Assignment 2

EBS Volume Creation – Windows Server

Screenshot 1 – Windows New Disk

```
Windows PowerShell
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Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\Administrator> get-disk

Number Friendly Name Serial Number              HealthStatus    OperationalStatus    Total Size Partition
                                                                                                Style
------ ------------- -------------              ------------    -----------------    ---------- ---------
0      NVMe Amazo... vol0127b9b4a225af51c_00000001.  Healthy     Online                 30 GB MBR
1      NVMe Amazo... vol0d09e92388c83ad94_00000001.  Healthy     Online                  5 GB RAW


PS C:\Users\Administrator> initialize-disk 1
PS C:\Users\Administrator> get-disk

Number Friendly Name Serial Number              HealthStatus    OperationalStatus    Total Size Partition
                                                                                                Style
------ ------------- -------------              ------------    -----------------    ---------- ---------
0      NVMe Amazo... vol0127b9b4a225af51c_00000001.  Healthy     Online                 30 GB MBR
1      NVMe Amazo... vol0d09e92388c83ad94_00000001.  Healthy     Online                  5 GB GPT


PS C:\Users\Administrator> _
```

Question 1: The "RAW" type simply means that the disk has not yet been initialized. In about 1-2 paragraphs, describe the difference between the GPT and MBR partition styles. Include differences in size limits, which one is more modern, and why you would use one over the other.

A: *MBR is older. It can work with disks up to 2 terabytes, and can only split a disk into four parts, or partitions. GPT is newer. It can work with really big disks—much bigger than what most people or even companies use today. And it can split a disk into lots more partitions, usually up to 128. GPT also has extra protection against data loss. Mostly, you'd want to use GPT because it can handle bigger disks and has more safety features. But you might need to use MBR for older systems that don't understand GPT.*

Question 2: Research the concept of Windows Storage Spaces. Write one to two paragraphs describing the functionality and how it would be useful in a large environment with multiple file servers.

A: ***Windows Storage Spaces is a feature in Windows that allows you to pool multiple physical drives together into a single virtual drive. This makes it easy to manage storage resources, as you can combine various types of drives, such as USB, SATA, and SAS. Storage Spaces allows for the pooling of storage across different servers, which simplifies the management process by consolidating available storage into one centralized location. In addition, Storage Spaces has robust data protection features. If a drive fails, it can be replaced with zero downtime, and the system will automatically rebuild the lost data. This feature, along with the option to mirror data across multiple drives, provides an***

additional layer of data security. Storage Spaces also supports thin provisioning, which allows for the dynamic allocation of storage based on current needs. This capability is particularly useful in large, rapidly evolving environments where storage needs can change frequently.

Question 3: Research the common file system types that Windows uses (FAT32, exFAT, NTFS, and ReFS). In one to two paragraphs, describe the common uses for each, how each is beneficial, and the key drawbacks of each type.

A: FAT32 is old but widely compatible, great for USB drives; however, it can't handle files over 4GB. exFAT is like a modern FAT32, perfect for SD cards and better for large files, but not as universal as FAT32. NTFS is the standard for Windows systems, supporting large files with extra security features, but it's not great for Mac or Linux compatibility. ReFS is the newest, focusing on data protection for large volumes, used mainly in big server environments, but it's not for booting up Windows or broad compatibility.

Screenshot 2 – Windows New Partition

```
PS C:\Users\Administrator> get-partition -Disknumber 1

   DiskPath: \\?\scsi#disk&ven_nvme&prod_amazon_elastic_b#4&8159206&0&000000#{53f56307-b6bf-11d0-94f2-00a0c91efb8b}

PartitionNumber  DriveLetter Offset                                Size Type
---------------  ----------- ------                                ---- ----
1                            17408                             15.98 MB Reserved

PS C:\Users\Administrator> new-partition -Disknumber 1 -DriveLetter e -UseMaximumSize

   DiskPath: \\?\scsi#disk&ven_nvme&prod_amazon_elastic_b#4&8159206&0&000000#{53f56307-b6bf-11d0-94f2-00a0c91efb8b}

PartitionNumber  DriveLetter Offset                                Size Type
---------------  ----------- ------                                ---- ----
2                E           16777216                           4.98 GB Basic

PS C:\Users\Administrator> get-partition -Disknumber 1

   DiskPath: \\?\scsi#disk&ven_nvme&prod_amazon_elastic_b#4&8159206&0&000000#{53f56307-b6bf-11d0-94f2-00a0c91efb8b}

PartitionNumber  DriveLetter Offset                                Size Type
---------------  ----------- ------                                ---- ----
1                            17408                             15.98 MB Reserved
2                E           16777216                            4.98 GB Basic

PS C:\Users\Administrator>
```

EBS Volume Creation – Linux Server

Screenshot 3 – Linux New Disk Creation

```
[ec2-user@ip-172-31-82-84 ~]$ sudo pvcreate /dev/xvdf
  Physical volume "/dev/xvdf" successfully created.
[ec2-user@ip-172-31-82-84 ~]$ sudo vgcreate data-vg /dev/xvdf
  Volume group "data-vg" successfully created
[ec2-user@ip-172-31-82-84 ~]$ sudo lvcreate -n data_l --extents 100%FREE data-vg
  Logical volume "data_l" created.
[ec2-user@ip-172-31-82-84 ~]$
```

Screenshot 4 – Linux New Disk File System/Mount

```
[ec2-user@ip-172-31-82-84 ~]$ sudo mkfs.xfs /dev/data-vg/data_1
meta-data=/dev/data-vg/data_1    isize=512    agcount=4, agsize=327424 blks
         =                       sectsz=512    attr=2, projid32bit=1
         =                       crc=1         finobt=1, sparse=1, rmapbt=0
         =                       reflink=1     bigtime=0 inobtcount=0
data     =                       bsize=4096    blocks=1309696, imaxpct=25
         =                       sunit=0       swidth=0 blks
naming   =version 2              bsize=4096    ascii-ci=0, ftype=1
log      =internal log           bsize=4096    blocks=2560, version=2
         =                       sectsz=512    sunit=0 blks, lazy-count=1
realtime =none                   extsz=4096    blocks=0, rtextents=0
[ec2-user@ip-172-31-82-84 ~]$ sudo mkdir /mnt/data
[ec2-user@ip-172-31-82-84 ~]$ sudo mount /dev/data-vg/data_1 /mnt/data
[ec2-user@ip-172-31-82-84 ~]$ df -hT
Filesystem                  Type      Size  Used Avail Use% Mounted on
devtmpfs                    devtmpfs  468M     0  468M   0% /dev
tmpfs                       tmpfs     477M     0  477M   0% /dev/shm
tmpfs                       tmpfs     477M  468K  476M   1% /run
tmpfs                       tmpfs     477M     0  477M   0% /sys/fs/cgroup
/dev/xvda1                  xfs       8.0G  1.7G  6.4G  21% /
tmpfs                       tmpfs      96M     0   96M   0% /run/user/0
tmpfs                       tmpfs      96M     0   96M   0% /run/user/1000
/dev/mapper/data--vg-data_1 xfs       5.0G   68M  5.0G   2% /mnt/data
[ec2-user@ip-172-31-82-84 ~]$
```

Screenshot 5 – Linux New Disk - Fstab

```
UUID=331356b7-9198-45c2-a25d-362fd1ed0afe    /           xfs    defaults,noatime  1   1
UUID=2389dcb0-458e-43db-b53c-ede4fd0932c0    /mnt/data   xfs    defaults,noatime  1   1
```

Screenshot 6 – Linux New Disk - Permanent

```
[ec2-user@ip-172-31-93-225 ~]$ df -hT
Filesystem                  Type      Size  Used Avail Use% Mounted on
devtmpfs                    devtmpfs  468M     0  468M   0% /dev
tmpfs                       tmpfs     477M     0  477M   0% /dev/shm
tmpfs                       tmpfs     477M  420K  476M   1% /run
tmpfs                       tmpfs     477M     0  477M   0% /sys/fs/cgroup
/dev/xvda1                  xfs       8.0G  1.7G  6.4G  21% /
tmpfs                       tmpfs      96M     0   96M   0% /run/user/1000
/dev/mapper/data--vg-data_1 xfs       5.0G   68M  5.0G   2% /mnt/data
[ec2-user@ip-172-31-93-225 ~]$ touch ~/text.txt
[ec2-user@ip-172-31-93-225 ~]$
```

EBS Volume Expansion - Windows

Screenshot 7 – Expanding E Drive

```
PS C:\Users\Administrator> $MaxSize = (Get-PartitionSupportedSize -DriveLetter e).sizeMax
PS C:\Users\Administrator> Resize-Partition -DriveLetter e -Size $MaxSize
PS C:\Users\Administrator> Get-Partition -DiskNumber 1


   DiskPath: \\?\scsi#disk&ven_nvme&prod_amazon_elastic_b#4&8159206&0&000000#{53f56307-b6bf-11d0-94f2-00a0c91efb8b}

PartitionNumber  DriveLetter Offset                                    Size Type
---------------  ----------- ------                                    ---- ----
1                            17408                                15.98 MB Reserved
2                E           16777216                              9.98 GB Basic


PS C:\Users\Administrator> _
```

Screenshot 8 – Expanding C Drive - Before

Volume	Layout	Type	File System	Status
(C:)	Simple	Basic	NTFS	Healthy (System, Boot, Page File, Active, Crash Dump, Primary Partition)
(E:)	Simple	Basic	NTFS	Healthy (Basic Data Partition)

Disk 0
Basic
35.00 GB
Online

(C:)
30.00 GB NTFS
Healthy (System, Boot, Page File, Active, Crash [

5.00 GB
Unallocated

Disk 1
Basic
9.98 GB
Online

(E:)
9.98 GB NTFS
Healthy (Basic Data Partition)

■ Unallocated ■ Primary partition

Screenshot 9 – Expanding C Drive - After

Volume	Layout	Type	File System	Status
(C:)	Simple	Basic	NTFS	Healthy (System, Boot, Page File, Active, Crash Dump, Primary Partition)
(E:)	Simple	Basic	NTFS	Healthy (Basic Data Partition)

Disk 0
Basic
35.00 GB
Online

(C:)
35.00 GB NTFS
Healthy (System, Boot, Page File, Active, Crash Dump, Primary Partition)

Disk 1
Basic
9.98 GB
Online

(E:)
9.98 GB NTFS
Healthy (Basic Data Partition)

EBS Volume Expansion - Linux

Screenshot 10 – Expanding Volume - PV

```
[ec2-user@ip-172-31-93-225 ~]$ sudo fdisk -l /dev/xvdf
Disk /dev/xvdf: 10 GiB, 10737418240 bytes, 20971520 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
[ec2-user@ip-172-31-93-225 ~]$ sudo pvdisplay
  --- Physical volume ---
  PV Name               /dev/sdf
  VG Name               data-vg
  PV Size               5.00 GiB / not usable 4.00 MiB
  Allocatable           yes (but full)
  PE Size               4.00 MiB
  Total PE              1279
  Free PE               0
  Allocated PE          1279
  PV UUID               zyulXa-dIqh-WU9z-2ckj-5psK-xo3R-4AEoxD

[ec2-user@ip-172-31-93-225 ~]$ sudo pvresize /dev/sdf
  Physical volume "/dev/sdf" changed
  1 physical volume(s) resized or updated / 0 physical volume(s) not resized
[ec2-user@ip-172-31-93-225 ~]$ sudo pvdisplay
  --- Physical volume ---
  PV Name               /dev/sdf
  VG Name               data-vg
  PV Size               <10.00 GiB / not usable 3.00 MiB
  Allocatable           yes
  PE Size               4.00 MiB
  Total PE              2559
  Free PE               1280
  Allocated PE          1279
  PV UUID               zyulXa-dIqh-WU9z-2ckj-5psK-xo3R-4AEoxD

[ec2-user@ip-172-31-93-225 ~]$
```

Screenshot 11 – Expanding Volume - LV

```
[ec2-user@ip-172-31-93-225 ~]$ sudo lvdisplay
  --- Logical volume ---
  LV Path                /dev/data-vg/data_l
  LV Name                data_l
  VG Name                data-vg
  LV UUID                xeIGCJ-EVGQ-xEQr-gg4O-FhF0-IOBl-O4fYmE
  LV Write Access        read/write
  LV Creation host, time ip-172-31-93-225.ec2.internal, 2023-06-19 20:06:07 +0000
  LV Status              available
  # open                 1
  LV Size                <5.00 GiB
  Current LE             1279
  Segments               1
  Allocation             inherit
  Read ahead sectors     auto
  - currently set to     256
  Block device           253:0

[ec2-user@ip-172-31-93-225 ~]$ sudo lvextend -l +100%FREE /dev/data-vg/data_l
  Size of logical volume data-vg/data_l changed from <5.00 GiB (1279 extents) to <10.00 GiB (2559 exten
ts).
  Logical volume data-vg/data_l successfully resized.
[ec2-user@ip-172-31-93-225 ~]$ sudo lvdisplay
  --- Logical volume ---
  LV Path                /dev/data-vg/data_l
  LV Name                data_l
  VG Name                data-vg
  LV UUID                xeIGCJ-EVGQ-xEQr-gg4O-FhF0-IOBl-O4fYmE
  LV Write Access        read/write
  LV Creation host, time ip-172-31-93-225.ec2.internal, 2023-06-19 20:06:07 +0000
  LV Status              available
  # open                 1
  LV Size                <10.00 GiB
  Current LE             2559
  Segments               1
  Allocation             inherit
  Read ahead sectors     auto
  - currently set to     256
  Block device           253:0

[ec2-user@ip-172-31-93-225 ~]$
```

Screenshot 12 – Expanding Volume – File System

```
[ec2-user@ip-172-31-93-225 ~]$ sudo df -hT
Filesystem                      Type      Size  Used Avail Use% Mounted on
devtmpfs                        devtmpfs  468M     0  468M   0% /dev
tmpfs                           tmpfs     477M     0  477M   0% /dev/shm
tmpfs                           tmpfs     477M  420K  476M   1% /run
tmpfs                           tmpfs     477M     0  477M   0% /sys/fs/cgroup
/dev/xvda1                      xfs       8.0G  1.7G  6.4G  21% /
tmpfs                           tmpfs      96M     0   96M   0% /run/user/1000
/dev/mapper/data--vg-data_l xfs           5.0G   68M  5.0G   2% /mnt/data
[ec2-user@ip-172-31-93-225 ~]$ sudo xfs_growfs /dev/mapper/data--vg-data_l
meta-data=/dev/mapper/data--vg-data_l isize=512    agcount=4, agsize=327424 blks
         =                       sectsz=512   attr=2, projid32bit=1
         =                       crc=1        finobt=1, sparse=1, rmapbt=0
         =                       reflink=1    bigtime=0 inobtcount=0
data     =                       bsize=4096   blocks=1309696, imaxpct=25
         =                       sunit=0      swidth=0 blks
naming   =version 2              bsize=4096   ascii-ci=0, ftype=1
log      =internal log           bsize=4096   blocks=2560, version=2
         =                       sectsz=512   sunit=0 blks, lazy-count=1
realtime =none                   extsz=4096   blocks=0, rtextents=0
data blocks changed from 1309696 to 2620416
[ec2-user@ip-172-31-93-225 ~]$ sudo df -hT
Filesystem                      Type      Size  Used Avail Use% Mounted on
devtmpfs                        devtmpfs  468M     0  468M   0% /dev
tmpfs                           tmpfs     477M     0  477M   0% /dev/shm
tmpfs                           tmpfs     477M  420K  476M   1% /run
tmpfs                           tmpfs     477M     0  477M   0% /sys/fs/cgroup
/dev/xvda1                      xfs       8.0G  1.7G  6.4G  21% /
tmpfs                           tmpfs      96M     0   96M   0% /run/user/1000
/dev/mapper/data--vg-data_l xfs           10G   104M  9.9G   2% /mnt/data
[ec2-user@ip-172-31-93-225 ~]$
```

Question 4: Do a little reading on LVM. In one to two paragraphs, describe what LVM is and the various components (PV, LV, VG) and how those components layer on top of each other.

A: Logical Volume Manager (LVM) is a tool in Linux for managing disk space. It uses three main components: Physical Volumes (PVs) are the actual disks or parts of disks. Volume Groups (VGs) combine PVs into one big storage pool. Logical Volumes (LVs) are like partitions. They are slices of VGs that your system uses as if they were regular disks. So, you put actual disks into a big pool (PVs into VG), then slice that pool into pieces your system can use (creating LVs). This makes managing and resizing disk space a lot easier.

Question 5: Research the common Linux file systems (EXT3, EXT4, XFS, swap). In one to two paragraphs, describe the common uses for each, how each is beneficial, and the key drawbacks of each type.

A: EXT3 is an older Linux filesystem that's reliable but lacks some modern features. EXT4 is a newer version of EXT3, used in many Linux systems. It handles larger files, reduces clutter, and has better performance, but might not always be the best for very specific tasks or extremely large storage. XFS is made for handling large files and lots of data traffic, perfect for servers and big data storage.

However, it may not be as fast as EXT4 for regular use, and deleted data can't be recovered. Swap isn't a filesystem, but a special space used when your system runs out of RAM. It's slower than using RAM and can slow down your system if used too much.

***The deliverable for Assignment 2 will be this document completed with the required screenshots and answers to the questions. You will submit this document in Canvas.