SFO15-100: 96Boards & the course upstream

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Event
SFO15
Agenda

● 96Boards program status
● Hardware ecosystem
● How Linaro is helping to achieve better upstream coverage both in software code and documentation
● Summary
96Board Program Status

- Infrastructure setup for 96Boards
  - Website: https://www.96boards.org/
  - Source code stored at github: https://github.com/96boards/
  - 96Boards Bugs: https://bugs.96boards.org/
  - Forums: https://www.96boards.org/forums/
  - In the news: https://www.96boards.org/hub/
  - Snapshots and Releases: http://builds.96boards.org/
  - Blog (coming soon)
Agenda

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Shipping 96Boards

HiKey

DragonBoard 410c
96Boards in Development

- **Actions Semi Bubblegum96**
  - Prototypes available now
  - BSP in development by Actions Semi
- **Freescale i.MX6 Board (Arrow)**
  - Expected in Q4
- **AMD EE Board**
  - Prototypes soon
- **Others in Development**
96Boards Mezzanine Boards

- Currently 3 boards are at some level of design or production
  - 96Boards UART Mezzanine
  - 96Boards SENSORS Mezzanine
  - 96Boards Grove Stackable Adapter Mezzanine
- We are looking to work with partners on others
  - 96Boards display (and camera?) module
UART Mezzanine Board

- In general availability today
- Very small size (1.4” x 0.5”)
- I/O Spec:
  - Attaches to 96Boards low-speed (LS) expansion connector
  - FT230X USB to UART adapter chip
  - USB bus powered - Connection is maintained when the baseboard power is cycled
  - Switchable between LS UART0 and UART1. (UART1 is the default console)
  - CTS/RTS with using UART0
  - TX and RX LEDs
  - Remote control of baseboard reset and power signals
  - Baseboard reset button
  - User LED connected to GPIOB (GPIOA on v1.0 of the adapter)
Sensors Mezzanine Board

- In limited availability today
- 96Boards CE footprint
- For CE and EE 96Boards

I/O Spec:
- Arduino Uno compatible
- UART interface between 96Boards and ATMEGA328
- UART interface for 96Boards console serial port to microUSB using FTDI FT230

ATMEGA328:
- 1 x UART
- 6 x GPIO
- 1 x ADC
- 2 x I2C (same bus)

96Boards:
- 2 x GPIO
- 2 x I2C (separate buses)

LEDs:
- Power
- Reset
- 4 from 96Boards GPIO
- 1 from ATMEGA328 GPIO
Grove Mezzanine Board

- In design
- 96Boards CE footprint
- I/O Spec:
  - Level shifters for 3.3V and 5V IO
  - Two voltage domains for mixed 3.3V and 5V IO, VIOA and VIOB
    - 2 physical switches to select IO voltage for each domain
  - LEDs
    - 5V Power
    - 3.3V Power
    - GPIOB (User controlled)
  - Stackable on the 96boards LS Connector
    - 2x20 2mm pin header on bottom side
    - 2x20 2mm socket strip on top side for stackable connections
  - Connectors
    - 17 SeeedStudio Grove Connectors
      - 3x I2C0
      - 3x I2C1
      - 10x GPIO
      - 1x UART0
    - 2x5 0.1” pitch right-angle header for I2C0, GPIO A-D and UART0 IO on VIOA domain
    - 2x7 0.1” pitch right-angle header for I2C1, GPIO E-L and UART1 IO on VIOB domain
    - 2x3 0.1” pitch right-angle header for SPI0 on VIOB domain
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● **DragonBoard 410c**
  ○ Schematics
  ○ Hardware Manual
  ○ Snapdragon 410 Device Specification
  ○ Snapdragon 410 GPIO Pin Assignment
  ○ Snapdragon 410 Hardware Register Description
  ○ download from [https://www.96boards.org/products/ce/dragonboard410c/](https://www.96boards.org/products/ce/dragonboard410c/)

● **HiKey**
  ○ Schematics
  ○ Hardware Manual
  ○ HI6220 Reference Manual
  ○ download from [https://www.96boards.org/products/ce/hikey/](https://www.96boards.org/products/ce/hikey/)
HiKey and Upstream

- BootLoaders
  - Deprecating proprietary fastboot bootloader
  - Current work in Linaro is on ARM TF + UEFI
    - nothing currently upstream for ARM TF or UEFI
    - planning for upstream starts at SFO15
  - Community has provided a U-Boot port (Peter Griffin)
    - Initial work in upstream U-Boot
    - New changes sent to mailing list
    - TODO: switch port to device tree for configuration
      - need better upstream DTB support in kernel first
HiKey and Upstream

- **Kernel**
  - Current best enabled tree is v3.18 on GitHub
  - v4.1
    - eMMC and microSD drivers merged, lacking proper DTS support
  - v4.2
    - minimum system, clock, UART0, GPIO/Pinmux merged
    - DTS for minimum system merged (hi6220-hikey.dts)
    - thermal support, CPUFreq drivers merged
    - with out of tree DTS, we can enable
      - reset, cpuidle, cpu hotplug (PSCI features)
HiKey and Upstream

- Kernel
  - v4.3
    - stub clock which uses mailbox features to trigger MCU to control dynamic frequencies including CPU/GPU/DDR
  - meeting held in Shenzhen last month
    - goal: to plan next steps in upstreaming kernel
    - outcome: larger set of resources committed to speed upstream submissions
  - v4.4 plans
    - plan to send v1 of all patchsets before end of October
    - CI jobs to test topic branches to be set up
HiKey and Upstream

- **Kernel**
  - v4.4 targeted subsystems
    - PMIC/regulator
    - SCTRL config (for MMC controller reset)
    - I2C, microSD high speed support, coresight support, DRM
    - bluetooth (DTS change only)
    - mailbox (already at v3 of patchset)
HiKey and Upstream

- **Kernel**
  - issues
    - SMMU/Ion enablement - changes to ARM IP
      - will need to work with community to merge with ARM support
    - ADV7533 - working with vendor on HDMI bridge changes
      - code shared with Dragonboard 410c
    - TI WIFI module - just got this working at mainline
      - changes need to be upstreamed
    - USB OTG - reuse dwc2 driver
      - PHY driver doesn’t support OTG, being worked on
      - USB host support pending
    - No audio support yet
HiKey and Upstream

- **Other software**
  - OPTEE port available for HiKey -- fully upstream
  - Real time port (Xenomai) being worked on
  - Port of EAS being done in premium services
    - learning exercise for development of training material
  - JTAG/OpenOCD are functional on the HiKey
    - community project
  - Docker now working on HiKey (Geoff Levand)
DragonBoard 410c and Upstream

- **Bootloaders**
  - first stage bootloaders are proprietary
  - uses open source bootloader (LK) starting at EL1
  - no known plans to port other bootloaders at this time
    - ARM TF would require proprietary firmware updates

- **Kernel**
  - kernel is basically mainline + some patches
  - Qualcomm and the LT have worked very hard at upstreaming
  - v4.0
    - Display: merged YUV/NV12 plane support in KMS
DragonBoard 410c and Upstream

- **Kernel**
  - v4.1
    - Basic support allowing mainline to boot on board
      - UART console, eMMC, DTS, clocks, GPIO, I2S, I2C
      - DRM: Support for Adreno 306 (GPU)
  - v4.2
    - PMIC regulators
    - Display: initial DSI support
    - Audio: ASOC APQ8016 sound card support
    - Removal of 11,000 lines of legacy MSM code
    - restart device node
    - PMIC GPIO and multipurpose pins (MPP)
DragonBoard 410c and Upstream

- **Kernel**
  - v4.3-rc1
    - SD card support
    - USB
    - LEDS
    - Display: full DSI support for most common resolutions
    - Qualcomm shared memory driver / IPC
    - RPM support over SMD
      - RPM is Cortex M companion for power management
    - RPM regulators
    - QFPROM support with new NVMEM framework
DragonBoard 410c and Upstream

- **Kernel**
  - features in discussion on the mailing list, expect upstream soon
    - Display: HDMI display support for all resolutions and HPD
    - USB host/OTG
    - CPUFreq: up to 1.2 GHz (full speed), with A53 clock driver and Adaptive voltage scaling
    - thermal sensors + cooling (cpu throttling)
    - high speed UART (3Mbps using DMA)
    - RPM clocks
    - remoteproc/PIL: firmware loader for Qualcomm peripherals
  - DSP, multimedia, WIFI
Kernel issues
- lack of PSCI support in mainline - only 1xA53 boots
- lack of A53 clock driver: 1xA53 @ 300MHz
- lack of Secure S-MMU support
  - multimedia and GPU require custom IOMMU driver
  - need updated TZ firmware to use upstream S-MMU driver
- ADV7533 support not upstream
- todo -- need rewrite or clean up to submit
  - V4L2 hardware codec support
    - 1080p video playback with GStreamer + V4L2 + GPU enabled
  - WLAN/BT using WCN36xx driver
DragonBoard 410c and Upstream

- **Kernel**
  - no plans at this time
    - camera: no CSI support, discussed but no firm plans for support
    - camera: no ISP support, no plans at all
    - GPS: no support
      - only supported in Android
      - under discussion on how to support in Linux
    - audio: no analogue audio support

- **Graphics**
  - GPU supported by FreeDreno and Mesa
  - All support fully upstream
96Boards GPIO support and Upstream

- Two software shared libraries known to work with 96Boards GPIO and other I/O
  - **96BoardsGPIO** - LGPL v2.1 license
    - prototype shared library that unifies GPIO access across all 96Boards, no interrupt support currently
      - Author works for Linaro
      - Has Python bindings, need to add Java, Perl, etc
  - **libsoc** - LGPL v2.1 license
    - shared library has been around for 2 years, works with 96Boards but does not unify GPIO access (yet), has interrupt support
      - Author has agreed to take patches to add 96Boards unification
        - Initial test looks very positive
      - Bindings will need to be added for Python, Java, Perl, etc
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- Hardware ecosystem
  - Two boards available, 2 more announced
  - Several more on the way
  - UART mezzanine board solved expensive serial cable problem
    - standardizes default debug serial port
  - New Arduino + Grove SENSORS mezzanine board
    - 96Board is host, Arduino connected via mezzanine connectors
      - use Grove sensors with 96Board or Arduino
  - schematics for all 96Boards available
  - schematics for UART mezzanine will be available
  - schematics for SENSORS mezzanine will be available
Summary

- Software ecosystem
  - should see significant code for released boards in upstream kernel by end of year
  - HiKey has end-to-end open source software support
    - bootloader, kernel
    - all except GPU - MALI still proprietary source
  - DragonBoard 410c is mostly open source
    - parts of boot path proprietary
    - LK, kernel open source
    - GPU is supported by open source!
  - Board and SoC documentation available
Summary

● Comments/Thoughts
  ○ What do you think so far?
● Mezzanine Boards you think are needed?
  ○ Who wants them?
● Questions?