Introduction to Intelligence Gathering

Cybersecurity Boot Camp

Pentesting Day 1

Class Objectives

By the end of class today, students will be able to:

□ Articulate the steps of the Penetration Testing Execution Standard.

□ Use Nmap to perform host discovery and port scan targets.

□ Use Nessus to perform vulnerability scans.

Introduction to Intelligence Gathering

Lesson Overview

Today, you'll be taking the first steps to becoming real hackers...

We'll cover:

- The business purpose and goals of penetration testing
- The Pentesting Execution Standard, a technical process for conducting a pentest
- Information gathering
- Vulnerability scanning
- Exploitation with Metasploit

With these techniques, we will be able to break into networks and cause serious damage to network infrastructure.

Don’t take this week’s lessons lightly...

Do not use the techniques and tools you’ll be learning against any computer you do not own or have expressed, written permission to be interacting with.

Business Goals of Penetration Testing

Penetration Testing

Pentesting is the systematic process of identifying an organization’s vulnerabilities and providing recommendations on how to fix them.

Goals of Penetration Testing

While breaking into machine is part of the pentesting process, the real **purpose** of an engagement is to **help the client improve their security**.

- A pentest is often referred to as an **engagement** by practitioners.
- Pentesters are hired to assess a company’s security controls by finding flaws, helping companies understand them, and then providing recommendations of how to prioritize and fix vulnerabilities.
- It often takes an external perspective to identify misconfigurations and subtle security holes.

Penetration Methods

Black-Box Penetration

Most engagements are black-box.

Penetration testers are expected to attack the target network as an **outsider**.

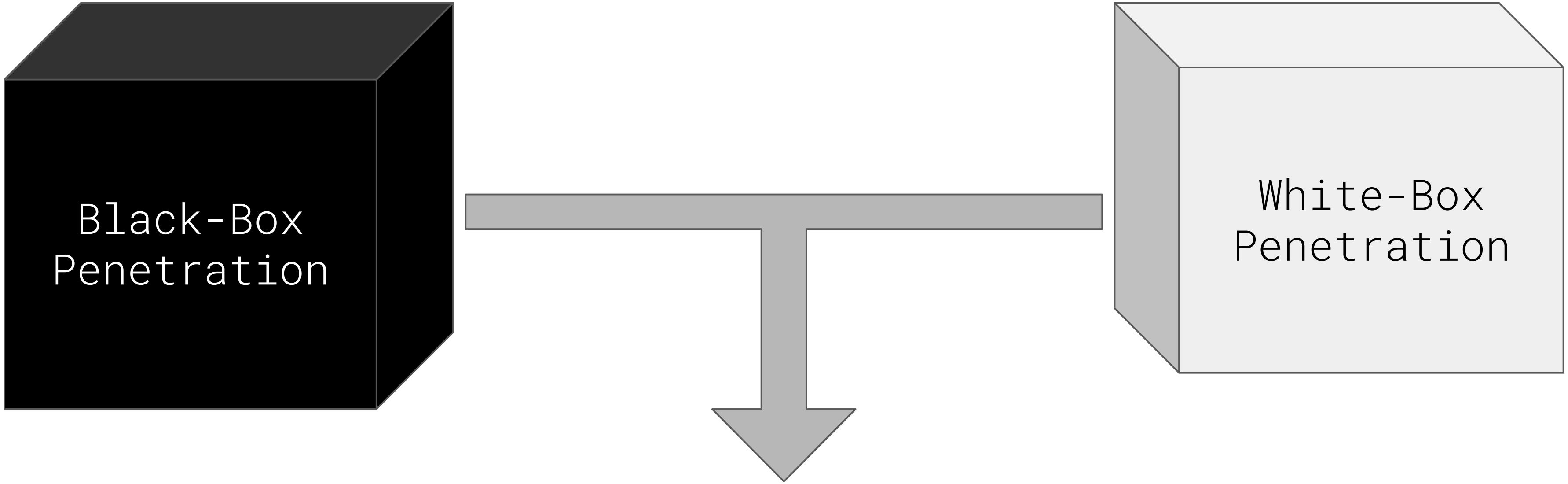
They are paid to learn as much as they can about the network using only the same tools available to an attacker on the public Internet.

White-Box Penetration

In **white-box** scenarios, pentesters have **full knowledge** of the network that is under scrutiny, allowing them to tear apart subtle security issues on behalf of their clients.

Most appropriate when the client wants a detailed analysis of all ***potential*** security flaws, rather than all exposed and visible vulnerabilities.

Penetration Methods



Black-Box Penetration

White-Box Penetration

Regardless of method, all pentesters are expected to provide the **main deliverable of a report** that summarizes their findings and recommends improvements.

Pentesting Execution Standard (PTES)

Most penetration test are executed using an industry standard series of steps known as the **Penetration Testing Execution Standard.**

- □ Pre-Engagement Interaction
- □ Intelligence Gathering / Mapping
- □ Threat Modeling
- □ Vulnerability Assessment
- □ Exploitation
- □ Post-Exploitation

Step 1: Pre-Engagement Interaction

Determining scope and purpose

Businesses are primarily concerned with how an exploited vulnerability can have major consequences on the business reputation, operations, bottom-line, etc.

When meeting with clients for the first time, pentesters need to determine:

Scope: the range of networks and buildings that pentesters are allowed to assess.

Purpose: areas of concern for the client. For example: “Can you read sensitive data without authorization?”

Step 2: Intelligence Gathering

Learning about a company's system

Passive reconnaissance	Active reconnaissance
Passive reconnaissance is the process of using publicly available information to learn as much as possible about the target . *Not* interacting with the client's network directly.	Active reconnaissance is the process of learning about the client's networks by actively interacting with them.
For example: Using Google to identify key figures in the organization; generating email lists; finding leaked documents exposed to search engines.	**For example:** port scanning, in which you attempt to connect to every port on the targeted machine, eventually finding which services are running on exposed ports.

Step 3: Threat Modeling and Vulnerability Assessment

Utilizing the the information gathered from Step 2

Using data obtained from intelligence gathering in order to determine:

- Where the system is likely to be most vulnerable?
- Which vulnerabilities are most severe?
- How to exploit the most critical vulnerability?

For example: After a pentester port-scans a network (Step 2: Intel Gathering), they will look at the list of exposed services and determine if any of the them are vulnerable by checking a database of vulnerabilities and exploits.

Step 4: Exploitation

Leveraging a vulnerability to compromise security

- **Automated Exploitation:** Pentesters use tools like `Metasploit` to automatically exploit known vulnerabilities.

- **Use of Pre-existing Exploits**: Consultants manually download and deploy exploits developed by other security researchers.

- **Custom Exploits**: Pentesters write their own exploits, typically requiring considerable research into the vulnerabilities discovered in the intelligence gathering phase

For example: if you find an exposed SSH server during your vulnerability analysis, you might attempt to exploit it with a brute-force attack.

Step 5: Post-Exploitation

Gaining administrative privileges or accessing sensitive data

Privilege escalation: Gaining administrative privileges, which usually implies unrestricted access to a system

- **Vertical escalation**: gaining higher privileges on the exploited machine.
- **Horizontal escalation**: moving between machines at the same privilege (using a user shell on Machine A to get a user shell on Machine B)

Data exfiltration: Stealing sensitive data, which can cause significant damage to a business if it fell into the wrong hands. Tactics include:

- Downloading files
- Running database queries
- Creating a user that allows access

Step 6: Finalizing Report

Reporting is not quite the last step...

Pentesters should be documenting data every step of the process.

The last step of a penetration test is finalizing the presentation of data, not collecting the data.

Intelligence Gathering Tools

Intelligence Gathering Tools

Pentesters commonly focus on two classes of vulnerabilities:

Network Vulnerabilities:
Vulnerabilities due to improperly configured services or poorly patched machines on the client's network.

Social Vulnerabilities:
Pentesters sometimes assess an organization's readiness for social engineering attacks by running phishing and other campaigns against their client's organization.

Intelligence Gathering Tools

At a minimum, intelligence gathering usually entails:

Mapping the Network: Finding machines controlled by your client, and mapping their connections to one another.

Fingerprinting Servers: Determining which services and operating systems are running on which machines.

Organizational Research: If social engineering attacks are in-scope, intelligence gathering also entails finding the names, contact information, and even social media profiles of as many employees as possible

A good baseline goal for intelligence gathering involves:

- Enumerating all subdomains associated with the client’s domain name.
- Port-scanning in-scope subdomains.
- Collecting as much email and social information as possible about the organization's employees.

Activity: Scanning and Enumeration

In this exercise, you’ll use ZenMap to scan and map a subnet.

Search for **Scanning and Enumeration Lab**

You will use the **Part 1 - Performing Initial Scans with Zenmap and Nmap** instructions inside the lab environment. Stop once you reach **Part 2 - Run a Vulnerability Scan with OpenVAS** instructions.

Suggested Time:
35 minutes

Nessus Set-up and Configuration

Vulnerability Assessment

Vulnerability scanning is the next step after information gathering.

After enumerating hosts and services, you correlate those services with known vulnerabilities.

- In previous lessons, we have used **Nmap** to perform vulnerability scans. Today, they'll revisit nmap, with additional focus on:
    - Scan types
    - Saving output
    - Researching vulnerabilities

Enumerating Services

Port scans determine which ports are exposed and which services are running on the target.

Nmap can scan both TCP and UDP ports.

- Most familiar services, such as `HTTP`, `FTP`, and `SMTP`, run over TCP.
- Notable services such as `DNS (53)`, `DHCP(67/68)`, and `TFTP (69)`, run over UDP.

Begin by conducting a SYN scan of a target.

- SYN scan exchange SYN-SYN/ACK packets, but do not open a connection.

Run a SYN Scan with: `nmap -sS <Target IP Addess>`

Run a UDP scan against specific ports: `nmap -sU -p53, 67,68,69 <Target IP Address>`

Banner Grabbing and Version Detection

Demonstrate with crackme.cenzic.com:

In order to exploit an exposed port, you need to know which service it furnished.

Nmap can determine which services are running on which port via **banner grabbing**:

- Banner grabbing opens a connection to a port and prints out anything that the server sends within five seconds.
- Servers often sends a string describing themselves, such as `220 FTP version 1.0\x0D\x0A`.

Nmap performs service and version detection with the -sV flag.

- `Nmap -sV crackme.cenzic.com`

Print full banners with `--script=banner`

- `Nmap -sV --script=banner crackme.cenzic.com`

Vulnerability Scanning

Attackers can often penetrate machines by exploiting known vulnerabilities in old software.

Attackers will look up a service by version in a database of known vulnerabilities and use the results to guide their exploitation.

We can automatically look up known vulnerabilities for a given service with the --script vulners switch.

- Install vulners with: **`curl -o /usr/share/nmap/scripts/vulners.nse https://raw.githubusercontent.com/vulnersCom/nmap-vulners/master/vulners.nse`**

Run: **`nmap -sV --script vulners crackme.cenzic.com`**

Save the results of this scan to a file: **`nmap -sV --script vulners crackme.cenzic.com -oN filename`**

Overview of Nessus

Vulners' output is sparse and difficult to parse.

Nessus provides a more powerful, graphical vulnerability scanning solution.

Nessus is used to:

- Port scan hosts
- Identify services
- Find vulnerabilities related to these services

Nessus allows you to save frequently used scan parameters, browse vulnerability in the web browser, and generate reports, and more.

Activity: Nessus Scanning and Reporting

In this activity, you will use Nessus to perform a vulnerability scan.

Search for **Nessus Scanning and Reporting**.

Be sure to launch the lab and run the requisite scans yourself as soon as you start the lab

Suggested Time:
40 minutes

Nessus Scanning and Reporting Review

8. Notice the different types of “Discovery type”.

i. How is this different/similar to NMAP?

Nessus Scanning and Reporting Review

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i. How is this different/similar to NMAP?

Nessus offers host enumeration, port scan (common ports), and port scan (all ports).

This is similar to Nmap in that it allows us to port scan a target, but different in that we have fewer options.

Nmap, for example, lets us select between TCP SYN and Connect scans, scan specific ports, etc.

Nessus Scanning and Reporting Review

11b. Notice the default for the SSL search is on “Known SSL ports.”

i. List one known SSL port.

ii. Why would you want to search for SSL “on all ports”?

Nessus Scanning and Reporting Review

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443 (HTTPS), 995 (POP3-SSL), 993 (IMAP-SSL)

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Nessus Scanning and Reporting Review

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443 (HTTPS), 995 (POP3-SSL), 993 (IMAP-SSL)

ii. Why would you want to search for SSL “on all ports”?

Encrypted services can run on any port. There is no reason admins can’t run SSL service son non-standard ports, such as running HTTPS on 8443.

Nessus Scanning and Reporting Review

12bii. Why would you want to add application/file white/blacklisting to your scan?

Nessus Scanning and Reporting Review

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These additions help you stay within the scope of your engagement and avoid sending traffic to delicate hosts.

Nessus Scanning and Reporting Review

19. Provide the OS running on each target.

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```
192.168.0.20:  Windows 7
192.168.0.221: Windows 8.1
192.168.0.112: Windows 7 Professional
192.168.0.125: Linux Kernel
```

The scan did not produce results for the other hosts.

Nessus Scanning and Reporting Review

26. What are three things that are different or similar between Nessus and Nmap?

Nessus Scanning and Reporting Review

26. What are three things that are different or similar between Nessus and Nmap?

- Nessus and Nmap both run port scans, but only Nessus is a specialized vulnerability scanner.
- Nmap provides more granular control over exactly how it scans targets.
- Nessus allows you to save profiles and generate reports, making it more useful than Nmap for generating artifacts for use in reports.

Nessus Scanning and Reporting Review

27. Provide an example of where/why you would use one over the other?

Is there an instance where you would not want to use either?

Nessus Scanning and Reporting Review

27. Provide an example of where/why you would use one over the other?

Nmap should be used for more granular port scanning.

- UDP scanning / banner grabbing on specific ports.

Nessus is useful for generating vulnerability reports.

Is there an instance where you would not want to use either?

No cases come to mind in which Nmap wouldn’t be useful, but Nessus is heavy for light/early-stage reconnaissance.

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