Project in AWS
Practice Lab

Reduce Storage Costs with EFS

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ABOUT THIS LAB

Amazon Elastic File System (Amazon EFS) provides a simple, serverless elastic file system that lets you share file data without provisioning or managing storage. In this lab, we modify three existing EC2 instances to use a shared EFS storage volume instead of duplicated Elastic Block Store volumes. This reduces costs significantly, as we only need to store data in one location instead of three. By the end of this lab, you will understand how to create EFS volumes and attach them to an EC2 instance. Make sure you're in the N. Virginia (us-east-1) region throughout the lab.

LEARNING OBJECTIVES

- Create an EFS File System
- Mount the EFS File System and Test It
- Remove Old Data

AWS Documentation about EFS: https://aws.amazon.com/efs/faq/

Source: https://learn.acloud.guru/course/certified-solutions-architect-associate/

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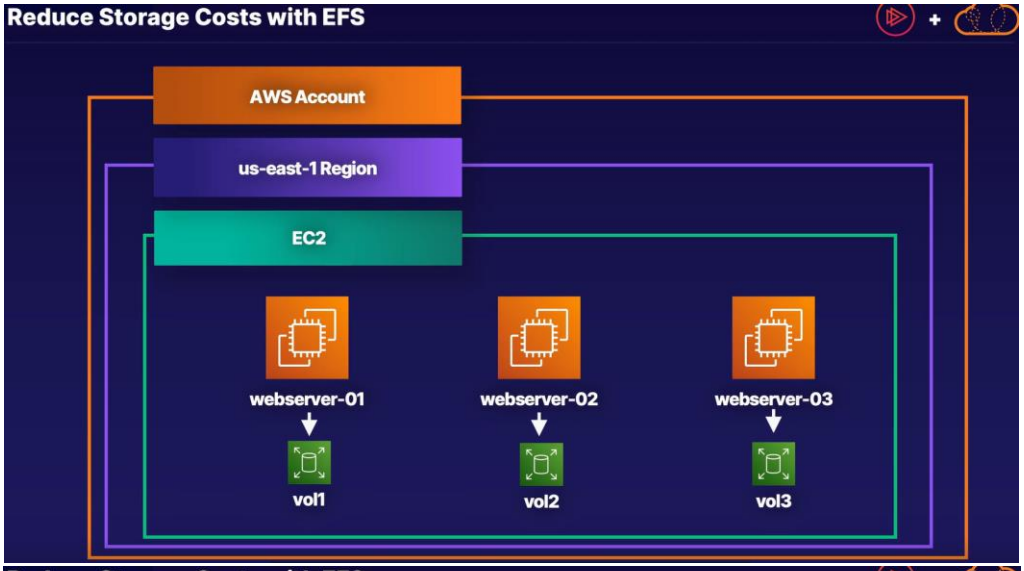
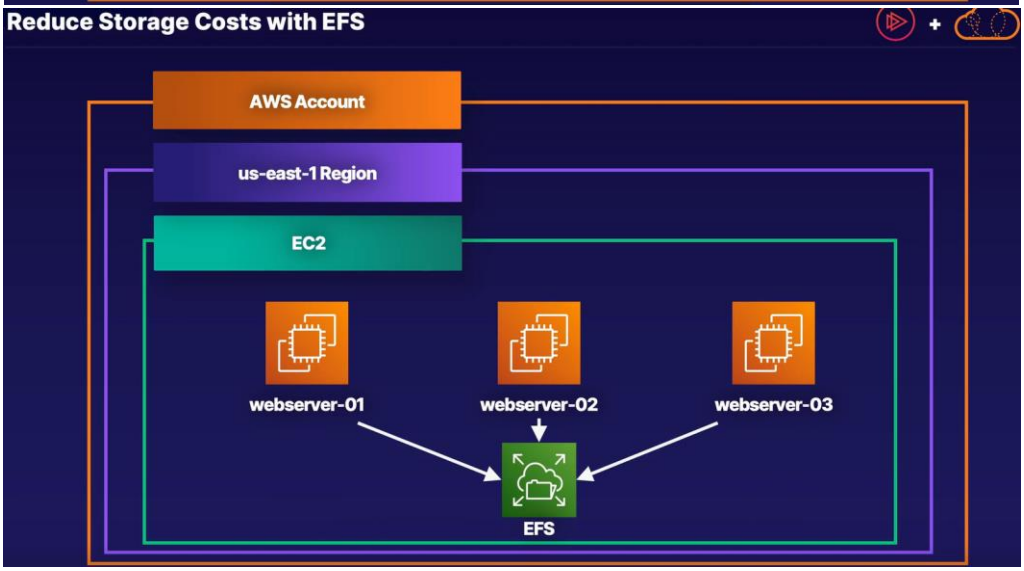
Lab Diagrams

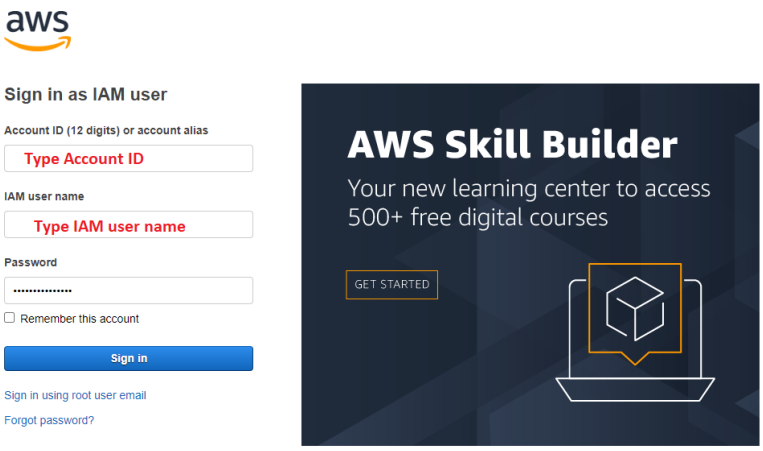




We have the AWS account in **us-east-1** Region, and we have 3 EC2 instances (3 web servers) that are all using a 10 GiB EBS volume per instance to store the same website data. Since the website data is the same across all 3 instances, we will attach a single EFS volume (shared EFS volume) and copy our data from the EBS volume to the EFS volume, and then unmount the EBS volumes and mount the **/data** file system to the new EFS volume.

We will repeat this on all 3 servers and delete the EBS volumes on the servers to save on storage costs.

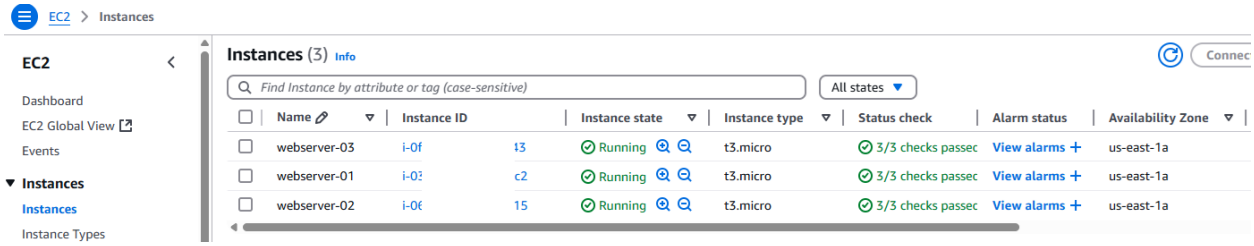
Log in to your AWS account



1. Create an EFS File System

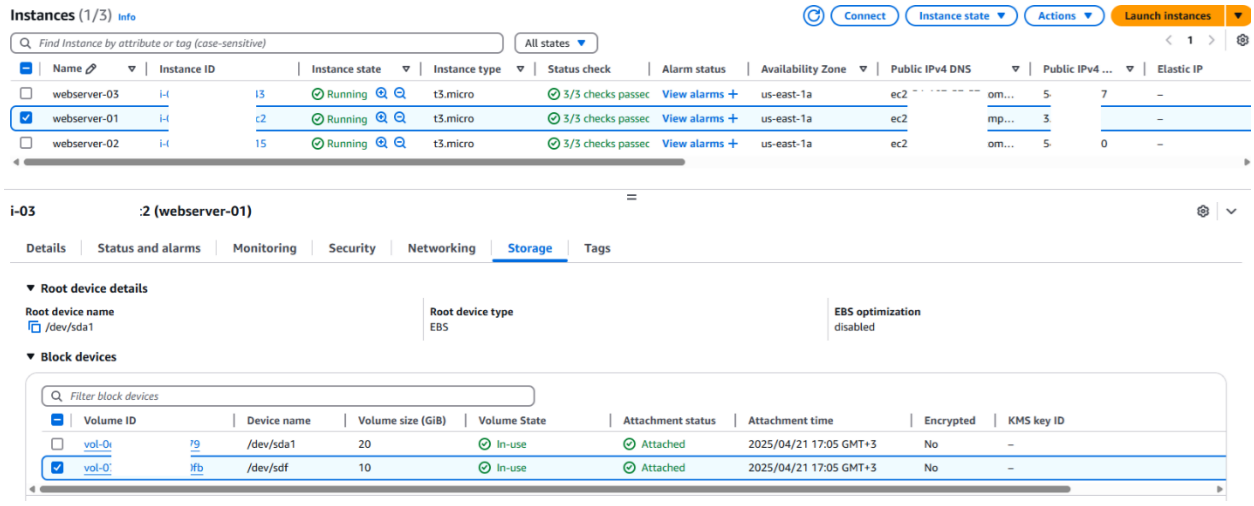
1.1. Review Your Resources

1. Once you are logged in to the AWS Management Console, navigate to **EC2 → Instances**.



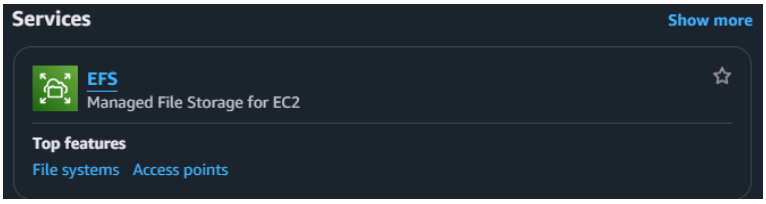
2. Click the checkbox next to ***webserver-01***. The instance details display below.

3. Select the **Storage** tab and note the 10 GiB disk attached to the volume. This is the same configuration used for ***webserver-02*** and ***webserver-03***.

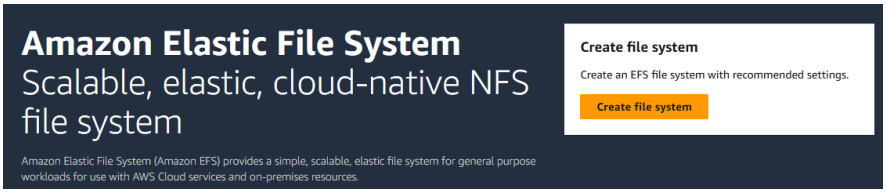


1.2. Create an EFS Volume

1. In a new browser tab, navigate to **EFS**.

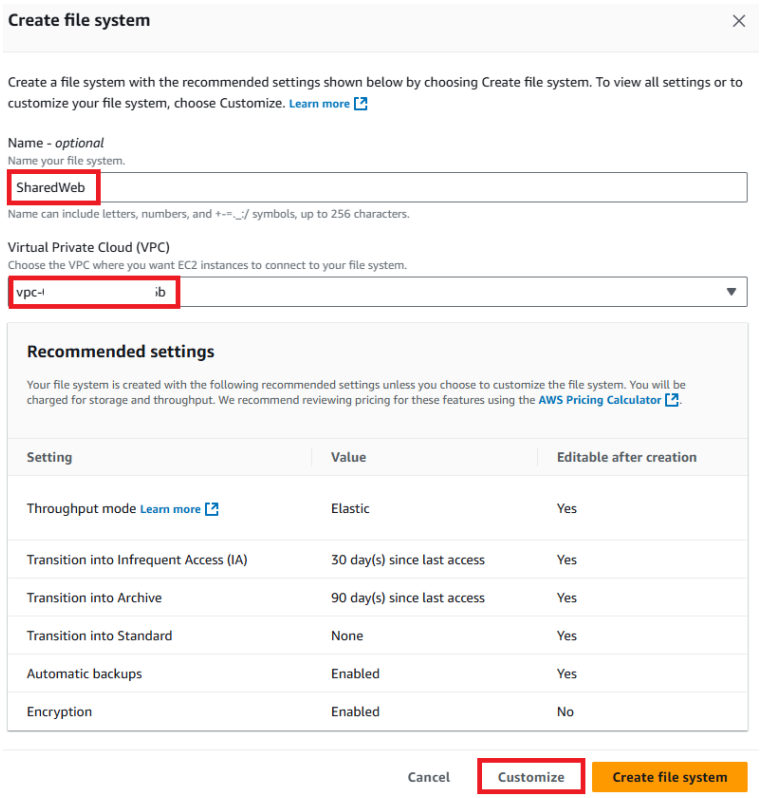


2. On the right, click **Create file system**.



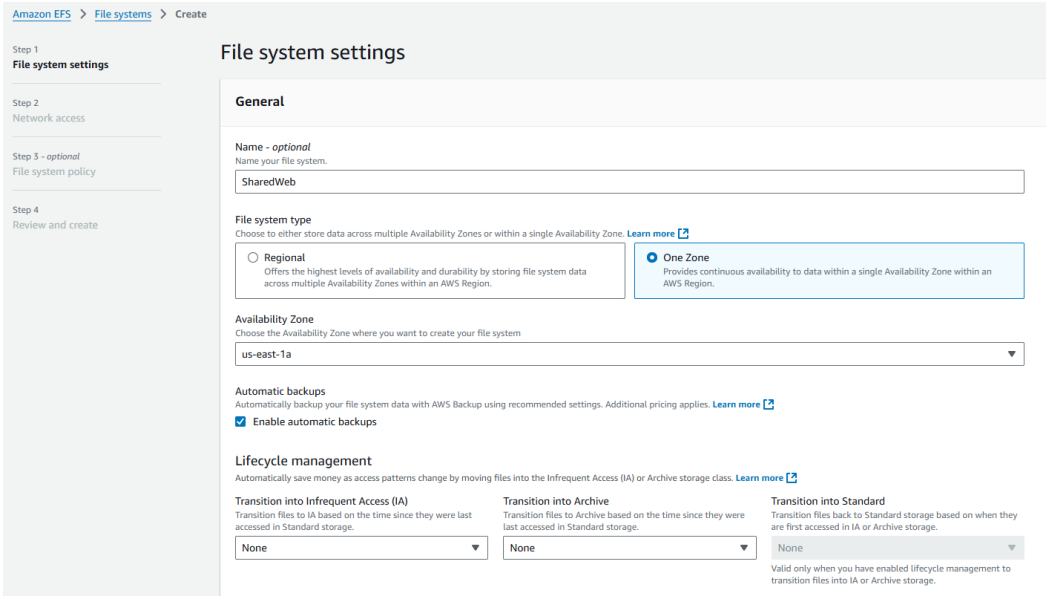
3. Fill in the file system details:
    a. **Name**: In the text box, enter ***SharedWeb***.
    b. **Virtual Private Cloud (VPC)**: Use the dropdown to select the provided VPC.

4. Click **Customize**.



a. For **file system type**: Select **One Zone**.
b. For **Availability Zone**: Leave **us-east-1a** selected.

5. In ***Lifecycle management***, under ***Transition into Archive*** click on the dropdown and make sure **None** is selected.

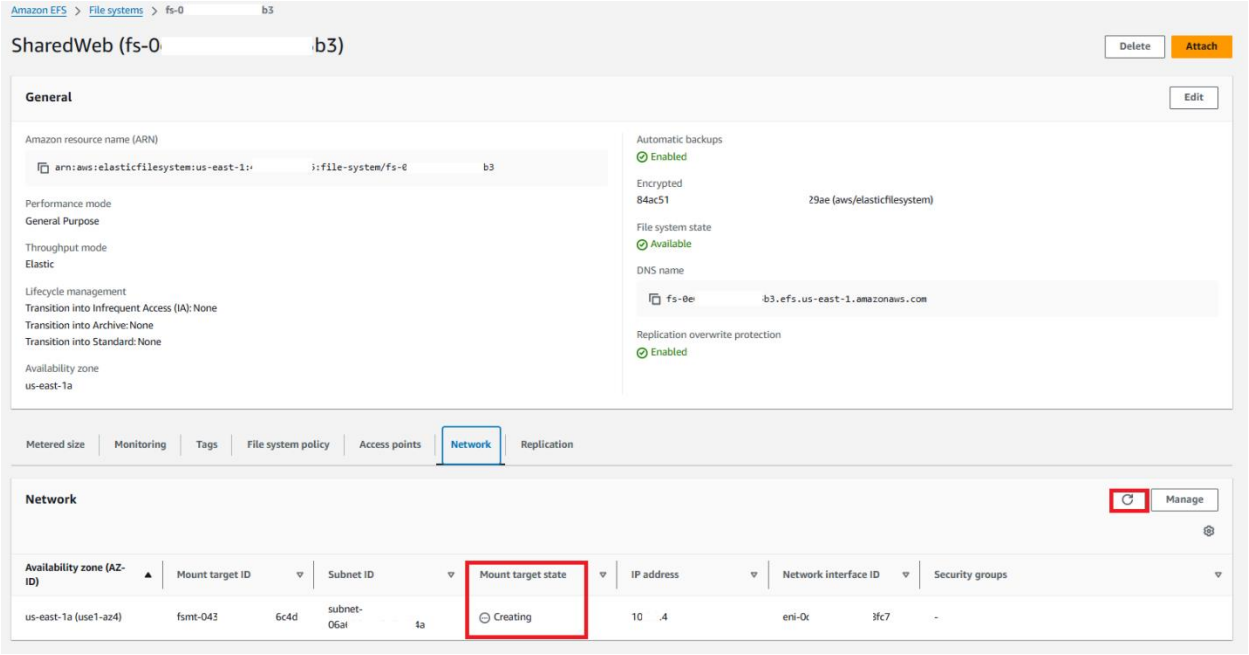


6. Click **Next → Next → Next → Create** to create the file system.

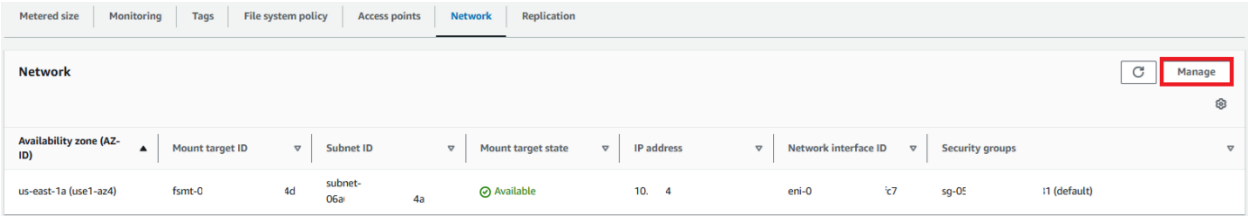
7. After the file system is successfully created, click ***View file system*** in the top right corner.

8. Select the **Network** tab and wait for the created network to become available.

   Note: You may need to refresh the Network details to see an updated mount target status.

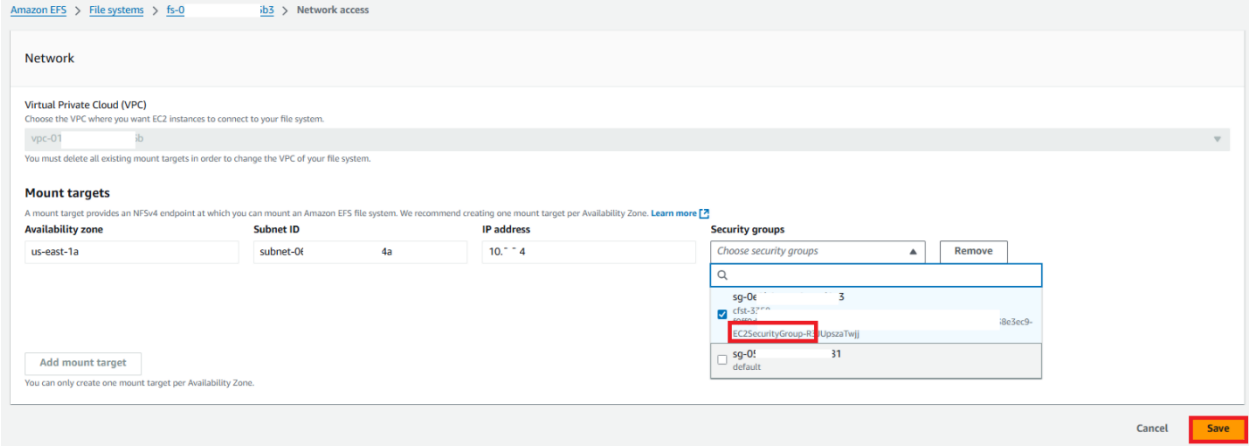


9. After the mount target state is available, click **Manage** on the right.



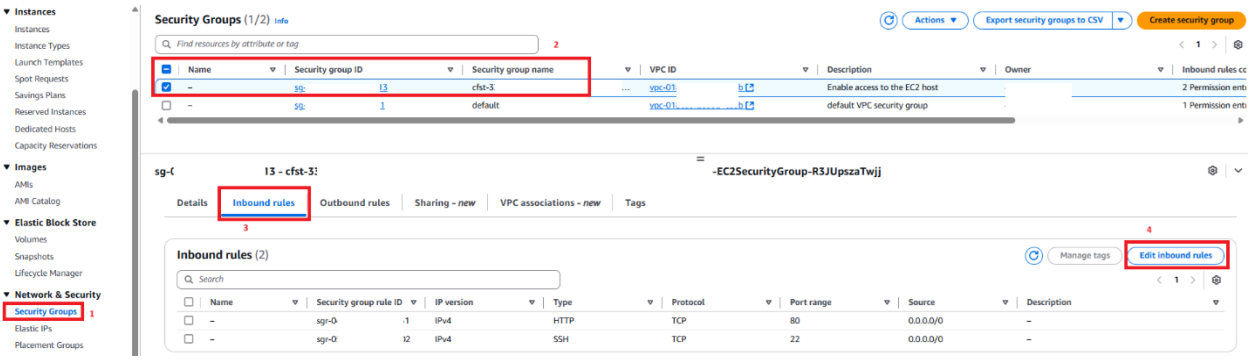
10. Under **Security groups**, remove the currently attached default security group and then use the dropdown menu to select the ***EC2SecurityGroup*** group (not the default group).

11. Click **Save**.

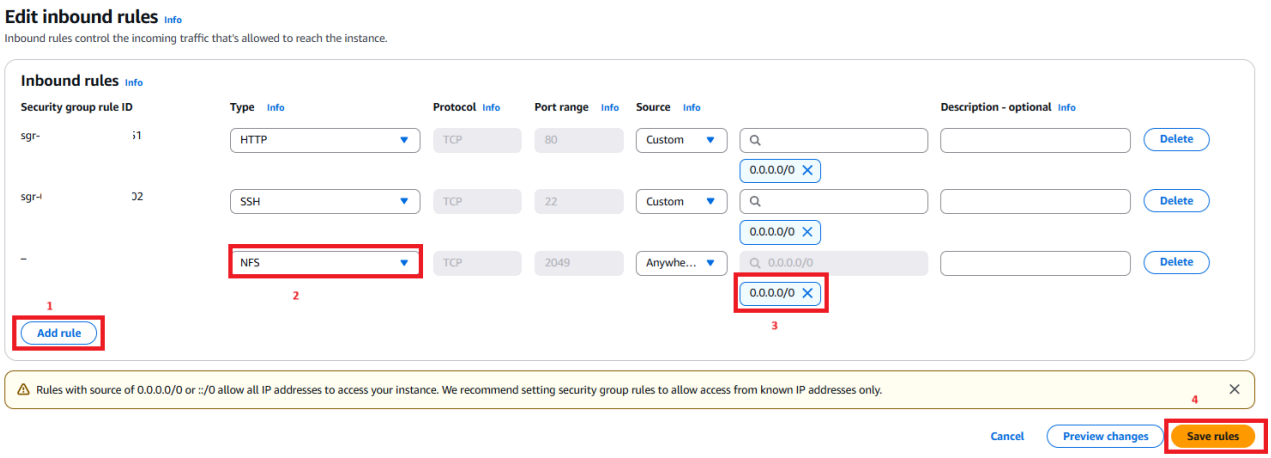


1.3. Configure the Security Groups

1. Navigate back to the **EC2** browser tab.
2. In the sidebar menu, select **Security Groups**.
3. Click the checkbox next to the **non-default security group** to show the security group details.
4. Select the ***Inbound rules*** tab and then click **Edit inbound rules** on the right.

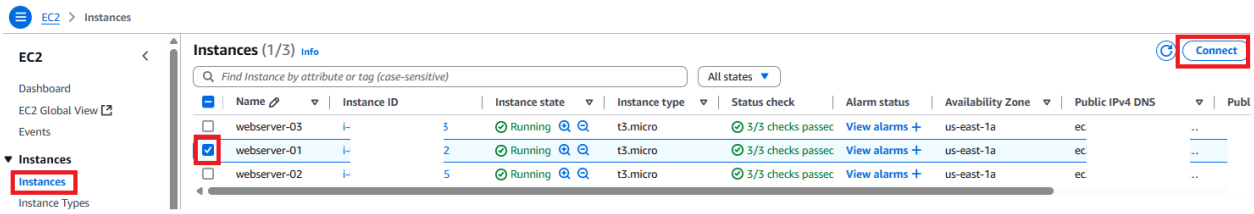


5. Click **Add rule** and configure the rule:
    a. **Type**: Use the dropdown to select **NFS**.
    b. **Source**: Use the text box to select **0.0.0.0/0**.
6. Click **Save rules**.

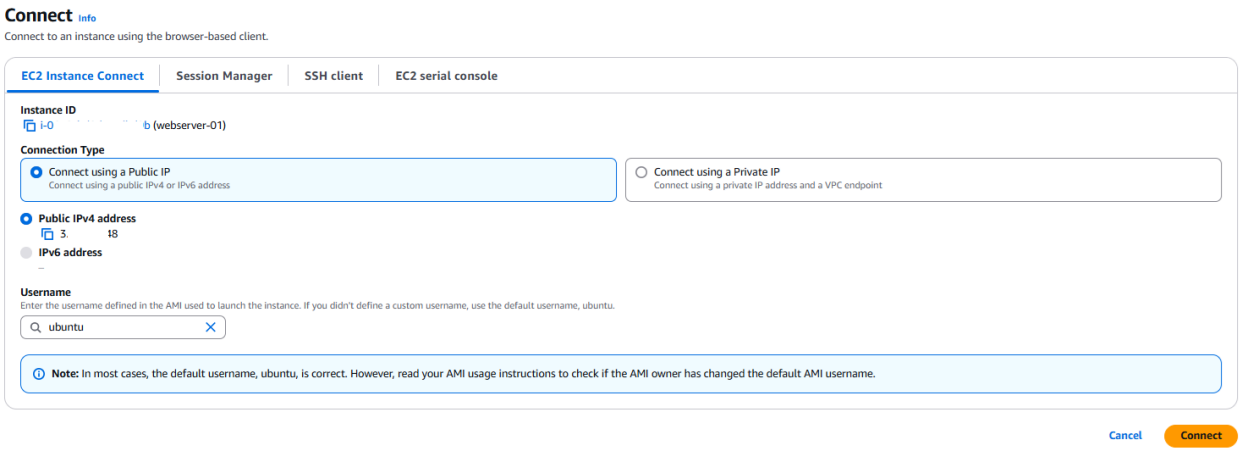


7. In the sidebar menu, select **EC2 Dashboard** and then select **Instances (running)**.

8. With ***webserver-01*** selected, click **Connect** along the top right.



9. Click **Connect**.



10. This should take you to a new terminal showing your EC2 instance in a new browser tab or window.

2. Mount the EFS File System and Test It

2.1. Mount the File System

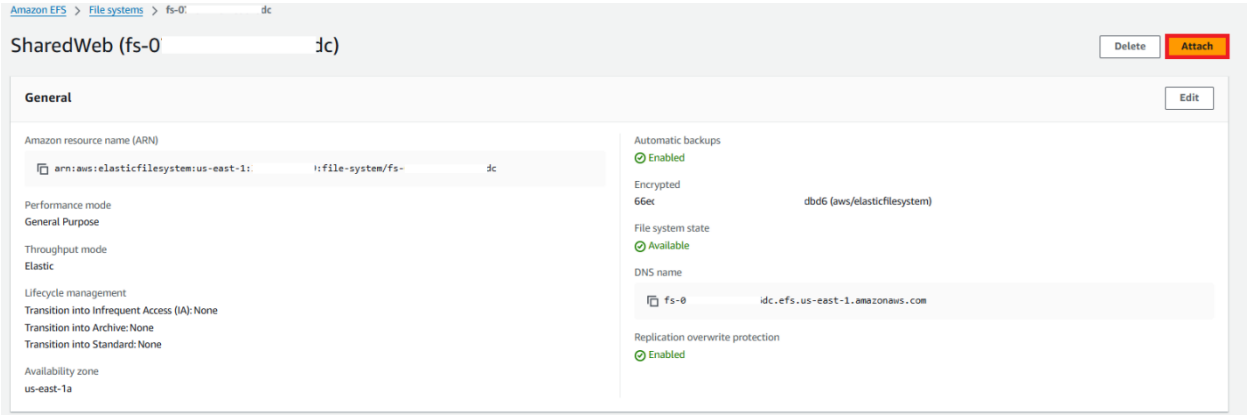
1. Click In the terminal, list your block devices: **lsblk**
2. View the data inside the 10 GiB disk mounted to **/data**: **ls /data**
3. You should see ***file.01-file.10*** listed.

```
ubuntu@ip-          :~$ lsblk
NAME         MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
loop0          7:0    0  24.4M  1 loop /snap/amazon-ssm-agent/6312
loop1          7:1    0  25.1M  1 loop /snap/amazon-ssm-agent/5656
loop2          7:2    0   104M  1 loop /snap/core/16928
loop3          7:3    0 104.2M  1 loop /snap/core/17200
loop4          7:4    0  55.4M  1 loop /snap/core18/2846
loop5          7:5    0 111.1M  1 loop /snap/lxd/33246
loop6          7:6    0  63.7M  1 loop /snap/core20/2434
loop8          7:8    0  73.9M  1 loop /snap/core22/1722
loop10         7:10   0 110.2M  1 loop /snap/lxd/31820
loop11         7:11   0  44.5M  1 loop /snap/snapd/23771
loop12         7:12   0  66.8M  1 loop /snap/core24/888
loop13         7:13   0  73.9M  1 loop /snap/core22/1908
loop14         7:14   0  55.4M  1 loop /snap/core18/2855
loop15         7:15   0  63.8M  1 loop /snap/core20/2501
nvme1n1      259:0    0    10G  0 disk /data
nvme0n1      259:1    0    20G  0 disk
└─nvme0n1p1  259:2    0    20G  0 part /
ubuntu@ip-          :~$ ls /data/
file.01  file.02  file.03  file.04  file.05  file.06  file.07  file.08  file.09  file.10
ubuntu@ip-          ~$
```

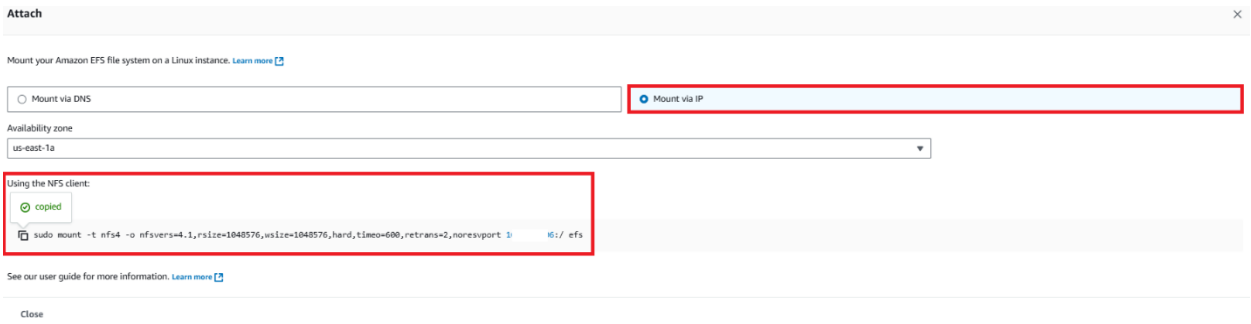
4. Create a directory (mount point) to attach your EFS volume: **sudo mkdir /efs**

```
ubuntu@ip-          :~$ sudo mkdir /efs
ubuntu@ip-          :~$
```

5. Navigate back to the **EFS** tab showing the SharedWeb file system details.
6. In the top right, click **Attach**.



7. In the dialog, select **Mount via IP**.
8. Copy the provided NFS command to your clipboard. We will do a tiny change.



9. Navigate back to the terminal and paste in the command.
10. Edit the mount point by changing **efs** to **/efs** in the command: **sudo mount -t nfs4 -o nfsvers=4.1,rsize=1048576,wsize=1048576,hard,timeo=600,retrans=2,noresvport [Your EFS Volume IP Here]:/ /efs**
11. Press **Enter** to run the command.

```
ubuntu@ip-          :~$ sudo mount -t nfs4 -o nfsvers=4.1,rsize=1048576,wsize=1048576,hard,timeo=600,retrans=2,noresvport 1          :/ /efs
ubuntu@ip-          :~$
```

2.2. Test the File System

1. View the newly mounted EFS volume: **ls /efs**
2. Nothing will be returned, but that shows that the EFS volume is mounted.

```
ubuntu@ip-          :~$ ls /efs
ubuntu@ip-          :~$
```

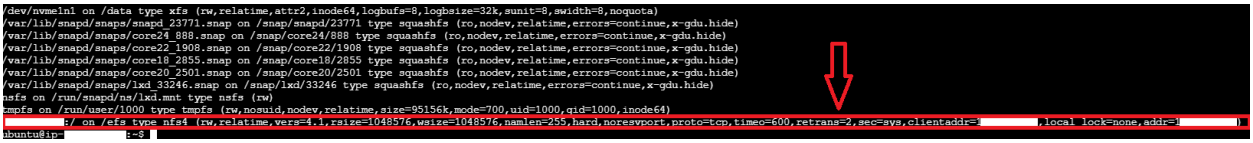
3. List the block devices again: **lsblk**
4. Your NFS mount is not yet listed.

```
ubuntu@ip-          :~$ lsblk
NAME         MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
loop0          7:0    0  24.4M  1 loop /snap/amazon-ssm-agent/6312
loop1          7:1    0  25.1M  1 loop /snap/amazon-ssm-agent/5656
loop2          7:2    0   104M  1 loop /snap/core/16928
loop3          7:3    0 104.2M  1 loop /snap/core/17200
loop4          7:4    0  55.4M  1 loop /snap/core18/2846
loop5          7:5    0 111.1M  1 loop /snap/lxd/33246
loop6          7:6    0  63.7M  1 loop /snap/core20/2434
loop8          7:8    0  73.9M  1 loop /snap/core22/1722
loop10         7:10   0 110.2M  1 loop /snap/lxd/31820
loop11         7:11   0  44.5M  1 loop /snap/snapd/23771
loop12         7:12   0  66.8M  1 loop /snap/core24/888
loop13         7:13   0  73.9M  1 loop /snap/core22/1908
loop14         7:14   0  55.4M  1 loop /snap/core18/2855
loop15         7:15   0  63.8M  1 loop /snap/core20/2501
nvme1n1      259:0    0    10G  0 disk /data
nvme0n1      259:1    0    20G  0 disk
└─nvme0n1p1  259:2    0    20G  0 part /
ubuntu@ip-          ~$
```

5. View the mounts: **mount**

```
ubuntu@ip-          :~$ mount
```

6. Toward the bottom, you should see that your NFS share is mounted on **/efs**.



7. View file system mounts: **df -h**

8. Again, you should see that your NFS share is mounted on /**efs**.

```
ubuntu@ip-          :~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        20G  4.0G   16G  21% /
devtmpfs        457M     0  457M   0% /dev
tmpfs           465M     0  465M   0% /dev/shm
tmpfs            93M  892K   93M   1% /run
tmpfs           5.0M     0  5.0M   0% /run/lock
tmpfs           465M     0  465M   0% /sys/fs/cgroup
/dev/loop1       26M   26M     0 100% /snap/amazon-ssm-agent/5656
/dev/loop0       25M   25M     0 100% /snap/amazon-ssm-agent/6312
/dev/loop2      104M  104M     0 100% /snap/core/16928
/dev/loop3      105M  105M     0 100% /snap/core/17200
/dev/loop8       74M   74M     0 100% /snap/core22/1722
/dev/loop4       56M   56M     0 100% /snap/core18/2846
/dev/loop6       64M   64M     0 100% /snap/core20/2434
/dev/loop10     111M  111M     0 100% /snap/lxd/31820
/dev/nvme1n1     10G  105M  9.9G   2% /data
/dev/loop11      45M   45M     0 100% /snap/snapd/23771
/dev/loop12      67M   67M     0 100% /snap/core24/888
/dev/loop13      74M   74M     0 100% /snap/core22/1908
/dev/loop14      56M   56M     0 100% /snap/core18/2855
/dev/loop15      64M   64M     0 100% /snap/core20/2501
/dev/loop5      112M  112M     0 100% /snap/lxd/33246
tmpfs            93M     0   93M   0% /run/user/1000
          :/    8.0E     0  8.0E   0% /efs
ubuntu@ip-          :~$
```

9. Move all files from **/data** to the **/efs** file system (-r = recursive, -a = to retain permissions, -v = verbose): **sudo rsync -rav /data/* /efs**

10. View the files now in the **/efs** file system: **ls /efs**

11. This time, a list should be returned.

```
ubuntu@ip-          :~$ sudo rsync -rav /data/* /efs
sending incremental file list
file.01
file.02
file.03
file.04
file.05
file.06
file.07
file.08
file.09
file.10

sent 46,659 bytes  received 206 bytes  93,730.00 bytes/sec
total size is 46,080  speedup is 0.98
ubuntu@ip-          :~$ ls /efs
file.01  file.02  file.03  file.04  file.05  file.06  file.07  file.08  file.09  file.10
ubuntu@ip-          :~$
```

The files were copied from /data to /efs

3. Remove Old Data

3.1. Remove Data from **webserver-01**

1. Unmount the partition: **sudo umount /data**

```
ubuntu@ip-
ubuntu@ip-
:~$ sudo umount /data
:~$
```

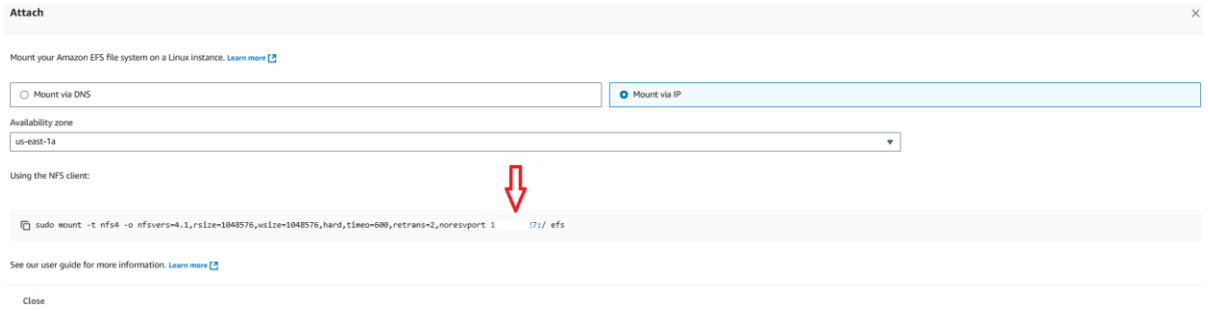
2. Now we need to edit our fstab so that the system doesn't try to mount this file system on reboot. Open the **/etc/fstab** file in an editor: **sudo vi /etc/fstab**

```
ubuntu@ip-
:~$ sudo vi /etc/fstab
```

3. Press "i" for INSERT.
4. Remove the line starting with **UUID**.

```
LABEL=cloudimg-rootfs   /        ext4   defaults,discard        0 0
UUID="0a22ebd9                   e0fa2a4" /data xfs defaults,nofail 0 2
```

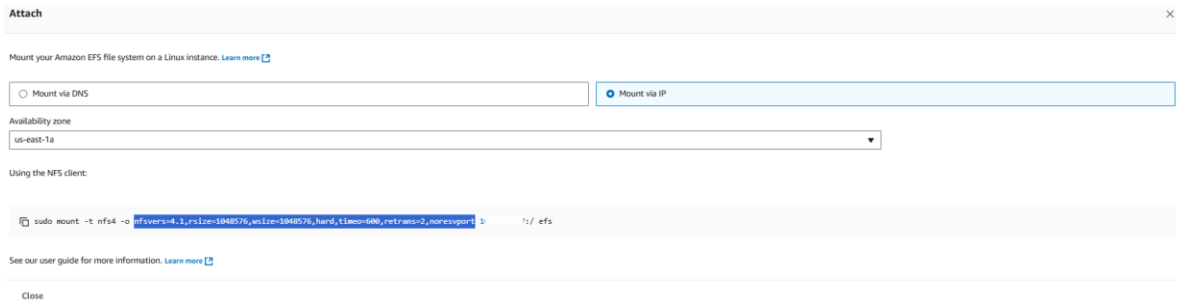
5. Build a new mount point:
    a. Navigate back to the **EFS** tab and ensure the **Attach** dialog is still open from the previous objective.
    b. Copy the IP address listed in the provided command.



    c. Navigate back to the terminal and paste your copied IP address and append **:/**.
    d. Press **Tab** twice so your cursor aligns with the **/** on the first line, and then add **/data**.
    e. Press **Tab** and then **Space** once so your cursor aligns with **ext4** on the first line, and then add **nfs4**.

```
LABEL=cloudimg-rootfs   /        ext4   defaults,discard        0 0
                 7:/            /data    nfs4
```

    f. Navigate back to the **EFS** tab and copy the options from the command (starting with ***nfsvers*** and ending with ***noresvport***).



g. Navigate back to the terminal and paste your copied options so they align with ***defaults, discard*** on the first line.

h. Press **Tab** and then add **0 0** to the end of your mount point entry.

i. Your mount point should now look like this:

j. <EFS MOUNT IP>:/ /data nfs4 <OPTIONS> 0 0

```
LABEL=cloudimg-rootfs   /        ext4   defaults,discard        0 0
[redacted]:/            /data    nfs4   nfsvers=4.1,rsize=1048576,wsize=1048576,hard,timeo=600,retrans=2,noresvport 0 0
```

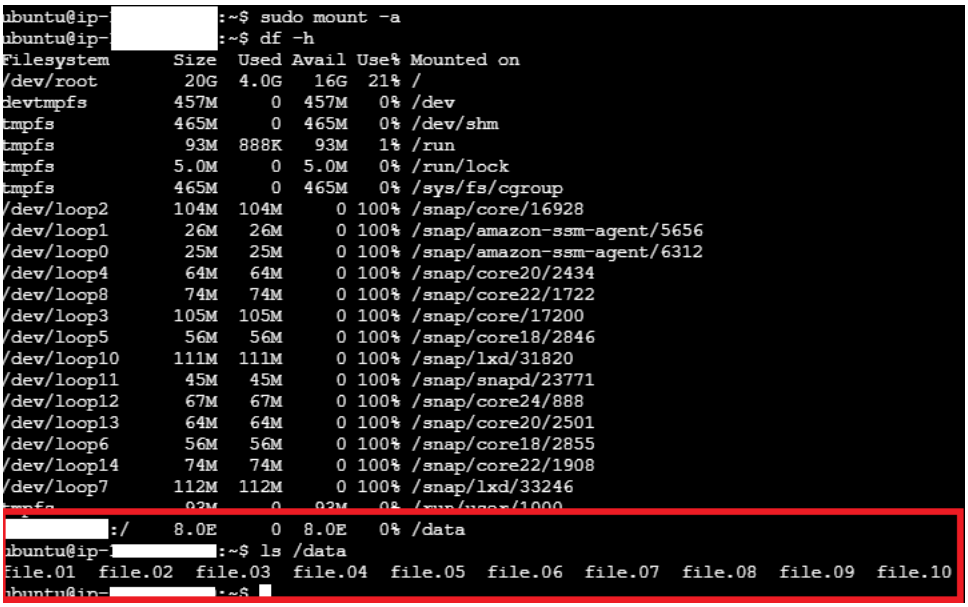
6. Press "**esc**" and "**:wq**" to save your changes.
7. Unmount the **/efs** to confirm your edits were successful: **sudo umount /efs**

   Note: If you receive an error message, wait about a minute and then run the command again.
8. View the file systems: **df -h**
9. You should see that you don't have **/data** or **/efs** mounted.

```
ubuntu@ip-[redacted]:~$ sudo umount /efs
ubuntu@ip-[redacted]:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        20G  4.0G   16G  21% /
devtmpfs        457M     0  457M   0% /dev
tmpfs           465M     0  465M   0% /dev/shm
tmpfs            93M  888K   93M   1% /run
tmpfs           5.0M     0  5.0M   0% /run/lock
tmpfs           465M     0  465M   0% /sys/fs/cgroup
/dev/loop2      104M  104M     0 100% /snap/core/16928
/dev/loop1       26M   26M     0 100% /snap/amazon-ssm-agent/5656
/dev/loop0       25M   25M     0 100% /snap/amazon-ssm-agent/6312
/dev/loop4       64M   64M     0 100% /snap/core20/2434
/dev/loop8       74M   74M     0 100% /snap/core22/1722
/dev/loop3      105M  105M     0 100% /snap/core/17200
/dev/loop5       56M   56M     0 100% /snap/core18/2846
/dev/loop10     111M  111M     0 100% /snap/lxd/31820
/dev/loop11      45M   45M     0 100% /snap/snapd/23771
/dev/loop12      67M   67M     0 100% /snap/core24/888
/dev/loop13      64M   64M     0 100% /snap/core20/2501
/dev/loop6       56M   56M     0 100% /snap/core18/2855
/dev/loop14      74M   74M     0 100% /snap/core22/1908
/dev/loop7      112M  112M     0 100% /snap/lxd/33246
tmpfs            93M     0   93M   0% /run/user/1000
ubuntu@ip-[redacted]:~$
```

10. Try and mount everything that is not already mounted: **sudo mount -a**
11. View the file systems again and check if <EFS MOUNT IP>:/ is mounted: **df -h**
12. You should see the NFS share is now mounted on **/data**.

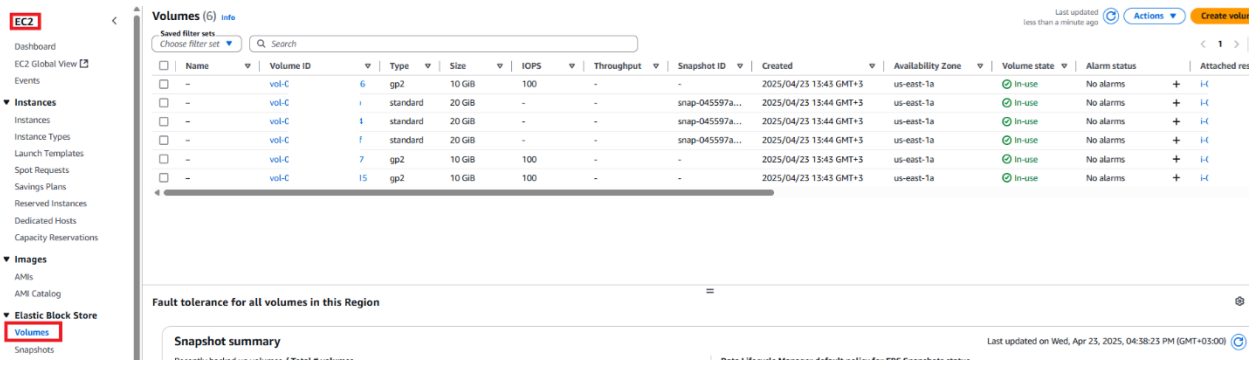
13. View the contents of /data: **ls /data**
14. You should see ***file.01-file.10*** listed.



Now that we don't need our 10 GiB volume on this server anymore, let's delete that EBS volume on EC2 (because it will use the EFS share).

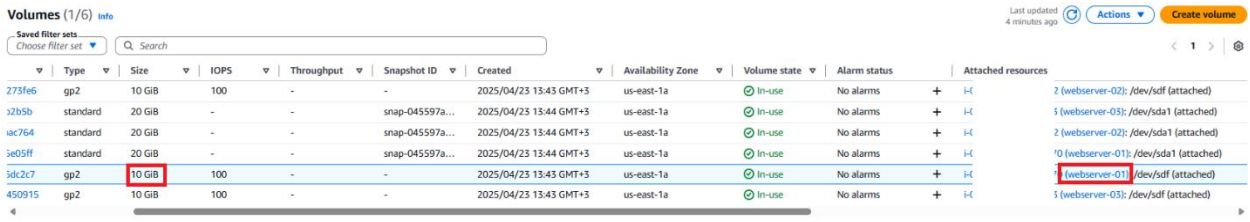
3.2. Remove the EBS Volume Attached to **webserver-01**

1. Navigate back to **EC2** tab showing the **Connect** to instance page.
2. Use the breadcrumb along the top of the page to select **EC2**.
3. In the **Resources** section of the main pane, click **Volumes**.

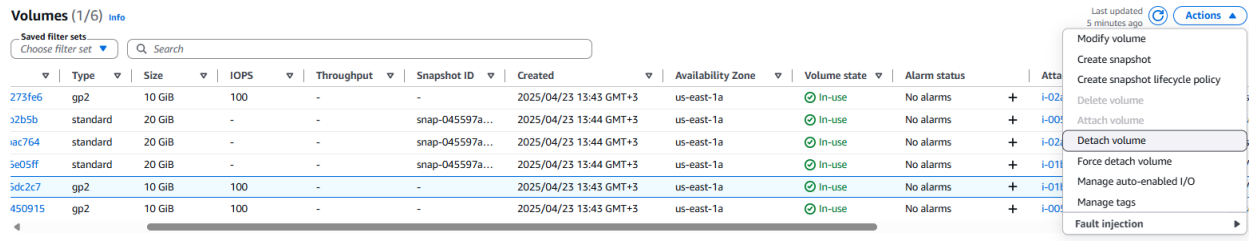


4. Scroll to the right and expand the **Attached resources** column to find the 10 GiB volume attached to ***webserver-01***.

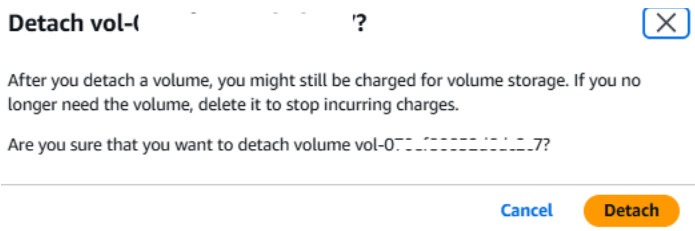
5. Click the checkbox next to the 10 GiB volume attached to ***webserver-01***.



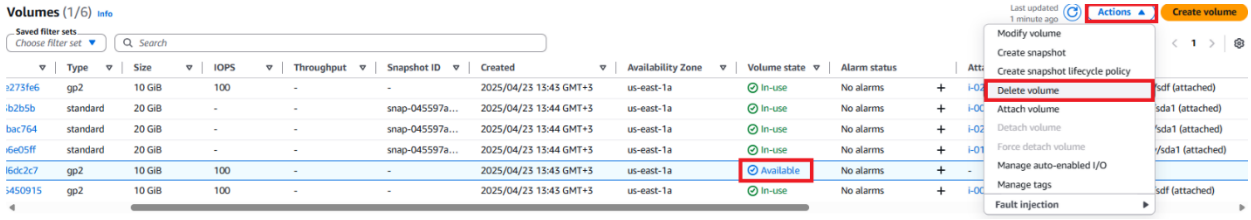
6. In the top right, use the **Actions** dropdown to select **Detach volume**.



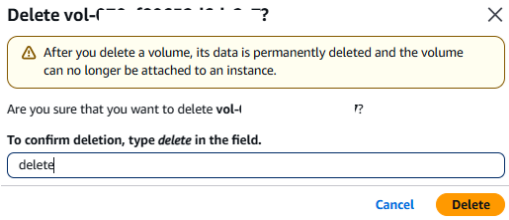
7. Click **Detach** to confirm your choice.



8. When the volume is detached, it will show as **Available**. You may need to refresh the page.
9. After the volume is detached, click the checkbox next to the same volume again.
10. In the top right, use the **Actions** dropdown to select **Delete volume**.

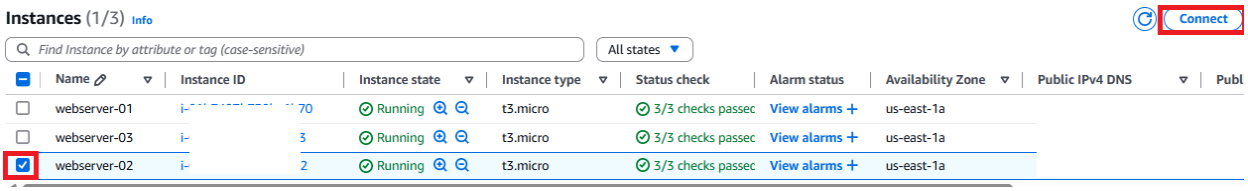


11. Click **Delete** to confirm your choice.

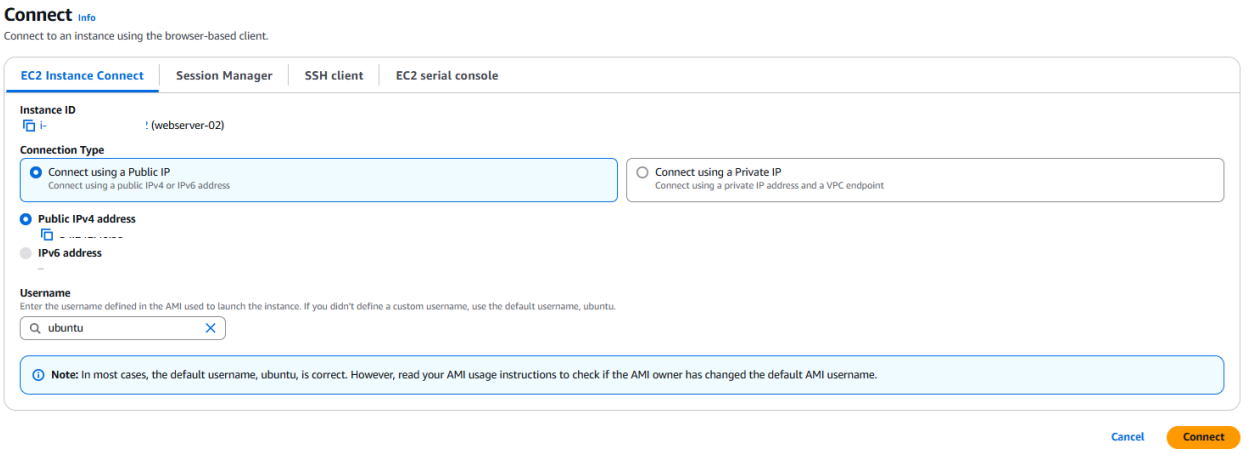


3.3. Remove Data from **webserver-02** and **webserver-03**

1. In the **EC2** sidebar menu, select **Instances**.
2. Click the checkbox next to ***webserver-02***.
3. Along the top of the page, click **Connect**.



4. Click **Connect**.



This should launch a terminal in a new browser window or tab.

5. Navigate to the ***webserver-01*** terminal and view the contents of **/etc/fstab**: **cat /etc/fstab**
6. Copy the mount point on the second line (starting with an IP) to your clipboard:

<EFS MOUNT IP>:/ /data nfs4 <OPTIONS> 0 0

```
ubuntu@ip-          :~$ cat /etc/fstab
LABEL=cloudimg-rootfs   /        ext4   defaults,discard        0 0
          :/            /data    nfs4   nfsvers=4.1,rsize=1048576,wsize=1048576,hard,timeo=600,retrans=2,noresvport 0 0
ubuntu@ip-          :~$
```

7. Navigate back to the terminal you launched for ***webserver-02***.
8. Unmount the **/data** partition: **sudo umount /data**
9. Open the **/etc/fstab** file in an editor: **sudo vi /etc/fstab**

```
ubuntu@ip-          :~$ sudo umount /data
ubuntu@ip-          :~$ sudo vi /etc/fstab
```

10. Edit **/etc/fstab**:
    a. Press “i” for INSERT.

b. Remove the line starting with **UUID** like we did in ***webserver-01***.

c. Paste in the line from your clipboard and reformat it so it aligns with the line above (it should look the same as in ***webserver-01***, so keep the same IP).

d. Press "**esc**" and "**:wq**" to save your changes.

```
LABEL=cloudimg-rootfs   /        ext4   defaults,discard        0 0
[redacted]:/            /data    nfs4   nfsvers=4.1,rsize=1048576,wsize=1048576,hard,timeo=600,retrans=2,noresvport 0 0
```

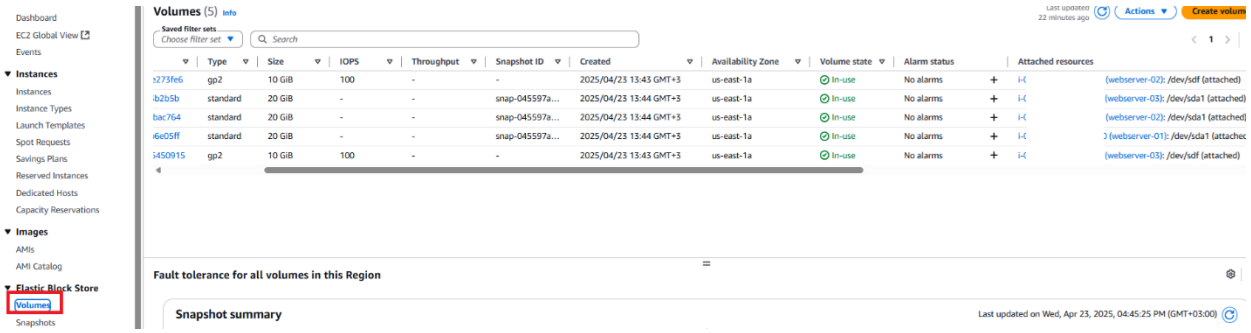
11. Mount the partition: **sudo mount -a**
12. View the file systems: **df -h**
13. View the contents of **/data**: **ls /data**
14. You should see ***file.01*** through ***file.10***, indicating you are using the shared EFS volume.

```
ubuntu@ip-[redacted]:~$ sudo mount -a
ubuntu@ip-[redacted]:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        20G  4.0G   16G  21% /
devtmpfs        457M     0  457M   0% /dev
tmpfs           465M     0  465M   0% /dev/shm
tmpfs            93M  892K   93M   1% /run
tmpfs           5.0M     0  5.0M   0% /run/lock
tmpfs           465M     0  465M   0% /sys/fs/cgroup
/dev/loop0       26M   26M     0 100% /snap/amazon-ssm-agent/5656
/dev/loop1       25M   25M     0 100% /snap/amazon-ssm-agent/6312
/dev/loop8       74M   74M     0 100% /snap/core22/1722
/dev/loop2      104M  104M     0 100% /snap/core/16928
/dev/loop7       64M   64M     0 100% /snap/core20/2434
/dev/loop3      105M  105M     0 100% /snap/core/17200
/dev/loop5       56M   56M     0 100% /snap/core18/2846
/dev/loop10     111M  111M     0 100% /snap/lxd/31820
/dev/loop11      45M   45M     0 100% /snap/snapd/23771
/dev/loop12      67M   67M     0 100% /snap/core24/888
/dev/loop13      74M   74M     0 100% /snap/core22/1908
/dev/loop14      56M   56M     0 100% /snap/core18/2855
/dev/loop15      64M   64M     0 100% /snap/core20/2501
/dev/loop4      112M  112M     0 100% /snap/lxd/33246
tmpfs            93M     0   93M   0% /run/user/1000
[redacted]:/    8.0E     0  8.0E   0% /data
ubuntu@ip-[redacted]:~$ ls /data/
file.01  file.02  file.03  file.04  file.05  file.06  file.07  file.08  file.09  file.10
ubuntu@ip-[redacted]:~$
```

15. Repeat this entire process for ***webserver-03***.

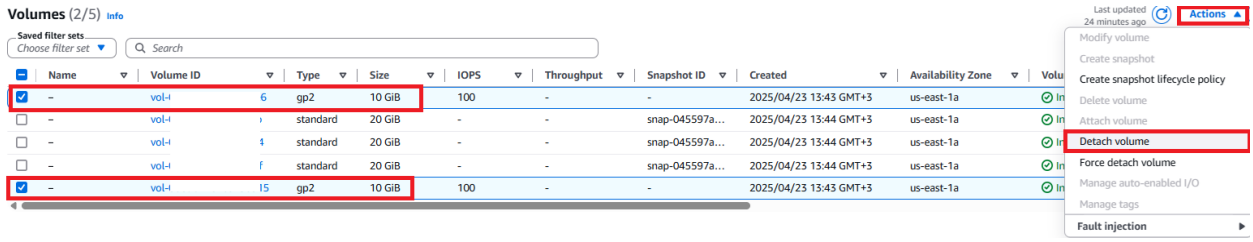
3.4. Remove EBS Volumes Attached to EC2

1. Navigate back to the **EC2** tab showing the **Connect to instance** page.
2. Use the breadcrumb along the top of the page to select **EC2**.
3. In the **Resources** section, select **Volumes**.

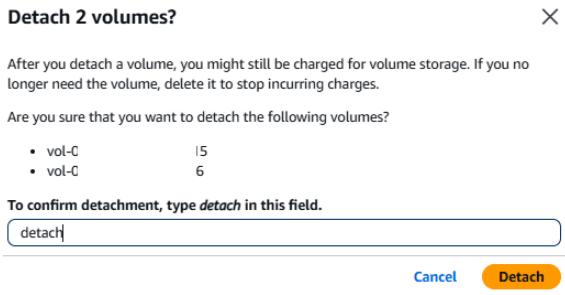


4. Check the checkboxes for both of the **10 GiB** volumes.

5. Use the **Actions** dropdown to select **Detach volume**.

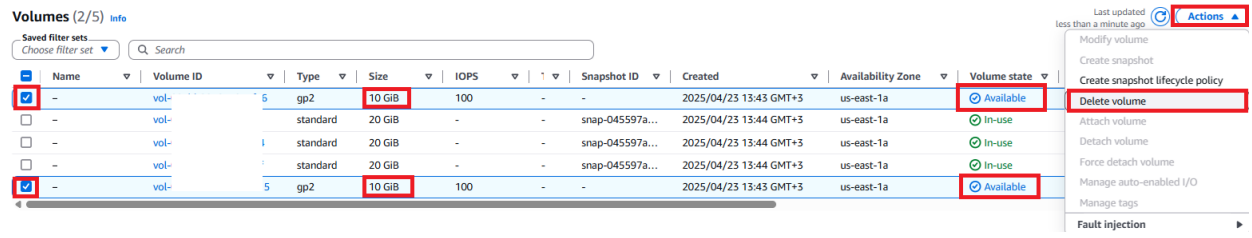


6. Type ***detach*** into the text box to confirm your choice, and then click **Detach**.

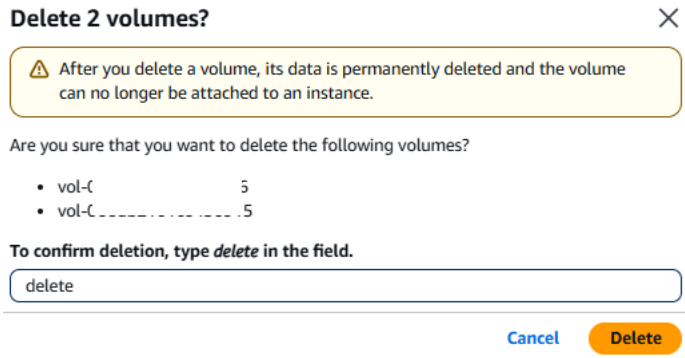


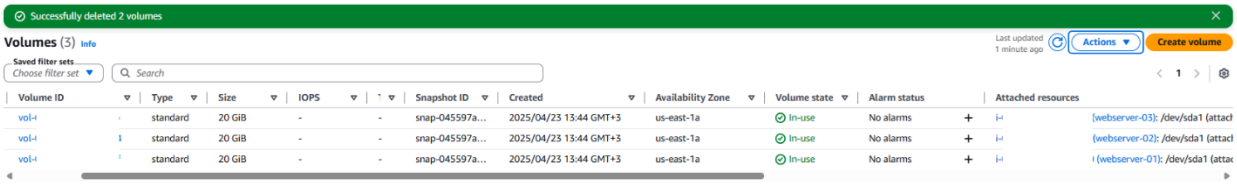
7. After both volumes are detached (volume state: Available), select them again using the checkboxes.

8. Use the **Actions** dropdown to select **Delete volume**.



9. Type ***delete*** into the text box to confirm your choice, and then click **Delete**.





We have successfully converted our 3 servers to use a shared EFS volume and deleted the 10 GiB storage volumes that were attached to those servers. This is a great cost-saving measure.