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HO#2.4
Scanning & Vulnerability Analysis: Part 2

This handout is continuation of our previous Handout, where we started practically understanding the second phase of penetration testing known as *Scanning and Vulnerability Analysis*. The objective of *scanning* part is to identify systems, services and potential entry points in a network by performing port scanning, NW scanning and Services detection using tools like `nmap, zenmap, unicorn, nikto` and so on. The objective of *vulnerability analysis* is to dig deeper and perform an in-depth examination to uncover known vulnerabilities, misconfigurations, or weaknesses. To perform vulnerability analysis, we have already covered the use of tools like `nessus, searchsploit` and `OpenVAS` in Handout2.3. Today we will perform **Scanning and Vulnerability Analysis using another famous tool called Metasploit Framework.**

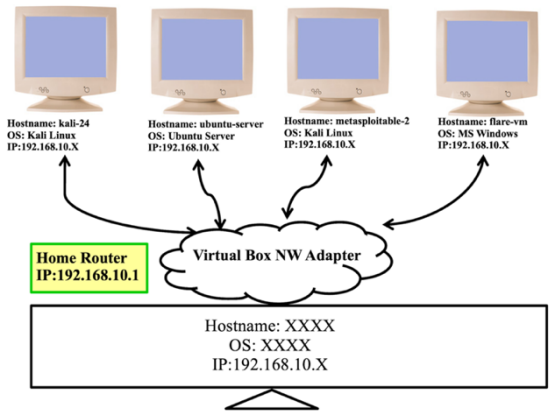
The steps that we normally perform during vulnerability analysis are:

- **Vulnerability Scanning:** Scanning the target for known vulnerabilities using databases like CVE (Common Vulnerabilities and Exposures).
- **Risk Evaluation:** Assessing the severity of discovered vulnerabilities, often using metrics like CVSS (Common Vulnerability Scoring System) to prioritize them.
- **Remediation Recommendations:** A detailed report highlighting specific vulnerabilities, their risk levels, and actionable steps to mitigate those vulnerabilities (e.g., patching, configuration changes, etc.).

Environment Setup

You can use the following machines for a hands-on practice of this handout in which I am using kali Linux as attacker machine and scanning Metasploitable 2:

1. Kali Linux (IP: x.x.x.x)
2. Metasploitable 2 (IP: x.x.x.x)



Overview of Metasploit Framework

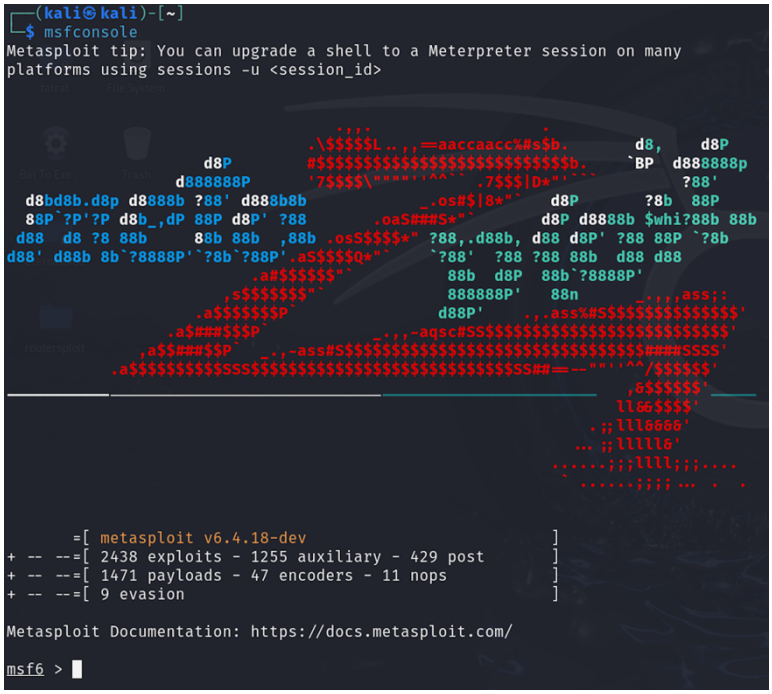
The Metasploit Framework is a widely used open-source penetration testing and exploitation platform developed by Rapid7. It provides security professionals and researchers with a comprehensive set of tools for *discovering* and *exploiting* vulnerabilities in various systems and applications. Kali Linux comes pre-installed with Metasploit framework.

Before we start, let us once again have a clear idea about *vulnerability*, *exploit* and *payload*. Consider a locked refrigerator containing chocolates, fruit trifle, cold drinks etc. Somehow you come to know about its ***vulnerability*** that it can be unlocked using a CD70 key, written on the door. You ***exploit*** that vulnerability and opens/unlock the refrigerator. Now the ***payload*** is the piece of program that performs the actual task once the vulnerability is exploited, i.e., eating/stealing the chocolates ☺

Accessing Metasploit Framework using msfconsole

There are many interfaces to Metasploit Framework (MSF), e.g., **`msfconsole`**, `msfcli`, `msfgui`, `msfweb`, `armitage`. The one we will be using is `msfconsole` which is probably the most popular interface to MSF. It provides an "all-in-one" centralized console and allows you efficient access to virtually all of the options available in the MSF. The `msfconsole` may appear intimidating at first, but once you learn the syntax of its commands you will learn to appreciate the power of utilizing this interface.
Once you will run `msfconsole` on your Kali Linux machine you will get a screenshot similar to the one given below, that displays some important information about Metasploit Framework:

```
$ sudo msfconsole
```



- ASCII logo
- Metasploit version (6.4.18),
  - 2438 `exploits`
  - 1255 `auxiliary`
  - 429 `post`
  - 1471 `payloads`
  - 47 `encoders`
  - 11 `nops`
  - 9 `evasions`

```
msf6> help
```

- Once `msfconsole` is running, you can use it's `help` command to check out the details about different commands.
- Making yourself familiar with these commands will help you throughout this course and will give you a strong foundation for working with Metasploit in general. Better to run `msfconsole` command as `sudo`, as you may need that power later. Good Luck ☺

Anatomy and Structure of Metasploit

- In Kali Linux, files related to Metasploit Framework are in `/usr/share/metasploit-framework` directory. Before moving ahead, one must explore the contents of this directory:
  `$ ls /usr/share/metasploit-framework`

```
┌──(kali㉿kali)-[/usr/share/metasploit-framework]
└─$ ls
app     documentation               modules          msfrpc     plugins          script-recon
config  Gemfile                     msfconsole       msfrpcd    Rakefile         scripts
data    Gemfile.lock                msfd             msfupdate  ruby             tools
db      lib                         msfdb            msfvenom   script-exploit   vendor
docs    metasploit-framework.gemspec msf-json-rpc.ru msf-ws.ru  script-password
```

- Almost all of your interaction with Metasploit will be through one of its many *modules*, located under **`/usr/share/metasploit-framework/modules/`** directory. The modules directory further contains `exploits`, `auxiliary`, `post`, `payloads`, `encoders`, `nops`, and `evasion` directories. Here is a brief description of each of these directories.

1. Exploit

- **Description:** Contains modules designed to exploit specific vulnerabilities in software and systems.
- **Examples:** Exploits for operating systems, network services, applications, etc.
- **Use Case:** Used to gain unauthorized access to a system by exploiting known vulnerabilities.

2. Auxiliary

- **Description:** Includes modules that perform various tasks other than exploitation, like information gathering and vulnerability analysis using port scanners, sniffers, fuzzers, etc. For example, inside the `auxiliary` sub-directory, you have the `scanner/portscan/` sub-directory having different port scanners written in Ruby language.
- **Examples:** You might need to perform a simple task of verifying whether a certificate of a particular server has expired or not, or you might want to scan your subnet and check whether any of the FTP servers allow anonymous access.
- **Use Case:** Used for information gathering, discovering vulnerabilities, and conducting preliminary attacks.

3. Payloads

- **Description:** Houses various payloads that runs remotely on the compromised system.
- **Subcategories:**
  - **Singles:** Self-contained payloads that perform a single task, e.g., create a user, bind a shell. (`modules/payloads/singles/windows/adduser.rb`)
  - **Stagers:** Small payloads that establish a connection to download and execute larger payloads.
  - **Stages:** Larger payloads that are delivered by stagers.
- **Use Case:** Used to execute commands, establish remote connections, and provide control over the target. *Meterpreter* is a Metasploit attack payload deployed using in-memory DLL injection so it resides entirely in memory and writes nothing to disk. It looks similar to an interactive shell, but can do a lot more than just executing shell commands.

4. Encoders

- **Description:** Contains modules used to encode payloads to evade detection by security solutions like antivirus software.
- **Examples:** Various encoding techniques like Base64, XOR, and others.
- **Use Case:** Used to obfuscate payloads to bypass security defenses.

5. Nops

- **Description:** Holds modules that generate No Operation (NOP) sleds, which are sequences of NOP instructions used in buffer overflow exploits. Adding NOPs can significantly help in modifying the payload signatures and thereby avoiding detection.
- **Examples:** NOP generators for different architectures.
- **Use Case:** Used to pad payloads and ensure proper execution within buffer overflow exploits.

6. Post

- **Description:** Contains modules for post-exploitation activities that can be executed on compromised systems.
- **Examples:** Privilege escalation, data extraction, maintaining access, and system manipulation.
- **Use Case:** Used after gaining access to a system to further exploit, escalate privileges, and maintain persistence on the target.

7. Evasion

- **Description:** Contains modules designed to evade detection by security mechanisms like firewalls and intrusion detection systems (IDS).
- **Examples:** Techniques to bypass network defenses and avoid triggering security alerts.
- **Use Case:** Used to stealthily bypass security defenses during an attack.

Basic Commands of **msfconsole**

I recommend to run `msfconsole` command as `sudo`, as you may need that power later. Since the Meterpreter provides a whole new environment, so students are advised to familiarize themselves with commands of this powerful tool. We will be extensively using these commands in this module, a summary of which are shown in the table below. Remember experimentation is the key to successful learning, so Good Luck ☺

Commands	Description
msf6 > help **msf6 >** help <command>	The simple **help** command will give you a list and small description of all available commands divided into different categories like core commands, module commands, job commands, resource script commands, database backend commands, and so on
msf6 > banner	Print a stunning ASCII art banner along with version information and module counts
msf6 > exit/quit	The **exit** or **quit** command will simply exit `msfconsole` utility
msf6 > show auxiliary **msf6 >** show exploits	The **show** command is passed one argument that can be `exploits`, `payloads`, `auxiliary`, `encoders`
msf6 > search telnet **msf6 >** search type:auxiliary telnet **msf6 >** search type:exploit telnet **msf6 >** search cve:2021-45046	There are thousands of modules in MSF, the **search** command is used to narrow down that list. The location of modules is inside the `/usr/share/metasploit-framework/modules/` directory.
msf6 >info auxiliary/scanner/portscan/syn	Once you have identified the module you are interested in using, you can use the **info** command to find out more about it
msf6>use auxiliary/scanner/portscan/syn **msf6 auxiliary(scanner/portscan/syn)>**	Once you are done with searching a specific module, then you give **use** command followed by the specific scanner/exploit/payload to change your context to that specific module, thus exposing type-specific commands. Once you are finished working with a specific module, you can issue the **back** command to move out of the current context.
msf6 auxiliary(scanner/portscan/syn)> show options	Each module has a list of parameters or options, you need to configure. So, once you are in the context of a particular module, you can issue the **show options** command to display which settings are available and/or required for that specific module
msf6 auxiliary(scanner/portscan/syn)>show advanced	To view any advanced options that may be available for a given module, you can use the **show advanced** command
msf6 exploit(multi/handler)>show payloads	When you are in the context of a particular exploit, running **show payloads** command will only display the payloads that are compatible with that particular exploit. Later you can select the payload of your choice using its name or number
msf6 exploit(multi/handler)>show targets	When you are in the context of a particular exploit, and you are not certain whether an OS is vulnerable to this exploit, the **show targets** command will display the supported OS targets. Later you can select the target of your choice using its name or number

msf6 exploit(multi/handler)> `set param value`	Before you can use a module to scan or exploit a target it needs to be configured for your specific use case. You can use the **`set`** command to update the value of a parameter
msf6 exploit(multi/handler)> `unset param`	The **`unset`** command is opposite of the set command, which removes a parameter previously configured with `set` command. You can remove all assigned variables with `unset all` command
msf6 exploit(multi/handler)> `setg RHOSTS <ip>`	You'll notice that some parameters, such as RHOSTS appear over and over again across multiple modules. Rather than repeatedly entering the RHOSTS value for each new module we load, we can use the **`setg`** command to set the value of that parameter for all modules
msf6 exploit(multi/handler)> `run`	Once you have configured all parameters marked as required for the module you have loaded, you can execute it using the **`run`** command

Performing Port Scannings (**portscan**) on Metasploitable2

- Inside MSF console, we can run the `nmap` command to perform a port scan, as we have done many a times in our Handout 2.3
  msf6> `nmap -sV <ip of M2>`

```
msf6 > nmap -sV 192.168.8.105
[*] exec: nmap -sV 192.168.8.105

Starting Nmap 7.94SVN ( https://nmap.org ) at 2024-09-05 05:23 EDT
Nmap scan report for 192.168.8.105
Host is up (0.0018s latency).
Not shown: 977 closed tcp ports (conn-refused)
PORT     STATE SERVICE     VERSION
21/tcp   open  ftp         vsftpd 2.3.4
22/tcp   open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp   open  telnet      Linux telnetd
25/tcp   open  smtp        Postfix smtpd
53/tcp   open  domain      ISC BIND 9.4.2
80/tcp   open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp  open  rpcbind     2 (RPC #100000)
139/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
512/tcp  open  exec        netkit-rsh rexecd
513/tcp  open  login       OpenBSD or Solaris rlogind
514/tcp  open  shell?
1099/tcp open  java-rmi    GNU Classpath grmiregistry
1524/tcp open  bindshell   Metasploitable root shell
2049/tcp open  nfs         2-4 (RPC #100003)
2121/tcp open  ftp         ProFTPD 1.3.1
3306/tcp open  mysql       MySQL 5.0.51a-3ubuntu5
5432/tcp open  postgresql  PostgreSQL DB 8.3.0 - 8.3.7
5900/tcp open  vnc         VNC (protocol 3.3)
6000/tcp open  X11         (access denied)
6667/tcp open  irc         UnrealIRCd
```

- There are many scanners inside Metasploit, that help us in information gathering inside the auxiliary module. There are a variety of port scanners that are available to us within `/usr/share/metasploit-framework/modules/auxiliary/scanner/portscan` directory like `syn.rb`, `tcp.rb`, `ack.rb` and so on.
  msf6> `search portscan`

```
msf6 > search portscan

Matching Modules
================

   #  Name                                                Disclosure Date  Rank    Check  Description
   -  ----                                                ---------------  ----    -----  -----------
   0  auxiliary/scanner/portscan/ftpbounce                .                normal  No     FTP Bounce Port Scanner
   1  auxiliary/scanner/natpmp/natpmp_portscan            .                normal  No     NAT-PMP External Port Scanner
   2  auxiliary/scanner/sap/sap_router_portscanner        .                normal  No     SAPRouter Port Scanner
   3  auxiliary/scanner/portscan/xmas                     .                normal  No     TCP "XMas" Port Scanner
   4  auxiliary/scanner/portscan/ack                      .                normal  No     TCP ACK Firewall Scanner
   5  auxiliary/scanner/portscan/tcp                      .                normal  No     TCP Port Scanner
   6  auxiliary/scanner/portscan/syn                      .                normal  No     TCP SYN Port Scanner
   7  auxiliary/scanner/http/wordpress_pingback_access    .                normal  No     Wordpress Pingback Locator
```

- The above screenshot shows different types of scans that we can perform on a network or on a specific machine. Let us perform the **syn** scan
  msf6> `use auxiliary/scanner/portscan/syn`
  msf6 auxiliary(scanner/portscan/syn)> `show options`

```
msf6 > use auxiliary/scanner/portscan/syn
msf6 auxiliary(scanner/portscan/syn) > show options

Module options (auxiliary/scanner/portscan/syn):

   Name       Current Setting  Required  Description
   ----       ---------------  --------  -----------
   BATCHSIZE  256              yes       The number of hosts to scan per set
   DELAY      0                yes       The delay between connections, per thread, in milliseconds
   INTERFACE                   no        The name of the interface
   JITTER     0                yes       The delay jitter factor (maximum value by which to +/- DELAY) in milliseconds.
   PORTS      1-10000          yes       Ports to scan (e.g. 22-25,80,110-900)
   RHOSTS                      yes       The target host(s), see https://docs.metasploit.com/docs/using-metasploit/basics/using-metasploit.html
   SNAPLEN    65535            yes       The number of bytes to capture
   THREADS    1                yes       The number of concurrent threads (max one per host)
   TIMEOUT    500              yes       The reply read timeout in milliseconds
```

- Now you need to set at least the RHOSTS parameter, you may change others as well and run

```
msf6 auxiliary(scanner/portscan/syn)> set RHOSTS <IP of M2>
msf6 auxiliary(scanner/portscan/syn)> set THREADS 50
msf6 auxiliary(scanner/portscan/syn)> run
```

- **Note:** Since we have run it only on the IP of the Metasploitable2 machine, so it has displayed the different open ports on that machine, you may run it on an entire network to get a more detailed view. However, that may take a bit of time.

```
msf6 auxiliary(scanner/portscan/syn) > set RHOSTS 192.168.8.104
RHOSTS ⇒ 192.168.8.104
msf6 auxiliary(scanner/portscan/syn) > set THREADS 50
THREADS ⇒ 50
msf6 auxiliary(scanner/portscan/syn) > run

[+]  TCP OPEN 192.168.8.104:21
[+]  TCP OPEN 192.168.8.104:22
[+]  TCP OPEN 192.168.8.104:111
[+]  TCP OPEN 192.168.8.104:139
[+]  TCP OPEN 192.168.8.104:445
[+]  TCP OPEN 192.168.8.104:512
[+]  TCP OPEN 192.168.8.104:513
[+]  TCP OPEN 192.168.8.104:1524
[+]  TCP OPEN 192.168.8.104:2121
[+]  TCP OPEN 192.168.8.104:3632
[+]  TCP OPEN 192.168.8.104:5432
[+]  TCP OPEN 192.168.8.104:5900
[+]  TCP OPEN 192.168.8.104:6667
[+]  TCP OPEN 192.168.8.104:8787
[*] Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
```

To Do: Students are advised to perform other scans inside the **portscan** directory at their own ☺

Performing SMB Scannings (**smb**) on Metasploitable2

- Now that we have determined which hosts are available on the network, we can attempt to determine the operating systems they are running. This will help us narrow down our attacks to target a specific system and will stop us from wasting time on those that aren't vulnerable to a particular exploit. SMB stands for Server Message Block, which is a client-server communication protocol that is used for shared access to files, directories, printers, securely over a network between different operating systems, i.e., windows-windows, Unix-Unix, and Unix-Windows. It uses TCP port 139 and 445 for communication.
- Let us search the different matching modules with the keyword smb:

```
msf6> search smb
```

```
msf6 > search smb

Matching Modules
================

   #    Name                                                      Disclosure Date  Rank       Check  De
scription
   -    ----                                                      ---------------  ----       -----  --
---------
   0    exploit/multi/http/struts_code_exec_classloader           2014-03-06       manual     No     Ap
ache Struts ClassLoader Manipulation Remote Code Execution
   1      \_ target: Java                                         .                .          .      .
   2      \_ target: Linux                                        .                .          .      .
   3      \_ target: Windows                                      .                .          .      .
   4      \_ target: Windows / Tomcat 6 & 7 and GlassFish 4 (Remote SMB Resource)  .                .      .
   5    exploit/osx/browser/safari_file_policy                    2011-10-12       normal     No     Ap
ple Safari file:// Arbitrary Code Execution
   6      \_ target: Safari 5.1 on OS X                           .                .          .      .
   7      \_ target: Safari 5.1 on OS X with Java                 .                .          .      .
   8    auxiliary/server/capture/smb                              .                normal     No     Au
thentication Capture: SMB
   9    post/linux/busybox/smb_share_root                         .                normal     No     Bu
syBox SMB Sharing
   10   exploit/linux/misc/cisco_rv340_sslvpn                     2022-02-02       good       Yes    Ci
sco RV340 SSL VPN Unauthenticated Remote Code Execution
   11   auxiliary/scanner/http/citrix_dir_traversal               2019-12-17       normal     No     Ci
trix ADC (NetScaler) Directory Traversal Scanner
   12   auxiliary/gather/crushftp_fileread_cve_2024_4040          .                normal     Yes    Cr
ushFTP Unauthenticated Arbitrary File Read
   13   auxiliary/scanner/smb/impacket/dcomexec                   2018-03-19       normal     No     DC
```

- There are a variety of SMB auxiliaries that are available to us within `/usr/share/metasploit-framework/modules/auxiliary/scanner/smb/` directory. Some of these are `smb_version.rb`, `smb_enumusers.rb`, `smb_login.rb` and so on. First let us use the following command to check out different types of scans that are there in the **smb** module
- **Let us use `smb_version`:** Remember when we ran `nmap` on Metasploitable2, we came to know that SMB service was running on port 139 and 445, but it did not tell us its version. Let us use `smb_version.rb` to check out.

```
msf6> use auxiliary/scanner/smb/smb_version
msf6 auxiliary(scanner/smb/smb_version)> show options
```

```
msf6 > use auxiliary/scanner/smb/smb_version
msf6 auxiliary(scanner/smb/smb_version) > show options

Module options (auxiliary/scanner/smb/smb_version):

   Name     Current Setting  Required  Description
   ----     ---------------  --------  -----------
   RHOSTS                    yes       The target host(s), see https://docs.metasploit.com/docs
   RPORT                     no        The target port (TCP)
   THREADS  1                yes       The number of concurrent threads (max one per host)
```

```
msf6 auxiliary(scanner/smb/smb_version)> set RHOSTS <IP of M2>
msf6 auxiliary(scanner/smb/smb_version)> set THREADS 50
msf6 auxiliary(scanner/smb/smb_version)> run
```

```
msf6 auxiliary(scanner/smb/smb_version) > run

[*] 192.168.8.110:445     - SMB Detected (versions:1) (preferred dialect:) (signatures:optional)
[*] 192.168.8.110:445     -   Host could not be identified: Unix (Samba 3.0.20-Debian)
[*] 192.168.8.110:        - Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
msf6 auxiliary(scanner/smb/smb_version) >
```

- So we have succeeded in finding the exact version, and that is Samba 3.0.20-Debian ☺

To Do: Students are advised to perform other scans inside the **smb** directory at their own ☺

Performing FTP Scannings (**ftp**) on Metasploitable2

- FTP is mostly used for file sharing between the client and server. It uses TCP port 21 for communication. There exist different types of FTP scans inside MSF, that we can perform on a network or on a specific machine inside the `/usr/share/metasploit-framework/modules/auxiliary/scanner/ftp` directory. Let me give you a brief description of some:
  - Some FTP servers are misconfigured in a way that allows anonymous access to remote users. The `anonymous.rb` probes the target FTP server to check whether it allows anonymous access.
  - The `ftp_version.rb` uses the banner grabbing technique to detect the version of the target FTP server.
  - The `ftp_login.rb` help us perform a brute-force attack against the target FTP server. For this to work, other than RHOSTS parameter, you must also configure the USERPASS_FILE parameter to the path to the file containing the username/password list. You can either create your own custom list that can be used for a brute-force attack, or there are many wordlists instantly available for use in Kali Linux, located at `/usr/share/wordlists`. ☺

- Let us perform **anonymous scan** on Metasploitable2**:**

```
msf6> use auxiliary/scanner/ftp/anonymous
msf6 auxiliary(scanner/ftp/anonymous)> show options
```

```
msf6 auxiliary(scanner/ftp/anonymous) > show options

Module options (auxiliary/scanner/ftp/anonymous):

   Name      Current Setting      Required  Description
   ----      ---------------      --------  -----------
   FTPPASS   mozilla@example.com  no        The password for the specified username
   FTPUSER   anonymous            no        The username to authenticate as
   RHOSTS                         yes       The target host(s), see https://docs.metasploit.com/docs/using-metasploit/basics/using-met
                                            asploit.html
   RPORT     21                   yes       The target port (TCP)
   THREADS   1                    yes       The number of concurrent threads (max one per host)
```

- Now you need to set at least the RHOSTS parameter, you may change others as well and run

```
msf6 auxiliary(scanner/ftp/anonymous)> set RHOSTS <IP of M2>
msf6 auxiliary(scanner/ftp/anonymous)> run
```

```
msf6 auxiliary(scanner/ftp/anonymous) > set RHOSTS 192.168.8.104
RHOSTS => 192.168.8.104
msf6 auxiliary(scanner/ftp/anonymous) > run

[+] 192.168.8.104:21      - 192.168.8.104:21 - Anonymous READ (220 (vsFTPd 2.3.4))
[*] 192.168.8.104:21      - Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
```

- The output shows that one can use the ftp client to access Metasploitable2 with username of `anonymous` and a blank password

```
$ ftp <ip of M2>
```

To Do: Students are advised to perform other scans inside the **ftp** directory at their own ☺

Performing HTTP Scannings (**http**) on Metasploitable2

- HTTP is a stateless application layer protocol used for the exchange of information on the World Wide Web. HTTP uses TCP port 80 for communication.
- Let us perform a **nmap** scan on port 80 of our Metasploitable2 machine.
  msf6> nmap -p 80 -sV <IP of M2>
  $ nmap -sV -p 80 <IP of M2>

```
┌──(kali㉿kali)-[~]
└─$ nmap -sV 192.168.8.110 -p 80
Starting Nmap 7.94SVN ( https://nmap.org ) at 2024-09-19 12:28 EDT
Nmap scan report for 192.168.8.110
Host is up (0.0011s latency).

PORT   STATE SERVICE VERSION
80/tcp open  http    Apache httpd 2.2.8 ((Ubuntu) DAV/2)

Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 7.07 seconds
```

- The above output shows that Apache httpd 2.2.8 Web server is running on port 80 at Matasploitable2 machine. The Apache HTTP Server is the most widely used web server software and runs on 67% of all web sites in the world. It is open source and is available for all UNICES, Mac, Linux and Microsoft platforms.
- Now in MSF, there are a variety of HTTP auxiliaries that are available to us within `/usr/share/metasploit-framework/modules/auxiliary/scanner/http/` directory, like `http_version.rb`, `dir_scanner.rb`, `robots_txt.rb` and so on.

1. Let us use `http_version.rb`:

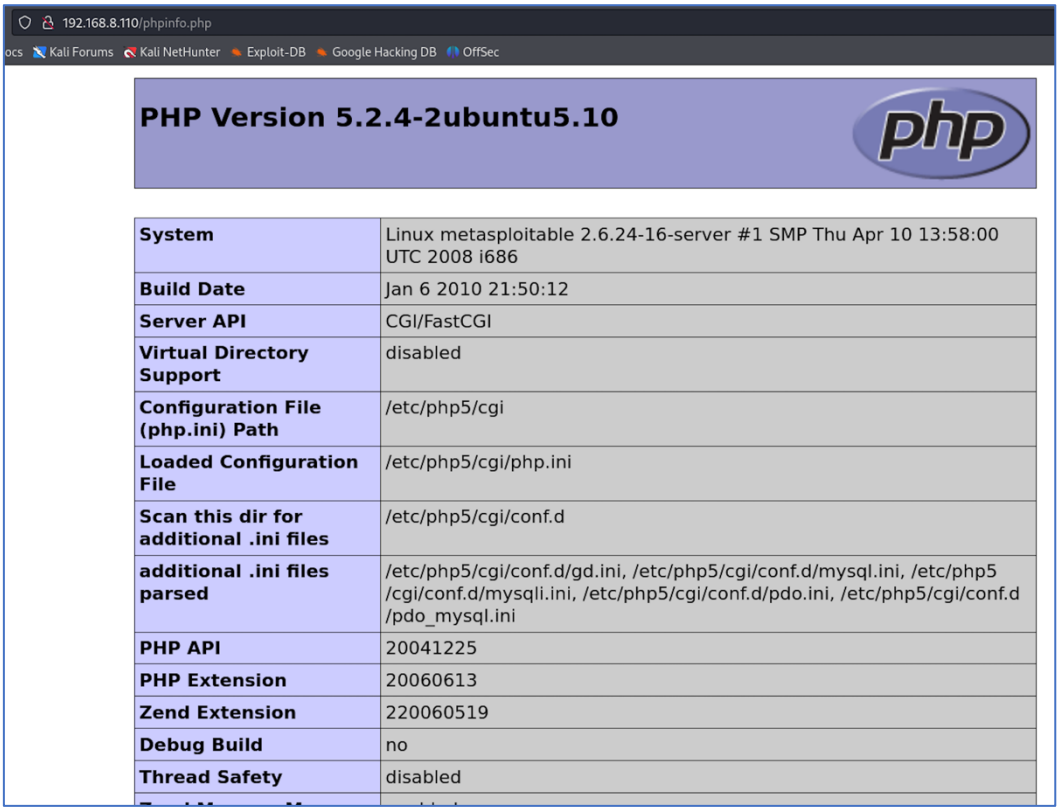
msf6> use auxiliary/scanner/http/http_version
msf6 auxiliary(scanner/http/http_version)> show options

```
msf6 > use auxiliary/scanner/http/http_version
msf6 auxiliary(scanner/http/http_version) > show options

Module options (auxiliary/scanner/http/http_version):

   Name     Current Setting  Required  Description
   ----     ---------------  --------  -----------
   Proxies                   no        A proxy chain of format type:host:port[,type:host:port][ ... ]
   RHOSTS                    yes       The target host(s), see https://docs.metasploit.com/docs/using-metasploit/basics/usin
                                       g-metasploit.html
   RPORT    80               yes       The target port (TCP)
   SSL      false            no        Negotiate SSL/TLS for outgoing connections
   THREADS  1                yes       The number of concurrent threads (max one per host)
   VHOST                     no        HTTP server virtual host


View the full module info with the info, or info -d command.
```

- We just need to set the RHOSTS parameter and run the scan.

```
msf6 auxiliary(scanner/http/http_version) > set RHOSTS 192.168.8.110
RHOSTS ⇒ 192.168.8.110
msf6 auxiliary(scanner/http/http_version) > run

[+] 192.168.8.110:80 Apache/2.2.8 (Ubuntu) DAV/2 ( Powered by PHP/5.2.4-2ubuntu5.10 )
[*] Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
msf6 auxiliary(scanner/http/http_version) >
```

- It's Apache 2.2.8 with PHP 5.2.4. In a browser on our Kali machine, we can navigate to http://192.168.231.109/phpinfo.php and confirm the information, which is shown in the screenshot below ☺



System	Linux metasploitable 2.6.24-16-server #1 SMP Thu Apr 10 13:58:00 UTC 2008 i686
Build Date	Jan 6 2010 21:50:12
Server API	CGI/FastCGI
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc/php5/cgi
Loaded Configuration File	/etc/php5/cgi/php.ini
Scan this dir for additional .ini files	/etc/php5/cgi/conf.d
additional .ini files parsed	/etc/php5/cgi/conf.d/gd.ini, /etc/php5/cgi/conf.d/mysql.ini, /etc/php5/cgi/conf.d/mysqli.ini, /etc/php5/cgi/conf.d/pdo.ini, /etc/php5/cgi/conf.d/pdo_mysql.ini
PHP API	20041225
PHP Extension	20060613
Zend Extension	220060519
Debug Build	no
Thread Safety	disabled

2. Let us use `dir_scanner.rb`:

Let us try some other scans in the http module and gather some more information about the web server. Let us use `dir_scanner.rb` on the Metasploitable2 and see what further information we can get:

```
msf6> use auxiliary/scanner/http/http_scanner
msf6 auxiliary(scanner/http/dir_scanner)> show options
msf6 auxiliary(scanner/http/dir_scanner)> set RHOSTS <IP of M2>
```

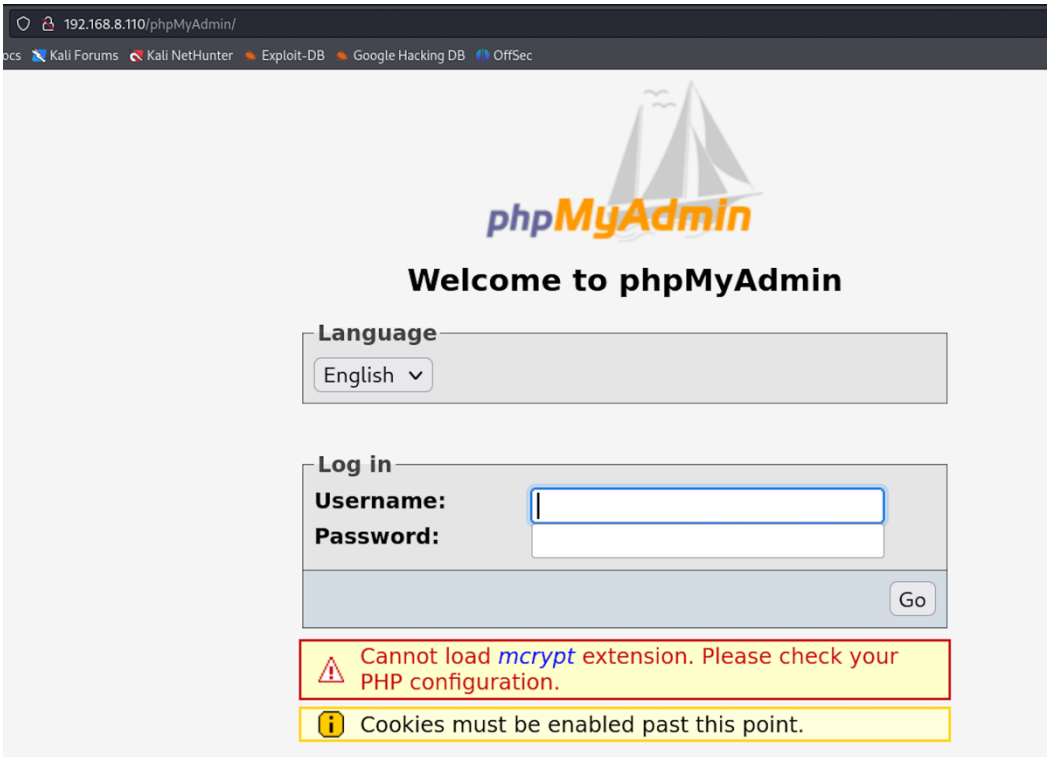
```
msf6 > use auxiliary/scanner/http/dir_scanner
msf6 auxiliary(scanner/http/dir_scanner) > show options

Module options (auxiliary/scanner/http/dir_scanner):

   Name        Current Setting                     Required  Description
   ----        ---------------                     --------  -----------
   DICTIONARY  /usr/share/metasploit-framework/dat  no        Path of word dictionary to use
               a/wmap/wmap_dirs.txt
   PATH        /                                   yes       The path  to identify files
   Proxies                                         no        A proxy chain of format type:host:port[,type:host:port][ ... ]
   RHOSTS                                          yes       The target host(s), see https://docs.metasploit.com/docs/using
                                                             -metasploit/basics/using-metasploit.html
   RPORT       80                                  yes       The target port (TCP)
   SSL         false                               no        Negotiate SSL/TLS for outgoing connections
   THREADS     1                                   yes       The number of concurrent threads (max one per host)
   VHOST                                           no        HTTP server virtual host

View the full module info with the info, or info -d command.

msf6 auxiliary(scanner/http/dir_scanner) > set RHOSTS 192.168.8.110
RHOSTS => 192.168.8.110
msf6 auxiliary(scanner/http/dir_scanner) >
```

- Let us run now

```
msf6 auxiliary(scanner/http/dir_scanner)> run
```

```
msf6 auxiliary(scanner/http/dir_scanner) > run

[*] Detecting error code
[*] Using code '404' as not found for 192.168.8.110
[+] Found http://192.168.8.110:80/cgi-bin/ 404 (192.168.8.110)
[+] Found http://192.168.8.110:80/doc/ 200 (192.168.8.110)
[+] Found http://192.168.8.110:80/icons/ 200 (192.168.8.110)
[+] Found http://192.168.8.110:80/index/ 404 (192.168.8.110)
[+] Found http://192.168.8.110:80/phpMyAdmin/ 200 (192.168.8.110)
[+] Found http://192.168.8.110:80/test/ 200 (192.168.8.110)
[*] Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
msf6 auxiliary(scanner/http/dir_scanner) >
```

- We got 6 directories. Going through their content might give us an edge to hack our target. Let us open the http://<IP of M2>:80/phpMyAdmin inside a browser on our Kali machine.



- Let us search exploitDB with Apache 2.2.8
  $ searchsploit apache 2.2.8

```
└─$ searchsploit apache 2.2.8
 ------------------------------------------------------------------------------------------------------ ---------------------------------
 Exploit Title                                                                                         |  Path
 ------------------------------------------------------------------------------------------------------ ---------------------------------
Apache + PHP < 5.3.12 / < 5.4.2 - cgi-bin Remote Code Execution                                        | php/remote/29290.c
Apache + PHP < 5.3.12 / < 5.4.2 - Remote Code Execution + Scanner                                      | php/remote/29316.py
Apache < 2.0.64 / < 2.2.21 mod_setenvif - Integer Overflow                                             | linux/dos/41769.txt
Apache < 2.2.34 / < 2.4.27 - OPTIONS Memory Leak                                                       | linux/webapps/42745.py
Apache CXF < 2.5.10/2.6.7/2.7.4 - Denial of Service                                                    | multiple/dos/26710.txt
Apache mod_ssl < 2.8.7 OpenSSL - 'OpenFuck.c' Remote Buffer Overflow                                   | unix/remote/21671.c
Apache mod_ssl < 2.8.7 OpenSSL - 'OpenFuckV2.c' Remote Buffer Overflow (1)                             | unix/remote/764.c
Apache mod_ssl < 2.8.7 OpenSSL - 'OpenFuckV2.c' Remote Buffer Overflow (2)                             | unix/remote/47080.c
Apache OpenMeetings 1.9.x < 3.1.0 - '.ZIP' File Directory Traversal                                    | linux/webapps/39642.txt
Apache Struts 2 < 2.3.1 - Multiple Vulnerabilities                                                     | multiple/webapps/18329.txt
Apache Struts 2.0.1 < 2.3.33 / 2.5 < 2.5.10 - Arbitrary Code Execution                                 | multiple/remote/44556.py
Apache Struts < 1.3.10 / < 2.3.16.2 - ClassLoader Manipulation Remote Code Execution (Metas            | multiple/remote/41690.rb
Apache Struts2 2.0.0 < 2.3.15 - Prefixed Parameters OGNL Injection                                     | multiple/webapps/44583.txt
Apache Tomcat < 5.5.17 - Remote Directory Listing                                                      | multiple/remote/2061.txt
Apache Tomcat < 6.0.18 - 'utf8' Directory Traversal                                                    | unix/remote/14489.c
Apache Tomcat < 6.0.18 - 'utf8' Directory Traversal (PoC)                                              | multiple/remote/6229.txt
Apache Tomcat < 9.0.1 (Beta) / < 8.5.23 / < 8.0.47 / < 7.0.8 - JSP Upload Bypass / Remote C            | jsp/webapps/42966.py
Apache Tomcat < 9.0.1 (Beta) / < 8.5.23 / < 8.0.47 / < 7.0.8 - JSP Upload Bypass / Remote C            | windows/webapps/42953.txt
Apache Xerces-C XML Parser < 3.1.2 - Denial of Service (PoC)                                           | linux/dos/36906.txt
Webfroot Shoutbox < 2.32 (Apache) - Local File Inclusion / Remote Code Execution                       | linux/remote/34.pl
 ------------------------------------------------------------------------------------------------------ ---------------------------------
Shellcodes: No Results
```

- Let us further filter our search with PHP 5.2.4.

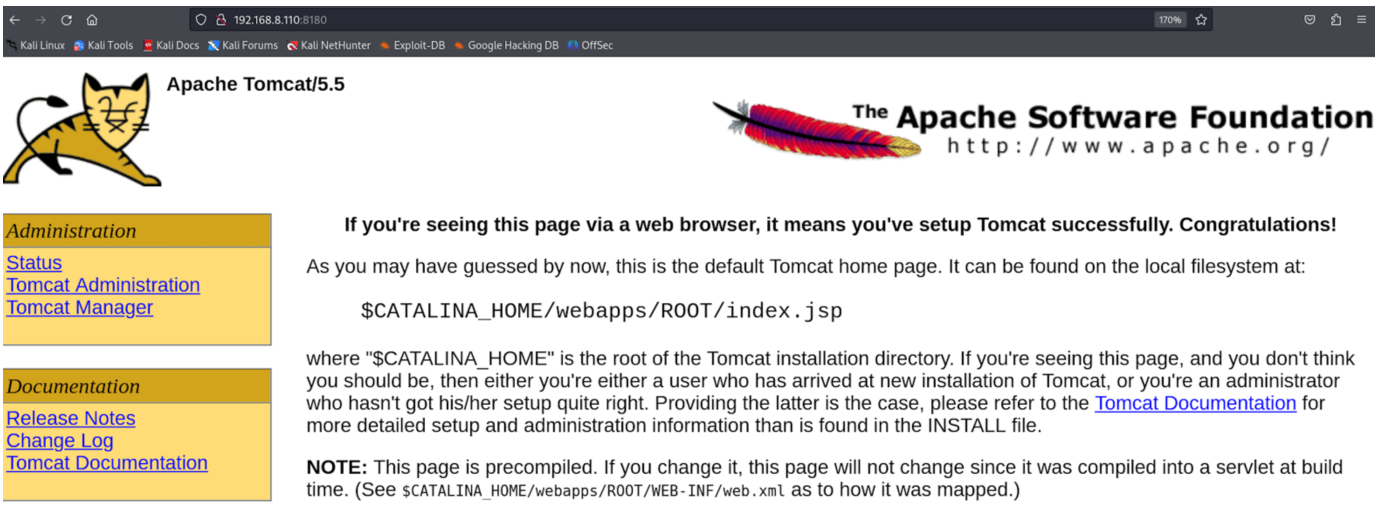
$ searchsploit apache 2.2.8 | grep php

```
┌──(kali㉿kali)-[~]
└─$ searchsploit apache 2.2.8 | grep php
Apache + PHP < 5.3.12 / < 5.4.2 - cgi-bin Remote Code Execution                   | php/remote/29290.c
Apache + PHP < 5.3.12 / < 5.4.2 - Remote Code Execution + Scanner                 | php/remote/29316.py
```

- We have found two vulnerabilities and their corresponding exploits. We will exploit this vulnerability in our next handout ☺

3. Let us use `tomcat_mgr_login.rb`:

- When we run `nmap` on Metaspoitable2, can see that 8180 port is open and running **tomcat** service. Now on your Kali machine, open a browser and type this url: http://<ip of M2>:8180



- The Apache HTTP server is primarily designed to serve static content (like HTML, CSS, and images) and handle HTTP requests. Works mainly with static files; can execute scripts (like PHP) using modules. Ideal for serving websites that don't require dynamic content generation or Java Servlets/JSP. On the contrary, the Apache Tomcat server is specifically designed to run Java Servlets and JavaServer Pages (JSP). It supports Java-based web applications, providing an environment for dynamic content generation.
- Let us use `tomcat_mgr_login.rb` on the Metasploitable2 and see what further information we can get:

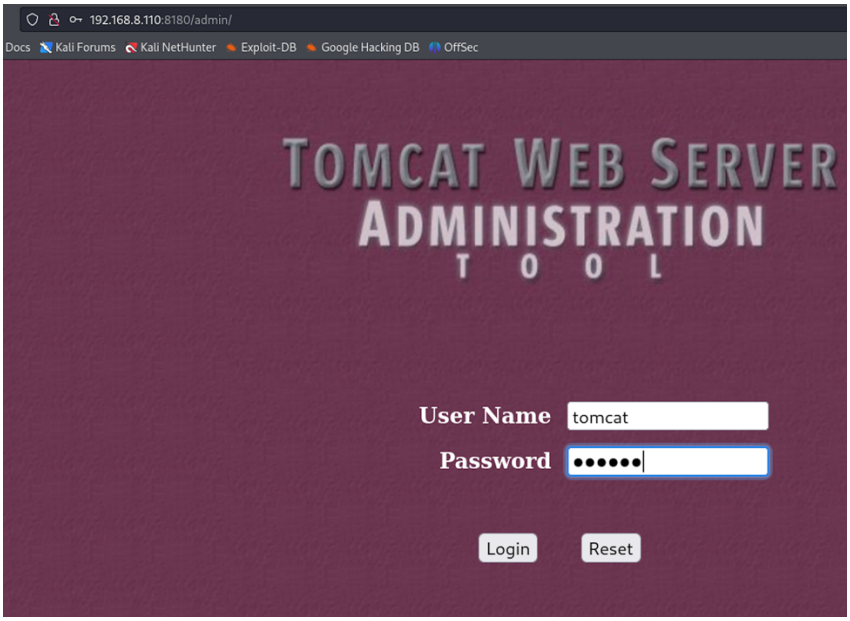
```
msf6> use auxiliary/scanner/http/tomcat_mgr_login
msf6 auxiliary(scanner/http/tomcat_mgr_login)> show options
```

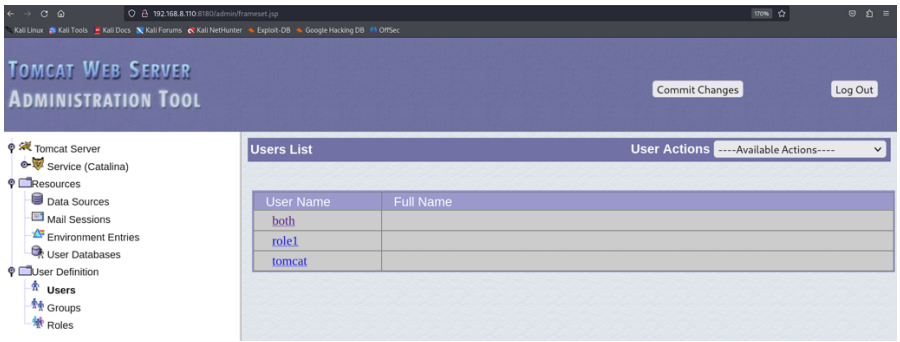
```
msf6 > use auxiliary/scanner/http/tomcat_mgr_login
msf6 auxiliary(scanner/http/tomcat_mgr_login) > show options

Module options (auxiliary/scanner/http/tomcat_mgr_login):

   Name              Current Setting                                Required  Description
   ----              ---------------                                --------  -----------
   ANONYMOUS_LOGIN   false                                          yes       Attempt to login with a blank username and password
   BLANK_PASSWORDS   false                                          no        Try blank passwords for all users
   BRUTEFORCE_SPEED  5                                              yes       How fast to bruteforce, from 0 to 5
   DB_ALL_CREDS      false                                          no        Try each user/password couple stored in the current
   DB_ALL_PASS       false                                          no        Add all passwords in the current database to the lis
   DB_ALL_USERS      false                                          no        Add all users in the current database to the list
   DB_SKIP_EXISTING  none                                           no        Skip existing credentials stored in the current data
                                                                              e, user, user&realm)
   PASSWORD                                                         no        The HTTP password to specify for authentication
   PASS_FILE         /usr/share/metasploit-framework/data/wo        no        File containing passwords, one per line
                     rdlists/tomcat_mgr_default_pass.txt
   Proxies                                                          no        A proxy chain of format type:host:port[,type:host:po
   RHOSTS                                                           yes       The target host(s), see https://docs.metasploit.com/
                                                                              it/basics/using-metasploit.html
   RPORT             8080                                           yes       The target port (TCP)
   SSL               false                                          no        Negotiate SSL/TLS for outgoing connections
   STOP_ON_SUCCESS   false                                          yes       Stop guessing when a credential works for a host
   TARGETURI         /manager/html                                  yes       URI for Manager login. Default is /manager/html
   THREADS           1                                              yes       The number of concurrent threads (max one per host)
   USERNAME                                                         no        The HTTP username to specify for authentication
   USERPASS_FILE     /usr/share/metasploit-framework/data/wo        no        File containing users and passwords separated by spa
                     rdlists/tomcat_mgr_default_userpass.txt                  ne
   USER_AS_PASS      false                                          no        Try the username as the password for all users
   USER_FILE         /usr/share/metasploit-framework/data/wo        no        File containing users, one per line
                     rdlists/tomcat_mgr_default_users.txt
   VERBOSE           true                                           yes       Whether to print output for all attempts
   VHOST                                                            no        HTTP server virtual host
```

```
msf6 auxiliary(scanner/http/tomcat_mgr_login)> set RHOSTS <IP of M2>
msf6 auxiliary(scanner/http/tomcat_mgr_login)> set RPORT 8180
msf6 auxiliary(scanner/http/tomcat_mgr_login)> set USERNAME tomcat
msf6 auxiliary(scanner/http/tomcat_mgr_login)> set PASSWORD tomcat
msf6 auxiliary(scanner/http/tomcat_mgr_login)> run
```

```
msf6 auxiliary(scanner/http/tomcat_mgr_login) > run

[+] 192.168.8.110:8180 - Login Successful: tomcat:tomcat
[-] 192.168.8.110:8180 - LOGIN FAILED: admin:tomcat (Incorrect)
[-] 192.168.8.110:8180 - LOGIN FAILED: admin:admin (Incorrect)
[-] 192.168.8.110:8180 - LOGIN FAILED: admin:manager (Incorrect)
[-] 192.168.8.110:8180 - LOGIN FAILED: admin:role1 (Incorrect)
[-] 192.168.8.110:8180 - LOGIN FAILED: admin:root (Incorrect)
[-] 192.168.8.110:8180 - LOGIN FAILED: admin:tomcat (Incorrect)
[-] 192.168.8.110:8180 - LOGIN FAILED: admin:s3cret (Incorrect)
```

- We have found the credentials ☺ From out Kali Linux machine, let us now try to login in the admin panel of tomcat server running on Metasploitable machine using the username:tomcat and password:tomcat.





To Do: Students are advised to perform other scans inside the **`http`** directory at their own ☺

Disclaimer

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