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Emotet: A Sophisticated and Persistent Malware for Stealing Information, its Attack and Prevention Strategies

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Abstract - *Many people use internet every day for different activities like browsing, sending emails, banking, social media, and downloading files and videos. EMOTET is an advanced type of virus that mainly focuses on financial systems and individuals to poach personal and financial information. It spreads by false emails to people and also by replicating on itself. It can download other types of malware that attack the system even more, and it can encrypt sensitive data, making it inaccessible to the user. The US-CERT has already warned people about this malware. According to a cybersecurity company called CrowdStrike, dealing with EMOTET can cost up to $1 million per incident. EMOTET usually spreads through phishing emails, which can contain malicious links or attachments, like fake PDFs or Microsoft Word documents. It's crucial to be careful and not click on suspicious links or attachments to avoid falling victim to this malware. This study intends to investigate the effects of Emotet on organizations and people as well as to find efficient preventative measures for this infection. The results of this paper provide valuable insights for businesses and individuals looking to protect themselves against the threat of Emotet and other sophisticated malwares.*

Key Words: Emotet, Spider, Malware, Phishing, Cyber Security, Prevention, Banking.

1.INTRODUCTION

Emotet, also known as Geodo, is a type of malware that first surfaced in early 2014 and poses a significant threat to computers and networks[13]. Since its discovery in June 2014, the Emotet malware has grown into a major threat distributor that distributes and drops additional banking Trojans like Trickbot and IceDiD. This offers malware-as-a-service. It is difficult to locate and eliminate because it has been around for a while and altered over time. The virus is known as MUMMY SPIDER by renowned cybersecurity firm CrowdStrike, and it frequently changes its payloads to avoid discovery. Its primary goal is to gain access to an infected device, collect data from the target, and download additional malware payloads to steal credentials. On the Windows operating system, Emotet replicates itself into fixed areas, making it challenging to fully remove. It's a risky malware that criminals might use to propagate banking Trojans and ransomware like Ryuk and Trickbot.[12] Security experts at G DATA found over 33,000 distinct Emotet versions in just the first half of 2019. Emotet Variant 1 is extremely dangerous due to its modular capabilities, which allow it to carry out coordinated DDOS attacks and steal money straight from the victim's bank account. These modules consist of spam bot, banking, and distribution modules.

Its most recent examples contain modules that can steal a variety of data from the target, including email client credentials, contact lists, web browser credentials, and email contents. It can propagate through LAN using spam or through WAN using SMB vulnerabilities. Recent spam campaigns by Emotet have been very effective at infecting users by making the emails appear more legitimate by using previously stolen email conversations.[5]

It can increase rights, brute-force local network credentials, harvest contacts and recent emails from Outlook, and proxy C2 traffic from other infected devices. As it collaborates with other types of malware, it spreads rapidly once it has access to a network and exposes devices to a wide range of threats. Emotet samples have increased recently, with spam campaigns mainly focusing on users in Lithuania, Greece, and Japan.[9] The most recent Emotet campaign, which made a big impression in many nations around the globe, is the subject of this report. The report examines the attack vector, maps the infrastructure used at different points in the campaign, and analyses Emotet's malicious payloads to determine their potential effect using a carefully crafted dataset.

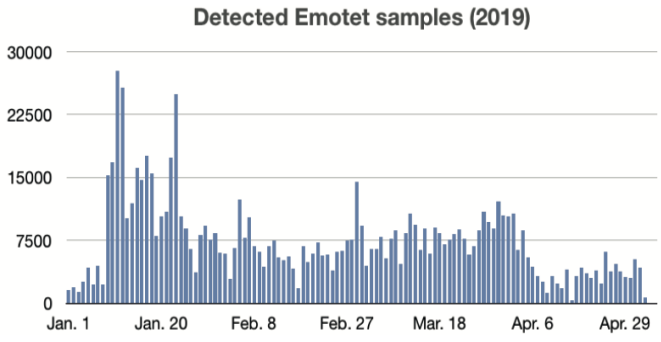


Fig-1: Detected Emotet samples on a daily basis.

Emotet is among the priciest malware, with remediation expenses of up to $1 million per incident, according to US-CERT. According to Sophos charts, Emotet regularly outperformed malware like GandCrab, HawkEye, Ursnif, Formbook, and AZORult in terms of frequency of sighting.

Every day, new Emotet spam campaigns and binaries are released, and countless spam emails are sent daily to guarantee widespread infections. [8]

2. LITERATURE SURVEY

Malware like Emotet, which has been around for a while and is spread through junk emails, is common. Malicious software, links, or document files with macro capability are the main entry points for it into a device.[1] In order to attract into clicking on dangerous URLs, the malware employs alluring wording like "your invoice" or "payment details." [4]. The virus was initially distributed through malicious JS files, but as it has advanced, it also makes use of documents with macro capability. Businesses and individuals have a difficult time analysing the malware because it is hard to detect. Additionally polymorphic, it has the capacity to alter itself each time it is downloaded onto the computer, making it difficult for AVs to successfully and pro-actively detect it. Furthermore, this malware lacks any signals and obtains updates via C & C servers in a way akin to how a laptop's operating system updates itself. Financial Trojans are among the malware types that this malware facilitates the installation of. Malware can also reveal private information like identities, passwords, and email addresses that have been taken.[4].

It is well known for its behavior, which involves surfing contact groups for email ids in specific and sending itself to the most important contacts. Since the mails are from genuine sources, they don't appear to be spam, and recipients are more likely to obtain the files because they are from reliable sources. The likelihood of the malware getting to the financial servers is significant if a user uses it as "password." Through Eternal Blue flaws connected to WannaCry attacks, the malware distributes [8].

A Banking Credentials Malware called Emotet Avoiding suspicious emails, according to the Stealer Pekta & Acarman team, can also help to prevent the device from becoming infected with adware [6]. For users of the Emotet malware, prior article didn't offer any SSA. This article will examine the user awareness problem in depth and give readers a thorough understanding of the Emotet malware's security situation. The purpose of this paper is to examine how similar, despite having different and largely unidentified origins, this specific group of malware's behaviours[12].

To identify particular network congestion patterns, ML techniques are frequently employed. With a 99 percent discovery rate, SSH congestion is found using a ripper learner [6]. To prevent models that depend on skewed port numbers that are given at random, they remove port nos. from attribute set. Compared specific flow exporters using ML techniques to enhance botnet congestion classification. The method involves using a 2-layer perception classifier to detect randomised bot congestion, which is a common technique used by bots to evade detection. Additionally, the approach involves employing transient diligence to differentiate between benign and harmful bot congestion.

The proposed work forms the basis for detecting and preventing the injection of the Emotet money-lending Trojan and malignant network congestion.

The behaviour-based ML categorization model can identify some instances of Emotet infection without examining the PPC or IP addresses of the program. Overall, the approach offers a robust and effective solution for detecting and preventing the Emotet money-lending Trojan and other forms of bot congestion.

3. METHODOLOGY

Emotet is a type of malware that is primarily spread through spam mails that contain malicious attachments or links to infected websites. Once Emotet infects a system, it can carry out a variety of attacks.

3.1. Attack Methodology

Emotet is a type of malware that is primarily spread through spam mails that contain malicious attachments or links to infected websites. Once Emotet infects a system, it can carry out a variety of attacks. Here is a stepwise elaboration of Emotet's attack steps and methods:

1. An Emotet MS Word file is sent to the user as an email attachment.
2. The user accepts the license agreement when opening the Microsoft Word document, thereby allowing Emotet macros to run.
3. The macro runs encoded code inside the document using the terminal (cmd.exe) in the background.
4. Command Prompt launches to connect malicious Emotet sites.
5. The malicious sites drop payloads onto the target's machine.
6. It installs Trojan modules like Trickbot, IceDiD on target machine, allowing it to steal users' financial and confidential information.
7. C2C (command and control) connection is used by Emotet to send stolen information to attacker.

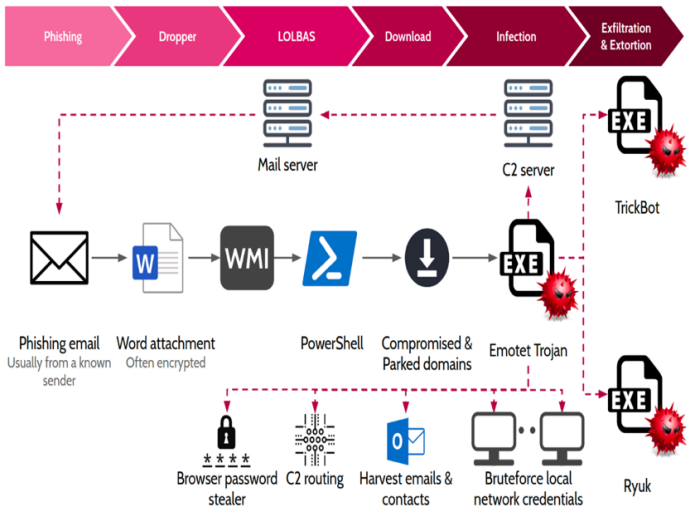
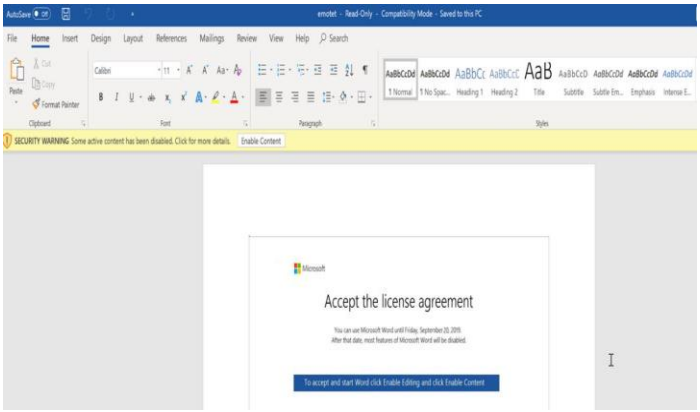


Fig-2: Emotet's method of attack

Initial infection: Emotet infects a system through a spam email that contains a malicious attachment or a link to an infected website. The email is usually designed to look legitimate and convincing, encouraging the user to click on link or open the attachment.



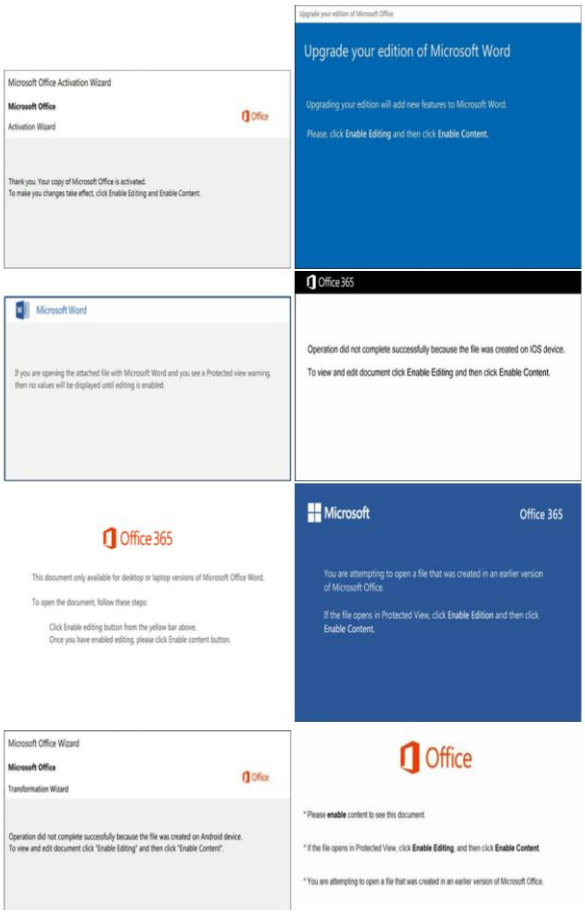


Fig-3: Macros embedded in Word Document with potential Emotet.

Malware installation: Once Emotet is downloaded onto a system, it starts to install itself and establish persistence by modifying the registry and creating new services or tasks. This makes it difficult for antivirus software to detect and remove malware.

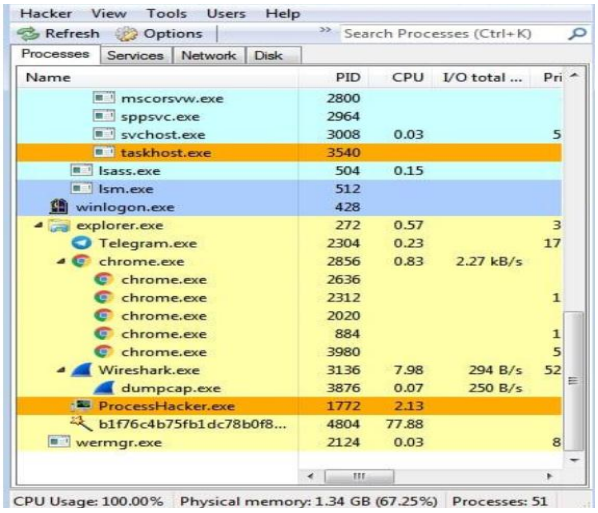


Fig-4: Malware infestation with Emotet

Network propagation: Emotet is designed to spread itself to other systems on the same network by using a variety of techniques such as brute-forcing passwords, exploiting vulnerabilities, and using stolen credentials. This allows Emotet to quickly infect multiple systems within an organization, making it more difficult to contain.

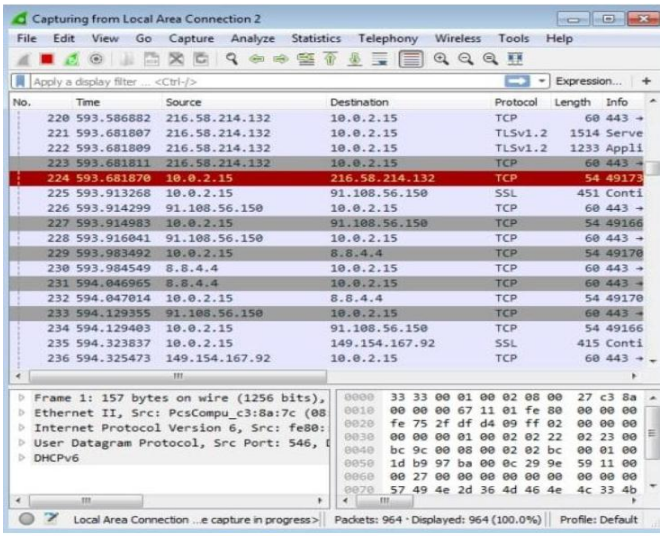


Fig-5: Network Propagation of Emotet

Information stealing: Emotet is primarily designed to steal sensitive information from infected systems. It uses keylogging and web injection techniques to capture and exfiltrate data such as email credentials, banking information, and other personal information. Emotet can also steal information by intercepting network traffic and searching for sensitive data.

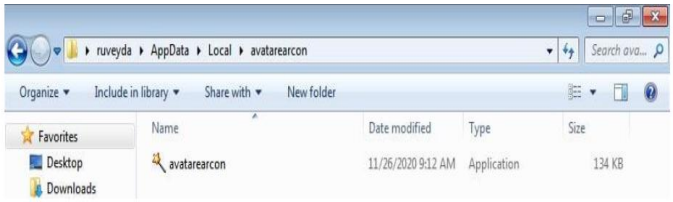


Fig-6: Directory that Emotet cloned into.

Delivery of other malware: Once Emotet has established a foothold on a system, it can be used to deliver other types of malware such as ransomware or banking Trojans. Emotet can also be used to distribute spam emails and phishing attacks, allowing attackers to spread their reach and target more victims.

Fig-7: Files created and multiplied by Emotet.

Command and control communication: Emotet communicates with remote command-and-control servers to receive commands and update itself with new capabilities. This allows attackers to control the malware and carry out further attacks as needed.

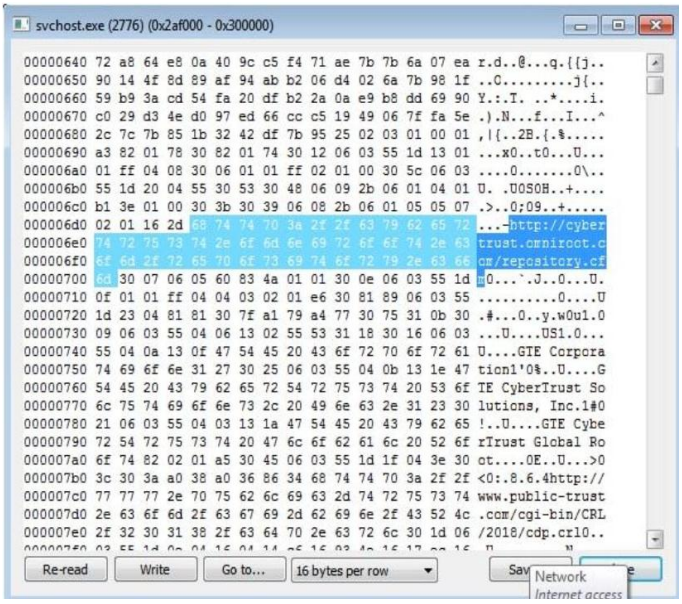


Fig-8: Emotet has been executed and ASCII Codes appear here.

Evasion techniques: Emotet is designed to evade detection and avoid removal by using a variety of techniques such as obfuscation, anti-analysis techniques, and code injection.

In conclusion, Emotet is a highly advanced and persistent piece of malware that employs a variety of techniques to infiltrate computer systems, steal information, and propagate to other devices. It poses a serious danger to computer systems and networks due to its capacity for continuous evolution and collaboration with other malware.

3.2. Prevention Strategies

The malware known as Emotet is very cunning and changes all the time to attempt to evade the measures taken to stop it. As a result, there isn't a single method to stop it from contaminating your computer or your company. Instead, you need to attempt to stop it in a variety of ways.

For instance, you can instruct users on how to spot suspicious emails, use virus-checking software, frequently update computer programs, use filters to block spam emails, restrict what users can do on their computers, regularly make backup copies of crucial files, and require users to log in with two different methods. All of these measures can lessen the likelihood that Emotet will infect your company, but since Emotet is constantly evolving, you must continue to update and review them.

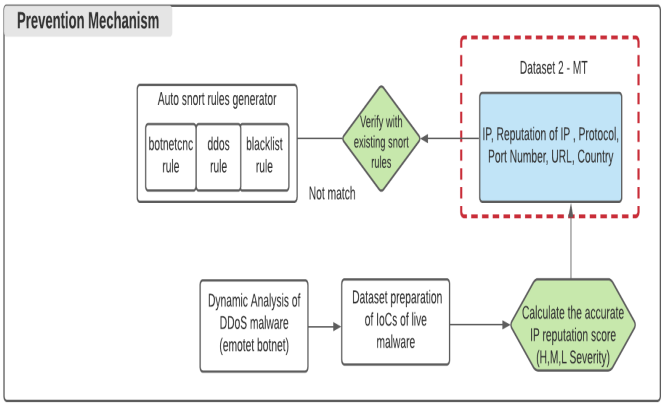


Fig-9: Emotet detection flow

To stop the spread of Emotet infection:

- Identify the infected system using Indicators of Compromise (IOCs) and isolate it.
- Identify the persistence of Emotet in Services, Scheduled Tasks, and Registry entries.
- Block Server Message Block communications between infected and other computers in the network.
- Reframe it and reset Local and domain credentials, change passwords for apps, and review and remove Emotet Phish emails from the Mail inbox.
- Implement and modify email filter and block policies, and stay away from using the Local Administrator and Domain Administrator accounts to access the compromised system.
- Transfer the infected system to a different VLAN to eliminate all artifacts while repairing the system.
- Educate employees on SSAs regarding Social Engineering and Phishing attacks.
- Warn staff members not to follow phishing links or open phishing attachments and not to share personal information, passwords, and usernames.
- Use GPO setup on Windows firewall rules to prevent client systems from sending inbound SMB communications.
- Implement a firewall and email policies to block, detect, and prevent malicious IP addresses and suspicious emails.
- Implement a least privilege policy that limits the amount of access that employees need to complete a particular task.
- Use DMARC to improve validation and lessen spam emails.
- Use designated administrators to restrict the no. of employees who have access to admin details.
- Establish two-factor authentication (2FA) for systems and apps to prevent unauthorized access.

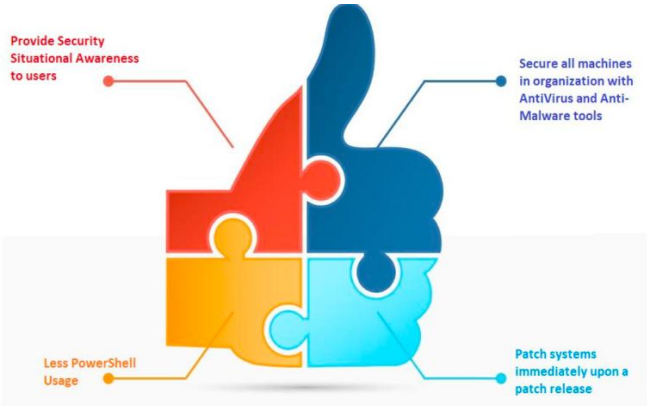


Fig-10: Emotet prevention best practices

4. RESULTS

In order to penetrate computer systems, the Emotet malware uses social engineering strategies like spear phishing links and attachments. A phishing email that appears to be from a reliable source but may have been compromised is what begins the infection process. Emotet dropper is unknowingly downloaded once the recipient taps on the malicious link or opens the attachment. The Emotet executable is launched by the dropper's malicious macro, enabling it to create a C2C link and extract data. Using this method, spam emails can be sent from compromised accounts and distant email service providers.

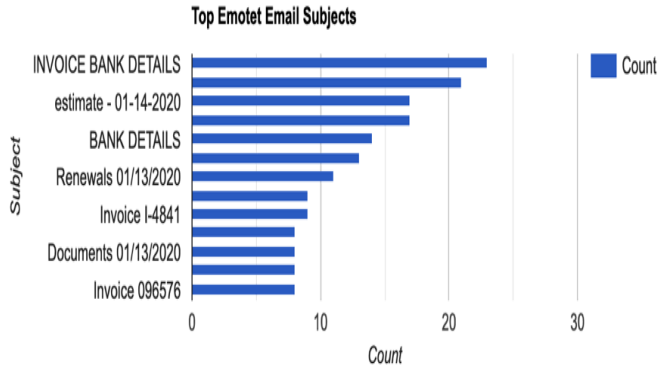


Fig-11: Email Subjects of Emotet.

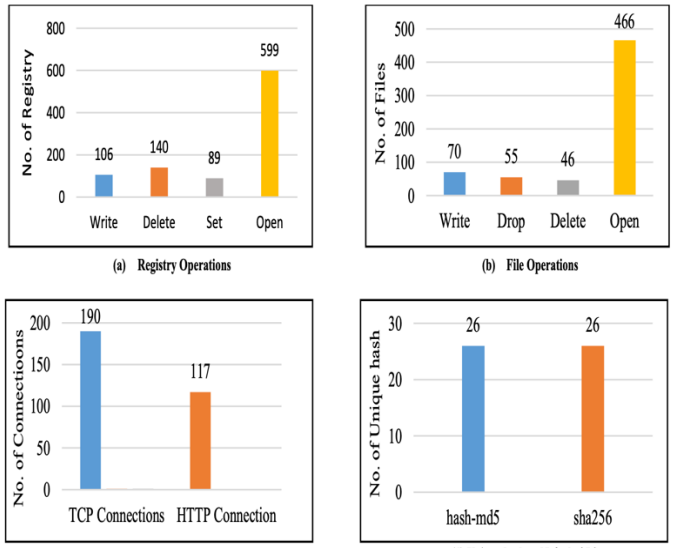


Fig-12: Emotet's Indicators of Compromise.

According to data research, Emotet malware is unfamiliar to most consumers. The job of identifying and preventing Emotet malware infections falls to organizations, but due to the malware's numerous variants, this can be difficult. It can be challenging to stop users from clicking on phishing links and files even with cybersecurity training.

Implementing host-based intrusion protection systems and group policy settings that limit server message protocol (SMB) communications in a network are crucial for thwarting Emotet malware. SMB is a protocol that facilitates contact between devices and networks, but if Emotet is successful in breaching the SMB, it has the ability to infect entire domains, including clients and servers.

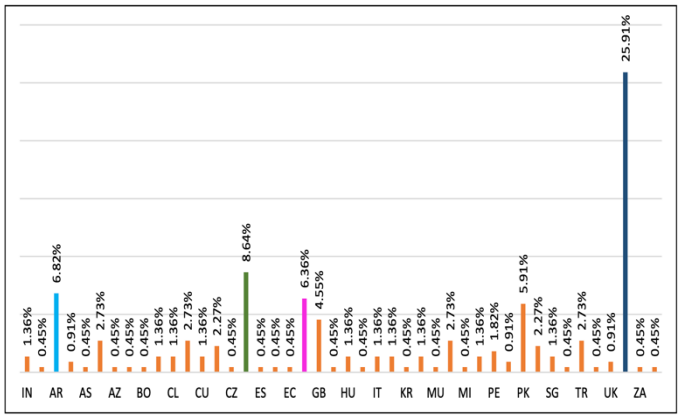


Fig-13: Country-wise No. of unique TCP connections initiated by Emotet

To sum up, more study is required to create practical strategies for lowering the risk posed by Emotet malware and protecting devices from it.

5. CONCLUSIONS

Due to its numerous variations and difficulty in detection, the Emotet virus is posing issues for numerous users and businesses. It becomes more difficult for people to get clear of it with each new version. The malware distributes to a person's devices the moment they click on a link or open an attachment. People, organisations should avoid opening suspicious emails, and staff members should be instructed not to rely on phishing links or documents in order to stop Emotet from infecting devices. In addition to outlining the value of Security Situational Awareness (SSA), the document provides tips on preventing Emotet infections. One important piece of advice is to keep an eye out for Emotet infections during SMB communications between client systems and to limit these communications by configuring Host-IPS or using group policy. This document offers advice on how to protect yourself from the Emotet malware in general.

REFERENCES

[1]. Niu, W., Li, T., Zhang, X., Hu, T., Jiang, T., & Wu, H. (2019). Using XGBoost to Discover Infected Hosts Based on HTTP Traffic. *Security and Communication Networks*, *2019*.

[2]. Ceschin, F., Botacin, M., Gomes, H. M., Oliveira, L. S., &Grégio, A. (2019, November). Shallow security: On the

creation of adversarial variants to evade machine learning-based malware detectors. In Proceedings of the 3rd Reversing and Offensive-oriented Trends Symposium (pp. 1-9).

[3]. Bhardwaj, A., & Goundar, S. (2019). A framework for effective threat hunting. Network Security, 2019(6), 15-19. doi:10.1016/s1353 4858(19)30074-1.

[4]. Azab, A., Layton, R., Alazab, M., & Oliver, J. (2014). Mining malware to detect variants. 2014 Fifth Cybercrime and Trustworthy Computing Conference. doi:10.1109/ctc.2014.11.

[5]. Threat Advisory. (2019). The evolution of Emotet: From banking Trojan to threat distributor. https://www.symantec.com/blogs/threat-intelligence/evolution-emotet-trojan-distributor.

[6]. Pektaş, A., & Acarman, T. (2018). Malware classification based on API calls and behavior analysis. IET Information Security, 12(2), 107-117. doi:10.1049/iet-ifs.2017.0430.

[7]. Soomro, T. R., & Hussain, M. (2019). Social Media-Related Cybercrimes and Techniques for Their Prevention. Applied Computer Systems, *24*(1), 9-17. [8]. Alert (TA18-201A) Emotet Malware. (July 20, 2018). Retrieved from https://www.us-cert.gov/ncas/alerts/TA18-201A**.**

[9]. Emotet: Nastier Than WannaCry and Harder to Stop. (Feb 2010). A Sophos Whitepaper Retrieved from https://i.crn.com/sites/default/files/ckfinderimages/userfiles/images/crn/custom/2019/Sophos_LC_Q219_emotet - nastier-than-wannacry-wp.PDF.

[10]. Littlefield (May 31, 2019). Three's a crowd: New Trickbot, Emotet & Ryuk Ransomware. Mediumhttps://littlefield.co/threes-a-crowd- new-trickbot-emotet-ryuk-ransomware-16d1e25f72f4.

[11]. Alexey Shulmin (Apr 9, 2015). The Banking Trojan Emotet: Detailed Analysis. Secure list. https://securelist.com/the-banking-trojan-Emotet-detailed-analysis/69560.

[12]. Cybereason Nocturnus (Apr 2, 2019). Triple Threat: Emotet Deploys Trickbot to Steal Data & Spread RYUK. Cybereason. https://www.cybereason.com/blog/triple-threat-emotet-deploys-trickbot-to-steal-data-spread-ryuk-ransomware.

[13]. ESET Research (Nov 9, 2018). Emotet Launches Major new Spam Campaign. Welivesecurity. https://www.welivesecurity.com/2018/11/09/emotet-launches-major-new-spam-campaign/

[14]. ASEC Report. Emotet Returns to Prey on Banking Information (2017).