Embedded Linux Conference 2017: Beagle BoF

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Beagle BoF outline

• ELC tomorrow: talks and showcase
• BeagleBone OSHW ecosystem
• New: BB Wireless, BB Blue, BB X15
• Debian images
• Debian 9 ("Stretch") planning
• U-Boot Overlays
• Development resources
ELC 2017: tomorrow!

- **ELC Technical Showcase**
  - BeagleBoard X15 & BeagleBone Blue
  - Wednesday, February 22, 5:10 pm - 7:00 pm
- **Educational Robotics Critical for the Future of Linux**
  - Jason Kridner, Texas Instruments
  - Wednesday, February 22 • 10:30am - 11:20am
- **Google Summer of Code and BeagleBoard.org**
  - Drew Fustini, BeagleBoard.org Foundation
  - Wednesday, February 22 • 11:30am - 12:20pm
### Open Source Hardware

#### BeagleBone derivatives

<table>
<thead>
<tr>
<th></th>
<th>Capes</th>
<th>HDMI</th>
<th>Flash</th>
<th>Special</th>
</tr>
</thead>
<tbody>
<tr>
<td>BeagleBoard.org BeagleBone</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>JTAG</td>
</tr>
<tr>
<td>BeagleBoard.org BeagleBone Black</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Arrow BeagleBone Black Industrial</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Industrial</td>
</tr>
<tr>
<td>Element14 BeagleBone Black Industrial</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Industrial</td>
</tr>
<tr>
<td>SeeedStudio BeagleBone Green</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Grove</td>
</tr>
<tr>
<td>SanCloud BeagleBone Enhanced</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>1GB, 1Gbit, wireless</td>
</tr>
<tr>
<td>BeagleBoard.org BeagleBone Blue</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Robotics</td>
</tr>
<tr>
<td>BeagleBoard.org BeagleBoard-X15</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Big jump in CPUs and I/O</td>
</tr>
</tbody>
</table>
BeagleBone Black Wireless

- WiFi 802.11b/g/n and Bluetooth 4.1 with BLE
- 1st Beagle with Octavo System-in-Package (SiP)
- Designed in EAGLE (BBB was OrCad/Allegro)
BeagleBoard.org BeagleBoard-X15
Jason Kridner

<table>
<thead>
<tr>
<th>What is demonstrated</th>
<th>What was improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open hardware computer</td>
<td>Fastest BeagleBoard available</td>
</tr>
<tr>
<td>Debian Linux system</td>
<td>More cores and more types of cores</td>
</tr>
<tr>
<td>Open source 2D graphics acceleration</td>
<td>Lots more I/O capability and bandwidth</td>
</tr>
<tr>
<td>Video acceleration</td>
<td>More RAM (2GB)</td>
</tr>
<tr>
<td>OpenCL C66 DSP support</td>
<td>Great open hardware ARM build platform</td>
</tr>
<tr>
<td>Mainline kernel support</td>
<td></td>
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<tr>
<td>GCC compiler support</td>
<td></td>
</tr>
<tr>
<td>✓ ARM Cortex-A15</td>
<td></td>
</tr>
<tr>
<td>✓ ARM Cortex-M4</td>
<td></td>
</tr>
<tr>
<td>✓ TI C66x</td>
<td></td>
</tr>
<tr>
<td>✓ TI PRU</td>
<td></td>
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</tbody>
</table>

Hardware Information  https://bbb.io/x15
Dual-core ARM Cortex-A15, dual C66x DSPs, quad programmable real-time units, 3×USB 3.0, PCIe, 2×gigE, 2GB RAM, 4GB eMMC flash, ...

Source code or detail technical information availability
https://github.com/beagleboard/beagleboard-x15
https://github.com/beagleboard/linux
https://github.com/beagleboard/image-builder
Debian images

- BeagleBoard.org Latest Firmware Images
  - 2016-11-06: Debian 8.6 ("Jessie")

- Debian Image Testing Snapshots
  - 2017-02-12
    - Machinekit
    - Jessie Snapshot LXQT (full desktop)
    - Jessie Snapshot IoT (smaller size)
    - Jessie Snapshot console (minimum size)
    - Stretch testing (the future!)
Debian 9 ("Stretch")

- root: password <blank> -> password "root"
- root: ssh access -> ssh access disabled
- debian: sudo doesn't ask for password -> sudo asks
- Device-tree-compiler: our v1.4.2-fork -> dtc git mainline
- Kernel: v4.4.x-ti/v4.9.x-ti
- U-boot: v2017.03+ with device tree overlays.
- U-Boot overlays by default with cape-universal overlay applied
U-Boot Overlays

- U-Boot now has Device Tree Overlay support
  - debian testing: 2017-01-03 (U-Boot Cape Manager edition)
- U-Boot Overlays is currently under development, while the items below may work on "last weeks" version
- Please report bugs to: beagleboard/bb.org-overlays/issues
  - Always double check the version you are using for comparison.
U-Boot Overlays

- **Migration Guide: U-Boot Overlays**
- **U-Boot /boot/uEnv.txt configuration**
  - enable_uboot_overlays=1
- **U-Boot Disable onboard devices**
  - Disable eMMC: disable_uboot_overlay_emmc=1
  - Disable HDMI VIDEO & AUDIO:
    disable_uboot_overlay_video=1
  - Disable HDMI AUDIO: disable_uboot_overlay_audio=1
  - Disable WL1835: disable_uboot_overlay_wireless=1
U-Boot Overlays

• U-Boot Override external capes
  – Cape device tree overlays: `beagleboard/bb.org-overlays`
  – `uboot_overlay_addr0=/lib/firmware/<file0>.dtbo`
  – `uboot_overlay_addr1=/lib/firmware/<file1>.dtbo`
  – `uboot_overlay_addr2=/lib/firmware/<file2>.dtbo`
  – `uboot_overlay_addr3=/lib/firmware/<file3>.dtbo`
  – Plus one custom cape: `dtb_overlay=/lib/firmware/<file4>.dtbo`

• U-Boot Cape Universal
  – Utilize `beaglebone-universal-io config-pin`
  – Enable in `/boot/uEnv.txt`: `enable_uboot_cape_cape_universal=1`
U-Boot Overlays

• U-Boot overlay white list will continue to grow
  – 0002-U-Boot-BeagleBone-Cape-Manager.patch

• If you have a cape, please test, and let's make sure everyone has a good out of box experience!
Development resources

- Mailing lists: bbb.io/discuss
- IRC: bbb.io/chat
- Kernel build:
  - RobertCNelson/ti-linux-kernel-dev
- Kernel repo:
  - beagleboard/linux
- DTB Rebuilder
  - RobertCNelson/dtb-rebuilder
- Device Tree Overlays for bb.org boards
  - beagleboard/bb.org-overlays