Section 3) EC2 Storage EBS AND EFS

**EBS Volume**

Machine generated alternative text:
What's an EBSVolume? 
• An EC2 machine loses its root volume (main drive) when it is manually 
terminated. 
• Unexpected terminations might happen from time to time (AWS would 
email you) 
• Sometimes, you need a way t 
u instance data somewhere 
• An EBS (Elastic Block Store) Volume is a network drive you can attach 
to your instances while they run 
• It allows your instances to persist data 
Amazon EBS 

Machine generated alternative text:
as Volume 
• It's a network drive (i.e. not a physical drive) 
• It uses the network to communicate the instance, which means there might be a bit of 
latency 
• It can be detached from an EC2 instance and attached to another one quickly 
• It's locked to an Availability Zone (AZ) 
• An EBS Volume in us-east- la cannot be attached to us-east- 1b 
• To move a volume across, you first need to snapshot it 
• Have a provisioned capacity (size in CBs, and IOPS) 
• You get billed for all the provisioned capacity 
• You can increase the capacity of the drive over time 

**NOTE : EBS volume attached to EC2 at AZ level**

Machine generated alternative text:
EBS Volume Types 
• EBS Volumes come in 4 types 
• GP2 (SSD): General purpose SSD volume that balances price and performance for a 
wide variety of workloads 
• 101 (SSD): Highest-performance SSD volume for mission-critical low-latency or high- 
throughput workloads 
• STI (HDD): Low cost HDD volume designed for frequently accessed, throughput- 
intensive workloads 
• SCI (HDD): Lowest cost HDD volume designed for less frequently accessed workloads 
• EBS Volumes are characterized in Size I Throughput I IOPS (I/O Ops Per Sec) 
• When in doubt always consult the AWS documentation — it's good! 

**EBS hands on**

**Note : while creating instance attached EBS volume in add storage tab**

Machine generated alternative text:
1. Choose AMI 
2. Choose Instance Type 
3. Configure Instance 
4. Add Storage 
5. Add Tags 
6. Configure Security Group 
7. Review 
Encryption i 
Not Encrypte 
Not Encrypte 
Step 4: Add Storage 
Your instance will be launched with the following storage device settings. You can attach additional EBS volumes and instance store volumes to your instance, or 
edit the settings of the root volume. You can also attach additional EBS volumes after launching an instance, but not instance store volumes. Learn more about 
storage options in Amazon EC2. 
Snapshot 
snap- 
027008546b601e269 
Search (case-insensit 
Size (GiB) 
8 
2 
Volume Type i 
General Purpose SSD (gp2) 
General Purpose SSD (gp2) 
'OPS 
100 / 3000 
100 / 3000 
Throughput 
(MB/s) (j) 
Delete on 
Termination 
Volume Type 
Root 
EBS 
Add New Volume 
Device 
Idev/xvda 
/dev/sdb v 
Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage. Learn more about free usage tier eligibility and 
usage restrictions. 
Cancel 
Previous 
Review and Launch 
Next: Add Tags 

NOTE : once EBS create just check volume section : two volume attached to it now

Machine generated alternative text:
aws 
Services v 
Create Volume 
Actions v 
devi 
Volume Wpe 
gp2 
gp2 
IOPS 
100 
100 
x 
developerlearn v 
Paris v 
Support v 
2020 at. . 
2020 at . 
Dedicated Hosts 
New 
Capacity Reservations 
Images 
AMIs 
Elastic Block Store 
Volumes 
Snapshots 
Lifecycle Manager 
Network & Security 
Security Groups New 
1 to 2 of 2 
Availability Zone 
eu-west-3b 
eu-west-3b 
Q Filter by tags and attributes or search by keyword 
State 
in. 
in. 
Name 
Volume ID 
vol-Ofb503bd.. 
vol-Of0544b7... 
Size 
2 GiB 
8 GiB 
Snapshot 
snap-0270085... 
Created 
October 3, 
October 3, 

Machine generated alternative text:
ec2-user@ip-172-31 
Windows powershell 
Copyright (C) Microsoft Corporation. All rights reserved. 
PS C:XUsersXsaurakes) ssh -i 
C:XUsersXsaurakesXDesktopXniagara docxaws stephaneXEc2Tutoria1.pem ec2-user@35.18a.251.71 
The authenticity of host '35.183.251.71 (35.183.251.71)' can't be established. 
ECDSA key fingerprint is SHA256:PHnwtWigcZ6Nq7RV90khawbCgQ1tdbftKhpJoyzb4HU. 
Are you sure you want to continue connecting (yes/no)? yes 
Warning: permanently added '35.188.251.71' (ECDSA) to the list of known hosts. 
Amazon Linux 2 AMI 
https : / / aws . amazon . com/amazon-linux-2/ 
2 package(s) needed for security, out of 13 available 
Run "sudo yum update" to apply all updates. 
Lec2-user@ip-172-31-22-8 M$ Isblk 
NAME 
MAJ :MIN RM SIZE RO TYPE MOUNTPOINT 
xvda 
ø 8G ø disk 
282 
I—xvdal 232:1 
ø 8G ø part / 
xvdb 
282:16 ø 2G a disk 
Lec2-user@ip-172-31-22-8 M$ 

**NOTE xvdb is not mounted:**

<https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-using-volumes.html>

**EBS volume hands on in powershell**

**So to mount it please follow below step**

**Sudo su**

**Login to aws using ssh**

sudo file -s */dev/xvdb*

sudo mkfs -t ext4 */dev/xvdb*

sudo mkdir */data ( to create data folder)*

sudo mount */dev/xvdb /data*

sudo cp /etc/fstab /etc/fstab.orig

Vi /etc/fstab

/dev/xvdb /data ext4 defaults,nofail 0 2

Sudo file -s /dev/xvdb

Machine generated alternative text:
troot@ip-172-31-22-8 sudo file -s /dev/xvdb 
/dev/xvdb: Linux rev 1.8 exta filesystem data, UUID-ØIØ41d88-4c62-4d82-8e4d-a6b2fa7d2e79 (needs journal recovery) (exten 
troot@ip-172-31-22-8 

Sudo /umount /data

Lsblk

Sudo mount -a

Machine generated alternative text:
ec2- 
ec2- 
ec2- 
ec2- 
IAME 
Uda 
user@ip-172-31-22-8 
user@ip-172-31-22-8 
user@ip-172-31-22-8 
user@ip-172-31-22-8 
M$ cd /data 
data)$ cd 
/ 1$ sudo umount /data 
/ 1$ Isblk 
MAJ .•MIN RM SIZE RO TYPE MOUNTPOINT 
282 : a 
ø 8G ø disk 
ø 8G ø part / 
ø 2G ø disk 
xvdal 232:1 
(Vdb 
282 : 16 
ec2-user@ip-172-31-22-8 / 1$ sudo mount -a 
ec2-user@ip-172-31-22-8 / 1$ Isblk 
IAME 
MAJ .•MIN RM SIZE RO TYPE MOUNTPOINT 
(Vda 
282 : a 
xvdal 232:1 
(Vdb 
282 : 16 
ø 8G ø disk 
ø 8G ø part / 
ø 2G ø disk / data 
ec2-user@ip-172-31-22-8 / 1$ 

**EBS VOLUME TYPE DEEP DIVE**

**While attaching volume**

Machine generated alternative text:
EBS Volume Types Use cases 
GP2 (from AWS doc) 
• Recommended for most workloads 
• System boot volumes 
• Virtual desktops 
• Low-latency interactive apps 
• Development and test environ nts 
• I GiB- 16TlB 
• Small gp2 volumes can burst IOPS to 3000 
• Max IOPS is 16,000... 
• 3 IOPS per GB, means at 5,334GB we are at the max IOPS 

Machine generated alternative text:
EBSVolumeTypes Use cases 
101 (from AWS doc) 
• Critical business applications that require sustained IOPS performance, or 
more than 1 6,000 IOPS per volume (gp2 limit) 
• Large database workloads, such as: 
• MongoDB, Cassandra, Microsoft SQL Server, MySQL, PostgreSQL, Oracle 
•4 GiB- 16TiB 
• IOPS is rovisioned (PIOPS) — MIN 100 - MAX 64,000 (Nitro instances) else 
MAX 9000 (other Instances) 

**IOPS:**

**IOPS** (input/output operations per second) is a popular performance metric used to distinguish one storage type from another. Similar to device makers, **AWS** associates **IOPS** values to the volume component backing the storage option. As **IOPS** values increase, performance needs and costs rise.

Machine generated alternative text:
EBSV01umeTypes Use cases 
STI (from AWS doc) 
• Streaming workloads requiring consistent, fast throughput at a low price. 
• Big data, Data warehouses, Log processing 
• Apache Kafka 
• Cannot be a boot volume 
• 500 GiB- 16TiB 
• Max IOPS is 500 
• Max throughput of 500 MiB/s — can burst 

Machine generated alternative text:
EBS Volume Types Use cases 
SCI (from AWS doc) 
• Throughput-oriented storage for large volumes of data that is 
infrequently accessed 
• Scenarios where the lowest storage cost is important 
• Cannot be a boot volume 
• 500 GiB- 16TiB 
• Max IOPS is 250 
• Max throughput of 250 MiB/s — can burst 

Machine generated alternative text:
EBS —Volume Types Summary 
• gp2: General Purpose Volumes (cheap) 
• 3 IOPS / GiB, minimum IOO lops, burst to 3000 lops, max 16000 IOPS 
• I GiB- 16TiB , +1 TB +3000 IOPS 
• io I : Provisioned IOPS (expensive 
• Min IOO lops, Max 64000 IOP 0 32000 (other) 
• 4 GiB - 16TiB. Size of volume re independent 
• stl : Throughput Optimized HD 
• 500 GiB- 16TiB , 500 MiB /s throughput 
• sc I : Cold HDD, Infrequently accessed data 
• 250 GiB- 16TiB , 250 MiB /s throughput 

**EBS vs Instance Store**

Machine generated alternative text:
EBS vs Instance Store 
• Some instance do not come with Root EBS volumes 
• Instead, they come with "Instance Store" (z ephemeral storage) 
• Instance store is physically attached t he machine (EBS is a network drive) 
. pros: 
• Better I/O performance 
• Good for buffer / cache / scratch ata .„rghpo content 
• Data survives reboots 
. Cons: 
• On stop or termination, the instance store is lost 
• You can't resize the instance store 
• Backups must be operated by the user 

Machine generated alternative text:
Local EC2 Instance Store 
• Physical disk attached to the 
physical server where your EC2 is 
• Very High IOPS (because physical) 
• Disks up to 7.5 T iB (can change 
over time), stripped to reach 30 
T iB (can change over time... ) 
• Block Storage (just like EBS) 
• Cannot be increased in size 
• Risk of data loss if hardware fails 
100% Random Read lops 
m125 
206,250 
412500 
825,000 
1.65 million 
3.3 million 
3.3 million 
42500 
85,000 
170,000 
250,000 
500,000 
I million 
2 million 
2 million 
Very high IOPS 
Write lops 
35,000 
70,000 
180,000 
360,000 
720,000 
1.4 million 
1.4 million 
32,500 
65,000 
130,000 
200,000 
400,000 
800,000 
1.6 million 
1.6 million 
Instance Size 
i3. large • 
i3.x1arge • 
i3.2xlarge 
i3.4xlarge 
i3.8x1arge 
i 3.16xIarge 
3. metal 
Ben. large • 
i 3en. xlarge • 
i3en.2xIarge • 
3en.3xIarge 
3en. "large 
arge 
arge 
3en. metal 

**EFS (Elastic file System) Overview**

The main **differences between EBS and EFS is** that **EBS is** only accessible from a single EC2 instance in your particular AWS region, while **EFS** allows you to mount the file system across multiple regions and instances. Finally, Amazon S3 **is** an object store good at storing vast numbers of backups or user files.

Machine generated alternative text:
EFS — Elastic File System 
• Managed NFS (network file system) that can be mounted on many EC2 
• EFS works with EC2 instances in multi-AZ 
• Highly available, scalable, expensive-(3x.gp2), pay per use 
EC2 
us-east-la 
e written a note here. 
st-lb 
Security Group 
EFS 
EC2 
us-east-lc 

Machine generated alternative text:
EFS — Elastic File System 
• Use cases: content management, web serving, data sharing, Wordpres 
• Uses NFSv4.l protocol 
• Uses security group to control access to EFS 
• Compatible with Linux based AMI (not Windows) 
• Encryption at rest using KMS 
• POSIX file system (—1-inux) that has a standard file API 
• File system scales automatically, pay-per-use, no capacity planning! 

Amazon **EFS** is a regional service storing data within and across multiple Availability Zones (AZs) for high availability and durability.

Machine generated alternative text:
EFS — Performance & Storage Classes 
• EFS Scale 
• 1 000s of concurrent NFS clients, 10 GB+ /s throughput 
• Grow to Petabyte-scale network file system, automatically 
• Performance mode (set at EFS creation time) 
• General purpose (default): latency-sensitive use cases (web server, CMS, etc.. .) 
• Max I/O — higher latency, throughput, highly parallel (big data, media processing) 
• Storage Tiers (lifecycle management feature — move file after N days) 
• Standard: for frequently accessed files 
• Infrequent access (EFS-IA): cost to retrieve files, lower price to store 

**EFS DEMO**

**Step one : first create efs security group ec2 to efs**

Machine generated alternative text:
Elastic File System 
x 
Amazon EFS File systems 
Step 1 
File system settings 
Step 2 
Network access 
Step 3 - optional 
File system policy 
Step 4 
Review and create 
Create 
File system settings 
General 
Name - optional 
Name your file system. 
Optional. Apply a name to your file system 
Name must not be longer than 256 characters, and must only contain letters, numbers, and these 
characters: + . 
Automatic backups 
Automatically backup your file system data with AWS Backup using recommended settings. Additional 
pricing applies. Learn more 
Enable automatic backups 
Lifecycle management 
Automatically save money as access patterns change by moving files into the EFS Infrequent Access storag 
class. Learn more 
30 days since last access 
File systems 
Access points 
AWS DataSync 
AWS Backup 
Documentation 
New! 

**Step 2 ) create 2 ec2 instance( in different availablity zone) that will be accessing file system**

**Note:** we want ec2 to access network file system for this install efs on these two instance

Created new security group for ec2 my efs demo

Step 3) **we need to attach efs on ec2 instance**

Machine generated alternative text:
) File systems 
Amazon EFS 
fs-e4910955 
General 
Performance mode 
General Purpose 
Throughput mode 
Bursting 
Lifecycle policy 
30 days since last access 
fs-e4910955 
Tags 
Delete 
Automatic backups 
@ Enabled 
Encrypted 
3c1055c8-094c-4f5e-97c3-77babc61c243 
(aws/elasticfilesystem) 
File system state 
@Available 
Attach 
Edit 
Network 
Metered size 
File system policy 
Access points 
Monitoring 

*Mouting efs to ec2*

NOTE : **for this we need to install amazon-efs-utils package in powershell**

**Login in aws using ssh**

**sudo yum install -y amazon-efs-utils**

**Mkdir efs**

sudo mount -t efs -o tls fs-e4910955:/ efs ---it will give timeout

Add security group

Machine generated alternative text:
Edit inbound rules 
Inbound rules control the incoming traffic that's allowed to reach the instance. 
Description - optional Info 
Inbound rules 
protocol 
Add rule 
port range Info 
A NOTE: Any edits made on existing rules result in the edited rule being deleted and a new rule created with the new details. This will cause traffic that depends 
on that rule to be dropped for a very brief period of time until the new rule can be created. 
Cancel 
Preview changes 
Save rules 

Machine generated alternative text:
) sg-Oe5e07c2cb875311f 
EC2 
Security Groups 
Edit inbound rules 
Info 
- MY efs demo 
Edit inbound rules 
sg- 
09b232ec485bb 
af01 
Description - optional 
allow instance to efsl 
x 
Info 
Del 
ete 
Inbound rules control the incoming traffic that's allowed to reach the instance. 
Inbound rules 
Info 
Protocol 
Info 
TCP 
Port range 
2049 
Info 
Source Info 
Custom v 
Type Info 
NFS 
Add rule 

EFS VS EBS

Machine generated alternative text:
EBS vs EFS — Elastic Block Storage 
Availability Zone 2 
EBS 
restore 
• EBS volumes.. 
• can be attached to only one instance at a time 
• are locked at the Availability Zone (AZ) level 
• gp2: 10 increases if the disk size increases 
• io I : can increase 10 independently 
• To migrate an EBS volume across AZ 
• Take a snapshot 
• Restore the snapshot to another AZ 
• EBS backups use 10 and you shouldn't run them 
while your application is handling a lot of traffic 
• Root EBS Volumes of instances get terminated 
by default if the EC2 instance gets terminated. 
(you can disable that) 
Availa bility Zone I 
EBS 
snapshot 
EBS Snapshot 

Machine generated alternative text:
EBS vs EFS - Elastic File system 
Availability Zone 2 
Linux 
Mount 
Target 
• Mounting I OOS of instances across AZ 
• EFS share website files (WordPress) 
• Only for Linux Instances (POSIX) 
• EFS has a higher price point than EBS 
• Can leverage EFS-IA for cost savings 
• Remember: EFS vs EBS vs Instance Store 
Availability Zone I 
Linux 
Mount 
, Target 
EFS 

EFS is a network file system (NFS) and allows to mount the same file system on EC2 instances that are in different AZ

**EC2 Instance store**

Is running a DB on EC2 instance store possible? It is possible to run a database on EC2. It is also possible to use instance store, but there are some considerations to have. The data will be lost if the instance is stopped, but it can be restarted without problems. One can also set up a replication mechanism on another EC2 instance with instance store to have a standby copy. One can also have back-up mechanisms. It's all up to how you want to set up your architecture to validate your requirements. In this case, it's around IOPS, and we build an architecture of replication and back up around i