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PMCP Extension Requirements for Data Broadcasting

Proposal on PMCP extension for data broadcasting

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1. Introduction

Data broadcasting provides user with interactive and enhanced services by sending data in broadcast television transport. Data delivers additional and useful information to viewer with a various type of media through a broadcast channel.

In order to provide content creators with the specification necessary to ensure their data to run on all kinds of receivers in equal performance, ATSC published DASE-1(DTV Application Software Environment-Level 1)[DASE] and ACAP(Advanced Common Application Platform)[ACAP] which define a software layer (middleware) that allows interactive and enhanced contents to run on receiver in a platform-independent manner. In particular, ACAP has been developed in need of the harmonization between DASE and OCAP(OpenCable Application Platform)[OCAP] published by CableLabs.

In order to provide viewers with data broadcasting through a broadcast channel, broadcasters need the emission station system to encode the data created according to the data broadcast standards[DASE, ACAP]. ATSC DIWG(Data Implementation Working Group) recommends not only functional components but also physical interfaces in the emission station for data broadcasting emission. However, ATSC DIWG don't define the specific interface message so as to operate each functional component.

With regard to interface message of the emission station, ATSC PMCP(Programming Metadata Communication Protocol)[PMCP] specifies the interface message relating to generating only PSIP table. Therefore, ATSC PMCP needs to be extended into interoperable interface specification to support data broadcasting. PMCP extension for data broadcasting can be developed by inserting Data Server into the existing PMCP reference system and defining the new element of encapsulation, signalling and announcement for data broadcasting.

This document describes the general requirements for developing the interoperable interface specification among equipments of data broadcasting emission system through the extension of existing PMCP. This document is divided into two parts: First, system requirement for data broadcasting, and then schema requirement for data broadcasting.

2. System Requirement

ATSC DIWG proposed the emission station environment for data broadcasting in IS/151[DIWG]. Figure 1 shows the essential components of the emission station environments. The emission station consists of Audio/Video Encoder, Emission Multiplexer, CA Generator, PSIP Server and Data Server.

The emission station generates MPEG-2 transport streams containing compressed video and audio with encapsulated data and system information tables.

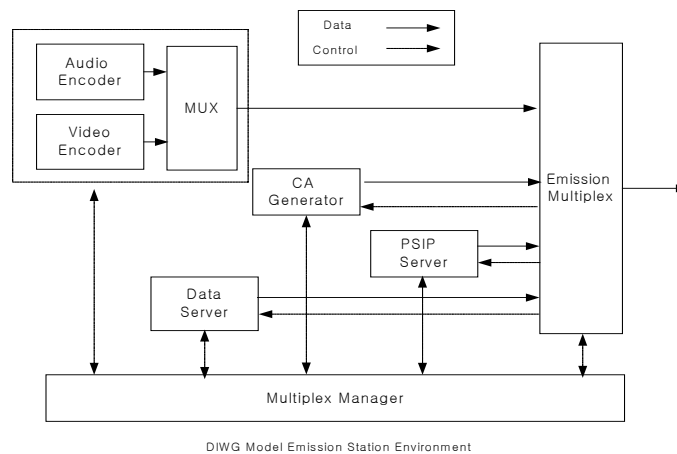


Figure 1. Emission Station Environment for Data Broadcasting

Data Server, one component in the emission station system, plays an important role in encapsulating data into MPEG-2 transport stream. Data server needs to be inputted with encapsulation information so as to generate data stream using the transport protocol defined in the data broadcast standard[A/9x][ACAP]. However, there is no the interface standard to define the message format and delivery protocol of encapsulation information. In contrary to Data Server, PSIP Server and CA Generator have input interface standard such as PMCP[PMCP]. PMCP[PMCP] can be applied to emission station for digital broadcasting as interoperable interface specification. Emission station based on PMCP, however, will need the new interface specification for data broadcasting when it adds Data Server into PMCP reference system.

Figure 2 shows the extension of PMCP reference system to encode data as well as to generate PSIP table.

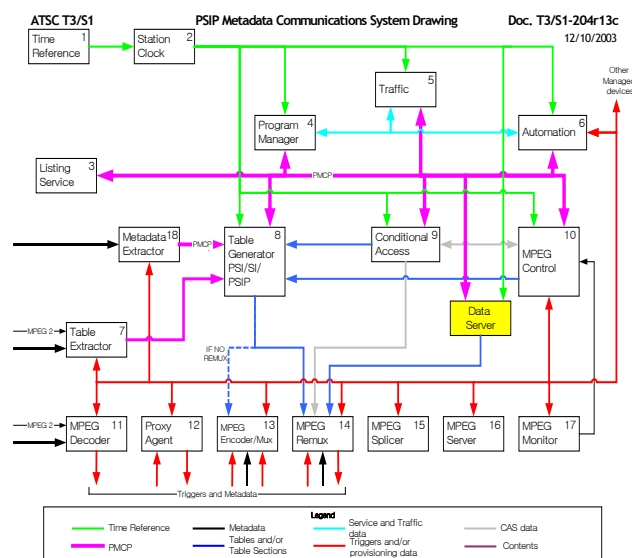


Figure 2. System Extension for Data Broadcasting

Data Server is connected into PMCP interface not only because Data Server needs to exchange the PMT information and announcement information with PSIP Server, but also because program management system, traffic system and automation system should control Data Server according to broadcasting schedule.

3. Schema Requirements

Existing PMCP schema should be extended because Data Server needs to receive the information such as encapsulation, signaling and announcement through PMCP interface. PMCP extension schema should consider the following requirements:

- PMCP extension schema should guarantee backward compatibility with existing PMCP schema
- PMCP extension schema should describe the encapsulation information to encapsulate data into MPEG-2 transport stream.
- PMCP extension schema should contain the signaling information to generate system table into MPEG-2 transport stream
- PMCP extension schema should include the announcement information to create program and system table for data service

PMCP extension schema for data broadcasting should be backward compatible with existing PMCP extension schema so that conventional emission station based on PMCP schema can easily be implemented to data broadcasting emission system in the future.

In addition, PMCP extension schema for data broadcasting needs to specify the information needed for the operation of Data Server through PMCP interface. Operation information consists of encapsulation, signalling and announcement. With respect to encapsulation and signalling protocol, ATSC defined data carousel[A/90], object carousel protocol[ACAP][A/95], IP multicast[A/92], synchronized/asynchronous data transmission[A/93]. ATSC also specified DET(Data Event Table) to announce data broadcasting service in A/90[A/90]. Although DET is not defined in ACAP, it might be used with announcement for ACAP in terrestrial data broadcasting.

The following sections outline the candidate metadata focused on only ACAP due to its high availability in real field.

3.1. Protocol Metadata

The protocol defined in ACAP provides data service through the use of DSM-CC User-to-User, Data and Object Carousel Protocol specified in ISO/IEC 13818-6[DSMCC].

Object carousel includes the following object message

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- ServiceGateway Message
 - Directory Message
 - File Message
 - Stream Message
 - Stream Event Message

In addition, Data Carousel to deliver object message consists of the following message.

- DSI(DownloadServerInitiate) Message
- DII(DownloadInfoIndication) Message
- DDB(DownloadDataBlock) Message

The above protocol metadata should be defined as schema for data broadcasting.

3.2. Signalling Metadata

The signalling information enables receivers not only to identify applications associated with a service and their location from which to recover them. ACAP specifies PMT(Program Map Table) and AIT(Application Information Table) to signal data application into receiver.

The following PMT descriptors identifies service component carrying the Application Information Table(AIT).

- PMT first loop descriptor
 - deferred_association_tag descriptor
- PMT second loop descriptor
 - data_broadcast_id descriptor
 - carousel_id descriptor
 - application_signalling descriptor
 - association_tag descriptor

The Application Information Table(AIT) provides full information on the data broadcast and allows the broadcaster to request that the receiver change the activation state of an application.

- AIT
 - application_type
 - organization_id
 - control_code
- AIT first loop descriptor
 - transport_protocol descriptor
 - dii_location descriptor
- AIT second loop descriptor

-
- transport_protocol descriptor
 - dii_location descriptor
 - application descriptor
 - application_name descriptor
 - application_icon descriptor
 - prefetch descriptor
 - acap_x_application descriptor
 - acap_x_application_location descriptor
 - acap_x_application_boundary descriptor
 - acap_j_application descriptor
 - acap_j_application_location descriptor

The above signaling metadata should be defined as schema for data broadcasting.

3.3. Announcement Metadata

Program and System Information Protocol(PSIP)[PSIP] is a collection of hierarchically arranged tables for describing system information and program guide. PSIP defines new table, named the Data Event Table(DET). DET contains information(titles, start time, etc.) for data services on specific virtual channels. Every event in DET shall include a Data Service Descriptor. The purpose of the Data Service Descriptor is to signal the maximum transmission bandwidth and associated buffer model requirements(size, leak rate) in connection with the entire data service. In addition to the Data Service Descriptor, an event announced in a DET may include an optional descriptor called the PID Count Descriptor. The purpose of this descriptor is to provide a total count of the PIDs used in the data service. In order to announce data service, schema for data broadcasting should include the information of DET, Data Service Descriptor and PID Count Descriptor as the followings:

- DET
 - start_time
 - data_id
- DET Descriptor
 - Data Service Descriptor
 - PID Count Descriptor

4. Summary

Figure 3 illustrates the relationship between existing PMCP schema and PMCP extension schema for data broadcasting. PMCP extension schema for data broadcasting includes PMCP schema because it adds the schema for encapsulation, signaling and announcement without modifying the existing PMCP schema.

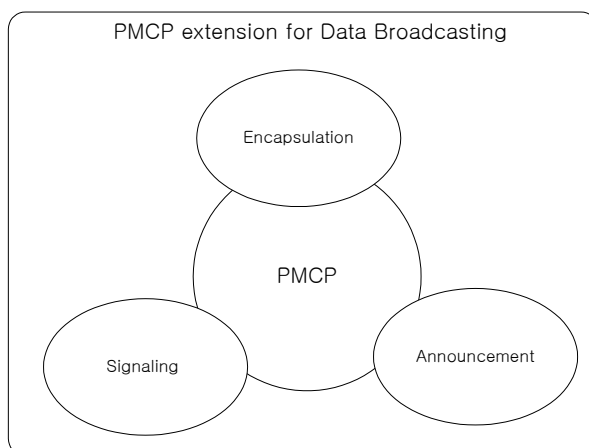


Figure 3. Relationship between PMCP and PMCP extension for Data Broadcasting

PMCP extension for data broadcasting should guarantee the interoperable interface among data broadcasting equipments. Data server, PSIP server, emission control system(program management, automation, traffic). In addition, PMCP extension for data broadcasting should be easily developed by extending current PMCP not only by adding data server into PMCP reference system model but also by defining new elements of announcement, signaling and encapsulation. PMCP extension for data broadcasting will be the second version of current PMCP. First version[PMCP] of PMCP supports only digital broadcasting. Second version of PMCP includes not only digital broadcasting but also data broadcasting

5. References

- [DASE] DTV Application Software Environment – Level 1 Standard, A/100, ATSC
- [ACAP] Advanced Common Application Platform, CS/101, ATSC
- [OCAP] OpenCable Application Platform Specification, OCAP 1.0, CableLabs
- [DIWG] Implementation of Data Broadcasting in DTV Station, IS/151, ATSC
- [PMCP] Programming Metadata Communication Protocol Standard, A/76, ATSC
- [A/90] Data Broadcast Standard, A/90, ATSC
- [A/92] Delivery of IP Multicast Sessions over Data Broadcast Standard, A/92,

ATSC

- [A/93] Synchronized/Asynchronous Trigger Standard, A/93, ATSC
- [A/95] Transport Stream File System Standard, A/95, ATSC
- [A/97] Software Download Protocol Standard, A/97, ATSC
- [DSMCC] Information Technology: Generic Coding of Moving Pictures and Associated Audio Information: Extensions for Digital Storage Media Command and Control, ISO 13818-6
- [PSIP] Program and System Information Protocol for Terrestrial Broadcast and Cable, A/65B, ATSC