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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

IPTV multimedia services and applications for IPTV – IPTV metadata

High-level specification of metadata for IPTV services

Recommendation ITU-T H.750

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Recommendation ITU-T H.750

High-level specification of metadata for IPTV services

Summary

Recommendation ITU-T H.750 gives the high-level specification of the metadata for IPTV services, with its elements and delivery protocols.

IPTV metadata, the information on services and content processed by the service and content delivery infrastructure, provides a descriptive and structural framework for managing IPTV services. The types of metadata for IPTV are service and content metadata, user metadata, metadata for content provisioning and management, metadata aggregation management, and rights and security related metadata. Aspects of discovery, delivery and transport, representation and management of metadata are covered in this Recommendation.

Source

Recommendation ITU-T H.750 was approved on 14 October 2008 by ITU-T Study Group 16 (2005-2008) under Recommendation ITU-T A.8 procedure.

FOREWORD

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

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High-level specification of metadata for IPTV services

1 Scope

This Recommendation gives the high-level specification of the metadata for IPTV services, its elements and delivery protocols.

The IPTV metadata is the information on services and content processed by service and content delivery infrastructure and provides a descriptive and structural framework for managing IPTV services.

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 F.750] Recommendation ITU-T F.750 (2004), *Metadata framework*.
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[ISO/IEC 15706] ISO/IEC 15706:2002/7, *Information and documentation – International Standard Audiovisual Number (ISAN) – Parts 1 and 2*.
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[ISO/IEC 15938-5] ISO/IEC 15938-5:2003, *Information technology – Multimedia content description interface – Part 5: Multimedia description schemes.*
<http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=34232>

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[ETSI TS 102 034] ETSI TS 102 034 V1.3.1 (2007), *Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks*.
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[ETSI TS 102 471] ETSI TS 102 471 V1.2.1 (2006), *Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Electronic Service Guide (ESG).*
<http://pda.etsi.org/pda/queryform.asp>

[ETSI TS 102 472] ETSI TS 102 472 V1.2.1 (2006), *Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Content Delivery Protocols.*
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[ETSI TS 102 822-3-1] ETSI TS 102 822-3-1 V1.4.1 (2007), *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 1: Phase 1 – Metadata schemas*.
<http://pda.etsi.org/pda/queryform.asp>

[ETSI TS 102 822-3-2] ETSI TS 102 822-3-2 V1.4.1 (2007), *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 2: System aspects in a uni-directional environment*.
<http://pda.etsi.org/pda/queryform.asp>

[ETSI TS 102 822-3-3] ETSI TS 102 822-3-3 V1.2.1 (2007), *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 3: Phase 2 – Extended Metadata Schema*.
<http://pda.etsi.org/pda/queryform.asp>

[ETSI TS 102 822-3-4] ETSI TS 102 822-3-4 V1.2.1 (2008), *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 4: Phase 2 – Interstitial metadata*.
<http://pda.etsi.org/pda/queryform.asp>

[ETSI TS 102 822-4] ETSI TS 102 822-4 V1.3.1 (2007), *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 4: Phase 1 – Content referencing*.
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[ETSI TS 102 822-6-1] ETSI TS 102 822-6-1 V1.4.1 (2007), *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 6: Delivery of metadata over a bi-directional network; Sub-part 1: Service and transport*.
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[ETSI TS 102 822-8] ETSI TS 102 822-8 V1.2.1 (2007), *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 8: Phase 2 – Interchange Data Format*.
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[IETF RFC 4287] IETF RFC 4287 (2005), *The Atom Syndication Format*.
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[OASIS 200401] OASIS Standard 200401 (2004), *Web Services Security: SOAP Message Security 1.0*. <http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-soap-message-security-1.0.pdf>

[OASIS WSBN] OASIS WSBN (2006), *Web Services Base Notification 1.3 (WS-BaseNotification)*. <http://docs.oasis-open.org/wsn/wsn-ws_base_notification-1.3-spec-os.pdf>

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 metadata: Structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment and management of the described entities. [b-ITU-T IPTVFG]

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 metadata fragments: A metadata fragment is a self-consistent atomic portion of a metadata instance. In this context, self-consistency means that fragments can be obtained in a random order and each fragment can be transmitted and updated independently.

3.2.2 metadata instance: A metadata instance is the data instance describing the instance of content or user, etc. A metadata instance has its data model defined by a corresponding metadata schema.

3.2.3 metadata schema: A metadata schema is the representation format for a specifying data model describing target instances.

3.2.4 usage environment: The usage environment is described by user characteristics, terminal capabilities, network characteristics and natural environment characteristics, where the content is being consumed.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
CS	Classification Scheme
DVB	Digital Video Broadcasting
EPG	Electronic Programme Guide
ESG	Electronic Service Guide
FLUTE	File deLivery over Unidirectional Transport
HTTP	HyperText Transfer Protocol
IPTV	Internet Protocol TeleVision
ISAN	International Standard Audiovisual Number
MPEG	Moving Picture Experts Group
PPV	Pay-Per View
QoS	Quality of Service

SDO Standards Development Organization

SIP Session Initiation Protocol

SOA Service-Oriented Architecture

SOAP Simple Object Access Protocol

VoD Video on Demand

XML eXtensible Markup Language

5 Conventions

No specific conventions have been used in this Recommendation.

6 IPTV metadata framework

6.1 Metadata framework

A general metadata framework is defined in [ITU-T F.750].

6.2 IPTV metadata service overview

Figure 6-1 illustrates metadata flows between metadata sources and client side metadata applications, including user navigation methods and interactive programme guides.

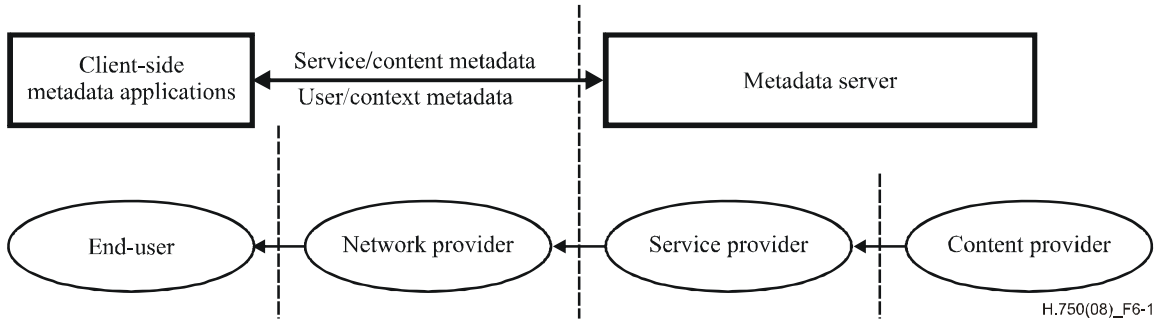

Figure 6-1 – IPTV metadata service overview

The metadata server is the entity responsible for aggregating metadata sets produced by content providers or service providers to describe services and content, as well as metadata sets generated or registered by metadata clients to describe end-user preference or context. These metadata sets are maintained in the database managed by the metadata server. The metadata maintained in the metadata server's database is accessed by, delivered to, or contributed from metadata clients through metadata delivery and exchange protocols. These clients are typically categorized as web-based navigation servers maintained by the service provider or client-side applications running on the IPTV client. Metadata directly consumed by a client-side metadata application is used for providing the network-transparent user interface for navigation, for example, a content overview listing integrated with local content storage management. The metadata server also stores and manages end-user profiles or context metadata required to support content or service adaptation.

6.3 Metadata representation

Most metadata instances which are generated according to industry standards and are compliant to them, which are represented in extensible markup language (XML), are not interoperable. There is a strong requirement that the semantics and representation scheme of metadata should be based on a common standardized data model and format. Ideally, names and terms should be selected from a

controlled vocabulary or thesaurus so that indexing, search and retrieval are more accurate. Standard representation, registration and maintenance procedures should be specified to ensure interoperability of controlled vocabularies. Existing and mature metadata standards, such as [ISO/IEC 15938-5] or [ETSI TS 102 822-3-1], shall be adopted or integrated to avoid reinvention of new metadata standards.

6.4 Classification scheme

The classification scheme (CS) is an MPEG-7 tool for the provision of controlled terminology for use in classification and is referred by some standardized metadata. The namespaces for CS extended or originally created for ITU-T IPTV services are specified and maintained with their detail CS definitions.

- Controlled terminology defined by standardized classification scheme (CS).
- CS namespace maintenance.

[ETSI TS 102 822-3-1] Annex A classification scheme.

6.5 Identity management

Identity management ensures uniqueness and integrity of content, service, content or service provider, user and device. It is required to allow service providers to offer service and content efficiently. Those identifiers may be used for service customization, content adaptation or advertisement targeting. The specific syntax of those identifiers and their encoding restrictions are for further study.

For example, [ETSI TS 102 822-4] specifies content resource identifiers.

In addition, [ISO/IEC 15706] ISAN identifies all types of audiovisual works and their relevant versions. Registration and allocation are done via registration agencies. ISAN permanently identifies an audiovisual work and its versions over its lifecycle.

Identifiers for service, content or service provider, user and device, and others are for further study.

6.6 Metadata API

IPTV middleware may provide the application programming interface (API) to access metadata information. Careful evaluation is required for deciding which level of API classes should be provided to fulfil generalized application requirements.

7 Discovery, transport and delivery of metadata

7.1 Metadata service discovery

Locating a particular service in question is provided by the service discovery function. This functionality is implemented by service description metadata and the service discovery protocol. Details are outside the scope of this Recommendation [b-ITU-T H.770]. The metadata service would be categorized in one of those services. The metadata service should be discovered in the same manner as other service attachments.

For example, [ETSI TS 102 539] specifies a mechanism for signalling and carrying metadata over an always-on bidirectional IP network. The specification allows for metadata describing both content on demand and live services already defined in [ETSI TS 102 034]. It specifies the mechanisms used for service discovery, service selection and the delivery of service discovery information.

7.2 Service provider metadata

The basic process of how a user starts consuming an IPTV service can be described in the following steps. The user finds a service provider and registers for the service usage. The entry point for finding a service provider of the user's preference provides listings of service metadata entry points and their providers. The user browses the available detailed offerings by service descriptions provided by those entry points. Then user selects offerings and starts consumption.

The description of the available IPTV service providers may contain, among others the following information for each service provider:

- Unique service provider identifier (e.g., a domain name).
- Service provider name in different languages.
- Service provider description in different languages.
- Entry point for subscription.
- Entry point to get description of IPTV services offered by this service provider.

7.3 Metadata delivery method

The metadata delivery protocol is implemented on the basis of a common transport stratum. There are several styles of metadata delivery, such as unicast or multicast, subscribe-notify, query-response or a mixture of those modes. These metadata delivery methods can be implemented on a SIP-based service platform, or a web service-based service-oriented architecture (SOA) framework. The delivery protocol should be modular so that different kinds of metadata delivery can be supported by a single protocol suite, e.g.:

- Push or pull mode of delivery.
- Unicast or multicast, ensuring reliability or not.
- Query-response; metadata bidirectional transport, XQuery.

For example, [ETSI TS 102 539] specifies push and pull modes of content description delivery for container-based and query/response-based protocols. DVB adopts the DVB-STP multicast transport protocol for push mode and the HTTP unicast protocol for pull mode as defined in [ETSI TS 102 034]. A profile for unicast query/response delivery using the simple object access protocol (SOAP) over HTTP specified in [ETSI TS 102 822-6-1] is also defined as optional. The query protocol can retrieve any portion of an XML instance identified by XPath predefined or dynamically assigned by the content guide service. [ETSI TS 102 822-8] defines the interchange data format for the delivery of metadata and content referencing information from different data sources.

As per clause 8 of [ETSI TS 102 471], metadata transport containers carrying ESG metadata instances are transported in FLUTE (see [b-IETF RFC 3926]) dynamic file delivery carousel sessions as described for file delivery in [ETSI TS 102 472].

7.4 Updating method

Outdated metadata should be updated automatically if delivered metadata is already cached or stored in the metadata client. The versioning and updating for delivered metadata is managed through a fragment updating method. The metadata consistency and reliability must be guaranteed by this method itself. When changes in the original metadata instance occur, it should be possible to notify clients with replicated instances of this metadata automatically. A mechanism should also be provided for maintaining the atomicity, consistency, isolation and durability of the related metadata fragments.

7.5 Metadata fragments

A metadata fragment is a self-consistent atomic portion of a metadata instance sent to the metadata client. In this context, self-consistency means that fragments can be obtained in a random order and each fragment can be transmitted and updated independently. The instance is identified through individual fragment IDs. The fragment can be defined or managed at the transport container level or the metadata representation, schema level.

Metadata instance identification, versioning and updating are for further study.

[ETSI TS 102 539] and [ETSI TS 102 471] rely on the fragment updating method defined in [ETSI TS 102 822-6-1]. The detail of the metadata fragment structure is in [ETSI TS 102 822-3-2], which defines how to split the metadata description into a number of self-contained fragments and how to identify them and mange their versions and expiration periods.

Clause 7.3 of [ETSI TS 102 471] provides the encapsulation mechanism for a set of ESG metadata fragments by providing the ability to assign a unique identifier (fragment ID) for the lifetime of an ESG fragment and indicating the current version of an ESG fragment.

[IETF RFC 4287] has 4.2.9 published and 4.2.15 updated for this purpose.

7.6 Metadata transport container

Metadata must be transport-protocol agnostic; thus, a generic transport envelope or container format may be required. The transport container contains metadata instances. The header of the transport container should contain information about the metadata representation scheme, such as the coding format, whether it is compressed or uncompressed, and the specific compression method used. If the metadata fragment is defined at the transport container level, the fragment should be encapsulated in the container with fragment management information, which allows the metadata client to identify new versions of a fragment without actually reading and comparing the content of the fragments. Fragment management information includes unique identification of the fragment, the version of the fragment instance and timing information, such as the start and end time of availability of the instance. The metadata in this container may be secured with cryptographic methods that prevent unauthorized modification by intermediate entities on its distribution path. In this case, security and integrity management parameters may be included in the header of the container. In some environments, the transport containers may be multiplexed with content delivery protocol data units as in-band delivery. The following items are for further study:

- Generalized metadata envelope.
- Fragment encapsulation, filtering information.
- Security considerations.
- Inband delivery (with content).

[ETSI TS 102 822-3-2] specifies an example of the structure of the container carrying the metadata fragment. The format of the container and additional requirements on the delivery layer to provide container identification, information about the type of data a container carries and the current version of a container are to be described.

Metadata fragments are encapsulated in the metadata container. The metadata container provides fragment aggregation, versioning and filtering. Metadata fragments may be represented in uncompressed or compressed forms, such as with BiM or GZIP (see clauses 6 and 7 of [ETSI TS 102 471]).

7.7 Metadata change notification

Notification of modifications to metadata within the metadata server should be propagated to metadata clients. If metadata is pre-cached or stored in a local metadata client database, the

metadata server must keep track of the most recent versions of the metadata instances already delivered. If the metadata server detects a modification, the most current version of those instances must be propagated to the clients and outdated metadata instances should be automatically discarded and updated to the latest version. Notification can be announced at a scheduled time or on demand by a client request. Clients should be able to declare their preferences for filtering the notifications. The following issues are for further study.

- Change notification subscription, delivery.
- Reliable transport for notification.

Web services notification [OASIS WSBN] provides a standardized way for a web service, or other entity, to disseminate event notifications to another set of clients. The SIP-specific framework for event notification [IETF RFC 3265] also specifies a flexible way to provide generalized event notification services. Both types of event notification can be applied to the publish/subscribe service model for metadata delivery management systems.

8 IPTV service and content metadata

This clause gives an overview of typical elements or attributes required for the standardized set of metadata. This clause is not intended to be exhaustive or restrictive.

8.1 Service and content metadata

Service and content metadata are descriptive information and must be able to be parsed by machines for consumption by the user interface. The end-user shall be able to navigate through a variety of service and content offerings in order to select a specific service to acquire the desired content.

Service metadata includes a detailed description used for service discovery and selection to activate a specific IPTV service. Content metadata is produced by content providers and service providers. Content providers typically supply title, synopsis, genre and other descriptive metadata about the content, while service providers assign the time of delivery, cost and other information about the service.

Elements required in service and content metadata are listed below.

Elements for content

- Identifier:
  - [ETSI TS 102 822-3-1] 6.3.6 programId, 6.3.7 groupId (Group), 6.4.2 InstanceMetadataId, 6.4.3 serviceId, 6.6.5 segmentId, 6.6.6 groupId (SegmentGroup).
  - [ETSI TS 102 822-3-3] 8.4 item_id, 8.5 component_id, 8.6 crid (Package).
  - [ETSI TS 102 471] 5.4.1 serviceID, 5.5.1 serviceBundleID, 5.6.1 contentID, 5.7.1 scheduleId.
  - [b-UPnP CDS2] B.8.3 upnp:programID, B.8.4 upnp:seriesID, B.8.5 upnp:channelID, B.9.1.1 upnp:channelGroupName@id, B.10.2 upnp:radioStationID.
  - [IETF RFC 4287] 4.2.6 id.
- Title/name (secondary title):
  - [ETSI TS 102 822-3-1] 6.3.4 Title (Program, Group), 6.4.2 Title (ProgramLocation), 6.4.3 Name (ServiceInformaion), 6.6.2 Title (Segment, SegmentGroup).
  - [ETSI TS 102 471] 5.4.1 ServiceName, 5.5.1 ServiceBundleName, 5.6.1 Title (Content).
  - [b-UPnP CDS2] B.8.1 upnp:programTitle, B.8.2 upnp:seriesTitle, B.9.1 upnp:channelGroupName, B.11.2 upnp:channelName.

  - [IETF RFC 4287] 4.2.14 title.
- Rights or Copyright information (including information about the content owner):
  - [IETF RFC 4287] 4.2.10 rights.
- Name of content provider, service provider (e.g., broadcasting organization):
  - [ETSI TS 102 822-3-1] 6.4.3 Owner (brand owner of the service).
  - [ETSI TS 102 471] 5.4.1 ServiceProvider, 5.5.1 ServiceBundleProvider.
  - [b-UPnP CDS2] B.9.4 upnp:serviceProvider.
- Primary (secondary) spoken language:
  - [ETSI TS 102 822-3-1] 6.3.4 Language (Program, Group), 6.3.5 AudioLanguage (Program, ProgramLocation) 6.4.3 ServiceLanguage.
  - [ETSI TS 102 822-3-3] 6.1.1.1 AudioLanguage (Component).
  - [ETSI TS 102 471] 5.4.1 ServiceLanguage, 5.6.1 Language (Content), 5.10.7.1 Language (Component).
  - [b-UPnP CDS2] B.7.7 dc:language.
- Primary (secondary) caption language (with speed parameter):
  - [ETSI TS 102 822-3-1] 6.3.4 CaptionLanguage (Program, Group).
  - [ETSI TS 102 471] 5.6.1 CaptionLanguage (Content), 5.10.7.1 OpenCaptionLanguage (Component).
- Genre:
  - [ETSI TS 102 822-3-1] 6.3.4 Genre (Program, Group), 6.4.2 Genre (ProgramLocation), 6.4.3 ServiceGenre, 6.6.2 Genre (Segment, SegmentGroup).
  - [ETSI TS 102 471] 5.4.1 ServiceGenre, 5.5.1 ServiceBundleGenre, 5.6.1 Genre (Content).
  - [b-UPnP CDS2] B.4.1 upnp:genre.
  - [IETF RFC 4287] 4.2.2 Category.
- Keywords:
  - [ETSI TS 102 822-3-1] 6.3.4 Keyword (Program, Group), 6.6.2 Keyword (Segment, SegmentGroup).
  - [ETSI TS 102 471] 5.6.1 Keyword (Content).
- Description (synopsis, abstract):
  - [ETSI TS 102 822-3-1] 6.3.4 Synopsis (Program, Group), 6.4.2 Synopsis (ProgramLocation), 6.4.3 ServiceDescription, 6.6.2 Synopsis (Segment, SegmentGroup).
  - [ETSI TS 102 471] 5.4.1 ServiceDescription, 5.5.1 ServiceBundleDescription, 5.6.1 Synopsis (Content).
  - [b-UPnP CDS2] B.7.1 dc:description.
  - [IETF RFC 4287] 4.2.13 Summary.
- Credits (e.g., actor/actress, director, producer, scenario writer):
  - [ETSI TS 102 822-3-1] 6.3.4 CreditsList (Program, Group), 6.6.2 CreditsList (Segment, SegmentGroup).
  - [ETSI TS 102 471] 5.6.1 CreditsList (Content).

  - [b-UPnP CDS2] B.3.1 upnp:artist, B.3.2 upnp:actor, B.3.3 upnp:author, B.3.4 upnp:producer, B.3.5 upnp:director, B.3.6 dc:publisher, B.3.7 dc:contributor, B.1.7 dc:Title, B.1.8 dc:Creator.
  - [IETF RFC 4287] 4.2.1 author, 4.2.3 contributor.
- Awards:
  - [ETSI TS 102 822-3-1] 6.3.4 AwardsList (Program, Group).
- Location and time of production:
  - [ETSI TS 102 822-3-1] 6.3.4 ProductionLocation, ProductionDate (Program, Group).
  - [b-UPnP CDS2] B.7.4 upnp:region, B.7.6 dc:date.
- Parental guidance or rating (with rating standards identifier):
  - [ETSI TS 102 822-3-1] 6.3.4 ParentalGuidance (Program, Group).
  - [ETSI TS 102 471] 5.4.1 ParentalGuidance (Service), 5.5.1 ParentalGuidance (ServiceBundle), 5.6.1 ParentalGuidance (Content).
- Review (with name or reviewing entity):
  - [ETSI TS 102 822-3-1] 6.3.8 Review.
  - [b-UPnP CDS2] B.8.9 upnp:rating.
- Type of content (promotional, advertisement):

  This element is for further study.
- Encrypted or not:
  - [ETSI TS 102 471] 5.4.1 clearToAir (Service), 5.7.1 clearToAir (ScheduleEvent).
- Preview, supplementary video and descriptive audio:
  - [ETSI TS 102 822-3-1] 6.3.4 RelatedMaterial (Program, Group), 6.6.2 RelatedMaterial (Segment, SegmentGroup).
  - [b-UPnP CDS2] B.5.4 dc:relation.
- Related web site:
  - [ETSI TS 102 822-3-1] 6.3.4 RelatedMaterial (Program, Group), 6.6.2 RelatedMaterial (Segment, SegmentGroup).
  - [ETSI TS 102 471] 5.4.1 RelatedMaterial (Service), 5.5.1 RelatedMaterial (ServiceBundle), 5.6.1 RelatedMaterial (Content).
  - [b-UPnP CDS2] B.5.4 dc:relation, B.2.1.19 res@contentInfoURI.
  - [IETF RFC 4287] 4.2.7 link.
- Information for invoking value-added applications, associated or un-associated, service provider-managed applications, e.g., news highlights, stock exchange, traffic conditions, sport results, in the form of text, images and other associated assets as enhancements:
  - [ETSI TS 102 822-3-1] 6.3.4 RelatedMaterial (Program, Group), 6.6.2 RelatedMaterial (Segment, SegmentGroup).
- Codec or format:
  - [ETSI TS 102 822-3-1] 6.3.5 Coding.
  - [ETSI TS 102 822-3-3] 6.1.1.1 Coding (Audio), 6.1.1.2 Coding (Video).
  - [ETSI TS 102 471] 5.10.7.1 Codec, ProfileLevelIndication.
- Aspect ratios, resolution, bit rate, frame rate for video:
  - [ETSI TS 102 822-3-1] 6.3.5 AspectRatio, HorizontalSize, VerticalSize, Bitrate, FrameRate.

  - [ETSI TS 102 822-3-3] 6.1.1.1 BitRate, AspectRatio, HorizontalSize, VerticalSize, FrameRate.
  - [ETSI TS 102 471] 5.10.7.1 Bandwidth, FrameRate.
  - [ETSI TS 102 822-3-1] B.2.1.10 res@resolution, B.2.1.6 res@bitrate.
- Mono, stereo, multi-channel indication for audio:
  - [ETSI TS 102 822-3-1] 6.3.5 MixType, NumOfChannels.
  - [ETSI TS 102 822-3-3] 6.1.1.1 MixType, NumOfChannels.
  - [ETSI TS 102 471] 5.10.7.1 Mode.
  - [b-UPnP CDS2] B.2.19 res@nrAudioChannels.
- Acquisition or delivery schedule, start/end availability, protocol and address:
  - [ETSI TS 102 822-3-1] 6.4.2 PublishedStartTime, PublishedEndTime, StartOfAvailability, EndOfAvailability, ProgramURL.
  - [ETSI TS 102 471] 5.7.1 PublishedStartTime, PublishedEndTime.
  - [b-UPnP CDS2] B.11.3 upnp:scheduledStartTime, B.11.4 upnp:scheduledEndTime.
- First/repeat delivery or live broadcast:
  - [ETSI TS 102 822-3-1] 6.4.2 FirstShowing, LastShowing, Repeat, Live.
  - [ETSI TS 102 471] 5.7.1 live, repeat.
  - [b-UPnP CDS2] B.8.10 upnp:episodeType.
- File format, file size:
  - [ETSI TS 102 822-3-1] 6.3.5 FileFormat, FileSize.
  - [ETSI TS 102 822-3-3] 6.1.3 FileFormat, FileSize.
  - [ETSI TS 102 471] 5.10.7.1 FileFormat, Storage.
  - [b-UPnP CDS2] B.2.1.3 res@size.
- Duration:
  - [ETSI TS 102 822-3-1] 6.3.4 Duration (Program, Group), 6.6.5 SegmentLocator (Segment), 6.6.6 Duration (SegmentGroup).
  - [ETSI TS 102 471] 5.6.1 Duration (Content).
  - [b-UPnP CDS2] B.2.1.4 res@duration.
- Content expiration date.
- Replacement timing.

Elements for collective content

In some cases, content needs to be a collection of various kinds of sub-content. For example, series is a collection of episodes. Previously, a group is well known as a collection of the same type of content, and a package is a collection of various types of content such as main content and related web pages.

Considering the relationship between metadata for service navigation and an application for service navigation, metadata for these collective contents would need to be defined separately from the applications for presenting them.

- Total number of sub-contents:
  - [ETSI TS 102 822-3-1] 6.3.7 numOfItems (Group), 6.6.6 numberOfSegments (SegmentGroup).
  - [b-UPnP CDS2] B.8.6 upnp:episodeCount.

- Ordered flag to indicate whether the sub-contents are ordered or not:
  - [ETSI TS 102 822-3-1] 6.3.7 ordered (Group), 6.6.6 ordered (SegmentGroup).
- IDs for sub-contents:
  - [ETSI TS 102 822-3-1] 6.3.6 index.
  - [ETSI TS 102 822-3-3] 8.4 item_id.
  - [b-UPnP CDS2] B.8.7 upnp:episodeNumber.
- Price and conditions of availability of collective content:
  - [ETSI TS 102 822-3-1] 6.3.4 PurchaseItem.
  - [b-UPnP CDS2] B.9.5 upnp:price.
- IDs for other collections of which this collection is a member:
  - [ETSI TS 102 822-3-1] 6.3.6 MemberOf (Program), 6.3.7 MemberOf (Group).

  Descriptions for each sub-content:
  - Content type:

    [ETSI TS 102 822-3-3] 6.1.3 ContentType.
  - Elements for content:

    [ETSI TS 102 822-3-3] 8.4 Item.
  - Description of usage environment where each sub-content is properly consumed:

    [ETSI TS 102 822-3-3] 6.2.8 TerminalInformation, NetworkInformation, NaturalEnvironmentInformation.
  - Description of user preferences and profile with which a user hopefully wants to consume the sub-content:

    [ETSI TS 102 822-3-3] 6.2.8 TargetUserPreferences, UserInformation.
  - Relationship information between sub-contents such as one is preceded by another one.

    [ETSI TS 102 822-3-3] 8.4 RelationType.

Elements for optional quality monitoring

- Video quality scores of compressed video data.

Elements for group of segment

- Play-list for digesting (e.g., highlights):
  - [ETSI TS 102 822-3-1] 6.6.6 SegmentGroupInformationType.
  - [ETSI TS 102 822-3-3] 8.4 SelectionType, ChoiceType.

Elements for service (or channel)

- Channel number, minor channel number (the minor channel number is used for two-part channel numbers):

  This element is for further study.
- Service (or channel) logo:
  - [ETSI TS 102 822-3-1] 6.4.3 Logo.
  - [ETSI TS 102 471] 5.4.1 ServiceLogo.
  - [b-UPnP CDS2] B.7.3 upnp:icon.
- Type of service, such as video-on-demand (VOD), live streaming:
  - [ETSI TS 102 822-3-1] 6.4.2 live.
  - [ETSI TS 102 471] 5.4.1 ServiceType, 5.6.1 ContentType, 5.7.1 live.

- Time-table (schedule):
  - [ETSI TS 102 822-3-1] 6.7.1 Schedule.
  - [ETSI TS 102 471] Compilation of 5.7.1 ScheduleEvent.
- Near VoD support or not:

  This element is for further study.
- Free or subscribed:
  - [ETSI TS 102 822-3-1] 6.4.2 Free (indicates whether or not access is free).
  - [ETSI TS 102 471] 5.4.1 freeToAir.
- Local network affiliate (describes the local network affiliate, such as KNSD is an NBC affiliate in San Diego, California; and KOMO is an ABC affiliate in Seattle, Washington):

  This element is for further study.
- Channel content advisory (used to label channels with adult content, enabling parents to block this content, if desired):

  This element is for further study.

Elements for describing delivery modes

- Push or pull:

  This element is for further study.
- Caching policy:

  This element is for further study.
- Pre-recording (for subtitles, captions, additional textual information, associated application):

  This element is for further study.
- Required quality of service (QoS) level
  - [ETSI TS 102 822-3-3] 6.2.8 NetworkInformation.

Elements for content adaptation

- Targeting (class of user profile, user preference):
  - [ETSI TS 102 822-3-3] 6.2.8 TargetUserPreferences, TargetUsageHistory, UserInformation.
- Interstitials (commercials and promos) replacement, replacement rules:
  - [ETSI TS 102 822-3-4] 7.6.1 InterstitialBreakType.
- Consumption control parameter, based on usage environment (device, network, etc.):
  - [ETSI TS 102 822-3-3] 6.2.8 TerminalInformation, NetworkInformation, NaturalEnvironmentInformation.

Elements for usage restrictions, usage rules

  - [ETSI TS 102 471] 5.8.1 UsageConstraints.
- ValidityPeriod:
  - [ETSI TS 102 822-5-1] 5.3 Time Window Start Date and Time Window End Date.
  - [b-UPnP CDS2] B.2.1.14 res@validityStart, B2.1.15 res@validityEnd.
- Output control (for display only or recording on storage device):
  - [ETSI TS 102 822-5-1] 5.3 High Definition Digital Export Control, Analogue Export Signalling, Analogue Standard Definition (SD) control, Simultaneous Rendering Count.

  - [b-UPnP CDS2] B.2.1.13 res@allowedUse (number of plays, copies), B.2.1.17 res@usageInfo.
- Trick mode enabled or not:
  - [ETSI TS 102 822-5-1] 5.3 Buffer Duration.
- Maximum buffering size or duration:
  - [ETSI TS 102 822-5-1] 5.3 Buffer Duration.
- Schedule (timeslots) for pay-per view (PPV).

  This element is for further study.
- Licensing and subscription information, e.g., retail price, billing models, discount, conditions and license information:
  - [ETSI TS 102 822-3-1] 6.3.4 PurchaseItem.
  - [ETSI TS 102 822-3-3] 6.4 ExtendedPurchaseItemType.
  - [ETSI TS 102 471] 5.8.1 PurchaseType.
  - [b-UPnP CDS2] B.9.5 upnp:price, B.9.6 upnp:payPerView.
- DRM type, clearing house or pricing server URL, license identification:
  - [ETSI TS 102 822-3-1] 6.3.4 PricingServerURL.
  - [ETSI TS 102 471] 5.8.1 PurchaseRequest, 5.9.1 PortalURL.
  - [b-UPnP CDS2] B.2.1.5 res@protection.
- Restricted area:
  - [ETSI TS 102 822-5-1] 5.3 Geographical Control.
- Expiration date or deletion management information:

  This element is for further study.
- Recordable or not, in service provider storage or consumer storage:
  - [b-UPnP CDS2] B.7.16 upnp:recordable.
- Payment models depend on amounts of interstitial content:

  This element is for further study.
- Content adaptation allowed or not, i.e., by transcoding:

  This element is for further study.

8.2 User metadata

User metadata is shared and a common structure describing profiles or context is related to an end-user. It could be represented by end-user preference, usage history, context for content consuming environment such as device and transport capability, or such as types of codec, QoS statistics, etc. They can be accessed by several applications over multiple service domains. These data elements are intended to be reusable between different applications. User metadata specifies customer-specific information required to support functions such as notification delivery for preferred content subscription, customization of content, consumption policy control, interstitial advertisement insertion, etc.

Elements for user profile or preference

  - [ETSI TS 102 822-3-3] 9 ExtendedUserDescription.
- User identifier:
  - [ETSI TS 102 822-3-1] 6.5.2.3 UserIdentifier.

- Demographic data:
  - [ETSI TS 102 822-3-3] 6.2.1 BioGraphicInformation, 6.2.6 Location.
- Favourite channels:
  - [ETSI TS 102 822-3-1] 6.5.2.2 UsagePreference.
  - [ISO/IEC 15938-5] 15.2.3.3 PublicationSource.
- Viewing behaviour:
  - [ETSI TS 102 822-3-1] 6.5.1.1 UsageHistory.
- Multiple personal profiles identification:

  This element is for further study.
- Personal profiles, personal preferences exchangeable or not, with other devices, e.g., PDRs:
  - [ETSI TS 102 822-6-3] 5 User Profile Message Interface.
- Support "personally linked" segments:

  This element is for further study.

Elements for audience measurement metadata

Audience measurement metadata consists of elements of measurements and context information.

- Measurements (details are for further study)
  - Minimum information for channel identification, content identification where the concept of a channel may not exist (e.g., downloads and content-on-request), and platform identification.
  - Additional information about viewed services and interactive services.
  - Other specific measures: e.g., information about receiver configuration, favourite channels, channel availability, quality and availability of services.
  - Timing.
- Context information:
  - Identification of users.
  - State and use of the receiver.
  - Localization of the user for mobile environments.
  - User authorization.
  - Capabilities of the device to receive the AV services, information about the environment.

Elements for device and network description

- Interface capability, e.g., bit rate, bandwidth restrictions of network interface:
  - [ISO/IEC 21000-7] 5.5.3 NetworkCapabilityType.
- Presentation capability (e.g., resolution, supported codec or format, media profile):
  - [ISO/IEC 21000-7] 5.4 TerminalCapabilitiesType.

Elements for service navigation user interface representation

These elements are for information. The details are for further study.

- Graphical presentation control information for a service navigation application such as fonts, icons, pointers, background pictures and the sound effects, etc.
- Certified "skins" of appearance of a service navigation application.

9 Metadata for content provisioning and management

9.1 Metadata for content provisioning

There are some metadata in the content provisioning phase exchanged across contributing networks that include both content providers and service providers. These descriptive metadata are required to provide details about the production, such as the title and responsible organization, location of the shot or shots, participants and other annotating information. It is essential for contributors to be consistent in how the metadata is added, terms are used and rules are followed, so that everyone involved provides information that is useful and understood by all parties within the metadata workflow with minimal duplication of effort.

The following is a typical set of descriptive metadata expected to be exchanged in the content-provisioning phase:

- Titles, group relationships and branding.
- Identification.
- Event and publication.
- Award.
- Captions description.
- Annotation and classification.
- Setting period.
- Scripting.
- Shot and key point.
- Participant.
- Contacts list, person, organization and location.
- Contract and right.
- Image format.
- Device parameters.
- Content type.

The detail of content provisioning is for further study.

9.2 Metadata aggregation management

There are some attributes required for managing the instance of metadata. It is likely that metadata from a number of independent content creators and publishers will need to be aggregated in a so-called metadata aggregator. The owner information of original metadata should be managed properly during the process of metadata aggregation or delivery.

- Metadata publisher, metadata owner.
- Metadata instance Copyright line (contains the legal text associated with the metadata Copyright).

[IETF RFC 4287] has 4.2.1 author, 4.2.3 contributor, 4.2.10 rights for these roles.

10 Rights and security-related metadata for IPTV

Rights metadata is used for content protection and can be considered part of content protection metadata. Security-related metadata subsumes content protection metadata.

10.1 Elements required for usage restrictions, usage rules

Information conveyed by the elements for usage restrictions and usage rules can be part of rights metadata.

10.2 User metadata security

The authentication and integrity validation of sub-blocks of the user metadata must be possible where good privacy protection is required. It should be possible to specify the access rights of a valid user to metadata instances. Metadata servers may be enabled to impose different levels of authorization requirements on metadata. Clause 6 of [ETSI TS 102 822-6-3] specifies security for metadata. [OASIS 200401] has a specification for messaging security.

The security for access, privacy control for user profiles and user metadata is for further study.

11 Metadata for public interest services

This item is for further study. Requirements are to be found in [b-ITU-T Y.1901].

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