Tcp/ip illustrated vol 2 pdf

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Transmission Control Protocol and Internet Protocol are two distinct computer network protocols. TCP and IP are so commonly used together, however, that TCP/IP has become standard terminology for referring to this suite of protocols. A protocol is an agreed-upon set of procedures and rules. When two computers follow the same protocols—the same set of rules—they understand each other and exchange data. Larry Washburn / Getty Images TCP/IP functionality is divided into four layers, each with its own set of agreed-upon protocols: The link layer consists of methods and protocols that operate only on a link, which is the network component that interconnects nodes or hosts in the network. Protocols in the layer include Ethernet and Address Resolution Protocol. The internet (or networking) layer connects independent networks to transport the packets containing the data across network boundaries. Protocols are IP and Internet Control Message Protocol. The transport layer handles communications between hosts and is responsible for flow control, reliability, and multiplexing. Protocols include TCP and User Datagram Protocol. The application layer standardizes data exchange for applications. Protocols include HyperText Transfer Protocol, File Transfer Protocol, Post Office Protocol Version 3, Simple Mail Transfer Protocol, and Simple Network Time Protocol. TCP/IP technically applies to network communications in which the TCP transport is used to deliver data across IP networks. Known as a connection-oriented protocol, TCP works by establishing a virtual connection between two devices through a series of request-and-reply messages sent across the physical network. TCP divides a message or file into packets that are transmitted over the internet and then reassembled when they reach their destination. IP is responsible for the address of each packet so that it gets to the correct destination. The average person on the internet works in a predominately TCP/IP environment. Web browsers, for example, use TCP/IP to communicate with web servers. The transfer of information work so seamlessly that millions of people use TCP/IP every day to send email, chat online, and play online games without ever being aware of it. FAQ Which network services or protocols use TCP/IP port 22? Generally, the network protocol Secure Shell (SSH) uses port 22. That number is also often used for secure logins, file transfers, and port forwarding. What's the difference between TCP and IP? Since TCP and IP are two different protocols, they perform two different functions. IP is responsible for finding the address where information is going to be sent, while TCP is responsible for delivering that information to the address. What is known as the TCP/IP Swiss Army Knife? The "TCP/IP Swiss Army Knife" is a common nickname for Netcat, a tool that's used to write data across networks using TCP or UDP protocols. Thanks for letting us know! Get the Latest Tech News Delivered Every Day Subscribe Tell us why! IP packets are the most critical and fundamental components of the protocol. They carry data during transmission and have a header that contains information helping them to find their way and to reassemble after transmission. The two main functions of the IP protocol are routing and addressing. To route packets to and from machines on a network, IP (the Internet Protocol) uses IP addresses which are carried along in the packets. Mongkol Nitirojsakul/EyeEm/Getty The brief descriptions in the picture are meaningful enough to give you an idea of the function of the header elements. However, some might not be clear: The identification tag helps reassemble the packet from several eventual fragments. Data sent over a network is broken down into small sections enveloped in these packets. IP networks, such as the internet, usually are not secure. Packets can be lost, delayed, and arrive in the wrong order. Once they arrive at the destination, the identification tag helps to identify the packet and to reassemble the data back to its original form. The fragmented flag states whether the packet can be fragmented or not. The fragment offset is a field to identify which fragment this packet is attached to. Time to Live (TTL) is a number that indicates how many hops (router passes) the packet can make before it dies. Usually, at each router, a packet is analyzed, and based on the information present at that router on other neighboring routers, a choice is made as to which route is best. The packet is then forwarded to that next router. In this configuration, a packet may well go round. There is also flooding as another method, which implies sending a copy of the packet to each neighboring router; then, only the target machine consumes the packet. Other packets will keep roaming. TTL is a number, typically 255, which decreases each time a packet passes a router. This way, redundant packets will ultimately die once the TTL reaches zero. The header checksum is a number used for error detection and correction during packet transmission. The data in the packet is fed into a mathematical algorithm. The resulting sum travels with the data in the packet. Upon reception, this sum is calculated again using the same algorithm. If it is the same as the original sum, the data is good. Otherwise, it is considered corrupt, and the packet discarded. The payload is the actual data being carried. Notice that data payload can be up to 64 KiloBytes, which is enormous compared to the totality of the header bits. Thanks for letting us know! Get the Latest Tech News Delivered Every Day Subscribe Tell us why! asharkyu/Shutterstock.com 40 years ago—in September 1981—DARPA published the finalized specifications of the TCP/IP protocol suite, which defines the basic rules for how the internet works. While TCP/IP didn't become widely adopted until 1983, this milestone can help us understand why TCP/IP was so important. What Is TCP/IP? TCP/IP is a protocol suite consisting of two main protocols conceived by Vint Cerf and Bob Kahn, Transmission Control Protocol (TCP) and Internet Protocol (IP). Internet Protocol defines addressing and routing—how packets of data flow through the network. The Transmission Control Protocol handles making connections and ensuring data packets get to their proper destination. The two protocols work together to create the foundation of the modern internet. RELATED: How Do IP Addresses Work? Why Was TCP/IP Created? Before the internet, the US Department of Defense (through ARPA), created a computer network called ARPANET that linked US government and university computers around the country. ARPANET came online in 1969. Prior to TCP, ARPANET used a protocol called NCP (Network Control Program) for making connections between machines on the network. According to the NCP/TCP transition plan (RFC801) published in November 1981, the need for TCP/IP arose from multiple fronts. Increasingly, experimental computer networks had begun using radio and satellite links rather than physical wires. Also, organizations had increasingly researched local networks—groups of machines communicating together within the same facility rather than over long distances. The architects of ARPANET realized that the underlying protocols then in use were "inadequate" for spanning all these different and new types of networks. A geographical map of ARPANET in 1980. DARPA At the same time, during the 1970s, companies such as IBM, DEC, AT&T, and Xerox had created their own proprietary, incompatible computer networks that fragmented the sharing of information. So the TCP/IP suite was immediately notable because it represented a non-proprietary, royalty-free, open-architecture solution that allowed computers of any kind to communicate through any medium, as long as the TCP/IP software was implemented on the system. Development on TCP and IP began in 1973 by Vint Cerf and Bob Kahn. After development throughout the 1970s by Cerf, Kahn, and others, DARPA published specifications on TCP and IP in RFC documents 791 and 793, dated September 1981, which represented the first public introduction of the finalized TCP/IP framework. How Does TCP/IP Work? TCP and IP are two separate technologies that work together, hand-in-hand, to achieve reliable connections through a heterogeneous (many different types of computers and links) computer network. As previously mentioned, IP handles addressing machines on the network and how blocks of data (called "packets") reach the proper destination. TCP ensures that the packets reach their destination without error, calling ahead to make sure there is a host to receive the information and, if the information is lost on the way or corrupted, re-transmitting the data until it gets there safely. TCP/IP's architects purposely separated the implementation of TCP and IP to make the network more flexible and modular. In fact, TCP can be swapped out with a different protocol called UDP that is faster but allows data loss in situations where 100% transmission accuracy isn't necessary, such as a telephone call or a video broadcast. Network engineers call this modular design a "protocol stack," and it allows some of the lower layers in the stack to be handled independently in a way that is most appropriate for the local machine architecture. Then the upper layers can work on top of those to communicate with each other. In the case of the Internet, this stack typically consists of four layers: Link Layer – Low-level protocols that work with a physical medium (such as Ethernet) Internet Layer – Routes packets (IP, for example) Transport Layer – Makes and breaks connections (TCP, for example) Application Layer – How people use the network (the web, FTP, and others) The protocols that handle the web (such as the HyperText Transfer Protocol, or HTTP) are on the application layer, and they work on top of TCP and IP. Thanks to this model, HTTP does not need to know how to make or break connections at a low level—all of that is handled by the protocols lower in the stack. It makes for a very flexible system and is the reason why TCP/IP were so successful and why they still serve as the backbone of the internet today. RELATED: The First Website: How the Web Looked 30 Years Ago When Did TCP/IP Come Into Use? While in development, TCP/IP came into experimental use as early as 1973. As its creators continued to refine the protocols, Internet Protocol (IP) went from version 1 to version 4 by 1981, which is still the version of IP still widely used today. Although DARPA introduced the first finalized version of the TCP and IP protocols (version 4) in September 1981, some ARPANET computers continued using the earlier ARPANET protocols (such as NCP) for a time. As with any entrenched technology, change can take time, and the architects of the plan designed a transition period between NCP and TCP that would end on January 1, 1983. Vint Cerf on the cover of the August 1996 issue of Boardwatch Magazine wearing an "IP on Everything" t-shirt in an era where IP wasn't the clear protocol winner. Boardwatch Magazine The January 1, 1983 "flag day" (a day when a dramatic change happens in computing), marked the beginning of widespread use of TCP/IP and the birth of the modern internet. Even then, other network protocols remained widely in use, and it wasn't until the mid-1990s that TCP/IP became the clear "winner" in what some call the Protocol Wars. RELATED: How Does the Internet Work? The Future of TCP/IP Currently, most of the internet runs on Internet Protocol version 4, commonly called "IPv4." But there's a newer version called "IPv6," introduced in 1998, that is slowly rolling out over time (very slowly). Among IPv6's most important features is support for 128-bit addresses, allowing for 340 trillion trillion trillion devices with unique IP addresses on the network. In contrast, IPv4 supports 32-bit addressing, allowing over 4.2 billion IP addresses. While 4.2 billion sounds like a lot, we've already reached the limit of IPv4 addresses assigned some time within the 2010s, depending on how you choose to measure it. Luckily, IPv4 and IPv6 are interoperable, so computer vendors, internet hosts, and assigning authorities have some breathing room while making the transition to IPv6 over time. Even with all its improvements, IPv6 traces it architecture back to the same research started by Cerf and Evans in 1973 and finalized in 1981. That's quite a legacy. Happy Birthday, TCP/IP!

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