Future of Home Media

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on behalf of Kazumasa ENAMI  
Science and Technical Research Laboratories  
NHK (Japan Broadcasting Corporation)

Outline

- Present status of and trends in home media
- Diversification of multimedia services
- The TV set will become Integrated Services Television
- Agenda for developing future home media
- NHK STRL's approach to research
- NHK STRL's research on related technologies
- Summary
Present status of and trends in home media

Problem of present home media

- TV, PC, and phone systems are built from physically separate components.
- A wide variety of non-networked cables are in use.
- No linkage exists between the information in terminals and broadcasting/communication media.
- No easy access to the desired information.
- Individual remote control devices for every system, with too many buttons for easy operation.
- Incomplete copyright protection system.
Development of infrastructure surrounding home media system

- Digitization of broadcasting
- Advancing broadband communications
- Storage technology (smaller size, larger capacity)
  - Home Server
- Development of portable terminals
  - Watching TV
  - iPod --- Podcasting
- Home network

Digital broadcasting services in Japan

- High picture quality / sound quality
  - HDTV and 5.1 surround stereo system
- Data broadcasting
  (program related data services, interactive data services)
- Multiprogramming
- High performance
  - Electronic Program Guide (EPG)
- Digital terrestrial TV broadcasting
  Along with digital satellite broadcasting services, there are
  - Services for mobile reception terminals (1 segment broadcasts)
  - Regional broadcasts
  - NHK Data Online
    - New service using the Internet connection of digital broadcasting receivers
Schedule of digitalization of broadcasting media in Japan

- **Digital Terrestrial TV**
  - Launched on Dec. 1, 2003
  - Tokyo, Nagoya, Osaka Metro Area
  - Reaching all of Japan
  - Other major capital cities (by Year 2006)
  - Switch-over in July 24, 2011

- **BS Digital TV**
  - Started on Dec. 1, 2000
  - Ceases by 2011 (expected)

- **BS Analog TV**
  - Ceases by 2007 (expected)

- **BS Analog HDTV**

- **CATV (re-transmission)**

- **Digital Terrestrial Audio**

Growth in digital BS subscribers and digital receivers in Japan

- **BS Digital Subscribers** (including NTSC Conversion on Cable)
  - 10.52 million

- **BS Digital Receivers**
  - 8.69 million
  - BS Digital Hi-Vision TV
  - BS Digital Tuner
  - BS Digital PDP Receivers
  - BS Digital LCD TV Receivers

- **Digital Terrestrial Receivers**
  - 6.18 million

Total number of households in Japan: 48 million

(As of September, 2005)
Communications infrastructure development in Japan

Increase in Internet population and its penetration rate

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Internet users</th>
<th>Penetration rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>11.55</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>16.94</td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>27.06</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>47.68</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>55.93</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>69.42</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>77.30</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>79.48</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Ministry of Internal Affairs and Communications; “Communications usage trend survey”)

Trend of broadband subscribers

<table>
<thead>
<tr>
<th>Year</th>
<th>DSL</th>
<th>FTTH</th>
<th>CATV</th>
<th>Wireless (FWA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>220</td>
<td>0</td>
<td>0.2</td>
<td>76</td>
</tr>
<tr>
<td>2000</td>
<td>860</td>
<td>0.5</td>
<td>64</td>
<td>28</td>
</tr>
<tr>
<td>2001</td>
<td>3,870</td>
<td>26</td>
<td>1,460</td>
<td>2,070</td>
</tr>
<tr>
<td>2002</td>
<td>2,070</td>
<td>30</td>
<td>70</td>
<td>2,380</td>
</tr>
<tr>
<td>2003</td>
<td>9,430</td>
<td>1,140</td>
<td>1,120</td>
<td>13,330</td>
</tr>
<tr>
<td>2004 (End of FY)</td>
<td>18,660</td>
<td>2,430</td>
<td>13,330</td>
<td>2,870</td>
</tr>
</tbody>
</table>

(Source: Ministry of Internal Affairs and Communications; 2005 White Paper; “Information and communications in Japan”)

Market prediction for storage

Demand projection for DVD and VCR in the world

(Source: JEITA (Japan Electronics and Information Technology Industries Association))

Market penetration rate for hard disk recorders in Japan (prediction)

(Source: NRI (Nomura Research Institute))
Market prediction for display

Demand projection for TV in the world

(Source: JEITA (Japan Electronics and Information Technology Industries Association))

Portable terminals - Watching TV -

Service will start next spring
Portable terminals - iPod -

Can also view content through Podcasting

Podcasting has become popular, especially in the United States

Easy to use

Video Podcasting

HDD digital TV - Portable devices

Main home network technologies

<table>
<thead>
<tr>
<th>Classification</th>
<th>AV systems</th>
<th>PC systems</th>
<th>Home appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networking technology</td>
<td>IEEE1394, IEEE802.11, etc.</td>
<td>IEEE802.3, IEEE802.11, Power-line communication</td>
<td>Power-line communication (10kHz to 450kHz), ECHONETZ, igBee, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2MHz to 30MHz), HomePNA, Bluetooth, etc.</td>
<td></td>
</tr>
<tr>
<td>Main application</td>
<td>TV, audio system, etc.</td>
<td>PC, PC peripherals.</td>
<td>Home appliances, security systems, etc.</td>
</tr>
<tr>
<td>Main purpose</td>
<td>Digital content sharing, etc.</td>
<td>Internet access, sharing a printer and other devices,</td>
<td>Heating and cooling, lighting management, home security, etc.</td>
</tr>
<tr>
<td>Max. transmission speed</td>
<td>High-speed (400Mbps)</td>
<td>Medium or High-speed (1Mbps to 1Gbps)</td>
<td>Low-speed (9.6kbps and higher)</td>
</tr>
</tbody>
</table>
Diversification of multimedia services

- Diversifying demands from viewers
- Media trend moves toward visualization
- Increase in broadband users
- Increase in users who want to transmit information
- Linkage between TV and the Internet
- Progress on media handling technologies
Opinions on Internet use on a TV (1)

Questionnaires given to advanced users

- **Satisfaction level of Internet use on a TV**
  - Satisfied: 35.5%
  - Dissatisfied: 25.6%

- **Future of Internet use on a TV**
  - Will be popular: 60.7%

Opinions on Internet use on a TV (2)

- **Advantages of Internet use on a TV**
  - Easier to view with a display larger than a PC.
  - Easier operation with a remote control device.
  - Faster startup compared to a PC.
  - Internet use in a living room or other place at my convenience.
  - Easy initial system setup.
  - Better sound than a PC.
  - Use Internet together with family in a living room or other place.
  - Faster loading and switching between web pages than on a PC.
  - Reasonable pricing for TV with Internet access capability.
  - No particular advantage.

- **Unsatisfactory aspects of Internet use on a TV**
  - Remote control device’s operability does not match that of PC.
  - Harder to view general websites with TV monitor.
  - Difficult to use the Internet while watching a TV program.
  - Higher prices for a TV with Internet access capability.
  - Difficult initial system setup.
  - Sharing TV with family makes it difficult to use the Internet.
  - Slower loading and switching between web pages than on a PC.
  - Slower system startup than a PC.
  - Poorer sound quality than a PC.
  - No particular unsatisfactory factor.
The TV set will become Integrated Services Television.

Fusing broadcasting, communications, and storage

Advances in broadcasting
- Analog broadcasting
  - Storage function
  - Communication function
  - Interactive programming
- Digital broadcasting
  - Storage function
  - Communication function
  - Digitization and utilization of communication function
- Present digital broadcasting
- Broadcasting based on home servers
  - Storage function
  - Communication function
  - Data download
  - New functions by broadcasting based on home servers

Advances in receivers
- Analog broadcasting receiver
- Connection with communication network
- Broadcast-wave (analog)
- Receiver for present-day digital broadcasting
- Broadcast-wave (digital)
- Receiver for broadcasting based on home servers
- Broadcast-wave (digital)
- Installation of large-capacity storage function
- Large-capacity storage system
- Communication network

Usage image example:
- Automatic storage and retrieval, digest viewing
- Recipient retransmits broadcast content over the Internet
Broadcasting based on home servers

- Home Server: large-capacity storage unit for TV programs
- Metadata enables “anytime viewing.”

Service will start around 2007

Conceptual image of future home media

Spoken command “I want to watch the program that I missed yesterday.”
Conceptual image of future home media

Integrated Services Television

- Broadcasting
- Remote medical care
- Broadcasting station server
- Video on-demand service
- Municipality
- Electronic service
- School
- Educational use

Home Network

Home server

Agent

Spoken command: "I want to watch the program that I missed yesterday."

Digest viewing

Anytime program viewing/data acquisition
Anywhere program viewing/data acquisition
Easy-to-use interface for everybody
Easy content-production for everybody
Safe connection and fee-charging
Latest function updates
Easy connection between devices
Rich video/audio expressions
Display tailored to viewing style
Seamless services using broadcasting, communication, and storage media
Content copyright protection

Agenda for developing future home media

Required functions

- Search
- Metadata
- Security
- Human interface
- Media handling
- Media conversion
- Content production technologies
- Media art
- Middleware
NHK STRL’s approach to research

NHK STRL Vision “NEXT”

To view a faraway scene as if it were nearby in real time
To enable sender and viewers to share information and emotions
To utilize information media for a broad range of daily activities and in times of emergency

“Human-oriented” system
R&D Framework

Broadcasting technology that learns from human possibilities

Ultimate broadcasting system with a heightened sensation of reality

Advanced content production and a mobile news-reporting system

Ubiquitous and universal services

Systems technology

Audio-video technology conveying a heightened sensation of reality

Content production technology that incorporates the knowledge of production experts

Network technology; Security technology

Highly functional wireless transmission technology

Flexible system construction technology

Human science

Image/speech recognition, language processing

Analysis and application for knowledge and sensibility

Psychology; Physiology

Fundamental device technology

Ultradevices, Ultra large-capacity recording devices

Devices with new functions

Nanophotonics materials

NHK STRL’s research on related technologies
**Metadata production system**

- Program script and shooting plan can be used for metadata production for drama and documentary program.
- Metadata can be efficiently produced for sports programs by combining image recognition, speech recognition, natural language processing, etc.

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**TVML (TV program Making Language)**

- A new program production mechanism that automatically generates programs from a script written in a computer language

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**TVML script**

```
... BOB = "Hello"
camera=close-up
BOB = "Today..."
movie = start
super = "NHK"
...
...
```

**Function**

- "Studio Shots" using real-time computer graphics and voice synthesis
- Superimposition of text
- Title displays for textual information
- Replay of movie files
- BGM using audio playback
Configuration of axi-vision camera

Conventional method
- Uses chroma-key
- Difficult to synthesize camera image and CG in three dimensions

Axi-vision’s method
- Doesn't need specific background
- Can synthesize camera image and CG in three dimensions in real-time by using depth information

HDTV axi-vision camera

- HDTV axi-vision camera is capable of detecting depth information of an object in real-time as well as colour HDTV video images.
- By using this camera, depth can be a key signal of synthesizing two images instead of chroma-key.
Dynamic 3D modeling

- Dynamic 3D models are generated from video images captured by multiple cameras.

The modeling studio
- diameter: 8 m
- height: 2.5 m
- 22 fire-wire cameras are used
- XGA (1024x768 pixels), 10 frames/sec

3D Video System
Archiving Traditional Performing Art

Virtual Puppet
A Human-Computer Interaction

Speech Rate Conversion Technology

Barrier-Free Information

- It allows the listener to reduce the rate of speech of program while maintaining the voice pitch, quality and the time frame of the program.
- It is also convenient for all generations to listen foreign language.
- Some elderly viewers have commented that the speech in recent broadcasting program seems too rapid for easy listening.

New radio and TV set built-in this function have been on a market for the first time by an consumer-electronics maker with our technical collaboration.
Speech Rate Conversion Technology

Method

Temporally duration of waveform is changed to keep fundamental period

- Faster
- Original
- Slower

Fundamental period (2~15 ms)

Slower playback of tape recording

Fundamental period is enlarged and pitch becomes lower

Morphovision—Distorted House

What is Morphovision?

Three-dimensional presentation system that can be seen by changing shape of solid objects within real time.

Purpose of development

The observer does not need special glasses to see an actual object take on different shapes and the effect can be seen from various angles.
Integrated security for broadcasting networks with broadband communication

Copyright protection and promotion of broadcasting content

- Safe, secure usage environment
  - Domain management
  - Metadata protection
  - Personal data protection

- Promoting rich information distribution
  - Encryption technology
  - User-friendliness

Assurance of content reliability
- Authentication, protection against impersonation

TV agent system

- Let’s anyone easily operate digital broadcasting receivers
- New Q&A function with a spoken dialogue TV operation capability.

TV Agent responding to a viewer’s question
Mobile terminals

- Get information related to a program with low-bit-rate video from data broadcasting or Internet

Low-bit-rate video from broadcasting channel

- Video: AVC/H.264 (about 128 kbps)
- Audio: AAC-SBR (about 48 kbps)
- Data Broadcasting
- Closed caption
- Wake up function in case of emergency

Information from broadcasting and communication channel

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TV reception via portable mobile communication device

- Intention to use portable communication device

Do you intend to use the following digital content services on the Internet via portable mobile communication device?

Wants to use TV reception function: 27.6%

- Reasons for the lack of interest in viewing digital terrestrial broadcast on cellular phones

Subjects who had responded that “I am not interested very much” to the question, “When do you think that you would start watching digital terrestrial broadcasting on a cellular phone after the service becomes available?” were asked for the reasons for their lack of interest.

Due to small screen

Requires design to display content on a small screen, or a larger screen

(Based on “Survey on awareness of digital broadcasting” (February 2005) by NHK.)
Flexible displays

- Flexible organic electroluminescence (EL) display
- Flexible liquid crystal display

Super Hi-Vision
(Ultra-high-definition, Wide-screen System with 4000 Scanning Lines)

- Future TV System with Greater Sensation of Reality
  - Effects
    - Strong sensation of reality (as if you are there)
    - More exciting live TV programs
  - Our objectives
    - Examine physical and psychological effects
    - Enhance the reality sensation for future TV systems
Summary

- R&D based on NHK STRL Vision: “NEXT”
  - “NEXT”: NHK EX Technology (Express, Excel and Expand)
  - Broadcasting technology that “learns” from the human potential
  - Ultimate broadcasting systems
  - Advanced program production and news-reporting systems
  - Ubiquitous and universal services

- Broadcasting will play an important role in the creation of culture and in the lives of people in environment of linkage between broadcasting and communication

- Multimedia processing technologies for content production and home media will be more important.