Review the hypothetical scenario below, then answer the subsequent questions.

Metropolis College is a smaller-size college that now has three campuses. Its main (and original) campus is located in downtown Metropolis, where about 600 students attend. About two years ago, the college established two satellite campuses in two smaller nearby towns – Angel Grove and Springfield – in an effort to better accommodate students living outside of Metropolis. Each satellite campus has one smaller classroom with a video feed to the main campus, and a lab where students can work on their assignments. Minimal network infrastructure has been setup at the satellite offices.

Choosing the right network setup is a challenge for Metropolis College given that its smaller size gives it access to fewer resources. The main campus connects to the Internet with a 10 Gbps fiber link, Angel Grove with a 7 Mbps DSL line, and Springfield with a 25 Mbps cable modem. Each campus has its own direct link to the Internet, and there are no WAN links between campuses. While Internet connectivity works well at the Metropolis campus, there are issues with Internet connectivity on both other campuses. In addition, both satellite campuses have been hacked in different ways due to network security issues. Metropolis College has hired you to identify the problems and propose solutions for their network issues.

**Issue 1 – Satellite Office Speeds**

Both satellite offices have Internet connectivity issues. Instructors at the Angel Grove campus often complain that the video feed to the main campus often stalls to the point that it’s not viable, and they have given up using it. Students using the Angel Grove lab machines complain that the software they use, which relies heavily on Internet communications, is painfully slow, almost to the point of being unusable. While students are not happy with the software performance on the Springfield campus, they are still able to use it to get their work done. Unfortunately, the video feed for instructors on the Springfield campus has the same issues as the Angel Grove campus. As a whole, people are becoming quite frustrated with these issues, and Metropolis College is worried that they may lose students, and even possibly instructors.

With some research you discover the following Internet connectivity options exist at the Angel Grove campus.

**Angel Grove Campus**

|  |  |
| --- | --- |
| **Option** | **Cost** |
| Use a DSL line at the maximum speed available, 12 Mbps. | $60 per month |
| Use a cable modem. | Three speeds are available: o 25 Mbps at $65 per month  o 50 Mbps at $90 per month  o 100 Mbps at $140 per month |

You discover the following options are available at the Springfield Campus. Note that the phone and cable providers are the same between both towns, but Springfield has a fiber option.

**Springfield Campus**

|  |  |
| --- | --- |
| **Option** | **Cost** |
| Use a DSL line at the maximum speed available, 12 Mbps. | $60 per month |
| Use a cable modem. | Three speeds are available: o 25 Mbps at $65 per month  o 50 Mbps at $90 per month  o 100 Mbps at $140 per month |
| Switch to using fiber. | Three speeds are available:  o 50 Mbps at $80 per month  o 200 Mbps at $150 per month  o 1 Gbps at $300 per month |

1. The first item the college needs to consider is which underlying technology to use at the satellite offices (DSL, cable modem, or fiber). Compare and contrast each of these three with at least 6 points of comparison, making sure to relate them back to the college’s needs at the satellite office.

|  |  |  |  |
| --- | --- | --- | --- |
|  | DSL | Cable modem | Fiber |
| Affordability | Moderate | Moderate | Moderate to low |
| Speed | Moderate(12Mbps) | High(25-100Mbps) | Very high(50-1024Mbps) |
| Reliability | Moderate | High | High |
| Cost | Low ($60) | Moderate ($65-140) | High ($80-300) |
| Video conferencing | Capacity good | Capacity good | Capacity good |
| Tech | Family P2P | Multipoint | Dedicated P2P |

2. Which technology and speed would you recommend for Internet connectivity at Angel Grove and Springfield? Explain why you believe this to be the best choice for each campus.

1. Angel Grove Campus

Now this campus is the 7 Mbps DSL line, and the problem is that feeding video is not viable and the heavy communication software is working slowly. So if the money is enough, I recommend the 50 Mbps cable modem line. It gives a fast download and suit for the heavy communication software. Also it can suit for the instructors to sending the video to the main campus.

1. Springfield Campus

Now this campus is the 25 Mbps cable modem line, and the problem is much similar to the Angel Grove Campus. But the software can still work. So if the money is enough, I recommend the 100Mbps cable modem line. It is moderate affordable and much more reliable. Also it has the good cost and good speed.

**Issue 2 – Metropolis Campus Hacked**

A server, which resides on the main campus, and which acts as the repository for student grades, was hacked. The incident actually went undiscovered for about three weeks, when it was discovered by happenstance by an instructor. She noticed the web grading program showing different grades for a couple of prior students than what she had assigned. She alerted the college’s small I.T. department, which used the only evidence they had on the matter – an audit log and a monthly backup file. The department discovered through the audit log that the attacker illegally gained access and downloaded all grades in the system, and that the attacker had actually carried out the hack at the lab in the Springfield campus! By comparing the backup file with the current data, they also discovered that a few specific student grades had been altered. Thankfully only a few grades were altered, but this raised the question if those few students were involved with the attack. Regardless, the college is scrambling to upgrade security on their network to prevent this and other kind of attacks in the future.

The server room at the Metropolis campus currently has only one network security control, which is a packet filtering firewall that sits between the Internet link and the server room. That firewall is configured to prevent inbound traffic coming in over a few ports, and outbound traffic leaving the campus over a few ports.

3. As one familiar with network security, you recognize it is essential that the campus secure its network perimeter so that only those authorized can gain access. Identify and describe two points of entry onto the main campus’s network that could potentially be used by an intruder to gain access to the network. Make sure to explain to the firm how the intruder could have gained access through each point of entry.

1. WLAN
2. LAN

4. Explain the mechanics of how the packet filtering firewall could be used to help secure Metropolis College’s network perimeter, for each of the points of entry described in #3. Would anything need to change with the firewall’s current setup to provide this network security?

Packet filtering is a firewall technique used to control network access by monitoring outgoing and incoming packets and allowing them to pass or halt based on the source and destination IP addresses, protocols and ports.

But the payload is not inspected and state is not remembered.

5. Identify a second kind of firewall not yet used, explain the mechanics of how it works to protect networks in general, and explain how this firewall could be used to secure the points of entry identified in #3.

Application-Level Firewall is more expensive and more complicated to install and manage than a packet-level firewall, because it examines the contents of the application-level packet and searches for known attacks. It has rules for each application they can process. For example, most application-level firewall can check Web packets, email packets, and other common protocols. In some case, special rules must be written by the organization to permit the use of application software it has developed.

6. There are additional ways to secure points of entry other than using firewalls. For each point of entry identified in #3 for the campus’ network, identity and describe a device or method that could be used to secure it other than a firewall.

One important element to prevent unauthorized users from accessing an internal LAN is physical security: preventing outsiders from gaining access into the organization’s office, server room, or network equipment facilities.

One wireless security technique is Wired Equivalent Privacy (WEP). With WEP, the AP requires the user to have a key to communicate with it. All data sent to and from the AP are encrypted so that they can only be understood by computers or devices that have the key. If a computer does not have the correct WEP key, it cannot understand any messages transmitted by the access point, and the access point will not accept any data that are not encrypted with the correct key.

**Issue 3 – Eavesdropping**

Several applications used by the college’s lab connect over the public Internet to the main office. You recognize that this has major security implications in that unauthorized people can potentially eavesdrop on the communications.

7. You further recognize that at the very least, directly encrypting the communications between the client and server in the application would protect against this eavesdropping. Explain to the college the purpose of encryption and how it would protect the applications’ communications.

One of the best ways to prevent intrusion is encryption, which is a means of disguising information by the use of mathematical rules known as algorithm. Actually, cryptography is the more general and proper term. Encryption is the process of disguising information, whereas decryption is the process of restoring it to readable form. When information is in readable form, it is called plaintext; when in encrypted form, it is called ciphertext. Encryption can be used to encrypt files stored on a computer or to encrypt data in transit between computers.

8. Also explain the differences between symmetric and asymmetric encryption, making sure to cover the topics below.

1. the number of keys involved
2. key management and distribution
3. mathematical operations performed on data
4. relative speed

* symmetric: one key; key must be shared among the sender and receiver; pseudorandom random numbers; fast
* asymmetric: two keys; each user has a public key and a private key; integer factorization and discrete logarithm; slow

9. Which of these two types of encryption would you recommend for the college’s applications?

asymmetric

**Tying It Together**

10. Taking a step back and looking at Metropolis College’s network as a whole, would establishing private WAN links between the campuses make for a more performant, reliable, and secure network? Explain.

It must be more performant, reliable and more security. Because this not use the local internet. This just link between the main and the campus

11. What would be the advantages and disadvantages of making the architectural change described in #10?

Advantages: more safer and the speed will upgrade.

Disadvantages: it will cost more money. And if use a low-cost way, it will cause a speed limit and capacity limit.

12. What other changes, administratively or technically, could take place to help secure the college’s network? Identify and describe at least two.

First, it needs to have remember all visit person. There should be software that save all access to the main server in a database table.

Second, it needs to employee a person to check the access record and the problem in the whole network. This person can take a part-time job in this college to save money. He needs to come to college regular to check the record and the problem.

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\_assignment5.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.