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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

IPTV multimedia services and applications for IPTV – IPTV service discovery up to consumption

Mechanisms for service discovery and selection for IPTV services

Recommendation ITU-T H.770

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Recommendation ITU-T H.770

Mechanisms for service discovery and selection for IPTV services

Summary

Recommendation ITU-T H.770 describes the mechanisms for service provider discovery, service discovery and selection for Internet protocol television (IPTV) services. The mechanisms enable IPTV terminal devices to provide the end-users with effective ways for consuming IPTV services. The expected types of IPTV services using service discovery information include linear television (TV), video on demand (VoD), etc.

This Recommendation identifies service discovery metadata elements and attributes providing information concerning service providers and contents/services, and its delivery protocols covering both unicast and multicast transport mechanisms.

This 2015 edition of the Recommendation adds notes on how to treat "Web Portal URL" in clause 7.1. It also modifies the examples of "Portal URL" and "Metadata server URL", changing those into "<scheme>://<server_name>[:<port>]/<path>". In clause 10 it also adds a text to show the example on "Metadata server URL". Moreover, "Preferred Content Guide Discovery record Location" is changed into "Preferred Content Guide Discovery record" in clauses 10.1 and 10.2, and its example has been changed to a Boolean value. Relevant elements/attributes in Appendix II are also changed. This edition of the Recommendation also adds a new service type, "Widget service", to Table 7.1-4.

History

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Delivery protocol, IPTV services, linear TV, metadata, service discovery, service discovery information, service provider, service provider discovery, service provider information.

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FOREWORD

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1 Scope

This Recommendation describes the mechanisms for service provider discovery, service discovery and selection for Internet protocol television (IPTV) services. The mechanisms enable IPTV terminal devices to provide the end-users with effective ways to discover and select IPTV services. The expected types of IPTV services using service discovery information include linear television (TV) and video-on-demand, etc.

This Recommendation identifies service discovery metadata elements and attributes providing information concerning service providers and contents/services, and its delivery protocols covering both unicast and multicast transport mechanisms.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.222.0] Recommendation ITU-T H.222.0 (2014) | ISO/IEC 13818-1:2015, *Information technology – Generic coding of moving pictures and associated audio information: Systems*.

[ITU-T H.264] Recommendation ITU-T H.264 (2014) | ISO/IEC 14496-10: 2014, *Advanced video coding for generic audiovisual services*.

[ITU-T H.610] Recommendation ITU-T H.610 (2003), *Full service VDSL – System architecture and customer premises equipment*.

[ITU-T H.701] Recommendation ITU-T H.701 (2009), *Content delivery error recovery for IPTV services*.

[ITU-T H.721] Recommendation ITU-T H.721 (2015), *IPTV terminal devices: Basic model*.

[ITU-T H.750] Recommendation ITU-T H.750 (2008), *High-level specification of metadata for IPTV services*.

[ITU-T H.765] Recommendation ITU-T H.765 (2015), *Packaged IPTV Application (Widget) Service*.

[ITU-T X.891] Recommendation ITU-T X.891 (2005) | ISO/IEC 24824-1:2007, *Information technology – Generic applications of ASN.1: Fast infoset*.

[ITU-T Y.1910] Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture*.

[ATIS-0800022] ATIS standard ATIS-0800022.v002 (2011), *IPTV Consumer Domain Device Configuration Metadata*.

[BBF TR-069] Broadband Forum TR-069 (2007), *CPE WAN Management Protocol v1.1,* plus Amendment 2.

[BBF TR-135] Broadband Forum TR-135 (2007), *Data Model for a TR-069 enabled STB.*

[ETSI EN 300 468] ETSI EN 300 468 V1.14.1 (2014), *Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems*.

[ETSI TS 101 154] ETSI TS 101 154 V1.11.1 (2012), *Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream*.

[ETSI TS 102 034] ETSI TS 102 034 V1.5.2 (2014), *Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks*.

[ETSI TS 102 472] ETSI TS 102 472 V1.3.1 (2009), *Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Content Delivery Protocols*.

[IETF RFC 768] IETF RFC 768 (1980), *User Datagram Protocol (UDP)*.

[IETF RFC 959] IETF RFC 959 (1985), *File Transfer Protocol*.

[IETF RFC 2236] IETF RFC 2236 (1997), *Internet Group Management Protocol, Version 2*.

[IETF RFC 2250] IETF RFC 2250 (1998), *RTP Payload Format for MPEG1/MPEG2 Video*.

[IETF RFC 2616] IETF RFC 2616 (1999), *Hypertext Transfer Protocol – HTTP/1.1*.

[IETF RFC 2818] IETF RFC 2818 (2000), *HTTP over TLS*.

[IETF RFC 3376] IETF RFC 3376 (2002), *Internet Group Management Protocol, Version 3*.

[IETF RFC 3550] IETF RFC 3550 (2003), *RTP: A Transport Protocol for Real-Time Applications*.

[IETF RFC 3810] IETF RFC 3810 (2004), *Multicast Listener Discovery Version 2 (MLDv2) for IPv6*.

[ISO/IEC 23001-1] ISO/IEC 23001-1 (2006), *Information technology – MPEG systems technologies – Part 1: Binary MPEG format for XML*.

[W3C XML] World Wide Web Consortium (W3C) Recommendation XML1.1 (2008), *Extensible mark-up language (XML) 1.0, Fifth Edition*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 broadcast [b-ITU-T M.60]: One-way transmission from one point to two or more other points.

3.1.2 content [b-ITU-T T.174]: Encoded generic value, media or non-media data.

3.1.3 electronic content guide (ECG) [ITU-T H.721]: A service navigation application used especially for streamed and downloaded content. ECG deals with metadata unlike service information used in terrestrial broadcasting.

3.1.4 electronic program guide (EPG) [b-ITU-T Y.1901]: A structured set of data, intended to provide information on available content that may be accessed by end-users.

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

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

3.1.6 EPG provider [b-ITU-T J.90]: The entity that collects, collates and assembles the elements of information that constitute the EPG database.

3.1.7 home network (HN) [b-ITU-T H.622]: Home network is the collection of elements that process, manage, transport and store information, thus enabling the connection and integration of multiple computing, control, monitoring, communication and entertainment devices in the home.

3.1.8 Internet protocol television (IPTV) [b-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.

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

3.1.10 IPTV terminal function (ITF) [b-ITU-T Y.1901]: The end-user function(s) associated with a) receiving and responding to network control channel messages regarding session set-up, maintenance, and teardown, and b) receiving the content of an IP transport from the network and rendering.

3.1.11 linear TV [b-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.

3.1.12 metadata [b-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.

NOTE – EPG metadata has many applications and may vary in depth from merely identifying the content package title or information to populate an EPG to providing a complete index of different scenes in a movie or providing business rules detailing how the content package may be displayed, copied, or sold.

3.1.13 middleware [b-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.

3.1.14 multimedia [b-ITU-T J.148]: The combination of multiple forms of media such as audio, video, text, graphics, fax, and telephony in the communication of information.

3.1.15 network provider [ITU-T Y.1910]: The organization that maintains and operates the network components required for IPTV functionality.

NOTE 1 – A network provider can optionally also act as service provider.

NOTE 2 – Although considered as two separate entities, the service provider and the network provider can optionally be one organizational entity.

3.1.16 package [b-ITU-T Y.1901]: A collection of content components that in some combination (either all or a subset) together provide an end-user experience and are intended to be used together.

NOTE – A package can be instantiated with or without audiovisual content depending on scenarios, in which audiovisual content and package can be tightly associated or can be loosely coupled enough to be handled (generation, delivery, consumption) independently.

3.1.17 portal [ITU-T H.721]: A portal presents information from diverse sources in a unified manner and provides a way to attach the communication services.

3.1.18 program specific information (PSI) [ITU-T H.222.0]: PSI consists of normative data which is necessary for the demultiplexing of Transport Streams and the successful regeneration of programs and is described in clause 2.4.4 of [ITU-T H.222.0]. An example of privately defined PSI data is the non-mandatory network information table.

3.1.19 service and content protection (SCP) [b-ITU-T Y.1901]: A combination of service protection and content protection.

3.1.20 service [b-ITU-T Y.101]: A structured set of capabilities intended to support applications.

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

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

3.1.22 service navigation [b-ITU-T H.720]: The presentation of information that allows the end-user to discover, select and consume services.

3.1.23 service provider [b-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.

3.1.24 set-top box (STB) [b-ITU-T J.183]: A device that contains demodulator, de-multiplexer, decoder, other functionalities and interfaces related to signal reception and presentation of the distributed programme at the subscriber's site.

3.1.25 stream [b-ITU-T J.200]: A unidirectional continuous flow of content.

3.1.26 subscriber [b-ITU-T M.3050.1]: The subscriber is responsible for concluding contracts for the services subscribed to and for paying for these services.

3.1.27 telecommunication service [b-ITU-T F.700]: Set of telecommunication capabilities that work in a complementary and cooperative way in order to let users perform applications.

3.1.28 terminal device (TD) [b-ITU-T Y.1901]: An end-user device which typically presents and/or processes the content, such as a personal computer, a computer peripheral, a mobile device, a TV set, a monitor, a VoIP Terminal or an audiovisual media player.

3.1.29 user device [b-ATIS-0800002]: Also known as home network end-device (HNED), home network device (HND), consumer equipment (CE), terminal and physical device. A piece of hardware equipment running its software and attached to a home network and being identified by a GUID, e.g., a MAC address. A single device can be used by one or more end-users.

3.1.30 video on demand (VoD) [b-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, etc.).

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

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 application: A functional implementation realized as software running in one or spread over several interplaying hardware entities.

3.2.2 SCP provider: A service provider that offers service and content protection (SCP) functionalities to the other service providers.

3.2.3 service platform: A set of functions that facilitate telecommunication services provided by the service providers.

NOTE – In the context of IPTV services, examples of service platform functions are service authentication, content aggregation and content delivery.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AV Audio Video

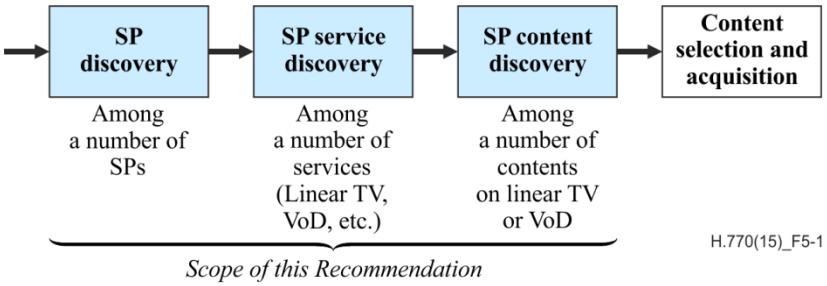
AVC Advanced Video Coding

AVD	Audio, Video and Data
ASN.1	Abstract Syntax Notation One
BAT	Bouquet Association Table
BBF	Broadband Forum
BCG	Broadband Content Guide
BiM	Binary MPEG format for XML
BIT	Broadcaster Information Table
CAS	Conditional Access System
CBR	Constant Bit Rate
CS	Configuration Server
DNS	Domain Name System
DRM	Digital Rights Management
DVBSTP	DVB SD&S Transport Protocol
ECG	Electronic Content Guide
EIT	Event Information Table
EPG	Electronic Program Guide
ETT	Extended Text Table
FEC	Forward Error Correction
FLUTE	File delivery over Unidirectional Transport
FQDN	Fully Qualified Domain Name
HN	Home Network
HNED	Home Network End-Device
HTML	Hyper Text Mark-up Language
HTTP	Hyper Text Transport Protocol
ID	Identifier
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPG	Interactive Program Guide
IPTV	Internet Protocol Television
ITF	IPTV Terminal Function
MAC	Media Access Control
MGT	Master Guide Table
MLD	Multicast Listener Discovery
MPEG	Moving Picture Experts Group
NIT	Network Information Table
PAT	Program Association Table
PER	Packed Encoding Rules

PID	Packet Identifier
PMT	Program Map Table
PSI	Program Specific Information
PSIP	Program and System Information Protocol
PVR	Personal Video Recorder
RF	Radio Frequency
RTCP	Real Time Control Protocol,
RTP	Real-time Transport Protocol
SADS	Service and Application Discovery and Selection
SCART	Société des Constructeurs d'Appareils Radiorécepteurs and Televiseurs. A connector standard that supports various common analogue signal types.
SCP	Service and Content Protection
SDT	Service Description Table
SI	Service Information
SIP	Session Initiation Protocol
SMS	Short Message Service
SOAP	Simple Object Access Protocol
SP	Service Provider
STB	Set-Top Box
TD	Terminal Device
TFTP	Trivial File Transfer Protocol
TLS	Transport Layer Security
TS	Transport Stream
UDP	User Datagram Protocol
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
VBR	Variable Bit Rate
VCT	Virtual Channel Table
VoD	Video on Demand
XML	extensible Mark-up Language

5 Introduction

Service discovery includes a number of steps toward content acquisition, as illustrated in Figure 5-1. The acquisition of the entry point data to start the service discovery process, which is assumed to be architecture-specific, is not part of this Recommendation.



NOTE

– 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 and acquisition: At the end of the navigation through the offered services and contents, the end-user selects a service or content and acquires it. This step is not part of this Recommendation.
– End-user and/or devices may be authenticated before service provider attachment or service attachment as part of the security provisions [b-ATIS-0800017].

Figure 5-1 – From service provider discovery to content acquisition

Each IPTV architecture has its own way to make the starting entry point(s) available to the IPTV terminal device.

A starting entry point might be:

– An IPTV service provider description provider entry point (when there are several IPTV service providers on the network and no specific service provider entry point is provided in the IPTV terminal device configuration data).

  NOTE 1 – IPTV service provider description provider is an organization providing service provider information.

– An IPTV service provider entry point (when there is only one IPTV service provider on the network or when a specific service provider entry point is provided in the IPTV terminal device configuration data). The IPTV service provider may be running a web-based solution, a metadata-based solution or both of them.
– One of the following:
  - a multicast address for delivering the entry point information described above;
  - location of service and application discovery and selection (SADS) functions (i.e., fully qualified domain name (FQDN) or unicast IP address). The SADS functional block provides for the discovery and selection of IPTV services and applications [ITU-T Y.1910].

The descriptions of the different steps for service discovery are described below. These are independent of any specific IPTV architecture.

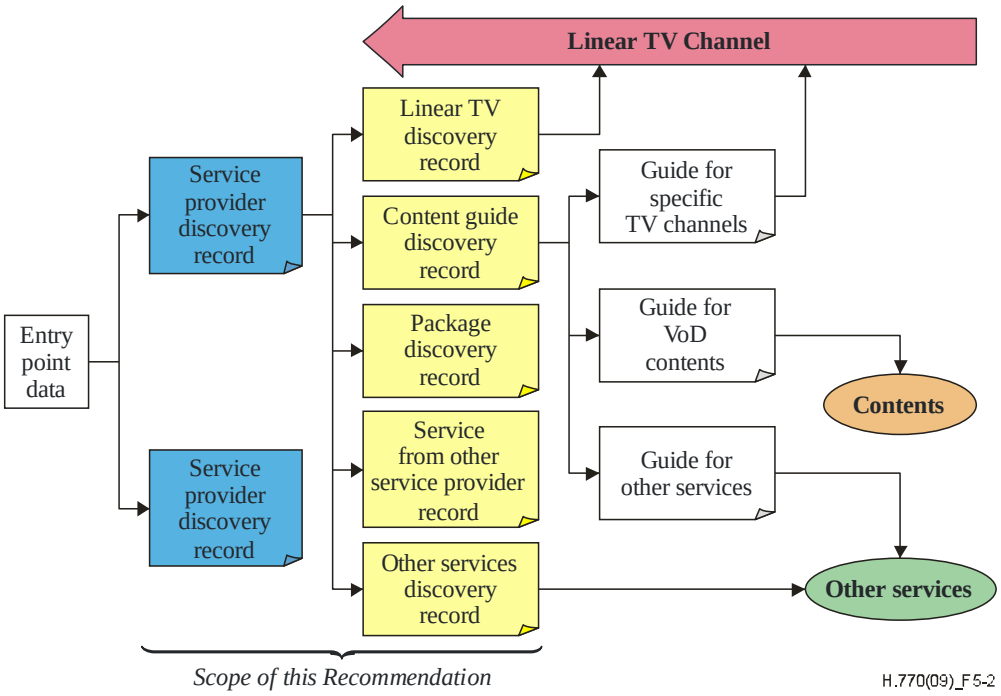


Figure 5-2 – From entry point data to service/content acquisition

NOTE 2 – Details of each record are explained in clauses 7 and 10.

There are several solutions for the IPTV terminal device to obtain the "entry point data", but this is part of the network signalling and therefore is not included here.

Figure 5-2 indicates the boundary between what is outside and inside the scope of this Recommendation.

In addition, exchange of service discovery information between the SADS functional block and IPTV terminal devices can be performed in push mode or pull mode [ITU-T Y.1910], or a mix of both, as follows:

– Push mode: the SADS functional block actively sends the service and application discovery information to the IPTV terminal devices.

– Pull mode: the IPTV terminal devices repeatedly request the service and application discovery information from the SADS functional block.

6 Service provider discovery process

The first step is to discover the IPTV service providers.

In the case where there is only one IPTV service provider or if the user is directly registered with one particular service provider, this first step is simpler.

In the case where there are several service providers and there is no preconfigured service provider, it is necessary to provide the end-user device with one or more starting entry point(s) from where to obtain the description of the service providers available on the network, and there are different solutions, depending on the IPTV architecture, to obtain these entry points.

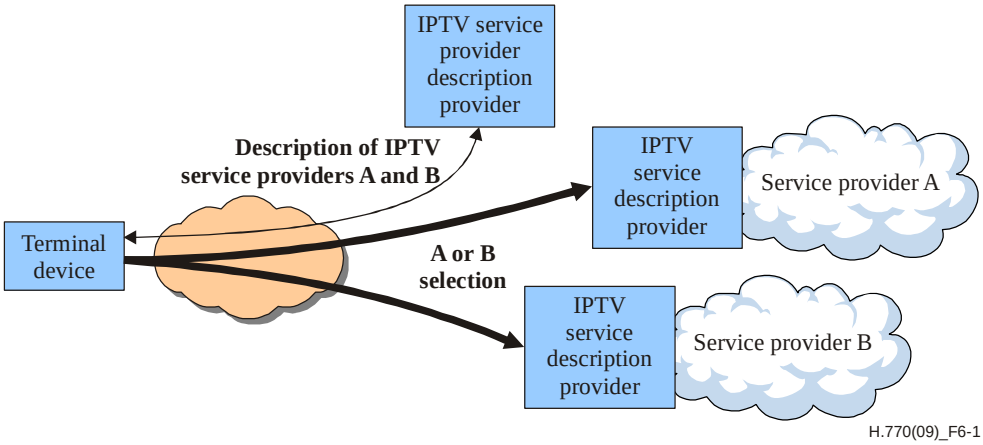


Figure 6-1 – Service provider discovery with a central IPTV service provider description provider

NOTE – IPTV service description provider is an organization providing information about IPTV services (e.g., EPG provider).

In Figure 6-1, there is one entry point which allows acquiring information about available service providers; this is the "IPTV service provider description provider" entry point.

An alternative solution without a central "IPTV service provider description provider" is also possible as described in Figure 6-2.

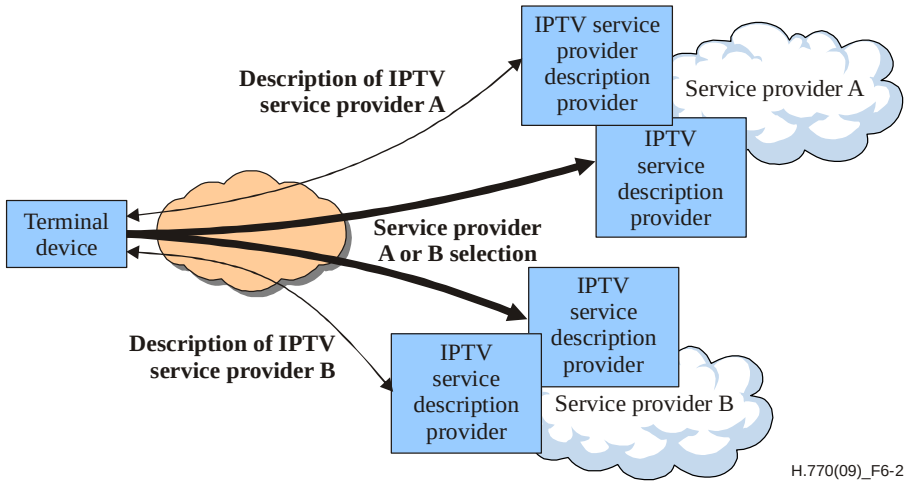


Figure 6-2 – Service provider discovery without a central service provider description provider

7 Service provider information

7.1 Service provider information record

This clause specifies the first level of information about service providers.

The information related to a service provider is called a "service provider information" record.

The service provider information record contains the first level description of a service provider.

Several service provider information records can be grouped together if there are several service providers to be described.

Table 7.1-1 lists the elements/attributes identified for the service provider information record.

Mandatory elements and attributes are shown as "M", optional ones are shown as "O", conditional requirements are shown as "C".

Table 7.1-1 – Service provider information record

Element/ attribute	Description	M/O/C	Example(s)
Record type	Type of this set of data (See Table 7.1-4).	M	Service provider information
Record version	Version of this record. It is incremented with any change to the service provider information record.	M	1
Record provider identifier	The unique identifier given to the IPTV service provider description provider described in clause 6 (e.g., an Internet DNS domain name, an URI, etc.).	O	itu-t.int <scheme>:// <authority>/
Individual service provider information (one per service provider)	Complex element containing basic information about service providers (see Table 7.1-2). Several individual service provider information entries are possible, each of them for a specific service provider.	M	–

The elements/attributes described in Table 7.1-2 have been identified to be part of the "individual service provider information".

Table 7.1-2 – Individual service provider information elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
Service provider identifier	The unique identifier given to the service provider (e.g., an Internet DNS domain name, an URI, etc.).	M	itu-t.int <scheme>://<authority>/
Individual service provider information version	Version of this set of individual service provider information elements. It is incremented with any change to the set of individual service provider information elements.	M	1
Service provider logo URI	Pointer to a service provider logo for potential display.	O	<scheme>://<authority>/<path>
Service provider name	Usual name of the service provider for display. Several names are possible, each of them in a specific language.	O	GTN
Service provider description	Textual description of the service provider for potential display. Several textual descriptions are possible, each of them in a specific language.	O	Geneva Telecommunication News

Table 7.1-2 – Individual service provider information elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
Web portal URL (Note)	URL for the portal to discover the service details using a Web-based solution. This portal may provide the direct path to several detailed IPTV services.	O	<scheme>://<authority> [:<port>]/<path>
Service offer summary (one per offering)	Complex element containing basic information about services offered by the service provider (see Table 7.1-3). Several service offer summary entries are possible, each of them for a specific service.	M	–
NOTE – "Web portal URL" should be used either in this table or in Table 7.1-3.			

The elements/attributes described in Table 7.1-3 have been identified to be part of the "service offer summary".

Table 7.1-3 – Service offer summary elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
Push address	Multicast location of the "detailed service offer" record described in clause 10. For details of address description, see Table 10.1-3 (e.g., Port number, IP address, Source).	C (Note 2)	–
Pull URL	Unicast location of the "detailed service offer" records described in clause 10.	C (Note 2)	<scheme>://<authority> [:<port>]/<path>
Web portal URL (Note 1)	URL for the portal to discover the service details using a Web-based solution. This portal may provide the direct path to several detailed IPTV services.	C (Note 2)	<scheme>://<authority> [:<port>]/<path>
CS location	Location of the IPTV configuration server, which is shown in clause 8, to be used to get the "Detailed Service Offer" records described in clause 10.	C (Note 2)	<scheme>:// <authority> [:<port>]/<path>
Offer type	Type of service discovery offered by a service provider (see Table 7.1-4).	O	Linear TV discovery

Table 7.1-3 – Service offer summary elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
Segment identifier and version (Note 3)	Identification of a segment containing the "detailed service offer" (or a part of it) with the indication of the latest version. Several segment identifiers and versions are possible if the detailed service offer is spread over several segments for transmission.	O	<id>.<version>
NOTE 1 – "Web portal URL" should be used either in this table or in Table 7.1-2. NOTE 2 – At least one of them is required to be presented. NOTE 3 – Segments are small divided units of "detailed service offer" information records. The service discovery information records may be of a substantial size, but only parts of them are needed by an IPTV terminal device at any one time. Also, changes to the records may be localized to part of the records. Segments are defined in the context of a single record type of service discovery information in Table 7.1-4 [ETSI TS 102 034].			

Classification of metadata records are specified by using "record type". Table 7.1-4 lists the record types a service provider may offer.

Table 7.1-4 – Details of record type

Record types		Reference
Service provider information		In this clause
Linear TV discovery		See clause 10.1
Package discovery		See clause 10.2
Content guide discovery		See clause 10.3
Service from other service providers discovery		See clause 10.4
Other services discovery (Note)	E-book	See clause 10.5
	SMS messaging	
	E-mail	
	Widget service [ITU-T H.765]	
NOTE – "Other services discovery" entries are not limited to those listed in this table.		

Figure 7-1 contains a graphical representation of an implementation example of the service provider information records.

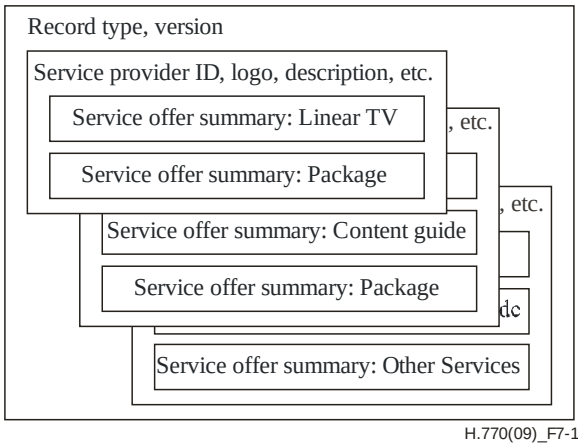


Figure 7-1 – Graphical representation of the service provider information record

Relevant standards are:

– Clause 5.2.5 of [ETSI TS 102 034] specifies the service provider discovery information.

– Clause 8 of [ATIS 0800022] also specifies the service provider discovery information.

7.2 Service role information

A single organization may play various roles. Supplementary elements may be appended to service provider information or to other elements for identifying these roles and for finding service groupings.

Service role information is necessary for cases such as the following:

– When a network provider and a service provider are separate organizational entities as shown in Figure 6-1 of [ITU-T Y.1910];

– When SCP functions [ITU-T Y.1910] are provided by an entity other than the service provider or the network provider.

While Appendix I shows possible examples using such service role information, the details of service role information are for further study.

7.3 Encoding of service provider information

The format and encoding of the service provider information record in this clause are:

– Service provider information is encoded in XML [W3C XML].

– Service provider information can optionally be compressed by using Fast Infoset [ITU-T X.891], ZLIB including GZIP format [ETSI TS 102 472] or BiM [ISO/IEC 23001-1].

8 Service provider information delivery protocol(s)

The recommended transport mechanisms for the delivery of the descriptions of IPTV service providers over IP are as follows:

– HTTP version 1.1 [IETF RFC 2616] for "Service provider information" delivery over unicast (pull mode);

– HTTP over TLS [IETF RFC 2818] for "Service provider information" delivery over unicast with secure manner (pull mode);

– IGMP version 2 [IETF RFC 2236] for "Service provider information" delivery over IPv4 multicast (push mode);

– IGMP version 3 [IETF RFC 3376] for "Service provider information" delivery over IPv4 multicast (push mode);
– MLD version 2 [IETF RFC 3810] for "Service provider information" delivery over IPv6 multicast (push mode);
– FLUTE [ETSI TS 102 472] for "Service provider information" delivery over IPv4/IPv6 multicast ("push mode");
– DVBSTP [ETSI TS 102 034]: a light protocol specified by DVB, used for delivery over multicast (push mode);
– TR-069 [BBF TR-069]: CPE WAN Management Protocol v1.1, Issue 1, Amendment 2, 2007. Appendix V describes how TR-069 is to be used to acquire service provider information and specifies extensions to TR-135 [BBF TR-135] STB data model to store this kind of information.

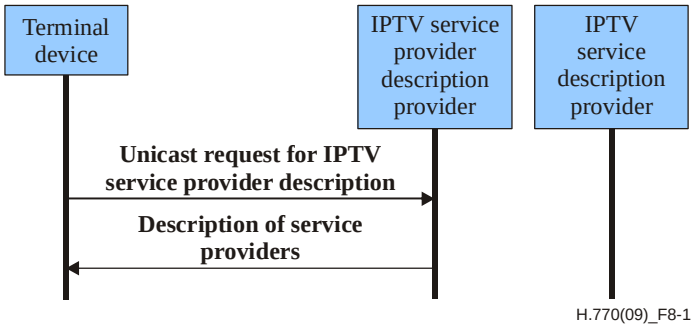


Figure 8-1 – Unicast request to get the description of the available IPTV service providers

In the case of Figure 8-1, the service provider description provider may answer with a set of metadata containing the description of the available service providers.

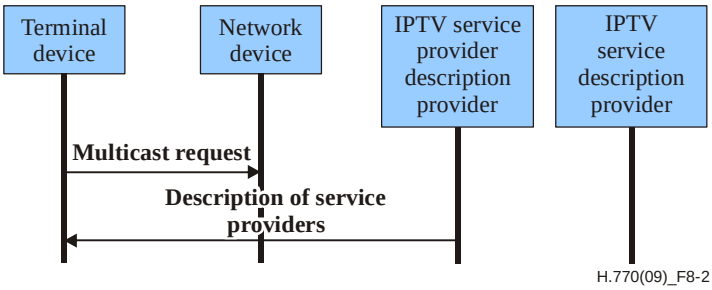


Figure 8-2 – Multicast request to receive the description of the available IPTV service providers

In the case of Figure 8-2, the service provider description provider periodically sends the set of metadata containing the description of the available service providers.

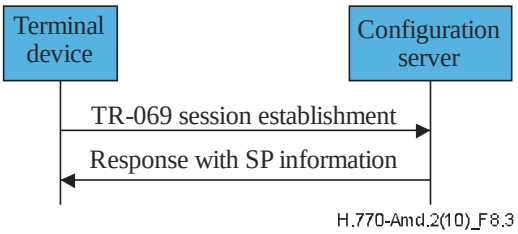


Figure 8-3 – Using TR-069 to receive the description of the available IPTV service providers

In the case of Figure 8-3, IPTV terminal devices acquire the set of metadata containing the description of the available service providers by using TR-069 protocol. Configuration server in this diagram is a component in the broadband network responsible for auto-configuration of the IPTV terminal devices.

9 Service discovery process

In the service provider information, the IPTV terminal device discovers all service providers available on the network.

If a specific service provider is already configured in the IPTV terminal device, the IPTV terminal device can proceed with a request to the service provider for the description of all services offered by this service provider.

If no specific service provider is already configured in the IPTV terminal device and if several service providers are available, the IPTV terminal device may display information about the available service providers extracted from the service provider information to allow the user to select one of them.

When the IPTV terminal device knows the service provider to which the end-user wants to connect, it can proceed with a request to the service provider for the description of all services offered by this service provider.

The access point for this request can be found in the service provider information.

10 Detailed service offer information

This clause specifies the elements and attributes which could be or must be included in the description of the services offered by a service provider.

A number of service types which could be offered by service providers have been identified and for each of them, metadata has been defined.

Here is the list of the specified service offers:

– linear TV discovery record,
– package (service collection) discovery record,
– content guide discovery record,
– service from other service providers discovery record,
– other services discovery record.

10.1 Linear TV discovery

The linear TV discovery record provides the necessary information to find available linear TV services.

With this record, linear TV delivered over MPEG-2 transport stream (TS) can have "service information (SI)" embedded. The SI obtains important information for the process of the service discovery, especially in traditional broadcasting services (e.g., used in up/down channel changing,

channel selection by channel numbers, or display of EPG). Information about individual services is acquired afterwards from the transport stream itself one by one through classical use of SI. When SI is embedded in TS, IPTV terminal devices need to connect to all services and parse all SI to build a service list [b-ETSI TS 102 542]. For details of the usage of TS with SI, see Appendix IV.

Table 10.1-1 lists the elements/attributes identified for the linear TV discovery record and Table 10.1-2 lists elements/attributes identified for the "linear TV service(s)" of Table 10.1-1.

Table 10.1-1 – Linear TV discovery record

Element/ attribute	Description	M/O/C	Example(s)
Record type	Type of this set of data.	M	Linear TV discovery record type
Service provider identifier	The unique identifier given to the service provider (e.g., an Internet DNS domain name, an URI, etc.).	M	itu-t.int<scheme>:// <authority>/
Record version	Version of this record. It is incremented with any change to this record.	M	1
Metadata server URL	URL for the metadata server of the current service (Note).	O	<scheme>://<server_name> [:<port>]/<path>
Portal URL	URL for the portal of the current service.	O	<scheme>://<server_name> [:<port>]/<path>
Purchase information URL	URL for the server that provides the purchasing information for this service. For security reasons, the scheme could be "https".	O	<scheme>://<server_name> [:<port>]/<path>
Linear TV service(s)	For detailed information on individual linear TV services, see Table 10.1-2.	M	–
NOTE – For example, metadata is assumed to be used when multi-vendors' IPTV terminal devices existed (e.g., migration of IPTV terminal devices). A request on the "Metadata server URL" shall return a record compliant with a schema that will be specified in a later revision of this Recommendation.			

Table 10.1-2 – Linear TV services elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
Service identifier	A unique name for the service within the service provider's domain.	M	Channel 1
Original network Id	Network Id of the originating delivery system. (Note 1)	O	0
Transport stream Id	Identification of the transport stream.	O	200
Service Id	Service identification within the TS. The service Id is the same as the program number in the corresponding program map table.	O	231

Table 10.1-2 – Linear TV services elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
Max bit rate	Maximum bit rates (in kbit/s) of the overall stream carrying the service.	O	4 000
Service location(s)	A number of linear TV service locations. At least one is required to be present. For a detailed description, see Table 10.1-3.	M	–
Audio coding	Details of the audio coding algorithms and purpose that the service may use.	O	Audio MPEG-1 Layer II
Video coding	Details of the video coding that may be used by the service.	O	Video ITU-T H.264 (AVC)
Service availability	It allows each service to have a list of "cells" (regions) with which the service is associated. By default, all the single services are available everywhere. There shall be at most one service availability element for each country code (See Table 10.1-5).	O	–
Streaming type	RTP or direct UDP streaming. By default, RTP streaming is assumed.	O	RTP
Multiplex mode	MPEG-2 TS or Time-stamped MPEG-2 TS. By default, MPEG-2 TS streaming is assumed. (Note 2)	O	MPEG-2 TS
NOTE 1 – Each linear TV service can be identified by the combination of original network Id, transport stream Id and service Id [ETSI TS 102 034]. NOTE 2 – For detail information of time-stamped MPEG-2 TS, see Appendix I of [ITU-T H.721].			

A service location is either a multicast or a unicast location. Table 10.1-3 lists the "service location" elements/attributes identified for service location(s) of Table 10.1-2.

Table 10.1-3 – Service location elements/attributes

Element/ attribute	Description (Note 1)	M/O/C	Example(s)
IP multicast address	IP multicast address at which the service may be accessed.	C (Note 2)	224.1.2.3
IP multicast port	IP multicast port at which the service may be accessed.	C (Note 2)	5 678
IP multicast source	IP multicast address of the source of the service.	C (Note 3)	224.10.102.13
Unicast URL	Unicast location to access the linear TV server.	C (Note 2)	<scheme>://<server_name> [:<port>]
NOTE 1 – When multiple service locations are included in this record, end-users can access one of them (e.g., one location is a main delivery site, and the others are proxy sites). NOTE 2 – Either multicast address and port or unicast URL is required, at least. NOTE 3 – Source address is mandatory when IPv6 multicast is deployed.			

Table 10.1-4 lists the forward error correction (FEC) elements/attributes which can be used together with multicast service location(s) in Table 10.1-2. For details of FEC, see [ITU-T H.701].

Table 10.1-4 – FEC elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
FEC base layer multicast address	IP multicast address for FEC base layer. If the IP multicast address is omitted, then the FEC flow is assumed to be on the same multicast address as the original data. For details of addressing, see Table 10.1-3.	M	–
FEC enhancement layer multicast address	IP multicast address for FEC enhancement layer. If the IP multicast address is omitted, then the FEC flow is assumed to be on the same multicast address as the original data. For details of addressing, see Table 10.1-3.	O	–
Maximum packet number in blocks	Maximum number of stream source packets that will occur between the first packet of a source block (which is included) and the last packet for that source block (source or repair).	O	8
Maximum FEC block duration	Maximum transmission duration of any FEC block (source and repair packets).	O	100
FEC specific information	FEC object transmission information for the FEC enhancement layer. This information contains the maximum source block length and the encoding symbol size. If FEC enhancement layer element is included, then this element is required to be included.	C (Note)	–
NOTE – This information is required when FEC enhancement layer is used.			

Table 10.1-5 lists the elements/attributes identified for the "service availability" of Table 10.1-2.

Table 10.1-5 – Service availability elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
Country code	Country for which the availability is being defined.	O	Switzerland
Availability	Flag to indicate whether the service is available in the country specified by "Country code". The default is true. When true, the service is available in the specified country with the exception of those regions identified by cells. When false, the service is not available in the specified country with the exception of those regions identified by cells.	O	False
Region codes	List of string identifiers representing geographical regions in the country identified by "Country code". The cells listed represent the exception to the value supplied by the flag, i.e., the negation of the "Availability" flag applies to any listed cells.	O	Geneva

Whereas a linear TV record can provide necessary information for linear TV discovery without SI in MPEG-2 TS, IPTV terminal devices can create a service list only with the received linear TV record. In this case, in order to provide information equivalent to SI, the following "additional linear TV discovery elements/attributes" should be used.

Table 10.1-6 lists additional linear TV discovery elements/attributes.

Table 10.1-6 – Additional linear TV discovery elements/attributes

Element/ Attribute	Description	M/O/C	Example(s)
Type of service	It shall be coded as per the relevant SI standards. Examples are linear TV service, digital radio sound service, mosaic service, data broadcast service, etc.	M	Linear TV
Priority SI source	Source of service information to give priority (XML record or SI) in case SI tables are present within TS. The default value is XML. (Note)	O	XML, SI, SI+XML
Service name	Service name for display in one or more languages.	O	Town scenery
Service description	Service description for potential display in one or more languages.	O	Video gallery of worldwide life style

Table 10.1-6 – Additional linear TV discovery elements/attributes

Element/ Attribute	Description	M/O/C	Example(s)
Content guide discovery record identifier(s)	Identifier(s) of the content guide discovery record(s) that carries the information on this service. If this element is present, it shall be used in preference to the service description.	O	Cgd.avd.0001
Preferred content guide discovery record	Property of being preferred content guide discovery record if there are multiple content guide discovery records in linear TV services.	O	True
Service genre(s)	One or more genre of the service (not individual programmes). For example, movie/drama channel or news/current affairs channel.	O	Sports, football/soccer
Announcement stream	Type of spoken announcements that are supported by the service (for example, emergency flash, road traffic flash, etc.). Furthermore, it informs about the transport method of the announcement and gives the necessary linkage information so that the announcement stream can be monitored.	O	–
Secondary service Id	Service replacement service Id which may be selected automatically by the IPTV terminal devices when the service being decoded fails.	O	itu-t.proxy.int
Mosaic information	Mosaic description element. It identifies the elementary cells of a mosaic service, groups different elementary cells to form logical cells, and establishes a link between the content of all or part of the logical cell and the corresponding service or package information.	O	–
NOTE – Both SI and XML record can be optionally used at the same time without priority.			

10.2 Package discovery record

The package discovery record provides a means for a collection of services to be marketed as, or grouped into, a single entity.

Table 10.2-1 lists the elements or attributes for this package discovery record.

Table 10.2-1 – Package discovery record

Element/ attribute	Description	M/O/C	Example(s)
Record type	Type of this set of data.	M	Package discovery record type
Service provider identifier	The unique identifier given to the service provider (e.g., an Internet DNS domain name, an URI, etc.).	M	itu-t.int <scheme>:// <authority>/
Record version	Version of this record. It is incremented with any change to this record.	M	1
Package identifier	Unique package identifier. This identifier is allocated by the service provider.	M	Pkg1011
Displayable	A Boolean value which indicates in combination with the package availability element, whether this package shall be presented to the user. The default value is true.	O	True
Package name	Package name for display in one or more languages.	O	AVD topics
Package description	Package description for display in one or more languages.	O	Hot technologies about audio, video and data
Content guide discovery record identifier	Identifier(s) of the content guide discovery record(s) that carries the information on this service. If this element is present, it shall be used in preference to the service description.	O	Cgd.avd.0001
Preferred content guide discovery record	If there are multiple content guide discovery records, this value indicates preferred content guide discovery record.	O	True
Package reference(s)	Identifiers of package(s) included in the current package. A package may include other package(s).	O	Pkg.2009.1012
Individual service(s)	List of services forming the package. For detail of service relevant elements, see Table 10.2-2.	M	–
Package availability	Package availability (support for regionalization). It allows each package to have a list of cells (regions) with which the package is associated. By default, the package is available everywhere. There shall be at most one Package availability element for each country code. Refer to service availability elements in Table 10.1-5.	O	–

Table 10.2-2 lists the elements/attributes identified for each "individual service" of Table 10.2-1.

A service may belong to more than one package. A service does not have to be part of any package.

Table 10.2-2 – Individual service elements/attributes

Element/ attribute	Description	M/O/C	Example(s)
Individual service provider identifier	Unique identifier for the service provider. If this is omitted, service provider identifier of Table 10.3-1 is used.	O	itu-t.avd.int
Service identifier	A unique name for the service within the service provider's domain	M	0001.0002.0003
Additional service description location	The URI of additional service description provided in the context of a package; this is not required to acquire a service.	O	<schema>://<server_name> [:<port>]/<path>
Logical channel number	The logical channel number of the service. (Note)	O	12
NOTE – The logical channel number provides a convenient way to select a service by assignment of a preferred number being different from a physical channel number.			

10.3 Content guide discovery record

Content guide in this clause refers to service navigation functionality for the end-users (e.g., ECG, BCG, IPG and EPG). The content guide discovery record provides a means to discover the locations of guides listing the content that is available, either live (e.g., through a linear TV offering) or via content on demand.

General aspects of metadata concerning the content guide are illustrated in [ITU-T H.750]. Details of the usage of elements and of attributes as the content guide are for further study.

NOTE – [b-ETSI TS 102 822-3-1] provides important information about content guide schemes. Besides ETSI, other standardization organizations carry out activities in the field of content guide standardization. See [b-ETSI TS 102 323] and [b-ATIS-0800020].

Several content guide discovery records can be grouped together if several guides are available.

Table 10.3-1 lists the elements/attributes identified for the content guide discovery record.

Table 10.3-1 – Content guide discovery record

Element/ attribute	Description	M/O/C	Example(s)
Record type	Type of this set of data.	M	Content guide discovery record type
Service provider identifier	The unique identifier given to the service provider (e.g., an Internet DNS domain name, an URI, etc.).	M	itu-t.int <scheme>://<authority>/
Record version	Version of this record. It is incremented with any change to this record.	O	1
Content guide discovery record identifier	The identifier of the content guide discovery record. It is allocated by the service provider.	M	Cgd.avd.0001

Table 10.3-1 – Content guide discovery record

Element/ attribute	Description	M/O/C	Example(s)
Content guide name	The name of this content guide for potential display. Several names are possible, each of them associated with a specific language.	O	Sports channel index
Content guide provider name	The name of the provider of this content guide for potential display. Several names are possible, each of them associated with a specific language.	O	World Sports News Corp
Content guide description	This is the description of this content guide for potential display. Several descriptions are possible, each of them associated with a specific language.	O	Fun sports: Football, tennis, ski, etc.
Content guide locator (Note)	Locator to access the broadband content guide. Several possibilities can be described (e.g., push mode, HTTP pull mode, SOAP [b-W3C SOAP] pull mode, etc.).	M	<scheme>://<server_name> [:<port>]/<path>
Content guide logo URI	Pointer to the logo of this content guide for potential display.	O	<scheme>://<server_name> [:<port>]/<path>
Content guide type	The content guide type. It indicates if the content guide relates to live programs, content on demand, both, or some other form of content.	O	Linear TV
Target service provider identifier	This is the identifier of the service provider whose content is described by this content guide.	O	Geneva entertainment channel
NOTE – A request on the "content guide locator" shall return a record compliant with a schema that will be specified in a later revision of this Recommendation.			

10.4 Service from other service providers record

A service provider can reference individual services or a complete offering provided by another service provider. Supplying its textual service identifier references a service. Supplying the service provider's identifier without a service list references an entire service provider's offering.

Elements and attributes for the "service from other service providers" record are listed in Table 10.4-1.

Table 10.4-1 – Service from other service providers record

Element/ Attribute	Description	M/O/C	Example(s)
Record type	Type of this set of data.	M	Service from other service provider record type
Service provider identifier	The unique identifier given to the service provider (e.g., an Internet DNS domain name, an URI, etc.).	M	itu-t.int <scheme>://<authority>/
Record version	Version of this record. It is incremented with any change to this record.	C (Note)	1
Referenced service provider identifier	The unique identifier given to the referenced service provider (e.g., an Internet DNS domain name, an URI, etc.).	O	itu-t.int <scheme>://<authority>/
Service identifier(s)	A unique identifier for the service within the referenced service provider's domain for each service from the referenced provider. Not required if the entire set of offerings from the service provider is referenced.	O	0003.0004.0005
NOTE – Record version is mandatory when the record is provided on request (i.e., "pull mode") and is optional when the record is multicast (i.e., "push mode").			

10.5 Other services discovery record

In addition to IPTV services (e.g., linear TV, content on demand), a variety of other services (e.g., short message service (SMS), e-mail, e-newspaper) may be offered.

The discovery record for other services includes at least the following core general information elements or attributes listed in Table 10.5-1.

Additional specific elements might be needed for each individual service type.

Table 10.5-1 – Other services discovery record

Element/ attribute	Description	M/O/C	Example(s)
Record type	Type of this set of data: SMS, e-mail, chat, e-newspaper, etc.	M	Chat discovery record type
Service provider identifier	The unique identifier given to the service provider (e.g., an Internet DNS domain name, an URI, etc.).	M	itu-t.int <scheme>://<authority>/
Record version	Version of this record. It is incremented with any change to this record.	O	1
Service name	Name of specific service specified by offer type; brand name provided by the service provider.	O	Geneva AVD chat

Table 10.5-1 – Other services discovery record

Element/ attribute	Description	M/O/C	Example(s)
Service identifier	It identifies an instance of the service allowing the service provider to provide multiple versions of the application or service.	M	srv.2.4.5
Service description	Textual description of the service for potential display. Several textual descriptions are possible, each of them in a specific language.	O	Chat with worldwide authorities
Service locator	Location (e.g., URI or IP addresses) to get access to the service (e.g., URI or IP addresses).	M	itu-t.int <scheme>://<authority>/

10.6 Encoding of detailed service offer information

Format and encoding of detailed service offers information in this clause are as follows:

– Detailed service offer information is encoded in XML [W3C XML].

– Detailed service offer information can optionally use Fast Infoset [ITU-T X.891], ZLIB including GZIP format [ETSI TS 102 472] or BiM [ISO/IEC 23001-1].

11 Detailed service offer information delivery protocol

The recommended transport mechanisms for the delivery of the descriptions of IPTV services offered by an IPTV service provider are:

– HTTP 1.1 [IETF RFC 2616] for "Detailed Service Offer" delivery over unicast (pull mode);

– HTTP over TLS;

– IGMP version 2 [IETF RFC 2236] for "Detailed Service Offer" delivery over IPv4 multicast (push mode);

– IGMP version 3 [IETF RFC 3376] for "Detailed Service Offer" delivery over IPv4 multicast (push mode);

– MLD version 2 [IETF RFC 3810] for "Detailed Service Offer" delivery over IPv6 multicast (push mode);

– DVBSTP [ETSI TS 102 034]: a light protocol specified by DVB, used for delivery over multicast (push mode);

– FLUTE [ETSI TS 102 472] for "Detailed Service Offer" delivery over IPv4/IPv6 multicast (push mode);

– TR-069 [BBF TR-069]: CPE WAN Management Protocol v1.1, Issue 1, Amendment 2, 2007. Appendix V describes how TR-069 is to be used to acquire detailed service offer information and specifies extensions to TR-135 [BBF TR-135] STB data model to store this kind of information.

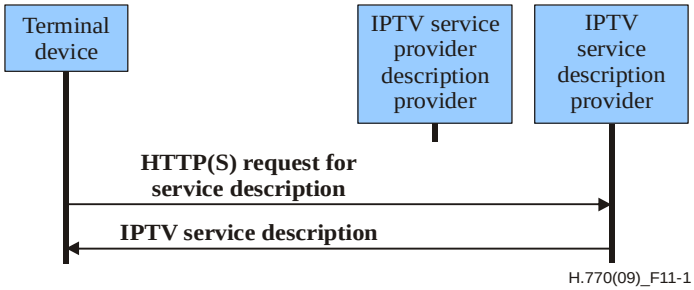


Figure 11-1 – HTTP or HTTP over TLS request for description of the IPTV services offered by a service provider

When using HTTP or HTTP over TLS, the service description provider may answer with a set of metadata containing the description of the available services.

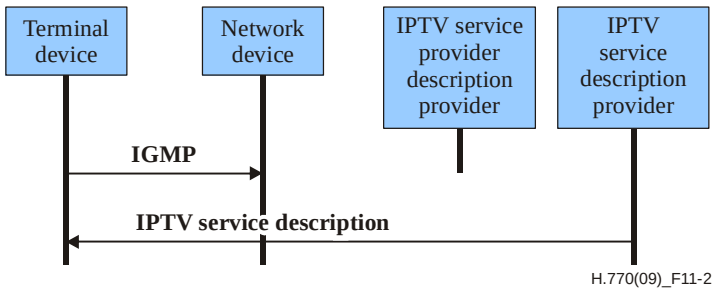


Figure 11-2 – IGMP or MLD join request to receive the description of the IPTV services offered by a service provider

For multicast, the service provider description provider periodically sends the set of metadata containing the description of the available services.

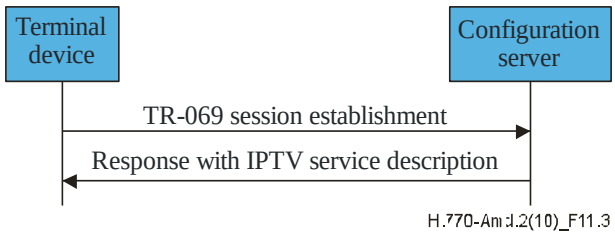


Figure 11-3 – Using TR-069 to receive the description of the IPTV services

In the case of Figure 11-3, IPTV terminal devices acquire the set of metadata containing the description of the available IPTV services by using TR-069 protocol.

12 Service selection process

By default, the IPTV terminal device may tune directly to the last linear TV channel watched in the past or to a preconfigured TV channel.

However, through the "detailed service offer" information and any referred guide, the IPTV terminal device may display the IPTV services offered by the selected service provider to allow the end-user to select one of them. Figure 12-1 is an example of service selection through a service guide description.

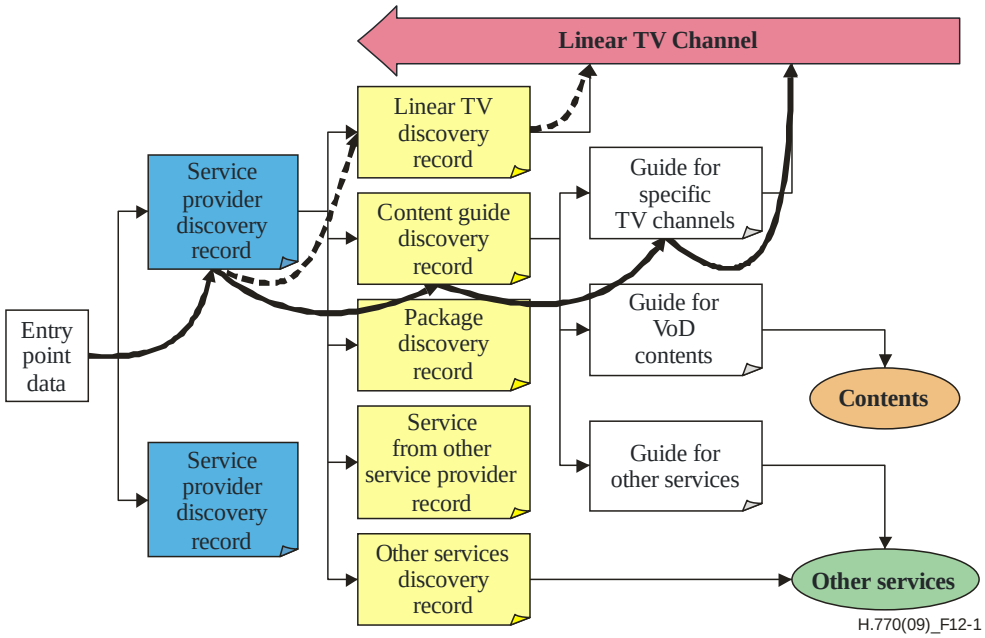


Figure 12-1 – Example of live channel selection through a service guide

In the example above, the IPTV terminal device proceeds as follows (along the bold line):

1) Acquisition of the "Service Provider Information" related to two service providers ("service provider discovery record" boxes).
2) Acquisition of the detailed service offer information of a certain service provider (content guide discovery, package discovery, service from other service provider discovery).
3) Access to TV content guide service (see clause 10.3).
4) Navigation through the guide.
5) Selection of a TV channel.
6) Tuning to the selected TV channel.

Another solution for the IPTV terminal device was to make use of the "linear TV discovery" description and to select from it a linear TV channel (along the dotted bold line).

For content selection and acquisition, with the exception of linear TV services, the IPTV terminal device proceeds as follows (as illustrated in Figure 12-2):

1) Acquisition of the "Service Provider Information" related to two service providers ("service provider discovery record" boxes).
2) Acquisition of the detailed service offer information of certain service provider (content guide discovery, package discovery, service from other service provider discovery, other services discovery).
3) Access to VoD guide service.
4) Navigation through the guide.
5) Selection of a content.
6) Request of the content.

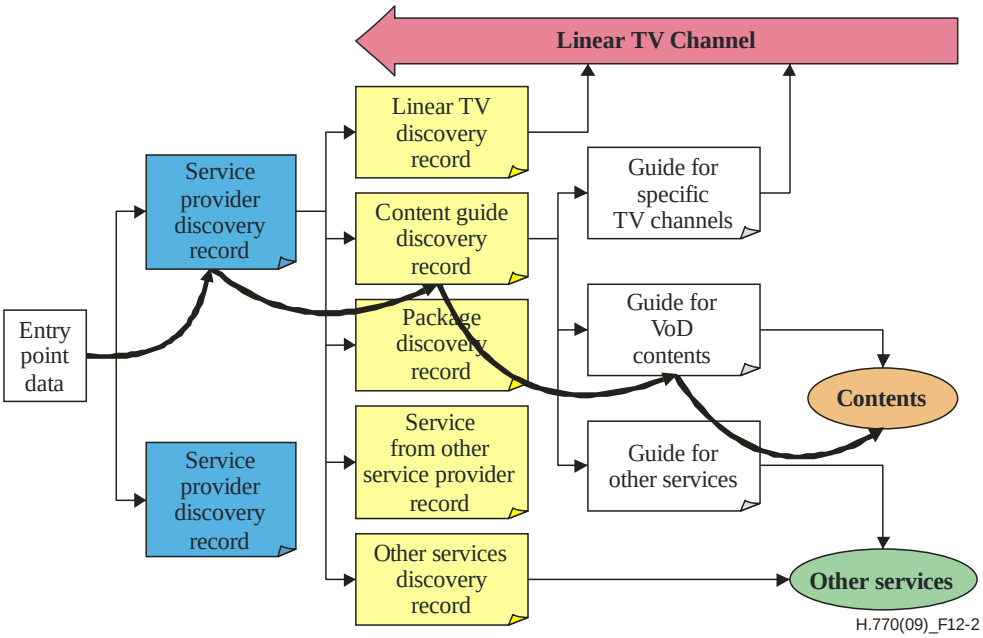


Figure 12-2 – Example of content selection through a VoD Guide

Annex A

Service discovery profile

(This annex forms an integral part of this Recommendation.)

The profiles in Tables A.1 and A.2 concern linear TV services. Profiles related to other IPTV services are for further study.

NOTE – These profiles do not prohibit being used in conjunction with SI tables at the same time.

Table A.1 – Profile A for linear TV

Items		Specification
Service provider discovery	Elements/attributes	Service provider discovery information (see clause 7)
	Delivery protocols	– HTTP 1.1 or HTTP over TLS as pull mode – DVBSTP as push mode
Service discovery	Elements/attributes	– Linear TV discovery (see clause 10.1) – Package discovery record (see clause 10.2) – Content guide discovery record (see clause 10.3)
	Delivery protocols	– HTTP or HTTP over TLS as pull mode – DVBSTP as push mode
NOTE – Pull mode and push mode are not mandatory simultaneously.		

Table A.2 – Profile B for linear TV

Items		Specification
Service provider discovery	Elements/attributes	Service provider discovery information (see clause 7)
	Delivery protocols	– HTTP 1.1 or HTTP over TLS as pull mode – FLUTE as push mode
Service discovery	Elements/attributes	– Linear TV discovery (see clause 10.1) – Package discovery record (see clause 10.2) – Content guide discovery record (see clause 10.3)
	Delivery protocols	– HTTP or HTTP over TLS as pull mode – FLUTE as push mode
NOTE – Pull mode and push mode are not mandatory simultaneously.		

Appendix I

Multiple service platforms

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

This appendix presents two use-cases to illustrate the usage of service role information from clause 7.2.

I.1 Introduction to service role information

A single organization may play various roles. Supplementary elements described in Table I.1-1 may be appended to service provider information or to other elements for identifying these roles and for finding service groupings.

Possible roles of IPTV service related entities are:

– Network provider: providing access network infrastructure for IPTV services.

– Service platform: facilitating IPTV services by providing equipment and services.

– SCP provider: providing service providers with SCP functionalities such as authentication, digital rights management (DRM) and conditional access system (CAS) functions.

– Service provider: providing linear TV, VoD, re-transmission, web services, etc., through "service platform".

Table I.1-1 – Service role information elements/attributes

Element name	Description	M/O/C	Example(s)
Network provider identifier	Information regarding the network provider.	O	Network provider name, unique ID
Service platform identifier	Information regarding the organizational entity providing equipment and IPTV services.	O	Platform provider name, unique ID
SCP provider identifier	Information regarding SCP systems.	O	SCP provider name, unique ID
NOTE 1 – The above elements assist in identifying service providers. The information can be easily handled by existing mechanisms such as those of [b-ETSI TS 183 063] and [b-ATIS-0800017]. Although there is no metadata format, when the service discovery information is transmitted using DVBSTP, the service provider identifier can be inserted into the multicast UDP packet header. NOTE 2 – Network_id may be used as the service platform identifier if SI is transmitted (see Appendix III).			

I.2 Multiple service platforms

In this use-case, multiple service platforms provide IPTV services produced by one service provider. The following conditions are assumed:

– The service provider is a type of "Complementary service provider" which is visible to the end-user (see [b-ITU-T M.3050.4]).

– The end-user can subscribe to any service platform.

– The service provider creates the service discovery information.

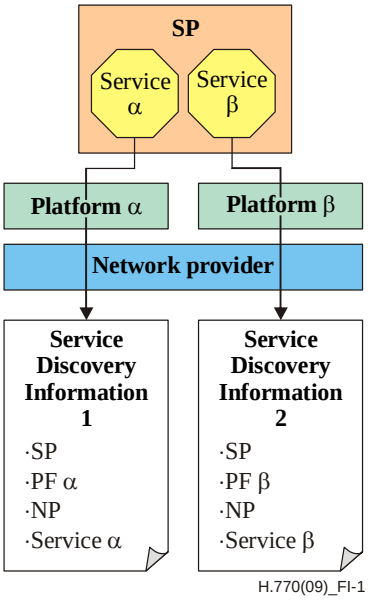


Figure I.1 – The case of providing different services from one service provider

NOTE – The exact format of service role information elements/attributes is for further study. These may be added to the "Service discovery information" (as indicated in Figure I.1), to the "Service provider discovery information" or distributed among them.

In this use-case, additional service provider information, such as network provider's service platform described in Table I.1-1, assists in the identification of available services. Arrow lines in Figure I.1 indicate the flows of services relevant to respective service discovery information. If an end-user subscribes only to "Service Platform α", service discovery information 1 is selected by the service platform identifier.

I.3 Service mobility

In this use-case, service mobility is possible through interworking between two different network providers. It is assumed that one service provider provides services through different service platforms. "Network Provider a" is normally accessed as the permanent home-network, and "Network Provider b" is temporarily used as a visited network.

When an end-user accesses the visited network, the IPTV terminal device checks the item concerning network provider identifier information and changes its configuration to the new network accordingly. Moreover, when an end-user accesses a visited network, the IPTV terminal device can properly select the relevant service discovery information with the service platform identifier.

In Figure I.2, "Network Provider b" is a visited network. The IPTV terminal has to select "Service Discovery Information 2" or "Service Discovery Information 3". Since the end-user subscribes to "Platform α", the IPTV terminal device would select "Service Discovery Information 2".

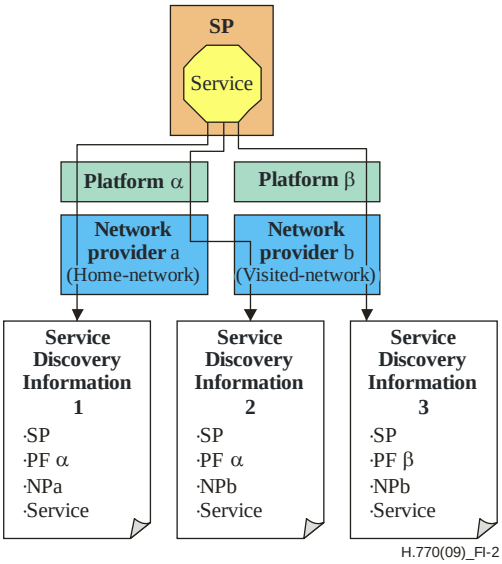


Figure I.2 – The case of service mobility

I.4 An example of service discovery processes

This clause illustrates the processes of service discovery for a case with multiple service entities. Figure I.3 shows a simple case to explain the processes. There are two network providers and two service providers; moreover, service provider S connects to two network providers. In this figure, content provider is the entity that owns or is licensed to sell content or content assets [ITU-T Y.1910], but this entity does not concern the service discovery processes.

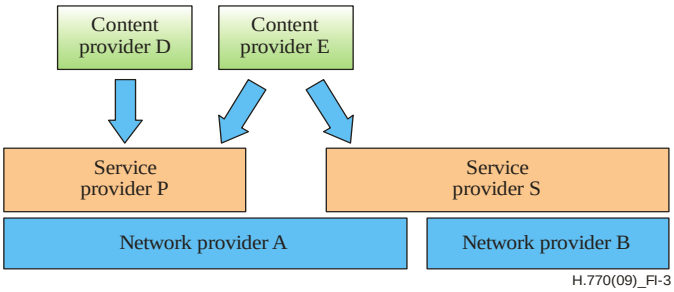


Figure I.3 – Basic IPTV service provider model

The details of the respective service discovery processes shown in Figure I.4 are as follows:

1) The IPTV terminal device, at network connection set-up on one of the network providers (A or B), gets one or more entry points from the network provider. There may be one entry point for each service provider or an entry point for a common service provider description repository.

2) From the left-side entry point(s), the terminal device gets the description of the IPTV service providers available on that network provider with a summary of the services offered by these service providers and entry points for detailed service offers.

3) From the third entry point for detailed service offer, the terminal device gets a detailed description of each service and can select one of them (e.g., Channel A).

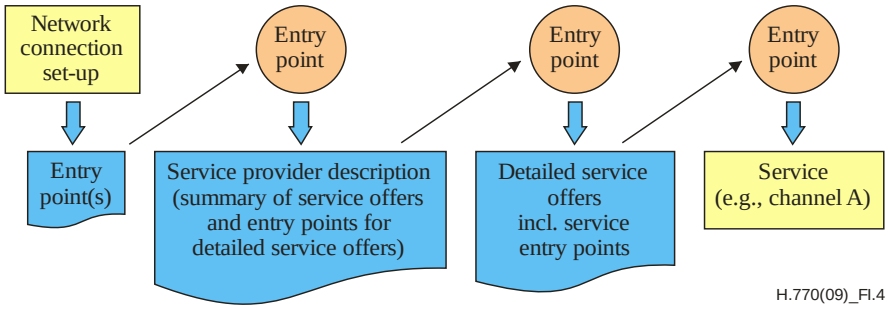


Figure I.4 – ITU-T H.770 service discovery process

Appendix II

Requirements in other standards organizations

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

In this part, requirement levels are compared to those of major standards organizations.

Mandatory elements and attributes are shown as "M", optional ones are shown as "O", conditional requirements are shown as "C" and "–" indicates that there are no corresponding elements/attributes.

Element and attribute names are the same as in the main text. Exact names of elements and attributes are different between standards; however, the corresponding elements and attributes are compared based on their semantics.

II.1 Service provider discovery information

Table II.1-1 – Service provider information record

Element/Attribute	DVB	ATIS-IIF	ITU-T
Record type	M	M	M
Record version	M	O	M
Individual service provider information	M	M	M

Table II.1-2 – Individual service provider information elements/attributes

Element/Attribute	DVB	ATIS-IIF	ITU-T
Service provider identifier	M (Note)	O	M
Individual service provider information version	M	O	M
Service provider logo URI	O	O	O
Service provider name	M	O	O
Service provider description	O	O	O
Web portal URL	–	O	O
Service offer summary(s)	M	–	M
NOTE – Uses DNS host name.			

Table II.1-3 – Service offer summary elements/attributes

Element/Attribute	DVB-IP	ATIS-IIF	ITU-T
Push address	M	M (Note 1)	C (Note 2)
Pull URL	O	M (Note 1)	C (Note 2)
Offer type	O	–	O
Segment identifier and version	O	–	O
NOTE 1 – One of locator information is required. NOTE 2 – One of them is required to be presented.			

II.2 Detailed service offer information

Table II.2-1 – Linear TV discovery record

Element/Attribute	DVB	ATIS	ITU-T
Record type	M	M	M
Service provider identifier	M (Note 1)	M	M
Record version	C (Note 2)	M	M
Metadata server URL	O	O	O
Portal URL	O	O	O
Purchase information URL	–	– (Note 3)	O
Linear TV service(s)	M	M	M
NOTE 1 – Uses DNS host name. NOTE 2 – Record version is mandatory when the record is provided on request (i.e., pull mode) and is optional when the record is multicast (i.e., push mode). NOTE 3 – Purchase information (e.g., rights owners, publishers) is treated as EPG metadata in ATIS. Requirement level in ATIS is optional [b-ATIS-0800020].			

Table II.2-2 – Linear TV services elements/attributes

Element/Attribute	DVB	ATIS	ITU-T
Service identifier	M (Note 1)	M	M
Original network Id	M	O	O
Transport stream Id	M	O	O
Service Id	M	O	O
Max bit rate	O	– (Note 2)	O
Service location(s)	M	M	M
Audio coding	O	O	O
Video coding	O	O	O
Service availability	O	–	O
Streaming type	O	–	O
Multiplex mode	–	– (Note 3)	O
NOTE 1 – Uses DNS host name. NOTE 2 – ATIS requires rate type such as constant bit rate (CBR), variable bit rate (VBR). NOTE 3 – ATIS handles IP or RF as content source.			

Table II.2-3 – Service location elements/attributes

Element/Attribute	DVB	ATIS	ITU-T
IP multicast address	M	M	M
IP multicast port	M	M	M
IP multicast source	O (Note)	O (Note)	O (Note)
Unicast URL	O	–	–
NOTE – Source address is mandatory when IPv6 multicast is deployed.			

Table II.2-4 – FEC elements/attributes

Element/Attribute	DVB	ATIS	ITU-T
FEC base layer multicast address	M (Note 1)	M	M
FEC enhancement layer multicast address	O (Note 1)	O	O
Maximum packet number in blocks	O	M	O
Maximum FEC block duration	O	M	O
FEC specific information	C (Note 2)	C (Note 2)	C (Note 2)
NOTE 1 – IP multicast port is mandatory for FEC. IP multicast and IP multicast source are optional. NOTE 2 – This information is required when FEC enhancement layer is used.			

Table II.2-5 – Service availability elements/attributes

Element/Attribute	DVB	ATIS	ITU-T
Country code	M	–	O
Availability	O	–	O
Region codes	O	–	O

Table II.2-6 – Additional linear TV discovery elements/attributes

Element/Attribute	DVB	ATIS	ITU-T
Type of service	M	M	M
Priority SI source	O	–	O
Service name	M	O (Note)	O
Service description	O	O (Note)	O
Content guide discovery record identifier(s)	O	–	O
Preferred content guide discovery record	O	O (Note)	O
Service genre(s)	O	O (Note)	O

Table II.2-6 – Additional linear TV discovery elements/attributes

Element/Attribute	DVB	ATIS	ITU-T
Announcement stream	O	–	O
Secondary service Id	O	–	O
Mosaic information	O	–	O
NOTE – Provided by EPG metadata [b-ATIS-0800020].			

Table II.3-1 – Package discovery record

Element/Attribute	DVB	ATIS	ITU-T
Record type	M	M (Note 1)	M
Service provider identifier	M (Note 2)	M (Note 1)	M
Record version	C (Note 3)	M (Note 1)	M
Package identifier	M	M (Note 1)	M
Displayable	O	–	O
Package name	M	–	O
Package description	O	M (Note 1)	O
Content guide discovery record identifier	O	–	O
Preferred content guide discovery record	O	–	O
Package reference(s)	O	–	O
Individual service(s) (Note 4)	M	M (Note 1)	M
Package availability	O	–	O
NOTE 1 – ATIS handles information regarding linear TV services as "Virtual Channel" related metadata. NOTE 2 – Uses DNS domain name. NOTE 3 – Record version is mandatory when the record is provided on request (i.e., "pull mode") and is optional when the record is multicast (i.e., "push mode"). NOTE 4 – At least one individual service element is required.			

Table II.3-2 – Individual service elements/attributes

Element name	DVB	ATIS	ITU-T
Individual service provider identifier	O	O (Note 1)	O
Service identifier	M	M	M
Additional service description	O	O (Note 2)	O
Logical channel number	O	M	O
NOTE 1 – ATIS can handle "virtual channel" related metadata as the equivalent identifiers [ATIS-0800022]. NOTE 2 – Provided by EPG metadata [b-ATIS-0800020].			

Table II.4-1 – Content guide discovery record

Element/Attribute	DVB	ATIS	ITU-T
Record type	M	M	M
Service provider identifier	M (Note 1)	O	M
Record version	C (Note 2)	O	O
Content guide discovery record identifier	M	–	M
Content guide name	M	–	O
Content guide provider name	O	M	O
Content guide description	O	O	O
Content guide locator	M	M	M
Content guide logo URI	O	O	O
Content guide type	O	–	O
Target service provider identifier	O	O	O
NOTE 1 – Uses DNS domain name. NOTE 2 – Record version is mandatory when the record is provided on request (i.e., "pull mode") and is optional when the record is multicast (i.e., "push mode").			

Table II.5-1 – Service from other service provider's record

Element/Attribute	DVB	ATIS	ITU-T
Record type	M	–	M
Service provider identifier	M (Note 1)	–	M
Record version	C (Note 2)	–	C (Note 2)
Referenced service provider identifier	–	–	O
Service identifier(s)	–	–	O
NOTE 1 – Uses DNS domain name. NOTE 2 – Record version is mandatory when the record is provided on request (i.e., "pull mode") and is optional when the record is multicast (i.e., "push mode").			

Table II.6-1 – Other service discovery record

Element/Attribute	DVB	ATIS	ITU-T
Record type	M	–	M
Service provider identifier	M (Note 1)	–	M
Record version	O (Note 2)	–	O
Service name	M	–	O
Service identifier	O	–	M
Service description	O	–	O
Service locator	M	–	M
NOTE 1 – Uses DNS domain name. NOTE 2 – Record version is mandatory when the record is provided on request (i.e., "pull mode") and is optional when the record is multicast (i.e., "push mode").			

Appendix III

The usage of TS with service discovery information

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

III.1 Study on the SI tables

Service information (SI) consists of information tables defined by each standard. In order to compare the tables, it is convenient to illustrate the terms and identifiers defined by DVB-SI ([ETSI EN 300 468]) and ARIB-SI ([b-ARIB B10]):

– network: collection of MPEG-2 transport stream (TS) multiplexes transmitted on a single delivery system.

– original_network_id: unique identifier of a delivery system (e.g., specific cable network, satellite network and terrestrial network).

– network_id: unique identifier of a current delivery system.

– service: sequence of programmes under the control of a broadcaster, which can be broadcast as part of a schedule.

– service_id: unique identifier of a service within a TS (i.e., channel).

– transport_stream_id: unique identifier of a TS within an original network.

– event_id: unique identifier of a programme within a service.

ATSC-PSIP ([b-ATSC A/65]) uses the idea of the following virtual channel:

– virtual channel: A virtual channel is a designation, usually a number, which is recognized by the end-user as a single entity that will provide access to a set of one or more digital elementary streams. It is called "virtual" because its identification (name and number) may be defined independently from its physical location.

– source_id: unique identifier for a virtual channel, almost the same as service_id.

Figure III.1 shows the image of entities carried over a delivery system using each identifier mentioned above.

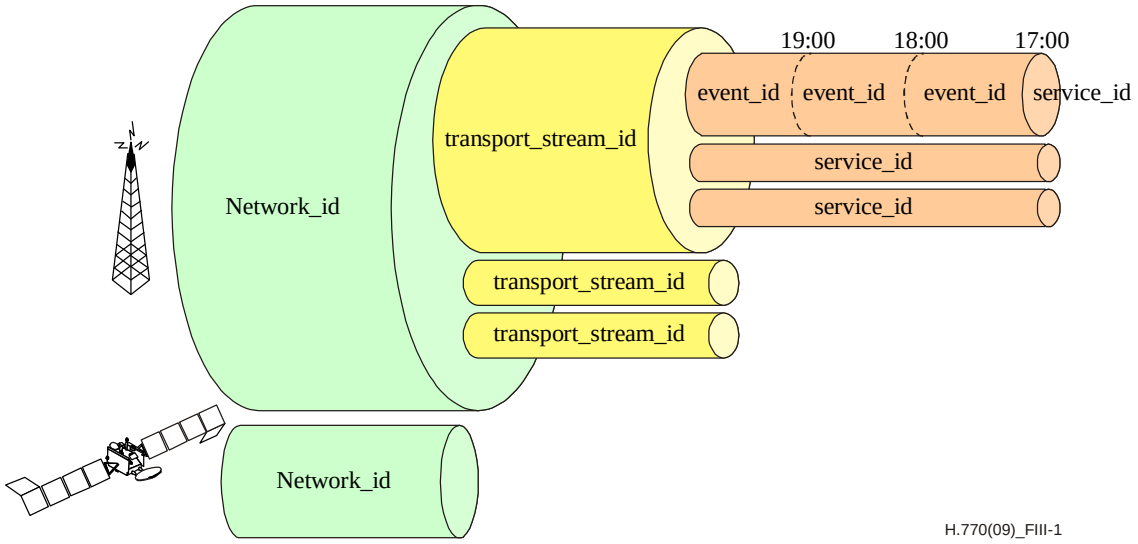


Figure III.1 – Network identifiers

DVB-SI/ARIB-SI usually specifies services uniquely by using a triplet of original_network_id, transport_stream_id and service _id.

Table III.1-1 shows the usage of the main tables of service information according to the different standards. Details of the tables (e.g., key elements/attributes, relationship among tables) and the usage of the tables are defined by each respective standards organization, except for PAT and PMT which are defined by [ITU-T H.222.0]. For example, ARIB originates broadcast information table (BIT) as a container of broadcaster information.

Table III.1-2 shows, in a simplistic way, the roles and characteristics of SI tables. For the details of SI tables (mainly original descriptors), see the relevant standard.

Table III.1-1 – Comparison of SI tables used in digital terrestrial (Note 1)

<table>
<tr><th></th><th>DVB-SI</th><th>ARIB-SI</th><th>ATSC-PSIP</th></tr>
<tr><td rowspan="2">ITU-T H.222.0 | ISO/IEC 13818-1</td><td colspan="3">PAT</td></tr>
<tr><td colspan="3">PMT</td></tr>
<tr><td rowspan="3">Individual definition</td><td colspan="2">NIT, SDT, BAT (Note 2)</td><td>MGT, VCT</td></tr>
<tr><td colspan="2">EIT (Note 2)</td><td>EIT, ETT</td></tr>
<tr><td>–</td><td>BIT</td><td>–</td></tr>
<tr><td colspan="4">NOTE 1 – This table omits some SI tables regarding system time, rights control and parental rating.
NOTE 2 – Exact descriptors contained in SI tables are different between DVB and ARIB.</td></tr>
</table>

Table III.1-2 – SI tables defined by standards development organizations

Table name		Information conveyed	Typical table identifiers (Notes 1, 2)	Looped identifier/ descriptor (Notes 1, 2)
Abbr.	Full name			
PAT	Program association table	Locations (the Packet identifier (PID)) of corresponding PMT, NIT	TS_id	Program number and program map table PID
PMT	Program map table	Locations of streams, program clock reference	program_number, PCR_ID	PID values for components of one or more programs
NIT	Network information table	TS and its transmitting path	network_id	original_network_id, TS_id
SDT	Service description table	Programmed channel as services within a TS	original_network_id, TS_id,	service_id, channel name
EIT	Event information table	TV programs within a programmed channel	original_network_id, TS_id, service_id	event_id, program name/description, broadcasting date and time
BAT	Bouquet association table	A set of programmed channels	bouquet_id	original_network_id, TS_id, bouquet name, service list
BIT	Broadcaster information table	SI transmission parameter of each broadcaster unit.	original_network_id	Broadcaster identifier/name, circulation periods of tables

Table III.1-2 – SI tables defined by standards development organizations

Table name		Information conveyed	Typical table identifiers (Notes 1, 2)	Looped identifier/ descriptor (Notes 1, 2)
Abbr.	Full name			
MGT	Master guide table	Top level of PSIP tables. Identifies what PSIP tables are in transport stream	Table_id	PID values for tables, table type
VCT	Virtual channel table	Content within a TS, its number as virtual channel	TS_id	Assigned_TS_id, Source_id, channel number
ETT	Extended text table	Detailed description of virtual channels and programs	ETT_table_id_extention	Text messages
NOTE 1 – Names of identifiers and descriptors are modified in this Recommendation. NOTE 2 – Looped identifier/descriptor are defined repeatedly in a table.				

III.2 Classification of TS with SI

Well-known "TS-Full SI" and "TS-Optional SI" defined by DVB are as follows:

– TS-Full SI [ETSI TS 102 034]: A transport stream with embedded service information (SI) as defined by broadcasting standards organizations (e.g., ARIB, ATSC and DVB).

– TS-Optional SI [ETSI TS 102 034]: A transport stream with MPEG PSI (PAT and PMT tables) as defined by ISO/IEC; all other MPEG-2 and other tables are optional.

These definitions are slightly modified for this Recommendation. Based on the definitions, TS-Optional SI includes TS-Full SI (i.e., TS-Full SI is a specific case of TS-Optional SI).

Linear TV services delivered over MPEG-2 transport stream (TS) can have "service information (SI)" embedded. The SI obtains important information for the process of service discovery, especially in traditional broadcasting services (e.g., used in up/down channel changing, channel selection by channel numbers, or display of EPG). Information on individual services is afterwards acquired from the transport stream itself, one by one, through classical use of SI. When SI is embedded in TS, IPTV terminal devices need to connect all services and parse all SI to build a service list (see [b-ETSI TS 102 542]).

"TS-Full SI" is compliant with the DVB-SI, ARIB-SI and ATSC-PSIP specifications (with all the SI/PSIP tables), but with a reduced/customized size, carried over IP, just as in retransmission of broadcast channel captured from satellite or terrestrial broadcast.

"TS-optional SI" is intended for the situation where a service provider wants to present its services, but cannot afford or does not want to use bandwidth for usual service description information ([ETSI TS 102 034]).

Concrete information contained in TS-Full SI (i.e., SI tables and their descriptors) is different for each standards development organization. For example, TS-Full SI defined by DVB which does not include NIT may be treated as TS-Optional SI in ARIB.

III.3 Variation of the usage of service discovery information

TS-Optional SI allows selecting and using SI tables within a transport stream as mentioned above. The following table shows the case of combination of service discovery information records. The detail of service information may be different for each country because of the details of their specifications. Case 1 may comprise DVB's TS-Full SI ([b-ETSI TS 102 542]).

Table III.3-1 – Variation of the TS with service discovery information

Information	SI	Case 1	Case 2	Case 3
Service provider	NIT	Service provider discovery records	NIT plus service provider discovery records	Service provider discovery records
Service description	SDT (Note 1)	SDT (Note 1)	SDT (Note 1)	Linear TV discovery records
Service location	NIT	Linear TV discovery records	NIT	Linear TV discovery records
Program schedule	EIT (Note 2)	EIT (Note 2)	EIT (Note 2)	Content guide discovery record (Note 4)
Package	BAT (Note 3)	BAT (Note 3)	Package discovery records	Package discovery records
Logical (virtual) channel	(VCT)	(VCT)	Package discovery records	Package discovery records
NOTE 1 – In case of ATSC, SDT corresponds to MGT plus EIT. NOTE 2 – In case of ATSC, EIT corresponds to MGT plus EIT. NOTE 3 – In case of ATSC, BAT corresponds to VCTs. NOTE 4 – Content guide discovery record supports discovery of a content guide which includes schedule information. The details of the content guide itself is for further study.				

Appendix IV

Alternative methods for entry point handling

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

Alternative methods for delivery and handling of entry data are as follows [b-ATIS-0800017], [b-ETSI TS 183 063]:

– Preconfigured methods

  • IPTV terminal devices may be preconfigured or manually configured with service discovery information.

– DHCP-based methods

  • DHCP [b-IETF RFC 2131] container option can deliver entry point data information when the IPTV terminal device acquires network information, such as its own IP address, from a DHCP server.

  NOTE 1 – There is substantial variation in the usage of container option and details of these have not been agreed by IETF.

  • Download methods (also known as pull mode).

  • IPTV terminal devices may download information using the unicast-based procedure such as trivial file transfer protocol (TFTP) [b-IETF RFC 1350], HTTP.

– TR-069 protocol-based method

  • Remote management system can provide addressing information of service providers with the TR-069 protocol ([BBF TR-069]).

– DNS service records (SRV)-based method

  • The result of DNS SRV [b-IETF RFC 2782] lookup can provide available IPTV service servers within the specified domain name.

  NOTE 2 – This method is often used when a session initiation protocol (SIP) server finds the locations of services as FQDN.

Appendix V

Service discovery using TR-069

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

V.1 Service discovery profile for TR-069

The profiles in Table V.1 concern service discovery in IPTV services by using TR-069 specifications [BBF TR-069].

Table V.1 – Profile for TR-069

Items		Specification
Service provider discovery	Elements/attributes	Service provider discovery information (see clause 7)
	Delivery protocols	TR-069
Service discovery	Elements/attributes	Linear TV discovery (see clause 10.1) Package discovery record (see clause 10.2) Content guide discovery record (see clause 10.3)
	Delivery protocols	TR-069

V.2 Service provider discovery using TR-069

V.2.1 Introduction

When after the network attachment, the search for entry points for IPTV service providers delivers the location of a network provider configuration server, the dialogue between the configuration server and the configuration client in the IPTV terminal device allows to configure in the "STBService" object (defined in [BBF TR-135]) either a list of entry points to get service provider information or directly the service information.

Entry points are either:

– Multicast address to get service provider information in push mode (IGMP, MLD, etc.).

– Unicast address to get service provider information in pull mode (HTTP, etc.).

– Unicast address to get service provider information using TR-069.

If entry points are available, the IPTV terminal device will acquire the service provider information using these entry points using the corresponding acquisition methods (pull or push modes).

An extension of TR-135 is defined as follows to store the service provider information as specified in clause 7 (Service provider information).

V.2.2 TR-135 extension for service provider discovery

The "STBService" object structure specified in TR-135 is represented in Figure V.1.

The TR-135 component "FrontEnd.IP" is extended by the addition of a new parameter "service discovery" as shown in Figure V.2.

The parameters in Table V.2 are added for service provider discovery.

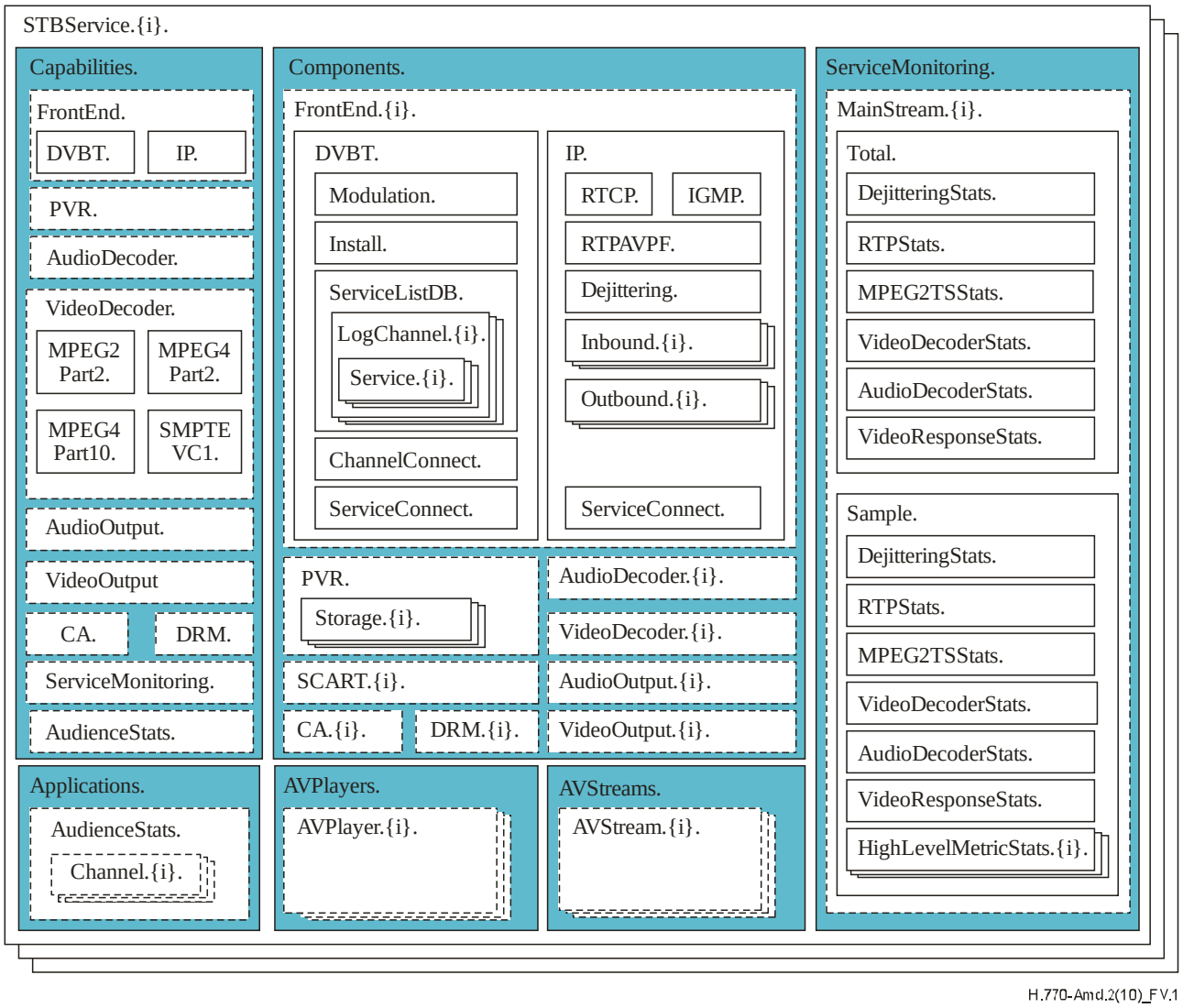


Figure V.1 – TR-135 STBService object structure

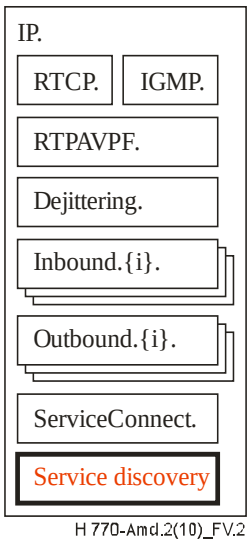


Figure V.2 – TR-135 Extension of FrontEnd.IP object structure

Table V.2 – Element/attributes for service provider discovery

Name	Type	Write	Description	Default
.STBService.{i}. Components.FrontEnd.{i}. IP.ServiceDiscovery.	object			
IptvServiceProviderInfoEntryList	string	–	List of entry points to get service provider information	Empty
.STBService.{i}. Components.FrontEnd.{i}. IP.ServiceDiscovery.ServiceProvider{i}.	object			
IptvServiceProviderInfoEntry	string	–	Entry point used to get the IptvServiceProviderInfo and to be used for updates	Empty
IptvServiceProviderInfo	string	–	Service provider information record as specified in ITU-T H.770	Empty

V.3 Detailed service offer discovery using TR-069

V.3.1 Introduction

When the entry point to get detailed service offers is the location of a configuration server, the terminal device relates with the configuration server using TR-069 to configure service provider services in the STBService object specified in TR-135 extended, as specified below.

The parameters in Table V.3 are added for detailed service offer discovery.

Table V.3 – Element/attributes for detailed service offer discovery

Name	Type	Write	Description	Default
.STBService.{i}.Components. FrontEnd.{i}.IP. ServiceDiscovery. ServiceProvider{i}.Service{i}.	object			
IptvServiceInfoEntry	string	–	Entry point used to get the IptvServiceInfo and to be used for updates.	Empty
IptvServiceInfo	string	–	Service record (detailed service information) as specified in ITU-T H.770.	Empty

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