ISO/IEC JTC 1/SC29/WG1 (ITU-T SG16)

Coding of Still Pictures

JBIG
Joint Bi-level Image Experts Group

JPEG
Joint Photographic Experts Group

TITLE: Final CfP for a JPEG Reference Software

SOURCE: Thomas Richter

PROJECT: JPEG

STATUS: Call for Proposals

REQUESTED ACTION: For immediate publication

DISTRIBUTION: Public

Contacts:
ISO/IEC JTC 1/SC29/WG1 Convener – Prof. Touradj Ebrahimi
EPFL/STI/IEL/GR-EB, Station 11, CH-1015 Lausanne, Switzerland
Tel: +41 21 693 2606, Fax: +41 21 693 7600, E-mail: Touradj.Ebrahimi@epfl.ch
JPEG Reference Software Call for Proposals

Introduction
While JPEG (Rec. ITU T.81 | ISO/IEC 10918) is still the most dominant still image format around, it may seem surprising that ISO/IEC never provided a reference software demonstrating a proper implementation of the standard, and as such, has given rise to third party implementations of ISO/IEC 10918 that, however, often implement the JPEG standard only incompletely, or sometimes even deviate from it. Given the market dominance of ISO/IEC 10918, it seems desirable to guide implementations to the correct implementation of this Recommendation | International Standard and to provide reference as how to reach conformance to it. JPEG has a long tradition of providing open source software based only on license-fee-free and royalty-free technology, and it is the goal of this call to identify a software that is available under such licenses, e.g. BSD or a GPL license.

Desired Features
The JPEG standard is designed as a “toolbox” approach, consisting of several orthogonal coding modes and features, only some of which have found wide market adoption. The JPEG standard only defines a codestream format, i.e. mechanisms how to encode raw sample values, but it did not provide means to interpret these samples. In particular, color spaces and sample positions remained undefined, and JFIF as (non-ISO, living) de-facto standard specified such processes later on. Only recently JFIF has been standardized by ISO. As such, WG1 considers it useful to include such additional features in a potential reference software, even though they are formally not part of ISO/IEC 10918-1. Other tools that are part of ISO/IEC 10918-1 have not found much market adoption, and WG1 may consider not to include them in a reference implementation as they are less relevant in practical applications.

This paragraph provides a prioritized list of features a potential reference software should provide. It is in addition necessary for the purpose of a software to act as a reference to ISO standards that all the codestreams it is able to generate are compliant to such standards.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Comments</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline sequential DCT process</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Extended sequential Huffman DCT based process with 8 bit sample precision</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Conformance to the error bounds specified in 10918-2</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Inclusion of an encoder in addition to a decoder</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>YCbCr to RGB (ITU.T 601) conversion</td>
<td>Not formally part of 10918-1, specified in 10918-5 and 18477-1</td>
<td>high</td>
</tr>
<tr>
<td>Upsampling and downsampling for 422 and 420</td>
<td>The upsampling and downsampling algorithm is not formally part of 10918-1, specified in 10918-5 and 18477-1, the signaling of the downsampling factors is, however, specified in 10918-1.</td>
<td>high</td>
</tr>
<tr>
<td>Extended progressive Huffman DCT process</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Conformance to the (tighter) error bounds specified in 18477-4</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Support for the restart markers RST_m</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Adobe “RGB” marker</td>
<td>Not formally part of 10918-1, specified in 10918-5 and 18477-1</td>
<td>high</td>
</tr>
<tr>
<td>Lossless (predictive) Huffman coding process with 2-16 bit sample precision</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Extended sequential Huffman DCT based process</td>
<td></td>
<td>high</td>
</tr>
</tbody>
</table>
### Submission requirements

Proponents are expected to deliver a JPEG encoder and decoder implementation in source code, along with instructions how to compile and run the provided sources. Ideally, the software should run on both Linux and Windows operating systems. Proponents are further asked to provide a table similar to the above that lists the JPEG tools and additional features their software implements.

### Evaluation of proposals

Proposed software will be tested according to the test procedures defined in ISO/IEC 10918-2, in particular error bounds of the software will be tested against the bounds defined in the above standard. In addition, the decoder will be tested against the error bounds for ISO/IEC 18477-1 (JPEG XT Part 1) with the codestreams provided for this part in ISO/IEC 18477-4. Note that ISO/IEC 18477-1 (JPEG XT Part 1) is a subset of the JPEG standard that does not introduce additional coding tools, though enforces stricter error bounds on compliant decoders. Furthermore, proposed software will be tested against the requested features listed in the above table in order to evaluate the completeness of the support of the JPEG standard.

<table>
<thead>
<tr>
<th>Feature Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placement of chroma components (centered or co-sited)</td>
<td>Not formally part of 10918-1, specified in 10918-5 and selectable by an APP marker specified there.</td>
</tr>
<tr>
<td>Improved coding performance through advanced techniques with constrained complexity overhead</td>
<td>Non-normative addition an encoder may want to provide, not specified anywhere.</td>
</tr>
<tr>
<td>Support for the DNL marker</td>
<td></td>
</tr>
<tr>
<td>Hardened implementation, i.e. robustness against several attack vectors, tested through a “fuzzing” test.</td>
<td></td>
</tr>
<tr>
<td>Extended sequential arithmetic coding DCT based process with 8 bit sample precision</td>
<td></td>
</tr>
<tr>
<td>Extended sequential arithmetic coding DCT based process with 12 bit sample precision</td>
<td></td>
</tr>
<tr>
<td>Extended progressive arithmetic coding DCT based process with 8 bit sample precision</td>
<td></td>
</tr>
<tr>
<td>Extended progressive arithmetic coding DCT based process with 12 bit sample precision</td>
<td></td>
</tr>
<tr>
<td>Lossless (predictive) arithmetic coding process</td>
<td></td>
</tr>
<tr>
<td>Additional integer upsampling and downsampling factors between 3 and 4</td>
<td></td>
</tr>
<tr>
<td>Hierarchical process combined with the baseline or extended DCT process</td>
<td></td>
</tr>
<tr>
<td>Hierarchical process combined with the lossless process</td>
<td></td>
</tr>
<tr>
<td>Support for ICC color spaces, inclusion of a color management module supporting generic ICC profiles</td>
<td>Not formally part of ISO/IEC 10918-1, but specified in ISO/IEC 10918-5 by an APP marker.</td>
</tr>
<tr>
<td>Fractional (generic) upsampling and downsampling factors</td>
<td>The codestream format also allows signaling of fractional sampling factors.</td>
</tr>
</tbody>
</table>
Timeline

The following schedule is planned for the development of the JPEG Reference software from the CfP to publication of the standard.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/2017</td>
<td>Draft CfP</td>
</tr>
<tr>
<td>07/2017</td>
<td>Final CfP</td>
</tr>
<tr>
<td>Sept. 26 2017</td>
<td>Submission deadline for response to CfP</td>
</tr>
<tr>
<td>Oct. 23-27 2017</td>
<td>Evaluation and Working draft (WD) at the 77th meeting of the WG1 committee</td>
</tr>
<tr>
<td>01/2018</td>
<td>CD</td>
</tr>
<tr>
<td>04/2018</td>
<td>DIS</td>
</tr>
<tr>
<td>07/2018</td>
<td>IS</td>
</tr>
</tbody>
</table>

IPR Conditions (ISO/IEC Directives)

Proponents are advised that this call is being made in the framework and subject to the common patent policy of ITU-T/ITU-R/ISO/IEC and other established policies of these standardization organizations. The persons named below as contacts can assist potential submitters in identifying the relevant policy information. It is, however, the goal of this project to provide the Reference Software under a Royalty Free (RF) license condition.

Contribution to Standardization

Proponents are informed that a standard specification will be created. If they submit a proposal and the proposed software is accepted for inclusion in the standard, they will hence have to attend subsequent WG1 meetings and contribute to the creation of various standard documents. Within this process, evolution and changes are possible.

Further Information

The JPEG Reference Software Ad Hoc Group has been established between 73rd and 75th JPEG meetings in order to continue activities and progress within the planned work. All interested parties are requested to register to the email reflector of the AHG.

E-mail reflector: jpeg-reference@listserv.uni-stuttgart.de
In order to subscribe to the mailing list, please follow the link: https://listserv.uni-stuttgart.de/mailman/listinfo/jpeg-reference and follow the steps of the e-mail being received.

Contacts

Touradj Ebrahimi (JPEG Convener)
Email: Touradj.Ebrahimi@epfl.ch

Thomas Richter (JPEG Reference AhG chair)
Email: thomas.richter@alumni.tu-berlin.de