There are three parts to this assignment relating to each lecture in Module 1.

Part 1: Layering and the Internet Model

Imagine that Creamy Ice is a large manufacturer of tasty ice cream and other frozen dessert products and has been in business for decades. Further imagine that the organization's manufacturing equipment, and related computers and devices, use a legacy networking model with legacy protocols, rather than the suite of protocols popular today.

The legacy model consists of four layers, and each layer on the sender communicates with that same layer on the receiver. On the sending device, the top layer is named the Codes Layer, and sends control codes, status codes, and associated small data items from the device's software. The control codes represent the issuance of a command or instruction for the intended device, while the status codes represent a notification about what is going on with a particular function on the device. Going downwards, the next layer is named the Formatting Layer, and arranges the codes and data into protocol data units (PDUs). The next layer downwards is named the Distribution Layer, and one function it performs is compressing the PDUs so that they use less bandwidth. Another function is that it distributes the PDUs to nearby equipment, devices, or computers, within the same building or campus. The bottommost layer is named the Encoding Layer and encodes the PDU into electrical signals and transmits the signals over shielded twisted pair (STP) Type 1 cable that connects all of the equipment, computers, and devices together.

The receiving device more or less performs the same functions in reverse. The Encoding Layer decodes the electrical signal into bits, then propagates the PDUs to the Distribution Layer. The Distribution Layer decompresses the PDUs and determines whether each PDU is meant for the local device, or for another one. If the PDU is intended for the local device, the layer will then propagate it upwards to the Formatting Layer. The Formatting Layer extracts the codes and data from the PDUs, putting them back into their raw form, and these are propagated to the Codes Layer. The Codes Layer simply gives the codes and data to the device software so it can take appropriate action. If the Distribution Layer initially determines that the PDU is intended for a device other than the local device, the layer will forward the PDU to the other device rather than propagating it to the Formatting Layer.

This legacy model is summarized below.

Sender			*Receiver*	
Codes Layer	Sends control codes, status codes, and small chunks of associated data		Codes Layer	Gives the codes and data to the device software
Formatting Layer	Formats the codes and data as standardized protocol data units (PDUs)		Formatting Layer	Extracts the codes and data from the PDUs and propagates them to the Codes Layer
Distribution Layer	Compresses the PDUs, then distributes them to nearby equipment, computers, or devices		Distribution Layer	Decompresses the PDUs, then checks whether the PDUs are intended for this device. If so, it propagates the PDUs to the Formatting Layer. If not, it forwards the PDUs to the next nearby device.
Encoding Layer	Encodes the PDUs in electrical signals and transmits them over STP Type 1 cable	➔	Encoding Layer	Receives the electrical signals, decodes them extracting the PDUs, and propagates the PDUs to the Distribution Layer

With this scenario in mind, address each topic below.

Topic 1: Layer Comparison

Compare and contrast the four layers of Creamy Ice's legacy network model with the five layers of the Internet model in use today. Focus on the significant aspects of the layers in both models, and make sure to cover all five layers of the Internet model in your answer.

There are few differences when compare between the four layers of Creamy Ice's legacy network model and five layers of the Internet model.

- There is only one layer (Distribution layer) which is responsible for compression and distribution the PDU's in the Creamy Ice's legacy network model, while there are 2 layers which is responsible for those functions, those functions are split between the Transport and Network layers.
- Type 1 cable is used in the Creamy Ice's legacy. In contrast, Internet model use several difference cables such as Rs-232C, Category 5, V.92
- All layers except the physical layer create a new PDU as the message passes through them in Internet Model.

Below is the table which will help to get clear view comparison between two models.

Creamy Ice's legacy network model		**Internet model**	
Codes Layer	This layer is comparable with the application layer. Defines the messages to be sent (Sends control codes, status codes,	**Application Layer**	User's access to the network. The user defines what messages are sent over the network.

	and small chunks of associated data in Sender side. Gives the codes and data to the device software in Receiver side.)		
This model does not have any layer which Link the application to the network and take care end-to-end connections, breaks up messages and reassembles message at destination. This job is executed by the distribution layer in this model.		**Transport Layer**	Linking the application layer software to the network. Takes care end-to-end connections. Breaking long messages into several smaller messages. Recombining the smaller messages back into the original larger message. Detect lost messages and request to resent those messages.
This model also lacks network layer which perform routing and IP addressing. Because this model is one route network which is nearby equipment, the routing is perform by the distribution layer as well.		**Network Layer**	It performs routing, in that it selects the next computer to which the message should be sent. It can find the address of that computer if it doesn't already know it.
Formatting Layer	Formats the codes and data as standardized protocol data units (PDUs) in Sender side. Extracts the codes and data from the PDUs and propagates them to the Codes Layer in Receiver side	**Data Link Layer**	Is responsible for moving a message from one computer to the next computer in the network path from the sender to receiver. Controls the physical layer by deciding when to transmit messages over the media. Formats the messages by indicating where they start and end. Detects and may correct any errors that have occurred during transmission. All layers except the physical layer create a new PDU as the message passes through them in Internet Model. This layer may use a protocol called Ethernet, has its own rules and PDU. Create Ethernet frame and instructs the physical hardware to transmit the Ethernet frame.
Distribution Layer	Compresses the PDUs, then distributes them to nearby equipment, computers, or devices in Sender side. Decompresses the PDUs, then checks whether the PDUs are intended for this device. If so, it propagates the PDUs to the Formatting Layer. If not, it forwards the PDUs to the next nearby device in Receiver side. This layer can be compared to the transport and network layers and do some tasks as data link layer in the Internet Model.		

Encoding Layer	Encodes the PDUs in electrical signals and transmits them over STP Type 1 cable in Sender side. Receives the electrical signals, decodes them extracting the PDUs, and propagates the PDUs to the Distribution Layer in Receiver side. This layer is comparable with Physical Layer in the internet model. STP type 1 cable defines the physical connection to nearby equipment, computers, or devices.

Physical Layer	Is the physical connection between the sender and receiver. The role is to transfer a series of electrical, radio, or light signals through the circuit. Contains all transmission media and hardware. Defines modulation schemes, types of symbols

Topic 2: The Benefits of Changing Models

Identify and describe several significant benefits for Creamy Ice if the organization were to change to using the Internet model.

The benefit of change model to Internet model:

- It is a scalable, this allows networks to be added without disrupting the current service in Creamy Ice organization.
- It is easy for Creamy Ice to upgrade and develop new software, because all one has to do is write software for one level at a time.
- The internet model offers a suite of protocols which are designed to work together to increase speed, and flexibility. Some protocols use in internet model are TCP/IP, HTTP
- Using Internet model, it allows Creamy Ice to create LANs, MANS and WANs depend on the size of organization.

Topic 3: The Disadvantages of Changing Models

Identify and describe significant disadvantages for Creamy Ice if the organization were to change to using the Internet model.

The disadvantages of changing model to Internet model:

- Time-consuming and cost because when Creamy Ice changes from legacy model to Internet model, the organize needs to update all computers, equipment's, and devices, software, and hardware to use the new protocols of Internet model and cost of hiring staff and training.
- Complexity, because there are several layers, each with its own software and PDUs, sending a message involves many software programs (one for each protocol) and many PDUs.
- The PDUs add to the total amount of data that must be sent (thus increasing the time it takes to transmit) and the different software packages increase the processing power needed in computers.

Part 2: Application Architecture

Assume that an organization's employees have each been given a computer and a core application to perform their work. Each employee's computer runs its own instance of the core application, which has the functions of both a client and a server. Files are not stored centrally on a dedicated file server in the organization's network but are stored on the individual computers where they were created. When someone needs a file not found on their own computer, that is, needs a file created by someone else, their application searches the network to find the desired resource and contacts the application running on the other person's computer to retrieve the file. This and all other communication occurs by the employees' computers directly contacting other employees' computers.

The CTO is considering having the core application rewritten to use a different networking architecture. With this scenario in mind, address each of the topics below.

Topic 1: Architecture Identification

Identify the networking application architecture used by the organization and explain the basic mechanics of how that architecture works, including how the four application functions would be divided.

Architecture identification:

- The networking application architecture used by the organization is Peer-to-Peer Architectures.

Basic mechanics:

- With Peer-to-Peer architecture, all computers act as both a client and a server. All computers perform all four functions: presentation logic, application logic, data access logic and data storage.
- With a Peer-to-Peer file sharing application, a user uses the presentation, application and data access logic installed on his or her computer to access the data stored on another computer in the network.
- With a Peer-to-Peer application-sharing network, other users in the network can use others' computers to access application logic as well

Topic 2: Switching to Client-Server

Identify and explain three issues the organization would need to address if it would like to switch from its current networking architecture to a two-tier, client-server architecture.

1. **Performance degradation:** when simultaneous client requests are made, the application is forced to make multiple requests to data source for data before presenting anything to the end user. These multiple data requests can affect the precious network performance. Thus, there arises a very high inhibition on scalability, availability, and performance on the systems.
2. **Maintenance**: if there is a small change affected in an application logic code, all the users accessing that code must be taken off from the systems. There, difficulties often arise in controlling software versions and distributing new versions.
3. **Security:** it is usually face struggle to implement reliable security since users must have login information for every data server.

Topic 3: Advantages and Disadvantages of Client-Server

Identify the advantages and disadvantages, for the organization, of switching from the organization's current networking architecture to a client-server architecture.

Advantages:

- Allow software and hardware from different vendors to be used together.
- More efficient because of distributed processing.
- A client-server provides scalability to perform multiple services which can be use by multiples users.
- More secure than peer-to-peer networks.
- Centralized control by the network administrator.
- Allowing backups or copy the data. Therefore, it is easier to recover files.
- Whole network is easily managed by using a server.
- Files and date are organized better.
- Files and data are easier to share and control from server.

Disadvantages:

- Difficulty in getting software from different vendors to work together smoothly.
- Might require middleware, a third category of software.
- Set up and maintenance cost is more expensive than peer-to-peer network.
- All computers on the network can be disrupted if server is failure.
- Simultaneous request of data from multiple clients to the server, the server may result overload and network congestion.

Part 3: Digital Communication Rates

Imagine that we need to digitally download the text of an ebook at the rate of 35 pages per minute. The number of lines per page is 15, and the number of characters per line is 35. With this scenario in mind, address each of the topics below.

1. Most of what is needed to calculate the number of bits sent per minute is present in the scenario above, but something is missing. What is it?

- The numbers of bits per character is missing.

2. What are the common values for this missing item, and where do these values come from?

The number of bits per character indicates the number of bits used to represent a single data character during serial communication.

There are three predominant coding schemes in use today:

1. ASCII: There are two types
   a. 7-bit code that has 128 valid character combinations
   b. 8-bit code that has 256 combinations
2. Unicode: UTF-16 is 16 bits per character, UTF-8 is 8 bits per characters
3. ISO 8859: is an 8-bit code that includes the ASCII codes plus non-English letters used by many European languages.

3. Which value would you choose from #2? There is not only one "correct" answer to this but do make sure to justify your choice.

I would choose ASCII coding scheme because is the most popular code for data communications and is the standard code on most microcomputers. I choose 8-bit code because It has more character combinations which is 256 combinations.

4. With your assumption in #3, calculate the bit rate needed, expressed as bits per second, to download the text of the ebook as described in the scenario. Recall that the bit-rate formula is:

R = b/t

where R is the bitrate, b is the number bits, and t is the unit of time.

First, Calculate the total number of bits in 35 pages as:

b = 35 pages x 15 (lines/pages) x 35 (characters/line) x 8 (bits/character) = 147,000 bits

We download 35 pages in t = 60 seconds, the bitrate is calculated as:

R = b/t = (147,000 bits)/ (60 seconds) = 2450 bits/second

5. Now that you have calculated the bit rate needed to download the ebook, let us consider how this relates to symbol transmission over a physical circuit. If a modulation scheme on a physical circuit encodes two bits in each symbol, what would the symbol rate need to be in order to download the ebook at the given rate (35 pages per minute)? Make sure to give the value and explain your reasoning.

We ask ourselves

2 (bits/symbol) * X (symbols/second) = 2450 (bits/second)

And we solve for X to get the symbol rate:

X (symbols/second) = 2450 (bits/second) * 1/2 (symbol/bits) = 1225 (symbols/second)

Symbol rate is a unit of signaling speed used to indicate the number of times per second the signal on the communication circuit changes. The bit rate and the symbol rate (or baud rate) are the same only when 1 bit is sent on each symbol.

6. Lastly, if the bandwidth of the circuit is quadrupled, but all other factors including the signal strength and noise strength are kept equal, what would happen to the capacity of the circuit? Make sure to explain your reasoning.

We have Shannon's formula:

$$C = B \times \log2\ (1 + S / N)$$

C – channel capacity (maximum supported data rate)
B – channel bandwidth
S – signal strength
N – noise strength
S/N – signal-to-noise ratio (SNR)

According to Shannon's formula, if the bandwidth of the circuit is quadrupled, but all other factors are kept equal, the capacity of the circuit (channel capacity) will increase quadrupled.

Your assignment will be evaluated according to the following rubric.

	Grade	Qualities Demonstrated by the Assignment Submission	Grade Assigned
Content (70%) Measures the quality of the content in the assignment	A+ ➔ 100	The content demonstrates exceptional understanding of all relevant subject matter and its inter-relationships. All major relevant issues are thoroughly covered, and all content is very focused and on-topic. There is no known way to improve the content, and there are absolutely no technical or coverage errors present.	
	A ➔ 96	The content demonstrates exceptional understanding of all relevant subject matter and its inter-relationships. All major relevant issues are thoroughly covered, and all content is very focused and on-topic. At most one insignificant technical or coverage error may be present.	
	A- ➔ 92	The content demonstrates deep understanding of all relevant subject matter and its inter-relationships. All major relevant issues are covered, and all content is on-topic.	
	B+ ➔ 88	The content demonstrates understanding of all relevant subject matter and its inter-relationships. Almost all major relevant issues are covered, and the content is at least reasonably on-topic.	
	B ➔ 85	The content demonstrates understanding of most relevant subject matter and its inter-relationships. Almost all major relevant issues are covered, and all content is at least reasonably on-topic.	
	B- ➔ 82	The content demonstrates moderate understanding of much relevant subject matter and its inter-relationships. There is reasonable coverage of major relevant issues, and the content is at least reasonably on-topic.	
	C+ ➔ 78	The content demonstrates some understanding of relevant subject matter and its inter-relationships. Some major relevant issues are covered, and at least some content is on-topic.	
	C ➔ 75	The content demonstrates understanding of a small portion of the relevant subject matter and its inter-relationships. Some major relevant issues are covered, and at least a small portion of the content is on-topic.	
	C- ➔ 72	The content demonstrates little understanding of and insight into the relevant subject matter and its inter-relationships. A small portion of the major relevant issues are covered. The focus of the content may be off topic or on insubstantial or secondary topics	
	D ➔ 67	The content demonstrates almost no understanding of or insight into the relevant subject matter and its inter-relationships. Almost none of the major relevant issues are covered, and the content may be almost entirely off-topic.	
	F ➔ 0	The content demonstrates no understanding of or insight into the relevant subject matter and its inter-relationships. No major relevant issues are covered, and the content is entirely off-topic.	
Exposition (30%) Measures how well the content is expressed	A+ ➔ 100	The presentation of all ideas and designs is exceptionally clear and persuasive; the entire submission is exceptionally organized. There is no known way to improve the clarity or organization of the submission.	
	A ➔ 96	The presentation of all ideas and designs is exceptionally clear and persuasive; the entire submission is exceptionally organized. There may be at most one insignificant way to improve the clarity or organization of the submission.	
	A- ➔ 92	The presentation of all ideas and designs is very clear and persuasive; the entire submission is very organized.	
	B+ ➔ 88	The presentation of all ideas and designs is clear and persuasive; the entire submission is organized.	
	B ➔ 85	The presentation of most ideas and designs is clear and persuasive; most of the submission is organized.	
	B- ➔ 82	The presentation of most ideas and designs is generally clear; most of the submission is reasonably organized.	
	C+ ➔ 78	Some parts of the submission are hard to understand; some parts are disorganized.	
	C ➔ 75	About half of the submission is hard to understand; about half is disorganized.	
	C- ➔ 72	Most parts of the submission are hard to understand; most parts are disorganized.	
	D ➔ 67	Almost all of the submission is hard to understand and disorganized.	
	F ➔ 0	The entire submission is hard to understand and disorganized.	
Overall Assignment Grade:			

Use the **Ask the Facilitators Discussion Board** if you have any questions regarding how to approach this assignment.

Save your assignment as ***lastnameFirstname_assignment1.doc*** and submit it in the *Assignments* section of the course.

For help uploading files please refer to the *Technical Support* page in the syllabus.