AWS re:Invent

CMP301

Backing up Amazon EC2 with Amazon EBS Snapshots

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Agenda

Agenda

- AWS storage and Amazon Elastic Block Store (EBS) overview
- EBS snapshots overview
- Automation and snapshot management
- Snapshot sharing and cross-region copies
- Encryption

More choice for more applications

Block storage

- General Purpose SSD
- Provisioned IOPS SSD
- Throughput Optimized HDD
- Cold HDD
- Elastic Volumes
- Amazon EC2 instance store

Twice as many block storage offerings as anyone else

Add capacity or change performance

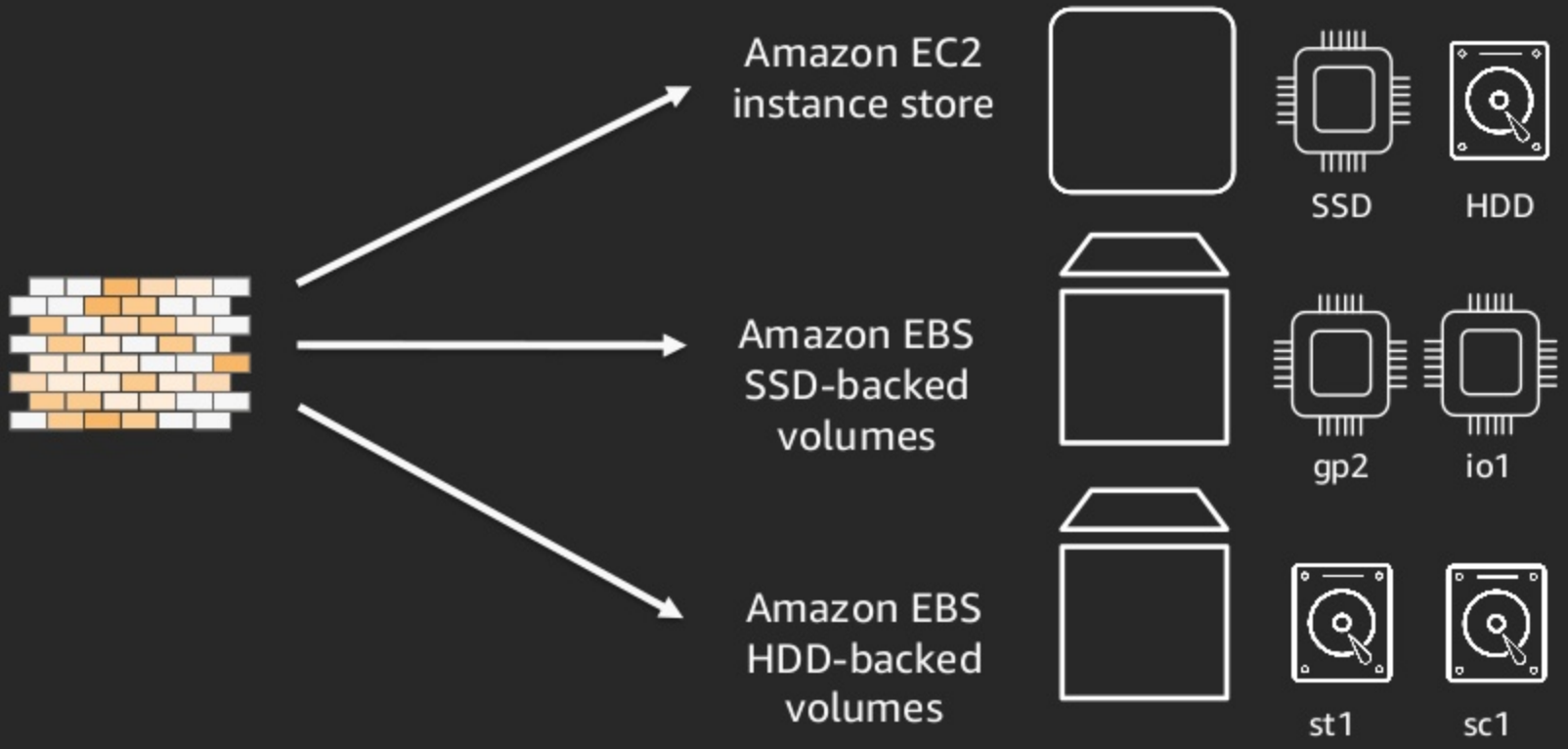
File storage

Amazon Elastic File Service (EFS)

Object storage

- Amazon S3 Standard
- Amazon S3 Standard-IA
- Amazon S3 One Zone-IA
- Amazon S3 Glacier

AWS block storage offerings

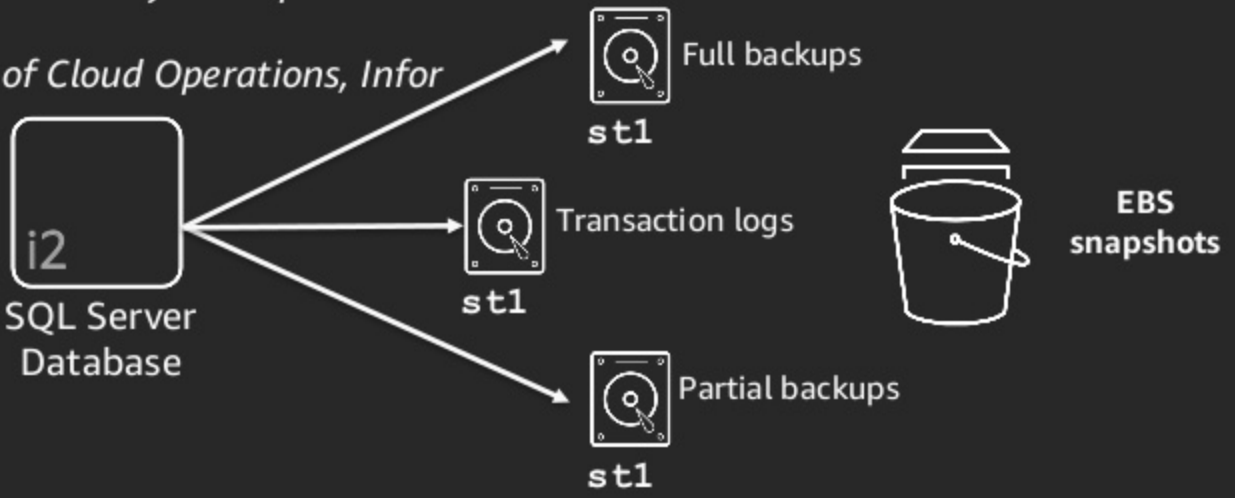


Hybrid volume backup example

Case study:
https://aws.amazon.com/solutions/case-studies/infor-ebs/

*"We've seen much stronger performance for our database backup workloads with the Amazon **EBS ST1** volumes, and we're also saving **75 percent** on our monthly backup costs."*

~Randy Young, Director of Cloud Operations, Infor



What is Amazon Elastic Block Store (EBS)?

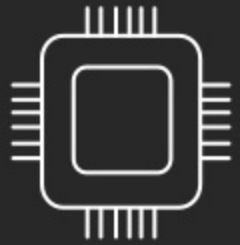
What is Amazon Elastic Block Store (EBS)?

- Block storage as a service
- Create, attach, manage volumes through an API
- Service accessed over the network
- SSD or HDD
- Encryption support
- Point-in-time snapshot support

What is Amazon Elastic Block Store (EBS)?

- 99.999 availability
- 0.1 – 0.2%
  annual failure rate (AFR)

Volume types and performance

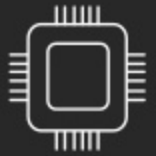


SSD-based

io1

$0.125/GiB*
$0.065/IOP*

Highest performance SSD volume designed for critical and I/O intensive workloads requiring 99.9% consistent performance



gp2

$0.10/GiB*

General purpose SSD volume that balances price and performance for a wide variety of workloads with predictable baseline and burst

*per GB month of provisioned storage (us-east-1)

Volume types and performance

HDD-based

st1

$0.045/GiB*

Low cost HDD volume designed for frequently accessed, throughput intensive sequential workloads

sc1

$0.025/GiB*

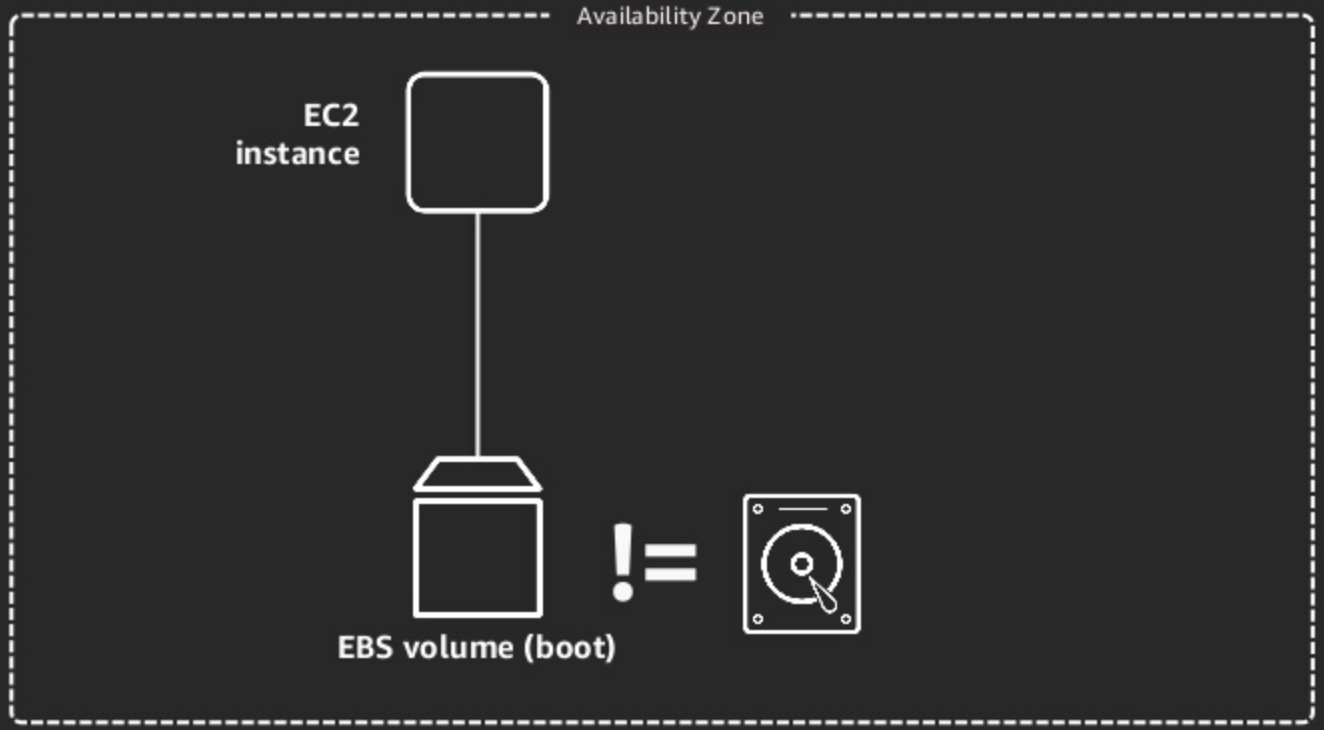
Lowest cost HDD volume designed for less frequently accessed sequential workloads

*per GB month of provisioned storage (us-east-1)

Elastic Volumes

- Increase volume size
- Modify performance
- Change volume type
- Continue using your application without downtime

What is Amazon Elastic Block Store (EBS)?



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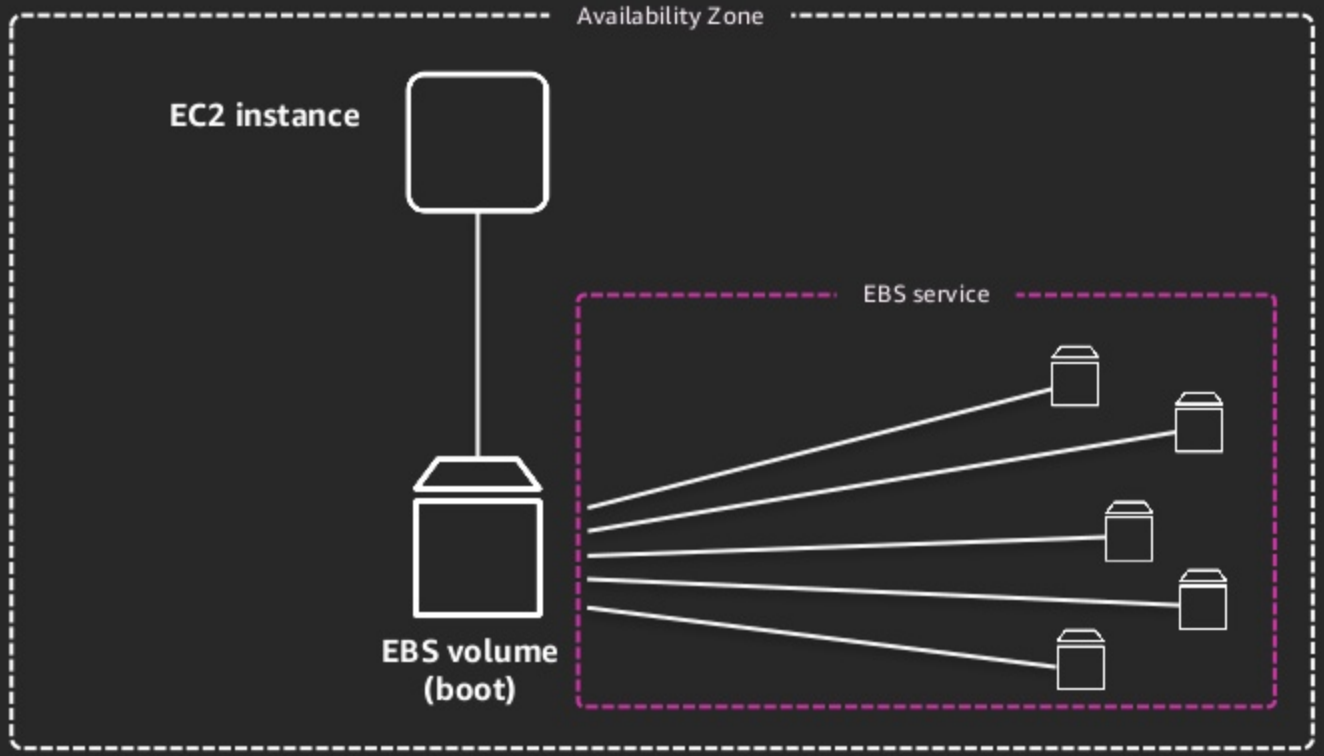

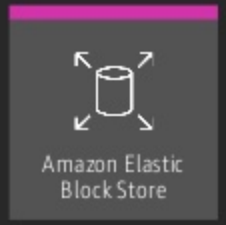

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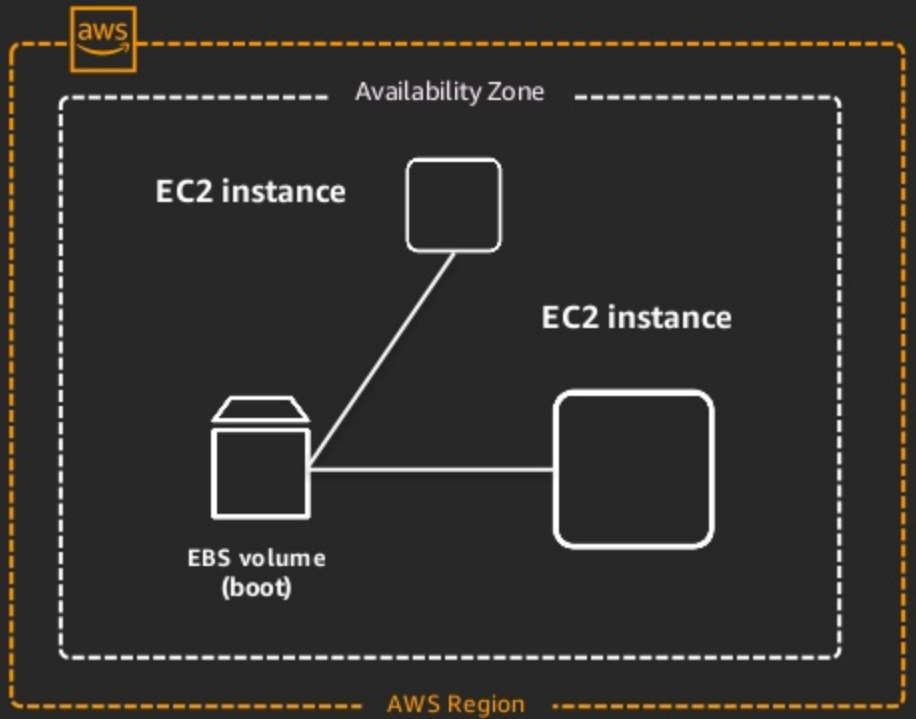
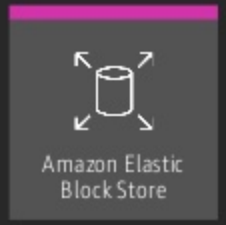


- Volumes persist independent of Amazon EC2
- Select storage and compute based on your workload
- Detach and attach between instances within the same Availability Zone



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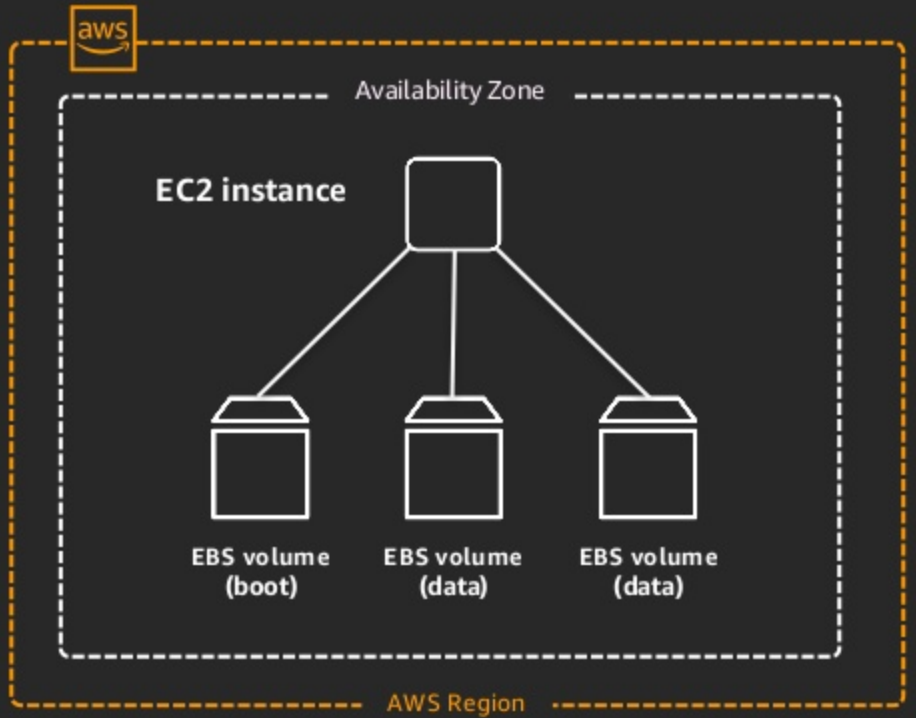
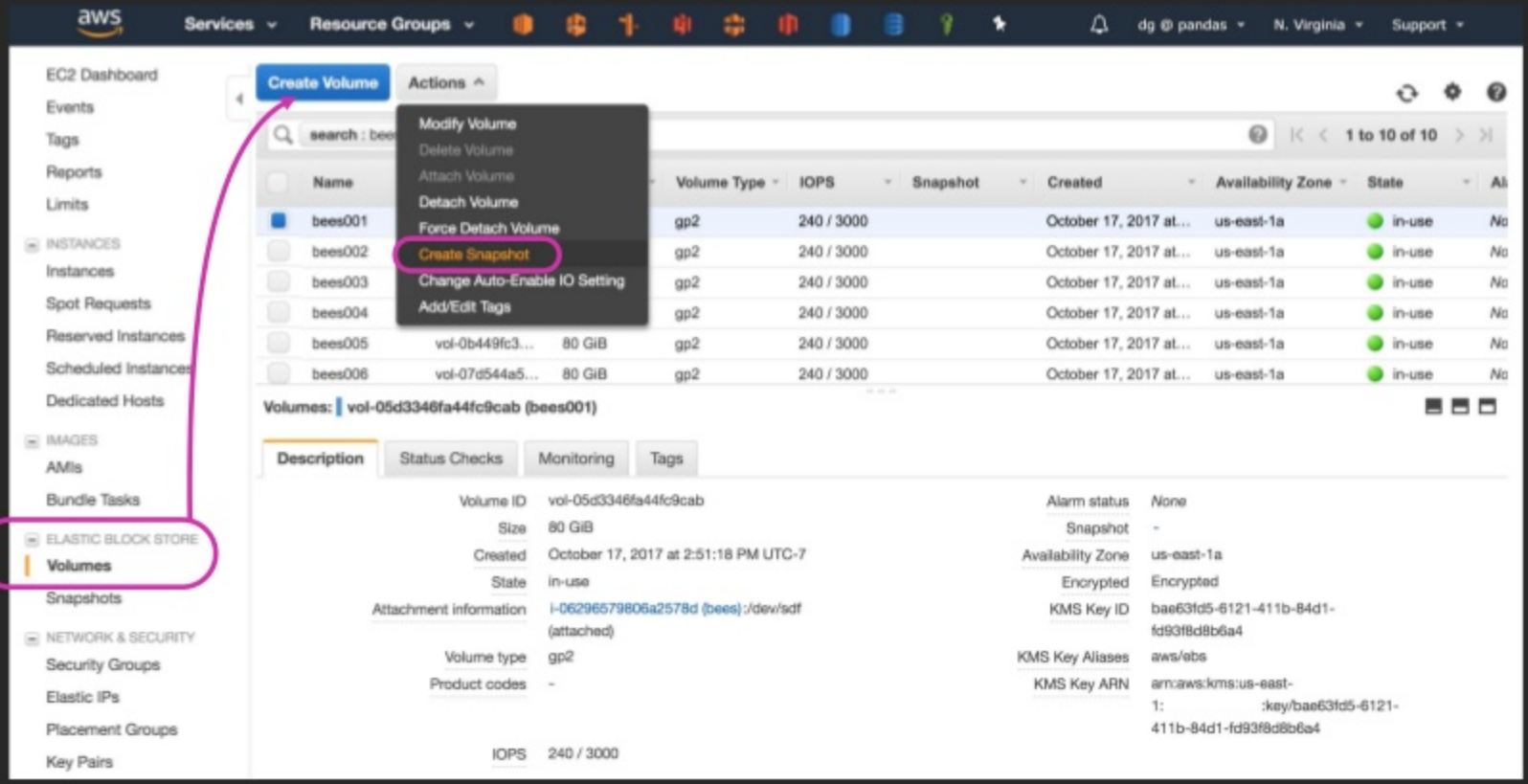


- One instance can have many volumes attached
- Volumes attach to one instance
- **Best Practice:** separate boot and data volumes

EBS Snapshot creation

Creating an EBS snapshot (AWS console)



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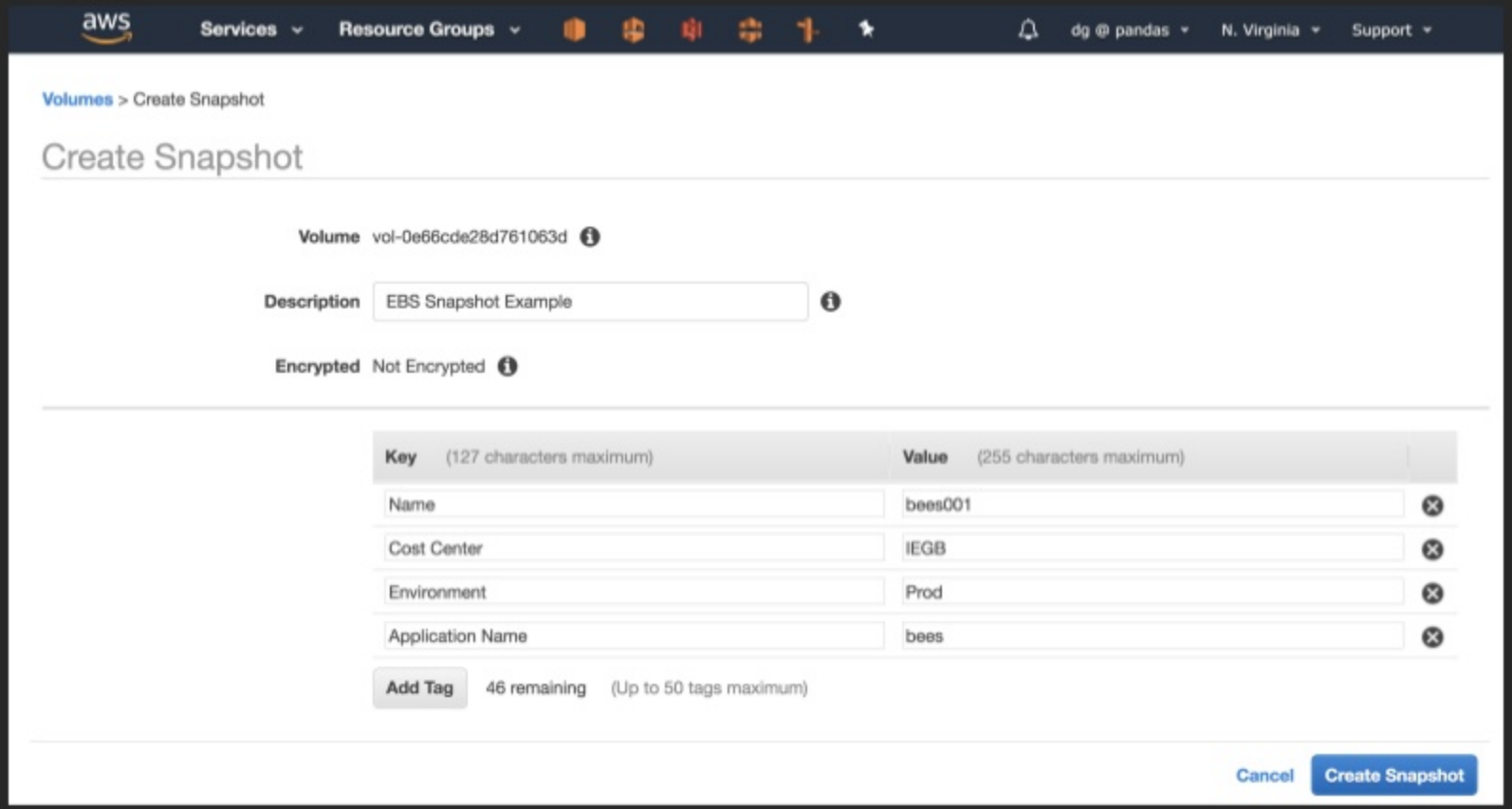

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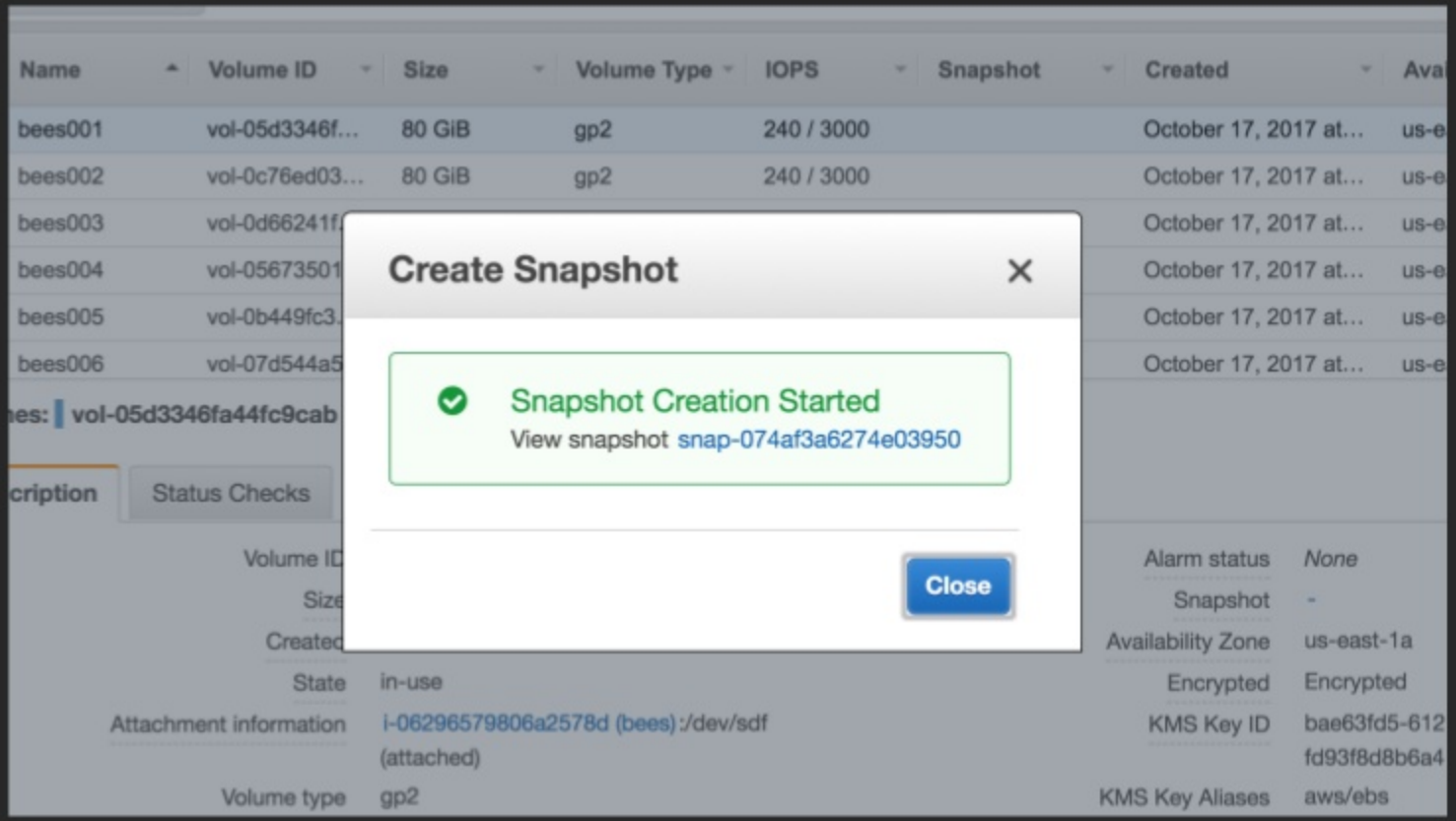
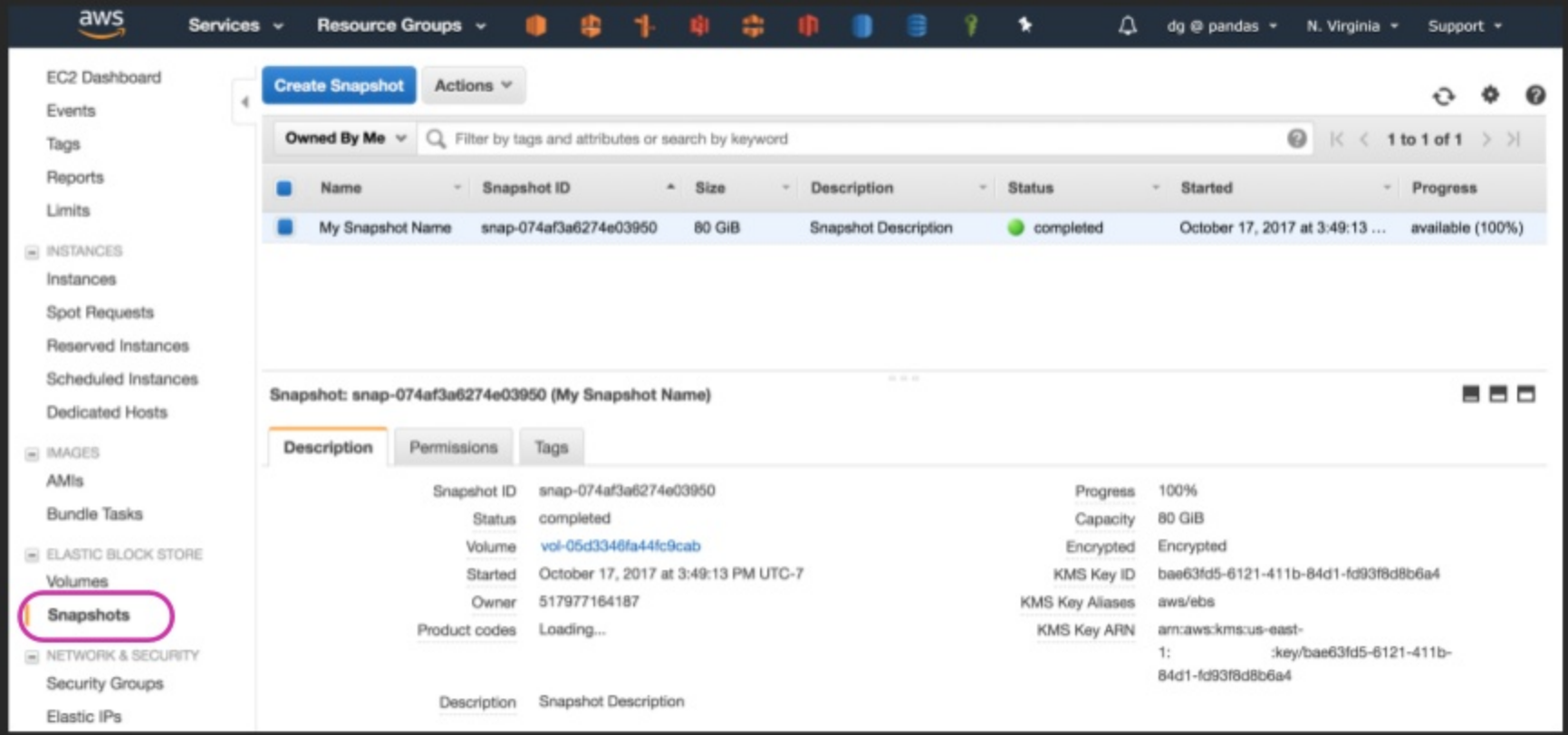


Viewing an EBS snapshot (AWS console)



Creating an EBS snapshot (AWS CLI)

```
[ec2-user@ebs ~]$ aws ec2 create-snapshot --volume-id vol-05d3346fa44fc9cab --description
"Snapshot Description"

{
    "Description": "Snapshot Description",
    "Tags": [],
    "Encrypted": true,
    "VolumeId": "vol-07c96678d6d69ffd7",
    "State": "pending",
    "VolumeSize": 100,
    "StartTime": "2018-11-26T06:14:16+00:00",
    "Progress": "",
    "OwnerId": "[redacted]",
    "SnapshotId": "snap-09befcd5c06219b47"
}
[ec2-user@ebs ~]$
```

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

Viewing an EBS snapshot (AWS CLI)

```
[ec2-user@ebs ~]$ aws ec2 describe-snapshots --snapshot-id snap-063f15dea2d87d3aa
{
    "Snapshots": [
        {
            "Description": "Snapshot Description",
            "VolumeSize": 100,
            "Encrypted": true,
            "VolumeId": "vol-07c96678d6d69ffd7",
            "State": "completed",
            "KmsKeyId": "arn:aws:kms:us-west-2::key/19fc8073-ef5e-4de2-84c0-6a0af43a22e97",
            "StartTime": "2018-11-26T06:14:16.687000+00:00",
            "Progress": "100%",
            "OwnerId": "[redacted]",
            "SnapshotId": "snap-09befcd5c06219b47"
        }
    ]
}
```

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

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 executed

Application-consistent, VSS-enabled Snapshots

VSS support with AWS Systems Manager (SSM)

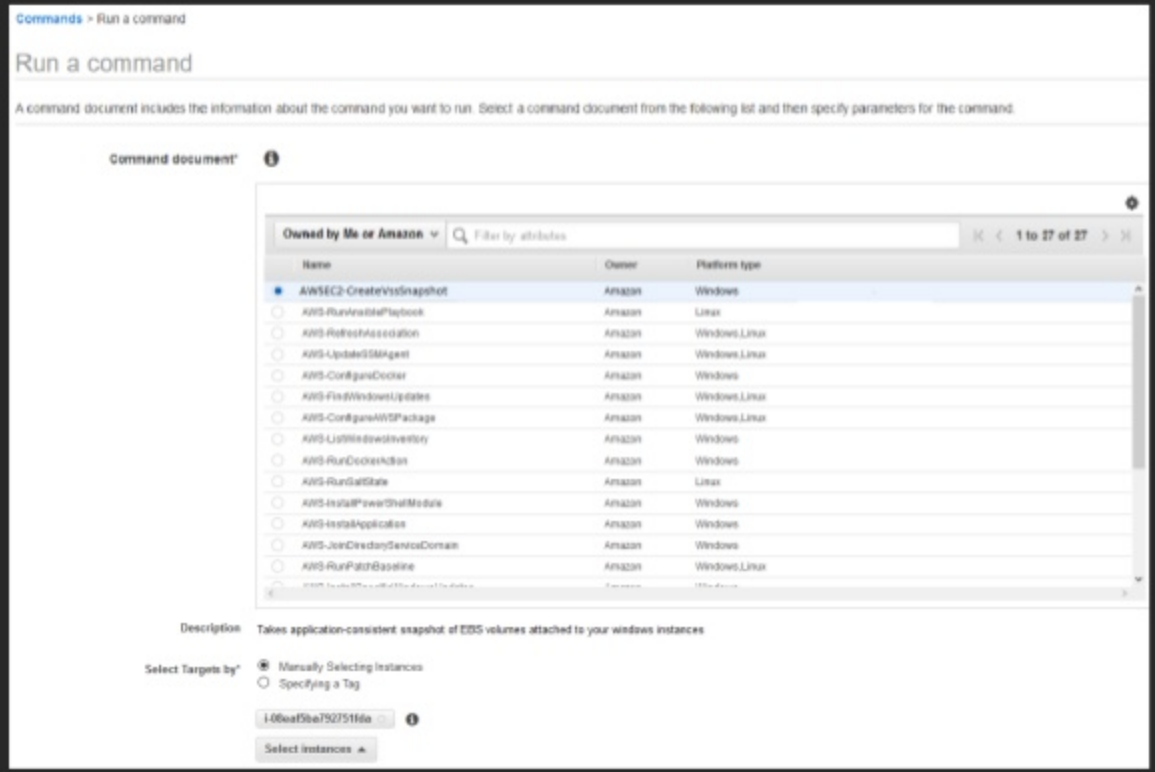
SSM + VSS

- VSS manages disk operations, such as file writes, when a backup is in progress
- VSS-enabled snapshots of Amazon EBS volumes are available through Amazon EC2 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.

VSS support with AWS Systems Manager (SSM)

- Call the Run Command:

AWSEC2-CreateVssSnapshot



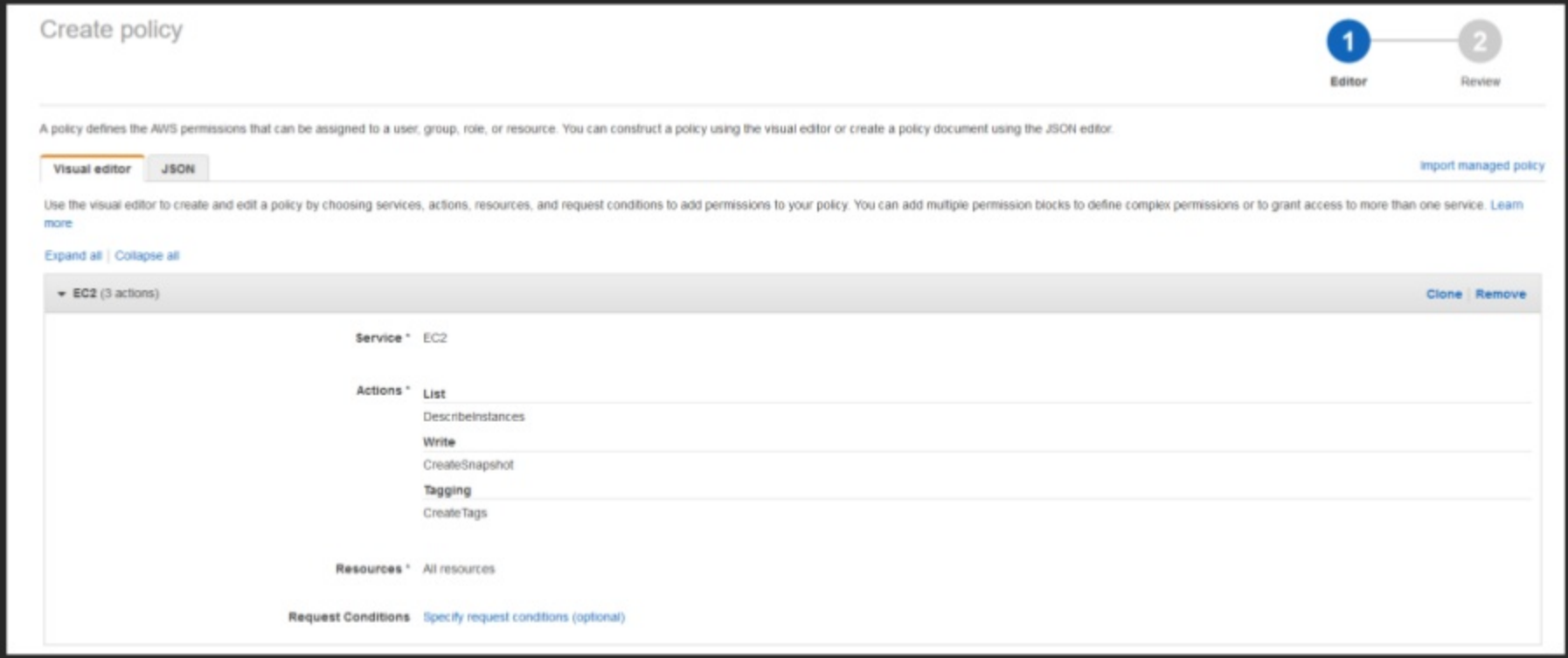
https://docs.aws.amazon.com/systems-manager/latest/userguide/integration-vss.html

VSS support with AWS Systems Manager (SSM)

- Select the instance
- Add description, tags
- Can exclude boot volume
- Run Command makes the VSS agent flush I/O, freeze

- SSM VSS included in Microsoft Windows Server AMI version 2017.11.21 and up

VSS support with AWS Systems Manager (SSM)



https://docs.aws.amazon.com/systems-manager/latest/userguide/integration-vss.html#integration-vss-restore

EBS snapshot scheduling

The old way…

Snapshot scheduling – the old way…

Tagging

AWS Lambda

Amazon EC2
Run command

EBS Snapshot scheduling with Amazon Data Lifecycle Manager

Amazon Data Lifecycle Manager (DLM)

Amazon Data Lifecycle Manager (DLM) automates the creation, retention, and deletion of Amazon EBS volume snapshots.

Amazon Data Lifecycle Manager (DLM)

- Use policies to enforce regular snapshot schedules
- Policies identify volumes to backup using tags
- Retain backups for compliance / audit requirements
- Control snapshot costs by optional automatic deletion of old snapshots
- Use IAM to control DLM policy access
- No cost to use – pay only for data stored in snapshots

Amazon Data Lifecycle Manager (DLM)

Use policies to set backup and retention schedules

Customer requirement

"All EC2 instance root volumes will be backed up once per day, saved for 7 days."

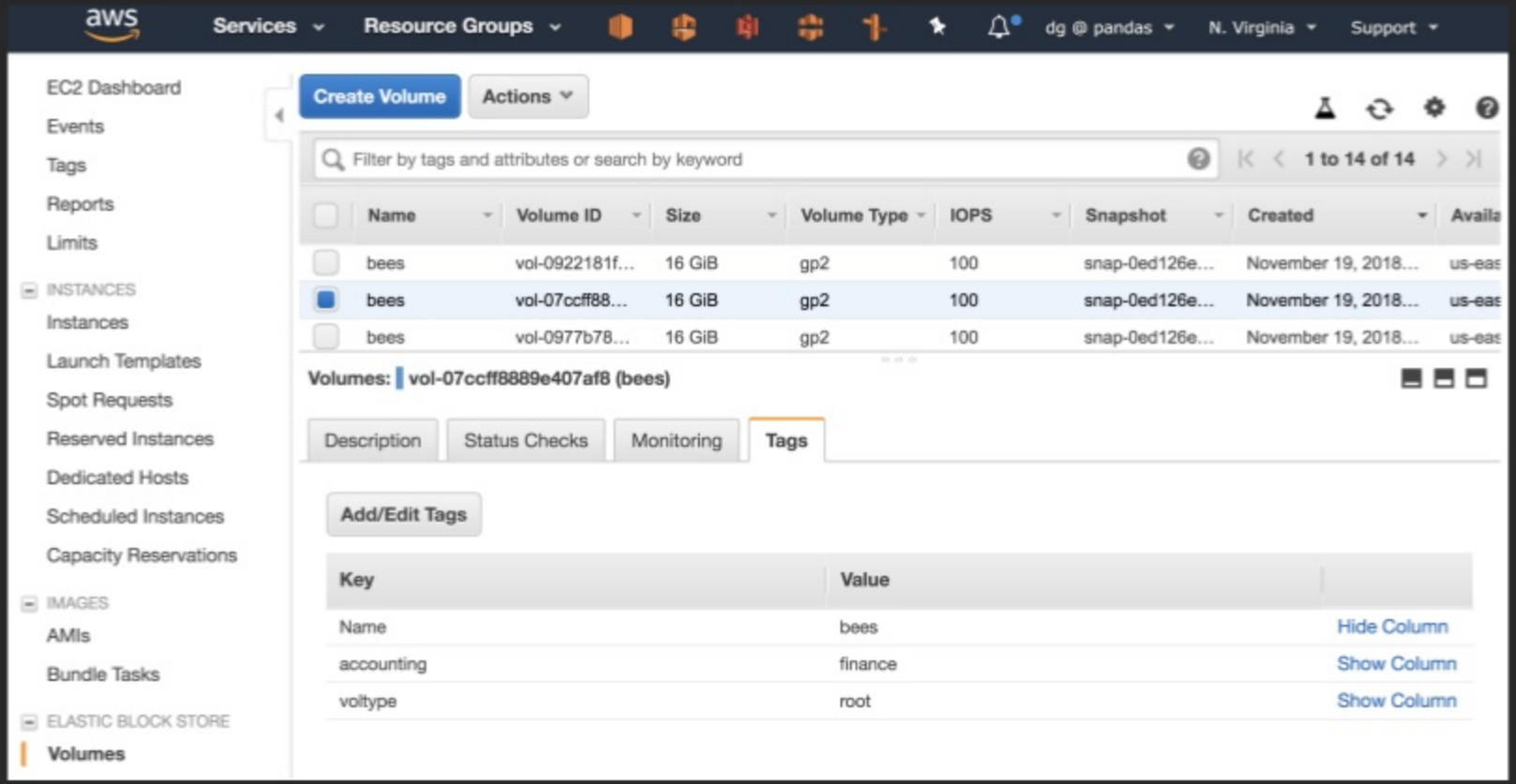
"All Finance or Accounting data volumes are backed up every 12 hours and retained for 10 days."

Data lifecycle policy

```
Tags:          voltype:root
Create:        every 24 hours
Start Time:    0700 UTC
Retention:     most recent 7
```

```
Tags:          dept:finance, dept:accounting
Create:        every 12 hours
Start Time:    0900 UTC
Retention:     most recent 20
```

Amazon Data Lifecycle Manager (DLM)



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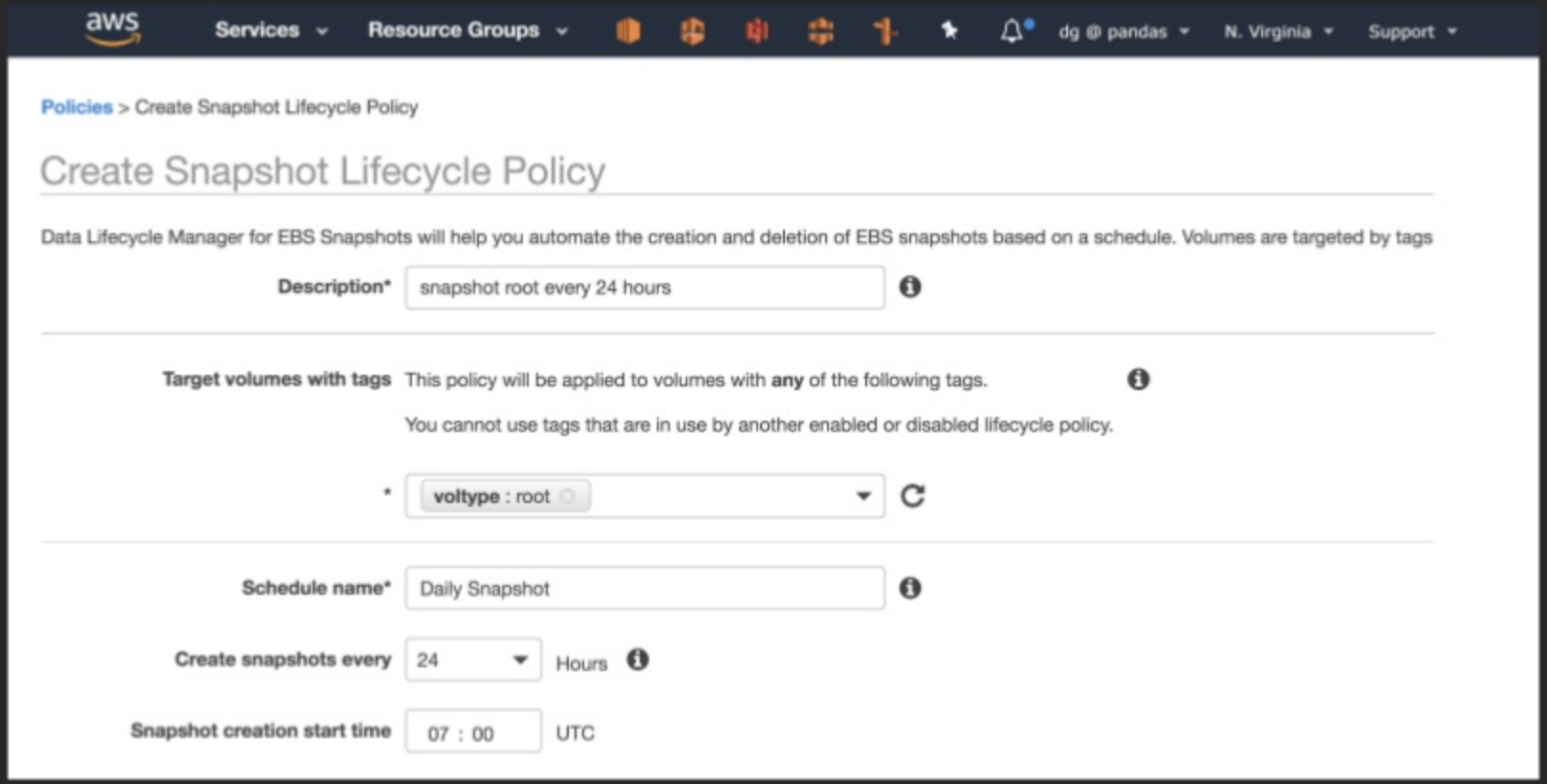

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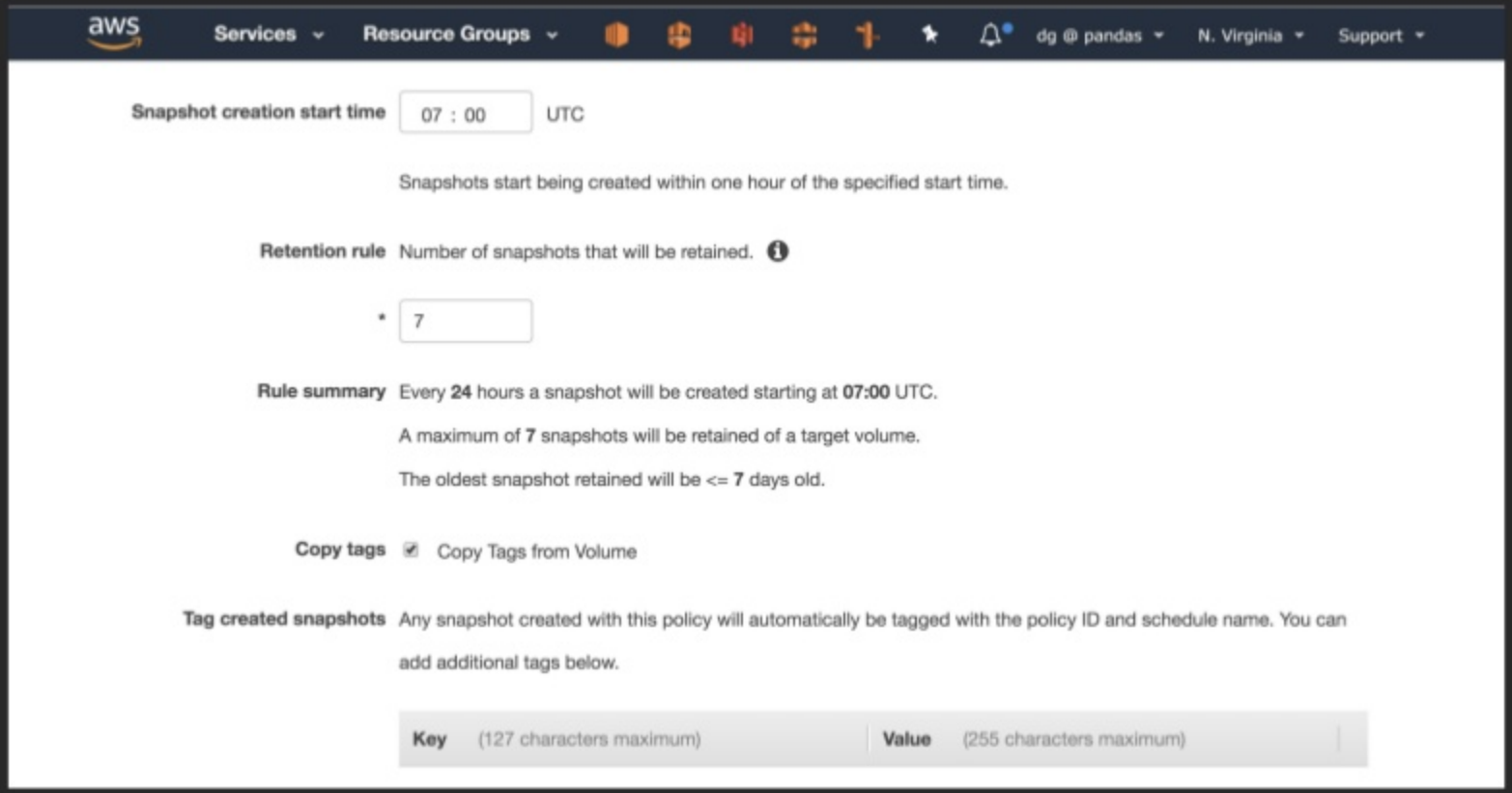

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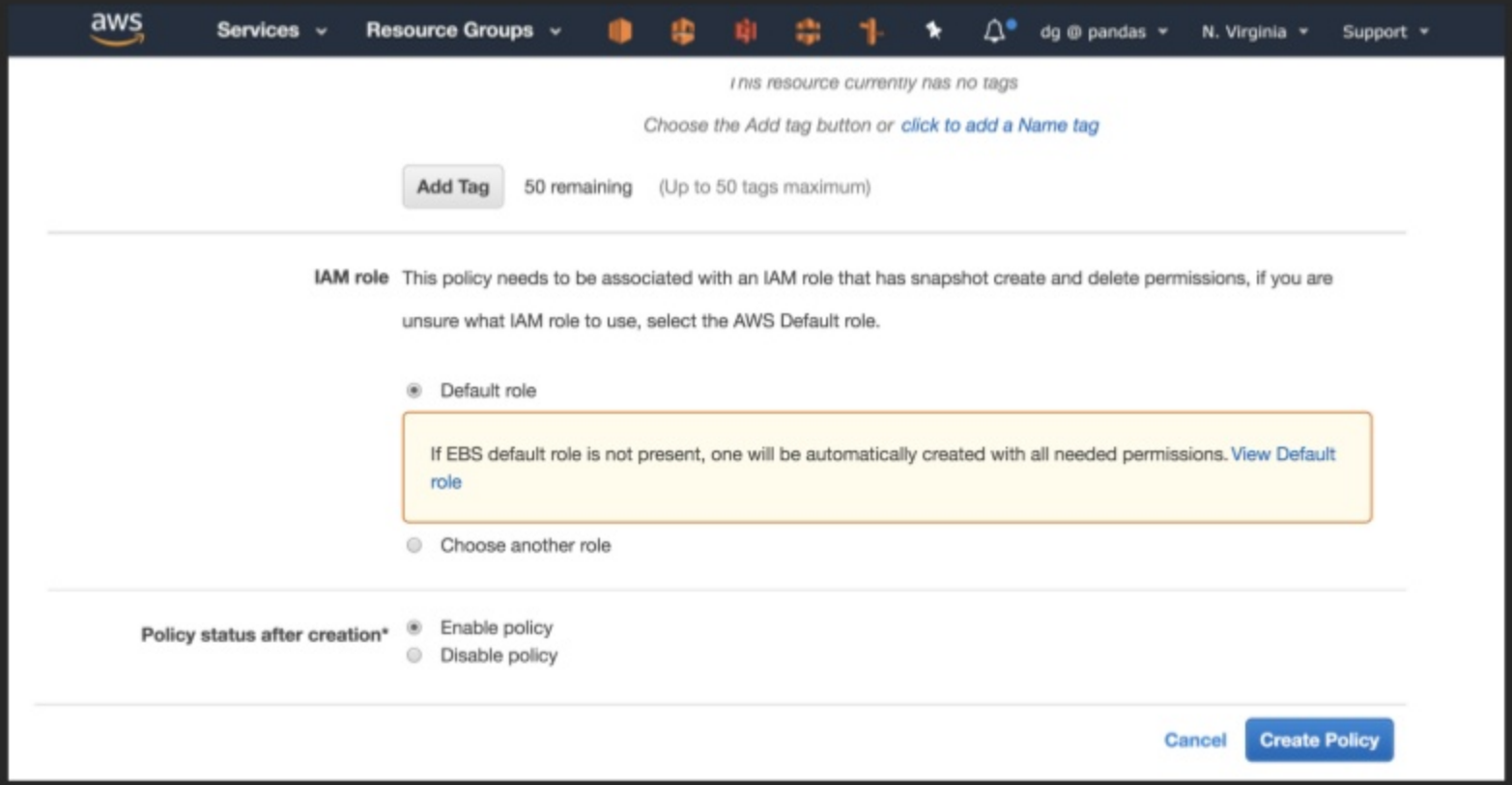

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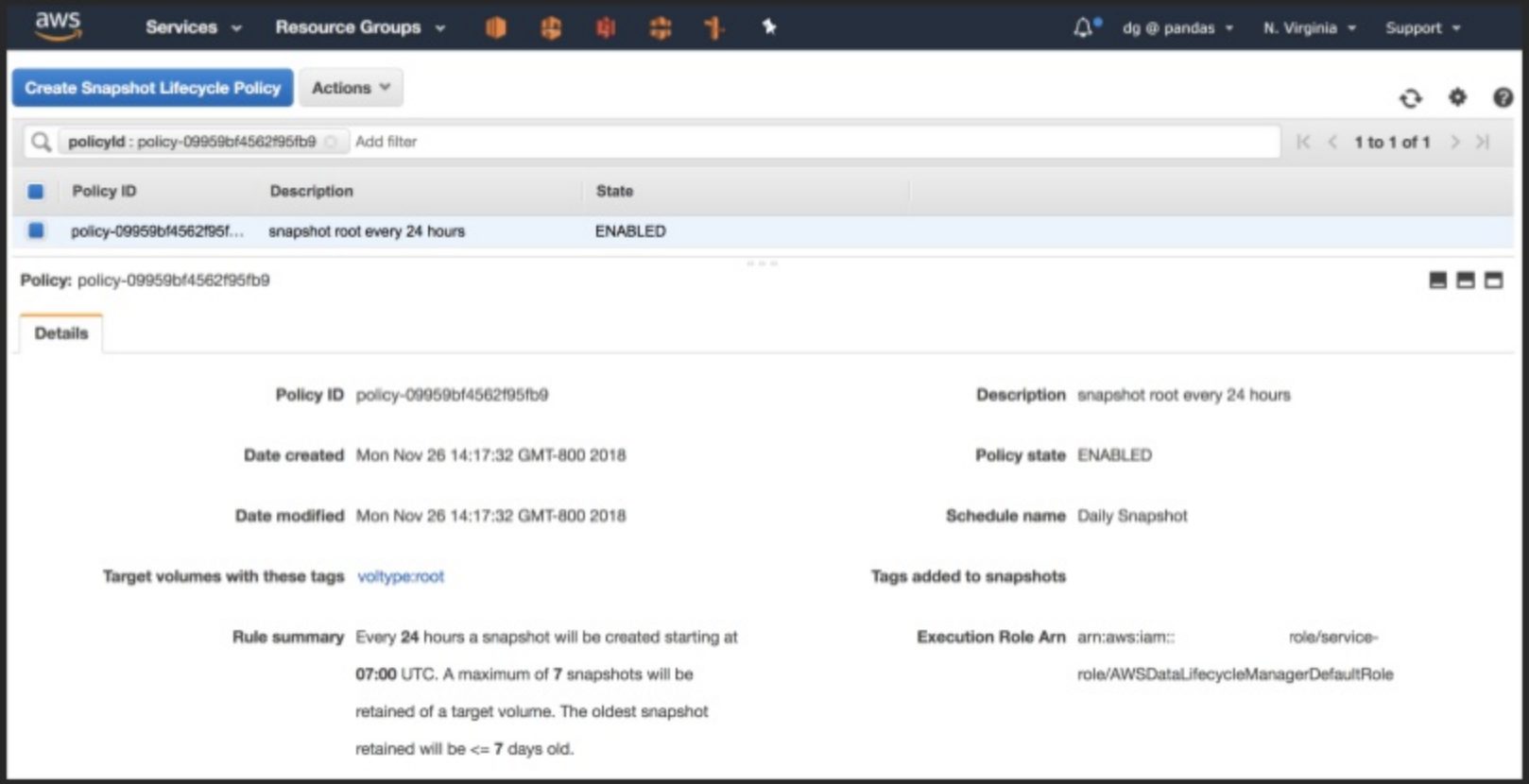
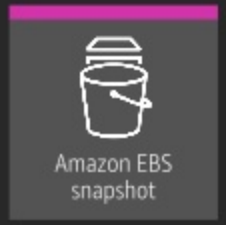


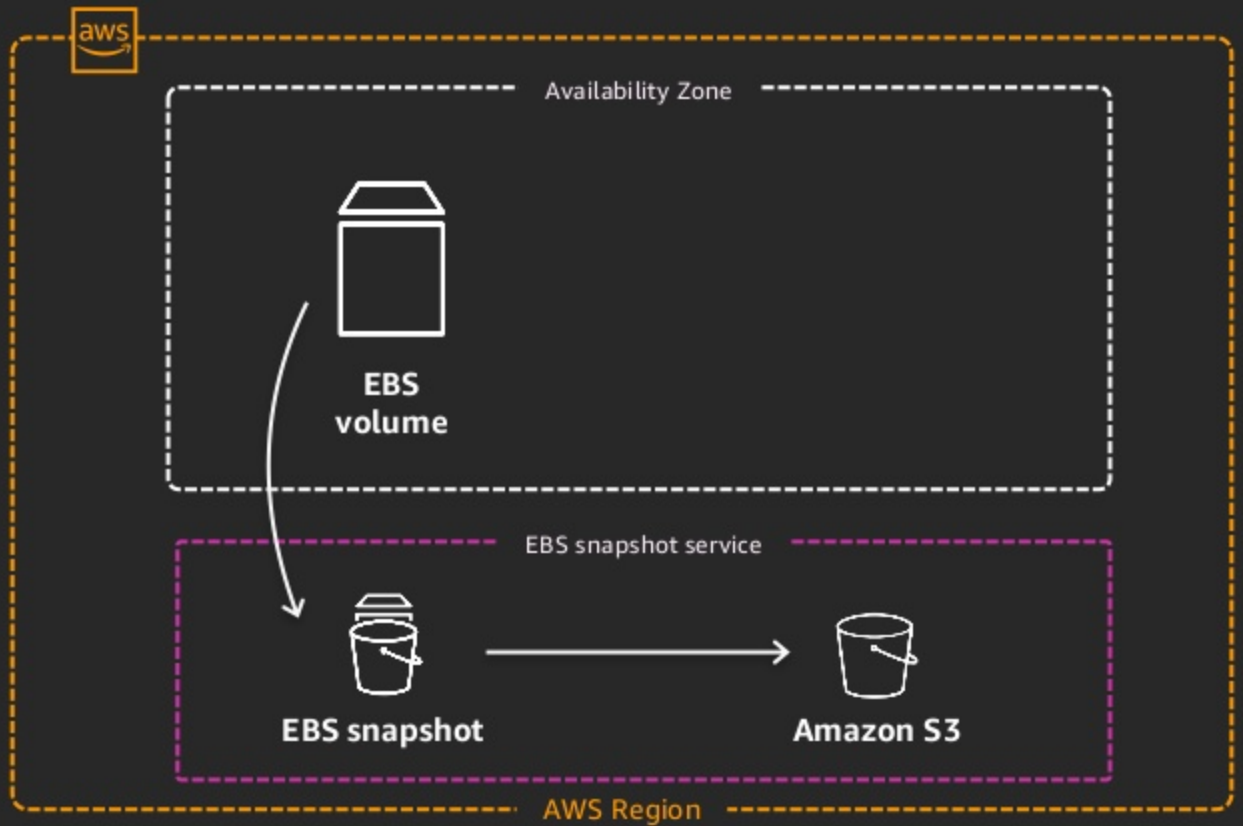
Every EBS snapshot functions as a full point-in-time backup.

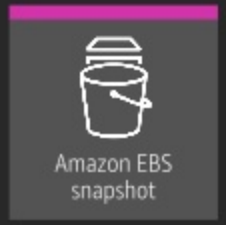
**To minimize costs, EBS snapshots are incremental –
You are billed only for unique blocks.**

How EBS snapshots work



How does an EBS snapshot work?





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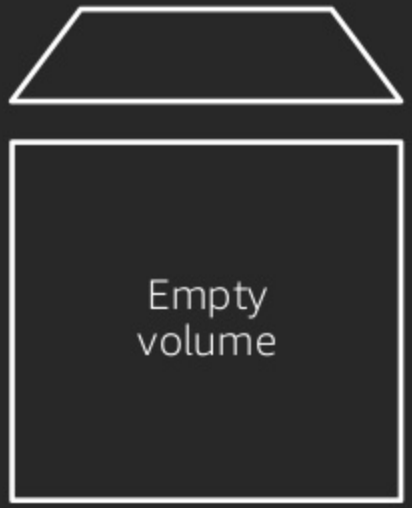
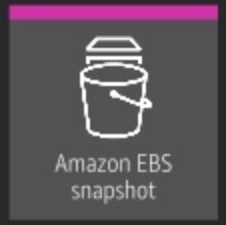


EBS volume

Snapshot of empty volume
(no data)



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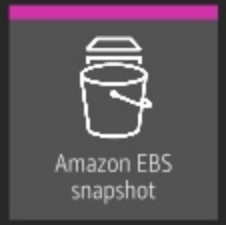

How does an EBS snapshot work?

Amazon EBS snapshot

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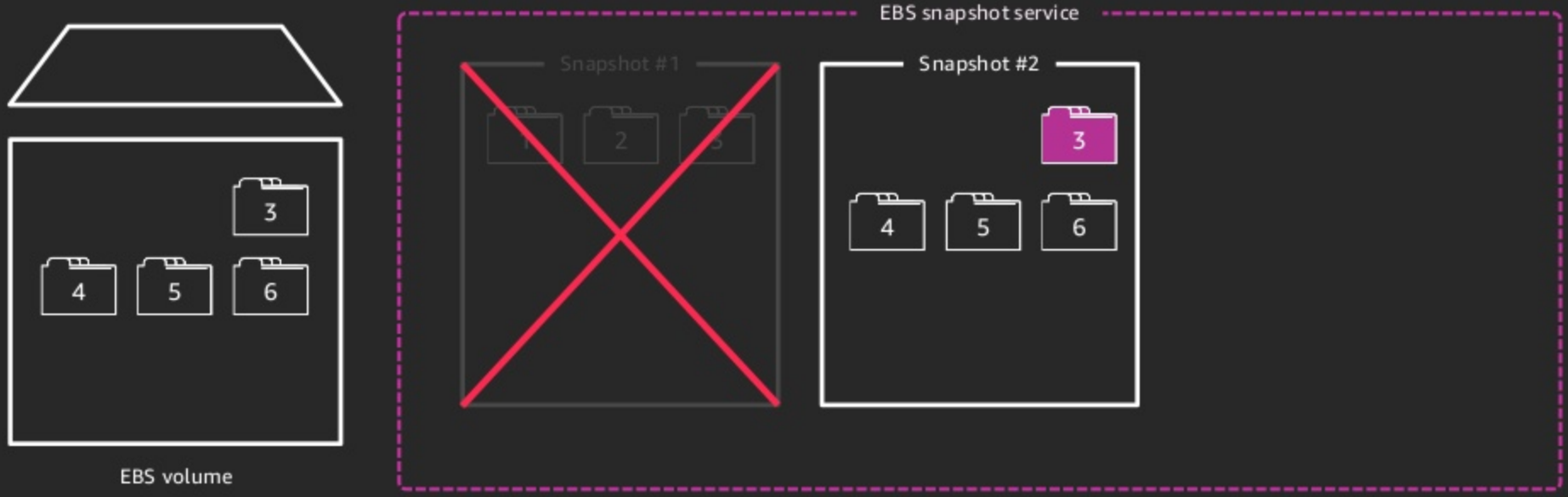
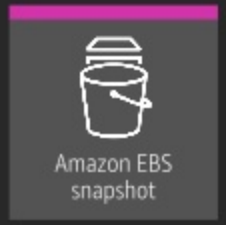




How does an EBS snapshot work?

EBS snapshot encryption

EBS snapshot encryption

When enabled, following types of data are encrypted:

- Data in flight between the volume and the instance
- Data at rest inside the volume
- Snapshots created from the volume

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

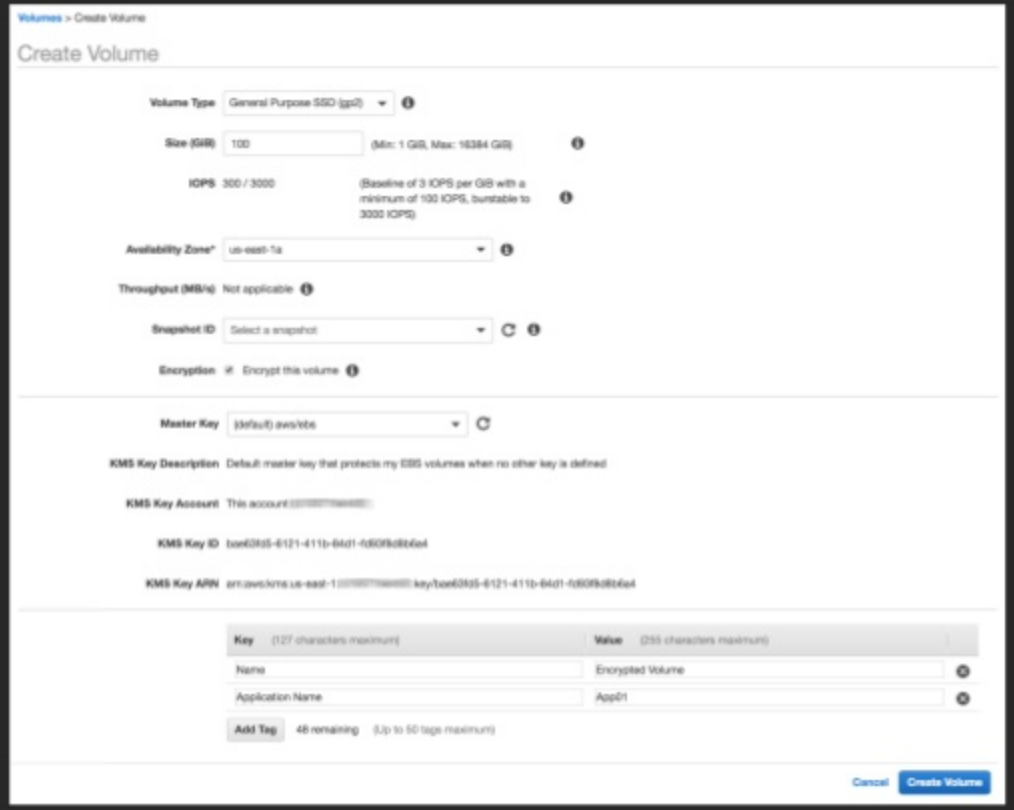
EBS snapshot encryption

- Snapshots of encrypted volumes are automatically encrypted
- Volumes that are created from encrypted snapshots are automatically encrypted
- When you copy an unencrypted snapshot that you own, you can encrypt it during the copy process
- When you copy an encrypted snapshot that you own, you can re-encrypt it with a different key during the copy process

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

Best practices – EBS snapshot encryption

EBS encryption:
data volumes



Best practices – EBS snapshot encryption

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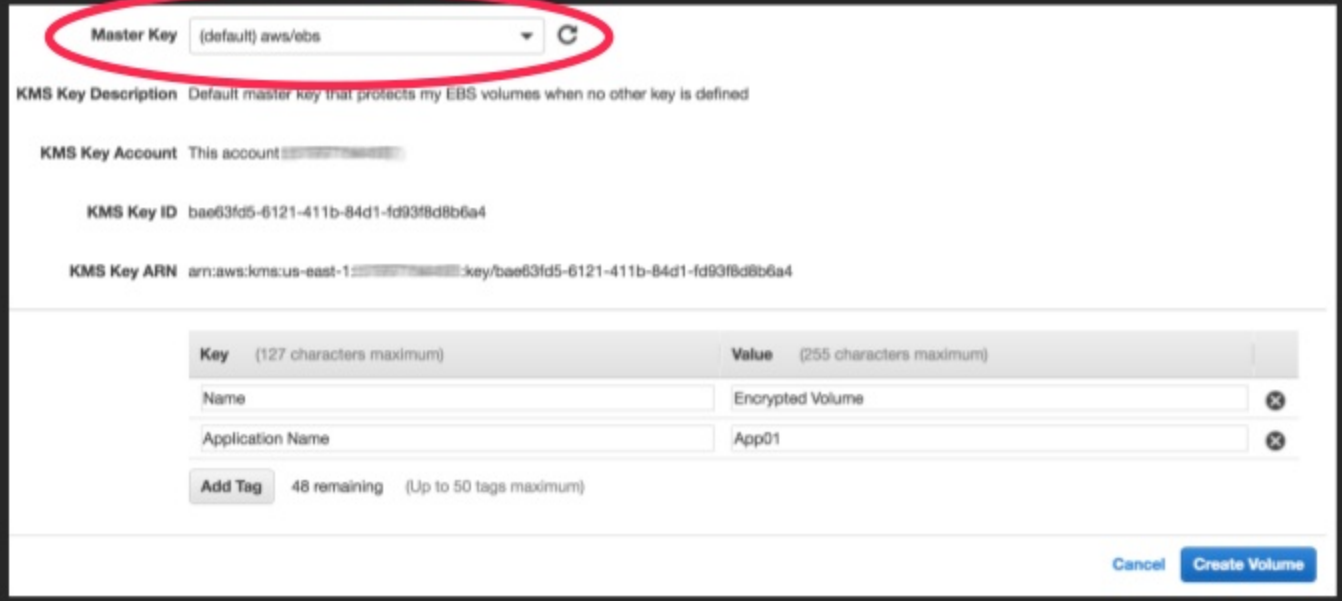
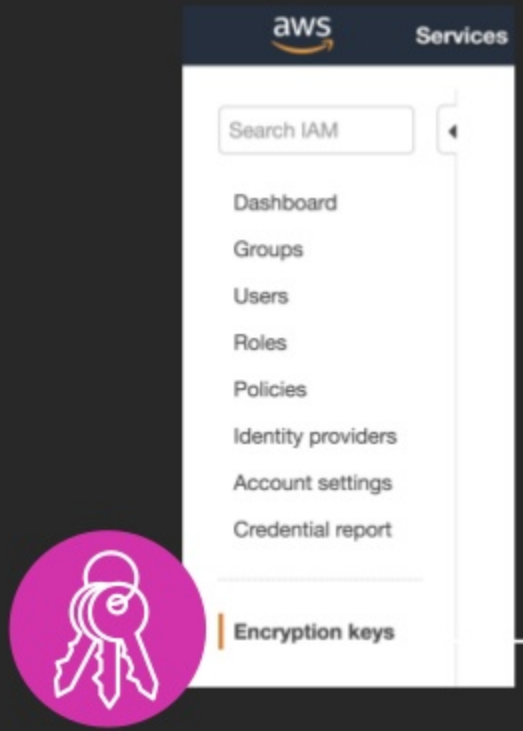


Best practices – EBS snapshot encryption

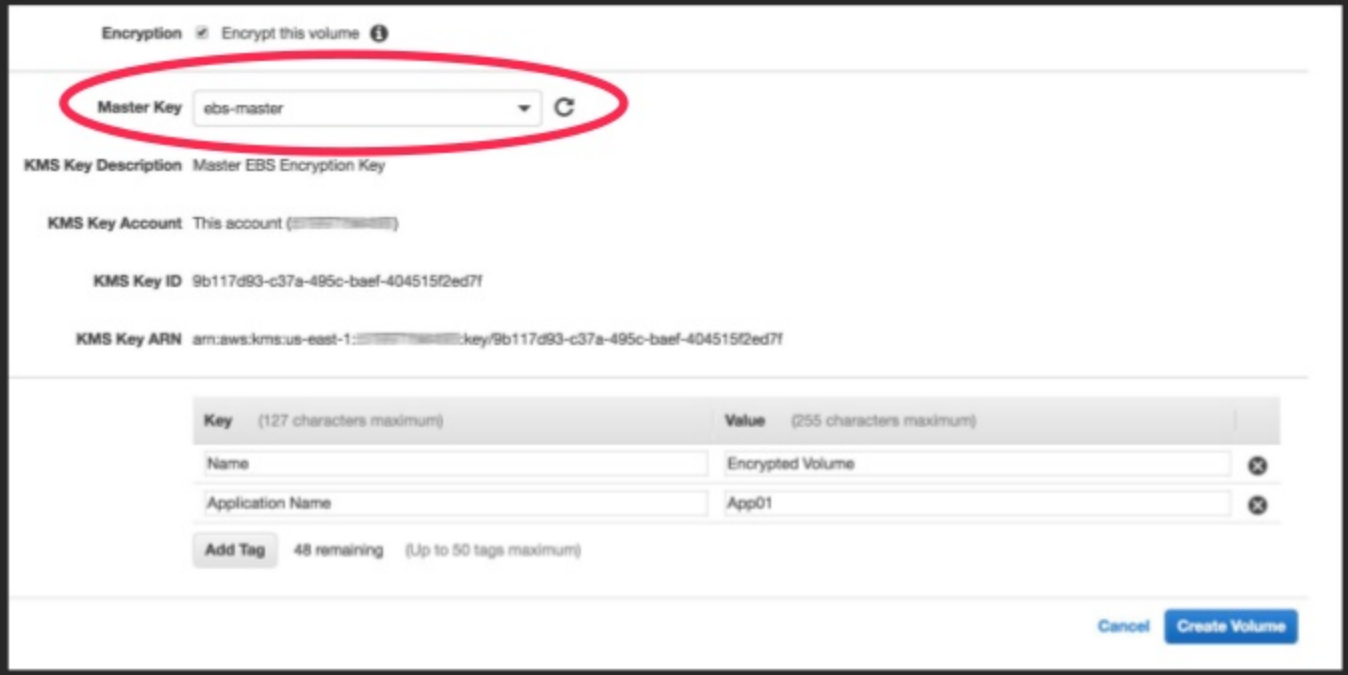


Create a new AWS KMS master key for EBS

- Define key rotation policy
- Enable AWS CloudTrail auditing
- Control who can use key
- Control who can administer key

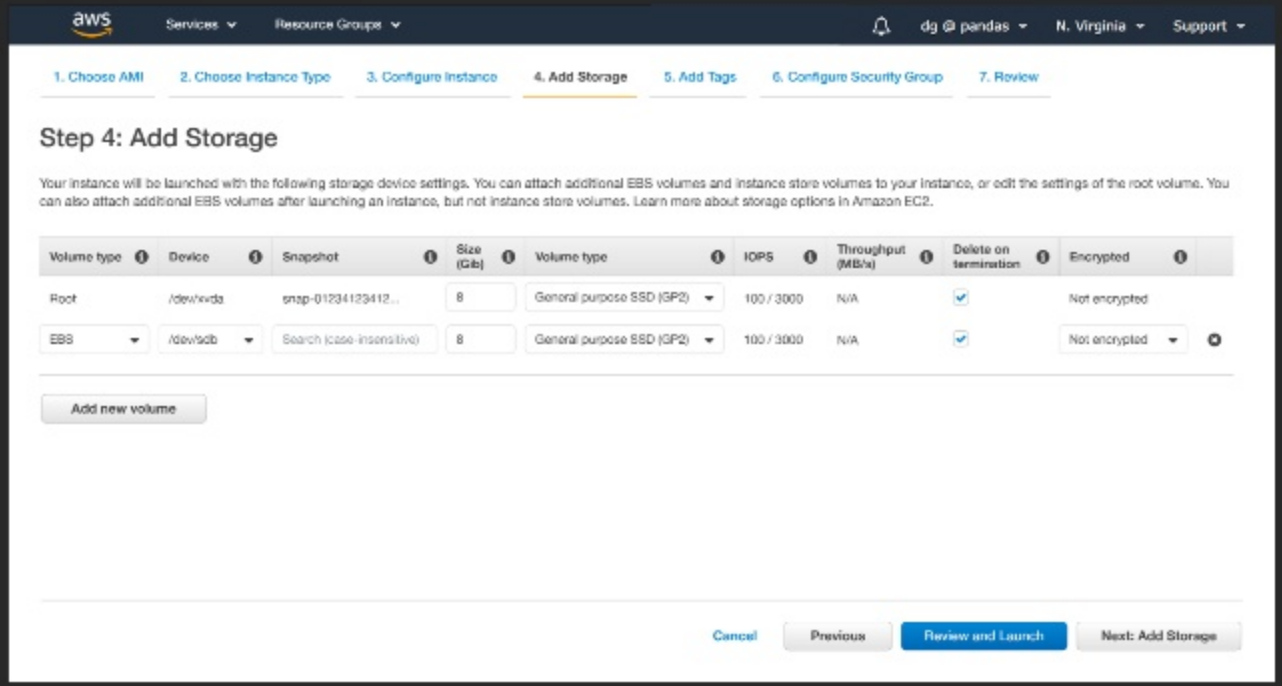
Best practices – EBS snapshot encryption

EBS encryption:
data volumes



RunInstances with custom CMKs

EBS encryption:
data volumes



RunInstances with custom CMKs

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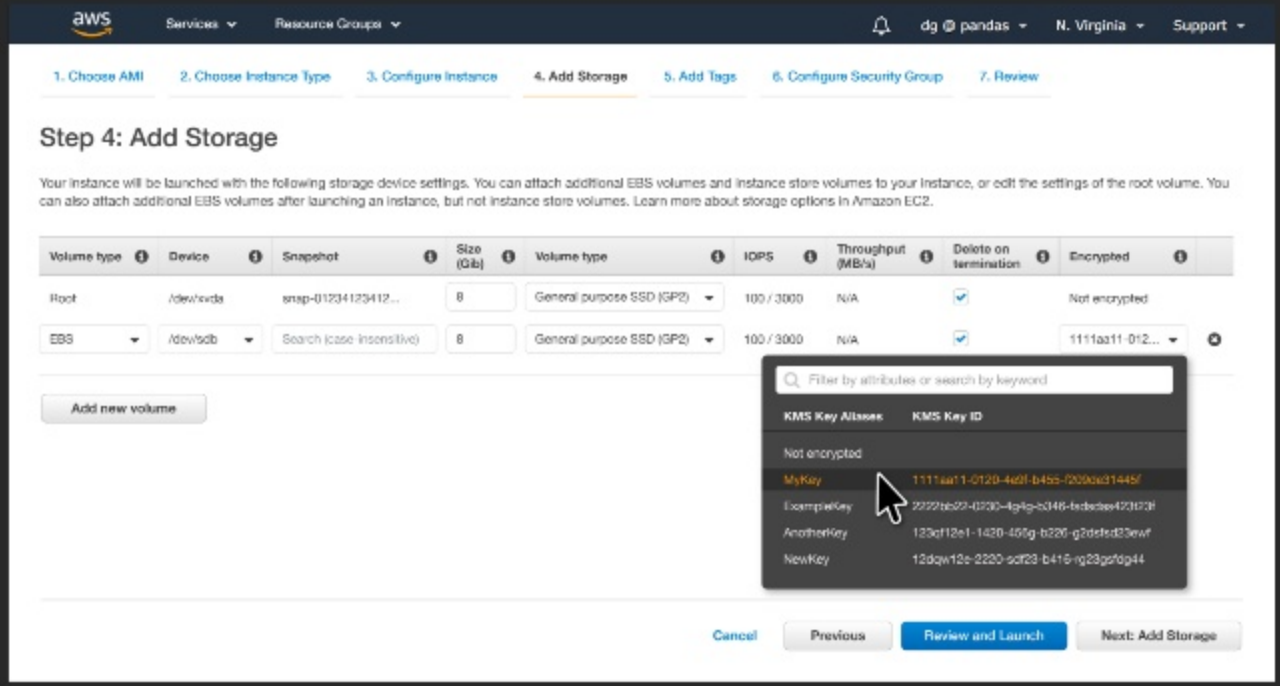
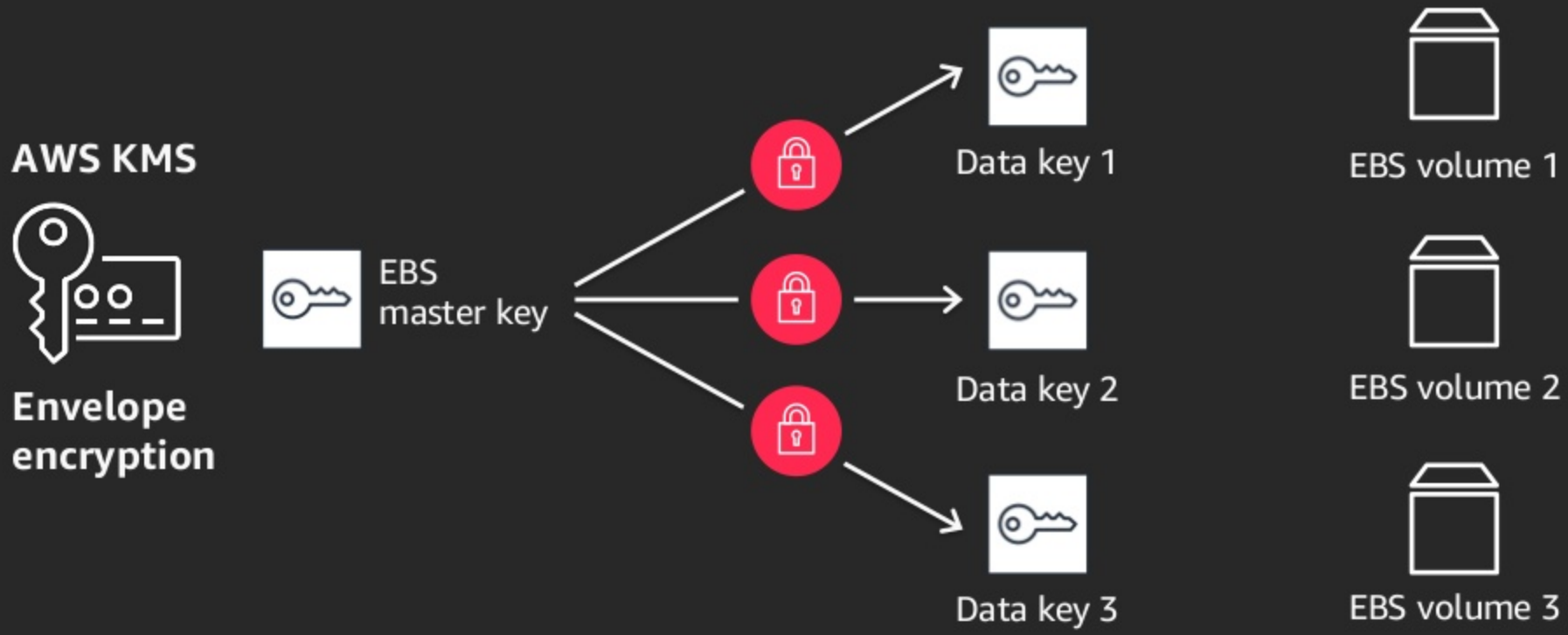
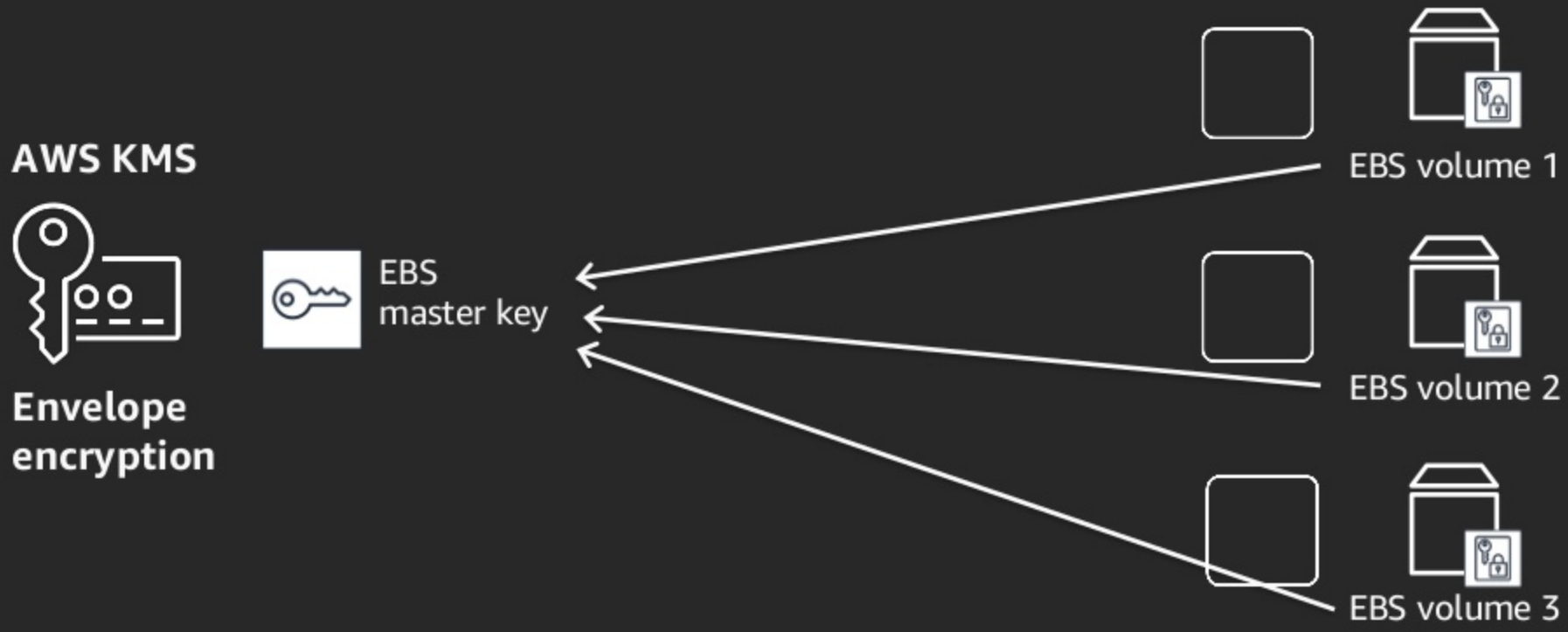
data volumes



EBS snapshot encryption



EBS snapshot encryption



EBS snapshot encryption

AWS KMS

EBS
master key

Envelope encryption

- Limits exposure risk
- Performance
- Simplifies key management

EBS volume 1

EBS volume 2

EBS volume 3

Preview: EBS encryption enhancements

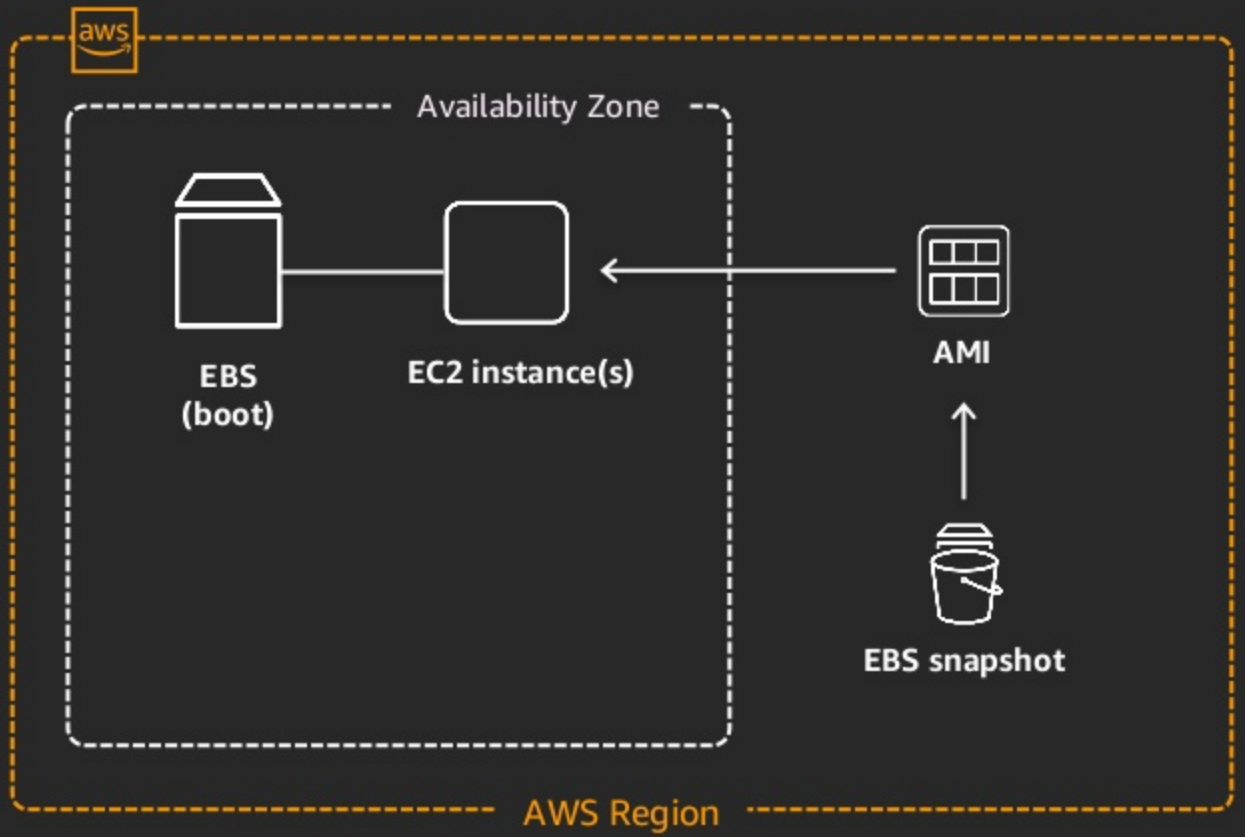
Preview: EBS encryption enhancements

- Launch encrypted EBS backed Amazon EC2 Instances from unencrypted AMIs
- Share custom CMK encrypted AMIs between accounts
- Launch encrypted EBS backed Amazon EC2 Instances from shared AMIs

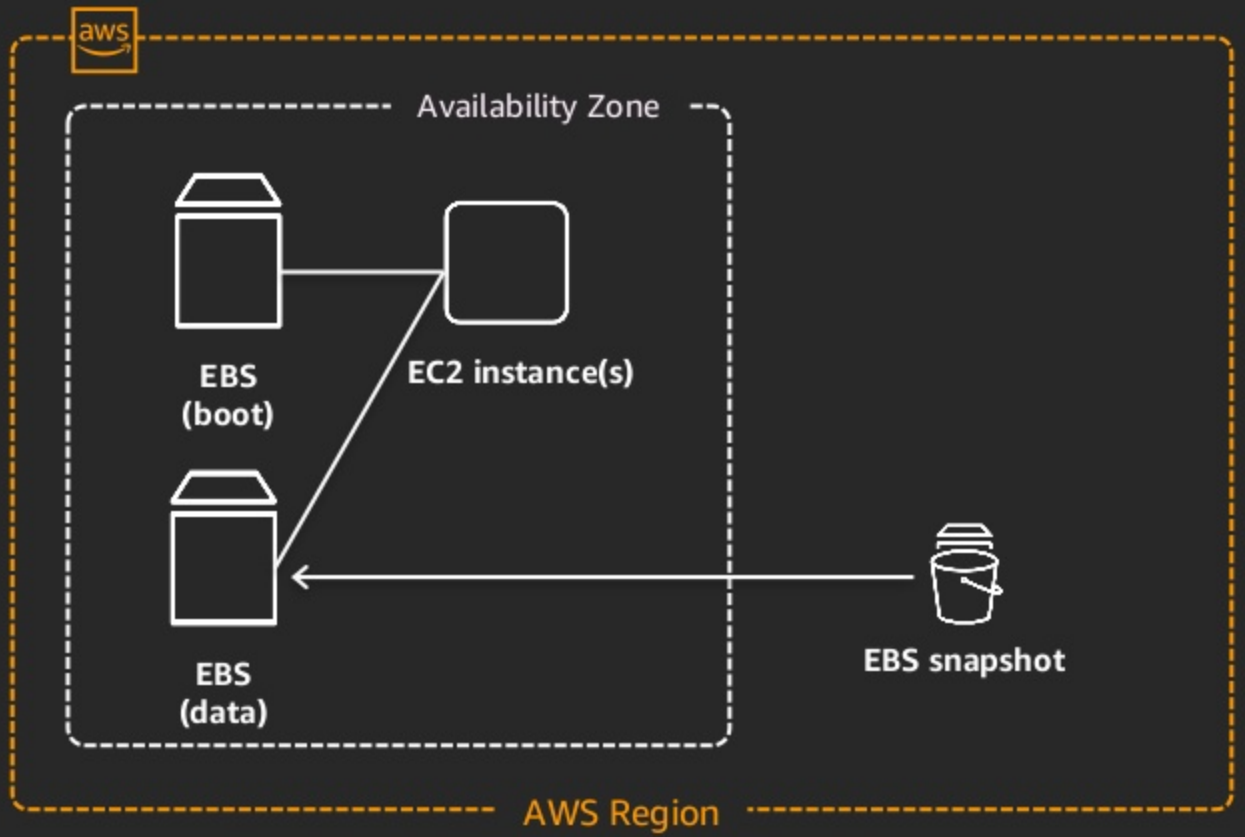
Contact us at: ebs-encryption-preview@amazon.com

What can you do with EBS snapshots?

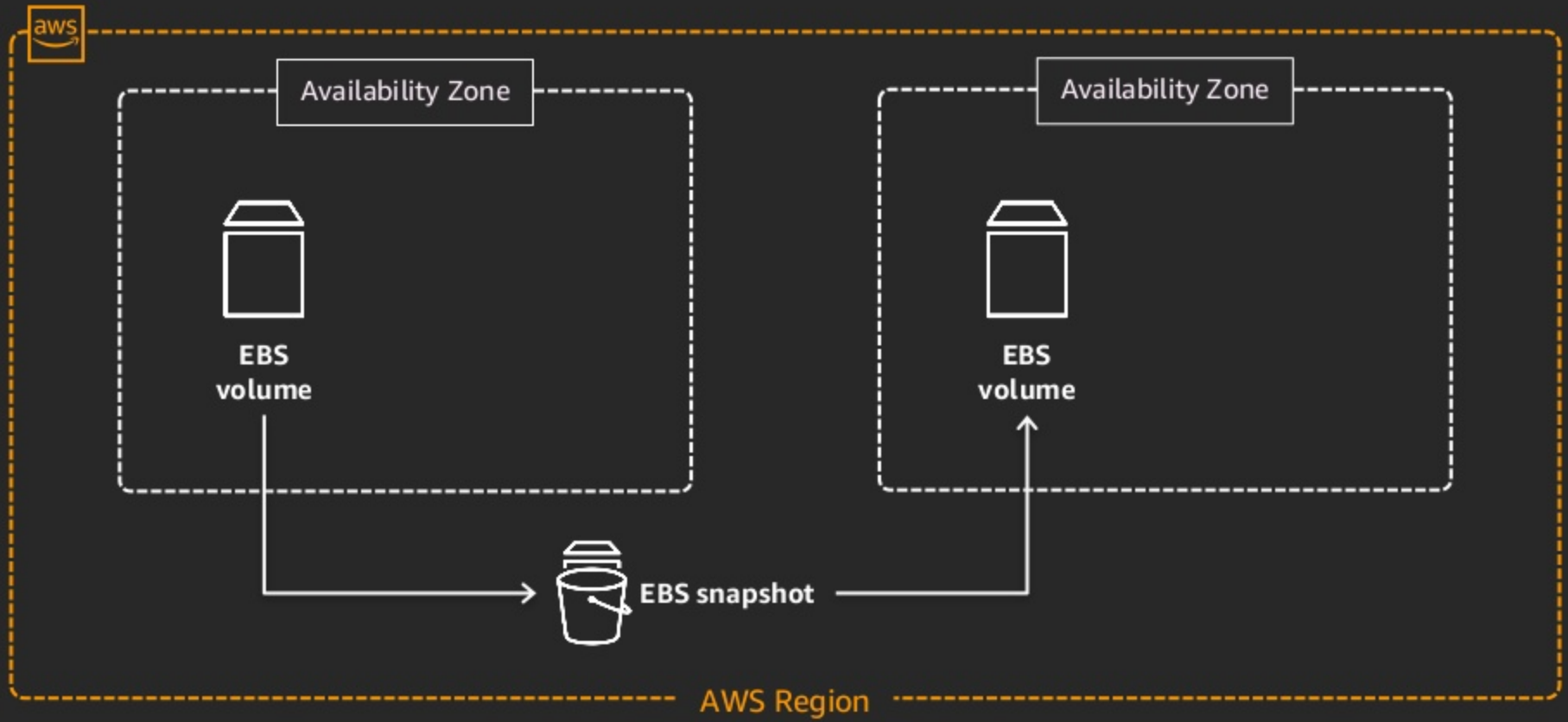
What can you do with a snapshot?



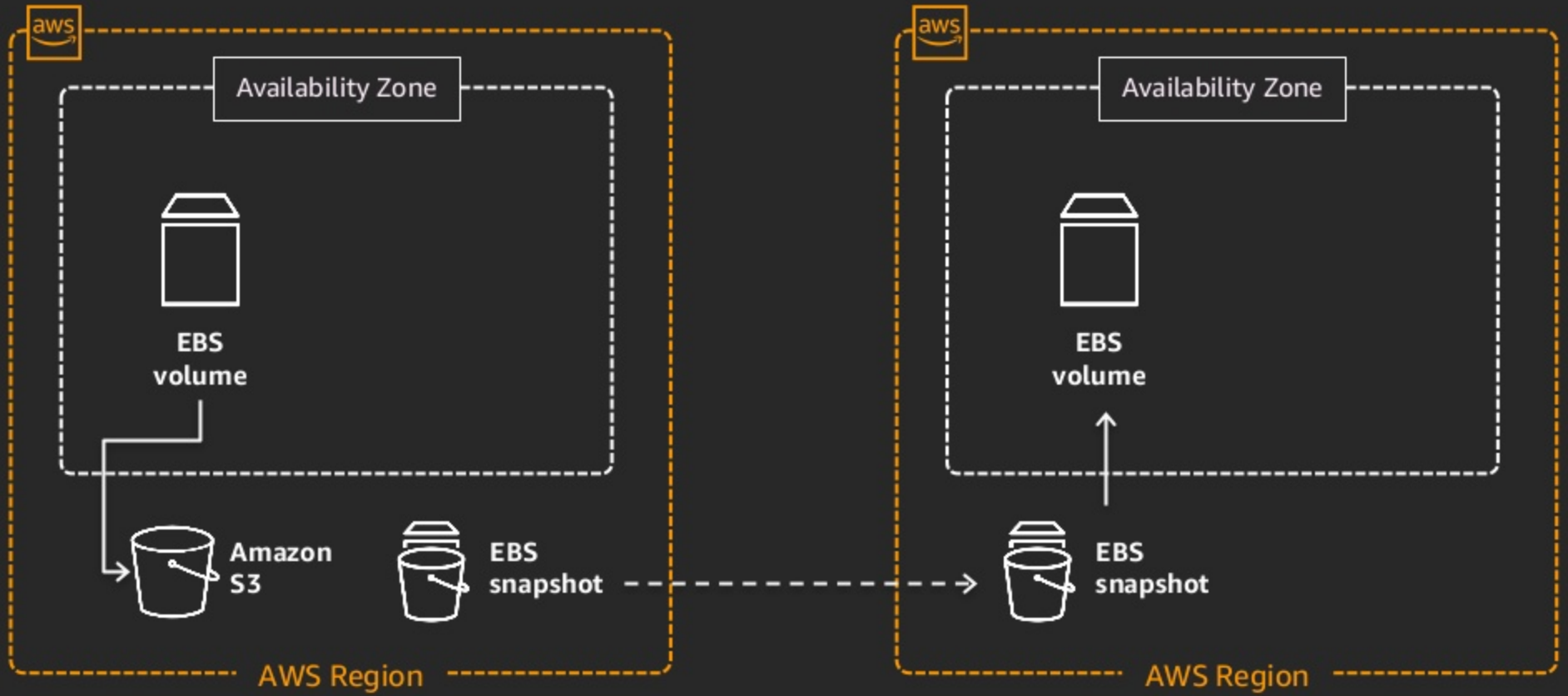
What can you do with a snapshot?



What can you do with a snapshot?



What can you do with a snapshot?



EBS snapshot copying

EBS Snapshot copying

- Amazon S3 encryption protects the enapshot in-transit during the copy operation
- The first copy to another region is always a full copy
- Snapshots are incremental after the first copy*

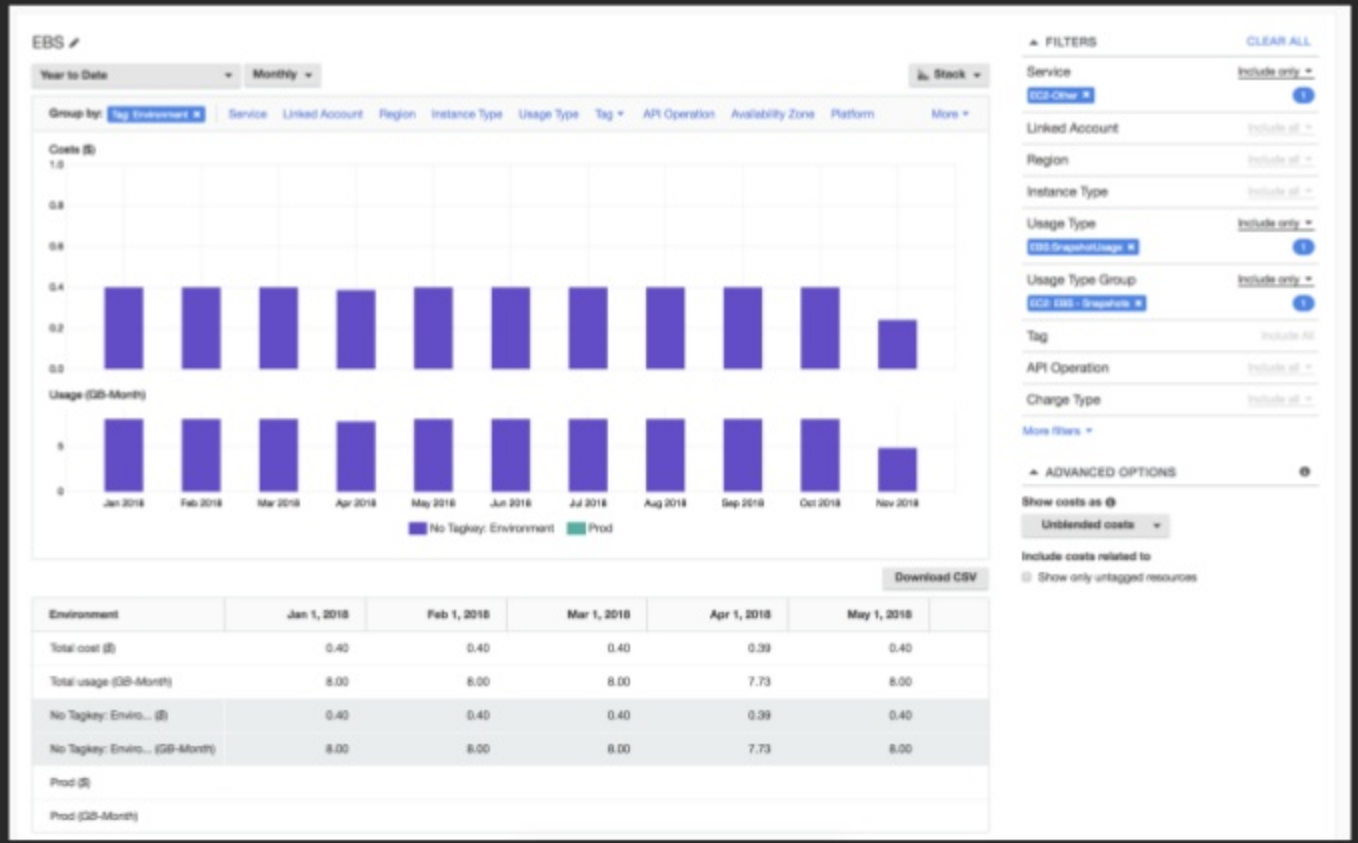
*The same CMK must be used on both ends to support subsequent incremental copies

EBS snapshot cost monitoring

EBS Snapshot cost monitoring

- Custom tags support key/value pairs
- Use tags for identification and management
- Activate tags for cost allocation tags to provide greater visibility into snapshot storage costs

EBS Snapshot cost monitoring



Environment	Jan 1, 2018	Feb 1, 2018	Mar 1, 2018	Apr 1, 2018	May 1, 2018
Total cost ($)	0.40	0.40	0.40	0.39	0.40
Total usage (GB-Month)	8.00	8.00	8.00	7.73	8.00
No Tag:key: Enviro... ($)	0.40	0.40	0.40	0.39	0.40
No Tag:key: Enviro... (GB-Month)	8.00	8.00	8.00	7.73	8.00
Prod ($)					
Prod (GB-Month)					

In closing…

In closing…

Tag, tag, tag!

Tag your environments to be easily identified and associated with the cost explorer

Automate!

Leverage Amazon Data Lifecycle Management (DLM) to automatically create and (optionally) delete snapshots

Encrypt

Encryption of Amazon EBS volumes is literally a checkbox. Use it!

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Encryption of Amazon EBS volumes is literally a checkbox. Use it!

Thank you!

David Green
Enterprise Solutions Architect
Amazon Web Services
@davidmgre

Please complete the session survey in the mobile app.