ICACRS

3rd International Conference on Automation, Computing and Renewable Systems

ICACRS - 2024

4-6, December 2024 | Pudukkottai, India

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Department of ECE
Mount Zion College of Engineering and Technology
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Message from the Chairperson

Greetings!

It is a dream come true as Mount Zion College of Engineering and Technology convenes the Third IEEE International Conference on Automation, Computing and Renewable Systems from 04th to 06th December 2024 at MZCET. The IEEE Student Branch of MZCET and the department of Electronics and Communication Engineering have strived hard to conduct this remarkable event. The theme of this conference encompasses the fields of electronics, computer science and electrical engineering, which is praiseworthy. It is a great pleasure to note that the resource persons for this conference hail from overseas countries and reputed universities. Let me pray and wish the conference a grand success and God's abundant blessings!

Mrs. Florence Jayabarathan,
Chairperson,
Mount Zion College of Engineering and Technology,
Pudukkottai, Tamil Nadu, India.

Message from the Director

Greetings!

On the eve of 2024, the IEEE Student Branch of MZCET & the department of Electronics and Communication Engineering have convened the Third IEEE International Conference in the MZCET campus. It is a memorable milestone to cherish and opens the vistas of Automation, Computing and Renewable Systems. I congratulate the conference team who have burnt their midnight oil in arranging this great event at MZCET. It is remarkable to note that resource persons from foreign countries and high-ranking universities are our chief guests and guest of honour at this memorable conference.

I wish and pray that this conference proceeding would remain imprinted in the minds of the delegates and let me wish the conference all the best!

Dr. Jayson K. Jayabarathan,
Director,
Mount Zion College of Engineering and Technology,
Pudukkottai, Tamil Nadu, India.

Message from the Academic Co-ordinator

Greetings!

Indeed, I am delighted to note that the IEEE Student Branch of MZCET and the department of Electronics and Communication Engineering have organized the Third IEEE International Conference in MZCET. The conference theme fits nicely to update the knowledge in the areas of automation, computing and renewable systems. I am sure that this conference event would be an eye-opener for the delegates to gather up-to-date knowledge and extend their vision to greater heights. I wish the conference a grand success and God's blessing.

Mrs. Vivian Rachel Jayson,
Academic Coordinator,
Mount Zion College of Engineering and Technology,
Pudukkottai, Tamil Nadu, India.

Message from the Conference Chair

Greetings!

I deem it a pleasure to pen a few lines wishing the Third IEEE International Conference on Automation, Computing and Renewable Systems a grand success. IEEE Student Branch of MZCET & the department of Electronics and Communication Engineering, MZCET have taken great pains to convene this memorable conference in a very grand manner. I congratulate them for their efforts in organizing this international conference event. It is a great pleasure to note that resource persons from overseas countries and professors of international repute are delivering special lectures in this remarkable event.

Once again, let me wish the conference a grand success and this event will add one more feather to the crown of MZCET.

Dr. Balamurugan P,
Principal,
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Enhanced Alert Generation System with Attacker IP for DoS Attacks

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***Abstract*—** The denial of service (DoS) attack carries a significant risk to network security as they can cause major disruptions and financial losses by flooding a network with excessive data. Different approaches can be utilized to carry out these attacks from basic flooding to more complex, distributed methods, and they can target multiple network layers, taking advantage of vulnerabilities to maximize damage. Complex attacks may be difficult for standard detection techniques, which depend on fixed limits, to identify since attackers frequently alter how they overcome fixed defences. Additionally, these techniques may produce false positives, which would result in useless alerts and resource usage. To overcome these obstacles, we have created an improved DoS detection system that uses Pyshark for in-depth packet analysis to keep track of network traffic in real-time. To provide essential data for an immediate reaction, the system observes the attacker's IP address and dynamically modifies its thresholds in response to traffic patterns. Real-time notifications via email containing the attacker's IP address and packet count are provided in the context of a threat detection, allowing for immediate reaction. This method strengthens network security by providing a more effective and rapid protection responses to attacks known as denial-of-service (DoS).

***Keywords*—** DoS attacks, network security, real-time monitoring, packet analysis, Pyshark, attacker IP tracking, network traffic analysis.

I. Introduction

In modern times, network security is a top priority for both users and companies. As our dependency on the internet increases, so does the risk of various cyber threats. Denial of Service (DoS) attacks are particularly dangerous because they can disrupt critical services, result in significant financial losses, and cause long-term reputational damage [14,19]. Preventing these attacks is essential to maintaining service availability and ensuring operational continuity. Common preventive strategies include IP blocking, rate limiting, and anomaly detection—methods that allow systems to filter malicious traffic, reduce the impact of abnormal network behavior, and safeguard against potential threats. A DoS attack typically operates by overwhelming a network with an excessive volume of traffic, rendering it unable to respond to legitimate requests [18].

Traditional DoS detection systems, which rely on predefined thresholds and static rules, are effective at detecting basic attacks but struggle with more complex ones [10]. Attackers are increasingly capable of modifying the strength and patterns of their traffic, making it challenging for these conventional systems to detect and respond to dynamic threats [20]. This limitation highlights the need for a more adaptive and intelligent approach to DoS detection [16].

To address these challenges, an improved DoS detection system has been developed that incorporates dynamic threshold adjustments and real-time network traffic monitoring [12]. This system utilizes Pyshark for accurate packet analysis, allowing for the precise detection of potential threats. By continuously monitoring network traffic, the system can adapt to changing conditions and identify potential attacks more effectively [21,24].

In addition to threat detection, the system is designed to monitor the IP addresses of potential attackers. Upon detecting a potential DoS attack, it promptly sends alerts via email, providing critical details such as the attacker's IP address and the number of packets involved [28]. This real-time communication enables network administrators to respond swiftly, minimizing the impact of the attack and ensuring a robust defense against the increasing risk of DoS attacks.

II. Literature Survey

Denial of Service (DoS) attacks utilize various methods to overwhelm a system or network, causing service disruptions. Several detection techniques have been developed to mitigate

these attacks. Packet analysis and anomaly detection are among the most researched approaches, focusing on identifying unusual traffic patterns that signal a potential DoS attack [26]. Below, we summarize different types of DoS attacks, and the detection methods explored in the existing literature.

A. Anomaly Detection Techniques

1. ***KNN-Based DoS Detection*:** The application of K-Nearest Neighbors (KNN) algorithms for detecting DoS attacks over IPv6 networks is examined, showing that classification models can effectively identify attack patterns and protect modern network architectures [1].
2. ***LAN-Based DDoS Detection*:** Approaches for detecting and preventing Distributed Denial of Service (DDoS) assaults on local Area Networks (LAN) are explored, focusing on real-time analysis and rapid response mechanisms to minimize disruption [4].
3. ***DoS in Control Systems*:** Various attack models in control systems are analyzed, offering insight into how DoS attacks compromise system stability and outlining security measures to counteract these threats [5,7].

B. Machine Learning-Based Detection Techniques

1. ***Cyber-Physical DoS Attack Prevention*:** Distributed state estimation techniques and active security controls are discussed as methods for countering DoS attacks in cyber-physical systems, ensuring reliable operation [11, 15].
2. ***DoS Detection in IoT Systems*:** Machine learning in Internet of Things (IoT) systems for DoS detection is explored, where algorithms analyze traffic to detect patterns associated with attacks and mitigate threats effectively [6, 8].

C. Network Structure-Based Detection Techniques

1. ***Application Layer DoS Attacks*:** Various attack strategies at the application layer are reviewed, along with defense mechanisms that can be implemented to safeguard against service interruptions [9].
2. ***DoS Attack in Smart Grids*:** Research explains the Challenges in identifying and preventing DoS attacks.in smart grids, emphasizing the importance of maintaining communication integrity in critical infrastructure [13, 27, 30].
3. ***SDN DoS Detection*:** The separation of the control and data planes in Software-Defined Networks (SDN) allows for enhanced traffic management, which is critical for Real-time detection and mitigation of DoS attacks [2, 3].

III. Existing Systems

Current systems for Denial of Service (DoS) attack detection and mitigation methods commonly employ signature-based, anomaly-based, and machine learning-driven detection techniques. Signature-based systems focus on recognizing well-known attack patterns, but they frequently have trouble spotting more recent or advanced DoS threats. that may employ unconventional strategies to evade detection.

Anomaly-based detection methods monitor network traffic to identify deviations from normal behaviour. While these systems can adapt to novel attack patterns, they frequently face challenges with high false positive rates, resulting in legitimate traffic being misclassified as malicious. This misclassification can lead to operational disruptions and hinder network performance.

Machine learning-based detection systems have emerged as a more advanced solution, capable of analyzing and classifying traffic patterns in real time. However, these systems typically require significant processing power and large training datasets, which makes them less practical for real-time applications across all contexts.

Despite their strengths, existing systems often lack comprehensive alerting mechanisms and the capability to trace the real-time IP address of the attacker. As a result, notifications could not reach network administrators in a timely manner. about ongoing attacks, which can impede effective response and remediation efforts.

Moreover, current systems face scalability issues as online activity volumes increase, leading to slower detection times and a higher likelihood of missed threats. They also struggle with processing complex data relationships or non-linear patterns, which limits their effectiveness against sophisticated DoS attacks. Existing methods often achieve accuracy percentages ranging from 85% to 92%. However, they frequently encounter high false positive rates and prolonged update cycles, which reduce their overall effectiveness against evolving DoS tactics. The inability to provide timely alerts further hampers network administrators' capacity to respond to emerging threats in a proactive manner.

IV. Proposed Methodology

The proposed strategy introduces a comprehensive framework aimed at enhancing the identification and prevention of Denial of Service (DoS) attacks. by leveraging Python and Pyshark. While existing literature has developed various approaches for handling DoS attacks in complex network environments like IPv6 and Software-Defined Networks (SDN), our approach builds upon these by providing a distributed and reliable detection system that specifically addresses key limitations in traditional methods. By integrating Python's flexibility with Pyshark packet analysis capabilities, Real-time observation is made possible by the system's design of network traffic, facilitating immediate alerts upon detecting suspicious activity. Furthermore, the dynamic tracking of intruder IP addresses offers significant advancement over previous approaches that relied on static entries or manual configurations.

The proposed system is designed with a focus on **continuous network monitoring** to ensure real-time detection and alerting of DoS attacks. By utilizing Pyshark for packet capture, the system monitors network traffic constantly, allowing it to identify abnormal activity as it occurs.

Pyshark is utilized in conjunction with Python to develop a robust packet capture and analysis system. The system is programmed to filter network packets and flag anomalous traffic patterns that align with typical DoS attack behaviours.

The project setup involves providing a secure virtual framework to defend the host machine during testing. Virtualization technologies such as VMware are used to establish three virtual machines (VMs) that mimic a real-world network setup. These VMs include a Windows machine as the target, a Kali Linux machine simulating the attacker, and an Ubuntu machine serving as the network monitoring system. This virtualized lab allows for thorough and safe experimentation without risking actual network infrastructure.

4.1 Code Execution: The process involves executing the developed Python script within a controlled virtual environment, allowing for ongoing, real-time network traffic monitoring. This script captures additionally analyses the network data, extracting the necessary parameters for efficient identification of DoS (denial of service) assaults.

4.*2.* Detecting DoS Attack: The detection of DOS attack is a critical component of the system. With the use of a Python script's real-time packet analysis features, network traffic is carefully inspected for indications of possible DoS activity. The system identifies suspicious patterns, such as sudden spikes in packet volume or repeated requests from a single IP address, triggering an alert to notify of the potential threat.

4.3 Tracing the attacker's IP address: In this stage, the alarm message is generated, and the attacker's IP address is recorded. The Python script developed during the earlier phase tracks the source of the Denial of Service (DoS) assault to determine the attacker's IP address, providing critical information for further analysis and response**.**

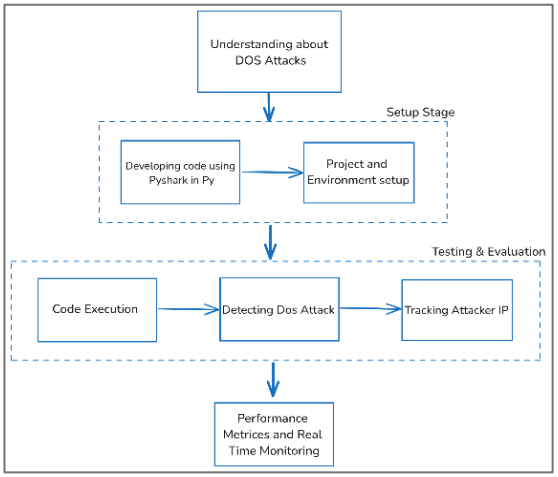

FIG 1. The Proposed System for Dos Attacks Alert Generation System

Fig.1 The diagram demonstrates the structure of the proposed system, focusing on how it detects and generates alerts for DoS attacks detection using Pyshark in Python. It begins with understanding DoS attacks, followed by the setup stage, which involves developing the code and configuring the project environment. The next phase is testing and evaluation, including code execution, detecting DoS attacks, and tracking the attacker's IP. Finally, the process concludes with real-time monitoring to assess the system's capability.

The proposed system employs **real-time IP tracking** through Pyshark for effective DoS attack detection. By capturing and analyzing packets continuously, it identifies suspicious IP addresses in real time, promptly alerting administrators with details like the attacker's IP, packets per second, and detection time. This immediate alerting allows quick actions to mitigate potential service disruptions.

V. EXPERIMENTAL RESULTS

The Experimental setup comprises three virtual machines: Kali Linux that imitate attacks, Windows to act as the victim, and Ubuntu to monitor the network. Ubuntu powers the detection system, and in this virtual lab, controlled studies assess how well the system recognizes and handles denial-of-service (DoS) threats. This setup provides a controlled platform to assess the robustness of the proposed solution.

TESTING: Validating is a crucial phase, particularly when integrating security features like DOS attack Identification technique. here is an organized approach for conducting thorough testing

Step 1: Launch VMware and begin the Ubuntu boot process.
Step 2: Create the Python script and store it to the Ubuntu network monitoring system.
Step 3: Use the command to monitor network traffic by running the script with root capabilities.
Step 4: Launch a terminal with enhanced sudo privileges on Kali Linux, the attacker's computer.
Step 5: Use hping3 or similar tool built for DoS attacks to start a DoS attack against the Windows target.
. as shown in Fig 2.

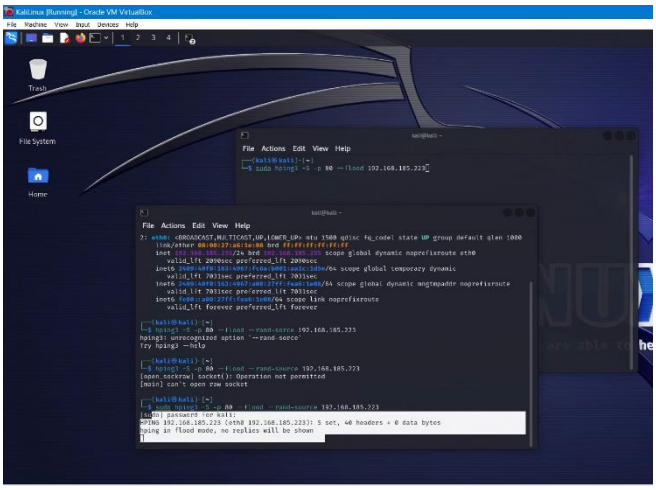

FIG 2: Using hping3 on Kali Linux

Step 6: Send a flood of packets to the victim machine (Windows) using hping3, targeting a specific port (e.g., port 80) to simulate the DoS attack.as shown in Fig 3.

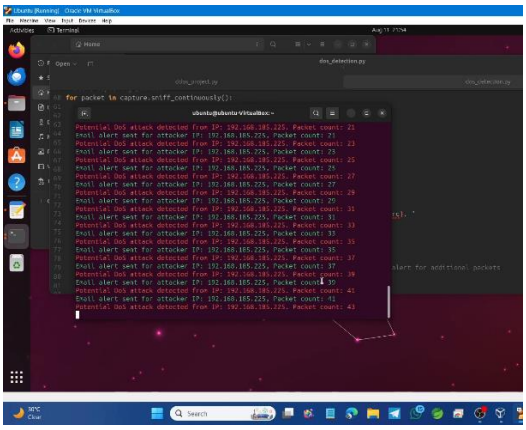

FIG.3: Identifying the Intruder IP in the Ubuntu terminal

Step 7: We continuously monitor Denial of Service (DoS) detection alerts within the Ubuntu terminal, which facilitates the determination of the IP address of the attacker. The output results not only reveal the attacker's IP but also confirm the detection of a potential DoS attack by the mechanism as depicted in Fig.4

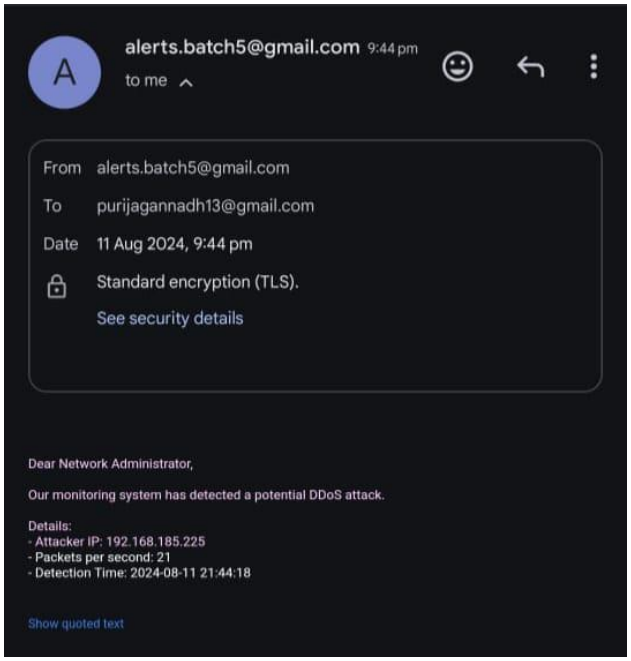

Fig.4 Monitoring system has detected a potential DOS attack with attacker IP address

Test results indicate that the system's continuous tracking mechanism provides timely notifications with a high level of accuracy. Administrators receive instant alerts, complete with the attacker's IP and packet rate. This continuous monitoring and immediate alerting significantly enhance the system's performance in maintaining network stability during an attack.

VI. METRICS OF EVALUATION &PERFORMANCE

Assessing this study's efficacy and efficiency is essential to determining its dependability in practical applications. The ratio of successfully discovered DoS incidents to the total number of attack attempts is defined as detection reliability, serving as a measure of the system's capability to accurately identify such threats. Results are validated by testing the system in a Virtual network setup, focusing on its accuracy and speed in detecting attacks. This confirms its effectiveness in real-time situations.

Additionally, detection time refers to the duration it takes for the system to recognize a DoS attack as a threat after its initiation; shorter detection times indicate enhanced response capabilities. Performance is enhanced by optimizing packet processing to reduce false alerts and resource usage, improving detection speed and accuracy.The system is also designed to generate real-time alerts, enabling immediate action to be taken in response to detected threats. Furthermore, the system's impact on network resources, including CPU and memory utilization, is evaluated to ensure that it operates smoothly without overloading the network.

TABLE I: Comparative Analysis Between Existing Systems and Proposed System

FEATURE	EXISTING SYSTEM	PROPOSED SYSTEM
Accuracy	93%	95%
True Positive	78	88
False Positive Rate	10%	7%
False Negative Rate	7%	5%
CPU	20%	16%

Table2: The proposed system offers significant improvements over the existing system with a higher accuracy rate of 95% compared to 93%. It reduces the False Positive Rate from 10% to 7% and False Negative Rate from 7% to 5%, ensuring more reliable detection

TABLE II: Proposed analysis of the Attacker IP Capturing

Metrices	Calculations
True Positives	38
True Negatives	0
False Positives	1

False Negatives	1
Detection Accuracy (TP+TN/TI)x100	94%
Detection Response	Instantly
Attacker IP Capturing Rate (Total Captured/TI)	96%
CPU Utilization	12%
Memory Utilization	28.10%

The Table 2 presents key performance metrics for the DoS attack detection system. With a detection accuracy of 94%, the system promptly responds to attacks while capturing attacker IPs at a 96% rate

CONCLUSION

The Evolution and implementation of the Enhanced DoS Detection with Attacker IP Tracking system yielded positive results in improving network security. Through exhaustive testing and evaluation, the system exhibited reliable detection of DoS attacks by accurately recognizing and tracking abnormal traffic patterns. The functionality to obtain the attacker's IP address, along with provision of real-time alerts, supplies network administrators with crucial information and facilitates rapid responses to emerging threats Moreover, guaranteeing that network performance was unaffected the Enhanced DoS Detection with Attacker IP Tracking system has the potential to evolve into an even more effective and adaptable solution for protecting network security and integrity against the increasing situation of cyber attacks.

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