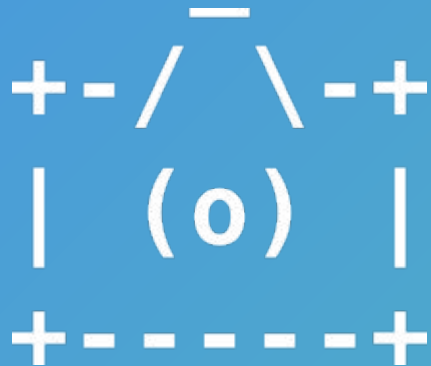


libcamera

Past Present Future



Embedded Recipes
Nice 2025

Kieran Bingham
kieran.bingham@ideasonboard.com



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| (o) |
+ - - - - +

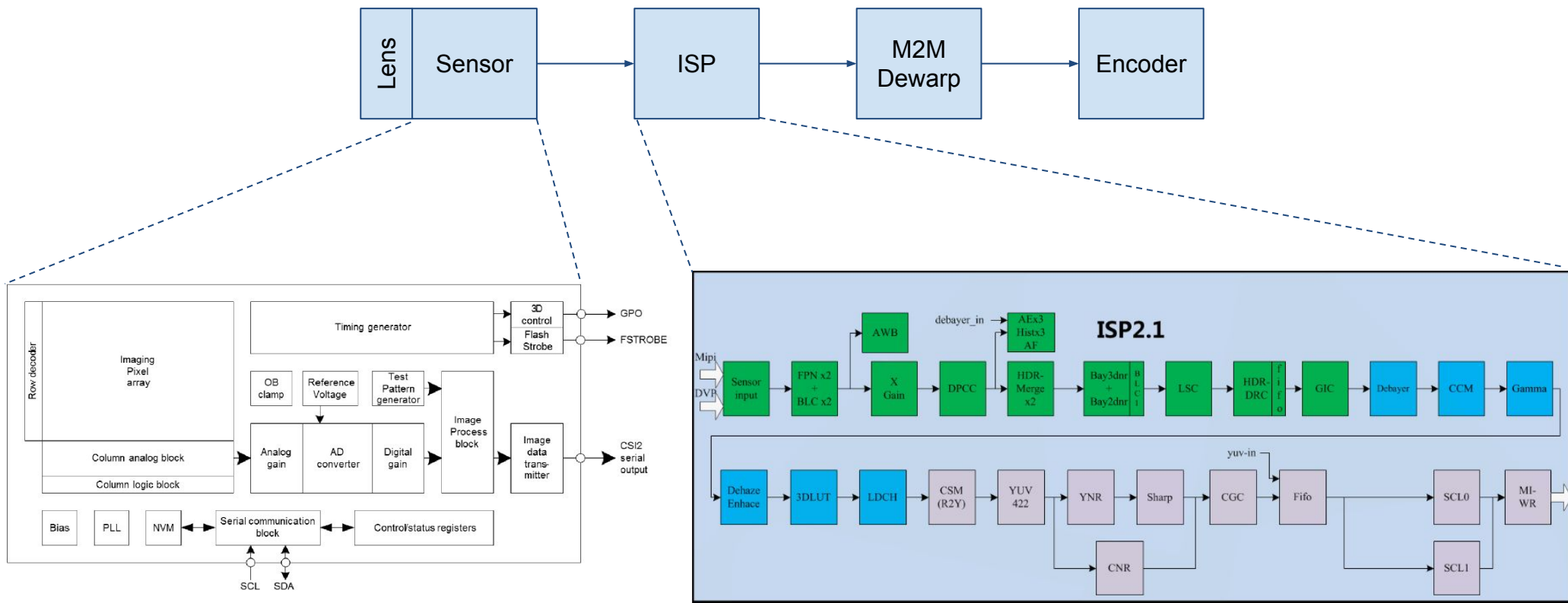
- Past
- Present
- Future
- Q+A (Lunch)



+ - / \ - +
| (o) |
+ - - - - +

- Past
- Present
- Future
- Q+A (Lunch)



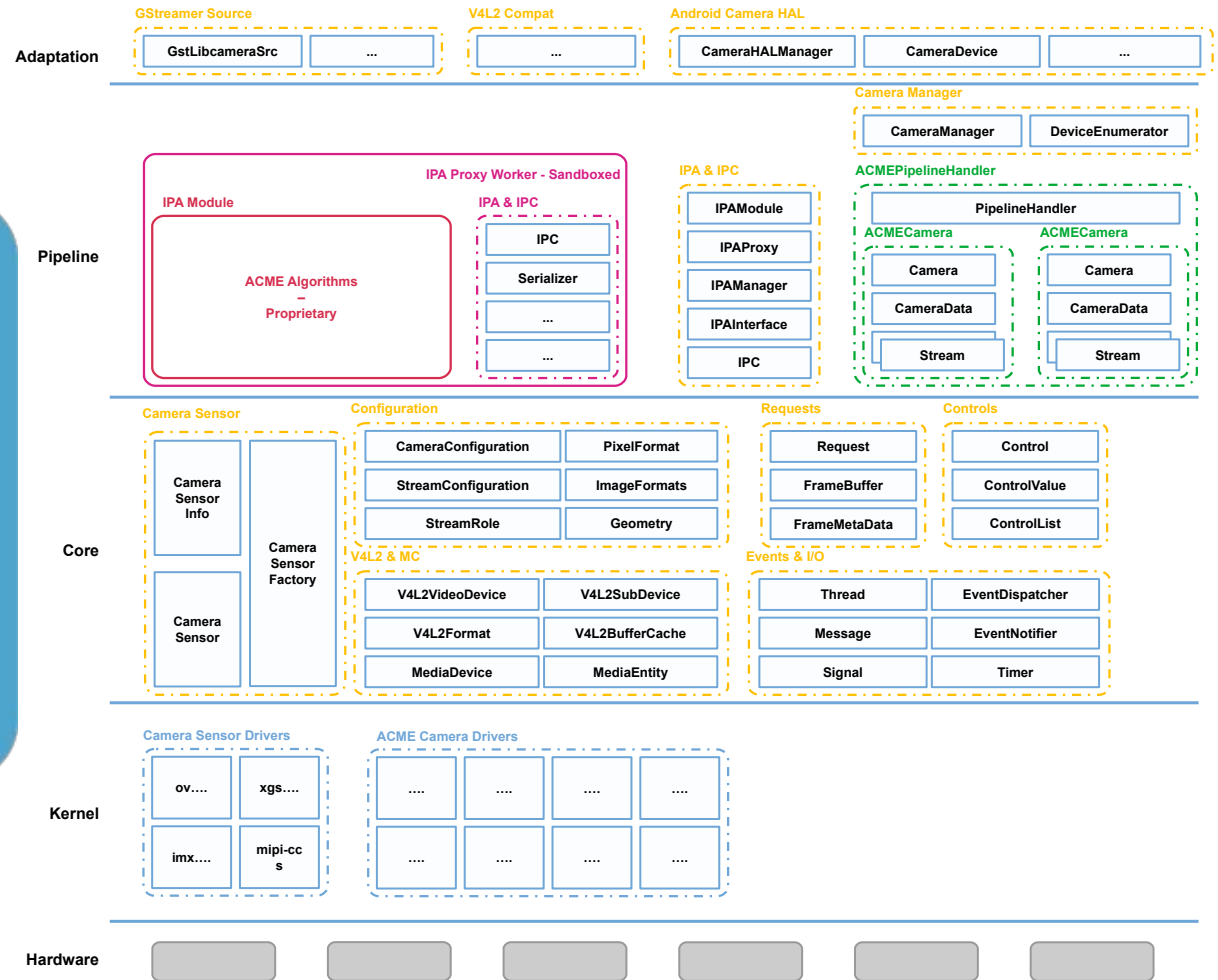
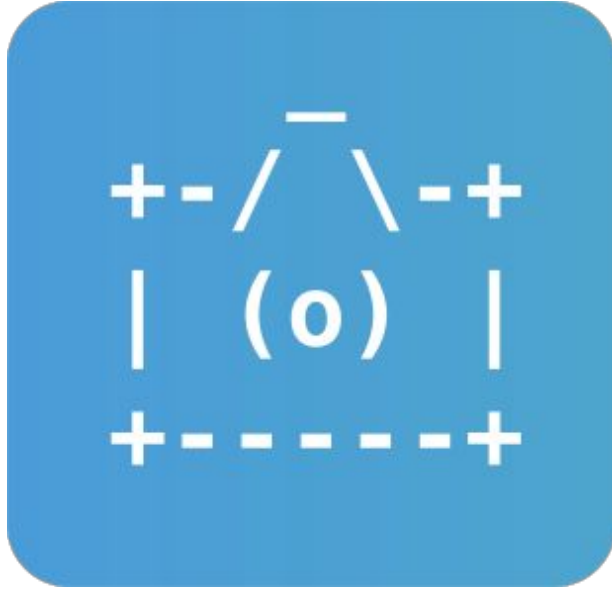


Camera Pipeline Complexity

HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)

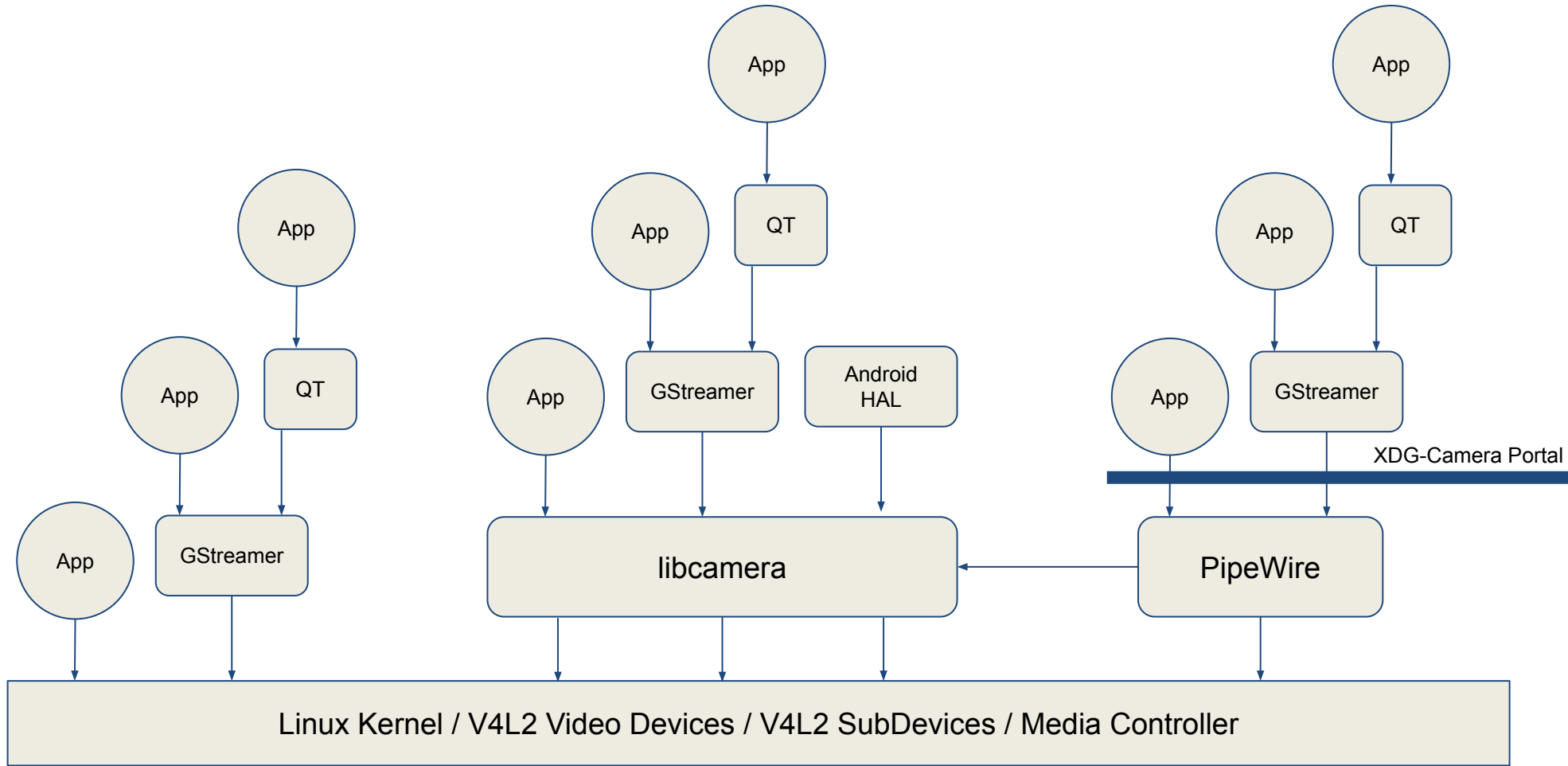


Obligatory XKCD : 927

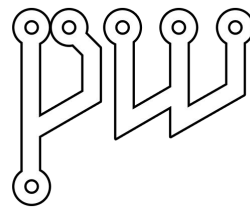


libcamera stack

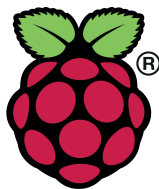
IDEAS
ON BOARD



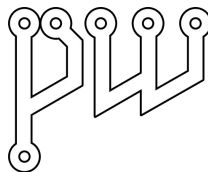
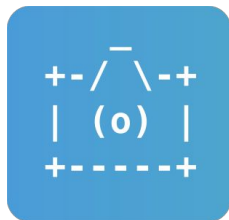
The linux multimedia stack



Frameworks



Raspberry Pi



XDG-Camera-Portal



WebRTC



Jitsi Meet



zoom

<https://flatpak.github.io/xdg-desktop-portal/#gdbus-org.freedesktop.portal.Camera>



Desktop + Mobile integration

+ - / \ - +
| (o) |
+ - - - - +

- Past
- Present
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- libcamera-0.5.0
 - Lots of fixes and code base clean up lately
 - libcamera-0.5.1 'Nice' within two weeks
- Newest Platform Support
 - RPi 5 platform support (Raspberry Pi)
 - Software ISP support (Redhat)
 - Mali-C55 base support (Ideas on Board, Linaro, ARM)
 - Virtual pipeline handler (Google)
- Tuning and developer tools



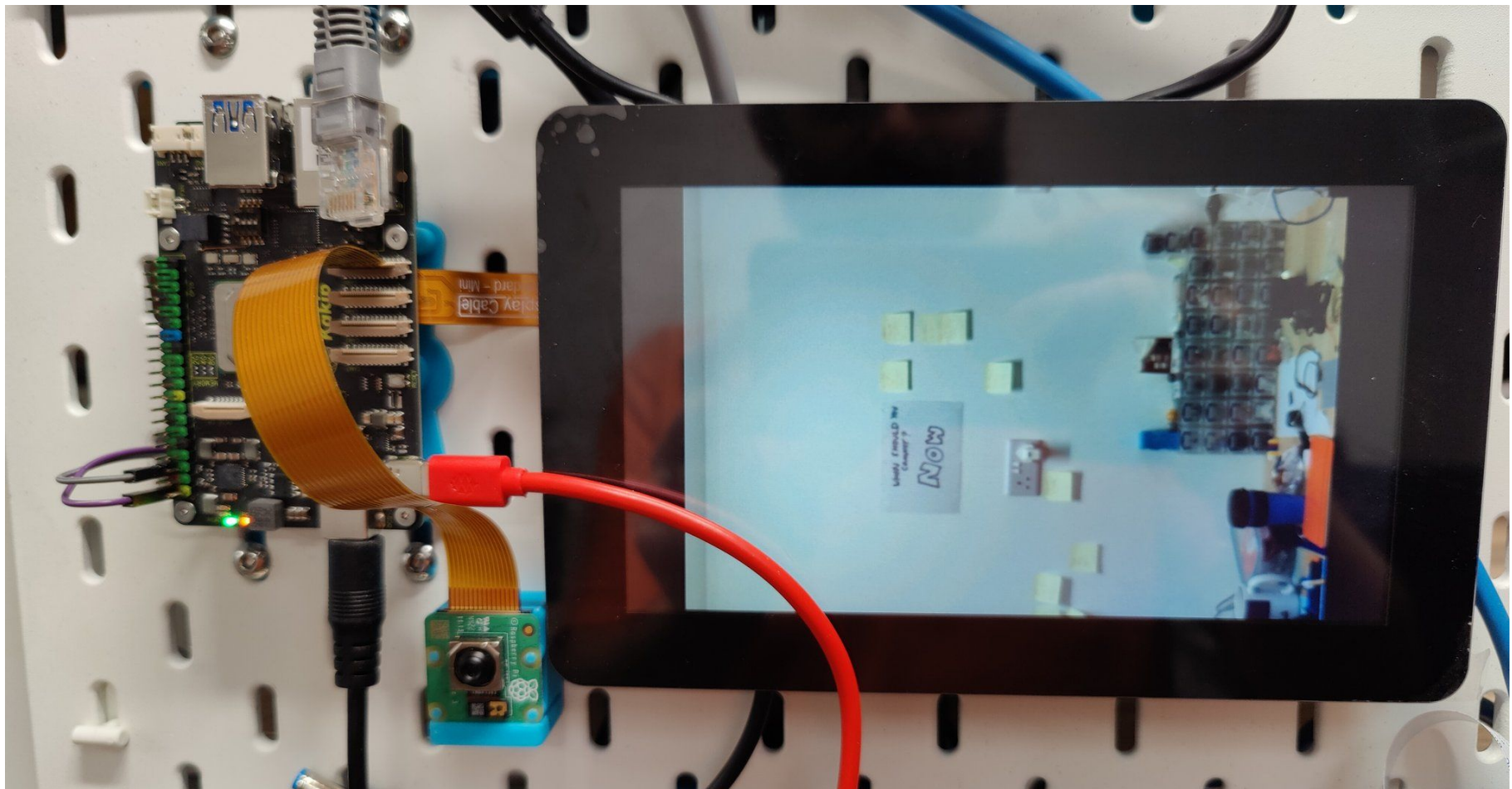
What's going on lately ?

```
kbingham@charm:~/iob/libcamera$ grep "\", {" src/libcamera/sensor/camera_sensor_properties.cpp
```

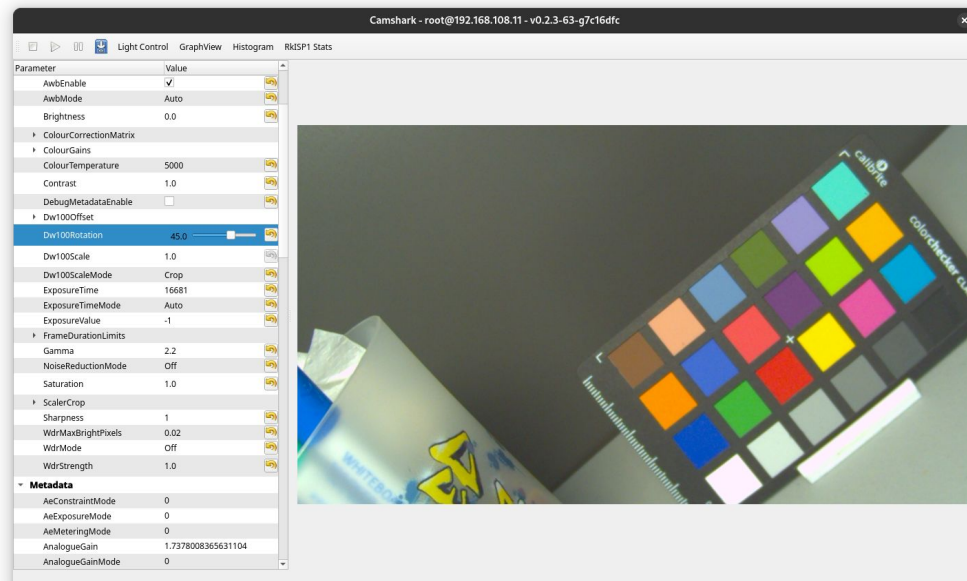
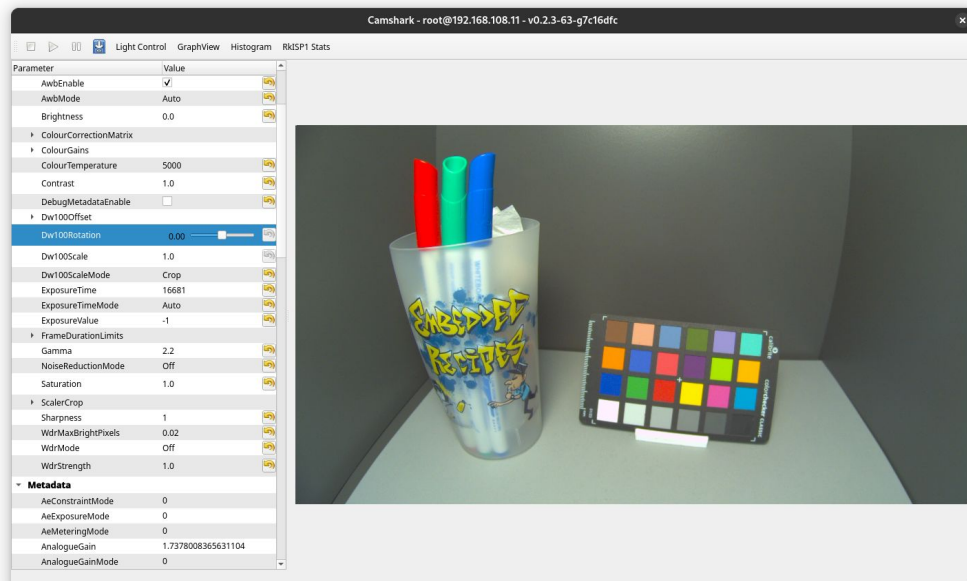
```
{ "ar0144", {  
  { "ar0521", {  
    { "gc05a2", {  
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        { "hi846", {  
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                                                        { "ov8858", {  
                                                          { "ov8865", {  
                                                            { "ov9281", {  
                                                              { "ov13858", {
```



Ever expandable supported sensors list



Renesas RZ/V2{H,N} - Mali-C55 - Kakip Board Bringup

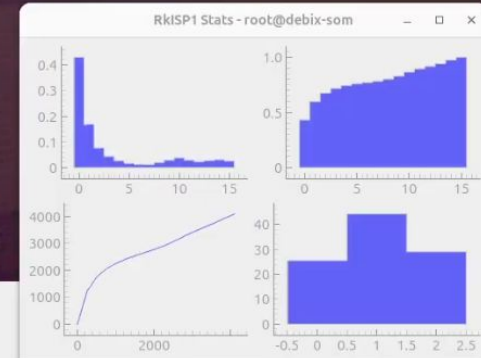
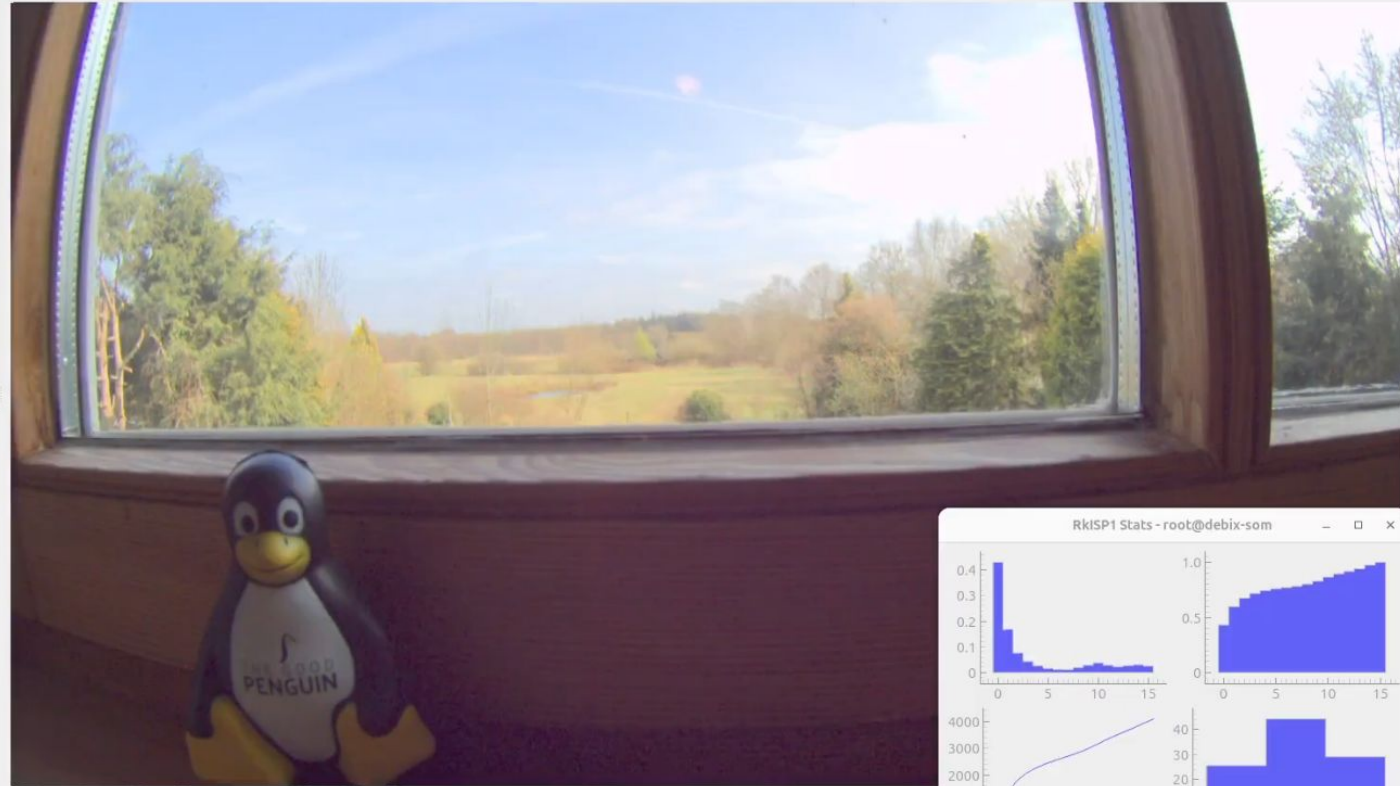


New features on the i.MX8MP - Dewarp

GraphView Histogram RkISP1 Stats

Parameter	Value
Controls	
AeConstraintMode	Normal
AeEnable	☒
AeExposureMode	Normal
AeMeteringMode	CentreWeighted
AnalogueGain	1
AnalogueGainMode	Auto
AwbEnable	☒
AwbMode	Auto
Brightness	0.0
ColourCorrectionMatrix	
ColourGains	
ColourTemperature	5000
Contrast	1.0
DebugMetadataEnable	☒
ExposureTime	16681
ExposureTimeMode	Auto
ExposureValue	0
FrameDurationLimits	
Gamma	2.2
NoiseReductionMode	Off
Saturation	1.0
ScalerCrop	
Sharpness	1
WdrMaxBrightPixels	0.02
WdrMode	HistogramEqualizal
WdrStrength	1.0
Metadata	
AeConstraintMode	0
AeExposureMode	0
AeMeteringMode	0
AnalogueGain	1.0
AnalogueGainMode	0
AwbCount	1015479
AwbEnable	True
ColourCorrectionMatrix	(1.85859000682308, -0.7
ColourGains	(1.7334891557693481, 1.5

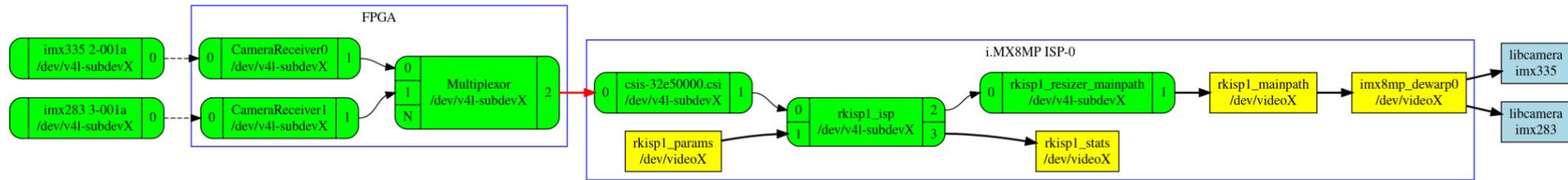
Click
through
for video
demo



New features on the i.MX8MP - WDR

IDEAS
ON BOARD

- Complex Cameras with even more Complex pipelines
 - 'MediaPipe' can generalise the input path
 - Not platform specific



New features on the i.MX8MP

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| (o) |
+ - - - - +

- Past
- Present
- Future
- Q+A (Lunch)

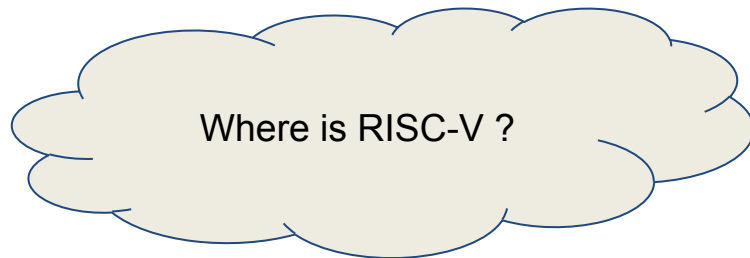


Feature Roadmap

- HDR support (from Ideas on Board)
- Multi-platform Sync support (from RPi)
- GPU ISP (From Linaro)
- Per frame control
- Re-processing API
- Modular Pipeline Handlers

Platforms

- Mali-C55 on Renesas Kakip
- Mali-C52? Cxxx? (Would love to see more variants supported)
- Amlogic C308
- NXP i.MX95
- Microchip
- STM32MP2



Frameworks

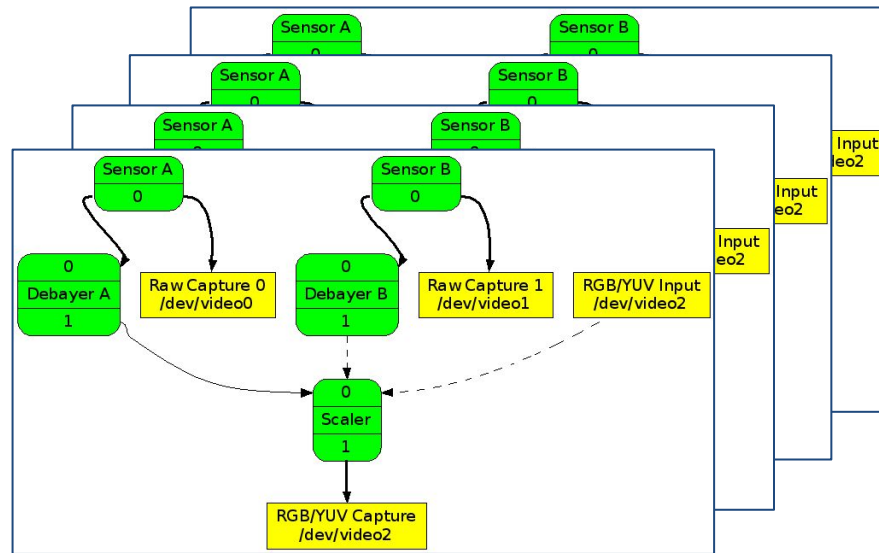
- OpenCV
- ffmpeg



Roadmap items

Time Multiplexed ISPs

- Sharing a single Media Device/Media Graph for time multiplexed ISPs
 - RPi 5
 - Mali-C55
 - ... Others ...



Multi-context ISP

Camera Sensor Raw

- Provides the framework we need to support streams and metadata!
- Meta data provides control loop accuracy

Complex input pipeline handling

- MediaPipe abstraction
- Serdes technologies (FPD-Link/GMSL)



Far future - What makes libcamera 1.0 happen?

- Stable C ABI (Maybe sooner than I expect?)
- Reprocessing API
- Per frame control

Surpassing the existing closed source camera stacks with both features and image quality



Towards 1.0 ...

**The future of camera support
on Linux is libcamera**



Future

+ - / \ - +
| (o) |
+ - - - - +

- Past
- Present
- Future
- One more thing
- Q+A (Lunch)





jobs@ideasonboard.com



One more thing ...

+ - / \ - +
| (o) |
+ - - - - +

- Past
- Present
- Future
- One more thing
- Q+A Lunch!

