CHAPTER 1

Introduction

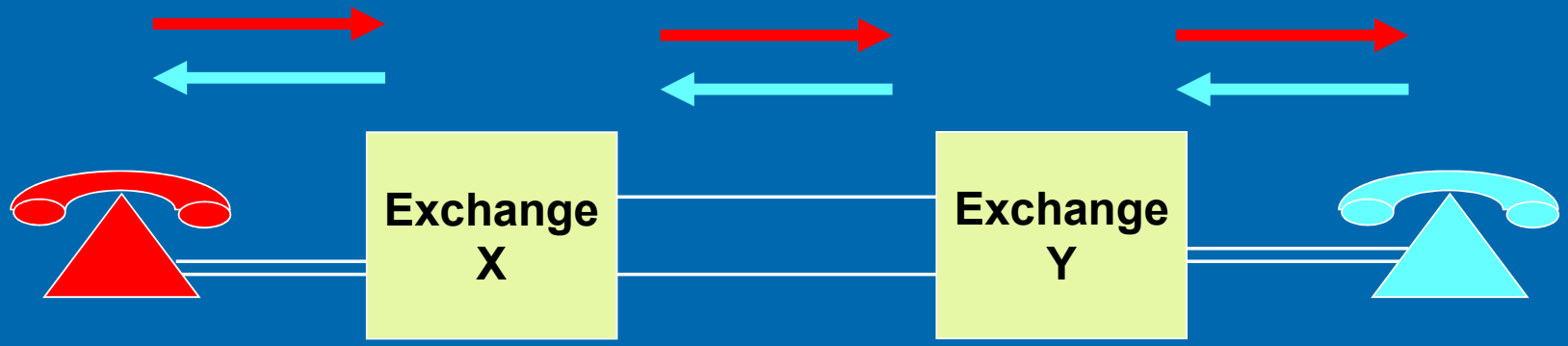
(Part 1 of 2)

Introduction

- **Electrical communication is the process of exchanging information in forms of electrical signals.**

  Information includes audio, visual, computer data, and other types

e.g.



Information transmission in telephone systems

Introduction

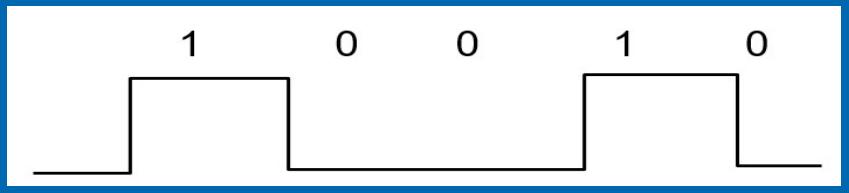
- **Electrical signals can be either analog or digital.**

Analog information source → **Analog Signal** → **Continuously varying voltage/current in both amplitude and time.**

e.g. Microphone →

Digital information source → **Digital Signal** → **A set of discrete values**

e.g. Computer →



1.1 Types of electrical communication systems

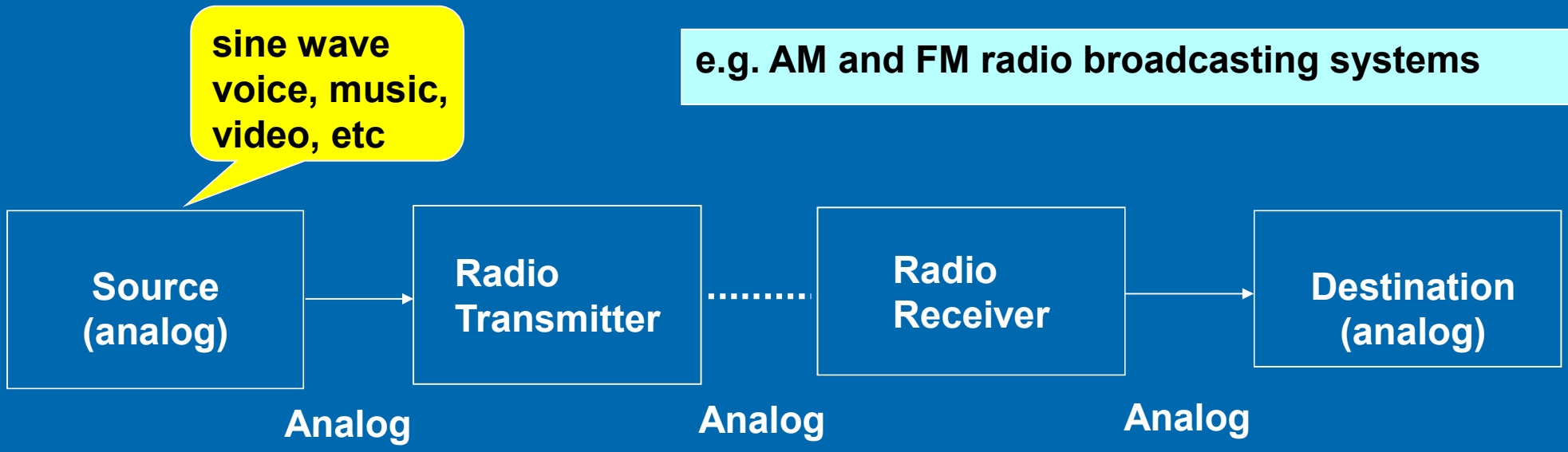
- Electrical communication systems are divided into analog communication systems and digital communication systems base on

  - the nature of the information source
  - the type of modulation scheme used

Analog communication systems

Transmit analog signals using analog modulation techniques.

e.g. AM and FM radio broadcasting systems

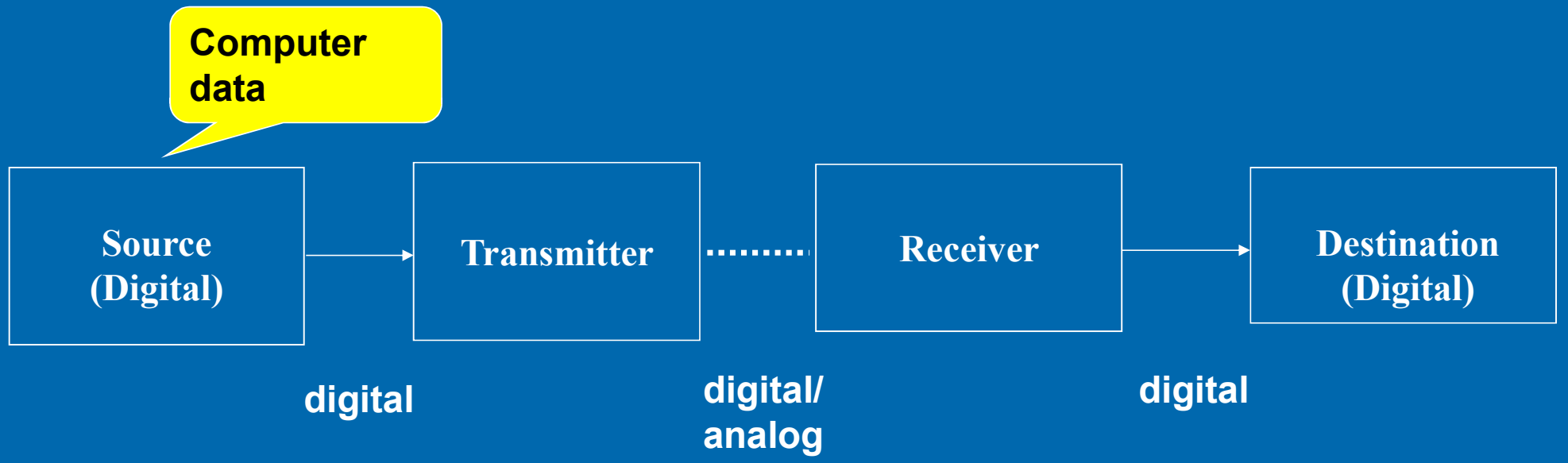


1.1 Types of electrical communication systems

Digital communication systems

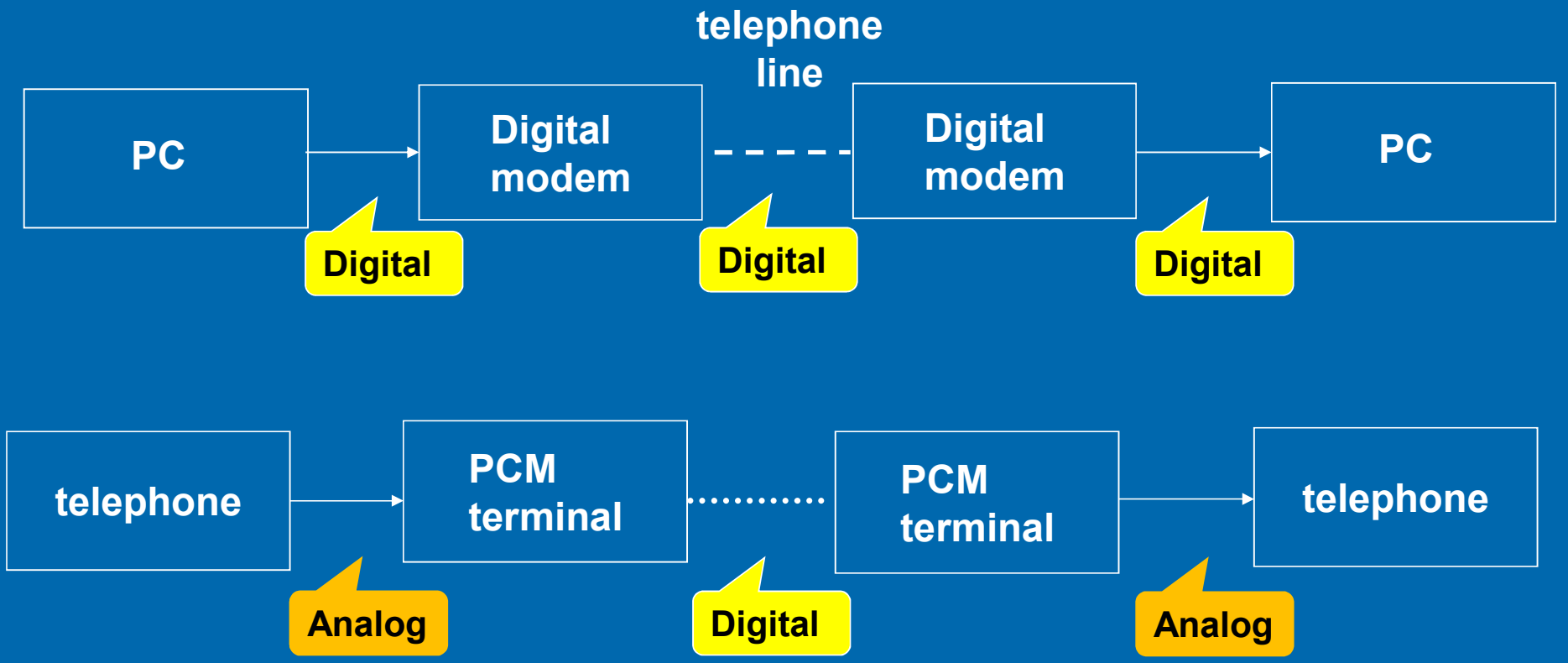
transmit digital information using digital modulation techniques.

e.g. Computer and mobile communication systems



1.1 Types of electrical communication systems

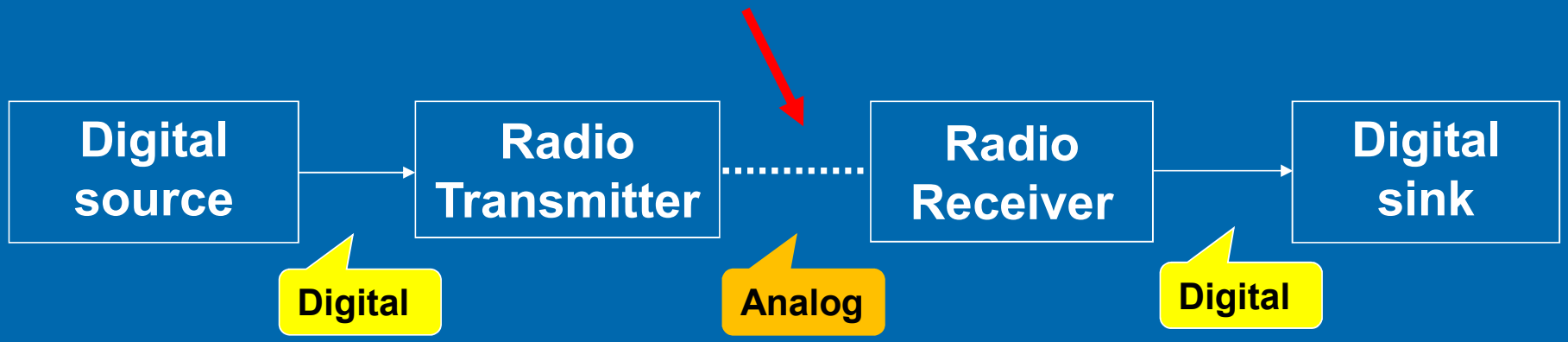
- **Digital signal may be generated by a digital source or converting an analog signal into digital signal through sampling and quantization.**



1.1 Types of electrical communication systems

- Also, digital signal may be transmitted using an analog waveform

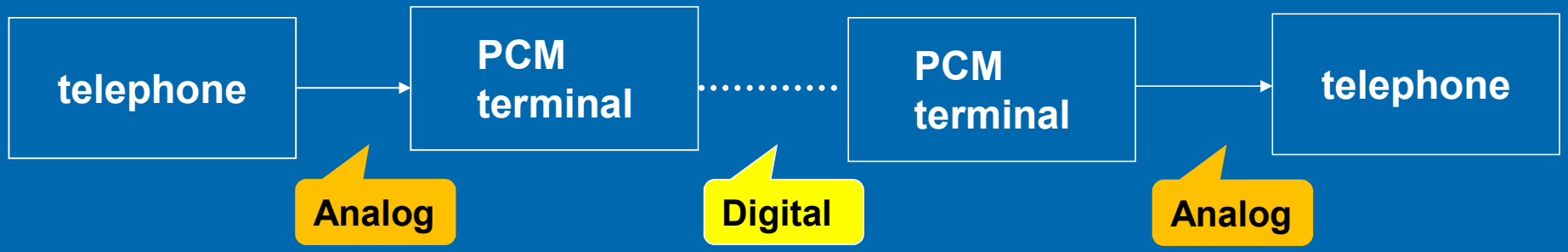
Representing digital signals using sinusoidal signals of varying amplitude, frequency or initial phase.



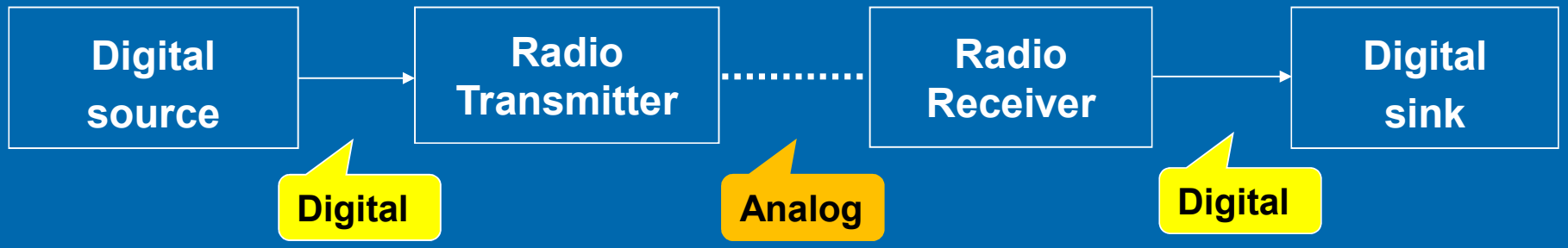
1.1 Types of electrical communication systems

- A communication systems that is part analog and part digital is known as a **hybrid system.**

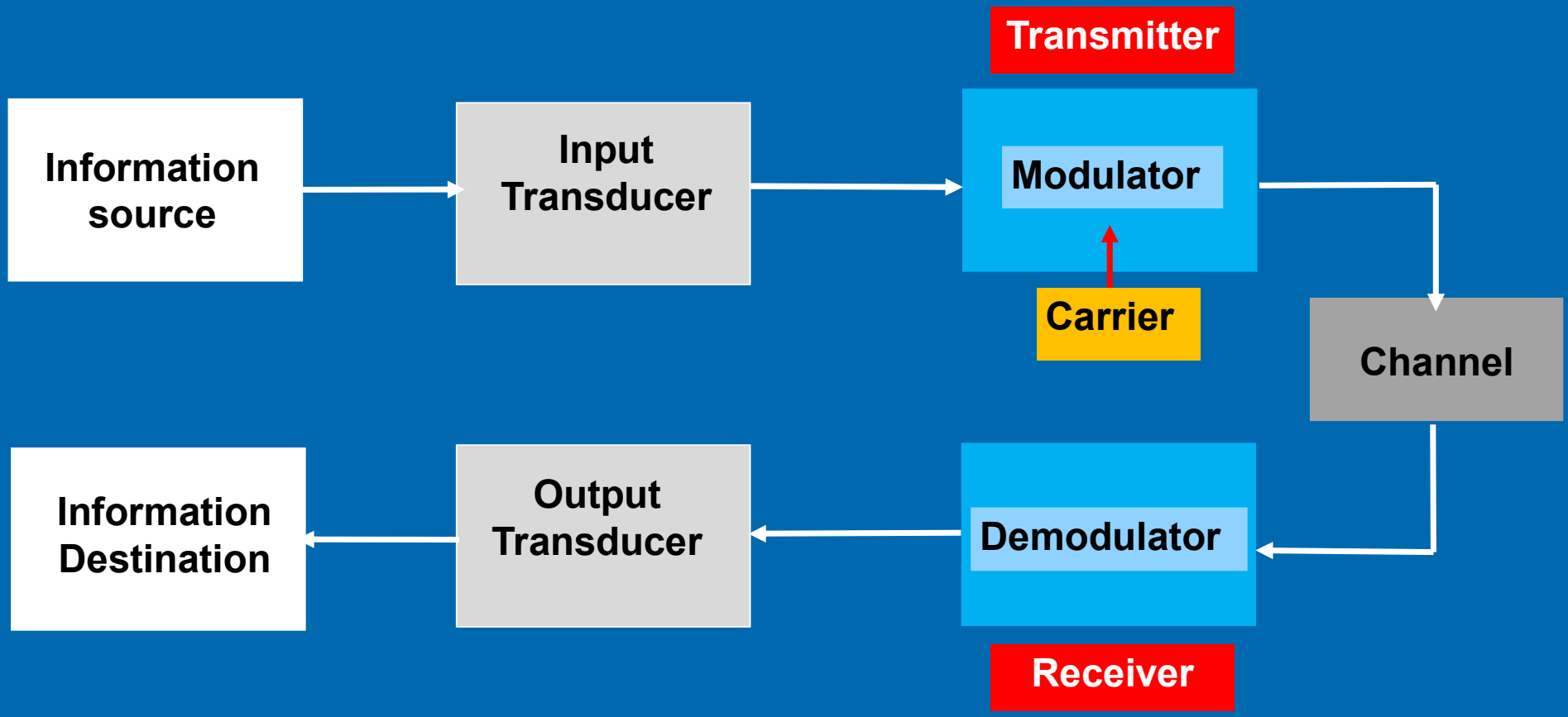
e.g. Transmitting sampled and quantized values of an analog message signal.



e.g. Transmitting digital information as an analog waveform through an analog channel via a modem

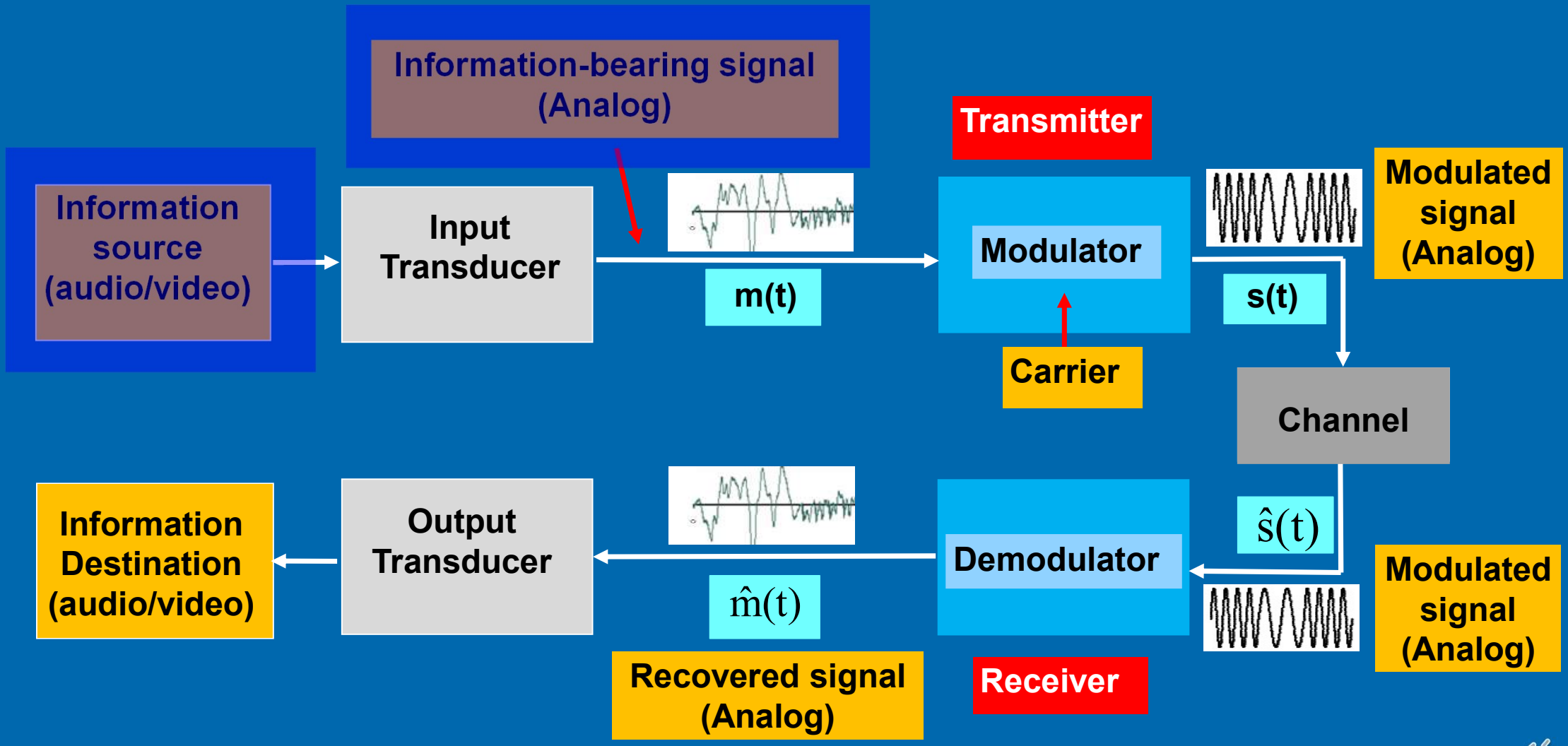


1.2 Elements of electrical communication systems



1.2 Elements of electrical communication systems

Elements of Analog communication systems



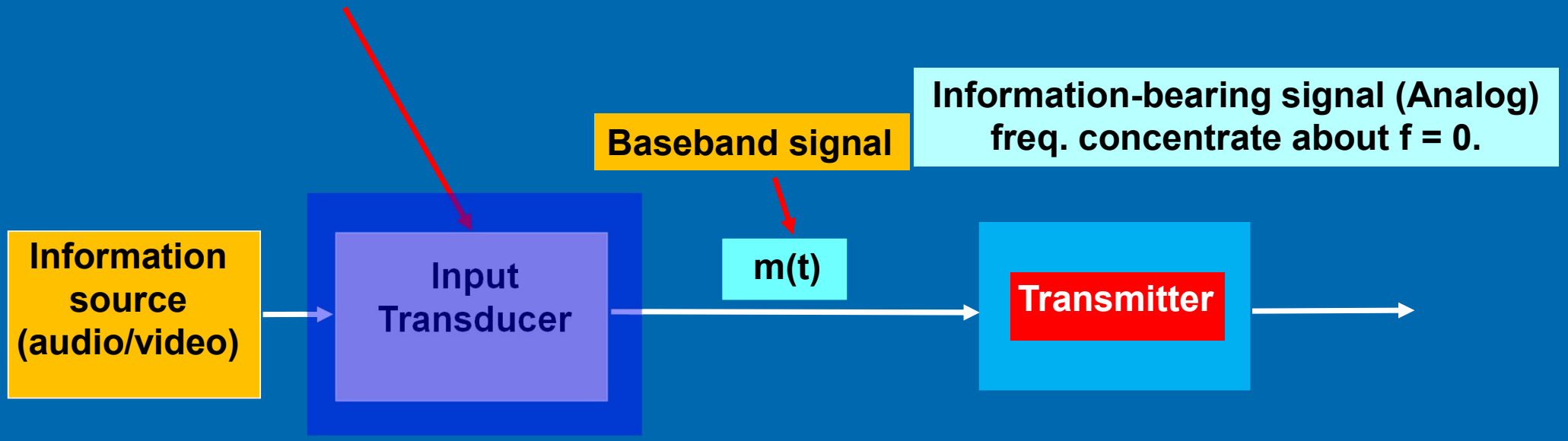
1.2 Elements of electrical communication systems

Elements of Analog communication systems

Input Transducer

Convert information into an electrical signal m(t).

e.g. Microphone for audio
Video camera for video



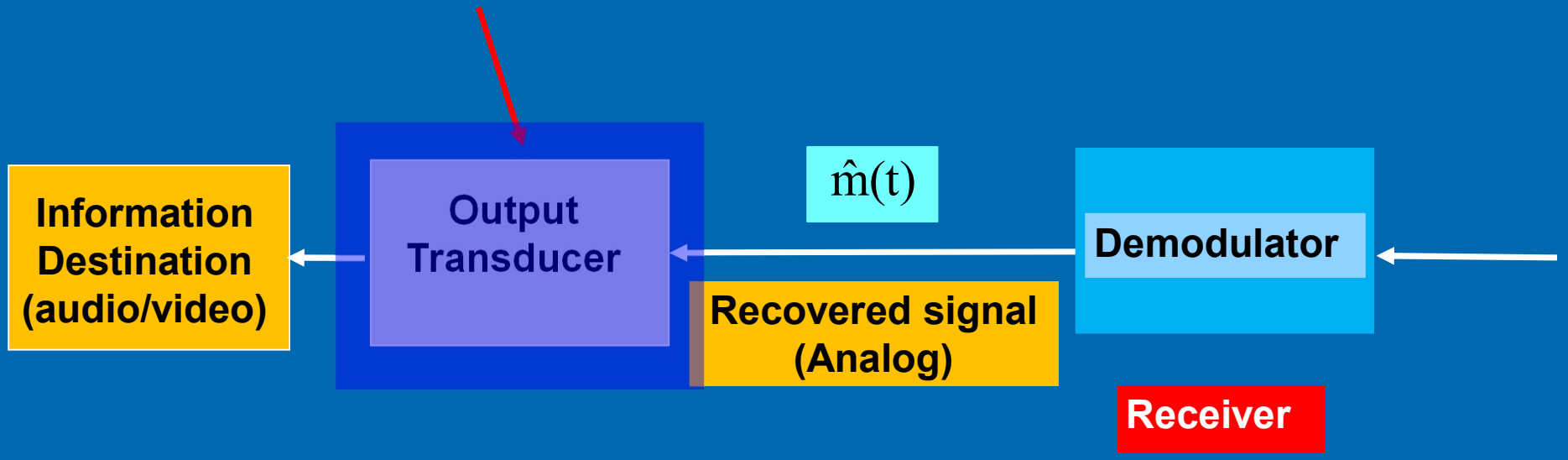
1.2 Elements of electrical communication systems

Elements of Analog communication systems

Output Transducer

Convert the received electrical signal $\hat{m}(t)$ to its original information form.

e.g. Loudspeaker, LCD or Plasma Screen

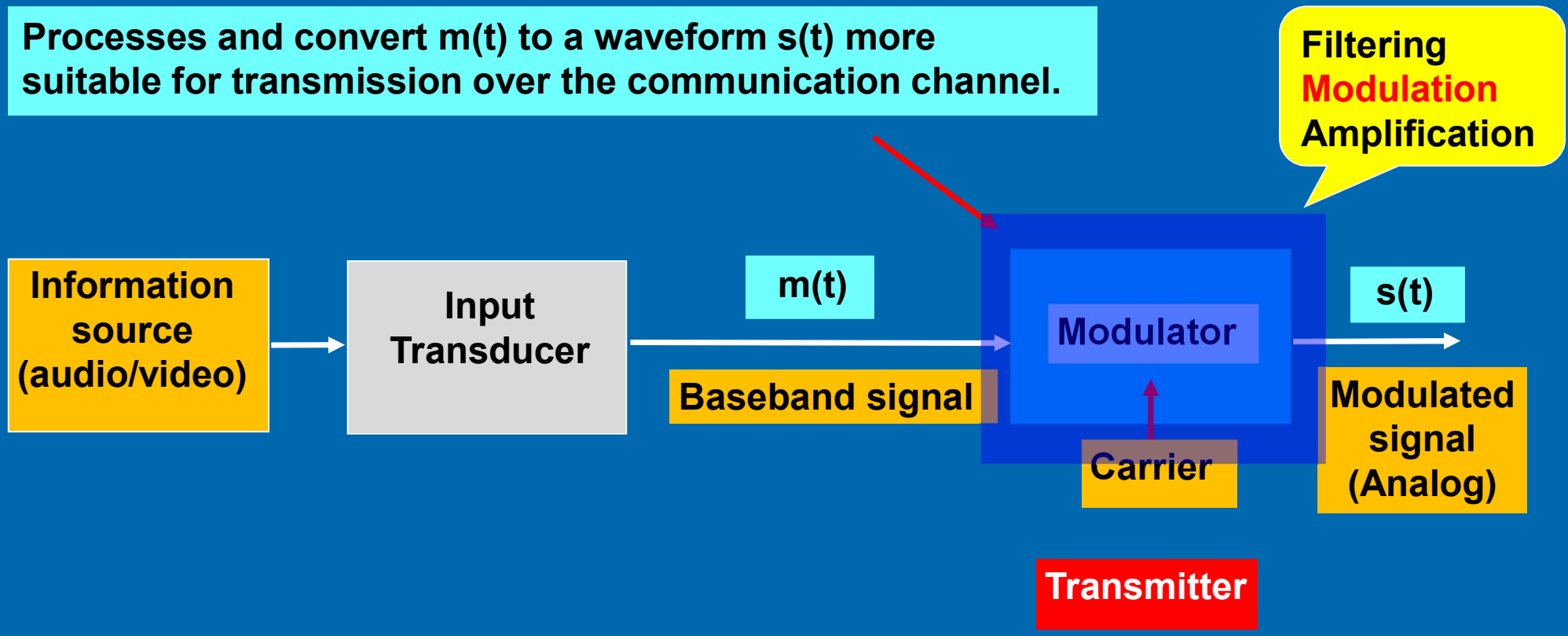


1.2 Elements of electrical communication systems

Elements of Analog communication systems

Transmitter

Processes and convert m(t) to a waveform s(t) more suitable for transmission over the communication channel.



1.2 Elements of electrical communication systems

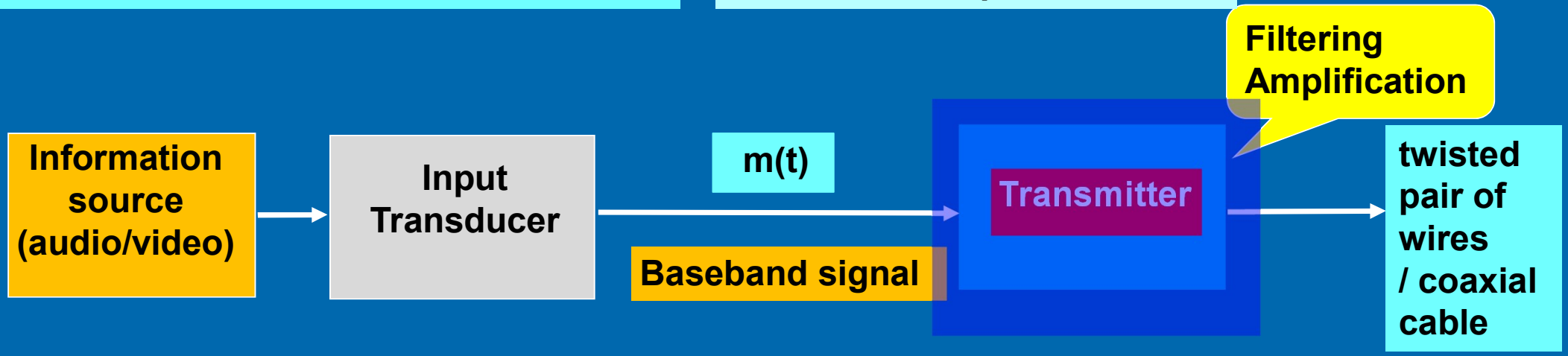
Elements of Analog communication systems

Baseband transmission

Without modulation

Transmit baseband signal m(t) directly over the channel

e.g. transmit audio signal over a telephone cable



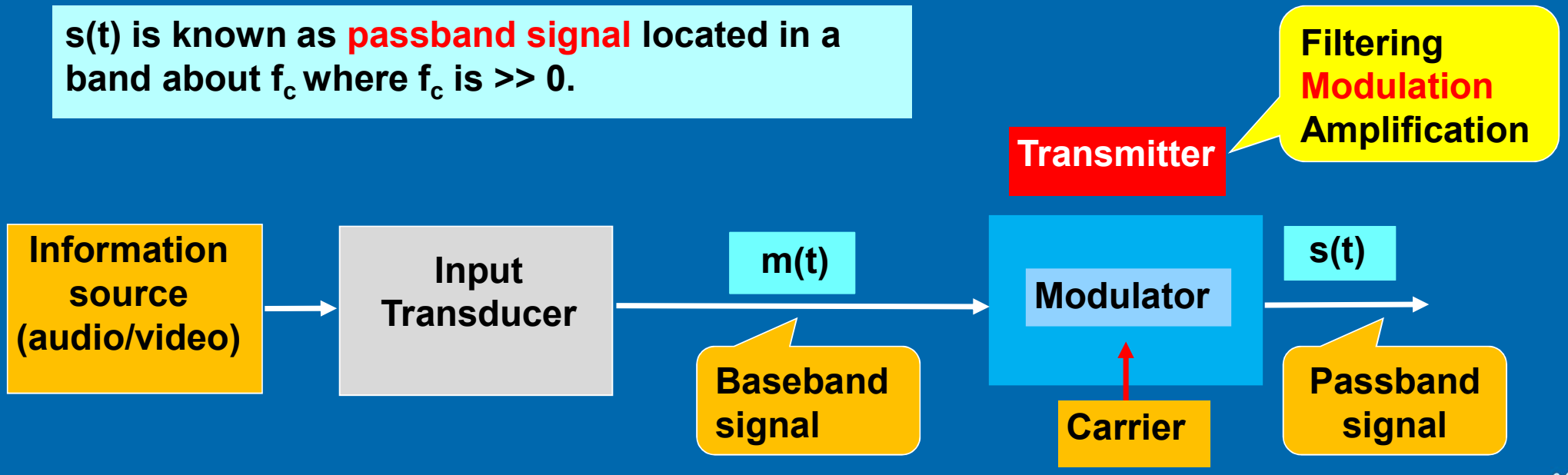
1.2 Elements of electrical communication systems

Elements of Analog communication systems

Passband transmission — **With modulation**

Superimpose m(t) on a high frequency carrier through a modulation process to generate s(t).

s(t) is known as passband signal located in a band about f_c where f_c is >> 0.



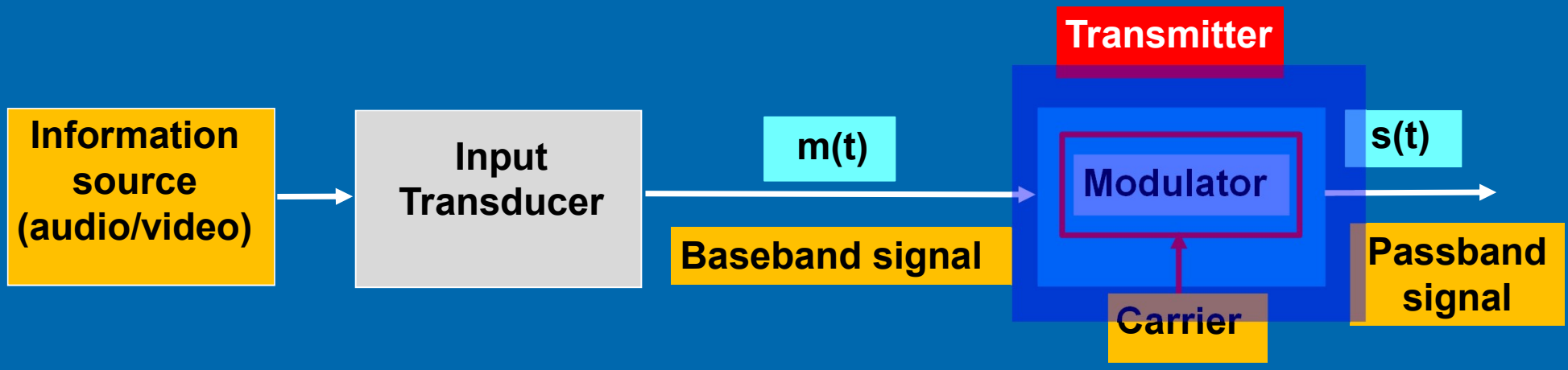
1.2 Elements of electrical communication systems

Elements of Analog communication systems

Modulation

Vary the amplitude, frequency or phase of the carrier in accordance with m(t).

m(t) is carried by the carrier wave in the form of variation in its amplitude, frequency or phase.



1.2 Elements of electrical communication systems

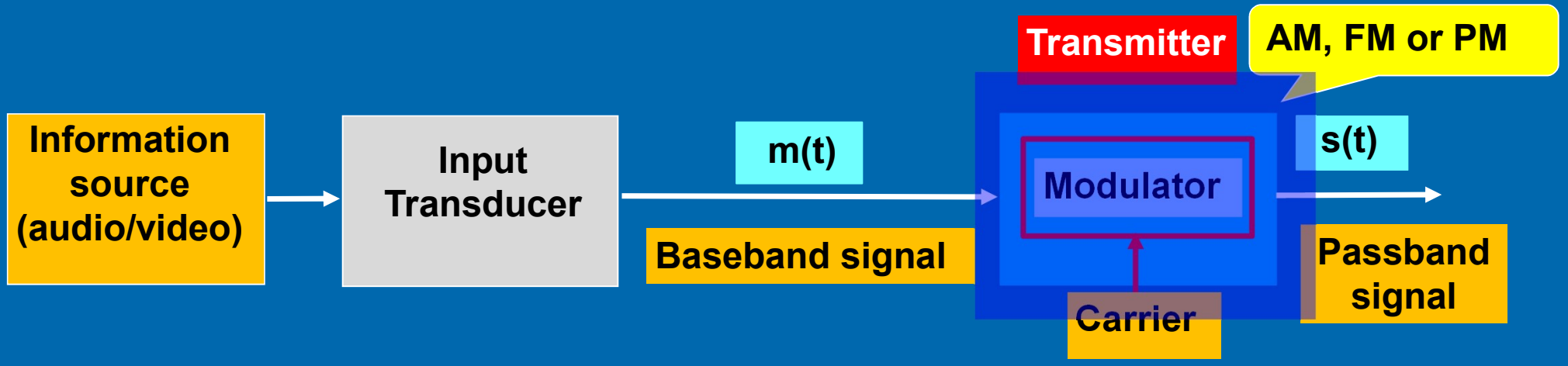
Elements of Analog communication systems

Modulation

Amplitude modulation (AM)
- Vary the amplitude of the carrier in accordance with the baseband signal.

Frequency modulation (FM)
- Vary the frequency of the carrier in accordance with the baseband signal.

Phase modulation (PM)
- Vary the phase of the carrier in accordance with the baseband signal.

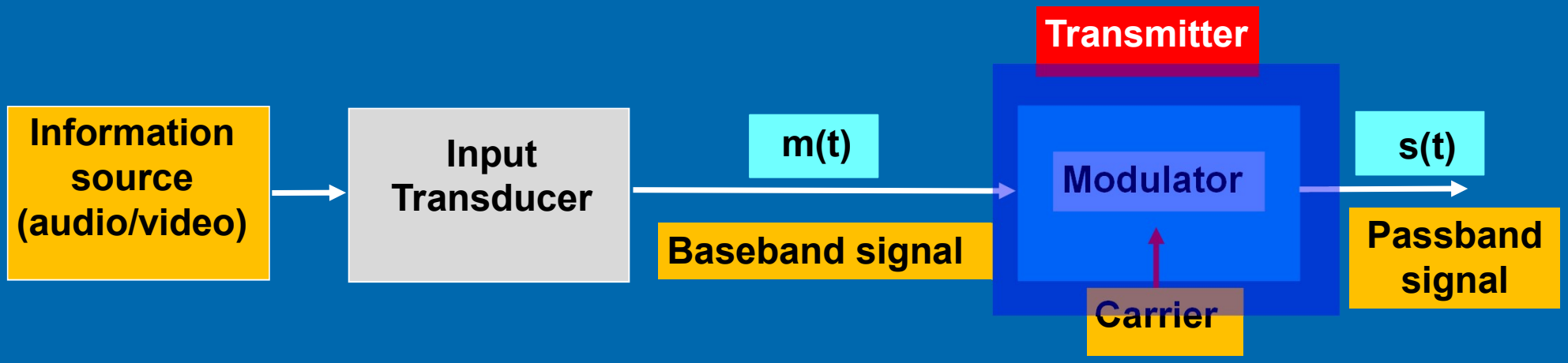


1.2 Elements of electrical communication systems

Elements of Analog communication systems

Modulation

- To match the properties of the passband signal, s(t), to the channel.
- To reduce the effect of noise and interference,
- To transmit signals simultaneous transmission without interference.
- To reduce anetenna size.



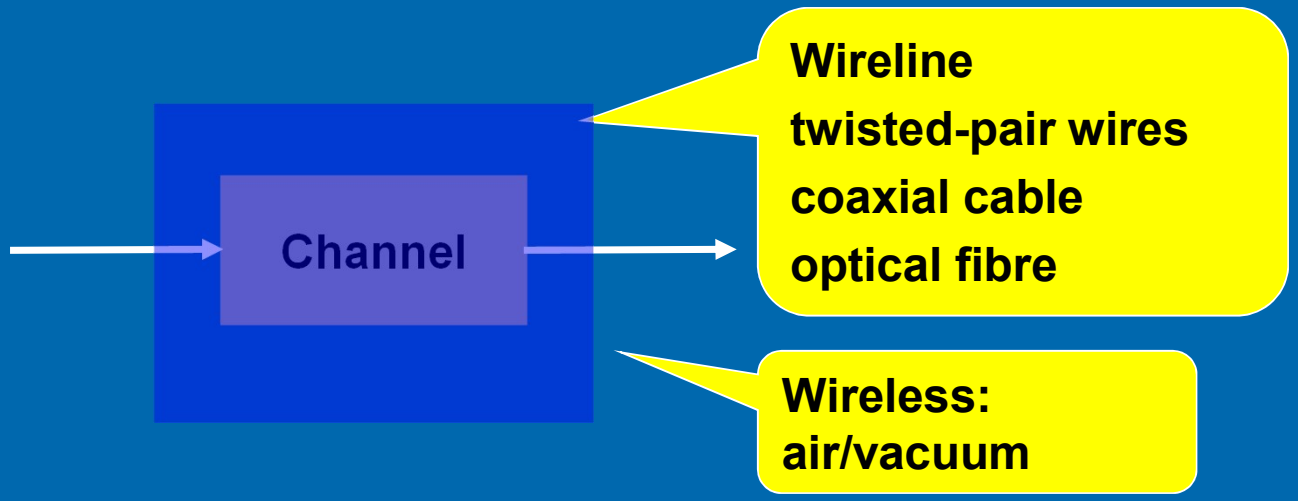
1.2 Elements of electrical communication systems

Elements of Analog communication systems

Communication Channel

Provide electrical connection between source and destination.

- signal degrades due to limited channel bandwidth and channel noise.



End

CHAPTER 1

(Part 1 of 2)