



# Network Discovery and Vulnerability Scanning

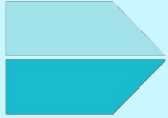
Cybersecurity  
Penetration Testing Day 2



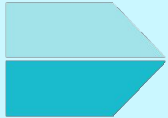
# Class Objectives

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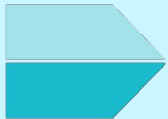
By the end of today's class, you will be able to:



Perform network enumeration using Nmap.



Properly use Nmap options.



Explain what the Nmap Scripting Engine (NSE) is and how it's used.

# Penetration Testing

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The five phases of an engagement include:

01

Reconnaissance

02

Scanning and Enumeration

03

Gaining Access

04

Maintaining Access

05

Covering Your Tracks


# Scanning and Enumeration

Today we'll use manual tools to scan networks and perform the following tasks:


Term	Definition
<b>Network mapping</b>	Using host discovery, we can identify network devices like servers, switches, and routers, and how they're physically interconnected.
<b>Service discovery</b>	Allows us to identify which services are running on which hosts, such as DNS, mail, or web servers.
<b>OS detection</b>	Also known as OS fingerprinting, lets us detect which operating system is running on a networked device, including OS name, vendor, software versions, and estimated device uptime.
<b>Security auditing</b>	The discovery process for finding OS versions and apps running on hosts to determine the depth of vulnerabilities.

# Nmap

Nmap, short for Network Mapper, is a free, open-source network scanning tool for performing network discovery and vulnerability scans.



Identifying devices running on a network.



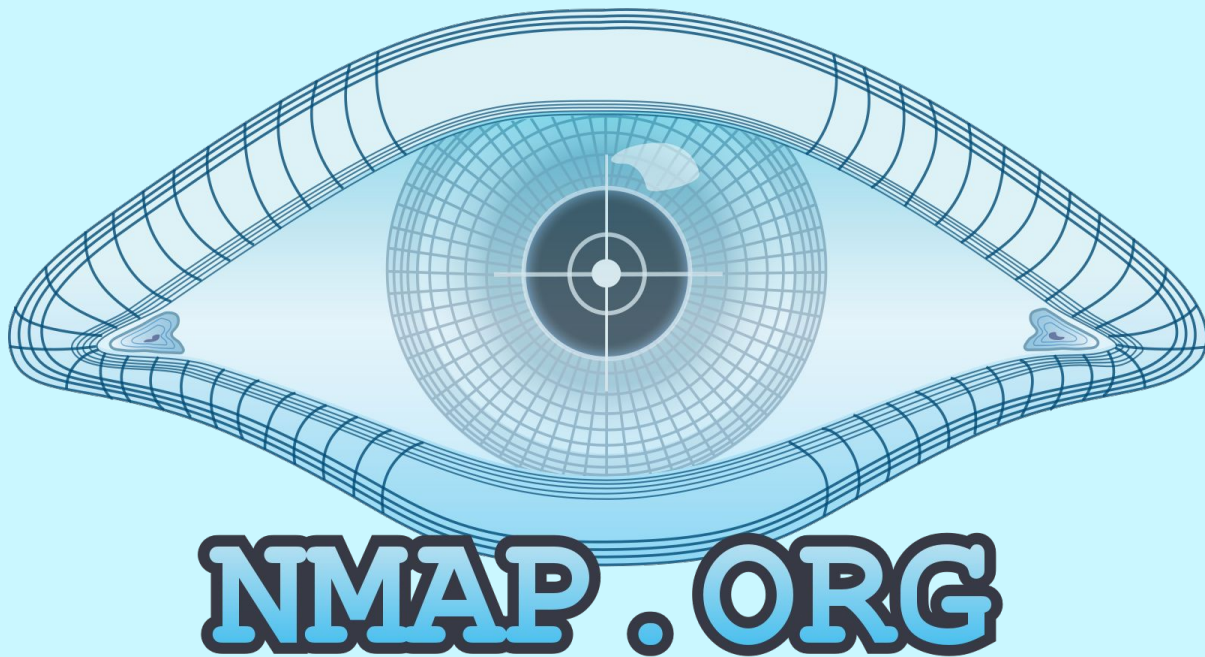
Discovering hosts, services, open ports, and IP addresses.



Detecting security risks.



...and much more.



# Nmap

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The most common Nmap functions include:



Ping scans



Port scans



Host scans



OS detection



Top port scans

# Nmap Scans

Nmap transmits data through scans and listens for responses with information about the network profile and topology.

Nmap's protocols use various packet structures, such as TCP, UDP, and ICMP, which work together to enumerate networks.





Nmap has many scan types and options. Some optimize performance, some optimize stealth, others optimize accuracy. We'll explore several in the next demonstration.



# Is Nmap Legal?

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Nmap is designed to help network defenders protect their networks from criminal hackers by identifying security vulnerabilities in the system.

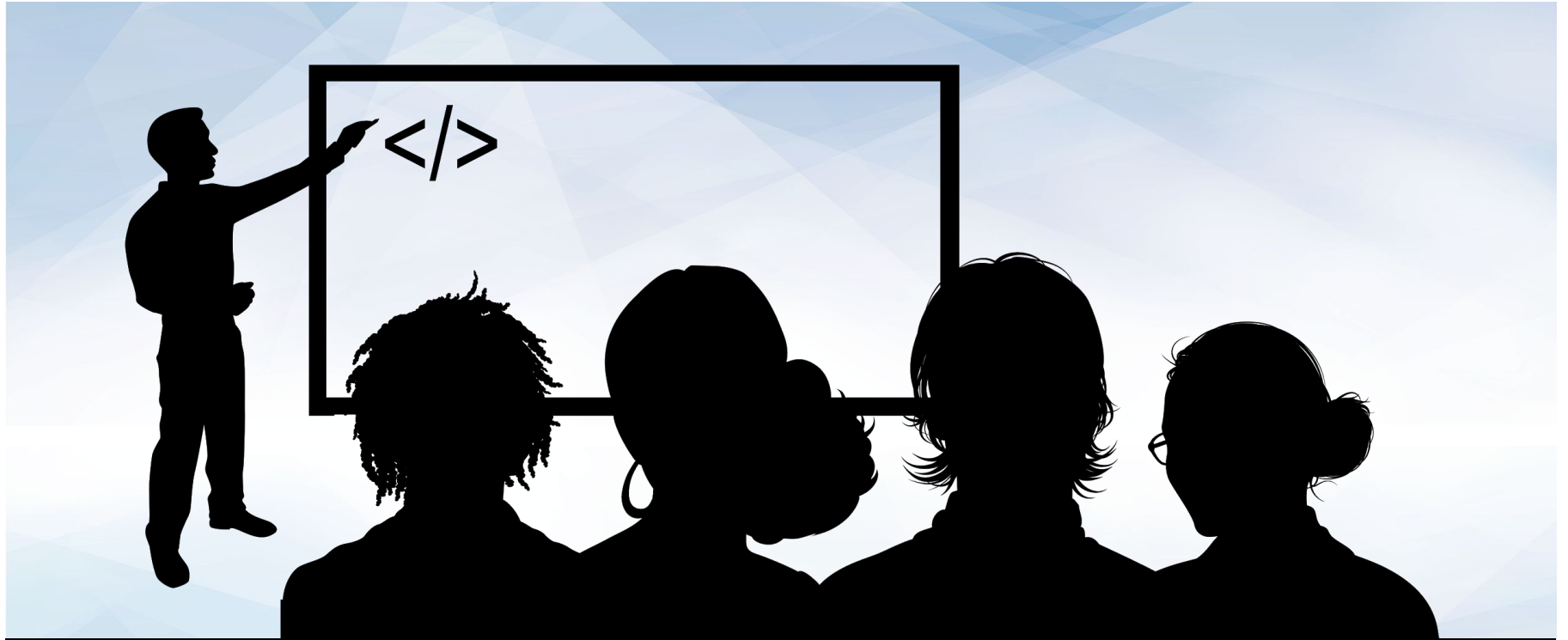
But hackers can use Nmap for the same aim: to probe networks for vulnerabilities.

While laws are complicated and vary by region, using Nmap to scan external networks without permission can lead to being banned by your ISP and felony charges.





You should always get  
**written permission** from the  
system owner before engaging  
in any type of network scan.



# Instructor Demonstration

## Nmap



## **Activity:** Port Scanning with Nmap

In this activity, you will experiment with various Nmap scanning options.

**Suggested Time:**  
25 Minutes





**Time's Up!** Let's Review.

# NSE Scripting

# NSE Scripting

The Nmap Scripting Engine (NSE) allows users to write and share scripts that automate a wide variety of networking tasks. Nmap comes with a pre-installed collection of NSE scripts that can be used to modify and create custom scripts for individual needs.

```
instructor@kali:~$ ls /usr/share/nmap/scripts/
```

```
acarsd-info.nse  
address-info.nse  
afp-brute.nse  
afp-ls.nse  
afp-path-vuln.nse  
afp-serverinfo.nse  
afp-showmount.nse  
ajp-auth.nse  
ajp-brute.nse  
ajp-headers.nse  
ajp-methods.nse  
ajp-request.nse  
allseeingeye-info.nse  
amqp-info.nse  
asn-query.nse  
auth-owners.nse  
auth-spoof.nse  
backorifice-brute.nse  
backorifice-info.nse  
bacnet-info.nse  
banner.nse  
bitcoin-getaddr.nse  
bitcoin-info.nse  
bitcoinrpc-info.nse
```

```
nosnmap-crtsh.nse  
hostmap-robtex.nse  
http-adobe-coldfusion-apsa1301.nse  
http-affiliate-id.nse  
http-apache-negotiation.nse  
http-apache-server-status.nse  
http-aspnet-debug.nse  
http-auth-finder.nse  
http-auth.nse  
http-avaya-ipoffice-users.nse  
http-awstatstotals-exec.nse  
http-axis2-dir-traversal.nse  
http-backup-finder.nse  
http-barracuda-dir-traversal.nse  
http-bigip-cookie.nse  
http-brute.nse  
http-cakephp-version.nse  
http-chrono.nse  
http-cisco-anyconnect.nse  
http-coldfusion-subzero.nse  
http-comments-displayer.nse  
http-config-backup.nse  
http-cookie-flags.nse  
http-cors.nse
```

```
ip-geolocation-geoplugin.nse  
ip-geolocation-ipinfodb.nse  
ip-geolocation-map-bing.nse  
ip-geolocation-map-google.nse  
ip-geolocation-map-kml.nse  
ip-geolocation-maxmind.nse  
ip-https-discover.nse  
ipidseq.nse  
ipmi-brute.nse  
ipmi-cipher-zero.nse  
ipmi-version.nse  
ipv6-multicast-mld-list.nse  
ipv6-node-info.nse  
ipv6-ra-flood.nse  
irc-botnet-channels.nse  
irc-brute.nse  
irc-info.nse  
irc-sasl-brute.nse  
irc-unrealircd-backdoor.nse  
iscsi-brute.nse  
iscsi-info.nse  
isns-info.nse  
jdpw-exec.nse  
jdpw-info.nse
```

```
rsa-vuln-roca.nse  
rsync-brute.nse  
rsync-list-modules.nse  
rtsp-methods.nse  
rtsp-url-brute.nse  
rusers.nse  
s7-info.nse  
samba-vuln-cve-2012-1182.nse  
script.db  
servicetags.nse  
shodan-api.nse  
sip-brute.nse  
sip-call-spoof.nse  
sip-enum-users.nse  
sip-methods.nse  
skypev2-version.nse  
smb2-capabilities.nse  
smb2-security-mode.nse  
smb2-time.nse  
smb2-vuln-uptime.nse  
smb-brute.nse  
smb-double-pulsar-backdoor.nse  
smb-enum-domains.nse  
smb-enum-groups.nse
```

# NSE

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There's over 600 scripts available in NSE. With these, you can perform almost any infosec research task. For example, we can use NSE scripting to perform:

01

DNS enumeration

02

Brute force attack

03

OS fingerprinting

04

Banner grabbing

05

Vulnerability  
detection

06

Vulnerability exploitation

07

Backdoor identification

08

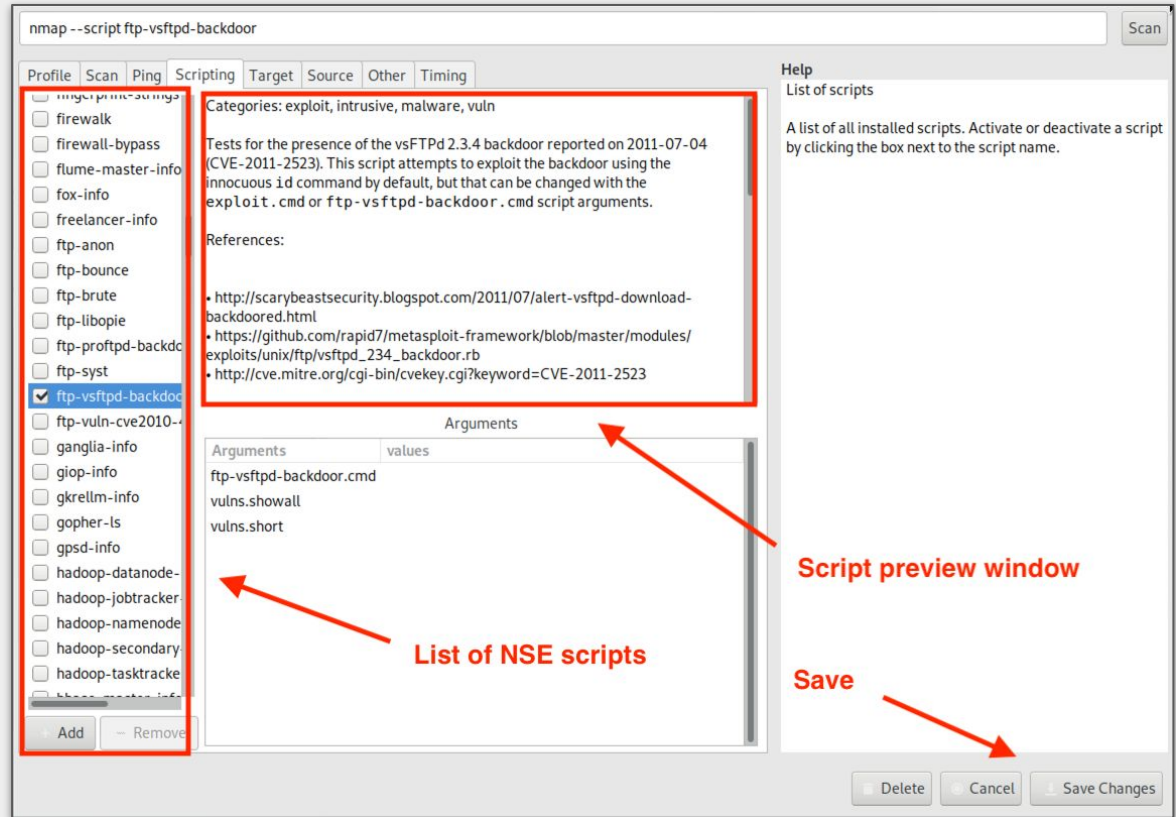
Malware discovery



# NSE in Action

We can use NSE to gather information on targets using scans.

While we can run scans directly on the command line, we can pair Nmap with a free, open-source GUI tool called **Zenmap**.



# Zenmap

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For example, Zenmap displays Nmap output in a convenient GUI display. It can also:  
Zenmap works with Nmap to make it more user-friendly.



Customize display options.



Provide summaries about a single host or a network scan.



Generate topology maps of discovered networks.

# Zenmap

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Zenmap benefits include:

01

## **Comparison**

Zenmap can compare changes between system scans run at different times, and differences between hosts.

02

## **Convenience and Discoverability**

While Nmap's hundreds of options can be overwhelming for beginners, Zenmap's simple interface helps beginners learn and understand Nmap scans.

03

## **Repeatability**

Zenmap has command profiles that make it easy to run scans more than once.

You can also use preinstalled shell scripts to perform common tasks.



# Instructor Demonstration

Zenmap



## **Activity:** NSE Scripting

In this activity, you will use Zenmap and its associated NSE scripts to gather intelligence about a target.

**Suggested Time:**  
25 Minutes





Countdown timer

15:00

(with alarm)



**Time's Up!** Let's Review.

# Vulnerability Scanning



# NSE Scripts vs. Vulnerability Scanning

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While NSE has its advantages, it also has disadvantages when compared to other vulnerability scanners.



NSE is not fully comprehensive, meaning many vulnerabilities are not covered.



NSE cannot perform a large number of scans simultaneously.



NSE is most efficient when performing single host scans.



NSE is most useful when doing basic information gathering or enumeration tasks.

# Vulnerability Scanning

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Vulnerability scanners such as **Nessus** can be used to identify vulnerabilities and create inventories of all interconnected systems.

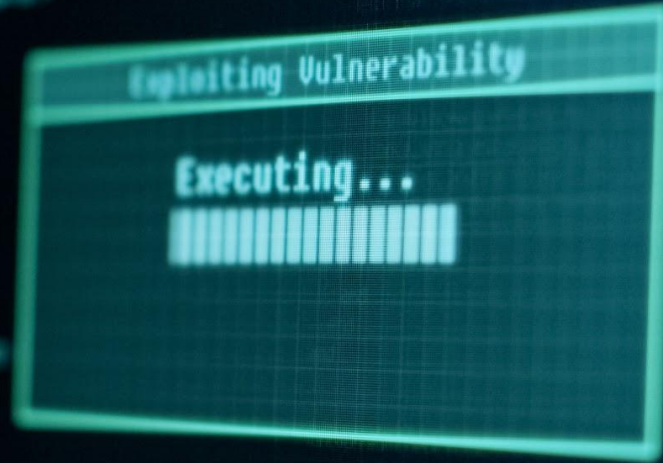


# Vulnerability Scanning

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Most vulnerability scanners will attempt to log into systems using default passwords or other credentials in order to establish a more detailed picture of the network infrastructure.

After establishing an inventory list, vulnerability scanners check each item against one or more databases of known vulnerabilities. This identifies which items are associated with specific threats.

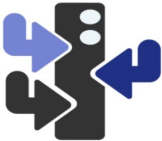


# NVD


The National Vulnerability Database (NVD) is a source of exploit information that grades each vulnerability based on its severity level.

The screenshot shows the NIST NVD homepage. At the top is the NIST logo and a 'NVD MENU' button. Below the header, the text 'Information Technology Laboratory' and 'NATIONAL VULNERABILITY DATABASE' are visible, along with a large 'NVD' logo. A navigation menu on the left lists: General, Vulnerabilities, Vulnerability Metrics, Products, Configurations (CCE), Contact NVD, Other Sites, and Search, each with a plus icon. To the right of the menu are three promotional graphics: 1) An icon of four arrows pointing towards a central server icon with the text 'CVSS/CWE from CVE List now Supported!'. 2) The CVSS logo with the text 'CVSS Version 3.1 Official Support!'. 3) An icon of three arrows pointing down to a server icon with the text 'New NVD CVE/CPE API and Legacy SOAP Service Retirement!'.


<b>General</b>	+			
<b>Vulnerabilities</b>	+			
<b>Vulnerability Metrics</b>	+			
<b>Products</b>	+			
<b>Configurations (CCE)</b>				
<b>Contact NVD</b>				
<b>Other Sites</b>	+			
<b>Search</b>	+			



**CVSS/CWE from  
CVE List now  
Supported!**



**CVSS Version  
3.1 Official  
Support!**

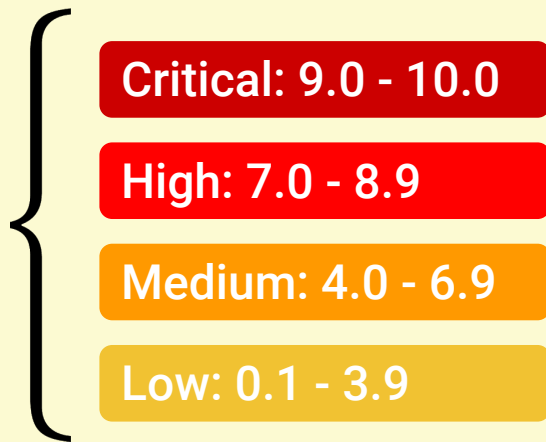


**New NVD  
CVE/CPE API  
and Legacy  
SOAP Service  
Retirement!**

# NVD

For example, NIST CVE-2016-0800 is detailed on the [nvd.nist.gov](https://nvd.nist.gov) webpage, which provides details, references, and a score of 5.9.

Severity levels are scored using the **Common Vulnerability Scoring System** (CVSS), and have the following ranges:





# Instructor Demonstration

Nessus



## **Activity:** Metasploitable Report

In this activity, you will use Nessus to generate a Metasploitable scan report.

**Suggested Time:**  
25 Minutes





**Time's Up!** Let's Review.



*The  
End*