

Intro

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Intro

- Platform: Beaglebone black (BBB) w/ audio hat
- Start in PD, delve into C++ eventually, even a little assembly!
- Introduce some hardware components as well - pots, caps, etc.
- Project: design an audio interactive app
- No tests, grade based on participation, assignments, and final project proposal/demo
- Make sure to cite any example code used, and describe what our personal contribution is
- Don't skip more than 2 classes or grade drop

Embedded Systems

- Really good at some tasks, less good at others
- Going to focus on single board computers (SBCs)
- Most SBCs have an audio interface
- Benefits to SBC
 - Less processes competing for resources/fewer interrupts
 - Can guarantee realtime requirements (if using realtime OS)
 - Lower latency because smaller buffer possible

Latency

- Audio Latency: buffer size in samples
- Control Latency: latency of input plus audio latency
- Controls typically parsed in a loop with fixed frequency
- Adds additional latency that is variable...
- Control parsing and audio buffer not necessarily integer multiples
- Must wait for both to complete to get signal through, so quite variable latency
- Variable latency → jitter (super annoying)

- USB period parsing 5 ms (pretty big)
- Problem: timbre strongly effected by jitter even $< 1\text{ms}$
- SBC can remove all jitter! analog to digital converter (ADC) runs way closer to audio sample rate.
- Bela w/ buffer size of 16 - fixed control latency of 0.35ms
- MIDI latency much worse - $2.85 \pm 2.5\text{ms}$