

Ensure Robust HEVC and VP9 Video Decoders and Speed Debug and Validation

Intel® Stress Bitstreams and Encoder 2016 (Intel® SBE)

Video Analysis, Debug, and Validation Tools



Intel® Stress Bitstreams and Encoder is part of the Intel® Media Server Studio product family.

Improve Compliance and Cut Engineering Costs and Time to Market

Intel® Stress Bitstreams and Encoder (Intel® SBE) allows you to:

- Perform extensive, production-scale media validation and debug
- Ensure robustness and compliance for HEVC and VP9 decoders and encoders
- Use industry-leading HEVC range extensions with HEVC 4:2:2 and 10-bit support
- Accelerate test validation cycles, reduce costs, and speed time to market
- Customize your own bitstreams for testing
- Assess and optimize your own stream base for coverage and usage efficiency

Validation Bitstreams for HEVC and VP9 Decoders

Intel SBE includes HEVC or VP9 video streams packaged with a unique software encoder. Bitstreams are carefully designed to integrate into enterprise-grade product compliance validation and debugging processes of VP9 and HEVC decoders, transcoders, players, and streaming solutions. To optimize for fast test cycles, we designed stress streams which provide a small footprint and excellent syntactical coverage. For quick debug if an issue is found, we provide a broad range of focused syntax stream tests. Unlike standards compliance bitstreams, Intel® SBE provides high-combinatorial coverage needed to test your decoder.

Extensive Validation Coverage for Industry Compliance

Due to the syntactical flexibility allowed in modern coding standards, video encoders are capable of producing variety of bitstreams. A decoder (or video player) needs a way to validate against every possible encoder in the market, both today and in the future. It seems impossible, but it is possible to model such encoders by creating a highly configurable encoder driven by an advanced entropy model—an Encoder Compiler. The output of this compiler is rigorously tested for coverage of important combinations of syntax elements and values. After an issue is found in decoder under test, it can be debugged using special streams designed to accelerate this debugging as well. Intel SBE allows developers to compare their decoders' output with known correct outputs to determine anomalies in their products and save overall validation and support cost.

Intel® Stress Bitstreams and Encoder

- **HEVC and VP9 Formats:** Supports HEVC Main/Main10/Main4:2:2 and 100% VP9 specs.
- **Debug Syntax, Test Syntax Bitstreams:** Debug a decoder and execute comprehensive validation.
- **Stress Bitstreams:** Test a decoder with spec bound conditions, maximizing memory read access and CABAC.
- **Random Encoders.** Make a new custom bitstream—HEVC up to Level 6.2; VP9 and HEVC.
- **Visual Coverage:** Visualize test bitstreams for system integrators.
- **Error Resilience:** Fix corrupted bitstreams and generating encoder for testing decoder's error concealment.
- **Bitstream Base Optimization and Coverage Visual Reporting Tools**
- **Reference Decoders and Checksums**
- **Detailed Coverage Report**

Intel® Stress Bitstreams and Encoder is a member of the Intel® Media Server Studio product family. It can be used alone or with Intel® Media Server Studio 2015 Professional Edition and Intel® Video Pro Analyzer.

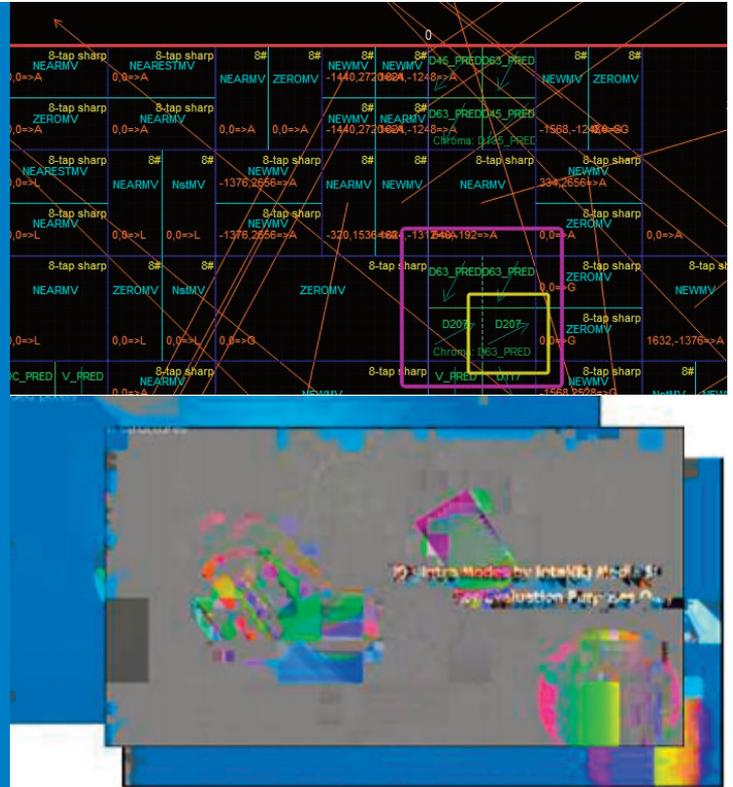


Figure 1. The advanced entropy model (top) is designed to create unusual combinations of syntax elements to push the limits of compliance bitstreams, as shown with Intel® Video Pro Analyzer.

HEVC and VP9 Bitstreams

Due to high demand for online video content, and bandwidth constraints, next generation, efficient video codecs like HEVC and VP9 are replacing AVC and MPEG-2 for future video feeds. Validation/QA and video codec development teams, content developers, and researchers can benefit from Intel Stress Bitstreams to ensure their video playback, streaming and distribution solutions can support all compliant formats inputs.

Cut Development Costs and Time to Market for Video Products

Intel carefully structured the streams to be as compact as possible during validation. (This reduces the time to validate your product.) Plus, the package contains a large number of streams to assist in debug.

You can also generate custom streams, which can be advantageous if you want to test, for example, syntax correctness of a filter or error resilience.

New Intel SBE developer tools give you the ability to build syntax and code branch coverage reports for any set of streams. Optimize your stream base to select only what's needed for particular test coverage, and dynamically improve it over time.

**Branch and Syntax Elements Coverage for
Intel® Stress Bitstreams & Encoder – Killer Streams**

High Level Summary

Files		Functions		Basic Blocks		Elements		Values	
Covered	%	Covered	%	Covered	%	Covered	%	Covered	%
47 of 48	97.91	546 of 571	95.62	5073 of 5705	88.92	79 of 79	100.0	3538 of 3548	99.71

Branch Coverage for source and header files

Sources	Functions		Basic Blocks		Syntax Elements				Sources	Functions		Basic Blocks		Syntax Elements			
	Covered	%	Covered	%	F	P	N	U		Covered	%	Covered	%	F	P	N	U
COMMON_VP9_ALLOCCOMMON.C	11 of 12	91.67	61 of 63	96.83					COMMON_VP9_MV.H	1 of 1	100.00	3 of 3	100.00				
COMMON_VP9_BLOCKD.C	6 of 6	100.00	77 of 77	100.00	2				COMMON_VP9_MVREF_COMMON.C	5 of 5	100.00	150 of 158	94.94	2			
COMMON_VP9_BLOCKD.H	11 of 11	100.00	28 of 28	100.00	7				COMMON_VP9_MVREF_COMMON.H	5 of 5	100.00	19 of 19	100.00	1			
COMMON_VP9_COMMON.H	4 of 4	100.00	18 of 18	100.00					COMMON_VP9_ONVVC_INT.H	12 of 12	100.00	57 of 58	98.28	23	2		
COMMON_VP9_CONVOLVE.C	28 of 28	100.00	170 of 170	100.00					COMMON_VP9_PRED_COMMON.C	8 of 8	100.00	360 of 360	100.00	3			
DECODER_VP9_DECODEFRAME.C	49 of 52	94.23	861 of 1039	82.87	52	2			COMMON_VP9_PRED_COMMON.H	5 of 5	100.00	24 of 24	100.00				
DECODER_VP9_DECODEMV.C	25 of 26	96.15	322 of 334	96.41	26				COMMON_VP9_PROB.C	2 of 2	100.00	12 of 12	100.00				
DECODER_VP9_DECODER.C	10 of 10	100.00	84 of 110	76.36	5				COMMON_VP9_PROB.H	6 of 6	100.00	20 of 20	100.00				
DECODER_VP9_DECODER.H	2 of 2	100.00	7 of 9	77.78	1				COMMON_VP9_QUANT_COMMON.C	3 of 3	100.00	23 of 23	100.00	3			
DECODER_VP9_DETOKENIZE.C	3 of 3	100.00	81 of 82	98.78	3				DECODER_VP9_READER.C	4 of 4	100.00	22 of 26	84.62				
DECODER_VP9_DSUBEXP.C	5 of 5	100.00	38 of 38	100.00					DECODER_VP9_READER.H	4 of 4	100.00	18 of 18	100.00				
COMMON_VP9_ENTROPY.C	3 of 3	100.00	36 of 36	100.00	1				DECODER_VP9_READ_BIT_BUFFER.C	4 of 4	100.00	14 of 14	100.00				
COMMON_VP9_ENTROPY.H	4 of 4	100.00	24 of 24	100.00	1				COMMON_VP9_RECONINTER.C	8 of 11	72.73	29 of 49	59.18	2			
COMMON_VP9_ENTROPYMODE.C	7 of 7	100.00	100 of 100	100.00	13				COMMON_VP9_RECONINTER.H	2 of 2	100.00	11 of 11	100.00	2			

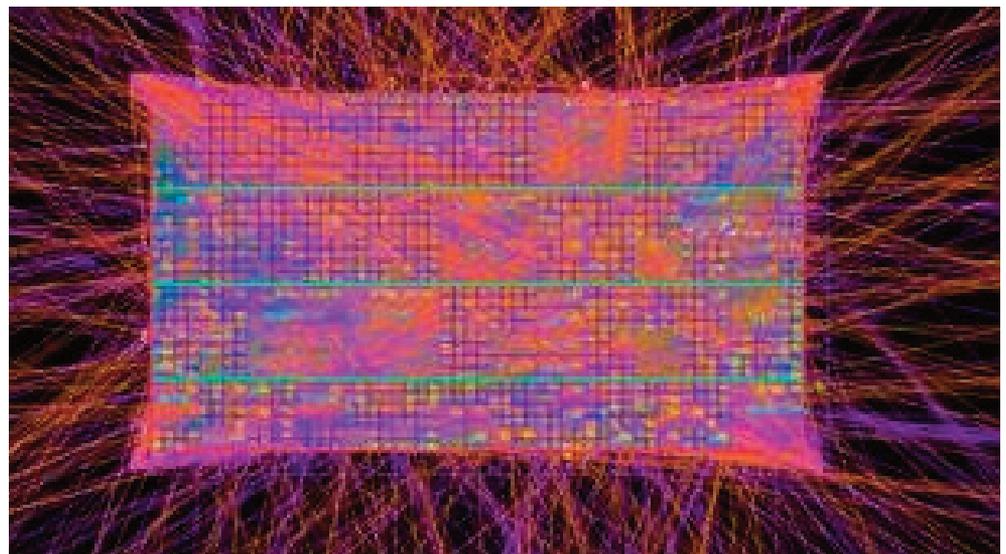


Figure 2. Intel stress bitstreams are designed to confuse decoders. In this example, compute complexity caused by special coding elements choices looks chaotic but are legal and produce perfectly correct results.

Features

- **HEVC Streams:** Main Profile (8-bit). Ultra compact our small validation streams for smoke test are only 13.5 MB, while our full debug syntax and stress streams require only 1.5 GB.
- **VP9 Streams:** Feature Set 1 for 8-bit 4:2:0, with latest Google* syntax. Ultra compact, the small validation streams are only 6.3 MB, while the full debug syntax and stress streams require only 1 GB.
- **Reference Decoders:** Get reference decoders for both HEVC and VP9.
- **Checksums:** Get checksums for all bitstreams matched against reference decoders.
- **Random Encoders**

HEVC Main/Main 10/Main 4:2:2 up to Level 6.2

VP9 and HEVC: Varying resolution, slice structure, GOP structure, and syntax constraints.

-VP9 FC1 Delivers VP9 Feature Set 1 (8-bit 4:2:0)

-VP9 FC2P1 Delivers VP9 Feature Set 2/Profile 1(8-bit 4:2:2/4:4:0/4:4:4 chroma sub sampling)

- VP9 FC2P2 Delivers VP9 Feature Set 2/Profile 2 (10-bit and 12-bit 4:2:0)
- VP9 FC2P3 Delivers VP9 Feature Set 2/Profile 3 (10-bit and 12-bit 4:2:2/4:4:0/4:4:4 chroma sub sampling)
- VP9 MixP0-P1, MixP0-P2, MixAll
- VP9 FC1 and FC2 Profile 2 Error Resilience
- **Visual Coverage:** Visual Test Bitstreams for system integrators: In addition to highly randomized bitstreams for compliance test, we provide Visual Bitstreams, which do not have visual artifacts and best fit for DigitalTV and STB verification.
 - VP9 FC1 Visual
 - VP9 FC2 Profile 2 Visual
- **Error Resilience:** Bitstreams to test decoder concealment to network bits and packet loss, in compliant encoders production

Technical Specifications

Hardware Requirements

- Intel® CPU supporting Intel® Streaming SIMD Extensions 2 (SSE2), 1GB RAM minimum
- 4 GB recommended when loading 4K pictures

Software Support

- Microsoft Windows* 7, 8, 8.1, 10, 32-bit/64-bit
- Ubuntu Linux* 12.04.64
- SUSE* Linux Enterprise Server 11-64
- Macintosh OS X* 10.9
- Encoders on Windows and Linux

For hardware and other technical requirements, see the latest Release Notes.

Get more information regarding performance and optimization choices in Intel® software products.

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Intel® Media Server Studio

Create innovative, enterprise-grade media solutions that deliver fast, high-density media transcoding, speed the transition to HEVC and 4K, and reduce costs. Learn more [here](#).

Intel® Video Pro Analyzer

Advanced video analysis software tools for HEVC, VP9, AVC, and MPEG-2 video coding standards allow deep visual inspection of the complete decoding process, extract statistics, debug, and more. Learn more [here](#).



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