
AWS
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STG212

Protect data and lower costs with Amazon EBS snapshots

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Agenda



Intro to Amazon EBS snapshots



Amazon Data Lifecycle Manager



Recycle Bin for EBS snapshots and AMIs



EBS Snapshot Archive

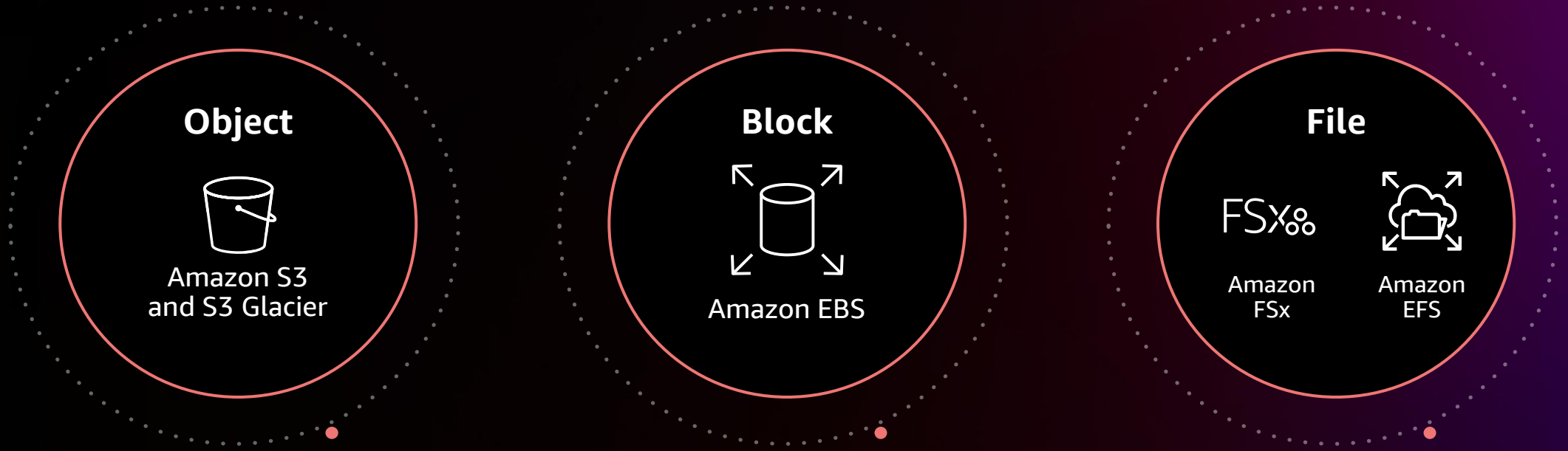


Amazon EBS direct APIs

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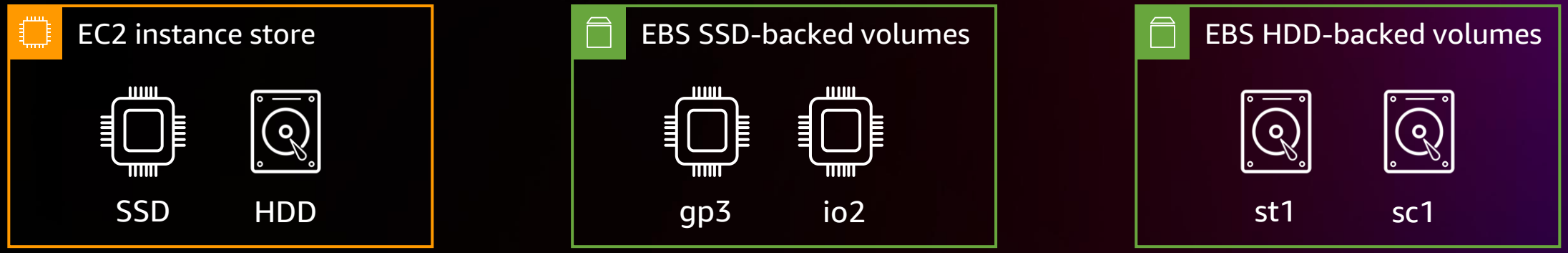






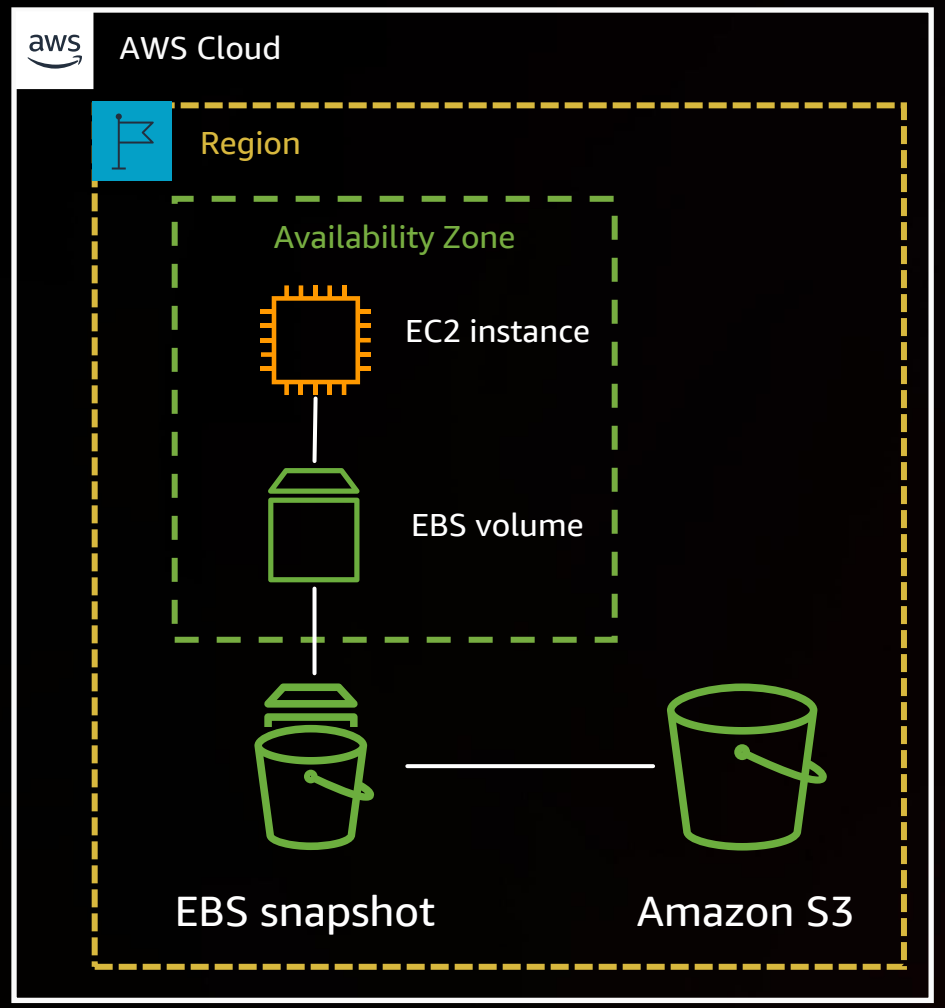
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AWS block storage offerings



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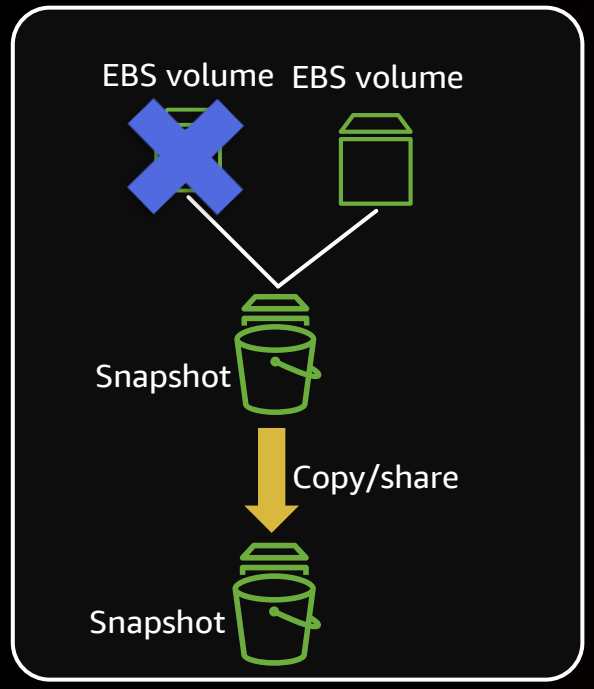
What are Amazon EBS snapshots?

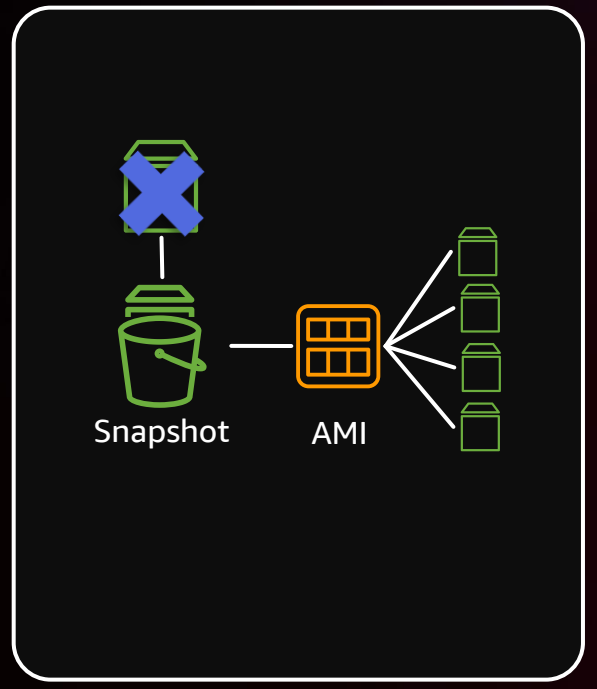


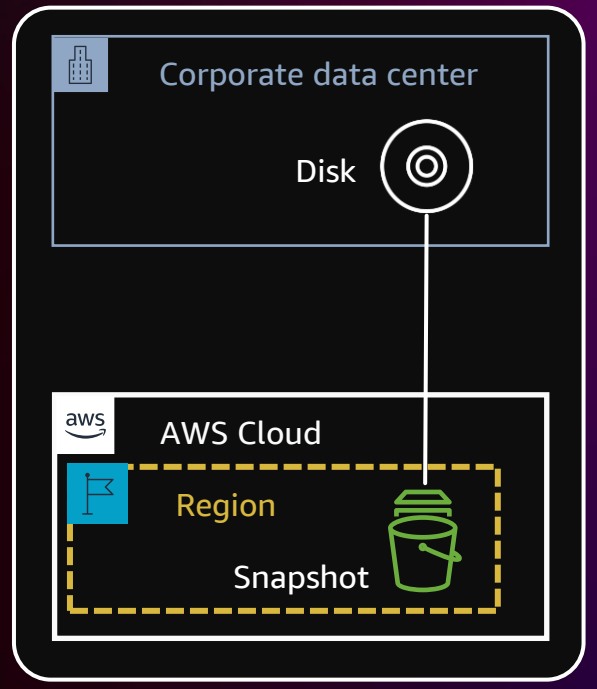
- **Point-in-time backups** of EBS volumes
- Stored on Amazon S3
- Properties
  - **Incremental** – only changed blocks stored
  - **Crash consistent** – completed I/Os persisted in next snapshot
  - Crash-consistent snapshots can be taken with **1 API call for a subset of volumes attached to an instance**
  - Can be **shared and copied** across accounts and AWS Regions

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How are snapshots used?







EBS backup and disaster recovery

Refresh, scale-up, data handoff workflows

Non-EBS backup and migration

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EBS snapshots customers



















































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Snapshots basics

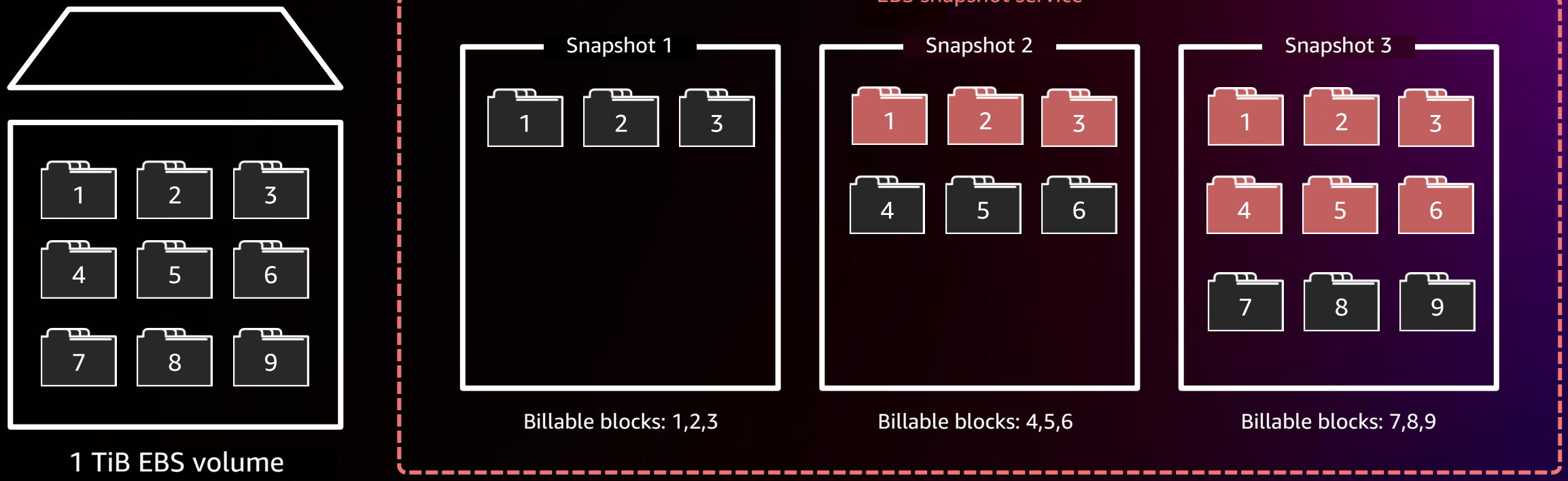
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How does an EBS snapshot work?



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How does an EBS snapshot work?



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Key things to remember



EBS snapshots:
Full point-in-time backup



EBS snapshots stored incrementally



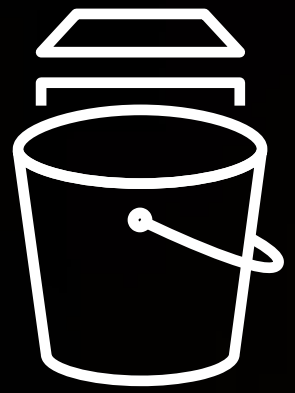
EBS snapshots charged for written blocks only

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Consistency of snapshots

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EBS snapshots are crash-consistent



Crash consistency

- Snapshots will contain the blocks of completed I/O operations
- Data not flushed to disk does not exist in the snapshot
- Similar to pulling the power cord of a server

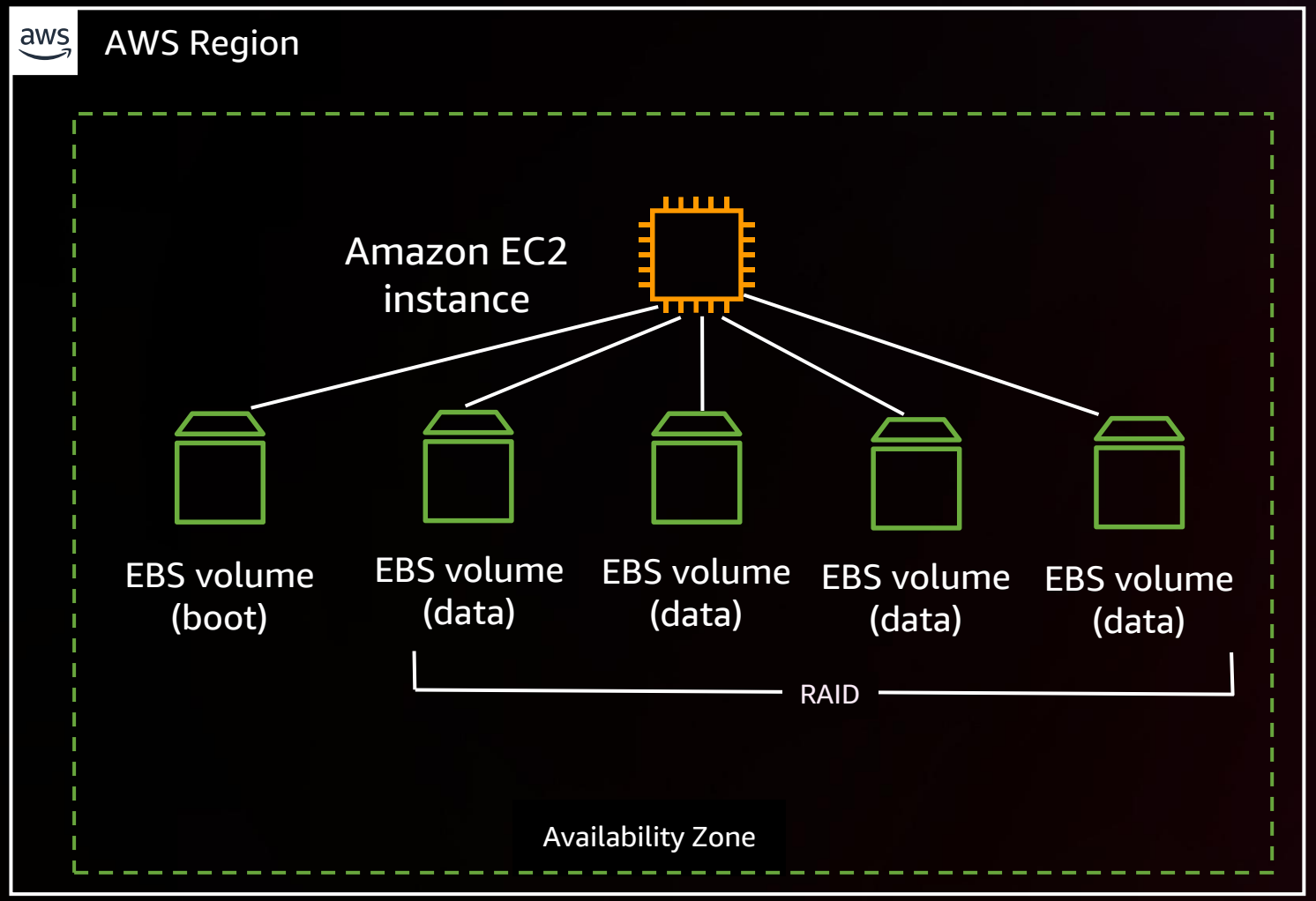
Application consistency

- Application data is flushed to disk prior to snapshot creation
- New writes to application(s) are halted during the snapshot creation process
- Unfreeze/unlock as soon as snapshot creation command is successfully completed

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EBS multi-volume, crash-consistent snapshots



Using the CreateSnapshots API, you can take point-in-time, crash-consistent snapshots across multiple EBS volumes attached to an EC2 instance

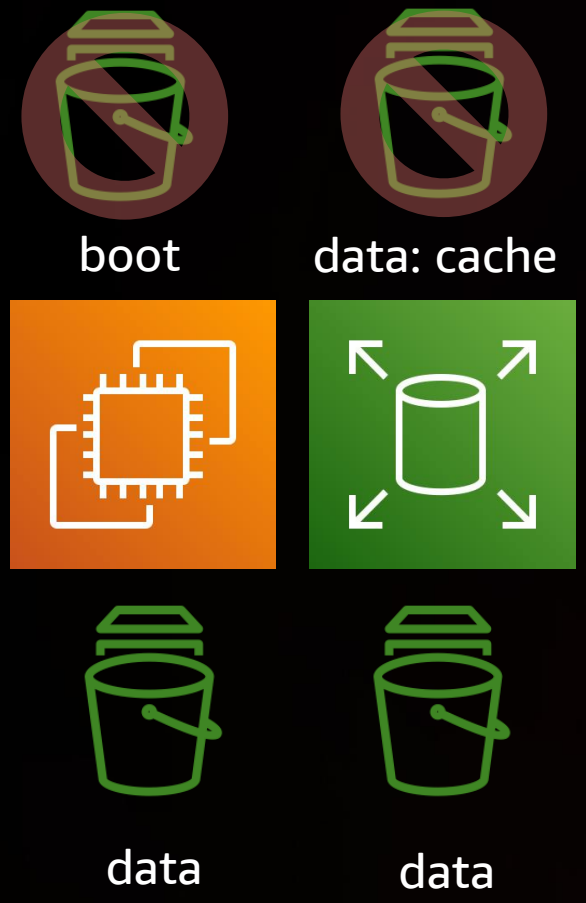
Best practice

- Separate boot and data volumes
- Snapshot regularly

https://docs.aws.amazon.com/cli/latest/reference/ec2/create-snapshots.html

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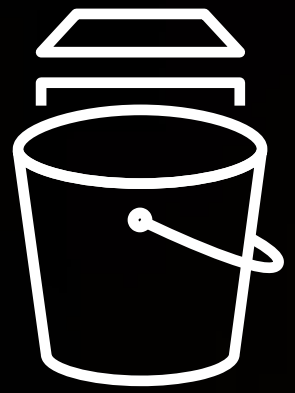
New! Snapshot a subset of data volumes



- **Simple** – replaces multiple API calls with a single CreateSnapshots call
- **Cost-efficient** – only snapshot the multi-attached volumes you select
- **Automated** – set tags in Amazon Data Lifecyle Manager policies to specify which volumes to exclude

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VSS support with AWS Systems Manager



Systems Manager + VSS

- VSS manages disk operations, such as file writes, when a backup is in progress
- VSS-enabled snapshots of Amazon EBS volumes are available through Systems Manager Run Command
- With VSS, you don’t need to use application-specific backup solutions, such as native SQL backup, or develop and maintain custom scripts

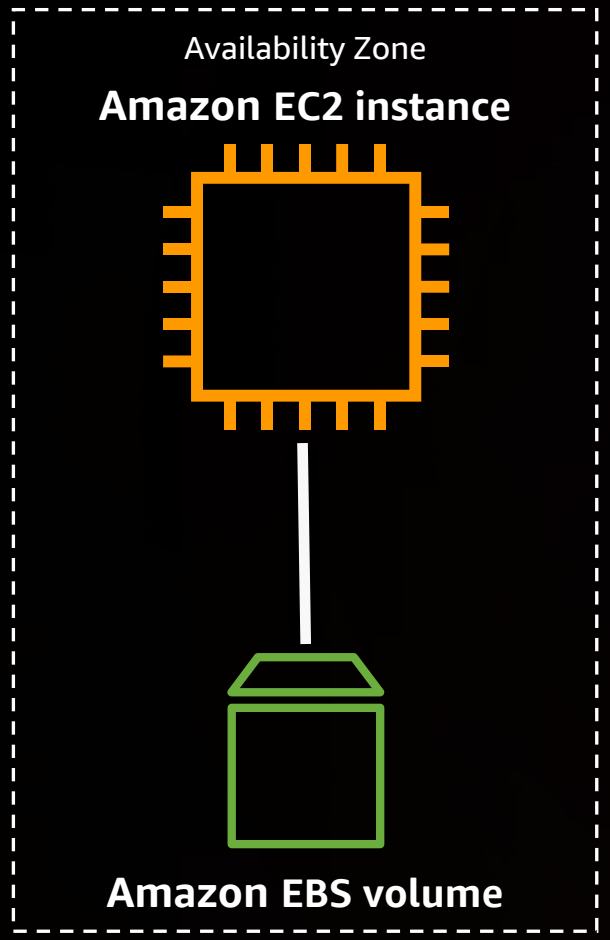
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EBS snapshot encryption

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Encryption – Amazon EBS



- Integrates with AWS KMS – AES-256 encryption
- Encrypted EBS volume implies the following are encrypted
  - **Data at rest** inside the volume
  - **Data moving** between the volume and instance
  - **Snapshots created** from the volume
  - **Volumes created** from such snapshots

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Amazon EBS snapshot encryption



- **Snapshots of encrypted volumes** are automatically encrypted
- **Volumes created from encrypted snapshots** are automatically encrypted
- You can **encrypt an unencrypted snapshot when you copy a snapshot**
- You can **re-encrypt a snapshot you own with a different key when you copy a snapshot**

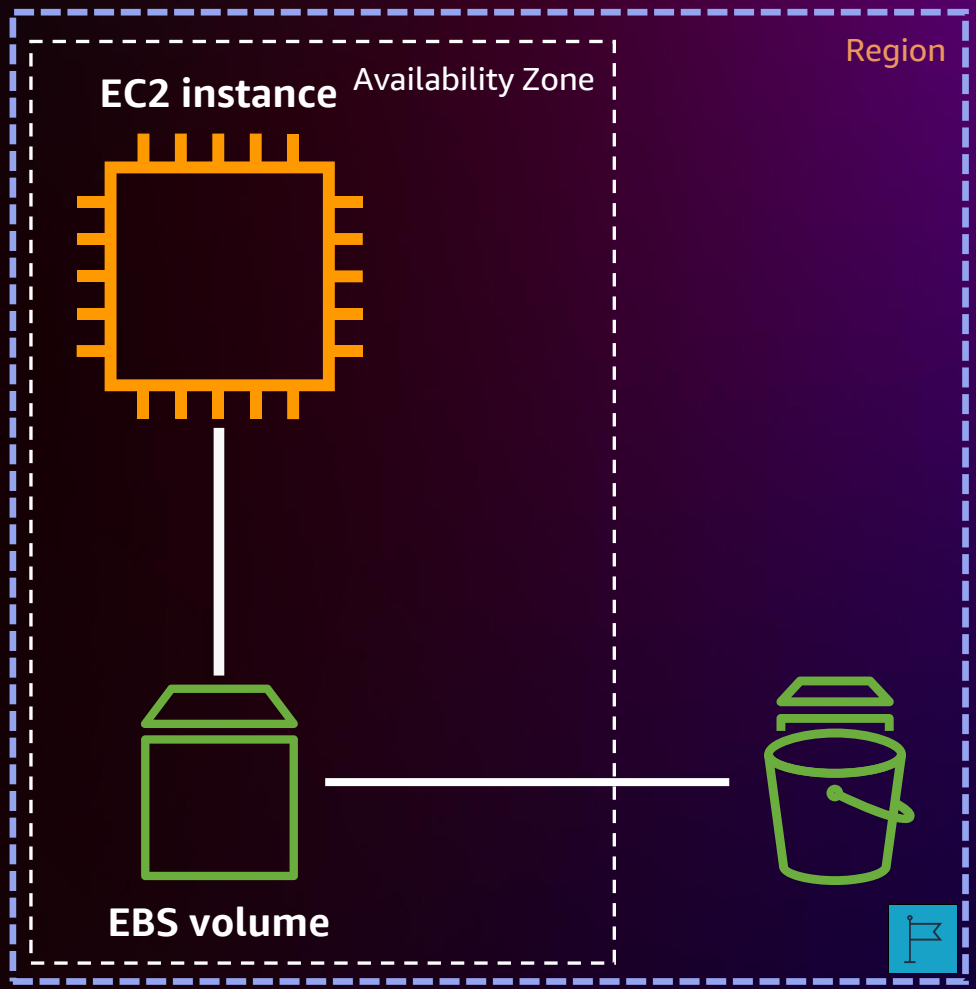
https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSEncryption.html

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Snapshots can be

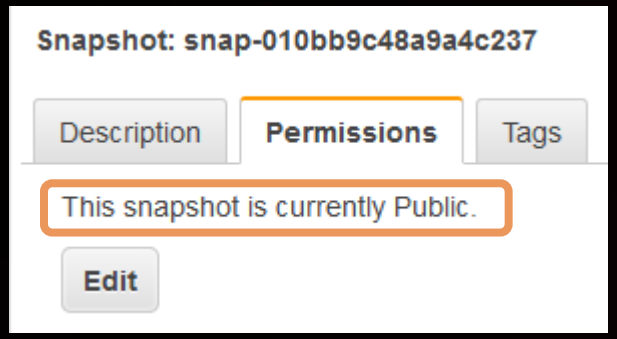
- Shared across accounts
- Copied across accounts
- Copied within accounts
- Copied across AWS Regions
- Create AMIs



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Best practice for sharing snapshots and AMIs

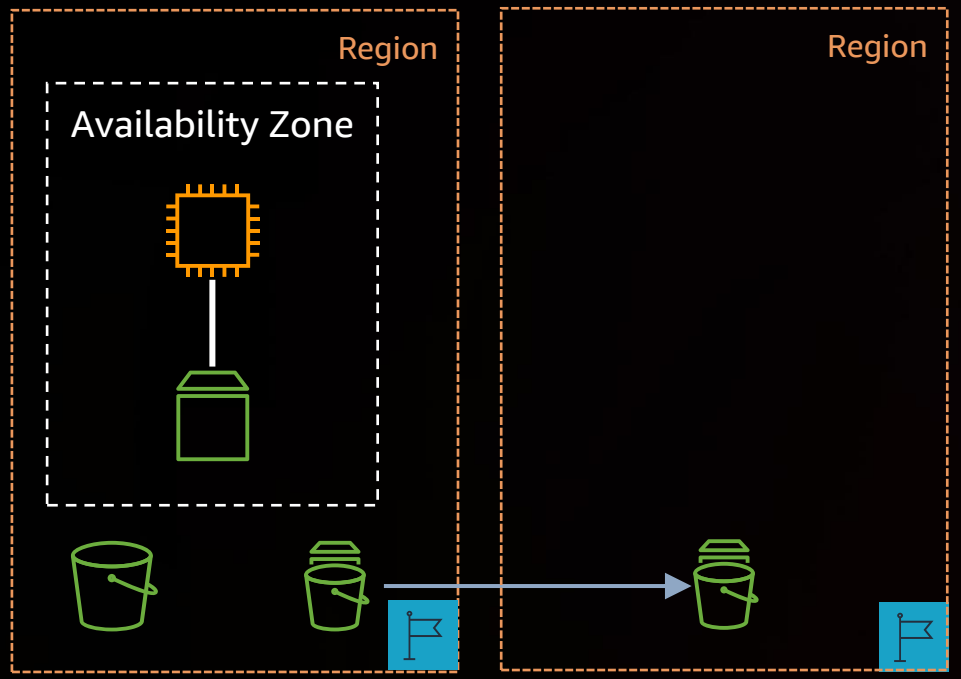
- Public sharing: Reasonable use case for AMIs – AWS Marketplace AMIs
- Share non-AMI snapshots with specific accounts
- **Within the same Region, you can share snapshots and AMIs without being billed for multiple full snapshots**
- To launch a volumes from a snapshot, a snapshot copy must be in the Region




```
snap-010bb9c48a9a4c237 --attribute createVolumePermission
{
    "SnapshotId": "snap-010bb9c48a9a4c237",
    "CreateVolumePermissions": [
        {
            "Group": "all"
        }
    ]
}
```

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Copy snapshots across Regions

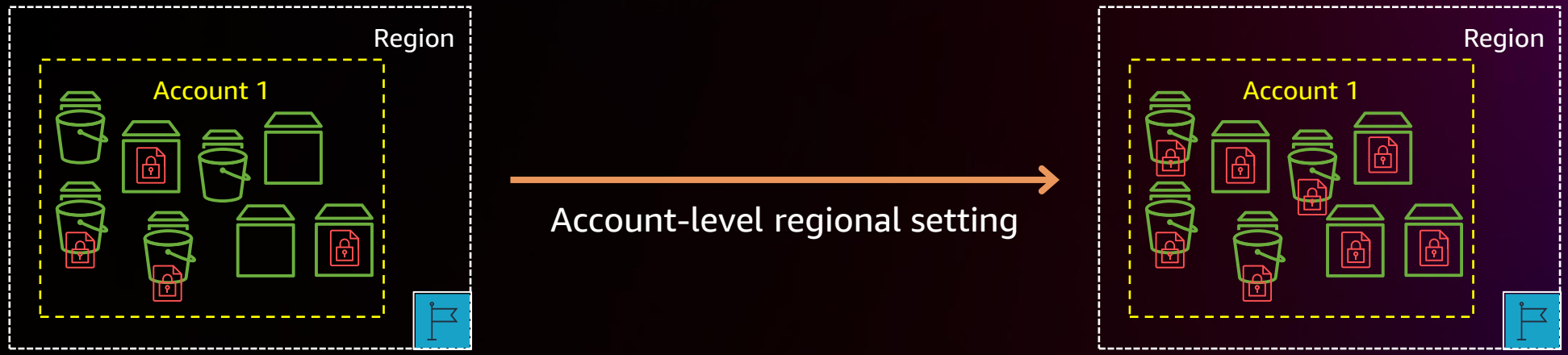


- Copy snapshots across accounts, across Regions
- Lock down resource-level permissions on target snapshot copy
- Multi-Region provides protection against regional events
- Permission lockdown protects against malicious or unintentional deletes of data

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How do I enforce encryption?

- EBS encryption by default (EBD) feature
- Enabled on a per account per Region level



Without changing workflows, newly launched volumes + snapshots are encrypted

aws ec2 enable-ebs-encryption-by-default

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Amazon Data Lifecycle Manager (DLM)

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Challenges with self-managed solutions



Forgotten snapshots incur additional costs



Scripting bugs lead to under or over retention



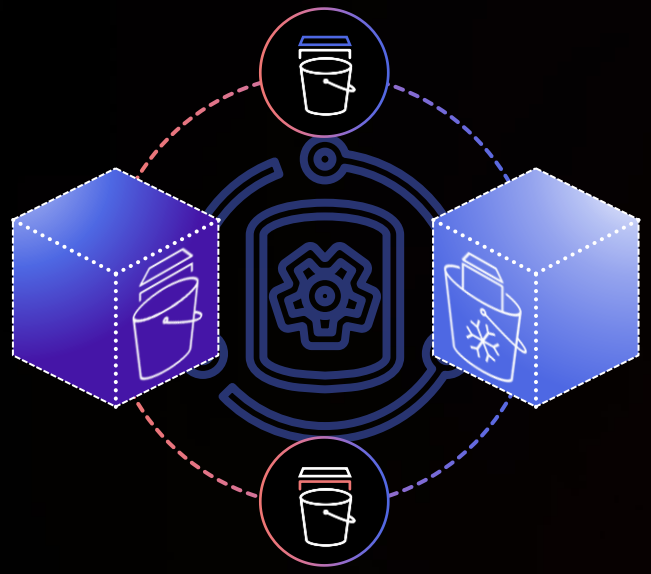
Multi-schedule snapshots management is challenging

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Amazon Data Lifecycle Manager

SIMPLE AUTOMATED WAY TO BACK UP DATA STORED ON AMAZON EBS VOLUMES



Policy and tag-based backup solution

Automated backup scheduling

- Automated backup retention management
- Automated archiving of snapshots

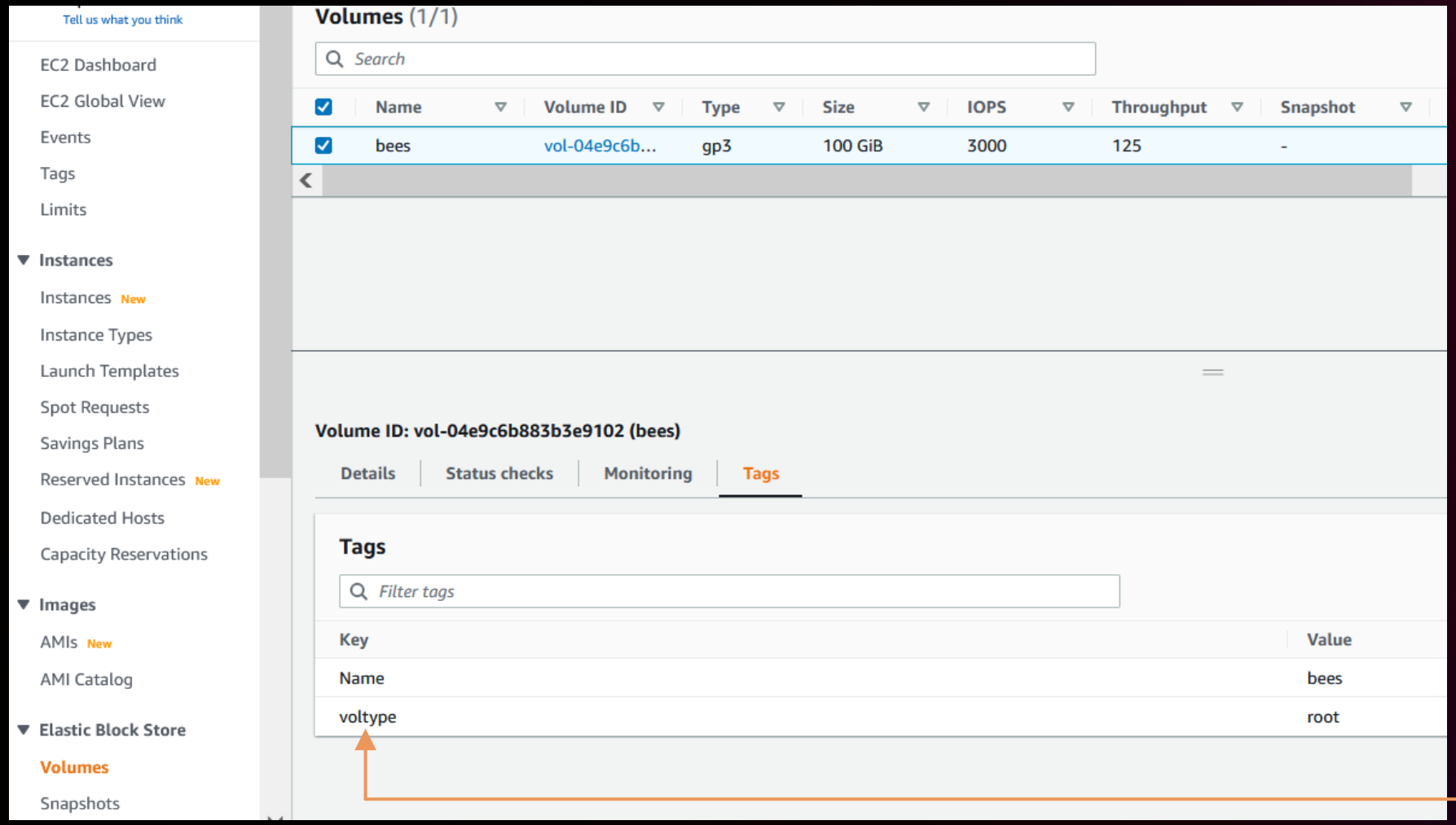
Use AWS Identity and Access Management (IAM) to control policy access

- No cost to use
- Control snapshot costs by automatically deleting old backups

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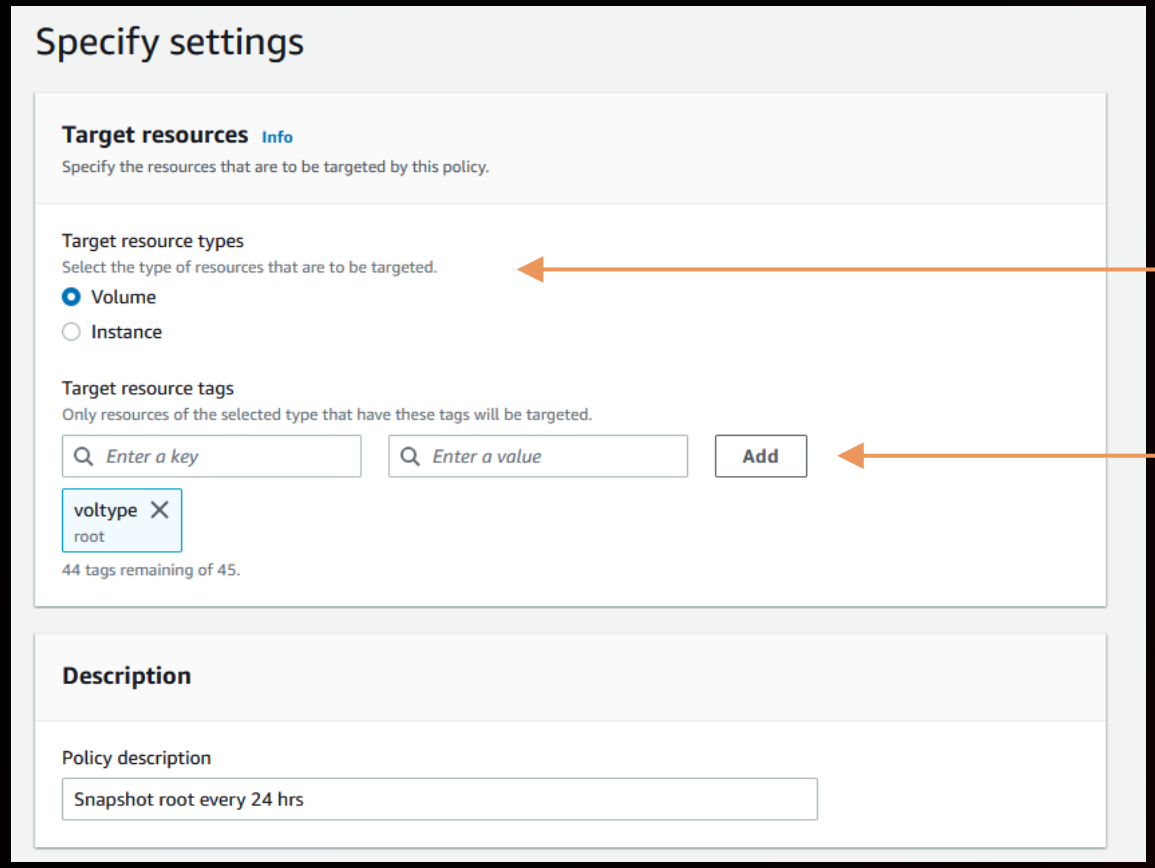
Amazon Data Lifecycle Manager



Add tags to the volumes you want to associate with Amazon Data Lifecycle Manager policies

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Amazon Data Lifecycle Manager scheduling features

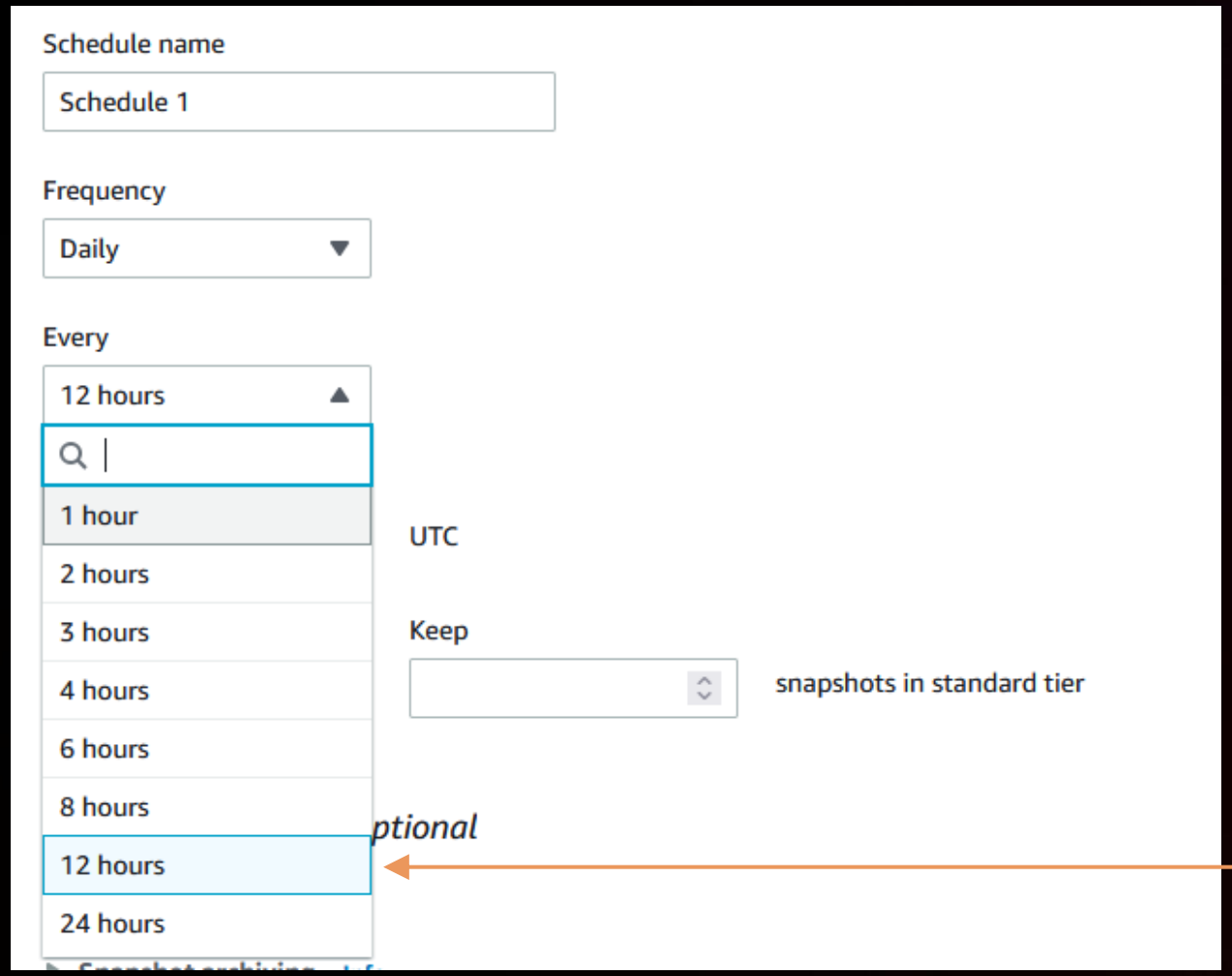


Select whether to target volumes or instances with the policy

Input the appropriate volume tags to target

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Amazon Data Lifecycle Manager scheduling features

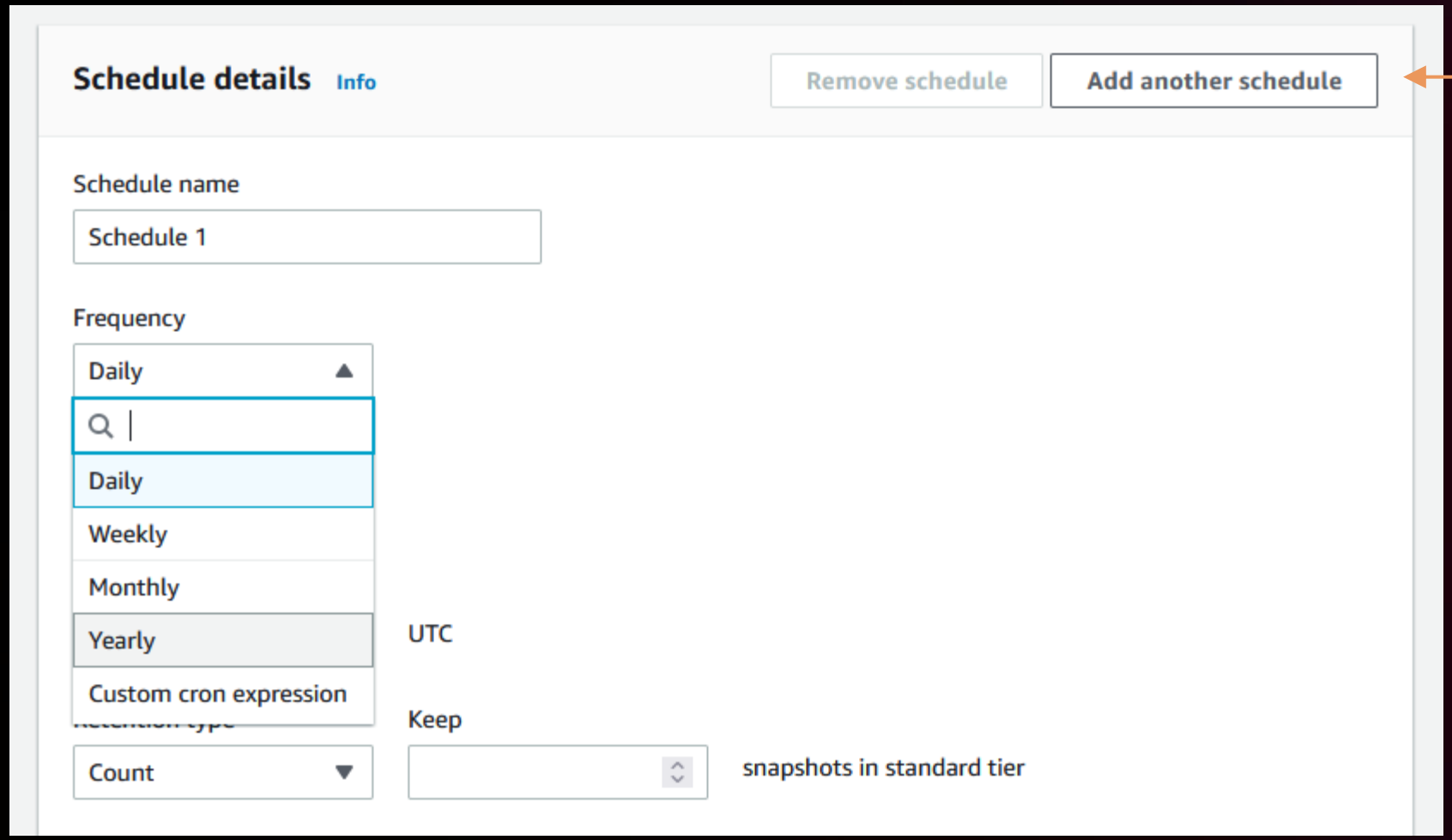


Reduce RPO on your Amazon Data Lifecycle Manager policy up to **1 hour**

Schedule snapshots from every hour to every 24 hours

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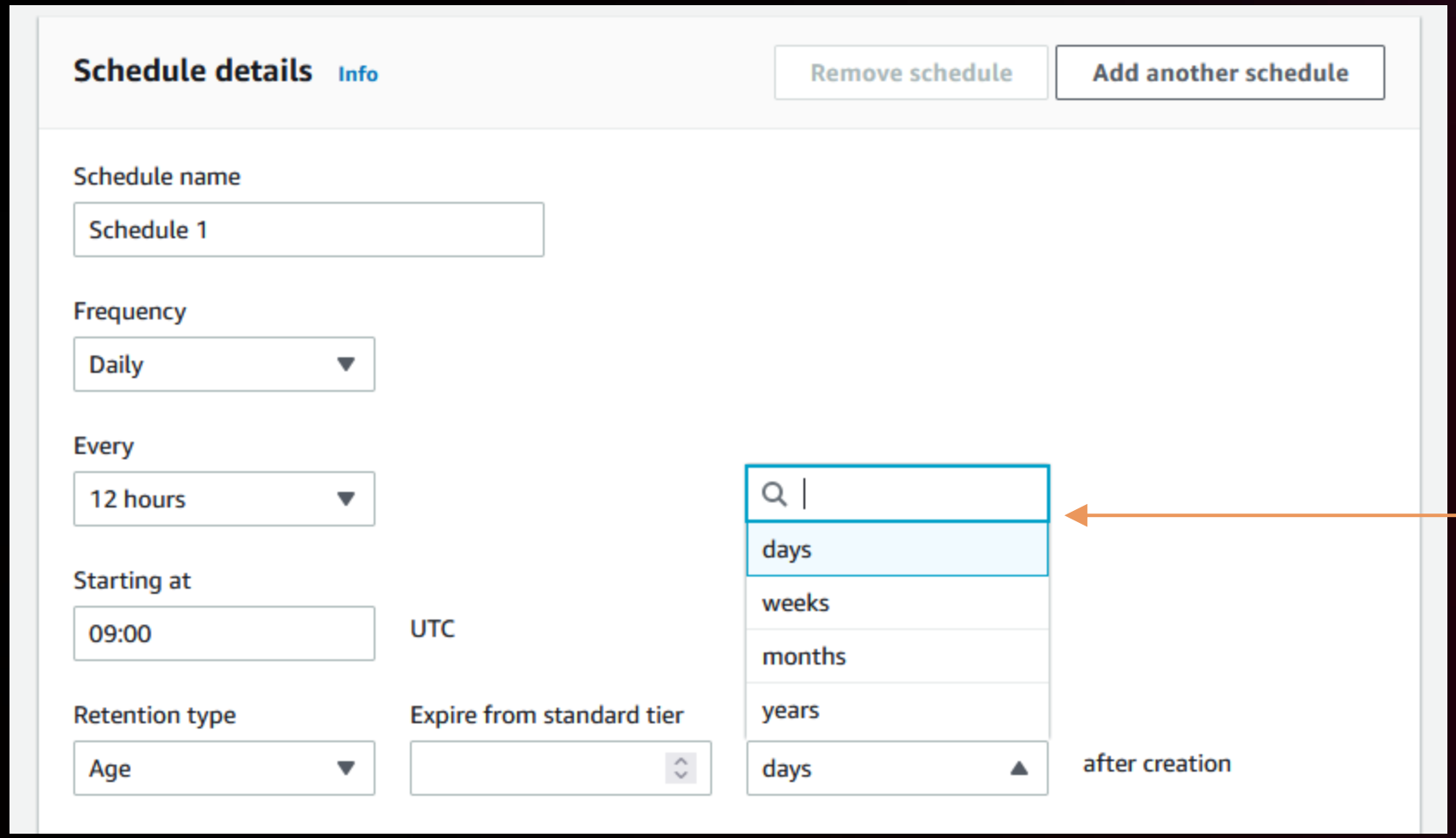
Amazon Data Lifecycle Manager scheduling features



Define multiple schedules in a single policy

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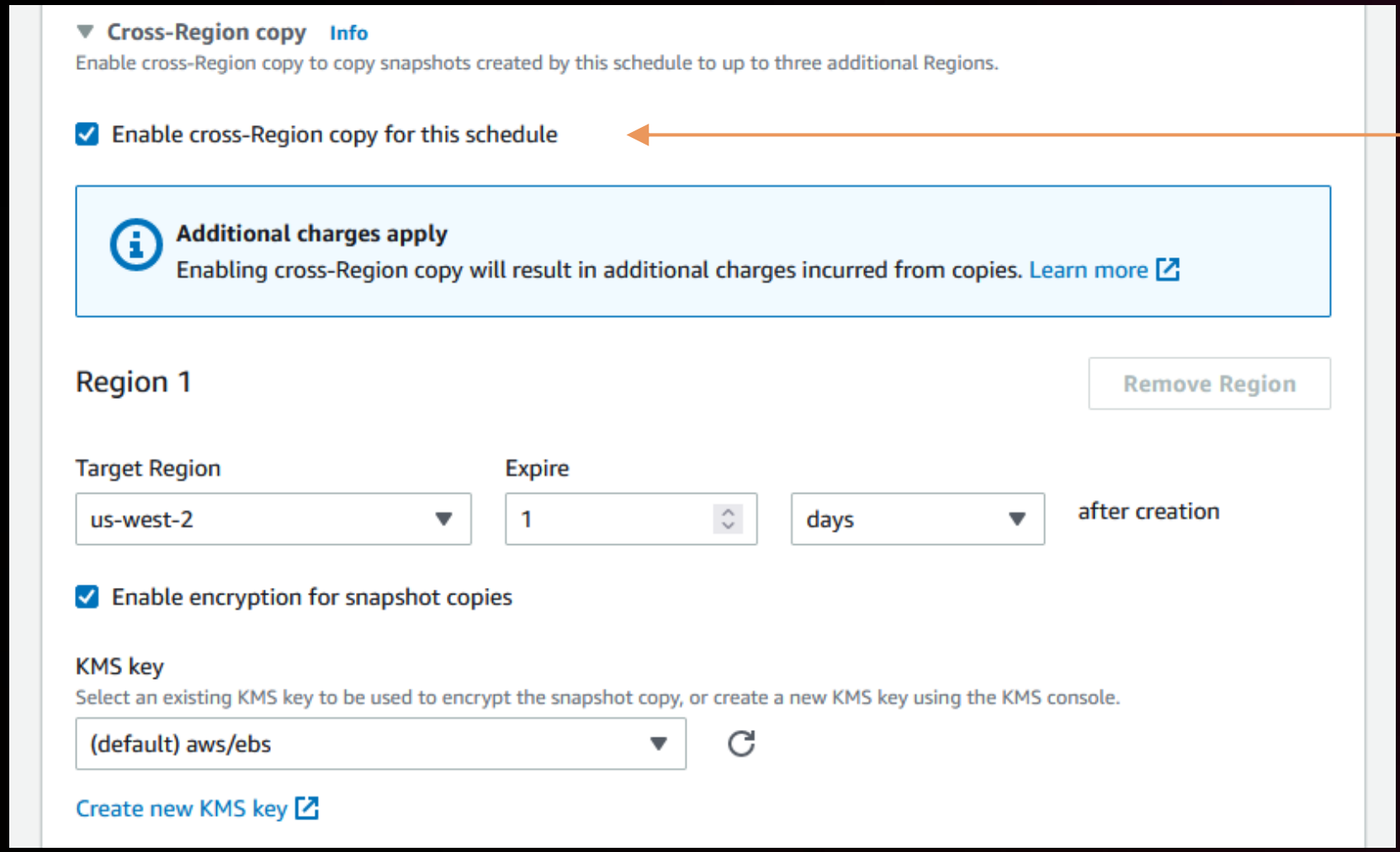
Amazon Data Lifecycle Manager retention features



Define retention based on days, weeks, months, or years

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Amazon Data Lifecycle Manager cross-Region copy features

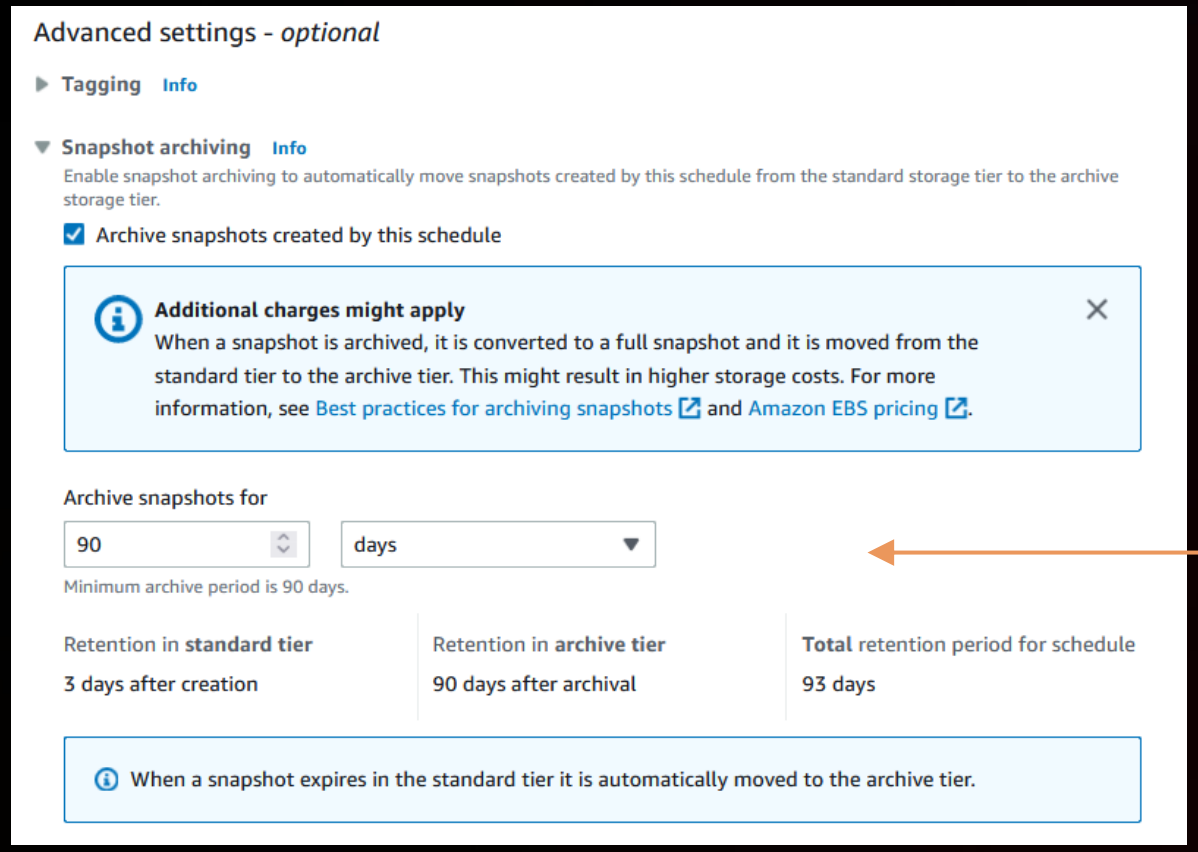


Automate copy across Region

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Amazon Data Lifecycle Manager snapshot archive feature

Automatically create and **archive monthly, quarterly, and yearly** snapshots



Define retention in archive tier

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Recycle Bin for EBS snapshots & AMIs

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Causes of accidental snapshot deletion



Simple human errors



Scripting bugs

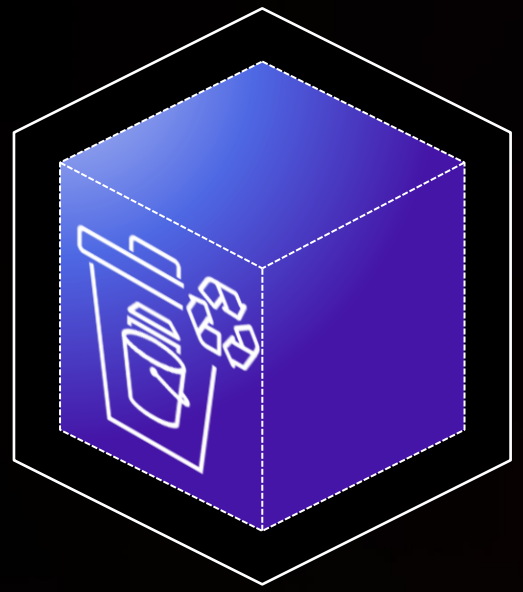


Accidental retention policy change

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Recycle Bin for EBS snapshots and AMIs

ALLOWS FOR QUICK RECOVERY OF DELETED SNAPSHOTS AND AMIS



Automatically retain deleted snapshots for a retention period you specify

Use retention rules to specify retention periods for all or some tagged snapshots in your account

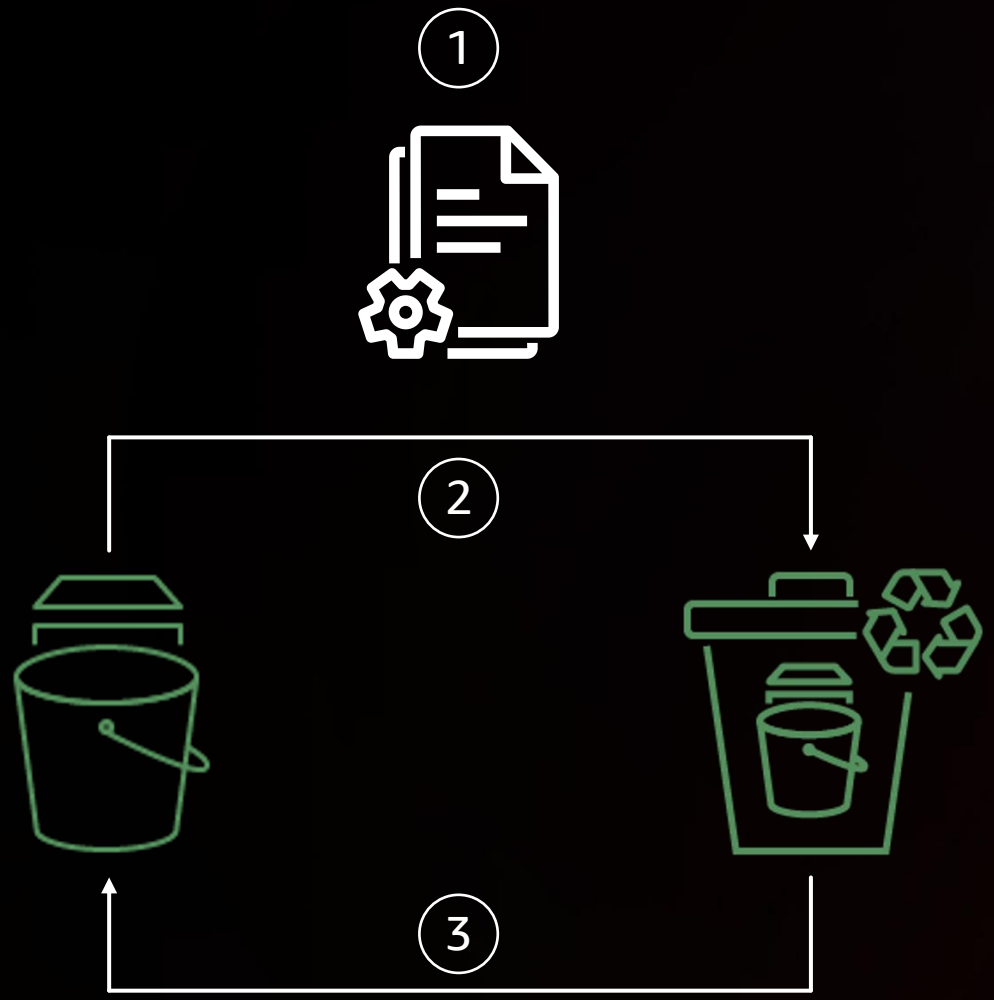
Pay EBS snapshot price for snapshots in Recycle Bin

Restrict access to Recycle Bin rules and resources using administrator IAM role

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Recycle Bin: How it works



1. Set up retention rules
    a. Account-level rules per Region
    b. Tag-based rules per Region

2. Retain deleted snapshots & AMIs in Recycle Bin

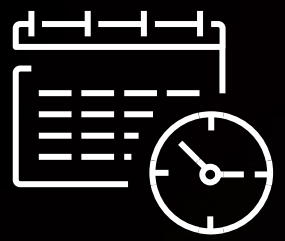
3. Recover deleted snapshots & AMIs before expiry of retention period

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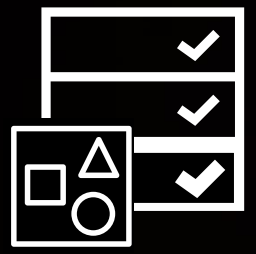
Managing retention rules

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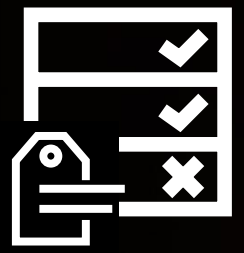
Recycle Bin retention rules



- Retention time: Specify retention length for snapshots or AMIs in Recycle Bin
- Permanent deletion after expiry of retention period



- Account-level rule: Applies to all snapshots or AMIs in your account per Region
- Protect all snapshots & AMIs in critical accounts



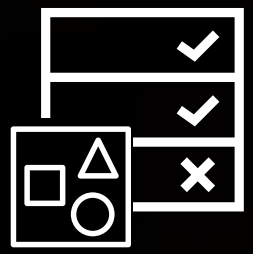
- Tag-based rules: Apply to tagged snapshots & AMIs in your account in a Region
- Protect critical snapshots or AMIs in your account to **optimize costs**

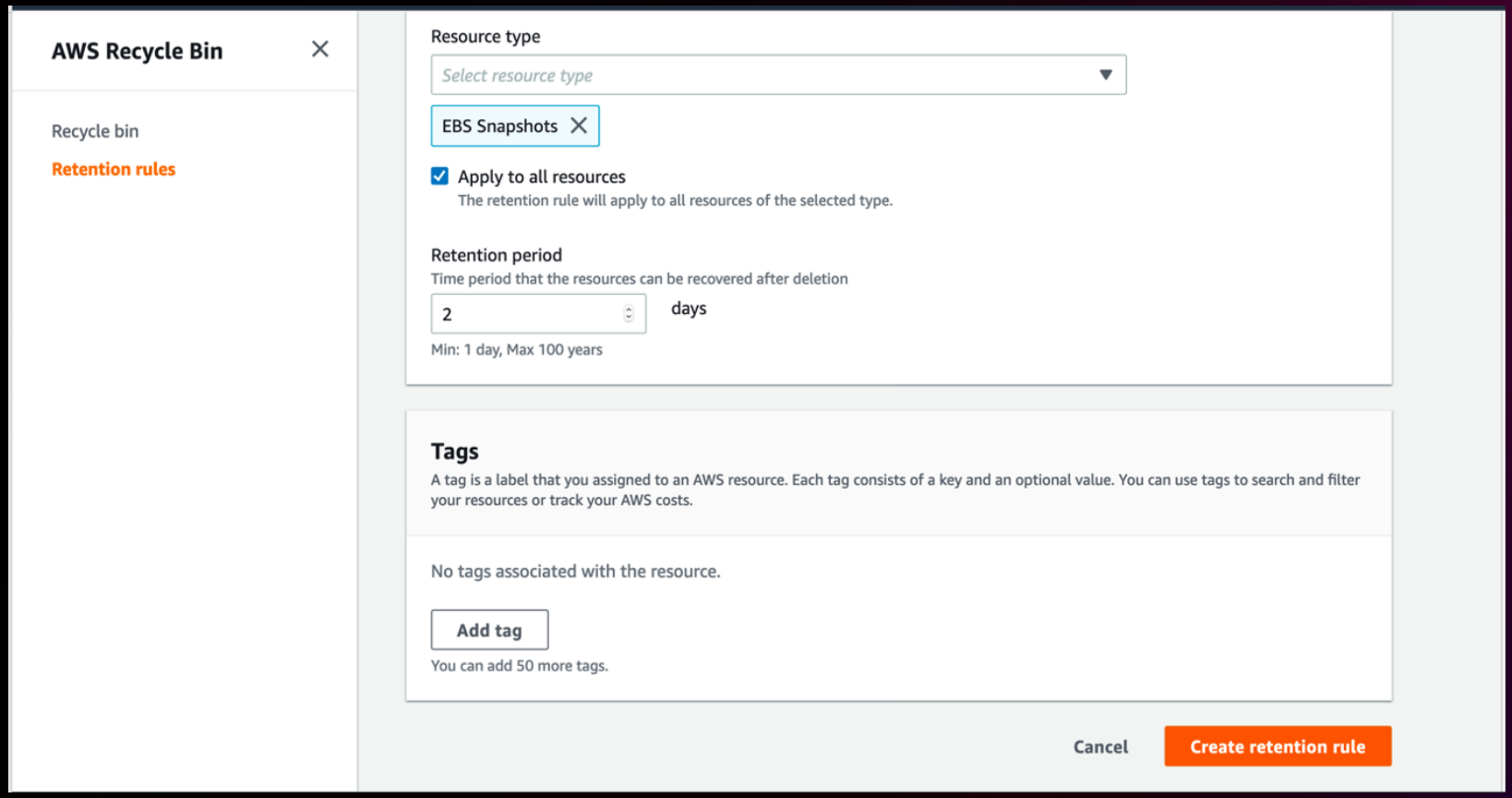
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Setting up retention rules without tags

RULES WILL APPLY TO ALL EBS SNAPSHOTS IN THE ACCOUNT IN THE REGION



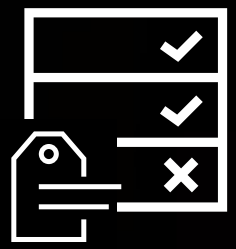


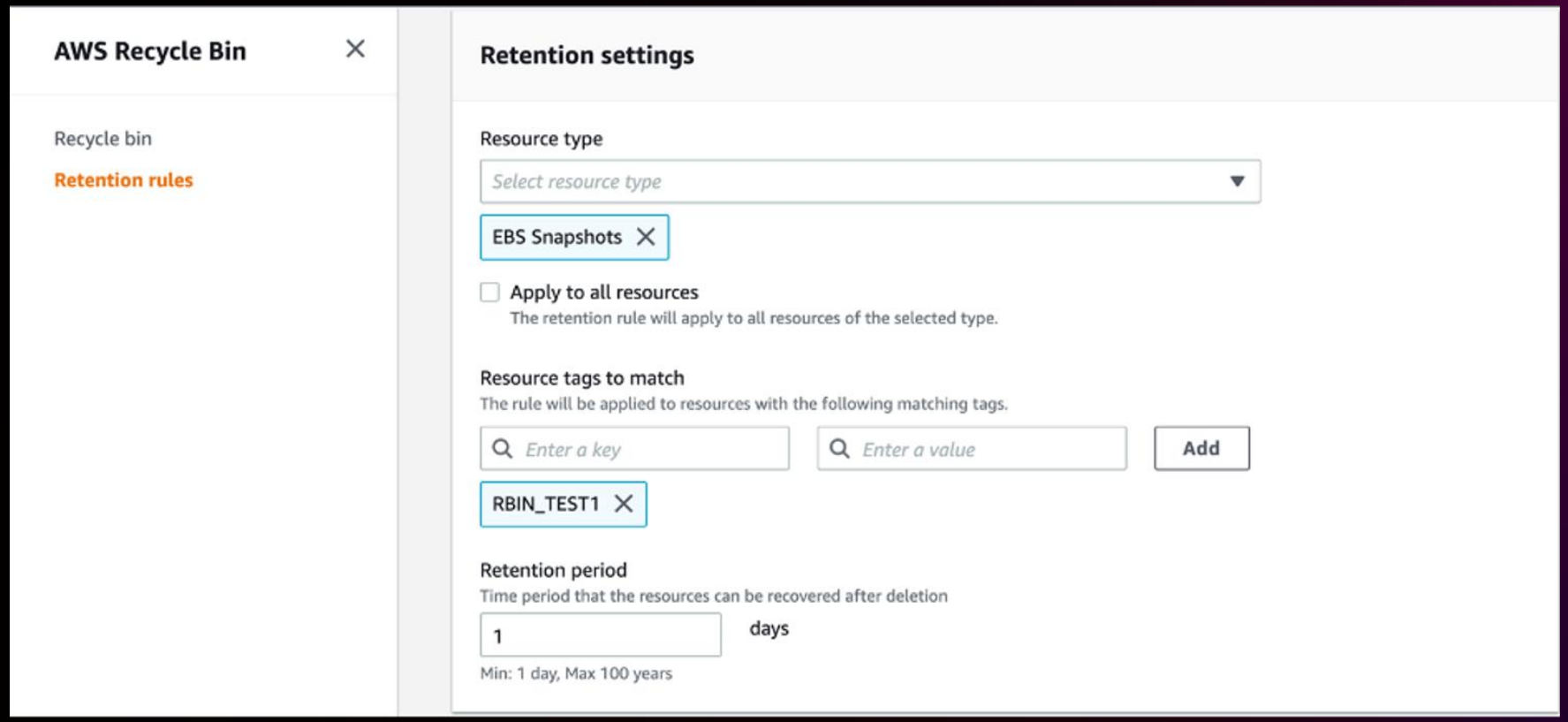

```
aws rbin create-rule --retention-period RetentionPeriodValue=2,RetentionPeriodUnit=DAYS --
resource-type EBS_SNAPSHOT --description "Match all snapshots" –region us-west-2
```

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Setting up retention rules with tags

RULES WILL APPLY TO EBS SNAPSHOTS IN THE REGION WITH MATCHING RESOURCE TAGS



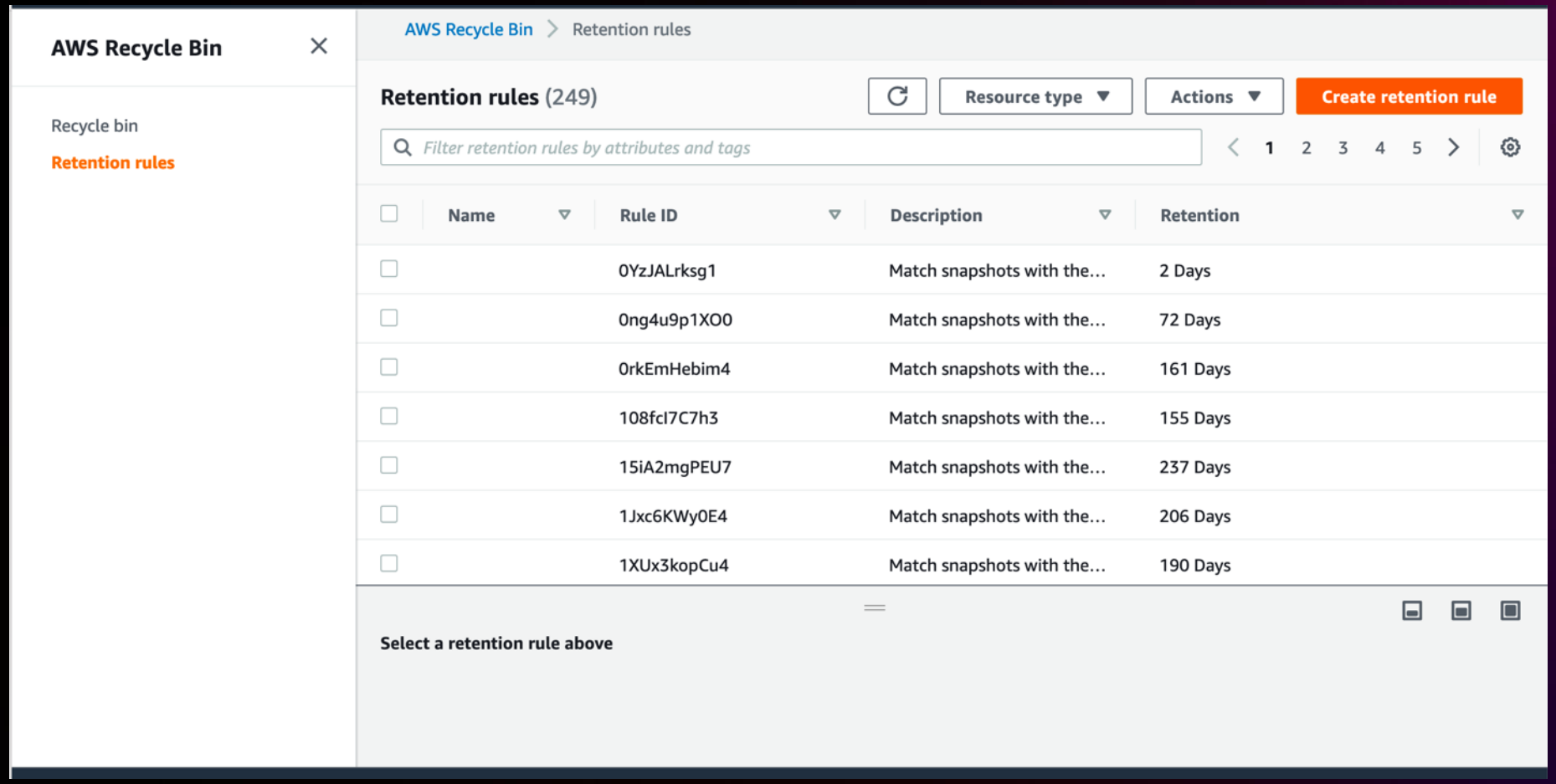



```
aws rbin create-rule --retention-period RetentionPeriodValue=1, RetentionPeriodUnit=DAYS --
resource-type EBS_SNAPSHOT --description "Match snapshots with the RBIN_TEST1" --resource-
tags ResourceTagKey=RBIN_TEST1, ResourceTagValue="" –region us-west-2
```

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Listing retention rules






```
aws rbin get-rule --identifier <id>
```

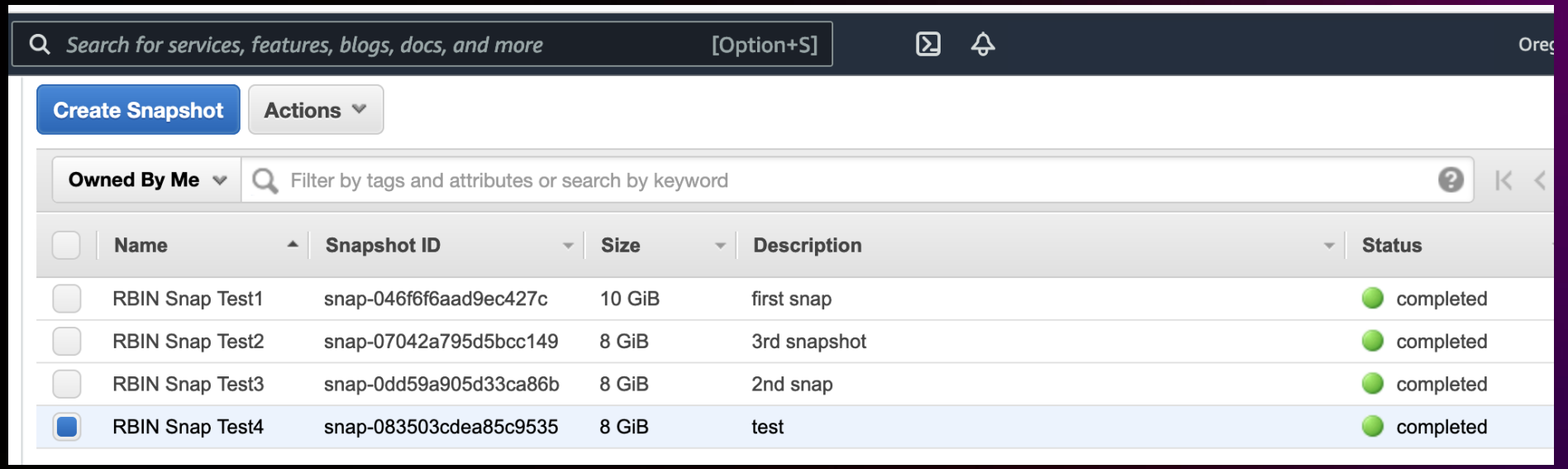
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Managing Recycle Bin snapshots

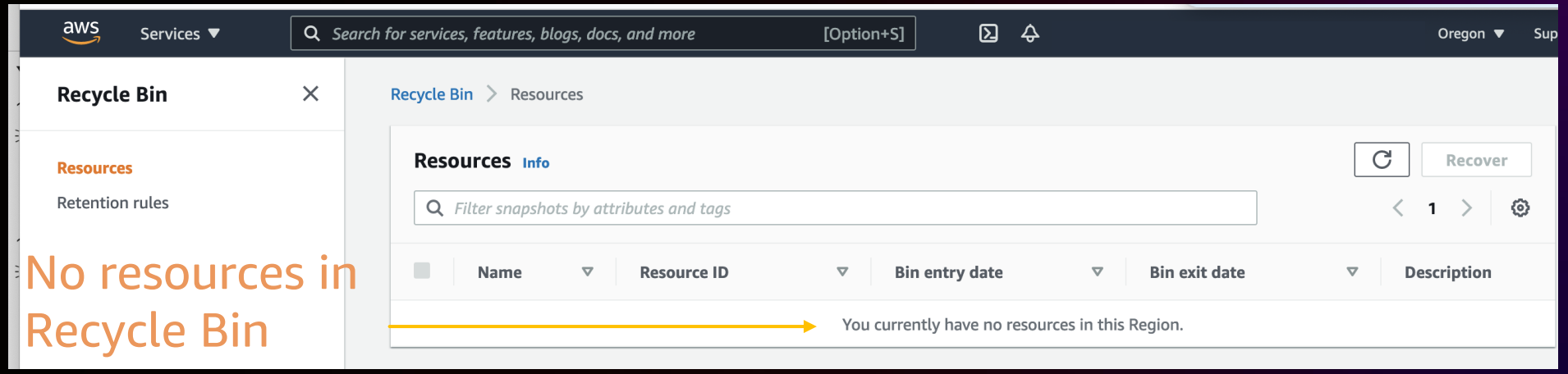
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What happens when a snapshot is deleted?







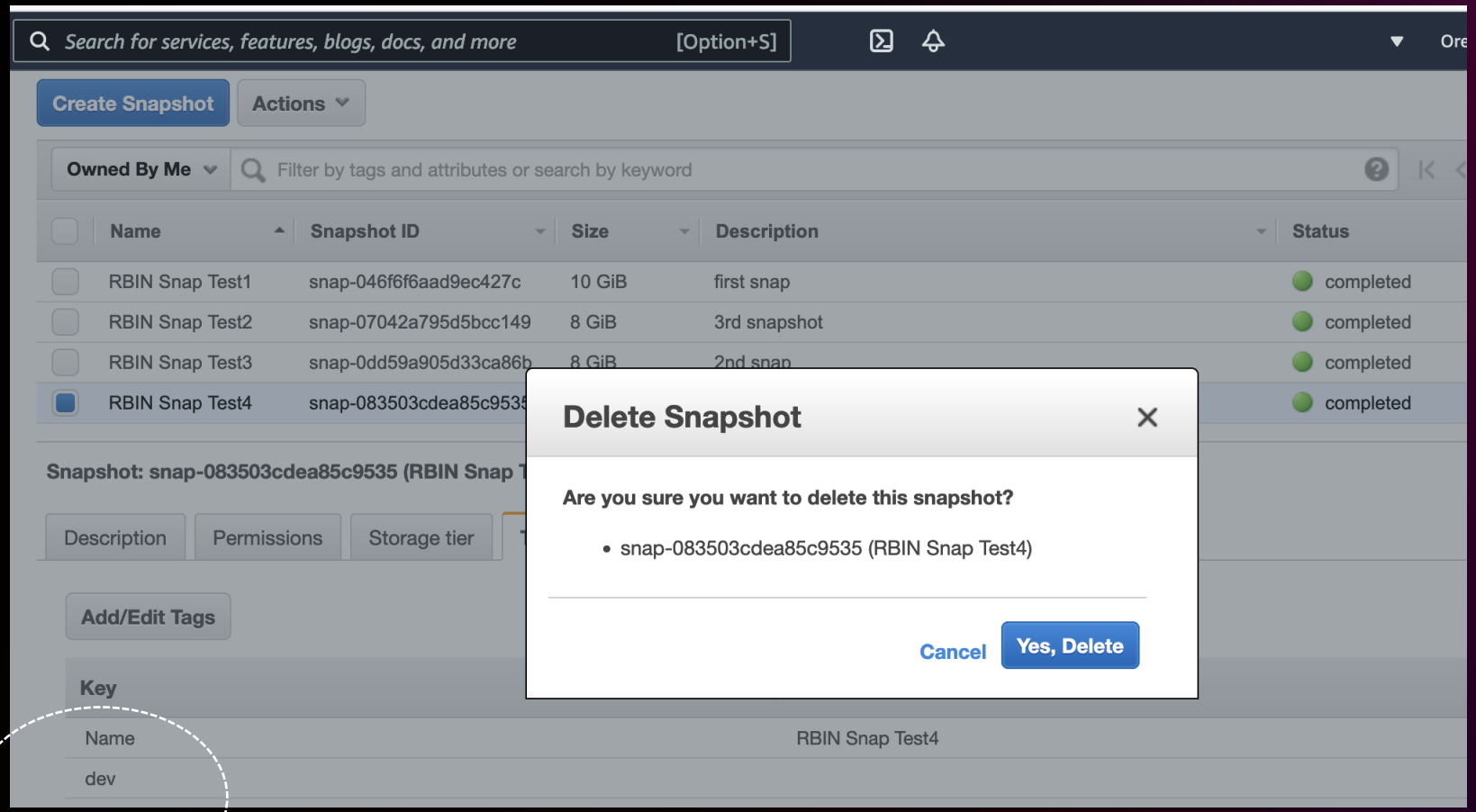


No resources in Recycle Bin

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Snapshot gets deleted . . .





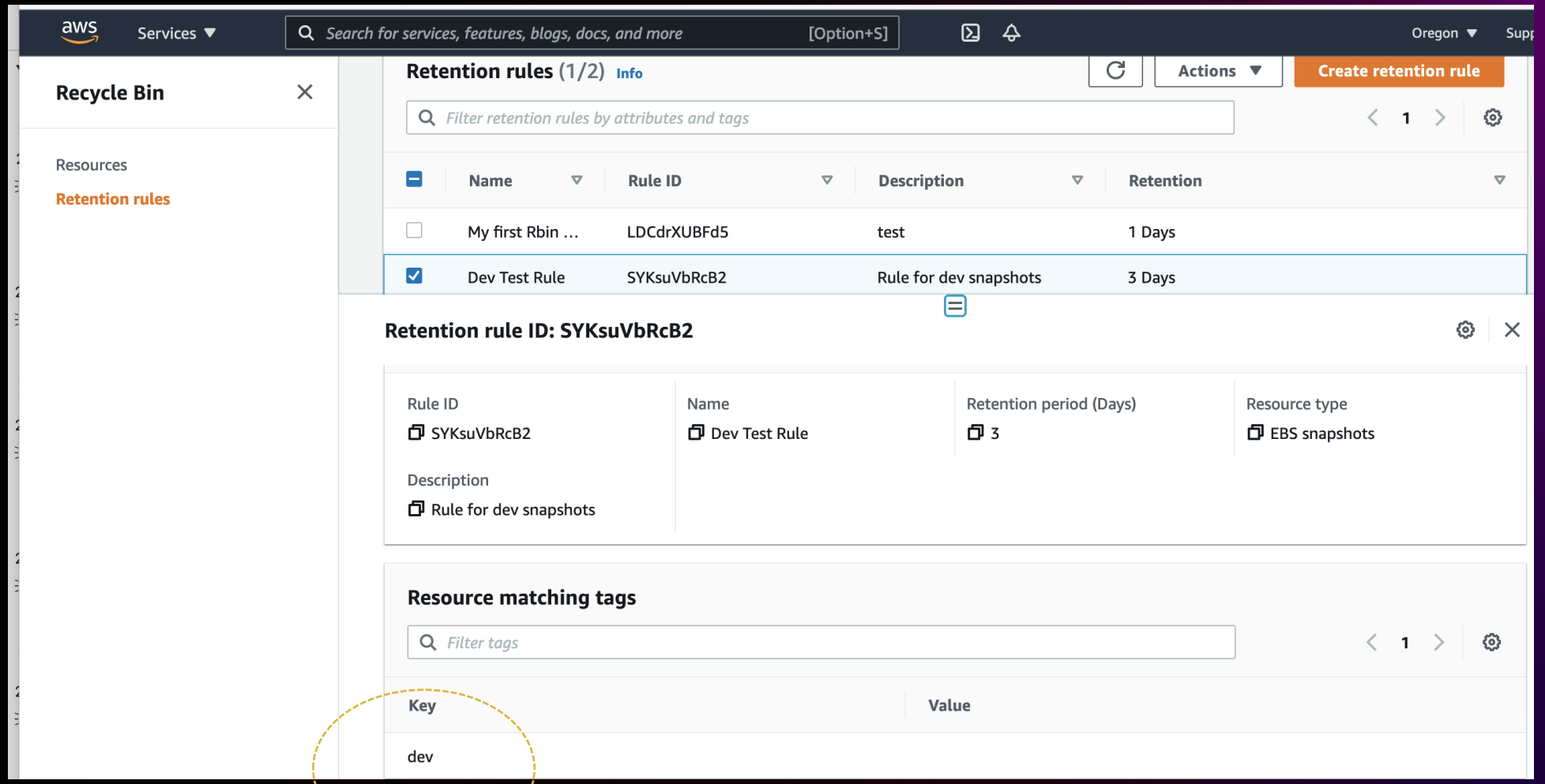
"dev"
resource tag

```
aws ec2 delete-snapshot --region us-west-2 --snap-083503cdea85c9535
```

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Tag-based retention rule kicks in . . .





3-day retention for snapshots tagged with “dev” tag

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Deleted snapshot moves into Recycle Bin



Search for services, features, blogs, docs, and more [Option+S]

Create Snapshot | Actions

Owned By Me | Filter by tags and attributes or search by keyword

Name	Snapshot ID	Size	Description	Status
RBIN Snap Test1	snap-046f6f6aad9ec427c	10 GiB	first snap	completed
RBIN Snap Test2	snap-07042a795d5bcc149	8 GiB	3rd snapshot	completed
RBIN Snap Test3	snap-0dd59a905d33ca86b	8 GiB	2nd snap	completed

Deleted snapshot **RBIN Snap Test 4** moves into Recycle Bin



Services | Search for services, features, blogs, docs, and more [Option+S] | Oregon | Support

Recycle Bin

Resources

Retention rules

Recycle Bin > Resources

Snapshot will be retained for 3 days

Resources (1/1) Info

Recover

Filter snapshots by attributes and tags

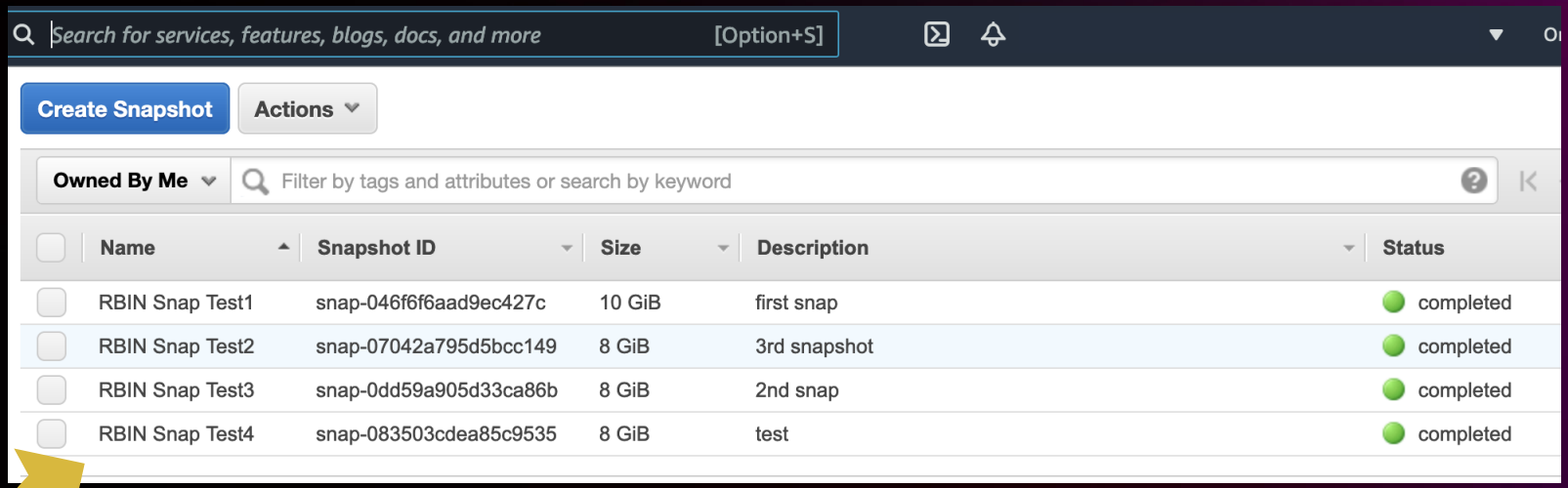
Name	Resource ID	Bin entry date	Bin exit date	Descript
RBIN Snap Test4	snap-083503cdea85c9535	Sun, 31 Oct 2021 20:29:11 GMT	Wed, 03 Nov 2021 20:29:11...	test

```
aws ec2 list-snapshots-in-recycle-bin --region us-west-2
```

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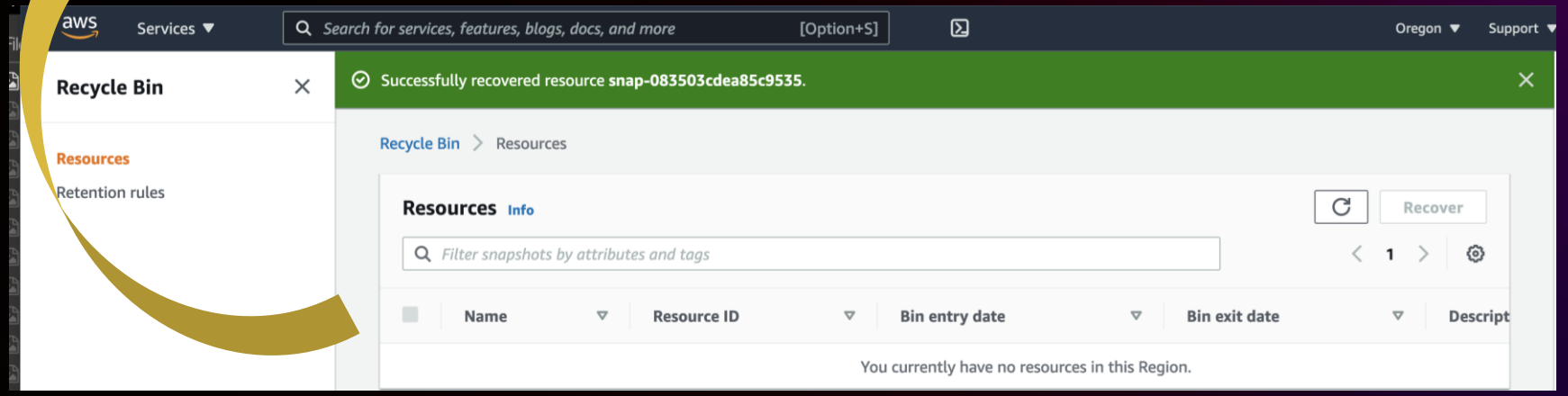
Recovering a snapshot from Recycle Bin





Snapshot **RBIN Snap Test 4** is instantaneously restored from Recycle Bin






```
aws ec2 restore-snapshot-from-recycle-bin --snapshot-id snap-083503cdea859535
```

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Recovered snapshots can be used immediately



EC2 > Volumes > vol-036221c0df8cf272f

vol-036221c0df8cf272f

Actions ▼ | Delete | Modify

Details

Volume ID vol-036221c0df8cf272f	Size 10 GiB	Type gp2	Volume status Okay
Volume state Available	IOPS 100	Throughput -	Encryption Not encrypted
KMS key ID -	KMS key alias -	KMS key ARN -	Snapshot snap-083503cdea85c9535
Availability Zone us-west-2a	Created Sun Oct 31 2021 14:15:44 GMT-0700 (Pacific Daylight Time)	Multi-Attach enabled No	Attached Instances -
Outposts ARN -			

```
aws ec2 create-volume --snapshot-id snap-083503cd3a85c9535 --availability-zone us-west-2a
```

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Managing Recycle Bin permissions

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Managing Recycle Bin permissions

Use **AWS Identity Access Management (IAM)** to restrict access to Recycle Bin rules and resources



Use **IAM administrator role** for managing Recycle Bin rule APIs



Use (default) **snapshot user role** to manage access to snapshot APIS

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Recycle Bin administrator IAM role example



```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "rbin:GetRule",
                "rbin:ListRules",
                "rbin:CreateRules",
                "rbin:UpdateRules",
                "rbin:DeleteRules",
                "rbin:TagResource",
                "rbin:UntagResource",
                "rbin:ListTagsForResource"
            ],
            "Resource": "*"
        }
    ]
}
```

aws

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Snapshot user IAM role example



```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "ec2:CreateSnapshot",
                "ec2:CreateSnapshots",
                "ec2:CreateVolume",
                "ec2:DescribeVolumes",
                "ec2:DeleteSnapshot",
                "ec2:DeleteVolume",
                "ec2:ModifySnapshotAttribute",
                "ec2:DescribeSnapshots",
                "ec2:ListSnapshotsInRecycleBin",
                "ec2:RestoreSnapshotFromRecycleBin",
                "ec2:CreateTags",
                "ec2:DescribeTags"
            ],
            "Resource": "*"
        }
    ]
}
```

Optionally move these to Recycle Bin administrator role for stricter protection

aws

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AVAILABLE NOW

Introducing Rule Lock for Recycle Bin

PROTECT YOUR RESOURCES FROM ACCIDENTAL OR MALICIOUS DELETION



Lock retention rules to prevent them from being modified or deleted

Protect your EBS snapshots and EC2 AMIs from malicious deletions and account breaches

Maliciously deleted resources are safely retained in the Recycle Bin and can be recovered later

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How it works



Create a new locked rule or lock an existing account-level rule

A locked rule can only be unlocked by users with unlock permissions

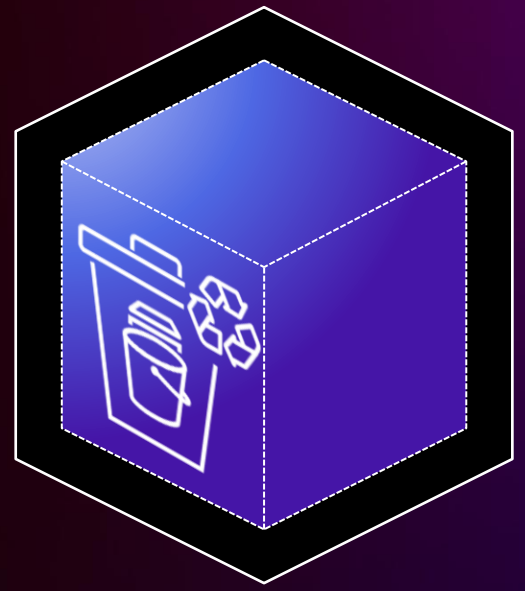
Unlocked rules stay locked for a configurable period of 7 to 30 days, giving a layer of protection against malicious attempts

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Considerations for using Recycle Bin

- 250 rules per account and 50 tags per rule
- Retention rule with longest retention wins
- Fast snapshot restore disabled for Recycle Bin snapshots; re-enable on recovery
- Sharing disabled for Recycle Bin snapshots; permissions retained for recovery
- Add/delete/modify tags allowed for Recycle Bin snapshots

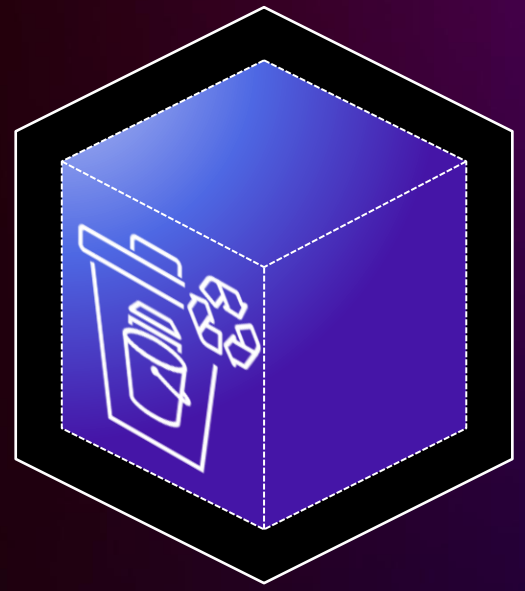


aws

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Call to action

- Evaluate your business risk and impact of loss of data
- Enable Recycle Bin for snapshots and AMIs
- Protect your business against accidental and malicious deletion



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EBS Snapshots Archive

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J&J deploys EBS Snapshots Archive to deliver compliance at scale and lower costs

Challenge: J&J needed a simple, low-cost solution to archive 100K+ snapshots for their 42K+ Amazon WorkSpaces. The archive needed to meet compliance and legal regulations, with requirements for a retention period of 20+ years.

Solution: J&J chose Amazon EBS Snapshots Archive and worked with the AWS Lambda team to successfully migrate 120K snapshots in 2 months. J&J also integrated EBS Snapshots Archive into their ediscovery workflow to automate snapshot archive and recovery.

Benefits:

- Acquired ability to meet compliance requirements and lower costs
- Archived 3 PB of data with a projected annual savings of $1M+
- Lower risk with no vendor vetting required, as EBS Snapshots Archive is an AWS solution

"We were looking for a simple, end-to-end AWS native capability that enabled cost-effective, long-term retention of snapshots and helps us address our long term retention compliance requirements for virtual desktops. EBS snapshots archive not only meets all our technical and compliance requirements, it also ensures that our cost for storage of snapshots is sustainable for years to come."

Gaurav Kapoor

Senior Manager

Johnson & Johnson

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EBS Snapshots Archive tier



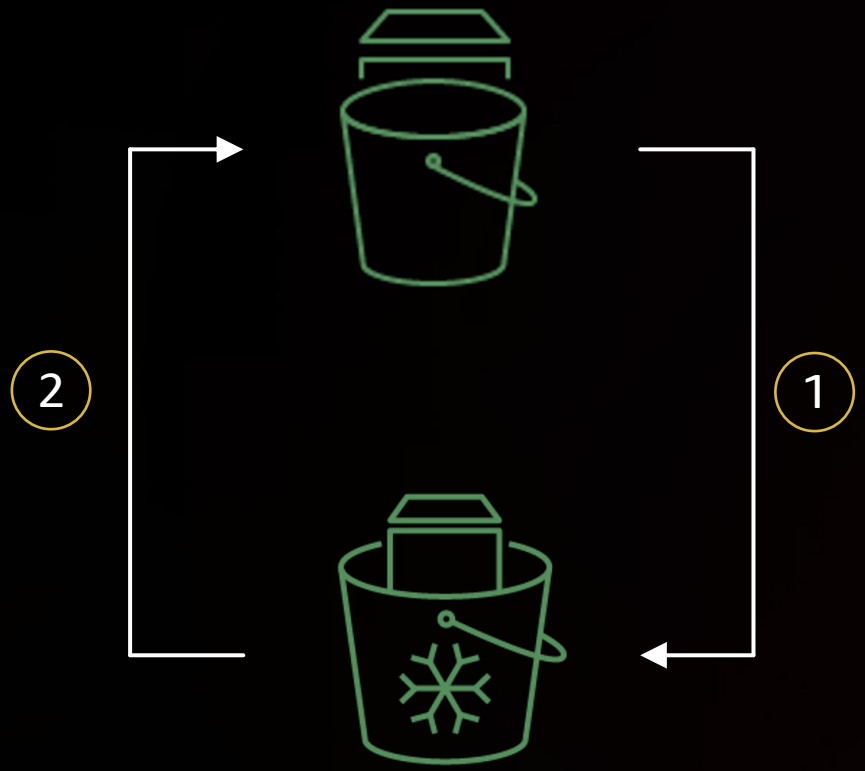
- **Long-term snapshot retention**
  - 90-day minimum retention period
- **Full, point-in-time backups**
- **Retrieve snapshot** before use
  - Retrieval time of hours
- **75% lower storage costs at $0.125/GB-mo**
  - $0.03/GB additional retrieval charges*

EBS Snapshots Archive tier provides low storage cost for long-term retention of rarely accessed EBS snapshots

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*For complete pricing information, visit aws.amazon.com/ebs/pricing

EBS Snapshots Archive: How it works



Archive snapshot

1

- Creates full version of snapshot and moves it into archive tier

Restore snapshot

2

- Restores a full version of your archive snapshot to the EBS Snapshot Standard tier
- Can be temporary or permanent

Simple APIs for archiving and restoring snapshots

aws

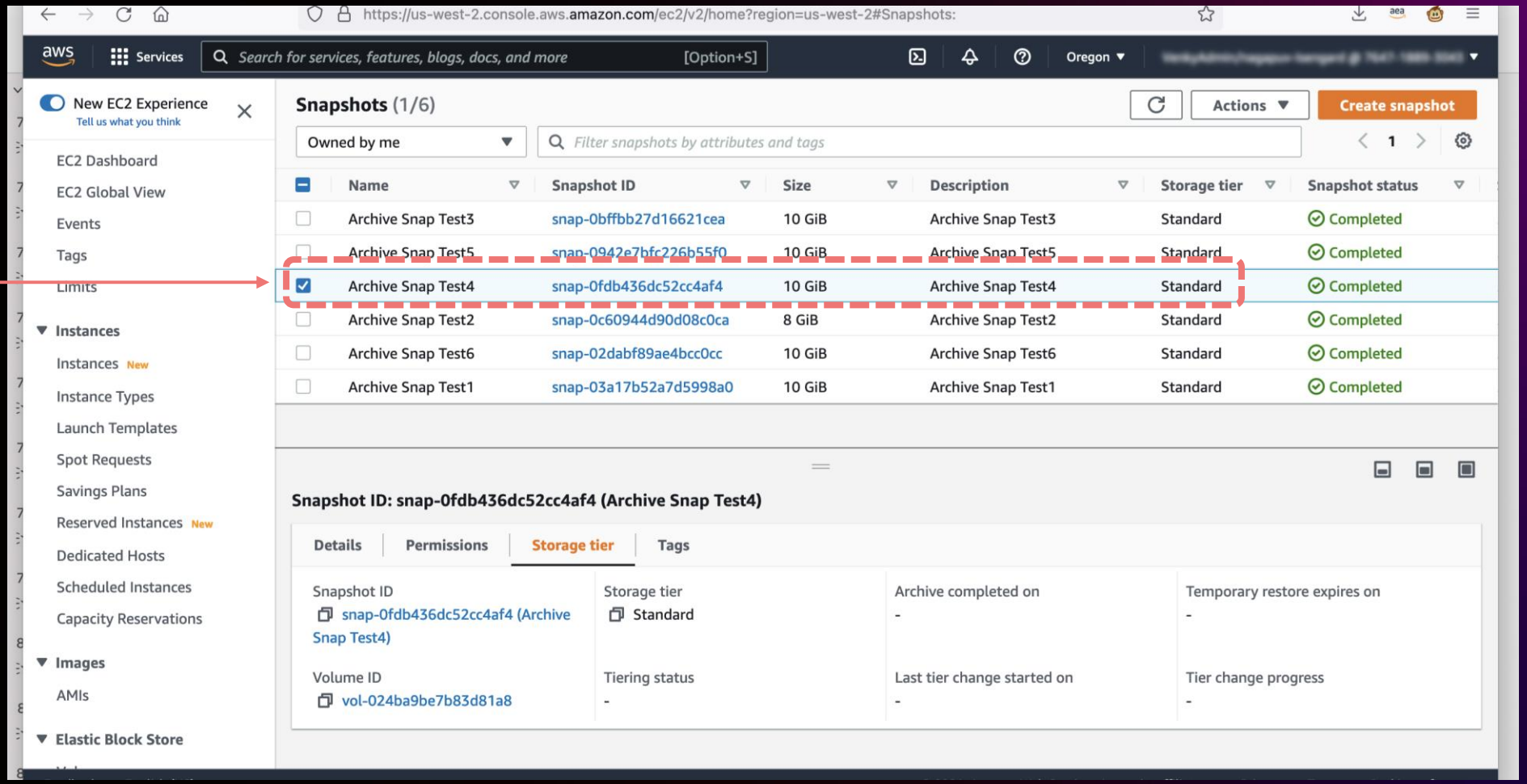
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Archiving EBS snapshots

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Archiving EBS snapshots



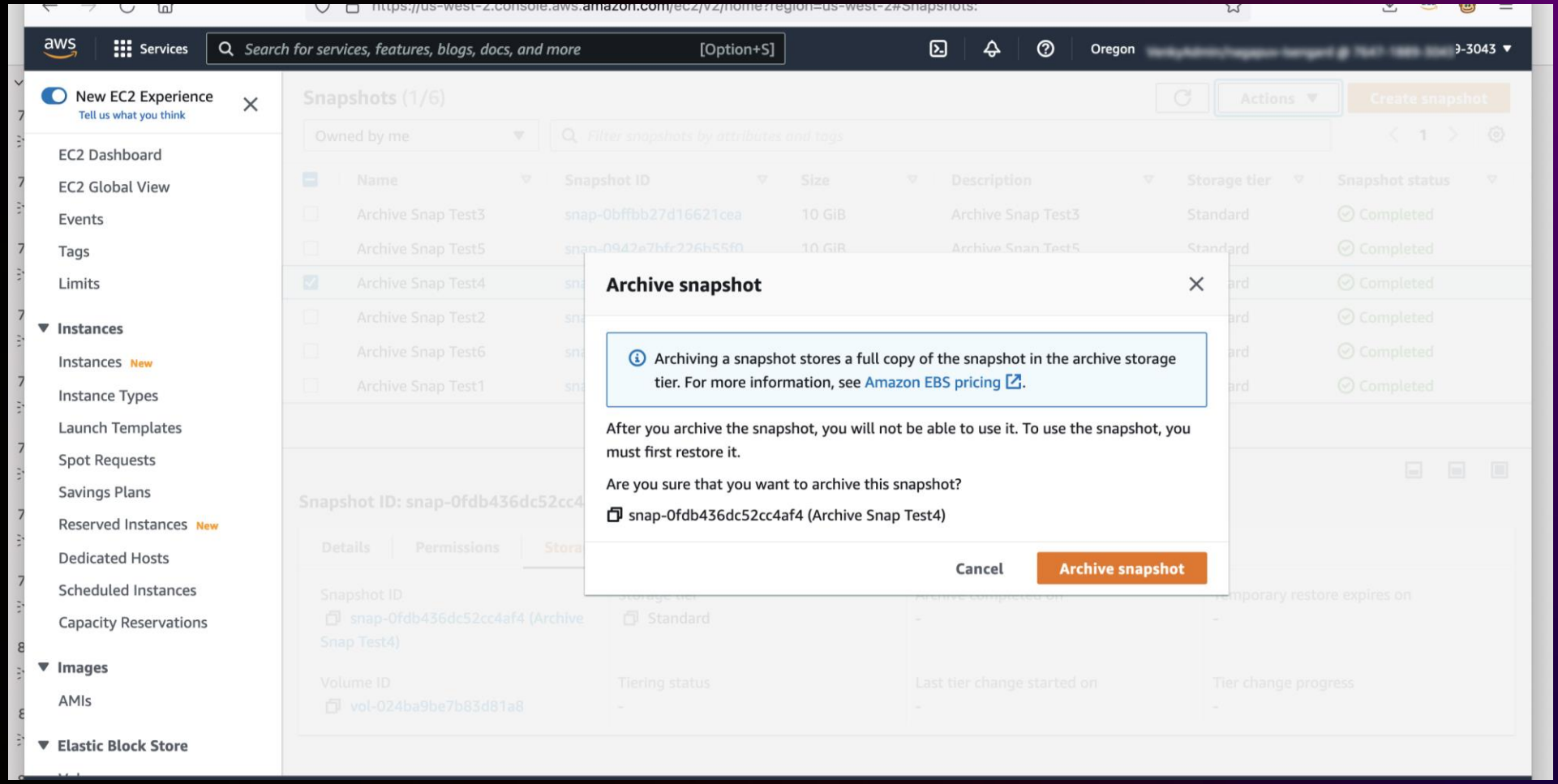


Archiving EBS snapshot snap-0fdb436dc52cc4af4 in standard tier

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Call ModifySnapshotTier to archive snapshot



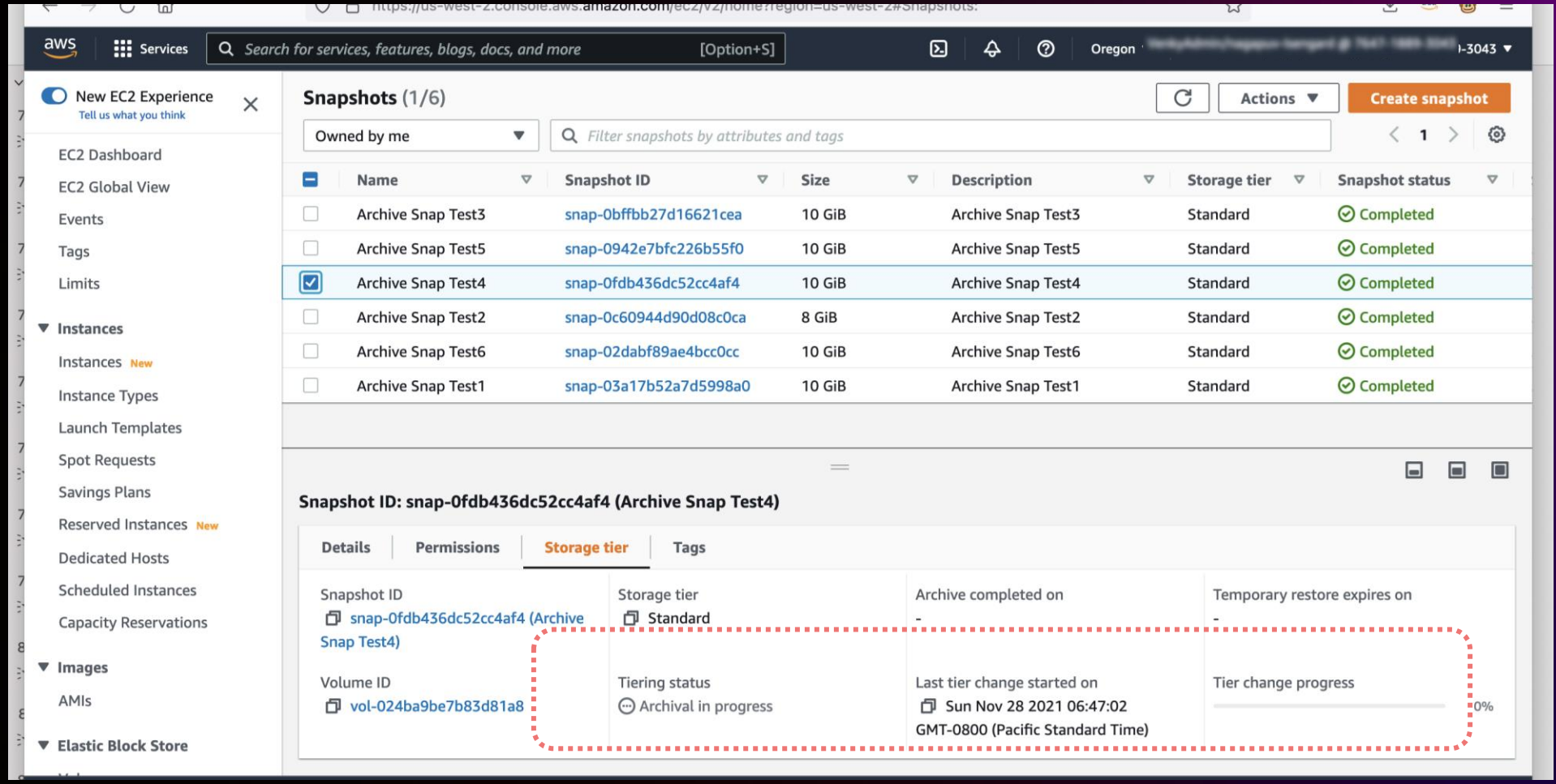



```
aws ec2 modify-snapshot-tier --snapshot-id snap-0fdb436dc52cc4af4
--region us-west-2 –storage-tier archive
```

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Call DescribeSnapshotTierStatus to check progress



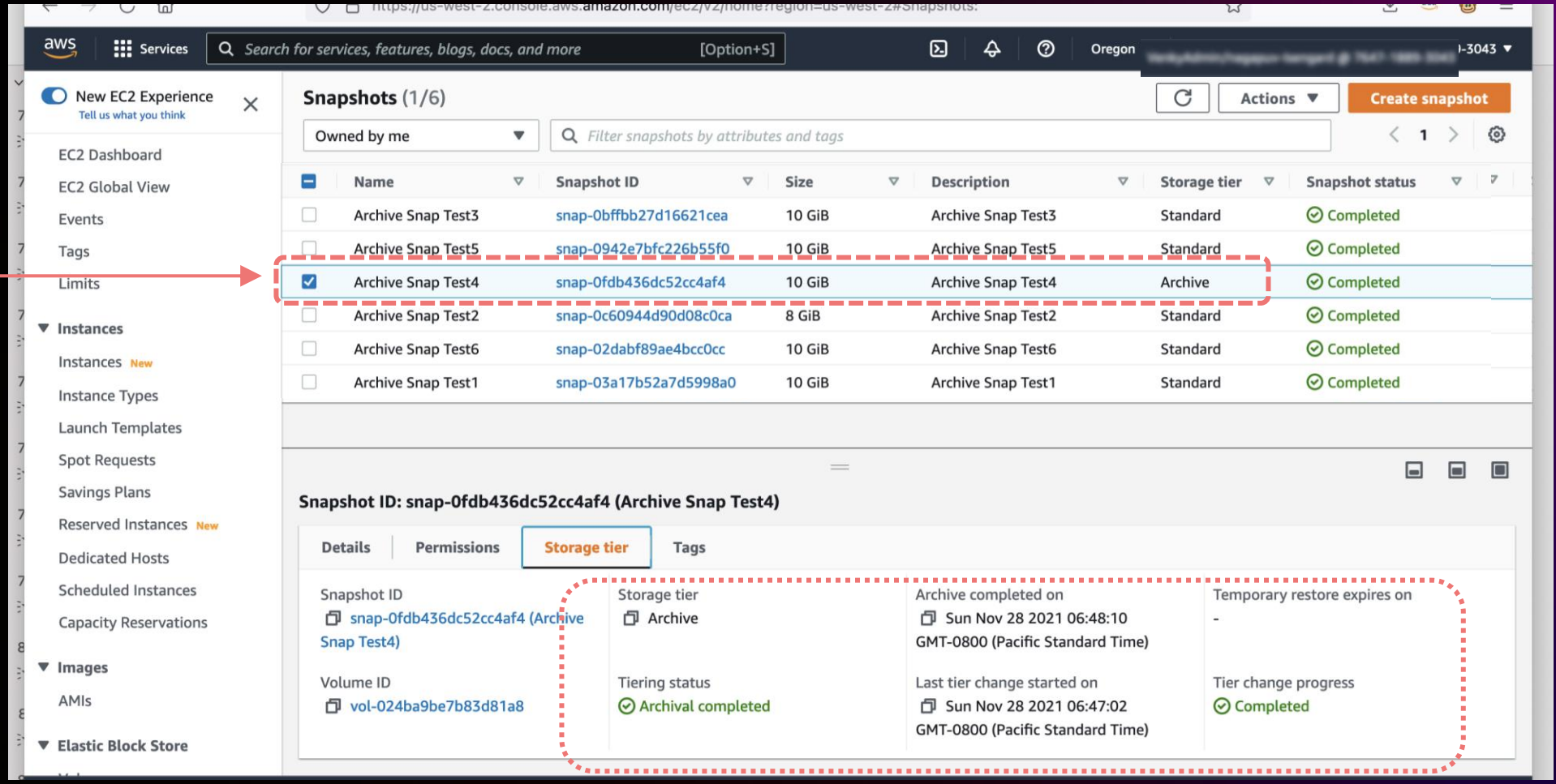



```
aws ec2 describe-snapshot-tier-status –region us-west-2
–snapshot-id snap-0fdb436dc52cc4af4
```

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Snapshot is tiered to archive





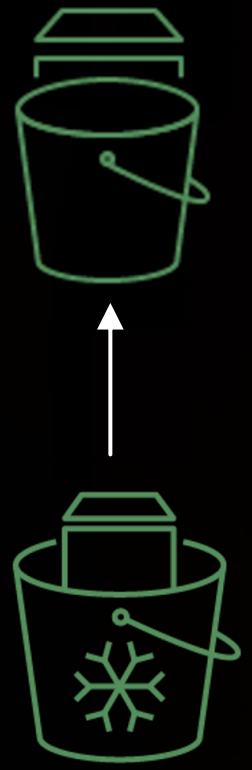

```
aws ec2 describe-snapshot-tier-status –region us-west-2
–snapshot-id snap-0fdb436dc52cc4af4
```

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Restoring EBS snapshots from archive

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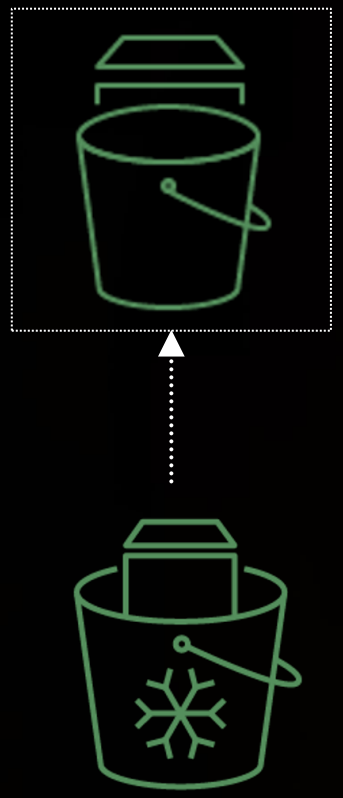
Restoring snapshots from archive

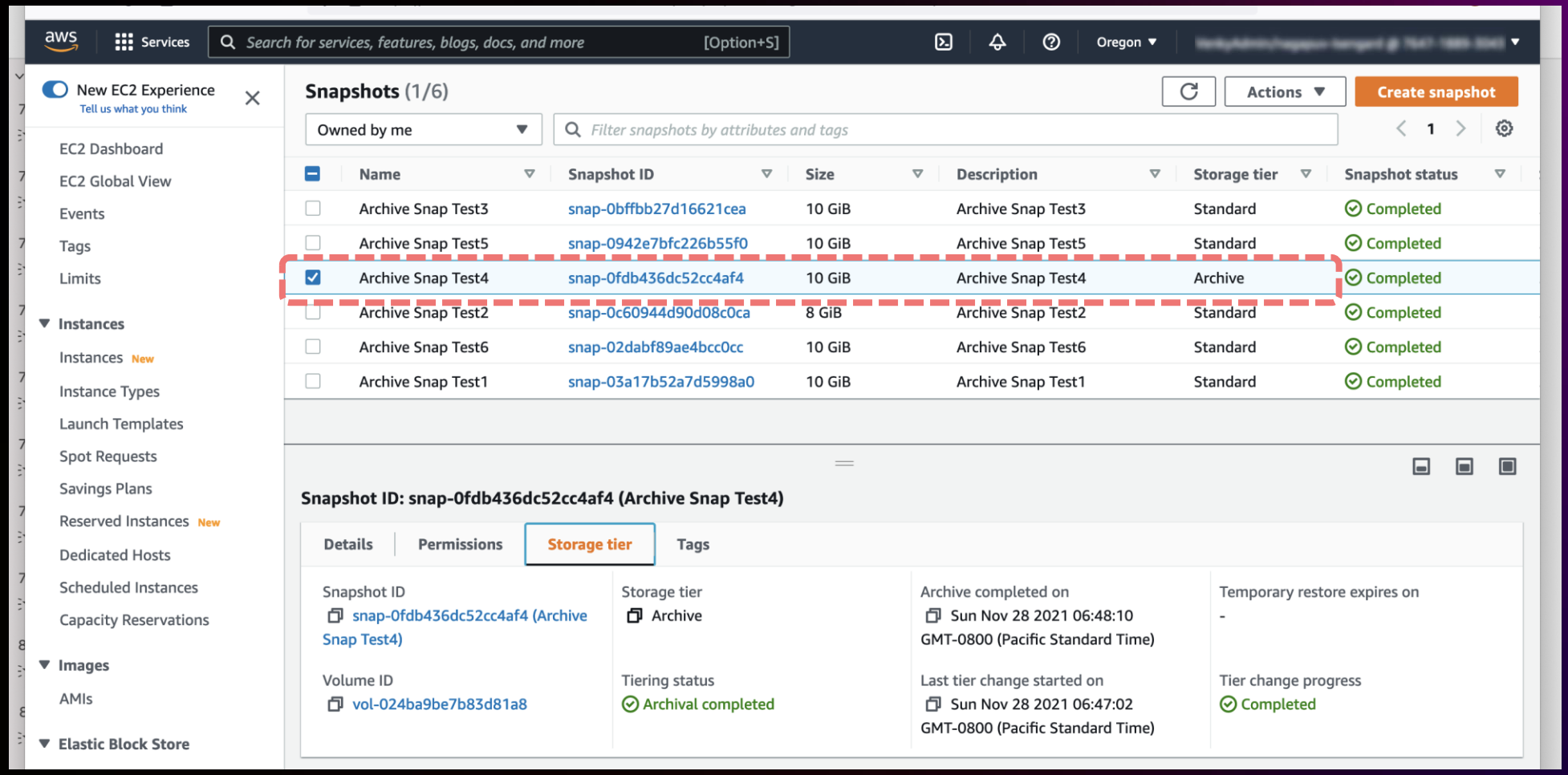


- **Retrieve snapshot from archive for regular use**
- **Retrieval time of hours**
  - Based on snapshot size (24–72 hours maximum)
- **Temporary restore**
  - Restore temporarily for up to 180 days to standard tier
  - Permanent copy stays in archive tier
- **Permanent restore**
  - Change snapshot tier to standard from archive
  - No copy in archive tier
  - Remember 90-day minimum retention in archive

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Choose an archived snapshot to restore

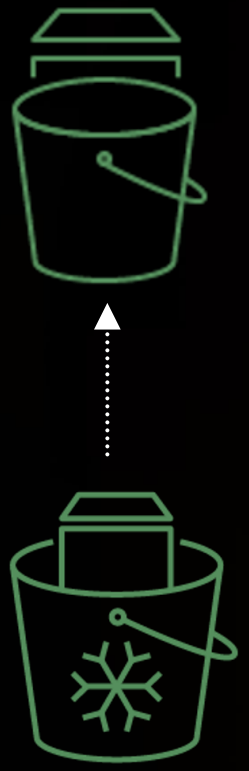


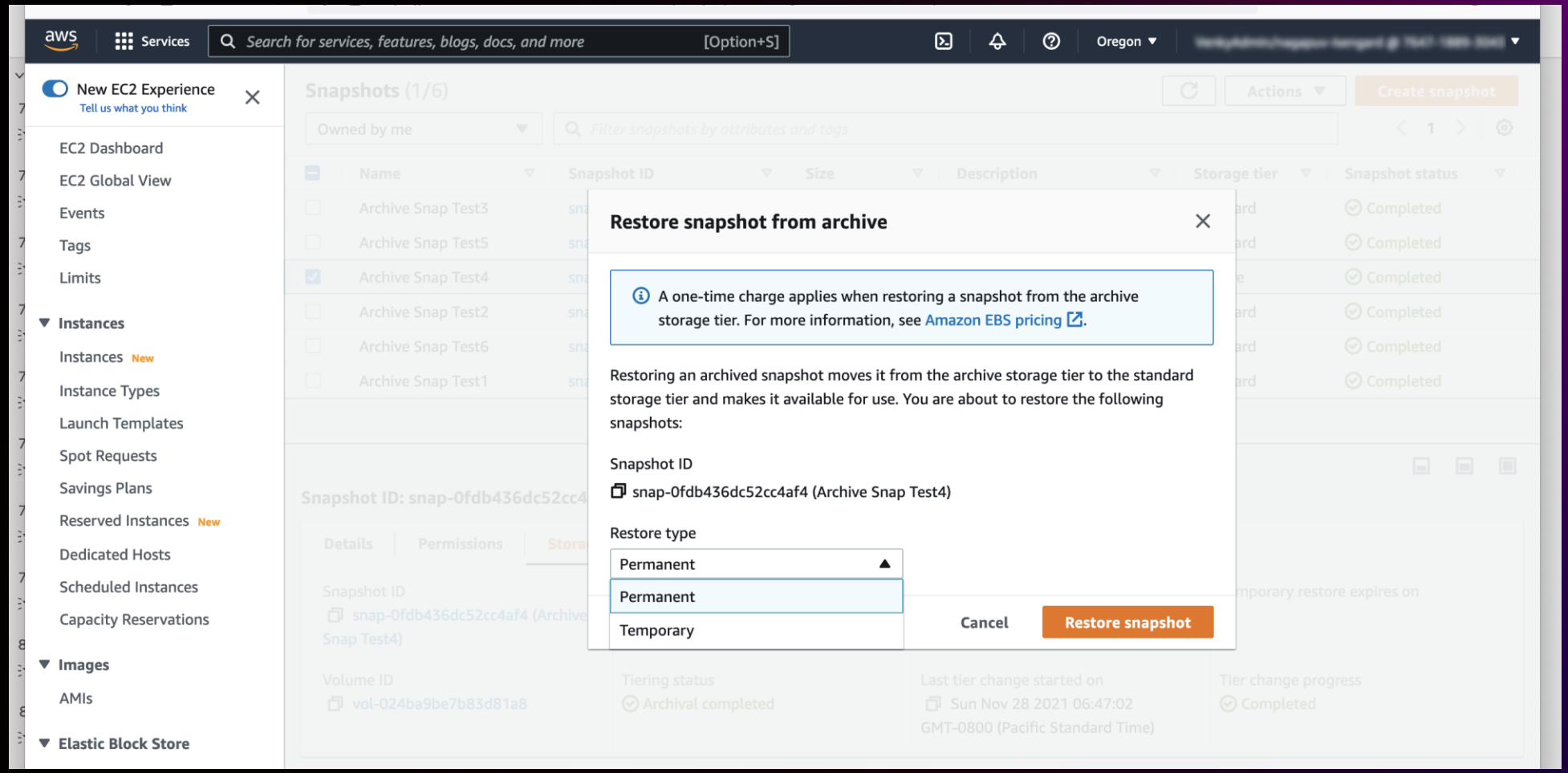


Only archived snapshots can be restored

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Restore snapshot permanently

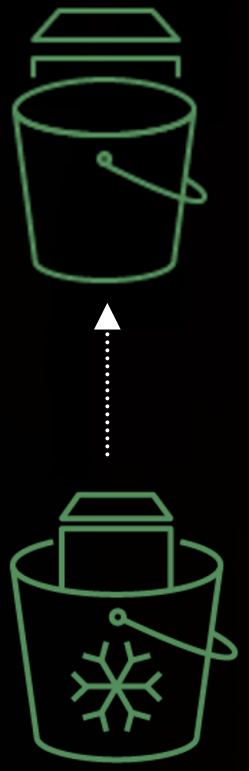


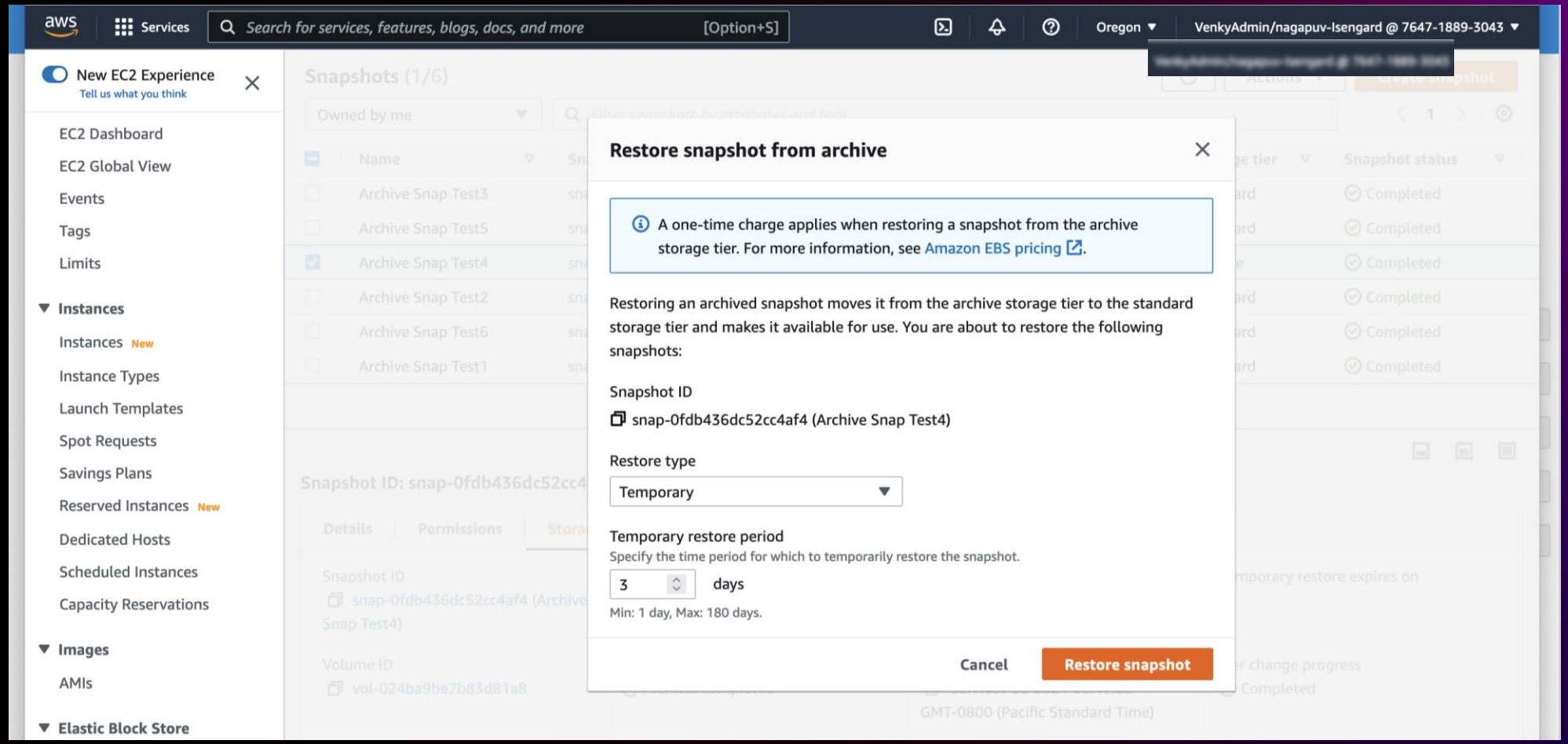



```
aws ec2 restore-snapshot-tier --snapshot-id snap-0fdb436dc52cc4af4 --
permanent-restore –region us-west-2
```

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Restore snapshot temporarily

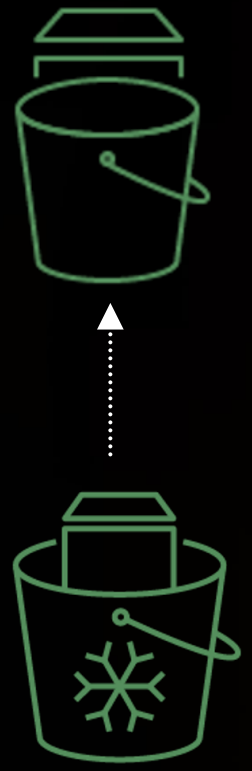


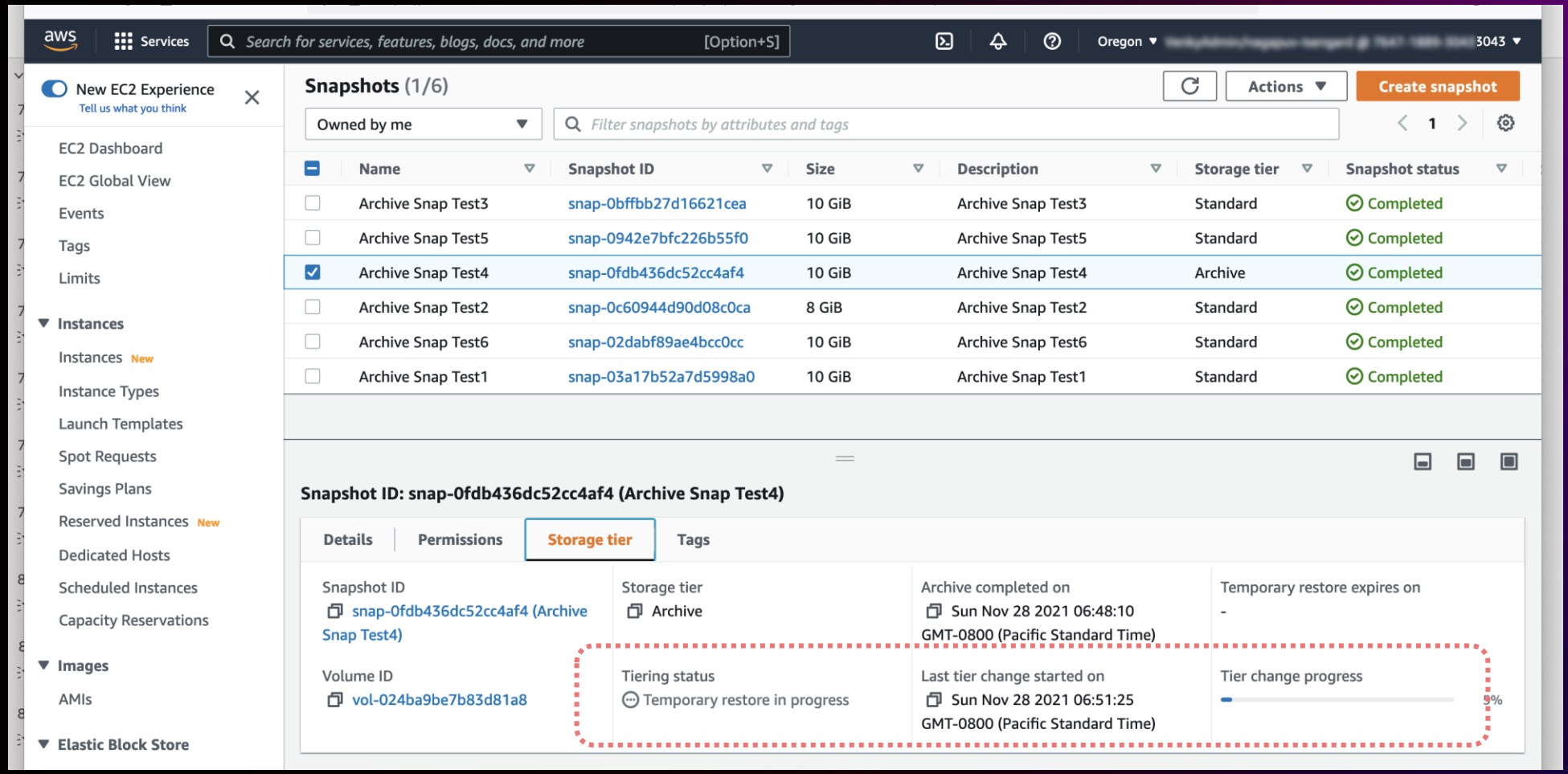



```
aws ec2 restore-snapshot-tier --snapshot-id snap-0fdb436dc52cc4af4 --
temporary-restore-days 3 –region us-west-2
```

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Call DescribeSnapshotTierStatus to check progress

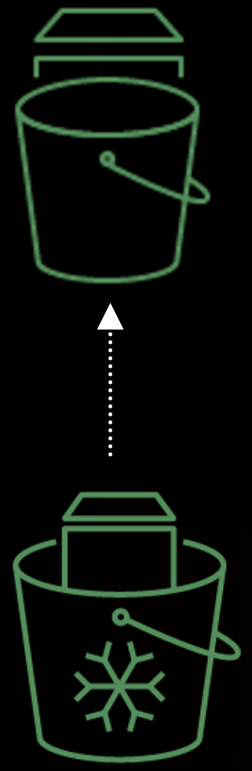


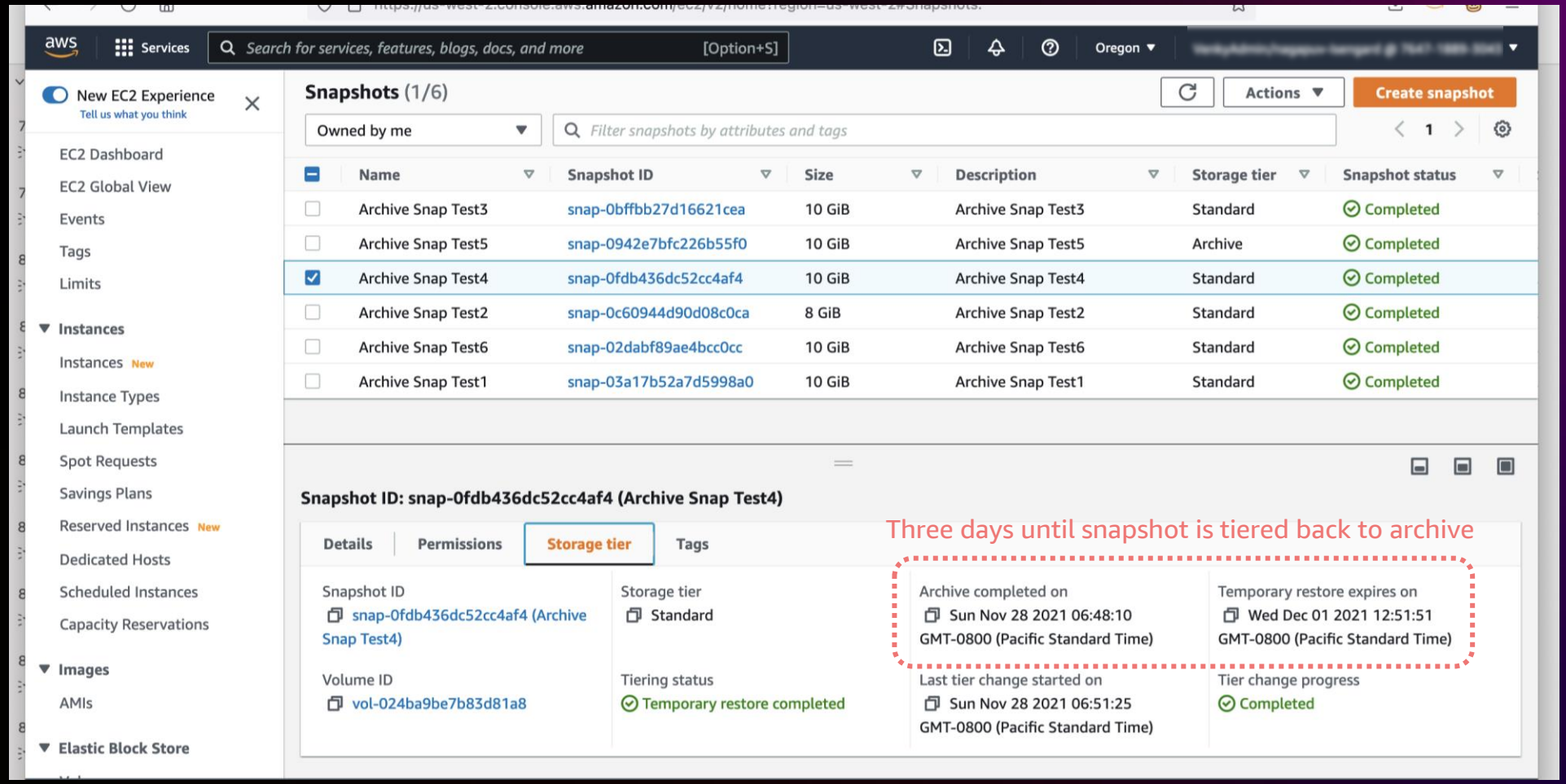



```
aws ec2 describe-snapshot-tier-status –region us-west-2 –snapshot-id
snap-0fdb436dc52cc4af4
```

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Snapshot is now restored to standard tier





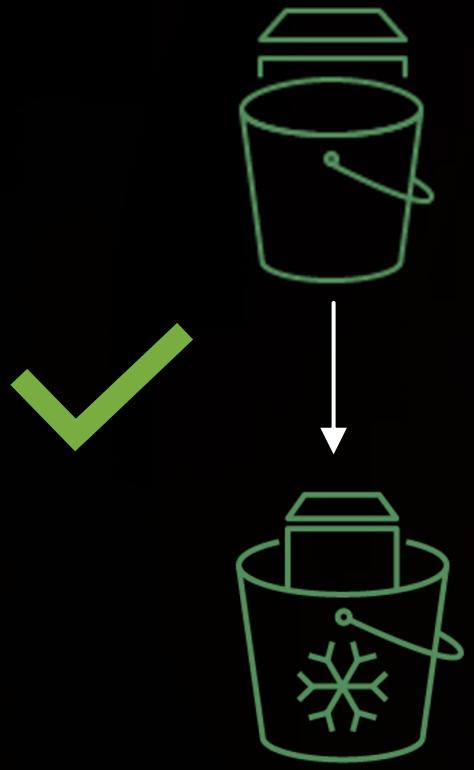

```
aws ec2 describe-snapshot-tier-status –region us-west-2 –snapshot-id snap-0fdb436dc52cc4af4
```

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Considerations for using EBS Snapshots Archive

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Considerations for archiving snapshots

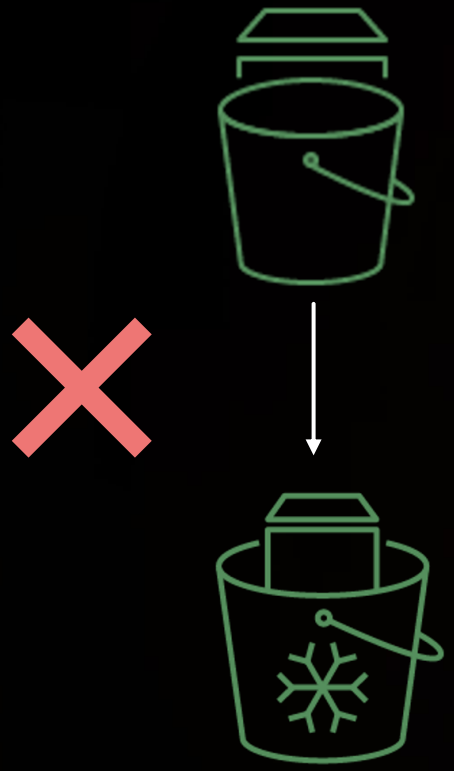


Which snapshots should you consider archiving?

- Last snapshots of inactive lineages
- Full snapshots for compliance
- Snapshots with >25% change rates

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Considerations for archiving snapshots



Which snapshots should you **not** consider archiving?

- Snapshots <25% change rates
- First snapshots of active lineages
- Last snapshots of active lineages

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Other considerations for EBS Snapshots Archive

- Only owner can archive snapshots
- FSR and sharing are disabled on archival
- Cannot archive AMI snapshots
- Recycle Bin supported for snapshot archives



For more details, visit: https://aws.amazon.com/ebs/snapshots/

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Key things to remember

- Use EBS snapshots archive tier for long-term retention needs and save costs up to 75%
- EBS snapshots archive tier supports full snapshots only
  - Carefully consider snapshots to archive
- Restore from EBS snapshots archive tier takes 24–72 hours



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EBS direct APIs

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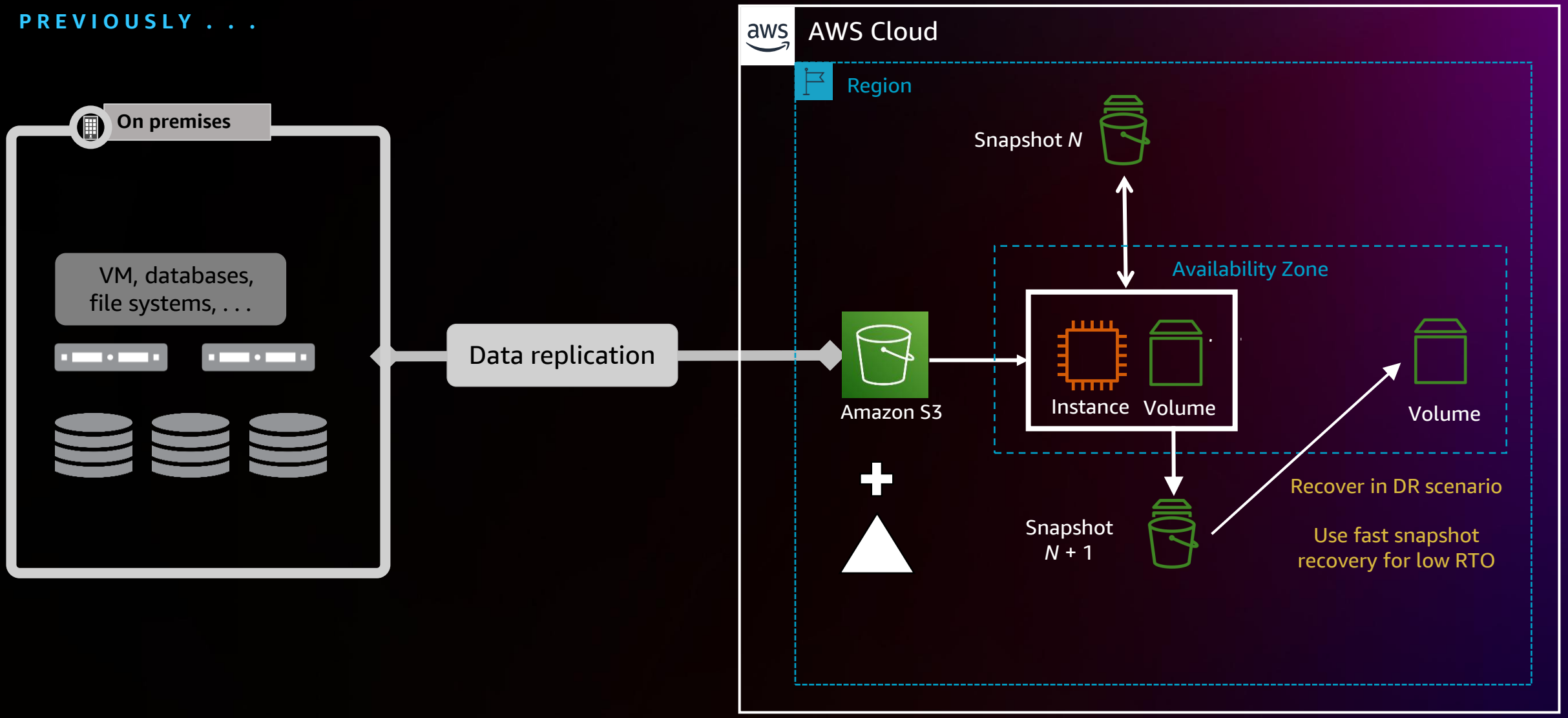
EBS direct APIs

- Efficient, simple, cost-effective, and direct way providing read and write capability for snapshot without using EBS volumes
- Two sets of API primitives
  - **Write APIs**
    - **Use case: Migrate block backups from on premises to AWS as EBS snapshots**
    - **Create snapshot by writing block data directly to your snapshots**
  - **Read APIs**
    - **Use case: Simplify and accelerate application backup workflows (used by backup providers)**
    - **Read block data from snapshot and identify the changes between two snapshots**

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Amazon EBS direct write APIs

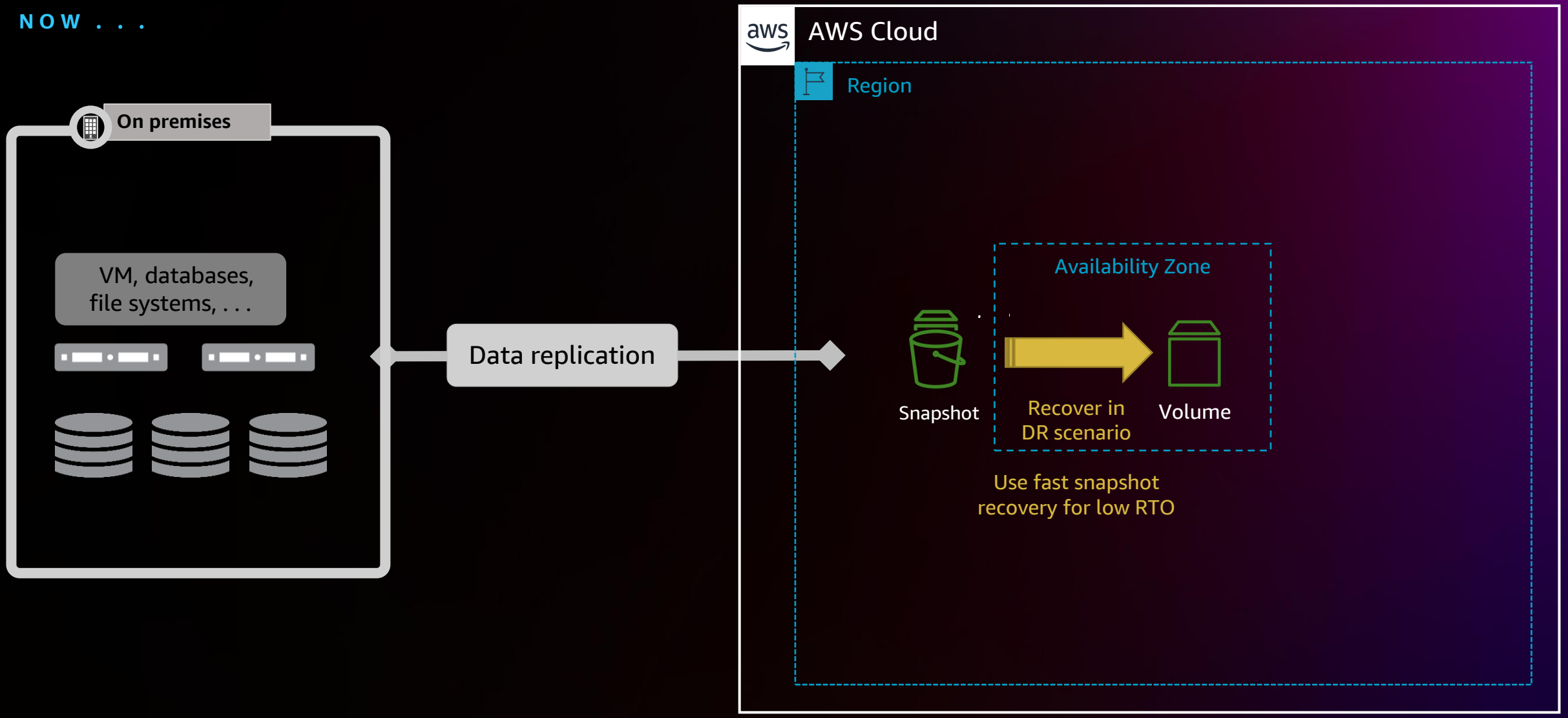
PREVIOUSLY . . .



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EBS direct write APIs

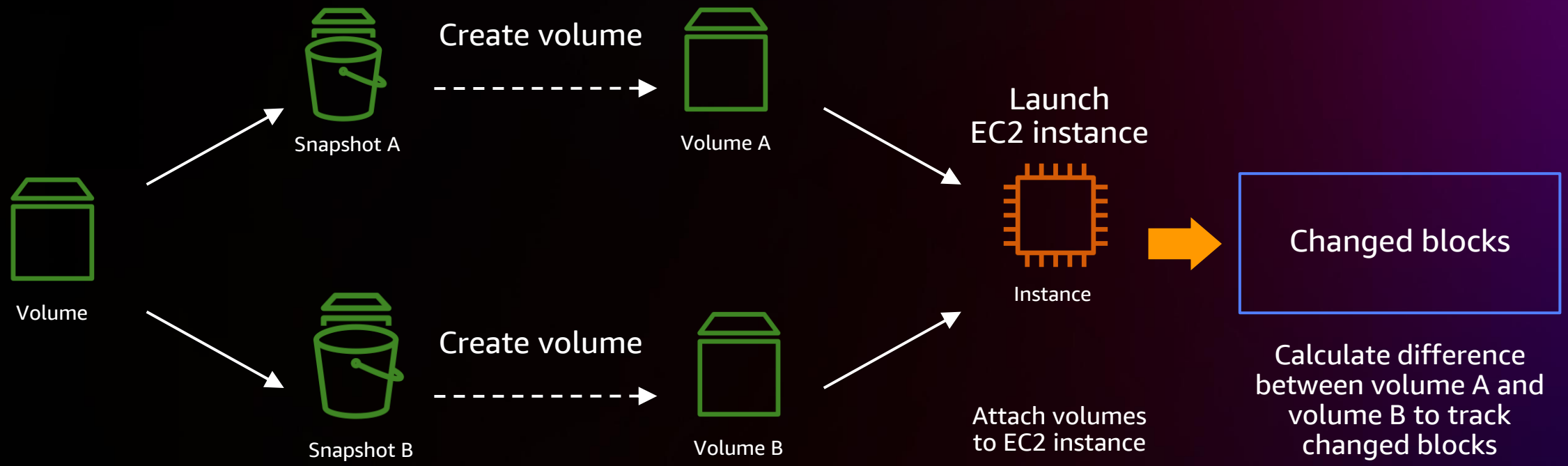
NOW . . .



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Amazon EBS direct read APIs

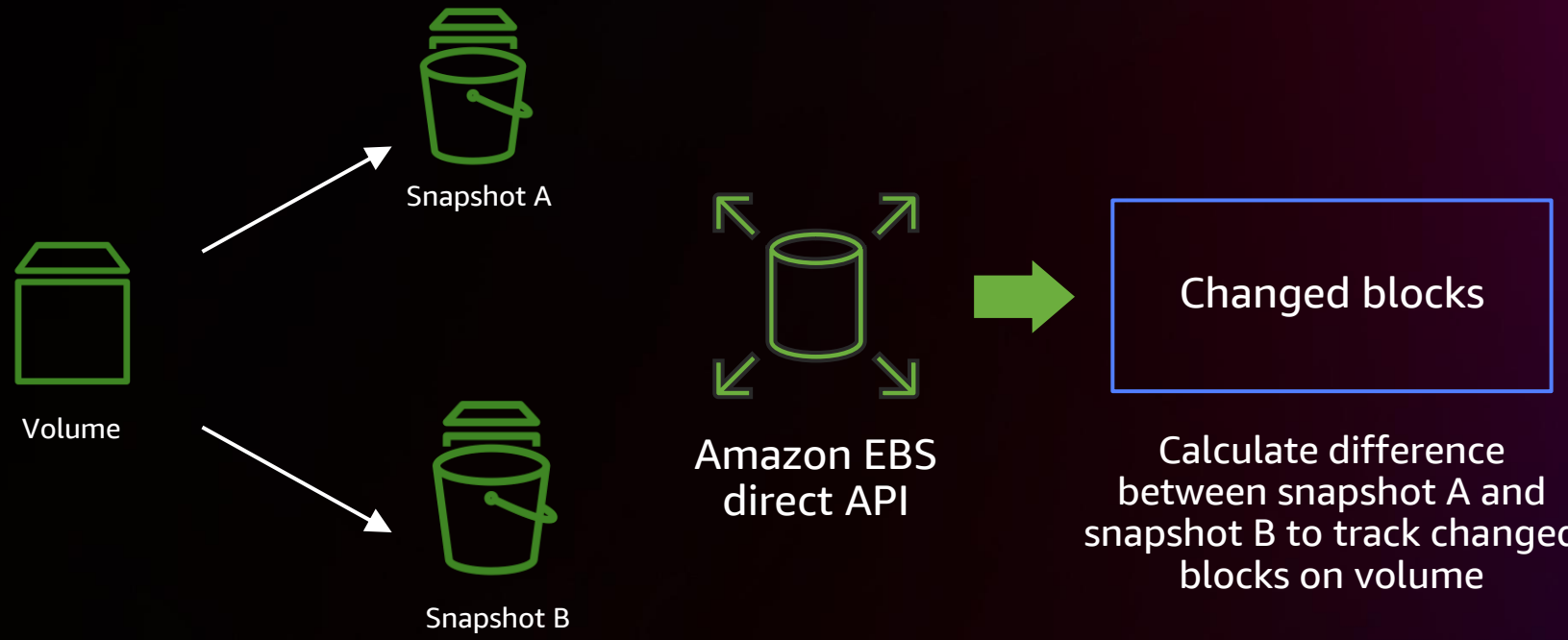
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Amazon EBS direct read APIs

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Write snapshot API

StartSnapshot

Use this API to create a snapshot with or without a parent snapshot

PutSnapshotBlock

Use this API to add data, in the form of individual blocks (size = 512K) to the specific snapshot

CompleteSnapshot

Use the API to seal the snapshot after all blocks are added

https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-accessing-snapshot.html

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Read snapshot API

ListSnapshotBlocks

Use this API to obtain information about the blocks in an EBS snapshots

GetSnapshotBlock

Use this API to read data, in the form of individual blocks (size = 512K) to the specific snapshot

ListChangedBlocks

Use the API to identify the changes in blocks between two snapshots

https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-accessing-snapshot.html

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Upcoming Sessions

Date	Time	Session ID	Type	Session Title
Wednesday, 11/30	8:30 AM	STG314-R	Workshop	Amazon EBS snapshots: Build protection and cost-optimize
Wednesday, 11/30	12:15 PM	STG406	Builders'	Build automated data protection and backup compliance with EBS Snapshots
Wednesday, 11/30	6:15 PM	STG405-R1	Chalk Talk	Best practices on operating at scale with Amazon EBS and EBS Snapshots (Repeat)
Friday, 12/2	8:30 AM	STG314-R1	Workshop	Amazon EBS snapshots: Build protection and cost-optimize (Repeat)

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Thank you!



Please complete the session survey in the **mobile app**

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