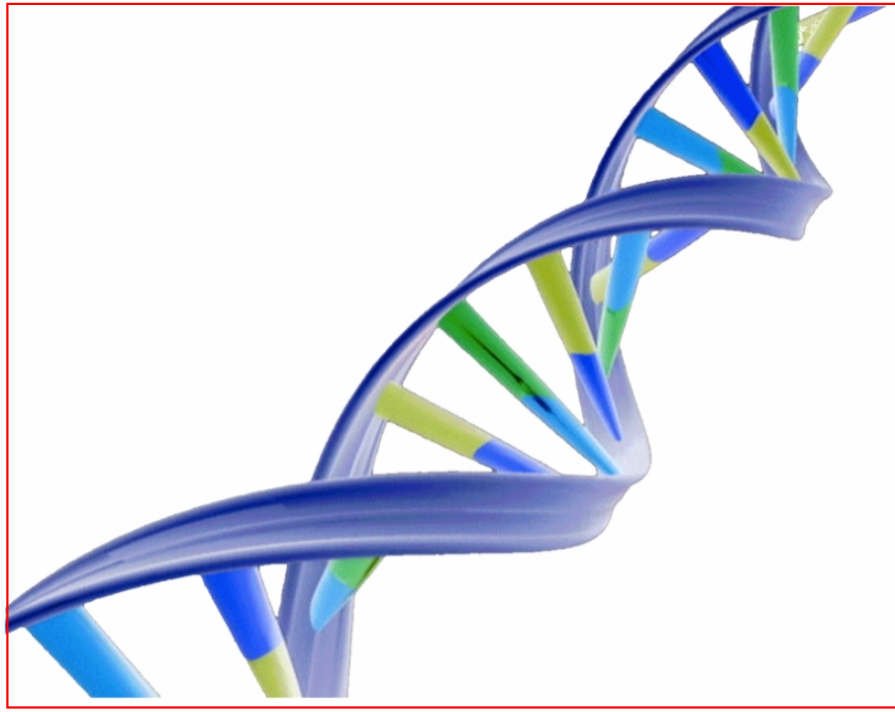
Communication and Signal Processing:
the complementary strands



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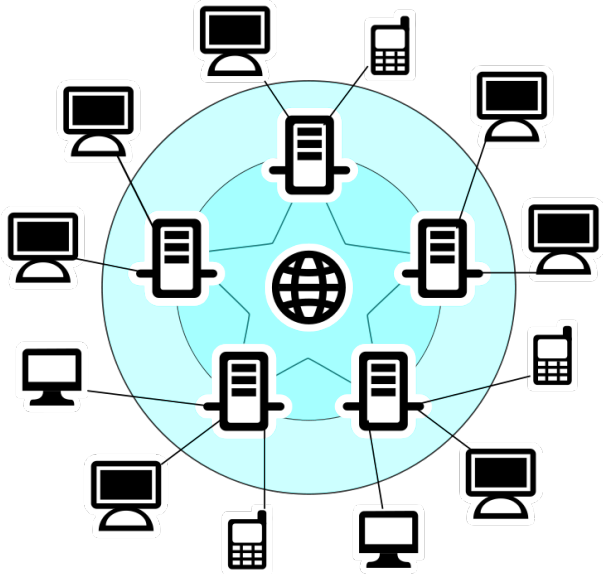
Subject:EE103 23B3933

A Parade

- Communication
- Signal Processing
- Compression
- Error Correction

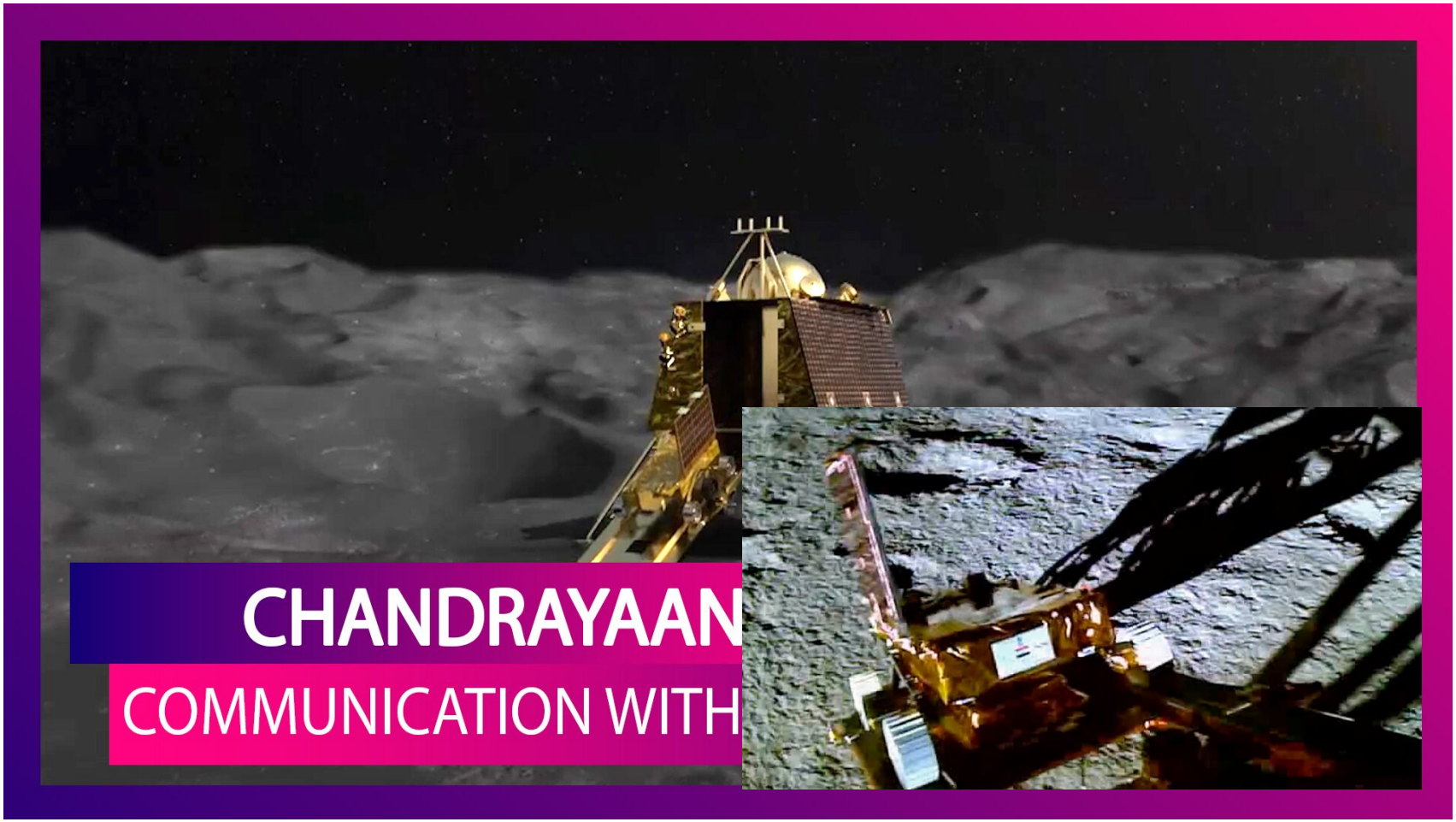
Courtesy: Google Images

Signals and Communication



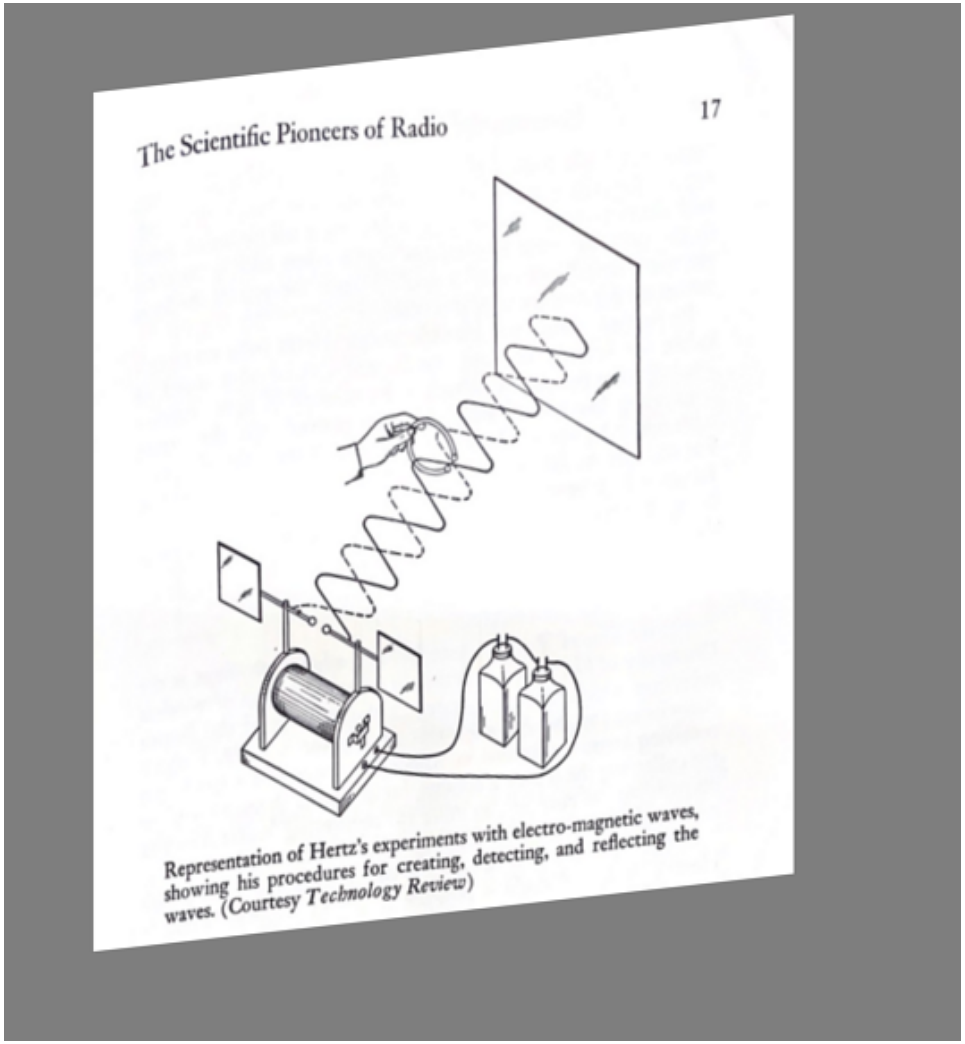
Courtesy: Google Images

Mission Critical



Courtesy: Google Images

Hertz'1889



James Clerk Maxwell - Gave the electromagnetic theory

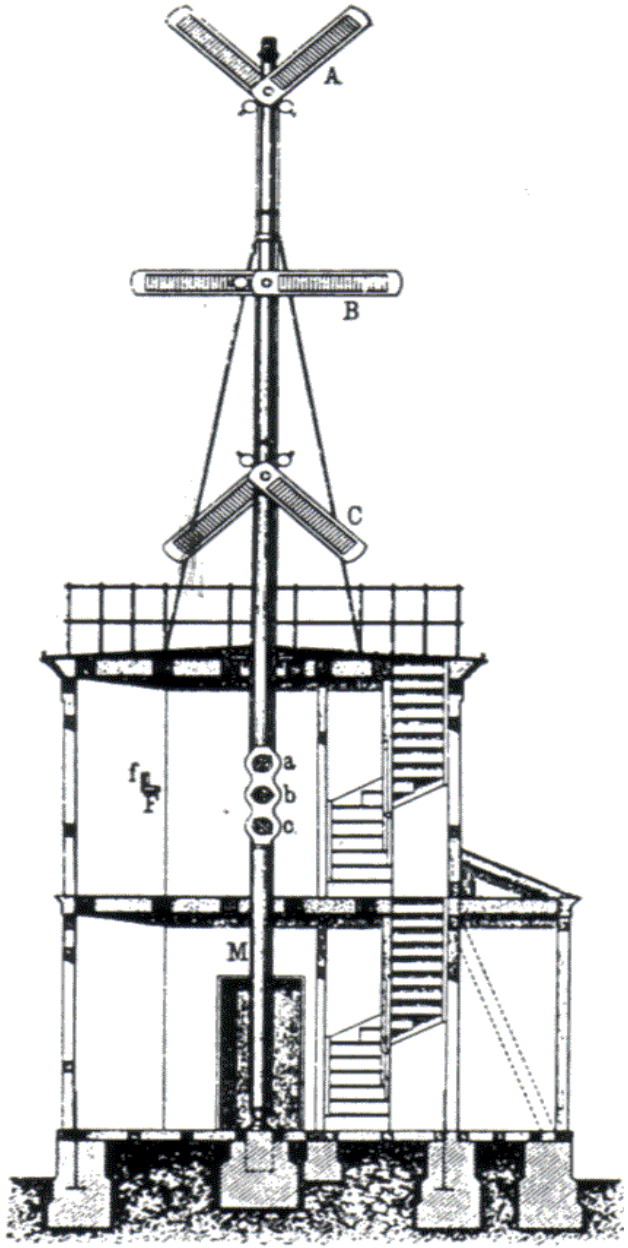
Heinrich Hertz - Proved the existence of EM Waves

Courtesy: Maclaurin, History of Broadcasting; Wikimedia

Historical Perspective 1840

City	Days
New York	12
Alexandria	13
Constantinople	19
Bombay	33
Calcutta	44
Singapore	45
Shanghai	57
Sydney	73

Table: Postal Delay from London



Courtesy: Wikipedia.org

Suteev's Summary (archive.org)

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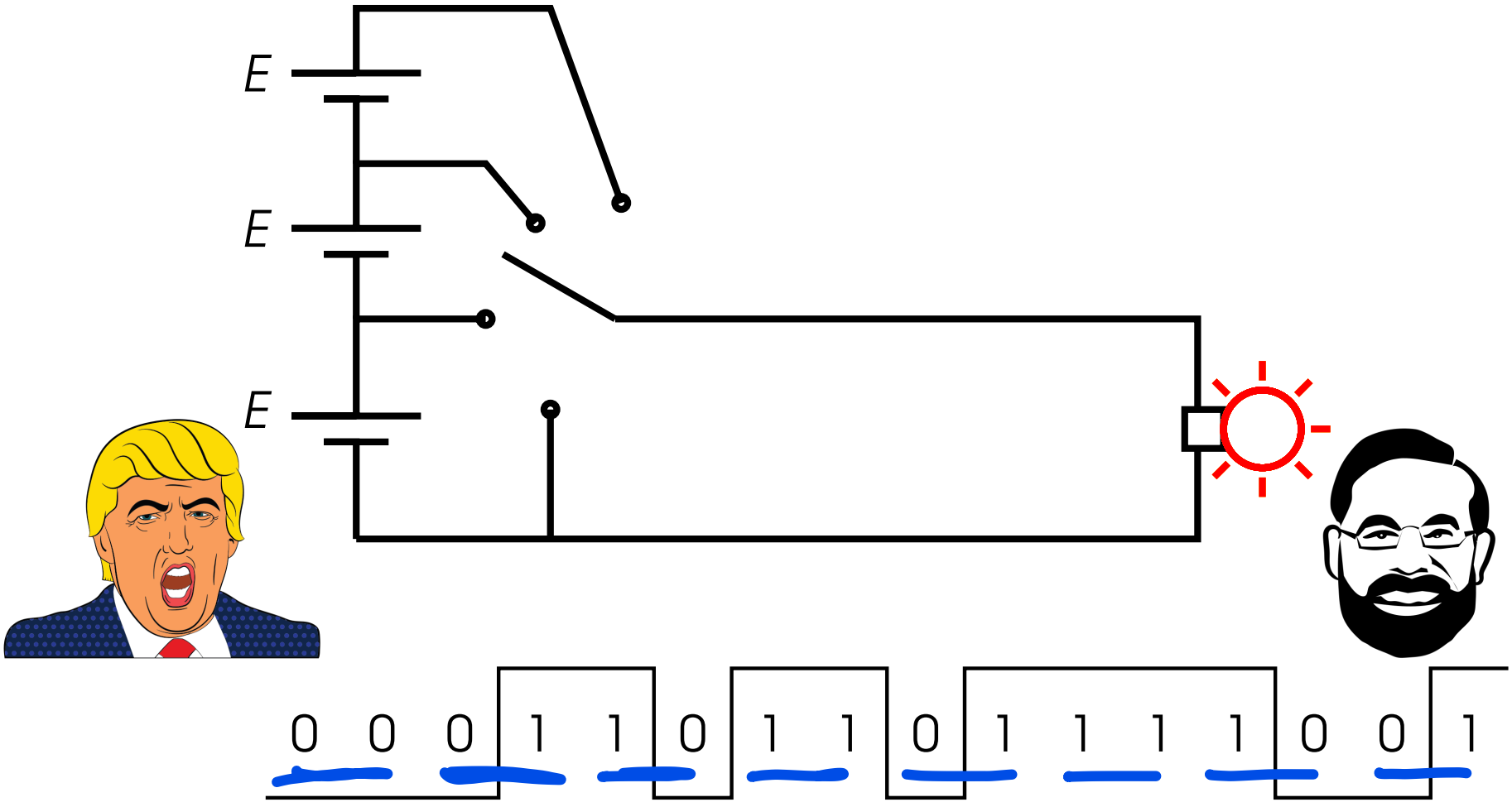
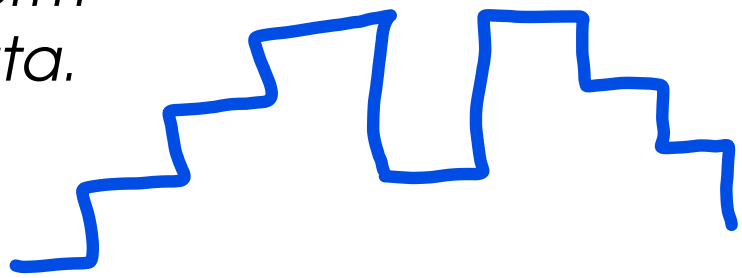
Telegraphy Idea



Exercises-I

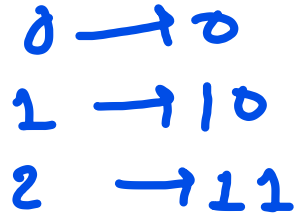
Exercise

Draw the communication waveform using 3 batteries, for the given data. Take $(Y, O, R) \rightarrow (1, 2, 3)$.



Exercise

Using two batteries in the last figure, give a ***scheme*** *to send the given data sequence.*

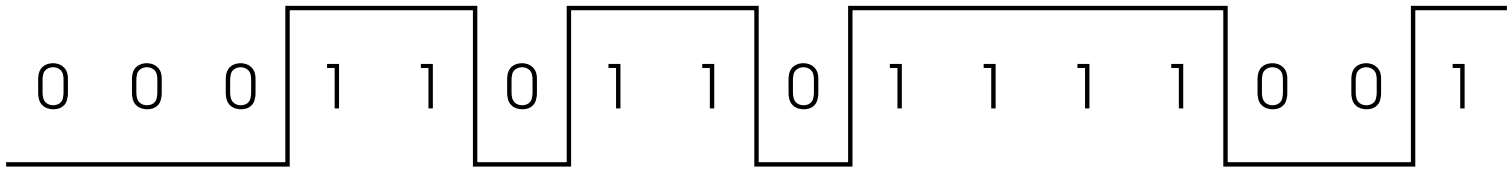


Q2. Data rate = log2(5) * 10^6 = 2321928.0948873 bits per second

Exercise

Can you suggest a scheme for bidirectional telegraphy, i.e. simultaneous communication between the two parties.

Data Rate Vs Switching Speed



Data-rate for a *speed* of β switchings per second:

- Using one battery

$$\textit{Data Rate} = \beta \text{ bits per sec .}$$

- Using three batteries

$$\textit{Data Rate} = 2 \times \beta \text{ bits per sec .}$$

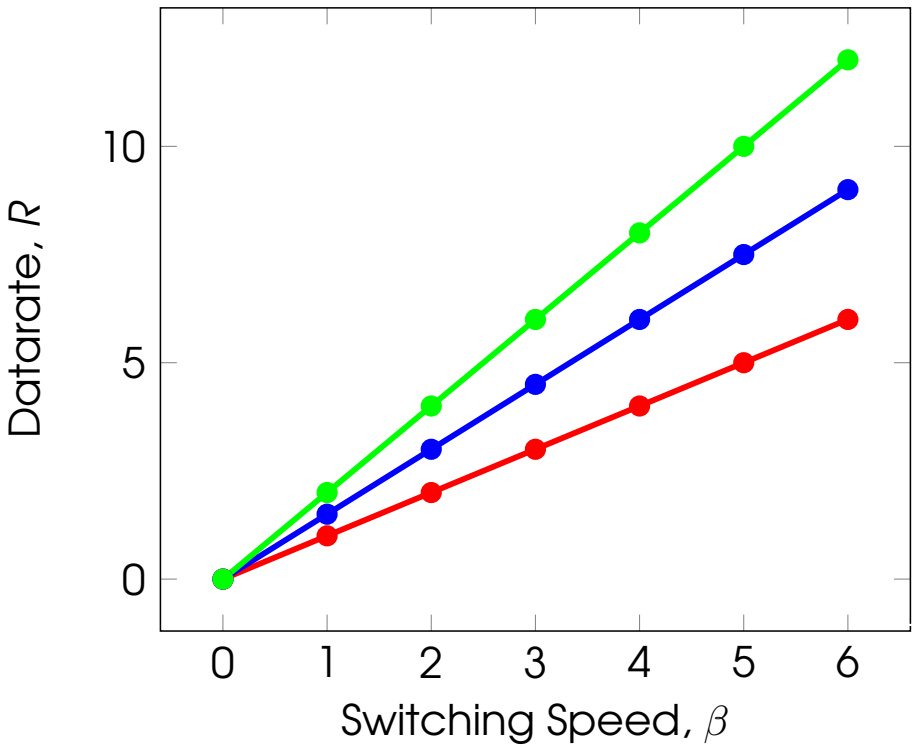
- Using two batteries

$$\textit{Data Rate} = 1.5 \times \beta \text{ bits per sec .}$$

- Challenge: Max data-rate using 2 batteries and β?

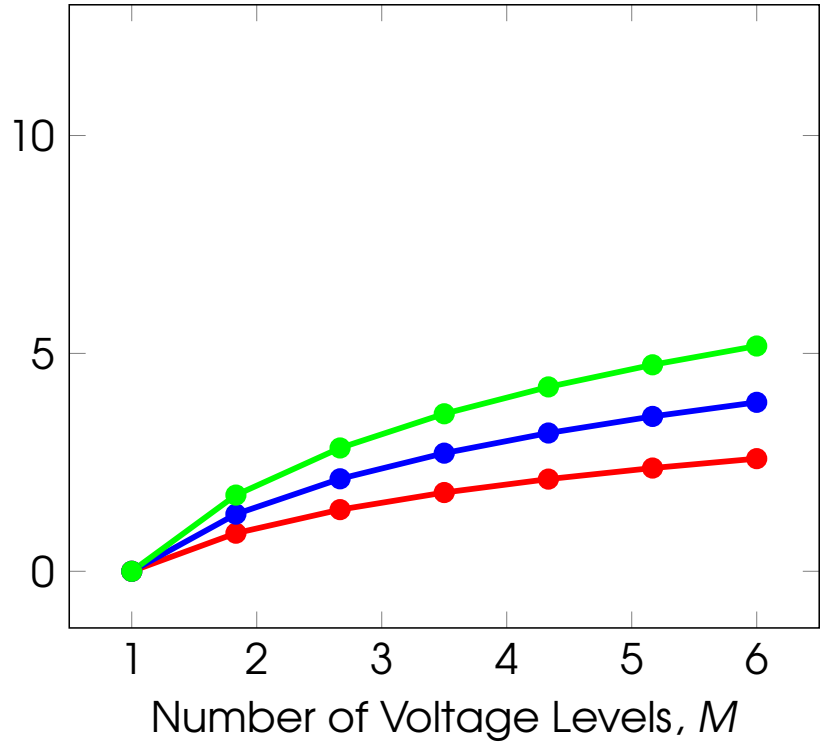
Bandwidth Vs Power

Data Rate = ß(log2(voltage levels))



`Linear' in bandwidth

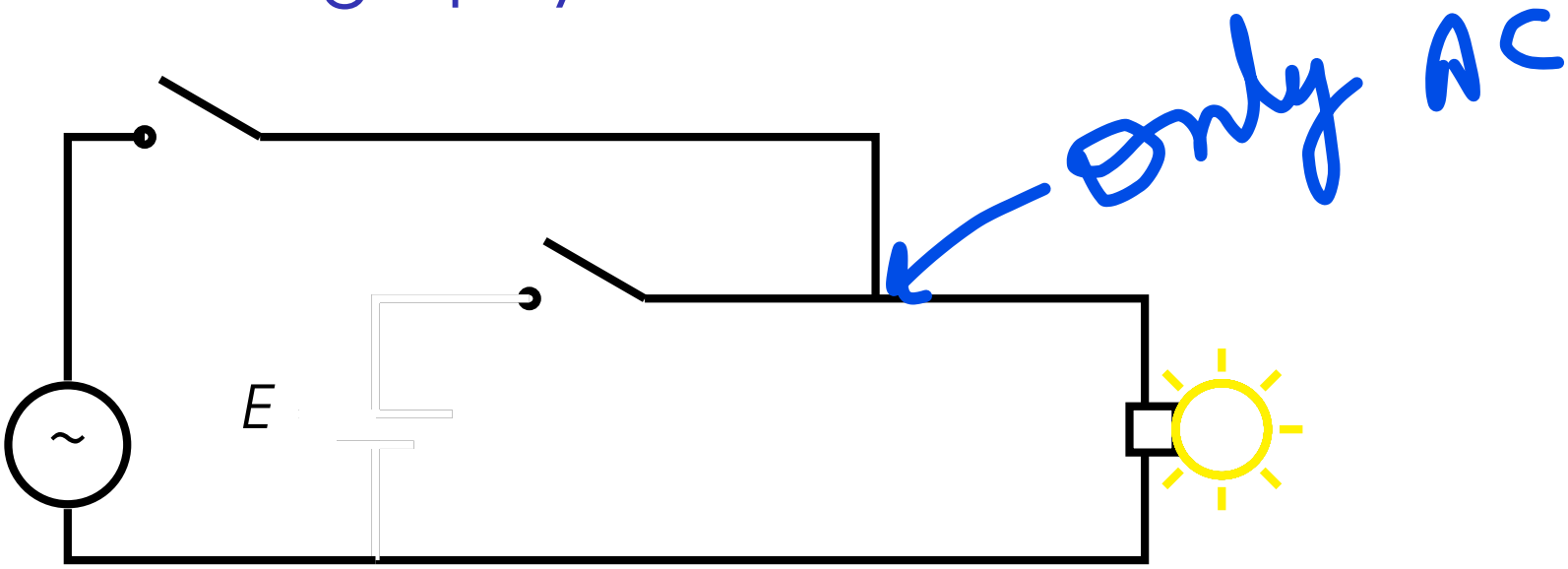
Data Rate = (batteries + 1)ß

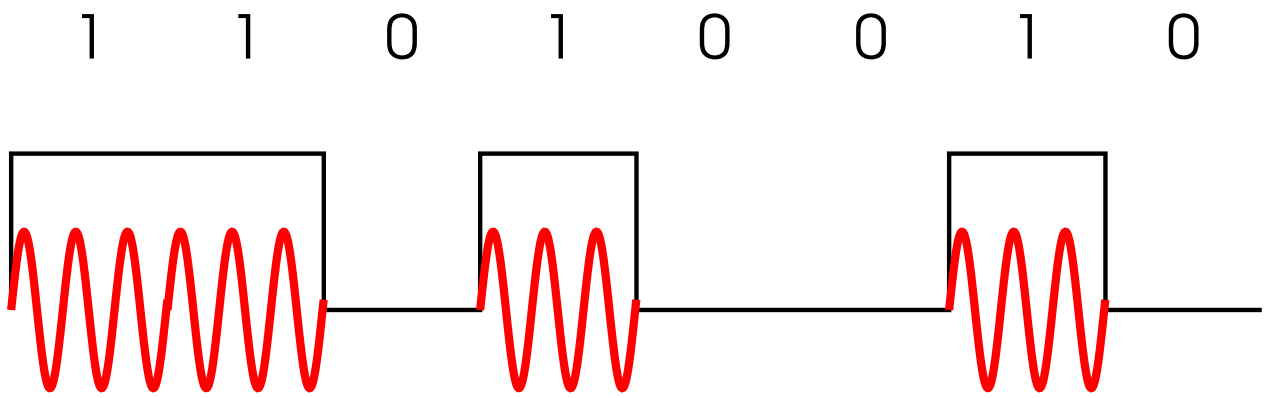


Logarithmic in # levels.

Levels = 2^no. of batteries; Levels = max number formed using (no. of batteries) bits. So (batteries) = log2 (levels)

Carrier-Telegraphy



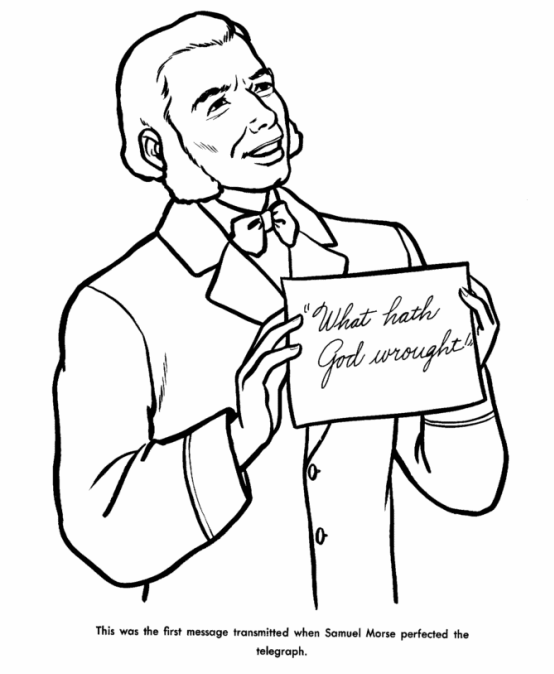


Suitable for longer distances

I L U T G M

International Morse Code

1. The length of a dot is one unit.
2. A dash is three units.
3. The space between parts of the same letter is one unit.
4. The space between letters is three units.
5. The space between words is seven units.

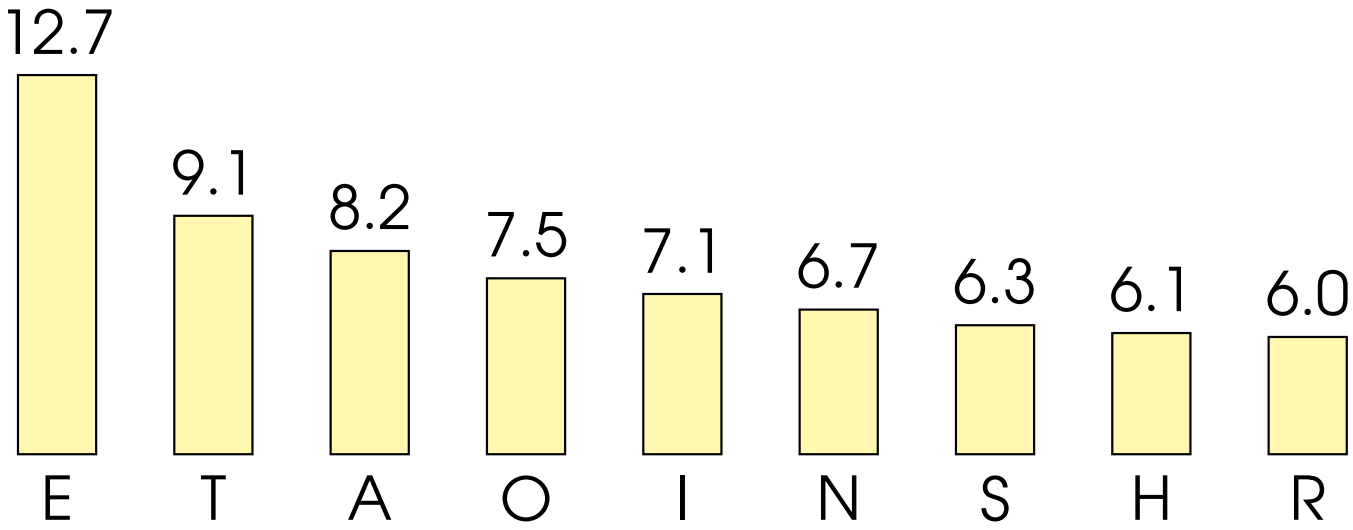


This was the first message transmitted when Samuel Morse perfected the telegraph.

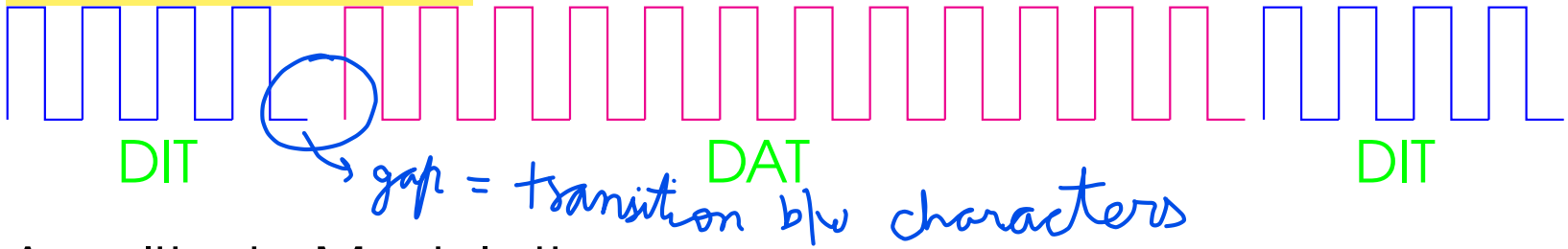
Frequent letters given shorter Length ⇒ Smaller Average

Telegraph: Salient Features

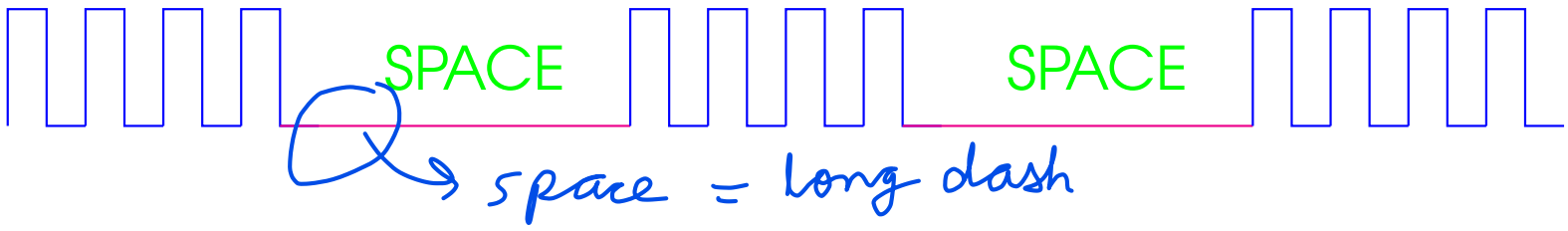
- Clever Encoding



- Time Modulation



- Amplitude Modulation

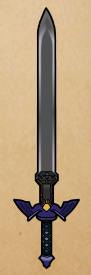


YHPARGOTPYRC

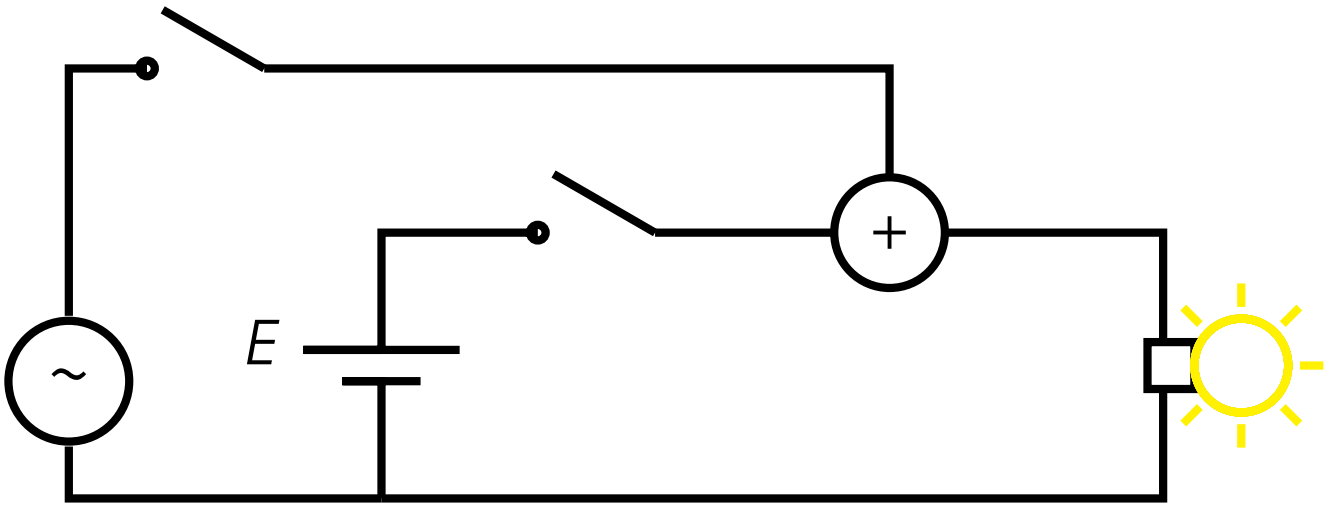
Use personality to decode the cipher text below. If you use many crypto schemes, the weakest one determines your fate. Unless applied correctly, cryptography is useless.

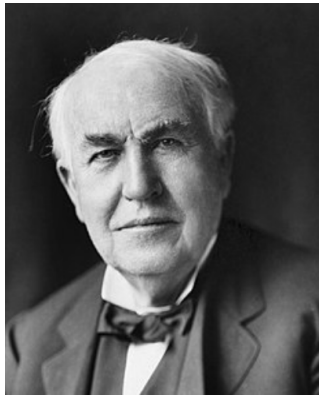
potslluf sselesu si yhpargrotpyrc ,yltcerroc deilppa sselnu potslluf etaf ruoy senim-reted eno tsekaew eht ,semehcs otpyrc ynam esu uoy fi potslluf woleb txet rehpic eht edoced ot ytilanosrep esu.

RJXGMFAJPGLX IK IDSOOS NQD, EQM GBOPKO JOKRQO CO NJFC MLOKO RPGMFJK PM IIME

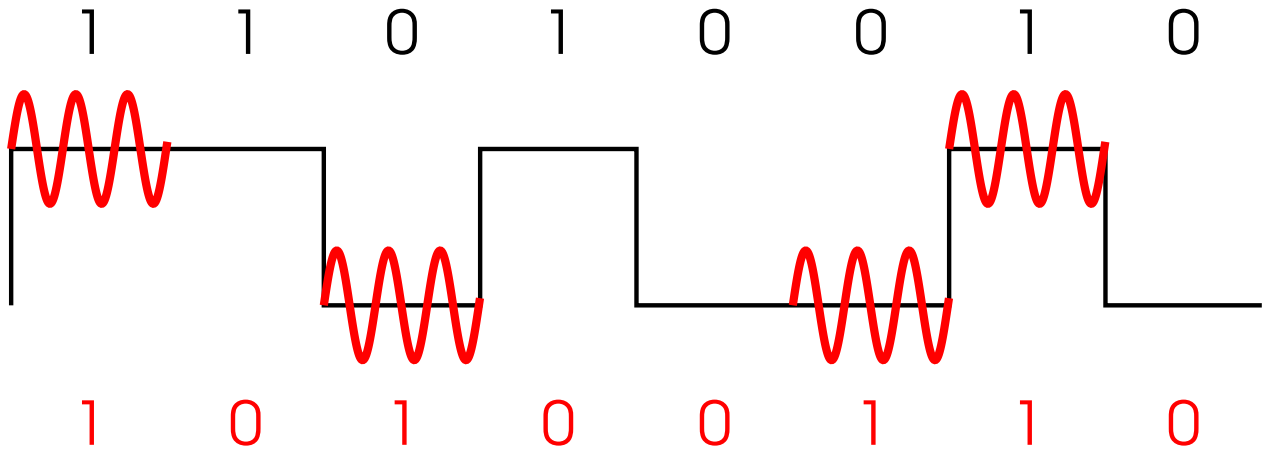


Multi-Telegraphy



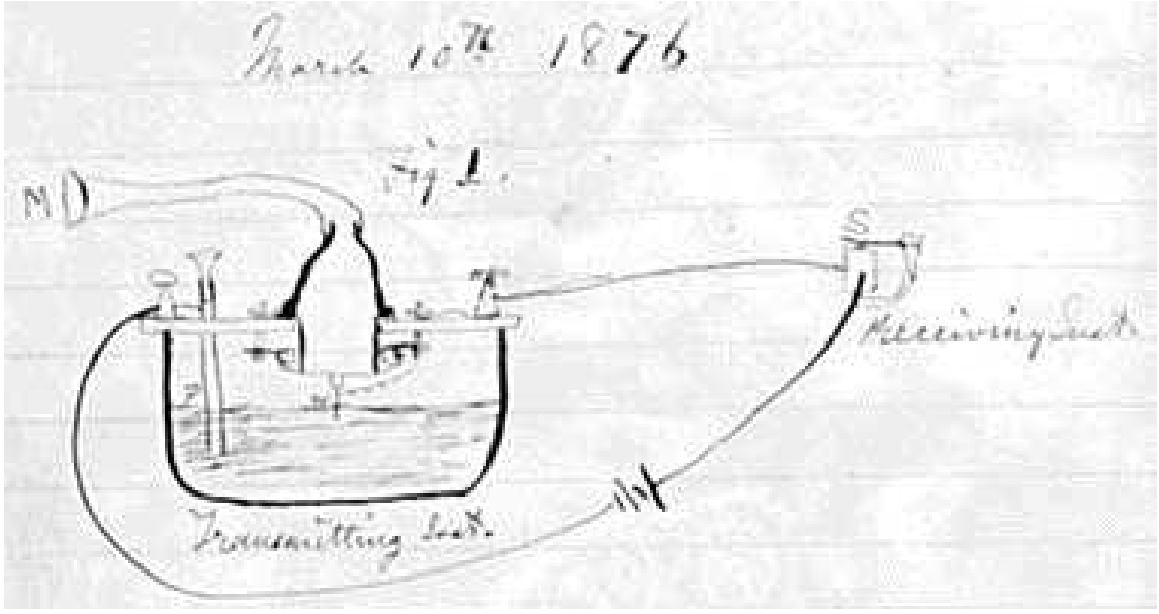


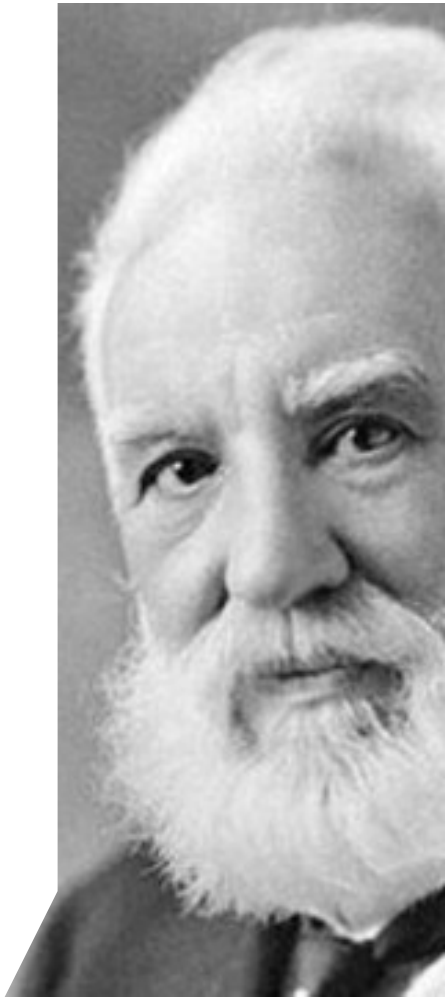
Thomas Edison - Invented the incandescent light bulb



Multiplexing several simultaneous streams

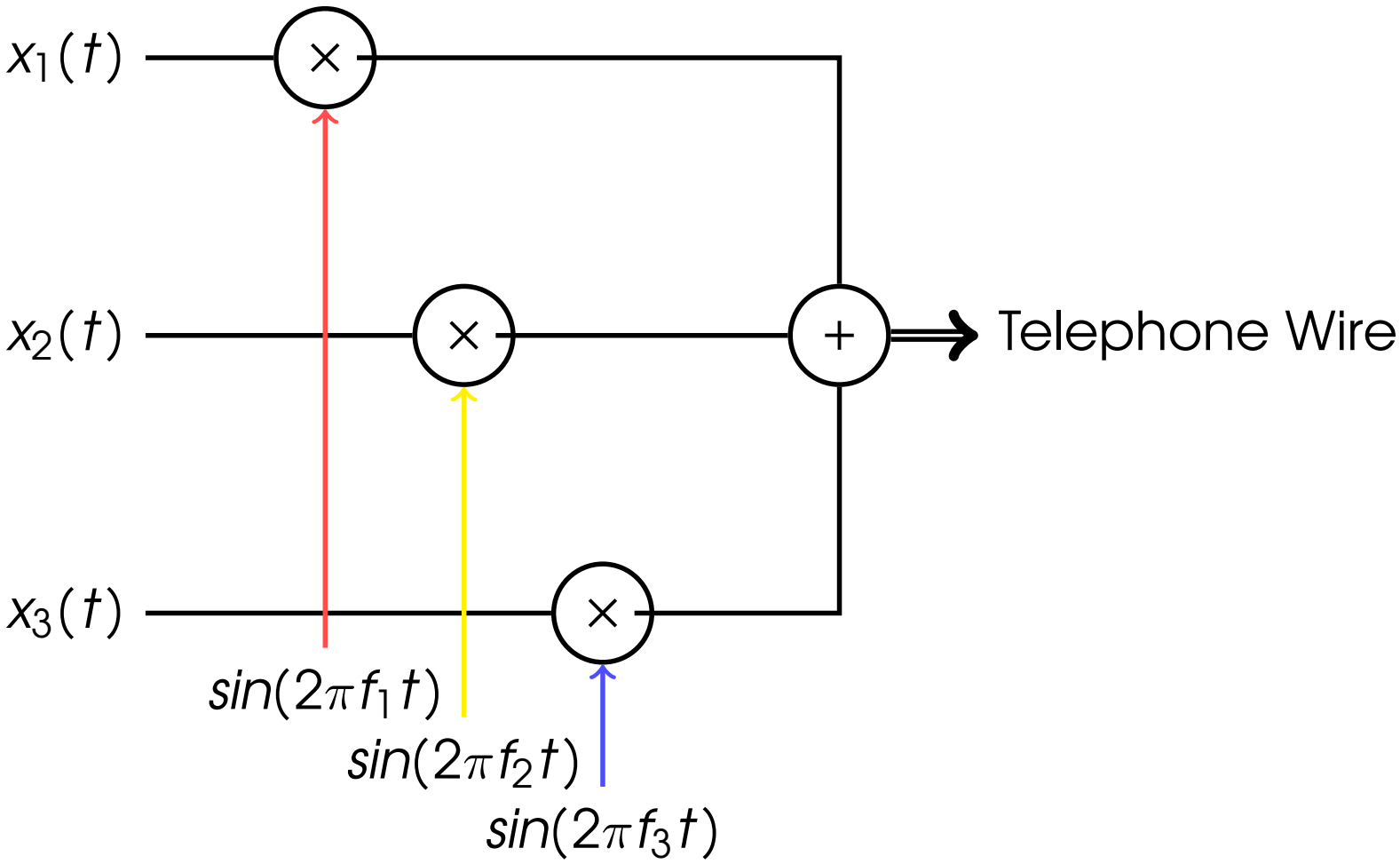
Ding Dong 1876





Alexander Graham Bell -
Invented the telephone

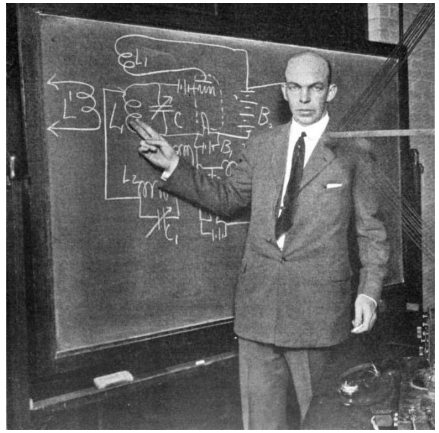
Telephony

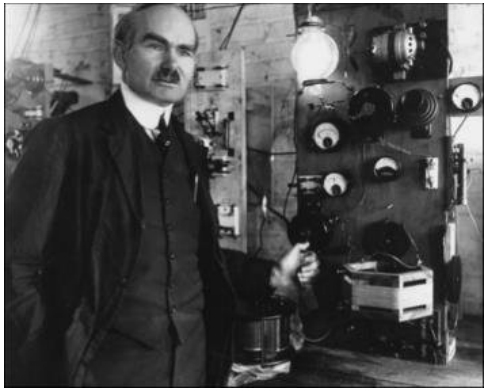


Radio Rivalry of Early 1900s: Friends and Foes

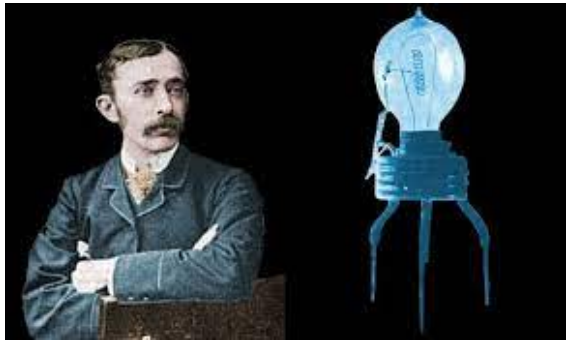
Guglielmo Marconi - Created radio waves based telegraph system

Edwin Howard Armstrong - Invented the FM Radio



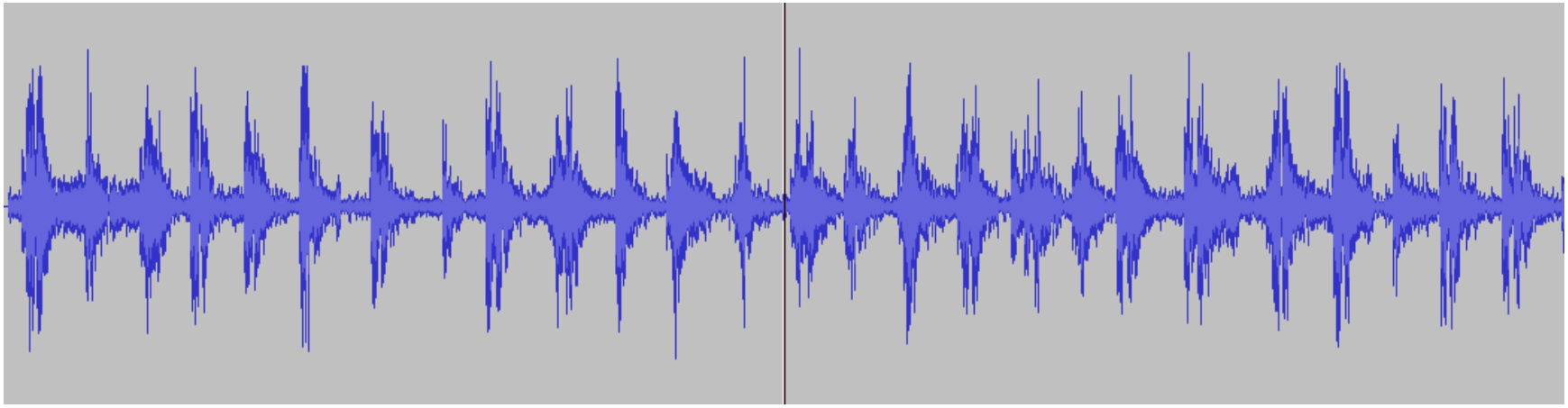


Lee de Forest - Made the first electronic amplifier

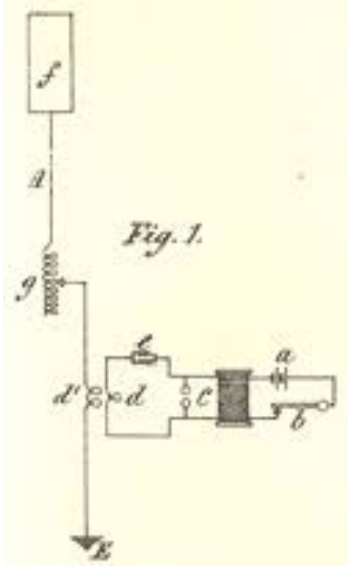


John Ambrose Fleming - Made the vacuum tube

Radio Transmitters

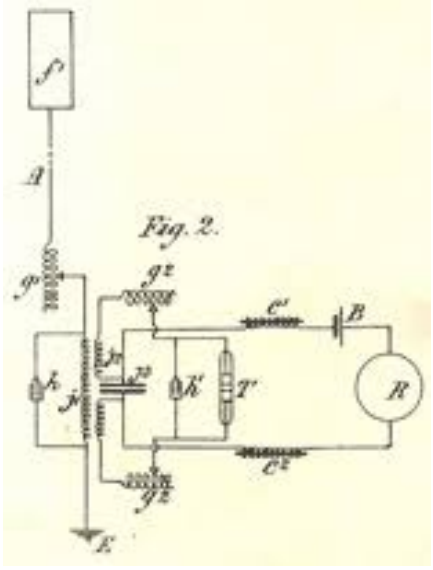


Telegraph Waveform: before filtering

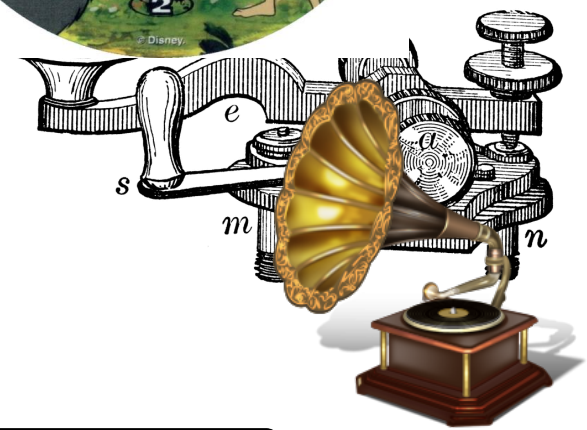


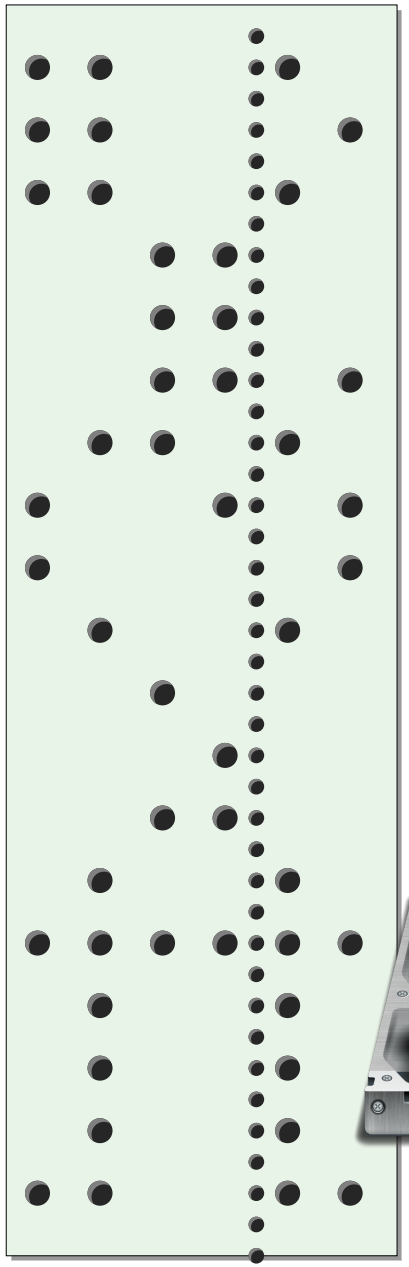
Marconi Transmitter

Marconi Receiver



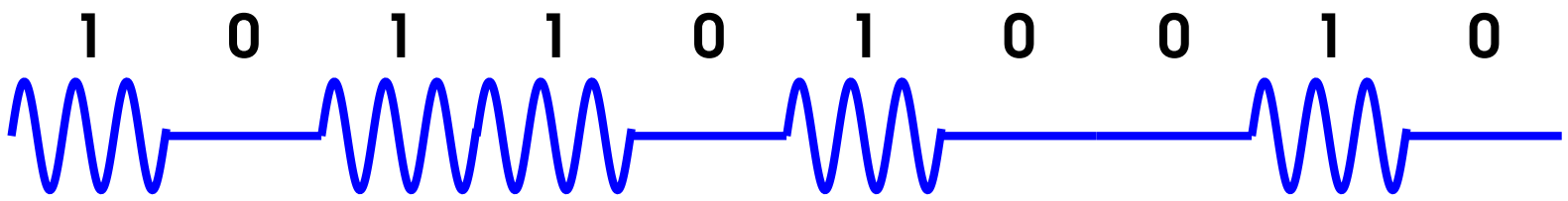
Digital Storage



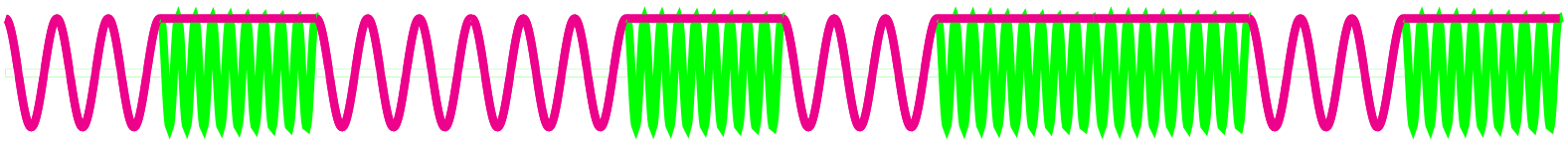


Courtesy: clipart-library.com

AM Vs FM



AM: amplitude of the carrier is varied: switched/continuous



FM: frequency of carrier wave is varied: switched/continuous

Listen to the FM: That is All for Today.