STELLA MARY'S COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai & Accredited by NAAC, Accredited by NBA (CSE & MECH))
Aruthenganvilai, Kallukatti Junction, Azhikal Post
Kanyakumari District – 629 202, Tamil Nadu

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Name of the Laboratory	:	**NETWORK SECURITY**
Laboratory Code	:	**CCS354**
Name of the Student	:	
University Register No.	:	
Branch	:	**CSE**
Semester	:	**VI**
Academic Year	:	**2023-2024 (EVEN)**

INSTITUTE VISION

To emerge as a premiere institution, acknowledged as a center for excellence imparting technical education, creating technocrats who can address the needs of the society through exploration and experimentation and uplift mankind.

INSTITUTE MISSION

To provide an education that transforms students, through rigorous course-work and by providing an understanding of the needs of the society and the industry.

DEPARTMENT VISION

To produce Computer Science professionals who can accomplish path-breaking solutions for a better society, through quality technical education, on gaining the required inter- personal, entrepreneurial and computing skills.

DEPARTMENT MISSION

- To impart a holistic and experiential learning experience by making use of innovative teaching methodologies.
- To provide optimal technology solutions through collaborative and life-long learning for industry and societal needs with universal ethical values.
- To nurture leadership skills and facilitate various co-curricular and extra-curricular activities to implant the spirit of entrepreneurship.
- To provide industry-institute-interaction opportunities in order to motivate inter-disciplinary research capabilities with an inquiring mind.

Program Educational Objectives (PEOs)

PEO1:

Graduates will be competent in creating innovative technologies through inter- disciplinary research and comprehensive skills sets that are suitable for the global computing industry.

PEO2:

Graduates will be capable of managing leading positions with a broad understanding of the application of ethics in evolving computer-based solutions for the societal needs.

PEO3:

Graduates will imbibe entrepreneurial qualities and develop their career by upgrading their, communication, analytical and professional skills constantly.

Program Specific Outcomes (PSOs)

PSO1:

Use data management techniques and algorithmic thinking for Software Design and Development practices.

PSO2:

Develop reliable IT solutions based on the expertise in Distributed Applications Development, Web Designing and Networking for various societal needs and entrepreneurial practices ethically.

PSO3:

Manage multidisciplinary environments effectively through their interpersonal and analytical skills and be responsible members and leaders of the society.

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<u>BONAFIDE CERTIFICATE</u>

This is to certify that this is a bonafide record of the work done by Mr./Ms. ________________________________of ______ semester B.E. Department of Computer Science and Engineering, Register No. ________________ for the ___________________________________ laboratory during the academic year 20 -20 (Odd/Even).

Faculty in-charge
(Name, date, designation & Department)

Head of the Department
(Name, date& Department)

Submitted for the practical examination held on __________

Internal Examiner

External Examiner

OBJECTIVE

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

OUTCOMES

At the **completion of the laboratory course** the student will be able to,

- **CO1:** Classify the encryption techniques
- **CO2**: Illustrate the key management technique and authentication.
- **CO3:** Evaluate the security techniques applied to network and transport layer
- **CO4:** Discuss the application layer security standards.
- **CO5:** Apply security practices for real time applications.

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Name of the laboratory: **Laboratory code:**

Date	Exp. No.	Name of the Experiment	Page No.	Marks	Signature

CONTENTS

Name of the laboratory: **Laboratory code:**

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Exp.no: 1 **IMPLEMENT SYMMETRIC KEY ALGORITHM**

Date:

AIM

To write a java program for implement symmetric key algorithm using AES.

ALGORITHM

Step1 :Start the program

Step2:Import the necessary packages

Step3:Generate the key

Step4:Get the original message from the user and create the cipher instance and initialize it to ENCRYPT_MODE

Step5:Encrypt the message

Step6:Convert the encrypted message to Base64 encoded string

Step7:Reinitialize the cipher to DECRYPT_MODE

Step8:Decrypt the message

Step9:Stop the program.

PROGRAM:

```
import javax.crypto.Cipher;
import javax.crypto.KeyGenerator;
import javax.crypto.SecretKey;
import java.nio.charset.StandardCharsets;
import java.util.Base64;
public class Main {
public static void main(String[] args) throws Exception {
// Generate key
SecretKey secretKey = KeyGenerator.getInstance("AES").generateKey();
// Original message
String originalMessage = "Hello, world!";
// Create Cipher instance and initialize it to ENCRYPT_MODE
Cipher cipher = Cipher.getInstance("AES");
cipher.init(Cipher.ENCRYPT_MODE, secretKey);
// Encrypt the message
byte[] encryptedMessage =
cipher.doFinal(originalMessage.getBytes(StandardCharsets.UTF_8));

// Convert the encrypted message to Base64 encoded string

String encodedMessage = Base64.getEncoder().encodeToString(encryptedMessage);

System.out.println("Original Message: " + originalMessage);

System.out.println("Encrypted Message: " + encodedMessage);

// Reinitialize the cipher to DECRYPT_MODE

cipher.init(Cipher.DECRYPT_MODE, secretKey);

// Decrypt the message

byte[] decryptedMessage = cipher.doFinal(Base64.getDecoder().decode(encodedMessage));

System.out.println("Decrypted Message: " + new String(decryptedMessage,
StandardCharsets.UTF_8));

}

}
```

OUTPUT

```
Original Message: Hello, world!

Encrypted Message: iWohhm/c89uBVaJ3j4YFkA==

Decrypted Message: Hello, world!
```

RESULT

Thus the program to implement symmetric key algorithm using AES was executed successfully.

Ex.no:2 IMPLEMENT ASYMMETRIC KEY ALGORITHM USING RSA ALGORITHM

AIM:

To develop an application to implement RSA public key cryptosystem using HTML and JavaScript.

ALGORITHM:

1. Choose two prime number p and q
2. Compute the value of n and p
3. Find the value of ***e*** (public key)
4. Compute the value of ***d*** (private key) using gcd()
5. Do the encryption and decryption

a. Encryption is given as,

c = te mod n

b. Decryption is given as,

t = cd mod n

PROGRAM:

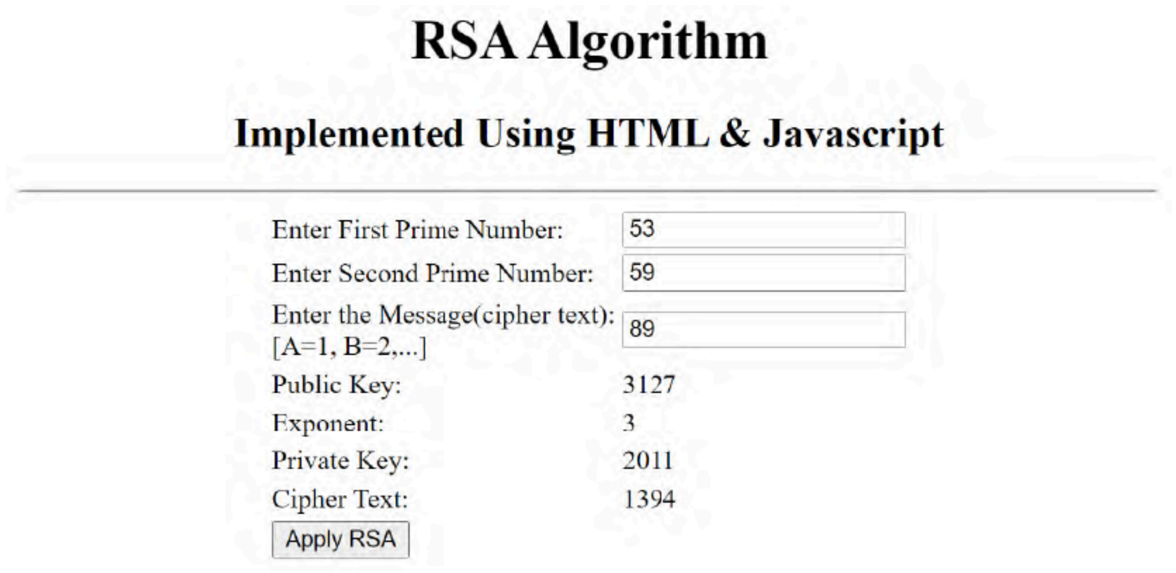
rsa.html

```
<html>
<head>
<title>RSA Encryption</title>
<meta name="viewport" content="width=device-width, initial-scale=1.0">
</head>
<body>
<center>
<h1>RSA Algorithm</h1>
<h2>Implemented Using HTML & Javascript</h2>
<hr>
<table>
<tr>
<td>Enter First Prime Number:</td>
<td><input type="number" value="53" id="p"></td>
</tr>
<tr>
<td>Enter Second Prime Number:</td>
<td><input type="number" value="59" id="q"></p> </td>
</tr>
```

```
<tr>
<td>Enter the Message(cipher text):<br>[A=1, B=2,...]</td>
<td><input type="number" value="89" id="msg"></p>
</td>
</tr>
<tr>
<td>Public Key:</td>
<td>
<p id="publickey"></p>
</td>
</tr>
<tr>
<td>Exponent:</td>
<td>
<p id="exponent"></p>
</td>
</tr>
<tr>
<td>Private Key:</td>
<td>
<p id="privatekey"></p>
</td>
</tr>
<tr>
<td>Cipher Text:</td>
<td>
<p id="ciphertext"></p>
</td>
</tr>
<tr>
<td><button onclick="RSA();">Apply RSA</button></td>
</tr>
</table>
</center>
```

```
</body>
<script type="text/javascript">
function RSA() {
var gcd, p, q, no, n, t, e, i, x;
gcd = function (a, b) { return (!b) ? a : gcd(b, a % b); };
p = document.getElementById('p').value;
q = document.getElementById('q').value;
no = document.getElementById('msg').value;
n = p * q;
t = (p - 1) * (q - 1);
for (e = 2; e < t; e++) {
if (gcd(e, t) == 1) {
break;
}
}
for (i = 0; i < 10; i++) {
x = 1 + i * t
if (x % e == 0) {
d = x / e;
break;
}
}
ctt = Math.pow(no, e).toFixed(0);
ct = ctt % n;
dtt = Math.pow(ct, d).toFixed(0);
dt = dtt % n;
document.getElementById('publickey').innerHTML = n;
document.getElementById('exponent').innerHTML = e;
document.getElementById('privatekey').innerHTML = d;
document.getElementById('ciphertext').innerHTML = ct;
}
</script>
</html>
```

Output


RSA Algorithm

Implemented Using HTML & Javascript

Enter First Prime Number: 53
Enter Second Prime Number: 59
Enter the Message(cipher text): [A=1, B=2,...] 89
Public Key: 3127
Exponent: 3
Private Key: 2011
Cipher Text: 1394

Result:

Thus the RSA algorithm has been implemented using HTML & CSS and the output has been verified successfully.

Ex.no:3

IMPLEMENT KEY EXCHANGE ALGORITHM USING DIFFIE-HELLMAN ALGORITHM

AIM:

To implement key exchange algorithm using Diffie-Hellman Algorithm.

ALGORITHM:

Diffie-Hellman algorithm is one of the most important algorithms used for establishing a shared secret. At the time of exchanging data over a public network, we can use the shared secret for secret communication.

1. We will take four variables, i.e., **P (prime), G (the primitive root of P),** and **a and b (private values)**.
2. The variables **P** and **G** both are publicly available. The sender selects a private value, either a or b, for generating a key to exchange publicly. The receiver receives the key, and that generates a secret key, after which the sender and receiver both have the same secret key to encrypt.

Steps	User 1	User 2
1.	**P, G** => available public keys.	**P, G** => available public keys.
2.	**a** is selected as a private key.	**b** is selected as a private key.
3.	Eq. to generate key: $x=G^a \bmod P$	Eq. to generate key: $y=G^b \bmod P$
4.	After exchanging keys, user1 receives key y.	After exchanging keys, user2 receives key x.
5.	User 1 generates a secret key by using the received key y: $k_a=y^a \bmod P$	User 2 generates a secret key by using the received key x: $k_b=x^b \bmod P$
	Algebraically, 5th step can be shown as follows: $k_a=k_b$	

Program

```
import java.util.*;

// create class DiffieHellmanAlgorithmExample to calculate the key for two persons

class DiffieHellmanAlgorithmExample {

   // main() method start
```

```
    public static void main(String[] args)
    {
        long P, G, x, a, y, b, ka, kb;
        // create Scanner class object to take input from user
        Scanner sc = new Scanner(System.in);
        System.out.println("Both the users should be agreed upon the public keys G and P");
        // take inputs for public keys from the user
        System.out.println("Enter value for public key G:");
        G = sc.nextLong();
        System.out.println("Enter value for public key P:");
        P = sc.nextLong();
        // get input from user for private keys a and b selected by User1 and User2
        System.out.println("Enter value for private key a selected by user1:");
        a = sc.nextLong();
        System.out.println("Enter value for private key b selected by user2:");
        b = sc.nextLong();
                // call calculatePower() method to generate x and y keys
        x = calculatePower(G, a, P);
        y = calculatePower(G, b, P);
        // call calculatePower() method to generate ka and kb secret keys after the exchange of x
  and y keys
        // calculate secret key for User1
        ka = calculatePower(y, a, P);
        // calculate secret key for User2
        kb = calculatePower(x, b, P);
        // print secret keys of user1 and user2
        System.out.println("Secret key for User1 is:" + ka);
        System.out.println("Secret key for User2 is:" + kb);
    }
    // create calculatePower() method to find the value of x ^ y mod P
    private static long calculatePower(long x, long y, long P)
    {
        long result = 0;
        if (y == 1){
            return x;
        }
        else{
            result = ((long)Math.pow(x, y)) % P;
            return result;
        }
    }
}
```

Output

```
Both the users should be agreed upon the public keys G and P
Enter value for public key G:
8
Enter value for public key P:
33
Enter value for private key a selected by user1:3
Enter value for private key b selected by user2:
2
Secret key for User1 is:25
Secret key for User2 is:25
```

Result:

Thus the program to implement key Exchange using Diffie-Hellman algorithm was executed successfully.

Ex.no:4

IMPLEMENT DIGITAL SIGNATURE SCHEME USING SHA 256

AIM:

To implement Digital Signature Scheme using SHA 256 Algorithm.

ALGORITHM:

Step 1: Start the program

Step 2: Append Padding bits.

Step3: Append Length - 64 bits are appended to the end.

Step 4: Prepare Processing Functions.

Step 5: Prepare Processing Constants.

Step 6: Initialize Buffers.

Step 7: Processing Message in 512-bit blocks (L blocks in total message).

Step 8: Produce 256 Hash Code.

Step 9: Stop the program.

Program

```
import java.math.BigInteger;
import java.nio.charset.StandardCharsets;
import java.security.MessageDigest;
import java.security.NoSuchAlgorithmException;
// Java program to calculate SHA hash value
class GFG2 {
  public static byte[] getSHA(String input) throws NoSuchAlgorithmException
  {
    // Static getInstance method is called with hashing SHA
    MessageDigest md = MessageDigest.getInstance("SHA-256");
    // digest() method called
    // to calculate message digest of an input
    // and return array of byte
    return md.digest(input.getBytes(StandardCharsets.UTF_8));
  }
  public static String toHexString(byte[] hash)
```

```
    {
        // Convert byte array into signum representation
        BigInteger number = new BigInteger(1, hash);
        // Convert message digest into hex value
        StringBuilder hexString = new StringBuilder(number.toString(16));
        // Pad with leading zeros
        while (hexString.length() < 64)
        {
            hexString.insert(0, '0');
        }
        return hexString.toString();
    }
    // Driver code
    public static void main(String args[])
    {
        try
        {
            System.out.println("HashCode Generated by SHA-256 for:");
            String s2 = "hello world";
            System.out.println("\n" + s2 + " : " + toHexString(getSHA(s2)));
            String s3 = "K1t4fo0V";
            System.out.println("\n" + s3 + " : " + toHexString(getSHA(s3)));
        }
        // For specifying wrong message digest algorithms
        catch (NoSuchAlgorithmException e) {
            System.out.println("Exception thrown for incorrect algorithm: " + e);
        }
    }
}
```

Output

```
HashCode Generated by SHA-256 for:
hello world : b94d27b9934d3e08a52e52d7da7dabfac484efe37a5380ee9088f7ace2efcde9
K1t4fo0V : 0a979e43f4874eb24b740c0157994e34636eed0425688161cc58e8b26b1dcf4e
```

Result:

Thus the program to implement Digital Signature Scheme using SHA 256 algorithm was executed successfully.

Ex.no:5

Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.

AIM:

To install Wire Shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.

What is Wireshark?

- Wireshark is a network packet analyzer. A network packet analyzer presents captured packet data in asmuch detail as possible. You could think of a network packet analyzer as a measuring device for examining what's happening inside a network cable, just like an electrician uses a voltmeter for examining what's happening inside an electric cable (but at a higher level, of course).
- Wireshark, a network analysis tool formerly known as Ethereal, captures packets in real time and display them in human-readable format. Wireshark includes filters, color-coding, and other features that let you dig deep into network traffic and inspect individual packets.

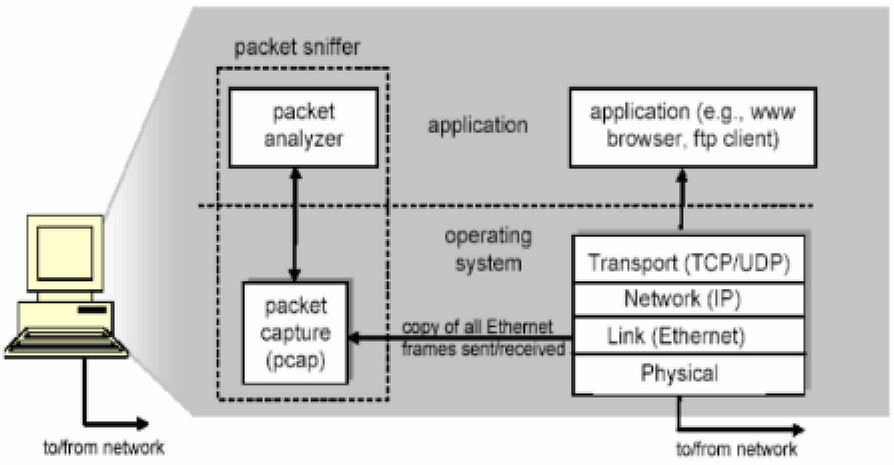


Figure 1: Packet sniffer structure

PACKET SNIFFER

The basic tool for observing the messages exchanged as packets on the network using a variety of protocols is called a packet sniffer. As the name suggests, a packet sniffer captures ("sniffs") messages being sent/received from/by your computer; it will also typically store and/or display the contents of the various protocol fields in these captured messages. A packet sniffer itself is passive. It observes messages being sent and received by applications and protocols running on your computer, but never sends packets itself. Similarly, received packets are never explicitly addressed to the packet sniffer. Instead, a packet sniffer receives a copy of packets that are sent / received from/by application and protocols executing on your machine.

Some intended purposes Here are some reasons people use Wireshark:

- Network administrators use it to troubleshoot network problems.
- Network security engineers use it to examine security problems.
- QA engineers use it to verify network applications.
- Developers use it to debug protocol implementations.
- People use it to learn network protocol internals.

Features

The following are some of the many features Wireshark provides:

- Available for UNIX and Windows.
- Capture live packet data from a network interface.
- Open files containing packet data captured with tcpdump/WinDump, Wireshark, and many other packetcapture programs.
- Import packets from text files containing hex dumps of packet data.
- Display packets with very detailed protocol information.
- Save packet data captured.
- Export some or all packets in a number of capture file formats.

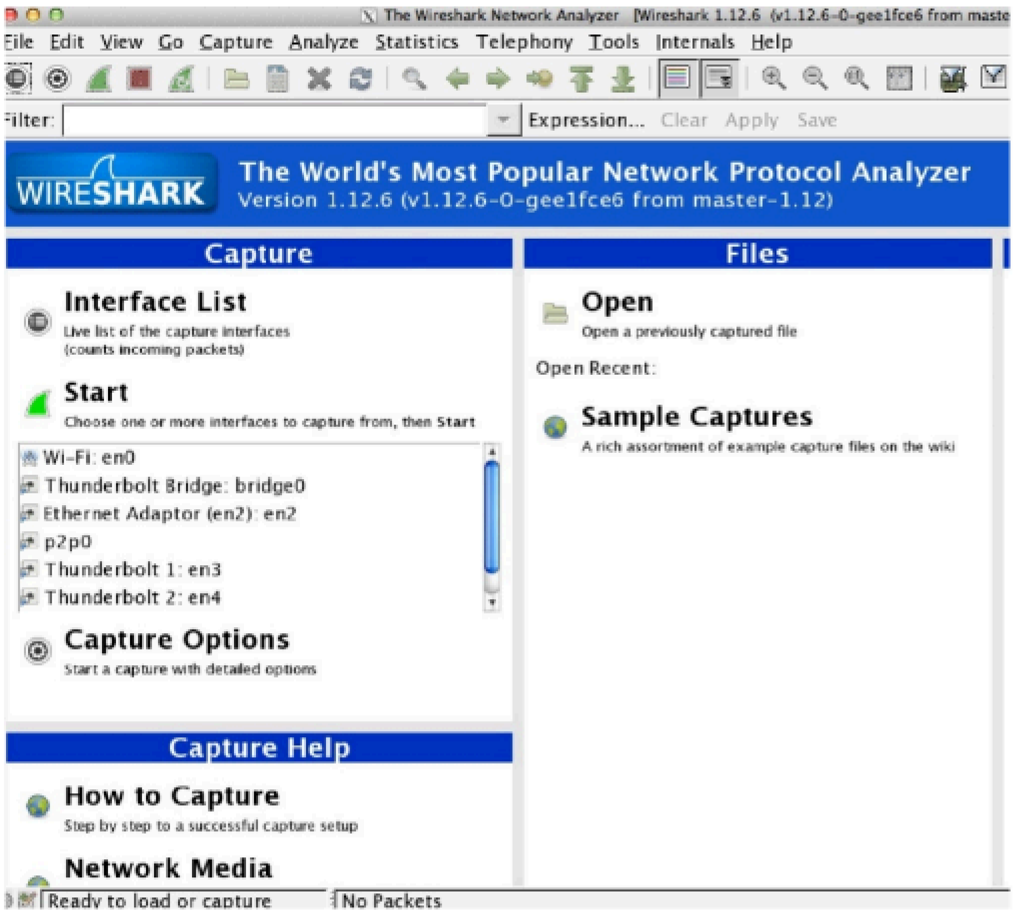
Getting Wireshark

Wireshark can be installed in any operating system, just go to

https:// www.wireshark.org/download.html

Running Wireshark

When you run the Wireshark program, the Wireshark graphical user interface will be displayed. Initially, no data will be displayed in the various windows. For Mac OSX users, you need to have XQuartz or X11 installed for Wireshark to work!!! Also, thefirst time you open Wireshark, it will take several seconds to start so be patient.


The Wireshark Network Analyzer [Wireshark 1.12.6 (v1.12.6-0-gee1fce6 from maste
File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help
Filter:
Expression... Clear Apply Save
WIRESHARK
Capture
Files
Capture Help
Interface List
Start
Capture Options
Open
Open Recent:
Sample Captures
How to Capture
Network Media
No Packets

The World's Most Popular Network Protocol Analyzer
Version 1.12.6 (v1.12.6-0-gee1fce6 from master-1.12)

Interface List — Live list of the capture interfaces (counts incoming packets)

Start — Choose one or more interfaces to capture from, then Start

- Wi-Fi: en0
- Thunderbolt Bridge: bridge0
- Ethernet Adaptor (en2): en2
- p2p0
- Thunderbolt 1: en3
- Thunderbolt 2: en4

Capture Options — Start a capture with detailed options

Open — Open a previously captured file

Sample Captures — A rich assortment of example capture files on the wiki

How to Capture — Step by step to a successful capture setup

Ready to load or capture

Figure 3: Initial screen for Wireshark.

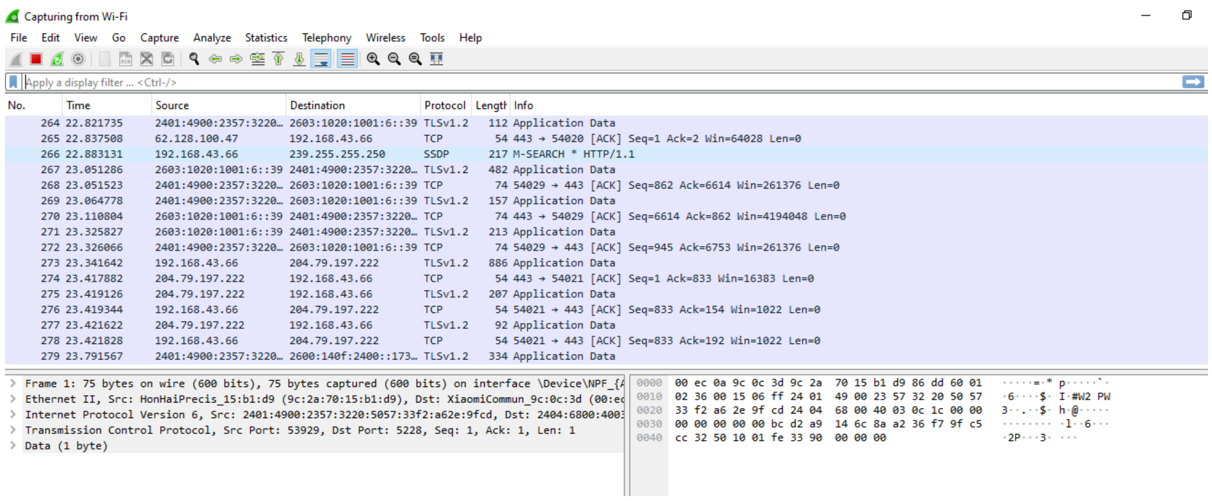
Need to select one of the Wireshark interfaces, if you are using your laptop connected over the WiFi, then you need to select the WiFi interface. If you are at a server, you need to select the Ethernet interface being used. In general, you can select any interface but that does not mean that traffic will flow through that interface. The network interfaces (i.e., the physical connections) that your computer has to the network are shown. The attached snapshot was taken from my computer. You may not see the exact same entries when you perform a capture in the 237 Lab. You will notice that eth0 and eth1 will be displayed. Click "Start" for interface eth0. Packet capture will now begin- all packets being sent / received from/by your computer are now being captured by Wireshark! After you select the interface, you should click on "START".

What is Wireshark?

Wireshark is a network packet analyzer. A network packet analyzer presents captured packet data in as much detail as possible. You could think of a network packet analyzer as a measuring device for
examining what’s
happening inside a network cable, just like an electrician uses a voltmeter for examining

what’s happening inside an electric cable (but at a higher level, of course)

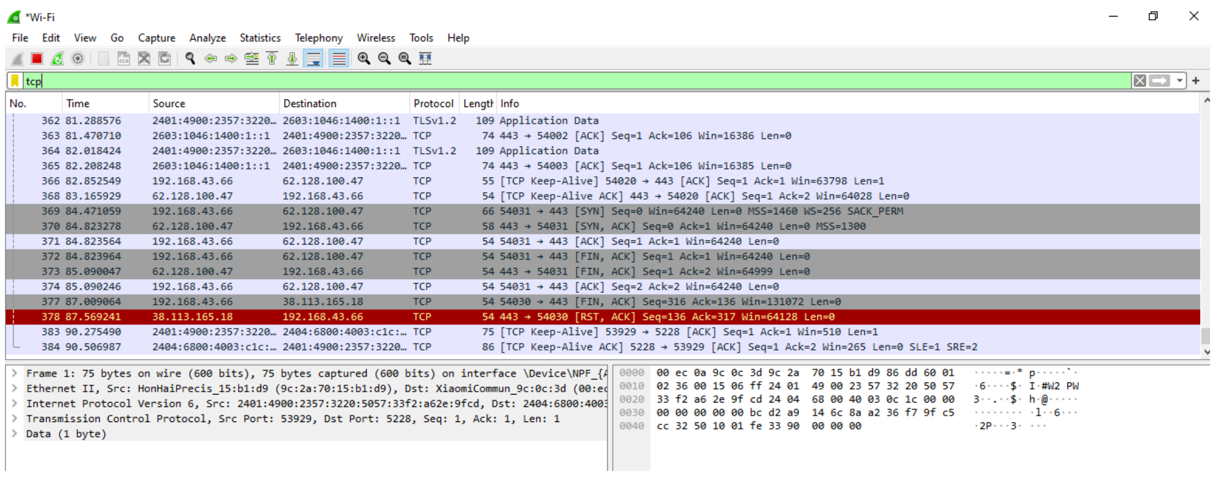
Output


Capturing from Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

```
No.     Time       Source                Destination           Protocol Length Info
    264 22.821735  2401:4900:2357:3220…  2603:1020:1001:6::39   TLSv1.2   112 Application Data
    265 22.837508  62.128.100.47         192.168.43.66         TCP        54 443 → 54020 [ACK] Seq=1 Ack=2 Win=64028 Len=0
    266 22.883131  192.168.43.66         239.255.255.250       SSDP      217 M-SEARCH * HTTP/1.1
    267 23.051286  2603:1020:1001:6::39  2401:4900:2357:3220…  TLSv1.2   482 Application Data
    268 23.051523  2401:4900:2357:3220…  2603:1020:1001:6::39   TCP        74 54029 → 443 [ACK] Seq=862 Ack=6614 Win=261376 Len=0
    269 23.064778  2401:4900:2357:3220…  2603:1020:1001:6::39   TLSv1.2   157 Application Data
    270 23.110804  2603:1020:1001:6::39  2401:4900:2357:3220…  TCP        74 443 → 54029 [ACK] Seq=6614 Ack=862 Win=4194048 Len=0
    271 23.325827  2603:1020:1001:6::39  2401:4900:2357:3220…  TLSv1.2   213 Application Data
    272 23.326066  2401:4900:2357:3220…  2603:1020:1001:6::39   TCP        74 54029 → 443 [ACK] Seq=945 Ack=6753 Win=261376 Len=0
    273 23.341642  192.168.43.66         204.79.197.222        TLSv1.2   886 Application Data
    274 23.417882  204.79.197.222        192.168.43.66         TCP        54 443 → 54021 [ACK] Seq=1 Ack=833 Win=16383 Len=0
    275 23.419126  204.79.197.222        192.168.43.66         TLSv1.2   207 Application Data
    276 23.419344  192.168.43.66         204.79.197.222        TCP        54 54021 → 443 [ACK] Seq=833 Ack=154 Win=1022 Len=0
    277 23.421622  204.79.197.222        192.168.43.66         TLSv1.2    92 Application Data
    278 23.421828  192.168.43.66         204.79.197.222        TCP        54 54021 → 443 [ACK] Seq=833 Ack=192 Win=1022 Len=0
    279 23.791567  2401:4900:2357:3220…  2600:140f:2400::173…  TLSv1.2   334 Application Data

> Frame 1: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface \Device\NPF_{A
> Ethernet II, Src: HonHaiPrecis_15:b1:d9 (9c:2a:70:15:b1:d9), Dst: XiaomiCommun_9c:0c:3d (00:ec
> Internet Protocol Version 6, Src: 2401:4900:2357:3220:5057:33f2:a62e:9fcd, Dst: 2404:6800:4003
> Transmission Control Protocol, Src Port: 53929, Dst Port: 5228, Seq: 1, Ack: 1, Len: 1
> Data (1 byte)

0000  00 ec 0a 9c 0c 3d 9c 2a  70 15 b1 d9 86 dd 60 01   ·····=·* p·····`·
0010  02 36 00 15 06 ff 24 01  49 00 23 57 32 20 50 57   ·6····$· I·#W2 PW
0020  33 f2 a6 2e 9f cd 24 04  68 00 40 03 0c 1c 00 00   3··.··$· h·@·····
0030  00 00 00 00 00 bc d2 a9  14 6c 8a a2 36 f7 9f c5   ········ ·l··6···
0040  cc 32 50 10 01 fe 33 90  00 00 00                  ·2P···3· ···
```


*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
tcp

```
No.     Time       Source                Destination           Protocol Length Info
    362 81.288576  2401:4900:2357:3220…  2603:1046:1400:1::1   TLSv1.2   109 Application Data
    363 81.470710  2603:1046:1400:1::1   2401:4900:2357:3220…  TCP        74 443 → 54002 [ACK] Seq=1 Ack=106 Win=16386 Len=0
    364 82.018424  2401:4900:2357:3220…  2603:1046:1400:1::1   TLSv1.2   109 Application Data
    365 82.208248  2603:1046:1400:1::1   2401:4900:2357:3220…  TCP        74 443 → 54003 [ACK] Seq=1 Ack=106 Win=16385 Len=0
    366 82.852549  192.168.43.66         62.128.100.47         TCP        55 [TCP Keep-Alive] 54020 → 443 [ACK] Seq=1 Ack=1 Win=63798 Len=1
    368 83.165929  62.128.100.47         192.168.43.66         TCP        54 [TCP Keep-Alive ACK] 443 → 54020 [ACK] Seq=1 Ack=2 Win=64028 Len=0
    369 84.471059  192.168.43.66         62.128.100.47         TCP        66 54031 → 443 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
    370 84.823278  62.128.100.47         192.168.43.66         TCP        58 443 → 54031 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1300
    371 84.823564  192.168.43.66         62.128.100.47         TCP        54 54031 → 443 [ACK] Seq=1 Ack=1 Win=64240 Len=0
    372 84.823964  192.168.43.66         62.128.100.47         TCP        54 54031 → 443 [FIN, ACK] Seq=1 Ack=1 Win=64240 Len=0
    373 85.090047  62.128.100.47         192.168.43.66         TCP        54 443 → 54031 [FIN, ACK] Seq=1 Ack=2 Win=64999 Len=0
    374 85.090246  192.168.43.66         62.128.100.47         TCP        54 54031 → 443 [ACK] Seq=2 Ack=2 Win=64240 Len=0
    377 87.009064  192.168.43.66         38.113.165.18         TCP        54 54030 → 443 [FIN, ACK] Seq=316 Ack=136 Win=131072 Len=0
    378 87.569241  38.113.165.18         192.168.43.66         TCP        54 443 → 54030 [RST, ACK] Seq=136 Ack=317 Win=64128 Len=0
    383 90.275490  2401:4900:2357:3220…  2404:6800:4003:c1c:…  TCP        75 [TCP Keep-Alive] 53929 → 5228 [ACK] Seq=1 Ack=1 Win=510 Len=1
    384 90.506987  2404:6800:4003:c1c:…  2401:4900:2357:3220…  TCP        86 [TCP Keep-Alive ACK] 5228 → 53929 [ACK] Seq=1 Ack=2 Win=265 Len=0 SLE=1 SRE=2

> Frame 1: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface \Device\NPF_{A
> Ethernet II, Src: HonHaiPrecis_15:b1:d9 (9c:2a:70:15:b1:d9), Dst: XiaomiCommun_9c:0c:3d (00:ec
> Internet Protocol Version 6, Src: 2401:4900:2357:3220:5057:33f2:a62e:9fcd, Dst: 2404:6800:4003
> Transmission Control Protocol, Src Port: 53929, Dst Port: 5228, Seq: 1, Ack: 1, Len: 1
> Data (1 byte)

0000  00 ec 0a 9c 0c 3d 9c 2a  70 15 b1 d9 86 dd 60 01   ·····=·* p·····`·
0010  02 36 00 15 06 ff 24 01  49 00 23 57 32 20 50 57   ·6····$· I·#W2 PW
0020  33 f2 a6 2e 9f cd 24 04  68 00 40 03 0c 1c 00 00   3··.··$· h·@·····
0030  00 00 00 00 00 bc d2 a9  14 6c 8a a2 36 f7 9f c5   ········ ·l··6···
0040  cc 32 50 10 01 fe 33 90  00 00 00                  ·2P···3· ···
```

Result:

Thus the experiment to install Wire Shark, tcpdump and observe data transferred in client server communication using UDP/TCP and identify the UDP/TCP datagram was analyzed successfully.

Ex.no:6

Explore Network Monitoring Tools

AIM:

To explore network monitoring tools.

Tools Used

- SolarWinds Network Performance Monitor
- Auvik
- Datadog Network Monitoring
- Paessler PRTG Network Monitor
- ManageEngine OpManager
- Domotz
- Checkmk
- Progress Whatsup Gold

THEORY

- Network monitoring tools are software that can use to evaluate network connections. These software programs can help you monitor a network connection and identify network issues, which may include failing network components, slow connection speed, network outage or unidentifiable connections.
- The Network management and monitoring tools can also help you resolve these issues or establish solutions that prevent specific issues from occurring in the future.

1. **SolarWinds Network Performance Monitor**

   - It is a multi-vendor monitoring tool. It allows users to monitor multiple vendors' networks at the same time. It also provides network insights for thorough visibility into the health of the networks. Some prominent features include network availability monitoring, intelligent network mapping, critical path visualisation, performance analysis and advanced alerting.

2. Auvik

- It is a network monitoring and management tool. It offers a quick implementation process that helps users to set up the tool easily. It also has a clean user interface that makes it easy to navigate and use. The tool provides in-depth network visibility that enables faster troubleshooting for network issues.
- Users can automate network visibility using Auvik. It provides real-time updates on network issues and configuration changes.

3. Datadog

- Network Monitoring offers services for on-premises devices and cloud networks. A highlighting feature of this tool is the visualisations. It offers various graphical representations of all the network connections on a system. It also allows users to track key metrics like network latency, connection churn and transmission control protocol (TCP) retransmits.

4. **Paessler's**
   - The network connection monitoring tool provides a clean user interface and network visibility on multiple devices. Users can track the health of different connection types like local area networks (LAN), wide area network (WAN), servers, websites, applications and services.
5. **ManageEngine OpManager**
   - It is a good network monitoring and managing tool for users that prefer in-depth view of network health and issues. This tool provides over 2000 network performance monitors that allow users to track and monitor their connections and perform detailed analyses on issues.
6. **Domotz**
   - It is an expansive tool that provides a list of features for monitoring network connections. It allows users to customise their network monitoring preferences. Users can write scripts the retrieve the data they wish to evaluate. It also allows connection to open ports on remote devices while ensuring network security.
7. **Checkmk**
   - It is a tool that allows users to automate it completely. You can customise its operations and enable it to perform tasks automatically. It also identifies network and security components without the user.
8. **Progress Whatsup Gold**
   - It is a basic network monitoring software. It provides a minimal user interface with essential features like device monitoring, application monitoring, analysing network traffic and managing configurations. The tool allows users to monitor cloud devices.

RESULT

Thus to explore network monitoring tools was done successfully.

What is Wireshark?

Wireshark is a network packet analyzer. A network packet analyzer presents captured packet data in as much detail as possible. You could think of a network packet analyzer as a measuring device for
examining what’s
happening inside a network cable, just like an electrician uses a voltmeter for examining

what’s happening inside an electric cable (but at a higher level, of course)

Ex.no:7

MD5 Algorithm

AIM:

To Calculate the message digest of a text using the MD5 algorithm.

ALGORITHM:

1. Append Padding Bits
2. Append Length - 64 bits are appended to the end
3. Prepare Processing Functions
4. Prepare Processing Constants
5. Initialize Buffers
6. Processing Message in 512-bit blocks (L blocks in total message)

Program

```
import java.math.BigInteger;
import java.security.MessageDigest;
import java.security.NoSuchAlgorithmException;
// Java program to calculate MD5 hash value
public class MD5 {
  public static String getMd5(String input)
  {
    try {
      // Static getInstance method is called with hashing MD5
      MessageDigest md = MessageDigest.getInstance("MD5");
      // digest() method is called to calculate message digest
      // of an input digest() return array of byte
      byte[] messageDigest = md.digest(input.getBytes());
```

```
            // Convert byte array into signum representation
            BigInteger no = new BigInteger(1, messageDigest);
            // Convert message digest into hex value
            String hashtext = no.toString(16);
            while (hashtext.length() < 32) {
                hashtext = "0" + hashtext;
            }
            return hashtext;
        }
        // For specifying wrong message digest algorithms
        catch (NoSuchAlgorithmException e) {
            throw new RuntimeException(e);
        }
    }
    // Driver code
    public static void main(String args[]) throws NoSuchAlgorithmException
    {
        String s = "Stella Mary's";
        System.out.println("Your HashCode Generated by MD5 is: " + getMd5(s));
    }
}
```

Output

```
Your HashCode Generated by MD5 is: 080d94bef2707a33e5bc20f336e4bc46
```

RESULT

Thus the Message Digest 5 (MD5) has been implemented and the output has been verified successfully.

What is Wireshark?

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Ex.no:8

Confidentiality and Authentication

AIM:

To write a java program for implement Message Authentication Code to examine confidentiality and authentication.

ALGORITHM:

1. Import Key generator library files.
2. Generate secret key.
3. Prepare the message to be sent to receiver.
4. Using SHA512 generate hash code.
5. Combine message and hash code and forward to receiver.
6. validate hash code.

Program

```
import javax.crypto.KeyGenerator;
import javax.crypto.Mac;
import javax.crypto.SecretKey;
import java.security.InvalidKeyException;
import java.security.NoSuchAlgorithmException;
public class MACExample {
   public static void main(String[] args) {
      try {
         // Step 1: Generate a symmetric key (K)
         KeyGenerator keygen = KeyGenerator.getInstance("HmacSHA512");
         SecretKey secretKey = keygen.generateKey();
         // Step 2: Compute MAC for a sample message (M)
         String message = "Hello, world!";
         Mac mac = Mac.getInstance("HmacSHA512");
         mac.init(secretKey);
         byte[] macBytes = mac.doFinal(message.getBytes());
         // Display the MAC (authentication tag)
         System.out.println("Message: " + message);
         System.out.println("MAC: " + bytesToHex(macBytes));
      } catch (NoSuchAlgorithmException e) {
         e.printStackTrace();
```

```
        }
         catch (InvalidKeyException e) {
        e.printStackTrace();
        }
    }
    // Helper method to convert bytes to hexadecimal
    private static String bytesToHex(byte[] bytes) {
        StringBuilder result = new StringBuilder();
        for (byte b : bytes) {
            result.append(String.format("%02x", b));
        }
        return result.toString();
    }
}
```

Output

```
Message: Hello, world!
MAC:
4b2b5a76f88d272185b00549bbbea7218359c6f4bb4a6295d67d20808e0cb9219b6bdfb9e494e08b0
e98e37c2830e8d21f513a1c2a2ae912794c57a6504f89c8
```

RESULT

Thus the java program for ensure confidentiality and authentication has been implemented and the output has been verified successfully.

What is Wireshark?

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Ex.no:9

Dictionary Attack

AIM:

Write a Java program to implement and show how to protect your system from the dictionary attack.

Dictionary Attack

- A dictionary attack is a type of password cracking technique used to gain unauthorized access to a system or account. In this method, an attacker utilizes a list of common words or phrases, often sourced from a dictionary or a wordlist, and systematically tries each entry as a password until access is granted.
- The process involves automated software that sequentially tests each word or phrase from the dictionary against the authentication mechanism (such as a login page) until it finds a match. This approach exploits the tendency of many users to choose weak passwords based on easily guessable terms, like common words, phrases, or easily predictable variations thereof.
- To enhance the effectiveness of a dictionary attack, attackers often use variations in spelling, common substitutions (such as replacing 'o' with '0' or 'e' with '3'), appending numbers or special characters, and other common password patterns.
- To protect against dictionary attacks, users are encouraged to choose strong, unique passwords that combine uppercase and lowercase letters, numbers, and special characters, making them more resistant to brute-force and dictionary-based cracking attempts.

ALGORITHM:

1. Import necessary library files.
2. Create class dictionary_atack_demo.
3. Prepare the more common password.
4. User scanner to take a input from keyboard.
5. Enter the password and check the strength.
6. Give the proper response based on the password.

Program

```
import java.util.Scanner;
public class DictionaryAttackDemo {
  public static void main(String[] args) {
    // Simulating a dictionary of common passwords
```

```
        String[] dictionary = {
            "password", "123456", "qwerty", "admin", "letmein"
            // Add more common passwords here
        };
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter your password: ");
        String userPassword = scanner.nextLine();
        // Check if the entered password is in the dictionary
        boolean isPasswordInDictionary = false;
        for (String commonPassword : dictionary) {
            if (userPassword.equals(commonPassword)) {
                isPasswordInDictionary = true;
                break;
            }
        }
        if (isPasswordInDictionary) {
            System.out.println("Password is weak! Please choose a stronger one.");
        } else {
            System.out.println("Password is secure. Good job!");
        }
        scanner.close();
    }
}
```

Output

```
Enter your password: 123456
Password is weak! Please choose a stronger one.
Enter your password: dfsdfds
Password is secure. Good job!
```

RESULT

Thus the java program for protect the password from dictionary attack has been implemented and the output has been verified successfully.

What is Wireshark?
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Ex.no:10

Create Firewall Setup

AIM:

Write a Java program to create firewall setup.

Firewall

- A firewall can be defined as a special type of network security device or a software program that monitors and filters incoming and outgoing network traffic based on a defined set of security rules. It acts as a barrier between internal private networks and external sources (such as the public Internet).
- The primary purpose of a firewall is to allow non-threatening traffic and prevent malicious or unwanted data traffic for protecting the computer from viruses and attacks. A firewall is a cybersecurity tool that filters network traffic and helps users block malicious software from accessing the Internet in infected computers.

ALGORITHM:

1. Import necessary library files.
2. Open Windows Defender Firewall.
3. Click Advanced Settings->click Inbound Rules.
4. Apply firewall rules.

Program

```
public class FirewallConfigurator {

   public static void addFirewallRule(String ruleName) {
      try {
    String command = "netsh advfirewall firewall add rule name=\"" + ruleName + "\"
protocol=TCP dir=in localport=80 security=authdynenc action=allow";
         Process process = Runtime.getRuntime().exec(command);
```

```
            process.waitFor();
            if (process.exitValue() == 0) {
                System.out.println("Firewall rule added successfully.");
            } else {
                System.out.println("Error adding firewall rule.");
            }
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
    public static void main(String[] args) {
        // Example usage:
        addFirewallRule("My Port 82");
    }
}
```

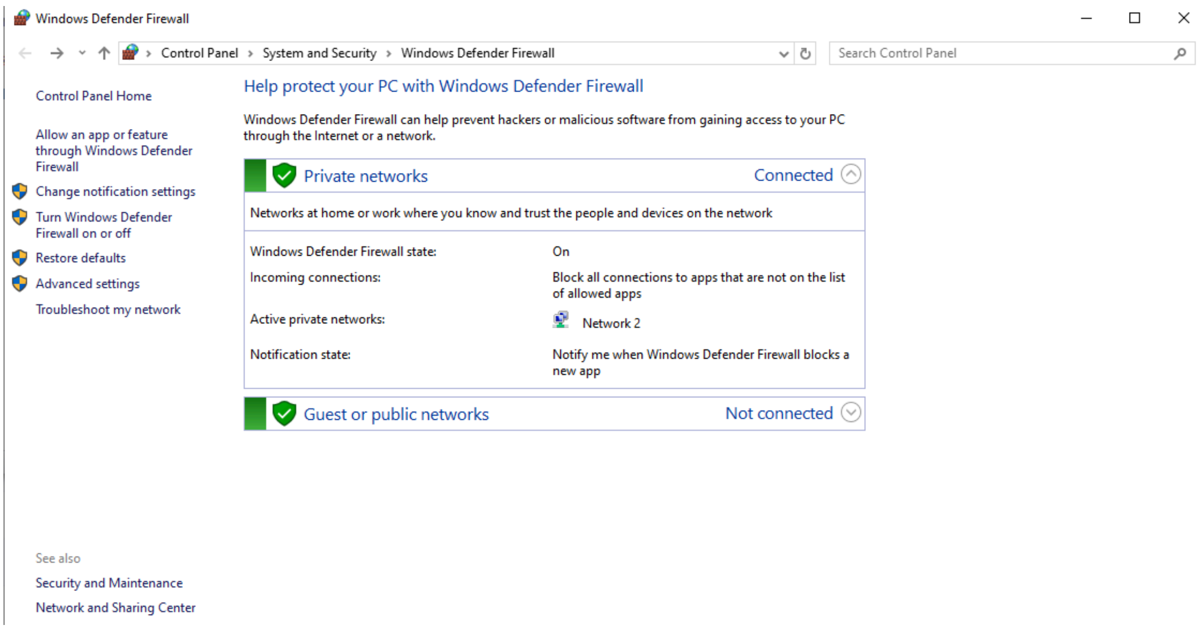
Output

Run this program in Administrator Command Prompt

```
C:\rr>java FirewallConfigurator

Firewall rule added successfully.
```

1) Open Windows Defender Firewall



Windows Defender Firewall

Control Panel › System and Security › Windows Defender Firewall

Search Control Panel

Control Panel Home

Allow an app or feature through Windows Defender Firewall

Change notification settings

Turn Windows Defender Firewall on or off

Restore defaults

Advanced settings

Troubleshoot my network

See also

Security and Maintenance

Network and Sharing Center

Help protect your PC with Windows Defender Firewall

Windows Defender Firewall can help prevent hackers or malicious software from gaining access to your PC through the Internet or a network.

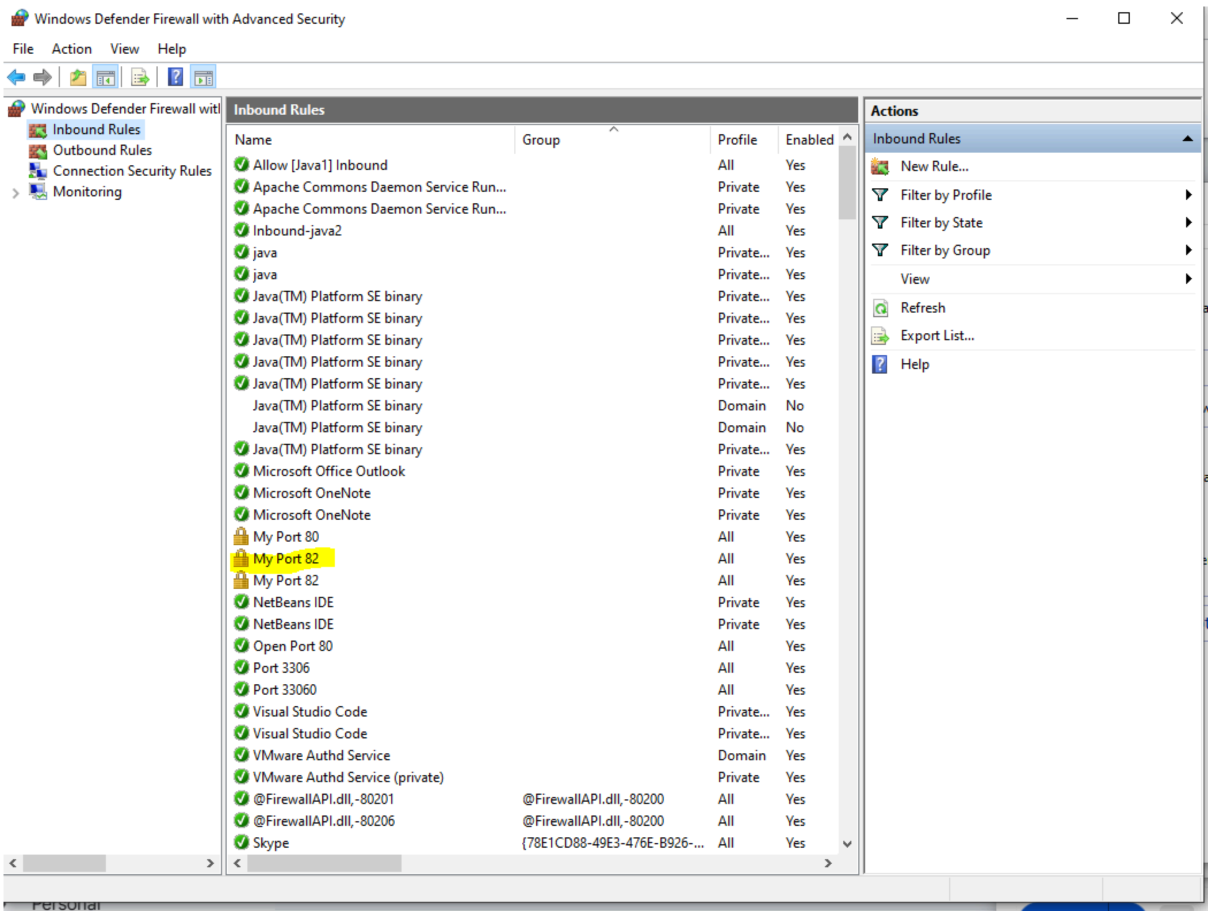
Private networks — Connected

Networks at home or work where you know and trust the people and devices on the network

Windows Defender Firewall state:	On
Incoming connections:	Block all connections to apps that are not on the list of allowed apps
Active private networks:	Network 2
Notification state:	Notify me when Windows Defender Firewall blocks a new app

Guest or public networks — Not connected

2) Click Advanced Settings->click Inbound Rules


Windows Defender Firewall with Advanced Security

File Action View Help

- Windows Defender Firewall witl
  - Inbound Rules
  - Outbound Rules
  - Connection Security Rules
  - Monitoring

Inbound Rules

Name	Group	Profile	Enabled
Allow [Java1] Inbound		All	Yes
Apache Commons Daemon Service Run...		Private	Yes
Apache Commons Daemon Service Run...		Private	Yes
Inbound-java2		All	Yes
java		Private...	Yes
java		Private...	Yes
Java(TM) Platform SE binary		Private...	Yes
Java(TM) Platform SE binary		Private...	Yes
Java(TM) Platform SE binary		Private...	Yes
Java(TM) Platform SE binary		Private...	Yes
Java(TM) Platform SE binary		Private...	Yes
Java(TM) Platform SE binary		Domain	No
Java(TM) Platform SE binary		Domain	No
Java(TM) Platform SE binary		Private...	Yes
Microsoft Office Outlook		Private	Yes
Microsoft OneNote		Private	Yes
Microsoft OneNote		Private	Yes
My Port 80		All	Yes
My Port 82		All	Yes
My Port 82		All	Yes
NetBeans IDE		Private	Yes
NetBeans IDE		Private	Yes
Open Port 80		All	Yes
Port 3306		All	Yes
Port 33060		All	Yes
Visual Studio Code		Private...	Yes
Visual Studio Code		Private...	Yes
VMware Authd Service		Domain	Yes
VMware Authd Service (private)		Private	Yes
@FirewallAPI.dll,-80201	@FirewallAPI.dll,-80200	All	Yes
@FirewallAPI.dll,-80206	@FirewallAPI.dll,-80200	All	Yes
Skype	{78E1CD88-49E3-476E-B926-...	All	Yes

Firewall Created Successfully

RESULT

Thus the java program for create firewall setup and the output has been verified successfully.

What is Wireshark?

Wireshark is a network packet analyzer. A network

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You could think of a
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Ex.no:11

Setup and Configure VPN Connection using JAVA Commands

AIM:

Write a Java program to Setup and Configure VPN Connection.

VPN

- VPN stands for Virtual Private Network. It's a technology that allows you to create a secure connection over the internet, typically between your device and a private network, such as a corporate network or a remote server.
- VPN configurations typically involve interacting with the underlying operating system's networking stack, which usually requires administrative privileges and access to system-level APIs, neither of which are readily available from within a Java program.
- However, you can interact with VPN configurations indirectly using Java by executing system commands. Below, I'll outline a basic approach using Java's ProcessBuilder class to execute shell commands for setting up a VPN connection.

ALGORITHM:

5. Import necessary library files.
6. Replace sudo openvpn --config /path/to/config.ovpn with the actual command you use to start your VPN connection.
7. ProcessBuilder is used to execute the command.
8. redirectErrorStream(true) merges the standard output and standard error streams, so you can handle both through the InputStreamReader.

Program

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
public class VPNConfiguration {
   public static void main(String[] args) {
      try {
         // Replace these commands with the actual commands for setting up the VPN
connection
         String[] commands = {"sudo", "openvpn", "--config", "/path/to/config.ovpn"};
         ProcessBuilder builder = new ProcessBuilder(commands);
```

```
            builder.redirectErrorStream(true);
            Process process = builder.start();
            // Read output from the process
            BufferedReader reader = new BufferedReader(new
InputStreamReader(process.getInputStream()));
            String line;
            while ((line = reader.readLine()) != null) {
                System.out.println(line);
            }
            // Wait for the process to finish
            int exitCode = process.waitFor();
            System.out.println("Process exited with code " + exitCode);
        } catch (IOException | InterruptedException e) {
            e.printStackTrace();
        }
    }
}
```

Output

Run this program in Administrator Command Prompt

waitFor() is called to wait for the process to finish and get the exit code.

```
Process exited with code 690
```

RESULT

Thus the java program for setup and configure VPN connection and the output has been verified successfully.

What is Wireshark? Wireshark is a network packet analyzer. A network packet

analyzer presents captured packet data in as much detail as possible. You could think of a network packet analyzer as a measuring device for examining what’s happening inside a network cable, just like an electrician uses a voltmeter for examining what’s happening inside an electric cable (but at a higher level, of cours