차세대 하이브리드 방송 전송 기술 MMT (MPEG Media Transport)

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More ways for consuming contents

- More platforms: Computers, tablets, phones, and so on...
- More ways: Fixed Internet, 3G/LTE, Wi-Fi, and so on...

More views for popular contents

- Flexibility of viewing condition (time, place, device) increased the hit ratio of popular contents
- Network is flooding with repeated/redundant uni-cast delivery of content

More variations for context awareness

- Multiple source contributed to single content
- User, Location, Device, Delivery Channel, and etc...
Challenges: MPEG-2 TS

Multiple sources but same time base (PCR)
Challenges: RTP

- Media/application specific payload format
- The sampling instance of the first octet
- Multiplexing???
New Requirements

- Flexible and dynamic access to multimedia components
- Easy conversion between the format for storage and the format for the packetized delivery
- Mixed use of multimedia components from multiple sources including the caches and the local storages

Multimedia over IP Environments
• MMT addresses different use cases around media distribution
• MMT defines a set of tools
  – The tools may be used independently (e.g. MMTP transport protocol only)
  – The tools may be used together according to the MMT data model to deliver an MMT Package

- HTML5 with multimedia
- MPEG Media Transport
- Transport Protocol (TCP, UDP)
- Internet Protocol (IP)
Three Functional Areas

- **Media Coding Layer**
  - **Presentation** (HTML5 with multimedia)
  - **Encapsulation Function**
  - **Delivery Function**
    - **Transport Protocol (TCP, UDP)**
    - **Internet Protocol (IP)**

Questions:
- How to describe the layout contents spatially and temporarily?
- How to construct content for easy handling by the delivery entity?
- How to packetize, multiplex content efficiently & adaptively?
- How to communicate with the other peer about the content and its packetization?
Relationship with other standards

Composition
- HTML5

Signaling message
- Encapsulation
  - ISOBMFF

Delivery
- FEC
  - MMT payload

Protocols:
- HTTP
- FLUTE
- RTP
- MMT protocol
- NTP

- Defined by MMT
- Referenced by MMT
MPEG-H
Pt 1 –
MMT

MPEG-H Pt1
MMT

MPEG-H Pt10
- FEC

MPEG-H Pt11
- CI
Package can be logically defined for dynamic creation for mash-up service

Each Asset is associated with delivery characteristics information

Temporal relations hip information is provided to optimize delivery order

Asset (and MPU) is uniquely identifiable for distributed caching & name-based search
### MMT Protocol

**MMT Protocol**

- **For each Asset:** one global unique identifier from other MPUs
- **For each packet_id:** the sequence number that is incremented individually
- **Delivery time instance of MMTP packet leaving the sending entity based on coordinated universal time (UTC)**

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<th>V</th>
<th>C</th>
<th>FEC</th>
<th>P</th>
<th>E</th>
<th>RES</th>
<th>packet_id</th>
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</table>

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
```

- `packet_sequence_number`
- `timestamp`
- `packet_counter`
- `private_user_data` | `payload_data` ...
- `source FEC payload ID`
MMT Protocol

MPU mode or Generic Object Delivery

- Complete data or first/middle/last fragment

A single DU for payload with MFU type is either a single complete MFU for timed media data or a single complete item for non-timed media data.
• Package Access (PA) message: contains minimum information for faster access to MMT package in case of unidirectional repeated message transmission

• Media Presentation Information (MPI) message: contains a whole or a subset of a presentation information document such as Composition Information or HTML5.

• MMT Package Table (MPT) message: contains all or a part of information required for a single Package consumption such as assets in a package;

• Clock Relation Information (CRI) message: contains clock related information used for the mapping between an NTP timestamp and MPEG-2 System Time Clock

• Device Capability Information (DCI) message: contains the required device capability information for Package consumption
CI = PMT + PAT + Assets (Spatial + Temporal) information
<mmtci:CI>
  <mmtci:view id="View1" mmtci:begin="0s" mmtci:end="indefinite">
    <mmtci:divLocation id="divL1" mmtci:begin="0s" mmtci:refDiv="Area1"/>
    <mmtci:divLocation id="divL2" mmtci:begin="0s" mmtci:refDiv="Area2"/>
    <mmtci:divLocation id="divL3" mmtci:begin="0s" mmtci:end="image2.Click" mmtci:refDiv="Area3"/>
    <mmtci:divLocation id="divL4" mmtci:begin="image2.Click" mmtci:refDiv="Area4"/>
    <mmtci:divLocation id="divL5" mmtci:begin="image2.Click" mmtci:refDiv="Area5"/>
  </mmtci:view>
  <mmtci:MediaSync refId="Video1" mmtci:begin="0s"> http://www.example.com/content/video.mp4 </mmtci:MediaSync>
</mmtci:CI>
Hypothetical Receiver Buffer Model
• MMT defines the interface between MMT sending and receiving entities
• MMT Sending Entity aggregates content from multiple content providers
MMT Delivery Model

- **Package can be serialized into a file for storage or packaged delivery & download**
- **Package can be packetized into MMT Protocol packets packetized delivery (real-time streaming)**
- **MPU identifies boundary smaller than a video frame for adaptive packetization**
- **MPU can be reconstructed even if some MFUs are discarded during the delivery**

**MMT File**

- CI
- DC
- MPU
- MPU
- MPU

**MMT Package**

- CI
- Transport Characteristics
- Asset
- Asset
- Asset

**MMT Packet**

- Packet Header
- Payload
- MFU
- MFU
- MFU
- MFU

**Serialization**

- MMT File
- MMT Package
- MMT Packet

**Packetization**

- Packetization
- Storage

**Unpacketization**

- Unpacketization
- Storage
ISOBMFF-based MPU for Delivery
MMT Encapsulation from ISOBMFF

Input ISOBM Video File

FTYP
MMPU
MOOV
TRAK (Video)
MDAT
Video Samples
MFU, 1/30sec

GOP, more than 1sec

MPU, 1sec

Asset, 11sec

Output MPU Files

FTYP
MMPU
MOOV
TRAK (Video)
MDAT
Video Samples
MMT Hint Samples

FTYP
MMPU
MOOV
TRAK (Video)
MDAT
Video Samples
MMT Hint Samples

FTYP
MMPU
MOOV
TRAK (Video)
MDAT
Video Samples
MMT Hint Samples

FTYP
MMPU
MOOV
TRAK (Video)
MDAT
Video Samples
MMT Hint Samples
- Service provider provides CI with personalized Ad.
- Server A broadcast MPUs multiplexed in consumption order
- 1st screen device discover 2nd screen device (e.g. DLNA)
- 1st screen device forward CI to 2nd screen device
- Server B unicast MPUs to 2nd screen device
- While 1st screen device presents V-MPU #2, 2nd screen device presents V-MPU#2a & A-MPU@2b
Major features of MMT

1. Presentation description complementing HTML5 with temporal synchronization and multi-screen association
2. Self-contained data format for delivery layer processing and easy conversion between storage and delivery use
3. Payload format agnostic to specific media type and application layer protocol with advanced jitter handling and multiplexing
Thank you!

Questions?