

13.1 Network Architectures & 13.2 Network Protocols

Notebook: How Computers Work [CM1030]

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Cornell Notes	Topic: 13.1 Network Architectures 13.2 Network Protocols	Course: BSc Computer Science
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Essential Question:		
What are the different configurations of a network and the different protocols that govern its communication?		
Questions/Cues:		
<ul style="list-style-type: none">• What is one way of classifying networks?• What is LAN?• What is WAN?• What is PAN?• What is a Cluster?• What is a Star Network?• What is a Bus Network?• What is a Switch?• What is Router?• What is the Client-Server model of communication in terms of network classification?• What is a Peer-to-peer Network?• What is a Protocol?• What is CSMA/CD?• What is the Application layer?• What is the Transport layer?• What is the Network Layer?• What is a Network Port?• What is TCP?• What is UDP?		
Notes		
<ul style="list-style-type: none">• Aside from physical connection, networks can be classified by how large an area they cover• LAN(Local Area Network) = connects comps that are close together or local to one another. ie. connected together in a single office or house.• WAN (Wide Area Network) = connects comps over a much bigger or wider area than a LAN• PAN (Personal Area Network) = mini wireless network that connects all devices on a person together. ie. mobile phone, laptop, smartwatch, wireless headphones, anything		

a person carries around with them that requires an active internet connection.

- Cluster = Comps are connected together so they can work together for needs that need a lot of computing power. These comps are networked together and do their work in parallel, but to the outside world they act as if they were a single computer. This type of combined computer is called a cluster.
 - More reliable than a machine because if one comp fails then others can carry on without it.
- Star Network = One central comp/device that all other comps are connected to, but aren't connected to each other directly. This is called a Star network.
 - Star networks very widely used in early day of computing, but still used today for WiFi where all devices connect to a wireless access point.
 - Less popular in modern times for other network setups because it is very reliant on main comp and whole network fails if main comp fails.
- Bus Network = all comps connected to single long wire which is called bus. Comps in network are all independently connected to the bus and can communicate with all other comps on bus without relying on central comp. Bus is conceptually a long wire, but in fact might be quite small, in most cases bus will actually be a hub like a connective box
 - Ethernet, most popular wide network architecture is a bus network
- Small Local Area Networks are connected to other networks to form wider area networks. They're connected by little comps that forward packets from one network to the other.
- Switch = connects networks of same type and typically forwards packets unchanged
- Router = connect different types of networks Ethernet and WiFi and have to translate packets between different protocols
- Client-Server model = individual comps called clients, all communicate with central comp called server. Clients & servers not typically connected directly to each other. Client-server isn't about physical connections but about virtual connections using network protocols.
- Peer-to-peer network = individual people's comps communicate directly with each other
- Protocol = set of rules that comps use to comm over networks.
- CSMA/CD(Carrier Sense Multiple Access with Collision Detection) = when comp transmits, it also checks if there are other transmissions on bus, if there are, it stops transmitting. Each comp waits a random amount of time until re-transmission. Since the time was random, it is very unlikely that other comp will transmit at same time. CSMA/CD implemented as part of Ethernet standard.
- App layer = is the innermost layer of the layers surrounding packet transmission. App protocols are specific to a particular app or type of app. ie. HTTP protocols for web pages & web browsers
- Transport layer = handles comm between start point and destination of a comm. Manages what the comps at each end do to communicate without worrying either about the content of the message or all the networks & routers in between the two comps. ie. TCP & UDP.
- Network layer = handles how packets are transmitted across different networks from one comp to another. It handles how the message is passed between one network and the next via routers. Network layer protocol is almost always IP, the internet protocol.
- Link layer = handles transmission across a single physical network, for example the Ethernet or WiFi protocols
- Network port = number attached to a packet, which tells your network software where to send that packet. Port 80 is used for HTTP protocol, Port 110 is used by POP3 email protocol, & classic video game DOOM has it own Port 666.
- TCP(Transmission Control Protocol) = a reliable transport layer protocol, which means that messages get through. TCP starts by establishing a connection between the two comps. This means it checks that they're both ready and able to exchange data, it does this by sending some packets whose sole purpose is to make sure that both comps are ready. In TCP, the device that wants to start communicating first sends a packet called "syn" short for synchronize, which is a request for a connection. The other comp gets

that packet and replies with a "syn-ack" which means synchronized-acknowledge; this means it confirms that it's received a syn & that it's ready to comm. Original device replies with an ack to acknowledge that it received the syn-ack & at this point they're both ready to talk.

- The first device sends its first packet & once the device at other end has received it, it sends an ack to acknowledge that it has been received, this way your device can be sure that the comm worked. TCP gives numbers to packets to keep track of data over the internet. The acknowledge always includes the packet #, so sender knows exactly which packets have been received. Once all packets are sent & received, connection is closed same way it was started.
- UDP(User Datagram Protocol) = is an unreliable transport layer protocol. It sends packets without acknowledging them or re-sending them. Ideally for fast communication in real-time that wouldn't work with TCP because consistent acknowledges would slow this down.

Summary

In this week, we learned about the different configurations of networks, the layers of packet transmission and in detail the two different kinds of transport layer protocols, TCP & UDP.