Why embedded cameras are difficult and how to make them easy

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Cameras are complex devices that need heavy hardware image processing operations. Control of the processing is based on advanced algorithms that must run on a programmable processor. This has traditionally been implemented in a dedicated MCU in the camera, but in embedded devices algorithms have been moved to the main CPU to save cost. Blurring the boundary between camera devices and Linux often left the user with no other option than a vendor-specific closed-source solution.

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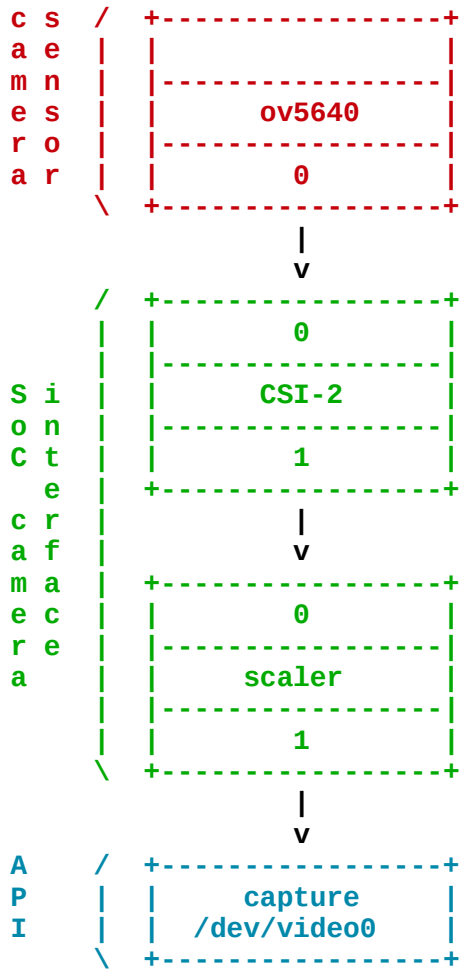
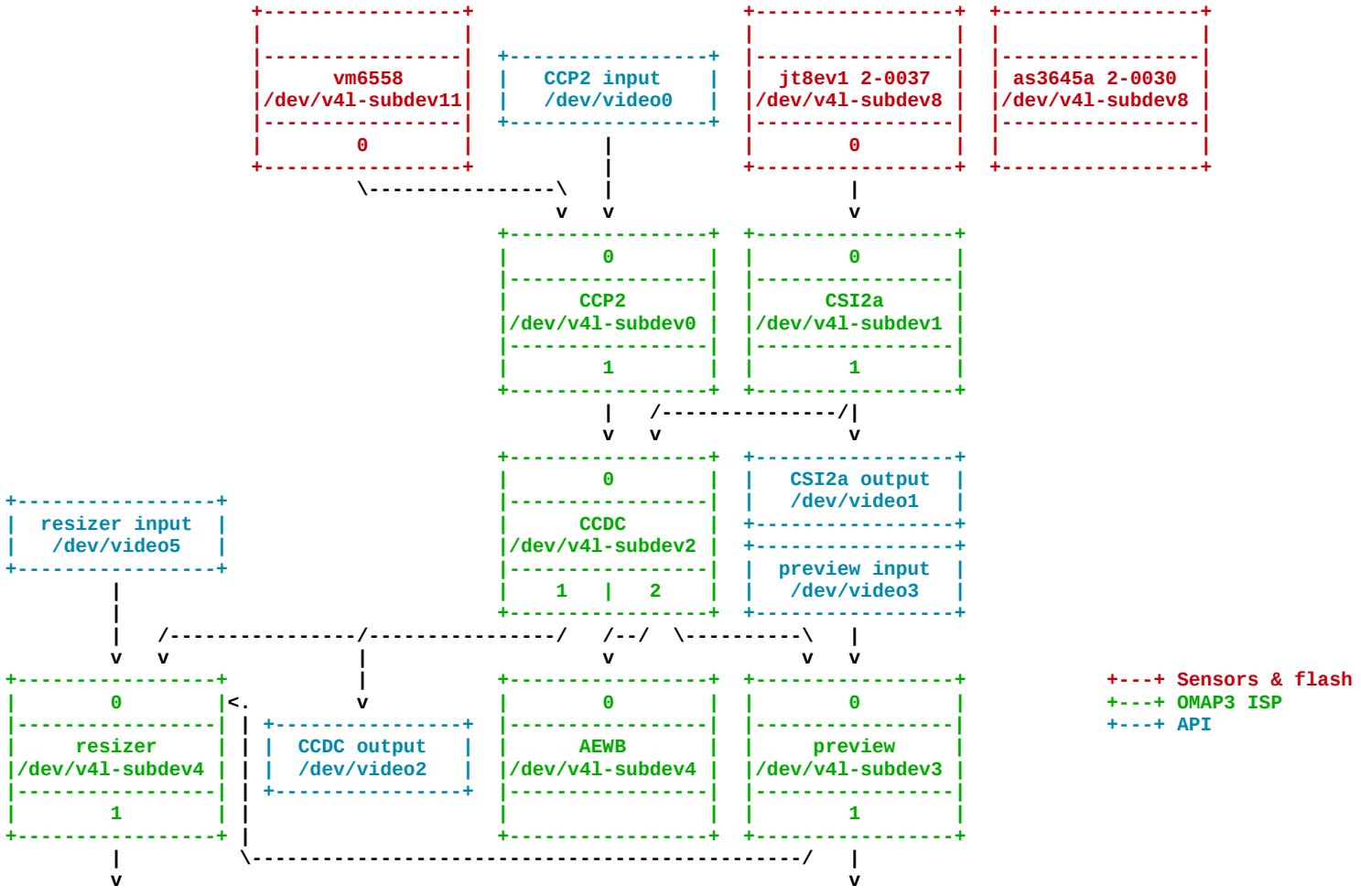
To address this problem the **Linux media community** has very recently started collaboration with the industry to develop a camera stack that will be open-source-friendly while still protecting vendor core IP. libcamera was born out of that collaboration and will offer modern camera support to Linux-based systems, including traditional Linux distributions, ChromeOS and Android.

IDEAS ON BOARD

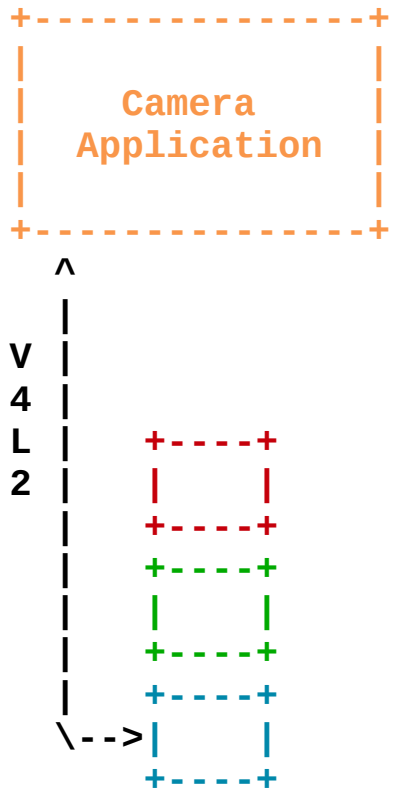

camera sensor
ov5640
0
SoC camera interface
0
CSI-2
1
0
scaler
1
API
capture
/dev/video0

Why?

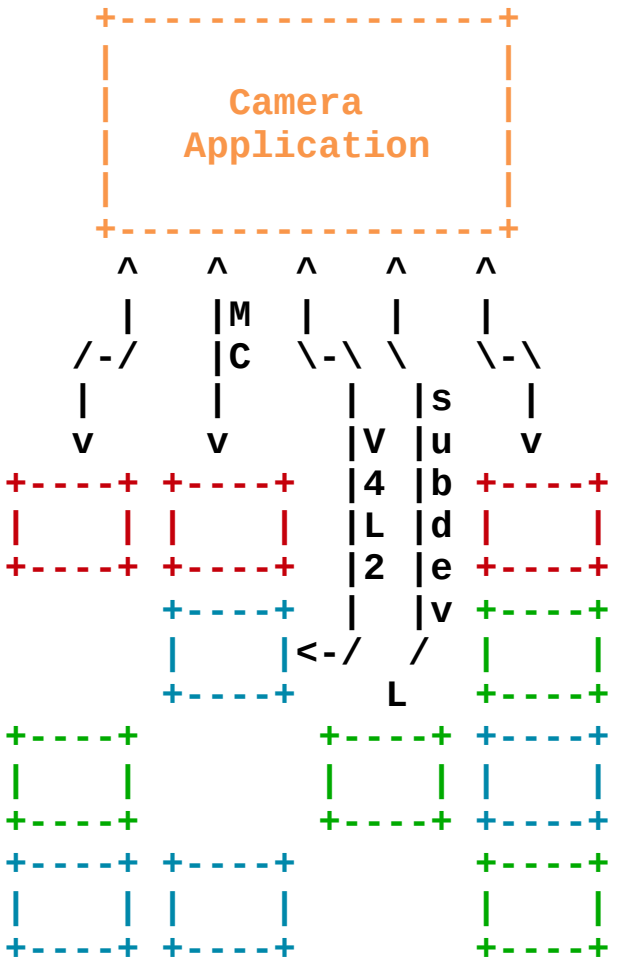


IDEAS ON BOARD

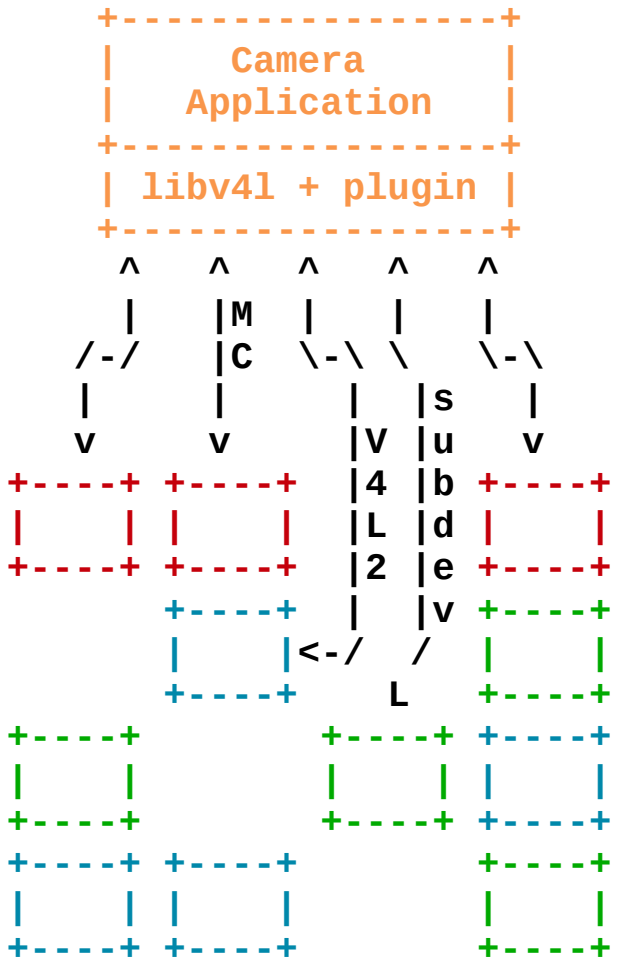
Why?



Why?



Why?


Camera
Application
libv4l + plugin
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C
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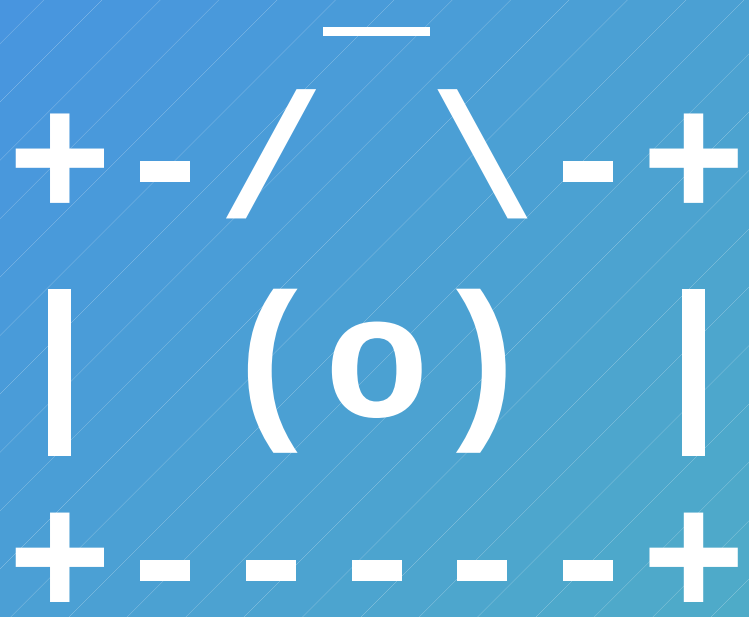
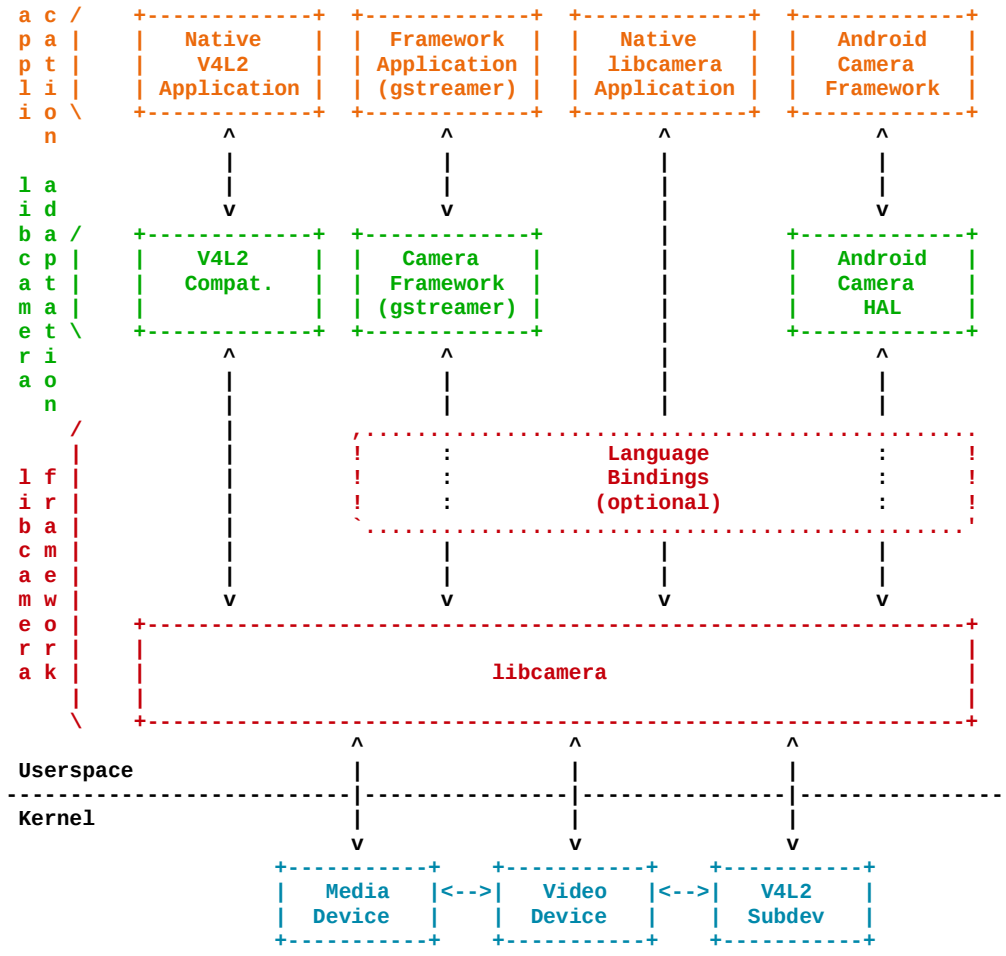
IDEAS
ON BOARD

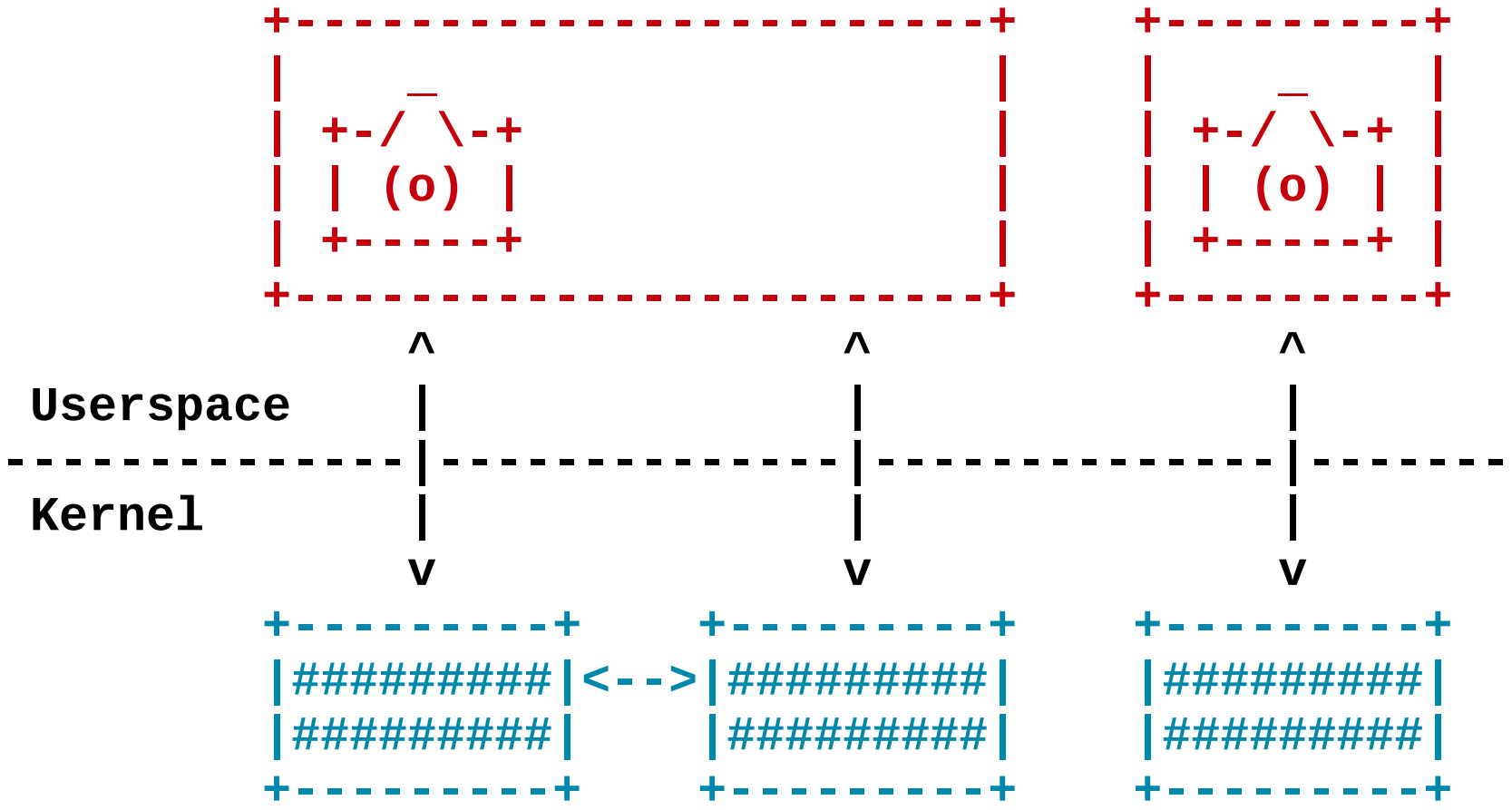
Why?



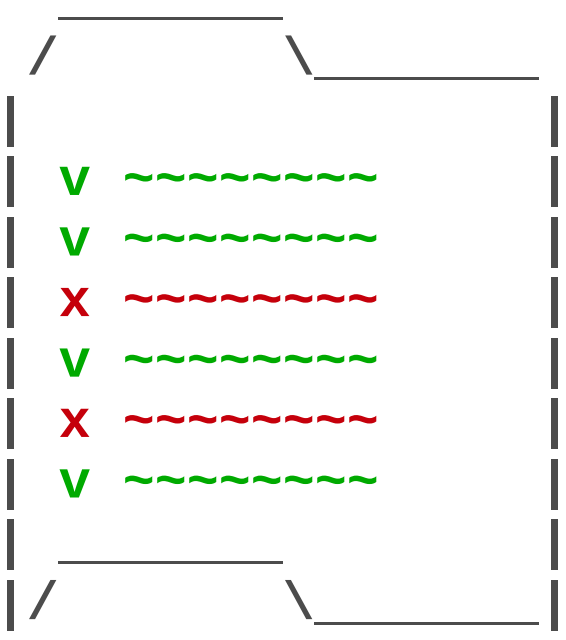
libcamera



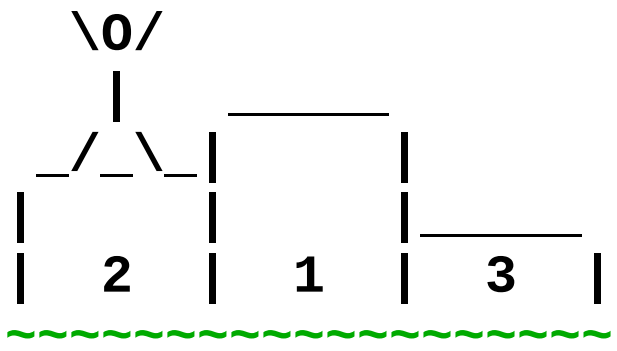
Camera Stack



Camera Devices & Enumeration

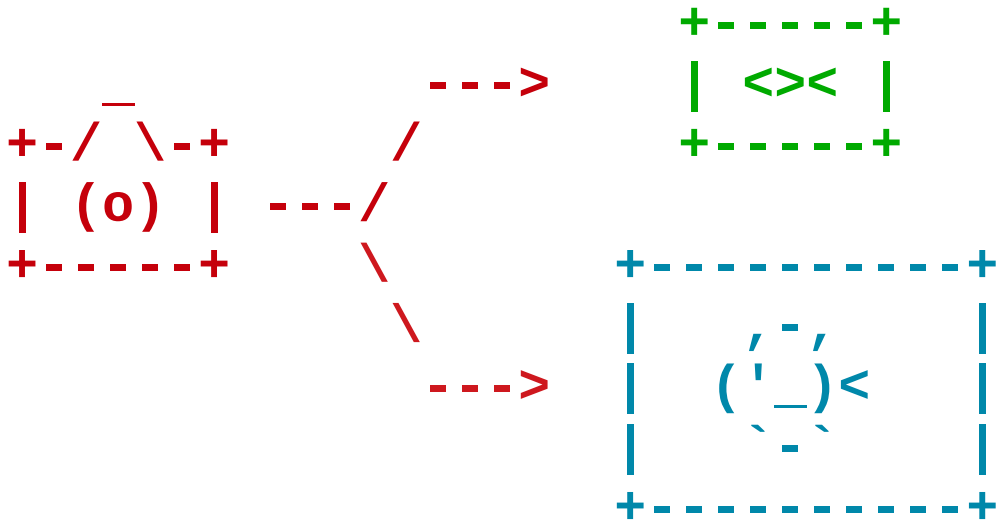


Capabilities

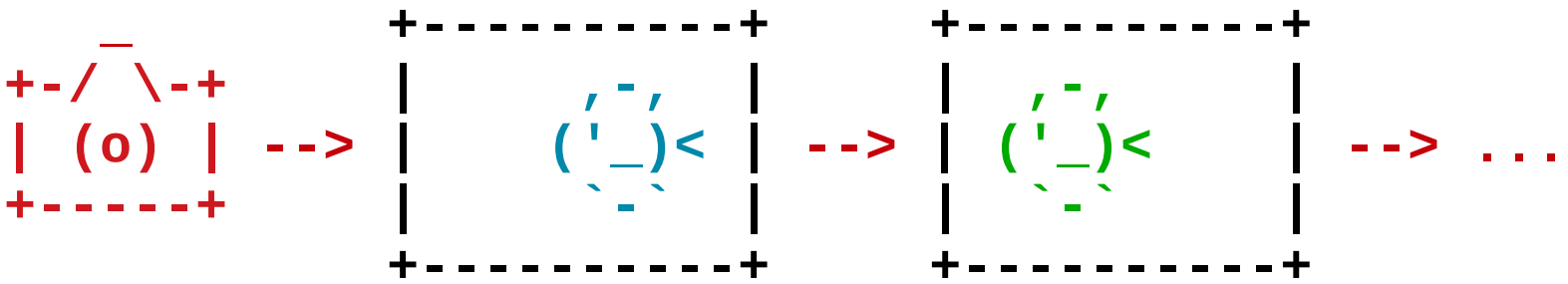


Profiles

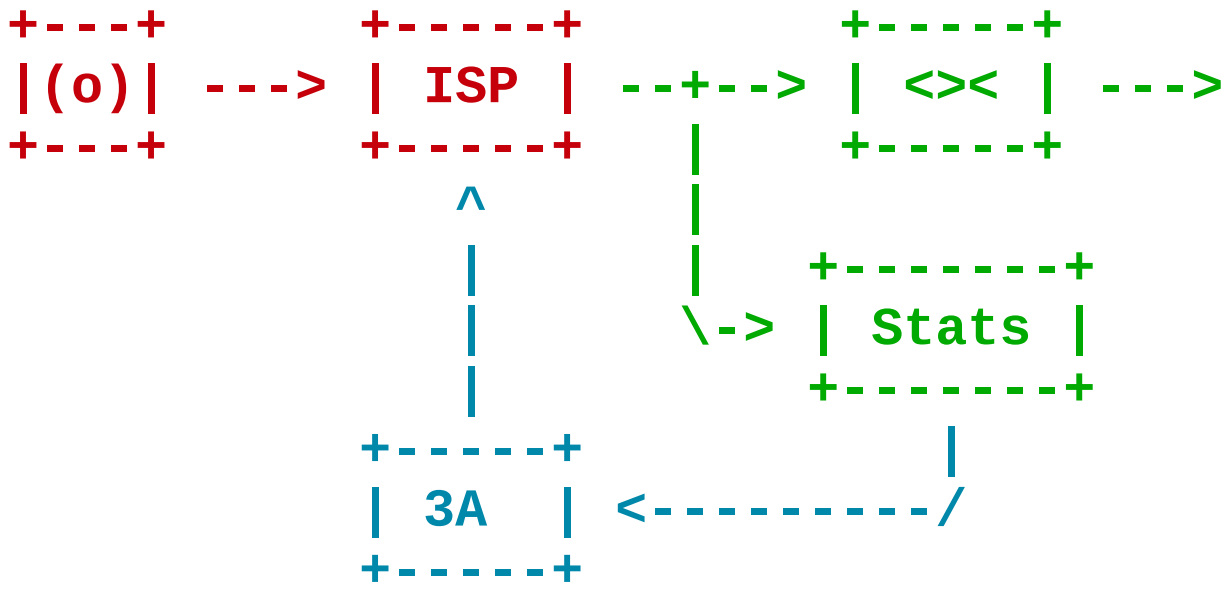
Capabilities & Profiles



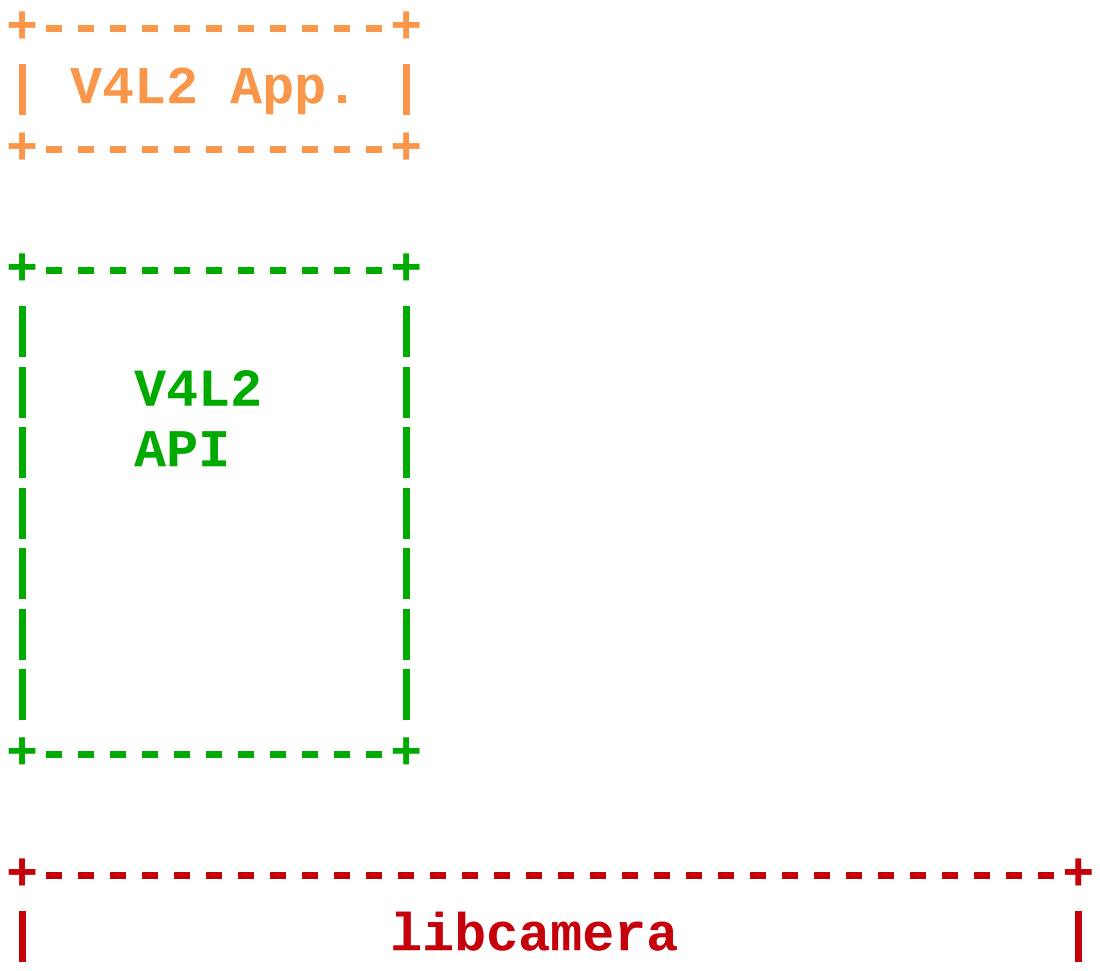
Streams



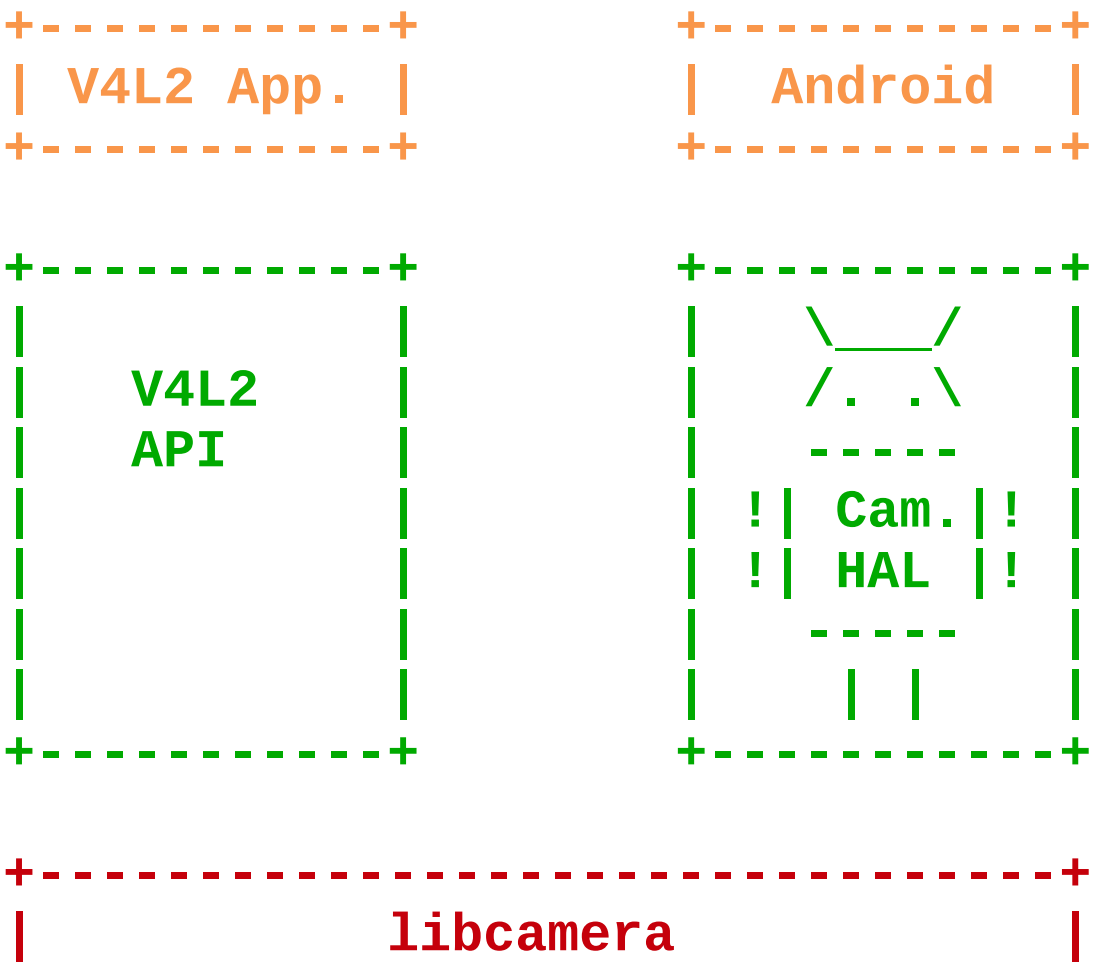
Per-Frame Controls



3A & Image Enhancement Algorithms



Adaptation



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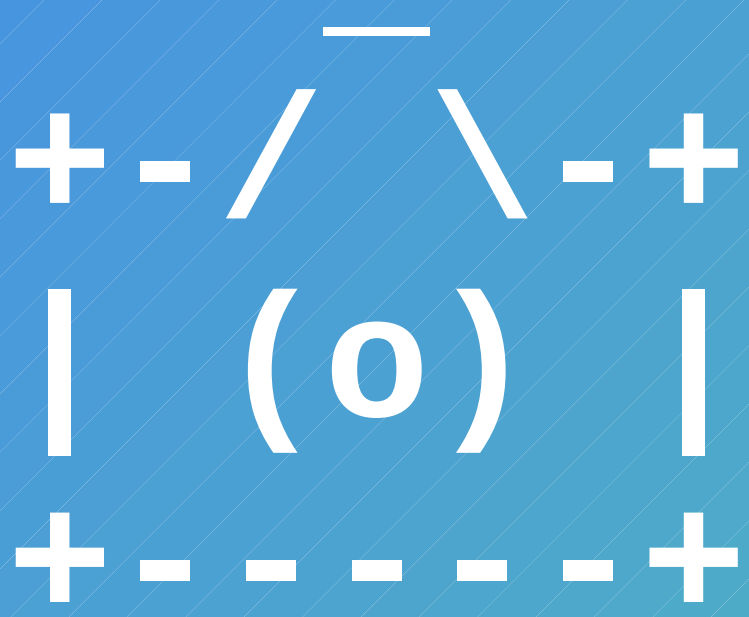
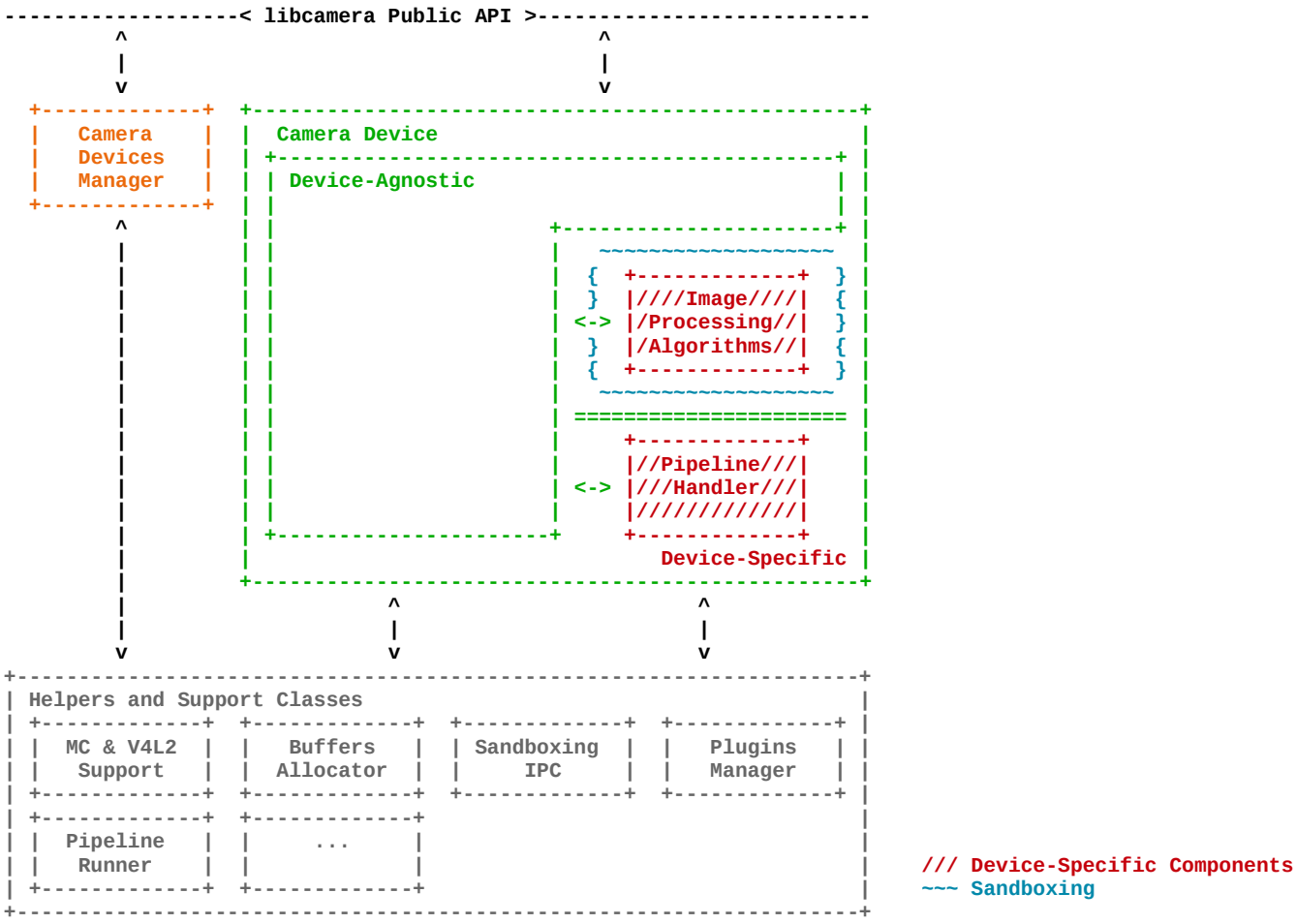
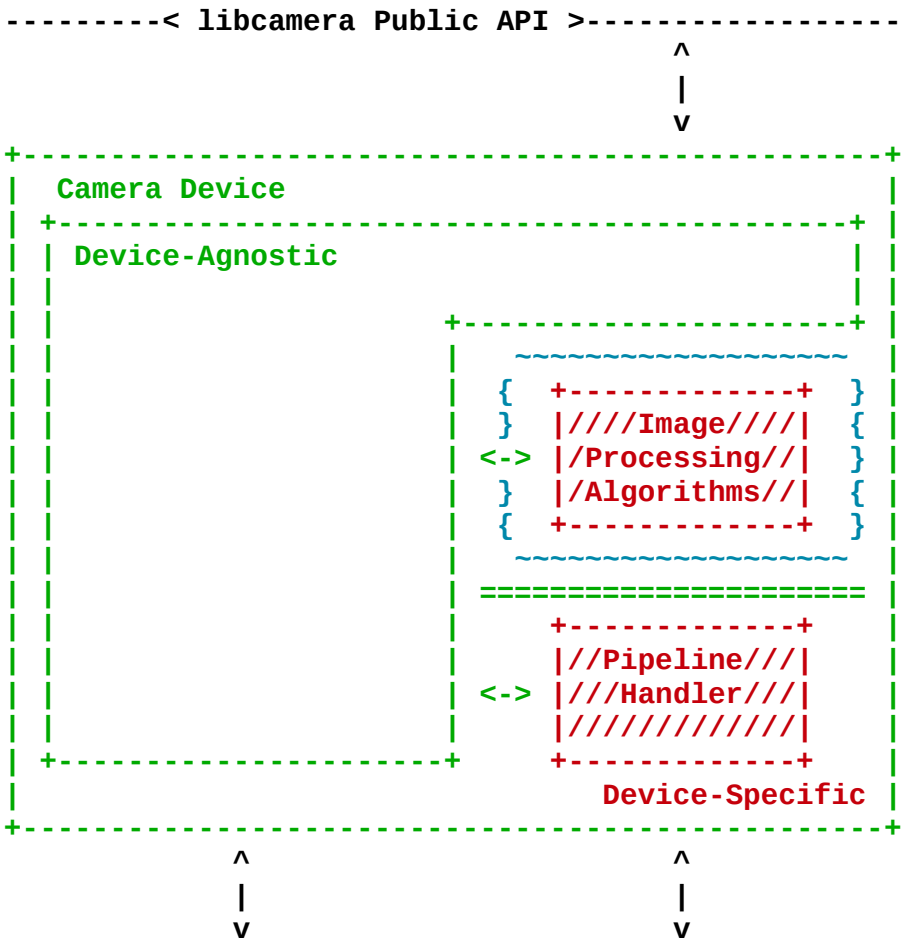


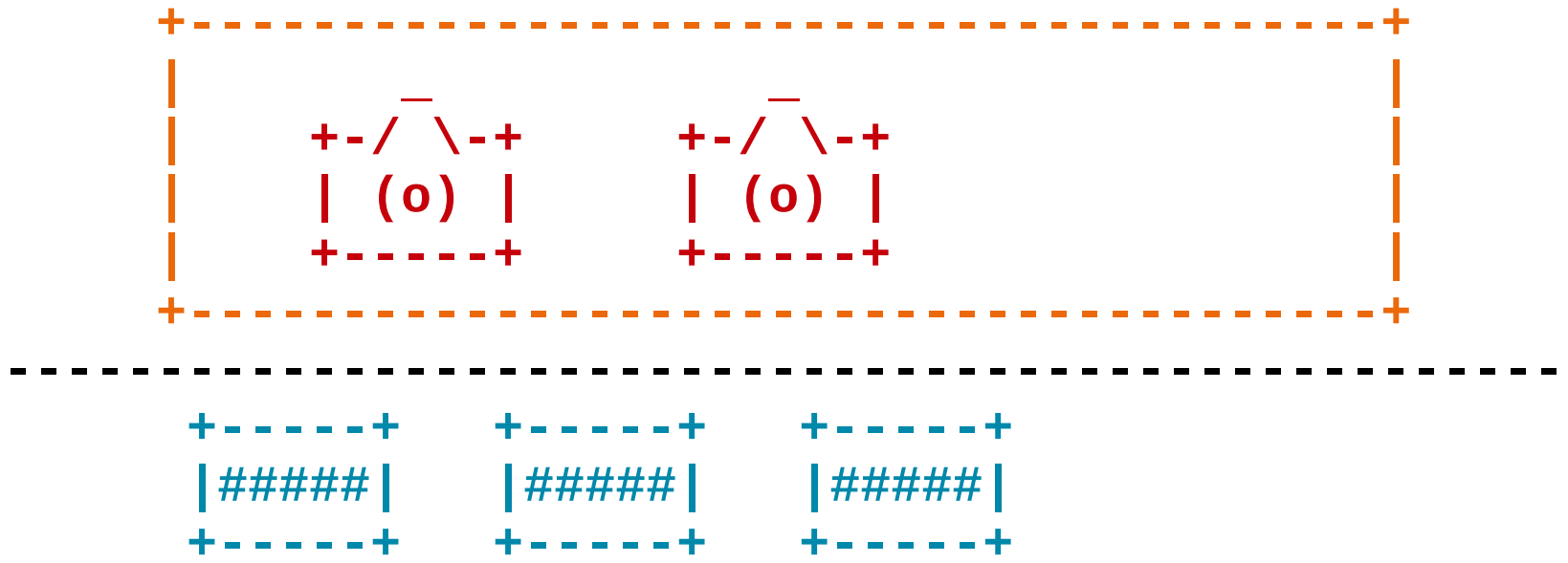
libcamera



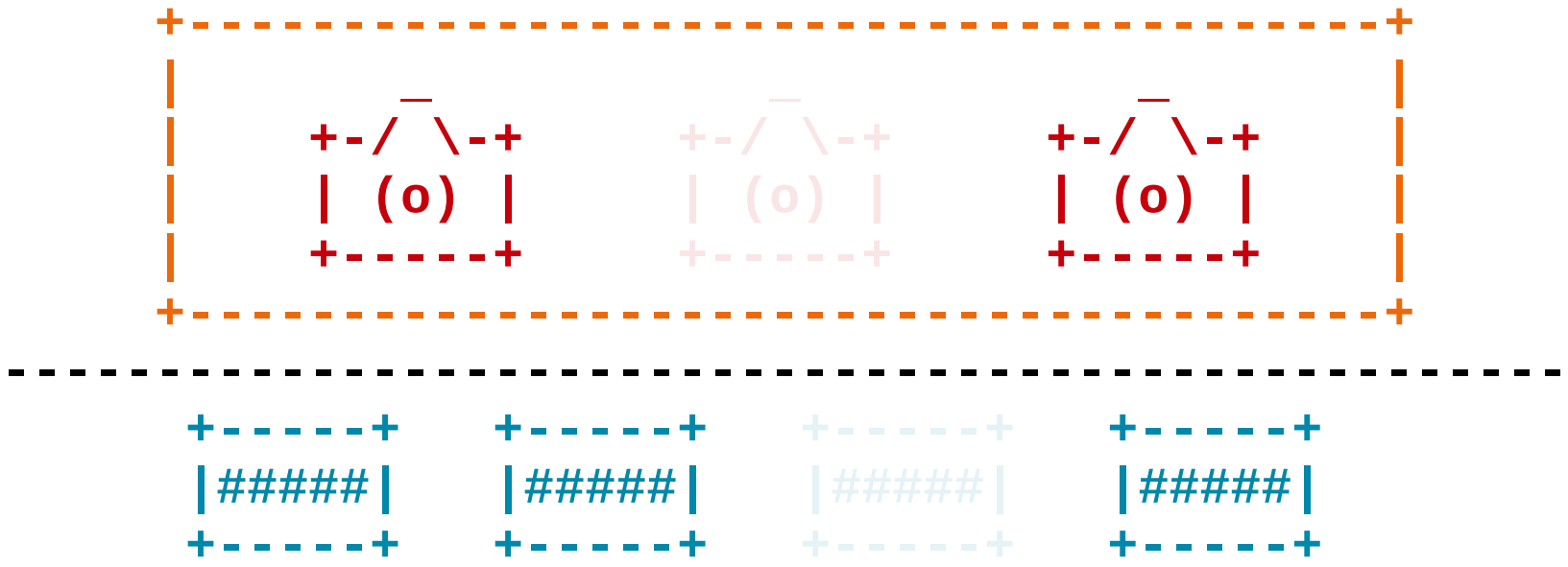
libcamera architecture



Camera Device



Camera Devices Manager



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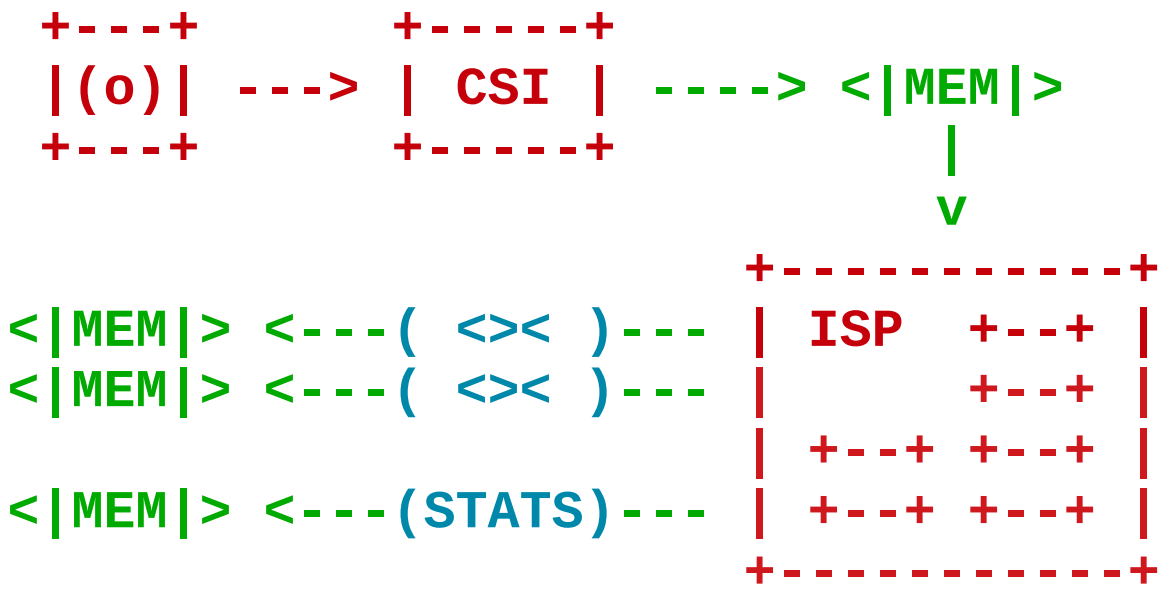


Pipeline Handler

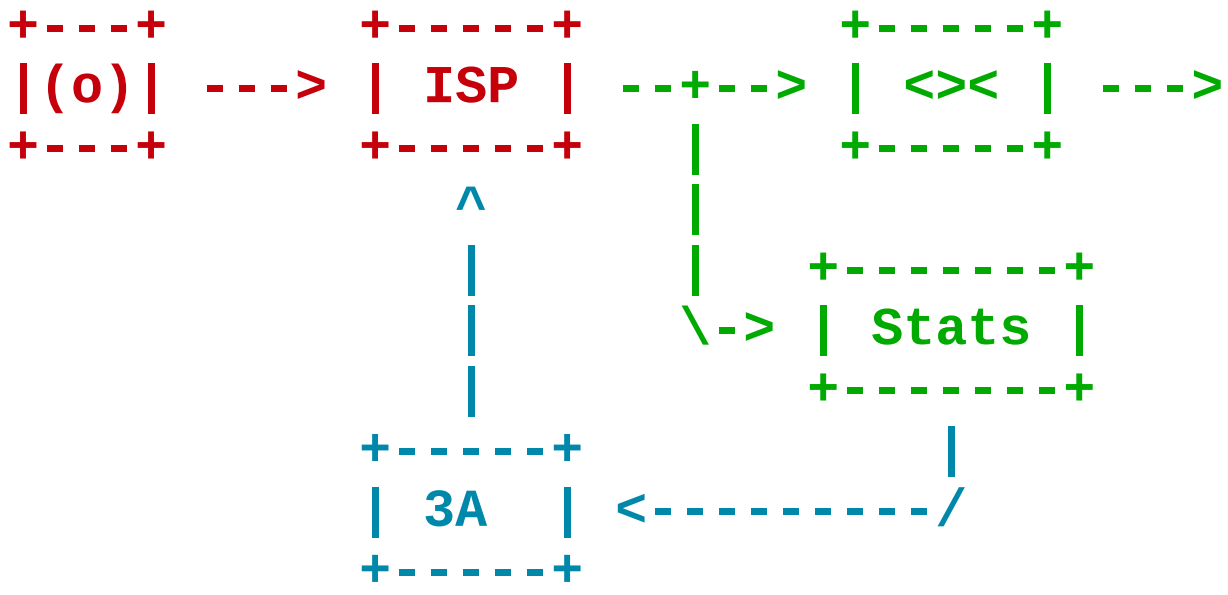
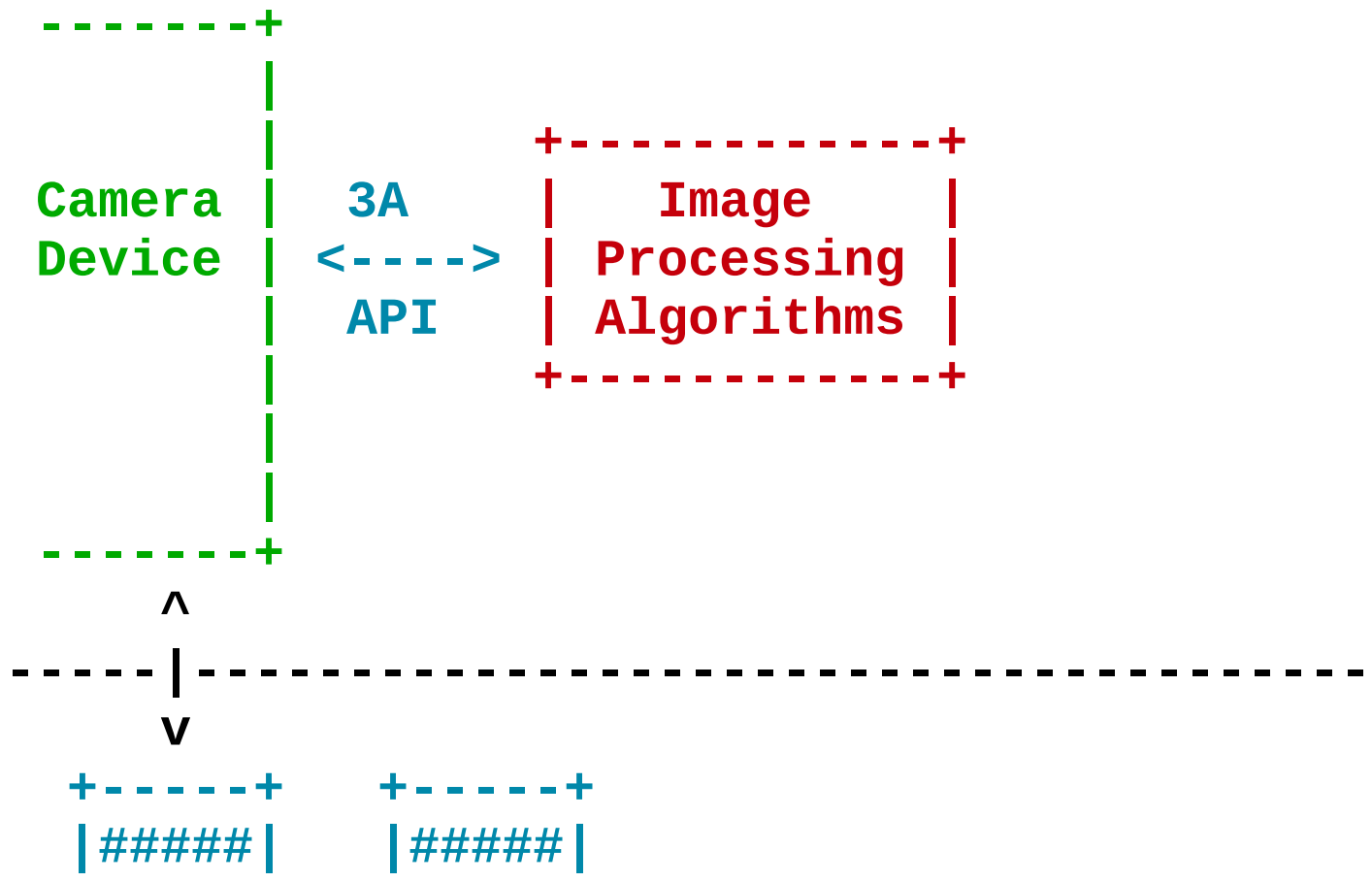


Image Processing Algorithms



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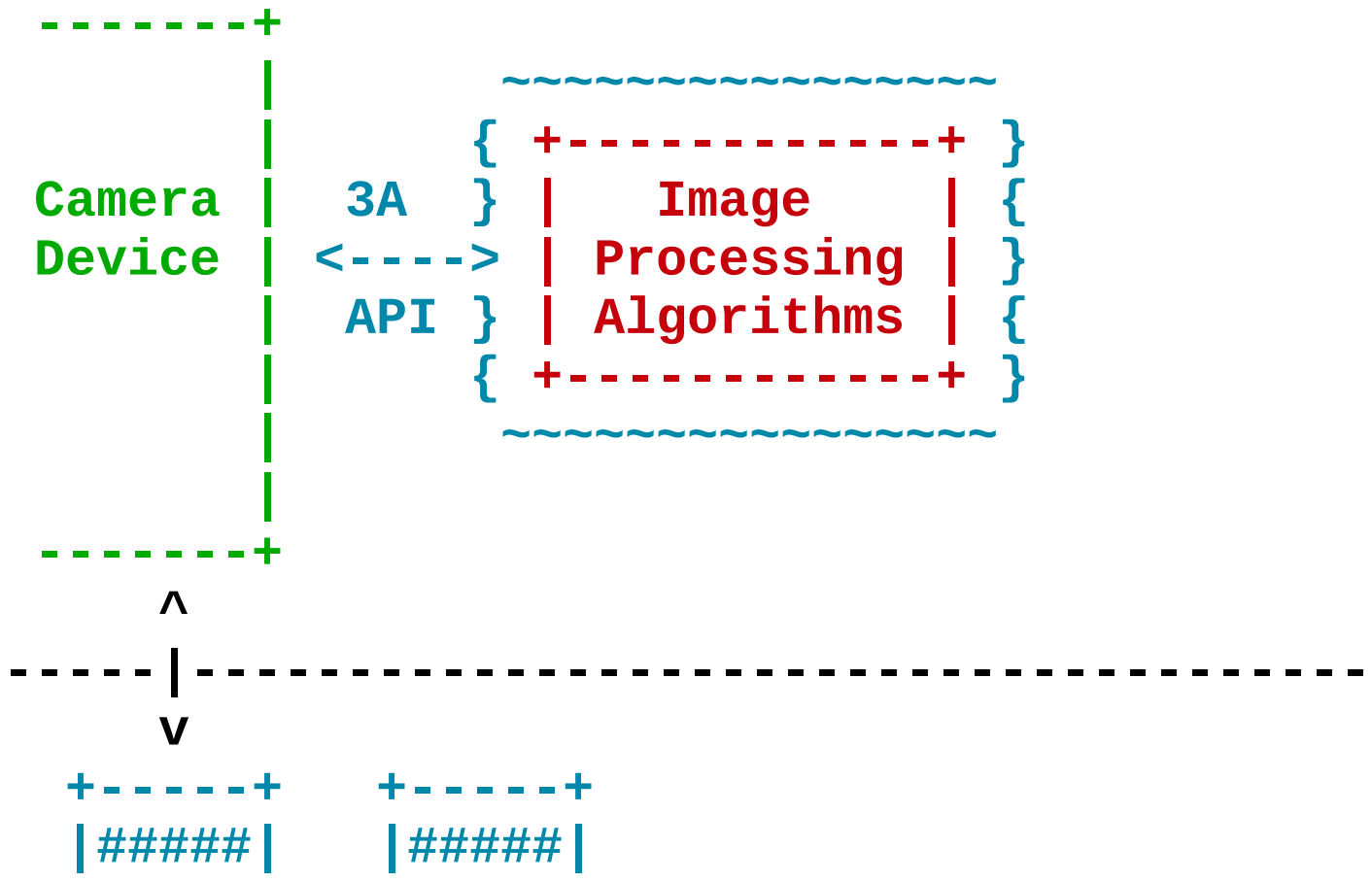

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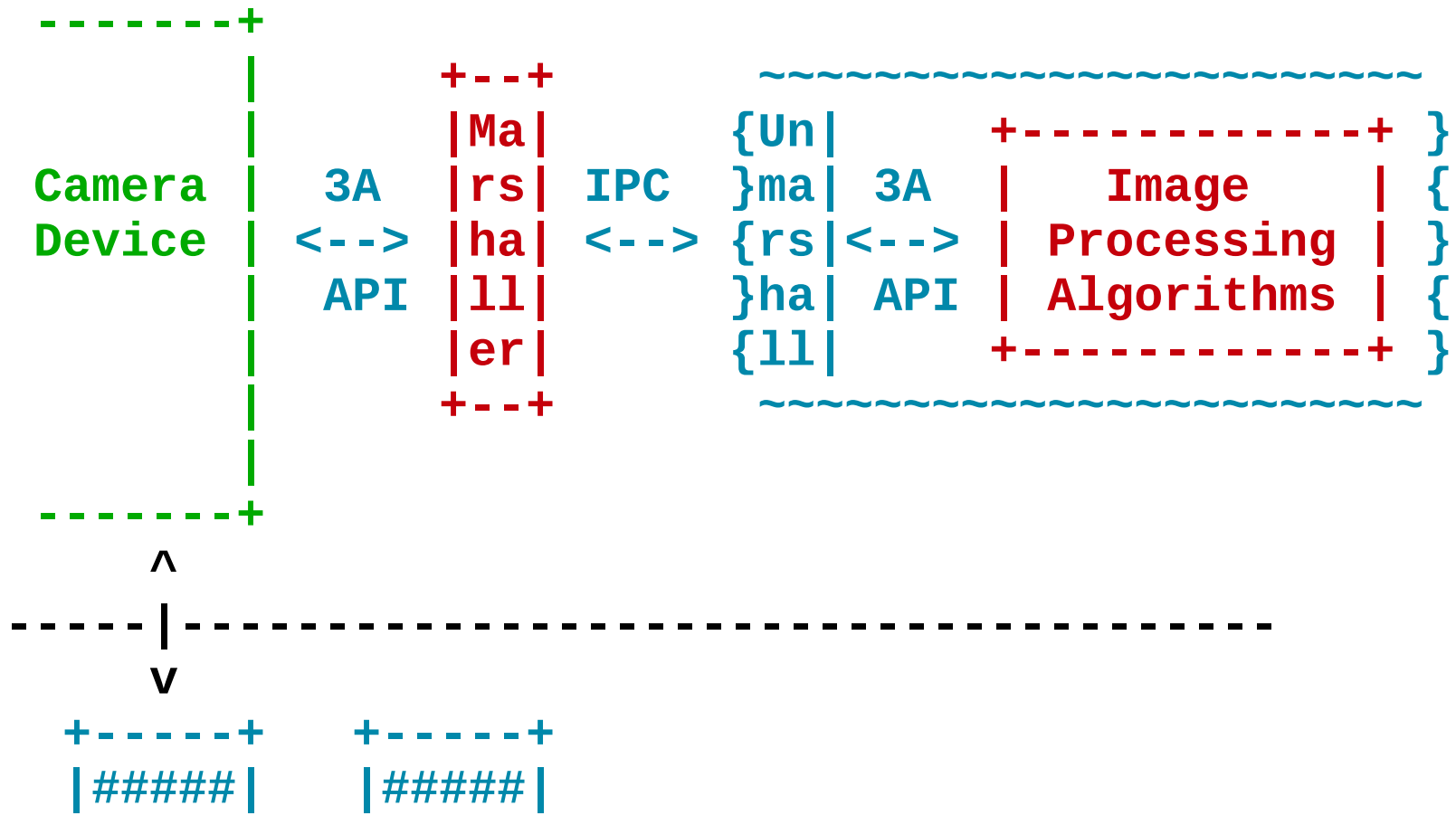

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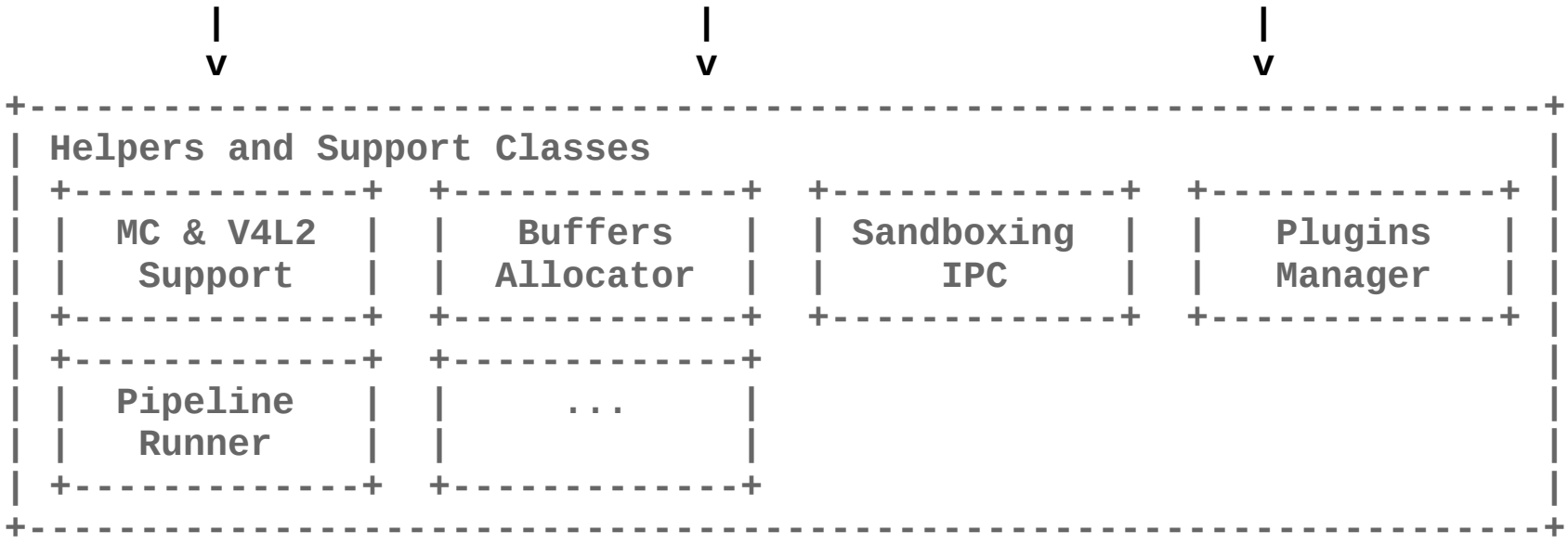
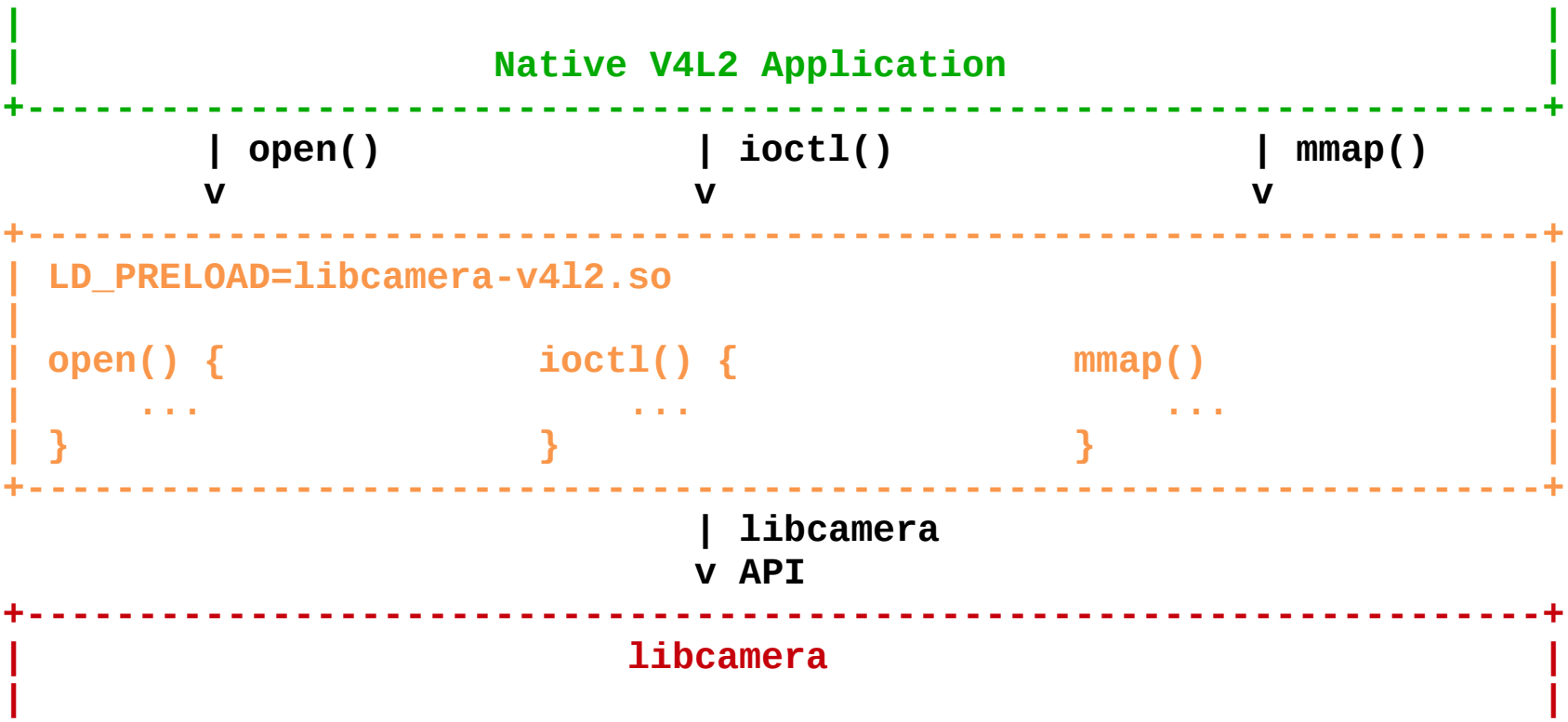
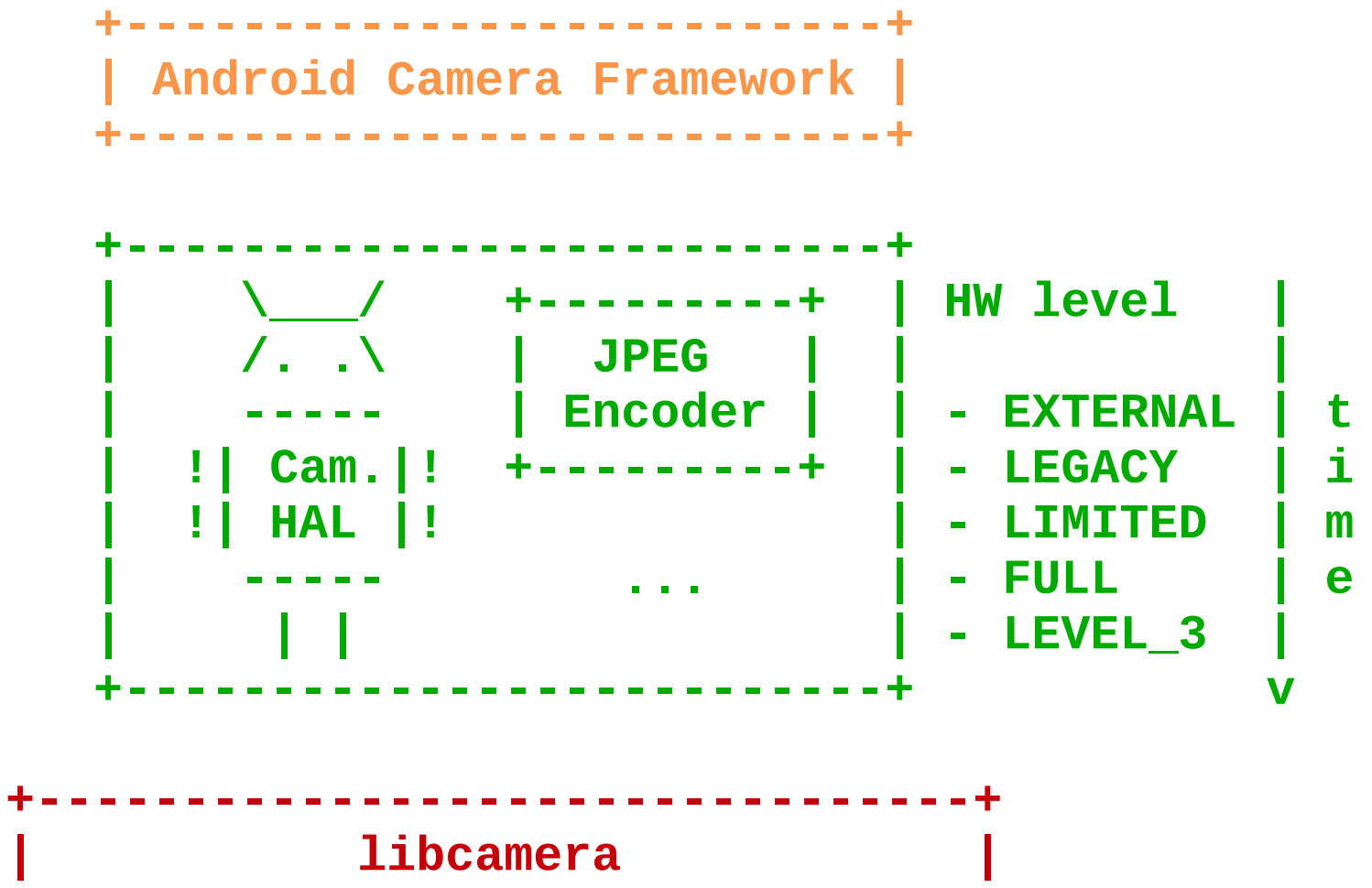


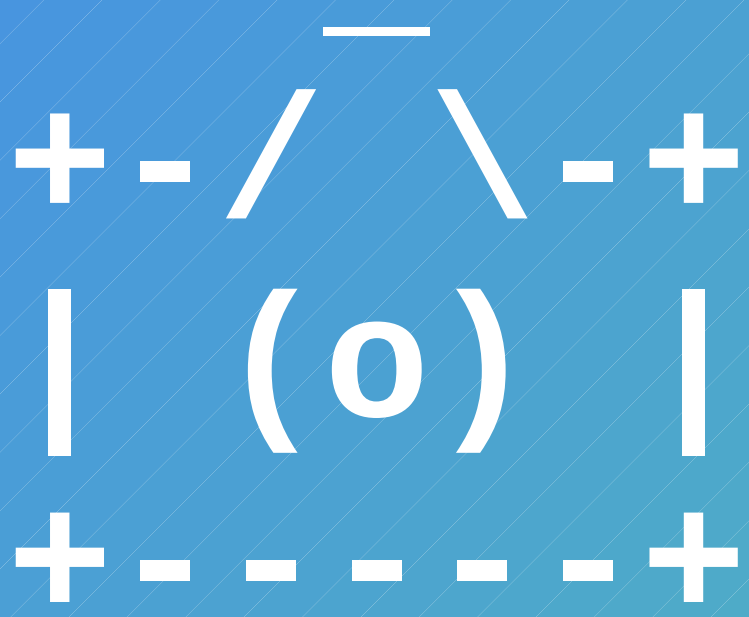
Helpers and Support Classes



V4L2 Compatibility



Android Camera HAL



libcamera

Contents

Welcome!

libcamera is developed as a free software project and welcomes contributors. Whether you would like to help with coding, documentation, testing, proposing new features, or just discussing the project with the community, you can join our official public communication hannels, or simply check out the code.

Mailing List

We use a public mailing list as our main mean of communication. You can find subcription information and the messages archive on the libcamera-devel **list information** page.

IRC Channel

For informal and real time discussions, our IRC channel on Freenode is open to the public. Point your IRC client to **#libcamera** to say hello.

Source Code

libcamera is in early stages of development, no releases are available yet. The source code is available from the project's **git tree**, hosted by **LinuxTV**.

```
$ git clone git://linuxtv.org/libcamera.git
```

Please refer to the README.md file included in the sources for compilation, installation and usage instructions.

Contribute

IDEAS ON BOARD

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laurent.pinchart@ideasonboard.com

Contact

Thank ye!