Amazon RDS for MySQL

High Availability and Disaster Recovery

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16th June, 2022
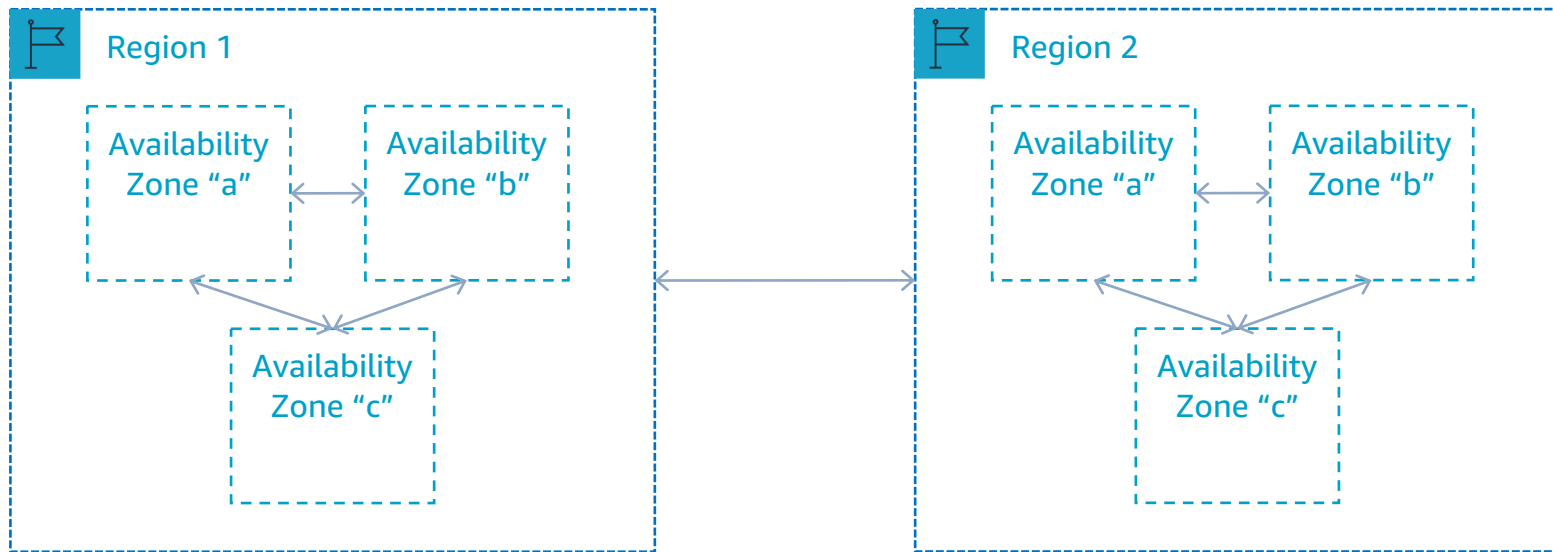
Agenda

- Introduction and background
- High availability
- Disaster recovery
- Q & A

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Introduction and Background – Regions and Availability Zone

AWS global infrastructure	Amazon RDS	Definitions and terms

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Introduction and Background – Managed database service

Managed relational database service, choice of popular database engines

MySQL   PostgreSQL   MariaDB   Microsoft SQL Server   ORACLE

Easy to administer

Easily deploy and maintain hardware, OS and DB software; built-in monitoring

Performant & scalable

Scale compute and storage with a few clicks; minimal downtime for your application

Available & durable

Automatic Multi-AZ data replication; automated backup, snapshots, and failover

Secure and compliant

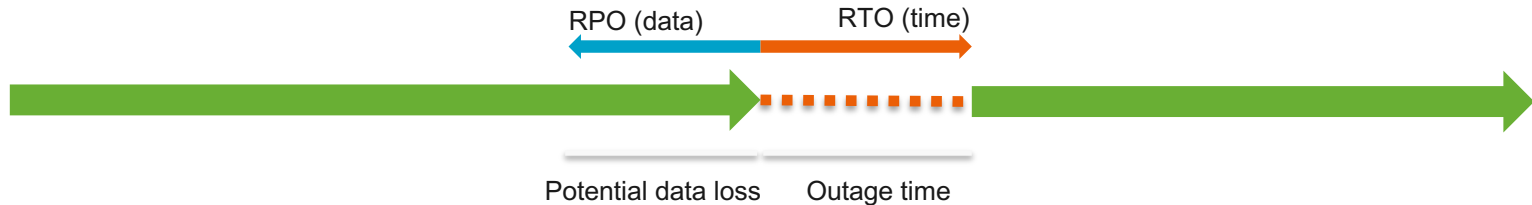Data encryption at rest and in transit; industry compliance and assurance programs

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Introduction and Background - Terminology

AWS global infrastructure	Amazon RDS	Definitions and terms

- Recovery Point Objective (RPO) and Recovery Time Objective (RTO)

RPO (data)   RTO (time)

Potential data loss   Outage time

- Synchronous vs asynchronous replication
- Automated and Manual Snapshots
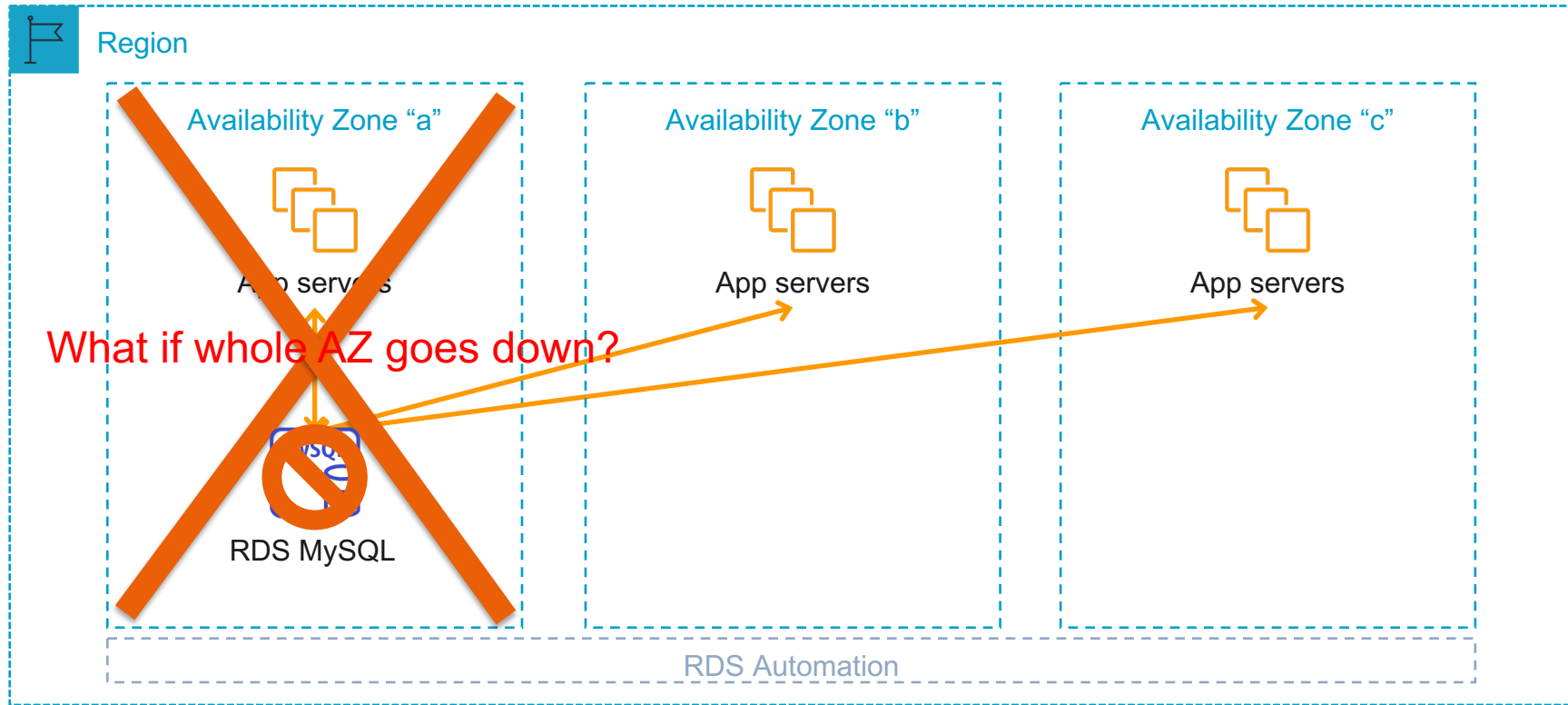- Logical and other replication methods

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High availability

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High availability with Amazon RDS MySQL
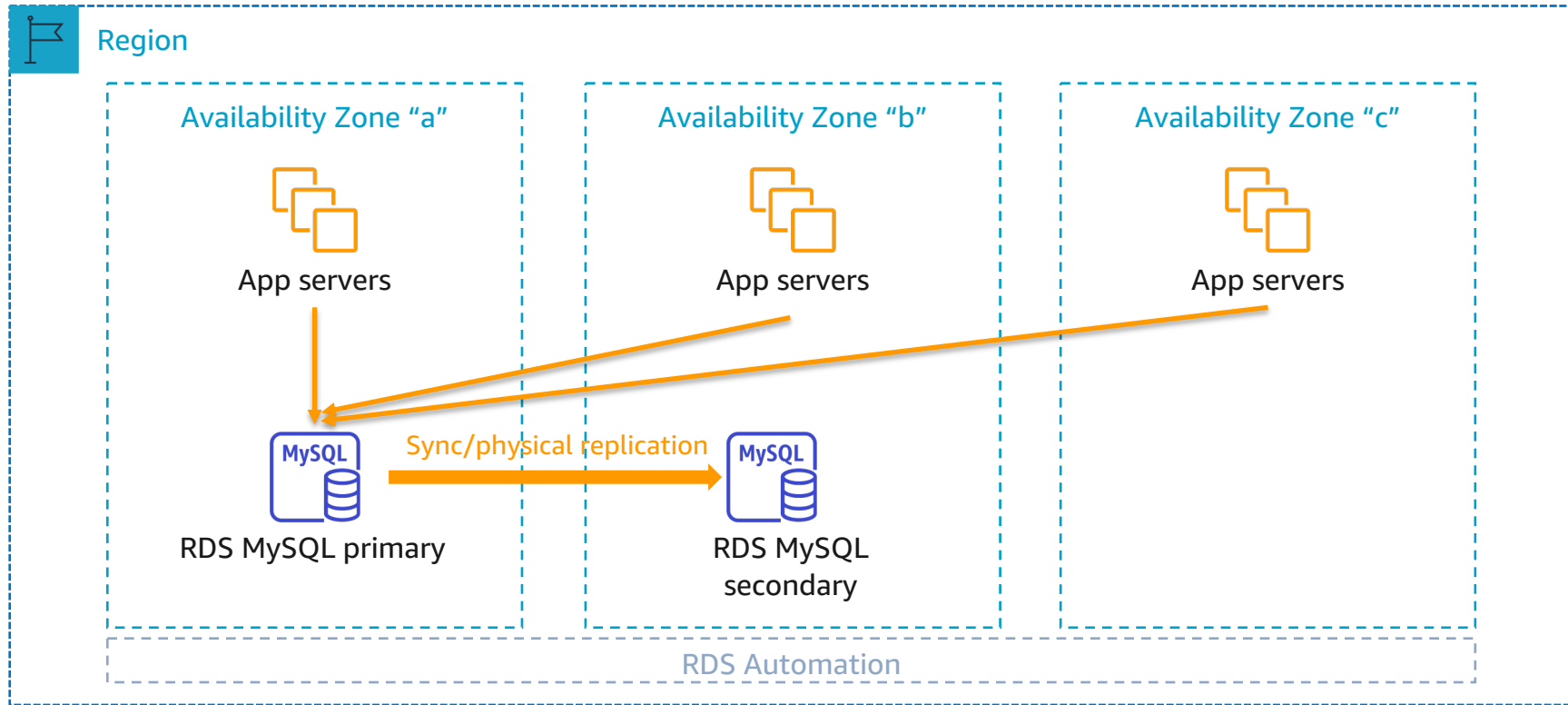
- RDS offers two Multi-AZ options

    - Multi-AZ DB instance deployment

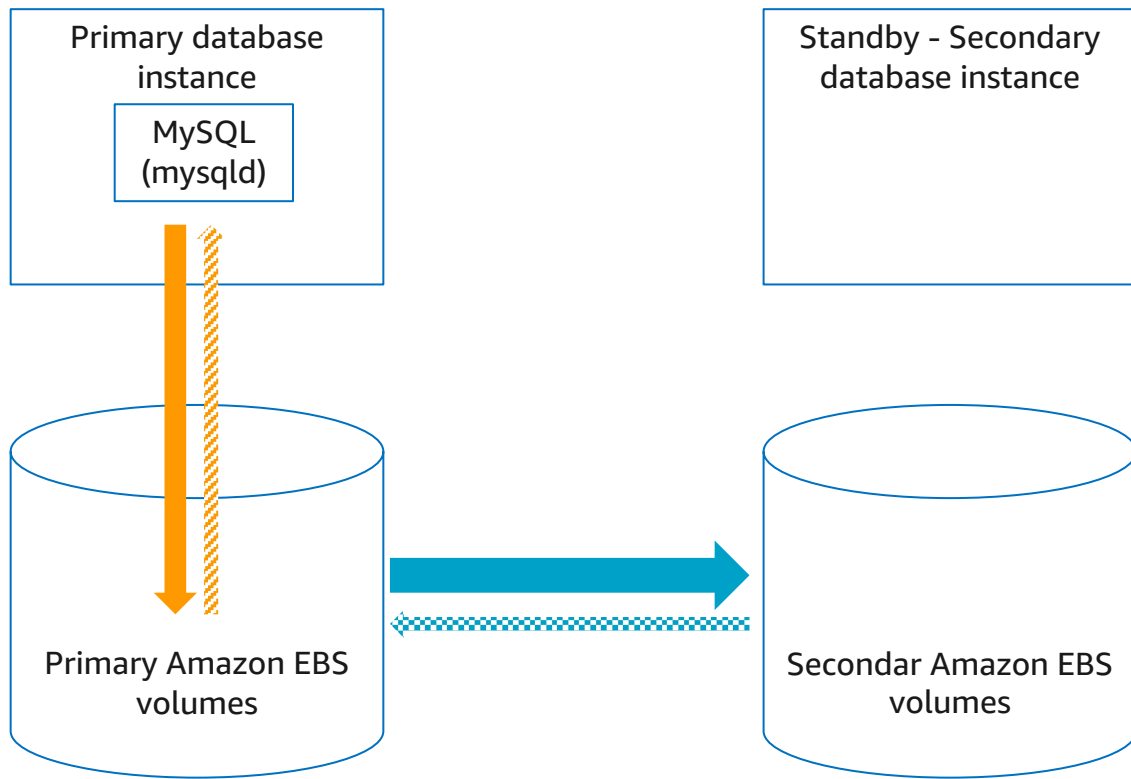   - Multi-AZ Cluster deployment

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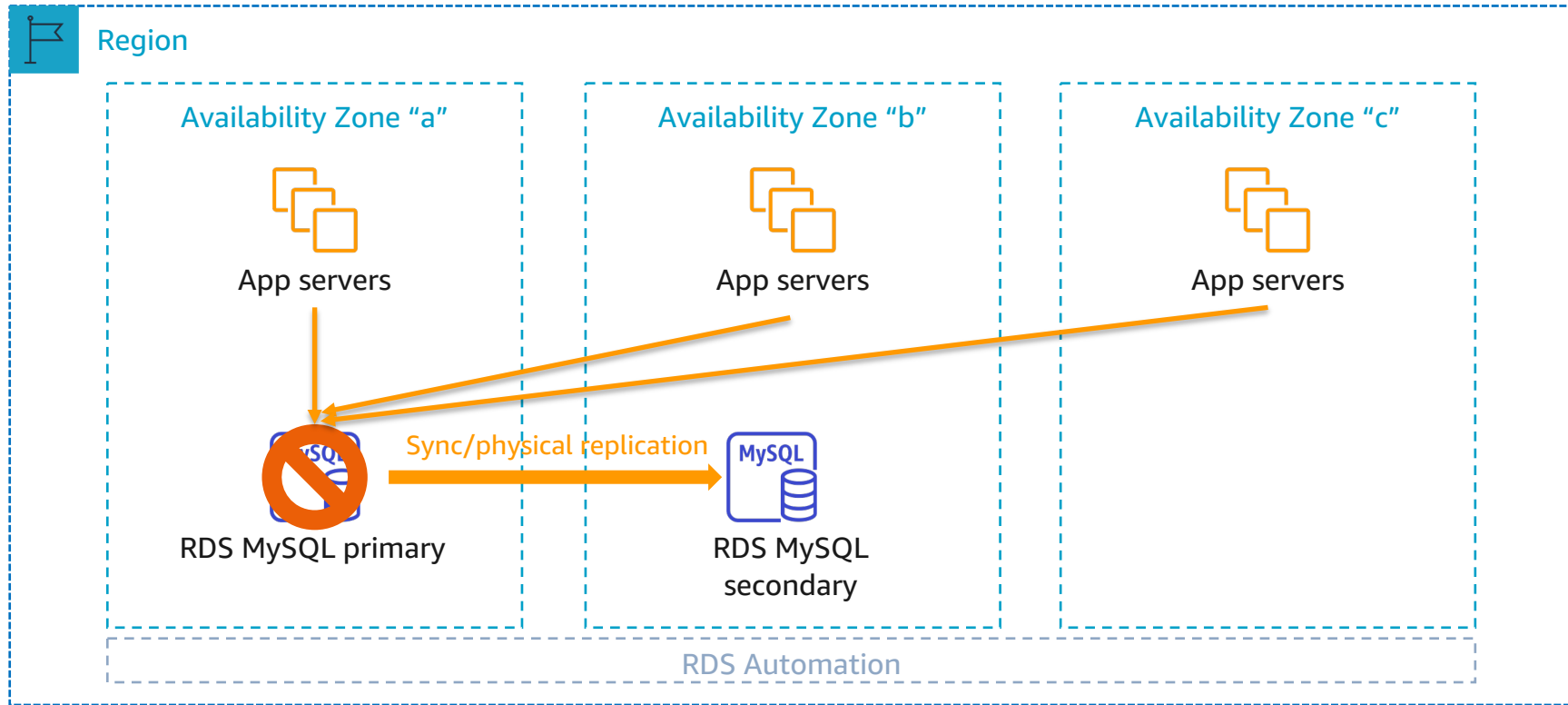# Multi-AZ DB instance deployment

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Single-AZ availability

Region

Availability Zone "a"

App servers

What if whole AZ goes down?

RDS MySQL

Availability Zone "b"

App servers

Availability Zone "c"

App servers

RDS Automation

Multi-AZ Instance Deployment

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Multi-AZ Instance Deployment Replication – How it works

Primary database instance

MySQL (mysqld)

Standby - Secondary database instance

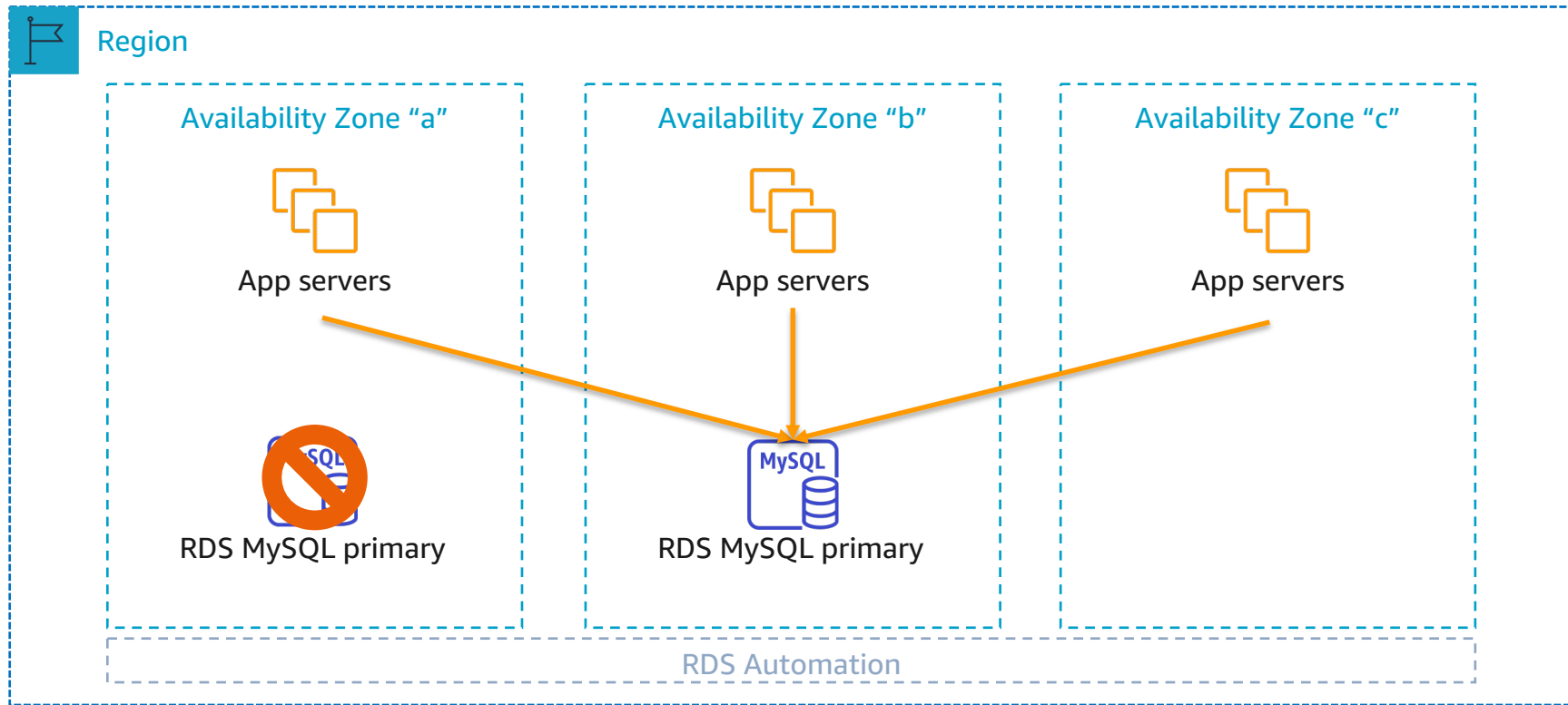Primary Amazon EBS volumes

Secondar Amazon EBS volumes

Write latency = cumulative latency of (local write + local acknowledgement) + ((remote write + remote acknowledgement))

aws

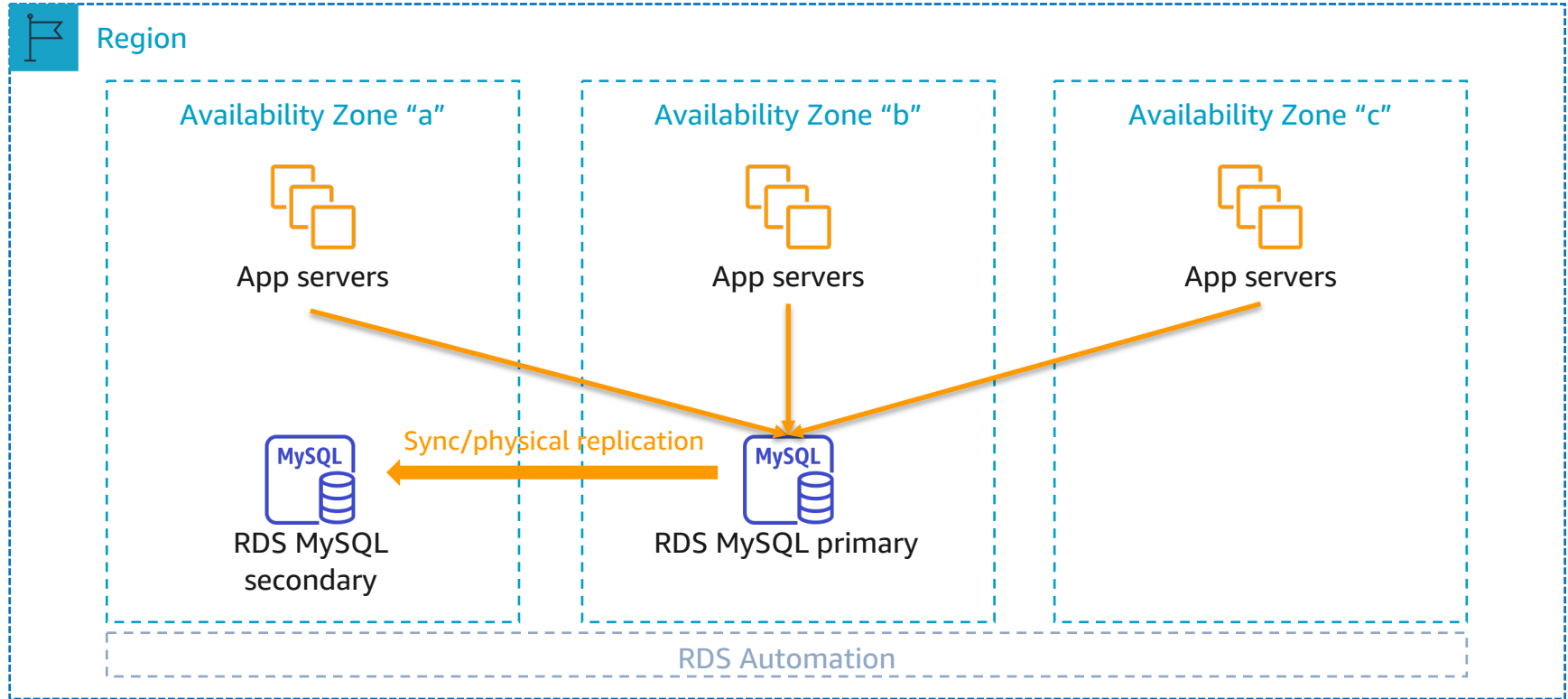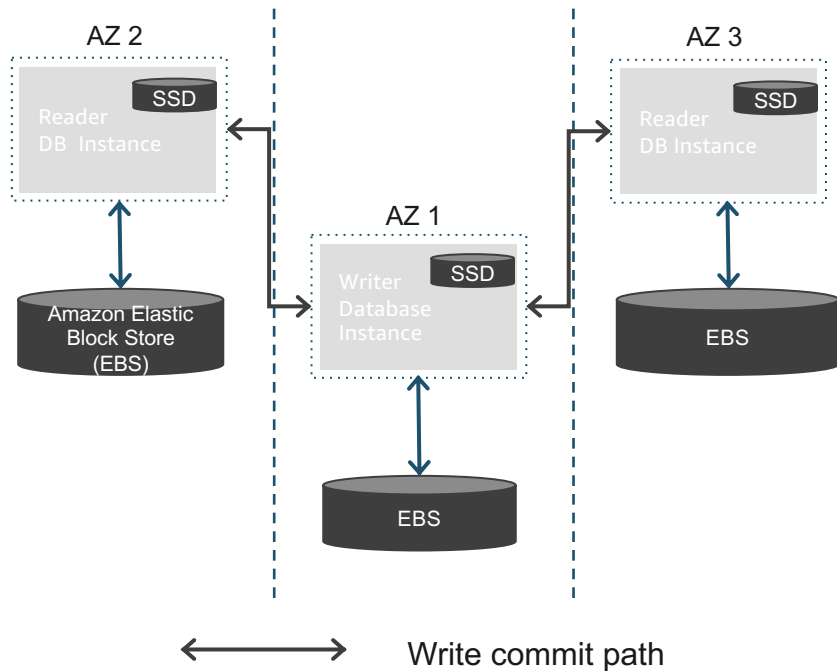# Multi-AZ Instance Deployment – failover process

Multi-AZ – failover process

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Multi-AZ – failover process

Multi-AZ DB cluster deployment

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How does this new deployment option work?

Multi-AZ with readable standbys

AZ 2

SSD

Reader
DB Instance

Amazon Elastic
Block Store
(EBS)

AZ 1

Writer
Database
Instance   SSD

EBS

AZ 3

SSD

Reader
DB Instance

EBS

↔ Write commit path

Commits writes on primary only after first standby acknowledges writing to SSD

Moves data asynchronously to EBS for durability

Serves reads from memory cache or from EBS

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Multi-AZ Cluster - Endpoints
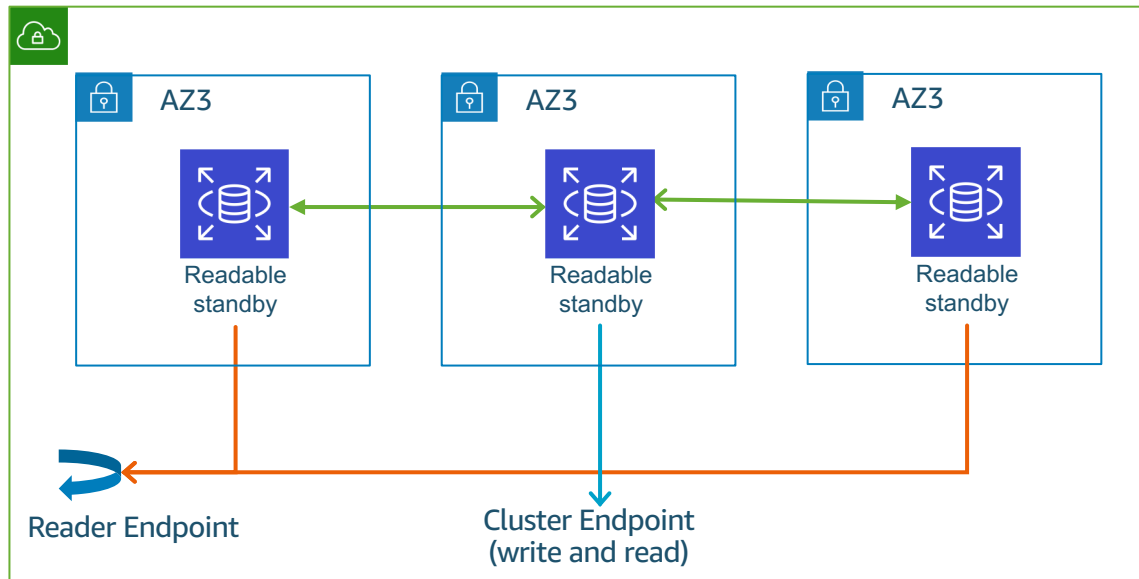
Cluster Endpoint

- Always follows writer instance

Reader Endpoint

- Send each read request to one of the reader instance

Instance Endpoint

- Connect to a specific DB instance within the Multi-AZ cluster

Amazon Confidential

Multi-AZ – Automatic failover

Automatic failover -

- Loss of availability in primary Availability Zone
- Loss of network connectivity to primary
- Compute unit failure on primary
- Storage failure on primary
- Certain types of database process crash

No Automatic failover -

- Database operations such as long running queries, deadlocks or database corruption errors

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Benefits of Multi-AZ

- 99.95% monthly uptime percentage SLA

- System upgrades like OS patching or DB Instance scaling applied first on the standby that increases the availability

- Backups are always taken from the standby instance

- The endpoint of the DB instance remains the same after a failover

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Best practices for Multi-AZ

- Keep a check on DNS caching and set small values for DNS time to live (TTL).

- To shorten failover time
  a. Use RDS Proxy (not supported for Multi-AZ DB Cluster) - reduces failover times for Amazon RDS databases by up to 66%
  b. Use smaller transactions, database recovery relies on transactions

- Use Amazon RDS DB events to monitor failovers
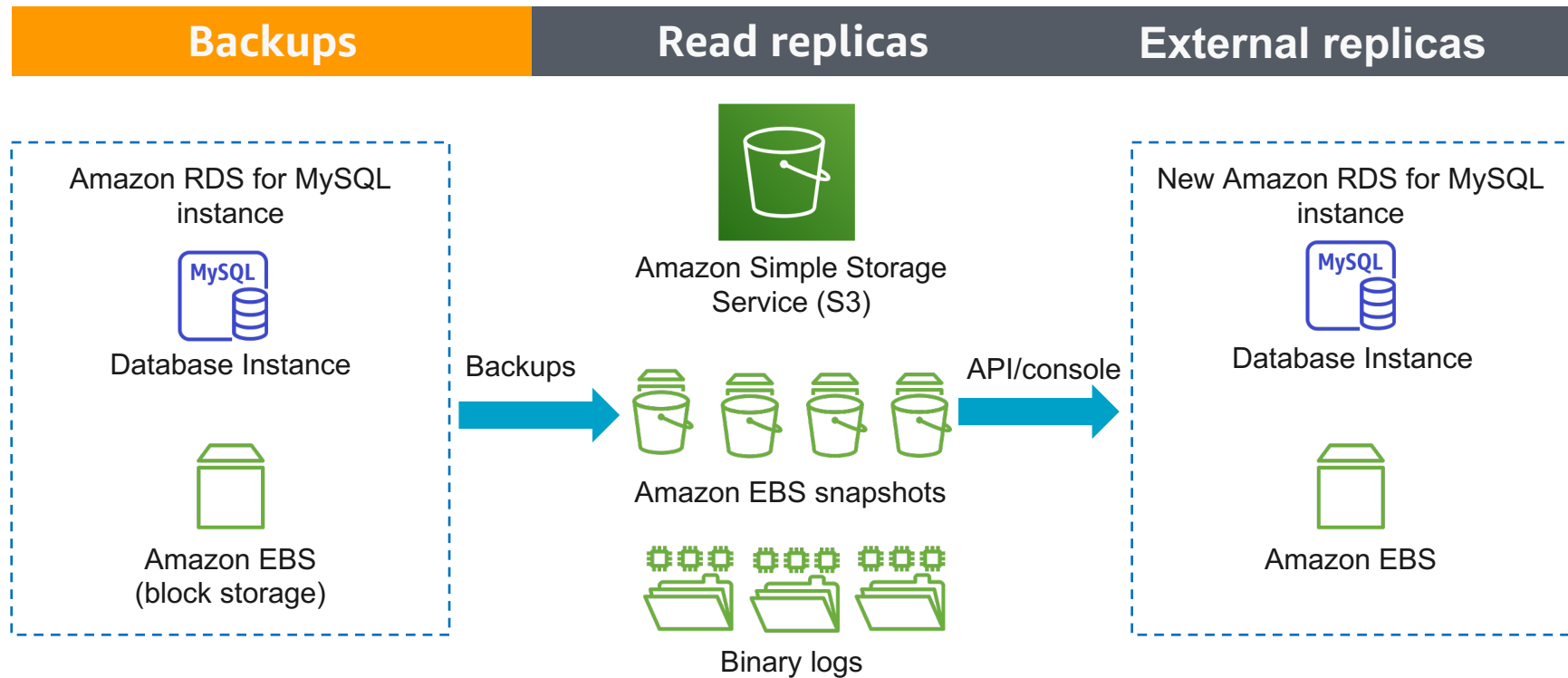
- Test the failovers

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Disaster recovery

Disaster recovery with Amazon RDS

Backups	Read replicas	External replicas

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Disaster recovery with Amazon RDS - Backups

Backups	Read replicas	External replicas

Amazon RDS for MySQL instance

Database Instance

Backups →

Amazon Simple Storage Service (S3)

Amazon EBS snapshots

API/console →

New Amazon RDS for MySQL instance

Database Instance

Amazon EBS
(block storage)

Binary logs

Amazon EBS

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RDS automated backups

- Enabled by default

- Daily snapshot of storage volume

- Binary logs swept to Amazon S3 every 5 minutes

- Managed retention up to 35 days (default 7 days)

- Retain automated backups when you delete a DB instance

Region

Amazon EBS volume

Running instance

Backups in Amazon S3

EBS Snapshots   Binary logs

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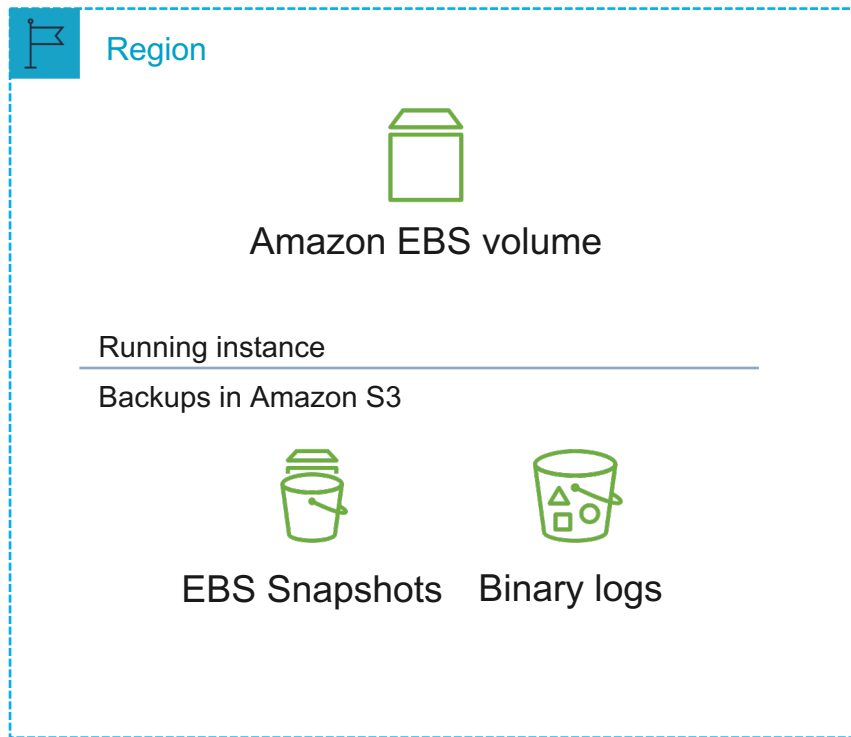
RDS manual backups

- 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

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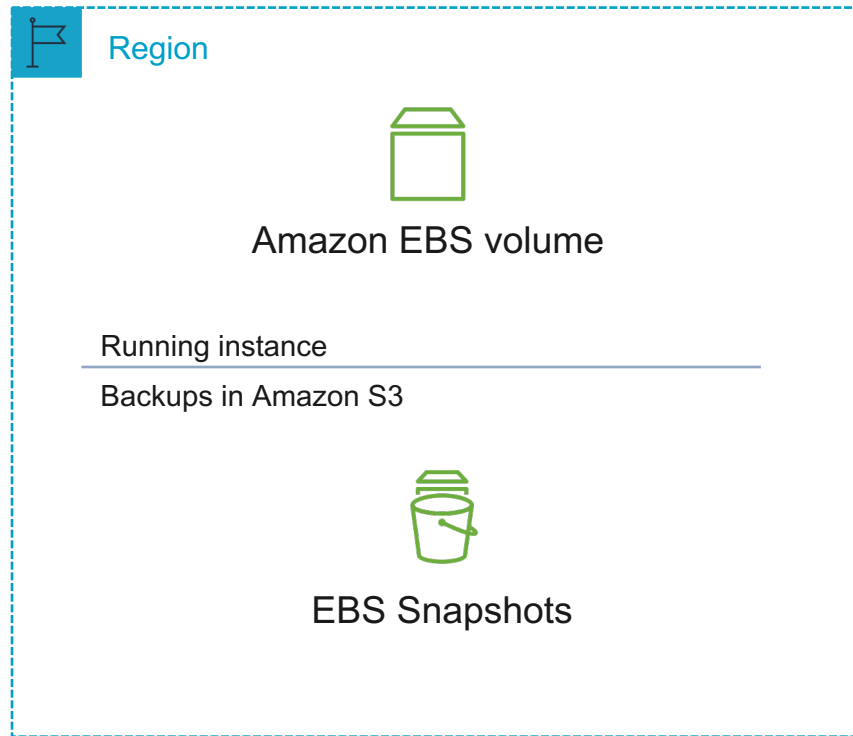
RDS Backups/ Snapshots

- Always incremental

- Performance impact

    - Single-AZ: require a brief (<1-second) pause in I/O

    - Multi-AZ: snapshot taken from secondary

    - Both: no performance impact while blocks are being backed up

- Copy snapshots to other regions/accounts

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Restore from snapshot

- Create a new instance from any snapshot
- Can restore in same or different account/region

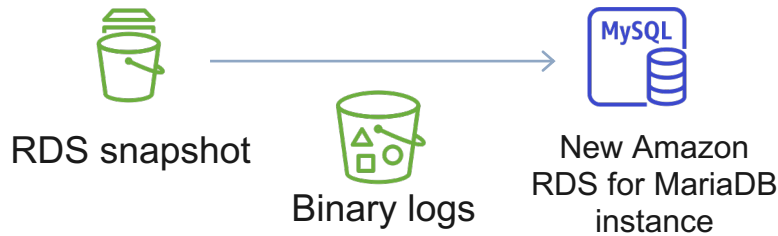RDS snapshot

New Amazon RDS for MySQL instance

Use cases:

- Primary images
- Disaster Recovery
- Test upgrades and application changes
- Clone environments

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Restore to a point in time

- Create a new instance as of a point in time
- Requires automated backups
- Available in the same region and account

Use cases:

- Recover from application errors or logical corruption
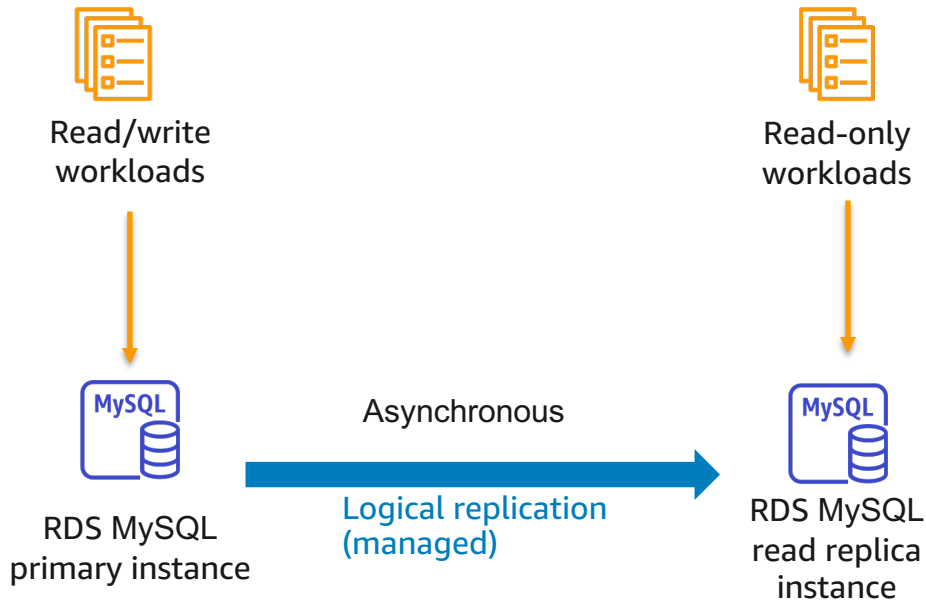- Recover from loss of Single-AZ instance
- DR

RDS snapshot

Binary logs

MySQL

New Amazon RDS for MariaDB instance

Disaster recovery with Amazon RDS – Read Replicas

Backups	Read replicas	External replicas

Read/write workloads

Read-only workloads

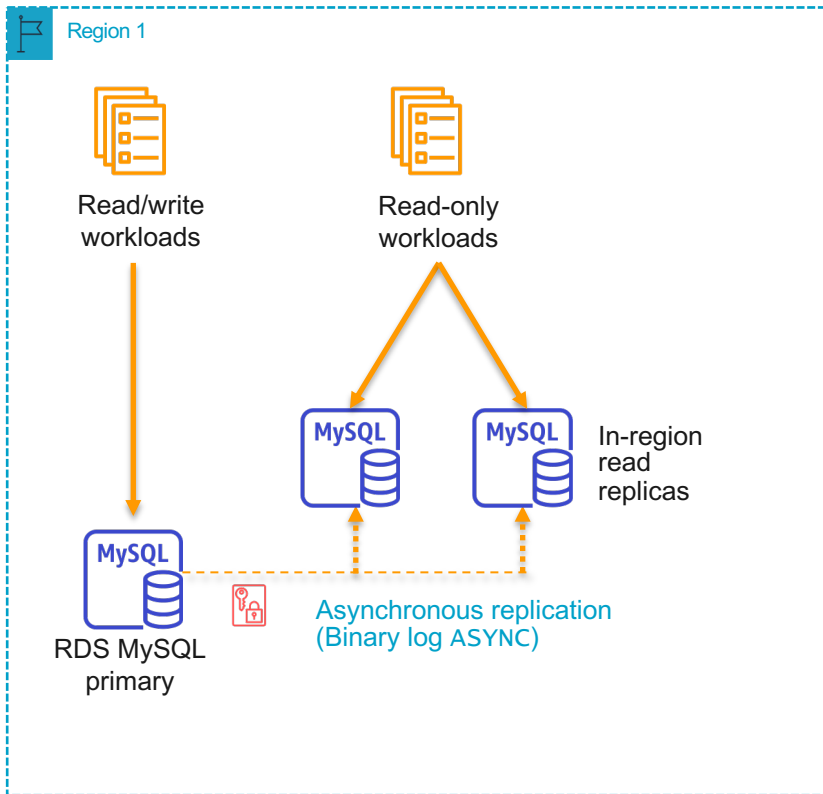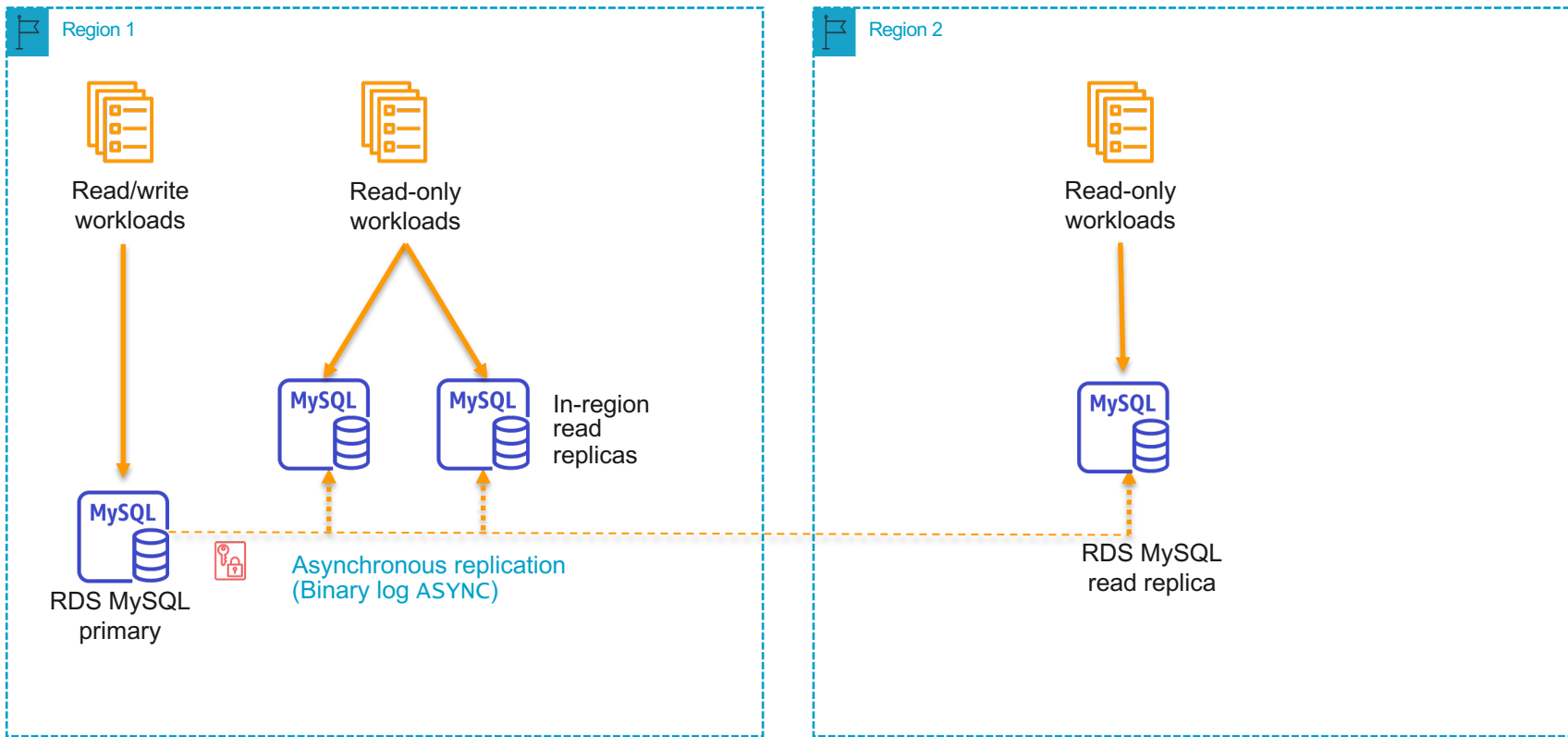RDS MySQL primary instance

Asynchronous

Logical replication (managed)

RDS MySQL read replica instance

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RDS for MySQL read replicas

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Cross-region Read Replica

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Cross-region Read Replica

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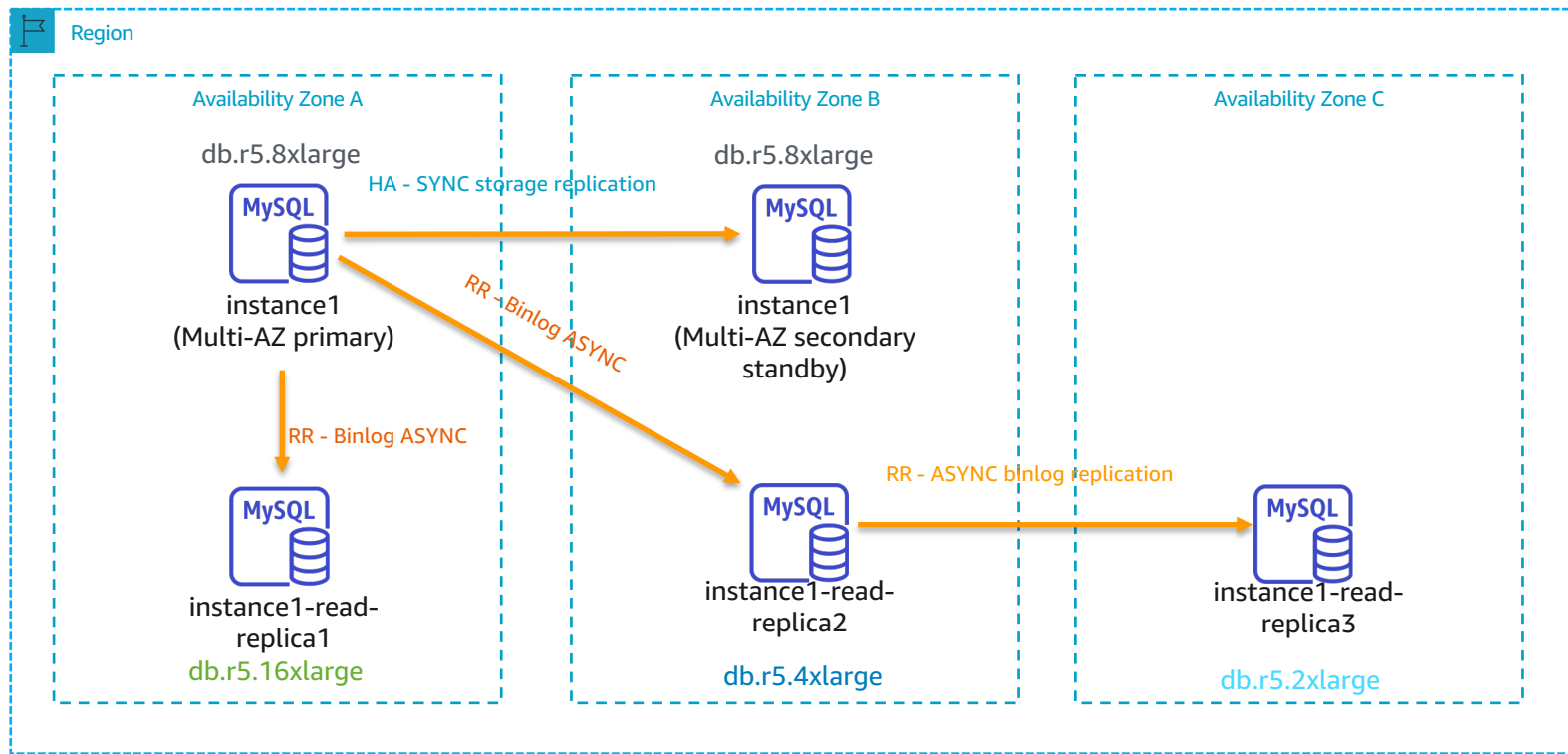
Cross-region Read Replica Promotion
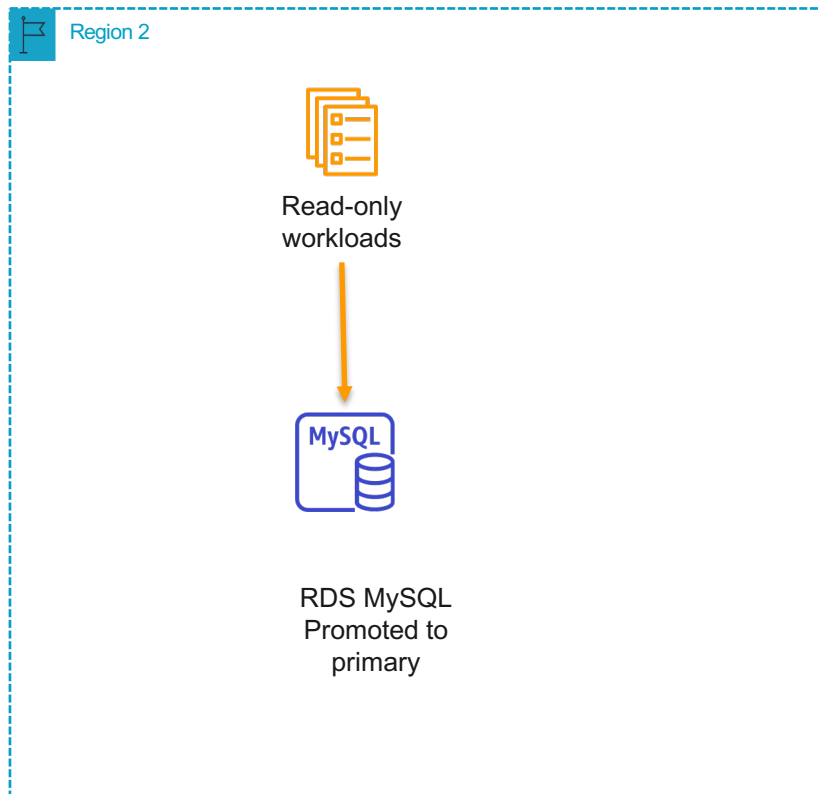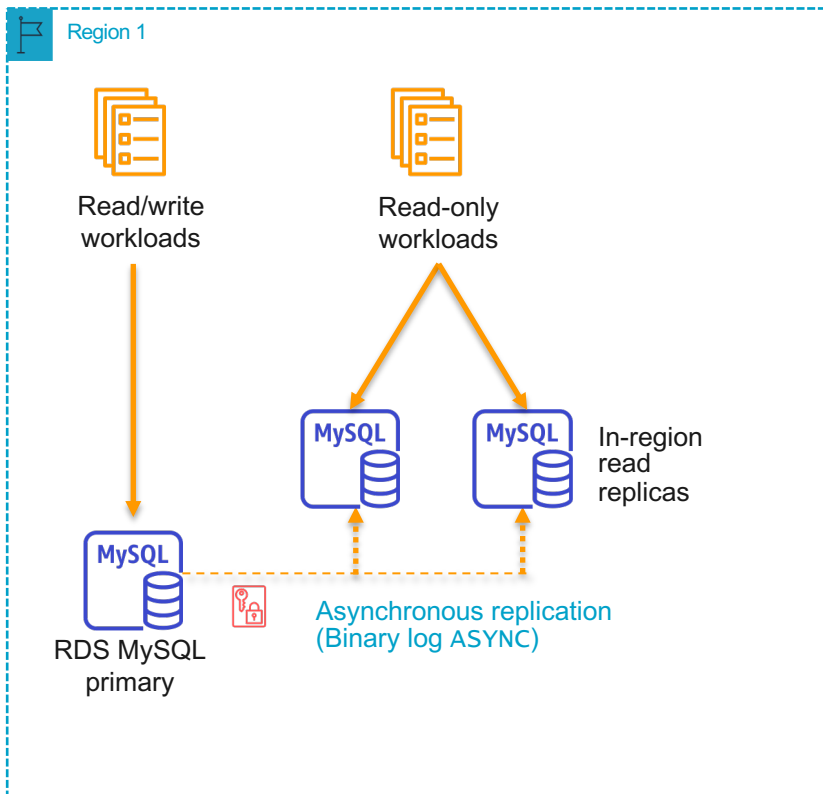
Disaster recovery with Amazon RDS – External Replicas

Backups	Read replicas	External replicas

Region 1

Read/write workloads

On prem workloads

RDS MySQL source instance

Asynchronous replication (binlog)

On-prem MySQL instance

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Q&A

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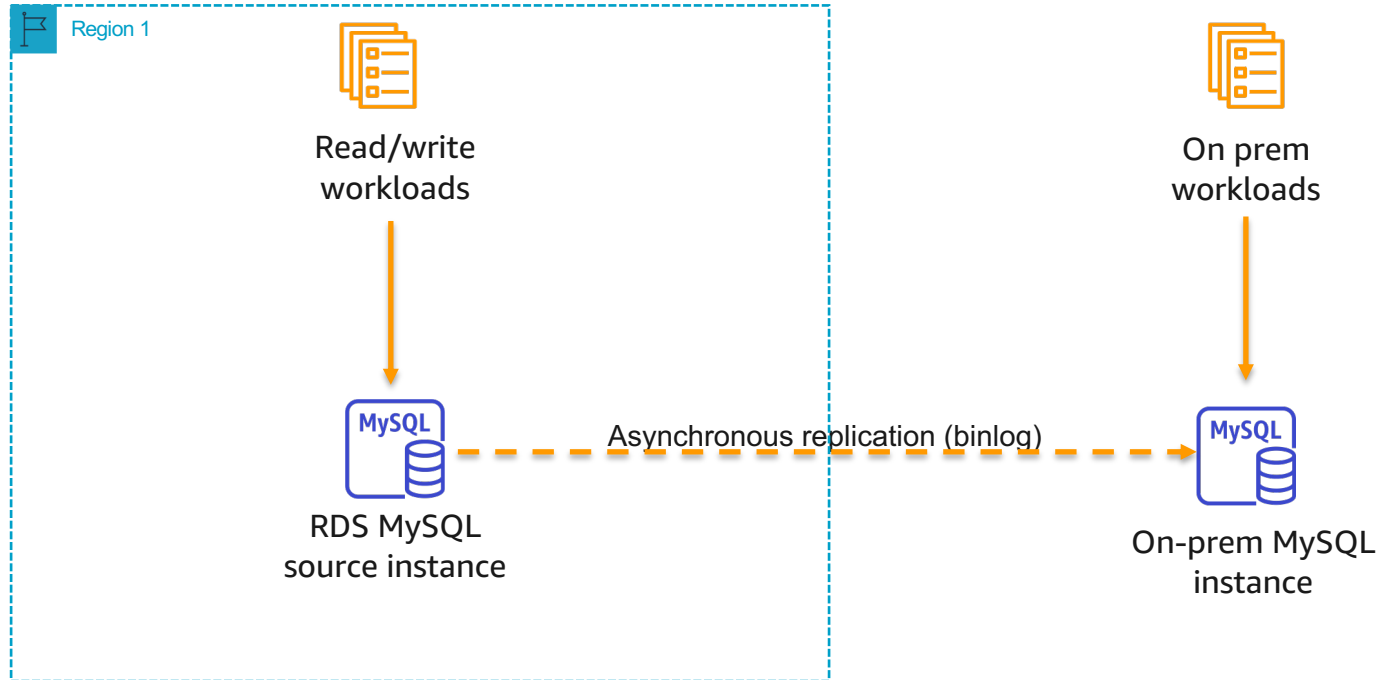
RDS HA/DR features

Feature	RPO (approximate)	RTO (approximate)
Multi-AZ for high availability	0*	1 to 2 minutes
Automated Snapshot restore	Hours	<1 hour
Manual Snapshot restore	Depends on the time of snapshot	< 1 hour
Point-in-time restore	5 Minutes	<1 to several hours
RDS Read replicas (in-region)	Depends on the replication lag	<5 minutes
RDS Read replicas (cross-region)	Depends on the replication lag	<5 minutes
External replicas	Depends on the replication lag	Minutes to hours

* Not approximation. RPO is exactly 0, because of synchronous replication.

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Thank you !