DATA COMMUNICATION

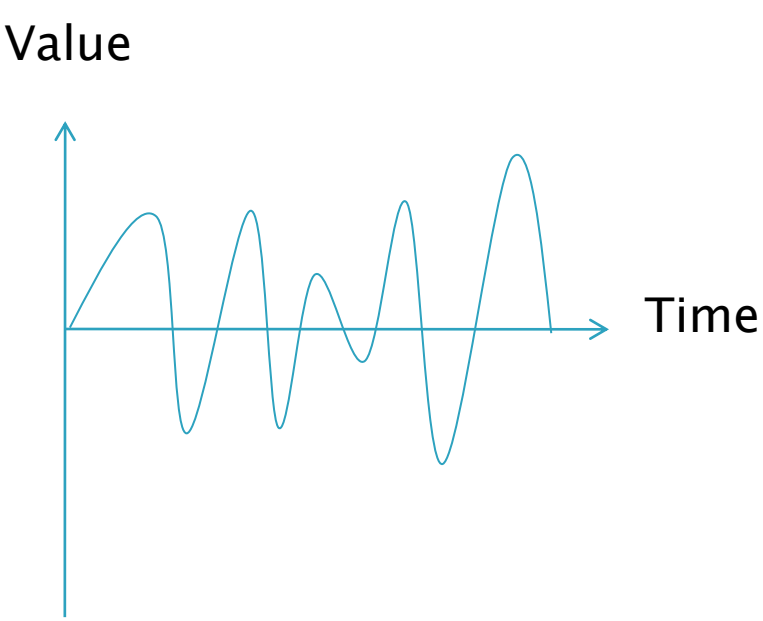
INTRODUCTION

- Data Concept
- Analog and Digital Signal
- Periodic and Non-Periodic Signal
- Sine Wave
- Wave length
- Time and Frequency Domain
- Composite Signal
- Bandwidth
- BPS and Bit Length

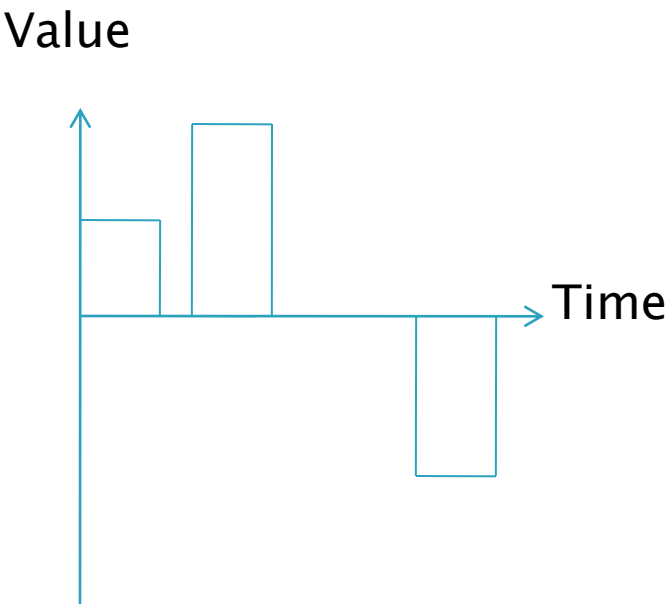
DATA.....

- Data is a usable to a person or application .
- Data should be transmitted from one place to another in the form of electromagnetic signals across a transmission medium.
  - *TO BE TRANSMITTED, DATA MUST BE TRANSFORMED TO ELCTROMAGNETIC SINGAL*
- Signals are divided into two categories
  - ANALOG SIGNAL
  - DIGITAL SIGNAL

COMPARISON OF ANALOG AND DIGITAL SIGNALS



Analog Signal



Digital Signal

ANALOG SIGNAL & DIGITAL SIGNAL

- Analog data refers to information that is continuous with respect to time and frequency.
- Signal has infinitely many levels of intensity over a period of time
- As the wave moves from place A to place B, it passes through and includes number of values along its path
  - Examples:
    - An analog clock(hours, minutes and sec.)
    - Human Voice

- Digital signal refers to a information that has discrete states.
- Signal has limited number of defined values
- Each value can be either 1 or 0
  - Examples:
    - A Digital clock(Suddenly change from 10:02 to 10:03)
    - Computer Memory(Data stored in form of 0s and 1s

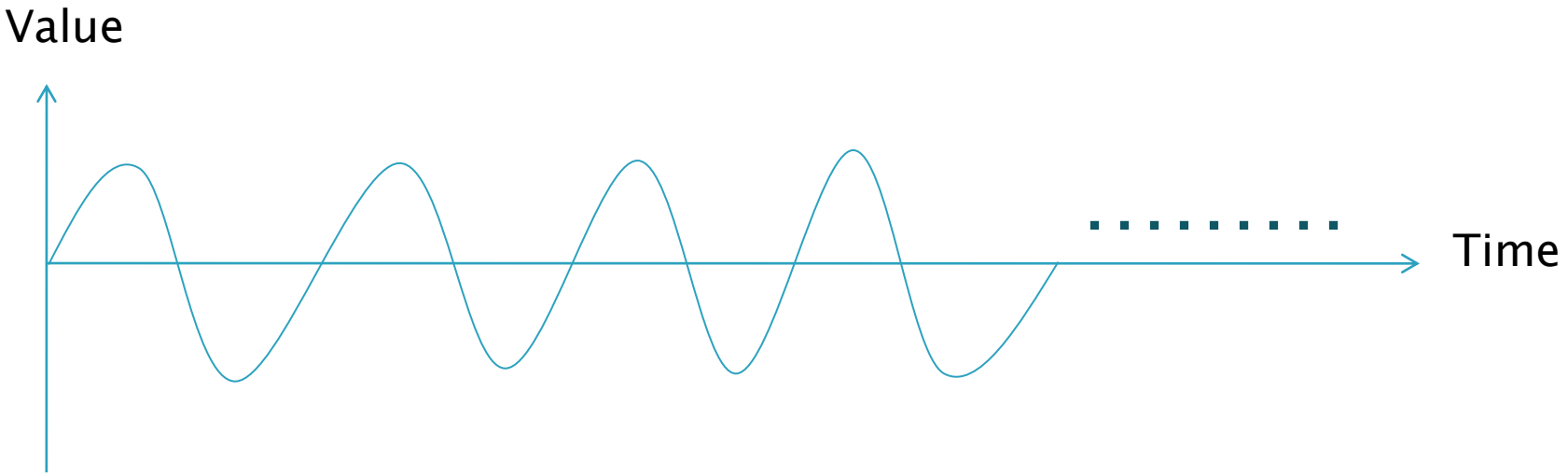
Periodic and Non-Periodic Signals

- Both analog and digital signals can take one of two forms : periodic or non-periodic

- A Periodic signal complete a pattern within a measurable time span or time frame, and repeats that pattern over subsequent identical periods.
  - Commonly used in analog signals, because they need less bandwidth.
- A non-periodic signal changes without exhibiting a pattern or cycle that repeats over a time.
  - Commonly used in digital signals, because they can represent variation in data.

Sine Wave

- A sine wave is the most fundamental form of a periodic analog signal

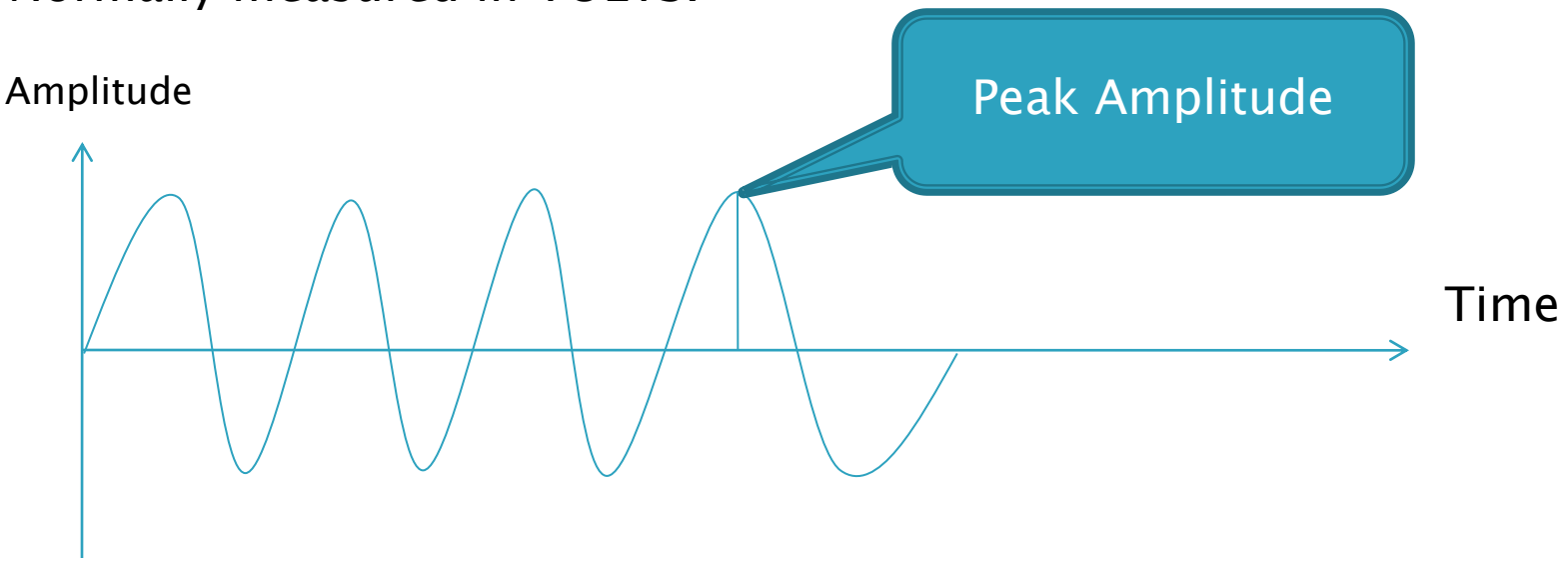


A Sine wave can be represented by three parameters:

- Peak Amplitude
- Frequency
- Phase

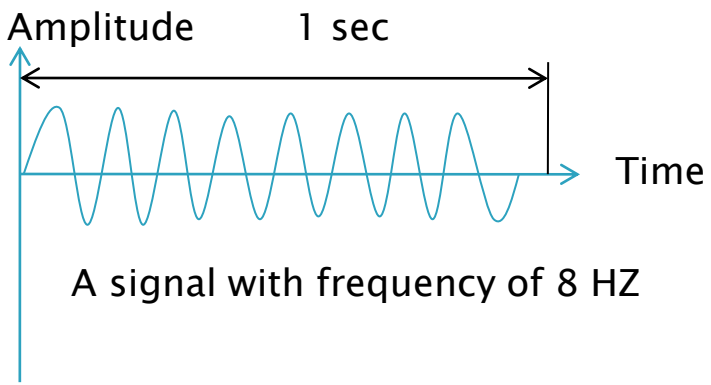
Sine Wave

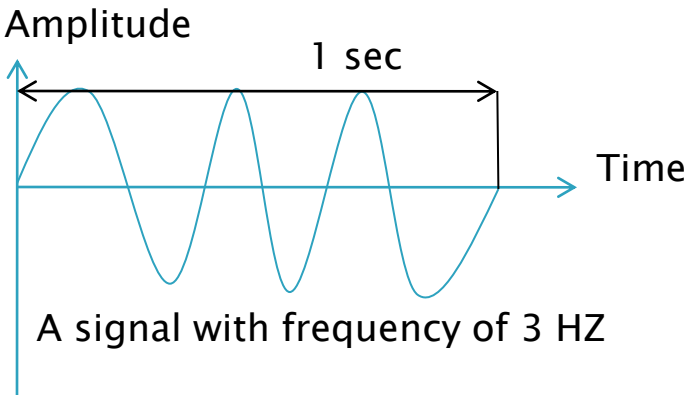
- Peak Amplitude
  - The peak amplitude of a signal is the absolute value of its highest intensity, proportional to the energy it carries.
  - Normally measured in VOLTS.



Sine Wave

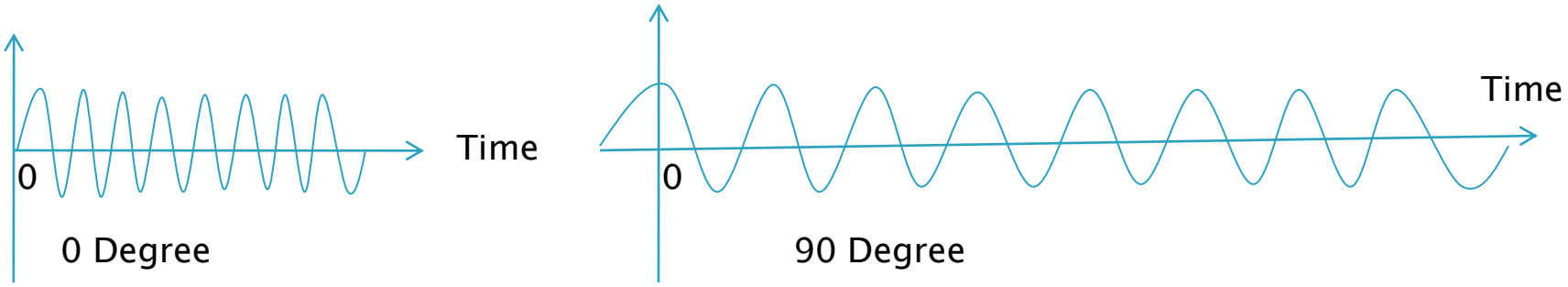
- Frequency
  - Frequency refers to the number of period in 1sec.
  - Formally expressed in Hertz(Hz), which is cycle per sec.
  - Period refers to the amount of time , in seconds , a signal needs to complete 1 cycle.
  - Period is the inverse of frequency and vice-versa.
    - F=1/T





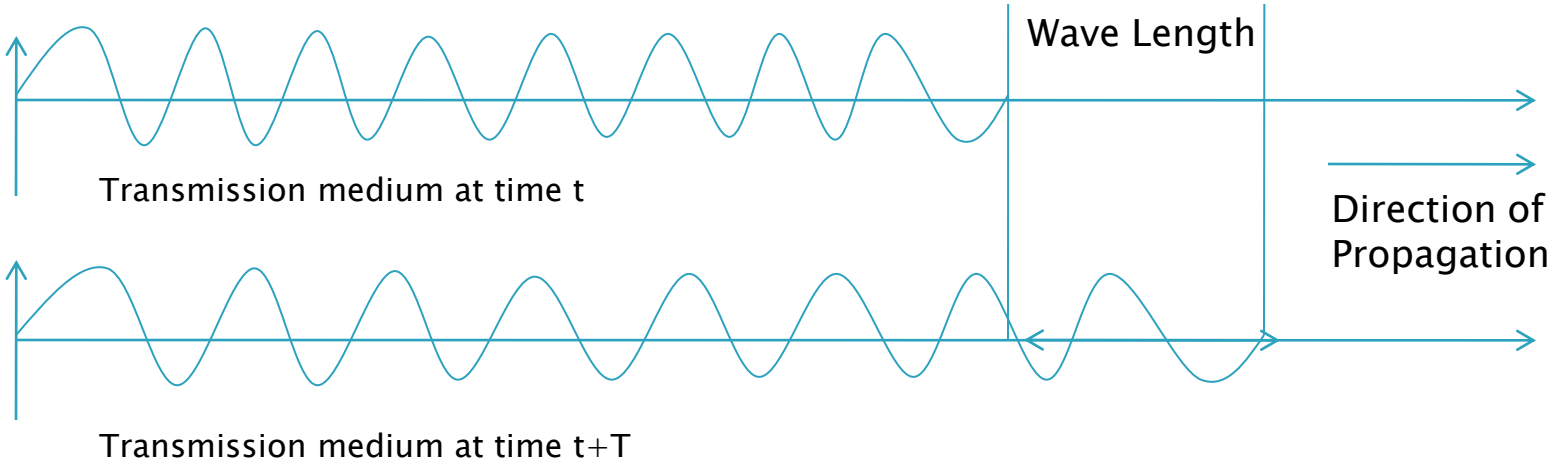
Sine Wave

- Phase
  - Phase describe the position of the waveform relative to time 0.
  - Wave as something that can be shifted backward or forward along with time axis, phase describe the amount of that shift.
  - Measured in degrees or radian
    - A phase shift of 360 degree correspondence to a shift of a complete period.



Wave Length

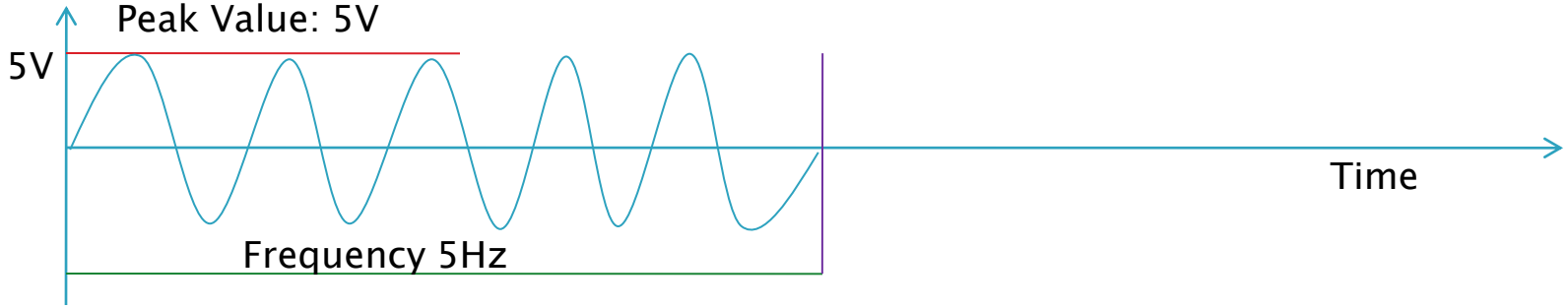
- Wavelength binds the period or the frequency of a simple sine wave to the propagation speed of the medium
- It is the distance a simple signal can travel in one period



Wavelength=propagation speed*Period

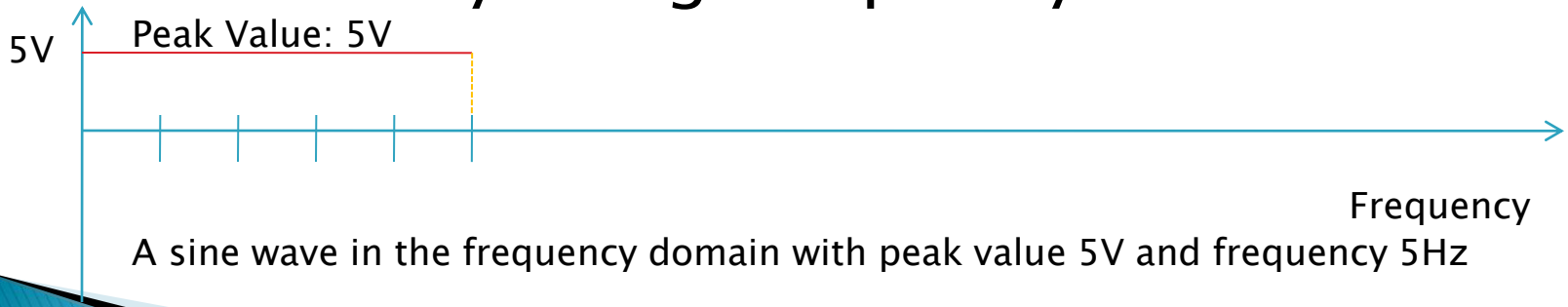
Time & Frequency Domain

- Sine wave by using Time-Domain Plot



A sine wave in the time domain with peak value 5V and frequency 5Hz

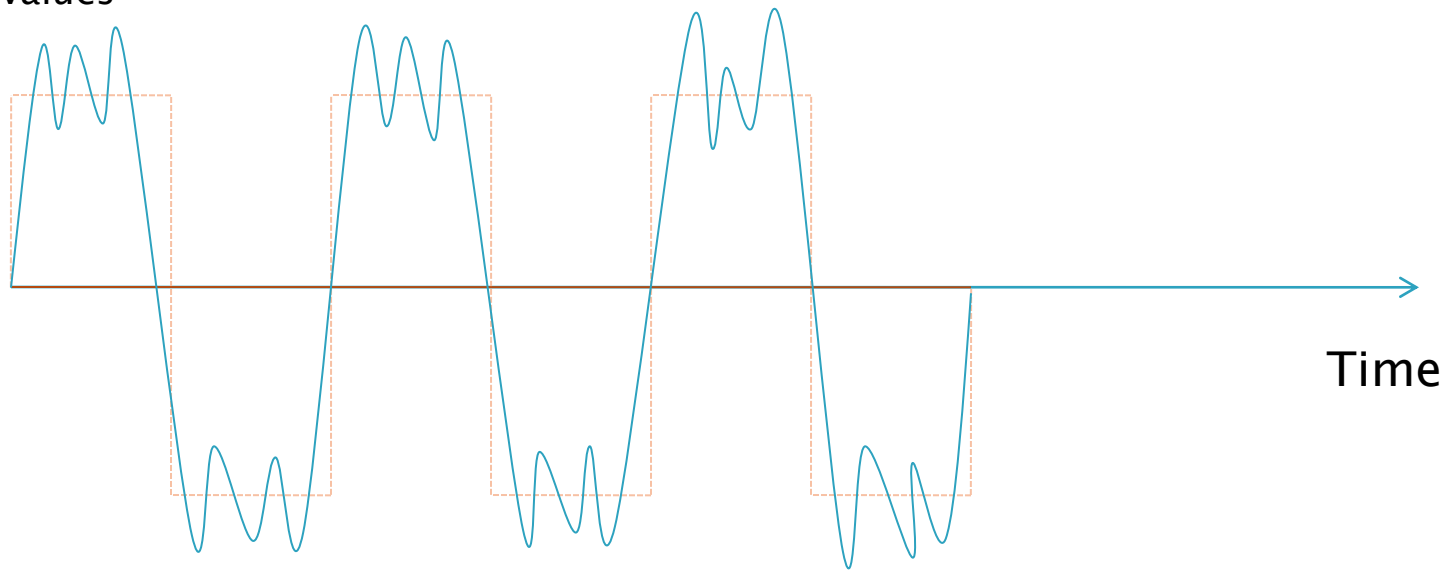
- Sine wave by using Frequency-Domain Plot



A sine wave in the frequency domain with peak value 5V and frequency 5Hz

Composite Signal

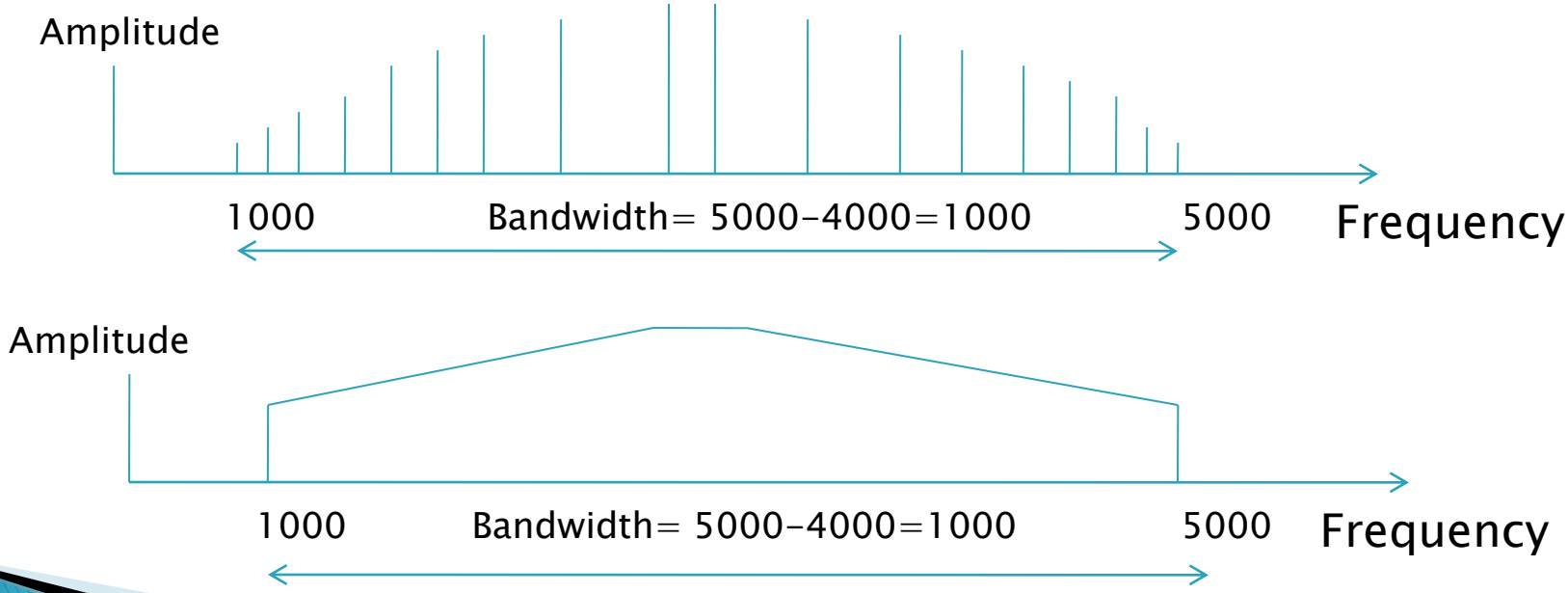
- Composite signal is a combination of simple sine waves with different frequencies, amplitudes and phases.
- It can be periodic or non-periodic.
  - A periodic composite signal can be decompressed into a series of simple sine waves with discrete frequencies, that have integer values(1,2,3, and so on)
  - A non-periodic composite signal can be decomposed into a combination of an infinite number of simple sine waves with continuous frequencies, that have real values



A composite periodic signal

Bandwidth

- The range of frequencies contained in a composite signal is its bandwidth.
- It is normally a difference between two numbers.
  - Example:
    - If a composite signal contains frequencies between 1000 and 5000, its bandwidth is 5000-1000=4000
- The Bandwidth of a composite signal is the difference between the highest and the lowest frequencies contained in that signal.



Bit Rate and bit length

- The Bit Rate is the number of bits sent in 1 sec, expressed in bps(bit per sec).
  - Bandwidth can also refer to the number of bits per second that a channel , a link, or even a network can transmit.
    - Example, one can say the bandwidth of a fast Ethernet network is a maximum of 100Mbps.This means that this network can send 100Mbps.

- The Bit length is the distance one bit occupies on the transmission medium.
  - Bit length= Propagation speed * bit duration