

Ensure Robust HEVC, VP9, and AVS 2.0 Video Decoders, 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. It can be used alone or with Intel® Media Server Studio Professional Edition and Intel® Video Pro Analyzer.

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 for VP9, HEVC, and AVS 2.0 decoders, transcoders, players, and streaming solutions.
- Ensure the robustness and compliance of decoders, validate with Stress, Syntax, Error Resilience, and Visual streams.
- Test HEVC decoder supporting Main, Main 10, Main 12, 4:2:2, and 4:4:4 (up to 12-bit), 4:0:0 (Monochrome) profiles, SHVC (scalability) extension.
- Accelerate decoder validation cycles, reduce costs, and speed time to market.
- Create custom bitstreams for testing and optimize your stream base for coverage and usage efficiency.

Validation Bitstreams for HEVC, VP9, and AVS 2.0 Decoders

Intel SBE provides HEVC, VP9, or AVS 2.0 video streams packaged with a unique software encoder to create custom validation content. Bitstreams are carefully designed for compliance, performance, and error resilience validation of VP9, HEVC, and AVS 2.0 decoders, transcoders, players, and streaming solutions. To run fast test cycles, we designed stress streams which provide a small footprint and excellent syntax coverage. For quick debug if an issue is found, we provide a broad range of focused syntax stream tests. Unlike bitstreams that are available at codec standard websites, 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 a variety of bitstreams. A decoder (or video player) needs a way to validate against every possible encoder available, both today and in the future. It seems impossible, but there is an approach that proves to be credible. It's a modeling of test scenarios by creating a highly configurable encoder driven by an advanced entropy model—a Random Encoder. The output of this encoder is rigorously tested for coverage of important combinations of syntax elements and

Intel® Stress Bitstreams and Encoder Highlights

- **HEVC, VP9, and AVS 2.0 profiles supported**
 - HEVC Main, Main 10, Main 12, Main 4:2:2 and 4:4:4 up to 12 bit), 4:0:0 (Monochrome), SHVC extension
 - VP9 Profiles 0, 1, 2, 3
 - AVS 2.0 Main and Main 10
- **Compliance (Syntax) Streams:** Ensure your decoder is compliant to standard.
- **Performance and Memory Bandwidth (Stress) Streams:** Test decoder under worst-case performance and memory bandwidth conditions.
- **Error Resilience:** Ensure decoder is robust and able to process broken and non-compliant streams.
- **Visual Streams:** Clean content to scan decoder output for visual artifacts by eyes.
- **Smoke Test Streams:** Small footprint and sufficient coverage are ideal for quick test runs.
- **Random Encoders:** Generate custom bitstreams for your specific test case.
- **Analytical Tools** for bitstream base optimization and visual coverage reporting
- **Reference Decoders and Checksums**
- **Detailed Coverage Report**

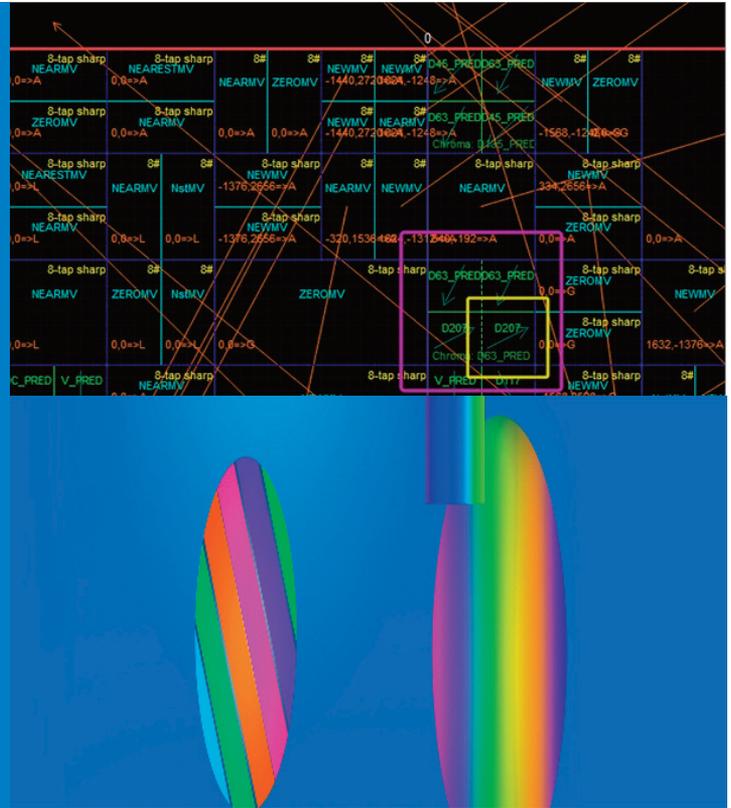


Figure 1. The advanced entropy model (top) is designed to create unusual combinations of syntax elements to push the limits of compliance bitstreams, as shown with Intel® Video Pro Analyzer. The bottom image shows an example of the result of a Random Encoder test to aid in debugging decoders.

and AVS 2.0 are replacing AVC and MPEG-2 for future video feeds. Validation and video codec development teams, content developers, and researchers can benefit from Intel SBE to ensure their video playback, streaming, and distribution solutions can support all compliant format inputs.

Cut Development Costs and Time to Market for Video Products

Intel carefully structured the streams to be as compact as possible to reduce time for validation. Plus, for quick testing for regression, smoke test streams can be used.

You can also use the Random Encoder to generate custom validation streams for your own test cases.

Analytical tools give you the ability to analyze coverage of existing test bitstream set, generate a visual syntax and code branch coverage report, and optimize your stream set for maximized coverage or select streams required for development and validation of particular codec feature.

values. After an issue is found in a 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 on overall validation and support costs.

HEVC, VP9, and AVS 2.0 Bitstreams

Due to high demand for online video content, plus bandwidth constraints, next-generation, efficient video codecs like HEVC, VP9,

Branch and Syntax Elements Coverage for Intel® Stress Bitstreams and Encoder — Smoke Test 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		Covered	%	Covered	%	F	P	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		

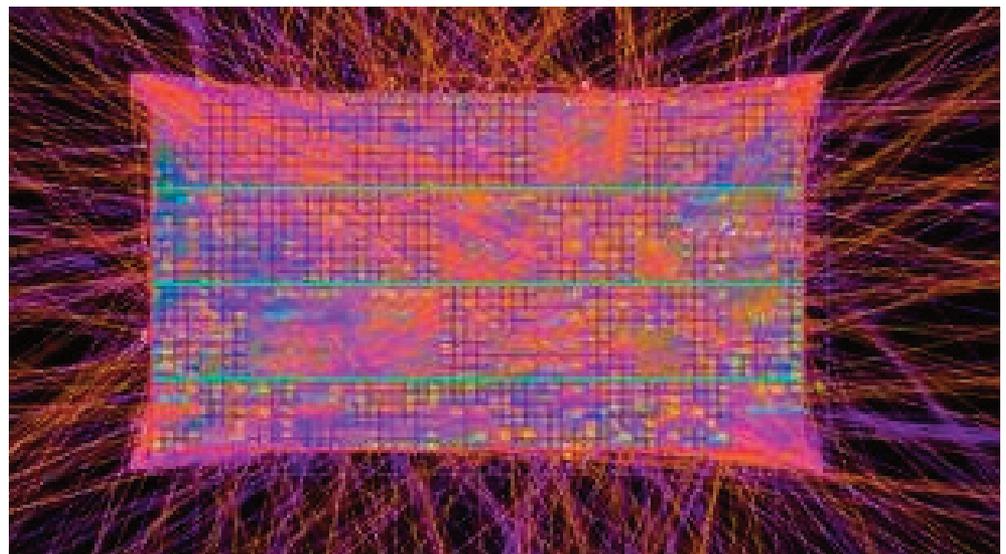


Figure 2. Intel SBE stress bitstreams are designed to confuse decoders. In this example, compute complexity caused by special coding elements choices looks chaotic but is legal and produces perfectly correct results.

Features/Stream Types

	HEVC	VP9	AVS 2.0
Stress and Syntax	✓	✓	✓
Error Resilience	✓	✓	No
Visual	No	✓	✓
Smoke Test	Yes	Yes	
Random Encoder	✓	✓	
Analytical Tools	✓	✓	

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



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Media developers, video experts, and validation engineers have even more power to build high-performance and quality media solutions.

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](#).

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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