96Boards Mezzanine Ecosystem

Robert Wolff - 96Boards Community Manager
Manivannan Sadhasivam - Applications Engineer

Linaro
connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Outline

- Mezzanine overview - Status update
  - New Guidelines
- Community Mezzanine Initiative
- The Common Misconception
- Contributors
- Current Templates
- Open Pipeline
- Some Output
- Handling future mezzanine

Linaro
connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Mezzanine - Status update

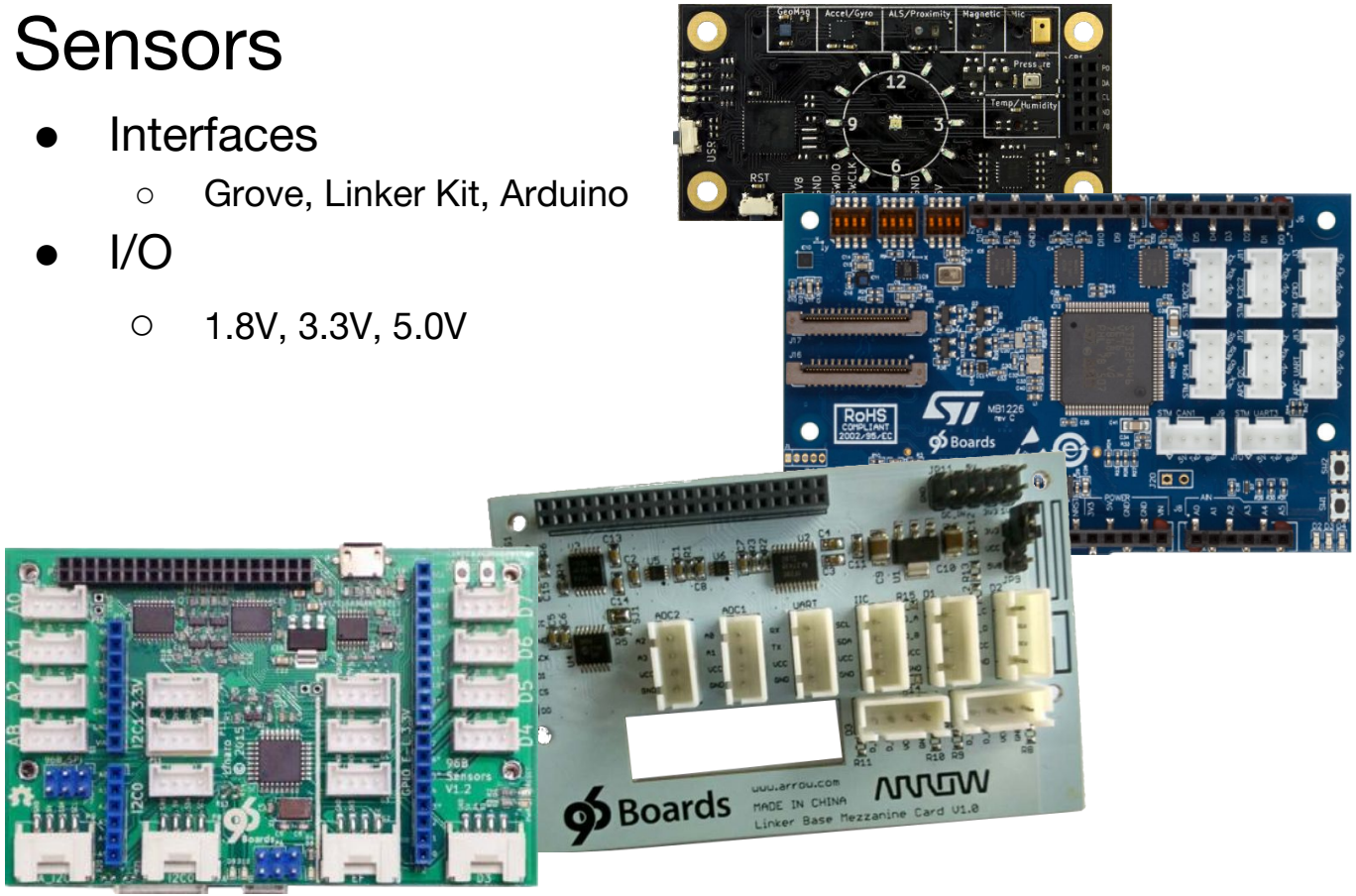
Guidelines: https://96boards.org/products/mezzanine/

Linaro connect
San Francisco 2017

ENGINEERS AND DEVICES WORKING TOGETHER

Sensors

- Interfaces
  - Grove, Linker Kit, Arduino
- I/O
  - 1.8V, 3.3V, 5.0V

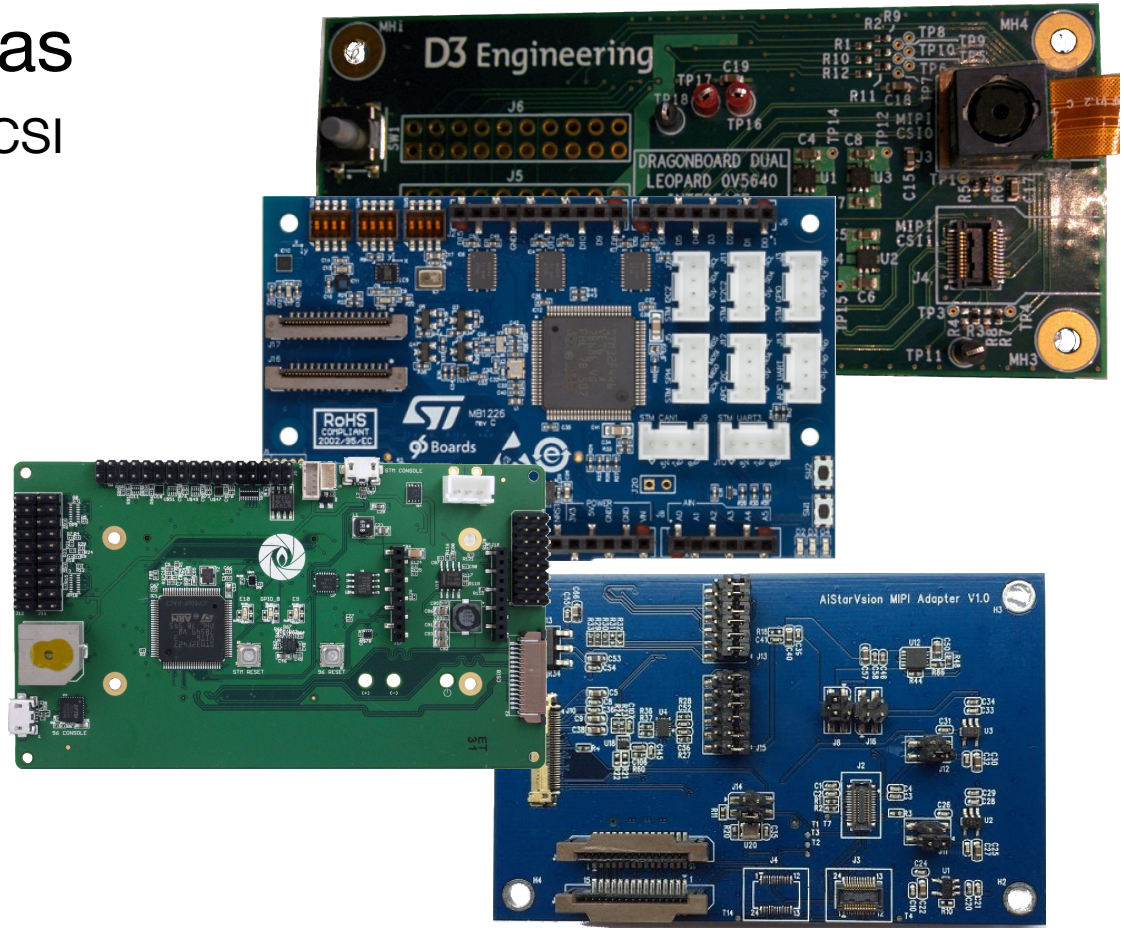


Linaro connect
San Francisco 2017

ENGINEERS AND DEVICES WORKING TOGETHER

Cameras

- MIPI-CSI



Linaro connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Displays

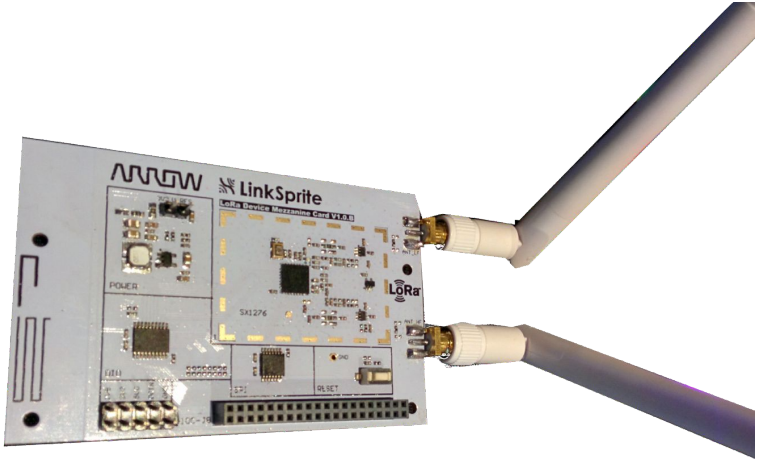
- HDMI
- MIPI-DSI

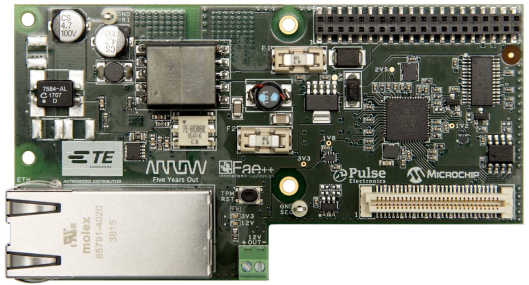
Linaro connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Connectivity

- LoRA
- Ethernet



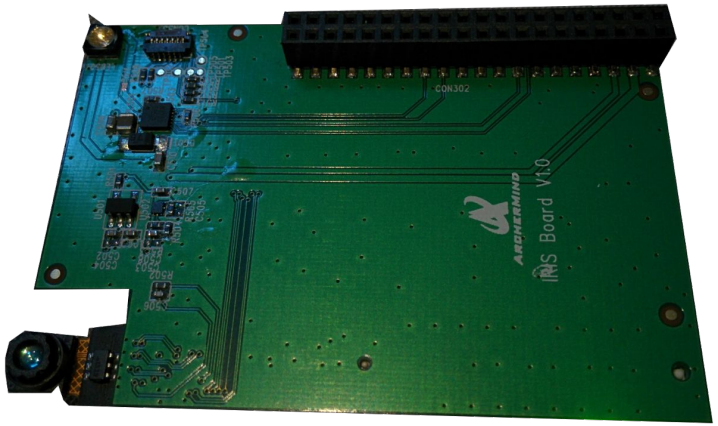


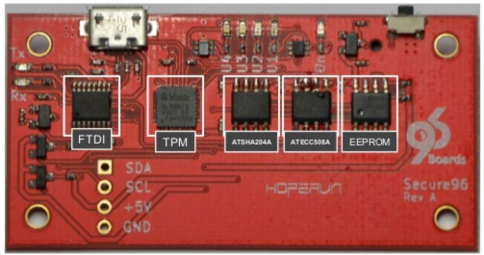
Linaro connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Security

- Retina + Fingerprint scanner
- Secure96



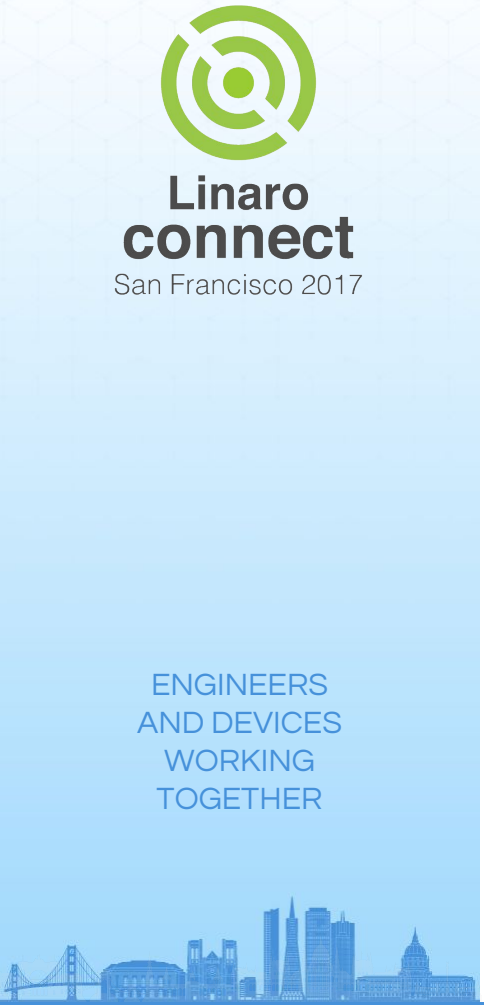


Verticals

- Robots
- Drones
- Compute (GPGPU, Heterogeneous, Machine Learning)
- Automation
- Healthcare
- Automotive
- Signage
- Media

Linaro connect
San Francisco 2017

ENGINEERS AND DEVICES WORKING TOGETHER



Verticals

	Inputs		Outputs	
	Sensors	Cameras	Displays	Actuators
Robots	✓	✓	×	✓
Drones	✓	✓	×	✓
Compute	×	×	×	×
Automation	✓	✓	✓	✓
Healthcare	✓	✓	✓	?
Automotive	✓	✓	✓	✓
Signage	×	×	✓	×
Media	×	×	✓	×

Linaro
connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Mezzanine Community Initiative

https://github.com/96boards/mezzanine-community

Linaro
connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

MYTH:

“If you build it they will come”

Linaro
connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

“If you build it, document it, market it, and maintain it they will come… and stay”

Linaro
connect
San Francisco 2017

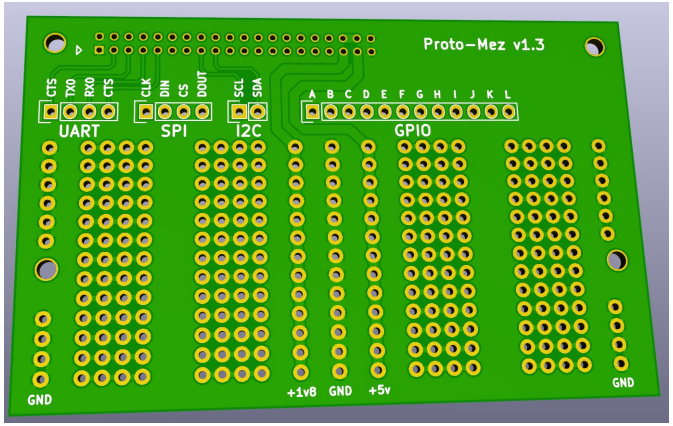
ENGINEERS
AND DEVICES
WORKING
TOGETHER

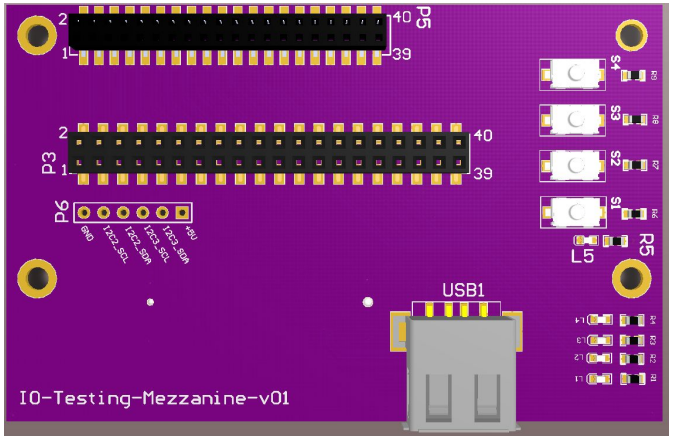
Lead Contributors

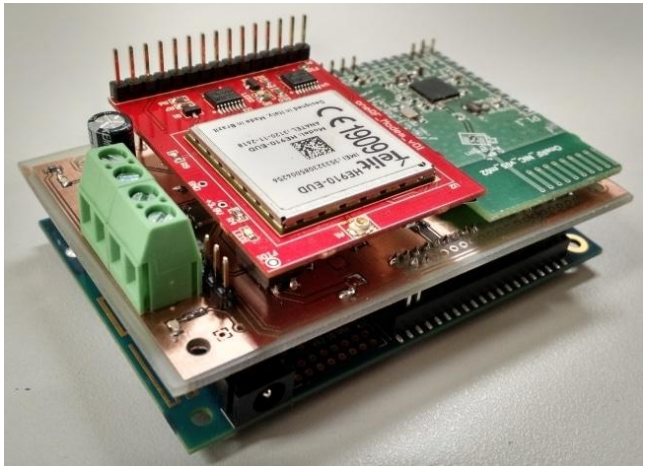
- Michael Welling
  - mwelling@ieee.org - Lead Maintainer
- Robert Wolff
  - robert.wolff@linaro.org - Community
- Rafael Christ
  - rafaelchrist@gmail.com - Altium / Eagle Reviewer
- Gustavo Retuci Pinheiro
  - gustavo_r_p@hotmail.com - Altium / Eagle Reviewer
- Sahaj Sarup
  - sahajsarup@gmail.com - Reviewer

Current Open Templates

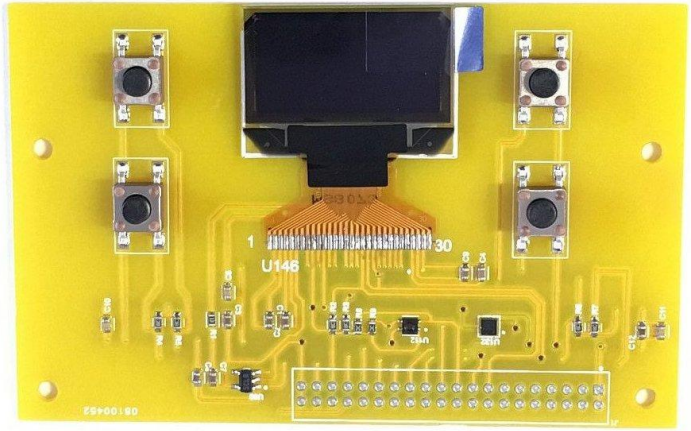
- kiCAD
- Altium
- Eagle


Proto-Mez v1.3
CTS
TXO
RXO
CTS
CLK
DIN
CS
DOUT
SCL
SDA
A B C D E F G H I J K L
UART
SPI
I2C
GPIO
GND
+1v8
GND
+5v
GND


P5
P3
P6
S4
S3
S2
S1
R5
L5
USB1
IO-Testing-Mezzanine-v01



96Boards


U148

Linaro
connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Open Pipeline

- GPS
- I/O testing Mezzanine
- DSI Touch-enabled Display
- RPi Header (allow use of RPi HATs)
- HiFi DAC, Standard i2s mezzanine
- 802.15.4 (e.g 6LoWPAN)
- Remote Power Mezzanine (Cycle Mezz)
- More...

Linaro
connect
San Francisco 2017

ENGINEERS
AND DEVICES
WORKING
TOGETHER

How to get involved...

Linaro connect
San Francisco 2017

Handling Future Mezzanines

Manivannan Sadhasivam

Types of Mezzanines we had so far...

- Level shifting Mezzanines
  - Sensors Mezzanine
- Analog Mezzanines
  - Arrow Linker Sprite Mezzanine
- Audio Mezzanines
  - Arrow Audio Mezzanine
- Camera Mezzanines
  - AiStarVision MIPI Adapter Mezzanine
  - D3 Camera Mezzanine
- Aerial Mezzanines
  - Aerocore 2 Mezzanine

Linaro
connect
San Francisco 2017

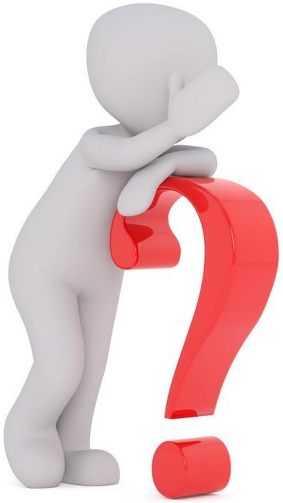
Future Mezzanines

- I2S Mezzanine
  - External Codec to manipulate I2S output on LS header
- GPS Mezzanine
  - External GPS interface
- Robot Mezzanine
  - Motor controller, PWM generator
- Connectivity Mezzanine
  - LORA, Ethernet
- Security Mezzanine
  - Fingerprint, TPM
- Rpi Header
  - Allows to use Rpi HATs

ENGINEERS
AND DEVICES
WORKING
TOGETHER

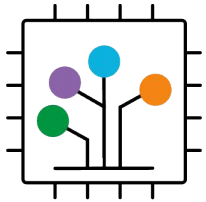
Pain Points - Future Mezzanines

- Detecting onboard Sensors
- Automatically loading corresponding drivers
- Notification to kernel about addition of Mezzanine



Solution - Device Tree (DT) Overlays

- Proposed by Pantelis Antoniou
- In Mainline since 3.19
- Enabled by OF_OVERLAY Kconfig option
  - Selects OF_DYNAMIC && OF_RESOLVER by default
- Support added to libfdt by Free Electrons
- Need ‘-@’ flag to compile both device tree and overlays
  - Adds __symbols__ in base device tree
  - Adds __symbols__, __fixups__, __local_fixups__ in overlays



devicetree
.org

Possible Methods of Loading DT Overlays...

Merging all overlays into base device tree	Doesn’t makes sense
Using Configfs interface	Not recommended
Using bootloader to apply overlays	Preferred method
Using a clone of Cape manager to load overlays	Preferred but cannot be mainlined

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Using Bootloader to load Overlays

- Use bootloader to apply overlays before passing the pointer to kernel
- Need to specify the overlays via env variable
- Requires no change in kernel
- Much recommended
- Common bootloaders:
  - U-boot
    - Overlay support mainlined by Free Electrons
  - LK
    - No support exist
    - Patching should be easy since it is using libfdt

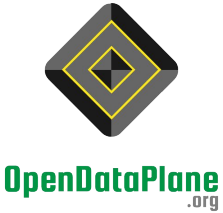
Linaro
connect
San Francisco 2017

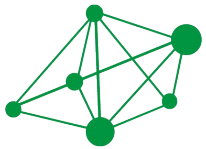
Using Cape Manager to load Overlays

- Need to implement a new interface
- Storing overlays:
  - EEPROMs in Mezzanine
  - Linux Root File System
- 1 wire bus can be used for detecting Mezzanines
  - Bitbanged w1-gpio driver could be used
- Problematic if overlays are stored in RFS
- Should be done at the initial stage of boot process
- Support cannot be mainlined if it is platform specific
- Other SBC's are also supporting:
  - Beaglebone Black
  - Raspberry pi

ENGINEERS
AND DEVICES
WORKING
TOGETHER

Useful Logos





Download Hi Res logos from here* to use on your slides

*http://link.linaro.org/logos

Some Images

- Download Hi Res photos from here* to use on your slides

*http://link.linaro.org/groupphotos

Linaro connect
San Francisco 2017

Thank You

#SFO17

BUD17 keynotes and videos on: connect.linaro.org

For further information: www.linaro.org