# CST 415 – Final

Wilsonville, Fall 2024

This is a take home final. You must turn in your final on Canvas by mid-night on finals night. You may use any and all resources available to you to complete this final. Turn in your own work. Do not copy/paste from a source (for example from the internet), instead read the source, understand the material and then put your answer into your own words.

## Section 1 – Terminology and Concepts (50 points)

Answer each question in this section with enough detail that the instructor understands that *you* understand the term or concept.

1. (6 points) Contrast the following terms:
   1. LAN address vs. Network address

LAN address is the physical address (MAC address) assigned to each card to be individual. LAN only works in the local network though so for larger structures like the internet we need to assign a network address to communicate properly. As such Network addresses are generally used for networks or over the internet.

* 1. Abrupt vs. Gracefull Release

Abrupt does not notify the server of release and thus data loss may occur. Graceful release is when the server is notified that the transfer is done then disconnects.

* 1. Hub vs. Switch

A hub broadcasts the same signal one to many, a switch is one to one/many with logic separating the signal.

1. (10 points) Draw the OSI model and give a 1 sentence description of each layer. Place the following protocols in the correct layer on your diagram: Ethernet, HTTP, UDP, ICMP, ARP, DNS, IP, TCP, SMTP, DHCP, SMTP.

|  |  |
| --- | --- |
| Application Layer | Directly interfaces with User Software to provide network service -> HTTP HTTPS DNS SMTP DHCP |
| Presentation Layer | Translation, encryption and Data Compression layer |
| Session Layer | Manages and maintains the session table |
| Transport Layer | TCP and UDP used to provide reliable or unreliable delivery |
| Network Layer | The logical addresses that make up the logical routing of networks at the IP Level |
| Data Link Layer | Physical MAC address that is then cast to the mapping done by ARP |
| Physical Layer | Actual 1s and 0s, cables the physical tangible equipment that is used by the rest |

1. (4 points) What characterizes a “routing domain”? Specifically, what do we know is consistent within a routing domain and how does that help route packets?

A group of systems that are networked together that are all using the same routing protocol. Basically anything connected to your router.

1. (5 points) Describe the concept of a “sliding window”. What is it used for and why is it used?

Basically, we shove more packets through up to a specific amount of traffic so that things can happen Asynchronously. It’s also more reliable since the packets are closer together and it keeps the traffic flowing.

1. (4 points) What are the trade-offs between choosing UDP or TCP for implementing your own application protocol? Describe at least one advantage and disadvantage for each.

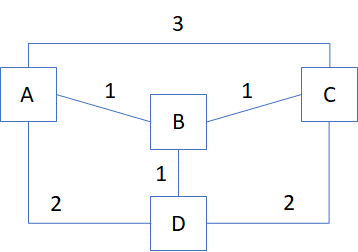
UDP is unreliable because of the lack of a guarantee that packets arrive. TCP is used for the transfer of files and does have a “guaranteed” amount of working.

1. (6 points) Contrast ARP and DHCP. What are they each used for? Describe how they work.

DHCP handles the setup of the DNS and gateway level, by sending them the IP and various other “advanced” Settings for windows. ARP is just a mathematical conversion of the MAC to an IP address to communicate with other devices.

1. (5 points) In the following diagram, what would the routing table look like on host A after the following sequence of reports:

A reports to B, C and D



B reports to A, C and D

C reports to A, B and D

D reports to A, B and C

A’s Routing Table:

|  |  |  |
| --- | --- | --- |
| **Destination** | **Next Hop** | **Cost** |
| B | B | 1 |
| C | C | 3 |
| D | D | 2 |

1. (5 points) Describe the distinction bewteen OSI Layer 2 and Layer 3. Why do these two exist as separate layers? Describe a real-world scenario, using actual protocol names, where the distinction is useful.

One reason would be that the two layers are used for different purposes. Layer 2 is like a fingerprint, designed to identify the device on a local level. Layer 3 is designed to talk across networks and move them from one place to another.   
  
A real-world issue of running out of IPs for the amount of computers there are in the world is solved by these layers being separated.

1. (5 points) In socket programming, when would you use ReceiveFrom() vs. Receive()? What must you do prior to calling each method?

RecieveFrom is used for UDP and requires the senders information.

Receive is for TCP when you have a connection already. Section 2 – Understanding Protocols (30 points)

Each question in this section relates to a specific network protocol. Write a couple paragraphs describing the protocol as required in the question. Be complete in your answers and ensure the instructor sees that you understand how the protocol works.

1. (10 points) Three PCs are on an Ethernet LAN, connected by a hub. Describe how the Ethernet protocol deals with collisions in this situation. How would the situation change if the hub were replaced by a switch?

All PCs share the same medium with a hub, if there is a collision there is a random amount of time that is waited before trying again. IF there are still collisions it just keeps doing that same pattern.

On the other hand, if you have a switch, you can have dedicated connections to each of the devices so there would not be a slowdown.

1. (10 points) A client program on a PC downloads a large data file from a server using TCP. Describe how the client connects to the server using a 3-way handshake and then downloads the data in order, without loss of data. Use specific TCP terminology in your description.

The client asks to talk

The server acknowledges the conversation

The client sends acknowledgement

Then the connection is established.

Once the client is connected to the server,

The server creates a thread that listens for the client

TCP Segments are provided from the server

The client Acknowledges

the conversation is continued

Once all packets are sent, the server sends disconnect and the disconnect is acknowledged

1. (10 points) Describe in detail what happens when a user uses a Web browser to access a static HTML file on a Web server using HTTP. The user’s PC and the Web server are on different computers, both on the same Ethernet LAN. Walk through the protocol stack, from HTTP to Ethernet and back, step by step, explaining what happens at each layer. Include what types of “addresses” are used at each layer.

Assuming:

You aren’t assigned a manual IP

You aren’t using a switch that has assigned the IP

You aren’t using any passthrough device (like a docking station)

You aren’t using WIFI on either device

You aren’t using two ports within the same computer

The web browser application triggers an event that sends a request. The client pc has information that is sent from the motherboard to the ethernet port, from there it travels across CAT cables to a switch or hub or modem through MACs being turned into IP addressing. From there the packets are routed using the appropriate procedure for the device that is being used to send a hello to the server. The server acknowledges the client using the reverse of the above pathway. Repeating until the content is received and the connection is closed. Section 3 – Applying Network Concepts (20 points)

Use what you have learned in this course to design a solution to the following problem, from a networking and network programming perspective. Be as descriptive and specific as possible. Name protocols. Include diagrams as appropriate. Feel free to attach more pages if you are inspired. A single diagram and a page of text are probably sufficient.

**Warning**: Do not name an existing application that meets the need… design your own!

You are creating an application for OIT students to collaborate on group projects. Students will be able to use lab PCs, laptops and mobile phones. Students in a group may be at any of OIT’s campuses or even at home when working together. Students may join a group at any time, and whenever they are “on-line”, the other students already on-line in the group should be notified within a few seconds. Students may chat, share files and use a shared whiteboard.

I would create a session manager that keeps track of the last ping from the user and then uses UDP sockets to manage the voice chat if there was one. From there I would want to have a client side state machine for controlling “online” sending a ping if online still, once away for 30 minutes send close. If they were to need the group document that would be done with TCP Sockets all connected to a different cursor in the program that is then pinged to all the other connected sockets in the session.