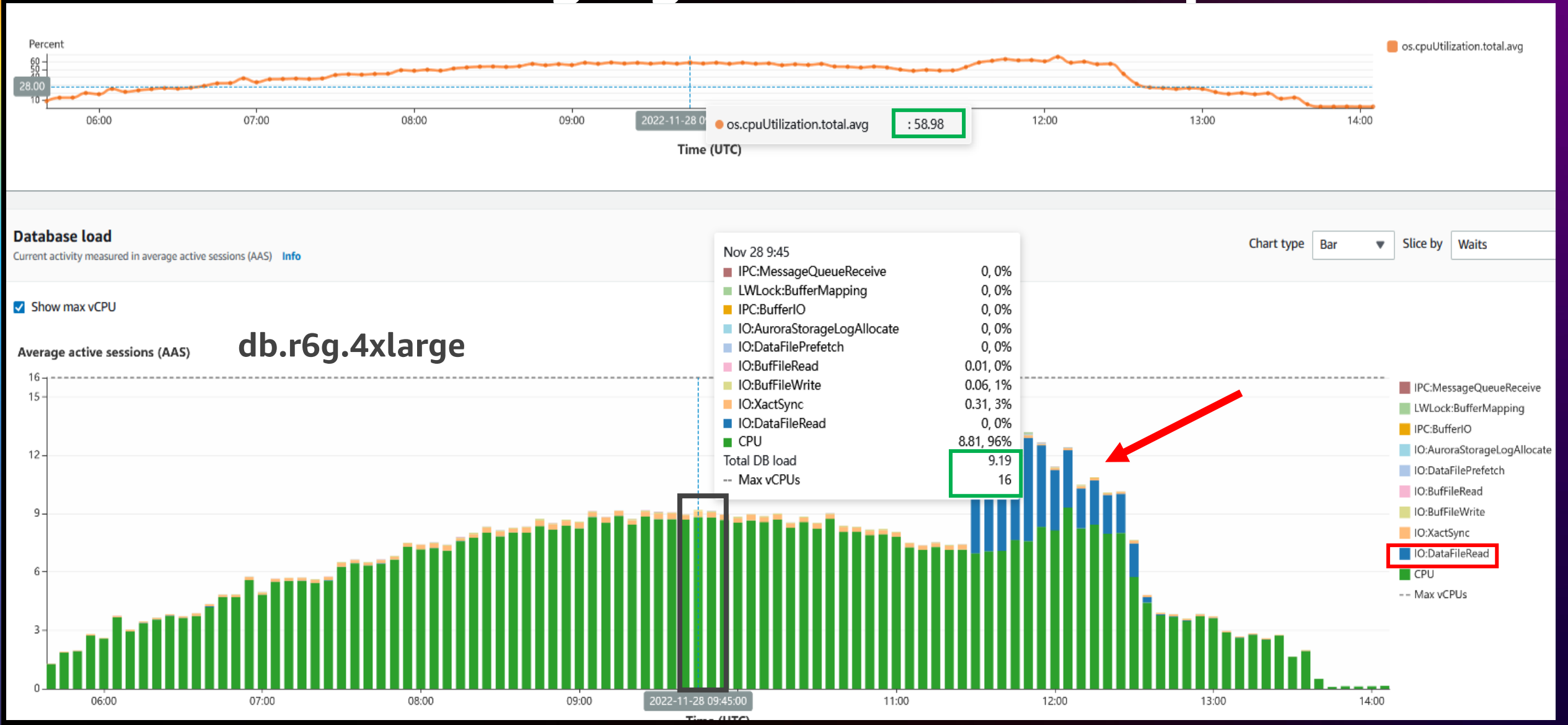
Instant, in-place scaling

- Scales in place in under a second by adding more CPU and memory resources and billed by the second
- No impact due to scaling even when running hundreds of thousands of transactions



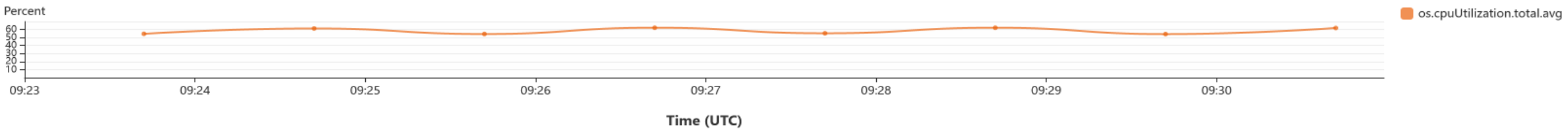
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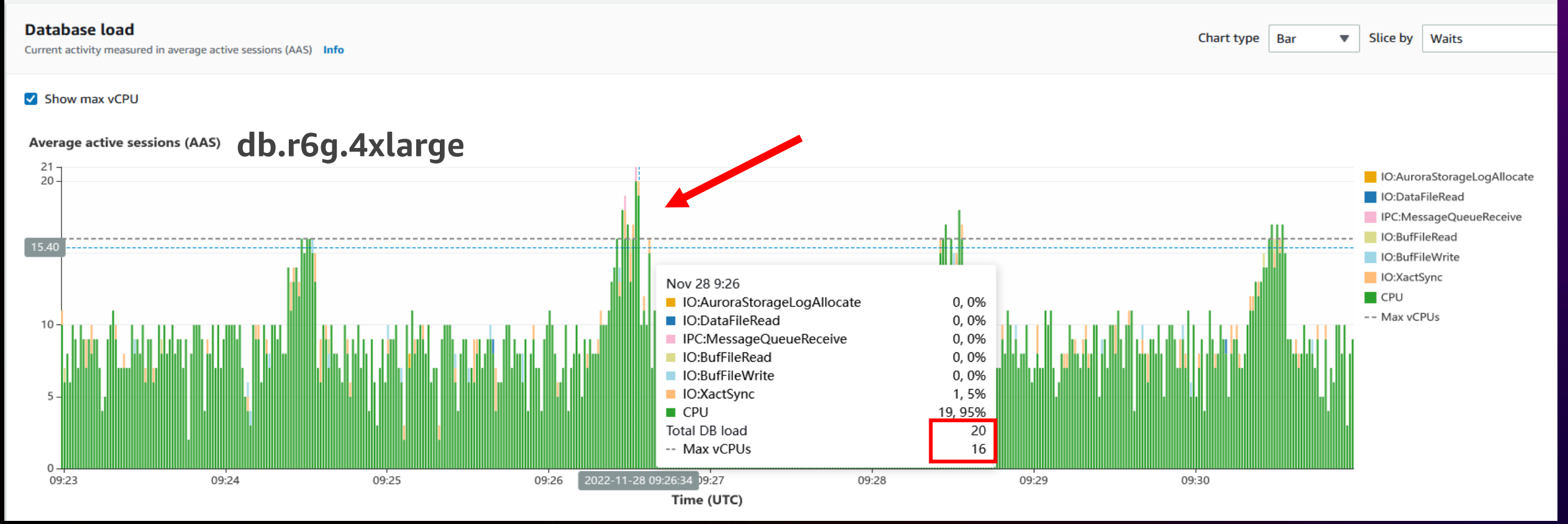
Aurora – challenging workload example



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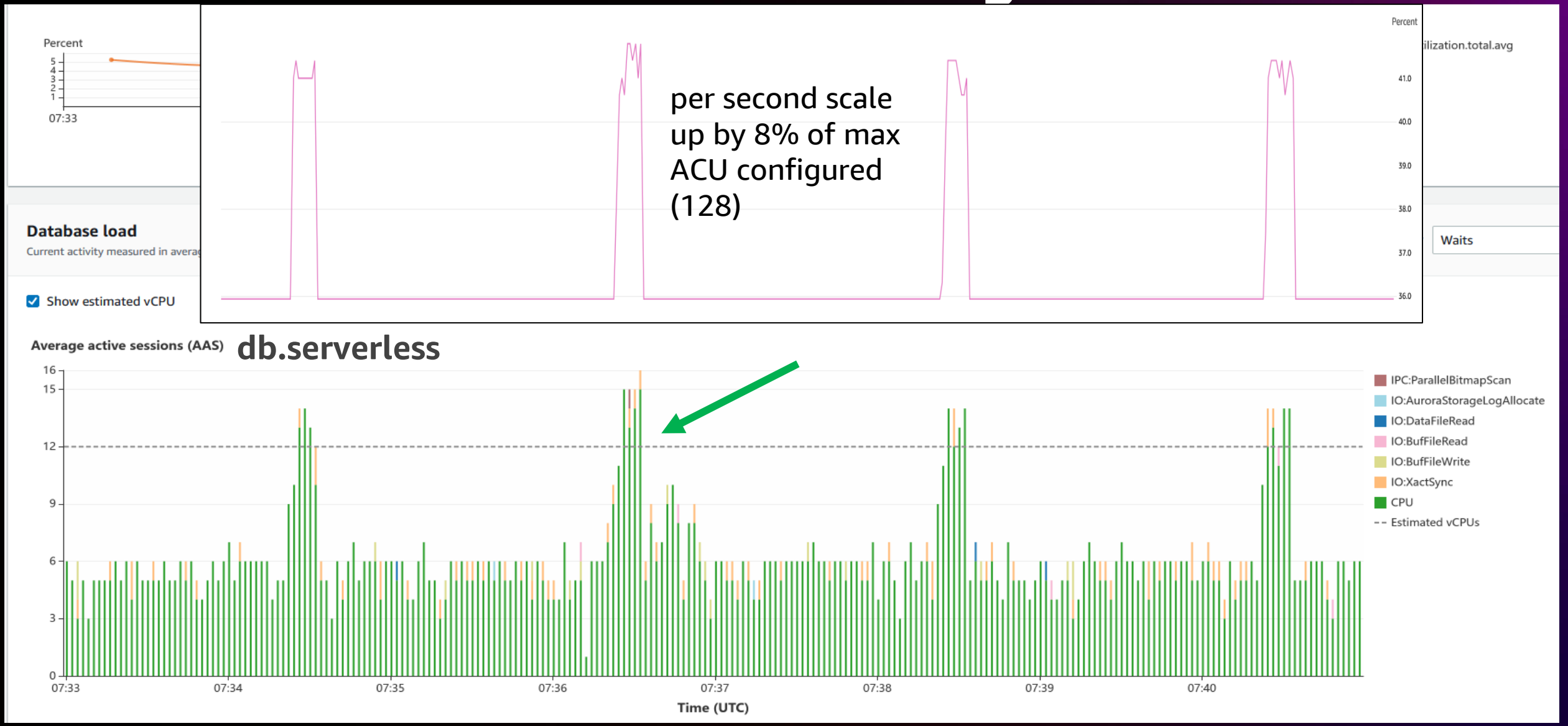
Aurora - challenging workload example





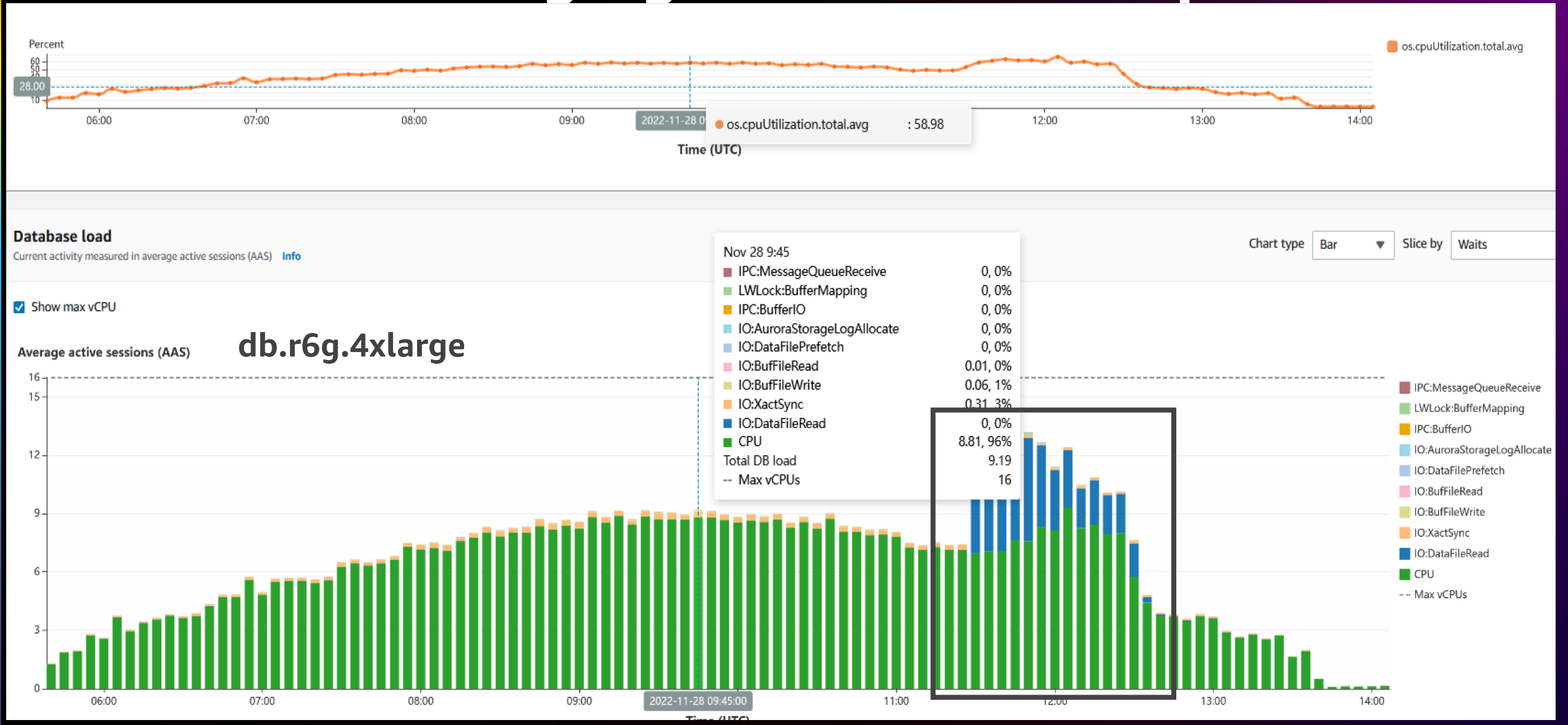
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Aurora Serverless – CPU scaling



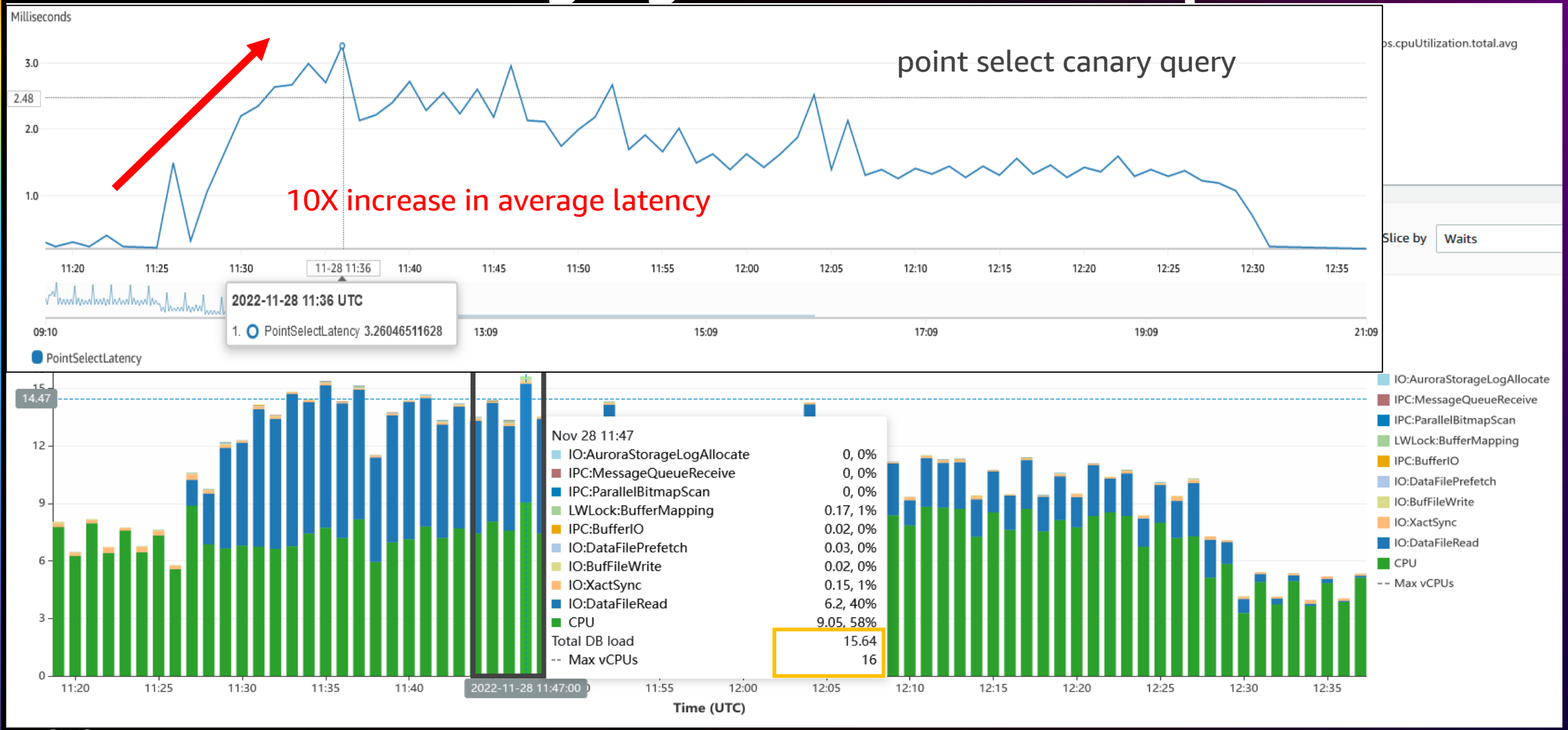
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Aurora - challenging workload example



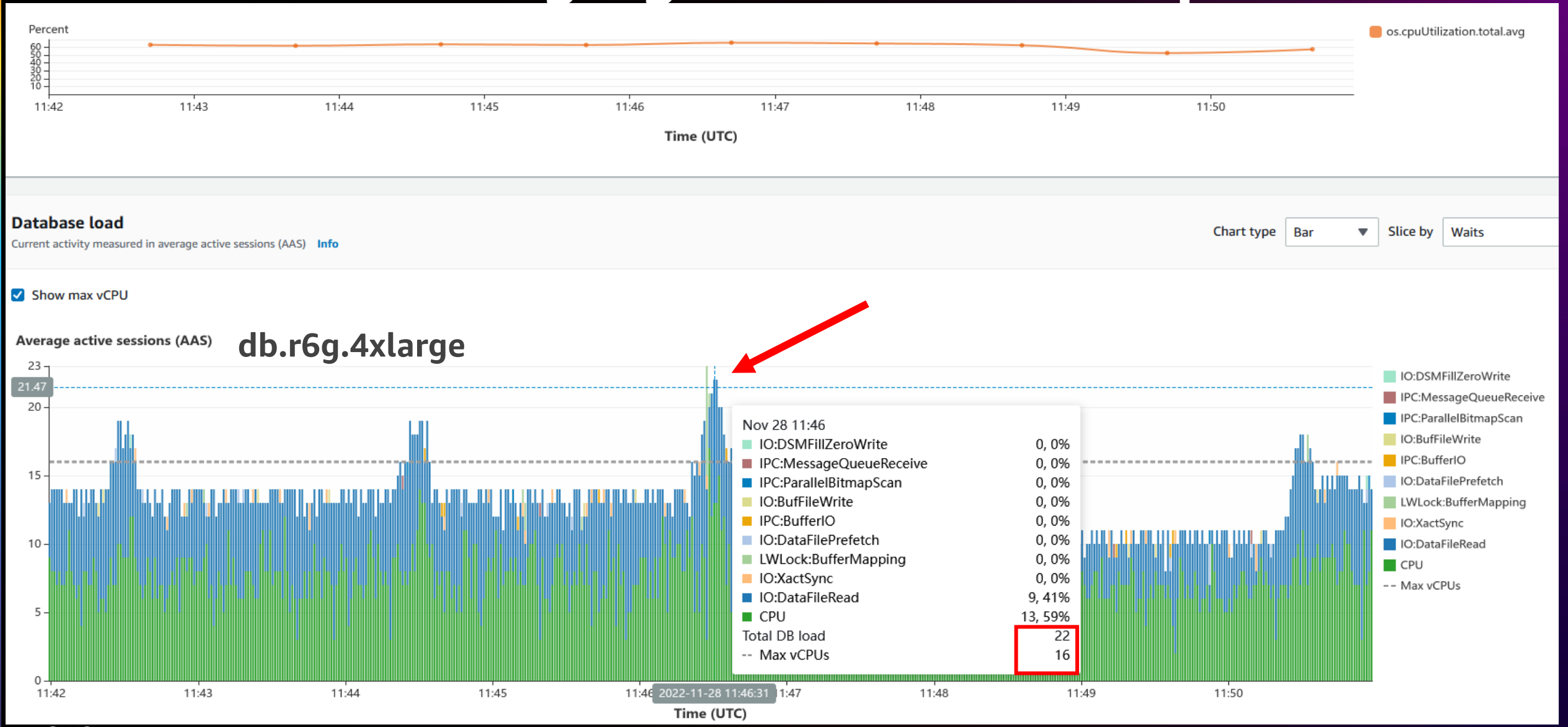
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Aurora - challenging workload example



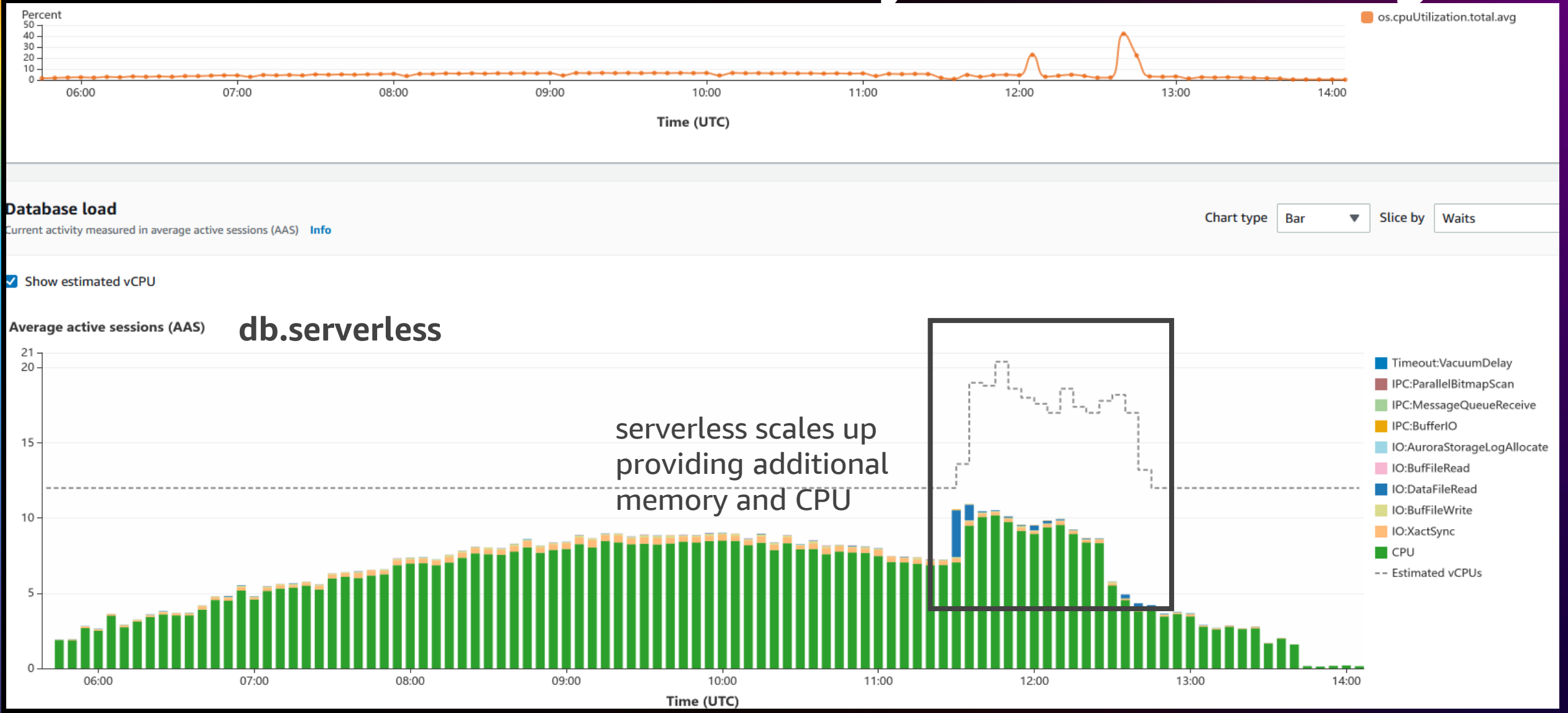
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Aurora - challenging workload example



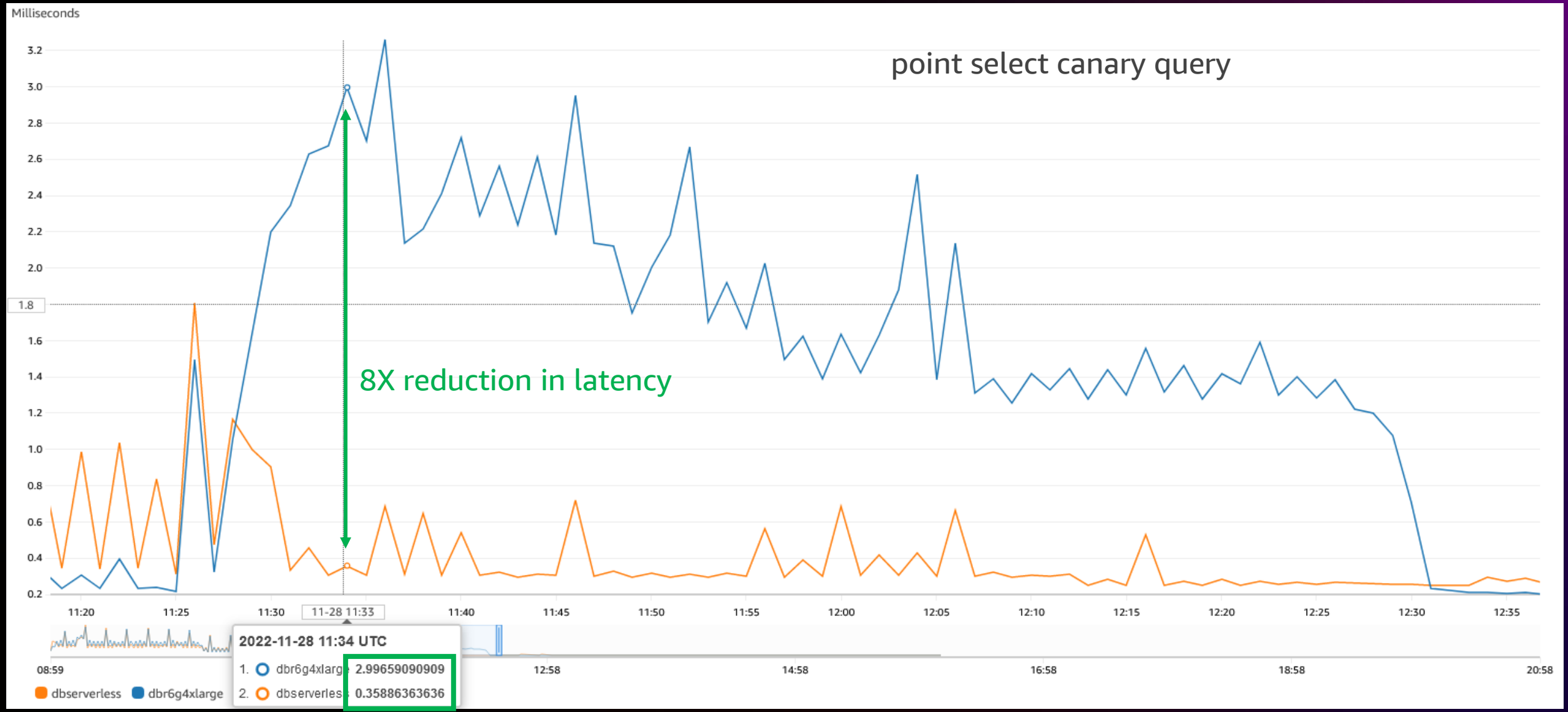
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Aurora Serverless – memory and CPU scaling



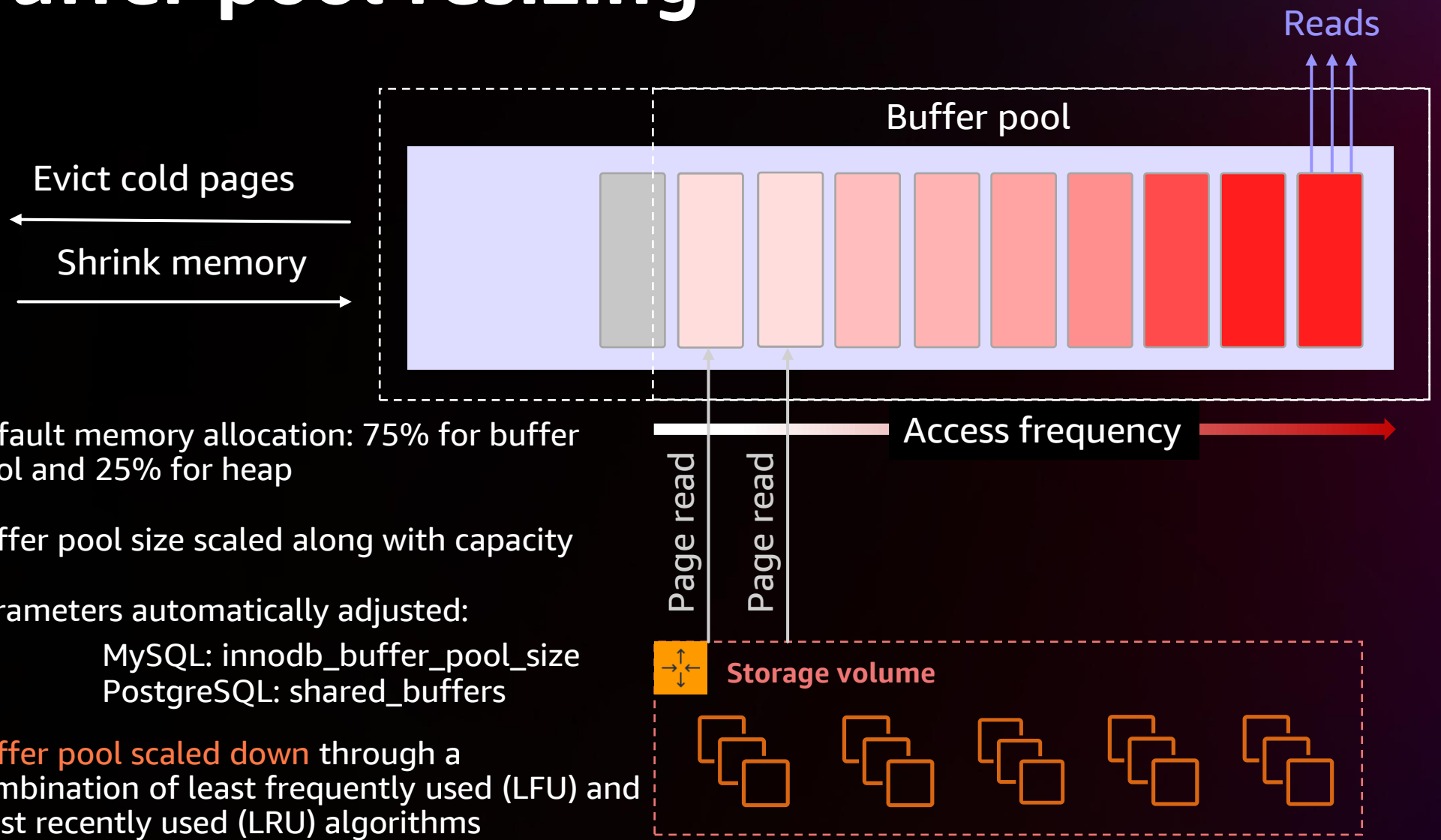
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Aurora Serverless – memory scaling



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Buffer pool resizing



Default memory allocation: 75% for buffer pool and 25% for heap

Buffer pool size scaled along with capacity

Parameters automatically adjusted:

MySQL: innodb_buffer_pool_size
PostgreSQL: shared_buffers

Buffer pool scaled down through a combination of least frequently used (LFU) and least recently used (LRU) algorithms

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Manageability – Amazon DevOps Guru for RDS

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Amazon DevOps Guru for RDS

A new Machine Learning (ML)-powered capability for Amazon RDS that automatically detects and diagnoses database performance and operational issues, enabling you to resolve bottlenecks in minutes



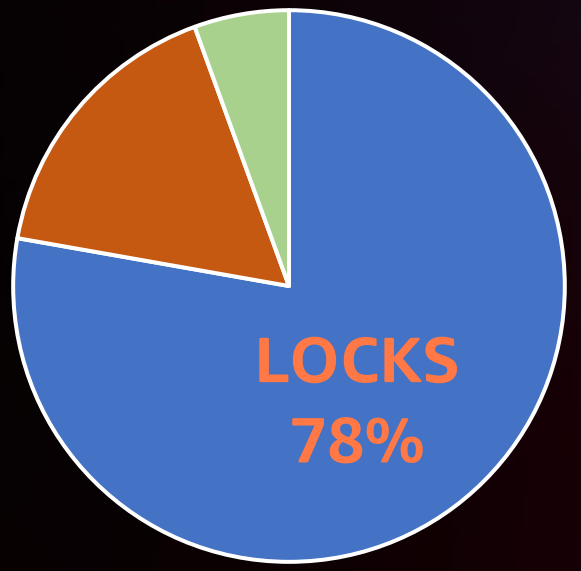


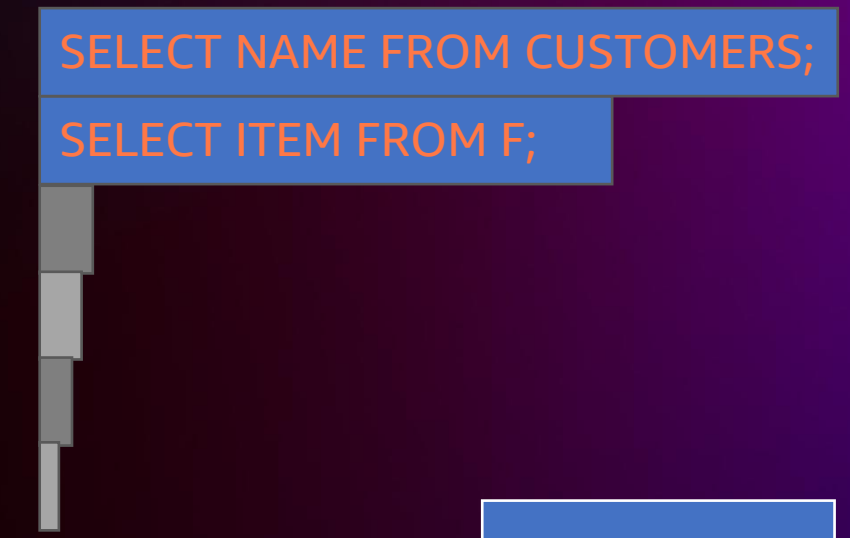
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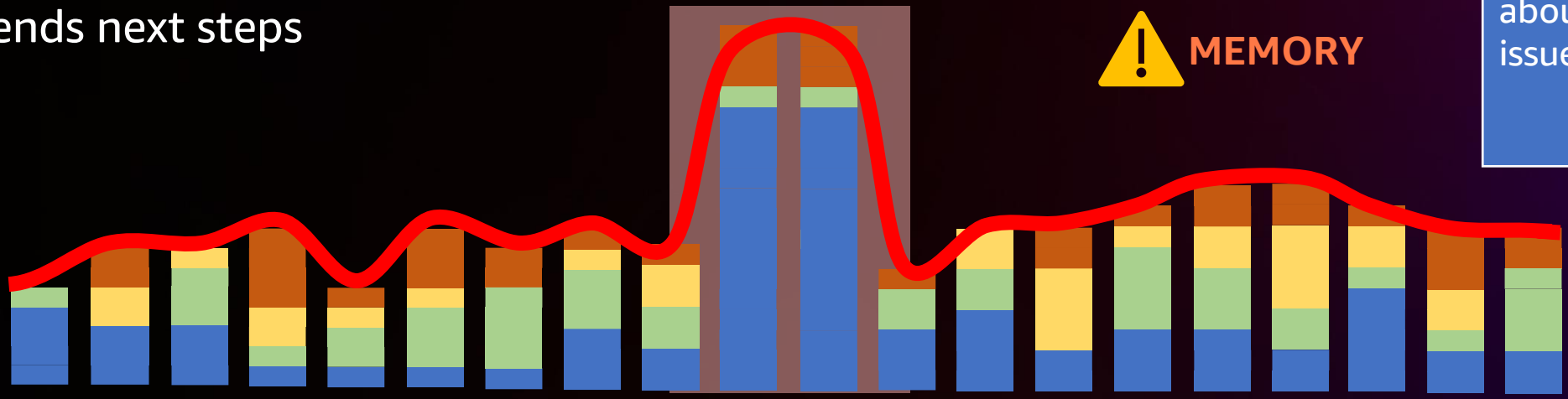
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DevOps Guru for RDS

- **Finds DB performance anomalies**
- **Analyzes the anomaly**
- **Highlights:**
  - Prevalent wait events
  - Prevalent SQL statements
  - Other anomalous metrics
- Recommends next steps



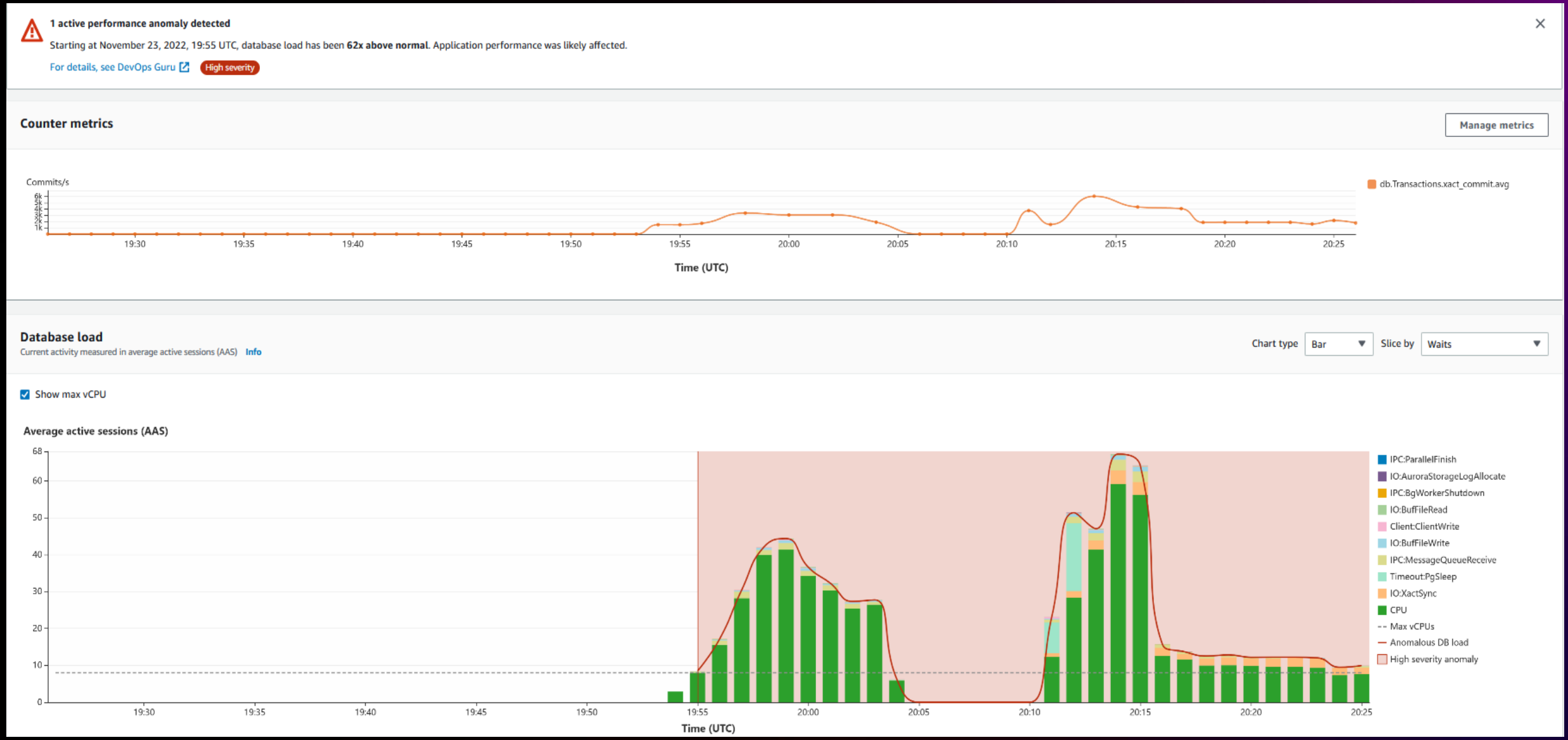




What to do about locking issues…

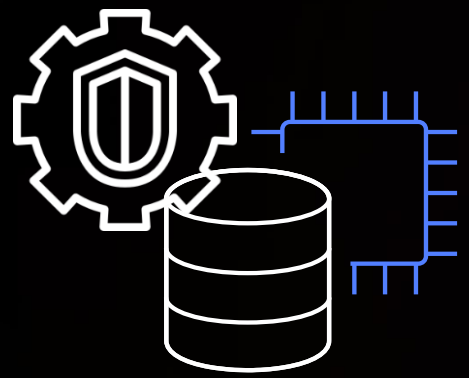
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DevOps Guru for RDS



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Introducing Amazon GuardDuty RDS Protection



Protect your data stored in Amazon RDS databases (starting with Amazon Aurora) by identifying suspicious login attempts to mitigate threats before they escalate

Continuously monitor all Aurora databases across your organization with a single click

Use machine learning to reduce noise and avoid alert fatigue

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Amazon GuardDuty RDS Protection:
How does it work?



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Amazon GuardDuty RDS Protection: Anomaly detection deep dive

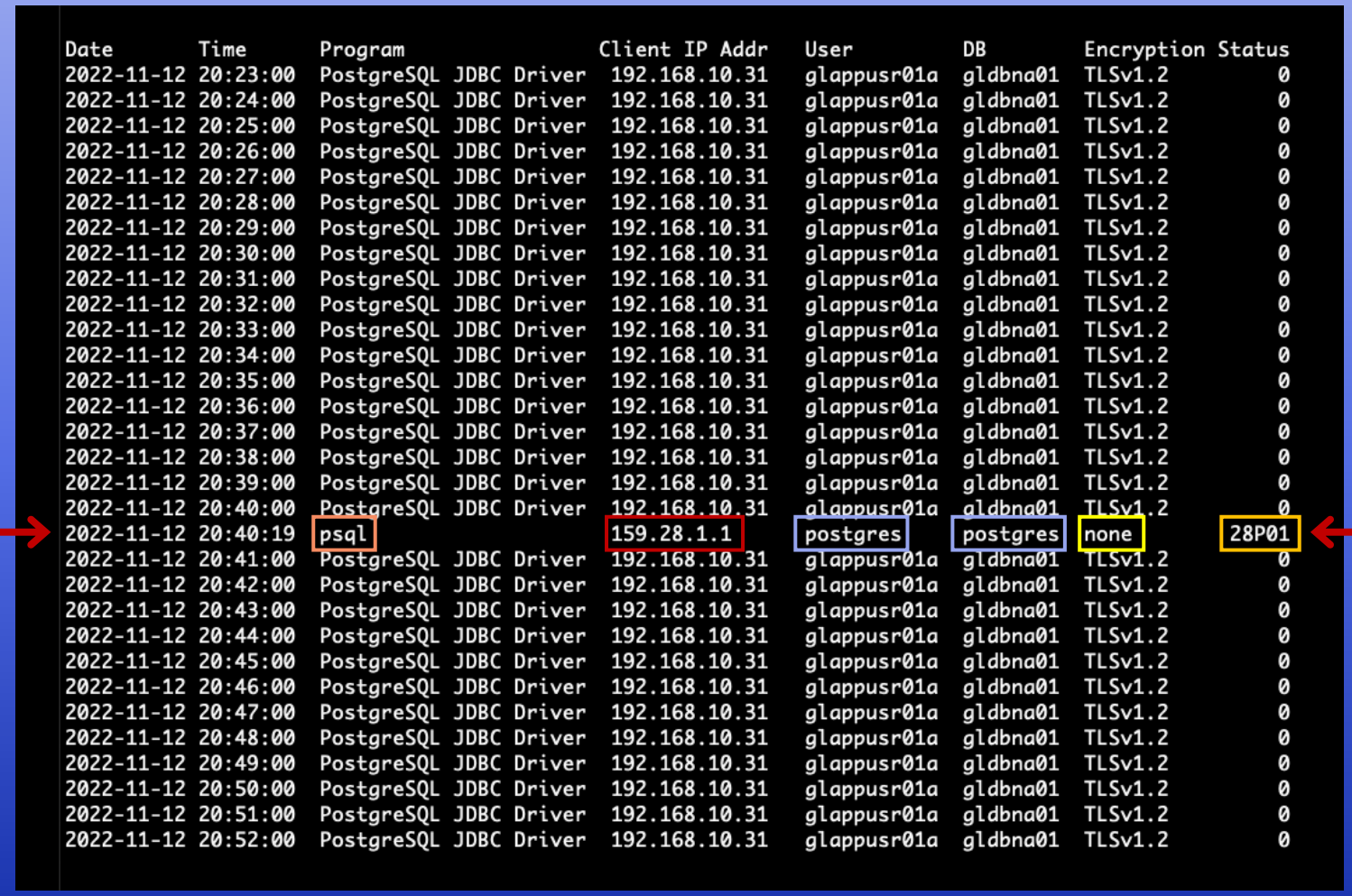




Detects suspicious activity

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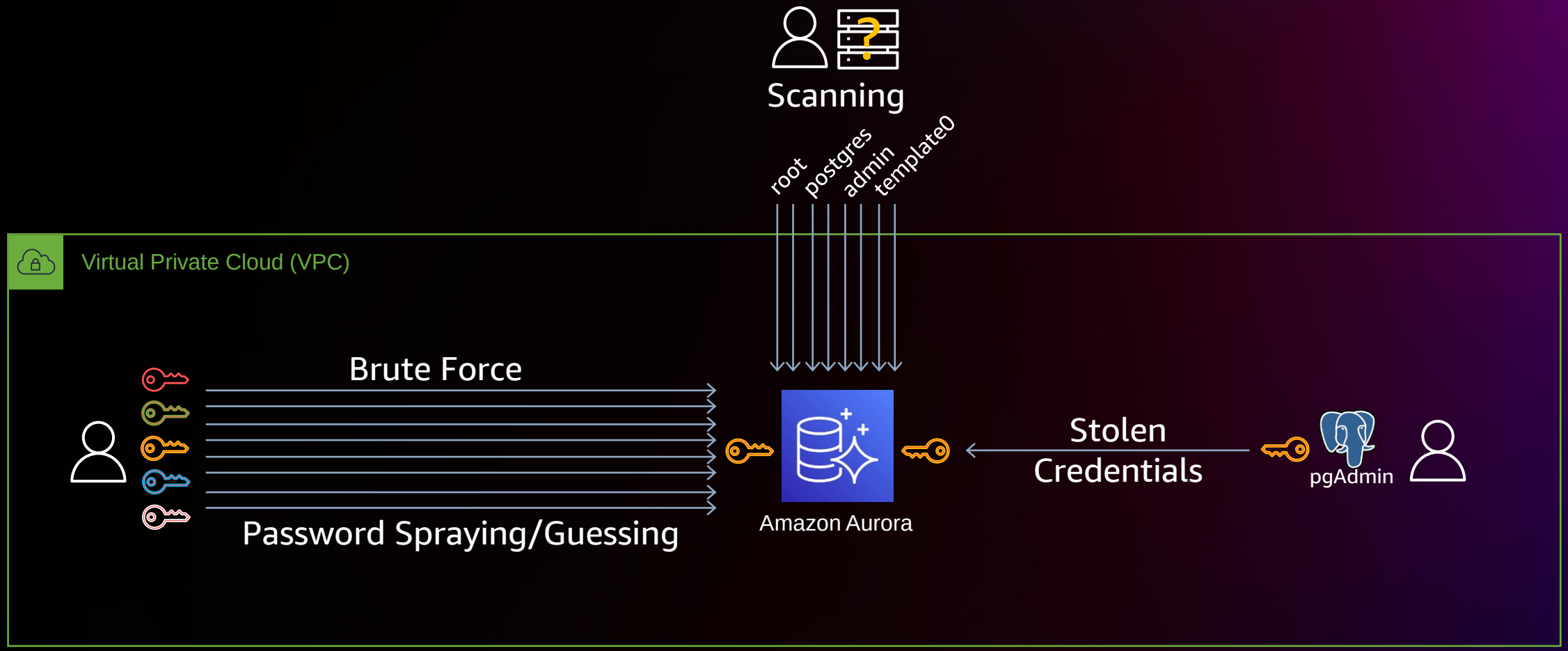
Amazon GuardDuty RDS Protection: Anomaly detection deep dive



Date	Time	Program	Client IP Addr	User	DB	Encryption	Status
2022-11-12	20:23:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:24:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:25:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:26:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:27:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:28:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:29:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:30:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:31:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:32:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:33:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
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2022-11-12	20:35:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:36:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:37:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:38:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:39:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:40:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:40:19	psql	159.28.1.1	postgres	postgres	none	28P01
2022-11-12	20:41:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
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2022-11-12	20:43:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:44:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:45:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:46:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:47:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:48:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:49:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
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2022-11-12	20:51:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0
2022-11-12	20:52:00	PostgreSQL JDBC Driver	192.168.10.31	glappusr01a	gldbna01	TLSv1.2	0

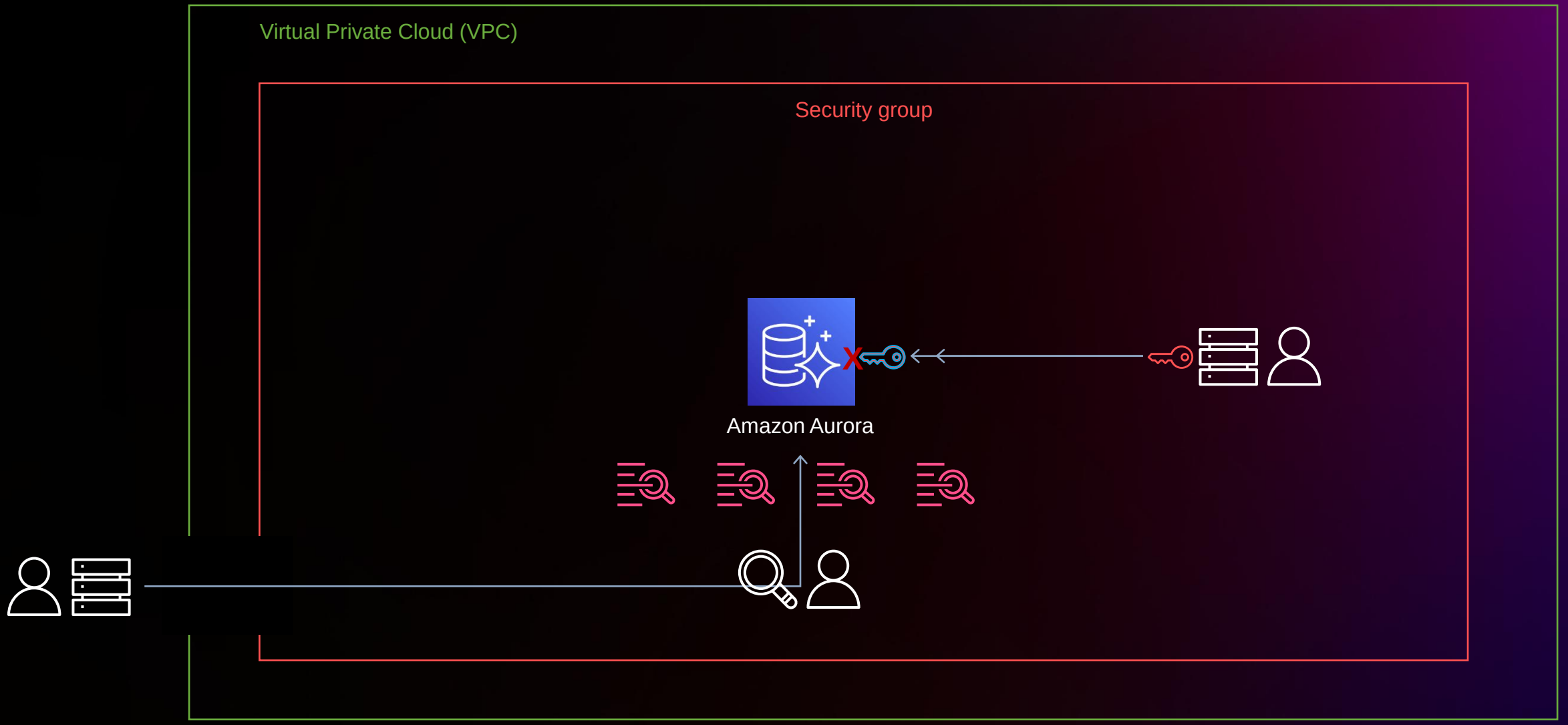
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What GuardDuty RDS Protection can detect



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When GuardDuty RDS Protection detects a threat you can quickly take action

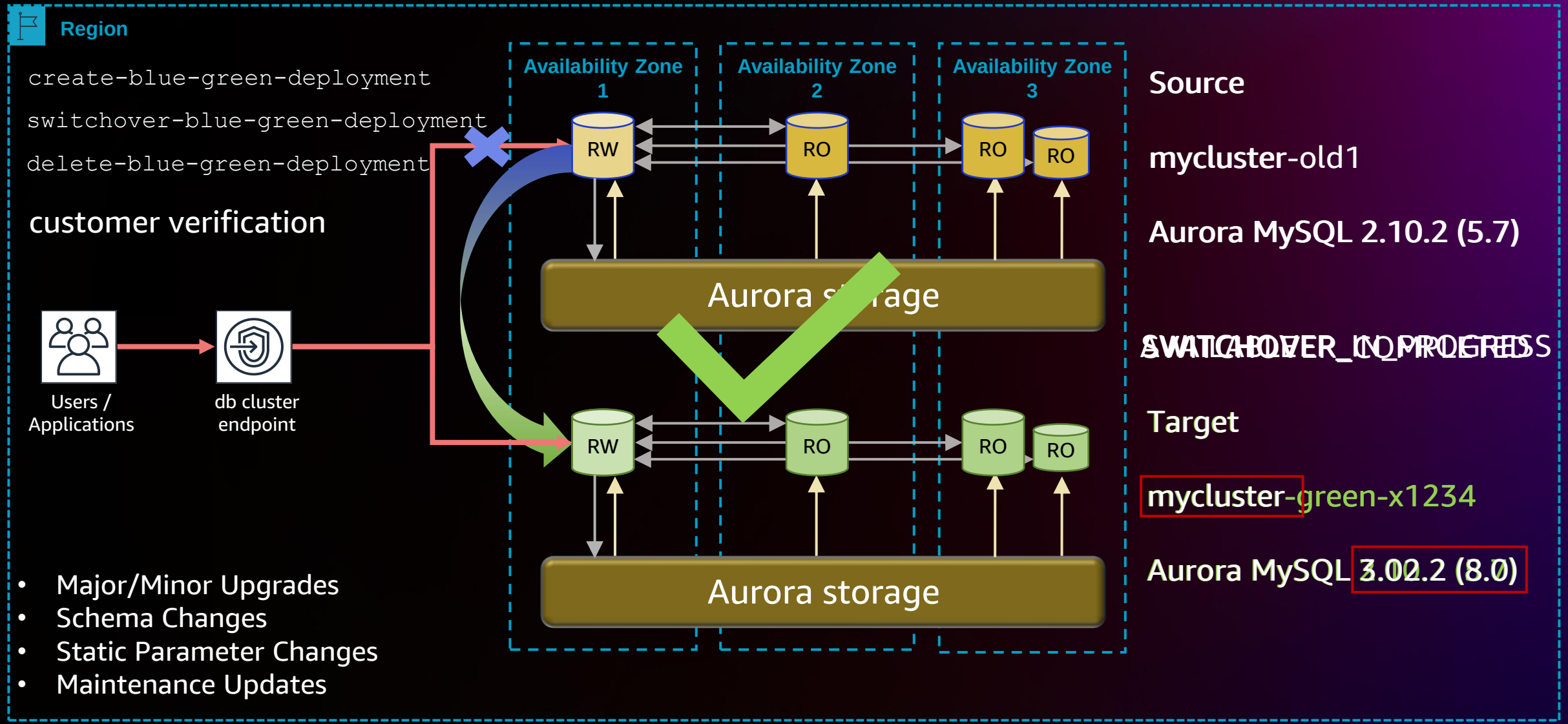


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Manageability – Blue/Green Deployments

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Amazon Aurora Blue/Green Deployments

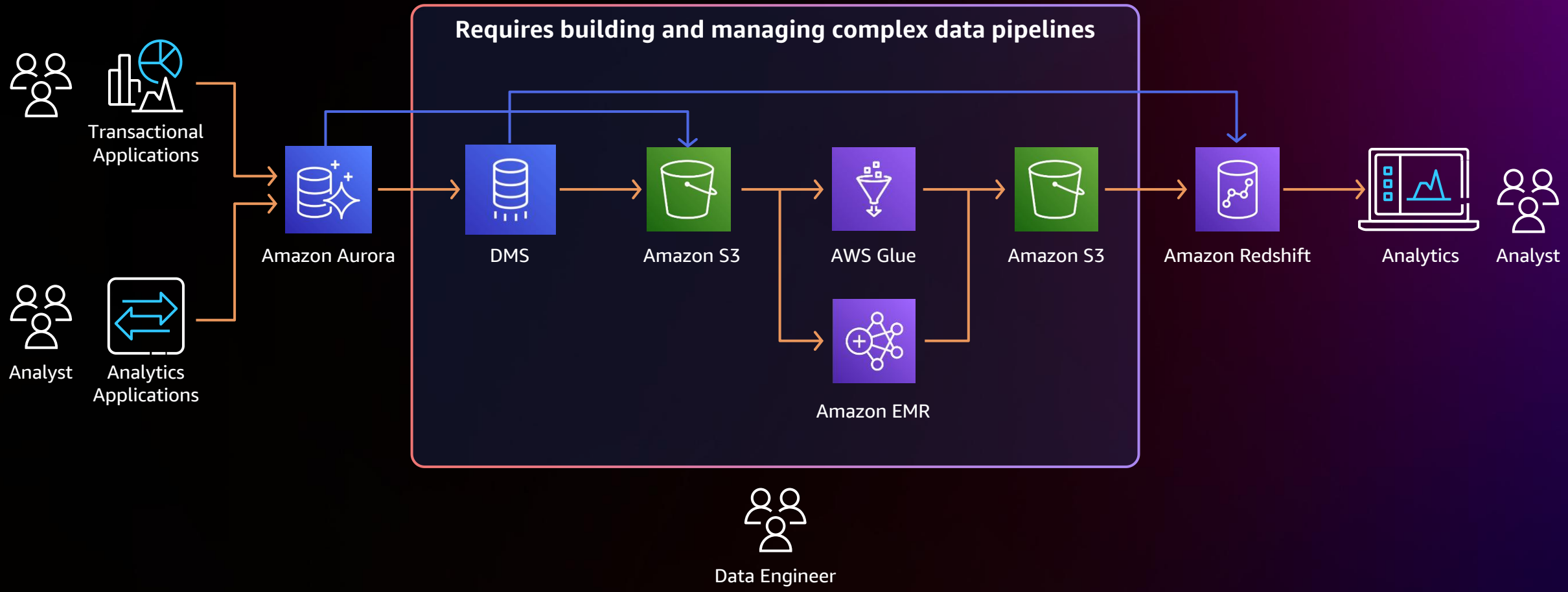


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Manageability – Redshift Integration

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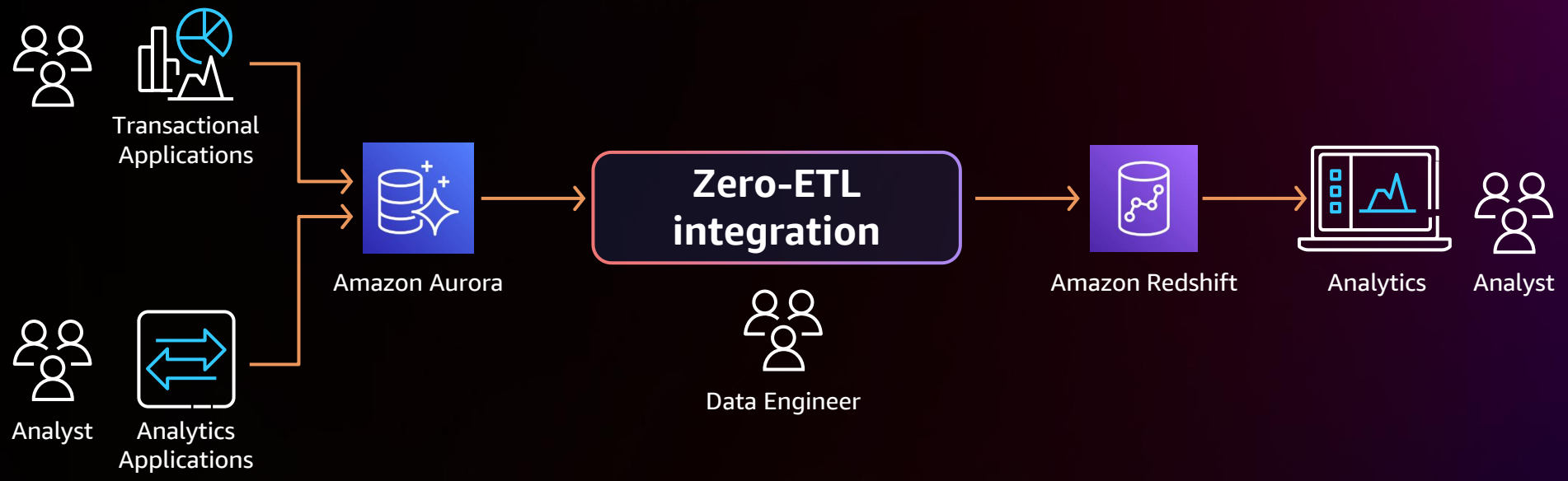
Transaction analytics at scale



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Introducing: Amazon Aurora zero-ETL integration with Amazon Redshift

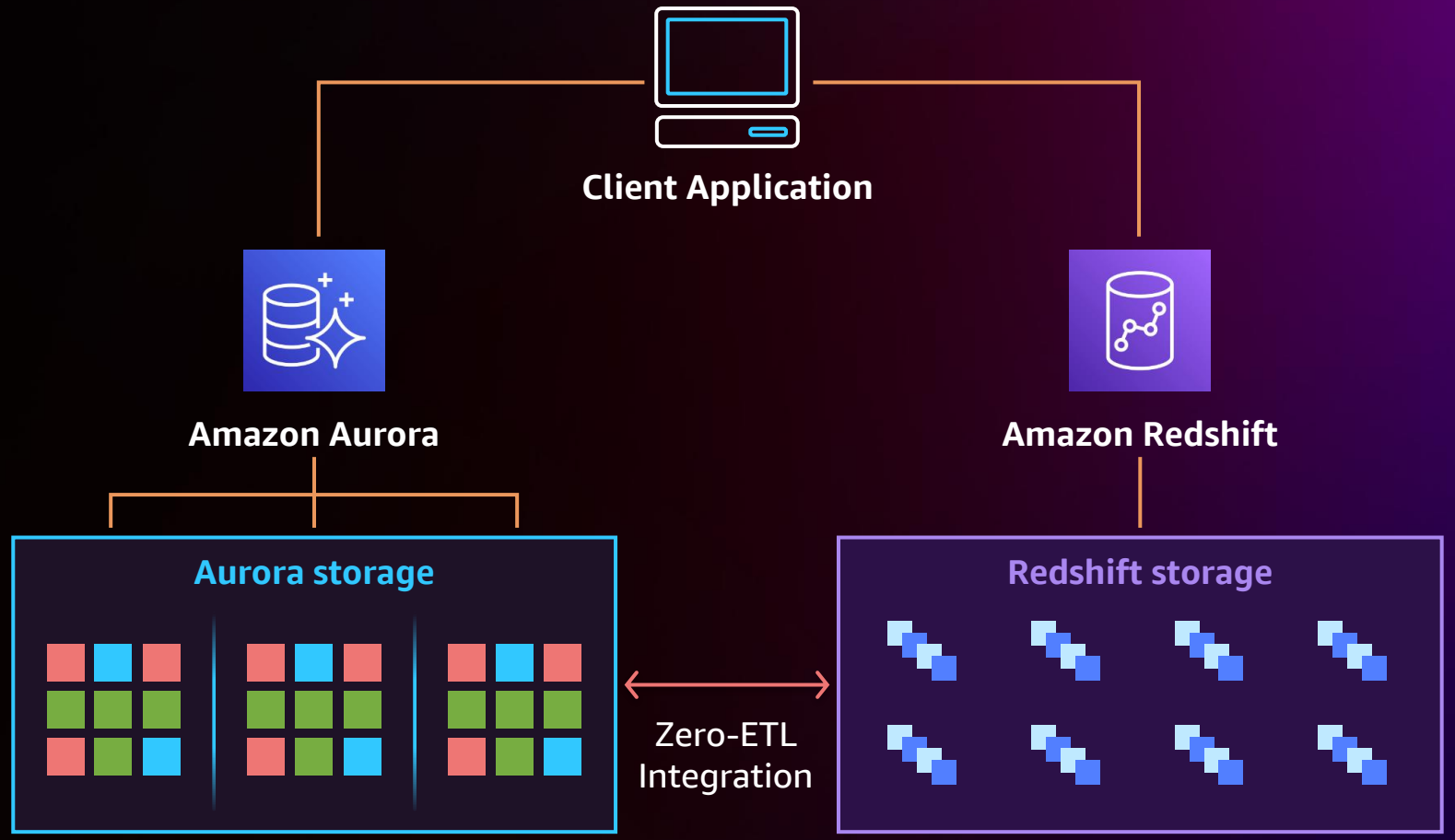
An **easy** and **secure** way to enable **near real-time analytics** on **petabytes of transactional data**



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Designed for simplicity and performance

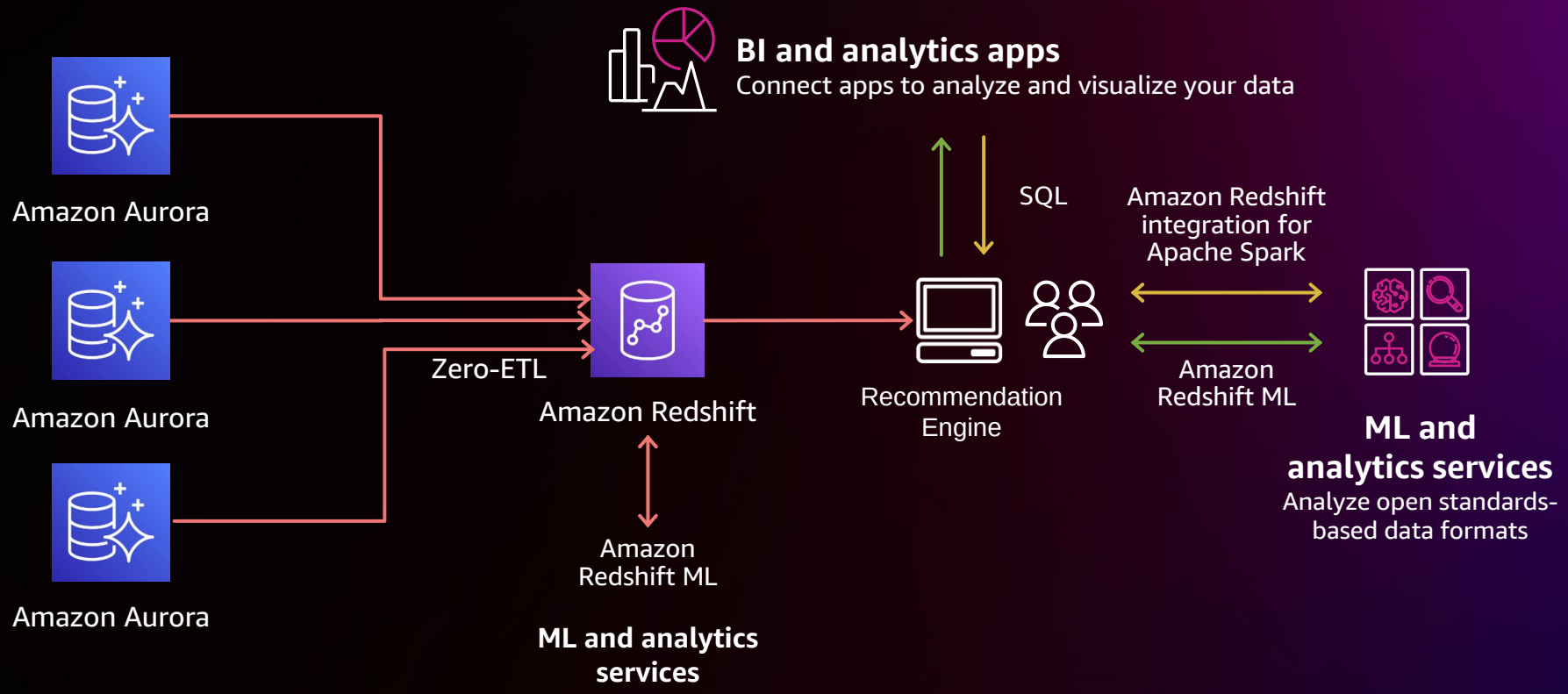
- Easy creation of Redshift integration target
- Automated data seeding and continuous replication at storage layer
- Run analytics along side ingestion
- Monitor progress, lag, and performance from Redshift system tables and CloudWatch



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Operational analytics across many databases

- 74 Amazon Aurora databases
- 200K-300K daily transaction
- <10 seconds lag
- 200TB
- 30B rows on largest table
- 70+ columns



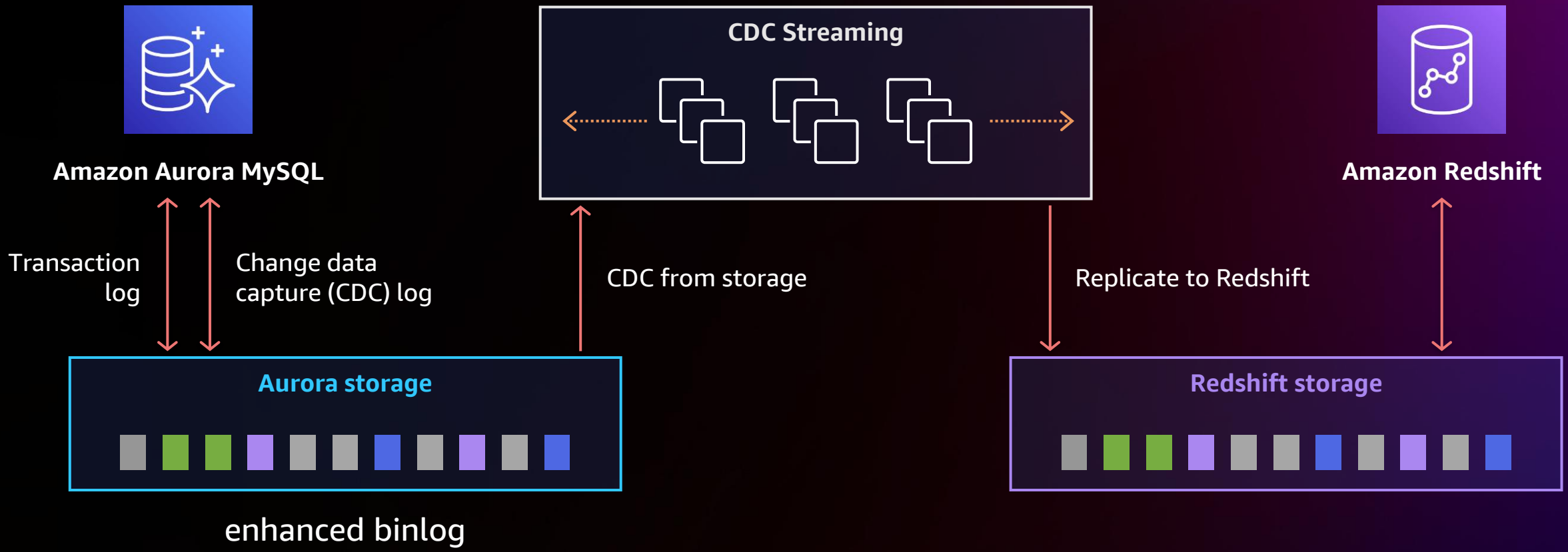
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Integration at the storage layer



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Integration at the storage layer



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Related sessions

DAT221	Breakout	PostgreSQL Trusted Language Extensions
DAT222	Breakout	Blue/Green Deployments
DAT328	Breakout	Amazon Aurora Zero-ETL to Amazon Redshift
SEC218	Breakout	Amazon GuardDuty RDS Protection

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Thank you!



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

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