STG218

Amazon EBS cost optimization

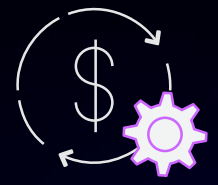
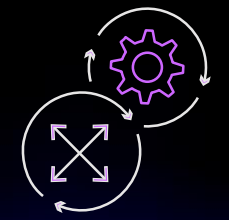
Ryan Sayre (he/him)
WW Sr. Storage Specialist for EBS
Amazon Web Services

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Amazon EBS cost optimization goals

- Lower costs by aligning workloads to appropriately matched services
- Acquire new and improved cost control and management habits
- Identify and retire under-utilized resources
- Adopt and leverage new service capabilities to improve application performance and resiliency

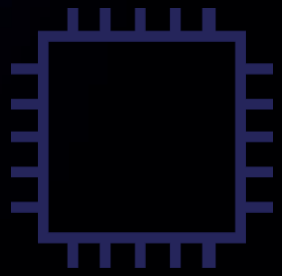


aws

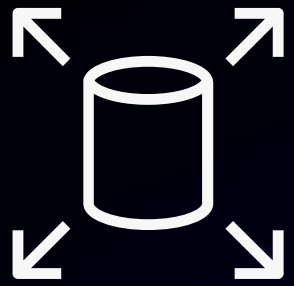
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Block storage portfolio



Instance storage

Temporary block-level storage attached to host hardware that is ideal for storage of information that frequently changes or is replicated across multiple instances



Amazon EBS

Easy to use, high performance block storage service designed for use with Amazon Elastic Compute Cloud (EC2) for both throughput and transaction intensive workloads

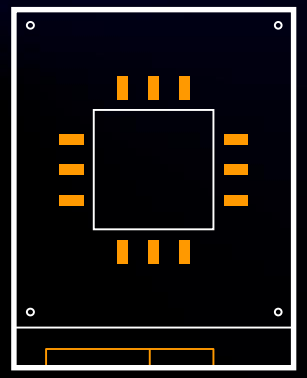


Amazon EBS snapshots

Incremental, point-in-time copies of your Amazon EBS data that can be used to restore new volumes, expand the size of a volume, or move volumes across Availability Zones

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Block volume types for applications

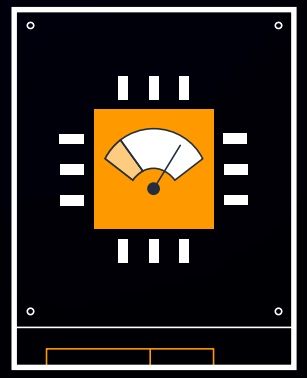


General-purpose SSD

NoSQL databases

Transactional workloads, low-latency applications

Apache Cassandra, MongoDB, Apache CouchDB

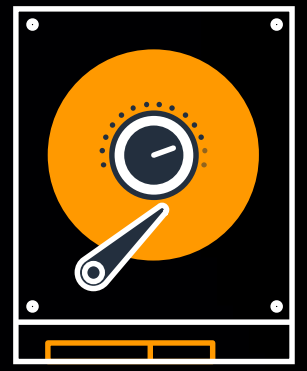


Provisioned IOPS SSD

Relational databases

I/O-intensive database applications

MySQL, Microsoft SQL Server, PostgreSQL, SAP, Oracle

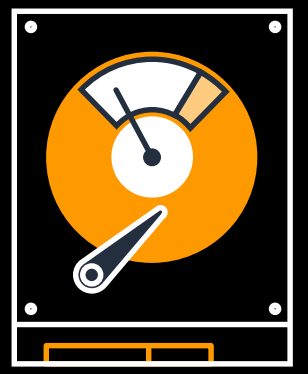


Throughput-optimized HDD

Big data, analytics

Large datasets and large I/O sizes

Apache Kafka, Splunk, Apache Hadoop, data warehousing



Cold HDD

File, reference data

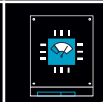
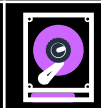
Less frequently accessed workloads with large, cold datasets

Reference data, near-archive, low I/O

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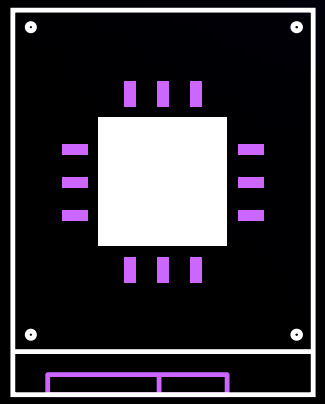
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Amazon EBS: Volume types

	 gp3 General purpose SSD	 io2 Provisioned IOPS SSD	 io2 Block Express (in preview)	 st1 Throughput optimized HDD	 sc1 Cold HDD
Use-cases	Relational and non-relational databases, enterprise applications, containerized workloads, big data, file system, media workflows	Large database workloads, mission-critical business applications requiring sustained high performance	Critical applications and databases requiring sustained IOPS	Big data workloads, data warehouses, log processing, streaming workloads	Large volumes of infrequently accessed data, cost-sensitive workloads
Volume size	1 GiB – 16 TiB	4 GiB–16 TiB	4 GiB–64 TiB	125 GiB–16 TiB	125 GiB–16 TiB
Max IOPS per volume	16,000	64,000	256,000	500	250
Max throughput per volume	1,000 MiB/s	1,000 MiB/s	4000 MiB/s	500 MiB/s	250 MiB/s
Pricing	**$0.08/GB-month** of provisioned storage **3,000 IOPS free** and $0.005/provisioned IOPS-month over 3,000 **125 MB/s free** and $0.04/provisioned MB/s-month over 125	**$0.125 per GB-month** of provisioned storage **$0.065 per provisioned IOPS-month** up to 32,000 **$0.046 per provisioned IOPS-month** from 32,001 to 64,000	**$0.125 per GB-month** of provisioned storage **$0.065 per provisioned IOPS-month** up to 32,000 **$0.046 per provisioned IOPS-month** from 32,001 to 64,000 **$0.032/provisioned IOPS-month** for greater than 64,000	**$0.045 per GB-month** of provisioned storage	**$0.015 per GB-month** of provisioned storage

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General purpose SSD volume recommended for most workloads: gp3



gp3

General purpose SSD

Ideal for relational and non-relational databases, enterprise applications, containerized workloads, big data, file system, media workflows

3,000 baseline IOPS (versus 3 IOPS/GiB in gp2) and 1,000 MiB/s (versus 250 MiB/s in gp2); provision throughput and IOPS separately from capacity

$0.08/GB-month*, up to 20% lower storage price than previous gp2 volumes

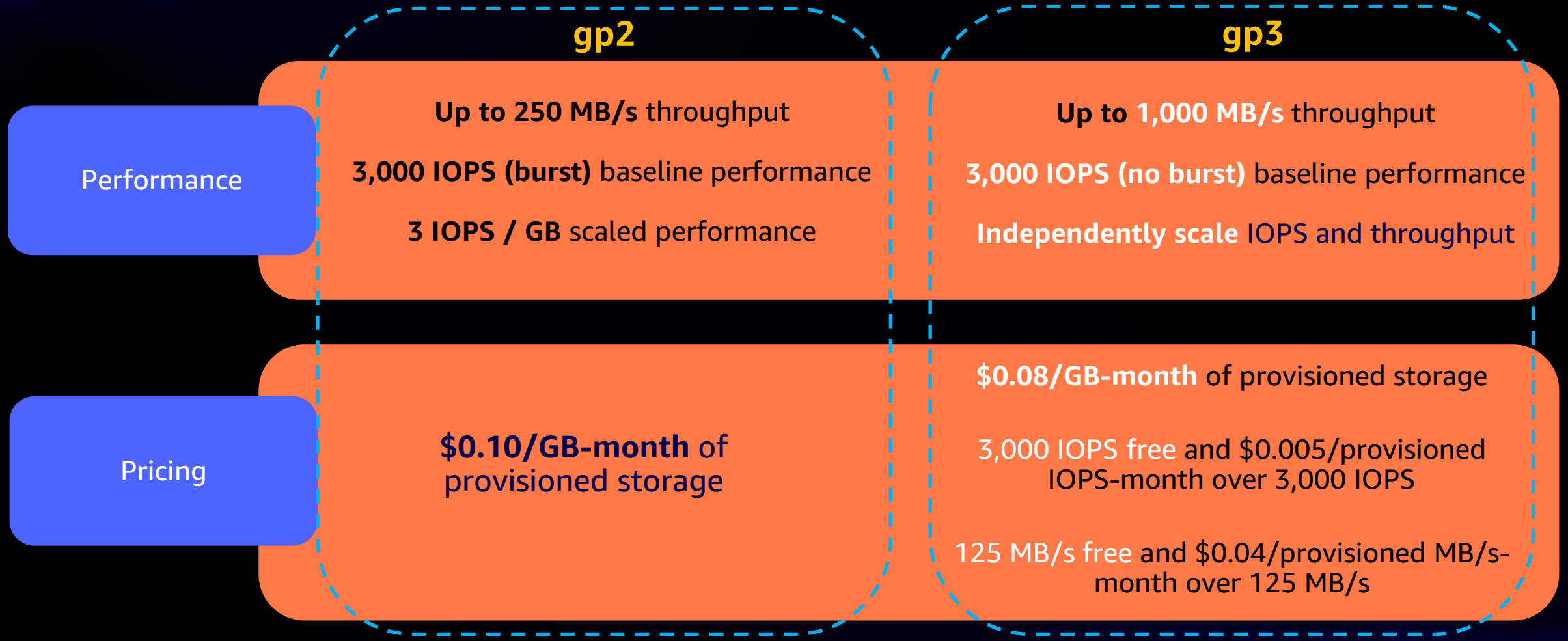
*Pricing is for US East (Ohio) Region

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gp3: Optimized volume

INDEPENDENTLY PROVISION IOPS AND THROUGHPUT AT UP TO 20% LOWER PRICE PER GB



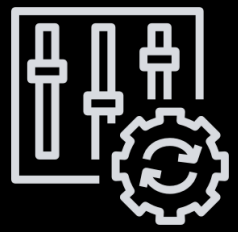
Use Amazon EBS volumes to migrate from gp2 to gp3 without application impact

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gp3: Higher performance at lower cost

- A 1 TB data volume is **20% cheaper** and delivers the same exact performance



- **The same volume can scale to 16,000 IOPS for an additional $65 versus $513 for gp2**

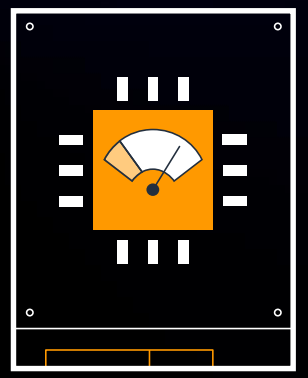
- A standard 32 GB boot volume is **20% cheaper** and delivers **30x more IOPS**



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New io2 Block Express



io2 Block Express

Provisioned IOPS SSD

Next-generation architecture powering SAN in the cloud

4x throughput and **4x** IOPS

Up to 4,000 MiB/s

Up to 256,000 IOPS

1,000:1 IOPS to GB

4x volume size up to 64 TB per volume

Sub-millisecond latency

Ideal for critical applications and databases requiring sustained IOPS

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io2: Cost optimized for higher performance

HIGH PERFORMANCE WORKLOADS WITH INCREASED DURABILITY AT LOWER PRICE POINTS

	io1	io2	io2 Block Express
Performance	**Up to 1000 MB/s** throughput **50 IOPS/GB** scaled performance **64000 Max IOPS** per volume **99.8% - 99.9%** durability	**Up to 1000 MB/s** Throughput **500 IOPS/GB** scaled performance **64000 Max IOPS** per volume **99.999%** durability	**Up to 4000 MB/s** Throughput **1000 IOPS/GB** scaled performance **256000 Max IOPS** per volume **99.999%** durability
Pricing	$0.125/GB-month provisioned storage $0.065/provisioned IOPS-month	$0.125/GB-month provisioned storage $0.065/provisioned IOPS-month up to 32,000 IOPS $0.046/provisioned IOPS-month from 32,001 to 64,000 IOPS	$0.125/GB-month provisioned storage $0.065/provisioned IOPS-month up to 32,000 IOPS $0.046/provisioned IOPS-month from 32,001 to 256,000 IOPS

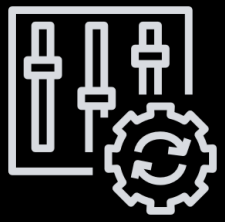
Use Amazon EBS volumes to migrate from io1 to io2 without application impact

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io2: Value for performance sensitive workloads

- 10x higher scaled performance and 100x higher durability compared to io1
- Scale to 64,000 IOPS for 10% lower cost than io1
- Scale to 256,000 IOPS with io2 Block Express for 37% lower cost than io1*
- Simplify management with lower number of volumes for high performance**



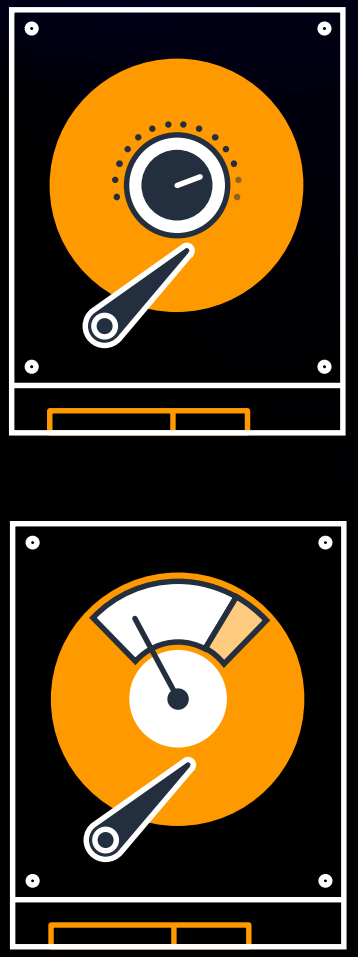


*4x io1 volumes each 16 TB compared to 1x io2 Block Express volume
**64 TB capacity/256 K IOPS: 1xVolume on io2BX vs. 4xVolumes on io1

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st1 & sc1: Value for data volumes at scale



Ideal for lower I/O applications and analytics workloads that require persistent local file systems

Minimum 125 GB (versus 1 GiB in gp3) and streaming throughput of up to 500 MiB/s for st1 and up to 250 MiB/s for sc1.

$0.045/GB-month* for st1 and $0.015/GB-month* for sc1 volumes

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HDD-based workloads (prominent examples)



st1

- Periodic scans of local data sets (content audits, deep search)
- Test & dev, online database backup & restore
- Media transcode & streaming I/O
- BYO logging analytics workloads
- Stream-optimized clustered file systems





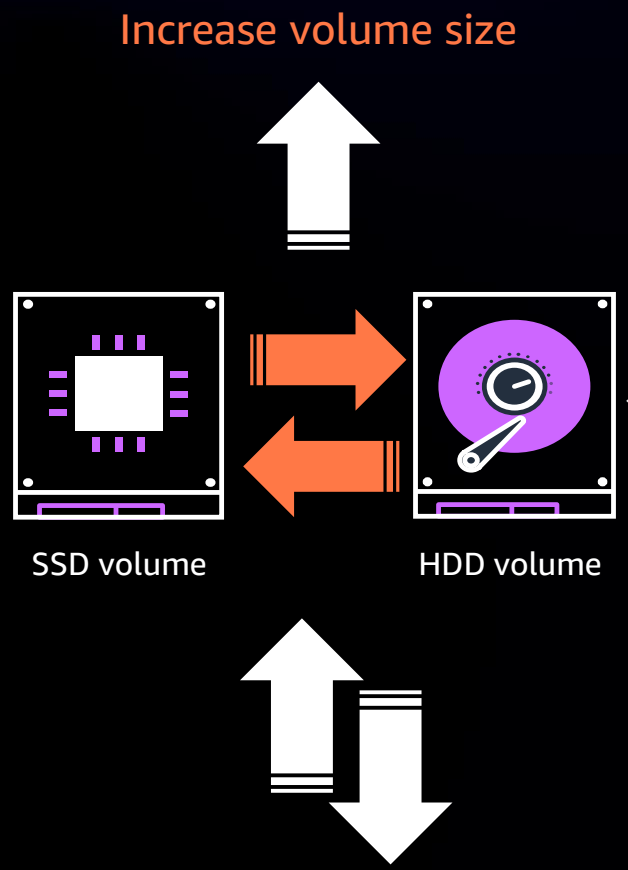
sc1

- Pre-archival data management
- Idle parking lot for cyclical data usage (online but not active)

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Elastic volumes

DYNAMICALLY CHANGE VOLUME FEATURES TO SUPPORT GROWTH AND CONTROL



100x more durability, 10x more scale performance and lower cost at higher IOPs compared to io1

Approx. 43% cheaper than gp3; HDD suited to sequential workloads

Provisioned IOPS SSD (io2)	Throughput optimized HDD (st1)
General purpose SSD (gp3)	Cold HDD (sc1)

Default for balanced workloads

About 81% cheaper than gp3

Provision EBS for minimum required size and expand as needed; maintenance is easy with zero downtime

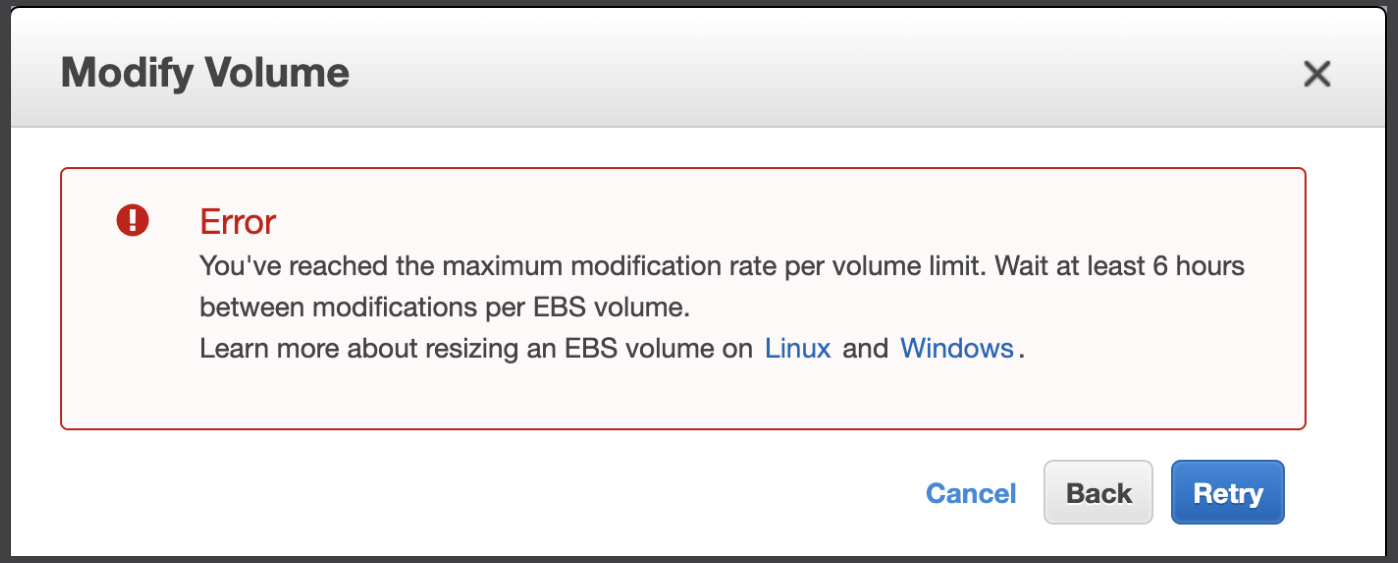
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Know your migration limits: Default modification & six-hour cooldown

```
% aws ec2 modify-volume --volume-id vol-0cbd5e9b2ad226356 --throughput 250

An error occurred (VolumeModificationRateExceeded) when calling the ModifyVolume
operation: You've reached the maximum modification rate per volume limit. Wait
at least 6 hours between modifications per EBS volume.
```



Please refer to modification and capacity quotas at https://console.aws.amazon.com/servicequotas/home/services/ebs/quotas

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Amazon Data Lifecycle Manager

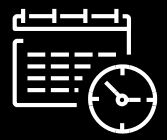
SIMPLE AUTOMATION ENSURING AMAZON EBS SNAPSHOTS ARE CREATED & DELETED ON A PERIODIC SCHEDULE



Policy and tag-based backup solution



Automated backup scheduling



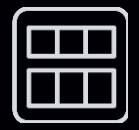
Automated backup retention management

Policy-based management



Snapshot

Policy-based snapshots with Amazon Data Lifecycle Manager (DLM)



AMI

Amazon Machine Images (AMIs) support in Amazon DLM
Policy-based AMI images management

Real-world example

One customer achieved up to 65% in cost reduction by Amazon EBS snapshots optimization

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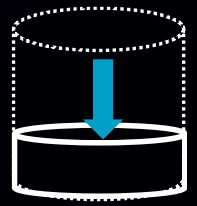
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Amazon EBS pricing efficiencies



Price reduction

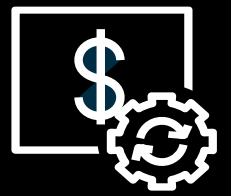
40% cost reduction in sc1 volumes



Reduced capacity

sc1 and st1 minimum size reduction

from 500 GB to 125 GB
Up to 85% cost savings for customers



Price optimization

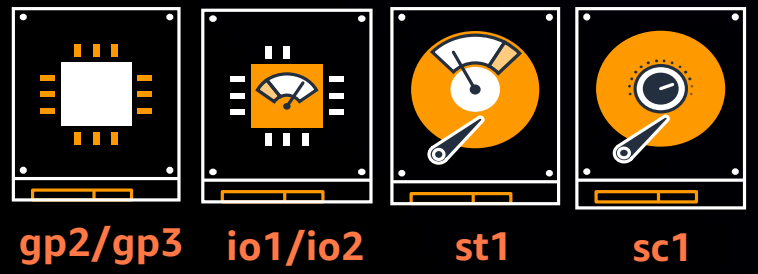
Tiered IOPS pricing for io2

Up to 37% cost savings between io1 vs io2

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CloudWatch metrics for Amazon EBS

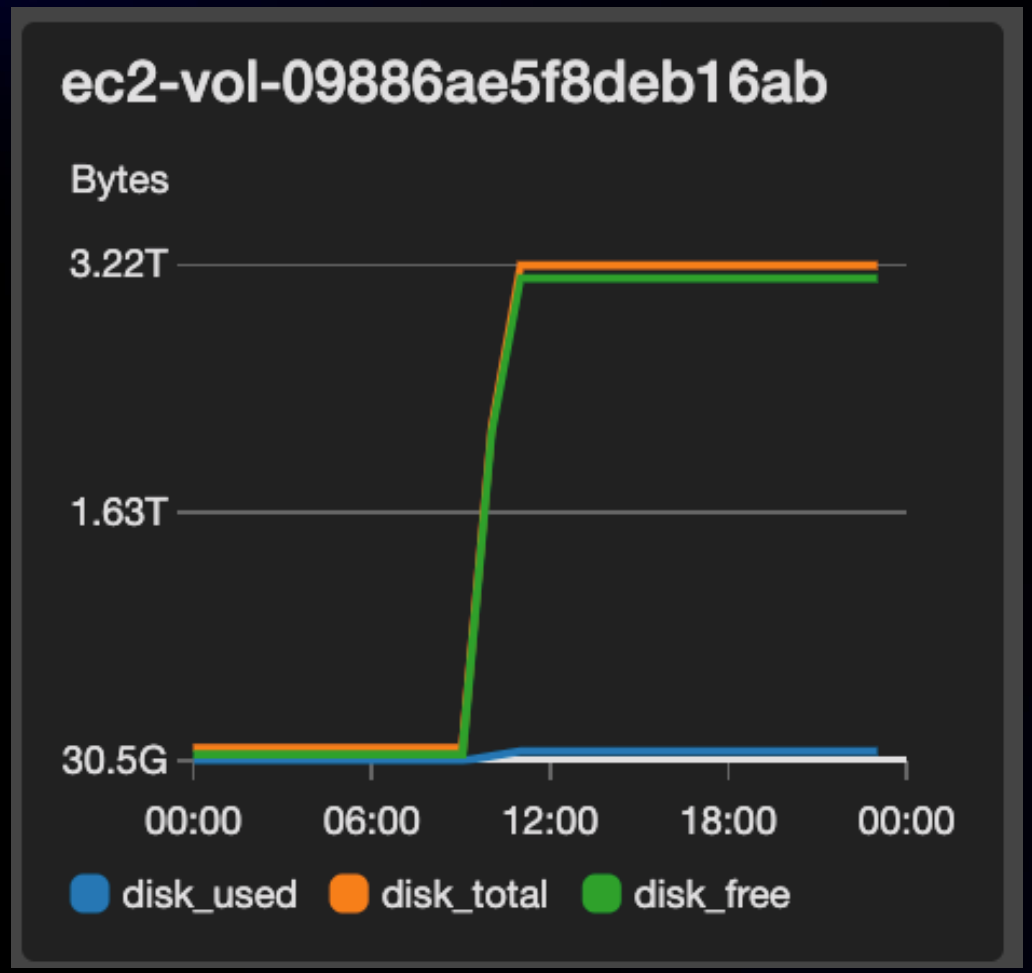


Important metrics to consider

BurstBalance	gp2, st1, sc1 only
VolumeReadBytes	All
VolumeWriteBytes	All
VolumeReadOps	All
VolumeWriteOps	All
VolumeQueueLength	All
VolumeThroughputPercentage	io1 and io2 only
VolumeConsumedReadWriteOps	io1 and io2 only

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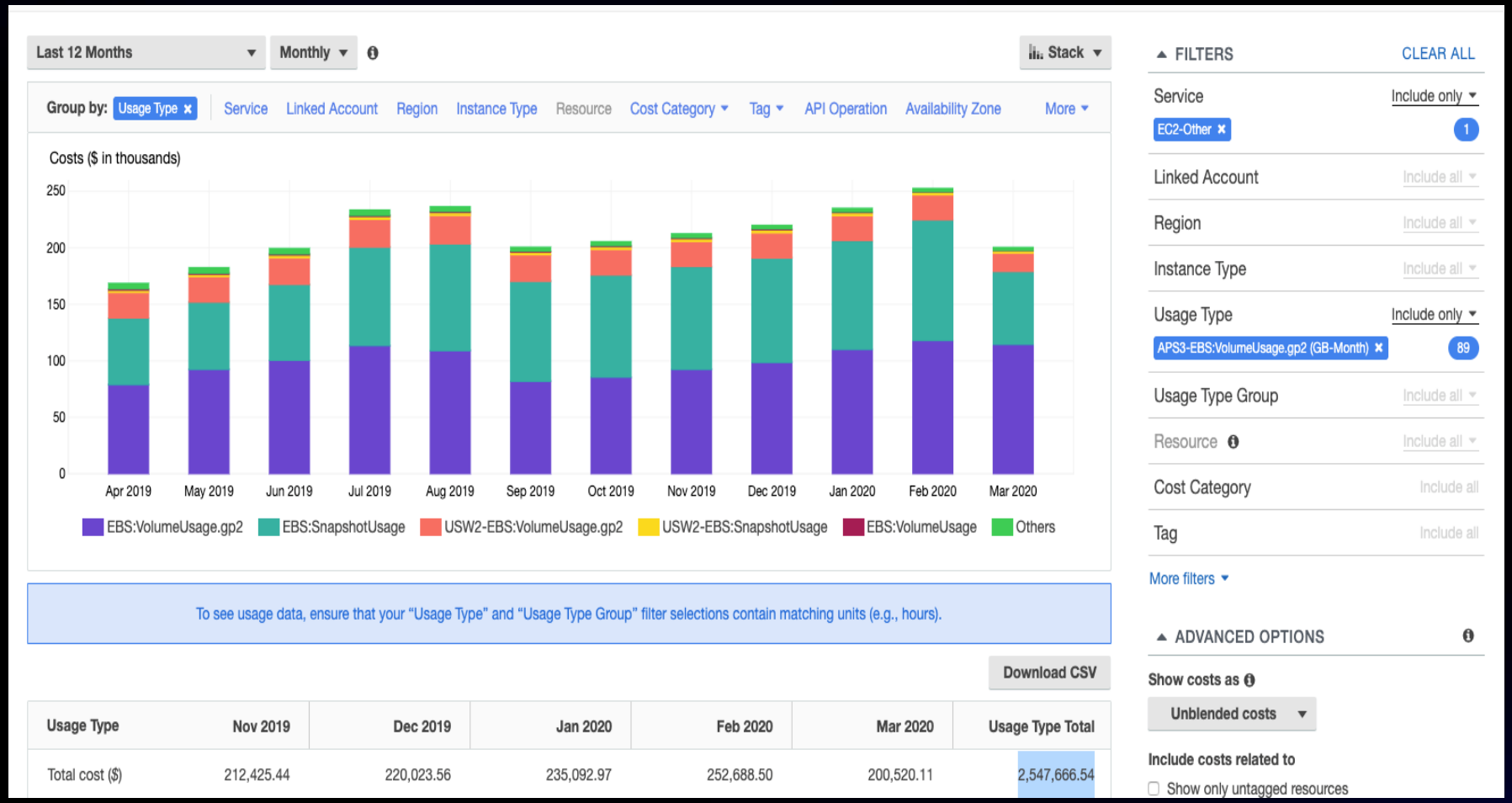
EC2 CloudWatch agent



Monitor Amazon EBS filesystem usage install agent on EC2 instance

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AWS Cost Explorer Amazon EBS usage (EC2-other)



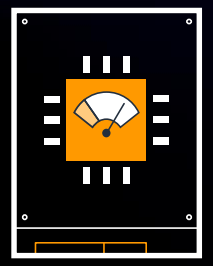
AWS Cost Explorer filter and group features

Consider st1, sc1 volume types for matching workloads

Snapshot hygiene – Amazon DLM

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Amazon EBS optimizations by AWS Compute Optimizer

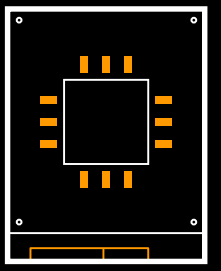


Optimize provisioned IOPS settings

io1/io2

Optimize size of gp2 volumes to meet performance

IOPS and throughput recommendations for gp3 volumes



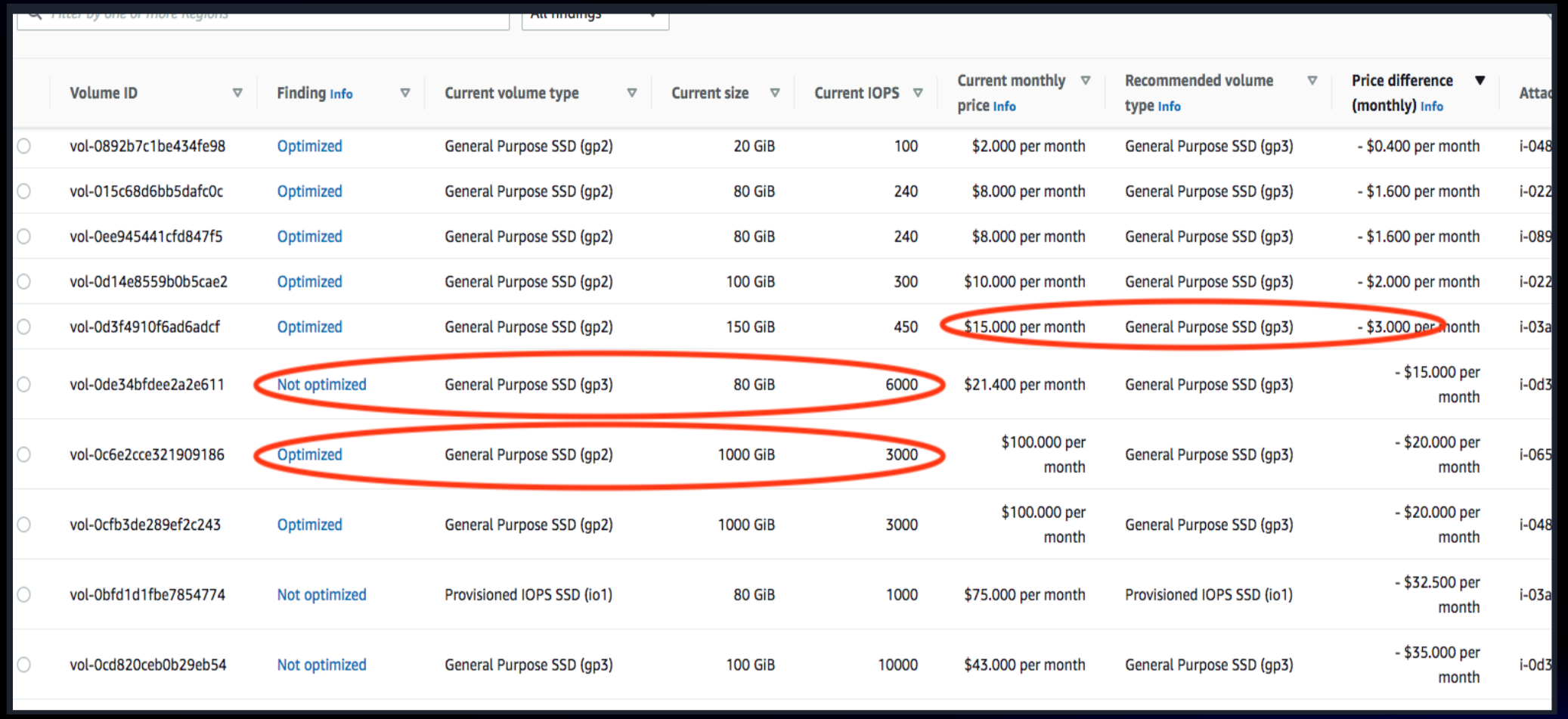
gp2/gp3

Eliminates manual optimization, available at no additional charge

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CAWS ompute Optimizer (EBS)



Volume ID	Finding Info	Current volume type	Current size	Current IOPS	Current monthly price Info	Recommended volume type Info	Price difference (monthly) Info	Attac
vol-0892b7c1be434fe98	Optimized	General Purpose SSD (gp2)	20 GiB	100	$2.000 per month	General Purpose SSD (gp3)	- $0.400 per month	i-048
vol-015c68d6bb5dafc0c	Optimized	General Purpose SSD (gp2)	80 GiB	240	$8.000 per month	General Purpose SSD (gp3)	- $1.600 per month	i-022
vol-0ee945441cfd847f5	Optimized	General Purpose SSD (gp2)	80 GiB	240	$8.000 per month	General Purpose SSD (gp3)	- $1.600 per month	i-089
vol-0d14e8559b0b5cae2	Optimized	General Purpose SSD (gp2)	100 GiB	300	$10.000 per month	General Purpose SSD (gp3)	- $2.000 per month	i-022
vol-0d3f4910f6ad6adcf	Optimized	General Purpose SSD (gp2)	150 GiB	450	$15.000 per month	General Purpose SSD (gp3)	- $3.000 per month	i-03a
vol-0de34bfdee2a2e611	Not optimized	General Purpose SSD (gp3)	80 GiB	6000	$21.400 per month	General Purpose SSD (gp3)	- $15.000 per month	i-0d3
vol-0c6e2cce321909186	Optimized	General Purpose SSD (gp2)	1000 GiB	3000	$100.000 per month	General Purpose SSD (gp3)	- $20.000 per month	i-065
vol-0cfb3de289ef2c243	Optimized	General Purpose SSD (gp2)	1000 GiB	3000	$100.000 per month	General Purpose SSD (gp3)	- $20.000 per month	i-048
vol-0bfd1d1fbe7854774	Not optimized	Provisioned IOPS SSD (io1)	80 GiB	1000	$75.000 per month	Provisioned IOPS SSD (io1)	- $32.500 per month	i-03a
vol-0cd820ceb0b29eb54	Not optimized	General Purpose SSD (gp3)	100 GiB	10000	$43.000 per month	General Purpose SSD (gp3)	- $35.000 per month	i-0d3

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AWS Trusted Advisor: Tool for idle resource identification

AWS Trusted Advisor (TA) provides best practices (or checks) in four categories



Red (action recommended)
Yellow (investigation recommended)
Green (no problem detected)

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AWS Trusted Advisor: Amazon EBS optimization options



Delete*

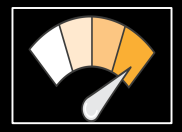
Unattached volumes: Amazon EBS volumes listed as "available" can be from stopped or terminated EC2 instances. These volumes can accrue cost even though they are not being used

Stale snapshots: Look for snapshots that are older then the retention policy; deleting them will reduce costs with no impact on volume



Protect

Under-utilized volumes: Look for network throughput and IOPS to check for any volume activity; if the volume hasn't been used in weeks, you can create a snapshot and delete the volume to optimize costs; this enables recovery, if required



Optimize

EBS optimized EC2 instances: Check for provisioned IOPS volumes attached to non-EBS optimized EC2 instance; use EBS-optimized instance

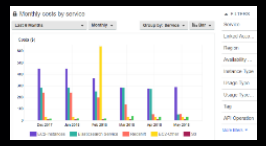
*Before any deletion, ensure that you validate the ability to delete against any business/process requirements

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Tools that provide cost visibility and speed to insight



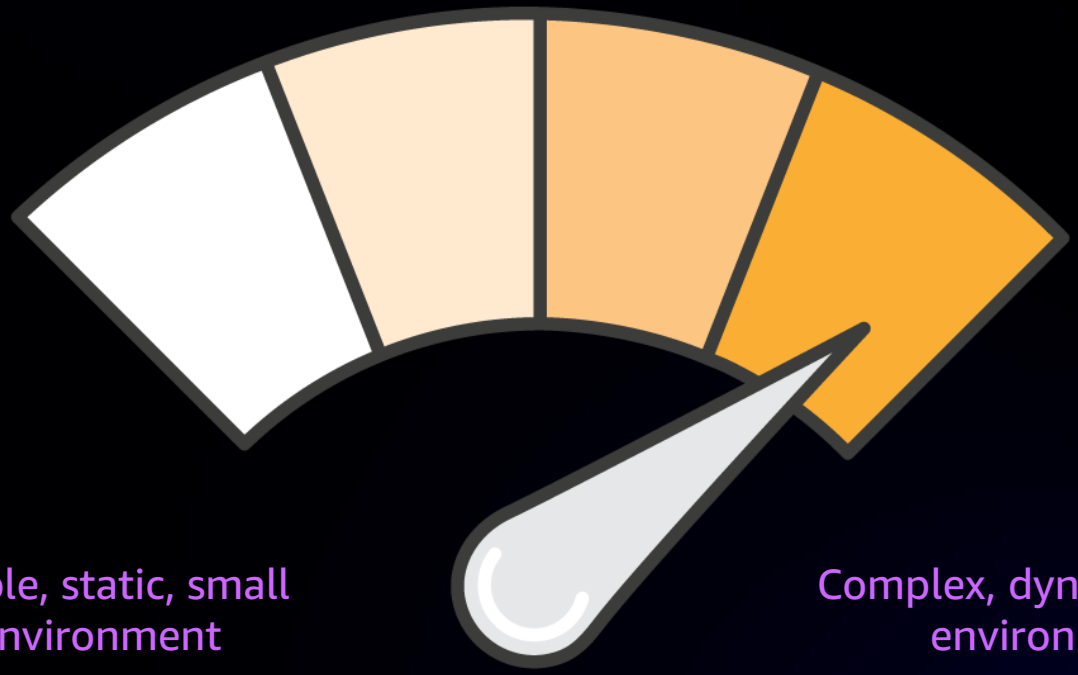
AWS Billing console



AWS Cost Explorer and AWS Budgets



Monthly AWS invoice





AWS Billing file analysis, DIY dashboards, and third party tools

Simple, static, small environment

Complex, dynamic, large environment

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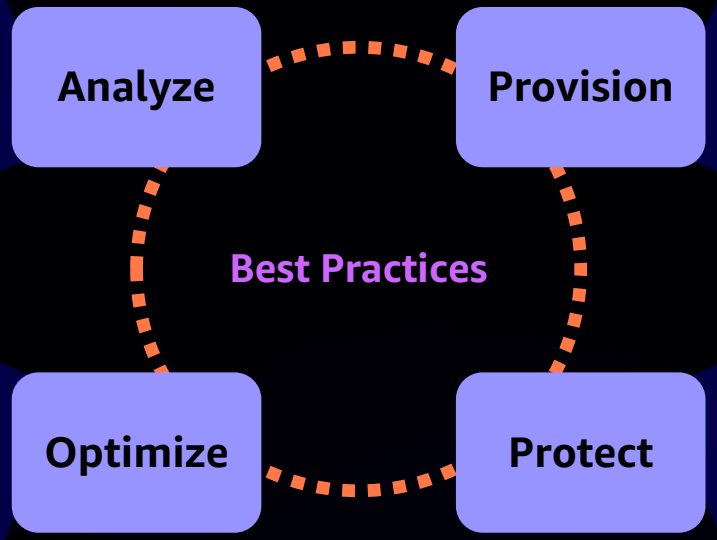
Amazon EBS cost optimization – Best practices

Gain insights

CloudWatch metrics for EBS

EC2 instance recommendation with AWS Compute Optimizer

Best practice recommendations with AWS Trusted Advisor



Optimize capacity

Unattached volumes: Delete volumes not attached to an EC2 instance

Stale snapshots: Delete snapshots with expired retention policies

Scale: Start with minimum required capacity and scale as you grow

Optimize Configuration

EBS-optimized instances: Right-size application requirements with optimized EC2 instance types

Provisioned IOPs: Balance gp3 pricing against io2 durability

Elastic volumes: Dynamically change volume features to support growth and control

Snapshots

Automate snapshot management with DLM

Check for underutilized volumes

Create snapshot for recoverability and delete volume

aws

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Summary

Most important step – Establish cost visibility

Choose the storage service to match your business application need

Find the obvious items for optimization; reduce unused, idle resources

Tag everything (volumes, instances, snapshots, and more)

Leverage tools for finding unused resources and optimize cost

Use elasticity to avoid waste

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Thank you!

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