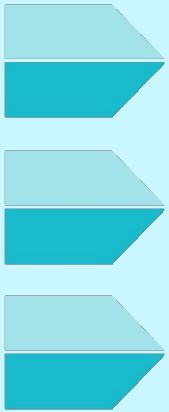
Network Discovery and Vulnerability Scanning

Cybersecurity

Penetration Testing Day 2

Class Objectives

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

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:

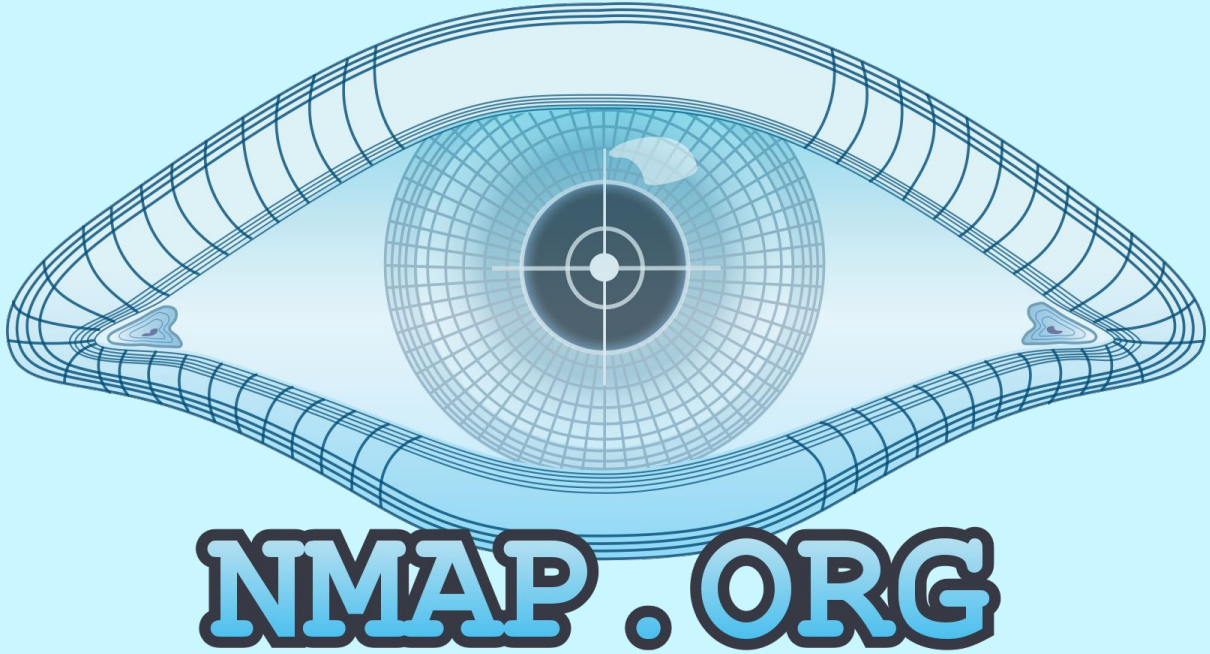
Term	Definition
Network mapping	Using host discovery, we can identify network devices like servers, switches, and routers, and how they're physically interconnected.
Service discovery	Allows us to identify which services are running on which hosts, such as DNS, mail, or web servers.
OS detection	Also 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.
Security auditing	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.

Nmap is useful for:

- Identifying devices running on a network.
- Discovering hosts, services, open ports, and IP addresses.
- Detecting security risks.
- ...and much more.



(nmap)

Nmap

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.

(Source)

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

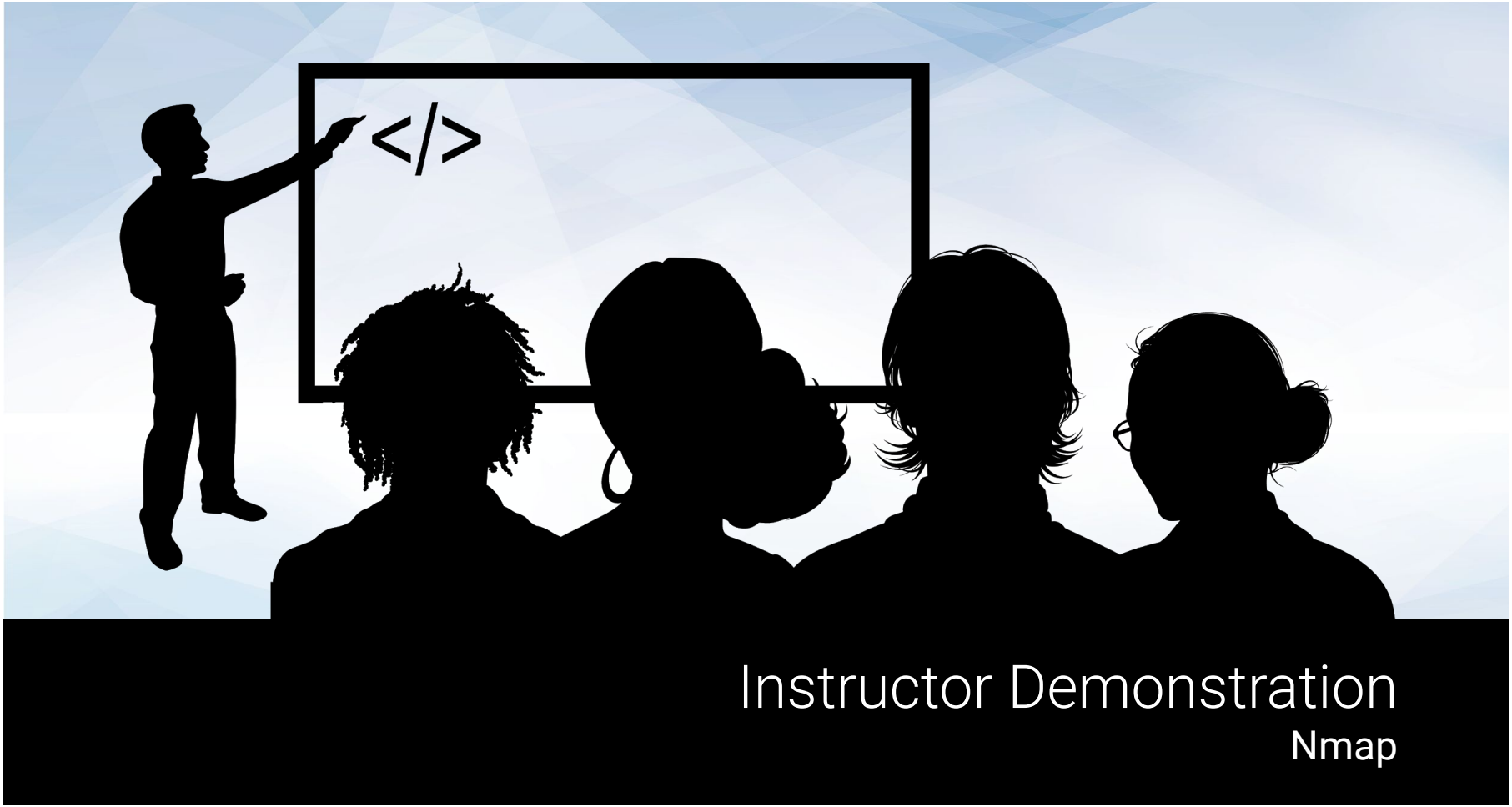
Is Nmap Legal?

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.

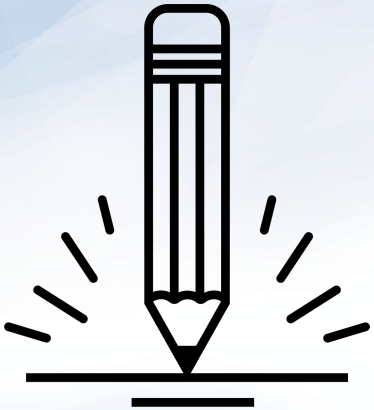
While laws are complicated and vary by region, using Nmap to scan external networks without permission can lead to being banned by your ISP and felony charges.

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 preinstalled 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                 hostmap-crtsh.nse                ip-geolocation-geoplugin.nse   rsa-vuln-roca.nse
address-info.nse                hostmap-robtex.nse               ip-geolocation-ipinfodb.nse    rsync-brute.nse
afp-brute.nse                   http-adobe-coldfusion-apsa1301.nse ip-geolocation-map-bing.nse  rsync-list-modules.nse
afp-ls.nse                      http-affiliate-id.nse            ip-geolocation-map-google.nse  rtsp-methods.nse
afp-path-vuln.nse               http-apache-negotiation.nse      ip-geolocation-map-kml.nse     rtsp-url-brute.nse
afp-serverinfo.nse              http-apache-server-status.nse    ip-geolocation-maxmind.nse     rusers.nse
afp-showmount.nse               http-aspnet-debug.nse            ip-https-discover.nse          s7-info.nse
ajp-auth.nse                    http-auth-finder.nse             ipidseq.nse                    samba-vuln-cve-2012-1182.nse
ajp-brute.nse                   http-auth.nse                    ipmi-brute.nse                 script.db
ajp-headers.nse                 http-avaya-ipoffice-users.nse    ipmi-cipher-zero.nse           servicetags.nse
ajp-methods.nse                 http-awstatstotals-exec.nse      ipmi-version.nse               shodan-api.nse
ajp-request.nse                 http-axis2-dir-traversal.nse     ipv6-multicast-mld-list.nse    sip-brute.nse
allseeingeye-info.nse           http-backup-finder.nse           ipv6-node-info.nse             sip-call-spoof.nse
amqp-info.nse                   http-barracuda-dir-traversal.nse ipv6-ra-flood.nse              sip-enum-users.nse
asn-query.nse                   http-bigip-cookie.nse            irc-botnet-channels.nse        sip-methods.nse
auth-owners.nse                 http-brute.nse                   irc-brute.nse                  skypev2-version.nse
auth-spoof.nse                  http-cakephp-version.nse         irc-info.nse                   smb2-capabilities.nse
backorifice-brute.nse           http-chrono.nse                  irc-sasl-brute.nse             smb2-security-mode.nse
backorifice-info.nse            http-cisco-anyconnect.nse        irc-unrealircd-backdoor.nse    smb2-time.nse
bacnet-info.nse                 http-coldfusion-subzero.nse      iscsi-brute.nse                smb2-vuln-uptime.nse
banner.nse                      http-comments-displayer.nse      iscsi-info.nse                 smb-brute.nse
bitcoin-getaddr.nse             http-config-backup.nse           isns-info.nse                  smb-double-pulsar-backdoor.nse
bitcoin-info.nse                http-cookie-flags.nse            jdwp-exec.nse                  smb-enum-domains.nse
bitcoinrpc-info.nse             http-cors.nse                    jdwp-info.nse                  smb-enum-groups.nse
```

NSE

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

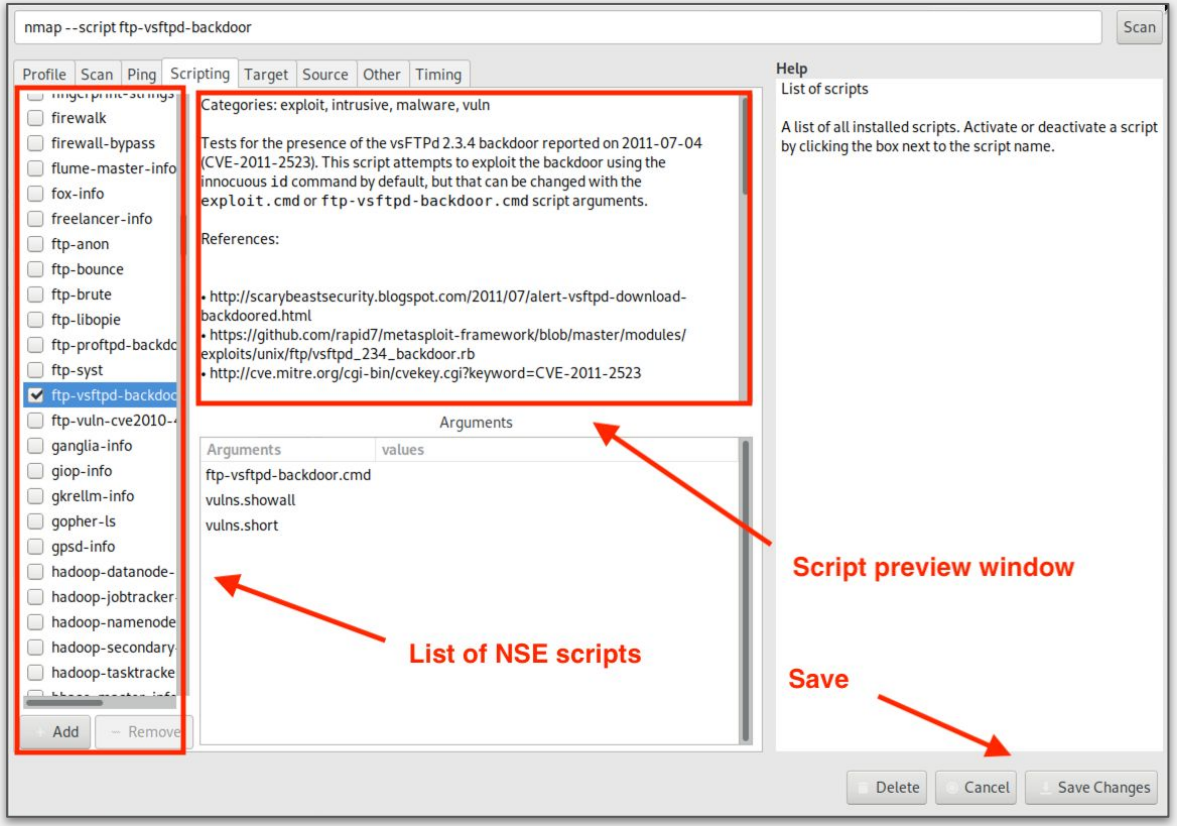
07 Backdoor identification

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

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

Zenmap benefits include:

01

Comparison

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

02

Convenience and Discoverability

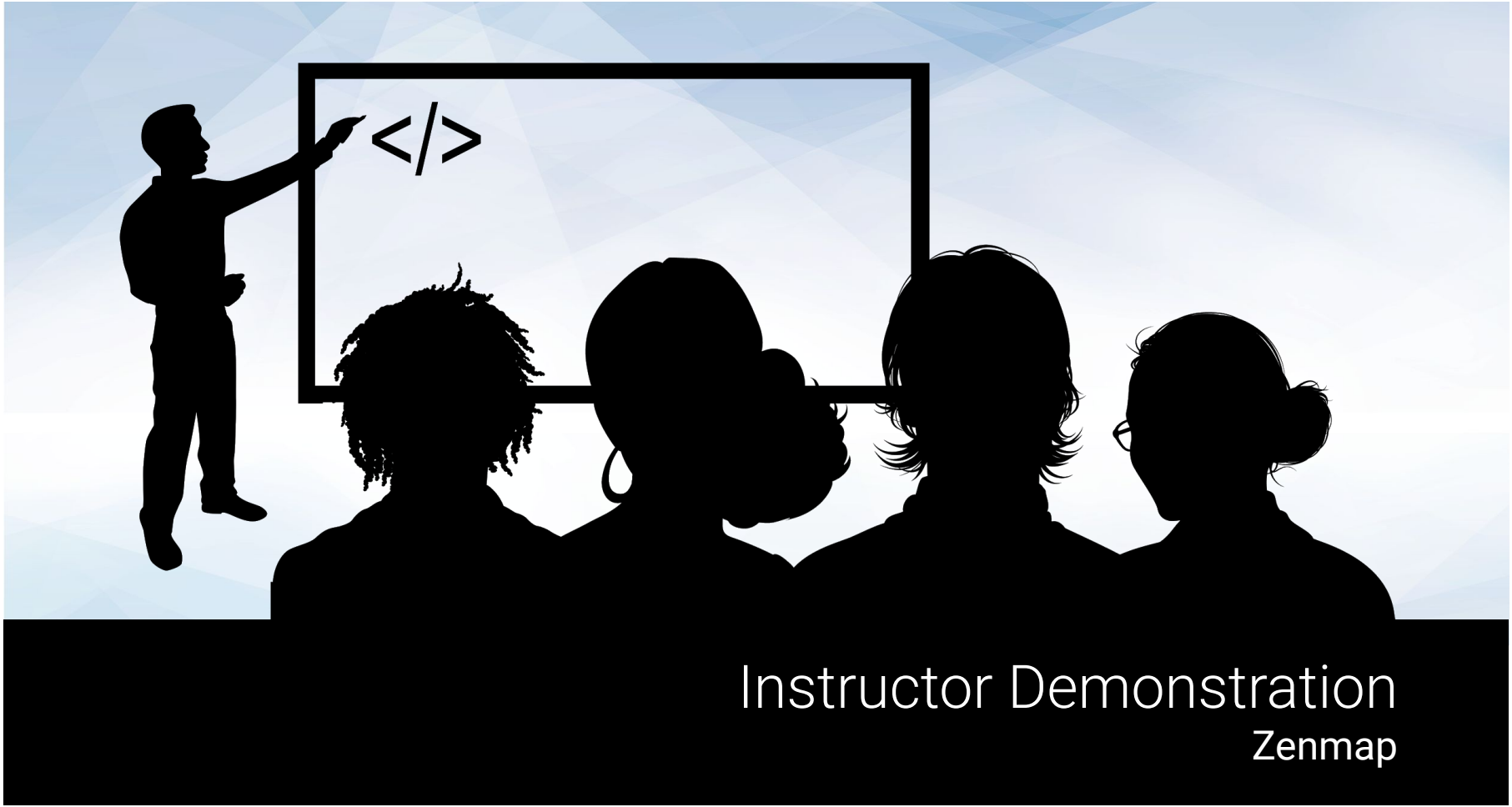
While Nmap's hundreds of options can be overwhelming for beginners, Zenmap's simple interface helps beginners learn and understand Nmap scans.

03

Repeatability

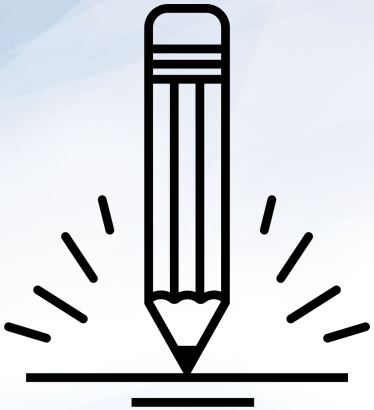
Zenmap has command profiles that make it easy to run scans more than once.

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

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

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

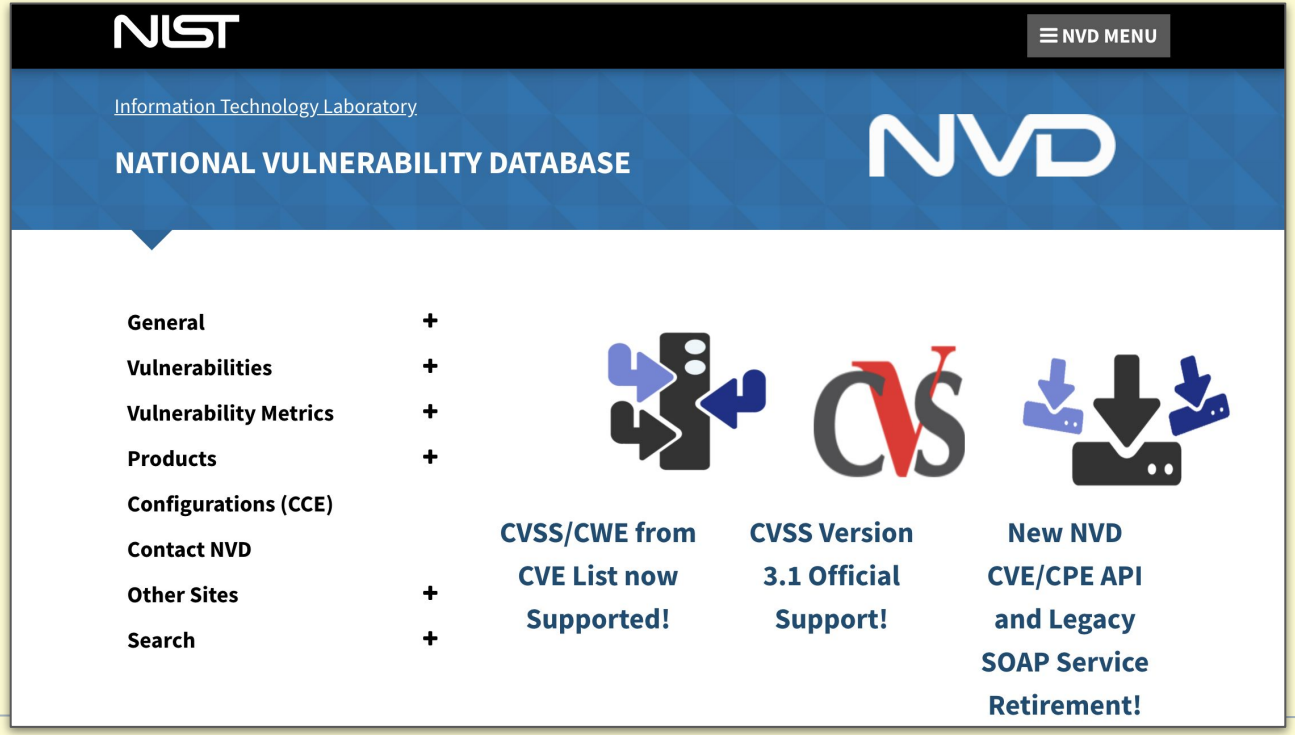
Vulnerability Scanning

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.



(nvd.nist.gov)

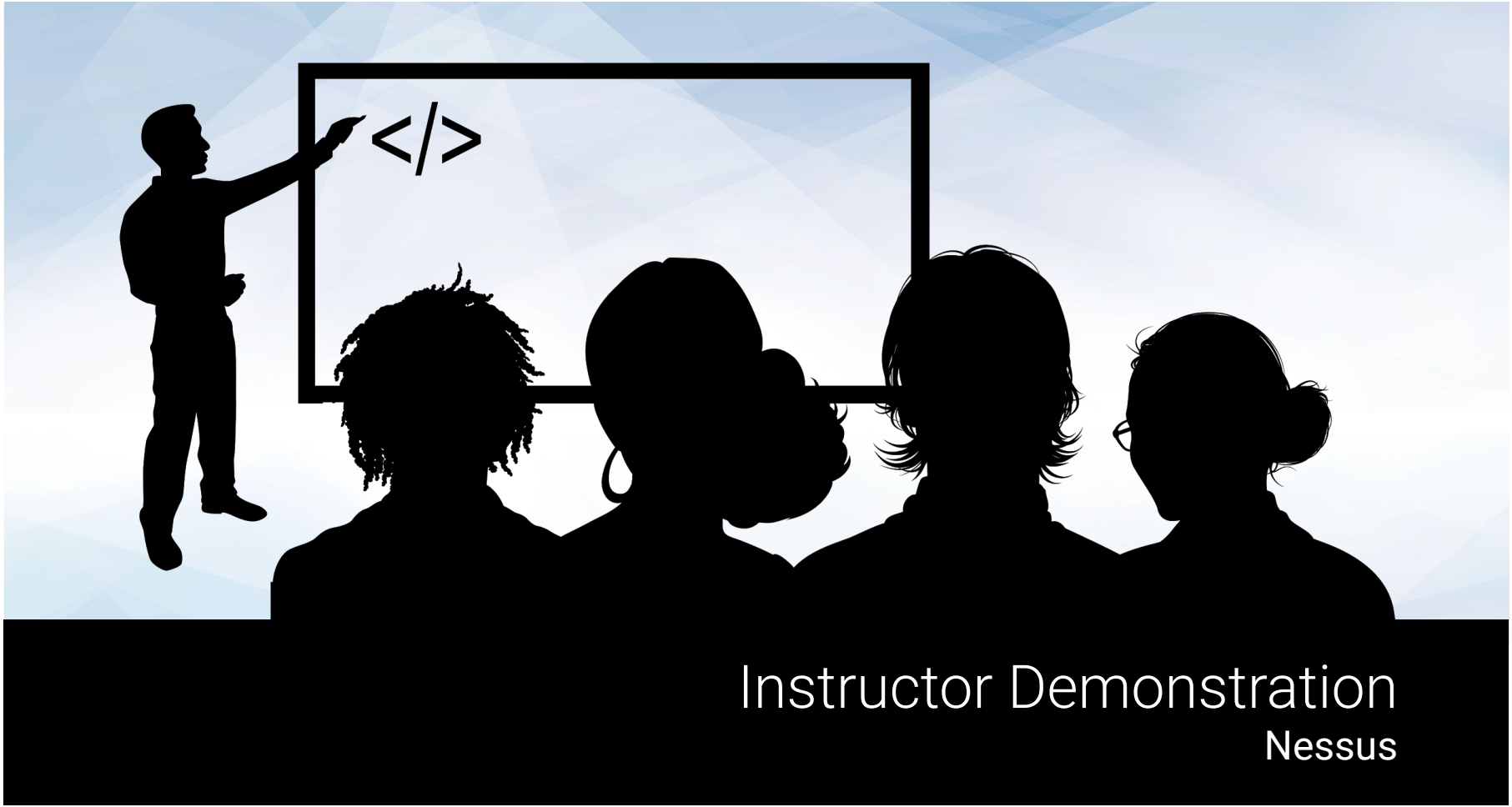
NVD

For example, NIST CVE-2016-0800 is detailed on the 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:

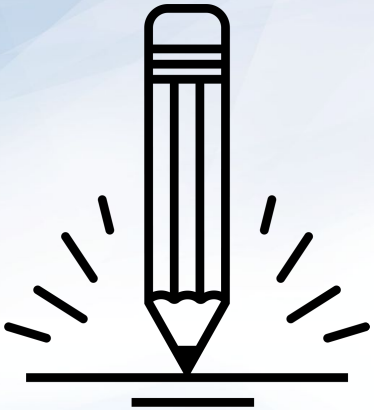
- Critical: 9.0 - 10.0
- High: 7.0 - 8.9
- Medium: 4.0 - 6.9
- Low: 0.1 - 3.9

(nvd.nist.gov)



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.