Intel® Media Products

Unlocking Next Generation Media for Communications and Client

with

Intel® Media Server Studio and
Intel® Integrated Native Development Environment

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

software.intel.com/en-us/intel-inde

(intel)

Agenda

Background – Emergent Media Standards

Overview of Intel's Media product portfolio

- Intel Media Server Studio

- Intel Integrated Native Development Environment

- Focus - Intel Camera RAW   * Demo

- Focus – Intel's HEVC Encoder   * Demo

- Focus topic – Intel Video Pro Analyzer   * Demo

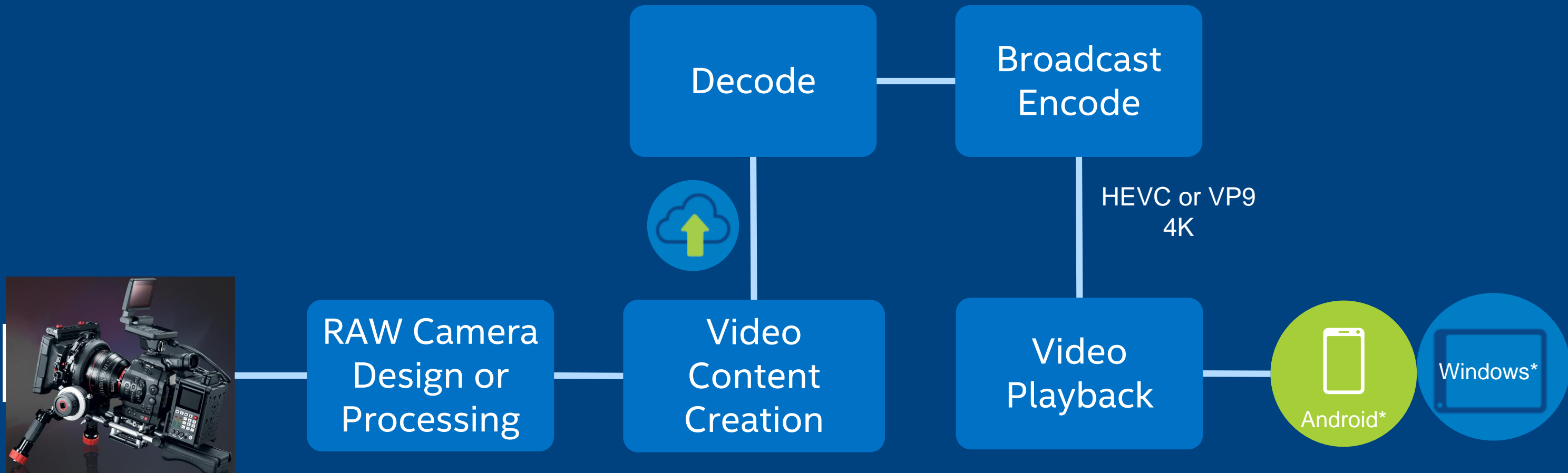- Focus topic – Intel Stress Bitstreams   * Demo

Emergent Media Standards

Key Drivers

- "Hong's Law" – (2X growth in coding efficiency every 8 years)

- Moore's law – growth in compute density

- Growth in capture and display resolution

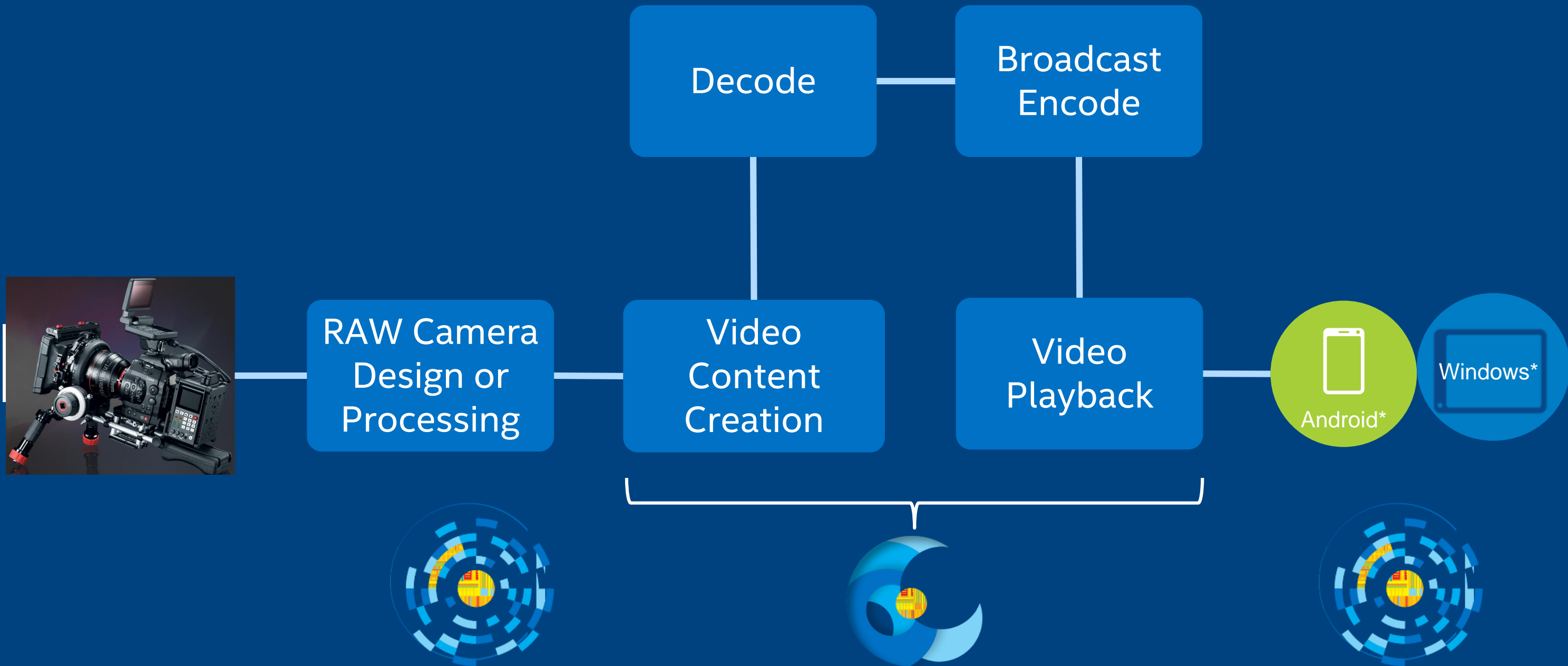- Growth in bit depth

- packet based streaming

Results

- HEVC and VP9 replacing AVC/H.264

- Continued growth in density with emphasis on heterogeneous architectures; RAW Media becomes feasible

- 4K is the new HD; 8K is coming!

- 10 bit and HDR

- OTT, DASH

(intel)
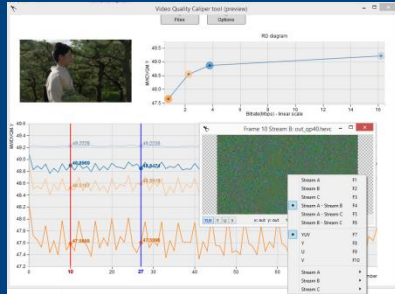
Intel® Media: Workflow of the Future

Decode

Broadcast Encode

HEVC or VP9 4K

RAW Camera Design or Processing

Video Content Creation

Video Playback

Android*

Windows*

Intel® Media: Workflow of the Future

Decode

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Intel® Media: Workflow of the Future

Media Server Studio Pro – Video Quality Caliper

Media Server Studio Essentials –AVC, Resize

Media Server Studio Pro - HEVC

Media Server Studio– Video Pro Analyzer

Decode

Broadcast Encode
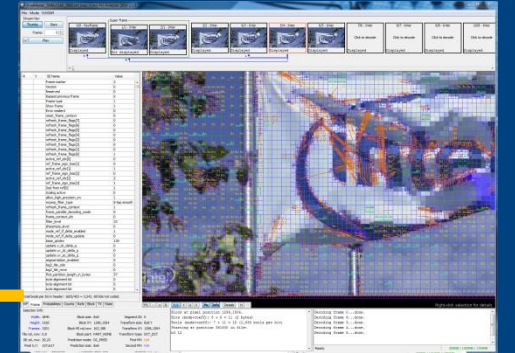
INDE Starter Edition – Media RAW

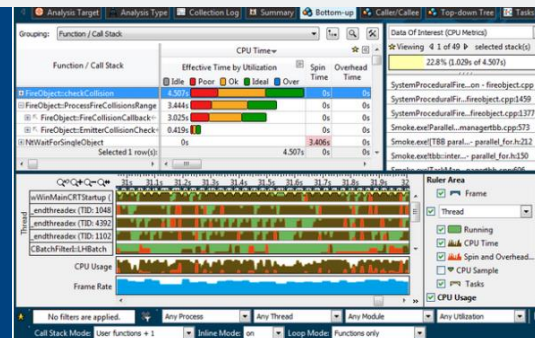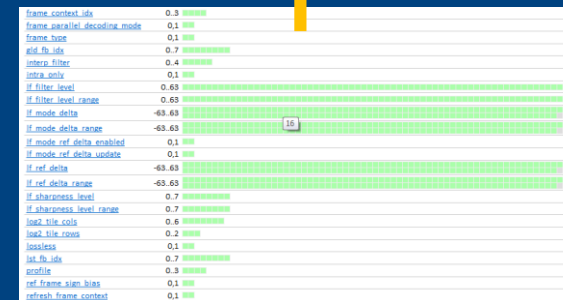RAW Camera Design or Processing

Video Content Creation

Video Playback

Android*

Windows*

Media Server Studio Pro – VTune

Media Server Studio– Stress Bitstreams

INDE – Media for Mobile and Media SDK for window

Intel® Media: Solutions for Every Target

Intel® Media Server Studio

Build highly optimized media infrastructure solutions:

Essentials Edition
Professional Edition
Intel® Video Pro Analyzer
Intel® Stress Bitstream and Encoder

The Intel® Integrated Native Developer Experience (Intel® INDE)

Cross-architecture for Windows* apps:

Media SDK* for Windows*
Audio for Windows*
Media RAW Accelerator for Windows*

Cross-platform meets native performance. Supports iOS*, Android* & Windows* RT:

Media for Mobile

Build Optimized Media Infrastructure and Solutions

Developer Types

Communications Infrastructure Developers	Video Software Experts	Enterprise Video Device Manufacturers	Cloud Based Media Services

Developer Needs

One Studio, Many platforms

- Cross architecture support for Linux* and Windows* under a single SDK
- One SDK for both Intel® Graphics and CPU
- Standard interface across Windows and Linux

High Video Quality and Performance

- Enterprise-quality video codecs
- Processing tools for datacenter and embedded usage
- Support for Industry-standards including AVC, MPEG-2, and HEVC

Analysis Capabilities

- Advanced tools for enhanced development and analysis capabilities
- Intel® Video Pro Analyzer
- Intel® Stress Bitstreams and Encoder
- Intel® Video Quality Caliper
- Intel® VTune Amplifier XE

Intel Media Server Studio

Tools and Runtimes	Essentials Edition	Professional Edition	Video Pro Analyzer	Stress Bitstreams
Linux and Windows Server QSV Codecs,	✓	✓		
OpenCL Builder	✓	✓		
Linux and Windows* Server Drivers	✓	✓		
Metrics Monitor	✓	✓		
HEVC Software Decoder		✓		
HEVC Encoder – Software and GPU		✓		
Premium Telecine and Interlace Reverser		✓		
Audio Encoders and Decoders		✓		
Intel® VTune™ Amplifier XE		✓		
Video Quality Caliper		✓	✓	
HEVC+VP9 Video Analyzer			✓	
HEVC Stress Streams				✓
VP9 Stress Streams				✓

Media Quality and Performance

Content and System Analysis

INDE – an Integrated suite of tools for X-OS and X-Arch development

Improving productivity at every step along the development chain

Getting Started

- Quickly set up a new environment or integrate INDE into your existing IDE and workflow
- Sample code to help you get started

Build

- Add media and context libraries to create exciting new app experiences
- Utilize OpenCL™, threading, performance primitives and compilers to increase your app's performance

Analyze & Debug

- Debug Android* apps from Visual Studio*
- Analyze your app to find performance bottlenecks

Visual Studio

ANDROID studio

eclipse

Download: www.intel.com/software/inde

Easily create apps for Windows* and Android* with Visual Studio* and C++

INDE makes creating an Android app as simple as a Windows app
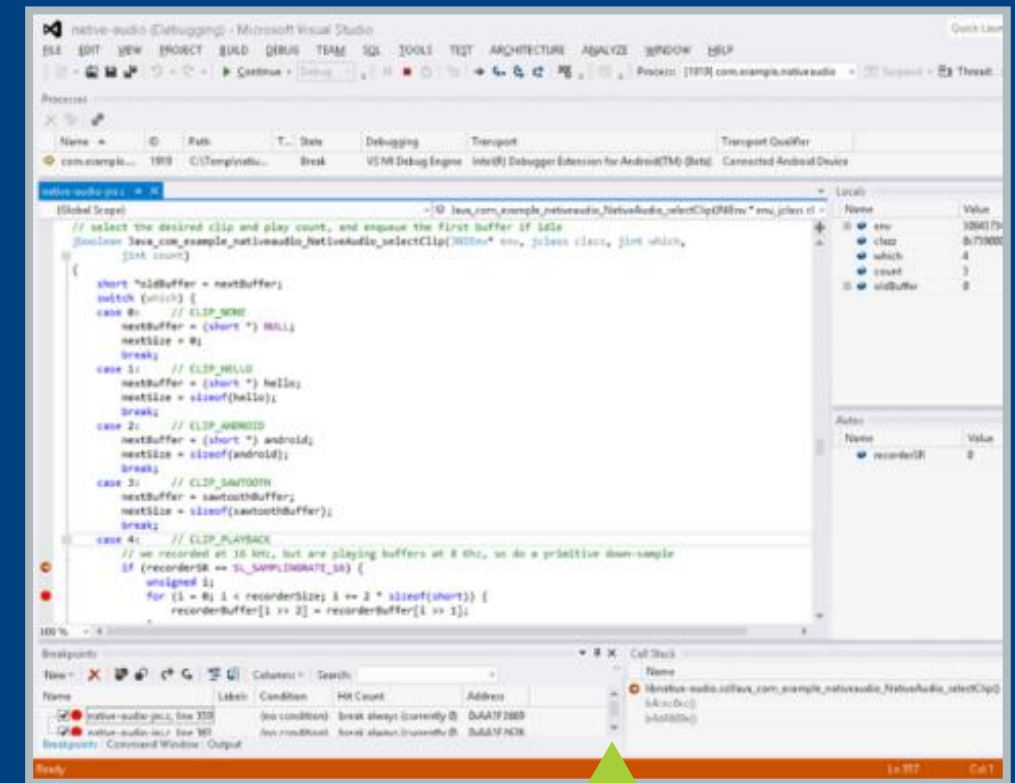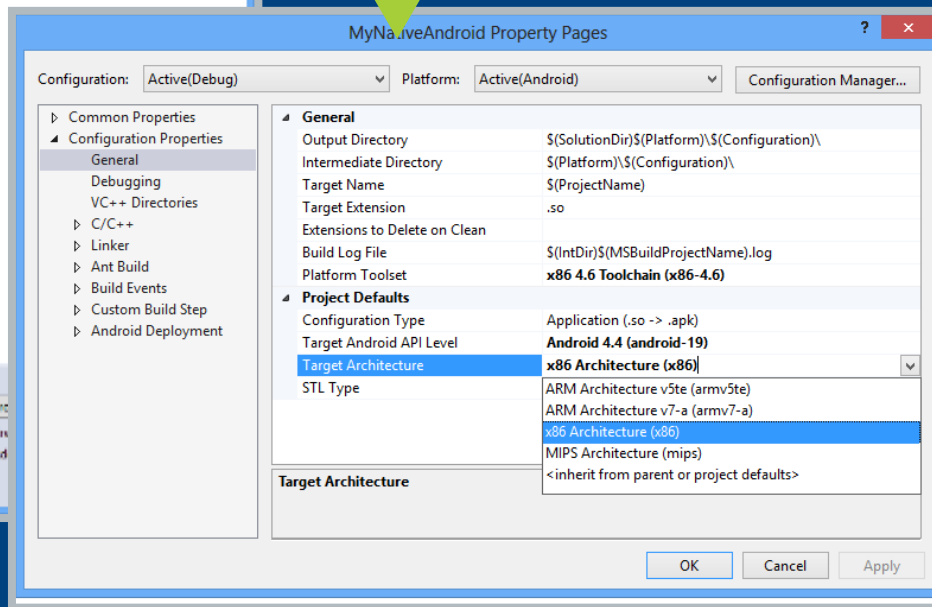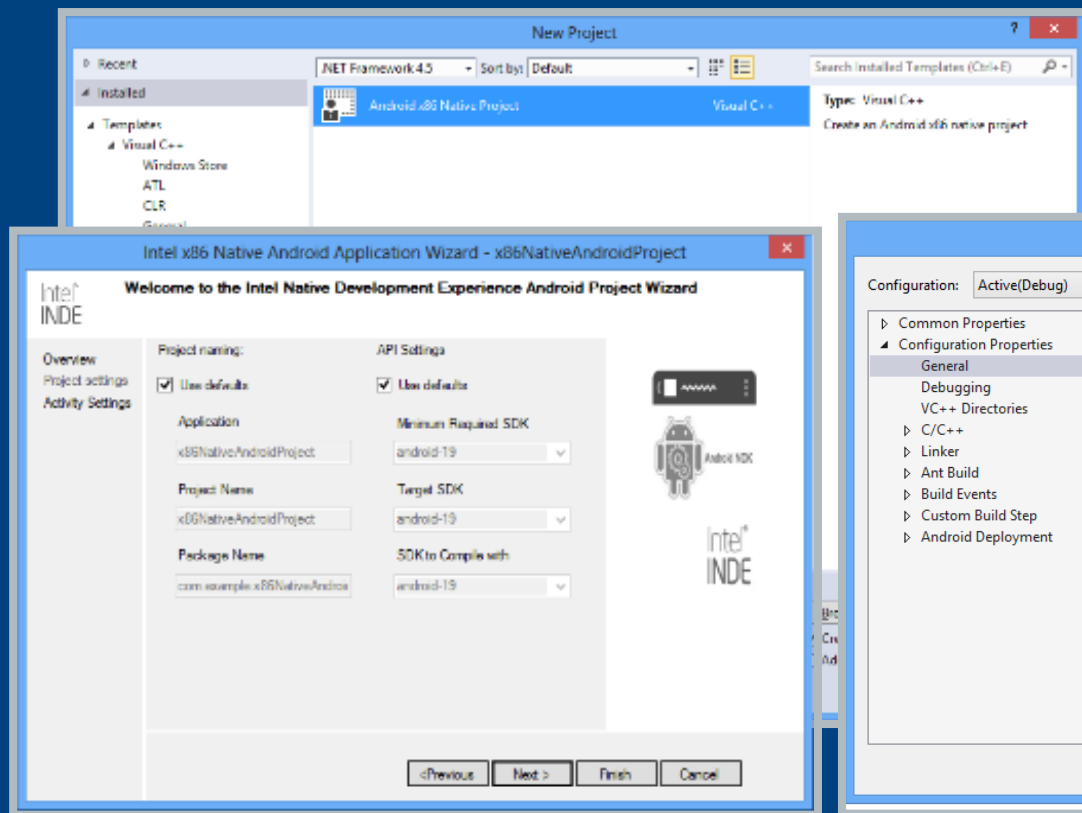
INDE allows you to debug your Android app directly from Visual Studio

Download: www.intel.com/software/inde

Intel® INDE: Feature Details

	FEATURE	STARTER EDITION: FREE	PROFESSIONAL EDITION: $299	ULTIMATE EDITION: $799
GETTING STARTED	IDE Integration for Android*	X	X	X
BUILD	Context Sensing SDK	X	X	X
	OpenCL™ Code Builder	X	X	X
	Media RAW Accelerator for Windows*	X	X	X
	Media for Mobile	X	X	X
	Media SDK for Windows*	X	X	X
	Audio for Windows*		X	X
	Intel® Threading Building Blocks			X
	Intel® Integrated Performance Primitives			X
	Intel® C++ Compilers			X
ANALYZE/DEBUG	Intel® HAXM	X	X	X
	System Analyzer	X	X	X
	Graphics Frame Analyzer	X	X	X
	Graphics Frame Debugger		X	X
	Platform Analyzer		X	X
	Debugger Extension for vs-Android*		X	X

Download: www.intel.com/software/inde

Intel Client and Mobile: 2 App Types, 2 Solutions

Media Client App Development Software
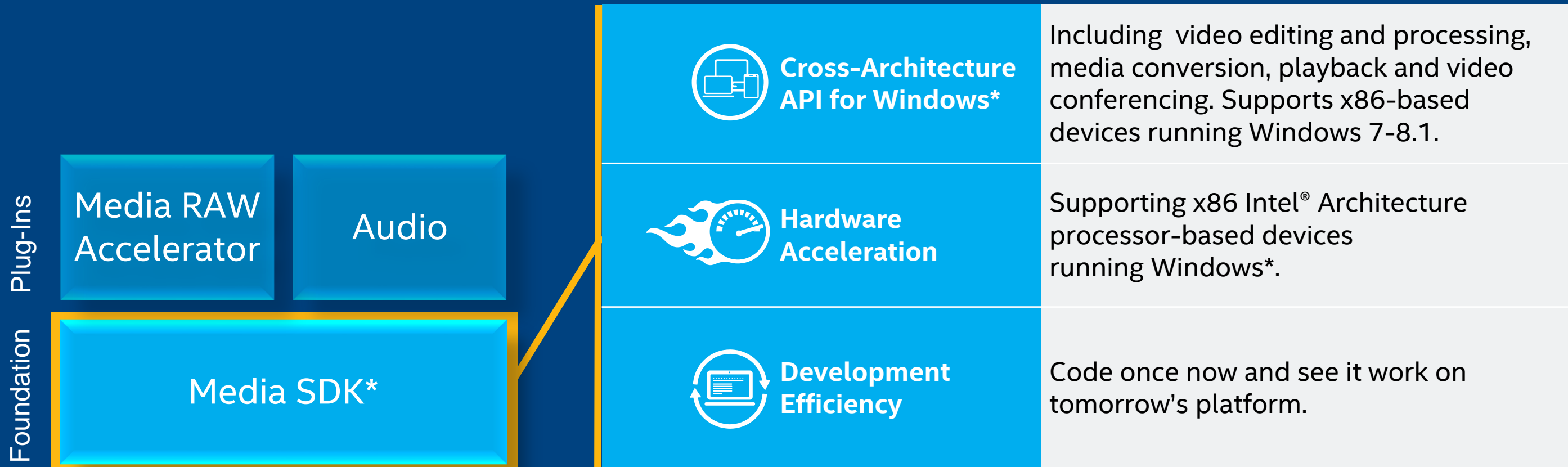
Cross-architecture for Windows* apps

Plug-Ins

Media RAW Accelerator	Audio

Foundation
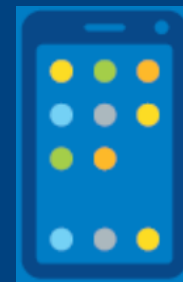
Media SDK*

Media Mobile App Development Software

Cross-platform meets native performance

iOS*   Android*   WinRT*

Complete code reuse C/C++ Wrapper
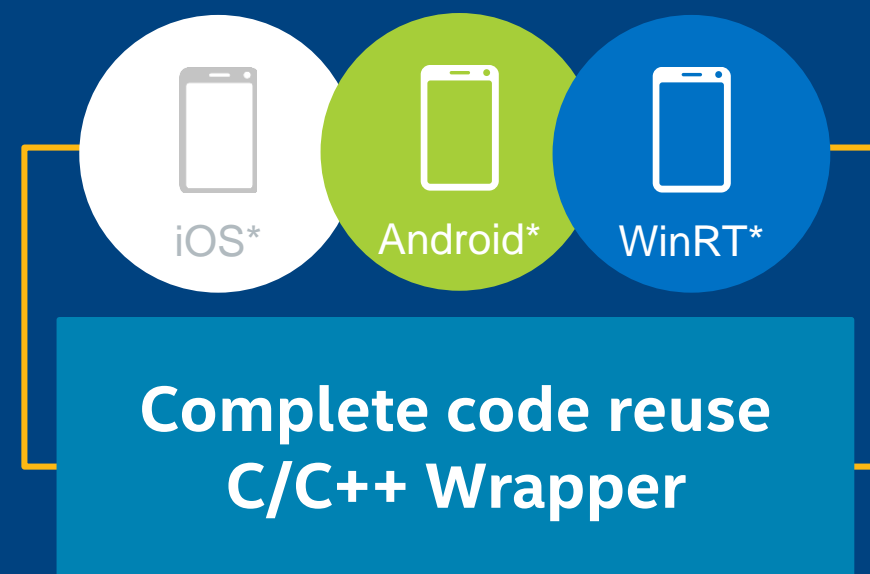
Media SDK for Windows*

A cross-platform API for developing media applications for Windows*

Cross-Architecture API for Windows*	Including video editing and processing, media conversion, playback and video conferencing. Supports x86-based devices running Windows 7-8.1.
Hardware Acceleration	Supporting x86 Intel® Architecture processor-based devices running Windows*.
Development Efficiency	Code once now and see it work on tomorrow's platform.

Plug-Ins

Media RAW Accelerator

Audio

Foundation

Media SDK*

EXPERIENCE TODAY: software.intel.com/media-client-solutions

Media RAW Accelerator for Windows*

Unleash visually stunning RAW media

Plug-Ins

Media RAW Accelerator

Audio

Foundation

Media SDK*

▶	**RAW Processing**	Design products deliver visually stunning media by enabling RAW photo and 4K RAW video processing.
🔥	**Hardware Acceleration**	GPU-accelerated capabilities supporting Intel® Architecture-based devices.
📋	**Deliver with Ease**	Library ease of use is illustrated with a simple console sample.

EXPERIENCE TODAY: software.intel.com/media-client-solutions

Audio for Windows*

Deliver quality sound with audio encode & decode for AAC & MPEG

Plug-Ins

Media RAW Accelerator

Audio

Foundation

Media SDK*

	Decode & Encode with Ease	A dedicated library for audio codec processing.
AAC	**AAC Audio Format Supported**	Decode low complexity (LC), long term prediction, parametric stereo, spectral brand replication (SBR) and HE AAC v. Encode LC & SBR, outputting for AAC-ADTS, RAW & ADIF. Stereo mode support for LR, JOINT & MS.
MPEG	**MPEG Audio Format Supported**	Decode MPEG-1 & MPEG-2 Audio Layers I, II & III.

EXPERIENCE TODAY: software.intel.com/media-client-solutions

Media for Mobile Architecture

Enabling app logic re-use X-OS & X-Architecture

C/C++ Wrapper enables complete code re-use

Android*

iOS*

WinRT*

Android Java Media Codec	iOS Objective C AV Foundation	Win RT C/C++ HMF / MFT

Features
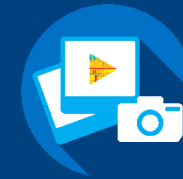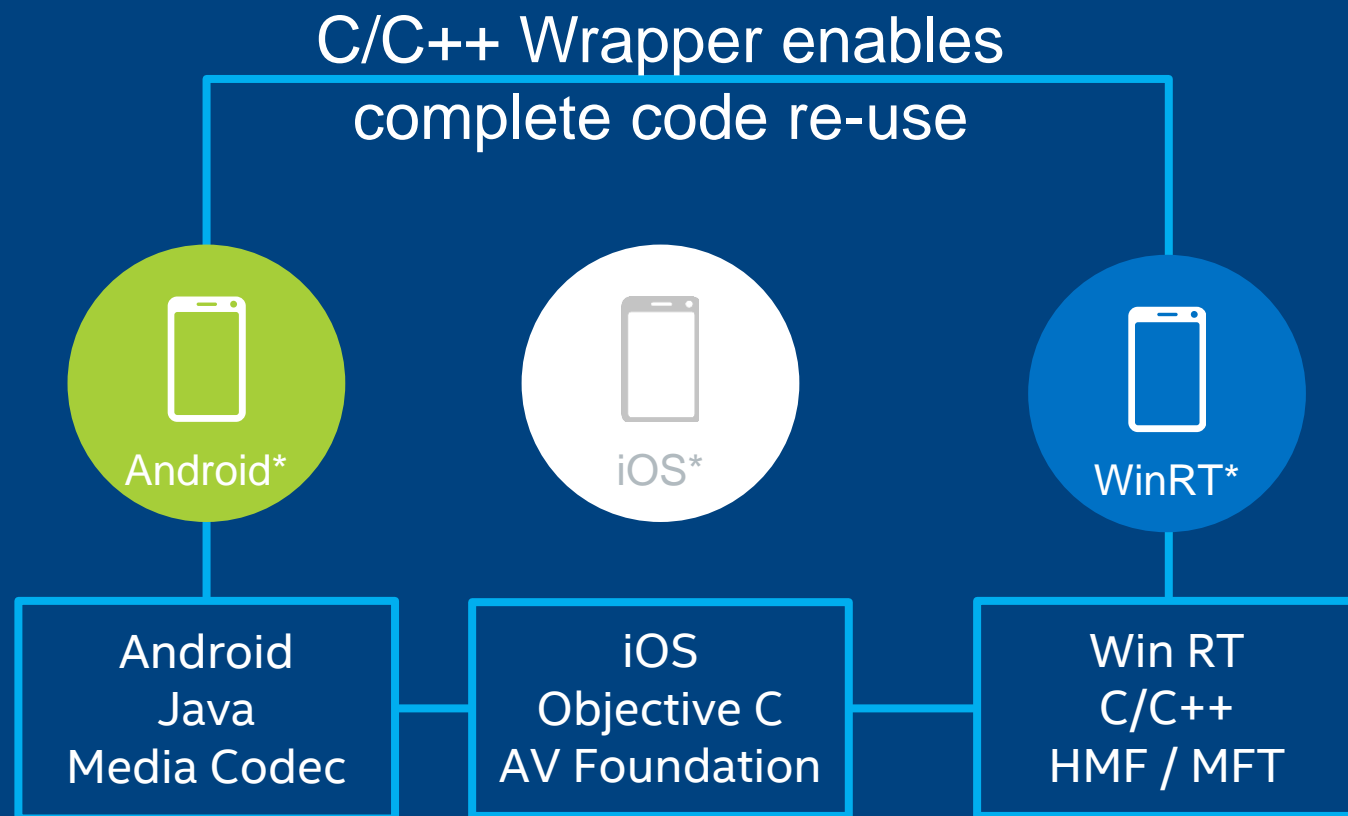
Media Composer
- Video Editing, File joining, effect application
- Transcoding, scene extraction/cropping

Media File Info
- Extracts file information and frame at designated location

Media Streamer
- Streams local media file to remote server
- Not for real time communications
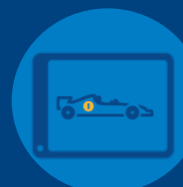
Camera & Game Capture
- Stream data from camera without incurring SW format conversion.
- GL Capture enables GL frame buffers to be encoded.

Audio Content Recognition
- Supports audio fingerprinting through Audible magic

Download: www.intel.com/software/inde

INDE Media RAW processing Fundamentals

RAW (Bayer)
DATA
10-14bit / samples

RGB DATA
8 bit / samples

Image
Sensor

Raw Data

White Balance → Debayer

Color Conversion → Gamma Correction

(Simplified RAW Processing) example
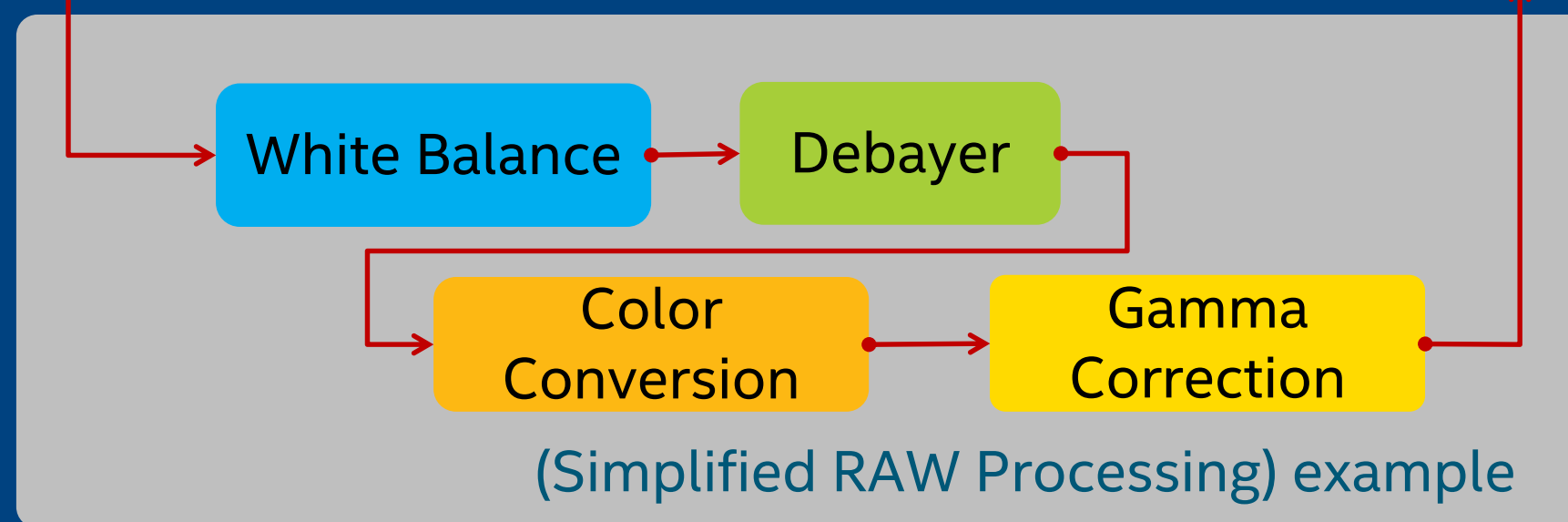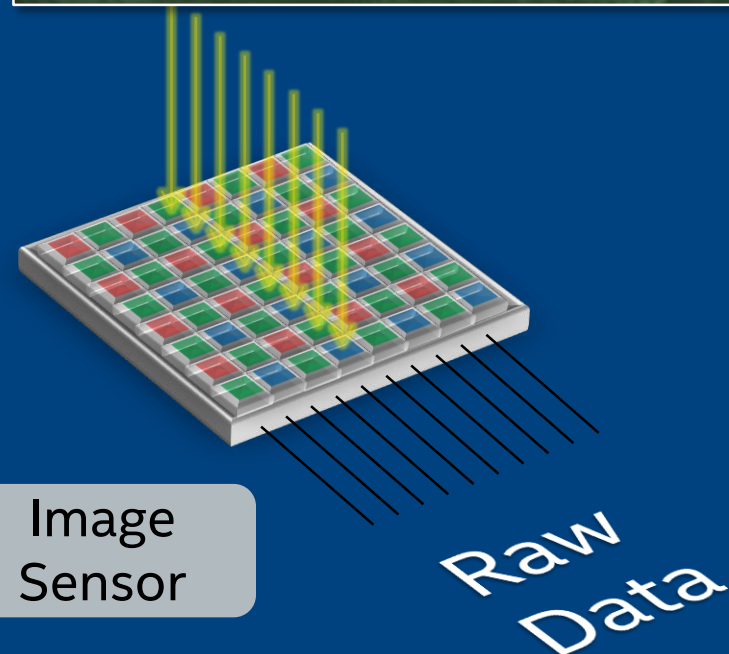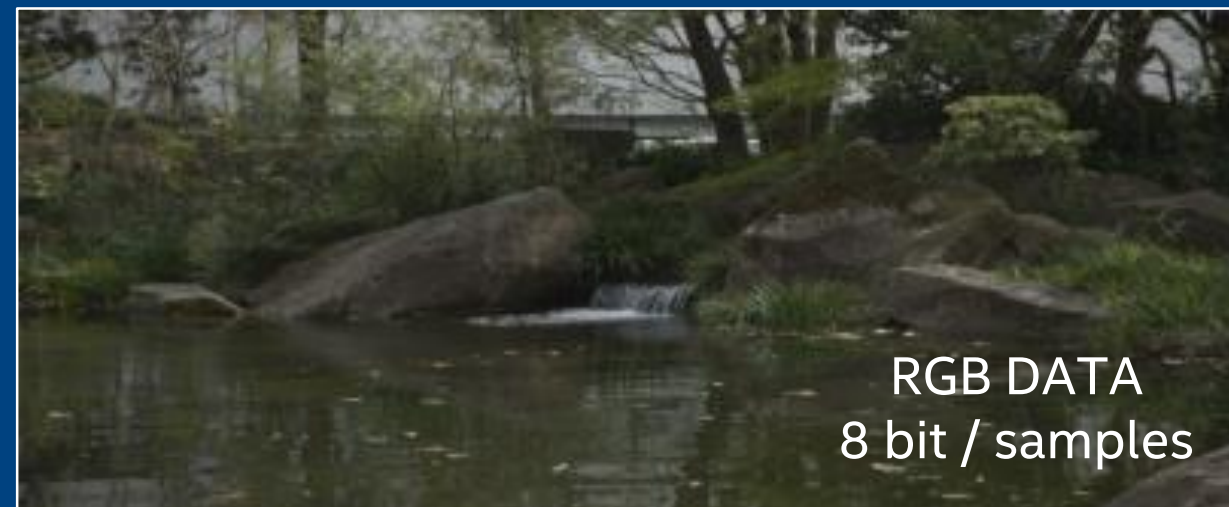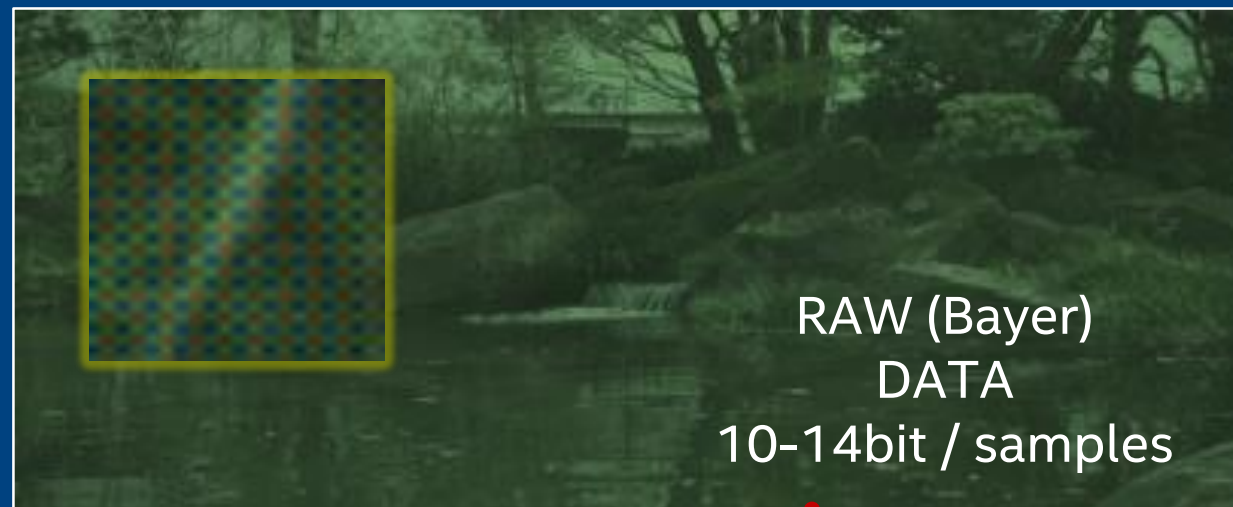
- Intel® INDE Media RAW Accelerator provides full set of modules like imaging processor inside DSLR or camera
- High Quality, High Performance, flexible setting.

Debayer

- High Quality Debayering : Direction-aware spatial filter utilizing correlation of neighboring pixels from multiple channels.   Able to run 4K@24fps on Core-i7 4770R.

Intel's HEVC encoder

Intel(R) Media Server Studio - Professional Edition
1080p HEVC Encode Quality/Performance
trends (Intel(R) Core-i7 4770k with Intel(R) HD Graphics 4600)

FASTER (Frames per Second)
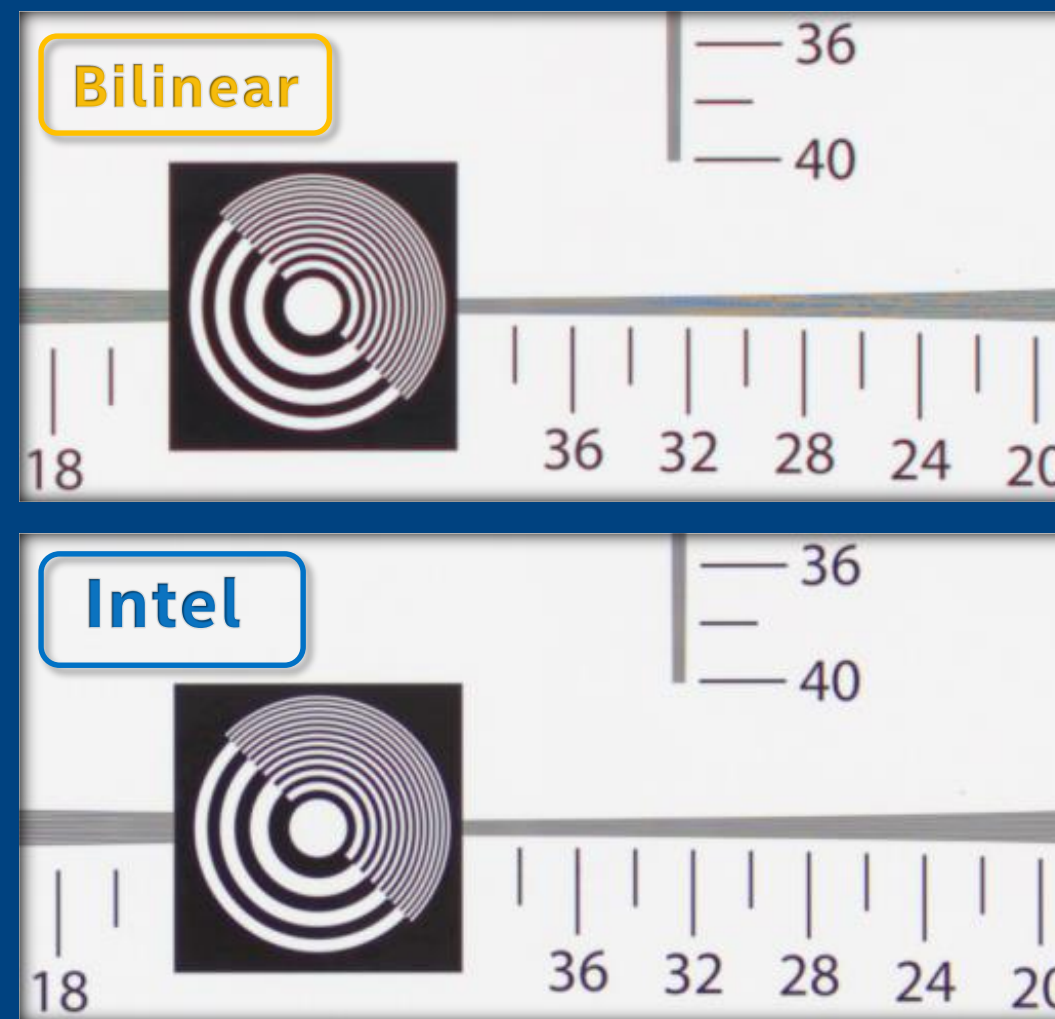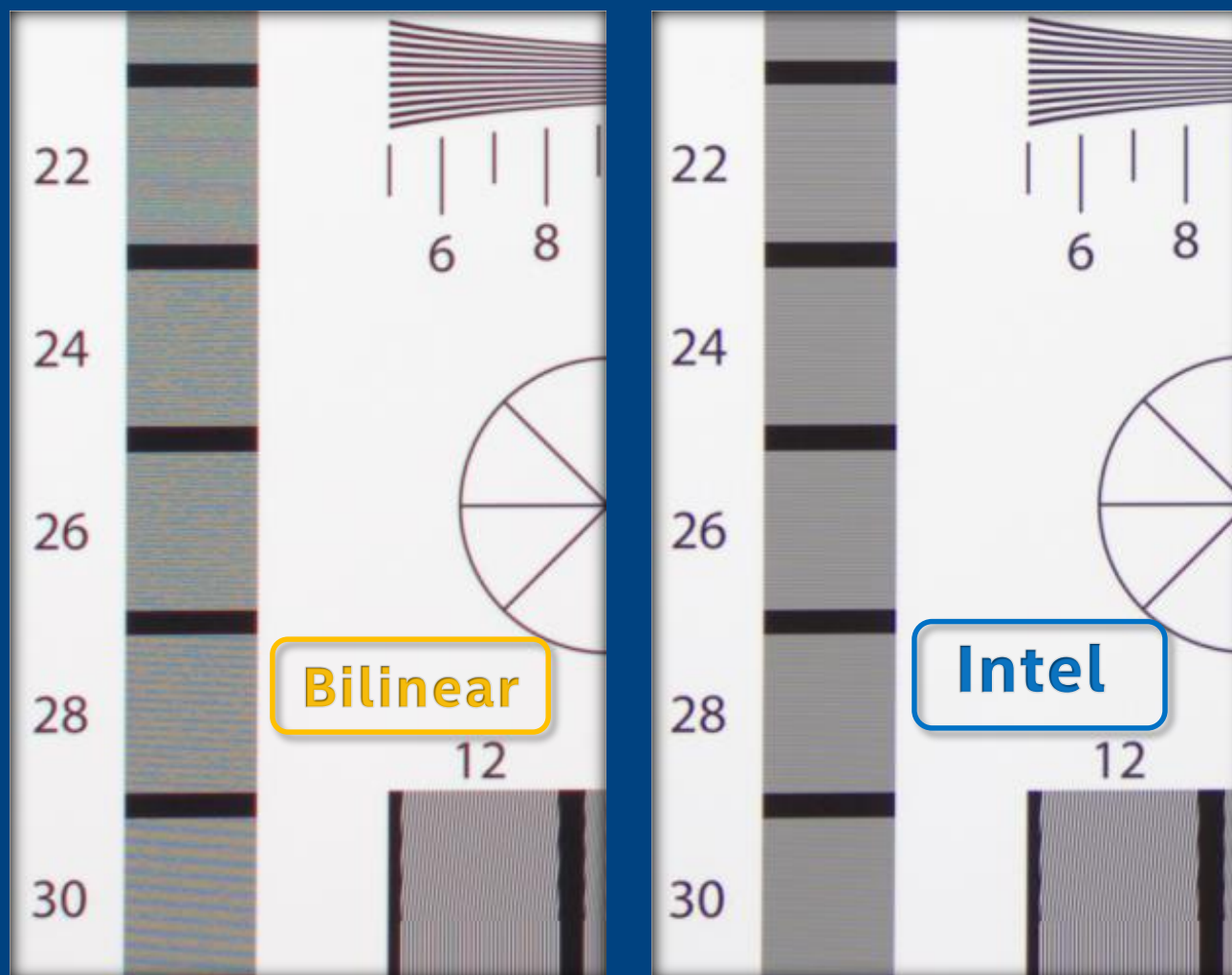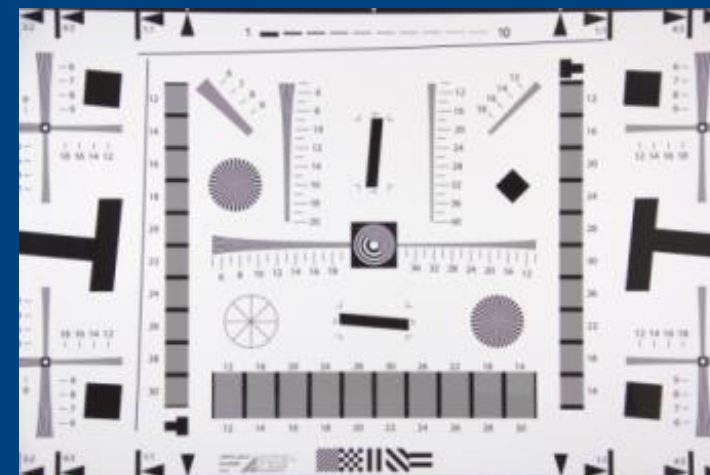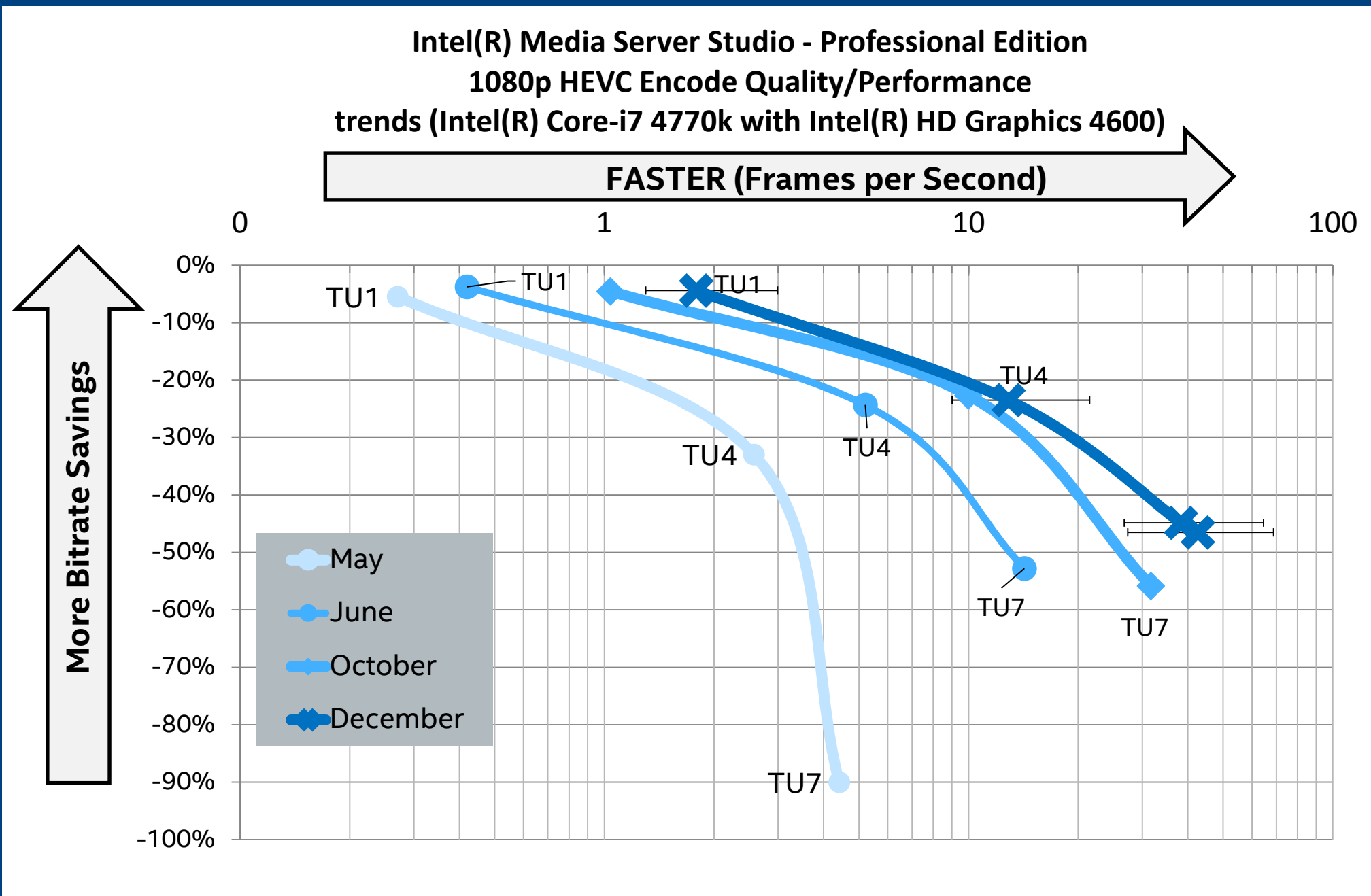
Top Quality or Top speed – your choice

Continuous gains in coding efficiency through the use of novel algorithms and Graphics Acceleration available on Intel® 4th generation Core Processors

Intel's HEVC encoder achieves first real-time 4K on Xeon E5 2697 v3

HEVC Encode Performance and CPU load-
"traffic" 3840x2048@30
Dual Intel® Xeon™ CPU E5-2697 v3 @ 2.60GHz
Constant QP and TU7 encoding presets
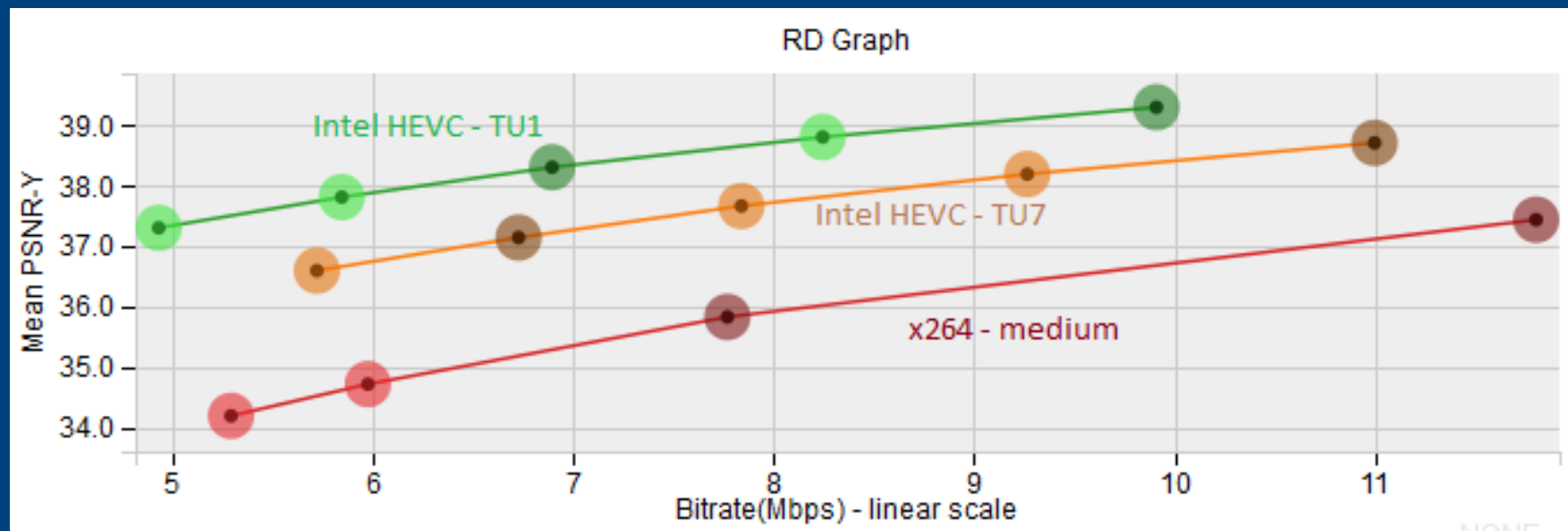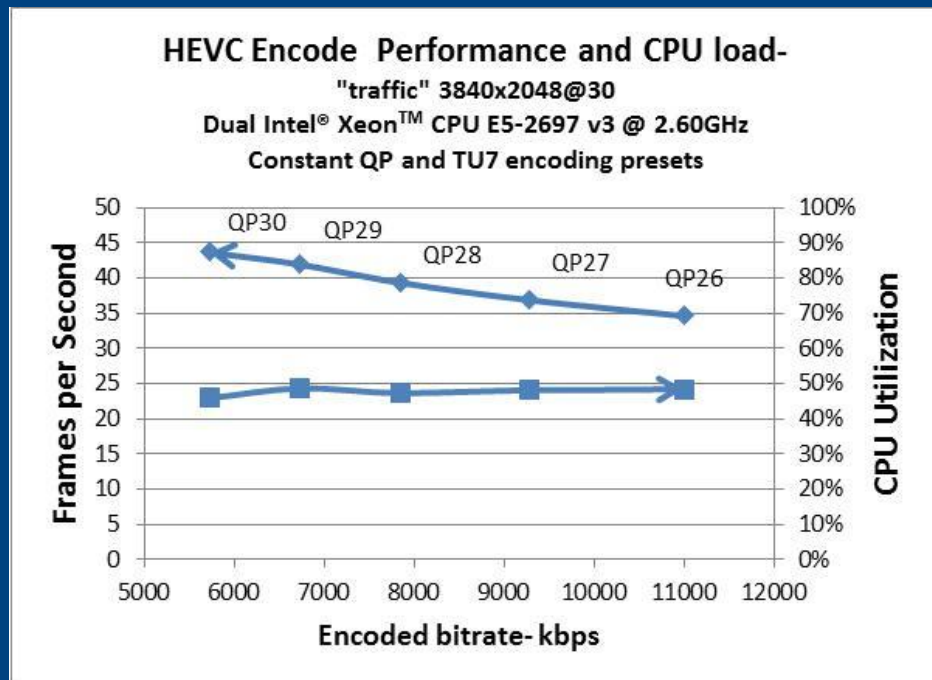
Our HEVC encoder is reliably faster than 30 fps at OTT and streaming bitrates on Xeon E5-2697 v3.

RD Graph

Figure 3 - Core-i7 477R) for the "traffic" sequence, comparing Intel HEVC and the popular open source AVC encoder. On this sequence, AVC objective quality is approximately equal to the Intel HEVC "Highest Speed" setting – but AVC requires 1.7X the bitrate.

If you want to reproduce these results, we used the sequences and BD-RATE process defined from our HEVC whitepaper at http://software.intel.com/en-us/intel-media-server-studio-support/product-library. Using the Media Server Studio 2015, R3 – Professional HEVC encoder and the sample video encoder on our website (follow link below to our samples package) we ran each sequence a number of times in CQP mode to compete both performance and quality. Bboth of these results are averaged over the sequences.

For the deep dive on Traffic sequence we selected a narrow range of QP's around 8mbps, using the latest ffmpeg-201312310git-d528882f-win64-static as comparison points for h264.

FFMPEG command line : %FFMPEG% –y –f rawvideo –vcodec rawvideo –s:v 3840x2048 –r 30 –pix_fmt yuv420p –i %STREAMIN4K% –c:v libx264 –f rawvideo –preset medium –x264-params keyint=1000:qp=35 –r 30 %OUTPUT%.   Intel HEVC encoder command line: sample_encode.exe h265 –i c:\content\yuv\uhd\Traffic_3840x2048_30.yuv –o sample_encode.265 –w 3840 –h 2048 –f 30 –cqp –qpi 30 –qpp 31 –qpb 31 –u speed –async 6 –sw

Video Pro Analyzer

Making bitstream debugging FUN
Whether you are targeting next generation HD video wireless display, mobile broadcast, mobile devices playback or web streaming solutions and applications, using the Intel Video Pro Analyzer 2015 to develop, research, or enhance VP9 and HEVC video codecs will save you time and money.

Supporting Linux, Windows, OS X
**HEVC up to 4:4:4 and 14-bit. VP9 – all profiles and bit depths AVC High profile (progressive only)**
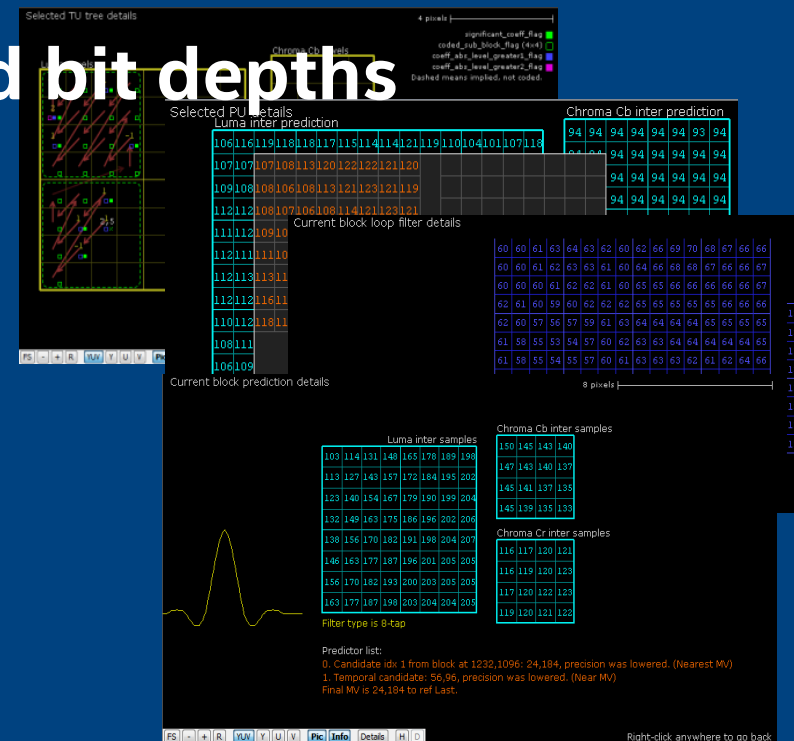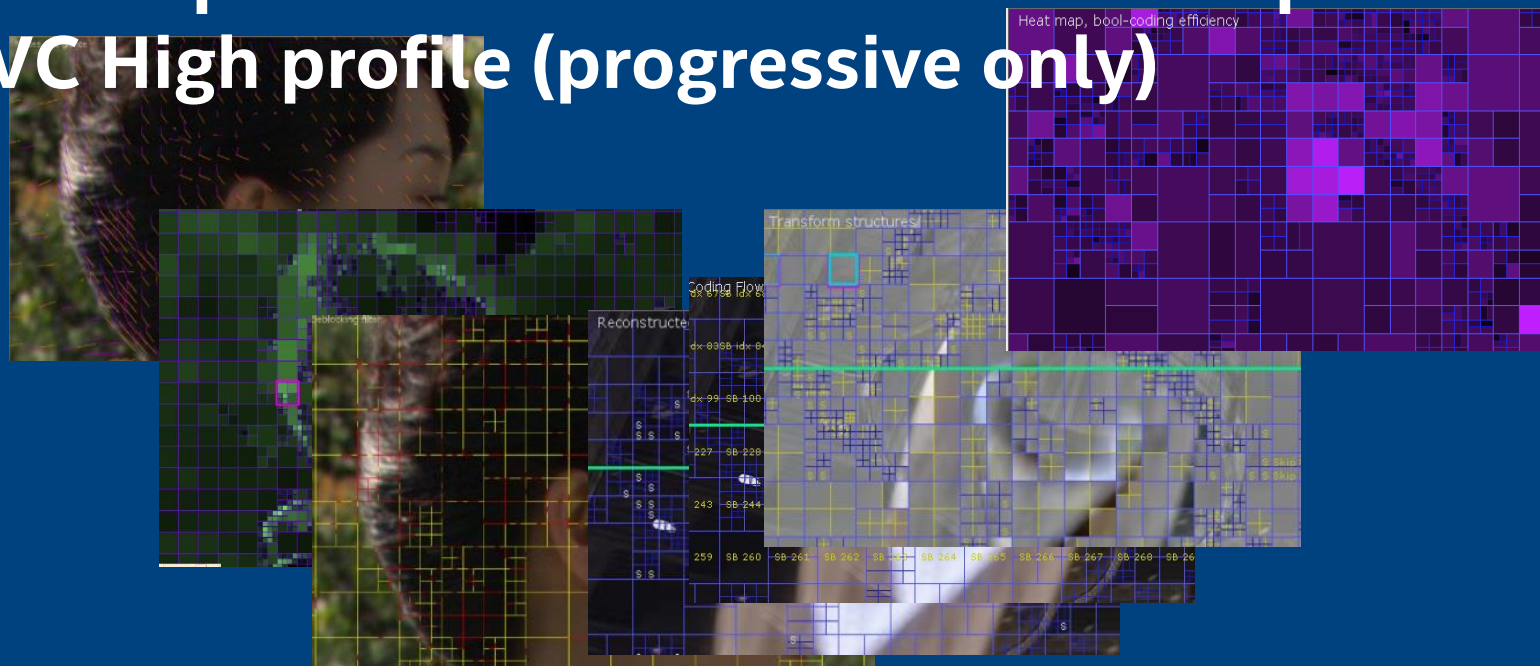
Stress Bitstreams and Encoder

Intel's test streams are carefully designed to integrate into your validation of VP9 and HEVC decoders, with resolutions up to 16k.

Our novel syntax compiler generates highly entropic syntax coverage. Full reports are included with each release, or use our coverage tool to analyze the complexity of your own content.

Focused syntax streams quickly aid debug of individual features when a failure is detected. Additional specialized focus tests include randomized scaling on each frame, DCT rounding correctness, and unusual resolutions and cropping.

Prove your solution can handle the worst with bitstreams designed to maximize compute complexity and memory bandwidth.

24
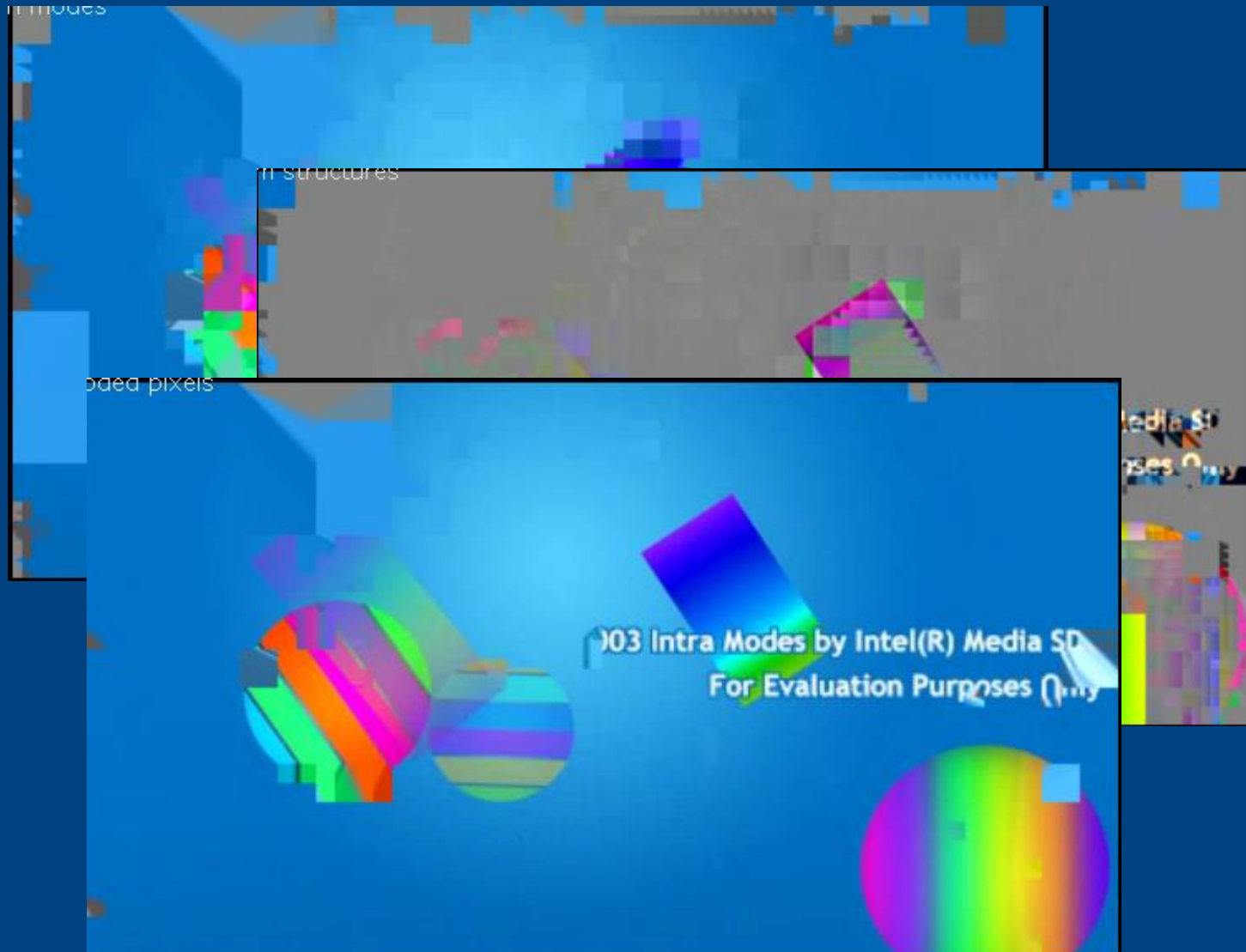
Stress Bitstreams Product structure

Feature/Tool	HEVC	VP9	Purpose
Debug Syntax streams	Y	Y	Development and debug codec in design
Worst case Memory Read Bandwidth/Worst Speed	Q2	Y	Put decoder in stress with maximized memory access and computation operations
Visual Clean streams*	Q2	Y	Visual naked eye testing
Stress Syntax streams	Y	Y	Comprehensive validation with minimal footprint
Smaller streams	Y	Y	Small resolutions and crops
Max Resolution	Level 6.2	16K	Test 4K, 8K, 16K resolutions
Randomized Scaling	N/A	Y	Randomized scaling factor for VP9 reference frames
Randomized Encoder	Y	Y	Configurable Encoder to create streams
High Bit Depth	10 Bit	10/12 Bit	VP9 Profile 2 & 3, HEVC Main 10
High Chroma subsampling	Q2	4:2:2/4:4:4	VP9 Profile 1 & 3, HEVC Rext 4:2:2 up to 12 bits in April'15

Random Stream Generator

Find Bugs in hours, not days

We've included our syntax compiler. You customize which syntax elements and parametric ranges are important for your product

You can

- Focus stream generation on a few elements to stress risky hardware

- Create your own "power virus" and explore the thermal stability of your part

- Shave hours off your release cycle by customizing tests for your market

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Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

Optimization Notice

Backup – GPU Metrics using Vtune Amplifier XE