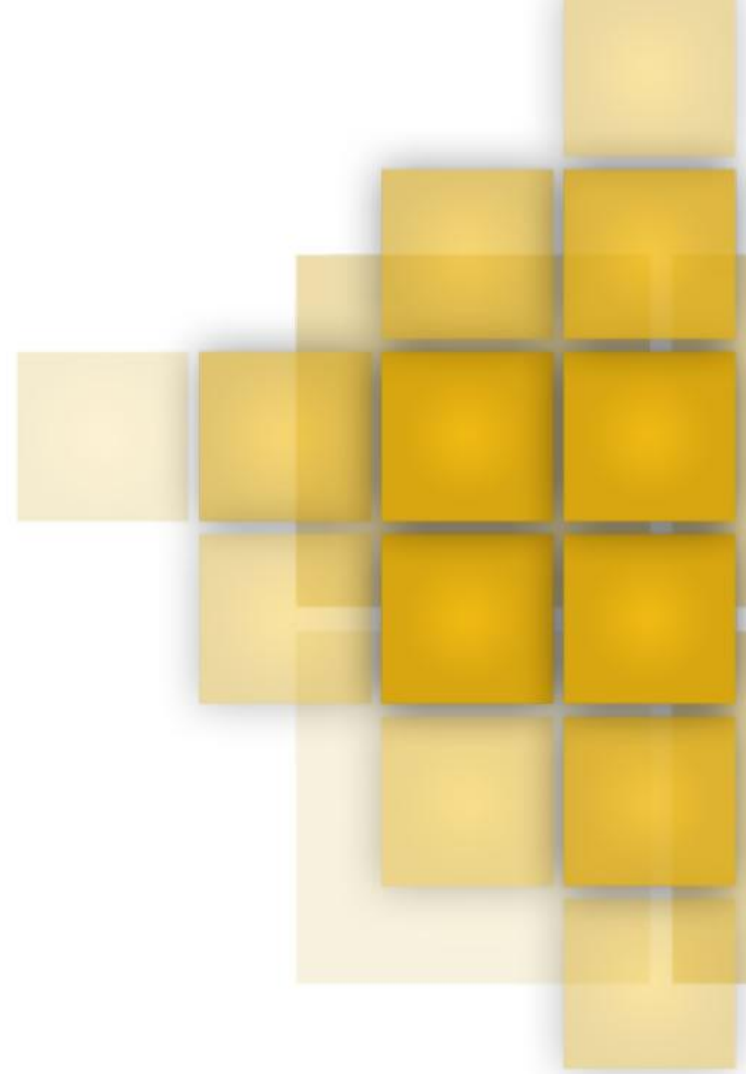# Android Multimedia Framework Overview

Li Li, Solution and Service Wind River

Agenda

- ## What is Multimedia in a mobile device
  - MPEG standard
  - File format
  - Codec

- ## Android Multimedia Framework
  - OpenCORE
  - OpenMAX
  - What we can do with this

# What is Multimedia in mobile device

- Multimedia is the most important component in modern mobile device with modem
  - Multimedia framework is used to process video/audio input and output to satisfy certain functionality including

- Video and Audio
  - Storage video and audio in media
  - Playback video and audio
  - Record video and audio

Audio, Video devices/input

Perfect!

Audio

Video

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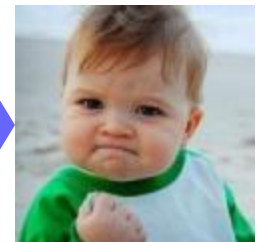
Codec/Decode and File Format

- What is their relationship

  - Container format specify how to wrap various meta-data/stream, most is coded data by codec

  - Theoretically, a container format could wrap any kinds of data, most container formats are specialized for specific data requirements

  - Container does not describe how the data warped is encoded. Always a program be able to identify and open a file ,but not be able to decode contained data. You maybe were told to download right decoder.

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Codec/Decode and File Format

- ## Codec/Decode

    - device or computer program capable of encoding and/or decoding a digital data stream or signal

    - A codec encodes a data stream or signal for transmission, storage or encryption and decode it for playback or editing.

        codec = coder + decoder

    - Raw multimedia data is huge, codec compress them to facilitate store and transfer

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Codec/Decode and File Format

- ## File Format

  - Also call container or wrapper format

  - Specify how different data elements and metadata coexist in a computer file or stream

  - Always contain coded video, coded audio, subtitles, chapter-information, maybe advertisement and synchronization information needed to playback various streams together

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Codec/Decode and File Format

- ## Codec - Audio
  - AAC, MPEG-4 Audio Part 3 subpart 4
  - AC-3, Dolby Digital codec
  - AMR, Adaptive Multi-Rate Audio codec
  - AMR-WB, Adaptive Multi-Rate Wideband
  - MP2, MPEG1/2 Audio Layer II
  - MP3, MPEG2 Audio Layer III
  - Vorbis, OGG audio, opensource project
  - Wma, Windows Media Audio
  - RealAudio, RealNetwork
  - ALAC, Apple Lossless Audio Codec

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Codec/Decode and File Format

- Codec -Video
    - MPEG –1, MPEG –1 Part 2
    - MPEG –2/H.262, MPEG –2 part 2
    - MPEG –4 ASP, MPEG –4 Part 2
    - MPEG –4 AVC/H.264, MPEG –4 Part 10
    - VC –1
        - The informal name of SMTP 421M video codec standard
        - Initially developed as a propriety video format by Microsoft before it was released as a formal SMPTE standard video format on April 3, 2006
    - VC –2
        - An open and royalty-free video compression format, Dirac. 2010 the SMPTE standardized Dirac Pro as VC –2.
    - VC –3
        - DNXHD, Digital Nonlinear Extensible High Definition
        - a lossy high-definition video post-production codec engineered for multi-generation compositing with reduced storage and bandwith requirements
        - The DNXHD codec was submitted to the SMPTE organization as the framework for the VC-3 family of standard.

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Codec/Decode and File Format

- ## Standard MPEG
  - Moving Picture Experts Group.
  - A working group of ISO/IEC in charge of the development of international standards for compression, decompression, processing and coded representation of moving pictures audio and their combination

- ## The standard for storage and retrieval of moving pictures and audio on storage media. Approved Nov. 1992
  - VCD
  - MP2, MPEG-1 Audio Layer II

- ## The standard for digital television. Approved Nov. 1994
  - DVD
  - MP3, MPEG-2 Audio Layer III

Codec/Decode and File Format

- ## MPEG -4

  - The standard for multimedia application

  - a developing standard

  - divided into a number of parts

    - Most are left to individual developers to decided whether to implement

    - probably no complete implementations of the entrire MPEG-4 set of standards

    - To deal with this, the standard includes concept of "profiles" and "levels"

      - allowing a specific set of capabilities to be defined in a manner appropriate for a subset of applications

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Codec/Decode and File Format

- MPEG-4 part 2, Advanced Simple Profile
  - used by codecs such as DiVX, Xvid, Nero Digital and 3ivx, Quicktime 6

- MPEG-4 part 10, MPEG-4 AVC (Advanced Video Coding)/H.264
  - used by x264 encoder, Nero Digital AVC, Quicktime 7, and high-definition video media like Blu-ray Disc

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Codec/Decode and File Format

- ## Video/Audio container
  - ### MPEG program stream
    - standard container for MPEG-1 and MPEG-2 elementary streams on reasonably reliable media such as disks; used also on DVD-Video discs
  - ### MPEG-2 program stream, MPEG-TS
    - Standard container for digital broadcasting and for transportation over unreliable media; used also on Blu-ray Disc Vedio; typically contains multiple video and audio stream, and an electronic program guide
  - ### MP4
    - Standard audio and video container for the MPEG-4 multimedia portfolio, based on MPEG-4 Part 12 and JPEG 2000 Part 12

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What need to do with Multimedia

- Container format parser to recognize and unwrap file

- Codec to encode/decode data.

- Synchronization among various stream

- Memory/Buffer management

- Stream track control, playback, backwards play, forward play

- Integrated into video/audio output system

- Take advantage of hardware accleration

  - Hardware codec

  - Hardware overlay

  - Hardware audio flinger

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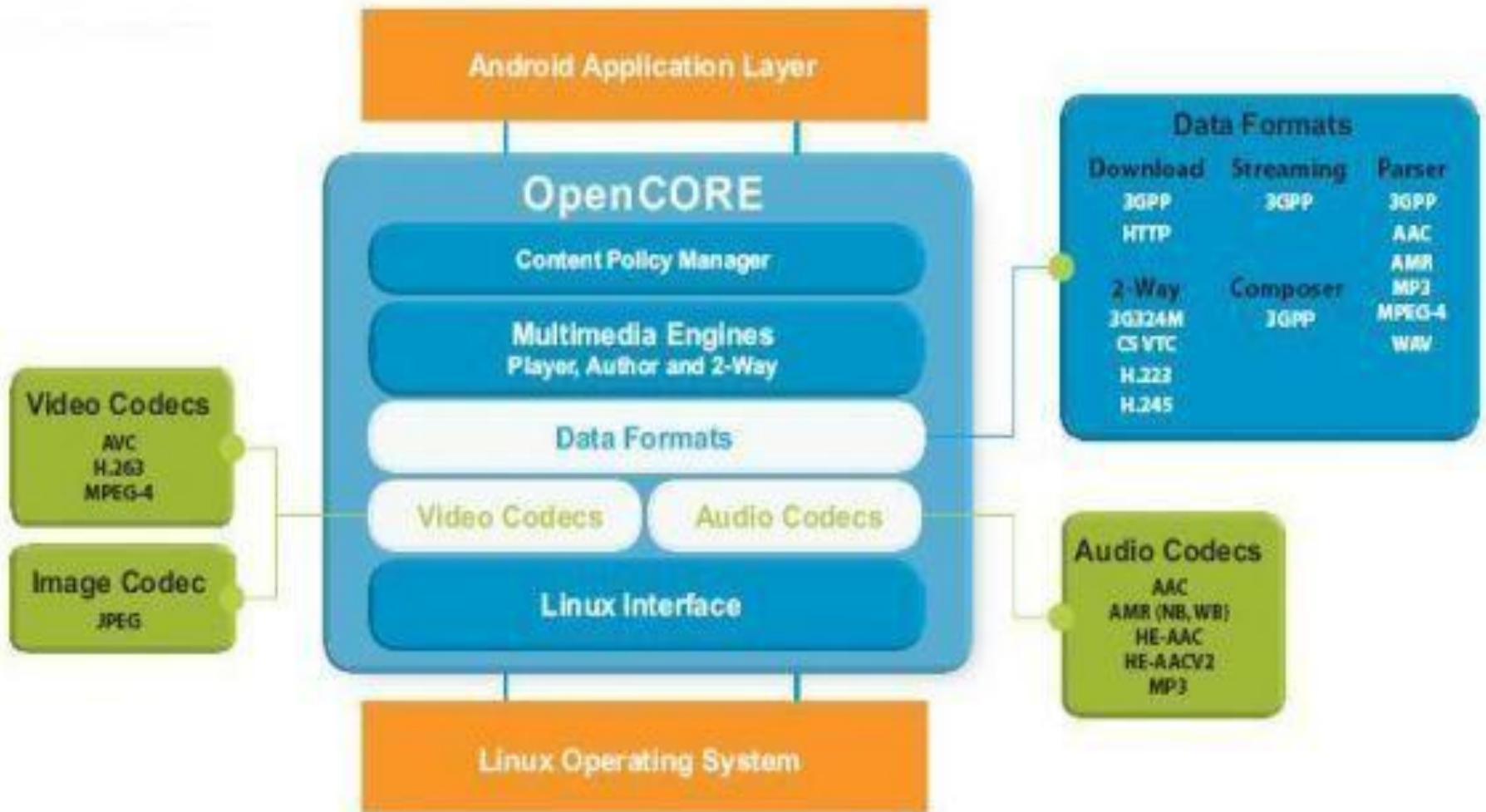# Android Multimedia Framework

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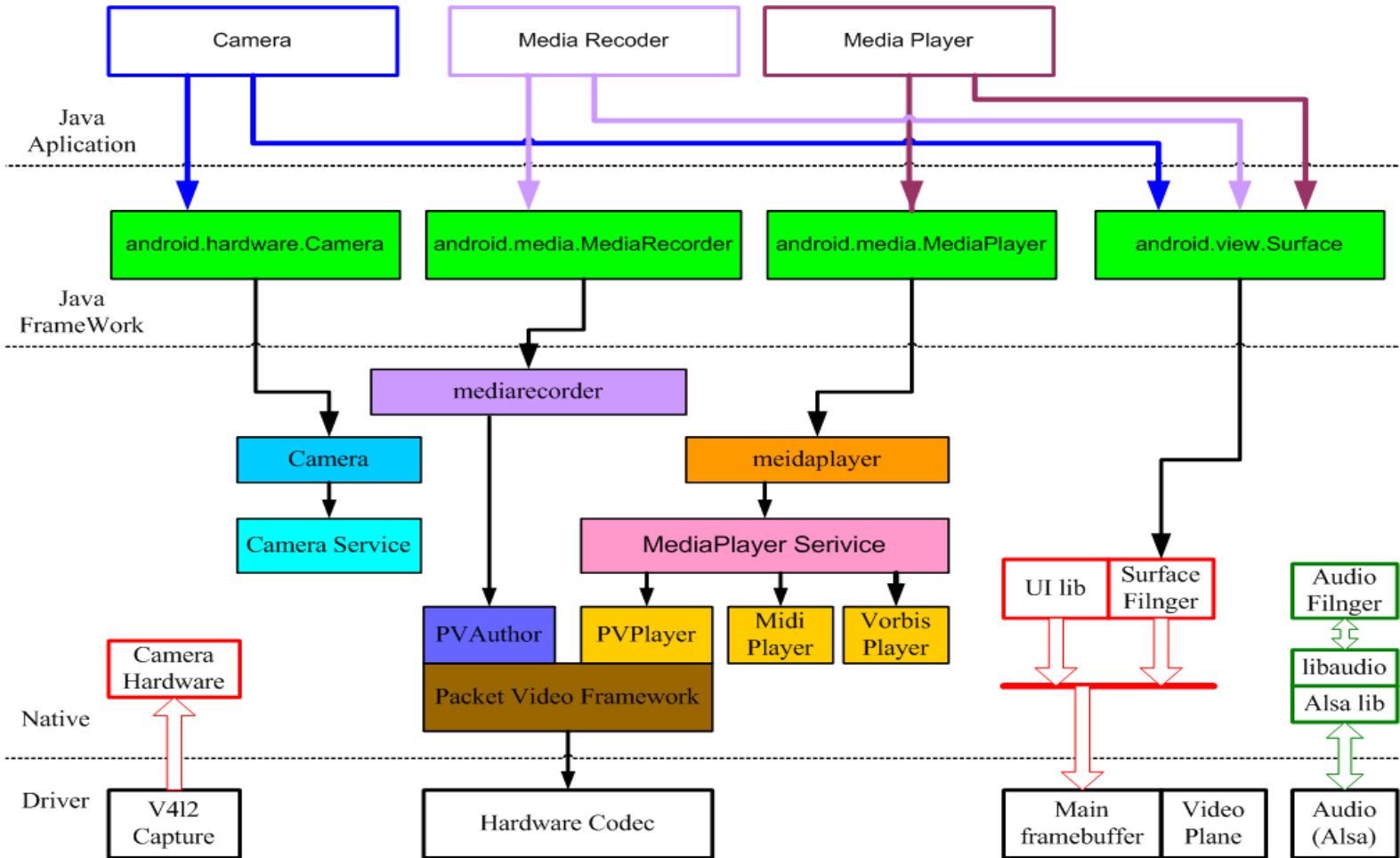
OpenCORE – Initial Android Multimedia Framework

- Android multimedia subsystem provided by PacketVideo

  - modular, extensible framework

    - Combining independent media processing components

    - file formats, codecs, streaming protocol components

    - rendering compoments

    - other elements in different ways to implement a wide variety of multimedia scenarios

  - abstraction a conception of NODE

    - the base of the modulization

    - Implementation in form of NODE for recognizer module, parser module, codec module, sink module
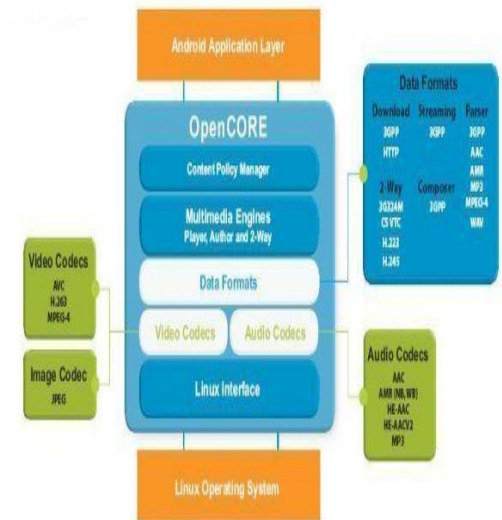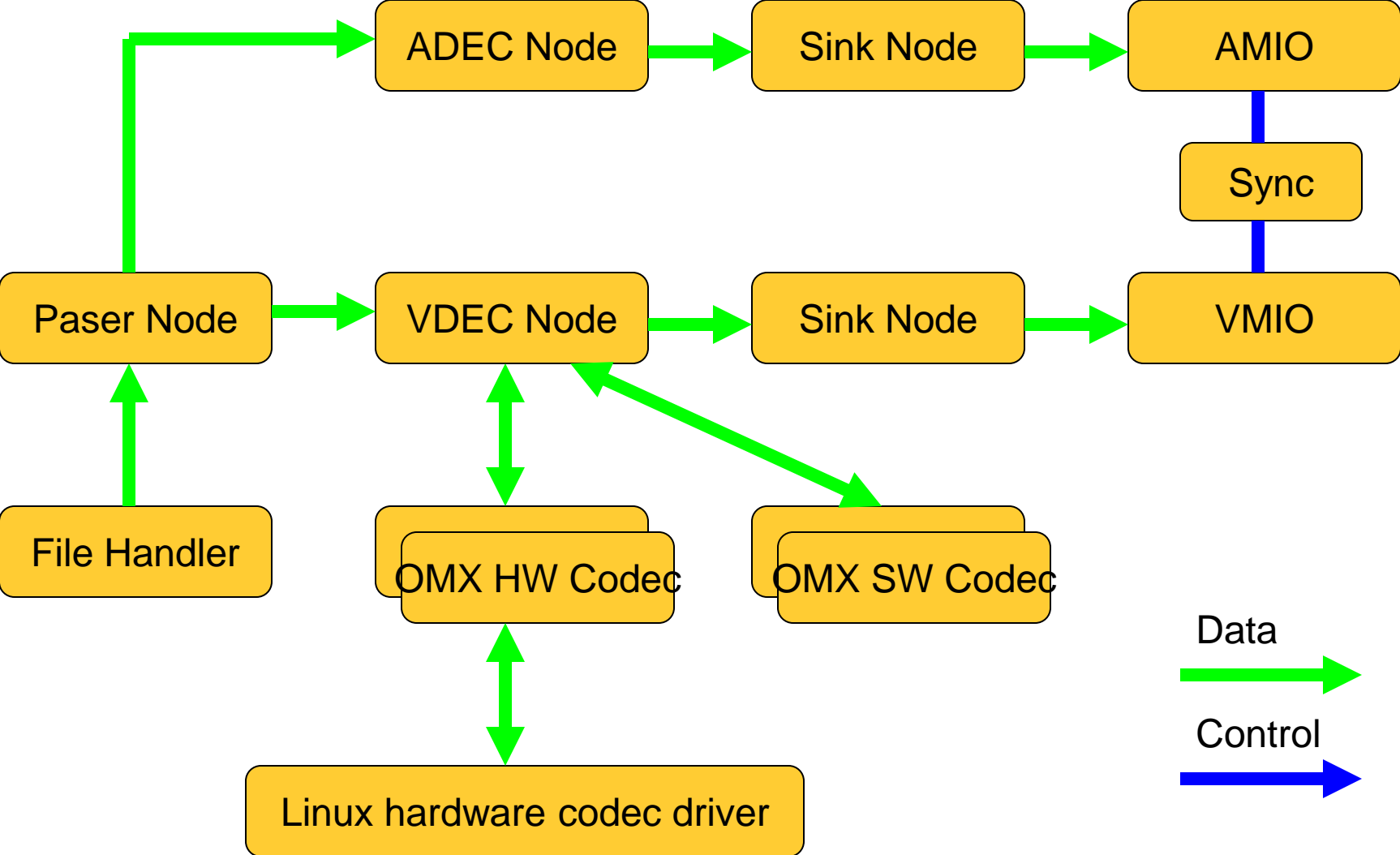
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OpenCORE – Initial Android Multimedia Framework

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OpenCORE – Initial Android Multimedia Framework

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OpenCORE – Initial Android Multimedia Framework

Container Format	Parser	Composer
MPEG4	yes	yes
3GPP	yes	yes
3GPP2	yes	no
MP3	yes	no
AAC	yes	no
AMR	yes	yes
WAV	yes	no

Type	Codec	Decoder	Encoder	Comments
Video	H.263	yes	yes	Baseline Profile
	MPEG-4	yes	yes	Simple Profile
	AVC/H.264	yes	yes	Constrained Baseline Profile
Audio	MP3	yes	no	
	AAC	yes	no	AAC, HE-AAC v1/v2
	AMR-NB	yes	yes	
	AMR-WB	yes	no	

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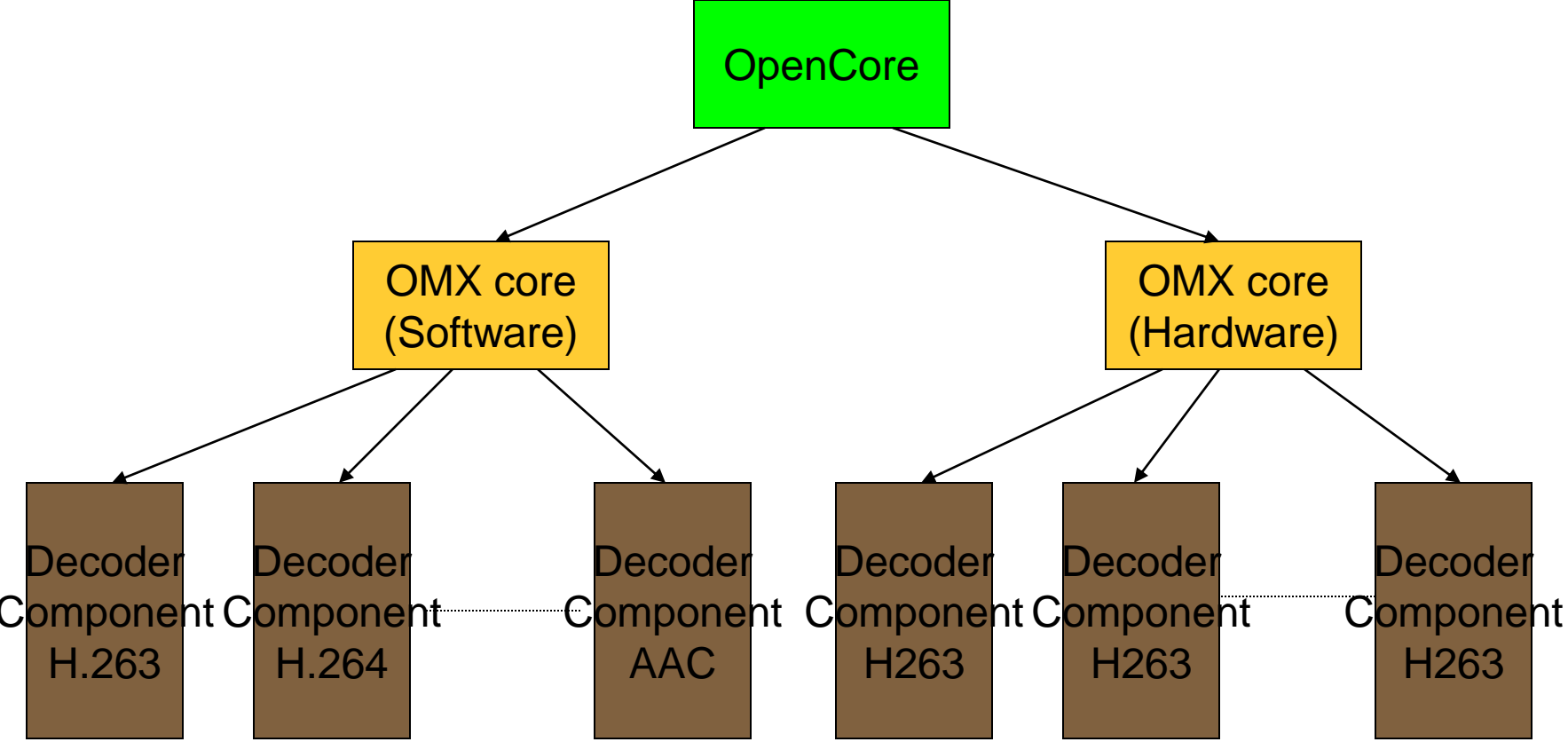# OpenMAX – Bridge Codec/Decode to Multimedia Framework

- the Integration Layer (IL) interface with Open Core
  - royalty-free, cross-platform API for
    - comprehensive streaming media codec and application portability
    - enable accelerated multimedia components to be developed, integrated and programmed across multiple operating systems and silicon platform
  - The OpenMAX API will be shipped with processors to enable library and codec
    - Rapidly and effectively make use of the full acceleration potential of new silicon
   - regardless of the underlying hardware architecture

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OpenMAX - Framework

Media applications can be written portably, independent of the underlying media platform

Media components can be integrated into flexible media graphs for advanced streaming media processing

Media components can be written using primitives for portability across diverse parallel and serial silicon architectures

Application

OpenMAX|AL — "Application Layer" Defines high-level playback and recording API

Platform Media Framework

OpenMAX|IL — "Integration Layer" Defines media component interfaces

| Audio Components e.g. MP3 | Video Components e.g. H.264 | Image Components e.g. JPEG |

OpenMAX|DL — "Development Layer" Defines low-level media primitives and concurrency constructs

Media Engines - CPUs, DSP, Hardware Accelerators etc.

OpenMAX layers can be implemented together or independently from the other layers

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OpenMAX Position in Android Multimedia Framework

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OpenMAX API list

- For each OMX core, there are function points need to be implmented.
  - pOMX_Init
  - pOMX_Deinit
  - pOMX_ComponentNameEnum
  - pOMX_GetHandle
  - pOMX_FreeHandle
  - pOMX_GetComponentsOfRole
  - pOMX_GetRoleofComponent
  - pOMX_SetupTunel
  - pOMX_GetContentPipe
  - pOMXConfigParser

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One Sample of Openmax Design

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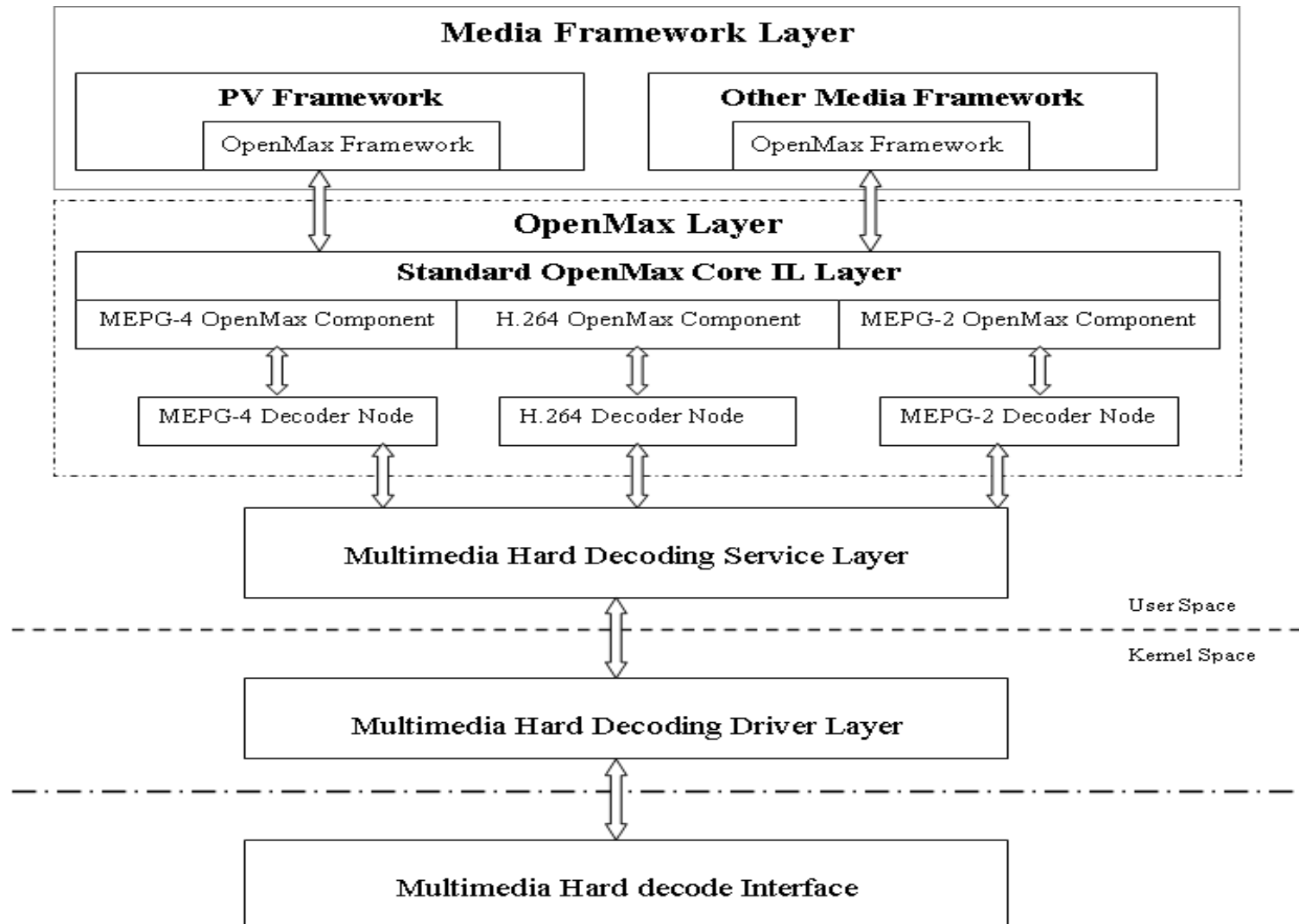
Commercialization

- Functionality

  - Does you support enough container format

  - Does you support necessary codec

  - Does you support stream, video over air

- Performance, critical

  - Video performance. Frame per second

  - Audio performance. High quality sound

  - Synchronization between video and audio

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Commercialization

- **Take advantage of SoC capability**
  - Design OMX IL layer for specific hardware codec component
  - Design Overlay take advantage of hardware gpu or video output controller
  - Design high quality audio solution

- **Whole system video buffer management scheme**
  - Share memory buffer between various hardware component
  - Decrease memory copy as possible

- **Synchronization scheme. Esp for some fault file**
  - Choose the right point to fix sync problem. In parser or codec.

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Commercialization
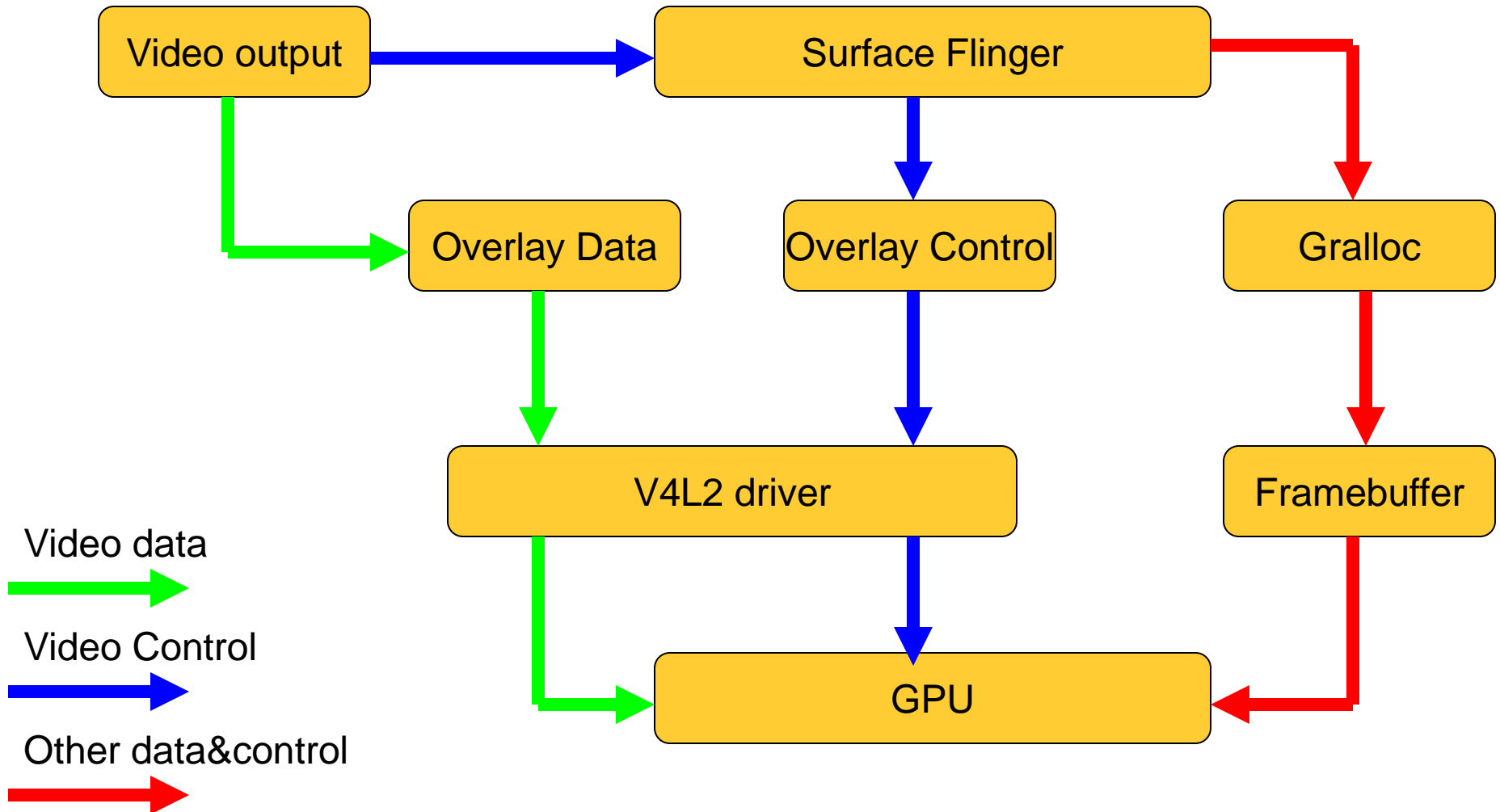
OpenCORE and Stagefright

- Android introduce Stagefright to replace OpenCORE start from éclair

- Either OpenCORE or Stagefright is linked to MediaPlayerService, so application level never know about them

- Both of them based on same conecption, but take different implementation

  – Stagefright take parser and decode as a whole. Opencore take them as individual node

  – Stagefright take parser, decoder, sink/output as serial operation. Opencore take them as parallel

  – Different Sychronization mechanism

- Easier for Stagefright to develop parser

- Adopt OMX from OpenCORE

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OpenCORE and Stagefright

- Short point and Stong point
  - OpenCORE more stable and mature, low risk
  - OpenCORE supports more container format and codec
  - Stragefright is more easier to development.

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