

The background features a dark blue gradient with abstract geometric shapes. On the left, a large triangle is formed by a vertical orange line and a diagonal orange line. On the right, a large curved shape transitions from orange to blue. A thin blue line forms a rectangle in the lower right quadrant.

# AWS re:Invent

NOV. 29 – DEC. 3, 2021 | LAS VEGAS, NV

DAT401

# Deep dive on Amazon Aurora

Richard Waymire

Senior Manager, Aurora Product Management

AWS



# Introduction

# Amazon Aurora

ENTERPRISE DATABASE AT OPEN SOURCE PRICE

Delivered as a **managed** service



Drop-in compatibility with MySQL and PostgreSQL

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Simplicity and cost-effectiveness of open-source databases

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Throughput and availability of commercial databases

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Simple pay-as-you-go pricing

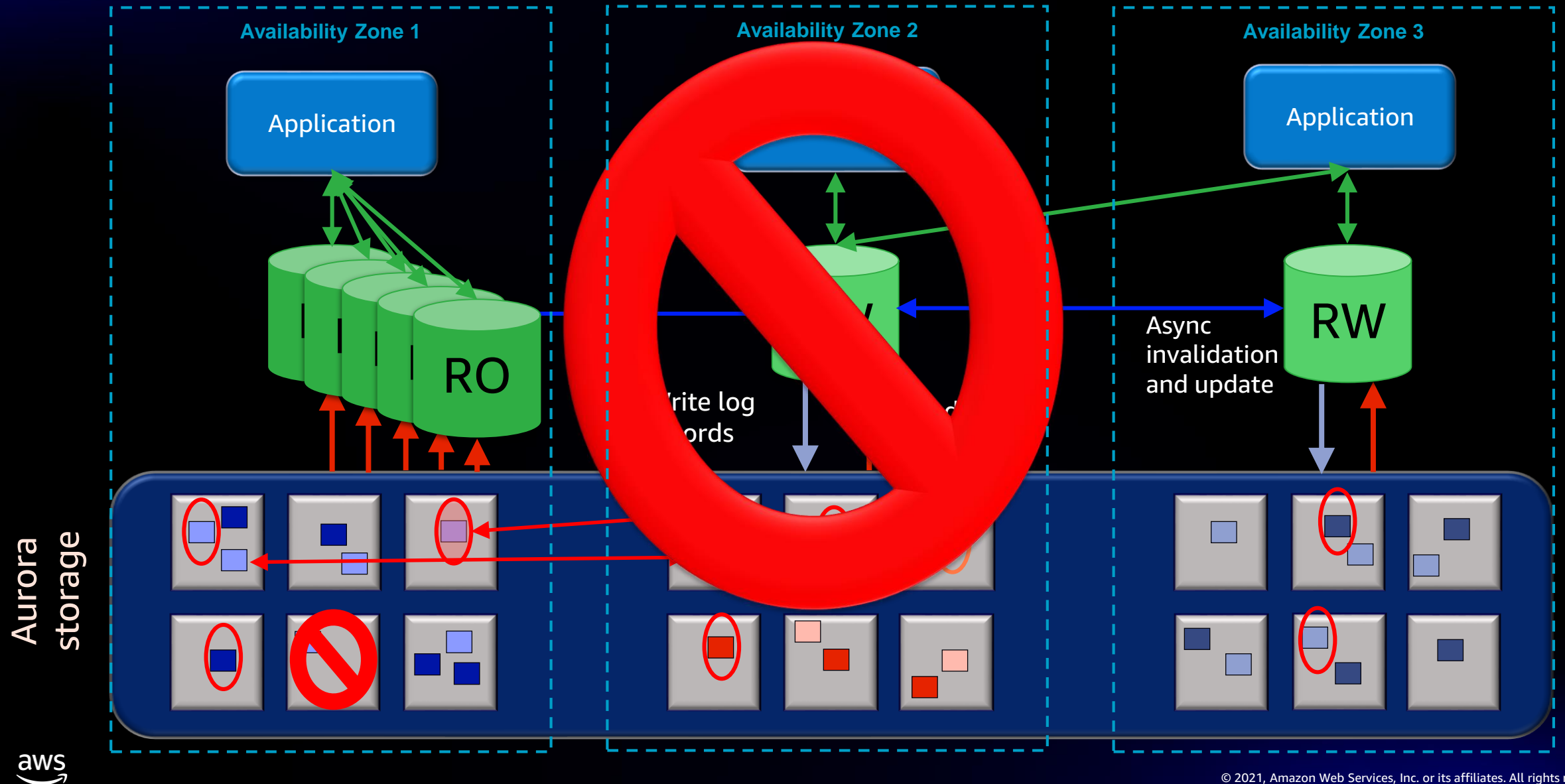
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# What's new since last re:Invent

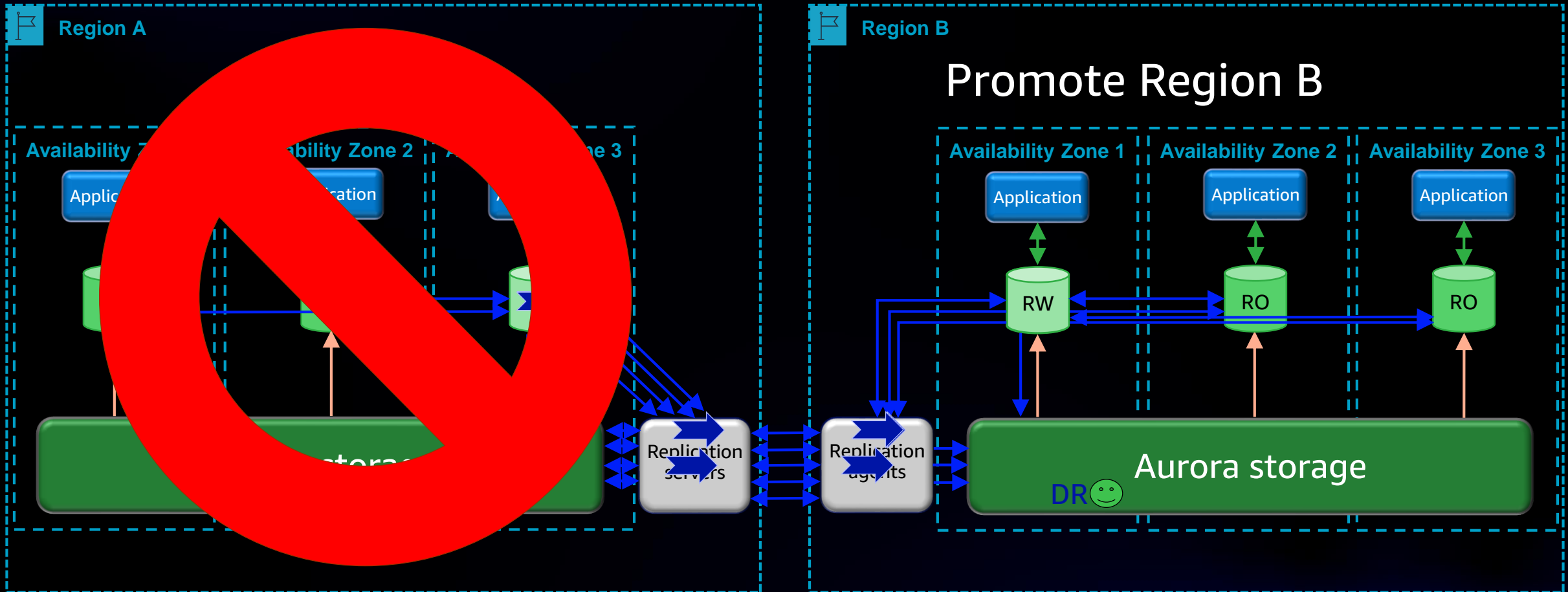
- Postgres:
  - Babelfish for Aurora PostgreSQL and Babelfish for PostgreSQL
  - PostgreSQL 12, 13 support
  - New Extensions: PostGIS 3.1, oracle\_fdw, pg\_partman, pg\_bigm, pg\_proctab, pg\_cron
- MySQL:
  - MySQL 8.0 support
  - Improved Read Replica Availability
- Both: Graviton2 (T4G, R6G, X2G) instance support

# Basic architecture

# Aurora storage and replicas

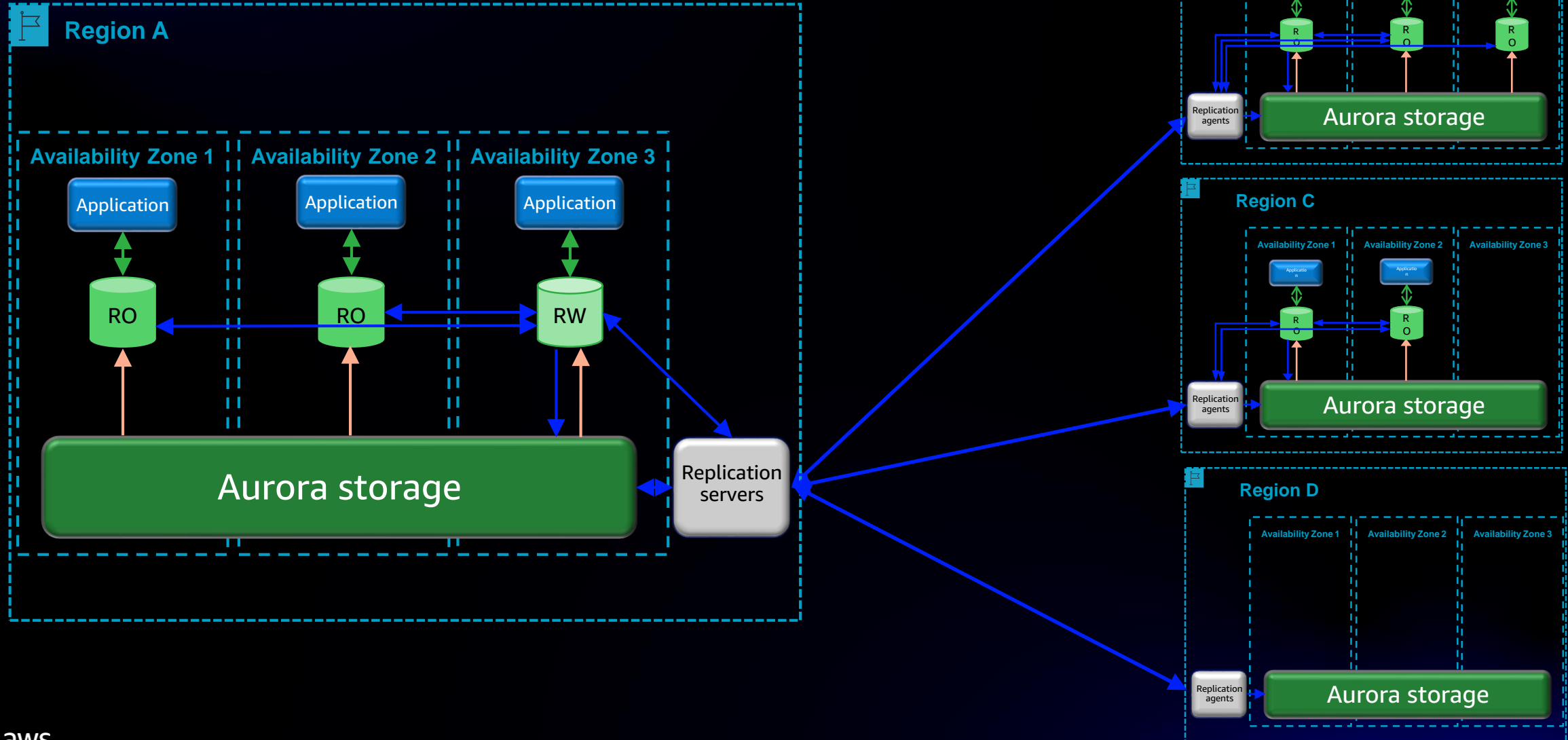


# Amazon Aurora global database



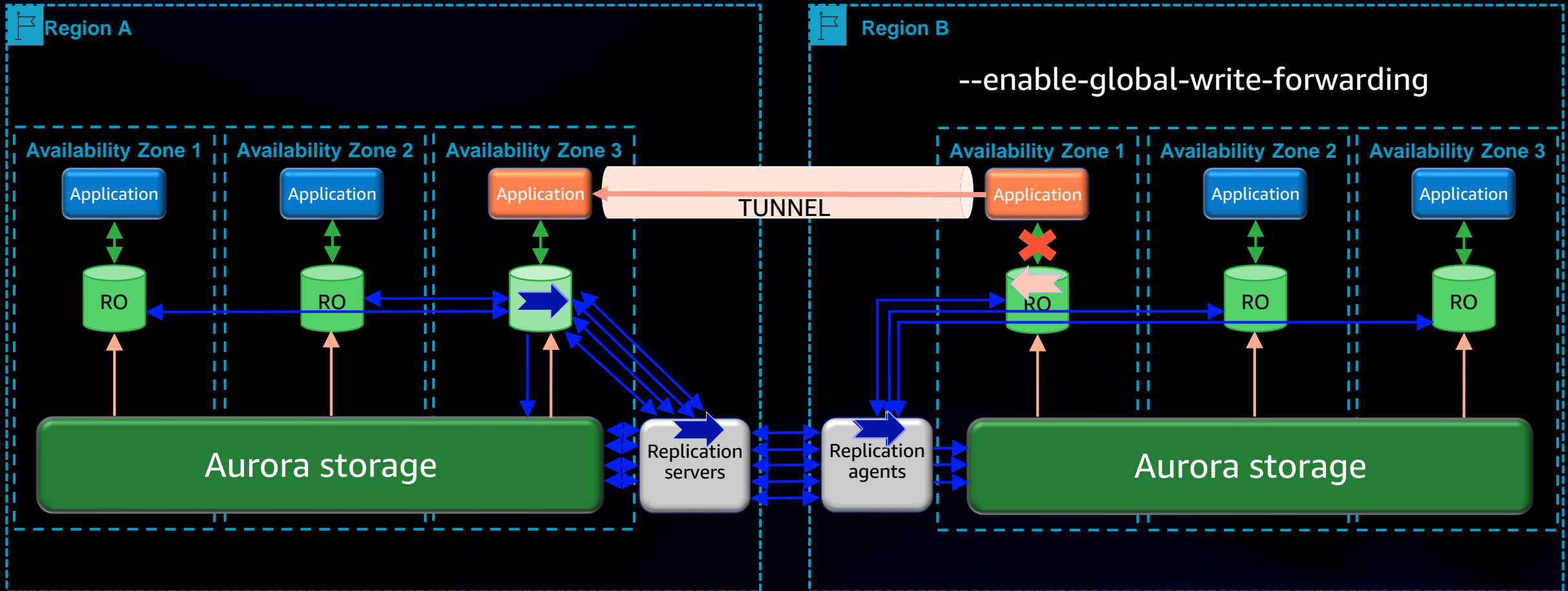


# Amazon Aurora global database



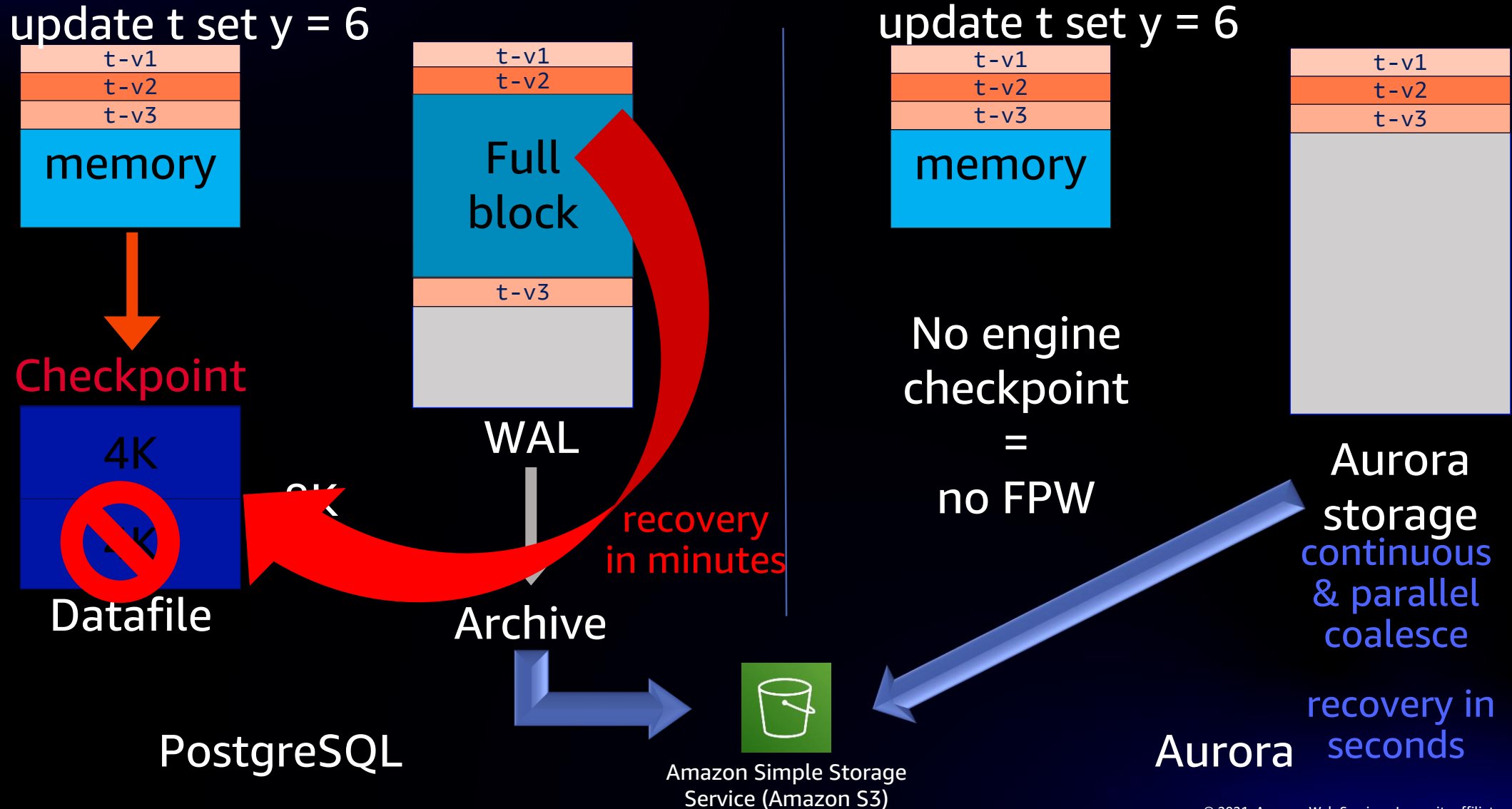
# Amazon Aurora global database

## WRITE FORWARDING

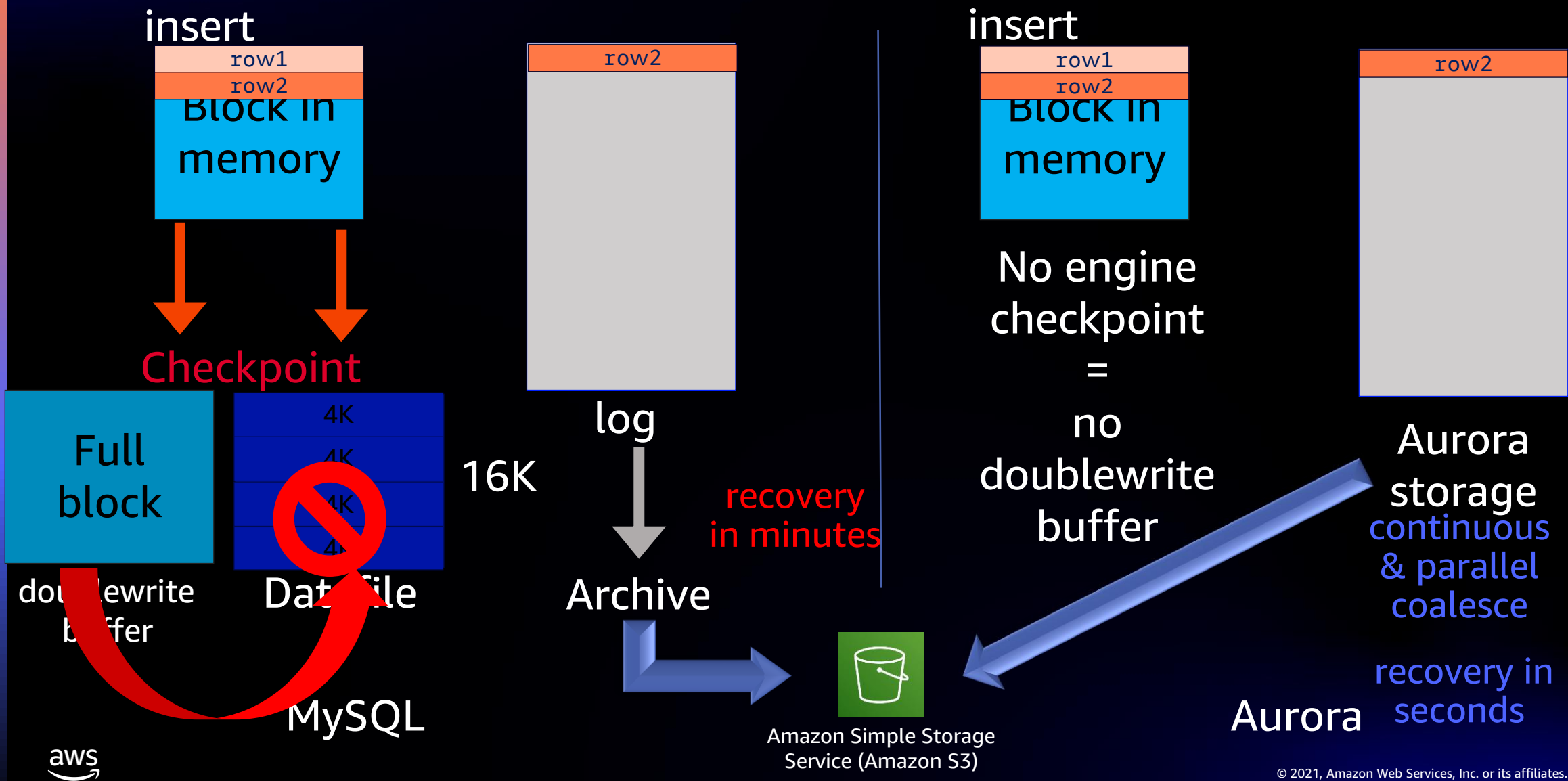


# Aurora storage internals

# Aurora PostgreSQL: Writing less

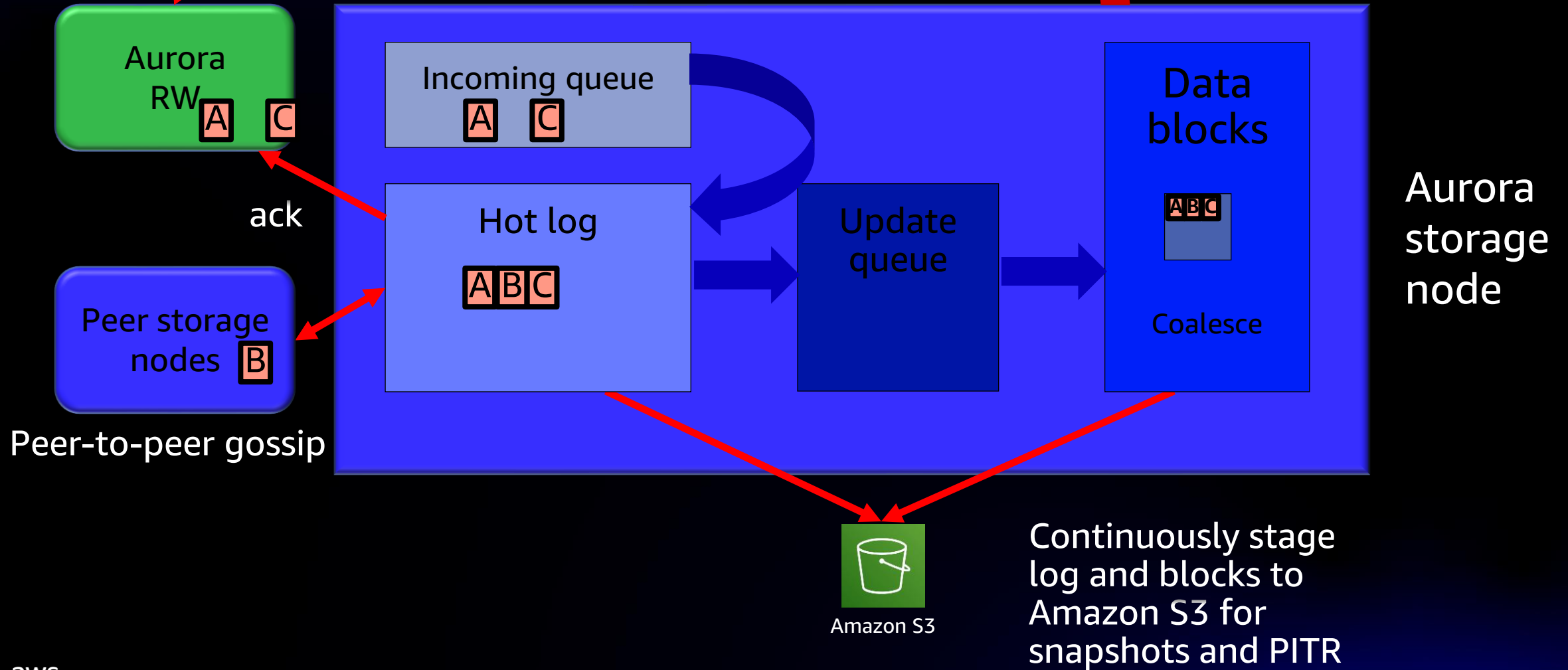


# Aurora MySQL: Writing less

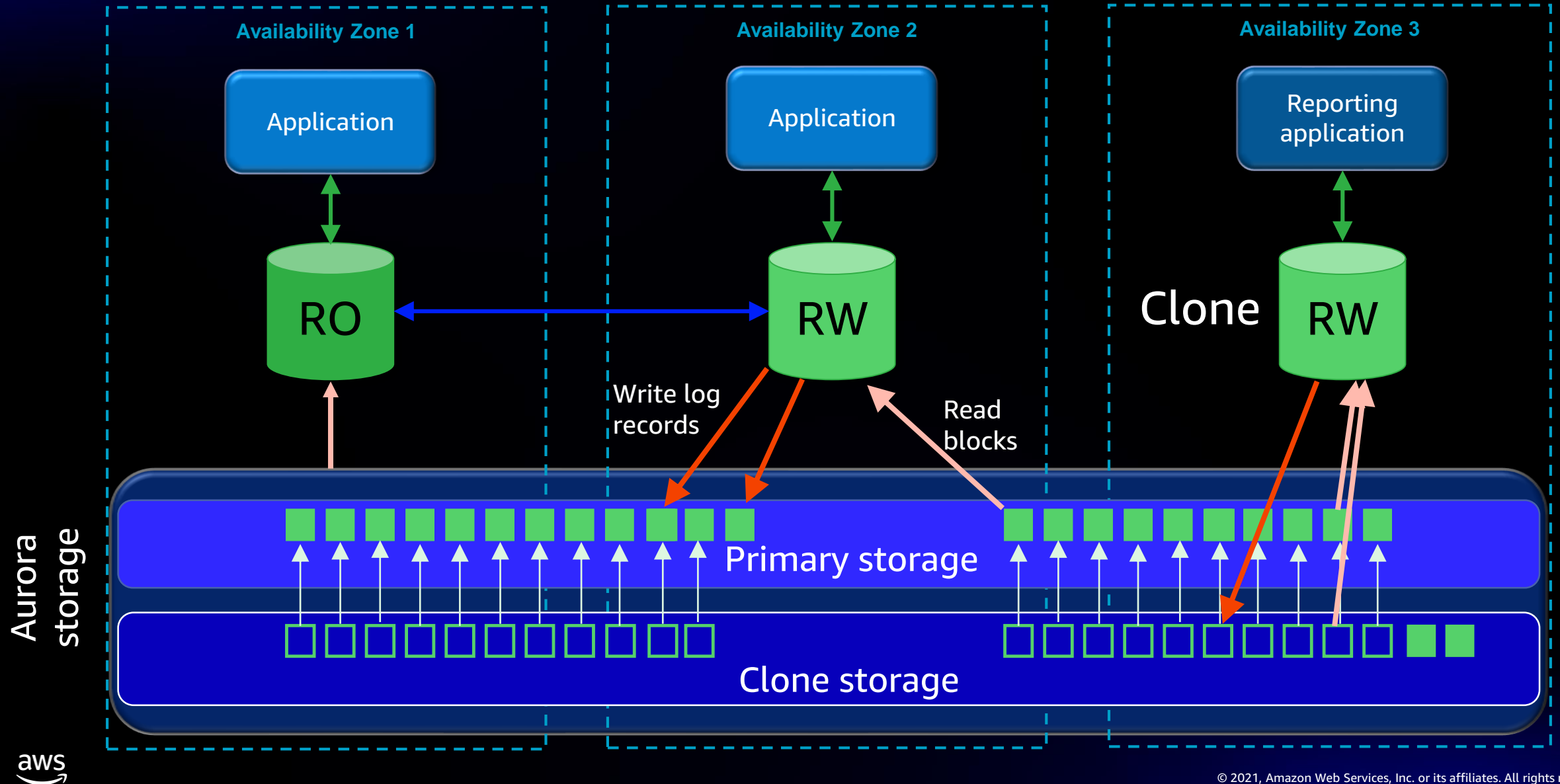


# Storage node

Read request



# Fast clones



1 2 3 4





# MySQL updates

# Aurora MySQL 3 with MySQL 8.0 compatibility

- Each Aurora MySQL 3 release will be compatible with a corresponding MySQL 8.0 community edition release
  - Aurora MySQL 3.01 is compatible with MySQL 8.0.23
- Binary log improvements
  - Multi-threaded replication (MTR)
  - Replication filtering
  - Binary log transaction compression
- Instant DDL
- Common Table Expressions (CTE)
- Window functions
- Expanded parallel query support (partitioned tables, aggregations, and BLOBS)
- Descending and invisible index types
- Role-based access control

# Improved Availability of Read Replicas

- Starting in MySQL 2.10 or higher
  - Reboot the writer, read replicas survive
  - Improves availability and allows long-running read queries to continue
    - May still reboot in some circumstances
    - CLI: `aws rds reboot-db-instance --db-instance-identifier mydbinstance`

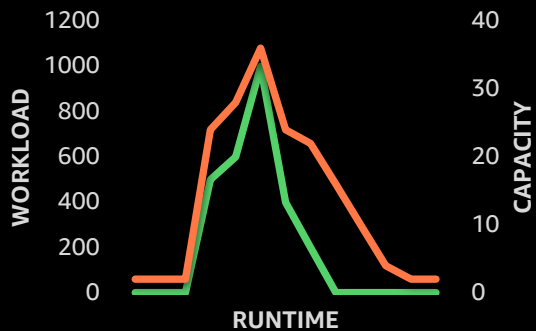
# PostgreSQL updates

# Aurora PostgreSQL 13 new features

- Improved performance on partitioned tables
  - Partition pruning improvements
  - Partitionwise joins
  - Logical replication of partitioned tables
- Parallelized vacuum for indexes
- Index de-duplication for B-tree indexes
- Faster sort operations

# Manageability – Aurora Serverless V2

# Aurora Serverless v2



Scale instantly - in a fraction of a second



Scale in **fine-grained increments** to provide just the right amount of database capacity

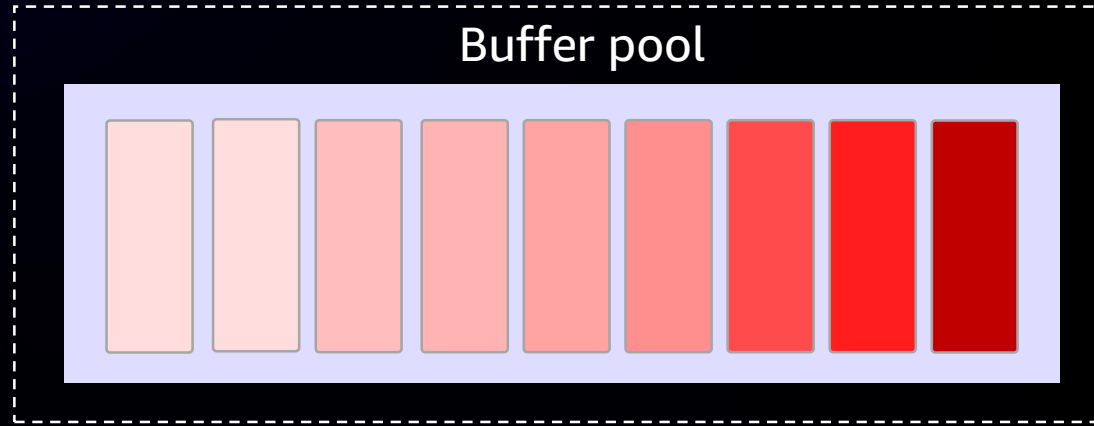


**Parity with Aurora capabilities** including read replicas, multi-AZ, Global Database



**Up to 90 percent cost savings** when compared to provisioning for peak load

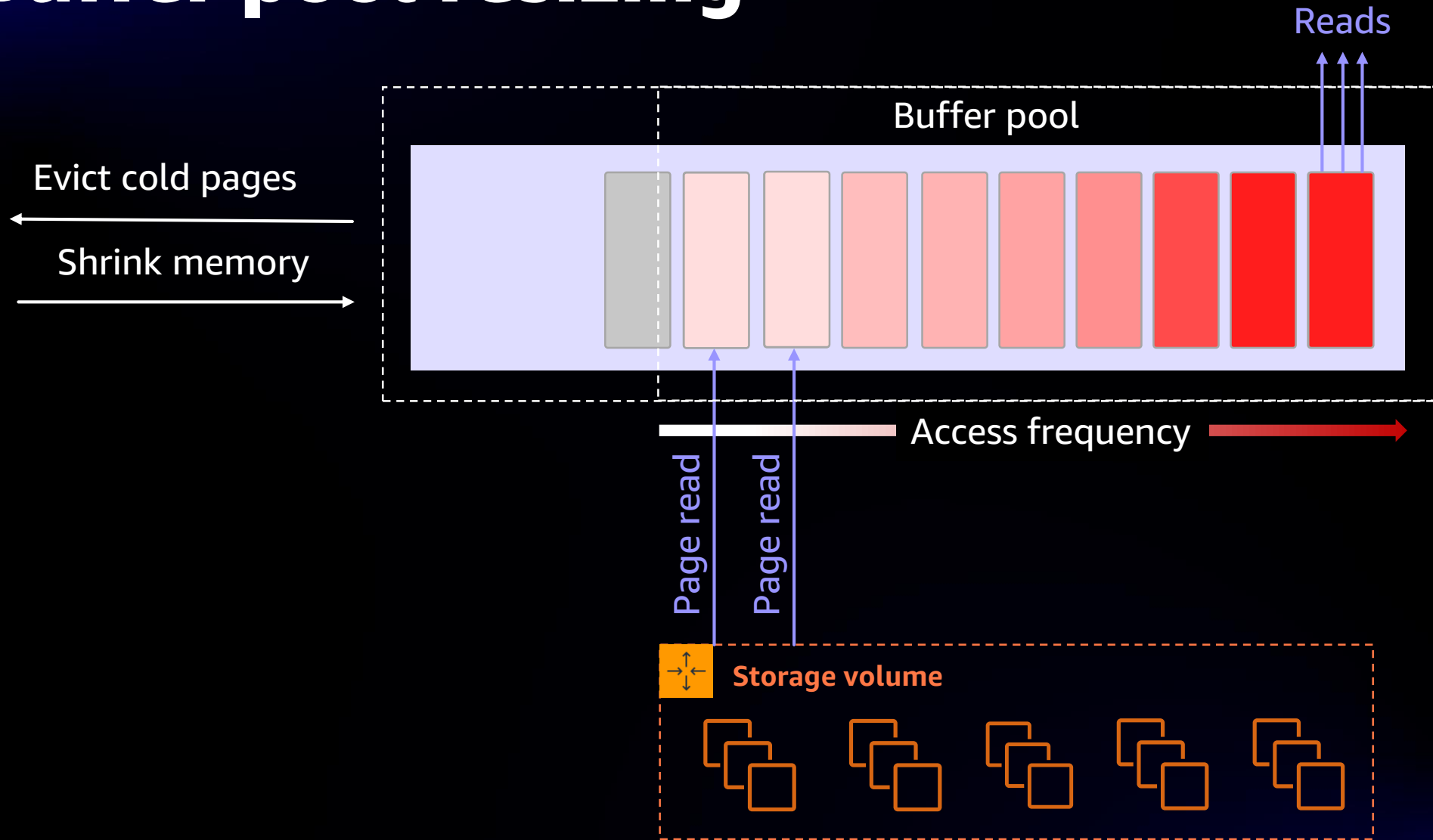
# Buffer pool resizing



- Default memory allocation: 75 percent for buffer pool and 25 percent for heap
- Buffer pool size scaled along with database 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



# Buffer pool resizing



# Manageability – Amazon DevOps Guru for RDS

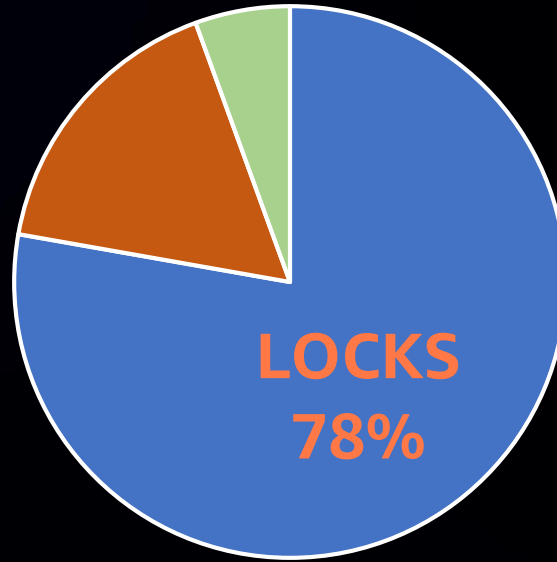
# Introducing Amazon DevOps Guru for RDS

**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.**



# DevOps Guru for RDS

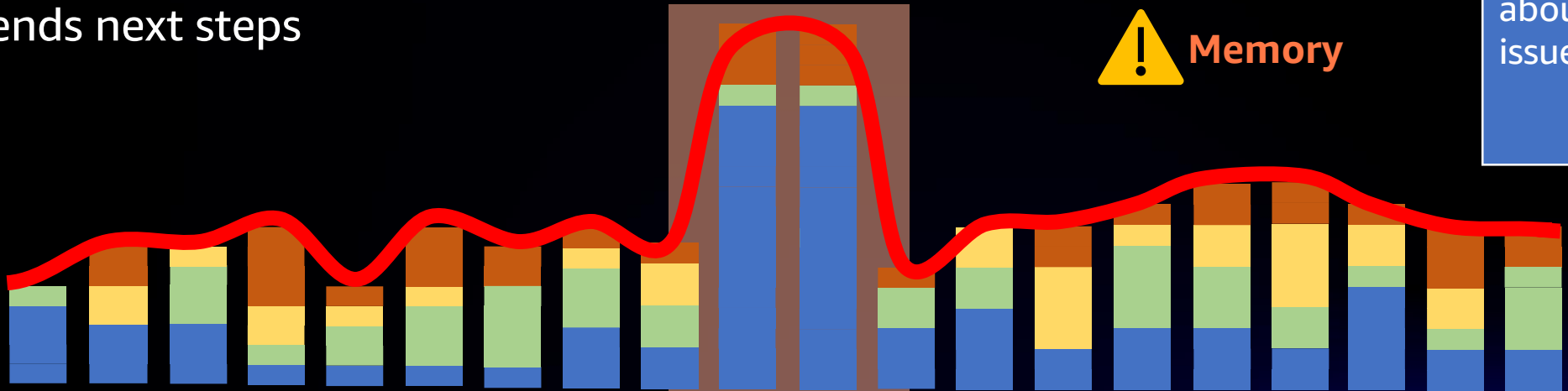
- Finds DB performance anomalies
- Analyzes the anomaly
- Highlights:
  - Prevalent wait events
  - Prevalent SQL statements
  - Other anomalous metrics
- Recommends next steps



```
SELECT NAME FROM CUSTOMERS;  
SELECT ITEM FROM F;
```



What to do  
about locking  
issues

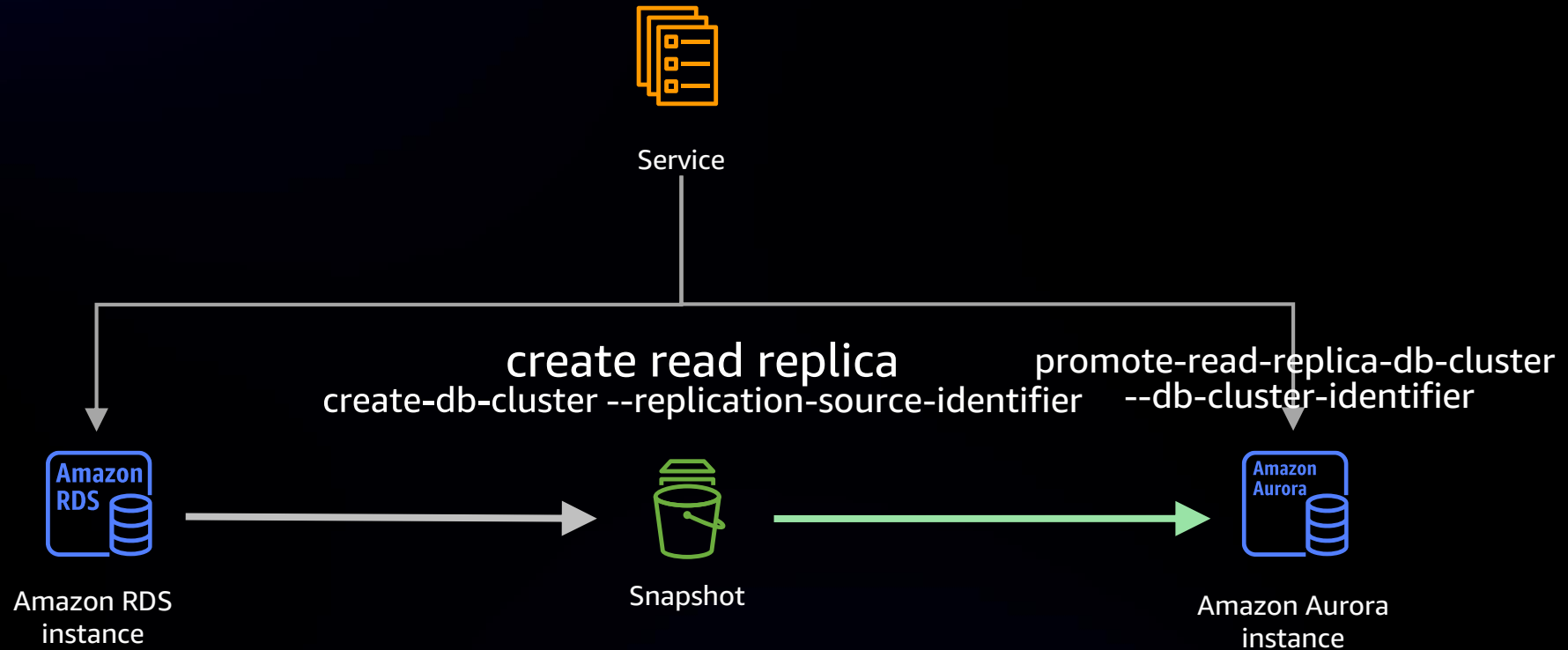


# Migration

# Migration to Aurora: Methods

- AWS Database Migration Service (AWS DMS)/Schema Conversion Tool (SCT)
- PostgreSQL: pg\_dump/pg\_restore
- MySQL: mysqldump, Percona XtraBackup
- Amazon RDS: Snapshot import
- Amazon RDS: Read replica

# Migration: Read replica



Catchup via asynchronous replication

# Migration – Babelfish for Aurora PostgreSQL



# Babelfish for Aurora PostgreSQL

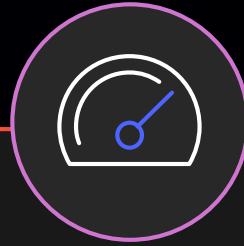
Run SQL Server applications on PostgreSQL with little to no code changes

## Keep existing queries



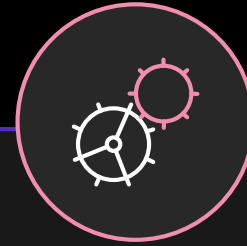
Translation layer enables Aurora PostgreSQL to understand Microsoft SQL Server's proprietary T-SQL

## Accelerate migrations



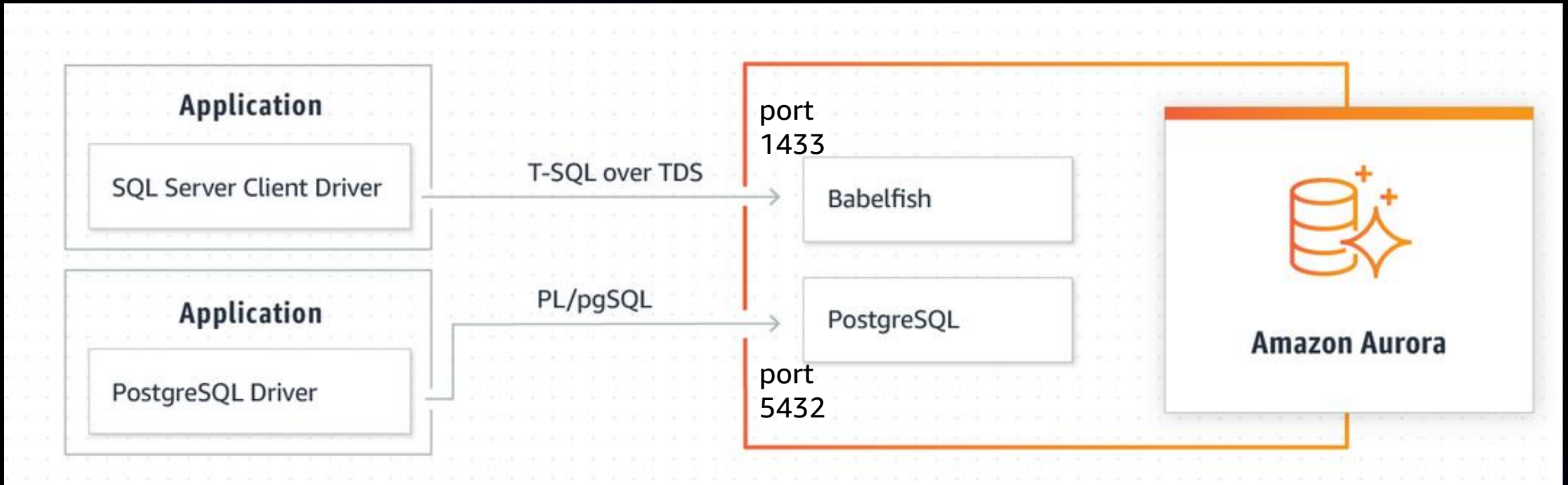
Lower risk and complete migrations faster, saving you months to years of work

## Freedom to innovate

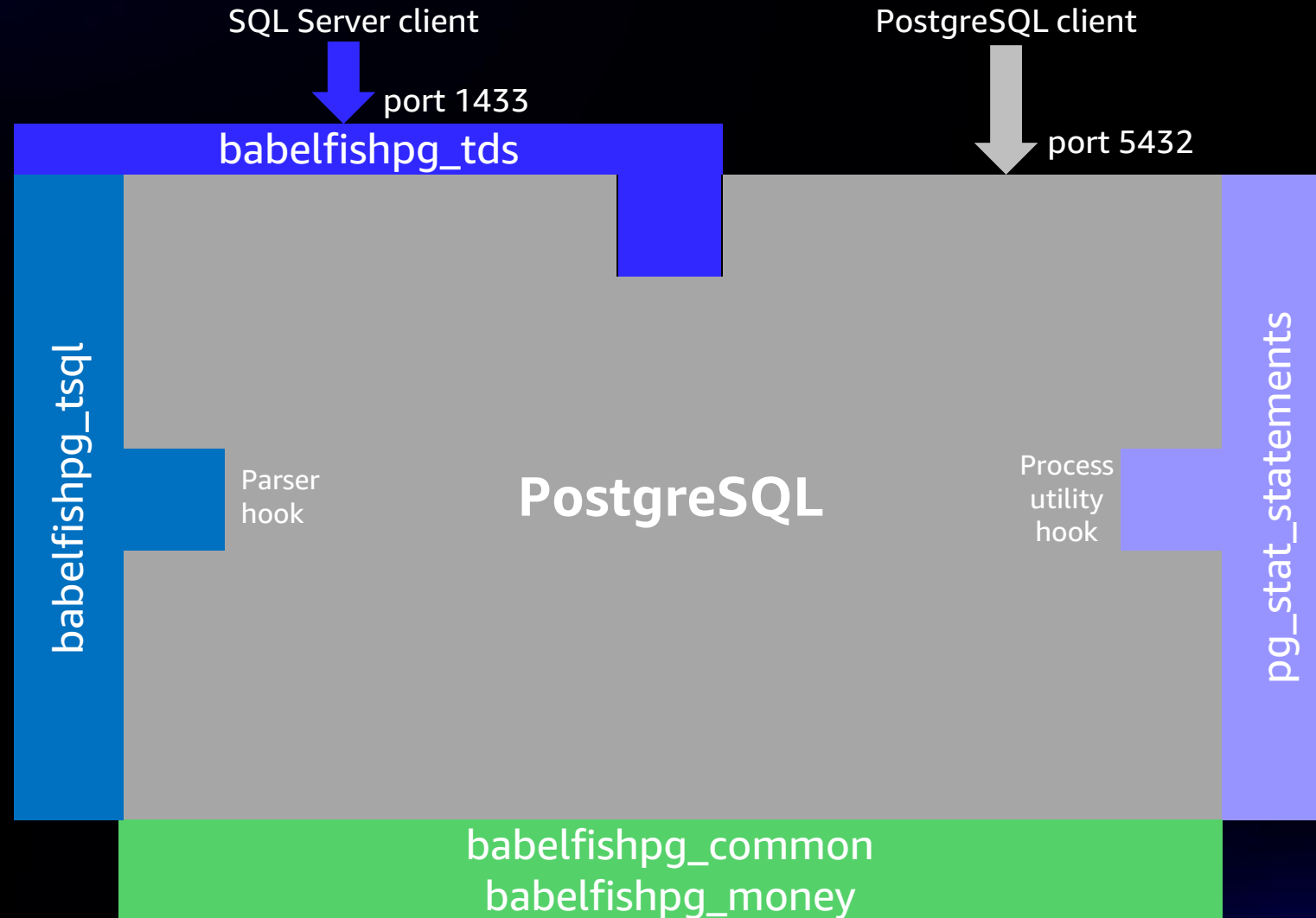


Run T-SQL code side-by-side with new open source functionality and continue developing with familiar tools

# Babelfish architecture

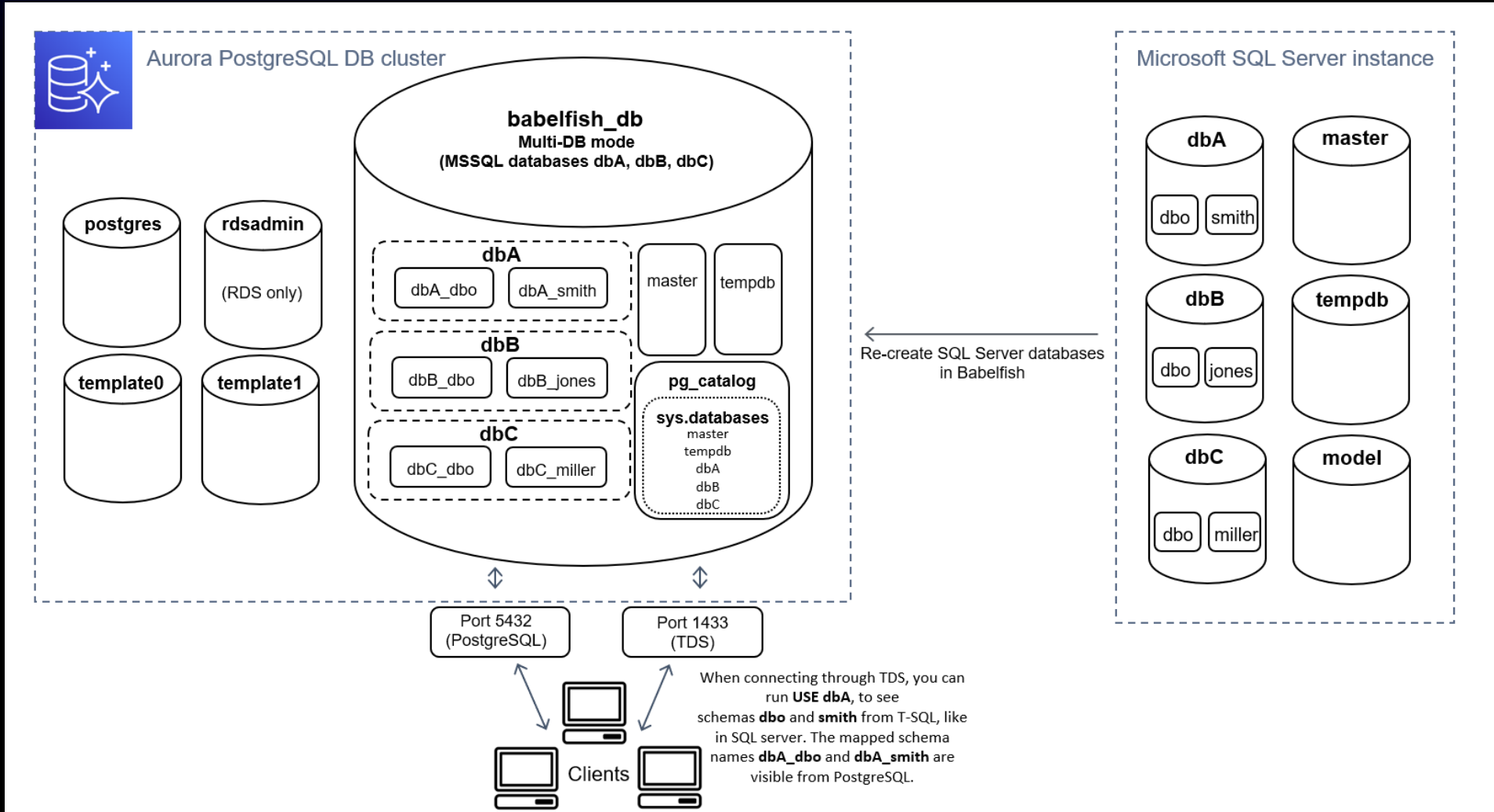


# Babelfish architecture



# Migrating SQL Server database structure

MULTI-DB MODE: SCHEMA NAMES FROM SQL SERVER USER DB ARE MAPPED TO DIFFERENT PG SCHEMA NAMES



# Related sessions

DAT401	Breakout	Deep Dive on Amazon Aurora (this session)
DAT201	Breakout	What's New in Amazon RDS
DAT302	Breakout	Instant and fine-grained scaling with Aurora Serverless v2
DAT305	Breakout	Enabling workloads for high availability and durability with Amazon RDS
DAT312	Chalk Talk	Deep Dive on Babelfish for Amazon Aurora PostgreSQL
DAT330	Builder	Achieving high availability and performance with Amazon Aurora Global Database
DAT313	Chalk Talk	Building an machine learning enabled application with Amazon Aurora ML
DAT315	Chalk Talk	Quickly building for the future with Amazon RDS
DAT325	Workshop	Running SQL Server on Amazon RDS and migrating to Aurora PostgreSQL with Babelfish

# Thank you!

Richard Waymire

Senior Manager, Amazon Aurora

