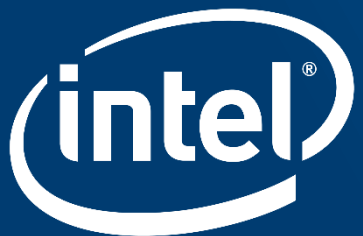


ENHANCE VIDEO PERFORMANCE USING INTEL HARDWARE AND SOFTWARE

Raghavendra Ural
IoT Developer Evangelist
[@ragural](#)

Agenda

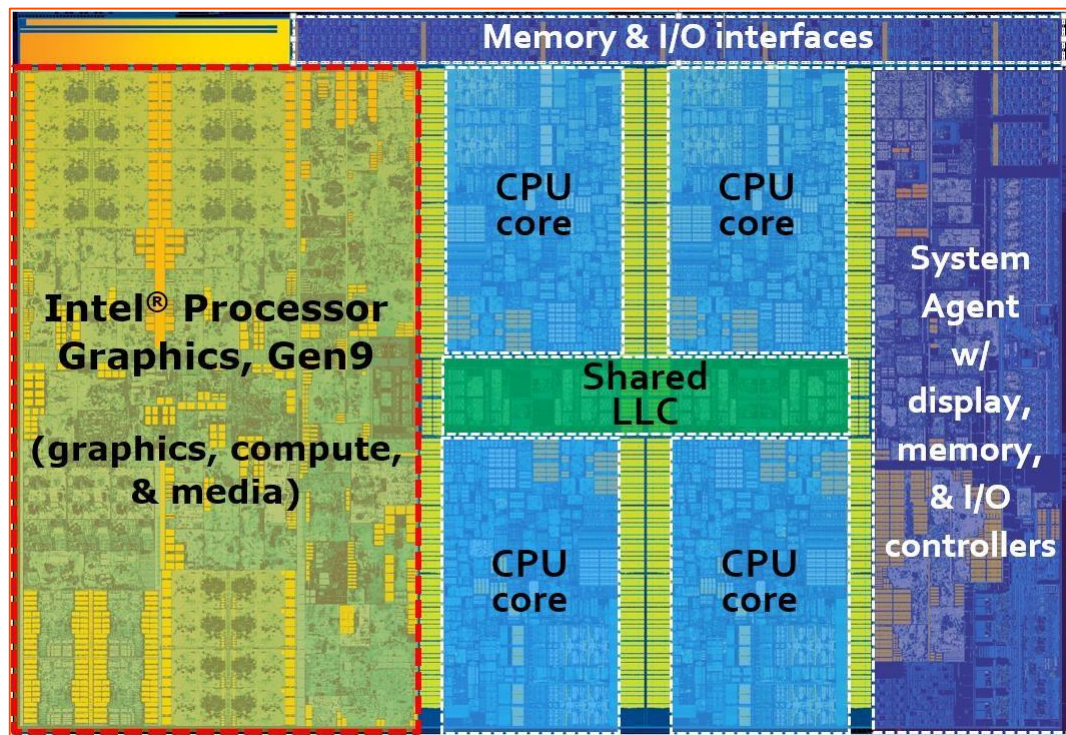
- ✓ Intel® Media SDK Overview
- ✓ Intel® Media Accelerator Reference Software Overview
- ✓ Intel® Components for digital signage and kiosk solutions
- ✓ Lab Overview



INTEL® MEDIA SDK OVERVIEW

CPU vs GPU

Intel Hardware is Heterogeneous



CPU

- Awesome general purpose performance
- Large software ecosystem

Other Programmable Intel Hardware

- GPU (shown here)
- IPU
- FPGA

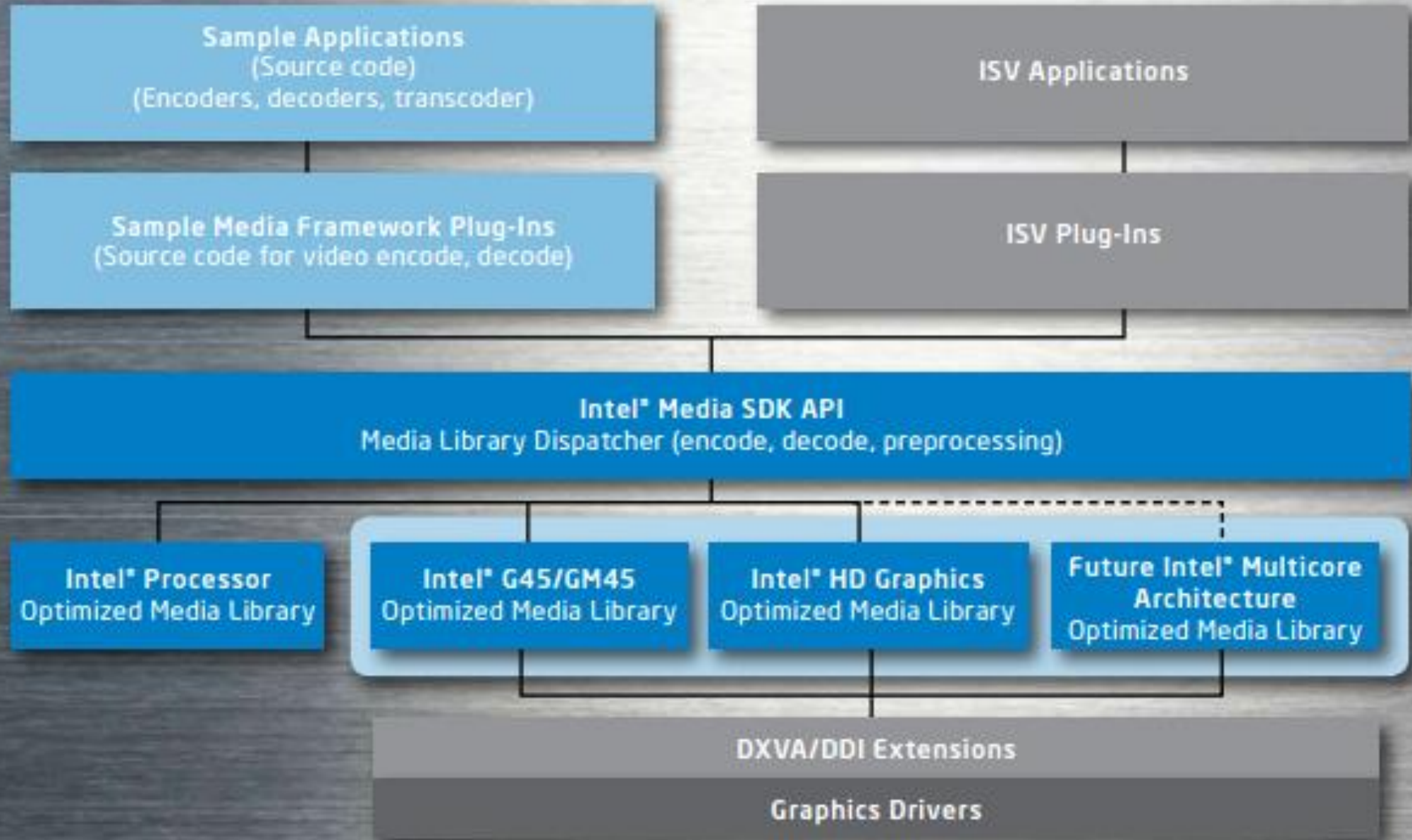
Intel® Media SDK Overview

- Intel® Media SDK equips developers with a standard API to create high-performance video solutions for consumer and professional uses.
- Intel® Media SDK provides easy access to hardware acceleration with Intel-optimized software fallback.
- Developers can also use their own software codecs as needed
- Development teams can shift resources from performance optimization for each individual hardware platform to focusing on feature innovation and application capabilities in their video solutions.

Intel® Media SDK Developer value proposition

- **Optimized routines** for delivering maximum video performance on a variety of platforms
- **Improved productivity** for development teams through greater efficiency
- **Built-in future proofing** of video applications with support for upcoming platforms

INTEL® MEDIA SDK HIGH-LEVEL ARCHITECTURE



Intel® Media SDK 2017 Supported Codecs

Standard	Encode	Decode
HEVC (main profile) (High Efficiency Video Coding)	HW	HW
AVC (Advanced Video Coding)	SW/HW/ low power	SW/HW
MPEG-2	SW/HW	SW/HW
MJPEG	SW/ HW	SW/ HW
MVC	SW/HW	SW/HW
VC-1	-	SW/HW

green=new in Intel® Media Server Studio for Gen9

Intel® Media SDK 2017

Supported Video Processing Features



N:1 Frame Composition

Resizing

Color Conversion

Deinterlacing

Denoising

Frame Rate Conversion

Brightness/Contrast/Saturation

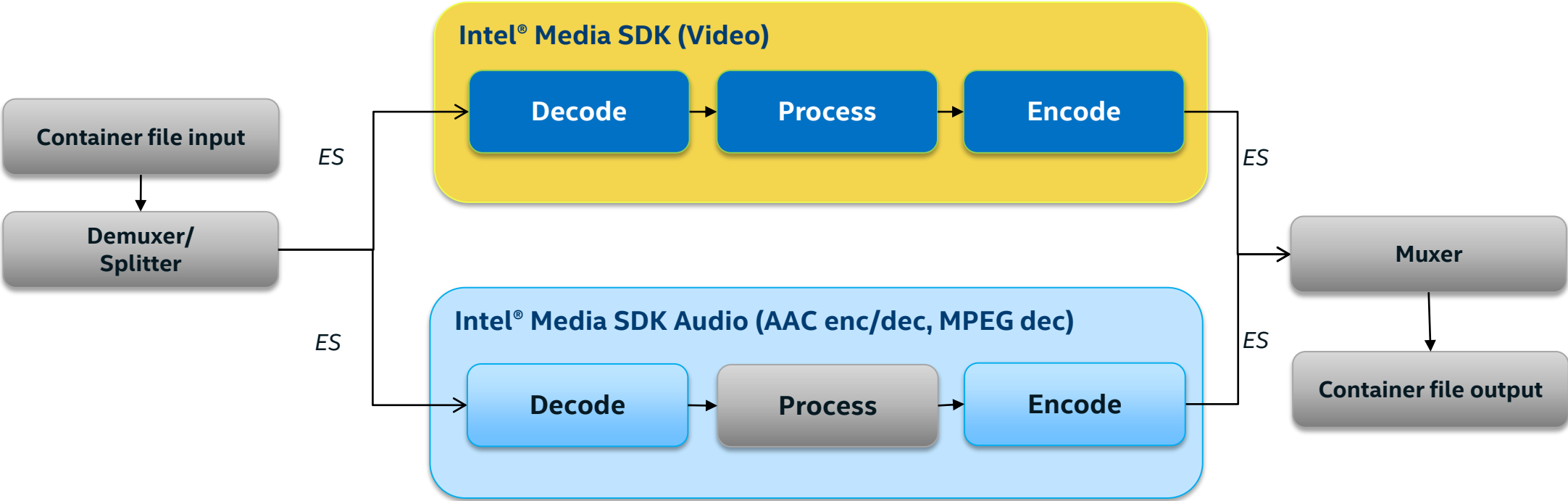
Sharpening

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Media Software Scope Diagram

Transcode pipeline



	Intel Media SDK/Intel® Media Server Studio focus
	Limited support
	Out of scope/external component

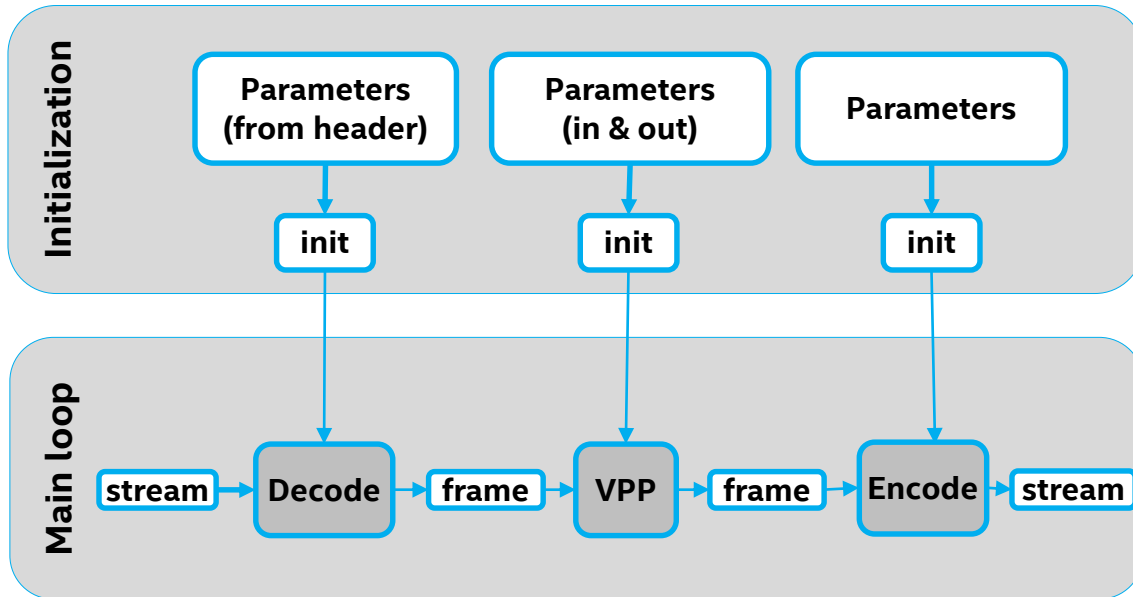
ES = Elementary stream

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Intel® Media SDK / Intel® Media Server Studio



Media accelerator framework
Codec based
High level/parameter interface
3 operations

Good option for:

- Accelerated video encode, decode
- (and short list of frame processing)

Links to More Information

- [Media Server Studio](#)
- [Media SDK](#)
- [Intel Media Code Samples](#)

Simple Encoding and Decoding

The following two pseudo-code examples illustrate the simplicity and efficiency of the Intel® Media SDK.

Decoding Procedures

```
Create SDK session
Initialize DECODE
Allocate I/O buffers
While (!EOF || FramesRemaining) do
    If !EOF, read bitstream from file
    Locate available frame buffers
```

```
DECODE::DecoderFrameAsync
CORE::SyncOperation
```

```
    Write output frames to file
Done
De-allocate I/O buffers
Close DECODE
Close SDK session
```

Encoding Procedures

```
Create SDK session
Initialize ENCODE
Allocate I/O buffers
For each frame do
    Locate available frame buffers
    Read raw frames from file
```

```
ENCODE::EncodeFrameAsync
CORE::SyncOperation
```









```
    If output bitstream available, then
        Write bitstream to file
    Endif
Done
De-allocate I/O buffers
Close ENCODE
Close SDK session
```


Decoding sample code

```
MFXVideoDECODE_DecodeHeader(session, bitstream, &init_param);
MFXVideoDECODE_QueryIOSurf(session, &init_param, &request);
allocate_pool_of_frame_surfaces(request.NumFrameSuggested);
MFXVideoDECODE_Init(session, &init_param);
sts=MFX_ERR_MORE_DATA;
for (;;) {
    if (sts==MFX_ERR_MORE_DATA && !end_of_stream())
        append_more_bitstream(bitstream);
    find_unlocked_surface_from_the_pool(&work);
    bits=(end_of_stream())?NULL:bitstream;
    sts=MFXVideoDECODE_DecodeFrameAsync(session,bits,work,&disp,&syncp);
    if (sts==MFX_ERR_MORE_SURFACE) continue;
    if (end_of_bitstream() && sts==MFX_ERR_MORE_DATA) break;
    ... // other error handling
    if (sts==MFX_ERR_NONE) {
        MFXVideoCORE_SyncOperation(session, syncp, INFINITE);
        do_something_with_decoded_frame(disp);
    }
}
MFXVideoDECODE_Close();
free_pool_of_frame_surfaces();
```

```
mfxVersion ver = { {1, 1} }; // minimum API version which supports multiple de
MFXInit(MFX_IMPL_HARDWARE_ANY, &ver, &auxSession);
```

Program Files (x86) > IntelSWTools > Intel(R)_Media_SDK_2016.0.2 > doc

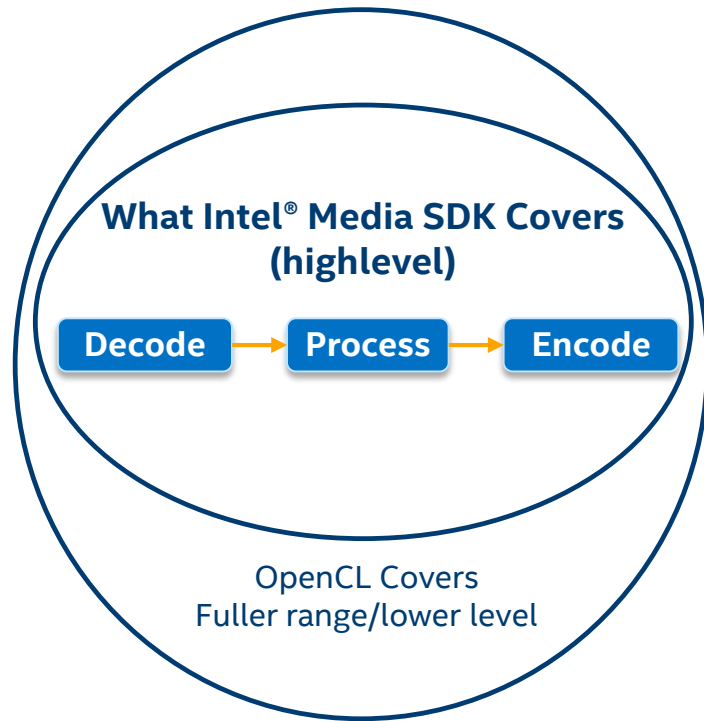
<input type="checkbox"/>	Name	Date modified
✦	 media-raw-accelerator-man.pdf	6/1/2016 4:15 PM
✦	 mediasdkaudio-man.pdf	6/2/2016 5:20 PM
✦	 mediasdk-distrib.pdf	2/1/2016 4:03 PM
✦	 mediasdkjpeg-man.pdf	6/1/2016 4:15 PM
✦	 mediasdk-man.pdf	6/1/2016 4:15 PM
✦	 mediasdkmvc-man.pdf	6/1/2016 4:15 PM
	 mediasdkscreenap-man.pdf	6/1/2016 4:15 PM
	 mediasdkusr-man.pdf	6/1/2016 4:15 PM

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OpenCL + Intel® Media SDK?



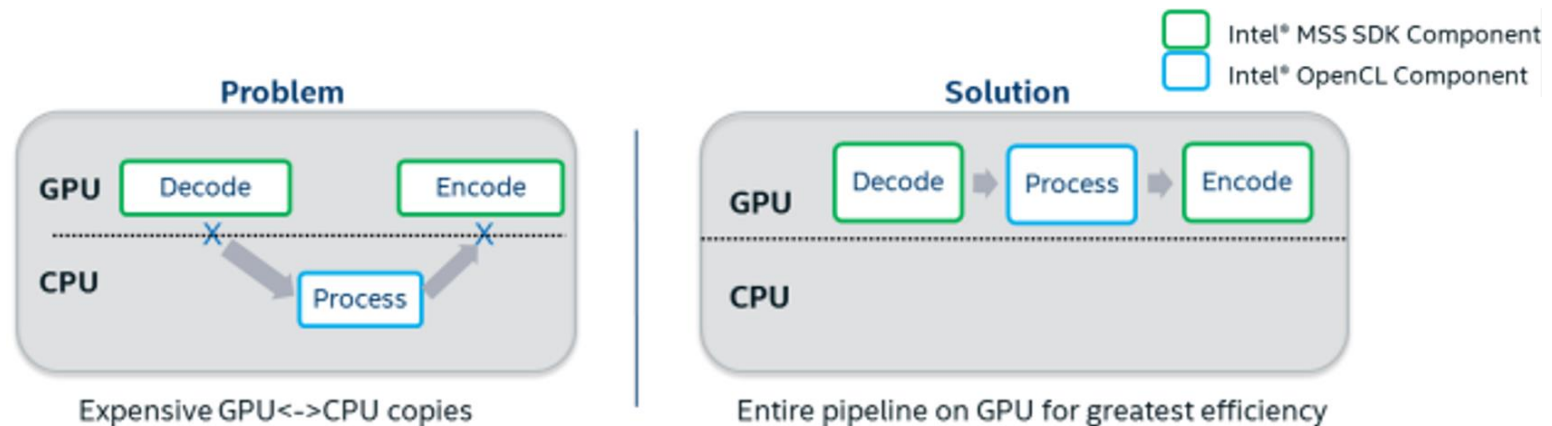
Media SDK provides optimized implementations for:

- Codecs
- Frame Processing Operations

For video processing tasks not in Media SDK's scope, extend with OpenCL

- Make use of growing GPU capabilities
- Keep pipelines on GPU

Example uses: color conversions, custom bit rate control



Media SDK Products

- Media SDK/Media Server Studio—The software API to the hardware codec on GPU.
- Hardware support: 3G Core(GEN 7), 4G Core(GEN 7.5), 5G Core(GEN 8), 6G Core(GEN 9) [see the details](#)
- OS Support: Windows 7/8/10, CentOS, Yocto, Android, Ubuntu.
- Application: Set Top Box, FFMpeg, G-Streamer, Media Server, IVI, Surveillance

How to get the Intel® Media SDK

Intel® Media Server Studio – 3 Editions (includes Free Community)



Platform / Device Targets

- [Select SKUs of Intel® Xeon® & Core™ processor-based platforms](#)
- Applications for media, communications infrastructure, video processing/conferencing, digital surveillance, video cloud & data center
- For HEVC, AVC, MPEG-2, MPEG-Audio

See [Technical Specifications](#) for System Requirements

[Download](#)
software.intel.com/intel-media-server-studio

Intel® Media SDK - FREE

Platform / Device Targets

- Intel® Core™ or Core™ M processors
- Select SKUs of Intel® Celeron™, Pentium™ & Atom™ processors with Intel® HD Graphics supporting Intel® Quick Sync Video
- Client devices – Desktop/mobile applications

See [Technical Specifications](#) for System Requirements

[Download](#)
software.intel.com/media-sdk

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More Resources

Intel® Media SDK

- software.intel.com/media-sdk

Intel® Media Server Studio

- software.intel.com/intel-media-server-studio

**Learn from Samples
& Tutorials**

- github.com/Intel-Media-SDK/samples

**Ask questions
at the forum**

- software.intel.com/forums/intel-media-sdk

Webinar Replays



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LAB OVERVIEW

What are we trying to solve?

Customer Requirement

- Need HD quality digital signage in my Airport for marketing activities
- Need faster service and lower downtime
- Real-time analytics on number of people looked at my signage

ISV Business Requirement

- Lower Recurring cost
 - Lower service visit
 - Lower network bandwidth usage
- Lower development time and faster time to market
- Easy maintenance and Centralized control
- Easy system upgrade





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Workshop Inventory



Intel® NUC Kit



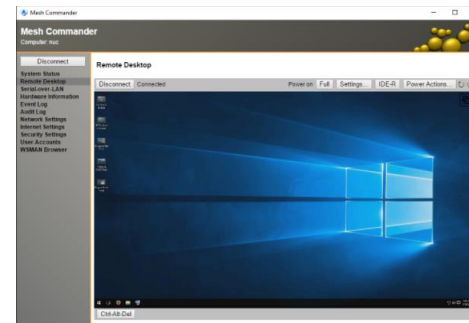
Intel® vPro
Technology



Python-OpenCV
and Camera



Intel® Media SDK



Intel® AMT, Mesh
Commander and
Mesh Central

[1] The edge device, gateway and sensors could change to a new technology or vendor

Developer kit is certified for the US, CAN, and EU and can be purchased under a single SKU. In other regions, components can be purchased separately

Code samples can be downloaded from GitHub

In some countries due to import/exports laws, the attendees may not be able to receive certain/all components of the kit

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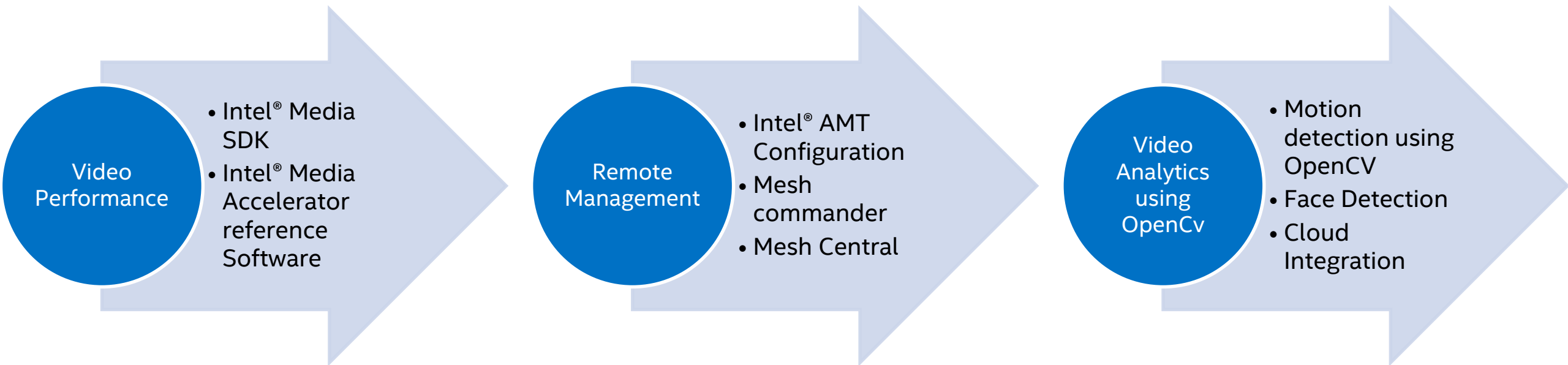
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Workshop Flow



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Workshop Setup

Wifi:

SSID = Intel_Retail

Password: intel@123

Documentation and Cloud

Documentation URL: <http://192.168.11.100:9000>

Cloud Server URL: <http://192.168.11.100:9002>

Mesh Central URL: <https://192.168.11.100>

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LET'S GET STARTED



INTEL® MEDIA ACCELERATOR REFERENCE SOFTWARE OVERVIEW

What is Intel® Media Accelerator Reference Software?

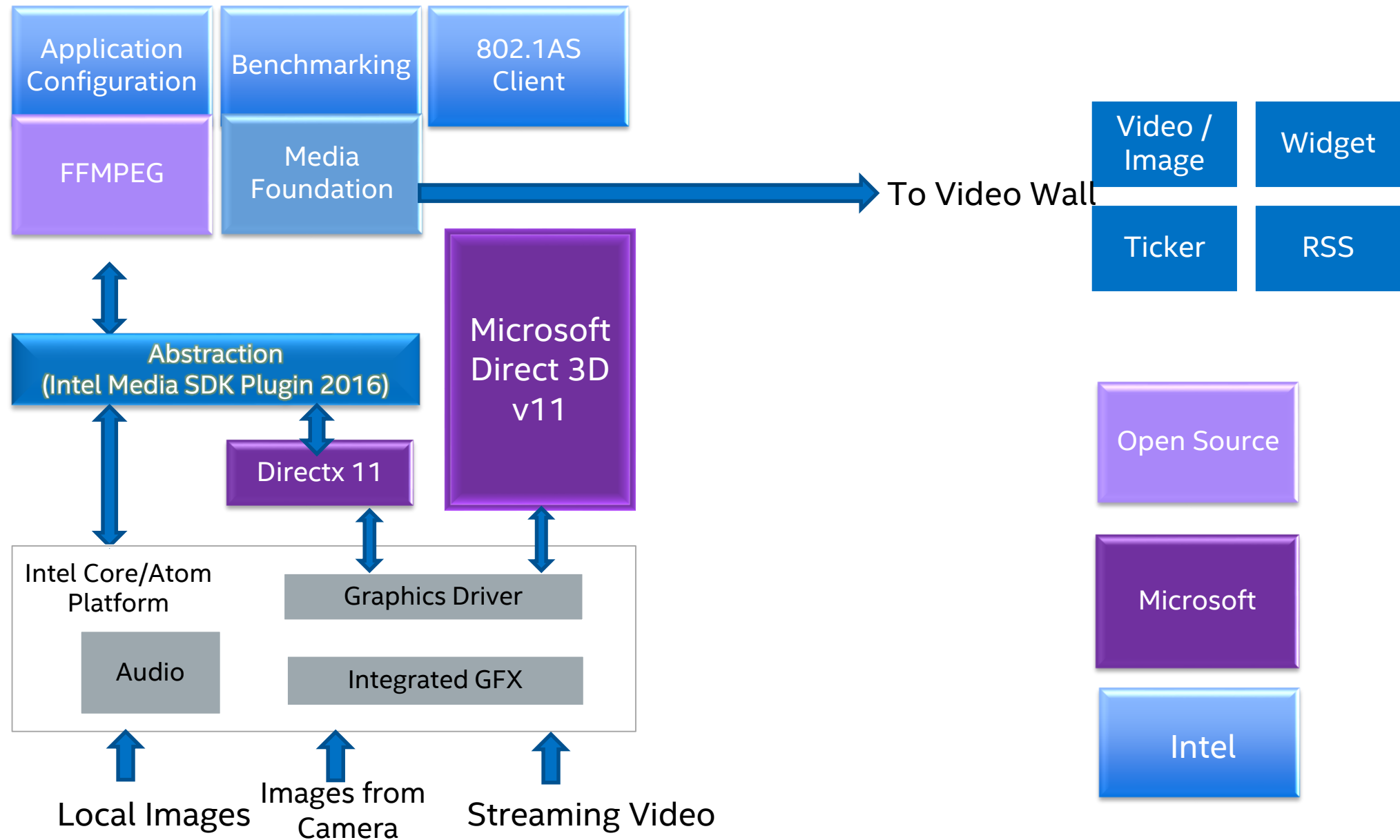
Intel licensed reference code for Digital Signage that uses the best practices for video decode, transcode, playback, compositing, blending, streaming and rendering by using a combination of Intel and other SDKs on Intel platforms

- Target Platforms – Intel Sky Lake/Kaby Lake Core & Braswell, Apollo Lake Atom Platforms
- OS supported – Windows 10
- SDK – FFMPEG, Media Foundation, Media SDK 2016, DirectX 11 (DXVA2.0+)

What is Intel® Media Accelerator Reference Software?

- Efficient Media Foundation Transforms running on Intel GFX for H264/HEVC based 4k/8k HDR media file decode
 - One of the customers, a leading CMS vendor in Asia, reported > 50% efficiency by moving to GFX offload for 4k content by using the filters in the reference codebase
- Creation of overlays and rich media zones by compositing with Direct3D canvas
- Video Sync software feature leveraging Intel Ethernet controllers which support 802.1AS

Architecture

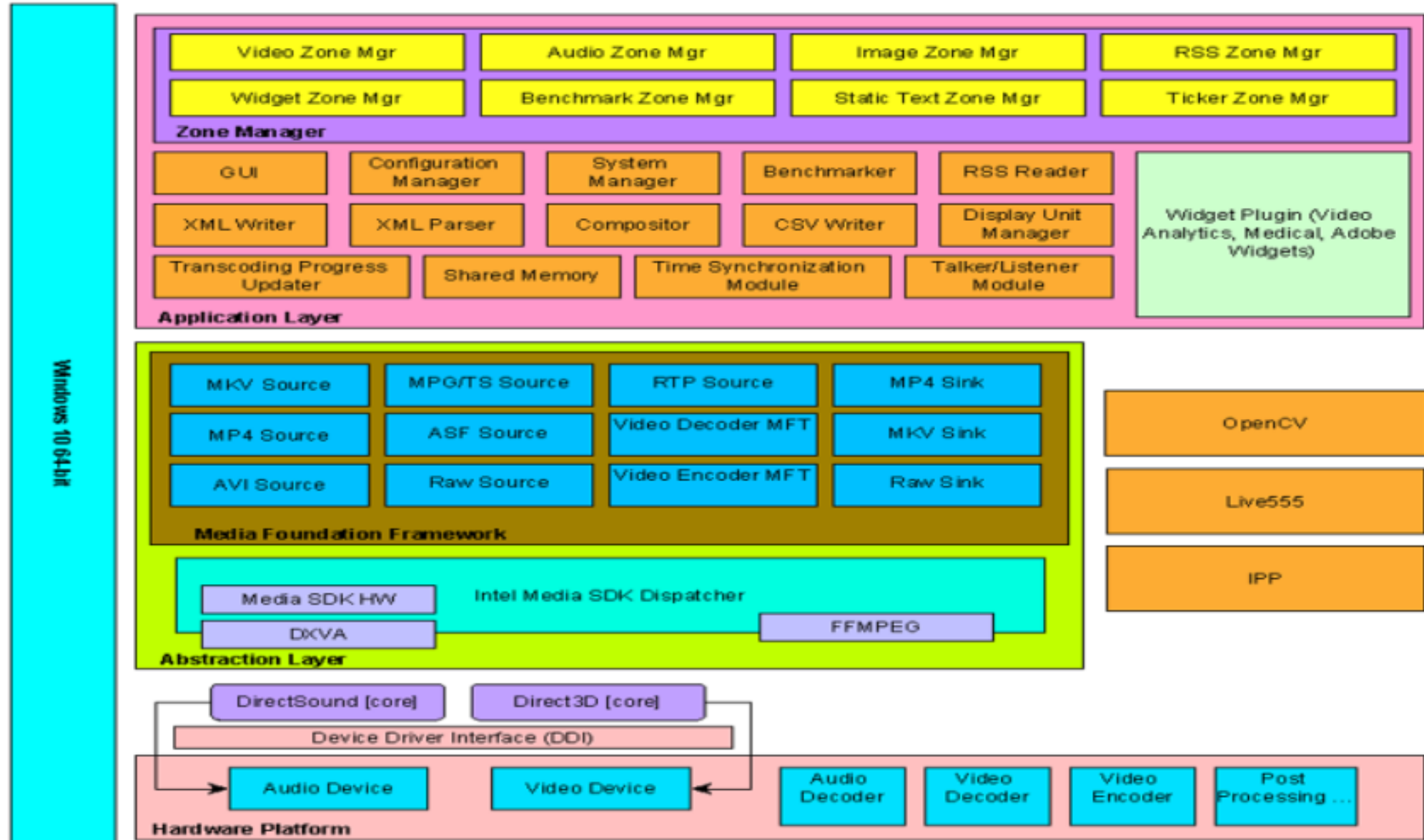


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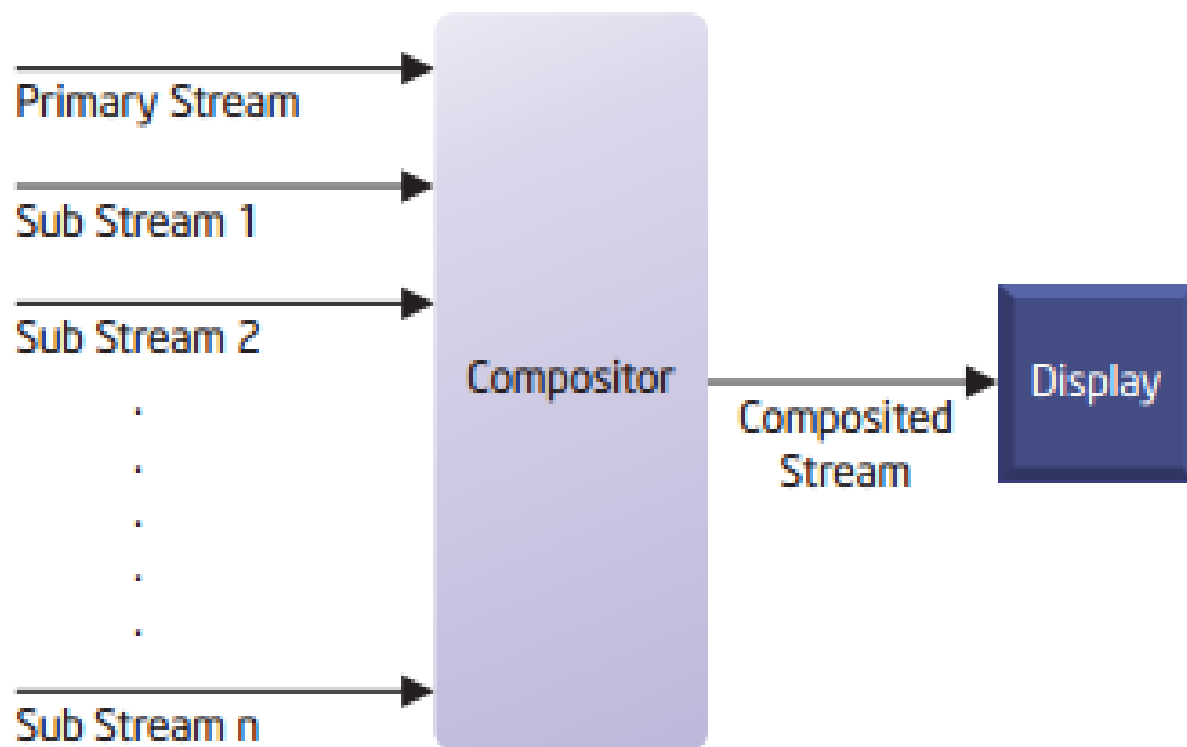
Architecture



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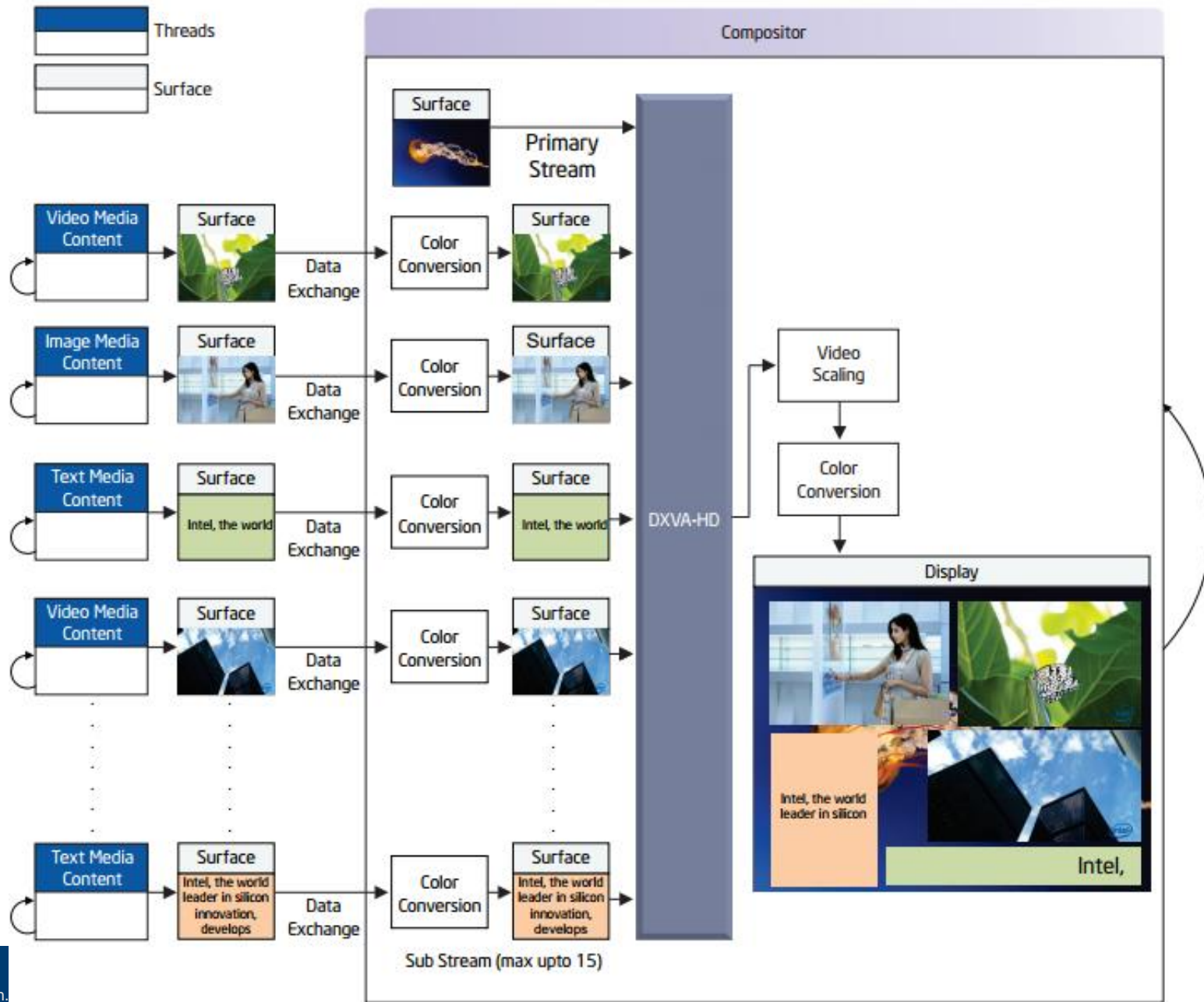
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Process flow



- Compositing is a technique of combining visual elements from separate sources into a single frame to create an illusion that all the elements are part of the same scene.
- This process involves a primary stream and multiple secondary streams
- The secondary streams are mixed together with the primary stream to form a single frame that gets rendered to the display

Process flow



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Video Zone Manager

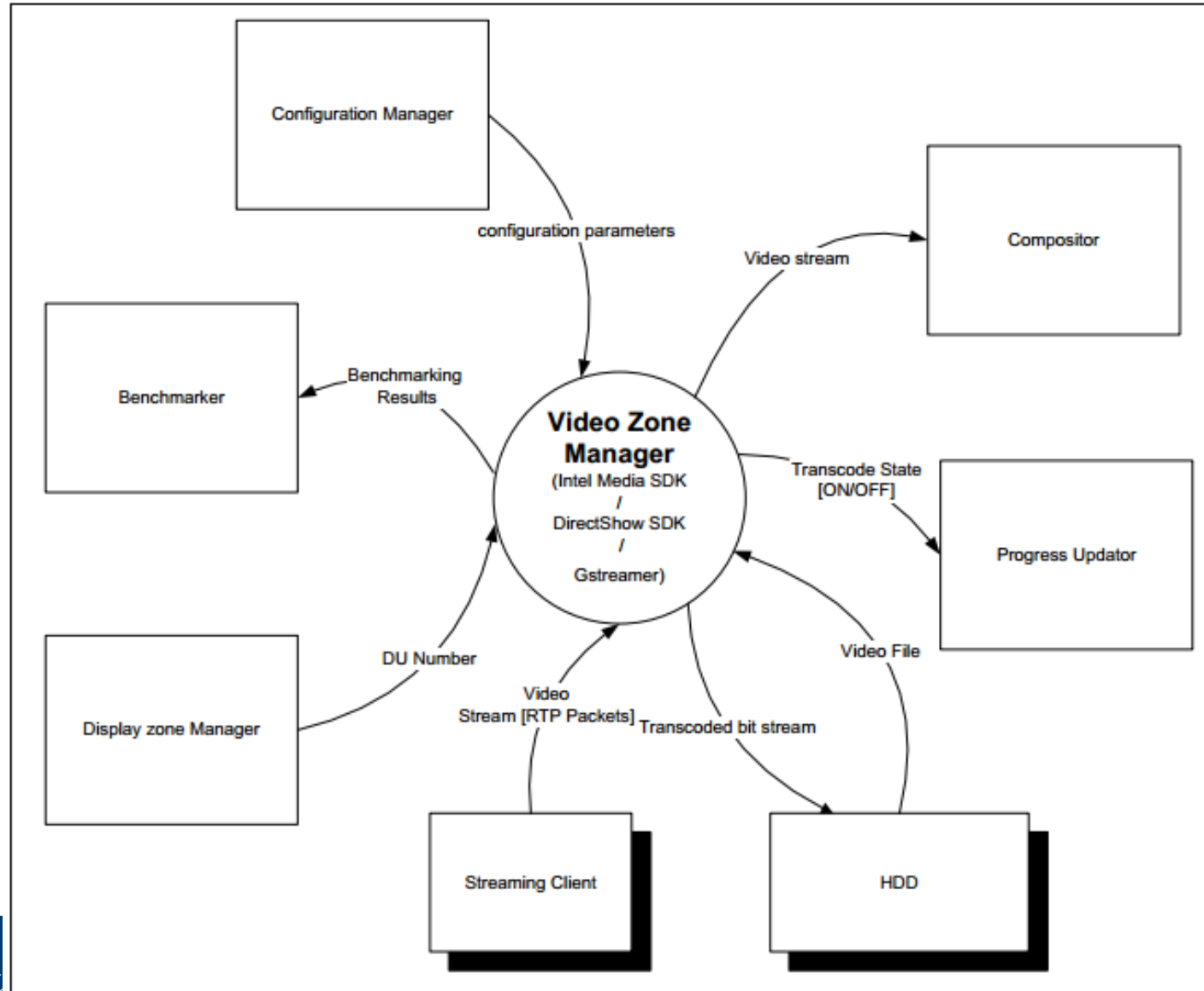
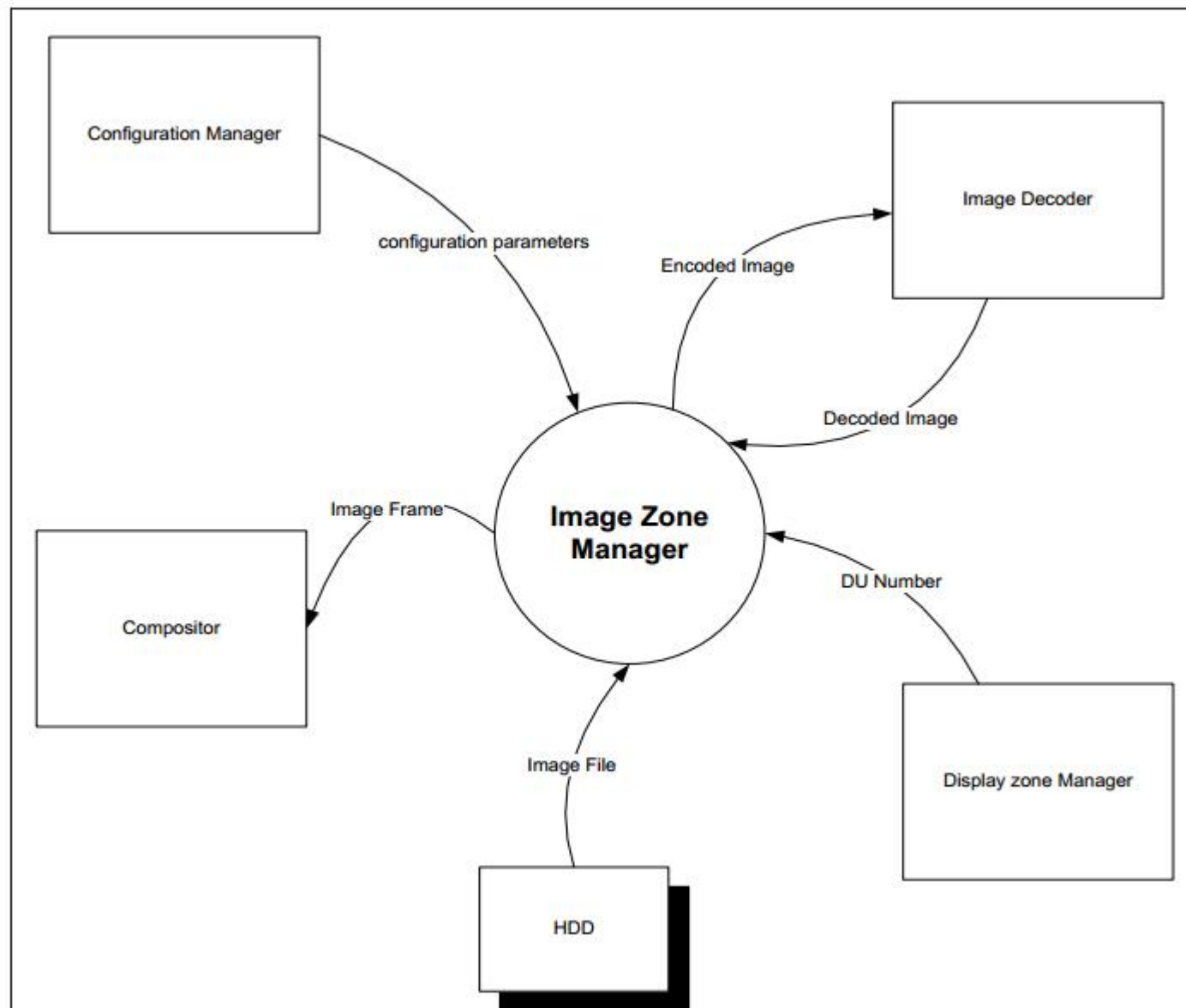
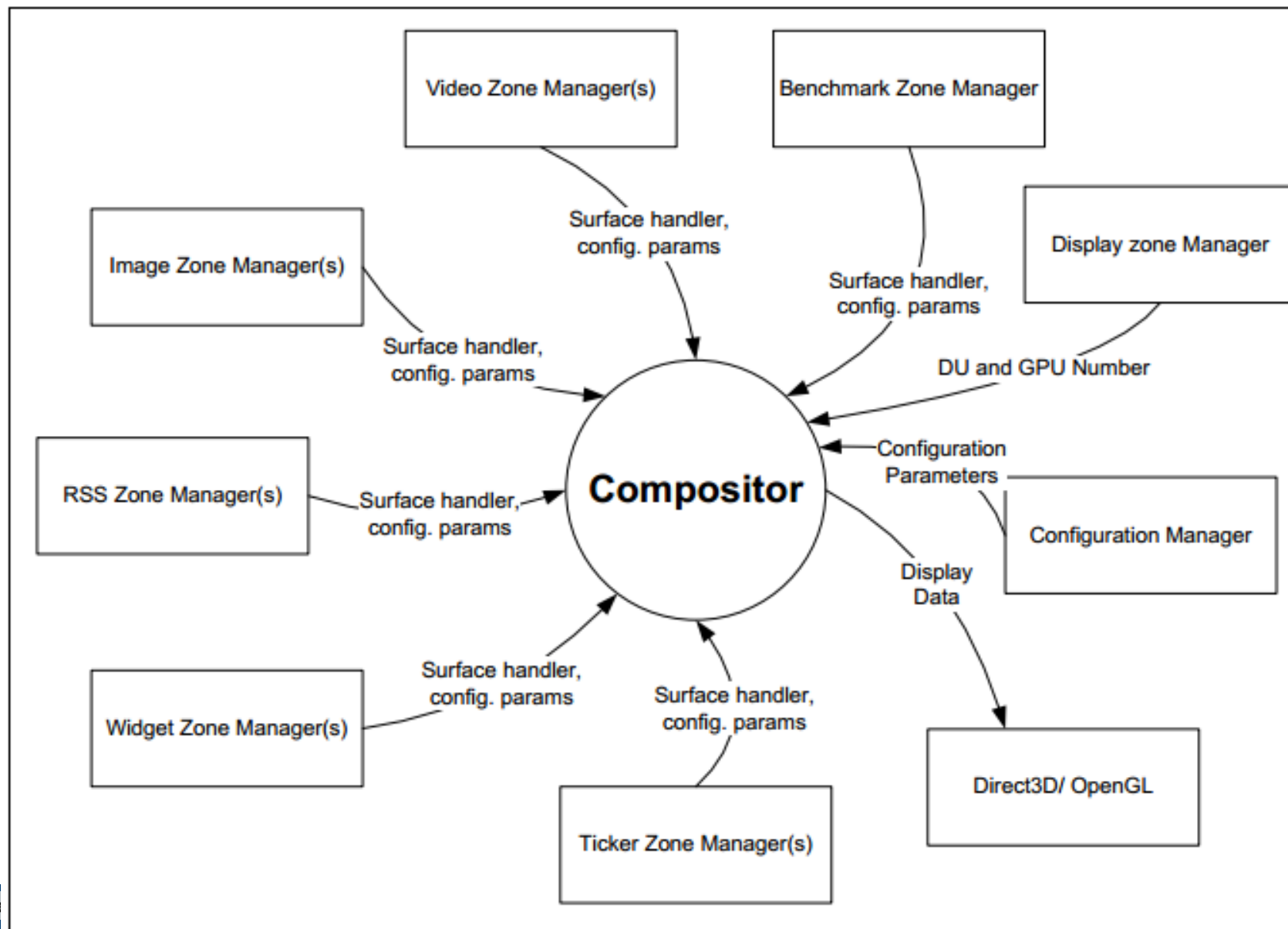


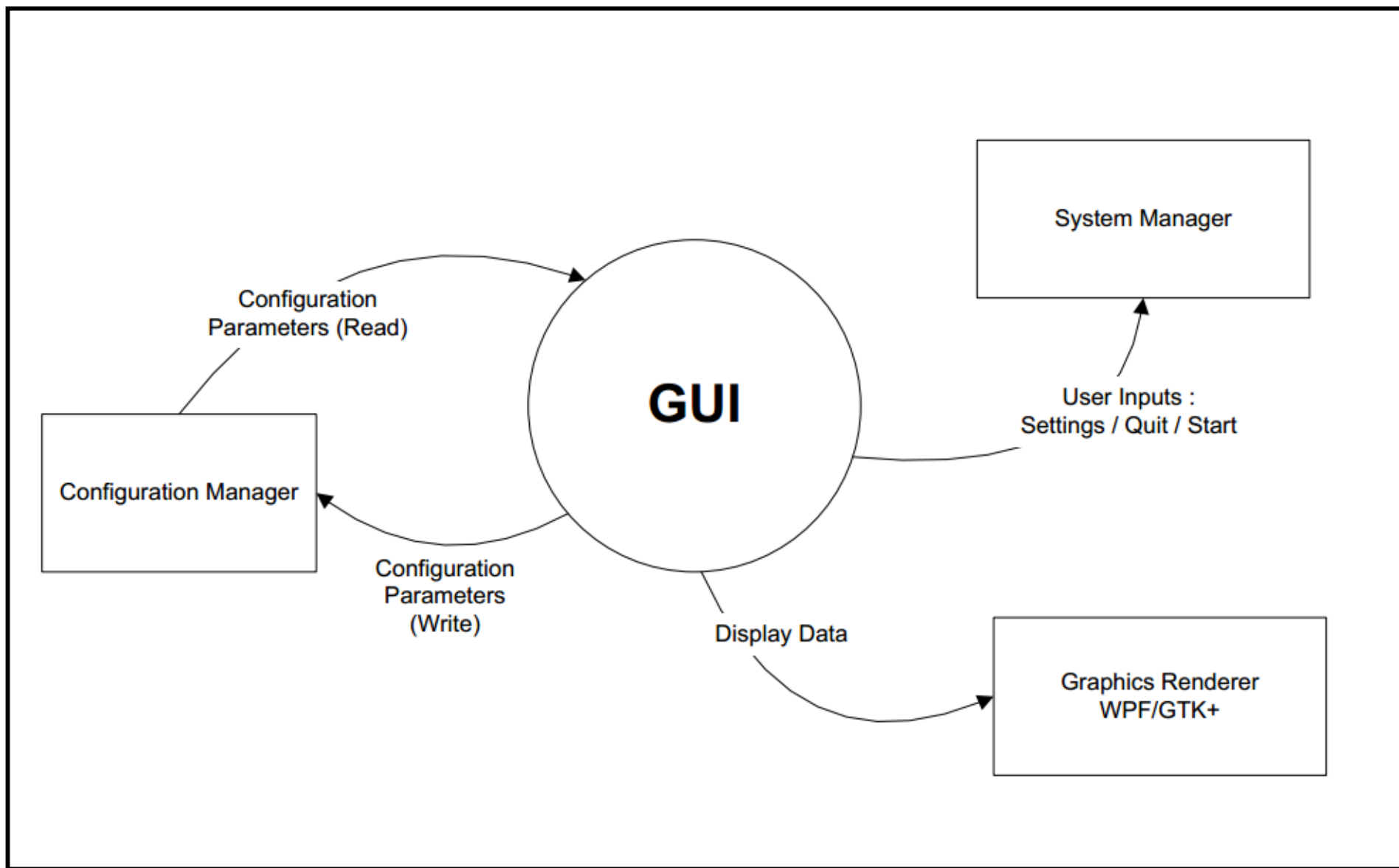
Image Zone Manager



Compositor



GUI

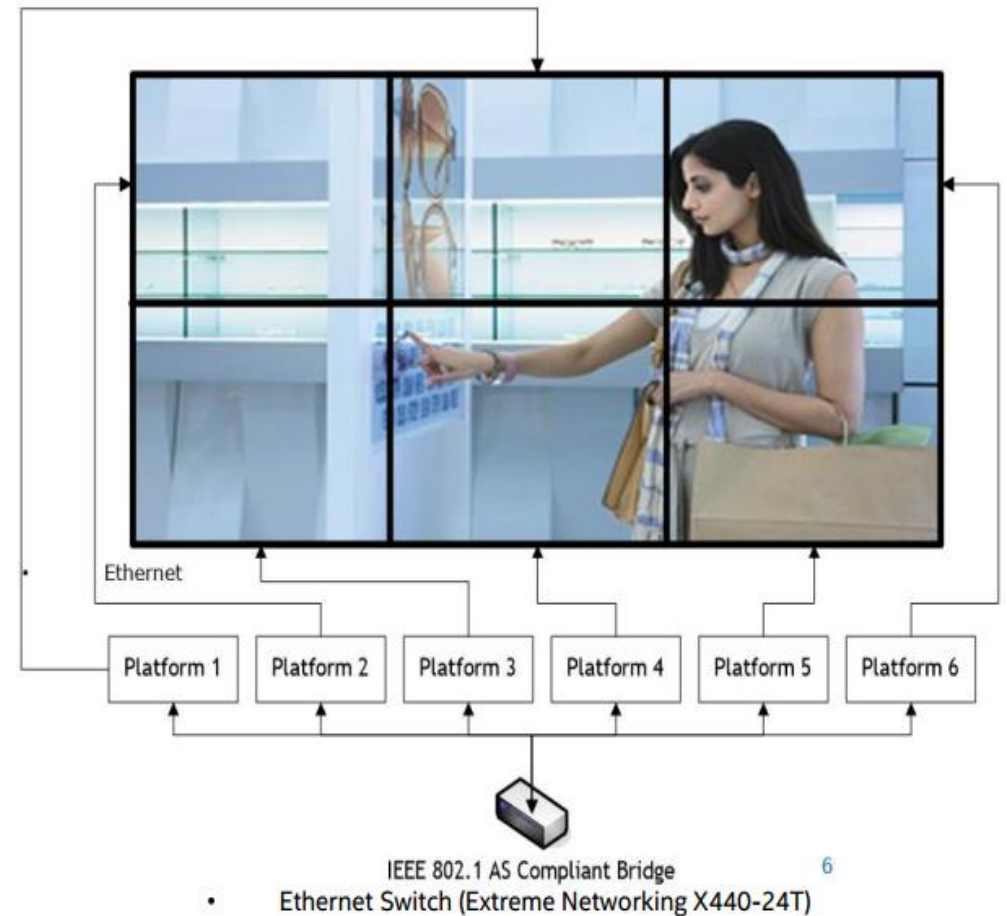


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Video Sync using Integrated GFX

- Media Accelerator Software uses 802.1AS (based on gPTP IEEE 1588) TSN std for implementing sync
- One platform or player is the master which synchronizes the displays on all the other platforms
- Each platform running an 802.1AS service to sync their clocks for video rendering
- Tested with 802.1AS compliant switch (Extreme Networking X440-24t)
- Configuration supports unlimited number of displays/devices



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INTEL® COMPONENTS FOR DIGITAL SIGNAGE AND KIOSK SOLUTIONS

Intel® Components for digital signage and kiosk solutions

Tier	Solution	Platform	Features
High	<ul style="list-style-type: none"> Multiple players & displays (i.e., video wall) Content: 4K Playback / real time feeds Touchscreens, mobile, gesture Advanced analytics Investment protection 	Embedded Box, OPS, Intel® Core™ i7 processors, Intel® SDM  	<ul style="list-style-type: none"> Gesture Interactivity Collage Display Video Analytics
Mainstream	<ul style="list-style-type: none"> Remote Management via Intel® AMT Single player/multiple screens HD video/real time feeds Touchscreen input/mobile device integration Audience analytics Options to expand 	Embedded Box, OPS, Intel® NUC Intel® Core™ i5 processors, Compute Stick (m5)    	<ul style="list-style-type: none"> Video Analytics AMT Remote management Security Multi Touch/4k Display
Value	<ul style="list-style-type: none"> Plug & play package: Single player/ up to 2 screens Content: still images, video; No in-house tech support 	Embedded, Intel NUC (Intel® Core™ i3 processors, Intel Celeron Intel® Atom™) Intel Compute Stick (Intel Atom) 	<ul style="list-style-type: none"> Dual Display 4K Playback Single Display
Entry		Embedded (Intel Atom) 	<ul style="list-style-type: none"> HD Playback

For updates and additional roadmap information, please go to <https://iotgresources.intel.com> and filter on roadmaps for the most up-to-date RSD roadmap

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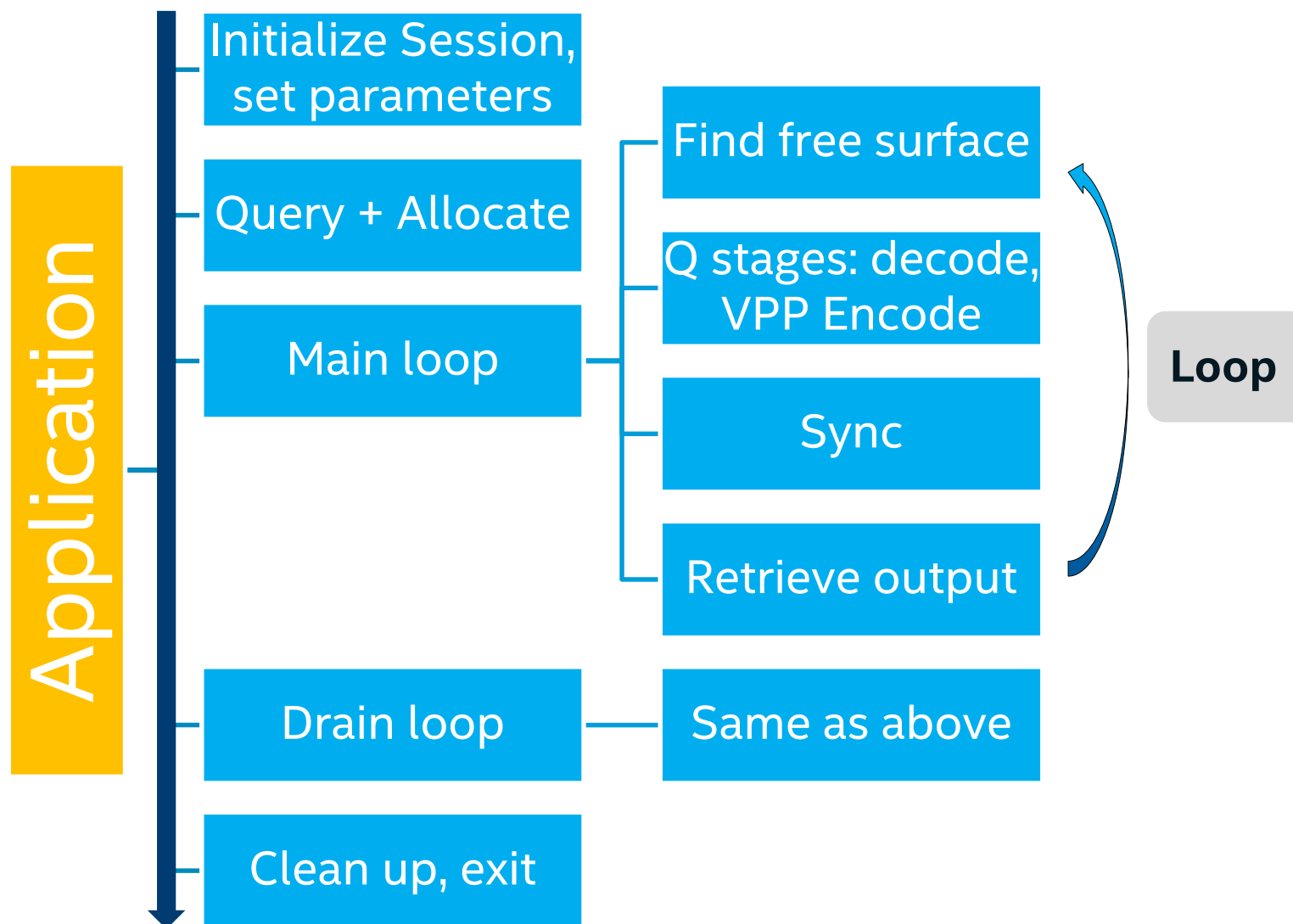
Intel Confidential





BACKUP

Basic Structure of an Intel® Media SDK-optimized Application











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Encode sample code

```
MFXVideoENCODE_QueryIOSurf(session, &init_param, &request);
allocate_pool_of_frame_surfaces(request.NumFrameSuggested);
MFXVideoENCODE_Init(session, &init_param);
sts=MFX_ERR_MORE_DATA;
for (;;) {
    if (sts==MFX_ERR_MORE_DATA && !end_of_stream()) {
        find_unlocked_surface_from_the_pool(&surface);
        fill_content_for_encoding(surface);
    }
    surface2=end_of_stream()?NULL:surface;
    sts=MFXVideoENCODE_EncodeFrameAsync(session, NULL, surface2, bits, &syncp);
    if (end_of_stream() && sts==MFX_ERR_MORE_DATA) break;
    ... // other error handling
    if (sts==MFX_ERR_NONE) {
        MFXVideoCORE_SyncOperation(session, syncp, INFINITE);
        do_something_with_encoded_bits(bits);
    }
}
MFXVideoENCODE_Close();
free_pool_of_frame_surfaces();
```

Program Files (x86) > IntelSWTools > Intel(R)_Media_SDK_2016.0.2 > doc

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✦	 media-raw-accelerator-man.pdf	6/1/2016 4:15 PM
✦	 mediasdkaudio-man.pdf	6/2/2016 5:20 PM
✦	 mediasdk-distrib.pdf	2/1/2016 4:03 PM
✦	 mediasdkjpeg-man.pdf	6/1/2016 4:15 PM
✦	 mediasdk-man.pdf	6/1/2016 4:15 PM
✦	 mediasdkmvc-man.pdf	6/1/2016 4:15 PM
	 mediasdkscreenap-man.pdf	6/1/2016 4:15 PM
	 mediasdkusr-man.pdf	6/1/2016 4:15 PM

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VPP sample code

```
MFXVideoVPP_QueryIOSurf(session, &init_param, response);
allocate_pool_of_surfaces(in_pool, response[0].NumFrameSuggested);
allocate_pool_of_surfaces(out_pool, response[1].NumFrameSuggested);
MFXVideoVPP_Init(session, &init_param);
in=find_unlocked_surface_and_fill_content(in_pool);
out=find_unlocked_surface_from_the_pool(out_pool);
for (;;) {
    sts=MFXVideoVPP_RunFrameVPPAsync(session,in,out,aux,&syncp);
    if (sts==MFX_ERR_MORE_SURFACE || sts==MFX_ERR_NONE) {
        MFXVideoCore_SyncOperation(session,syncp,INFINITE);
        process_output_frame(out);
        out=find_unlocked_surface_from_the_pool(out_pool);
    }
    if (sts==MFX_ERR_MORE_DATA && in==NULL) break;
    if (sts==MFX_ERR_NONE || sts==MFX_ERR_MORE_DATA) {
        in=find_unlocked_surface(in_pool);
        fill_content_for_video_processing(in);
        if (end_of_input_sequence()) in=NULL;
    }
}
MFXVideoVPP_Close(session);
free_pool_of_surfaces(in_pool);
free_pool_of_surfaces(out_pool);
```