Cable Television in Japan

May 26, 2017
Japan Cable Laboratories
Overview of
Japanese Cable Television industry
Japanese Cable Television

- The first Japanese cable television station began operation in 1955, two years after Japan Broadcasting Corporation (NHK) started television broadcasting, to retransmit NHK programs to a spring resort 150 kilometers north of Tokyo.
- As of March 2015, cable television reaches 52.2% of Japanese households, with 29.2 million subscribers (households), of which 9.8 million subscribe to paid channels

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Fiscal year 2014
Number of Commercial Operators: 294
Total Commercial Revenues: 497.5 billion JYen
### Yearly Increase of Cable Television Subscribers

#### (Source: MIC)

<table>
<thead>
<tr>
<th>Year</th>
<th>RF</th>
<th>IP Multicast</th>
<th>Penetration %</th>
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<tbody>
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<td>1998</td>
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*Note: The graph provides a visual representation of the yearly increase of cable television subscribers from 1998 to 2015.*
Yearly Increase of Cable Television Revenue

(Source: MIC)
Broadband Services Subscribers

(Source: MIC)
Evolution of Japanese Cable STB and Services
Evolution of Cable STB in Japan


Accelerated evolution after 2008

Smart TV

1st Generation Digital STB

2nd Generation STB

Smart TV compatible
- Downloadable applications
- Interactive with smartphones and home network
- ITU-T J.295/296 (Hybrid Cable STB)

3rd Gen STB
4K UHDTV
- 4K Video
- 5.1ch audio
- ITU-T J.297 (4K Cable STB)

High Quality Video

Large Display, Less power consumption

SD HD UHD

H.262 MPEG2 H.264 MPEG4 AVC H.265 HEVC

VR/AR

OTT Single Platform
- Google TV
- AppleTV
- Hulu
- Netflix
- YouTube

Broadcasters Platform
- HbbTV
- Hybridcast

Manufacturers Platform
- Samsung
- Panasonic
- acTVila

Home Network
- DLNA
- HTML5
- DAE

Improved UI/UX

Improved UI/UX

High Quality Video

Large Display, Less power consumption

Large LCD OLED VR/AR

SD HD UHD

H.262 MPEG2 H.264 MPEG4 AVC H.265 HEVC

Downloadable applications
Interactive with smartphones and home network
ITU-T J.295/296 (Hybrid Cable STB)
Smart TV services with $2^{nd}$ Gen STB

- Cable Operator
  - Service Delivery Platform (SDP)
  - APP
  - Content
  - Meta data
  - ID
  - Search
  - Billing

- Mobile NW (3G, 3.9G, 4G), Wi-Fi
- HFC (DOCSIS) or FTTH
- Internet
- Internet Video
- Internet Radio
- Cable Portal

- 2$^{nd}$ Gen STB
- Target Ad.
- Multiple DVR
- Remote UI (2$^{nd}$ screen)
- HTML5, Android Applications
- Common APPs (Games, Widgets, Tools, etc)

- Smartphone & Tablet
- Multi-device
- Content to go
- NAS
3rd Generation STB

4K UHDTV

Remote Viewing

Multi-device

3rd Gen STB

Remote control
EPG
Personalized Portal

Wi-Fi

Services for and in collaboration with tablets and smartphones

Mirroring

on the road
4K Services in Japan

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<tr>
<th>Broadcasters</th>
<th>Telco</th>
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<tr>
<td>NexTV-F</td>
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<td>CS124°/128°</td>
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</table>

NexTV-F: Channel 4K (Experimental Satellite Service on CS 124/128)

Terrestrial: No Plan

Broadcasting Satellite 110°E: Experimental 4K/8K (ch.17)

Communications Satellite 110°E: Commercial 4K/8K (RHCP & LHCP)

CS124°/128°: Sky Perfect 4K (Commercial Service)

NTT Plala IP VoD: Oct 2014 - Hikari TV 4K

4K AcTVila IP VoD: Dec 2014 - 4K AcTVila

Cable TV 4K: Retransmission of Channel 4K (RF/IP)

Cable 4K(RF) | Cable 4K(IP)

Cable TV 4K IP VOD: Apr 2016 - Milplus 4K

Cable TV 4K RF VOD: May 2015 - J:COM On Demand
4K services supported by 3rd Gen. STB

- **Cable 4K RF & IP**
  - Cable 4K RF with 64 bit encryption
  - Cable 4K IP with Marlin CAS/DRM (AES128 encryption)

- **New cable channels with AES 128 encryption (ACAS)**
  - In anticipation of Hollywood 4K movies

- **Retransmission of Advanced Satellite Broadcasting**
  - AES 128 encryption (ACAS)
  - MMT (MPEG Media Transport) in place of MPEG2 TS

- **IP VoD**
  - MPEG DASH
  - Common Encryption Scheme (CENC) (ITU-T J.1005/1006)
Cable 4K Content Distribution Scheme

Production
- Cable TV stations
- Content Providers

Compilation
- Cable 4K Platform
- Japan Cable and Telecommunications Association (JCTA)
  Policy making and supervision for content production and compilation

Distribution
- NW
- RF
- IP
- Cable Headend
- NW
- RF
- IP
- Cable Headend
Cable 4K RF Transmission System

25Mbit/s bitrate

Content A
Content B
Content C
AJC-CMS

HEVC File Encoder
Playout Storage
Multiplexer
Scrambler
IP Transmission (TS→IP)

CAS ECM/EMM
CAS Server

IP Transmission (IP→TS)

64 QAM
NIT
Subscriber Management System (SMS)

EPG
PSI/SI

All Japan Cable Content Management System

4K TV
STB

Content
Cable Platform
Cable Operator HE
Subscriber
Cable 4K IP Transmission System

- **HEVC File Encoder**
- **Playout Storage**
- **L3/SW**
- **Configuration**
  - SI
  - SNTP
  - DRM (Marlin)
- **Authentication & Authorization Server**
- **Subscriber Management System (SMS)**
  - Permission, etc
- **CMTS**
- **OLT**
- **STB**
- **4K TV**
- **STB**

All Japan Cable Content Management System

- **Content A**
- **Content B**
- **Content C**

Flow:
- Content → Cable Platform → Cable Operator HE → Subscriber
New cables channels with AES128

• Use of ACAS (AES 128 Encryption)
  – This is in response to US MovieLabs Specification for Enhanced Content Protection, which defines the following, among others:
    • Use of a cipher of AES 128 or better
    • Can revoke and renew versions of client component
    • Provision of hardware root of trust (HRoT)
  – The same CAS system as the Advanced Satellite Broadcasting (next slide)

• Use of H.265 HEVC and H.264/AVC
  – This enables up to four times more efficient bandwidth usage than the existing cable channels.
Retransmission of advanced satellite service

- Ten (10) 4K channels on Japanese Broadcasting Satellite (BS) starting in December 2018
  - Ten (10) 4K channels (6 on right-hand circular polarization (RHCP), 4 on left-hand circular pol (LHCP))
  - One (1) 8K channel on LHCP

- New equipment required to carry those services over cable:
  - HE and STB to send and receive MMT (MPEG Media Transport) replacing MPEG-2 TS
  - CAS system with 128bit AES (ACAS)
  - HDR TV (HLG)
  - For 8K, HE and STB capable of channel bonding scheme as defined in Annex A of ITU-T J.183
MMT (MPEG Media Transport)

- **ISO/IEC 23008 (March 2014)**
  MPEG-H: High efficiency coding and media delivery in heterogeneous environments

- MMT is defined as Part 1 of MPEG-H

- MPEG-H suite includes HEVC (H.265) as Part 2

**Part 1: MPEG Media Transport (MMT)**

- Part 2: High Efficiency Video Coding (HEVC)
- Part 3: 3D Audio
- Part 10: FEC Codes for MPEG Media Transport
- Part 11: Composition coding for MMT
Advantage of MMT

- MMT has the following features which overcome the shortcomings of MPEG-2 TS:
  1. Can synchronize streams from different sources (e.g. streams from broadcasting and broadband), using NTP
  2. Uses variable length packets – suitable for transporting high bit rate streams or large size files

Example: Main video via broadcasting network, while videos from different cameras via telco network
MMT Protocol Stack

- MMT packets are annexed to IP header
- IP packets are multiplexed* using TLV (Type Length Value) for transmission over digital broadcasting channel

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<th>Video</th>
<th>Audio</th>
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**Source:** ARIB STD-B60 “Media Transport on Digital Broadcasting”

*ITU-R BT.1869

**TMCC:** Transmission and Multiplexing Configuration and Control
(ISDB system parameters; not on cable channel)
Broadcasters’ CAS Security Chip (ACAS)

- HRoT by means of a dedicated hardware chip
- Path between SoC and the CAS chip is securely encrypted
- CAS software renewable by software download

- Scrambler: AES 128
- CAS: standardized (one type)
- SoC: not dependent on CAS security chip
HDR (High Dynamic Range)

- HDR is a technology to extend the luminance of video signal
- Two main standards to define HDR transfer functions
  - HLG: Hybrid Log Gamma
  - PQ: Perceptual Quantization
- Japanese broadcasters will use HLG for the time being, with PQ for further study
ACS (Auto Configuration Server)

- Using broadband Forum TR-069 (Technical Report 069: CPE WAN Management Protocol), cable operators can remotely configure and maintain STBs
  - Remote configuration
  - Diagnostics
  - Firmware update
  - Collection of audience measurement data
Hybridcast™

- Hybridcast is a Japanese equivalent of Europe’s HbbTV (Hybrid Broadcast Broadband TV)

From NHK Science and Technology Research Laboratories web site
Remote Viewing

- Remote viewing is a service which enables Mobile Digital Media Players (M-DMP) such as smartphones and tablets outside the home, to view broadcasting content (real time and recorded) from Digital Media Servers (DMS) such as TV, STB and recording devices inside the home.

- Requirements for remote viewing has been developed in consultation with Japanese broadcasters, and now documented in ARIB TR-B14 (in Japanese).

*Next Generation Television & Broadcasting Promotion Forum
Remote Viewing

- Mobile players must be paired with a digital media server (DMS) such as STB inside the home, before it is carried outside the home. Up to six players can be paired with a DMS but only one player can use this service at a time.

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<th>Media Format(H.264)</th>
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<tbody>
<tr>
<td>360P(SD) or 480P(SD)</td>
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<td>Optionally: 180P(SD), 720P(HD), 1080P(HD)</td>
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*Must be paired every three months*
# Cable STB Roadmap

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<td>Advanced BS Retransmission</td>
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<td>TS (Experimental)</td>
<td>MMT  - Commercial Service  - ACAS (AES128)</td>
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<td>Cable Platform/Headend</td>
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</table>

**Event**
- Rio de Janeiro Olympics
- PyeongChang World Cup
- Tokyo Olympics

**Cable 4K(RF)**
- MPEG2-TS  - C-CAS (Multi-2)

**Cable 4K(IP)**
- MPEG2-TS  - Marlin (AES128)

**Advanced BS Retransmission**
- TS (Experimental)
- MMT  - Commercial Service  - ACAS (AES128)

**Cable Platform/Headend**
- MMT⇒TS conversion
- 8K⇒4K transcoding
- ACAS (AES128)
- SimulCrypt: C-CAS and ACAS
- ACS(Auto Configuration Server)
- 8K (RF) J.183 (Multiple QAM)
- 4K/8K (MMT IP)

**STB**
- Cable 4K
- Remote viewing
- Hybridcast
- Reader for “My Number” card
- High Dynamic Range (HDR) TV
- Google VP9 (OTT)
- 120P
- 22.2ch audio