INTERNATIONAL STANDARD

ISO/IEC 15444-9

Second edition
2023-05

Information technology — JPEG 2000 image coding system —

Part 9: Interactivity tools, APIs and protocols

Technologies de l'information — Système de codage d'images JPEG 2000 —
Partie 9: Outils d'interactivité, interfaces de programmes d'application et protocoles

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted.

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This document was prepared by ITU-T (as ITU-T T.808) and drafted in accordance with its editorial rules, in collaboration with Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This second edition cancels and replaces the first edition (ISO/IEC 15444-9:2005), which has been technically revised. It also incorporates the Amendment(s) ISO/IEC 15444-9:2005/Amd 1:2006, ISO/IEC 15444-9:2005/Amd 2:2008, ISO/IEC 15444-9:2005/Amd 3:2008, ISO/IEC 15444-9:2005/Amd 4:2010 and ISO/IEC 15444-9:2005/Amd 5:2014 and the Technical Corrigenda ISO/IEC 15444-9:2005/Cor 1:2007, ISO/IEC 15444-9:2005/Cor 2:2008 and ISO/IEC 15444-9:2005/Cor 3:2011.

The main changes are as follows:

— extends support for the file format specified in Rec. ITU-T T.815 | ISO/IEC 15444-16;

— clarifies normative server responsibilities in response to certain request fields documented in Annex C;

— removes the registration authority (Annex L); and

— adds media type registration information (Annex O).

A list of all parts in the ISO/IEC 15444 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

INTERNATIONAL STANDARD ISO/IEC 15444-9
RECOMMENDATION ITU-T T.808

Information technology – JPEG 2000 image coding system: Interactivity tools, APIs and protocols

Summary

Rec. ITU-T T.808 | ISO/IEC 15444-9 provides a network protocol that allows for the interactive and progressive transmission of JPEG 2000 coded data and files from a server to a client. The first edition of this Recommendation | International Standard dates to 2005. It has since then been supplemented by amendments and corrigenda. Additionally, other members of the JPEG 2000 family of Recommendations | International Standards, that are capable of being used with the network protocol described in this Recommendation | International Standard have since been introduced. This second edition incorporates the changes associated with these developments, without modifying the original scope.

This Recommendation was developed jointly with ISO/IEC JTC 1/SC 29/WG 1 (JPEG), and is common text with ISO/IEC 15444-9.

This second edition cancels and replaces the first edition, which has been technically revised.

The main changes compared to the previous edition are as follows:

1. consolidates all outstanding amendments and corrigenda published since the first edition;
2. extends support for the file format specified in Rec. ITU-T T.815 | ISO/IEC 15444-16;
3. clarifies normative server responsibilities in response to certain request fields documented in Annex C;
4. removes the registration authority (Annex L); and
5. adds media type registration information (Annex O).

This Recommendation contains an electronic attachment that is available from the ITU website at: https://handle.itu.int/11.1002/2000/7460, and from the ISO website at: https://standards.iso.org/iso-iec/15444/-9\ed-2/en.

History

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Keywords

API, application programme interface, image coding, interactivity, JPEG 2000, protocols.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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Introduction

Rec. ITU-T T.800 | ISO/IEC 15444-1 (JPEG 2000) is a specification that describes an image compression system that allows great flexibility, not only for the compression of images but also for access into the codestream. The codestream provides a number of mechanisms for locating and extracting portions of the compressed image data for the purpose of retransmission, storage, display, or editing. This access allows storage and retrieval of compressed image data appropriate for a given application without decoding.

The purpose of this Recommendation | International Standard is to provide a network protocol that allows for the interactive and progressive transmission of JPEG 2000 coded data and files from a server to a client. This protocol allows a client to request only the portions of an image (by region, quality or resolution level) that are applicable to the client's needs. The protocol also allows the client to access metadata or other content from the file.

The substantive updates in this edition, compared to Edition 1, are:

1. consolidates all outstanding amendments and corrigenda published since the first edition;
2. extends support the file format specified in Rec. ITU-T T.815 | ISO/IEC 15444-16;
3. clarifies normative server responsibilities in response to certain request fields documented in Annex C;
4. removes the registration authority (Annex L); and
5. adds media type registration information (Annex O).

INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – JPEG 2000 image coding system: Interactivity tools, APIs and protocols

1 Scope

This Recommendation | International Standard[1] defines, in an extensible manner, syntaxes and methods for the remote interrogation and optional modification of JPEG 2000 codestreams and files in accordance with their definition in Rec. ITU-T T.800 | ISO/IEC 15444-1 and other members of the Rec. ITU-T T.8xx | ISO/IEC 15444-x family of Recommendations | Standards.

In this Recommendation | International Standard, the defined syntaxes and methods are referred to as the JPEG 2000 Interactive Protocol, "JPIP", and interactive applications using JPIP are referred to as "JPIP systems."

JPIP specifies a protocol consisting of a structured series of interactions between a client and a server by means of which image file metadata, structure and partial or whole image codestreams can be exchanged in a manner that avoids or minimises the communication of information not required by client. This Recommendation | International Standard includes definitions of the semantics and values to be exchanged, and suggests how these can be passed using a variety of existing network transports.

With JPIP, the following tasks can be accomplished in varying, compatible ways:

- the exchange of capabilities;
- the negotiation of capabilities to use in a session;
- the request and transfer of the following elements from a variety of containers, such as JPEG 2000 files, JPEG 2000 codestreams and other container files:
  - selective data segments;
  - selective and defined structures;
  - parts of an image or its related metadata.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- Recommendation ITU-T T.800 | ISO/IEC 15444-1, *Information technology – JPEG 2000 image coding system: Core coding system.*
- Recommendation ITU-T T.801 | ISO/IEC 15444-2, *Information technology – JPEG 2000 image coding system: Extensions.*
- Recommendation ITU-T T.802 | ISO/IEC 15444-3, *Information technology – JPEG 2000 image coding system: Motion JPEG 2000.*
- Recommendation ITU-T T.805 | ISO/IEC 15444-6, *Information technology – JPEG 2000 image coding system: Compound image file format.*
- Recommendation ITU-T T.809 | ISO/IEC 15444-10, *Information technology – JPEG 2000 image coding system: Extensions for three-dimensional data.*
- Recommendation ITU-T T.814 | ISO/IEC 15444-15, *Information technology – High-Throughput JPEG 2000.*
- Recommendation ITU-T T.815 | ISO/IEC 15444-16, *Information technology – Encapsulation of JPEG 2000 images into ISO/IEC 23008-12.*

[1] This Recommendation | International Standard contains an electronic attachment that is available from the ITU website at: https://handle.itu.int/11.1002/2000/7460, and from the ISO website at: https://standards.iso.org/iso-iec/15444/-9\ed-2/en.

- IETF RFC 768 (1980), *User Datagram Protocol*. Available from World Wide Web: http://www.ietf.org/rfc/rfc0768.txt.
- IETF RFC 2046 (1996), *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types*. Available from World Wide Web: http://www.ietf.org/rfc/rfc2046.txt.
- IETF RFC 2616 (1999), *Hypertext Transfer Protocol – HTTP/1.1*. Available from World Wide Web: http://www.ietf.org/rfc/rfc2616.txt.
- IETF RFC 3986 (2005), *Uniform Resource Identifiers (URI): Generic Syntax*. Available from World Wide Web: https://datatracker.ietf.org/doc/html/rfc3986.
- IETF RFC 5234 (2008), *Augmented BNF for Syntax Specifications: ABNF*. Available from World Wide Web: https://datatracker.ietf.org/doc/html/rfc5234.
- IETF RFC 9293 (2022), *Transmission Control Protocol*. Available from World Wide Web: https://datatracker.ietf.org/doc/html/rfc9293.

3 Definitions

For the purposes of this Recommendation | International Standard, the terms and definitions given in Rec. ITU-T T.800 | ISO/IEC 15444-1 and Rec. ITU-T T.801 | ISO/IEC 15444-2 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at https://www.electropedia.org

3.1 JPEG 2000 definitions

The following definitions are used within this Recommendation | International Standard. In some cases, these definitions differ from those used in other standards and/or Recommendations.

3.1.1 **J2KI**: A file that conforms to the `'j2ki'` brand specified in Rec. ITU-T T.815 | ISO/IEC 15444-16.

3.1.2 **J2KS**: A file that conforms to the `'j2ks'` brand specified in Rec. ITU-T T.815 | ISO/IEC 15444-16.

3.1.3 **JPH**: The file format specified in Rec. ITU-T T.814 | ISO/IEC 15444-15: High Throughput JPEG 2000.

3.1.4 **JPEG 2000 codestream**: Codestream conforming to the specification in Rec. ITU-T. T.800 | ISO/IEC 15444-1, possibly including capabilities specified elsewhere.

3.1.5 **JPEG 2000 family file**: File conforming to one of the file formats defined in the Rec. ITU-T T.8xx | ISO/IEC 15444-x family of Recommendations | Standards.

3.1.6 **JPM**: The file format specified in Rec. ITU-T T.805 | ISO/IEC 15444-6.

3.1.7 **metadata**: Any collection of "boxes" from a JPEG 2000 family file.

3.1.8 **MJ2**: The file format specified in Rec. ITU-T T.802 | ISO/IEC 15444-3.

3.2 HTTP definitions

The following definitions are intended to match HTTP/1.1. In the case of any difference, these definitions shall be used.

3.2.1 **connection**: Transport layer virtual circuit established between two programs for the purpose of communication.

3.2.2 **entity**: The information transferred as the payload of a request or response.

Note on entry: An entity consists of metainformation in the form of entity-header fields and content in the form of an entity-body.

3.2.3 **proxy**: An intermediary program which acts as both a server and a client for the purpose of making requests on behalf of other clients.

Note on entry: Requests are serviced internally or by passing them on, with possible translation, to other servers.

3.3 JPIP definitions

The following definitions are used within this Recommendation | International Standard. In some cases, these definitions differ from those used in other standards and/or Recommendations.

3.3.1 cache (client-side): Cache managed by the Client for storing JPIP data-bins.

Note on entry: The Client might have a limited cache and might have to purge cached JPIP data-bins from time to time.

3.3.2 cacheable response: Response that may be stored within a cache for use in answering subsequent requests.

Note on entry: Even if a resource is cacheable, there might be additional constraints on whether a cache can use the cached copy for a particular request.

3.3.3 cache-model (server-side): Server-side estimation of the data-bins or portions of data-bins that are available in the client's cache.

Note on entry: The server can add items to its estimation of the client's cache because it assumes successfully delivery, or because it has received acknowledgements of transmitted data, or because of cache-model update statements.

3.3.4 channel: Mechanism for grouping requests and responses such that only one request/response is active at a time within the group.

Note on entry: Multiple channels can be used to issue multiple requests and receive multiple responses concurrently.

3.3.5 client: Program that establishes connections for the purpose of sending requests.

3.3.6 codestream image region: Intersection between the image and the region defined by the Offset and Region Size.

Note on entry: The codestream image region can be empty (no area).

3.3.7 data-bin: Set of bytes of the same type of data which can be partially delivered.

3.3.8 incremental-codestream: Representation of the codestream as a collection of data-bins (main header, tile header, precinct or tile data-bins) having the same codestream identifier.

3.3.9 JPIP index table: File format box which provides information about the location of portions of a file or codestream.

3.3.10 JPEG 2000 family target: Target that corresponds to a JPEG 2000 family file.

3.3.11 logical target: Specific representation of specific original named resource, or a byte range from that specific original named resource, to which the JPIP request is directed.

Note on entry: The specific representation might be transcoded from the original named resource.

3.3.12 message: Set of bytes from a single data-bin and the header identifying those bytes and the data-bin.

3.3.13 raw codestream: Representation of the codestream as a single metadata-bin.

3.3.14 request: Group of fields and values sent from the client to the server to obtain portions of an image or metadata.

3.3.15 resource: Network data object or service that can be identified by a URI.

3.3.16 response: Bytes sent from the server to the client after receiving a request.

3.3.17 server: Application program that accepts connections in order to service requests by sending back responses.

Note on entry: Any given program might be capable of being both a client and a server; use of these terms refers only to the role being performed by the program for a particular connection, rather than to the program's capabilities in general.

3.3.18 session: Collection of requests and responses applying to the same resource for which the server maintains a cache model.

3.3.19 session-based: Where the server maintains a cache model.

3.3.20 stateless: Single request where the server does not make use of a cache-model in determining the response.

3.3.21 target: Logical identification of JPIP data.

Note 1 on entry: This is the name of the main target and is often the name of a file on the server.

Note 2 on entry: JPEG 2000 files or codestreams might be available in multiple representations (e.g., return type, precinct size) or vary in other ways, each identified by a unique logical target.

3.3.22 tile header: All tile-part headers for a specific tile.

3.3.23 view-window: The portion of the image data that the client desires, as expressed by the combination of the following fields that appear in the request: Region Size, Offset, Frame Size, Codestream, Codestream Context, Sampling Rate, ROI and Layers.

Note on entry: The view-window is often smaller than the whole image data.

3.3.24 slice: Subset of voxels in a volumetric image with the same Z coordinate.