OpenPipe
“freedom for your fingers”

OSHW bagpipes & beyond...
A bit of history

- Back in 20\textsuperscript{th} century (year 2000)
- Galician Bagpipes MIDI controller
- PIC16F84 μC (code in ASM)
- Resistive interface (ON/OFF) (pins & screws)
- 5 pin DIN MIDI connector (standard MIDI)
- Only one unit produced (2 HMI)
- OSHW was not mainstream
Back to the present

- Winter 2011
- Arduino & DIY & MAKER & OSHW
- MPR121 Capacitive Touch Sensor Controller
- SparkFun Breakout Board
- PWM sound generation
- VIDEO
The OpenPipe Breakout

- MPR121 works great! (low latency, continuous sensing, easy, ...)
- We would like to learn Eagle PCB, assembly process, etc., from a DIY approach
- SMD homemade soldering (toaster reflow station)
- RESULT: The OpenPipe Breakout Board layout works!
The OpenPipe Breakout
OpenPipe Breakout & Arduino PWM sound

- WaveTable Synthesis 44100 Hz @ 8bit
- Additive Synthesis (more later...)
- PROS: Easy setup
- CONS: “Low” sound quality
- VIDEO, VIDEO with RC LPF
OpenPipe Breakout & Arduino Audio Codec Shield

- PWM sound is not amazing :(
- How to improve sound quality? Audio Codec
- OpenMusicLabs Wolfson WM8731 Shield
- PROS: Improved sound quality
- CONS: Still “short” samples

VIDEO
OpenPipe Breakout & Arduino Music Instrument Shield

- Arduino based samples too short
- How to improve sound quality? MIDI Synthesis
- Sparkfun Music Instrument Shield (VS1053)
- PROS: Simple Arduino code, multiple instruments
- CONS: Still “low” bagpipes sound quality
- VIDEO
OpenPipe Breakout & MIDI output

- How to improve sound quality? Connecting to a “computer”
- Arduino & MIDI choices:
  - Arduino MIDI Shield
  - Serial to MIDI conversion
  - MIDI over USB
    - Tweaking Arduino
  - OpenPipe USB-MIDI Shield !!!
    - LUFA, OpenMoko USB ID, DFU, HW compatible
- Compatible with iOS & Android !!!
- VIDEO, VIDEO
The APPS

- Synthesizers
  - GarageBand (Mac), FluidSynth (Lin,Win,Mac), any MIDI synth.
  - Keyboard Sounds (Android) & bs-16i (iOS)
  - UPiper (Mac, Win, iOS)
  - bs-16i with Bagpipes SoundFonts
  - Latency, Jailbreak and Lightning issues
- WIP Custom xplatform desktop app ( FluidSynth + RTMidi + QT)
- WIP Custom mobile app (FluidSynth for iOS and Android)
OpenSource Bagpipes Samples

- We need good sound samples for feeding hungry Synthesizers
- Good samples are expensive or require hard studio work
- Let's take a simpler approach and see what happens...
- FFT for partial power measurement of medium-quality recorded samples
- Additive Synthesis for virtual sample generation
- Python powered
The OpenPipe ONE

- Everything inside the pipe
- AT90USB1286 (128K FLASH, 8K RAM)
- MPR121 Capacitive Sensor Controller
- MICRO USB
- I2C & ADC expansion
- Haptic feedback
The OpenPipe future

- Several OpenPipe Breakouts all over the world
- Some early contributors
- Some people interested in musical aspects
- Some people interested in educational aspects
- More Arduino shields (integrated RAM or FLASH?)
- OpenPipe ONE Work In Progress
  - Currently beta-testing
  - Planning first production
- OpenPipe Apps for desktop & mobile
- OpenPipe TWO?
Thanks & Happy OpenPiping!!!