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Bringing Stateless Video Decoder Support To Linux

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Connect
VIRTUAL • SPRING 2021

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About me

- Over 11 years at Collabora
- Core GStreamer developer
- Contribute to Linux Media

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2011

The beginning of Linux CODECs

- Google partners with Samsung and Asus
- Produce the first ARM Chromebook
- Based on Exynos 5 SoC
- Includes Samsung MFC Decoder
- MFC V4L2 M2M driver landed mainline

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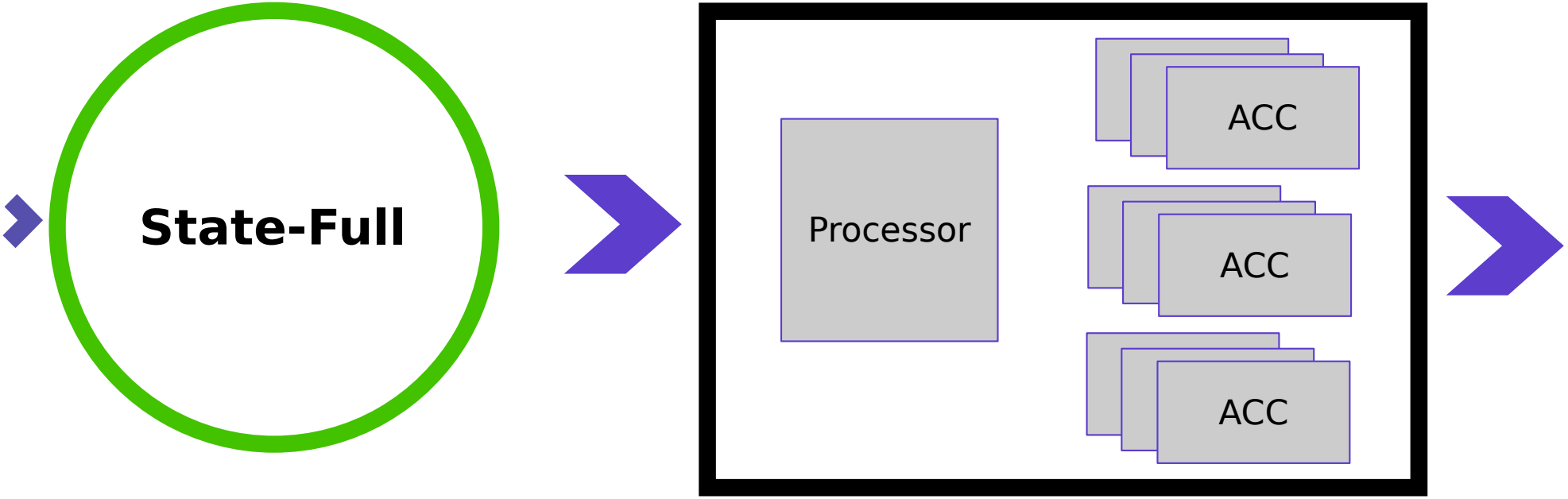
CODA Driver

2014

- CODA driver was added
  - Design from Chips&Media
  - CODA Hx4 and 960 support
- Enabling i.MX51 and i.MX6
- Reversed engineering


State-Full
Processor
ACC
ACC
ACC

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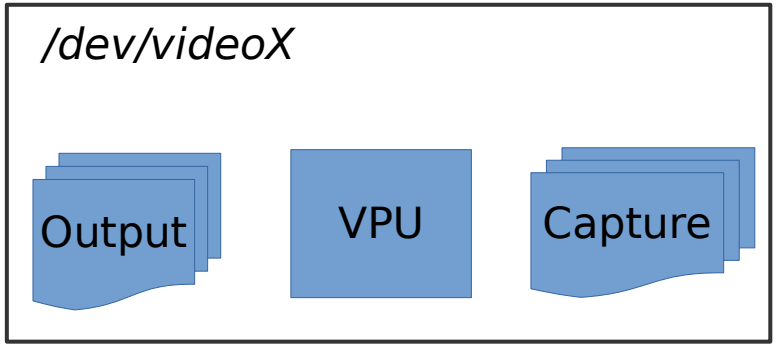
V4L2 M2M



- A V4L2 output queue is used for the bitstream
- A V4L2 capture queue is used for the decoded pictures
- Additional control flow are added to support draining, flushing
- Inter-queue configuration flow is needed

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Pros	Cons
• Minimal per CODEC code needed	• Requires a firmware • Harder to multiplex

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The beginning of Linux State-Less CODECs

2015

- Google partners with Rockchip
- 2nd gen of ARM Chromebook
- New type of CODEC hardware
- Rockchip VDPU ?

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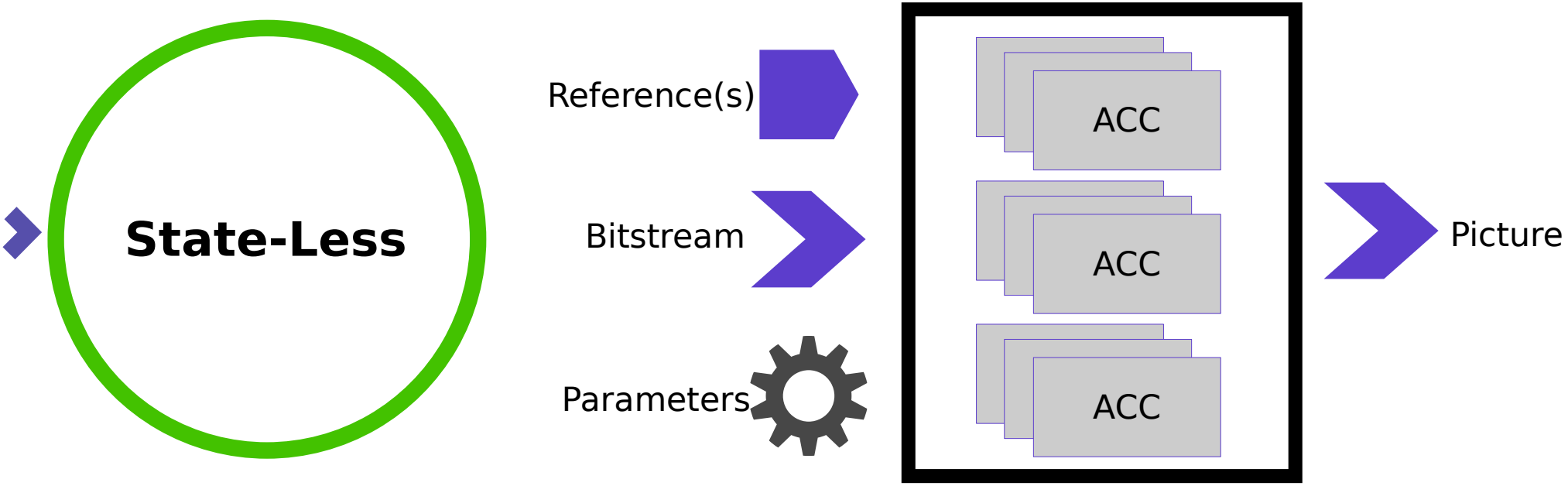
State-Less
Reference(s)
Bitstream
Parameters
ACC
ACC
ACC
Picture

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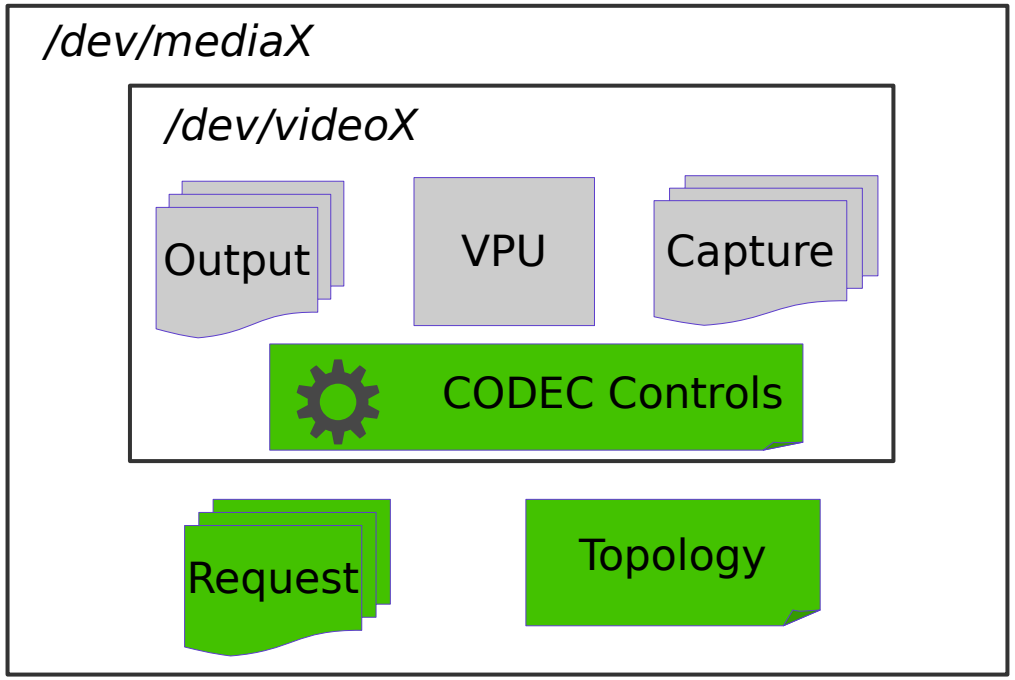
V4L2 M2M + Request



- Per-frame (or slice) controls are associated with bitstream buffers using requests
- References are signaled using user defined timestamps
- Better identification can be done using the Media Controller topology

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V4L2 Specific Process

- Allocate a Request (an FD)
- Set per-frame/slice params for this request
- Queue a v4l2_buffer for the request
- Queue the request
- Poll the request FD for completion

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MediaTek VPU

2016

- State-full H.264, VP8 and VP9 decode
- Tiled output only (requires HW converter)

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Qualcomm Venus

2017

- State-full MPEG4, MPEG2, H.264, VC1, H.264, VP8, VP9 and HEVC decode
- MPEG4, H.263, H.264, VP8, HEVC

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Upstreaming Stalled

- Could not settle on the Request / Job API
- Low knowledge of CODEC decoding process by the linux-media maintainers
- Only one hardware to test the API design
- No formal specification (not that state-full CODEC had any either)

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Allwinner VPU support Kickstarter by Bootlin

2018

- Request API is finalized
- MPEG2 Support landed in Staging
- H.264 support was progressing (but only sliced based)
- Reversed engineered from binary userspace blob
- VA-API userspace drivers

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2019

- The crowd funding had gain good momentum
- A formal specification was merged
- H264, VP8, HEVC uAPI added as staging control API
- Cedrus gained H264 and HEVC support
- RK3288 driver was mainlined (MPEG2, H264, VP8)
- RK3288 driver was renamed Hantro !

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2020

- RK3399 JPEG, MPEG2, H.264 support landed
- GStreamer gained base classes for state-less CODEC, with already merge DXVA2 and NVDEC support
- **GStreamer** H.264 and VP8 V4L2 support landed
- Embedded World Conference 2020 **canceled**
- VA V4L2 Request driver was abandoned

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2021

- H.264 uAPI stable in 5.11
- VP8 uAPI stable in 5.13
- HEVC uAPI is in bad shape
- VP9, MPGE2 and HEVC uAPI being worked on
- Starting to use conformance test (with fluster*)
- Encoder support still under discussion

* https://github.com/fluendo/fluster

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