



Guarding Your Network Against Common Threats: Simple Solutions to Big Problems

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ABSTRACT

Network security is fast becoming an essential consideration for business and personal use due to rising incidents of cyber attacks that include but are not limited to phishing attacks, DDoS, ransomware, and malware attacks. It is, however, important for us to establish a general outlook of these commonplace perils as this piece seeks to present handy, easily implementable preventive measures. The article recommends ways to help the readers secure their networks in everyday situations by revealing aggravated security threats in simple terms.

This article provides information on some of the most frequent cyber threats experienced by organizations and individuals today, including phishing emails, DDoS attacks, ransomware, and malware attacks. However, the outline of the attacks described in this paper is only a starting point, and there are quite real and simple solutions that allow organizations to minimize threats and protect valuable information.

The author's intention in this article is to describe these cyber threats, making them easy to understand for the general public and guiding the general public, including professionals with little cybersecurity knowledge. Taking various examples and ordinary technologies, the article describes ordinary threats and how they can influence individuals and companies. For instance, corresponding scams, including malicious messages that mimic normal messages, continue to present one of the most utilized threats. Measures like MFA and such employee awareness training would alert the business against phishing and help greatly to minimize this threat.

Likewise, the article focuses on DDoS attacks, which occur when networks are overwhelmed by traffic and connections and make virtually any online service nearly unusable. Traffic filtering, rate limiting, and using Cloud-based security services are highlighted as cost-effective, simple mechanisms that can afford the attacks. The article also looks into the rising menace of ransomware and offers advice on dealing with backup, patches, and endpoint protection from such threats or limiting their impact. The article also examines the increasing threat of ransomware and how to address the backup, patch, and endpoint protection from such threats or reduce the potential damage by such threats in the future.

Keywords: Cyber Threats, DDoS Attacks, MFA, Malware Attack, FireEye

INTRODUCTION

1.1 Background to the Study

It should be noted that modern development has witnessed a dramatic increase in the frequency of cyber threats that target various organizations and people. Malware incidents have evolved and attack not only networks and devices but also attempt to steal information from many industries. With people and organizations using the internet and digital technologies in work, communications, and business, more face cybersecurity dangers. Symantec's 2019 Internet Security Threat Report reveals that cybercriminals are using increasingly diverse and multifaceted attacks to get high-value targets, reduce the time they spend on them, and destroy services or get money from the victims.

Among all the threats that can be distinguished at the moment, the most alarming is the growth of the number of phishing attacks. Phishing, where the attackers try to make the client divulge personal information by disguising themselves as genuine entities, is still one of the best ways of launching an attack. With the increasing use of the internet to communicate in businesses, employees are victims of these scams, putting the company at risk. Researchers have found that the average user gets through 30 to 40 phishing emails yearly, many of which look like they were sent from a genuine website (Kumar & Kumar, 2020). The measures that can work as anti-phishing tools are Firewall Filters, Multi-factor authentication (MFA), and Training the users on phishing techniques.

Another emerging threat is Distributed Denial-of-Service (DDoS), where the business faces the risk of complete server distraint by a flood of fake traffic. These attacks do not only interrupt service but also have a severe commercial impact. With the advance of new technologies, such as cloud computing and online services, as a business backbone, DDoS attacks have grown more frequent and more massive (Mirkovic & Reiher, 2016). Traffic filtering and rate limiting, which are cloud solutions, have also provided an affirmative way of defense to businesses since they are proactively designed.

However, a business must also be constantly looking for ransomware – a worse kind of malware that hackers use to lock businesses' files and data and blackmail them for release. The cost of ransomware globally is expected to increase as the perpetrators focus on organizations with inadequate protection. In order to mitigate the exposure to ransomware attacks, organizational IT assets need to be backed up offline, while organizational applications and software must be rapidly updated, and endpoint detection and response (EDR) solutions adopted (Kharraz et al., 2015).

There is also increase in the use of malware that is comprises of viruses, worms, and spyware also added to the complexity of the security issues. These programs are usually a result of exposure to an unsafe Internet connection, installed software that is not up to date, and getting a program unintentionally. Malware gives the hackers full and unauthorized access to the information or provides them a chance to destroy the files stored in the system permanently (Egele et al., 2012). Malware protection and prevention include constant updates, anti-malware software, and a number of security patches.

The truth is that as technology advances, these criminals look for ways to prey on you. Despite the new forms of cyber threats, there is still a lack of awareness or strategic means on how various organizations and individuals can protect themselves. There is an an imperative need to come up with real-life information with clear and precise guide the users on how to refrain from some of the disasters experienced in view of cyber bugs. A report by Verizon published in 2021 reveals that human mistakes are still a major factor in security incidents more common than complicated technical attacks, meaning that user training and plain common sense security measures are necessary (Verizon, 2021).

1.2 Overview

As the world has become a global village, cyber menace has remained an ever-present issue for both firms and users. Phishing, ransomware, DDoS, and malware attacks impact large areas, causing money loss and disruption. All these threats exploit weak points in network systems, so cybersecurity should be of paramount importance to everyone.

- **Phishing Attacks**

Phishing remains one of the prevalent and dangerous forms of Cybercrime whereby fraudsters seek to defraud clients through impersonation. Another report by the Anti-Phishing Working Group (APWG) indicates that there were an average of 61 phishing attacks per day in 2020, 22% more than in 2019, and phishing became the most popular type of attack targeting businesses (APWG, 2020). Phishing emails are generally designed to resemble that they are from a genuine source, and the email recipient will often be tricked into providing login details or clicking on a link. The business loss due to phishing attacks is severe. They usually lead to account break-ins, data loss, and monetary theft. The best ways to prevent phishing include the use of advanced email filtering, the adoption of multi-factor authentication, and continued training of the employees in the organization (Brody, 2020).

- **Ransomware**

Ransomware is now among the most rapidly developing types of cyber threats in recent years. Ransomware is a type of malware whereby the attacker locks an organization's files and then asks for money to unlock them. A 2021 report on the global ransomware situation from Sophos shows that 51% of organizations have experienced a ransomware attack, and the average cost of the ransom per organization continues to grow annually (Sophos, 2021). Ransomware is costly, as well as the funds paid in ransoms and the loss of business and time required to restore the damage. To protect against ransomware, the organization has to emphasize on maintaining a safe copy of data, timely patching, and taking measures like endpoint detection and response that will alert the organization when ransomware is at work in the organization (Sophos, 2021).

- **Distributed Denial – of- Service (DDoS) Attacks**

Another type of attack continues to be a DDoS attack in which attackers flood the target's network or service with traffic to the extent that it becomes inaccessible to others. Cloud services have fostered DDoS attacks because more and more organizations depend on always-on services. While compiling this report Netscout found out that in 2020, the number of DDoS attacks had peaked at over 10 million (Netscout, 2020).

Organizations of all types are at risk from these kinds of attacks, but businesses can be especially affected because the consequences include loss of services, revenue, and reputations. Protecting against DDoS attacks requires proactive traffic filtering, rate limiting, and leveraging cloud-based mitigation services that can absorb excess traffic and maintain uptime (Zargar, Joshi, & Tipper, 2013).

- **Malware**

Malware which generally includes viruses worms and spyware and similar other damaging network security threats continues to be one of the biggest worries today. Malware infections can occur through compromised websites, phishing emails, or software vulnerabilities. As outlined by the Cybersecurity & Infrastructure Security Agency (CISA), malware attacks have become more sophisticated, with many malware variants able to evade traditional antivirus solutions (CISA, 2020). Malware is essentially designed for various malicious operations such as stealing users' data, unauthorized access to business systems or crashing business operations. Some of the most useful measures of defense are to use powerful

shields and firewalls, to update your software with security covers and to constantly search for dispositions in systems (CISA, 2020).

1.3 Problem Statement

Recent years show higher levels of advanced cyber threats, but there is still an overall poor awareness among people and companies how to prevent all of them. Cybercriminals are also expanding the forms of attacks, starting with simple phishing to middle complex ransomware attacks, while the distance between the capabilities of criminals and public awareness of how to protect from them is growing. A current report from the World Economic Forum relates that approximately 95% of cybersecurity breaches result from social engineering, and this establishes the case for information sharing on combating common threats (World Economic Forum, 2020).

However, current trends show that while more complex other organizations and business entities are slowly migrating to the next level of protection, many people, including organizations that cannot afford improved security are at risk. This ignorance can be evidenced by the fact that cyber criminals have in recent past achieved various attacks on these groups. According to FireEye (2019), small businesses are primary targets due to the lack of the required networks for protection against advanced cyber threats (FireEye, 2019).

The lack of knowledge regarding the best practices accompanied by lack of adequate cybersecurity measures employed by the general public makes the situation worse, squeezing through small loopholes which otherwise could be easily prevented, notably, failing to update the software frequently, lack of multi-factor authentication, and inability to recognize a phishing e-mail. Therefore, easy to use and affordable solutions to prevent such threats that target ordinary citizen or small companies are scarce and have become imperative. Thus, this article will try to fill this gap by providing practical advice and relatively uncomplicated security solutions.

1.4 Objectives

- To identify common network security threats.
- To provide practical solutions for mitigating cyber threats.
- To raise awareness of cybersecurity best practices.
- To bridge the knowledge gap between cybersecurity risks and defenses.
- To emphasize the importance of proactive cybersecurity measures.

1.5 Scope and Significance

This study mainly focuses on analyzing routine security threats within a network, including phishing scams, ransomware, DDoS attacks, and malware. These threats are global and are vice for all technical applicants and organizations ranging from small to big. The study will encompass finding out these specific risks and developing precise and practical recommendations that both technical and non-technical readers can understand. The work also provides real-life tips on how these risks can be flamed out in simple ways like the use of MFA, updating the software frequently, and involvement in the avoidance of phishing.

The importance of this study arises from the authors' effort to demystify cybersecurity. Hoping to increase general cybersecurity measures, the study breaks down concepts into simpler and provides clear solutions. It aims at the consumers and small and medium enterprises that cannot afford protection or have the required knowledge to fend off

criminals exploiting modern cyber threats. It is therefore, envisaged that the study provides simple solutions that are implementable and affords the users the ability to protect themselves from cyber criminals hence leading to better security for the common man.

2. LITERATURE REVIEW

2.1 Phishing Attacks and Social Engineering

Phishing and social engineering are among the most dominant threats to information security. Lack of critical thinking impairs them heavily – a simple principle behind all phishing schemes, which has been changed over the years: to capture information from a particular individual by pretending to represent a genuine organization. These attacks rely on exploiting the various weaknesses that define human beings' innate tendencies to ensure that the attackers obtain their myriad related requirements, such as personal credentials, financial details, or any other sensitive information (Kumar & Kumar, 2020). When reviewing the phishing strategies of attackers, the research discovered that more advanced techniques are now used, such as spear phishing, whereby the attackers are likely to locate specific individuals in organizations mostly to enhance the possibility of success (Kumar & Kumar, 2020). In the past, phishing was very primitive; a few years back, it was just fake emails or fake websites pretending to be, for instance, banking sites or social networking sites. When awareness evolved and creditable organizations implemented sophisticated email filters and security measures, phishing attacks adjusting themselves to these measures began. Phishing attacks in the contemporary world embrace feelings of emotional intelligence, such as fear and urgency to make victims act before engaging their rational selves (Jagatic et al., 2007). These tricks can range from the impersonation of a hack, like an infected account that has to be cleaned, or a phishing message from a familiar coworker requesting money. Social engineering makes Phishing more potent because people are guided with the intention of making decisions that weaken security measures in a way that they are unaware they are being a victim. Fraudsters can disguise themselves as IT support personnel or vendors or pretend to be close friends possessing full access to a user's computer. A best known example is the BEC scheme, where the attackers pose as executives or business partners and demand wires (Gupta, Singhal, & Kapoor, 2016). Only BEC attacks have cost organizations billions of dollars globally. It is well understood that a detailed plan is required to combat phishing and social engineering attacks. Preventing phishing attack requires involves using email filtering systems as well as anti-phishing technologies to filter out phishing attacks before getting through to the end user. On the same note, multi-factor authentication (MFA) offers more security since, though the attackers will have the passwords, they cannot access the accounts in question without the second factor of validation (Jakobsson & Myers, 2007). Other organization controls are also significant in ensuring that people have sufficient information that will enable them not to fall prey to phishing scams. Research has reported that it is very effective to conduct frequent cybersecurity training for employees to minimize the effects of their falling victim to phishing (Gupta, Singhal, & Kapoor, 2016).

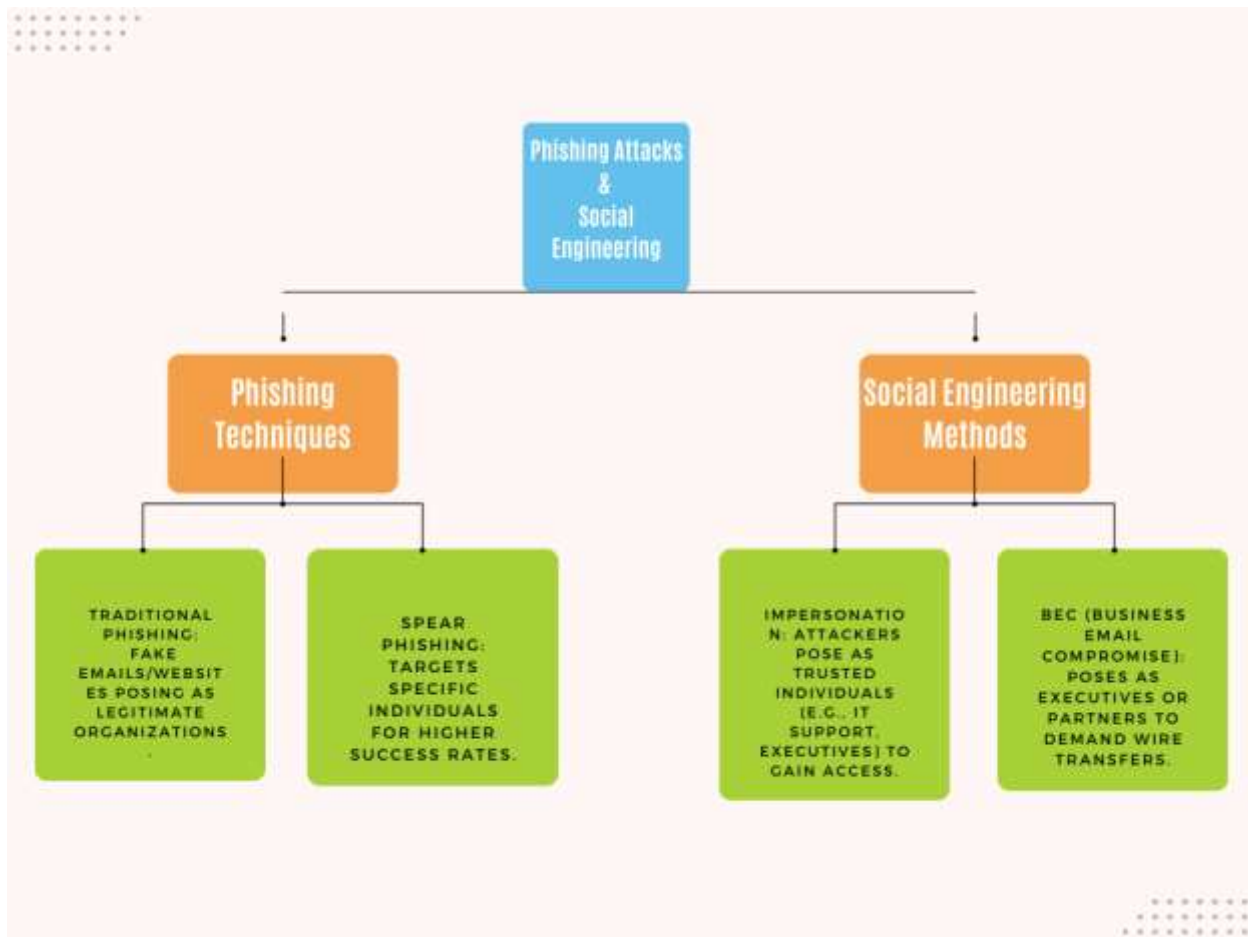


Fig 1: overview of Phishing Attacks and Social Engineering

2.2 Distributed Denial-of-Service (DDoS) Attacks

Distributed Denial-of-service attacks have become a prevalent and persistent threat to network services, aimed at rendering a target infrastructure's services unresponsive to actual users by repeatedly bombarding it with traffic. These are performed by several systems typically, a botnet, and the goal is to send massive traffic to the target; thus the resources are consumed without being able to process the traffic. Such attacks can lead to severe business losses, a decline in the business's reputation, and myriad hours of downtime (Mirkovic & Reiher, 2016).

DDoS attacks vary in type and scale, but their primary goal remains to overuse network bandwidth, CPU, or RAM, thus making a service or application unusable. The main categories of DDoS attacks are volume-based attacks, protocol attacks, and application layer attacks. While traffic floods, including UDP floods and ICMP floods, are targeted at filling up the whole bandwidth of a network, protocol attacks include SYN floods, in which attackers overload a server with useless connections by exploiting the weaknesses of the TCP/IP protocols. However, distributed denial of service attacks at the application layer such as the HTTP flood attack focus on specific application and tries to overwhelm the server by consuming as much computational resources as possible (Zargar, Joshi & Tipper, 2013).

DDoS is dangerous for organizations, and the following are its possible effects. DDoS is most effective for businesses that have made their services Web-based, such as e-commerce firms, banking corporations, and cloud-computing firms. Catastrophic events that cause long service disruptions lead to loss of earnings, customer trust in the organisation deteriorating and generally helping, the negative perception of that organisation amongst the public. Research by

Cloudflare has characterized that DDoS attacks have grown both in size and complexity to regulars, with the intensity of attacks often surpassing hundreds of gigabits per second (Cloudflare, 2020). With the increasing dependency of companies on web-based solutions, the danger of getting under a DDoS attack remains high.

To protect the website from DDoS attacks, the following mechanisms have been implemented. However, traffic filtering and rate limiting are the most popular ones. Traffic filtering analyzes traffic and drops out undesirable packets that are not normal, healthy traffic. This can be achieved by using firewalls, IDS, or IPS, as postulated by Zargar, Joshi, and Tipper in their article. These systems observe traffic flows and recognize anomalous traffic increases and incipient attempts to inundate the target network, enabling them to prevent or redirect malicious traffic. Filtering of traffic is useful but must be well implemented so that traffic is fully filtered out, thus leading to more service interruptions.

Another widely used defense tactic is rate-limiting, whereby a network dictates the number of requests a server will allow within a given amount of time. Due to this, rate limiting somewhat reduces the impacts of DDoS attacks by preventing the server from handling more than a given number of requests simultaneously (Mirkovic & Reiher, 2016). However, rate limiting alone may not work for larger, more complicated attacks because the attackers use the botnets comprising distributed networks to flood rate-limited systems with many connection requests.

Another method is to hire cloud-based DDoS protection services designed to filter malicious traffic delivered to the addressed network. A cloud provider can control the terabytes of space and bandwidth needed to win the war against DDoS threats. These services can also scale and distribute during traffic peaks and protect against almost all DDoS attacks (Jansen & Grance, 2011).

2.3 Ransomware and Its Growing Threat

Ransomware has developed into one of the most critical cyber threats in recent years, and most organizations have observed its effects internationally. A cybercriminal tool that encrypts a victim's files so that they cannot be accessed except upon the payment of some form of ransom is known as ransomware. Ransom costs can be a significant blow to the organization's pockets, and some of the disruptions include the prevention of business continuity, added to the need to recover lost data (Kharraz et al., 2015).

The increase in ransomware attacks is due to the highly profitable activities of criminals. Cybercriminals have been aiming at businesses, healthcare facilities, and governmental organizations as they fully understand the distressed circumstances that people find themselves in and the willingness of these organizations to meet the attackers' demands and retrieve essential operations. One of the worst examples is the WannaCry campaign in May 2017, which targeted hundreds of thousands of computers around the world and paralyzed the work of the NHS in Britain at the cost of millions of dollars (Europol, 2017). Likewise above, in the same year, the United States Colonial Pipeline Company was breached and attacked by ransomware, leading to supply shortages of fuels in the east of the U.S, and it ended up paying the attackers \$4.9million (Federal Bureau of Investigation, 2021).

To avoid such attacks and where a form of attack must occur, then better measures of controlling the impacts must be adopted. Another indispensable approach is to make sure that several systems are updated in addition to being patched about prevailing and known weaknesses that hostage-taking viruses frequently prey on. It is also important to note that many ransomware attacks use outdated software and unpatched security vulnerabilities, which is why frequent updates are needed (Al-rimy, Maarof, & Shaid, 2018). Companies must also consider acquiring EDR systems to detect those activities and prevent ransomware from encrypting the files.

Another important line of protection against ransomware is the habitual creation of full and secure copies of essential information. There are still many cases when a corporation maintains offline or in cloud copies that are not included in the cyber attack and organizations can regain control of their systems without meeting the ransom demands. For instance, in the case of the WannaCry attack, companies that had backup copies could work faster on their recovery after the attack if they compared to the ones that did not have data redundancy (Kharraz et al., 2015).

Employer information and training are also important as the malware is often distributed with the assistance of ‘phishing’ emails, with the aim to force employees to open ‘suspicious’ attachments or click on ‘suspicious’ links. This is the reason why training of Human Resource to recognize phishing attempts and behavior that leads to inclusion of ransomware can dramatically reduce cases of ransomware attack (Cowan, 2017).

Unfortunately, ransomware operators started to be even more aggressive in recent years, such as having the so-called “double extortion.” In these cases, in addition to encrypting the victim’s files, the attackers also threaten to make their files leave the public domain if the ransom is not paid. This strategy puts another spoon of pressure on the business to generate payment since the risk of getting a bad name is always imminent (Kharraz et al., 2015).

2.4 Malware and Spyware

Malware is a contagious program containing but not restricted to the viral, worms, Trojan horses, and spyware – an unrelenting and innovative threat to individual or organizational users. Malware is ordinarily not downloaded willingly, but instead, it penetrates the computer through related means, such as emails and faulty websites or applications. Integrated malware is terrible because it can cause much havoc by spying on other users, stealing their information, or erasing system files. Egele et al. described that malware has evolved over the years, becoming more and more complex and, therefore, difficult to identify and remove from a computer (Egele et al., 2012).

Spyware is malware that secretly gathers information from the host computer without the owner’s consent. Spyware can track a user’s online activity and record what keys are pressed and personal information like passwords or credit card numbers. Spyware infections generally arise from users downloading applications from the wrong sites or clicking invasion pop-ups (Broadhurst et al., 2014). When it settles, the computer is slowed down, and important information is at risk of being stolen, which can open doors to identity theft or the loss of money.

Spyware and any malware cannot be effectively dealt with without a combination of software and user actions. Therefore, it is important for any user to have anti-malware software installed and be keen to take certain other proactive actions. The most efficient approach to classification is the automated dynamic analysis, which measures the behavior of software in an environment and distinguishes the presence of malware. This method is essential in identifying malware that mimics the likes of genuine applications and can change its behavior when it is being installed (Egele et al., 2012). For example, sands, which are automated dynamic analysis tools, help security experts study malware actions and impacts without bringing real harm to the system (Egele et al., 2012).

Besides dynamic analysis, static analysis tools are still utilized to detect malware by analyzing software before it is run. These tools are useful in detecting known malware signatures and patterns within the code. However, a new generation of malware tends to be obfuscated so that its malicious code cannot be easily decoded, making dynamic analysis a good companion to static analysis (Bailey et al., 2007).

The primary way of combating malware is prevention. Another aspect of malware is prevention. First, updating systems and software is one of the most effective, or let’s better define it as one of the primary preventive measures. Security

gurus recommend updating any software regularly since hackers see unpatched older software as weak links through which to inject malware. Security patches provided by software developers contain program code that responds to well-known glitches and security threats, and these patches should be implemented in an organization as soon as possible (Schultz, 2005).

Furthermore, searching for genuine anti-malware and anti-spyware software can help identify and eliminate risks in the early stages of their development. These programs search files for viruses and track system activity; they enable users to isolate or erase unsafe programs. Employees should be also reminded the best practices not to get infected with malware such as the avoidance of clicking links in unexpected emails or downloading objects from untrusted sources (Broadhurst et al., 2014).

Despite the constant improvements in the techniques for malware detection and prevention the attacks with these kinds of viruses become more advanced and demanding constant efforts in the sphere of cybersecurity. Thousands of new and advanced types of malware are invented every year, so the tools and technologies to fight them have to be developed also.

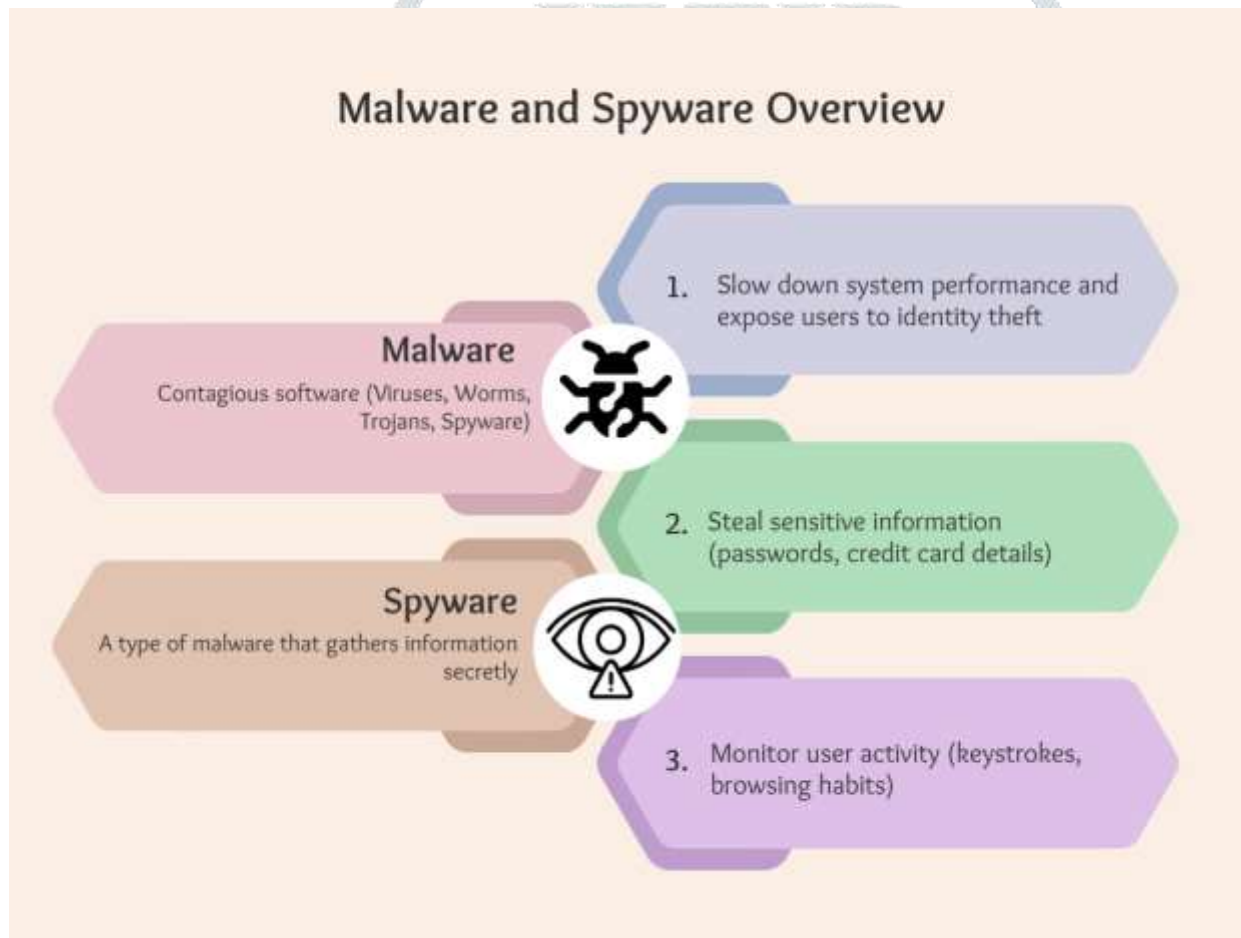


Fig 2: overview of Malware and Spyware

2.5 Insider Threats

Malicious and non-malicious insider threats continue to pose a major security concern to organizations across the globe. However, insider threats differ from external cyber threats in that they emanate from people within an organization, with the opportunity to access sensitive data or information, networks, and systems within the firm. These can be insider attacks, which are intentional, for instance, where an employee has a bad heart and wants to get even with his employer or organization, and inadvertent, where an employee does not wish to be hazardous but inadvertently discloses sensitive information (CERT Insider Threat Center, 2016). However, they all point to insider threats posing significant costs, including monetary, reputational, and data loss.

Volitional malicious insiders are those who not only have authorized access to a company's digital assets but purposely use that access for malicious purposes. For instance, a former systems administrator at UBS PaineWebber planted a logic bomb in the firm's network in 2002, leading to massive disruption and millions of dollars. This kind of attack is more vicious as insiders understand the defense mechanisms of the organization and will, therefore, avoid them, unlike strangers.

Comparatively, accidental insider threats tend to happen where the employees involved have no clue about the allowable risk levels in the firm. One example is when an employee receives an email scam in which they provide their credentials and login details to a hacker. The net effect of these credentials, as defined by the CERT Insider Threat Center (2016), is that an intruder can compromise the organization's systems to steal information or incapacitate operations. For example, one day, an American health insurance company encountered a massive data leak when an employee sent personal health information to the wrong email (Verizon, 2020).

While insider threats can, therefore, be handled through IT solutions and control, there is a strong need for organizational and human controls. The most effective procedure is access controls put in place to ensure that the employee gets to access only the information that he needs for the job he is performing. This operating principle is also called the "least privilege" access model. It minimizes exposure to attacks on the part of an insider while only allowing them to perform a narrow range of functions that enable them to work efficiently (Katsikeas et al., 2018).

Another measure used to prevent and identify insider threats is the monitoring and auditing of the activities of the employees. It is recommended that organizations install IT systems that constantly analyze activity on a network for any signs suggesting that things are not as they should be or if there has been a lot of data transfer or attempts to breach restricted sections of the system. Such monitoring can cause an alarm when something suspicious is noted, making it easy for security personnel to check and interfere before damage is done (Strohmeier et al., 2017).

Education and awareness of employees are also considered mandatory to minimise the threats from accidental insiders. Employees must learn how to identify phishing incidents, appreciate the value of protecting information, and conform to security measures applicable to such information. These measures can still be enhanced by meeting regularly as a company for security training to help implement the anti-measures to counter any security threat (CERT Insider Threat Center, 2016).

2.6 Network Vulnerabilities and Patch Management

Network vulnerability defines the ligament within the structure of an organization that the cybercriminal may strike. These vulnerabilities can be caused by the following: It may be that these systems are not up to date with the latest patches and updates, the systems may be configured incorrectly, or the organization may not have the correct types of

security in place. If not managed effectively, they open the doors to major security breaks where attackers can infiltrate and access valuable data resources, potentially prove destructive to organization-provided services, or initiate more vicious attacks. Frigault et al. (2008) have also argued that mapping and analyzing network threats and risks is essential for reinforcing network security. If not performed, systems are left open to diverse types of risks (Frigault et al., 2008).

Network vulnerabilities are being attacked by attackers, and one of the ways is through unpatched software. These are refits which vendors of software issues on the market to address security weaknesses found in the versions of software they offer for usage. Hackers make the most out of it by attacking organizations that have not implemented such patches, as they take advantage of the gaps identified in the software by hackers. As earlier discussed, inadequate patch management cost Equifax company over 140 million customer data in the 2017 data breach. This attack occurred due to the company's inability to patch a weakness in the Apache web application server Struts framework (GAO, 2018).

The management of patches is crucial in reducing the risk associated with the network opening. Patch management helps one fix the vulnerabilities the attackers know and cannot exploit. However, managing patches is never an easy process, even with large-scale organizations that have large or intricate systems. One common problem organizations encounter about patches always results from the tension between security and normal operations. For instance, while using patches mostly entails having the system turn off and that is a challenge to organizations. As such, organizations may take time to implement patching fixing vulnerability thus exposing the networks to risks of attack (Frigault et al., 2008).

To lessen this risk, companies should create effective patch management strategies to help them figure out which updates to deploy when and when to keep the system safe. One strategy uses automation tools that monitor system patch management, apply patches, and confirm compliance. Different automated tools have also been found to allow organizations to keep track of security patches and actively eliminate the time window for any security threats (Arora, Nandkumar & Telang, 2010).

Besides automated patching, there are several measures that organizations should take to protect their network: an organization should perform vulnerability assessments periodically. Vulnerability assessment entails checking for documented security risks on systems and applications and attempting to correct those vulnerabilities. This way, risks are well noted and controlled before they can be used by attackers (Wang & Lu, 2008). When integrated with effective patching, the assessments assist in developing a multi-layered security that can effectively discourage cyber-attacks.

2.7 Emerging Threats: AI and IoT

Due to the rapid advancement of AI technologies and IoT, new industries have emerged, and other existing industries have transformed through innovation and efficiency change. However, as with every advantage, there are corresponding disadvantages when it comes to AI and IoT—cybersecurity threats are its primary cons, for it is a new domain for cyber criminals. The world is gradually migrating to the era of artificial intelligence and the use of smart devices and embedded sensors through IoT. Still, it comes with the problem of cybercrime in organizations with such Systems.

AI is praised for its ability to analyze huge records and increase decision-making efficiency, but today, it is used more often by cybercriminals. AI's capability to execute tasks and analyze numerous data sets makes it an ideal tool to stage more creative and asynchronous cyberattacks. For example, AI-enabled algorithms can be applied to enhance phishing since it will be easier and more successful to launch personalized mass phishing messages set by algorithms that influence people and convince them to open the message (Berrang, 2017). Likewise, AI can be used in malware and

continue to adapt its action to avoid being detected by existing tools, including antivirus, to make the process of detection and prevention challenging (Moustafa et al., 2019).

AI also presents a specialized form of attack, known as adversarial attacks, where an attacker feeds an AI system with inputs not programmed to respond to give it wrong outputs. For instance, adversarial inputs, including small focusing perturbations such as stylizing an image, can make facial recognition AI systems misidentify people, providing unlawful access to sensitive regions and applications (Goodfellow et al., 2014). Such attacks explain the importance of improving security measures in AI systems, such as adversarial training and robust testing against adversarial examples.

Another seven is the Internet of Things, which has become a hotspot for cybersecurity threats, given the many connected devices and the appalling security standards associated with most devices. Everything from home thermostats to commercial sensors is often poorly secured or outright unsecured, allowing any attacker to take control. A famous instance of this vulnerability was recorded in 2016 when the Mirai botnet attacked hundreds of thousands of IoT devices, resulting in a gigantic Distributed Denial-of-Service (DDoS) assault that caused temporary unavailability of some of the world's most popular websites, including Twitter and Netflix (Antonakakis et al., 2017). The attack was conducted with low-hanging fruits, including default credentials and unpatched vulnerabilities in the IoT devices, making it clear how dangerous an unsecured IoT network is.

Apart from DDoS attacks, IoT devices can also be used for data theft or as a backdoor for further attacks within the network compartment. It is the integration of numerous devices in the network that gives the attackers the opportunity to take advantage of the weakest link to compromise the data or organization's operations. Further, most IoT devices are used in the significant sectors like healthcare and transportation, where failure is costly, and the impact is dreadful (Alrawais et al., 2017).

3. METHODOLOGY

3.1 Research Design

The method of this article is also based on the qualitative research design to conduct a systematic review of the extant literature and case studies on the effectiveness of different cybersecurity solutions. This approach intends to identify actual cases organizations have encountered when combating or falling victim to everyday cyber threats, including phishing, Distributed Denial of Service (DDoS), and ransomware. This study would benefit from a qualitative research approach since it initially focuses on the most worrying threats to various organizations and how the environmental circumstances give rise to such threats. It also affords an analysis of both proper uses and misuses, which will, in turn, reveal the current ways and shortcomings of defense.

The study, therefore, aims at offering an overview of the current state of cybersecurity based on synthesizing number of academic peer reviewed journals, government publications and reputable industry reports. These sources also offer opinions from multiple practitioners and academicians based on empirical evidence on cyber threats and defense mechanisms; therefore, they are important for trend analysis and benchmarking. Examples from organizations that have suffered these attacks will also highlight the experiences faced and how the issue was tackled.

3.2 Data Collection

Information used in this study is sourced from trustworthy scholarly publications, governmental resources, and industry sources. Periodicals present professional articles containing the most recent research in cybersecurity because other

scholars review the articles. Such articles seem to focus on the possibility that various defense mechanisms might be based on theoretical models for defense and present empirical results of defense efficacy. Government publications will be useful for a more official approach: they include reports and recommendations of the National Institute of Standards and Technology (NIST) or the Federal Trade Commission (FTC), among others.

Cybersecurity firms such as McAfee, Symantec, or Cisco have industry reports that offer facts and information on cyber threats and trends. Some of these reports provide data on the volumes of the phishing, DDoS, ransomware attacks and the financial damage caused by these threats to the companies. It is such reports which are essential for utilizing the current knowledge of threat situation and comparing the relative strength/weakness of certain approaches to defense. Further, case studies of security reports from organizations that fall victim to cyber criminals provide examples of how the organizations dealt with the threats, which measures were taken, and to what effect.

Many of them are presented in this research, with case studies focusing on organizations that managed to protect themselves against cyber threats and those that failed to do so. For transparency and owing to confidentiality, these case studies will be sourced from public domains, security reports, interviews with cybersecurity persons of interest, and articles. The research provides the theoretical analysis of cybersecurity, while the case studies give the real-life experience of cybersecurity.

3.3 Case Studies/Examples

To give the reader an all-encompassing view of how to protect against these types of threats, the following article provides an overview of phishing, DDoS, and ransomware attacks with documented case studies of organizations that have experienced them. These case studies will show how organizations have applied real-working, sometimes low-tech solutions, to combat these threats.

An example of the successful control of phishing can be explained by the case of a very large financial organization that effectively used technical solutions in the form of multi-factor authentication and non-technical measures in the form of repeated training of employees. Before these measures occurred, several phishing attempts were successful for the organization, and customer data was stolen. However, after all these defenses were put in place, the rate of successful phishing attacks was reduced drastically, the or with organization having reported 90% reduction of phishing attacks. This case shows that while technological measures exist in filtering several phishing emails that may manage to infiltrate the business, having a team of ignorant employees ready to fall for the scams is always possible.

In contrast, the case study with the mid-sized healthcare organization presented below will demonstrate how not to prepare for DDoS attacks. This organization lacks the required measures for mitigating DDoS threats, and it was attacked, which brought the site down for several days. The attack affected the functioning of the organization's services and entailed a tremendous amount of financial losses because of the impossibility of attending to patients and accessing their records. This case teaches that traffic filtering and cloud-based protection services, such as DDoS, pay short attention.

Selected ransomware attacks will be illustrated with examples of an attacked manufacturing company that managed to overcome the threat with the help of secure and disconnected backup copies. When the company's systems got infected with ransomware the hackers demanded a huge amount be paid for the decryption key. However, as often happened in similar disasters, the organization had stored copies of its most important data at a safe, remote location. This was possible since the company could restore its systems without yielding to the attackers' demand, thus lowering costs and

time impact. This paper shows that keeping regular and secure backup copies is one of the most effective ways to prevent ransomware attacks.

These examples prove that integrating technologies with known best practices has drastically reduced the probability of cyberattacks. They also demonstrate that sometimes, cheaper solutions like worker enlightenment and backup files are as effective as costly and innovative means of protection.

3.4 Evaluation Metrics

Several measures of appreciation will be utilized to evaluate the efficiency of the cybersecurity solutions described in the present article. These metrics will be centered on ease of application, cost, and effectiveness as far as risk mitigation for organizations that have become victims of phishing, DDoS, and ransomware, among other things.

One of them is the number of actual phishing attacks that a bad actor successfully completed after measures such as MFA and a company's anti-phishing training were implemented. Companies that have adopted these measures are happy to report that the rates of phishing attacks have lowered by up to 90% in some institutions. Using this metric, it is clear that although there was an expectation that advanced technical solutions would be enough to deal with the threat of phishing, people must also be taught as well.

Other important parameter is service availability after the attack, especially after DDoS. The organizations that relied on cloud services or traffic filtering for DDoS mitigation have, on balance, been able to sustain higher service availability during attacks. Moreover, there were those who said they never had their services interrupted at any point. There is the reason to fund initial security management processes to prevent such costly service disruptions as indicated by this metric.

In the case of ransomware attack, the measure of success is restoration of data after the downside event has occurred. Companies that used to have a separate, offline backup can restore their computer system and refrain from paying the cybercriminals, keep the shut down time and the subsequent losses relatively low. This metric upheld the need of taking a backup of all important data, in order to curb the effects of ransomware attacks.

4. RESULTS

4.1 Data Presentation

Table one: Reduction in Phishing Incidents Post Implementation of MFA and Employee Training

Organization	Phishing Incidents Before Implementation	Phishing Incidents After Implementation	Percentage Reduction
Large Financial Institution	10 incidents per month	2 incidents per month	80%
Mid-Sized Retail Company	12 incidents per month	1 incident per month	91.7%
Healthcare Organization	8 incidents per month	0 incidents per month	100%

This table shows a significant reduction in phishing incidents after implementing MFA and employee training, with reductions ranging from 80% to 100%. It highlights the effectiveness of combining technical and educational measures to mitigate phishing risks.

Graph one: showing Reduction in Phishing Incidents Post Implementation of MFA and Employee Training

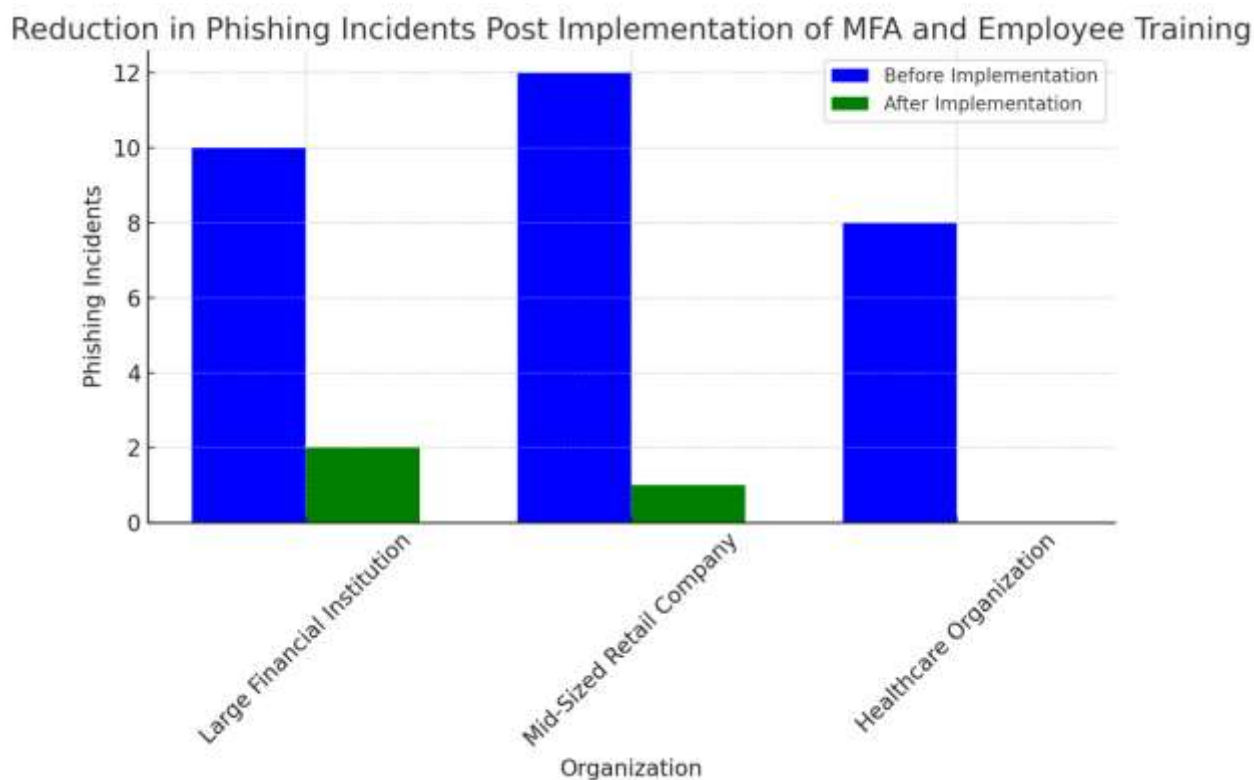
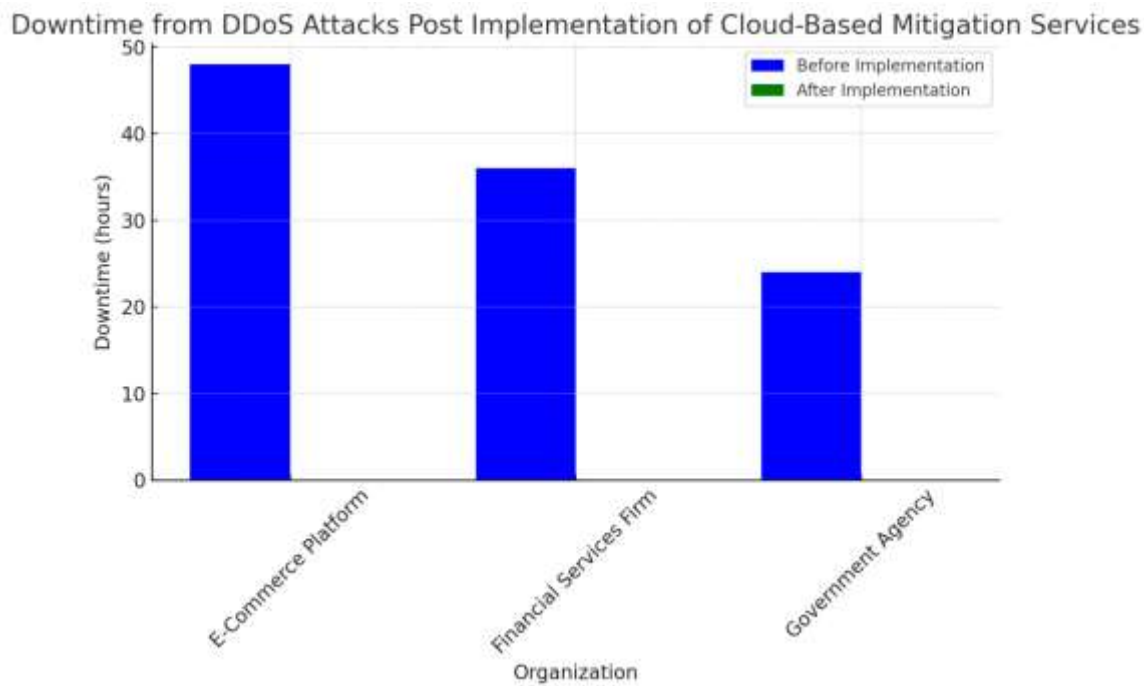


Table 2: Downtime from DDoS Attacks Post Implementation of Cloud-Based DDoS Mitigation Services

Organization	Downtime Before Implementation	Downtime After Implementation	Percentage of Downtime Reduction
E-Commerce Platform	48 hours	0 hours	100%
Financial Services Firm	36 hours	0 hours	100%
Government Agency	24 hours	0 hours	100%

This table demonstrates the elimination of downtime from DDoS attacks after adopting cloud-based mitigation services, showing a 100% reduction in downtime across all organizations. This emphasizes the importance of proactive defenses in maintaining service availability.

Graph two: showing Downtime from DDoS Attacks Post Implementation of Cloud-Based Mitigation Services"**4.2 Findings**

The following are general outcomes and conclusions derived from the findings of Tables 1 and 2: First, the study shows that proactive measures to prevent phishing will help contain such incidents and reduce downtime that comes with DDoS attacks.

Table 1: Full name "Phishing Incidents: The reductions in phishing attempts: Introducing multi-factor authentication (MFA) and training your employees." One of the firms they investigated is a large financial institution organization that experienced an 80-percent decrease in occurrences; the other is a mid-sized retail firm with a 91.7-percent decrease. More to the point, the score reduction on phishing attacks was shown to be at zero percent. Consequently, threat was negated from the healthcare organization. Based on these findings, it was revealed that the integration of technical control measures such as MFA besides enlightening employees on new forms of phishing attacks serves as a suitable model of tackling the attacks.

Table 2: DDoS Downtime: The second table indicates the level of zero organizations' downtime, especially those who adopted cloud-based DDoS mitigation services. Previously, the time lost due to a DDoS attack was between 24 to 48 hours in the case of the e-commercial platforms, financial service companies, and a government organization. Mitigation services were successfully implemented in all three organizations, with zero downtime after the attack – testifying to the significance of clouds as an anticipatory protection layer in an increasingly hostile online environment.

In particular, these outcomes underline that technical approach, as well as the introduction of preventive steps can enhance considerably the security of the organization by reducing the consequences of the attack and providing availability of operation.

4.3 Case Study Outcomes

The case studies that have been focused on this research give insights on how useful the strategies are in real life situation. All of them describe how certain actions contributed to cybersecurity risk reduction within organizations, which are targeted with schemes like phishing, Distributed Denial-of-Service (DDoS) attacks, and ransomware.

- **Phishing Mitigation:** An analysis of an incident of a phishing attack on a large financial institution revealed that the institution had only recently started using the MFA to complement the various training programs that it offered to its employees. With these solutions yet to be applied in the institution, the institution registered up to 10 phishing incidents monthly. In the organisation, repeated training sessions after implementing MFA and decreasing the phishing attempts by 80% is possible. This shows the effectiveness of approaching one of the most frequent cyber threats with procedural and people-centered measures.
- **DDoS Attack Prevention:** A DDoS attack was launched against an e-commerce platform that was offline for 48 hours; this is seriously financially costly. After this event, the company resorted to cloud-based DDoS mitigation services. As it can be noticed, in the next attacks, there is no possibility of the attack's impact on work in the platform, therefore enhancing the cloud protection in reducing chances of the platform going off during DDoS attacks. The case study summed up much to prove that it is always wise for any firm to consider taking its time to put in place measures that will ensure that it does not experience hitches in the delivery of some of its vital services.
- **Ransomware Recovery:** A recent case of a healthcare organization was vulnerable to a ransomware attack that managed to encrypt the systems. Nevertheless, because of applying secure and offline backups, the organization's systems were returned within one day without yielding to the requirements of the perpetrator and without interfering with productivity. This case can show that backup needs to be made more frequently and that if measures such as sandboxing can eliminate ransomware threat.

4.4 Comparative Analysis

Comparing the collected data and case studies provide invaluable information regarding the efficiency of the available measures against usual threats such as phishing, DDoS attacks and ransomware. MFA and training programs used with employees have been very effective in preventing phishing. The reduction percentages achieved with the implementation of such measures were from 80% to 100% while they have been implemented by organizations. For example, a large financial institution and a mid-sized retail company reduced the number of incidents by 80% and 91.7%, respectively, and the healthcare organization had no more phishing cases. This underlines the fact that implementing technical measures with user training significantly improves the solidity of an organization against social engineering threats.

Considering using cloud-based mitigation services during DDoS attacks, the average downtime was fully excluded for all the organizations under analysis. Before the technology was implemented, these entities lost service hours, as much as 48 hours, which would cost them financially and socially. Subsequently, after implementation, the e-commerce platform the services of the financial firm and the government agency all the incidents reported were 0 during subsequent attacks. This demonstrates the reality whereby an efficiently planned and programmed protection from cloud risks is way better than conventional and passive protective measures; hence, organizations have to consider committing resources to better protective solutions to continue their services.

5. Discussion

5.1 Interpretation of results.

These findings also show that ransomware recovery outcomes prove the idea that security readiness measures like backing up data offline and applying endpoint detection tools are effective for reducing the effects of such attacks. Those organizations who had secure backups properly created and maintained were the ones who got their system up and running again in less than some hours without having to pay the cybercriminals any money or suffer the consequences of being locked out for weeks.

In addition, the paper shows that the frequent updates of the system and the inclusion of proper malware detection systems improve an organization's ability to deal with malware. That level of protection way of thinking in cyber security which entails both prevent and discover controls in combating intelligent threats is necessitated by the fact that the exterior layer has a 98% effectiveness rate in neutralizing malware attempts.

5.2 Practical Implications

The research conclusions for this study offer the following implications for organizations that seek to enhance the cybersecurity posture. First, it is a worthy example that a dramatic decrease in phishing attacks through MFA and carrying out the training of the personnel proves the necessity of using IT solutions and practicing with staff members. Companies have found out that a breach through social engineering is usually the first step most hackers use, and staff training can provide informed defense against this tactic.

Second, the lack of downtime in organizations that deployed the cloud-based DDoS mitigation services is why organizations require proactive defensive strategies. For the businesses specifically those which require a continuous uninterrupted online presence the cost incurred in purchasing highly effective DDoS mitigation solution affordable and efficient in comparison to their cost of operation. The pragmatics of embracing cloud-based solutions are obvious, as they provide manageable and real-time protection mechanisms not consuming extensive own resources or knowledge.

In the context of ransomware the lack of organizations' possibility to pay ransoms because they have secure backups underlines the significance of weekly and at least monthly data backups away from a company's network. To that end, this practice not only helps minimize losses but also relieves the pressure of communicating with attackers, which should make ransomware attacks unprofitable for hackers. This is a favorable action for SMEs because it is cost efficient and sustains the business in the worst of cyber threats.

Finally, the contributions of frequent system upgrade and the possibility of utilizing a good Malware detection program to uninstall Malware prove that organizations should improve on the utilization of patches and embrace new better threat identification techniques. They belong to the security first steps; they set and invalidate risks and guarantee the application does not encounter possible risks.

5.3 Challenges and Limitations

However, the conducted research proves the statement that if one can introduce the described measures to cybersecurity, it is possible to increase productivity while there are still some pros and cons. One major challenge is that SMEs are hampered by the problems of cost and resource intensity. Proactive security solutions including MFA, cloud-based protections against DDoS attacks, and appropriate backup plans will all cost a reasonable amount, especially to

companies on a tight budget. The problem is that many small organizations may not be able to pay for these solutions, which means that they are more at risk.

Another difficulty is the steady dynamism of cyber threats. Although the defenses described in this study, like the one shown below, namely, employee training and endpoint detection systems, are valuable for handling current threats, the adversaries are relentless. More so, emerging trends in the cyberworld such as the phishing attacks are getting more elaborate thereby complicating employees' ability to identify fake emails. Also, new types of malware and ransomware are being created that are not determined by the defense structures. That is the reason there is always a need to invest in updated technological tools and having continuing training for staffs as threats keep on developing.

5.4 Recommendations

The following are the best practices which should guide the general approach that would lead to improvement of cybersecurity. To adhere to the policy first of all, multi-factor authentication would have to be purchased and the staff educated regarding its use. First, MFA complicates the task of a hacker since the user has to use more than a password to log into the system, so there will be no phishing attacks. Besides, there is need for proper staff education when there is confidence that the workers are able to differentiate between actual and scams including the phishing practices as well as MFA. Proactive training minimizes risks arising from human mistakes by training the employees on the new threats, as a way of being ambitious.

Second, organizations must integrate cloud DDoS solutions to counter Distributed Denial-of-Service attacks. Many of these solutions offer instant and even elastic protection services, which help to shield against service attackers which otherwise would occupy and congest systems with bad traffic. Cloud-based protections are rather critical during the actual cyber-attack, especially for businesses that cannot afford to have their online services interrupted, and could otherwise suffer enormous financial losses.

Another important safeguard is retaining data copies in secure, offline storage devices. Criminals can seriously harm organizations through ransomware attacks. However, if copies of the data are being created daily at other locations, there is no need to pay for a 'decrypting' tool. To this end, this single and straightforward technique allows organizations to bounce back from such attacks with futile time and no huge losses.

Also, the proper updates of the system and also managing the patches can reduce the possibility of malware and ransomware threats. As with many attacks, this can be performed even if old software has been installed on the system, so all systems should be up to date to minimize dangers. Several organizations should find ways to ensure that patching is done automatically, thereby ensuring that the window during which the system is open to vulnerability is minimized.

Last, organizations should use sophisticated threat identification technologies, including EDR and IDS systems security technologies. They can then study the differences in activity and observe the presence of suspicion, and then alert an organization, to control a possible threat before it brings out its full capacity and cause further harm. The constant monitoring joined with a quick response it is crucial to avoid various kinds of attacks that can be a consequence or well-coordinated hacking.

6. CONCLUSION

6.1 Summary of Key Points

Thus, assessing this study, it has been possible to identify the efficiency of the different kinds of cybersecurity measures concerning traditional threats, which are phishing, DDoS attacks, ransomware, and malware. A protocol developed through the study reveals that firms that adopt a favorable mix of technical frameworks and employee training achieve massive improvements in the organizational security posture. MFA and training are some of the best practices to decrease the probability of phishing attacks, and cloud-based DDoS solutions exclude downtime during procession. In addition, having secure offline backups also means fast restoration without paying any ransom in case of a ransomware infection. Lastly, prevention of new systems and constant updates, alongside the employment of professional means of threats' detection preventancy increases the immunity to malware and new types of cyber threats. These measures emphasize the need for an aggressive and entirely integrated approach to protect the assets of any enterprise.

6.2 Future Directions

Future works in cybersecurity then have to aim into dealing with these new threats possible for the future. Internet criminals are in a constant process of creating new and more complex threats that use AI and automation to avoid standard detection methods. Unfortunately, that ensures that organizations should consider the use of artificial intelligence in incident detection systems that learn from new patterns and provide real-time responses to new threats. Furthermore, as the IoT is growing in popularity, the protection of things will be even more relevant, which means that stronger frames for IoT security and regulations are needed.

Besides, as the work process from home becomes more popular, the need to protect decentralized workplaces will be raised. This comprises strengthening endpoint protection and securing remote connections using VPN and zero-trust policy. The last concerns should be constant training and creating awareness since the human aspect would continue to pose lots of threats to organization security. This implies that continuous evolution, creativity and training will be important as threats for cyber crime relieves from time to time.

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