

NSBM Green University

Faculty of Computing BSc. (hons) in Computer Science

CN 101.3 Data Communications & Network

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Inclass Test Evaluation

Group 28

Group Members

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Workload Metrix

Student ID	Contribution
22790	10%
22786	10%
23196	10%
23610	10%
22765	10%
22967	10%
23210	10%
22794	10%
22784	10%
22788	10%

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Description About the domain

Nalinda's house technological summary.

Nalinda's house consists of a network with 20 Computers, 30 smart phones, 5 smart TV's and 10 CCTV's cameras.

The house has two stories; hence the devices are connected to the internet through two Local Area Networks.

Store 1

- 15 Smartphones, 2TV's, 10 Computers, 5 CCTVs are operating in LAN of store 1.
- In here 15 smartphones and the 2 TVs are interconnected using a wireless router. 15 smartphones should have the mobility therefore wireless connection is the perfect type.
- 5 PC's out of 10 are connected to an ADSL router which consists of 8port LAN switch. ADSL router is responsible for managing traffic between networks by forwarding data packets to their intended IP addresses.
- In here IPsec firewall and SSL VPN remote access firewall are used to secure the IP communications as well as to secure remote access via a web portal.
- 4 computers are connected to a ring topology where it works as a workstation computer. This workstation is used for high performance.
- Workstation is connected to LAN via ADSL modem and a switch. A large storage server is built for managing the local area network.
- Remote (Home) PC is used for the management of LAN, and it is connected to the cable router directly. Also, the wireless router is given an extended connection using cable router.
- 5 CCTVs are connected to the DVR. DVR (Digital Video Recorder) is local storage where all the recorded videos are stored. It is then connected to the cable router.
- Using home PC, can access to the CCTV video by other devices because it is connected to Local Area Network.

Bridge is used to connect the 2 LAN's and the similar networks in the two stores of the house. Normally bridges used connects LAN's that has a similar protocol. It provides communication between the devices(nodes).

Store 2

- 15 Smartphones, 3TV's, 10 Computers, 5 CCTVs are operating in LAN of store 2.
- In here 15 smartphones and the 3 TVs are interconnected using a wireless router. 15 smartphones should have the mobility therefore wireless connection is the perfect type.
- 5 PC's out of 10 are connected to an ADSL router which consists of 8port LAN switch. ADSL router is responsible for managing traffic between networks by forwarding data packets to their intended IP addresses.
- In here IPsec firewall and SSL VPN remote access firewall are used to secure the IP communications as well as to secure remote access via a web portal.
- 4 computers are connected to a ring topology where it works as a workstation computer. This workstation is used for high performance.
- Workstation is connected to LAN via ADSL modem and a switch. A large storage server is built for managing the local area network.
- Remote (Home) PC is used for the management of LAN, and it is connected to the cable router directly. Also, the wireless router is given an extended connection using cable router.
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Network Design Proposal

Prepared for Nalindas' home network

Overview of the Network

This is a requirement for home network solution. Client Nalinda is an introductory level computer user. Client must be able to perform his work with network without any disturbances. Network performances must be in high range. This network contains wired as well as wireless computer devices. Because of that both wired and wireless connections, network should have better connection and good data transfer speed. Network should be scalable, ability to add new computer devises. Computer network should be secure. Data transmitted over the network must be protected from unwanted accesses, and other situations. All hardware and devices should be utilized.

Requirements

- 1. House is a two-store house.
- 2. Connect 20 Computers to the network
- 3. Connect 30 Smartphones
- 4. 5 Smart TV operates in the network
- 5. Include 10 CCTV

Purpose

By considering this network, this network is a group of computers and peripheral devices that spread over a small distinct geographic area. It's a twostore house. Therefore, we categorize this network as a LAN (Local Area Network).

For each floor using separate two switches, helps to improve performance and maintainability of the network.

Client might have workstation pcs; ring topology network configuration is suitable for apply. It reduces the chance of packet collisions and increase speed of data transferring.

Smartphones and TVs connect with network through Wi-Fi connection. Establishing Wi-Fi routers and wireless access points for each floor is suitable to maintain a static connection with wireless devices.

Implement DHCP (Dynamic Host Configuration Protocol) server to configure network devices to communicate on an Ip network.

Implement Proxy server in the computer network.

Firewalls, encryption are essential to protect the network from unwanted unauthorized accesses.

CCTV connect network through DVR with Wi-Fi router.

Background

Under this project, we propose a network solution for Nalinda's house. In our action plan, we divide work with members in the group. We have to network 20 computers, 30 smartphones and 5 smart TVs and 10 CCTVs. Our plan is to acheive the requirements with a minimum cost and we are certain and competent that we can complete this DCN project with expected outcomes.

Diagram of your proposed plan



DEVICE AND CABLE LIST

List of devices: -

- Switches
 - Switch
 - 8-Port LAN switch
- DVR
- Bridge
- Router
 - Wi-Fi Router
 - ADSL Router
 - Cable Router
- ADSL Modem

List of Cables: -

- RJ-45 Network Cable
- Twisted Pair Cable
- Coaxial Cable

Switch: -

Switch is networking device that operating at data link layer of the OSI model. Switches connecting devices in a network and uses data packet switching to send and receive data frames over the network.

Switch is an intelligent network device and also switch has many ports to which so many computers are plugged in. when we are using 8_port LAN switch for connect PC's in Nalinda's house. And another switch use for connecting between ADSL modem and Server. When we talk about the importance about the switch there are,

- Then Switch uses MAC address to send data frames to selected ports in switch.
- And switch is supporting one-to-one, one-to-many and one-to-all data communications.
- Switch is Full duplex transmission mode.





Bridge: -

Bridge is a computer network device that provide interconnection with the other bridge networks that also use the same protocols. Bridge works at the data link layer of the OSI model for connecting two different networks. Bridge is a device that dividing LAN network into two segments and store all the connected PC's MAC Address in bridges table.

• Main purpose of a bridge is reducing the network traffic.

In here we decide to use a bridge for connect DVR and Cable router in Nalinda's house network.





DVR: -

DVR (Digital Video Recorder) is used to save security of video images in a hard-Drive. Now a days most CCTV cameras are using for capture analog pictures. So, DVR can convert analog Signals into digital Signals and compress those signals.

DVR is coming with 4,8,16 camera port inputs and many cameras can be connected to the DVR.

There has frame per second technology in this device. The frames per second (Fps) can measure to how many pictures record in DVR at a second.

In here we decide to connect 5 Cameras to DVR each store house and a bridge.





Router: -

Routers can connect local area network to another network or the internet. Also, router can forward data packets between networks. Routers have two or more data lines from different IP addresses and data packets come as a one line and routers can read the network address information.

Routers have interfaces for different types of physical layers and copper cables, fiber optics cables or wireless transmission media use for connecting those layers. There are more types of routers in networking. We use Wi-Fi router, ADSL router and cable router for network Nalinda's house.

➢ Wi-Fi Router

Wireless router or Wi-Fi router common use in homes or small areas. Wi-Fi router is also a hardware device that internet service providers use connect their cable and combines the networking functions of a wireless access point.

We use Wi-Fi router for connect all smart devices in Nalinda's house.



> ADSL Router

ADSL stands for Asymmetric Digital Subscribe Line. ADSL is a speed interenet service provided telephone lines that coexit with telephone service. ADSL routers can be wired or wireless. We use a ADSL router for connect between LAN network and 8-Port LAN switch.



Cable Router

When we need to use cable Internet for the our network we must to need to use the Cable router. Cable routers are usually integrated with a modem frequently incorporating firewall.



ADSL Modem: -

ADSL modem receives data from Internet service provider through the telephone line. And Modem converts the analog signals from the ISP to the Digital Signals from another router or PC (it's call Modulates and Demodulates). Then ADSL router job is to push this data signals other connected devices.



Cables: -

RJ-45 Network Cable

Rj-45 Cable commonly used for Ethernet networking. There are two types of cable use for networking. They are standard patch cables and crossover cables. Standard cable used for connecting computer to network router and crossover cable is most used to same devices ex: two computers connect directly without use router or switch.



Twisted Pair Cable

Twisted pair cables are made use copper. Twisted pair cables have two conductors each with its plastic insulations twisted together. There are two types of twisted pair cables. They are Unshielded twisted pair (UTP) cable and shielded twisted pair (STP) cable. Unshielded twisted pair cable can be shielded only plastic cover but shielded twisted pair cable have a metal foil or braided mesh.



Coaxial Cable

Coaxial cable generally used by telephone companies and ISP companies. These cables have been for a long time as a technology. Coaxial cable has a shield without succumbing to interference from the environment factors. There is a copper core, and it can transmit data quickly. There are cable sizes in these coaxial cables. The three most common sizes are RG-6, RG-11, and RG-59.





Technical description

(Explanation of how these devices work as per OSI Model)

01) Physical layer



Physical layer is the first and bottom layer of the osi model. This layer is, as the name suggests, all the physical parts that connect the computer together. Consider about Nalinda's house network, in here cables and connectors work on this layer. Purpose of the physical layer is transmitting bits over a physical link between devices, encodes bits into a physical signal, decodes bits from a physical signal.



Physical layers convert this binary sequence into signal and transmit over local media. It can be an electrical signal .in case of copper cable or land cable light signal .in case of optical fiber

And radio signal in case of air. So, signal generated by physical layer depends on the type of media used to connect two devices, at the receiver physical layer receives signals convert it to bits and pass it to data link layer as a frame.

02) Data link layer

This layer is responsible for organizing bits into frames and ensuring hop to hop delivery. Also assign the mac address of sender and receiver. This is the layer on which the switches operate on.



In this network all the computers in a specific network get plugged into a switch so that they can communicate each other.

Data link layer is responsible for implementation of point to point flow and error control mechanism.

Data Packets from Network Layer Data Link Layer Data link layer receive data packets from network layer which contain IP addresses of sender and receiver there are two kinds of addressing

-logical addressing



Data link layer controls how data is placed and received from the media. Data link layer send and receives the frame from the media. The technique used to get the frame on and off the media is called media assess control.



There may be several devices connected to a common media. If two or more devices send data at the same time, then there may be possibility of the collision of the two-message resulting in a useless message that neither recipient can understand. To avoid these situations.

03) Network layer

Logical addressing is done at network layer where sender and receiver's IP addresses are assigned to each data packet.

-physical addressing



Physical addressing done by data link layer where MAC addresses of both devices are assigned to the received data packet.MAC address is a 12-digit alphanumeric number embedded in NIC of your computer by the manufacturer.

Data unit in data link layer is called frame data link layer is embedded as a software in NIC of a computer and provide means to transfer data from one computer to another via a local media. Local media include copper wire, optical fiber or air for radio signals. Please note, here media does not correspond to audio, video, animation etc. it refers to the physical link between two or more computers or networks.



Assume, network 01 is nalinda's network



consider two distant host, a laptop and a desktop, communicating with each other.as laptop and desktop are connected to different network, so they will use

network layer protocols, IP for example to communicate with each other. In this example, the desktop is connected to router R1 via an Ethernet cable. Router R1 and R2 are connected via a satellite link and laptop is connected to router R2 via wireless link. Now desktop wants to send some data to laptop. Based on the medium used to connect desktop and router R1 data link layer – embedded as software in NIC of desktop add some data in head and tail of IP packet and converts it to a frame, an Ethernet frame in this case. Router R1 receives this Ethernet frame, de-capsulate it to IP packet and then encapsulates it again to frame so that it can cross satellite line to reach router R2. Router R2 will again de-capsulate the received frame and re-capsulate based on the medium used to connect router R2 and laptop, wireless data link frame in this case. Laptop receives wireless data link frame, de-capsulate and then forward the IP packet to network layer and finally to the application layer. So, network layer or higher level layers are able to transfer data over media, which are LAN cable and air in this case with the help of data link layer.



The data link layer keeps on eye on when the shared media is free. So that device can transmit data for the receiver. This is called carrier sense multiple access CSMA. So data link layer with its media access control methods, controls when data is placed and received from the media.



The tail of each frame contains bit which are used to detect errors in the received frame. These occur due to certain limitations of media used for transferring data.

04) Transport layer

The fourth layer from the bottom is called the transport layer of the osi reference model. This layer guarantees an end-to-end error-free connection between the two different hosts or devices of networks. (It is responsible for delivery of an entire message from an application program on the source device to a similar application program on the destination device.) Transport layer control the reliability of communication through *segmentation, flow control and error control*.



In segmentation data receive from session layer is divide into small data units called segments. Each segment contains a source and destination port number and a sequence number. Port number help to direct each segment to the correct application and sequence number helps to reassemble segments into the correct order to form correct message at the receiver inside the nalind's house.

In flow control, transport layer controls the amount of data being transmitted. Consider, smartphones are connected to a server. Suppose server can transmit data maximum at 200 MBPs. each mobile phone can process data maximum at 20 MBPS. Now nalinda downloading a file from the server, but server starts sending data at 100 mbps which is greater than the rate mobile phone can process. So mobile phone with the help of transport layer can tell the server to slow down data transmission rate up to 20 MBPS So that no data gets close. Similarly, if server is sending data at 10 MBPS, mobile phone tells the server. Increased data transmission rate to 20 MBPS to maintain system performance.



In the data communication when send or receive data between the each other in inside his store houses ,,the transport layer decide how much information should be sent at a time between two devices(it can be between smartphones/smart tv and smart phones, pc<->smartphones, smart TVs or between two store houses different devices.).And also when nalinda or someone communicating with a website (like chrome, Microsoft edge) using the computer or smart devices in his house , this layer will decide how much data he can transfer and receive at a given point of time.

Transport layer also helps in error control. If some data does not arrive the destination (it can be smartphones, smart TVs or computers in this scenario) transport layer uses automatic repeat request schemes to retransmit the lost or corrupted data. a method called checksum is added to each segment by the transport layer to find out received corrupted segment.

()

Error Control:



Protocols of transport layer are transmission control protocol or TCP and User Datagram protocol or UDP. Transport layer performs two types of services. Connection oriented transmission and connectionless transmission. Connection oriented transmission is done via TCP. connectionless transmission is done via UDP.UDP is unreliable protocol. Once data is transmitted between two hosts, the receiver host doesn't send any acknowledgment of receiving the data packets. Thus, the sender will keep on sending data without waiting for an acknowledgment. The end host will be any machine like a computer, smartphone according to this given scenario. UDP is used where it does not



matter whether we have received all data. For example, in inside the nalind's house when they can use online streaming movies, songs, games, voice over IP, TFTP, DNS, etc. On the other hand, TCP is used where full data delivery is must for example World Wide Web, email, FTP, etc.

Transport layer passes data segments through the network layer and Responsible for complete data transfer.



05) Session layer

This layer permits the users of different platforms to set up an active communication session between themselves.

The main function of this layer is to provide sync in the dialogue between the two distinctive applications.

this layer helps in settings up and managing connections enabling sending or receiving of data followed by termination of connections or sessions. NETBOIS or network Basic input output System is an example APIs which allows applications on computers to communicate with each other in nalinda's store houses. Just before a session or a connection is established with a server, server perform a function called authentication. after the authentication the session and connection are establish between the computer and the server



After authenticating the user authorization is checked. both of this authentication and authorization are performed by session layer. And session layer keeps the track of the files being downloaded. Consider in this scenario a web pages contain the links, text, different images etc. these contain methods are stored as separate files on the web server. in the store houses there have computers, smart TVs, smartphones. So, when nalinda request for a website in his web browser (can be computer, smartphones) his web browser opens a separate session to the web server to download each of these text/images' files separately. These files are received in the form of the data packets. Session layer keeps a track of which data packet belong to which file and tracks where the data packets go.So session layer helps to do session management.

06) Presentation layer

this is the 6 th layer from the bottom of the OSI reference model

Presentation layer receives data from application layer. This data is in the characters and numbers. presentation layers convert this characters and numbers into the machine understandable binary codes

Example-- \rightarrow ACSII to EBCDIC code

When nalinda send or receive some data between the smartphones, computers, or smart TVs that data goes to the presentation layer and convert into the binary codes. So, this is called translation which is the one of the functions in inside the presentation layer. Also, before data is transmitted presentation layer reduces the number of bits that are used to represent the original data. this bit reduce process we called that is data compression. From this data compression process he can reduce the amount of space used to store the original file. If the file has small size, it can be received another device or the destination in very less time. So, the data compression process is very useful for audio or video streaming via using the smart phones, smart TVs, computers in nalinda's house



To maintain the integrity of data before transmission data is encrypted Encryption enhances the security of sensitive data.at the scenario inside the store houses using between the two devices sender side data is encrypted and receiver side data is decrypted. SSL protocol or secure Sockets Layer protocol is used in presentation layer. for Both encryption and decryption. So, presentation layer performs 3 basic functions. Translation, compression, and encryption- Decryption.

07) Application layer

This is the layer which is the topmost layer in osi model. This layer is used for the network applications. That application means google chrome, Firefox, outlook, skype etc.



In this scenario web browser is running in the computers it does not reside the application layer, but it uses the application layer protocols \rightarrow HTTP/HTTPS/FTP ...etc. For the web surfing. all applications are depending on the application layer protocols to function.



So in this scenario using the smart devices nalinda can do file transferring (he can do this with the help of FTP protocol),emails(with using SMTP protocol),web surfing (this can be done with the help of HTTP/HTTPS protocols),virtual terminals(use the TELNET protocol) etc. so this give the services for different network applications with the help of protocols to perform activities using computers or smart devices which is done in inside the nalinda's house

Conclusion

Overall, networking an entire home is a complex task. There we need to focus on several areas. Among them cost, security, durability, speed and efficiency are special. We identified the customer's needs and implemented the most suitable solution. Therefore, we decided that L A N is more suitable for this project. We then drew a diagram to get an overview of the plan. To reduce costs, we used U T P substitutes instead of Fibrotic here. Furthermore, we have used two routers to reduce congestion here. Here we have used a bridge to increase the speed. Designed accordingly, this networking system is the most practical solution that can be applied to Nalinda's home.