



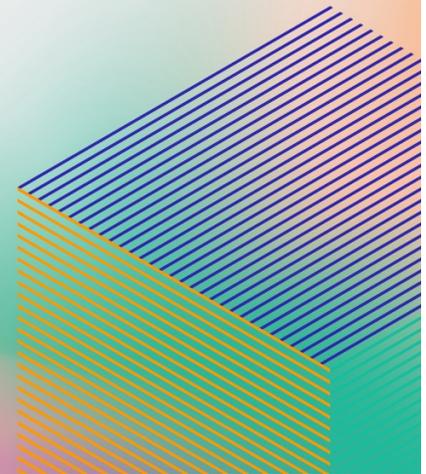
SQLBITS2022-RDSMSSQL

SQLBITS - MARCH 2022

Amazon RDS for SQL Server **- *Deploying SQL Server on the AWS Cloud***

John Q. Martin (HE | HIM)

Specialist Solutions Architect
AWS



Presenter Details



John Q. Martin (HE | HIM)

Specialist Solutions Architect
AWS

Over 15 years experience working with data platform technology on-premises and in cloud based environments.

AWS and Microsoft Certified.
Chartered IT Professional.



AGENDA

What we will be covering today.

1. Introduction to AWS ecosystem

- Key terminology and concepts.
- What is Amazon RDS for SQL Server.
- High-level overview of architecture & objective for the day.

2. Deploying & Configuring Amazon RDS for SQL Server

- Core infrastructure requirements.
- Parameter & Option Groups.
- High Availability.

3. Database Migration Options

- Backup & Restore.
- AWS Database Migration Service.

4. Security & Compliance Options

- IAM
- Instance Security

5. Disaster Recovery

6. Monitoring, Scaling, and Optimisation



Logistics of the day

Coffee Breaks

- 10:30 – 11:00
- 15:00 – 15:30

Lunch

- 12:30 – 13:30
- Expo Hall
- Served in pre-filled pots

Fire Safety

- At either end of the Excel. (In the car park beside the Aloft or the square beside the Novotel)
- No alarm test planned.

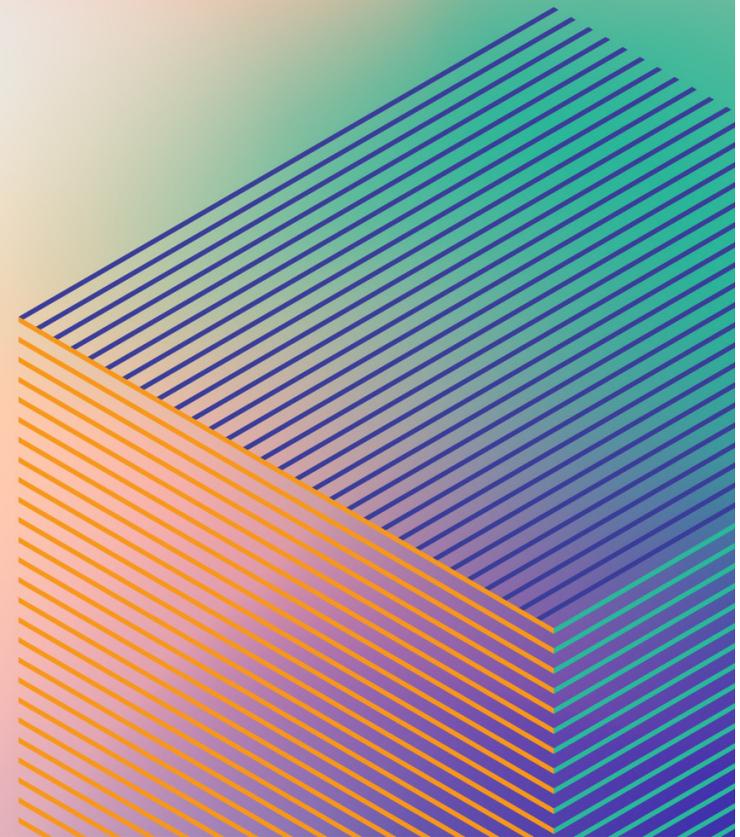
Event Specifics

- See helpers in Orange shirts or speak to team at registration desk.

AWS Terminology & Concepts.



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



The Well Architected Framework.

Building scalable and secure solutions in the AWS Cloud

Operational Excellence

Running & Monitoring

Continuous Improvement

Automation

Security

Protecting information

Authentication & Authorisation

Event Detection

Reliability

Recovery Quickly

Distributed System Design

Recovery Planning

Performance Efficiency

Allocation of Resources

Scale-up Vs. Scale-out

Matching evolving needs

Cost Optimization

Avoid Unnecessary Costs

Scaling without overspending

Cost Visibility & Management

Sustainability

Minimizing environmental impact.

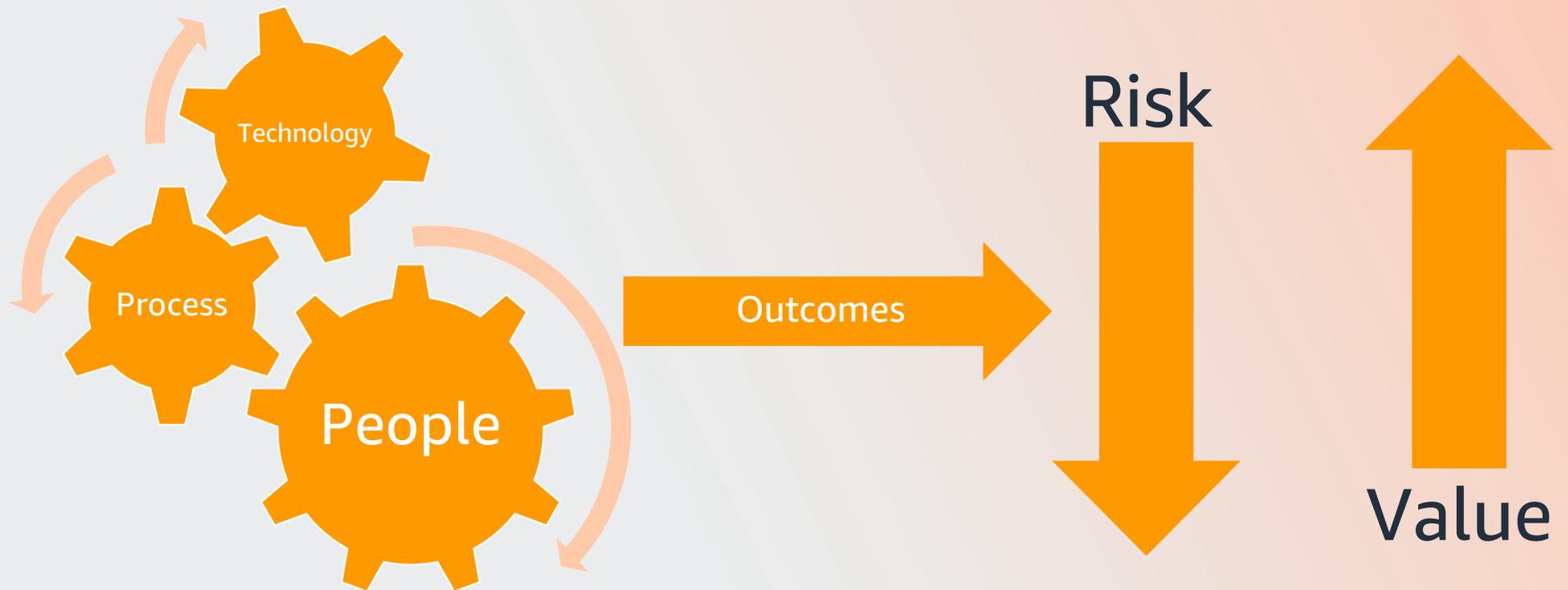
Maximizing utilization

Minimise downstream impacts



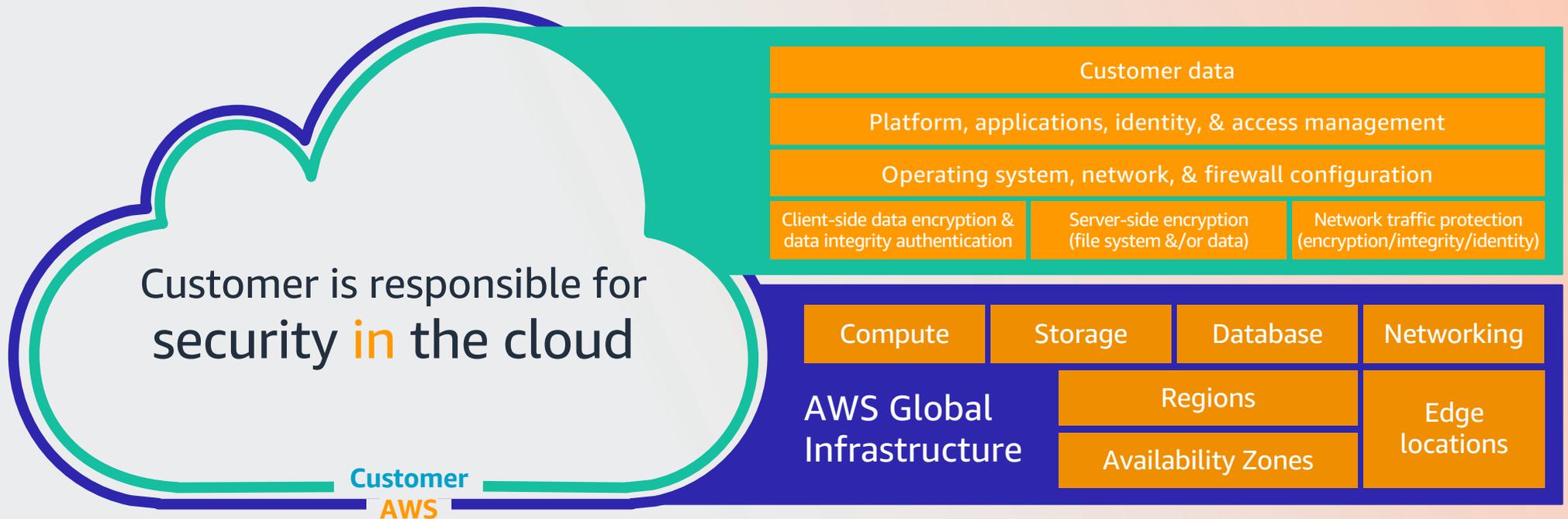
The Cloud Adoption Framework.

Building scalable and secure solutions in the AWS Cloud



Shared Responsibility Model.

Building scalable and secure solutions in the AWS Cloud



AWS is responsible for security **of** the cloud



Regions and Availability Zones.

Building scalable and secure solutions in the AWS Cloud



Region & Number of Availability Zones

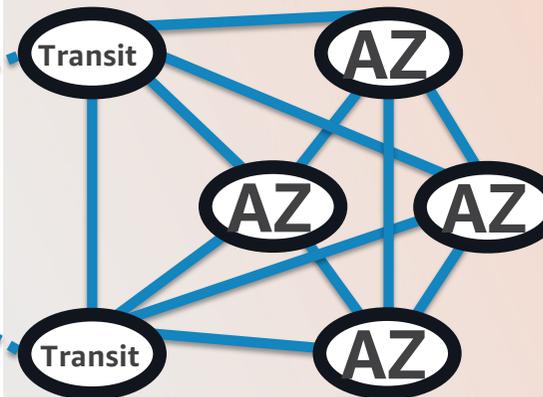
○ Announced Regions
Spain, Switzerland, Israel, UAE, Hyderabad, Auckland, Canada West, and Melbourne

25 Regions
81 Availability Zones
230+ Points of Presence



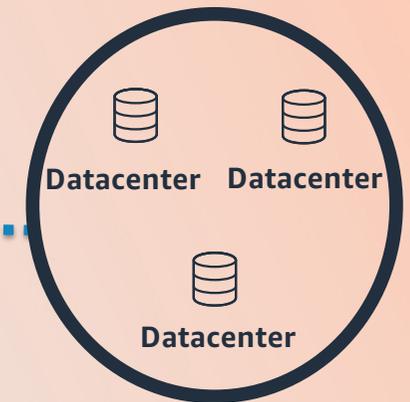
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

AWS Region



A Region is a physical location in the world where we have multiple Availability Zones.

AWS Availability Zone (AZ)

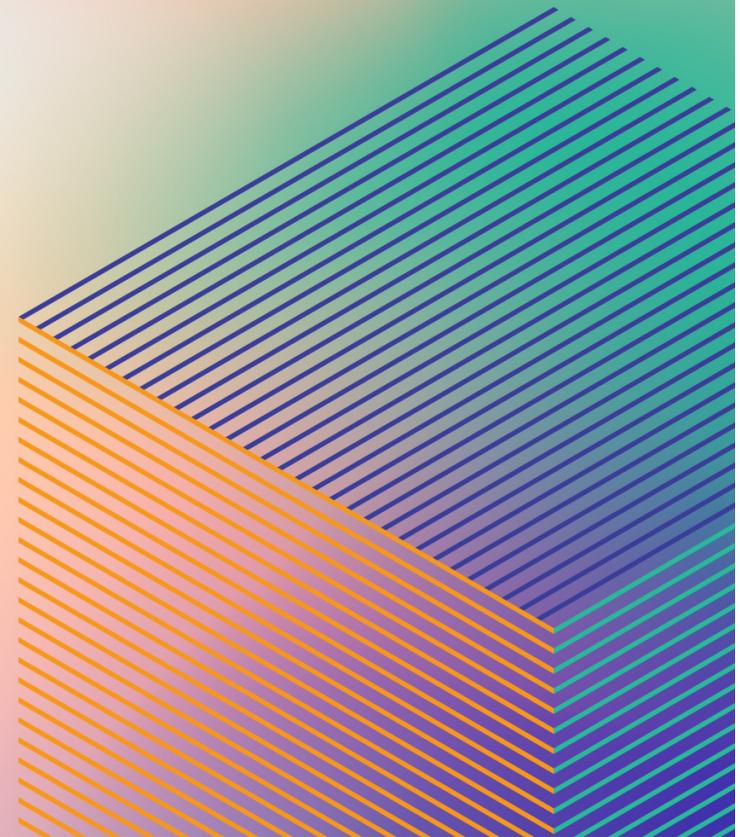


Availability Zones consist of one or more discrete data centers, each with redundant power, networking, and connectivity, housed in separate facilities.

What is Amazon RDS for SQL Server?



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



Amazon RDS for SQL Server

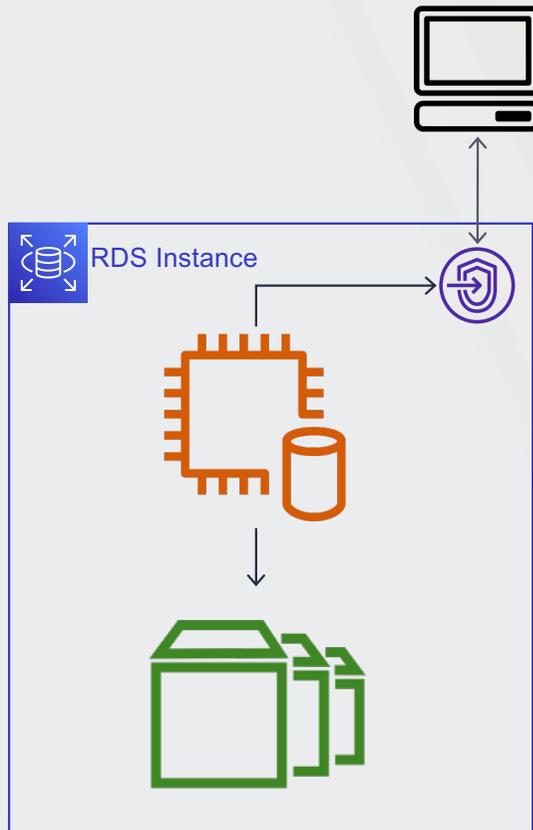
Managed SQL Server Database Service.

- On-Demand AWS Managed Database Infrastructure Service delivering the Microsoft SQL Server database engine.
 - Support for SQL Server 2012 to 2019
 - Express, Web, Standard, and Enterprise Edition
 - License Included
- Push-button Scaling
 - Instance Classes for compute and memory resources when you need them
 - Auto-scaling storage capacity and IOPS



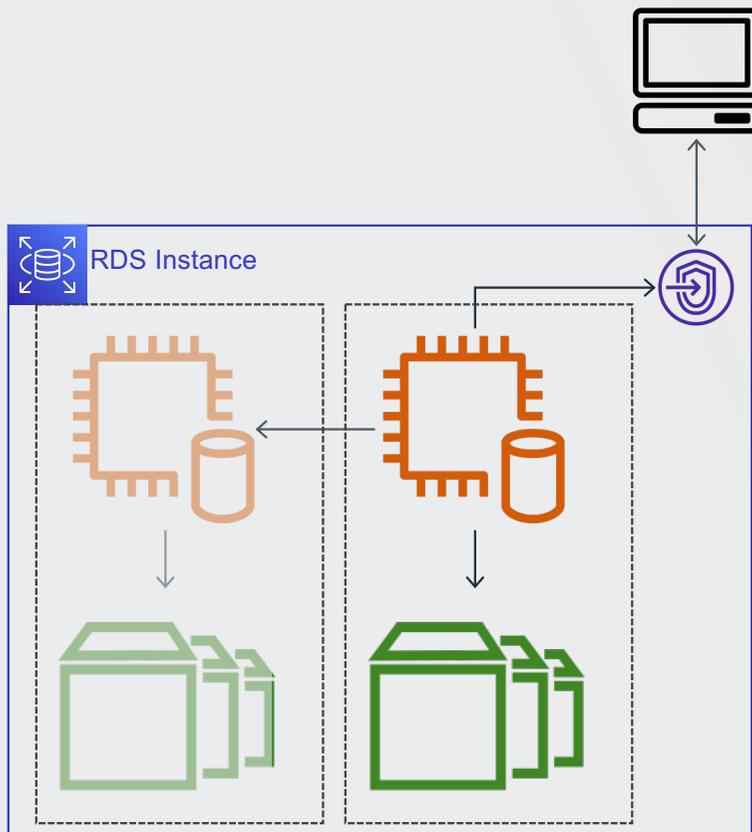
Amazon RDS for SQL Server

Managed SQL Server Database Service.



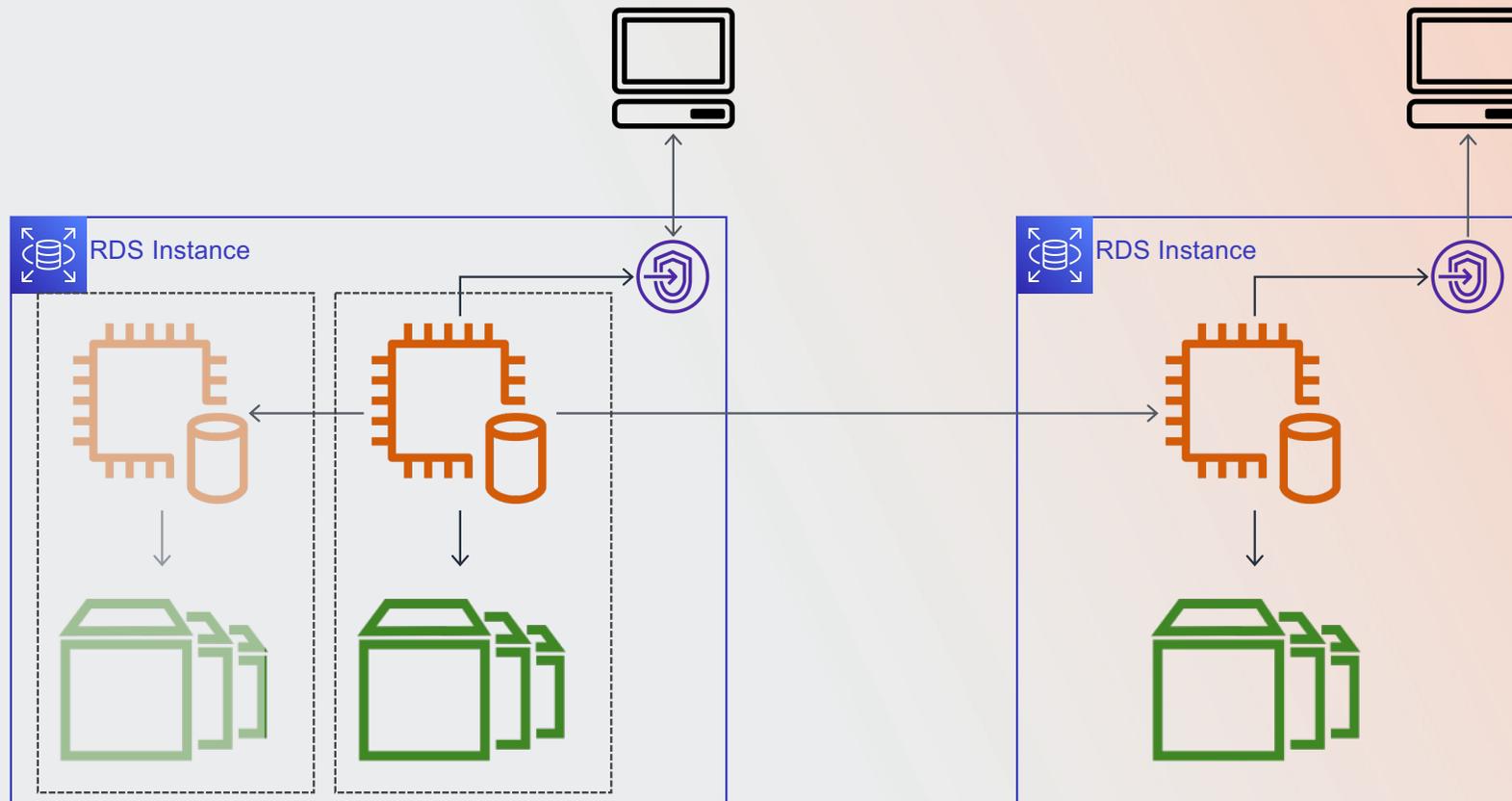
Amazon RDS for SQL Server

Managed SQL Server Database Service.



Amazon RDS for SQL Server

Managed SQL Server Database Service.



Amazon RDS for SQL Server

Managed SQL Server Database Service.

Meeting Business Requirements

Database Optimisation

Application Level Security

Database Design

Scaling

High Availability

Database Backups

DBMS Patching

DBMS Install/Maintenance

OS Patching

OS Installation

Power, HVAC, Network



Amazon RDS for SQL Server

Managed SQL Server Database Service.

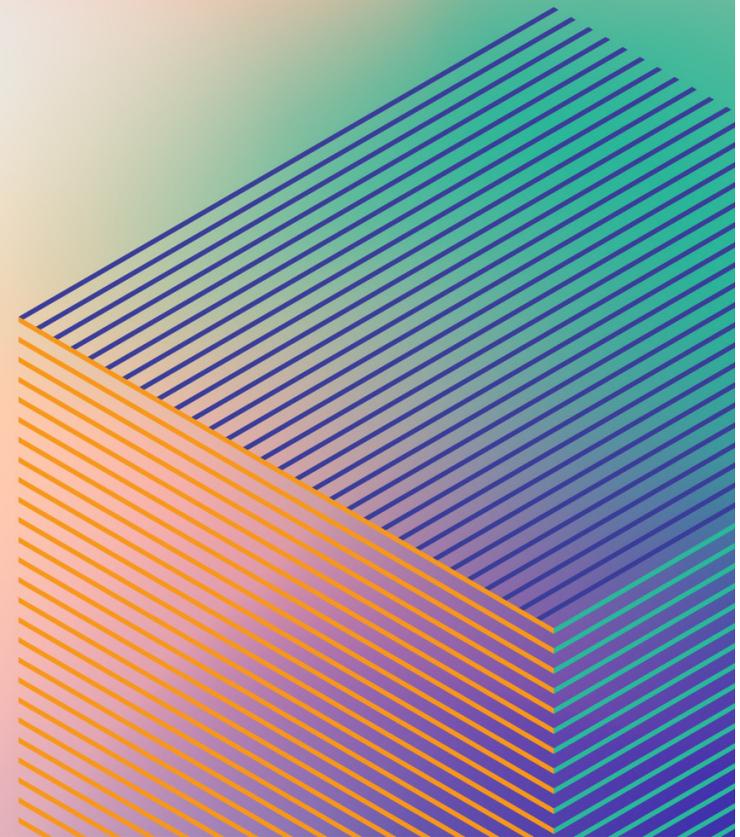
- Customer responsibilities for database maintenance.
 - Consistency checking (CHECKDB)
 - Index and Statistics Maintenance (e.g. Ola's scripts)
 - Logins and database level security
- User Initiated Backup Options
 - Built-in SQL Server backup to S3 (FULL, DIFFERENTIAL)
 - Manual Snapshots



Deploying RDS for SQL Server.

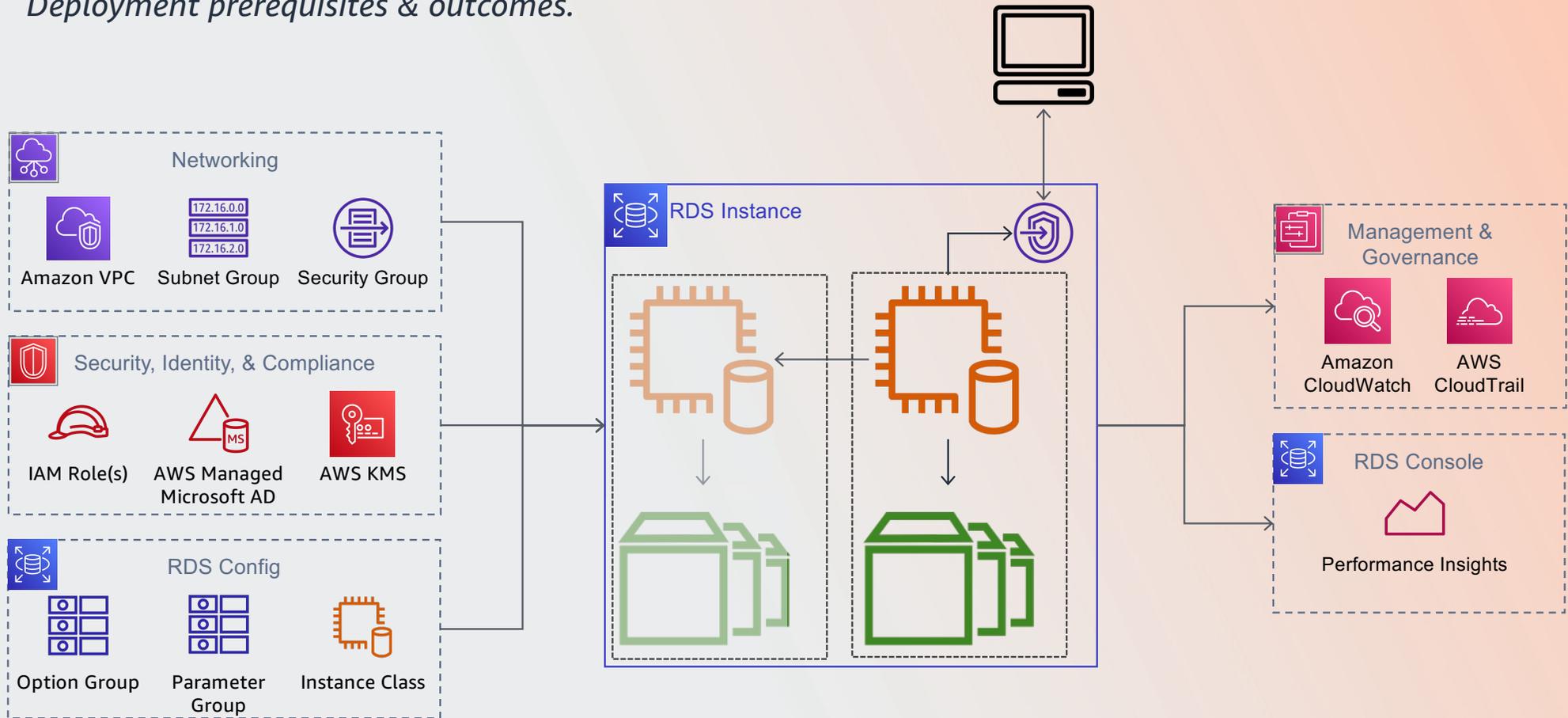


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



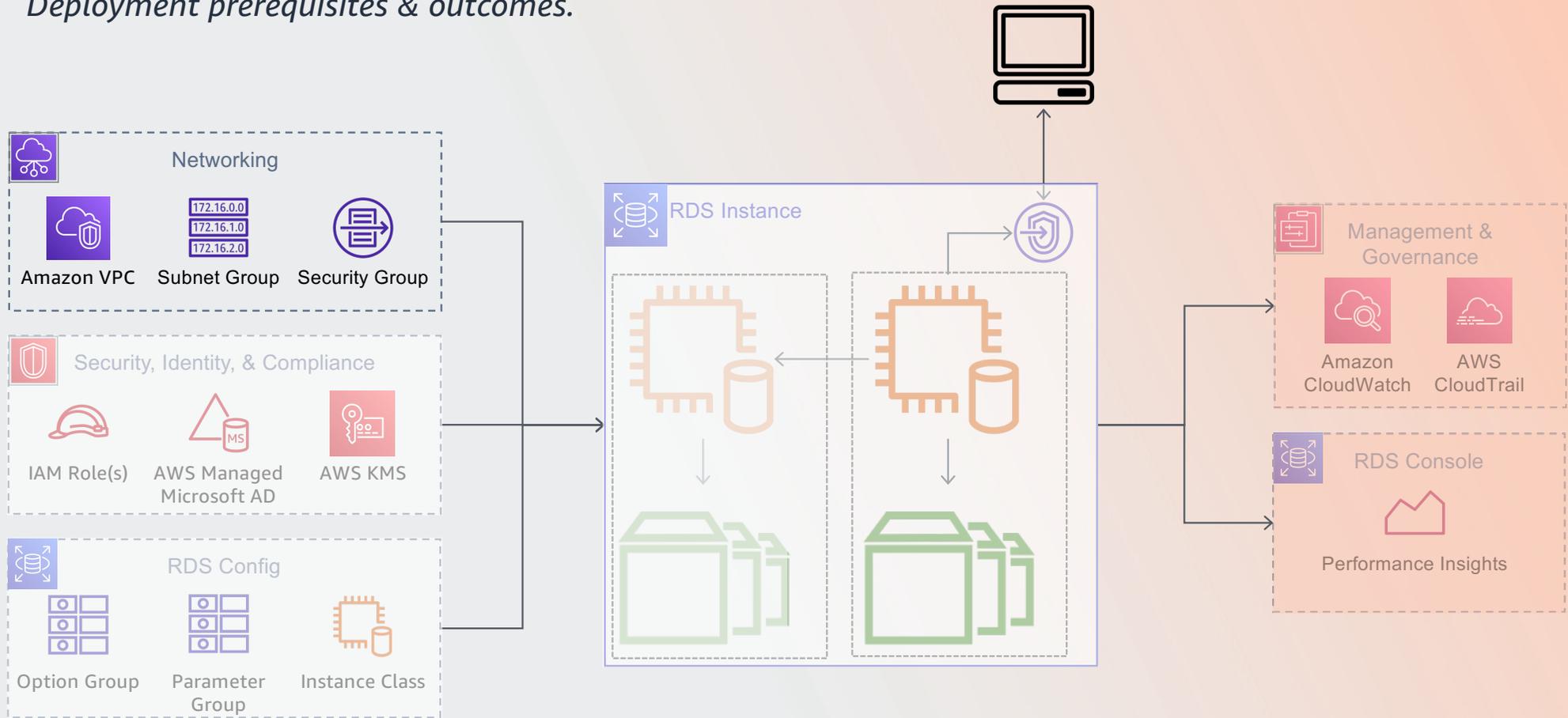
Amazon RDS for SQL Server

Deployment prerequisites & outcomes.



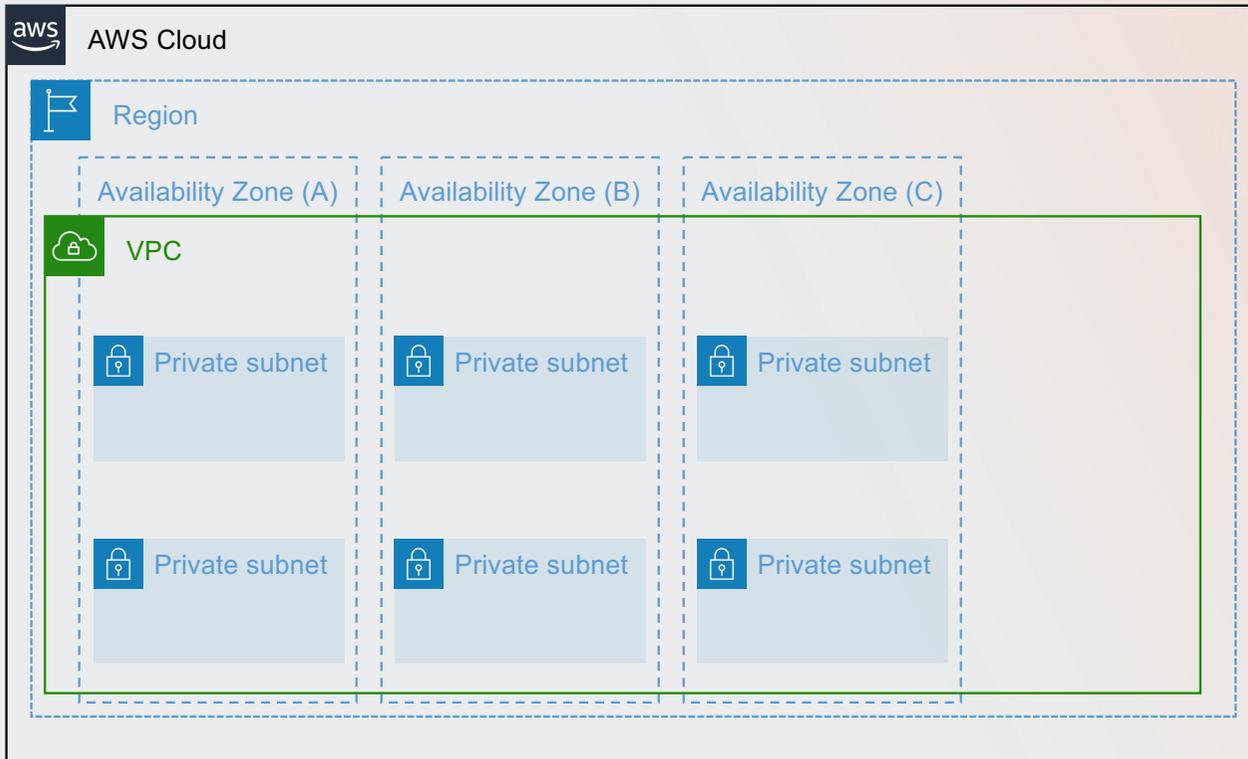
Amazon RDS for SQL Server

Deployment prerequisites & outcomes.



Networking for RDS

RDS for SQL Server network components.



Amazon Virtual Private Cloud (VPC)

- **Customer controlled network environment.**
- **Secure hybrid connectivity.**
- **Access control to resources within VPC.**

Networking for RDS

RDS for SQL Server network components.

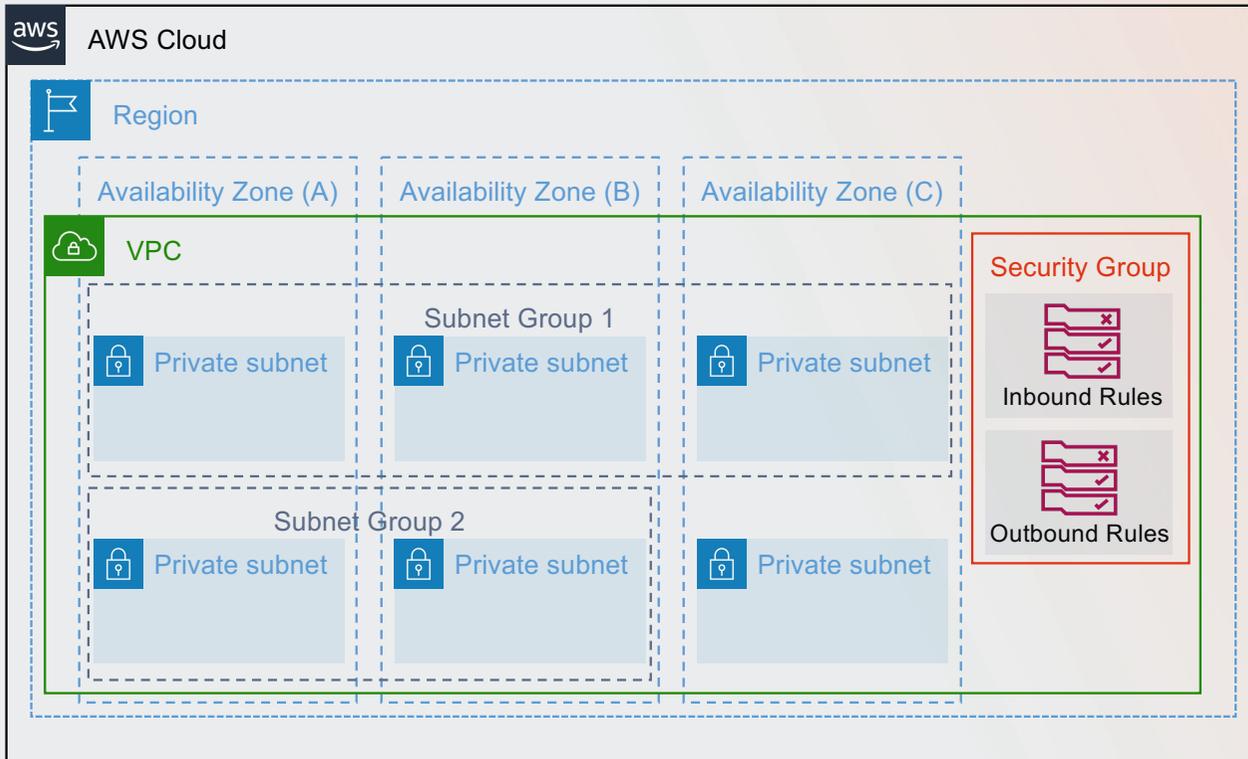


Subnet Groups

- **Collection of subnets.**
- **Used by Database Instances for connectivity.**
- **Subnets must be in two or more different AZs.**

Networking for RDS

RDS for SQL Server network components.

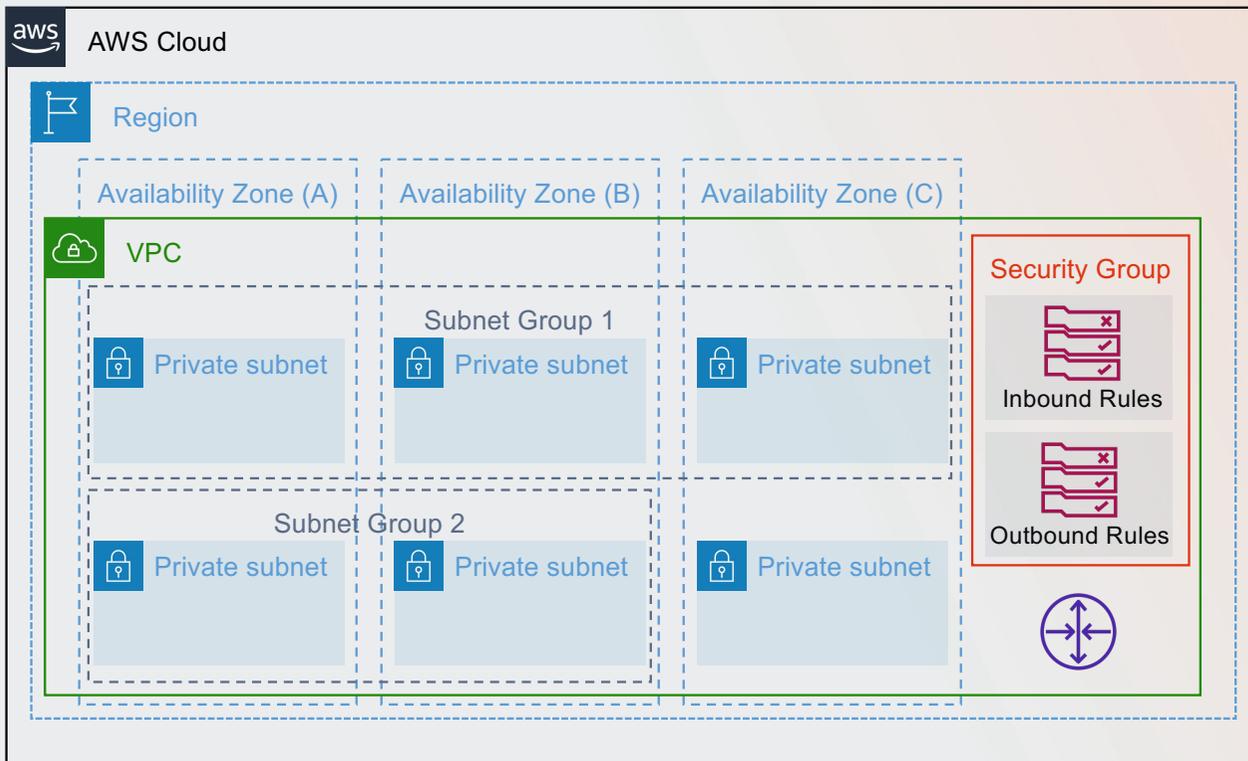


Security Groups

- Acts like a virtual firewall for instances they are linked to.
- Stateful for request/response traffic.
- Can be used to manage access from other security groups.

Networking for RDS

RDS for SQL Server network components.



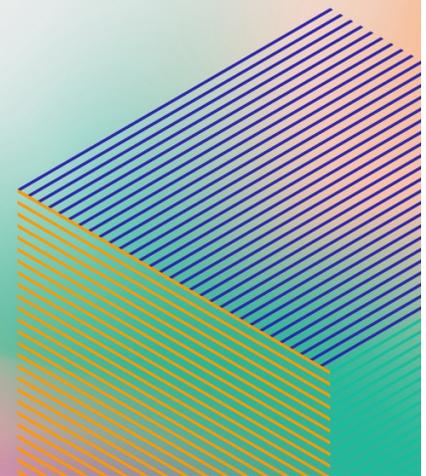
Routing

- **Main route table created by default.**
- **Custom route tables needed for specific routing requirements.**

Demo

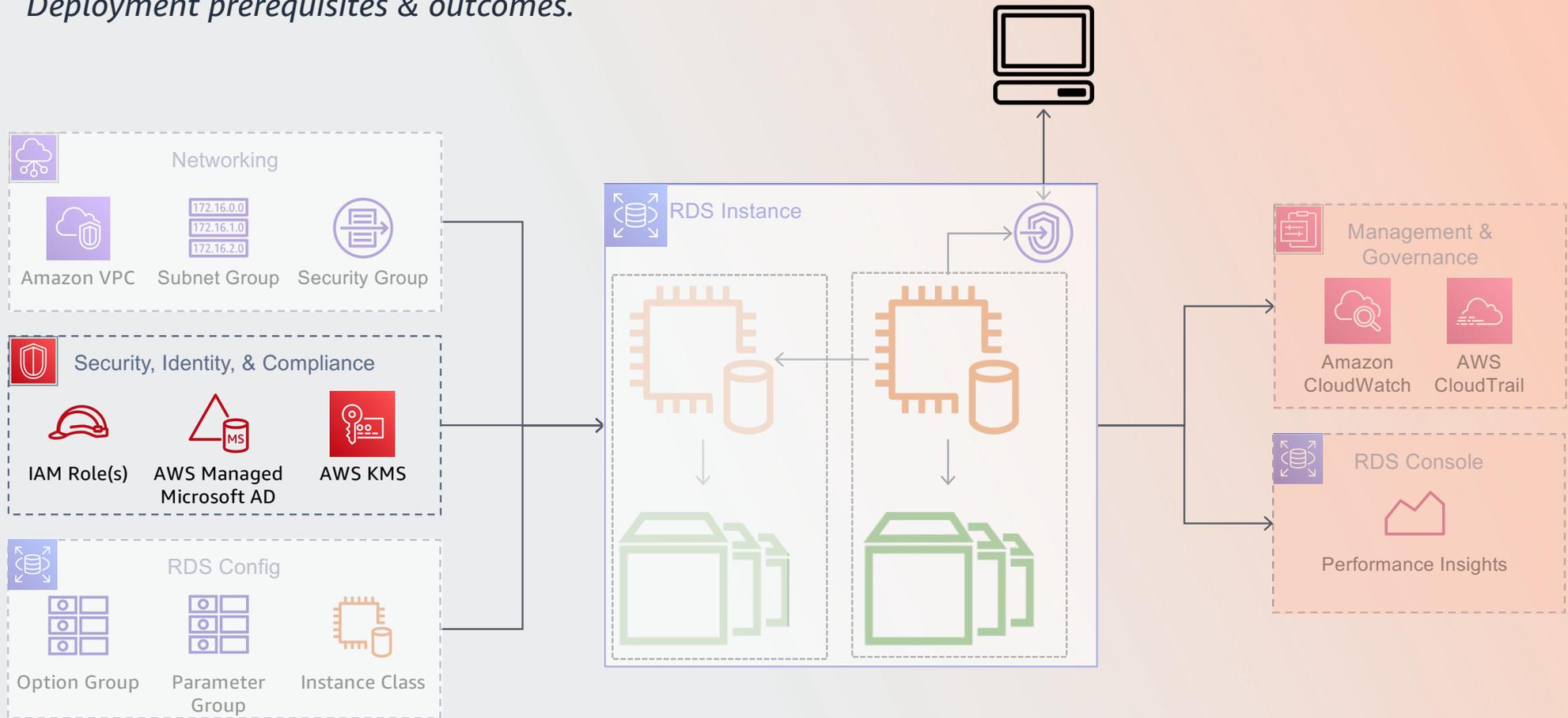


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



Amazon RDS for SQL Server

Deployment prerequisites & outcomes.

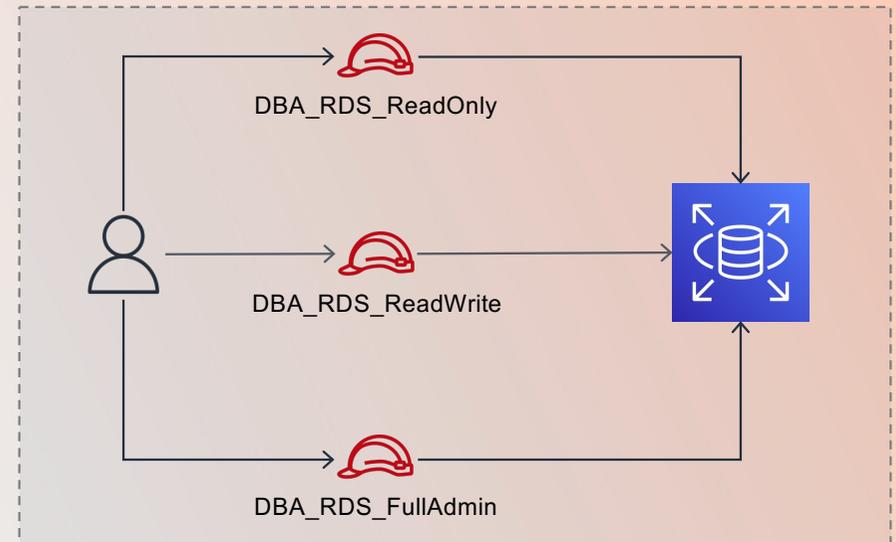


Security, Identity, and Compliance

Authentication and Authorisation for Amazon RDS for SQL Server.

IAM Roles

- Control Access to AWS account for DBA team
- AWS IAM is primarily about *managing infrastructure* and not access to the data within the RDS instance
- On-prem identities are *exchanged* for an IAM role that is *assumed* to perform API actions with temporary credentials
- Avoid large aggregated permission sets and drive towards least permission



Security, Identity, and Compliance

Authentication and Authorisation for Amazon RDS for SQL Server.

IAM Policies

- Principal, Action, Resource, Condition
- Who can do what to which resources under which circumstances
- Authorise allowed actions and define denied guardrails for what must never be allowed
- Multiple policy constructs which can be used depending on the requirements and the service.
- Defined using YAML or JSON document defining the actions that can be performed.

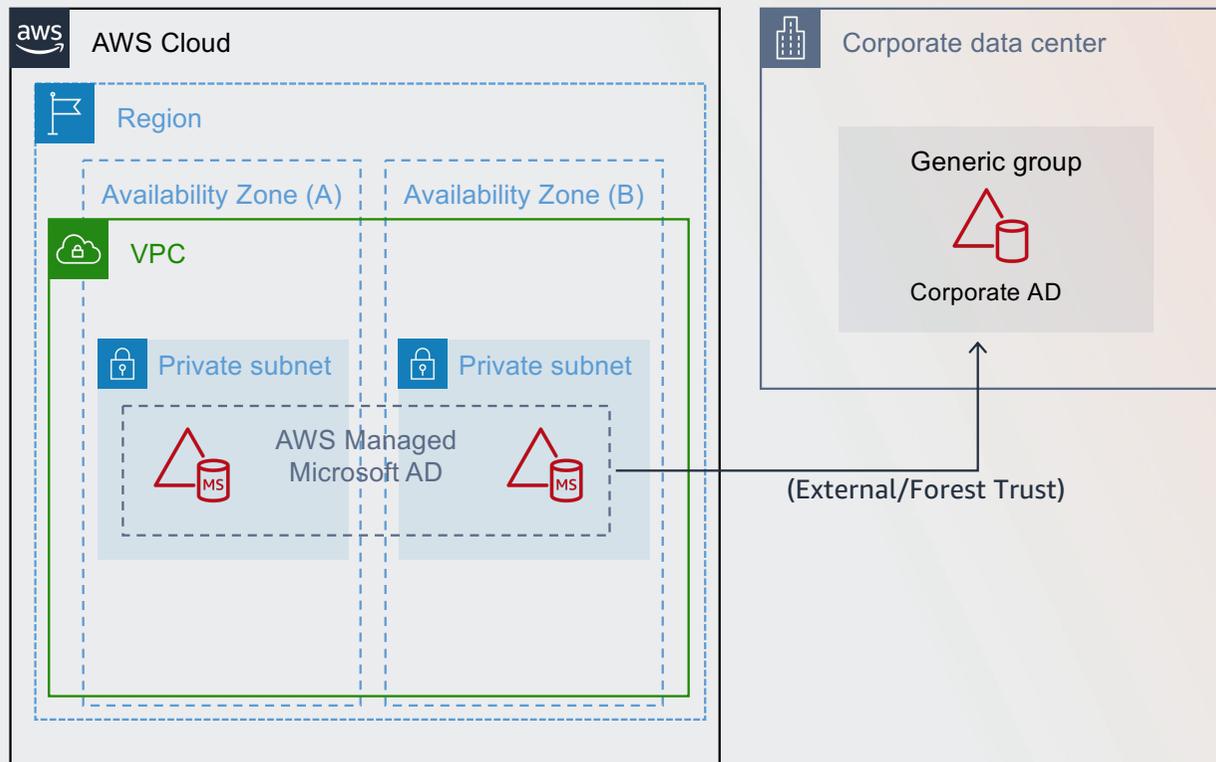
```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "rds:*",
      "Resource": ["arn:aws:rds:eu-west-1:*:*"]
    },
    {
      "Effect": "Allow",
      "Action": ["rds:Describe*"],
      "Resource": ["*"]
    }
  ]
}
```

Allow full RDS access within a specific region.



Security, Identity, and Compliance for RDS

RDS for SQL Server authorisation and authentication.



AWS Managed AD

- Required for Windows Authentication with RDS for SQL Server.
- Can form trusts with self-managed Microsoft Active Directory.
- Can be deployed in a resilient multi-AZ pattern.

Security, Identity, and Compliance

Authentication and Authorisation for Amazon RDS for SQL Server.

AWS Key Management Service

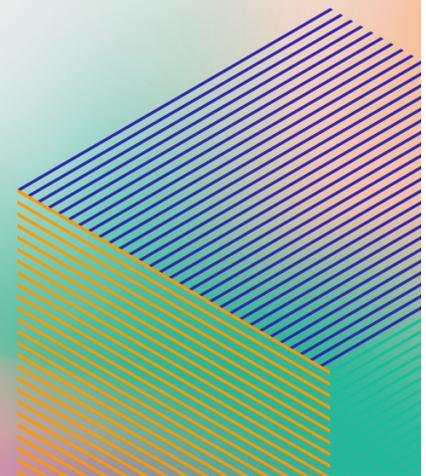
- Managed service to create and manage cryptographic keys, both symmetric for at-rest data encryption & asymmetric for sign/verify or encrypt/decrypt
- Integrates with Amazon RDS to encrypt instance infrastructure – at rest – it does not relate to encrypting fields or columns
- AWS or Customer Managed key options.
- Automatic or manual key rotation options
- Key material & cryptographic operations are only ever within the validated cryptographic module in the KMS HSM fleet



Demo

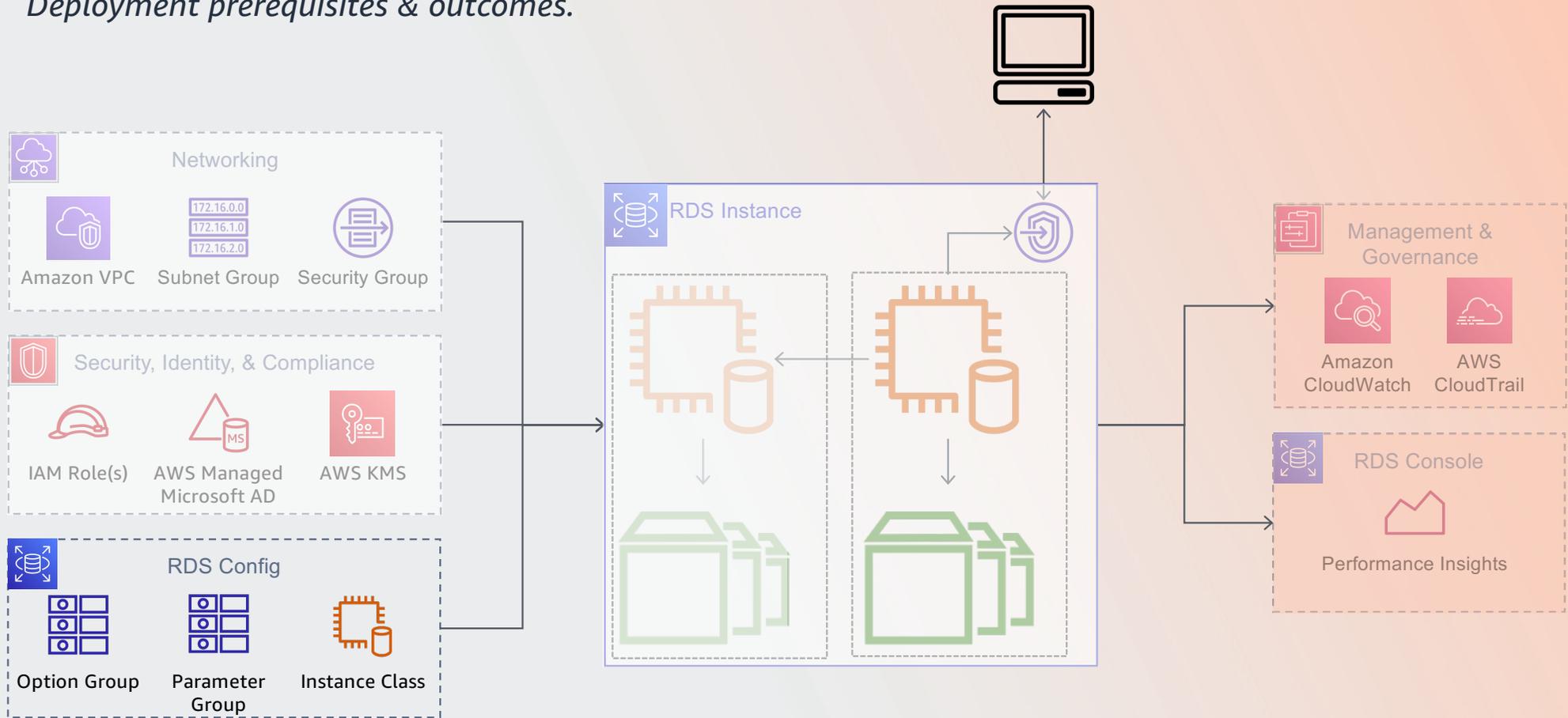


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



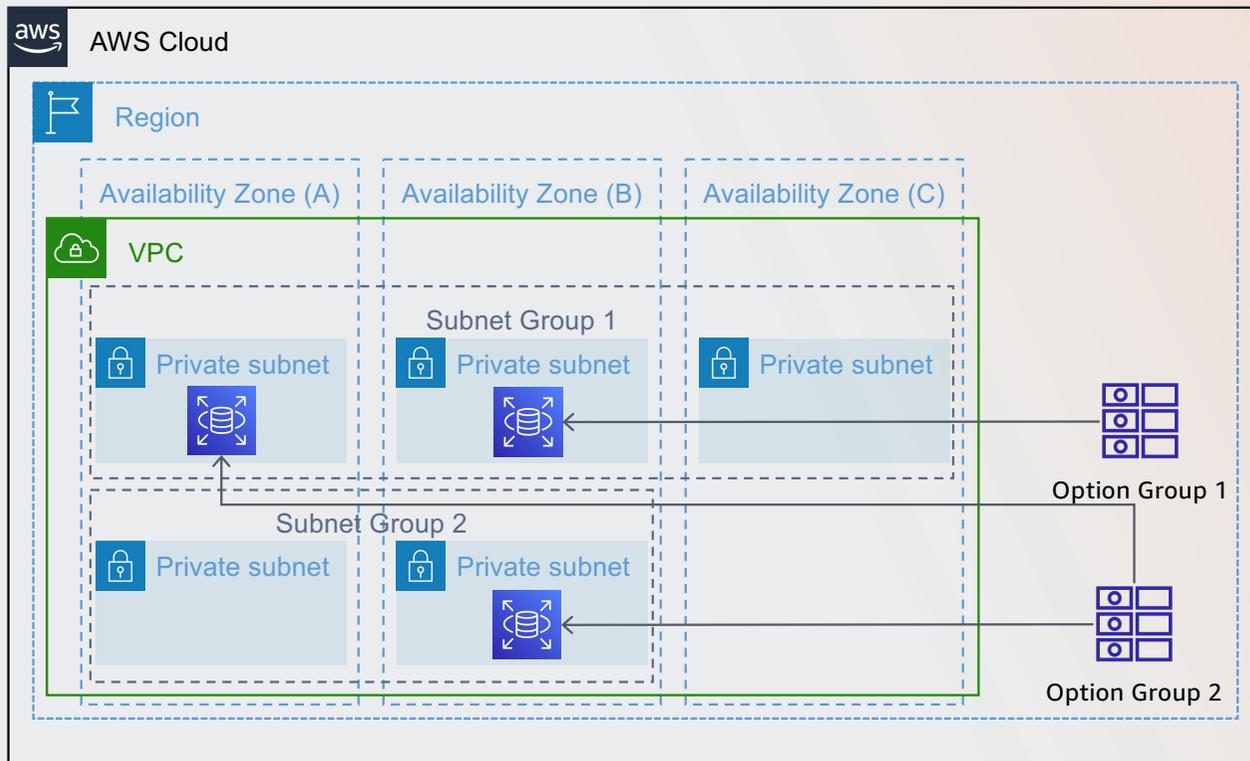
Amazon RDS for SQL Server

Deployment prerequisites & outcomes.



Amazon RDS Configuration

Controlling features, functionality, and capability.

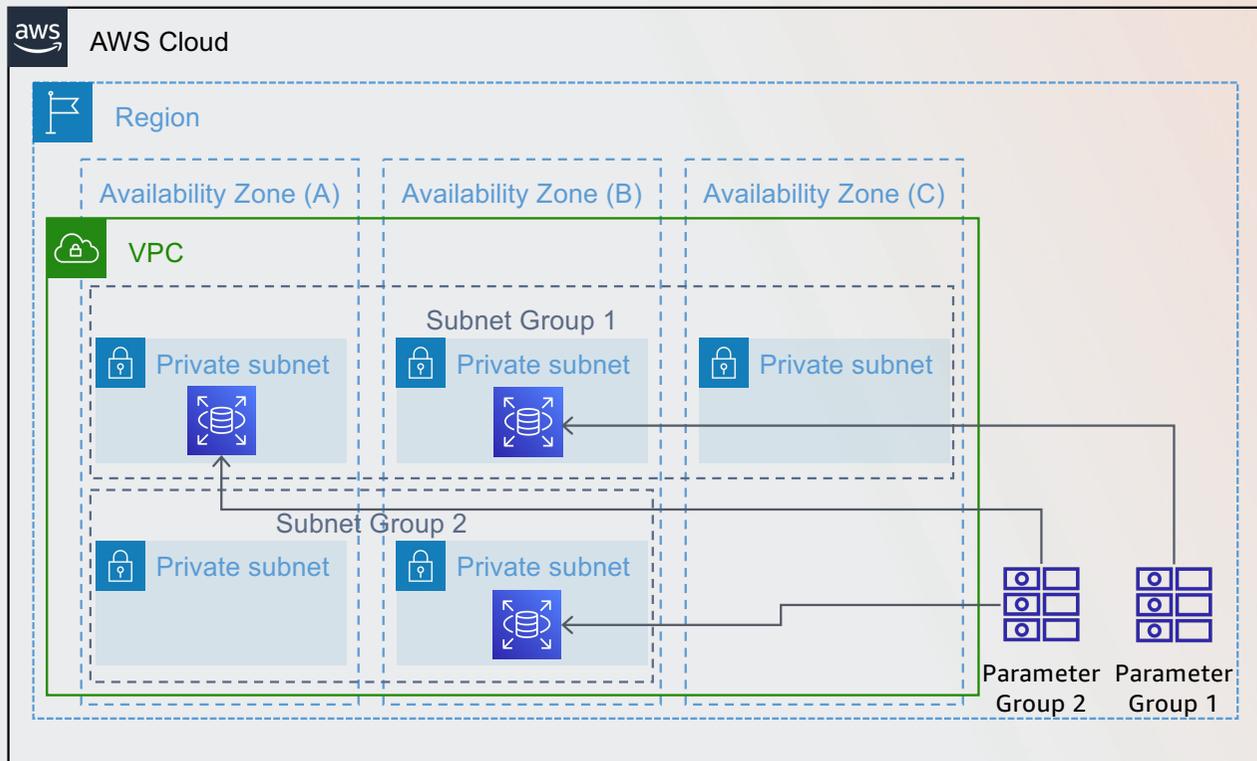


Option Groups

- Used for feature deployment and configuration.
- Can apply to one or more instances.

Amazon RDS Configuration

Controlling features, functionality, and capability.

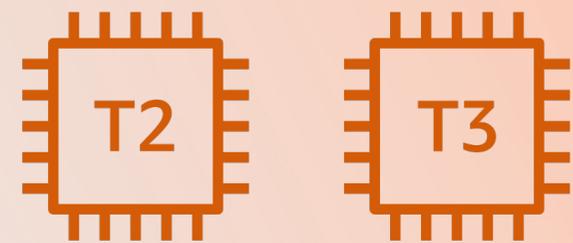
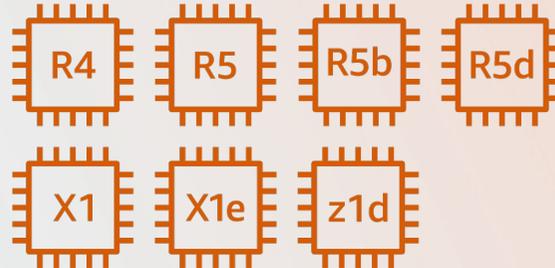
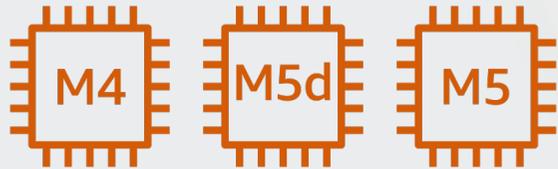


Parameter Groups

- Used for SQL Server configuration (`sp_configure`).
- Can apply to one or more instances.
- Some settings cannot be altered.

Amazon RDS Configuration

Controlling features, functionality, and capability.



General Purpose

Provide a balance of compute, memory, and networking resources.

Can handle diverse workloads where resource usage is balanced.

Memory Optimized

Designed to deliver fast performance for memory based workloads.

Good for databases, in-memory cache, or real-time big data analytics.

Burstable Performance

Provide a baseline level of CPU performance, with ability to burst higher if needed.

Useful for spikey workloads where there is a high degree of idle time.

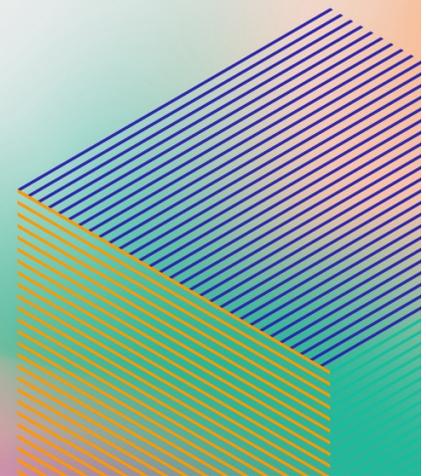
db.m5d.8xlarge



Demo

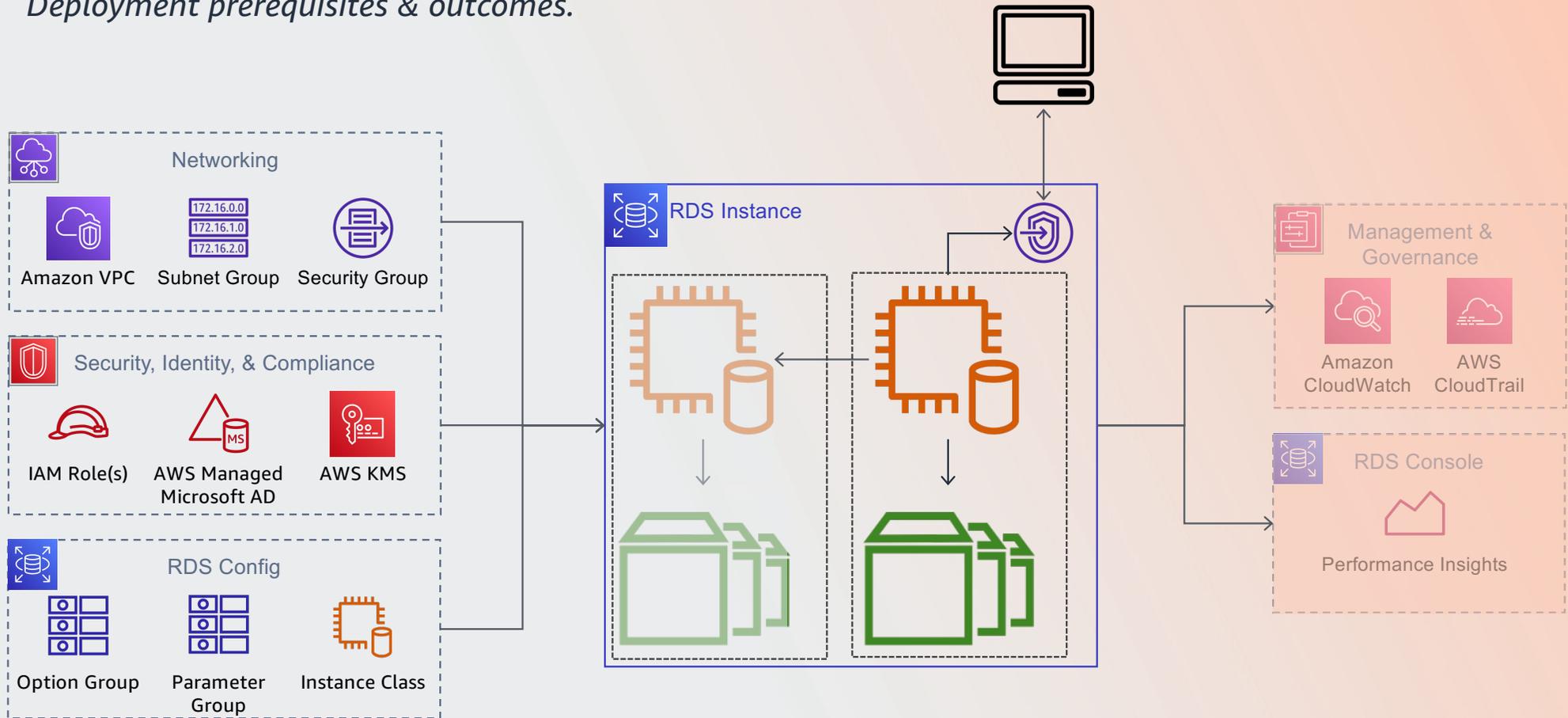


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



Amazon RDS for SQL Server

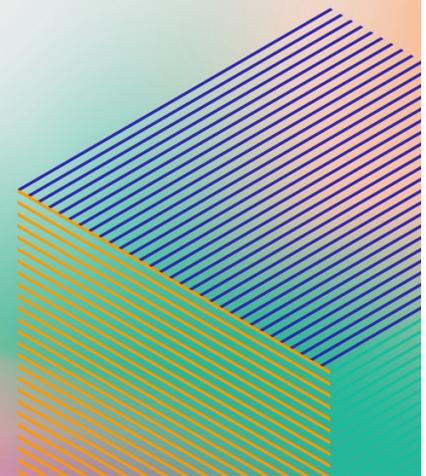
Deployment prerequisites & outcomes.



Demo

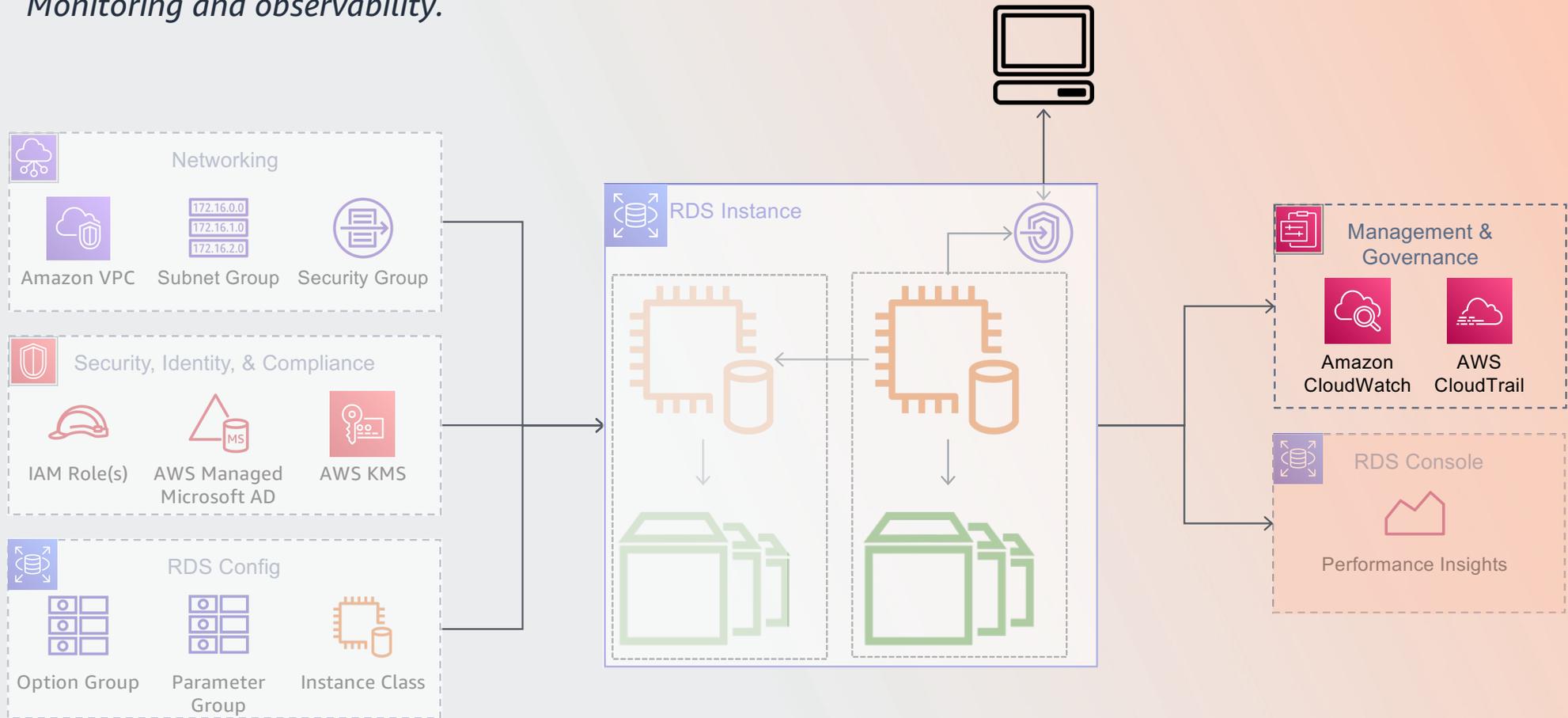


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



Amazon RDS for SQL Server

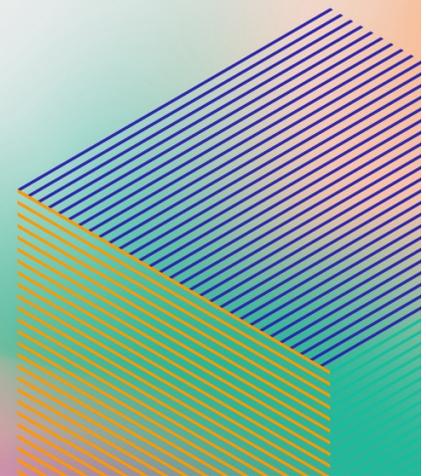
Monitoring and observability.



Demo

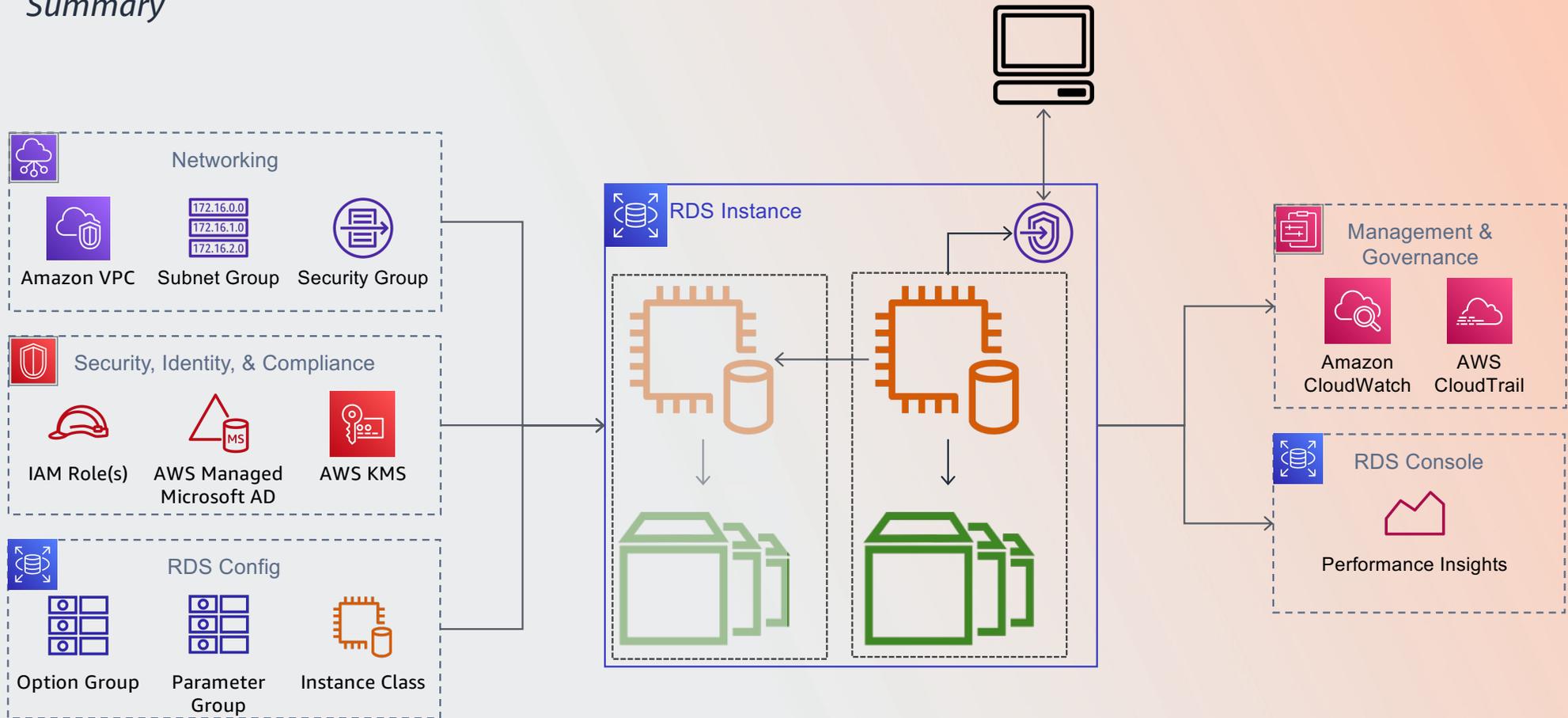


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



Amazon RDS for SQL Server

Summary



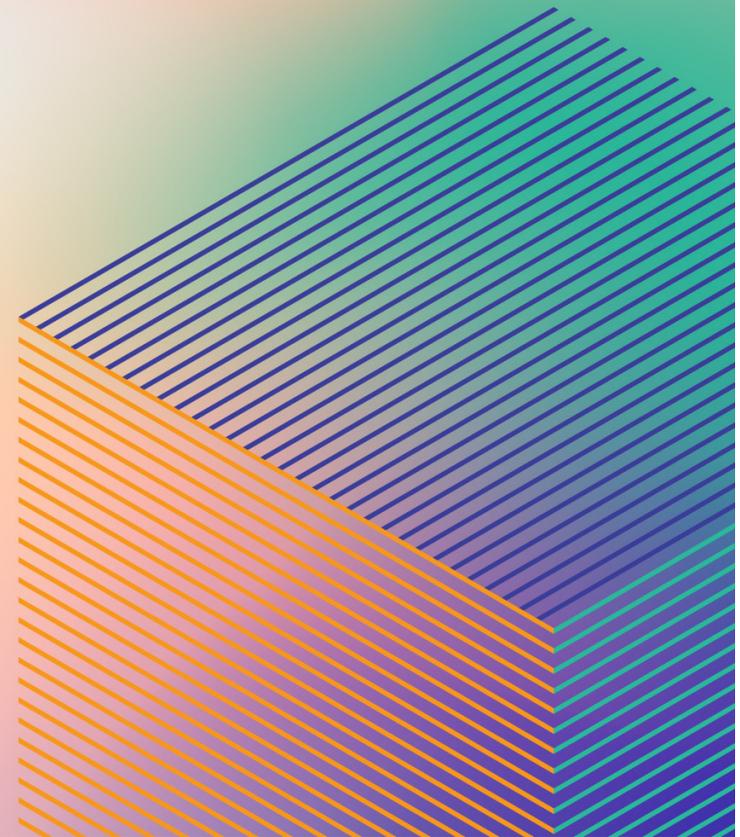
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Create and Connect to a Microsoft SQL Server Database with Amazon RDS:
<https://aws.amazon.com/getting-started/hands-on/create-microsoft-sql-db/>

Migrating databases to RDS for SQL Server.

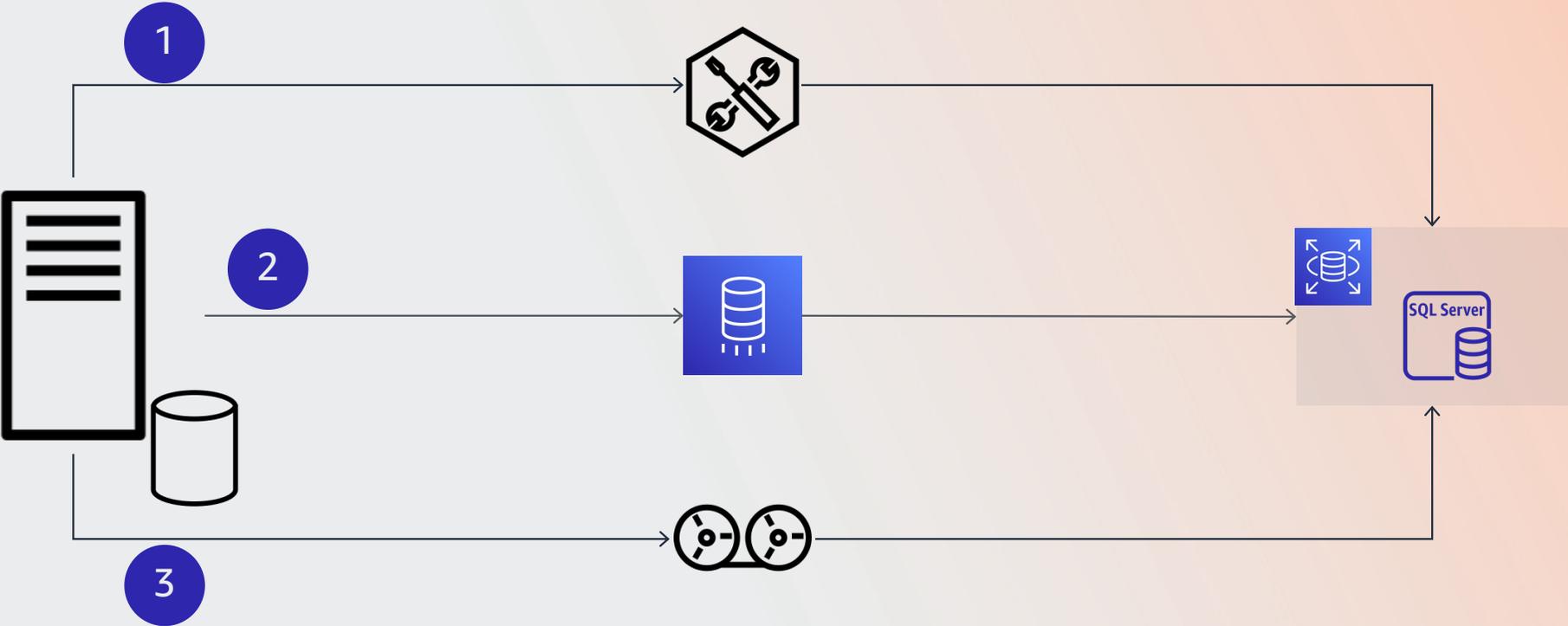


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



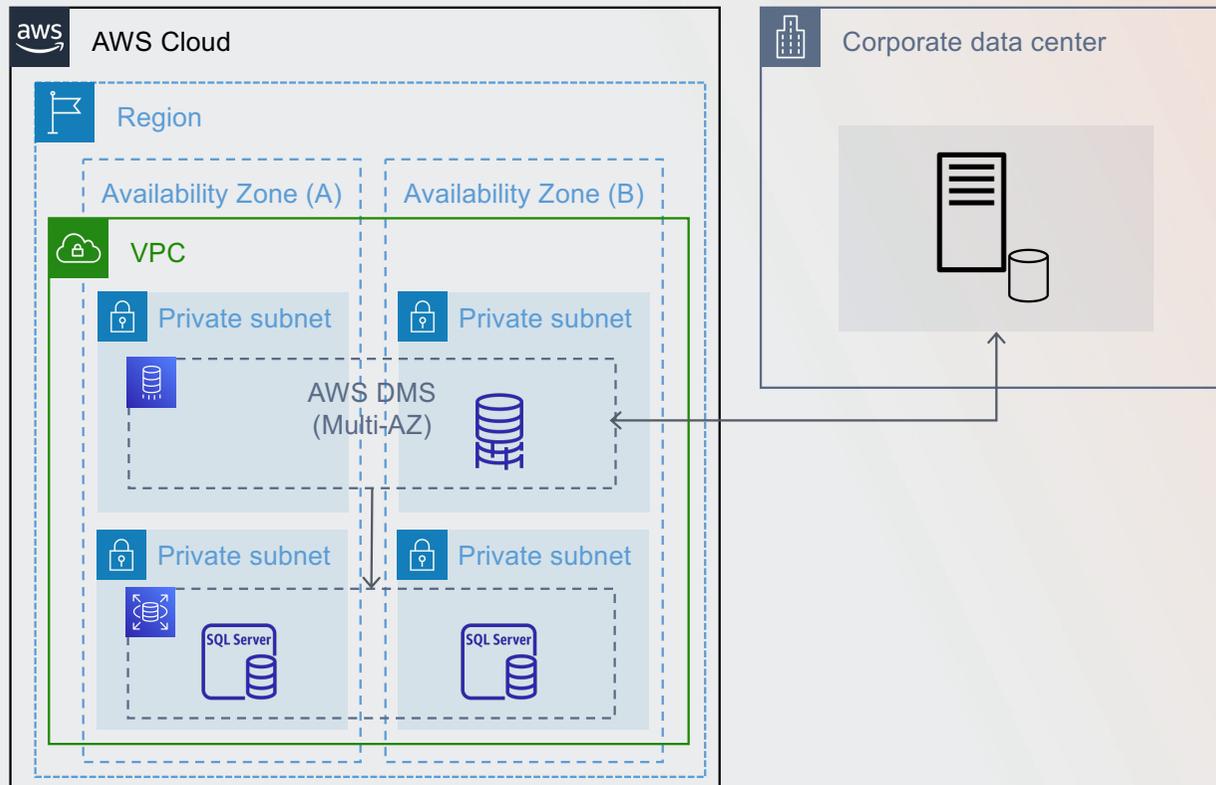
Migration Options

Migrate databases from self-managed to Amazon RDS for SQL Server.



AWS Database Migration Service

Moving databases to the cloud.



AWS DMS

- Migration of data from one database to another.
- Use in conjunction with SCT for non-data objects.
- Single-load or continuous replication options.

AWS Database Migration Service

Service components and features.



Replication Instance

Compute instances which run the DMS service, scaled to availability and throughput needs.



Source Endpoint

Source database which is to have data migrated from.



Target Endpoint

Destination database for migrated data.



Migration Tasks

Migration activity, one-off, or continuous. Transfer of in-row and LOB data.



Monitoring

Performance metrics sent to Amazon CloudWatch for centralised monitoring.



AWS Database Migration Service

Recommended practices to migrate data with AWS DMS.

Effective planning is vital for a successful migration. Know what needs to move, and perform pre-analysis to spot issues first.

Select an instance class which has sufficient memory to process the data volumes.

Leverage row filtering for large table migration.

Tune the parallel load value for the DMS task depending on the number of tables to be migrated.

Break migrations down into multiple tasks based on transactional consistency.

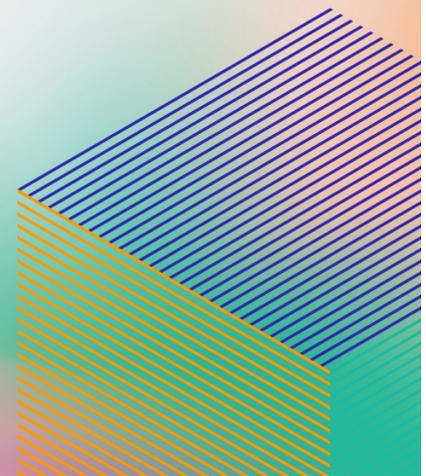
Reduce bottlenecks on the destination database by turning off unnecessary capabilities.



Demo

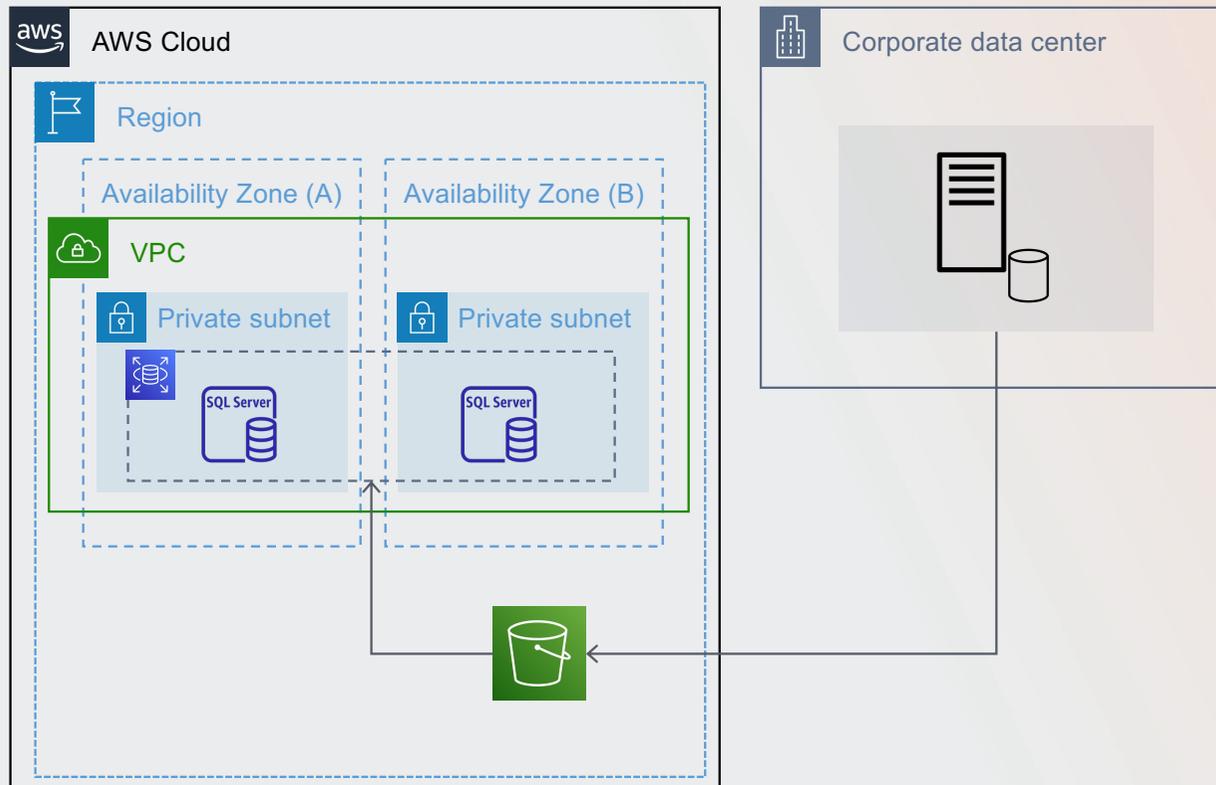


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



SQL Server Backup & Restore

Moving databases to the cloud.



Backup & Restore – S3

- Backup from self-managed SQL Server to S3 bucket.
- Restore from S3 to RDS for SQL Server Instance.
- Cannot restore to multi-AZ deployment.

Copying data to Amazon S3

Moving database backup files to Amazon S3.

CLI or PowerShell

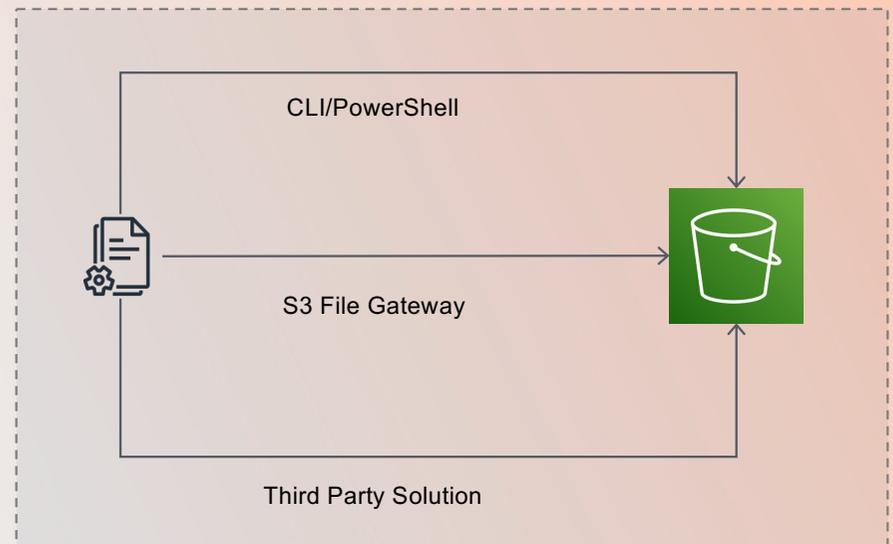
- Build into existing or new automation tasks with script components.

File Gateway

- Abstract synchronisation complexity out of backup process.

Third-Party Solutions

- Various ISV options in the AWS Marketplace.



Copying data to Amazon S3

Using the AWS CLI & PowerShell to copy data.

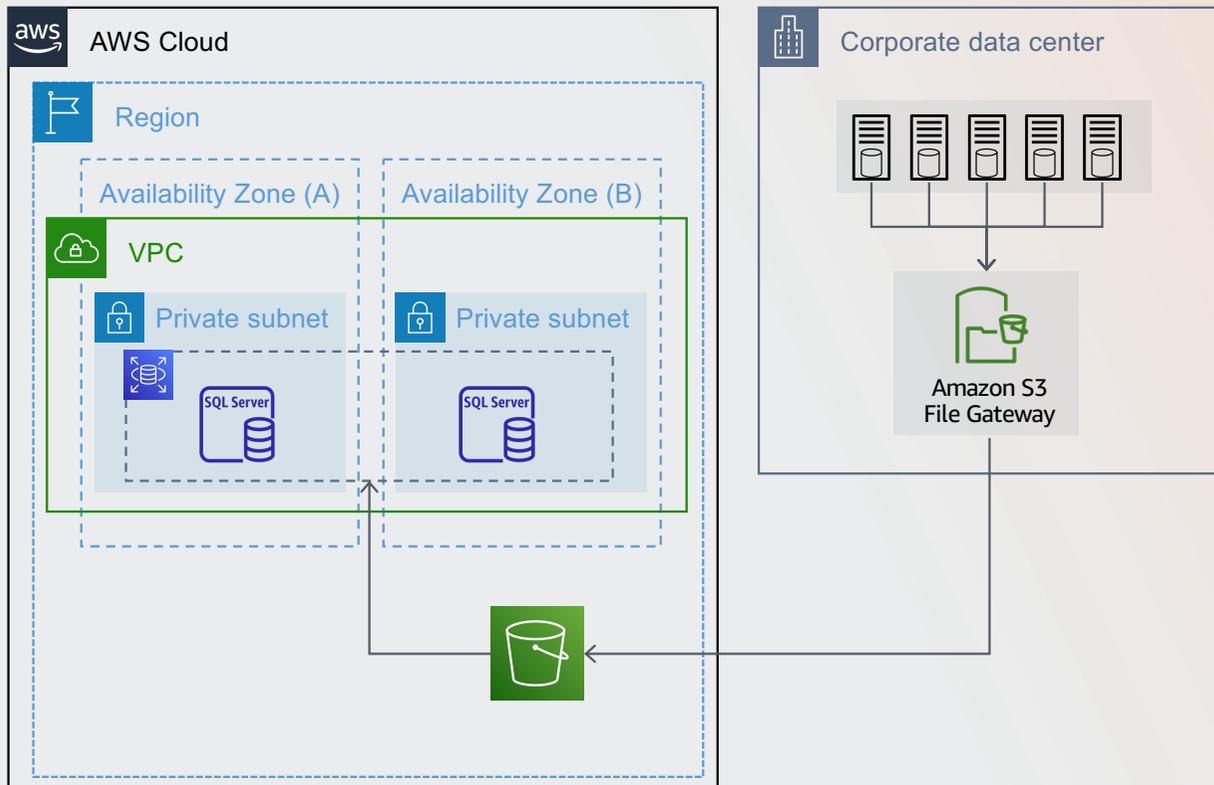
Command Line Tools

- CLI, PowerShell Module, or SDK allow for variety of scripting languages to be used.
- Build your own scripts to backup and transfer to Amazon S3.
- Automate using existing solutions in your businesses.
- Need to build in your own validation, error handling, and logging.
- Still need to run pre-migration compatibility assessments.



Copying data to Amazon S3

Using the Amazon S3 File Gateway to copy data.



S3 File Gateway

- Migration of data from one database to another.
- Use in conjunction with SCT for non-data objects.
- Single-load or continuous replication options.

Restoring from Amazon S3 to Amazon RDS

Restoring SQL Server database backup files from S3.

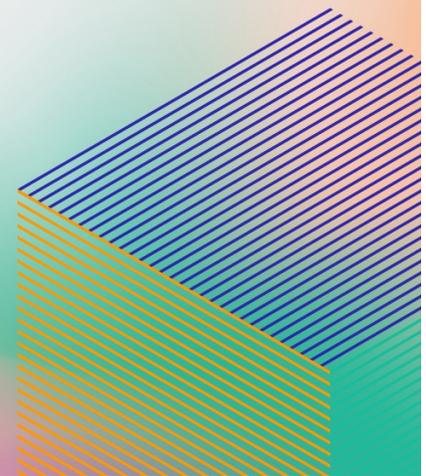
- Need to enable native backup & restore for RDS for SQL Server instance.
- Create IAM Role so that RDS for SQL Server instance can access the Amazon S3 bucket.
- Use built-in stored procedures to initiate restore activity.
- Use No Recovery to do partial restores for a combination of Full, Differential, and log restores.



Demo



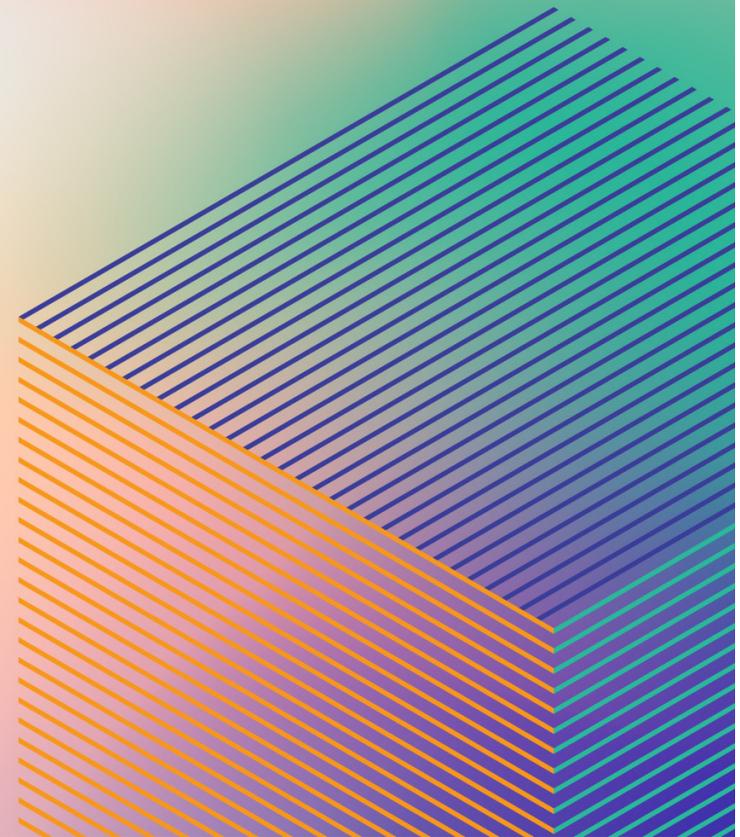
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



RDS for SQL Server Security and Compliance.

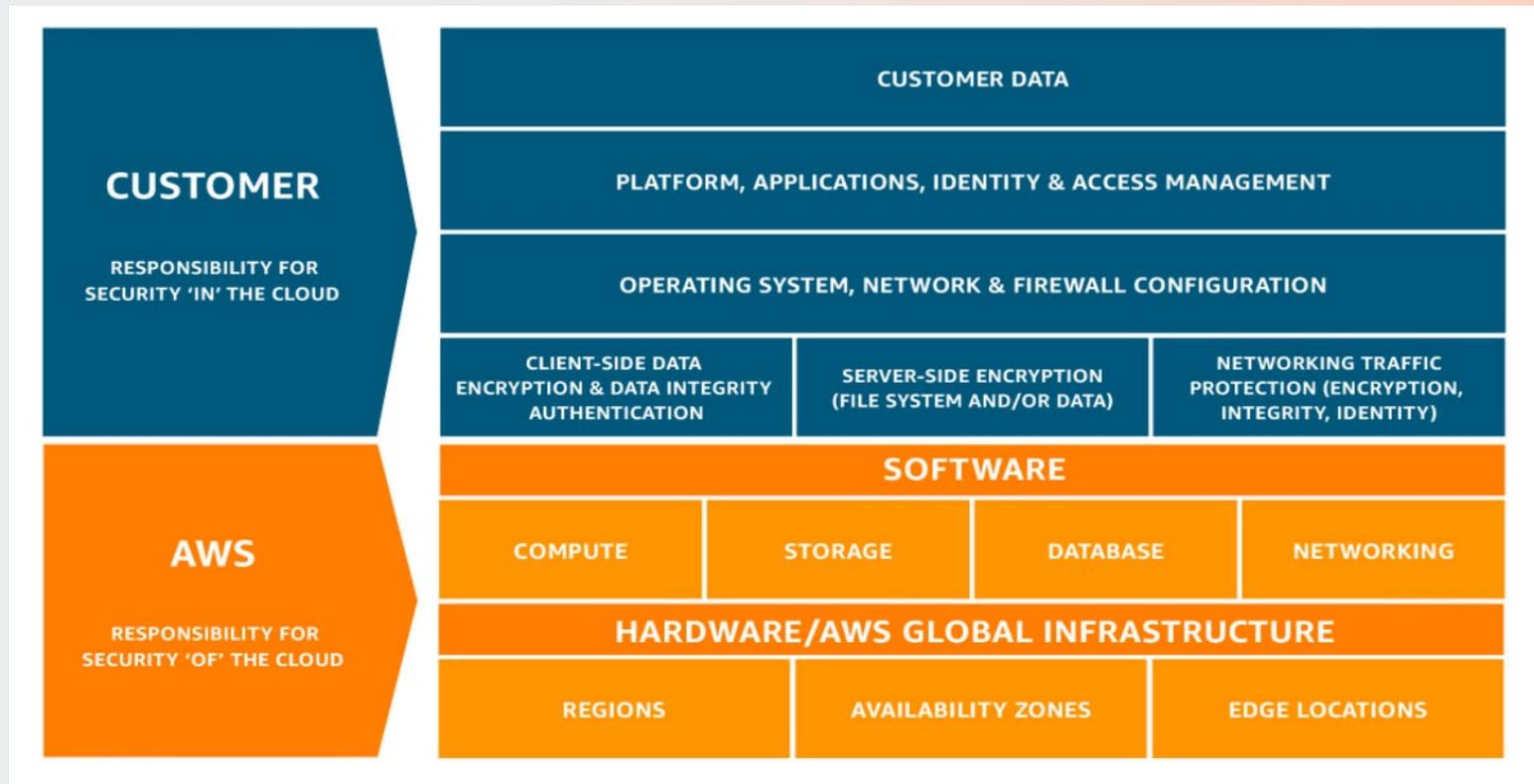


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



Shared Responsibility Model

Understanding areas of responsibility.



Securing Amazon RDS for SQL Server

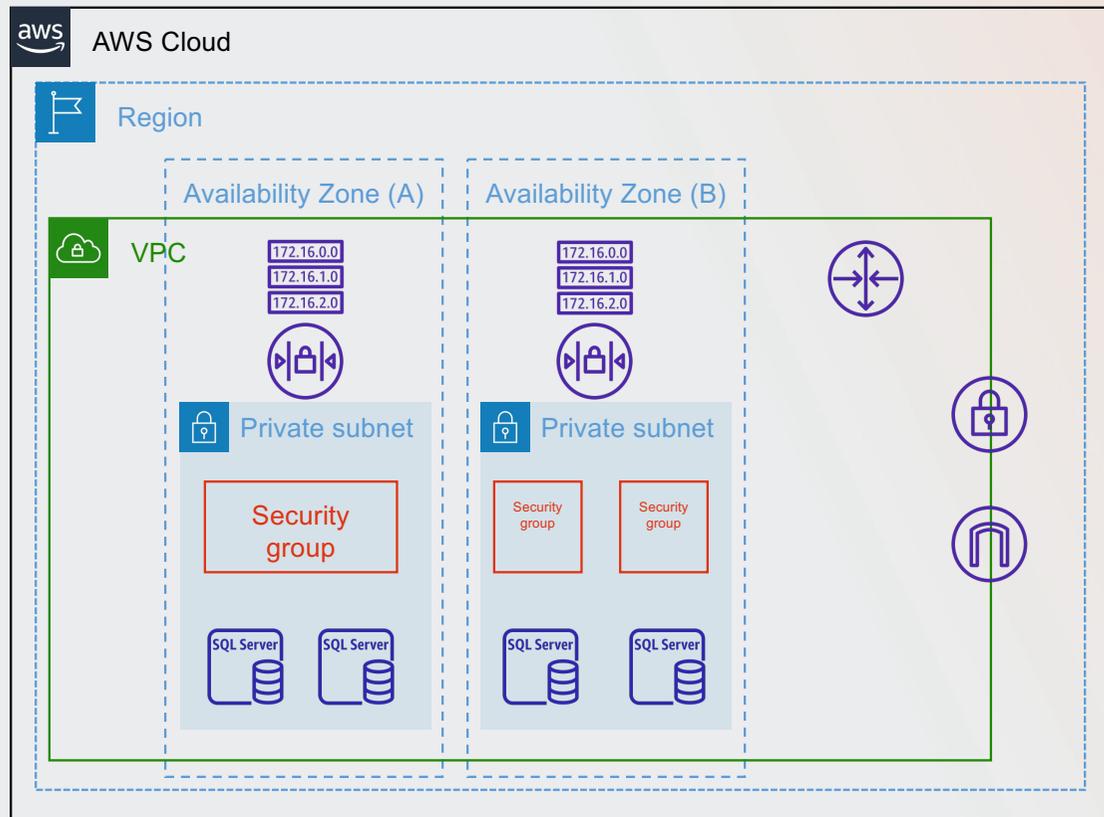
Defence in depth with layering.

Layer	Controls
Network topology	Amazon VPC: Control subnets, AZ specificity (DB subnet groups), route tables and NACLs
Firewall	Security groups: Per-instance firewall to allow or deny traffic
Public access	Avoid it – RDS instances should almost never be in a public subnet (with a route to the Internet)
Encryption	Forced SSL supported; Encrypted DB instances' storage using AWS KMS , TDE, column-level encryption (Always Encrypted)
Application access to the instance	Use AWS Secrets Manager to securely hold, vend, and rotate secrets for your instance
Resource control	Use AWS Identity and Access Management (IAM) to control instance management & lifecycle permissions, work to only grant least privileges
Data access	Native SQL Server capabilities, SQL & Windows Auth.
Audit	Use AWS CloudTrail to log AWS API invocations Use SQL Server Audit to audit database and server operations



Security, Identity, and Compliance for RDS

RDS for SQL Server authorisation and authentication.



Network Traffic Flow

- Security Groups protect the instance.
- Network ACLs protect the subnet.
- Route tables used to send traffic to the correct network segments or endpoints.
- Compliance coverage: PCI-DSS, C5 (Germany), SOC2, ISO27001, et al

TLS Version Control

How to configure specific TLS versions with Parameter Groups.

Parameters Cancel editing Preview changes Reset Save changes

Q rds.t X < 1 > ⚙

<input type="checkbox"/>	Name ▾	Values	Allowed values	Modifiable ▾	Source ▾	Apply type ▾	Data type ▾	Description
<input type="checkbox"/>	rds.tls10	default ▾	default, enabled, disabled	true	system	static	string	TLS 1.0.
<input type="checkbox"/>	rds.tls11	disabled	default, enabled, disabled	true	system	static	string	TLS 1.1.
<input type="checkbox"/>	rds.tls12	enabled	default, enabled, disabled	false	system	static	string	TLS 1.2.

Note: In the screenshot, the 'Values' dropdown for 'rds.tls12' is open, showing 'default' selected and 'enabled' as an option.



Data Security in Transit

Encrypting TDS network traffic to and from the database.

Set `rds.force_ssl` : Forces all client connections to be TLS encrypted

```
73 00 65 00 6c 00 65 00 63 00 74 00 20 00 66 00 s.e.l.e.c.t..f.
69 00 72 00 73 00 74 00 5f 00 6e 00 61 00 6d 00 i.r.s.t._n.a.m.
65 00 2c 00 73 00 73 00 6e 00 2c 00 73 00 61 00 e.s.s.n..s.a.
6c 00 61 00 72 00 79 00 20 00 66 00 72 00 6f 00 l.a.r.v..f.r.o.
6d 00 20 00 74 00 65 00 73 00 74 00 2e 00 64 00 m.t.e.s.t..d.
62 00 6f 00 2e 00 65 00 6d 00 70 00 6c 00 6f 00 b.o..e.m.p.l.o.
79 00 65 00 65 00 20 00 77 00 68 00 65 00 72 00 y.e.e..w.h.e.r.
65 00 20 00 65 00 6d 00 70 00 6c 00 5f 00 69 00 e.e.m.p.l..i.
64 00 3d 00 31 00 30 00 30 00 d.=.1.0. 0.
```

```
00 00 00 09 00 a7 1e 00 09 04 d0 00 34 0a 66 00 .....4.f.
69 00 72 00 73 00 74 00 5f 00 6e 00 61 00 6d 00 i.r.s.t._n.a.m.
65 00 00 00 00 00 09 00 a7 0b 00 09 04 d0 00 34 e.....4
03 73 00 73 00 6e 00 00 00 00 00 09 00 a7 1e 00 .s.s.n.....
09 04 d0 00 34 06 73 00 61 00 6c 00 61 00 72 00 ....4.s.a.l.a.r.
79 00 d1 04 00 4a 6f 68 6e 0b 00 31 32 33 2d 34 y...Joh.n..123-4
35 2d 36 37 38 39 07 00 31 30 30 30 30 30 fd 5-6789..1000000.
10 00 c1 00 01 00 00 00 00 00 00 00 00 00 .....
```



```
6c cb ac a8 42 20 c5 7e 37 8d 37 5f 08 20 c2 e2 l...B ~ 7.7_...
63 c0 d0 97 ec c2 d3 5d 78 4c 53 15 5d 99 8e e2 c.....] xLS.]...
ad 69 6e d1 d6 dc 15 db f2 29 72 d6 54 e1 47 18 .in.....)r.T.G.
8d 0e 1d b7 3d 66 2c 1f 07 0a 99 6f bc 3d ec 16 ...=f,..o.=...
24 a6 15 6b 32 23 69 18 86 65 fb d6 59 2f ec fe $.k2#i..e.Y/...
1c c9 25 66 7e be 25 6e a8 ae 76 26 4e 2a c6 d8 ..%f~%n..v&N*...
73 eb 99 9a 56 c9 2c e3 0b e4 19 43 8e 86 a9 0e s..V,..C....
df 41 fc 37 2e 71 6c 3f 09 88 a7 8b 6e da 58 50 .A.7.ql? ..n.XP
ca f5 74 0a ac 13 8f ..t....
```

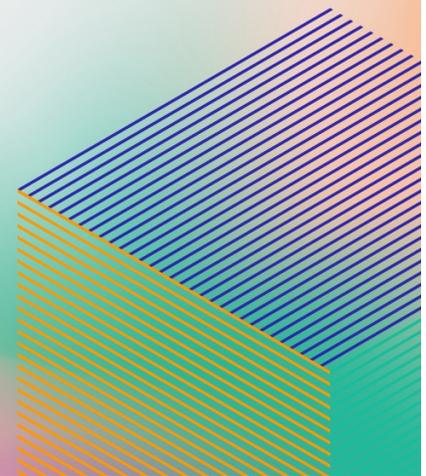
```
0a 22 19 91 e0 f6 d6 5b f8 1b d8 c9 5b c6 b3 2a ..".....[.....[*
8b e3 06 20 2c 82 45 e4 d1 44 66 69 0f 28 67 d5 ... ,.E. Dfi.(g.
12 f1 59 46 33 35 13 ac 0d d8 aa 04 38 67 2c 26 ..YF35.....8g,&
09 58 0a db 94 2d 1a c5 8b 2d 60 a0 96 17 88 79 .X.....-`.....y
c1 12 e2 eb ff de 51 a2 d3 41 e7 a6 1c af be 6f .....Q..A.....o
ec ab 10 13 10 00 d8 46 c9 ec 93 6d 89 41 72 d5 .....F...m.Ar.
2e ca 23 d8 fa 14 2d 87 01 b6 59 91 03 6d f1 e9 .#.....Y.m..
db ea 2f 40 8a f2 03 e0 84 85 d3 3c a9 54 d2 72 ../@.....<.Tr
d8 89 b2 af 07 fd 47 .....
```



Demo

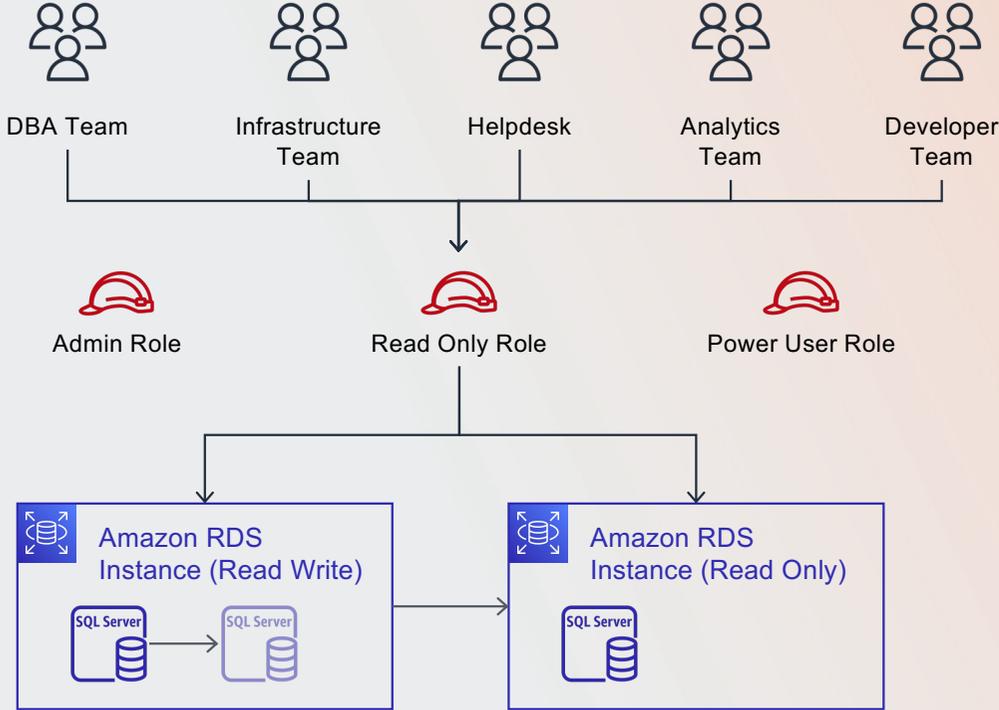


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



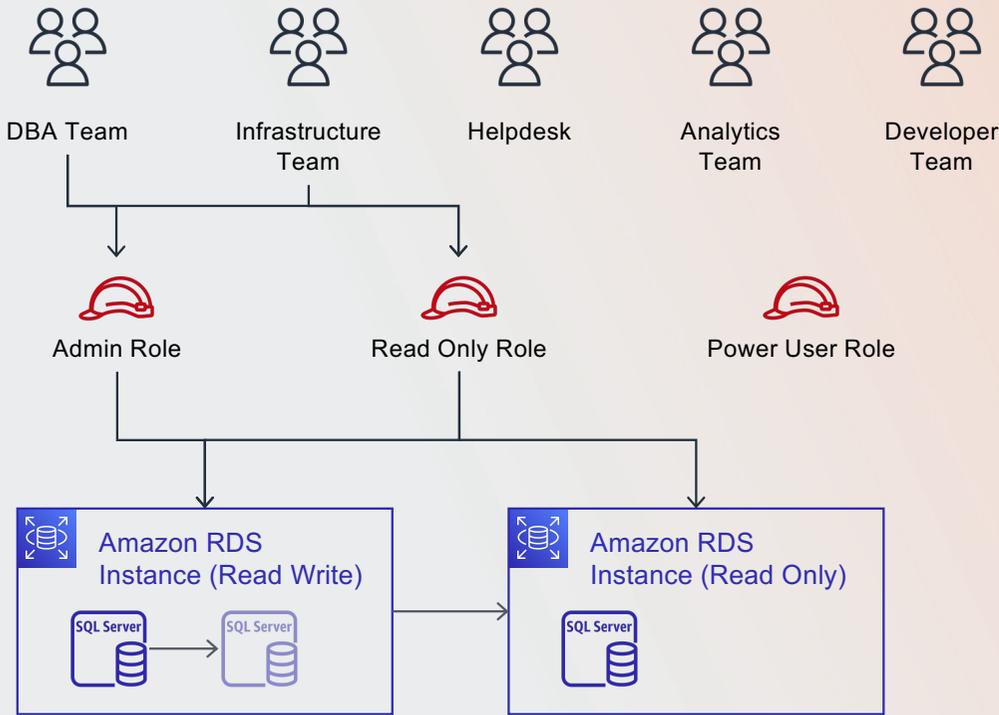
IAM Access Control

Managing Amazon RDS for SQL Server infrastructure with IAM



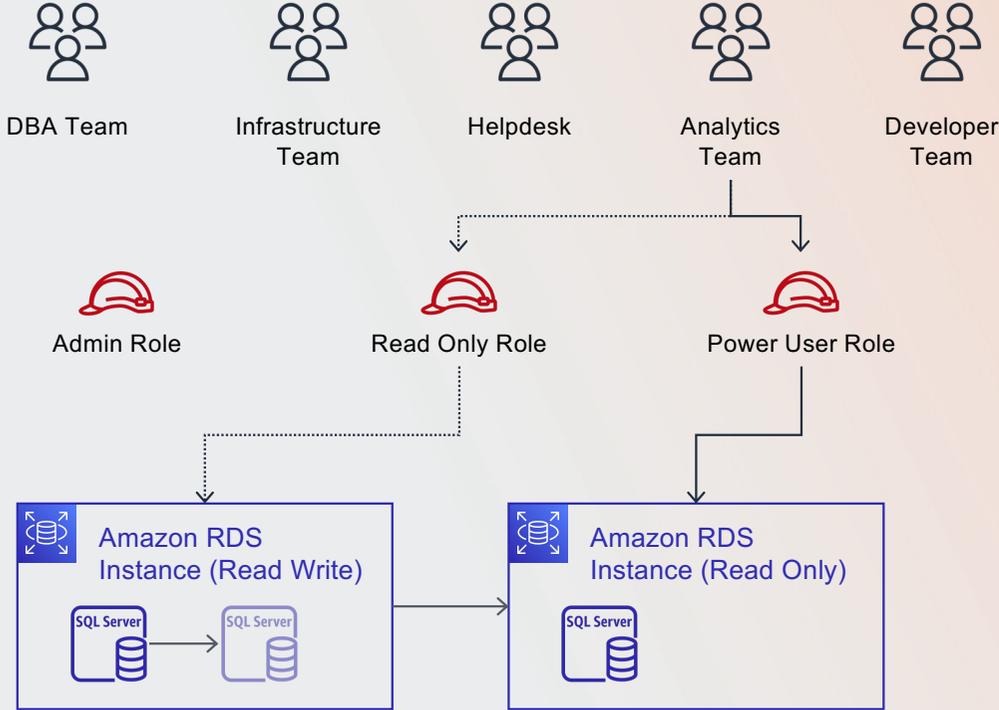
IAM Access Control

Managing Amazon RDS for SQL Server infrastructure with IAM



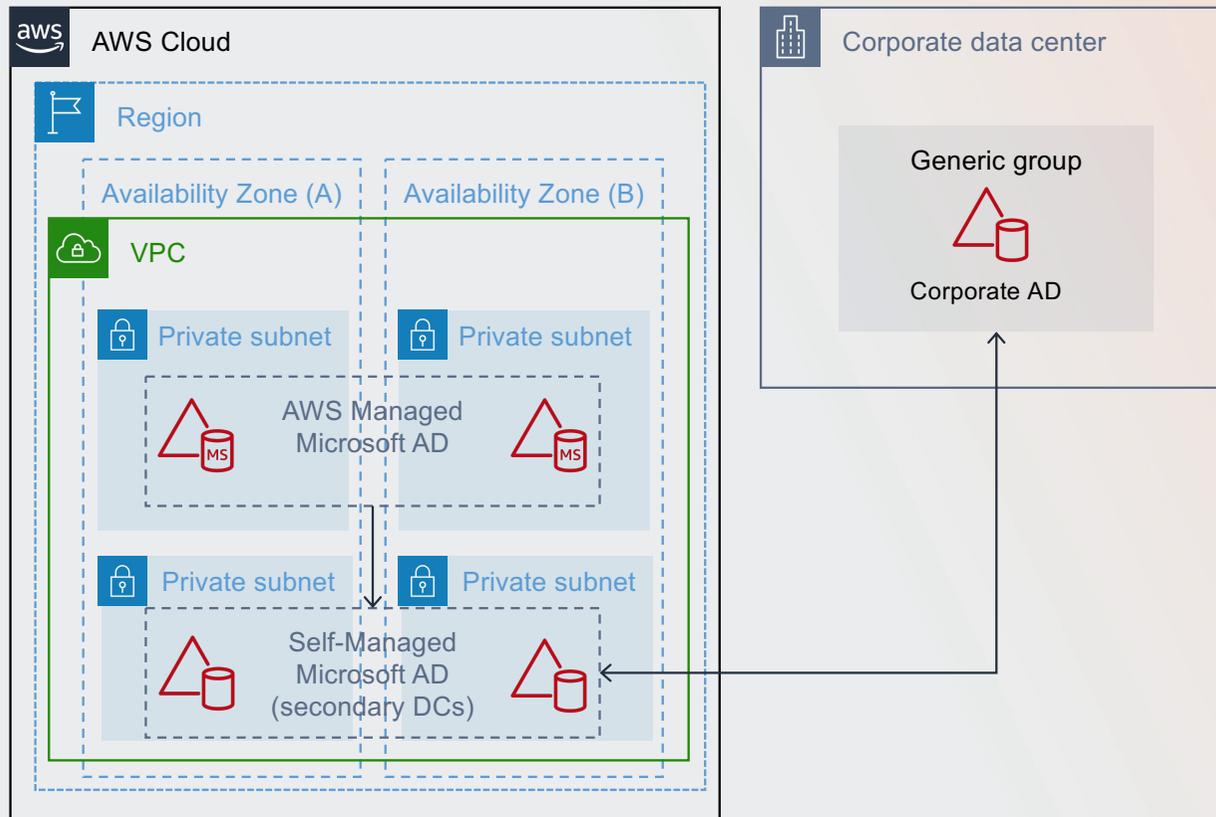
IAM Access Control

Managing Amazon RDS for SQL Server infrastructure with IAM



Security, Identity, and Compliance for RDS

RDS for SQL Server authorisation and authentication.



AWS Managed AD

- Extend network using Direct Connect or VPC.
- For improved resiliency deploy self-managed domain controllers into AWS VPC.
- One-way forest trust is a more conservative choice over two way trust.

Security, Identity, and Compliance for RDS

RDS for SQL Server authorisation and authentication.

AWS Managed AD

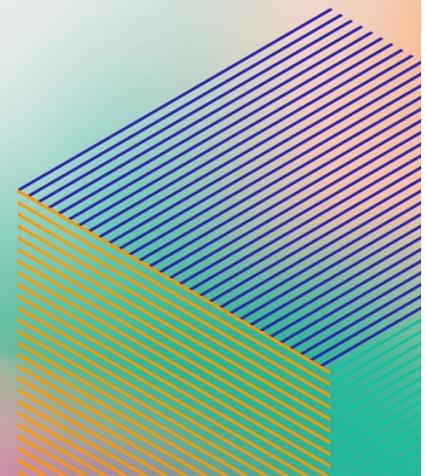
- Extend network using Direct Connect or VPC.
- For improved resiliency deploy self-managed domain controllers into AWS VPC.
- One-way forest trust is a more conservative choice over two way trust.



Demo



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

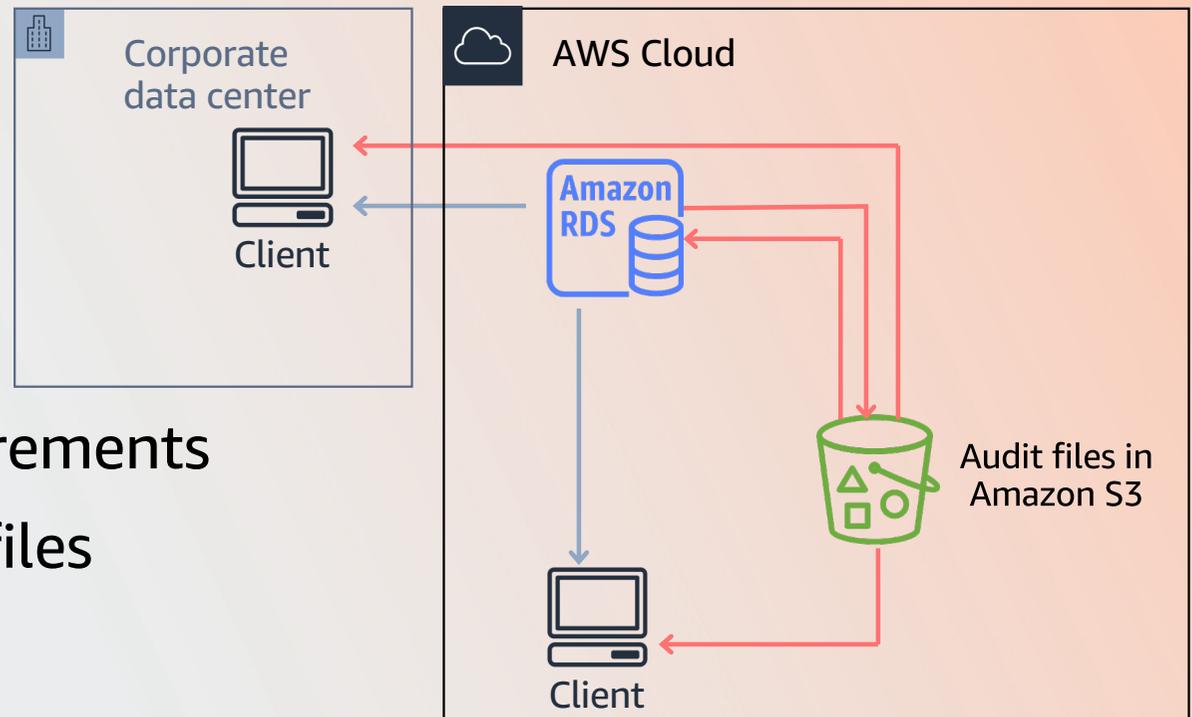


SQL Server audit

Tracking activity inside RDS for SQL Server.

Why?

- Increase accountability
- Anomaly detection
- Track usage
- Satisfy compliance requirements
- Record events to binary files



SQL Server audit

How ?

Enabled via option groups

Where?

Stored in your S3 bucket

Options:

Server-side file compression

Configurable retention

The screenshot displays the configuration interface for SQL Server audit in the AWS RDS console. It is divided into three main sections:

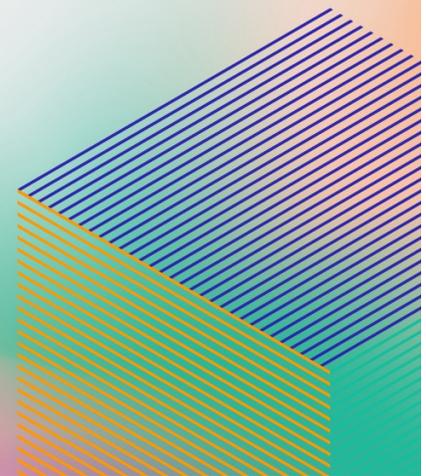
- Option details:** Shows the option group name as 'reinvent-demo-option-group' and the selected option name as 'SQLSERVER_AUDIT'. A description below the dropdown reads: 'Use to offload SQL Server Audit logs to your S3 bucket. It grants your DB instance acce...'
- S3 destination:** Shows the S3 bucket name as 'reinvent-demo-s3'.
- Additional configuration - optional:** This section is expanded and contains three sub-sections:
 - Compression:** The 'Enable compression' checkbox is checked. A note states: 'Enabling compression will compress audit logs to ZIP file before offloading to your S3 bucket.'
 - Retention:** The 'Enable retention' checkbox is checked. A note states: 'Enabling retention will keep audit logs on the RDS instance for the configured amount of time. Otherwise the audit logs are removed immediately after being offloaded to S3 bucket.'
 - Retention window:** A numeric input field is set to '840' with the unit 'hours'. Below the field, it indicates a range of '1 to 840 hours'.



Demo



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



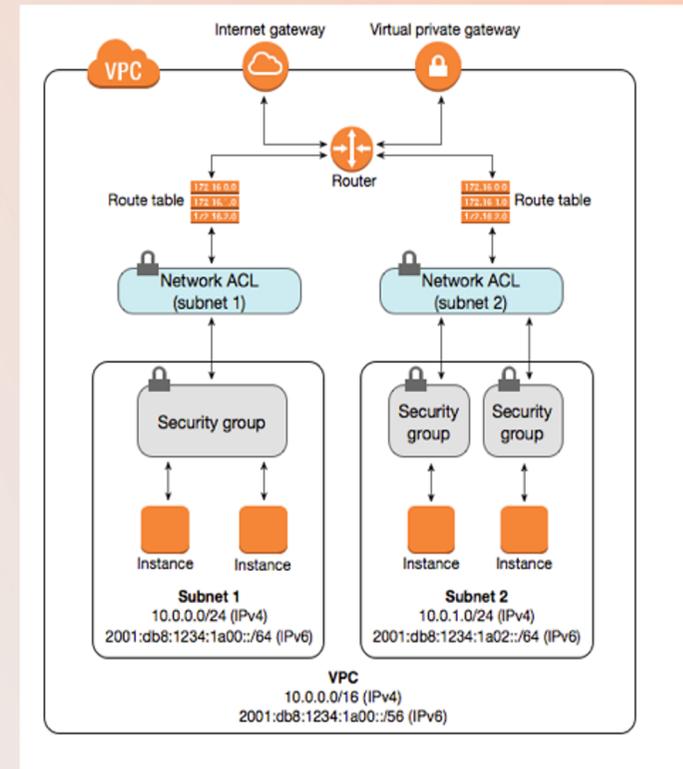
Security – best practices

Use AWS Identity and Access Management (IAM) accounts to control access to Amazon RDS API actions

Restrict database accessibility

Avoid enabling public access

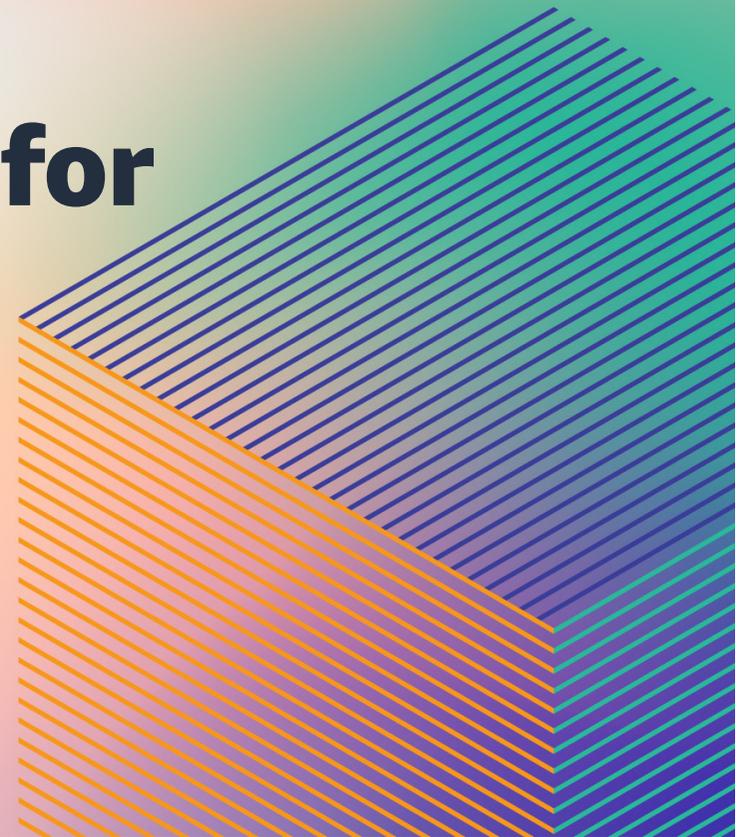
Avoid using port 1433 if you need public access.



Disaster Recovery Options for RDS for SQL Server.



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



“By failing to prepare you are preparing to fail.”

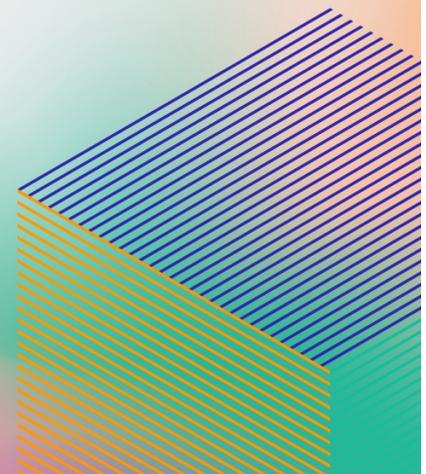
Benjamin Franklin

Founding father of the United States.

“Everything fails, all the time.”

Dr. Werner Vogels

CTO Amazon.com



Preparation is everything

Documentation, Process, Practice.

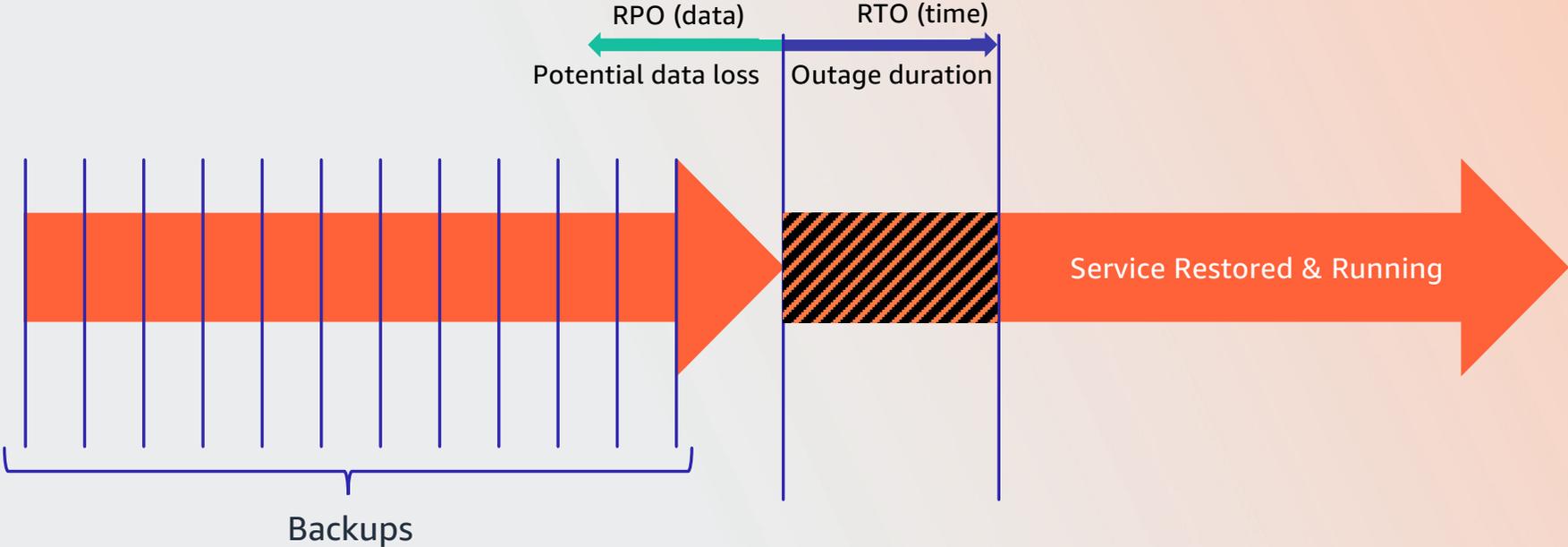
Do not build a backup strategy, **build a recovery strategy.** That is, having backups doesn't matter. It only matters if you have a demonstrated capability to restore.

Define key terminology in business language and map to technical requirements where appropriate.

Take a system-wide view rather than component level recovery.



Recovery Objectives



Key Terminology

High Availability Vs. Disaster Recovery

High Availability

- Automatic with no human intervention.
- Designed for handling component failure within a system.
- Minimal data loss (in-flight data) and very low RTO.

Disaster Recovery

- Human triggered event – automate the *process* but not the *decision*
- Designed for recovery from a significant outage where systems are inoperable.
- Higher data loss potential (committed data), and RTO measured in hours.



Disaster recovery considerations

What constitutes a disaster?

What other infrastructure is needed?

How will you handle data loss?

What are your business requirements?

Test!! Perform recovery drills

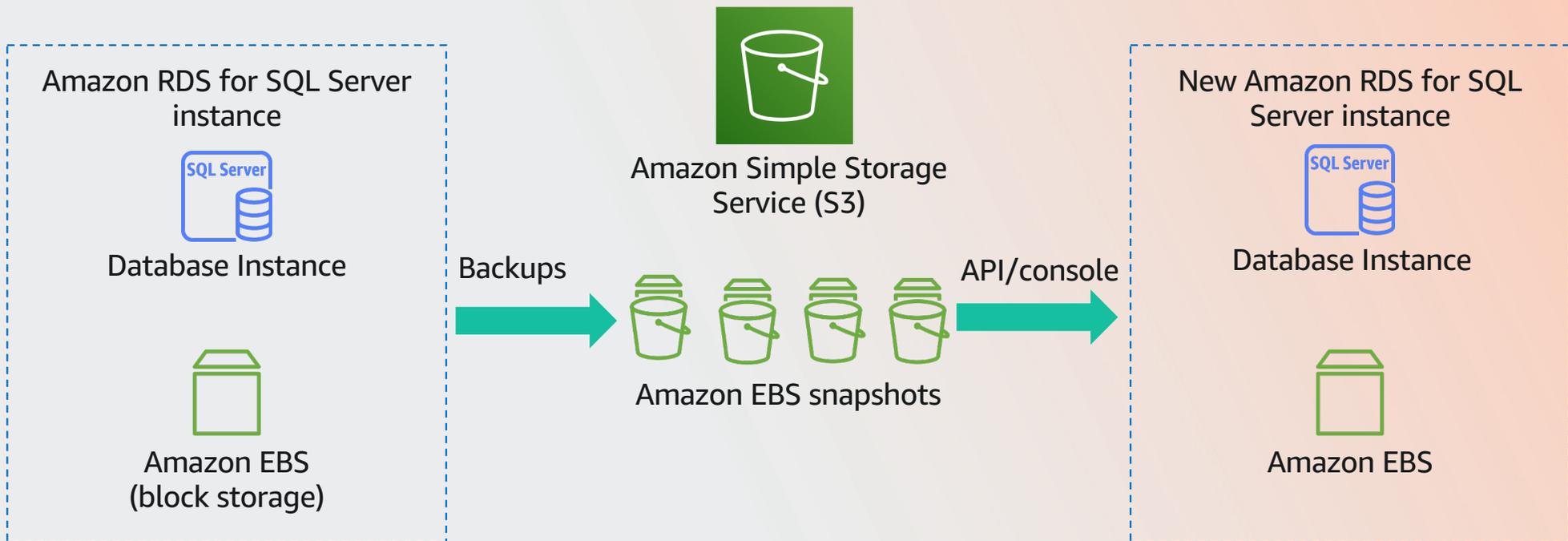


Disaster recovery with Amazon RDS for SQL Server

Snapshot

Native Database Backup

Logical Replication



RDS for SQL Server - snapshot

Database instance level backup

- Automated or manual

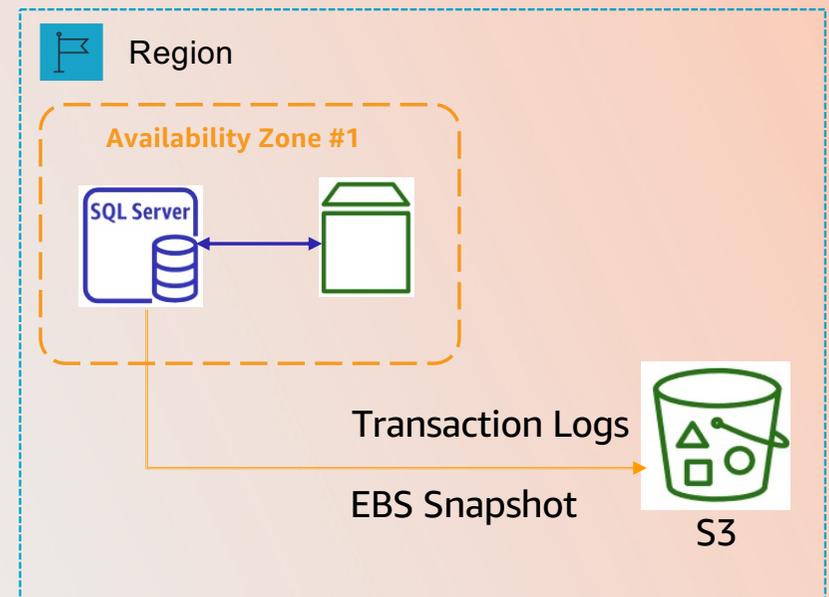
Automated snapshot

- Daily snapshot during backup window
- Leverage SQL Server application consistent EBS snapshots
- T-log backup to S3 every 5 minutes (recovery model set to full)
- Retained up to 35 days

Manual snapshot

- Take a snapshot any time
- Kept until you delete

DB
App



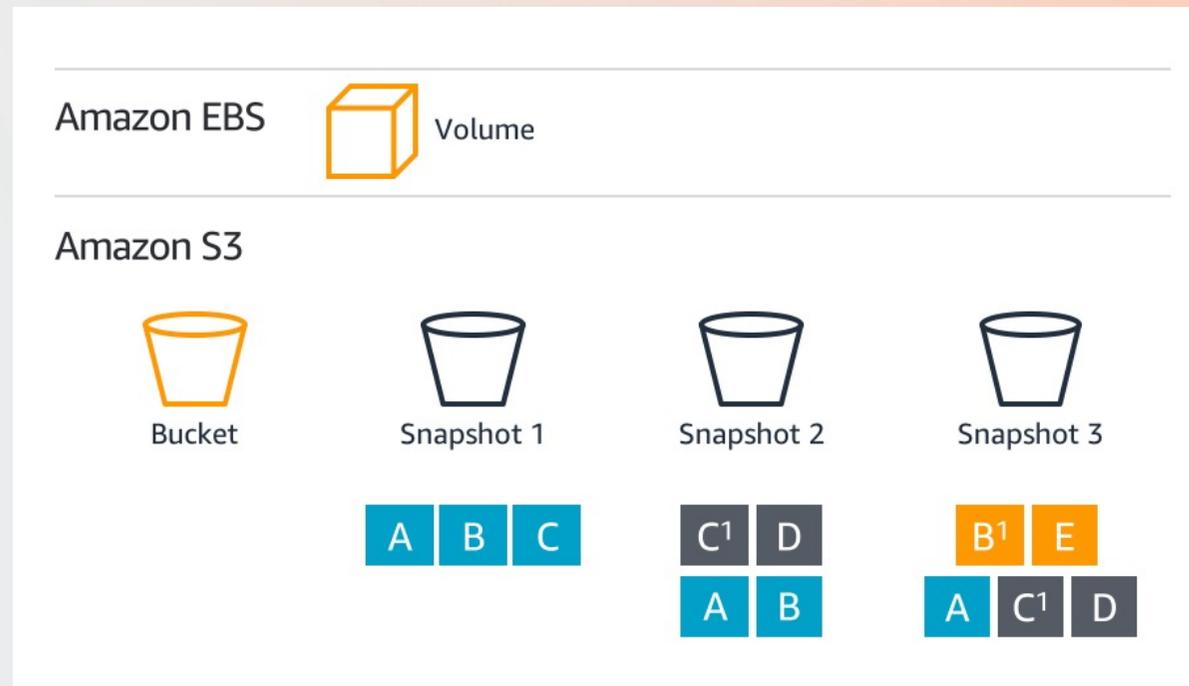
RDS for SQL Server - snapshot

Amazon S3 - 11 x 9s durability

Inherits encryption

Copy Snapshots

- Cross accounts
- Cross regions - DR
- Copy automatic to manual for long term retention



Snapshot - best practices

Set retention to a positive value to enable automatic backup

Take manual snapshots to reduce Point-in-time recovery (PiTR) replay window

Storage IO might be suspended briefly during backup (typically under a few milliseconds). You may experience elevated latency for a few seconds during backup

Disable backup for data load (deletes automatic backups)



Restoring Amazon RDS for SQL Server Snapshots

Considerations and recommended practices.

Restore creates a new database instance

- Define the instance configuration just like a new instance
- Will inherit parameter, security, and option groups from source DB instance

New volumes are hydrated from Amazon S3

- While the volume is usable immediately, full performance requires the volume to warm up until fully instantiated



Original Instance



Snapshot

RestoreDBInstance
FromDBSnapshot



New Instance

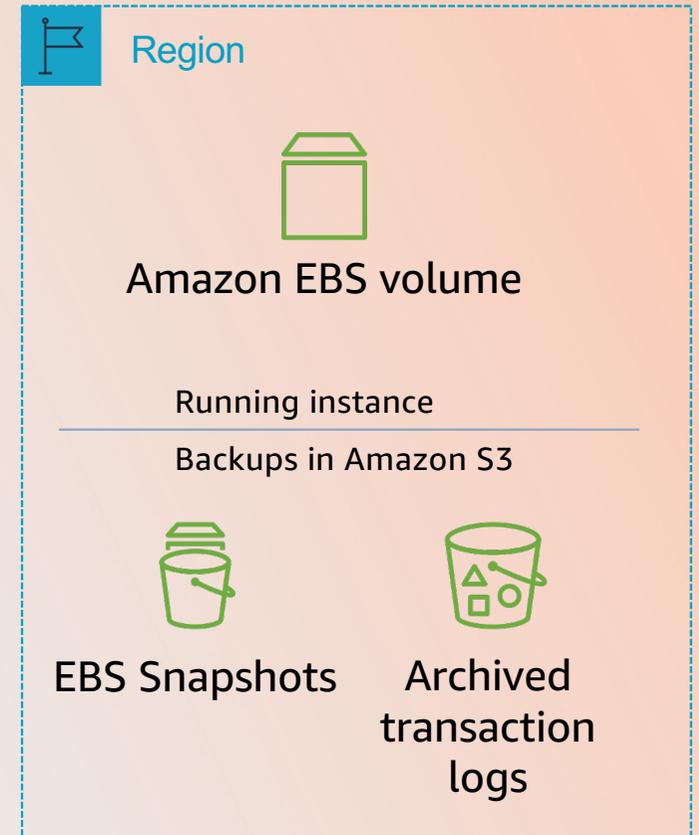
RDS Automated Backups

Enabled by default

Daily snapshot of storage volumes

Archived transaction logs backed up to Amazon S3 every 5 minutes

Managed retention up to 35 days (default 7 days)



Restoring Amazon RDS for SQL Server Snapshots

Considerations and recommended practices.

Required: full recovery mode

Restore to any second in backup retention

Latest restorable time typically <5 minutes



Original Instance



Snapshot

RestoreDBInstance
ToPointInTime

Transaction Logs



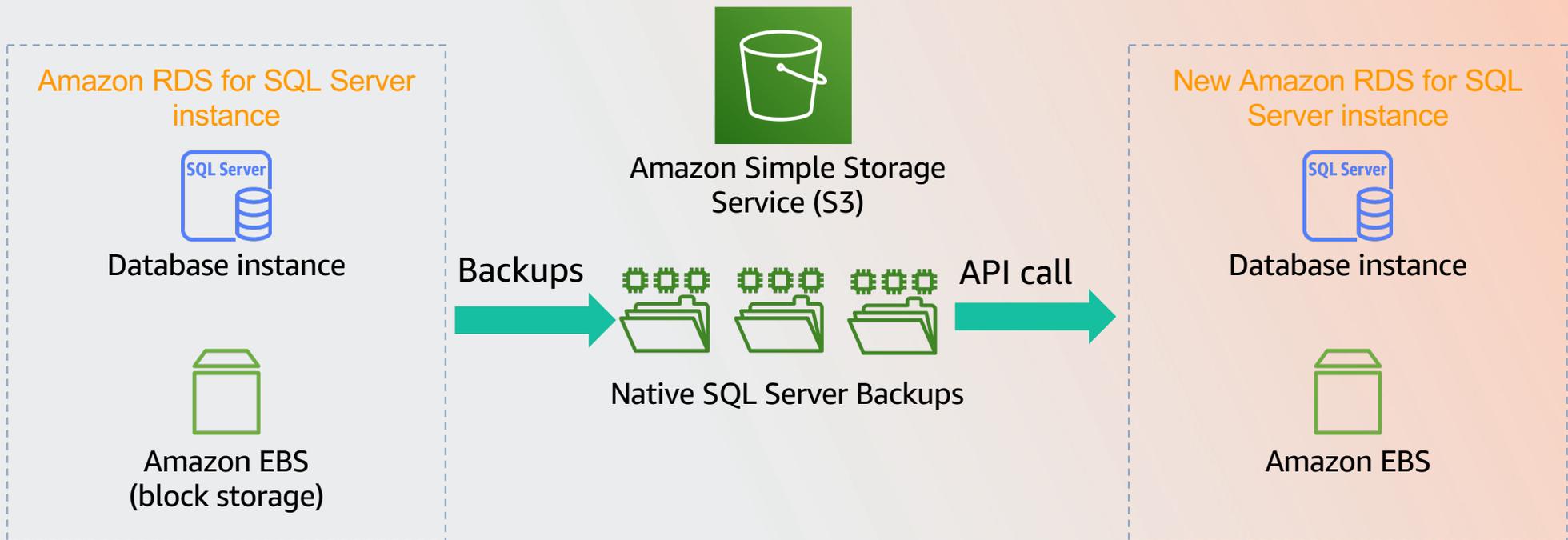
New Instance

Disaster recovery with Amazon RDS for SQL Server

Snapshot

Native Database Backup

Logical Replication



RDS Manual Backups

Request a snapshot at any time

Copy automated (system) snapshots to manual

Retained until you delete them



Region



Amazon EBS volume

Running instance

Backups in Amazon S3



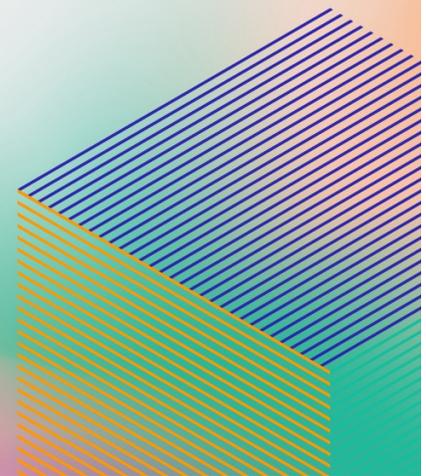
EBS Snapshots



Demo



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

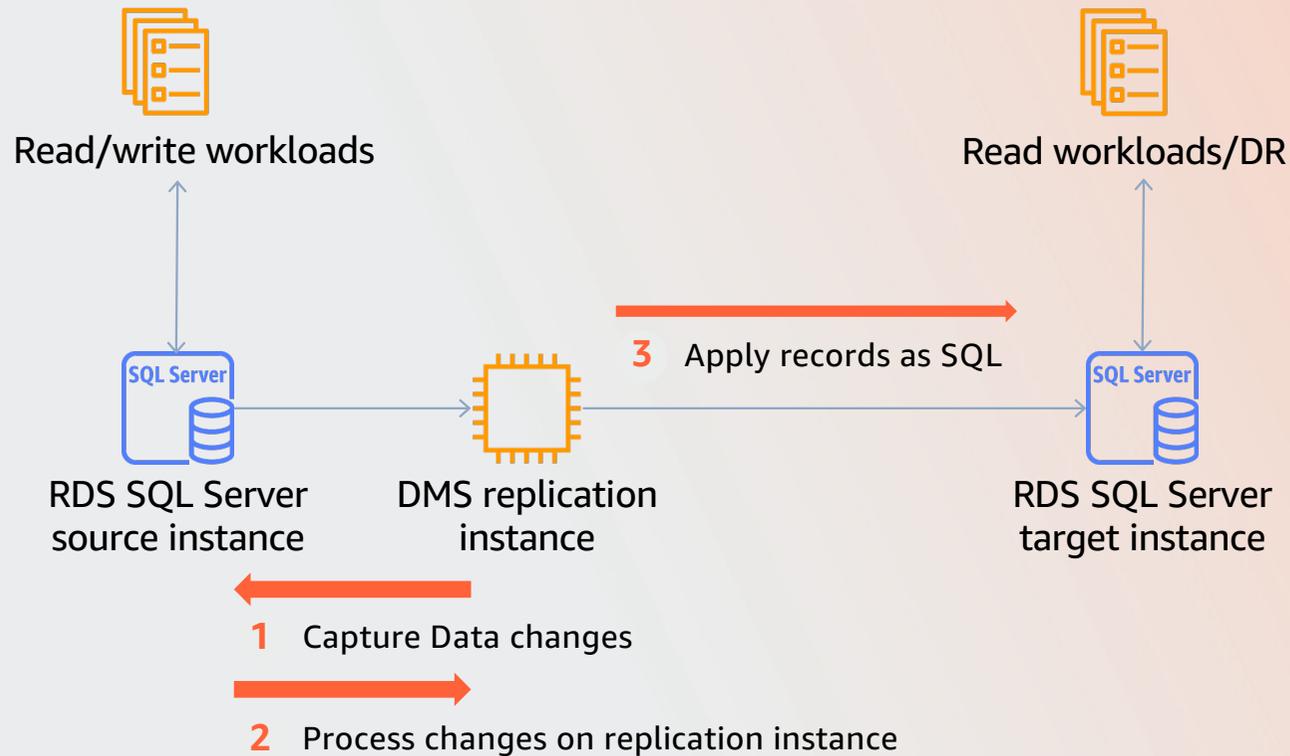


Disaster recovery with Amazon RDS for SQL Server

Snapshot

Native Database Backup

Logical Replication



Amazon RDS for SQL Server read replicas

Offload read traffic to secondary database instance(s)

Fully managed Always On Availability Group

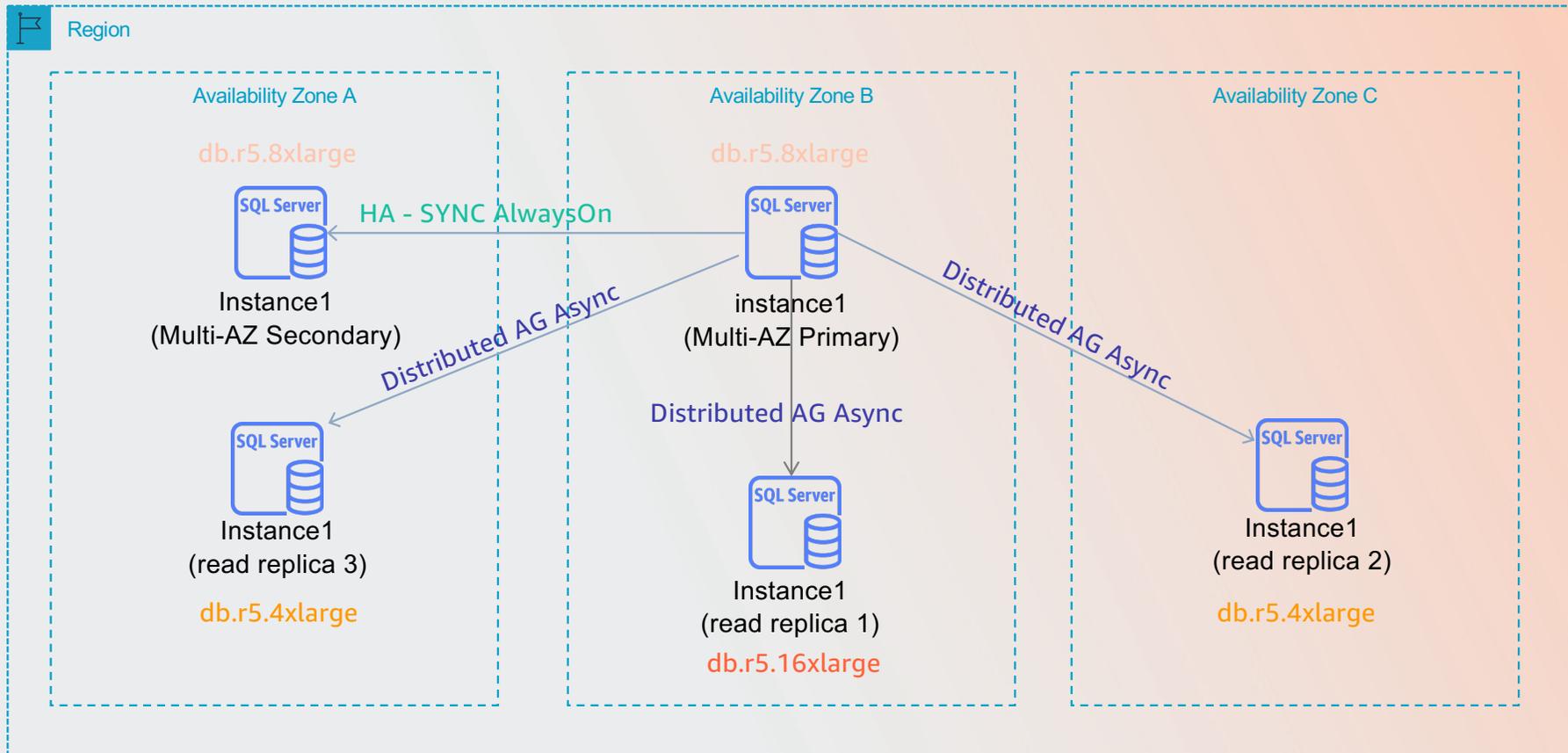
Using the Distributed Availability Group feature

- Up to 5 replicas per source instance
- Must be in the same region as source instance
- Source instance must be Multi-AZ

Read replicas can be promoted as new standalone databases



Amazon RDS for SQL Server read replicas



Amazon RDS for SQL Server HA/DR features

Feature	RPO (approximate)	RTO (approximate)
Multi-AZ for high availability	0	10 sec to 1 minutes*
Snapshot restore	Hours	30 minutes*
Point-in-time restore	Minutes	30 minutes to few hours*
Read replica promotion (in-region)	Minutes	<5 minutes
Logical replica promotion	Minutes to hours	Minutes to hours

**crash recovery time not included*



Summary

Recommended practices for Amazon RDS for SQL Server DR.

Plan, practice, review, and iterate disaster recovery activities on a regular basis.

Document as much as possible, use business language and context to aid decision makers.

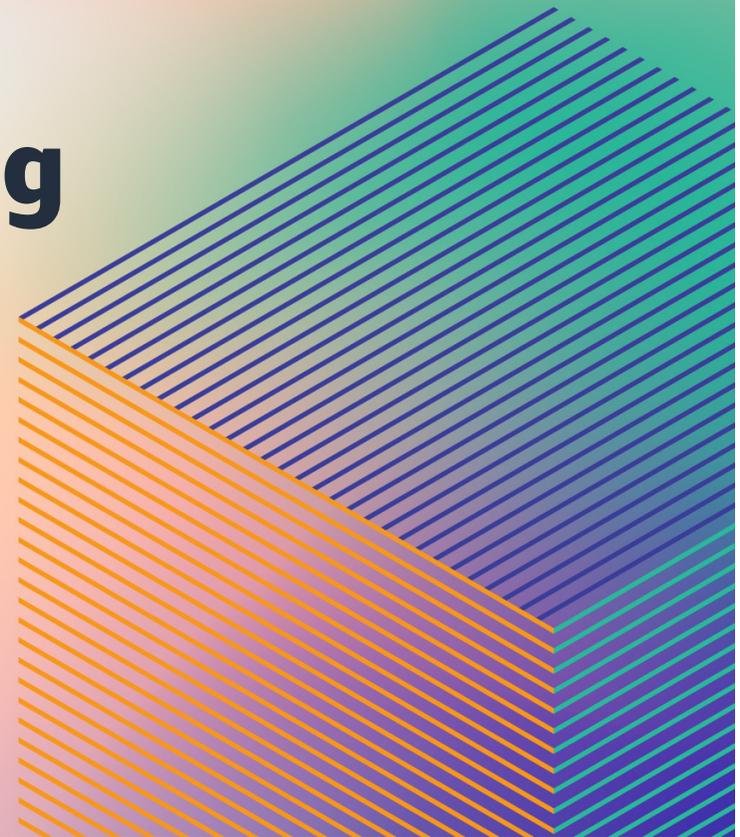
Store hard-copy, and off-site copies of documentation which is accessible in the event of a major disaster.



Monitoring, and Optimizing RDS for SQL Server.



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



Performance monitoring tools at a glance

Amazon CloudWatch metrics/Enhanced Monitoring : Monitor core (CPU, memory, disk) metrics

Amazon CloudWatch Logs: Publish SQL Server Agent logs and Error logs to CloudWatch

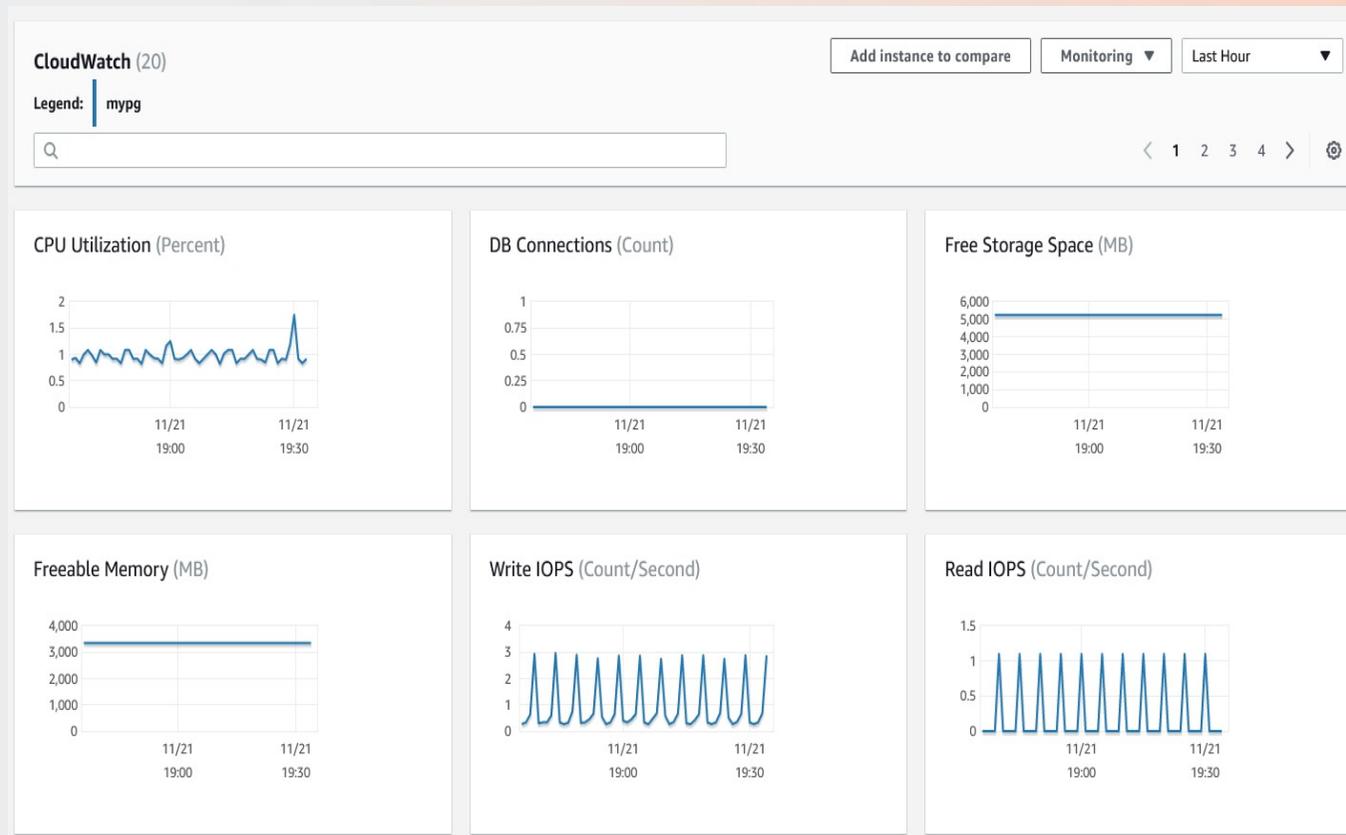
Performance Insights: Query and wait level performance data

SQL Server native tools: DMVs, Profiler, Extended Events.

AWS Marketplace 3rd party solutions.



Amazon CloudWatch Metrics



CPU

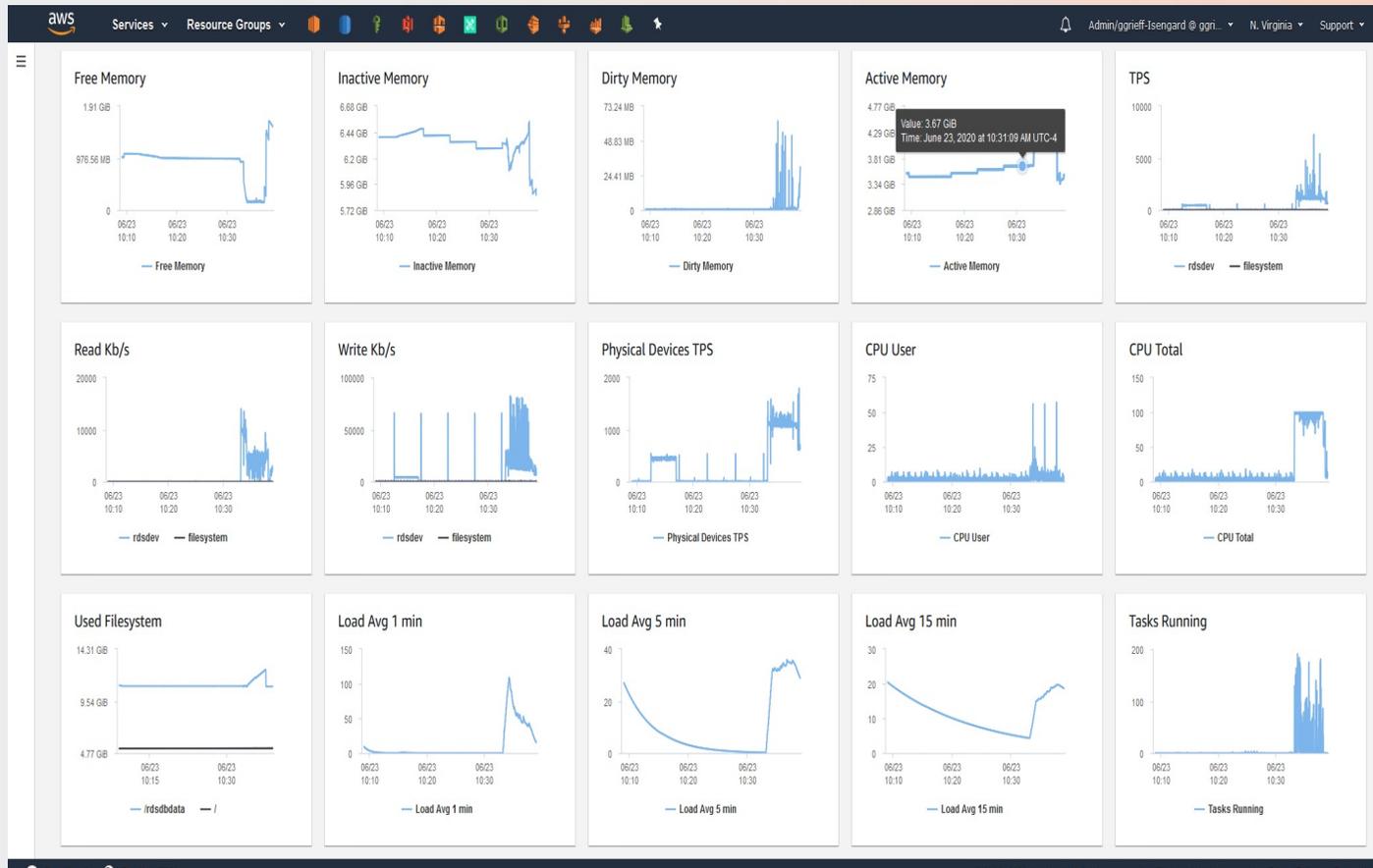
Memory

Storage

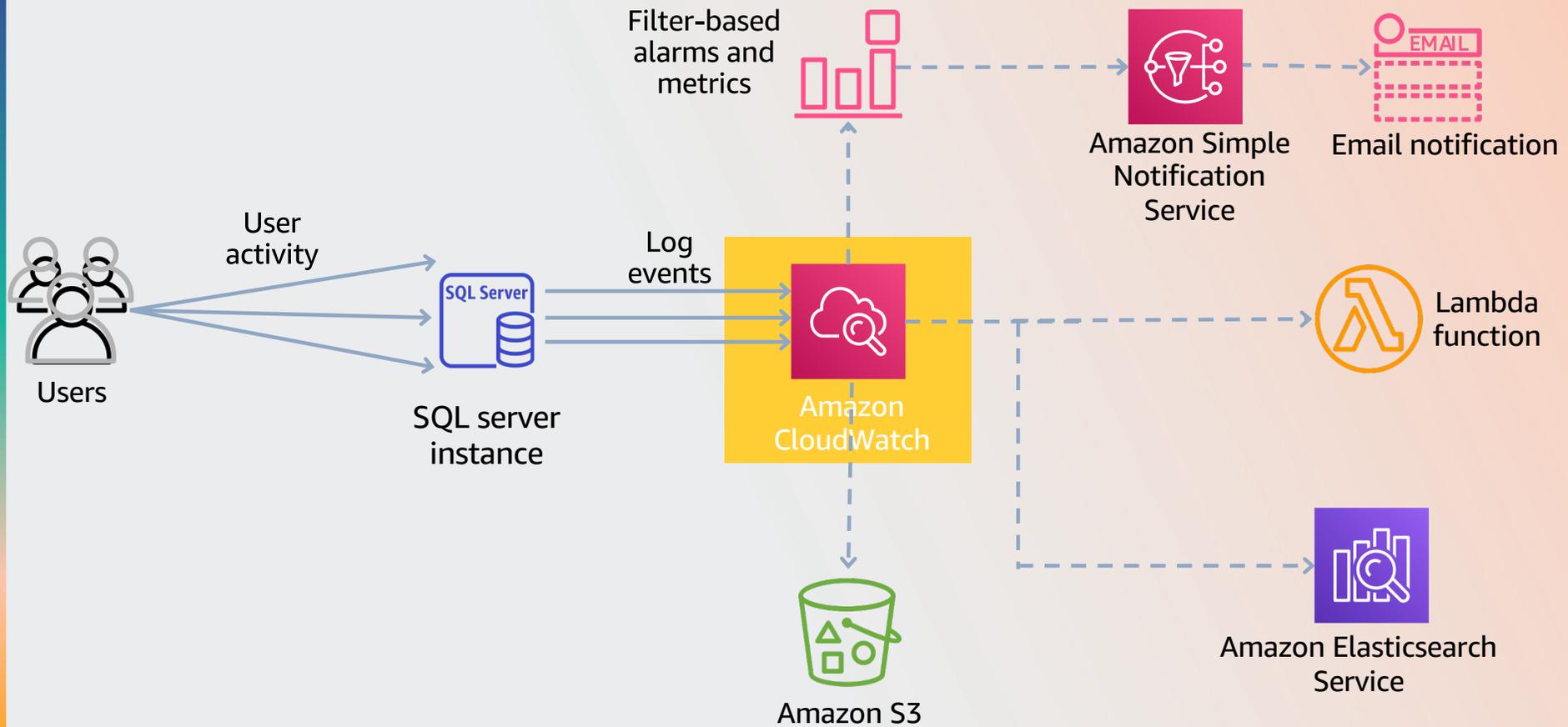
Engine



Amazon RDS Enhanced Monitoring



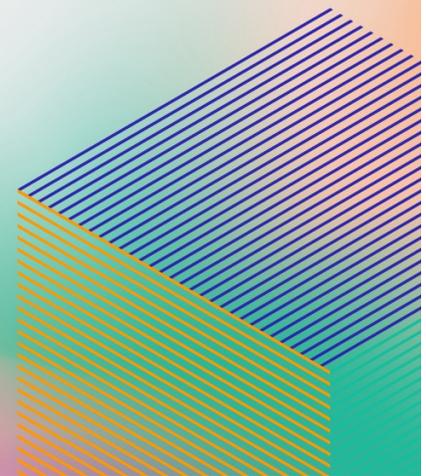
Amazon CloudWatch Logs integration



Demo.



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



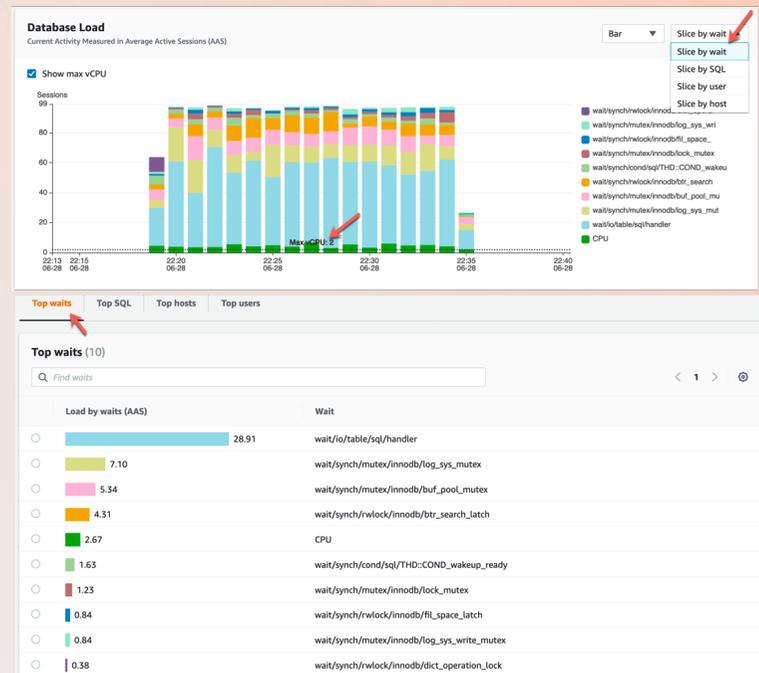
Performance Insights

Easy and powerful dashboard showing load on your database

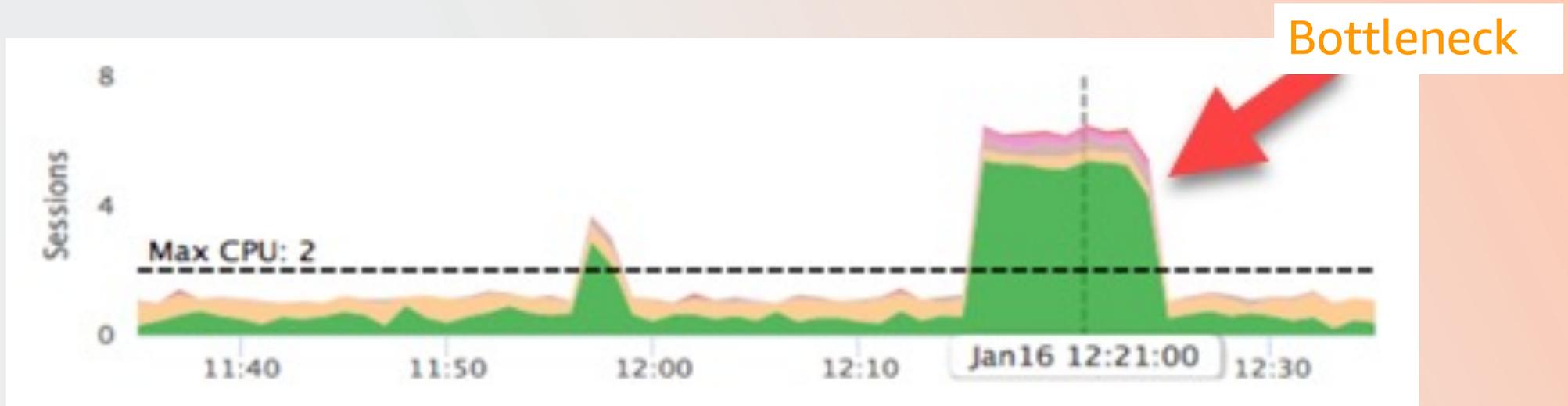
Uses Average Active Session (AAS) as a load aggregation method over time

Helps you identify source of bottlenecks: top SQL queries, wait statistics

7 days of performance data history free – perfect for developers; up to 2 years of long term retention for production use cases



Performance Insights – CPU bottleneck



Identify CPU bottleneck:

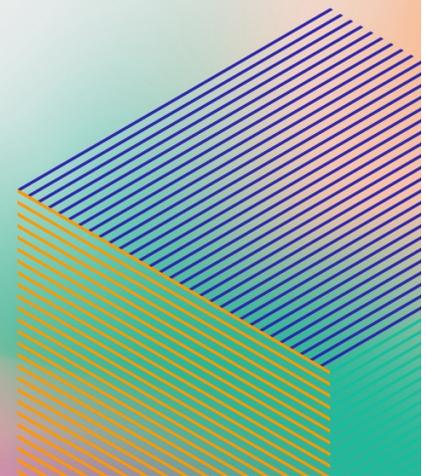
- CPU usage constantly spiking over allocated CPUs

Re-do screen grab

Demo.



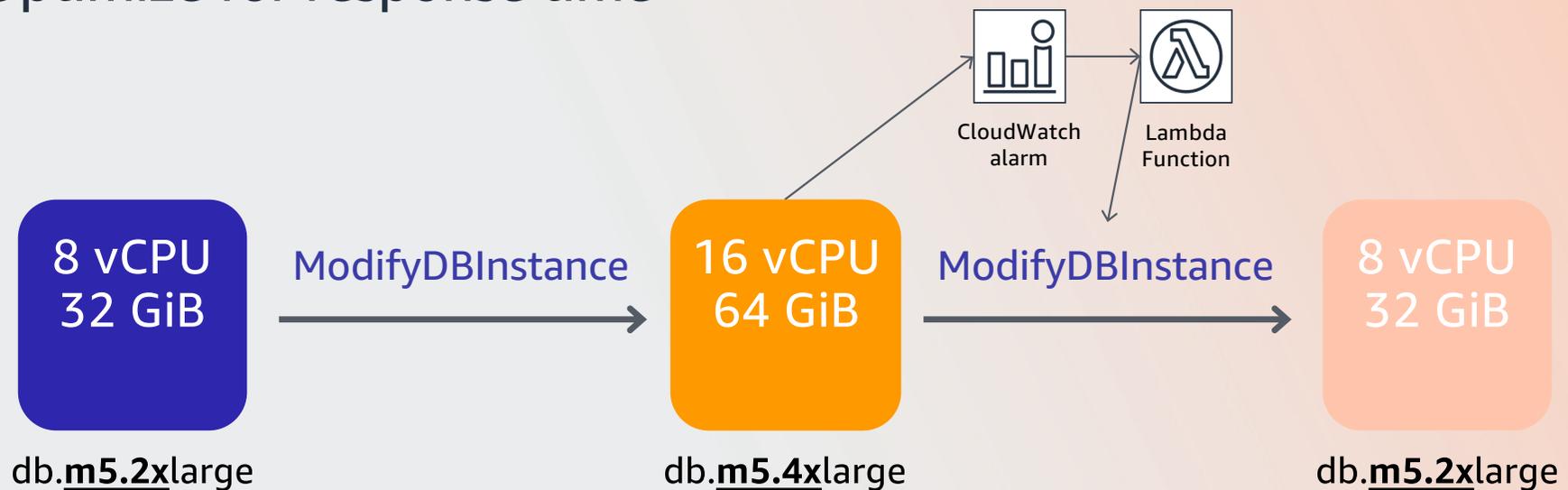
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.



Scale for your workload

Scale up and down

- Predictable workloads with periodic peaks
- Failover with Multi-AZ
- Optimize for response time



Monitoring & Optimization Summary

Monitoring using CloudWatch and Performance Insights provides deep visibility to instance operation.

Leverage CloudWatch Metrics for custom notification and response options.

Configure meaningful retention policies for monitoring data based on business cycles.

Performance Insights provides capabilities within the RDS console for troubleshooting SQL Server engine performance.

Manage the scale of your resources based on performance requirements and minimise unused overhead wherever possible.



Overall Summary

Amazon RDS for SQL Server provides a managed service for hosting your databases in the cloud.

Understand the shared responsibility model to ensure secure deployments within the AWS Cloud.

RDS for SQL Server supports Windows Authentication which can integrate with your existing self-managed domain.

Databases can be migrated in several ways which can provide minimal downtime if needed with DMS.

There are options for automated and manual backups to meet your RPO/RTO and retention requirements.

Monitor workloads using Amazon CloudWatch and Performance Insights, and AWS CloudTrail for AWS API auditing.





**Please complete the
session survey**



Thank you!

John Q. Martin

Specialist Solutions Architect
Acceleration Lab
AWS
Jqmartin@amazon.com

Lawrence Britt

Specialist Solutions Architect
Databases
AWS

Peter M. O'Donnell

Principal Solutions Architect
Security Specialist
AWS

