

***MET CS 625 Business Data Communication and Networks
Assignment 3***

Review the hypothetical scenario below which concerns local area networks (LANs), then answer the series of questions about the scenario. Make sure each answer is thoroughly explained and that your reasoning behind your answers is included. Explain any significant assumptions or interpretations you made for the scenario as well.

Lollipopola Scenario

Lollipopola, an organization that manufactures lollipops and other candies, uses many local area networks in its corporate office. Lollipopola naturally used earlier forms of Ethernet based on hubs when LANs were first becoming popular. The LAN speeds in the corporate office have been upgraded across the organization several times over the years, with most groups now using 100 Mbps (some groups are still using 10 Mbps). Those using 100 Mbps are using switches, while the rest are still using 10 Mbps hubs. The cables for the subnets run to utility closets, and each closet contains the subnet's switch or hub. Lollipopola has wireless access only for the offices of the board of directors.

The CTO, recognizing the current trends, has asked Delaney, the network manager, to upgrade the speed of the network, to use more modern technology, and to add additional wireless capabilities. Delaney submitted the following proposal.

Network Design

The network staff will interview the high-level executives to determine what applications the organization uses. Using this information, the network staff will carefully calculate the speeds needed by each group.

The staff will then contact various vendors to review their prices through discount negotiations or bid requests and determine the cheapest devices available to support the speeds necessary for each group. The goals are twofold -- to minimize purchase cost, and to buy from as many different vendors as possible to avoid vendor lock-in (i.e. avoid being tied to only one vendor). This process will take about a year-and-a-half.

During the interview process, the staff will also ask the executives about who needs wireless access, to get a rough number of users that would use it.

Network Implementation

After the technologies and speeds have been designed, some groups will be given 100Mbps speed subnets connected to switches, which will be placed in the server room. Although 1Gbps speeds are available, using this slower speed allows re-use of existing 100Mbps switches to save cost. Groups with wired access will have no wireless access, to save cost. If several employees in a group need wireless access, the entire group will be given only wireless access via the 802.11i protocol; and their wired access will be removed to save cost. Each group will either have 100Mbps wired access, or 802.11i wireless access, but not both.

Wireless access points will only be placed next to groups that need wireless access. If no one needs wireless access in a certain part of the building, no access point will be added. Access points will also be placed around the edges of the building, so that employees can access the network with their laptop at the picnic tables and outdoor areas.

The upgrades will be rolled out one small area at a time, to avoid work disruptions. This process will take about 12 months.

Part 1: LANs

1. Delaney's proposal eliminates hubs in favor of switches. Compare and contrast the characteristics of each type of device with regards to the following aspects:

- **Throughput**
- **Frame Collisions**
- **Frame Loss**
- **Security**
- **Future Growth and Speed Upgrades**

Hub	Switch
Throughput: Ethernet's logical topology is a bus topology. All computers are connected to one half-duplex circuit running the length of the network that is called the bus. All frames from any computer flow onto the central cable (or bus) and through it to all computers on the LAN. Every computer on the bus receives all frames sent on the bus. Because all computers share the same multipoint circuit and must take turns using it	Throughput: Ethernet's topology is a logical star and a physical star. Each circuit connected to a switch is not shared with any other devices, only the switch and the attached computer use it. Many switches support full duplex circuits, so each circuit can simultaneously send and receive. When switch receives a frame from computer, it looks at the address on the frame and retransmits the frame only on the circuit connected to that computer, not to all circuits as a hub would. Result, no computer needs to wait because another computer is transmitting.
Frame Collisions: There is only one collision domain in Hub, if two computers accidentally transmit at the same time, there would be a collision.	Frame Collisions: Each port has its own collision domain, and there are only two devices (the switch or other device) on it, so it eliminates great chance of occurring of frame collisions. Collisions do not occur in full-duplex Ethernet networks.
Frame Loss: Hubs perform frame flooding so there are huge chances of frame losses	Frame Loss: Frames can be lost if port buffers are overwhelmed with traffic.
Security: because all frames are sent to all computers in the same collision domain, security is a problem because any frame can be read by any computer.	Security: Switch is more secure because When switch receives a frame from computer, it looks at the address on the frame and retransmits the frame only on the circuit connected to that computer, not to all circuits as a hub would.
Future Growth and Speed Upgrades: -Most companies don't use hub-based	Future Growth and Speed Upgrades: -Switch will have more future growth to

Ethernet today, but products are still available and are very cheap. -Bandwidth is divided by number of ports.	enhance network security and speed rather than the hub. -All ports operate at the maximum speed.
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Part 2: Wireless LANs

2. The CTO asked for wireless capabilities, and Delaney's proposal includes access points to this end. What are two security vulnerabilities that would be easier to exploit on Lollipopola's new WLAN when compared to its existing wired LANs?

Wired LAN	Wireless LAN
To gain access to the network, one must gain physical access to the building and physically connect to a cable.	Anyone walking or driving within the range of an AP (even outside the offices) can begin to use the network.
It is difficult to create a network-wide denial-of-service attack.	It is easy to create a network-wide denial-of-service attack, given the right (but lost-cost) equipment.

3. What are three steps that could be taken to mitigate or eliminate these WLAN vulnerabilities?

1. **Secure the Access Point:** Place the AP at a location where broadcast radius is within the company premises and where it will be hard to get
2. **Use encrypted communication:** Every communication between AP and computer should be encrypted (use strong encryption)
3. **MAC address Filtering:** Set up AP to communicate only with computers that have MAC which is in the trusted MAC addresses list.

4. What wireless protocol(s) (other than the one selected) would provide Lollipopola with fast and secure WLAN access, while being readily available in modern network devices?

1. **WEP:** The AP requires the user to have a key to communicate with it. All data sent to and from the AP are encrypted. WEP has a number of serious weaknesses. Hacker can use dictionary-based attacks.
2. **WPA:** is a newer, more secure type of security. WPA works in ways similar to WEP: Every frame is encrypted using a key, and the key can be fixed in the AP or can be assigned dynamically as users login. The keys are longer than WEP and harder to break. The key is changed for every frame the is transmitted to the client.

Part 3: Network Design

In this part, you review Delaney's design, determine what parts work well and what parts are problematic, write an alternative proposal, and explain why your proposal is better than Delaney's. *For all problems in this part, make sure to consider at least the following areas:*

- Speed
- Cost
- Network management
- Security
- Functionality

5. What elements of Delaney's proposal are problematic? Identify them and explain what the issues are.

Network Design:

Delaney's proposal is using traditional network design which is expensive and takes time.

There is some problematic in network design:

1. Interview the high-level executives to determine what applications the organization uses: *It's good to ask and determine what applications organization uses but not interview with high-level executives. There may be someone who particular in charge in it in the organization. The high-level executives always have their different tasks.*
2. Calculate the speeds needed by each group: Use ample capacity in the modern-day network design because modern day network traffic is rapidly growing.
3. Determine the cheapest devices available to support the speeds necessary for each group: This might affect the technology design. Today, the costs have shifted, the emphasis in network design is no longer on minimizing hardware cost, it is reducing the staff time needed to operate them – save money now in equipment costs but pay much more over the long term in staff costs.
4. Process will take about a year-and-a-half: This is the most important issues because the process is too long and the technology of computers, networking devices and circuit technology is rapidly changing.
5. Ask the executives about who need wireless access: There may be someone who particular in charge in it in the organization. The executives may not answer these questions (especially in the large organizations)

Network Implementation:

There is some problematic in network implementation:

1. Groups with wired access will have no wireless access, to save cost: it is ok to save cost, but wireless access should be distributed to everyone for convenience.
2. If several employees in a group need wireless access, the entire group will be given only wireless access: The wireless access should not be the primary access and are often established as a convenience.
3. Wireless access points will only be placed next to groups that need wireless access: Access Point are typically distributed evenly.
4. Access points will also be placed around the edges of the building: This can bring up some security concerns
5. Process will take about 12 months: This process is taking too long, in one year there might have better version of the devices and wireless network.

6. What elements of Delaney's proposal work well? Identify them and explain why they work well.

Network Design:

1. Contact various vendors to review their prices through discount negotiations or bid requests.
2. To minimize purchase cost, and to buy from as many different vendors as possible to avoid vendor lock-in.

Because multivendor network also tends to be less expensive because it is unlikely that one vendor will always have the cheapest hardware, software, and services in all product categories. Multivendor environments tend to provide better performance because it is unlikely that one vendor provides the best hardware, software, and services in all categories.

Network Implementation:

1. Some groups will be given 100Mbps speed subnets connected to switches, which will be placed in the server room. Although 1Gbps speeds are available, using this slower speed allows re-use of existing 100Mbps switches to save cost: This is definitely to save cost when organization can re-use the switches which meet their requirement.
2. The 802.11i protocol: this is the newest, most secure type of WLAN security.
3. The upgrades will be rolled out one small area at a time, to avoid work disruptions: this is good because I minimize the effect of the normal operation of the organization.

7. Now that you have reviewed the characteristics, positives, and negatives of Delaney's proposal, write an alternative proposal that does not exhibit the same issues. The proposal should contain both a network design and a network implementation section and should also correct all the issues you listed in #5.

Design Network:

In my proposal, I use modern day approach to network design that call building block network design. The key to this design is that networks that use a few standard components throughout the network are cheaper in the long run than networks that use a variety of different components on different parts of the network.

The basic design process involves three steps that performed repeatedly: need analysis, technology design, and cost assessment.

1. Need Analysis.

The goal of needs analysis is to understand why the network is being built and what users and applications it will support. The staff needs to understand current and future needs.

- Staff will assess the map of the building and figure out where the users and computers will locate and make decision where the server will locate.
- Staff review the list of applications that will use the network and identify the location of each (Email, Web, and similar are less heavy traffic user. Multimedia application are heavy traffic users)
- Categorize network needs for each segment – application and user into mandatory, desirable, and wish-list requirements.
- Design the network logically first.
- Classify users into normal and high traffic users to minimize the different kinds of devices. Buy the same devices for classification

2. Technology Design:

One the needs have been defined in the logical network design; the next step is to develop a physical network design.

- **Designing Clients and Servers:** Staff starts with the client and server computers needed to support the users and applications. Staff need to decide if they need to purchase new computer or just upgraded the server to the newest technology. Users and servers for applications needing more powerful computers are assigned some advanced computers. Allocate base level client computers to typical users and base level servers to typical application.
- **Designing circuits and devices:** Deciding on the fundamental technology and protocols (Ethernet, TCP/IP etc.) and choose the capacity each circuit will operate. Assess current and future circuit loading, amount of data to be transmitted on a circuit, focus on either average or peak circuit traffic, and estimate sizes and types of standard and advance circuits for each LAN.

- **Network design tool:** Use to simulate design process and examine results to see estimated delays and throughput, change the design if necessary and rerun stimulation.
- **Deliverable:** Staff present a set of physical network designs.

3. Cost Assessment.

- Assess the costs of various physical network design (cost of software, hardware, and circuits).
- Develop RFP and specify what equipment, software, and services are desired and ask vendors to provide their best price.
- After the vendor has been selected, revised physical network diagram.
- Provides support for the network design, expressed in business objectives.

Implementation Network:

- After completing network design, following the basic process involves three steps (Need analysis, Technology design and Cost assessment) that are performed repeatedly. Implementation network is next phase.
- Categorize the user base on their network traffic generated and provide their capable computers. Users and servers for applications needing more powerful computers are assigned some advanced computers. Purchased or upgrade the server.
- Relocate server to a central network which will connect using longer cables.
- Equipped or update with management software.
- Train or hire new staff to handle upgraded devices, monitor network, use policy-based management to set priority policies for traffic
- Established services level agreement with ISP.
- Replace switch and keep existing 100Mbps switches to save cost
- Replace high latency devices and upgrade the server with higher device memory.
- To minimize network traffic is to use content caching and see if content delivery providers can be used where needed.
- Wireless access point is established as convenience and not put near the building edge to avoid security concerns. Wired access will be primary connection.
- Implementation security control Wireless access point by using 802.11i protocol.
- The upgrades will be rolled out one small area at a time, to avoid work disruptions. Build the network out of standard devices (Legos).

8. Explain specifically why your proposal is better than Delaney's proposal.

My proposal is better than Delaney's proposal because:

1. Building block approach is simpler than Delaney's approach (Traditional approach).

2. Building-block approach uses a few standard components throughout the network are cheaper in the long run.
3. Carry a very narrow range of products.
4. It's cheaper to train staff on a few kinds of products.
5. Start with a few standard components with ample capacity without extensive traffic analysis. uses them over and over again, even if they provide more capacity than is needed.
6. Save cost in long run by using modelling and simulation.

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 your Facilitator Discussion Board** if you have any questions regarding how to approach this assignment.

Save your assignment as ***lastnameFirstname_assignment3.doc*** and submit it in the *Assignments* section of the course.

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