INTERNATIONAL STANDARD

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Information technology — Dynamic adaptive streaming over HTTP (DASH) —

Part 2: Conformance and reference software

Technologies de l'information — Diffusion en flux adaptatif dynamique sur HTTP (DASH) —
Partie 2: Conformité et logiciel de référence

Reference number
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Foreword

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The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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ISO/IEC 23009-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 23009 consists of the following parts, under the general title *Information technology — Dynamic adaptive streaming over HTTP (DASH)*:

— *Part 1: Media presentation description and segment formats*

— *Part 2: Conformance and reference software*

— *Part 3: Implementation guidelines* [Technical Report]

— *Part 4: Segment encryption and authentication*

Introduction

This part of ISO/IEC 23009 specifies the conformance and reference software. The conformance and reference software of ISO/IEC 23009 serves three main purposes:

— validation of the written specification of the several parts of ISO/IEC 23009;

— clarification of the written specification of the several parts of ISO/IEC 23009; and

— conformance testing for checking interoperability for the various applications against the reference software which aims to be compliant with ISO/IEC 23009.

Information technology — Dynamic adaptive streaming over HTTP (DASH) —

Part 2:
Conformance and reference software

1 Scope

This part of ISO/IEC 23009 specifies the conformance and reference software implementing the normative clauses of all parts of ISO/IEC 23009. That is, test vectors comprising Media Presentation Descriptions, Segments, and combinations thereof that conform or do not conform to the normative clauses of the other parts of ISO/IEC 23009 and corresponding software modules.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) shall apply.

ISO/IEC 19757-3, *Information technology — Document Schema Definition Languages (DSDL) — Part 3: Rule-based validation — Schematron*

ISO/IEC 23009-1, *Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats*

W3C XLINK, *XML Linking Language (XLink) Version 1.1*, W3C Recommendation 06, May 2010

W3C XML, *Extensible Markup Language (XML) 1.1 (Second Edition)*, W3C Recommendation 16, August 2006, edited in place 29 September 2006

W3C XML SCHEMA, *XML Schema Definition Language (XSD)*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO/IEC 23009-1 apply.

3.2 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO/IEC 23009-1 apply.

4 Media presentation conformance

4.1 Overview

A Media Presentation conforming to ISO/IEC 23009-1 obeys the rules for the Media Presentation Description (MPD), and the Segments referenced within the MPD. To verify the conformance of a Media Presentation, the following steps need to be completed:

- The conformance of the MPD as according to 5.
- The conformance of the Segments which includes the conformance of individual Segments and Representations as well as the conformance of Representations that are jointly provided in Adaptation Sets and Periods. For details refer to 6.

The process of MPD and segment conformance checking is shown in Figure 1.

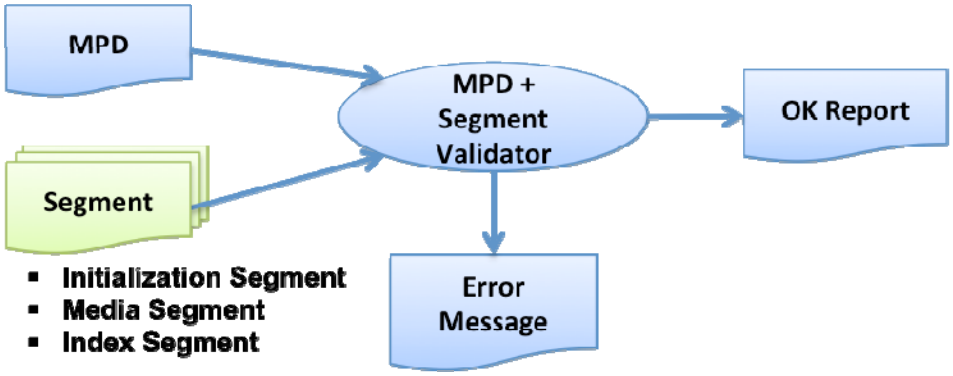

Figure 1 — MPD and segment validation

MPD + Segment Validator: gets as an input the MPD and segments referenced from within the MPD and performs the MPD and segment validation according to the rules defined in annex B. On success, the output is an OK report, otherwise an error message is provided.

4.2 Software Tools

The following software tools are included

- MPD conformance software
- ISO BMFF Segment Validation
- MPEG-2 TS Segment Validation
- Conformance Software for Dynamic Services (missing)

All software tools are available at http://standards.iso.org/ittf/PubliclyAvailableStandards\ISO_IEC_23009-2/

5 MPD conformance

5.1 General

This clause specifies the MPD conformance checking and corresponding software modules which comprises three steps as depicted in Figure 2. Detailed means to perform MPD conformance checking are provided in annex A.

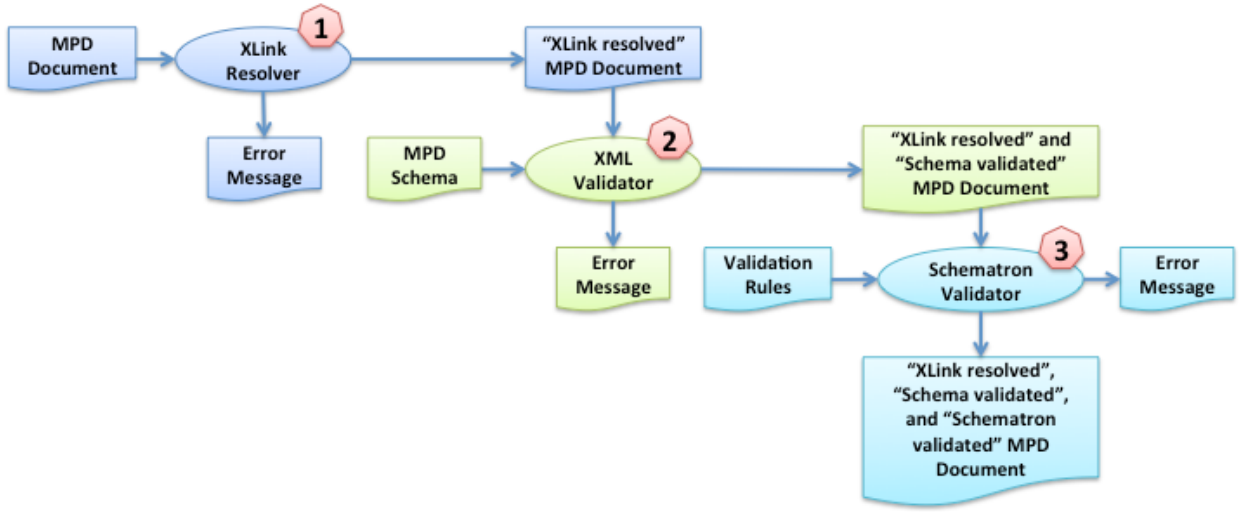

Figure 2 — MPD conformance checking

Step 1 (XLink Resolver): gets as an input a MPD document and resolves all W3C XLINK attributes as defined in ISO/IEC 23009-1. In case an error occurs, the corresponding error message shall be provided; otherwise the XLink resolved MPD document is provided. The details for this step of MPD conformance checking are defined in A.2.

Step 2 (XML Validator): gets as an input an XLink resolved MPD document and performs the XML validation (i.e., well-formed and valid) against the MPD schema as defined in W3C XML and W3C XML SCHEMA. In case an error occurs, the corresponding error message shall be provided, otherwise the XLink resolved and schema validated MPD document is provided. The details for this step of MPD conformance checking are defined in A.3.

Step 3 (Schematron Validator): gets as an input a XLink resolved and schema validated MPD document and performs the Schematron validation as defined in ISO/IEC 19747-3 according to the rules defined in A.4.2. In case an error occurs, the corresponding error message shall be provided, otherwise the XLink resolved, schema validated, and Schematron validated MPD document is provided. The details for this step of MPD conformance checking are defined in A.4

For validating a MPD document with the chain depicted in Figure 2 the following command may be used which requires Ant [2].

```
ant run -Dinput="filetovalidate.mpd"
```

The program outputs for each step a message. If an error occurs during one step the following steps are not executed.

5.2 Static MPD conformance

An MPD with **MPD**`@type="static"` shall comply with the rules in 5.1.

In addition, the availability of all resources in the MPD during the **MPD**`@availabilityStartTime` and the **MPD**`@availabilityEndTime` shall be checked. A function `remoteFileExists($url)` may be executed for each segment that is documented in the MPD. The function shall return true for all Segments in the MPD during the time interval of **MPD**`@availabilityStartTime` and the **MPD**`@availabilityEndTime`. The following snippet shows an example for the `remoteFileExists` function written in PHP.

```
function remoteFileExists($url) {
    $curl = curl_init($url);

    //don't fetch the actual page, you only want to check the connection is ok
    curl_setopt($curl, CURLOPT_NOBODY, true);

    //do request
    $result = curl_exec($curl);

    $ret = false;

    //if request did not fail
    if ($result !== false) {
        //if request was ok, check response code
        $statusCode = curl_getinfo($curl, CURLINFO_HTTP_CODE);

        if ($statusCode == 200) {
            $ret = true;
        }
    }

    curl_close($curl);

    return $ret;
}
```


6 Segment conformance

6.1 Overview

Segment conformance verifies that the segments offered in the MPD conform to the DASH specification.

This includes the conformance

— Segments offered within one Representation. For details refer to 6.2.

— Representations offered within one Adaptation Set. For details refer to 6.3.

— Adaptation Sets offered within one Period. For details refer to 6.4.

— Segments offered in a dynamic Media Presentation. For details refer to 6.5.

6.2 Representation conformance

6.2.1 ISO base media file format

The Representation conformance rules as well as the implementation of the conformance rules for ISO base media file format based segments are provided in Table 1.

Table 1 — Representation conformance rules for ISO base media file format

	Clause in 23009-1	Rule	Conformance Check Implementation
1	6.1	Media Segment formats shall comply with the respective container formats (ISO BMFF and MPEG-2 TS). *This should be verifiable by the respective conformance software*.	Implemented
2	6.2.1	The Initialization Segment shall not contain any media data with an assigned presentation time	Implemented
3	6.2.1	A Media Segment shall contain a number of complete access units.	Implemented
4	6.2.1	If it is the first Media Segment in the Representation, it shall contain only media streams that start with a SAP of type 1 or 2.	Implemented
5	6.2.1	A Media Segment shall contain sufficient information to time-accurately present each contained media component in the Representation without accessing any previous Media Segment in this Representation provided that the Media Segment contains a SAP for each media stream (not verifiable on container level).	Implemented
6	6.2.3.2	A Media Segment shall specify all Media Presentation times relative to the start of the Period and compensated with the value of the @presentationTimeOffset. The presentation time in Media Segments shall be accurate to ensure accurate alignment of all Representations in one Period. *i)* earliest_*presentation_time shall be equal to the sum of all temporally preceding subsegments in the representation.* *ii) The* duration *of a subsegment indexed by an 'sidx' shall be equal to the sum of the durations of all the subsegments it indices.*	Implemented
7	6.3.2.1	A media data box containing data referenced by a movie fragment ('moof') box shall follow that movie fragment box and precede the next movie fragment box, if any, containing information about the same track.	Implemented
8	6.3.2.1	For a Media Subsegment, the value of the reference_type field in the describing Segment Index ('sidx') box shall be set to 0.	Implemented
9	6.3.2.3	If the Segment Index is provided the Segment Index ('sidx') box in ISO/IEC 14496-12 shall be used.	Implemented

	Clause in 23009-1	Rule	Conformance Check Implementation
10	6.3.2.4	If the Subsegment Index is provided the Subsegment Index ('ssix') box in ISO/IEC 14496-12 shall be used.	Implemented
11	6.3.3	The Initialization Segment shall contain an "ftyp" box, and a "moov" box.	Implemented
12	6.3.3	It shall not contain any "moof" boxes.	Implemented
13	6.3.3	The tracks in the "moov" box shall contain no samples (i.e. the entry_count in the "stts", "stsc", and "stco" boxes shall be set to 0).	Implemented
14	6.3.3	The "mvex" box shall be contained in the "moov" box. The "mvex" box also sets default values for the tracks and samples of the following movie fragments.	Implemented
15	6.3.4.2	'styp' box, if present, shall carry 'msdh' as a compatible brand.	Implemented
16	6.3.4.2	Each Media Segment shall contain one or more whole self-contained movie fragments. A whole, self-contained movie fragment is a movie fragment ('moof') box and a media data ('mdat') box that contains all the media samples that do not use external data references referenced by the track runs in the movie fragment box.	Implemented
17	6.3.4.2	Each 'moof' box shall contain at least one track fragment.	Implemented
18	6.3.4.2	The 'moof' boxes shall use movie-fragment relative addressing for media data that does not use external data references and the flag 'default-base-is-moof' shall also be set; absolute byte-offsets shall not be used for this media data.	Implemented
19	6.3.4.2	Each 'traf' box shall contain a 'tfdt' box.	Implemented
20	6.3.4.2	Each Media Segment may contain one or more 'sidx' boxes. If 'sidx' is present in a Media Segment, the first 'sidx' box shall be placed before any 'moof' box and the first Segment Index box shall document the entire Segment.	Implemented
21	6.3.4.3	In each self-contained movie fragment, the movie fragment ('moof') box is immediately followed by its corresponding media data ('mdat').	Implemented
22	6.3.4.3	Each Media Segment shall contain one or more 'sidx' boxes.	Implemented

	Clause in 23009-1	Rule	Conformance Check Implementation
23	6.3.4.3	The first 'sidx' box shall be placed before any 'moof' box and shall document Subsegments that span the composition time of the entire Segment.	Implemented
24	6.3.4.3	Each Media Segment shall carry 'msix' as a compatible brand.	Implemented
25	6.3.4.4	The Subsegment Index box ('ssix') shall be present and shall follow immediately after the 'sidx' box that documents the same Subsegment. This immediately preceding 'sidx' shall only index Media Subsegments.	Implemented
26	6.3.4.4	It shall carry 'sims' in the Segment Type box ('styp') as a compatible brand.	Implemented
27	6.3.5.2	The Indexed Self-Initializing Media Segment shall carry 'dash' as a compatible brand.	Implemented

6.2.2 MPEG-2 transport stream

The Representation conformance rules as well as the implementation of the conformance rules for MPEG-2 transport stream based segments are provided in Table 2.

Table 2 — Representation conformance rules for MPEG-2 transport stream

	Clause in 23009-1	Rule	Conformance Check Implementation
1	6.1	Media Segment formats shall comply with the respective container formats (ISO BMFF and MPEG-2 TS). *This should be verifiable by the respective conformance software*.	Implemented
2	6.2.1	The Initialization Segment shall not contain any media data with an assigned presentation time	Implemented
3	6.2.1	A Media Segment shall contain a number of complete access units.	Partially implemented
4	6.2.1	If it is the first Media Segment in the Representation, it shall contain only media streams that start with a SAP of type 1 or 2 (not verifiable on container level).	Partially implemented
5	6.2.1	A Media Segment shall contain sufficient information to time-accurately present each contained media component in the Representation without accessing any previous Media Segment in this Representation provided that the Media Segment contains a SAP for each media stream (not verifiable on container level).	Implemented

	Clause in 23009-1	Rule	Conformance Check Implementation
6	6.2.3.2	A Media Segment shall specify all Media Presentation times relative to the start of the Period and compensated with the value of the @presentationTimeOffset. The presentation time in Media Segments shall be accurate to ensure accurate alignment of all Representations in one Period. *i)* earliest_*presentation_time shall be equal to the sum of all temporally preceding subsegments in the representation.* *ii) The* duration *of a subsegment indexed by an 'sidx' shall be equal to the sum of the durations of all the subsegments it indices.*	Not implemented
7	6.4.2.1	A subsegment shall contain complete access units for the indexed media stream (i.e., stream for which reference_ID equals PID)	Not implemented
8	6.4.2.2	PES packet starting at I_{SAU} shall contain only an integral number of access units and shall contain a PTS.	Not implemented
9	6.4.2.3	If the Segment Index is provided the Segment Index ('sidx') box in ISO/IEC 14496-12 shall be used for Segment Indexing.	Not implemented
10	6.4.2.3	reference_ID field of `sidx` box shall be the PID value of the indexed stream.	Not implemented
11	6.4.2.3	All media offsets within `sidx` boxes shall be to the first (sync) byte of a TS packet	Not implemented
12	6.4.2.4	If the Subsegment Index is provided the Subsegment Index ('ssix') box in ISO/IEC 14496-12 shall be used for indexing byte ranges within a subsegment	Not implemented
13	6.4.2.4	All media offsets within `ssix` boxes shall be to the first (sync) byte of a TS packet	Not implemented
14	6.4.3.2	An Initialization Segment shall be a valid MPEG-2 TS, conforming to ISO/IEC 13818-1.	Implemented
15	6.4.3.2	The concatenation of an Initialization Segment with any Media Segment shall have the same presentation duration as the original Media Segment.	Not implemented

	Clause in 23009-1	Rule	Conformance Check Implementation
16	6.4.3.2	The Initialization Segment shall contain mandatory untimed initialization information as defined in 6.4.3.1 ISO/IEC 23009-1 in this order: i) PAT; ii) PMT; iii) PCR iv) If MPEG-2 Conditional Access is used, ECM.	Implemented (w/o ECM)
17	6.4.4.2	Media Segments shall contain complete MPEG-2 TS packets,	Implemented
18	6.4.4.2	Media Segments shall contain exactly one program,	Implemented
19	6.4.4.2	All time-varying initialization information shall be present between I_{SAP} and I_{SAU} and/or in the Index Segment, if present.	Implemented
20	6.4.4.2	No Media Segment shall depend on initialization information appearing in any preceding Media Segment.	Implemented
21	6.4.4.2	Media Segments should contain only complete PES packets.	Implemented
22	6.4.4.3	All information necessary for decrypting, or locating information required to decrypt, the encrypted TS packets in a (Sub)Segment shall be present before the encrypted packet(s) to which they apply, either in the same (Sub)Segment, and/or in the Initialization Segment (if used).	Not implemented
23	6.4.4.4	A Self-initializing Media Segment shall contain at the least all mandatory untimed and timed initialization information as defined in 6.4.3.1 of ISO/IEC 23009-1.	Implemented
24	6.4.5	A Bitstream Switching Segment shall be a valid MPEG-2 TS, conforming to ISO/IEC 13818-1.	Not implemented
25	6.4.5	A Bitstream Switching Segment when concatenated with any Media Segment shall not alter the Media Presentation timeline for the corresponding Media Segment.	Not implemented
26	6.4.5	If initialization information is carried within a Bitstream Switching Segment, it shall be identical to the one in the Initialization Segment, if present, of the Representation.	Not implemented