Nmap Scans using Hex Value of Flags

January 31, 2018 By Raj Chandel

In this article, we are going to scan the target machine by sending TCP flags through their hexadecimal value and the actual Flag name can be confirmed by analysis of Nmap traffic through Wireshark.

Let's have a look over Hex value of TCP Flag in given below table which we are going to use in Nmap for port enumeration.

Flags	Decimal Value	Hexadecimal Value
NULL	0	0x00
FIN	1	0x01
SYN	2	0x02
RST	4	0x04
PSH	8	0x08
ACK	16	0x10
URG	32	0x20
ECE	64	0x40
CWR	128	0x80
NS	256	0x100

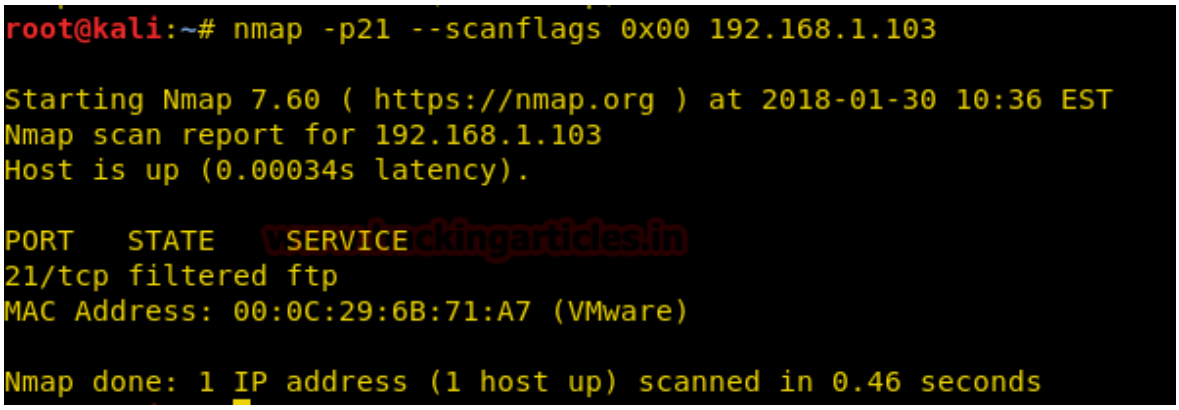
NULL Scan

In this scan, we are sending the NONE flag of the tcp by using its hexadecimal value on the target machine to enumerate the state of ports is open, closed or filtered.

Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

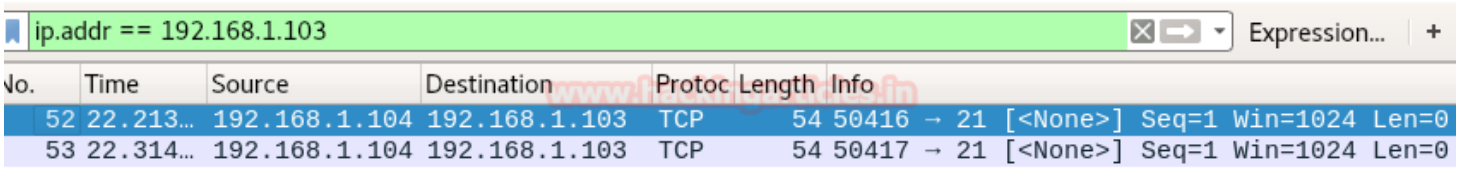
```
nmap -p21 --scanflags 0x00 192.168.1.103
```

From given below image you can observe we have found port 21 filtered.



When network admin will capture the incoming traffic he will get a packet for TCP-NONE flag, here we have used Wireshark for network packet analysis and we found that it is showing **TCP-NONE packet** for hex

value **0x00** coming from 192.168.1.104 on port 21 as shown in given below image.



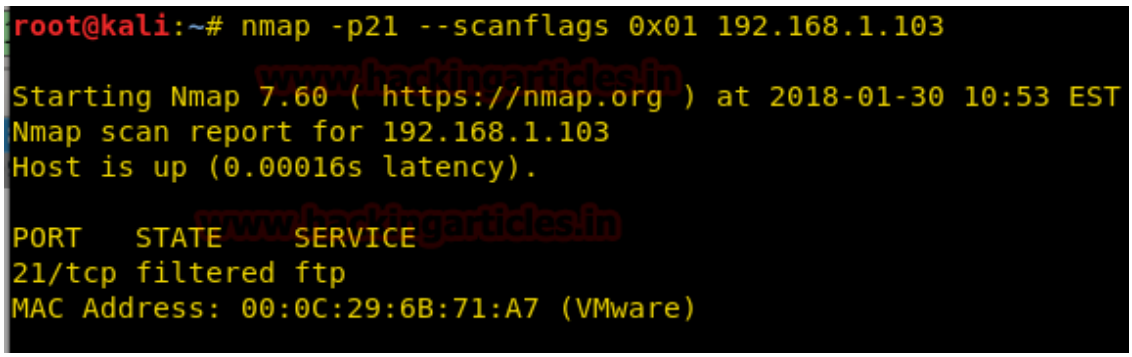
FIN Scan

TCP-FIN flag always used for finishing the communication with the target network. In this scan, we are sending the FIN flag of the tcp by using its hexadecimal value on the target machine to enumerate the state of ports is open, closed or filtered.

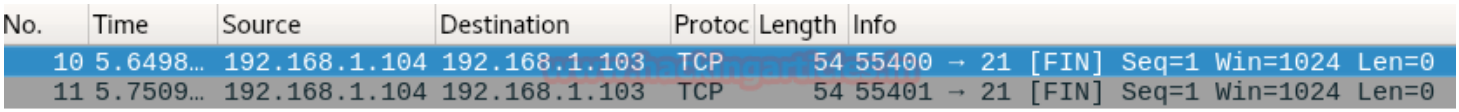
Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x01 192.168.1.103
```

From given below image you can observe we have found port 21 filtered.



When network admin will capture the incoming traffic he will get a packet for TCP-FIN flag, here we have used Wireshark for network packet analysis and we found that it is showing **TCP-FIN packet** for hex value **0x01** coming from 192.168.1.104 on port 21 as shown in given below image.



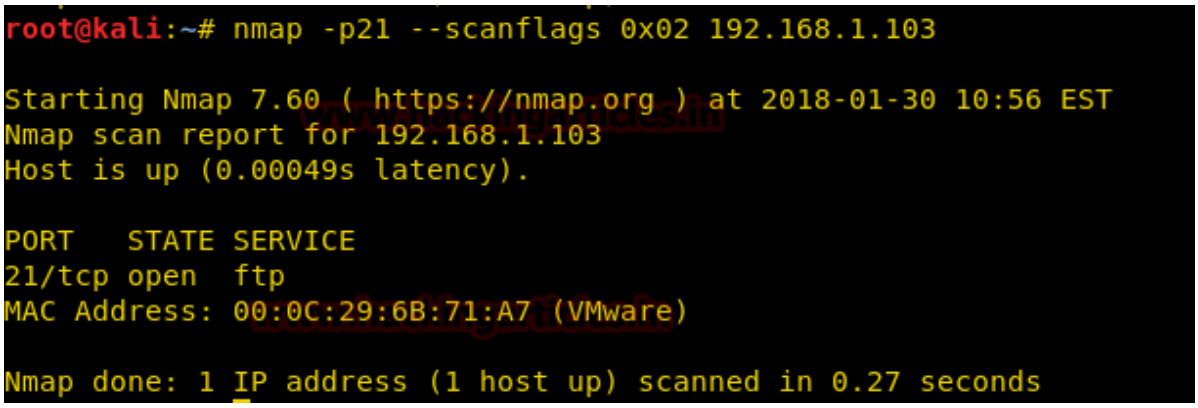
SYN Scan

TCP-SYN flag always initiates communication to establish a connection with the target network. In this scan, we are sending the SYN flag of the tcp by using its hexadecimal value on the target machine to enumerate the state of ports is open, closed or filtered.

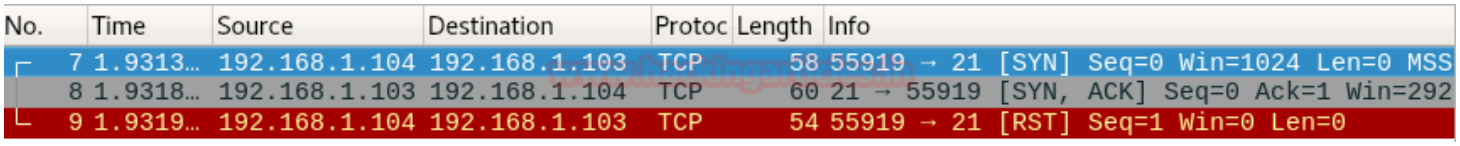
Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x02 192.168.1.103
```

From given below image you can observe we have successfully found port 21 open.



When network admin will capture the incoming traffic he will get a packet for TCP-SYN flag, here we have used Wireshark for network packet analysis and we found that it is showing **TCP-SYN packet** for hex value **0x02** coming from 192.168.1.104 on port 21 as shown in given below image.



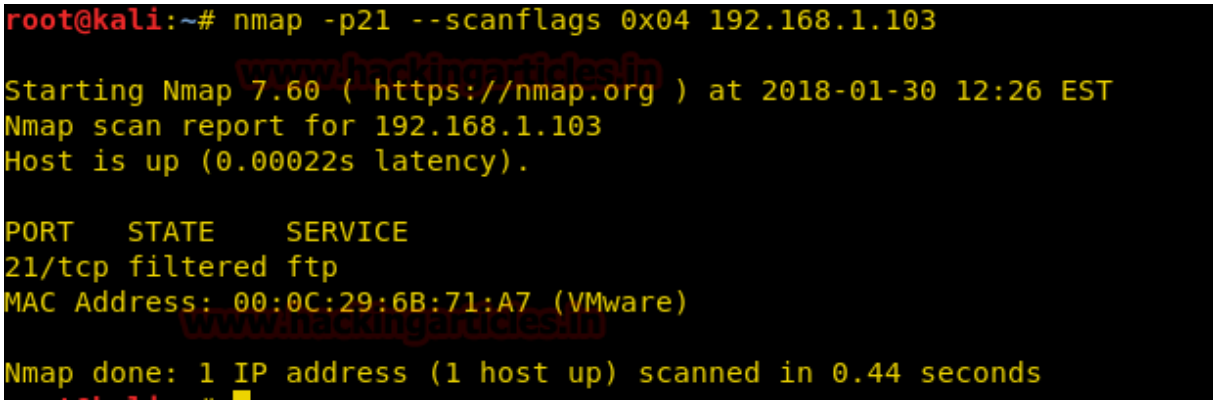
Reset Scan

RST flag is used to reset the connection between the sender machine and the target machine. In this scan, we are sending the RST flag of the tcp by using its hexadecimal value on the target machine to enumerate the state of ports is open, closed or filtered.

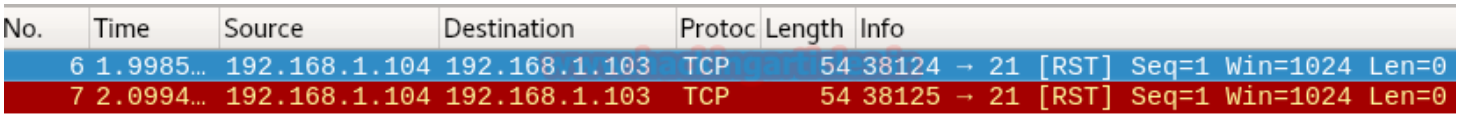
Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x04 192.168.1.103
```

From given below image you can observe we have found port 21 filtered.



When network admin will capture the incoming traffic he will get a packet for TCP-RST flag, here we have used Wireshark for network packet analysis and we found that it is showing **TCP-RST packet** for hex value **0x04** coming from 192.168.1.104 on port 21 as shown in given below image.



No.	Time	Source	Destination	Protoc	Length	Info
6	1.9985…	192.168.1.104	192.168.1.103	TCP	54	38124 → 21 [RST] Seq=1 Win=1024 Len=0
7	2.0994…	192.168.1.104	192.168.1.103	TCP	54	38125 → 21 [RST] Seq=1 Win=1024 Len=0

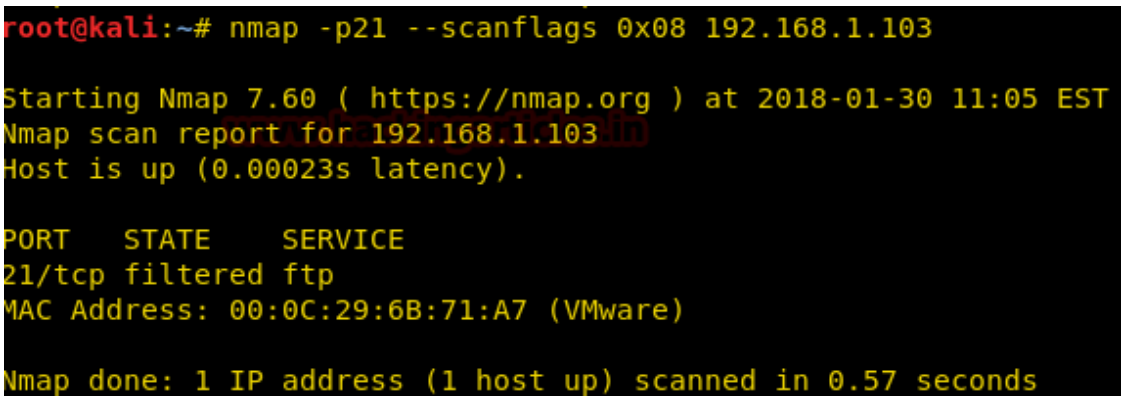
PUSH Scan

In this scan, we are sending the PSH flag of the tcp by using its hexadecimal value on the target machine to enumerate the state of ports is open, closed or filtered.

Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x08 192.168.1.103
```

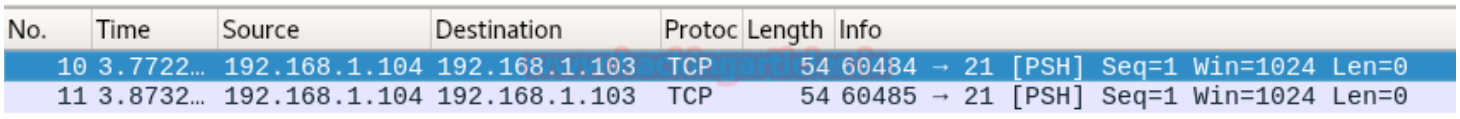
From given below image you can observe we have found port 21 filtered.



```
root@kali:~# nmap -p21 --scanflags 0x08 192.168.1.103

Starting Nmap 7.60 ( https://nmap.org ) at 2018-01-30 11:05 EST
Nmap scan report for 192.168.1.103
Host is up (0.00023s latency).

PORT   STATE    SERVICE
21/tcp filtered ftp
MAC Address: 00:0C:29:6B:71:A7 (VMware)

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

When network admin will capture the incoming traffic he will get a packet for TCP-PSH flag, here we have used Wireshark for network packet analysis and we found that it is showing **TCP-PSH packet** for hex value **0x08** coming from 192.168.1.104 on port 21 as shown in given below image.

PUSH flag is used to push the process priority higher of the packet to the target machine.



No.	Time	Source	Destination	Protoc	Length	Info
10	3.7722…	192.168.1.104	192.168.1.103	TCP	54	60484 → 21 [PSH] Seq=1 Win=1024 Len=0
11	3.8732…	192.168.1.104	192.168.1.103	TCP	54	60485 → 21 [PSH] Seq=1 Win=1024 Len=0

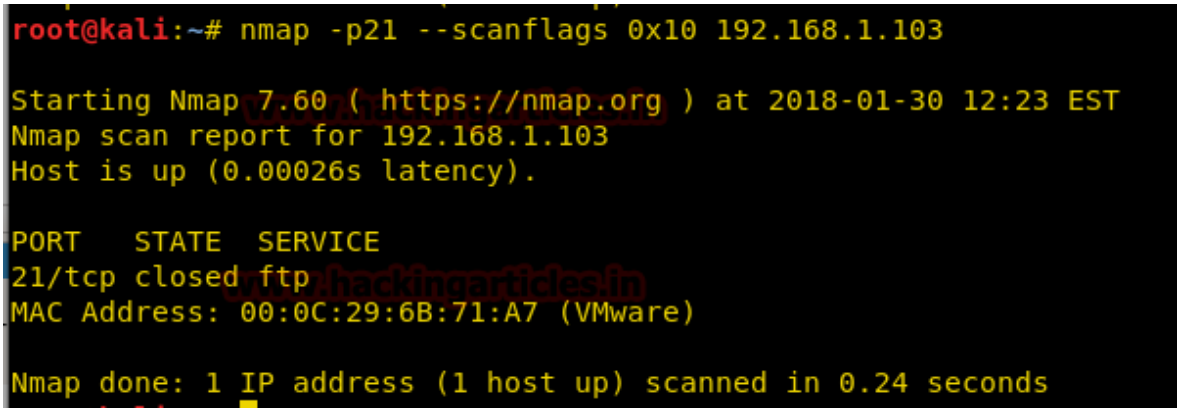
ACK Scan

Ack flag is used to acknowledge the sender machine whether the packet is received or dropped by the target. So that the sender again sends the lost or dropped packet on the target network to complete the communication process. Here we are sending the ACK flag of the tcp by using its hexadecimal value on the target machine to enumerate the state of ports is open, closed or filtered.

Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x10 192.168.1.103
```

From given below image you can observe we have found port 21 closed.



When network admin will capture the incoming traffic he will get a packet for TCP-ACK flag, here we have used Wireshark for network packet analysis and we found that it is showing **TCP-ACK packet** for hex value **0x10** coming from 192.168.1.104 on port 21 as shown in given below image.

Open and closed ports will both return an RST packet. Nmap then labels them as unfiltered, meaning that they are reachable by the ACK packet, but whether they are open or closed is undetermined. Ports that don't respond, or send certain ICMP error messages back (type 3, code 0, 1, 2, 3, 9, 10, or 13), are labeled filtered. (**From Nmap.org**)

No.	Time	Source	Destination	Protoc	Length	Info
6	0.9904…	192.168.1.104	192.168.1.103	TCP	54	49958 → 21 [ACK] Seq=1 Ack=1 Win=1024 Len
7	0.9909…	192.168.1.103	192.168.1.104	TCP	60	21 → 49958 [RST] Seq=1 Win=0 Len=0

Urgent Scan

URG flag is used to set the high process priority of the packet to the target. So that target machine stops processing the current packet and process the URG Flag packet. In this scan, we are sending the Urg flag of the tcp by using its hexadecimal value on the target machine to enumerate the state of ports is open, closed or filtered.

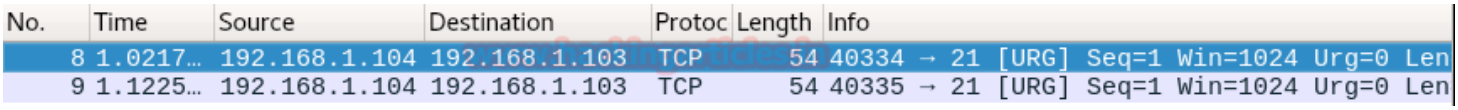
Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x20 192.168.1.103
```

From given below image you can observe we have found port 21 filtered.

```
root@kali:~# nmap -p21 --scanflags 0x20 192.168.1.103

Starting Nmap 7.60 ( https://nmap.org ) at 2018-01-30 12:28 EST
Nmap scan report for 192.168.1.103
Host is up (0.00016s latency).

PORT   STATE    SERVICE
21/tcp filtered ftp
MAC Address: 00:0C:29:6B:71:A7 (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.44 seconds
```

When network admin will capture the incoming traffic he will get a packet for TCP-URG flag, here we have used Wireshark for network packet analysis and we found that it is showing **TCP-URG packet** for hex value **0x20** coming from 192.168.1.104 on port 21 as shown in given below image.



No.	Time	Source	Destination	Protoc	Length	Info
8	1.0217…	192.168.1.104	192.168.1.103	TCP	54	40334 → 21 [URG] Seq=1 Win=1024 Urg=0 Len
9	1.1225…	192.168.1.104	192.168.1.103	TCP	54	40335 → 21 [URG] Seq=1 Win=1024 Urg=0 Len

XMAS Scan

In this scan, we are sending the combination of the hexadecimal value of the different flag on the target machine. As we know in Xmas scan combination of three TCP-flags [FIN, PSH, URG] are used to enumerate state of the port.

By adding the value of the flag, which is equal to the hexadecimal value of the sender's hexadecimal value as described in given below the table.

Flags	Hexadecimal	Decimal Value
FIN	0x01	1
PUSH	0x08	8
URG	0x20	32
Total	**0x29**	41

Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x29 192.168.1.103
```

From given below image you can observe we have found port 21 filtered.

```
root@kali:~# nmap -p21 --scanflags 0x29 192.168.1.103

Starting Nmap 7.60 ( https://nmap.org ) at 2018-01-30 12:50 EST
Nmap scan report for 192.168.1.103
Host is up (0.00023s latency).

PORT   STATE    SERVICE
21/tcp filtered ftp
MAC Address: 00:0C:29:6B:71:A7 (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.47 seconds
```

When network admin will capture the incoming traffic he will get packet for TCP flags [FIN, PSH, URG] here we have used Wireshark for network packet analysis and we found that it is showing **TCP-packet** of **FIN, PSH, URG** for hex value **0x29** coming from 192.168.1.104 on port 21 as shown in given below image.

No.	Time	Source	Destination	Protoc	Length	Info
8	0.8926…	192.168.1.104	192.168.1.103	TCP	54	52840 → 21 [FIN, PSH, URG] Seq=1 Win=1024
9	0.9931…	192.168.1.104	192.168.1.103	TCP	54	52841 → 21 [FIN, PSH, URG] Seq=1 Win=1024

Manual Combination of Flags [FIN, SYN, PSH]

Let have a quick review over decimal to hexadecimal conversion with the help of the following table:

Decimal Number	Hexadecimal Number
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

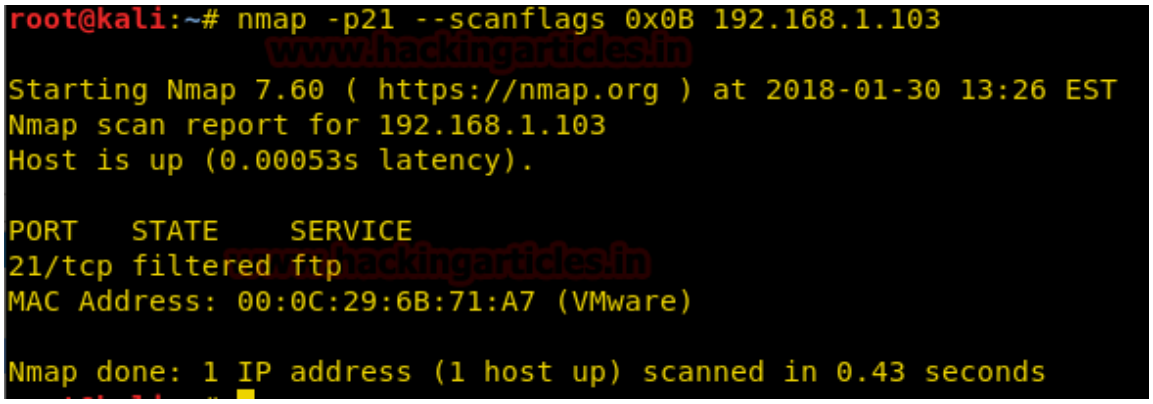
Now repeat the same methodology by changing the combination of the flag to enumerate the state of any port. For example, we want to scan any port by sending a combination of three flags [FIN, SYN, and PSH] so let identify hex value for the sum of three flags.

Flags	Hexadecimal	Decimal Value
FIN	0x01	1
SYN	0x02	2
PUSH	0x08	8
Total	**0x0B**	11

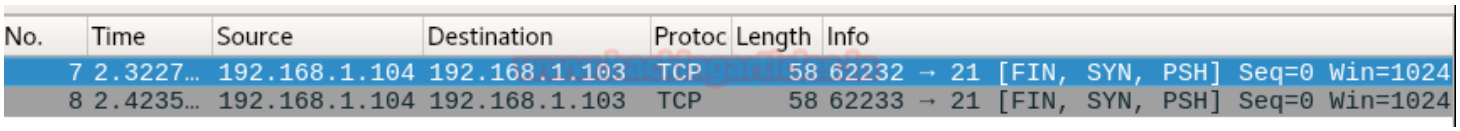
Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x0B 192.168.1.103
```

From given below image you can observe we have found port 21 filtered.



When network admin will capture the incoming traffic he will get packet for TCP flags [FIN, SYN and PSH] here we have used Wireshark for network packet analysis and we found that it is showing **TCP-packet** of **FIN, SYN,PSH** for hex value **0x0B** coming from 192.168.1.104 on port 21 as shown in given below image.



Manual Combination of Flags [FIN, RST, PSH]

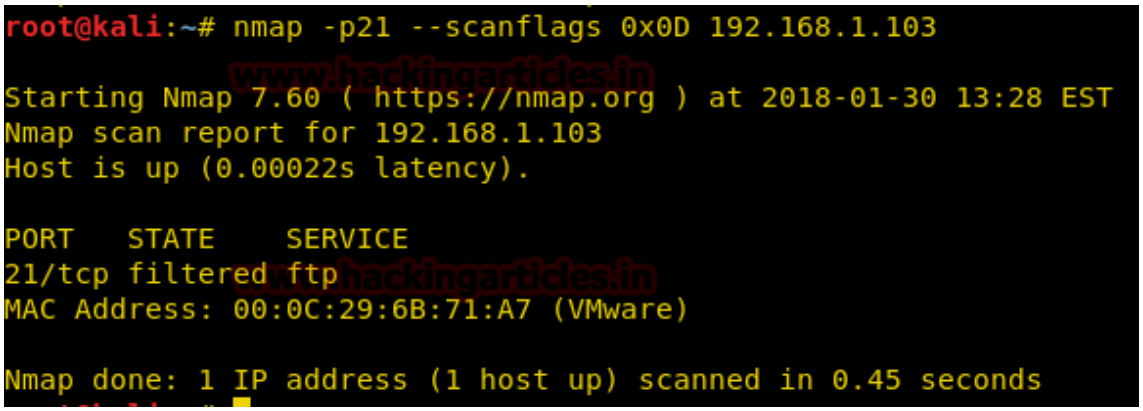
Now repeat the same methodology by changing the combination of the flag to enumerate the state of any port. For example, we want to scan any port by sending a combination of three flags [FIN, RST, and PSH] so let identify hex value for the sum of three flags.

Flags	Hexadecimal	Decimal Value
FIN	0x01	1
RST	0x04	4
PUSH	0x08	8
Total	**0x0D**	13

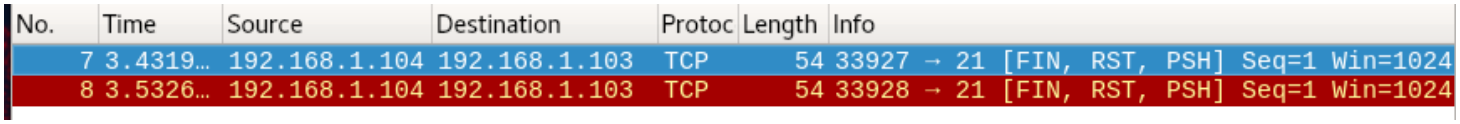
Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x0D 192.168.1.103
```

From given below image you can observe we have found port 21 filtered.



When network admin will capture the incoming traffic he will get packet for TCP flags [FIN, RST, and PSH] here we have used Wireshark for network packet analysis and we found that it is showing **TCP-packet** of **FIN, RST,PSH** for hex value **0x0D** coming from 192.168.1.104 on port 21 as shown in given below image.



Manual Combination of Flags [FIN, SYN, RST, PSH]

Now repeat the same methodology by changing the combination of the flag to enumerate the state of any port. For example, we want to scan any port by sending a combination of four flags [FIN, SYN, RST, and PSH] so let identify hex value for the sum of four flags.

Flags	Hexadecimal	Decimal Value
FIN	0x01	1
SYN	0x02	2
RST	0x04	4
PUSH	0x08	8
Total	**0x0F**	15

Now execute given below command for enumerating state of any port, here we want to identify state for port 21.

```
nmap -p21 --scanflags 0x0F 192.168.1.103
```

From given below image you can observe we have found port 21 filtered.

```
root@kali:~# nmap -p21 --scanflags 0x0F 192.168.1.103

Starting Nmap 7.60 ( https://nmap.org ) at 2018-01-30 13:17 EST
Nmap scan report for 192.168.1.103
Host is up (0.00018s latency).

PORT   STATE    SERVICE
21/tcp filtered ftp
MAC Address: 00:0C:29:6B:71:A7 (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.48 seconds
```

When network admin will capture the incoming traffic he will get packet for TCP flags [FIN, SYN, RST, and PSH] here we have used Wireshark for network packet analysis and we found that it is showing **TCP-packet** of **FIN, SYN, RST, PSH** for hex value **0x0F** coming from 192.168.1.104 on port 21 as shown in given below image.

No.	Time	Source	Destination	Protoc	Length	Info
98	8.7608…	192.168.1.104	192.168.1.103	TCP	58	61581 → 21 [FIN, SYN, RST, PSH] Seq=0 Win
99	8.8614…	192.168.1.104	192.168.1.103	TCP	58	61582 → 21 [FIN, SYN, RST, PSH] Seq=0 Win