

Presented by

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Date

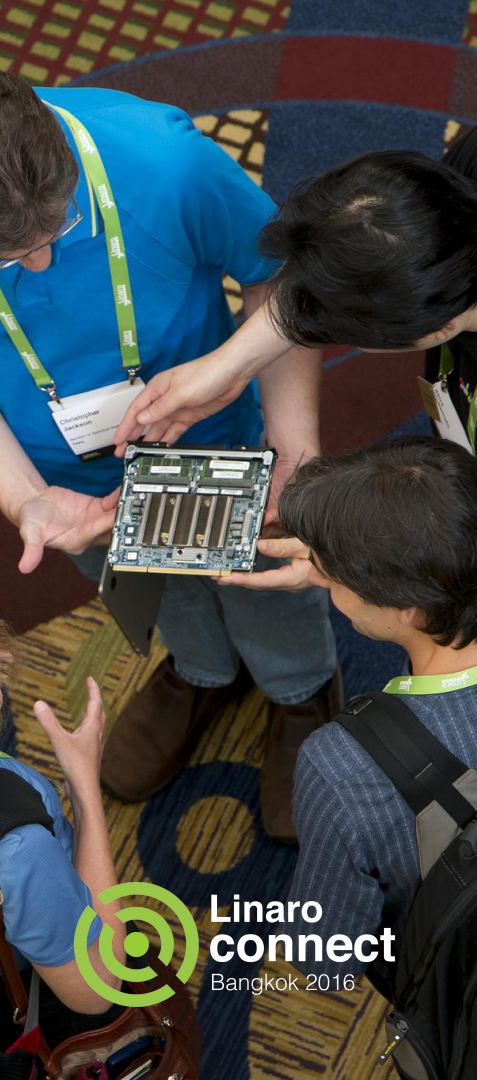
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Event

Linaro Connect BKK16

96Boards - TV Platform

Developing the Specification



Overview

- Motivation for a TV Platform Specification
- Comparison with CE Spec
- TV Platform requirements
 - Alignment with EE Specification
 - Hardware
- Variances from EE Spec
- TV Platform Board Layout
- Software Requirements
- Additional Considerations

Motivation for TV Platform Specification

- The goal is to define a readily available, low cost TV Platform that can accommodate a range of functionality and designs ranging from Home Gateways to OTT Streaming boxes to TV boards that meet the needs of developers
- Target mid- to high-market segments
 - Low cost for community acceptance:
 - < \$50 for mid-range board
 - < \$99 for high-end board
- The requirements of a low cost development platform targeted at embedded Set-top box and TV markets were not satisfied by the current 96Boards Consumer Edition (CE) and Enterprise Edition (EE) specifications

Comparison with 96Boards CE spec

- The 96Boards CE specification contained many of the desired media capabilities and peripherals, however:
 - Issues for some non-mobile SoCs with the MIPI DSI/CSI signals on the High Speed connector
 - Some set-top SoCs do not provide these mobile signals
 - Preferred to have a dedicated Ethernet port (RJ45) and UART on board
 - Ultra-small low-profile “card” form factor (85mm x 54mm) too small for a general set-top with a full complement of media connectors
 - The CE extended form factor option has some layout challenges due to the position of the low-speed expansion connector in the middle of the board

TV Platform Requirements

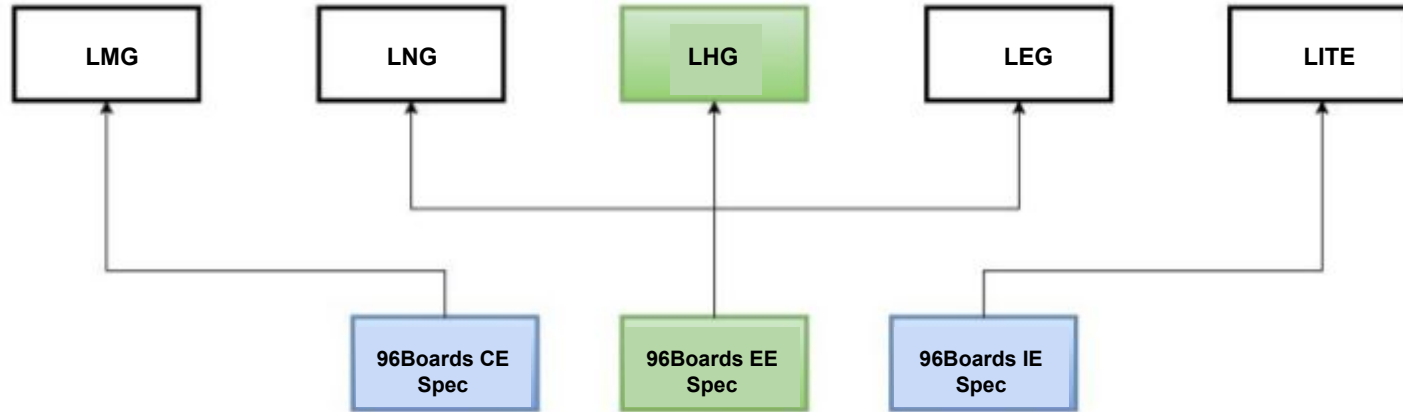
- Some popular boards used for comparison were the RPi2, Cubie4, nVidia ADT, as well as a reference board from STMicro B2120
 - Employed as references to initiate the requirements collection
 - Served as a basis for the initial specification
- No requirement to make the TV platform board a ‘product’; it is a development platform
- The TV Platform board can be based on either 32- or 64-bit SoC platforms
- More important to have a flexible platform to address different designs and market segments
- Worked with the LHG Steering Committee members to take initial requirements back to their hardware teams and provide feedback
 - Determined which features were mandatory and which were optional

TV Platform Requirements - EE Alignment

- After review of the requirements, it was decided the 96BoardsTV Platform specification will adopt the EE specification as a baseline
 - The EE board has the required flexibility to accommodate the range of solutions for the TV platform
 - Deliberately more flexible and can provide ample space for the SoC and supporting components
- The I/O is flexible and can fit any STB requirements
- Aligning with the EE specification prevented fragmentation of the 96Boards core specifications
- After a few revisions, the first draft of the TV Platform specification was created (Dec. 2015)

96Boards TV Platform - EE Alignment

- The EE specification is a common baseline for multiple segment groups
- For TV platform supports all the mandatory EE specification requirements, with a few modifications or exemptions
- The TV Platform specification is owned by the 96Boards team



TV Platform Hardware Requirements

- Hardware (1 of 2)

Board Form Factor	160mm x 120mm	EE Standard Form Factor
RAM	Min. 1 GB; 2GB recommended	
Flash	Min. 8 GB	eMMC memory
WiFi	min. 802.11 g/n; 802.11ac recommended	min. @ 2.4 GHz
Bluetooth LE (optional)	If provided, min. BLE 4.0	optional

TV Platform Hardware Requirements

- Hardware (2 of 2)

Output Display: min. one HDMI output	Min. HDMI 1.4; HDMI 2.0 rec. Min. HDCP 2.0; HDCP 2.2 rec.	Recommended settings are for 4k video with > 30 fps; Layout location specified.
Input HDMI (Optional)	Same as above	For TV Boards
Optional Video	Composite, Component, S-Video	Not expecting older analog peripherals to be used
Ethernet	RJ45 System Ethernet Port	Recommended \geq 100 Mbps
Audio	Mandatory: HDMI Audio Optional: Stereo I/O, S/PDIF	
Low Speed Connector (40-pin low profile)	Mandatory: location specified in EE spec	

TV Platform Options

- Additional functionality options
 - The TV platform specification is flexible and allows the board maker to add a variety of peripherals

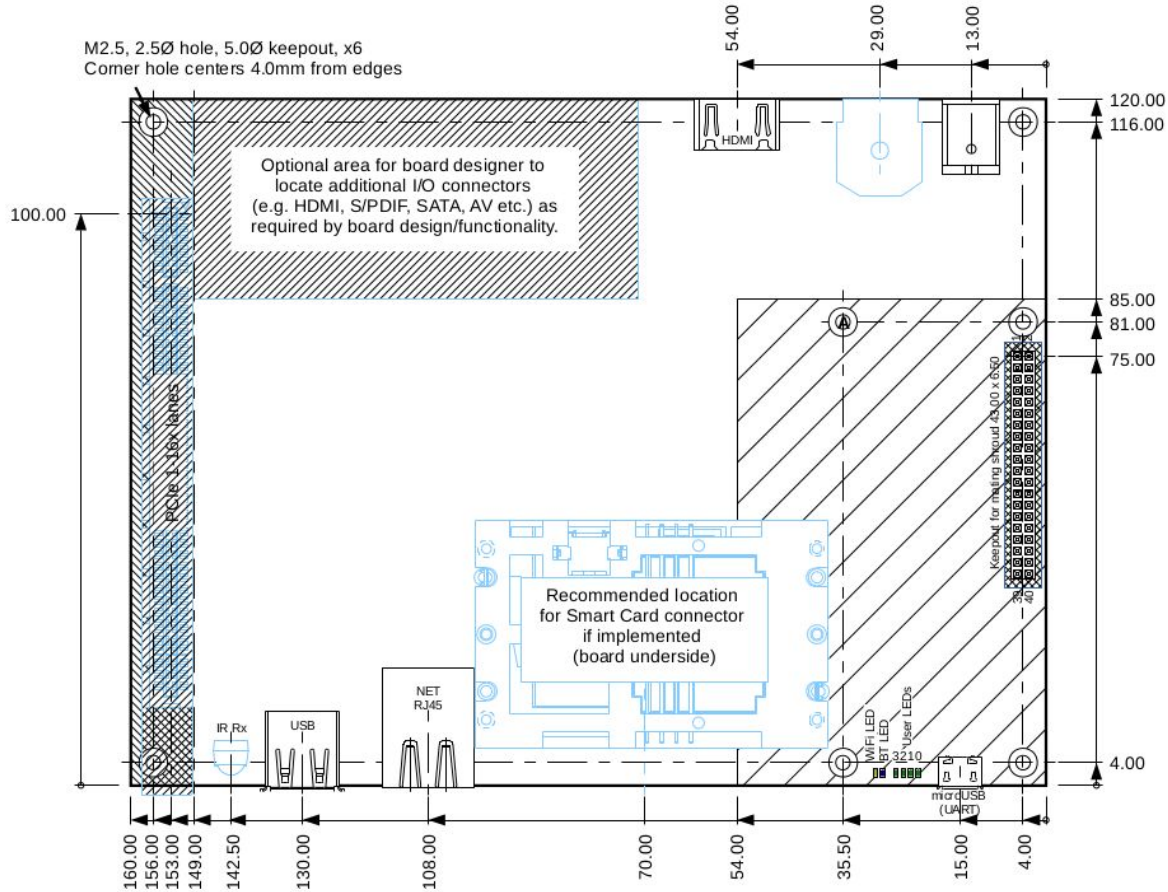
User Input	Optional: Infrared (IR) detector	Place at front of board for line of sight operation. More advanced implementations may use RF4CE remote controls
Security Interfaces	Optional: SmartCard I/F	ISO/IEC 7816 compliant
Transport Stream I/F	Optional: Parallel Connector	Interface to tuner card (e.g., ATSC/DVB)

Variations from the EE specification

- The following variations are permitted for the TV Platform specification:

Power Connection	The EE specification requires 2 power connectors: A TV platform version may omit the high power 4 pin DIN (up to 180 W) connector if the board design is such that a maximum of 90W will be drawn from the barrel jack connector. The barrel jack connector shall always be implemented.	Additional power may be required if PCIe is implemented.
Boot ROM	The EE specification requires a minimum of 64MB of bootable flash memory. The TV Platform specification requires a minimum of 8GB of flash storage. If this storage is bootable then the EE specification is met. If the TV platform board designer wishes to implement a separate boot ROM then the size is at the discretion of the designer, and may be less than 64MB whether or not the flash storage is bootable.	In considering the boot ROM size requirements, designers should note that a separate boot ROM may be used for SoC-dependent binary code blobs as well as the boot software itself.
Ethernet	The location of the RJ45 Connector is recommended to be at the front of the board.	May place at back of board.

TV Platform Board Layout



Software Requirements

- Kernel
 - Based on one of the following that can be built from source code and required binary blobs:
 - kernel.org latest “mainline” or “stable” kernel
 - Latest Google-supported Android kernel version
 - One of the latest two kernel.org LTS kernels (e.g., Linaro LSK)
- Operating System
 - Latest released (stable) version of one or more open source distributions for a 96Boards TV Platform design
 - Android, Debian, Ubuntu, Fedora, Red Hat
 - Linaro or vendor supported Linux using OE/Yocto

Software Requirements

- LHG uses Open Embedded / Yocto build system
- Boot architecture (at least one open source implementation available)
 - Support for vendor or open source bootloader (UBoot/FDT, UEFI/ACPI, UEFI/FDT)
 - Support for secure execution environment (strongly recommended)
 - Unlocked bootloader for OP-TEE
 - Support for ARM Trusted Firmware (for ARMv8), including PSCI APIs (optional)
- Accelerated graphics support
 - Graphics drivers need to be fully supported with either open source code or through royalty free binary drivers
 - Vendor will provide updated binary drivers/libraries to support new mainline kernel features

Additional Considerations

- ARM Trusted Firmware and OP-TEE
 - In order to implement support for ARM TF and/or an open source trusted execution environment, such as OPTEE, mechanisms are required to allow modifications to the bootloader.
- Automated Testing
 - The board can be automatically powered up; i.e., the board can be power cycled easily and return to the bootloader stage without manual intervention
 - Network boot capability from BL provided via NFS (e.g., UBoot implementation that supports network boot capability is desirable)
- ARM GPU
 - LHG uses Wayland-Weston with DRM/KMS and dma-buf extensions
 - ARM Mali GPU libraries support this in Midgard, ARM's Mali-T600 and T-700 family GPUs
 - Older ARM Mali libraries 400/450 (Utgard family) require additional support from ARM for these features

Additional Considerations

- Grouping of Connectors
 - Most set-top boxes have all network, media connectors grouped on the back of the box
 - The front of the box usually has USB connector(s) for user access with USB sticks for photos and/or videos
 - Any user input devices requiring line of sight communications are also on the front
- User Access
 - Frequently accessed switches, buttons, connectors are easily accessible
- Power Management
 - In order to monitor power usage of the SoC, the ability to connect external probes to the board for power measurements is desirable

Thank you!

Please visit: <https://wiki.linaro.org/LHG>

and <https://www.96boards.org/>