Time to complete this assignment: 12 hours.

Task 1: Create a Single Linux LVM Partition on Each New Drive (/dev/sdb, /dev/sdc, /dev/sdd, and /dev/sde)

```
fdisk /dev/sdb
fdisk /dev/sdc
fdisk /dev/sdd
fdisk /dev/sde
```

After creating partitions, marked these partitions as Linux LVM by changing the partition type to '8e' using t in fdisk. Wrote the changes and exit from fdisk.

Task 2: Create a Software RAID Array

Used the mdadm command to create a RAID array from the partitions I chose to create a RAID 5 array (*striping with parity*) using the partitions sdb1, sdc1, sdd1, and sde1.

```
mdadm --create /dev/md0 --level=5 --raid-devices=4 /dev/sdb /dev/sdc /dev/sdd
/dev/sde
```

Reasoning: RAID 5 was selected for this application due to several key reasons. RAID 0 was not considered as it lacks fault tolerance, and the priority was to ensure data integrity. RAID 1 was not chosen because it effectively duplicates data, requiring a 100% overhead in storage capacity, which was deemed inefficient for the available drives. RAID 2, 3, and 4 were not selected as they are less common and not as well-suited for general-purpose data storage as RAID 5. RAID 6, while offering a higher level of fault tolerance with dual parity, was not chosen due to slightly reduced write performance and increased storage space usage compared to RAID 5. Further, RAID 6 would be an overkill for the goal. Given the goals of this, a balanced approach that combines fault tolerance, efficient storage use, and write performance led to the selection of RAID 5 as the most practical and well-reasoned choice.

Checked the status of RAID array

```
cat /proc/mdstat
```

Made the RAID array persistent

```
mdadm --detail --scan > /etc/mdadm.conf
```

Task 3: Create a Volume Group

Created a volume group named ‘savg’ using the vgcreate command using the RAID array md0.

```
vgcreate savg /dev/md0
```

Task 4: Create a Logical Volume /tmp (1GB in size) and an ext4 File System

```
lvcreate -L 1G -n tmp savg
```

Format the logical volume with ext4

```
mkfs -t ext4 /dev/savg/tmp
```

Create a mount point for /tmp and mount the "tmp" logical volume with specific options

```
mkdir /mnt/tmp
mount -o nodev,nosuid,noexec /dev/savg/tmp /mnt/tmp
```

Task 5: Create a Logical Volume /home (80% of the Remainder of Newly Added Storage) and an XFS File System

Created a logical volume (LV) named "/home" within the "savg" VG, using 80% of the remaining space

```
lvcreate -l +80%FREE -n home savg
```

Formatted the logical volume with XFS

```
mkfs -t xfs /dev/savg/home
```

Created a mount point for /home and mount the "home" logical volume with the nodev option

```
mkdir /mnt/home
sudo mount -o nodev /dev/savg/home /mnt/home
```

Updated the fstab file to include the logical volumes

```
/dev/savg/tmp   /mnt/tmp   ext4   defaults   0 0
/dev/savg/home  /mnt/home  xfs    defaults   0 0
```

Restarted the daemon and mounted all filesystems

```
systemctl daemon-reload
mount -a
```

Tested the config by rebooting Machine E. Voila!

However, we still have not achieved the objective of reducing the size of /, since the original /home is mounted on /. We want to migrate and mount /home to our new file system, i.e., /dev/mapper/savg-home and mount /tmp to /dev/mapper/savg-tmp.

To do this, I created a backup folder under /mnt/backup/home and /mnt/backup/tmp and moved all files from /home and /tmp to their respective backup folders preserving all attributes.

```
rsync -avp /home /mnt/backup/home
rsync -avp /tmp /mnt/backup/tmp
```

Next, I unmounted /home and removed the directory.

```
umount /home && rm -rf /home
```

I created /home again, updated /etc/fstab to mount /home to /dev/mapper/savg-home, moved all the files from backup to /home and remounted /home.

```
mkdir /home
mkdir /tmp
vim /etc/fstab
#add these lines to /etc/fstab
#----
/dev/mapper/savg-tmp   /tmp   ext4   defaults   0 0
/dev/mapper/savg-home  /home  xfs    defaults   0 0
#-----
rsync -avp /mnt/backup/home /home
rsync -avp /mnt/backup/tmp /tmp
systemctl daemon-reload
mount -a
```

Configured and tested the setup. Post this, I delete /mnt/backup/home, /mnt/backup/tmp, /mnt/home, /mnt/tmp.

Extra credit (20%): Implement quotas on /home to limit the amount of storage that any Dunder-Mifflin employee may use to a soft limit of 1000MB, a hard limit of 1200MB and a grace period of 1 day. Apply the same limits to the managers, accounting and sales groups.

Since this is xfs, I used xfs_quota to implement quotas.

```
users=$(mscott snir8112 pbeesly .....)
for u in $users; do xfs_quota -xc "limit bsoft=1000m bhard=1200m ${u}" /home;
done
```

On checking the report of /home, it was successfully set!

```
[root@machinee /]# xfs_quota -x -c "report -h" /home
      [454/1918]
User quota on /home (/dev/mapper/savg-home)

                        Blocks

User ID      Used   Soft   Hard Warn/Grace

---------- --------------------------------
```

```
root         4K    0     0  00 [0 days]

mscott       189.1M  1000M   1.2G  00 [------]

jhalpert   178.5M  1000M   1.2G  00 [------]

dschrute   243.1M  1000M   1.2G  00 [------]

pbeesly      219.9M  1000M   1.2G  00 [------]

abernard   221.5M  1000M   1.2G  00 [------]

plapin       12K  1000M   1.2G  00 [------]

shudson      12K  1000M   1.2G  00 [------]

amartin      42.9M  1000M   1.2G  00 [------]

omartinez  223.0M  1000M   1.2G  00 [------]

kmalone      20K  1000M   1.2G  00 [------]

dphilbin     84.0M  1000M   1.2G  00 [------]
kkapoor      58.9M  1000M   1.2G  00 [------]
tflenderson 168.6M  1000M   1.2G  00 [------]
mpalmer      12K  1000M   1.2G  00 [------]
cbratton   111.7M  1000M   1.2G  00 [------]
snir8112     88K  1000M   1.2G  00 [------]


Group quota on /home (/dev/mapper/savg-home)
                        Blocks
Group ID     Used    Soft    Hard Warn/Grace
---------- ---------------------------------
root         4K    0     0  00 [0 days]
mscott       189.1M       0      0  00 [------]
jhalpert   178.5M       0      0  00 [------]
dschrute   243.1M       0      0  00 [------]
pbeesly      219.9M       0      0  00 [------]
abernard   221.5M       0      0  00 [------]
plapin       12K    0      0  00 [------]
shudson      12K    0      0  00 [------]
amartin      42.9M       0      0  00 [------]
omartinez  223.0M       0      0  00 [------]
kmalone      20K    0      0  00 [------]
```

```
dphilbin     84.0M        0      0  00 [------]
kkapoor      58.9M        0      0  00 [------]
tflenderson 168.6M        0      0  00 [------]
mpalmer      12K    0      0  00 [------]
cbratton    111.7M        0      0  00 [------]
snir8112     88K    0      0  00 [------]
managers     0   1000M   1.2G  00 [------]
sales        0   1000M   1.2G  00 [------]
accounting   0   1000M   1.2G  00 [------]
```

Setting limits for groups

```
  xfs_quota -x -c 'limit -g bsoft=1000m bhard=1200m gqperiod=86400 managers'
/home
  xfs_quota -x -c 'limit -g bsoft=1000m bhard=1200m gqperiod=86400 sales' /home
  xfs_quota -x -c 'limit -g bsoft=1000m bhard=1200m gqperiod=86400 accounting'
/home
```

Setting grace period of 1 day

```
xfs_quota -x -c 'timer -p -b 1 day' /dev/mapper/savg-home
```