



# Introduction to Amazon Relational Database Service (Amazon RDS)

**Steve Abraham**  
**Principal Solutions Architect**



# AWS Data Services to Accelerate Your Move to the Cloud

## Databases to Elevate your Apps

*Relational*

*Non-Relational  
& In-Memory*

## Analytics to Engage your Data

*Inline Data Warehousing Reporting  
Data Lake*



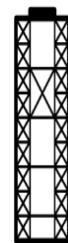
RDS  
Open  
Source

RDS  
Commercial

Aurora

DynamoDB  
& DAX

ElastiCache



EMR  
Elasticsearch  
Service



Redshift

Spectrum



Glue



Athena

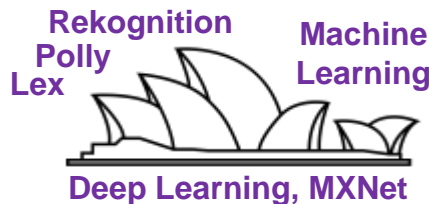


QuickSight



Database Migration  
Schema Conversion

*Migration for DB Freedom*



*Amazon AI to Drive the Future*

# Amazon RDS



- Multi-engine support
  - Aurora, MySQL, MariaDB, PostgreSQL, Oracle, SQL Server
- Automated provisioning, Scaling, Patching, Backup/Restore
- High availability with RDS Multi-AZ, Auto-Failover
  - 99.95% SLA for Multi-AZ deployments
- Security
- Monitoring

Amazon  
Aurora

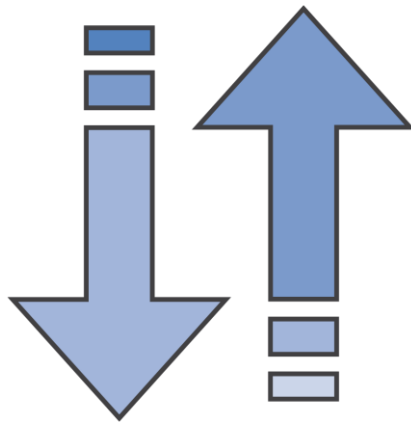


ORACLE®



# Provisioning and Effortless Scaling

- Handle higher load or lower usage
- Naturally grow over time
- Control costs



# Read Replicas

Bring data close to your customer's applications in different regions

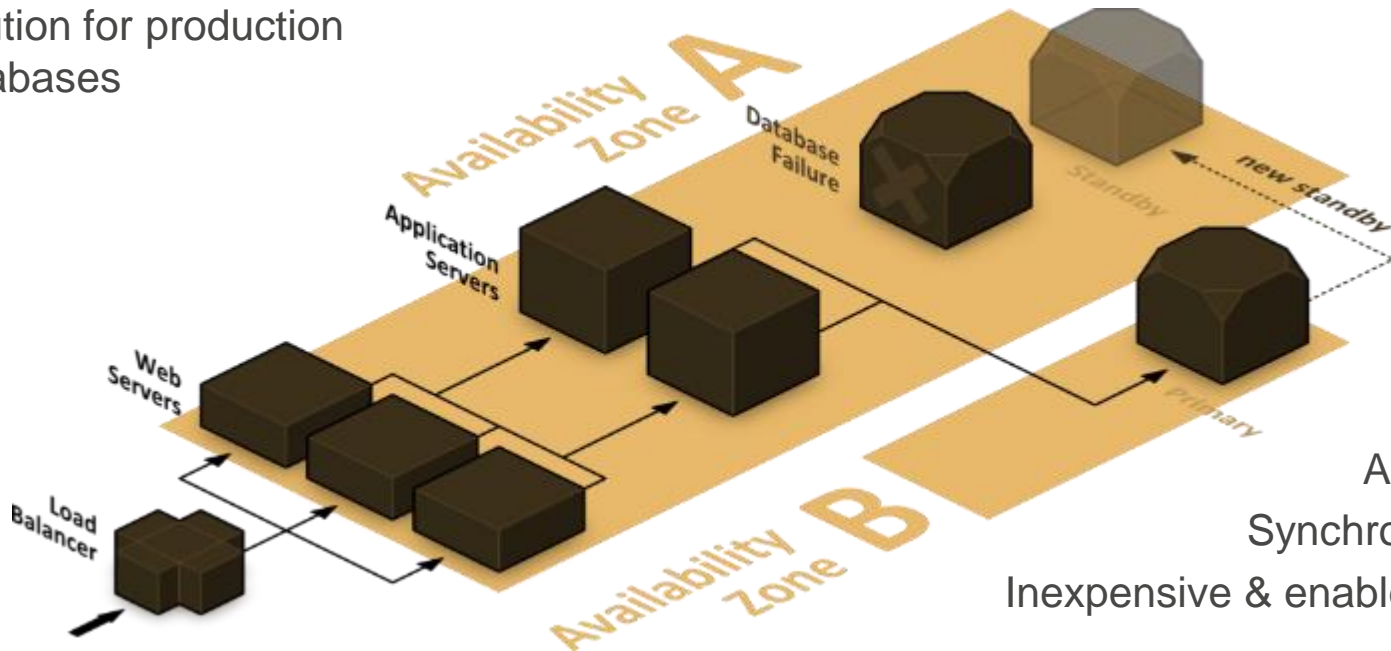
Relieve pressure on your master node for supporting reads and writes

Promote a Read Replica to a master for faster recovery in the event of disaster



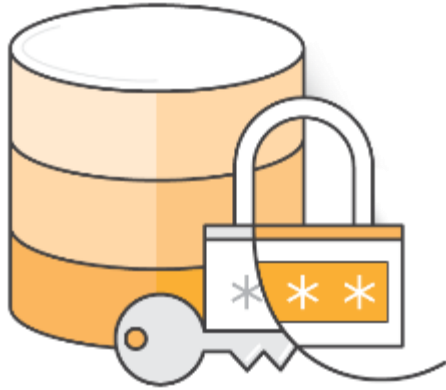
# High Availability Multi-AZ Deployments

Enterprise-grade fault tolerance  
solution for production  
databases



Automatic failover  
Synchronous replication  
Inexpensive & enabled with one click

# Security and Compliance

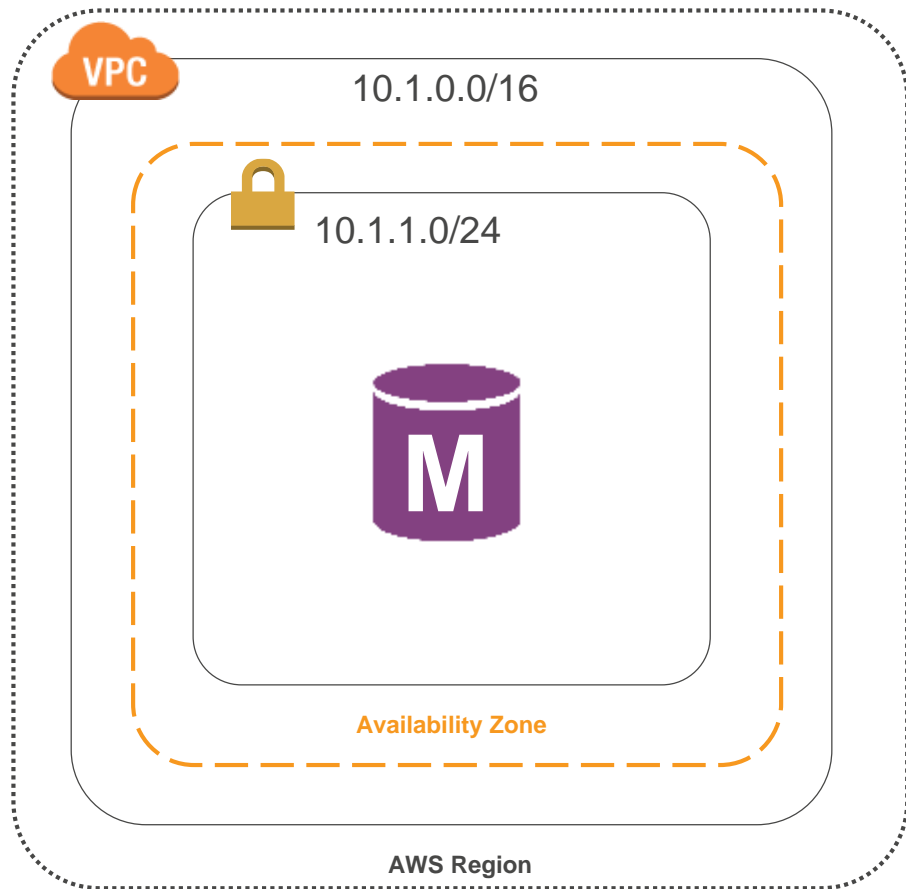


- Network Isolation
- Database instance IP firewall protection
- AWS IAM based resource-level permission controls
- Encryption at rest using AWS KMS or Oracle/Microsoft TDE
- SSL protection for data in transit
- Assurance programs for finance, healthcare, government and more

# Amazon Virtual Private Cloud (Amazon VPC)

Securely control network configuration

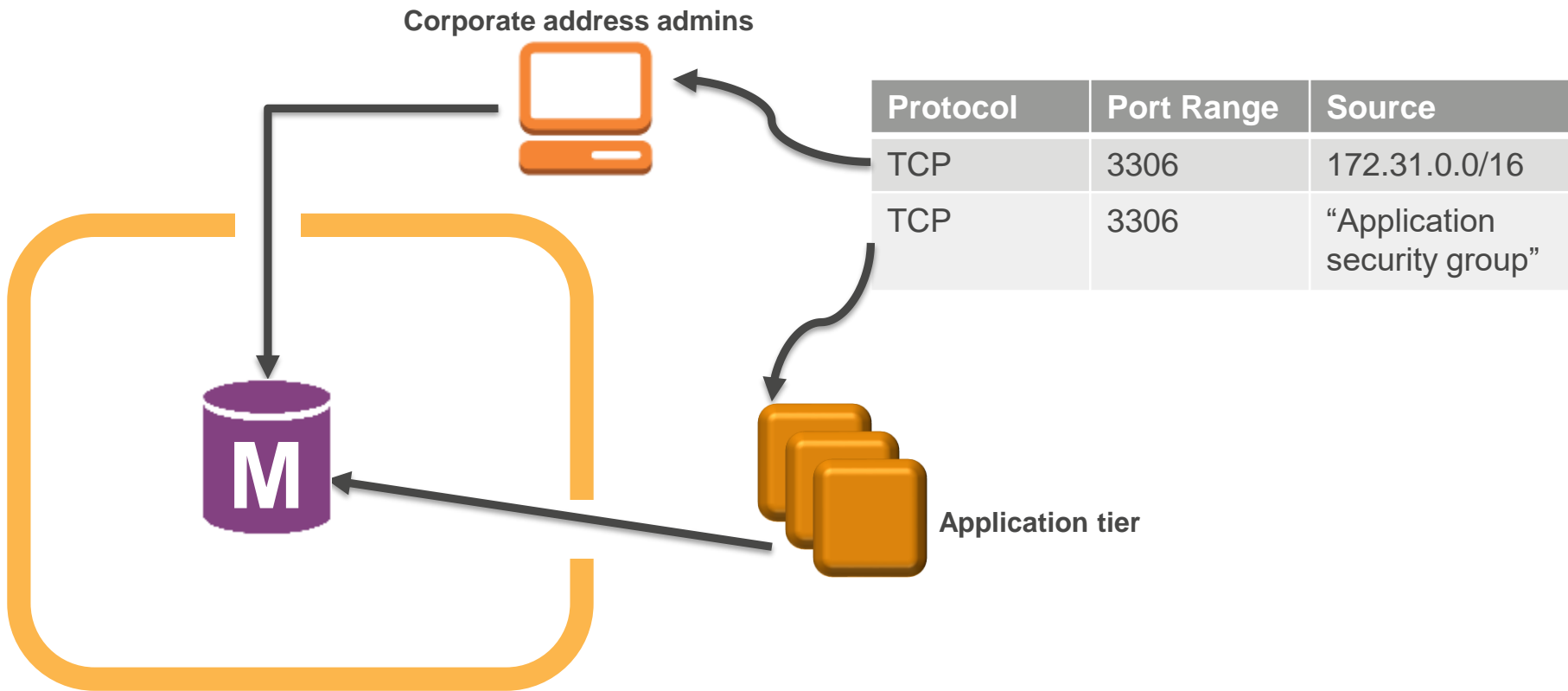
## Manage connectivity





# Security groups

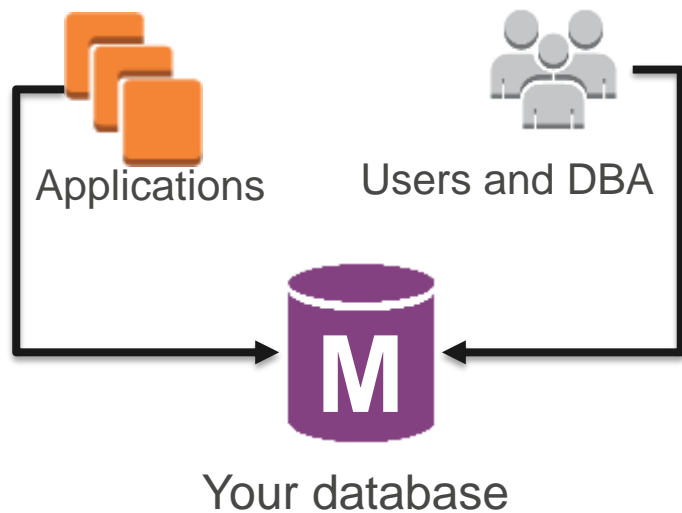
## Database IP firewall protection



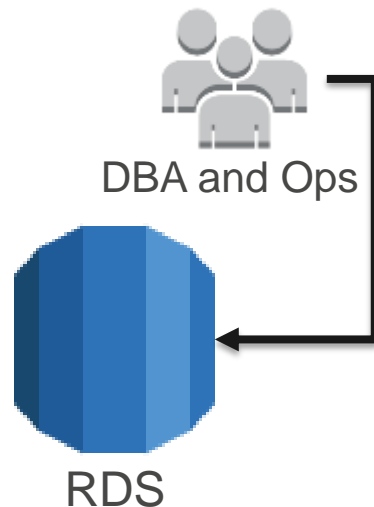
# IAM governed access

You can use AWS Identity and Access Management (IAM) to control who can perform actions on RDS

## Controlled with database grants



## Controlled with IAM



# At Rest Encryption for all RDS Engines

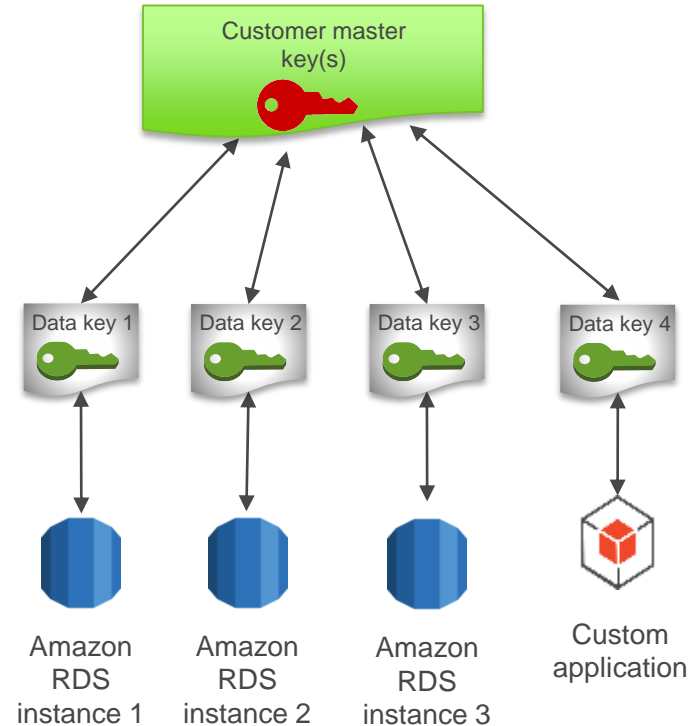
## AWS Key Management Service (KMS)

Two-tiered key hierarchy using envelope encryption:

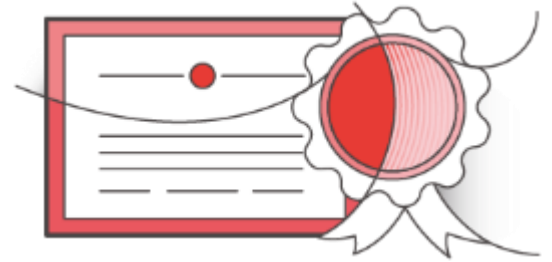
- Unique data key encrypts customer data
- AWS KMS master keys encrypt data keys
- Available for **ALL** RDS engines

Benefits:

- Limits risk of compromised data key
- Better performance for encrypting large data
- Easier to manage small number of master keys than millions of data keys
- Centralized access and audit of key activity



# Compliance



Singapore MTCS



27001/9001  
27017/27018

# Compliance

## Aurora

SOC 1, 2, 3  
ISO 20001/9001  
ISO 27107/27018  
PCI  
HIPAA BAA

## PostgreSQL

SOC 1, 2, 3  
ISO 20001/9001  
ISO 27107/27018  
PCI  
FedRamp  
HIPAA BAA  
UK Gov. Programs  
Singapore MTCS

## MySQL

SOC 1, 2, 3  
ISO 20001/9001  
ISO 27107/27018  
PCI  
FedRamp  
HIPAA BAA  
UK Gov. Programs  
Singapore MTCS

## MariaDB

SOC 1, 2, 3  
ISO 20001/9001  
ISO 27107/27018  
PCI

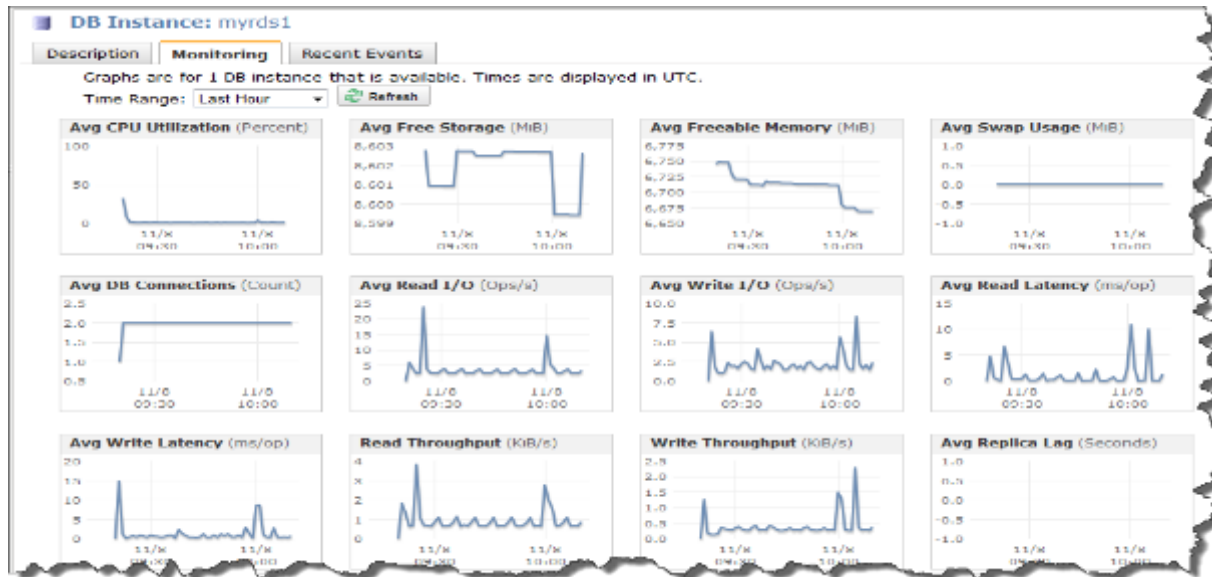
## Oracle

SOC 1, 2, 3  
ISO 20001/9001  
ISO 27107/27018  
PCI  
FedRamp  
HIPAA BAA  
UK Gov. Programs  
Singapore MTCS

## SQL Server

SOC 1, 2, 3  
ISO 20001/9001  
ISO 27107/27018  
PCI  
UK Gov.  
Programs  
Singapore MTCS

# Standard monitoring



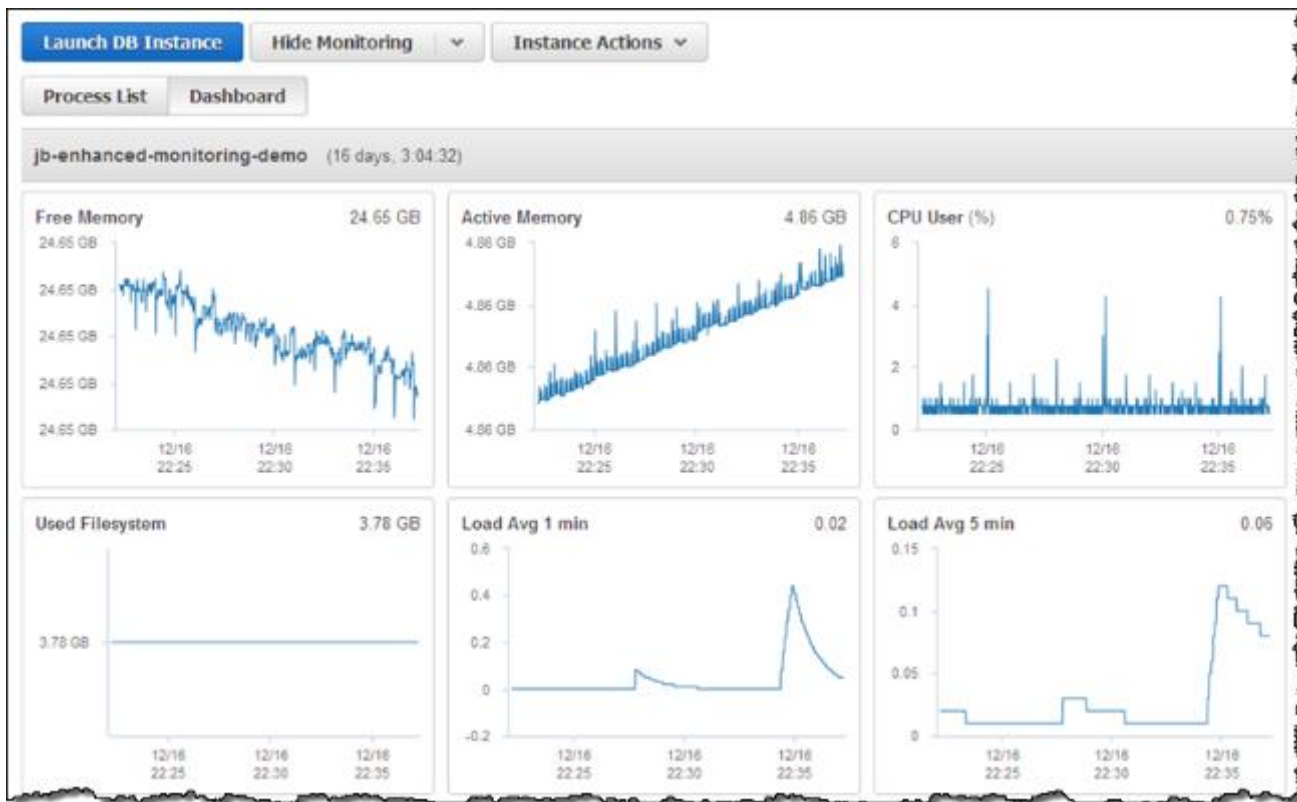
## Amazon CloudWatch metrics for Amazon RDS

- CPU utilization
- Storage
- Memory
- Swap usage
- DB connections
- I/O (read and write)
- Latency (read and write)
- Throughput (read and write)
- Replica lag
- Many more

## Amazon CloudWatch Alarms

- Similar to on-premises custom monitoring tools

# Enhanced Monitoring



Access to over 50 new CPU, memory, file system, and disk I/O metrics as low as 1 second intervals

# Amazon RDS Customers





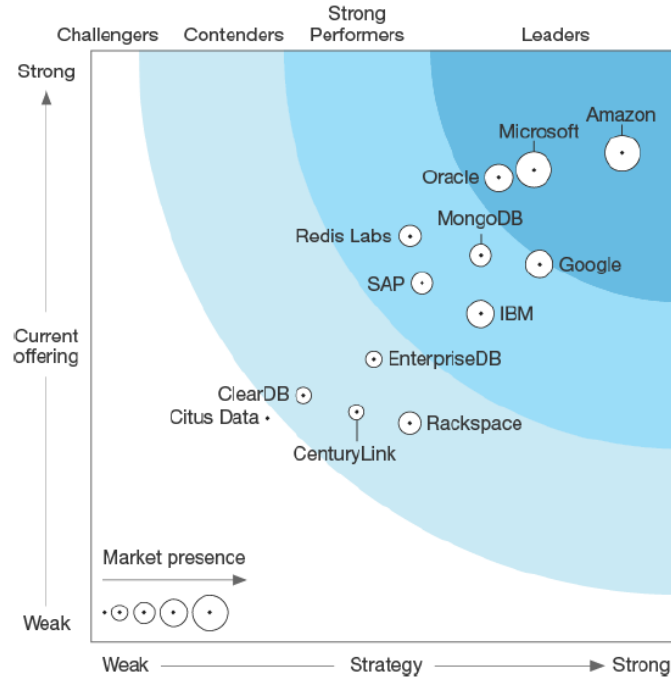
# Airbnb – Amazon RDS for MySQL



- Airbnb moved its main MySQL database to Amazon RDS with only 15 minutes of downtime
- RDS simplifies much of the time-consuming administrative tasks associated with databases so engineers can spend more time on features
- Uses asynchronous master-slave replication to improve website performance launched via the RDS console or an API call
- Leverages multi-Availability Zone (Multi-AZ) for high availability

# The Forrester Wave™: Database-As-A-Service, Q2 2017

FIGURE 4 Forrester Wave™: Database-As-A-Service, Q2 '17



The Forrester Wave™ is copyrighted by Forrester Research, Inc. Forrester and Forrester Wave™ are trademarks of Forrester Research, Inc. The Forrester Wave™ is a graphical representation of Forrester's call on a market and is plotted using a detailed spreadsheet with exposed scores, weightings, and comments. Forrester does not endorse any vendor, product, or service depicted in the Forrester Wave. Information is based on best available resources. Opinions reflect judgment at the time and are subject to change.

# **Amazon Aurora: Reinventing the Relational Database**

# Key Questions We Asked

- What if we started from a clean sheet of paper with only constraint being that the database was a relational database?
- Could we offer much better performance by leveraging the massive scale of our cloud?
- Could we give you a database with designed durability indistinguishable from 100% and availability of 99.99%?
- ...And could we be better and cheaper than the 30-year old commercial databases in use today?

# Amazon RDS for Aurora

A new relational database engine, built from the ground up to leverage AWS



**Fastest growing service  
in AWS history**

- MySQL compatible with up to 5x better performance on the same hardware: 100,000 writes/sec & 500,000 reads/sec
- Scalable with up to 64 TB in single database, up to 15 read replicas
- Highly available, durable, and fault-tolerant custom SSD storage layer: 6-way replicated across 3 Availability Zones
- Transparent encryption for data at rest using AWS KMS
- Stored procedures in Amazon Aurora can invoke AWS Lambda functions

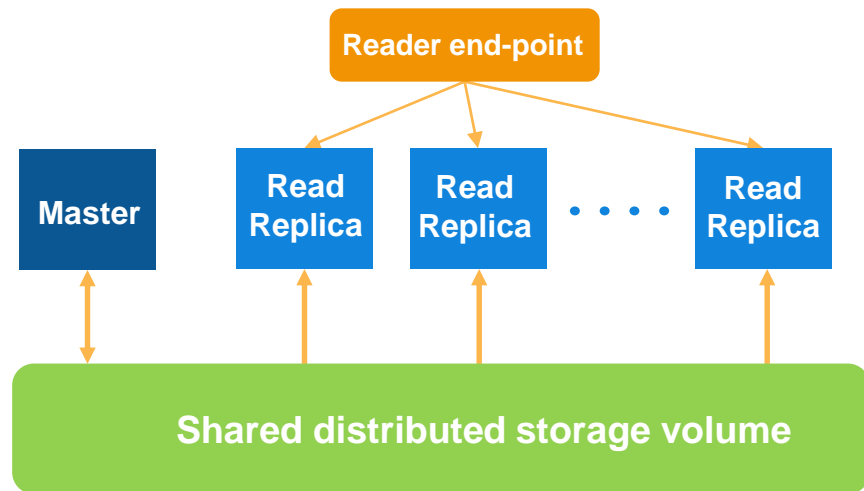
# Amazon Aurora Customers



# Use case: Near real-time analytics and reporting

A customer in the travel industry migrated to Aurora for their core reporting application accessed by ~1,000 internal users.

- Replicas can be created, deleted and scaled within minutes based on load.
- Read-only queries are load balanced across replica fleet through a DNS endpoint – no application configuration needed when replicas are added or removed.
- Low replication lag allows mining for fresh data with no delays, immediately after the data is loaded.
- Significant performance gains for core analytics queries - some of the queries executing in 1/100<sup>th</sup> the original time.



- ▶ Up to 15 promotable read replicas
- ▶ Low replica lag – typically < 10ms
- ▶ Reader end-point with load balancing

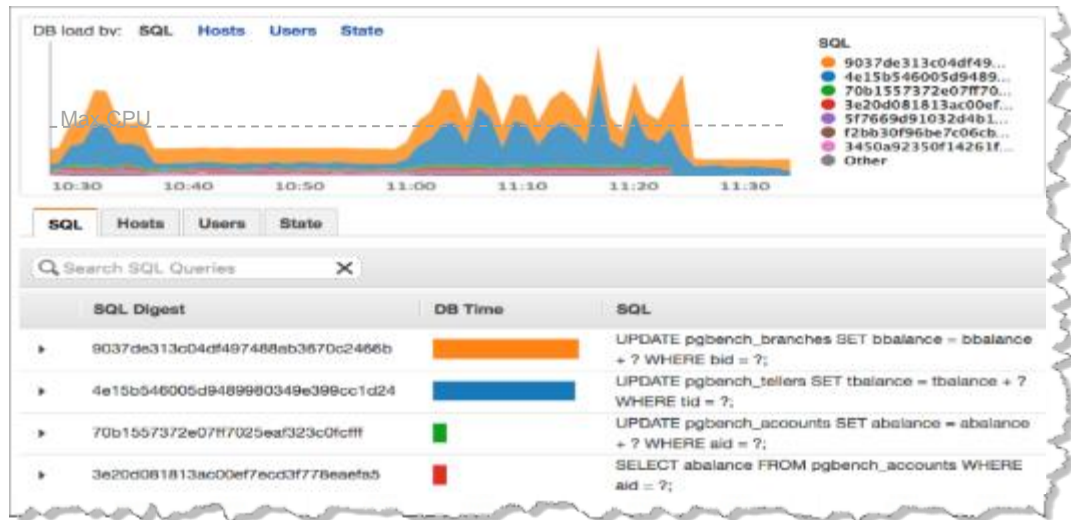
# Amazon Aurora is now PostgreSQL-compatible



- PostgreSQL 9.6 compatibility with support for PostGIS
- All the features you expect from Amazon Aurora including 15 read replicas with <10ms lag, shared storage, failover without data loss, 6-way replication across 3 Availability Zones, encryption with AWS KMS
- Available now in preview



# Amazon RDS Performance Insights



## Simplify monitoring from the AWS Management Console

- Database load: Identifies database bottlenecks
  - Easy
  - Powerful
- Identifies source of bottlenecks
  - Top SQL
- Adjustable time frame
  - Hour, day, week, and longer

# AWS Database Migration Service



- Fully managed service for migration from on-premises to the AWS Cloud with minimal downtime
- Migrates data to and from all widely used commercial and open source DBs
- Schema Conversion Tool that converts source DB schemas, stored procedures and application code to a different target format
- Supports homogenous and heterogeneous data replication
- A terabyte-sized DB can be migrated for as little as \$3

# Database Conversion Capabilities in SCT

## Source Database

Microsoft SQL Server

MySQL, MariaDB

Oracle

Oracle Data Warehouse

PostgreSQL

Teradata, Netezza, Greenplum

HP Vertica, SQL Server DW

MongoDB

## Target Database

➔ Amazon Aurora, MySQL, PostgreSQL

➔ Amazon Aurora, PostgreSQL

➔ Amazon Aurora, MySQL, PostgreSQL

➔ Amazon Redshift

➔ Amazon Aurora, MySQL

➔ Amazon Redshift

➔ Amazon Redshift

➔ Amazon DynamoDB

# AWS Database Migration Service Customers



# Heterogeneous Migration



- Oracle private DC to RDS PostgreSQL migration
- Used the AWS Schema Conversion Tool to convert their database schema
- Used on-going replication (CDC) to keep databases in sync until they reached the cutover window
- Benefits:
  - Improved reliability of the cloud environment
  - Savings on Oracle licensing costs
  - SCT Assessment Report let them understand the scope of the migration

Learn more..  
**[aws.amazon.com/rds](https://aws.amazon.com/rds)**

**Thank you!**

