BeagleBone Cookbook Webinar Series
Recipe #1 – Playing and Recording Audio

October 27, 2015
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BeagleBone Black
Ready to explore and use in minutes

Truly flexible open hardware and software development platform

All you need is in the box

Proven ecosystem from prototype to product

BeagleBone Black – the most flexible solution in open-source computing

• Ready to use
  • USB client network
  • Built-in tutorials
  • Browser based IDE
  • Flashed w/Debian
• Fast and flexible
  • 1-GHz Sitara ARM
  • 2x200-MHz PRUs
  • 512-MB DDR3
  • On-board HDMI
  • 65 digital I/O
  • 7 analog inputs
• Support for numerous Cape plug-in boards

http://beagleboneuces.com

~$50
BeagleBone Black board features

10/100 Ethernet
USB Host
Easily connects to almost any everyday device such as mouse or keyboard
microHDMI
Connect directly to monitors and TVs
microSD
Expansion slot for additional storage
512MB DDR3
Faster, lower power RAM for enhanced user-friendly experience

Boot Button
Serial Debug
DC Power

Expansion headers
Enable cape hardware and include:
- 65 digital I/O
- 7 analog
- 4 serial
- 2 SPI
- 2 I2C
- 8 PWMs
- 4 timers
- And much much more!

1-GHz Sitara AM335x ARM® Cortex™-A8 processor
Provides a more advanced user interface and up to 150% better performance than ARM11

Compatible with Debian Linux Distribution
8-bit bus accelerates performance
Frees the microSD slot to be used for additional storage for a less expensive solution than SD cards

Money saving extras:
- Power over USB
- Included USB cable
- 4-GB on-board storage
- 4-GB on-board storage using eMMC

Development interface and directly powers board from PC

Power Button
LEDS
Reset Button
USB Client

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Power Button
LEDS
Reset Button
USB Client
Simple browser-based interactions

http://beagleboard.github.io/bone101
Cloud9 IDE hosted locally
Zero install and exposes command-line

```javascript
var b = require('bonescript');
var leds = ['USR0', 'USR1', 'USR2', 'USR3', 'P0_14'];
for(var i in leds) {
    b.pinMode(leds[i], b.OUTPUT);
}

var state = b.LOW;
for(var i in leds) {
    b.digitalWrite(leds[i], state);
}

setInterval(toggle, 1000);
function toggle() {
    if(state === b.LOW) state = b.HIGH;
    else state = b.LOW;
    for(var i in leds) {
        b.digitalWrite(leds[i], state);
    }
}
```
10,000s of developers building connected devices today

- Medical analysis, assistance and information management
- Home information, automation and security systems
- Home and mobile entertainment and educational systems
- New types of communications systems
- Personal robotic devices for cleaning, upkeep and manufacturing
- Remote presence and monitoring
- Automotive information management and control systems
- Personal environmental exploration and monitoring
BeagleBone Cookbook
http://beagleboard.org/cookbook

- 99 recipes covering
  - Basics
  - Sensors
  - Displays and outputs
  - Motors
  - Internet of things
  - Kernel
  - Real-time I/O
  - Capes
Possible audio solutions

- Built-in HDMI audio
  - connect to TV or HDMI-audio adapter
- Audio cape
  - SPI, I²S and I²C available
- USB Bluetooth dongles
  - BlueZ → https://wiki.debian.org/Bluetooth/Alsa
- USB audio adapter ← this will be our approach
  - Easy to find adapters on Amazon, etc.
Step #0 – Prerequisites

• Connect to the board per recipe 1.2
  – http://beagleboard.org/getting-started

• Verify the software image per recipe 1.3 and potentially updating per recipe 1.9
  – http://beagleboard.org/latest-images
Step #1 – Boot with USB audio adapter

- Power up with USB audio adapter inserted
  - Some kernels don’t like USB hotplugging
  - USB power typically sufficient, but add a power adapter if you see issues

- Verify driver loaded
  - lsusb
  - dmesg
Step #2 – Test playback

• Discover devices
  – man aplay
  – aplay -l
  – aplay -L

• Playback samples
  – aplay -D "default:CARD=Device" /usr/share/sounds/alsa/Front_Center.wav
Step #3 – Test record

• Use the mixer to set the input gain
  – alsamixer

• Record a sample
  – man arecord
  – arecord -f dat -D "default:CARD=Device" test.wav
Step #4 – Set default audio

- Write to ~/.asoundrc
- Enables you to use applications without specifying the card each time
- Example requires `apt-get install flite`
  - flite -t "Hello!"

```plaintext
pcm.!default {
    type plug
    slave {
        pcm "hw:1,0"
    }
}
ctl.!default {
    type hw
    card 1
}
```
More about ALSA
Advanced Linux Sound Architecture - [http://alsa-project.org](http://alsa-project.org)

- Includes user space library for application programming
- Supports many devices
- ALSA SoC supports adding codecs to embedded boards
More

• Nice set of tutorials from 13-year old Alek Mabry
  – http://einsteiniumstudios.com/speak.html
• Shortcuts to updates and examples from the book
  – http://beagleboard.org/cookbook