Nmap Cheatsheet

Contents

This document shall contain everything I have learned so far about nmap. I must keep it up-to-date because I feel a bit inundated in this cybersecurity journey to be frank.

1 Basic Nmap Commands

1.1 Service and Version Detection (-sV)

This is the Service Detection flag *(yes; `-sV` is a single flag, not a combination of both `s` AND `V`)*, which will tell you the name and description of the identified services.

Service and Version Detection

```
$ sudo nmap -sV {target_IP}

Starting Nmap 7.80 ( https://nmap.org ) at 2025-03-28 06:27 GMT
Nmap scan report for 10.10.171.202
Host is up (0.00011s latency).
Not shown: 994 closed ports
PORT     STATE SERVICE    VERSION
7/tcp    open  echo
9/tcp    open  tcpwrapped
13/tcp   open  daytime?
17/tcp   open  qotd?
22/tcp   open  ssh        OpenSSH 9.6p1 Ubuntu 3ubuntu13.5 (Ubuntu
    Linux; protocol 2.0)
8008/tcp open  http       lighttpd 1.4.74

2 services unrecognized despite returning data. If you know the
   service/version, please submit the following fingerprints at
   https://nmap.org/cgi-bin/submit.cgi?new-service :
# [Detailed fingerprint data omitted for brevity]

MAC Address: 02:89:EC:B7:74:EF (Unknown)
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 14.00 seconds
```

1.2 Default Script Scan (-sC)

I sometimes use this one instead of `-sV` because it runs *default scripts*[1], which can give out additional information depending on the services running on the target. You can see a comparison in outputs between the two flags in the two boxes below.

Default Script Scan

```
$ sudo nmap -p- -sC {target_IP} # Do you notice how I had to scan all ports, not
just the top 1000 most common?

Starting Nmap 7.80 ( https://nmap.org ) at 2025-03-28 09:22 GMT
Nmap scan report for 10.10.219.233
Host is up (0.00024s latency).
Not shown: 65526 closed ports
PORT    STATE SERVICE
22/tcp  open  ssh
25/tcp  open  smtp
|_smtp-commands: debra2.thm.local, PIPELINING, SIZE 10240000, VRFY, ETRN, STARTTLS
    , ENHANCEDSTATUSCODES, 8BITMIME, DSN, CHUNKING,
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
|_ssl-date: TLS randomness does not represent time
53/tcp  open  domain
| dns-nsid:
|_  bind.version: 9.18.28-1~deb12u2-Debian
80/tcp  open  http
|_http-title: Welcome to nginx on Debian!
110/tcp open  pop3
|_pop3-capabilities: PIPELINING SASL UIDL STLS AUTH-RESP-CODE RESP-CODES CAPA TOP
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
111/tcp open  rpcbind
| rpcinfo:
|   program version    port/proto  service
|   100000  2,3,4        111/tcp   rpcbind
|   100000  2,3,4        111/udp   rpcbind
|   100000  3,4          111/tcp6  rpcbind
|_  100000  3,4          111/udp6  rpcbind
143/tcp open  imap
|_imap-capabilities: more LOGIN-REFERRALS have IDLE post-login STARTTLS listed
    ENABLE capabilities LOGINDISABLEDA0001 Pre-login SASL-IR OK ID LITERAL+
    IMAP4rev1
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
993/tcp open  imaps
|_imap-capabilities: LOGIN-REFERRALS more IDLE capabilities OK post-login ENABLE
    listed have Pre-login SASL-IR AUTH=PLAINA0001 ID LITERAL+ IMAP4rev1
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
995/tcp open  pop3s
|_pop3-capabilities: PIPELINING SASL(PLAIN) UIDL USER AUTH-RESP-CODE RESP-CODES
    CAPA TOP
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
MAC Address: 02:DD:7B:88:3D:75 (Unknown)

Nmap done: 1 IP address (1 host up) scanned in 20.77 seconds
```

[1] Default NSE Scripts, Nmap.org

Service Version Detection for Comparison

```
$ sudo nmap -sV {target_IP}

Starting Nmap 7.80 ( https://nmap.org ) at 2025-03-28 09:21 GMT
Nmap scan report for 10.10.219.233
Host is up (0.0062s latency).
Not shown: 991 closed ports
PORT    STATE SERVICE  VERSION
22/tcp  open  ssh      OpenSSH 9.2p1 Debian 2+deb12u3 (protocol 2.0)
25/tcp  open  smtp     Postfix smtpd
53/tcp  open  domain   ISC BIND 9.18.28-1~deb12u2 (Debian Linux)
80/tcp  open  http     nginx 1.22.1
110/tcp open  pop3     Dovecot pop3d
111/tcp open  rpcbind  2-4 (RPC #100000)
143/tcp open  imap     Dovecot imapd
993/tcp open  ssl/imap Dovecot imapd
995/tcp open  ssl/pop3 Dovecot pop3d
MAC Address: 02:DD:7B:88:3D:75 (Unknown)
Service Info: Host:  debra2.thm.local; 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 13.00 seconds
```

1.3 OS Detection (-O)

Nmap sends a series of TCP and UDP packets to the remote host and examines practically every bit in the responses.

OS Detection Scan

```
$ sudo nmap -O {target_IP}

Starting Nmap 7.95 ( https://nmap.org ) at 2025-03-28 18:41 +03
Nmap scan report for # {redacted}
Host is up (0.0044s latency).
Not shown: 994 closed tcp ports (reset)
PORT     STATE    SERVICE
21/tcp   filtered ftp
22/tcp   filtered ssh
23/tcp   filtered telnet
53/tcp   open     domain
80/tcp   open     http
8022/tcp filtered oa-system
MAC Address: # {redacted}
Device type: general purpose
Running: Linux 3.X|4.X|5.X
OS CPE: cpe:/o:linux:linux_kernel:3 cpe:/o:linux:linux_kernel:4 cpe:/o:linux:linux_kernel:5
OS details: Linux 3.10 - 4.11, Linux 5.10 - 5.13
Network Distance: 1 hop
```

1.4 Aggressive Scan

What if you can have both OS detection and version detection with a single scan? That's what the aggressive scan is for. It enables OS detection, version detection, script scanning, and traceroute.

Aggressive Scan

```
$ sudo nmap -A {target_IP}

Starting Nmap 7.80 ( https://nmap.org ) at 2025-03-28 09:21 GMT
Nmap scan report for 10.10.219.233
Host is up (0.0062s latency).
Not shown: 991 closed ports
PORT    STATE SERVICE  VERSION
22/tcp  open  ssh      OpenSSH 9.2p1 Debian 2+deb12u3 (protocol 2.0)
| ssh-hostkey:
|   256 b9:bc:8f:01:5f:59:23:d3:3a:a2:2d:04:10:e5:04:2d (ECDSA)
|_  256 c0:11:12:52:14:b3:e2:3d:41:bc:3e:94:bb:73:5f:89 (ED25519)
25/tcp  open  smtp     Postfix smtpd
|_smtp-commands: debra2.thm.local, PIPELINING, SIZE 10240000, VRFY, ETRN, STARTTLS, ENHANCEDSTATUSCODES, 8BITMIME, DSN,
   CHUNKING,
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
53/tcp  open  domain   ISC BIND 9.18.28-1~deb12u2 (Debian Linux)
| dns-nsid:
|_  bind.version: 9.18.28-1~deb12u2-Debian
80/tcp  open  http     nginx 1.22.1
|_http-title: Welcome to nginx on Debian!
|_http-server-header: nginx/1.22.1
110/tcp open  pop3     Dovecot pop3d
|_pop3-capabilities: PIPELINING SASL UIDL STLS AUTH-RESP-CODE RESP-CODES CAPA TOP
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
111/tcp open  rpcbind  2-4 (RPC #100000)
| rpcinfo:
|   program version    port/proto  service
|   100000  2,3,4        111/tcp   rpcbind
|   100000  2,3,4        111/udp   rpcbind
|   100000  3,4          111/tcp6  rpcbind
|_  100000  3,4          111/udp6  rpcbind
143/tcp open  imap     Dovecot imapd
|_imap-capabilities: more LOGIN-REFERRALS have IDLE post-login STARTTLS listed ENABLE capabilities LOGINDISABLEDA0001 Pre-
   login SASL-IR OK ID LITERAL+ IMAP4rev1
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
993/tcp open  imaps?
| fingerprint-strings:
|   DNSStatusRequestTCP, DNSVersionBindReqTCP, Help, RPCCheck, SSLSessionReq, TerminalServerCookie:
|     * OK [CAPABILITY IMAP4rev1 SASL-IR LOGIN-REFERRALS ID ENABLE IDLE LITERAL+ AUTH=PLAIN] Dovecot ready.
|   GenericLines, NULL:
|     * OK [CAPABILITY IMAP4rev1 SASL-IR LOGIN-REFERRALS ID ENABLE IDLE LITERAL+ AUTH=PLAIN] Dovecot (Debian) ready.
|   GetRequest:
|     * OK [CAPABILITY IMAP4rev1 SASL-IR LOGIN-REFERRALS ID ENABLE IDLE LITERAL+ AUTH=PLAIN] Dovecot ready.
|     BAD Command received in invalid state.
|   HTTPOptions:
|     * OK [CAPABILITY IMAP4rev1 SASL-IR LOGIN-REFERRALS ID ENABLE IDLE LITERAL+ AUTH=PLAIN] Dovecot ready.
|     BAD Command received in invalid state.
|   RTSPRequest:
|     * OK [CAPABILITY IMAP4rev1 SASL-IR LOGIN-REFERRALS ID ENABLE IDLE LITERAL+ AUTH=PLAIN] Dovecot ready.
|     BAD Command received in invalid state.
|_    OPTIONS RTSP/1.0
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
995/tcp open  pop3s?
| fingerprint-strings:
|   DNSStatusRequestTCP, DNSVersionBindReqTCP, GenericLines, GetRequest, HTTPOptions, Help, NULL, RPCCheck, RTSPRequest,
   SSLSessionReq, TerminalServerCookie:
|_    +OK Dovecot (Debian) ready.
| ssl-cert: Subject: commonName=debra2.thm.local
| Not valid before: 2021-08-10T12:10:58
|_Not valid after:  2031-08-08T12:10:58
MAC Address: 02:DD:7B:88:3D:75 (Unknown)
Device type: general purpose
Running: Linux 5.X
OS CPE: cpe:/o:linux:linux_kernel:5
OS details: Linux 5.0 - 5.4
Network Distance: 1 hop
Service Info: Host:  debra2.thm.local; OS: Linux; CPE: cpe:/o:linux:linux_kernel

TRACEROUTE
HOP RTT     ADDRESS
1   6.16 ms 10.10.219.233

OS and Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 22.77 seconds
```

2 Host Discovery

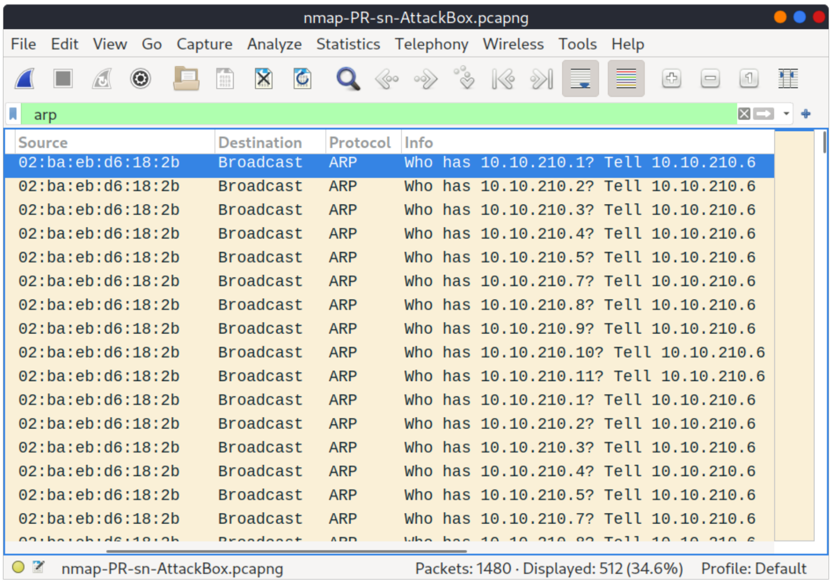
2.1 ARP Scan (-PR)

The ARP scan, `-PR`, is what you'd typically use if you're already in the network that you want to scan for live systems. The `-sn` flag here is necessary because it prevents nmap from scanning for open ports after the ARP scan.

ARP Scan

```
$ sudo nmap -sn -PR 192.168.100.7/24

Starting Nmap 7.95 ( https://nmap.org ) at 2025-03-29 02:07 +03
Nmap scan report for 192.168.100.1
Host is up (0.0016s latency).
MAC Address: # This will show for all the live hosts, for all the
upcoming Discovery Host scans in this document, but I'll redact
them just in case.
Nmap scan report for 192.168.100.9
Host is up (0.092s latency).
Nmap scan report for 192.168.100.12
Host is up (0.054s latency).
Nmap scan report for 192.168.100.13
Host is up (0.11s latency).
Nmap scan report for 192.168.100.15
Host is up (0.082s latency).
Nmap scan report for 192.168.100.16
Host is up (0.10s latency).
Nmap scan report for 192.168.100.25
Host is up (0.053s latency).
Nmap scan report for 192.168.100.28
Host is up (0.061s latency).
Nmap scan report for 192.168.100.7
Host is up.
Nmap done: 256 IP addresses (9 hosts up) scanned in 28.27 seconds
```


nmap-PR-sn-AttackBox.pcapng
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
arp

```
Source             Destination  Protocol  Info
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.1? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.2? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.3? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.4? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.5? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.7? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.8? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.9? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.10? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.11? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.1? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.2? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.3? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.4? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.5? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.7? Tell 10.10.210.6
02:ba:eb:d6:18:2b  Broadcast    ARP       Who has 10.10.210.8? Tell 10.10.210.6
```

nmap-PR-sn-AttackBox.pcapng   Packets: 1480 · Displayed: 512 (34.6%)   Profile: Default

Figure 1: Wireshark capture of ARP scan packets, a network different from the aforementioned by the way.

2.2 ICMP Scans

> We'd rarely send these ICMP packets for the discovery of our system's own subnet, ARP Scans would be better in that case since firewalls tend to block ICMP packets a lot.

2.2.I Echo Scan (-PE)

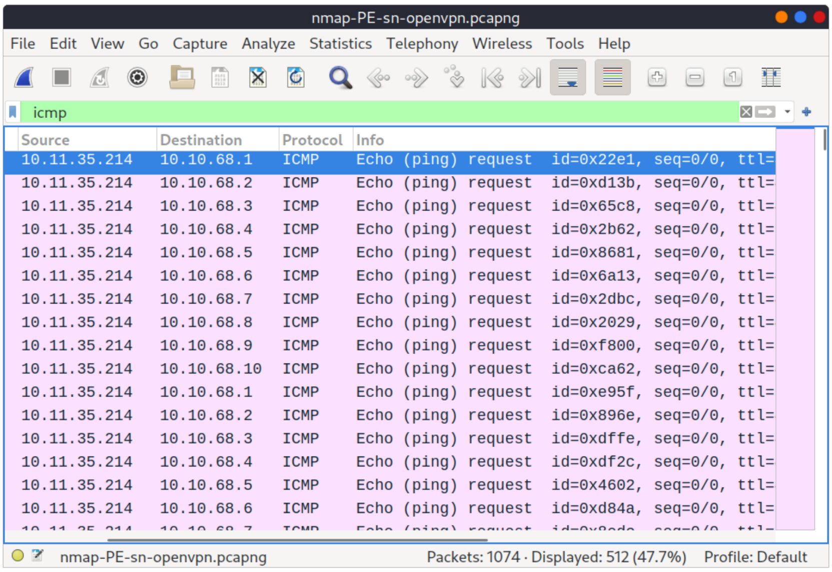
Either way, the `-PE` scan sends the ICMP Type 8 packets (i.e. same as your `ping` command).

ICMP Echo Scan (-PE)

```
$ sudo nmap -sn -PE 192.168.100.7/24

Starting Nmap 7.95 ( https://nmap.org ) at 2025-03-29 03:06 +03
Nmap scan report for 192.168.100.1
Host is up (0.0039s latency).
Nmap scan report for 192.168.100.12
Host is up (0.33s latency).
Nmap scan report for 192.168.100.13
Host is up (0.74s latency).
Nmap scan report for 192.168.100.15
Host is up (0.072s latency).
Nmap scan report for 192.168.100.16
Host is up (0.32s latency).
Nmap scan report for 192.168.100.25
Host is up (0.11s latency).
Nmap scan report for 192.168.100.28
Host is up (0.73s latency).
Nmap scan report for 192.168.100.7
Host is up.
Nmap done: 256 IP addresses (8 hosts up) scanned in 9.18 seconds
```

Do you notice how it discovered 8 devices, whilst the previous ARP scan discovered 9?



icmp

Source	Destination	Protocol	Info
10.11.35.214	10.10.68.1	ICMP	Echo (ping) request id=0x22e1, seq=0/0, ttl=
10.11.35.214	10.10.68.2	ICMP	Echo (ping) request id=0xd13b, seq=0/0, ttl=
10.11.35.214	10.10.68.3	ICMP	Echo (ping) request id=0x65c8, seq=0/0, ttl=
10.11.35.214	10.10.68.4	ICMP	Echo (ping) request id=0x2b62, seq=0/0, ttl=
10.11.35.214	10.10.68.5	ICMP	Echo (ping) request id=0x8681, seq=0/0, ttl=
10.11.35.214	10.10.68.6	ICMP	Echo (ping) request id=0x6a13, seq=0/0, ttl=
10.11.35.214	10.10.68.7	ICMP	Echo (ping) request id=0x2dbc, seq=0/0, ttl=
10.11.35.214	10.10.68.8	ICMP	Echo (ping) request id=0x2029, seq=0/0, ttl=
10.11.35.214	10.10.68.9	ICMP	Echo (ping) request id=0xf800, seq=0/0, ttl=
10.11.35.214	10.10.68.10	ICMP	Echo (ping) request id=0xca62, seq=0/0, ttl=
10.11.35.214	10.10.68.1	ICMP	Echo (ping) request id=0xe95f, seq=0/0, ttl=
10.11.35.214	10.10.68.2	ICMP	Echo (ping) request id=0x896e, seq=0/0, ttl=
10.11.35.214	10.10.68.3	ICMP	Echo (ping) request id=0xdffe, seq=0/0, ttl=
10.11.35.214	10.10.68.4	ICMP	Echo (ping) request id=0xdf2c, seq=0/0, ttl=
10.11.35.214	10.10.68.5	ICMP	Echo (ping) request id=0x4602, seq=0/0, ttl=
10.11.35.214	10.10.68.6	ICMP	Echo (ping) request id=0xd84a, seq=0/0, ttl=
10.11.35.214	10.10.68.7	ICMP	Echo (ping) request id=0x8ede, seq=0/0, ttl=

nmap-PE-sn-openvpn.pcapng Packets: 1074 · Displayed: 512 (47.7%) Profile: Default

Figure 2: Wireshark capture of Echo Request packets, a network different from the aforementioned by the way.

2.2.II Timestamp Scan (-PP)

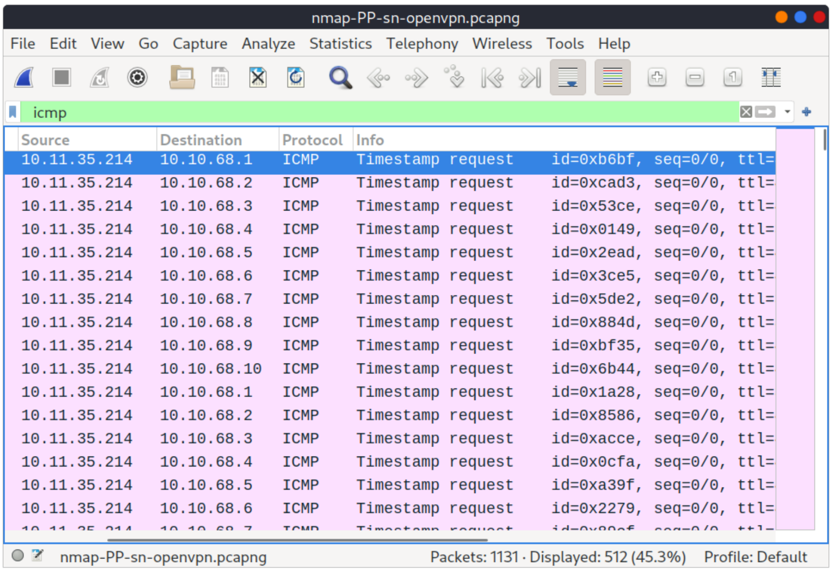
Because ICMP echo requests tend to be blocked, you might also consider ICMP Timestamp (ICMP Type 13) to tell if a system is online.

ICMP Timestamp Scan (-PP)

```
$ sudo nmap -sn -PP 192.168.100.7/24

Starting Nmap 7.95 ( https://nmap.org ) at 2025-03-29 03:53 +03
Nmap scan report for 192.168.100.1
Host is up (0.0016s latency).
Nmap scan report for 192.168.100.9
Host is up (0.075s latency).
Nmap scan report for 192.168.100.12
Host is up (0.12s latency).
Nmap scan report for 192.168.100.13
Host is up (0.083s latency).
Nmap scan report for 192.168.100.14
Host is up (0.058s latency).
Nmap scan report for 192.168.100.15
Host is up (0.033s latency).
Nmap scan report for 192.168.100.16
Host is up (0.073s latency).
Nmap scan report for 192.168.100.25
Host is up (0.077s latency).
Nmap scan report for 192.168.100.7
Host is up.
Nmap done: 256 IP addresses (9 hosts up) scanned in 14.88 seconds
```

We got "9 hosts up" once again!



Source	Destination	Protocol	Info
10.11.35.214	10.10.68.1	ICMP	Timestamp request id=0xb6bf, seq=0/0, ttl=
10.11.35.214	10.10.68.2	ICMP	Timestamp request id=0xcad3, seq=0/0, ttl=
10.11.35.214	10.10.68.3	ICMP	Timestamp request id=0x53ce, seq=0/0, ttl=
10.11.35.214	10.10.68.4	ICMP	Timestamp request id=0x0149, seq=0/0, ttl=
10.11.35.214	10.10.68.5	ICMP	Timestamp request id=0x2ead, seq=0/0, ttl=
10.11.35.214	10.10.68.6	ICMP	Timestamp request id=0x3ce5, seq=0/0, ttl=
10.11.35.214	10.10.68.7	ICMP	Timestamp request id=0x5de2, seq=0/0, ttl=
10.11.35.214	10.10.68.8	ICMP	Timestamp request id=0x884d, seq=0/0, ttl=
10.11.35.214	10.10.68.9	ICMP	Timestamp request id=0xbf35, seq=0/0, ttl=
10.11.35.214	10.10.68.10	ICMP	Timestamp request id=0x6b44, seq=0/0, ttl=
10.11.35.214	10.10.68.1	ICMP	Timestamp request id=0x1a28, seq=0/0, ttl=
10.11.35.214	10.10.68.2	ICMP	Timestamp request id=0x8586, seq=0/0, ttl=
10.11.35.214	10.10.68.3	ICMP	Timestamp request id=0xacce, seq=0/0, ttl=
10.11.35.214	10.10.68.4	ICMP	Timestamp request id=0x0cfa, seq=0/0, ttl=
10.11.35.214	10.10.68.5	ICMP	Timestamp request id=0xa39f, seq=0/0, ttl=
10.11.35.214	10.10.68.6	ICMP	Timestamp request id=0x2279, seq=0/0, ttl=

nmap-PP-sn-openvpn.pcapng Packets: 1131 · Displayed: 512 (45.3%) Profile: Default

Figure 3: Wireshark capture of Timestamp Request packets.

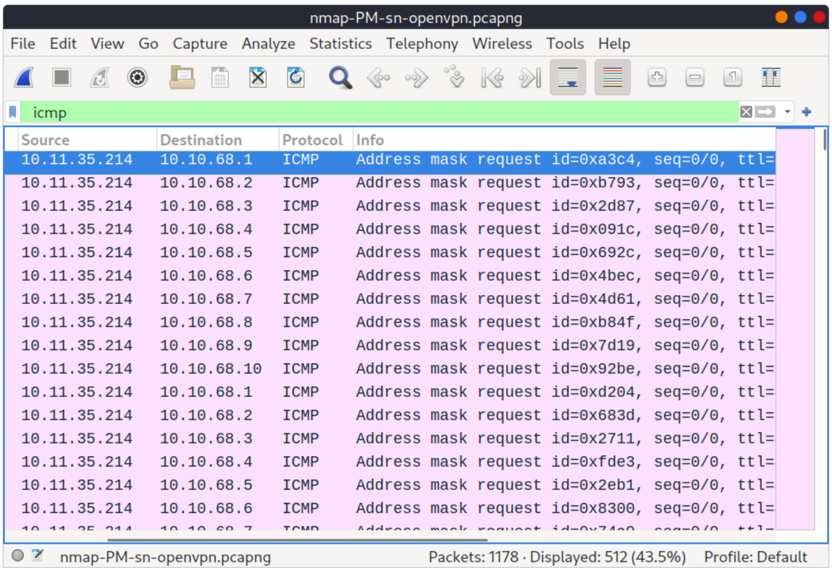
2.2.III Address Mask Scan (-PM)

Similarly, Nmap uses address mask queries (ICMP Type 17) and checks whether it gets an address mask reply (ICMP Type 18).

ICMP Address Mask Scan (-PM)

```
$ sudo nmap -sn -PM 192.168.100.7/24

Starting Nmap 7.95 ( https://nmap.org ) at 2025-03-29 03:53 +03
Nmap scan report for 192.168.100.1
Host is up (0.042s latency).
Nmap scan report for 192.168.100.12
Host is up (0.21s latency).
Nmap scan report for 192.168.100.13
Host is up (0.21s latency).
Nmap scan report for 192.168.100.15
Host is up (0.10s latency).
Nmap scan report for 192.168.100.16
Host is up (0.19s latency).
Nmap scan report for 192.168.100.25
Host is up (0.071s latency).
Nmap scan report for 192.168.100.28
Host is up (1.5s latency).
Nmap scan report for 192.168.100.7
Host is up.
Nmap done: 256 IP addresses (8 hosts up) scanned in 9.39 seconds
```



icmp

Source	Destination	Protocol	Info
10.11.35.214	10.10.68.1	ICMP	Address mask request id=0xa3c4, seq=0/0, ttl=
10.11.35.214	10.10.68.2	ICMP	Address mask request id=0xb793, seq=0/0, ttl=
10.11.35.214	10.10.68.3	ICMP	Address mask request id=0x2d87, seq=0/0, ttl=
10.11.35.214	10.10.68.4	ICMP	Address mask request id=0x091c, seq=0/0, ttl=
10.11.35.214	10.10.68.5	ICMP	Address mask request id=0x692c, seq=0/0, ttl=
10.11.35.214	10.10.68.6	ICMP	Address mask request id=0x4bec, seq=0/0, ttl=
10.11.35.214	10.10.68.7	ICMP	Address mask request id=0x4d61, seq=0/0, ttl=
10.11.35.214	10.10.68.8	ICMP	Address mask request id=0xb84f, seq=0/0, ttl=
10.11.35.214	10.10.68.9	ICMP	Address mask request id=0x7d19, seq=0/0, ttl=
10.11.35.214	10.10.68.10	ICMP	Address mask request id=0x92be, seq=0/0, ttl=
10.11.35.214	10.10.68.1	ICMP	Address mask request id=0xd204, seq=0/0, ttl=
10.11.35.214	10.10.68.2	ICMP	Address mask request id=0x683d, seq=0/0, ttl=
10.11.35.214	10.10.68.3	ICMP	Address mask request id=0x2711, seq=0/0, ttl=
10.11.35.214	10.10.68.4	ICMP	Address mask request id=0xfde3, seq=0/0, ttl=
10.11.35.214	10.10.68.5	ICMP	Address mask request id=0x2eb1, seq=0/0, ttl=
10.11.35.214	10.10.68.6	ICMP	Address mask request id=0x8300, seq=0/0, ttl=

nmap-PM-sn-openvpn.pcapng Packets: 1178 · Displayed: 512 (43.5%) Profile: Default

Figure 4: Wireshark capture of Address Mask Request packets.

Bonus: if you were to NOT specify one of the techniques above, just used ***nmap -sn*** with no other flags, Nmap's default behaviour would be to reverse-DNS online hosts. And to skip that, you can use ***-n*** flag.

2.3 TCP/UDP Host Discovery

2.3.I TCP SYN Scan (-PS)

Nmap will send TCP SYN packets and won't complete the TCP 3-way handshake even if the port is open, as shown in the figure below the terminal's output. By default, Nmap will send the SYN packet to port 80.

TCP SYN Scan (-PS)

```
$ sudo nmap -PS -sn 10.10.68.220/24

Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 13:45 EEST
Nmap scan report for 10.10.68.52
Host is up (0.10s latency).
Nmap scan report for 10.10.68.121
Host is up (0.16s latency).
Nmap scan report for 10.10.68.125
Host is up (0.089s latency).
Nmap scan report for 10.10.68.134
Host is up (0.13s latency).
Nmap scan report for 10.10.68.220
Host is up (0.11s latency).
Nmap done: 256 IP addresses (5 hosts up) scanned in 17.38 seconds
```

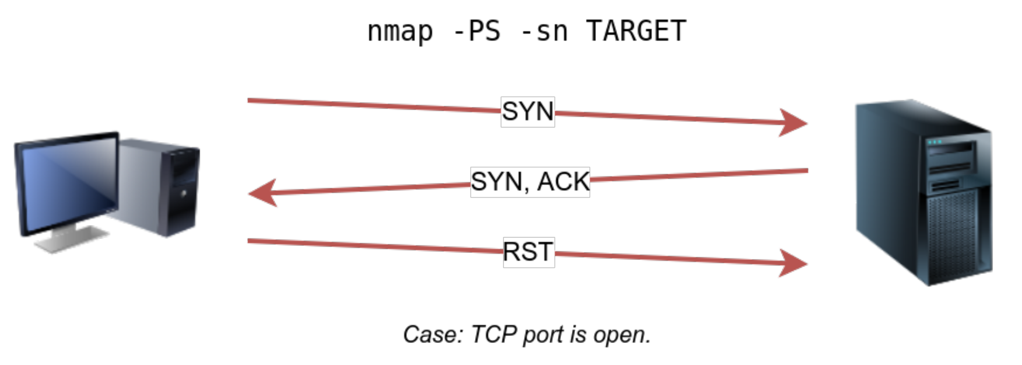
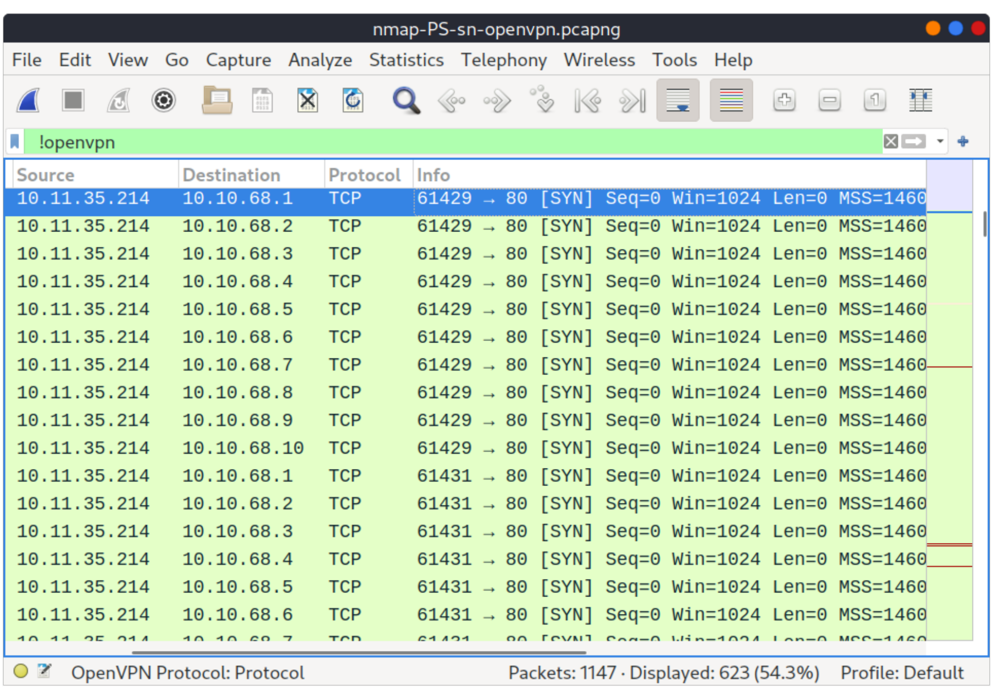


Figure 1: SYN Packet sent for Host Discovery, the user has root privileges.


nmap-PS-sn-openvpn.pcapng
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
!openvpn

```
Source        Destination   Protocol  Info
10.11.35.214  10.10.68.1    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.2    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.3    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.4    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.5    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.6    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.7    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.8    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.9    TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.10   TCP       61429 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.1    TCP       61431 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.2    TCP       61431 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.3    TCP       61431 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.4    TCP       61431 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.5    TCP       61431 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
10.11.35.214  10.10.68.6    TCP       61431 → 80 [SYN] Seq=0 Win=1024 Len=0 MSS=1460
```

OpenVPN Protocol: Protocol   Packets: 1147 · Displayed: 623 (54.3%)   Profile: Default

Figure 2: Do you notice how Nmap is sending the SYN packets to port 80? Twice? For each IP in the specified subnet.

2.3.II TCP ACK Scan (-PA)

As you have guessed, this sends a packet with an ACK flag set. Again, by default, Nmap will send the ACK packet to port 80.

TCP ACK Scan (-PA)

```
$ sudo nmap -PA -sn 10.10.68.220/24

Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 13:46 EEST
Nmap scan report for 10.10.68.52
Host is up (0.11s latency).
Nmap scan report for 10.10.68.121
Host is up (0.12s latency).
Nmap scan report for 10.10.68.125
Host is up (0.10s latency).
Nmap scan report for 10.10.68.134
Host is up (0.10s latency).
Nmap scan report for 10.10.68.220
Host is up (0.10s latency).
Nmap done: 256 IP addresses (5 hosts up) scanned in 29.89 seconds
```

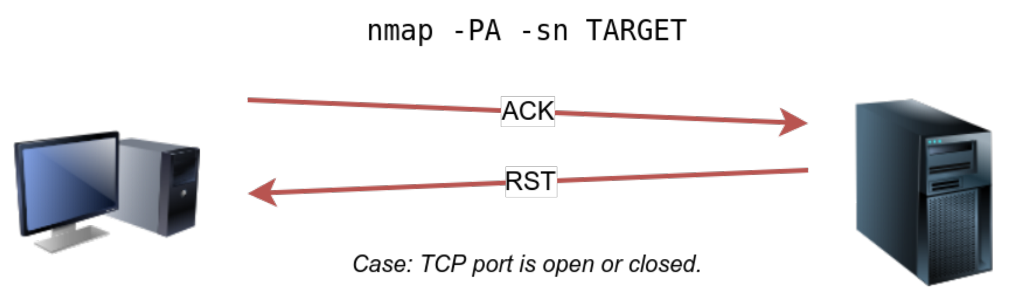
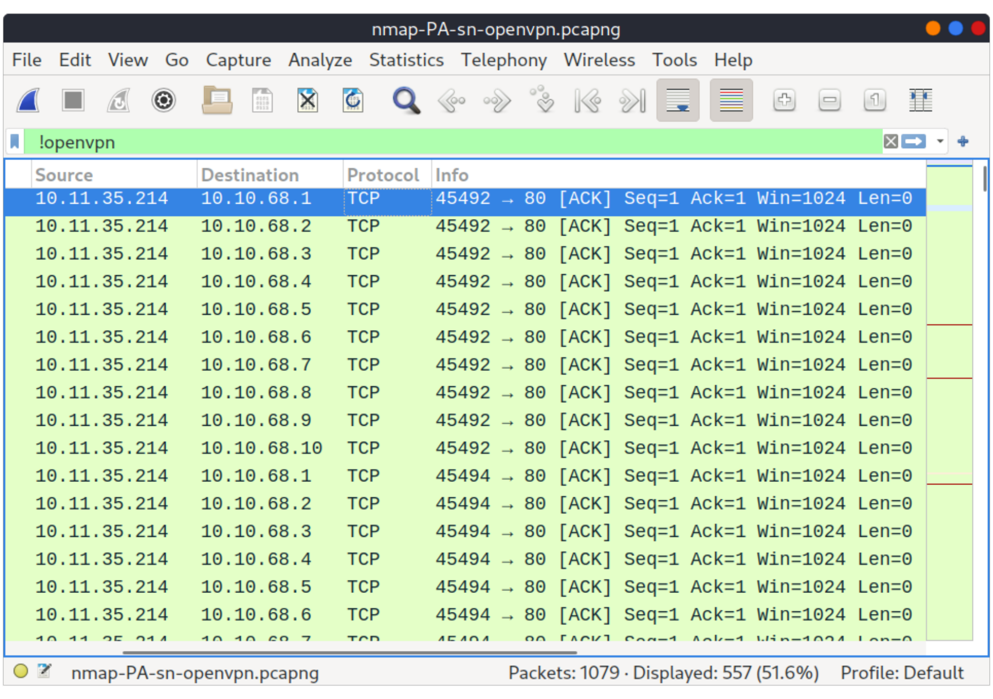


Figure 3: TCP Packet with Ack flag set sent for Host Discovery, doesn't matter whether the port is open or closed


nmap-PA-sn-openvpn.pcapng
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
!openvpn

```
Source        Destination   Protocol  Info
10.11.35.214  10.10.68.1    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.2    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.3    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.4    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.5    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.6    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.7    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.8    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.9    TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.10   TCP       45492 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.1    TCP       45494 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.2    TCP       45494 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.3    TCP       45494 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.4    TCP       45494 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.5    TCP       45494 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
10.11.35.214  10.10.68.6    TCP       45494 → 80 [ACK] Seq=1 Ack=1 Win=1024 Len=0
```

nmap-PA-sn-openvpn.pcapng   Packets: 1079 · Displayed: 557 (51.6%)   Profile: Default

2.3.III UDP Scan (-PU)

Finally, we can use UDP to discover if the host is online. Contrary to TCP SYN ping, sending a UDP packet to an open port is not expected to lead to any reply. However, if we send a UDP packet to a closed UDP port, we expect to get an ICMP port unreachable packet; this indicates that the target system is up and available, and that's exactly why Nmap will be sending to uncommon UDP ports, so that an ICMP destination unreachable is triggered.

UDP Scan (-PU)

```
$ sudo nmap -PU -sn 10.10.68.220/24

Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 13:45 EEST
Nmap scan report for 10.10.68.52
Host is up (0.10s latency).
Nmap scan report for 10.10.68.121
Host is up (0.10s latency).
Nmap scan report for 10.10.68.125
Host is up (0.14s latency).
Nmap scan report for 10.10.68.134
Host is up (0.096s latency).
Nmap scan report for 10.10.68.220
Host is up (0.11s latency).
Nmap done: 256 IP addresses (5 hosts up) scanned in 9.20 seconds
```

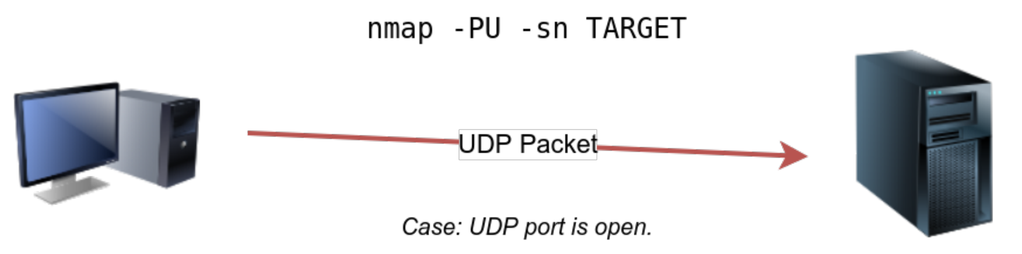


Figure 4: UDP Packet sent for Host Discovery, port is open and we don't get any reply.

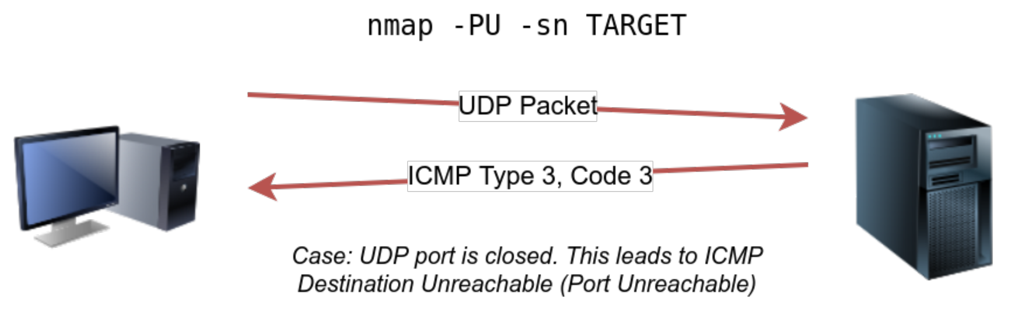
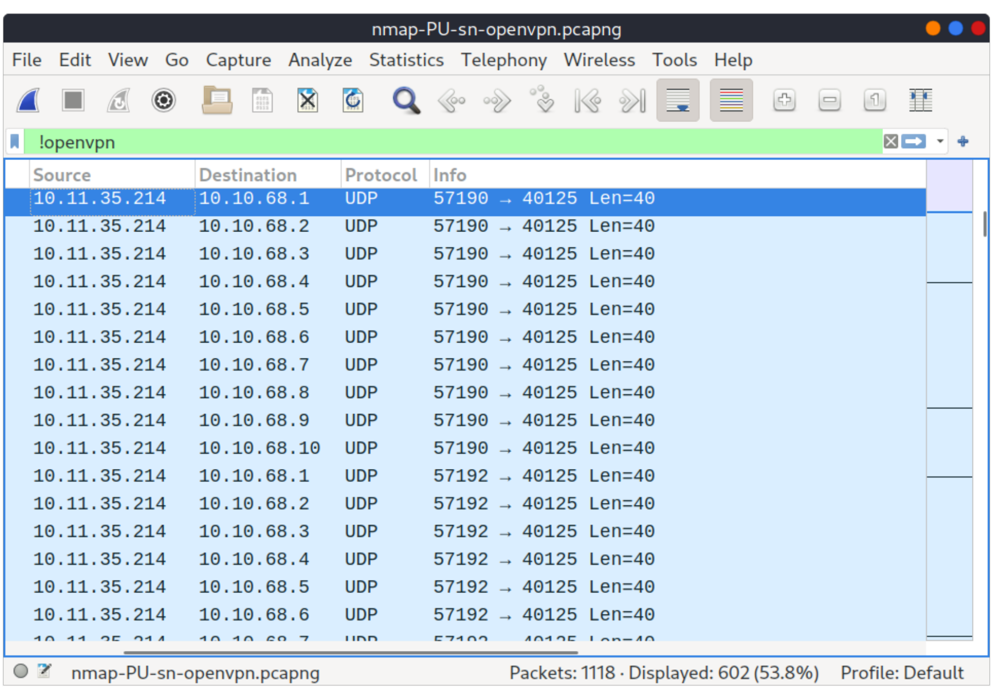

nmap -PU -sn TARGET
UDP Packet
ICMP Type 3, Code 3
Case: UDP port is closed. This leads to ICMP
Destination Unreachable (Port Unreachable)

Figure 5: UDP Packet sent for Host Discovery, port is closed and we get a port unreachable packet.


nmap-PU-sn-openvpn.pcapng
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
!openvpn

```
Source        Destination   Protocol  Info
10.11.35.214  10.10.68.1    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.2    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.3    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.4    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.5    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.6    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.7    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.8    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.9    UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.10   UDP       57190 → 40125 Len=40
10.11.35.214  10.10.68.1    UDP       57192 → 40125 Len=40
10.11.35.214  10.10.68.2    UDP       57192 → 40125 Len=40
10.11.35.214  10.10.68.3    UDP       57192 → 40125 Len=40
10.11.35.214  10.10.68.4    UDP       57192 → 40125 Len=40
10.11.35.214  10.10.68.5    UDP       57192 → 40125 Len=40
10.11.35.214  10.10.68.6    UDP       57192 → 40125 Len=40
```

nmap-PU-sn-openvpn.pcapng   Packets: 1118 · Displayed: 602 (53.8%)   Profile: Default

Figure 6: Do you notice how Nmap is sending the UDP packets to uncommon ports multiple times for each IP address in the specified subnet?