How to Create CIS-Compliant Partitions on AWS

If you use CIS (Center for Internet Security) ruleset in your security scans, you may need to create a partitioning scheme in your AMI that matches the recommended CIS rules. On AWS this becomes slightly harder if you use block storage (EBS). In this guide I'll show how to create a partitioning scheme that complies with CIS rules.

Prerequisites:

- AWS account
- CentOS 7 operating system

CIS Partition Rules

On CentOS 7, there are several rules for partitions which both logically separate webserver-related files from things like logs, and limit execution of files (like scripts, or git clones, for example) in directories accessible by anyone (such as /tmp, /dev/shm, and /var/tmp).

The rules are as follows:

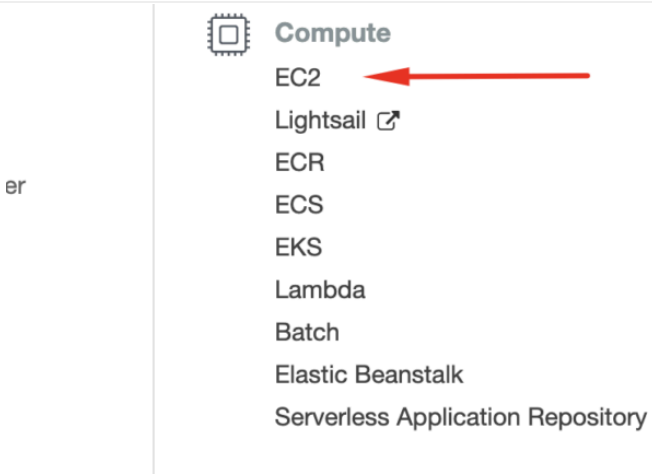
- 1.1.6 Ensure separate partition exists for /var
- 1.1.7 Ensure separate partition exists for /var/tmp
- 1.1.8 Ensure nodev option set on /var/tmp partition
- 1.1.9 Ensure nosuid option set on /var/tmp partition
- 1.1.10 Ensure noexec option set on /var/tmp
- 1.1.11 Ensure separate partition exists for /var/log
- 1.1.12 Ensure separate partition exists for /var/log/audit
- 1.1.13 Ensure separate partition exists for /home
- 1.1.14 Ensure nodev option set on /home partition
- 1.1.15 Ensure nodev option set on /dev/shm partition
- 1.1.16 Ensure nosuid option set on /dev/shm partition
- 1.1.17 Ensure noexec option set on /dev/shm partition

Below I'll explain how to create a partition scheme that works for all the above rules.

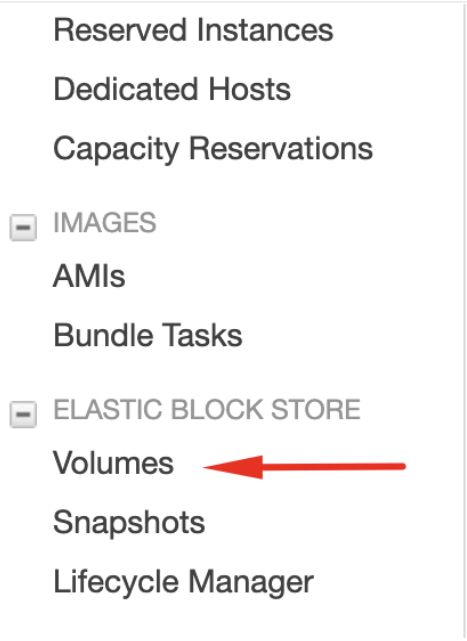
Build your server

Start by building a server from your standard CentOS 7 AMI (Amazon Machine Image – if you don't have one yet, there are some available on the Amazon Marketplace).

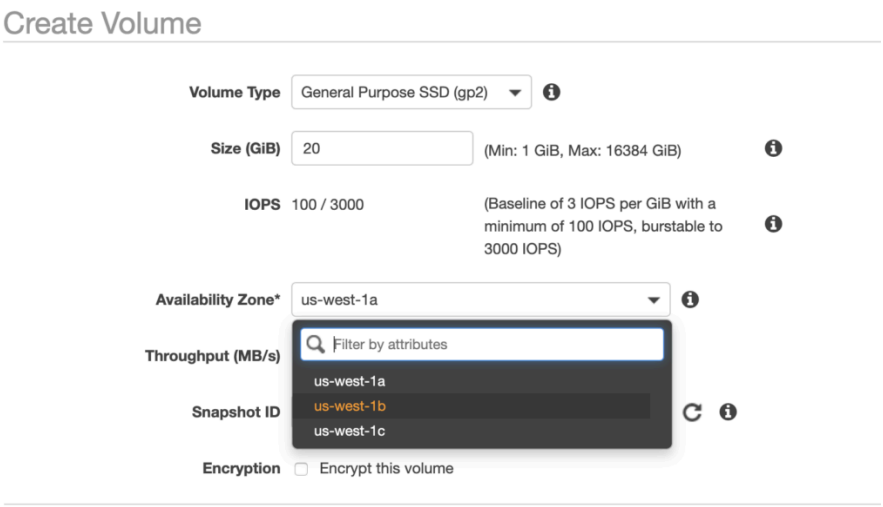
Sign in to your Amazon AWS dashboard and select EC2 from the *Services* menu.



In your EC2 (Elastic Compute Cloud dashboard), select the "Launch Instance" menu and go through the steps to launch a server with your CentOS 7 AMI. For ease of use I recommend using a t2-sized instance. While your server is launching, navigate to the "Volumes" section under the *Elastic Block Store* section:



Click “Create Volume” and create a basic volume in the same Availability Zone as your server.



After the volume is created, select it in the list of EBS volumes and select “Attach volume” from the dropdown menu. Select your newly-created instance from the list, and **make sure the volume is added as *dev/sdf*.** *

*This is important – if you were to select "/dev/sda1" instead, it would try to attach as the boot volume, and we already have one of those attached to the instance. Also note, these will not be the names of the /dev/ devices on the server itself, but we'll get to that later.

Partitioning

Now that your server is built, login via SSH and use `sudo -i` to escalate to the root user. Now let's check which storage block devices are available:

```
# lsblk
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOIN
 xvda      259:0    0   20G  0 disk
 └─xvda1 259:1    0   20G  0 part /
 xvdf      259:2    0   20G  0 disk
```

If you chose t2 instance sizes in AWS, you likely have devices "xvda" and "xvdf," where "xvdf" is the volume we manually added to the instance. If you chose t3 instances you'll likely see device names like `nvme0n1` instead. These devices are listed under `dev` on your instance, for reference.

Now we'll partition the volume we added using **parted.**

```
Sector size (logical/physical): 512B/512B
Partition Table: gpt
Disk Flags:

Number  Start  End  Size  File system  Name  F

(parted) mklabel gpt
(parted) mkpart vartmp ext4 2MB 5%
(parted) mkpart swap linux-swap 5% 10%
(parted) mkpart home ext4 10% 15%
(parted) mkpart usr ext4 15% 45%
(parted) mkpart varlogaudit ext4 45% 55%
(parted) mkpart varlog ext4 55% 65%
(parted) mkpart var ext4 65% 100%
(parted) unit GiB
(parted) p
Model: Xen Virtual Block Device (xvd)
Disk /dev/xvdf: 18.0GiB
Sector size (logical/physical): 512B/512B
Partition Table: gpt
Disk Flags:

Number  Start    End      Size     File system
  1      0.00GiB  1.00GiB  1.00GiB  ext4
  2      1.00GiB  2.00GiB  1.00GiB  linux-swap
  3      2.00GiB  4.00GiB  2.00GiB  ext4
  4      4.00GiB  9.00GiB  5.00GiB  ext4
  5      9.00GiB  11.0GiB  2.00GiB  ext4
  6      11.0GiB  12.4GiB  1.40GiB  ext4
```

```
(parted) align-check optimal 2
2 aligned
(parted) align-check optimal 3
3 aligned
(parted) align-check optimal 4
4 aligned
(parted) align-check optimal 5
5 aligned
(parted) align-check optimal 6
6 aligned
(parted) align-check optimal 7
7 aligned
(parted) quit
Information: You may need to update /etc/fstab
```

Now when you run `lsblk` you'll see the 7 partitions we created:

```
# lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
xvda    202:0    0   20G  0 disk
└─xvda1 202:1    0   20G  0 part /
xvdf    202:80   0   18G  0 disk
├─xvdf1 202:81   0  3.6G  0 part
├─xvdf2 202:82   0  922M  0 part
├─xvdf3 202:83   0  922M  0 part
├─xvdf4 202:84   0  4.5G  0 part
├─xvdf5 202:85   0  921M  0 part
```

After you've run through the steps above, you'll have created the partitions, but now we need to mount them and copy the correct directories to the proper places.

First, let's make the partitions filesystems using `mkfs`. We'll need to do this for every partition *except the one for swap!* Note that we're leaving out partition ID 2 in our loop below, which was the swap partition. After creating the filesystems, we'll use `mkswap` to format our swap partition. Note also that you may need to change the "xvdf" parts to match the name of your secondary filesystem if it's not xvdf.

```
# for I in 1 3 4 5 6 7; do mkfs.ext4 /dev/xvdf
# mkswap /dev/xvdf2
```

Next, we'll mount each filesystem. Start by creating directories (to which we will sync files from their respective places in existing the filesystem). Again, if your filesystem is not "xvdf" please update the commands accordingly before running.

```
# mkdir -p /mnt/vartmp /mnt/home /mnt/usr /mnt
# mount /dev/xvdf1 /mnt/vartmp
# mount /dev/xvdf3 /mnt/home
# mount /dev/xvdf4 /mnt/usr
# mount /dev/xvdf5 /mnt/varlogaudit
# mount /dev/xvdf6 /mnt/varlog
# mount /dev/xvdf7 /mnt/var
```

have to exclude the separated directories from the sync and create them as empty folders with the default 755 directory permissions.

```
# rsync -av /var/tmp/ /mnt/vartmp/
# rsync -av /home/ /mnt/home/
# rsync -av /usr/ /mnt/usr/
# rsync -av /var/log/audit/ /mnt/varlogaudit/
# rsync -av --exclude=audit /var/log/ /mnt/var
# rsync -av --exclude=log --exclude=tmp /var/
# mkdir /mnt/var/log
# mkdir /mnt/var/tmp
# mkdir /mnt/var/log/audit
# mkdir /mnt/varlog/audit
# chmod 755 /mnt/var/log
# chmod 755 /mnt/var/tmp
# chmod 755 /mnt/var/log/audit
# chmod 755 /mnt/varlog/audit
```

Last, to create the `/tmp` partition in the proper way, we need to take some additional steps:

```
# systemctl unmask tmp.mount
# systemctl enable tmp.mount
# vi /etc/systemd/system/local-fs.target.wants
```

Inside the `/etc/systemd/system/local-fs.target.wants/tmp.mount` file, edit the /tmp mount to the following options:


```
Options=mode=1777,strictatime,noexec,nodev,nos
```

Now that the files are in the proper mounted directories, we can edit the `/etc/fstab` file to tell the server where to mount the files upon reboot. To do this, first, we'll need to get the **UUID**s of the partitions we've created:

```
# blkid
/dev/xvda1: UUID="f41e390f-835b-4223-a9bb-9b45
/dev/xvdf2: UUID="238e1e7d-f843-4dbd-b738-8898
/dev/xvdf3: UUID="ac9d140e-0117-4e3c-b5ea-53bb
/dev/xvdf4: UUID="a16400bd-32d4-4f90-b736-e36c
/dev/xvdf6: UUID="a29905e6-2311-4038-b6fa-d1a8
/dev/xvdf7: UUID="ac026296-4ad9-4632-8319-6406
```

In your `/etc/fstab` file, enter (something like) the following, replacing the UUIDs in this example with the ones in your `blkid` output.

Be sure to scroll all the way over to see the full contents of the snippet belov

```
#
# /etc/fstab
# Created by anaconda on Mon Jan 28 20:51:49 2
#
# Accessible filesystems, by reference, are ma
# See man pages fstab(5), findfs(8), mount(8)
#

UUID=f41e390f-835b-4223-a9bb-9b45984ddf8d /
```

```
UUID=ac026296-4ad9-4632-8319-6406b20f02cd /var
UUID=238e1e7d-f843-4dbd-b738-8898d6cbb90d swap
UUID=dbf88dd8-32b2-4cc6-aed5-aff27041b5f0 /var
tmpfs                                     /dev
tmpfs                                     /tmp
```

If you were to type `df -h` at this moment, you'd likely have output like the following, since we mounted the /mnt folders:

```
# df -h
Filesystem      Size  Used Avail Use% Mounted
/dev/xvda1       20G  2.4G   18G  12% /
devtmpfs        1.9G     0  1.9G   0% /dev
tmpfs           1.9G     0  1.9G   0% /dev/shm
tmpfs           1.9G   17M  1.9G   1% /run
tmpfs           1.9G     0  1.9G   0% /sys/fs/
tmpfs           379M     0  379M   0% /run/use
/dev/xvdf1      3.5G   15M  3.3G   1% /mnt/var
/dev/xvdf3      892M   81M  750M  10% /mnt/hom
/dev/xvdf4      4.4G  1.7G  2.5G  41% /mnt/usr
/dev/xvdf5      891M  3.5M  826M   1% /mnt/var
/dev/xvdf6      1.8G   30M  1.7G   2% /mnt/var
/dev/xvdf7      5.2G  407M  4.6G   9% /mnt/var
```

But, after a reboot, we'll see those folders mounted as /var, /var/tmp, /var/log, and so on. One more important thing: If you are using *selinux*, you will need to restore the default

Wait a few minutes, and then SSH in to your instance once more. Post-reboot, you should see your folders mounted like the following:

```
# df -h
Filesystem      Size  Used Avail Use% Mounted
 devtmpfs        1.9G  4.0K  1.9G   1% /dev
 tmpfs           1.9G     0  1.9G   0% /dev/sh
 tmpfs           1.9G   25M  1.9G   2% /run
 tmpfs           1.9G     0  1.9G   0% /sys/fs
 /dev/xvda1   20G  5.7G   15G  29% /
 /dev/xvdf4  4.8G  2.6G  2.0G  57% /usr
 /dev/xvdf7  7.4G  577M  6.4G   9% /var
 /dev/xvdf3  2.0G  946M  889M  52% /home
 /dev/xvdf1  991M  2.6M  922M   1% /var/tmp
 /dev/xvdf6  1.4G  211M  1.1G  17% /var/log
 /dev/xvdf5  2.0G  536M  1.3G  30% /var/log/au
 tmpfs           256M  300K  256M   1% /tmp
 tmpfs           389M     0  389M   0% /run/us
 tmpfs           389M     0  389M   0% /run/us
```

Voila! You've successfully created partitions that are compliant with CIS rules. From here you can select your instance in the EC2 dashboard, click "Actions" > "Stop," and then "Actions" > "Image" > "Create Image" to create your new AMI using these partitions for use going forward!

Please note, I've done my best to include information for other situations, but these instructions may not apply to

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Comments

Dex says
October 17, 2019 at 9:23 am

Thank you for taking the time to put this together. I followed your steps and everything worked perfectly. Awesome content!

Reply

Disinformer says
October 24, 2019 at 2:09 pm

Awesome article! This worked great for me. It's really important to point out that the order in the fstab file is not the same as the order on the blkid command. Just keep an eye on which UUID is with what label or else you'll have a problem! Keep up the good work!

Great article !!

I tried to follow all steps it's looking good but unfortunately I cannot access my test EC2 instance after reboot 😕

please you advice about How to restore the default file and directory contexts when using selinux?

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