

Internet Protocols

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Part 1: Research Report

There has been a rapid expansion in internet and it resulted in a success disaster for the IP addresses. The main noticeable issue is the exhaustion of IP and increased expansion of routing table. As a measure CIDR addressing policies are implemented for reducing the wastage of IP address. For resolving the problem NAT routers were also deployed for later a new version of the IP addressing protocol was introduced named as IPv6. The currently used IPv4 address is of 32 bits and IPv6 address proposed in the year 1998 is of 128 bits (Ipv6observatory.eu. 2019). The transformation from IPv4 to Ipv6 is time taking and needs lots of efforts and equipment's to be used for the transformation. The requirement and benefits of IPv6 and cost of deployment is researched and discussed in the report.

The deployment of IPv6 is monitored based on 3 different activities that are running parallel. Data is collected from different channels for qualitative and quantitative analysis of deployment level of IPv6. Extensive data collection tools are used such that it can be adopted in context of evolution. The gathered datasets are analyzed collectively and individually and analyzing large datasets would help in using the statistical analysis and generate graphs depending on the advice of experts and case studies (Goyal and Arora 2017). Dissemination is used depending on paper communication, workshops and conferences. The aim of the research is to project co-existence of IPv4 and Ipv6 with single existence and its adoption in the business can ensure continuity in the business and help future growth of the organization. An assumption is made that IPv6 headers are streamlined for efficiency and it allows greater flexibility in the network for supporting different features. The new devices and network equipment's supports the IPv6 addressing and dual stack architecture. Since the backbone of the network is largely based on IPv4 the transition of IPv4 to IPv6 would take a lots of time. In the IPv4 network MPLS helps in

reducing the queue delay since MPLS checks the label and the IP header is not utilized for routing decisions and forwarding the packets (Plonka and Berger 2017). The application of MPLS in IPv6 results in increased queue delay since the MPLS header is added and causes increased in packet size.

The TCP/IP design architecture is introduced for bringing flexibility and enabling growth in internet. It is used for providing uninterrupted internet communication regardless of losses in gateways and networks. The IPv4 is currently used for governing the communication over the internet and with its shortage IANA (Internet Assigned Number Authority) IPv4 address emptied on 3rd February 2011 and Regional Internet Registries (RIRs) IP address that are unallocated can exhaust soon. Thus there is a requirement of actively deploying the successor of IPv4 i.e. IPv6 such that the RIRs and ISPs can continue their service (Tang *et al.* 2017). The IPv6 architecture helps in improving security, authentication and configuring the devices automatically. The main barrier for transition of Ipv6 is the limited compatibility for the existing IPv4 device seeking for communication with the IPv6 configured devices and IPv6 devices seeking to communicate with the existing IPv4 devices. The IPv4 configured devices cannot communicate with IPv6 configured device since the header format of the IP addresses are different from each other. There is also lack of robust translation and thus some software and protocols may not be functioning on the devices configured with IPv6 address (Ahmed *et al.* 2017). There are also different network management tools that is currently designed for IPv4 network and it may lack in effective implementation in Ipv6 configured networks.

There are different transition technologies that are developed for transition of IPv4 network to IPv6 and enable communication with all the type of network. The performance of IPv4 and IPv6 network is analyzed for evaluation of transition effect on behavior of the network. The OPNET

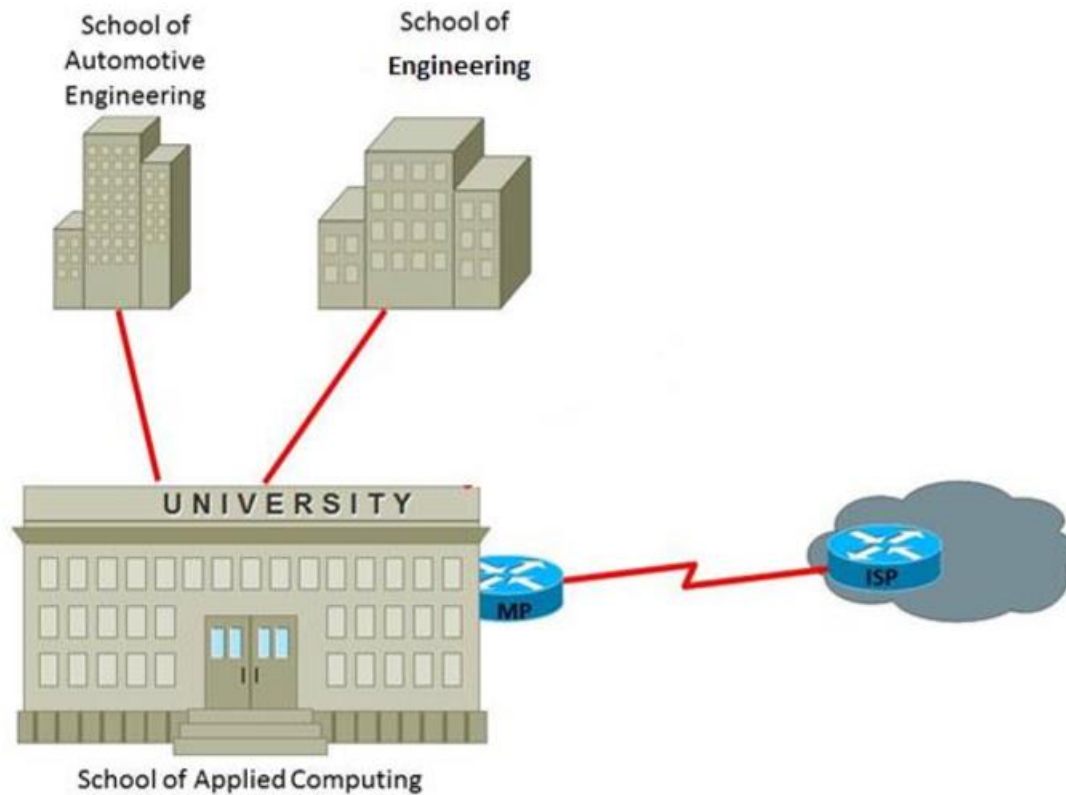
modeler can be used for simulating an IPv6 and IPv4 network for identification of the throughput. From the evaluation it has been found that IPv6 network has a higher throughput and CPU utilized for the IPv4 network is minimum (Yan *et al.* 2016). With the TCP protocol the dual stack configured network has less delay. Among the different migration technique dual stack mechanism is widely used for transition of a network. Here the network devices are configured with both Ipv4 and IPv6 network address. Until the adoption of the Ipv6 scheme a temporary solution for addressing the Ipv4 exhaustion issue is using the private IPv4 address. The private IP address acts as a temporary solution since it is not addressed uniquely. The host configured with a private IP address can communicate with a host configured with public IP address with the application of network address translation but on the other hand the host with public IP address cannot communicate with the host having private IP address (Montavont, Cobârzan and Noel 2015). The use of private IP address can help in resolving the issue of mobile IP network i.e. GPRS and other cellular network technologies. There are different system that can help in adoption of IPv6 network without the need of changes in software or hardware platform for the devices on users end. The mechanism is the implementation of transparent gateway and it can offer the user virtually unlimited address space but transition period when the coexistence of IPv4 and IPv6 network is necessary is longer.

The IPv6 was developed by Internet engineering Task Force and it works in the Internet Layer for the packet switching network. It is responsible for providing end to end transmission of datagrams across the multiple network. It provides additional features that are not present in IPv4 and also offers more address space than its predecessor. The address configuration, router announcement and network renumbering can be simplified with the application of IPv6. Packet fragmentation is used in IPv6 for the end points for the simplification of processing the packets

(Murdock *et al.* 2017). The subnet size of IPv6 is standardized by fixing host identified portion size for an address to 64 bits. The main design requirement of the IPv6 is the network security and contains the original specification of IPSec. For the management of IPv6 address it is divided into three types of addresses such as unicast, Any cast and multicast. The unicast address is used in single interface and the data packet sent to this type is identified by the address. In case of any cast address it acts as an identifier for multiple interfaces. The data packet sent to any cast address is delivered to the interface identified by the address. For multicast address the data packet is delivered to all the interface that is identified by the address. The address space of Ipv6 is larger than Ipv4 and it is 128 bits and thus it has 2^{128} addresses (Anbar *et al.* 2016). The longer address of IPv6 helps in simplification of address allocation and enables aggregation of routes for the implementation of special addressing feature. The IPv6 subnet has the standard size of 2^{64} addresses and it is the square of the size of the whole Ipv4 address space. The space utilization of pv6 is smaller than Ipv4 but the efficiency of routing and management would be improved due to its improvement in large space of subnet and aggregation of hierarchical routes.

The IPv6 hosts has the ability of configuring themselves automatically when they are connected in the IPv6 network and it uses Network discovery protocol with the use of ICMPv6 messages for router discovery. When the device is connected with the network for the first time a link local router solicitation message request is sent for identifying the configuration parameters. A response is received from the router with an advertisement packet containing configuration parameters for the internet layer. A special case of requirement is presented by the router for addressing the configuration since most of the time it receives the auto configuration information for e.g. prefix advertisement and router (Gont *et al.* 2017). A special router renumbering protocol can be used for achievement of stateless configuration. For the IPv4 network renumbering an

existing network for a new connectivity provider is a major effort. With the implementation of Ipv6 the prefix announced by a few router can be used for renumbering the entire network and since the host identifier can be self-configured independently. The IPv6 address is unsuitable for stateless transmission and it can allow stateful configuration similarly with IPv4 by using manual static configuration or DHCPv6. The IPv6 also has the support of globally unique IP addresses and the design is created for reemphasizing the different principles of traditional network design (Te Lu *et al.* 2017). With the application of this approach a unique address is assigned to each device such that it is globally reachable from different location in the internet. It also helps in tracking the network activity of the device. The use of Ipv6 auto configuration the MAC address is used for making the address unique and exposes the hardware for providing a unique handle for online activity.

Part 2: IP Addressing Scheme***IP addressing scheme for School of Applied Computing***

Major Network: **172.17.12.0/22**

Available IP addresses in major network: **1022**

Number of IP addresses needed: **439**

Available IP addresses in allocated subnets: **654**

About **66%** of available major network address space is used

About **67%** of subnetted network address space is used

Subnet Name	Needed Size	Allocated Size	Address	Mask	Dec Mask	Assignable Range	Broadcast
Staffs	20	30	172.17.14.96	/27	255.255.255.224	172.17.14.97 - 172.17.14.126	172.17.14.127
Lab301	60	62	172.17.13.0	/26	255.255.255.192	172.17.13.1 - 172.17.13.62	172.17.13.63
Lab302	30	30	172.17.14.64	/27	255.255.255.224	172.17.14.65 - 172.17.14.88	172.17.14.89
Lab303	36	62	172.17.14.0	/26	255.255.255.192	172.17.14.1 - 172.17.14.62	172.17.14.63
Lab304	45	62	172.17.13.128	/26	255.255.255.192	172.17.13.129 - 172.17.13.190	172.17.13.191

						172.17.13.1 90	
Lab30 6	40	62	172.17.13.1 92	/26	255.255.255.1 92	172.17.13.1 93 - 172.17.13.2 54	172.17.13.2 55
Lab30 8	140	254	172.17.12.0	/24	255.255.255.0	172.17.12.1 - 172.17.12.2 54	172.17.12.2 55
Lab30 9	50	62	172.17.13.6 4	/26	255.255.255.1 92	172.17.13.6 5 - 172.17.13.1 26	172.17.13.1 27
Lab31 0	18	30	172.17.14.1 28	/27	255.255.255.2 24	172.17.14.1 29 - 172.17.14.1 58	172.17.14.1 59

IP addressing scheme for School of Automotive Engineering

Major Network: **172.19.12.0/22**

Available IP addresses in major network: **1022**

Number of IP addresses needed: **283**

Available IP addresses in allocated subnets: **400**

About **41%** of available major network address space is used

About **71%** of subnetted network address space is used

Subnet Name	Needed Size	Allocated Size	Address	Mask	Dec Mask	Assignable Range	Broadcast
Staffs	25	30	172.19.13.96	/27	255.255.255.224	172.19.13.97 - 172.19.13.126	172.19.13.127
Lab101	40	62	172.19.12.128	/26	255.255.255.192	172.19.12.129 - 172.19.12.190	172.19.12.191
Lab102	25	30	172.19.13.64	/27	255.255.255.224	172.19.13.65 - 172.19.13.88	172.19.13.89

Lab103	35	62	172.19.13.0	/26	255.255.255.1	172.19.13.1	172.19.13.6
					92	- 172.19.13.6 2	3
Lab205	40	62	172.19.12.1	/26	255.255.255.1	172.19.12.1	172.19.12.2
			92		92	93 - 172.19.12.2 54	55
Lab206	48	62	172.19.12.6	/26	255.255.255.1	172.19.12.6	172.19.12.1
			4		92	5 - 172.19.12.1 26	27
CAD lab	20	30	172.19.13.1	/27	255.255.255.2	172.19.13.1	172.19.13.1
			28		24	29 - 172.19.13.1 58	59
Lab301	50	62	172.19.12.0	/26	255.255.255.1	172.19.12.1	172.19.12.6
					92	- 172.19.12.6 2	3

IP addressing scheme for School of Engineering

Major Network: **172.18.12.0/22**

Available IP addresses in major network: **1022**

Number of IP addresses needed: **406**

Available IP addresses in allocated subnets: **622**

About **63%** of available major network address space is used

About **65%** of subnetted network address space is used

Subnet Name	Needed Size	Allocated Size	Address	Mask	Dec Mask	Assignable Range	Broadcast
Staffs	18	30	172.18.14.96	/27	255.255.255.24	172.18.14.97 - 172.18.14.126	172.18.14.127
Lab201	20	30	172.18.14.64	/27	255.255.255.24	172.18.14.65 - 172.18.14.94	172.18.14.95
Lab202	80	126	172.18.12.0	/25	255.255.255.128	172.18.12.1 - 172.18.12.127	172.18.12.127

						172.18.12.1 26	
Lab20 3	65	126	172.18.13.0	/25	255.255.255.1 28	172.18.13.1 - 172.18.13.1 26	172.18.13.1 27
Lab20 5	25	30	172.18.14.3 2	/27	255.255.255.2 24	172.18.14.3 3 - 172.18.14.6 2	172.18.14.6 3
Lab40 4	45	62	172.18.13.1 28	/26	255.255.255.1 92	172.18.13.1 29 - 172.18.13.1 90	172.18.13.1 91
Lab40 8	28	30	172.18.14.0	/27	255.255.255.2 24	172.18.14.1 - 172.18.14.3 0	172.18.14.3 1
Lab40 9	80	126	172.18.12.1 28	/25	255.255.255.1 28	172.18.12.1 29 -	172.18.12.2 55

						172.18.12.2 54	
Lab410	45	62	172.18.13.1 92	/26	255.255.255.1 92	172.18.13.1 93 - 172.18.13.2 54	172.18.13.2 55

Test Center IP address Scheme

Major Network: **172.18.12.0/22**

Available IP addresses in major network: **1022**

Number of IP addresses needed: **22**

Available IP addresses in allocated subnets: **32**

About **4%** of available major network address space is used

About **69%** of subnetted network address space is used

Subnet Name	Needed Size	Allocated Size	Address	Mask	Dec Mask	Assignable Range	Broadcast
Test Center Data	21	30	172.18.12.0	/27	255.255.255.24	172.18.12.1 - 172.18.12.30	172.18.12.31
Test Center Voice	1	2	172.18.12.32	/30	255.255.255.52	172.18.12.33 - 172.18.12.34	172.18.12.35

Open Access Lab

Major Network: **172.20.12.0/22**

Available IP addresses in major network: **1022**

Number of IP addresses needed: **250**

Available IP addresses in allocated subnets: **254**

About **25%** of available major network address space is used

About **98%** of subnetted network address space is used

Subnet Name	Needed Size	Allocated Size	Address	Mask	Dec Mask	Assignable Range	Broadcast
Open Access Lab	250	254	172.20.12.0	/24	255.255.255.0	172.20.12.1 - 172.20.12.254	172.20.12.255

IPv6 Address for 6 servers in University Building

2002:ac15:0c00::/125

Start Range: 2002:ac15:c00:0:0:0:0:0

End Range: 2002:ac15:c00:0:0:0:0:7

No. of host: 8

IPv6 Address for the link between MP and ISP

2002:ac15:0c11::/126

Start Range: 2002:ac15:c11:0:0:0:0:0

End Range: 2002:ac15:c11:0:0:0:0:3

No. of host: 4

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