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Deploying Internet Protocol Version 6 (IPv6) Case Study of Research and Education Network Uganda - RENU

Abstract

Interconnected systems require Internet Protocol (IP) addressing information for communication over the internetwork. There are two versions of IP addressing i.e. IP version 4 (IPv4) and IP version 6 (IPv6). IPv4 is the robust 32-bit long addressing protocol that has been in use in the Transmission Control Protocol /Internet Protocol (TCP/IP) networks since the 1970s. IPv6 is the new 128-bit long version of IP addressing family being deployed, mostly due to the exhaustion of the IPv4 address space.

IPv6 offers new and improved features, for example among others, huge address space. With 128-bits IPv6 offers four times more address bits than IPv4. During design, IPv6 protocols like the Internet Control Message Protocol (ICMP) were improved to support stateful and stateless autoconfiguration of devices meaning that the absence of a Dynamic Host Control Protocol (DHCP) server does not halt link communication. The IPv6 header was also simplified by removing unnecessary information and options with the aim of improving performance. This has allowed fast route convergence despite the fact that an IPv6 address is four times larger than an IPv4 address.

With enough unique addresses available, IPv6 also restores untranslated communication as was initially intended for the Internet.

Research and Education Network for Uganda (RENU) is among the emerging National Research and Education Networks (NRENs) in Africa that have fully adopted IPv6. By equipping the engineers with skills to deploy, maintain and support IPv6 networks, RENU managed to deploy IPv6 at the access, core, edge and datacenter using dual stack method. With the available IPv4 and IPv6 addresses, RENU members now have enough IP addresses to serve the growing researchers population and can easily integrate onto the dual stacked NREN access network and access the NREN services on both protocols. With the increase in number of connected members enabling IPv6, RENU accounts for about 36% of the total IPv6 traffic in the Uganda.

The adoption of IPv6 in many networks is still a challenge as it usually calls for hardware upgrades among others. This paper documents the deployment technique used by RENU, the challenges faced during and after deployment and the different solutions proposed.

Keywords

Transmission Control Protocol (TCP), Internet Protocol addresses, Dual stack, Deployment

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