

ECS332 2015/1

Part I

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1 Introduction to communication systems

1.1. Shannon's insight [8]:

The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point.

Definition 1.2. Figure 1 [8] shows a commonly used model for a (single-link or point-to-point) communication system. All information transmission systems involve three major subsystems—a transmitter, the channel, and a receiver.

- (a) **Information**¹ source: produce a **message**
 - Messages may be categorized as **analog** (continuous) or **digital** (discrete).
- (b) **Transmitter**: operate on the message to create a **signal** which can be sent through a channel
- (c) **Channel**: the medium over which the signal, carrying the information that composes the message, is sent
 - All channels have one thing in common: the signal undergoes **degradation** from transmitter to receiver.

¹The concept of information is central to communication. But information is a loaded word, implying semantic and philosophical notions that defy precise definition. We avoid these difficulties by dealing instead with the message, defined as the physical manifestation of information as produced by the source. [3, p 2]

- Although this degradation may occur at any point of the communication system block diagram, it is customarily associated with the channel alone.
 - This degradation often results from *noise*² and other undesired signals or *interference*³ but also may include other *distortion*⁴ effects as well, such as fading signal levels, multiple transmission paths, and filtering.
- (d) **Receiver:** transform the signal back into the message intended for delivery
- (e) **Destination:** a person or a machine, for whom or which the message is intended

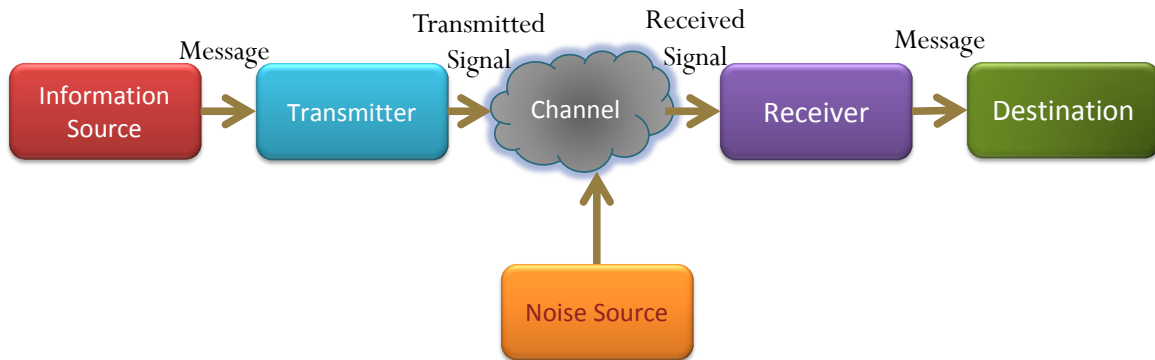


Figure 1: Schematic diagram of a general communication system

²Noise refers to random and unpredictable electrical signals produced by natural processes both internal and external to the system. [3, p 4]

³Interference is contamination by extraneous signals from human sources other transmitters, power lines and machinery, switching circuits, and so on. Interference occurs most often in radio systems whose receiving antennas usually intercept several signals at the same time. [3, p 4]

⁴Distortion is waveform perturbation caused by imperfect response of the system to the desired signal itself. Unlike noise and interference, distortion disappears when the signal is turned off. If the channel has a linear but distorting response, then distortion may be corrected, or at least reduced, with the help of special filters called equalizers. [3, p 4]