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# Introductory Chapter: Multiplexing History - How It Applies to Current Technologies

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## 1. Definition of multiplexing

It is fascinating to know that the multiplexing can be employed and defined from different points of views and different disciplines. For example, Dr. E. Julius Dasch, former manager of the NASA National Space Grant Program, defines multiplexing on his dictionary book [1] as:

*...the simultaneous transmission of different data from a spacecraft using a single channel. The data stream is separated into frames that carry codes for different information, such as temperatures, pressures, and the state of on-board computers.*

In a media and communication dictionary book [2], multiplexing is mentioned as:

*Digital television transmission allows for multiplexing, whereby multiple channels are bundled together and sent simultaneously in a single stream of data.*

In a computer science dictionary book [3], multiplexing is described as:

*...the process of combining multiple messages simultaneously on the same physical or logical transmission medium. There are two main types: time division multiplexing (TDM) and frequency division multiplexing (FDM).*

The list continues for the Internet, optic engineering, graphics, phytography, laser and photonics geology, earth sciences, and many more.

## 2. Short history of multiplexing

The history of multiplexing goes back to the 1800s, when Samuel Morse developed his telegraph system which enabled long-distance communications [4]. Later in 1874, Thomas Edison invented diplexing to transmit two individual messages over one line at the same time [5]. Later in 1894 and the 1930s, time-division multiplexing (TDM) and frequency division multiplexing (FDM) came into existence [6, 7].

## 3. Application of multiplexing in current technology

One of the expectations about 5G technologies is to support enormous capacity, approximately 1000 times devices per squared kilometer [8]. In order to satisfy this

requirement, several technologies have been suggested and developed, and one of the most attractive approaches is known as massive multiple-input multiple-output (MIMO), and that is where, for example, spatial multiplexing comes to use [9]. From signal processing side, for instance, employing multiple carriers all the way to arranging antennas and network management, multiplexing technique provides accessing resources by dividing and sharing it among users. In the other side, de-multiplexing has to be applied at the receiver side to inverse all the processes and extract the information sent.

One particular example for application of multiplexing is seen in orthogonal frequency division multiplexing (OFDM) systems [10]. The signal is spread between different subcarriers, and the frequency bandwidth is efficiently used [11].

#### **4. Conclusion**

This chapter is an introduction to the book titled *Multiplexing*. A variety of definitions of multiplexing from different points of view are presented, and a short history of the origin of multiplexing is briefly discussed. The potential and application for existing and future technologies are also discussed.

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