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# Design and Evaluation of Service Signaling Structure based on MMT for Terrestrial UHD Broadcasting Systems

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**Abstract.** UHD broadcasting provides 4 to 16 times much sharper videos than that provided by HDTV, and also provides multichannel audios. MMT was suggested for the next generation multimedia delivery service to provide terrestrial UHD broadcasting steadily. However, MMT signaling protocol didn't have necessary information to transport terrestrial UHD broadcasting service efficiently now. In this paper, we propose the signaling structure including signaling table such as NIT, RRT, and SDT for the reception of terrestrial UHD broadcasting.

**Keywords:** MMT, UHD, Signaling, ATSC

## 1 Introduction

Terrestrial broadcasting has totally changed into digital TV in the end of year 2012, and it is preparing new era of UHD broadcasting now in 2014. UHD broadcasting provides 4 to 16 times much sharper videos than that provided by HDTV, and also provides multichannel audios so that enables to receive next generation realization broadcasting. To provide terrestrial broadcasting steadily, present system encounters problems with the lack of transport capacity of bandwidth. Internal standard broadcasting uses ATSC 2.0 of ATSC (Advanced Television System Committee), but ATSC proposed the newer version ATSC 3.0 which is now in progress, and MMT was suggested for the next generation multimedia delivery service.

MMT can be applied to both the broadcasting network and the communication network. MMT signaling performs important function that delivers information first to receiver to prepare receiving environment properly. However, MMT signaling protocol didn't have necessary information to transport terrestrial UHD broadcasting service efficiently now. For example, RRT is not considered in MMT which usually used in broadcasting protocol. RRT(Rating Region Table) should be considered in MMT signaling for the essential signaling role. In this paper, we propose the signaling structure including signaling table such as NIT, RRT, and SDT for the reception of terrestrial UHD broadcasting.

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# 2 Related Works

## 2.1 MMT

As shown in Fig. 1 (a), MMT can provide broadcasting based on IP in terrestrial, satellite, and cable broadcasting network. MMT signaling area makes device set environment for delivery and reception, and defines the message format that provides essential signaling information for the Package. MMT signaling messages use a general format consisting of three common fields, on specific field (for each signaling message type), and a message payload. All the signaling messages of the common format include message_id, version information, and length. The signaling message includes signaling tables, package structure of the table, the PI Document and the Clock Information and before transmitting and receiving data, prepared the device of the reception environment so that they can efficiently exchange information.

# 3 Design and Evaluation of Service Signaling Protocol

In MMT signaling, there is information to transport and receive logical data 'Package'. There are 5 signaling messages for package reception. PA message has whole signaling table information including MP table, MPI table, and PA table. MPI message includes MPI table, MP table and carries a complete or a subset of PI document. MPT message includes MP table and has information related to a Package. CRI message includes CRI table and carries clock related information to be used for mapping between the NTP timestamp and MPEG-2 STC. DCI message includes DCI table and contains information on required device capabilities.

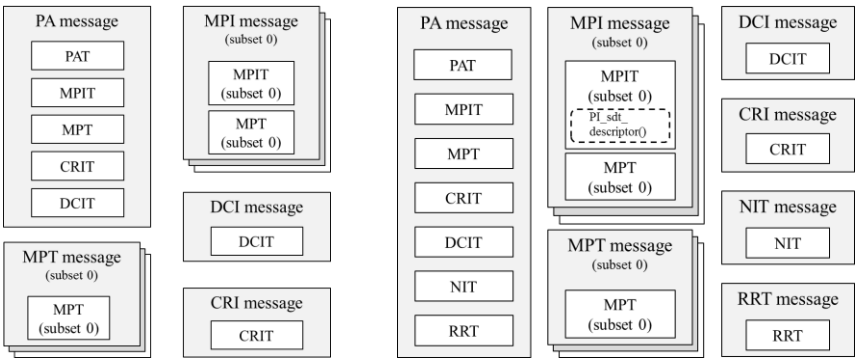


**Fig. 1.** (a) is the existing signaling structure in MMT, and (b) is the signaling structure we suggest.

As the following present MMT signaling table structure is inadequate for the broadcasting service. Therefore we suggest table addition as shown in Fig. 1 (b) in this paper.

| Syntax | Value | No. of bits | Mnemonic |
|---|---|---|---|
| MPI_message () { | | | |
| *message_id* | | 16 | uimsbf |
| *version* | | 8 | uimsbf |
| *length* | N1 | 32 | uimsbf |
| extension { | | | |
| *reserved* | '111 | 7 | uimsbf |
| *associated_MP_table_flag* | 1111' | 1 | bslbf |
| } | | | |
| *message_payload* { | | | |
| *MPI_table()* | | | |
| if (*associated_MP_table_flag*) | | | |
| { | | | |
| *MP_table ()* | | | |
| } | | | |
| } | | | |
| } | | | |

(a)

| Syntax | Value | No. of bits | Mnemonic |
|---|---|---|---|
| MPI_table () { | | | |
| *table_id* | | 8 | uimsbf |
| *version* | | 8 | uimsbf |
| *length* | N1 | 16 | uimsbf |
| *reserved* | '1111' | 4 | bslbf |
| *PI_mode* | | 2 | uimsbf |
| *reserved* | '11' | 2 | bslbf |
| PI_content_count | | | |
| for (i =0; i<N3; i++) { | N2 | 16 | uimsbf |
| ⋮ | | | |
| PI_SDT_descriptors { | N8 | 16 | uimsbf |
| SD_table_descriptors_length | | 8 | uimsbf |
| for (i=0; i<N8; i++) { | | | |
| SD_table_descriptors_byte | | | |
| } | | | |
| } | | | |
| } | | | |

(b)

**Fig. 2.** (a) is the structure of MPI message, and (b) is the suggested structure of MPI table including PI_SDT_descriptor.

| Syntax | Value | No. of bits | Mnemonic |
|---|---|---|---|
| NI_table () { | | | |
| *table_id* | | 8 | uimsbf |
| *version* | | 8 | uimsbf |
| *length* | | 16 | uimsbf |
| for (i=0; i<N1; i++) { | N1 | | |
| transport_stream_id | | 32 | uimsbf |
| original_network_id | | 32 | uimsbf |
| reserved_future_use | | 4 | bslbf |
| transport_descriptors_length | | 12 | uimsbf |
| for(j=0;j<N2;j++){ | N2 | | |
| descriptor() | | | |
| } | | | |
| } | | | |
| } | | | |

(a)

| Syntax | Value | No. of bits | Mnemonic |
|---|---|---|---|
| NI_descripter () { | | | |
| for (i=0; i<N1; i++) { | N1 | | |
| transport_stream_name_length | | 8 | |
| transport_stream_name_text() | | var | uimsbf |
| original_network_name_length | | 8 | |
| original_network_name_text() | | var | uimsbf |
| } | | | |
| } | | | |

(b)

| Syntax | Value | No. of bits | Mnemonic |
|---|---|---|---|
| RR_table () { | | | |
| *table_id* | | 8 | uimsbf |
| *version* | | 8 | uimsbf |
| *length* | | 32 | uimsbf |
| *reserved* | | | |
| table_id_extension{ | | 16 | uimsbf |
| reserved | | 16 | uimsbf |
| rating_region | | 4 | bslbf |
| } | | 12 | uimsbf |
| rating_region_name_length | | 8 | uimsbf |
| ration_region_name_text() | | var | |
| dimensions_defined | N1 | 8 | uimsbf |
| for (i=0; i<N1; i++) { | | | |
| dimension_name_length | | 8 | uimsbf |
| dimension_name_text() | | var | |
| reserved | '111' | 3 | |
| graduated_scale | | 1 | bslbf |
| values_defined | N2 | 4 | uimsbf |
| for(j=0;j<N2;j++){ | | | |
| abbrev_rating_value_length | | 8 | uimsbf |
| abbrev_ration_value_text() | | var | |
| rationg_value_length | | 8 | uimsbf |
| ration_value_text() | | var | |
| } | | | |
| } | | | |
| reserved | '11111 | 6 | |
| descriptors_length | 1' | 10 | uimsbf |
| for(j=0;j<N3;j++){ | N3 | | |
| descriptor() | | | |
| } | | | |
| } | | | |

(c)

**Fig. 3.** The structure of NIT is composed like (a) in Fig. 3. The descriptor in Fig. 3 (a) is composed as shown in the Fig. 3 (b). This descriptor delivers the current name and the original name of the service. The structure of RRT is derived from the table structure in ATSC as shown in Fig. 3 (c).

MMT should consider environment that uses both the communication network and the broadcasting network, it is necessary that a table like NIT should be considered which adjust channel frequency and modulator characteristic. RRT is an essential signaling table for the broadcasting system. It is used for the broadcasting rate information for the country and regions. Broadcasting cannot be transported and received without rate information. Rate information should be delivered before transporting broadcasting data, so RRT is necessary table which should be considered in MMT. NIT is for the appropriateness of MPI table and MP table in MPI message like the picture above when associate_MP_table_flag is '1'. As shown in Fig. 2 (a), SDT is also essential for noticing broadcasting channel and provider's information. SDT has information of services included in transport stream. MPI table has information of contents for PI, so we included SDT into MPI table as a descriptor which provides additional service of contents. MPI table has information of contents for PI, so we included SDT into MPI table as a descriptor which provides additional service of contents as shown in Fig 2. (b).

## 4 Conclusion

NIT, RRT and SDT essentially need to be included in MMT signaling protocol to receive terrestrial UHD broadcasting service quickly and properly. In this paper, we suggested signaling structure including NIT, RRT and SDT for terrestrial UHD broadcasting based on MMT. Efficiency in the processing speed and the early load status of message should be considered in the future study.

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