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AMENDMENT 5: UDP transport and additional enhancements to JPIP

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

AMENDEMENT 5: Transport UDP et autres améliorations du JPIP

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INTERNATIONAL STANDARD
RECOMMENDATION ITU-T

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

Amendment 5

UDP transport and additional enhancements to JPIP

1) Clause 6.1

Replace the third paragraph in this clause (between Figure 3 and Figure 4) with the following text:

This protocol can be used over several different transports as shown in Figure 4. This Recommendation | International Standard includes informative annexes on the use of the JPIP protocol over HTTP, TCP and UDP, and provides suggestions for other example implementations. The JPIP protocol itself is neutral with respect to underlying transport mechanisms for the client requests and server responses, except in regard to channel requests represented by the New Channel ("cnew") request field (see C.3.3) and the New Channel ("JPIP-cnew") response header (see D.2.3), where transport-specific details shall be communicated. This Recommendation | International Standard defines four specific transports, which are identified by the strings "http", "https", "http-tcp" and "http-udp" in the value string associated with New Channel requests.

2) Clause A.3.6.4

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Replace clause A.3.6.4 with the following new clause A.3.6.4:

Wherever header, precinct or tile data bins exist, their codestream ID shall appear in a Placeholder box within an appropriate metadata bin. The only exception to this requirement is for unwrapped JPEG 2000 codestreams, which are not embedded within a JPEG 2000 family file format.

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The codestream ID values that appear within the relevant Placeholder box shall conform to any requirements imposed by the containing file format. For example, JPX files formally assign a sequence number to codestreams that are found in Contiguous Codestream boxes or Fragment Table boxes, either at the top level of the file, or within Multiple Codestream boxes. The first codestream in the logical target shall have a codestream ID of 0; the next shall have a codestream ID of 1; and so forth.

Placeholders that reference multiple codestream IDs may be used only where the meaning of those codestreams is well defined by the type of the box that is being replaced. For JPX files, Contiguous Codestream boxes, Fragment Table boxes and Multiple Codestream boxes may be replaced by Placeholder Boxes that specify codestream IDs. Placeholders replacing Contiguous Codestream boxes and Fragment Table boxes may specify only a single codestream ID, while a placeholder replacing a Multiple Codestream box may specify multiple codestream IDs, corresponding to the number of codestreams that are found within the box.

3) Clause B.1

Replace the second paragraph of B.1 with the following:

The purpose of sessions is to reduce the amount of explicit communication required between the client and server. Within a session, the server is expected to remember client capabilities and preferences supplied in previous requests so that this information need not be sent in every request. Even more importantly, the server may keep a log of data it knows the client to have received so that this information need not be re-transmitted in response to future requests. This log is subsequently referred to as the cache model. The cache model would typically be persistent for the duration of a session. Unless explicitly instructed otherwise, the server may assume that the client caches all data it receives within a session, and may model the client's cache, sending only those portions of the compressed image data or metadata which the client does not already have in its cache.

4) Clause C.1.2

Replace the `server-control-field` *and* `client-cap-pref-field` *lists with the following:*

```
server-control-field = align                        ; C.7.1
                     / wait                         ; C.7.2
                     / type                         ; C.7.3
                     / drate                        ; C.7.4
                     / sendto                       ; C.7.5
                     / abandon                      ; C.7.6
                     / barrier                      ; C.7.7
                     / twait                        ; C.7.8

client-cap-pref-field = cap                         ; C.10.1
                     / pref                         ; C.10.2
                     / csf                          ; C.10.3
                     / handled                      ; C.10.4
```

5) Clause C.3.3

Replace the second and third paragraphs with the following text:

The value string identifies the names of one or more transport protocols that the client is willing to accept. This Recommendation | International Standard defines only the transport names, "http", "https", "http-tcp", and "http-udp". Details of the use of JPIP over the "http" transport appear in Annex F. Annex G describes the use of JPIP over the "http-tcp" transport and Annex K describes the use of JPIP over the "http-udp" transport.

If the server is willing to open a new channel, using one of the indicated transport protocols, it shall return the new channel identifier token using the New Channel response header (see D.2.3). In this case, the present request is the first request within the new channel.

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6) Equation C-3

Modify equation C-3 with the following augmented version of the equation and subsequent explanatory text, to take account of the new rotation support in ISO/IEC 15444-2:2004/Amd.3. While making these editorial changes, note that many of the symbols from the original equation are similar.

First, define the rotated frame size, offset, width and height of the composite image as follows:

$$\begin{bmatrix} ox^F, oy^F, \\ XO^F_{inst}, YO^F_{inst} \end{bmatrix} = \begin{bmatrix} (fx - ox - sx), & (fy - oy - sy), \\ (W_{comp} - XO_{inst} - Wt_{inst}), & (H_{comp} - YO_{inst} - Ht_{inst}) \end{bmatrix}$$

$$\begin{bmatrix} fx^\theta, fy^\theta, ox^\theta, oy^\theta, W^\theta_{comp}, H^\theta_{comp}, \\ XO^\theta_{inst}, YO^\theta_{inst}, Wt^\theta_{inst}, Ht^\theta_{inst} \end{bmatrix} = \begin{cases} \begin{bmatrix} fx,\ fy,\ ox,\ oy,\ W_{comp},\ H_{comp}, \\ XO_{inst}, YO_{inst},\ Wt_{inst},\ Ht_{inst} \end{bmatrix} & \text{if } R_{inst} = 0^\circ \mid \text{NoFlip} \\ \begin{bmatrix} fy,\ fx,\ oy,\ ox^F,\ H_{comp}, W_{comp}, \\ YO_{inst},\ XO^F_{inst},\ Ht_{inst},\ Wt_{inst} \end{bmatrix} & \text{if } R_{inst} = 90^\circ \mid \text{NoFlip} \\ \begin{bmatrix} fx,\ fy,\ ox^F,\ oy^F, W_{comp},\ H_{comp}, \\ XO^F_{inst},\ YO^F_{inst}, Wt_{inst},\ Ht_{inst} \end{bmatrix} & \text{if } R_{inst} = 180^\circ \mid \text{NoFlip} \\ \begin{bmatrix} fy,\ fx,\ oy^F,\ ox,\ H_{comp}, W_{comp}, \\ YO^F_{inst},\ XO_{inst}, Ht_{inst}, Wt_{inst} \end{bmatrix} & \text{if } R_{inst} = 270^\circ \mid \text{NoFlip} \\ \begin{bmatrix} fx,\ fy,\ ox^F,\ oy\ , W_{comp}, H_{comp}, \\ XO^F_{inst}, YO_{inst}, Wt_{inst}, Ht_{inst} \end{bmatrix} & \text{if } R_{inst} = 0^\circ \mid \text{Flip} \\ \begin{bmatrix} fy,\ fx,\ oy,\ ox,\ H_{comp}, W_{comp}, \\ YO_{inst},\ XO_{inst},\ Ht_{inst},\ Wt_{inst} \end{bmatrix} & \text{if } R_{inst} = 90^\circ \mid \text{Flip} \\ \begin{bmatrix} fx,\ fy,\ ox,\ oy^F, W_{comp},\ H_{comp}, \\ XO_{inst},\ YO^F_{inst}, Wt_{inst},\ Ht_{inst} \end{bmatrix} & \text{if } R_{inst} = 180^\circ \mid \text{Flip} \\ \begin{bmatrix} fy,\ fx,\ oy^F,\ ox^F,\ H_{comp}, W_{comp}, \\ YO^F_{inst},\ XO^F_{inst},\ Ht_{inst}, Wt_{inst} \end{bmatrix} & \text{if } R_{inst} = 270^\circ \mid \text{Flip} \end{cases} \quad \text{(C-3a)}$$

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In the above, W_{comp} and H_{comp} are the width and height of the composited image, specified in the composition box; Wt_{inst} and Ht_{inst} are the composited width and height as determined by the compositing instruction; XO_{inst} and YO_{inst} are the horizontal and vertical compositing offsets as determined by the compositing instruction; Ws_{inst} and Hs_{inst} are the width and height of the potentially cropped compositing layer as determined by the compositing instruction; XC_{inst} and YC_{inst} are the horizontal and vertical compositing layer cropping offsets as determined by the compositing instruction; and R_{inst} is derived from the ROT field of the compositing instruction, if any. If the compositing instruction contains no ROT field or the ROT field is 0, R_{inst}=0°|NoFlip. Otherwise, the rotation angle for R_{inst} (expressed in degrees clockwise) is obtained from the least significant 3 bits of the ROT field using Table M-47 of Rec. ITU-T T.801 | ISO/IEC 15444-2, while the Flip|NoFlip status for R_{inst} is set to Flip if bit 4 of the ROT field is non-zero and NoFlip otherwise.

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Then, define the modified frame size `fx″`, `fy″` as follows:

$$fx'' = \left\lfloor fx^\theta \cdot \frac{XR_{reg}}{XS_{reg}} \cdot \frac{Wt^\theta_{inst}}{Ws_{inst}} \cdot \frac{W_{cod}}{W^\theta_{comp}} \right\rfloor; \quad fy'' = \left\lfloor fy^\theta \cdot \frac{YR_{reg}}{YS_{reg}} \cdot \frac{Ht^\theta_{inst}}{Hs_{inst}} \cdot \frac{H_{cod}}{H^\theta_{comp}} \right\rfloor \quad \text{(C-3b)}$$

To compute the modified region, first define the clipped region edges:

$$x_{min} = \left\lfloor XO^\theta_{inst} \cdot \frac{fx^\theta}{W^\theta_{comp}} \right\rfloor; \quad y_{min} = \left\lfloor YO^\theta_{inst} \cdot \frac{fy^\theta}{H^\theta_{comp}} \right\rfloor$$

$$x_{lim} = \left\lceil \left(XO^\theta_{inst} + Wt^\theta_{inst}\right) \cdot \frac{fx^\theta}{W^\theta_{comp}} \right\rceil; \quad y_{lim} = \left\lceil \left(YO^\theta_{inst} + Ht^\theta_{inst}\right) \cdot \frac{fy^\theta}{H^\theta_{comp}} \right\rceil \quad \text{(C-3c)}$$

The modified region size sx″ and sy″ and region offsets ox″ and oy″ are then given as:

$$
\begin{aligned}
sx'' &= \min\left\{\left(ox^{\theta} + sx^{\theta}\right), x_{\lim}\right\} - \max\left\{ox^{\theta}, x_{\min}\right\} \\
sy'' &= \min\left\{\left(oy^{\theta} + sy^{\theta}\right), y_{\lim}\right\} - \max\left\{oy^{\theta}, y_{\min}\right\} \\
ox'' &= \max\left\{ox^{\theta}, x_{\min}\right\} - \left\lceil \left(\left(XO_{inst}^{\theta} - \left(XC_{inst} - \frac{XO_{reg}}{XS_{reg}} \right) \cdot \frac{Wt_{inst}^{\theta}}{Ws_{inst}} \right) \cdot \frac{fx^{\theta}}{W_{comp}^{\theta}} \right) \right\rceil \\
oy'' &= \max\left\{oy^{\theta}, y_{\min}\right\} - \left\lceil \left(\left(YO_{inst}^{\theta} - \left(YC_{inst} - \frac{YO_{reg}}{YS_{reg}} \right) \cdot \frac{Ht_{inst}^{\theta}}{Hs_{inst}} \right) \cdot \frac{fy^{\theta}}{H_{comp}^{\theta}} \right) \right\rceil
\end{aligned} \qquad \text{(C-3d)}
$$

7) Clause C.4.7

Add "jpxf" context-range type; change the definition of context-range to:

```
context-range = jpxl-context-range / jpxf-context-range / mj2t-context / jpm-
context / reserved-context
```

Add the following definitions to the end of the list:

```
jpxf-context-range = "jpxf" "<" jpx-frame-indices ">" [ "[" jpx-thread "]" ]

jpx-frame-indices = sampled-range

jpx-thread = UINT
```

Replace:

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"This Recommendation | International Standard defines three specific types of context-range"

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with:

"This Recommendation | International Standard defines four specific types of context-range"

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Append the following text at the end of the clause:

A `jpxf-context-range` may be used to compactly identify a range of compositing layers and coordinate remapping transformations which could alternately be identified via a `jpxl-context-range`. The equivalent jpx-layers and jpxl-geometry values may be obtained by expanding composited frames into their constituent JPX compositing layers and compositing instructions in the manner described below.

If the logical target does not contain a JPX Composition box, the server shall ignore any `jpxf-context-range`. Otherwise, the instructions found within the JPX Composition box together describe a sequence of composited frames, as described in Annex M of Rec. ITU-T T.801 | ISO/IEC 15444-2. These composited frames may be numbered f=0, 1, … F_{comp}–1 and are considered to belong to a base presentation thread t=0. If the logical target also contains Composition layer extensions ("jplx") boxes, these boxes may contribute additional presentation threads. As explained in Annex M of Rec. ITU-T T.801 | ISO/IEC 15444-2, a Compositing Layer Extensions box contributes Tjclx presentation threads, each of which has the same number of composited frames, Fjclx, where the values of Tjclx and Fjclx for each Compositing Layer Extensions box are specified by its Compositing Layer Extensions Info sub-box. Together, the collection of all Compositing Layer Extensions boxes in the logical target defines T global presentation threads, where T is the maximum of the associated **Tjclx** values. For each t in the range 1 through T, global presentation thread t consists of the F_{comp} composited frames from the Composition box, followed by the **Fjclx** frames defined by compositing group g = min{t, **Tjclx**} of each successive Compositing Layer Extensions box for which **Tjclx** is non-zero.

If no jpx-thread value is supplied, or jpx-thread is 0, the `jpxf-context-range` includes only those composited frames contributed by the Composition box whose indices f match jpx-frame-indices; there are at most F_{comp} of these. Otherwise, the `jpxf-context-range` includes all composited frames from global presentation thread t = min{T, jpx-thread} whose indices f match jpx-frame-indices.

8) New clause C.7.5 Sendto

Add new clause C.7.5 with the following text:

```
sendto      = "sendto" "=" host ":" port ";" mbw ";" bpc
host        = token
port        = UINT
bpc         = UINT
```

If this request field is present, the server is requested to deliver response data for this request as UDP datagrams to the supplied `host` (name or IP literal), using the supplied `port` number, with a maximum delivery bandwidth of `mbw`, and a maximum of `bpc` bytes in each data chunk, including the 8-byte chunk header. The bandwidth may be expressed in terms of bits/second, kilobits/second, megabits/second, gigabits/second or terabits/second; for a definition of `"mbw"`, see 10.2.4. The `bpc` value shall be no smaller than 32 and no larger than 4096.

This request field may only be used to direct the response data associated with an established "http-udp" transport. Servers shall ignore the request field if the transport type associated with the request is not "http-udp". Otherwise, response data is framed into chunks and delivered via UDP datagrams in the manner described in Annex K. Moreover, in this case, the client shall not send acknowledgement datagrams in response to these delivered chunks, nor should the server expect them.

The effect of this request field is non-persistent; it applies only to the response data associated with the request in which it is found.

NOTE 1 – A request is associated with the "http-udp" transport type in one of two possible circumstances: a) the request contains a "new-channel" request field and the server grants the request with a new channel that uses the "http-udp" transport, as indicated by the `JPIP-cnew` response header; or b) the request specifies a channel-id that has been issued for a channel using the "http-udp" transport and no new JPIP channel is issued by the server in response to this request.

NOTE 2 – Because response data delivered to the address specified by a Sendto request field is not explicitly acknowledged, clients should pay particular attention to the abandon and barrier request fields, which can be used to effect reliable communications. Also, because the server receives no acknowledgement information from which to estimate channel conditions, such as bandwidth and loss probability, it is the client's responsibility to perform whatever estimation may be necessary and supply an appropriate delivery bandwidth and chunk size.

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9) New clause C.7.6 Abandon

Add the following new clause C.7.6

```
abandon          = "abandon" "=" 1#chunk-range
chunk-range      = chunk-qid ":" chunk-seq-range
chunk-qid        = UINT
chunk-seq-range  = UINT-RANGE
```

This request field allows the client to explicitly inform the server about the absence of one or more data chunks that may have been sent in response to previous requests. Each occurrence of `chunk-range` informs the server of one or more data chunks that should be considered not to have arrived at the client. The server shall not consider any of the data associated with JPIP messages contained within these identified data chunks received or cached by the client, for the purpose of responding to this request or any subsequent request on this or any other JPIP channel, except in the event that the server receives, or has received, explicit acknowledgement of the arrival of these data chunks via acknowledgement datagrams.

If the request does not specify a channel-id which has been issued for a channel using the HTTP-UDP transport, the client shall not include any Abandon request field and the server shall ignore any such request field that it encounters.

NOTE – The Abandon request field can be used regardless of whether the Sendto request field is present in the same request.

The `chunk-range` values identify data chunks via the 16 low-order bits of the request ID and the chunk sequence number; both of these values are found in the relevant chunk headers, as described in Annex K. The request ID component is identified by `chunk-qid` and matches the contents of the Request ID field in the chunk header the client wants to negatively acknowledge; no `chunk-range` shall have a `chunk-qid` value outside the range 0 to 65535.

The Abandon request field only applies to data chunks which have been transmitted or would be transmitted in response to previous requests within the same channel. To avoid ambiguity, servers shall ignore any Abandon request field which is part of the first request in a new JPIP channel – i.e., the request in which the channel's New Channel request field appears. Also, the Abandon request field does not apply to data chunks belonging to requests that have been excluded by means of a Barrier request field that appeared in a previous request within the channel.