SUNWAY

INT'L BUSINESS SCHOOL

Program Name: Bachelor of Computer Science (HONS)

Course Code: CSC_1612

Course Name: DATA COMMUNICATION AND NETWORKING

Research Paper Summary

Date of Submission: 21st January, 2022

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Semester: Second

Submitted To:

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A Comparative Study on IPv4 and IPv6

Abstract

With the current pace of ICT penetration, more than 50 billion devices will be linked to the internet by 2020, and IPv4 will be unable to provide Internet Protocol (IP) addresses to this rapidly developing networked society. In 2019, IPv6 is expected to replace IPv4 and become the mainstream Internet protocol. This article compares IPv4 and IPv6, as well as the function of IPv6 in the future scenario of a developing connected society.

Introduction

The experimental Internet Stream Protocol was allocated IP version number 5, which was not referred to as IPv5, resulting in a version gap. Almost all of IPv4's useable addresses have already been issued, leaving just about 1.3 billion addresses available for network expansion. Due to the scarcity of public IPv4 addresses, many individuals and organizations are forced to employ Network Address Translation (NAT) to translate a single public address to numerous private ones. Because the experimental Internet Stream Protocol was assigned IP version number 5, which was not referred to as IPv5, there existed a version gap. Almost all usable IPv4 addresses have already been assigned, leaving just roughly 1.3 billion addresses accessible for network growth. Due to the shortage of public IPv4 addresses, many people and businesses are obliged to use Network Address Translation (NAT) to convert a single public address to several private addresses.

IPv6 is a new addressing system that multiplies the amount of network address bits from 32 bits to 128 bits (compared to IPv4). Because route prefixes may be readily aggregated in routing updates, IPv6's wide address space is capable of dealing with global Internet expansion. IP security is built into IPv6, but it is an unwelcome extra in IPv4.

With IPv6, both households and businesses will be issued all-around address prefixes and will be able to connect easily, subject to certain constraints such as firewall clarity and accurate communication. This new address allocation convenience guarantees that address prefixes are distributed worldwide based on constrained connection requirements rather than actual origin. The commercial benefit to enterprises all over the world is that they can postpone accepting available IPv6 address space until their ISP has exhausted the acceptable number of IPv4 accessible address prefixes.

Methodology

Dual Stack, as the name implies, refers to the use of two protocol stacks to facilitate both IPv4 and IPv6 in routers and hosts. Dual Stack Internetworking devices make it easier to handle and forward both sorts of packets. These devices are capable of processing both IPv6 and IPv4 packets. To make packet forwarding decisions, the datagram header is examined. The suitable stack is picked based on DNS address queries and lookups. Dual Stack facilitates and supports communication between similar nodes, allowing for IPv4-to-IPv4 and IPv6-to-IPv6 communication.

Tunneling allows you to wrap one version of IP into another, bridging incompatible networks. Tunneling connects two remote IPv6 networks and allows them to communicate across IPv4 lines, or vice versa. It is one of the simplest ways to switch to IPv6 and does not need hardware upgrades.

The tunnels are classified as follows: 6to4 – According to RFC [3056], 6to4 is automated router-to-router tunneling that uses the IP prefix 2002::/16 to identify a node that implements 6to4. With 6to4, two isolated IPv6 islands are interfaced with one another with low overhead settings and without the need to actively configure tunnels. The isolated IPv6 node is given a prefix of 2002:v4ADDR::/48 with an embedded IPv4 address. (v4ADDR is a router-configured unique IPv4 address.)

Translates are the mechanisms used to transform protocol headers between IPv6 and IPv4 nodes. They can occur at any of the TCP/IP levels, including the Network, Transport, and Application Layers. In contrast to tunneling, translates change or carry conversion of IP packets between IPv6/IPv4, which frequently results in attribute or information loss. Full translation keeps some kind of session or mapping with references to earlier translations. Several translation methods based on SIIT (Stateless IP/ICMP Translation Algorithm) have been proposed. The SIIT algorithm serves as a foundation for methods such as BIS, BIA, and NAT-PT. It has no effect on header checksum values, but it disregards several extension headers and IPv4 choices, resulting in the loss of critical header information.

Results

Dual stacking is the most popular and secure migration approach. 6 to 4 tunneling is useful for transporting IPv6 data over an IPv4 network. Older apps may continue to function while being moved to IPv6, since updated APIs to handle IPv6 addresses and DNS lookups using IPv6 addresses are supported. Dual stacking can take place on the same or distinct device interfaces.

Discussions

IPv6 offers both state-full and stateless address configuration, i.e. address configuration in the presence of a DHCP for IPv6 (DHCPv6) server. There are several ways to run both protocols on a device's interface at the same time, including tunneling IPv6 over IPv4 and vice versa. Cisco employs Network Address Translation-Protocol Translation (NAT-PT) to convert IPv4 to IPv6.

IPv6 is expected to replace IPv4 by 2019, while IP will continue to be the Internet's foundation technology until 2030. Over the period 1997 to 2025, the cost of transitioning to IPv6 in the United States will be roughly $73 billion. China has the best Internet alive installed abject in the world and more users than available IPv4 addresses, with over 200 actor users. In 2007, Australian government prepared its IPv6 implementation strategy for government agencies. The strategy proposed that all government agencies implement IPv6 capable hardware and platforms by 2012 to operate dual-stack IPv4/IPv6 environments by 2015.

Conclusion

As important uses for IPv6 have yet to emerge, IPv6 will be the protocol of Next Generation Networks. With more than US $350 trillion expected to be invested in basic infrastructure over the next 30 years, there is plenty of room for ICT research to contribute to the establishment of a connected society.

Governments and businesses must work together to ensure the success and rapid adoption of IPv6. Migrating to IPV6 requires paying close attention to device capabilities, system design, scalability, administration, and service provider.

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