TryHackMe Web Enumeration

Saikat Karmakar | AUG 18 : 2021

Gobuster Modes

"dir" Mode

Dirbuster has a "dir" mode that allows the user to enumerate website directories. This is useful when you are performing a penetration test and would like to see what the directory structure of a website is. Often, directory structures of websites and web-apps follow a certain convention, making them susceptible to brute-forcing using wordlists. At the end of this room, you'll run Gobuster on *Blog* which uses WordPress, a very common *Content Management System* (CMS). WordPress uses a very specific directory structure for its websites.

Gobuster is powerful because it not only allows you to scan the website, but it will return the status codes as well. This will immediately let you know if you as an outside user can request that directory or not. Additional functionality of Gobuster is that it lets you search for files as well with the addition of a simple flag!

Using "dir" Mode

To use "dir" mode, you start by typing `gobuster dir`. This isn't the full command, but just the start. This tells Gobuster that you want to perform a directory search, instead of one of its other methods (which we'll get to). It has to be written like this or else Gobuster will complain. After that, you will need to add the URL and wordlist using the `-u` and `-w` options, respectively. Like so:

```
gobuster dir -u http://10.10.10.10 -w /usr/share/wordlists/dirbuster/directory-list-2.3-medium.txt
```

Note: The URL is going to be the base path where Gobuster starts looking from. So the URL above is using the root web directory. For example, in a typical Apache installation on Linux, this is */var/www/html*. So if you have a "**products**" directory and you want to enumerate that directory, you'd set the URL as *http://10.10.10.10/**products***. You can also think of this like *http://example.com/path/to/folder*. Also notice that I specified the protocol of HTTP. This is important and required.

This is a very common, simple, and straightforward command for Gobuster. This is typically what I will run when doing capture the flag style rooms on TryHackMe. However, there are some other helpful flags that can be useful in certain scenarios

Other Useful Flags

These flags are useful in certain scenarios. Note that these are not all of the flag options, but some of the more common ones that you'll use in penetration tests and in capture the flag events. If you'd like the full list, you can see that here.

Flag	Long Flag	Description
-c	--cookies	Cookies to use for requests
-x	--extensions	File extension(s) to search for
-H	--headers	Specify HTTP headers, -H 'Header1: val1' -H 'Header2: val2'
-k	--no-tls-validation	Skip TLS certificate verification
-n	--no-status	Don't print status codes
-P	--password	Password for Basic Auth
-s	--status-codes	Positive status codes
-b	--status-codes-blacklist	Negative status codes
-U	--username	Username for Basic Auth

A very common use of Gobuster's "dir" mode is the ability to use it's `-x` or `--extensions` flag to search for the contents of directories that you have already enumerated by providing a list of file extensions. File extensions are generally representative of the data they may contain. For example, **`.conf`** or **`.config`** files usually contain configurations for the application - including sensitive info such as database credentials.

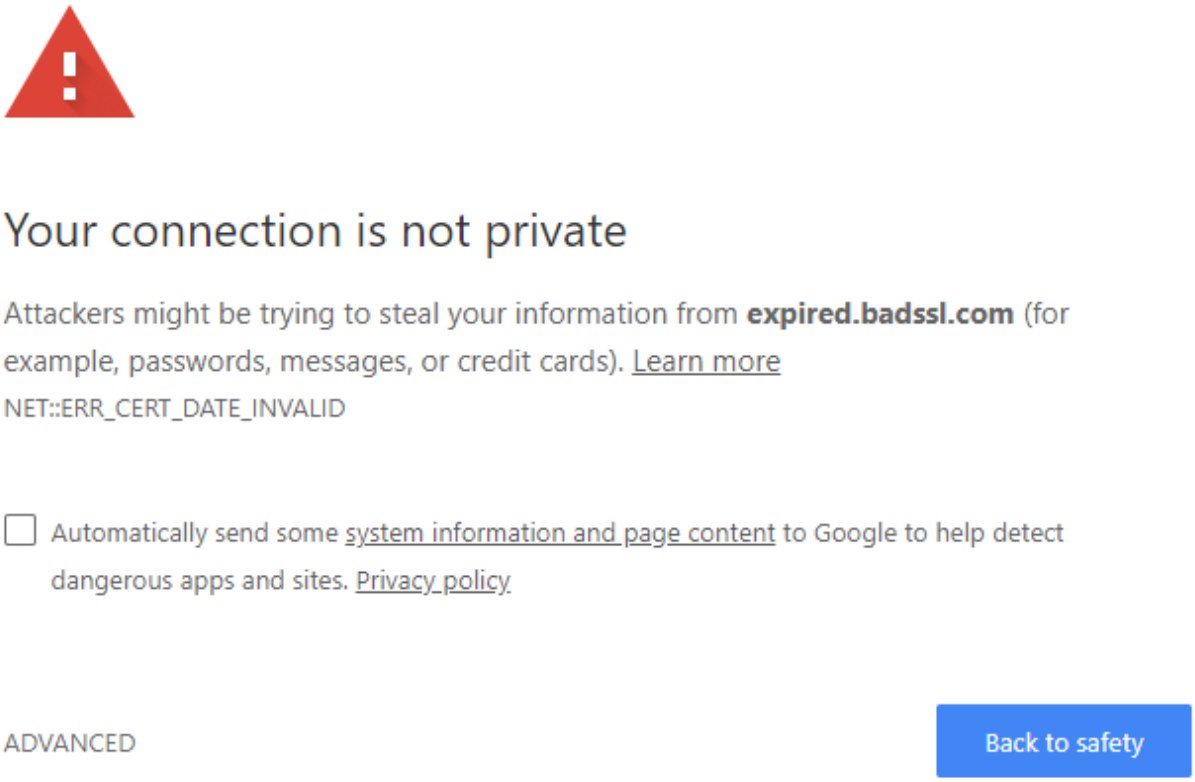
A few other files that you may wish to search for are .txt files or other web application pages such as **`.html`** or **`.php`** . Let's assemble a command that would allow us to search the "myfolder" directory on a webserver for the following three files:

1. html
2. js
3. css

```
gobuster dir -u http://10.10.252.123/myfolder -w /usr/share/wordlists/dirbuster/directory-list-2.3-medium.txt -x.html,.css,.js
```

The -k Flag

The -k flag is special because it has an important use during penetration tests and captures the flag events. In a capture the flag room on TryHackMe for example, if HTTPS is enabled, you will most likely encounter an invalid cert error like the one below



In instances like this, if you try to run Gobuster against this without the `-k` flag, it won't return anything and will most likely error out with something gross and will leave you sad. Don't worry though, easy fix! Just add the `-k` flag to your scan and it will bypass this invalid certification and continue scanning and deliver the goods!

Note: This flag can be used with "dir" mode and "vhost" modes

"dns" Mode

The next mode we'll focus on is the "dns" mode. This allows Gobuster to brute-force subdomains. During a penetration test (or capture the flag), it's important to check sub-domains of your target's top domain. Just because something is patched in the regular domain, does not mean it is patched in the sub-domain. There may be a vulnerability for you to exploit in one of these sub-domains. For example, if State Farm owns statefarm.com and mobile.statefarm.com, there may be a hole in mobile.statefarm.com that is not present in statefarm.com. This is why it is important to search for subdomains too!

Using "dns" Mode

To use "dns" mode, you start by typing `gobuster dns`. Just like "dir" mode, this isn't the full command, but just the start. This tells Gobuster that you want to perform a sub-domain brute-force, instead of one of one of the other methods as previously mentioned. It has to be written like this or else Gobuster will complain. After that, you will need to add the domain and wordlist using the -d and -w options, respectively. Like so:

```
gobuster dns -d mydomain.thm -w /usr/share/wordlists/SecLists/Discovery/DNS/subdomains-top1million-5000.txt
```

This tells Gobuster to do a sub-domain scan on the domain "mydomain.thm". If there are any sub-domains available, Gobuster will find them and report them to you in the terminal.

Other Useful Flags

-d and -w are the main flags that you'll need for *most* of your scans. But there are a few others that are worth mentioning that we can go over. They are in the table below.

Flag	Long Flag	Description
-c	--show-cname	Show CNAME Records (cannot be used with '-i' option)
-i	--show-ips	Show IP Addresses
-r	--resolver	Use custom DNS server (format server.com or server.com:port)

There aren't many additional flags to be used with this mode, but these are the main useful ones that you may use from time to time. If you'd like to see the full list of flags that can be used with this mode, check out the documentation

"vhost" Mode

The last and final mode we'll focus on is the "vhost" mode. This allows Gobuster to brute-force virtual hosts. Virtual hosts are different websites on the same machine. In some instances, they can appear to look like sub-domains, but don't be deceived! Virtual Hosts are IP based and are running on the same server. This is not usually apparent to the end-user. On an engagement, it may be worthwhile to just run Gobuster in this mode to see if it comes up with anything. You never know, it might just find something! While participating in rooms on TryHackMe, virtual hosts would be a good way to hide a completely different website if nothing turned up on your main port 80/443 scan.

Using "vhost" Mode

To use "vhost" mode, you start by typing `gobuster vhost`. Just like the other modes, this isn't the full command, but just the start. This tells Gobuster that you want to perform a virtual host brute-force, instead of one of the other methods as previously mentioned. It has to be written like this or else Gobuster will complain. After that, you will need to add the domain and wordlist using the `-u` and `-w` options, respectively. Like so:

```
gobuster vhost -u http://example.com -w /usr/share/wordlists/SecLists/Discovery/DNS/subdomains-top1million-5000.txt
```

This will tell Gobuster to do a virtual host scan http://example.com using the selected wordlis

WPScan

Introduction to WPScan

First released in June 2011, WPScan has survived the tests of time and stood out as a tool that every pentester should have in their toolkits.

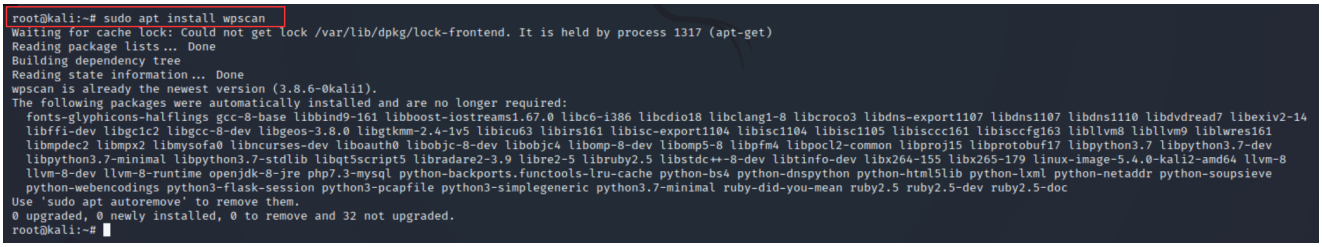
The WPScan framework is capable of enumerating & researching a few security vulnerability categories present WordPress sites - including - but not limited to:

- Sensitive Information Disclosure (Plugin & Theme installation versions for disclosed vulnerabilities or CVE's)
- Path Discovery (Looking for misconfigured file permissions i.e. wp-config.php)
- Weak Password Policies (Password bruteforcing)

- Presence of Default Installation (Looking for default files)
- Testing Web Application Firewalls (Common WAF plugins)

Installing WPScan

Thankfully for us, WPScan comes pre-installed on the latest versions of penetration testing systems such as Kali Linux and Parrot. If you are using an older version of Kali Linux (such as 2019) for example, WPScan is in the apt repository, so can be installed by a simple `sudo apt update && sudo apt install wpscan`

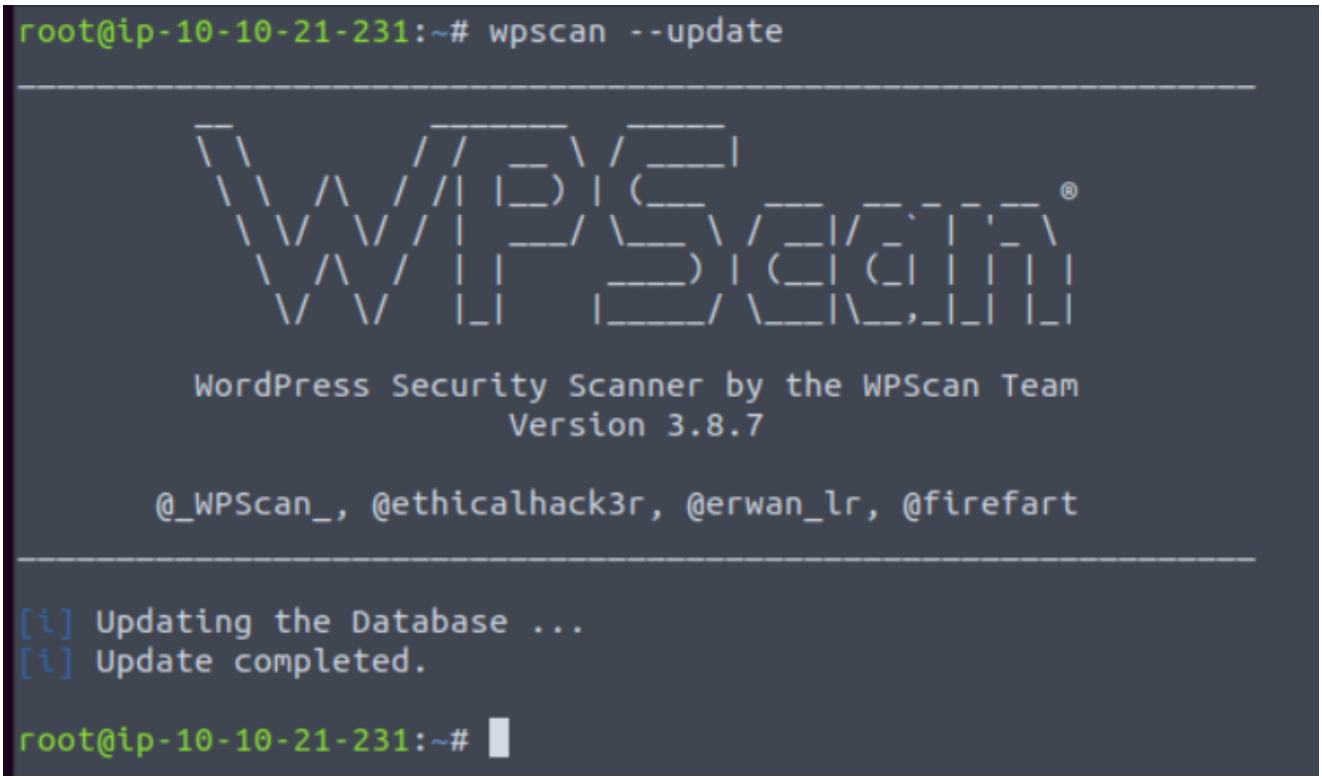


Installing WPScan on other operating systems such as Ubuntu or Debian involves extra steps. Whilst the TryHackMe AttackBox comes pre-installed with WPScan, you can follow the developer's installation guide for your local environment.

A Primer on WPScan's Database

WPScan uses information within a local database as a primary reference point when enumerating for themes and plugins. As we'll come to detail later, A technique that WPScan uses when enumerating is looking for common themes and plugins. Before using WPScan, it is highly recommended that you update this database before performing any scans.

Thankfully, this is an easy process to do. Simply run `wpscan --update`



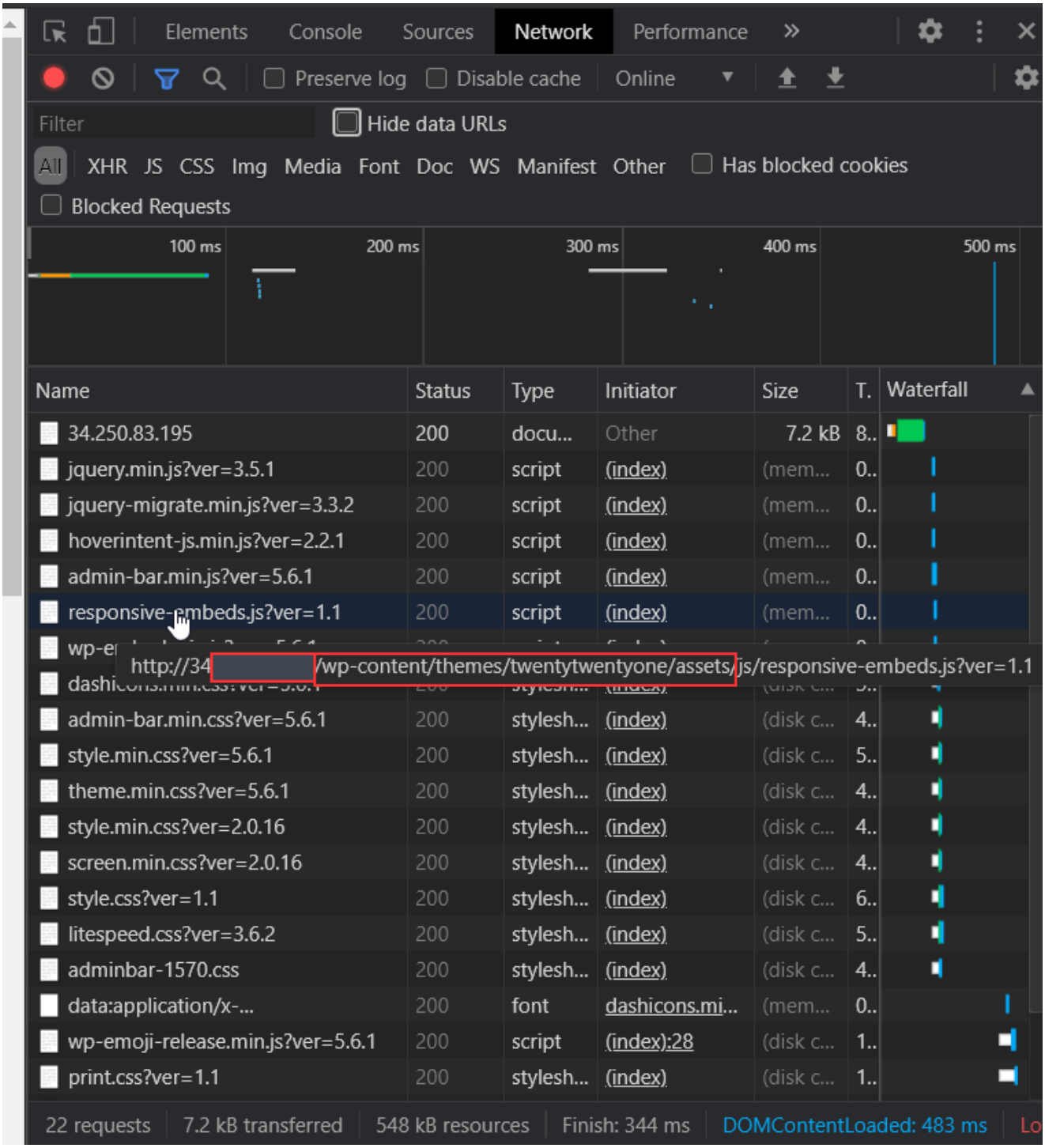
We briefly discussed the various things that WPScan is capable of discovering on a system running WordPress in Task 7. However, let's dive into this a bit further, demonstrate a few examples of the various scans used to retrieve this information and highlighting how these scans work exactly.

Enumerating for Installed Themes

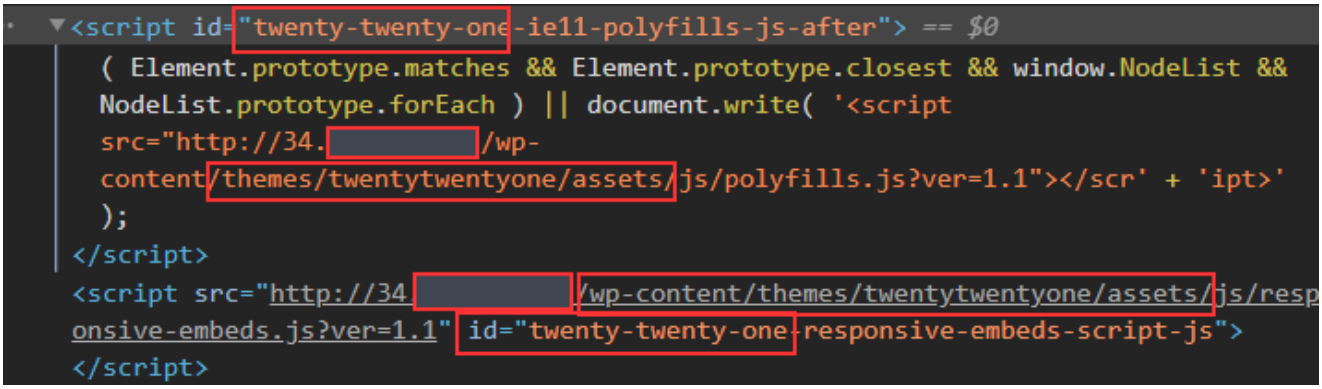
WPScan has a few methods of determining the active theme on a running WordPress installation. At a premise, it boils down to a technique that we can manually do ourselves. Simply, we can look at the assets our web browser loads and then looks for the location of these on the webserver. Using the

"Network" tab in your web browsers developer tools, you can see what files are loaded when you visit a webpage.

Take the screenshot below, we can see many assets are loaded, some of these will be scripts & the stylings of the theme that determines how the browser renders the website. Highlighted in the screenshot below is the URL: http://redacted/wp-content/themes/twentytwentyone/assets/



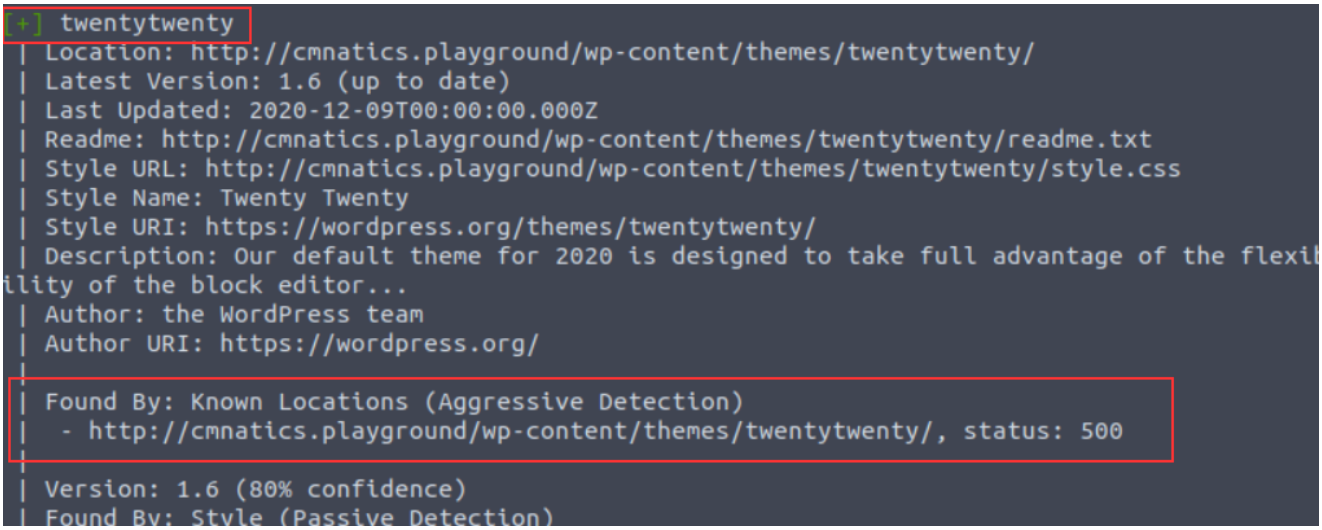
We can take a pretty good guess that the name of the current theme is "twentytwentyone". After inspecting the source code of the website, we can note additional references to "twentytwentyone"



However, let's use WPScan to speed this process up by using the `--enumerate` flag with the `t` argument like so:

```
wpscan --url http://cmnatics.playground/ --enumerate t
```

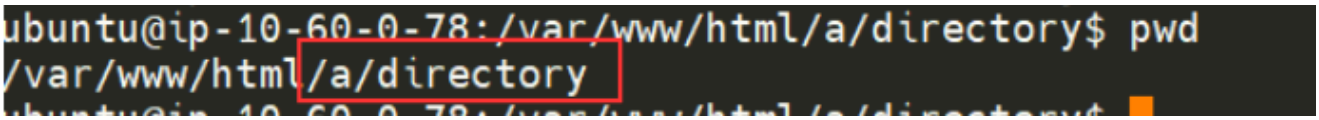
After a couple of minutes, we can begin to see some results:



The great thing about WPScan is that the tool lets you know how it determined the results it has got. In this case, we're told that the "twentytwenty" theme was confirmed by scanning "*Known Locations*". The "twentytwenty" theme is the default WordPress theme for WordPress versions in 2020.

Enumerating for Installed Plugins

A very common feature of webservers is "Directory Listing" and is often enabled by default. Simply, "Directory Listing" is the listing of files in the directory that we are navigating to (just as if we were to use Windows Explorer or Linux's `ls` command. URL's in this context are very similar to file paths. The URL http://cmnatics.playground/a/directory is actually the configured root of the *webserver/a/directory:*



"Directory Listing" occurs when there is no file present that the webserver has been told to process. A very common file is "index.html" and "index.php". As these files aren't present in /a/directory, the contents are instead displayed:

WPScan can leverage this feature as one technique to look for plugins installed. Since they will all be located in /wp-content/plugins/pluginname, WPScan can enumerate for common/known plugins.

In the screenshot below, "easy-table-of-contents" has been discovered. Great! This could be vulnerable. To determine that, we need to know the version number. Luckily, this handed to us on a plate by WordPress.

```
[+] easy-table-of-contents
 | Location: http://cmnatics.playground/wp-content/plugins/easy-table-of-contents/
 | Latest Version: 2.0.16 (up to date)
 | Last Updated: 2021-02-01T18:43:00.000Z
 | Readme: http://cmnatics.playground/wp-content/plugins/easy-table-of-contents/README.txt
 | [!] Directory listing is enabled
 |
 | Found By: Known Locations (Aggressive Detection)
 |  - http://cmnatics.playground/wp-content/plugins/easy-table-of-contents/, status: 200
 |
 | Version: 2.0.16 (100% confidence)
 | Found By: Readme - Stable Tag (Aggressive Detection)
 |  - http://cmnatics.playground/wp-content/plugins/easy-table-of-contents/README.txt
 | Confirmed By: Readme - ChangeLog Section (Aggressive Detection)
 |  - http://cmnatics.playground/wp-content/plugins/easy-table-of-contents/README.txt
```

Reading through WordPress' developer documentation, we can learn about "Plugin Readme's" to figure out how WPScan determined the version number. Simply, plugins must have a "README.txt" file. This file contains meta-information such as the plugin name, the versions of WordPress it is compatible with and a description.

Example Readme

```
1  === Plugin Name ===
2  Contributors: (this should be a list of wordpress.org userid's)
3  Donate link: http://example.com/
4  Tags: comments, spam
5  Requires at least: 5.1
6  Tested up to: 5.2
7  Requires PHP: 7.2
8  Stable tag: 4.3
9  License: GPLv2 or later
10 License URI: http://www.gnu.org/licenses/gpl-2.0.html
11
12 Here is a short description of the plugin.  This should be no more than 150 characters.
13
```

Expand full source code

An Example ReadMe. (WordPress Developer Documentation., 2021)

WPScan uses additional methods to discover plugins (such as looking for references or embeds on pages for plugin assets). We can use the `--enumerate` flag with the `p` argument like so:

```
wpscan --url http://cmnatics.playground/ --enumerate p
```

Enumerating for Users

We've highlighted that WPScan is capable of performing brute-forcing attacks. Whilst we must provide a password list such as *rockyou.txt*, the way how WPScan enumerates for users is interestingly simple. WordPress sites use authors for posts. Authors are in fact a type of user.

And sure enough, this author is picked up by our WPScan:

```
[i] User(s) Identified:

[+] cmnatic
 | Found By: Author Id Brute Forcing - Author Pattern (Aggressive Detection)
 | Confirmed By: Login Error Messages (Aggressive Detection)
```

This scan was performed by using the `--enumerate` flag with the `u` argument like so:

```
wpscan --url http://cmnatics.playground/ --enumerate u
```

The "Vulnerable" Flag

In the commands so far, we have only enumerated WordPress to discover what themes, plugins and users are present. At the moment, we'd have to look at the output and use sites such as MITRE, NVD and CVEDetails to look up the names of these plugins and the version numbers to determine any vulnerabilities.

WPScan has the `v` argument for the `--enumerate` flag. We provide this argument alongside another (such as `p` for plugins). For example, our syntax would like so: `wpscan --url http://cmnatics.playground/ --enumerate vp`

Note, that this requires setting up WPScan to use the WPVulnDB API which is out-of-scope for this room.

```
[!] No WPVulnDB API Token given, as a result vulnerability data has not been output.
[!] You can get a free API token with 50 daily requests by registering at https://wpvulndb.
com/users/sign_up
```

Performing a Password Attack

After determining a list of possible usernames on the WordPress install, we can use WPScan to perform a bruteforcing technique against the username we specify and a password list that we provide. Simply, we use the output of our username enumeration to build a command like so: `wpscan —-url http://cmnatics.playground —-passwords rockyou.txt —-usernames cmnatic`

```
[+] Performing password attack on Wp Login against 1 user/s
Trying cmnatic / lauren Time: 00:00:03 <            > (95 / 14344391)  0.00%  ETA: ??:??:??
```

Adjusting WPScan's Aggressiveness (WAF)

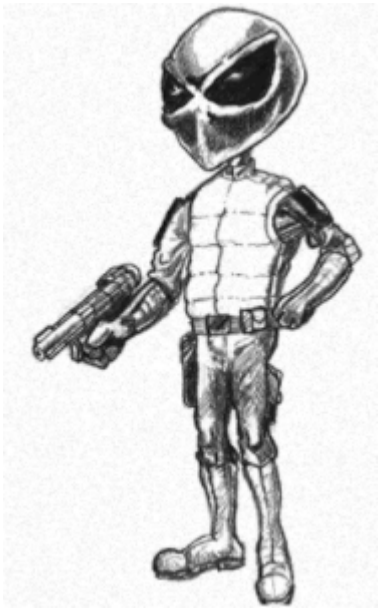
Unless specified, WPScan will try to be as least "noisy" as possible. Lots of requests to a web server can trigger things such as firewalls and ultimately result in you being blocked by the server.

This means that some plugins and themes may be missed by our WPScan. Luckily, we can use arguments such as `--plugins-detection` and an aggressiveness profile (passive/aggressive) to specify this. For example: `--plugins-detection aggressive`

Summary - Cheatsheet

Flag	Description	Full Example
p	Enumerate Plugins	--enumerate p
t	Enumerate Themes	--enumerate t
u	Enumerate Usernames	--enumerate -u
v	Use WPVulnDB to cross-reference for vulnerabilities. Example command looks for vulnerable plugins (p)	--enumerate vp
aggressive	This is an aggressiveness profile for WPScan to use.	--plugins-detection aggressive

Nikto



Introduction to Nikto

Initially released in 2001, Nikto has made leaps and bounds over the years and has proven to be a very popular vulnerability scanner due to being both open-source nature and feature-rich. Nikto is capable of performing an assessment on all types of webservers (and isn't application-specific such as WPScan.). Nikto can be used to discover possible vulnerabilities including:

- Sensitive files

- Outdated servers and programs (i.e. vulnerable web server installs)
- Common server and software misconfigurations (Directory indexing, cgi scripts, x-ss protections)

Installing Nikto

Thankfully for us, Nikto comes pre-installed on the latest versions of penetration testing systems such as Kali Linux and Parrot. If you are using an older version of Kali Linux (such as 2019) for example, Nikto is in the apt repository, so can be installed by a simple `sudo apt update && sudo apt install nikto`

Installing Nikto on other operating systems such as Ubuntu or Debian involves extra steps. Whilst the TryHackMe AttackBox comes pre-installed with Nikto, you can follow the developer's installation guide for your local environment.

Basic Scanning

The most basic scan can be performed by using the -h flag and providing an IP address or domain name as an argument. This scan type will retrieve the headers advertised by the webserver or application (I.e. Apache2, Apache Tomcat, Jenkins or JBoss) and will look for any sensitive files or directories (i.e. login.php, /admin/, etc)

An example of this is the following: `nikto -h vulnerable_ip`

```
^Croot@ip-10-10-226-155:~# nikto -h 10.10.11.219:8080
- Nikto v2.1.5
---------------------------------------------------------------------------
+ Target IP:          10.10.11.219
+ Target Hostname:    ip-10-10-11-219.eu-west-1.compute.internal
+ Target Port:        8080
+ Start Time:         2021-02-04 18:32:24 (GMT0)
---------------------------------------------------------------------------
+ Server: No banner retrieved
+ The anti-clickjacking X-Frame-Options header is not present.
+ No CGI Directories found (use '-C all' to force check all possible dirs)
+ Server leaks inodes via ETags, header found with file /favicon.ico, fields: 0xW/21630 0x1552492604000
+ OSVDB-39272: favicon.ico file identifies this server as: Apache Tomcat
+ Allowed HTTP Methods: GET, HEAD, POST, PUT, DELETE, OPTIONS
+ OSVDB-397: HTTP method ('Allow' Header): 'PUT' method could allow clients to save files on the web server.
+ OSVDB-5646: HTTP method ('Allow' Header): 'DELETE' may allow clients to remove files on the web server.
+ /examples/servlets/index.html: Apache Tomcat default JSP pages present.
+ Cookie JSESSIONID created without the httponly flag
+ OSVDB-3720: /examples/jsp/snp/snoop.jsp: Displays information about page retrievals, including other users.
+ OSVDB-3233: /manager/manager-howto.html: Tomcat documentation found.
root@ip-10-10-226-155:~#
```

Note a few interesting things are given to us in this example:

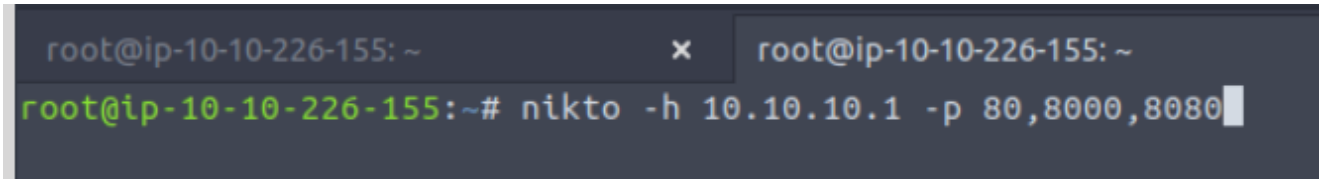
- Nikto has identified that the application is Apache Tomcat using the favicon and the presence of "*/examples/servlets/index.html*" which is the location for the default Apache Tomcat application.
- HTTP Methods "*PUT*" and "*DELETE*" can be performed by clients - we may be able to leverage these to exploit the application by uploading or deleting files.

Scanning Multiple Hosts & Ports

Nikto is extensive in the sense that we can provide multiple arguments in a way that's similar to tools such as Nmap. In fact, so much so, we can take input directly from an Nmap scan to scan a host range. By scanning a subnet, we can look for hosts across an entire network range. We must instruct Nmap to output a scan into a format that is friendly for Nikto to read using Nmap's `-oG` flags

For example, we can scan 172.16.0.0/24 (subnet mask 255.255.255.0, resulting in 254 possible hosts) with Nmap (using the default web port of 80) and parse the output to Nikto like so: `nmap -p80 172.16.0.0/24 -oG - | nikto -h -`

There are not many circumstances where you would use this other than when you have gained access to a network. A much more common scenario will be scanning multiple ports on one specific host. We can do this by using the `-p` flag and providing a list of port numbers delimited by a comma - such as the following: `nikto -h 10.10.10.1 -p 80,8000,8080`



Introduction to Plugins

Plugins further extend the capabilities of Nikto. Using information gathered from our basic scans, we can pick and choose plugins that are appropriate to our target. You can use the `--list-plugins` flag with Nikto to list the plugins or view the whole list in an easier to read format online.

Some interesting plugins include:

Plugin Name	Description
apacheusers	Attempt to enumerate Apache HTTP Authentication Users
cgi	Look for CGI scripts that we may be able to exploit
robots	Analyse the robots.txt file which dictates what files/folders we are able to navigate to
dir_traversal	Attempt to use a directory traversal attack (i.e. LFI) to look for system files such as /etc/passwd on Linux (http://ip_address /application.php?view=../../../../../../etc/passwd)

We can specify the plugin we wish to use by using the `-Plugin` argument and the name of the plugin we wish to use...For example, to use the "*apacheuser*" plugin, our Nikto scan would look like so: `nikto -h 10.10.10.1 -Plugin apacheuser`

Verbosing our Scan

We can increase the verbosity of our Nikto scan by providing the following arguments with the `-Display` flag. Unless specified, the output given by Nikto is not the entire output, as it can sometimes be irrelevant (but that isn't always the case!)

Argument	Description	Reasons for Use
1	Show any redirects that are given by the web server.	Web servers may want to relocate us to a specific file or directory, so we will need to adjust our scan accordingly for this.
2	Show any cookies received	Applications often use cookies as a means of storing data. For example, web servers use sessions, where e-commerce sites may store products in your basket as these cookies. Credentials can also be stored in cookies.
E	Output any errors	This will be useful for debugging if your scan is not returning the results that you expect!

Tuning Your Scan for Vulnerability Searching

Nikto has several categories of vulnerabilities that we can specify our scan to enumerate and test for. The following list is not extensive and only include the ones that you may commonly use. We can use the `-Tuning` flag and provide a value in our Nikto scan:

Category Name	Description	Tuning Option
File Upload	Search for anything on the web server that may permit us to upload a file. This could be used to upload a reverse shell for an application to execute.	0
Misconfigurations / Default Files	Search for common files that are sensitive (and shouldn't be accessible such as configuration files) on the web server.	2
Information Disclosure	Gather information about the web server or application (i.e. verison numbers, HTTP headers, or any information that may be useful to leverage in our attack later)	3
Injection	Search for possible locations in which we can perform some kind of injection attack such as XSS or HTML	4
Command Execution	Search for anything that permits us to execute OS commands (such as to spawn a shell)	8
SQL Injection	Look for applications that have URL parameters that are vulnerable to SQL Injection	9

Saving Your Findings

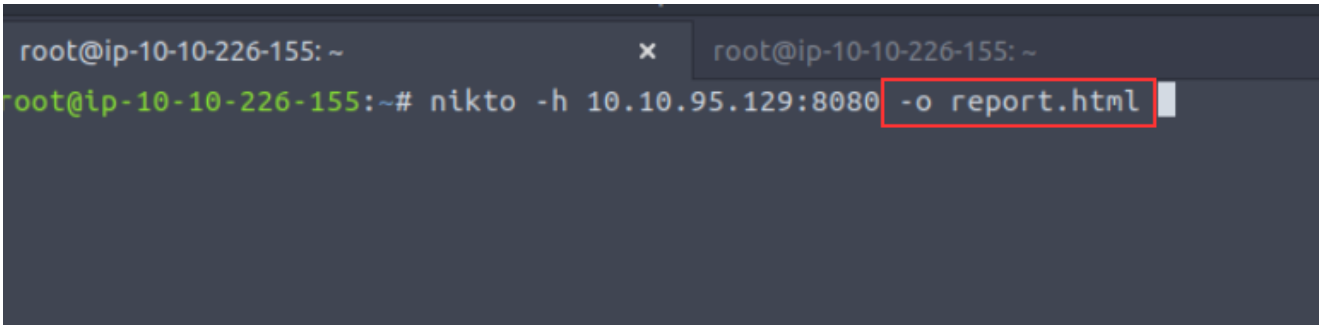
Rather than working with the output on the terminal, we can instead, just dump it directly into a file for further analysis - making our lives much easier!

Nikto is capable of putting to a few file formats including:

- Text File
- HTML report

We can use the `-o` argument (short for `-Output`) and provide both a filename and compatible extension. We *can* specify the format (`-f`) specifically, but Nikto is smart enough to use the extension we provide in the `-o` argument to adjust the output accordingly.

For example, let's scan a web server and output this to "*report.html*": `nikto -h http://ip_address -o report.html`



ip-10-10-95-129.eu-west-1.compute.internal / 10.10.95.129 port 8080

Target IP	10.10.95.129
Target hostname	ip-10-10-95-129.eu-west-1.compute.internal
Target Port	8080
HTTP Server	Apache-Coyote/1.1
Site Link (Name)	http://ip-10-10-95-129.eu-west-1.compute.internal:8080
Site Link (IP)	http://10.10.95.129:8080

URI	/
HTTP Method	GET
Description	Server: http://ip-10-10-95-129.eu-west-1.compute.internal:8080 Apache-Coyote/1.1
Test Links	http://ip-10-10-95-129.eu-west-1.compute.internal:8080/ http://10.10.95.129:8080/
OSVDB Entries	OSVDB-0