C|EH™
Certified Ethical Hacker

Module 03

Scanning Networks

Module Objectives

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- Understanding Network Scanning Concepts
- Understanding various Scanning Tools
- Understanding various Scanning Techniques
- Understanding various Techniques to Scan Beyond IDS and Firewall
- Understanding Banner Grabbing
- Drawing Network Diagrams
- Overview of Scanning Pen Testing

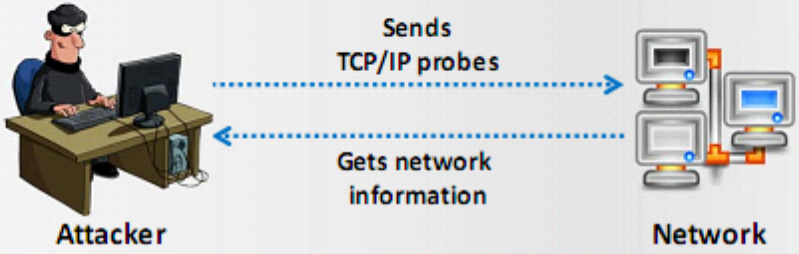
Module Flow

1. Network Scanning Concepts
2. Scanning Tools
3. Scanning Techniques
4. Scanning Beyond IDS and Firewall
5. Banner Grabbing
6. Draw Network Diagrams
7. Scanning Pen Testing

Overview of Network Scanning

- Network scanning refers to a set of procedures used for **identifying hosts**, **ports**, and **services** in a network
- Network scanning is one of the **components of intelligence gathering** which can be used by an attacker to create a profile of the target organization

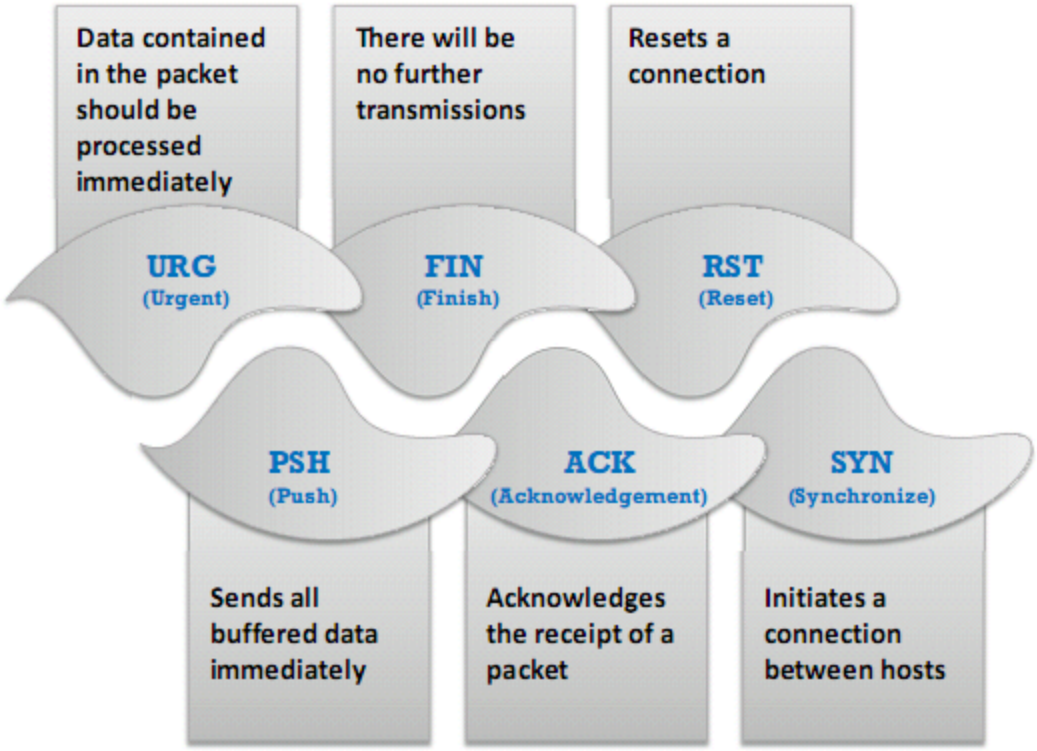
Network Scanning Process

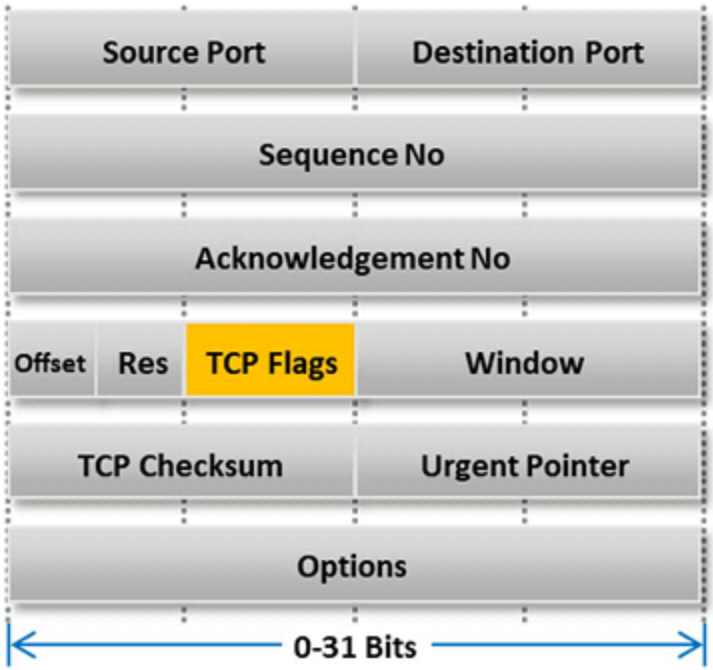


Objectives of Network Scanning

- To discover live hosts, IP address, and open ports of live hosts
- To discover operating systems and system architecture
- To discover services running on hosts
- To discover vulnerabilities in live hosts

TCP Communication Flags



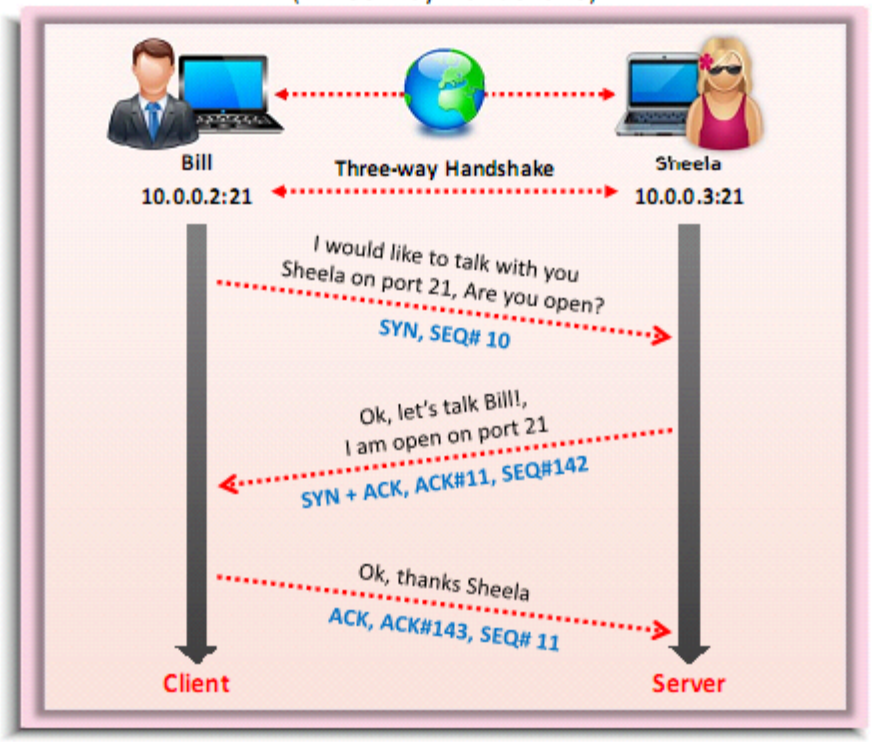


Standard TCP communications are controlled by flags in the TCP packet header

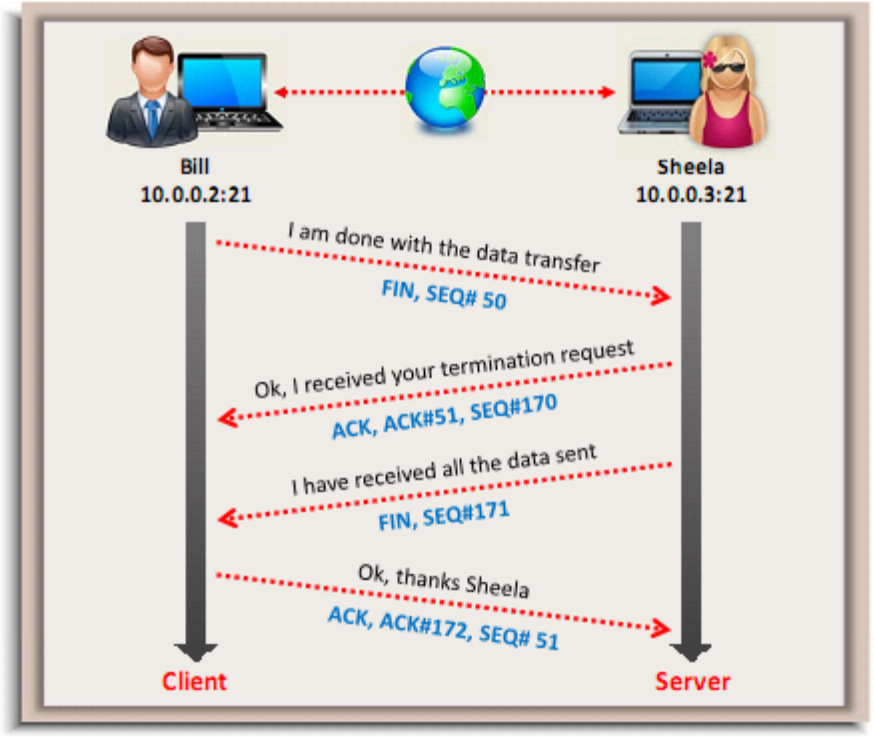
TCP/IP Communication

TCP Session Establishment

(Three-way Handshake)

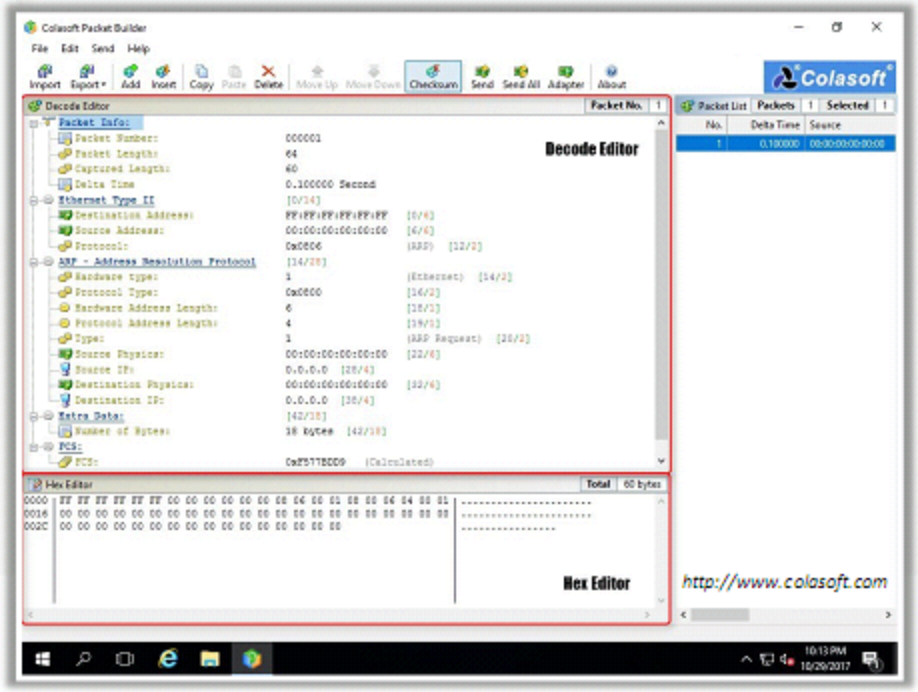


TCP Session Termination



Creating Custom Packet Using TCP Flags

- Colasoft Packet Builder enables the creation of custom network packets to **audit networks for various attacks**
- Attackers can also use it to create fragmented packets to **bypass firewalls and IDS systems** in a network



Packet Crafting Tools

- NetScanTools Pro (*https://www.netscantools.com*)
- Ostinato (*http://ostinato.org*)
- WAN Killer (*http://www.solarwinds.com*)
- Packeth (*http://packeth.sourceforge.net*)
- LANforge FIRE (*http://www.candelatech.com*)

Scanning in IPv6 Networks

IPv6 increases the IP address size from **32 bits** to **128 bits**, to support more levels of addressing hierarchy

Traditional network scanning techniques will be **computationally less feasible** due to the larger search space (64 bits of host address space or 2^{64} addresses) provided by the IPv6 in a subnet

Scanning in the IPv6 network is more difficult and complex when compared to the IPv4. Additionally, a number of scanning tools do not support ping sweeps on **IPv6 networks**

Attackers need to harvest IPv6 addresses from **network traffic**, **recorded logs**, or **Received from**: and other header lines in the archived email or Usenet news messages

Scanning the IPv6 network, however, offers a large number of hosts in a subnet. Once an attacker is able to compromise one host in the subnet, he or she can probe the "**all hosts**" and **link local multicast address**

Module Flow

1. Network Scanning Concepts
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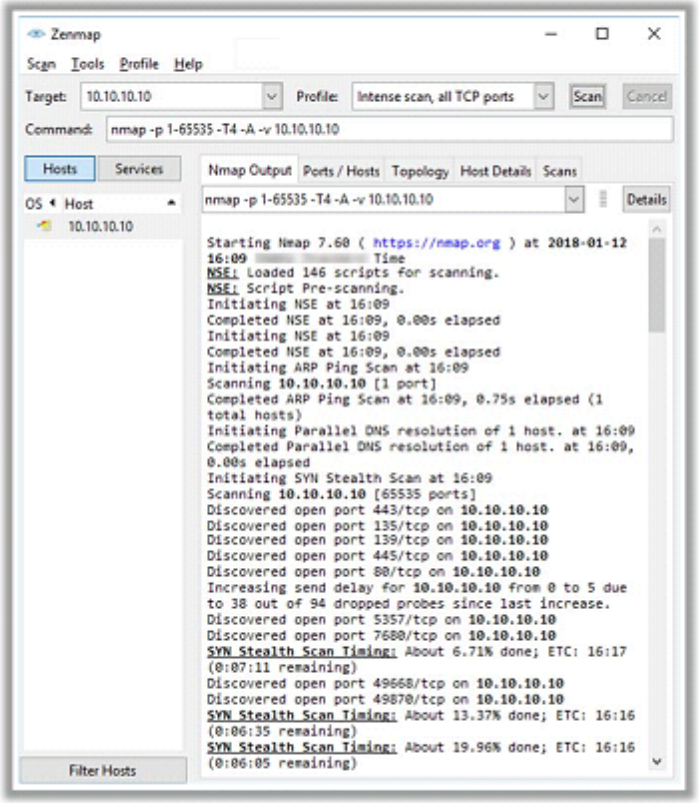
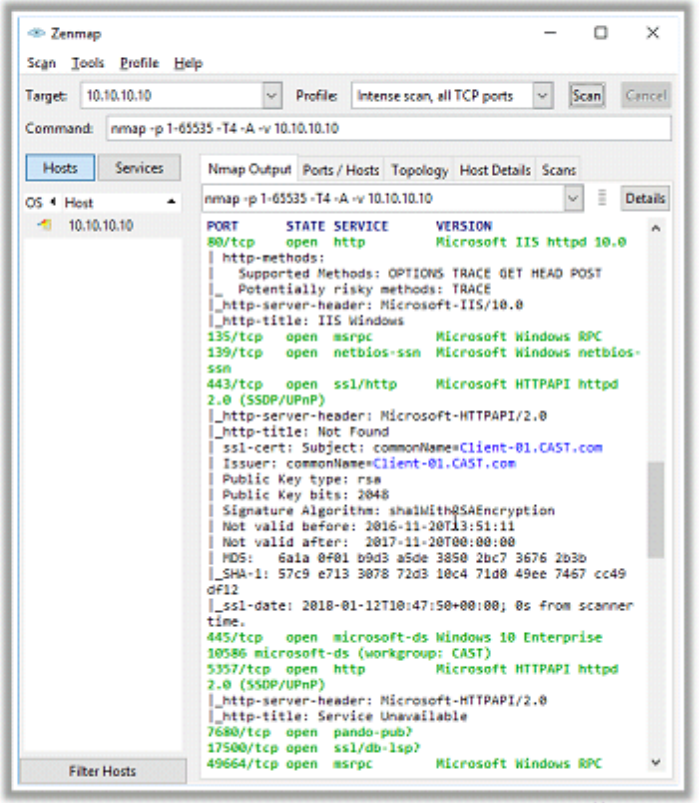
Scanning Tool: Nmap

- Network administrators can use Nmap for network inventory, managing service upgrade schedules, and monitoring host or service uptime
- Attacker uses Nmap to extract information such as live hosts on the network, services (application name and version), type of packet filters/firewalls, operating systems, and OS versions





https://nmap.org

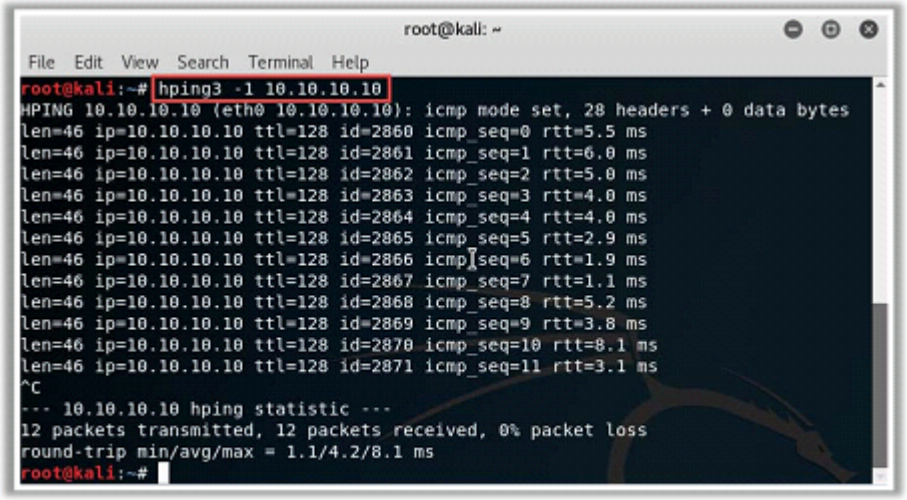
Scanning Tool: Hping2 / Hping3

1. Command line **network scanning** and **packet crafting** tool for the TCP/IP protocol

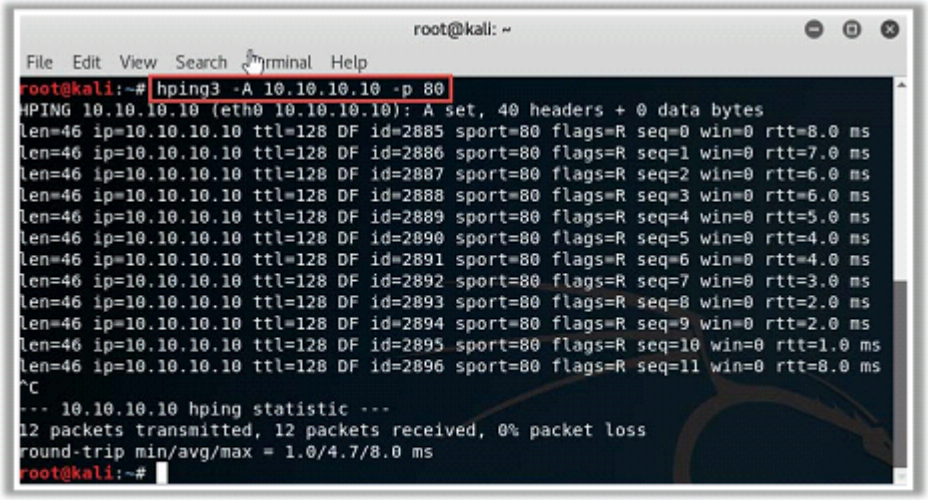
2. It can be used for **network security auditing**, **firewall testing**, manual path MTU discovery, advanced traceroute, remote OS fingerprinting, remote uptime guessing, TCP/IP stacks auditing, etc.

http://www.hping.org

ICMP Scanning



ACK Scanning on port 80



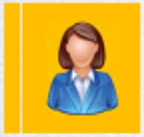
Hping Commands

ICMP Ping

```
hping3 -1 10.0.0.25
```

ACK scan on port 80

```
hping3 -A 10.0.0.25 -p 80
```



UDP scan on port 80

```
hping3 -2 10.0.0.25 -p 80
```

Collecting Initial Sequence Number

```
hping3 192.168.1.103 -Q -p 139 -s
```

Firewalls and Time Stamps

```
hping3 -S 72.14.207.99 -p 80 --tcp-timestamp
```

SYN scan on port 50-60

```
hping3 -8 50-60 -S 10.0.0.25 -V
```

FIN, PUSH and URG scan on port 80

```
hping3 -F -P -U 10.0.0.25 -p 80
```

Scan entire subnet for live host

```
hping3 -1 10.0.1.x --rand-dest -I eth0
```

Intercept all traffic containing HTTP signature

```
hping3 -9 HTTP -I eth0
```

SYN flooding a victim

```
hping3 -S 192.168.1.1 -a 192.168.1.254 -p 22
--flood
```

Scanning Tools

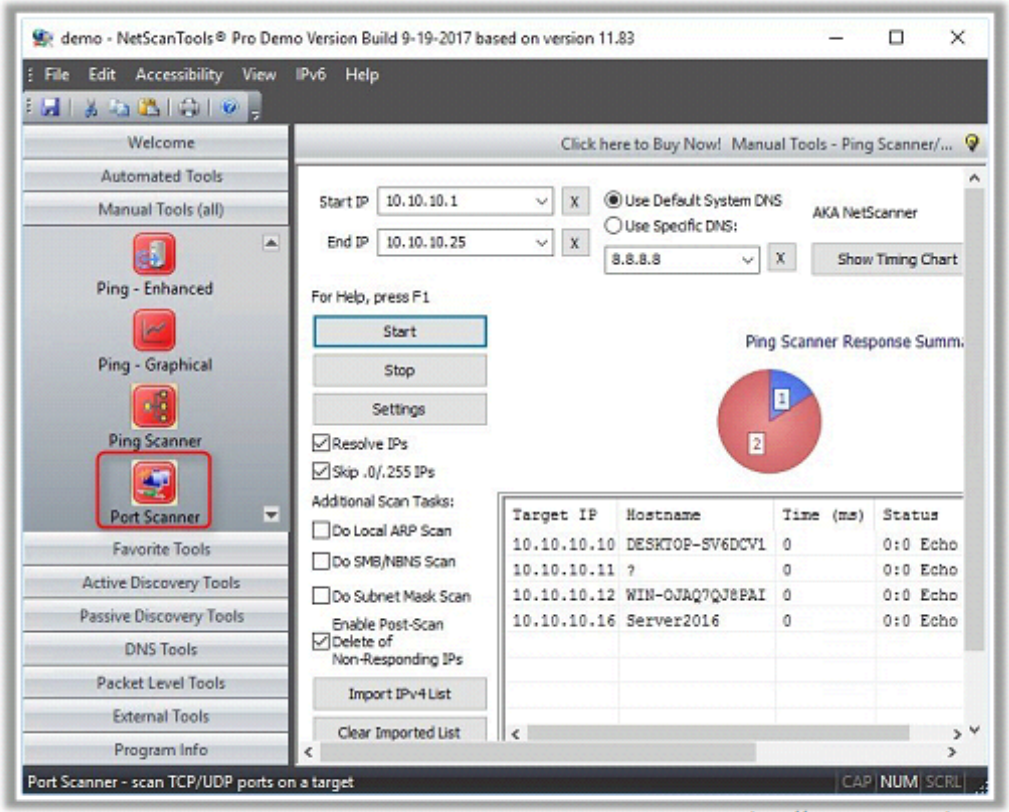
NetScanTools Pro

- Network Tools Pro assists in **troubleshooting**, **diagnosing**, **monitoring**, and **discovering** devices on the network
- It lists **IPv4/IPv6** addresses, hostnames, **domain names**, email addresses, and URLs automatically or manually (using manual tools)

Scanning Tools

- SuperScan (*https://www.mcafee.com*)
- PRTG Network Monitor (*https://www.paessler.com*)
- OmniPeek (*https://www.savvius.com*)
- MiTeC Network Scanner (*http://www.mitec.cz*)
- NEWT Professional (*http://www.komodolabs.com*)
- MegaPing (*http://www.magnetosoft.com*)

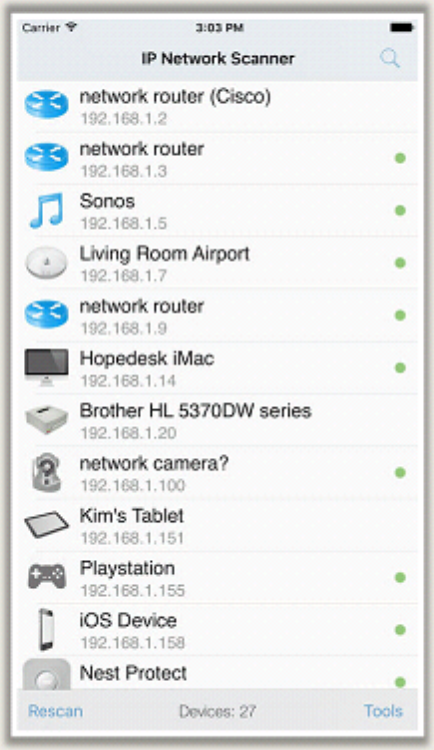
NetScanTools Pro



http://www.netscantools.com

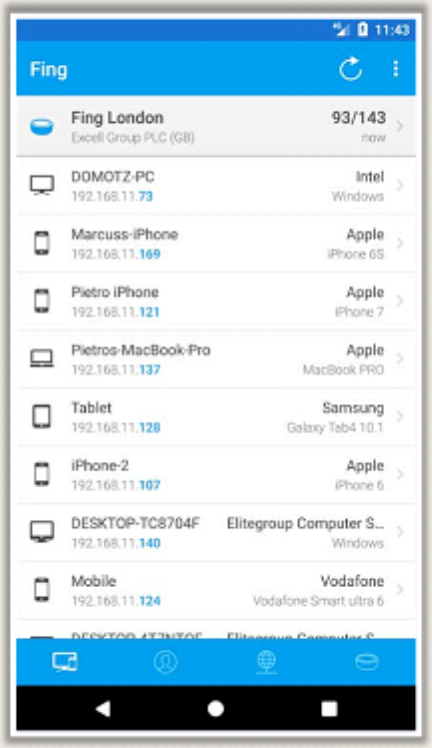
Scanning Tools for Mobile

IP Scanner



http://10base-t.com

Fing



https://www.fing.io

Hackode
https://play.google.com

zANTI
https://www.zimperium.com

cSploit
http://www.csploit.org

FaceNiff
http://www.effecthacking.com

PortDroid Network Analysis
https://play.google.com

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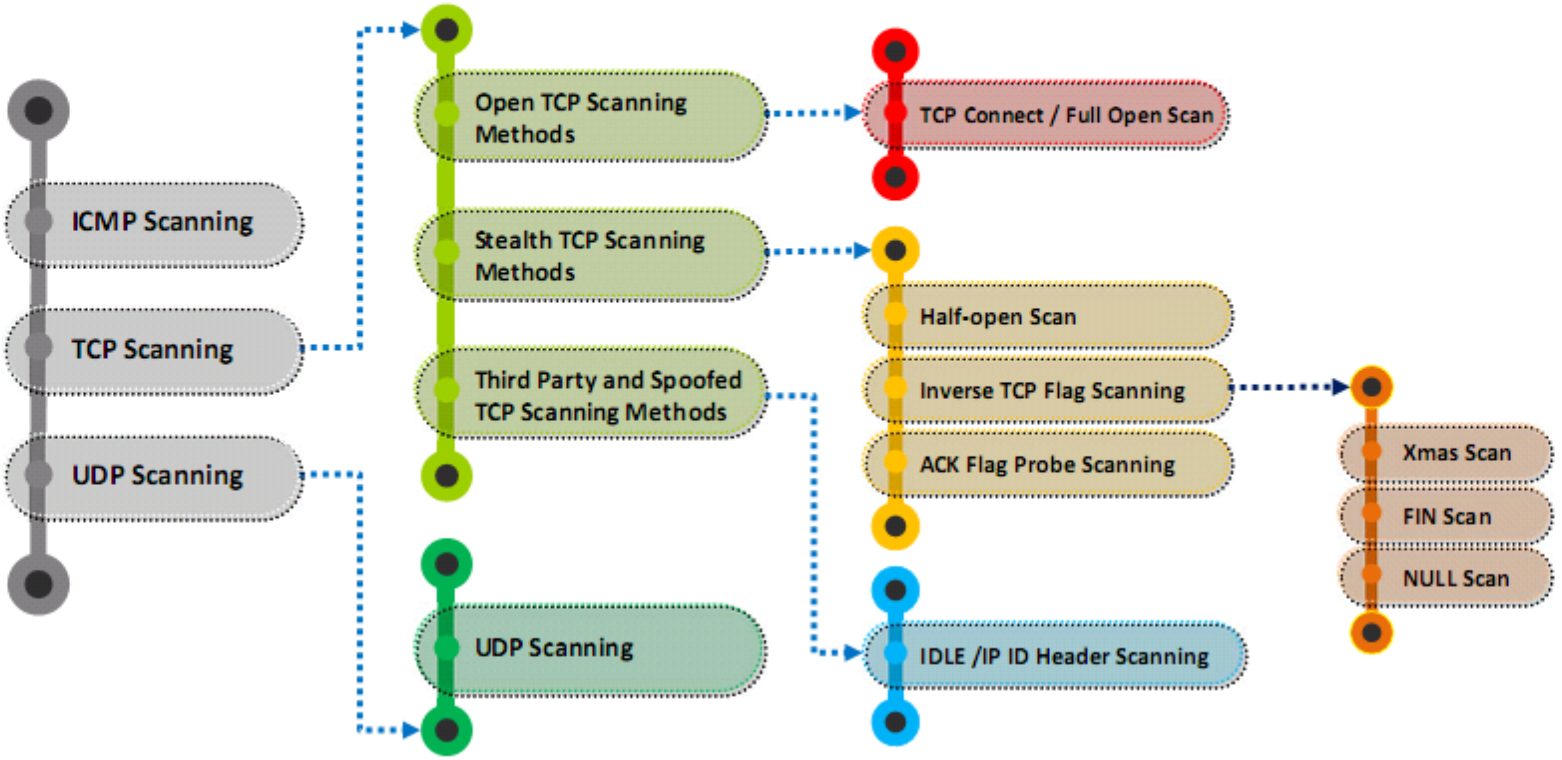
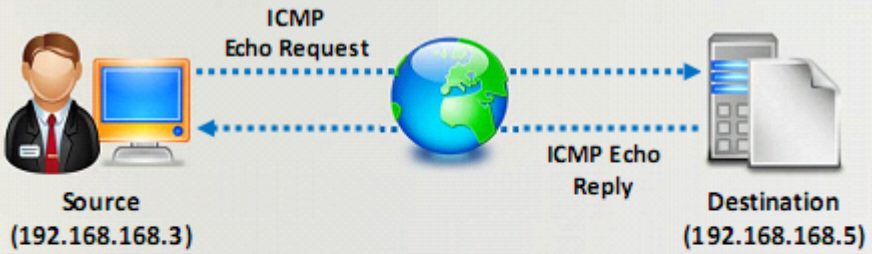
Scanning Techniques

- The scanning techniques are **categories according to the type of protocol used** for communication

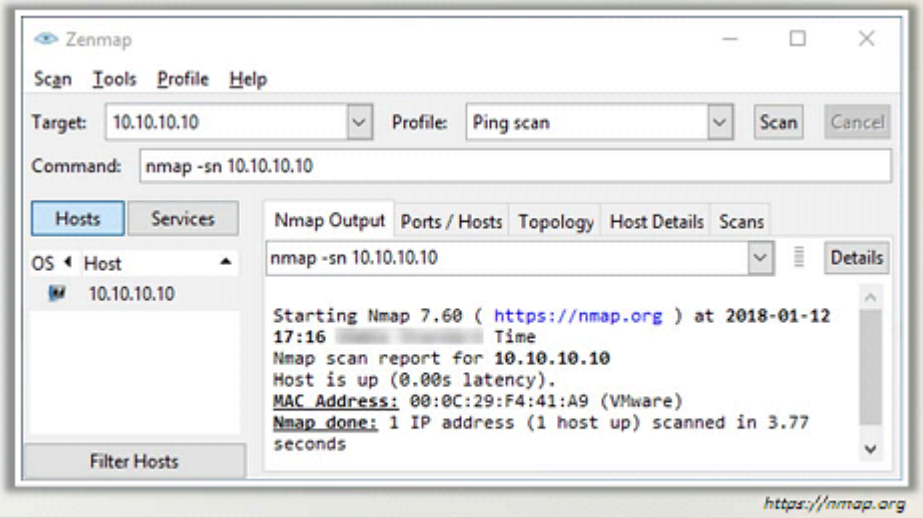


ICMP Scanning - Checking for Live Systems

- Ping scan involves sending **ICMP ECHO requests** to a host. If the host is alive, it will return an ICMP ECHO reply
- This scan is useful for **locating active devices** or determining if the **ICMP is passing through a firewall**



The ping scan output using Nmap

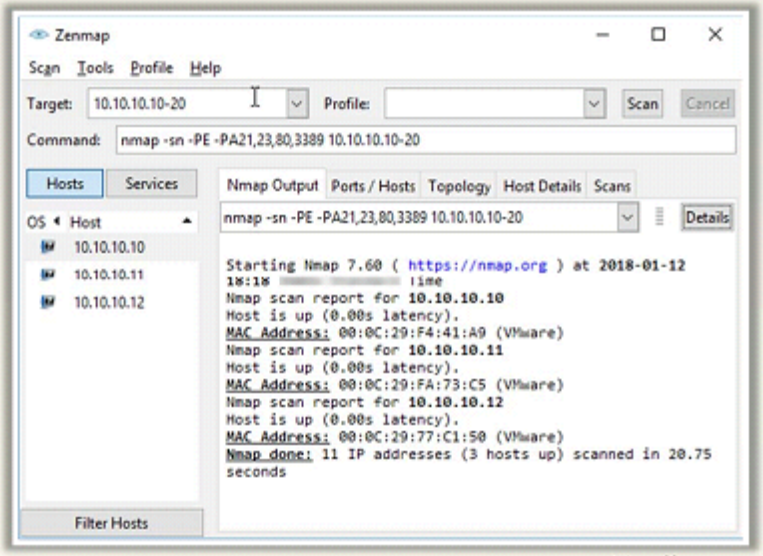


https://nmap.org

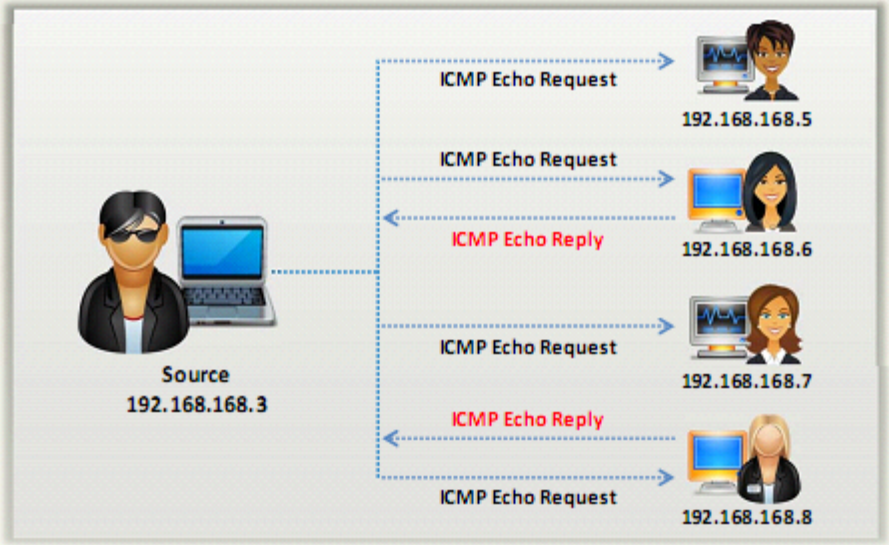
Ping Sweep - Checking for Live Systems

- Ping sweep is used to determine the **live hosts from a range of IP addresses** by sending ICMP ECHO requests to multiple hosts. If a host is alive, it will return an ICMP ECHO reply
- Attackers calculate subnet masks by using the **Subnet Mask Calculators** to identify the number of hosts that are present in the subnet
- Attackers subsequently use ping sweep to create an **inventory of live systems** in the subnet

The ping sweep output using Nmap



https://nmap.org



Ping Sweep Tools

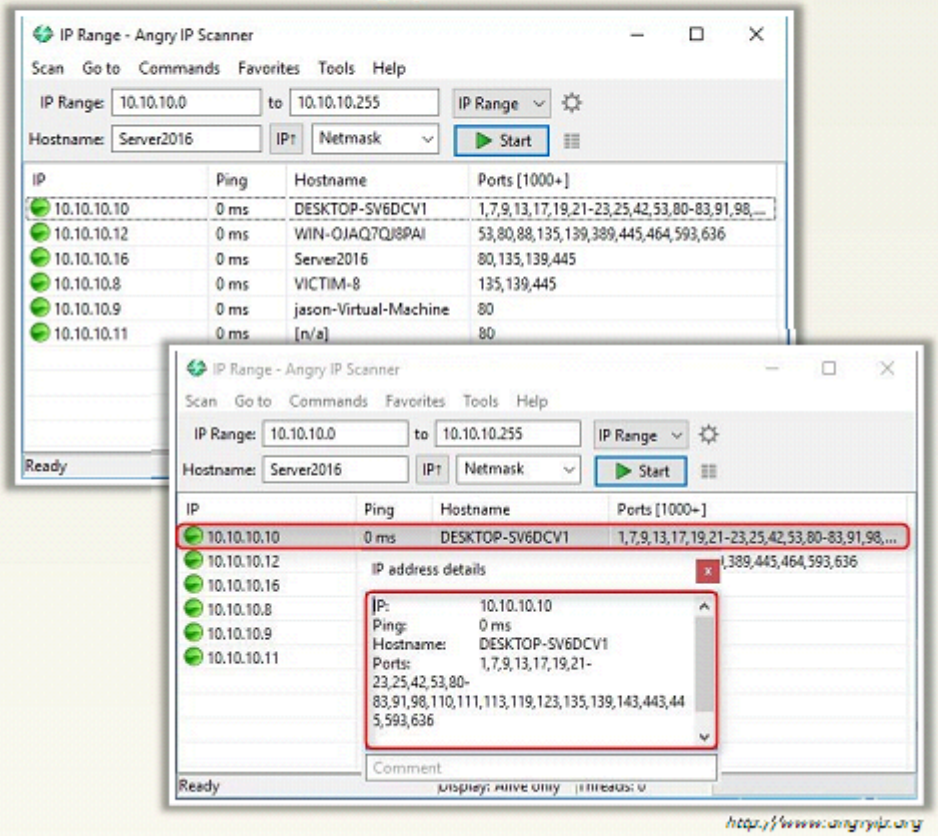
Angry IP Scanner

Angry IP Scanner pings each IP address to check if they are alive, then it optionally resolves its hostname, **determines the MAC address**, **scans ports**, etc.

Ping Sweep Tools

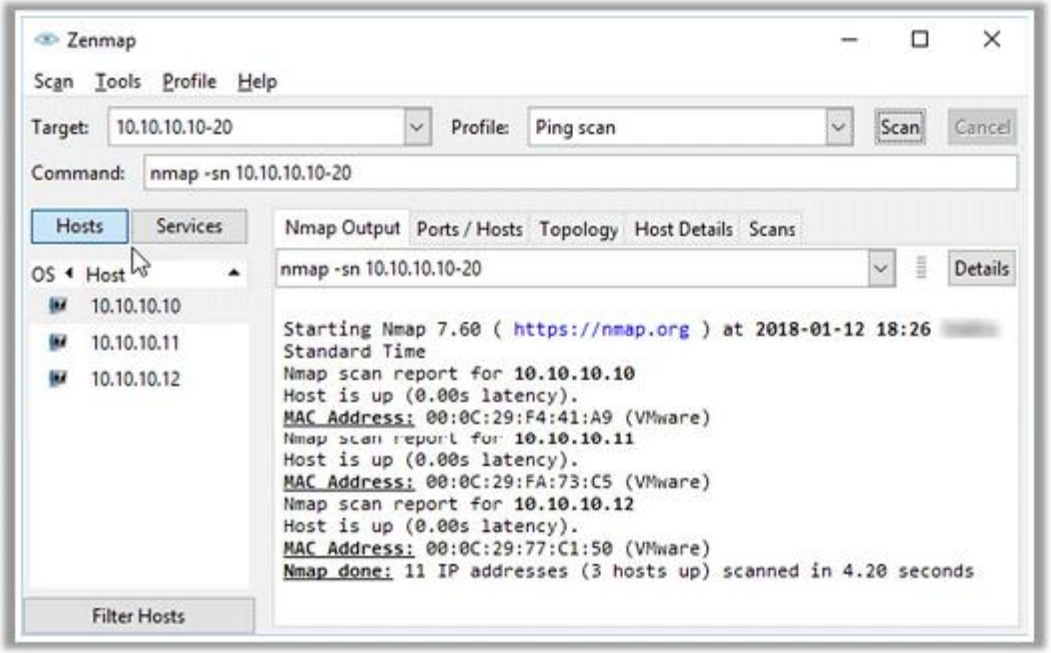
- SolarWinds Engineer's Toolset (*http://www.solarwinds.com*)
- NetScanTools Pro (*https://www.netscantools.com*)
- Colasoft Ping Tool (*http://www.colasoft.com*)
- Visual Ping Tester (*http://www.pingtester.net*)
- OpUtils (*https://www.manageengine.com*)

Angry IP Scanner



ICMP Echo Scanning

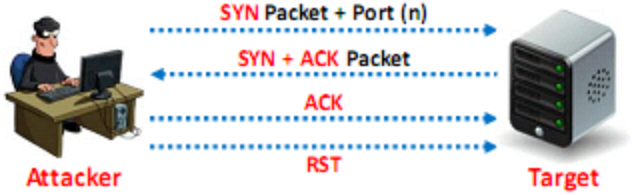
- In the real sense, this is not port scanning, since the **ICMP** does not have a port abstraction
- However, it is sometimes useful in determining which hosts in a network is up by **pinging** all of them
- `nmap -P cert.org/24 152.148.0.0/16`



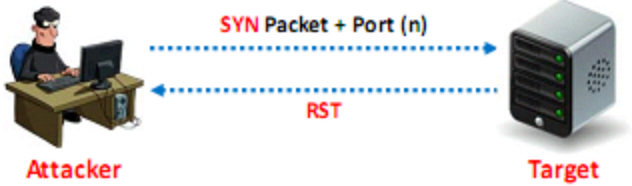
TCP Connect / Full Open Scan

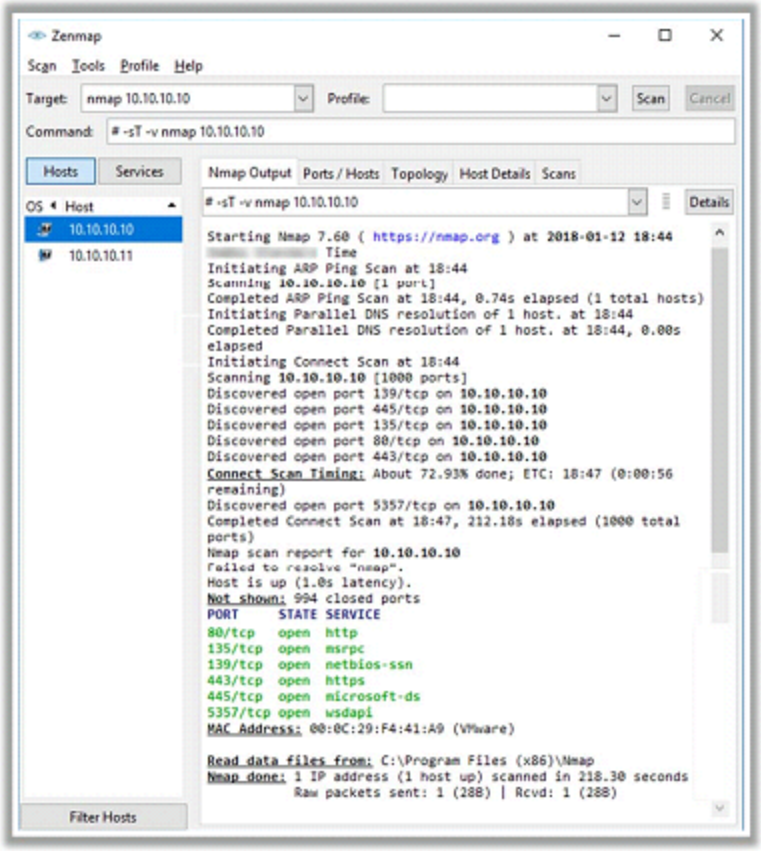
- The TCP Connect scan detects when a port is open after completing the **three-way handshake**
- TCP Connect scan **establishes a full connection** and tears it down by sending an **RST packet**
- It does not require the **super user privileges**

Scan result when a port is open



Scan result when a port is closed



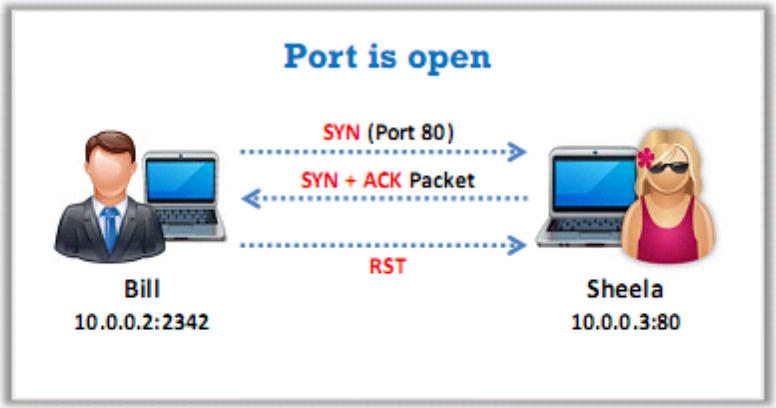


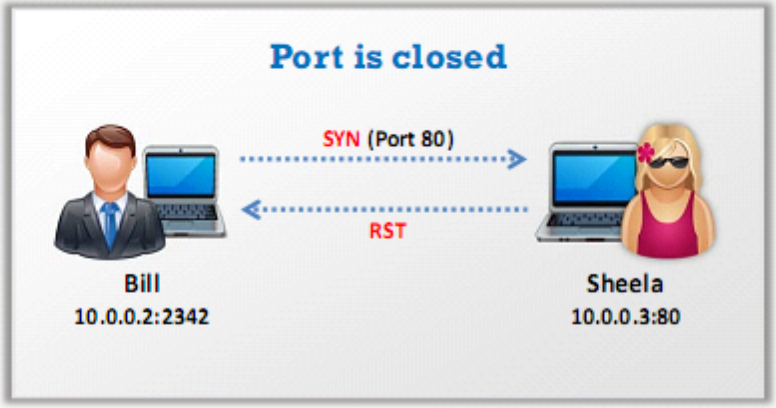
Stealth Scan (Half-open Scan)

- The Stealth scan involves resetting the TCP connection between the client and server abruptly before completion of **three-way handshake signals**, hence, making the connection half open
- Attackers use stealth scanning techniques to **bypass firewall rules**, **logging mechanism**, and hide themselves as usual under network traffic

Stealth Scan Process

The client sends a single **SYN** packet to the server to the appropriate port	**01**
If the port is open, subsequently, the server will responds with an **SYN/ACK** packet	**02**
If the server responds with an **RST** packet, then the remote port is in the "closed" state	**03**
The client sends the **RST** packet to close the initiation before a connection can ever be established	**04**



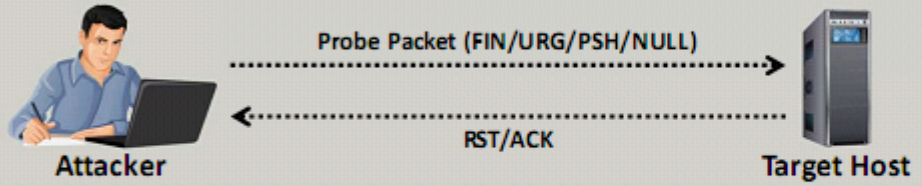


Inverse TCP Flag Scanning

01 Attackers send TCP probe packets with a TCP flag (FIN, URG, PSH) set or with no flags, no response implies that the port is open while RST means that the port is closed

02 Port is open

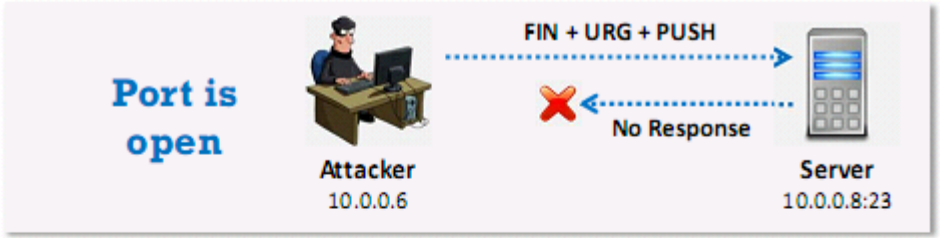
03 Port is closed

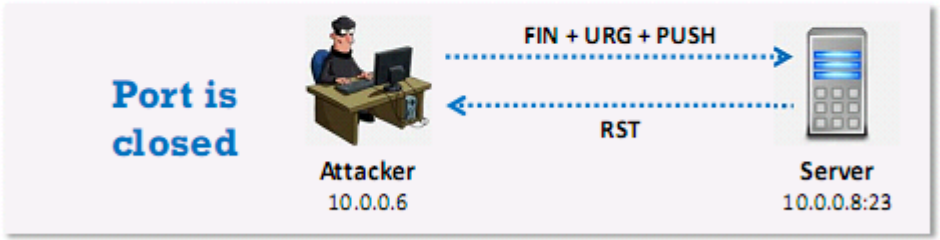


Note: Inverse TCP flag scanning is known as FIN, URG, PSH scanning based on the flag set in the probe packet. It is known as null scanning if there is no flag set

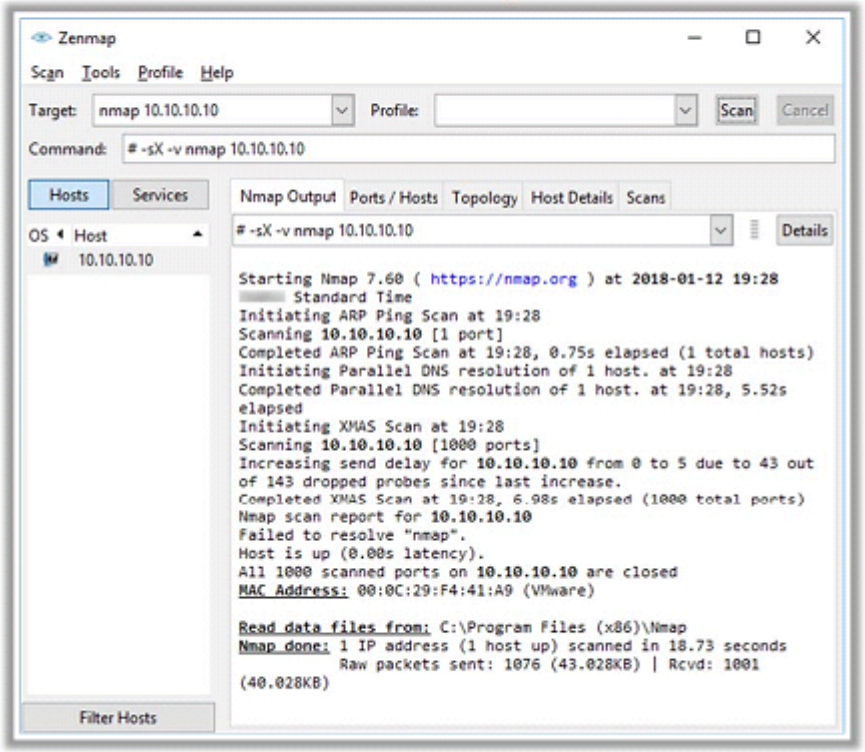
Xmas Scan

- In Xmas scan, attackers send a TCP frame to a remote device with FIN, URG, and PUSH flags set
- FIN scan works only with OSes with RFC 793-based TCP/IP implementation
- It will not work against any current version of Microsoft Windows





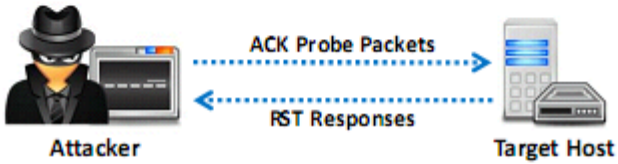
Xmas Scan Using Nmap



ACK Flag Probe Scanning

- Attackers send **TCP probe packets with ACK flag** set to a remote device and then **analyzes the header information** (TTL and WINDOW field) of received RST packets to find out if the **port is open or closed**

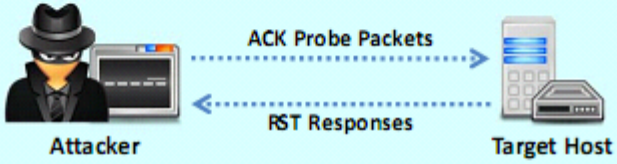
TTL based ACK flag probe scanning




```
1: host 10.2.2.11 port 20: F:RST -> ttl: 80 win: 0
2: host 10.2.2.11 port 21: F:RST -> ttl: 80 win: 0
3: host 10.2.2.11 port 22: F:RST -> ttl: 50 win: 0
4: host 10.2.2.11 port 23: F:RST -> ttl: 80 win: 0
```

If the **TTL value of RST packet** on a particular port is less than the boundary value of **64**, then that **port is open**

WINDOW based ACK flag probe scanning

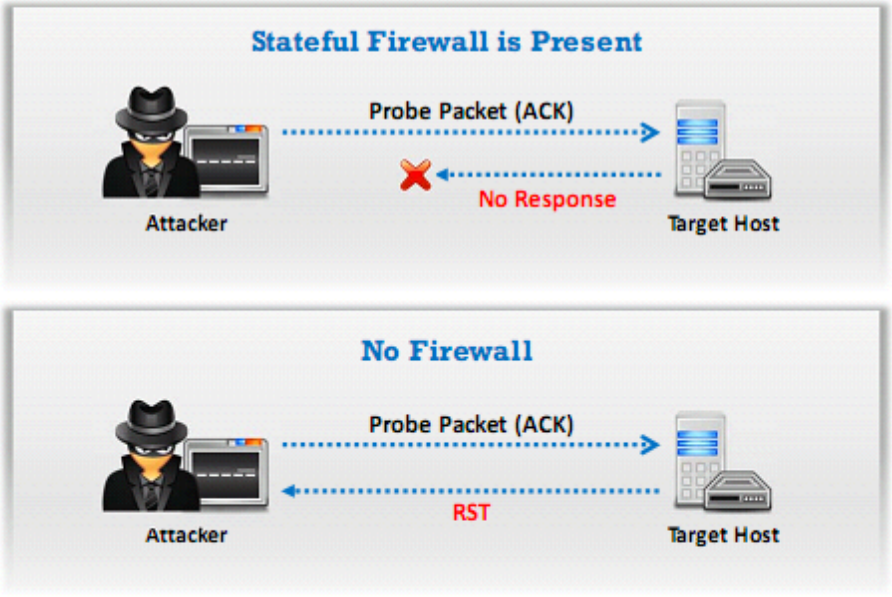


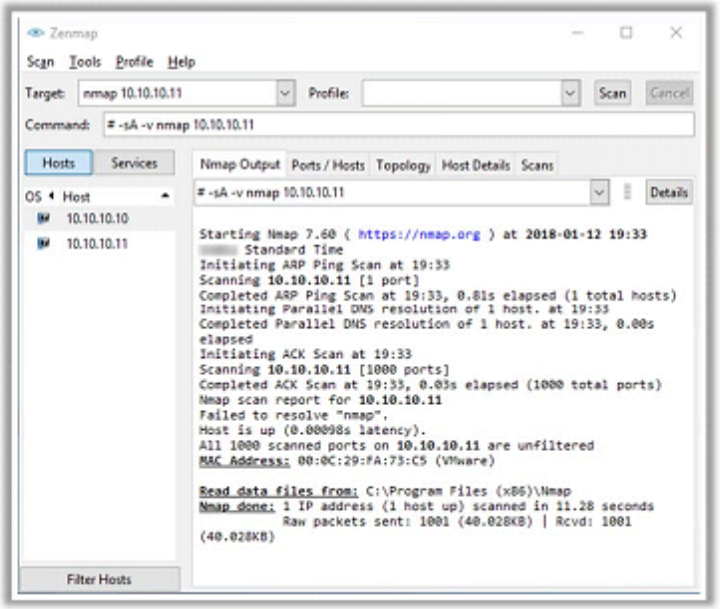

```
1: host 10.2.2.12 port 20: F:RST -> ttl: 64 win: 0
2: host 10.2.2.12 port 21: F:RST -> ttl: 64 win: 0
3: host 10.2.2.12 port 22: F:RST -> ttl: 64 win: 512
4: host 10.2.2.12 port 23: F:RST -> ttl: 64 win: 0
```

If the **WINDOW value of RST packet** on a particular port has a **non zero value**, then that **port is open**

ACK Flag Probe Scanning (Cont'd)

- ACK flag probe scanning can also be used to **check the filtering system of target**
- Attackers send an **ACK probe packet** with a random sequence number, no response implies that the **port is filtered** (stateful firewall is present) and RST response means that the **port is not filtered**

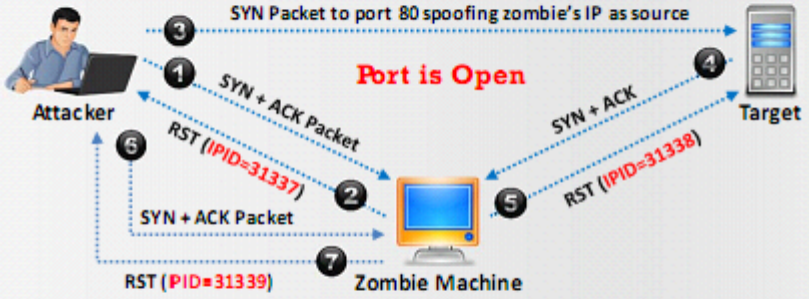


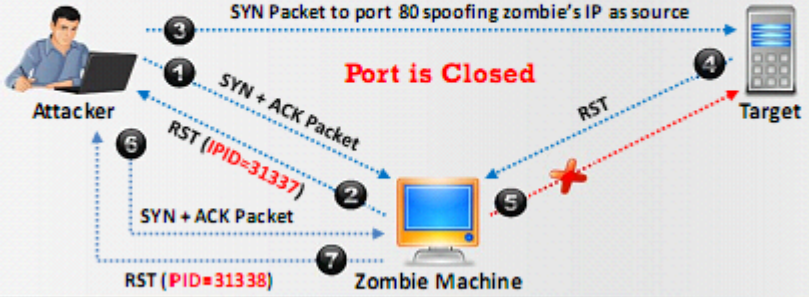


IDLE/IPID Header Scan

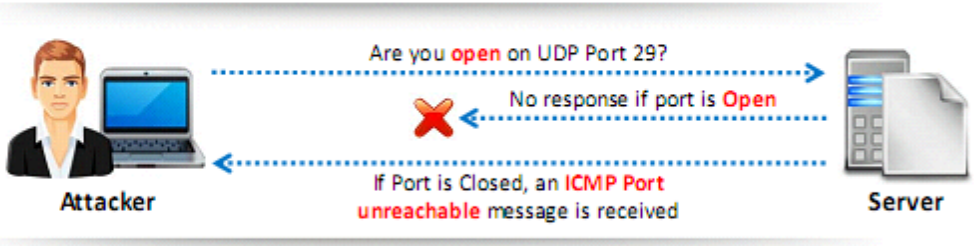
- Every IP packet on the Internet has a fragment identification number (IPID); OS increases the IPID for each packet sent, thus, probing an IPID gives an attacker the **number of packets sent** after the last probe
- A machine that receives an **unsolicited SYN|ACK packet** will respond with an RST. An unsolicited RST will be ignored

1. Send SYN + ACK packet to the zombie machine to **probe its IPID number**
2. A zombie machine not expecting an SYN + ACK packet will send **RST packet**, disclosing the IPID. However, always analyse the RST packet from the zombie machine to **extract IPID**
3. Send SYN packet to the **target machine (port 80)** to spoof the IP address of the "zombie"
4. If the port is open, the target will send **SYN+ACK Packet** to the zombie and in response the zombie will send an RST to the target
5. If the port is closed, the target will send an **RST to the zombie** but the zombie will not send anything back
6. Probe the zombie IPID again, IPID increased by **2 will indicate an open port** whereas **1 will indicate a closed port**





UDP Scanning

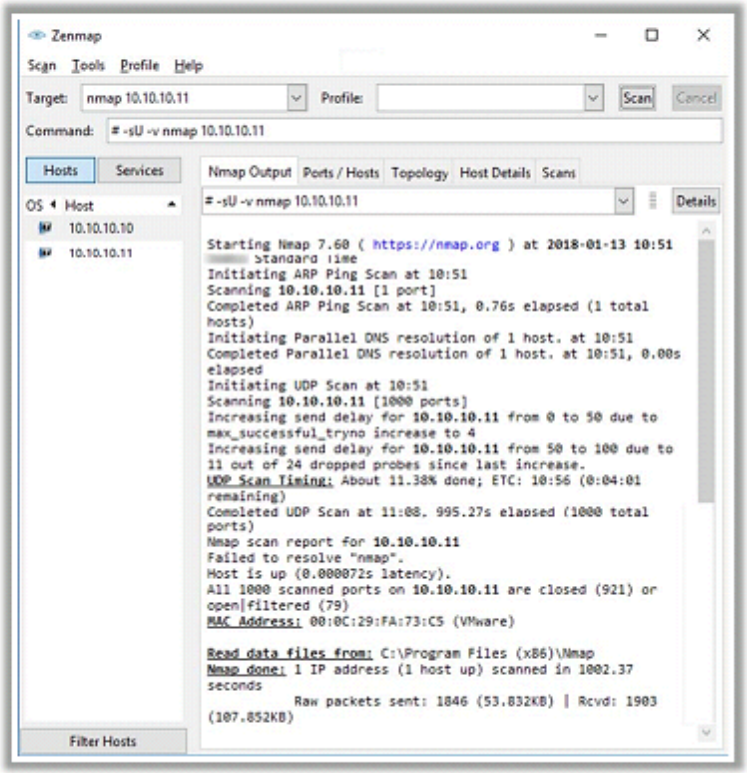


UDP Port Open

- There is no three-way TCP handshake for UDP scan
- The system does not respond with a message when the port is open

UDP Port Closed

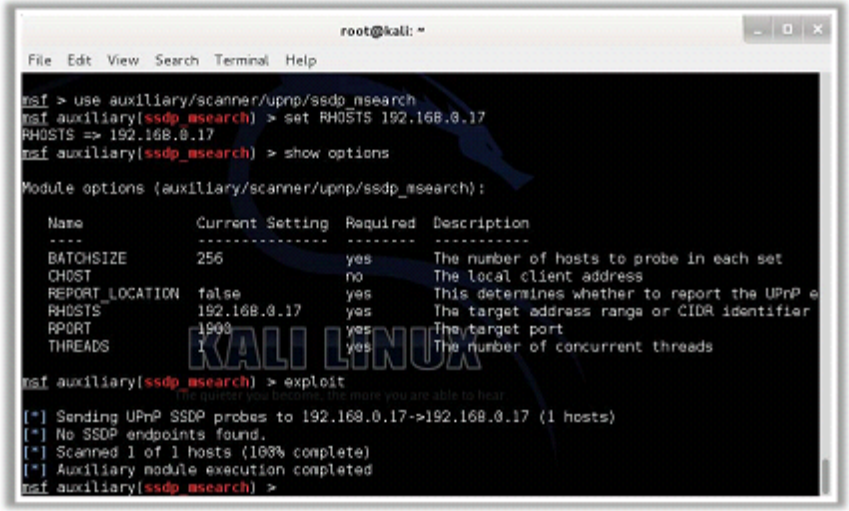
- If a UDP packet is sent to a closed port, the system will respond with an ICMP port unreachable message
- Spywares, Trojan horses, and other malicious applications use UDP ports



SSDP and List Scanning

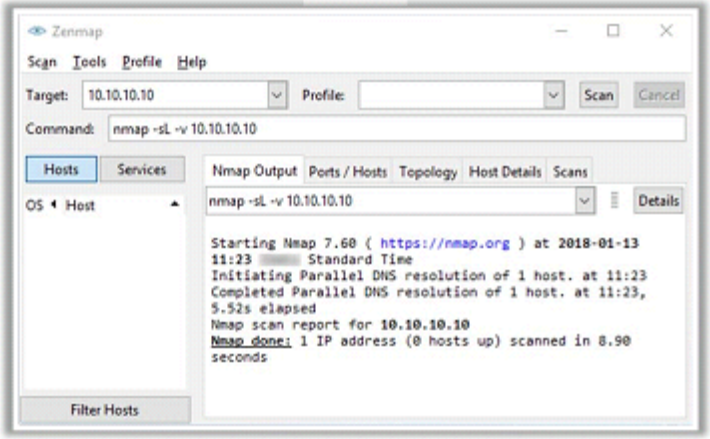
SSDP Scanning

- The Simple Service Discovery Protocol (SSDP) is a network protocol that works in conjunction with the UPnP to detect plug and play devices
- Vulnerabilities in UPnP may allow attackers to launch Buffer overflow or DoS attacks
- Attacker may use UPnP SSDP M-SEARCH information discovery tool to check if the machine is vulnerable to UPnP exploits or not



List Scanning

- This type of scan simply generates and prints a list of IPs/Names without actually pinging them
- A reverse DNS resolution is carried out to identify the host names



Port Scanning Countermeasures

01 Configure **firewall** and **IDS rules** to detect and block probes

02 Run the **port scanning tools** against hosts on the network to determine whether the firewall properly **detects the port scanning activity**

03 Ensure that the mechanism used for **routing and filtering** at the routers and firewalls respectively **cannot be bypassed** using a particular source ports or source-routing methods

04 Ensure that the **router**, **IDS**, and **firewall firmware** are updated to their latest releases/version

05 Use **custom rule set** to lock down the network and block **unwanted ports** at the firewall

06 Filter all **ICMP messages** (i.e. inbound ICMP message types and outbound ICMP type 3 unreachable messages) at the **firewalls and routers**

07 Perform **TCP and UDP scanning** along with ICMP probes against your organization's IP address space to **check the network configuration and its available ports**

08 Ensure that the **anti scanning** and **anti spoofing** rules are properly configured

Module Flow

1. Network Scanning Concepts
2. Scanning Tools
3. Scanning Techniques
4. Scanning Beyond IDS and Firewall
5. Banner Grabbing
6. Draw Network Diagrams
7. Scanning Pen Testing

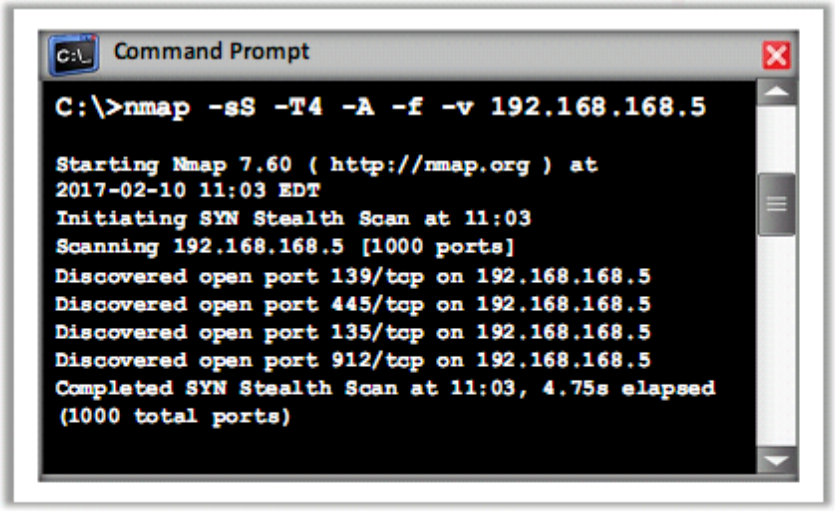
IDS/Firewall Evasion Techniques

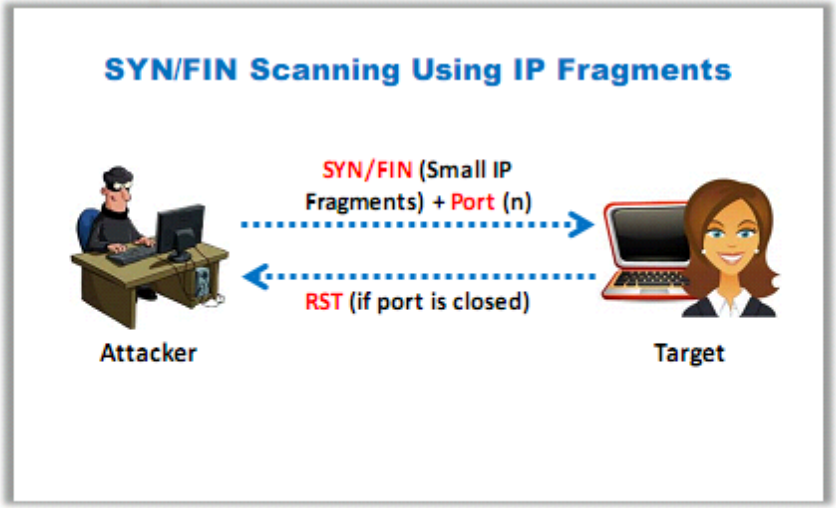
- **Packet Fragmentation**: Sending fragmented probe packets to the intended server which re-assembles it after receiving all the fragments
- **Source Routing**: Specifying the routing path for the malformed packet to reach the intended server
- **IP Address Decoy**: Generating or manually specifying IP addresses of the decoys so that the IDS/Firewall cannot determine the actual IP address
- **IP Address Spoofing**: Changing source IP addresses so that the packet appears to be from someone else
- **Proxy Server**: Using chain of proxy servers to hide the actual source of a scan and evade certain IDS/firewall restrictions

Packet Fragmentation

- Packet fragmentation refers to the **splitting of a probe packet into several smaller packets** (fragments) while sending it to a network
- It is not a new scanning method but a **modification** of the previous techniques

- The **TCP header** is split into several packets so that the packet filters are not able to detect what the packets intends to do

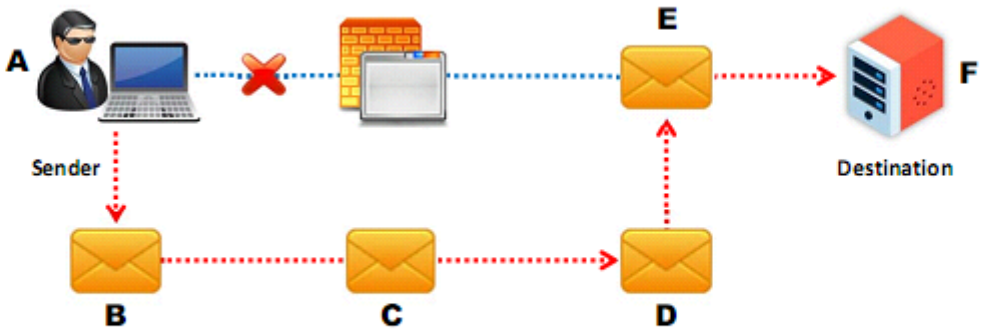




Source Routing

- As the packet travels through the nodes in the network, each **router examines** the destination IP address and **chooses the next hop** to direct the packet to the destination
- Source routing refers to sending a packet to the intended destination with partially or completely **specified route** (without firewall-/IDS-configured routers) in order to evade IDS/firewall
- In source routing, the **attacker** makes some or all of these decisions on the router

The figure shows source routing, where the originator dictates eventual route of traffic



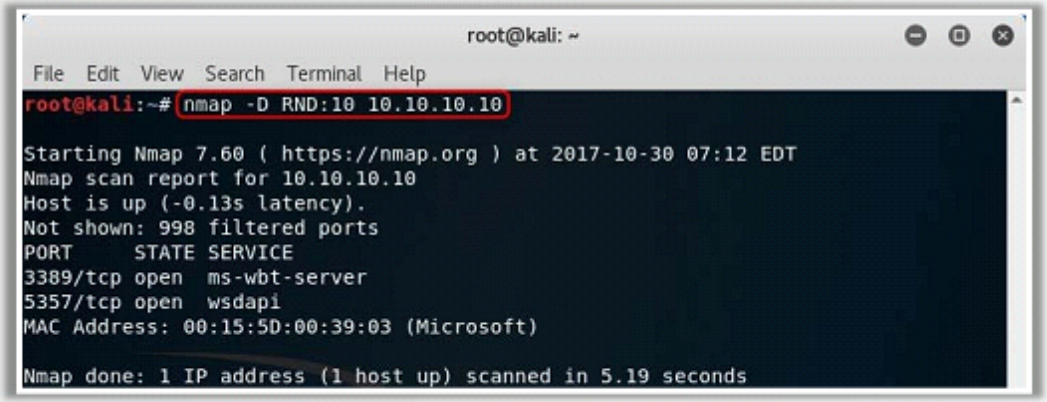
IP Address Decoy

- IP address decoy technique refers to **generating or manually specifying IP addresses of the decoys** in order to evade IDS/firewall
- It appears to the target that the **decoys as well as the host(s)** are scanning the network
- This technique makes it **difficult for the IDS/firewall to determine** which IP address was actually scanning the network and which IP addresses were decoys

Decoy Scanning using Nmap

Nmap has two options for decoy scan:

- **`nmap -D RND:10 [target]`**
  (Generates a random number of decoys)
- **`nmap -D decoy1,decoy2,decoy3,..`** etc.
  (Manually specify the IP addresses of the decoys)



IP Address Spoofing

- IP spoofing refers to **changing the source IP addresses** so that the attack **appears to be coming from someone else**
- When the victim replies to the address, it goes back to the **spoofed address** and not to the **attacker's real address**
- Attackers modify the **address information** in the IP packet header and the source address bits field in order to bypass the IDS/firewall

IP spoofing using Hping3:

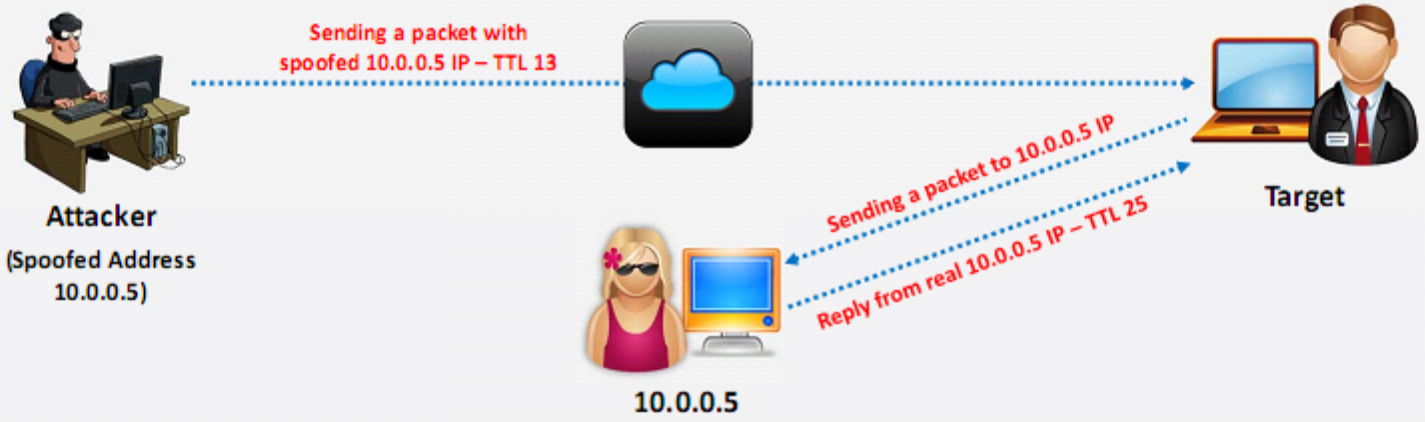
```
Hping3 www.certifiedhacker.com
-a 7.7.7.7
```

Note: You will not be able to complete the three-way handshake and open a successful TCP connection with a spoofed IP addresses

IP Spoofing Detection Techniques: Direct TTL Probes

01 Send packet to host of suspect spoofed packet that triggers reply and compare TTL with suspect packet; if the **TTL in the reply is not as the same** as the packet being checked, it implies that it is a spoofed packet

02 This technique is successful when the attacker is in a **different subnet** from that of the victim



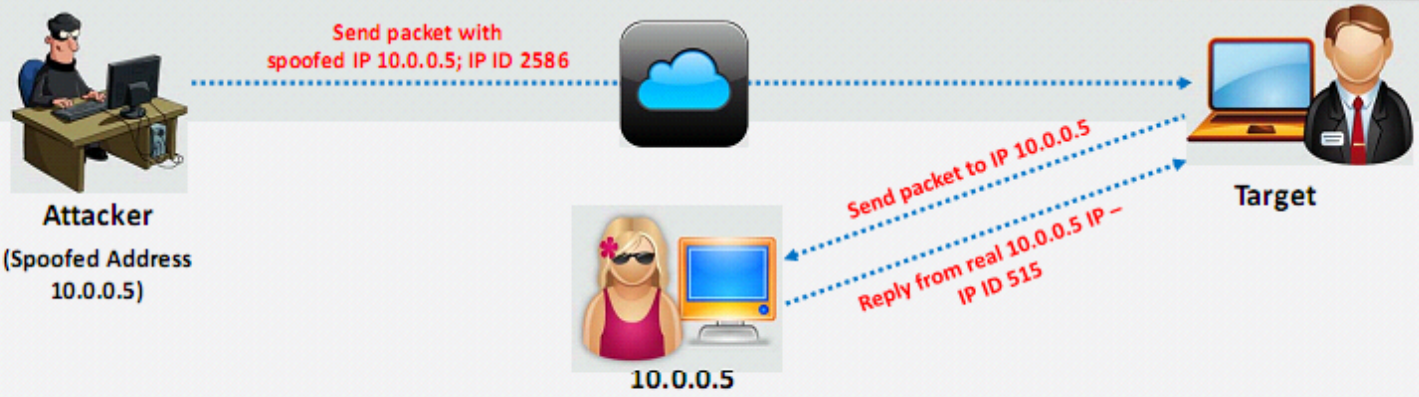
Note: Normal traffic from one host can contrast TTLs depending on traffic patterns

IP Spoofing Detection Techniques: IP Identification Number

01 Send probe to host of suspect spoofed traffic that triggers reply and **compare the IP ID** with suspect traffic

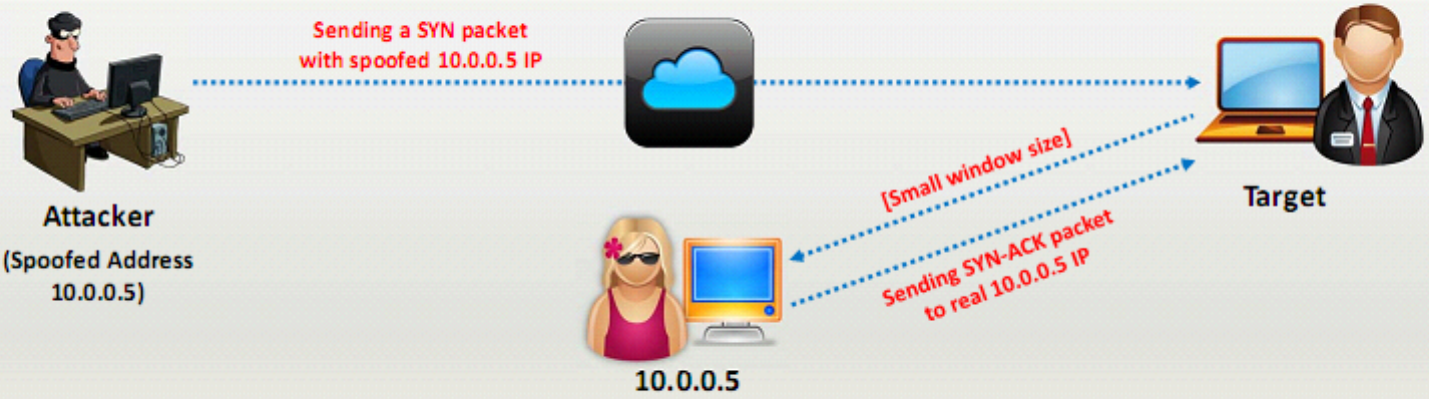
02 If IP IDs are **not close in value** to the packet being checked, suspect traffic is spoofed

03 This technique is deemed successful even if the attacker is in the **same subnet**



IP Spoofing Detection Techniques: TCP Flow Control Method

- Attackers sending spoofed TCP packets, will not receive the target's SYN-ACK packets
- Attackers cannot therefore be responsive to change in the congestion window size
- When received traffic continues after a window size is exhausted, most probably the packets are spoofed



IP Spoofing Countermeasures

Encrypt all the network traffic using cryptographic network protocols such as IPsec, TLS, SSH, and HTTPS

Use random initial sequence number to prevent IP spoofing attacks based on sequence number spoofing

Use multiple firewalls providing multi-layered depth of protection

Ingress Filtering: Use routers and firewalls at your network perimeter to filter incoming packets that appear to come from an internal IP address

Do not rely on **IP-based authentication**

Egress Filtering: Filter all outgoing packets with an invalid local IP address as source address

Proxy Servers

A proxy server is an application that can **serve as an intermediary** for connecting with other computers

Why Attackers Use Proxy Servers?

- To hide the actual source of a scan and evade certain IDS/firewall restrictions
- To mask the actual source of the attack by impersonating a fake source address of the proxy
- To remotely access intranets and other website resources that are normally off limits
- To interrupt all the requests sent by a user and transmit them to a third destination, hence victims will only be able to identify the proxy server address
- To chain multiple proxy servers to avoid detection





Note: A search in Google will list thousands of free proxy servers

Proxy Chaining

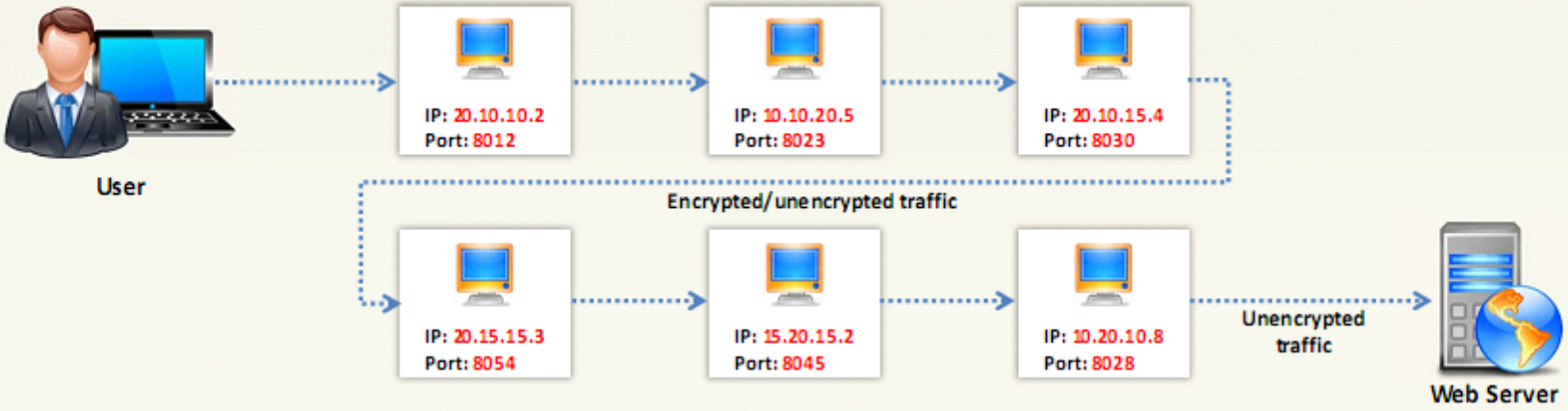
01 User **requests a resource** from the destination

02 Proxy client at the user's system connects to a **proxy server** and passes the request to proxy server

03 The proxy server **strips the user's identification information** and passes the request to next proxy server

04 This process is repeated by all the proxy servers in the **chain**

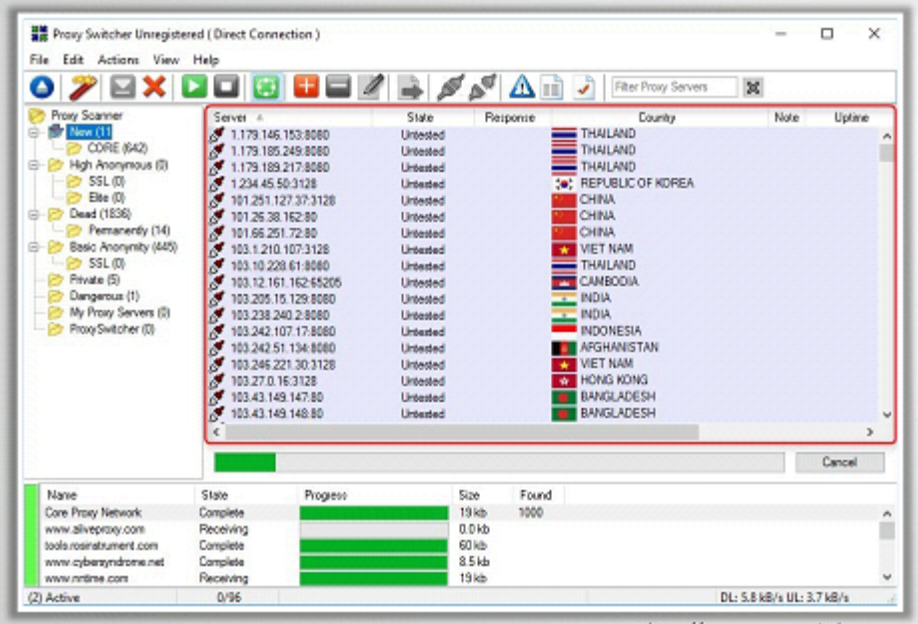
05 At the end, the **unencrypted request** is passed to the web server



Proxy Tools: Proxy Switcher and Proxy Workbench

Proxy Switcher

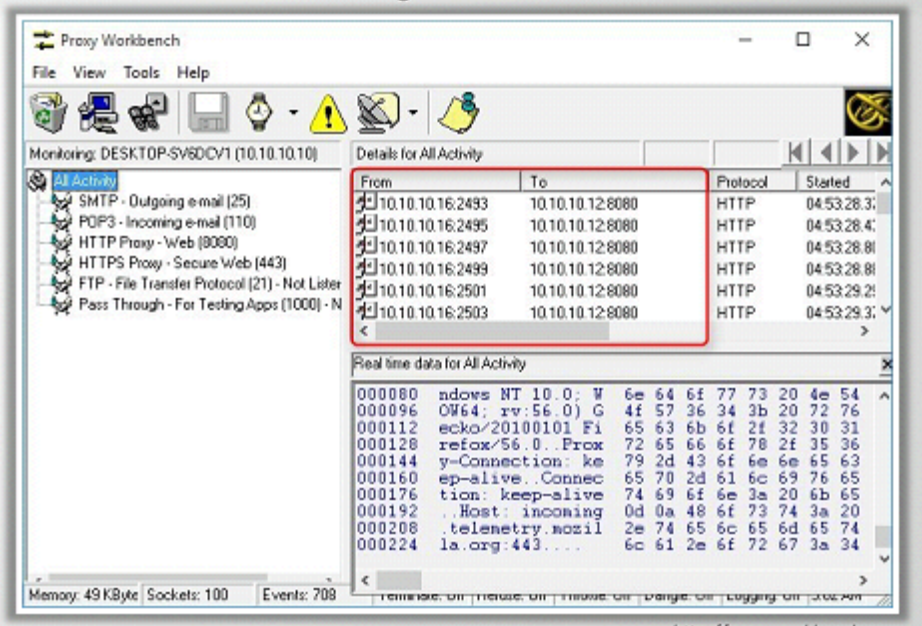
- Proxy Switcher allows you to **surf anonymously on the Internet** without disclosing your IP address



http://www.proxyswitcher.com

Proxy Workbench

- Proxy Workbench is a proxy server that **displays data passing through it in real time**, allows you to drill into a particular TCP/IP connection, view their history, save the data to a file, and view the socket connection diagram

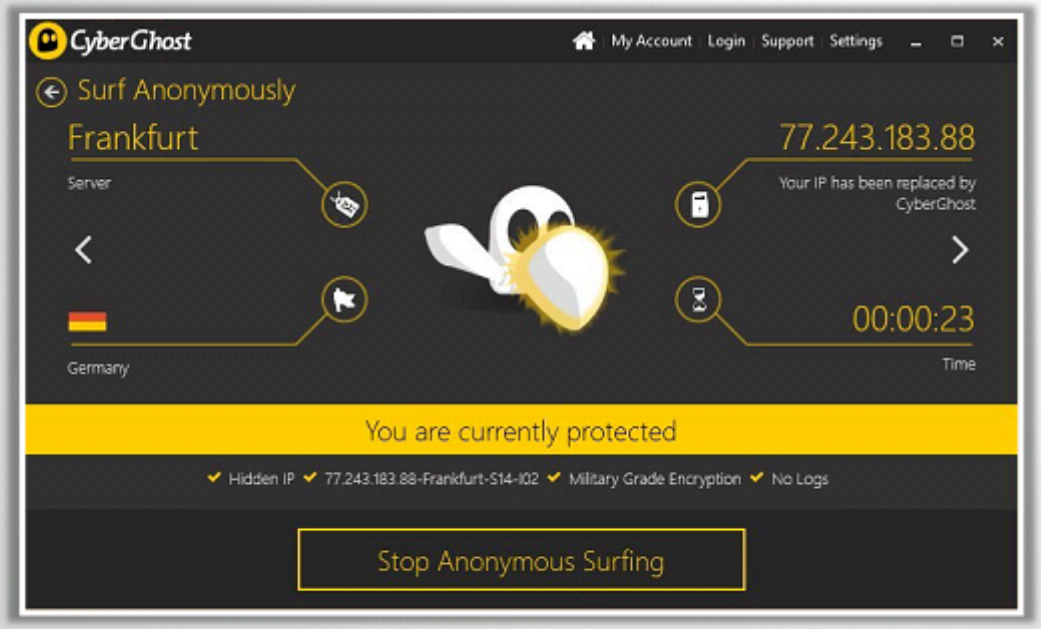


http://proxyworkbench.com

Proxy Tools

CyberGhost VPN

- CyberGhost allows you to protect your online privacy, surf anonymously, and access blocked or censored contents
- It hides your IP and replaces it with one of your choice, allowing you to surf anonymously



https://www.cyberghostvpn.com

Tor
https://www.torproject.org

Burp Suite
https://www.portswigger.net

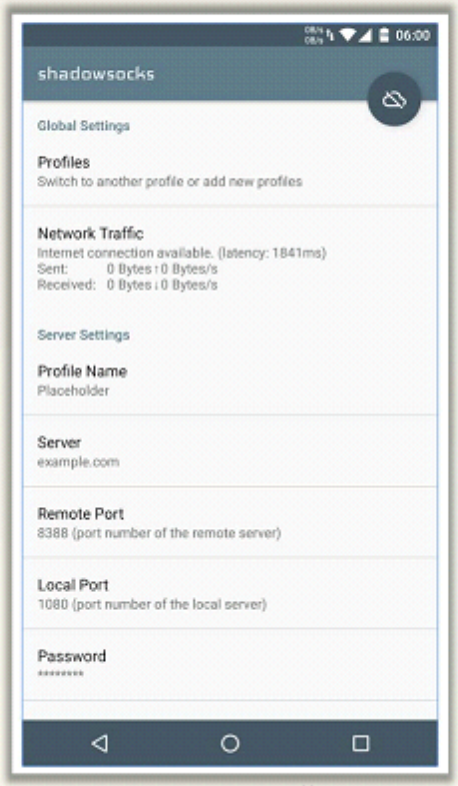
Hotspot Shield
https://www.hotspotshield.com

Proxifier
https://www.proxifier.com

Charles
https://www.charlesproxy.com

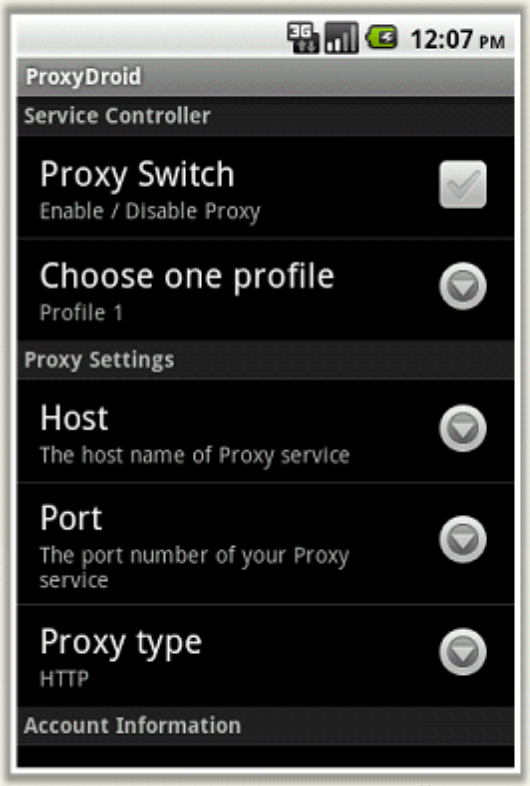
Proxy Tools for Mobile

Shadowsocks



https://shadowsocks.org

ProxyDroid



https://github.com

- **CyberGhost VPN** — https://www.cyberghostvpn.com
- **Servers Ultimate** — http://www.icecoldapps.com
- **Hotspot Shield** — https://www.hotspotshield.com
- **NetShade** — http://www.raynersw.com
- **Proxy Manager** — https://play.google.com

Anonymizers

An anonymizer removes all the identifying information from the user's computer while the user surfs the Internet

Anonymizers make activity on the Internet untraceable

Anonymizers allow you to bypass Internet censors

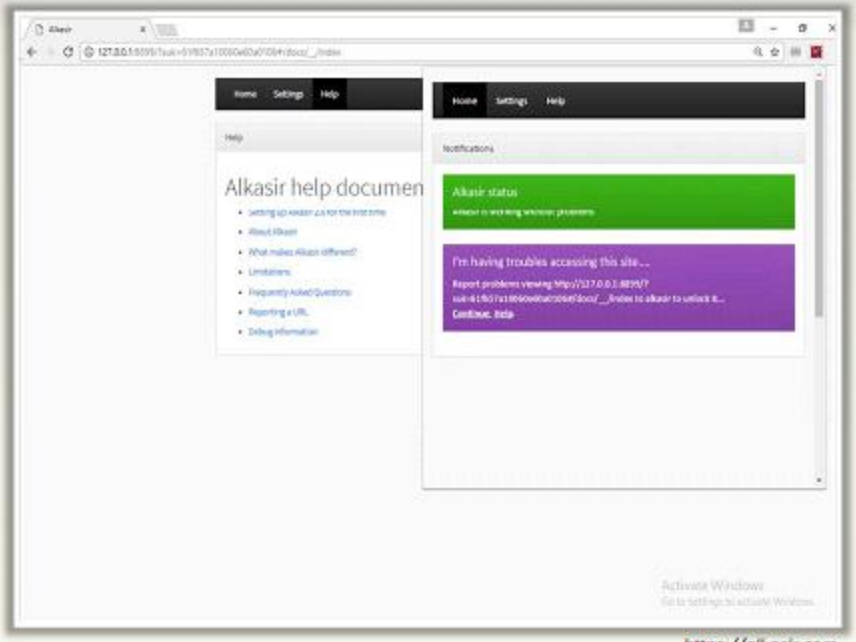
Why use Anonymizer?

- Privacy and anonymity
- Protects from online attacks
- Access restricted content
- Bypass IDS and Firewall rules

Censorship Circumvention Tools: Alkasir and Tails

Alkasir

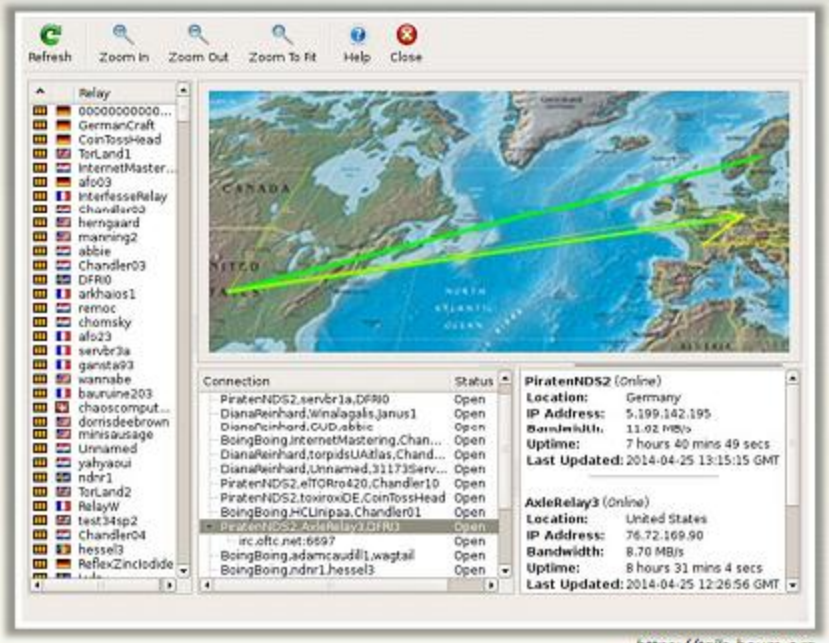
- Alkasir is a **cross-platform**, open-source, and robust website censorship circumvention tool that also **maps censorship patterns** around the world



https://alkasir.com

Tails

- Tails is a **live operating system**, that user can start on any computer from a DVD, USB stick, or SD card

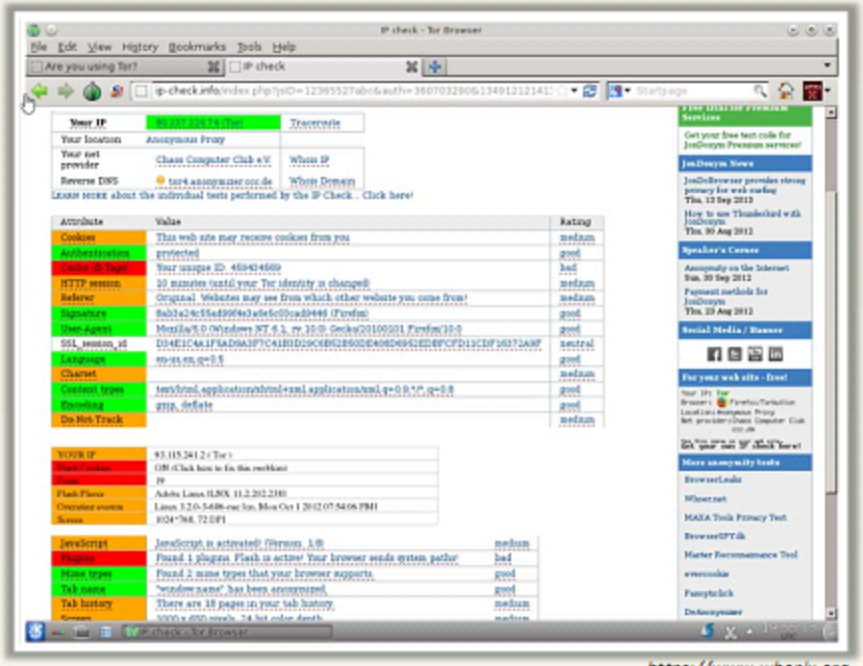


https://tails.boum.org

Anonymizers

Whonix

- Whonix is a **desktop operating system** designed for advanced security and privacy



https://www.whonix.org

TunnelBear
https://www.tunnelbear.com

Invisible Internet Project (I2P)
https://geti2p.net

JonDo
https://anonymous-proxy-servers.net

Proxify
https://proxify.com

Psiphon
https://psiphon.ca

Anonymizers for Mobile

Orbot

https://guardianproject.info

Psiphon

https://psiphon.ca

OpenDoor

https://itunes.apple.com

Module Flow

1. Network Scanning Concepts
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6. Draw Network Diagrams
7. Scanning Pen Testing

Banner Grabbing

Banner grabbing or OS fingerprinting is the method used to **determine the operating system running on a remote target system**. There are two types of banner grabbing: active and passive

Identifying the OS used on the target host allows an attacker to **figure out the vulnerabilities the system posses** and the exploits that might work on a system to further **carry out additional attacks**

Active Banner Grabbing

- **Specially crafted packets** are sent to remote OS and the responses are noted
- The responses are then compared with a database to **determine the OS**
- Responses from different OSes varies due to differences in the **TCP/IP stack implementation**

Passive Banner Grabbing

- **Banner grabbing from error messages**

  Error messages provide information such as the type of server, type of OS, and SSL tool used by the target remote system.
- **Sniffing the network traffic**

  Capturing and analyzing packets from the target enables an attacker to determine the OS used by the remote system.
- **Banner grabbing from page extensions**

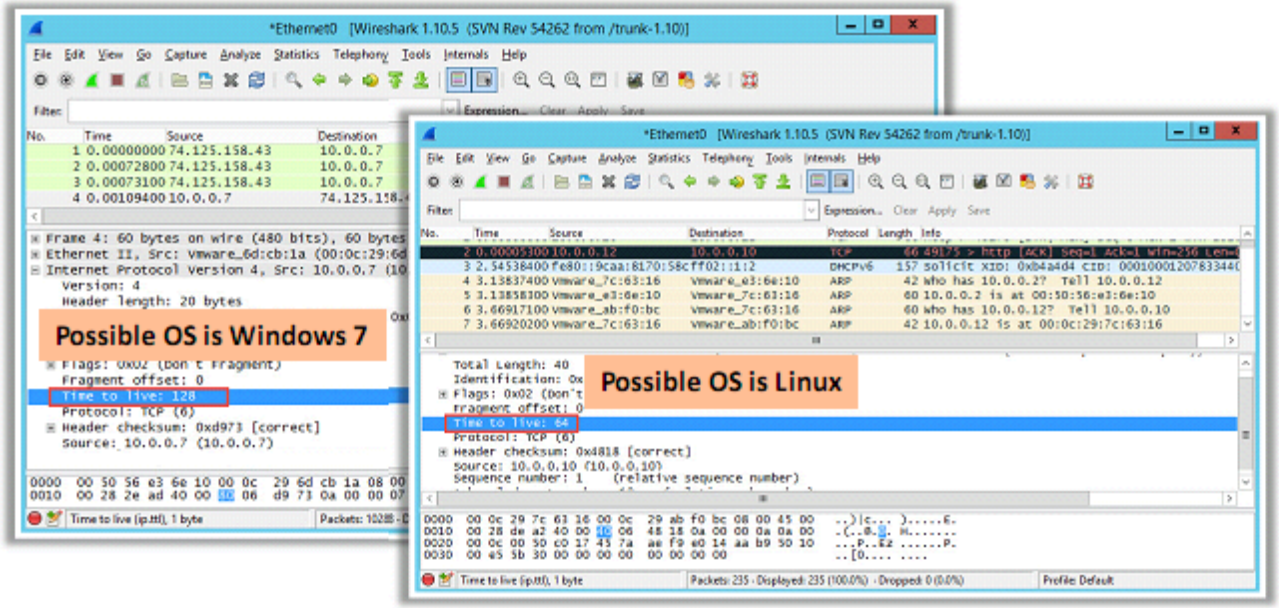
  Looking for an extension in the URL may assist in determining the application's version.

  Example: .aspx => IIS server and Windows platform

Note: We will discuss passive banner grabbing in later modules.

How to Identify Target System OS

- Attacker can identify the OS running on the target machine by looking at the **Time To Live (TTL)** and **TCP window size** in the IP header of the first packet in a TCP session
- **Sniff/capture the response** generated from the target machine by using packet-sniffing tools like Wireshark and observe the TTL and TCP window size fields



Values for the Operating Systems

Operating System	Time To Live	TCP Window Size
Linux (Kernel 2.4 and 2.6)	64	5840
Google Linux	64	5720
FreeBSD	64	65535
OpenBSD	64	16384
Windows 95	32	8192
Windows 2000	128	16384
Windows XP	128	65535
Windows 98, Vista and 7 (Server 2008)	128	8192
iOS 12.4 (Cisco Routers)	255	4128
Solaris 7	255	8760
AIX 4.3	64	16384

Banner Grabbing Countermeasures

Disabling or Changing Banner

- Display **false banners** to mislead or deceive attackers
- **Turn off unnecessary services** on the network host to limit the information disclosure
- Use **ServerMask** (*http://www.port80software.com*) tools to disable or change banner information
- Apache 2.x with `mod_headers` module - use a directive in `httpd.conf` file to change banner information **Header set Server "New Server Name"**
- Alternatively, change the `ServerSignature` line to `ServerSignature Off` in `httpd.conf` file

Hiding File Extensions from Web Pages

- File extensions reveal information about the **underlying server technology** that an attacker can utilize to launch attacks
- Hide file extensions to **mask the web technology**
- Change **application mappings** such as .asp with .htm or .foo, etc. to disguise the identity of the servers
- Apache users can use **mod_negotiation** directives
- IIS users use tools such as **PageXchanger** to manage the file extensions

✓ **It is better if the file extensions are not used at all**

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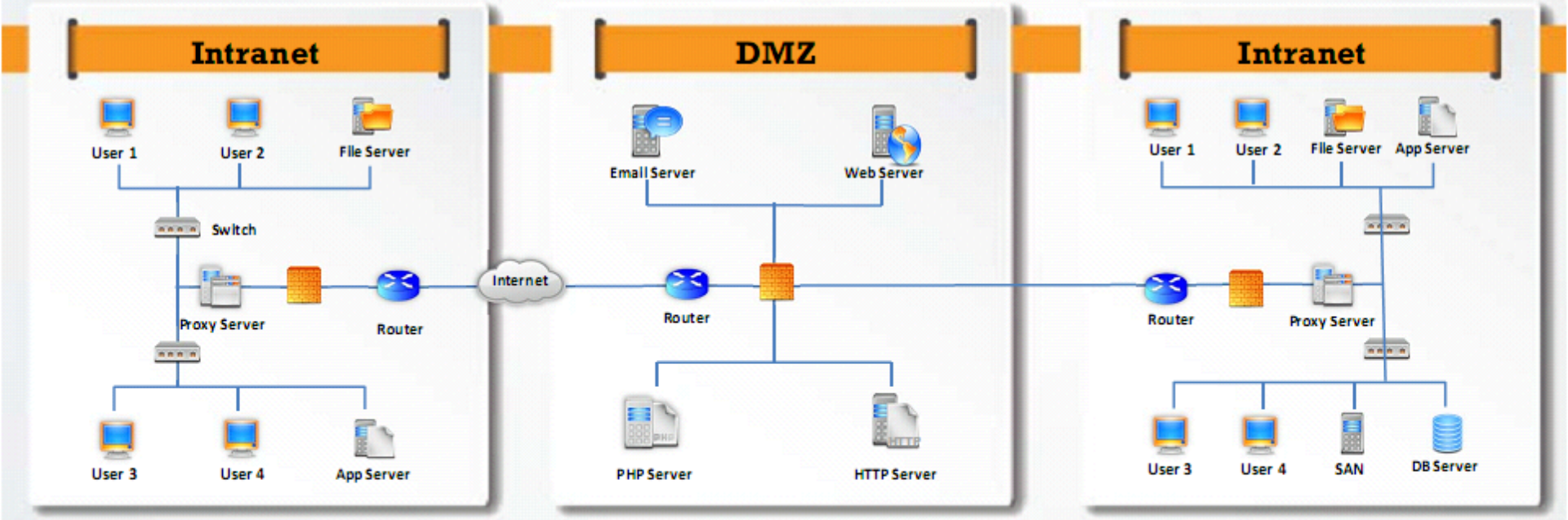
Drawing Network Diagrams

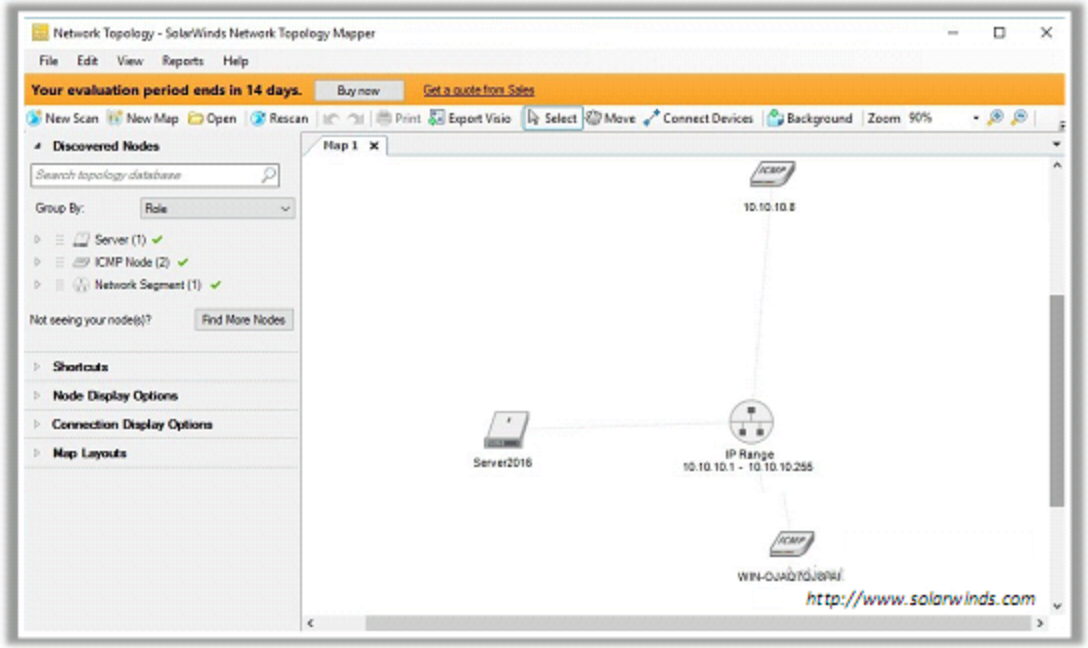
- Drawing target's network diagram gives valuable information about the **network and its architecture** to an attacker
- Network diagram shows **logical or physical path** to a potential target



Network Discovery and Mapping Tools

Network Topology Mapper

- Network Topology Mapper discovers a network and produces a comprehensive network diagram
- It displays in-depth connections such as OSI Layer 2 and Layer 3 topology data



- **OpManager**
  https://www.manageengine.com
- **The Dude**
  https://mikrotik.com
- **NetSurveyor**
  http://nutsaboutnets.com
- **NetBrain**
  https://www.netbraintech.com
- **Spiceworks Inventory**
  https://www.spiceworks.com

Network Discovery Tools for Mobile

Scany

http://happymagenta.com

Network "Swiss-Army-Knife"

http://foobang.weebly.com

- **PortDroid Network Analysis**
  https://play.google.com
- **NetX - Network Discovery Tools**
  https://play.google.com
- **Network Mapper**
  https://play.google.com
- **Fing - Network Tools**
  https://www.fing.io
- **ezNetScan**
  https://play.google.com

Module Flow

1. Network Scanning Concepts
2. Scanning Tools
3. Scanning Techniques
4. Scanning Beyond IDS and Firewall
5. Banner Grabbing
6. Draw Network Diagrams
7. Scanning Pen Testing

Scanning Pen Testing

- The network scanning penetration test helps to determine the network's **security posture** by identifying **live systems**, discovering **open ports**, associating **services**, and grabbing **system banners** from a remote location to simulate a network hacking attempt

- The penetration testing report will help the **system administrators** to:

Close **unused ports**

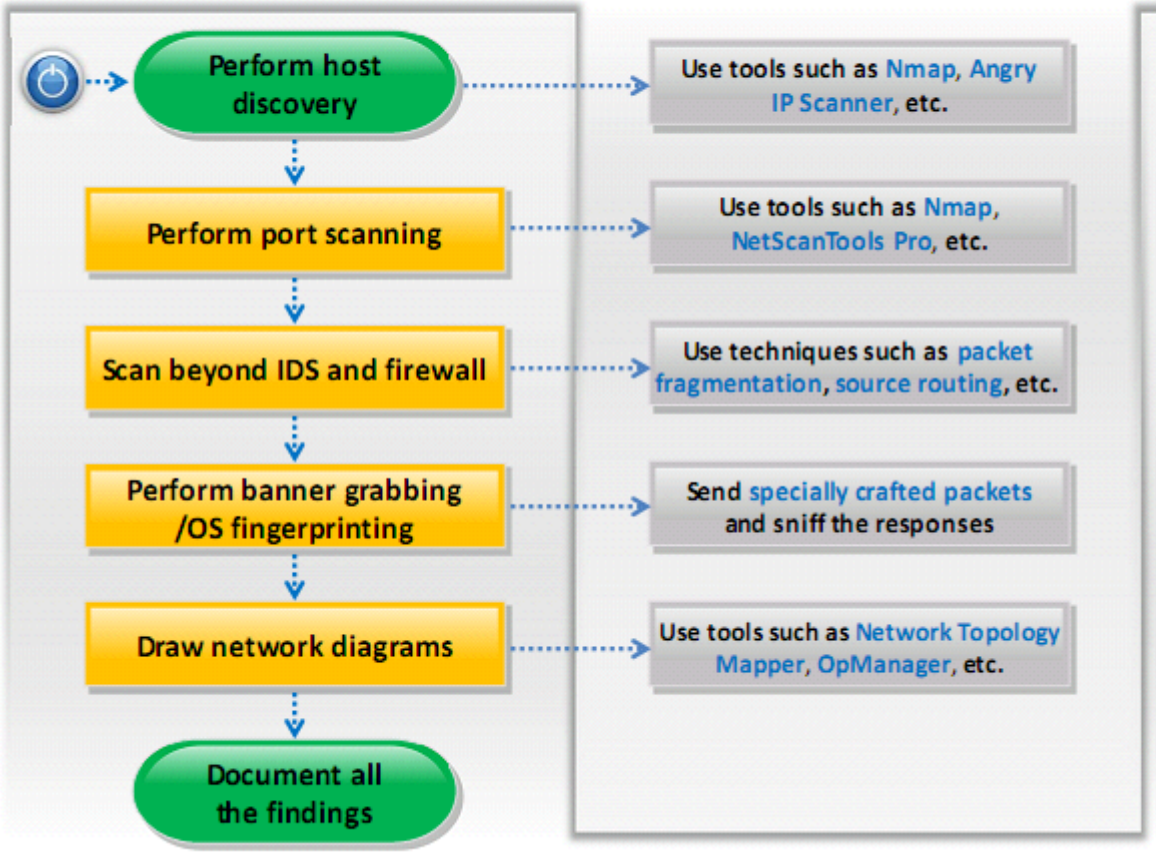
Disable **unnecessary services**

Hide or customize banners

Troubleshoot service configuration errors

Calibrate **firewall rules**

Scanning Pen Testing (Cont'd)



- Check for the live hosts using tools such as **Nmap**, **Angry IP Scanner**, **SolarWinds Engineer's toolset**, **NetScanTools Pro**, etc.
- Check for open ports using tools such as **Nmap**, **NetScanTools Pro**, **Hping3**, **PRTG Network Monitor**, **SuperScan**, etc.
- Scan beyond IDS and firewall using techniques such as **packet fragmentation**, **source routing**, **IP address spoofing**, etc.
- Perform banner grabbing/OS fingerprinting by sending **specially crafted packets** to the targeted machine and then comparing the responses with the database
- Draw network diagrams of the vulnerable hosts using tools such as **Network Topology Mapper**, **OpManager**, **The Dude**, **NetSurveyor**, **NetBrain**, etc.
- Document all the findings

Module Summary

- The objective of scanning is to discover live systems, active/running ports, the operating systems, and the services running on the network
- Attacker determines the live hosts from a range of IP addresses by sending ICMP ECHO requests to multiple hosts
- Attackers use various scanning techniques to bypass firewall rules and logging mechanism, and hide themselves as usual under network traffic
- Banner grabbing or OS fingerprinting is the method applied or used to determine the operating system running on a remote target system
- Drawing the target's network diagram gives valuable information about the network and its architecture to an attacker
- Attackers use proxy servers to hide the actual source of a scan and evade certain IDS/firewall restrictions
- A chain of proxies can be created to evade a traceback to the attacker