REDES TRONCALES

voz

datos

FDM

MPLS

ETH

POS

TDM

RDSI

FR

ATM

PDH

T-MPLS

SDH

NG-SDH

OTN

IMS

OTH

GMPLS

Fibra
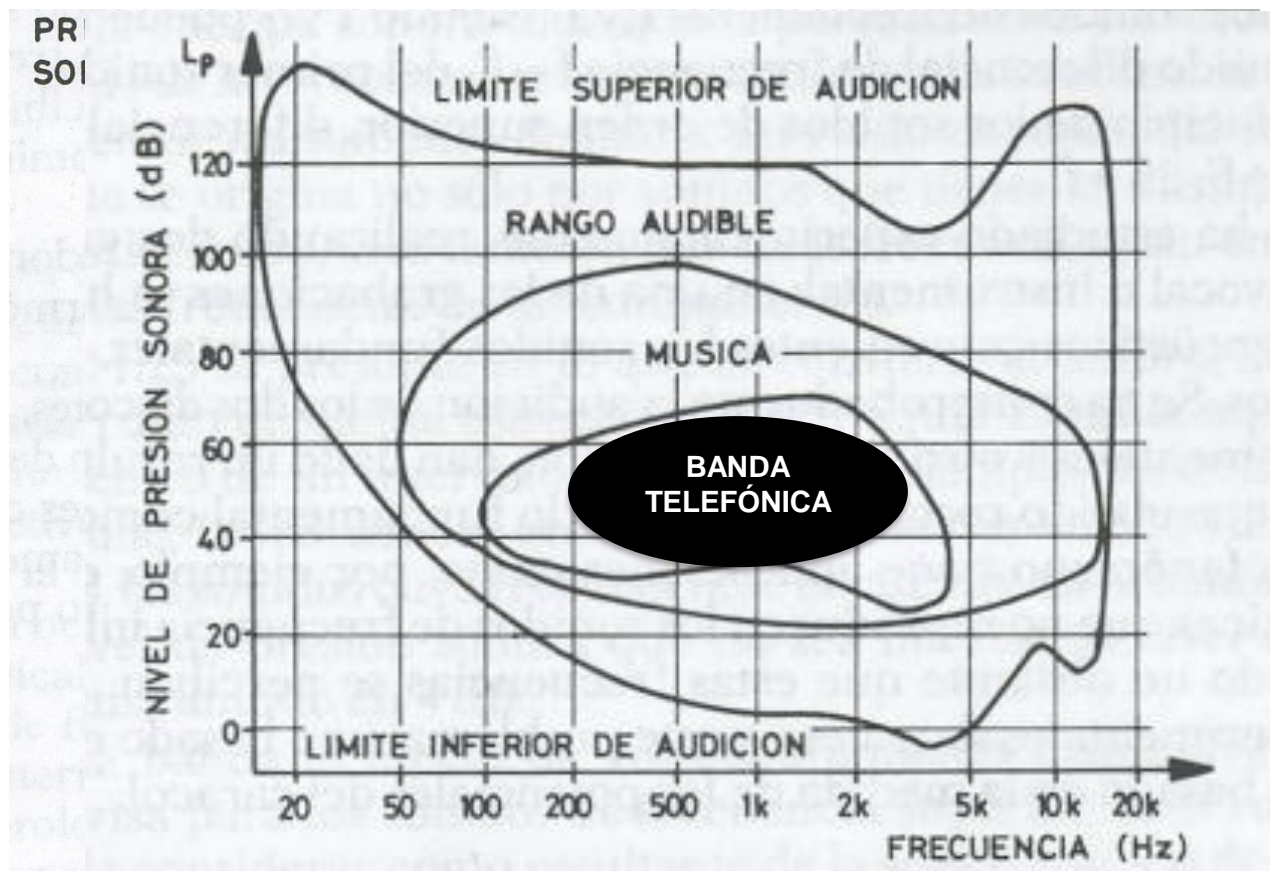
WDM

PON

De dónde viene todo???

https://youtu.be/-58pRtWr17s

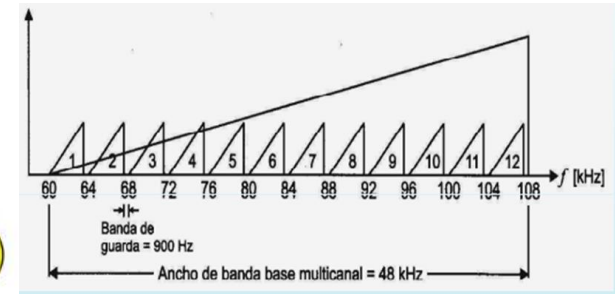# De donde viene todo ???

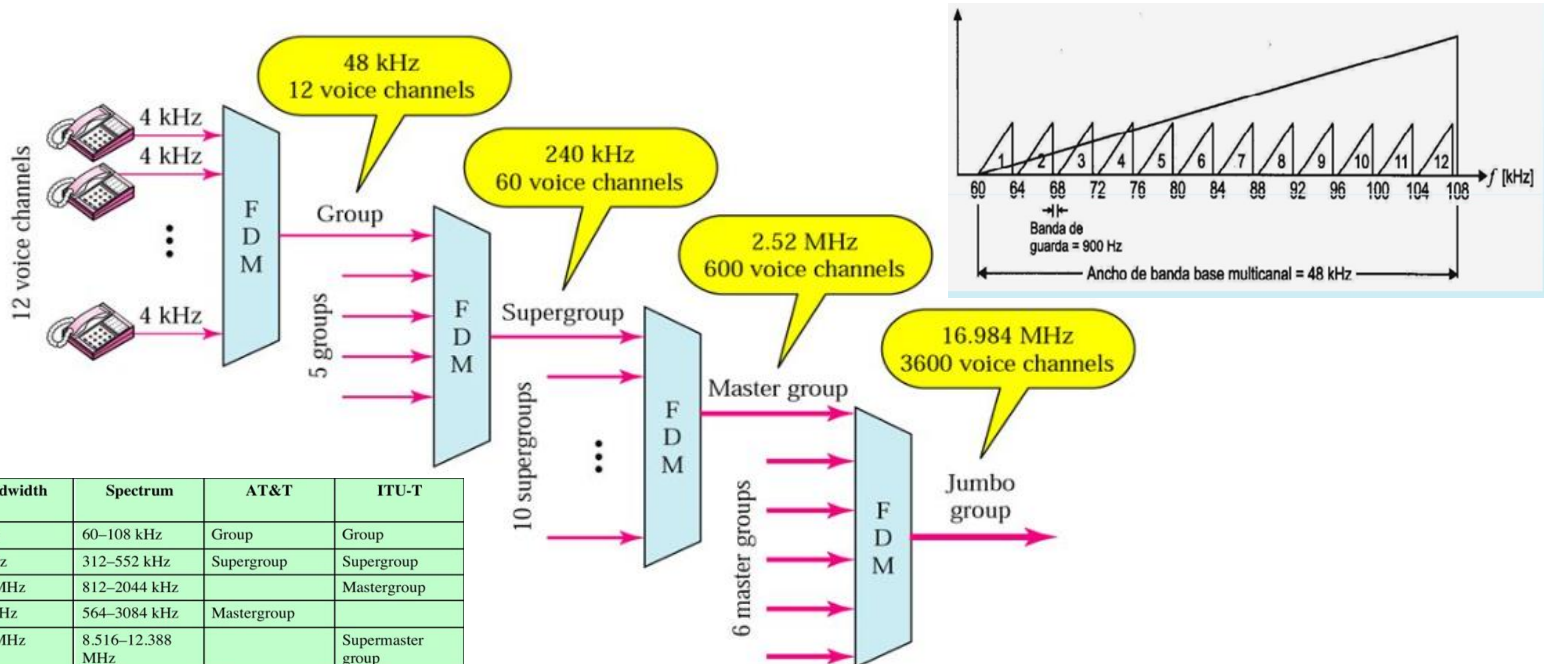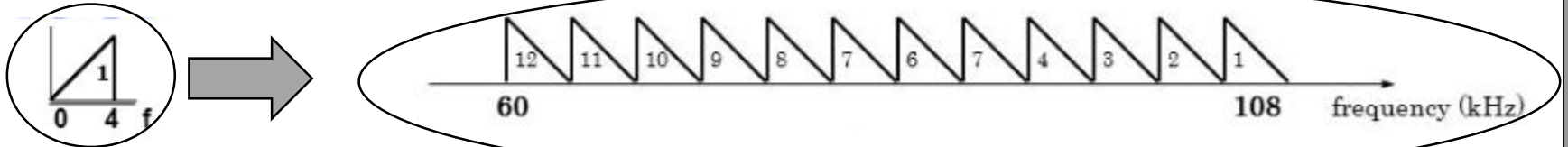# De la voz a la red óptica

Variación de la presión sonora del oído con la frecuencia.

Todo empieza en la voz

| Number of Voice Channels	Bandwidth	Spectrum	AT&T	ITU-T
12	48 kHz	60–108 kHz	Group	Group
60	240 kHz	312–552 kHz	Supergroup	Supergroup
300	1.232 MHz	812–2044 kHz		Mastergroup
600	2.52 MHz	564–3084 kHz	Mastergroup	
900	3.872 MHz	8.516–12.388 MHz		Supermaster group
N × 600			Mastergroup multiplex	
3,600	16.984 MHz	0.564–17.548 MHz	Jumbogroup	
10,800	57.442 MHz	3.124–60.566 MHz	Jumbogroup multiplex	

Y se complica con el paso a digital

- CBR (Constant Bit Rate)
- Uncompressed 64 kbps
  - 8000 samples/sec × 8bits/sample
- Voice coding standards
  - MOS (Mean Opinion Score)

ITU-T Rec.	Codec	Data rate	MOS	Delay
G.711	PCM	64 kbps	4.4	0.75 ms
G.726	ADPCM	32 kbps	4.2	1 ms
G.728	LD-CELP	16 kbps	4.2	3~5 ms
G.729	CS-ACELP	8 kbps	4.2	10 ms
G.729a	CS-ACELP	8 kbps	4.2	10 ms
G.723.1	MP-MLQ	6.3 kbps	3.98	30 ms
G.723.1	ACELP	5.3 kbps	3.5	30 ms
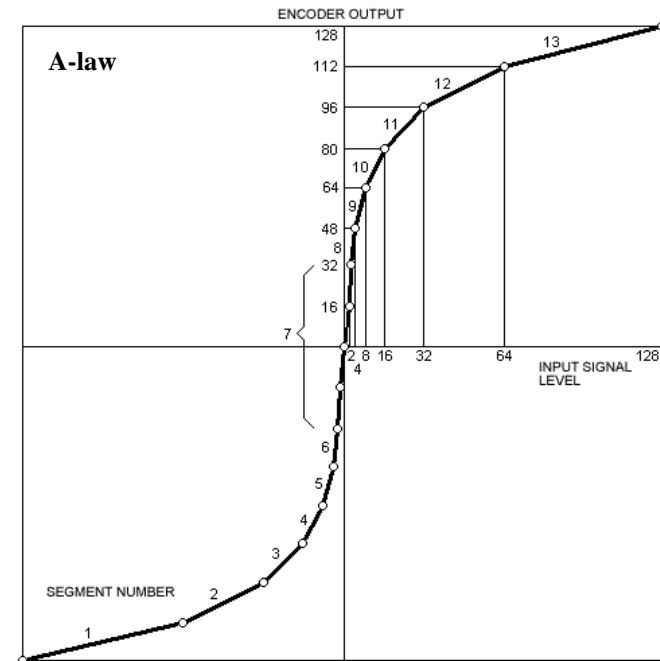
Codec	Bit Rate (k/sec)	Compression	Codec Type (see text)
Full Rate	13	8	RTE-LTP
Enhanced Full Rate (EFR)	12.2	8.5	ACELP
Half Rate	5.6	18.4	VSELP
AMR 12.2	12.2	8	ACELP
AMR 10.2	10.2	10.2	ACELP
AMR 7.95	7.95	13.1	ACELP
AMR 7.4	7.4	14.1	ACELP
AMR 6.7	6.7	15.5	ACELP
AMR 5.9	5.9	17.6	ACELP
AMR 5.15	5.15	20.2	ACELP
AMR 4.75	4.75	21.9	ACELP

TDM
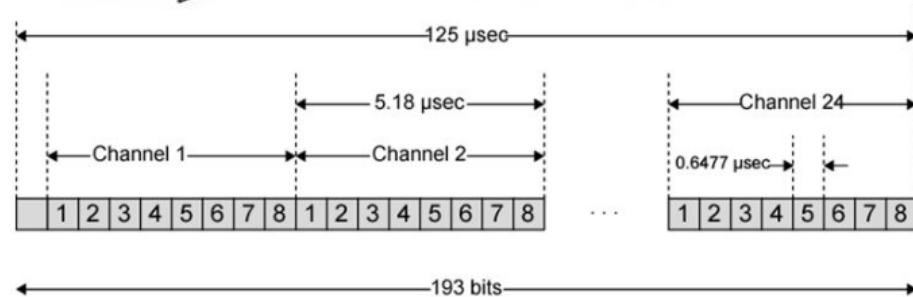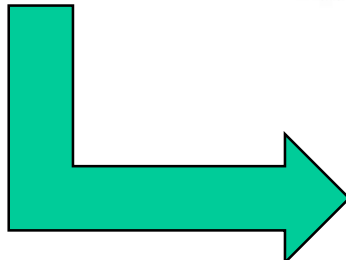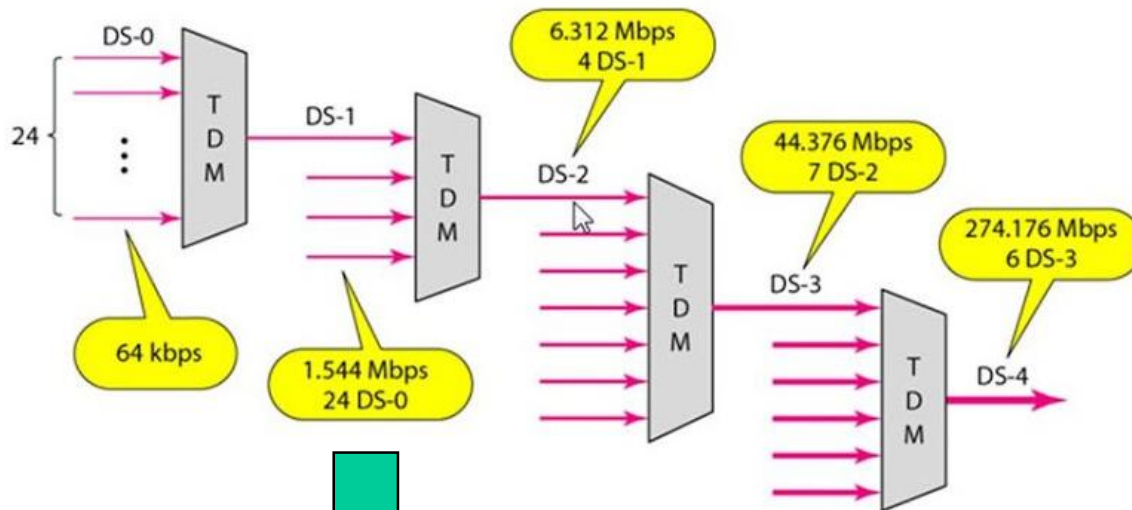
1. The first bit is a framing bit, used for synchronization.
2. Voice channels:
   8-bit PCM used on five of six frames.
   7-bit PCM used on every sixth frame; bit 8 of each channel is a signaling bit.
3. Data channels:
   Channel 24 is used for signaling only in some schemes.
   Bits 1-7 used for 56 kbps service $(8000 \times 7 \text{ bits} = 56 \text{ kbps})$
   Bits 2-7 used for 9.6, 4.8, and 2.4 kbps service.