TCP/IP Network

TCP/IP is a network model designed to support network communication, even if the computer are from different manufacture.

TCP/IP was developed by the U.S. Department of Defense to specify how computers transfer data from one device to another. TCP/IP puts a lot of emphasis on accuracy, and it has several steps to ensure that data is correctly transmitted between the two computers.

Here's one way it does that. If the system were to send the whole message in one piece, and if it were to encounter a problem, the whole message would have to be re-sent. Instead, TCP/IP breaks each message into packets, and those packets are then reassembled on the other end. In fact, each packet could take a different route to the other computer, if the first route is unavailable or congested.

The purpose of the layers is to keep things standardized, without numerous hardware and software vendors having to manage communication on their own. It's like driving a car: All the manufacturers agree on where the pedals are, so that's something we can count on between cars. It also means that certain layers can be updated, such as to improve performance or security, without having to upgrade the entire thing.

The four layers of the TCP/IP model

TCP/IP is a datalink protocol that is used on the internet. Its model is split into four distinct layers. Used together, they can also be referred to as a suite of protocols.

DataLink Layer

-The datalink layer (also called the link layer, network interface layer, or physical layer) is what handles the physical parts of sending and receiving data using the Ethernet cable, wireless network, network interface card, device driver in the computer, and so on.

Error Detection and Correction TCP/IP Model

Errors in DataLink Layer

-It is essential to know what types of errors may occur while transmission of data in the data link layer

i-Single Bit Error: In a frame, there is only one bit, anywhere though, which is corrupt.

ii-Multiple Bit Error: Frame is received with more than one bit in a corrupted state.

iii-Burst Error: Frame contains more than one consecutive bits corrupted.

Error Detection

-Errors in the received frames are detected utilizing Parity Check and Cyclic Redundancy Check (CRC).

-In both cases, few extra bits are sent along with actual data to confirm that bits received at the other end are the same as they were sent. If the counter-check at the receiver's end fails, the bits are considered corrupted.

Parity Check

-One extra bit is sent along with the original bits to make the number of 1s either even in case of even parity, or odd in case of odd parity.

-The receiver simply counts the number of 1s in a frame.

-If the count of 1s is even and even parity is used, the frame is considered to be not-corrupted and is accepted.

-If the count of 1s is odd and odd parity is used, the frame is still not corrupted.

-For example, if even parity is used and the number of 1s is even then one bit with the value 0 is added. This way number of 1s remains even. If the number of 1s is odd, to make it even a bit with value 1 is added.

Cyclic Redundancy Check(CRC)

>This technique involves binary division of the data bits being sent.

-The divisor is generated using polynomials.

-The sender performs a division operation on the bits being sent and calculates the remainder.

-The sender adds the remainder at the end of the actual bits.

-Actual Data Bits + Remainder = Codeword

-The receiver performs division operations on codewords using the same CRC divisor.

-If the remainder contains all zeros the data bits are accepted, otherwise it is considered as there some data corruption occurred in transit.

Error Correction

Error correction can be done in two ways.

Backward Error Correction

-When the receiver detects an error in the data received, it requests back the sender to retransmit the data unit.

-Backward error correction is simple and can only be efficiently used where retransmitting is not expensive. For example, fiber optics.

Forward Error Correction

-When the receiver detects some error in the data received, it executes an error-correcting code, which helps it to auto-recover and to correct some kinds of errors.

-Forward Error Correction is used in the case of wireless transmission because retransmitting may cost too much.

-To correct the error in the data frame, the receiver must know exactly which bit in the frame is corrupted. To locate the bit in error, redundant bits are used as parity bits for error detection.

Internet Layer

-The internet layer (also called the network layer or IP layer) controls the movement of accepts and delivers packets for the network. This layer includes the powerful Internet Protocol (IP), the Address Resolution Protocol (ARP), and the Internet Control Message Protocol (ICMP).

Transport Layer

-The transport layer is what provides a reliable data connection between two devices. It divides the data in packets, acknowledges the packets that it has received from the other device, and makes sure that the other device acknowledges the packets it receives.

Application Layer

-The application layer is the group of applications that require network communication. This is what the user typically interacts with, such as email and messaging. Because the lower layers handle the details of communication, the applications don’t need to concern themselves with this.