

Computer Networks Assignment

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1 Introduction

This report explores critical aspects of modern networking, focusing on Network Address Translation (NAT), the challenges of IPv4 address exhaustion, and the comparison between IPv4 and IPv6 protocols.

2 Questions and Answers

2.1 Importance of NAT (Network Address Translation)

Network Address Translation (NAT) plays a crucial role in modern networking. Let's delve into its importance and functionalities.

2.1.1 Functions of NAT

NAT enables private IP addresses to be translated into public IP addresses, allowing multiple devices within a local network to share a single public IP address for internet access. This process enhances network security by masking internal IP addresses from external networks, thereby reducing the risk of direct attacks.

2.2 Why IPv4 Addresses Were Not Enough?

The adoption and growth of the internet led to the exhaustion of IPv4 addresses. Let's analyze the reasons behind this challenge.

2.2.1 Factors Contributing to IPv4 Address Exhaustion

IPv4 addresses are limited to a 32-bit address space, allowing approximately 4.3 billion unique addresses. The rapid proliferation of internet-connected devices, including smartphones, IoT devices, and computers, has outpaced the availability of IPv4 addresses. Additionally, inefficient address allocation and the need for larger address blocks have further exacerbated the exhaustion issue.

2.3 IPv4 vs IPv6: A Comparison

IPv6 was developed as a successor to IPv4. Let's compare these two protocols based on their features and capabilities.

2.3.1 Key Differences between IPv4 and IPv6

IPv4	IPv6
Uses 32-bit addresses, allowing approximately 4.3 billion unique addresses.	Uses 128-bit addresses, providing an exponentially larger address space (over 340 undecillion addresses).
IPv4 addresses are classified into classes (A, B, C) and use NAT for address conservation.	IPv6 addresses are hexadecimal and use hierarchical addressing and subnetting for efficient address allocation.
IPv4 does not natively support auto-configuration and requires DHCP for address assignment.	IPv6 supports stateless address auto-configuration (SLAAC) and DHCPv6 for dynamic address allocation.
Network security relies on NAT and additional security measures.	IPv6 integrates IPsec (Internet Protocol Security) for end-to-end security and authenticates and encrypts data packets.

3 Conclusion

This assignment highlighted the significance of NAT in network security and efficiency, the reasons behind IPv4 address exhaustion, and the advancements offered by IPv6 over IPv4. Understanding these concepts is essential for addressing current and future challenges in networking infrastructure.