# Media on Android

March 2016

by Edison Wang
(@wew)

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| 140 | 11 |
| --- | --- |
| Countries with LTE | LTE scheduled |

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# Video

A stream of bytes that represents a series of **images** and **sound** to be presented to the on the screen and the speaker in a predetermined **pattern**.

# Video Playback

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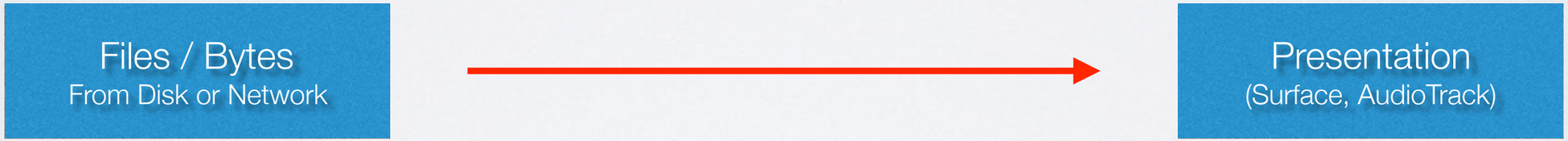


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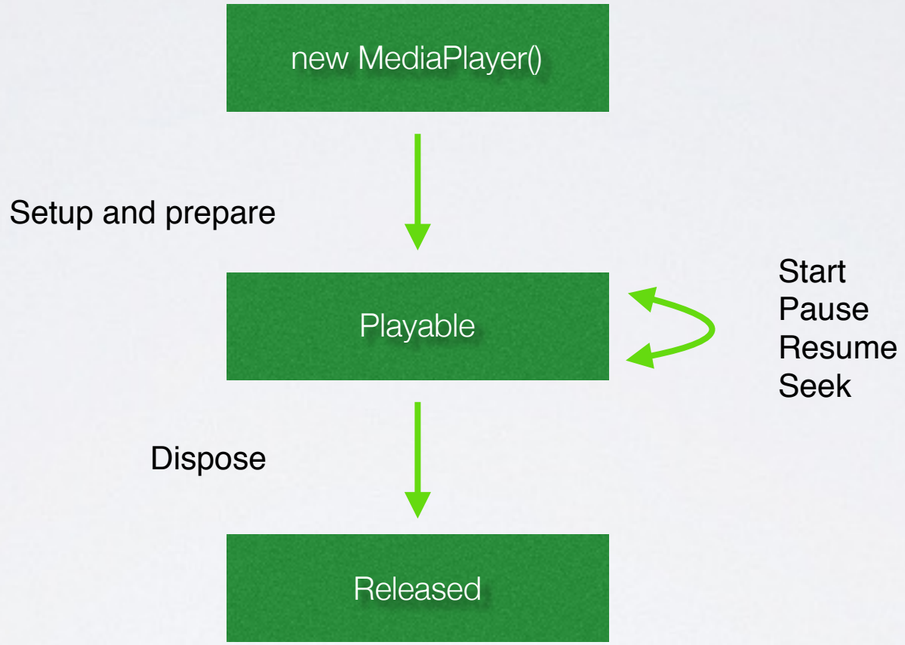
# MediaPlayer

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  - Inconsistent states - Call via a handler queue.
  - Hanging objects - Make sure to release references.
- Most cases it requires a Surface to be ready - View’s ownership.
  - You can have multiple of them, just make sure to keep track.

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  - OpenGL ES texture you can manage on your own or managed by a View
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- **Grafika**: https://github.com/google/grafika
- SurfaceView vs TextureView

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# We want more

- What about adaptive playback?
- What about custom buffer control during playback?
- What about playback rate change?
- What about animations and transitions?
- What about control over performance?

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# ExoPlayer

- http://developer.android.com/guide/topics/media/exoplayer.html
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- Super responsive open source repo; ships separately.
- Reliable since API 16 (19 preferred).
- Supports streaming : DASH / HLS / SmoothStreaming out of box.
- Supports Common Encryption out of box.
- Much more accurate seek if needed.
- Super easy to use; highly customizable.

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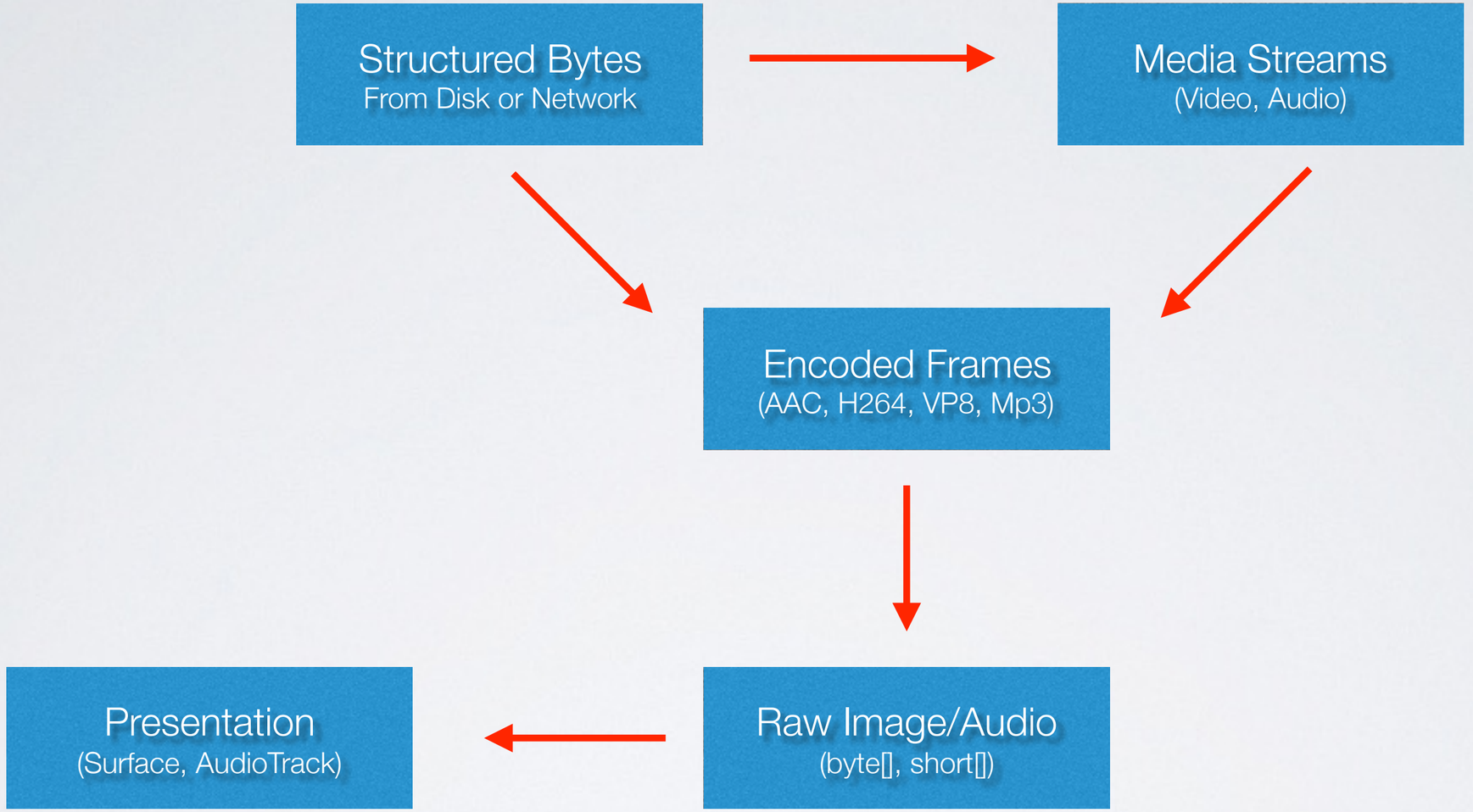
Structured Bytes
From Disk or Network
Media Streams
(Video, Audio)
Encoded Frames
(AAC, H264, VP8, Mp3)
Raw Image/Audio
(byte[], short[])
Presentation
(Surface, AudioTrack)

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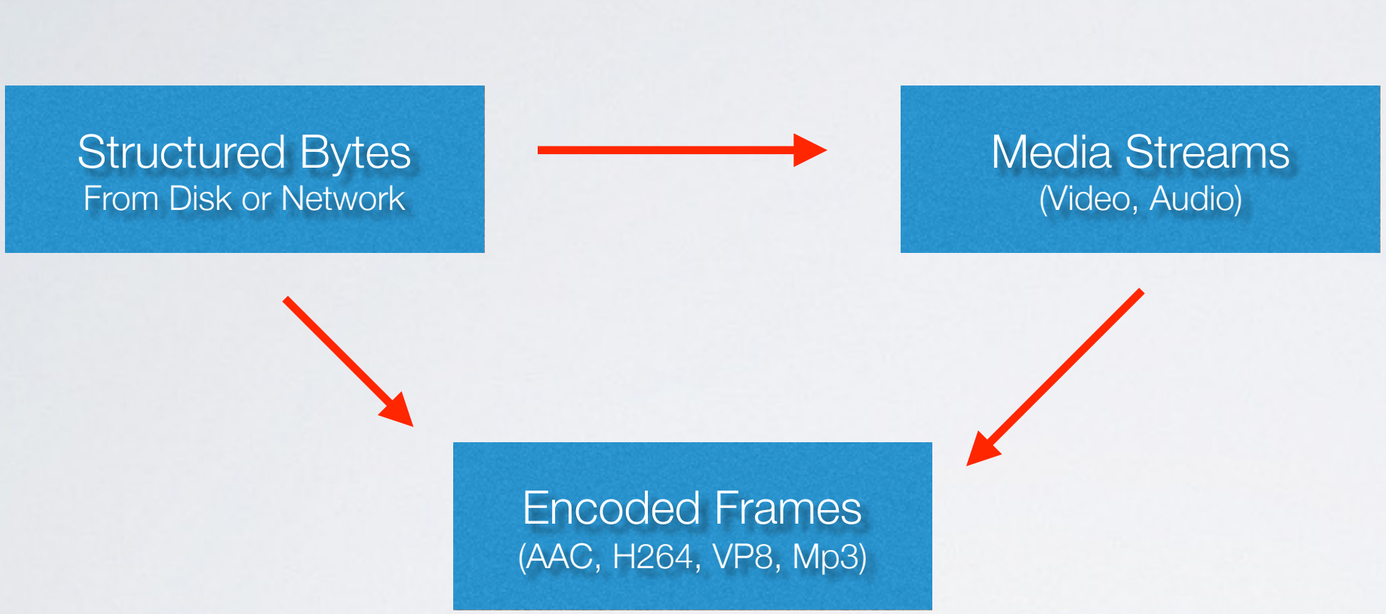


- MediaExtractor
- MediaMetadataRetriever
- FFmpeg (libavformat)
- Adaptive Manifest Manager

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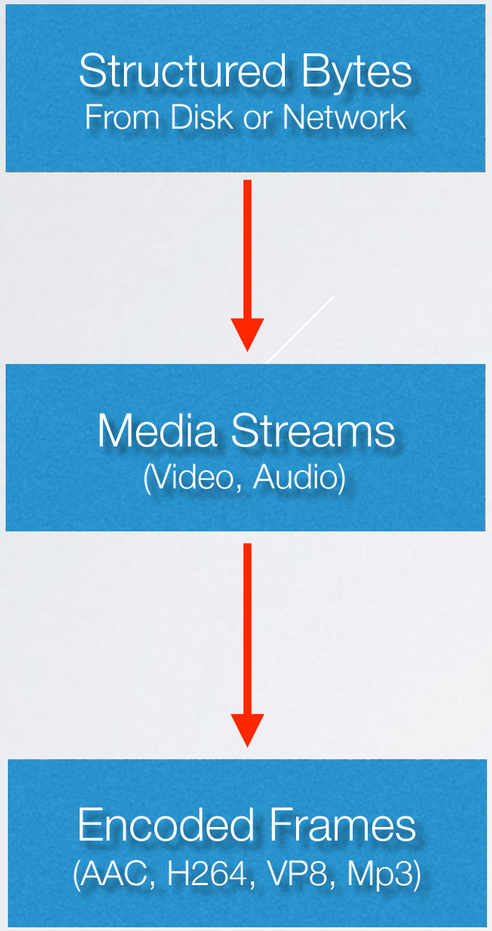
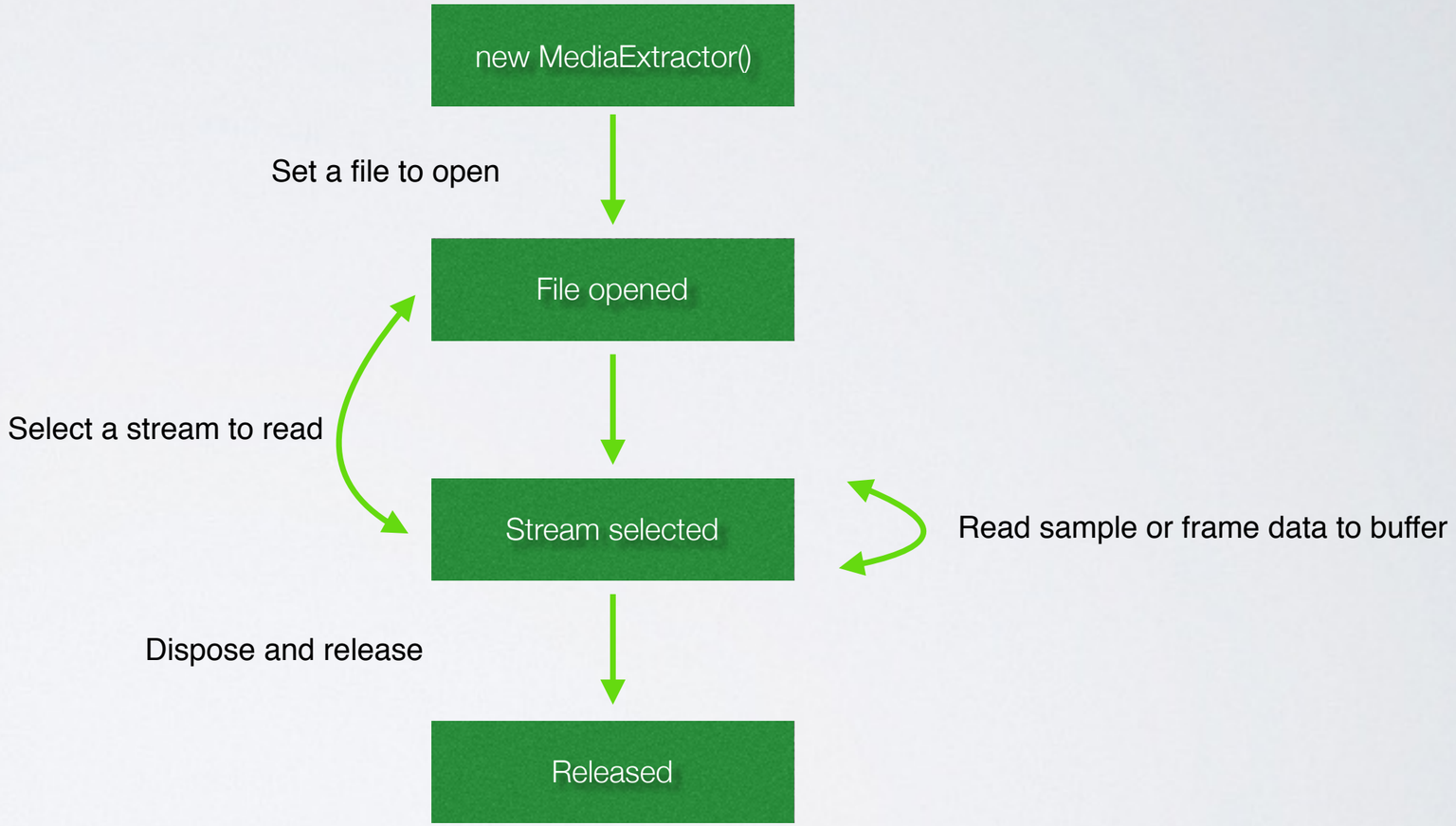
# MediaExtrator (API 16)

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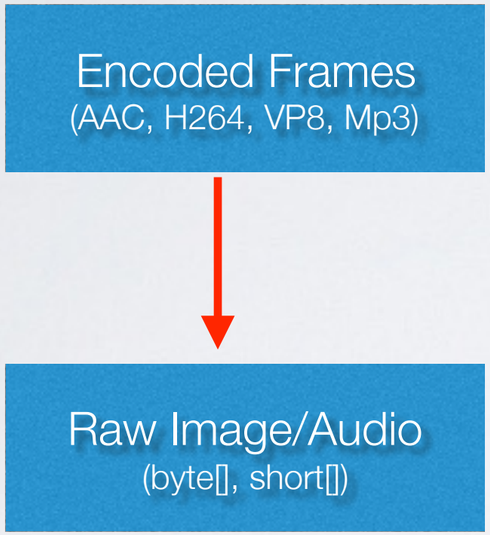


- OMX (hardware, NDK only)
- MediaCodec (API 16, hardware)
- FFmpeg (AVCodec etc, software)

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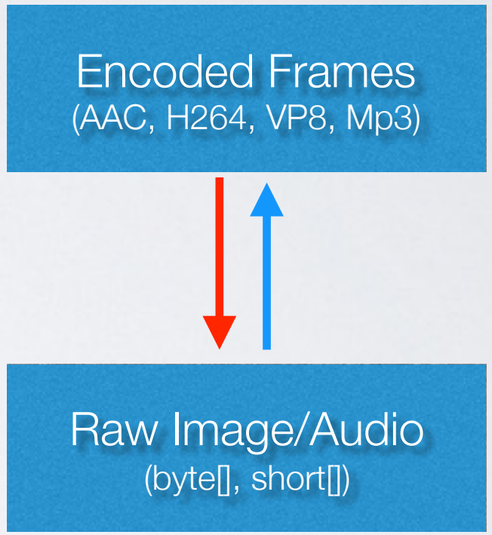
# MediaCodec

- Decoding alright since API 16, but encoding input not usable until API 19.
- For all video frames, do things via Surface proxy.

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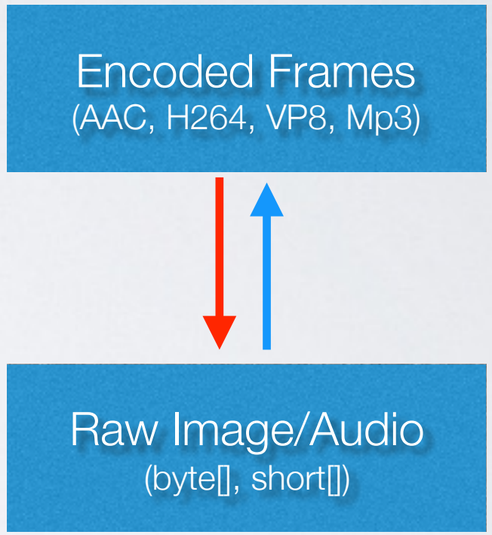
# MediaCodec

- Decoding alright since API 16, but encoding input not usable until API 19.
- For all video frames, do things via Surface proxy.
- Create and configure MediaCodec.
  - Loop through inputs.
    - Wait until input buffer is ready to give an input.
    - Wait until output buffer is ready and read result. *
  - Dispose resources.

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# Audio Presentation

- A pipe between decoded samples and audio output.
- You put small chunks of samples into it at a time.
- Never leave it thirsty during playback.
- Fade on raw samples.
- Save the front for smooth looping.
- Amount of Samples = Measurement of Elapsed Time.
  - Keep in mind the delay variables.

Presentation
(Surface, AudioTrack)

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# Video Presentation

- Always use audio as the time source
- Timestamps are stored via BufferInfo from MediaCodec.
- Scale the timestamps if you are doing a speed change.
- When ready, release the buffer to be outputted.
- Play around with timing tolerances on devices if having trouble syncing.
- Multi-purpose.

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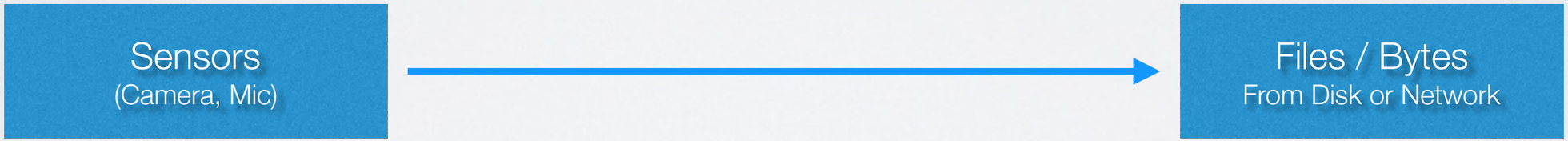
# Recording



# Road to encoded

- Color conversion via **RenderScript**
  - super optimized NDK code can achieve similar result 50x faster than do it via Java.
- Image manipulation (crop, rotation, inversion, etc.) via Matrix & Canvas.
- Encode to final video frame.  (bottleneck)
- **Avoid GC: All intermediate objects are initialized before hand and reused.**
- Lots of pre-allocated buffers and objects.
  - largeHeap=true.
  - Separate dedicated process for more RAM budgets and avoid memory fragmentation.

# Audio from Mic

- AudioRecord to save the day.
- Continuous sample gathering in small chunks.
- THREAD_PRIORITY_URGENT_AUDIO.
- Avoid GC_ALLOC for world pauses.

# Video from Camera

- PreviewCallback.onPreviewFrame(byte[] data)
- Set a callback via Camera.setOnPreviewCallback()
  - uses a new byte[] every frame -> GC -> lag.
- Use Camera.setOnPreviewCallbackWithBuffer() instead.
  - manual buffer management via Camera.addBuffer()
- OR… Just use Camera2 where you can have accurate timing.

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# Questions?

- AMA! :)
- Thank you!
- hello@edisonwang.com
- @wew
- We are hiring at Spiral!

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