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(Deemed to be University)

Submitted in partial fulfilment of the requirements for the
award of Bachelor of Technology Degree in
Information Technology

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This is to certify that this Project Report is the Bonafide work of **Suravaram Dhanush (Reg. No. 40120095)** who carried out the project entitled "**Creation Of Disk Partition and mounting it to CINDER**" under my supervision from Jan 2023 to Apr 2023.



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COURSE COMPLETION LETTER

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ABSTRACT

In this project, we describe the process of creating a storage volume for an EC2 instance using LVM and the Cinder backend. The author begins by creating an EC2 instance and connecting to it via SSH. They then use the DD command utility to create a sparse image file, which is mounted to a loop device. A logical volume is created on the sparse image using LVM. The author then enables LVM as a backend for Cinder, which allows for flexible and scalable use of the storage volume. Finally, a volume is created and attached to the instance.

This project provides a useful example of how to create and manage storage volumes for EC2 instances. By using LVM, the author demonstrates how to easily allocate and manage storage, while the use of the Cinder backend allows for scalable and flexible use of this storage. The step-by-step process outlined in this project can serve as a helpful guide for those looking to create storage volumes for their own EC2 instances.

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LIST OF ABBREVIATIONS

ABBREVIATION	EXPANSION
AWS	Amazon Web Services
LVM	Logical Volume Manager
EC2	Elastic Compute Cloud
GCP	Google Cloud Platform
SSH	Secure Shell

Chapter 1

INTRODUCTION

In this project, we provide a detailed overview of the process of creating a storage volume for an EC2 instance using Logical Volume Manager (LVM) and the Cinder backend.

Cloud computing has become an increasingly popular choice for businesses and individuals, offering the ability to easily create and manage virtual machines and storage volumes such as those provided by Amazon's Elastic Compute Cloud (EC2) service. In this project, we walk through the steps required to create an EC2 instance and connect to it via Secure Shell (SSH). We then use the DD command utility to create a sparse image file which is mounted to a loop device, and a logical volume is created on top of it using LVM.

We discuss the benefits of using LVM as a backend for the Cinder storage service, and provide an overview of how to enable LVM as a Cinder backend. Enabling LVM allows for more efficient management and allocation of storage resources, particularly in cloud computing environments where resources are shared among multiple users.

Finally, we demonstrate how to create a volume and attach it to the instance, bringing together all the components of the project and showcasing how the storage volume can be used in practice. The step-by-step instructions we provide are designed to be accessible to readers of all skill levels, and offer a comprehensive guide to creating and managing storage volumes in a cloud computing environment.

Overall, this project serves as a practical demonstration of the benefits of using LVM and the Cinder backend to efficiently manage storage resources in a cloud computing environment. By following the steps outlined in this project, readers can gain a better understanding of how to create and manage storage volumes for their own EC2 instances.

1.1 Significance of Cloud Machine (EC2) In This Project

The use of EC2 instances is central to the implementation of this project, which involves managing storage resources for virtual machines in the cloud. EC2 instances are a type of virtual machine provided by Amazon Web Services (AWS), which can be used to run a wide range of applications and services in a scalable and cost-effective manner.

One of the key benefits of using EC2 instances is the ability to quickly provision and de-provision virtual machines as needed, without the need for physical hardware. This makes it possible to scale up or down resources depending on demand, which can help to optimise performance and reduce costs.

In the context of this project, EC2 instances are used to host virtual machines that require storage resources. The storage resources are managed using LVM and Cinder, which allow for efficient allocation and management of storage volumes. By integrating these technologies with EC2 instances, it is possible to provide a flexible and scalable storage solution for virtual machines running in the cloud.

The use of EC2 instances also enables the implementation of additional features, such as auto-scaling and load balancing, which can further optimise the performance and cost-effectiveness of the storage solution. For example, auto-scaling can be used to automatically increase or decrease the number of EC2 instances depending on demand, while load balancing can distribute traffic across multiple instances to ensure high availability and performance.

Overall, the use of EC2 instances plays a crucial role in the implementation of this project, providing a scalable and flexible platform for managing storage resources for virtual machines in the cloud. By leveraging the benefits of EC2 instances, it is possible to provide a storage solution that is optimised for performance, scalability, and cost-effectiveness, while also supporting a wide range of use cases and workloads.

1.2 Alternatives for AWS EC2

Amazon Web Services (AWS) Elastic Compute Cloud (EC2) is a popular cloud computing platform that allows businesses to run applications in the cloud without having to invest in hardware or infrastructure. While AWS EC2 is a widely used and highly regarded platform, there are alternatives that businesses can consider.

- **Microsoft Azure:** Azure is a cloud computing platform offered by Microsoft. It offers a wide range of services, including virtual machines, web applications, and storage. Like AWS EC2, Azure provides on-demand computing resources that can be scaled up or down as needed. One advantage of Azure over AWS is its tight integration with other Microsoft products, such as Office 365 and Windows Server.
- **Google Cloud Platform (GCP):** GCP is a cloud computing platform offered by Google. It offers a wide range of services, including virtual machines, storage, and data analytics. Like AWS EC2, GCP provides on-demand computing resources that can be scaled up or down as needed. Advantage of GCP over AWS is its expertise in data analytics and machine learning.
- **DigitalOcean:** DigitalOcean is a cloud computing platform that specialises in providing simple, affordable virtual private servers (VPS). While it may not offer the same range of services as AWS EC2 or Azure, it provides an easy-to-use interface and competitive pricing. DigitalOcean is ideal for businesses that need a simple, affordable VPS solution.
- **Linode:** Linode is a cloud computing platform that offers virtual private servers (VPS) with high performance and excellent uptime. Like DigitalOcean, Linode provides an easy-to-use interface and competitive pricing. Linode is ideal for businesses that need a high-performance VPS solution.
- **Vultr:** Vultr is a cloud computing platform that provides high-performance virtual private servers (VPS) with low latency and fast network speeds. Like DigitalOcean and Linode, Vultr provides an easy-to-use interface and competitive pricing. Vultr is ideal for businesses that need a high-performance VPS solution with low latency.

In conclusion, while AWS EC2 is a popular and highly regarded cloud computing platform, there are alternatives that businesses can consider. Microsoft Azure, Google Cloud Platform, DigitalOcean, Linode, and Vultr are all excellent alternatives to AWS EC2, and each has its strengths and weaknesses. Ultimately, the best choice will depend on the specific needs of your business.

1.3 AWS Over Its Alternatives

Amazon Web Services (AWS) is a cloud computing platform that has been in operation since 2006. It is the largest cloud computing platform in the world, with millions of customers and a vast array of services. While there are alternative cloud computing platforms, AWS remains a popular choice for businesses of all sizes. Here are some reasons why AWS is preferred over its alternatives:

- **Global Infrastructure:** AWS has a global infrastructure that spans 77 availability zones in 24 regions, providing businesses with the ability to deploy applications and services closer to their customers. No other cloud provider has such a vast and robust infrastructure.
- **Variety of Services:** AWS has a vast array of services that cover almost every aspect of cloud computing, including storage, computing, analytics, security, and more. AWS has more than 200 services, making it a one-stop-shop for businesses that require multiple cloud services.
- **Scalability:** AWS provides businesses with the ability to scale their computing resources up or down quickly. This allows businesses to adjust to changing demands and only pay for the resources they need.
- **Security:** AWS has a robust security architecture that provides businesses with the ability to secure their applications and data. AWS is compliant with numerous security standards, including SOC 1/2/3, ISO 27001, and PCI DSS.
- **Cost-effective:** AWS offers businesses cost-effective pricing models, including pay-as-you-go, reserved instances, and spot instances. AWS provides businesses with significant savings compared to traditional IT infrastructure.

In conclusion, AWS remains a popular choice for businesses of all sizes due to its global infrastructure, variety of services, scalability, security, and cost-effectiveness.

While there are alternative cloud computing platforms, AWS's unique combination of features and benefits makes it the preferred choice for many businesses.

1.4 SSH

SSH (Secure Shell) is a network protocol that provides a secure means of accessing and managing remote computer systems. SSH was designed to replace insecure protocols such as Telnet and FTP, which transmitted data and login credentials in plaintext, leaving them vulnerable to interception and unauthorized access.

The primary function of SSH is to allow users to log in to remote systems securely and execute commands on them. SSH encrypts all data that is transmitted between the client and the server, including login credentials, commands, and data. This makes it extremely difficult for attackers to intercept and view sensitive information.

SSH is widely used by system administrators and developers to manage remote servers, transfer files securely, and tunnel traffic between two networked systems. SSH is also used to access networked devices such as routers and switches, providing a secure way to manage and configure them remotely.

One of the most popular implementations of SSH is OpenSSH, an open-source implementation of the SSH protocol. OpenSSH is available on most Unix-based systems, including Linux and macOS, and is often pre-installed on these systems. OpenSSH provides a suite of tools for secure remote access and file transfer, including `ssh`, `scp`, and `sftp`.

In conclusion, SSH is a vital tool for remote system administration and management, providing a secure means of accessing and managing remote systems. SSH is widely used by system administrators and developers to manage remote servers, transfer files securely, and tunnel traffic between two networked systems. OpenSSH is the most popular implementation of SSH and is available on most Unix-based systems.

1.5 Sparse Portion

Sparse Portion is a term used in the context of large-scale distributed systems and refers to the part of the data that is non-zero, i.e., the data that has a value other than zero. This concept is often used in machine learning, data analysis, and other fields that deal with large datasets. large-scale distributed systems, such as those used in cloud computing, it is often challenging to store and process vast amounts of data efficiently. This is because most datasets are sparse, i.e., they contain a large number of zero values, and storing or processing these values is often a waste of resources. Sparse Portion is the part of the data that is non-zero, and by focusing on this portion of the data, we can reduce the amount of data that needs to be stored and processed, thereby improving performance and reducing resource requirements.

Sparse Portion is especially significant in machine learning, where large datasets are often used to train models. Machine learning algorithms typically involve a large number of calculations, and processing all the data in a dataset can be computationally expensive. By focusing on the Sparse Portion of the data, we can reduce the number of calculations required, thereby improving the speed and efficiency of the algorithm. This approach is often used in deep learning, where sparse data is common, and can help to reduce the memory requirements of neural networks.

Sparse Portion is also essential in data analysis, where it is often necessary to perform operations such as filtering, aggregation, and transformation on large datasets. By focusing on the Sparse Portion of the data, we can reduce the amount of data that needs to be processed, thereby improving performance and reducing resource requirements. This approach is often used in big data systems, where the volume of data is enormous, and processing all the data is often impractical.

In conclusion, Sparse Portion is a vital concept in large-scale distributed systems, machine learning, and data analysis. By focusing on the non-zero part of the data, we can reduce the amount of data that needs to be stored and processed, thereby improving performance and reducing resource

requirements. This approach is especially useful in deep learning, where sparse data is common, and can help to reduce the memory requirements of neural networks. Sparse Portion is an essential tool for anyone working with large datasets, and understanding this concept can help to improve the efficiency and effectiveness of data processing and analysis.

1.6 DD Commands

DD is a powerful and versatile Unix utility that is used to copy and convert data. It is often used for creating backups, creating disk images, and transferring data between devices. In this note, we will explore some of the most common uses of the dd command.

- Copying disks and partitions: One of the most common uses of dd is to copy the contents of a disk or partition to another disk or partition. This can be useful for creating a backup or for transferring data between devices. The basic syntax for copying a disk or partition is as follows: `dd if=/dev/source of=/dev/destination`. Here, `/dev/source` is the device file for the source disk or partition, and `/dev/destination` is the device file for the destination disk or partition.
- Creating disk images: dd can also be used to create disk images, which are files that contain the contents of a disk or partition. This can be useful for creating backups or for transferring data over a network. To create a disk image, you can use the following syntax: `dd if=/dev/source of=image-file.img`. Here, `image-file.img` is the name of the file that will contain the disk image.
- Zeroing out disks: When disposing of a disk, it is often necessary to zero out the contents of the disk to prevent sensitive data from being recovered. dd can be used to zero out the contents of a disk or partition. The syntax for zeroing out a disk is as follows: `dd if=/dev/zero of=/dev/disk bs=1M`. Here, `/dev/disk` is the device file for the disk that you want to zero out.

- Converting data: dd can also be used to convert data between different formats. For example, you can use dd to convert a file from ASCII to EBCDIC by using the following syntax: `dd if=file.txt of=ebcdic-file.txt conv=ebcdic`. Here, `conv=ebcdic` tells dd to convert the data to the EBCDIC format.
- Checking and repairing disks: dd can be used to check for and repair bad sectors on a disk. The syntax for checking a disk is as follows: `dd if=/dev/source of=/dev/null bs=512 conv=noerror,sync`. Here, `/dev/null` is used as a sink for the data, and `bs=512` specifies the block size. The `conv=noerror,sync` option tells dd to continue copying data even if it encounters errors and to pad any incomplete blocks with zeros.

Overall, dd is a powerful and versatile utility that can be used for a wide range of tasks. However, it is important to use dd with caution, as it can easily overwrite or delete data if used incorrectly.

1.7 Loop Device

A loop device is a virtual device in Unix-based operating systems that allows a file to be treated as if it were a block device, such as a disk or a partition. This means that you can use a file as if it were a physical device, with all the same capabilities and limitations.

To create a loop device, you need to use the `losetup` command. The basic syntax for creating a loop device is `losetup /dev/loopX /path/to/file`, where `/dev/loopX` is the name of the loop device that you want to create, and `/path/to/file` is the path to the file that you want to associate with the loop device.

Once a loop device has been created, you can use it just like a regular block device. For example, you can create a file system on the loop device using the `mkfs` command and then mount the file system using the `mount` command.

One of the most common uses for loop devices is to create disk images. You can use the `dd` command to create an image of a physical disk or partition, and then associate the image file with a loop device using `losetup`.

Once the loop device has been created, you can mount the file system contained in the disk image and access its contents.

Loop devices are also useful for disk encryption. You can create an encrypted disk image using the `dd` command and then associate it with a loop device using `losetup`. Once the loop device has been created, you can use it as if it were a regular disk, but all data that is written to the disk will be automatically encrypted.

Overall, loop devices are a powerful and flexible tool for working with block devices in Unix-based operating systems. They can be used for a wide range of tasks, from creating disk images to encrypting data to testing file systems.

1.8 Logical Volume

Logical Volume Management (LVM) is a storage management technology that allows you to create and manage logical volumes, which are virtual partitions that can span multiple physical disks or partitions. LVM is available on many Linux distributions and is particularly useful for managing large storage volumes.

At the core of LVM is the concept of a physical volume (PV), which is a block device that can be used as a building block for logical volumes. You can use disks, partitions, or even RAID arrays as physical volumes. Once you have one or more physical volumes, you can create a volume group (VG), which is a collection of one or more physical volumes. You can then create logical volumes (LVs) within the volume group.

One of the key benefits of LVM is that it allows you to resize logical volumes dynamically. This means that you can add or remove physical volumes from a volume group, and then resize the logical volumes within the group to take advantage of the additional storage. This makes it easy to manage large storage volumes without having to worry about physical disk layouts or partitioning schemes.

Another benefit of LVM is that it provides a layer of abstraction between the physical disks and the logical volumes. This means that you can move logical volumes between physical volumes or even between different servers without having to worry about the physical disk layout. This makes it easy to migrate data between servers or to upgrade storage hardware without having to take the entire system offline.

To work with LVM, you'll need to use a set of command-line tools such as `pvcreate`, `vgcreate`, `lvcreate`, `pvresize`, `vgextend`, and `lvextend`. These tools allow you to create physical volumes, volume groups, and logical volumes, as well as resize them as needed.

Overall, LVM is a powerful tool for managing storage on Linux systems. By using logical volumes instead of traditional partitions, you can easily manage large storage volumes, resize volumes dynamically, and migrate data between servers without worrying about the physical disk layout.

1.9 LVM

Logical Volume Management (LVM) is a flexible storage management technology that allows you to create and manage logical volumes on top of physical storage devices. LVM is available on many Linux distributions and is particularly useful for managing large storage volumes.

At the core of LVM are three key concepts: physical volumes (PVs), volume groups (VGs), and logical volumes (LVs). A physical volume is a block device, such as a disk or a partition, that is used as a building block for creating logical volumes. A volume group is a collection of one or more physical volumes that are grouped together to form a larger storage pool. Finally, a logical volume is a virtual block device that is created within a volume group and can be used to store data.

One of the main benefits of LVM is that it allows you to resize logical volumes dynamically. This means that you can add or remove physical volumes from a volume group, and then resize the logical volumes within the group to take advantage of the additional storage. This makes it easy to manage large storage volumes without having to worry about physical disk layouts or partitioning schemes.

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Overall, LVM is a powerful and flexible tool for managing storage on Linux systems. By using logical volumes instead of traditional partitions, you can easily manage large storage volumes, resize volumes dynamically, and migrate data between servers without worrying about the physical disk layout.

1.10 Cinder

Cinder is an open-source block storage service that is part of the OpenStack cloud computing platform. It allows you to create and manage block storage volumes that can be attached to virtual machines running on OpenStack.

At the core of Cinder is the concept of a block storage volume. A volume is a block device that can be attached to a virtual machine and used as a persistent storage device. Cinder allows you to create, delete, and resize volumes as needed, and provides a range of options for storing data, including local storage, network-attached storage (NAS), and storage area networks (SANs). One of the main benefits of Cinder is its integration with OpenStack. Since it is part of the OpenStack platform, it integrates seamlessly with other OpenStack services such as Nova (compute), Neutron (networking), and Horizon (dashboard). This makes it easy to manage storage for OpenStack-based virtual machines, and provides a single point of control for all of your cloud infrastructure.

Cinder also provides a range of features for managing block storage volumes, including support for snapshots and backups, encryption and compression, and the ability to create volume types with different performance characteristics. Additionally, it provides a flexible API that allows you to automate storage management tasks and integrate Cinder with other tools and services.

To use Cinder, you'll need to deploy OpenStack and configure the Cinder service. Once Cinder is up and running, you can use the OpenStack dashboard or the Cinder command-line tools to create and manage volumes. Overall,

Cinder is a powerful and flexible block storage service that is well-suited for

managing storage in OpenStack-based cloud environments. Its integration with other OpenStack services and its range of features make it a popular choice for organizations that need to manage large amounts of storage for virtual machines running in the cloud.

1.11 Alternatives for cinder

While Cinder is a powerful and popular block storage service for OpenStack, there are several alternative storage solutions that you can consider depending on your specific needs and use case.

- **Ceph:** Ceph is an open-source software-defined storage platform that provides block, file, and object storage. It is highly scalable and can be deployed on commodity hardware, making it a cost-effective alternative to traditional storage systems. Ceph integrates with OpenStack and provides a robust and flexible storage solution for cloud environments.
- **GlusterFS:** GlusterFS is an open-source distributed file system that provides scalable and flexible storage for cloud environments. It can be deployed on commodity hardware and provides features such as replication, erasure coding, and tiered storage. GlusterFS can also be integrated with OpenStack and provides a range of options for managing storage in cloud environments.
- **Swift:** Swift is an open-source object storage system that is part of the OpenStack platform. It provides highly scalable and durable storage for unstructured data, such as images, videos, and documents. Swift is designed for large-scale storage and can be deployed on commodity hardware, making it a cost-effective alternative to traditional storage systems.
- **NFS:** Network File System (NFS) is a distributed file system that allows you to access files across a network. NFS provides a simple and flexible way to share files between servers and can be used to store data for virtual machines running on OpenStack. NFS is supported by many storage vendors and can be integrated with OpenStack using the Cinder-NFS driver.

Overall, there are several alternatives to Cinder that you can consider depending on your specific needs and use case. By evaluating your storage

requirements and comparing the features and benefits of each solution, you can choose the storage solution that best meets your needs.

1.12 Cinder over its alternatives

Cinder is a powerful and widely used block storage service that is part of the OpenStack cloud computing platform. While there are several alternative storage solutions available, Cinder has several advantages that make it a popular choice for managing storage in OpenStack-based cloud environments.

- **Integration with OpenStack:** One of the key advantages of Cinder is its seamless integration with other OpenStack services, such as Nova (compute), Neutron (networking), and Horizon (dashboard). This provides a unified and easy-to-use interface for managing storage, compute, and networking resources in your cloud environment.
- **Wide range of storage options:** Cinder provides a range of options for storing data, including local storage, network-attached storage (NAS), and storage area networks (SANs). This allows you to choose the storage solution that best meets your performance and cost requirements.
- **Flexibility and scalability:** Cinder is highly flexible and scalable, allowing you to create, delete, and resize volumes as needed. It also provides support for snapshots and backups, encryption and compression, and the ability to create volume types with different performance characteristics.
- **Active development community:** Cinder has a large and active development community, with regular updates and improvements to the platform. This ensures that Cinder remains a reliable and up-to-date storage solution for OpenStack-based cloud environments.

While there are several alternative storage solutions available, Cinder's integration with OpenStack, wide range of storage options, flexibility and scalability, and active development community make it a popular choice for managing storage in cloud environments. By choosing Cinder, you can ensure that your storage solution is reliable, flexible, and well-supported.

CHAPTER 2

System Analysis

2.1 Aim & Scope

Aim of this project is to provide a comprehensive guide to creating and managing storage volumes for EC2 instances using Logical Volume Manager (LVM) and the Cinder backend.

Cloud computing has become an increasingly popular choice for businesses and individuals, but managing storage resources in this environment can be complex. This project aims to simplify the process of creating and managing storage volumes by walking readers through the steps required to create an EC2 instance, connect to it via SSH, and set up a storage volume using LVM.

Scope of this project is to provide readers with a practical understanding of how to create and manage storage volumes using LVM and the Cinder backend. By following the step-by-step instructions provided, readers will learn how to create a sparse image file, mount it to a loop device, and create a logical volume using LVM. They will also learn how to enable LVM as a backend for the Cinder storage service, and how to create and attach a volume to an EC2 instance.

This project is designed to be accessible to readers of all skill levels. While it does require some basic knowledge of cloud computing and Linux command line tools, we have provided detailed explanations and examples to ensure that readers can follow along even if they are not experts in these areas.

Ultimately, the aim of this project is to provide readers with a practical understanding of how to create and manage storage volumes in a cloud computing environment. By doing so, we hope to empower readers to make the most of their cloud computing resources and efficiently manage their storage needs.

2.2 How does it work

Overview of LVM and Cinder Backend:

Logical Volume Manager (LVM) is a storage management tool that allows for the efficient allocation and management of storage resources. It allows users to create logical volumes that span multiple physical disks, making it easier to manage and allocate storage resources as needed. The Cinder backend is a storage service provided by OpenStack, which allows users to create and manage block storage volumes for virtual machines. By enabling LVM as a backend for Cinder, users can take advantage of the benefits of both tools to more efficiently manage their storage resources.

Creating an EC2 Instance:

The first step in creating and managing storage volumes for an EC2 instance is to create the instance itself. This can be done using the AWS Management Console, the AWS CLI, or an SDK. Once the instance is created, users can connect to it using SSH, allowing them to access the command line interface, execute commands to create and manage storage volumes.

Creating a Sparse Image File:

Before creating a logical volume using LVM, users need to create a sparse image file that will serve as the basis for the volume. This can be done using the DD command utility, which allows users to create a file of a specific size with all its contents set to zero. By creating a sparse image file, users can create a logical volume that takes up only the space that is actually needed, rather than allocating a fixed amount of space that may not be fully utilized.

Mounting the Sparse Image File to a Loop Device:

Once the sparse image file is created, users need to mount it to a loop device. A loop device is a virtual device that allows a file to be mounted as a block device. By mounting the sparse image file to a loop device, users can treat it as a physical disk and create a logical volume on top of it using LVM.

Creating a Logical Volume using LVM:

After mounting the sparse image file to a loop device, users can create a logical volume on top of it using LVM. This involves creating a physical volume, a volume group, and a logical volume, each of which is assigned a unique identifier. By creating a logical volume using LVM, users can allocate and manage storage resources more efficiently, making it easier to scale up or down as needed.

Enabling LVM as a Cinder Backend:

To use LVM as a backend for the Cinder storage service, users need to enable it in the Cinder configuration file. This involves specifying the LVM driver as the backend for Cinder, as well as providing information on the LVM physical volume, volume group, and logical volume that will be used to store the block storage volumes.

Creating and Attaching a Volume:

Finally, once LVM has been enabled as a backend for Cinder, users can create and attach a volume to the EC2 instance. This involves creating a new volume using the Cinder API or the CLI, specifying the size and other parameters as needed. Once the volume is created, it can be attached to the instance using the EC2 API or the CLI, allowing users to use it as a block storage device for their virtual machine.

CHAPTER 3

SYSTEM DESIGN AND IMPLEMENTATION

System Design:

The basic system design for creating and managing storage volumes using LVM and Cinder involves several components:

- **EC2 Instance:** This is the virtual machine that will be running on the EC2 service and which will need to access the storage volumes.
- **LVM:** Logical Volume Manager is a storage management tool that allows for the efficient allocation and management of storage resources.
- **Cinder Backend:** Cinder is a block storage service provided by OpenStack, which allows users to create and manage block storage volumes for virtual machines.
- **Sparse Image File:** This is a file that is created using the DD command utility and which will serve as the basis for the logical volume that will be created using LVM.
- **Loop Device:** This is a virtual device that allows a file to be mounted as a block device, which is needed to create a logical volume using LVM.
- **Physical Volume:** This is a disk partition or physical disk that is used as a basis for creating a volume group using LVM.
- **Volume Group:** This is a collection of physical volumes that are grouped together to form a larger logical volume.
- **Logical Volume:** This is the volume that is created using LVM and which is used as the backend for the Cinder block storage service.
- **Cinder Volume:** This is the volume that is created using the Cinder API or CLI and which is attached to the EC2 instance.

Implementation:

The implementation details for creating and managing storage volumes using LVM and Cinder involve several steps:

- **Creating the EC2 Instance:** The first step is to create the EC2 instance itself. This can be done using the AWS Management Console, the AWS CLI, or an SDK.

- ***Creating the Sparse Image File:*** Once the EC2 instance is created, the next step is to create the sparse image file that will serve as the basis for the logical volume. This can be done using the DD command utility.
- ***Mounting the Sparse Image File to a Loop Device:*** Once the sparse image file is created, the next step is to mount it to a loop device, which can be done using the losetup command.
- ***Creating a Logical Volume using LVM:*** After the sparse image file is mounted to a loop device, the next step is to create a logical volume on top of it using LVM. This involves creating a physical volume, a volume group, and a logical volume, each of which is assigned a unique identifier.
- ***Enabling LVM as a Cinder Backend:*** Once the logical volume is created using LVM, the next step is to enable LVM as a backend for the Cinder storage service. This involves specifying the LVM driver as the backend for Cinder and providing information on the LVM physical volume, volume group, and logical volume that will be used to store the block storage volumes.
- ***Creating and Attaching a Cinder Volume:*** Finally, once LVM has been enabled as a backend for Cinder, users can create and attach a volume to the EC2 instance using the Cinder API or CLI. This allows users to use the volume as a block storage device for their virtual machine.

3.2 Ideation Map

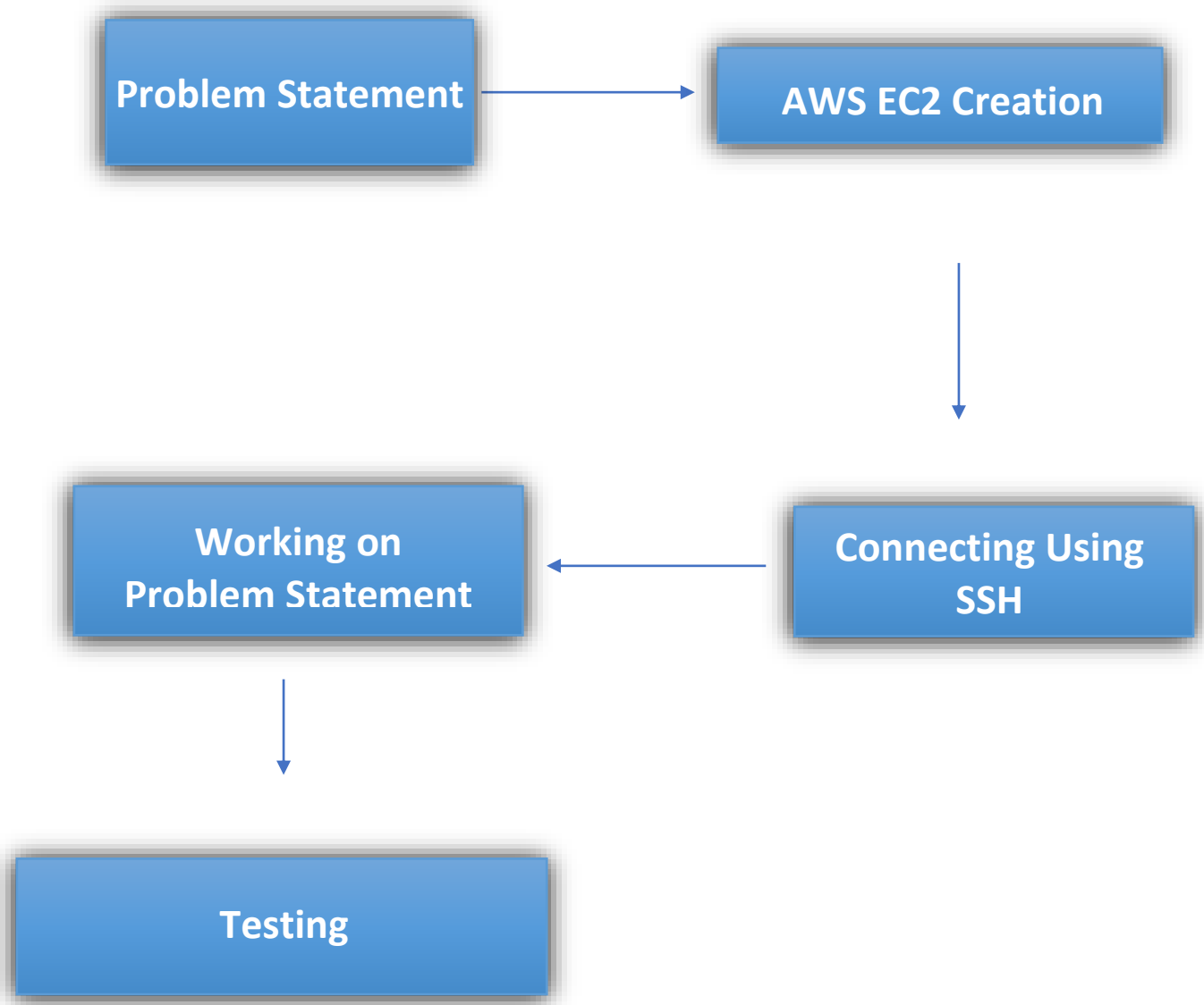


Fig.3.1 Ideation Map

CHAPTER 4

RESULTS AND DISCUSSION

```
[ubuntu@ip-172-31-36-91:~]$ dd if=/dev/zero of=myparse.img bs=1 count=0 seek=1G
0+0 records in
0+0 records out
0 bytes copied, 0.000193847 s, 0.0 kB/s
[ubuntu@ip-172-31-36-91:~]$ sudo losetup -f myparse.img
[ubuntu@ip-172-31-36-91:~]$ losetup -a
/dev/loop1: []: (/var/lib/snapd/snaps/core18_2714.snap)
/dev/loop8: []: (/home/ubuntu/sparsefile.img)
/dev/loop6: []: (/var/lib/snapd/snaps/snapd_18933.snap)
/dev/loop4: []: (/var/lib/snapd/snaps/snapd_18596.snap)
/dev/loop11: []: (/home/ubuntu/sparsefile.img)
/dev/loop2: []: (/var/lib/snapd/snaps/core20_1852.snap)
/dev/loop0: []: (/var/lib/snapd/snaps/amazon-ssm-agent_6312.snap)
/dev/loop9: []: (/home/ubuntu/sparsefile.img)
/dev/loop7: []: (/home/ubuntu/sparsefile.img)
/dev/loop5: []: (/var/lib/snapd/snaps/core18_2721.snap)
/dev/loop12: []: (/home/ubuntu/myparse.img)
/dev/loop3: []: (/var/lib/snapd/snaps/lxd_24322.snap)
/dev/loop10: []: (/home/ubuntu/sparsefile.img)
[ubuntu@ip-172-31-36-91:~]$ sudo mkfs.ext4 /dev/loop12
mke2fs 1.46.5 (30-Dec-2021)
Discarding device blocks: done
Creating filesystem with 262144 4k blocks and 65536 inodes
Filesystem UUID: 8bcd1ad6-eb38-4c34-8522-f323837dfa66
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376

Allocating group tables: done
Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done

[ubuntu@ip-172-31-36-91:~]$ sudo mkdir /mnt/myparse
[ubuntu@ip-172-31-36-91:~]$ sudo mount /dev/loop12 /mnt/myparse
[ubuntu@ip-172-31-36-91:~]$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root       7.6G  2.3G  5.3G  31% /
tmpfs           484M   0  484M   0% /dev/shm
tmpfs          194M  876K  193M   1% /run
tmpfs           5.0M   0   5.0M   0% /run/lock
/dev/xvda15     105M   6.1M   99M   6% /boot/efi
tmpfs           97M   4.0K   97M   1% /run/user/1000
/dev/loop12     974M   24K  907M   1% /mnt/myparse
[ubuntu@ip-172-31-36-91:~]$
```

Fig.4.1: Creating Sparse portion and mounting a loop device

```

[ubuntu@ip-172-31-36-91:~$ lvm
  WARNING: Running as a non-root user. Functionality may be unavailable.
[lvm> exit
  Exiting.
[ubuntu@ip-172-31-36-91:~$ dd if=/dev/zero of=sparseforlv.img bs=1M count=100 seek=500
100+0 records in
100+0 records out
104857600 bytes (105 MB, 100 MiB) copied, 0.103624 s, 1.0 GB/s
[ubuntu@ip-172-31-36-91:~$ sudo losetup -f sparseforlv.img
[ubuntu@ip-172-31-36-91:~$ losetup -a
/dev/loop1: [ ]: (/var/lib/snapd/snaps/core18_2714.snap)
/dev/loop8: [ ]: (/home/ubuntu/sparsefile.img)
/dev/loop6: [ ]: (/var/lib/snapd/snaps/snapd_18933.snap)
/dev/loop13: [ ]: (/home/ubuntu/sparseforlv.img)
/dev/loop4: [ ]: (/var/lib/snapd/snaps/snapd_18596.snap)
/dev/loop11: [ ]: (/home/ubuntu/sparsefile.img)
/dev/loop2: [ ]: (/var/lib/snapd/snaps/core20_1852.snap)
/dev/loop0: [ ]: (/var/lib/snapd/snaps/amazon-ssm-agent_6312.snap)
/dev/loop9: [ ]: (/home/ubuntu/sparsefile.img)
/dev/loop7: [ ]: (/home/ubuntu/sparsefile.img)
/dev/loop5: [ ]: (/var/lib/snapd/snaps/core18_2721.snap)
/dev/loop12: [ ]: (/home/ubuntu/mysparse.img)
/dev/loop3: [ ]: (/var/lib/snapd/snaps/lxd_24322.snap)
/dev/loop10: [ ]: (/home/ubuntu/sparsefile.img)
[ubuntu@ip-172-31-36-91:~$ sudo pvcreate /dev/loop13
  Physical volume "/dev/loop13" successfully created.
[ubuntu@ip-172-31-36-91:~$ sudo vgcreate myvg /dev/loop13
  Volume group "myvg" successfully created
[ubuntu@ip-172-31-36-91:~$ sudo lvcreate -L 50M -n mylv myvg
  Rounding up size to full physical extent 52.00 MiB
  Logical volume "mylv" created.
[ubuntu@ip-172-31-36-91:~$ sudo mkfs.ext4 /dev/myvg/mylv
mke2fs 1.46.5 (30-Dec-2021)
Discarding device blocks: done
Creating filesystem with 13312 4k blocks and 13312 inodes

Allocating group tables: done
Writing inode tables: done
Creating journal (1024 blocks): done
Writing superblocks and filesystem accounting information: done

ubuntu@ip-172-31-36-91:~$ █

```

Fig.4.2: Creating Logical Volume on the sparse image

```

[ubuntu@ip-172-31-36-91:~$ dd if=/dev/zero of=cinder.img bs=1M count=100 seek=500
100+0 records in
100+0 records out
104857600 bytes (105 MB, 100 MiB) copied, 0.0883729 s, 1.2 GB/s
[ubuntu@ip-172-31-36-91:~$ sudo losetup -f cinder.img
[ubuntu@ip-172-31-36-91:~$ sudo pvcreate /dev/loop14
Physical volume "/dev/loop14" successfully created.
[ubuntu@ip-172-31-36-91:~$ sudo vgcreate cinder-volumes /dev/loop14
Volume group "cinder-volumes" successfully created
[ubuntu@ip-172-31-36-91:~$ sudo apt-get install cinder-volume
Reading package lists... Done

```

Fig.4.3: Making LVM as enabled backend of cinder

```

ubuntu@ip-172-31-36-91:~$ sudo vi /etc/cinder/cinder.conf
ubuntu@ip-172-31-36-91:~$ sudo systemctl restart cinder-volume.service
ubuntu@ip-172-31-36-91:~$ █

```

Fig.4.4: Making LVM as enabled backend of cinder

CHAPTER -5

CONCLUSION

In this project, we have explored the use of LVM and the Cinder backend to manage storage resources for EC2 instances. We have discussed the basic system design and implementation details required to create and manage storage volumes using these tools, including the creation of a sparse image file, mounting it to a loop device, creating a logical volume using LVM, enabling LVM as a backend for Cinder, and creating and attaching a Cinder volume.

The use of LVM and the Cinder backend offers several advantages for managing storage resources, including the ability to efficiently allocate and manage storage volumes, as well as the ability to scale up or down as needed. By using these tools, users can create and manage their storage resources more effectively, making it easier to meet the demands of their virtual machines.

In conclusion, the use of LVM and the Cinder backend is a powerful approach for managing storage resources for EC2 instances, and it can provide significant benefits in terms of efficiency, scalability, and ease of use. By following the steps outlined in this project, users can take advantage of these tools and achieve better management of their storage resources.

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