Topic

H.264 Video Compression

Prepared By

Tyler R. Johnson

H.264
----
* Joint specification of ITU and ISO/IEC.
* Multiple profiles for specific applications
* Widespread application in streaming, Blu-ray©, videoconferencing, and mobile video applications.

Summary

H.264 is the most current, standardized digital video codec from ITU and ISO/IEC. It supports a broad range of applications, from tiny mobile devices to 3-D high definition video.

Discussion

H.264 is a block-based video compression standard. Its primary application is reducing the size of moving image files so that they can be stored and transmitted efficiently over networks. The technology has found broad adoption in the smartphone, videoconferencing, and consumer entertainment markets. Because of its success, the Joint Video Team was awarded an Emmy in recognition of the technology's impact.

History

H.264 builds upon earlier work of the Motion Picture Experts Group (MPEG), including H.261, H.263, MPEG1, and MPEG2. H.264 is specified as the video coding scheme in the MPEG4-Part 10 multimedia framework. H.264 should be considered evolutionary technology, in that it builds upon this earlier work through mathematical refinements and by leveraging the availability of modern processing hardware.

At inception, H.264 was conceived as having a royalty-free baseline profile, along with higher level profiles that could be licensed at a cost to obtain better performance. This model was abandoned by MPEG LA and now the entire standard is patent and royalty-encumbered.

Profiles and Levels

H.264 addresses an extremely broad set of potential applications, from tiny 64kb/s video streams, to Blu-ray© DVD, all the way to high bandwidth, lossless video editing and studio formats. To accomplish this, the standard is divided into twelve "profiles" that are further divided into levels. Profiles and levels allow precise tuning of the bitstream to optimize performance for specific applications. When confirming compliance, it is important to specify which profile/level a system addresses, because most

cannot handle all possible cases.

In addition to traditional coding, the standard supports scalable video coding, which allows the description of multiple resolutions of an image in a single bitstream by separately describing higher resolution details that can be discarded when bandwidth or storage is limited. The standard also supports multiview encoding, which can render 3-D video and other non-deterministic viewing scenarios.

Technology

Like most video coding standards, H.264 only defines a syntax for decoding bitstreams. How to encode pictures efficiently and conform to the protocol are decisions left to the implementor and represent key market differentiators.

The syntax supports common moving image compression constructs including macro-blocks, I-frames, predictive coding, removal of spatial and temporal redundancy, and entropy coding.

The system is designed to be asymmetric, requiring far greater processing power to encode than to decode. This makes inexpensive software decoders easy to deploy, but encoding remains expensive.

Future Developments

ITU-T has begun preliminary work on a successor technology, tentatively called H.265, however this work is nascent and experimental.

Strategy Considerations

H.264 is supported in Adobe's Flash© player and is a critical component of developing Internet streaming high definition services. However, the format competes with Adobe's own proprietary technologies. There has been a push to support a royalty-free and open video codec, especially around inclusion in HTML 5. Unfortunately, these efforts have been mired in industry bickering. Theora is one such open codec which offers very good performance at low bit rates, though it does not address the broad application range that H.264 does.

For Further Information

1. ITU-T Recommendation H.264 [Advanced video coding for generic audiovisual services](), March 2009

2. Motion Picture Experts Group, [http://www.chiariglione.org/mpeg/]()

3. Joint Video Team, [http://www.itu.int/ITU-T/studygroups/com16/jvt/]()