Pentesting Lab

Reconnaissance and Initial Access

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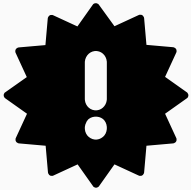
Announcements



- Last week's slides: `https://isec.tugraz.at/ptl`
- CTFd is online: `https://ptl.vuln.at`
  - Register and create/join a team of two
  - Submit flags for the lecture challenges

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A Word of Warning

- We are showing real examples from the internet
- We mainly used Shodan.io; it's okay to look, but not touch
- Port scanning is a gray area, so always get permission first

Motivation

Goal for This Lecture

- Assessments are always time constrained
- It's important to find lucrative targets efficiently
- We want to start developing your killer instinct

Why Reconnaissance?

- Depending on the type of assessment
  - ... we might get a list of target machines
  - ... internal network access
  - ... an IP address range
  - ... or nothing at all

Why Reconnaissance? Cont.

- Knowledge is power, right?
- Reconnaissance lays the groundwork for the pentest
- Well-performed recon means a higher chance of success

Host and Service Discovery

- What are we looking for?
  - Live hosts within the network
  - A list of running services on those hosts
  - Including the service versions → *fingerprinting*
  - We are looking for easily exploitable targets, and ...
  - High-value targets, such as domain controllers
- How do we get this information?
  - Network scanners: Nmap or MASSCAN
  - Domain Name System (DNS)
  - Plenty of other sources ...

- What if we start empty-handed? Just a company's website
- We can ask DNS for hostnames (and IP addresses)
- We can try a DNS zone transfer

- There are plenty of DNS/TLS history sites online, e.g.:
  - `https://dnsdumpster.com`
  - `https://www.shodan.io`
  - `https://crt.sh`
- We can also bruteforce subdomains
- If we are lucky, the customer has DNS Zone Transfers enabled
- Toolbox: `dig`, `nslookup`, `DNSEnum`, `DNSRecon`, ...

- DNS servers perform a zone transfer to sync their databases
- This is normal and required to allow for DNS delegation, etc.
- However, if the server is misconfigured, an adversary (we) can:
  - ... trigger a zone transfer
  - ... retrieve their zone file
  - ... and now know their entire DNS configuration
- Let's perform a zone transfer, shall we?

```
# Do a DNS zone transfer
$ dig axfr @nsztm1.digi.ninja zonetransfer.me
```

Port Scanning

- Now that we have a list of hostnames and/or IPs, we want to know:
  - ... whether those machines are alive
  - ... what kind of services they provide
- Naive approach: Use ping and connect to open ports
- Better approach: Use specialized tools that are:
  - **FAST**, **ACCURATE**, and (somewhat) **STEALTHY**
  - we want to run port scanners, like Nmap and MASSCAN

- Nmap: the Network mapper
- De facto standard for port scanning
- Provides the best service discovery
- Is reasonably fast for smaller networks
  - Takes around one hour to scan all ports of 100-200 hosts
  - Your mileage may vary - speed depends on many factors

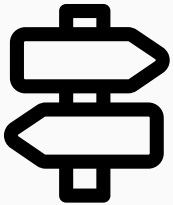
```
# Scan all ports of a single host with
# scripts and service discovery enabled
$ sudo nmap -sC -sV -T4 -p- -oN nmap.txt 10.10.10.213
```

- What does this command do?
- Let's ask explainshell.com

- MASSCAN: the MASs IP port SCANner
- Provides only basic service discovery
- However, it is blazing fast (up to 25 million packets/second)
  - We don't want to get blocked before getting started
  - Hint: Always use rate limiting!

Port Scanning at Scale

- Let's say we have a `10.0.0.0/8` network
- That means there are 16 777 214 hosts to scan
- Solution: Use a hybrid approach
  - Start with running `masscan`
  - Identify open ports on hosts within the network
  - Feed this information into `nmap` for service discovery
  - Bonus points for having an ELK Stack to visualize the results



- We know something is running on a given port, e.g., 22
- How do we find out what it is and which version is installed?
- Many services display a banner at the start of a new connection
- Often, we can use Netcat to get what we need:

```
[rob@jd:~]$ nc -vn 10.79.253.10 22
Connection to 10.79.253.10 22 port [tcp/*] succeeded!
SSH-2.0-OpenSSH_8.9p1 Ubuntu-3ubuntu0.6
```

Identifying Vulnerabilities

Finding Suitable CVEs

- Earlier, we said we are looking for easily exploitable targets
- Sometimes, Nmap finds us outdated services with CVEs
  - `8080/tcp open http Apache Tomcat 9.0.27`
  - Exploit DB, Shodan Exploits, Sploitus, or Vulners DB
  - we find CVE-2020-9484 and get a shell

```
# Show exploits for Apache Tomcat
$ searchsploit "apache tomcat"

# Search a Nmap XML result file for vulnerabilities
$ searchsploit --nmap scan.xml

# Copy an exploit to the current working directory
$ searchsploit -m 7618
```

Recon exercise: Perform a **TCP port scan** against the target across **all ports**, including version and service discovery, to get the flag. We will discuss your conclusions afterward - you have ten minutes.

Target accessible via **webssh.vuln.at** or VPN (**TBA**). IP: `10.0.2.5`

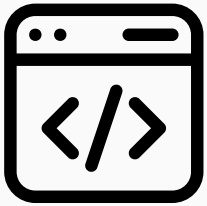
Or through the **internet** (might be slower). IP: `20.107.31.252`

Initial Access

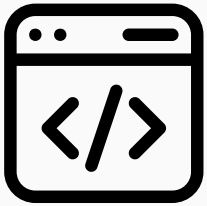
Core Services

- Most companies rely on the same set of core services
  - DNS for name resolution
  - LDAP for centralized user management
  - SSH for remote access and administration
  - SMB for file and printer sharing
  - And plenty more ...
- Some also leverage insecure or outdated protocols
  - Telnet, FTP, VNC, etc.

HTTP (80, 443)



- Hypertext Transfer Protocol (80, 443)
- What makes web applications such a promising target?
- They are widely used and provide a large attack surface
- More features typically means more room for error



- How can we probe and infiltrate a web service?
  - ... gather useful information (usernames, email addresses, etc.)
  - ... look out for verbose error messages
  - ... fuzz for files, directories (`.git/`), and virtual hosts
  - ... check for web server and application CVEs, e.g., NGINX, GitLab, etc.
  - ... find a vulnerability in the application itself
- Toolbox: `SecLists`, `ffuf`, `Nuclei`, `Nikto`, `WPScan`, ...

FTP (20, 21)

- File Transfer Protocol (20, 21)
- Ancient (50+ years old) and unencrypted
- Typically requires username/password
- But may allow anonymous login:

```
# Download all files from an FTP server
$ wget -m ftp://anonymous:anonymous@example.com
```

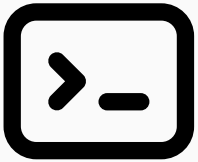
- Toolbox: `ftp`, `Wget`, `Netcat`, ...

SMB (139, 445)

- Server Message Block (139, 445)
- Particularly common in corporate (Windows) environments
- Mostly used for file and printer sharing, but can do more, e.g., IPC
- Typically requires authentication but may allow null sessions:

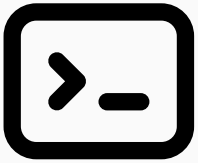
```
# Initiate a session with null credentials,
# i.e., <blank>:<blank> or guest:<blank>
$ smbclient --no-pass -L //example.com
```

- Enumeration should answer the following questions:
  - Can we access shares or printers anonymously?
  - If yes: Is there some juicy data we can download?
  - If no: Is the protocol version vulnerable?
- Plenty of exploits, such as EternalBlue and SMBGhost
- Toolbox: `smbclient`, `SMBMap`, `NetExec`, `Enum4linux`, ...



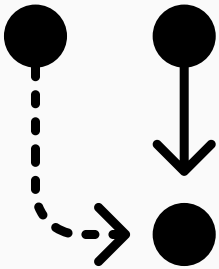
- Secure Shell (22)
- Successor of Telnet and Remote Shell
- Remote terminal access on Linux, Windows, and more
- Lots of other services rely on it, e.g., Git, Ansible, etc.

SSH (22) Cont.



- Except for a few CVEs, SSH is pretty secure
- So what is there to do during enumeration?
  - Once you obtained a password, spray it!
  - Check (especially networking equipment) for default credentials
  - Look out for private keys, they'll let us through the door

WinRM (5985, 5986) and PsExec (135, 445)



- WinRM and PsExec are popular SSH alternatives on Windows
- WinRM users must be part of `Remote Management Users` group
- PsExec is basically RPC and SMB (see the port)

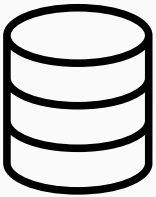
```
# WinRM with standard username and password
    authentication
$ evil-winrm -u <username> -p <password> -i <ip-address>

# WinRM with pass the hash (PtH) authentication
$ evil-winrm -u <username> -H <NTLM> -i <ip-address>
```

- Toolbox: `Evil-WinRM`, `WMIC`, `PowerShell`, ...

LDAP (389, 636)

- Lightweight Directory Access Protocol (389, 636)
- Provides a centralized (or distributed) resource directory
- The data is represented in a tree structure
- Holds user accounts, groups, device information, etc.

LDAP (389, 636) Cont.



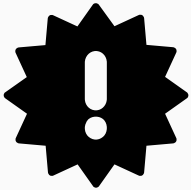
- Gaining access to directory information is crucial
- This way, we get an understanding of the organization's structure
- Sometimes, LDAP might contain some sensitive information
  - Passwords in description fields
  - Hashed account passwords, etc.
- What to do if we don't have an account in the network?

```
# Do an anonymous bind and search
$ ldapsearch -H ldaps://example.com:636/ \
    -x -s base -b '' "(objectClass=*)" "*" +
```

- Toolbox: `ldapsearch`, `NetExec`, `Nmap (ldap-* scripts)`, ...

Kerberos (88)

- Kerberos (88)
- Ticket-based authentication protocol for distributed environments
- Microsoft's Active Directory uses Kerberos by default
- And a lot can go wrong when configured incorrectly
- We will hear more about AD and Kerberos in future sessions
- `https://www.tarlogic.com/blog/how-to-attack-kerberos`
- Toolbox: `Impacket`, `Mimikatz`, `Rubeus`, `Kerbrute`, ...



- Check out these awesome resources
  - `https://book.hacktricks.wiki`
  - `https://orange-cyberdefense.github.io/ocd-mindmaps`
- Take detailed notes while working on the machines

Questions?


OUR DEVICES ARE NOW 100% SECURE.
I TURNED THEM ALL OFF.
HOW DID YOU DO THAT?
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