CAMSS Questionnaire
Xiph.Org response

Benjamin M. Schwartz <bens@alum.mit.edu>, Timothy B. Terriberry <tterribe@xiph.org>,

Ralph Giles <giles@xiph.org>, Silvia Pfeiffer <silviapfeiffer1@gmail.com>,

Kat Walsh <kat@wikimedia.org>, Greg Maxwell <greg@xiph.org>

Xiph.Org was invited to respond to a questionnaire related to a pilot assessment of video codecs in eGovernment for the European Commission. The questionnaire comes from the CAMSS project which is part of an initiative to provide recommendations for interoperable technology. Xiph.Org is a not-for-profit organization that develops free and open multimedia technology well suited to the broad and equitable access requirements inherent in many eGovernment applications.

This document represents Xiph.Org's response to the CAMSS assessment questions regarding both the Xiph.Org standards development processes and the Theora video coding standard in particular. We are grateful to Clémentine Valayer for giving us the opportunity to describe our processes and standards in detail, and to the IDABC for all their work to improve interoperability of digital systems. It is structured as a point-by-point response to the "market criteria" (Part 4) and "standardisation criteria" (Part 5) questions. We have endeavored to provide complete, precise, and concise responses. If you would like any further information or clarification regarding Xiph.Org and its standards, please do not hesitate to contact the listed authors.

This document represents a snapshot of the wiki page on which it was developed[1]. Any further clarifications may occur on that page. This snapshot of the responses is offered in the hope that it may be useful for print and archival purposes.

Part 4: Market Criteria

Market support

Does the standard have strong support in the marketplace?

Yes. For example, among web browsers, support for Xiph's Ogg, Theora, and Vorbis standards is now included by default in Mozilla Firefox, Google Chrome, and the latest versions of Opera, representing hundreds of millions of installed users just in this market alone. On Windows, DirectShow filters exist which also enable all Windows applications that use the DirectShow framework to use Xiph's Ogg, Theora, and Vorbis standards. A QuickTime component exists which enables use of Xiph's Ogg, Theora, and Vorbis standards in all Mac OS X applications that make use of the QuickTime framework — which includes Safari/Webkit, iMovie, QuickTime, and many others.

What products exist for this formal specification?

Theora is a video codec, and as such the required products are encoders, decoders, and transmission systems. All three types of products are widely available for Theora.

How many implementations of the formal specification are there?

Xiph does not require implementors to acquire any license before implementing the specification. Therefore, we do not have a definitive count of the number of implementations. In addition to the reference implementation, which has been ported to most modern platforms and highly optimized for x86 and ARM CPUs and TI C64x+ DSPs, we are aware of a number of independent, conformant or mostly-conformant implementations. These include two C decoders[2], a Java decoder[3], a C# decoder, an FPGA decoder[5],and an FPGA encoder[6].

Are there products from different suppliers in the market that implement this formal specification?

Yes. Corporations such as Atari, Canonical, DailyMotion, Elphel, Fluendo, Google, Mozilla, Novell, Opera, Red Hat, Sun Microsystems, and Ubisoft have supplied products with an implementation of the Theora standard.

Are there many products readily available from a variety of suppliers?

Yes. Theora has been deployed in embedded devices, security cameras, video games, video conferencing systems, web browsers, home theater systems, and many other products. A complete, legal, open-source reference implementation can also be downloaded free of charge, including components for all major media frameworks (DirectShow, gstreamer, and Quicktime), giving most applications the ability to use the codec.

What is the market share of the products implementing the formal specification, versus other implementations of competing formal specifications?

Theora playback is extremely widely available, covering virtually the entire market of personal computers. Theora is also increasingly available in mobile and embedded devices. Since we do not require licensing for products that implement the specification, we do not have market share numbers that can be compared with competing formal specifications. Because implementations are readily available and free, Theora is included in many products that support multiple codecs, and is sometimes the only video codec included in free software products.

Who are the end-users of these products implementing the formal specification?

The end users are television viewers, video gamers, web surfers, movie makers, business people, video distribution services, and anyone else who interacts with moving pictures.

Maturity

Are there any existing or planned mechanisms to assess conformity of the implementations of the formal specification?

Yes. In addition to a continuous peer review process, we maintain a suite of test vectors[7] that allow implementors to assess decoder conformity. We also provide free online developer support and testing for those attempting to make a conforming implementation. An online validation service[8] is available.

Is there a reference implementation?

Yes. Xiph maintains a reference implementation called libtheora[9]. In addition to serving as a reference, libtheora is also highly optimized to achieve the maximum possible speed, accuracy, reliability, efficiency, and video quality. As a result, many implementors of Theora adopt the reference implementation.

Is there an open source implementation?

Yes. libtheora is made available under a permissive BSD-like license. Its open-source nature also contributes to its quality as a reference implementation, as implementors are welcome to contribute their improvements to the reference. There are also several other open source implementations in addition to the reference.

Does the formal specification show wide adoption *across different domains*?

Yes. In addition to the private companies mentioned in the previous section, Theora has also been specified as the sole format supported by non-profit organizations such as Wikipedia, currently the 6th largest website in the world, and as one of a small number of preferred formats supported by other public institutions, such as the Norwegian government.

Does the formal specification show wide adoption *in an open environment*?

Yes. On open/free operating systems such as those distributed by Novell/SuSE, Canonical, and Red Hat, Theora is the primary default video codec.

Does the formal specification show wide adoption *in a similar field*?

Yes. Most prominently, Theora has been used for eGovernment video distribution in the United States at Metavid[10]. Metavid is the most comprehensive, interactive archive of video footage from the United States legislature. Metavid not only distributes video; they also enable citizen engagement by allowing them to annotate videos and correct transcripts. Metavid distributes its entire archive in Theora format. Metavid's source code is entirely open and reusable for any purpose, providing instant access to best practices for eGovernment with Theora. Metavid's video display component is also available separately as mv_embed[11], which provides reusable best practices for easy Theora display on the web.

Another important user of Theora is Wikipedia, which distributes video exclusively in Theora format. Wikipedia's best practices for Theora distribution are encapsulated in OggHandler[12], which can be freely reused by anyone using the open-source MediaWiki software.

Has the formal specification been in use and development long enough that most of its initial problems have been overcome?

Yes. Theora was derived from VP3, which was originally released in May 2000. The Theora specification[13] was completed in 2004. Theora has now been used in a wide variety of applications, on the full spectrum of computing devices.

Is the underlying technology of the standard well-understood? (e.g., a reference model is well defined, appropriate concepts of the technology are in widespread use, the technology may have been in use for many years, a formal mathematical model is defined, etc.)

Yes. The underlying technology has been in use for nearly a decade, and most of the concepts have been in widespread use for even longer.

Is the formal specification based upon technology that has not been well-defined and may be relatively new?

No. The formal specification is based on technology from the On2 VP3 codec, which is substantially similar to simple block-transform codecs like H.261. This class of codecs is extremely well understood, and has been in active use for over 20 years.

Has the formal specification been revised?

The formal specification of the Theora decoder has been stable for years. However, the text of the specification is continuously revised, based on user feedback, to improve the clarity and accuracy of the description of the technology.

Is the formal specification under the auspices of an architectural board?

No. Although officially maintained by the Xiph.Org Foundation, anyone is free to join this organization, and one need not even be a member to make contributions. However, the core developers will review contributions and make sure they do not contradict the general architecture and they work well with the existing code and the test cases.

Is the formal specification partitioned in its functionality?

No. Theora is very deliberately not partitioned, to avoid the confusion created by a "standard" composed of many incompatible "profiles". The Theora standard does not have any optional components. A compliant Theora decoder can correctly process any Theora stream.

To what extent does each partition participate to its overall functionality?

N/A.

To what extent is each partition implemented?

N/A.

Re-usability

Does the formal specification provide guidelines for its implementation in a given organisation?

Yes. For example, the Theora specification[13] provides "non-normative" advice and explanation for implementors of Theora decoders and encoders, including example algorithms for implementing required mathematical transforms. Xiph also maintains a documentation base[14] for implementors who desire more guidelines beyond the specification itself.

Can other cases where similar systems implement the formal specification be considered as successful implementations and good practices?

Xiph's standards have successfully been implemented by many organisations in a wide variety of environments. We maintain lists[15] of products which implement Theora support, many of them open source, so that others may use them as a reference when preparing their own products.

Is its compatibility with related formal specification documented?

Yes. For example, the Theora specification also documents the use of Theora within the standard Ogg encapsulation format[16], and the TheoraRTP draft specification[17] explains how to transmit Theora using the RTP standard[18]. In addition, the specification documents Theora's compatibility with ITU-R B.470, ITU-R B.601, ITU-R B.709, SMPTE-170M, UTF-8[19], ISO 10646, and Ogg Vorbis[20].

Part 5: Standardisation Criteria

Availability of Documentation

The availability of documentation criteria is linked to cost and online availability. Access to all preliminary results documentation can be online, online for members only, offline, offline, for members only or not available. Access can be free or for a fee.

Every Xiph standard is permanently available online to everyone at no cost. For example, we invite everyone to download the most up-to-date copy of the Theora specification, and the latest revision of the Vorbis specification. All previous revisions are available from Xiph's revision control system[21].

Intellectual Property Right

Availability of the IPR or copyright policies of the organisation (available on-line or off-line, or not available);

The reference implementations of each codec include all necessary IPR and copyright licenses for that codec, including all documentation, and are freely available to everyone.

Organisation's governance to disclose any IPR from any contributor (ex-ante, online, offline, for free for all, for a fee for all, for members only, not available)

Xiph does not require the identification of specific patents that may be required to implement a standard; however, it does require an open-source compatible, royalty free license from a contributor for any such patents they may own before the corresponding technology can be included in a standard. These licenses are made available online, for free, to all parties.

The level of IPR set "mandatory" by the organisation (no patent, royalty free patent, patent and RAND with limited liability , patent and classic RAND, patent with explicit licensing, patent with defensive licensing, or none);

All standards, specifications, and software published by the Xiph.Org Foundation are required to have "open-source compatible" IPR. This means that a contribution must either be entirely clear of any known patents, or any patents that read upon the contribution must be available under a transferable, irrevocable public

nonassertion agreement to all people everywhere. For example, see our On2 patent nonassertion warrant[22]. Other common "royalty free" patent licenses are either not transferable, are revocable under certain conditions (such as patent infringement litigation against the originating party), or otherwise impose restrictions that would prevent distribution under common OSI[23]-approved licenses. These would not be acceptable.

The level of IPR "recommended" by the organisation (no patent, royalty free patent, patent and RAND with limited liability, patent and classic RAND, patent with explicit licensing, patent with defensive licensing, or none).

Xiph's recommended IPR requirements are the same as our mandatory requirements.

Accessibility

Does a mechanism that ensures disability support by a formal specification exist?

Yes. Xiph ensures support for users with disabilities by providing specifications for accessible technologies independent of the codec itself. Notably, the Xiph OggKate[24] codec for time-aligned text and image content provides support for subtitles for internationalisation, captions for the hearing-impaired, and textual audio descriptions for the visually impaired. Further, Ogg supports multiple tracks of audio and video content in one container, such that sign language tracks and audio descriptions can be included in one file. For this to work, Xiph has defined Skeleton[25] which holds metadata about each track encapsulated within a single Ogg file. When Theora is transmitted or stored in an Ogg container, it is automatically compatible with these accessibility measures.

Is conformance governance always part of a standard?

Yes. Xiph's standards always precisely specify the requirements that an implementation must meet in order to be considered conformant.

Is a conformance test offered to implementers?

Yes. Xiph maintains a freely available suite of test vectors[7] and an online validation service[8] that can be used by anyone to check confirm basic conformance, in addition to tools such as the oggz-validate program included with liboggz, which has been widely used for conformance testing.

Is conformance validation available to implementers?

Yes. Informal conformance testing is available to implementors upon request, and Xiph has provided such testing for a number of implementations in the past.

Is conformance certification available?

Yes. Xiph does not require certification, but maintains the right to withhold the use of our trademarks from implementors who act in bad faith. Implementors may, however, request explicit permission to use our trademarks with a conforming implementation.

Is localisation of a formal specification possible?

Yes. We welcome anyone who wishes to translate Xiph specifications into other languages. We have no policy requiring that the normative specification be written in English.

Interoperability governance

Open identification in formal specifications

Yes. The Xiph codecs can be precisely identified by their MIME types, as formally defined by IETF RFC 5334[26], an open specification.

open negotiation in formal specifications

Yes. For example, a draft RTP specification[17] describes how Theora interoperates with the Session Description Protocol (SDP)[27], a mechanism for negotiating the parameters of RTP sessions.

open selection in formal specifications

Yes. There are many open specifications that provide a mechanism for selecting Theora from among many codecs. One such specification is HTML 5 video[28], which allows the user agent to select Theora based on its MIME type, using the source element.

Meeting and consultation

Is the organisation is open to all types of companies and organisations and to individuals?

Yes. Xiph welcomes representatives from all companies and organizations as well as all individuals.

Does the standardisation process may specifically allow participation of members with limited abilities when relevant?

Yes. Standardization occurs almost entirely in text-based, accessible internet communications channels, allowing participants with disabilities to engage fully in the standards development process.

Are meetings are open to all members?

Xiph meetings are open to everyone. We charge no fee for and place no restrictions on attendance or participation. For example, anyone interested in contributing to the Theora specification may join the Theora development mailing list[29].

Can all participate in the formal specification creation process?

Yes. All people are welcome to participate in the specification creation process. No dues or fees are required to participate.

Can non-members participate in the formal specification creation process?

Yes. Xiph does not maintain an explicit list of members, and no one is excluded from contributing to specifications as they are developed.

Consensus

Does the organisation have a stated objective of reaching consensus when making decisions on standards?

There is no explicitly stated objective of reaching consensus. However, when new contributions are made, the key specification developers will be able to veto the introduction of a new feature. Generally, differences are discussed openly and new features are adapted until they fit the overall architecture of the standard, at which stage they are introduced into the specification, standard and software.

If consensus is not reached, can the standard be approved?

The standard can be approved without consensus via the decision of a "director" or similar.

Is there a formal process for external review of standard proposals by interest groups (nonmembers)?

Since anyone may participate in the development process and make proposals, there is no need for a separate formal process to include proposals by nonmembers.

Due Process

Can a member formally appeal or raise objections to a procedure or to a technical specification to an independent, higher instance?

Yes. Even if a member fails an appeal within the organization, because all of the technology Xiph standardizes is open and freely implementable, they are always free to develop their own, competing version.

Such competing versions may even still be eligible for standardization under the Xiph umbrella.

Changes to the formal specification

Are suggested changes made to a formal specification presented, evaluated, and approved in the same way as the formal specification was first defined?

The exact same process is used for revisions to the standard as was used for the original development of the standard, and thus the answers to all of the above questions remain the same.

Support

Does the organisation provide support until removal of the published formal specification from public domain?

Xiph.Org standards are never removed from the public domain. Xiph endeavors to provide support for as long as the standard remains in use.

Does the organisation make the formal specification still available even when in non-maintenance mode?

Yes. All Xiph.Org standards are freely licensed and will always be available.

Does the organisation add new features and keep the formal specification up-to-date?

Yes. Xiph maintains its ecosystem of standards on a continuous basis.

Does the organisation rectify problems identified in initial implementations?

Yes. Xiph maintains a problem reporting system[30] that is open to the public, and invites everyone to submit suggestions for improvements. Improvements are made both to the standards documents and to the reference implementations.

Does the organisation only create the formal specification?

No. Xiph also produces high-quality reusable reference implementations of its standards, released under an open license.

References

[1] The Wiki version of this document: http://wiki.xiph.org/IDABC_Questionnaire_2009

[2] FFmpeg (http://ffmpeg.org/) and Qtheora (http://sourceforge.jp/projects/qtheora/) contain third-party C language implementations of Theora decoding.

[3] Jheora is a Java implementation of Theora decoding. http://www.theora.org/cortado/

[4] C# decoder: http://www.wreckedgames.com/downloads/cSharpTheora.zip

[5] Verilog (hardware design) decoder: http://svn.xiph.org/trunk/theora-fpga/

[6] Verilog (hardware design) encoder: http://sourceforge.net/projects/elphel/

[7] Theora testsuite: http://v2v.cc/~j/theora_testsuite/

[8] Ogg validation tool: http://validator.xiph.org/

[9] libtheora is Xiph.Org's reference implementation of the theora encoder and decoder: http://downloads.xiph.org/releases/theora/

[10] Metavid is an open video archive of the US congress: http://metavid.org/

[11] mv_embed is the Free Software embedded video engine used by Metavid: http://metavid.org/wiki/Mv_Embed

[12] OggHandler is the multimedia display engine used on Wikipedia and other MediaWiki sites: http://www.mediawiki.org/wiki/Extension:OggHandler

[13] Theora formal specification: http://theora.org/doc/Theora.pdf

[14] Xiph.Org community wiki: http://wiki.xiph.org/Main_Page

[15] A non-exhaustive list of products with Theora support: http://wiki.xiph.org/TheoraSoftwarePlayers

[16] RFC 3533 defines the Ogg encapsulation: http://www.ietf.org/rfc/rfc3533.txt

[17] Draft specification for RTP transmission of Theora: http://svn.xiph.org/trunk/theora/doc/draft-ietf-avt-rtp-theora-00.txt

[18] RFC 3550 defines RTP: http://tools.ietf.org/html/rfc3550

[19] RFC 2044 documents the use of UTF-8 on the Internet: http://tools.ietf.org/html/rfc2044

[20] Vorbis formal specification: http://xiph.org/vorbis/doc/Vorbis_I_spec.html

[21] Xiph.Org's revision control system: http://svn.xiph.org/

[22] On2 patent non-assert document: http://svn.xiph.org/trunk/theora/LICENSE

[23] The OSI certified open-source licenses:http://www.opensource.org/

[24] Ogg Kate specification: http://wiki.xiph.org/OggKate

[25] Ogg Skeleton specification: http://wiki.xiph.org/Ogg_Skeleton

[26] Xiph.Org mime-type descriptions: http://wiki.xiph.org/index.php/MIMETypesCodecs Formal mime specification for Ogg: http://tools.ietf.org/html/rfc5334

[27] RFC 3264 defines SDP http://tools.ietf.org/html/rfc3264

[28] HTML5 specification: http://www.whatwg.org/specs/web-apps/current-work/multipage/video.html#video

[29] Theora development mailing-list: http://lists.xiph.org/pipermail/theora-dev/

[30] Xiph.Org problem reporting system: https://trac.xiph.org/report