

Term Paper: Internet Protocol (IP)

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Abstract— Today, Internet is also considered as the fundamental need. Internet Protocol (IP) is the basis of the internet. With the help of Internet Protocol, we were able to achieve our very important goal of interconnecting many heterogeneous machines. Internet Protocol (IP) is the most fundamental communication protocol . This paper states what is Internet Protocol (IP), its Functions, what is Datagram, its basic structure, different Versions of Internet Protocol, Goals of Internet Protocol, Applications and Drawbacks of Internet Protocol.

Keywords— IP; Internet Protocol; IPv4; Datagram; Network Layer; IP Address

I. INTRODUCTION

- The Internet Protocol (IP) provides for the carriage of datagrams from a source hosts to destination hosts, possibly passing through one or more routers and networks in the process. A datagram is a finite length packet of bits containing a header and data. The hosts must create Datagram Header and the routers must examine them for the purpose of making routing decisions, and modify them as the IP packets make their way from the source to the destination.[2][3]
- The Internet Protocol (IP) is the most fundamental communication protocol in the TCP/IP Protocol Suite (that is Transport Communication Protocol/ Internet Protocol Suite), for relaying datagrams across network boundaries.[8]
- The Internet Protocol helps in establishing internet with the help of its routing function which enables internetworking.
- The function of Internet Protocol (IP) is to deliver packets from source host to destination host with the help of only and only IP Addresses which are in the packet headers. Hence, to perform this function, Internet Protocol (IP) defines packet structure that encapsulate the data which is supposed to be delivered.[8]
- Internet Protocol (IP) also perform function of defining the addressing methods which are used to label the datagram with source and destination information.
- The internet protocol implements two basic functions: addressing and fragmentation.[6]
- Internet Protocol (IP) provides unreliable and connectionless packet delivery for the internet.
 - The Internet Protocol (IP) is connectionless as every packet of information is treated by it independently.[7]
 - The Internet Protocol (IP) is unreliable as it does not guarantee delivery of the information as it does not require any acknowledgement from the sending host, the receiving host or the intermediate hosts. [7]

II. WORKING PRINCIPLE / DESCRIPTION

- Internet Protocol (IP) transmits the data in the form of Datagram that is the basic unit of data exchange in Internet Protocol (IP) Layer is Internet Datagram. The size of datagram is variable. Header and Data are two parts into which datagram is divided. The header which is generally of the size from 20 to 60 Bytes contains such information which helps in routing and delivery of the packets. The method of nesting the data in a packet with the header to form datagram is known as encapsulation.[1][9] The format of Internet Protocol (IP) Datagram:

Bits					
0	4	8	16	19	31
Version	Length	Type of Service	Total Length		
Identification			Flags	Fragment Offset	
Time to Live		Protocol	Header Checksum		
Source Address					
Destination Address					
Options					
Data					

➤ Where,

Version - Version of Internet Protocol (IP) used

Length - the Datagram Header length

Type of Service - It contains total of five sub-fields. These sub-fields specifies the type of precedence, delay, throughput and reliability desired for that packet. The default values of these five subfields are routine precedence, normal delay, normal throughput and normal reliability

Total Length - Total length of the datagram including data as well as header

Identification - Contains a unique integer that identifies the datagram

Flags - Controls datagram fragmentation, along with the Identification field. The Fragment Flags specify whether the datagram can be fragmented and whether the current fragment is the last one.

Fragment Offset - Specifies the offset of this fragment in the original Datagram

Time to Live - Specifies the time limit of the datagram to remain in the internet so as to prevent the misrouted datagram from remaining in the internet for indefinite period of time. Its default value is 255 seconds.

Protocol - Specifies high level protocol type

Header Checksum - Indicates a number computed to ensure the integrity of the header values

Source Address - Internet Protocol (IP) Address of the sending host

Destination Address - Internet Protocol (IP) Address of the receiving host

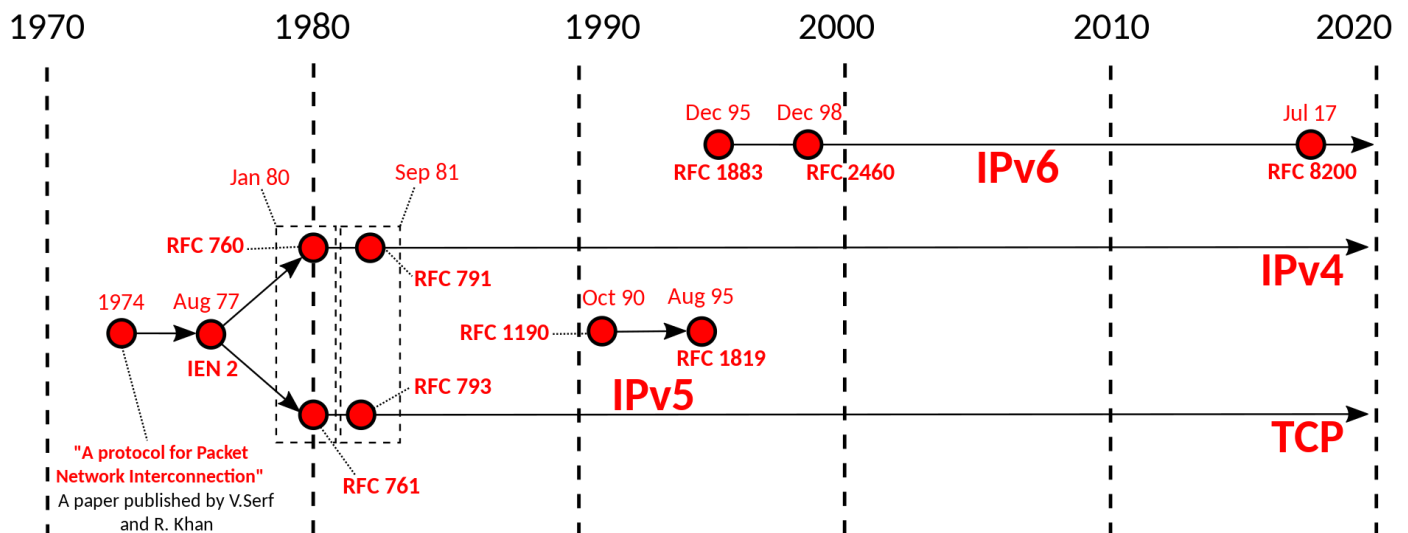
Options - Provides network testing and debugging options

Data - Data is the information which is to be transferred

III. ADDITIONAL INFORMATION AND CONTENT ON INTERNET PROTOCOL (IP)

- **Versions of Internet Protocol (IP):**

- IP (Internet Protocol) versions 1 to 3 were experimental versions.
- The most dominant internetworking protocol in the internet and which is widely in use today is IPv4 (Internet Protocol version 4).
- Internet Protocol version 5 (IPv5) was used by Internet Stream Protocol which was an experimental streaming protocol which was not adopted.
- The successor to Internet Protocol version 4 (IPv4) is Internet Protocol version 6 (IPv6). Internet Protocol version 6's (IPv6) most prominent difference from Internet Protocol version 4 (IPv4) is the size of addresses. Internet Protocol version 4 (IPv4) uses 32 bits that is 4 Bytes for addressing which can produce 4.3 billion (4.3×10^9) distinct addresses. Internet Protocol version 6 (IPv6) uses 128 bits that is 16 Bytes for addressing which can produce 3.4×10^{38} distinct addresses. Although, adoption of Internet Protocol version 6 (IPv6) is very slow.[4]



- **Link Capacity:** Link capacity is the maximum size of data packets possible to transmit on a given link. It is measured in unit known as Maximum Transmission Unit (MTU). Data packet size greater than link capacity is not able to transmit. To remove this limitation, a provision was made in the Internet Protocol Version 4 (IPv4). The IPv4 Internetworking layer automatically fragments a datagram into smaller units for transmission and also provides re-ordering of fragments received out of order.[8]
- **Security:** In the earlier versions of Internet Protocol (IP), security aspects and needs of public and international networks could not be adequately anticipated but with the newer versions of Internet Protocol (IP) are improving on its security but still it is not up to mark and still more research is needed to make it more secure.[8]
- **IP Address:** It is assigned to every device or domain that connects to internet for unique identification. It is series of characters and is converted to human

readable form with the help of Domain Name System (DNS) so that it is easy to remember. Each packet will contain IP Address of both source and receiver with the help of whom routing is done.

- **Goals of the Internet Protocol (IP):**

- The fundamental goal was to provide useful interconnections among many heterogeneous machines.[5]
- The goal comparison in between the years 1988 and 2008.[5]

1988	2008
1. Communication should not stop because of loss of networks or gateways. 2. Multiple types of communication services must be supported. 3. Variety of networks must be accommodated. 4. Must permit distributed management of its resources. 5. Cost effective. 6. Must permit host attachment with a low level of effort. 7. Accountable resources must be used.	1. Security 2. Availability and resilience 3. Economic viability 4. Better management 5. Meet society's needs 6. Longevity 7. Support for tomorrow's computing 8. Support tomorrow's applications 9. Fit for purpose

IV. RELATED APPLICATIONS AND EXAMPLES

- Example: When an E-mail is to be sent from source to destination, the TCP (Transmission Control Protocol) server in the Transport Layer at the host will divide the message into multiple number of packets. TCP (Transmission Control Protocol) at Transport Layer also number this packets and then forward them to the Internet Protocol (IP) at the Network Layer to transmit them to reach Network Layer of the destination server. Although, every packet is to be transmitted to the same destination, they may take different routes to reach the same. When the packets arrive at the destination server's Internet Protocol (IP) at Network Layer, it hands them back to the TCP (Transmission Control Protocol) at the Transport Layer which reassembles the packets and hands them to the destination's Application Layer where it shows in the inbox.[7]

V. CONCLUSION

- World is advancing very fast with the help of Internet which is possible with the help of Internet Protocol (IP).
- Internet Protocol (IP) is connectionless and unreliable protocol which does not give any guarantee of successfully transmitting the data.

- In order to make Internet Protocol(IP) reliable, it must be paired with another protocol at the Transport Layer which is reliable such as TCP which is Transmission Control Protocol.

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