

Multimedia Systems and Hitachi Initiatives

— Digital Consumer Equipment and Multimedia Systems —

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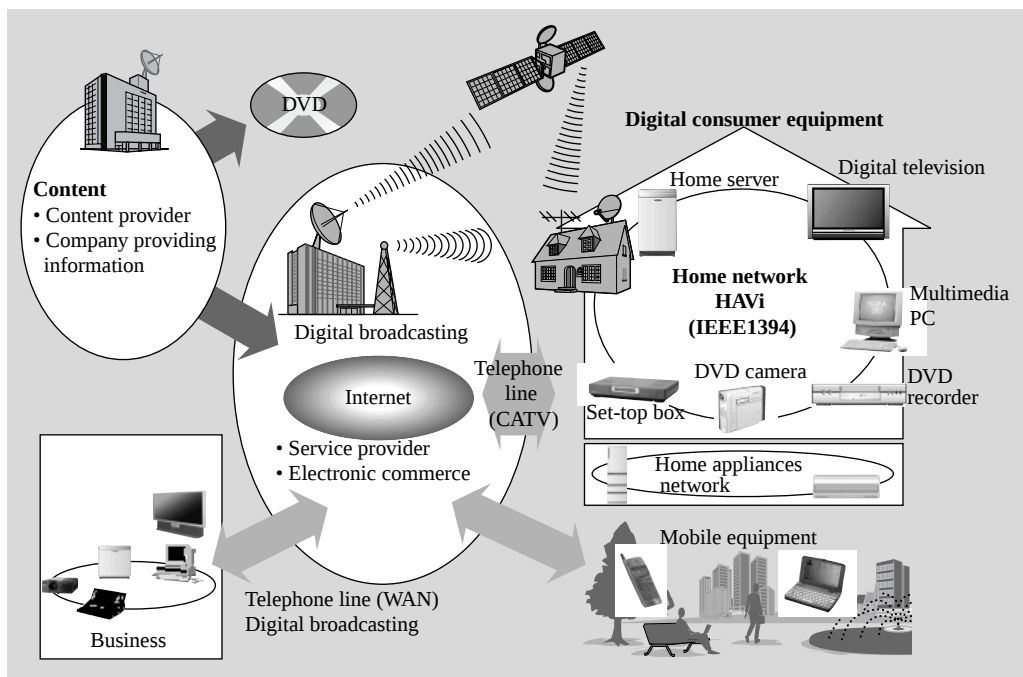
OVERVIEW: The Internet has become part of the social infrastructure, mobile telephones are in widespread use, digital broadcasting has commenced, transmission speeds are increasing, and a digital versatile disc (DVD) has been developed. A multimedia society is rapidly emerging in which image and information services are available anytime and anywhere: in the home, at the office and in remote locations. Hitachi has been active in the area of digital consumer equipment, dealing with multimedia primarily for the home and for individuals. We have been developing devices that are swiftly becoming more diversified and more complex, such as mobile equipment for digital broadcasting, DVDs, and mobile telephones, with convenience and ease of use the guiding concept. We are also working with multimedia systems, including business-business and business-consumer image delivery, information services via the Internet using mobile telephones, mobile business systems using handheld PCs, and digital archive systems that use DVD. As we enter the 21st century and the true age of multimedia, Hitachi will contribute in the diverse areas of hardware, software and services for a more enjoyable and richer life that organically combines individuals and society.

INTRODUCTION

THE number of Internet users has risen 50% within the last year in Japan, and now exceeds 20 million. The function of connecting a PC via a network using

a modem or Ethernet^{*1} is rapidly being seen as a matter of course.¹⁾

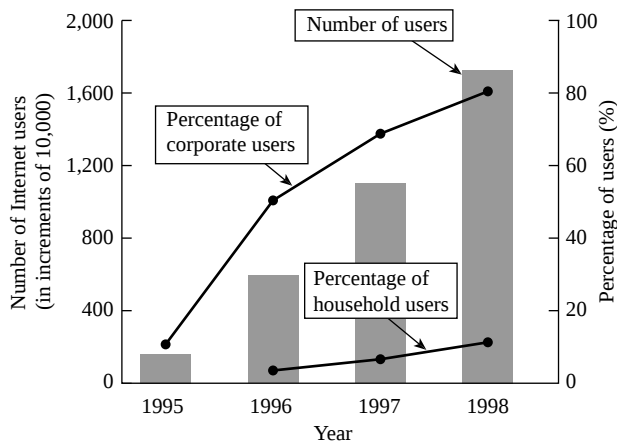
^{*1} Ethernet is a product name belonging to Fuji Xerox Co., Ltd.



HAVi: home audio-visual interoperability
DVD: digital versatile disc

Fig. 1—A Multimedia Environment for Individuals and Households: An Image of Digital Consumer Equipment and Multimedia Systems.

An array of media including the Internet, digital broadcasting and packages (DVD) permit access to content (information content) and also create a multimedia system environment for business.



1. Corporations with at least 300 employees were surveyed around Japan (except the agriculture, forestry, fishery and mining sectors).
2. This figure was created with reference to the "1999 Communications White Paper," "1999 Internet White Paper" and others.

Fig. 2— Status of Diffusion of the Internet in Japan.
This figure indicates that the Internet has been rapidly popularized, the diffusion rate among corporations is over 80% and it has taken root as a part of the social infrastructure.

There are now more than 50 million subscribers to mobile phones, including PHS (personal handyphone systems), and more than 99% of communications have been digitized. A 64-kbit/s data communication service has started, a web browser has recently been included in mobile phone devices, and a range of services are available, including e-mail. Further steady growth can be expected, such that the day when there is one telephone for every person is certainly in sight.

Broadcasting is also being digitized, with the CS (communications satellite) broadcasting already underway. BS (broadcast satellite) digital broadcasting will commence in 2000, following by the digitization of terrestrial wave broadcasting in 2003.

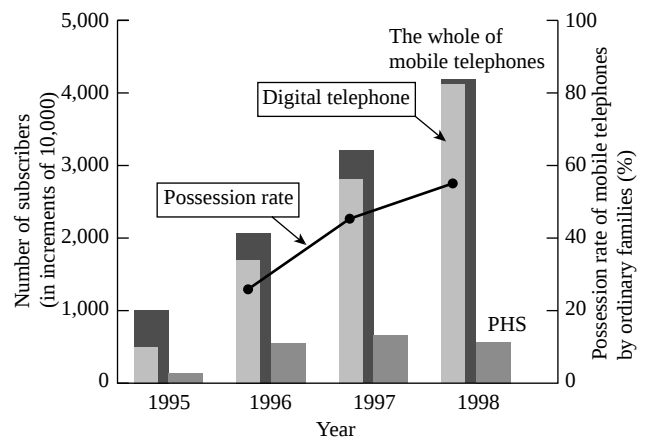
The rapid progress of digitization and networking is enabling diverse information to be obtained more freely, and is making communications possible anywhere. In this environment, people are more likely to want devices and services that anyone can use and that can be readily accessed.

This paper describes digital consumer equipment that enables these services to be enjoyed by households and by individuals, trends in business-consumer and business-business multimedia, as well as Hitachi's own initiatives.

MEDIA AND MARKET TRENDS

The Internet and Telecommunications

The Internet is used by more than 150 million people worldwide, and the number of home users



This figure was created with reference to the "1999 Communications White Paper," the "1999 Internet White Paper," "1999 Survey on Trends in Telecommunications Use by the Ministry of Posts and Telecommunications" and other sources.

Fig. 3— Number of Subscribers and Changes in Rate of Ownership of Mobile Telephones in Japan.
Mobile telephones have rapidly increased in popularity, and more than 50% of households own mobile telephones in some form.

already accounts for more than 10% of Japanese households. Internet access is already provided by more than 80% of Japanese companies with 300 employees or more ²⁾ (Fig. 2).

To create a telecommunications environment that supports these users, high-speed access line networks need to be set up, particularly high-speed digital circuit links to households.

Reflecting this demand, more than 4,400,000 INS64 lines were in use as at the end of 1998, representing rapid growth with a net rate of increase of 69 percent. The INS64 service permits simultaneous use of two 64 kbit/s ISDN (Integrated Services Digital Network) channels. In 1999, it was announced that communications fees would be charged on a flat rate, a decision that is expected to further fuel demand. And at the end of 1999 a service known as xDSL (x digital subscriber line), which speeds up existing telephone circuit networks, will be started in Japan. This same service is already being tested in the United States, where it is called "ADSL." There are other promising systems, including a method of connecting a cable modem with a CATV cable, and an approach that uses satellite circuits.

Household ownership of mobile telephones is also increasing rapidly, and the mobile phones themselves are becoming more digitized (Fig. 3).

In 1998, packet service at 28.8 kbit/s was introduced throughout Japan. In 1999, a service at 64 kbit/s was launched. A service using the CDMA (code

division multiple access) system has started, and web browsers are being installed in mobile telephones. This is enabling a range of services to be offered through mobile telephones, such as news, weather forecasts, ticket booking, banking, and e-mail. The standardization of IMT-2000 (International Mobile Telecommunications-2000) is progressing, aiming at higher speeds to permit the transmission of quasi-moving images (up to 2 Mbit/s), as well as high quality and the delivery of global services, which can be used worldwide.

The Internet is becoming accessible from a widening range of devices. Now, in addition to PCs, the Internet can be accessed from mobile telephones, handheld PCs using Windows CE*2 and information equipment such as game machines. Telecommunications circuits are also getting faster, and new services for content delivery has been introduced, for example, MP3 [MPEG (Moving Picture Expert Group) Audio Layer-3] which is used to download music.

Digital Broadcasting

Digital broadcasting is expected to encourage the production of new kinds of programs, such as data broadcasting, multimedia broadcasting and bi-directional broadcasting. It will also digitize the transmission systems of existing program broadcasting.

*2 Windows is a registered trademark of Microsoft Corp. in the U.S. and other countries.

Digital broadcasting began with CS broadcasting in 1998. Today, two stations, Sky PerfecTV! and DirecTV, are broadcasting via more than 200 channels. At least 1,300,000 households were receiving broadcasts as of March 1999.

In addition, the commencement of BS digital broadcasting is planned using the second-stage BS-4 satellite in 2000. There are other plans as well, including digital High-Definition broadcasting, data broadcasting, and digital voice broadcasting which can send still images, simple moving images and voice simultaneously (from 2001) (Fig. 4).

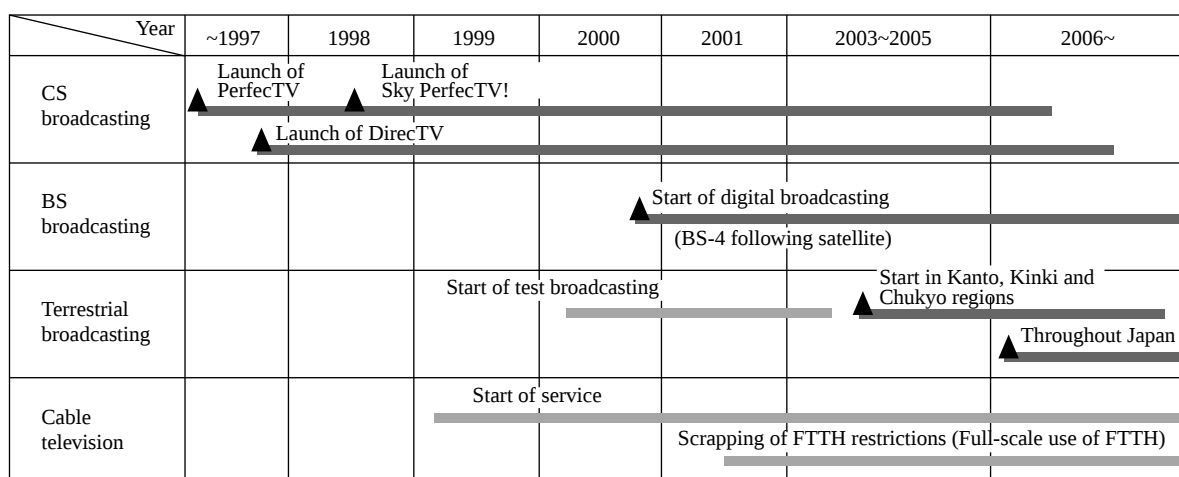
Terrestrial wave digital broadcasting was launched in major cities in the United States in 1998, and is scheduled to start in Japan in 2003.

Some stations began offering digital CATV services in 1998, and attention has been drawn to trends in FTTH (fiber to the home), which will be deregulated in 2001.

D-VHS (digital VHS) VTR has been marketed in Japan as a device to record digital broadcasting, and in the United States, a device to record broadcasts to a hard disk drive is available. Another promising product for the future is a recorder using the digital versatile disc (DVD).

Package Media (DVD)

More than 80% of the content of the CD-ROM (compact disc read-only memory) are games, while almost all of the content of DVD consists of images (films). More than 2,000 titles are already available



FTTH: fiber to the home

* Created with reference to the "1999 Communications White Paper," the "1999 Internet White Paper" and other sources.

Fig. 4— Schedule for Digital Broadcasting in Japan.

BS broadcasting will start in 2000 and terrestrial broadcasting will be digitized in three major cities in 2003.

TABLE 1. Example Applications Realized by the 4.7-Gbyte DVD-RAM

The 4.7-Gbyte DVD-RAM would permit the introduction of home image recorders, mass storage file systems for business use and other products.

Example application	Description
Home video recorder	Record moving images and voice for about two hours for one side (about four hours for both sides) in the MPEG2 high quality mode (4.6 Mbit/s), and about four hours for one side (about eight hours for both sides) in extended-play mode (2.3 Mbit/s).
Video camera	Record for one hour (both sides) for 4.7 Gbyte [an 8 cm disc (about 1.4 Gbyte) that is a mini version of the 12 cm disc].
Document recording	Record about 140,000 A4 pages (approximately 30 kbyte) (equal to about 180 files, each 5 cm thick)
Library system	Construct of a high-capacity system of 470 Gbyte with a 100-stack disc changer. Permits storage of about 900 hours of voice data of 480 Mbyte in one hour.

for sale or rental in Japan, and more than 4,000 titles are available in the United States.

In the United States, over one million DVD players were shipped in 1998, and shipments are expected to top three million units in 1999. For DVD-ROMs for personal computers, more than five million units were shipped worldwide in 1998, and more than ten million units are expected to be sold in 1999, now that MPEG2 can be replayed using software.

DVD-ROM content is principally played back on personal computers, and includes games, dictionaries and maps. Hitachi Digital Heibonsha has published Sekai Daihyakkajiten (world encyclopedia). DVD-ROM is the subject of considerable expectations, as the successor to CD-ROM.

In the area DVD, DVD-RAM (random access memory) has been introduced as an erasable storage medium with a capacity of 2.6 Gbyte. Standardization of a 4.7-Gbyte DVD-RAM is now complete, and will be commercialized in the future, as the most promising medium for the digital consumer equipment age. Table 1 lists examples of applications that can be realized with a 4.7-Gbyte DVD-RAM.

DIGITAL CONSUMER EQUIPMENT AND SYSTEM DEVELOPMENT

The Internet

In the mobile communications sector, in 1999 Hitachi became one of the first companies to develop

a mobile telephone for the cdmaOne system^{*3} which incorporates a web browser, as a digital consumer product using the Internet. This type of mobile phone enables direct connection with the Internet and also permits the provision of news and other information, in addition to electronic commerce such as ticket bookings and e-mail. In the future, faster transmission speeds should enable the start of services for delivering content such as music. And when IMT-2000 is standardized in 2000, communications at up to 2 Mbit/s will be possible anywhere in the world, enabling communications with still and moving images.

In the portable information terminal sector, Hitachi is marketing handheld PCs that use Windows CE as operating system. Linking this PC with the Internet gives access to e-mail and other services.

As a system for business, we propose a system that permits reporting by e-mail and the exchange of business documents. This system also considers information exchange with associates, using Internet technologies for direct connections with the intranet, the company's internal network, to take into account changes in the form of work. The system would consider, for example, the increasing number of people working from home, and would provide more active support for sales activities.

Broadcasting

In September 1999, Hitachi introduced a television for digital consumers that is ready for the BS digital signals planned to be used for broadcasting from 2000. By connecting this television to a BS digital tuner, the user can view programs delivered via a range of signals: [High-Definition broadcasting 1125i (1080i), progressive broadcasting 525P (480P), and standard broadcasting 525i (480i)], enjoying high quality images. For "Mojinet" with programs using the standard indices recommended by the Character Broadcasting Promotion Council, information such as weather forecasts and news can be displayed on the screen as text, as well as in the form of ordinary programs. The decision on D3 has facilitated connections of high picture quality with digital media equipment, which are expected to become popular in the future.

We have launched an image delivery project using data broadcasting as a system. By combining a large display with a liquid-crystal projector, we have enabled a total image service to be provided.

Storage

Now that the standards for the 4.7-Gbyte DVD-

^{*3} cdmaOne is a registered trademark of CDG (CDMA Development Group).

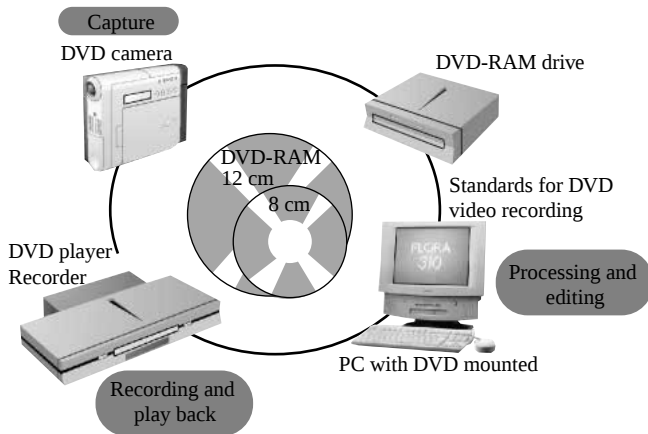


Fig. 5— Examples of Digital Consumer Products Using DVD-RAM.

The spread of DVD will promote the fusion of AV and PC, enabling users to enjoy images anywhere.

RAM in DVDs have been set, we predict the debut of combination PC and AV (audio-visual) digital consumer equipment with DVDs installed. Fig. 5 shows the concept for applications of DVDs in products. The standards set for DVD video recording has permitted real-time recording of moving images lasting up to 135 minutes (4.6 Mbit/s) or 64,000 still images on a 4.7-Gbyte disk. This has enabled digital consumer products that use DVD-RAM as their medium.

This also permits real-time play back, editing and recording using a camera which records in a DVD-RAM medium or a video recorder for recording broadcasts. These functions can also be delivered via a PC with a DVD-RAM drive installed. To create this DVD camcorder, Hitachi developed “MPEG2 Codec LSI,” which reduces power consumption to 0.36 W, compared to traditional consumption of 1 W to 1.5 W. We expect the DVD-RAM to form the core of removable media in the digital consumer equipment age, once DVD-RAM play back becomes possible with a DVD player in the future.

Hitachi has also commercialized this DVD-RAM as a digital archive system for office use. Right now, systematization by combining a 2.6 Gbyte DVD-RAM drive and a disk changer (100, 150 discs) facilitates connections with networks and permits the construction of a high-capacity archive system of up to 390 Gbyte. In the future, a 4.7 Gbyte DVD-RAM will be employed, the standards for which have only recently been decided, resulting in a higher-capacity and higher-speed (with a data transfer rate twice as fast as that of a 2.6-Gbyte DVD-RAM) digital archive

system.

As a PC device, we have developed a high-speed, high-performance DVD-ROM drive that is compatible with the 2.6-Gbyte DVD-RAM. We plan to further develop this, aiming at achieving compatibility with the 4.7-Gbyte DVD-RAM.

Multimedia Systems

To create a multimedia environment in which digital image information can be viewed and used in the home, Hitachi is supporting IEEE 1394 and HAVi (Home Audio-Visual Interoperability), the leading candidates for home networks. These will form a network system that will facilitate the connectivity of home digital equipment, with high speeds and high performance. In the future, gateways for connecting networks between the home and outside, a home server for storing and managing large volumes of information and information equipment such as AV equipment and PCs will all be able to be connected, despite differences among manufacturers. When this happens, it will result in a more convenience home life. Hitachi is also actively exploring the potential of the delivery service using the CDMA system, planning to transform it into a comprehensive system that encompasses services as well as terminals in the so-called B to C (business to consumer) field. And Hitachi has developed a system that is compatible with MPEG1 networks, to enable images captured by a camera to be converted into MPEG1 signals, and to facility transmission via a network. This system can also be used for the construction of security and other systems.

In this digital and multimedia broadcasting era, we expect that in the display unit field the most popular home display unit will be large-scale plasma displays, liquid crystal rear-projection televisions and liquid crystal displays as PC and personal monitors. Hitachi has released a 42-inch plasma display and also adopted an 18-inch super-TFT (thin film transistor) liquid crystal display for the PC “FLORA.”

CONCLUSIONS

This paper has described the trends and tasks concerning digital consumer equipment and multimedia systems, as well as Hitachi’s initiatives.

We anticipate the emergence of an environment that will enable an array of services to be accessed anywhere, thanks to such factors as faster transmission speeds, lower prices, the increased popularity of the Internet, and full-scale digital broadcasting.

Hitachi will propose comprehensive systems,

including services that range from digital consumer products for the home, to multimedia systems for business applications.

REFERENCES

- (1) The Japan Internet Association: Internet White Paper 1999.
- (2) Ministry of Posts and Telecommunications: Communications White Paper 1999.
- (3) Multimedia Content Promotion Association: Multimedia White Paper 1999.
- (4) Yoshikawa Tsuboi, et al., "A Low-Power Single-Chip MPEG2 CODEC LSI," IEEE 1999 Custom Integrated Circuits Conference.

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