

Databases In The Cloud



Technical Deep Dive into Amazon RDS for Oracle

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Database Engineer

Amazon Web Services

General Overview

of Amazon Relational Database Service (RDS)

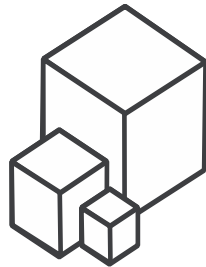
- 📦 Fast Database Provisioning
- 📦 Easy Database Scaling
- 📦 Choice of Database Engines
- 📦 Free Tier

Fast Database Provisioning with RDS

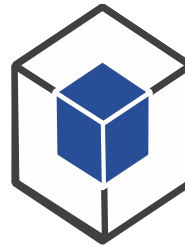
Multiple ways to start and manage your Amazon RDS for Oracle resources



Amazon RDS
**Management
Console**



AWS Command
Line Tools (**CLI**)



AWS **SDKs**

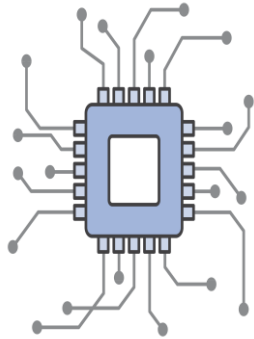


AWS
CloudFormation
templates

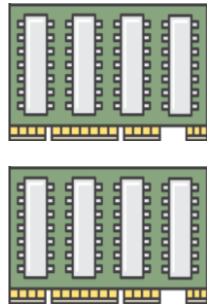
Easy Database Scaling

RDS DB Instance Class

RDS Storage Type



Compute Capabilities
vCPUs



Memory Capabilities
GB of RAM



Network Performance
MB/s (Throughput)



Storage Performance
I/O Throughput

Instance class families:

General Purpose (**M1,2,3,4**)

Memory Optimized (**R3**)

Burstable Capacity (**T2**)

Range of DB instance classes:

From: 1 vCPU and 1 GB of RAM

To: 40 vCPU and 244 GB RAM

Up to 10 Gbps Network

Storage types:

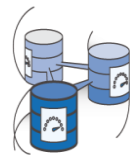
Magnetic to 6 TB

SSD Provisioned IOPS to 6 TB

SSD General Purpose to 6 TB

Choice of Database Engines

ORACLE



Amazon Aurora



AWS Free Tier for One Year

<https://aws.amazon.com/rds/free/>

AWS Free Tier includes the following each month, for one year:

- 750hrs of RDS in a db.t2.micro Instance
- 20GB of Storage
- 10 million I/Os
- 20GB for Backups each month

AWS Free Tier for One Year

<https://aws.amazon.com/rds/free/>

Other AWS Services free for one year:

- **EC2** – Virtual Machines
- **S3** – Object Storage
- **IOT** – Connected Devices
- **EC2 Container Registry**
- **DynamoDB** – NoSQL Database
- **SWF** – Simple Workflow
- **SQS/SNS** – Simple Queue/Simple Notification
- **SES** – Simple Email
- **Lambda** – Serverless Compute
- and more...

AWS Simple Monthly Calculator

Transparent Pricing:

<https://calculator.s3.amazonaws.com/index.html>

On-Demand, Hourly Billing for greatest flexibility

<https://aws.amazon.com/rds/reserved-instances/>

Reserved Instances for significant discounts for longer term contracts up to 3 years



Technical Deep Dive into Amazon RDS for Oracle

- 📦 High Availability
- 📦 Security and Compliance
- 📦 Database Migration

High Availability

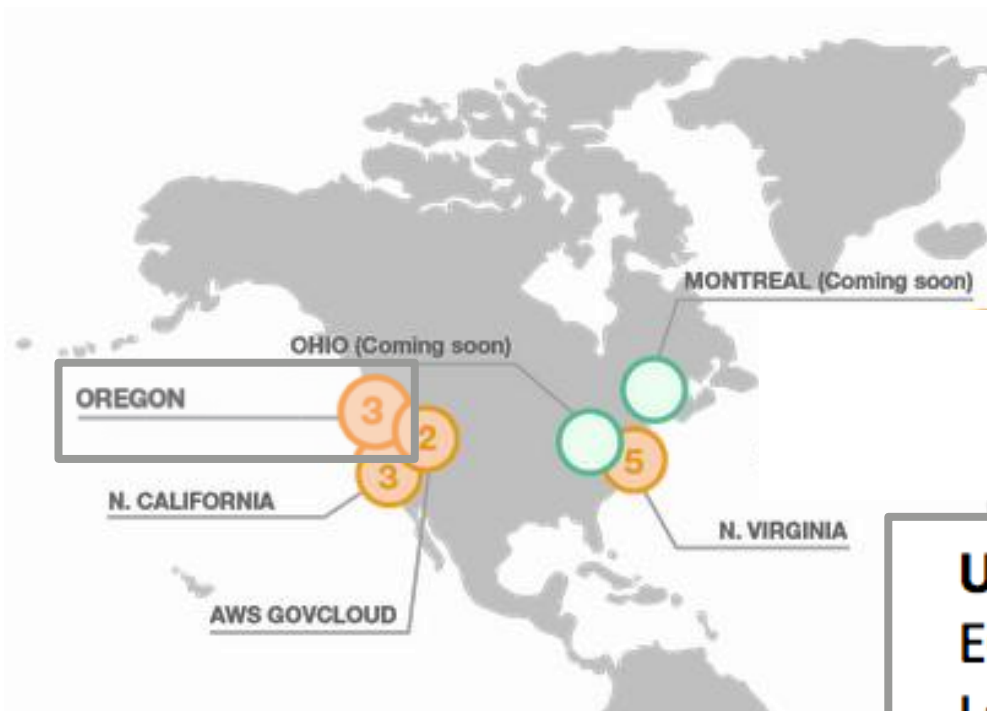
with Amazon RDS for Oracle

- Global and Redundant Data Centers
- Multi-AZ Standby Databases

AWS High Availability Global Redundant Data Centers



AWS High Availability Global Redundant Data Centers



US East (Northern Virginia) Region

EC2 Availability Zones: 5*
Launched 2006

US West (Northern California) Region

EC2 Availability Zones: 3*

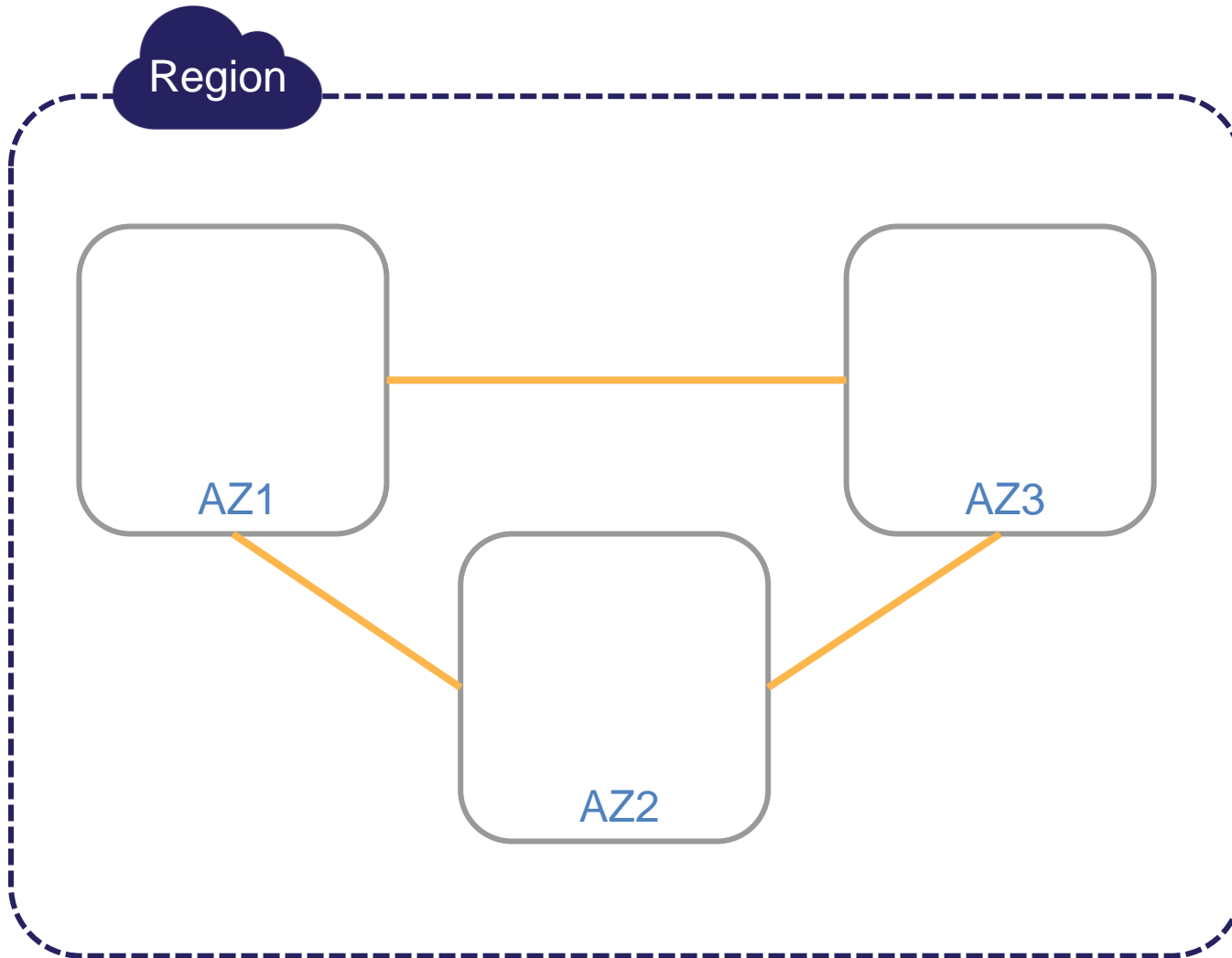
US West (Oregon) Region

EC2 Availability Zones: 3
Launched 2011

AWS GovCloud (US) Region

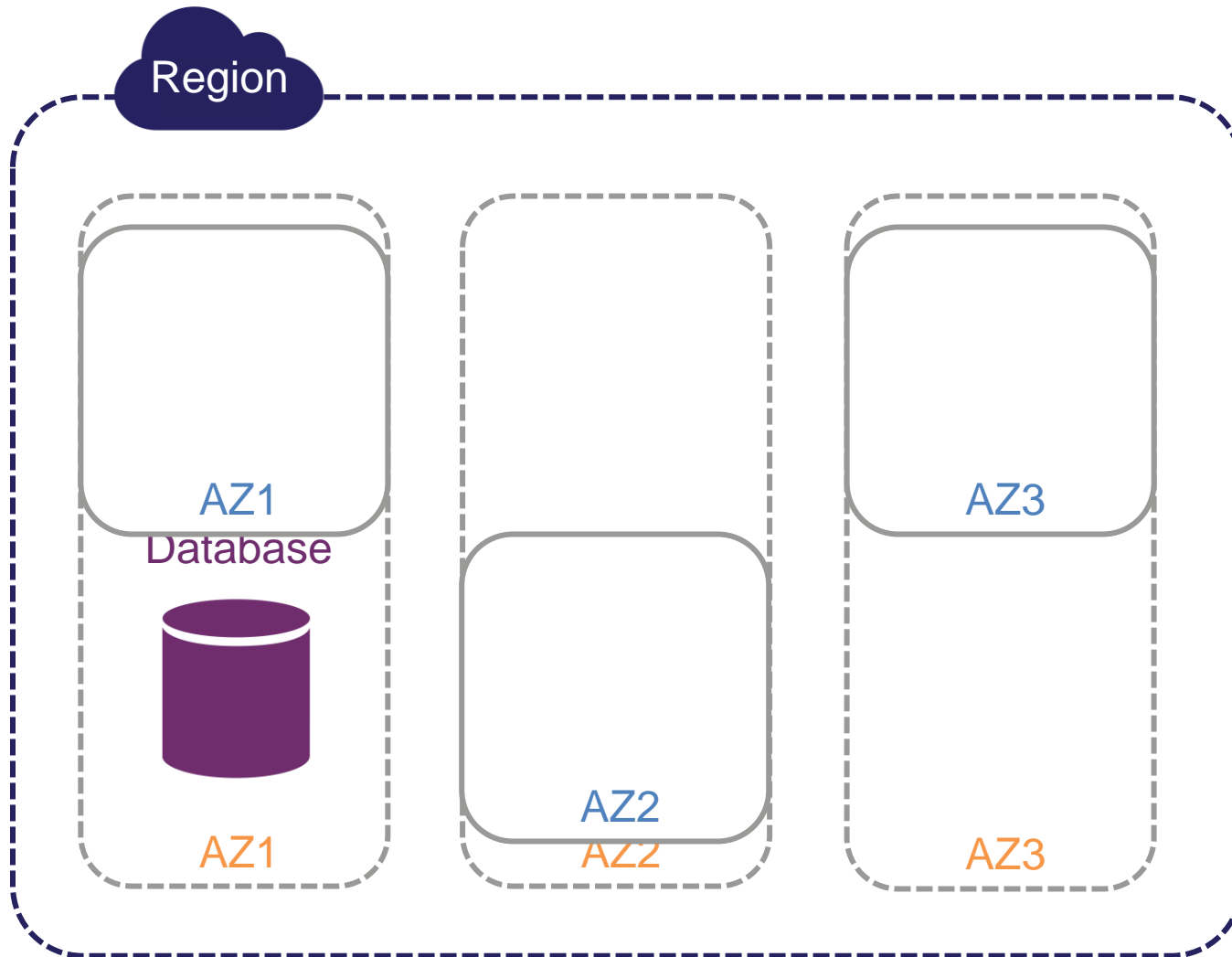
EC2 Availability Zones: 2
Launched 2011

AWS High Availability Regions and Availability Zones (AZ)



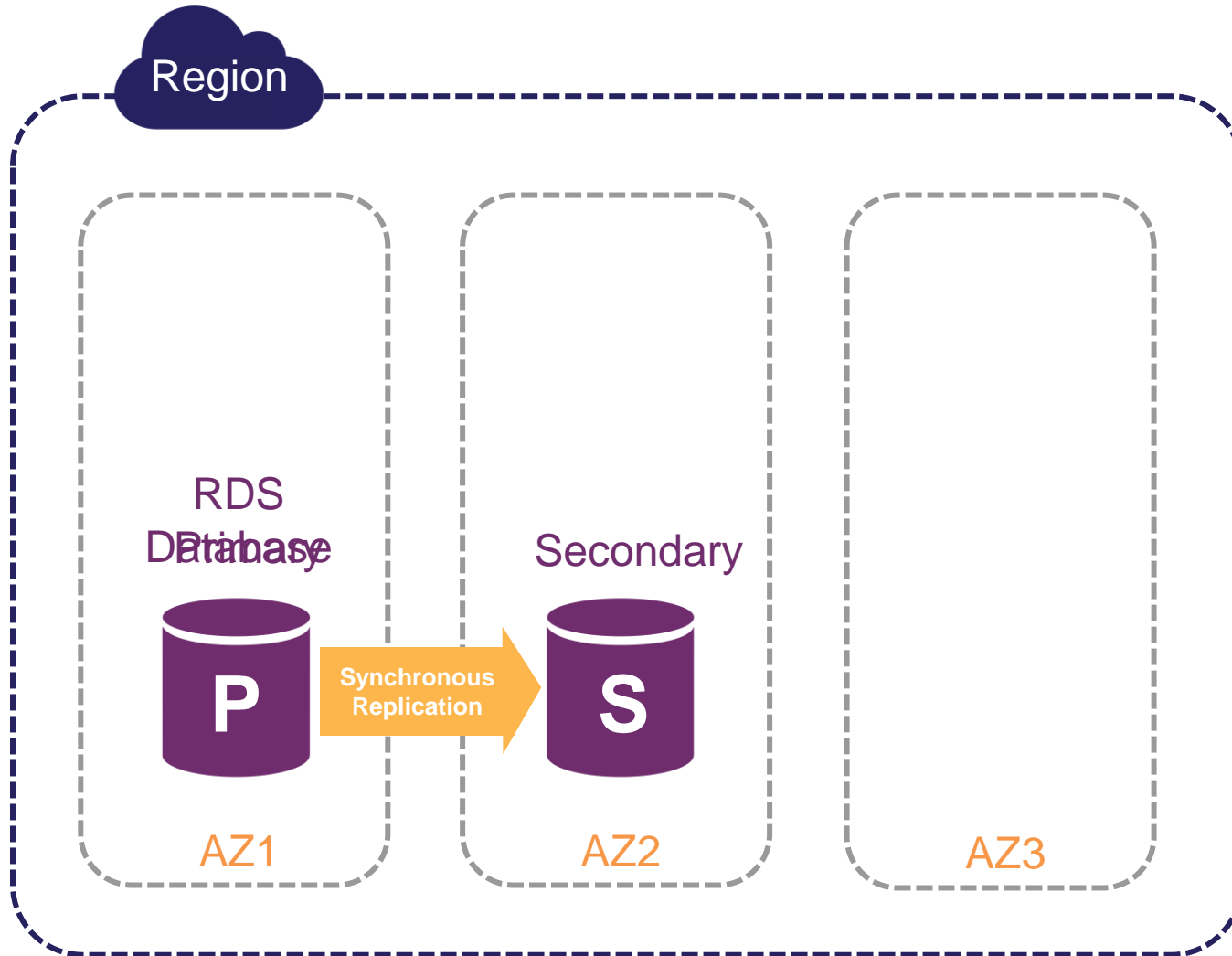
AWS High Availability

Single Availability Zones (Single-AZ)

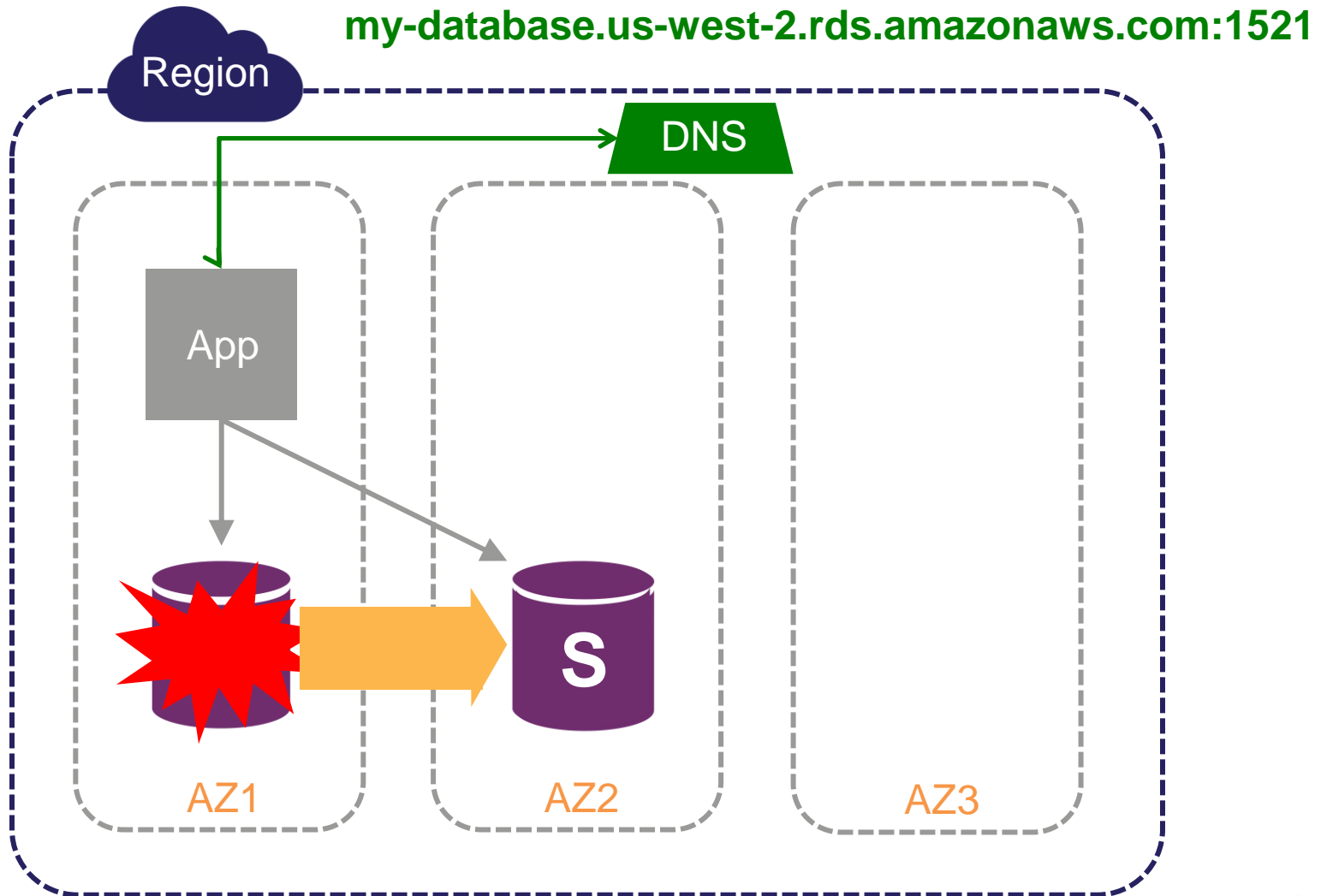


AWS High Availability

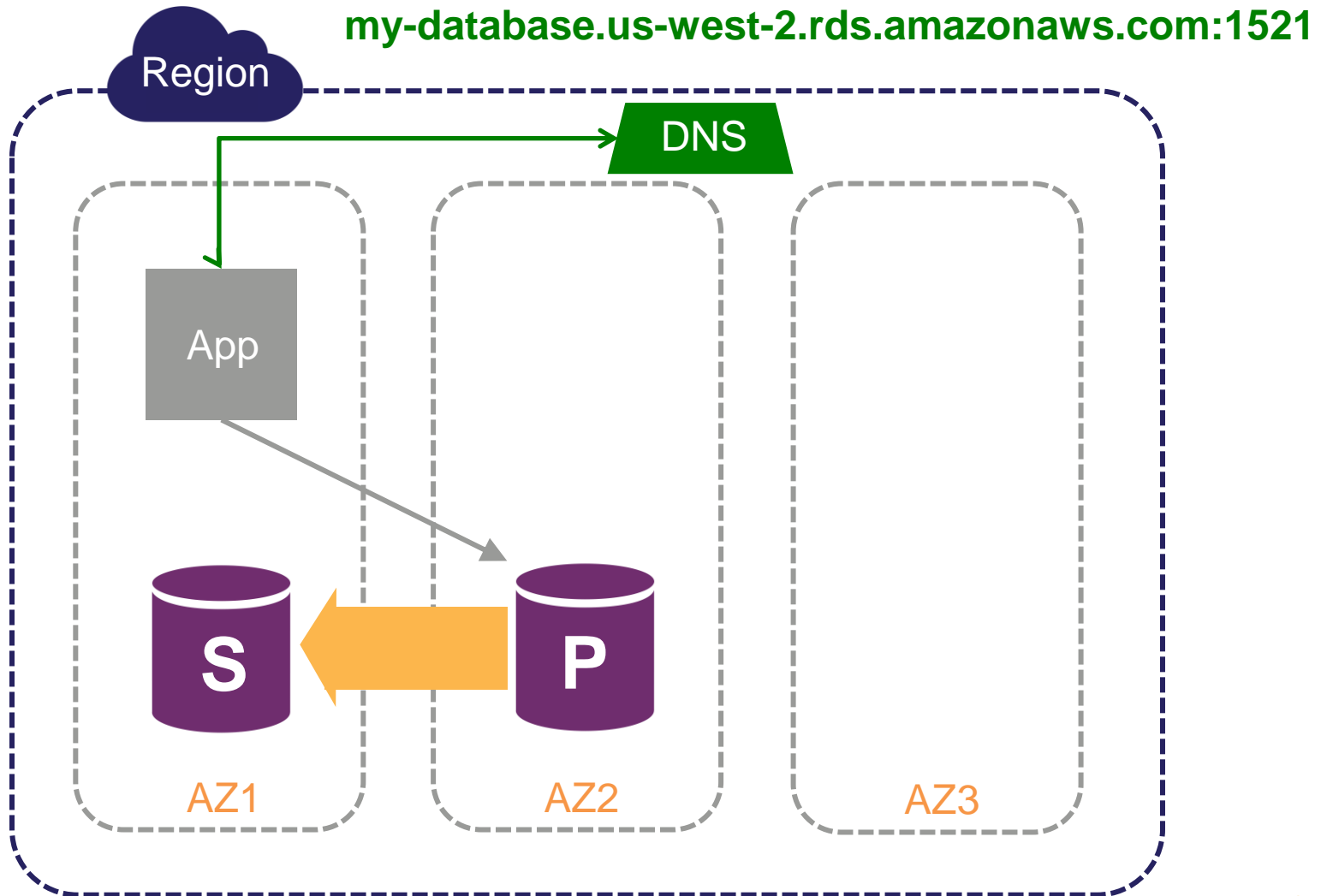
Multiple Availability Zone (Multi-AZ)



AWS High Availability Multi-AZ Failure Scenario

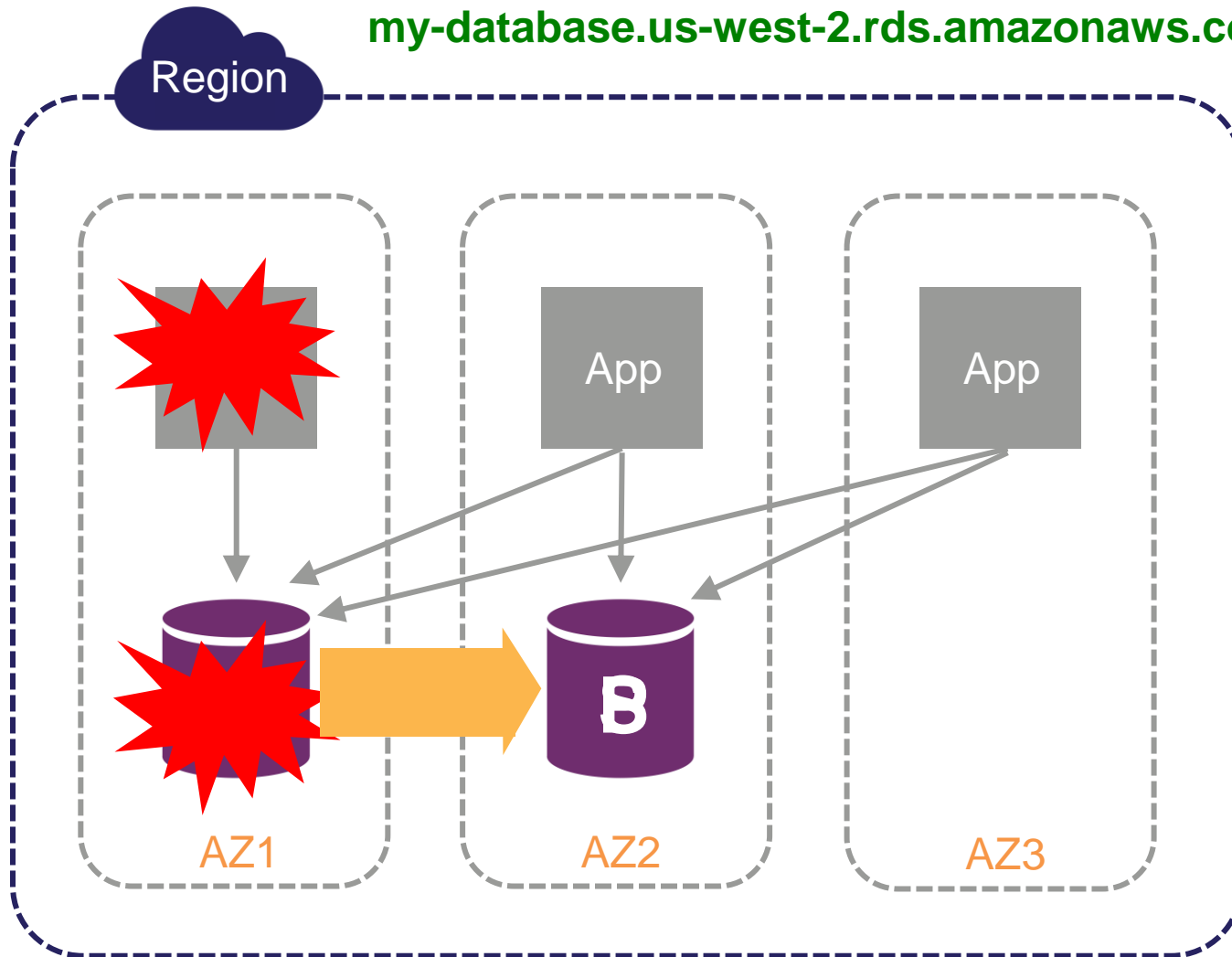


AWS High Availability Multi-AZ Failure Scenario



AWS High Availability Multi-AZ and Applications

`my-database.us-west-2.rds.amazonaws.com:1521`



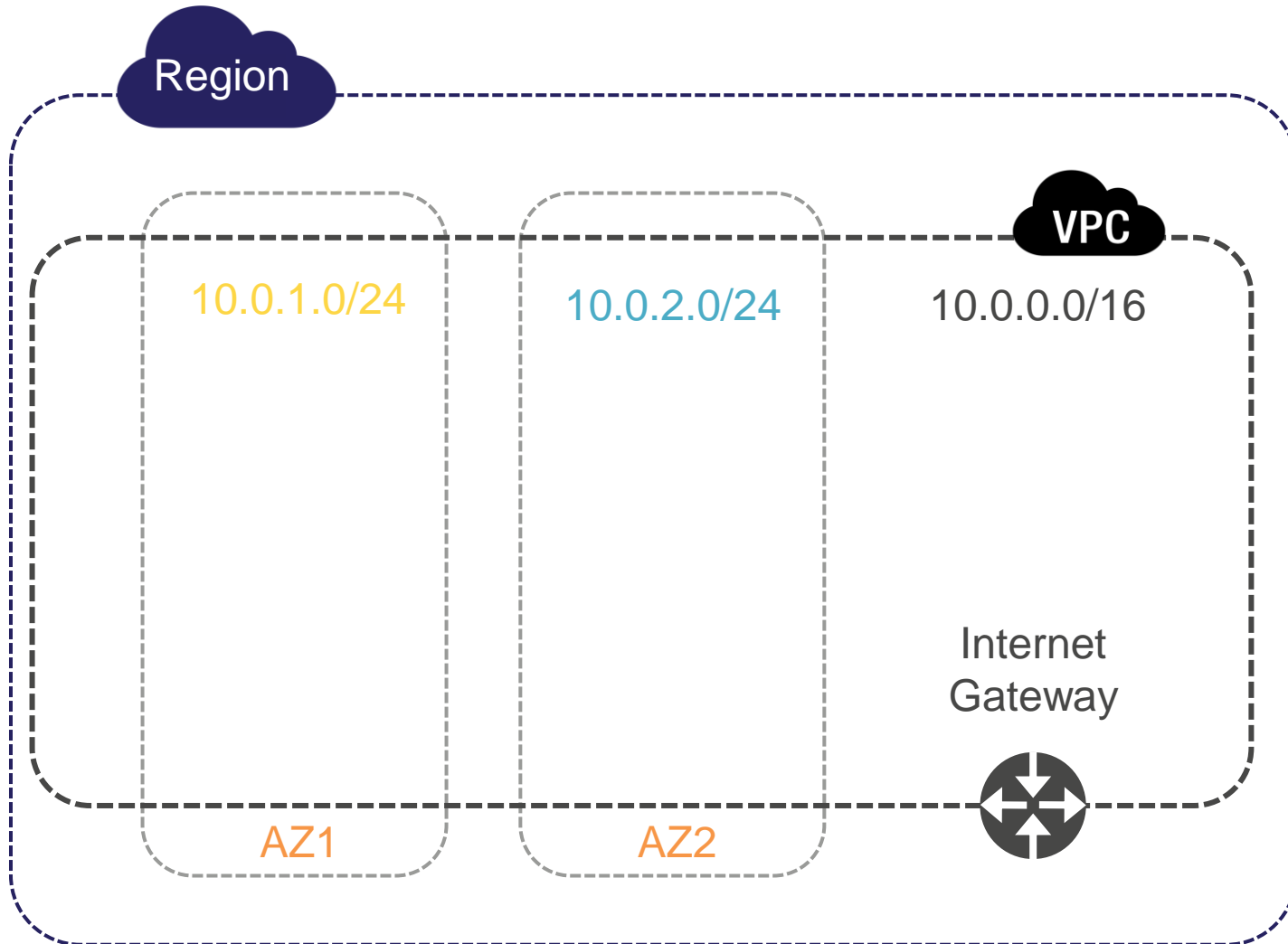
Security and Compliance

with Amazon RDS for Oracle

- Access Control
- Encryption
- Compliance

Access Control

Virtual Private Cloud (VPC)



Access Control

Connecting to AWS

Public Internet

- Customers connect to AWS endpoints
- Your internal AWS usage from your company network, usually over SSL/TLS

VPN

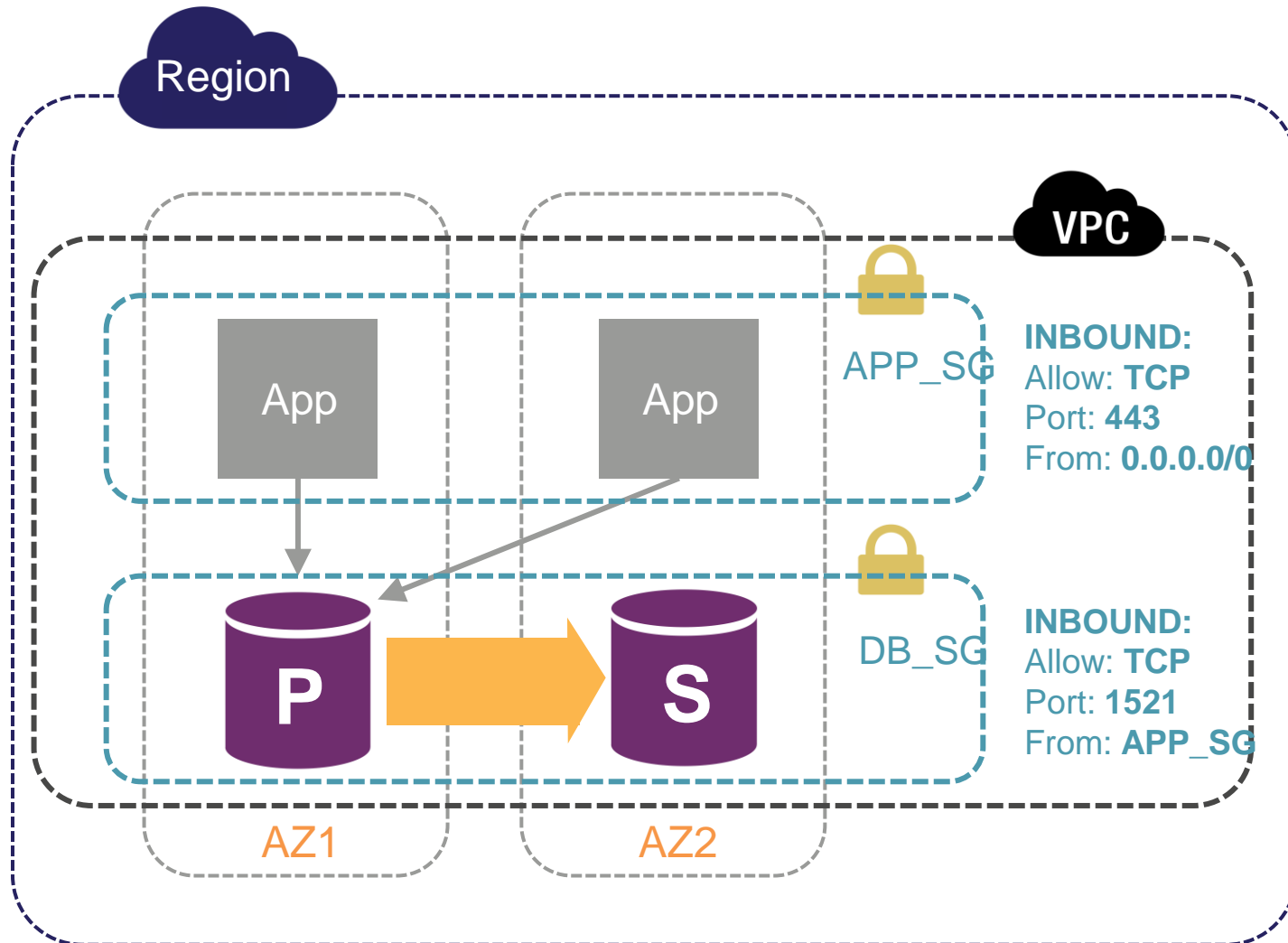
- IPSec Hardware VPN over public internet
- Two AWS VPN endpoints for failover

AWS Direct Connect

- Private network link into AWS
- AWS acts like an extension to your existing network
- Lower cost for Network usage with your ISP and with AWS
- More consistent network latency

Access Control

VPC and Security Groups



Access Control

Authentication and Logging

AWS Security Mechanisms

Identity and Access Management (IAM)

CloudTrail – monitor API calls to AWS resources

CloudWatch – monitor performance as well as changes to instances, snapshots, security groups

Oracle Database Security Mechanisms

Users, roles, privileges

'audit_trail' parameter

Virtual Private Database

Encryption

Encryption at Rest

AWS RDS Encryption at Rest – uses industry standard AES-256 encryption

Oracle Transparent Data Encryption (TDE)

Oracle TDE with Hardware Security Module (TDE_HSM) – stores keys in AWS

CloudHSM

Encryption in Transit

SSL/TLS *recently launched*

Oracle Native Network Encryption (NNE)

Regulatory Compliance with Amazon RDS for Oracle

CJIS

CSA

FIPS 140-2

HIPAA

IRAP

ISO 9001, 27001, 27017, 27018

ITAR

MPAA

NIST

PCI DSS

SOC 1, 2, 3



<https://aws.amazon.com/compliance>

Database Migration

with Amazon RDS for Oracle

- 📦 Migrating Databases to the Cloud

AWS Database Migration

Migrating to the Cloud

Small Databases

Oracle SQL Developer

Oracle Export/Import

Large Databases

Oracle SQL*Loader (best for limited schemas)

CTAS / INSERT over database link

Oracle Data Pump Network Mode

Zero-Downtime

AWS Database Migration Service (DMS)

Oracle GoldenGate

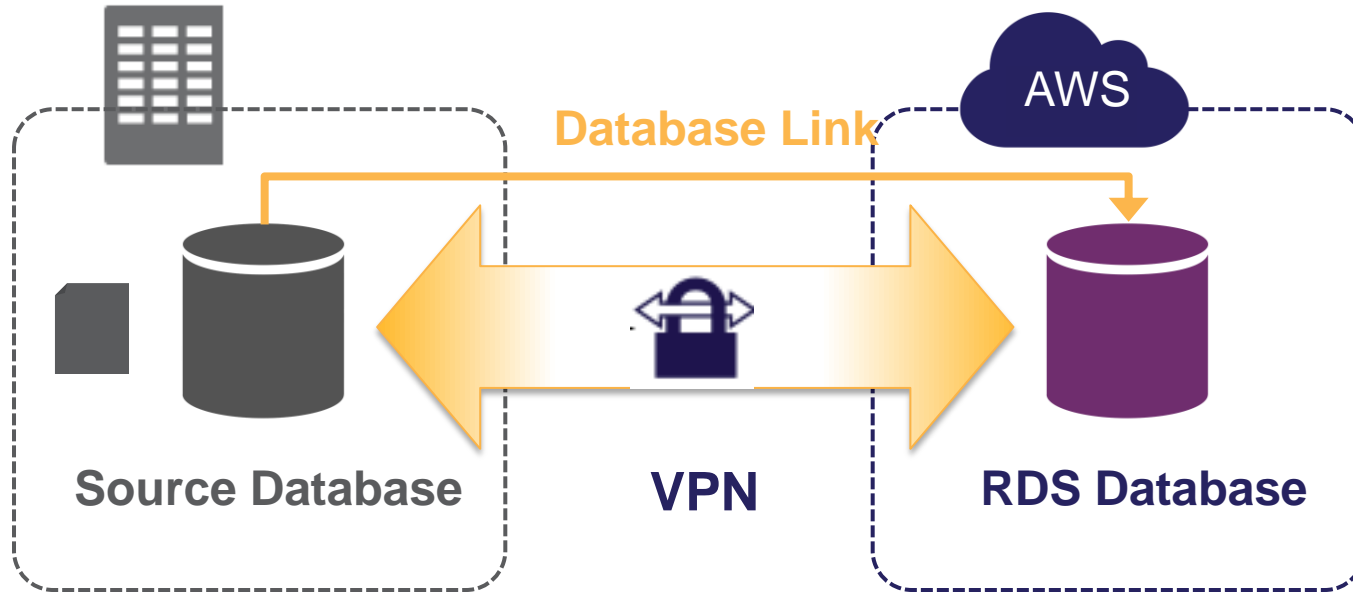
Oracle Materialized Views (best for smaller databases)

Very Large Databases (or Small Network Pipes)

AWS Import/Export Snowball + EC2 + DMS

AWS Database Migration

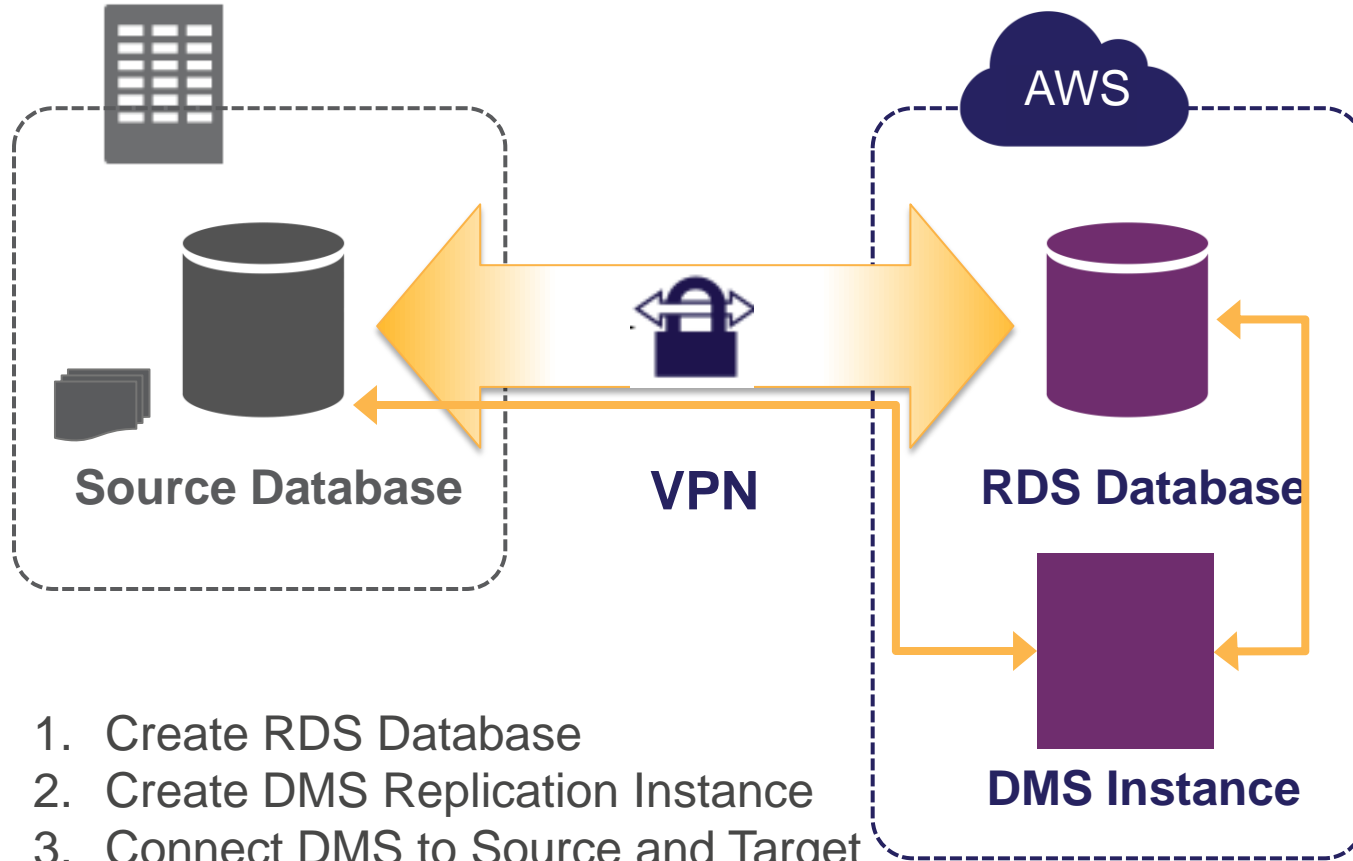
Oracle Data Pump from On-Premises to RDS



1. Create RDS Database
2. Schema Export (expdp) on source
3. Create DB Link on source to target
4. Transfer dump file over DB Link with `DBMS_FILE_TRANSFER`
5. Import dump file (impdp)
6. Remove dump file on target

AWS Data Migration

Data Migration Service (DMS)



1. Create RDS Database
2. Create DMS Replication Instance
3. Connect DMS to Source and Target
4. Enable Supplemental Logging on Source
5. Use DMS to Create Tables on Target and Load Data

AWS Database Migration

RDS Oracle Best Practices



Before Initial Data Load

Create tables and primary keys only

Put database in NOARCHIVELOG mode

- set Backup Retention to zero

Use Single-AZ



After Initial Data Load

Create secondary indexes and triggers

Switch to ARCHIVELOG mode

Switch to Multi-AZ if necessary



Optimize Hardware and Network

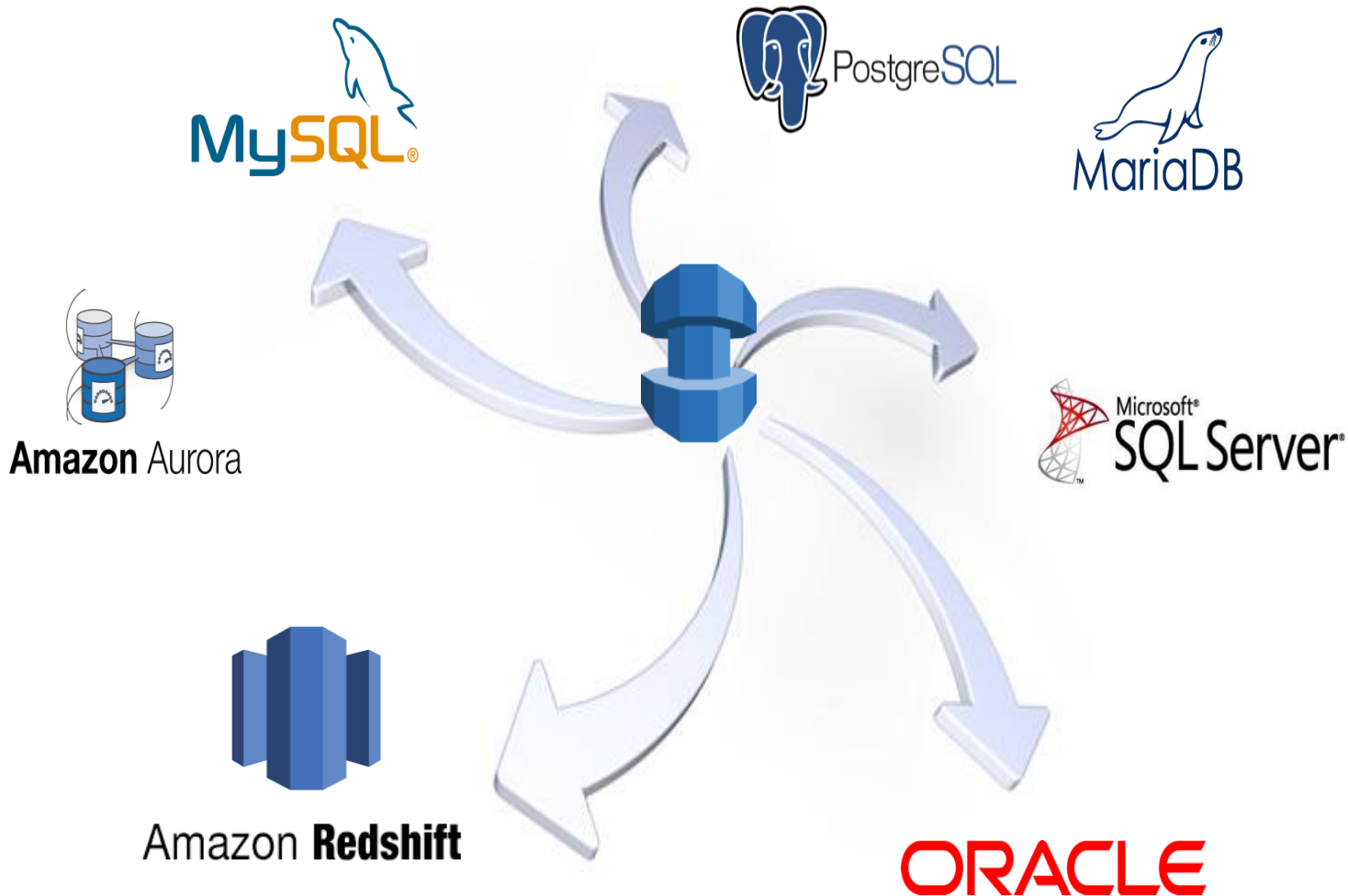
Choose appropriate instance type and storage

- Use EBS-Optimized instances

Scale down instance type after data load

AWS Database Migration

Migrate and Replicate Between DB Engines



AWS Services

AWS Services

Compute

- EC2**
Virtual Servers in the Cloud
- Elastic Beanstalk**
Run and Manage Web Apps
- Lambda**
Run Code in Response to Events

Storage & Content Delivery

- S3**
Scalable Storage in the Cloud
- CloudFront**
Global Content Delivery Network
- Elastic File System** PREVIEW
Fully Managed File System for EC2
- Glacier**
Archive Storage in the Cloud
- Import/Export Snowball**
Large Scale Data Transport

Database

- RDS**
Managed Relational Database Service
- DMS** PREVIEW
Data Migration Service

Networking

- VPC**
Isolated Cloud Resources
- Route 53**
Scalable DNS and Domain Name Registration

Developer Tools

- CodeCommit**
Code in Private Git Repositories
- CodeDeploy**
Automate Code Deployments
- CodePipeline**
Release Software using Continuous Delivery

Management Tools

- CloudWatch**
Monitor Resources and Applications
- CloudFormation**
Create and Manage Resources with Templates
- CloudTrail**
Track User Activity and API Usage
- Config**
Track Resource Inventory and Changes
- OpsWorks**
Automate Operations with Chef
- Service Catalog**
Create and Use Standardized Products

Internet of Things

- AWS IoT**
Connect Devices to the Cloud

Game Development

- GameLift**
Deploy and Scale Session-based Multiplayer Games

Mobile Services

- Mobile Hub**
Build, Test, and Monitor Mobile Apps
- Cognito**
User Identity and App Data Synchronization
- Device Farm**
Test Android, FireOS, and iOS Apps on Real Devices in the Cloud
- Mobile Analytics**
Collect, View and Export App Analytics
- SNS**
Push Notification Service

Application Services

- SES**
Email Sending and Receiving Service
- SQS**
Message Queue Service
- SWF**
Workflow Service for Coordinating Application Components

Enterprise Applications

- WorkSpaces**
Desktops in the Cloud
- WorkDocs**
Secure Enterprise Storage and Sharing Service
- WorkMail**
Secure Email and Calendaring Service

Security & Identity

- Identity & Access Management**
Manage User Access and Encryption Keys

Machine Learning

- Elasticsearch Service**
Run and Scale Elasticsearch Clusters
- Kinesis**
Work with Real-Time Streaming Data
- Machine Learning**
Build Smart Applications Quickly and Easily

Q & A

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