

AWS re:Invent

NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV



STG306

Best practices for EBS volumes & performance monitoring using CloudWatch

Heather Horbochuk

Principal Product Manager
Amazon EBS
AWS

Leslie Sanchez

Senior Product Manager
Amazon EBS
AWS



Agenda

Amazon EBS overview

Selecting Amazon EBS volume types

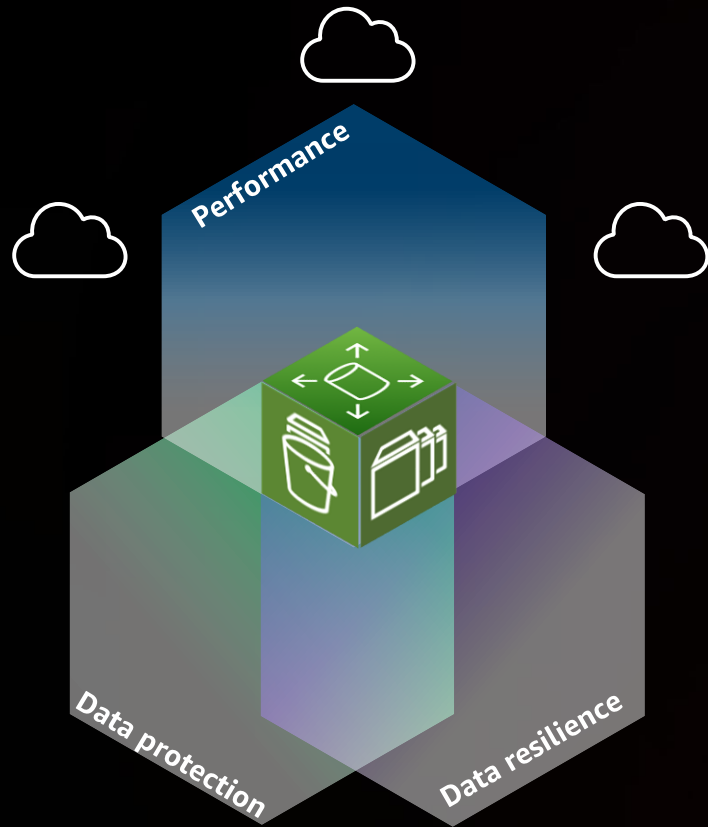
Tools for optimizing Amazon EBS for performance and cost

Monitoring your volumes via Amazon CloudWatch

Optimizing Amazon EBS with AWS Compute Optimizer and AWS Trusted Advisor



What is Amazon EBS?



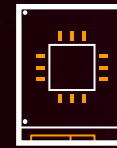
Amazon Elastic Block Store (EBS) is an easy-to-use, secure, high-performance, block-storage service designed for use with Amazon EC2. EBS is optimized for throughput and transaction-intensive workloads at any scale.

What is Amazon EBS?

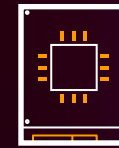
- Block storage **volumes** as a service attached to Amazon EC2 instances
- **Flexible** storage and performance for dynamic workloads such as stateful containers
- Create, attach, and manage volumes through **API**, **SDK**, or **AWS console**
- Point-in-time **snapshots** and tools to automate backup and retention via policies



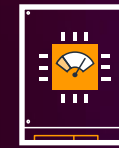
SSD-backed volumes



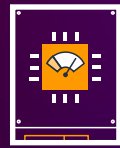
gp2



gp3



io1



io2



HDD-backed volumes



st1

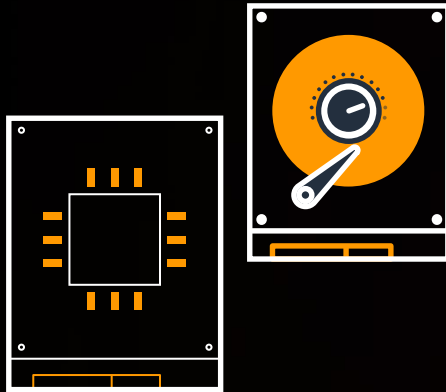


sc1

Selecting Amazon EBS for performance and cost

Best practices for optimizing Amazon EBS for performance

1



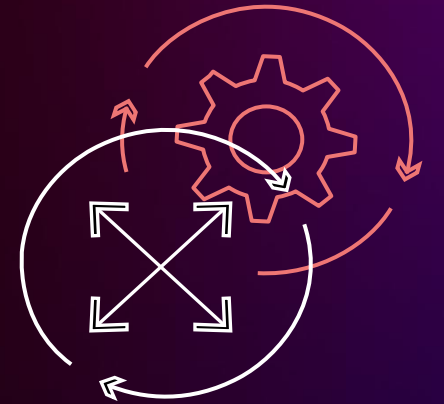
Select the right volume type for your workload

2



Select the right EC2 instance for your workload

3



If a mission-critical workload, build for high availability

Understand your mission



Databases

PostgreSQL, MySQL
Cassandra, MongoDB



Data and analytics

Kafka, Splunk, Hadoop,
data warehousing



Media

Transcoding, encoding,
render farms



File

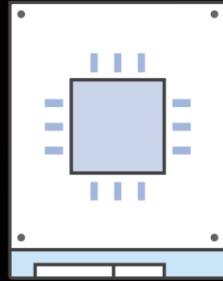
CIFS, NFS
archive

Understand your mission

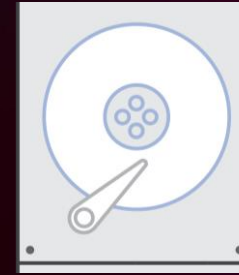
Tier 1 (critical)

Everything else

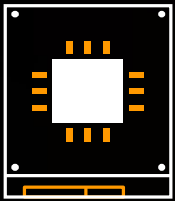
1 Select the right volume for your workload



SSD

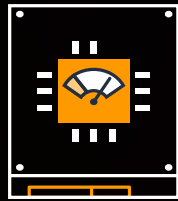


HDD



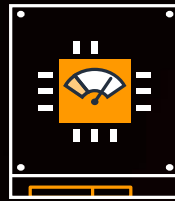
gp3

General-purpose
SSD



io2

Provisioned IOPS
SSD



io2 Block
Express



st1

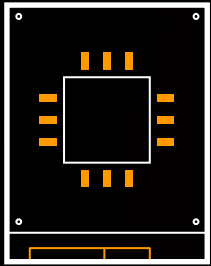
Throughput-
optimized HDD



sc1

Cold
HDD

1 Choosing the right volume type for your application

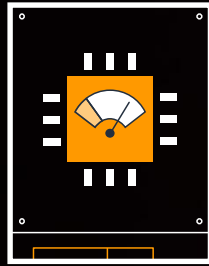


General-purpose
SSD
(gp3)

NoSQL databases

Transactional workloads,
low-latency applications

Cassandra,
MongoDB, CouchDB

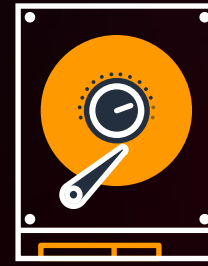


Provisioned IOPS
SSD
(io2)

Relational databases

I/O-intensive
database applications

MySQL, SQL Server,
PostgreSQL, SAP, Oracle

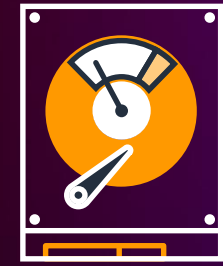


Throughput-optimized
HDD
(st1)

Big data, analytics

Large datasets and
large I/O sizes

Kafka, Splunk, Hadoop,
data warehousing



Cold
HDD
(sc1)

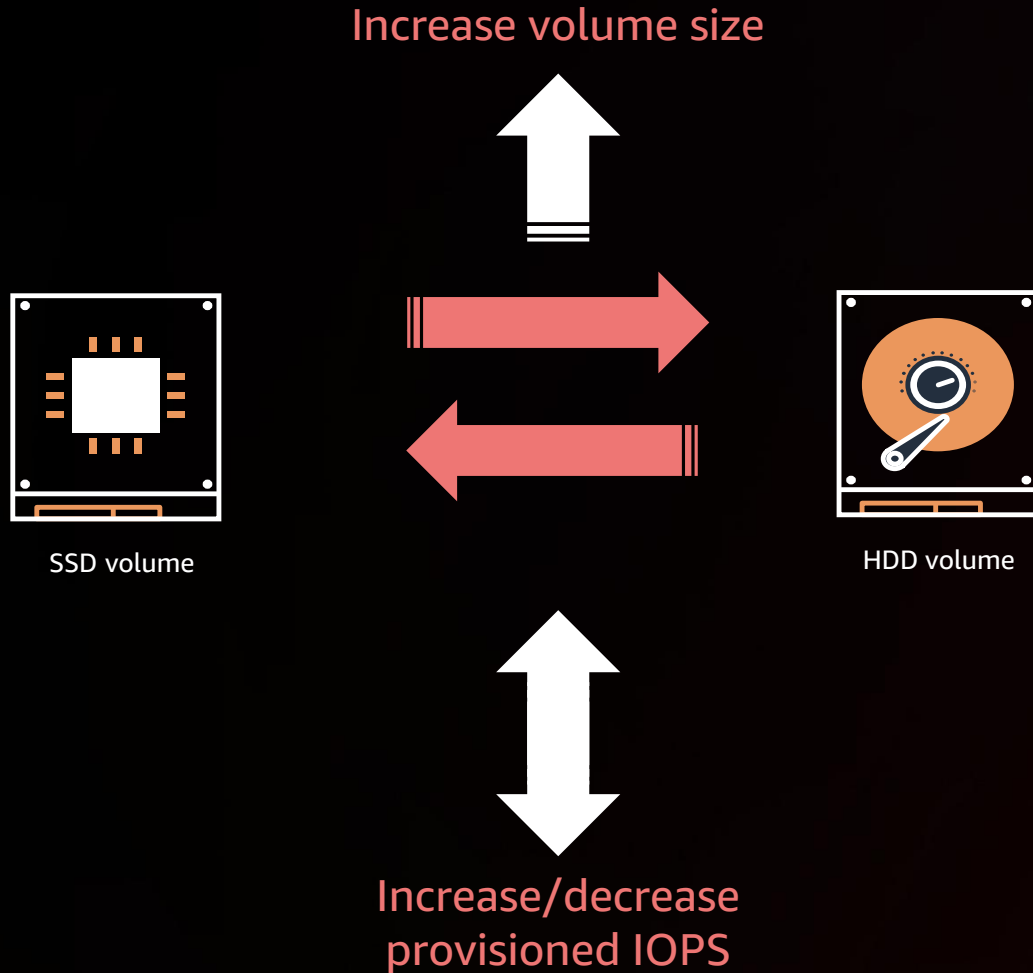
File, reference data

Less-frequently
accessed workloads with
large, cold datasets

Reference data,
near-archive, low I/O

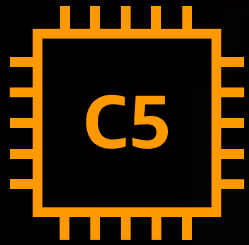
1 Elastic volumes

DYNAMICALLY CHANGE VOLUME FEATURES TO SUPPORT GROWTH AND CONTROL

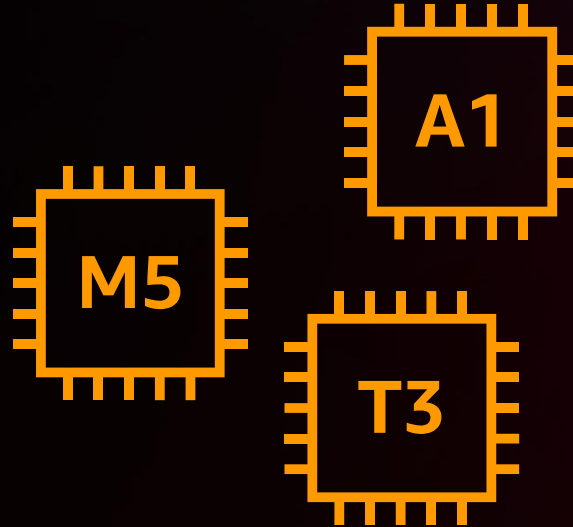


Provision Amazon EBS for minimum required size and expand as needed. Maintenance is easy with zero downtime.

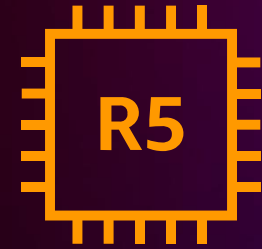
2 EC2 instance selection



Compute-
optimized



General
purpose



Memory-
optimized

2

Choosing the right EC2 instance: Amazon EBS-optimized

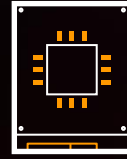


c4.large



Dedicated to Amazon EBS

500Mb/s ~ 62.5 MiB/s
4,000 16K IOPS



gp3

2TiB GP3 volume:
3,000 IOPS
125 MiB/s throughput

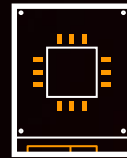


c4.4xlarge



Dedicated to Amazon EBS

2 Gb/s ~ 250 MiB/s
16,000 16K IOPS



gp3

2TiB GP3 volume:
3,000 IOPS
125 MiB/s throughput

Select the EC2 instance that has the right network,
RAM, and CPU resources for your applications

2

Choosing the right EC2 instance: Amazon EBS-optimized burst



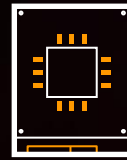
30 minutes
of burst



c6g.large



4,750 Mb/s ~ 594 MiB/s
20,000 16K IOPS



gp3

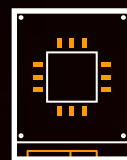
2TiB GP3 volume:
3,000 IOPS
125 MiB/s max throughput



c6g.large



630 Mb/s ~ 79MiB/s
3,600 16K IOPS

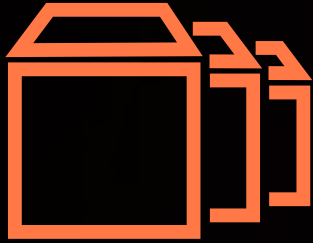


gp3

2TiB GP3 volume:
3,000 IOPS
125 MiB/s max throughput

3

Building for high availability



Replicate across
Availability Zones



Make periodic backups
of your Amazon EBS
volumes using
Amazon EBS
snapshots

Other best practices

- Avoid RAID for redundancy
 - RAID1 halves the Amazon EBS bandwidth
- Encrypt your data as needed
- Start small and increase volume size as needed

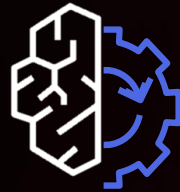
Tools for optimizing performance and cost

Tools for Amazon EBS optimization

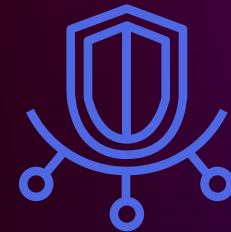
GAIN INSIGHTS INTO YOUR EBS DEPLOYMENT



Use **Amazon CloudWatch** metrics to gain insight into performance and utilization of Amazon EBS volumes



AWS Compute Optimizer provides optimization recommendations for EC2 instances and EBS volumes



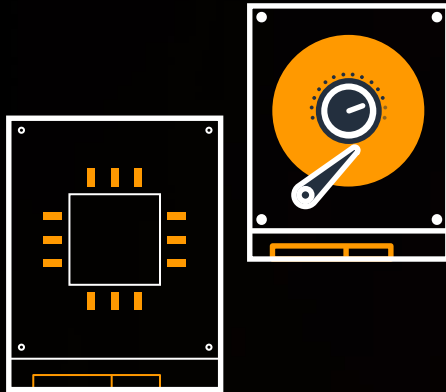
AWS Trusted Advisor provides best practices in cost optimization, security, performance, and fault tolerance

Monitoring Amazon EBS performance with Amazon CloudWatch



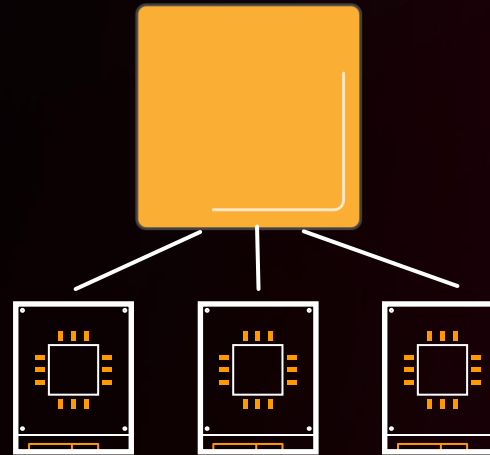
3 ways to understand your Amazon EBS performance

1



Monitor at the individual volume level

2



Monitor volume performance at the Amazon EC2 instance level

3

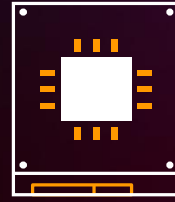


Monitor at the OS layer using custom metrics

1 Monitoring performance at the volume level

- Monitor **volume-level** performance
- Metrics are available when a volume is attached to your Amazon EC2 instance
- In 1-minute granularity
- Metrics available under the **AWS/EBS** namespace

1 CloudWatch metrics for Amazon EBS



gp2/gp3



io1/io2



st1



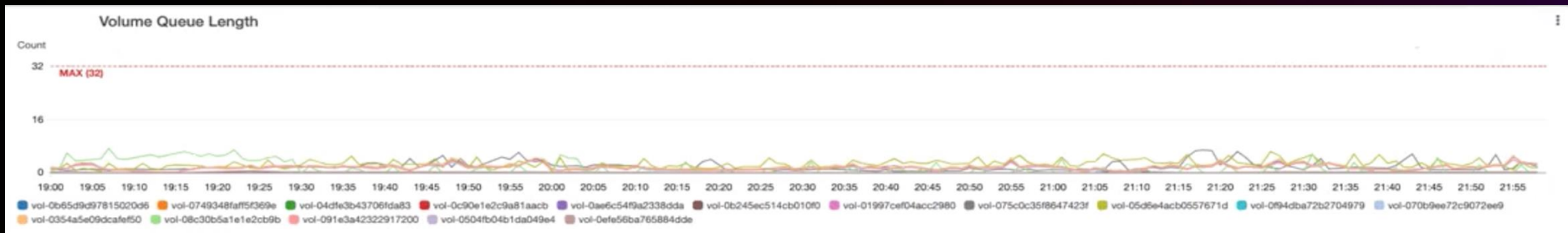
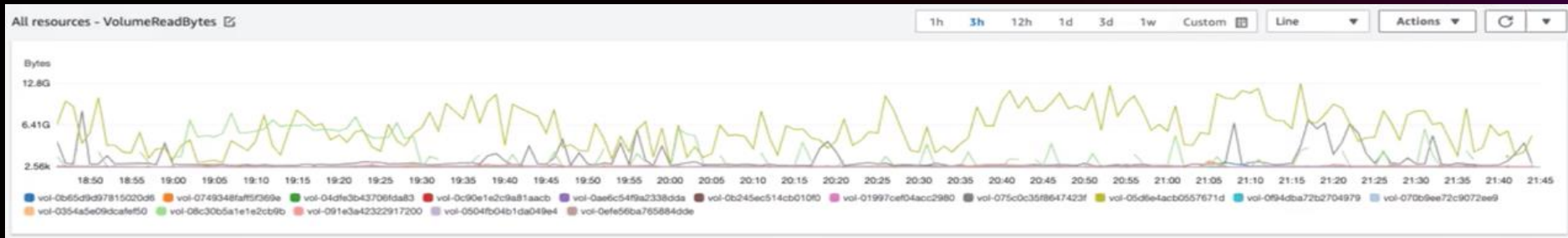
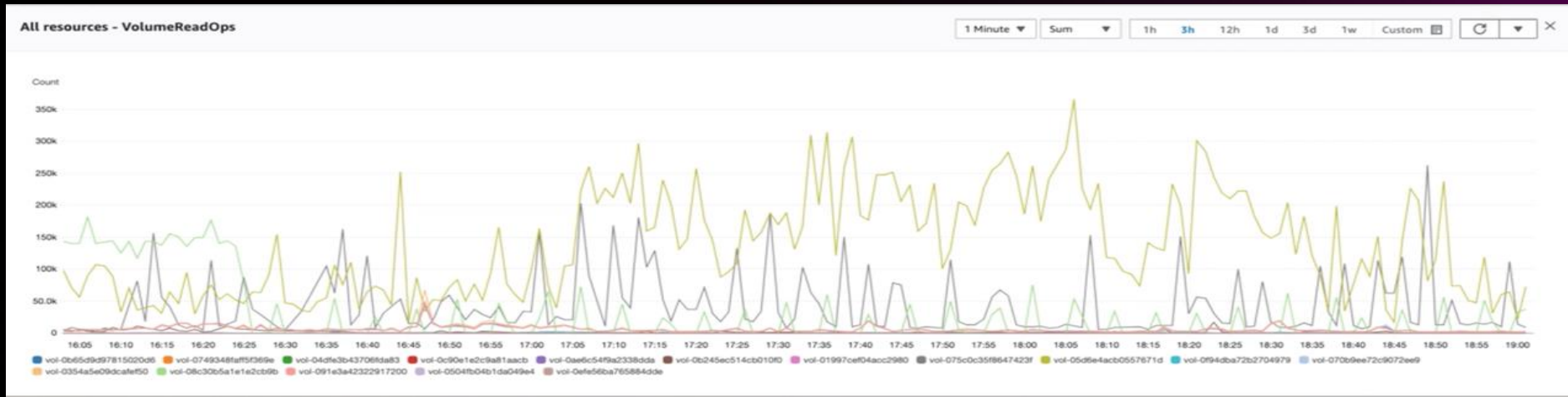
sc1

Important metrics to consider

VolumeReadBytes / VolumeWriteBytes	Total bytes transferred during the period	All
VolumeReadOps / VolumeWriteOps	Total I/O during the period	All
VolumeTotalReadTime / VolumeTotalWriteTime	Total number of seconds spent by all I/O that completed in a specified period of time	All
VolumeQueueLength	The number of I/O requests waiting to be completed	All
BurstBalance	The percentage of I/O credits (for gp2) or throughput credits (for st1 and sc1) remaining in the burst bucket	gp2, st1, sc1 only

1

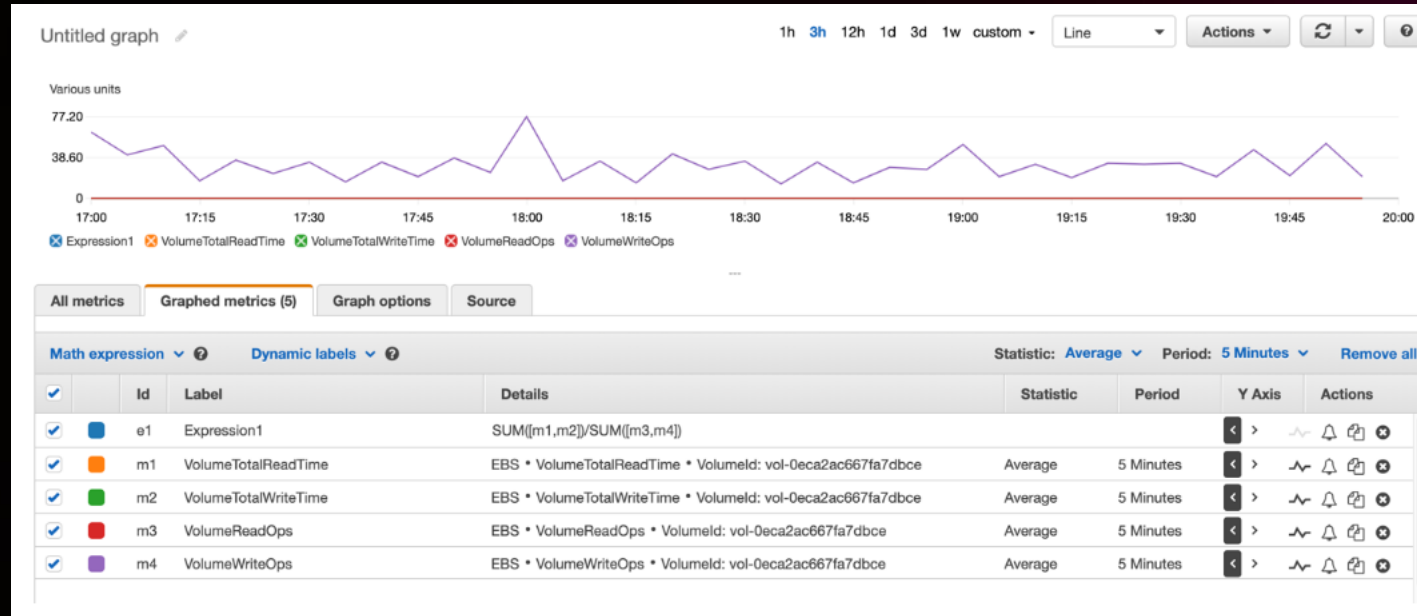
CloudWatch metrics for Amazon EBS



1 CloudWatch metrics for Amazon EBS

- Monitor your volume level latency:

$(\text{VolumeTotalReadTime} + \text{VolumeTotalWriteTime}) / (\text{VolumeReadOps} + \text{VolumeWriteOps})$

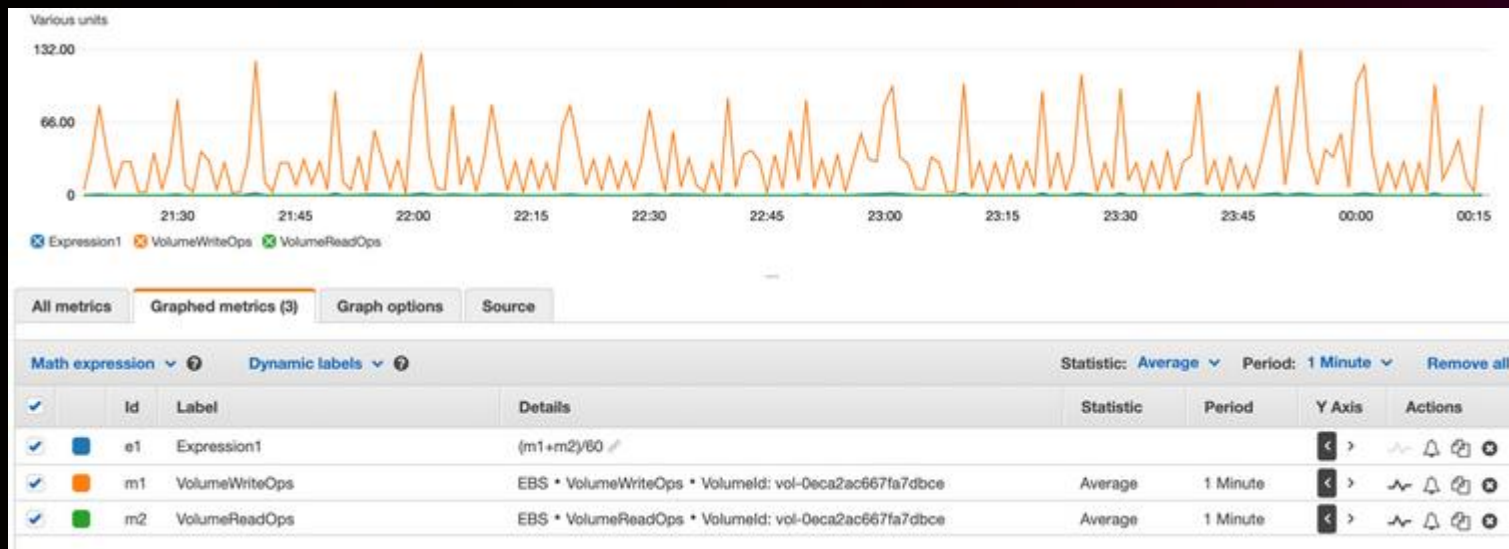


1 CloudWatch metrics for Amazon EBS

- Monitor your volume level IOPS and throughput:

$$\text{IOPS} = (\text{VolumeReadOps} + \text{VolumeWriteOps}) / \text{Time [seconds]}$$

$$\text{Throughput MBps} = (\text{VolumeReadBytes} + \text{VolumeWriteBytes}) / 1024 / \text{Time [seconds]}$$



2 Monitoring Amazon EBS performance at the instance level

- Monitor performance at the **instance level**
- Metrics compiles usage for all Amazon EBS volumes attached to the instance
- 5-minute granularity by default
 - 1 minute granularity available with detailed monitoring
- Metrics available under the **AWS/EC2** namespace

2 Monitoring Amazon EBS performance at the instance level

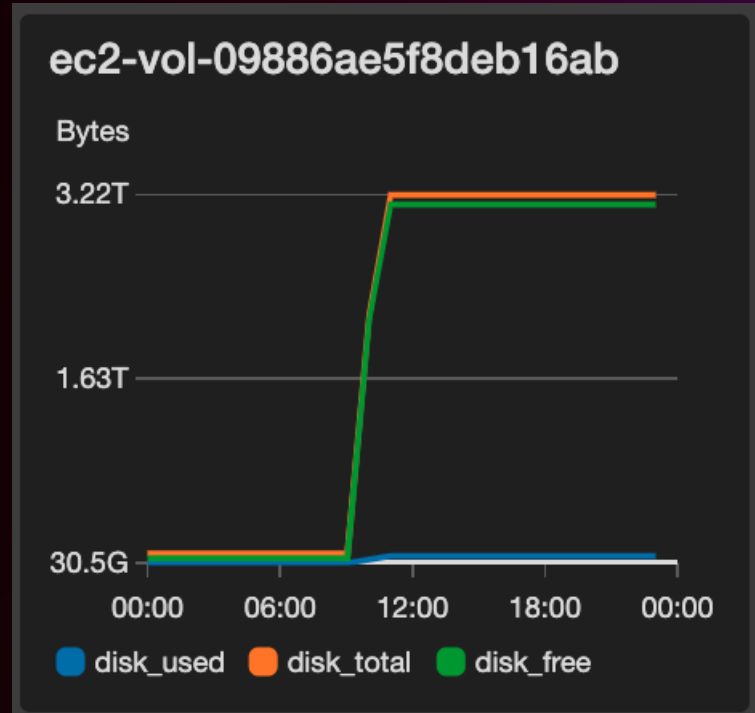
Important metrics to consider

VolumeReadBytes / VolumeWriteBytes	Total bytes transferred during the period
VolumeReadOps / VolumeWriteOps	Total I/O during the period

Note: DiskReadBytes/DiskWriteBytes is only applicable to local instance storage

3 Monitoring performance at the application level

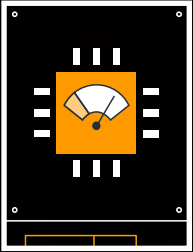
- Monitor performance at the **application level**
- Get custom metrics by enabling the CloudWatch agent in the EC2 instance
- Up to 1-second granularity



Optimizing Amazon EBS with Compute Optimizer and Trusted Advisor



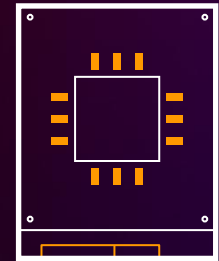
Amazon EBS optimizations by Compute Optimizer



Optimize provisioned IOPS settings

io1/io2

Optimize size of gp2 volumes to meet performance
IOPS and throughput recommendations for gp3 volumes



gp2/gp3

Compute Optimizer (Amazon 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

Trusted Advisor

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



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

Amazon EBS optimization with Trusted Advisor



AWS Trusted Advisor

Provides best practices in cost optimization, security, performance and fault tolerance.

Security

EBS public snapshots

Checks the permission settings for your Amazon EBS volume snapshots and alerts you if any snapshots are marked as public.

Performance (incl with Business/Enterprise support)

EBS-optimized EC2 instances

Check for provisioned IOPS volumes attached to non-EBS optimized EC2 instance. Use EBS-optimized instance.

Cost optimization (incl with Business/Enterprise support)

Unattached volumes

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.

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.

Fault tolerance (incl with Business/Enterprise support)

EBS snapshots age

Checks the age of the snapshots for your Amazon EBS volumes (either available or in use).

Amazon EBS key takeaways

- **Select the best volume and instance** for your application
- **Use flexible tools** to scale and manage
- **Monitor** your volumes use CloudWatch metrics
- **Optimize** using Compute Optimizer and Trusted Advisor

Thank you!

Heather Horbochuck
Therhorbochuk [LinkedIn]

Leslie Sanchez
Leslie-Sanchez [LinkedIn]



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

