

Data rate :- date at which d.c take place.
e.g 50, 150, 300, 600, 1200, 9600, 115200 bps.

osc in RS232 operates at 1.843MHz, which is divided by 1600 to obtain 115200 data rate.

Data bit :- no. of bits transmitted for each character
i.e. 5 or 6 or 7 or 8 bits (in ASCII 7 bits)

Start bit :- if data bits are of 7 or 8, 1 stop bit
in 5 or 6 2 stop bits.

Parity ? even or odd
for even char, the parity bit (1 or 0) will be added in such a way the total no. of bits will be even
if parity is set to none, then parity bit would be ignored.

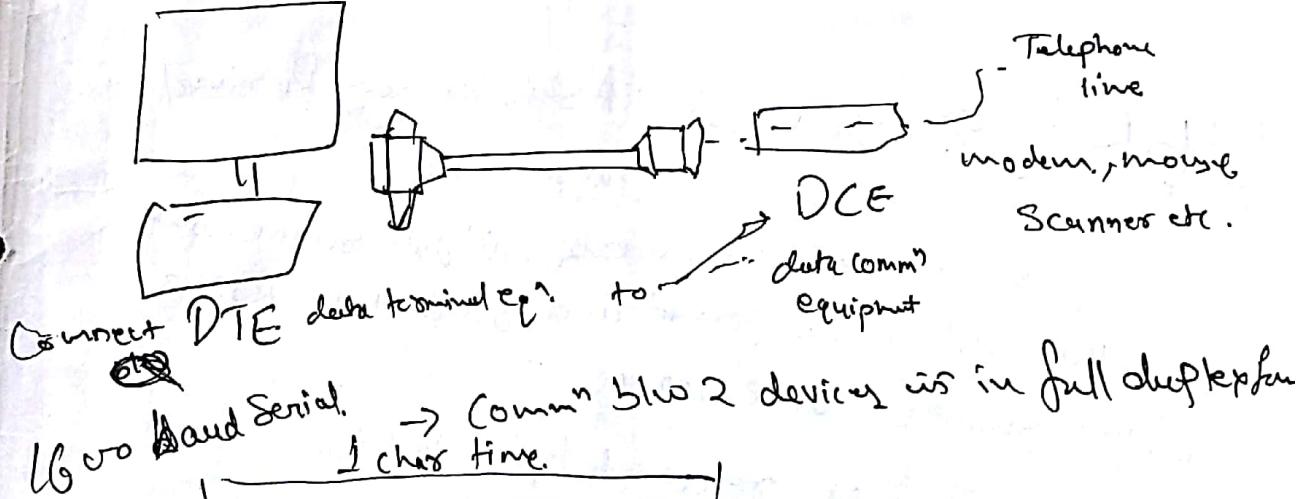
Flow Control ? is protocol for D.T Speed
selected issues.

→ is protocol to stop/resume d.t. also known as handshaking.
RST → Request to send → device want to send data
CTS → Clear to send → receiver ready to receive data

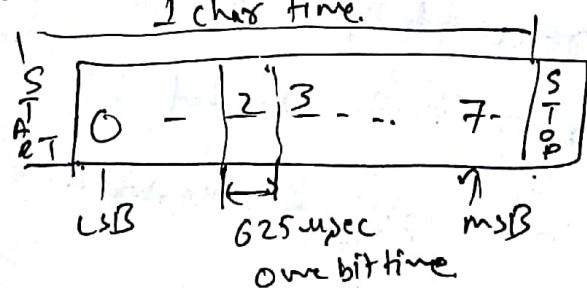
Communication Interfaces

- send data to host for data Analysis & Processing CUI
- System to System Communication Tr/Rx data.
- No. of ES may need to map to Shared data.
- To connect with internet.
- for SW upgrades and data synchronization.
- RS 232 / UART Serial Comm.
 - ↳ one of the oldest and most widely used

Comm' interfaces



Using Hand serial. → Comm b/w 2 devices is in full duplex
1 char time.



- Receiving device decodes data bits using start bit & stop bits
- Asynchronous Comm. → no CLK signal is transmitted.
- Parity bit is for error detection.

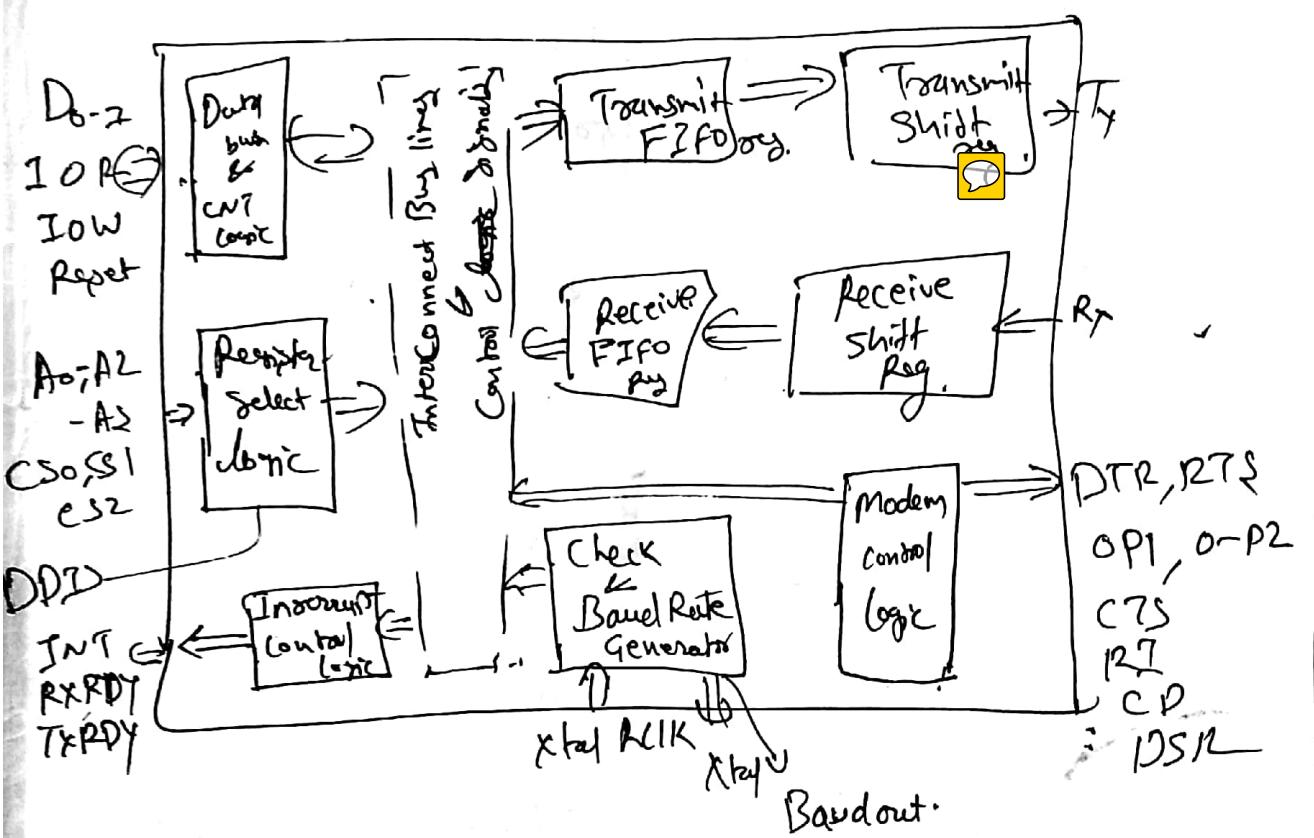
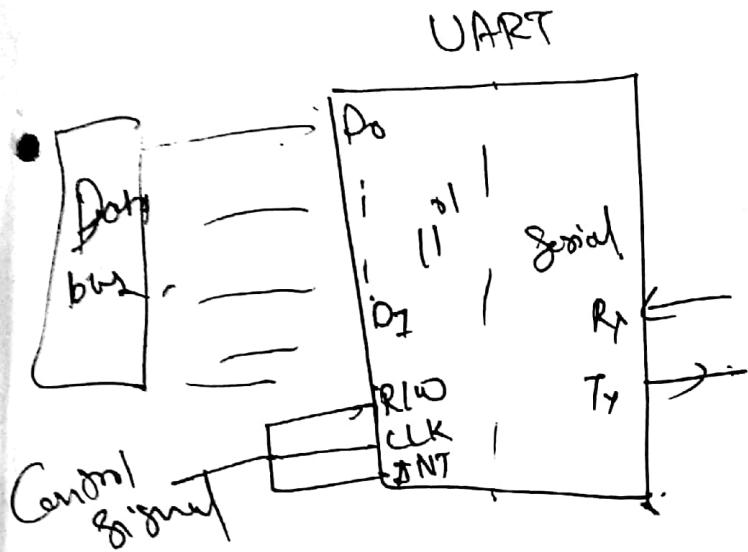
9 pin port

1. ^{from DCE} Carrier detect (CD)
 2. ^{from DCE} Receive data (RxD)
 3. Transmit data (TxD) ^{to DCE}
Data Terminal Ready (DTR)
^{outgoing hand shake}
 - 4.
 5. Signal Ground common ref voltage
 6. Data set Ready (DSR)
 7. Request to Send (RTS)
 8. Clear to send (CTS)
 9. Ring indicator (incoming signal from modem)
^{from DCE}
- hand shake

UART ? Universal Asynchronous Receiver
Transmitter

→ Programing script converts 1st data received from
CPU into serial format and send it to RS232
level shifter - vice versa.

- ↳ Converts received bytes to bits
- ↳ Add a parity bit if needed.
- ↳ handles interrupt from keyboard & mouse.



RS232 Standard specifies a distance of 15.2 meter
 UART " " , 100 meter using RS232 cable.

uni USB \Rightarrow Master / Slave architecture
Serial Bus

\Rightarrow Self Powered or Powered by bus.

\Rightarrow Can Supply 500 mA Current to the devices.

Pin	F ⁿ
1	+5V Power (VBUS)
2	Differential data line, D+
3	Differential data line D-
4	Power & Signal Ground

Version. Transfer Rate. (Mbps)

USB 1.1 1.5 & 12

USB 2.0 (Hi speed)
2001 480

USB 3.0 SuperSpeed
(2008) 4800

USB 3.1 (2014) 9600

USB OTG (On The Go)

\Rightarrow make devices to communicate each other.

\Rightarrow Enabling the device to be USB host

\rightarrow Attach - detection protocol (ADP)

\rightarrow Session Request Protocol (SRP)

\rightarrow Host Negotiation Protocol (HNP)

Comm" Protocol :- (1) Communication b/w the host & the devices.
are in the form of packets.

(2) Supports Plug and Play.

(3) When a device is connected, the host obtains

(a) Configuration & prop of dev

(b) Unique ID to identify device n/w

When a device is removed, the hub informs
the host

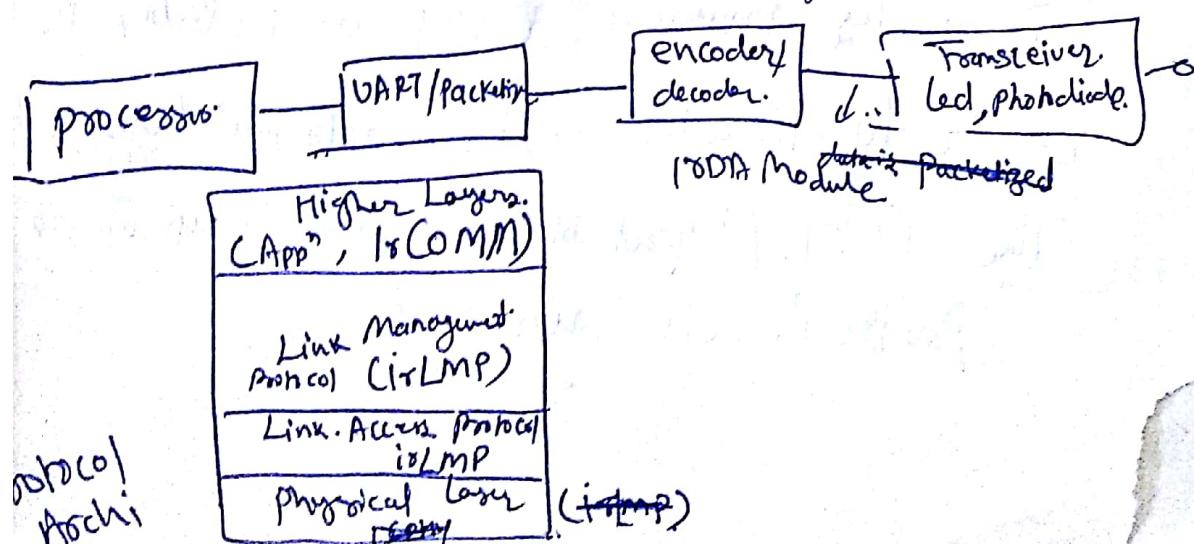
Short data packets are exchanged for
handshaking, ACK, capabilities of the device info
Packet size (1023 bytes)

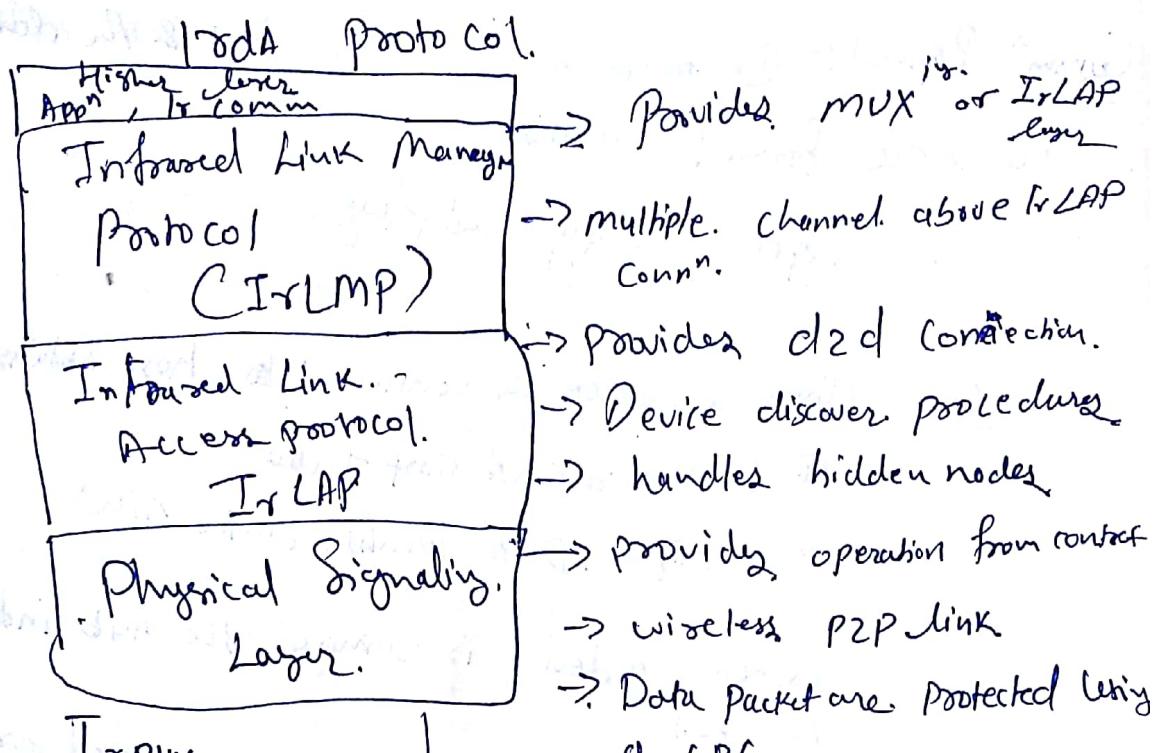
Device class :- Each device has a unique ID b/w
(device descriptor)

(classes :- display, Comm, audio, mass storage and)
HMI (Keyboard, Front Panel Knobs, Control Panel etc)

Infrared \Rightarrow used in TV, VCR, AC etc.

I_oDA \Rightarrow Infrared Data Association.
Founded in 1993





IrPHY

①

→ Data transmission from 9600 b/s

→ IrDa data has range of 1 meter

Serial IR (SIR) with bidir
Fast IR (FIR)
IrDA Control

→ has range of 5mtr

IrComm → emulates Standard Serial port.

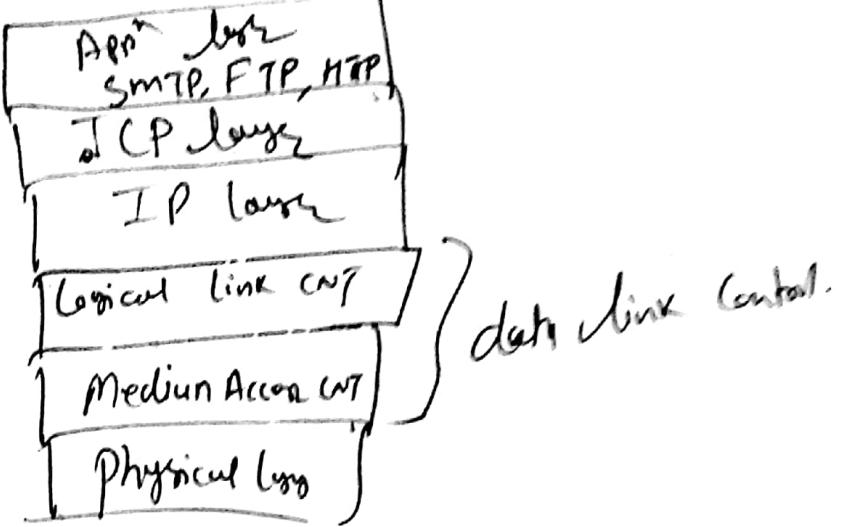
Ethernet

→ Ethernet chip, associated
Protocol Stack

→ To Connect Es. to LAN.

→ provides physical layer and data link layer functionality. Above data link layer

The TCP/IP protocol stack and the app" layer protocols will run



Physical layer: RJ45 - Jack.

⇒ Ethernet transmit balance differential Signals.

In each pair 1 wire carries signal voltage between +2.5V and -2.5V
 2nd wire - - - - - between -2.5V to 0
 hence Signal difference is 5 Volts.

Pin no.	F ⁿ behavior
1	Trans data TD+
2	TD-
3	Rec data RD+
4	NC
5	RD-
6	TD+
7	NC
8	NC

Speed of 10Mbps & 100Mbps are supported.

Data link layer

LLC.

Protocol's for Connⁿ establishment,

flow control, acks.

MAC

used Carrier Sense Multiple Access
collisions detection.

CSMA/CD →

Shares medium.

→ Each ethernet interface will have unique
Ethernet address of 48 bits.

IEEE 802.11

↳ WLAN or Wireless Local Area Network
& Personal Area Network.

→ Covering physical & MAC layers of WLAN

↳ LLC is same as E-LAN.

→ Physical medium for 802.11 WLANs are

a. Data rate supported ~~is~~ - 1 Mbps, - 2 mbps.

b. Direct Sequence Spread Spectrum. operating in 2.4 GHz ISM band

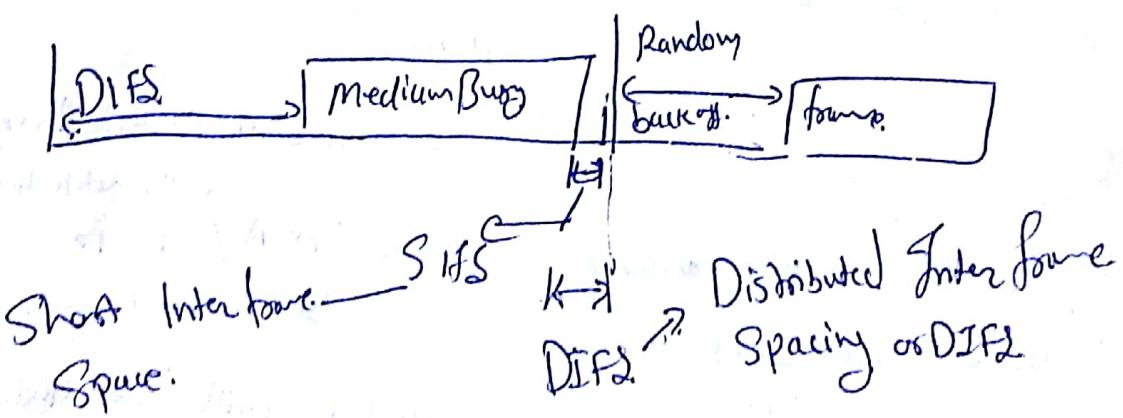
Up to 7-channels each with a data rate of

1 or 2 Mbps. Can be used.

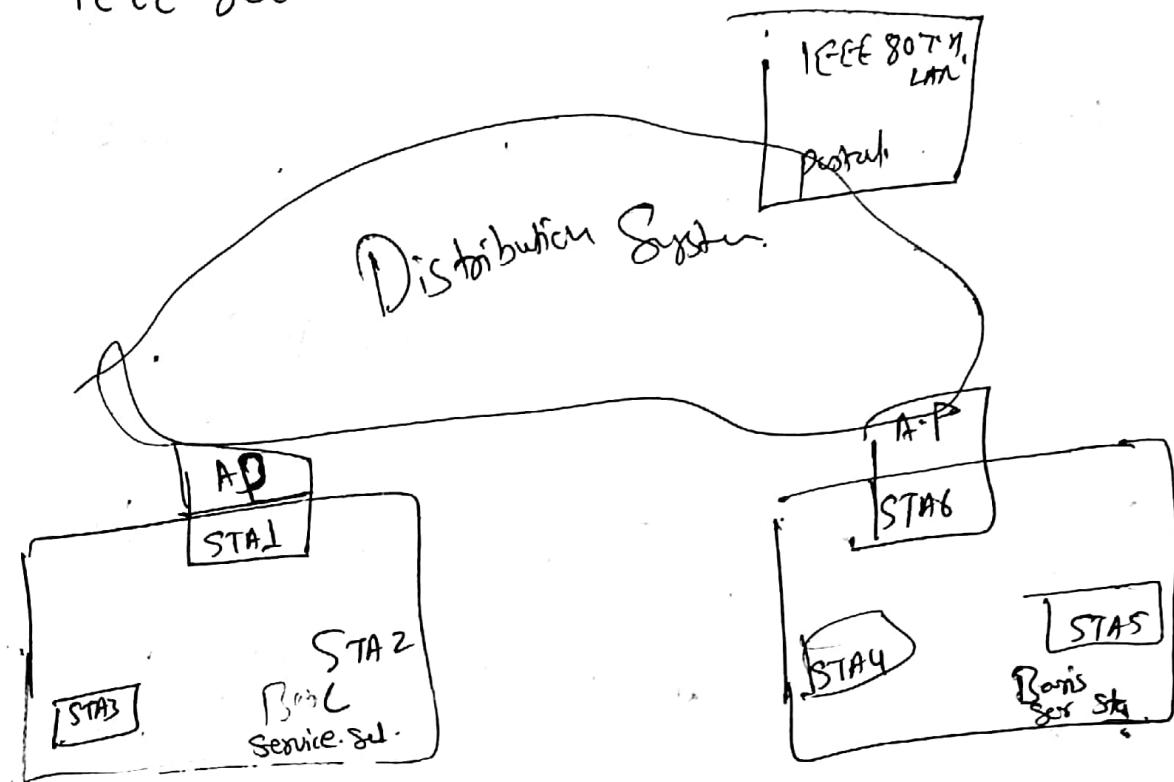
Extension of IEEE 802.11 is 802.11b. (Support 2.4 GHz at 2.4 GHz, with a range of 100 meters).

IEEE 802.11a → supports data rate of 54 mbps & 5 Gbps.

802.11g supports 54 mbps in 2.4 GHz band!



IEEE 802.11b → wifi



Bluetooth

- ↳ low cost technology.
- ↳ ISM (Industrial, Scientific & medical) band based radio transmission.
- ↳ range: typically 10 meters - 100 meters.
- ↳ Bluetooth Special Interest Group (SIG)
founded in 1998 by Ericsson, Intel, IBM, Toshiba, & Nokia.
released Version 1.0 in July 1999.

BT

Bluetooth System Specification

① freq. of operation: ISM freq. range 2400 - 2483.5 MHz

Guard Band of 2MHz.

79 channels, each 1 MHz B.W.

② Modulation, GFSK, or modulation tech.,

Binary 1 is represented by +ve freq. deviation

0 by -ve freq. -11-

BER of minimum 1%.

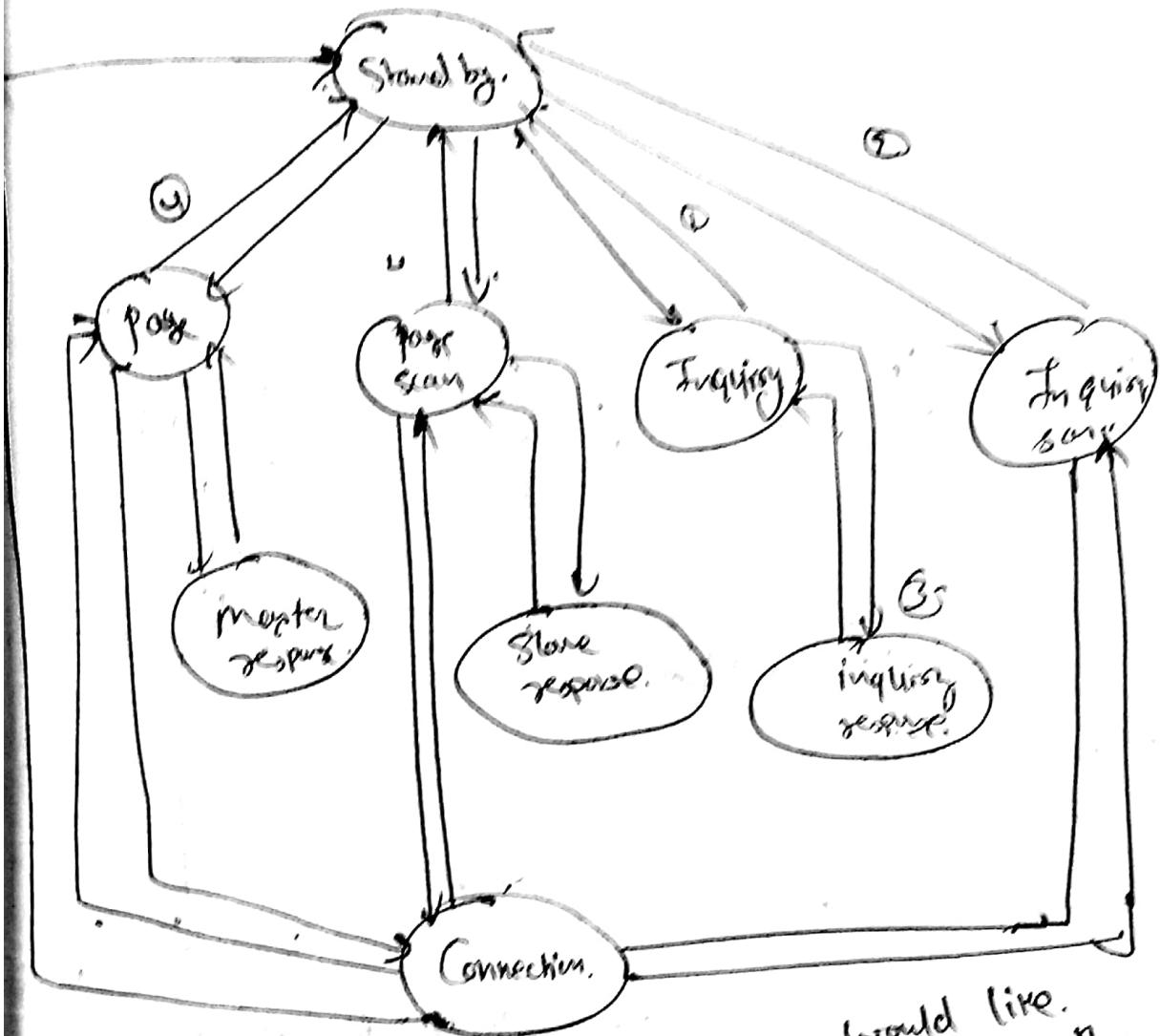
Service Support: Both data. and voice.

Syn. Connection Oriented (SCO) for voice.

Asyn. Connection less (ACL) for data.

Data rate: 64 Kbps - for voice. } in Mod. dir.
57.6 Kbps - for data }

	Classic BT	BLE Tech.
Data Payload throughput Bit/sec (net)	2Mbps. ↓ 2Mbps.	~ 100 Kbps. ↓ Strong.
Robustness,	Strong	Up to 250 m
Range.	Up to 1000 m.	Strong. < 0.003%
Connection set-up time	Week. < 6s	No
Voice capable	Yes	



→ Page State:- When a device ~~would like~~ connect with another device.

~~Def~~

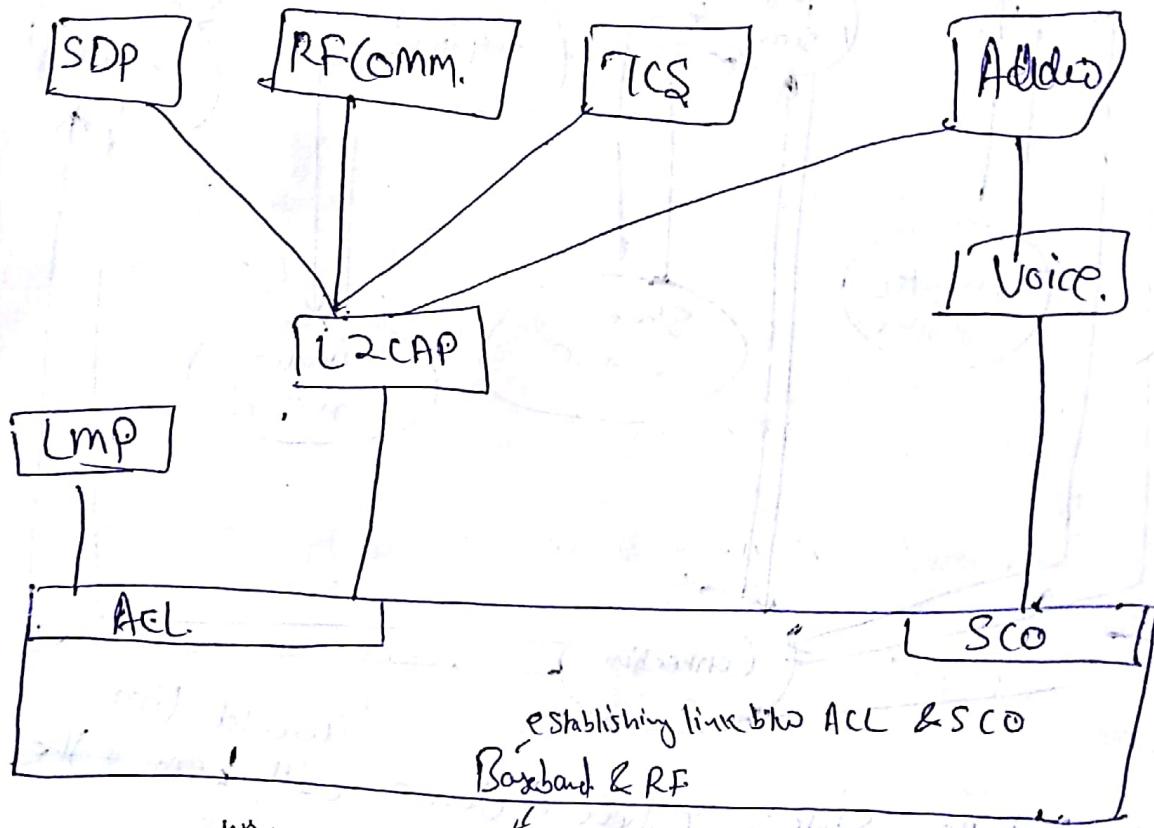
↪ Device will become master & Page. for other device.

↪ When device receive, Page Scan. Packed it, enter in the Slave mode.

↪ Hold: device will stop receiving the data traffic for a specific amount of time. So other device can use the channel.

↪ Sniff:- slave will be given instruction like listen starting with Slot = S, T - period, N, Slots.

↪ Park :- device only listens to beacon signal from the Master occasionally, to Sync with Master but no DT.



Async. Connectionless link. Provides audio interface.
 ACL → Data Services. Bandwidth & RF
 SCO → Voice Services. Also for addressing & managing. No different
 Sync. connection-oriented link. States of Bluetooth device.

LMP ⇒ Link Manager Protocol.

- ↳ Set up Control Link.
- ↳ Authentication. → Challenge Response Scheme. → You throw a challenge and check whether the other device can correctly respond on that challenge.
- ↳ Encryption. ⇒ Confidentiality. ⇒ Master sends a key, with which data is encrypted to all slaves. MSG
- ↳ LMP message.

- Clock offset, seq → Synchronization.
- Timing accuracy, info seq: ensure synchronization.
- Implementation:- need to have same LMP version.
- Type of packets supported
- Switching, M/S state.
- Name request.
- Deauth. → Clear a connection.
- Hold mode: if no deauth. to send.
- Pending mode: To be synch with Master but no participation in D-T.

- Quality of Service (QoS) Parameter Exchange
 - ↳ no. of repetitions for Broadcast packet.
 - ↳ Delay & B.W allocation.

Logical Link Control & Adaptation Protocol (L2CAP)

- ↳ runs above Base-Band and carries out the data link layer functionality.
- ↳ only for ACL links. Packet size 64 bytes.
- ↳ run on hosts, e.g. desktop, phone, etc.
- ↳ does not support multicasting.
- ↳ Protocol Mux:- A packet received by L2CAP has to pass it onto the correct higher layer.
- ↳ Segmentation & reassembly:- Segmented into small baseband packets & sent to baseband layer.
- ↳ Received packets are reassembled & sent to higher layers.

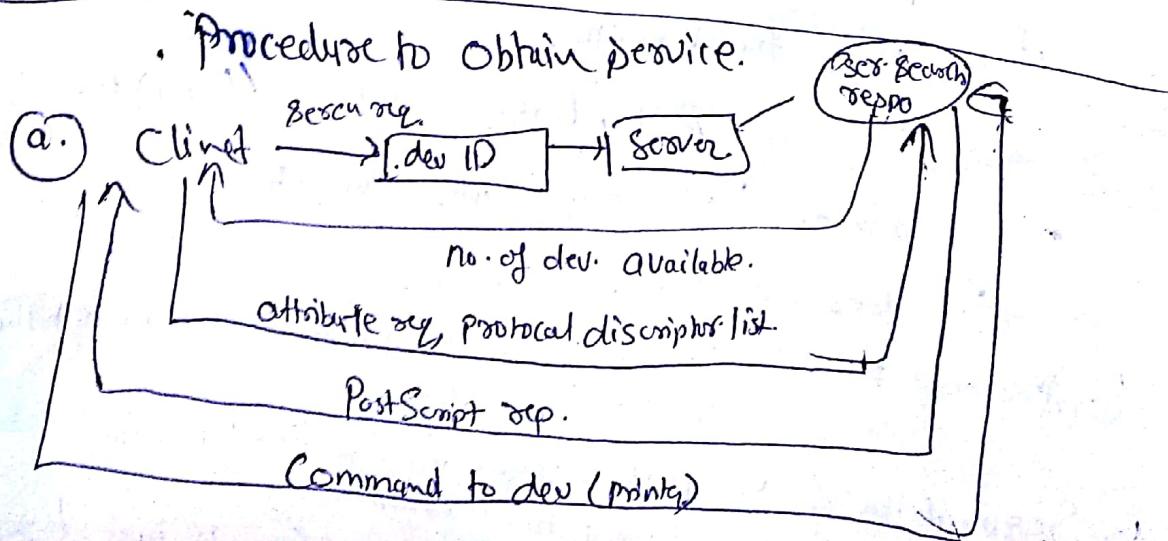
- AOS \Rightarrow
- \rightarrow delay specification.
 - \rightarrow receiving response from lower layer like
 - \hookrightarrow connection indication.
 - \hookrightarrow Connⁿ confirmation,
 - \hookrightarrow _____ -ve, pending
 - \hookrightarrow timeout indication.
 - \hookrightarrow AOS violation, cancellation.

Service Discovery Protocol (SDP.)

\hookrightarrow Capability to create ad-hoc NWs.

\hookrightarrow discovering services offered by a device.

- ① Can search for service needed by it in Piconet.
- ② discover service based on class of service.
(e.g laptop wants print service)
- ③ Browsing Services.
- ④ To discover service on another device without consulting the third device.



RF Comm

↳ transport Protocol \Rightarrow emulates RS232, GPRS/L2CAP

↳ Emulates Signal of RS232 :

↳ 102 GND

↳ 103 Transmit Data TD

↳ 104 Rx Data

↳ 105 Req. to send CRTE

106 Clear to Send (CTS)

107 Data Set Ready (DSR)

108 Data Carrier Detect DTI2

109 Data Terminal Ready DTR

110 Ring Indicator DTR

RFComm is derived from GSM (Global Sys for Mobile Comm's)

Telephony Control protocol Spec. (TCS) :

↳ To establish, voice comm (worked with SCO links)

Host Control Interfaces

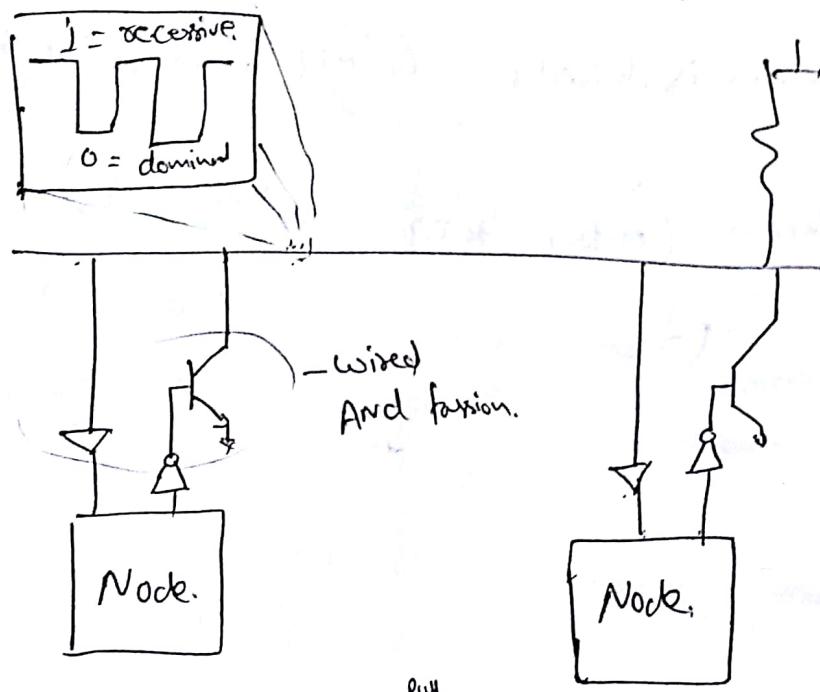
↳ Setting up & disconnection of links

↳ Control of busband features (idle, sleep times)

↳ Retrieving Status info

CANBUS

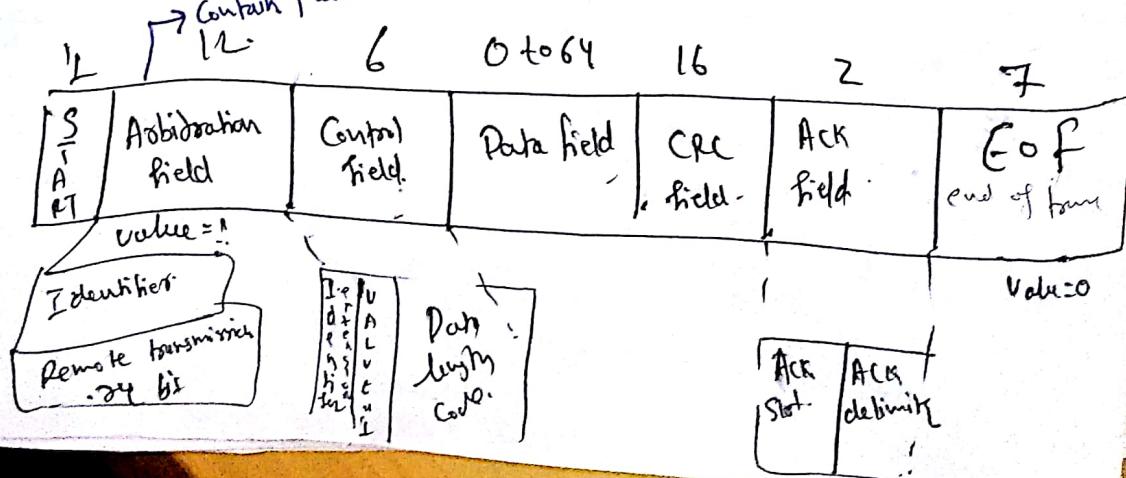
- ↳ Designed for automotive electronics.
 - ↳ Used in 1991.
 - ↳ Used bit-serial transmission.
 - ↳ Rate \rightarrow 1 mbps over twisted pair 40 meters

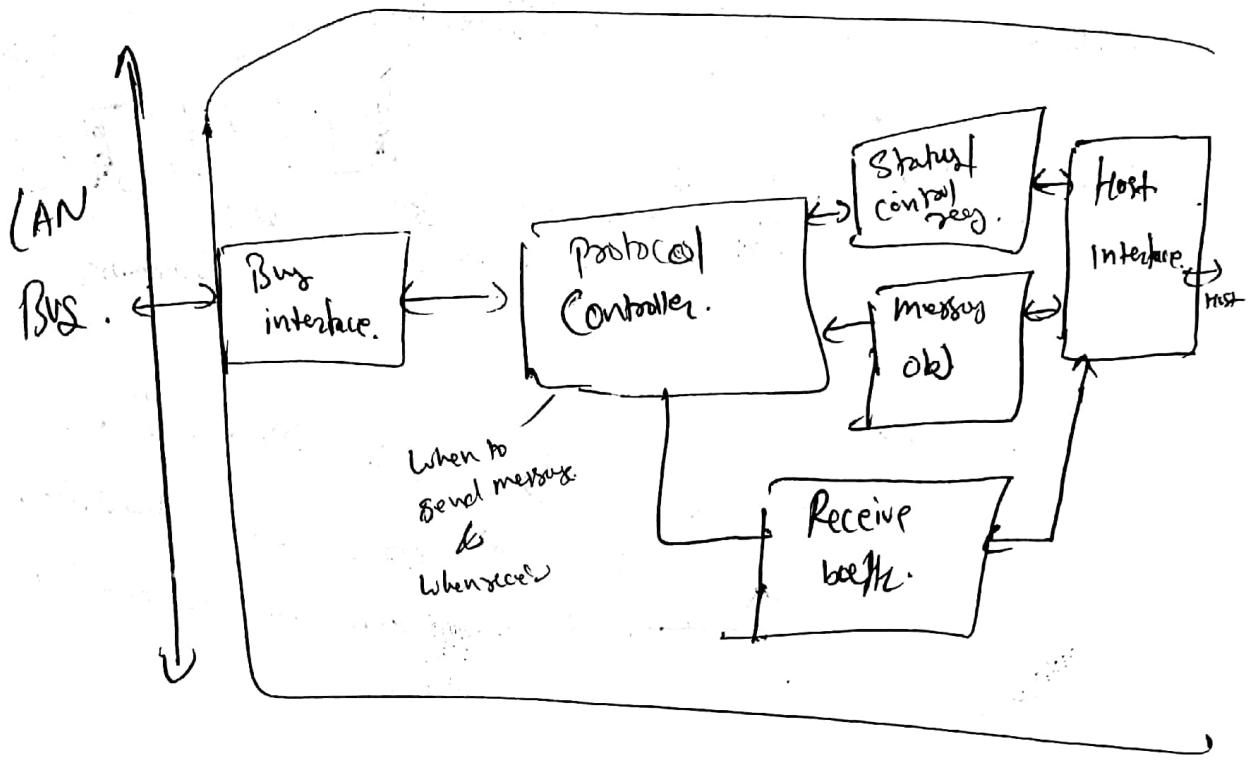


→ ○ dominant over 1. ("bus down if any node on bus pulls

→ excessive \Rightarrow When all nodes are transmitting.

Dominant \Rightarrow When a node transmitting a CTS packet's destination addr.





I₂C \Rightarrow

low cost

easy to implement

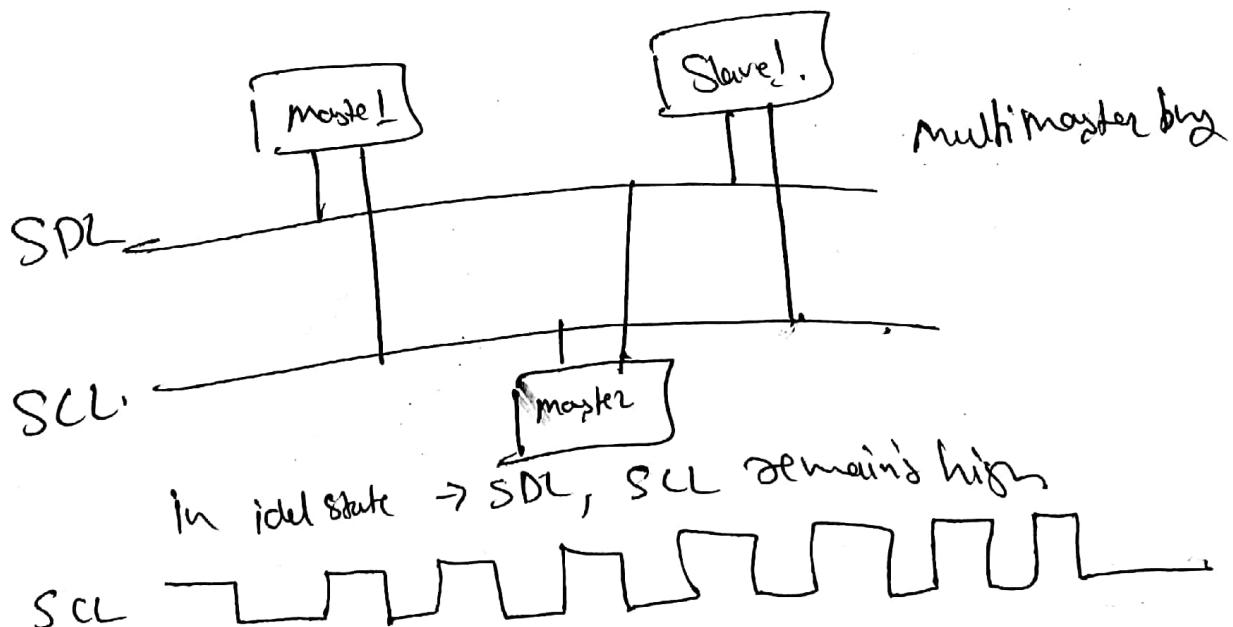
Speed \rightarrow 100 Kbps. to 400 Kbps.

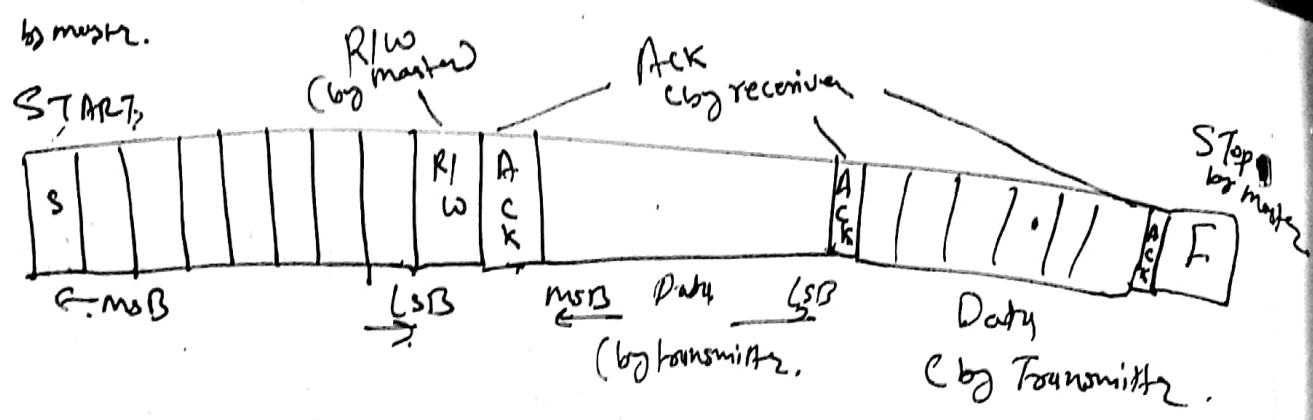
\rightarrow philips

Only two lines.

(a) SDA : - Serial data line. \rightarrow data.

(b) SCL Serial Clock line. \rightarrow valid data on data line





Start. SDA
SCL.

The chip issues the 1st pull SDA (data) line. & next pull SCL (clock) line.

Stop

By Master. 1st release the SCL & then SDA line.

N/w to describe interconnections b/w the processing elements.

26
int'l. workshop

- ↳ Real time performance.
- ↳ Power Consumption
- ↳ Cost

many process → it is expensive to make hP processor.
→ m.p helps to achieve R.T Performance.

OSI model.

Appn : End user interface.

Presentation. Data format.

Sessions : Appⁿ dialog. mech. for controlling the interaction of end user service across a n/w, e.g. data grouping, checkpointing.

Transport : Connection; optimize n/w resource utilization

N/W : End to End service. multihop's network.

Datalink :- error detection & control across a singlalink. (Reliable d.)

Physical :- basic connections, electrical, mechanical, and physical layer.

A
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