**NITTE MEENKASHI INSTITUTE OF TECHNOLOGY**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**Client Server Programming using Dual Stack Host**

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**Project Team Members**

S Bharath (1NT18EC134)

Shaik Abdul Aleem (1NT18EC143)

Likith N (1NT18EC083)

Rizwan Khan (1NT18EC134)

Logo

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**Project Supervisor**

Prof. Sitaram Yaji

Professor

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**Team Details**

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| --- | --- | --- | --- | --- | --- | --- |
| **Team Number** | **Name of the Student** | **USN** | **Section** | **Mobile** | **Email** | **Address for Correspondence** |
| 16 | S Bharath | 1NT18EC134 | C |  |  |  |
| Shaik Abdul Aleem | 1NT18EC143 | C |  |  |  |
| Likith N | 1NT18EC083 | C |  |  |  |
| Rizwan Khan | 1NT18EC134 | C |  |  |  |

**CLIENT SERVER PROGRAMMING USING DUAL STACK HOST**

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Synopsis Submitted for the Final Year Project

By

S BHARATH 1NT18EC134

SHAIK ABDUL ALEEM 1NT18EC143

LIKTH N 1NT18EC083

RIZWAN KHAN 1NT18EC130

**Project Guide**

**Prof. Sitaram Yaji**

Assistant/Associate/Professor

Dept. of Electronics and Communication Engineering

Nitte Meenakshi Institute of Technology

Yelahanka, Bangalore-560064

## Declaration by Students

*We the students* ***S BHARATH (USN: 1NT18EC134), SHAIK ABDUL ALEEM (USN: 1NT18EC143), LIKITH N (USN: 1NT18EC083)*** *and* ***RIZWAN KHAN (USN: 1NT18EC130)*** *are aware of project conduction procedure and evaluation rubrics. We are also aware that, the project phases are evaluated through continuous assessment.*

|  |  |
| --- | --- |
| ***Name of the Student*** | ***Signature*** |
|  |  |
| *S BHARATH* |  |
|  |  |
| *SHAIK ABDUL ALEEM* |  |

*LIKITH N*

*RIZWAN KHAN*

## Confirmation by Guide

*I* ***Prof.*** ***SITARAM YAJI,*** *shall guide the above-mentioned students in the project entitled “****Client Server Programming using Dual Stack Host****” and direct students to submit the project for the academic year 2021-2022.*

***Signature of the Guide***

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| **Introduction** |
| The internet can be accessible worldwide which is system of interconnected networks. Two current versions of the Internet Protocol (IPv4 and IPv6 ) are provided by Internet Assigned Numbers Authority (IANA). IPv4 protocol in network enables data sharing between two or more computers which minimize time and energy wastages. IPv4 protocol was already allotted to Regional Internet Registries (RIR) and there is no more IPv4 address to allot and IANA has started issuing the IPv6 address to RIR. In February 2011, all IPv4 addresses had vanished and now we are going for IPv6.  With the exhaustion of the IPv4 addressing space quickly approaching, it has become a high priority for service providers, enterprises, IP appliances manufacturers, application developers, and governments to begin their own deployments of IPv6. A seamless migration from IPv4 to IPv6 is hard to achieve.  Therefore several mechanisms are required which ensures smooth, stepwise an independent change to IPV6. Not only is the transition, integration of IPv6 is also required into the existing networks. The solutions (or mechanisms) can be divided into three categories: dual stack, tunneling and translation.  Dual-stack is a preferred, most versatile way to deploy IPv6 in existing IPv4 environments.  In dual-stack, both hosts and routers will communicate with both IPv4 and IPv6. The dual stack hosts use IPv6 address while communicating with IPv6 hosts. It will use IPv4 address for communicating with IPv4 hosts. |
| **Literature Survey** |
| **Implementation of IPv6 Over IPv4 Using Dual Stack Transition Mechanism (DSTM) on 6iNet**  - Moving from Internet Protocol version Four (IPv4) to Internet Protocol version six (IPv6) is not straightforward because IPv4 and IPv6 are incompatible protocols. To enable the smooth integration between IPv4 and IPv6, several transition mechanisms have been proposed by IETF IPng Transition Working Group (NGTrans). One of them is Dual Stack Transition Mechanism (DSTM).  The DSTM architecture is consist of three (3) parts. They are the client (using FreeBSD and Linux as an operating system), the server and the DSTM gateway or called tunnel end-point router (TEP). The client is the machine that consist the code to put on an IPv6-only dual stack node to allow connections to the IPv4 world. The server machine also consist the code to relay between clients and the IPv4 world and it runs on a node connected to the both IPv4 and IPv6 providers. Lastly the gateway or TEP, is the machine that in charge of encapsulation and decapsulation of IPv4 over IPv6 packets. Only the gateway requires having direct IPv4 connectivity and a permanent IPv4 address. The server and gateway are often implemented on the same physical machine where the TEP is integrated in the server code  Implementation of IPv6/IPv4 Dual-Stack Transition Mechanism  With the rapid development of Internet, IPv4 protocol can no longer meet the needs of users. This is mainly due to the limitations of IPv4 in terms of addresses, routing and security. Correspondingly, IPv6 has the advantage of large address space, security, mobility, quality of service and so on. So IPv6 protocol has become the inevitable trend of network development. However IPv4 and IPv6 are incompatible protocols, so a solution to transition is required. In order to achieve smooth and stepwise transition, IETF recommends three kinds of transition mechanisms: dual stack, tunneling and translation technology.  The migration to IPv6 needs to happen. For at least the foreseeable future, IPv4 and IPv6 will coexist and there is no deadline or switchover date to go from IPv4 to IPv6. The transition is expected to take years. The Internet Engineering Task Force (IETF) has created various protocols, tools, and mechanisms to help network administrators migrate their networks to IPv6. These techniques can be divided into three categories:   1. Dual-Stack   A dual-stack device has complete support for both IPv4 and IPv6. It can be a host, printer, server, router, or any device that can be configured to support both protocols. In the IPv4 world, this includes IPv4 addresses, Address Resolution Protocol (ARP), and Internet Control Message Protocol (ICMP) for IPv4. An IPv4 router supports IPv4 static routes and IPv4 routing protocols such as Enhanced Interior Gateway Routing Protocol (EIGRP) and Open Shortest Path First version 2 (OSPFv2). In the IPv6 realm, support means more than just a network header with longer addresses. IPv6 support includes IPv6 global unicast and link-local addresses, ICMPv6 operations including Stateless Address Auto configuration (SLAAC), and Duplicate Address Detection (DAD). An IPv6 router needs to route IPv6 packets using static routes and IPv6 routing protocols such as EIGRP for IPv6 and OSPFv3. An IPv6 router sends out ICMPv6 Router Advertisement messages and can perform tunnelling or translation services.When communicating with an IPv4 device, it behaves like an IPv4-only device. When communicating with an IPv6 device, it acts like an IPv6-only device. In Step 1 of Figure.1, dual-stack host A sends a DNS query for the quad-A (AAAA) record for www.example.com. In Step 2, the DNS server returns a DNS query response containing both the quad-A and A records for www.example.com. Host A uses the quad-A record to begin communications with the www.example.com server   1. Transition   Another type of IPv4-to-IPv6 transition mechanism is tunneling. Like other transition methods, tunneling should be considered a temporary solution until native IPv6 can be employed. A tunnel is nothing more than encapsulating one IP packet inside another. A tunnel can be an IPv4 packet encapsulated in another IPv4 packet or, for that matter, any network layer protocol over another network layer protocol. One of the challenges in integrating IPv6 into the current IPv4 networks is the ability to transport IPv6 packets over IPv4-only networks. One way to do this is to use a tunnel or, in IPv6, what is known as a Tunneling is a technique that allows devices in isolated IPv6 networks to send IPv6 packets over the IPv4 network. [6] A tunnel has two types of protocols, a transport protocol and a passenger protocol. overlay tunnel. Overlay tunnels encapsulate IPv6 packets in IPv4 packets for delivery across an IPv4 infrastructure.   1. Translation   Network Address Translation (NAT) is a familiar method in IPv4, commonly used to translate between private (RFC 1918) addresses and public IPv4 address space. NAT64 transparently provides access between IPv6-only and IPv4- only networks. Address Family Translation (AFT) or simply translation, provides communications between IPv6-only and IPv4-only hosts and networks. AFT performs IP header and address translations between these two network layer protocols. Like other transition methods, translation is not a long-term strategy and the ultimate goal should be native IPv6. However translation offers two major advantages over tunneling: i. Translation provides a means for gradual and seamless migration to IPv6. ii. Content providers can provide services transparently to IPv6 Internet users. IPv4 to IPv6 Migration and Performance Analysis using GNS3 and Wireshark Internet Protocol (IP) is the best-known Layer 3 or Network layer protocol. Presently two versions of IP are assigned by Internet Assigned Number Authority (IANA). The designers of IPv4 did not envision the explosive growth of its use. 4.3 billion Addresses seemed more than enough. The IPv4 protocol is not particularly efficient in its use of the available space, with many addresses being wasted. The internet authorities started to predict address exhaustion in the late 1980s and IPv6 was developed in the 1990s as the long-term solution. A. Dual-Stack Transition Technique IPv4 and IPv6 do not have to be an ‘either or’ decision. In a dual stack implementation, a network interface can have both an IPv4 and IPv6 address at the same time. It can communicate using either of the protocol available. B. Design and Configuration of the Dual-Stack Transition Technique Dual stack is designed to support both the IPv4 and IPv6 addresses on the same network interface, thereby allowing the data to transfer from IPv4 network to IPv6 network using both static and dynamic routing. The network consists of five routers, two Ethernet switches, and four end hosts. All router interfaces, as well as the hosts, have been configured with an IPv4 address as well as with an IPv6 address. The network can then communicate using either protocol. IPv4 and IPv6 performance comparison in IPv6 LTE network Mobile network operators are deploying IPv6 to their mobile networks in recent years, to support ever increasing mobile and IoT devices. They also adopt IPv4-IPv6 transition techniques to provide connectivity from their IPv6 networks to IPv4 networks. Since IPv6 deployment to mobile network is still in an early stage, the performance assessment on IPv6 based mobile network is needed, regarding both IPv6 and IPv4.  **IPV6 Transition Technologies** With the depletion of IPv4 addresses, network operators started to speed up IPV6 deployment into their networks. Because it is impossible to change their network to IPV6 at once, IPv4 and IPV6 will coexist for a few years. IPV6 transition techniques are developed to support seamless transition from IPv4 to IPv6. The techniques can be categorized into:   * Dual-stack: Dual-stack devices have IPv4 and IPV6 stacks together. It can maintain the same topology as the IPv4 network and is easy to deploy. However, it still needs IPv4 addresses and old routers may have limited capabilities to support IPv6. * Tunneling: To send IPV6 packets over IPv4 backbone, a dual-stack edge router encapsulates IPV6 packet to IPv4 packet and transmits to the IPv4 backbone. It needs no changes to the backbone and only edge routers are needed to have a dual-stack. However, it suffers from scalability issue with the large number of tunnels and cause unnecessary packet fragmentation. * Address Translation: A network address translator is placed between IPv4 and IPV6 network, to create a bridge between those networks. Address translation can be performed on the network layer and above layers. On the network layer, IPv4 header is replaced to IPV6 header and vice versa. (e.g., 464XLAT) On the application layer, the IP address contained in the application header is translated (e.g., DNS64) |
| **Limitations of the Existing Work and Motivation** |
| Transition to IPv6 is in progress in LANs and WAN. A dual stack host may need to communicate with IPv4 only host and IPv6 only host. This is an implementation project for this scenario. |
| **Objectives of the Project** |
| The following are the objectives of present work:   * Implementation of client server programming on dual stack host. * Dual stack host running two server programs * Ipv4 client ( data application/TCP) * Ipv6 client ( VoIP, udp) * Both clients contacting dual stack host at the same time * Desktop/Laptop and Raspberry Pi boards will be used for establishing Communication |
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| **Fig 1. Block Diagram of Dual Stack Network**      **Fig 2. Block Diagram of IPv4 vs. IPV4/IPV6 (Dual Stack ) Protocol** |
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