1.3t: Lesson 3: TCP/IP

# The TCP/IP Networking Model

Hi, it’s me Nige here again. Last time we discussed the OSI model, and how It’s not convenient, or sensible, to have a single protocol with all of the things we need to agree on, we showed you how the OSI divides the work between several different protocols, in a stack, and we talked over each of the layers.

There is also another model, and that is the TCP/IP model.

# Transmission Control Protocol / Internet Protocol

It is simpler than OSI, only 4 layers.

Its development was originally funded by U.S. Department Of Defense, therefore it is also known as the DOD model.

This is the standard used by the Internet – and almost everywhere else.

The layers of the TCP/IP model are:

1. Datalink or network access,
2. Networking or Internet,
3. Transport and,
4. Application.

Just for comparison we’ll actually start at the top of the TCP/IP model and go down it, it’s important to remember that the sender starts at the top preparing a packet, and the receiver will start at the bottom of the stack!

# Application layer

The Application Layer of the TCP/IP Model consists of various protocols that perform all the functions of the OSI model’s Application, Presentation and Session layers. This includes interaction with the application, data translation and encoding, dialogue control and communication coordination between systems.

# Transport layer

There are many more protocols available in the Application layer. All of them take the user data and add a header and pass it down to the Transport layer to be sent across the network to the destination. The TCP/IP transport layer’s function is same as the OSI layer’s transport layer. It is concerned with end-to-end transportation of data and setups up a logical connection between the hosts.

Two protocols available in this layer are Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). TCP is a connection oriented and reliable protocol that uses windowing to control the flow and provides ordered delivery of the data in segments.

On the other hand, UDP simply transfers the data without the bells and whistles. Though these two protocols are different in many ways, they perform the same function of transferring data and they use a concept called port numbers to do this. The following sections cover port numbers before looking into TCP and UDP in detail.

# Port numbers

A host in a network may send traffic to or receive from multiple hosts at the same time. The system would have no way to know which data belongs to which application. TCP and UDP solve this problem by using port numbers in their header. Common application layer protocols have been assigned port numbers in the range of 1 to 1024. These ports are known as well-known ports. Applications implementing these protocols listen on these port numbers. TCP and UDP on the receiving host know which application to send the data to based on the port numbers received in the headers.

On the source host each TCP or UDP session is assigned a random port number above the range of 1024. So that returning traffic from the destination can be identified as belonging to the originating application. Combination of the IP address, Protocol (TCP or UDP) and the Port number forms a socket at both the receiving and sending hosts. Since each socket is unique, an application can send and receive data to and from multiple hosts.

# Internet layer

Once TCP and UDP have segmented the data and have added their headers, they send the segment down to the Network layer. The destination host may reside in a different network far from the host divided by multiple routers. It is the task of the Internet Layer to ensure that the segment is moved across the networks to the destination network.

The Internet layer of the TCP/IP model corresponds to the Network layer of the OSI reference model in function. It provides logical addressing, path determination and forwarding.

The Internet Protocol (IP) is the most common protocol that provides these services. Also working at this layer are routing protocols which help routers learn about different networks they can reach and the Internet Control Message Protocol (ICMP) that is used to send error messages across at this layer.

# Internet Protocol (IP)

The Internet layer in the TCP/IP model is dominated by IP with other protocols supporting its purpose. Each host in a network and all interfaces of a router have a logical address called the IP address. All hosts in a network are grouped in a single IP address range similar to a street address with each host having a unique address from that range similar to a house or mailbox address. Each network has a different address range and routers that operate on layer 3 connect these different networks.

# Network access layer

This controls the hardware devices and media that make up the network, our cables or wireless connection.

OK, that’s the end of this session on introduction to modern networks, you should have watched the three videos, the introduction where we discussed signals, the second covering the OSI and this one of course covering the TCP/IP.

There is another video for this week and it’s a practical, covering Wireshark.