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Institute of Computer Science & Technologys

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Laboratory №2 Report

Discipline: Information Security

Theme: Nmap utility

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“__” _________2017 г.

Saint-Petersburg
2017

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Nmap (”Network Mapper”) – a free and open source utility for network discovery and se-curity auditing

1.1 Objectives

After completing this module you will be able to:

1. perform network discovery with various TARGET SPECIFICATION (hostnames, IP addresses, networks, etc.);
2. perform HOST DISCOVERY;
3. apply a variety of SCAN TECHNIQUES;
4. perform PORT SPECIFICATION AND set SCAN ORDER;
5. perform SERVICE/VERSION DETECTION;
6. perform SCRIPT SCAN;
7. perform OS DETECTION;
8. manage TIMING AND PERFORMANCE.

1.2 Task

1. List targets to scan;
2. Probe open ports to determine service/version info;
3. Study nmap-services, nmap-os-db, nmap-service-probes;
4. (OPTIONAL) Add new service to nmap-service-probes (create a minimal tcp server, get its name and version by nmap);
5. Output to xml-format file;
6. Study nmap stages and modes using Wireshark.

Perform VM Metasploitable2 scanning using db_nmap from metasploitframework.

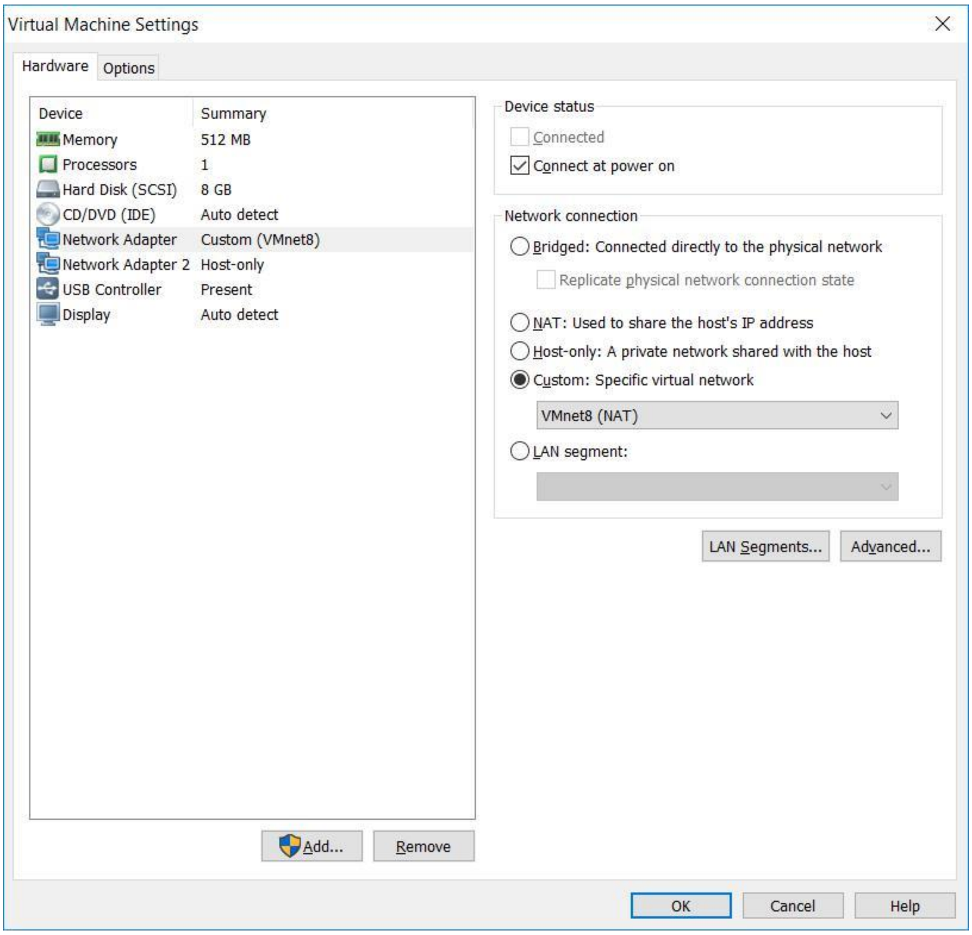
Get 5 records from nmap-service-probes and describe them. Choose one Nmap Script and describe it

Work Progress

2.1 Preparing

1. Download last kali linux and metasploitable2 distributions;
2. Install it in VMware Workstation;
3. Setting up common network;
4. Define the IP addresses of virtual machines;
5. Check ping request's in both ways.

As common network choosed - VMnet8.



Virtual Machine Settings

Device	Summary
Memory	512 MB
Processors	1
Hard Disk (SCSI)	8 GB
CD/DVD (IDE)	Auto detect
Network Adapter	Custom (VMnet8)
Network Adapter 2	Host-only
USB Controller	Present
Display	Auto detect

Device status

□ Connected

☑ Connect at power on

Network connection

○ Bridged: Connected directly to the physical network

□ Replicate physical network connection state

○ NAT: Used to share the host's IP address

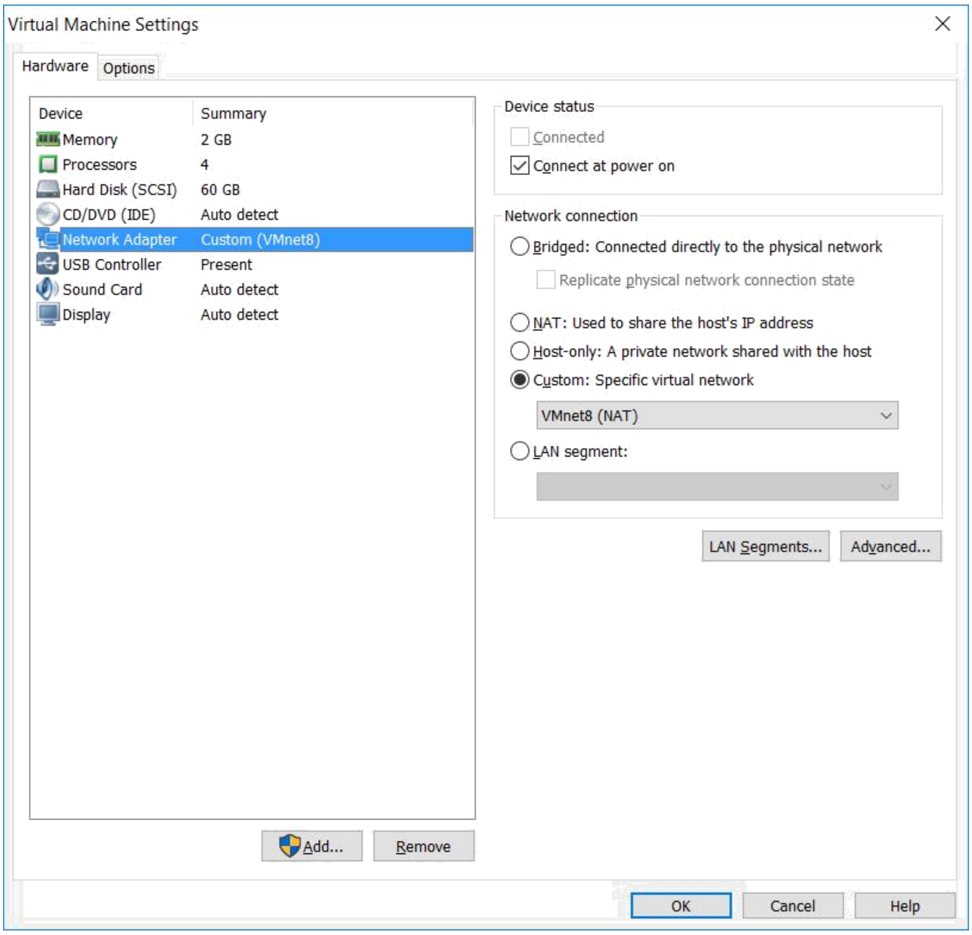
○ Host-only: A private network shared with the host

● Custom: Specific virtual network

VMnet8 (NAT)

○ LAN segment:

Figure 2.1: Metasploitable2 settings



Device	Summary
Memory	2 GB
Processors	4
Hard Disk (SCSI)	60 GB
CD/DVD (IDE)	Auto detect
Network Adapter	Custom (VMnet8)
USB Controller	Present
Sound Card	Auto detect
Display	Auto detect

Device status

□ Connected

☑ Connect at power on

Network connection

○ Bridged: Connected directly to the physical network

□ Replicate physical network connection state

○ NAT: Used to share the host's IP address

○ Host-only: A private network shared with the host

● Custom: Specific virtual network

VMnet8 (NAT)

○ LAN segment:

Figure 2.2: Kali settings

Now power on VM’s and define their IP addresses.

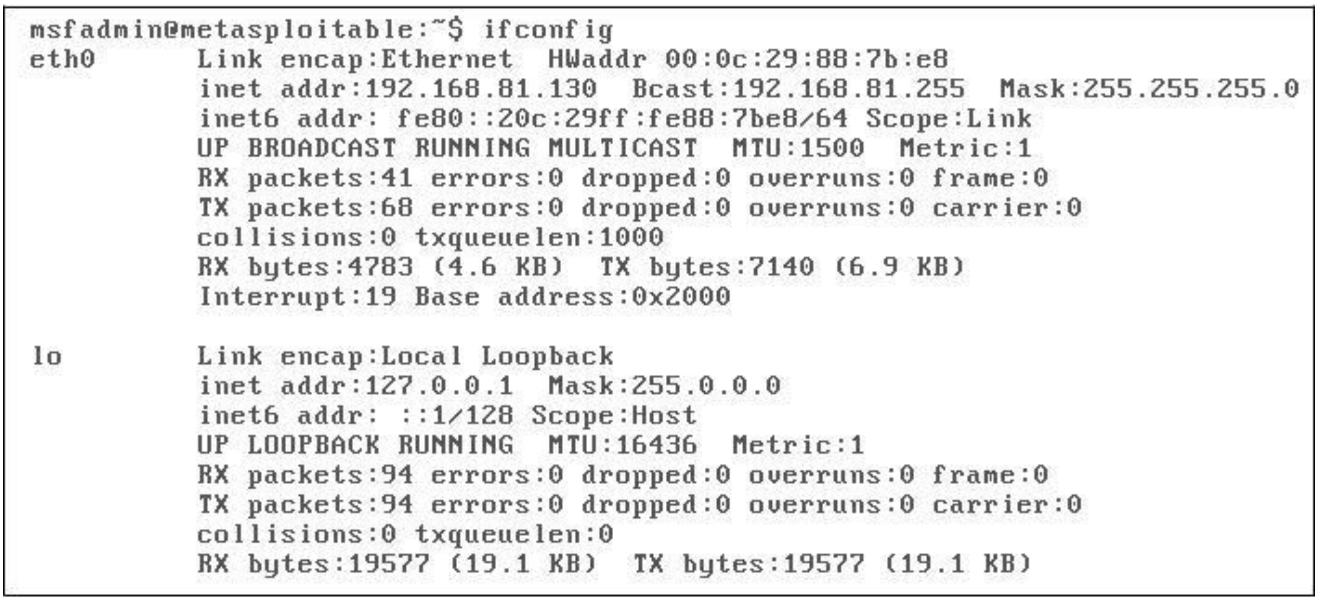

```
msfadmin@metasploitable:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:88:7b:e8
          inet addr:192.168.81.130  Bcast:192.168.81.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe88:7be8/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:41 errors:0 dropped:0 overruns:0 frame:0
          TX packets:68 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4783 (4.6 KB)  TX bytes:7140 (6.9 KB)
          Interrupt:19 Base address:0x2000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:94 errors:0 dropped:0 overruns:0 frame:0
          TX packets:94 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:19577 (19.1 KB)  TX bytes:19577 (19.1 KB)
```

Figure 2.3: Metasploitable2 ifconfig

```
root@kali:~# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.81.129  netmask 255.255.255.0  broadcast
   ,!192.168.81.255
```

```
        inet6 fe80::20c:29ff:feed:c99e  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:ed:c9:9e  txqueuelen 1000  (Ethernet)
        RX packets 69  bytes 7784 (7.6 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 36  bytes 3002 (2.9 KiB)
        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 26  bytes 1518 (1.4 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 26  bytes 1518 (1.4 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

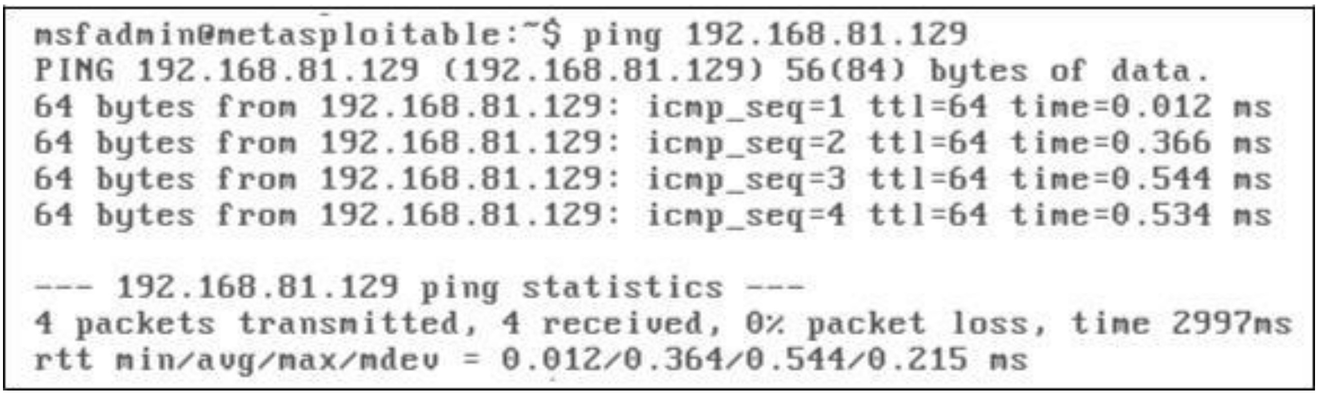
Listing 2.1: Kali ifconfig

Using ifconfig command, i defined IP addresses:

Metasploitable2 IP - 192.168.81.130

Kali IP - 192.168.81.129

To test that VM see each other, use the ping command.



```
msfadmin@metasploitable:~$ ping 192.168.81.129
PING 192.168.81.129 (192.168.81.129) 56(84) bytes of data.
64 bytes from 192.168.81.129: icmp_seq=1 ttl=64 time=0.012 ms
64 bytes from 192.168.81.129: icmp_seq=2 ttl=64 time=0.366 ms
64 bytes from 192.168.81.129: icmp_seq=3 ttl=64 time=0.544 ms
64 bytes from 192.168.81.129: icmp_seq=4 ttl=64 time=0.534 ms

--- 192.168.81.129 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 2997ms
rtt min/avg/max/mdev = 0.012/0.364/0.544/0.215 ms
```

Figure 2.4: Metasploitable2 ping

```
root@kali:~# ping 192.168.81.130
PING 192.168.81.130 (192.168.81.130) 56(84) bytes of data.
64 bytes from 192.168.81.130: icmp_seq=1 ttl=64 time=2.08 ms
64 bytes from 192.168.81.130: icmp_seq=2 ttl=64 time=0.542 ms
64 bytes from 192.168.81.130: icmp_seq=3 ttl=64 time=0.579 ms
64 bytes from 192.168.81.130: icmp_seq=4 ttl=64 time=0.669 ms
^C
192.168.81.130 ping statistics
4 packets transmitted, 4 received, 0% packet loss, time 3061ms
rtt min/avg/max/mdev = 0.542/0.968/2.085/0.647 ms
```

Listing 2.2: Kali ping

Ping requests were successfully completed, which means that the network is working suc-cessfully.

2.2 List targets to scan

The following command will be used to scan the network:

nmap -sn 192.168.81.0-255

Key sn means only ping scan, without port scan. 0-255 means in what range nmap should find target's.

```
root@kali:~# nmap sn 192.168.81.0 255

Starting Nmap 7.60 ( https://nmap.org ) at 2017 11 04 06:13 EDT
Nmap scan report for 192.168.81.1
Host is up (0.00050s latency).
MAC Address: 00:50:56:C0:00:08 (VMware)
Nmap scan report for 192.168.81.2
Host is up (0.00033s latency).
MAC Address: 00:50:56:EF:06:7B (VMware)
Nmap scan report for 192.168.81.130
Host is up ( 0.10s latency).
MAC Address: 00:0C:29:88:7B:E8 (VMware)
Nmap scan report for 192.168.81.254
Host is up ( 0.12s latency).
MAC Address: 00:50:56:E1:C6:C7 (VMware)
Nmap scan report for 192.168.81.129
Host is up.
Nmap done: 256 IP addresses (5 hosts up) scanned in 3.23 seconds
```

Listing 2.3: NMAP scanning result

Metasploitable2 was successfully found.

2.3 Probe open ports to determine service/version info

Now scan 10 most popular ports at Metasploitable2 IP address.

```
root@kali:~# nmap top ports 10 192.168.81.130

Starting Nmap 7.60 ( https://nmap.org ) at 2017 11 04 08:37 EDT
Nmap scan report for 192.168.81.130
Host is up (0.00045s latency).
PORT      STATE   SERVICE
21/tcp    open    ftp
22/tcp    open    ssh
23/tcp    open    telnet
25/tcp    open    smtp
80/tcp    open    http
110/tcp   closed  pop3
139/tcp   open    netbios ssn
443/tcp   closed  https
445/tcp   open    microsoft ds
```

```
3389/tcp closed ms wbt server
MAC Address : 00:0C:29:88:7B:E8 (VMware)

Nmap done : 1 IP address (1 host up) scanned in 0.71 seconds
```

Listing 2.4: NMAP scanning ports

Now determine service and version info with the sV key.

```
root@kali:~# nmap sV 192.168.81.130

Starting Nmap 7.60 ( https://nmap.org ) at 2017 11 04 08:40 EDT
Nmap scan report for 192.168.81.130
Host is up (0.00033s latency).
Not shown : 977 closed ports
PORT      STATE SERVICE     VERSION
21/tcp    open  ftp         vsftpd 2.3.4
22/tcp    open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol
   ,!2.0)
23/tcp    open  telnet      Linux telnetd
25/tcp    open  smtp        Postfix smtpd
53/tcp    open  domain      ISC BIND 9.4.2
80/tcp    open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp   open  rpcbind     2 (RPC #100000)
139/tcp   open  netbios ssn Samba smbd 3.X 4.X (workgroup:
   ,! WORKGROUP)
445/tcp   open  netbios ssn Samba smbd 3.X 4.X (workgroup:
   ,! WORKGROUP)
512/tcp   open  exec        netkit rsh rexecd
513/tcp   open  login       OpenBSD or Solaris rlogind
514/tcp   open  tcpwrapped
1099/tcp  open  rmiregistry GNU Classpath grmiregistry
1524/tcp  open  shell       Metasploitable root shell
2049/tcp  open  nfs         2 4 (RPC #100003)
2121/tcp  open  ftp         ProFTPD 1.3.1
3306/tcp  open  mysql       MySQL 5.0.51a 3ubuntu5
5432/tcp  open  postgresql  PostgreSQL DB 8.3.0 8.3.7
5900/tcp  open  vnc         VNC (protocol 3.3)
6000/tcp  open  X11         (access denied)
6667/tcp  open  irc         UnrealIRCd
8009/tcp  open  ajp13       Apache Jserv (Protocol v1.3)
8180/tcp  open  http        Apache Tomcat/Coyote JSP engine 1.1
MAC Address : 00:0C:29:88:7B:E8 (VMware)
Service Info: Hosts: metasploitable.localdomain, localhost, irc.
   ,!Metasploitable.LAN; OSs: Unix, Linux; CPE: cpe:/o:linux:

   ,!linux_kernel
Service detection performed. Please report any incorrect results
   ,!at https://nmap.org/submit/ .
Nmap done : 1 IP address (1 host up) scanned in 14.48 seconds
```

Listing 2.5: NMAP version info

2.4 Study nmap-services, nmap-os-db, nmap-service-probes

Theese files can be found in the directory /usr/share/nmap.

The nmap-services file is a registry of port names to their corresponding number and pro-tocol. Each entry has a number representing how likely that port is to be found open. Most lines have a comment as well.

```
tcpmux     1/tcp      0.001995    # TCP Port Service Multiplexer [rfc
   ,!1078] |       TCP Port Service Multiplexer
tcpmux     1/udp      0.001236    # TCP Port Service Multiplexer
compressnet    2/tcp      0.000013      # Management Utility
compressnet    2/udp      0.001845      # Management Utility
compressnet    3/tcp      0.001242      # Compression   Process
compressnet    3/udp      0.001532      # Compression   Process
unknown    4/tcp      0.000477
rje 5/tcp     0.000000        # Remote Job Entry
rje 5/udp     0.000593        # Remote Job Entry
unknown    6/tcp      0.000502
echo       7/sctp     0.000000
echo       7/tcp      0.004855
echo       7/udp      0.024679
unknown    8/tcp      0.000013
discard    9/sctp     0.000000    # sink null
discard    9/tcp      0.003764    # sink null
discard    9/udp      0.015733    # sink null
unknown    10/tcp     0.000063
systat     11/tcp     0.000075    # Active Users
systat     11/udp     0.000577    # Active Users
unknown    12/tcp     0.000063
daytime    13/tcp     0.003927
daytime    13/udp     0.004827
unknown    14/tcp     0.000038
netstat    15/tcp     0.000038
unknown    16/tcp     0.000050
```

Listing 2.6: Some lines of nmap-services

The nmap-os-db data file contains hundreds of examples of how different operating systems respond to Nmap’s specialized OS detection probes. It is divided into blocks known as finger-prints, with each fingerprint containing an operating system’s name.

```
# Linux 3.5.0 17 generic #28 Ubuntu SMP Tue Oct 9 19:31:23 UTC
   ,! 2012 x86_64 x86_64      x86_64     GNU/Linux, Linux Mint 14
# Google Chromecast
# MikroTik RouterOS 6.0rc  14
# Aastra SIP DECT 4.0SP1
# Android version 4.1.2, Kernel 3.4.0
# Amazon FireStick and FireTV
Fingerprint Linux 2.6.32 3.10
Class Linux | Linux | 2.6.X | general purpose
CPE cpe:/o:linux:linux_kernel:2.6 auto
Class Linux | Linux | 3.X | general purpose
```

```
CPE cpe:/o:linux:linux_kernel:3 auto
SEQ(SP=ED 10B%GCD=1 6%ISR=F0 114%TI=Z%CI=Z%II=I%TS=7|8|9|A|B)
OPS(O1=M5B4ST11NW1|M5B4ST11NW2|M5B4ST11NW3|M5B4ST11NW4|M5B4ST11NW5
      ,!|M5B4ST11NW6|M5B4ST11NW7|M5B4ST11NW8|M5B4ST11NW9|M5B4ST11NWA
      ,!%O2=M5B4ST11NW1|M5B4ST11NW2|M5B4ST11NW3|M5B4ST11NW4|
      ,!M5B4ST11NW5|M5B4ST11NW6|M5B4ST11NW7|M5B4ST11NW8|M5B4ST11NW9|
      ,!M5B4ST11NWA%O3=M5B4NNT11NW1|M5B4NNT11NW2|M5B4NNT11NW3|
      ,!M5B4NNT11NW4|M5B4NNT11NW5|M5B4NNT11NW6|M5B4NNT11NW7|
      ,!M5B4NNT11NW8|M5B4NNT11NW9|M5B4NNT11NWA%O4=M5B4ST11NW1|
      ,!M5B4ST11NW2|M5B4ST11NW3|M5B4ST11NW4|M5B4ST11NW5|M5B4ST11NW6|
      ,!M5B4ST11NW7|M5B4ST11NW8|M5B4ST11NW9|M5B4ST11NWA%O5=
      ,!M5B4ST11NW1|M5B4ST11NW2|M5B4ST11NW3|M5B4ST11NW4|M5B4ST11NW5|
      ,!M5B4ST11NW6|M5B4ST11NW7|M5B4ST11NW8|M5B4ST11NW9|M5B4ST11NWA%
      ,!O6=M5B4ST11)
WIN(W1=3890%W2=3890%W3=3890%W4=3890%W5=3890%W6=3890)
ECN(R=Y%DF=Y%T=3B 45%TG=40%W=3908%O=M5B4NNSNW1|M5B4NNSNW2|
      ,!M5B4NNSNW3|M5B4NNSNW4|M5B4NNSNW5|M5B4NNSNW6|M5B4NNSNW7|
      ,!M5B4NNSNW8|M5B4NNSNW9|M5B4NNSNWA%CC=N|Y)
T1(R=Y%DF=Y%T=3B 45%TG=40%S=O%A=S+%F=AS%RD=0)
T2(R=N)
T3(R=N)
T4(R=Y%DF=Y%T=3B 45%TG=40%W=0%S=A%A=Z%F=R%RD=0)
T5(R=Y%DF=Y%T=3B 45%TG=40%W=0%S=Z%A=S+%F=AR%RD=0)
T6(R=Y%DF=Y%T=3B 45%TG=40%W=0%S=A%A=Z%F=R%RD=0)
T7(R=Y%DF=Y%T=3B 45%TG=40%W=0%S=Z%A=S+%F=AR%RD=0)
U1(DF=N%T=3B 45%TG=40%IPL=164%UN=0%RIPL=G%RID=G%RIPCK=G|I%RUCK=G%
      ,!RUD=G)
IE(DFI=N%T=3B 45%TG=40%CD=S)
```

Listing 2.7: One of many fingerprint’s

nmap-service-probes file contains the probes that the Nmap service/version detection sys-tem (-sV or -A options) uses during port interrogation to determine what program is listening on a port.

```
##############################NEXT PROBE
      ,!##############################
# SSLv3 ClientHello probe. Will be able to reliably identify the
      ,!SSL version
# used, unless the server is running SSLv2 only. Note that it will
      ,!also detect
# TLSv1 only servers, based on a failed handshake alert.
Probe TCP SSLSessionReq q|\x16\x03\0\0S\x01\0\0O\x03\0?G\xd7\xf7\
      ,!xba,\xee\xea\xb2`~\xf3\0\xfd\x82{\xb9\xd5\x96\xc8w\x9b\xe6\
      ,!xc4\xdb<=\xdbo\xef\x10n\0\0(\0\x16\0\x13\0\x0a\0f\0\x05\0\
      ,!x04\0e\0d\0c\0b\0a\0`\0\x15\0\x12\0\x09\0\x14\0\x11\0\x08\0\
      ,!x06\0\x03\x01\0|
rarity 1
ports 322,443,444,465,548,636,989,990,992,993,994,995,1241,1311,
      ,!1443,2000,2252,2443,3443,4433,4443,4444,4911,5061,5443,5550,
      ,!
      ,!  6443,6679,6697,7000,7210,7272,7443,8009,8181,8194,8443,8531,
    ,!8883,9001,9443,10443,14443,44443,60443
fallback GetRequest

# OpenSSL/0.9.7aa, 0.9.8e
match ssl m|^\x16\x03\0\0J\x02\0\0F\x03\0| p/OpenSSL/ i/SSLv3/ cpe
    ,!:/a:openssl:openssl/
# Microsoft IIS/5.0 note that OpenSSL must go above this one
    ,!because this is more general
match ssl m|^\x16\x03\0..\x02\0\0F\x03\0|s p/Microsoft IIS SSL/ o/
    ,!Windows/ cpe:/a:microsoft:iis/ cpe:/o:microsoft:windows/a
# Novell Netware 6 Enterprise Web server 5.1 https
# Novell Netware Ldap over SSL or enterprise web server 5.1 over
    ,!SSL
match ssl m|^\x16\x03\0\0:\x02\0\x006\x03\0|p/Novell NetWare SSL/
    ,! o/NetWare/ cpe:/o:novell:netware/a
# Cisco IDS 4.1 Appliance
match ssl m|^\x16\x03\0\0\*\x02\0\0&\x03\0\xd10:\xbd\\\x8e\xe3\x15
    ,!\x1c\x0fZ\xe4\x04\x87\x07\xc0\x82\xa9\xd4\x0e\x9c1LXk\xd1\
    ,!xd2\x0b\x1a\xc6/p\0\0\n\0\x16\x03\0\x026\x0b\0\x022\0| p/
    ,!Cisco IDS SSL/ d/firewall/
# PGP Corporation Keyserver Web Console 7.0custom Apache 1.3
# PGP LDAPS Keyserver 8.X
match ssl m|^\x16\x03\0\0\+\x02\0\0'\x03\0...\?|s p/PGP
    ,!Corporation product SSL/
# Unreal IRCd SSL
# RemotelyAnywhere
match ssl m|^\x16\x03\0\0\*\x02\0\0&\x03\0\?|
# Tumbleweed SecureTransport 4.1.1 Transaction Manager Secure Port
    ,! on Solaris
# Dell Openmanage
match ssl m|^\x15\x03[\x01\x00]\0\x02\x01\0$| p/multi vendor SSL/
# Probably Oracle https?
match ssl m|^}\0\x02\0\0\0\0\0\0\0\0\0\0\0\0\0| p/Oracle https/
match ssl m|^\x15\x03\0\0\x02\x02\(31666:error:1408A0C1:SSL
    ,!routines:SSL3_GET_CLIENT_HELLO:no shared cipher:s3_srvr\.c
    ,!:881:\n| p/Webmin SSL Control Panel/
match ssl m|^20928:error:140760FC:SSL routines:
    ,!SSL23_GET_CLIENT_HELLO:unknown protocol:s23_srvr\.c:565:\n|
    ,!p/qmail pop3d behind stunnel/cpe:/a:djb:qmail/
```

Listing 2.8: Some lines of nmap-service-probes

The Probe directive tells Nmap what string to send to recognize various services. All of the directives discussed later operate on the most recent Probe statement. The arguments are as follows:

1. <protocol>

   - This must be either TCP or UDP.

2. <probename>

- Plain English name for the probe.

3. <probestring>

    - Tells Nmap what to send. It must start with a q, then a delimiter character which begins and ends the string. Between the delimiter characters is the string that is actually sent.

2.5 Add new service to nmap-service-probes (create a mini-mal tcp server, get its name and version by nmap)

The source code of echo-server is shown below.

```
package server;

import java.net.*;
import java.io.*;

public class Server {

    private static int SERVER_PORT=8090;
    private static String SERVER_IP="127.0.0.1";

    private static String VERSION = "1.0";

    public static void main(String[] args) {
        try {
            ServerSocket serverSocket = new ServerSocket(
,! SERVER_PORT, 0, InetAddress.getByName(SERVER_IP));
            System.out.println("Server started.");
            Socket clientSocket = serverSocket.accept();
            PrintWriter out = new PrintWriter(clientSocket.
,! getOutputStream(), true);
            BufferedReader in = new BufferedReader(new
,! InputStreamReader(clientSocket.getInputStream()));
            String inputLine;
            while (true) {
                inputLine = in.readLine();
                if(inputLine != null){
                    if(inputLine.equals("version"))
                        out.println(VERSION);
                    else
                        out.println(inputLine);
                }
            }
        } catch (IOException e) {
            System.out.println("Exception caught when trying to
,! listen on port " + SERVER_PORT + " or listening for a
,! connection");
```

```
                System.out.println(e.getMessage());
            }
        }
}
```

Listing 2.9: Server.java

```
root@kali:~/Desktop/tcpServer# javac server/Server.java
root@kali:~/Desktop/tcpServer# java server/Server
Server started.
```

Listing 2.10: Compiling and starting server

Echo server was successfully detected, but nmap did not determine what it is, not even that this is echo-server.

```
root@kali:~# nmap sV p 8090 127.0.0.1

Starting Nmap 7.60 ( https://nmap.org ) at 2017 11 04 12:55 EDT
Nmap scan report for localhost (127.0.0.1)
Host is up (0.000045s latency).

PORT      STATE SERVICE       VERSION
8090/tcp open  opsmessaging?
1 service unrecognized despite returning data. If you know the
    ,! service/version, please submit the following fingerprint at
    ,! https://nmap.org/cgi bin/submit.cgi?new service :
SF Port8090 TCP:V=7.60%I=7%D=11/4%Time=59FDF102%P=x86_64 pc linux
    ,! gnu%r(si
SF:mple tcp server ver,8,"version\n");

Service detection performed. Please report any incorrect results
    ,! at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 11.61 seconds
```

Listing 2.11: Nmap scanning(unsuccessful)

Now add the server description to the nmap-service-probes.

```
root@kali:~# tail n7 /usr/share/nmap/nmap service probes
##################################NEXT PROBE
    ,! ##################################
# Echo TSP server.
Probe TCP echo tcp server ver q|version\r\n|
rarity 9
ports 8090
match s tc ps m|^1\.0$| p/Echo TCP Server/ v/1.0/
```

Listing 2.12: Adding description

And scan with nmap again.

```
root@kali:~# nmap sV p 8090 127.0.0.1

Starting Nmap 7.60 ( https://nmap.org ) at 2017 11 04 13:02 EDT
```

```
Nmap scan report for localhost (127.0.0.1)
Host is up (0.000065s latency).

PORT      STATE SERVICE VERSION
8090/tcp open  stcps   Echo TCP Server 1.0

Service detection performed. Please report any incorrect results
    ,! at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 6.54 seconds
```

Listing 2.13: Nmap scanning(successful)

As expected, nmap successfully determined my echo server.

2.6 Output to xml-format file

Adding oX key for output to xml file.

```
root@kali: # nmap -sV -p 8090 -oX myOutput.xml 127.0.0.1
```

```
<?xml version=”1.0” encoding=”UTF 8”?>
<!DOCTYPE nmaprun>
<?xml stylesheet href=”file:///usr/bin/../share/nmap/nmap.xsl”
    ,! type=”text/xsl”?>
<!Nmap 7.60 scan initiated Sat Nov 4 13:26:07 2017 as: nmap
    ,! sVp 8090 oX myOutput.xml 127.0.0.1>
<nmaprun scanner=”nmap” args=”nmap sV p 8090 oX myOutput.xml
    ,! 127.0.0.1” start=”1509816367” startstr=”Sat Nov 4 13:26:07
    ,! 2017” version=”7.60” xmloutputversion=”1.04”>
<scaninfo type=”syn” protocol=”tcp” numservices=”1” services
    ,! =”8090”/>
<verbose level=”0”/>
<debugging level=”0”/>
<host starttime=”1509816367” endtime=”1509816373”><status state=”
    ,! up” reason=”localhost response” reason_ttl=”0”/>
<address addr=”127.0.0.1” addrtype=”ipv4”/>
<hostnames>
<hostname name=”localhost” type=”PTR”/>
</hostnames>
<ports><port protocol=”tcp” portid=”8090”><state state=”open”
    ,! reason=”syn ack” reason_ttl=”64”/><service name=”stcps”
    ,! product=”Echo TCP Server” version=”1.0” method=”probed” conf
    ,! =”10”/></port>
</ports>
<times srtt=”48” rttvar=”5000” to=”100000”/>
</host>
<runstats><finished time=”1509816373” timestr=”Sat Nov 4 13:26:13
    ,! 2017” elapsed=”6.57” summary=”Nmap done at Sat Nov 4
    ,! 13:26:13 2017; 1 IP address (1 host up) scanned in 6.57
    ,! seconds” exit=”success”/><hosts up=”1” down=”0” total=”1”/>
```

```
</runstats>
</nmaprun>
```

Listing 2.14: myOutput.xml

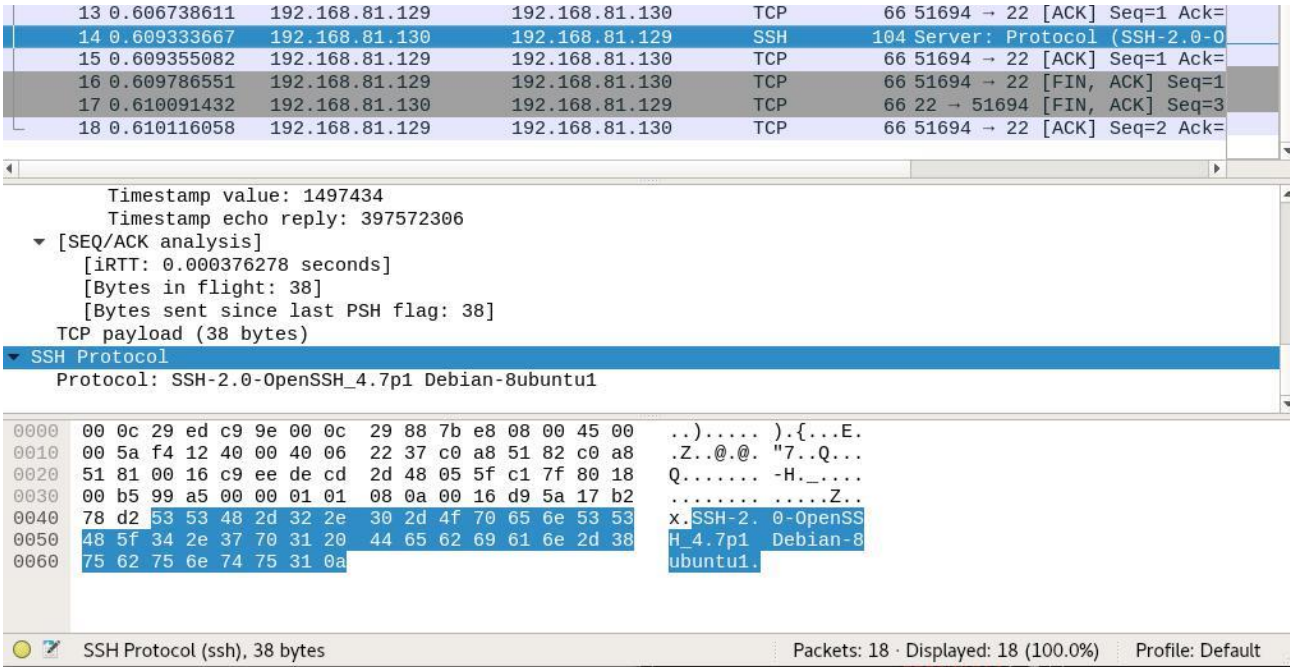
2.7 Study nmap stages and modes using Wireshark

Scanning port 22

```
root@kali:~# nmap sV 192.168.81.130 p22

Starting Nmap 7.60 ( https://nmap.org ) at 2017 11 04 14:23    EDT
Nmap scan report for 192.168.81.130
Host is up (0.00041s latency).

PORT     STATE SERVICE VERSION
22/tcp open   ssh       OpenSSH 4.7p1  Debian 8ubuntu1 (protocol 2.0)
MAC Address:    00:0C:29:88:7B:E8 (VMware)
Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel

Service detection   performed. Please report any incorrect results
    ,! at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 0.97 seconds
```

Listing 2.15: Scanning port 22

Let’s see what is in the packets, that captured with wireshark.



```
13 0.606738611   192.168.81.129   192.168.81.130   TCP    66 51694 → 22 [ACK] Seq=1 Ack=
14 0.609333667   192.168.81.130   192.168.81.129   SSH   104 Server: Protocol (SSH-2.0-O
15 0.609355082   192.168.81.129   192.168.81.130   TCP    66 51694 → 22 [ACK] Seq=1 Ack=
16 0.609786551   192.168.81.129   192.168.81.130   TCP    66 51694 → 22 [FIN, ACK] Seq=1
17 0.610091432   192.168.81.130   192.168.81.129   TCP    66 22 → 51694 [FIN, ACK] Seq=3
18 0.610116058   192.168.81.129   192.168.81.130   TCP    66 51694 → 22 [ACK] Seq=2 Ack=
```

```
        Timestamp value: 1497434
        Timestamp echo reply: 397572306
  ▾ [SEQ/ACK analysis]
      [iRTT: 0.000376278 seconds]
      [Bytes in flight: 38]
      [Bytes sent since last PSH flag: 38]
    TCP payload (38 bytes)
▾ SSH Protocol
    Protocol: SSH-2.0-OpenSSH_4.7p1 Debian-8ubuntu1
```

```
0000  00 0c 29 ed c9 9e 00 0c  29 88 7b e8 08 00 45 00   ..)..... ).{...E.
0010  00 5a f4 12 40 00 40 06  22 37 c0 a8 51 82 c0 a8   .Z..@.@. "7..Q...
0020  51 81 00 16 c9 ee de cd  2d 48 05 5f c1 7f 80 18   Q....... -H._....
0030  00 b5 99 a5 00 00 01 01  08 0a 00 16 d9 5a 17 b2   ........ .....Z..
0040  78 d2 53 53 48 2d 32 2e  30 2d 4f 70 65 6e 53 53   x.SSH-2. 0-OpenSS
0050  48 5f 34 2e 37 70 31 20  44 65 62 69 61 6e 2d 38   H_4.7p1  Debian-8
0060  75 62 75 6e 74 75 31 0a                            ubuntu1.
```

SSH Protocol (ssh), 38 bytes
Packets: 18 · Displayed: 18 (100.0%)
Profile: Default

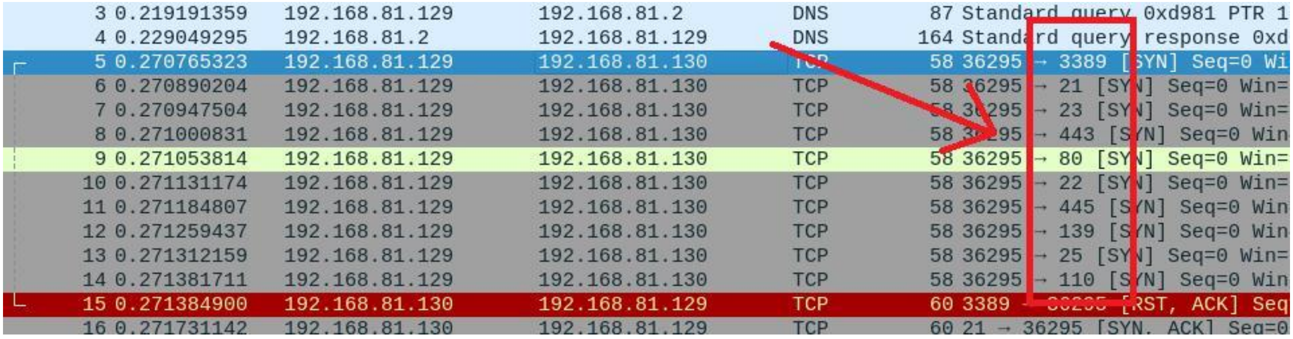
Figure 2.5: Wireshark packets

In response message, we see name of service at this port.

Now let’s see what happens when the command below is used.

```
root@kali:~# nmap top ports 10 192.168.81.130

Starting Nmap 7.60 ( https://nmap.org ) at 2017 11 04 14:57 EDT
Nmap scan report for 192.168.81.130
Host is up (0.00080s latency).

PORT       STATE   SERVICE
21/tcp     open    ftp
22/tcp     open    ssh
23/tcp     open    telnet
25/tcp     open    smtp
80/tcp     open    http
110/tcp    closed  pop3
139/tcp    open    netbios ssn
443/tcp    closed  https
445/tcp    open    microsoft ds
3389/tcp   closed  ms wbt server
MAC Address: 00:0C:29:88:7B:E8 (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.57 seconds
```

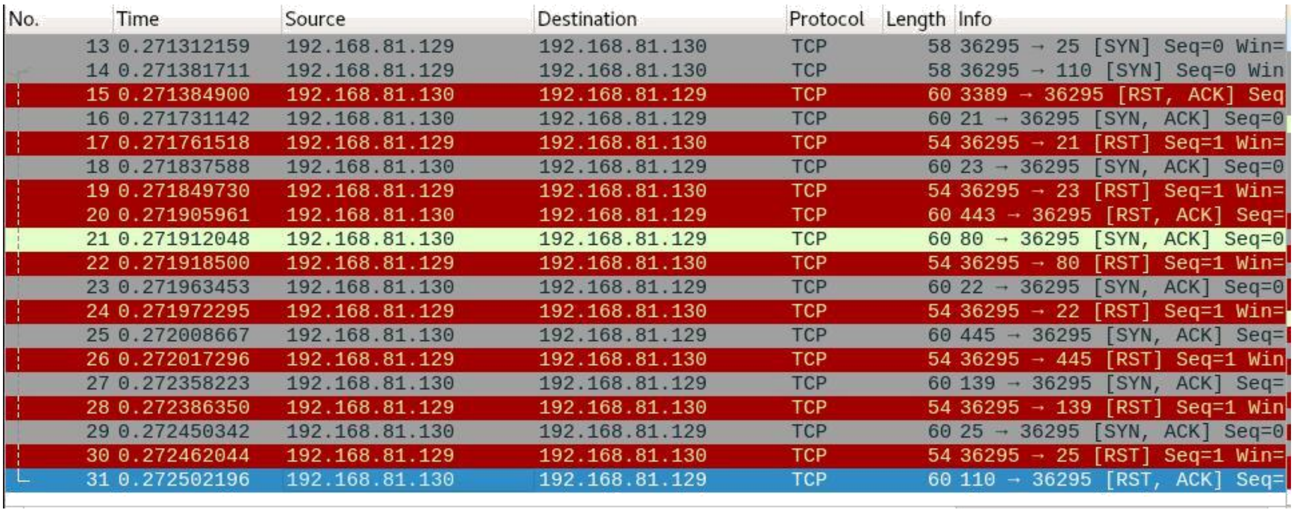
Listing 2.16: 10 most popular ports



```
 3 0.219191359   192.168.81.129   192.168.81.2     DNS    87 Standard query 0xd981 PTR 1
 4 0.229049295   192.168.81.2     192.168.81.129   DNS   164 Standard query response 0xd
 5 0.270765323   192.168.81.129   192.168.81.130   TCP    58 36295 → 3389 [SYN] Seq=0 Wi
 6 0.270890204   192.168.81.129   192.168.81.130   TCP    58 36295 → 21 [SYN] Seq=0 Win=
 7 0.270947504   192.168.81.129   192.168.81.130   TCP    58 36295 → 23 [SYN] Seq=0 Win=
 8 0.271000831   192.168.81.129   192.168.81.130   TCP    58 36295 → 443 [SYN] Seq=0 Win
 9 0.271053814   192.168.81.129   192.168.81.130   TCP    58 36295 → 80 [SYN] Seq=0 Win=
10 0.271131174   192.168.81.129   192.168.81.130   TCP    58 36295 → 22 [SYN] Seq=0 Win=
11 0.271184807   192.168.81.129   192.168.81.130   TCP    58 36295 → 445 [SYN] Seq=0 Win
12 0.271259437   192.168.81.129   192.168.81.130   TCP    58 36295 → 139 [SYN] Seq=0 Win
13 0.271312159   192.168.81.129   192.168.81.130   TCP    58 36295 → 25 [SYN] Seq=0 Win=
14 0.271381711   192.168.81.129   192.168.81.130   TCP    58 36295 → 110 [SYN] Seq=0 Win
15 0.271384900   192.168.81.130   192.168.81.129   TCP    60 3389 → 36295 [RST, ACK] Seq
16 0.271731142   192.168.81.130   192.168.81.129   TCP    60 21 → 36295 [SYN, ACK] Seq=0
```

Figure 2.6: Wireshark packets

The screenshot highlights that 10 requests were sent to the most popular ports.

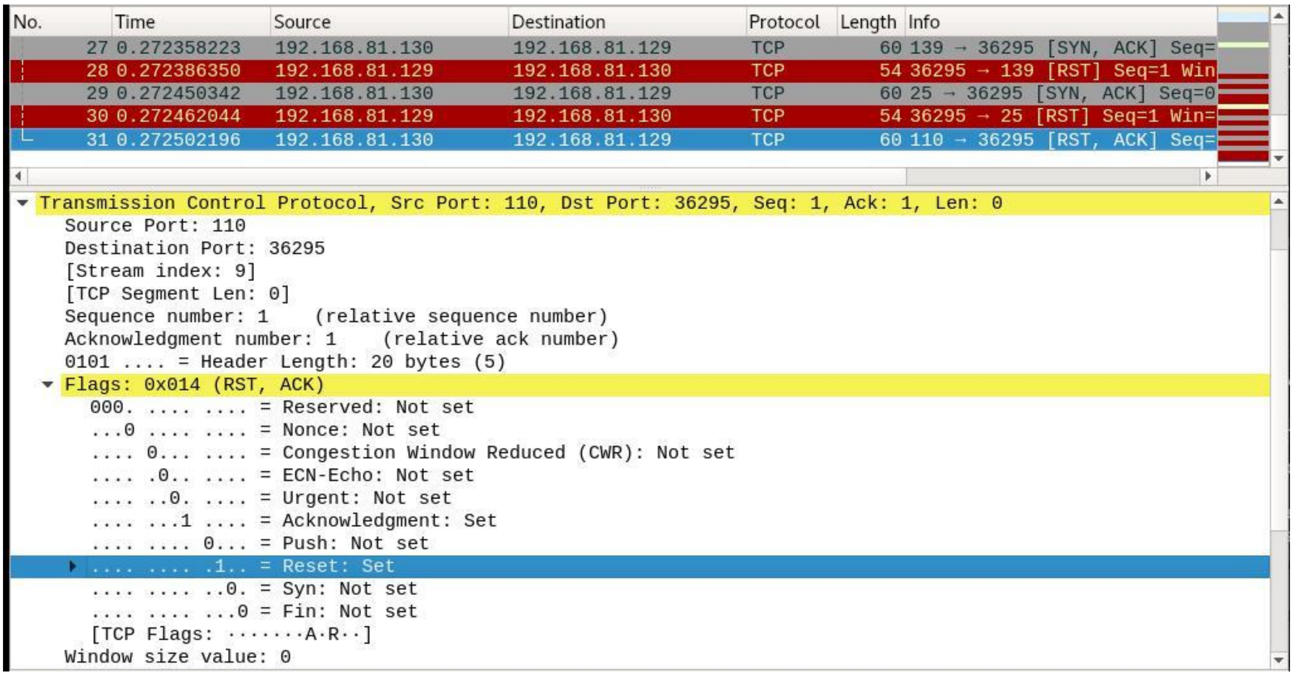


```
No.   Time          Source           Destination      Protocol  Length Info
   13 0.271312159   192.168.81.129   192.168.81.130   TCP          58 36295 → 25 [SYN] Seq=0 Win=
   14 0.271381711   192.168.81.129   192.168.81.130   TCP          58 36295 → 110 [SYN] Seq=0 Win
   15 0.271384900   192.168.81.130   192.168.81.129   TCP          60 3389 → 36295 [RST, ACK] Seq
   16 0.271731142   192.168.81.130   192.168.81.129   TCP          60 21 → 36295 [SYN, ACK] Seq=0
   17 0.271761518   192.168.81.129   192.168.81.130   TCP          54 36295 → 21 [RST] Seq=1 Win=
   18 0.271837588   192.168.81.130   192.168.81.129   TCP          60 23 → 36295 [SYN, ACK] Seq=0
   19 0.271849730   192.168.81.129   192.168.81.130   TCP          54 36295 → 23 [RST] Seq=1 Win=
   20 0.271905961   192.168.81.130   192.168.81.129   TCP          60 443 → 36295 [RST, ACK] Seq=
   21 0.271912048   192.168.81.130   192.168.81.129   TCP          60 80 → 36295 [SYN, ACK] Seq=0
   22 0.271918500   192.168.81.129   192.168.81.130   TCP          54 36295 → 80 [RST] Seq=1 Win=
   23 0.271963453   192.168.81.130   192.168.81.129   TCP          60 22 → 36295 [SYN, ACK] Seq=0
   24 0.271972295   192.168.81.129   192.168.81.130   TCP          54 36295 → 22 [RST] Seq=1 Win=
   25 0.272008667   192.168.81.130   192.168.81.129   TCP          60 445 → 36295 [SYN, ACK] Seq=
   26 0.272017296   192.168.81.129   192.168.81.130   TCP          54 36295 → 445 [RST] Seq=1 Win
   27 0.272358223   192.168.81.130   192.168.81.129   TCP          60 139 → 36295 [SYN, ACK] Seq=
   28 0.272386350   192.168.81.129   192.168.81.130   TCP          54 36295 → 139 [RST] Seq=1 Win
   29 0.272450342   192.168.81.130   192.168.81.129   TCP          60 25 → 36295 [SYN, ACK] Seq=0
   30 0.272462044   192.168.81.129   192.168.81.130   TCP          54 36295 → 25 [RST] Seq=1 Win=
   31 0.272502196   192.168.81.130   192.168.81.129   TCP          60 110 → 36295 [RST, ACK] Seq=
```

Figure 2.7: Wireshark packets

As result wireshark got 10 answers. Now let’s how nmap understand that port state is open or closed.

For example port 110 in state closed.

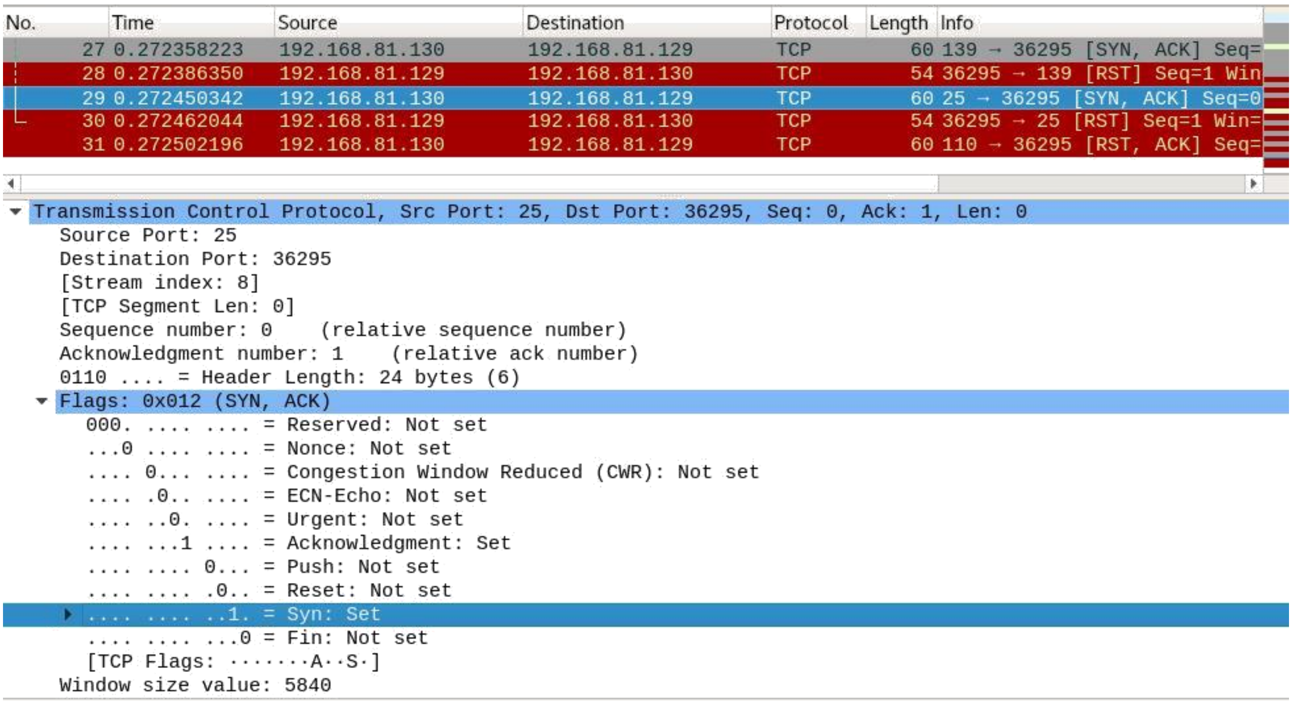


```
No.   Time          Source           Destination      Protocol  Length Info
   27 0.272358223   192.168.81.130   192.168.81.129   TCP          60 139 → 36295 [SYN, ACK] Seq=
   28 0.272386350   192.168.81.129   192.168.81.130   TCP          54 36295 → 139 [RST] Seq=1 Win
   29 0.272450342   192.168.81.130   192.168.81.129   TCP          60 25 → 36295 [SYN, ACK] Seq=0
   30 0.272462044   192.168.81.129   192.168.81.130   TCP          54 36295 → 25 [RST] Seq=1 Win=
   31 0.272502196   192.168.81.130   192.168.81.129   TCP          60 110 → 36295 [RST, ACK] Seq=

Transmission Control Protocol, Src Port: 110, Dst Port: 36295, Seq: 1, Ack: 1, Len: 0
    Source Port: 110
    Destination Port: 36295
    [Stream index: 9]
    [TCP Segment Len: 0]
    Sequence number: 1    (relative sequence number)
    Acknowledgment number: 1    (relative ack number)
    0101 .... = Header Length: 20 bytes (5)
  Flags: 0x014 (RST, ACK)
      000. .... .... = Reserved: Not set
      ...0 .... .... = Nonce: Not set
      .... 0... .... = Congestion Window Reduced (CWR): Not set
      .... .0.. .... = ECN-Echo: Not set
      .... ..0. .... = Urgent: Not set
      .... ...1 .... = Acknowledgment: Set
      .... .... 0... = Push: Not set
      .... .... .1.. = Reset: Set
      .... .... ..0. = Syn: Not set
      .... .... ...0 = Fin: Not set
      [TCP Flags: ·······A·R··]
    Window size value: 0
```

Figure 2.8: TCP flag RST

This porst is closed, because in response messege we got RST flag, which means, accord-ing to the tcp methodology, that there is no connection.

Port 25(Open) don’t have this flag.



```
No.  Time         Source          Destination     Protocol Length Info
  27 0.272358223  192.168.81.130  192.168.81.129  TCP      60 139 → 36295 [SYN, ACK] Seq=
  28 0.272386350  192.168.81.129  192.168.81.130  TCP      54 36295 → 139 [RST] Seq=1 Win
  29 0.272450342  192.168.81.130  192.168.81.129  TCP      60 25 → 36295 [SYN, ACK] Seq=0
  30 0.272462044  192.168.81.129  192.168.81.130  TCP      54 36295 → 25 [RST] Seq=1 Win=
  31 0.272502196  192.168.81.130  192.168.81.129  TCP      60 110 → 36295 [RST, ACK] Seq=

▾ Transmission Control Protocol, Src Port: 25, Dst Port: 36295, Seq: 0, Ack: 1, Len: 0
    Source Port: 25
    Destination Port: 36295
    [Stream index: 8]
    [TCP Segment Len: 0]
    Sequence number: 0    (relative sequence number)
    Acknowledgment number: 1    (relative ack number)
    0110 .... = Header Length: 24 bytes (6)
  ▾ Flags: 0x012 (SYN, ACK)
      000. .... .... = Reserved: Not set
      ...0 .... .... = Nonce: Not set
      .... 0... .... = Congestion Window Reduced (CWR): Not set
      .... .0.. .... = ECN-Echo: Not set
      .... ..0. .... = Urgent: Not set
      .... ...1 .... = Acknowledgment: Set
      .... .... 0... = Push: Not set
      .... .... .0.. = Reset: Not set
    ▸ .... .... ..1. = Syn: Set
      .... .... ...0 = Fin: Not set
      [TCP Flags: ·······A··S·]
    Window size value: 5840
```

Figure 2.9: RST flag not setted

2.8 Perform VM Metasploitable2 scanning using db_nmap from metasploit framework

To use db_nmap, need to perform steps below:

1. start posgresql server;
2. initialize the database with the msfdb init command;
3. start the console of the msfconsole.

Then use db_nmap, which has same functionality as nmap, but all results will be stored in the database.

```
msf > db_nmap v sV 192.168.81.130
[*] Nmap: Starting Nmap 7.60 ( https://nmap.org ) at 2017 11 04
   ,! 22:24 EDT
[*] Nmap: NSE: Loaded 42 scripts for scanning.
[*] Nmap: Initiating ARP Ping Scan at 22:24
[*] Nmap: Scanning 192.168.81.130 [1 port]
[*] Nmap: Completed ARP Ping Scan at 22:24,0.26s elapsed (1 total
   ,!hosts )
[*] Nmap: Initiating Parallel DNS resolution of 1 host. at 22:24
[*] Nmap: Completed ParallelDNS resolution of 1host. at 22:24,
   ,! 0.00s elapsed
[*] Nmap: Initiating SYN StealthScan at 22:24
[*] Nmap: Scanning 192.168.119.128 [1000 ports]
[*] Nmap: Discovered open port 25/tcp on 192.168.81.130
[*] Nmap: Discovered open port 53/tcp on 192.168.81.130
    Nmap: Discovered open port 139/tcp on 192.168.81.130
[*]
```

```
[*] Nmap: Discovered open port 23/tcp on 192.168.81.130
[*] Nmap: Discovered open port 21/tcp on 192.168.81.130
[*] Nmap: Discovered open port 445/tcp on 192.168.81.130
[*] Nmap: Discovered open port 22/tcp on 192.168.81.130
[*] Nmap: Discovered open port 5900/tcp on 192.168.81.130
[*] Nmap: Discovered open port 111/tcp on 192.168.81.130
[*] Nmap: Discovered open port 3306/tcp on 192.168.81.130
[*] Nmap: Discovered open port 80/tcp on 192.168.81.130
[*] Nmap: Discovered open port 8180/tcp on 192.168.81.130
[*] Nmap: Discovered open port 6667/tcp on 192.168.81.130
[*] Nmap: Discovered open port 2049/tcp on 192.168.81.130
[*] Nmap: Discovered open port 8009/tcp on 192.168.81.130
[*] Nmap: Discovered open port 514/tcp on 192.168.81.130
[*] Nmap: Discovered open port 6000/tcp on 192.168.81.130
[*] Nmap: Discovered open port 513/tcp on 192.168.81.130
[*] Nmap: Discovered open port 1524/tcp on 192.168.81.130
[*] Nmap: Discovered open port 512/tcp on 192.168.81.130
[*] Nmap: Discovered open port 2121/tcp on 192.168.81.130
[*] Nmap: Discovered open port 5432/tcp on 192.168.81.130
[*] Nmap: Discovered open port 1099/tcp on 192.168.81.130
[*] Nmap: Completed SYN Stealth Scan at 22:24, 9.45s elapsed (1000
    ,!total ports)
[*] Nmap: Initiating Service scan at 22:24
[*] Nmap: Scanning 23 services on 192.168.81.130
[*] Nmap: Completed Service scan at 22:24, 14.22s elapsed (23
    ,!services on 1 host)
[*] Nmap: NSE: Script scanning 192.168.81.130.
[*] Nmap: Initiating NSE at 22:24
[*] Nmap: Completed NSE at 22:24, 0.92s elapsed
[*] Nmap: Initiating NSE at 22:24
[*] Nmap: Completed NSE at 22:24, 0.09s elapsed
[*] Nmap: Nmap scan report for 192.168.81.130
[*] Nmap: Host is up (0.00089s latency).
[*] Nmap: Not shown: 977 closed ports
[*] Nmap: PORT STATE SERVICE VERSION
[*] Nmap: 21/tcp open ftp vsftpd 2.3.4
[*] Nmap: 22/tcp open ssh OpenSSH 4.7p1 Debian 8ubuntu1 (protocol
    ,!2.0)
[*] Nmap: 23/tcp open telnet Linux telnetd
[*] Nmap: 25/tcp open smtp Postfix smtpd
[*] Nmap: 53/tcp open domain ISC BIND 9.4.2
[*] Nmap: 80/tcp open http Apache httpd 2.2.8 ((Ubuntu) DAV/2)
[*] Nmap: 111/tcp open rpcbind 2 (RPC #100000)
[*] Nmap: 139/tcp open netbios ssn Samba smbd 3.X 4.X (workgroup
    ,!: WORKGROUP)
[*] Nmap: 445/tcp open netbios ssn Samba smbd 3.X 4.X (workgroup
    ,!: WORKGROUP)
[*] Nmap: 512/tcp open exec netkit rsh rexecd
[*] Nmap: 513/tcp open login OpenBSD or Solaris rlogind

[*] Nmap: 514/tcp open tcpwrapped
[*] Nmap: 1099/tcp open rmiregistry GNU Classpath grmiregistry
[*] Nmap: 1524/tcp open shell Metasploitable root shell
[*] Nmap: 2049/tcp open nfs 2 4 (RPC #100003)
[*] Nmap: 2121/tcp open ftp ProFTPD 1.3.1
[*] Nmap: 3306/tcp open mysql MySQL 5.0.51a 3ubuntu5
[*] Nmap: 5432/tcp open postgresql PostgreSQL DB 8.3.08.3.7
[*] Nmap: 5900/tcp open vnc VNC (protocol 3.3)
[*] Nmap: 6000/tcp open X11 (access denied)
[*] Nmap: 6667/tcp open irc UnrealIRCd
[*] Nmap: 8009/tcp open ajp13 Apache Jserv (Protocol v1.3)
[*] Nmap: 8180/tcp open http Apache Tomcat/Coyote JSP engine 1.1
[*] Nmap: MAC Address: 00:0C:29:88:7b:e8 (VMware)
[*] Nmap: Service Info: Hosts: metasploitable.localdomain,
   ,!localhost,irc.Metasploitable.LAN; OSs: Unix, Linux;
CPE: cpe:/o:linux:linux_kernel
[*] Nmap: Read data files from: /usr/bin/../share/nmap
[*] Nmap: Service detection performed. Please report any incorrect
   ,!results at https://nmap.org/submit/ .
[*] Nmap: Nmap done: 1 IP address (1 host up) scanned in 32.19
   ,! seconds
[*] Nmap: Raw packets sent: 1411 (61.821KB) | Rcvd: 1411 (55.542KB
   ,!)
```

Listing 2.17: db_nmap output

2.9 Get 5 records from nmap-service-probes and describe them.

Let’s analyze a Listing 2.8. It describes the behavior of various services that work with the SIP protocol.

Line 12975 separates one set of rules from another.

Line 12979 contains the probe directive. It is used to indicate which data is sent during the service definition process. The command already analyzed at page 10.

In the line 12980, the rarity parameter is set to 1. The higher its value (maximum 9), the fewer chances to expect results from this test.

The line 12981 indicates the port number to which data will be sent from the probe direc-tive. In our case, we use array of ports (then they are separated by commas), but in general there can be one single port. Also, if needed to install an encrypted connection over SSL (then the sslports directive is used instead of the ports).

Now let’s analyze 12988, 12991, 12993 lines. All theese lines had the match directive that tells nmap how to accurately determine the service using the received response to the re-quest sent by the previous probe directive. This directive is used in the case when the received response completely coincides with the template. In this case, the testing of the port is con-sidered complete, and with the help of additional specifiers, nmap builds a report on the name of the application, the version number and additional information received during the test.

The syntax of the match:

match <service> <pattern> [<versioninfo>]

where

- service - This is simply the service name that the pattern matches. Examples would be ssh, smtp, http, or snmp. As a special case, you can prefix the service name with ssl/, as in ssl/vmware-auth. In that case, the service would be stored as vmware-auth tunneled by SSL.
- pattern - This pattern is used to determine whether the response received matches the service given in the previous parameter. The format is like Perl, with the syntax being m/[regex]/[opts]. The “m” tells Nmap that a match string is beginning. The forward slash
  (/) is a delimiter, which can be substituted by almost any printable character as long as the second slash is also replaced to match.
- versioninfo - The <versioninfo> section actually contains several optional fields. Each field begins with an identifying letter (such as h for “hostname”). Next comes a delimiter character which the signature writer chooses. The preferred delimiter is slash (‘/’) un-less that is used in the field itself. Next comes the field value, followed by the delimiter character.

2.10 Choose one Nmap Script and describe it

Let’s describe script named as unittest.nse.

```
local stdnse = require ”stdnse”
local unittest = require ”unittest”

description = [[
Runs unit tests on all NSE libraries.
]]


@args unittest.run     Run tests. Causes <code>unittest.testing()</
    ,! code> to
                       return true.

    @args unittest.tests Run tests from only these libraries (,! d
    efaults to all)

@usage
    nmap   script unittest   script args  unittest.run

@output
Pre scan script results:
| unittest:
|_ All tests passed

author = ”Daniel Miller”

license = ”Same as Nmap See https://nmap.org/book/man legal.html”

categories = {”safe”}

```

```
28
29 prerule = unittest.testing
30
31 action = function()
32   local libs = stdnse.get_script_args(”unittest.tests”)
33   local result
34   if libs then
35     result = unittest.run_tests(libs)
36   else
37     result = unittest.run_tests()
38   end
39   if #result == 0 then
40     return ”All tests passed”
41   else
42     return result
43   end
44 end
```

Listing 2.18: unittest.nse

In first two lines, variables stdnse and unittest are declared for later use in the script.

In line 4 describes the purpose of this module - run unit tests on all NSE libraries.

In line’s from 9 to 20 we see comment’s, what arguments must be passed, example of usage and output of result.

In the line 22 the author is indicated, in the 24th line the type of license.

Line 26 defines the categories of the script. There are 10 categories in total. The safe cat-egory says that the script is safe, and his work will not lead to incorrect operation or stopping of any service.

In the remaining lines, the main logic of the script is presented. In the parameter, you can specify libraries and only for them will be held a unittest’s. If you do not specify a parameter, the unittests will be run for all libraries. To perform tests, the unittest.run_tests() function is calling, and if its return result 0 then this means that all tests were successful.

Conclusion

As result in this report i learned how to use nmap tool - a powerful tool for researching a new network or studying the effects of external penetration.

Nmap features include:

- Host discovery – Identifying hosts on a network. For example, listing the hosts that re-spond to TCP and/or ICMP requests or have a particular port open.
- Port scanning – Enumerating the open ports on target hosts.
- Version detection – Interrogating network services on remote devices to determine application name and version number.
- OS detection – Determining the operating system and hardware characteristics of net-work devices.

Also results can be saved in external XML file or into database, using db_nmap.