Unit - 2

Network Switching technique :-
Switching communication networks are those in which data transferred from source to destination is routed between various intermediate nodes. Switching is the technique by which nodes control or switch data to transmit it between specific points on a network. There

There are 3 common switching techniques :-

1) Circuit Switching
2) Packet Switching
3) Message Switching

1) Circuit switching :-

- Circuit switching is a switching technique that establishes a dedicated path between senders and receives.
- Circuit switching in a network operates in a similar way as the telephone works.
- A complete end-to-end path must exist before the communication takes place.
- Circuit switching is used ~~to~~ in public telephone network. It is used for voice

transmission

- Fixed data can be transferred at a time in circuit switching technology.

2) Packet Switching :-

- The packet switching is a switching technique in which the message is sent in one go, but it is divided into smaller pieces, and they are sent individually.
- Packets will travel across the network, taking the shortest path as possible.
- All the packets are reassembled at the receiving end in correct order.
- If any packet is missing or corrupted, then the message will be sent to resend the message.

If the correct order of the packets is reached, then the acknowledgment message will be sent.

3) Message switching :-

- Message switching is a switching technique in which a message is transferred as a complete unit and routed through intermediate nodes at which it is stored and forwarded.
- In message switching technique, there is no establishment of a dedicated path between the sender and receiver.
- Message switcher are programmed in such a way so that they can provide the most efficient routes.
- Each and every node stores the entire message and the forward it to the next node. This type of network is known as store and forward network.
- Message switching treats each message as an independent entity.

Virtual Circuit Switching :-

(i) Virtual Circuit switching is also known as connection-oriented switching.

(ii) Call request and call accept packets are used to establish a connection between the sender and receiver

(iii) In this case, the path is fixed for the duration of a logical connection

(iv) In the case of virtual circuit switching, a preplanned route is established before the message are sent.

(v) When a route (path) is established, data will be transferred.

(vi) ~~Call request and~~ If the user wants to terminate the connection a clear signal is sent for the termination.

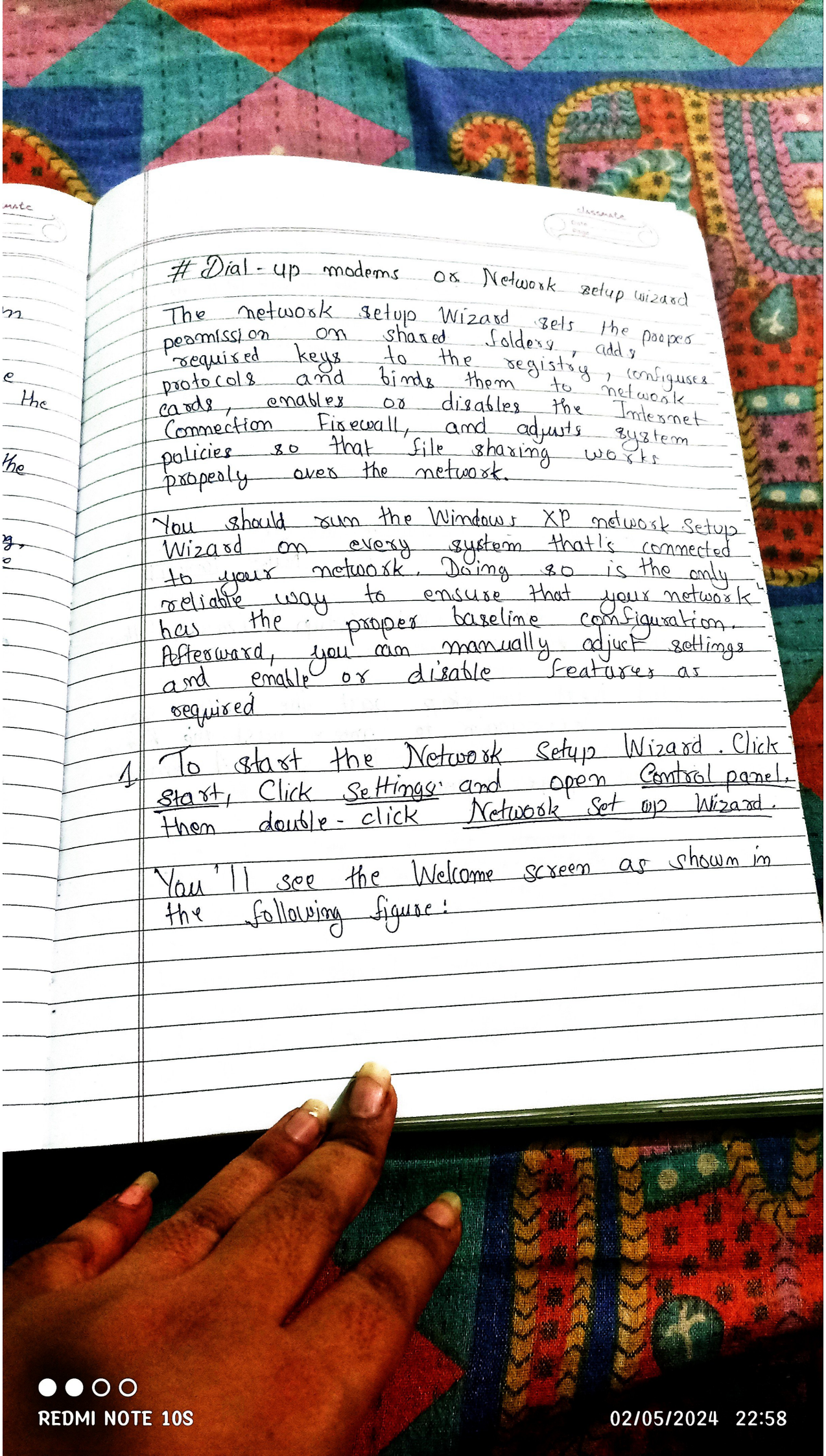
Dial-up modems or Network setup wizard

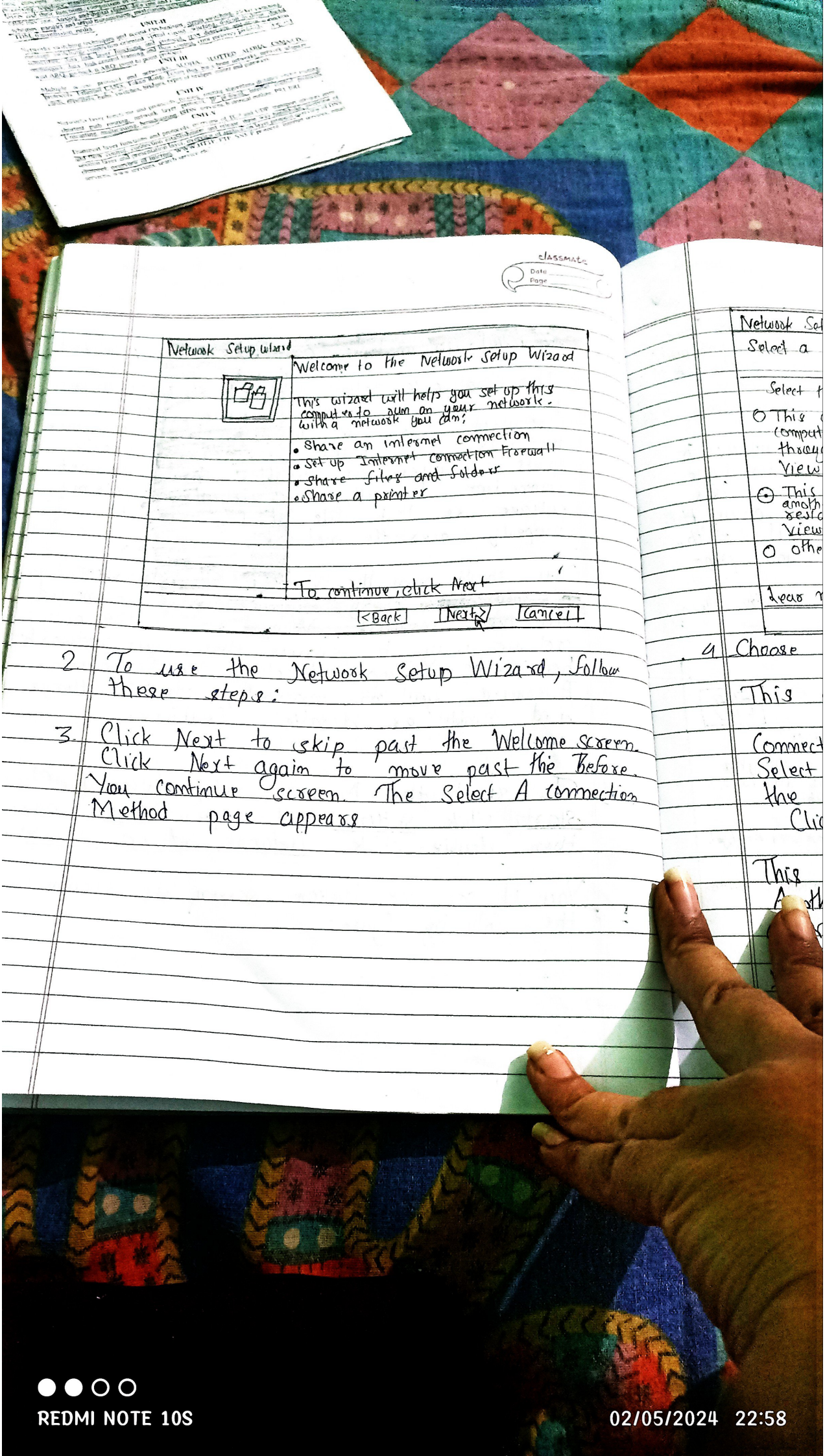
The network setup Wizard sets the proper permission on shared folders, adds required keys to the registry, configures protocols and binds them to network cards, enables or disables the Internet Connection Firewall, and adjusts system policies so that file sharing works properly over the network.

You should run the Windows XP network Setup Wizard on every system that's connected to your network. Doing so is the only reliable way to ensure that your network has the proper baseline configuration. Afterward, you can manually adjust settings and enable or disable features as required

1. To start the Network Setup Wizard. Click Start, Click Settings and open Control panel, then double-click Network Set up Wizard.

You'll see the Welcome screen as shown in the following figure:




Network Setup Wizard
Welcome to the Network Setup Wizard
This wizard will helps you set up this computer to run on your network with a network you can;
• Share an internet connection
• Set up Internet connection Firewall
• Share files and folders
• Share a printer
To continue, click Next
< Back
Next >
Cancel
2 To use the Network Setup Wizard, follow these steps:
3. Click Next to skip past the Welcome screen. Click Next again to move past the Before You continue screen. The Select A connection Method page appears
4 Choose
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02/05/2024 22:58

Network Setup Wizard

Select a connection method

Select the statement that best describes this computer:

○ This computer connects directly to the Internet. The other computers on my network connect to the Internet through this computer.
View an example

⊙ This computer connects to the Internet through another computer on my network or through a residential gateway.
View an example

○ Other

Learn more about home or small office network configurations.

< Back | Next > | Cancel

1. Choose one of these three options:

This computer connects Directly to the Internet - The other computers On my Network Connect to the Internet through this Computer. Select this option if you have already set up the Internet connection on the computer. Click Next to continue

This Computer connects to the Internet through Another Computer on My Network. Or through a residential gateway - If you use a router or residential gateway to manage shared Internet access, select this option and click Next to continue. If you use Internet Connection Sharing and

you see this screen, stop and check your Internet connection. If ICS is properly set up, the wizard should display a different page of the wizard, as described at the end of this section.

Other - Select this option if your computer is connected to the internet directly or through a hub, or if your network has no Internet access. If you choose this option and click Next, you will see the Other Internet Connection Methods page.

If you choose other, choose one of the following options.

Network Setup Wizard

Other internet connection methods....

Select the statement that best describes this computer:

(●) This computer connects to the internet directly or through a network hub. Other computers on my network also connect to the internet directly or through a hub.
View an example

( ) This computer connects directly to the internet. I do not have a network yet.
View an example.

( ) This computer belongs to a network that does not have an internet connection.
View an example.

Learn more about home or small office network configurations.

< Back Next > Cancel

Otherwise

4. If yo connect to th Conne

5. Confirm Connec Give page

6. Chec Comp clos cont

7. On no pa w C

8.

Otherwise skip to step 4

4. If your computer has more than one network connection, one of which is directly connected to the Internet, the Select Your Internet Connection page appears.

5. Confirm that the wizard has selected the correct connection and click Next to continue. The Give This Computer A Description And Name page appears.

6. Check the name of the computer listed in the Computer Name box. Adjust the name and description if necessary, and click Next to continue.

7. On the Name Your Network page, enter the name of your workgroup. Note that this page is not like the previous page, in which the wizard correctly remembers your computer name. If you don't want to use the default workgroup name of MSHOME, you must manually change it here.

Click Next to move to the Ready to apply Network Setting page

8. Scroll through the summary of changes the wizard is about to make to your network configuration.

Network Setup Wizard

Ready to apply network settings

The wizard will apply the following settings. This process may take a few minutes to complete and cannot be interrupted.

Settings:

internet connection settings

internet connection: local area connection

Network settings:

Computer description:

Computer name: PRO2

Workgroup name: MSHOME

To apply these setting, click Next

<Back | Next > | Cancel

To make any changes to the settings you choose, use the Back button. If you're satisfied with the results, click Next to apply the changes immediately. The wizard displays an animation graphic while it works.

Digital Subscriber line

* Digital Subscriber :-
DSL

Digital subscribes also known as ~~digital data~~ digital subscriber line. DSL (Digital subscriber line) is a modern ~~transport high~~ technology that uses existing telephone line to transport high-bandwidth data, such as multimedia and video to service subscribers. DSL provides dedicated, point-to-point, public network access. This DSL connection is typically between a network service provider (NSP), central office and the customer site or on local loops created either within buildings or campuses. ~~Con~~ DSL draws significant attention from implementers and service providers. This is because it delivers high-bandwidth data rates to ~~changer~~ dispersed locations with relatively small changes to the existing telecommunications infrastructure. Digital subscriber line (DSL) is a communication technology that provides high-bandwidth digital communication over standard telephone lines formed of copper wires.

★ Data link layer :-

The data link layer is the protocol layer in a program that handles the moving of data into and out of a physical link in a network. The data link layer is layer 2 in the open systems Interconnection (OSI) architecture model for a set of telecommunication protocols.

Function of the Data - link layer :-

1) Framing :- The packet received from the Network layer is known as a frame in the Data link layer. At the sender's side, DLL receive packets from the Network layer and divides them into small frames, then sender's each frame bit-by-bit to the physical layer. It also attaches some special bits (for error control and addressing) at the header and end of the frame. At the receiver's end, DLL takes bits from the physical layer organize them into the Frame, and sends them to the network layer.

2) Addressing :- The data link layer encapsulates the source and destination's MAC address / physical address in the header of each frame to ensure node-to-node delivery. MAC address in

the unique hardware address that is assigned to the device while manufacturing.

3) Error Control: Data can get corrupted due to various reasons like noise, attenuation etc. So, it is the responsibility of the data link layer (DLL) detect the error in the transmitted data and correct it using error detection and correction techniques respectively. DLL adds error detection bits into the frame's header so that receiver can check received data is correct or not.

4) Flow control: If the receiver's receiving speed is lower than the sender's speed, then this can lead to an overflow in the receiver's buffer and some frames may get lost, so it's the responsibility of DLL to synchronize the sender's and receiver's speeds and establish flow control between them.

5) Access control: When multiple devices share the same communication channel there is high probability of collision, so it's the responsibility of DLL to check which device has control over the channel and CSMA/CD and CSMA/CA can be used to avoid collisions and loss of frames in the channel.

Some common data link protocols are :

1) Synchronous data link protocols (SDLC) :-
It is a subset of HDLC
SDLC is basically a communication protocol of computer. It usually supports multipoint links even error recovery or error correction also. It is usually used to carry SNA (System network architecture) traffic and is present precursor to HDLC it is also designed by IBM in 1975. It is also used to connect all of the remote devices to mainframe computers at central locations may be in point-to-point (one-to-one) or point-to-multipoint (one-to-many) connections. It is also used to make sure that the data units should arrive correctly and with right flow from one network point to next network point.

2) High-level data link protocol (HDLC) :- HDLC is basically a protocol that is now assumed to be an umbrella under which many wide area protocols sit. It is also adopted as a part of X.25 network. ~~It was originally created and developed by ISO in 1979. This protocol is generally based on SDLC.~~ It also originally created and developed by ISO in 1979. This protocol is generally based on SDLC. It also provides best-effort unreliable service and also reliable

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service. HDLC is a bit-oriented protocol that is applicable for point-to-point and multipoint communication both.

3) Serial line Interface protocol (SLIP) :- SLIP is generally an older protocol that is just used to add a framing byte at end of IP packet. It is basically a data link control facility that is required for transferring IP packets usually among Internet service providers (ISP) and a home user over a dial-up link. It is an encapsulation of the TCP/IP especially designed to work with over serial ports and several router connections simply for communication. It is some limitations like it does not provide mechanisms such as error correction or error detection.

4) Point-to-Point protocol (PPP) :-

PPP is a protocol that is basically used to provide same functionally as SLIP. It is most robust protocol that is used to transport other types of packets also among with IP packets. It can also be required for dial-up and leased router lines. It basically provides framing method to decside frames. It is a character-oriented protocol that is also used for error detection. It is also used to provides two protocols i.e. NCP and LCP. LCP is used for bringing lines up, negotiation (बातचीत, chat)

of options, bringing them down whereas NCP is used for negotiating network layer protocols. It is required for same serial interface like that of HDLC.

5) Link control protocol (LCP):-

It was originally developed and created by IEEE 802.2. It is also used to provide HDLC style services on LAN (local area network). LCP is basically a PPP protocol that is used for establishing, configuring, testing, maintenance, and ending or terminating links for transmission of data frames.

6) Link access Procedure (LAP):-

LAP protocols are basically a data link layer protocols that are required for framing and transferring data across point-to-point links. It also includes some reliability service feature.

There are basically three types of LAP:-

1) LAPB (Link access procedure balanced)
2) LAPD (Link access procedure Dchannel)
3) LAPF (Link access procedure Framemode bearer services).

It is actually originated from IBM, SDLC,

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7) Network

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which is being submitted by IBM to the ISP simply for standardization.

7) Network Control protocol (NCP):-

NCP was also an older protocol that was implemented by ARPANET (Advance research project agent network). It basically allows users to have access to use computers and some of the devices at remote locations and also to transfer files among two or more computer. It is generally a set of protocols that is forming a part of PPD. NCP is always available for each and every higher-layer protocol that is supported by PPD. NCP was replaced by TCP/IP in the 1980s.

Flow control in Data link layer :-

Flow control is design issue at Data link layer. It is a technique that generally observer that proper flow of data from sender to receiver. It is very essential because it is possible for sender to transmit data or information at very fast rate and hence receiver can receive this information and process it. This can happen only if receiver has very high load of traffic as compared to sender, or if receiver has power of processing less as compared to sender. Flow control is basically a technique that gives permission to two of stations that are working and processing at different speeds to just communicate with one another.

Techniques of flow control in Data link layer:

There are basically two types of techniques being developed to control the flow of data.

1) Stop-and-wait flow control:

This method is the easiest and simplest form of flow control. In this method, basically message or data is broken down into various multiple frames, and then receiver indicates its readiness to receive frame of data.

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When acknowledgement is received, then only sender will send or transfer the next frame. This process is continued untill sender transmits EOT (End of transmission) frame. In this method, only one of frames can be in transmission at a time. It leads to inefficiency i.e. less productivity if propagation delay is very much longer than the transmission delay and ultimately in this method sender send single frame and receiver take one frame at a time and sent acknowledgement (which is next frame number only) for new frame.

Advantages -

(i) This method is very easiest and simple and each of the frames is checked and acknowledged well.

(ii) This method is also very accurate.

Disadvantages -

(i) This method is fairly slow.

(ii) In this, only one packet or frame can be sent at a time.

(iii) It is very inefficient and makes the transmission

process very slow.

2) Sliding window flow control:

This method is required where reliable in-order delivery of packets or frames is very much needed like in data link layer. It is point to point protocol that assumes that none of the other entity tries to communicate until current data or frame transfer gets completed. In this method, sender transmits or sends various frames or packets before receiving any acknowledgement. In this method, both the sender and receiver agree upon total number of data frames after which acknowledgement is needed to be transmitted. Data link layer requires and uses this method that simply allows sender to have more than one unacknowledged packet "In-flight" at a time. This increases and improves network through put and ultimately in this method sender sent multiple frame but receiver take one by one and after completing on frame acknowledge (which is next frame number only) for new frame.

Advantages:

(i) It performs much better than stop-and-wait flow control.

(ii) This metho

(iii) Multiple fram

Disadvantag

(i) The main sender an of multiple

(ii) The recei packets o

Stop-and- Contro

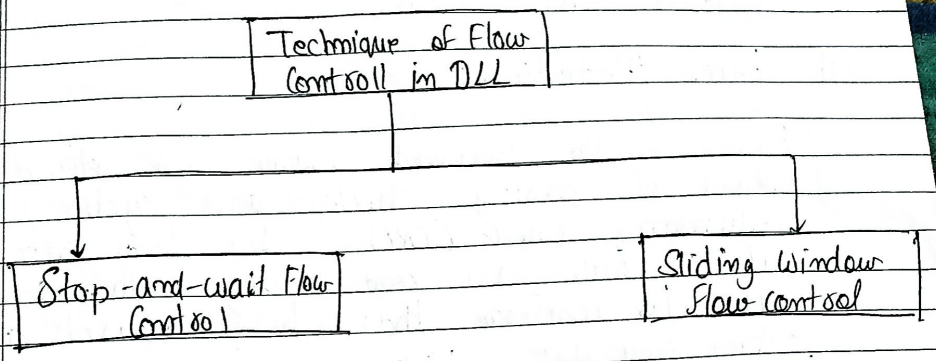
(ii) This method increases efficiency.

(iii) Multiple frames can be sent one after another.

Disadvantages:

(i) The main issue is complexity at the ~~rs~~ sender and receiver due to the transferring of multiple frames.

(ii) The receiver might receive data frames or packets out the sequence.



Error detection & Correction :-

There are many reasons such as noise, cross-talk etc, which may help data to get corrupted during transmission. The upper layer work on some generalized view of network architecture and are not aware of actual hardware data processing. Data-link layer uses some error control mechanism to ensure that frames (data bit streams) are transmitted with certain level of accuracy. But to understand how error is controlled, it is essential to know what type of errors may occure.

(1) Error Detection :-

Error in the received frame are detected by means of parity check and cyclic redundancy check (CRC). In both cases, few extra bits are sent along with actual data to confirm that bits received at other end are same as they were sent. If the counter check at receiver end fails, the bits are considered corrupted.

(a) Parity check :

One extra bit is ~~used~~ sent along with the original bits to make number of 1s either even in case of even parity, or

odd in
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1s in it.
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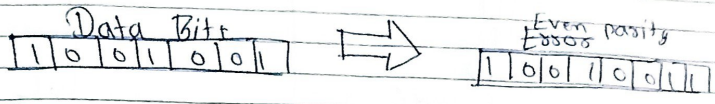
odd in case of odd parity. The sender while creating a frame counts the number of 1s in it. For ex., if even parity is used and number of 1s is even then one bit with value 0 is added. This way number of 1s remains even, if the number of 1s is odd, to make it even a bit with value 1 is added.



The receiver simply counts the no. of 1s in a frame. If the count of 1s is even parity is used, the frame is considered to be not corrupted and is accepted. If the count of 1s is odd and odd parity is used, the frame is still not corrupted.

(b) Cyclic Redundancy check (CRC):-

CRC is a different approach to detect if the received frame contains valid data. This technique involves binary division of the data bits being sent. The divisor is generated using polynomials. The sender performs a division operation on the bits being sent and calculates and remainder. Before sending the actual bits, the sender adds the remainder at the end of the actual bits. Actual data bits plus the remainder is called a codeword. The sender transmits data

bits as codewords.

Divisor

Sender

```
      11
101 | 1100|
     101
      110
      101
       111
       101
        10
```

Data bits

CRC

Receiver

```
      111
101 | 1100 | 10
     101     Data bits + CRC
      110
      101
       11|
       10|
        101
        101
        000
```

No error

At the other end, the receiver performs division operation on codewords using the same CRC divisor. If the remainder contains all zero the data bits are accepted, otherwise it is considered as there some data corruption occurred in transmit.

2) Error Correction :-

In the digital world, error detection can be done in two ways :

a) Backward error Correction :

When the receiver detects an error in the data received, it requests back the sender to retransmit the data unit

b) Forward error

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6) Forward error correction:

When the receiver detects some errors in the data received it executes error-correcting code, which helps it to auto-recover and to correct same kinds of errors.

Stop and Wait ARQ:-

- Propagation Delay: Amount of time taken by a packet to make a physical journey from one router to another router.

$$\text{Propagation delay} = \frac{\text{(Distance between routers)}}{\text{Velocity of propagation}}$$

- Round trip time (RTT) = $2 *$ ~~Propagation delay~~
  Amount of time taken by a packet to reach the receiver + Time taken by acknowledgement to reach the sender
- Time Out (TO) = $2 *$ RTT
- Time to ~~Time~~ Live (TTL) = $2 *$ Time Out.
  (Maximum TTL is 188 seconds)

* Characteristics :-

- Used in connection-oriented communication.
- It offers error and flow control.
- It is used in Data link and transport layers.

- Stop and wait for ARQ mainly implements the sliding window protocol concept with window size 1.

Simple Stop and wait :-

Sender :

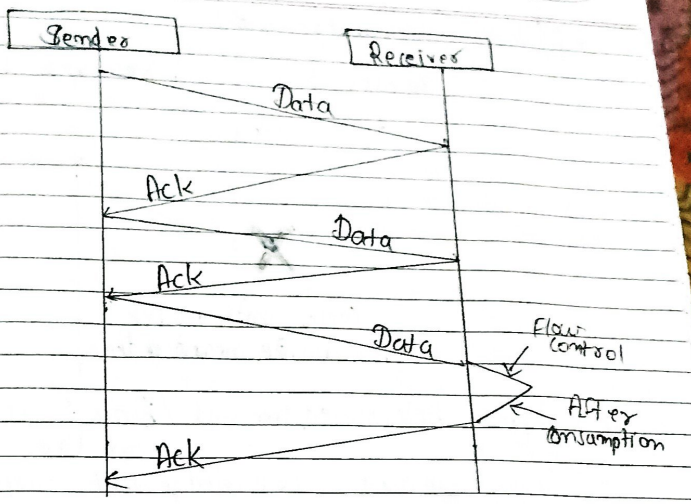
Rule 1) Send one data packet at a time.

Rule 2) Send the next packet only after receiving acknowledgement for the previous.

Receiver :

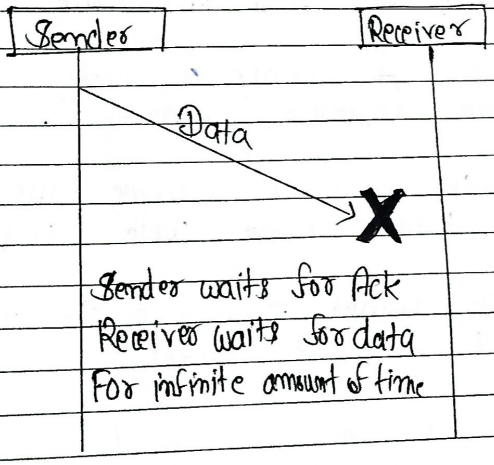
Rule 1) Send acknowledgement after receiving and consuming a data packet.

Rule 2) After consuming packet acknowledgement need to be sent (Flow control).



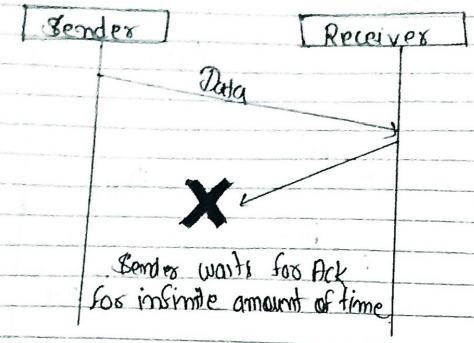
Problems :-

1. Lost Data



Sender waits for Ack
Receiver waits for data
For infinite amount of time

2) Lost acknowledgement:



3) Delayed Acknowledgement / Data: After a timeout on the sender side a long-delayed acknowledgement might be wrongly considered as acknowledgement of some other recent packet.

⇒ Working of stop and wait for ARQ:

1) Sender 'A' sends a data frame or packet with sequence number 0.

2) Receiver 'B' after receiving the frame, sends an acknowledgement with sequence number. a (The sender number of the next expected data frame or packet)

There is only a one-bit sequence number that implies that both sender and receiver

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only.

⇒ Go-B

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ii) Go-Back-N ARQ:

In go-back-n ARQ is the sender's window size. Suppose we say that go-back-3 which means that the 3 frames can be sent at a time before expecting the acknowledgement from the receiver.

It uses the principle of protocol pipelinging in which the multiple frames can be sent before receiving the acknowledgement of the first frame.

In go-back-n ARQ, the frame are numbered sequentially as go-back-n ARQ sends the multiple frames at a time that requires the numbering approach to distinguish the frame from another frame, and these numbers are known as the sequential numbers.

The numbers of framer that can be sent at a time totally depends on the size of the sender's window. So, we can say that 'N' is the number of frames that can be sent at a time before receiving the acknowledgement from the receiver.

If the acknowledgement of a frame is not received within an agreed-upon time period,

then all the frames available in the current window will be retransmitted.

The sequence number of the outbound frames depends upon the size of the sender's window. Suppose the sender's window size is 2, and we have ten frames to send, then the sequence numbers will not be 1, 2, 3, 4, 3, 6, 7, 8, 9, 10. Let's understand through an example.

- N is the sender's window size
- If the size of the sender's window is 4 then the sequence number will be 0, 1, 2, 3, 0, 1, 2, 3, 0, 1, 2, and so on.

The number of bits in the sequence number is 2 to generate the binary sequence 00, 01, 10, 11.