Real-Time High Performance Multimedia Systems on Android

Ittiam

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Agenda

- Android on Embedded
- Typical Real Time Multimedia System
- Key Challenges
- Designing/Integrating multimedia systems into the Android Framework and Runtime
- Android API Standardization

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- Android on Embedded

Typical Real Time Multimedia System

Key Challenges

Designing/Integrating multimedia systems into the Android Framework and Runtime

Android API Standardization

Android on Embedded

- Embedded System?
  - A system dedicated for a particular real time application

- Hardware Capabilities (an example)
  - **Processor speed** - 1.5Ghz QuadCore
  - **RAM** – As high as 2GB
  - **External Memory** – Scalable up to 64GB
  - **GPU** – Multicore GPUs like Adreno 320
  - **VISA Accelerators** – Full HD / Multi-channel capable accelerators

- Multi Media Applications on Embedded
  - Video Conferencing, streaming systems, Surveillance and more

Android on Embedded

Why Android for Embedded systems?

- One of the fastest growing operating system that is outgrowing the mobile and tablet space
- Open source
- Linux++ : Ideal for an embedded system with a screen
- Access to thousands of apps from the Android Market
- …

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Android on Embedded

- Typical Real Time Multimedia System

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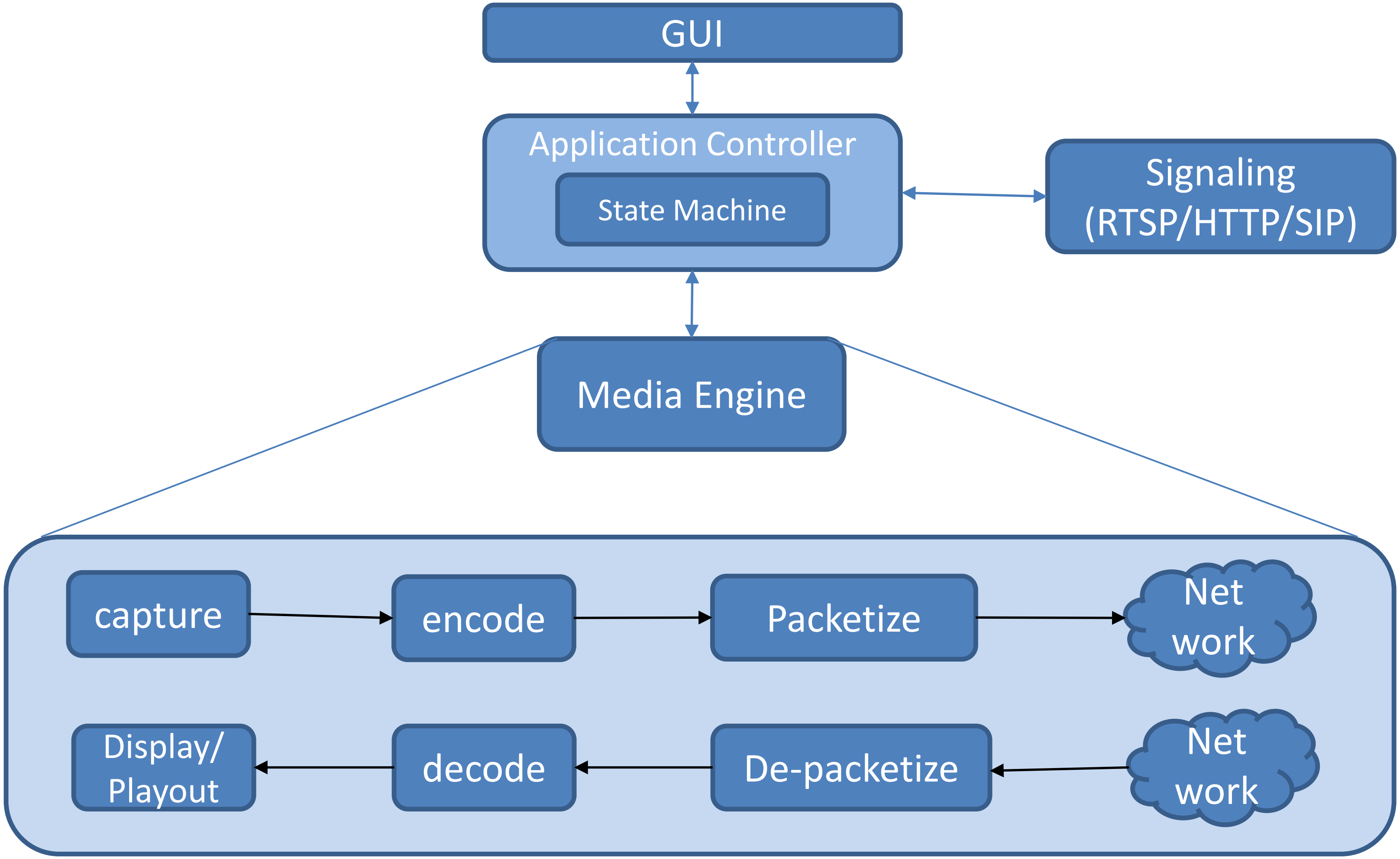
Real Time System

A real-time system is any information processing system which has to respond to externally generated input stimuli within a finite and specified period – the correctness depends not only on the logical result but also the time it was delivered.

Video Conferencing: An example…



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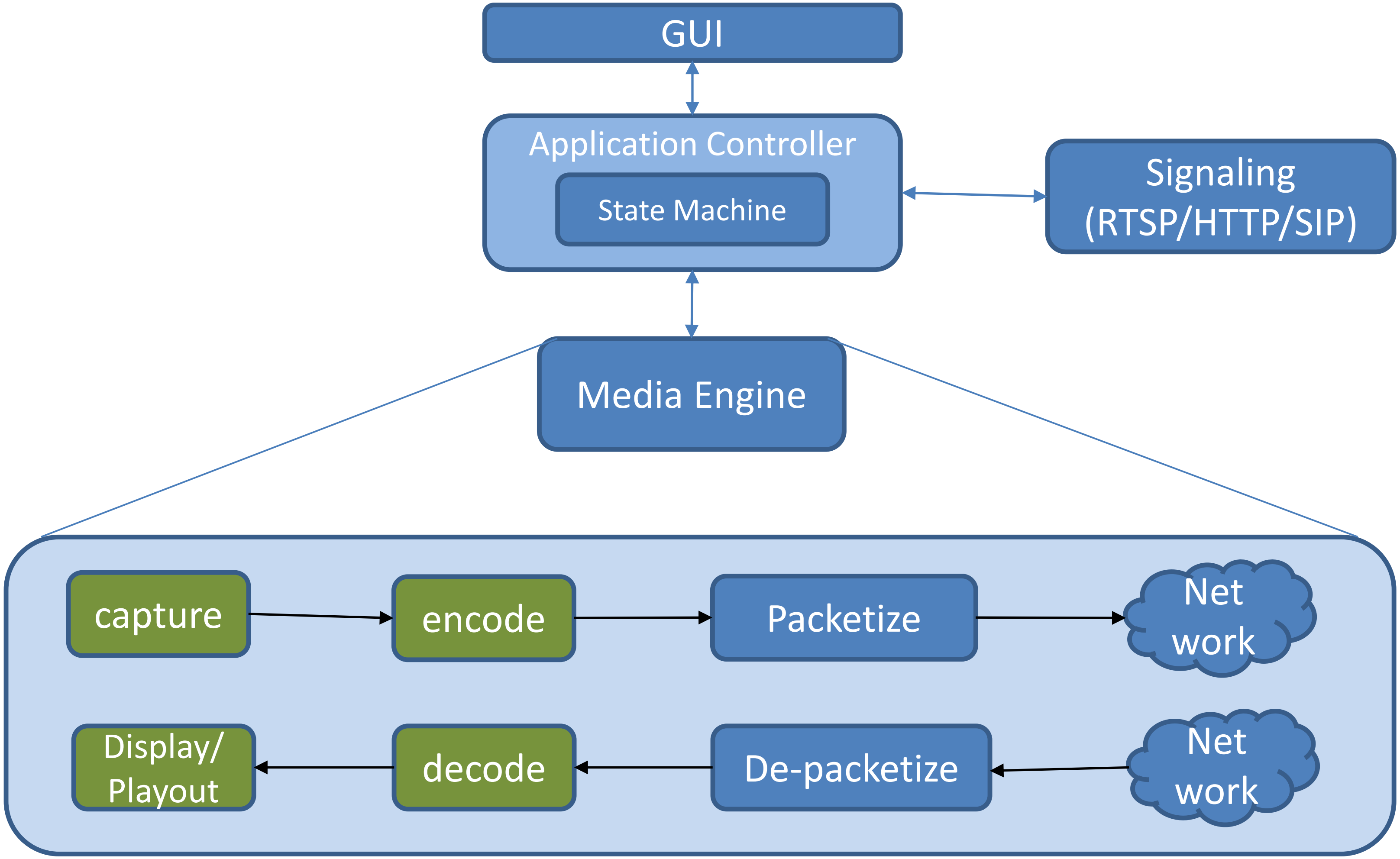
Video Conferencing: An example…



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Android on Embedded

Typical Real Time Multimedia System

- **Key Challenges**

Designing/Integrating multimedia systems into the Android Framework and Runtime

Android API Standardization

Key Challenges

- Low Latency
- High Performance
- Low System Load => Maintain Battery Life
- Quality of Service
- Co-Existence with other Applications
- Portability

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Typical Real Time Multimedia System

Key Challenges

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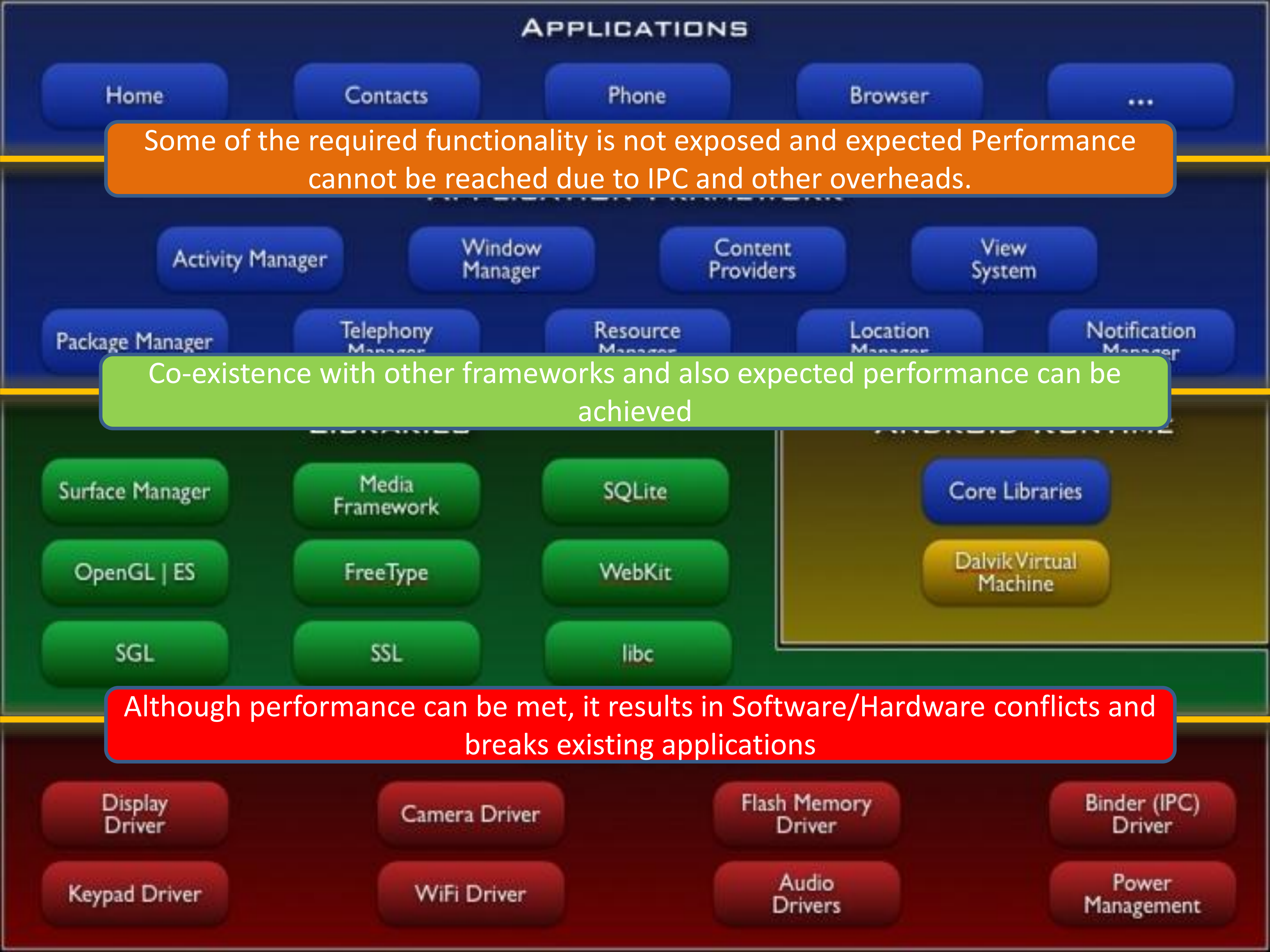
Android API Standardization

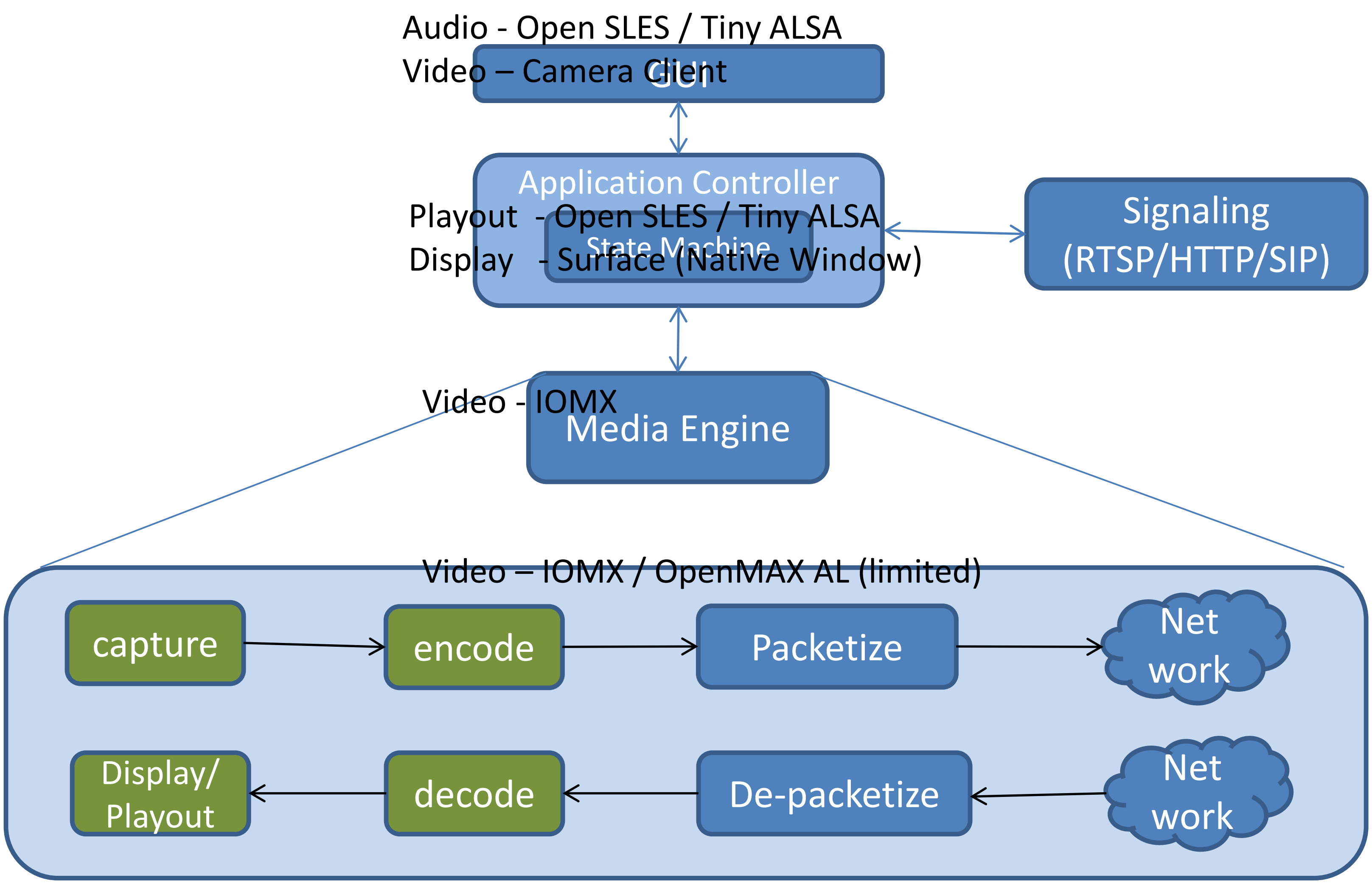


Some of the required functionality is not exposed and expected Performance cannot be reached due to IPC and other overheads.

Co-existence with other frameworks and also expected performance can be achieved

Although performance can be met, it results in Software/Hardware conflicts and breaks existing applications

Native Framework Interfaces


Audio - Open SLES / Tiny ALSA
Video – Camera Client

Playout - Open SLES / Tiny ALSA
Display - Surface (Native Window)

Video - IOMX

Video – IOMX / OpenMAX AL (limited)

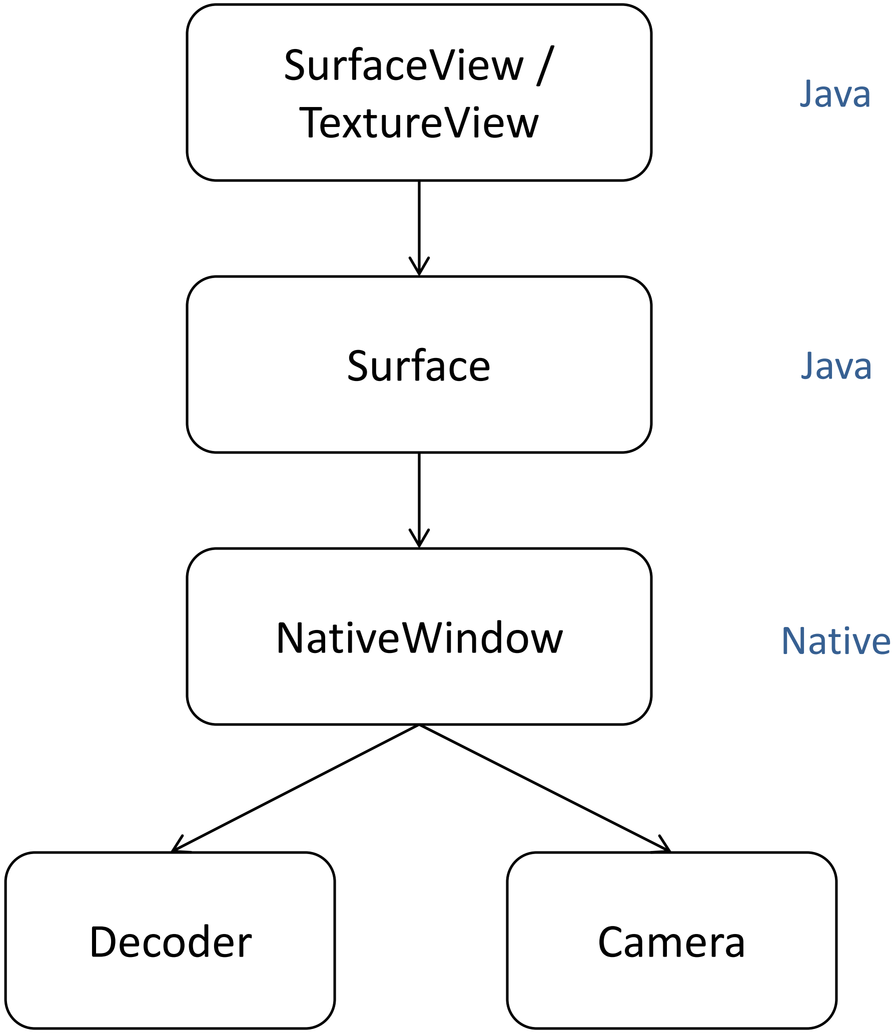
Audio

- Capture and Playout
  - Open SLES
    - Standardized at NDK
    - Latency ~ 200ms
  - Tiny ALSA
    - Not standardized at NDK, requires access of Audio HAL
    - Latency ~ 40ms => Meant for ultra low latency system
- Audio encode and decode
  - Software Codecs
  - Requires low processing power

Video – Capture

- Camera Client
  - Can provide frames that can be directly fed to the encoder – No copy overheads
  - Provides tunneled preview mode
  - Gives control for low level camera operations

Video - Display



Video – Encode/Decode

- iOMX Interface
  - Android Native Interface to OpenMaxIL
  - Applications get access to hardware accelerated codecs through an iOMX client
  - Not standardized
- OpenMAX AL
  - Standardized NDK APIs available only for Media Player
  - Supports minimalistic configuration

Are we there yet?

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- High Performance
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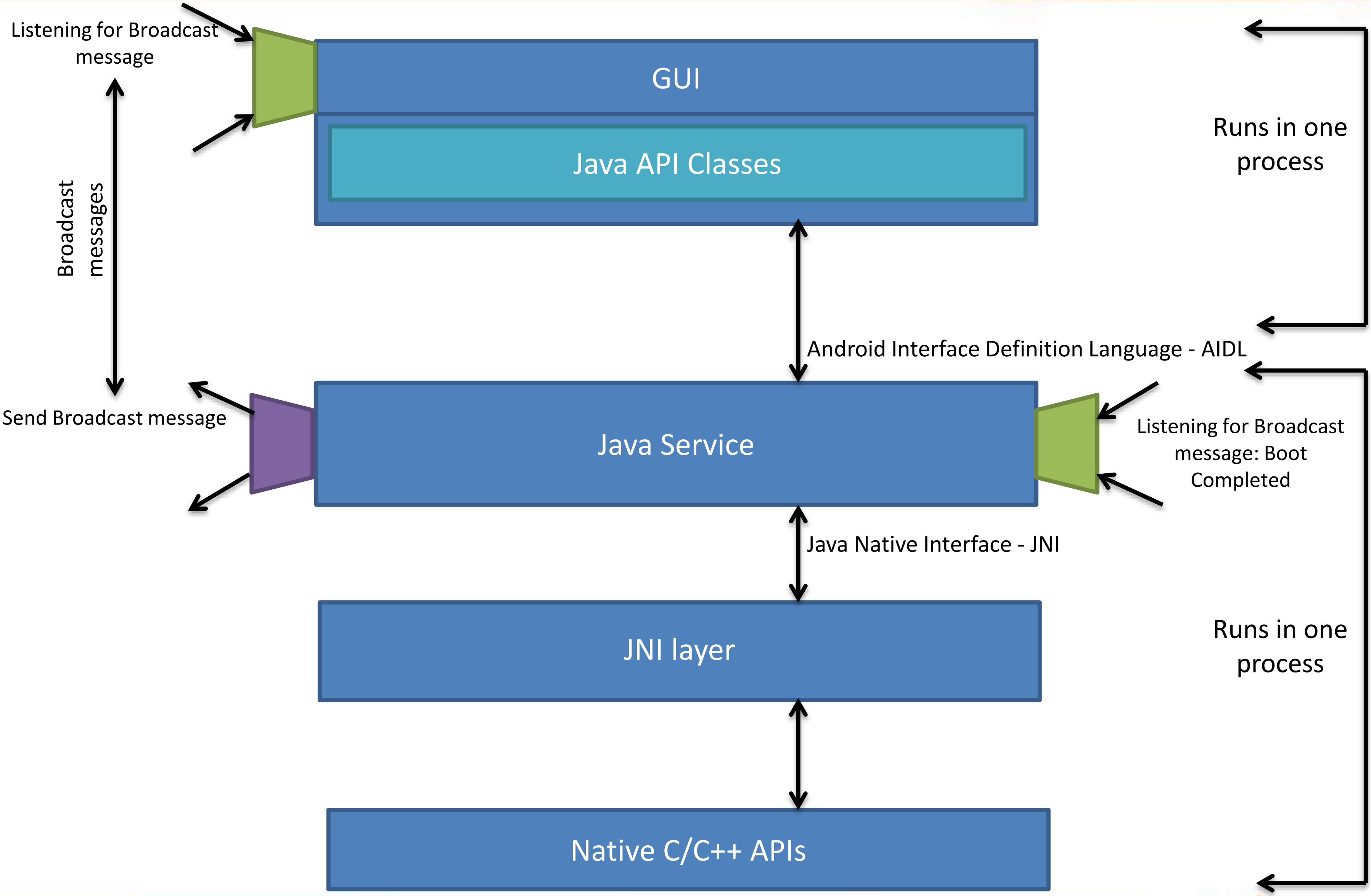
Integrating application with Android


Listening for Broadcast message
GUI
Java API Classes
Runs in one process
Broadcast messages
Android Interface Definition Language - AIDL
Send Broadcast message
Java Service
Listening for Broadcast message: Boot Completed
Java Native Interface - JNI
JNI layer
Runs in one process
Native C/C++ APIs

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Android API Standardization

- **Video Capture**
  - Camera APIs can be standardized at NDK
- **Video Display**
  - Native Window APIs like queue/dequeue and so on can be standardized at NDK
- **Video Encode**
  - An independent video encode APIs can be added to NDK
- **Video Decode**
  - APIs can further be enriched by adding support for configuration like low delay settings and so on
- **Audio Capture/Playout**
  - OpenSLES - already supported in NDK. Minor enhancements required.

Q & A

It is not the answer that enlightens, but the question.
- **Eugene Ionesco**

Thank you