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.

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.
Why?
Why?
Why?
Why?
libcamera
Camera Stack
Camera Devices & Enumeration
Capabilities & Profiles

- Capabilities
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- Profiles
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IDeAS ON BOARD
Streams
Per-Frame Controls
3A & Image Enhancement Algorithms
Adaptation
Adaptation
libcamera architecture
Camera Device

---------< libcamera Public API >------------------

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+-------------------------------------------------+
|  Camera Device                                  |
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| | Device-Agnostic                             | |
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|                     |
|/Pipeline///        |
|///Handler///      |
|..........................|

Device-Specific

---------< libcamera Public API >------------------
Pipeline Handler
Image Processing Algorithms
Image Processing Algorithms
Image Processing Algorithms
Helpers and Support Classes

- MC & V4L2 Support
- Buffers Allocator
- Sandboxing IPC
- Plugins Manager
- Pipeline Runner
- ...
Native V4L2 Application

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<thead>
<tr>
<th>open()</th>
<th>ioctl()</th>
<th>mmap()</th>
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LD_PRELOAD=libcamera-v4l2.so

open() {
  ...
}

ioctl() {
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mmap() {
  ...
}

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libcamera

V4L2 Compatibility
Android Camera HAL

Android Camera Framework

\___/
/ . . \ --- JPEG Encoder ---
```
| Cam. | !
| HAL | !
```

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<th>HW level</th>
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<tr>
<td>- EXTERNAL</td>
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<td>- LEGACY</td>
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<td>- LIMITED</td>
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<td>- FULL</td>
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<td>- LEVEL_3</td>
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libcamera

IDEAS ON BOARD
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 channels, or simply check out the code.

Mailing List

We use a public mailing list as our main means of communication. You can find subscription 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
? !
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Thank ye!