ASSIGNMENT 1

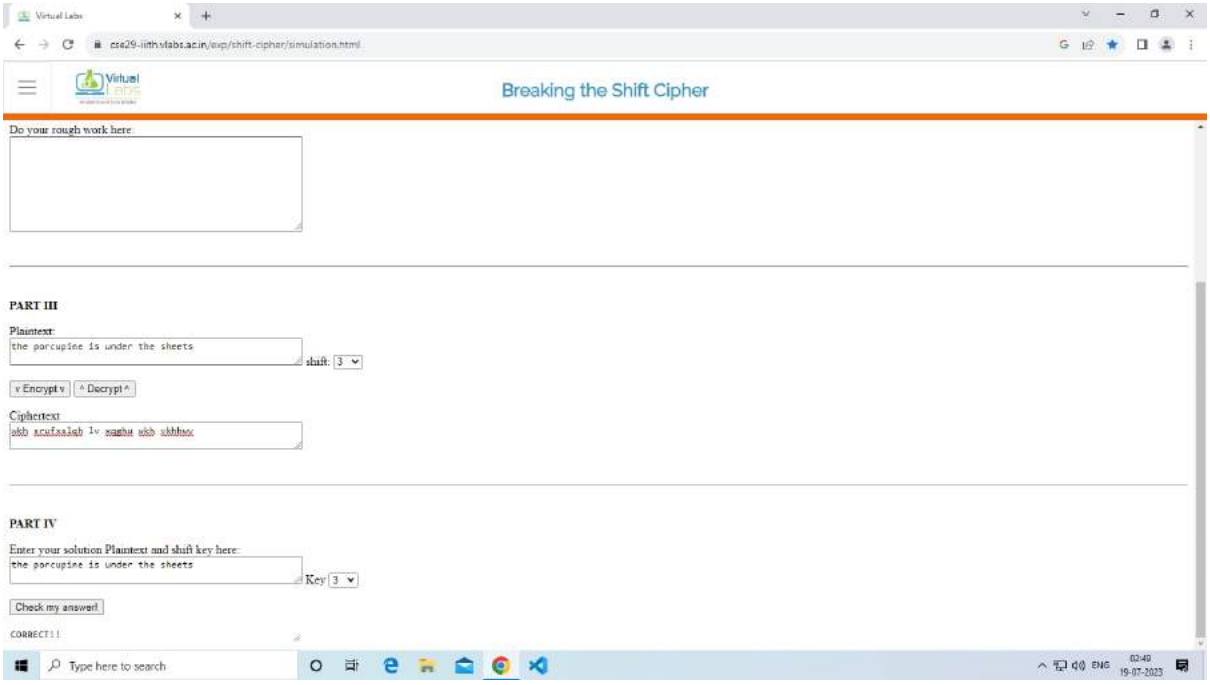
AIM : Breaking the shift cipher and Mono-alphabetic Substitution Cipher using Frequency analysis method.

LO MAPPED : LO1

THEORY :

1. Shift Cipher :
   A shift cipher, also known as a Caesar cipher, is a simple encryption technique where each letter in the plaintext is shifted a certain number of positions down or up the alphabet. This technique is named after Julius Caesar, who is said to have used it to communicate securely.
   A private-key encryption scheme consists of a set of all possible messages, called the message space M, and three algorithms, namely,
   (a) Gen
   (b) Enc
   (c) Dec

   The algorithm for key generation Gen is used to choose a key k at random from the set of all possible secret keys, denoted by the key space K.
   The algorithm for encryption Enc takes as inputs the message m and the secret key k and outputs the ciphertext c.
   The algorithm for decryption Dec inputs the ciphertext c and the key k and outputs the message m.



2. Mono-alphabetic Substitution Cipher :
   A monoalphabetic substitution cipher is a type of encryption method where each letter in the plaintext is replaced with a fixed corresponding letter in the ciphertext. In other words, every occurrence of a particular letter in the plaintext is consistently replaced with the same letter in the ciphertext. This type of cipher is relatively simple and can be easily broken through frequency analysis, where the frequency of letters in the ciphertext is compared to the expected frequency of letters in the language being encrypted (e.g., English).

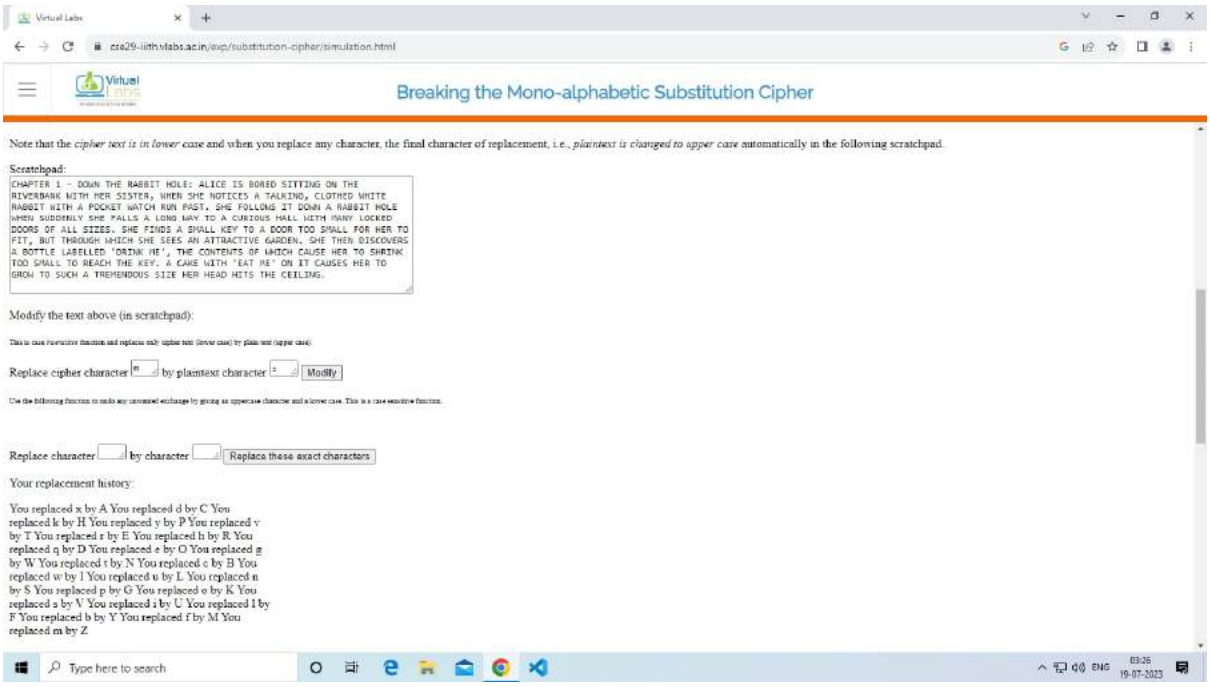
   Consider we have the plain text "cryptography". By using the substitution table below, we can encrypt our plain text as follows: abc def gh i j k l mno pqr s t u vwx yz

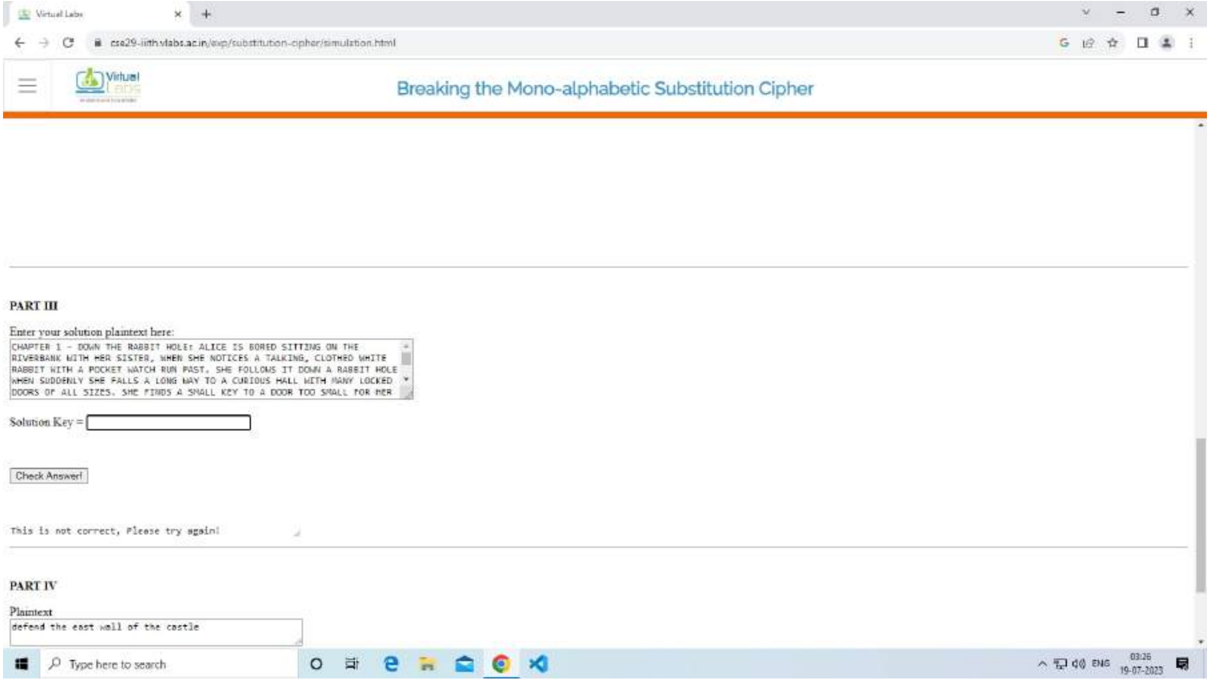
   JI BRKTCNOFQYG AUZHSVWMXL DEP

   plain text: c r y p t o g r a p h y

   cipher text: B S E Z W U C S J Z N E

   Hence we obtain the cipher text as "BSEZWUCSJZNE".





CONCLUSION : In this assignment we understood and implemented the shift cipher and Mono-alphabetic Substitution Cipher using Frequency analysis method.

ASSIGNMENT 2

AIM : Cryptoanalysis or decoding of polyalphabetic ciphers : Playfair, Vigenere Cipher

LO MAPPED : LO1

THEORY :

1. Playfair Cipher :
   The Playfair cipher is a symmetric encryption technique that uses a 5x5 matrix of letters to encrypt and decrypt messages. It's named after its inventor, Charles Wheatstone, and Lord Playfair who popularized it. The cipher is used to substitute pairs of letters in a plaintext with corresponding pairs of letters from the matrix.

   Construction of the Playfair Matrix:
   To construct the matrix, a keyword is used. The matrix is filled with the unique letters of the keyword followed by the remaining letters of the alphabet (excluding 'J' to avoid confusion with 'I'). The matrix is read left-to-right and top-to-bottom.

   Let's use the keyword "KEYWORD" to construct the matrix:

```
K E Y W O
R D A B C
F G H I L
M N P Q S
T U V X Z
```

   Encryption Process:

   i. Break the plaintext into pairs of letters. If there's a repeated letter or an odd number of letters, insert a filler (often 'X') to make pairs.

   ii. For each pair of letters:

   - If the letters are in the same row of the matrix, replace them with the letters to their right (looping back to the start if at the end of the row).
   - If the letters are in the same column, replace them with the letters below (looping back to the top if at the bottom of the column).
   - If the letters are in different rows and columns, form a rectangle with the two letters and replace them with the other two corners of the rectangle.

   Example:
   Let's encrypt the message "HELLO WORLD" using the Playfair cipher with the key "KEYWORD".

i. Break the message into pairs and add fillers if needed: "HE LX LO WO RL DX"

ii. Apply the rules to each pair:

- "HE" becomes "WO"
- "LX" becomes "IG"
- "LO" becomes "FC"
- "WO" becomes "WO" (since the letters are the same)
- "RL" becomes "IM"
- "DX" becomes "PL"

The encrypted message is: "WOFCWOIGIMPL"

Decryption Process:

The decryption process is essentially the reverse of the encryption process. You use the same Playfair matrix and rules to replace each pair of letters with their original letters.

2. Vigenere Cipher :
The vigenere cipher is an algorithm that is used to encrypting and decrypting the text. The vigenere cipher is an algorithm of encrypting an alphabetic text that uses a series of interwoven caesar ciphers. It is based on a keyword's letters. It is an example of a polyalphabetic substitution cipher. This algorithm is easy to understand and implement. This algorithm was first described in 1553 by Giovan Battista Bellaso. It uses a Vigenere table or Vigenere square for encryption and decryption of the text. The vigenere table is also called the tabula recta.

Here's how the Vigenère cipher works:

i. Key Preparation:

Choose a keyword, which is a word or phrase that both the sender and receiver know. The length of the keyword determines how many shifts are used in the encryption process. For example, if the keyword is "KEY," it has three letters, so each letter in the plaintext will be shifted by a different value, determined by the corresponding letter's position in the keyword.

ii. Encryption:

To encrypt a message, repeat the keyword as many times as necessary to match the length of the plaintext. Then, for each letter in the plaintext, find its corresponding letter in the keyword and use that letter's position in the alphabet as the shift value.

Let's see an example:

Plaintext: HELLO
Keyword: KEY

Repeating the keyword to match the length of the plaintext: KEYKE

For each letter in the plaintext, find the corresponding letter in the keyword and determine the shift value:

- H (7th letter of the alphabet) + K (11th letter of the alphabet) = O (15th letter)
- E (4th letter) + E (5th letter) = J (9th letter)
- L (12th letter) + Y (25th letter) = I (9th letter)
- L (12th letter) + K (11th letter) = X (24th letter)
- (15th letter) + E (5th letter) = T (20th letter)

So, the encrypted message using the Vigenère cipher with the keyword "KEY" is "OJIXT."

To decrypt the message, the receiver uses the same keyword to shift the letters in the encrypted message back to their original positions.

CONCLUSION : In this assignment We understood the working of Playfair and Vigenere cipher and successfully implemented the simulation of Playfair and Vigenere cipher using an online tool Dcode.

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ASSIGNMENT 3

AIM : Block cipher modes of operation using Advanced Encryption Standard (AES)

LO MAPPED : LO2

THEORY :

The Advanced Encryption Standard (AES) is a symmetric encryption algorithm used to secure data. It was established as a federal standard by the National Institute of Standards and Technology (NIST) in the United States in 2001 and has since become one of the most widely used encryption algorithms globally.

AES operates on blocks of data and supports key lengths of 128, 192, and 256 bits. The key length determines the level of security, with longer keys providing stronger encryption. AES is considered highly secure and is widely used in various applications, including securing communications over the internet, encrypting files, and protecting sensitive data in various computer systems and devices.

The AES algorithm uses a series of transformations, including substitution, permutation, and mixing operations, to encrypt and decrypt data. It is a symmetric key algorithm, which means that the same key is used for both encryption and decryption. This key is kept secret, and the security of AES relies on the strength of this secret key.

AES has several advantages:

- Security: AES is considered highly secure when used with appropriate key lengths. Its security is based on the difficulty of performing mathematical operations that would reveal the key.
- Efficiency: AES is designed to be computationally efficient, making it suitable for use in various applications, including resource-constrained devices.

- Standardization: AES is an international standard, which means that it's widely supported and implemented in various software and hardware products.
- Versatility: AES can be used in various modes of operation to meet specific security requirements, such as Cipher Block Chaining (CBC), Electronic Codebook (ECB), and others.
- Flexibility: AES supports different key lengths, allowing users to choose the level of security that suits their needs.

Block cipher modes of operation are techniques used to apply block ciphers like the Advanced Encryption Standard (AES) to encrypt large streams or messages of data. These modes define how to handle data that is larger than the fixed block size of the block cipher (e.g., 128 bits for AES). Each mode has unique characteristics and use cases. Here's a theoretical overview of some common block cipher modes of operation when using AES:

1. **Electronic Codebook (ECB) Mode:**

ECB is one of the simplest block cipher modes of operation, and it's easy to understand conceptually. However, it has certain limitations and security concerns, which make it less suitable for many practical encryption scenarios.

i. Block-by-Block Encryption:
   - In ECB mode, the plaintext message is divided into fixed-size blocks, typically 128 bits (16 bytes) for AES since AES is a 128-bit block cipher. If the plaintext is not an exact multiple of this block size, padding is usually added to make it fit.

ii. Independently Encrypting Blocks:
   - Each plaintext block is encrypted separately using the same encryption key. This means that the encryption of one block doesn't depend on the content or ciphertext of any other block in the message.

iii. Repetition Issue:
   - One of the significant drawbacks of ECB mode is that identical plaintext blocks will produce identical ciphertext blocks. This lack of diffusion is a vulnerability because it reveals patterns in the original data. For example, if you encrypt an image using ECB mode, regions of uniform color will be evident in the encrypted image.

iv. No Initialization Vector (IV):

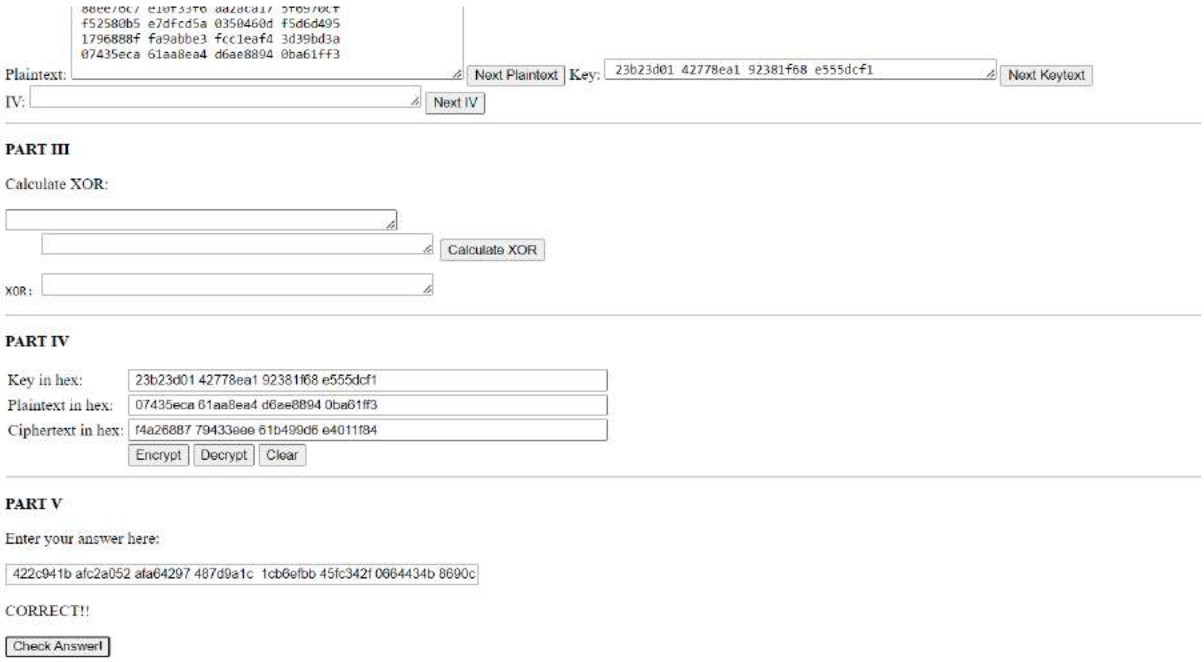
- ECB mode does not use an Initialization Vector (IV), which is used in other modes like CBC to add randomness and prevent identical blocks from encrypting to the same ciphertext. This lack of an IV means that the same plaintext encrypted multiple times with the same key will always produce the same ciphertext.

v. Not Suitable for Secure Applications:

- Due to the repetition issue and the lack of an IV, ECB mode is not recommended for secure communications or data encryption in scenarios where confidentiality and security are critical.

vi. Use Cases:

- Despite its shortcomings, ECB mode can be appropriate in some specific cases. For example, when the data blocks are guaranteed to be unique or when encryption and decryption are done on small, non-repetitive datasets. It's also used in certain applications like disk encryption, but usually in combination with other encryption techniques to address its limitations.



2. **Cipher Block Chaining (CBC) :**

Cipher Block Chaining (CBC) is a block cipher mode of operation used to encrypt plaintext data with a symmetric encryption algorithm like the Advanced Encryption Standard (AES). It is one of the most commonly used modes and provides confidentiality and some level of data integrity.

Here's a detailed explanation of how CBC mode works:

i. Initialization Vector (IV):
- CBC mode requires an Initialization Vector (IV), which is a random value of the same block size as the cipher (e.g., 128 bits for AES).
- The IV is used to initialize the encryption process and should be different for each message or session.
- The IV is typically prepended to the ciphertext or transmitted alongside it so that the recipient can decrypt the message.

ii. Block Division:
- The plaintext message is divided into fixed-size blocks, typically matching the block size of the cipher (e.g., 128 bits for AES).
- If the last block is shorter than the block size, padding is often added to make it the correct size.

iii. Block Chaining:
- CBC mode operates by chaining the encryption of each block with the previous block's ciphertext.
- The IV is XORed with the first plaintext block to create the initial "previous ciphertext block."

iv. Encryption Process:
- To encrypt each block, CBC performs the following steps:
- XOR the current plaintext block with the previous ciphertext block.
- Encrypt the result using the encryption key with the chosen block cipher (e.g., AES).
- The output of the encryption becomes the current ciphertext block.

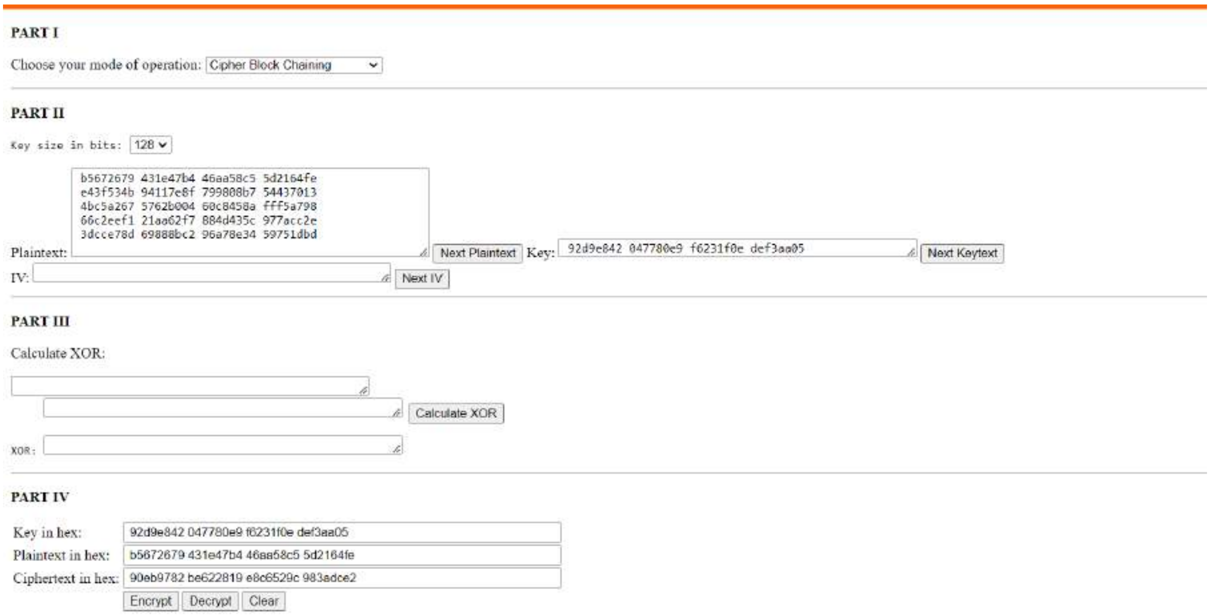
v. Initialization Vector for the Next Block:
- The ciphertext produced from the encryption process for one block becomes the "previous ciphertext block" for the next block.
- This chaining ensures that identical plaintext blocks produce different ciphertext blocks, adding an element of diffusion and enhancing security.

vi. Finalization and Padding:
- After processing all plaintext blocks, the final ciphertext blocks are obtained.
- If padding was added in step 2, it may need to be removed during decryption.

vii. Decryption:
- To decrypt a CBC-encrypted message, the recipient must have the same IV and encryption key.
- Each ciphertext block is decrypted using the encryption key.
- The result is XORed with the previous ciphertext block to obtain the plaintext block.
- The IV is used only for the first block.

It's important to note the following regarding CBC mode:

- CBC provides confidentiality because it ensures that identical plaintext blocks do not produce identical ciphertext blocks, making it resistant to pattern analysis.
- It does not provide data integrity or authentication on its own. To achieve data integrity and authenticity, an additional mechanism like HMAC (Hash-based Message Authentication Code) or GCM (Galois/Counter Mode) can be used in combination with CBC.
- The security of CBC mode relies on the proper generation and management of the IV and the security of the encryption key.
- CBC mode is susceptible to padding oracle attacks if not implemented securely, which is why it is essential to follow best practices when using it in practice. Padding oracle attacks can leak information about the plaintext.



3. Output Feedback Mode :

Output Feedback (OFB) is one of the modes of operation for block ciphers like the Advanced Encryption Standard (AES). OFB mode transforms a block cipher into a synchronous stream cipher, which means it generates a keystream of random data that is XORed with the plaintext to produce the ciphertext. Here's a more detailed explanation of how OFB mode works:

i. Initialization:
- Like other block cipher modes, OFB starts with an initialization phase.
- An Initialization Vector (IV) is required, which should be a random value and should be kept secret. The IV should be the same length as the block size (e.g., 128 bits for AES).
- The IV is used as the input to the block cipher (AES) encryption algorithm in the first step.

ii. Keystream Generation:
- In OFB mode, a sequence of random bits, known as the keystream, is generated.
- The keystream is typically generated in blocks of the same size as the block size of the block cipher (e.g., 128 bits for AES).

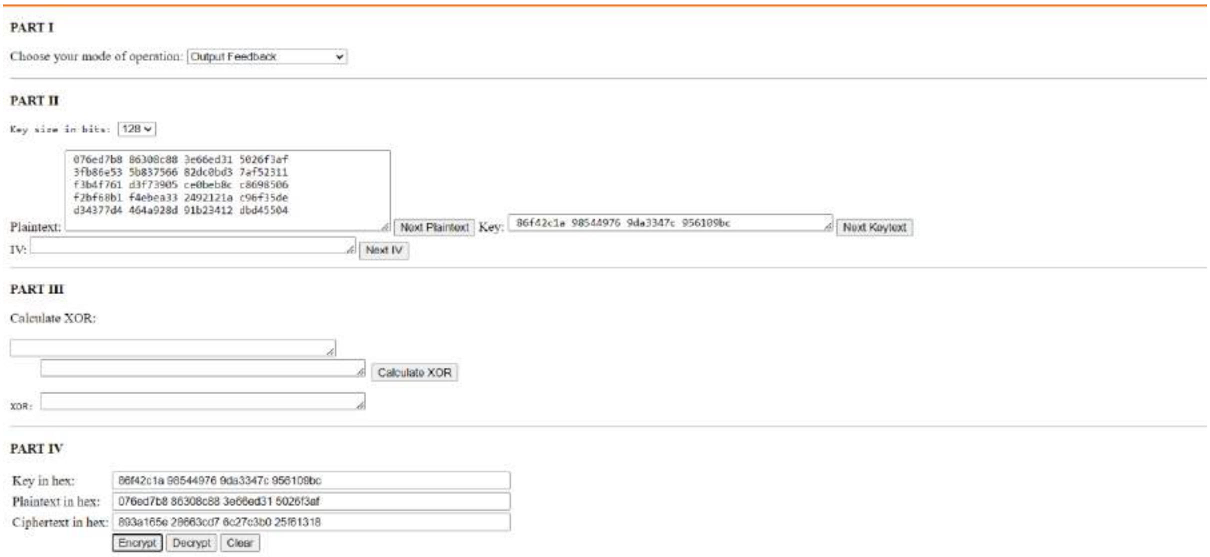
- To generate the keystream, the IV is encrypted using the block cipher (AES) in the first step.

iii. Encryption:
- To encrypt the plaintext, the keystream is XORed (bitwise exclusive OR) with the plaintext.
- The result of this XOR operation is the ciphertext for that block.
- The same keystream is used for encrypting subsequent blocks of plaintext.

iv. Decryption:
- Decryption in OFB mode is essentially the same as encryption because XORing the ciphertext with the same keystream will produce the original plaintext.
- This property makes OFB mode highly suitable for situations where encryption and decryption need to be symmetric (the same process is used for both).

v. Advantages and Use Cases:
- OFB mode is particularly useful when you need to encrypt data in a streaming fashion or in a random-access manner, as you don't need to wait for the entire plaintext to be available before encrypting it.
- It provides a level of error propagation, meaning that errors in ciphertext are confined to the block in which they occur and do not affect the decryption of subsequent blocks.
- OFB does not provide data integrity or authentication on its own. To ensure data integrity, a separate mechanism like a Message Authentication Code (MAC) can be used.

vi. Security Note:
- OFB mode is considered secure as long as the same IV is not reused with the same encryption key. Reusing an IV can lead to security vulnerabilities.
- The security of OFB relies on the confidentiality of the keystream. If the keystream becomes predictable or known, it can compromise the security of the encryption. Therefore, the block cipher's security is crucial.



4. Counter (CTR) Mode:

CTR mode is a block cipher mode of operation that transforms a block cipher, such as the Advanced Encryption Standard (AES), into a stream cipher. It’s designed for encrypting large amounts of data with good parallelization, making it suitable for modern hardware and software implementations. CTR mode offers confidentiality, but it does not provide data integrity or authentication by itself. To achieve data integrity and authentication, it’s often combined with other techniques like HMAC.

Here's how CTR mode works:

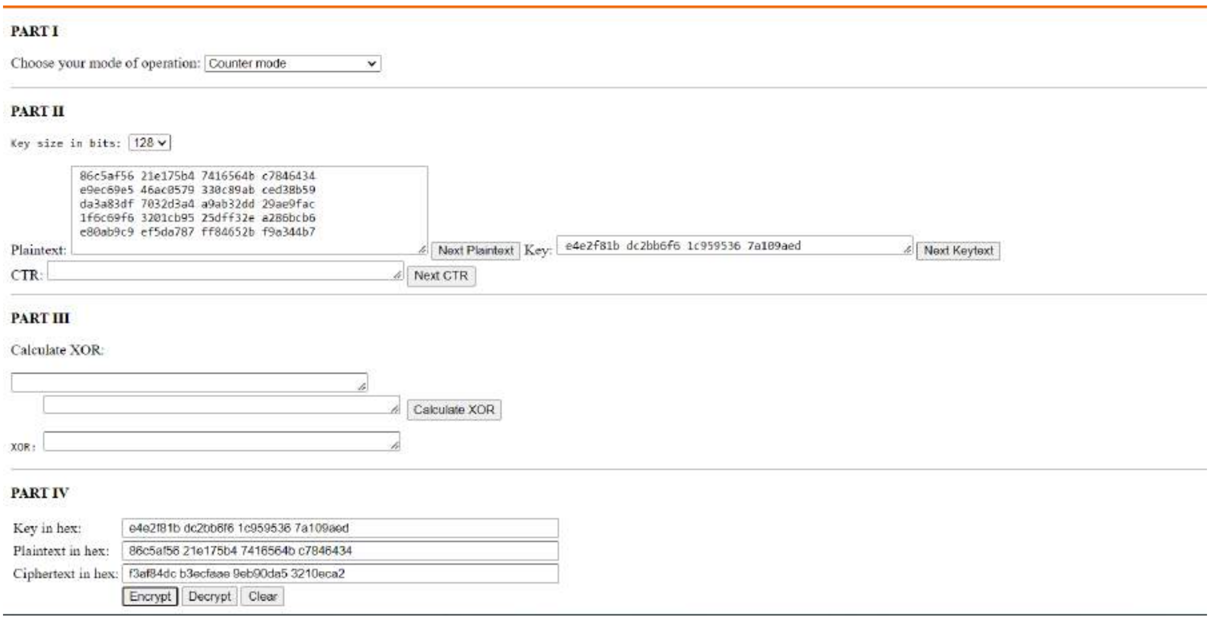
i. Initialization:
- Choose a secret encryption key (e.g., a 128-bit or 256-bit AES key).
- Generate a unique nonce (number used once) for each message. The nonce should be long enough to ensure uniqueness but can be public.
- Initialize a counter value (usually a 64-bit or 128-bit counter) to a predetermined starting value.

ii. Keystream Generation:
- For each block of plaintext, increment the counter value.

- Encrypt the counter value using the block cipher (AES) with the secret key. This produces a pseudorandom output, known as the keystream.
- XOR the keystream with the corresponding block of plaintext to obtain the ciphertext.

iii. Decryption:

- To decrypt the ciphertext, the recipient uses the same secret key and the same nonce.
- The recipient increments the counter value in the same way as the sender did.
- Encrypt the counter value with the secret key to produce the same keystream.
- XOR the keystream with the ciphertext to recover the original plaintext.



CONCLUSION :

In this assignment we learned about Advanced Encryption Standard (AES) and various block cipher modes of operation like Electronic Codebook (ECB) Mode , Cipher Block Chaining (CBC) , Output Feedback Mode , Counter (CTR) Mode.

ASSIGNMENT 4

AIM : Implementation and analysis of RSA cryptosystem and Digital Signature Scheme using RSA .

LO MAPPED : LO2

THEORY :

The RSA (Rivest-Shamir-Adleman) cryptosystem is a widely used asymmetric encryption algorithm for secure communication and data protection. It involves key generation, encryption, and decryption. Here's a high-level overview of implementing and analyzing RSA:

i. Key Generation:
- Choose two large prime numbers, p and q.
- Compute n = p * q.
- Calculate ϕ(n) = (p-1) * (q-1), which is Euler's totient function.
- Choose an encryption exponent, e, such that 1 < e < ϕ(n) and gcd(e, ϕ(n)) = 1.
- Compute the decryption exponent, d, as the modular multiplicative inverse of e modulo ϕ(n).
- The public key is (n, e), and the private key is (n, d).

ii. Encryption:
- Convert the plaintext message into a numeric representation, m.
- Compute the ciphertext c = m^e mod n.

iii. Decryption:
- Calculate the plaintext message m = c^d mod n.

Digital Signature Scheme using RSA:

RSA can also be used for digital signatures, which provide authenticity, integrity, and non-repudiation to digital messages. Here's how to implement a basic digital signature scheme using RSA:

i. Key Generation:
- Generate a pair of keys as in the RSA cryptosystem.

ii. Signature Generation:
- Hash the message to create a fixed-size digest.
- Encrypt the digest using the sender's private key, resulting in the digital signature.

iii. Signature Verification:
- Decrypt the received digital signature using the sender's public key to obtain the received digest.
- Hash the received message to obtain a digest.
- Compare the received digest with the computed digest. If they match, the signature is valid.

Steps Of Digital Signature Generation And Verification Process:-

A digital signature is created using hash algorithms or a scheme of algorithms like DSA and RSA that use public key and private key encryptions. The sender uses the private key to sign the message digest (not the data), and when they do, it forms a digital thumbprint to send the data. Digital signature solutions use crypto-algorithms to convert both the document to be signed and the private key (which is already in character form), into a new set of encrypted characters.

When a signed document is authenticated using the public key, the signer is aware of who created it & whether the document has been altered since being digitally signed. The decryption process gets back the original hashed document, and this can be compared to the encrypted hash, to determine the authenticity of the document & the digital signature.

To verify the identity of the signer and the digital signature, DSC or Digital Signature Certificate is issued. DSC is a secure digital public key that does all the decrypting & authenticates the identity of the holder.

i. Hashing the Message: The first step in digital signature generation is to create a hash value of the message or document that needs to be signed. A cryptographic hash function, such as SHA256, is applied to the entire content of the message, generating a fixed-size output known as the message digest.
ii. Private Key Signing: The signer uses their private key (associated with their public key) to encrypt the generated message digest. This process is typically performed using asymmetric encryption algorithms like RSA or DSA. The result is the digital signature.
iii. Attaching the Digital Signature: The digital signature, which is the encrypted message digest, is attached to the original message or document. The combination of the message/document and the attached digital signature forms the digitally signed message.
iv. Digital Signature Verification: Hashing the Received Message: Upon receiving the digitally signed message, the recipient first extracts the digital signature from the message.
v. Public Key Decryption: The recipient uses the public key of the sender to decrypt the digital signature. This process retrieves the original message digest that was hashed by the sender.

vi. Hashing the Received Message: The recipient then independently calculates the message digest of the received message or document using the same cryptographic hash function that the sender used.

vii. Comparing Digests: Next, the recipient compares the computed message digest with the one obtained from decrypting the digital signature. If both digests match, it indicates that the message or document has not been tampered with during transmission, and the digital signature is valid.

viii. Signature Verification: Finally, the recipient verifies the authenticity of the digital signature by ensuring that the decrypted message digest was encrypted using the associated private key of the supposed sender. If the verification process is successful, the digital signature is considered valid, and the message's integrity and origin are confirmed.

CONCLUSION : In conclusion, RSA is a widely used asymmetric encryption algorithm that plays a crucial role in digital signature generation and verification. RSA key generation establishes secure public and private key pairs, ensuring the confidentiality and authenticity of digital messages. When combined with the digital signature process, RSA enables non-repudiation, guaranteeing the integrity and origin of digital data.

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ASSIGNMENT – 5

AIM : To explore Hashdeep tool in kali linux for generating , matching and auditing hash of files.

LO MAPPED : LO2

THEORY :

Hashdeep is a command-line utility used in computer forensics and digital file verification to calculate and compare hash values (checksums) of files. It is a part of the Hashdeep Suite and is widely used in Computer and Network Security (CNS) for various purposes. Here's an overview of Hashdeep in CNS:

1. Purpose of Hashdeep:

Hashdeep serves several key purposes in CNS and digital forensics:

- Data Integrity Verification: Hashdeep is used to verify the integrity of files and directories by generating cryptographic hash values for them. If any part of a file changes, its hash value will change as well, indicating potential data tampering or corruption.
- Digital Investigations: In digital investigations, Hashdeep helps forensic analysts ensure the authenticity and integrity of digital evidence. It can be used to create hash databases of digital evidence and then verify their integrity during analysis.
- Data Deduplication: Hashdeep can be used to identify duplicate files in a dataset by comparing hash values. This is useful for optimizing storage space and improving data management.
- Security Auditing: In network security and auditing, Hashdeep can be used to create hash databases of critical files and periodically verify them to detect unauthorized changes or intrusion attempts.

2. How Hashdeep Works:

Hashdeep operates by calculating cryptographic hash values for files and directories. Here's how it typically works:

- Hash Calculation: Hashdeep supports various cryptographic hash algorithms, such as MD5, SHA-1, and SHA-256. It calculates hash values for individual files or all files within a directory and its subdirectories.
- Hash Database Creation: Hashdeep can create a hash database file that stores the calculated hash values along with file paths. This database can be used for later verification.
- Verification: To verify the integrity of files, Hashdeep compares the hash values of files against the values stored in the hash database. If any file has a different hash value from what's recorded in the database, it indicates a potential issue.
- Reporting: Hashdeep generates reports that provide details about the verification process, including which files have changed or remain unchanged. These reports are valuable for forensic analysis or auditing purposes.

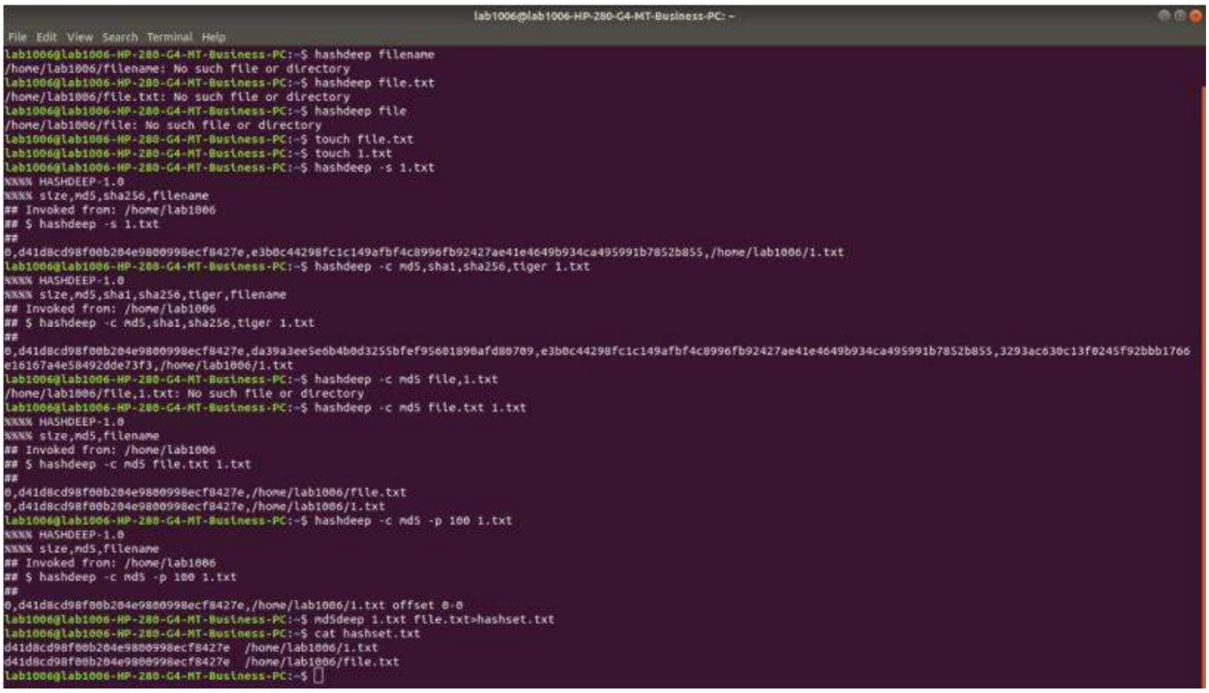
How to use hashdeep :

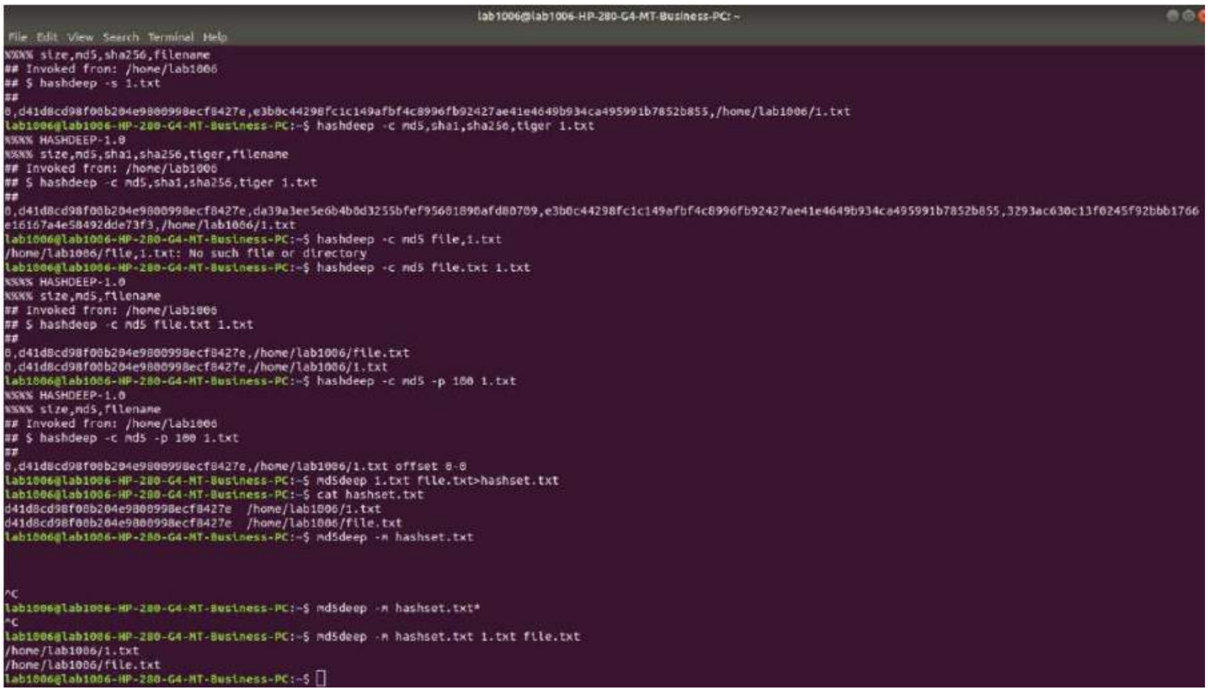
1. 1.To check the version of Hashdeep :
   Hashdeep -V
2. To display help about Hashdeep :
   Hashdeep -h or Hashdeep -hh
3. To display the manual page of Hashdeep :
   man Hashdeep
4. To display the manual page of any specific hash algorithm supported
   By Hashdeep : man md5deep
5. To hash a file : Hashdeep filename
6. To supress any error messages : Hashdeep -s filename
7. To apply multiple hash algorithms than default :
   Hashdeep -c md5,sha1,sha256,tiger filename
8. To hash multiple files (say all text files) using md5 :
   Hashdeep -c md5 *.txt
9. To hash multiple files (say all text files) using md5 and sha1 :

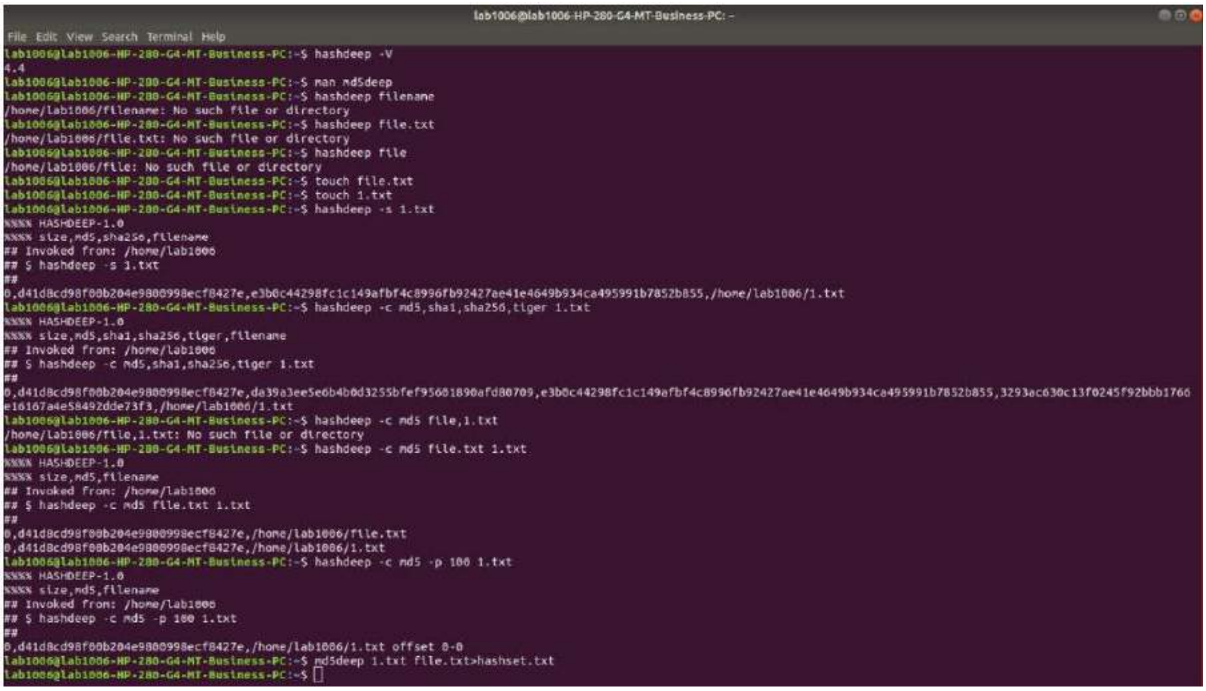
Hashdeep -c md5,sha1 *.txt

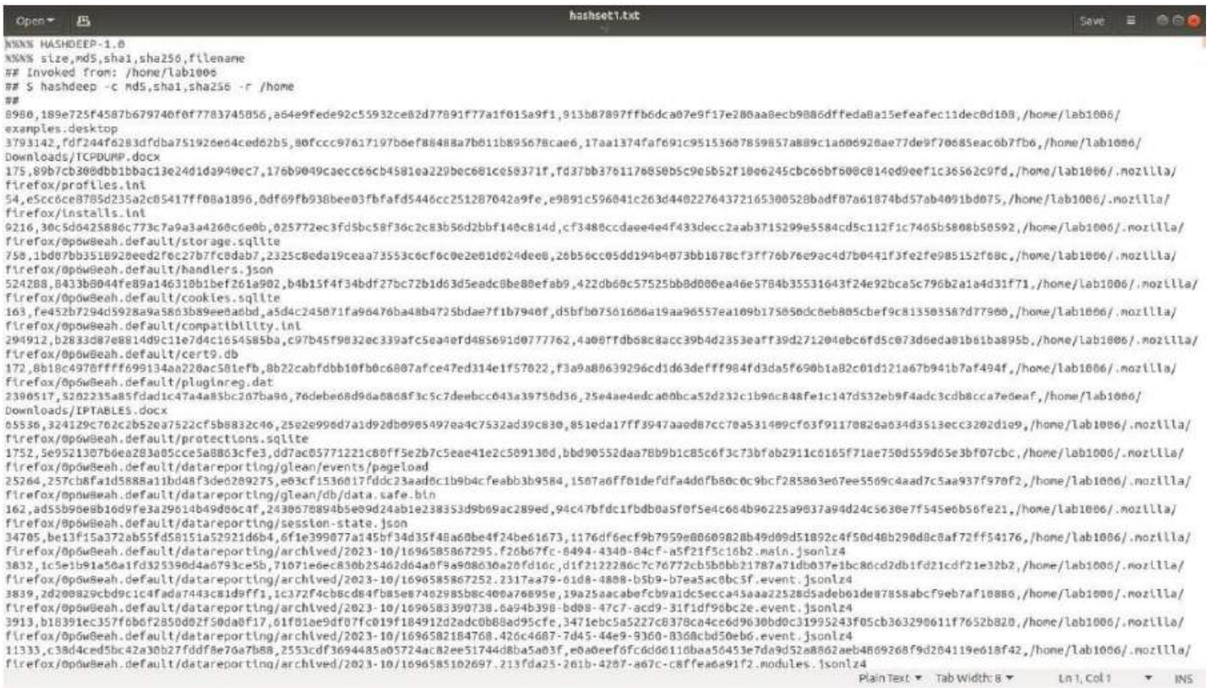
10.Hashing block of files : Hashdeep -c md5 -p 100 example.txt

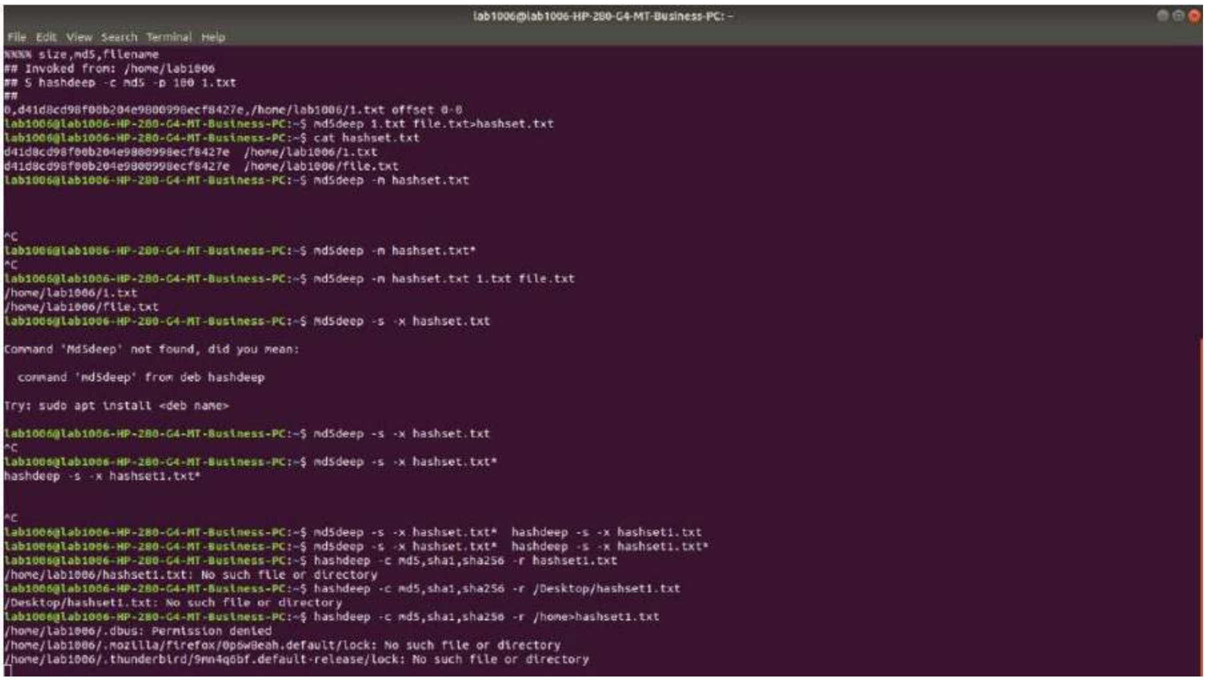
OUTPUT :






lab1006@lab1006-HP-280-G4-MT-Business-PC: ~
File Edit View Search Terminal Help
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep -V
4.4
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ man md5deep
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep filename
/home/lab1006/filename: No such file or directory
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep file.txt
/home/lab1006/file.txt: No such file or directory
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep file
/home/lab1006/file: No such file or directory
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ touch file.txt
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ touch 1.txt
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep -s 1.txt
%%%% HASHDEEP-1.0
%%%% size,md5,sha256,filename
Invoked from: /home/lab1006
$ hashdeep -s 1.txt
##
0,d41d8cd98f00b204e9800998ecf8427e,e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855,/home/lab1006/1.txt
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep -c md5,sha1,sha256,tiger 1.txt
%%%% HASHDEEP-1.0
%%%% size,md5,sha1,sha256,tiger,filename
Invoked from: /home/lab1006
$ hashdeep -c md5,sha1,sha256,tiger 1.txt
##
0,d41d8cd98f00b204e9800998ecf8427e,da39a3ee5e6b4b0d3255bfef95601890afd80709,e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855,3293ac630c13f0245f92bbb1766e16167a4e58492dde73f3,/home/lab1006/1.txt
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep -c md5 file,1.txt
/home/lab1006/file,1.txt: No such file or directory
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep -c md5 file.txt 1.txt
%%%% HASHDEEP-1.0
%%%% size,md5,filename
Invoked from: /home/lab1006
$ hashdeep -c md5 file.txt 1.txt
##
0,d41d8cd98f00b204e9800998ecf8427e,/home/lab1006/file.txt
0,d41d8cd98f00b204e9800998ecf8427e,/home/lab1006/1.txt
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ hashdeep -c md5 -p 100 1.txt
%%%% HASHDEEP-1.0
%%%% size,md5,filename
Invoked from: /home/lab1006
$ hashdeep -c md5 -p 100 1.txt
##
0,d41d8cd98f00b204e9800998ecf8427e,/home/lab1006/1.txt offset 0-0
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ md5deep 1.txt file.txt>hashset.txt
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$


Open
hashset1.txt
Save
%%%% HASHDEEP-1.0
%%%% size,md5,sha1,sha256,filename
Invoked from: /home/lab1006
$ hashdeep -c md5,sha1,sha256 -r /home
##
8980,189e725f4587b679740f0f7783745056,a64e9fede92c55932ce82d77891f77a1f015a9f1,913b87897ffb6dca07e9f17e280aa8ecb9886dffeda8a15efeafec11dec0d108,/home/lab1006/
examples.desktop
3793142,fdf244f6283dfdba751926e64ced62b5,80fccc97617197b6ef88488a7b011b895678cae6,17aa1374faf691c95153687859857a889c1a606920ae77de9f70685eac6b7fb6,/home/lab1006/
Downloads/TCPDUMP.docx
175,89b7cb300dbb1bbac13e24d1da940ec7,176b9049caecc66cb4581ea229bec601ce50371f,fd37bb376117685 0b5c9e5b52f10e6245cbc66bf600c014ed9eef1c36562c9fd,/home/lab1006/.mozilla/
firefox/profiles.ini
54,e5cc6ce8785d235a2c05417ff08a1896,0df69fb930bee03fbfafd5446cc251287042a9fe,e9891c596041c263d440227643721653005 28badf07a61874bd57ab4091bd075,/home/lab1006/.mozilla/
firefox/installs.ini
9216,30c5d6425886c773c7a9a3a4260c6e0b,025772ec3fd5bc58f36c2c83b56d2bbf140c814d,cf3480ccdaee4e4f433decc2aab3715299e5584cd5c112f1c7465b5808b58592,/home/lab1006/.mozilla/
firefox/0pow0eah.default/storage.sqlite
750,1bd07bb3518920eed2f6c27b7fc0dab7,2325c8eda19ceaa73553c6cf6c0e2e01d024dee8,26b56cc05dd194b4073bb1878cf3ff76b76e9ac4d7b0441f3fe2fe985152f68c,/home/lab1006/.mozilla/
firefox/0pow0eah.default/handlers.json
524288,8433b8044fe89a146310b1bef261a902,b4b15f4f34bdf27bc72b1d63d5eadc8be88efab9,422db60c57525bb8d000ea46e5784b35531643f24e92bca5c796b2a1a4d31f71,/home/lab1006/.mozilla/
firefox/0pow0eah.default/cookies.sqlite
163,fe452b7294d5928a9a5863b89ee8a6bd,a5d4c245071fa96476ba48b4725bdae7f1b7940f,d5bfb07561606a19aa96557ea109b175050dc8eb805cbef9c81350358 7d77900,/home/lab1006/.mozilla/
firefox/0pow0eah.default/compatibility.ini
Plain Text
Tab Width: 8
Ln 1, Col 1
INS



CONCLUSION : In conclusion, Hashdeep plays a pivotal role in Computer and Network Security and digital forensics by providing a robust means to verify data integrity, authenticate digital evidence, and enhance security practices. Its flexibility, automation capabilities, and open-source nature make it a valuable tool for safeguarding digital assets and conducting thorough investigations.

ASSIGNMENT - 6

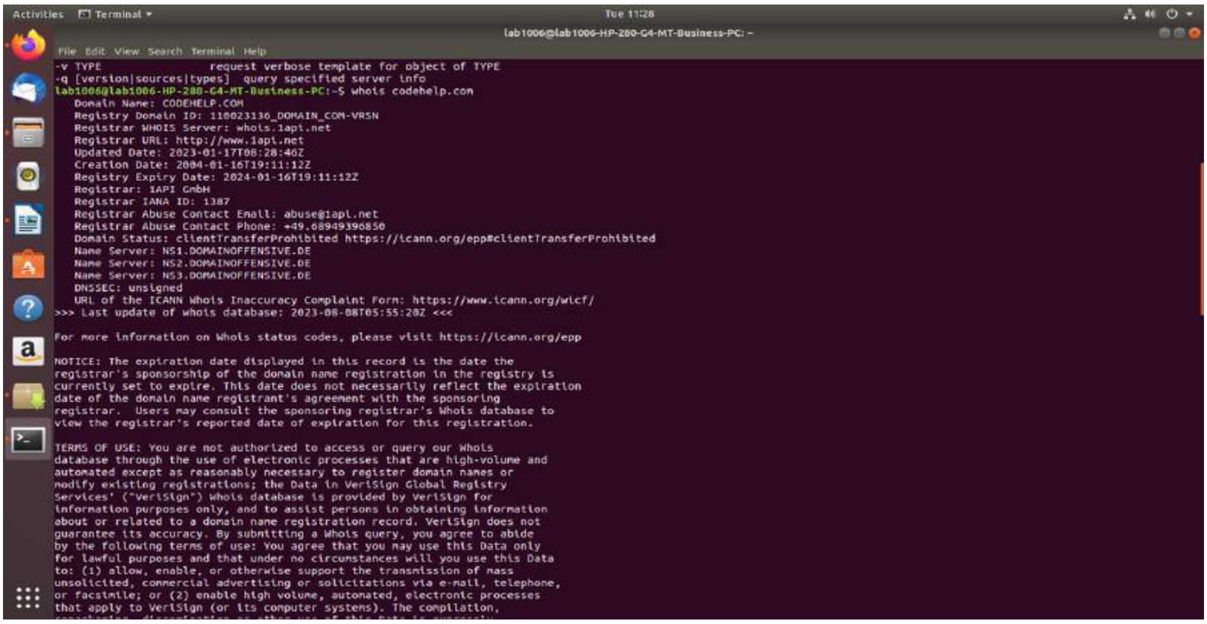
AIM : Study the use of network reconnaissance tools like WHOIS, dig , traceroute , nslookup , nikto , Dmitry to gather information about networks and domain registrars .

LO MAPPED : LO3

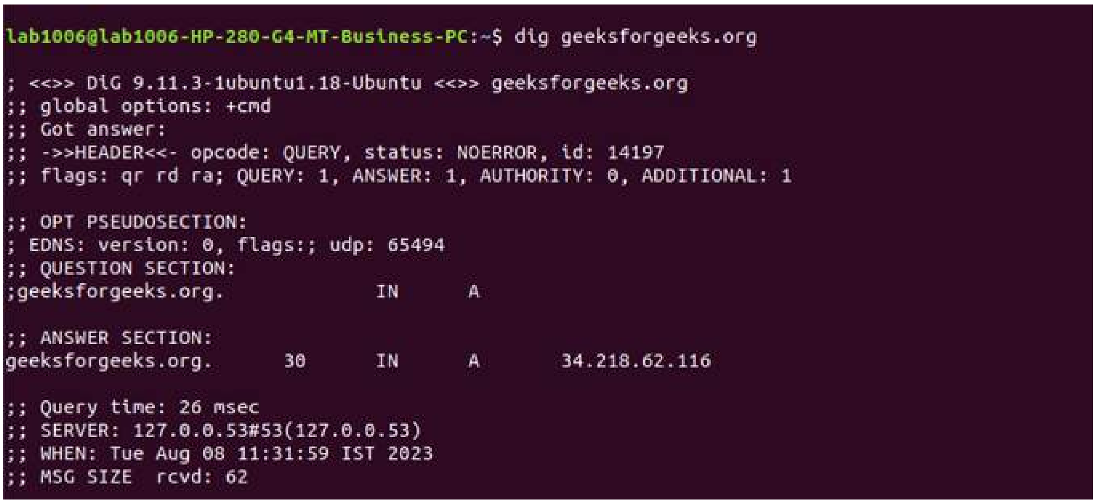
THEORY :

Commands :

1) WHOIS :
The whois command displays information about a website's record. You may get all the information about a website regarding its registration and owner's information.



2) dig : **dig** command stands for ***Domain Information Groper***. It is used for retrieving information about DNS name servers. It is basically used by network administrators. It is used for verifying and troubleshooting DNS problems and to perform DNS lookups.



```
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ dig geeksforgeeks.org

; <<>> DiG 9.11.3-1ubuntu1.18-Ubuntu <<>> geeksforgeeks.org
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 14197
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

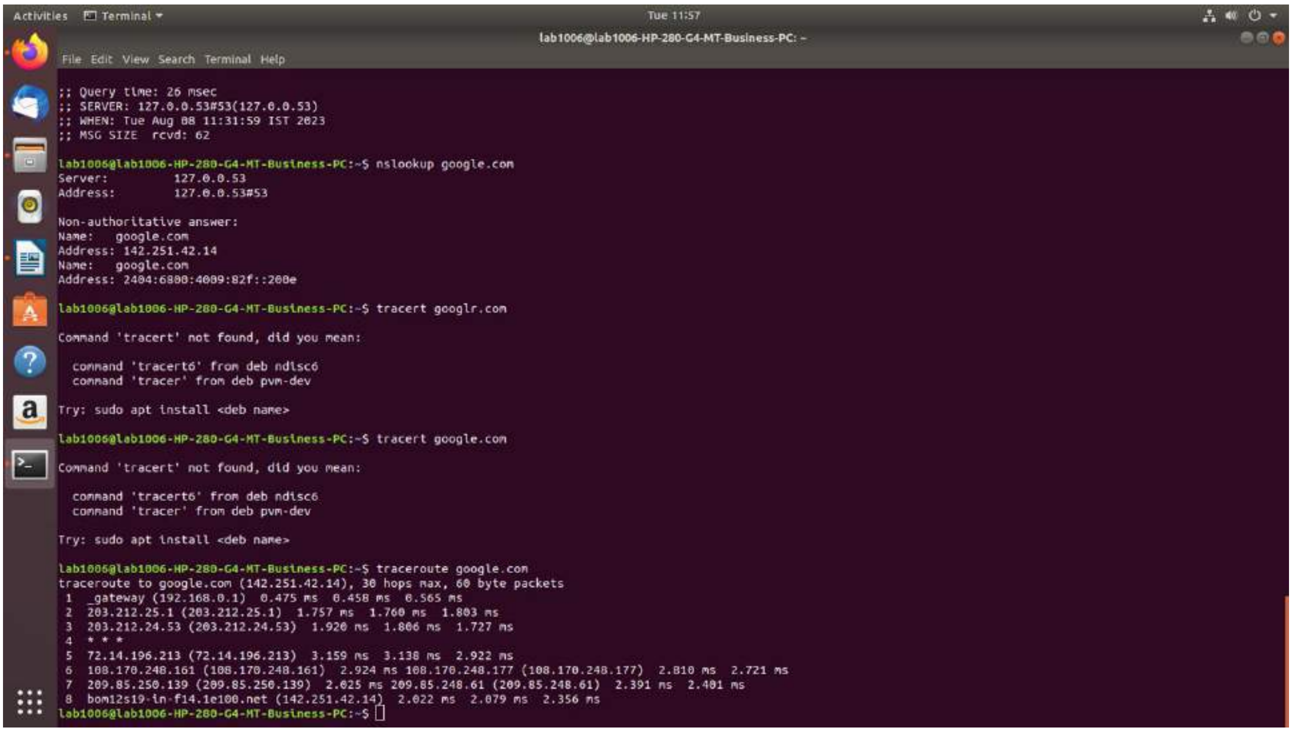
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;geeksforgeeks.org.             IN      A

;; ANSWER SECTION:
geeksforgeeks.org.      30      IN      A       34.218.62.116

;; Query time: 26 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Aug 08 11:31:59 IST 2023
;; MSG SIZE  rcvd: 62
```

3) traceroute :

Traceroute is a widely used command-line utility available in almost all operating systems. It shows you the complete route to a destination address. It also shows the time is taken (or delays) between intermediate routers.




```
;; Query time: 26 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Aug 08 11:31:59 IST 2023
;; MSG SIZE  rcvd: 62

lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ nslookup google.com
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
Name:   google.com
Address: 142.251.42.14
Name:   google.com
Address: 2404:6800:4009:82f::200e

lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ tracert googlr.com

Command 'tracert' not found, did you mean:

  command 'tracert6' from deb ndisc6
  command 'tracer' from deb pvm-dev

Try: sudo apt install <deb name>

lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ tracert google.com

Command 'tracert' not found, did you mean:

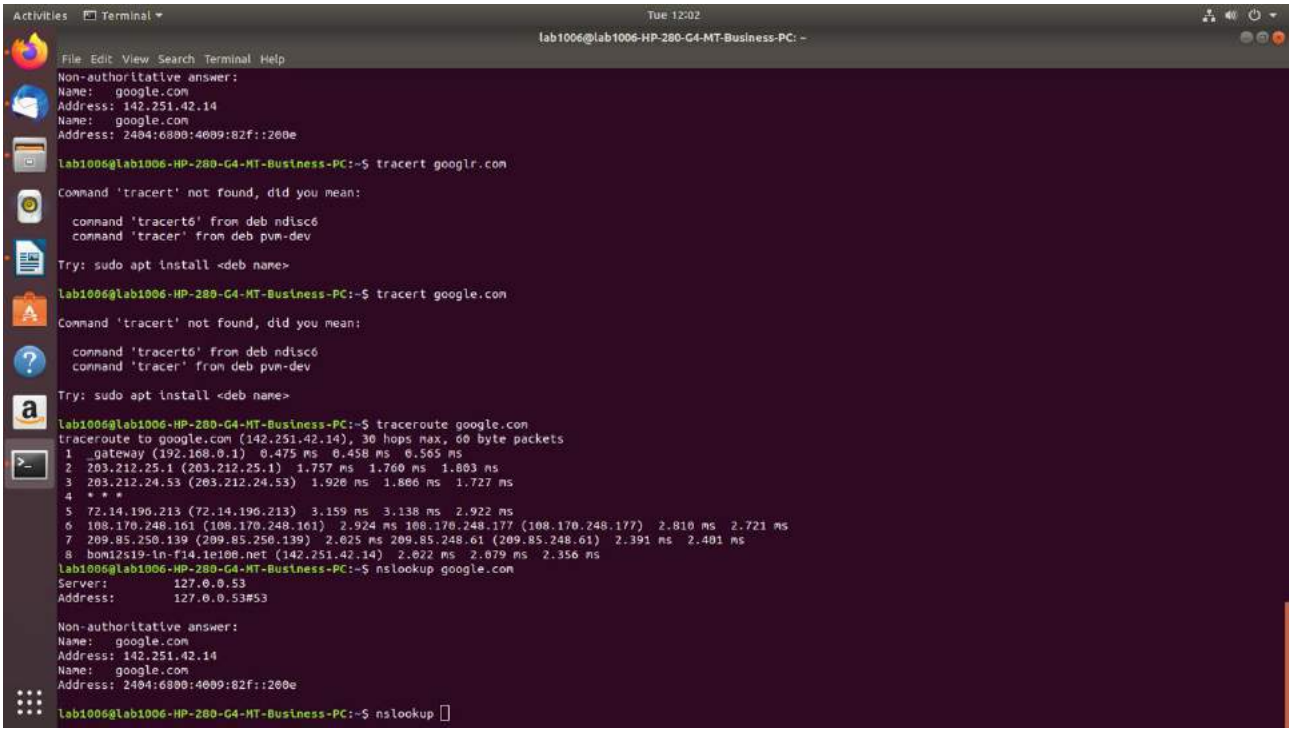
  command 'tracert6' from deb ndisc6
  command 'tracer' from deb pvm-dev

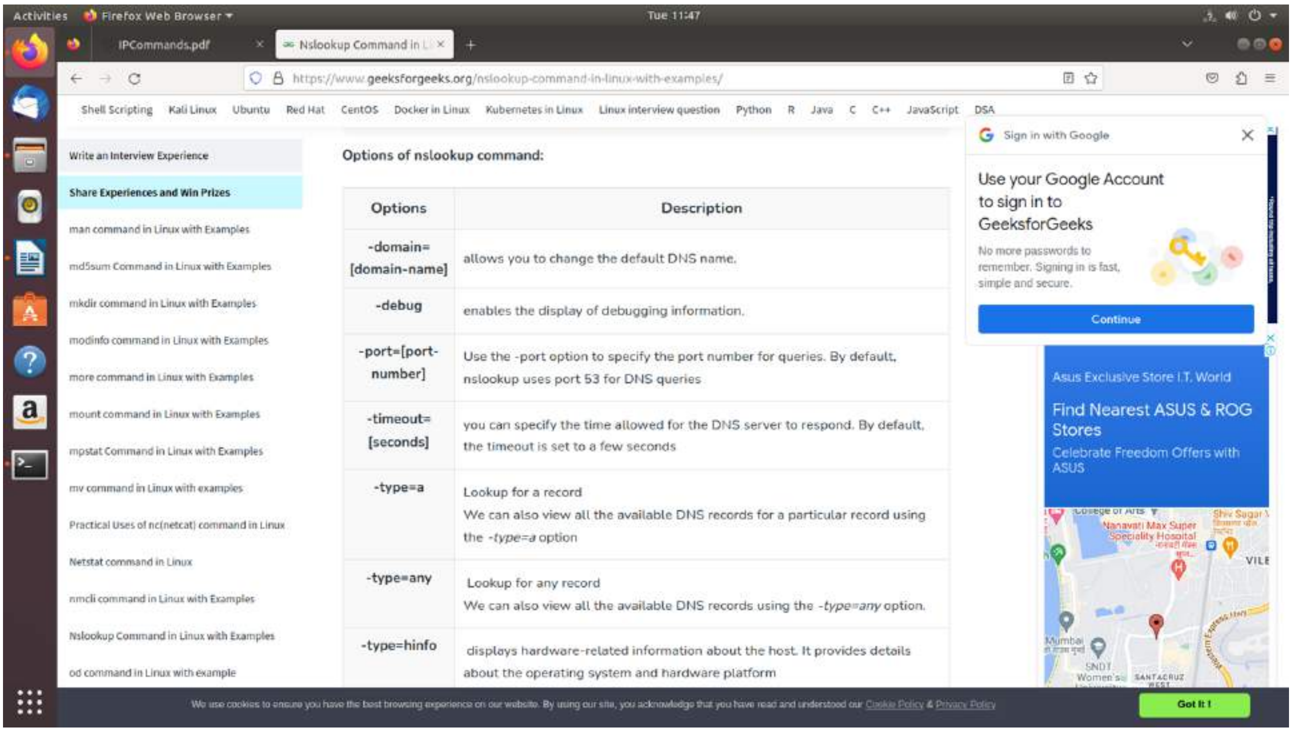
Try: sudo apt install <deb name>

lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ traceroute google.com
traceroute to google.com (142.251.42.14), 30 hops max, 60 byte packets
 1  _gateway (192.168.0.1)  0.475 ms  0.458 ms  0.565 ms
 2  203.212.25.1 (203.212.25.1)  1.757 ms  1.760 ms  1.803 ms
 3  203.212.24.53 (203.212.24.53)  1.920 ms  1.806 ms  1.727 ms
 4  * * *
 5  72.14.196.213 (72.14.196.213)  3.159 ms  3.138 ms  2.922 ms
 6  108.170.248.161 (108.170.248.161)  2.924 ms 108.170.248.177 (108.170.248.177)  2.810 ms  2.721 ms
 7  209.85.250.139 (209.85.250.139)  2.025 ms 209.85.248.61 (209.85.248.61)  2.391 ms  2.401 ms
 8  bom12s19-in-f14.1e100.net (142.251.42.14)  2.022 ms  2.079 ms  2.356 ms
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ 
```

4) nslookup :

Nslookup (stands for “Name Server Lookup”) is a useful command for getting information from the DNS server. It is a network administration tool for querying the Domain Name System (DNS) to obtain domain name or IP address mapping or any other specific DNS record. It is also used to troubleshoot DNS-related problems.





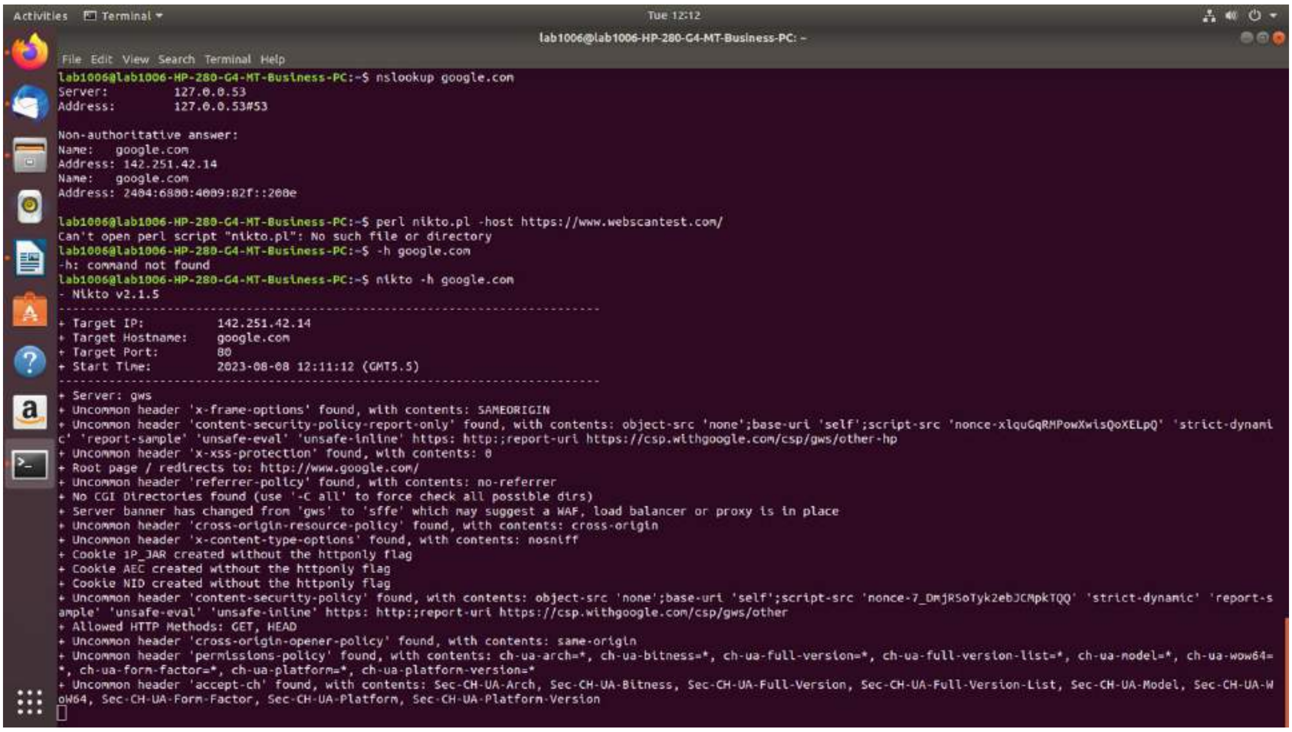
5) NIKTO :

Nikto is an Open Source software written in Perl language that is used to scan a web-server for the vulnerability that can be exploited and can compromise the server. It can also check for outdated version details of 1200 server and can detect problems with specific version details of over 200 servers. It can also fingerprint server using favicon.ico files present in the server. It is not designed to be a particularly a stealth tool rather than it is designed to be fast and time-efficient to achieve the task in very little time. Because of this, a web admin can easily detect that its server is being scanned by looking into the log files.

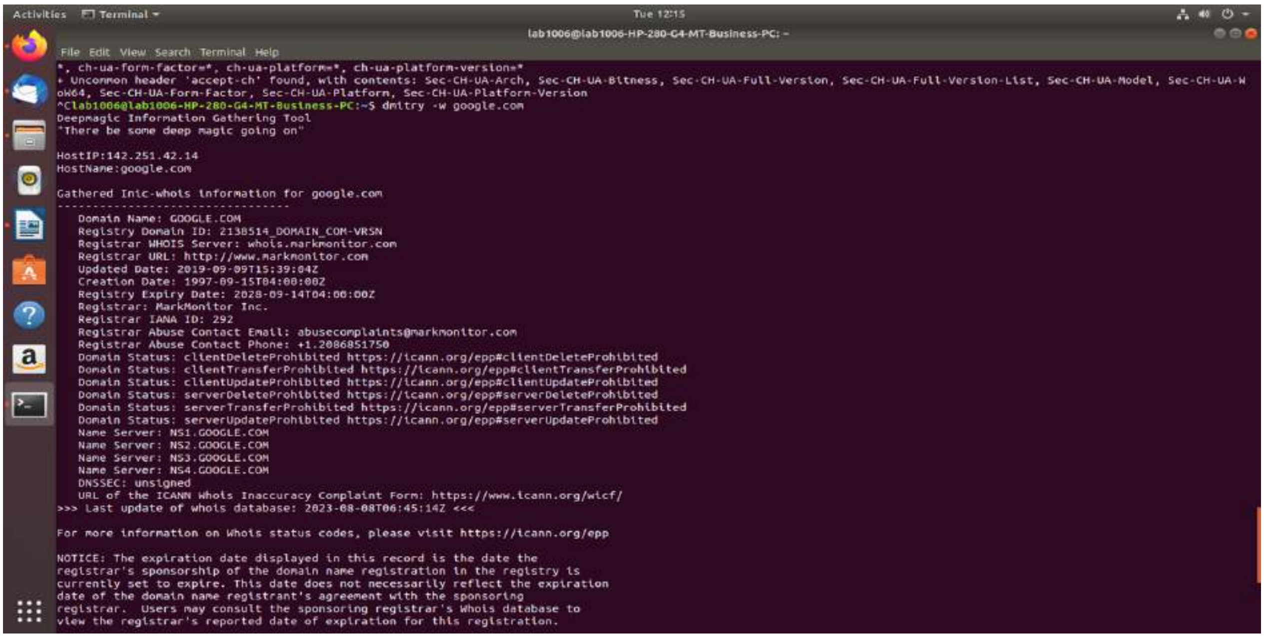
It can also show some items that do not have security problem but are info only which shows how to take full use of it to secure the web-server more properly.

Features:

- Full support for SSL
- Finds sub-domain
- Supports full HTTP Proxy
- Outdated component report
- Result saved in multiple format (xml, csv etc)
- Username guessing
- Gives details of installed software
- Takes Nmap file as input to scan port in a web-server.
- Able to perform dictionary attack.
- Updated easily



6) Dmitry :
Dmitry stands for **DeepMagic Information Gathering Tool.** Dmitry is a **free** and **open-source** tool that is available on **GitHub.** We used this tool for information gathering. Dmitry is a **command-line** tool. With the help of the Dmitry tool, we can gather information about the target, which we can then use for **social engineering attacks**. It can be used to collect a variety of useful information.



CONCLUSION : We studied and implemented the network reconnaissance tools like WHOIS, dig , traceroute , nslookup , nikto , Dmitry .

NAME : SOUMIL SALVI

ROLL NO : 104

ASSIGNMENT – 7

AIM : Study of packet sniffer tools Wireshark and TCPDUMP.

LO MAPPED : LO3

THEORY :

Wireshark :

Wireshark is an open-source and cross-platform packet sniffer tool widely used for network protocol analysis. It provides a graphical user interface (GUI) that simplifies the process of capturing, inspecting, and dissecting network packets. Key features of Wireshark include:

- Packet Capture: Wireshark can capture packets from various network interfaces, including Ethernet, Wi-Fi, and loopback, allowing you to monitor both local and remote traffic.
- Protocol Support: Wireshark supports a vast range of network protocols, from common ones like TCP, UDP, and HTTP to more specialized protocols used in industrial control systems and IoT devices.
- Powerful Filtering: It offers sophisticated filtering capabilities, enabling users to focus on specific packets of interest based on criteria like source/destination IP, port numbers, and protocol.
- Packet Inspection: Wireshark displays packet details in a human-readable format, including protocol headers and payload, making it easy to understand the content and structure of network communication.
- Live Capture and Offline Analysis: You can capture packets live or analyze saved packet capture files, allowing for post-event analysis.

TCPDUMP :

TCPDump is a widely used packet sniffer and network traffic analysis tool in the field of computer networking and security. Here's a theoretical overview of TCPDump, its purpose, capabilities, and how it works:

1. Purpose of TCPDump:

TCPDump is designed for capturing and analyzing network traffic at the packet level. It serves several important purposes, including:

- Network Troubleshooting: It helps network administrators diagnose and troubleshoot network issues by examining the raw packets flowing through a network interface.
- Security Analysis: Security professionals use TCPDump to monitor network traffic for signs of suspicious or malicious activity, such as intrusion attempts or malware infections.
- Network Monitoring: TCPDump is used for continuous monitoring of network traffic to gather statistics, detect anomalies, and ensure network performance.
- Protocol Analysis: It allows in-depth analysis of network protocols and their behavior, aiding in protocol debugging and optimization.

2. How TCPDump Works:

TCPDump operates at a low level in the networking stack, capturing packets directly from a network interface. Here's how it works:

- Packet Capture: TCPDump captures packets as they pass through a network interface. It can capture packets from various network layers, including Ethernet, IP, TCP, UDP, and more.
- Filtering: Users can specify filters to capture only the packets that match certain criteria. This can be based on source or destination IP addresses, port numbers, protocol types, or other packet attributes.
- Packet Display: TCPDump can display captured packets in real-time, showing details like packet headers, timestamps, source/destination IP addresses, and payload data.
- Output Options: Captured packets can be displayed on the terminal or saved to a file for later analysis. The output format can be customized to various formats, including human-readable text or binary formats.

- Protocol Decoding: TCPDump has the ability to decode and display the contents of various network protocols, making it easier to understand the purpose and structure of network traffic.

Explain various commands in tcpdump to capture different types of packets.

1. Capture All Traffic on a Specific Interface:

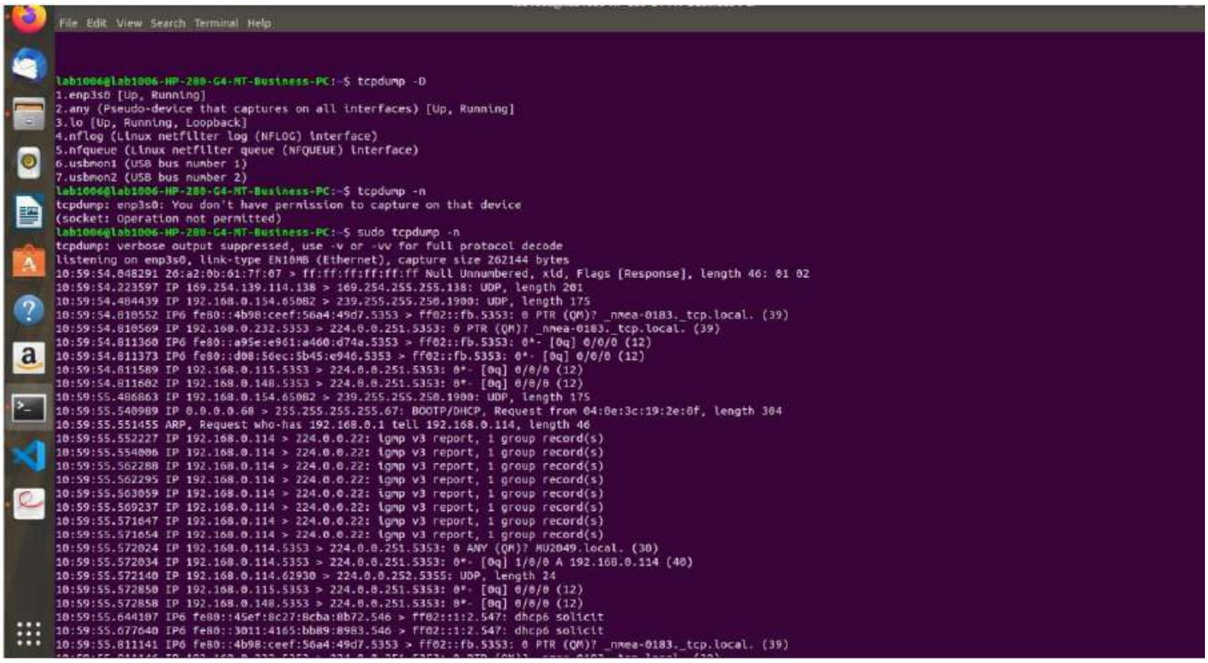
   sudo tcpdump -i eth0

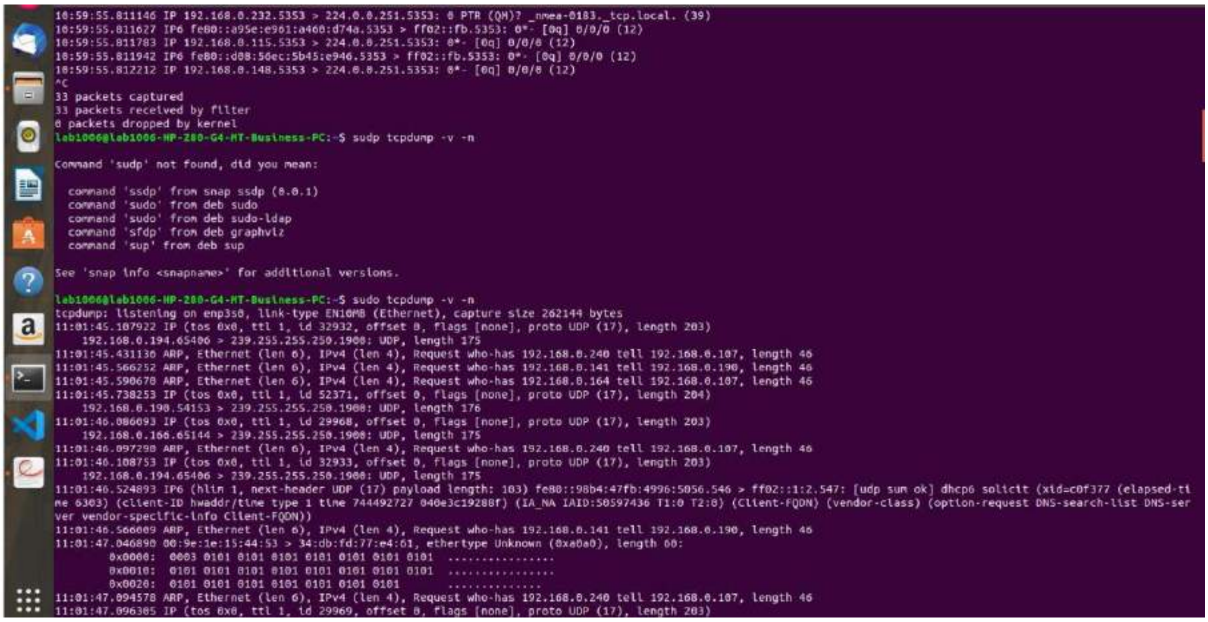
   This captures all traffic on the "eth0" network interface.

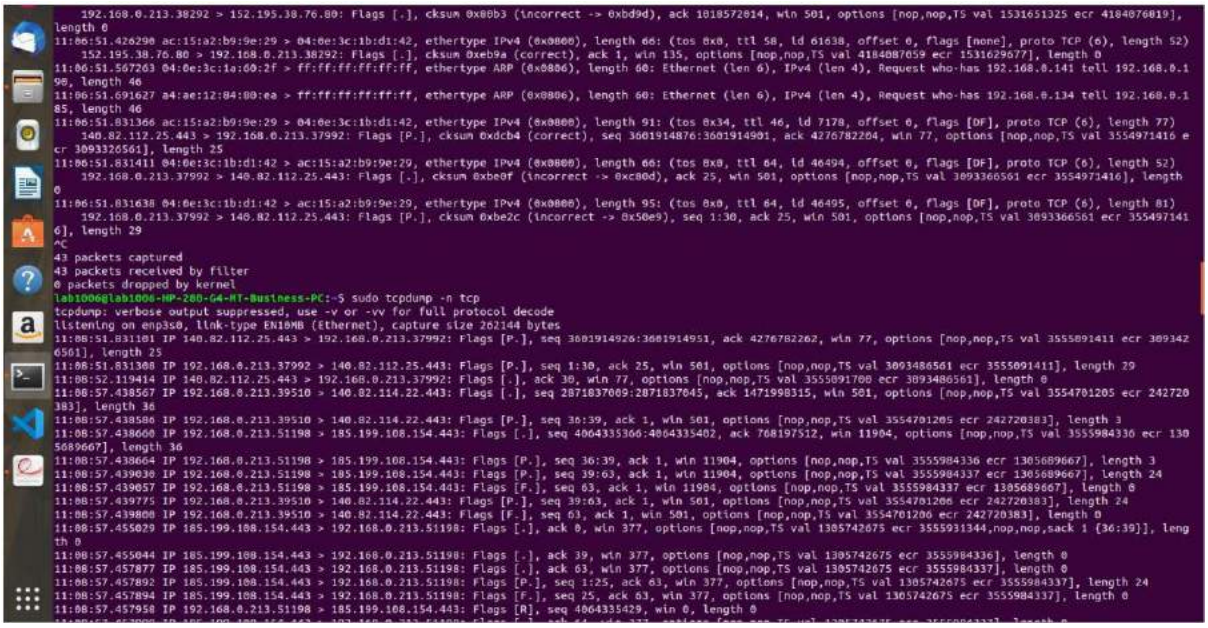
2. Capture Traffic to or from a Specific IP Address:
   sudo tcpdump host 192.168.1.100
   This captures all traffic to or from the IP address "192.168.1.100".
3. Capture Traffic on a Specific Port:
   sudo tcpdump port 80
   This captures all traffic on port 80.
4. Capture Traffic Using a Specific Protocol:
   sudo tcpdump icmp
   This captures ICMP (ping) traffic.
5. Capture Traffic from a Specific Source IP:
   sudo tcpdump src 192.168.1.200
   This captures traffic originating from IP address "192.168.1.200".
6. Capture Traffic to a Specific Destination IP:
   sudo tcpdump dst 192.168.1.100
   This captures traffic directed to IP address "192.168.1.100".
7. Capture Traffic on a Specific Port Using a Protocol:
   sudo tcpdump udp port 53
   This captures UDP traffic on port 53 (DNS).
8. Capture Traffic Using a Combination of Filters:
   sudo tcpdump src 192.168.1.100 and port 22
   This captures traffic originating from IP address "192.168.1.100" and using port 22 (SSH).
9. Capture Traffic with Specific Packet Size:
   sudo tcpdump greater 1000
   This captures packets larger than 1000 bytes.

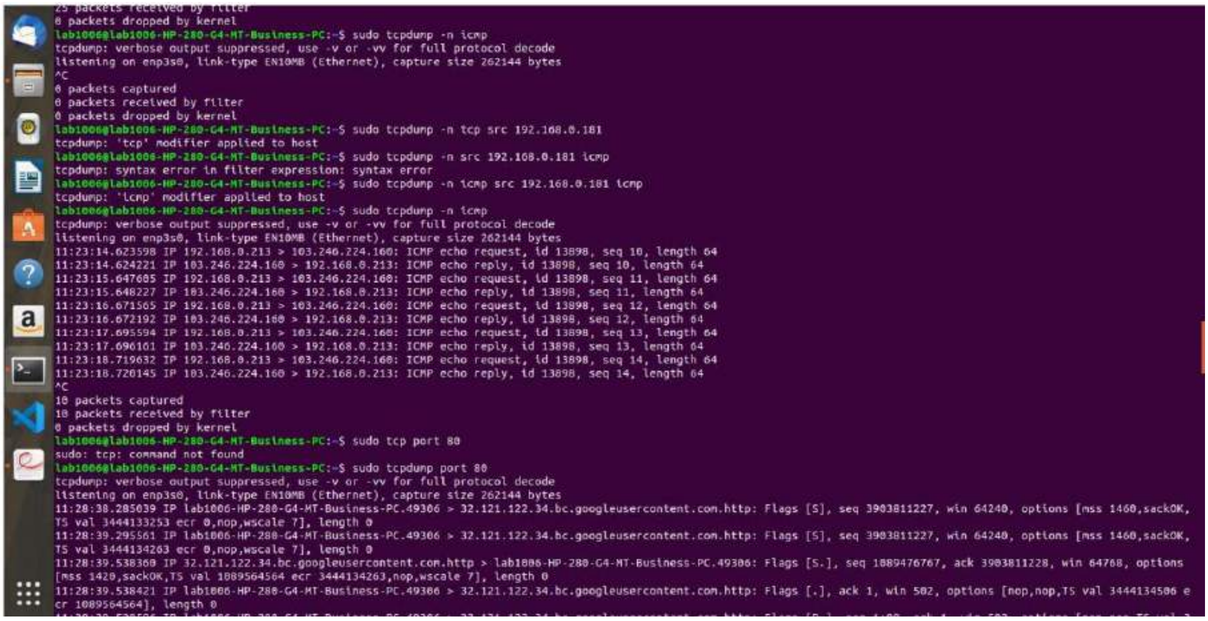
10. Capture Specific Number of Packets:
    sudo tcpdump -c 10
    This captures 10 packets and then exits.
11. Capture Packets Using Hexadecimal Filter:
    sudo tcpdump -X 'tcp[13] & 2 != 0'
    This captures only SYN packets (TCP packets with the SYN flag set).
12. Capture and Save Output to a File: sudo tcpdump -i eth0 -w output.pcap
    This captures traffic on the "eth0" interface and saves it to the "output.pcap" file.

OUTPUT :




10:59:55.811146 IP 192.168.0.232.5353 > 224.0.0.251.5353: 0 PTR (QM)? _nmea-0183._tcp.local. (39)
10:59:55.811627 IP6 fe80::a95e:e961:a460:d74a.5353 > ff02::fb.5353: 0*- [0q] 0/0/0 (12)
10:59:55.811783 IP 192.168.0.115.5353 > 224.0.0.251.5353: 0*- [0q] 0/0/0 (12)
10:59:55.811942 IP6 fe80::d08:56ec:5b45:e946.5353 > ff02::fb.5353: 0*- [0q] 0/0/0 (12)
10:59:55.812212 IP 192.168.0.148.5353 > 224.0.0.251.5353: 0*- [0q] 0/0/0 (12)
^C
33 packets captured
33 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudp tcpdump -v -n
Command 'sudp' not found, did you mean:
command 'ssdp' from snap ssdp (0.0.1)
command 'sudo' from deb sudo
command 'sudo' from deb sudo-ldap
command 'sfdp' from deb graphviz
command 'sup' from deb sup
See 'snap info <snapname>' for additional versions.
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -v -n
tcpdump: listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
11:01:45.107922 IP (tos 0x0, ttl 1, id 32932, offset 0, flags [none], proto UDP (17), length 203)
192.168.0.194.65406 > 239.255.255.250.1900: UDP, length 175
11:01:45.431136 ARP, Ethernet (len 6), IPv4 (len 4), Request who-has 192.168.0.240 tell 192.168.0.107, length 46
11:01:45.566252 ARP, Ethernet (len 6), IPv4 (len 4), Request who-has 192.168.0.141 tell 192.168.0.190, length 46
11:01:45.590678 ARP, Ethernet (len 6), IPv4 (len 4), Request who-has 192.168.0.164 tell 192.168.0.107, length 46
11:01:45.738253 IP (tos 0x0, ttl 1, id 52371, offset 0, flags [none], proto UDP (17), length 204)
192.168.0.190.54153 > 239.255.255.250.1900: UDP, length 176
11:01:46.086093 IP (tos 0x0, ttl 1, id 29968, offset 0, flags [none], proto UDP (17), length 203)
192.168.0.166.65144 > 239.255.255.250.1900: UDP, length 175
11:01:46.097298 ARP, Ethernet (len 6), IPv4 (len 4), Request who-has 192.168.0.240 tell 192.168.0.107, length 46
11:01:46.108753 IP (tos 0x0, ttl 1, id 32933, offset 0, flags [none], proto UDP (17), length 203)
192.168.0.194.65406 > 239.255.255.250.1900: UDP, length 175
11:01:46.524893 IP6 (hlim 1, next-header UDP (17) payload length: 103) fe80::98b4:47fb:4996:5056.546 > ff02::1:2.547: [udp sum ok] dhcp6 solicit (xid=c0f377 (elapsed-time 6303) (client-ID hwaddr/time type 1 time 744492727 040e3c19288f) (IA_NA IAID:50597436 T1:0 T2:0) (Client-FQDN) (vendor-class) (option-request DNS-search-list DNS-server vendor-specific-info Client-FQDN))
11:01:46.566009 ARP, Ethernet (len 6), IPv4 (len 4), Request who-has 192.168.0.141 tell 192.168.0.190, length 46
11:01:47.046890 00:9e:1e:15:44:53 > 34:db:fd:77:e4:61, ethertype Unknown (0xa0a0), length 60:
0x0000: 0003 0101 0101 0101 0101 0101 0101 0101 ....
0x0010: 0101 0101 0101 0101 0101 0101 0101 0101 ....
0x0020: 0101 0101 0101 0101 0101 0101 0101 ....
11:01:47.094578 ARP, Ethernet (len 6), IPv4 (len 4), Request who-has 192.168.0.240 tell 192.168.0.107, length 46
11:01:47.096305 IP (tos 0x0, ttl 1, id 29969, offset 0, flags [none], proto UDP (17), length 203)


192.168.0.213.38292 > 152.195.38.76.80: Flags [.], cksum 0x80b3 (incorrect -> 0xbd9d), ack 1018572014, win 501, options [nop,nop,TS val 1531651325 ecr 4184076019], length 0
11:06:51.426290 ac:15:a2:b9:9e:29 > 04:0e:3c:1b:d1:42, ethertype IPv4 (0x0800), length 66: (tos 0x0, ttl 58, id 61638, offset 0, flags [none], proto TCP (6), length 52)
152.195.38.76.80 > 192.168.0.213.38292: Flags [.], cksum 0xeb9a (correct), ack 1, win 135, options [nop,nop,TS val 4184087059 ecr 1531629677], length 0
11:06:51.567263 04:0e:3c:1a:60:2f > ff:ff:ff:ff:ff:ff, ethertype ARP (0x0806), length 60: Ethernet (len 6), IPv4 (len 4), Request who-has 192.168.0.141 tell 192.168.0.190, length 46
11:06:51.691627 a4:ae:12:84:80:ea > ff:ff:ff:ff:ff:ff, ethertype ARP (0x0806), length 60: Ethernet (len 6), IPv4 (len 4), Request who-has 192.168.0.134 tell 192.168.0.185, length 46
11:06:51.831366 ac:15:a2:b9:9e:29 > 04:0e:3c:1b:d1:42, ethertype IPv4 (0x0800), length 91: (tos 0x34, ttl 46, id 7178, offset 0, flags [DF], proto TCP (6), length 77)
140.82.112.25.443 > 192.168.0.213.37992: Flags [P.], cksum 0xdcb4 (correct), seq 3601914876:3601914901, ack 4276782204, win 77, options [nop,nop,TS val 3554971416 ecr 3093326561], length 25
11:06:51.831411 04:0e:3c:1b:d1:42 > ac:15:a2:b9:9e:29, ethertype IPv4 (0x0800), length 66: (tos 0x0, ttl 64, id 46494, offset 0, flags [DF], proto TCP (6), length 52)
192.168.0.213.37992 > 140.82.112.25.443: Flags [.], cksum 0xbe0f (incorrect -> 0xc80d), ack 25, win 501, options [nop,nop,TS val 3093366561 ecr 3554971416], length 0
11:06:51.831638 04:0e:3c:1b:d1:42 > ac:15:a2:b9:9e:29, ethertype IPv4 (0x0800), length 95: (tos 0x0, ttl 64, id 46495, offset 0, flags [DF], proto TCP (6), length 81)
192.168.0.213.37992 > 140.82.112.25.443: Flags [P.], cksum 0xbe2c (incorrect -> 0x50e9), seq 1:30, ack 25, win 501, options [nop,nop,TS val 3093366561 ecr 3554971416], length 29
^C
43 packets captured
43 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -n tcp
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
11:08:51.831101 IP 140.82.112.25.443 > 192.168.0.213.37992: Flags [P.], seq 3601914926:3601914951, ack 4276782262, win 77, options [nop,nop,TS val 3555091411 ecr 3093426561], length 25
11:08:51.831308 IP 192.168.0.213.37992 > 140.82.112.25.443: Flags [P.], seq 1:30, ack 25, win 501, options [nop,nop,TS val 3093486561 ecr 3555091411], length 29
11:08:52.119414 IP 140.82.112.25.443 > 192.168.0.213.37992: Flags [.], ack 30, win 77, options [nop,nop,TS val 3555091700 ecr 3093486561], length 0
11:08:57.438567 IP 192.168.0.213.39510 > 140.82.114.22.443: Flags [.], seq 2871037009:2871037045, ack 1471998315, win 501, options [nop,nop,TS val 3554701205 ecr 242720383], length 36
11:08:57.438586 IP 192.168.0.213.39510 > 140.82.114.22.443: Flags [P.], seq 36:39, ack 1, win 501, options [nop,nop,TS val 3554701205 ecr 242720383], length 3
11:08:57.438600 IP 192.168.0.213.51198 > 185.199.108.154.443: Flags [.], seq 4064335366:4064335402, ack 768197512, win 11904, options [nop,nop,TS val 3555984336 ecr 1305689667], length 36
11:08:57.438664 IP 192.168.0.213.51198 > 185.199.108.154.443: Flags [P.], seq 36:39, ack 1, win 11904, options [nop,nop,TS val 3555984336 ecr 1305689667], length 3
11:08:57.439030 IP 192.168.0.213.51198 > 185.199.108.154.443: Flags [P.], seq 39:63, ack 1, win 11904, options [nop,nop,TS val 3555984337 ecr 1305689667], length 24
11:08:57.439057 IP 192.168.0.213.51198 > 185.199.108.154.443: Flags [F.], seq 63, ack 1, win 11904, options [nop,nop,TS val 3555984337 ecr 1305689667], length 0
11:08:57.439775 IP 192.168.0.213.39510 > 140.82.114.22.443: Flags [P.], seq 39:63, ack 1, win 501, options [nop,nop,TS val 3554701206 ecr 242720383], length 24
11:08:57.439800 IP 192.168.0.213.39510 > 140.82.114.22.443: Flags [F.], seq 63, ack 1, win 501, options [nop,nop,TS val 3554701206 ecr 242720383], length 0
11:08:57.455029 IP 185.199.108.154.443 > 192.168.0.213.51198: Flags [.], ack 0, win 377, options [nop,nop,TS val 1305742675 ecr 3555931344,nop,nop,sack 1 {36:39}], length 0
11:08:57.455044 IP 185.199.108.154.443 > 192.168.0.213.51198: Flags [.], ack 39, win 377, options [nop,nop,TS val 1305742675 ecr 3555984336], length 0
11:08:57.457877 IP 185.199.108.154.443 > 192.168.0.213.51198: Flags [.], ack 63, win 377, options [nop,nop,TS val 1305742675 ecr 3555984337], length 0
11:08:57.457892 IP 185.199.108.154.443 > 192.168.0.213.51198: Flags [P.], seq 1:25, ack 63, win 377, options [nop,nop,TS val 1305742675 ecr 3555984337], length 24
11:08:57.457894 IP 185.199.108.154.443 > 192.168.0.213.51198: Flags [F.], seq 25, ack 63, win 377, options [nop,nop,TS val 1305742675 ecr 3555984337], length 0
11:08:57.457958 IP 192.168.0.213.51198 > 185.199.108.154.443: Flags [R], seq 4064335429, win 0, length 0



```
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -n icmp
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
^C
0 packets captured
0 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -n tcp src 192.168.0.181
tcpdump: 'tcp' modifier applied to host
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -n src 192.168.0.181 icmp
tcpdump: syntax error in filter expression: syntax error
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -n icmp src 192.168.0.181 icmp
tcpdump: 'icmp' modifier applied to host
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -n icmp
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
11:23:14.623598 IP 192.168.0.213 > 103.246.224.160: ICMP echo request, id 13898, seq 10, length 64
11:23:14.624221 IP 103.246.224.160 > 192.168.0.213: ICMP echo reply, id 13898, seq 10, length 64
11:23:15.647605 IP 192.168.0.213 > 103.246.224.160: ICMP echo request, id 13898, seq 11, length 64
11:23:15.648227 IP 103.246.224.160 > 192.168.0.213: ICMP echo reply, id 13898, seq 11, length 64
11:23:16.671565 IP 192.168.0.213 > 103.246.224.160: ICMP echo request, id 13898, seq 12, length 64
11:23:16.672192 IP 103.246.224.160 > 192.168.0.213: ICMP echo reply, id 13898, seq 12, length 64
11:23:17.695594 IP 192.168.0.213 > 103.246.224.160: ICMP echo request, id 13898, seq 13, length 64
11:23:17.696161 IP 103.246.224.160 > 192.168.0.213: ICMP echo reply, id 13898, seq 13, length 64
11:23:18.719632 IP 192.168.0.213 > 103.246.224.160: ICMP echo request, id 13898, seq 14, length 64
11:23:18.720145 IP 103.246.224.160 > 192.168.0.213: ICMP echo reply, id 13898, seq 14, length 64
^C
10 packets captured
10 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcp port 80
sudo: tcp: command not found
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump port 80
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
11:28:38.285039 IP lab1006-HP-280-G4-MT-Business-PC.49306 > 32.121.122.34.bc.googleusercontent.com.http: Flags [S], seq 3903811227, win 64240, options [mss 1460,sackOK,TS val 3444133253 ecr 0,nop,wscale 7], length 0
11:28:39.295561 IP lab1006-HP-280-G4-MT-Business-PC.49306 > 32.121.122.34.bc.googleusercontent.com.http: Flags [S], seq 3903811227, win 64240, options [mss 1460,sackOK,TS val 3444134263 ecr 0,nop,wscale 7], length 0
11:28:39.538360 IP 32.121.122.34.bc.googleusercontent.com.http > lab1006-HP-280-G4-MT-Business-PC.49306: Flags [S.], seq 1089476767, ack 3903811228, win 64768, options [mss 1420,sackOK,TS val 1089564564 ecr 3444134263,nop,wscale 7], length 0
11:28:39.538421 IP lab1006-HP-280-G4-MT-Business-PC.49306 > 32.121.122.34.bc.googleusercontent.com.http: Flags [.], ack 1, win 502, options [nop,nop,TS val 3444134506 ecr 1089564564], length 0
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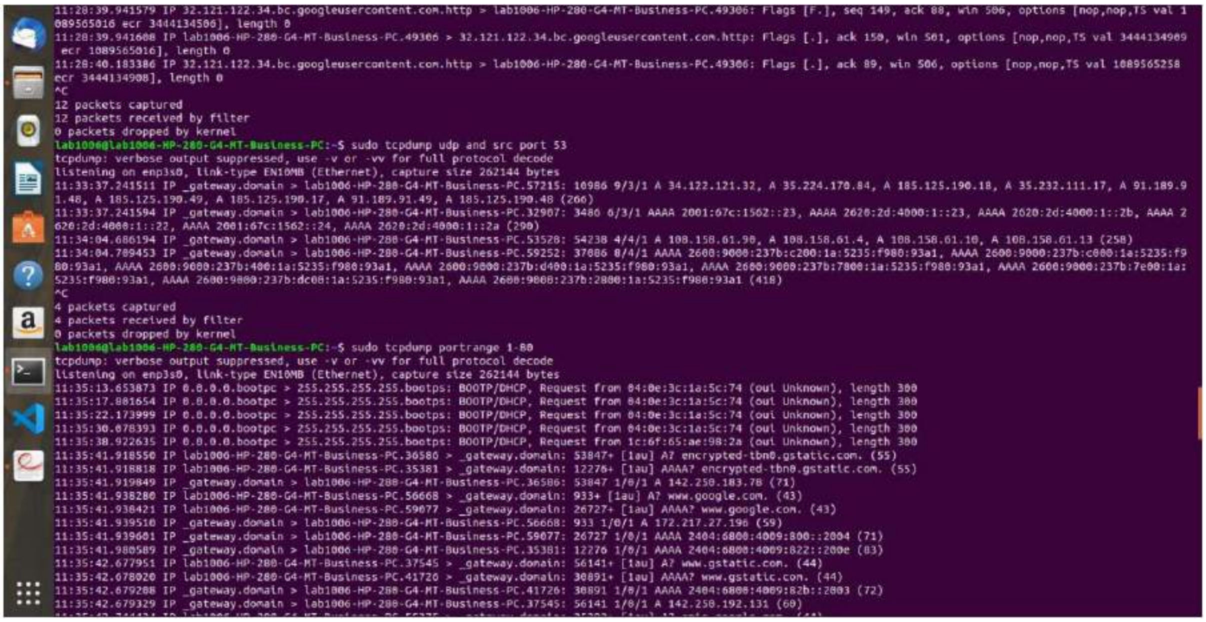

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11:28:39.941579 IP 32.121.122.34.bc.googleusercontent.com.http > lab1006-HP-280-G4-MT-Business-PC.49306: Flags [F.], seq 149, ack 88, win 506, options [nop,nop,TS val 1089565016 ecr 3444134506], length 0
11:28:39.941608 IP lab1006-HP-280-G4-MT-Business-PC.49306 > 32.121.122.34.bc.googleusercontent.com.http: Flags [.], ack 150, win 501, options [nop,nop,TS val 3444134909 ecr 1089565016], length 0
11:28:40.183386 IP 32.121.122.34.bc.googleusercontent.com.http > lab1006-HP-280-G4-MT-Business-PC.49306: Flags [.], ack 89, win 506, options [nop,nop,TS val 1089565258 ecr 3444134908], length 0
^C
12 packets captured
12 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump udp and src port 53
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
11:33:37.241511 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.57215: 10986 9/3/1 A 34.122.121.32, A 35.224.170.84, A 185.125.190.18, A 35.232.111.17, A 91.189.91.48, A 185.125.190.49, A 185.125.190.17, A 91.189.91.49, A 185.125.190.48 (266)
11:33:37.241594 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.32907: 3486 6/3/1 AAAA 2001:67c:1562::23, AAAA 2620:2d:4000:1::23, AAAA 2620:2d:4000:1::2b, AAAA 2620:2d:4000:1::22, AAAA 2001:67c:1562::24, AAAA 2620:2d:4000:1::2a (290)
11:34:04.686194 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.53528: 54238 4/4/1 A 108.158.61.90, A 108.158.61.4, A 108.158.61.10, A 108.158.61.13 (258)
11:34:04.789453 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.59252: 37086 8/4/1 AAAA 2600:9000:237b:c200:1a:5235:f980:93a1, AAAA 2600:9000:237b:c000:1a:5235:f980:93a1, AAAA 2600:9000:237b:400:1a:5235:f980:93a1, AAAA 2600:9000:237b:d400:1a:5235:f980:93a1, AAAA 2600:9000:237b:7800:1a:5235:f980:93a1, AAAA 2600:9000:237b:7e00:1a:5235:f980:93a1, AAAA 2600:9000:237b:dc00:1a:5235:f980:93a1, AAAA 2600:9000:237b:2800:1a:5235:f980:93a1 (418)
^C
4 packets captured
4 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump portrange 1-80
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
11:35:13.653873 IP 0.0.0.0.bootpc > 255.255.255.255.bootps: BOOTP/DHCP, Request from 04:0e:3c:1a:5c:74 (oui Unknown), length 300
11:35:17.881654 IP 0.0.0.0.bootpc > 255.255.255.255.bootps: BOOTP/DHCP, Request from 04:0e:3c:1a:5c:74 (oui Unknown), length 300
11:35:22.173999 IP 0.0.0.0.bootpc > 255.255.255.255.bootps: BOOTP/DHCP, Request from 04:0e:3c:1a:5c:74 (oui Unknown), length 300
11:35:30.078393 IP 0.0.0.0.bootpc > 255.255.255.255.bootps: BOOTP/DHCP, Request from 04:0e:3c:1a:5c:74 (oui Unknown), length 300
11:35:38.922635 IP 0.0.0.0.bootpc > 255.255.255.255.bootps: BOOTP/DHCP, Request from 1c:6f:65:ae:98:2a (oui Unknown), length 300
11:35:41.918550 IP lab1006-HP-280-G4-MT-Business-PC.36586 > _gateway.domain: 53847+ [1au] A? encrypted-tbn0.gstatic.com. (55)
11:35:41.918818 IP lab1006-HP-280-G4-MT-Business-PC.35381 > _gateway.domain: 12276+ [1au] AAAA? encrypted-tbn0.gstatic.com. (55)
11:35:41.919849 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.36586: 53847 1/0/1 A 142.250.183.78 (71)
11:35:41.938280 IP lab1006-HP-280-G4-MT-Business-PC.56668 > _gateway.domain: 933+ [1au] A? www.google.com. (43)
11:35:41.938421 IP lab1006-HP-280-G4-MT-Business-PC.59077 > _gateway.domain: 26727+ [1au] AAAA? www.google.com. (43)
11:35:41.939510 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.56668: 933 1/0/1 A 172.217.27.196 (59)
11:35:41.939601 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.59077: 26727 1/0/1 AAAA 2404:6800:4009:800::2004 (71)
11:35:41.980589 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.35381: 12276 1/0/1 AAAA 2404:6800:4009:822::200e (83)
11:35:42.677951 IP lab1006-HP-280-G4-MT-Business-PC.37545 > _gateway.domain: 56141+ [1au] A? www.gstatic.com. (44)
11:35:42.678020 IP lab1006-HP-280-G4-MT-Business-PC.41726 > _gateway.domain: 30891+ [1au] AAAA? www.gstatic.com. (44)
11:35:42.679288 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.41726: 30891 1/0/1 AAAA 2404:6800:4009:82b::2003 (72)
11:35:42.679329 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.37545: 56141 1/0/1 A 142.250.192.131 (60)
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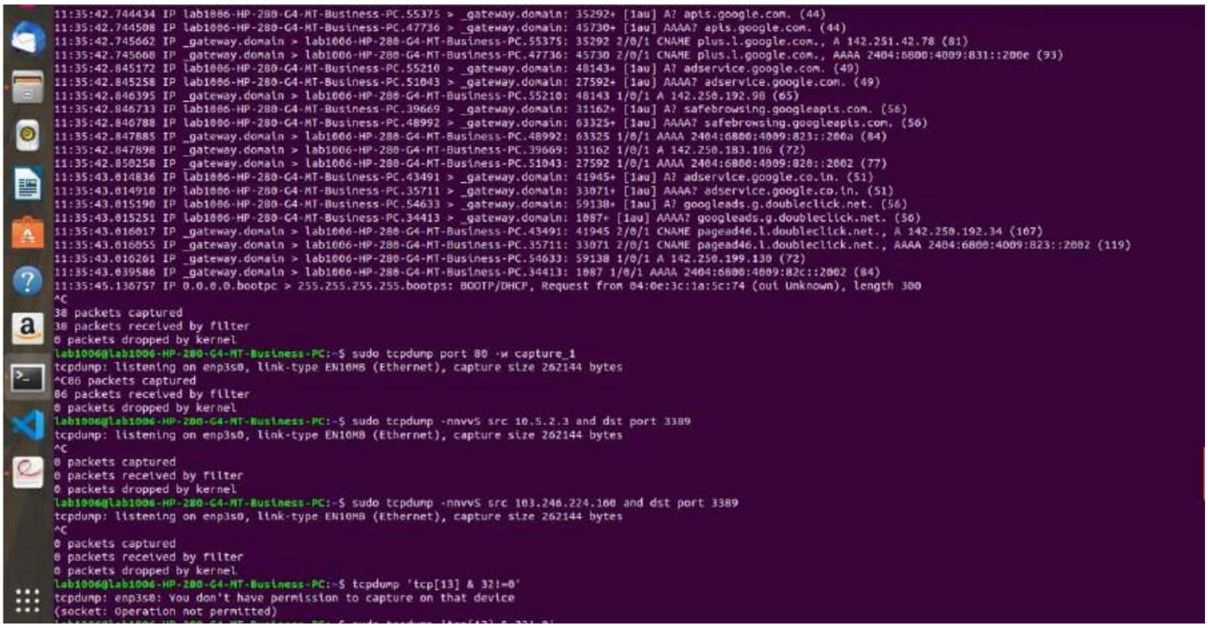
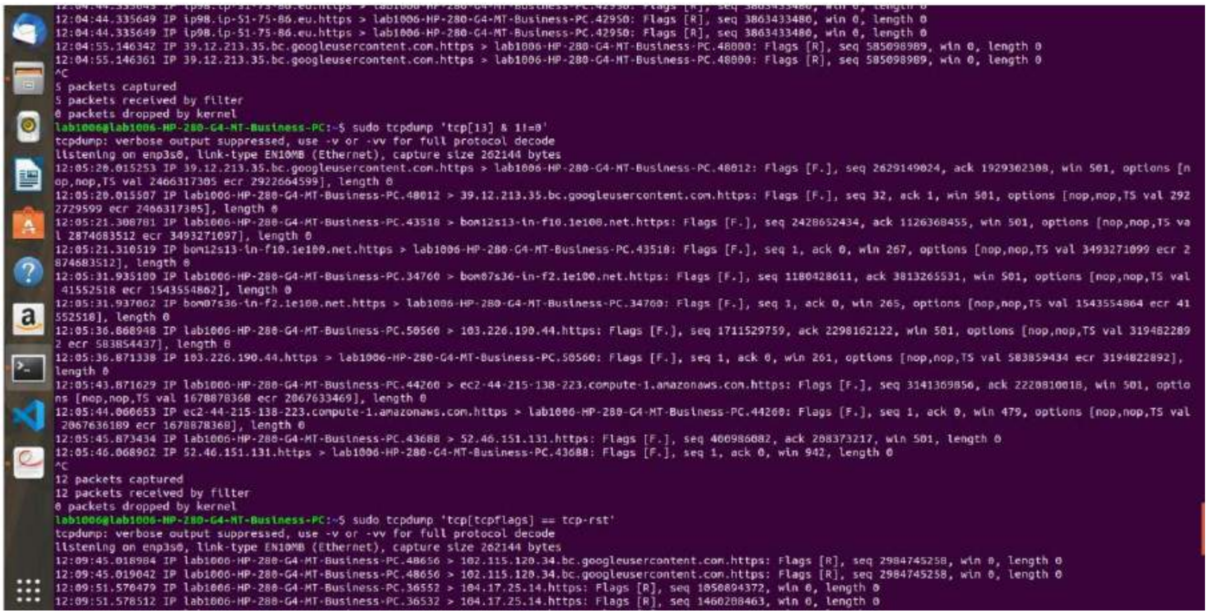
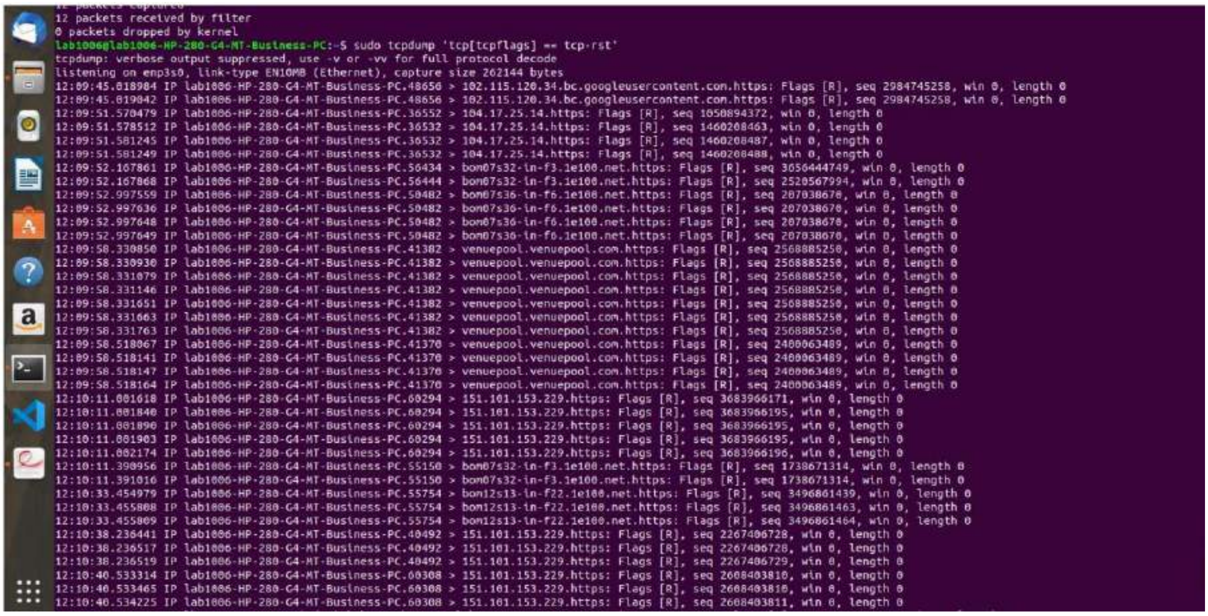

11:35:42.744434 IP lab1006-HP-280-G4-MT-Business-PC.55375 > _gateway.domain: 35292+ [1au] A? apis.google.com. (44)
11:35:42.744508 IP lab1006-HP-280-G4-MT-Business-PC.47736 > _gateway.domain: 45730+ [1au] AAAA? apis.google.com. (44)
11:35:42.745662 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.55375: 35292 2/0/1 CNAME plus.l.google.com., A 142.251.42.78 (81)
11:35:42.745668 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.47736: 45730 2/0/1 CNAME plus.l.google.com., AAAA 2404:6800:4009:831::200e (93)
11:35:42.845172 IP lab1006-HP-280-G4-MT-Business-PC.55210 > _gateway.domain: 48143+ [1au] A? adservice.google.com. (49)
11:35:42.845258 IP lab1006-HP-280-G4-MT-Business-PC.51043 > _gateway.domain: 27592+ [1au] AAAA? adservice.google.com. (49)
11:35:42.846395 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.55210: 48143 1/0/1 A 142.250.192.98 (65)
11:35:42.846733 IP lab1006-HP-280-G4-MT-Business-PC.39669 > _gateway.domain: 31162+ [1au] A? safebrowsing.googleapis.com. (56)
11:35:42.846788 IP lab1006-HP-280-G4-MT-Business-PC.48992 > _gateway.domain: 63325+ [1au] AAAA? safebrowsing.googleapis.com. (56)
11:35:42.847885 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.48992: 63325 1/0/1 AAAA 2404:6800:4009:823::200a (84)
11:35:42.847898 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.39669: 31162 1/0/1 A 142.250.183.106 (72)
11:35:42.850258 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.51043: 27592 1/0/1 AAAA 2404:6800:4009:820::2002 (77)
11:35:43.014836 IP lab1006-HP-280-G4-MT-Business-PC.43491 > _gateway.domain: 41945+ [1au] A? adservice.google.co.in. (51)
11:35:43.014910 IP lab1006-HP-280-G4-MT-Business-PC.35711 > _gateway.domain: 33071+ [1au] AAAA? adservice.google.co.in. (51)
11:35:43.015190 IP lab1006-HP-280-G4-MT-Business-PC.54633 > _gateway.domain: 59138+ [1au] A? googleads.g.doubleclick.net. (56)
11:35:43.015251 IP lab1006-HP-280-G4-MT-Business-PC.34413 > _gateway.domain: 1087+ [1au] AAAA? googleads.g.doubleclick.net. (56)
11:35:43.016017 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.43491: 41945 2/0/1 CNAME pagead46.l.doubleclick.net., A 142.250.192.34 (107)
11:35:43.016055 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.35711: 33071 2/0/1 CNAME pagead46.l.doubleclick.net., AAAA 2404:6800:4009:823::2002 (119)
11:35:43.016261 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.54633: 59138 1/0/1 A 142.250.199.130 (72)
11:35:43.039586 IP _gateway.domain > lab1006-HP-280-G4-MT-Business-PC.34413: 1087 1/0/1 AAAA 2404:6800:4009:82c::2002 (84)
11:35:45.136757 IP 0.0.0.0.bootpc > 255.255.255.255.bootps: BOOTP/DHCP, Request from 04:0e:3c:1a:5c:74 (oui Unknown), length 300
^C
38 packets captured
38 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump port 80 -w capture_1
tcpdump: listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
^C86 packets captured
86 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -nnvvS src 10.5.2.3 and dst port 3389
tcpdump: listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
^C
0 packets captured
0 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump -nnvvS src 103.246.224.160 and dst port 3389
tcpdump: listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
^C
0 packets captured
0 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ tcpdump 'tcp[13] & 32!=0'
tcpdump: enp3s0: You don't have permission to capture on that device
(socket: Operation not permitted)


12:04:44.335649 IP ip98.ip-51-75-86.eu.https > lab1006-HP-280-G4-MT-Business-PC.42950: Flags [R], seq 3863433480, win 0, length 0
12:04:44.335649 IP ip98.ip-51-75-86.eu.https > lab1006-HP-280-G4-MT-Business-PC.42950: Flags [R], seq 3863433480, win 0, length 0
12:04:55.146342 IP 39.12.213.35.bc.googleusercontent.com.https > lab1006-HP-280-G4-MT-Business-PC.48000: Flags [R], seq 585098989, win 0, length 0
12:04:55.146361 IP 39.12.213.35.bc.googleusercontent.com.https > lab1006-HP-280-G4-MT-Business-PC.48000: Flags [R], seq 585098989, win 0, length 0
^C
5 packets captured
5 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump 'tcp[13] & 1!=0'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
12:05:20.015253 IP 39.12.213.35.bc.googleusercontent.com.https > lab1006-HP-280-G4-MT-Business-PC.48012: Flags [F.], seq 2629149024, ack 1929302308, win 501, options [n
op,nop,TS val 2466317305 ecr 2922664599], length 0
12:05:20.015507 IP lab1006-HP-280-G4-MT-Business-PC.48012 > 39.12.213.35.bc.googleusercontent.com.https: Flags [F.], seq 32, ack 1, win 501, options [nop,nop,TS val 292
2729599 ecr 2466317305], length 0
12:05:21.308781 IP lab1006-HP-280-G4-MT-Business-PC.43518 > bom12s13-in-f10.1e100.net.https: Flags [F.], seq 2428652434, ack 1126368455, win 501, options [nop,nop,TS va
l 2874683512 ecr 3493271097], length 0
12:05:21.310519 IP bom12s13-in-f10.1e100.net.https > lab1006-HP-280-G4-MT-Business-PC.43518: Flags [F.], seq 1, ack 0, win 267, options [nop,nop,TS val 3493271099 ecr 2
874683512], length 0
12:05:31.935180 IP lab1006-HP-280-G4-MT-Business-PC.34760 > bom07s36-in-f2.1e100.net.https: Flags [F.], seq 1180428611, ack 3813265531, win 501, options [nop,nop,TS val
41552518 ecr 1543554862], length 0
12:05:31.937062 IP bom07s36-in-f2.1e100.net.https > lab1006-HP-280-G4-MT-Business-PC.34760: Flags [F.], seq 1, ack 0, win 265, options [nop,nop,TS val 1543554864 ecr 41
552518], length 0
12:05:36.868948 IP lab1006-HP-280-G4-MT-Business-PC.50560 > 103.226.190.44.https: Flags [F.], seq 1711529759, ack 2298162122, win 501, options [nop,nop,TS val 319482289
2 ecr 583854437], length 0
12:05:36.871338 IP 103.226.190.44.https > lab1006-HP-280-G4-MT-Business-PC.50560: Flags [F.], seq 1, ack 0, win 261, options [nop,nop,TS val 583859434 ecr 3194822892],
length 0
12:05:43.871629 IP lab1006-HP-280-G4-MT-Business-PC.44260 > ec2-44-215-138-223.compute-1.amazonaws.com.https: Flags [F.], seq 3141369850, ack 2220810018, win 501, optio
ns [nop,nop,TS val 1678878368 ecr 2067633469], length 0
12:05:44.060653 IP ec2-44-215-138-223.compute-1.amazonaws.com.https > lab1006-HP-280-G4-MT-Business-PC.44260: Flags [F.], seq 1, ack 0, win 479, options [nop,nop,TS val
2067636189 ecr 1678878368], length 0
12:05:45.873434 IP lab1006-HP-280-G4-MT-Business-PC.43688 > 52.46.151.131.https: Flags [F.], seq 400986082, ack 208373217, win 501, length 0
12:05:46.068962 IP 52.46.151.131.https > lab1006-HP-280-G4-MT-Business-PC.43688: Flags [F.], seq 1, ack 0, win 942, length 0
^C
12 packets captured
12 packets received by filter
0 packets dropped by kernel
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo tcpdump 'tcp[tcpflags] == tcp-rst'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp3s0, link-type EN10MB (Ethernet), capture size 262144 bytes
12:09:45.018984 IP lab1006-HP-280-G4-MT-Business-PC.48656 > 102.115.120.34.bc.googleusercontent.com.https: Flags [R], seq 2984745258, win 0, length 0
12:09:45.019042 IP lab1006-HP-280-G4-MT-Business-PC.48656 > 102.115.120.34.bc.googleusercontent.com.https: Flags [R], seq 2984745258, win 0, length 0
12:09:51.576479 IP lab1006-HP-280-G4-MT-Business-PC.36552 > 104.17.25.14.https: Flags [R], seq 1050894372, win 0, length 0
12:09:51.578512 IP lab1006-HP-280-G4-MT-Business-PC.36532 > 104.17.25.14.https: Flags [R], seq 1460288463, win 0, length 0



CONCLUSION : In conclusion, the study of packet sniffer tools Wireshark and tcpdump reveals their complementary roles in network analysis, with Wireshark offering a user-friendly, interactive interface, while tcpdump provides efficiency and automation through its command-line capabilities. Together, these tools empower network professionals to effectively monitor, troubleshoot, and analyze network traffic across a range of scenarios.

ASSIGNMENT – 8

AIM : Installation of NMAP and using it with different options to scan open ports , perform OS fingerprinting , ping scan , TCP port scan , UDP port scan , etc

LO MAPPED : LO4

THEORY :

Nmap (Network Mapper) is a powerful open-source tool used for network discovery and security auditing. It's widely used for scanning networks, detecting open ports, performing OS fingerprinting, and more.

1. TCPSYN SCAN :
   The TCP SYN Scan, also known as the "half-open" or "stealth" scan, is a widely used scanning technique in Nmap for discovering open ports on a target system. It is considered one of the most common and stealthy port scanning methods. The TCP SYN Scan works by sending TCP SYN (synchronize) packets to the target's ports and analyzing the responses received.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sS www.google.com

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 15:16 IST
Nmap scan report for www.google.com (142.250.192.132)
Host is up (0.0025s latency).
Other addresses for www.google.com (not scanned): 2404:6800:4009:82b::2004
rDNS record for 142.250.192.132: bom12s18-in-f4.1e100.net
Not shown: 998 filtered ports
PORT    STATE SERVICE
80/tcp  open  http
443/tcp open  https

Nmap done: 1 IP address (1 host up) scanned in 9.12 seconds
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006#
```

2. UDP SCAN
   A UDP scan in Nmap involves probing a target host for open User Datagram Protocol (UDP) ports, which are used for various network services. Unlike TCP, UDP is connectionless, making it more challenging to determine the state of ports. Nmap's UDP scan sends UDP packets to target ports and analyzes the responses to identify open ports. However, due to the lack of reliable feedback, UDP scanning can be slower and less accurate than TCP scanning. It is commonly used to discover services that might be missed by traditional TCP scans and to assess potential attack vectors in network security assessments.

```
krad# nmap -sU -v felix

Starting Nmap ( https://nmap.org )
Nmap scan report for felix.nmap.org (192.168.0.42)
(The 997 ports scanned but not shown below are in state: closed)
PORT    STATE         SERVICE
53/udp  open|filtered domain
67/udp  open|filtered dhcpserver
111/udp open|filtered rpcbind
MAC Address: 00:02:E3:14:11:02 (Lite-on Communications)

Nmap done: 1 IP address (1 host up) scanned in 999.25 seconds
```

3. TCP FIN SCAN
   The TCP FIN scan in Nmap is a stealthy port scanning technique that leverages the TCP FIN flag to determine the state of target ports. When a FIN (Finish) flag is sent to a closed port, an ideal response should be a TCP RST (Reset) indicating the port is closed. However, if the port is open, no response or an unexpected response might be received. This approach exploits the lack of standardized behavior in response to FIN packets, allowing the scanner to deduce the port's state. This scan is often used to identify firewall rules and evade intrusion detection systems due to its non-standard behavior.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sF www.google.com

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 15:30 IST
Nmap scan report for www.google.com (142.250.192.132)
Host is up (0.0036s latency).
Other addresses for www.google.com (not scanned): 2404:6800:4009:82b::2004
rDNS record for 142.250.192.132: bom12s18-in-f4.1e100.net
All 1000 scanned ports on www.google.com (142.250.192.132) are open|filtered

Nmap done: 1 IP address (1 host up) scanned in 11.38 seconds
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006#
```

4. NULL SCAN
   A null scan in Nmap is a stealthy port scanning technique where the TCP header flags, particularly the SYN, FIN, and RST flags, are intentionally omitted during connection attempts to target ports. This approach seeks to exploit certain operating system behaviors that result in varying responses. If the port is open, a lack of response suggests a filtered state, while an RST response indicates a closed port. Null scans are useful for evading basic firewall rules and gaining insights into the target's state while minimizing detection.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sN www.google.com

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 15:35 IST
Nmap scan report for www.google.com (142.250.192.132)
Host is up (0.0021s latency).
Other addresses for www.google.com (not scanned): 2404:6800:4009:82b::2004
rDNS record for 142.250.192.132: bom12s18-in-f4.1e100.net
All 1000 scanned ports on www.google.com (142.250.192.132) are open|filtered

Nmap done: 1 IP address (1 host up) scanned in 21.43 seconds
```

5. XMAS
   The XMAS scan is a stealthy port scanning technique in Nmap that involves sending a TCP packet with the FIN, URG, and PUSH flags set. This scan is used to identify open ports on a target system by observing how it responds to these non-standard combinations of flags. If a port is open, the target might respond differently, revealing its state. The XMAS scan can help in identifying poorly configured or potentially vulnerable systems, but it might not work against all types of systems due to variations in their response to such packets.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sX www.google.com

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 15:44 IST
Nmap scan report for www.google.com (142.250.192.132)
Host is up (0.0029s latency).
Other addresses for www.google.com (not scanned): 2404:6800:4009:82b::2004
rDNS record for 142.250.192.132: bom12s18-in-f4.1e100.net
All 1000 scanned ports on www.google.com (142.250.192.132) are open|filtered

Nmap done: 1 IP address (1 host up) scanned in 21.43 seconds
```

6. TCP ACK SCAN
   TCP ACK scan is a reconnaissance technique employed in Nmap, where the ACK flag is set in packets sent to target ports. This method aims not to reveal open or closed ports but to determine the firewall rules of the target system. If a RST (reset) packet is received in response, the port is deemed unfiltered, while lack of response suggests a filtered port. While not as commonly used for port scanning, TCP ACK scan aids in understanding network configurations and refining subsequent scanning strategies.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sA www.google.com

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 15:39 IST
Nmap scan report for www.google.com (142.250.192.132)
Host is up (0.0023s latency).
Other addresses for www.google.com (not scanned): 2404:6800:4009:82b::2004
rDNS record for 142.250.192.132: bom12s18-in-f4.1e100.net
Not shown: 998 filtered ports
PORT    STATE      SERVICE
80/tcp  unfiltered http
443/tcp unfiltered https

Nmap done: 1 IP address (1 host up) scanned in 18.19 seconds
```

7. TCP CONNECT SCAN
   TCP Connect Scan in Nmap involves establishing a full connection to target ports, thereby determining their open or closed state. This method initiates a three-way handshake with the target system, making it more accurate but also more conspicuous and easily detectable by intrusion detection systems. It provides reliable results for determining port status, aiding in network analysis and security assessments.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sT tsec.edu

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 15:20 IST
Nmap scan report for tsec.edu (162.241.70.62)
Host is up (0.21s latency).
rDNS record for 162.241.70.62: 162-241-70-62.webhostbox.net
Not shown: 929 filtered ports, 59 closed ports
PORT     STATE SERVICE
22/tcp   open  ssh
25/tcp   open  smtp
53/tcp   open  domain
80/tcp   open  http
110/tcp  open  pop3
143/tcp  open  imap
443/tcp  open  https
465/tcp  open  smtps
587/tcp  open  submission
993/tcp  open  imaps
995/tcp  open  pop3s
3306/tcp open  mysql

Nmap done: 1 IP address (1 host up) scanned in 14.11 seconds
```

8. IP SCAN
   An IP scan in Nmap involves probing a range of IP addresses to determine which hosts are online and responsive on a network. Using ICMP echo requests (ping) or other techniques, Nmap swiftly identifies active hosts, enabling network administrators to pinpoint available targets for further exploration such as port scanning, OS detection, or security auditing.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sO www.google.com

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 15:42 IST
Nmap scan report for www.google.com (142.250.192.132)
Host is up (0.0024s latency).
Other addresses for www.google.com (not scanned): 2404:6800:4009:82b::2004
rDNS record for 142.250.192.132: bom12s18-in-f4.1e100.net
Not shown: 254 open|filtered protocols
PROTOCOL STATE SERVICE
1        open  icmp
6        open  tcp

Nmap done: 1 IP address (1 host up) scanned in 5.54 seconds
```

9. PING SCAN
   A ping scan in Nmap is a swift and essential network reconnaissance technique used to determine the availability of hosts within a given network. By sending ICMP echo requests (ping) to target hosts, Nmap identifies live systems, assisting in network mapping and initial assessment. This approach swiftly distinguishes active hosts while providing a foundational understanding of the network's scope, making it a crucial tool for network administrators and security professionals alike.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sP www.yahoo.com

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 15:49 IST
Nmap scan report for www.yahoo.com (202.165.107.49)
Host is up (0.10s latency).
Other addresses for www.yahoo.com (not scanned): 202.165.107.50 2406:2000:e4:160
5::9000 2406:2000:e4:1605::9001
rDNS record for 202.165.107.49: media-router-fp73.prod.media.vip.sg3.yahoo.com
Nmap done: 1 IP address (1 host up) scanned in 0.91 seconds
```

10. OS DETECTION
    The OS detection scan in Nmap is a powerful feature that allows users to identify the operating system running on a target host. By analyzing how the host responds to various network probes and comparing the results to a database of known OS characteristics, Nmap can make an educated guess about the operating system in use. This information is valuable for network administrators and security professionals to better understand the target environment and assess potential vulnerabilities that might be specific to certain operating systems.

```
root@lab1006-HP-280-G4-MT-Business-PC:/home/lab1006# nmap -sO www.yahoo.com

Starting Nmap 7.60 ( https://nmap.org ) at 2023-08-09 16:01 IST
Nmap scan report for www.yahoo.com (202.165.107.49)
Host is up (0.11s latency).
Other addresses for www.yahoo.com (not scanned): 202.165.107.50 2406:2000:e4:160
5::9001 2406:2000:e4:1605::9000
rDNS record for 202.165.107.49: media-router-fp73.prod.media.vip.sg3.yahoo.com
Not shown: 255 open|filtered protocols
PROTOCOL STATE SERVICE
1        open  icmp

Nmap done: 1 IP address (1 host up) scanned in 9.96 seconds
```

CONCLUSION : In conclusion, the experiment focused on the installation and utilization of Nmap, a versatile and powerful network scanning tool. By employing a range of options and techniques, including ping scans, TCP and UDP port scans, OS fingerprinting, and more, the experiment aimed to provide a comprehensive understanding of network discovery and security auditing

NAME : SOUMIL SALVI

ROLL NO : 104

ASSIGNMENT 9

AIM : Simulate DOS attack using HPING3.

LO MAPPED : LO5

THEORY :
What is Denial of Service Atack?

A Denial of Service (DoS) attack is a malicious attempt to disrupt the normal functioning of a computer system, network, or online service by overwhelming it with a flood of illegitimate requests or traffic. The primary goal of a DoS attack is to make a resource, such as a website or server, unavailable to its intended users. It does so by consuming the target's resources, such as bandwidth, processing power, or memory, to the point where it cannot handle legitimate requests.

Explain SYN flood, ICMP flood and SMURF attack.

Three common types of DoS attacks:

i. SYN Flood Attack:

A SYN flood attack is a type of network-based DoS attack that targets the threeway handshake process in the Transmission Control Protocol (TCP), which is used for establishing connections between devices on the internet.

In a TCP connection, the client sends a SYN (synchronize) packet to initiate a connection with a server. The server is expected to respond with a SYN-ACK (synchronizeacknowledgment) packet, and then the client responds with an ACK (acknowledgment) packet to complete the handshake and establish the connection.

In a SYN flood attack, the attacker sends a high volume of SYN packets to the target server, but they do not complete the handshake by sending the expected ACK packets. This leaves the server waiting for the final ACKs, tying up its resources and preventing it from accepting legitimate connections.

SYN flood attacks can quickly overwhelm a server's ability to handle incoming connections, leading to service disruption.

ii. ICMP Flood Attack:

An ICMP (Internet Control Message Protocol) flood attack, also known as a "ping flood" attack, targets the ICMP protocol, which is used for network diagnostics, particularly the "ping" command.

In this type of attack, the attacker sends a high volume of ICMP echo requests (ping requests) to the target system. Each request typically generates a response from the target, creating a flood of traffic.

ICMP flood attacks can consume the target's network bandwidth and processing resources, making it difficult for legitimate network traffic to pass through. This results in network congestion and service degradation or unavailability.

iii. SMURF Attack:

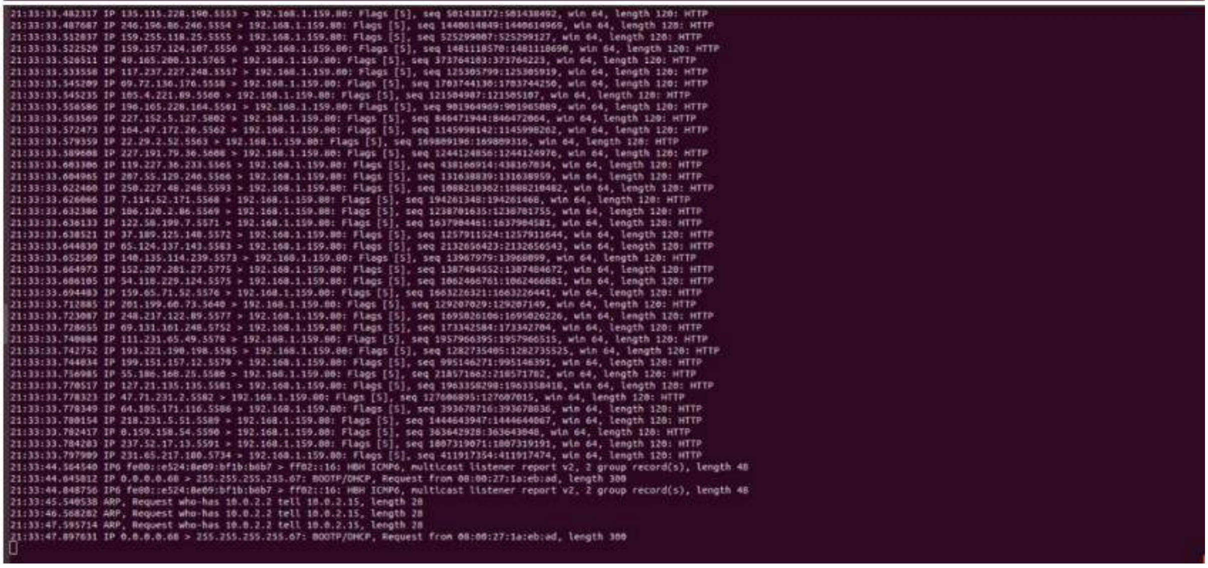
A SMURF attack is a network-based DoS attack that takes advantage of ICMP and IP addressing. In a SMURF attack, the attacker sends a large number of ICMP echo request (ping) packets to an IP broadcast address, typically spoofing the source IP address to make it appear as if the requests are coming from the victim's IP address. When these requests are sent to the broadcast address, all devices on the target network respond with ICMP echo replies. With a high enough volume of requests, this can flood the victim's network, overwhelming its resources and causing a DoS. To mitigate DoS attacks, organizations use various security measures, including firewalls, intrusion detection systems (IDS), intrusion prevention systems (IPS), and content delivery networks (CDNs). These tools help identify and filter out malicious traffic, allowing legitimate traffic to reach its destination. Additionally, proper network design and configuration can help minimize the impact of DoS attacks.

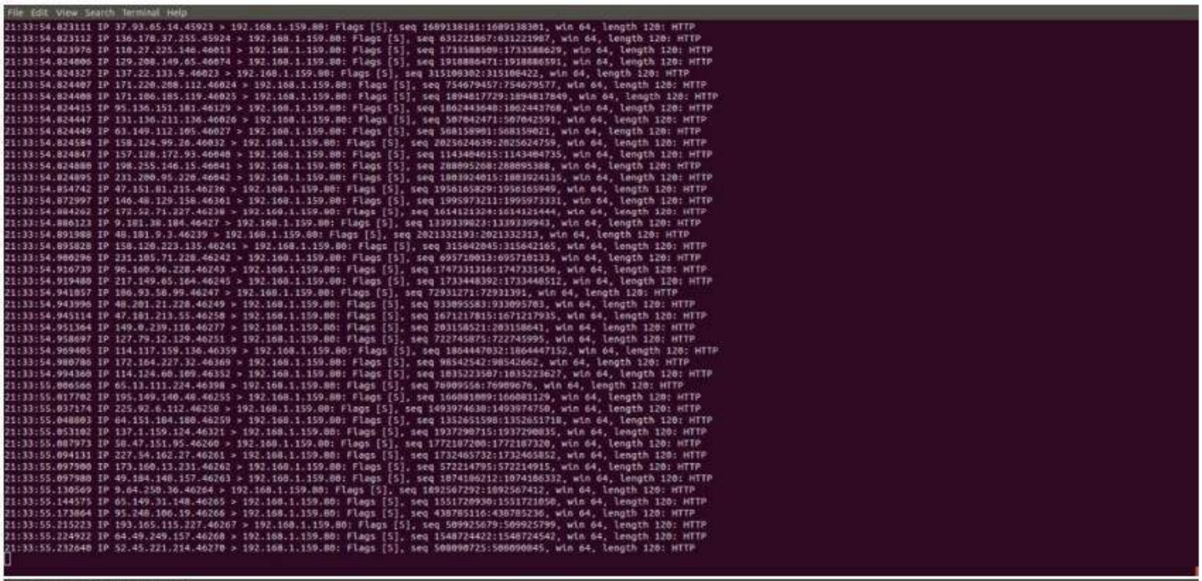
Write the Hping3 commands used for performing SYN flood and ICMP flood.

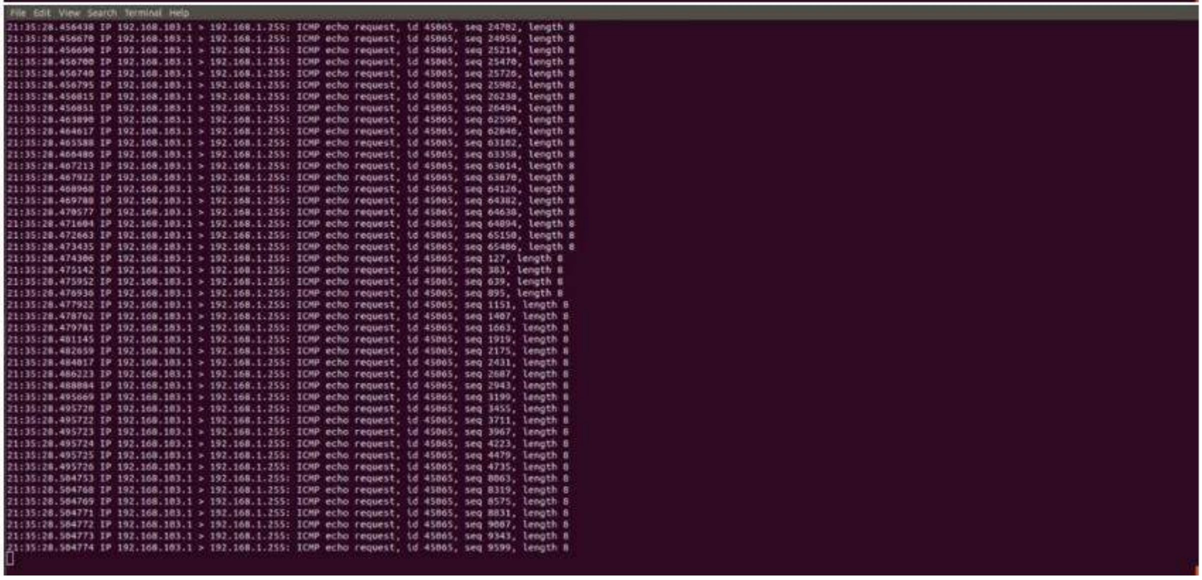
- Syn flood :
  hping3 -c 15000 -d 120 -S -w 64 -p 80 --flood --rand-source 192.168.1.159
- ICMP flood:
  hping3 -1 --flood -a 192.168.103 192.168.1.255

OUTPUT :


prasad@prasad-VirtualBox:~$ sudo apt-get install hping3
[sudo] password for prasad:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
hping3
0 upgraded, 1 newly installed, 0 to remove and 40 not upgraded.
Need to get 107 kB of archives.
After this operation, 284 kB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu bionic/universe amd64 hping3 amd64 3.a2.ds2-7 [107 kB]
Fetched 107 kB in 1s (94.1 kB/s)
Selecting previously unselected package hping3.
(Reading database ... 165323 files and directories currently installed.)
Preparing to unpack .../hping3_3.a2.ds2-7_amd64.deb ...
Unpacking hping3 (3.a2.ds2-7) ...
Setting up hping3 (3.a2.ds2-7) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
prasad@prasad-VirtualBox:~$ man hping3
prasad@prasad-VirtualBox:~$ man hping3
prasad@prasad-VirtualBox:~$ hping3 -c 15000 -d 120 -S -w 64 -p 80 --flood --rand-source 192.168.1.159
[open_sockraw] socket(): Operation not permitted
[main] can't open raw socket
prasad@prasad-VirtualBox:~$ sudo su
[sudo] password for prasad:
root@prasad-VirtualBox:/home/prasad# ^C
root@prasad-VirtualBox:/home/prasad# hping3 -c 15000 -d 120 -S -w 64 -p 80 --flood --rand-source 192.168.1.159
HPING 192.168.1.159 (enp0s3 192.168.1.159): S set, 40 headers + 120 data bytes
hping in flood mode, no replies will be shown
^C
--- 192.168.1.159 hping statistic ---
10859977 packets transmitted, 0 packets received, 100% packet loss
round-trip min/avg/max = 0.0/0.0/0.0 ms
root@prasad-VirtualBox:/home/prasad# hping3 -1 --flood -a 192.168.103.1 192.168.1.255
HPING 192.168.1.255 (enp0s3 192.168.1.255): icmp mode set, 28 headers + 0 data bytes
hping in flood mode, no replies will be shown
^C
--- 192.168.1.255 hping statistic ---
1175083 packets transmitted, 0 packets received, 100% packet loss
round-trip min/avg/max = 0.0/0.0/0.0 ms
root@prasad-VirtualBox:/home/prasad#







CONCLUSION : Learnt more about the network analysis and security assessment tools. Explored various network probing and testing techniques, which are valuable skills in the field of network administration and cybersecurity. Also executed several hping3 commands and performed DOS attack using hping3

NAME : SOUMIL SALVI

ROLL NO : 104

ASSIGNMENT 10

AIM : To study and configure Firewalls using IP tables

LO MAPPED : LO6

THEORY :

In computer networking and cybersecurity, a firewall is a fundamental component of a Computer Network Security (CNS) system designed to protect a network or a computer system from unauthorized access, malicious attacks, and the spread of malware. Firewalls serve as a barrier between a trusted internal network and untrusted external networks (e.g., the internet), controlling the flow of network traffic based on a set of predetermined security rules and policies. Here's an explanation of how firewalls work in CNS:

IPTABLES :

Iptables is a powerful and widely used firewall and packet filtering tool in the context of computer networking and security (CNS - Computer Network Security). It is commonly used on Linux-based operating systems to manage network traffic by defining rules and policies for allowing or blocking specific packets.

Here's how iptables works in a nutshell:

i. Rule-Based Packet Filtering: Iptables works by defining a set of rules that specify how network packets should be treated. These rules can be configured to allow or deny packets based on various criteria such as source and destination IP addresses, port numbers, and protocols.
ii. Tables and Chains: Iptables organizes rules into tables (e.g., filter, nat, mangle) and chains (e.g., INPUT, OUTPUT, FORWARD). Each table serves

a specific purpose, such as filtering packets or performing Network Address Translation (NAT).

iii. Packet Processing: When a network packet enters a system with iptables, it goes through a series of predefined rules in the relevant chains and tables. Each rule is evaluated sequentially.

iv. Matching and Action: Iptables rules use matching criteria to determine if a packet matches a rule. If a match is found, the corresponding action (e.g., ACCEPT, DROP, LOG) is taken. For example, a rule might allow incoming packets from a specific IP address and drop all others.

v. Default Policies: Each chain has a default policy (e.g., ACCEPT, DROP) that specifies what action to take if a packet doesn't match any of the rules in that chain. Default policies act as a fallback for unmatched packets.

vi. Stateful Inspection: Iptables can also perform stateful packet inspection, which allows it to keep track of the state of network connections. This is particularly useful for protocols like TCP, where connections have states (e.g., NEW, ESTABLISHED, RELATED).

Here are some common rules for configuring the iptables firewall, along with explanations of each rule:

i. Allow All Incoming Traffic on a Specific Port: This rule allows incoming traffic on a specific port, such as allowing incoming web traffic on port 80.

- Command: sudo iptables -A INPUT -p tcp --dport 80 -j ACCEPT
- Explanation: This rule appends (-A) a new rule to the INPUT chain, specifying that incoming (-p tcp) traffic on port 80 should be accepted (-j ACCEPT).

ii. Allow All Outgoing Traffic: This rule allows all outgoing traffic from your server.

- Command: sudo iptables -A OUTPUT -j ACCEPT
- Explanation: This rule appends a new rule to the OUTPUT chain, which allows all outgoing traffic (-j ACCEPT).

iii. Allow SSH Access (Port 22): This rule allows incoming SSH traffic on port 22, which is useful for remote server administration.
- Command : sudo iptables -A INPUT -p tcp --dport 22 -j ACCEPT
- Explanation: This rule allows incoming SSH traffic on port 22.

iv. Block All Incoming Traffic Except Established Connections: This rule blocks all incoming traffic except for connections that are already established or related to established connections.
- Command : sudo iptables -A INPUT -m conntrack --ctstate RELATED,ESTABLISHED -j ACCEPT
- Explanation: This rule uses the conntrack module to match connections in the RELATED or ESTABLISHED state and accepts them.

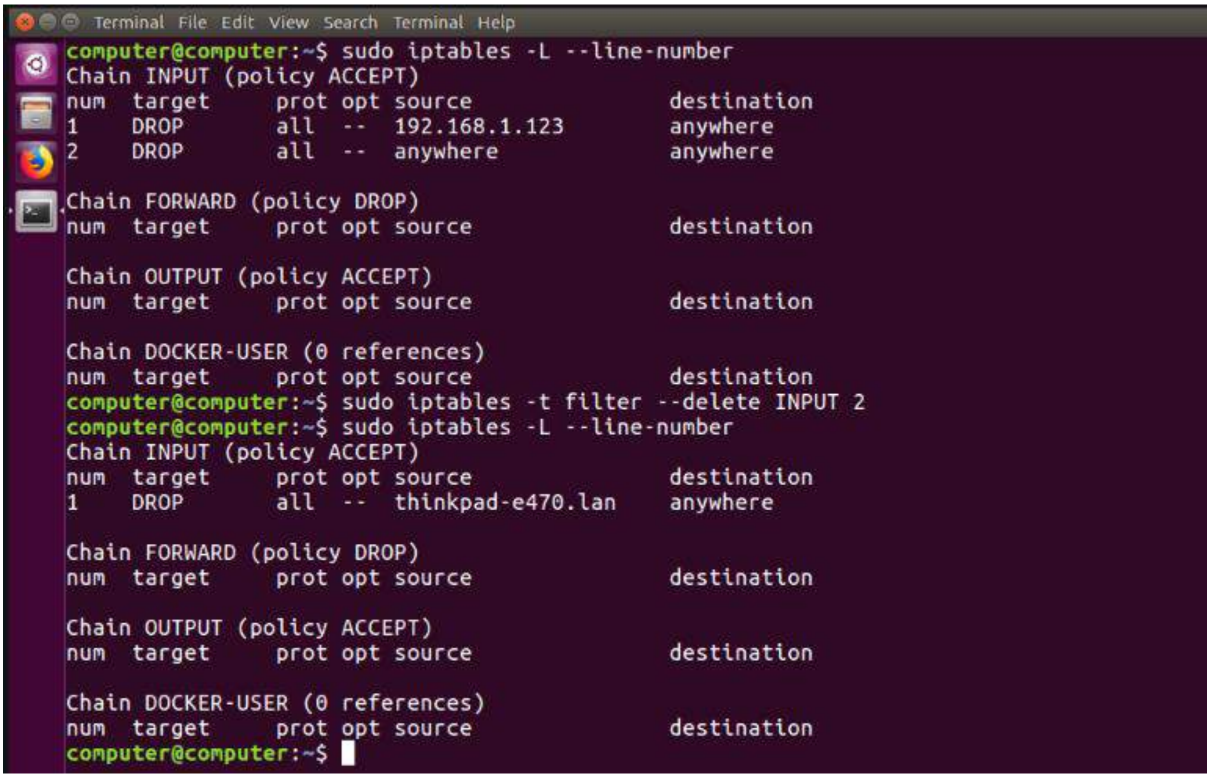
v. Block Specific IP Address or Range: This rule blocks incoming traffic from a specific IP address or range.
- Command : sudo iptables -A INPUT -s 192.168.1.100 -j DROP
- Explanation: This rule blocks incoming traffic from the IP address 192.168.1.100.

vi. Redirect Ports (Port Forwarding): This rule redirects incoming traffic on one port to another port, typically used for setting up port forwarding.
- Command : sudo iptables -t nat -A PREROUTING -i eth0 -p tcp --dport 80 -j REDIRECT --to-port 8080
- Explanation: This rule is used to redirect incoming traffic on port 80 to port 8080.

vii. Delete a Rule by Line Number: To delete a specific rule, you can reference it by its line number using the -D option.
- Command : sudo iptables -D INPUT 3

Basic Commands :

- sudo iptables -L



- -A - Append this rule to a rule chain. Valid chains for what we're doing are INPUT,

FORWARD and OUTPUT, but we mostly deal with INPUT in this tutorial, which affects only incoming traffic.

- -p - The connection protocol used.
- --dport - The destination port(s) required for this rule. A single port may be given, or a range may be given as start:end, which will match all ports from start to end, inclusive.
- -j - Jump to the specified target. By default, iptables allows four targets:
- ACCEPT - Accept the packet and stop processing rules in this chain.
- REJECT - Reject the packet and notify the sender that we did so, and stop processing rules in this chain.
- DROP - Silently ignore the packet, and stop processing rules in this chain.
- LOG - Log the packet, and continue processing more rules in this chain.

Allows the use of the --log-prefix and --log-level options.

- -i - Only match if the packet is coming in on the specified interface.

• -I - Inserts a rule. Takes two options, the chain to insert the rule into, and the rule number it should be.

• -I INPUT 5 would insert the rule into the INPUT chain and make it the 5th rule in the list.

• -v - Display more information in the output. Useful for if you have rules that look similar without using -v.

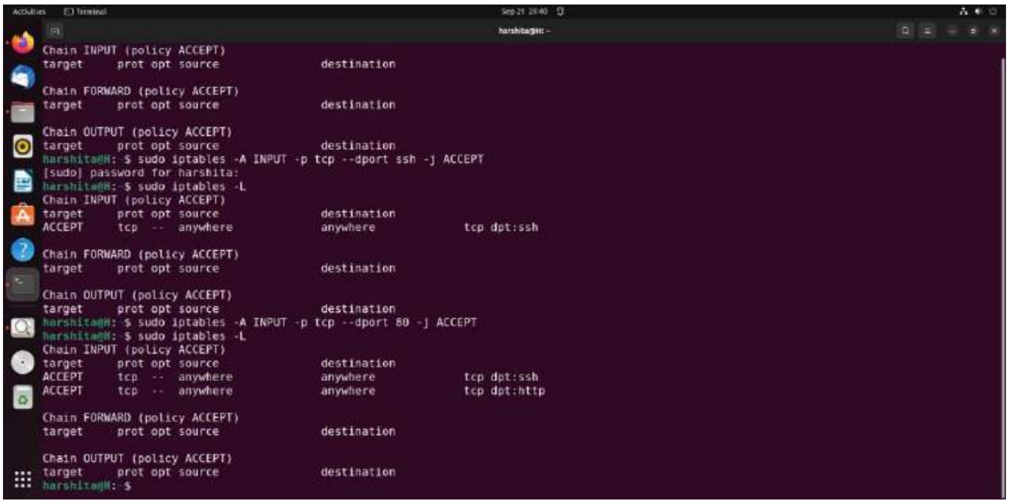
• -s --source - address[/mask] source specification

• -d --destination - address[/mask] destination specification

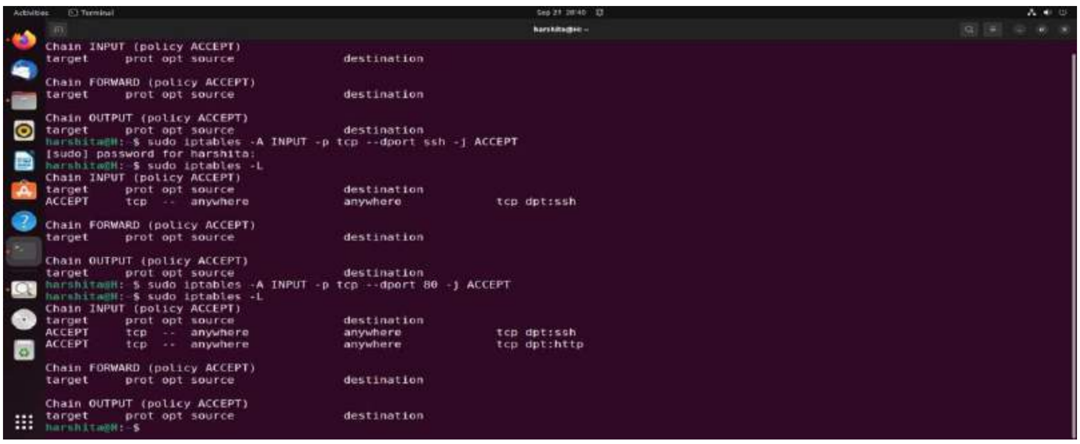
• -o --out-interface - output name[+] network interface name ([+] for wildcard)

Allowing Incoming Traffic on Specific Ports :

- sudo iptables -A INPUT -p tcp --dport ssh -j ACCEPT



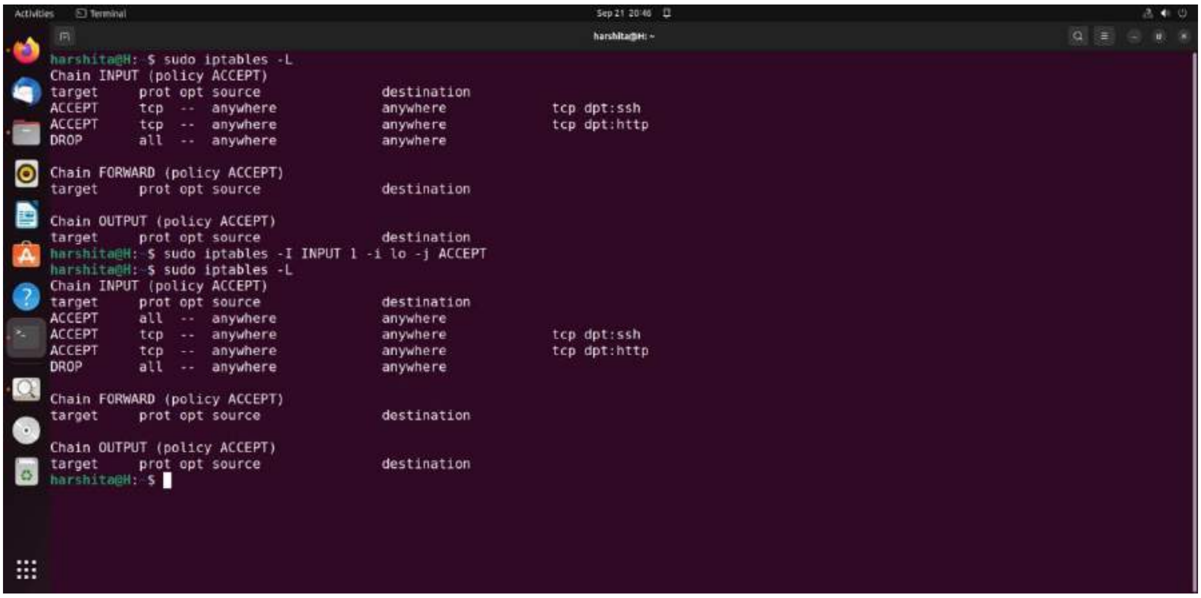
- sudo iptables -A INPUT -p tcp --dport 80 -j ACCEPT



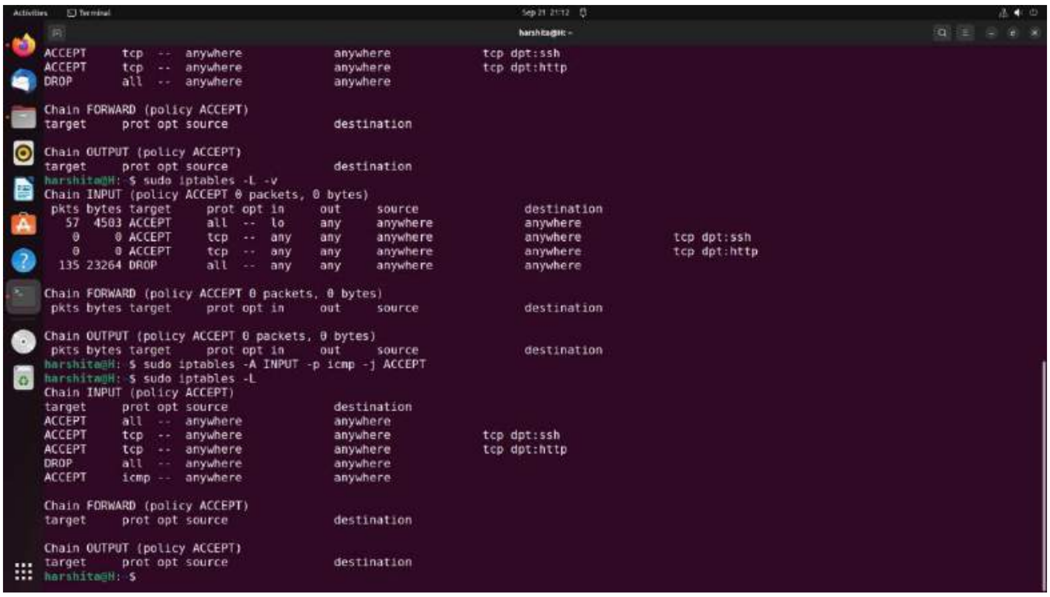
Editing iptables :

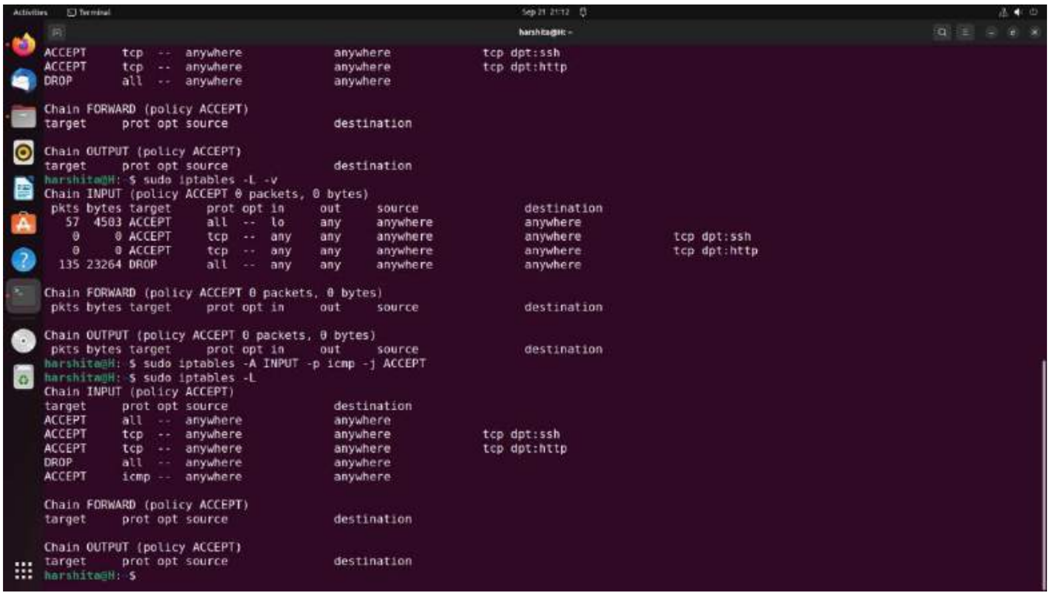
The only problem with our setup so far is that even the loopback port is blocked. We could have written the drop rule for just eth0 by specifying -i eth0, but we could also add a rule for the loopback. If we append this rule, it will come too late - after all the traffic has been dropped. We need to insert this rule before that. Since this is a lot of traffic, we'll insert it as the first rule so it's processed first.

- sudo iptables -I INPUT 1 -i lo -j ACCEPT sudo iptables -L

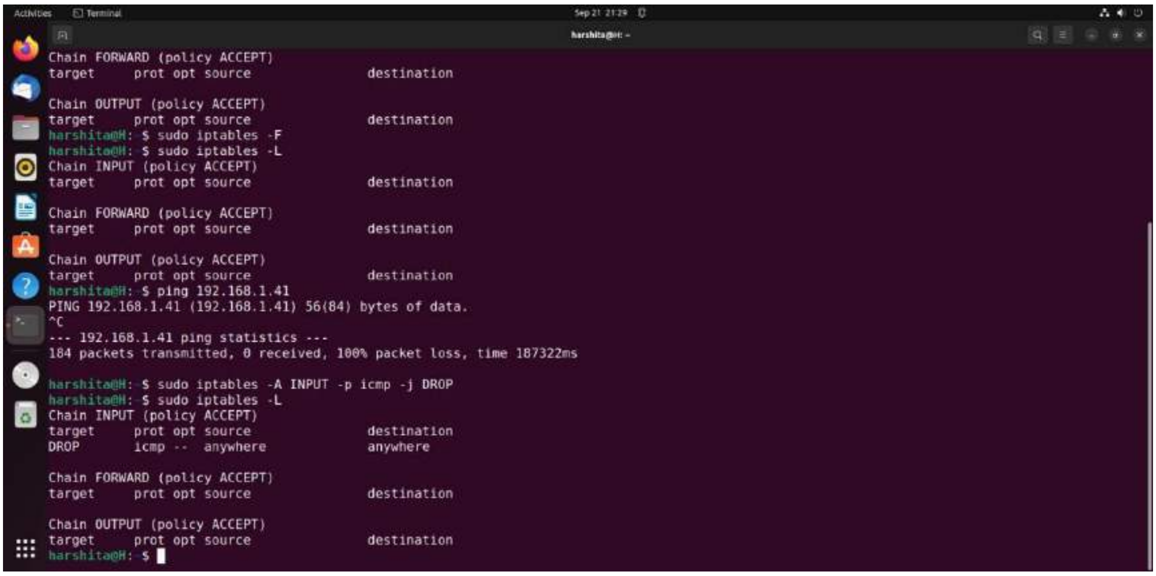


- sudo iptables -L -v
- sudo iptables -A INPUT -p icmp -j ACCEPT

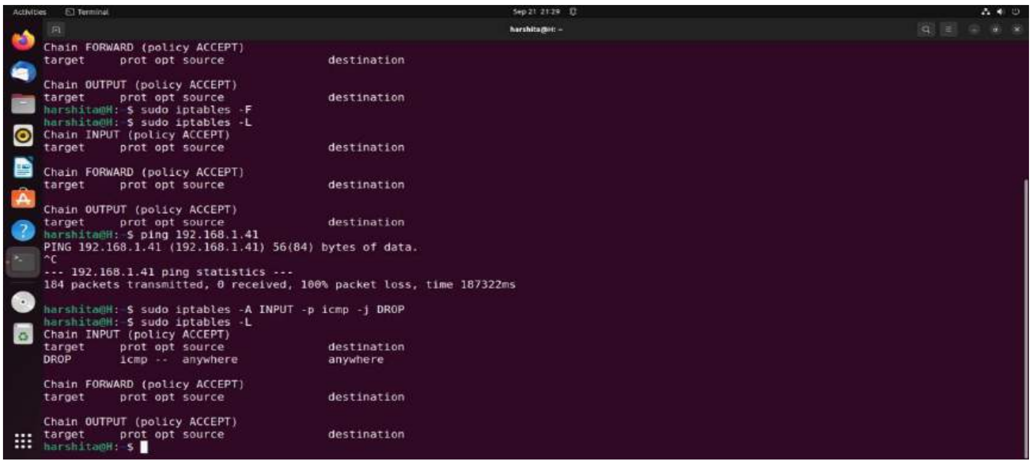




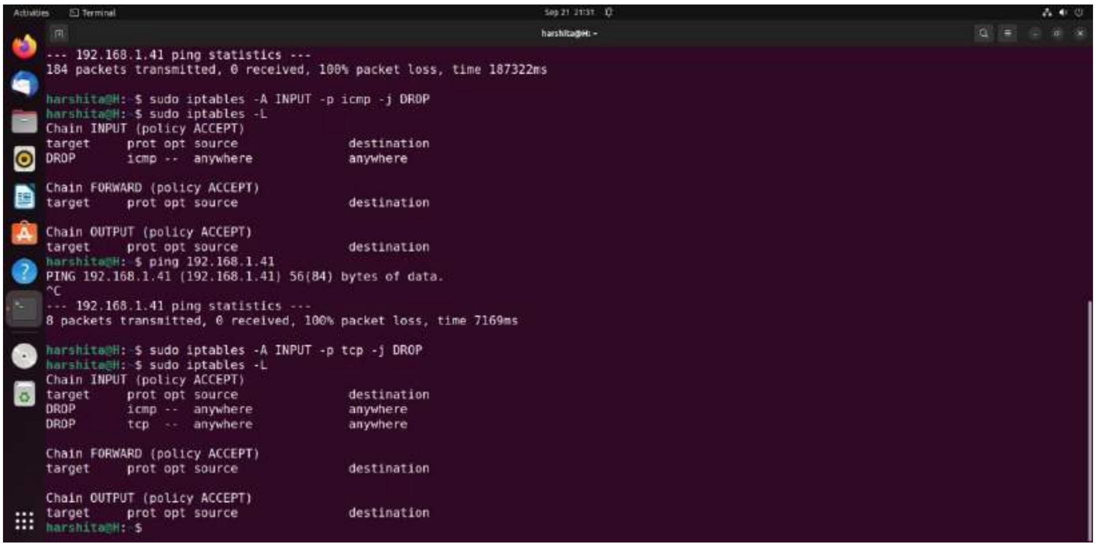
- sudo iptables -F
- sudo iptables -L

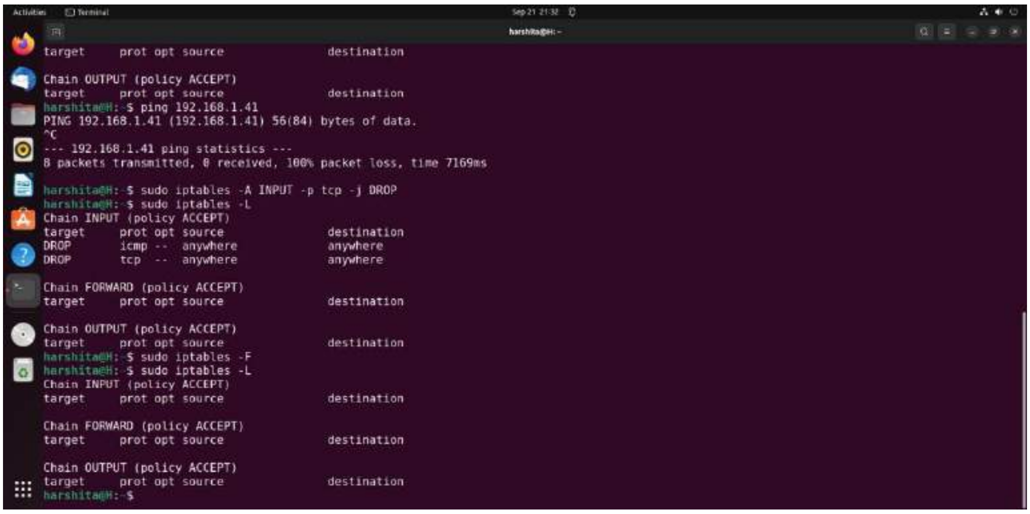


- sudo iptables -A INPUT -p icmp -j DROP



- sudo iptables -A OUTPUT -p icmp -j DROP
- sudo iptables -L now try to ping neighbour ping 192.168.1.41





CONCLUSION : In this assignment we studied about Firewalls and IPTABLES and executed different commands for the same .

NAME : SOUMIL SALVI

ROLL NO : 104

ASSIGNMENT 11

AIM : Installing snort, setting in Intrusion Detection Mode and writing rules for Intrusion Detection

LO MAPPED : LO6

THEORY :

Steps to Install snort and configure it in Intrusion Detection Mode.

1. Check the name of the interface using command ifconfig.

2. Install snort in ubuntu machine using command sudo apt-get install snort

3. While installing the snort, name of the interface will be asked on which snort is supposed to listen. Enter the interface name observed in step 1.

4. Run the command sudo gedit /etc/snort/snort.conf . This opens snort configuration file.

5. Make following changes to configuration file.

   a. ipvar HOME_NET 192.168.0.0/24 (in section 1)

6. Open new terminal. Open ftp.rule file in it by typing the command sudo gedit /etc/snort/rules/ftp.rules (optional)

7. Open new terminal and type the command sudo snort -T -c /etc/snort/snort.conf -i enp3s0 to validate that all rules are there.

We use the

-T flag to test the configuration file,

-c flag to tell Snort which configuration file to use, and -i to specify the interface that Snort will listen on.

8. Type the command sudo snort -A console -q -u snort -g snort -c /etc/snort/snort.conf -i enp3s0 (to start snort in NIDS mode)

We use the

-A console The ‘console’ option prints fast mode alerts to stdout

-q Quiet mode. Don’t show banner and status report.

-u snort Run Snort as the following user after startup

-g snort Run Snort as the following group after startup

-c /etc/snort/snort.conf The path to our snort.conf file

-i enp3s0 The interface to listen on (change to your interface if different)

9. Now go to kali linux machine.

10. Type command nmap 192.168.0.107 on it to start port scanning of ubuntu machine and observe the output in terminal where snort is started in detection environment.

When you execute this command, you will not initially see any output. Snort is running, and is processing all packets that arrive on eth0 (or whichever interface you specified with the -i flag). Snort compares each packet to the rules it has loaded (in this case our single ICMP Ping rule), and will then print an alert to the console when a packet matches our rule.

11. Then try pinging ubuntu machine by typing the command ping 192.168.0.107 and observe the output in terminal where snort is started in detection mode.

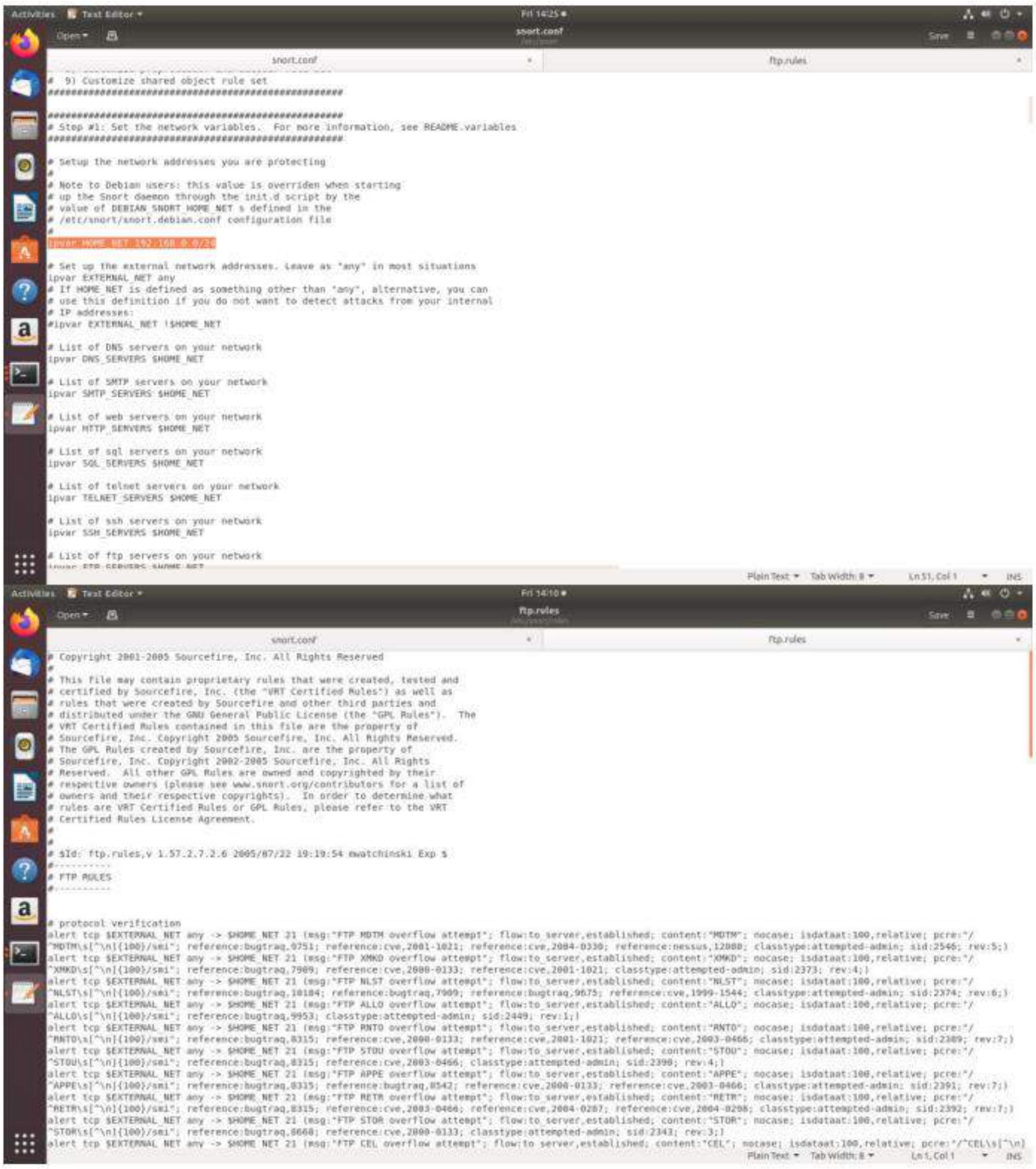
12. Adding rule for detecting ping activity performed by another machine:

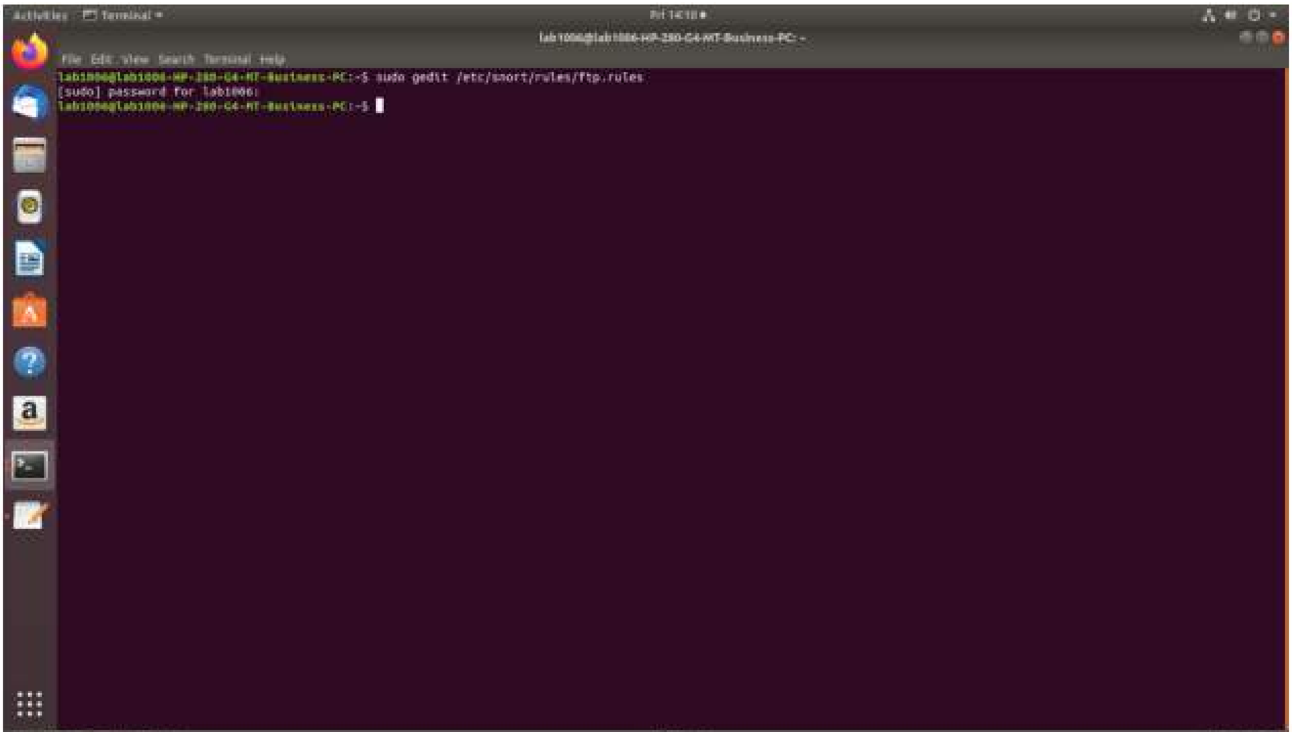
- In ubuntu machine, type the following command to create a file called local.rules : sudo gedit /etc/snort/rules/local.rules
- Write the following rule in it: alert icmp any any -> $HOME_NET any (msg:"ICMP test detected"; GID:1; sid:10000001; rev:001; c lasstype:icmp- event;)
- Save the local.rules file.
- Comment the following lines in configuration file (snort.conf) of snort: icmp.rules and icmp-info.rules
- Add the local.rules file in section 7 of configuration file of snort by writing: include $RULE_PATH local.rules
- Validate the changes made in snort.conf file by writing the command in terminal: sudo snort -T -c /etc/snort/snort.conf -i enp3s0

- Set the snort in Intrusion Detection Mode by typing the command: sudo snort -A console -q -u snort -g snort -c /etc/snort/snort.conf - i enp3s0
- Now from kali machine ping the ubuntu machine and see the alert generated.
- Observe the difference between the alerts generated when icmp.rules and icmp-info.rules are used and when local.rules is used to detect the ping activity.

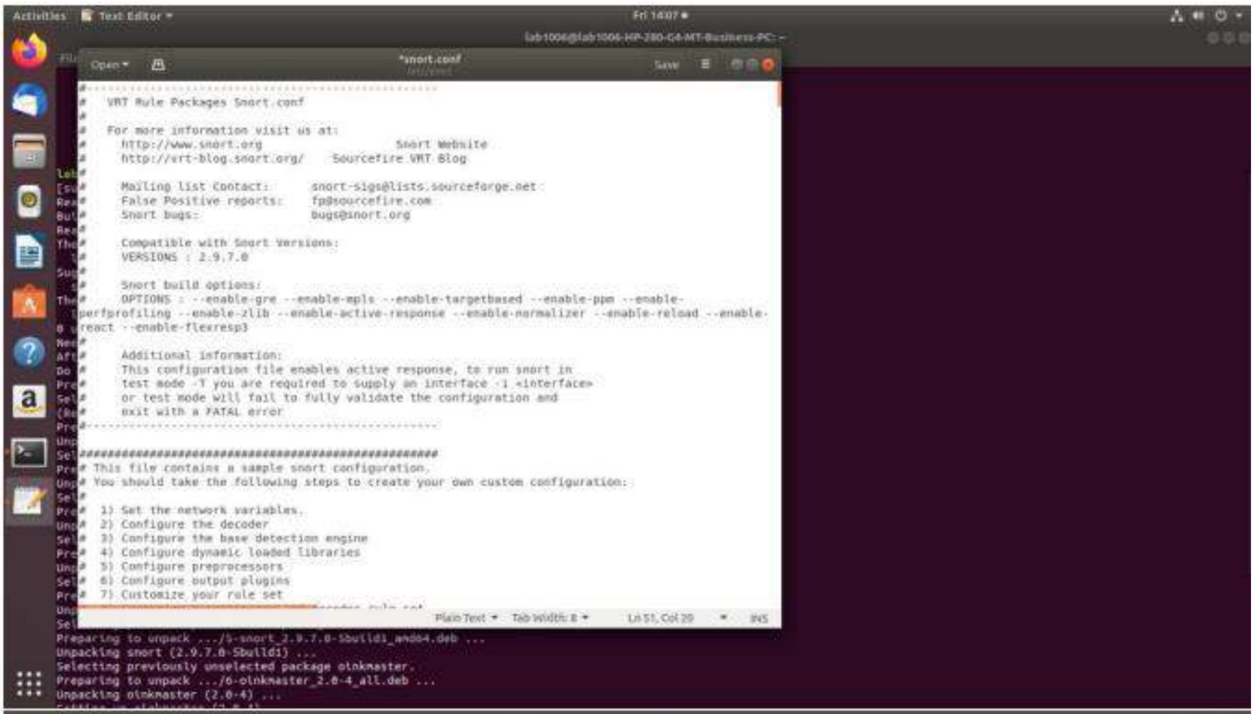
Reference Link for Demo: https://www.youtube.com/watch?v=iBsGSsbDMyw

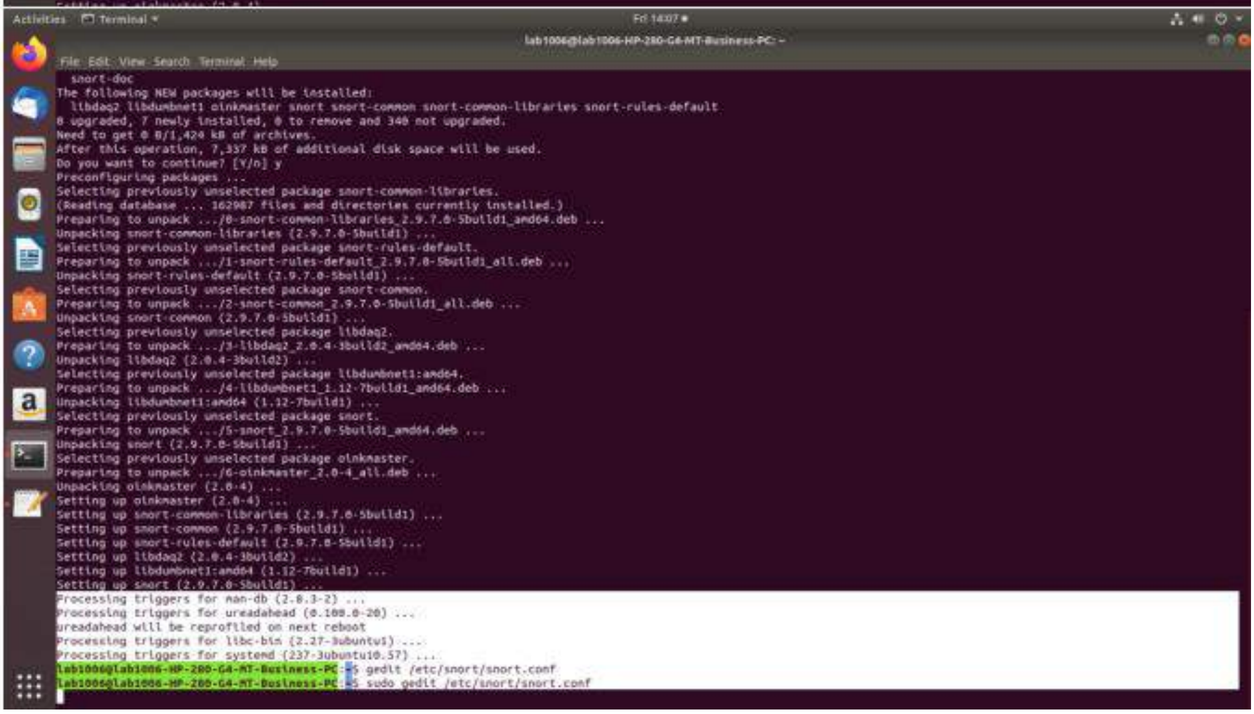
OUTPUT :

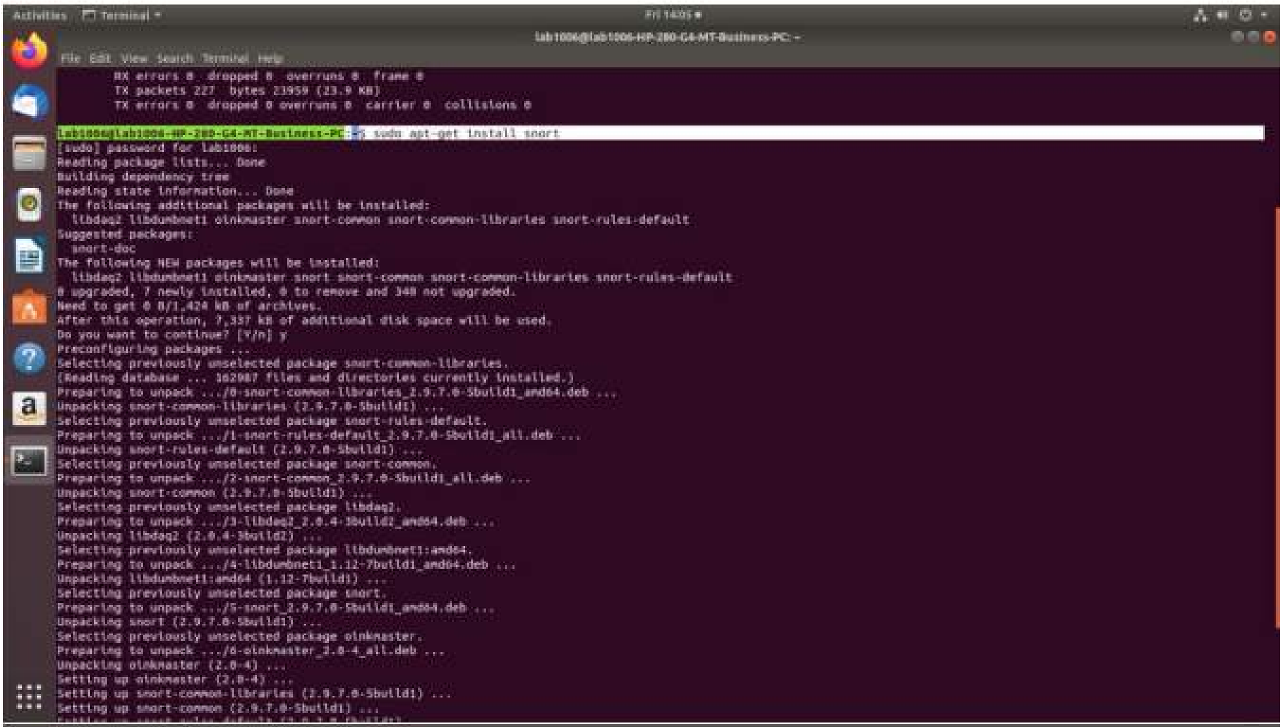


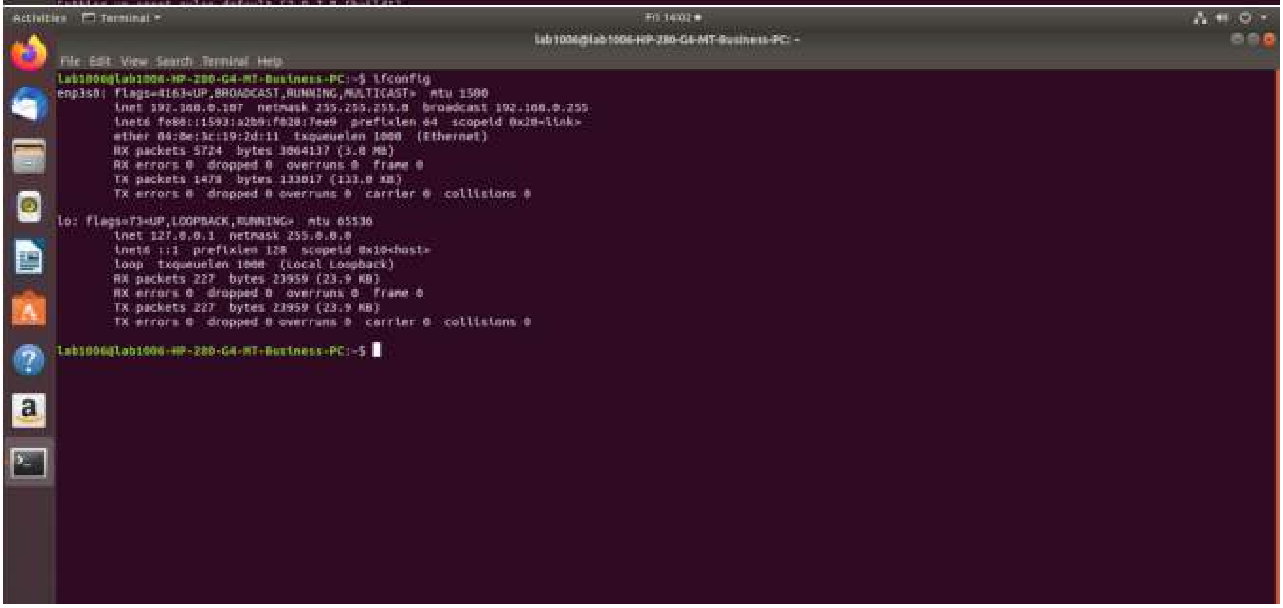

Activities
Terminal
File Edit View Search Terminal Help
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo gedit /etc/snort/rules/ftp.rules
[sudo] password for lab1006:
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$

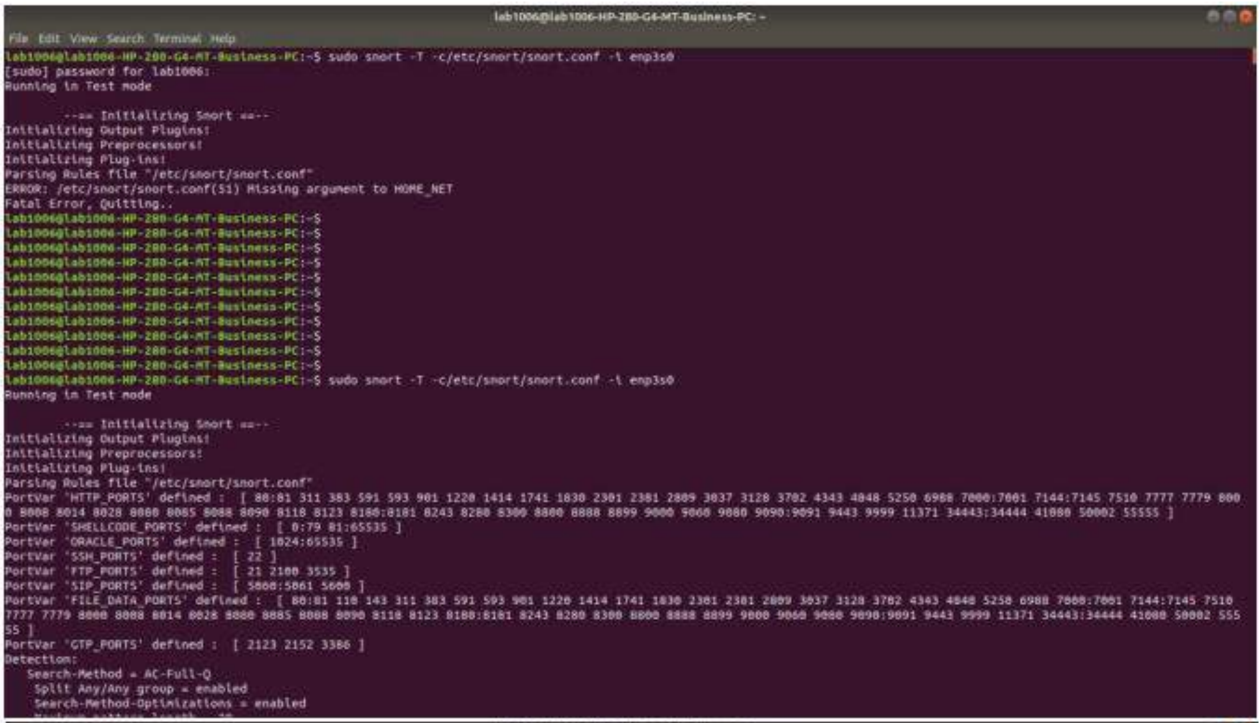

Activities
Text Editor
Open
snort.conf
Save
1) Set the network variables.
2) Configure the decoder
3) Configure the base detection engine
4) Configure dynamic loaded libraries
5) Configure preprocessors
6) Configure output plugins
7) Customize your rule set
8) Customize preprocessor and decoder rule set
9) Customize shared object rule set
###
###
Step #1: Set the network variables. For more information, see README.variables
###
Setup the network addresses you are protecting
#
Note to Debian users: this value is overriden when starting
up the Snort daemon through the init.d script by the
value of DEBIAN_SNORT_HOME_NET s defined in the
/etc/snort/snort.debian.conf configuration file
#
ipvar HOME_NET any 192.168.0.0/24
Set up the external network addresses. Leave as "any" in most situations
ipvar EXTERNAL_NET any
If HOME_NET is defined as something other than "any", alternative, you can
use this definition if you do not want to detect attacks from your internal
IP addresses:
#ipvar EXTERNAL_NET !$HOME_NET
List of DNS servers on your network
ipvar DNS_SERVERS $HOME_NET
List of SMTP servers on your network
ipvar SMTP_SERVERS $HOME_NET
List of web servers on your network
ipvar HTTP_SERVERS $HOME_NET
List of sql servers on your network
ipvar SQL_SERVERS $HOME_NET
List of telnet servers on your network
ipvar TELNET_SERVERS $HOME_NET
Plain Text
Tab Width: 8
INS


Activities
Text Editor
Fri 14:07
lab1006@lab1006-HP-280-G4-MT-Business-PC: ~
Open
*snort.conf
Save
VRT Rule Packages Snort.conf
#
For more information visit us at:
http://www.snort.org   Snort Website
http://vrt-blog.snort.org/   Sourcefire VRT Blog
#
Mailing list Contact: snort-sigs@lists.sourceforge.net
False Positive reports: fp@sourcefire.com
Snort bugs: bugs@snort.org
#
Compatible with Snort Versions:
VERSIONS : 2.9.7.0
#
Snort build options:
OPTIONS : --enable-gre --enable-mpls --enable-targetbased --enable-ppm --enable-perfprofiling --enable-zlib --enable-active-response --enable-normalizer --enable-reload --enable-react --enable-flexresp3
#
Additional information:
This configuration file enables active response, to run snort in
test mode -T you are required to supply an interface -i <interface>
or test mode will fail to fully validate the configuration and
exit with a FATAL error
This file contains a sample snort configuration.
You should take the following steps to create your own custom configuration:
#
1) Set the network variables.
2) Configure the decoder
3) Configure the base detection engine
4) Configure dynamic loaded libraries
5) Configure preprocessors
6) Configure output plugins
7) Customize your rule set
Plain Text
Tab Width: 8
Ln 51, Col 20
INS
Preparing to unpack .../5-snort_2.9.7.0-5build1_amd64.deb ...
Unpacking snort (2.9.7.0-5build1) ...
Selecting previously unselected package oinkmaster.
Preparing to unpack .../6-oinkmaster_2.0-4_all.deb ...
Unpacking oinkmaster (2.0-4) ...


Activities
Terminal
Fri 14:07
lab1006@lab1006-HP-280-G4-MT-Business-PC: ~
File Edit View Search Terminal Help
snort-doc
The following NEW packages will be installed:
libdaq2 libdumbnet1 oinkmaster snort snort-common snort-common-libraries snort-rules-default
0 upgraded, 7 newly installed, 0 to remove and 340 not upgraded.
Need to get 0 B/1,424 kB of archives.
After this operation, 7,337 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Preconfiguring packages ...
Selecting previously unselected package snort-common-libraries.
Preparing to unpack .../0-snort-common-libraries_2.9.7.0-5build1_amd64.deb ...
Unpacking snort-common-libraries (2.9.7.0-5build1) ...
Selecting previously unselected package snort-rules-default.
Preparing to unpack .../1-snort-rules-default_2.9.7.0-5build1_all.deb ...
Unpacking snort-rules-default (2.9.7.0-5build1) ...
Selecting previously unselected package snort-common.
Preparing to unpack .../2-snort-common_2.9.7.0-5build1_all.deb ...
Unpacking snort-common (2.9.7.0-5build1) ...
Selecting previously unselected package libdaq2.
Preparing to unpack .../3-libdaq2_2.0.4-3build2_amd64.deb ...
Unpacking libdaq2 (2.0.4-3build2) ...
Selecting previously unselected package libdumbnet1:amd64.
Preparing to unpack .../4-libdumbnet1_1.12-7build1_amd64.deb ...
Unpacking libdumbnet1:amd64 (1.12-7build1) ...
Selecting previously unselected package snort.
Preparing to unpack .../5-snort_2.9.7.0-5build1_amd64.deb ...
Unpacking snort (2.9.7.0-5build1) ...
Selecting previously unselected package oinkmaster.
Preparing to unpack .../6-oinkmaster_2.0-4_all.deb ...
Unpacking oinkmaster (2.0-4) ...
Setting up oinkmaster (2.0-4) ...
Setting up snort-common-libraries (2.9.7.0-5build1) ...
Setting up snort-common (2.9.7.0-5build1) ...
Setting up snort-rules-default (2.9.7.0-5build1) ...
Setting up libdaq2 (2.0.4-3build2) ...
Setting up libdumbnet1:amd64 (1.12-7build1) ...
Setting up snort (2.9.7.0-5build1) ...
Processing triggers for man-db (2.8.3-2) ...
Processing triggers for ureadahead (0.100.0-20) ...
ureadahead will be reprofiled on next reboot
Processing triggers for libc-bin (2.27-3ubuntu1) ...
Processing triggers for systemd (237-3ubuntu10.57) ...
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ gedit /etc/snort/snort.conf
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo gedit /etc/snort/snort.conf


Activities
Terminal
Fri 14:05
lab1006@lab1006-HP-280-G4-MT-Business-PC: ~
File Edit View Search Terminal Help
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 227 bytes 23959 (23.9 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo apt-get install snort
[sudo] password for lab1006:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
libdaq2 libdumbnet1 oinkmaster snort-common snort-common-libraries snort-rules-default
Suggested packages:
snort-doc
The following NEW packages will be installed:
libdaq2 libdumbnet1 oinkmaster snort snort-common snort-common-libraries snort-rules-default
0 upgraded, 7 newly installed, 0 to remove and 348 not upgraded.
Need to get 0 B/1,424 kB of archives.
After this operation, 7,337 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Preconfiguring packages ...
Selecting previously unselected package snort-common-libraries.
(Reading database ... 162987 files and directories currently installed.)
Preparing to unpack .../0-snort-common-libraries_2.9.7.0-5build1_amd64.deb ...
Unpacking snort-common-libraries (2.9.7.0-5build1) ...
Selecting previously unselected package snort-rules-default.
Preparing to unpack .../1-snort-rules-default_2.9.7.0-5build1_all.deb ...
Unpacking snort-rules-default (2.9.7.0-5build1) ...
Selecting previously unselected package snort-common.
Preparing to unpack .../2-snort-common_2.9.7.0-5build1_all.deb ...
Unpacking snort-common (2.9.7.0-5build1) ...
Selecting previously unselected package libdaq2.
Preparing to unpack .../3-libdaq2_2.0.4-3build2_amd64.deb ...
Unpacking libdaq2 (2.0.4-3build2) ...
Selecting previously unselected package libdumbnet1:amd64.
Preparing to unpack .../4-libdumbnet1_1.12-7build1_amd64.deb ...
Unpacking libdumbnet1:amd64 (1.12-7build1) ...
Selecting previously unselected package snort.
Preparing to unpack .../5-snort_2.9.7.0-5build1_amd64.deb ...
Unpacking snort (2.9.7.0-5build1) ...
Selecting previously unselected package oinkmaster.
Preparing to unpack .../6-oinkmaster_2.0-4_all.deb ...
Unpacking oinkmaster (2.0-4) ...
Setting up oinkmaster (2.0-4) ...
Setting up snort-common-libraries (2.9.7.0-5build1) ...
Setting up snort-common (2.9.7.0-5build1) ...

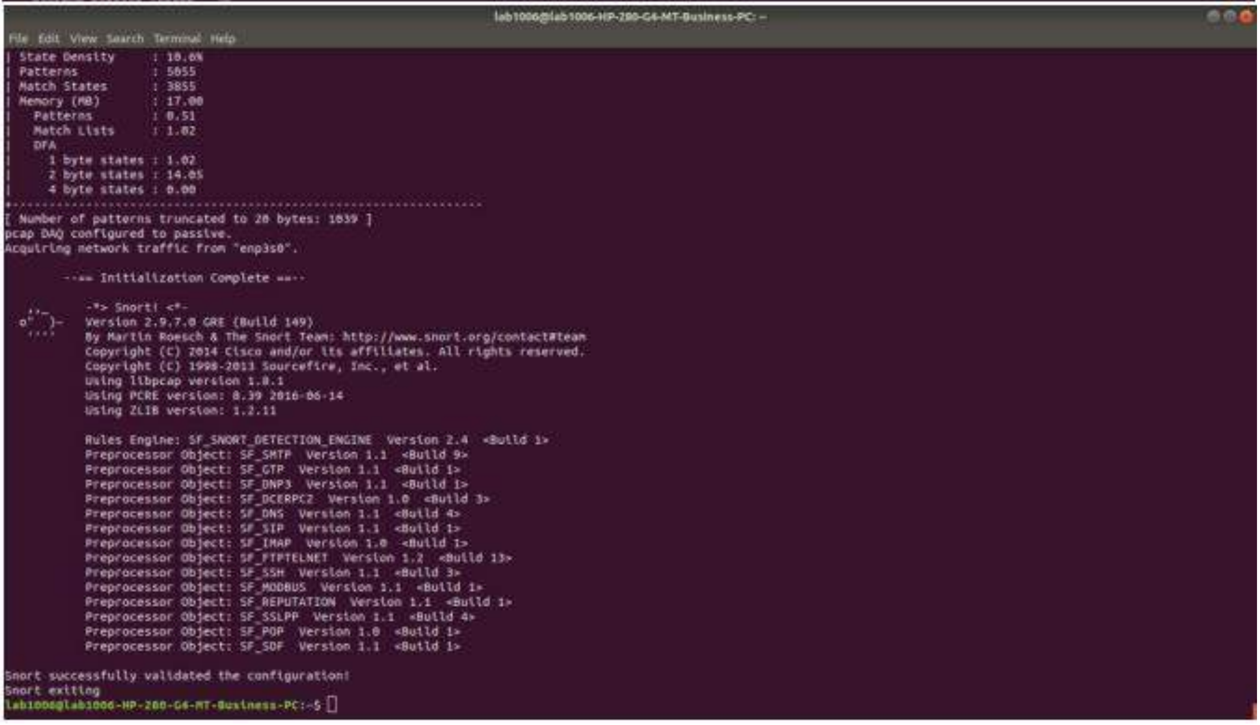

Activities
Terminal
Fri 14:02
lab1006@lab1006-HP-280-G4-MT-Business-PC: ~
File Edit View Search Terminal Help
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ ifconfig
enp3s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
inet 192.168.0.107 netmask 255.255.255.0 broadcast 192.168.0.255
inet6 fe80::1593:a2b9:f028:7ee9 prefixlen 64 scopeid 0x20<link>
ether 04:0e:3c:19:2d:11 txqueuelen 1000 (Ethernet)
RX packets 5724 bytes 3064137 (3.0 MB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 1478 bytes 133017 (133.0 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
inet 127.0.0.1 netmask 255.0.0.0
inet6 ::1 prefixlen 128 scopeid 0x10<host>
loop txqueuelen 1000 (Local Loopback)
RX packets 227 bytes 23959 (23.9 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 227 bytes 23959 (23.9 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$



```
lab1006@lab1006-HP-280-G4-MT-Business-PC: ~
File  Edit  View  Search  Terminal  Help
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo snort -T -c/etc/snort/snort.conf -i enp3s0
[sudo] password for lab1006:
Running in Test mode

        --== Initializing Snort ==--
Initializing Output Plugins!
Initializing Preprocessors!
Initializing Plug-ins!
Parsing Rules file "/etc/snort/snort.conf"
ERROR: /etc/snort/snort.conf(51) Missing argument to HOME_NET
Fatal Error, Quitting..
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo snort -T -c/etc/snort/snort.conf -i enp3s0
Running in Test mode

        --== Initializing Snort ==--
Initializing Output Plugins!
Initializing Preprocessors!
Initializing Plug-ins!
Parsing Rules file "/etc/snort/snort.conf"
PortVar 'HTTP_PORTS' defined :  [ 80:81 311 383 591 593 901 1220 1414 1741 1830 2301 2381 2809 3037 3128 3702 4343 4848 5250 6988 7000:7001 7144:7145 7510 7777 7779 800
0 8008 8014 8028 8080 8085 8088 8090 8118 8123 8180:8181 8243 8280 8300 8800 8888 8899 9000 9060 9080 9090:9091 9443 9999 11371 34443:34444 41080 50002 55555 ]
PortVar 'SHELLCODE_PORTS' defined :  [ 0:79 81:65535 ]
PortVar 'ORACLE_PORTS' defined :  [ 1024:65535 ]
PortVar 'SSH_PORTS' defined :  [ 22 ]
PortVar 'FTP_PORTS' defined :  [ 21 2100 3535 ]
PortVar 'SIP_PORTS' defined :  [ 5060:5061 5600 ]
PortVar 'FILE_DATA_PORTS' defined :  [ 80:81 110 143 311 383 591 593 901 1220 1414 1741 1830 2301 2381 2809 3037 3128 3702 4343 4848 5250 6988 7000:7001 7144:7145 7510
7777 7779 8000 8008 8014 8028 8080 8085 8088 8090 8118 8123 8180:8181 8243 8280 8300 8800 8888 8899 9000 9060 9080 9090:9091 9443 9999 11371 34443:34444 41080 50002 555
55 ]
PortVar 'GTP_PORTS' defined :  [ 2123 2152 3386 ]
Detection:
   Search-Method = AC-Full-Q
    Split Any/Any group = enabled
    Search-Method-Optimizations = enabled
```



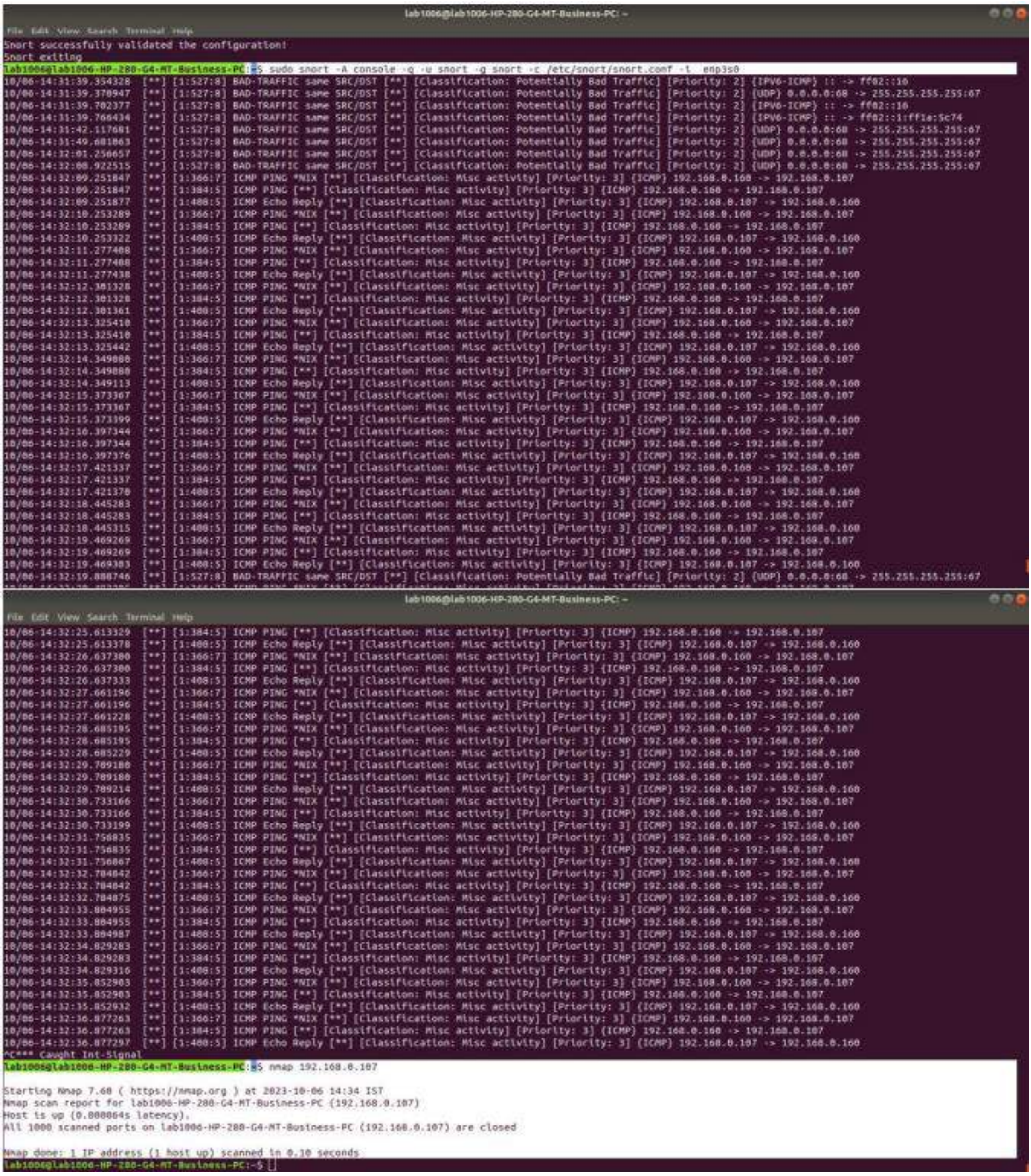
```
lab1006@lab1006-HP-280-G4-MT-Business-PC: ~
File  Edit  View  Search  Terminal  Help
| State Density      : 10.6%
| Patterns           : 5055
| Match States       : 3855
| Memory (MB)        : 17.00
|   Patterns         : 0.51
|   Match Lists      : 1.02
|   DFA
|     1 byte states : 1.02
|     2 byte states : 14.05
|     4 byte states : 0.00
+----------------------------------------------------------------
[ Number of patterns truncated to 20 bytes: 1039 ]
pcap DAQ configured to passive.
Acquiring network traffic from "enp3s0".

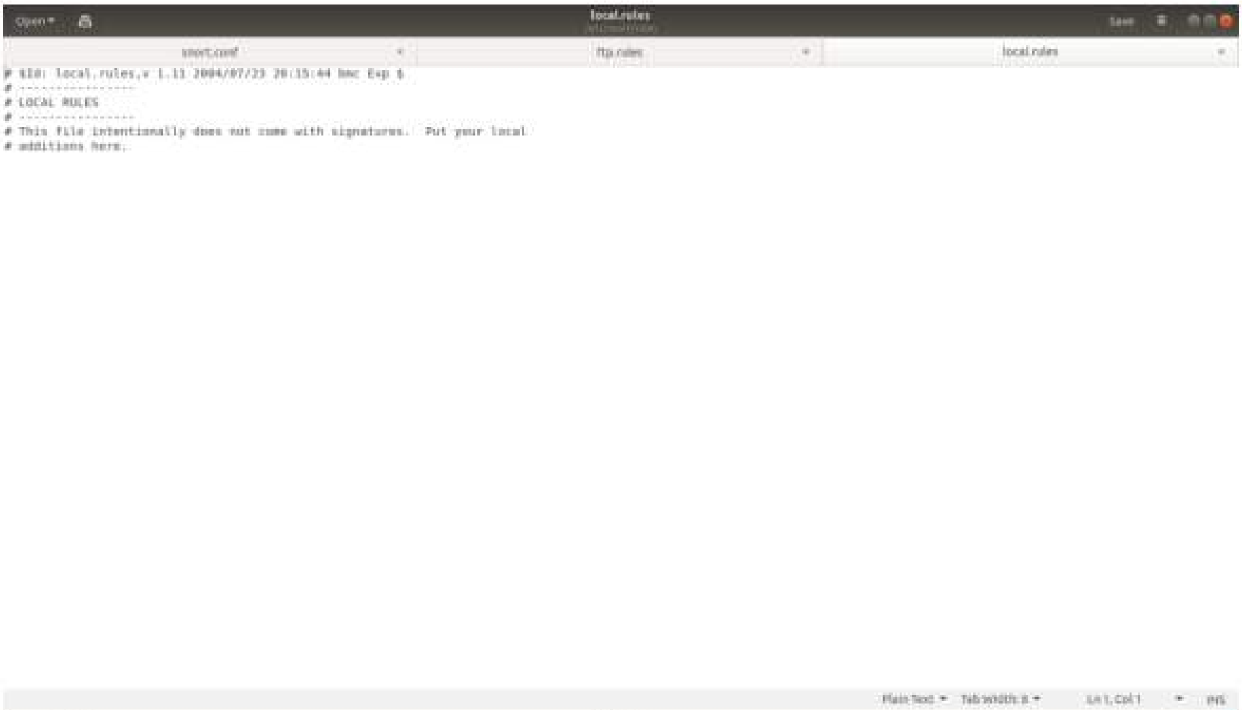
        --== Initialization Complete ==--

   ,,_     -*> Snort! <*-
  o"  )~   Version 2.9.7.0 GRE (Build 149)
   ''''    By Martin Roesch & The Snort Team: http://www.snort.org/contact#team
           Copyright (C) 2014 Cisco and/or its affiliates. All rights reserved.
           Copyright (C) 1998-2013 Sourcefire, Inc., et al.
           Using libpcap version 1.8.1
           Using PCRE version: 8.39 2016-06-14
           Using ZLIB version: 1.2.11

           Rules Engine: SF_SNORT_DETECTION_ENGINE  Version 2.4  <Build 1>
           Preprocessor Object: SF_SMTP  Version 1.1  <Build 9>
           Preprocessor Object: SF_GTP  Version 1.1  <Build 1>
           Preprocessor Object: SF_DNP3  Version 1.1  <Build 1>
           Preprocessor Object: SF_DCERPC2  Version 1.0  <Build 3>
           Preprocessor Object: SF_DNS  Version 1.1  <Build 4>
           Preprocessor Object: SF_SIP  Version 1.1  <Build 1>
           Preprocessor Object: SF_IMAP  Version 1.0  <Build 1>
           Preprocessor Object: SF_FTPTELNET  Version 1.2  <Build 13>
           Preprocessor Object: SF_SSH  Version 1.1  <Build 3>
           Preprocessor Object: SF_MODBUS  Version 1.1  <Build 1>
           Preprocessor Object: SF_REPUTATION  Version 1.1  <Build 1>
           Preprocessor Object: SF_SSLPP  Version 1.1  <Build 4>
           Preprocessor Object: SF_POP  Version 1.0  <Build 1>
           Preprocessor Object: SF_SDF  Version 1.1  <Build 1>

Snort successfully validated the configuration!
Snort exiting
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$
```

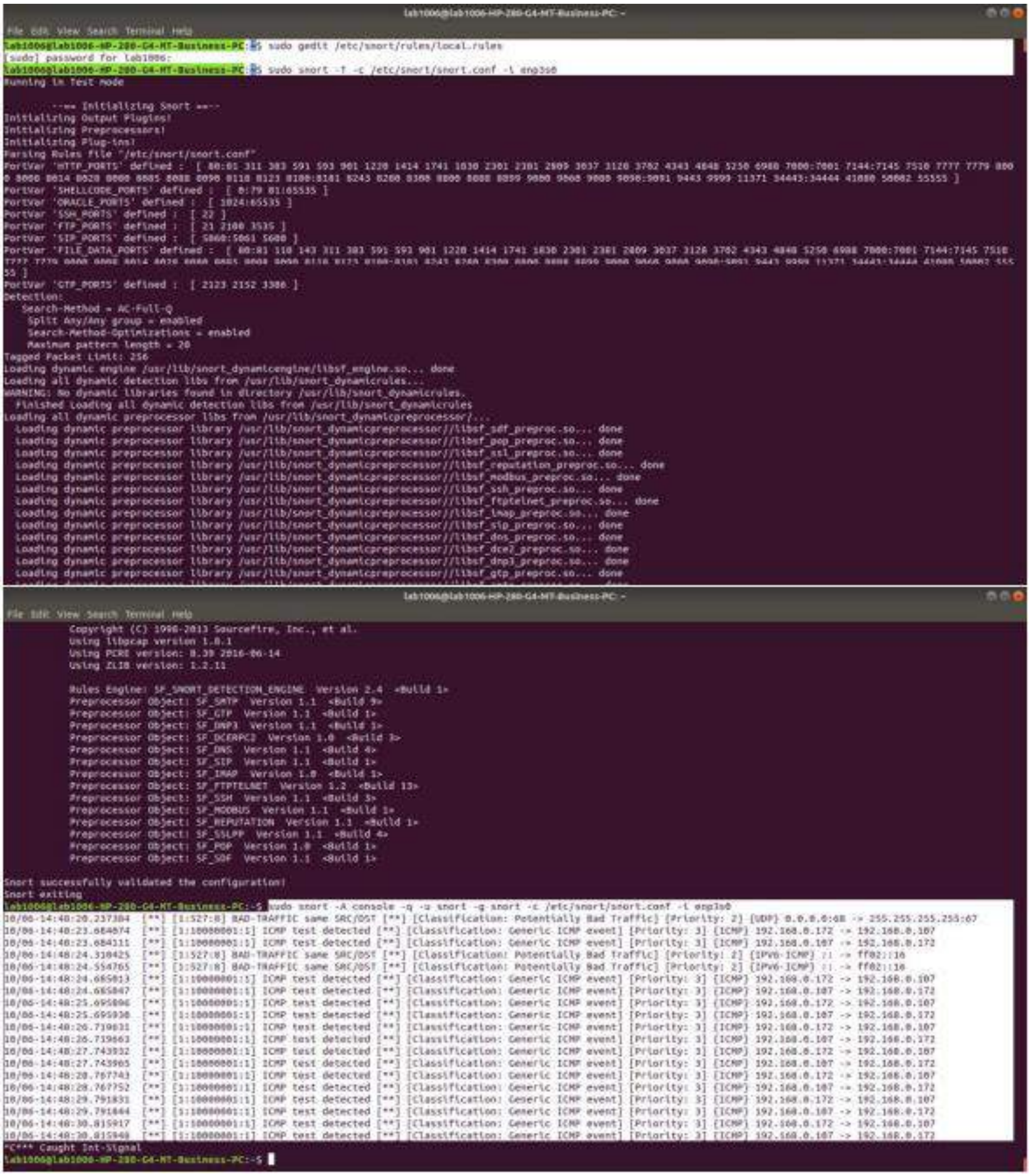

lab1006@lab1006-HP-280-G4-MT-Business-PC: ~
File Edit View Search Terminal Help
Snort successfully validated the configuration!
Snort exiting
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ sudo snort -A console -q -u snort -g snort -c /etc/snort/snort.conf -i enp3s0
^C*** Caught Int-Signal
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$ nmap 192.168.0.107
Starting Nmap 7.60 (https://nmap.org) at 2023-10-06 14:34 IST
Nmap scan report for lab1006-HP-280-G4-MT-Business-PC (192.168.0.107)
Host is up (0.000064s latency).
All 1000 scanned ports on lab1006-HP-280-G4-MT-Business-PC (192.168.0.107) are closed
Nmap done: 1 IP address (1 host up) scanned in 0.10 seconds
lab1006@lab1006-HP-280-G4-MT-Business-PC:~$


Open
local.rules
Save
snort.conf
ftp.rules
local.rules
$Id: local.rules,v 1.11 2004/07/23 20:15:44 bmc Exp $

LOCAL RULES

This file intentionally does not come with signatures. Put your local
additions here.
Plain Text
Tab Width: 8
Ln 1, Col 1
INS


Open
*snort.conf
Save
*snort.conf
ftp.rules
local.rules
#include $RULE_PATH/file-executable.rules
#include $RULE_PATH/file-flash.rules
#include $RULE_PATH/file-identify.rules
#include $RULE_PATH/file-image.rules
#include $RULE_PATH/file-multimedia.rules
#include $RULE_PATH/file-office.rules
#include $RULE_PATH/file-other.rules
#include $RULE_PATH/file-pdf.rules
include $RULE_PATH/finger.rules
include $RULE_PATH/ftp.rules
#include $RULE_PATH/icmp-info.rules
#include $RULE_PATH/icmp.rules
include $RULE_PATH/imap.rules
#include $RULE_PATH/indicator-compromise.rules
#include $RULE_PATH/indicator-obfuscation.rules
#include $RULE_PATH/indicator-shellcode.rules
include $RULE_PATH/info.rules
#include $RULE_PATH/malware-backdoor.rules
#include $RULE_PATH/malware-cnc.rules
#include $RULE_PATH/malware-other.rules
#include $RULE_PATH/malware-tools.rules
include $RULE_PATH/misc.rules
include $RULE_PATH/multimedia.rules
include $RULE_PATH/mysql.rules
include $RULE_PATH/netbios.rules
include $RULE_PATH/nntp.rules
include $RULE_PATH/oracle.rules
#include $RULE_PATH/os-linux.rules
#include $RULE_PATH/os-other.rules
#include $RULE_PATH/os-solaris.rules
#include $RULE_PATH/os-windows.rules
include $RULE_PATH/other-ids.rules
include $RULE_PATH/p2p.rules
#include $RULE_PATH/phishing-spam.rules
#include $RULE_PATH/policy-multimedia.rules
#include $RULE_PATH/policy-other.rules
include $RULE_PATH/policy.rules
#include $RULE_PATH/policy-social.rules
#include $RULE_PATH/policy-spam.rules
include $RULE_PATH/pop2.rules
include $RULE_PATH/pop3.rules
#include $RULE_PATH/protocol-finger.rules
#include $RULE_PATH/protocol-ftp.rules
Plain Text
Tab Width: 8
INS



CONCLUSION : In conclusion, this assignment involved the installation and configuration of Snort, a powerful Intrusion Detection System. By following the step-by-step instructions, we successfully installed Snort, edited its configuration file, and executed rules to detect ICMP activities.

NAME : SOUMIL SALVI

ROLL NO : 104

ASSIGNMENT 12

AIM : Explore the GPG tool of Linux to implement email security

LO MAPPED : LO6

THEORY :

What is private key ring and public key ring ?

a)Public key ring

The public key ring contains the public keys of other users. These keys are made available to the public so that anyone can encrypt messages to the user. The public key ring is typically shared with other users by exporting it to a file or by adding it to a PGP keyserver .

The public key contains the following information:

The user's name or email address

The user's fingerprint, which is a unique identifier for the key

The key's algorithm and strength

The key's expiration date

When someone wants to encrypt a message to you, they will use your public key. The message will be encrypted using the public key, but it can only be decrypted using the corresponding private key.

b)Private key ring

The private key ring contains the private keys of the user. These keys are kept secret and should not be shared with anyone. The private key ring is typically protected by a password or passphrase.

The private key contains the following information:

The user's name or email address

The user's fingerprint, which is a unique identifier for the key

The key's algorithm and strength

The key's expiration date

The private key is used to decrypt messages that have been encrypted with the user's public key. It is also used to sign messages, which allows the recipient to verify that the message was sent by the intended sender.

The public key ring and the private key ring are essential for using PGP. They allow users to encrypt and decrypt messages securely.

Write the commands used for key generation, export and import of keys and signing and encrypting the message in gpg tool.

Key generation

The following command generates a new GPG key pair:

gpg --gen-key

This command will prompt you for some information, such as your name, email address, and key length.

Export and import of keys

The following command exports the public key to a file:

gpg --export --output public.key

The following command imports the public key from a file:

gpg --import public.key

The following command exports the private key to a file:

gpg --export-secret-key --output private.key

The following command imports the private key from a file:

gpg --import-secret-key private.key

Signing and encrypting the message

The following command signs a message:

gpg --sign message.txt

The following command encrypts a message:

gpg --encrypt --recipient recipient@example.com message.txt

The recipient can then decrypt the message using their private key.

Some additional details about the commands:

The gpg command is the main GPG command.

The --gen-key option generates a new GPG key pair.

The --export option exports a key to a file.

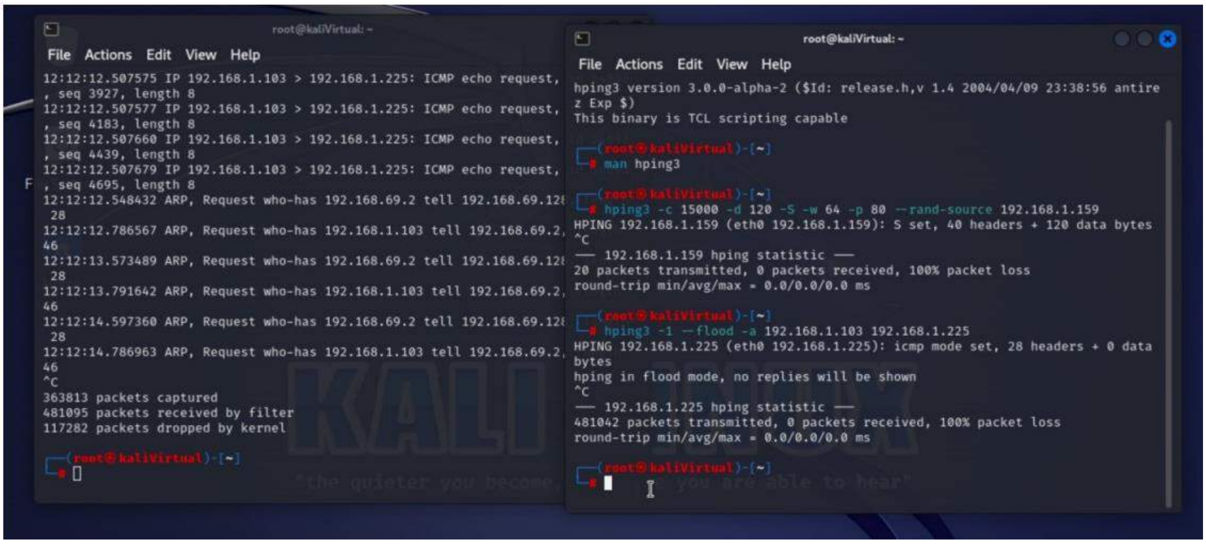
The --import option imports a key from a file.

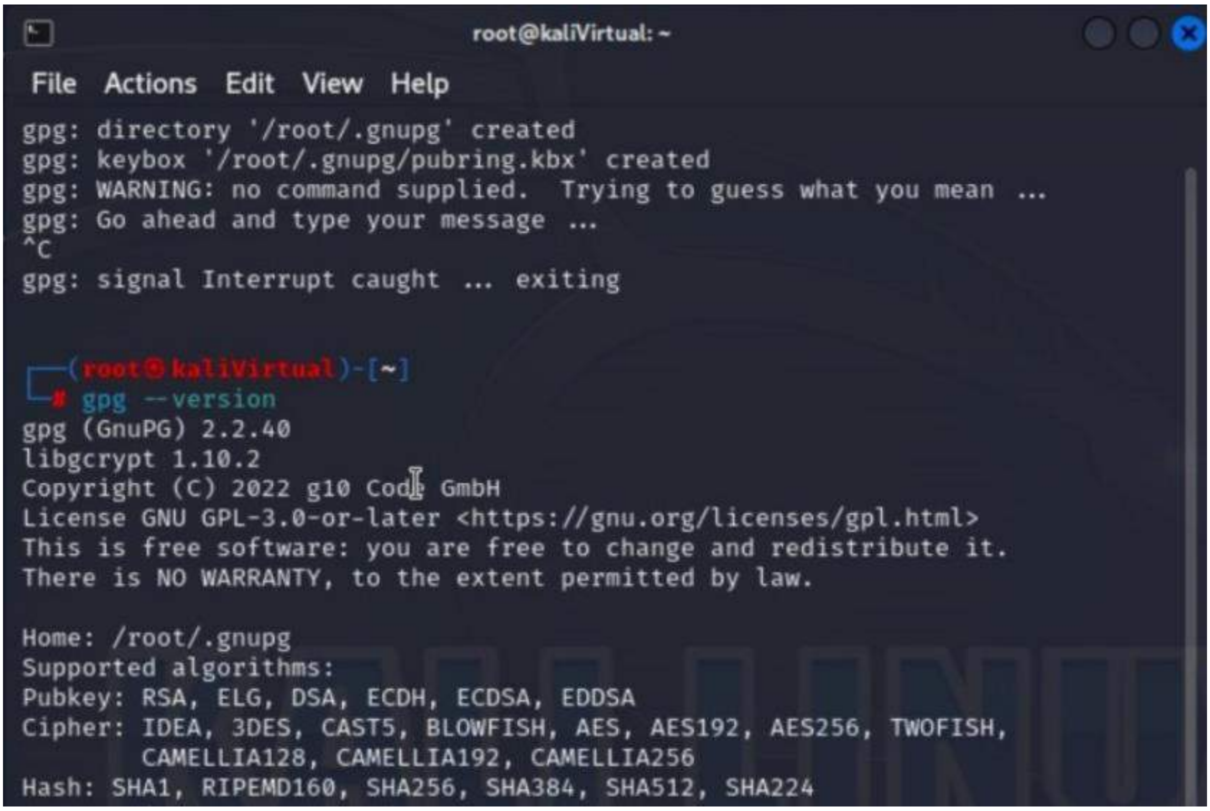
The --sign option signs a message.

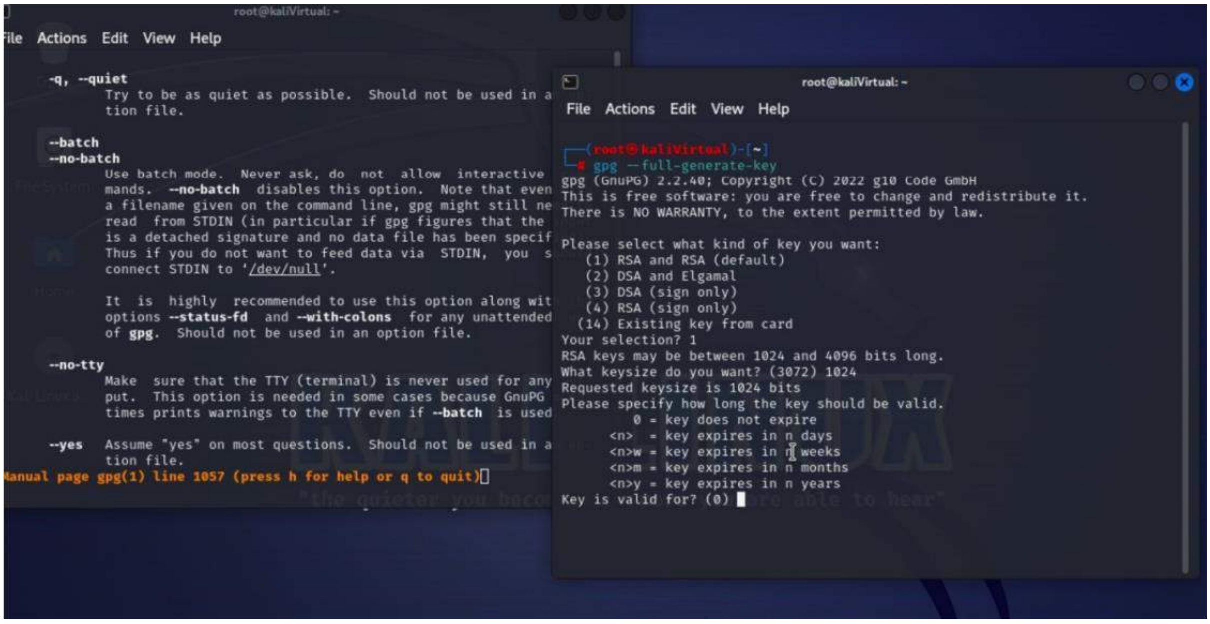
The --encrypt option encrypts a message.

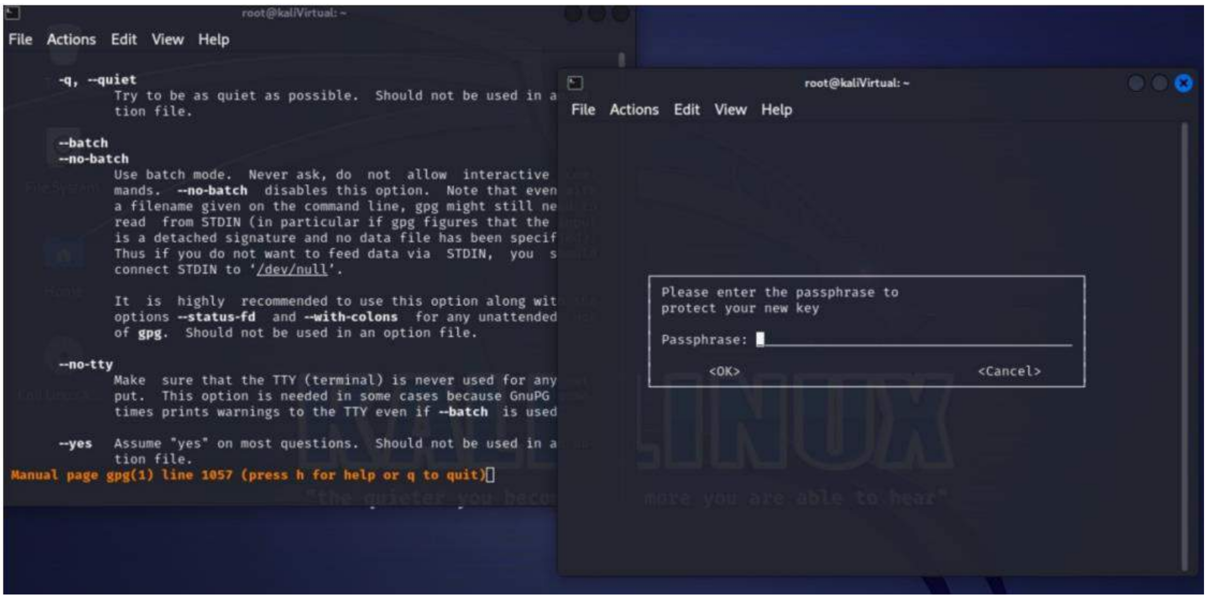
The --recipient option specifies the recipient of the encrypted message.

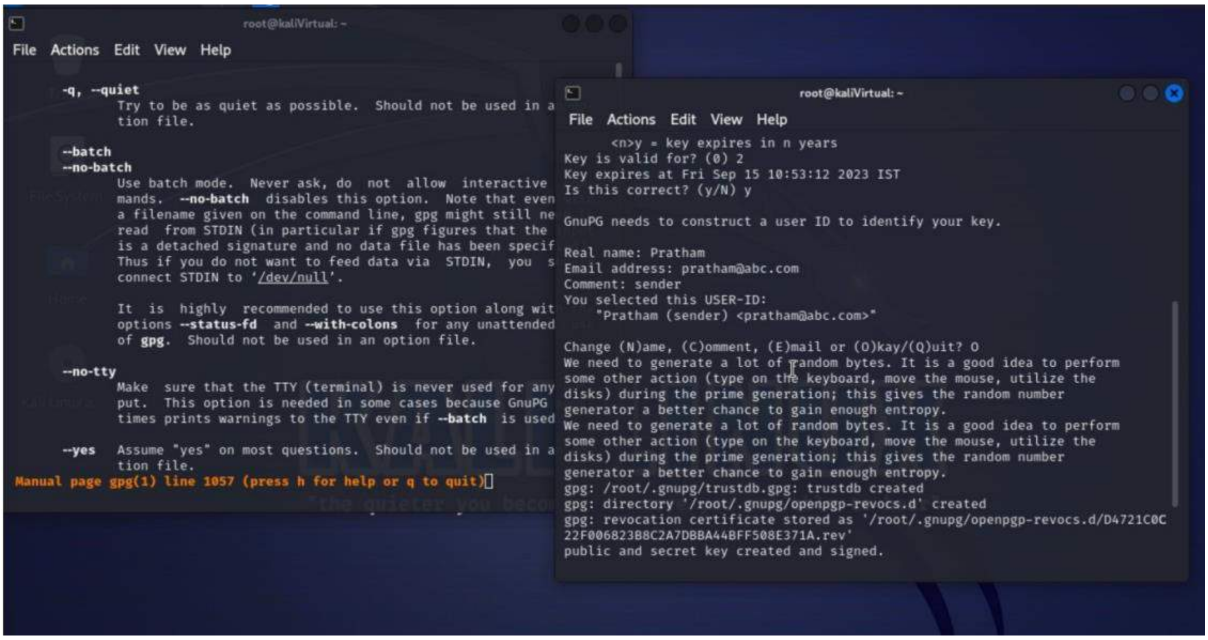
OUTPUT :

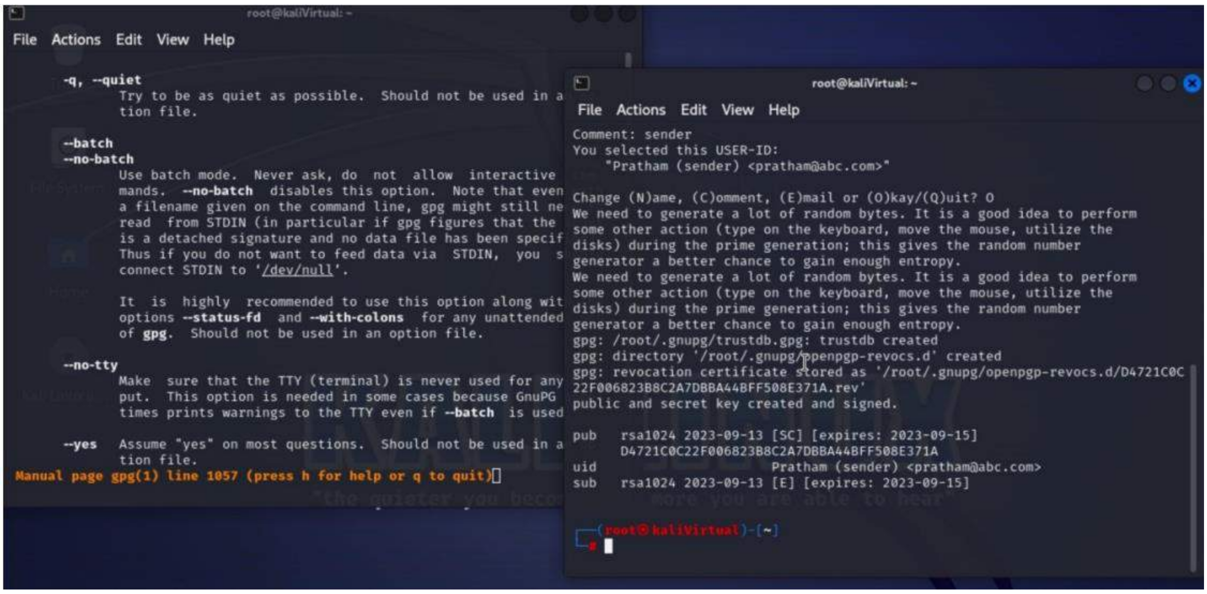


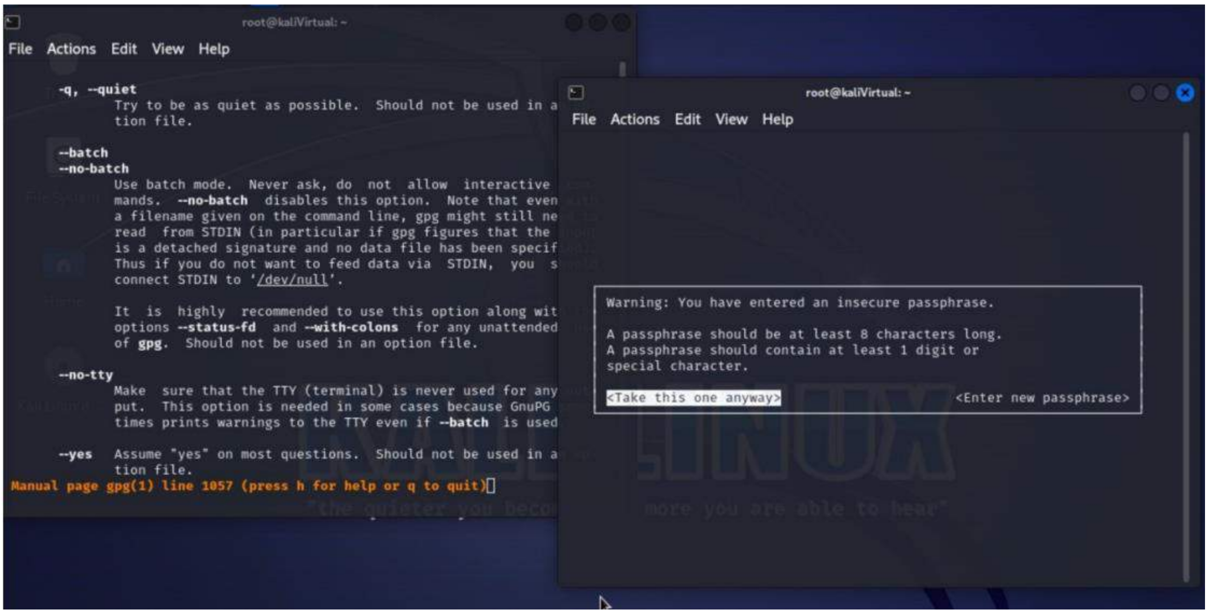

root@kaliVirtual: ~
File Actions Edit View Help
gpg: directory '/root/.gnupg' created
gpg: keybox '/root/.gnupg/pubring.kbx' created
gpg: WARNING: no command supplied. Trying to guess what you mean ...
gpg: Go ahead and type your message ...
^C
gpg: signal Interrupt caught ... exiting
(root㉿kaliVirtual)-[~]
gpg --version
gpg (GnuPG) 2.2.40
libgcrypt 1.10.2
Copyright (C) 2022 g10 Code GmbH
License GNU GPL-3.0-or-later <https://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Home: /root/.gnupg
Supported algorithms:
Pubkey: RSA, ELG, DSA, ECDH, ECDSA, EDDSA
Cipher: IDEA, 3DES, CAST5, BLOWFISH, AES, AES192, AES256, TWOFISH,
CAMELLIA128, CAMELLIA192, CAMELLIA256
Hash: SHA1, RIPEMD160, SHA256, SHA384, SHA512, SHA224


root@kaliVirtual: ~
File Actions Edit View Help
-q, --quiet
Try to be as quiet as possible. Should not be used in a
tion file.
--batch
--no-batch
Use batch mode. Never ask, do not allow interactive
mands. --no-batch disables this option. Note that even
a filename given on the command line, gpg might still ne
read from STDIN (in particular if gpg figures that the
is a detached signature and no data file has been specif
Thus if you do not want to feed data via STDIN, you s
connect STDIN to '/dev/null'.
It is highly recommended to use this option along wit
options --status-fd and --with-colons for any unattended
of gpg. Should not be used in an option file.
--no-tty
Make sure that the TTY (terminal) is never used for any
put. This option is needed in some cases because GnuPG
times prints warnings to the TTY even if --batch is used
--yes Assume "yes" on most questions. Should not be used in a
tion file.
Manual page gpg(1) line 1057 (press h for help or q to quit)
root@kaliVirtual: ~
File Actions Edit View Help
(root㉿kaliVirtual)-[~]
gpg --full-generate-key
gpg (GnuPG) 2.2.40; Copyright (C) 2022 g10 Code GmbH
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Please select what kind of key you want:
(1) RSA and RSA (default)
(2) DSA and Elgamal
(3) DSA (sign only)
(4) RSA (sign only)
(14) Existing key from card
Your selection? 1
RSA keys may be between 1024 and 4096 bits long.
What keysize do you want? (3072) 1024
Requested keysize is 1024 bits
Please specify how long the key should be valid.
0 = key does not expire
<n> = key expires in n days
<n>w = key expires in n weeks
<n>m = key expires in n months
<n>y = key expires in n years
Key is valid for? (0)


Please enter the passphrase to
protect your new key
Passphrase:
<OK>
<Cancel>


<n>y = key expires in n years
Key is valid for? (0) 2
Key expires at Fri Sep 15 10:53:12 2023 IST
Is this correct? (y/N) y
GnuPG needs to construct a user ID to identify your key.
Real name: Pratham
Email address: pratham@abc.com
Comment: sender
You selected this USER-ID:
"Pratham (sender) <pratham@abc.com>"
Change (N)ame, (C)omment, (E)mail or (O)kay/(Q)uit? O
gpg: /root/.gnupg/trustdb.gpg: trustdb created
gpg: directory '/root/.gnupg/openpgp-revocs.d' created
gpg: revocation certificate stored as '/root/.gnupg/openpgp-revocs.d/D4721C0C22F006823B8C2A7DBBA44BFF508E371A.rev'
public and secret key created and signed.





CONCLUSION : Learnt about GPG tool in linux and how it provides email security , executed several commands related to GPG and also explored more about public key ring and private key rings

NAME : SOUMIL SALVI

BATCH : TE-T2

ROLL NO : 104

CNS THEORY ASSIGNMENT – 1

Q) Explain the padding scheme used in RSA. Why it is used ? What is its limitation ? (LO2)

ANS :

RSA (Rivest-Shamir-Adleman) is a widely used asymmetric encryption algorithm that relies on the mathematical properties of large prime numbers. Padding in RSA is crucial to address some of the limitations and vulnerabilities of the basic RSA algorithm. Let's dive into the padding scheme used in RSA, why it is necessary, and its limitations.

Padding Scheme used in RSA:

RSA padding schemes are used to add extra data to the plaintext message before encryption and to remove it after decryption. The two most common padding schemes used in RSA are PKCS#1 v1.5 padding and OAEP (Optimal Asymmetric Encryption Padding).

1. PKCS#1 v1.5 Padding:

PKCS#1 (Public Key Cryptography Standards #1) padding, version 1.5, is one of the most common padding schemes used with RSA encryption. It was introduced to address security vulnerabilities in the original RSA scheme. PKCS#1 v1.5 padding consists of the following steps:

a. Message Formatting:

- Convert the plaintext message (M) into an integer.

- Determine the length of the modulus (n) used in the RSA encryption.

b. Generate Padding:

- Add a leading byte of 0x00.
- Add a byte with the value 0x02.
- Append random non-zero bytes to fill the space between the 0x02 byte and the message.
- Finally, concatenate the message itself.

c. Encryption:

- The padded message is then encrypted using the RSA public key.

The decryption process reverses these steps, removing the padding and recovering the original message. Proper padding validation is crucial to ensure security when using PKCS#1 v1.5 padding.

This padding scheme has been widely used in practice but is considered less secure compared to OAEP because it doesn't provide semantic security against chosen ciphertext attacks.

2. OAEP (Optimal Asymmetric Encryption Padding):

OAEP is a more modern and secure padding scheme used with RSA. It aims to provide additional security against chosen plaintext attacks. The OAEP padding scheme involves the following steps:

a. Message Formatting:

- Convert the plaintext message (M) into an integer.
- Determine the length of the modulus (n) and the hash function parameters used in the RSA encryption.

b. Generate Random Padding (P):

- Generate a random number (seed) of a specified length.
- Expand the seed using a cryptographic hash function to produce a larger random mask.
- XOR the message with the random mask.

c. Generate a Masked Seed:

- Hash the seed and the public key parameters.
- XOR the result with the generated mask to create a masked seed.

d. Combine the Masked Seed and Masked Message:

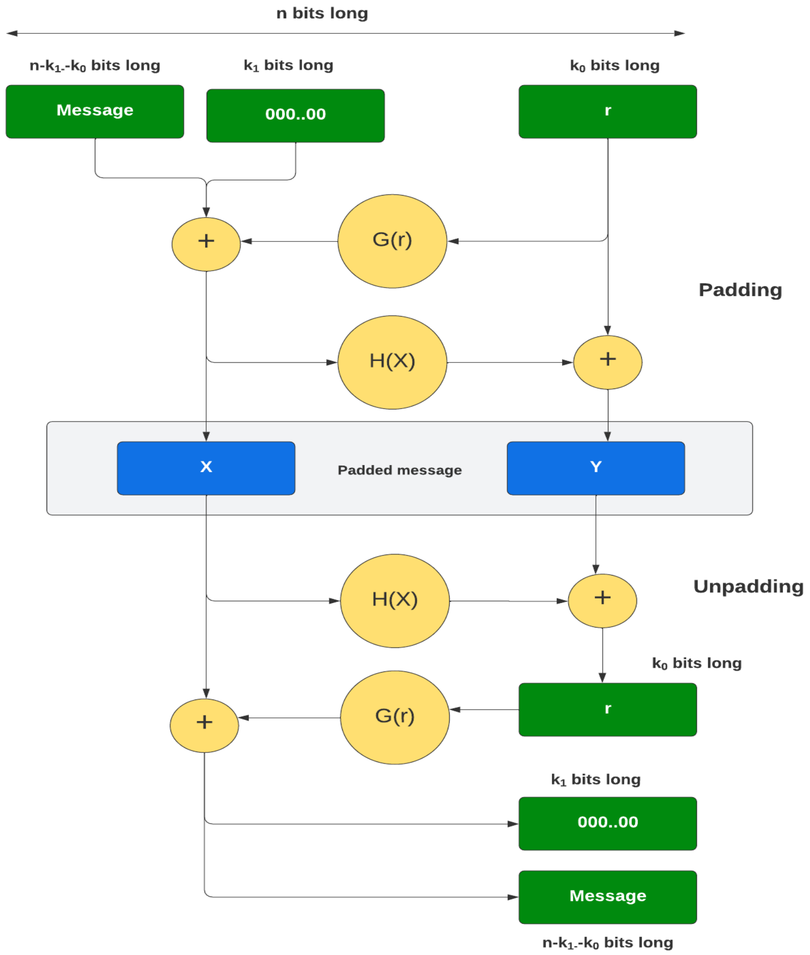
- Concatenate the masked seed and the masked message.

e. Encryption:

- The combined value from step d is then encrypted using the RSA public key.

The decryption process reverses these steps, recovering the original message by reversing the mask and XOR operations.

OAEP is considered more secure than PKCS#1 v1.5 padding due to its probabilistic nature and resistance to certain types of attacks. It is recommended for most modern RSA implementations.



Why Padding is Used in RSA:

Padding in RSA serves several crucial purposes:

a) Security: Padding adds randomness and complexity to the plaintext before encryption, making it harder for attackers to exploit patterns or vulnerabilities in the original message. Without padding, RSA encryption is vulnerable to certain attacks, including attacks based on the mathematical properties of RSA itself.
b) Deterministic Encryption: RSA encryption without padding is deterministic, meaning that the same plaintext will always produce the same ciphertext. This property can be a security risk, especially when encrypting the same message multiple times. Padding introduces randomness, ensuring that even identical plaintexts will result in different ciphertexts, adding an additional layer of security.
c) Preventing Information Leakage: Padding ensures that the length of the plaintext is not directly revealed by the length of the ciphertext. Without padding, an attacker might be able to guess the length of the plaintext by analyzing the length of the ciphertext.
d) Avoiding Weaknesses: Padding schemes are designed to avoid known vulnerabilities and weaknesses in RSA encryption, such as attacks based on small encryption exponents or other mathematical properties of the RSA algorithm.

Limitations of Padding in RSA:

While padding in RSA is essential for security and compatibility, it does have some limitations:

a. Padding Oracle Attacks: Padding in RSA is designed to add randomization to the data being encrypted to thwart certain attacks, like the homomorphic property of RSA. However, in some cases, an attacker can exploit vulnerabilities in the padding scheme to launch padding oracle attacks. These attacks involve sending specially crafted ciphertexts and observing how the server responds to determine if the padding is valid or not. If an attacker can learn about the padding, it might be possible to recover the plaintext. Proper padding scheme design and careful implementation are essential to prevent padding oracle attacks.

b. Insecure Padding Schemes: The security of RSA encryption heavily relies on the choice of padding scheme. Older or poorly designed padding schemes may be vulnerable to attacks. For example, PKCS#1 v1.5 padding is known to have security issues, and it's recommended to use more secure padding schemes like OAEP (Optimal Asymmetric Encryption Padding) or PSS (Probabilistic Signature Scheme) when using RSA.

c. Padding Overhead: Padding adds additional bytes to the plaintext message before encryption. This overhead can be a limitation when encrypting small messages, as the ratio of padding to actual data can be relatively high. This might not be efficient for some applications.

d. Limited Key Length: RSA encryption becomes less secure as the key length decreases. With smaller key sizes, the padding can become a significant portion of the ciphertext, reducing the amount of data that can be encrypted securely. To maintain security, longer key lengths are needed, which can be computationally expensive.

e. Performance: The padding and encryption process in RSA can be computationally intensive, especially with larger key sizes. This can limit the performance of RSA encryption and decryption, making it less suitable for real-time applications with high data throughput.

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ROLL NO : 104

CNS THEORY ASSIGNMENT – 2

Q) What is Intrusion Detection System? Explain different types of intrusion detection systems with their working . State the advantages and limitations of each.

ANS :

An Intrusion Detection System (IDS) is a critical component of network security infrastructure designed to identify and respond to security threats and breaches within a computer system or network. IDSs play a vital role in maintaining the confidentiality, integrity, and availability of data by monitoring and analyzing network traffic and system activities for signs of unauthorized or malicious activities.

Purpose of the IDS :

- Security Monitoring: IDS is designed to monitor network traffic, system logs, and user activities to identify and report any signs of unauthorized access, malicious activities, or security policy violations.
- Threat Detection: It helps in the early detection of various cybersecurity threats, including intrusion attempts, malware infections, insider threats, and denial-of-service (DoS) attacks.
- Incident Response: By providing timely alerts and reports, IDS enables organizations to respond quickly to security incidents, minimizing potential damage and reducing the time between detection and mitigation.

Types of Intrusion Detection Systems:

i. **Network-Based Intrusion Detection System (NIDS):**

<u>Working:</u>

- Monitoring Traffic: Continuously monitoring network traffic passing through a specific network segment or boundary.

- Analyzing Packets: Examining data packets within the monitored traffic for signs of suspicious or malicious activity.
- Signature Comparison: Comparing the content of packets against predefined rules and signatures that represent known attack patterns.
- Alert Generation: When a potential intrusion or attack is detected, NIDS generates alerts or logs the event to notify administrators.
- Real-time Protection: NIDS can operate in real-time, allowing for immediate response to detected threats, either through alerts or automated actions like blocking malicious traffic

Advantages:

- Can monitor multiple devices and services on a network.
- Can detect attacks that originate from within or outside the network.
- Provides visibility into network-level threats.

Limitations:

- May generate a high number of false positives if not properly configured.
- Cannot inspect encrypted traffic without decryption mechanisms.
- May not be effective against sophisticated, zero-day attacks.

ii. Host-Based Intrusion Detection System (HIDS):

Working:

- Event Monitoring: HIDS continuously monitors activities on the host, including file system changes, system logs, and running processes.
- Anomaly Detection: It compares observed behaviors with predefined baselines and rules to detect anomalies or deviations from expected patterns.
- Alert Generation: When an anomaly is detected, HIDS generates alerts or logs the suspicious activity, providing details about the event and its severity.
- Rule-Based Analysis: HIDS relies on predefined rules and signatures to identify known attack patterns or suspicious actions.
- Forensic Information: In addition to alerting, HIDS provides detailed forensic information about the detected incidents, aiding in post-incident analysis and response.

Advantages:

- Provides detailed insights into host-level activities.
- Effective in detecting insider threats and rootkit installations.
- Can monitor operating system logs and file integrity.

Limitations:

- Limited to the host system it's installed on.
- May require significant resources to monitor many hosts.
- Vulnerable if the host itself is compromised.

iii. Anomaly-Based Intrusion Detection System:

Working:

- Baseline Establishment: Anomaly-based IDS initially establishes a baseline of normal system or network behavior by monitoring and analyzing typical activities, such as network traffic patterns, system resource usage, and user behavior.
- Continuous Monitoring: The IDS continually monitors and collects data from the target environment, comparing current activity to the established baseline. It looks for deviations that may indicate suspicious or malicious behavior.
- Anomaly Detection: When the IDS identifies activity that significantly differs from the baseline, it flags it as an anomaly. This could include unexpected network connections, unusual file access patterns, or atypical system resource usage.
- Alert Generation: Upon detecting an anomaly, the IDS generates alerts or notifications to security personnel or administrators. These alerts provide details about the detected deviation and its potential significance.
- Investigation and Response: Security professionals then investigate the alerts to determine whether the detected anomaly represents a genuine security threat. Depending on the severity and nature of the anomaly, appropriate response measures are taken, which may include further analysis, mitigation, or incident response actions.

Advantages:

- Effective at detecting previously unknown attacks.
- Adapts to changing attack patterns.
- Reduces false positives compared to signature-based systems.

Limitations:

- Can generate false negatives if anomalies are not well-defined.
- May require a significant amount of historical data for accurate baselining.
- Can be resource-intensive to continuously analyze and learn.

iv. Signature-Based Intrusion Detection System:

Working:

- Signature Database: The IDS maintains a database of known attack signatures, which are specific patterns or sequences of data that are characteristic of known threats and vulnerabilities.
- Traffic Monitoring: The IDS continuously monitors incoming network traffic or system activities, such as log entries, packets, or system calls.
- Pattern Matching: It compares the observed data with the signatures in its database. If it identifies a match or a close resemblance, it raises an alert.
- Alert Generation: When a signature match is detected, the IDS generates an alert, typically including details about the nature of the attack, the affected system or network, and the time of the event.
- Response or Notification: Depending on its configuration, the IDS can take various actions, such as logging the event, sending notifications to administrators, or triggering countermeasures to block or mitigate the attack.

Advantages:

- Effective at detecting known and well-defined attacks.
- Generates fewer false positives when compared to some anomaly-based systems.
- Suitable for rapid threat identification.

Limitations:

- Ineffective against zero-day attacks or attacks with modified signatures.
- Requires regular signature updates to remain effective.
- May produce false positives when legitimate traffic resembles known attacks.

v. Behaviour-Based Intrusion Detection System:

Working:

- Baseline Establishment: BIDS establishes a baseline of normal behavior by monitoring and learning typical patterns of activities within a network or system over time.
- Anomaly Detection: It continuously compares current behavior against the established baseline. Any deviation from the baseline is considered an anomaly.
- Alert Generation: When an anomaly is detected, the BIDS generates alerts or notifications to security personnel or administrators.
- Machine Learning: Many BIDS use machine learning algorithms to adapt and improve their baseline models over time, reducing false positives.
- Continuous Monitoring: BIDS operates in real-time, providing continuous monitoring and early detection of unusual or malicious behavior, which helps prevent security breaches.

Advantages:

- Effective at identifying complex and multi-stage attacks.
- Can detect insider threats that exhibit abnormal behaviour.
- Less reliant on specific attack signatures.

Limitations:

- May require fine-tuning to differentiate between normal and abnormal behaviour.
- Potential for false positives if behavioural profiles are not accurately defined.
- Resource-intensive, especially in large networks.