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4 February 2022

HW: Fundamentally, How Do Networks Work

1)   Video 1 - What is the Internet

a)   What is the Internet?

The internet is a distributed network of hardware that can send electronic messages quickly throughout the network.

b)   Who are Vint Cerf and Bob Kahn?

Vint Cerf and Bob Kahn are the creators of the first experimental packet network, what is now the internet.

c)   What is the ARPANET

The advanced research project agency network, a defense agency research project of decentralized movements of information.

d)   What problem was Paul Baran trying to solve and what was his solution?

How to build a communication network that couldn't be destroyed by a nuclear attack. His solution was to distribute the communications along the network, rather than keeping it centralized.

e)   Who controls the Internet?

Nobody, (but in a sense, everyone) due to decentralized approach to routing packets. Nobody determines the processes of the entire Network, but it is in the best interest of everyone to relay packets throughout each node or network towards their destination.

f)   What is the primary motivation for Networks?

To allow everyone to share information, regardless of distance of geographical obstacles.

2)   Video 2 - The Internet – Wires, Cables and WIFI

a)   Compare the Internet to the Postal Service, compare and contrast.

The internet is similar to the Postal Service in the way that they transport something from node to node until it reaches its desired location. However, it is different in the sense that all that is travelling are bits, not physical packages.

b) What are bits, bytes and how to we measure large amounts of them.

Bits are the atoms of information, 1 and 0s are used to communicate with other networks. We measure larger amounts of bits by grouping them together in groups of 1,024 (Megabyte, Gigabyte, ect).

c) What are the three methods that are used to transmit bits?

We use electricy, light, and radio waves to transmit bits.

d) Explain bandwidth, bit rate and latency?

Bandwidth is the maximum transmission rate of a device. Bit rate is the number of bits we can send over a certain amount of time. Latency is the amount of time it takes for a bit to reach the destination.

e) How does fiber optic cable work?

Fiber optic cables use light beams angles at different angles to send multiple bits simultaneously. This allows for a fast transfer of bits with less loss.

f) How does wireless communication work?

They typically use radio signals to send bits, translating them into 1 and 0s before sending them over the network.

3)   Video 3 - IP Addresses and DNS

a) What is the internetworking protocol?

A standard protocol for communicating from device to device.

b) How did Vint Cerf define the Internet?

Vint Cerf defines the Internet as a network of networks.

c) What is a protocol and how do we add new applications to the Internet?

A protocol is a well-known set of rules and standards used to communicate between machines. We add new applications by

d) What does IP do, and why do we have different IP versions?

IP represents the computers' location for sending and receiving information. We all have different IP addresses just like each house has its own unique address, to differentiating themselves among others.

e) What is DNS and what does it do?

The DNS system is an open public communications protocol. It associates names of sites (like google.com) with their IP addresses to help other devices connect without typing the sites actual IP address.

f)   Define Internet scalability and what are the implications?

Because there is no single DNS server, anyone can create a connection to the existing web of networks. One implication of this is the lack of oversight, leading to potentially malicious actions from others, such as DNS spoofing.

4)   Video 4 - The Internet: Packets, Routing and Reliability

a)   How is data delivered to you reliably? In your answer, use the terms Packet, router, IP, route, fault tolerant, TCP, acknowledgement, redundancy, scale, and fault tolerance.

Data is reliability delivered to your device in packets. Packets are transported from one computer to the next in any route, usually determined by current traffic. The device IP and requested servers IP are both captured for back-and-forth communications. Routers are computers specifically designed for determining the best route of these packets. By having many paths to choose from allows the network to be fault tolerant, as one or many routes may fail, and packet communications would still occur using different routes. TCP is the transmission control protocol and allows the packets to first be accounted for before accessing the media. This acknowledgment by the TCP ensures all packets are delivered or requested again if they weren't delivered initially. Both protocols are scalable, meaning that more routers allow for more reliability.

b)   How is it possible for computers to connect, communicate and collaborate together?

The series of routers enable computers to connect and communicate through the internet. Although all information isn't delivered in a straight path from server to device, the system of networks allows for information (packets) to be transported in the most effective route to its destination.

5)   Video 5 - The Internet: HTTP and HTML

Define and explain each of the following terms explain their purpose or function:

a)   Browser

A browser is a piece of software that allows you to access web pages.

b)   URL

The Uniform Resource Locator, or web address is the "nickname" or domain name given to a specific IP address.

c)   Server

        A Server is another computer that communicates with your device to post the information you are requesting. The server is where the information is stored, waiting for your request.

d)   HTTP

        HTTP stands for Hypertext Transfer Protocol, which is the language used by one computer to ask another for a specific document.

e)   GET and POST

        Get requests are a request sent by a device, requesting the hosts server sends back a specific document or supporting piece of data, like images or other media. Posts request are the pieces of information you would like sent back to the host server. This could be a form, like feedback or login credentials.

f)   Cookies

        Cookie data is information saved on the local computer and used for validation purposes when sending and receiving information with a server.

g)   Secure Socket Layer and Transport Layer Security

        Secure Socket Layer and Transport Layer Security is added security to ensure that communications proceed on a secure channel. These add layers of security protect the information being sent through the internet from snooping or tampering.

h)   Digital certificate

        A digital certificate is published by trusted entities that verify the identity of the website being accessed and could be compared to an ID card, ensuring that the connection to the website is a secure one, and no information could be compromised.

i)   DNS

        Along with HTTP, DNS manages the sending and receiving of web files across the internet.

j)   TCP and Routing

        TCP and Routing manages the breakdown and transportation of packets between computers and servers.

6)   Video 6 - The Internet: Encryption and Public Keys

a)   What are encryption and decryption and why are they important?

        Encryption is the scrambling of text to make it unreadable without the decryption key. Decryption is the process of translating the scramble/encrypted text into readable text. This is important as any information that is stolen in the process of making its way towards its destination cannot be read and would be useless to those who intercepted the information.

b)   Compare and contrast symmetric and asymmetric encryption?

Symmetric encryption occurs when both parties have the agreed upon key, so both parties can encrypt and decrypt any messages. Asymmetric encryption occurs when the public key is available to anyone wanting to send an encrypted message, but the message can only be decrypted by whomever has the private key.

c)   Describe Public and private key and who they are used?

The public key is used by anyone wanting to submit information in an encrypted fashion, whereas the private key is only used by the individual receiving the information and is used to decrypt the messages sent by others.

7)   Video 7 - The Internet: Cyber Security & Crime

a)   What vulnerabilities exist and how can they be exploiting?

Hardware and software vulnerabilities exist, and more often than not, the exploitation occurs by taking advantage of an unintentional decisions made by the user.

b)   Describe and explain Viruses, DDOS, and Phishing?

A virus is an executable program that once executed can harm the users computer, then even spread to other computers. Once the virus is installed, data could be stolen, and the party responsible may even control the programs on your device. Distributed Denial of Service occurs when many computers try to access the same website in hopes to overwhelm the servers. Sometimes millions or trillions of requests can happen simultaneously, causing the servers to stop responding. Phishing is attempted to fool computer users into accessing media through an email or other communication lines with the intent to deceive. After clicking on a fake link, users believe they are on a protected/legitimate site, when in reality, they are on a site created by the scammers to steal information.

c)   What are steps you can use to avoid getting hacked?

Some steps I can take to protect myself from getting hacked would be to use strong passwords, to check for authentic web addresses, and installing system security updates often, along with not installing any software I down trust.

8)   Video 8 - The Internet: How Search Works

a)   Does a web search scan the whole internet?

A web search does not scan the entire internet, due to the number of sites out there.

b)   What special software scans the WWW and how do they work?

A spider is used prior to the search to collect information about each webpage, then is indexed for future searches.

c)   How does a search result get top listing?

A result gets the top listing if much of the information on the webpage matches what is searched, included in titles, or as text on the page. The number of other webpages that link a specified webpage can also determine the ranking of the webpage upon being searched.

d)   What is the most famous ranking algorithm? What is the most important factor considered?

Googles ranking system is most popular as it takes into account the number of other webpages that contain a link to a specific webpage. The idea here is that the more interesting/desirable pages will be linked more often, thus appearing further up on the results list.

e)   How do search engines figure out the context of a search request

Using machine learning, the engine is able to understand the idea behind the word and correlate certain supporting words with specific ideas. An example of this might be searching the word "bars". In this context, the search engine understands the idea of an alcoholic bar and doesn't show you places where you can by metal bars for construction purposes, or lyrical rap bars.