# Transmission Simulation

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# 1 Introduction

This document has the goal of illustrating the functioning of a telecommunication system transmission from the beginning to the end. The full schematic - containing every step - of a transmission system is presented in figure 1. Before exploring the mathematical background hidden between the steps, it is crucial to understand what every phase of the system means.

- ◇ *Source.* The source device is whichever device is sending a signal; it could be a television, a computer, a smartphone or anything else.
- ◇ *Formatting Device.* The formatting device's task is to translate the information from analogic to digital which translates in sampling the continuous analogic signal and creating a discrete digital signal that can be transmitted through digital devices.

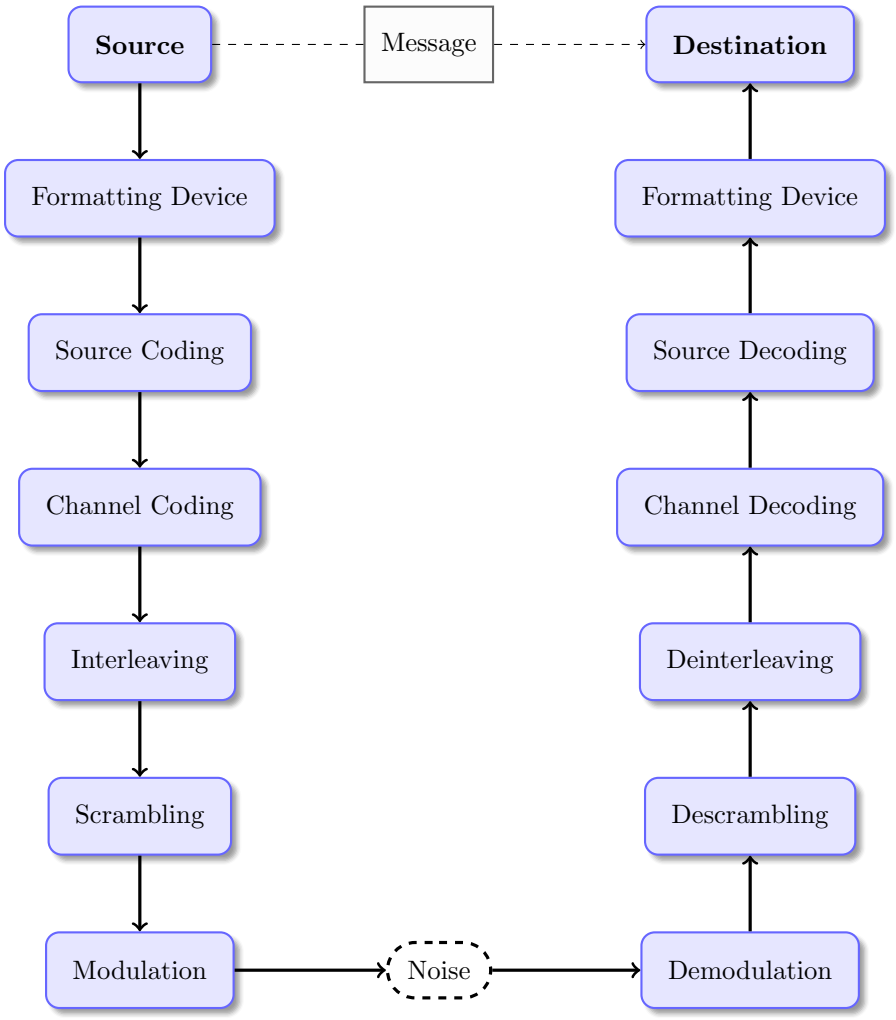


Figure 1: The diagram of the digital information transmission system.

◇ *Source Coding.* Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

◇ *Channel Coding.* Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

◇ *Interleaving.* The interleaver is needed to transform package errors into indipendent errors. This is achieved by changing ordering of the symbols that will be transmitted.

◇ *Scrambling.* Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

◇ *Modulation.* The modulation process' goal is to match the spectrum of the transmitted signal with the transmission channel bandwidth making the signal more noise-immune and increasing the data-transfer rate; these operations are performed by the *modulator*. There are different types of modulation, the one utilized in this project is the *Binary Phase Shift Keying*, which is one of the most effective modulation against noise.

◇ *Noise.* The noise is a crucial obstacle to cross to have a successful transmission; the noise is the main reason for a wrongly transmitted symbol. There are different types of noise, some of them are generated by other transmissions, others are due to the physical medium and others are caused by the intermediate devices between the transmission. Nevertheless, in every transmission, there will be the *Gaussiam White Noise* which is a thermal noise caused by the Big Bang.

◇ *Demodulation.* In this phase the demodulator device, after recieving the disturbed signal, will try to detect the signal in order to regenerate the original one. Sometimes the noise energy will be stronger than the signal energy generating errors that will be corrected in the next steps.

- ◇ *Descrambling.* Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

- ◇ *Deinterleaving.* The deinterleaver reorders the transmitted symbols in the opposite way that the interleaver did. In such a way the *burst* errors that occurred during the transmission will became single errors that can be easily recovered.

- ◇ *Channel Decoding.* Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

- ◇ *Source Decoding.* Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

- ◇ *Formatting Device.* During the transmission this device converts the signal from analogic to digital, during the reception of the signal the formatting device translates the discrete digital signal into a continuous analogic signal.

- ◇ *Destination.* The destination device is whichever device will recieve the signal. Likewise the source device, it could be a satellite, a smarphone, a server or anything else.