

Physical Layer

Bandwidth : capacity carried by the cable (WEEK 7 Applied)

Network cable

- Related to electrical & mechanical properties of the transmission
- Data signal
- modulation & demodulation

* Bandwidth

measured in :

- Hertz
- mbps

* Coaxial cable (obsolete)

- expensive at
- bandwidth → ok

↳ NOT as good as optical fibre

BUT better than twisted pair

* Twisted pair (normally used) ⇒ twist wires to eliminate crosstalk

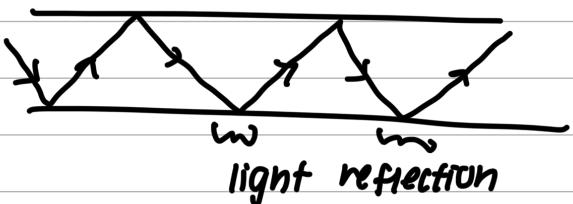
- unshielded twisted pair (UTP) → CAT 6
- shielded twisted pair (STP) → CAT 5



twist together to
eliminate crosstalk

* Optical fiber

- highest bandwidth
- uses light source
 - ↳ speed of light
- shielded (light travel inside)
- measured in terms of wavelength
- affordable cost



Wireless (EM wave)

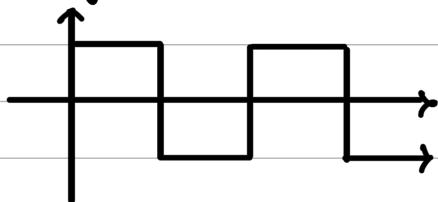
Physical Layer

Physical media & Transmission Types

Digital (most computers now)

↳ '0' or '1'

↳ signal:



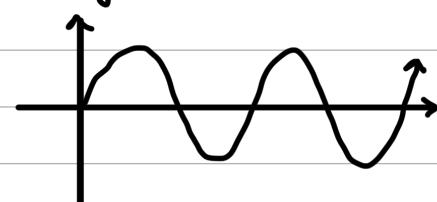
Analog (e.g. microphone)

↳ continuous

↳



↳ signal:



* phones / computer

↳ convert analog signal
to digital signal

↳ if stream radio on
phone / computer

Modulation :

- conversion from analog
to digital or other way
around

Analog eg. ① wifi
② FM radio

Digital eg. ③ Ethernet

④ VoIP

↳ ethernet

↳ optical fibre

modem : modulation + demodulation

↳ send signal ↳ receive signal

↳ double check

Physical Layer

- * This topic focus only on
 - Digital transmission
 - Analog transmission

① DIGITAL TRANSMISSIONS (LOW OR HIGH)

↳ types : unipolar, polar, non-return-to-zero, return-to-zero

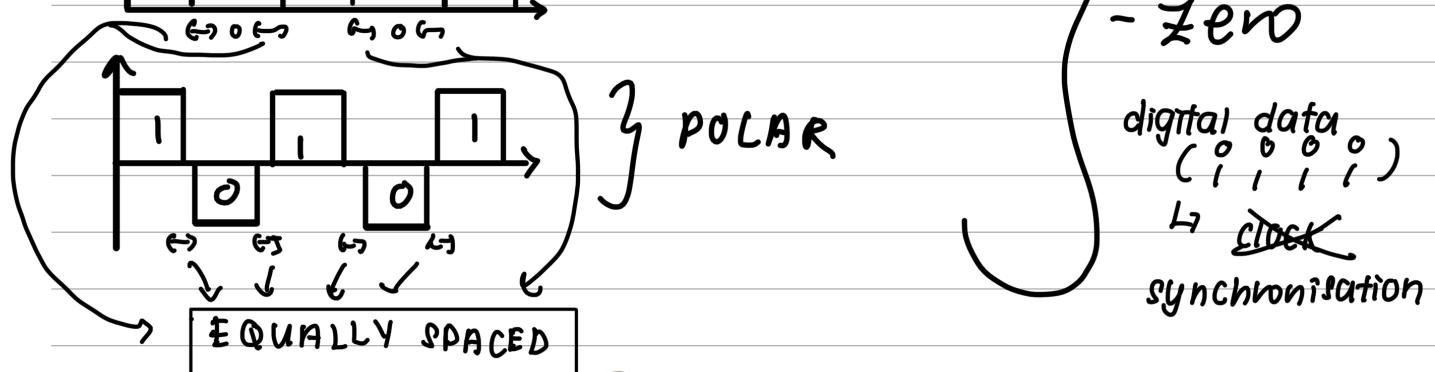
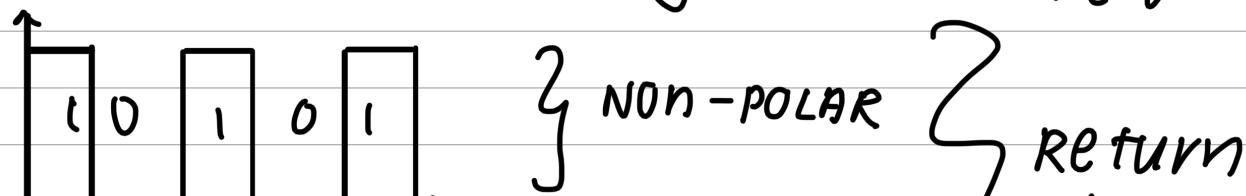
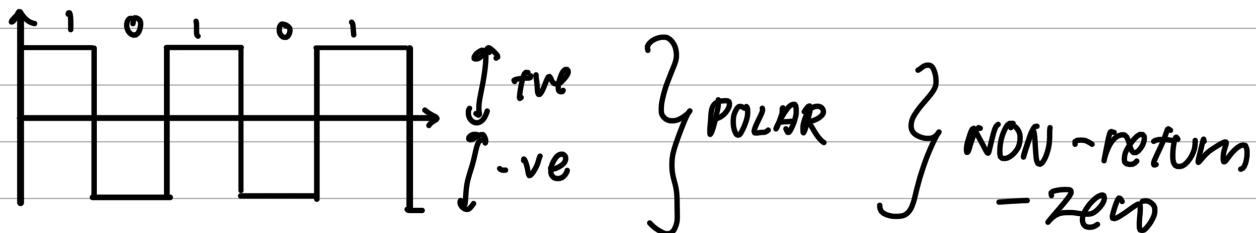
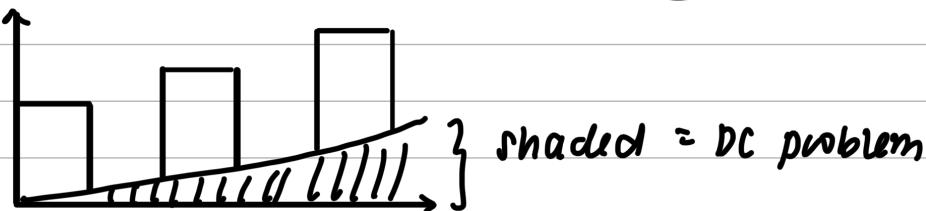
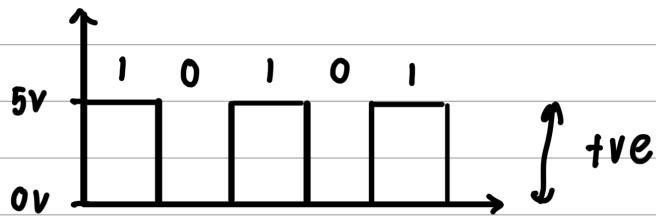
DIGITAL DATA : 10101

UNIPOLAR : "focus on +ve"

↳ problem on DC

→ capacitor → residual charges

↳ accumulate +ve charges



* MANCHESTER CODING : SIGNAL SYNCHRONIZE ITSELF → OPTIMIZE RELIABILITY

digital data
(1, 0, 1, 0, 1)

↳ CLOCK
SYNCHRONIZATION

Physical Layer

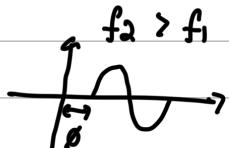
② ANALOG TRANSMISSION

Types : AM, PM, FM

DIGITAL DATA

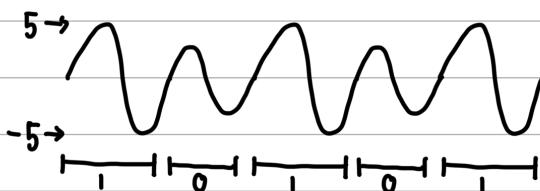
$$W(t) = A \sin(2\pi f_1 t + \phi)$$

$\overline{L} f_1 \overline{L} f_2$



AM :

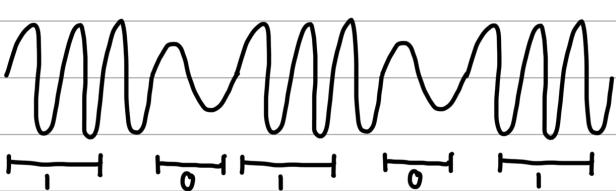
FM :



$$A_1 = 5v \rightarrow 1$$

$$A_2 = 0v \rightarrow 0$$

* On-off-keying (OOK)

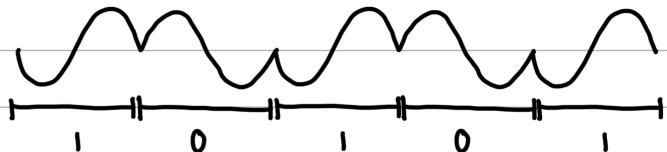


$$f_1 \Rightarrow \text{high} \rightarrow 1$$

$$f_2 \Rightarrow \text{low} \rightarrow 0$$

* 'A & ϕ fixed'

PM :



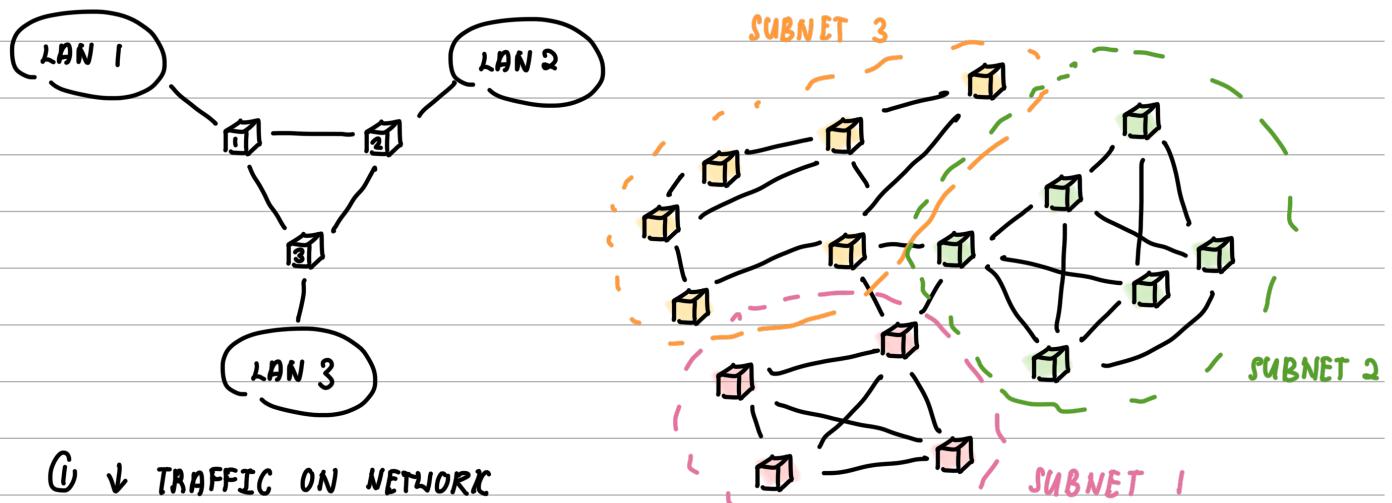
$$\phi_1 \rightarrow 0^\circ = 0$$

$$\phi_2 \rightarrow 180^\circ = 1$$

Network Layer

SUBNETTING

↳ LOCAL AREA NETWORK (LAN) = subnet



Network Layer

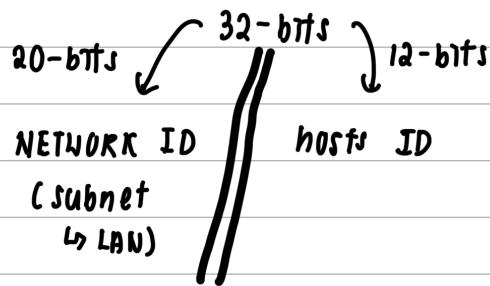
IPv4 (protocol)

↳ 32-bits (dotted decimal notation)

↳ 192.168.1.3

↓ ↓ ↓ ↓
8-bits 8-bits 8-bits 8-bits

} Address space = 2^{32} hosts



* 2^{20} subnet → each subnet 2^{12} hosts

same network?

↳ check subnet mask

↳ same subnet ID = same LAN

Eg. 255.255.255.0
↓
24-bits ↳ subnet : 2^{24} network ID
↓
8-bits ↳ hosts : 2^8 host ID

Eg. 196.168.249.10 & 196.168.244.225 is from the same LAN (network)

Network Layer