Network Performance and Transmission Impairments

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Network Performance and Transmission Impairments

Network performance: It refers to measures of service quality of a network as seen by the customer

Bandwidth

- One characteristic that measures network performance is bandwidth
- However, the term can be used in two different contexts with two different measuring values bandwidth in hertz and bandwidth in bits per second

Bandwidth in Hertz

- Bandwidth in hertz is the range of frequencies contained in a composite signal or the range of frequencies a channel can pass.
- For example , we can say the bandwidth of a subscriber telephone line is 4 kHz.

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Bandwidth in Bits per Seconds

- The term bandwidth can also refer to the number of bits per second that a channel, a link or even a network can transmit
- For example, one can say the bandwidth of a Fast Ethernet network (or the links in this network) is a maximum of 100 Mbps

Relationship

- There is an explicit relationship between the bandwidth in hertz and bandwidth in bits per second Basically, an increase in bandwidth in hertz means an increase in bandwidth in bits per second

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Jitter

We can roughly say that jitter is a problem if different packets of data encounter different delays and the application using the data at the receiver site is time-sensitive (Ex. audio and video data)

Throughput

- The throughput is a measure of how fast we can actually send data through a network
- For example, we may have a link with a bandwidth of 1 Mbps, but the devices connected to the end of the link may handle only 200 kbps. This means that we cannot send more than 200 kbps through this link

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Latency (Delay)

- The latency or delay defines how long it takes for an entire message to completely arrive at the destination from when the first bit is sent out from the source.
- We can say that latency is made of four components
  1) propagation time
  2) transmission time
  3) queuing time
  4) processing time

Latency =propagation time +transmission time +queuing time +processing time

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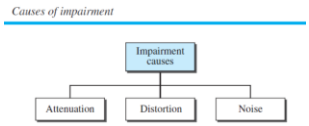
TRANSMISSION IMPAIRMENT

- Signals travel through transmission media, which are not perfect. The imperfection causes signal impairment.
- This means that the signal at the beginning of the medium is not the same as the signal at the end of the medium



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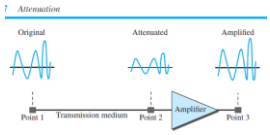
Attenuation

- Attenuation means a loss of energy.
- When a signal, simple or composite, travels through a medium, it loses some of its energy in overcoming the resistance of the medium



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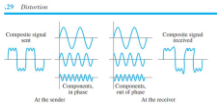
Decibel

To show that a signal has lost or gained strength, engineers use the unit of the decibel

Distortion $\mathrm{dB} = 10 \log_{10} \frac{P_2}{P_1}$

- Distortion means that the signal changes its form or shape
- Distortion can occur in a composite signal made of different frequencies Each signal component has its own propagation speed (see the next section) through a medium and, therefore, its own delay in arriving at the final destination



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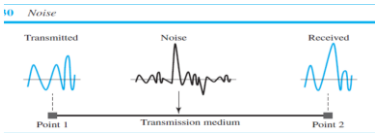
Noise

- **Noise** is another cause of impairment.
- Several types of noise, such as thermal noise, induced noise, crosstalk, and impulse noise, may corrupt the signal.



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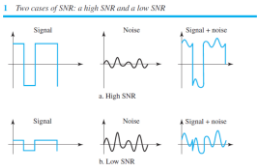
Signal to Noise Ratio (SNR)

- We need to know the ratio of the signal power to the noise power.
- The signal-to-noise ratio is defined as

$$\mathrm{SNR} = \frac{\text{average signal power}}{\text{average noise power}}$$



Thank you!