Analog to digital conversion

Sampling and reconstruction

Analog to digital conversion

- Analog communication seems a good enough idea, but it has many disadvantages
  - It cannot be manipulated easily
    analog source also have statistics that can be exploited to reduce the signal description

Analog VS digital

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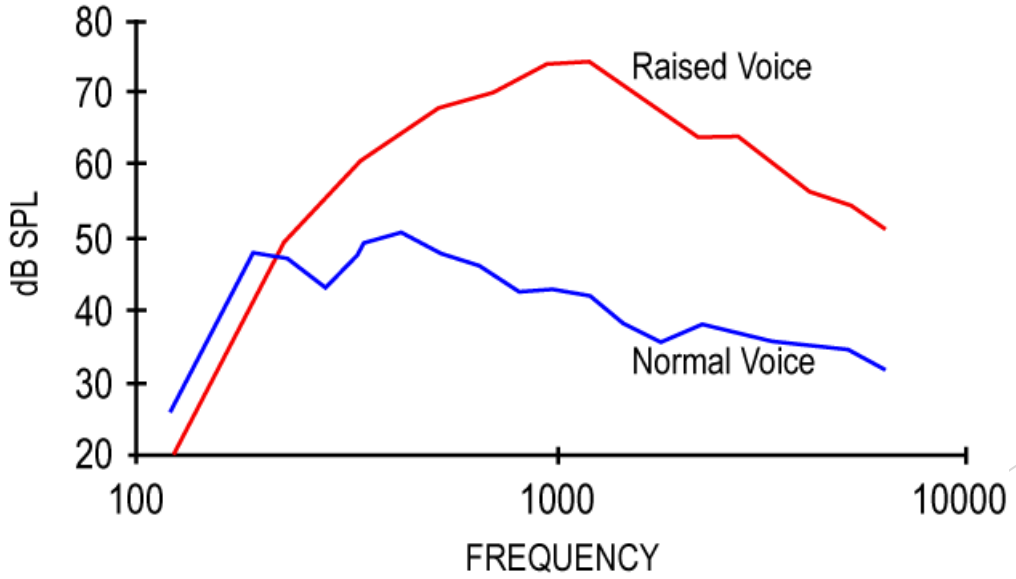

Analog VS digital

- If we sample a signal, processing becomes much easier and we can do all sort of non-linear, adaptive, time-varying operations
  - This really reduces the bandwidth requirement of transmission

Analog VS digital

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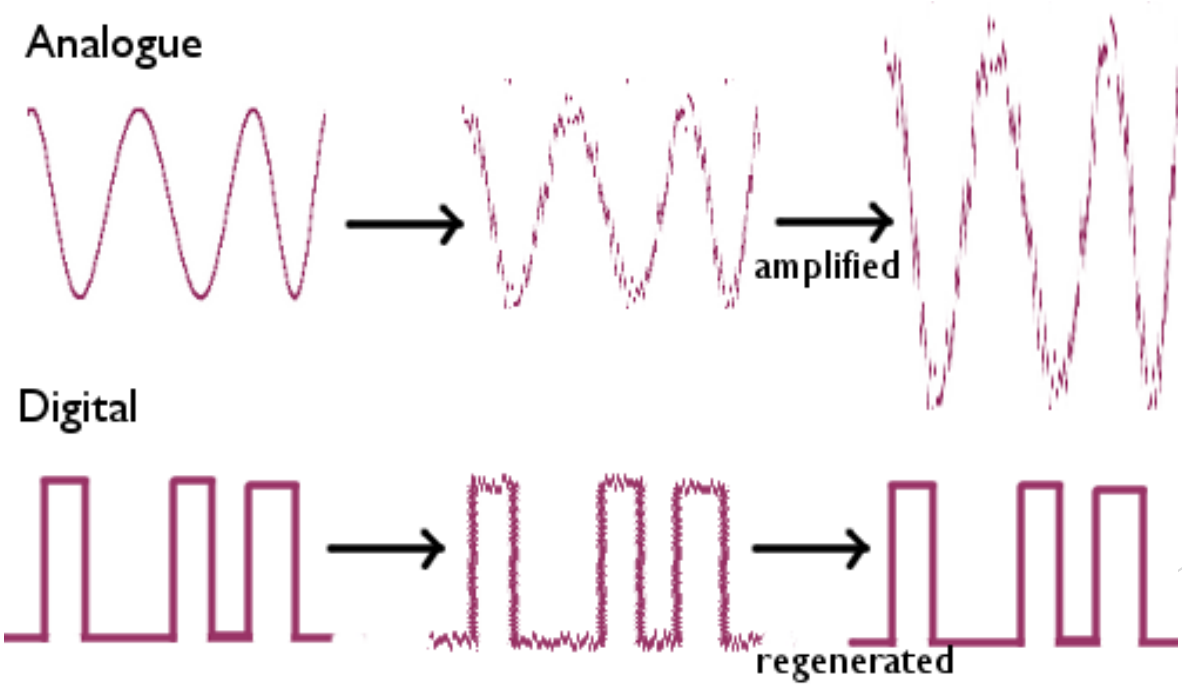
  - The precision of an analog signal is infinite but it's hard to distinguish the message from noise and distortion



Analog VS digital

- Analog communication seems a good enough idea, but it has many disadvantages
  - The precision of an analog signal is infinite but it's hard to distinguish the message from noise and distortion
    - You guys probably don't remember how long distance calls used to sound!

Analog VS digital

- Most importantly, we can do coding to digital signals much more easily than in analog signals.
  - How would you protect the message against noise without increasing the power?

Analog VS digital

- What other **pro and cons** do you see?

Analog VS digital

- Analog transmissions are still useful
  - When the transmitter/receiver has complexity restrictions
  - When the noise is very low
  - When the data has no redundancy
- BUT
  - In general we will prefer digital transmissions over analog ones

Analog VS digital

- This means one thing:
  - Most sources are analog
  - We want digital transmissions
    - We need to **convert analog to digital**
    - Then transmit
    - Then convert **digital to analog** back again

AD / DA conversion

- Conversion
  - Convert continuous time into discrete time
    - **Sampling**
  - Convert continuous amplitude into discrete amplitudes
    - **Quantization**

Sampling

- **C2D**
  We take equally spaced samples of the analog signal

- **D2C**
  We reconstruct the signal from the samples through some form of (maybe random) interpolation

Time for a break

See you in 15mins