

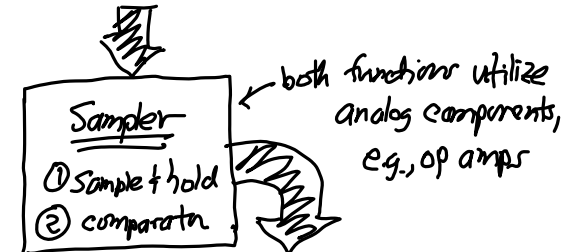
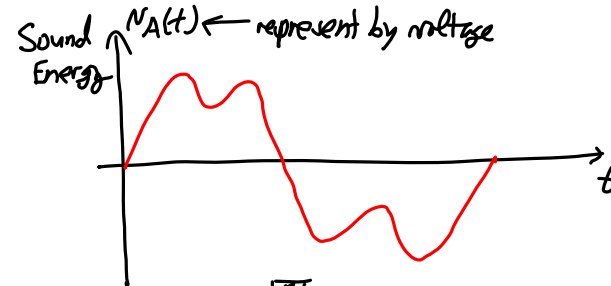
Lecture 2: Signals & Communications

- Announcements:
- Lecture 1 pdfs and video already posted on the course website in the "Lecture" link
- HW#1 online
- Discussions start next week
- Labs start the week after next
 - ↳ Monday, Sept. 3 is a holiday, so the Monday lab will start one week later
 - ↳ The Tuesday lab starts Sept. 4
- Will let in concurrent enrollments next week
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- Lecture Topics:
- ↳ Review of Signal Types
- ↳ Motivation: Digital Communications
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• Signal Types:

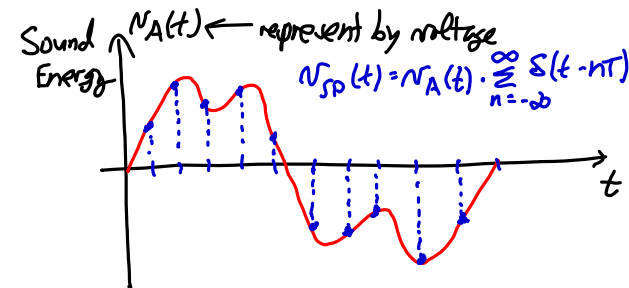
1) Analog Signal:

- ↳ The majority of physical signals are analog
- ↳ "analog" comes from the fact that analog electronic signals and the physical signals they represent are analogous
- ↳ Continuous time, continuous amplitude

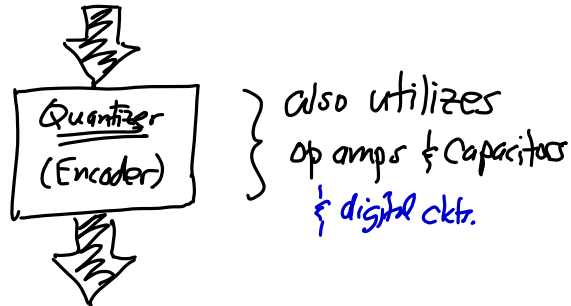


2) Sampled-Data Signal:

- ↳ Discrete time, continuous amplitude

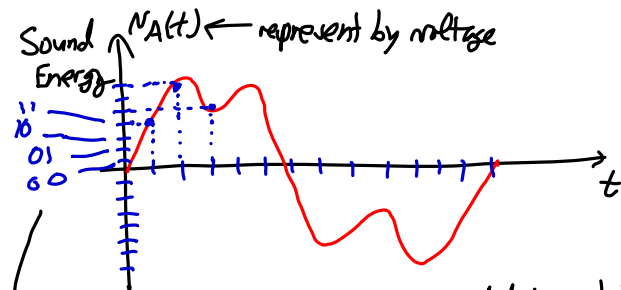


- ↪ If sample fast enough (i.e., at the Nyquist rate = $2 \times$ the highest bandwidth), then can retain all the original information in the original analog signal
- ↪ If you cannot do this, then you lose information!



3) Digital Signal

- ↪ Discrete time, discrete amplitude



These values can now be encoded in a binary representation and processed via digital electronics

⇒ Problem: Lose information through quantization

$$\text{Lost Info} \propto \frac{1}{\# \text{ of levels}}$$

- Advantages of Digital:
 - ↪ More complex processing possible due to higher density of electronics (i.e., VLSI)
 - ↪ Easier to store, e.g., mp3's more reliable than analog records
 - ↪ Easier to interpret, e.g., digital vs. analog clock (with hands)
- Disadvantages of Digital:
 - ↪ Loss of information through quantization and sampling
 - ↪ In many cases, not as fast as analog (smaller bandwidth)
 - ↪ The speed disadvantage is easy to see in wireless communications, which is why analog is so important for wireless
- Go to Digital Communications Example