IP Shuffle:
Random IP Address Assignment for Network Interfaces

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Abstract

This paper presents a Bash script that assigns random IP addresses to network interfaces. The script generates random IP addresses within specified ranges and validates their availability and compatibility within the network gatway. It ensures efficient and reliable IP address assignment through functions for IP addresses generation, availability checking, network configuration validation, and gateway reachability verification. The ip-shuffle script offers a practical solution for scenarios requiring dynamic IP address allocation, contributing to streamlined network management processes. The script's validity is enhanced by its error handling and support for Linux.

1 Introduction

The MTD technique that were working towards is IP shuffling, to make lateral movement reconnaissance much more difficult. This strategy involves the dynamic changing of IP addresses of systems on a network. In our model, we have a private subnet containing 3 virtual machines. These machines perform IP address rotation, executing erratic or periodic shifts across a 254 different IP addresses. Furthermore, our diagram illustrates an instance where one of these computers, denoted as Computer 1, has been compromised. By continuously changing IP addresses in an unpredictable manner, IP shuffling impedes the reconnaissance efforts of attackers, making it difficult for them to pinpoint and exploit vulnerabilities. The diagram delineates the intricate architecture of our network infrastructure, illustrating the hierarchical arrangement of networks, subnets, and their corresponding topological relationships. Within this schematic representation, the affected computer is depicted, providing a visual reference to its position within the broader network.

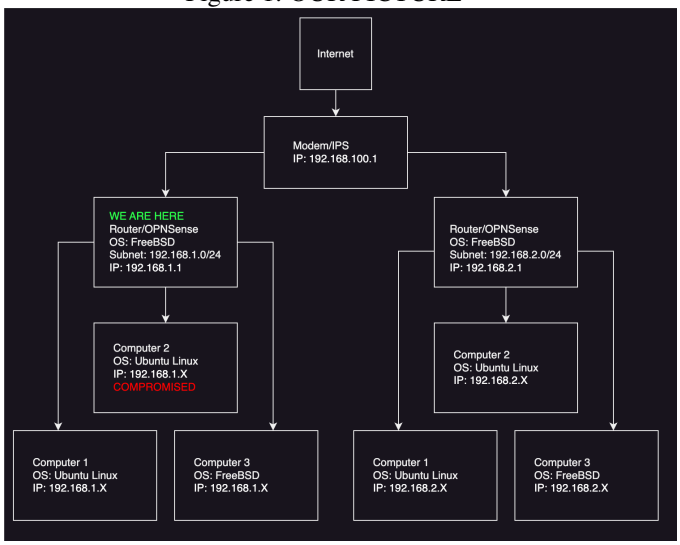
2 Threat Background

In the realm of network security, the concept of Moving Target (MT) techniques has gained significant traction. These techniques operate across various facets of computer systems with the aim of altering elements susceptible to exploitation by potential attackers. When considering the application of MT techniques within network defense strategies, dynamic IP address assignment, as employed in IP shuffling, emerges as a prominent example. By dynamically changing IP addresses, network interfaces can effectively obscure targets from potential attackers, making it more challenging for them to identify and exploit vulnerabilities. This proactive approach aligns with the broader goals of MT techniques, which prioritize enhancing system resilience against cyber threats. Notably, while certain MT techniques like Address Space Layout Randomization (ASLR) have achieved widespread adoption in modern operating systems, the implementation of IP shuffling represents an additional layer of defense that can complement existing security measures. Through the adoption of IP shuffling and other MT techniques, organizations can strengthen their overall security posture and mitigate the impact of cyber threats. For instance the practice of dynamically changing IP addresses, randomizing memory layouts, and employing temporary encryption for memory contents fall within the spectrum of MT techniques [2].

3 System Design

The ip-shuffle script embodies a systematic approach to dynamic IP address assignment for network interfaces in Linux and FreeBSD environments. Leveraging Bash scripting at its core, the script orchestrates the IP address allocation process seamlessly. Upon execution, the program runs every 3 minutes unless the user wants a different runtime, the script dynamically configures essential network parameters including the gateway, base IP, IP range, and network interface details, providing a flexible framework for network configuration. Through the utilization of dedicated functions such as

Figure 1: OUR PICTURE




```
 generate_random_ip (),
check_ip_availability(),
and validate_network_config(),
```

the script ensures the integrity and compatibility of the assigned IP addresses with the network infrastructure. Furthermore, the incorporation of error trapping mechanisms and support for common Unix signals enhances the script's reliability and r esilience during execution, safeguarding against potential errors or interruptions. By adhering to modular design principles, the script maintains flexibility and extensibility, allowing for seamless adaptation to diverse network configurations and environments. In essence, the ip-shuffle script encapsulates a robust solution for automating network interface configuration tasks, embodying a sophisticated yet accessible approach to dynamic IP address management.

4 Evaluation

This is our evaluation.

5 Conclusion

MTD is proposed as one of the "game-changing" themes in cyber security. Its vision is described as follows: create, evaluate, and deploy mechanisms and strategies which are diverse, continually shifting and change over time to increase complexity and costs for attackers, limit the exposure of vulnerabilites and opportunities for attack, and increase system resiliency [1]. IT WORKED!!! The ip-shuffle script presents a robust solution for dynamically allocating random IP addresses to network interfaces, a critical element of network security strategies aimed at deterring potential attackers. Through the use of Bash scripting, it provides functionalities for generating IP addresses, checking availability, and validating network configurations, ensuring efficient and reliable IP address assignment. Its error handling capabilities and responsiveness to Unix signals improve reliability during execution, strengthening network resilience against errors or disruptions. Additionally, its modular design allows for easy adaptation to different network setups and environments, making it a valuable tool for automating tasks related to network interface configuration. Moreover, ip-shuffle embodies the concept of IP shuffling, a technique designed to complicate attackers' reconnaissance efforts by constantly changing IP addresses in an unpredictable manner. By assigning random IP addresses dynamically, ip-shuffle contributes to organizations' proactive defense stance, increasing the difficulty for attackers to identify and exploit vulnerabilities. In essence, ip-shuffle represents a sophisticated yet user-friendly approach to managing dynamic IP addresses, empowering organizations to enhance their overall security posture and mitigate the impact of cyber threats.

References

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[2] Hamed Okhravi, Thomas Hobson, David Bigelow, and William Streilein. Finding focus in the blur of moving-target techniques. *IEEE Security & Privacy*, 12(2):16–26, 2013.