Internet Protocols

The way of making rules …

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- **Preface**

My desired area in network field is network protocols. I fascinated the way those rules are formed and previous **IPv4** and currently **IPv6**. Here is what I found about that topic from **Wikipedia.**

1) Introduction

The **Internet Protocol** (**IP**) is the principal communications protocol used for relaying datagrams (packets) across an internetwork using the Internet Protocol Suite. Responsible for routing packets across network boundaries, it is the primary protocol that establishes the Internet.

IP is the primary protocol in the Internet Layer of the Internet Protocol Suite and has the task of delivering datagrams from the source host to the destination host solely based on their addresses. For this purpose, IP defines addressing methods and structures for datagram encapsulation.

Historically, IP was the connectionless datagram service in the original Transmission Control Program introduced by Vint Cerf and Bob Kahn in 1974, the other being the connection-oriented Transmission Control Protocol (TCP). The Internet Protocol Suite is therefore often referred to as TCP/IP.

The first major version of IP, now referred to as Internet Protocol Version 4 (IPv4) is the dominant protocol of the Internet, although the successor, Internet Protocol Version 6 (IPv6) is in active, growing deployment worldwide.

2) Services provided

The Internet Protocol is responsible for addressing hosts and routing datagrams (packets) from a source host to the destination host across one or more IP networks. For this purpose the Internet Protocol defines an addressing system that has two functions. Addresses identify hosts and provide a logical location service. Each packet is tagged with a header that contains the meta-data for the purpose of delivery. This process of tagging is also called encapsulation.

3) Reliability

The design principles of the Internet protocols assume that the network infrastructure is inherently unreliable at any single network element or transmission medium and that it is dynamic in terms of availability of links and nodes. No central monitoring or performance measurement facility exists that tracks or maintains the state of the network. For the benefit of reducing network complexity, the intelligence in the network is purposely mostly located in the end nodes of each data transmission, cf.

end-to-end principle. Routers in the transmission path simply forward packets to the next known local gateway matching the routing prefix for the destination address.

As a consequence of this design, the Internet Protocol only provides best effort delivery and its service is characterized as unreliable. In network architectural language it is a connection-less protocol, in contrast to so-called connection-oriented modes of transmission. The lack of reliability permits various error conditions, such data corruption, packet loss and duplication, as well as out-of-order packet delivery. Since routing is dynamic for every packet and the network maintains no state of the path of prior packets, it is possible that some packets are routed on a longer path to their destination, resulting in improper sequencing at the receiver.

The only assistance that the Internet Protocol provides in Version 4 (IPv4) is to ensure that the IP packet header is error-free through computation of a checksum at the routing nodes. This has the side-effect of discarding packets with bad headers on the spot. In this case no notification is required to be sent to either end node, although a facility exists in the Internet Control Message Protocol (ICMP) to do so.

IPv6, on the other hand, has abandoned the use of IP header checksums for the benefit of rapid forwarding through routing elements in the network.

The resolution or correction of any of these reliability issues is the responsibility of an upper layer protocol. For example, to ensure in-order delivery the upper layer may have to cache data until it can be passed to the application.

In addition to issues of reliability, this dynamic nature and the diversity of the Internet and its components provide no guarantee that any particular path is actually capable of, or suitable for, performing the data transmission requested, even if the path is available and reliable. One of the technical constraints is the size of data packets allowed on a given link. An application must assure that it uses proper transmission characteristics. Some of this responsibility lies also in the upper layer protocols between application and IP. Facilities exist to examine the maximum transmission unit (MTU) size of the local link, as well as for the entire projected path to the destination when using IPv6. The IPv4 internetworking layer has the capability to automatically fragment the original datagram into smaller units for transmission. In this case, IP does provide re-ordering of fragments delivered out-of-order.

4) IP addressing and routing

Perhaps the most complex aspects of IP are IP addressing and routing. Addressing refers to how end hosts become assigned IP addresses and how sub networks of IP host addresses are divided and grouped together. IP routing is performed by all hosts, but most importantly by internetwork routers, which typically use either interior gateway protocols (IGPs) or external gateway protocols (EGPs) to help make IP datagram forwarding decisions across IP connected networks.

5) Version history

In May 1974, the Institute of Electrical and Electronic Engineers (IEEE) published a paper entitled "A Protocol for Packet Network Interconnection."[3] The paper's authors, Vint Cerf and Bob Kahn, described an internetworking protocol for sharing resources using packet-switching among the nodes. A central control component of this model was the "Transmission Control Program" (TCP) that incorporated both connection-oriented links and datagram services between hosts. The monolithic Transmission Control Program was later divided into a modular architecture consisting of the Transmission Control Protocol at the connection-oriented layer and the Internet Protocol at the internetworking (datagram) layer. The model became known informally as TCP/IP, although formally referenced as the Internet Protocol Suite.

The Internet Protocol is one of the determining elements that define the Internet. The dominant internetworking protocol in the Internet Layer in use today is IPv4; with number 4 assigned as the formal protocol version number carried in every IP datagram. IPv4 is described in RFC 791 (1981).

The successor to IPv4 is IPv6. Its most prominent modification from version 4 is the addressing system. IPv4 uses 32-bit addresses (c. 4 billion, or 4.3×109, addresses) while IPv6 uses 128-bit addresses (c. 340 undecillion, or 3.4×1038 addresses). Although adoption of IPv6 has been slow, as of June 2008, all United States government systems have demonstrated basic infrastructure support for IPv6 (if only at the backbone level).

Version numbers 0 through 3 were development versions of IPv4 used between 1977 and 1979. [Citation needed] Version number 5 was used by the Internet Stream Protocol, an experimental streaming protocol. Version numbers 6 through 9 were proposed for various protocol models designed to replace IPv4: SIPP (Simple Internet Protocol Plus, known now as IPv6), TP/IX (RFC 1475), PIP (RFC 1621) and TUBA (TCP and UDP with Bigger Addresses, RFC 1347). Version number 6 was eventually chosen as the official assignment for the successor Internet protocol, subsequently standardized as IPv6.

A humorous Request for Comments that made an IPv9 protocol center of its storyline was published on April 1, 1994 by the IETF. It was intended as an April fool’s Day joke. Other protocol proposals named "IPv9" and "IPv8" have also briefly surfaced, though these came with little or no support from the wider industry and academia.