International Telecommunication Union

ITU-T   Technical Paper

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(30 July 2010)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS
Infrastructure of audiovisual services - Communication
procedures

HSTP.CONF-H770
Conformance testing specification for H.770

International
Telecommunication
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Summary

This technical paper provides conformance test specifications regarding service discovery specified in ITU-T Rec.H.770 "Mechanisms for service discovery and selection for IPTV services". The test involves testing both the capabilities and behaviour of an implementation and checking what is observed against the conformance requirements.

It is intended that this Technical Paper will be incorporated at a later stage as part of ITU-T Rec. H.770.

Change Log

This document contains Version 1 of the ITU-T Technical Paper on "*Conformance testing specification for H.770*" approved at the ITU-T Study Group 16 meeting held in Geneva, 19-30 July 2010.

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Conformance testing specification for H.770

Summary

The purpose of conformance testing is to increase the probability that different implementations are able to interconnect. Conformance testing in this document explains test specifications regarding service discovery specified in ITU-T Rec.H.770 "Mechanisms for service discovery and selection for IPTV services". The test involves testing both the capabilities and behaviour of an implementation, and checking what is observed against the conformance requirements in the Recommendation and against what the implementer states the implementation capabilities are.

It is intended that this Technical Paper will be incorporated at a later stage as part of ITU-T Rec. H.770.

Keywords

IPTV, conformance, conformance testing, service discovery, service provider discovery, detailed service offer discovery, metadata, semantics of metadata, transport protocols, IPTV terminal device

CONTENTS

ITU-T Technical Paper HSTP.CONF-H770

Conformance testing specification for H.770

1   Scope

This Document specifies a set of tests and procedures designed to indicate whether IPT V terminal devices meet the normative requirements concerning semantics of metadata elements/attributes and its transportation methods specified in ITU-T Rec. H.770. This set of conformance tests can provide a basic level of interoperability testing.

2   References

[ITU-T H.770]	Recommendation ITU-T H.770 (2009), *Mechanisms for service discovery and selection for IPTV services*
[ITU-T X.290]	Recommendation ITU-T X.290 (1995)	ISO/IEC 9646-1 (1994), *OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – General concepts*
[ITU-T X.291]	Recommendation ITU-T X.291 (1995)	ISO/IEC 9646-2:1994, *OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – Abstract test suite specification*
[ITU-T X.293]	Recommendation ITU-T X.293 (1995)	ISO/IEC 9646-4:1994*, OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – Test realization*
[ITU-T X.296]	Recommendation ITU-T X.296 (1995)	ISO/IEC 9646-7:1995, OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – Implementation conformance statement
[ISO/IEC TR 10000-1]	ISO/IEC TR 10000-1:1992, *Information Technology – Framework and taxonomy of International Standardized Profiles – Part 1: Framework*

3   Definitions

3.1   Terms defined elsewhere

3.1.1   Application [ITU-T Y.101]: A functional implementation realized as software running in one or spread over several interplaying hardware entities.

3.1.2   Conformance log [ITU-T X.290]: A human-readable record of information produced as a result of a test campaign, which is sufficient to record the observed test outcomes and verify the assignment of test results (including test verdicts).

3.1.3   Conformance Testing [ITU-T X.290]: Testing the extent to which an IUT is a conforming implementation.

3.1.4   Conforming Implementation [ITU-T X.290]: An IUT which satisfies both static and dynamic conformance requirements, consistent with the capabilities stated in the ICS(s).

3.1.5   Content [ITU-T T.174]: Encoded generic value, media or non-media data

3.1.6   Dynamic conformance requirement [ITU-T X.290]: One of the requirements which specify what observable behaviour is permitted by the relevant specification(s) in instances of communication.

3.1.7   End-user [ITU-T Y.1910]: The actual user of the products or services.

NOTE 1 - The end-user consumes the product or service. An end-user can optionally be a subscriber.

3.1.8   Implementation conformance statement (ICS) [ITU-T X.290] : A statement made by the supplier of an implementation or system claimed to conform to a given specification, stating which capabilities have been implemented

3.1.9   Implementation conformance statement (ICS) profoma [ITU-T X.290]: A document, in the form of a questionnaire, which when completed for an implementation or system becomes an ICS.

3.1.10   Implementation under test (IUT) [ITU-T X.290]: An implementation of one or more OSI protocols in an adjacent user/provider relationship, being that part of a real open system which is to be studied by testing.

3.1.11   IPTV [ITU-T Y.1901]: Multimedia services such as television, video, audio, text, graphics, data delivered over IP-based networks managed to support the required level of QoS/QoE, security, interactivity and reliability.

3.1.12   IPTV terminal device [ITU-T Y.1901]: A terminal device which has ITF functionality, e.g. a STB.

3.1.13   IPTV Terminal Function (ITF) [ITU-T Y.1901]: The functionality within the home network that is responsible for terminating the IP signal, and converting the content into a renderable [i.e. enabling to be seen and/or heard] format.

3.1.14   Linear TV [ITU-T Y.1901]: A television service in which a continuous stream flows in real time from the service provider to the terminal device and where the user cannot control the temporal order in which contents are viewed.

3.1.15   Metadata [ITU-T Y.1901]: Structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment, and management of the described entities.

3.1.16   Middleware [ITU-T Y.1901]: A layer of software between applications and resources, which consists of a set of service enablers that allow multiple functionalities running on one or more devices in an IPTV system to interact across a network

3.1.17   Pass (verdict) [ITU-T X.290]: A test verdict given when the observed test outcome gives evidence of conformance to the conformance requirement(s) on which the test purpose of the test case is focused, and when no invalid test event has been detected.

3.1.18   Semantics [ITU-T Z.341]: The rules and conventions governing the interpretation and assignment of meaning to constructions in a language

3.1.19   Service [ITU-T Y.101]: A structure set of capabilities intended to support applications.

3.1.20   Service Information (SI) [ETSI EN 300 468]: Digital data describing the delivery system, content and scheduling/timing of broadcast data streams, etc.

NOTE 2 - It includes MPEG-2 PSI together with independently defined extensions.

3.1.21   Service provider [ITU-T M.1400]: A general reference to an operator that provides telecommunication services to customers and other users either on a tariff or contract basis. A

service provider may or may not operate a network. A service provider may or may not be a customer of another service provider.

3.1.22 Static conformance requirement [ITU-T X.290]: One of the requirements that specify the limitations on the combinations of implemented capabilities permitted in a real open system which is claimed to conform to the relevant specification(s).

3.1.23 Stream [ITU-T J.200]: A unidirectional continuous flow of content.

3.1.24 Syntax [ITU-T M.3030]: The structure of expressions in a language, and the rules governing the structure of a language. The relationships among characters or groups of characters, independent of their meanings or the manner of their interpretation and use. (ISO/IEC 11179-1).

3.1.25 Verdict [ITU-T X.290]: A statement of "pass", "fail" or "inconclusive", as specified in an abstract test case, concerning conformance of an IUT with respect to that test case when it is executed.

3.1.26 Video on demand (VoD) [ITU-T Y.1901]: A service in which the end-user can , on demand, select and view a video content and where the end-user can control the temporal order in which the video content is viewed (e.g. the ability to start the viewing, pause, fast forward, rewind).

NOTE 3 - The viewing may occur sometime after the selection of the video content.

3.2   Terms defined in this document

N/A

4   Abbreviations and acronyms

This document uses the following abbreviations and acronyms:

AV	Audio video
DNS	Domain Name Server
DVBSTP	DVB SD&S transport protocol
HTTP	Hyper text transport protocol
ICS	Implementation conformance statement
IUT	Implementation under test
SADS	Service and application discovery and selection
SI	Service information
SP	Service provider
URI	Uniform resource indicator
URL	Uniform resource locator
VOD	Video on demand
XML	Extensible mark-up language

5   Introduction

5.1   Scope of testing

A real system is said to exhibit conformance if it complies with the requirements of applicable specifications specified by ITU-T Recommendation in its communication with other real systems. ITU-T Recommendation [ITU-T H.770] includes specifications of service discovery processes that

specify metadata, metadata transport protocols or protocol profiles, and metadata encoding rules or information objects. As to detailed service discovery processes, the introduction part of [ITU-T H.770] illustrate following processes towards content acquisition.

– *SP Discovery: Discovery of the Service Providers available on the network*

– *SP Service discovery: Discovery of the services offered by a specific or all Service Providers.*

– *SP Content discovery: Discovery of the individual services or contents from a specific Service Provider.*

– *Content selection & acquisition: At the end of the navigation through the offered services and contents, the end-user selects a service or content and acquires it.*

Scope of this document regarding conformity test of [ITU-T H.770] is the same as [ITU-T H.770] (i.e., SP discovery and SP service discovery). Figure 5.1 also shows the scope of this document.
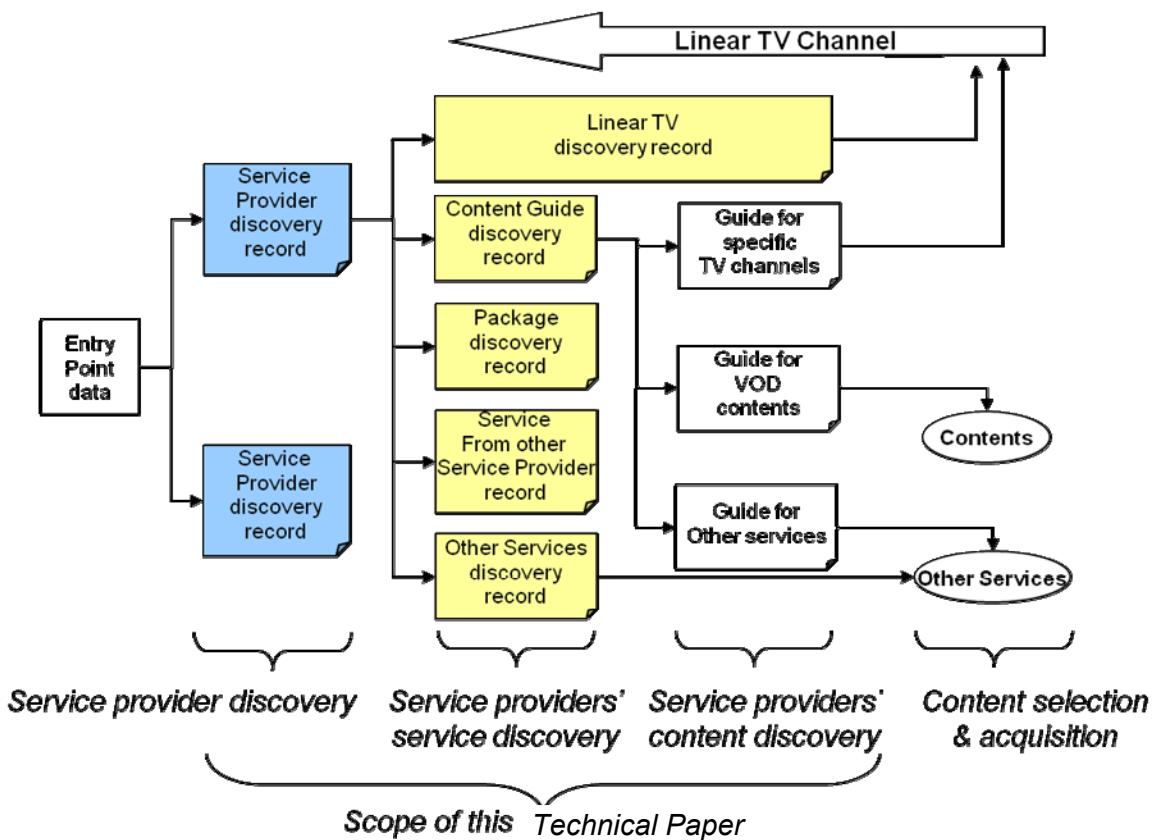
Note - Details of scope of this document is highlighted with blue and yellow.

Figure 5.1: From entry point data to service/content acquisition

5.2   Conformity requirements

To claim compliance with base specifications, an IPTV terminal device has to accept and use:

– all mandatory elements/attributes specified in base specifications;

– all conditional elements/attributes for which at least one of them is mandatory;

– all the conditional elements/attributes which are mandatory if an optional element/attribute is present;

– all optional elements should be accepted even if not used

Requirements of testing in this document are categorized into followings [ITU-T X.290]:

– static conformance requirements: specifying the limitation on the combinations of implemented capabilities (e.g., metadata, transport protocols) described in sub-clause 6.1, 6.2, 6.3, 7.1, 7.2, 7.3 and Appendix I. These are claimed to be supported by using implementation conformance statement (ICS);

– dynamic conformance requirements: specifies what observable behaviour described in sub-clause 6.4 and 7.4.

5.3   Test scenarios

Linear TV and VOD are treated as basic IPTV services in [ITU-T H.770] according to [b_ITU-T Y.Sup5]; therefore, these two services are appropriate as test cases. Diagrams in [ITU-T H.770] have already illustrated typical steps up to select services by using base specifications. Figure 5.2 shows processes to reach Linear TV services, and Figure 5.3 shows processes up to select VOD services.

Test objects regarding metadata in this document are as follows:

– Object 1: Service provider discovery information: providing locations of service providers (cf. Appendix I.1)

– Object 2: Linear TV discovery information: providing a way to directly access to Linear TV services (cf. Appendix I.2);

– Object 3: Content guide discovery information: providing a convenient way to access to both Linear TV and VOD services (cf. I.3).
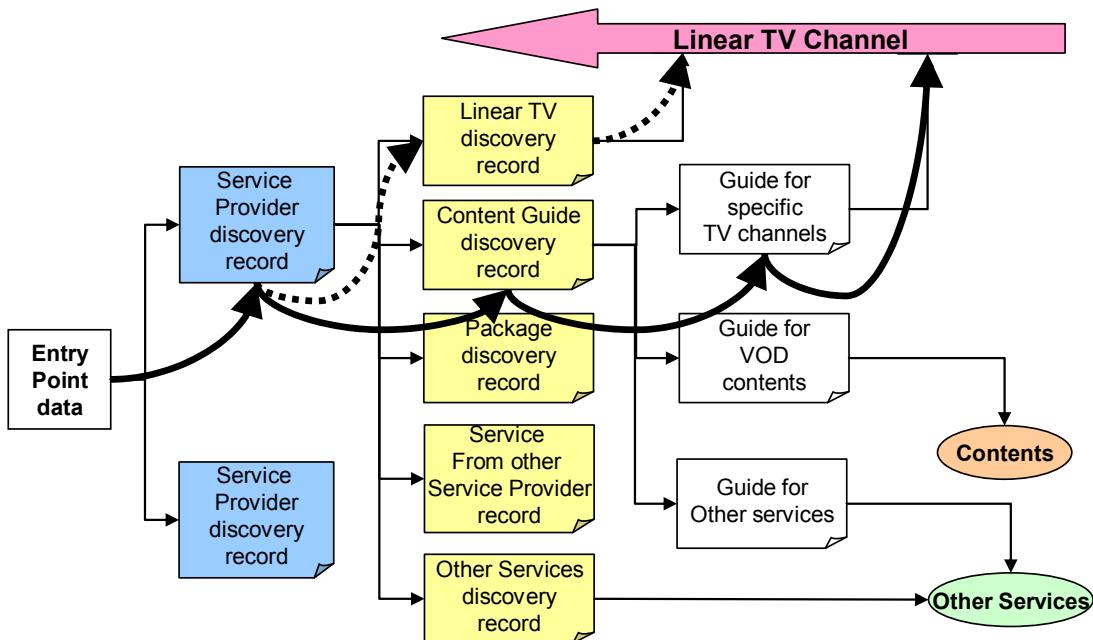
Figure 5.2: Example of live channel selection through a service guide as per Figure 12-1 of [H.770]
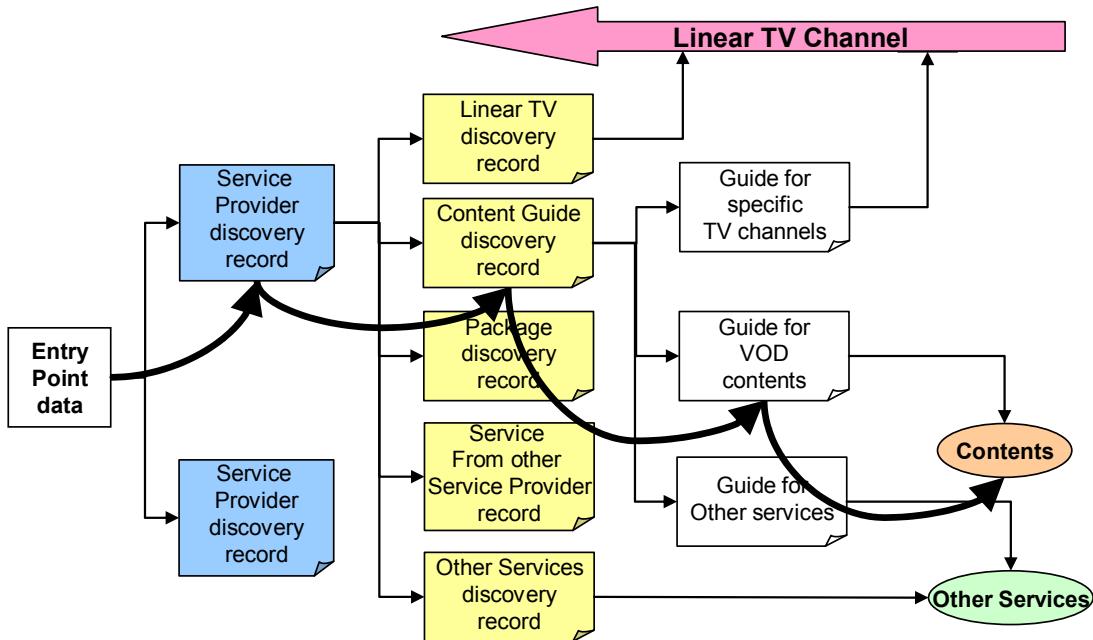
Figure 5.3: Example of content selection through a VoD Guide as per Figure 12-2 of [H.770]

Hence, following test cases for conformance testing are possible:

–   Case 1: Linear TV discovery using a linear TV discovery record;

–   Case 2: Linear TV discovery using a content guide discovery record;

–   Case 3: VOD services discovery using a content Guide Discovery record

   NOTE 1 - Current content guide discovery specifications can also contain multiple content guide locations within a record (e.g. content guide discovery information consists of a provider 1's Linear TV guide and a provider 2's VOD guide).

   NOTE 2 - In the case of testing a Linear TV service, case 1 and case 2 may be combined (e.g., a linear TV discovery information provides a location of SI stream for channel selection and a content guide discovery information provides locations of IPTV contents themselves).

5.4   Test methods

5.4.1   Test system

A test environment is illustrated in Figure 5.2 and consists of

1.   a test system which chiefly provides communication capabilities in order to deliver metadata through service discovery processes, and

2.   an IPTV terminal device, which requests and interprets the metadata, as implementation under test (IUT).

The test system described in this document is required to be equipped with:

–   Metadata delivery functionality: a HTTP server for pull mode and/or DVBSTP/FLUTE server for push mode according to the IPTV terminal device;

–   Metadata storage functionality: generic file system and/or data base; however, the detailed specification is not defined in this document;
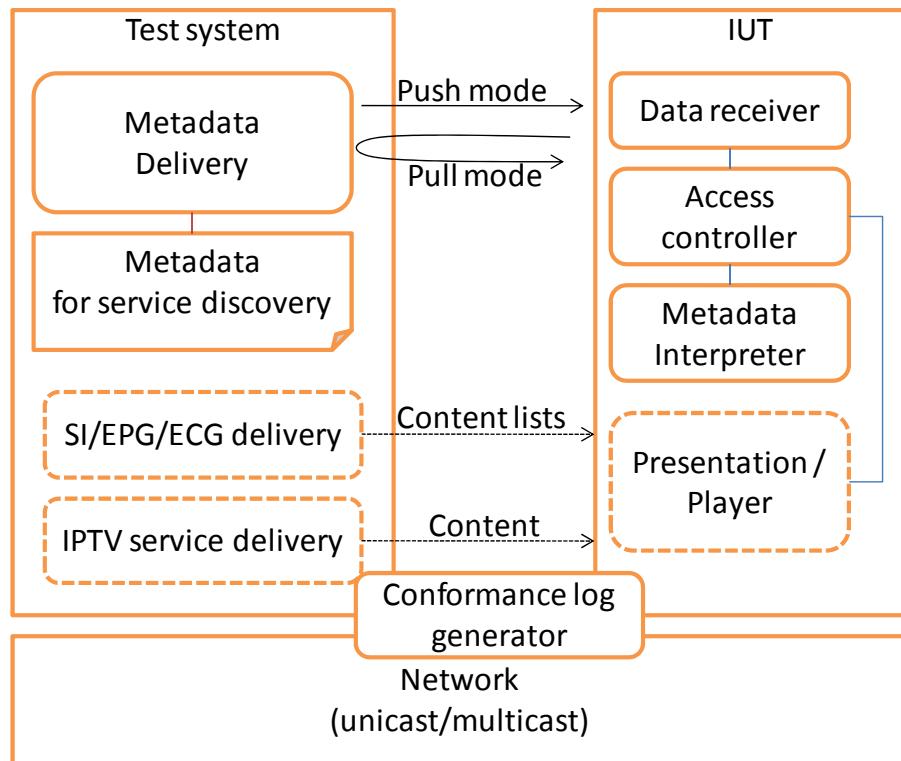
Figure 5.2: Test environment for local testing

- Network functionality: a unicast network for pull mode and/or a multicast network for push mode. IPv4 and/or IPv6 shall be selected based on the specification of the IPTV terminal device. Provisioning of DNS in order to manage IP addresses of all network equipment is also envisioned;

  o Details of transport protocols are described in clause 6.3 and 7.3 respectively.

- Conformance log generator: watch the communication between the test system and the IPTV terminal device, and generate the log (e.g., packet capturing software).

  NOTE - Following functions of the IPTV terminal devices may be supplementary used to check behaviours whether service discovery processes completely work or not:

  o Content selection functionality: If service discovery is completed, a contents-list are shown or a tester can select IPTV services by a remote controller. This functionality is depended on the implementation of the IPTV terminal device.

  o Content delivery/presentation functionality: presentation of content is out of scope

Preceding the conformance testing, the specifications of the test environment are to be shown to the IUT suppliers or implementers (e.g., software product xyz ver. 1.2.1 as HTTP server) [ITU-T X.291].

5.4.2 Conformance log

A conformance log is a human-readable record of information produced as a result of a test campaign, sufficient to record the observed test outcomes and verify the assignments of test verdicts. This information combines the observations of the actual test events which occur when the test system is run against an IPTV terminal device, with information which relates those events to the test cases concerned [ITU-T X.293].

In each step, when an IPTV terminal device communicate with the test system as described in clauses 6.4 and 7.4, conformance logs should be collected and checked in a verdict process regarding both static and dynamic conformance requirements.

5.5 Proforma of implementation conformance statement (ICS)

The specific requirements to be met by suppliers in respect of each ICS they are to provide, shall be stated in base specifications. The ICS proforma shown in Appendix I "Check-lists" are in the form of a questionnaire to be completed by the supplier or implementer [ITU-T X.291].

NOTE - [ITU-T H.770] specifies just semantics of elements/attributes, and detailed syntaxes of the elements/attributes (e.g., name of elements, schema of record) have been studied in another document. Relations between base specifications and implementation ones should be clearly shown by filling-in columns "Remark" in the tables in Appendix.

6 Conformance for service provider discovery

6.1 Metadata conformance

The metadata for service provider discovery are specified in sub-clause 7.1 of [ITU-T H.770]. Tables of corresponding elements/attributes of check-list in Appendix I.1 shall be filled-in and done verdict.

6.2 Encoding conformance

The encoding formats for service provider discovery are specified in sub-clause 7.3 of [ITU-T H.770]. An encoding part of the check-list in Appendix I shall be filled-in and done verdict.

6.3 Transport conformance

The transport protocols for service provider discovery are specified in clause 8 of [ITU-T H.770]. A protocol relevant part of the check-list in Appendix I shall be filled-in and done verdict.

6.4 Procedure to test service provider discovery

Functionalities regarding service provider discovery that claims conformance with base specifications shall pass the following normative test as observation of behaviours of an IPTV terminal devices:

1) A test metadata shall be created according to sub-clause 6.1 and 6.2 (cf. service provider discovery information in Table I.1-1, Table I.1-2 and Table I.1-3 in Appendix I);

   NOTE - Validation of the metadata should be checked beforehand.

2) Store the metadata created in first step into the test system;

3) A test IPTV terminal device connects to the test system over an IP network;

   NOTE - Details of network attachment specifications are out of scope of this document.

4) A test IPTV terminal device acquires the service provider discovery information stored in second step over an IP network with at least one of the following methods specified by sub-clause 6.3

   –   metadata delivery with HTTP (pull mode)

   –   metadata delivery with DVBSTP/FLUTE (push mode)

   NOTE - the timing of acquiring metadata depends on implementation of the IPTV terminal device (e.g., power-on, operations of a resident application).

5) Test pass if the IPTV terminal device (interprets the metadata after fourth step and) automatically accesses to the location in the test system according to the metadata. The exact location is indicated as service offer summary type of information (cf. Table I.1-3 in Appendix I) :

NOTE - Conformance log shall be recorded from third and fifth step.

7 Conformance for detailed service offer discovery

7.1 Metadata conformance

The metadata for detailed service offer discovery are specified in sub-clause 10.1, 10.3 and 10.4 of ITU-T Rec. H.770. Tables of corresponding elements/attributes of check-list in Appendix I.2 shall be filled-in and done verdict.

7.2 Encoding conformance

The encoding formats for detailed service offer discovery are specified in sub-clause 10.6 of [ITU-T H.770]. An encoding part of the check-list in Appendix I shall be filled-in and done verdict.

7.3 Transport conformance

The transport protocols for detailed service offer discovery are specified in sub-clause 11 of [ITU-T H.770]. A protocol relevant part of the check-list in Appendix I shall be filled-in and done verdict.

7.4 Procedure to test detailed service offer discovery

A functionality regarding detailed service offer discovery that claims conformance with [ITU-T H.770] shall pass the following normative test:

1) A test metadata shall be created based on sub-clause 7.1 and 7.2 (cf. linear TV discovery information in sub-clause I.2, content guide discovery information in sub-clause I.3 of Appendix I);

NOTE - Validation of the metadata should be checked beforehand.

2) Store the metadata file create in first step into the test system;

3) Service provider discovery processes described sub- clause 6.4 shall be done;

4) An IPTV terminal acquires the metadata stored in second step over an IP network with at least one of the following methods specified by sub-clause 7.3

   – metadata delivery over HTTP (pull mode)

   – metadata delivery over DVBSTP/FLUTE (push mode)

5) Test pass if the test IPTV terminal device interprets the metadata and automatically accesses to the server indicated by the metadata. The exact location is indicated in the following elements/attributions;

   – Object 2: Linear TV service discovery information (cf. service location elements/attributes in Table I.2-3 in Appendix I)

   – Object 3: Content guide discovery information (cf. content guide locator in Table I.3-1 in Appendix I)

NOTE 1 - An access log shall be collected from fourth and fifth step.

NOTE 2 - This normative test does not require a presentation such as a content list for service selection if the result can be checked with the log.

Appendix I

Check-lists for conformance testing

(This appendix does not form an integral part of this document)

Columns "Status" in tables show requirement levels of elements/attributes for reference. Mandatory elements/attributes are shown "M", optional ones are shown as "O" and conditional requirements are shown as "C".

Columns "Support" are used to put down whether [ITU-T H.770] elements/attributes are used or not [ITU-T X.296].

The common notations for support answers are:

−   supported Y, y, YES or yes

−   not supported N, n, NO, no

−   no answer required N/A, n/a or "-"

Columns "Remarks" is used to put down relevancies to [ITU-T H.770] specifications.

NOTE - If optional elements/attributes are used according to specific rules, it should be also described (ex., only if Linear TV is served, this element is required). Conformity can be objectively checked.

I.1   Service provider discovery information

Table I.1-1: Service provider information record

Element / Attribute	Status	Support	Remark
Record Type	M		
Record Version	M		
Individual Service Provider Information	M		

Table I.1-2: Individual service provider information elements/attributes

Element / Attribute	Status	Support	Remark
Service Provider Identifier	M		
Individual Service Provider Information Version	M		
Service Provider Logo URI	O		
Service Provider Name	O		
Service Provider Description	O		
Web Portal URL	O		
Service Offer Summary (s)	M		

Table I.1-3: Service offer summary elements/attributes

Element / Attribute	Status	Support	Remark
Push Address	C (Note)		
Pull URL	C (Note)		
Offer Type	O		
Segment Identifier and Version	O		

NOTE - One of them is required to be presented.

I.2   Linear TV discovery information

Table I.2-1: Linear TV discovery record

Element / Attribute	Status	Support	Remarks
Record Type	M		
Service Provider Identifier	M		
Record Version	M		
Metadata server URL	O		
Portal URL	O		
Purchase Information URL	O		
Linear TV Service(s)	M		

Table I.2-2: Linear TV Services elements/attributes

Element / Attribute	Status	Support	Remark
Service Identifier	M		
Original Network Id	O		
Transport Stream Id	O		
Service Id	O		
Max bit rate	O		
Service Location(s)	M		
Audio Coding	O		
Video Coding	O		
Service Availability	O		
Streaming Type	O		
Multiplex Mode	O		

Table I.2-3: Service location elements/attributes

Element / Attribute	Status	Support	Remark
IP Multicast Address	M		
IP Multicast Port	M		
IP Multicast Source	O (Note)		
Unicast URL	O		

NOTE - Source address is mandatory when IPv6 multicast is deployed.

Table I.2-4: FEC elements/attributes

Element / Attribute	Status	Support	Remark
FEC Base Layer Multicast Address	M		
FEC Enhancement Layer Multicast Address	O		
Maximum Packet Number in blocks	O		
Maximum FEC Block Duration	O		
FEC specific information	C (Note)		

NOTE - This information is required when FEC enhancement layer is used.

Table I.2-5: Service availability elements/attributes

Element / Attribute	Status	Support	Remark
Country Code	O		
Availability	O		
Region Codes	O		

Table I.2-6: Additional linear TV discovery elements/attributes

Element / Attribute	Status	Support	Remark
Type of service	M		
Priority SI Source	O		
Service Name	O		
Service Description	O		
Content Guide Discovery record Identifier(s)	O		
Preferred Content Guide Discovery record Location(s)	O		
Service Genre(s)	O		
Announcement stream	O		
Secondary Service Id	O		
Mosaic Information	O		

I.3 Content guide discovery information

Table I.3-1: Content guide discovery record

Element / Attribute	Status	Support	Remark
Record Type	M		
Service Provider Identifier	M		
Record Version	O		
Content Guide Discovery record Identifier	M		
Content Guide Name	O		
Content Guide Provider Name	O		
Content Guide Description	O		
Content Guide Locator (Note)	M		
Content Guide Logo URI	O		
Content Guide Type	O		
Target Service Provider Identifier	O		

NOTE - A request on the "Content Guide Locator" shall return a record compliant to a schema that will be specified in a later revision of the present document

I.4 What is to be tested

It should be identified that the IPTV services scenarios and/or delivery mode (i.e., protocols) and information objects which are to be the focus of the conformance assessment [ITU-T X.296]. This information can be described as a following table.

Table I.4-1: Table of what is to be tested

IPTV service	Process	Mode	Protocol (version)	Information objects	Encoding	Verdict
	Service provider discovery			Service provider information		
	Detailed service discovery					

I.5 How to use check-lists

Following tables show examples of using check-lists.

Table I.5-1: Example of description of checking elements/attributes

Element / Attribute	M/O/C	Support	Remark
Record Type	M	*y*	*Equivalent to a test element "SP"*
Record Version	M	*y*	
OfferType	O	*y*	*Equivalent to a test element "Linear TV". Only if Linear TV is provided, this element is required*

Table I.5-2: Example of description of another checking

IPTV service	Process	Mode	Protocol (Version)	Information objects	Encoding (Compression)	Verdict
Linear TV	Service provider discovery	*Pull*	*TCP HTTP(1.1)*	Service provider information	*XML (No-compress)*	*Pass*
	Detailed service discovery	*Pull*	*TCP HTTP(1.1)*	*Linear TV information*	*XML (No-compress)*	*Pass*

Appendix II

Reference points for conformance test

Figure II.1 shows only reference points concerning IPTV terminal devices extracted from [ITUT Y.1910]. Right-side round-square boxes are server-side or network-side functionalities. Following reference points are related to this draft document.

II.1   Reference point E0

The E0 reference point is between SADS client functional block and the server-side SADS functional block [ITU-T Y.1910].

This reference point is used to discover service provider/services themselves, and select IPTV services and applications.

II.2   Reference point E5

The E5 reference point is between the multicast content delivery client functional block and the multicast control point functional block [ITU-T Y.1910].

This reference point is used to exchange messages for joining multicast channels, e.g. IGMP messages.

II.3   Reference point E6

The E6 reference point is between the unicast content delivery client functional block and the content delivery control functional block [ITU-T Y.1910].

This reference point is used to exchange content control message, e.g. video recording commands.
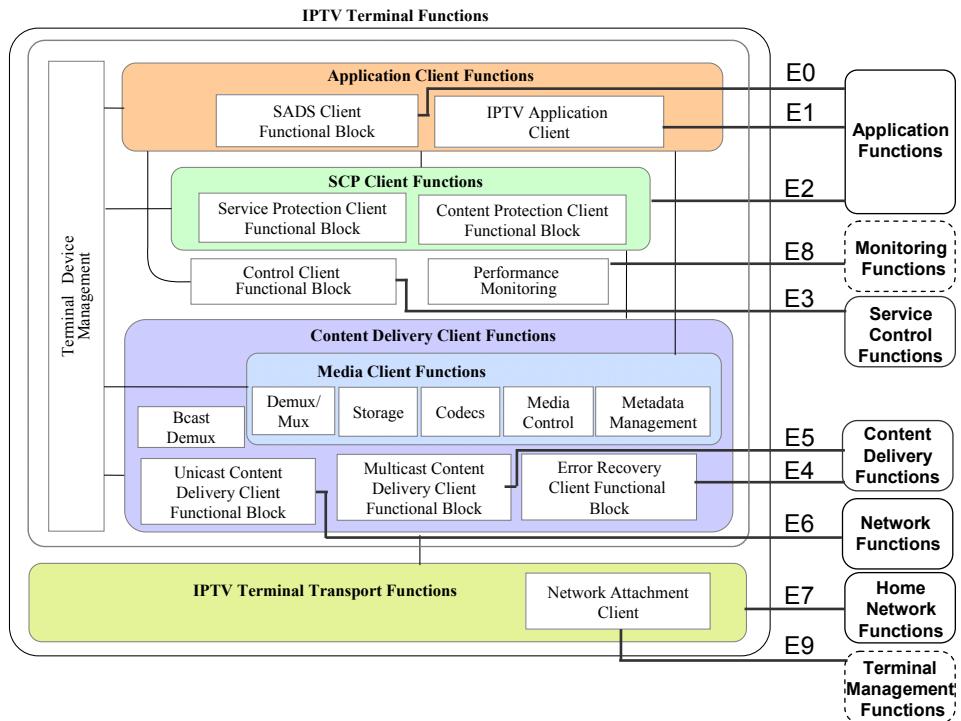
Figure II.1: Reference points on protocols of IPTV terminal devices

Bibliography

[b_ITU-T H.264.1]   ITU-T Recommendation H.264.1 (2009), *Conformance specification for H.264 advanced video coding*