

The Spatial Digital Equalizer

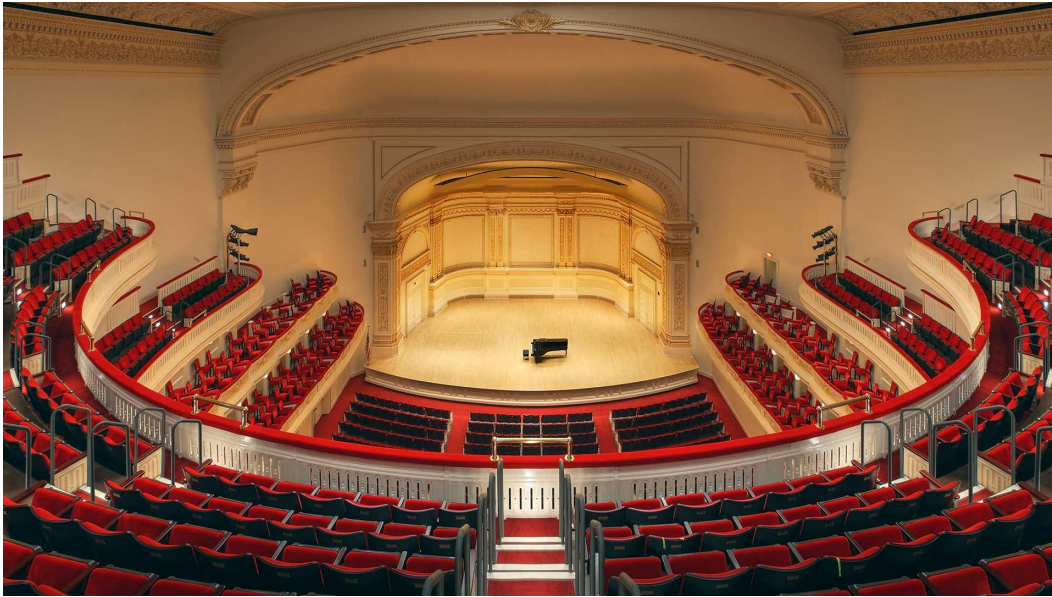
Alex Sludds

Priya Kikani

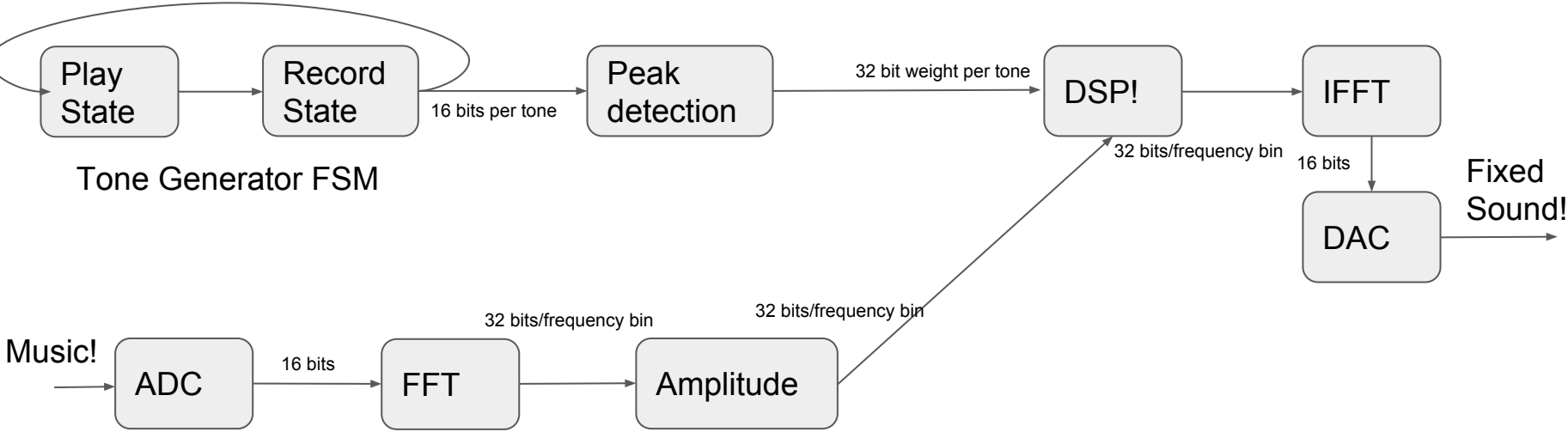
Mentor: Alex Sloboda

Overview

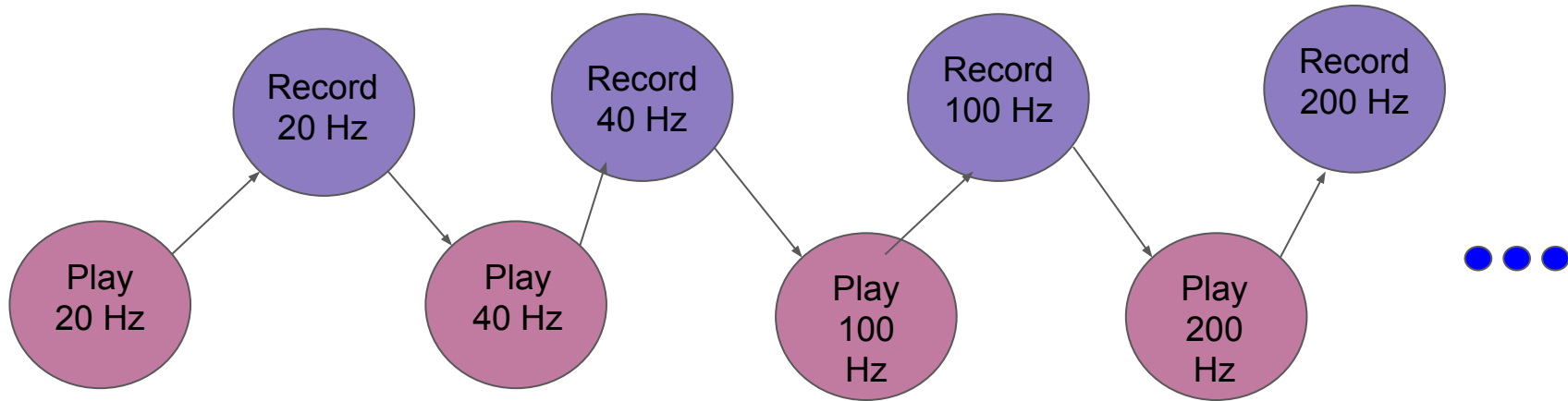
Adjust music for room and speaker attenuation



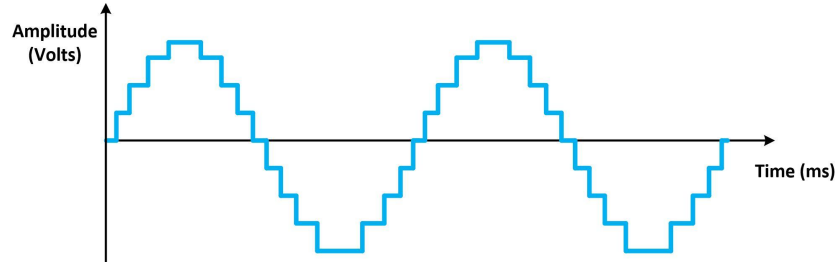
Block Diagram



Major Modules: Record/Playback FSM

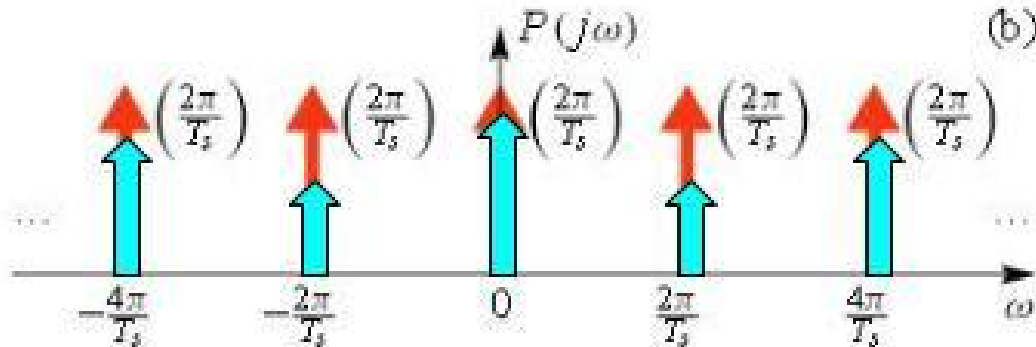


Within the “Play” state, the **tone generator**: 16 bit sinusoidal with appropriate frequency sent to ADC



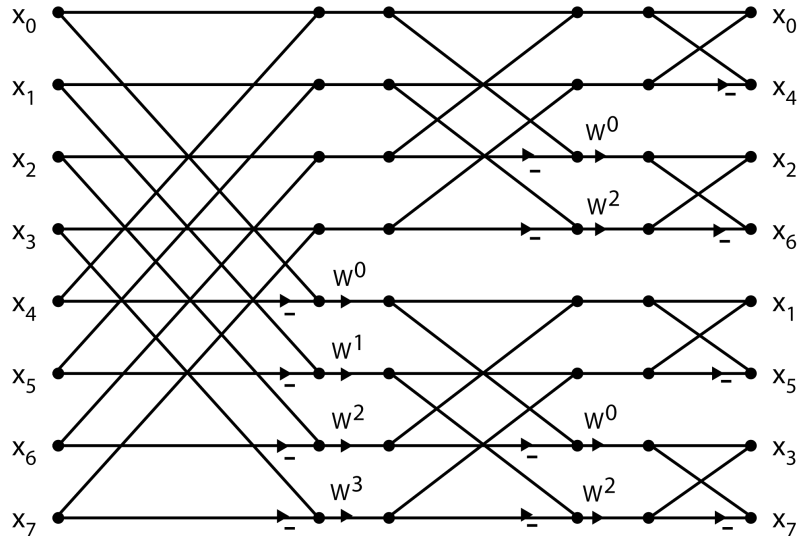
Major Modules: Peak Detection For Each Tone

1. **Note: This calculation can take multiple clock cycles w/o consequence**
2. compute square of data_in; assert “done” when calculation is complete
3. drive data_out based on rising edge of “done” signal to allow for computation time
4. compute moving average to collapse data into singular frequency weight



Major Modules: Fast Fourier Transform

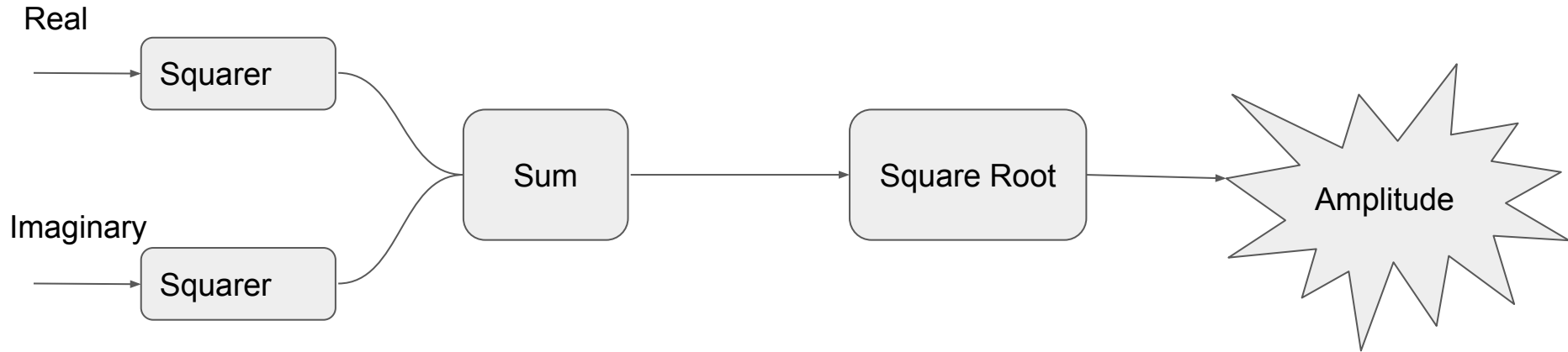
- Takes a configuration signal for number of bins
- Takes data input
- Returns all all frequency information at once



Major Modules : FFT Amplitude Converter

Takes real and complex values of FFT and returns amplitude.

Uses pipelined ideas from puck_pixel lpset problem



DSP and Sexy Presets

- Initial DSP is simply subtracting attenuation
- Later DSP will also include such sexy presets as:
 - Bass
 - Treble
 - EDM
 - BASS EXTREME!
 - Rock



Testing



Timeline

Week 1: Priya - Play and record FSM

Sludds - Sound > FFT > IFFT > Same Sound

Week 2: Priya - Envelope Detection and Generate Transfer Functions of Various Rooms

Sludds - FFT + Amplitude into DSP

Week 3: Testing and sexy presets

Week 4: Film us! Party! Take Alex Sloboda out to dinner :)