

Academic Task-3

“Use any open-source tool to find partial and full multimedia files (video files) in DataStream. Explore any other five features from the same software.”

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CHAPTER-01

INTRODUCTION

Computer forensics is the practice of investigating and analyzing digital devices and electronic data to identify, preserve, recover, and present electronic evidence. It is used in legal, civil, and criminal investigations to uncover evidence that can be used in court or other legal proceedings.

The field of computer forensics has grown in importance in recent years due to the proliferation of digital devices and electronic data, which have become integral to our daily lives. These devices and data can be used to commit crimes, and as such, they can be a valuable source of evidence.

Computer forensics is a branch of digital forensic science that involves the preservation, analysis, and presentation of electronic evidence in a manner that is admissible in a court of law. It involves the use of various techniques and tools to investigate digital devices such as computers, smartphones, and other electronic storage media.

The primary goal of computer forensics is to identify, extract, and analyze digital evidence to support legal proceedings. This evidence can include data such as documents, emails, chat logs, images, videos, and other electronic artifacts that may be relevant to an investigation. It is the application of forensic science techniques to digital evidence to investigate and solve computer crimes, such as cyber-attacks, hacking, data theft, and other forms of digital crimes. Computer forensic investigations involve collecting and analyzing digital evidence, such as computer files, network logs, emails, and other data that may be stored on a computer or a digital device.

The goal of computer forensics is to uncover evidence that can be used in legal proceedings. This may include identifying the source of a cyber-attack, recovering deleted data, tracing internet activity, and analyzing communication logs. The digital evidence that is collected during a computer forensic investigation must be preserved and analyzed in a way that is admissible in court.

Computer forensic investigators use a variety of tools and techniques to uncover digital evidence, including specialized software, forensic analysis tools, and specialized hardware.

These tools help investigators to identify and recover data from a wide range of digital devices, including computers, servers, smartphones, and other digital devices.

Computer Forensics is an important field that plays a critical role in investigating and solving digital crimes. With the increasing reliance on technology in our daily lives, computer forensic investigators are in high demand and are an essential part of the law enforcement and legal system.

Computer forensics experts use specialized tools and techniques to analyze digital data, including deleted files, hidden files, and metadata. They can recover information that has been deleted, altered, or encrypted, and they can also determine when data was created, modified, or accessed.

The process of computer forensics involves several key steps, including identification, preservation, collection, examination, analysis, and reporting. Each step is critical to ensuring that electronic evidence is properly collected, analyzed, and presented in court.

- Identification: The first step in computer forensics is to identify the digital devices and data that may be relevant to an investigation. This includes identifying the type of device and the location of the data, such as on a hard drive or in the cloud.
- Preservation: Once digital devices and data have been identified, they must be preserved to prevent tampering or loss of evidence. This may involve creating an exact copy of the device or data, known as a forensic image, which can be used for analysis without altering the original evidence.
- Collection: After digital evidence has been preserved, it must be collected in a manner that preserves its integrity and chain of custody. This may involve physically seizing the device or data or using specialized software to collect data remotely.
- Examination: Once digital evidence has been collected, it must be examined to determine its relevance and admissibility. This may involve analyzing the metadata of electronic files, recovering deleted files, or decrypting encrypted data.
- Analysis: After examination, digital evidence must be analyzed to draw conclusions about its significance to an investigation. This may involve correlating data from multiple devices, identifying patterns of activity, or reconstructing digital events.

- **Reporting:** Finally, the findings of a computer forensics investigation must be reported in a clear and concise manner that can be understood by non-technical stakeholders, such as judges or juries. This may involve presenting evidence in court, writing reports, or providing expert testimony.

Computer forensics experts must have a strong technical background and a deep understanding of the legal and regulatory frameworks surrounding digital evidence. They must also adhere to strict ethical standards to ensure that the evidence they collect and analyze is admissible in court and is not compromised in any way.

Overall, computer forensics plays a critical role in modern investigations and is an essential tool for law enforcement agencies, legal professionals, and other stakeholders seeking to uncover electronic evidence. Its importance is only expected to grow as technology continues to evolve, and electronic data becomes even more integral to our daily lives.

Foremost is primarily a data recovery tool, and while it can be used as part of **disk forensics**, it is not a full-fledged disk forensic tool. Foremost is designed to recover deleted files from storage devices and can be used to analyze the contents of a hard drive or other storage device to locate and recover specific files that may be of interest to a forensic investigator.

Disk forensics is a branch of digital forensics that involves the analysis of storage devices, such as hard drives, USB drives, and memory cards, to recover data and provide evidence in legal cases. The goal of disk forensics is to reconstruct a timeline of events and determine how a storage device was used, what data was stored on it, and who accessed it.

Disk forensics typically involves the acquisition of a complete image of the storage device, including all of its data, metadata, and file system information. This image is then analyzed using various tools and techniques to identify deleted files, hidden files, and other information that may be of interest to a forensic investigator.

The first step in disk forensics is often to create a bit-for-bit image of the storage device. This is typically done using specialized hardware or software that can make an exact copy of the

device without altering its contents. This image is then stored on a separate storage device for analysis.

Once the image has been created, the forensic investigator can begin to analyze it using various tools and techniques. This may involve examining the file system to identify files that have been deleted or hidden, searching for specific keywords or phrases that may be relevant to the investigation, or using advanced algorithms to recover files that have been partially overwritten or fragmented.

One of the key challenges in disk forensics is dealing with encrypted or password-protected data. In some cases, it may be possible to recover encrypted data by analyzing the file system or metadata, but in other cases, the investigator may need to use specialized software or hardware to crack the encryption and gain access to the data.

Another challenge in disk forensics is dealing with large storage devices, such as multi-terabyte hard drives. Analyzing such devices can be a time-consuming process, and the investigator may need to use specialized software or hardware to speed up the analysis.

In addition to the technical challenges of disk forensics, investigators must also be aware of legal and ethical considerations. For example, they must ensure that they have obtained proper authorization before conducting a forensic analysis, and they must take care to preserve the integrity of the data and avoid altering or deleting any information.

Overall, disk forensics is a complex and challenging field that requires specialized knowledge and expertise. By using the right tools and techniques, forensic investigators can uncover valuable information and provide important evidence in legal cases.

1.1. Objective of the project

The objective of this project is to demonstrate the use of an open-source tool, specifically Foremost, to find partial and full multimedia files (video files) in DataStream. The project aims to showcase the capabilities of Foremost in identifying and recovering multimedia files that have been deleted or lost from a storage device.

In addition to finding multimedia files, the project also seeks to explore other features of Foremost.

The project will involve using Foremost in a Linux environment, specifically Ubuntu. The steps involved in installing and using Foremost will be documented and explained, making the project accessible to those with limited experience using open-source tools.

Overall, the objective of this project is to provide a practical example of how Foremost can be used to recover multimedia files and to demonstrate the range of features that this tool offers for data recovery and analysis. The project will be useful to anyone interested in multimedia file recovery, open-source tools, and data analysis.

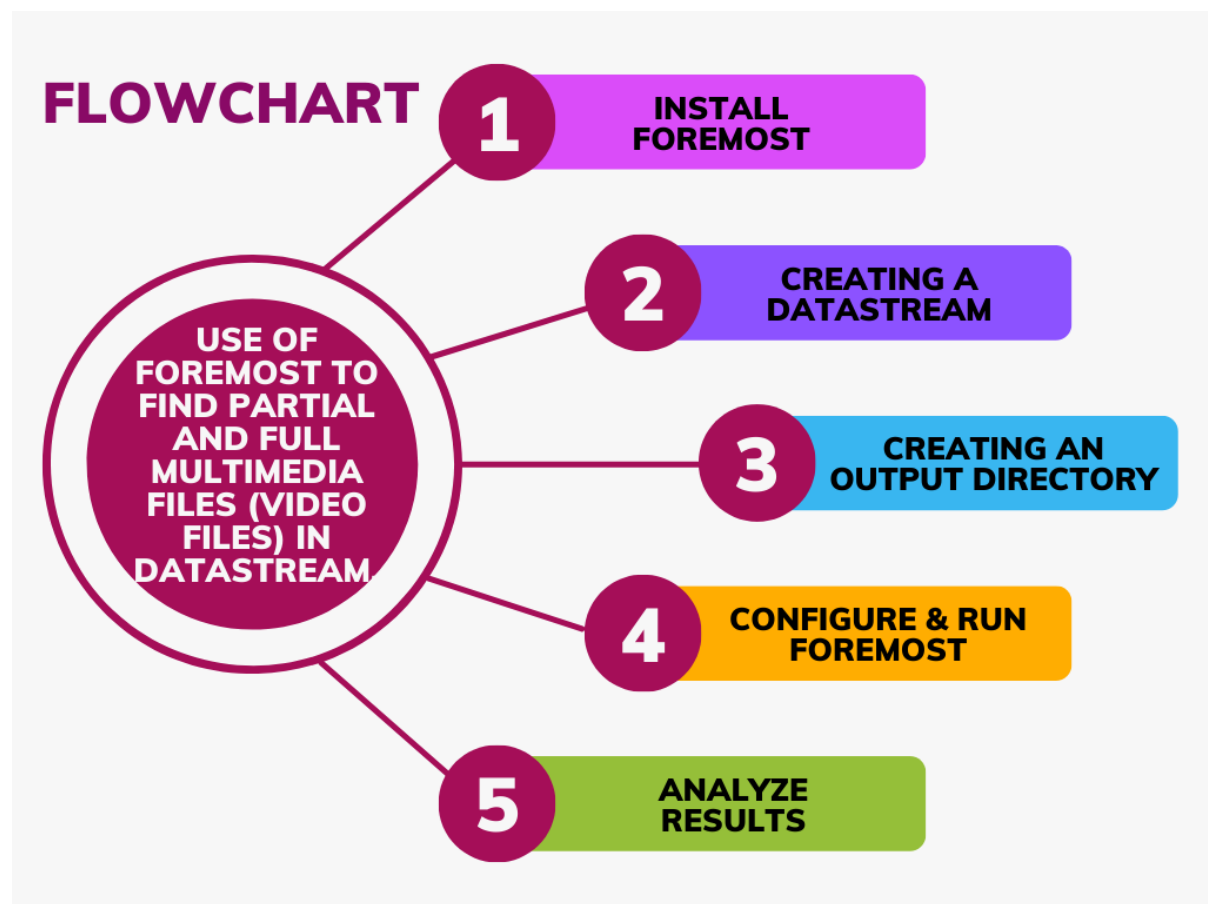


Fig1: Flowchart of the process

1.2. Description of the project

Foremost is a popular digital forensic tool that is used for data recovery and analysis. It can search through raw data and carve out files of various types. The objective of this project is to use Foremost to search through a DataStream for partial and full multimedia files, specifically video files.

A DataStream is a sequence of data that is transmitted over a network. This project will focus on using Foremost to search through a DataStream, which may contain a variety of multimedia files, including videos.

The first step of the project will involve setting up Foremost and configuring it to search for video files. This will involve specifying the file format of the video files that Foremost should search for. It is important to note that video files may be fragmented across multiple packets in a DataStream, so Foremost will need to be configured to search for partial video files as well.

Once Foremost is configured, the next step will be to test it by running it on sample DataStreams that contain video files. The goal of this testing phase is to evaluate the effectiveness of Foremost in finding both full and partial video files.

Finally, the project will involve documenting the process and results of using Foremost to search for video files in a DataStream. The documentation will include a detailed description of the setup and configuration of Foremost, as well as the results of the testing phase.

The end result of this project will be a valuable tool for digital forensic investigators who need to search through DataStreams for video files. By using Foremost to search for partial and full multimedia files, investigators will be able to quickly and accurately recover video files that may be crucial to a case.

1.3. Scope of the project

The scope of this project is to demonstrate the capabilities of the open-source tool Foremost in finding partial and full multimedia files (video files) in DataStream, as well as to explore and showcase some of the additional features of the software. The project will involve installing

and using Foremost in a Linux environment, specifically Ubuntu, and will focus on the recovery of multimedia files from various types of storage devices, such as hard drives, memory cards, and USB drives.

In addition to the core functionality of identifying and recovering multimedia files, the project will also explore some of the more advanced features of Foremost. This may include file carving, which is used to recover fragmented or corrupted files, custom configurations to improve the accuracy of file recovery, file exclusion to exclude certain file types or extensions from the recovery process, recursive scanning to identify and recover files stored in different locations, and bulk recovery to recover multiple files simultaneously.

The project will also provide a detailed guide to using Foremost, including step-by-step instructions for installation and use, as well as best practices for data recovery and analysis. This guide will be aimed at users with a range of experience levels, from beginners to more experienced users.

The scope of the project includes the followings:

- Identification of suitable DataStream: The project will identify a DataStream that contains multimedia files, specifically video files. The DataStream may be in any format, including digital or physical storage media.
- Installation and configuration of Foremost: The project will install and configure the Foremost tool, which is an open-source program for file recovery, to identify and extract video files from the given DataStream.
- Partial and Full Video File Recovery: The project will extract both partial and full multimedia files, specifically video files, from the DataStream using Foremost. The project will also test the accuracy of the recovered files.
- Documentation: The project will provide detailed documentation of the installation, configuration, and use of Foremost for video file recovery. The documentation will include step-by-step instructions for the entire process, including screenshots.

Overall, the scope of this project is to demonstrate the power and versatility of Foremost as an open-source tool for multimedia file recovery and analysis, and to provide a practical guide for users looking to recover lost or deleted multimedia files.

1.4. Additional Features of the software “Foremost”

These may include:

1. File Carving: Foremost allows for the recovery of fragmented or corrupted files by "carving" data from a storage device and reassembling it into usable files.
2. Custom Configurations: The tool allows users to configure custom file headers and footers to improve the accuracy of file recovery.
3. File Exclusion: Users can specify certain file types or extensions to be excluded from the recovery process, which can save time and resources.
4. Recursive Scanning: Foremost can scan subdirectories and nested file structures to identify and recover files that may have been stored in different locations.
5. Bulk Recovery: Users can recover multiple files simultaneously, which can be especially useful when dealing with large data sets.
6. Multiple Output Formats: Foremost can output recovered files in various formats, including raw binary, ASCII, and HTML.
7. Logging: Foremost can log its activity to a file, making it easier to review its output.
8. Quiet mode: Foremost can be run in quiet mode, suppressing all output except for recovered files.

CHAPTER-02

SYSTEM DESCRIPTION

2.1. Target System Description

Ubuntu is a free, open-source operating system that is based on the Linux kernel. It is known for its user-friendly interface, stability, security, and versatility. Ubuntu is widely used by individuals, businesses, and governments around the world. One of the key features of Ubuntu is its user-friendly interface. The operating system comes with a clean and modern graphical interface, which is easy to use and navigate. It also supports a wide range of desktop environments, including GNOME, KDE, Xfce, and Unity, allowing users to customize their experience to their liking.

Another key feature of Ubuntu is its stability. The operating system is known for its reliability and is designed to run for long periods of time without crashing or experiencing issues. Ubuntu achieves this by using a stable and well-tested Linux kernel, as well as by implementing strict quality control measures for all software included in the operating system. Security is another important feature of Ubuntu. The operating system is designed with security in mind and comes with a range of built-in security features, including a firewall, encryption tools, and secure boot. Additionally, Ubuntu receives regular security updates and patches, ensuring that it remains protected against the latest security threats. Versatility is also a key feature of Ubuntu. The operating system can be used on desktops, laptops, servers, and even mobile devices. It is highly customizable and comes with a wide range of software applications pre-installed, including web browsers, media players, productivity tools, and more. Additionally, Ubuntu supports a wide range of hardware, making it easy to use on a variety of different devices.

One of the main benefits of Ubuntu is its package management system. The operating system uses the Advanced Package Tool (APT) to manage software packages. APT is a powerful and flexible tool that allows users to easily install, update, and remove software packages from a central repository. This makes it easy to keep the operating system and all installed software up-to-date. Ubuntu also has a large and active community of developers and users who contribute to its development and support. The Ubuntu community is made up of individuals and organizations from around the world who work together to improve the operating system

and provide support to users. This community-driven approach has helped to make Ubuntu one of the most popular and widely used Linux distributions.

In addition to its core features, Ubuntu also offers a range of additional benefits. For example, it is free and open-source, meaning that anyone can download and use the operating system without paying for a license. It is also highly customizable, with a range of customization options available for users who want to tailor their experience to their specific needs. Additionally, Ubuntu comes with a range of developer tools and resources, making it a popular choice for software developers and IT professionals. Overall, Ubuntu is a stable, secure, and versatile operating system that offers a wide range of features and benefits. Its user-friendly interface, robust security features, and flexible package management system make it a popular choice for individuals, businesses, and governments around the world.

2.2. Assumptions and Dependencies

Assumptions:

1. The data stream containing the multimedia files is accessible from the Ubuntu system where the Foremost tool is installed.
2. The multimedia files are in a format that is supported by the Foremost tool.
3. The user has basic knowledge of the Linux command line and file system navigation.

Dependencies:

1. Ubuntu or any other Linux distribution.
2. Foremost tool installed on the Ubuntu system. It can be installed using the command:
`sudo apt-get install foremost`
3. A terminal emulator or the command-line interface to run the Foremost tool.
4. Multimedia files in a data stream that needs to be recovered.
5. Sufficient storage space to store the recovered multimedia files.

It is important to note that the success of using Foremost to recover multimedia files from a data stream depends on several factors, such as the condition of the data stream, the type of

multimedia files, and the complexity of the file system. Hence, it is advisable to have a backup of important data to avoid any data loss.

2.3. Functional/Non-Functional Dependencies

Functional dependencies:

1. Availability of the data stream containing multimedia files.
2. The Foremost tool must be able to recognize and recover the multimedia files from the data stream.
3. Sufficient storage space to store the recovered multimedia files.

Non-functional dependencies:

1. System performance: The recovery process using Foremost can be resource-intensive and may slow down the system.
2. Security: The recovered multimedia files may contain sensitive information, and it is important to ensure that the recovery process is secure and does not compromise data privacy.
3. Usability: The Foremost tool is a command-line interface tool, and users need to have basic knowledge of the Linux command line to use it effectively.
4. Availability of support: Foremost is an open-source tool, and users may need to rely on online resources or user communities for support in case of issues or errors during the recovery process.
5. Compatibility: The Foremost tool may not be compatible with all file systems or multimedia file formats, and users should ensure that the tool is appropriate for the specific use case before attempting to use it.

2.4. Data set used in support of your project (if any then paste the link)

NOT APPLICABLE

CHAPTER-03

ANALYSIS REPORT

3.1. System Snapshots and Full Analysis Report

Creating Disk Image

There are different methods to create a disk image in Ubuntu, depending on the type of disk you want to create an image of and the purpose of the disk image. Here are some common methods to create a disk image in Ubuntu:

1. Create a disk image using dd command: The "dd" command is a powerful command-line tool that can create a bit-by-bit copy of a disk or partition. To create a disk image using the dd command, open a terminal window and enter the following command:

```
sudo dd if=/dev/sda of=/path/to/image/file.img
```

Replace "/dev/sda" with the device name of the disk you want to create an image of, and "/path/to/image/file.img" with the path and name of the image file you want to create.

2. Create a disk image using GNOME Disks: GNOME Disks is a graphical utility that allows you to manage disks and partitions, including creating disk images. To create a disk image using GNOME Disks, open GNOME Disks, select the disk or partition you want to create an image of, and click on the gear icon in the toolbar. Select "Create Disk Image" and choose the location and format of the disk image.
3. Create a disk image using Clonezilla: Clonezilla is a free and open-source disk imaging and cloning tool that can create and restore disk images. To create a disk image using Clonezilla, download and burn the Clonezilla ISO to a CD or USB drive, boot your computer from the Clonezilla media, and follow the prompts to create a disk image.
4. Create a disk image using ddrescue: ddrescue is a data recovery tool that can create disk images of damaged or failing disks. To create a disk image using ddrescue, open a terminal window and enter the following command:

```
sudo ddrescue /dev/sda /path/to/image/file.img /path/to/logfile.log
```

Replace "/dev/sda" with the device name of the disk you want to create an image of, and "/path/to/image/file.img" and "/path/to/logfile.log" with the paths and names of the image file and log file you want to create.

These are the main four methods to create a disk image in Ubuntu. Apart from the above-mentioned software there are many more different software's that can be used for the same.

In our case we are using Ubuntu in a Virtual Machine, so there is only one disk partition, so all the data of the Ubuntu is in a single disk. Since there is only one disk, so it is containing the operating system as well and it is not possible to create a disk image of the disk in which operating system is there. So, in our case creation of disk image in Ubuntu is not possible.

Creating DataStream

Before delving into the specifics of using Foremost, it's important to have a basic understanding of what DataStream's are. In computing, a DataStream is a sequence of digital data that is transmitted or stored as a continuous stream. This can include video and audio streams, as well as other types of data.

In the context of digital forensics, DataStream's can be of particular interest as they may contain hidden or deleted files that are not visible through traditional file system analysis. This is because DataStream's are stored within a file, but not necessarily as part of the file's regular data.

It's not possible to create a data stream in Ubuntu as data streams are created as part of the file system in Windows. However, in Ubuntu, you can create a disk image that can contain a data stream.

For the same there is a need of a disk image, and it can't be fulfilled as our Ubuntu operating system is in a Virtual Machine and there is only one disk partition therefore all the data including the operating system is in the same disk and it is not possible to create a disk image of the disk in which operating system is present.

But to serve the purpose of showing the process we will create data stream using a single file by using the command:

```
cat file_name > example.ds
```

- The file should be present in the home directory, or the terminal should be working with the directory in which the file is present.
- You can give any name to the data stream in place of example.

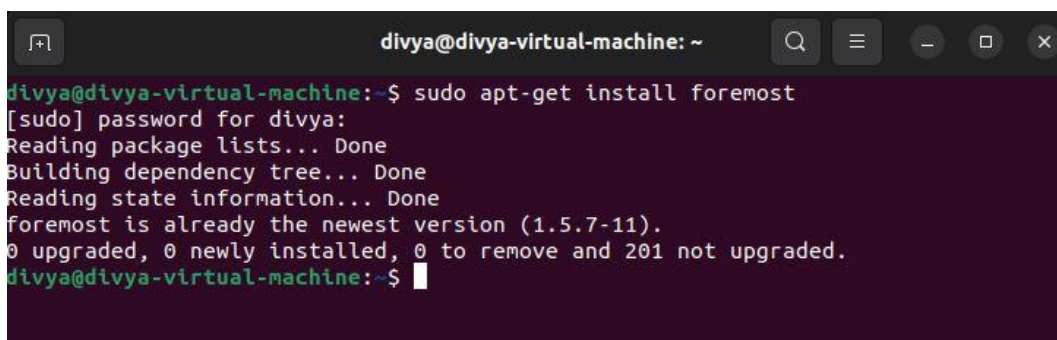
Running Foremost Tool

Foremost is an open-source digital forensics tool that is designed to recover files from disk images, partitions, and other types of digital media. It works by searching through the binary data of a file system or disk image, looking for known file headers and footers to identify the file types it can recover. Foremost is particularly useful in cases where files have been deleted or lost due to corruption or other forms of damage.

When it comes to finding partial and full multimedia files (specifically video files) in a DataStream, Foremost can be a powerful tool to use.

Here is a step-by-step description of how to use the open-source tool Foremost to find partial and full multimedia files (video files) in a DataStream in Ubuntu:

1. Install Foremost: If Foremost is not already installed on your Ubuntu system, install it using the command "sudo apt-get install foremost" in the terminal.

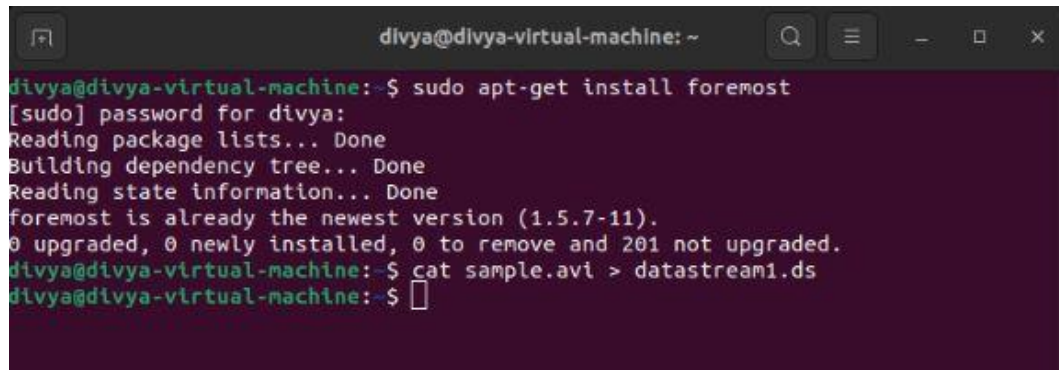
A screenshot of a terminal window titled 'divya@divya-virtual-machine: ~'. The terminal shows the command 'sudo apt-get install foremost' being executed. The output indicates that the package is already installed at the latest version (1.5.7-11) and no action is required. The terminal text is as follows:

```
divya@divya-virtual-machine:~$ sudo apt-get install foremost
[sudo] password for divya:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
foremost is already the newest version (1.5.7-11).
0 upgraded, 0 newly installed, 0 to remove and 201 not upgraded.
divya@divya-virtual-machine:~$
```

Fig2: Screenshot showing the terminal when the Foremost tool is installed

2. Creating a DataStream: Create a DataStream file from the video file by run the following command:

```
cat sample.avi > datastream1.ds
```



```
divya@divya-virtual-machine: ~  
divya@divya-virtual-machine:~$ sudo apt-get install foremost  
[sudo] password for divya:  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
foremost is already the newest version (1.5.7-11).  
0 upgraded, 0 newly installed, 0 to remove and 201 not upgraded.  
divya@divya-virtual-machine:~$ cat sample.avi > datastream1.ds  
divya@divya-virtual-machine:~$
```

Fig3: Screenshot showing creation of Datastream from a video file

Datastream has been created.

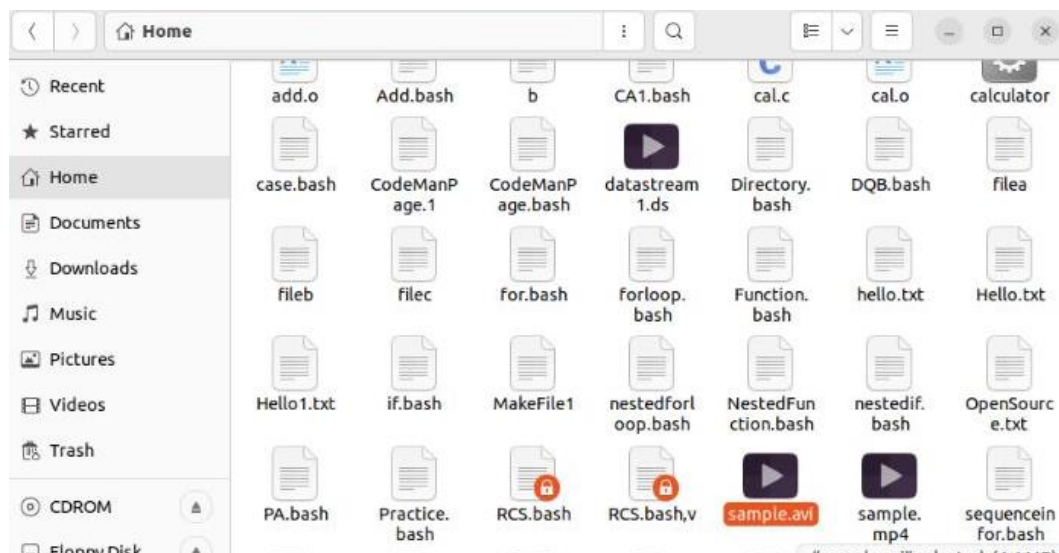
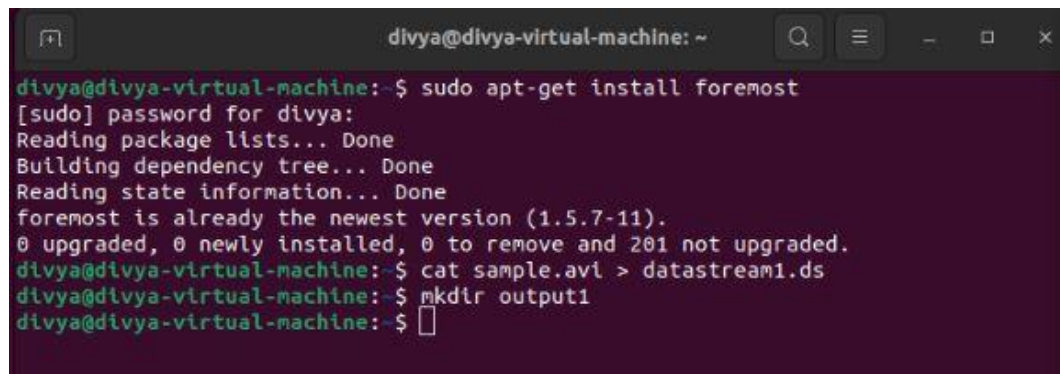


Fig4: Screenshot showing that the Datastream has been created in the home directory

3. Create an output directory: Create an output directory where the recovered files will be saved. You can do this by using mkdir command in the terminal. The code for the save is as follows:

mkdir output



```
divya@divya-virtual-machine: ~  
divya@divya-virtual-machine:~$ sudo apt-get install foremost  
[sudo] password for divya:  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
foremost is already the newest version (1.5.7-11).  
0 upgraded, 0 newly installed, 0 to remove and 201 not upgraded.  
divya@divya-virtual-machine:~$ cat sample.avi > datastream1.ds  
divya@divya-virtual-machine:~$ mkdir output1  
divya@divya-virtual-machine:~$
```

Fig5: Screenshot showing the terminal for creation of output directory

Directory has been created.

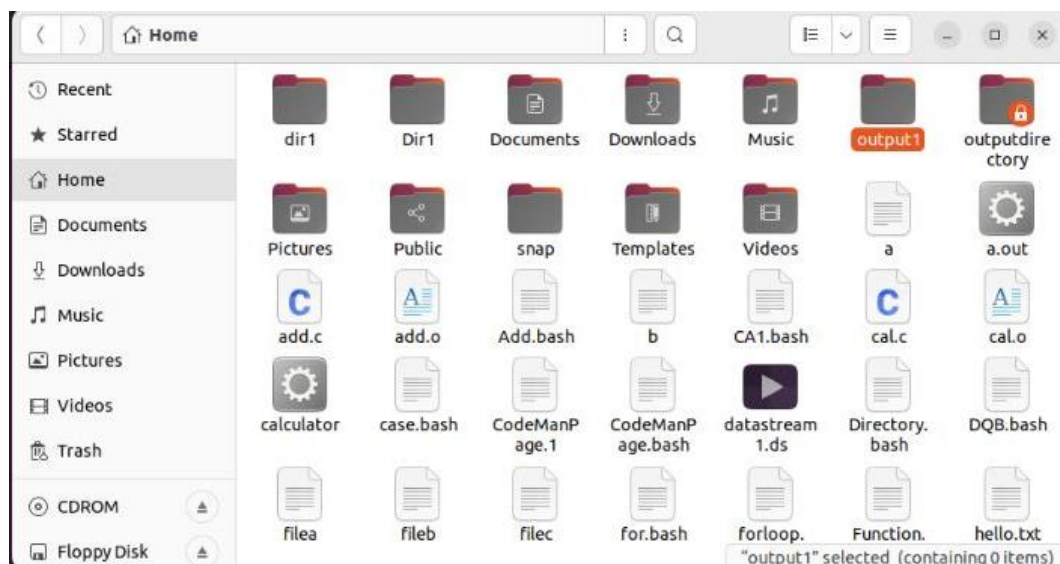
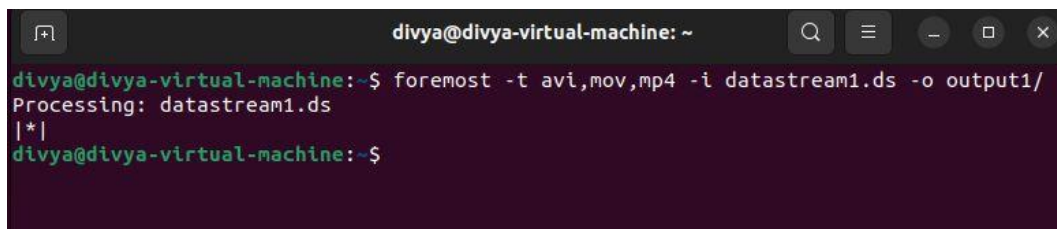


Fig6: Screenshot showing that the output directory has been created in the home directory

4. Configure Foremost: Next, configure Foremost to search for video files in the DataStream. Foremost supports a wide range of file types and can be customized to search for specific file extensions. In this case, the configuration file should be edited to only include video file extensions.
5. Run Foremost: Once Foremost is properly configured, run the tool and direct it to the DataStream where the video files are suspected to be located. Foremost will search through the binary data of the DataStream, looking for known video file headers and footers to identify the file types it can recover. Use the following command in the terminal:

```
"foremost -t avi,mov,mp4 -i datastream1.ds -o output1"
```

This command tells Foremost to search for multimedia files with extensions ".avi", ".mov", and ".mp4" in the specified DataStream "datastream1.ds" and save the recovered files to the directory "output1".

A screenshot of a terminal window with a dark background. The window title is "divya@divya-virtual-machine: ~". The prompt is "divya@divya-virtual-machine:~\$". The command entered is "foremost -t avi,mov,mp4 -i datastream1.ds -o output1/". The output shows "Processing: datastream1.ds" followed by a vertical bar and an asterisk "|*|". The prompt returns to "divya@divya-virtual-machine:~\$".

```
divya@divya-virtual-machine: ~  
divya@divya-virtual-machine:~$ foremost -t avi,mov,mp4 -i datastream1.ds -o output1/  
Processing: datastream1.ds  
|*|  
divya@divya-virtual-machine:~$
```

Fig7: Screenshot showing the terminal for running of the foremost command to search for multimedia files and creation of copy of the multimedia files in the output directory

6. Wait for Foremost to complete: Foremost may take some time to complete its search depending on the size of the DataStream and the number of files that need to be recovered. Monitor the progress of Foremost by checking the terminal output.

7. **Analyze Results:** After Foremost has finished scanning the DataStream, it will output a list of files it has recovered. The recovered files will be stored in a directory specified in the configuration file. Analyze the results to identify any partial or full video files that were recovered.

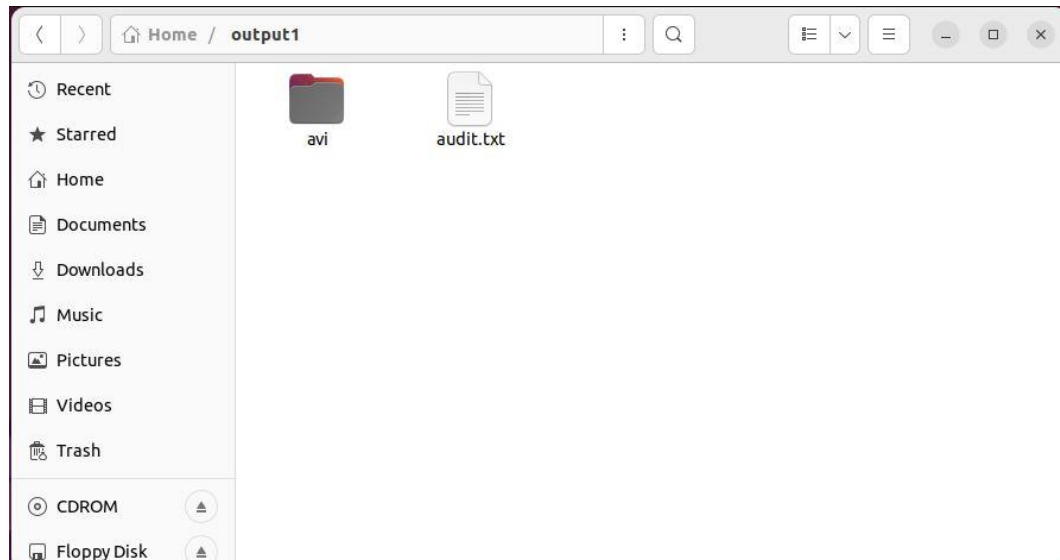


Fig8: Screenshot showing that the output has been generated in the output directory

```

1 Foremost version 1.5.7 by Jesse Kornblum, Kris Kendall, and Nick Mikus
2 Audit File
3
4 Foremost started at Sat Apr  8 11:12:00 2023
5 Invocation: foremost -t avi,mov,mp4 -i datastream1.ds -o output1/
6 Output directory: /home/divya/ output1
7 Configuration file: /etc/foremost.conf
8 -----
9 File: datastream1.ds
10 Start: Sat Apr  8 11:12:00 2023
11 Length: 4 MB (4408688 bytes)
12
13 Num      Name (bs=512)      Size      File Offset  Comment
14
15 0:      00000000.avi          4 MB              0
16 Finish: Sat Apr  8 11:12:00 2023
17
18 1 FILES EXTRACTED
19
20 avi:= 1
21 -----
22
23 Foremost finished at Sat Apr  8 11:12:00 2023

```

Fig9: Screenshot showing that the details of the audit.txt

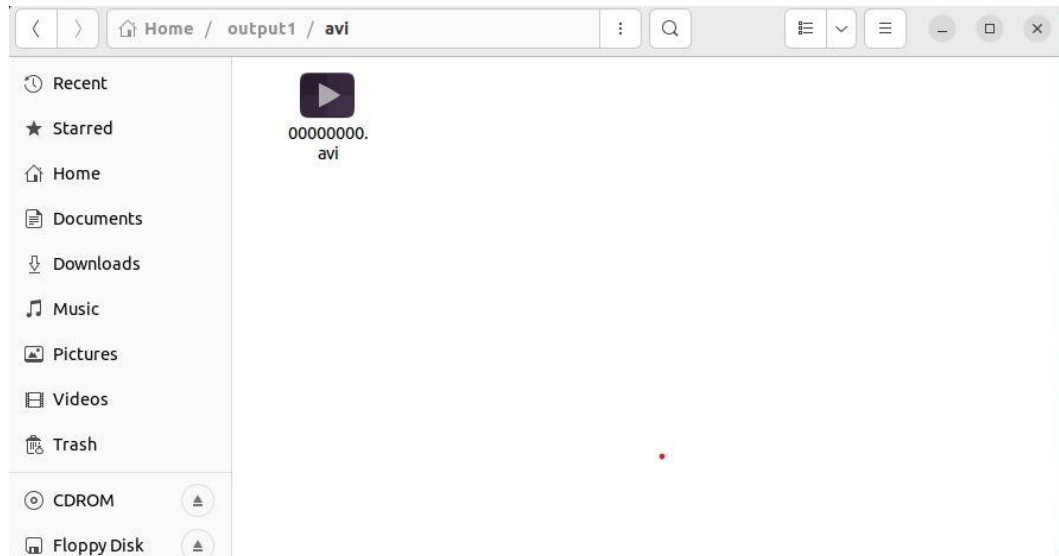


Fig10: Screenshot showing the copy of the multimedia file that has been created

By following these steps, you should be able to use Foremost to search for and recover partial and full multimedia files (video files) in a DataStream in Ubuntu.

Conclusion

In conclusion, Foremost is a powerful open-source tool that can be used to find partial and full multimedia files (specifically video files) in DataStreams. By searching through the binary data of a file system or disk image, Foremost can identify known file headers and footers to identify the file types it can recover. With the right configuration, Foremost can be a valuable asset for digital forensics investigators looking to recover hidden or deleted files from DataStreams.

CHAPTER-04

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