Overview of ITU-T H.721 Recommendation for IPTV Terminal Device

Hiroaki Nishimoto, Director, Sumitomo Electric Networks
Sumitomo Electric Industries, Ltd.

(Contact : iptv-info@sei-networks.com)
Index

1. Trends in Standardization Activities for IPTV
   - Spreading of broadband IP video service and standardization
     (From FG-IPTV to IPTV-GSI)
   - Interop Events
2. ITU-T Recommendations for End Systems
3. Overview of H.72X series recommendations for IPTV TD
4. Target Services of H.721 recommendation
5. Details of H.721
6. HSTP.CONF-H721 – Conformance Test Specification
7. Example for Commercial Deployment of H.721
8. Conclusion
1. Trends in Standardization Activities for IPTV

Spreading of broadband IP video service and standardization (From FG-IPTV to IPTV-GSI)

- IP video services on Broadband IP network has been widespread.
- In 2006 ITU launched the Focus Group to promote the standardization for IPTV.
- In 2008 inherited to IPTV-GSI.
- Since 2010 ITU-T has started the conformance and interoperability test event for ITU-T H.700 series standard compliant IPTV products in the world (Interop Event).
1. Trends in Standardization Activities for IPTV

ITU Interop Event on IPTV

- Conformity and Interoperability testing of ITU-T H.700 series compliant products

- Target recommendations
  (1) H.701 (Error Recovery)
  (2) H.721 (IPTV Terminal Device)
  (3) H.740 (Event Handling and Audience Measurement)
  (4) H.750 (Metadata)
  (5) H.761 (NCL Ginga)
  (6) H.762 (LIME)
  (7) H.770 (Service Discovery)

- H.721 was tested in IOT events
  - 1st IOT (Jul. 2010@Geneve), 2nd IOT (Sep. 2010@Singapore),
  - 3rd IOT (Dec. 2010@Pune), 4th IOT (Jul. 2011@Rio de Janeiro)
The 1st Interop Event

- From July 20th to 23rd 2010 in Geneva (ITU HQ)

Participants: Cisco, Mitsubishi, NEC, NTT, OKI, PUC-Rio and Sumitomo

- Press Release: www.itu.int/ITU-T/newslog/CategoryView,category,IPTV.aspx
- Photos: www.flickr.com/photos/itupictures/
- Videos: www.youtube.com/watch?v=CpJml_5aQrA
The 1st Interop Event

- From July 20th to 23rd 2010 in Geneva (ITU HQ)

Key speech by Dr Hamadoun Touré, Secretary General, ITU

A view of conformance test

Many Telco Carriers, Medias including ITU secretary general visited the showcase

A scene of Briefing for IOT

Certificate of Participation

Certificate issued for participants
The 2nd Interop Event

- From September 23rd to 27th 2010 in Singapore (Fusionopolice)

Participants: Cisco, Mitsubishi, NEC, NTT, OKI, PUC-Rio, Sumitomo, TVStorm, V One Multimedia

[http://www.youtube.com/watch?v=oRRve8sJKTY](http://www.youtube.com/watch?v=oRRve8sJKTY)
The 3rd Interop Event and Showcase

- Dec 14th - 17th 2010 in Pune (Sinhgad Polytechnic)

New Participants: Tech Mahindra

System configuration of the Showcase

H.770 Operator and Service Discovery
H.721 IPTV Basic Terminal Device

H.750 TV Anytime Metadata
H.762 LIME Middleware

Servers

- LinearTV ch1
- LinearTV ch2
- LinearTV ch3

- Remote Access Point
- VOD

Contents Information
- H.264 (MPEG2-TS)
- TTS
- RTP Protocol
- IPv6

- Remote Booking for STB

Clients

RSP 1
H.750 MetaData based “Hikari TV” service

RSP 2
H.762 LIME based “SUMI TV” service

Service Provider Discovery

- CDN COMP
- META DATA
- WEB
- Firm Upgrade

- NTP
- DHCP
- DNS
- RA

Smart Phone

USB HDD

IP-STB

IP-STB
The 4th Interop Event and Showcase

- From July 18th to 22th 2011 in Rio de Janeiro

  IOT Participants: OKI, PUC-Rio, Sumitomo, TOTVS
  ShowCase Participants: Mitsubishi, OKI, PUC-Rio, Sumitomo, TOTVS, ZTE

- New Test Case: H.761 (Ginga NCL) and H.762 (LIME)
2. ITU-T Recommendations for End System

IPTV Multimedia Application and End System (H.700-799 Series/J.700 series)
- H.IPTV-MAP
- H.701 (content error-recovery)
- H.770 Service discovery

IPTV Terminal H.720-729
- H.720 Overview
  - J.702 Legacy
- H.721 Basic
- H.IPTV-TDES.3 Full-fledged
- H.IPTV-TDES.4 Mobile

Middleware H.730-739
- H.IPTV-DSMW Distributed MW
- J.701 Broadcast MW
- H.IPTV-WBTM Web-based MW
- H.750 Metadata

AP Event handling H.740-749
- H.IPTV-AEH
  - AP Event handling
- H.IPTV-AM
  - Audience Measurement

Multimedia App. Framework H.760-769
- H.760 (MAFR.0): Framework
- H.761 (MAFR.9): Ginga
- H.762: LIME
- H.IPTV-MAFR4: CEA-2014
- H.IPTV-MAFR5 MHEG-5

Home Network
- H.622.1 (Home NW)
- H.IPTV-RM
  - (HN Remote Mgmt)
- H.IPTV-NGN-RM
  - (NGN based HW)
- J.RG-REQ
  - (CATV RGW)
- J.LASDP-REQ
  - (local SDP)

SG9 Recommendations (J.*)
SG16 Recommendations (H.*)
3. Overview of H.72X series recommendations for IPTV TD

**Consented**
H.720 “Overview of IPTV terminal devices and end systems”
H.721 “IPTV terminal devices : Basic model”

**Under Study**
H.IPTV-TDES.3 “IPTV Terminal Device : Full-fledged model”
H.IPTV-TDES.4 “IPTV terminal device : Mobile model”
3. Over view of H.72X series recommendations for IPTV TD

- Services for each terminal device model

<table>
<thead>
<tr>
<th>Terminal device model</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic model (H.721)</td>
<td>“Basic Services”</td>
</tr>
<tr>
<td></td>
<td>Linear TV, Video on demand (VOD), Portal Service, etc.</td>
</tr>
<tr>
<td>Full-fledged model (TDES.3)</td>
<td>”Basic Services”+ “Advanced Services”</td>
</tr>
<tr>
<td></td>
<td>Push VOD, Video Phone, Advertisement, PVR, Audience measurement, Personal Broadcasting, etc.</td>
</tr>
<tr>
<td>Mobile model (TDES.4)</td>
<td>“Basic Services” + Mobile oriented Services</td>
</tr>
<tr>
<td></td>
<td>Linear TV &amp; VOD for mobile, Interactive Services, advertisement based on user location</td>
</tr>
</tbody>
</table>
3. Overview of H.72X series recommendations for IPTV TD

- Scope and relationship of each H.72X recommendation
4. Target services and Scopes of H.721 Recommendation

- Linear TV and VoD services
- Services on managed network
- Targeted both for STB of service operator and IPTV embedded TV sets in the retail market
- Service navigation functions
  - Remote Controller, EPG, Portal etc.
- Interactive services
- Public interest services
  - Emergency Broadcast, Subtitle, Sign language, and so on
5. Details of H.721

(1) Linear TV service

- Multicast delivery
- Programs on temporal order
- Include IP retransmission of Terrestrial and Satellite Broadcasting
5. Details of H.721

(2) Video on-demand Service

- Unicast delivery
- Contents is served by end-user’s choice
- Support trick-plays
  - Variable playback speed control, fast-forward play, rewind, pause, etc.
5. Details of H.721
(3) Functional components of H.721 terminal device

IPTV Terminal Functions

Application Client Functions
- SADS Client Functional Block
- IPTV Application Client

SCP Client Functions
- Service Protection Client Functional Block
- Content Protection Client Functional Block
- Control Client Functional Block
- Performance Monitoring

Content Delivery Client Functions
- Unicast Content Delivery Client Functional Block
- Multicast Content Delivery Client Functional Block
- Error Recovery Client Functional Block

Media Client Functions
- Demux/Mux
- Storage
- Codecs
- Media Control
- Metadata Management

IPTV Terminal Transport Functions
- Network Attachment Client

Terminal Device Management

Demux
- Broadcast Demux
- Unicast Content Delivery Client Functional Block

Codecs
- Media Control
- Metadata Management

Storage
- Error Recovery Client Functional Block

Metadata
- Network Attachment Client
Functions of each component (1)

- Terminal Transport Functions

- Network communication Interface

- Communication processing
  - RTP, UDP, HTTP/TLS, TCP, IP, IGMP/MLD

- Network attachment processing
  - DHCP, DNS
Content Delivery Client Functions

- Multicast content delivery client function block
  - IGMPv2, MLDv2

- Unicast content delivery client functional block
  - RTP and RTSP
  - HTTP for VoD contents selection

- Error recovery client functional block
  - FEC based error recovery (H.701)
Functions of each component (3)

- **Media Client Functions**
  - Playback and trick mode functionalities for VoD
    - Playback, Fast-Forward, Rewind, Pause, Stop, Chapter, etc.
  - Demux/mux functional block
    - MPEG2 TS/TTS, clock synchronization
  - Codec functional block (Decoding)
    - Video: MPEG2 (ITU-T H.262), MPEG4/AVC (ITU-T H.264)
    - Audio: MPEG-2AAC, MPEG-1 L2, MPEG-4 HE-AAC, AC-3
  - Storage functional block
    - Storing ID of services, password, License key
  - Metadata management
    - Caching, Searching, Parental control
Functions of each component (4)

- **SCP Client Functions**

  SCP=Service and Content Protection

- **Service protection client functions**
  - Secure communication channel
  - Authentication with SCP server
  - CRL update and management

- **Content protection client functions**
  - Content key acquisition
  - Extraction of the descrambling key from ECM
Functions of each component (5)

- IPTV Application Client Functions
  - Handling HTML/BML,
  - metadata to replay control
  - EPG/ECG

- SADS client functions
  - Service provider discovery
  - Service discovery
  - Service selection
    (compliant with H.770)
Functions of each component (6)

- **Other functions**

- **Control client functions**
  - *RACF resource management*

- **Terminal device management**
  - *Remote management*

- **Physical Interface**
  - *Rest button, Remote controller*
  - *RGB, DVI, Digital Audio, HDMI*
6. Conformance testing specification for H.721

- **HSTP.CONF-H721**

  - *New draft recommendation was created in Shanghai meeting in March 2010.*
  - *Approved in SG16 meeting in July 2010.*
  - *Added some new test items in later meetings.*
Example of Commercial IPTV Deployment of H.721

- Multi-ch HDTV
- IP Retransmission of Terrestrial HDTV
- IP Retransmission of BS HDTV
- Video Archives
- Video On Demand
- Karaoke Music
- E-Commerce

NGN

ONU HGW

Home Network (Ethernet / 802.11n / PLC / HPNA...)

Master Bed Room

Living Room

Children’s Room

StreamCruiser IP-STB

Digital Recording

USB2.0

Third Party USB-HDDs

HDMI

TV
7. Example for Commercial Deployment of H.721
ITU-T H.721 Compliant Commercial IP-STB in Japan
(Sumitomo StreamCruiser IP-STB for NTT Groups Hikari TV service)

- Service and Provider Discovery (ITU-T H.770)
- Supports multiple UI Middlewares
  - TVAnytime MetaData (ITU-T H.750) compliant high speed resident applications
  - LIME (ITU-T H.762) and HTML5-subset compliant browser based middleware realized the contents creation by service operator
- Supreme QoS with using Application Layer FEC (ITU-T H.701)
- IP Re-transmission of Digital Terrestrial TV and 1080i Full HD (H.721, H.264)
- Contents Protection with using IPTV Forum standard DRM (Marlin)
- Supports NGN (New Generation Network) and IPv6 Multicast MLDv2
- Service expansion provided by reliable Firmware Update Server : STManager
7. Example for Commercial Deployment of H.721
An example for the penetration of IPTV service by standardization in Japan

- **1st-Gen. IPTV**: Custom specification per servicer, expensive TCO & the lack of retransmission of major Terrestrial TV contents prevented the penetration of IPTV

<table>
<thead>
<tr>
<th>Group</th>
<th>NTT</th>
<th>KDDI</th>
<th>Softbank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicer</td>
<td>NTT-COM/OCN-Theater</td>
<td>Plala/4thMEDIA</td>
<td>OnDemand TV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hikari Plus TV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BBTV</td>
</tr>
<tr>
<td>Network</td>
<td>IPv6 FTTH</td>
<td>IPv4 FTTH/DSL</td>
<td></td>
</tr>
<tr>
<td>Codec</td>
<td>MPEG2TS</td>
<td>MPEG2PS 6Mbps</td>
<td>MPEG2</td>
</tr>
<tr>
<td>Service</td>
<td>Multicast TV</td>
<td>61ch</td>
<td>35ch</td>
</tr>
<tr>
<td></td>
<td>VOD</td>
<td>61ch</td>
<td>30ch</td>
</tr>
<tr>
<td></td>
<td>Karaoke</td>
<td>6,000 titles</td>
<td>5,000 titles</td>
</tr>
<tr>
<td></td>
<td>Game</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>

- **2nd-Gen. IPTV**: In Mar 2008, NTT-Plala’s “Hikari-TV” has started its commercial service, which compliant with the IPTV Forum Japan Standard that is a proactive deployment of ITU-T H.721

<table>
<thead>
<tr>
<th>Service</th>
<th>(1) IP re-transmission of Terrestrial Digital TV, (2) Multicast TV, (3) VOD, (4) Karaoke, (5) Archives On Demand, (6) USB-HDD Digital Recording</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network</td>
<td>NGN or FTTH Service</td>
</tr>
<tr>
<td>Codec</td>
<td>H.264(AVC) / MPEG2, TS/TTS, 10Mbps to 14Mbps(HD), 4 to 6Mbps(SD)</td>
</tr>
<tr>
<td>DRM</td>
<td>Marlin</td>
</tr>
</tbody>
</table>

The number of the subscriber of the standard compliant IPTV service “Hikari TV” exceeds 1M within 2 years
8. Conclusion

- H.721 specifies the functions to be supported by IPTV terminal devices that are operated on the managed network.

- The main target devices are IP-STB and TV set embedded with IPTV function.

- Included services are Linear-TV, VoD, Service navigation and public internet services.

- Conformance testing specifications (HSTP.CONF-H721) was approved and tested in ITU-T Interop events.

- Multiple of H.721 compliant terminal devices has been already implemented and deployed.
Thank you

Hiroaki Nishimoto, Director, Sumitomo Electric Networks
Sumitomo Electric Industries, Ltd.

(Contact : iptv-info@sei-networks.com)