TryHackMe Walkthrough: Common Attacks

Introduction

Our existence in a digital world makes it imperative that we understand and can protect against common attacks.

This room will discuss some of the most common techniques used by attackers to target people online. It will also teach some of the best ways to prevent the success of each technique.

Without further ado, let's begin!

Social Engineering

What is Social Engineering?

Social Engineering is the term used to describe any cyberattack where a *human* (rather than a computer) is the target; for this reason, it is sometimes referred to as "People Hacking". For example, if an attacker wishes to obtain a victim's password, they *could* attempt to guess or brute-force the password — *or* they could simply ask you.

Whilst the example linked above is relatively straightforward, social engineering attacks can become very complex and often result in an attacker gaining significant control over a target's life — both online and offline. Social engineering attacks are often multi-layered and escalate due to the snowball effect. For example, an attacker may start off by obtaining a small amount of publicly available information from a victim's social media presence, which they could then use to get more information from, say, your phone or broadband provider. The information obtained from the second stage could then be used to gain more useful information, then escalate step-by-step to something like the victim's bank account.

The best way to understand social engineering is to see it in action! These videos from Defcon23 (one of the largest hacking conferences in the world) and CNN demonstrate some of the immense power in social engineering. They are both well worth a watch!

Other Forms of Social Engineering

Charismatic hackers calling your phone company and taking possession of your account is one form of social engineering; however, there are many other types. Social engineering is a *vast* topic, encompassing any attack that relies on tricking humans into giving the attacker access, rather than attacking the technology directly. Whilst direct interaction with targets is the most common style of social engineering, other examples include dropping USB storage devices in public (e.g. in company car parks) in the hope

that someone (often a company employee) will pick one up and plug it into a sensitive computer. In a similar vein, attackers may leave a "charging cable" plugged into a socket in a public place. In actuality, the cable contains malicious software such as keyloggers or tools to take control of the victim's device.

In short, the limits to social engineering are at the bounds of an attacker's imagination. A good social engineer can (and will) use a plethora of psychological tricks under any plausible context to "hack" their targets.

Case Study: Stuxnet

Stuxnet was the name given to a particularly nasty computer virus (allegedly developed by the governments of the United States and Israel) that was originally used to target the Iran nuclear programme in 2009. Due to its ability as a "worm" to self-replicate (i.e. clone itself across networks — including the internet), the virus escaped and became much more widespread than was intended. Multiple variants now also exist, making Stuxnet a particularly hard-hitting and notorious weapon. You can read more about the background of Stuxnet here.

What makes Stuxnet particularly interesting for this section is the original method of infection. The virus can clone itself across networks, but that doesn't help much when the target network is a nuclear weapons development facility with no access to the wider internet. The question became: how can you get a virus into a network that doesn't let anything in or out? The answer was simple: drop malicious USB devices in places where workers at companies that dealt with the facility would find them and hope that one of them plugged the device into a work computer. In this case, the gamble worked, with Stuxnet causing severe damage to the Iran nuclear programme and effectively destroying many of the nuclear centrifuges.

Staying Safe from Social Engineering Attacks

In many ways, it is very tricky to stay safe from social engineering as it won't always be *you* who the attacker is talking to, but rather someone who can give them what they need without your consent (e.g. calling your bank whilst pretending to *be* you, so as to access your bank account). That said, there are still measures you can take to protect yourself from Social Engineering attacks:

- Always make sure to set up multiple forms of authentication, and ensure that providers respect these. For example, set difficult to guess — or otherwise incorrect — answers to security questions (making sure to store the answers somewhere safe!), and make sure that these questions are asked when you try to access accounts over the phone.
- Never plug external media (e.g. USBs/CDs/etc) into a computer that you care about or that is connected to any other devices. Ideally, don't plug the media in at all, and instead give it to your local police for safekeeping.
- Always insist on proof of identity when a stranger calls or messages you claiming to work for a company whose services you use. Where possible, confirm with a known phone number or email address that the call or message you received was legitimate (i.e. use a trusted method to get in contact with the company to confirm). Remember that no legitimate employee will ever ask for your password or other information that protects your account.

Answer the questions below

1. What was the original target of Stuxnet? **The Iran Nuclear Program**

Phishing

Overview

Phishing is one of the most common cyber attack types employed by scammers and bad actors, targeting individuals and businesses indiscriminately. In many cases, phishing is the initial attack vector used to gain access to a company's infrastructure before performing further attacks against the corporate network. Whilst there are many automated tools now available to help combat phishing threats, phishing is still one of the most prolific attack vectors around.

What is Phishing?

Phishing is a sub-section of social engineering. Whereas social engineering is a very general term used to describe any attack that takes advantage of a human rather than a computer system, phishing specifically describes attacks whereby a scammer or other attacker tricks a victim into opening a malicious webpage by sending them a text message, email, or another form of online correspondence. Traditionally, "phishing" simply referred to emails; however, in the days of instant messaging, text messages,

and voice/video calling, the term has evolved to blanket these other categories. These other forms are sometimes referred to individually as "smishing" — phishing over SMS — and "vishing" — phishing over voice chat — respectively. These attacks are very widespread (indeed, the chances of you *not* having been on the receiving end of such an attack are slim!) and are frequently deployed on massive scales using lists of leaked or stolen phone numbers and email addresses.

Phishing messages usually deploy psychological trickery (for example, inducing a false sense of urgency to make victims act rashly) and nearly always involve getting a victim to click on a link to a web application owned by the attacker. The victim is then often asked to enter sensitive information — for example, login details or credit card information — at which point the malicious site stores the information and the attack is complete. Alternatively, the victim may inadvertently install malware from the malicious page, thus giving an attacker an entry point into their device and network.

There are three primary types of phishing attacks:

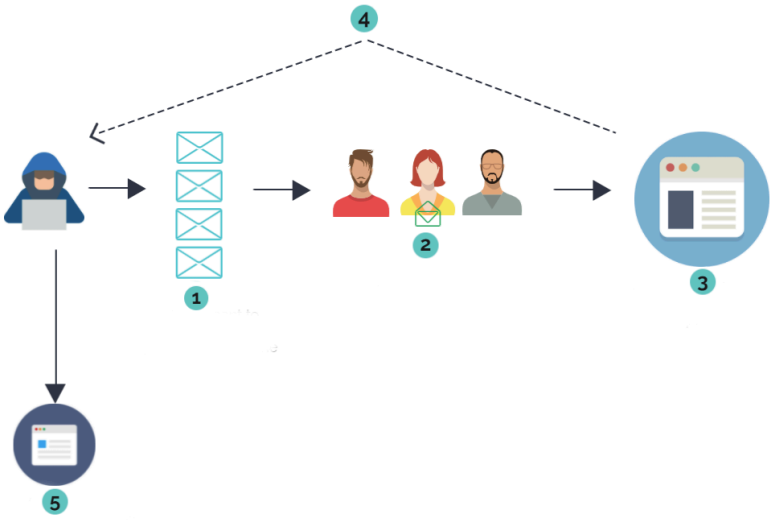
Attack Type	**Definition**
General Phishing	A simple, mass phishing attack which doesn't target anyone in particular, although they may aim for large groups (e.g. PayPal users, or Amazon customers). These large-scale campaigns are usually simple and are generally (but not always) fairly easy to spot as the messages and malicious sites are often not very well crafted and frequently contain many immediately visible errors.

Spearphishing	More targeted than general phishing, spearphishing aims for an individual or small group (e.g. employees of a specific company). Spearphishing campaigns are generally better crafted than the correspondence and malicious sites used in general phishing as they are designed to target a particular group, often as part of a more extensive campaign against the target.
Whaling	Even more specific than spearphishing, whaling targets high-value individuals (e.g. a C-Suite executive in a target company). The messages are generally extremely well crafted and tend to be very hard to spot.

Be aware that you are much more likely to encounter a general phishing attack than a spearphishing or whaling attack in your day-to-day life. This may not be the case in your work life, however — especially if you are a high-ranking member of a company.

An example of a popular general phishing scenario (or "pretext") would be receiving an email purportedly from "Amazon", informing you that your account has been used to buy a very costly item (e.g. the latest iPad). You are then provided with a link to view your purchase history. The link *looks* like it goes to `https://amazon.co.uk` but will actually take you to an attacker-controlled web application (that looks identical to the Amazon login page), asking you to enter your Amazon credentials. When you enter your credentials, you get redirected to the real Amazon orders page, where you find that there are no unauthorised purchases... yet. The attacker will then use your duly provided credentials to *actually* order expensive items with your account.

This process is shown in the following diagram:



1. The attacker sends out a malicious phishing email campaign
2. Prospective victims receive the emails — some of them open the email and click the link
3. The victims enter their credentials into the attacker's fake web page
4. The web page stores the credentials or sends them directly to the attacker
5. The attacker uses the credentials to access the site, thus taking over the victims' accounts

Phishing attacks work best when the malicious web page mimics an existing (usually well-known) web page. For this reason, attackers/scammers will usually use one of many freely available tools to simply clone an existing page, which can then be edited at their leisure.

The end goal of a phishing attack can vary significantly depending on who is performing the attack. For example, a low-level scammer may simply be after sensitive information (e.g., bank details), whereas a high-powered group of malicious hackers may be targeting a specific organisation with the intention of causing further damage.

Identifying Phishing Attacks

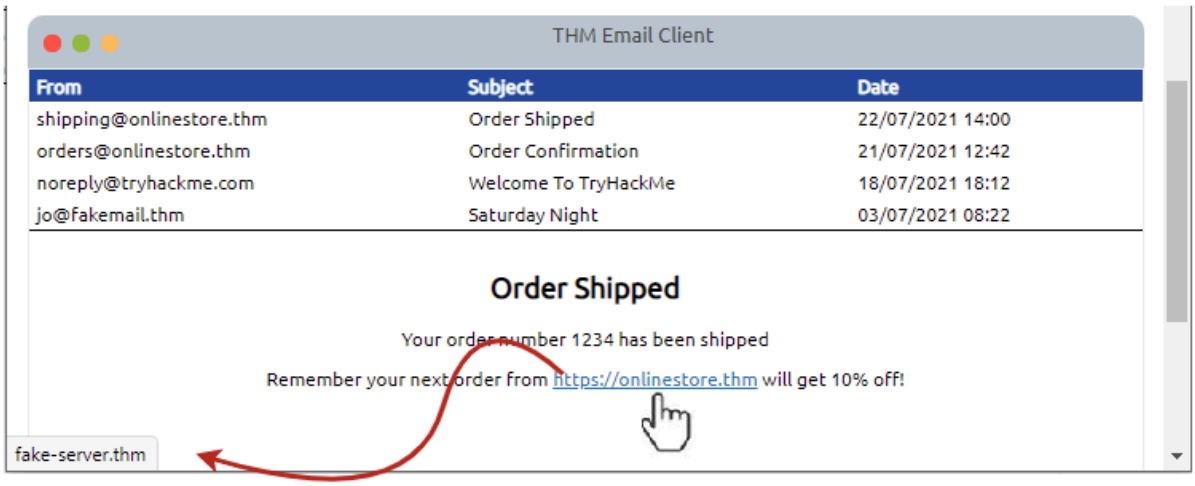
Many generic phishing attacks are relatively easy to spot; they frequently have poor grammar and often do not address their victims by name (instead leaving the greetings

generic — e.g., "Dear customer"). That said, other instances can be *extremely* difficult to spot, with some attacks being thorough enough to fool cybersecurity professionals.

Regardless of the attack type, in many cases, the pretext will be plausible — for example: the Amazon scam listed above, or a (fake) message from your "bank" telling you that there has been unusual activity with your account and to please log in to review it. This is especially true for spearphishing or whaling attacks where the pretext will be very carefully tailored to the target.

Equally, the domain name for the malicious site will usually be similar (but never identical) to the domain name used by the legitimate website. As a real-world example from 2021, a group of scammers sent out a mass phishing campaign over SMS, mimicking the British Royal Mail service and using the domain name `https://royalmai1.co.uk` (as opposed to `https://royalmail.co.uk`). By exchanging the final "`l`" for the number one, the scammers were able to successfully register a domain name that looked almost identical to the domain name of their cloned website; this is a very common tactic.

Also, bear in mind that HTML emails (effectively any email that looks fancy and contains formatting/graphics) can also be used to mask the real domain name in use. For example, the text in the email may be "`https://amazon.co.uk`"; however, the link *actually* goes to "`https://am4zon.co.uk`". You can see this by hovering your mouse over the link in a desktop application — the real link should appear at the bottom of the screen as in this graphic:



You can try this for yourself with the link below!

https://tryhackme.com

In a similar vein, the "From" email address in an email-based phishing campaign will often be suspicious. Many generic mass phishing campaigns will simply use Gmail addresses — not bothering to use a domain name associated with the company they are spoofing. This is a dead giveaway that the email is suspicious.

The best way to identify a phishing email is simply to keep your eyes open and look for anything suspicious — all but the best will have a mistake *somewhere*.

Staying Safe from Phishing Attacks

There are a variety of things that you can (and should!) do to keep yourself safe from phishing attacks:

- Delete unknown or untrusted emails without opening them. If you can see anything suspicious in the email, also report it as spam to your email provider, or forward it to your IT Security department if you received the email at work.
- *Never* open attachments from untrusted emails — this includes any attachments from a legitimate contact that you were not expecting.
- *Do not* click on embedded links in emails or messages. Where possible, navigate to the real website in your web browser and access the content that way. If you absolutely *must* click on the link, ensure that the domain name is correct and that the link points to where you think it does.
- *Always* make sure that your device and antivirus software are up-to-date.
- Avoid making your personal information (e.g. email address and phone number) public if possible. If you *must* publish personal details publicly, create a "burner" email address (a temporary address made for one purpose, then destroyed soon afterwards) for the occasion, then destroy it as soon as it is no longer required.

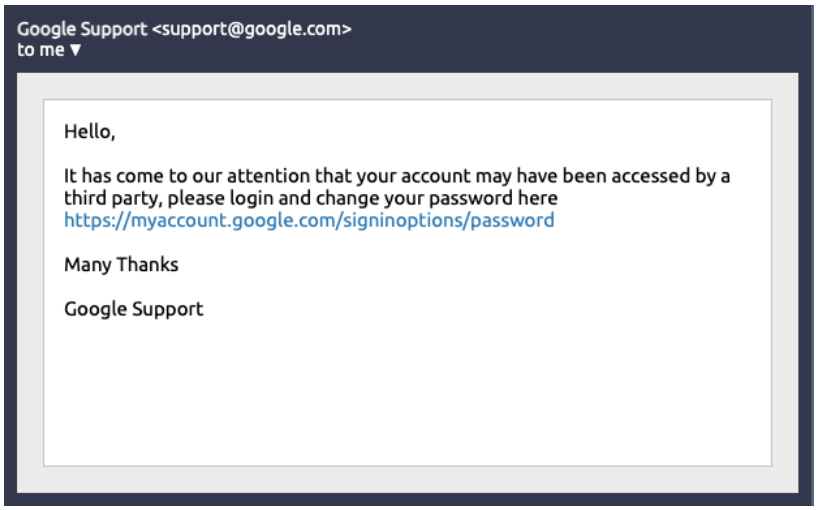
It's worth noting at this point that anyone can fall for a phishing attack — especially a complex one that has been made to look very realistic. If you accidentally fall for one, don't panic! Make sure that you change any affected passwords immediately, and contact IT Services if the attack happens at work.

Answer the questions below

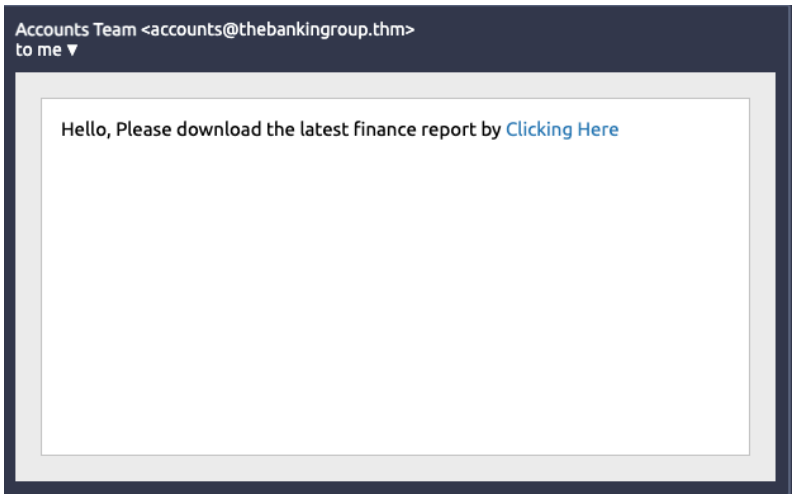
Click the green "View Site" button at the top of this task if you haven't already done so.

The static site will display a series of emails and text messages. You will be asked to identify which of these messages are genuine and which are phishing attempts. Once you have successfully identified all of the messages you will be presented with a flag to enter, here.

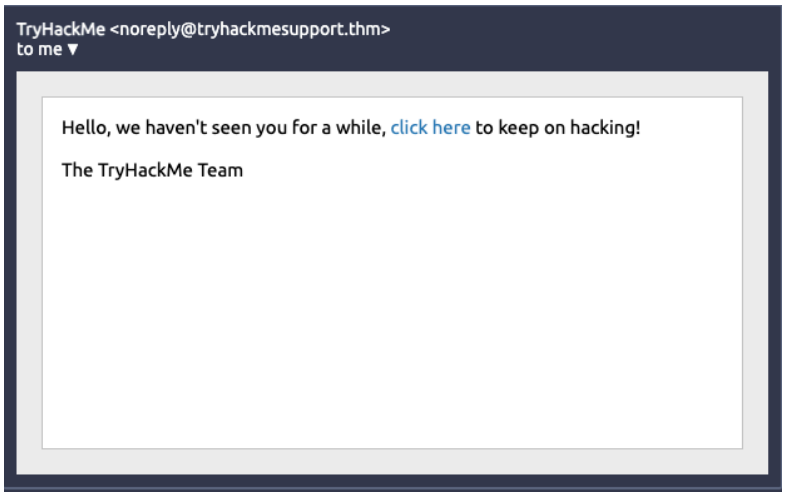
Good luck!

1. 

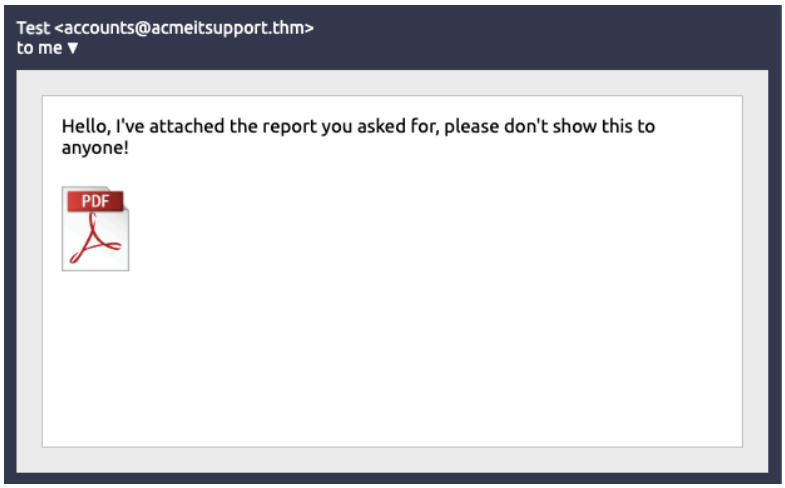
   Phishing

2. 

   Phishing

3. 

Email looks safe

4. 

Phishing

What is the flag? **THM{I_CAUGHT_ALL_THE_PHISH}**

Malware and Ransomware

Overview

Despite the steady advance of antivirus software solutions, malware (and ransomware in particular) is an ever-growing threat.

Malware (short for "malicious software") can be defined as any software designed to perform malicious actions on behalf of an attacker. There are many different kinds of malware: we will be focussing on generic malware and ransomware specifically in this task.

Once installed, attackers commonly use malware to steal information, cause damage, or execute arbitrary commands on the infected system. Malware is often used to perform a set of tasks referred to as "Command and Control" (or C2/C&C). C2 malware connects back to a waiting server and allows an attacker to control the infected system remotely, often incorporating many simple tasks such as keylogging as built-in parts of the malicious software.

Ransomware

A specialised class of malware: ransomware is used to infect as many systems as possible, encrypting the data on the devices and holding it to ransom. If the victims pay the attackers within a set timeframe (usually via a cryptocurrency such as Bitcoin), the data is *theoretically* returned.

Ransomware usually spreads by exploiting known vulnerabilities in commonly installed software (e.g. the Microsoft Windows operating system); it can be extremely fast-spreading once an infection begins, and can demand millions in ransom money. The goal of a ransomware attack is to infect as many systems as possible, then make as much data inaccessible as possible by encrypting it with a key known only to the attacker. Once the attack is complete, the malware usually displays a window that looks something like this:

Wannacry Instruction Window

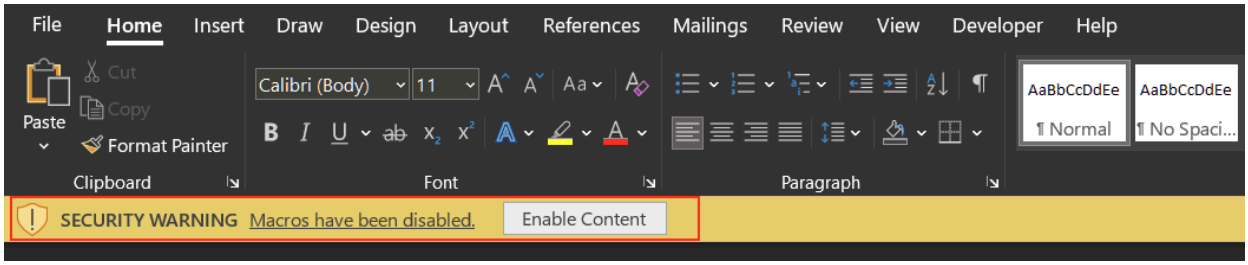
This window gives the victims the time limit and instructions on how to pay, as well as a rundown on what exactly has happened to their data. The example above is from the infamous Wannacry ransomware .

With the ransom paid, the malware may or may not decrypt the data and self-destruct, depending entirely on how nice the attackers are.

Delivery Methods

There are various ways that an attacker can infect a target with malware — many of these revolve around social engineering or phishing attacks. For example, an attacker may send a victim an email containing a Microsoft Word or Excel file that contains a malicious macro (code that is embedded inside the document set to run when a user

opens the file). These will not run by default unless the user clicks the "Enable Content" button at the top of the screen to enable macros:



"Enable Content" button in Microsoft Word

However, there are situations in which a user may genuinely wish to execute macros, and a good attacker will capitalize on these pretexts to convince the victim to click the button.

Similarly, the attacker may send the file as a compiled `.exe`, a PDF, a `.ps1` PowerShell Script or `.bat` Batch script, an HTML application file (`.hta`), or even a `.js` JavaScript file to be executed by the JavaScript interpreter built into Windows.

In short, there are *many* different ways and formats in which an attacker can send code to a victim. Once the code is executed, the infection begins.

Alternatively, the attacker may exploit a vulnerability in public-facing infrastructure in a corporate environment (for example, a webserver), thus giving themselves an opening into the internal network and allowing them to start a larger attack, facilitated by malware.

Staying Safe

Staying safe from malware (and ransomware in particular) is best done with a combination of awareness and keeping things up to date!

- Always accept updates and patches when offered — especially in important software like operating systems. Updates often contain fixes to security flaws, so it is important to get these in place as soon as possible.
- Never click on suspicious links, especially in emails. Try not to open file attachments if possible. If a message looks suspicious, delete it, or forward it to the appropriate team if using your work account.
- Always be on the lookout for people trying to get you to download or run files — especially over email or instant messaging.
- Never plug unknown media devices (e.g. USB devices) into important computers. If you find a device in public, do not plug it into your work laptop!
- Always back up important data — this will be discussed in more detail later in the room and can be crucial in recovering from a ransomware attack.
- Make sure that your antivirus software is always up-to-date and activated.

Note: *If you or your business get infected with ransomware, do not pay the ransom. Instead, call your local authorities immediately, and try to contain the infection by disabling your router or otherwise physically preventing the infected device from connecting to anything else. Do not power the infected device off, as this can sometimes destroy any potential opportunities to decrypt the data without paying.*

Answer the questions below

1. What currency did the Wannacry attackers request payment in? **Bitcoin**

Passwords and Authentication

Overview

For better or worse, passwords are an integral part of most authentication systems. We use passwords to protect everything, from our social media accounts to our banking applications. Unfortunately, despite their significant importance, it is still all-too-easy to create and use an insecure password, and even easier to take other actions that lower the overall security of the system. For example, even the most robust password in the world is useless if written on a whiteboard in full view of a web-camera — especially if the same password is used for more than one service.

This task will cover password security, as well as other measures you can take to strengthen your overall authentication security.

What Makes A Strong Password?

Advice on what constitutes a strong password has changed over time. In the past, people were advised to choose complex passwords that were easy to remember, for example:

```
@Ed1nburgh#1988-2000!
```

The password above is a collection of lowercase and uppercase characters, including symbols and numeric digits. It is over eight characters long (making it almost impossible to attack by brute-force with our current level of technology) and is created using knowledge that is unlikely to be held by anyone other than the owner of the password. Importantly, it also doesn't conform to normal patterns (using unusual symbols, exchanging only *some* characters of l33t speak, and containing a date range as opposed to a single date), making it harder to guess. For all intents and purposes, this is a traditionally strong password. That said, the personal connection means that this password could potentially still be made weaker through social engineering or in-depth information gathering on a target.

Current best practices lean more towards length than complexity. For example:

```
Vim is _obviously_, indisputably the best text editor in
existence!
```

By using a pass*phrase* rather than a traditional password, the password is significantly longer whilst still retaining some of the more complex elements — despite not looking quite so obfuscated. This has the advantage of being easier to remember whilst still being incredibly difficult to brute-force.

Ideally, however, you should use long, completely random passwords. For example:

```
w41=V1)S7KIJGPN,dII>cHEh>FRVQsj3M^]CB
```

These take millions of years to crack and are objectively the most secure option available. The drawback is usability; however, this is largely mitigated by using a *password manager*, which will be discussed in the next task.

What Makes A Weak Password?

People often go for simple passwords that mean something to them, often following one of a few "simple" patterns. For example, a commonly used pattern is a name/location, followed by a year, followed by an exclamation mark. For example:

```
Gareth2012!
```

This is enough to satisfy most password complexity requirements (lowercase and uppercase characters, over eight characters, contains numerical digits and a symbol); however, it is trivial to guess if an attacker knows that you have a son called Gareth who was born in 2012. This kind of password is inherently extremely insecure.

In short, any password that could easily be guessed by someone who knows you relatively well (this includes an attacker looking at your social media) is a bad idea!

Equally, short passwords (especially those that don't contain any non-alphanumeric characters) are weak against brute-force attacks. We will look at this in more depth later in the task.

Of equal importance to password strength is password reuse. You can have the strongest password in the world, but if you use it across numerous accounts and it gets leaked, an attacker can simply use the same strong password on all affected accounts. Equally, if you find out that your password has been exposed, you will have a *lot* of work to do changing all of your account passwords!

Exposed Passwords

Unfortunately, not every service stores passwords securely (making it doubly important that you don't reuse passwords!).

Background Information: Safe Password Storage (Click to read)

When you sign up for an online account, the provider must store a copy of your password in order to validate it the next time you sign in; but this poses a huge problem: how can the passwords be stored securely?

- Storing the passwords as plain text (e.g. the same way you submit them) isn't an option as every password will instantly be leaked if the database is ever hacked.
- *Encrypting* the passwords is an improvement, but not by much. If the passwords are stored encrypted, then they can also be *decrypted* — an attacker simply has to obtain the key, and they can turn every encrypted password back into plaintext. Encrypting passwords was part of what made the 2013 Adobe breach so serious.
- The industry-standard password storage method is referred to as *password hashing*. Password hashing (or simply "hashing") involves using complicated mathematical algorithms to take any input and turn it into a unique, fixed-length output in a way that is impossible to reverse. This means that when you sign up, your password will be hashed and stored in the database in a way that stops everyone (including server administrators) from being able to read it!
  When you try to sign in, the same algorithm is applied to the password that you supply: if the stored hash matches the hash of the password you are trying to log in with (remembering that the same input will always create the same unique output), then you are considered to have successfully authenticated.

Ideally, every service would hash user passwords with a secure algorithm. Even if the entire database were leaked, the attackers would still need to waste valuable time and computational power attempting to brute-force the (otherwise useless) hashes to find the plaintext passwords. This is why it is so important that passwords are long and preferably of a decent level of complexity: the longer the password and the larger the number of potential characters involved, the more power it takes to effectively *guess* the password input used to generate a hash.

So, what happens if a service gets hacked and their database containing user account information gets leaked? As a best-case scenario, the service has used a secure hashing algorithm, and you have a strong password — in this case, your password is safe, but your email address or username may still be leaked publicly (so expect some spam emails).

As a worst-case scenario, your plaintext password is either immediately available, or is easy for an attacker to find. If this happens then both your username and password are

known to the attacker, allowing them to take over your account or perform "credential stuffing" attacks — using your stolen username and password pair against other services to see if you reused them elsewhere. These leaked databases containing credentials frequently appear on the dark web, which leads us to our final point in this section: data exposure notification services.

The largest and most well-known data exposure checker is called "Have I Been Pwned?". It exists as a free online service that scours data dumps and catalogues all of the information found, allowing users to enter their email addresses to see if they have been included in any breaches. *Have I Been Pwned* also allows you to add yourself to a notification list, meaning that you will receive an email notifying you if your email address appears in any data breaches.

Whilst not a perfect defence, notification services give you a vital early warning to change your passwords (hopefully) *before* you get hacked.

Password Attacks

An attacker has a few options when it comes to attacking passwords and authentication systems. Some attacks are entirely local (i.e. working entirely on a device owned by the attacker without interacting with the target service at all), others are remote attacks involving the original server.

Local attacks require a stolen copy of the credentials in question. The attacker will take a file full of stolen usernames/emails and hashed passwords, then use software to effectively try to guess the input that created the hash either using randomly generated sequences of characters (slower but more thorough) or by using a pre-generated wordlist of possible passwords (faster but much more likely to miss things). Hybrid types are also very widely used; these are when an attacker takes an existing wordlist and *mutates* it to add new characters, symbols, or random elements. Local password attacks will be demonstrated in the interactive element for this task.

Remote attacks tend to be one of two categories; they either involve attempting to brute-force known usernames by sending requests to the server and seeing what it responds with, or they use known username and password pairs from previous breaches to see if they are valid on the target site — this is the aforementioned credential stuffing.

Answer the questions below

Put yourself in the shoes of a malicious hacker. You have managed to dump the password database for an online service, but you still have to crack those hashes!

Click the green button at the start of the task to deploy the interactive hash brute-forcer!

Based on the content of the website, you have generated a list of likely passwords, which is as follows:

TryH@ckMe
TryHackMe123
THM123456
qwertyuiop123
TryHackMe2021
TryHackMe123!
TryHackMe345
TryHackM3!

Copy the list of passwords into the "Password List" field of the hash cracker, then click "Go"!

Look at the "Current Word / Hash" section of the hash cracker.

Notice that for each word in the list you entered, the cracker is creating an MD5 hash of the word then comparing it to the Target Hash. If the two hashes match then the password has been found!

The hash cracker should find the password that matches the target hash very quickly.

What is the password? **TryHackMe123!**

Multi-Factor Authentication and Password Managers

Multi-Factor Authentication

Multi-**F**actor **A**uthentication (or MFA) is a term used to describe any authentication process where you need more than one thing to log in. The most common example of this is when you enter the password for an account, then get asked for a six-digit code that is sent to your phone and usually expires after fifteen minutes or so. This particular second authentication factor is

referred to as a **T**ime-based **O**ne **T**ime **P**assword (or TOTP) and is one of the most common second factors currently in use.

Background Information: Three Factors of Authentication (Click to Read)

There are three main factors that can be considered when implementing multi-factor authentication; these are:

- Something you *have* (e.g. a smart card, a TOTP, or a hardware authenticator such as a "YubiKey". You may also have experienced your bank asking you to insert your card into a card reader and enter your PIN code before allowing access to online banking services — this is the same principle)
- Something you *know* (e.g. a password)
- Something you *are* (i.e. biometric data such as a fingerprint or iris scan)

An ideal authentication uses all three of these — for example; it may require a password, a smart card, and a fingerprint before allowing the user access to the system.

Unfortunately, most individuals do not have access to a smart card reader, an expensive hardware authenticator (e.g. the aforementioned YubiKey) or a fingerprint scanner. They *do* have access to a smartphone which can be used to receive or access time-based one time passwords. As such, mobile-based MFA is amongst the most common multi-factor authentication methods implemented for personal use. Whilst not ideal, two factors are better than one.

You should always activate multi-factor authentication where available. Doing so means that an attacker must obtain more than one factor if they wish to compromise any of your accounts — for example, they must have both the password and your phone (or the ability to intercept your text messages). Many people see it as an "unnecessary hassle"; however, it is well worth it for the added security!

Unfortunately, SMS (text message) based TOTP authentication — despite being the most commonly used — is far from the most secure as there have been documented cases of attackers managing to reroute a victim's texts without undue difficulty[1].

So, if not SMS then what? Time-based one-time passwords are still the most accessible form of second-factor authentication for most users; fortunately, it's possible to generate them yourself!

Most services will provide you with an option to use an "Authenticator App" for MFA. When you select this option, you will be presented with a QR code as well as a "secret key" — either of which can be scanned or imported into an app such as Authy or Google Authenticator (Android | IOS). Once you have added your secret key for the application, these apps can generate TOTP codes entirely on your device without requiring any network connectivity or interceptable SMS.

Password Managers and Generating Strong Passwords

As mentioned previously, the most secure passwords are simply long, completely random strings of characters, digits, and symbols. Unfortunately, these random passwords are very difficult to memorise — indeed, memorising a different 60-digit, randomly generated password for every online account is simply not feasible for most people.

Enter: Password Managers.

At the most basic level, password managers provide a safe space to store your passwords. They store passwords in "vaults": encrypted storage either locally on your own device, or as an online service (which also usually allows you to access your passwords from any device). These vaults are accessed using a master password — the only password you need to remember — or (more commonly in recent years) biometric data such as a fingerprint. Some password managers are free, whilst others require a paid subscription. That said, the features and usability provided by paid offerings often make them well worth the expense!

The more fully-featured password managers usually also include a range of additional capabilities, such as storing other types of data (e.g. images, files, etc.), auto-filling passwords automatically for other services, and secure password generation. Having these features available means that you can quickly and easily generate very strong passwords and store them automatically, then seamlessly have the password entered for you when you attempt to log into an app, all within the same application.

Password managers are the recommended way to handle authentication for your many accounts; however, it is worth remembering that the security of the whole structure can revolve around a single master password, so make sure that it's solid!

Some common password managers include:

- 1Password
- LastPass
- KeePass
- Bitwarden

There are many others available! Each password manager has its own advantages and disadvantages, so it is well worth doing some research to find the one that suits you best.

1. https://krebsonsecurity.com/2021/03/can-we-stop-pretending-sms-is-secure-now/

Answer the questions below
Where you have the option, which should you use as a second authentication factor between SMS based TOTPs or Authenticator App based TOTPs (SMS or App)? **App**

Public Network Safety

The Problem

The internet plays a *gargantuan* role in modern life, with most people being connected in some way virtually constantly. As such, most public spaces (e.g. cafés, restaurants, public transport) are fully equipped with public WiFI to let people catch up on email (or, equally likely, play the latest hit mobile game). What many people *don't* realise is that expecting public WiFi to be available can prove to be very dangerous indeed.

Public WiFi, whilst incredibly handy, also gives an attacker ideal opportunities to attack other users' devices or simply intercept and record traffic to steal sensitive information. This latter technique can be as simple as exploiting the fact that most people *expect* to see public networks available. The attacker can quickly set up a network of their own and monitor the traffic of everyone who connects; this is referred to as a "man-in-the-middle" attack and is very easy to carry out. For example, if you were to connect to a network belonging to an attacker then logged into an account for a website that doesn't use an encrypted (HTTPS) connection, the attacker could simply pluck your credentials out of the network traffic and use them to log into your account for themselves. This scenario will be explored in more detail in the interactive element to this task; however, it is fortunately significantly less likely to occur with modern

websites which implement T ransport L ayer S ecurity (TLS) to encrypt traffic between their servers and users as standard.

Equally, being connected to any network (regardless of whether you trust it or not) makes your device visible to others on the network. You never know who else is on a public network or what their intentions might be!

The Solutions

The *ideal* solution to this problem is simply not connecting to untrusted networks. Beneficial though public wireless connections are, it will always be safer to use a mobile hotspot or private network. Unfortunately, the ideal solution is not always feasible; when this is the case, we must rely on other methods of staying safe.

V irtual P rivate N etworks (VPNs) encrypt all traffic leaving and re-entering your machine, rendering any interception techniques useless as the intercepted data will simply look like gibberish. Whilst it is possible to host your own VPN server for free, most people prefer to use one of the many online solutions. Some of these commercial solutions are free, but be warned: free VPNs tend not to provide the best security and often harvest your data themselves to make a profit. That said, the price of a good VPN is more than worth it for the increased safety when operating on untrusted networks. There are many good options around, including ProtonVPN and Mullvad VPN , to name two.

Website Connection Security

In addition to the actions that you take to protect *yourself* , it is also important to be aware of the measures that online services take to protect you.

All websites should now only serve information in the safety of an encrypted connection. As with using a VPN, this prevents an attacker from reading, or modifying your web traffic if they intercept it. The encrypted connection used to create HTTPS (H yper T ext T ransfer P rotocol S ecure)

is referred to as TLS (T ransport L ayer S ecurity), and in most browsers is represented by a padlock to the left of the search bar, which indicates that the connection is secure:

TLS Padlock in Firefox

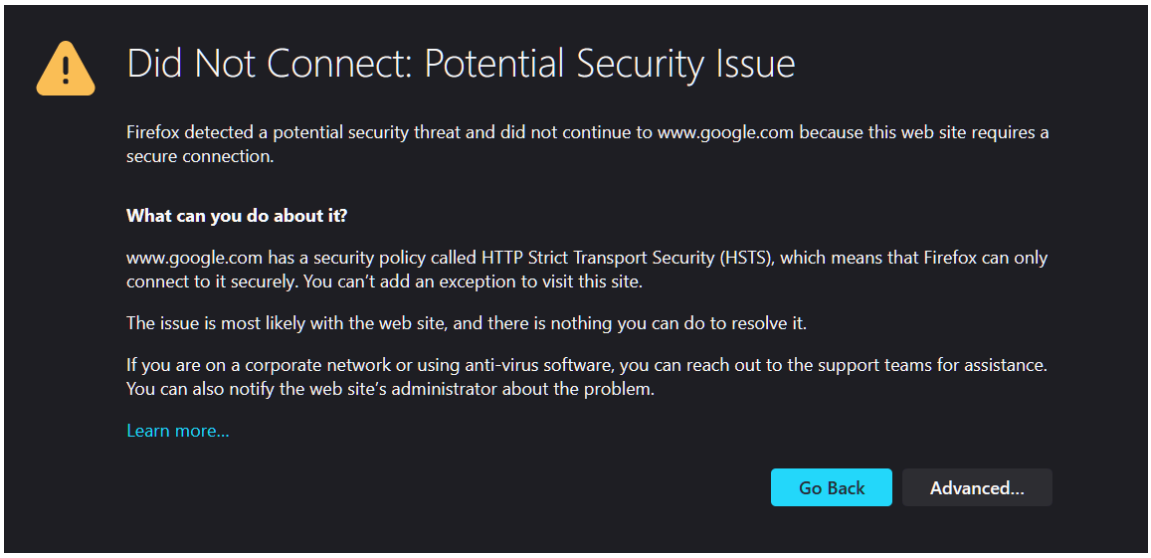
With this in place, your traffic can only be decrypted in very select circumstances: namely, if it is a work or school managed device and you are connected to a work/school network.

Note: The presence of the padlock indicates that the connection is secure; it does not guarantee that the website itself is* safe *. In other words, a malicious website can still easily have a TLS cert (meaning that your traffic with the server* is *encrypted), but that doesn't stop the site from having a malicious purpose.

If you are accessing a website *without* the padlock symbol, never enter any credentials or sensitive information — especially if you are using an untrusted network.

In some instances, you may also see a padlock with a cross through it or an exclamation mark over it; this indicates that the connection is *theoretically* secure but that there is something wrong with the certificate in use by the server. The presence of this altered padlock icon can mean anything from the server administrator simply letting the certificate go out of date to an attacker actively meddling with the security of your connection. In other words: if the icon is anything other than a regular padlock, *do not trust that connection is secure.*

You may also encounter full-page errors related to certificate security when trying to access web pages; these can look soething like this:



Certificate Error Message in Firefox

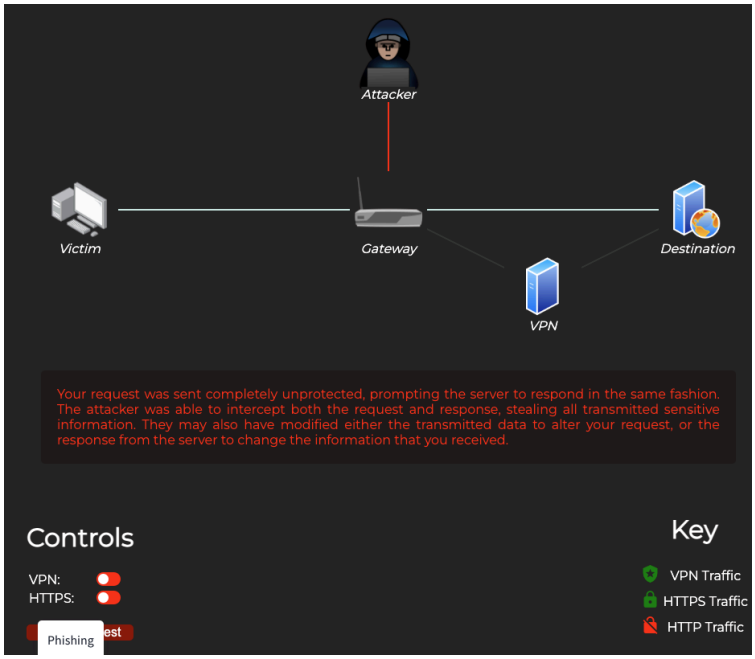
As a general rule, if you see an error like this, you should click the "Go Back" button (or equivalent in other browsers); it usually means that there is something wrong with the encrypted connection, potentially leaving your traffic open to being stolen.

Answer the questions below

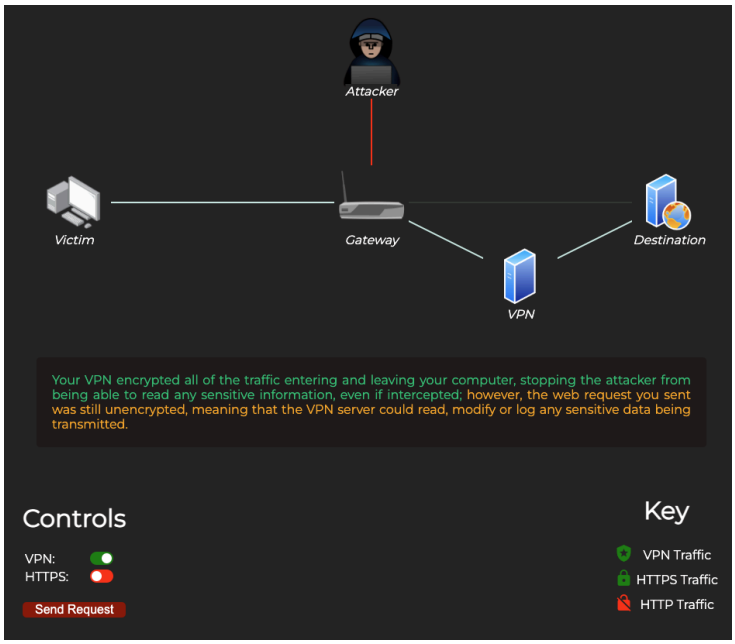
Deploy the interactive content by clicking the green button at the top of the task.

The interactive content for this task demonstrates what can happen if information is sent over a potentially unsafe network with various types of encryption (or lack thereof). There is no flag for this task, but you are encouraged to try each of the different scenarios, mixing and matching the options provided in the control box at the bottom right of the screen.

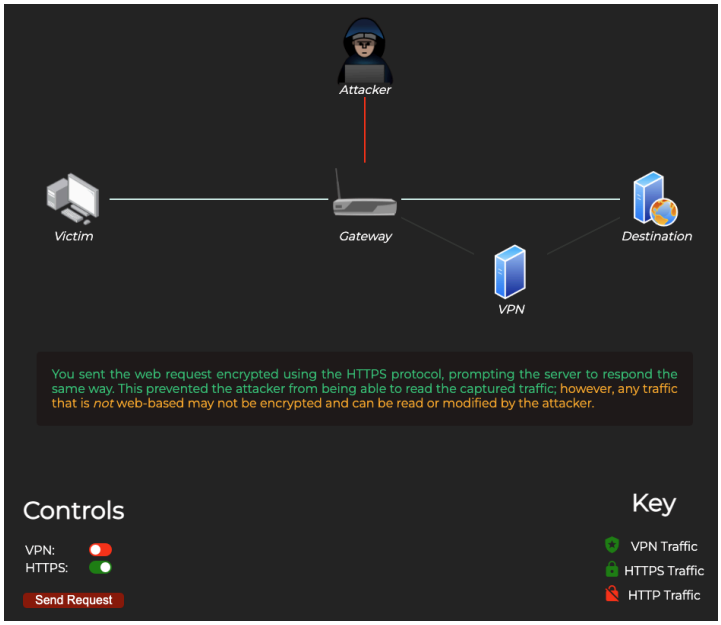
Without VPN And/Or HTTPS



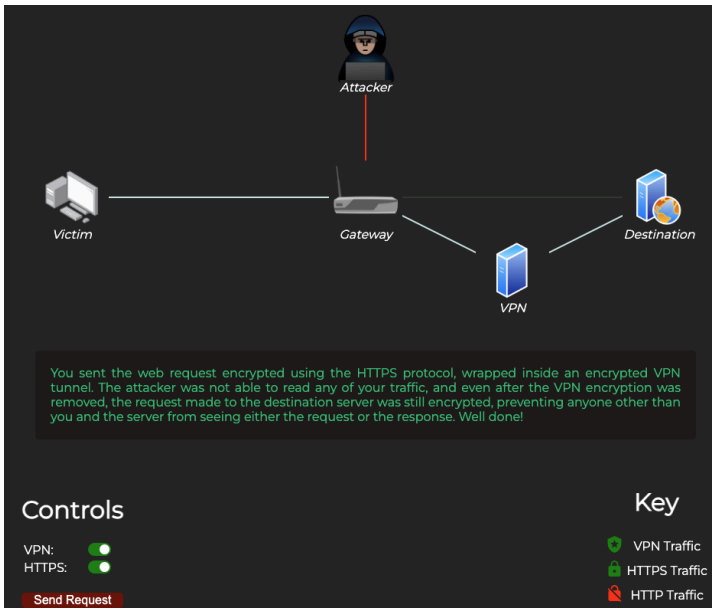
With VPN And Without HTTPS



With HTTPS And Without VPN



With VPN And With HTTPS



Backups

Overview

Backups are arguably the single most important defensive measure you can take to protect your data. No matter what happens, if you have taken appropriate steps to back your information up, you will always be able to recover almost regardless of the severity of the damage.

Whether the data in question is all-important business-critical data at work or the family photos at home, backups are a simple insurance measure that pays for itself many times over should the worst come to pass.

Depending on the data in question, taking and restoring from backups could be as simple as dragging and dropping folders into Google Drive. That said, there are also many software solutions available to help automate backups and take the pain out of restoration.

The Golden 3,2,1 Rule

The golden standard for taking backups is relatively simple and is often called the "3,2,1 rule".

The 3,2,1 rule specifies that:

You should always keep at least **three** up-to-date copies of your data; this can include the original copy, but all copies must be maintained.

Backups should be stored on at least **two** different storage mediums; for example: a cloud backup and a USB device. This can include a hard drive on your PC.

One (or more) backups should be stored "off-site". Cloud services such as Google Drive are ideal for personal use in this regard.

Your backups should be safe if all three conditions of the 3,2,1 rule have been met; *but* of equal importance is the *frequency* at which you take backups. There's no point in keeping your backups stored securely if they are all a year old!

How frequently you backup your data is up to you and usually depends on the sensitivity of the data, compared to the risk of compromise and the amount of backup

space available. For example, a multi-billion pound corporation handling sensitive data is at high risk of a ransomware attack and may wish to take full backups two or three times a day. By comparison, a home user may only feel the need to take backups once or twice a week.

Answer the questions below

1. What is the minimum number of up-to-date backups you should make? **3**
2. Of these, how many (at minimum) should be stored in another location? **1**

Updates and Patches

Updates are an essential part of the software development lifecycle; they allow developers to add new features, fix bugs and otherwise simply alter aspects of the product. When vulnerabilities are discovered in software, the developers usually release special updates called patches that contain a fix for the vulnerability or otherwise "patch" the security issue.

For this reason, it is imperative that you update software whenever possible — especially for things like operating systems (e.g. Windows or macOS) where vulnerabilities can be particularly dangerous, as seen in the case study below.

Unfortunately, all software eventually loses support from its maintainers, becoming deprecated and no longer receiving updates (e.g. Windows 7) — this is referred to as the software being EOL (End Of Life). At this point, the software must be replaced as soon as possible. If replacing the software is not possible then the device should be segregated as far as is possible to prevent exploitation of the vulnerabilities that will inevitably be found and left unpatched.

Antivirus Updates

Most antivirus software packages receive very frequent updates; this is because they largely work using a local database of known exploit signatures, which must be kept up-to-date.

In other words: when new malware is discovered, it gets sent around antivirus vendors who generate a "signature" that identifies this particular piece of malicious software. These signatures are then distributed to every device on the planet that uses the

antivirus software, ensuring that your installed antivirus solution is kept up-to-date on all the latest (known) malware.

If antivirus software is not allowed to update it will still be able to catch some malware through other methods. However, the local signature database will quickly become outdated, resulting in malicious software potentially falling through the gaps. In short: if the antivirus wants to update, let it!

Case Study: Eternal Blue

Eternal Blue is believed to have been discovered by the United States **N**ational **S**ecurity **A**gency (the NSA) and was leaked to the general public in April 2017. The vulnerability affects an integral part of the Windows operating system and gives a remote attacker complete control over the target at the highest level of privileges. You can see this for yourself in the "Blue" room on TryHackMe.

Microsoft quickly released a patch (the infamous MS17-010) which was designed to remove the vulnerable component in the software; however, many administrators simply chose not to download it for one reason or another.

Why is this important? Eternal Blue was the transmission vector that the Wannacry ransomware (discussed in task 4) used to spread and infect new devices! Eternal Blue gave full access to a target remotely, making it a perfect vulnerability to exploit with a self-replicating virus. Despite a patch having been made available months before the appearance of Wannacry, the ransomware was still able to attack millions of unpatched systems, with devastating effects.

You can read more about Eternal Blue here.