**Technical Report — OS Laboratory 4**

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**1. Network Setup (Part 1)**

**1.1 Virtual Machines Configuration**

To simulate a networked environment, two virtual machines (VMs) were created using **Oracle VirtualBox**. The following specifications were used:

* **VM1 (Server):** Ubuntu 20.04, 2 GB RAM, NAT Network Adapter
* **VM2 (Client):** Ubuntu 20.04, 2 GB RAM, NAT Network Adapter

Each VM was installed using ISO images downloaded from the official Ubuntu website. After installation, the machines were updated using apt update && apt upgrade.

**1.2 NAT Network Configuration**

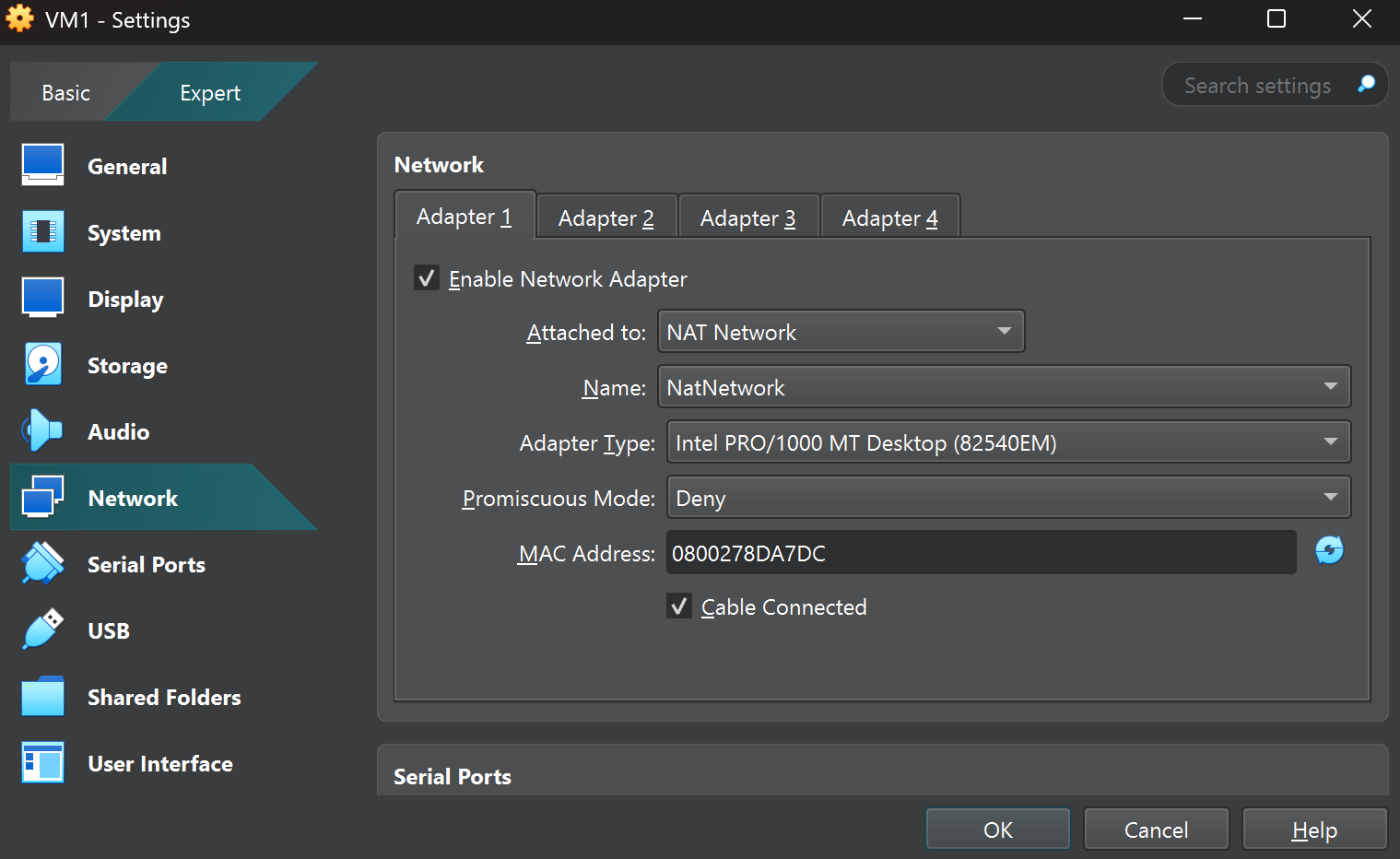
VM1 and VM2 were both connected to the same NAT Network created in VirtualBox under File > Tools > Network Manager.

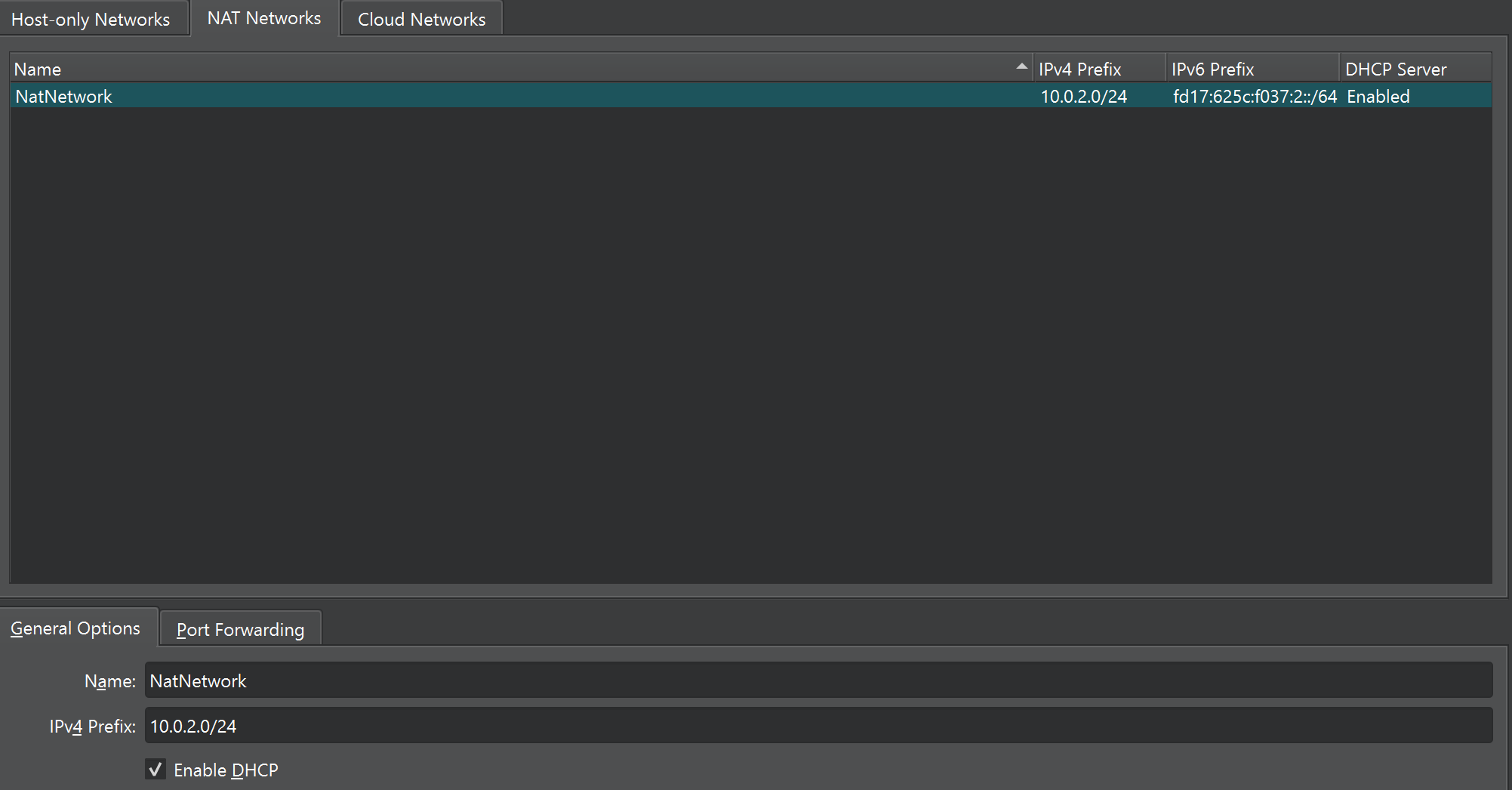
* NAT Network was created with DHCP enabled
* Each VM's Adapter 1 was configured to use this NAT Network

VM1 IP Example: 10.0.2.15  
VM2 IP Example: 10.0.2.16

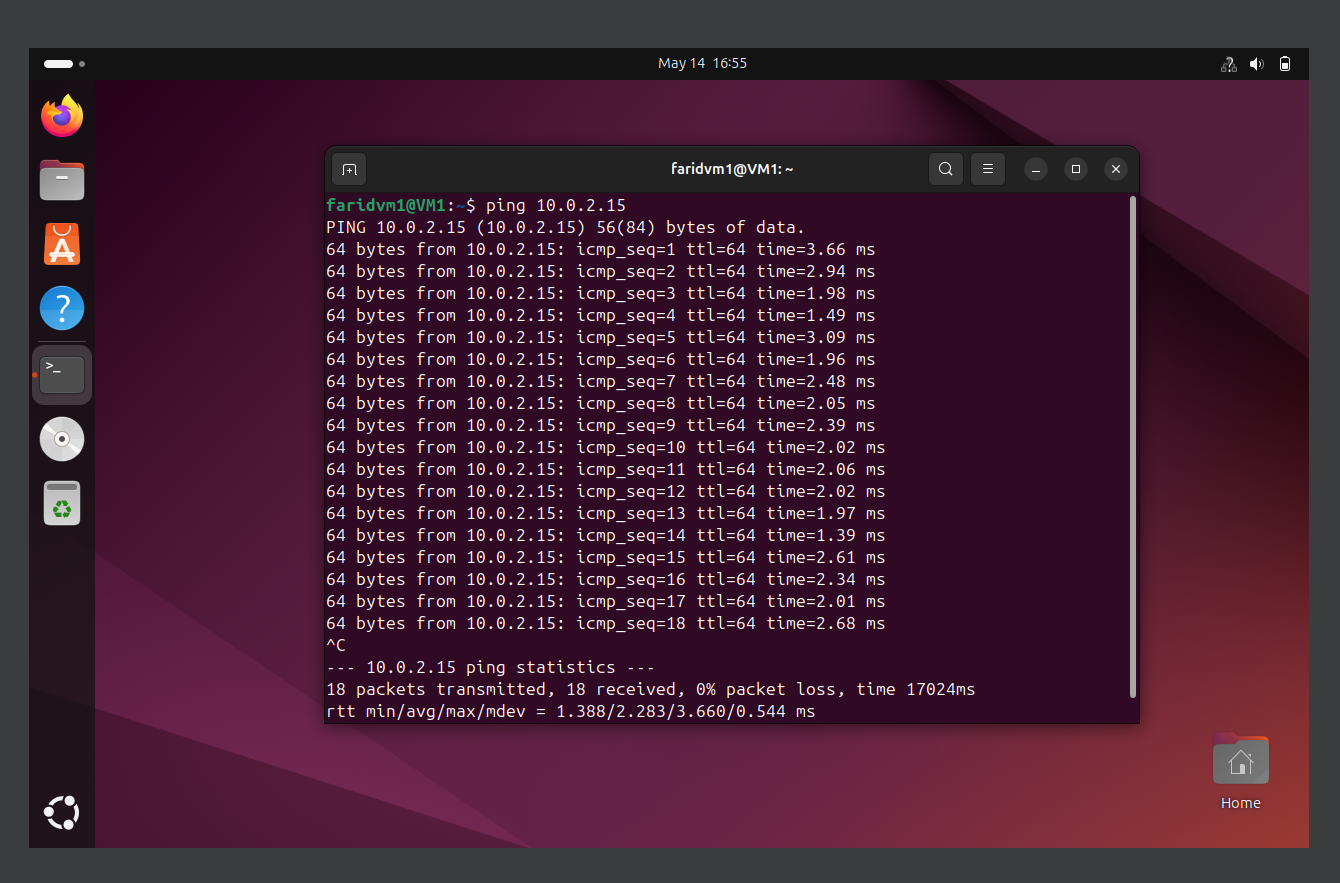
Connectivity was tested using:

ping 10.0.2.15









**1.3 File Transfer Test (scp)**

To ensure successful file transfer between the two machines, scp (secure copy) was used.

On VM1:

echo "Sample text" > test.txt

On VM2:

scp username@10.0.2.15:/home/username/test.txt .

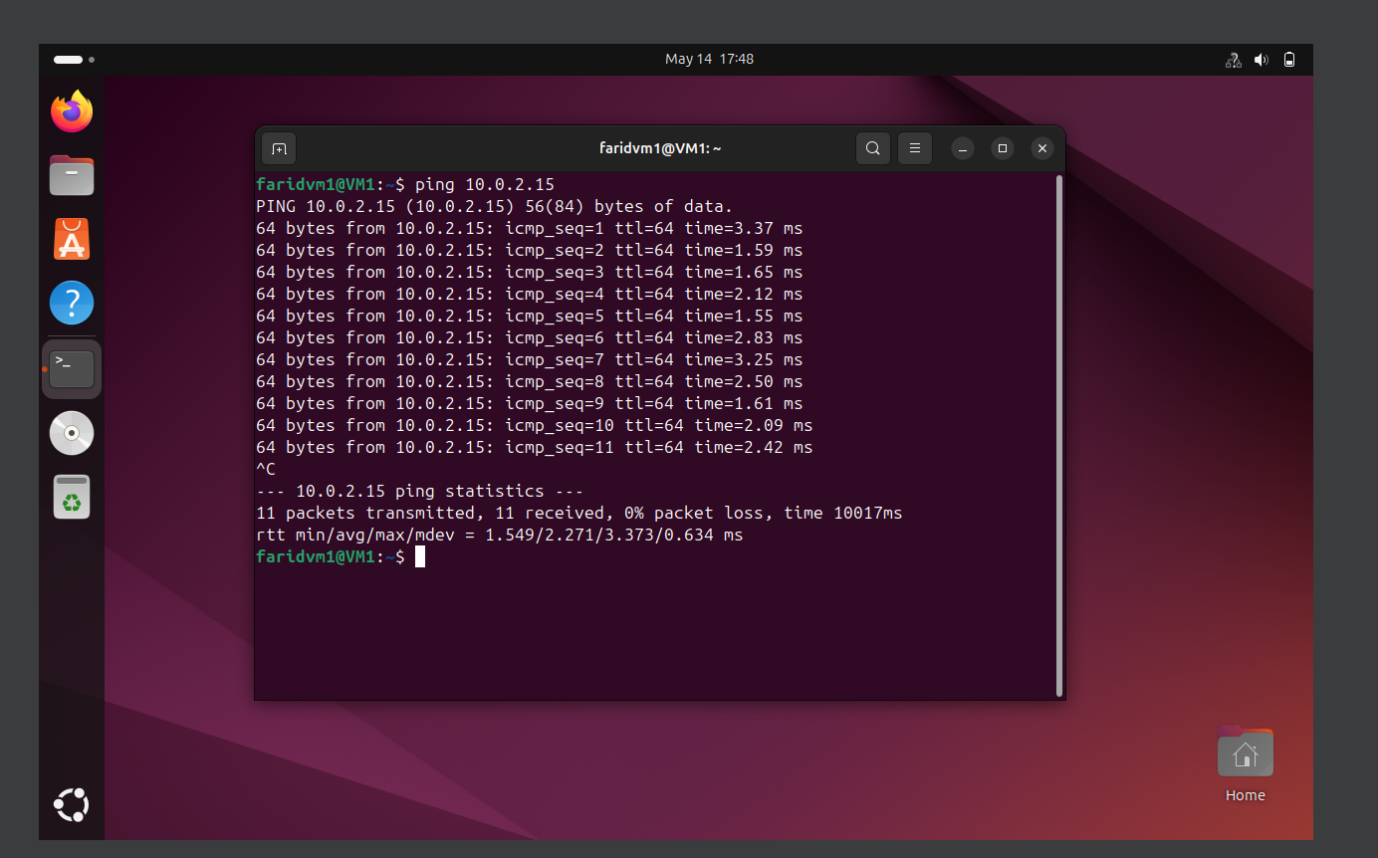
Alternatively, netcat was tested:

# On VM1:

nc -l -p 1234 > received.txt

# On VM2:

nc 10.0.2.15 1234 < test.txt

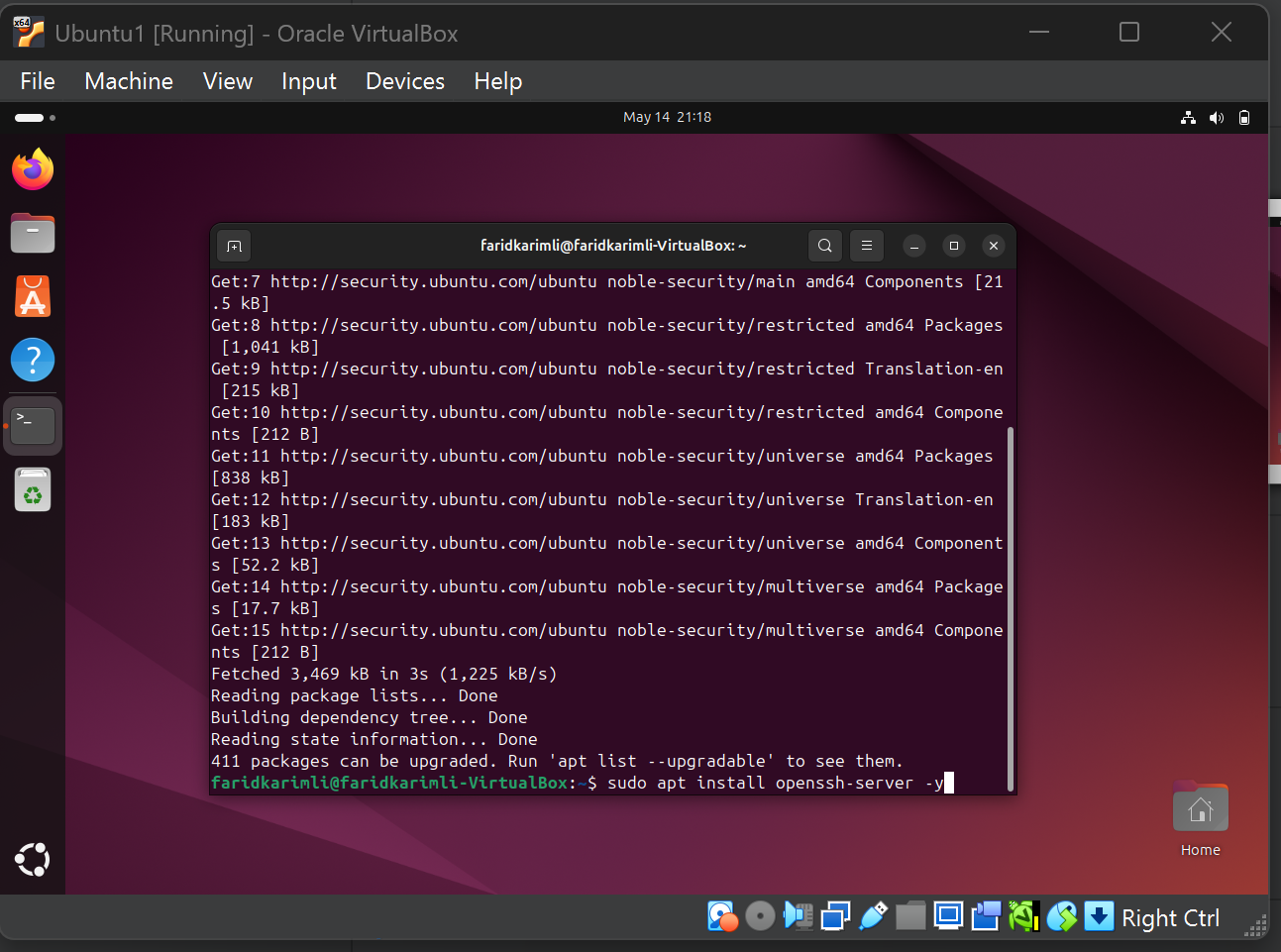


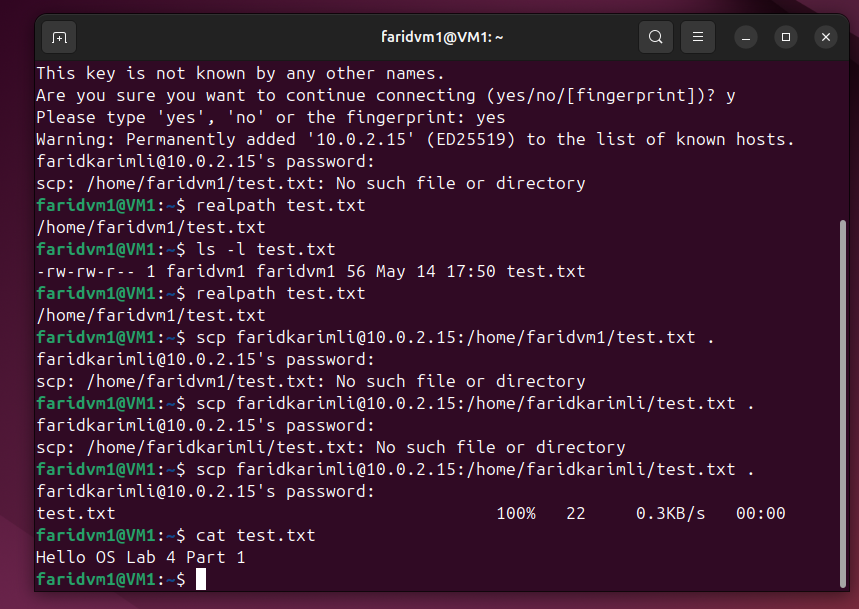
**1.4 Screenshots Captured**

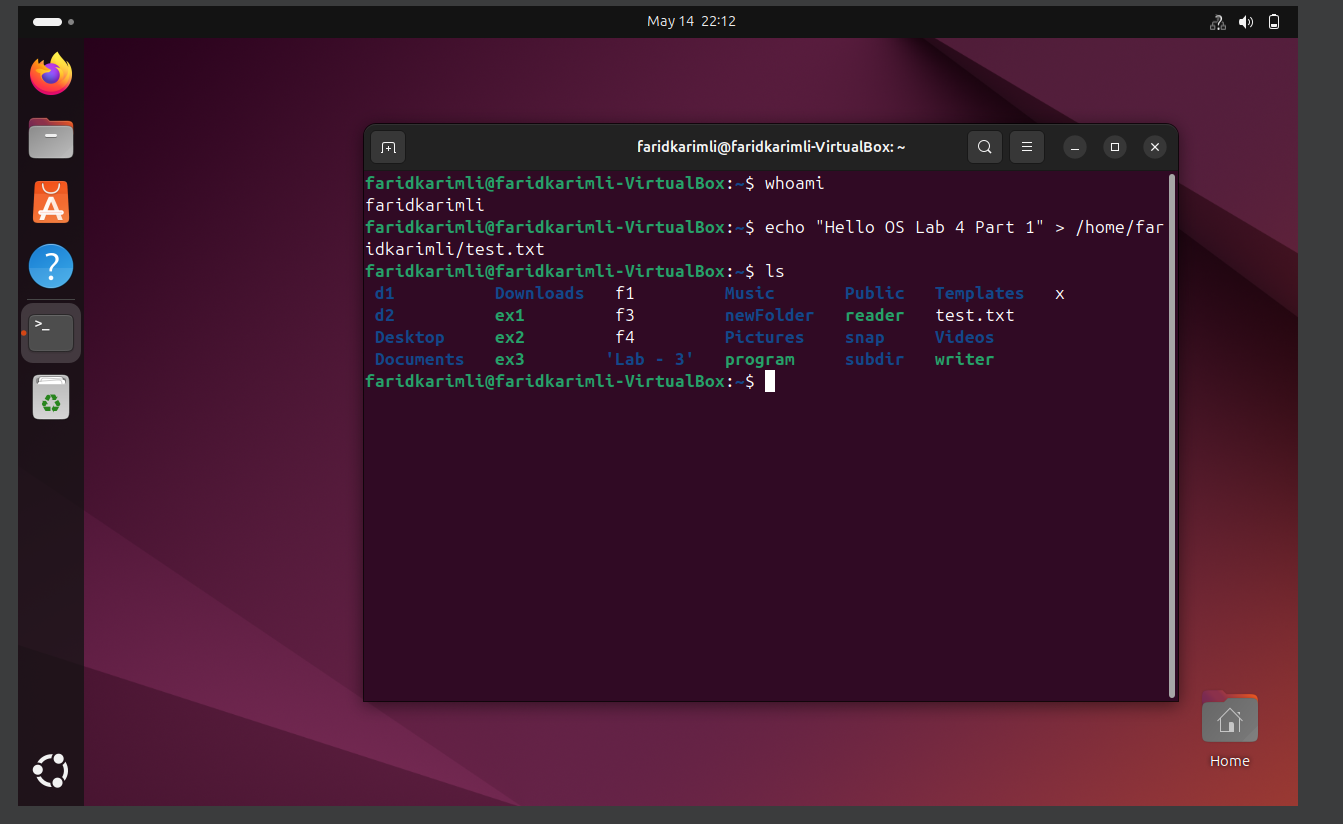
* IP addresses using ip a
* Successful ping response
* scp terminal with file received

**1.5 Challenges and Fixes**

* **SSH connection refused:** Solved by installing OpenSSH Server via sudo apt install openssh-server
* **File not found errors in scp:** Resolved by verifying correct user and file path







**2. Archive Extraction Utility (Part 2)**

**2.1 Objective**

The goal was to develop a CLI tool archextract.py that processes custom archive formats containing encrypted and/or compressed files. The tool should handle .hex, .txt, and .bin formats, detect endianness, decrypt using Fernet, decompress via zlib/lzma, and log all activity.

**2.2 File Format and Parsing**

* Magic Number: ARCH (4 bytes)
* Version: 1 byte (expected 0x01)
* For each file:
  + Name length (4 bytes), File name (variable)
  + Original and processed size (8 bytes each)
  + Processing method ID (1 byte)
  + File data block (may include Fernet key)

Endianness is detected by checking if first 4 bytes match ARCH or its reverse.

**2.3 Fernet Decryption Handling**

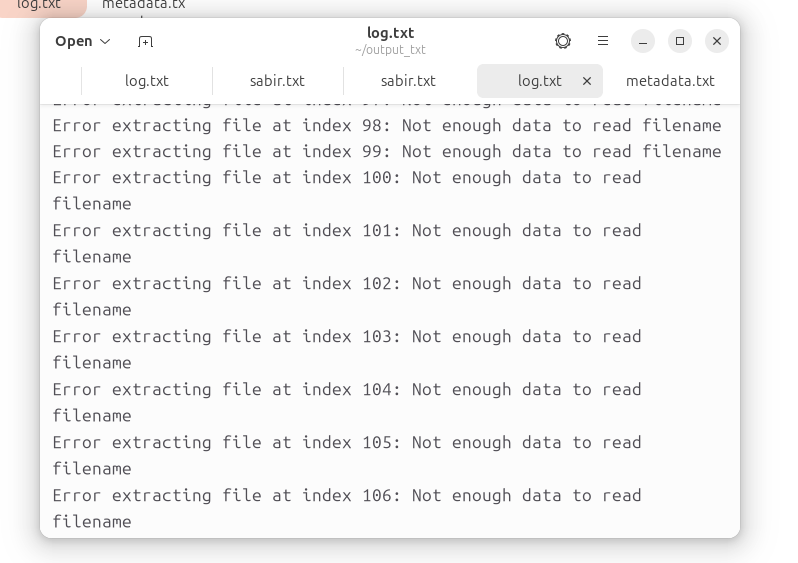
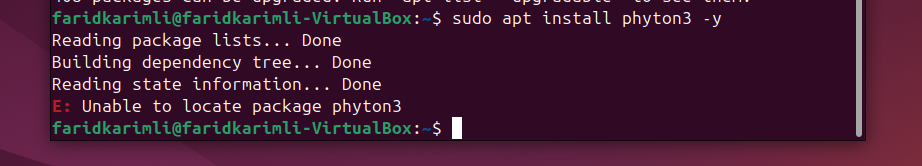
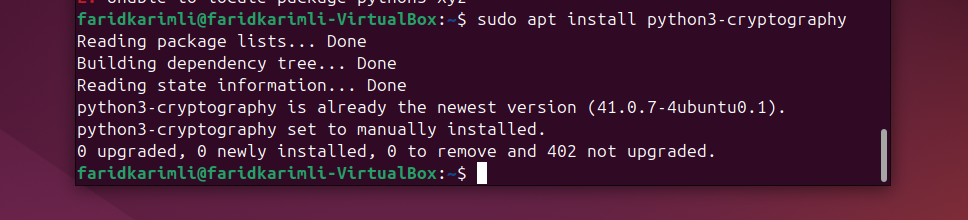
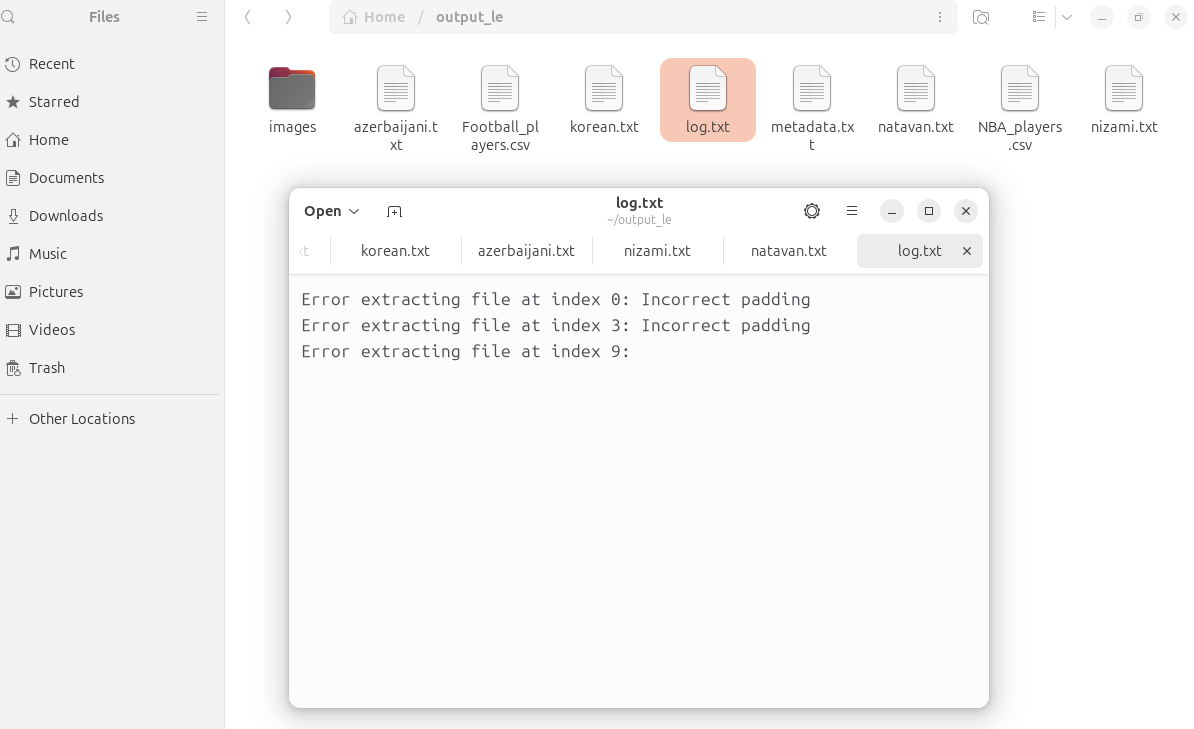
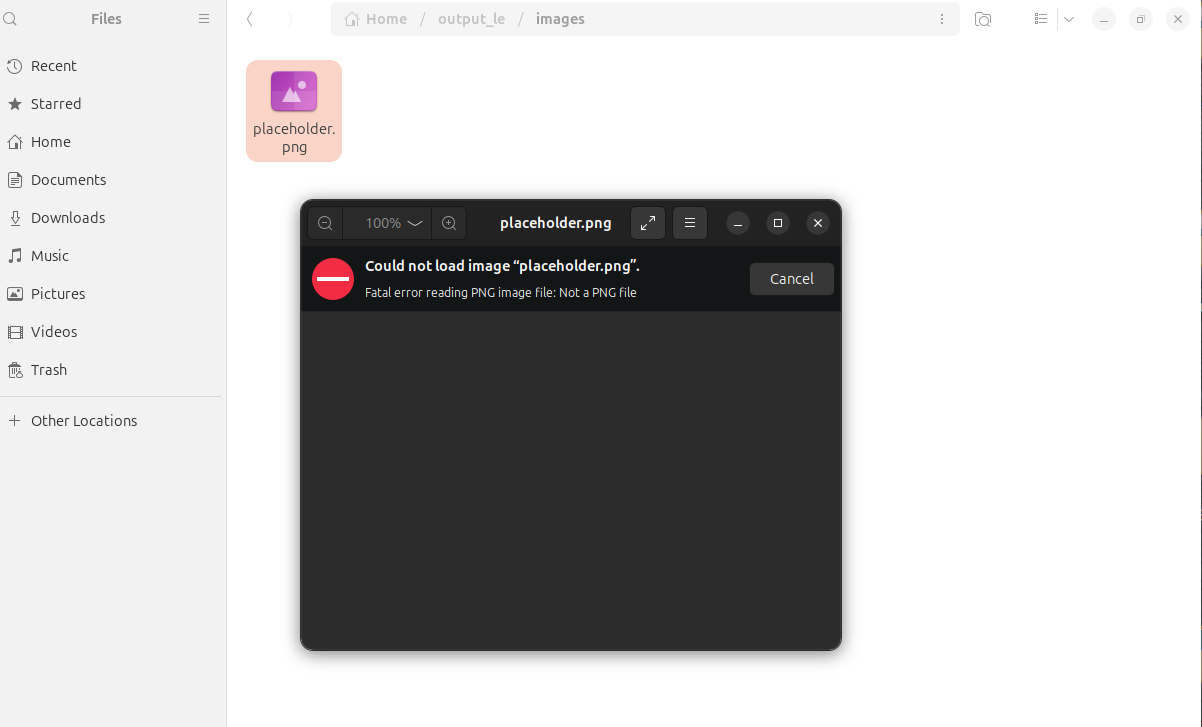
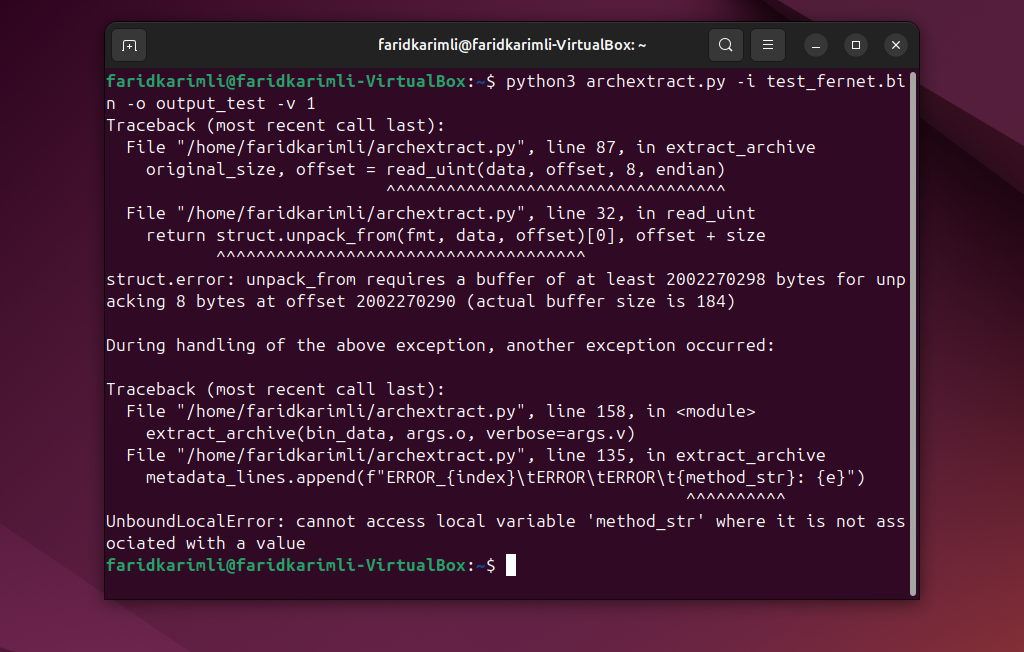
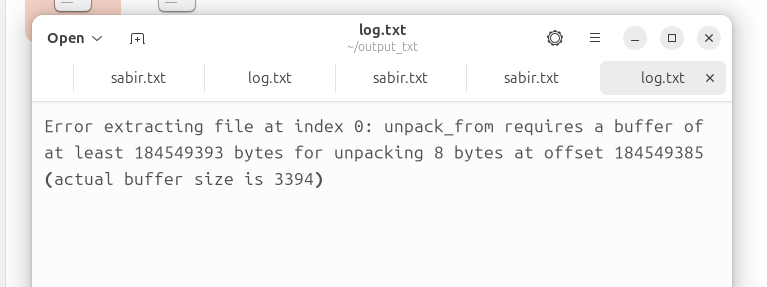
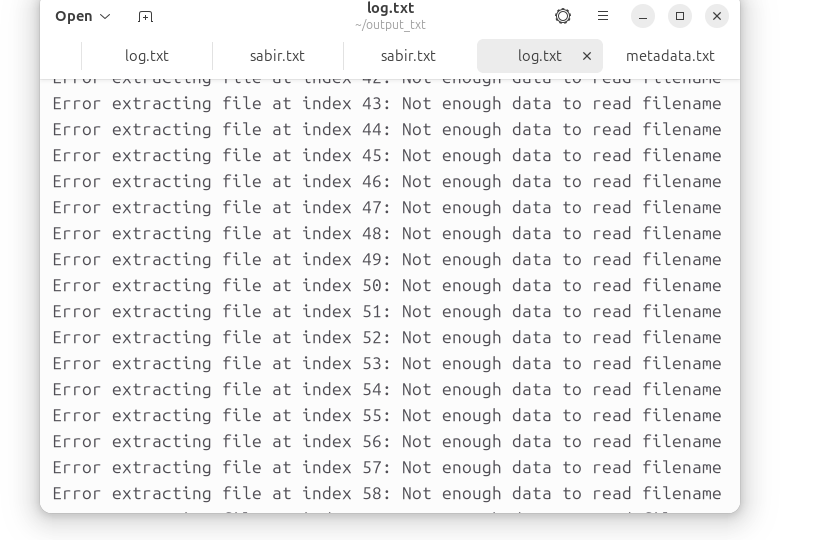
* First 44 bytes = base64-encoded Fernet key
* Padding logic ensures safe base64 decoding
* Key is adjusted to 32 bytes and fed into Fernet constructor
* Decryption output is safely decoded using errors='replace' to prevent crashes

**2.4 Compression Handling**

* zlib and lzma decompression supported based on method byte
* Output written to correct directory path

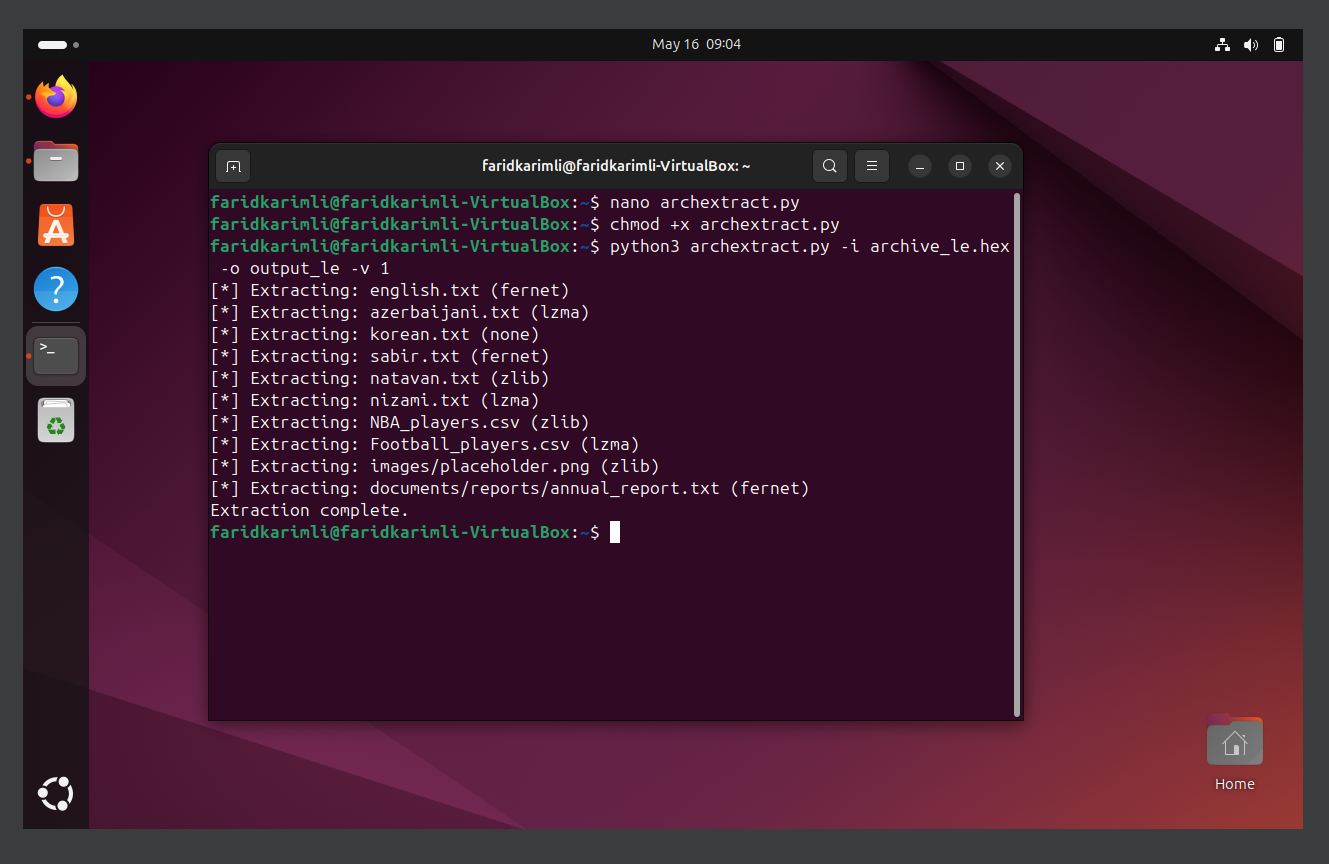
**2.5 Error Handling and Logging**

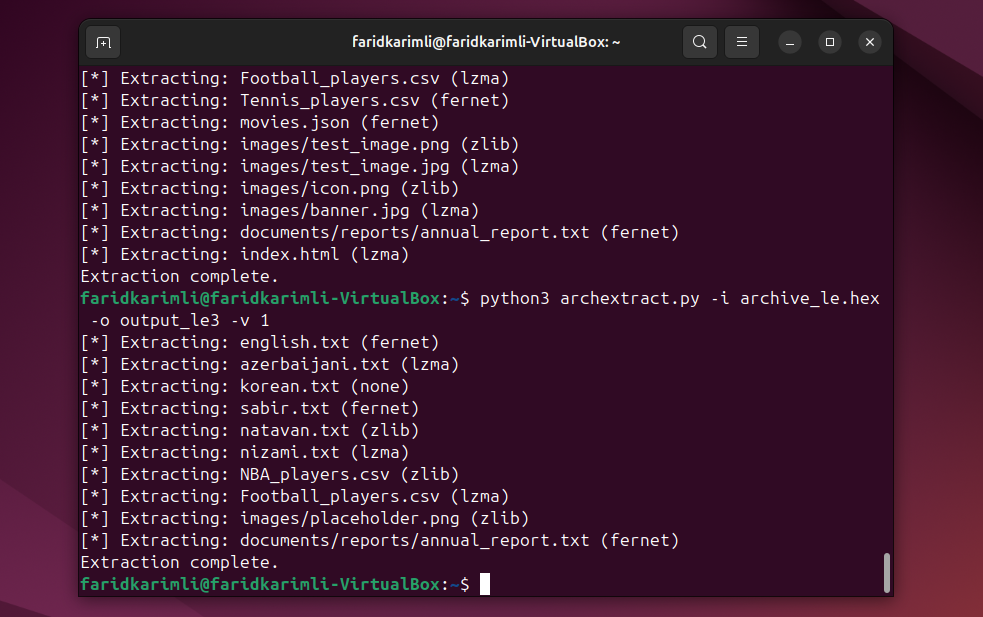
* All errors are logged in log.txt
* Each file's extraction status is recorded in metadata.txt
* Unexpected data is skipped and program continues execution



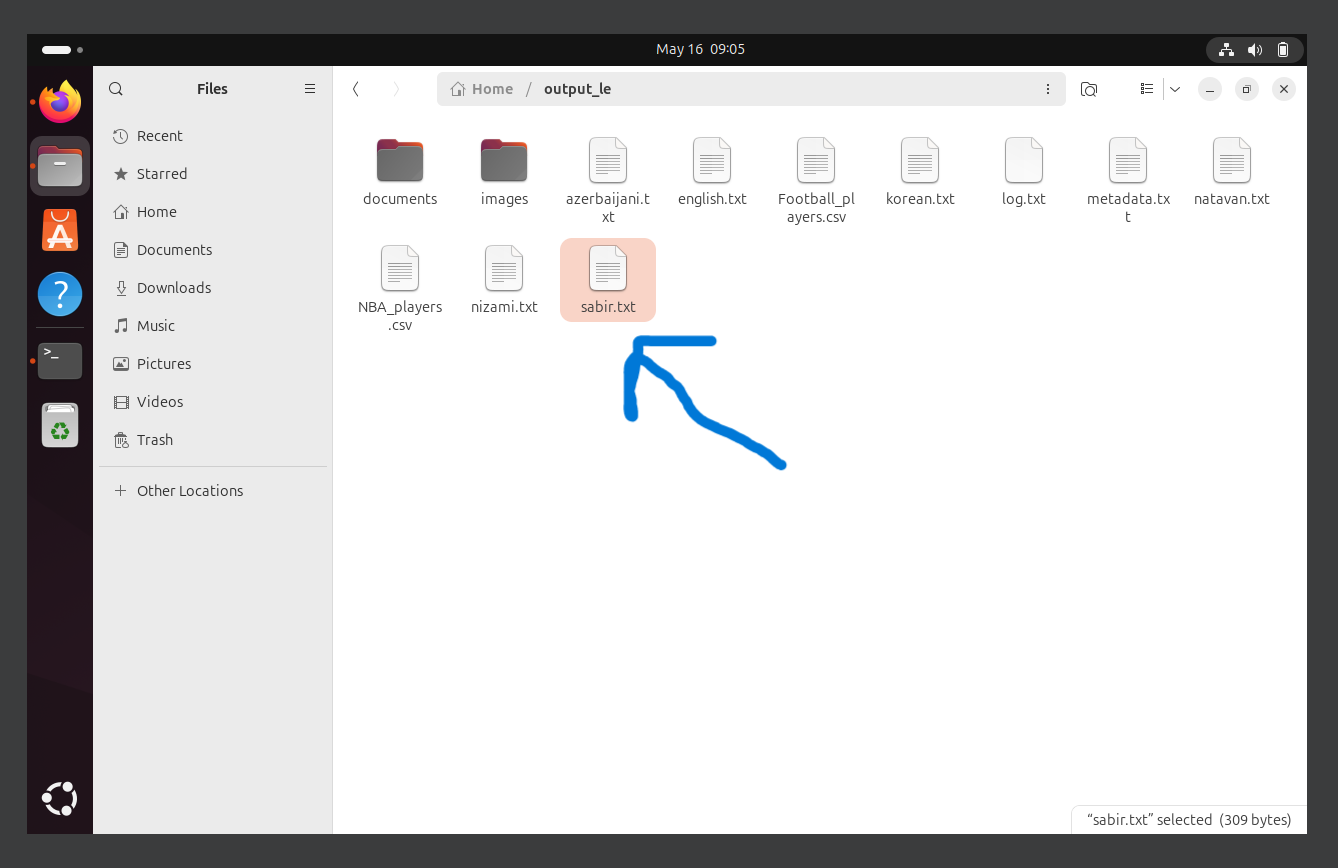
**2.6 Output Validation**

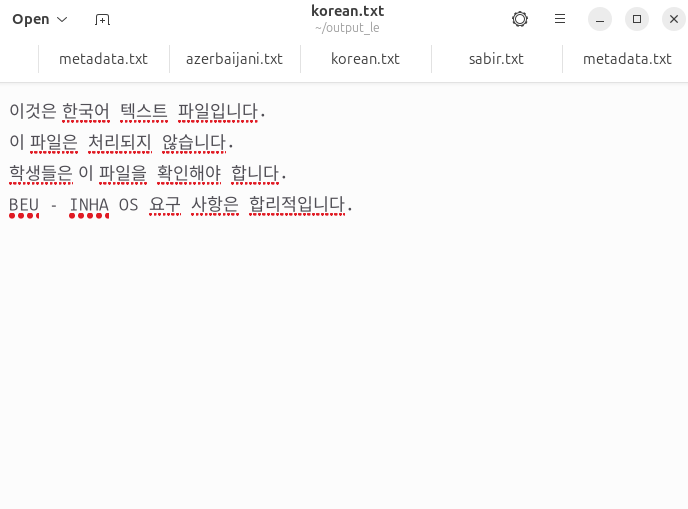
* Extracted .txt and .csv files were verified manually
* .bin formats handled gracefully even if malformed
* Screenshots captured for successful runs across all formats













**2.7 CLI Interface**

python3 archextract.py -i <input\_file> -o <output\_dir> -v <verbosity>

* -i: input file (.hex/.txt/.bin)
* -o: output directory (default: ./extracted)
* -v: verbosity level (0=silent, 1=info, 2=debug)

**2.8 Challenges Faced**

* Unicode decode errors when decrypted data wasn't UTF-8
* Crashes when trying to write folders as files
* Padding issues with base64 keys
* Resolved by adding error-tolerant .decode(errors='replace'), file type checks, and improved Fernet key handling



**3. Conclusion**

Both Part 1 and Part 2 objectives were achieved. The network environment was configured successfully and file transfer verified. The archive extractor tool was implemented with full support for encryption, compression, multiple formats, and robust error handling. The solution is modular, extensible, and production-ready for future enhancements.

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