

ATSC Standard: Programming Metadata Communication Protocol Standard

Advanced Television Systems Committee

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The Advanced Television Systems Committee, Inc., is an international, non-profit organization developing voluntary standards for digital television. The ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

Specifically, ATSC is working to coordinate television standards among different communications media focusing on digital television, interactive systems, and broadband multimedia communications. ATSC is also developing digital television implementation strategies and presenting educational seminars on the ATSC standards.

ATSC was formed in 1982 by the member organizations of the Joint Committee on InterSociety Coordination (JCIC): the Electronic Industries Association (EIA), the Institute of Electrical and Electronic Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable Television Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). Currently, there are approximately 140 members representing the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

ATSC Digital TV Standards include digital high definition television (HDTV), standard definition television (SDTV), data broadcasting, multichannel surround-sound audio, and satellite direct-to-home broadcasting.

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ATSC Standard: Programming Metadata Communication Protocol

1. SCOPE

1.1 Purpose

This standard defines a method for communicating metadata related to PSIP (program and system information protocol), including duplicate data that needs to be entered in other locations in the transport stream. Communication is based on a protocol utilizing XML message documents generated in accordance with a Programming Metadata Communication Protocol (PMCP) XML Schema defined herein.

1.2 Extensibility

This first version of the PMCP standard does not make provision for communication of metadata needed to support optional data services in the broadcast transport stream, metadata needed to support directed channel change (DCC), or metadata needed for PSIP in proposed E-VSB transmissions. These items will be addressed in future revisions to the standard.

PMCP is also capable of extension to incorporate additional metadata and transactions not directly related to PSIP.

1.3 Application

PMCP communications are intended to apply to systems and equipment that affect production of PSIP tables and the digital television transport stream in studio and network centers and associated remote program planning and listing services.

1.4 Organization

The document is organized as follows:

- Section 1 – Provides this general introduction.
- Section 2 – Lists reference documents.
- Section 3 – Provides definitions of terms, acronyms and abbreviations used in this document.
- Section 4 – Defines the transport mechanisms to be used for PMCP communications.
- Section 5 – Describes the PMCP XML schema and how it is used.
- Annex A – A text and graphical view of the PMCP schema.
- Annex B – Provides some informative Use Case XML documents illustrating the use of PMCP.
- Annex C – Provides an informative description of the PSIP metadata system environment in which PMCP is expected to operate.
- Annex D – Lists the electronic files that support this standard (available from the ATSC web site).

2. REFERENCES

The following documents are applicable to this Standard:

- [1] Extensible Markup Language (XML) 1.0 (Second Edition), W3C Recommendation 6 October 2000, <http://www.w3.org/TR/2000/REC-xml-20001006> (*normative*)
- [2] XML Schema, W3C Recommendation, 2 May 2001, <http://www.w3.org/TR/2001/REC-xmlschema-0-20010502/> (*normative*)
- [3] A/53C, “Advanced Television Standard, Revision B with Amendments 1 and 2”, Advanced Television Systems Committee, Washington, D.C., May 21, 2004 (*normative*)
- [4] A/65B “Program and System Information Protocol for Terrestrial Broadcast and Cable (Revision B)”, Advanced Television Systems Committee, Washington, D.C., March 1, 2003 (*normative*)
- [5] “Code Point Registry”, Advanced Television Systems Committee, Washington, D.C. (*normative*)
- [6] ISO 15706:2002 Information and documentation – International Audiovisual Number (ISAN) Amendment 1: Alternate Encodings (*normative*)
- [7] ISO 20925-1:200x, Information and documentation – Version identifier for audiovisual works (V-ISAN) – Part 1: Format and use (*normative*)

3. DEFINITIONS

3.1 Compliance Notation

As used in this document, “shall” denotes a mandatory provision of this standard. “Should” denotes a provision that is recommended but not mandatory. “May” denotes a feature whose presence does not preclude compliance, and that may or may not be present at the option of the implementer.

3.2 Abbreviations and Terms

The following terms, acronyms and abbreviations are used in this specification:

automation event	An entry in a playlist that triggers an action by an automation system to initiate playback, start a machine, switch a signal, control an effect, change a configuration, or other action that changes the content or configuration of a program output channel.
attribute	A qualifier on an XML tag that provides additional information.
CDATA	A predefined XML tag for Character DATA that says, “don't interpret these characters”, as opposed to Parsed Character Data (PCDATA), in which the normal rules of XML syntax apply.
content	Essence plus its metadata .
contentID	A label for content . This may take the form of a global label such as ISAN , or a “house number”.
EPG	Electronic program guide.

essence	Actual program material (audio, video and/or data).
GPS	Global Positioning System.
GPS Time	Time signal distributed via GPS comprising number of seconds elapsed since 0000 Universal Time on January 6 1980. Offset from UTC by an integer number of seconds (currently 13) due to leap seconds added to UTC but not to GPS time.
interstitial	A special kind of work of typically less than 5 minutes inserted between program segments . May comprise advertisements, promotions, or other short program material .
ISAN	International Standard Audiovisual Number.
metadata	Information about essence .
multiplexer	A device that combines MPEG-2 packets from one or more elementary streams into one or more MPEG-2 transport stream outputs containing a multiplex of packets, or that combines multiple transport streams into a system level multiplex.
namespace	A standard that enables the definition of a unique label for the set of element names defined by a specific schema . A document using that schema can be included in any other document without having a conflict between XML element names. The elements defined in the schema are then uniquely identified so that, for example, the parser can tell when an element called <name> should be interpreted according to that schema, rather than using the definition for an element called "name" in a different schema.
packet identifier	A unique integer value used to associate elementary streams of a program in a single or multi-program transport stream.
PID	See packet identifier .
playlist	Also known as the “traffic schedule”. A sequential list of automation events to be played back for a station output channel.
program element	A generic term for one of the elementary streams or other data streams that may be included in a program. For example: audio, video, data, etc.
program segment	Portion of a TV program as defined in the traffic format assigned to the program.
PSIP event	A defined period of time on a virtual channel with associated metadata related to a show .
remultiplexer	A packet multiplexer capable of combining MPEG-2 transport stream packets from one or more inputs containing a multiplex of packets into one or more MPEG-2 transport stream outputs.
root	The outermost element in an XML document that contains all other elements.

schedule	The binding of shows to virtual channels at particular times. A schedule is the generic name for “Television Schedule” that consists of multiple audio-video presentations carried on a channel over a period of time.
schema	A database-inspired method for specifying constraints on XML documents using an XML-based language. Since schemas are founded on XML, they are hierarchical, so it is easy to create an unambiguous specification and possible to determine the scope over which definitions and comments are meant to apply.
show	The composition of the primary work and interstitials in a single timeline suitable for broadcast.
show segment	A contiguous subset of a show identified with a single start time and end time pair referenced to the show’s timeline.
Tag	A piece of text that describes a unit of data, or element, in XML . The tag is distinguishable as <i>markup</i> , as opposed to data, because it is surrounded by angle brackets (< and >). For example, the element <Channel>My 100</Channel> has the start tag <Channel>, the end tag </Channel>, which enclose the data “100”. To treat such markup syntax as data, an entity reference or a CDATA section is used.
TCP/IP	Transport Control Protocol/Internet Protocol
traffic format	A defined structure that specifies for each traffic system the organization of a primary work and interstitials . A series of traffic formats linked together form a 24 hour broadcast log. Traffic formats are typically linked to a specific program.
traffic system	A management system comprising a database for tracking the sale of advertising, and the scheduling of program elements , advertising, promotional announcements, and other interstitial material.
UTC	Coordinated Universal Time, the basis for the worldwide system of time. Determined using atomic clocks and maintained by the US Naval Observatory and other laboratories around the world. Adjusted occasionally with leap seconds to maintain synchronization with the solar day based on the rotation of the earth.
valid XML	A valid XML document, in addition to being well formed , conforms to all the constraints imposed by a Schema . It does not contain any tags that are not permitted by the schema, and the order of the tags conforms to the schema’s specifications.
value	Used in XML to indicate the number or characters entered for a particular parameter or variable.
virtual channel	The designation, usually a number, that is recognized by the user as the single entity that will provide access to a set of one or more digital elementary streams or an analog TV program. It is called “virtual” because its identification (name

and number) may be defined independently from its physical location.

- V-ISAN** **ISAN** combined with a version identifier to provide a globally unique identifier of the version of an audiovisual work.
- W3C** The World Wide Web Consortium (<http://www.w3c.org/>). The international body that governs Internet standards.
- well-formed** An **XML** document that is syntactically correct. To determine whether or not a well-formed document is valid, a validating parser and a **schema** are required.
- work** A completed artistic creation, produced or accomplished through the effort, activity or agency of a person or group, comprised of any combination of picture (or video) essence, sound (or audio) essence and/or data (or auxiliary) **essence**.
- work segment** A contiguous subset of a **work**; identified with a single start time and end time pair referenced to the work's timeline; and a defined subset of the elements of the work.
- XML** Extensible Markup Language.
- XML document** In general, an **XML** structure in which one or more elements can contain text intermixed with sub-elements.
- XML element** A unit of **XML** data, delimited by tags which can enclose other elements. For example, in the **XML** structure, “<VirtualChannels><Channel>..</Channel>><Channel>..</Channel></VirtualChannels>”, the <VirtualChannels> element contains two <Channel> elements
- XML schema** The W3C schema specification for XML documents.

4. TRANSPORT

4.1 Transport Methods

The PMCP protocol may be implemented using two different transport mechanisms, File Based and Connection Based transport, depending on the users' needs. All PMCP-compliant devices shall support both mechanisms as specified in Section 4.2 and 4.3 and both methods may coexist in the same system. By agreement with the providers of all affected devices, system implementers may use other protocols, not specified herein, for communication within a system.

4.2 File Based Transport

File Based transfer will usually be used where large amounts of data needs to be communicated from one system to another without the need for acknowledgement, and where timing is not critical. The user will simply download a file containing the XML document from the originating device and import it into the receiving device. Alternatively, the files may be pushed or pulled to the receiving device in an automatic process.

4.2.1 Common Folders

Receiving devices that implement the file based transport mechanism shall utilize at least one folder where new content is placed. This folder may be on the device itself or elsewhere across any accessible network. The receiving device may automatically detect when new content is available in this folder or may periodically poll the folder for new content.

Separate folders should be used for different receiving devices since the defined file name scheme identifies the message origin but not the intended recipient.

If required there should be other folders for files that will not automatically be processed when moved to a receiving device.

4.2.2 File Name

The originating device shall utilize a common naming scheme for the files so that the receiving device can be set up to identify the files. The file name shall be in the format of:

“PMCPyyyymmdd<Device>nnnnnnnnnn.xml”

where:

“yyyymmdd” is the year, month, and day that the file was sent (using UTC clock)

<Device> is a string of up to 14 letters and digits that identifies the creator of the file uniquely in the system

“nnnnnnnnnn” is a 10-character decimal number including leading zeros

4.3 Connection Based Transport

Connection Based transport of PMCP requires that there be a direct network connection between the sending and receiving devices.

4.3.1 TCP/IP

TCP/IP protocol shall be used for communication. The server default port number shall be 3821¹. Systems and devices shall have the ability of changing this port number to accommodate cases where 3821 is in conflict with something else in the facility.

4.3.2 TCP/IP Connections

Each device using the PMCP protocol that will receive and respond to messages shall act as a server. Each device using the protocol to initiate the sending of messages shall act as a client. Devices that plan to both send and receive messages shall act as both a server and a client.

A TCP/IP connection shall be initiated by a PMCP client to connect to a PMCP server. A server that can also be a client shall be responsible for managing the connection separately from the other client connections. A client shall be allowed to open connections to as many PMCP servers as are available.

¹ Port number 3821 is also assigned to PMCP for UDP communications, in case this protocol is used in accordance with Section 4.1.

4.3.3 Inactive Connections

It is expected that inactive and abnormal TCP connections will be detected and managed by TCP protocols. In addition, PMCP clients shall periodically monitor the status of connected servers and the transport connection by sending either heartbeat requests as defined in Section 5.11, or any other request as defined in Section 5.4.2. Also, PMCP servers shall monitor the status of connected clients and the transport connection by looking for heartbeat requests as defined in Section 5.11, or any other request as defined in Section 5.4.2.

Arrangements for managing connection failures and what to do in each case are left up to implementation by each manufacturer.

4.3.4 Unicast

The PMCP protocol shall support only unicast over TCP/IP connections. If multicast functionality is required, it may be implemented by the client opening connections to all devices.

4.3.5 List of Devices to Connect To

Each PMCP device that is configured as a client shall store a list of available PMCP devices (configured as servers) that it will need to communicate with. This list shall contain the IP address or DNS name of the device, the port number, the Device Name, and its Device Type (see Section 5.5). Arrangements for setting up and maintaining this list are left up to implementation by each manufacturer.

4.3.6 List of Devices to Accept Connections From

It is recommended that each device that is configured as a server should keep a list of the IP addresses or DNS names for devices that it will accept connections from. This list may or may not be the same as the list of devices it can connect to. If the list is present, then devices that attempt to connect and are not in the list shall not be allowed a connection. Arrangements for setting up and maintaining this list are left up to implementation by each manufacturer.

4.3.7 Initiation of Servers

When a device that is configured as a server is turned on, it shall begin accepting TCP/IP connections. When a client attempts to connect to the server, the server should reference its list of Devices to Accept Connections From (if present) before deciding to accept the connection.

4.3.8 Sending of Messages

Once a connection is made from a client to a server, only the client may initiate communication. This communication can either be a “push” of information where the client sends data to the server, or a “pull” where the client requests certain information from the server. If there is a need for the server to initiate messages to the client, then a separate TCP/IP connection shall be opened where the client/server roles are reversed.

4.3.9 Encryption

By agreement with the providers of all affected devices, system implementers may use methods of encryption, not specified herein, for secure communication within a system.

4.3.10 Message format

All messages in PMCP shall be sent as XML documents as defined in Section 5.

5. XML SCHEMA DESCRIPTION

5.1 Introduction

The Extensible Markup Language (XML) [1] is a standard that allows structuring of information in a text document so that it is both human and machine-readable. It has a hierarchical structure, it can be easily extended and each piece of information can be labeled. A document compliant to the XML standard is said to be “well-formed”.

The XML Schema standard (XML Schema) [2] defines a way of describing a specific format for an XML document. A schema specifies which elements are allowed in a document, which elements can be the children of another element, which attributes an element can have and the data types that an element or an attribute can have. An XML document that complies with a given schema is said to be “valid”.

The PMCP schema defined in Annex A describes the structure of a Programming Metadata Communication Protocol (PMCP) message. It is mostly the transformation of the parameters and data needed to generate the tables defined in the ATSC transport (A/53C [3]) and PSIP (A/65B [4]) standards. Due to the nature of XML, it can be further extended to include other metadata that is not directly related to PSIP.

In the event of any discrepancy between the PMCP schema in Annex A and any other paragraph in this standard, the Annex A schema shall take precedence.

5.2 Namespace

The elements and attributes defined in a schema are referred to as a “markup vocabulary” and are specific to a given schema. It is envisaged that for the majority of users of this XML-based standard PMCP will be the default vocabulary of the XML document, or will unambiguously coexists with other vocabularies where explicit namespace use is unnecessary.

It is possible that there may be applications using PMCP where XML documents may contain markup vocabulary defined by multiple XML schemas. For those rare cases where the use of namespace cannot be avoided, the four lower-case letters “pmcp” shall be used as a namespace prefix to refer to the elements and attributes defined in this standard.

5.2.1 Examples:

1) Private PMCP Information - PMCP is default and WM is explicit.

```
<PmcpMessage xmlns=http://www.atsc.org/pmcp/2004/2.0
xmlns:wm="http://www.atsc.org/wm/2003/0.9"...>
...
...
  <PrivatePmcpInformation>
    <wm:Key date="yyyy-mm-dd">
      ...
      <wm:Channel .....>
        ...
      </wm:Channel>
```

```

    </wm:Key>
  </PrivatePmcpInformation>
</PmcpMessage>

```

2) SOAP Example where PMCP message is contained inside another XML SOAP document (namespace is not required).

```

<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
  <SOAP-ENV:Body>
    <PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="17365" origin="psip_generator" dateTime="
      2003-12-16T09:30:48-05:00" type="reply">
      <PmcpReply id="12345" origin="automation_main" dateTime="2003-12-16T09:30:47-05:00" status="OK"/>
    </PmcpMessage>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```

5.3 Naming Conventions

In order to guarantee consistency in the way elements, attributes and values are named the following conventions have been followed in the PMCP schema:

Elements:

- a. All elements have their first letter of every word capitalized. Example **T**ransport**S**tream.
- b. Element names do not contain any space, underscore or hyphen sign.
- c. Acronyms in token names are treated like English words so only the first letter is capitalized. Example: **P**sip**E**vent.

Attributes:

- a. All attributes start with a lower case letter.
- b. Any first letter of any word after the first one is capitalized.
- c. Attributes names do not contain any space or underscore.
- d. Acronyms in attribute names follow the same rules applied to English words, e.g. **p**mt**P**id.

String Values of Attributes:

- a. String values of attributes may use lower or upper case letters.
- b. Values do not contain spaces.
- c. Multiple word values are separated by an underscore.

5.4 PMCP Messages

Each PMCP message has a root element called “PmcpMessage”. It has a certain number of required attributes that identify the type of the message, its origin, and generation time. Unless

otherwise described here, the semantics of all attributes shall be interpreted as described in [3] and [4].

5.4.1 Message Validity

Each PMCP message shall conform to the PMCP XML schema defined in Annex A. Senders may transmit messages conforming to other schemas, but messages shall not extend the schema of Annex A without formally declaring it as a new schema according to [1]. Receivers may reject malformed messages or messages conforming to a schema other than that defined in Annex A as further described below.

A PCMP message is valid if and only if it is valid with respect to the PMCP schema in Annex A and all constraints specified elsewhere in this standard.

5.4.2 Message Type

A PMCP message is either of type “information” (default), “request”, or “reply”. An information message may be sent to communicate some set of metadata information. A request message may be sent to communicate or request some information. Zero, one or two reply messages may be sent to acknowledge a specific information message. One or two reply messages shall be sent to acknowledge a specific request message. No reply message shall be sent otherwise. A reply message shall contain the “PmcpReply” element. No “PmcpReply” element shall be present in an information or request message.

A system heartbeat request message is sent using the root PmcpMessage alone. All other information, request, and reply messages comprise the root element and one or more child elements, and their attributes, as defined in the schema.

5.5 Device Identification

5.5.1 Device Name

Each device utilizing PMCP shall have a unique, alphanumeric Device Name. This name shall be unique within the facility (but not necessarily globally). The definition of the device name is left up to implementation by each manufacturer, and it is expected that this will be part of a device’s initial setup.

5.5.2 Device Type

The device type shall be included in all messages sent from the device, and may aid receiving devices in determining message priority and applicability. Device types shall be assigned and recorded in the ATSC Code Point Registry [5]. The device types are expected to be relatively broad in scope, and it is possible that multiple devices within a facility will be of the same device type. **Table 5.1** identifies the currently defined device types.

Table 5.1 PMCP Device Types

Automation
Conditional_Access
MPEG_Control
Program_Management
Table_Generator
Traffic
Listing_Service
Metadata_Extractor
Table_Extractor

5.6 Message Identification

Every message sent via PMCP shall have a Message ID number and Date/Time stamp so that the individual messages can be acknowledged. In addition, it shall include the Device Name and Device Type of the originating device so that the receiving device can identify the sender and take appropriate actions. This information shall be transmitted as part of the XML.

5.6.1 Message ID

The Message ID shall be a sequential number assigned by the originating device. Message ID numbering arrangements are left up to implementation by each manufacturer but shall be in accordance with the PMCP schema.

5.6.2 Time and Date Stamp

The timestamp shall indicate the time and date that the message was sent. The time and date shall be presented in standard XML schema dateTime format, including the offset from UTC (see Section 5.10).

5.7 Acknowledgement

The sending device shall have the option of asking for an acknowledgment for each message sent. The “PmcpReply” element is used for this and has a required “status” attribute that shall have one of the values “valid”, “invalid”, “OK” or “error”. It is envisioned that the request for acknowledgements will be used primarily in the connection based protocol, although it could be implemented with files if so desired.

5.7.1 Valid

Except as indicated below, a reply message with status “valid” shall be generated by the receiving device upon receipt of a properly formatted message containing a request for acknowledgement. This acknowledgement shall serve to let the sending device know that the message has been received and that it appears to be valid with regard to this schema. It will not, however, indicate that action has been taken on the message. When the reply message responds with “valid”, then a second reply (with “OK” or “error” status) shall be sent later to indicate the

final processing status. If the “OK” or “error” message is generated in time to satisfy the “first acknowledgement” timeout criteria in 5.7.5, then the prior “valid” reply is not required.

5.7.2 Invalid

A reply message with status “invalid” shall be generated when the message has been received but does not comply with the schema described in this document and cannot be processed.

5.7.3 OK

When the receiving device has finished acting on a message containing a request for acknowledgement, it shall send a reply message with status “OK”. This acknowledgement shall indicate that the action has been completed successfully.

5.7.4 Error

If the action was not completed correctly, a reply message with status “error” shall be returned to the sending device along with a description of why the action could not be completed.

5.7.5 Acknowledgement Timeout

The timeout period during which a first acknowledgment message should be received shall be configurable per connection, with a default value of 100 ms. If no response at all has been received by the sending device in this time period, it may consider the message lost and initiate a resend.

Since it is impossible to determine how long each and every action resulting from a request message will take, there is no timeout period for reply messages with status “OK” or “error” that are sent following a “valid” reply message. Therefore, it is up to the sending device to determine the proper amount of time to wait after sending the request message before deciding that the message was not acted upon.

5.7.6 Multiple Requests

It is recommended that the sending device should not simply take a single lack of response to indicate a failed device or connection, but instead poll the device again to verify that there is no response.

The number of retries on the client side and the maximum time allowed between requests on both the client and the server sides shall be configurable per connection to address a wide variety of network configurations.

Further arrangements for managing lost messages, “error” and “invalid” messages and any resulting alarms and actions are left up to implementation by each manufacturer.

5.8 PmcpMessage Action Attributes

Many elements in a PmcpMessage may have an “action” attribute. The allowed values are “read”, “add”, “update” and “remove”. Only a request message may contain “action” attributes with the value “read”. A reply message shall not contain any “action” attribute.

- If an element has no “action” attribute, it is being sent for context and the receiver reads only the attributes necessary to uniquely identify the element. This element’s children may have an “action” attribute with any value.

- If an element has an “action” attribute with the value “read”, a reply message shall be sent in return, and it shall contain the current attributes and children for this element. The receiver of the request message should ignore all children elements and all attributes that are not necessary for unique identification.
- If an element has an “action” attribute with the value “add”, the whole element, including its children, may be added to the current environment of the receiver. If a child of such an element has an “action” attribute, its value shall be “add”. If there was already an element with the same ID, it and its children should be replaced.
- If there is an “action” attribute with the value “update”, all current attributes may be updated with the given values in the receiver environment. Each child element may have its own independent “action” attribute.
- If an element has an “action” attribute with the value “remove”, the referenced element may be deleted from the receiver environment of the receiving device. Only the attributes required for unique identification should be interpreted by the receiver. All children elements and all other attributes should be ignored.

5.9 PmcpMessage Children

Figure 5.1 shows the highest-level children of a PMCP message.

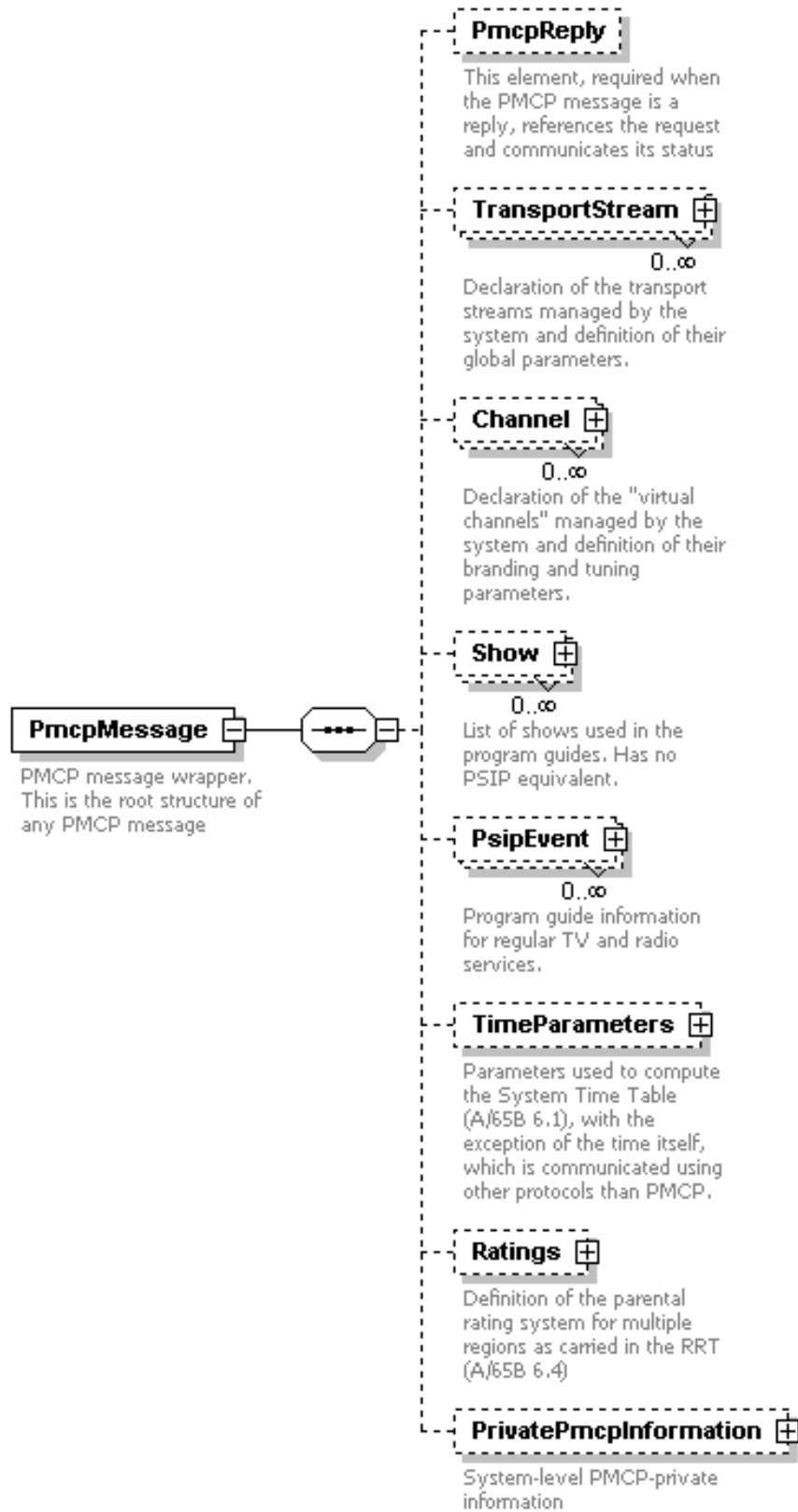


Figure 5.1 PMCP message diagram.

In this diagram, the dotted lines surrounding a child element mean that this element is optional and may not be present. The “0..∞” symbol means that the element may be present an infinite number of times.

Other child elements are defined in the schema as children of the elements shown above. These carry specific metadata related to the parent element, they also may have children, and so on in a hierarchical fashion.

Unless stated in the next sections, an element is uniquely referenced by its required attribute. No two elements sharing the same reference shall be present in a PMCP message.

5.9.1 PmcpReply

The “Reply” element is a special case message used in various ways as described in Section 5.7.

5.9.2 Transport Stream

A “TransportStream” element carries the information about a transport stream that is managed by the system. It carries only the information that applies to the whole transport stream and not to a specific channel.

A Transport Stream is uniquely referenced by its `tsid` and network attributes. In a system where TSIDs are unique, such as US terrestrial DTV, the network attribute may be omitted, otherwise it is required.

5.9.3 Channel

A “Channel” element carries the information about an ATSC “virtual channel” (see A/65B [4], Section 6.3 on the VCT). All the information found at this level is currently valid for the channel and supersedes whatever information is associated with the current PSIP event (see A/65B [4], Section 6.5 on the EIT, and Section 5.9.5.1 below).

The `tsid` and network attributes of the transport stream that carries the channel shall be present if necessary to uniquely define the referenced channel. A channel is referenced by either its `channelNumber` or `sourceId` attribute, and one of these attributes shall always be present. `ChannelNumber` shall be the default method of identification, but devices intended for use in a station environment shall support both methods of identification. By agreement with the providers of all affected devices, system implementers may choose to implement `sourceID` for channel identification between devices in a closed system environment such as an individual station.

5.9.4 Show

The “Show” element may be used to communicate metadata about a show independently of when it is scheduled. Both the “ContentId” and “ShowData” elements are required. The “ContentId” element shall contain the show label for one or more numbering schemes and should uniquely reference a show.

Where PMCP system implementers choose to use the `HouseNumber` or `AlternateId` identifiers for `ContentId`, they should ensure that the scheme used provides unique identification for the show for as long as the show is persistent in any part of the system that may receive PMCP messages relying on those identifiers. In the event that duplication of the `ContentId`

occurs, it must be accepted that any updated show data will be applied to more than one show with the same identifier.

5.9.4.1 ISAN and V-ISAN

The V-ISAN numbering scheme used for the ContentIDType/Isan element is defined in ISO 15706 [6] and ISO 20925-1 [7]. The attributes for the IsanType shall comply with the constraints defined in [6] and Annex D of [7].

5.9.5 PsipEvent

The “PsipEvent” element is the main structure used to communicate both current and future electronic program guide (EPG) information. It shall always have an “EventId” element, used to label or reference the event. The channel used to carry the PSIP Event is referenced through a mandatory “channelNumber” attribute. Optional “tsid” and “network” attributes may be used to further specify the channel when the channel number is not unique in the system. The “Current” element may be used to reference the current event of the channel when no other reference is known. The “Default” element references a default PSIP event, used by the PSIP Generator to fill in the empty time slots of the channel. All other PSIP events shall be referenced using at least one of the following elements:

- PmcpEventId is the preferred referencing method and consists of the event creator device name combined with a unique sequential number assigned by this creator.
- InitialSchedule may be used either to assign the start time initially scheduled by the creator or to reference an event by its initial start time when the PmcpEventId is not known. The initially scheduled start time shall not be modified during the existence of a PSIP event. Adjustments to the actual start time shall be done through the “startTime” attribute of the “PsipEvent” element.
- PsipEventId may be used to reference an event by its PSIP event_id, as carried in the EIT. This value is assigned by the PSIP Generator. It is therefore not known before the event has been scheduled in the PSIP Generator.

5.9.5.1 Precedence for PSIP Event Metadata

The order of precedence for the receiving device with respect to default, current, and regular PSIP events shall be:

- The current parameters associated with the channel, where available, supersede channel information that was otherwise set with PSIP event metadata for the current event.
- Regular and current PSIP events are normally used to communicate schedule information.
- The default PSIP event is used whenever no other information is available about a particular schedule time slot.

The information about an event may be communicated in two non-exclusive ways:

- The PSIP event may be linked to a show defined either previously or in the same PMCP message through a “ContentId” element.
- The PSIP event may contain its own “ShowData” element.

When the same type of information is provided through both mechanisms in the same message, the information coming from the “ShowData” element shall take precedence.

Multiple events may be linked to the same show. This provides an efficient way of using the same metadata for multiple events.

5.9.6 PrivatePmcpInformation

The PrivatePmcpInformation element is the mechanism used to carry private elements and attributes in a PCMP message. The following constraints apply:

- Elements not defined in the PMCP schema (Private PCMP Elements) are prohibited except when enclosed by the PrivatePmcpInformation element.
- Attributes not defined in the PMCP schema are prohibited except when in Private PMCP Elements.
- All private elements and attributes shall use an XML namespace prefix.

5.9.7 Other Children

The PmcpMessage children: TimeParameters and Ratings carry the values for the various parameters in the PSIP System Time Table (STT) and Regional Rating Table (RRT) and map to those tables.

5.10 PMCP Time Messages

All PMCP time fields defined in the PMCP Schema follow the standard XML date/time format and, using the timezone offset syntax, can refer to any time zone (see <http://www.w3.org/TR/xmlschema-2/#datetime>). Based on the techniques described in Annex C, PMCP time will be ultimately referenced to UTC. The PSIP Event has additional optional start frame time and duration frame attributes to allow times for Events to be specified with frame accuracy where this is required.

5.11 Heartbeat

In a connection-based implementation, each PMCP client shall poll each PMCP server that it is connected to with a heartbeat request and shall look for a heartbeat reply message back.

Each PMCP server shall monitor each connected PMCP client by looking for periodic heartbeat request messages.

5.11.1 Heartbeat Messages

The heartbeat request shall be sent using the root PmcpMessage alone as indicated in Section 5.4.2. This message shall include the sending device’s type and identification, and shall have a "type" attribute with the value "request".

The heartbeat reply is the acknowledgement of the heartbeat request, as defined in Section 5.7, normally with status attribute “OK”.

Examples of such messages are given in Annex B.

5.11.2 Heartbeat Timing

On the client side, the interval between heartbeat request messages shall be configurable per connection. Its minimum value shall be less than or equal to one second. Its maximum value shall be greater than or equal to one minute. In the event that any other message with an acknowledgement request is sent by the client within the same period, this may take the place of the heartbeat request.

The timeout period that the client shall use for the acknowledgement response is defined in Section 5.7.5. The client shall ensure that the heartbeat request interval is always greater than this timeout.

5.11.3 Server Heartbeat Timeout

The server heartbeat timeout is defined as the maximum duration that the server waits between two heartbeat request messages before deciding that a message has been lost. It shall be configurable per connection. Its minimum value shall be less than or equal to one second. Its maximum value shall be greater than or equal to one minute.

It is recommended that the server should not simply take a single lost heartbeat request to indicate a failed device or connection, but instead wait for subsequent messages to verify if they are also lost. The number of heartbeat periods to wait before considering the connection lost shall be configurable per connection. In order to prevent false communication failure alarms, while detecting communication failures in a timely fashion, the server time out period and number of periods to wait should be adjusted during system set up based on the heartbeat message period set for the client.

5.11.4 Failed Device

If a device does not respond to repeated polling messages, the sending device should assume that the device is no longer in service and should address the backup device if one exists.

Further arrangements for managing heartbeat messages and any resulting alarms and actions are left up to implementation by each manufacturer.

5.12 Message Priority and Conflict Management

In many cases, it is foreseeable that a given device could receive multiple, potentially conflicting, pieces of information from different sources. How these conflicts are handled is left up to implementation by each manufacturer. Possible methods include “Last Message” mode where the last message sent (based on the message send time) is used, or a more intelligent approach where the receiving device takes into account the sender’s name and device type and the amount of time before air. It is expected that certain devices will have more relevant or more reliable information depending on how close to broadcast time it is for the related PSIP event. In these cases, having a message send time, and device name and type to identify the sending device will aid the receiving device in making a decision on how best to handle the messages.

It is recommended that the PSIP table generator and other systems’ validity rules should be configurable based on input from a user interface or configuration control system, as may be necessary for network and station operational changes.

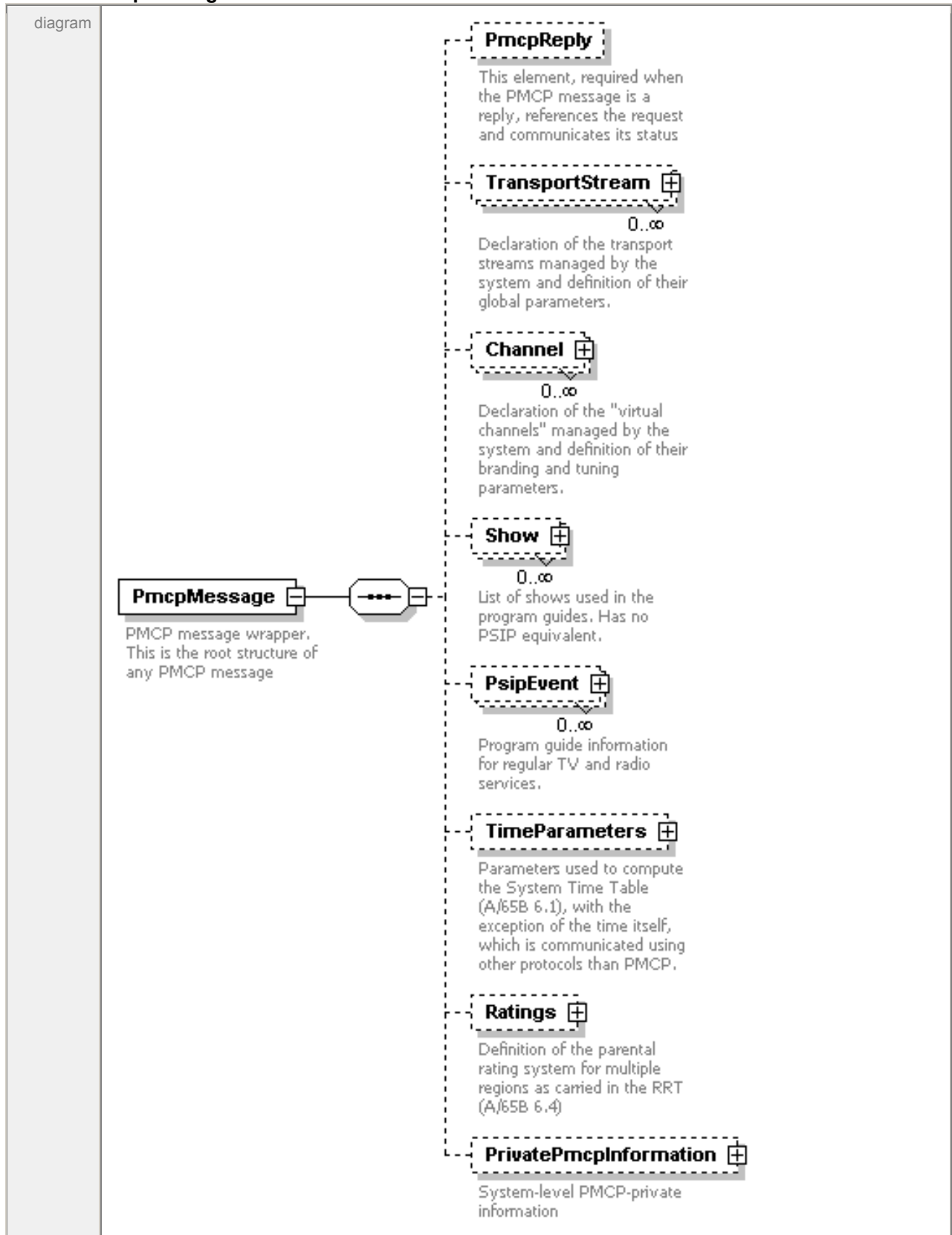
Annex A: PMCP Schema

Schema **PMCP2.0.xsd**

targetNamespace: <http://www.atsc.org/pmcp/2004/2.0>

Elements	Complex types	Simple types
<u>PmcpMessage</u>	<u>Ac3AudioType</u>	<u>actionType</u>
	<u>AlternateIdType</u>	<u>audioldType</u>
	<u>AudiosType</u>	<u>audioServiceType</u>
	<u>Caption608Type</u>	<u>bitRateKbpsType</u>
	<u>Caption708Type</u>	<u>bsidType</u>
	<u>CaptionsType</u>	<u>ccServiceType</u>
	<u>ChannelCopyType</u>	<u>channelNumberType</u>
	<u>ChannelType</u>	<u>channelStatusType</u>
	<u>ConditionalAccessType</u>	<u>dsDayOfMonthType</u>
	<u>ContentIdType</u>	<u>dsHourType</u>
	<u>DescriptorType</u>	<u>elementaryErrorType</u>
	<u>DimensionType</u>	<u>errorType</u>
	<u>ElementaryStreamType</u>	<u>isanCheckType</u>
	<u>EventIdType</u>	<u>isanEpisodeType</u>
	<u>HouseNumberType</u>	<u>isanRootType</u>
	<u>InitialScheduleType</u>	<u>isanVersionType</u>
	<u>IsanType</u>	<u>languageType</u>
	<u>ParentalRatingType</u>	<u>mainidType</u>
	<u>PmcpEventIdType</u>	<u>messageType</u>
	<u>PmcpReplyType</u>	<u>modulationType</u>
	<u>PrivateInformationType</u>	<u>networkTypeType</u>
	<u>PrivatePmcpInformationType</u>	<u>numChannelsType</u>
	<u>PsipEventIdType</u>	<u>onePartType</u>
	<u>PsipEventType</u>	<u>pathSelectType</u>
	<u>RatingsType</u>	<u>pidType</u>
	<u>RatingType</u>	<u>privateInformationDataType</u>
	<u>RatingValueType</u>	<u>psipEventIdType</u>
	<u>RedistributionControlType</u>	<u>serviceType</u>
	<u>RegionType</u>	<u>shortNameType</u>
	<u>ShowDataType</u>	<u>statusType</u>
	<u>ShowType</u>	<u>twoPartType</u>
	<u>TableType</u>	
	<u>TextType</u>	
	<u>TimeParametersType</u>	
	<u>TimeShiftedServiceType</u>	
	<u>TransportStreamType</u>	

element **PmcpMessage**



children	<u>PmcpReply</u> <u>TransportStream</u> <u>Channel</u> <u>Show</u> <u>PsipEvent</u> <u>TimeParameters</u> <u>Ratings</u> <u>PrivatePmcpInformation</u>				
attributes	Name	Type	Use	Default	Annotation
	id	xsd:unsignedInt	required		unique number assigned to the message by its originating system
	origin	xsd:string	required		Device name of the originating system of the message
	originType	xsd:string	required		Type of the originating system (see ATSC code point registry)
	destination	xsd:string	optional	all	Device name of the intended destination for the message
	dateTime	xsd:dateTime	required		Date and time of generation of the message
	type	messageType	optional	information	Message type
	error	errorType	optional		
annotation	PMCP message wrapper. This is the root structure of any PMCP message				

element **PmcpMessage/PmcpReply**

type	<u>PmcpReplyType</u>
annotation	This element, required when the PMCP message is a reply, references the request and communicates its status

element **PmcpMessage/TransportStream**

type	<u>TransportStreamType</u>
annotation	Declaration of the transport streams managed by the system and definition of their global parameters.

element **PmcpMessage/Channel**

type	<u>ChannelType</u>
annotation	Declaration of the "virtual channels" managed by the system and definition of their branding and tuning parameters.

element **PmcpMessage/Show**

type	<u>ShowType</u>
annotation	List of shows used in the program guides. Has no PSIP equivalent.

element **PmcpMessage/PsipEvent**

type	<u>PsipEventType</u>
annotation	Program guide information for regular TV and radio services.

element **PmcpMessage/TimeParameters**

type	<u>TimeParametersType</u>
annotation	Parameters used to compute the System Time Table (A/65B 6.1), with the exception of the time itself, which is communicated using other protocols than PMCP.

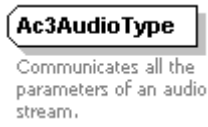
element **PmcpMessage/Ratings**

type	<u>RatingsType</u>
annotation	Definition of the parental rating system for multiple regions as carried in the RRT (A/65B 6.4)

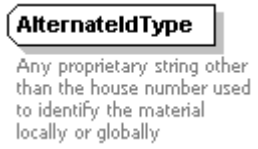
element **PmcpMessage/PrivatePmcpInformation**

type	<u>PrivatePmcpInformationType</u>
annotation	System-level PMCP-private information

complexType **Ac3AudioType**

diagram					
used by	element <u>AudiosType/Ac3Audio</u>				
attributes	Name	Type	Use	Default	Annotation
	audioid	audioidType	required		ID of the audio service in the virtual channel. Links to an elementary stream.
	lang	languageType	optional		Language of the audio stream carried in the ISO_639_language_descriptor
	serviceType	audioServiceType	optional	complete_main	Audio service type. Complete_main is the default (A/65B 6.9.1)
	numChannels	numChannelsType	optional	2/0	Number of audio channels in the elementary stream (A/65B 6.9.1)
	bitRateKbps	bitRateKbpsType	optional	448	Bit rate of the elementary stream in kbps (A/65B 6.9.1)
	exactBitRate	xsd:boolean	optional	false	Indicates if bitRateKbps is an exact value or an upper bound (A/65B 6.9.1)
	surround	xsd:boolean	optional		Indicates if the audio service is surround (A/65B 6.9.1)
	fullSvc	xsd:boolean	optional	true	Indicates whether the elementary stream can be decoded alone or must be presented along with other audio streams (A/65B 6.9.1)
	mainid	mainidType	optional		ID of the audio stream, if its fullsvc flag is set to true (A/65B 6.9.1)
	asvcflags	xsd:unsignedByte	optional		If the fullsvc flag is set to false, each bit in this byte indicates with which main audio streams this elementary stream can be presented (A/65B 6.9.1)
	bsid	bsidType	optional	8	Version of the AC-3 standard used by the audio stream. Default is 8 (A/65B 6.9.1)
	action	actionType	optional		
	error	errorType	optional		
annotation	Communicates all the parameters of an audio stream.				

complexType **AlternateldType**

diagram					
type	extension of xsd:string				
used by	Elements <u>ContentIdType/Alternateld</u> <u>ContentIdType/Alternateld</u> <u>ContentIdType/Alternateld</u>				
attributes	Name	Type	Use	Default	Annotation
	idType	xsd:string	required		This attribute uniquely identifies the type of alternate Id communicated in the element
	action	actionType	optional		
	error	errorType	optional		
annotation	Any proprietary string other than the house number used to identify the material locally or globally				

complexType **AudiosType**

diagram					
children	<u>Null</u> <u>Ac3Audio</u>				
used by	elements <u>ChannelType/Audios</u> <u>ShowDataType/Audios</u>				
attributes	Name action error	Type actionType errorType	Use optional optional	Default	Annotation
annotation	List of audio services				

element **AudiosType/Null**

annotation	Means that there is no audio service
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element **AudiosType/Ac3Audio**

type	<u>Ac3AudioType</u>
annotation	Individual audio service

complexType **Caption608Type**

diagram					
used by	Element <u>CaptionsType/Caption608</u>				
attributes	Name action error	Type actionType errorType	Use optional optional	Default	Annotation
annotation	Used to indicate the presence of 608 line 21 analog captions				

complexType Caption708Type

diagram					
used by	element <u>CaptionsType/Caption708</u>				
attributes	Name	Type	Use	Default	Annotation
	service	ccServiceType	required		708 captions service number
	lang	languageType	optional		Language of the caption service
	wideAspectRatio	xsd:boolean	optional		Indicates the aspect ratio for which the caption service has been formatted
	easyReader	xsd:boolean	optional		Indicates if the caption service is formatted for beginner readers.
	action	actionType	optional		
	error	errorType	optional		
annotation	Describes a 708 DTVCC digital captions service				

complexType CaptionsType

diagram					
children	<u>Null</u> <u>Caption608</u> <u>Caption708</u>				
used by	elements <u>ChannelType/Captions</u> <u>ShowDataType/Captions</u>				
attributes	Name	Type	Use	Default	Annotation
	action	actionType	optional		
	error	errorType	optional		
annotation	Caption Service Descriptor (A/65B 6.9.3)				

element CaptionsType/Null

annotation	Means that there is no caption service
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element CaptionsType/Caption608

type	<u>Caption608Type</u>
annotation	Indicates that analog captions are present

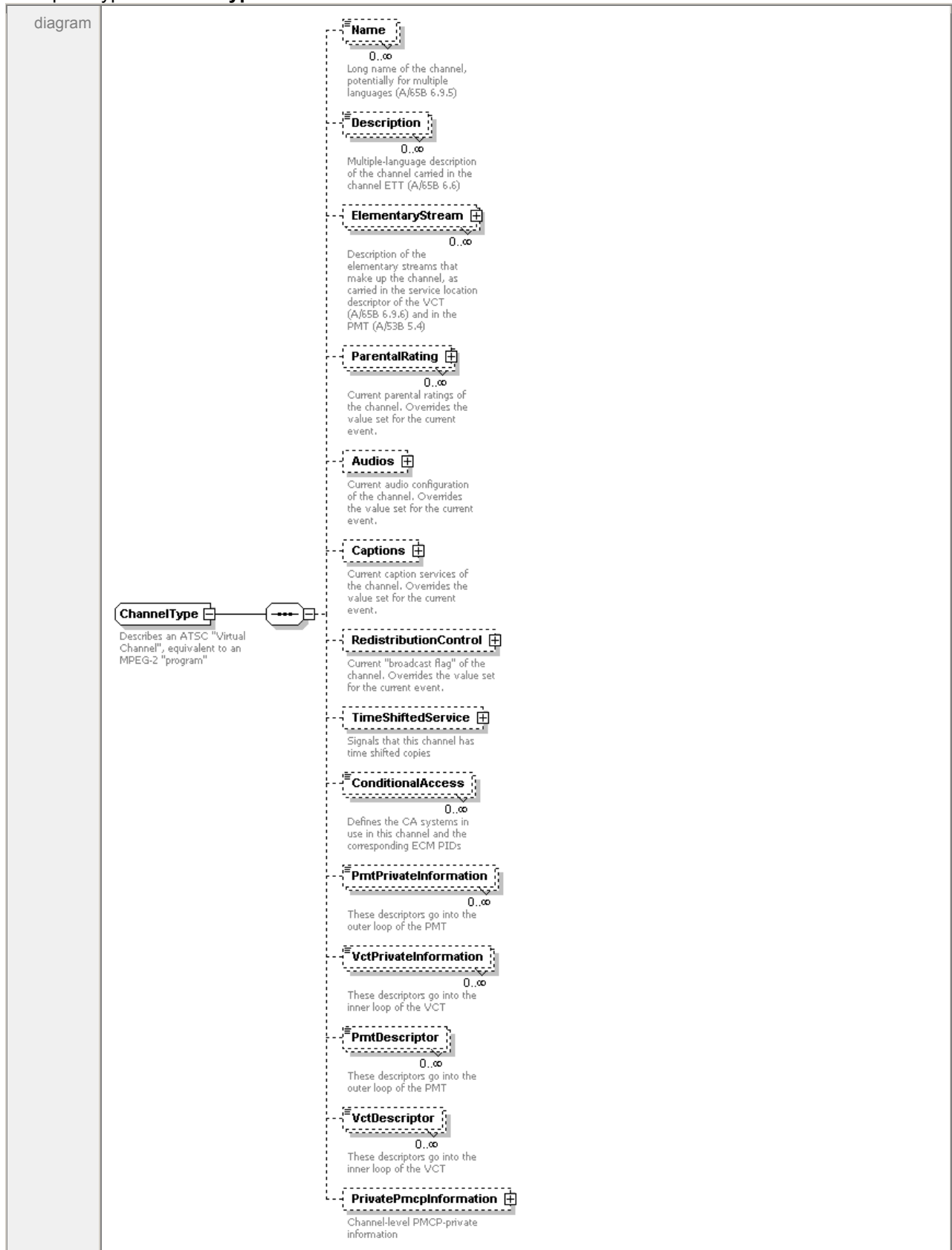
element CaptionsType/Caption708

type	<u>Caption708Type</u>
annotation	Describe digital captions services

complexType **ChannelCopyType**

diagram					
used by	element <u>TimeShiftedServiceType/Copy</u>				
attributes	Name	Type	Use	Default	Annotation
	timeShift	xsd:duration	required		Delay compared to the reference channel
	channel	channelNumberType	required		Channel number of the time-shifted copy
annotation	Type for a time shifted service				

complexType ChannelType



children	<u>Name</u> <u>Description</u> <u>ElementaryStream</u> <u>ParentalRating</u> <u>Audios</u> <u>Captions</u> <u>RedistributionControl</u> <u>TimeShiftedService</u> <u>ConditionalAccess</u> <u>PmtPrivateInformation</u> <u>VctPrivateInformation</u> <u>PmtDescriptor</u> <u>VctDescriptor</u> <u>PrivatePmcplInformation</u>				
used by	element <u>PmcpMessage/Channel</u>				
attributes	Name	Type	Use	Default	Annotation
	channelNumber	channelNumberType	optional		Two-part or one-part channel number of the virtual channel
	tsid	xsd:unsignedShort	optional		TSID of the carrying transport stream (A/65B 6.3)
	network	xsd:unsignedShort	optional		Network identifier, used when the TSID is not unique in the system
	programNumber	xsd:unsignedShort	optional		MPEG-2 program number used by the virtual channel (A/65B 6.3)
	sourceId	xsd:unsignedShort	optional		PSIP source_id (A/65B 6.3)
	status	channelStatusType	optional		Current activity status of the channel (A/65B 6.3 hidden and hide_guide)
	type	serviceType	optional		Type of the primary service provided by the channel: TV, radio or data (A/65B 6.3 service_type)
	ca	xsd:boolean	optional		Specifies if this channel is partly or completely encrypted and access-controlled (A/65B 6.3 access_controlled)
	shortName	shortNameType	optional		PSIP short name (7 characters max.) (A/65B 6.3)
	outOfBand	xsd:boolean	optional		When true, signals that the PSIP data is not carried in the same physical channel as the virtual channel itself (A/65B 6.3.2)
	pmtPid	pidType	optional		PID used to carry the MPEG-2 PMT of the channel (A/53B 5.4)
	pcrPid	pidType	optional		PID used to carry the PCR fields of the channel, same as video PID per ATSC rules (A/53B 5.4)
	action	actionType	optional		
	error	errorType	optional		
annotation	Describes an ATSC "Virtual Channel", equivalent to an MPEG-2 "program"				

element **ChannelType/Name**

type	<u>TextType</u>
annotation	Long name of the channel, potentially for multiple languages (A/65B 6.9.5)

element **ChannelType/Description**

type	<u>TextType</u>
annotation	Multiple-language description of the channel carried in the channel ETT (A/65B 6.6)

element **ChannelType/ElementaryStream**

type	<u>ElementaryStreamType</u>
annotation	Description of the elementary streams that make up the channel, as carried in the service location descriptor of the VCT (A/65B 6.9.6) and in the PMT (A/53B 5.4)

element **ChannelType/ParentalRating**

type	<u>ParentalRatingType</u>
annotation	Current parental ratings of the channel. Overrides the value set for the current event.

element ChannelType/Audios

type	<u>AudiosType</u>
annotation	Current audio configuration of the channel. Overrides the value set for the current event.

element ChannelType/Captions

type	<u>CaptionsType</u>
annotation	Current caption services of the channel. Overrides the value set for the current event.

element ChannelType/RedistributionControl

type	<u>RedistributionControlType</u>
annotation	Current "broadcast flag" of the channel. Overrides the value set for the current event.

element ChannelType/TimeShiftedService

type	<u>TimeShiftedServiceType</u>
annotation	Signals that this channel has time shifted copies

element ChannelType/ConditionalAccess

type	<u>ConditionalAccessType</u>
annotation	Defines the CA systems in use in this channel and the corresponding ECM PIDs

element ChannelType/PmtPrivateInformation

type	<u>PrivateInformationType</u>
annotation	These descriptors go into the outer loop of the PMT

element ChannelType/VctPrivateInformation

type	<u>PrivateInformationType</u>
annotation	These descriptors go into the inner loop of the VCT

element ChannelType/PmtDescriptor

type	<u>DescriptorType</u>
annotation	These descriptors go into the outer loop of the PMT

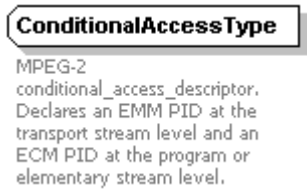
element ChannelType/VctDescriptor

type	<u>DescriptorType</u>
annotation	These descriptors go into the inner loop of the VCT

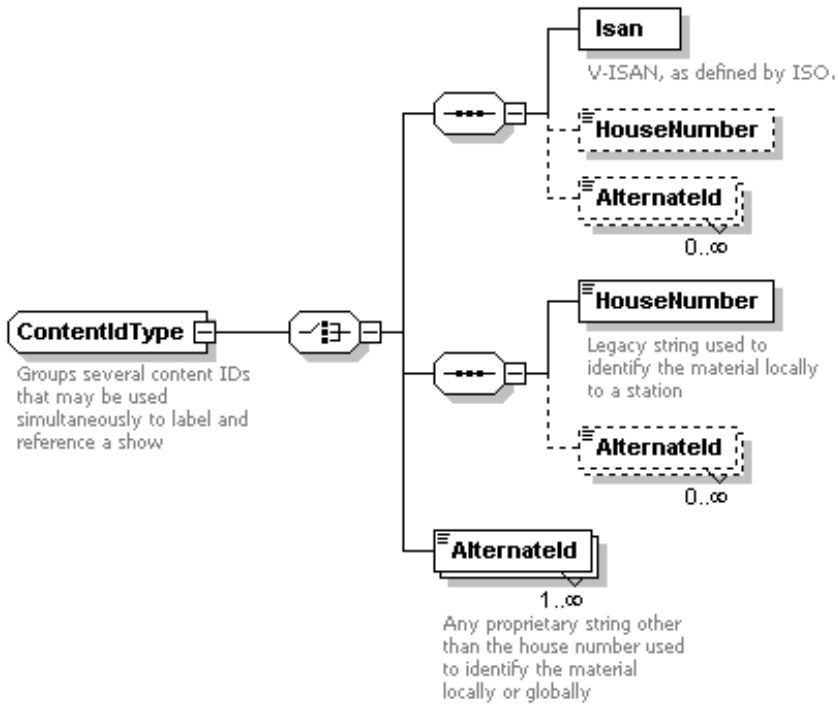
element ChannelType/PrivatePmcplInformation

type	<u>PrivatePmcplInformationType</u>
annotation	Channel-level PMCP-private information

complexType **ConditionalAccessType**

diagram					
type	extension of xsd:hexBinary				
used by	elements <u>TransportStreamType/ConditionalAccess</u> <u>ChannelType/ConditionalAccess</u> <u>ElementaryStreamType/ConditionalAccess</u>				
attributes	Name	Type	Use	Default	Annotation
	systemId	xsd:unsignedShort	required		Conditional access system ID
	pid	pidType	optional		EMM or ECM PID, depending on context
	action	actionType	optional		
	error	errorType	optional		
annotation	MPEG-2 conditional_access_descriptor. Declares an EMM PID at the transport stream level and an ECM PID at the program or elementary stream level.				

complexType **ContentIdType**

diagram					
children	<u>Isan</u> <u>HouseNumber</u> <u>Alternateld</u> <u>HouseNumber</u> <u>Alternateld</u> <u>Alternateld</u>				
used by	elements <u>ShowType/ContentId</u> <u>PsipEventType/ContentId</u>				
attributes	Name	Type	Use	Default	Annotation
	action	actionType	optional		
	error	errorType	optional		
annotation	Groups several content IDs that may be used simultaneously to label and reference a show				

element **ContentIdType/Isan**

type	<u>IsanType</u>
annotation	V-ISAN, as defined by ISO.

element **ContentIdType/HouseNumber**

type	<u>HouseNumberType</u>
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element **ContentIdType/Alternateld**

type	<u>AlternateldType</u>
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element **ContentIdType/HouseNumber**

type	<u>HouseNumberType</u>
annotation	Legacy string used to identify the material locally to a station

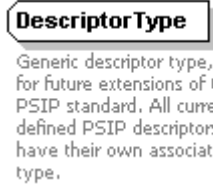
element **ContentIdType/Alternateld**

type	<u>AlternateldType</u>
------	------------------------

element **ContentIdType/Alternateld**

type	<u>AlternateldType</u>
annotation	Any proprietary string other than the house number used to identify the material locally or globally

complexType **DescriptorType**

diagram					
type	extension of xsd:hexBinary				
used by	elements <u>RegionType/Descriptor</u> <u>PsipEventType/EitDescriptor</u> <u>TransportStreamType/MgtDescriptor</u> <u>TableType/MgtDescriptor</u> <u>ChannelType/PmtDescriptor</u> <u>ElementaryStreamType/PmtDescriptor</u> <u>TimeParametersType/SttDescriptor</u> <u>TransportStreamType/VctDescriptor</u> <u>ChannelType/VctDescriptor</u>				
attributes	Name	Type	Use	Default	Annotation
	descriptorTag	xsd:unsignedByte	required		Descriptor tag
	action	actionType	optional		
	error	errorType	optional		
annotation	Generic descriptor type, used for future extensions of the PSIP standard. All currently defined PSIP descriptors have their own associated type.				

complexType DimensionType

diagram					
children	<u>Name Value</u>				
used by	element <u>RegionType/Dimension</u>				
attributes	Name	Type	Use	Default	Annotation
	graduatedScale	xsd:boolean	required		Indicates if the dimension is graduated
	action	actionType	optional		
	error	errorType	optional		
annotation	Type for a dimension in a rating region				

element DimensionType/Name

type	<u>TextType</u>
annotation	Name of the dimension

element DimensionType/Value

type	<u>RatingValueType</u>
annotation	Possible values for a given dimension

complexType **ElementaryStreamType**

diagram					
children	Name ConditionalAccess PmtPrivateInformation PmtDescriptor				
used by	element ChannelType/ElementaryStream				
attributes	Name	Type	Use	Default	Annotation
	pid	pidType	required		PID used to carry the elementary stream stream_type as defined by MPEG-2 and ATSC and carried in the PMT and service location descriptor ID of an audio stream in a channel. Links to an Ac3Audio element.
	type	xsd:unsignedByte	optional		
	audiold	audioldType	optional		
	action	actionType	optional		
	error	errorType	optional		
annotation	Defines an elementary stream, i.e. an MPEG-2 PID. Used to build the service location descriptor and the PMT.				

element **ElementaryStreamType/Name**

type	TextType
annotation	Elementary stream name, carried in the component name descriptor (A/65B 6.9.8)

element **ElementaryStreamType/ConditionalAccess**

type	ConditionalAccessType
annotation	Defines the CA systems in use for the elementary stream and the corresponding ECM PIDs

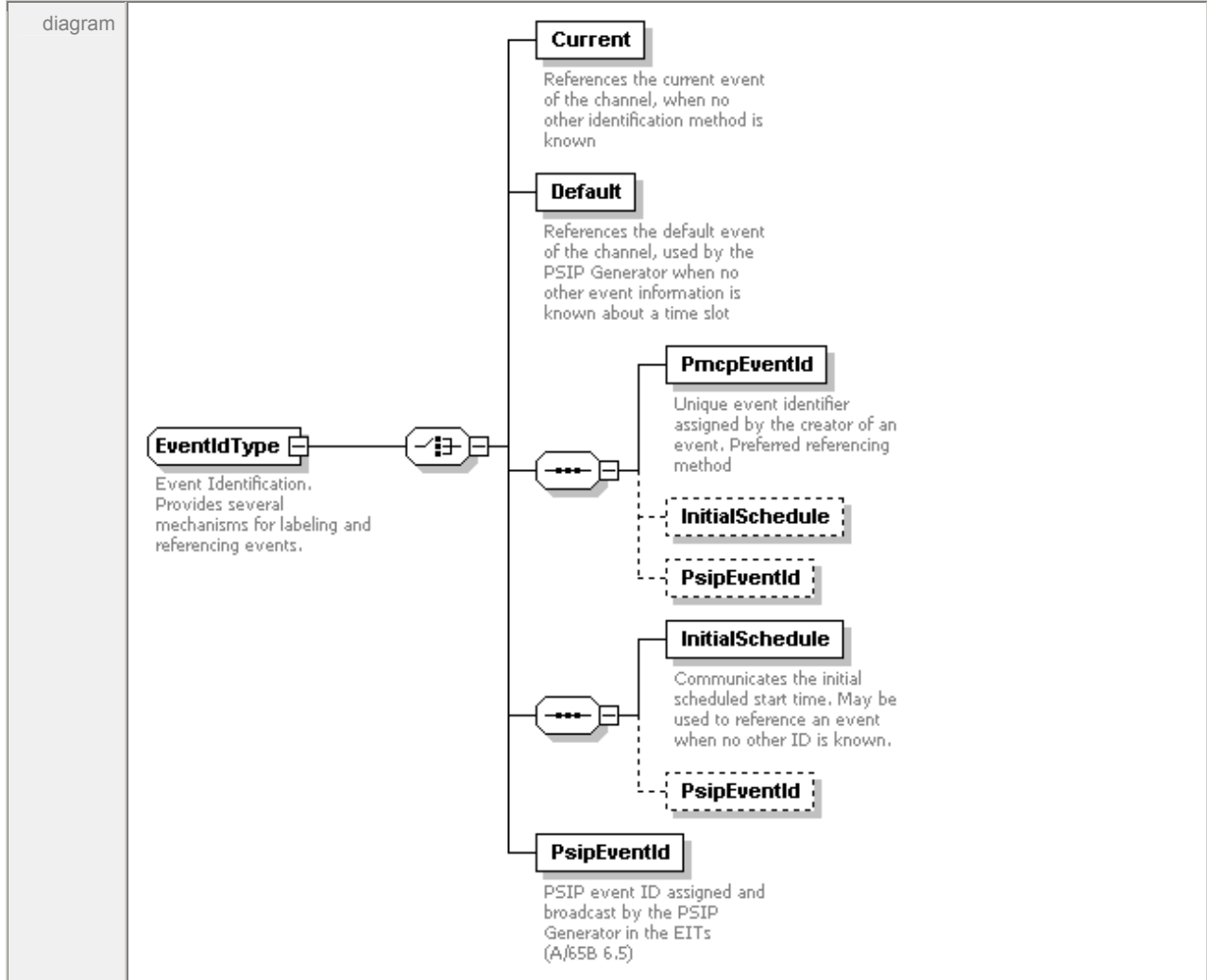
element **ElementaryStreamType/PmtPrivateInformation**

type	PrivateInformationType
annotation	These descriptors go into the inner loop of the PMT

element **ElementaryStreamType/PmtDescriptor**

type	DescriptorType
annotation	These descriptors go into the inner loop of the PMT

complexType **EventIdType**



children	Current Default PmcpeventId InitialSchedule PsipeventId InitialSchedule PsipeventId PsipeventId
----------	--

used by	element PsipeventType/EventId
---------	--------------------------------------

attributes	Name	Type	Use	Default	Annotation
	channelNumber	channelNumberType	required		Channel number of the channel that carries the event TSID of the transport stream that carries the event, used if the channel number is not unique in the system
	tsid	xsd:unsignedShort	optional		
	network	xsd:unsignedShort	optional		
	action	actionType	optional		Network identifier of the channel that carries the event, used when the TSID is not unique in the system
	error	errorType	optional		

annotation	Event Identification. Provides several mechanisms for labeling and referencing events.
------------	--

element EventIdType/Current

annotation	References the current event of the channel, when no other identification method is known
------------	---

element EventIdType/Default

annotation	References the default event of the channel, used by the PSIP Generator when no other event information is known about a time slot
------------	--

element EventIdType/PmcpEventId

type	<u>PmcpEventIdType</u>
annotation	Unique event identifier assigned by the creator of an event. Preferred referencing method

element EventIdType/InitialSchedule

type	<u>InitialScheduleType</u>
------	-----------------------------------

element EventIdType/PsipEventId

type	<u>PsipEventIdType</u>
------	-------------------------------

element EventIdType/InitialSchedule

type	<u>InitialScheduleType</u>
annotation	Communicates the initial scheduled start time. May be used to reference an event when no other ID is known.

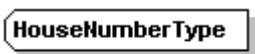
element EventIdType/PsipEventId

type	<u>PsipEventIdType</u>
------	-------------------------------

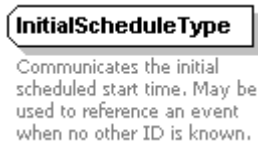
element EventIdType/PsipEventId

type	<u>PsipEventIdType</u>
annotation	PSIP event ID assigned and broadcast by the PSIP Generator in the EITs (A/65B 6.5)

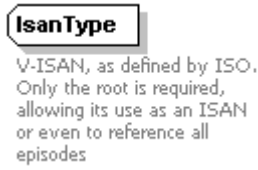
complexType HouseNumberType

diagram	 <p>Legacy string used to identify the material locally to a station</p>				
type	extension of xsd:string				
used by	elements <u>ContentIdType/HouseNumber</u> <u>ContentIdType/HouseNumber</u>				
attributes	Name action error	Type actionType errorType	Use optional optional	Default	Annotation
annotation	Legacy string used to identify the material locally to a station				

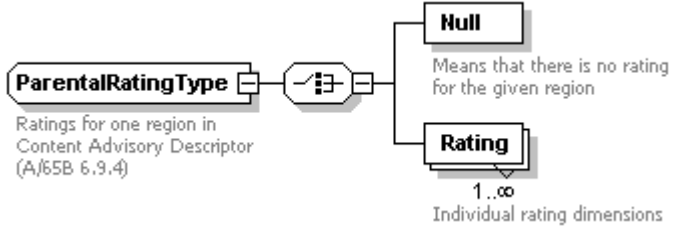
complexType InitialScheduleType

diagram					
used by	elements EventIdType/InitialSchedule EventIdType/InitialSchedule				
attributes	Name	Type	Use	Default	Annotation
	startTime	xsd:dateTime	required		Start time initially scheduled for the event.
	action	actionType	optional		
	error	errorType	optional		
annotation	Communicates the initial scheduled start time. May be used to reference an event when no other ID is known.				

complexType IsanType

diagram					
used by	element ContentIdType/Isan				
attributes	Name	Type	Use	Default	Annotation
	root	isanRootType	required		
	episodeOrPart	isanEpisodeType	optional		
	check1	isanCheckType	optional		
	version	isanVersionType	optional		
	check2	isanCheckType	optional		
	action	actionType	optional		
	error	errorType	optional		
annotation	V-ISAN, as defined by ISO. Only the root is required, allowing its use as an ISAN or even to reference all episodes				

complexType ParentalRatingType

diagram					
children	Null Rating				
used by	elements ChannelType/ParentalRating ShowDataType/ParentalRating				
attributes	Name	Type	Use	Default	Annotation
	region	xsd:unsignedByte	required		Rating region, as defined by the ATSC Code Point Registry
	action	actionType	optional		
	error	errorType	optional		
annotation	Ratings for one region in Content Advisory Descriptor (A/65B 6.9.4)				


element **ParentalRatingType/Null**

annotation	Means that there is no rating for the given region
------------	--

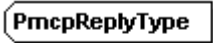
element **ParentalRatingType/Rating**

type	RatingType
annotation	Individual rating dimensions


complexType **PmcpEventIdType**

diagram	 <p>Unique event identifier assigned by the creator of an event. Preferred referencing method</p>				
used by	element EventIdType/PmcpEventId				
attributes	Name	Type	Use	Default	Annotation
	creator	xsd:string	required		Device name of the initial event creator
	id	xsd:unsignedInt	required		Number assigned by the creator
	action	actionType	optional		
	error	errorType	optional		
annotation	Unique event identifier assigned by the creator of an event. Preferred referencing method				


complexType **PmcpReplyType**

diagram	 <p>This element, required when the PMCP message is a reply, references the request and communicates its status</p>				
used by	element PmcpMessage/PmcpReply				
attributes	Name	Type	Use	Default	Annotation
	id	xsd:unsignedInt	required		id of the request message
	origin	xsd:string	required		Originating system of the request message
	originType	xsd:string	optional		Type of the originating system for the request message
	destination	xsd:string	optional	all	Intended destination for the request message
	dateTime	xsd:dateTime	required		Date and time of generation of the request message
	status	statusType	required		Indicates the result of processing the request
annotation	This element, required when the PMCP message is a reply, references the request and communicates its status				


complexType **PrivateInformationType**

diagram	 <p>ATSC Private Information descriptor, used for sending private data in an ATSC table (A/53B Amendment 2, 5.7.3.4)</p>				
type	extension of <u>privateInformationDataType</u>				
used by	elements <u>PsipEventType/EitPrivateInformation</u> <u>TransportStreamType/MgtPrivateInformation</u> <u>TableType/MgtPrivateInformation</u> <u>ChannelType/PmtPrivateInformation</u> <u>ElementaryStreamType/PmtPrivateInformation</u> <u>RegionType/PrivateInformation</u> <u>TimeParametersType/SttPrivateInformation</u> <u>TransportStreamType/VctPrivateInformation</u> <u>ChannelType/VctPrivateInformation</u>				
facets	maxLength 251				
attributes	Name	Type	Use	Default	Annotation
	formatIdentifier	xsd:unsignedInt	required		Format Identifier registered by SMPTE
	action	actionType	optional		
	error	errorType	optional		
annotation	ATSC Private Information descriptor, used for sending private data in an ATSC table (A/53B Amendment 2, 5.7.3.4)				

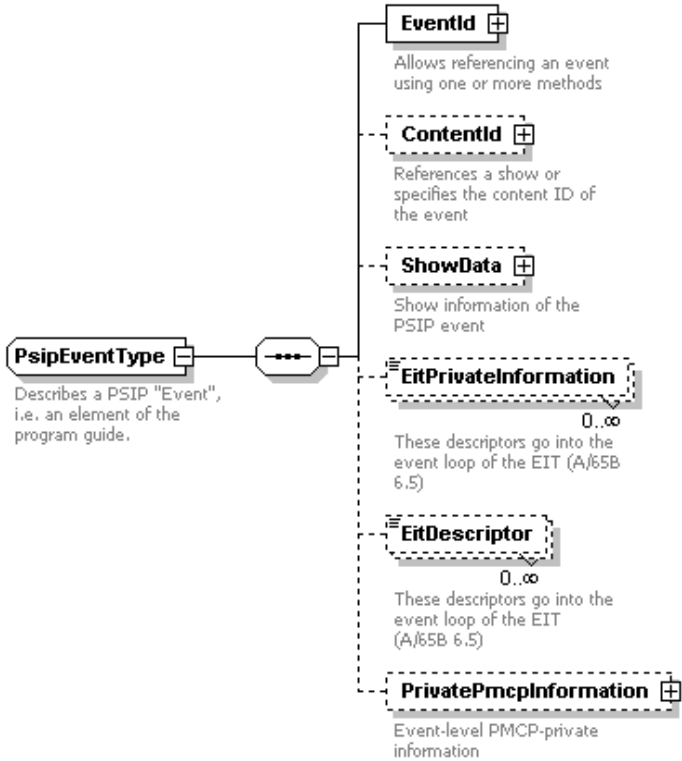
complexType **PrivatePmcpInformationType**

diagram	 <p>Any sequence of well-formed private xml elements. Allows systems to carry additional private information in a PMCP message</p>				
used by	elements <u>PmcpMessage/PrivatePmcpInformation</u> <u>TransportStreamType/PrivatePmcpInformation</u> <u>ChannelType/PrivatePmcpInformation</u> <u>ShowType/PrivatePmcpInformation</u> <u>PsipEventType/PrivatePmcpInformation</u>				
annotation	Any sequence of well-formed private xml elements. Allows systems to carry additional private information in a PMCP message				

complexType **PsipEventIdType**

diagram					
used by	elements <u>EventIdType/PsipEventId</u> <u>EventIdType/PsipEventId</u> <u>EventIdType/PsipEventId</u>				
attributes	Name	Type	Use	Default	Annotation
	eventId	psipEventIdType	required		Event_id as defined by PSIP and carried in the EIT
	action	actionType	optional		
	error	errorType	optional		

complexType **PsipEventType**

<p>diagram</p>																																																								
<p>children</p>	<p><u>EventId ContentId ShowData EitPrivateInformation EitDescriptor PrivatePmcpInformation</u></p>																																																							
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<p>annotation</p>	<p>Describes a PSIP "Event", i.e. an element of the program guide.</p>																																																							

element PsipEventType/EventId

type	<u>EventIdType</u>
annotation	Allows referencing an event using one or more methods

element PsipEventType/ContentId

type	<u>ContentIdType</u>
annotation	References a show or specifies the content ID of the event

element PsipEventType/ShowData

type	<u>ShowDataType</u>
annotation	Show information of the PSIP event

element PsipEventType/EitPrivateInformation

type	<u>PrivateInformationType</u>
annotation	These descriptors go into the event loop of the EIT (A/65B 6.5)

element PsipEventType/EitDescriptor

type	<u>DescriptorType</u>
annotation	These descriptors go into the event loop of the EIT (A/65B 6.5)

element PsipEventType/PrivatePmcpInformation

type	<u>PrivatePmcpInformationType</u>
annotation	Event-level PMCP-private information


complexType RatingsType

diagram	<p>Describes the ratings system and is used to build the Rating Region Table (A/65B 6.4)</p> <p>1..255 Rating system for one region</p>				
children	<u>Region</u>				
used by	element <u>PmcpMessage/Ratings</u>				
attributes	Name action error	Type actionType errorType	Use optional optional	Default	Annotation
annotation	Describes the ratings system and is used to build the Rating Region Table (A/65B 6.4)				

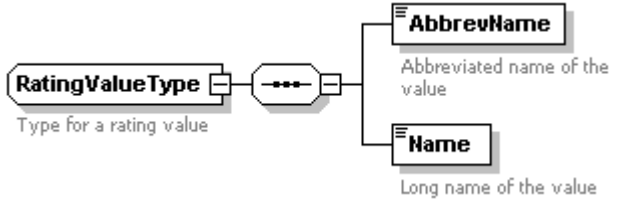
element RatingsType/Region

type	<u>RegionType</u>
annotation	Rating system for one region

complexType RatingType

diagram					
used by	element <u>ParentalRatingType/Rating</u>				
attributes	Name	Type	Use	Default	Annotation
	dimension	xsd:string	required		Name of the dimension
	value	xsd:string	optional		Name of the rating value
	action	actionType	optional		
	error	errorType	optional		
annotation	Rating for one dimension in Content Advisory Descriptor (A/65B 6.9.4)				

complexType RatingValueType

diagram					
children	<u>AbbrevName Name</u>				
used by	element <u>DimensionType/Value</u>				
attributes	Name	Type	Use	Default	Annotation
	action	actionType	optional		
	error	errorType	optional		
annotation	Type for a rating value				

element RatingValueType/AbbrevName

type	<u>TextType</u>
annotation	Abbreviated name of the value

element RatingValueType/Name

type	<u>TextType</u>
annotation	Long name of the value

complexType **RedistributionControlType**

diagram					
children	Null				
used by	elements ChannelType/RedistributionControl/ShowDataType/RedistributionControl				
attributes	Name	Type	Use	Default	Annotation
	action	actionType	optional		
	error	errorType	optional		
annotation	Redistribution Control Descriptor (A/65B 6.9.13)				

element **RedistributionControlType/Null**

annotation	Means that there is no redistribution control descriptor
------------	--

complexType **RegionType**

diagram					
children	Name Dimension PrivateInformation Descriptor				
used by	element RatingsType/Region				
attributes	Name	Type	Use	Default	Annotation
	id	xsd:unsignedByte	required		Region ID, as defined by the ATSC Code Point Registry
	action	actionType	optional		
	error	errorType	optional		
annotation	Type for the rating system of a region				

element **RegionType/Name**

type	TextType
annotation	Name of the region

element **RegionType/Dimension**

type	<u>DimensionType</u>
annotation	Existing dimensions for the region

element **RegionType/PrivateInformation**

type	<u>PrivateInformationType</u>
annotation	These descriptors go into the outer loop of the RRT

element **RegionType/Descriptor**

type	<u>DescriptorType</u>
annotation	These descriptors go into the outer loop of the RRT

complexType **ShowDataType**

diagram					
children	<u>Name</u> <u>Description</u> <u>ParentalRating</u> <u>Audios</u> <u>Captions</u> <u>RedistributionControl</u>				
used by	elements <u>ShowType/ShowData</u> <u>PsipEventType/ShowData</u>				
attributes	Name action error	Type actionType errorType	Use optional optional	Default	Annotation
annotation	Describes the metadata of a show				

element **ShowDataType/Name**

type	<u>TextType</u>
annotation	Multiple-language title of the show (A/65B 6.5)

element **ShowDataType/Description**

type	<u>TextType</u>
annotation	Multiple-language description of the show carried in the Event ETT (A/65B 6.6)

element **ShowDataType/ParentalRating**

type	<u>ParentalRatingType</u>
annotation	Parental rating of the show for one region

element **ShowDataType/Audios**

type	<u>AudiosType</u>
annotation	Audio services associated with the show

element **ShowDataType/Captions**

type	<u>CaptionsType</u>
annotation	Caption services associated with the show

element **ShowDataType/RedistributionControl**

type	<u>RedistributionControlType</u>
annotation	Sets the "broadcast flag" of the show

complexType **ShowType**

diagram						
children	<u>ContentId</u> <u>ShowData</u> <u>PrivatePmcpInformation</u>					
used by	element <u>PmcpMessage/Show</u>					
attributes	Name	Type	Use	Default	Annotation	
	action	actionType	optional			
	error	errorType	optional			
annotation	Describes a show, i.e. an abstract entity which becomes a PSIP Event when it is scheduled					

element **ShowType/ContentId**

type	<u>ContentIdType</u>
annotation	Communicates at least one of the possible IDs for the show

element **ShowType/ShowData**

type	<u>ShowDataType</u>
annotation	Carries the actual information about the show

element **ShowType/PrivatePmcplInformation**

type	<u>PrivatePmcplInformationType</u>
annotation	Show-level PMCP-private information

complexType **TableType**

diagram					
children	<u>MgtPrivateInformation</u> <u>MgtDescriptor</u>				
used by	element <u>TransportStreamType/Table</u>				
attributes	Name	Type	Use	Default	Annotation
	tableType	xsd:unsignedShort	required		MGT table type (A/65B 6.2)
	tablePid	pidType	optional		PID used to carry the table (A/65B 6.2)
	periodMs	xsd:positiveInteger	optional		Repetition period of the table, in milliseconds
	action	actionType	optional		
	error	errorType	optional		
annotation	Contains the information about a PSIP table, used to build the MGT (A/65B 6.2)				

element **TableType/MgtPrivateInformation**

type	<u>PrivateInformationType</u>
annotation	These descriptors go into the inner loop of the MGT

element **TableType/MgtDescriptor**

type	<u>DescriptorType</u>
annotation	These descriptors go into the inner loop of the MGT

complexType TextType

diagram					
type	extension of xsd:string				
used by	elements <u>RatingValueType/AbbrevName</u> <u>ChannelType/Description</u> <u>ShowDataType/Description</u> <u>TransportStreamType/Name</u> <u>ChannelType/Name</u> <u>ElementaryStreamType/Name</u> <u>ShowDataType/Name</u> <u>RegionType/Name</u> <u>DimensionType/Name</u> <u>RatingValueType/Name</u>				
attributes	Name	Type	Use	Default	Annotation
	lang	languageType	required		
	action	actionType	optional		
	error	errorType	optional		
annotation	Multiple string structure of PSIP (A/65B 6.10)				

complexType TimeParametersType

diagram					
children	<u>SttPrivateInformation</u> <u>SttDescriptor</u>				
used by	element <u>PmcpMessage/TimeParameters</u>				
attributes	Name	Type	Use	Default	Annotation
	gpsUtcOffset	xsd:unsignedByte	optional		Current GPS UTC offset, as published by the International Earth Rotation Service (A/65B 6.1)
	dsStatus	xsd:boolean	optional		Current daylight savings status (A/65B 6.1 and Annex A)
	dsDayOfMonth	dsDayOfMonthType	optional		If DST is to change within a month, day of change (A/65B 6.1 and Annex A)
	dsHour	dsHourType	optional		If DST is to change within a month, hour of change (A/65B 6.1 and Annex A)
	action	actionType	optional		
	error	errorType	optional		
annotation	Declares the parameters that go into the System Time Table (A/65B 6.1), except for the time itself, which is communicated through other means				

element TimeParametersType/SttPrivateInformation

type	<u>PrivateInformationType</u>
annotation	These descriptors go into the STT

element TimeParametersType/SttDescriptor

type	<u>DescriptorType</u>
annotation	These descriptors go into the STT

complexType **TimeShiftedServiceType**

diagram	<pre> classDiagram class TimeShiftedServiceType { "Time Shifted Service Descriptor (A/65B 6.9.7)" } class Copy { "1..20 Time shifted service" } TimeShiftedServiceType "1" -- "1..20" Copy </pre>				
children	Copy				
used by	element ChannelType/TimeShiftedService				
attributes	Name	Type	Use	Default	Annotation
	action	actionType	optional		
	error	errorType	optional		
annotation	Time Shifted Service Descriptor (A/65B 6.9.7)				

element **TimeShiftedServiceType/Copy**

type	ChannelCopyType
annotation	Time shifted service

complexType **TransportStreamType**

<p>diagram</p>																																														
<p>children</p>	<p><u>Name</u> <u>ConditionalAccess</u> <u>Table</u> <u>MgtPrivateInformation</u> <u>VctPrivateInformation</u> <u>MgtDescriptor</u> <u>VctDescriptor</u> <u>PrivatePmcplInformation</u></p>																																													
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error	errorType	optional																																												
<p>annotation</p>	<p>Used to define the parameters of a transport stream</p>																																													

element TransportStreamType/Name

Type	<u>TextType</u>
annotation	Name of the transport stream. Not used in PSIP.

element TransportStreamType/ConditionalAccess

type	<u>ConditionalAccessType</u>
annotation	Defines the CA systems in use and the corresponding EMM PIDs

element TransportStreamType/Table

type	<u>TableType</u>
annotation	Defines the broadcast parameters of a PSIP table.

element TransportStreamType/MgtPrivateInformation

type	<u>PrivateInformationType</u>
annotation	These descriptors go into the outer loop of the MGT (A/65B 6.2)

element TransportStreamType/VctPrivateInformation

type	<u>PrivateInformationType</u>
annotation	These descriptors go into the outer loop of the VCT (A/65B 6.3)

element TransportStreamType/MgtDescriptor

type	<u>DescriptorType</u>
annotation	These descriptors go into the outer loop of the MGT (A/65B 6.2)

element TransportStreamType/VctDescriptor

type	<u>DescriptorType</u>
annotation	These descriptors go into the outer loop of the VCT (A/65B 6.3)

element TransportStreamType/PrivatePmcplInformation

type	<u>PrivatePmcplInformationType</u>
annotation	Transport Stream-level PMCP-private information

simpleType actionType

type	restriction of xsd:string
used by	Attributes <u>RatingValueType/@action</u> <u>DimensionType/@action</u> <u>PsipEventIdType/@action</u> <u>InitialScheduleType/@action</u> <u>PmcpEventIdType/@action</u> <u>AlternateIdType/@action</u> <u>HouseNumberType/@action</u> <u>IsanType/@action</u> <u>Caption708Type/@action</u> <u>Caption608Type/@action</u> <u>Ac3AudioType/@action</u> <u>RatingType/@action</u> <u>RegionType/@action</u> <u>EventIdType/@action</u> <u>ShowDataType/@action</u> <u>ContentIdType/@action</u> <u>TransportStreamType/@action</u> <u>ChannelType/@action</u> <u>ShowType/@action</u> <u>PsipEventType/@action</u> <u>TimeParametersType/@action</u> <u>RatingsType/@action</u> <u>TextType/@action</u> <u>ConditionalAccessType/@action</u> <u>TableType/@action</u> <u>PrivateInformationType/@action</u> <u>DescriptorType/@action</u> <u>ElementaryStreamType/@action</u> <u>ParentalRatingType/@action</u> <u>AudiosType/@action</u> <u>CaptionsType/@action</u> <u>RedistributionControlType/@action</u> <u>TimeShiftedServiceType/@action</u>
facets	enumeration read enumeration add enumeration update enumeration remove
annotation	Enables the sender of a message to indicate, for each element, which action should be performed on the current element. The rules governing the allowed values can be found in the PMCP Standard.

simpleType audioldType

type	restriction of xsd:unsignedByte
used by	attributes <u>ElementaryStreamType/@audiold</u> <u>Ac3AudioType/@audiold</u>
facets	minInclusive 1
annotation	Type for an audiold attribute

simpleType audioServiceType

type	restriction of xsd:string
used by	attribute <u>Ac3AudioType/@serviceType</u>
facets	enumeration complete_main enumeration music_and_effects enumeration visually_impaired enumeration hearing_impaired enumeration dialogue enumeration commentary enumeration emergency enumeration voice_over
annotation	Possible audio service types (A/65B 6.9.1)

simpleType bitRateKbpsType

type	restriction of xsd:unsignedShort
used by	attribute <u>Ac3AudioType/@bitRateKbps</u>
facets	maxInclusive 448
annotation	Type for bit rate of AC-3 elementary stream in kbps (A/65B 6.9.1)

simpleType bsidType

type	restriction of xsd:unsignedByte
used by	attribute <u>Ac3AudioType/@bsid</u>
facets	maxExclusive 32
annotation	Type for version of AC-3 standard used by an AC-3 audio stream (A/65B 6.9.1)

simpleType ccServiceType

type	restriction of xsd:unsignedByte
used by	attribute <u>Caption708Type/@service</u>
facets	minInclusive 1 maxInclusive 63
annotation	Type for 708 caption service number (A/65B 6.9.3 caption_service_number)

simpleType channelNumberType

type	union of (<u>onePartType</u> , <u>twoPartType</u>)
used by	attributes <u>ChannelCopyType/@channel</u> <u>ChannelType/@channelNumber</u> <u>EventIdType/@channelNumber</u>
annotation	Specifies the format of a two-part or one-part channel number

simpleType channelStatusType

type	restriction of xsd:string
used by	attribute <u>ChannelType/@status</u>
facets	enumeration active enumeration inactive enumeration hidden
annotation	Channel activity status (A/65B 6.3 hidden and hide_guide)

simpleType dsDayOfMonthType

type	restriction of xsd:unsignedByte
used by	attribute <u>TimeParametersType/@dsDayOfMonth</u>
facets	maxInclusive 31
annotation	Number of day in month (A/65B 6.1 and Annex A)

simpleType dsHourType

type	restriction of xsd:unsignedByte
used by	attribute <u>TimeParametersType/@dsHour</u>
facets	maxInclusive 18
annotation	Hour of the day (A/65B 6.1 and Annex A)

simpleType elementaryErrorType

type	restriction of xsd:string
used by	simpleType errorType
facets	pattern (element_does_not_exist .*_out_of_range .*_missing .*_change_denied)(:.*)?
annotation	Type for an elementary error

simpleType errorType

type	list of elementaryErrorType
used by	attributes TimeShiftedServiceType/@error ContentIdType/@error ShowDataType/@error EventIdType/@error RegionType/@error RatingType/@error Ac3AudioType/@error Caption608Type/@error Caption708Type/@error IsanType/@error HouseNumberType/@error AlternateIdType/@error PmcpEventIdType/@error InitialScheduleType/@error PsipEventIdType/@error DimensionType/@error RatingValueType/@error PmcpMessage/@error TransportStreamType/@error ChannelType/@error ShowType/@error PsipEventType/@error TimeParametersType/@error RatingsType/@error TextType/@error ConditionalAccessType/@error TableType/@error PrivateInformationType/@error DescriptorType/@error ElementaryStreamType/@error ParentalRatingType/@error AudiosType/@error CaptionsType/@error RedistributionControlType/@error
annotation	Used in a message of type "reply" with a status of "error" to indicate where and why an error occurred

simpleType isanCheckType

type	restriction of xsd:string
used by	attributes IsanType/@check1 IsanType/@check2
facets	pattern [dA-Za-z]
annotation	Type for the check digits of a V-ISAN

simpleType isanEpisodeType

type	restriction of xsd:string
used by	attribute IsanType/@episodeOrPart
facets	pattern [dA-Fa-f]{4}
annotation	Type for the episode part of an ISAN or V-ISAN

simpleType isanRootType

type	restriction of xsd:string
used by	attribute IsanType/@root
facets	pattern [dA-Fa-f]{4}-[dA-Fa-f]{4}-[dA-Fa-f]{4}
annotation	Type for the root part of an ISAN or V-ISAN

simpleType isanVersionType

type	restriction of xsd:string
used by	attribute <u>IsanType/@version</u>
facets	pattern <code>[\dA-Fa-f]{4}-[\dA-Fa-f]{4}</code>
annotation	Type for the version part of a V-ISAN

simpleType languageType

type	restriction of xsd:string
used by	attributes <u>TextType/@lang</u> <u>Ac3AudioType/@lang</u> <u>Caption708Type/@lang</u>
facets	pattern <code>[a-z]{3}</code>
annotation	Three-letter language code per ISO-639-2

simpleType mainidType

type	restriction of xsd:unsignedByte
used by	attribute <u>Ac3AudioType/@mainid</u>
facets	maxExclusive 8
annotation	Type for mainid of an AC-3 audio stream (A/65B 6.9.1)

simpleType messageType

type	restriction of xsd:string
used by	attribute <u>PmcpMessage/@type</u>
facets	enumeration information enumeration request enumeration reply
annotation	Possible message types

simpleType modulationType

type	restriction of xsd:string
used by	attribute <u>TransportStreamType/@modulation</u>
facets	enumeration analog enumeration SCTE_mode_1 enumeration SCTE_mode_2 enumeration 8_VSB enumeration 16_VSB enumeration private
annotation	Possible modulations

simpleType networkType

type	restriction of xsd:string
used by	attribute <u>TransportStreamType/@networkType</u>
facets	enumeration terrestrial enumeration cable enumeration satellite
annotation	Possible network types

simpleType numChannelsType

type	restriction of xsd:string
used by	Attribute <u>Ac3AudioType/@numChannels</u>
facets	enumeration 1/0 enumeration 2/0 enumeration 3/0 enumeration 2/1 enumeration 3/1 enumeration 2/2 enumeration 3/2 enumeration 1 enumeration 2_or_less enumeration 3_or_less enumeration 4_or_less enumeration 5_or_less enumeration 6_or_less
annotation	Possible values for the number of audio channels in an AC-3 elementary stream (A/65B 6.9.1)

simpleType onePartType

type	restriction of xsd:unsignedShort
used by	simpleType <u>channelNumberType</u>
facets	maxExclusive 16384
annotation	Type for one-part channel number for cable

simpleType pathSelectType

type	restriction of xsd:string
used by	attribute <u>TransportStreamType/@pathSelect</u>
facets	enumeration path_1 enumeration path_2
annotation	Possible paths for cable systems with multiple cables

simpleType pidType

type	restriction of xsd:unsignedShort
used by	attributes ChannelType/@pcrPid ConditionalAccessType/@pid ElementaryStreamType/@pid ChannelType/@pmtPid TableType/@tablePid
facets	maxExclusive 8192
annotation	Specifies the format of an MPEG-2 PID.

simpleType privateInformationDataType

type	restriction of xsd:hexBinary
used by	complexType PrivateInformationType
facets	maxLength 251
annotation	Specifies the format of private data to be carried in ATSC tables

simpleType psipEventIdType

type	restriction of xsd:unsignedShort
used by	attribute PsipEventIdType/@eventId
facets	maxExclusive 16384
annotation	Type for a PSIP Event_id

simpleType serviceType

type	restriction of xsd:string
used by	attribute ChannelType/@type
facets	enumeration analog_television enumeration digital_television enumeration digital_radio enumeration data_broadcast
annotation	Type of the primary service provided by the channel: TV, radio or data (A/65B 6.3 service_type)

simpleType shortNameType

type	restriction of xsd:string
used by	attribute ChannelType/@shortName
facets	maxLength 7
annotation	PSIP short name (7 characters max.) (A/65B 6.3)

simpleType statusType

type	restriction of xsd:string
used by	attribute <u>PmcpReplyType/@status</u>
facets	enumeration valid enumeration invalid enumeration OK enumeration error
annotation	Status of a reply message

simpleType twoPartType

type	restriction of xsd:string
used by	simpleType <u>channelNumberType</u>
facets	pattern [1-9][0-9]{0,2}-[0-9]{1,3}
annotation	Type for two-part channel number (Major-Minor)

Annex B: PMCP Use Cases (informative)

Printouts of sample PMCP XML documents are provided below to illustrate the use of some of the PMCP messages:

- HeartbeatRequest.xml
- HeartbeatReply.xml
- ErrorMessage.xml
- ScheduleDownload.xml
- ScheduleRead.xml
- DurationChange.xml
- EventNameChange.xml
- ShowNameChange.xml
- EventShift.xml
- Captions.xml
- AudioInformationStart.xml
- AudioInformationNext.xml
- AudioInformationStop.xml
- PrivateInformation.xml

HeartbeatRequest.xml

```
<!--Sample PMCP document showing how to send a heartbeat request-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="12345" origin="automation_main" originType="Automation"
destination="psip_generator" dateTime="2003-12-16T09:30:47-05:00" type="request"/>
```

HeartbeatReply.xml

```
<!--Sample PMCP document showing how to reply to a heartbeat request-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="17365" origin="psip_generator"
originType="Table_Generator" destination="automation_main" dateTime="2003-12-16T09:30:48-05:00" type="reply">
  <PmcpReply id="12345" origin="automation_main" destination="psip_generator" dateTime="2003-12-16T09:30:47-
05:00" status="OK"/>
</PmcpMessage>
```

ErrorMessage.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP showing an error message-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="4294967295" origin="PsipGenerator"
originType="Table_Generator" dateTime="2003-12-17T09:30:47-05:00">
  <PmcpReply id="5464758" origin="Traffic" dateTime="2003-12-17T09:30:45-05:00" status="error"/>
  <PsipEvent>
    <EventId channelNumber="56-3">
      <PmcpEventId creator="Traffic" id="657484"/>
    </EventId>
    <ShowData error="Name_missing"/>
  </PsipEvent>
```

```

<PspEvent error="element_does_not_exist">
  <EventId channelNumber="56-3">
    <PmcpEventId creator="Traffic" id="657485"/>
  </EventId>
</PspEvent>
<PspEvent error="ShowData_change_denied duration_out_of_range">
  <EventId channelNumber="56-3">
    <PmcpEventId creator="Traffic" id="657486"/>
  </EventId>
</PspEvent>
</PmcpMessage>

```

ScheduleDownload.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP file showing an initial schedule download-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="4294967295" origin="Listing Service"
originType="Listing_Service" dateTime="2000-12-16T09:30:47-05:00" destination="PSIP Generator">
  <PspEvent action="add" duration="PT30M">
    <EventId channelNumber="57-2">
      <InitialSchedule startTime="2000-12-16T10:00:00-05:00"/>
    </EventId>
    <ShowData>
      <Name lang="eng">Barney & Friends</Name>
      <Description lang="eng">Exercise/Dance</Description>
      <ParentalRating region="1">
        <Rating dimension="Children" value="TV-Y"/>
      </ParentalRating>
      <Audios>
        <Ac3Audio audioid="1" lang="eng"/>
      </Audios>
      <Captions>
        <Caption708 service="1" lang="eng"/>
      </Captions>
    </ShowData>
  </PspEvent>
  <PspEvent action="add" duration="PT30M">
    <EventId channelNumber="57-2">
      <InitialSchedule startTime="2000-12-16T10:30:00-05:00"/>
    </EventId>
    <ShowData>
      <Name lang="eng">Dragon Tales</Name>
      <Description lang="eng">Crash Landings/The Big Cake Mix-Up</Description>
      <ParentalRating region="1">
        <Rating dimension="Children" value="TV-Y"/>
      </ParentalRating>
      <Audios>
        <Ac3Audio audioid="1" lang="eng"/>
        <Ac3Audio audioid="2" lang="spa"/>
      </Audios>
      <Captions>
        <Caption708 service="1" lang="eng"/>
      </Captions>
    </ShowData>
  </PspEvent>
  <PspEvent action="add" duration="PT30M">
    <EventId channelNumber="57-2">
      <InitialSchedule startTime="2000-12-16T11:00:00-05:00"/>
    </EventId>
    <ShowData>
      <Name lang="eng">Between The Lions</Name>
      <Description lang="eng">Pecos Bill Cleans Up The West</Description>
      <ParentalRating region="1">
        <Rating dimension="Children" value="TV-Y"/>
      </ParentalRating>
    </ShowData>
  </PspEvent>

```

```

    <Audios>
      <Ac3Audio audiold="1" lang="eng"/>
      <Ac3Audio audiold="2" lang="eng" serviceType="visually_impaired"/>
    </Audios>
    <Captions>
      <Caption708 service="1" lang="eng"/>
    </Captions>
  </ShowData>
</PspEvent>
<PspEvent action="add" duration="PT30M">
  <EventId channelNumber="57-2">
    <InitialSchedule startTime="2000-12-16T11:30:00-05:00"/>
  </EventId>
  <ShowData>
    <Name lang="eng">Arthur</Name>
    <Description lang="eng">My Music Rules/That's A Baby Show</Description>
    <ParentalRating region="1">
      <Rating dimension="Children" value="TV-Y"/>
    </ParentalRating>
    <Audios>
      <Ac3Audio audiold="1" lang="eng"/>
      <Ac3Audio audiold="2" lang="eng" serviceType="visually_impaired"/>
    </Audios>
    <Captions>
      <Caption708 service="1" lang="eng"/>
    </Captions>
  </ShowData>
</PspEvent>
<PspEvent action="add" duration="PT30M">
  <EventId channelNumber="57-2">
    <InitialSchedule startTime="2000-12-16T12:00:00-05:00"/>
  </EventId>
  <ShowData>
    <Name lang="eng">Nova</Name>
    <Description lang="eng">Dying to Be Thin</Description>
    <ParentalRating region="1">
      <Rating dimension="Entire Audience" value="TV-PG"/>
    </ParentalRating>
    <Audios>
      <Ac3Audio audiold="1" lang="eng"/>
      <Ac3Audio audiold="2" lang="eng" serviceType="visually_impaired"/>
    </Audios>
    <Captions>
      <Caption708 service="1" lang="eng"/>
    </Captions>
  </ShowData>
</PspEvent>
<PspEvent action="add" duration="PT30M">
  <EventId channelNumber="57-2">
    <InitialSchedule startTime="2000-12-16T12:30:00-05:00"/>
  </EventId>
  <ShowData>
    <Name lang="eng">Great Food</Name>
    <Description lang="eng">Rick Stein's "Toddlers Can Cook!"</Description>
    <ParentalRating region="1">
      <Rating dimension="Entire Audience" value="TV-G"/>
    </ParentalRating>
    <Audios>
      <Ac3Audio audiold="1" lang="eng"/>
    </Audios>
    <Captions>
      <Caption708 service="1" lang="eng"/>
    </Captions>
  </ShowData>
</PspEvent>
<PspEvent action="add" duration="PT3H">

```

```

<EventId channelNumber="57-3">
  <InitialSchedule startTime="2000-12-16T10:00:00-05:00"/>
</EventId>
<ShowData>
  <Name lang="eng">PBS Kids Bookworm Bunch</Name>
  <ParentalRating region="1">
    <Rating dimension="Children" value="TV-Y"/>
  </ParentalRating>
  <Audios>
    <Ac3Audio audioid="1" lang="eng"/>
  </Audios>
  <Captions>
    <Caption708 service="1" lang="eng"/>
  </Captions>
</ShowData>
</PspEvent>
</PmcpMessage>

```

ScheduleRead.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP document showing how to read ("pull") a portion of the schedule information for a channel-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="3297993104" origin="PspGenerator"
originType="Table_Generator" dateTime="2003-12-17T09:30:47-05:00" type="request">
  <PspEvent action="read" duration="PT24H">
    <EventId channelNumber="34-3">
      <InitialSchedule startTime="2003-12-18T00:00:00-05:00"/>
    </EventId>
  </PspEvent>
</PmcpMessage>

```

DurationChange.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP document showing how to change the duration of an event-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="4294967295" origin="Traffic" originType="Traffic"
dateTime="2003-12-17T09:30:47-05:00">
  <PspEvent action="update" duration="PT1H19M" durationFrame="17">
    <EventId channelNumber="57-1">
      <InitialSchedule startTime="2000-12-16T10:00:00-05:00"/>
    </EventId>
  </PspEvent>
</PmcpMessage>

```

EventNameChange.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP document showing how to change the name of an event using its initial scheduled start time as a
reference-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="4294967295" origin="Traffic" originType="Traffic"
dateTime="2003-12-17T09:30:47-05:00">
  <PspEvent>
    <EventId channelNumber="57-1">
      <InitialSchedule startTime="2000-12-16T10:00:00-05:00"/>
    </EventId>
    <ShowData>
      <Name lang="eng" action="update">Welcome to Sesame Street</Name>
    </ShowData>
  </PspEvent>
</PmcpMessage>

```

ShowNameChange.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP document showing how to change the name of a show-->

```



```
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="4294967295" origin="Traffic" originType="Traffic"
dateTime="2003-12-17T09:30:47-05:00">
  <Show action="update">
    <ContentId>
      <Isan root="2B1A-FF17-3E20" episodeOrPart="6541" check1="7" version="48CD-78B1" check2="B"/>
    </ContentId>
    <ShowData>
      <Name lang="eng" action="update">Welcome to Sesame Street</Name>
    </ShowData>
  </Show>
</PmcpMessage>
```

EventShift.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP document showing how to change the start time of an event using the initial scheduled start time as a
reference-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="4294967295" origin="Traffic" originType="Traffic"
dateTime="2003-12-17T09:30:47-05:00">
  <PspEvent action="update" startTime="2000-12-16T11:00:00-05:00" startFrame="15">
    <EventId channelNumber="57-1">
      <InitialSchedule startTime="2000-12-16T10:00:00-05:00"/>
    </EventId>
  </PspEvent>
</PmcpMessage>
```

Captions.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP document showing various caption services-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="4947205" origin="Traffic" originType="Traffic"
dateTime="2003-12-18T09:32:47Z">
  <PspEvent duration="PT30M" action="add">
    <EventId channelNumber="57-3">
      <InitialSchedule startTime="2003-12-18T09:40:00Z"/>
    </EventId>
    <ShowData>
      <Name lang="eng">Caillou</Name>
      <Description lang="eng">Big Brother Caillou</Description>
      <ParentalRating region="1">
        <Rating dimension="Children" value="TV-Y"/>
      </ParentalRating>
      <Audios>
        <Ac3Audio audioid="1" lang="eng"/>
      </Audios>
      <Captions>
        <Caption608/>
        <Caption708 service="1" lang="eng"/>
        <Caption708 service="9" lang="spa"/>
        <Caption708 service="10" lang="fre"/>
        <Caption708 service="59" lang="ger"/>
        <Caption708 service="60" lang="ita"/>
        <Caption708 service="63" lang="por"/>
      </Captions>
    </ShowData>
  </PspEvent>
</PmcpMessage>
```

AudioInformationStart.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Channel information (overrides current event)-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="3294967567" origin="AC-3 audio encoder"
originType="Metadata_Extractor" dateTime="2003-12-17T09:30:47-05:00">
  <Channel channelNumber="57-2">
```

```

    <Audios>
      <Ac3Audio action="add" audiold="1" lang="eng" numChannels="3/2" surround="true"/>
    </Audios>
  </Channel>
</PmcpMessage>

```

AudioInformationNext.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<!--Channel information (overrides current event)-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="3294967568" origin="AC-3 audio encoder"
originType="Metadata_Extractor" dateTime="2003-12-17T09:31:03-05:00">
  <Channel channelNumber="57-2">
    <Audios>
      <Ac3Audio action="add" audiold="1" lang="spa" numChannels="2/0" surround="false"/>
    </Audios>
  </Channel>
</PmcpMessage>

```

AudioInformationStop.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<!--Channel information cancelled (current event used again)-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" id="3294967568" origin="AC-3 audio encoder"
originType="Metadata_Extractor" dateTime="2003-12-17T09:31:03-05:00">
  <Channel channelNumber="57-2">
    <Audios>
      <Ac3Audio action="remove" audiold="1"/>
    </Audios>
  </Channel>
</PmcpMessage>

```

PrivateInformation.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<!--Sample PMCP document showing how to send some private information using the PMCP protocol-->
<PmcpMessage xmlns="http://www.atsc.org/pmcp/2004/2.0" xmlns:pri="http://www.vendor.com/pmcpExtensions/1.0" id="1"
origin="SIMS(1)" originType="Program_Management" dateTime="2003-07-28T15:00:00">
  <PrivatePmcpInformation>
    <pri:PvtTable-Name>Segment Classes</pri:PvtTable-Name>
    <pri:PvtTable-Layout>
      <pri:PvtColumn PvtColumn-Name="code" PvtColumn-Type="char(3)"/>
      <pri:PvtColumn PvtColumn-Name="description" PvtColumn-Type="char(30)"/>
      <pri:PvtColumn PvtColumn-Name="active" PvtColumn-Type="char(1)"/>
      <pri:PvtColumn PvtColumn-Name="special_order_only" PvtColumn-Type="char(1)"/>
    </pri:PvtTable-Layout>
    <pri:PvtTable-Record>
      <pri:PvtColumn PvtColumn-Name="code" PvtColumn-Value="NB"/>
      <pri:PvtColumn PvtColumn-Name="description" PvtColumn-Value="News Break"/>
      <pri:PvtColumn PvtColumn-Name="active" PvtColumn-Value="Y"/>
      <pri:PvtColumn PvtColumn-Name="special_order_only" PvtColumn-Value="N"/>
    </pri:PvtTable-Record>
    <pri:PvtTable-Record>
      <pri:PvtColumn PvtColumn-Name="code" PvtColumn-Value="NC"/>
      <pri:PvtColumn PvtColumn-Name="description" PvtColumn-Value="No Cops - All day"/>
      <pri:PvtColumn PvtColumn-Name="active" PvtColumn-Value="Y"/>
      <pri:PvtColumn PvtColumn-Name="special_order_only" PvtColumn-Value="N"/>
    </pri:PvtTable-Record>
  </PrivatePmcpInformation>
</PmcpMessage>

```


2. **Station Clock** A device that generates and/or distributes time signals to devices and systems within the station. May include a highly stable internal clock that is updated on a regular basis from an external standard reference such as GPS or the US Naval Observatory. Typically provides local time at the station, referenced to UTC. Outputs SMPTE time code and/or NTP (network time protocol) and/or proprietary time clock signals. May be combined with a video sync generator.
3. **Listing Service** A third-party service using a database where program information is collected and compiled into programming data, for delivery to broadcasters and to other media for program guide publication.
4. **Program Manager** A management and planning system, including a database of program elements, used to produce the broadcast schedule to be carried over one or more channels.
5. **Traffic** A management system comprising a database for tracking the sale of advertising and the scheduling of advertising, promotional announcements, program elements, and other interstitial material.
6. **Automation System** A management and control system comprising a database of schedule information used for triggering multiple devices with precision timing, for frame or near frame accurate operation of a broadcast system.
7. **Table Extractor** A bridge device that monitors a transport stream for the presence of PIDs carrying tables, and parses the table data for use by other devices.
8. **Table Generator** Also referred to as the PSIP Generator. A server device that creates defined system information table structures, including PSIP, associated with a multiplex of programs, that are inserted into a transport stream for play out in the multiplex.
9. **Conditional Access** A component or collection of components used for encrypting a PID, a program event, a channel or collection of channels, or any combination of the above, in order to restrict access to the material to certain authorized groups of users only.
10. **MPEG Control** A manager, control system, or set of controls used to manipulate the configuration and operation of any of the components of an MPEG system. May control device parameters directly or enable, modify or delete profiles used to operate the equipment, and manage redundancy and log errors.
11. **MPEG Decoder** A device that transforms a compressed MPEG-encoded bitstream into an analog or uncompressed digital video or audio signal.
12. **Proxy Agent**
 - 1) A device (usually a computer) that bridges between two protocols so that incompatible interface messages can be passed from one domain to another.
 - 2) A device used for protocol translations for extending signal reach beyond network limitations.

13. MPEG Encoder A transformation device used to convert a video, audio or raw data signal into a compressed bitstream of packetized data (packetized elementary stream or PES) carried as a multiplex of PIDs over a transport stream in real time.
14. MPEG Remultiplexer A device capable in real time of disassembling and re-assembling packet streams from one or more MPEG-2 transport stream inputs into one or more transport stream outputs containing a multiplex of packets.
15. MPEG Splicer A real time device that allows switching between compressed bitstreams, providing seamless or near-seamless program transitions triggered from commands either in the transport stream or from an external control system.
16. MPEG Server A disk-based storage device that stores content in the MPEG domain.
17. MPEG Monitor A device that monitors the attributes of a compressed bitstream and that may log and report out-of-limit parameters and occurrences.
18. Metadata Extractor A device that extracts metadata transported with an associated video or audio signal and forwards it for use by other devices

C.2 PMCP Data Flow

Programming metadata flow between devices and systems will vary depending on the requirements of the broadcaster, the number and type of program and traffic support services used, and the degree of automation implemented. Arrangements are described below for one possible flow of information using PMCP. Not all broadcasters will implement all functions mentioned. Time periods mentioned for metadata transfer may change in the future since it is possible that the use of PMCP and other new technological advances will change operational practices.

C.2.1 Program Planning and Listing Service

Long-term program planning and scheduling may take place in the Program Manager (4). This system may take input from station staff and also from the network that the station belongs to (if any). A draft television schedule, usually covering many weeks or months for the television station output channel(s), is typically sent monthly using PMCP to the Listing Service (3) and to Traffic (5) (updates may be sent more frequently). The listing service may add detailed information about the particular shows, including actual durations, titles and content details, and then may send a revised schedule back to the station using PMCP. The Listing Service may also distribute program schedules to other news media for publication. For schedules sent to the station, a 16-day rolling schedule may be used, with daily or more frequent downloads.

C.2.2 Traffic, PSIP Generator, and Automation

At the station the schedule with program information may be received by Traffic and the PSIP Table Generator (8), and may also be fed back to program management. The PSIP Generator may use the information from the Listing Service to populate much of the PSIP table information. Meanwhile Traffic establishes the detailed daily schedule and on-air playlist, taking

account of network and local programming, advertisements, promotional and other interstitial material. One or more Alternate Schedules may also be created to cater for different operational scenarios, live program over-runs, emergencies, etc. The detailed playlist, typically covering one day (often more at weekends and holidays) is distributed from Traffic to Automation (6), usually one to three days before the airdate, and an associated schedule with PSIP events is sent from Traffic to the PSIP Generator using PMCP.

Once control of the schedule has been handed over to Automation, any changes to the schedule may be communicated from Automation to the PSIP Generator using PMCP. It should be noted that the Traffic and Automation system databases may not hold all the detailed show content information downloaded from the listing service to the PSIP generator, so updates about the schedule sent from Traffic or Automation to the PSIP Generator may update PSIP event times, durations and other information, while leaving other show details already entered into the PSIP tables intact.

C.2.3 Other Sources of PSIP Information

Where the Network generates PSIP information for network programs, this can be distributed to the station along with a program in an MPEG bitstream. The metadata may be extracted using the Table Extractor (7) and fed to the PSIP generator using PMCP.

Some PSIP information associated with a show (e.g., caption service information, parental advisory, AC-3 audio, broadcast flag) can be carried in data packets inserted into the baseband video or audio streams. This metadata may be extracted using the Metadata Extractor (18) and fed to the PSIP generator using PMCP to update the appropriate current channel parameters.

Some PSIP information can be generated by particular hardware associated with the MPEG encoding and distribution process, and may not be known to upstream planning systems, or may over-ride previously entered values (e.g. audio stereo or surround sound mode). This metadata may be sent by MPEG Control (10) and fed to the PSIP Generator using PMCP to update the appropriate current channel parameters.

C.2.4 Last-Minute Schedule Changes

Automation controls the on-air program switching of the station output in real-time. If last-minute changes to the schedule are required, this may take place in Traffic, in which case a new play list is produced and equivalent schedule updates are sent to the PSIP Generator. If the schedule changes are made in Automation, with manual intervention from the master control operator, then Automation may send updates for particular events to the PSIP Generator using PMCP.

If a decision is taken to switch to an alternate schedule, then new schedule information is sent to the PSIP Generator. This could be in the form of updates from automation, or as a new schedule download from traffic to the PSIP generator.

C.3 Station Timing

An accurate time reference is required for a station to broadcast programs to a published schedule, synchronized with program contributions from a network or other sources, and including accurate PSIP time information. Use of the following techniques will help ensure that

automation control and on-air switching can be carried out with frame accuracy, and that PSIP time accuracy will meet the +/- 1 second requirement of A/65B.

C.3.1 Time Reference

The automation system and any other time-sensitive systems and equipment affecting on-air operations should be locked to a feed of SMPTE time code or other timing signal from a station master clock system. The PSIP table generator and other computer-based systems should be locked to the station master clock or to a source of the same standard time distributed through the local area network. Depending on broadcast operational requirements, the time used by the station may be local time or UTC (sometimes informally referred to as GMT – Greenwich Mean Time, now an obsolete term).

The accuracy of the station clock should be maintained with a standard external reference. Several methods exist including radio broadcast signals, telephone dial-up, Internet access and GPS. Whichever way the time signal is received, to maintain a uniform time system the ultimate time reference should be a national laboratory source of UTC (in the US this is the US Naval Observatory in Washington DC).

Systems and equipment external to the station that send signals and information affecting current operations in real time should also be referenced directly or indirectly to UTC.

Systems such as the traffic system, program management system, and program listing service, typically process program schedule and timing information in non-real time and off line from the on-air broadcast chain. It is noted that timing reference accuracy for these systems may therefore be less stringent than for on-air devices. However, if such systems may on occasions be required to send PSIP information or other metadata for current on-air program events, then they should use the same ultimate timing reference and have the same timing accuracy as the PSIP generator.

C.3.2 GPS Time

GPS time is defined as the number of seconds elapsed since 0000 Universal Time on January 6, 1980. It is offset from UTC by an integer number of seconds (currently 13) due to leap seconds added to UTC but not to GPS time. The time offset is distributed with the GPS signal, so any station clock or other device that is referenced to GPS is locked to UTC and is aware of actual UTC time.

C.4 Assumptions

The following assumptions apply to equipment and systems designed for use with PMCP:

- a) Metadata for a given program element in the transport stream may arrive at multiple locations and multiple times.
- b) The actual broadcast time, duration and/or content of a PSIP event may change and the associated metadata may need to be updated.
- c) When a change occurs in the transport stream it is acceptable that updates to affected system information and PSIP tables may miss the first instance of transmission of the table after the transport stream change occurs. Therefore equipment that makes a change in one or more characteristics of the transport stream may report the changes to other affected equipment

immediately after the change is made. This does not preclude advance notice for tables that send advance information.

- d) Automation, Traffic, and some other systems may handle program segments at a more detailed level than used for PSIP events. Only information about the primary automation event that coincides with the start of the PSIP event (as determined by station policy) will be communicated from these systems to other equipment and systems as the PSIP event. Primary and secondary automation events at other times may affect the configuration of the transmitted bitstream and such information may be communicated as channel information updates at any time.

Annex D: List of Electronic Files

The following electronic files are available from ATSC: see <http://www.atsc.org/standards.html>.

PMCP Schema

- PMCP2.0.xsd

PMCP Use Cases

- AudioInformationNext.xml
- AudioInformationStart.xml
- AudioInformationStop.xml
- Captions.xml
- DurationChange.xml
- ErrorMessage.xml
- EventNameChange.xml
- EventShift.xml
- HeartbeatReply.xml
- HeartbeatRequest.xml
- PrivateInformation.xml
- ScheduleDownload.xml
- ScheduleRead.xml
- ShowNameChange.xml