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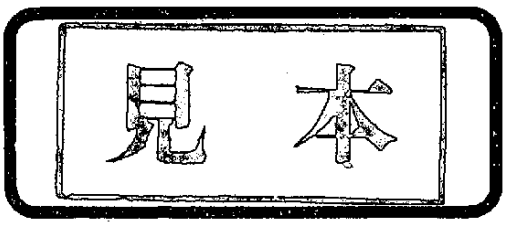

Japan Information Processing

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Japanese ISDN: Present and Future

No. 91

Japan Computer Quarterly

1992

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JIPDEC is a non-profit organization founded in 1967 with the support of the Ministry of International Trade and Industry, the Ministry of Posts and Telecommunications and related industry circles for the purpose of promoting information processing and the information processing industry in Japan.
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No. 91

From the Editor

The rapid progress of telecommunications technology has brought about a remarkable degree of informatization in Japanese industry. In addition, the recent appearance of compact, high performance information equipment, such as personal computers and word processors, is even spreading informatization to the personal level, namely, individuals and daily life. The progress of telecommunications technology and the liberalization of communication lines has triggered the construction of information networks within enterprises, between enterprises, and between industry groups, as well as international networks and personal computer networks.

Computer performance is improving rapidly owing to technological innovation, but R&D efforts have mainly been directed towards finding ways to store large amounts of digital data and process it at high speeds. Therefore, computer data is basically digital data even now, something that is not likely to change. However, telephone lines are designed to transmit voice wave signals using analog signals. Therefore, the digital signals used by computers must be converted into analog signals using special equipment (such as a modem) for transmission over a telephone line. Cost and technological convenience could be improved enormously if digital signals could be transmitted without the need for conversion into analog signals.

Humans communicate largely through the senses of hearing and sight. Until now, separate media have been used for different senses - telephones and radio for transmitting voice, TV, movies and videotex for transmitting images, and written documents for communication through characters. However, in human communications in their true, original form, all these are integrated together. Technological problems are what have made it necessary to use different media.

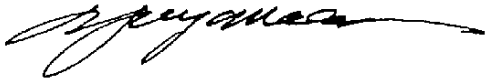
ISDN integrates various forms of communication media, including telephone, facsimile, data communications and image communications, using one communication line, and implements high-speed transmission at the same time. This is an epoch-making technology that brings communication through media closer to the original form of communication between humans.

Most databases have been used to store character information, such as documents and abstracts, for reference purposes, but the need to store numerical values and graphic information, such as constantly changing economic information and various kinds of statistical data, etc., has increased. The recent trend is towards "fact databases" that store image and voice data as well. The best method for understanding the meaning of real-world information is to experience it in a form that is as close as possible to the way it is experienced in reality. For

example, when it comes to a bird singing, it is far more realistic to hear the song of itself than to look at characters representing the song. Even more realistic information can be obtained by seeing the bird itself and its motions in the form of an image. A considerable amount of information would be necessary to transmit everything about a bird's song using only characters and numerical values. And when information is transmitted using characters and numerical information alone, not only is a large amount of data needed, the result is far less satisfactory than the immediacy of information obtained by direct seeing and hearing. This is why the so-called multi-media database, which integrates a large variety of media, including characters, numerical values, voice and graphics, is attracting so much attention of late. In addition, interest is focusing on so-called hypermedia, with which a large variety of information can be retrieved and managed according to the human approaches to thinking, conception and recognition. Intelligent hypermedia with even more affinity to man will be implemented in the future by the use of frontier technology such as AI technology.

These technologies will continue to enhance database utilization, and ISDN will play an important role in the sophisticated and efficient use of databases. RWCP (Real-World Computing Partnership) was organized in Japan in July, 1992. Association members are studying areas in which computers have been less than proficient, such as human sensitivity and pattern recognition. The accomplishments of such R&D efforts will move computer applications closer to the human experience. ISDN will constitute one of the important infrastructure technologies that will support the information society of the future. However, many problems, including standardization and security, must be solved to promote the international expansion of ISDN service.

The present issue of JCQ introduces recent ISDN trends in Japan, and contains articles on the current state of ISDN services, examples of ISDN installation, and future technological trends. I hope this information will be of use to our readers, and would also like to express my gratitude to the authors of the articles.



Yuji Yamadori
Director
Research & International Affairs

Present State of ISDN Services

Atsushi Yano
General Manager
ISDN Promotion Dept.
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1. Growth of ISDN

(1) Overview of ISDN

ISDN (Integrated Services Digital Network) is a new network service capable of providing telephone, facsimile data, still pictures, moving pictures, and other services on a single line.

With ISDN, it has become unnecessary for users to subscribe to separate lines for each service. In addition, common carriers are no longer required to construct separate communications networks for each service. Users can also use high-speed communication lines from 64 kb/s to 1.5 Mb/s through switched line networks.

ISDN is an indispensable infrastructure for the Information Society of the next century.

(2) History of ISDN

In April 1988, NTT started "INS Net 64," an ISDN service providing a Basic Rate Interface (BRI: 2B+D, B=64 Kbit/s channel, D=16 Kbit/s channel), and looked upon as the foundation of the Information Society. NTT added "INS Net 1500" as a Primary Rate Interface (PRI: 23B+D or 24B) in June 1989, and a packet communication mode for INS Net 1500 in June 1990.

With the expansion of service areas, the number of users has increased, which has resulted in various types of application deployment.

In this paper, we will report on trends in ISDN with a focus on applications deployed over time.

(3) Benefits of ISDN

What were the factors that actually attracted users to decide on ISDN services?

Figure 1 shows the results of a survey asking users why they began using INS Net.

These results reflect two major advantages of ISDN: 1) high degree of value-added communications, and 2) reduced communications cost.

Respondents praised ISDN for its high speed transmission of a large volume of data, high quality and accuracy of information, and simultaneous use of multiple lines, which can lead to diversified applications.

Actually, use of ISDN services taking advantage of value-added communications is increasing.

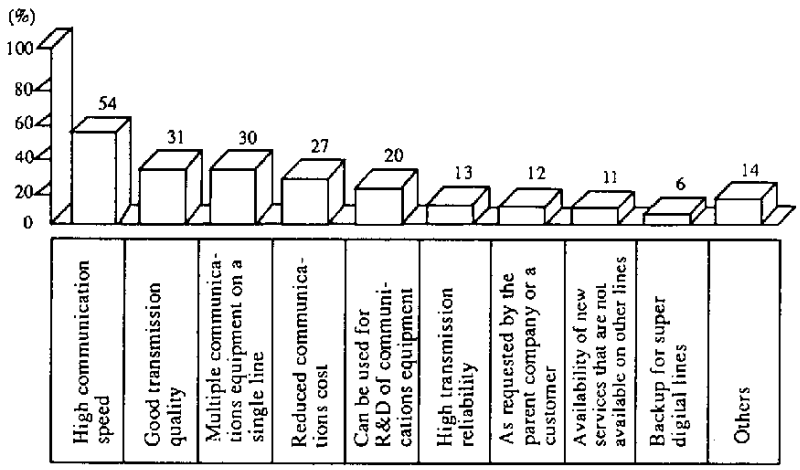


Figure 1 INS Net Service Utilization Status
(Source: User Survey)

(4) Status of ISDN

Since NTT started INS Net 64 service in the three areas of Tokyo, Nagoya and Osaka with 114 lines (nine users) in April 1988, NTT has significantly increased service supply areas every year. This situation is summarized in Table 1.

At the end of the 1989 fiscal year (March 1990), there were 195 ISDN service areas covering all the prefectural capitals in Japan. By the following March, the number of areas had been increased to 1,222 covering over 90% of cities where demand was revealed. By March 1992, the service had been expanded to 2,049 areas. This covered almost all such cities and 94% of telephone service subscribers. (There are about 4,400 areas across Japan.)

As the geographical area coverage has increased, the number of lines contracted by users has significantly increased as well. This trend is shown in Figure 2.

By March 1992, the number of contracted lines surpassed 100 thousand lines in terms of the INS Net 64 unit (the number of lines for INS Net 1500 is counted as 10 times that of INS Net 64 when both INS Net 64 and INS Net 1500 are tabulated together). The number of lines continues to grow at a monthly rate of 5,000 to 6,000 lines.

Table 1 Growth of Service Supply Areas

	March 1989	March 1990	March 1991	March 1992
No. of Service Supply Areas	29	195	1,222	2,049
Type of Area Expansion	3 major cities	Prefectural capitals	Areas where demand clearly exists	

As shown in the figure, packet communication mode service (INS-P) provided by INS Net 64 has been on the rise. As of the end of March 1992, 33% of users who contracted for INS Net 64 were using INS-P. The number of users is expected to increase even more in the future.

(5) Types of Utilization

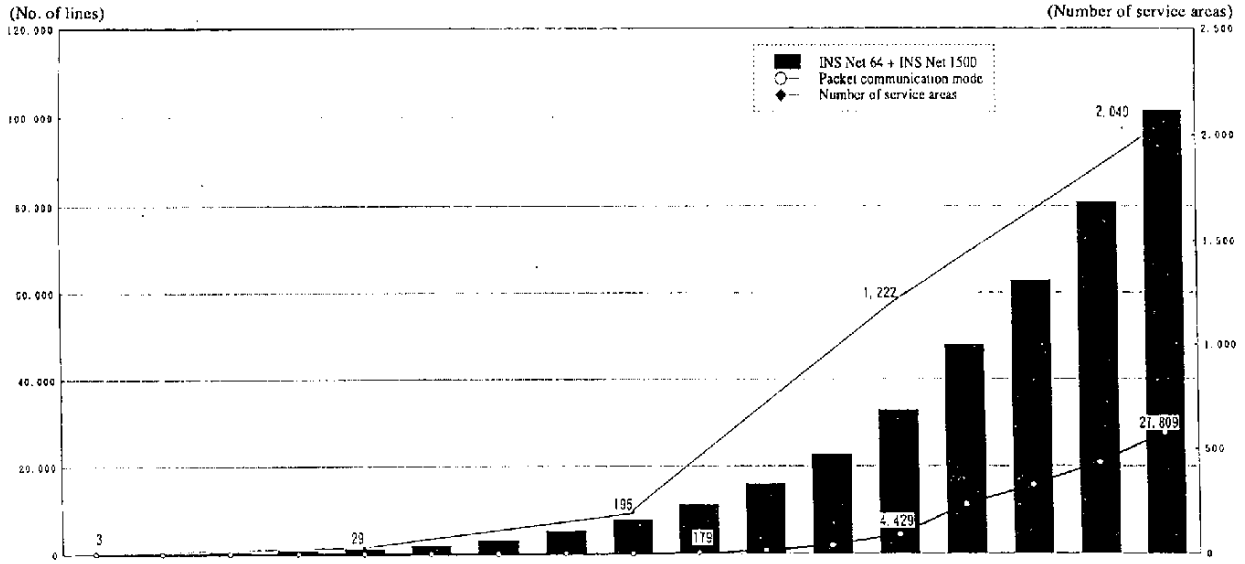
Figure 3 shows the results of a survey targeting large users as to what types of information they are transmitting through INS Net.

As can be seen, for INS Net 64, data transmission (including the 24% of POS data transmission) accounts for 74%, which is followed by facsimile communication at 14%. These two types of transmission account for 88%, and the percentage of facsimile utilization and integrated utilization is gradually increasing.

In this way, the demand for INS Net 64 is thought to be extensive because of the need for data transmission at high speed and low cost.

In INS Net 1500, PBX utilization accounts for 68%, which is followed by data transmission at 18%. The ratio of image utilization is gradually increasing.

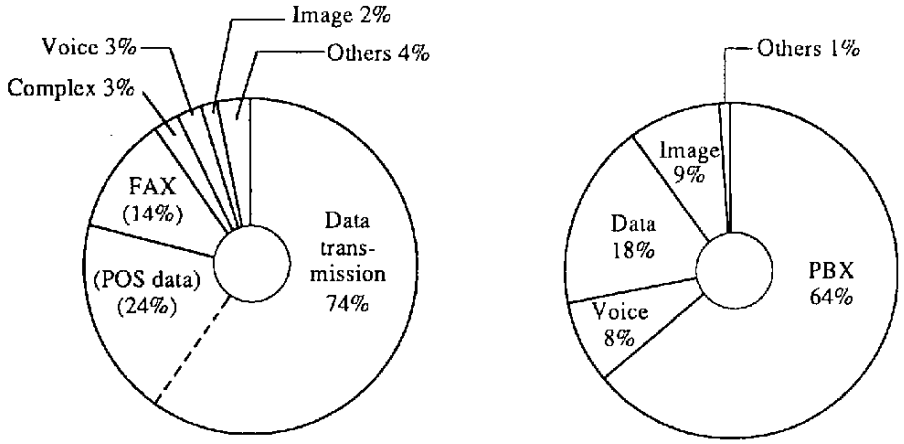
As for the high PBX utilization, it appears that users are attracted by the much lower cost compared with multiple analog lines of similar performance and by the integrated utilization of G4



Item \ Date	4.19.88	6/88	9/88	12/88	3/89	6/89	9/89	12/89	3/90	6/90	9/90	12/90	3/91	6/91	9/91	12/91	3/92
No. of lines contracted by users	114	221	537	877	1,198	1,949	3,213	5,274	7,744	11,283	15,902	22,893	32,913	48,055	62,873	80,885	101,649
Breakdown: INS Net 64 (INS-P)	114 (—)	221 (—)	537 (—)	877 (—)	1,198 (—)	1,739 (—)	2,723 (—)	4,554 (—)	6,574 (—)	9,413 (171)	13,062 (669)	16,873 (1,999)	27,313 (4,405)	40,595 (11,155)	52,793 (15,618)	67,705 (20,805)	84,139 (27,767)
Breakdown: INS Net 1500 (INS-P)	— (—)	— (—)	— (—)	— (—)	— (—)	21 (—)	49 (—)	72 (—)	117 (—)	187 (8)	234 (13)	402 (17)	550 (24)	746 (24)	1,008 (33)	1,318 (36)	1,751 (42)
(Number of service areas)	3				29				195				1,222				2,049

Notes 1. INS Net 64 service was started on Apr. 19, 1988. INS Net 1500 service was started on Jun. 27, 1989. The packet communication mode service was started on Jun. 1, 1990.
2. No. of lines contracted by users = INS Net 64 + INS Net 1500 × 10
3. Figures in parentheses are number of packet communication use (double count)

Figure 2 Number of Contracted Users for INS Net



Data as of Oct. 30, 1991 (n = 29,500)
(a) INS Net 64 Utilization

Data as of Oct. 30, 1991 (n=822)
(b) INS Net 1500 Utilization

Figure 3 INS Net Utilization

Table 2 Trends in Communications Equipment

	December 1989			May 1992		
Communications Equipment	No. of Vendors	No. of Products	Approximate Price Range	No. of Vendors	No. of Products	Approximate Price Range
Terminal Adapter	8	29	80K – 400K yen	26	122	80K – 3.0M yen
G4 Fax	11	16	1.68M – 3.8M yen	13	43	0.98 – 3.8M yen *1
TV Telephone	6	6	2.5M – 6.0M yen	5	7	0.95 – 7.5M yen
TV Conference System	11	15	10M – 32M yen	14	32	5M – 20M yen
Interface Board	3	3	300K – 500K yen	30	40	100K – 960K yen
FD Transfer Equipment	–	–	–	4	7	0.3M – 0.97M yen
Digital PBX	9	16	Depends on system functions	15	37	Depends on system functions
Total	27	85	–	61	288	–

*1 Minimum price for plain-paper type is 1.5M yen

No. of vendors: 2.3 times
No. of products: 3.4 times

facsimile terminals and image terminals attached to the PBX extension lines.

User application of ISDN services has become more diversified as the variety of communications equipment has expanded. This expansion is summarized in Table 2.

Comparing the number of vendors, number of products and price range between December 1989 and May 1992, we see an increase of about 2.3 times in the number of vendors and about 3.4 times in the number of products over the two and half years.

As for price, more and more products have become available on the low-cost side. In particular, a price reduction of about 60% is seen for G4 facsimile devices, and one of about 40% for TV telephones. A substantial price reduction has been achieved.

Also, the number of terminal adapters (TA), including ones for packet switching, has rapidly increased for data use in transmission. In additinon, the number of TAs used for interconnecting LANs has been rapidly increasing since around 1992.

2. Most Used Applications

If we compare ISDN with the telephone network, we notice a large difference in their data transmission volume. For example, when we transmit data using the telephone network, the maximum data rate is around 4800 bps in general. When using INS Net 64, however, the maximum is 64 Kbps, which is more than 10 times faster. As a result, many diversified applications have been developed.

The followings will present some examples of popular applications.

(1) Examples of Data Communication Applications

1) POS Systems

POS systems are used to cut down on labor at sales counters in retail stores and the like. The systems are also used for sales support by accumulating point-of-sale information such as "who bought what, and when?"

For chain stores having a number of distributed outlets, POS data can be collected at a central office utilizing the advantages of high-speed ISDN.

In the case of INS Net 64, two B channels and one D channel are available on one line. We can therefore assign different functions to each channel. For example, we can use B-channel line switching for high-volume information such as daily sales data, and D-channel packet switching for low-volume information such as inventory reports. This makes for effecient data transmission (See Figure 4).

2) Floppy Disk Transfer System

As mentioned earlier, it takes a great amount of time to transmit a large volume of data using the telephone network, but it can be done in a short time using ISDN.

For example, it takes about 40 minutes to send the information on one floppy disk (about 1 Megabyte) using the telephone network, but we can send it in about three minutes using INS Net 64.

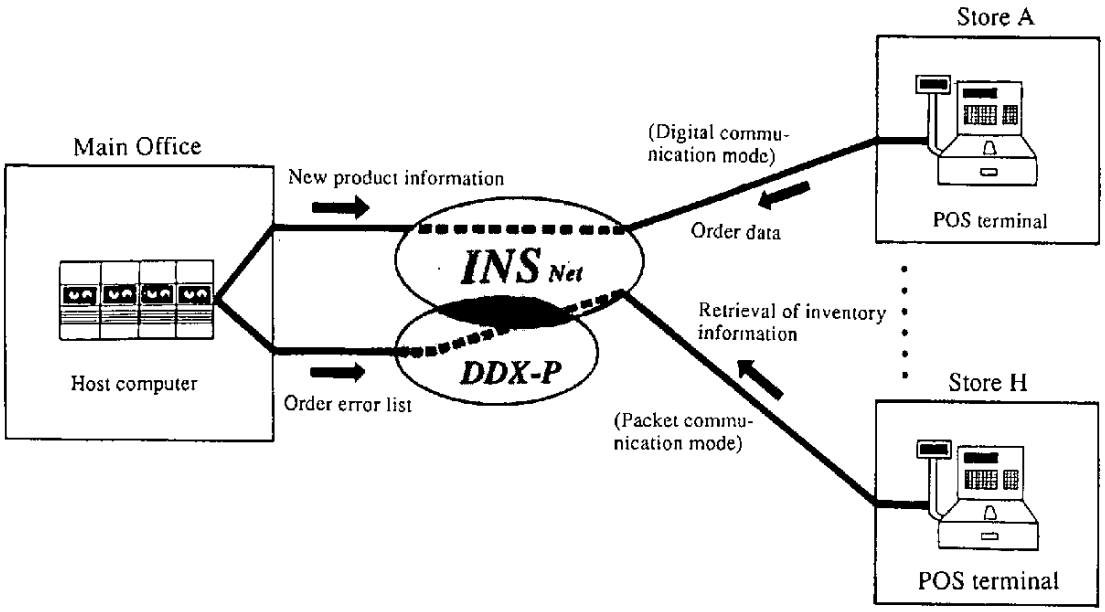


Figure 4 POS System

Recently a floppy disk transfer unit has been developed which can transmit the entire contents of a floppy disk to remote locations using INS Net. Similar to facsimile devices, the operation of the unit is simple and can be learned by anyone. You simply push the appropriate buttons after inserting the floppy disk (See Figure 5).

You can also use a file transfer unit on your PC by incorporating an ISDN interface board in combination with communication software. In this case, you can transfer specific files of data on a floppy disk.

3) Connection Between LANs

Following the spread and increased use of LANs (Local Area Networks), the need for inter-LAN connection in remote locations has increased.

There has been more and more applications using INS Net to connect between LANs (See Figure 6).

Users appear to prefer INS Net for connecting LANs because of its high speed and low cost and because it can be connected to many locations as a switched line network.

(2) Examples of Fax Applications

In addition to being able to transmit a A-4 size copy in only about four seconds, the G4 facsimile device can reproduce characters, illustrations and pictures sharply at 400 dpi resolution, which is about eight times higher than that of the G3 standard mode.

For example, this function can be used for G4 facsimile communications between a main municipal ward office and branch or liaison offices to issue, for example, copies or extracts of a family register (See Figure 7).

As a result, about one third of all family register copies are, now being issued via facsimile devices by local governments in several cities near Tokyo. This has made a large contribution to speeding up resident services.

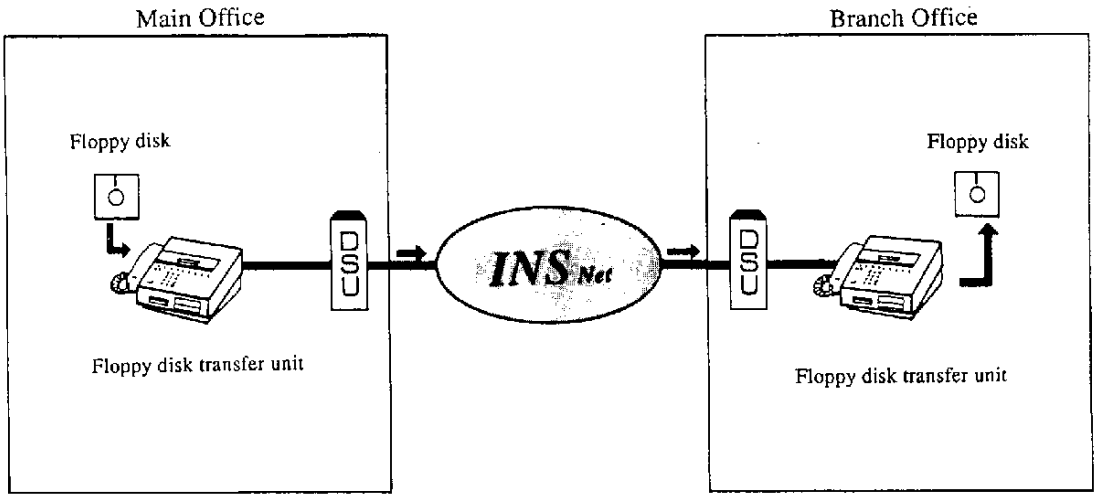


Figure 5 Floppy Disk Transfer System

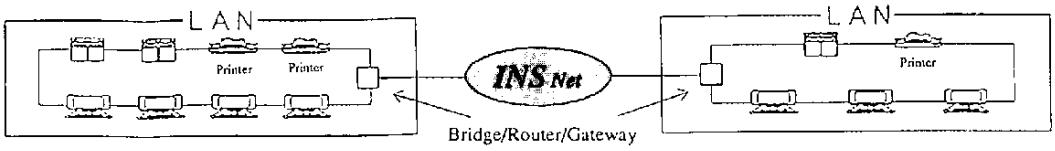


Figure 6 Connection between LANs

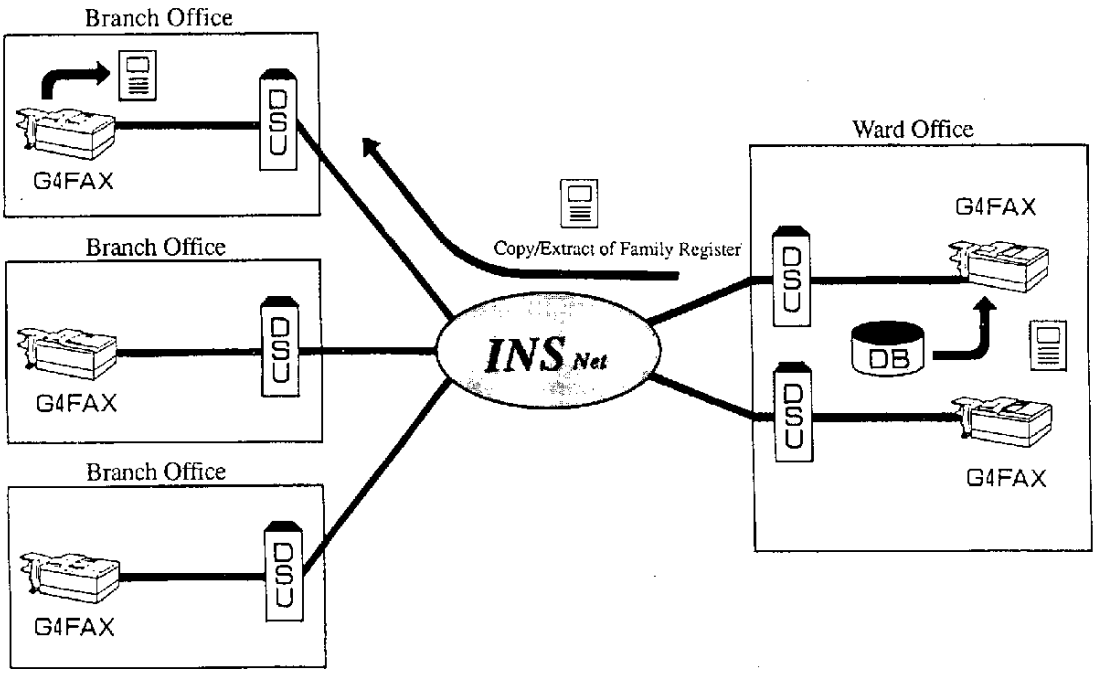


Figure 7 G4 Facsimile Communications System

(3) Examples of Image Applications

One of the most popular image applications is this TV conference system (See Figure 8).

For example, by using switched line INS Net, it is now possible to hold a TV conference with almost any other TV conference system due to the efforts made to improve mutual connectivity of TV conference systems based on ISDN international standards.

It is also possible to conduct conferences while viewing pictures, charts and tables on the screen using document and picture transmission functions. This can save the expense and time required for business trips.

In a certain company, the TV conference function is used between the company president and customers who are visiting a remote branch office. The same system can also be used for international conferences, meetings, etc.

(4) Complex Applications (Using a PBX)

In an business enterprise, it is not uncommon to need several communications applications at one time, such as when holding a TV conference in which documents, precision drawings and visual materials are needed from remote locations by G4 facsimile. By using INS Net, you can create a higher density communications environment by combining voice terminals, data terminals and image terminals. This can help company activities proceed much more smoothly (See Figure 9).

Furthermore, you can substantially reduce initial costs and running costs compared with the telephone network by using INS Net 1500 as lines between PBX and the telephone switching system.

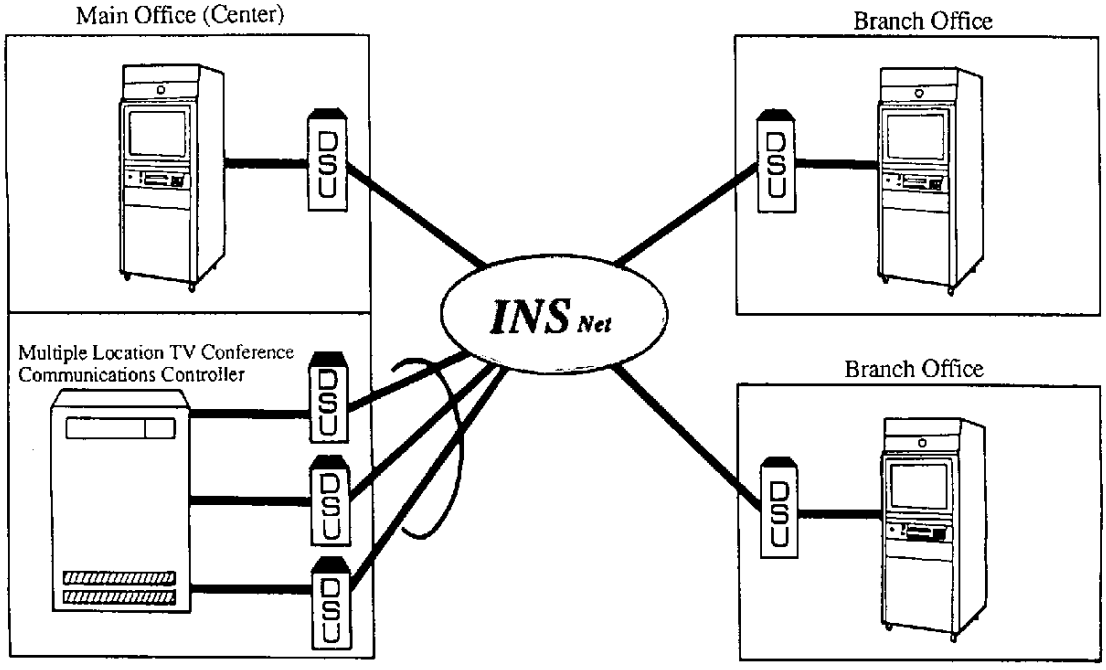


Figure 8 TV Conference System

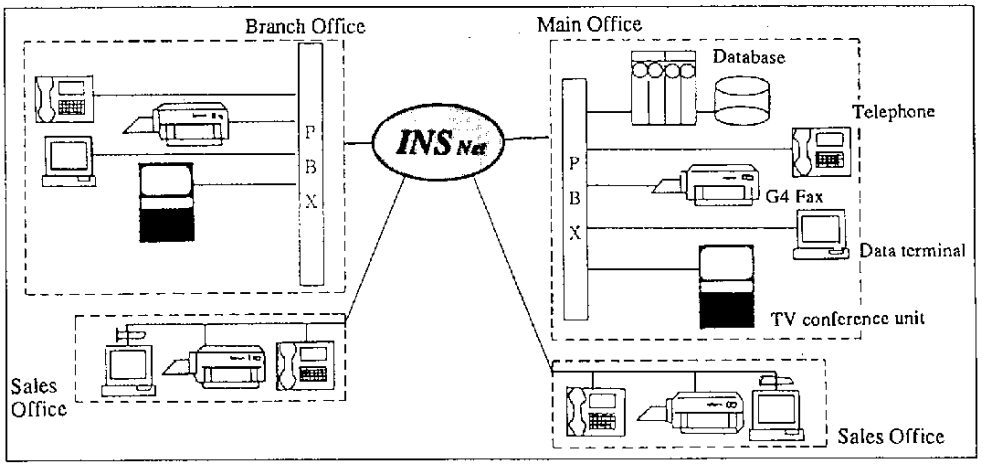


Figure 9 Complex Applications (Using PBX)

3. Interesting New Applications

I have described popular applications in the previous section. Here, I would like to introduce several interesting applications that make the most of ISDN characteristics.

(1) Voice Applications

1) Voice Conference System

You can hold an economical voice conference by connecting multiple locations with digital telephones using INS Net (See Figure 10).

In this system, it is possible to connect nearby locations one by one instead of connecting all the conference telephones to the host computer (①, ②, and ③ in the figure).

As a result, it is unnecessary to create multiple lines at the center, and you can keep the total connecting distance and set communication fees to a minimum.

2) High-quality Voice Transmission System

This system transmits voice coded by a 7kHz codec, which has a wider band than the telephone network (3.4 kHz), through the 64 Kbps information channel of INS Net.

A radio broadcasting station in a local area uses this system for live broadcasting of professional baseball games.

In the past, in order to relay outside broadcasts, stations used broadcasting- standard leased lines (50 Hz - 10 kHz), or sent voice by wireless means to a station using an on-site radio relay car. This system using INS Net has been adopted as the most convenient and best voice-quality system (See Figure 11).

3) High-quality Sound Broadcasting System

This system can transmit 7 kHz of voice to a maximum of about 800 locations utilizing the high quality features of INS Net.

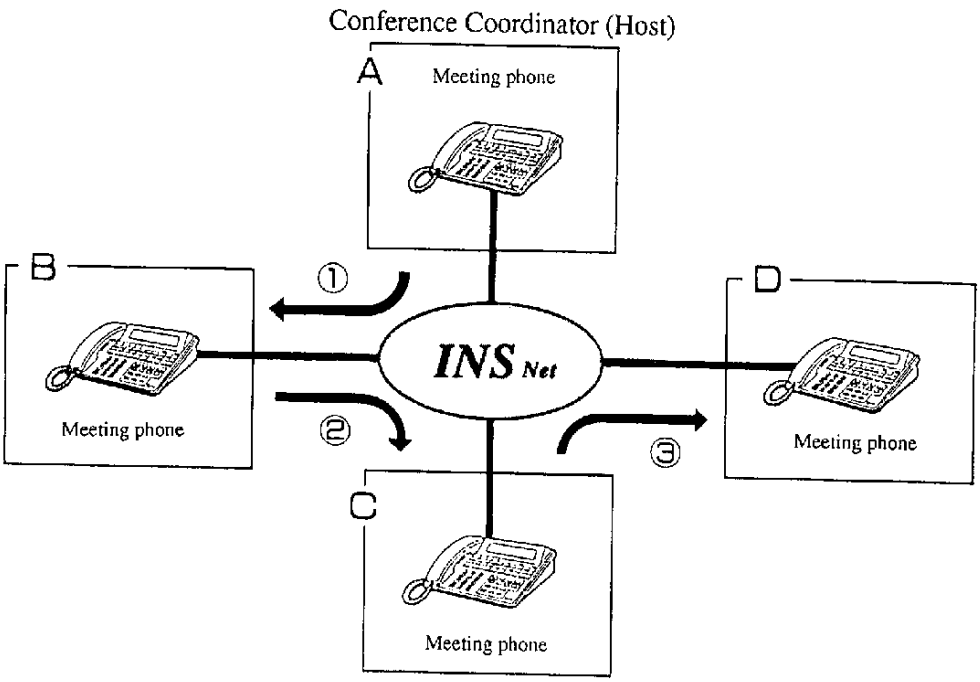


Figure 10 Voice Conference System

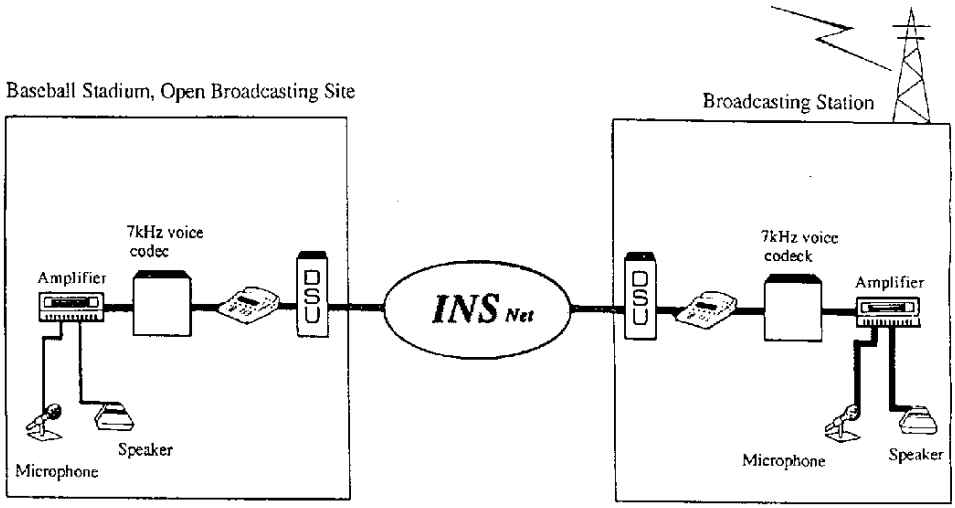


Figure 11 High-quality Voice Transmission System

This is very convenient when you want to simultaneously transmit the same information to a large number of locations (See Figure 12).

For example, at one company, this system is used to transmit the president's speeches or executives' instructions to branches across Japan. The system can also be used by securities companies and financial institutions to transmit urgent information such as sudden changes in foreign exchange and stock markets.

In the system, information dispatch is not limited to the center. The system can transmit the voice of one member to all other members, and diversified two-way communications are possible.

As for other applications, we can think of remote education by vocational schools, and information transfer between headquarters and branches of companies, or between administrative organizations during emergencies.

(2) Image Applications

1) Remote Monitor System

In the telephone network, image transmission of 1 frame per 30 seconds is the limit, but using INS Net 64 the transmission can be improved to 3 frames per second. As a result, remote monitors and reception services can provide customers with a sense of "closeness" through video pictures.

As an example, the system can be used to remotely monitor ATM equipment at banks (See Figure 13).

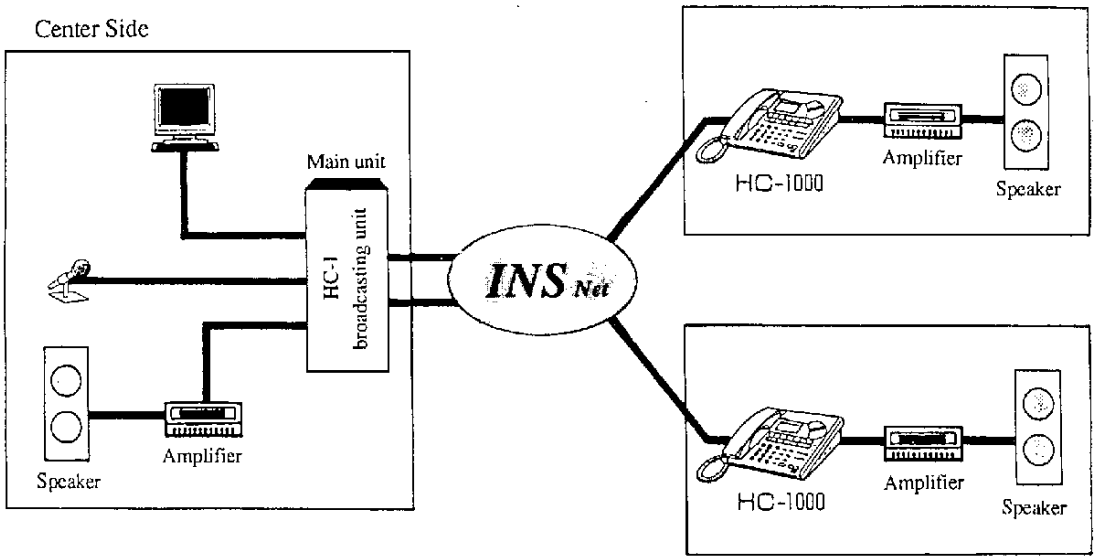


Figure 12 High-quality Sound Broadcasting System

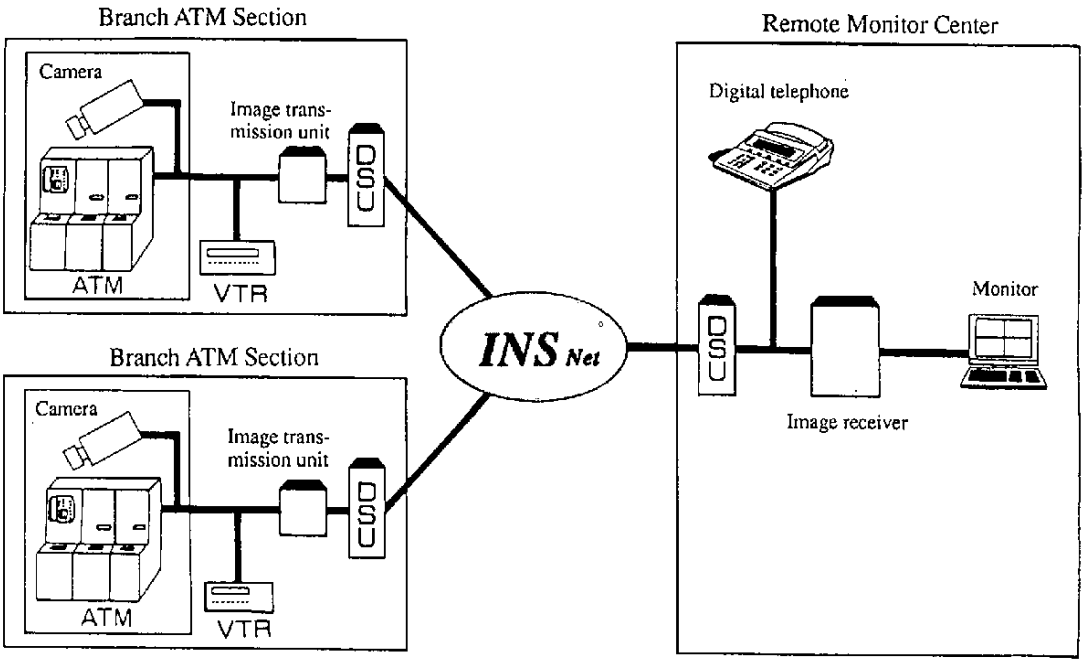


Figure 13 Remote Monitor System (For Use with an ATM)

2) Still Picture Transfer System for Digital Still Cameras

This system can transmit color images taken by a digital still camera with a memory card to remote locations by telephotograph terminals.

For example, in the case of automobile insurance coverage work, a picture of a car damaged by an accident can be quickly sent to an assessment specialist, thereby improving the efficiency of the claim process (See Figure 14).

3) Still Color Image Transmission System

Using INS Net 1500, this system can transmit color images that require a vast amount of high precision data in several minutes (See Figure 15).

Completed images of prints developed at the design studio of the main office using a computer are verified by the customer and then transmitted to a plant for processing and printing.

As a result, time spent on travel between a design studio, a customer, and a plant can be substantially reduced and significant improvement achieved in job performance.

4. Connectivity with Foreign Countries

The benefits of ISDN such as high speed and high quality together with its economical advantages will be especially apparent in international areas.

There are an increasing number of cases where G4 facsimile devices and TV conference systems have been installed for the purpose of reducing communications expenses and facili-

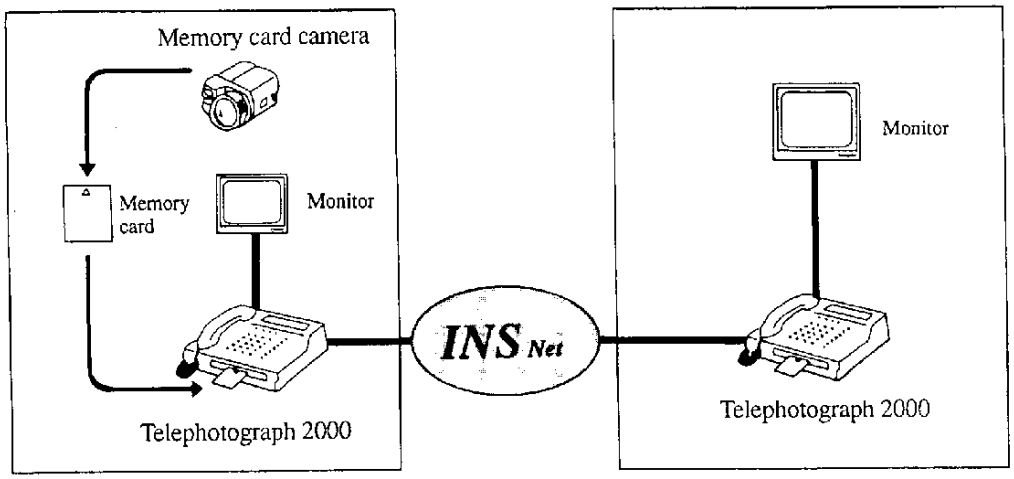


Figure 14 Still Picture Transfer System (for Digital Still Camera)

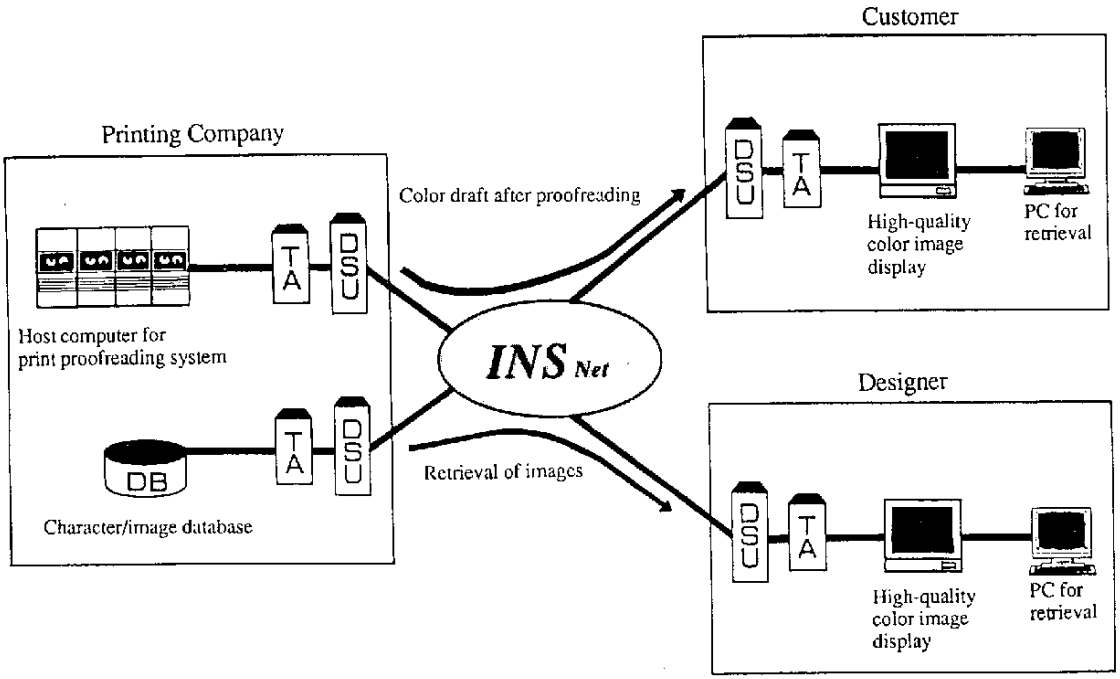


Figure 15 Still Color Image Transmission System

tating information exchange. There are also cases where data communications are being made through terminal adapters.

We believe that this demand will become stronger in the future.

At present, NTT's INS Net 64 is connectible to 14 countries or areas including the United States, the United Kingdom, France, Italy, San Marino, Vatican City, Germany, Belgium, Spain, the Netherlands, Sweden, Australia, Singapore and Hong Kong via KDD's international lines. There are plans to connect with Switzerland, New Zealand and Denmark during this fiscal year.

5. Future Plans

The construction of a variety of ISDN systems to meet users' needs has become easier as new application packages and devices are developed and prices decrease.

As you can see in Figure 16, the base of single-product-type markets has been added to nationwide and regional system markets.

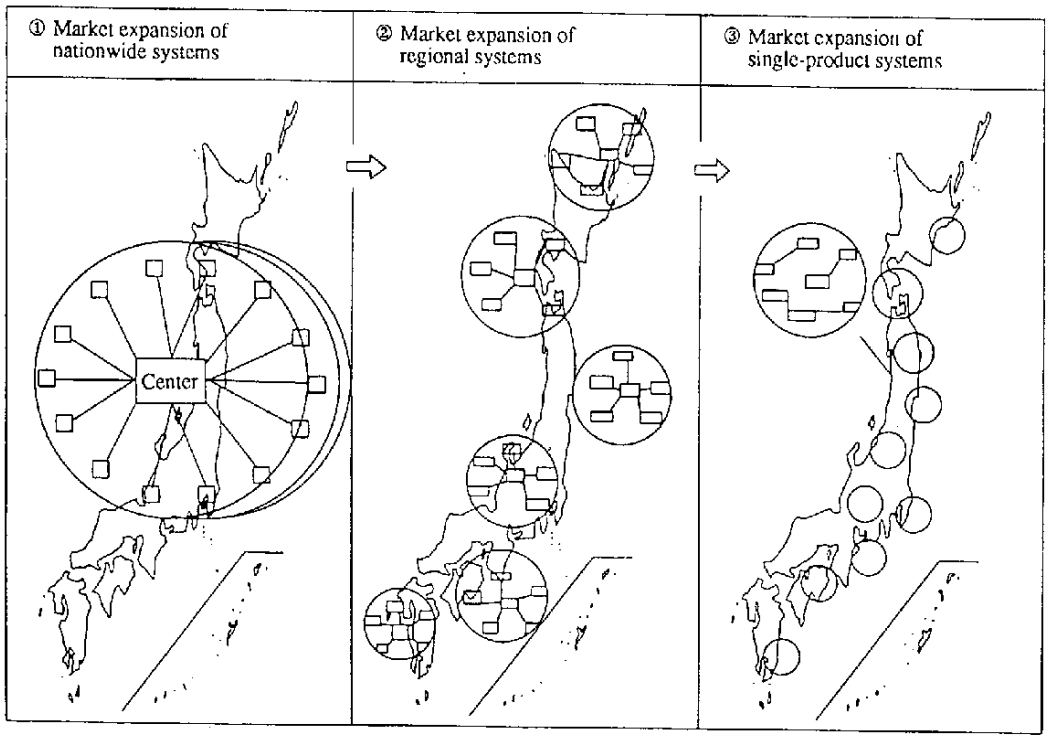


Figure 16 Sales Market Expansion

6. Future Challenges

We can expect that the construction of ISDN's next generation of communications infrastructure will create a new and very attractive world for communications users. However, an enormous amount of funds are necessary for the construction of network facilities.

The great challenge for the future is how to effectively make investments for constructing an ISDN foundation, taking into consideration revenues and expenditures. It is necessary that an agreement be reached as to who will pay for the infrastructure, when that investment will be made, and how much will be made.

The future course of ISDN, the infrastructure of the Information Society, will be determined by the future strategies of users, communications carriers and communications equipment vendors, taking into consideration short-term income and expenditure balance, long-term investment, and return on investment.

Multimedia Information System which Uses ISDN VIX (Versatile Intelligence Exchange)

Reiko Kinoshita
Business Information System 2nd Division
Fuji Research Institute Corporation

1. PREFACE

One trend resulting from the advent of the SIS (Strategic Information System) boom is the tendency to view the computer as an effective strategic tool for expanding market share rather than merely as a tool for streamlining and automating job processing. In addition, there are an increasing variety of user needs; users now demand highly economical tools that are suited to various applications. In response to these trends, Fuji Research Institute Corp. has accomplished the construction of a multimedia information system for the coming age of ISDN in an 18-month project term.

2. BASIC CONCEPT OF SYSTEM CONSTRUCTION

The basic concept of our multimedia system is to integrate the presentation of information on a computer in a manner that is more natural to the user using data from various kinds of media, such as text, graphics, voice, music, etc. In making this multimedia system a reality, one of our other key concerns was to support peripherals and high-speed, high-quality communication methods. Our multimedia system is based on these design philosophies. It provides the following:

- Suitability for various applications
- Adaptability to strategic information networks using ISDN
- Superior cost-effectiveness
- Flexibility to keep pace with the latest technology

This system thus offers solutions for multimedia applications that can meet a variety of needs. It is called VIX (Versatile Intelligence eXchange).

3. SYSTEM FUNCTIONALITY REQUIREMENTS

The features required of this system are the following:

(1) Technical features

- Terminals which display and handle large quantities of binary data for static images, voice, MIDI (Musical Instruments Data Interface), etc.
- Host computer database functions and transaction functions to handle binary data from terminals
- High-quality, high-speed transfer of binary data between the ISDN terminals and host computer

(2) User interface features

- System that is easy-to-use for the routine jobs of end users
- Flexibility to adapt to various applications
- Full turnkey system for users

(3) Service features

- Suitability for the business conditions of different industries and different companies
- Fault tolerance functions that enable in 24-hour operation
- Capability to provide additional services such as network monitoring, etc.

Incorporating all these system features makes this a strategic information system that enables companies to survive in a severe business environment or obtain a competitive edge.

4. SYSTEM CONFIGURATION

VIX is composed of a host computer and terminals connected via ISDN lines. VIX can execute transactions for the multimedia database in the host computer. It can also exchange files with that database. The host computer is a fault-tolerant computer with redundancy in all its components. If one component fails, another component takes over with no interruption in normal processing, so long as that component is normal. The faulty component is diagnosed automatically and repairs are made automatically if possible. The use of this host computer enables 24-hour system operation all year round. (See Figure 1.)

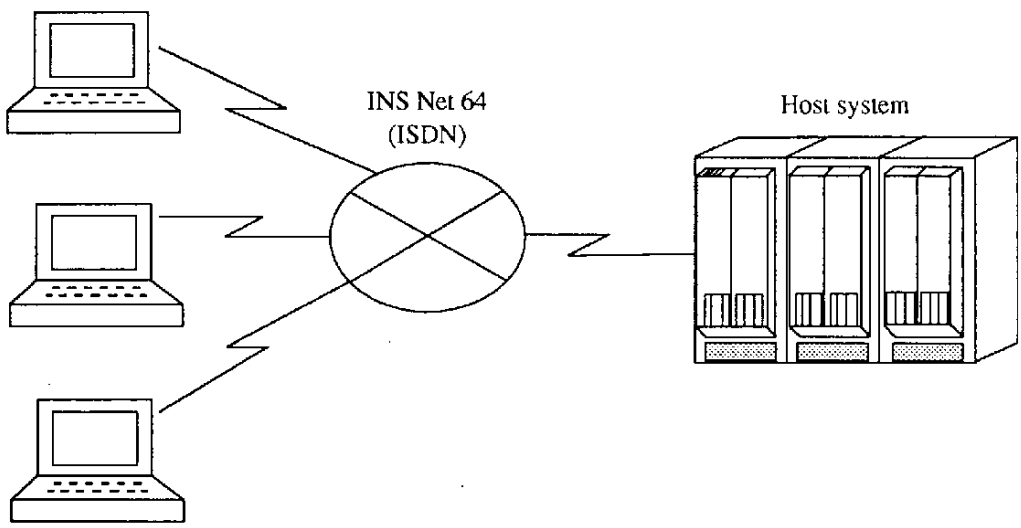


Figure 1 VIX System Configuration

5. SYSTEM'S BASIC FUNCTIONS

The terminals and host computer each have their own basic VIX functions. The following is a description of these functions, and Figure 2 shows their construct.

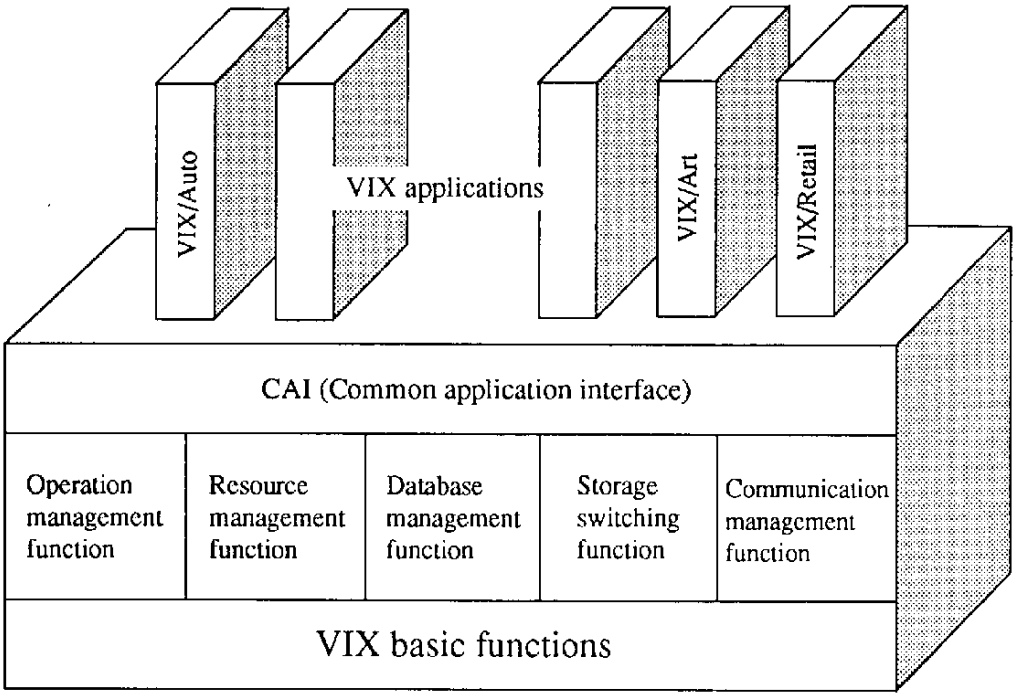


Figure 2 VIX System's Basic Functions

(1) Terminal basic functions

Terminal applications will vary depending on the application area, making it difficult to assign basic functions to terminals. However, each terminal provides the following basic functions:

- Obtains, compresses, extends, and displays static image data, and increases and decreases its size.
- Obtains and reproduces voice data.
- Obtains MIDI data and plays music.
- Supports touch panel operation.
- Supports mouse operation.
- Provides data communications with the host computer and executes transaction functions via ISDN lines.
- Controls the peripherals and applications simultaneously (multitask function) to realize excellent user interface.
- Offers the user interface editing tools useful in creating applications.

Various peripherals are connected to each terminal (see Figure 3). However, since MS-DOS is a single-task OS which cannot control all these peripherals simultaneously, we have incorporated an originally developed mechanism into the multimedia system that enables multitasking to be effected by time division.

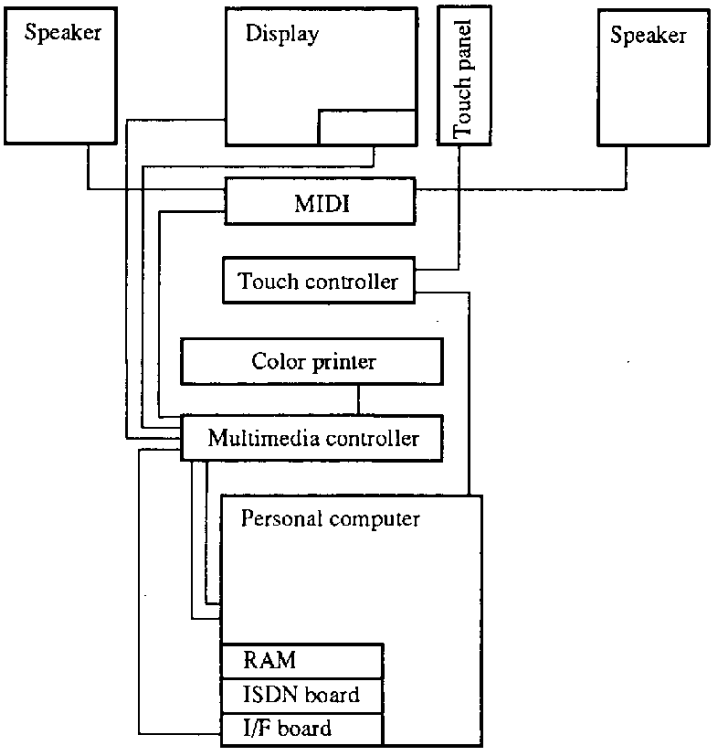


Figure 3 System Peripheral Configuration

This mechanism treats control of each part of an application using the concept of specific, individual "tasks". It switches between tasks by internal timer interruption so that applications appear to run simultaneously.

This mechanism enables simultaneous execution of communication through ISDN, MIDI handling, voice processing, application processing, etc., (see Figure 4).

(2) Host computer basic functions

The host computer executes mainly the following database functions and online transaction functions:

- Retrieves, adds, deletes, and changes text data and binary data via ISDN lines.
- Retrieves text data under compound conditions via ISDN lines.
- Sends text data and binary data in files via ISDN lines.
- Obtains information about files to be downloaded.
- Obtains information about files to be uploaded.
- Controls data processing programs in the host (for executing host computer programs from terminals)

The host computer uses our company's own multi-process OS. The host system software is composed of a plurality of resident processes.

These include a process control process which monitors and controls each process, a communication control process which controls com-

munication, and an application process which actually accesses the database and executes transaction processing (see Figure 5). Even if any one of these processes terminates abnormally for some reason, it will restart automatically.

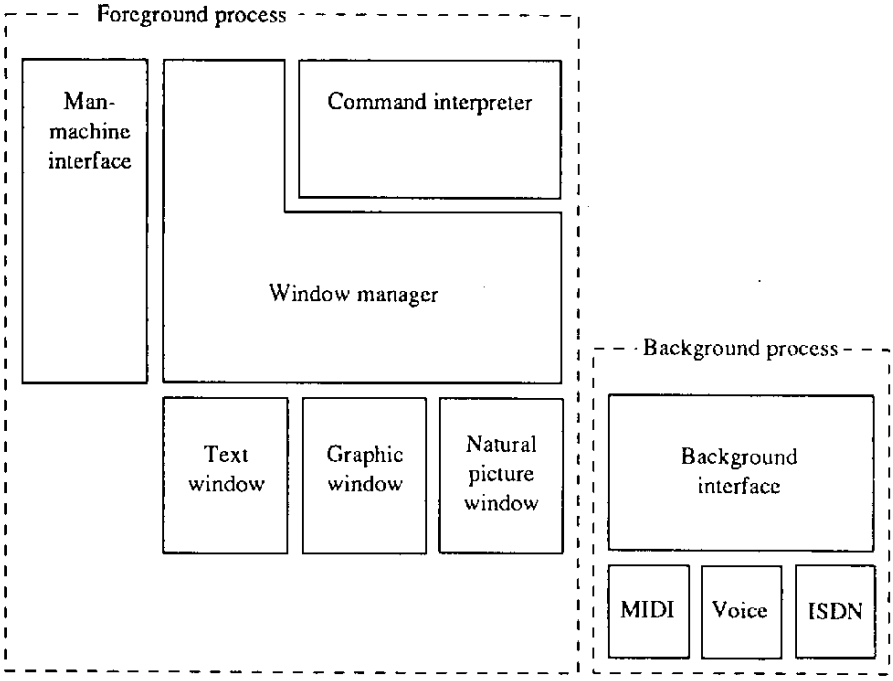


Figure 4 Multitask Process Concept

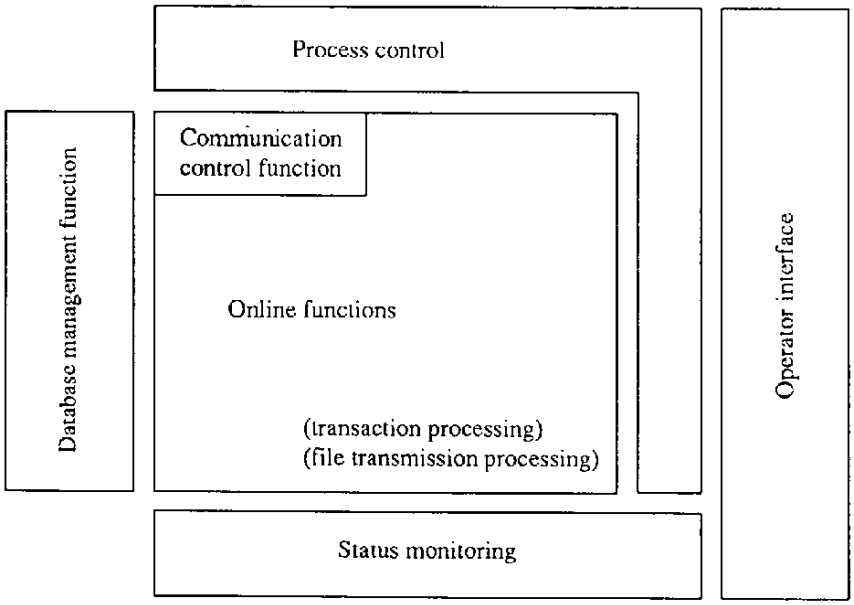


Figure 5 Host Computer Basic Functions

6. EXAMPLE APPLICATIONS

(1) Used-car information retrieval system

The year before last, we built a used-car sales support system based on VIX. This system handles multimedia data such as static image data and MIDI data.

About 35 terminals were installed at Nissan dealers in Kanagawa Prefecture. The used-car sales support system searches the used-car inventory of each Nissan dealer. This system has been operating through communication with the host computer at Fuji Research Institute since December 1990.

① System overview

The Nissan dealers wish to beat the used-car dealers of other companies in terms of sales. Therefore, they use the system for such purposes as:

- Solving the problem of reduction in used-car exhibition space due to increased land prices and land shortages in cities.
- Immediately meeting an ever-widening variety of user needs
- Enlarging business opportunities by sharing inventory
- Making nonexhibition sales and unattended sales by multimedia terminal possible in the future
- Upgrading Nissan's image through the introduction of multimedia terminals

For system operations, data entered by each dealer about their present inventory is used intact as text. Pictures of cars in stock maintained at the centralized management warehouse are taken using a still camera, and the images stored on floppy disks are entered from touch panel terminals. All data is stored in the database of the host computer at Fuji Research Institute. Each Nissan dealer can access this database for retrieval of data. Figure 6 shows the system concept.

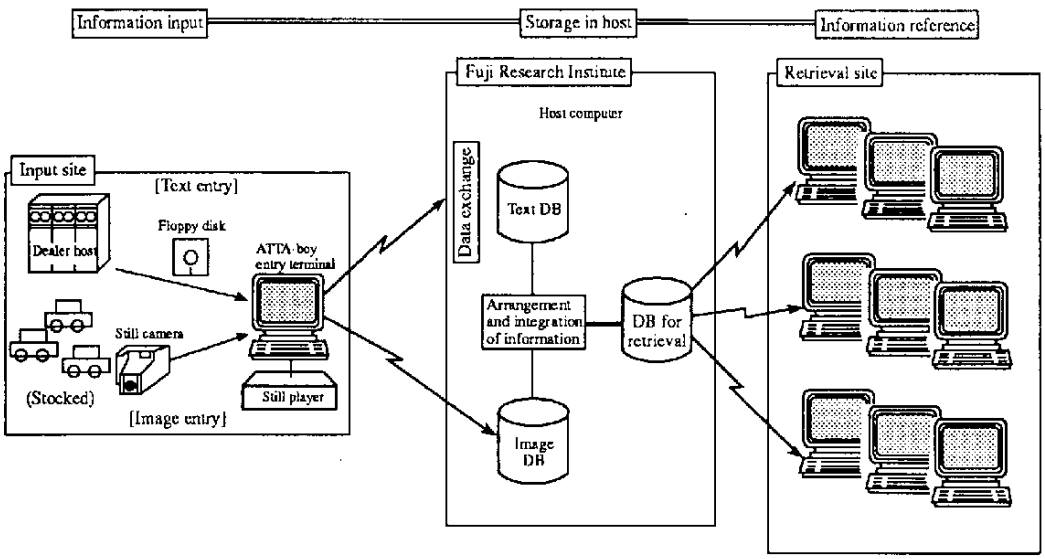


Figure 6 Used-car Information Retrieval System

② Features

This system has the following features:

- Simple terminal operations by touch panel
- Displays static images and data lists concerning cars which meet specified conditions for selection (such as type, name, price, and accessories).
- Displays further details on the selected car.
- Produces printouts of any screen information.
- Plays background music with MIDI.
- Displays a list of special cars and detailed information about them.

③ Evaluation

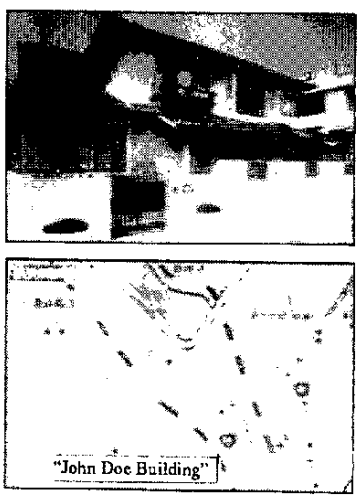
Currently, 10% to 20% of the Nissan customers purchase used cars through use of this system alone. Not all of their customers use this system, but the system promotes sales and attracts the attention of customers. In addition, it enables the dealers to easily find out the situation with regard to the type of used car desired by the customer, thereby increasing the efficiency of negotiations. A larger percentage of customers are expected to use this system as its usefulness is further improved through such actions as cataloging of additional used cars. We are planning to investigate the effects of this system in Kanagawa Prefecture, and then install terminals in other areas.

(2) Real-estate information retrieval system

VIX is available for use in real-estate information retrieval. Using VIX for retrieval of this kind of information has several advantages including:

- Ability to retrieve real-estate information according to compound conditions such as price, location, etc.
- Ability to display not only the room arrangement and location map, but also building appearance, room interiors, and environment
- Ability to introduce a wide range of properties and enlarge business opportunities

Figure 7 shows examples of graphic images.



Price: ¥47,000,000

Address: 3-18 Shibamata Katsushika-ku Tokyo

Distance: 20 minutes' walk from Shibamata Station Keisei Dentetsu

Area: Land: 260.88 m²
Building: 240.49 m²

Floor space rate: 88/90

Room arrangement: 6 LDK
1F LDK, 8-mat Western-style room, 8-mat Japanese-style room
2F 10-mat Western-style room, 8-mat Western-style room, 8-mat Japanese-style room, 6-mat Japanese-style room

Road attachment: 4 m on west side

Construction: Wooden, 2-story house

Room arrangement | Environment | Details | Return

Figure 7 Real-estate Information Retrieval System

(3) Personnel information retrieval system

Another multimedia application is personnel information retrieval for companies and talent banks. Using VIX for this sort of information retrieval is expected to result in the following effects:

- Persons better suited for each post can be selected by displaying not only the profiles of their work records but also their photographs, résumés and voices.
- In-house communications can be improved.
- Personnel can be introduced when they are transferred or employed.

Figure 8 shows an example of a graphic image.

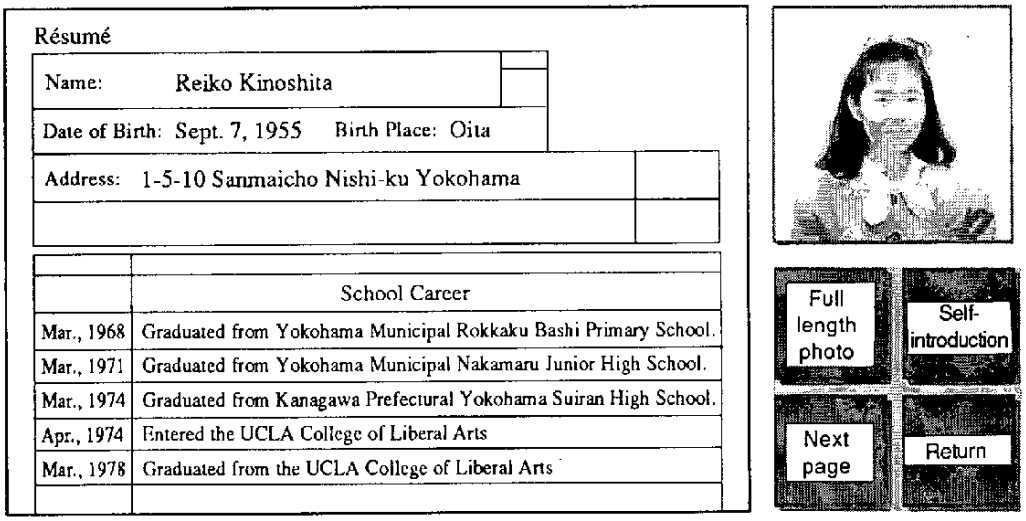


Figure 8 Personnel Information Retrieval System

7. FUTURE DEVELOPMENT PLANS FOR VIX

Multimedia will become more sophisticated as our information-oriented society matures. Some of the problems we will face in the future will be how to resolve the differences among multimedia data formats, compress multimedia data, and integrate multimedia data handling methods. To overcome these challenges, we must keep up with the progress in technology.

In order to extend system capabilities and boost system performance, we are currently planning to address the development of plans for the following:

- Connection to G4 facsimile machines and telephones
- Addition of terminals by connection to INS1500
- Implementation of a terminal system under OS/2.

- Mass storage in an external data server such as an optical disk
- Operation under UNIX environment
- Implementation of a pass-through function for a mainframe machine
- Distributed processing by network between hosts

As of September, 1992, the following development plans have already been implemented.

- Use of new media such as animation
- Connection between terminals and LAN
- Implementation of a terminal system under DOS/V.

ISDN at Nihon Keizai Shimbun

Shozo Fujii
Senior Engineer
Telecommunications Department
Systems R&D Bureau
Nihon Keizai Shimbun, Inc.

1. Introduction

At Nihon Keizai Shimbun, Inc., which is a "comprehensive economy-oriented information media company", we utilize computer and network systems in all stages of our activities for the collection, analysis, processing and distribution of news and information.

Our newspaper production system consists of ANNECS (Automated Nikkei Newspaper Editing & Composing System) and several peripheral subsystems. Our system for the input of data into ANNECS is called PLES (PaperLess Editing System). PLES enables news reporters to input domestic and overseas news into ANNECS on-line using PCs and to edit news articles using WSs. ANNECS outputs its data to the newspaper transmission system, which outputs composed newspaper images to 25 distributed printing plants both within Japan and overseas.

Networks play an important role in the input of news from domestic and overseas locations and for the transmission of newspaper images to the domestic and overseas printing houses. We currently use both a leased line network using high speed digital lines and a public telephone network. We recently started to use 64 Kbps ISDN and plan to expand its utilization.

In this article, I will introduce the way we have applied ISDN to 1) the PLES system (Internetworking) and to 2) our newspaper image transmission system. We are also making plans for the use of G4 facsimile and for the concentration of telephone lines by means of INS-1500.

2. Use of ISDN for Internetworking

2-1 PLES System

News, which constantly arises both in Japan and in other countries, is always being sent to us from news reporters and news agencies. In the past, hand-written manuscripts by reporters and manuscripts sent by FAX machine were inputted into the computer used for newspaper production by specialist operators at the newspaper offices. The development and dissemination of Japanese language word processors has made it possible for the reporters themselves to input their manuscripts into the computer at the head office via their personal computers (which are used by reporters as terminals).

In November, 1992, Nihon Keizai Shimbun started full-scale operation of the PLES system. We plan to completely eliminate paper (manuscript paper) from the editorial office.

News reporters input the manuscripts of their articles directly from PCs. The editors (news desk) edit, revise, and correct the copy entirely on the displays of UNIX workstations (which are used as terminals by the news desk). Original manuscripts, final manuscripts and manuscripts from news agencies are registered in corresponding files in file servers. Our news reporters can retrieve and refer to these manuscripts from any location using their PCs.

Since every reporter has a PC, we have 1,000 PCs throughout the country. We also have 250 WSs for the news desk throughout the country, including 200 units at the head office in Tokyo. Also, we have five file servers for manuscripts and several subsystems for ANNECS. All of these have been connected by network.

An integrated LAN system was constructed at the Tokyo head office as part of our information infrastructure. This LAN is shared by PLES and other systems. Two FDDI LANs were installed as a backbone to connect the office building vertically. Several ETHERNET cables have been installed on each floor as branch LANs. Twisted pair LAN has been installed for all tables in the editorial office. Our bases throughout the country and overseas have been connected by a WAN which connects and extends the various LANs (Figure 1).

Triangular connections have been formed between the LANs at the Tokyo head office, the computer center in Tokyo, and the Osaka head office using high speed digital lines. The Tokyo head office is connected to LANs in five locations, including the Sapporo and Nagoya branch offices, while the Osaka head office is connected to LANs in three locations, including the Fukuoka branch office. Digital lines (64 Kbps) are used for connections between these LANs, and ISDN was adopted as a back-up.

2-2 Use of ISDN for Connecting LANs

The LANs are connected using routers. We have adopted CISCO (U.S.A.) gateway servers (AGS, MGS, IGS), which are multi-protocol routers. TCP-IP is the standard communication protocol on the network, but other protocols are supported as well.

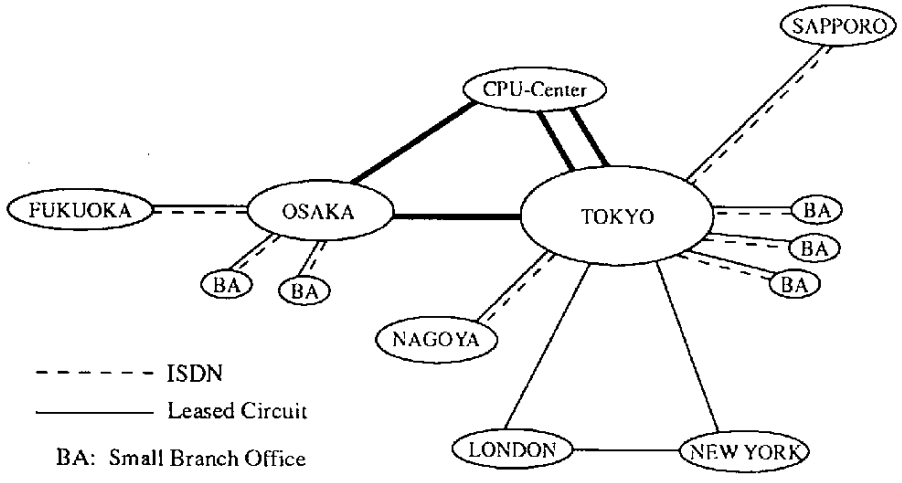


Figure 1 Nikkei's PLES Network

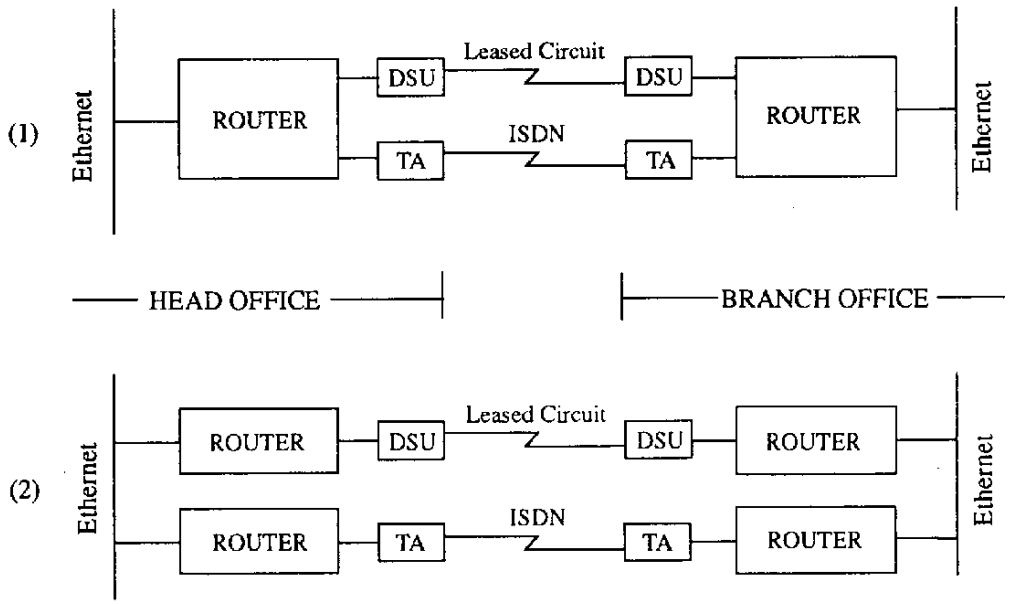


Figure 2 Internetworking Configuration

The resulting hardware configuration has the form shown in Figure 2-(2) because both lines and routers are duplicated. When a leased line fails, a call can be made manually from a terminal adaptor (TA). Then, an ISDN route is established by the routing protocol of the router to enable communications. In the event of a line failure, it is desirable to be able to detect it, perform automatic calling, change to the routing table, and re-connect the destination before the session between the host and the terminal gets disconnected, namely, within the specified session time-out period.

TAs that have functions for detection of a line faults and automatic switching to ISDN have recently been developed. Such TAs can be used for a system with the configuration shown in Figure 2-(1). Routers which eliminate the need for a terminal adapter by providing an ISDN interface have already been developed.

The ISDN connection functions of inter-LAN connection equipment (routers) have been developed to perform the following steps.

1) The router performs automatic calling and connection in the event of a leased line fault or overloaded communications (load balancing).

2) The router dials the destination ISDN line at the time of datagram transfer and closes the session automatically at the end of the transfer.

3) The router controls two basic channels (2B) and transmits to two addresses separately.

These functions, as well as functions which will be developed in the future, will implement more efficient and intelligent utilization of ISDN for

LAN-LAN inter-networking than would be the case with leased lines.

3. Use of ISDN for Newspaper Image Transmission

3-1 Remote Printing and Newspaper Image Transmission

Distributed printing (remote printing), by which newspapers are printed at local printing plants, has been widely adopted by newspaper companies throughout the world in order to fulfill their mission to distribute newspapers to their readers as quickly as possible. Nihon Keizai Shimbun started to use distributed printing in 1964, before any other newspaper company in Japan. At present, our newspapers are printed at 20 domestic and 5 overseas printing plants. We initially adopted remote printing in order to prevent delays in transmitting the news to remote locations in Japan. However, we interextended it to the Metropolitan area in order to solve the problem of newspaper delivery truck traffic congestion and to prevent the printing time from becoming overly long, since this increases in proportion to the number of copies. This then led to the complete separation of the editing department and the printing department, when the printing functions at the head office were moved to another printing plant.

Remote printing is supported by newspaper image transmission technology (press facsimile) and the newspaper image transmission network (Figure 3).

Newspaper image data produced by computer at the Tokyo head office is sent from our "Newspaper Image Transmission System (FM subsystem)" via network to high-precision, high-speed press facsimile recorders at our remote printing plants in Japan and in other countries.

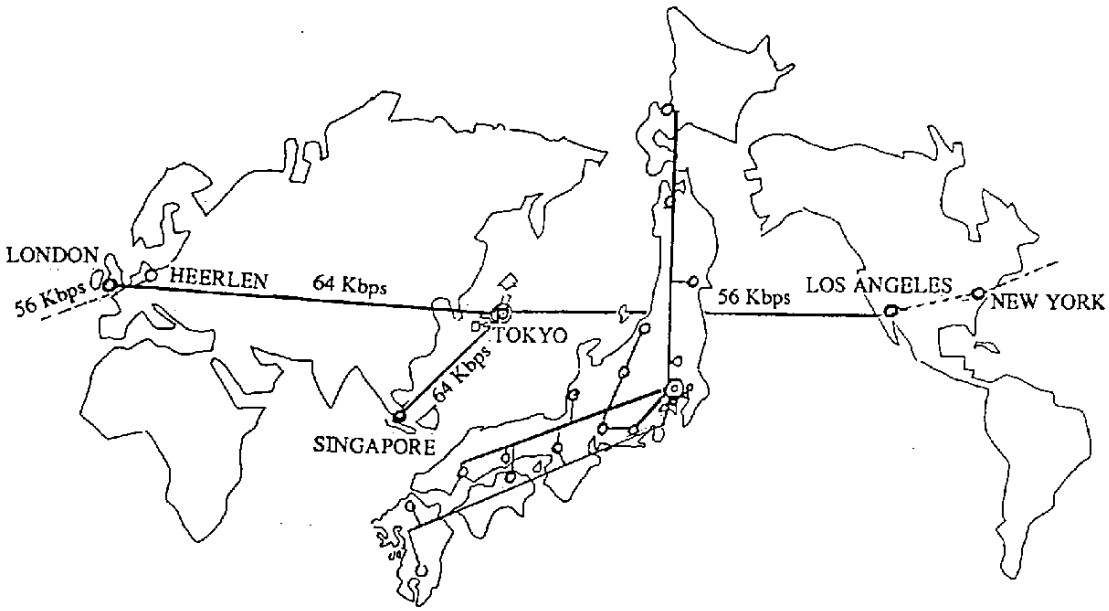


Figure 3 Press Facsimile & Remote Printing Network

The newspaper images outputted by these recorders are sent to the plate making and printing processes. Printing starts simultaneously at all the printing plants throughout the country.

The methods and specifications of the Nihon Keizai Shimbun newspaper image transmission system are summarized below.

(a) Number of remote printing plants : 20 in Japan and 5 overseas

(b) Newspaper image transmission equipment : ANNECS FM subsystem at Tokyo head office; flat bed scanning type scanners in Osaka and Fukuoka

(c) Newspaper image receiving equipment : FT-223 press facsimile receiver made by NEC; optical rotary type in internally-mounted film cylinder; speed of 9000 rpm in Japan and 6000 rpm overseas; scanning line density of 454,681,909 lpi

(d) Circuits : 768 Kbps high speed digital lines with some branches (domestic); 64/56 Kbps digital lines (overseas)

(e) Transmission speed : 192 Kbps × 3 (simultaneous transmission of 3 pages) (domestic); 64/56 Kbps (overseas)

(f) Transmission time : 2 minutes on average (domestic); 5 minutes on average (overseas), (except color images)

(g) Transmission mode : HDLC

(h) Error correction method : Reject-type ARQ

(i) Data compression method : Adaptive prediction two-dimensional coding method

Each printing plant in Japan receives 100 to 200 pages per day. Current problems related to newspaper image transmission involve (1) Shortening the transmission time (higher speed), (2) Achieving high fidelity (high scanning line density) and (3) Achieving faultless operation (high stability). These problems can be solved by increasing the speed of the transmission system (circuits) and improving measures to deal with faults (back-up), and are related to increases in direct transmission expenses.

3-2 Overseas Newspaper Image Transmission and Use of ISDN

We started printing in the U.S. (Los Angeles, New York) and Europe (the Netherlands) in 1987, in Singapore in 1990, and in London in 1992.

In principle, the same system is used for both domestic and overseas newspaper image transmission. Therefore, domestic and overseas transmission is performed using the same operating procedures at the Tokyo head office. Since 64 Kbps digital lines (56 Kbps digital lines between Japan and the U.S.A.) are used for transmission, transmission time is about 5 minutes. About 40 to 50 pages are sent daily on average.

International circuits are stable. Although they fail less frequently than domestic lines, when they do restoration sometimes takes a long time. A line failure can cripple or delay newspaper publication. However, back-up lines are not necessarily economical from the standpoint of transmission costs.

The installation of international ISDN as a back-up line has been put forward, because international ISDN service is well established.

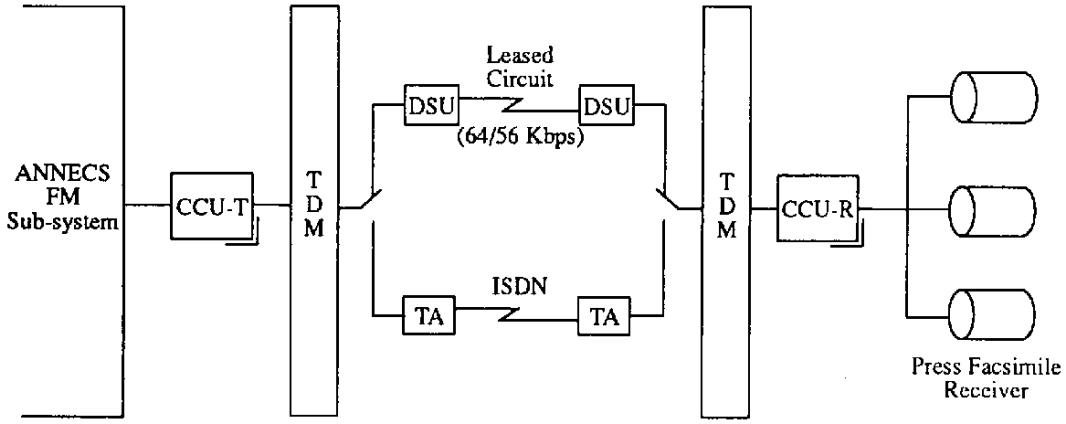


Figure 4 System Diagram of Press Facsimile Transmission

Figure 4 shows the basic system configuration adopted for ISDN. The following items had to be studied in installing ISDN.

1) Has international ISDN service been started between Japan and the destination? How firmly it has taken root and how far it has been disseminated are closely related to the stability of service. Local lines in the U.S. require particularly a careful study.

2) Terminal adaptor (TA) models must be selected carefully. In a foreign country, a model designated by the common carrier in that country must be used. For example, terminal adaptors that have passed the KDD inter-communication test should be selected. A 64/56 Kbps conversion function is required for transmission between Japan and the U.S.A. The Hitachi HN-5101-4B or OEM products of this model were adopted for use in Japan.

When ISDN is used only as a back-up line, the configuration can be simplified by adopting manual switching on both the Japanese and foreign sides. However, it is desirable for TAs to have the following functions, and such TAs have already been developed.

1) Function for remote switching from Tokyo

2) Functions for detecting faults in leased lines, and for automatic calling and connection to ISDN

There is a constant need to shorten the time it takes for overseas newspaper image transmission. So inexpensive high-speed lines are needed. A TA with function for 128 Kbps bulk transmission using two basic channels (2B) on one ISDN line and a TA enabling higher speed bulk transmission by bundling ISDN lines have been announced. If foreign carriers allow the use of such TAs, ISDN will become more advantageous for use in newspaper image transmission.

5. Postscript

Communication networks are what constitute the lifeline of the press. We have always studied

and introduced the latest communication technologies and services and improved the quality and increased the speed of our networks. In every phase of development, how much importance we have attached to our private network constructed with leased lines and how much importance we have attached to common carrier public networks have depended on the state of the available technologies and services.

I feel that the relative importance of these two will change with the appearance of high-function, high-speed ISDN. In this paper, I have introduced the first steps we have taken in the application of ISDN to our newspaper production system. We will continue to develop communications equipment and applications that will take advantage of the outstanding functions of ISDN, and construct networks in which leased lines and public networks can coexist effectively.

Current State and Outlook of the Leased High Speed Digital Service

Michitaro Ohnishi
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Leased Circuit Service Department
Nippon Telegraph and Telephone Corporation

(1) Brief Description of the Leased High Speed Digital Service

Telecommunication services can be classified broadly into public services (such as telephone service, ISDN and packet communication service) and leased services (private services). A public service user shares a transmission line with other users via a switching system according to connection time or data volume, while a leased service user occupies a transmission line around the clock.

Public and leased services can be classified by such factors as the transmission speed and the analog/digital interface. Table 1 roughly shows the relationship of these services.

As Table 1 shows, the leased high speed digital service in the leased service group corresponds to ISDN in the public service group. This service is available in 12 communication speeds from 64 kb/s to 6 Mb/s (12 speeds : 64 kb/s, 128 kb/s, 256 kb/s, 384 kb/s, 512 kb/s, 768 kb/s, 1 Mb/s, 1.5 Mb/s, 3 Mb/s, 4.5 Mb/s, 6 Mb/s).

Table 1 Public Services and Leased Services

Classification			Low speed service	High speed service
Interface	Public/ leased	Method of transmission line sharing		
Analog interface	Public service	Shared with others according to connection time	Telephone service (3.4 kHz band)	———
	Leased service	Occupied exclusively around the clock	Leased analog service (mainly 3.4 kHz band)	———
Digital interface	Public service	Shared with others according to connection time	Circuit switching service (200 b/s ~ 48 kb/s)	Integrated Services Digital Network (ISDN) (64 kb/s ~ 1.5 Mb/s)
		Shared with others according to data volume	Packet switching service (200 b/s ~ 48 kb/s)	ISDN packet (64 kb/s) or Frame Relay*1
	Leased service	Occupied exclusively around the clock	Leased digital service (50 b/s ~ 9600 b/s)	Leased high speed digital service (64 kb/s ~ 6 Mb/s)

(Note) *1 Frame Relay technology was developed by extending packet switching. The thruput can be raised (up to 1.5 Mb/s) by simplifying communication procedures. The commercialization of this service is being planned.

Compared with public services, leased services have the following merits.

1) Since the charge is fixed regardless of communication time and total data volume (communication time x communication density), it is economical for heavy users (long communication time and large data volume).

2) Since the transmission route is generally fixed, stable quality can be maintained.

3) Since a user exclusively occupies a transmission line, other users have no influence on it (unavailability due to congestion).

4) Since the destinations are fixed, no wrong connections occur.

On the other hand, they have the following demerits.

1) It is not economical when the communication time is short or the total data volume is small.

2) Since the destinations are fixed, it is difficult to change destinations freely.

Therefore, each user selects the best service in consideration of his communication needs as well as the merits and demerits of various services.

Figure 1 shows the applicable areas of various services from the standpoint of communication time and communication density (data volume/connection time). When the communication density is low, the packet service and ISDN packet featuring the volume charge system are economical. When the communication density is quite high and the communication time is relatively short, the telephone service and ISDN featuring the duration charge system are economical.

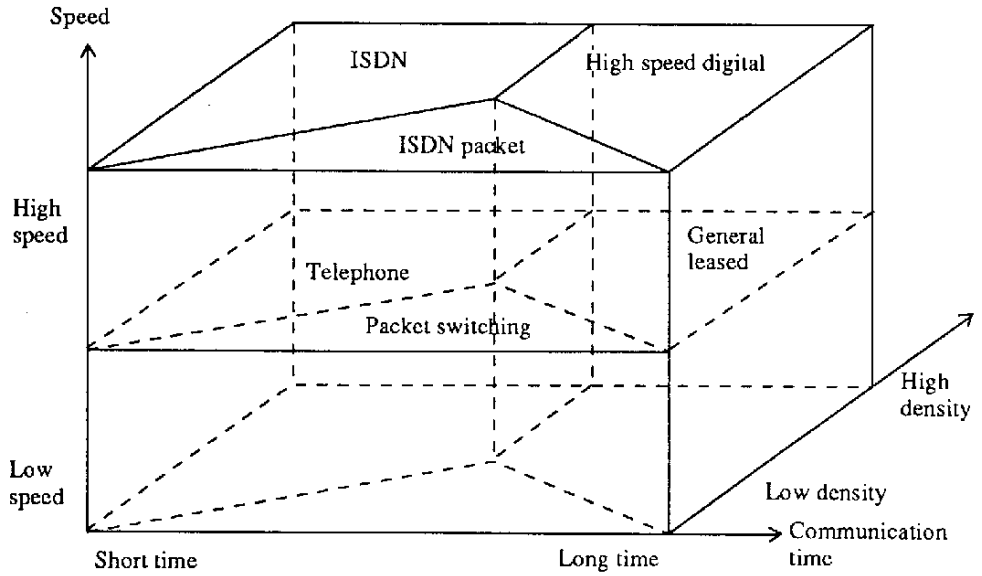


Figure 1 Applicable Areas of Various Services (Relation of Communication Speed, Communication Time, Communication Density)

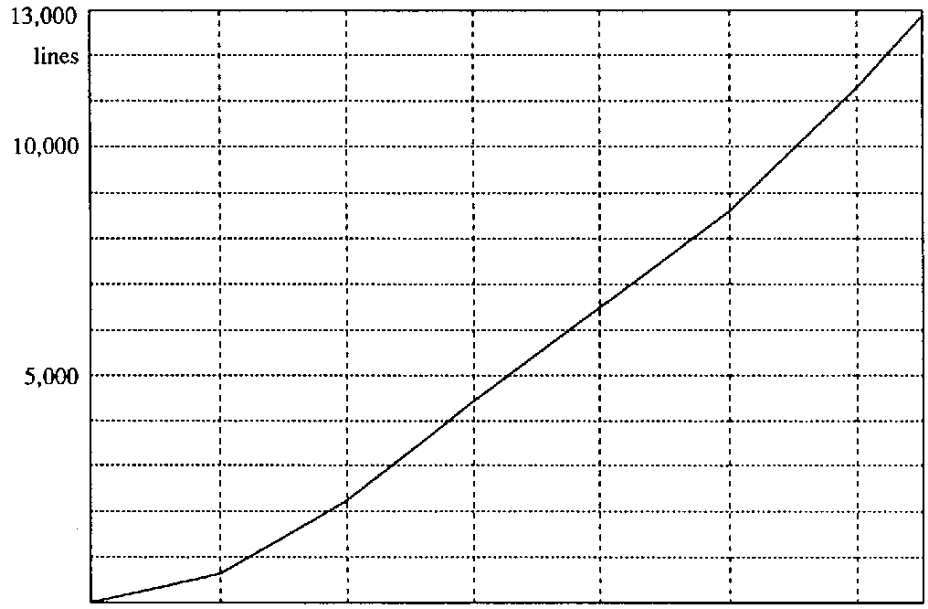
(2) Changes in Leased High Speed Digital Line Utilization

The leased high speed digital service was started in November, 1984. The service will become 8 years old in November, 1992. Table 2 shows how the number of lines changed yearly. It has increased by more than 2,000 lines every year, maintaining a high annual growth rate of over 30%. The total number of lines throughout the country is 12,883 at the end of September, 1991.

Initially, the leased high speed digital service was used mainly for replacing previous voice and data transmission services in order to save communication expenses. Later, those applications which were implemented by the leased high speed digital service, such as teleconference, CAD/CAM and high speed file transfer, have increased.

At the beginning, enterprises used the leased high speed service for connecting the head office and branch offices in order to rationalize internal office work. The recent trend is to construct systems for exchanging order information with business partners and systems for raising the accuracy and speed of account settlement and processing. The service is now used in many cases for connecting enterprises.

Table 2 Transition of Number of Leased High Speed Digital Lines



Fiscal year	End of FY 1984	End of FY 1985	End of FY 1986	End of FY 1987	End of FY 1988	End of FY 1989	End of FY 1990	End of Sept. 1991
Number of lines	27	640	2,125	4,407	6,454	8,558	11,283	12,883

(Note) The figures indicate the total number of high speed digital lines in Japan as quoted from the Communications White Paper (edited by Ministry of Posts and Telecommunications).

Recently, the application field of the leased high speed digital service has been expanding further along with the popularity of systems which aim to save production costs and raise efficiency by linking order processing and production lines (called CIM (Computer Integrated Manufacturing) and strategic information systems (SIS) which aim to increase competitiveness by connecting distribution and sales information with production.

Terminals for the leased high speed digital service are usually connected to a line via a multi-media time division multiplexer (M-TDM) because various applications, including data and voice, are used. Terminals like PBX are rarely connected directly to a line (See Figure 2).

(3) Outlook of Leased Services

The leased high speed digital service will play an increasing important role as trunk lines of network systems as the importance of CIM and SIS increases and networks are expanded to cover not only large enterprises, but also smaller enterprises.

As the speed of various data terminals is raised, previous users of the leased low speed service are beginning to shift to the 64 kb/s and similar classes of high speed service. As a result, the trunk lines of networks will move toward higher speed and larger capacity.

There is a new demand for a service above the highest speed service (6 Mb/s) that is currently

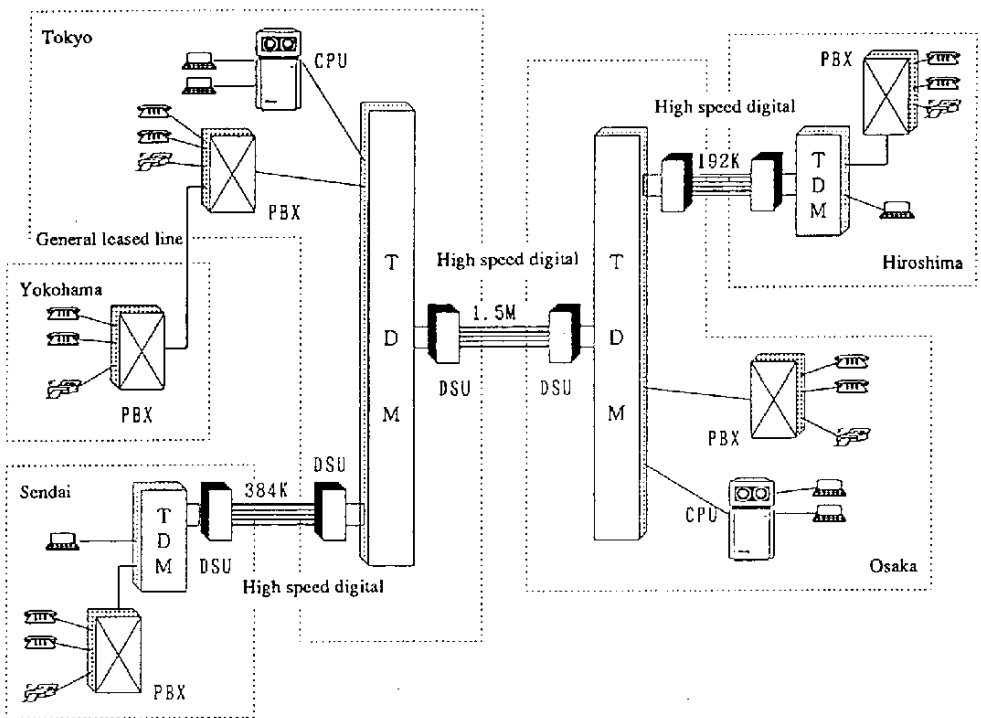


Figure 2 Example of Leased High Speed Digital Service System

available. This demand is rising among users who want to remotely use a supercomputer or connect high speed LANs. It will be necessary to offer a higher speed service in the future.

In the field of telecommunications technology, R&D of new technologies like Frame Relay and ATM*2 are being pursued. We must study how to support those needs (such as high speed data transmission having burst characteristics) which have been hard to meet by the existing services and technologies by the use of these new technologies.

(Note) *2 ATM (asynchronous transfer mode) is a key technology for implementing B-ISDN. It can transmit fixed length cells (consisting of a 5-byte header and 48-byte data) at 156 Mb/s or 600 Mb/s.

Switching Technology for Broadband ISDN

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The realization of B-ISDN (broadband integrated services digital network), which will support information and communication systems in the 21st century, is rapidly approaching. The technology that will lie at the heart of B-ISDN systems is asynchronous transfer mode technology (ATM). This article describes how ATM makes B-ISDN development possible, basic ATM concepts and features, and recent trends in ATM development.

What is B-ISDN?

NTT introduced its ISDN service in April 1988, before any other carrier worldwide. This integrated communications service is called N-ISDN (narrow-band integrated services digital network), and carries voice and data at speeds of 64 Kbits/s to 1.5 Mbit/s.

While N-ISDN performs transmissions rapidly at several times to several dozens of times the speed of an ordinary analog telephone circuit, its upper transmission speed is limited to 1.5 Mbits/s. Nevertheless, certain applications, such as HDTV motion picture communication and inter-local area network (LAN) swift file transfer, will require even faster transmission speeds. To meet this need, it will be necessary to provide much higher transmission speeds, ranging from several hundred to 10,000 times faster than an analog circuit, as well as the

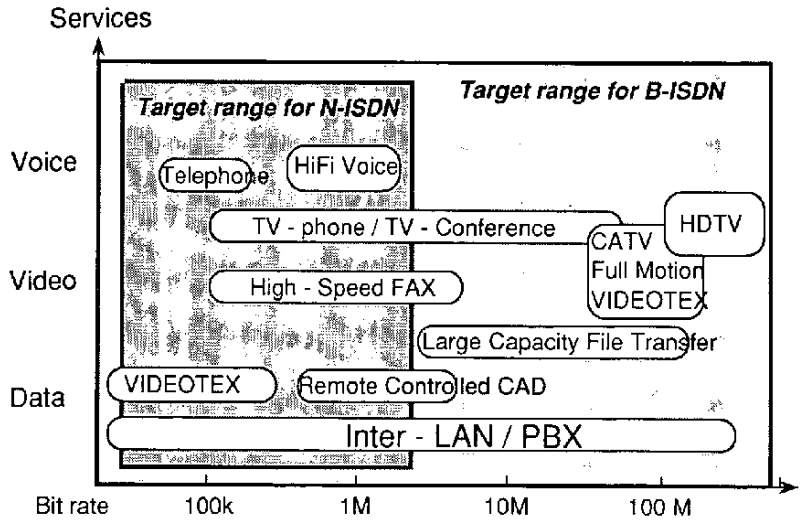

Figure 1 Broadband Service and Required Bandwidth

capability to handle integrated multimedia such as voice, data, and video signals (see Figure 1). Thus, in the future communications networks must be able to:

(1) Efficiently transmit information at speeds ranging from 64 Kbits/s to several hundred Mbits/s.
(2) Simultaneously and economically execute conventional pre-specified bit rate transmissions and variable bit rate (burst) transmissions such as packet transmissions.
(3) Satisfy the different quality requirements of different media, such as the transit delay requirements of voice transmissions and the transmission error requirements of data transmissions.
(4) Respond well to dynamic changes, accommodating variable connection formats and traffic characteristics.
(5) Deliver economical services under unpredictable demand conditions.

Even as NTT introduced N-ISDN services in Japan, developers were already considering the next level of development, the B-ISDN system, and research and development have progressed steadily since then.

The three major differences between B-ISDN and N-ISDN are:

(1) N-ISDN uses existing copper wire pairs, while B-ISDN employs optical-fiber cables.
(2) N-ISDN is a circuit-based network, while B-ISDN is based on packet-switching.
(3) N-ISDN uses a pre-specified bit rate, for example 16 Kbits/s or 64 Kbits/s. In contrast, B-ISDN operates more flexibly, defining only the upper bit rate limit (155.52 Mbits/s or 622.08 Mbits/s).

ATM: A Key Technology in B-ISDN

To be able to create a high speed network with flexible data transmission speeds, the switching system must have new functions that differ from those of conventional switches. The key to providing these functions is the technology called ATM (asynchronous transfer mode).

ATM is an outgrowth of a number of technological achievements, such as introduction of optical fiber cables and progress in LSI technology. With the introduction of optical fibers into communications networks, transmission errors diminish. This enables the transport network to dedicate itself entirely to information transfer by delegating most flow and error control to the terminals. Advances in LSI technology enable systems to process protocols and perform switching economically and automatically without software control.

Principles of ATM

Currently, there are two basic switching principles: circuit switching and packet switching. Circuit switching provides switching operations at pre-specified bit rates, so it cannot easily handle variable bit rate transmission.

Packet switching, however, does accommodate variation in switching speed. But because the handling of transmission protocols takes place through software control, this system imposes limits on transmission speed. Also, it is difficult to transmit continuous information, such as voice information, because of delays.

ATM overcomes the technological limitations of both circuit switching and packet switching,

providing the power for swift transmission of multimedia information, including voice and video signals, which involve severe real-time constraints (see Figure 2).

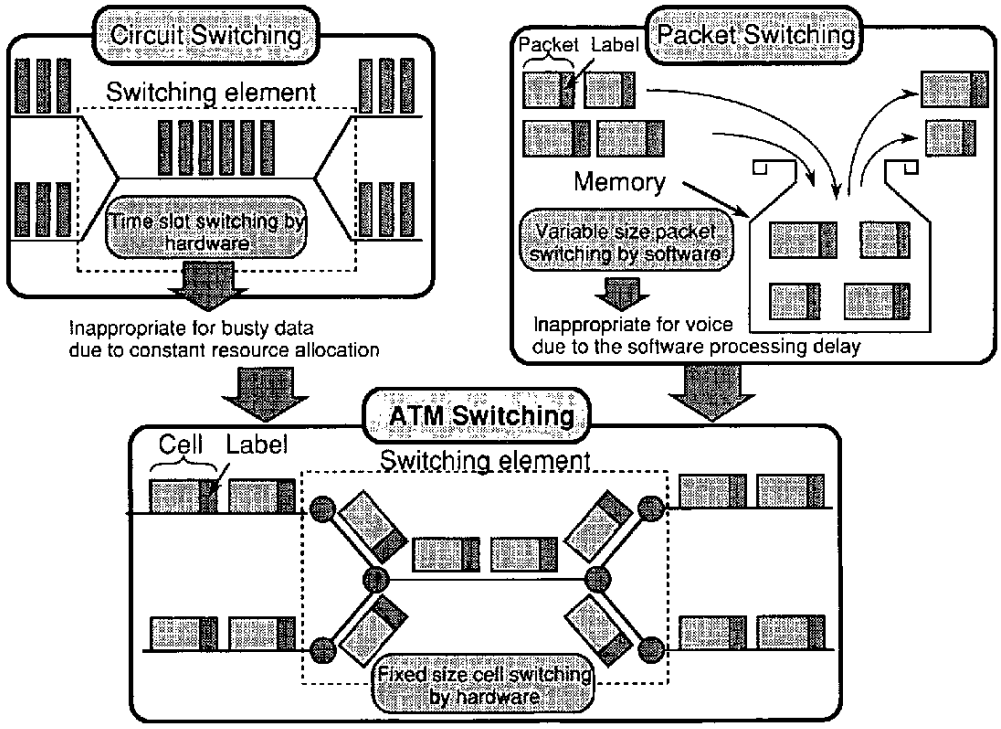

Figure 2 Asynchronous Transfer Mode

In ATM networks, digitized voice, data, and video signals are divided into pre-defined 53-byte blocks, known as cells. Before transmission, the system gives each cell a header with a destination. While the cells resemble conventional packets, the fixed length simplifies the protocol, so transmission can take place on a hardware, rather than a software basis. These features make a high-speed, broadband network possible because the cells are treated in a uniform manner at all stages of operation: at the terminals, by the transmission equipment, and by the switching systems responsible for communications (see Figure 3).

High-speed Switching Circuits: The key to ATM

The key to implementing ATM is to have a switching system which performs high speed switching of cells (see Figure 4). Multi-stage LSI switches in a matrix arrangement form the heart of an ATM system. It is possible to use one of three construction methods: (1) gate type switches, where the buffers are in the input/output section and the switching section is composed of gates; (2) memory type switches, where the buffers are in the switching section and switching is executed by reading from and writing into the buffers; and (3) ring type switches, which use high-speed optical fiber rings.

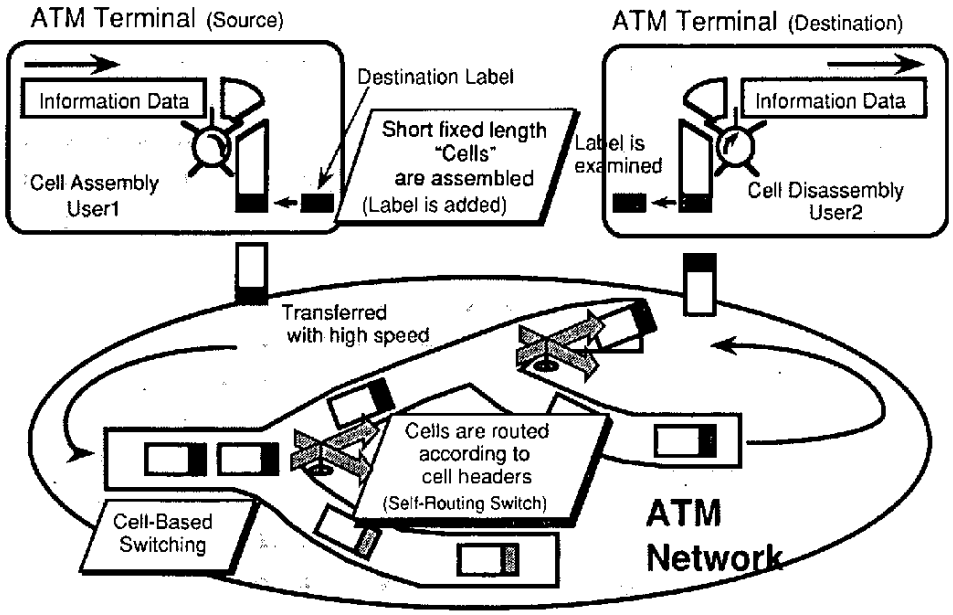

Figure 3 Mechanism of ATM

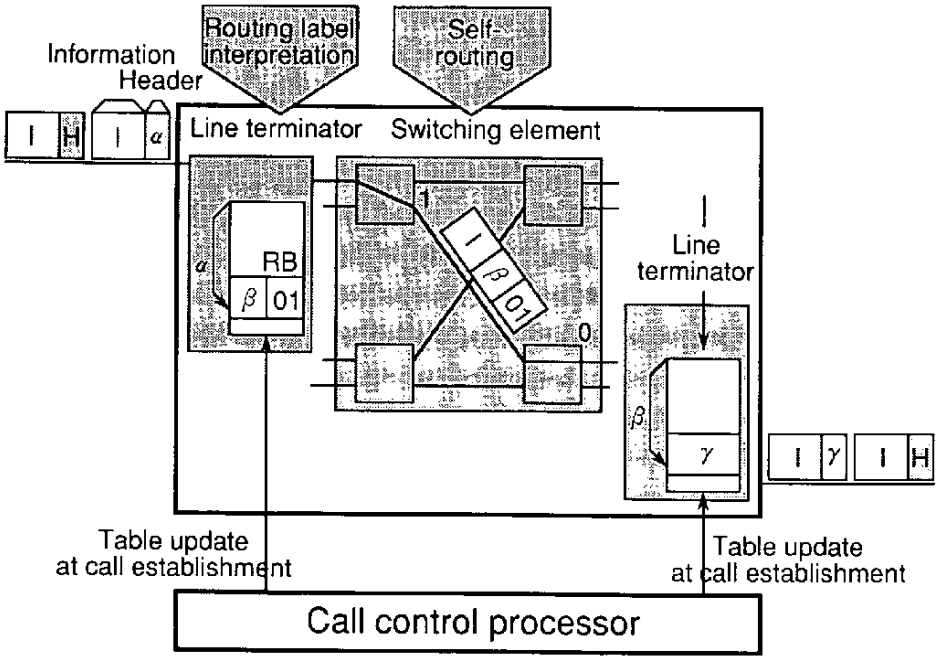

Figure 4 Principle of ATM Self-routing Switch

Representative examples of the gate type include the Banyan switches developed by AT&T and Bellcore in the U.S.A. These switches do not require internal buffers, and thus it is easy to construct element switches with a low integration level. Also, they operate at high speed, and it is relatively easy to construct element switches which avoid internal cell collisions.

PRELUDE, announced by CNET in France, is an example of a memory type switch. This ATM switch suffers from read/write bottlenecks in the memory section, where cells tend to concentrate. The complexity of the memory management arrangement also hinders attempts to work at faster speeds. This type of ATM switch is suitable for small to medium-sized switching systems.

The Owell ring provides an example of a system with a ring construction. Proposed by BTRL of Britain, this system suffers from speed bottlenecks, owing to the concentration of cells in the rings.

International Race to Develop ATM Systems

Up until 1989, engineers at communications device makers focused on integrating ATM switching functions on LSI chips, and verifying their operating capabilities. Since 1990, however, manufactures have been competing to announce trial ATM systems with subscriber interface devices and terminals for commercial applications.

The reason behind this is that the basic recommendations for B-ISDN standards were determined at the CCITT (Comité Consultatif International Télégraphique et Téléphonique) SG XVIII general meeting held in December 1990, thus standardizing hardware design requirements.

NTT began studying ATMs in 1986 and developed a full-fledged ATM switching system in October 1989 (Photo 1). This experimental system is composed of an ATM switching system, an ATM ring system, an ATM terminal, an ATM cell assembly and disassembly device known as CLAD, plus a system for conversion from conventional interface to ATM interface (see Figure 5). This is the world's first total network system that is connected to HDTV (high-definition TV) and multimedia terminals (Photo 2).

NTT unveiled this ATM system at Telecom 91 (sponsored by the International Telecommunication Union), which was held in Geneva, Switzerland, in October 1991. The ATM system exhibited a "live presentation" of future communications technology using B-ISDN; this show attracted many visitors.

B-ISDN Development Scenario

Although the CCITT determined the basic B-ISDN recommendations in 1990, many technical issues still remain unresolved, and many items must be standardized before an actual, full-scale B-ISDN service can be made available. Some of these issues are: dealing with cell discard in an ATM network; how to prevent delay time even longer than in conventional circuit switching; and how to eliminate time delay variations. In addition, various requirements for maintenance and operation must be prescribed for commercial applications.

Common carriers and suppliers throughout the world are addressing these problems, and the CCITT is expected to issue the first edition of its

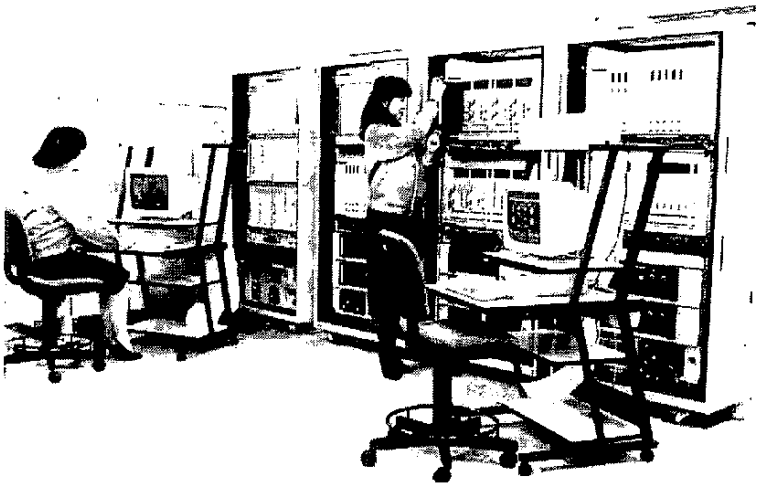

Photo 1 Experimental ATM System

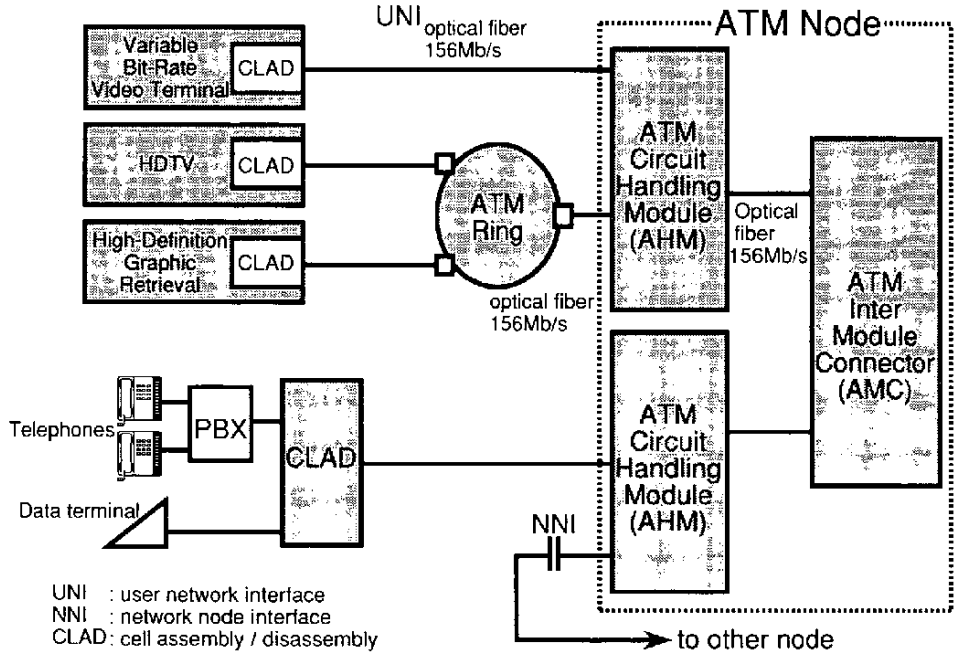

Figure 5 Experimental ATM System

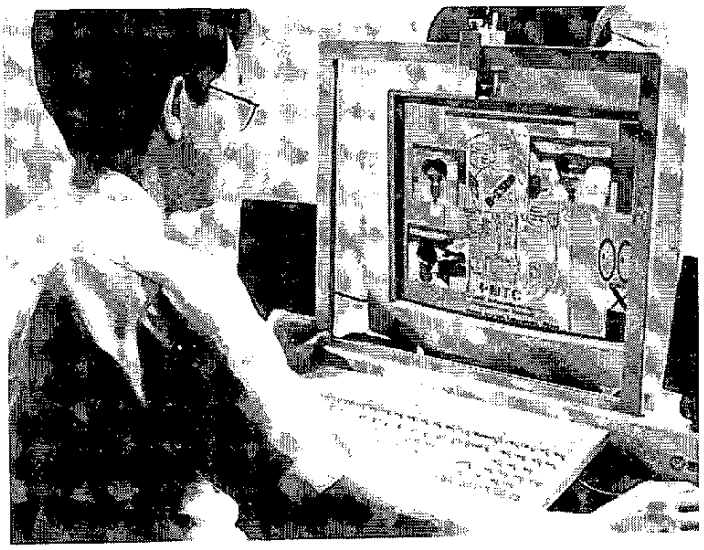

Photo 2 Multimedia Terminal

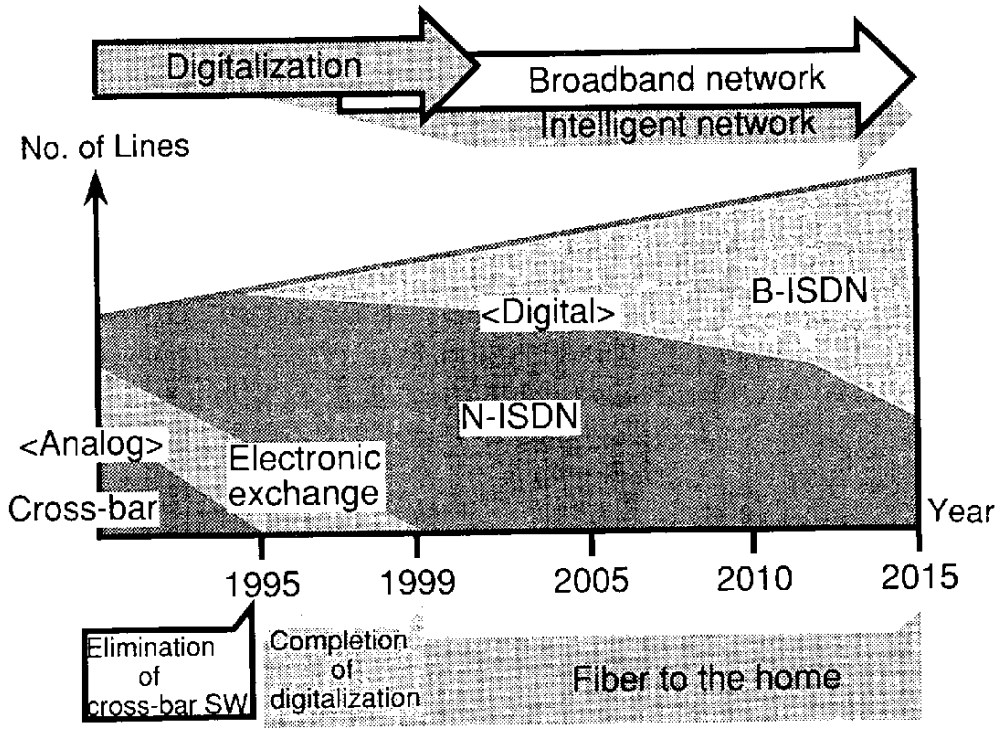

Figure 6 Network Evolution

recommendations at the end of 1992. Trial service may be ready to start before the issuance of final recommendations scheduled for 1996, as was the case for today's ISDN.

Toward the middle of the 1990s, and at latest by the late 1990s, service providers will begin to offer special wide-area ATM services on a limited basis, in response to business demand, and part of the existing N-ISDN trunk line network may be replaced by a large capacity ATM trunk line network around 2000 (see Figure 6).

B-ISDN and the User

The applications that are expected to become possible with increased transmission volume are targeted mainly at video data communications; this holds true for ISDN, Frame Relay, SMDS, and B-ISDN. In some respects users do not know what the differences are there between these media as options for solving their problems.

Although B-ISDN could be positioned as a basic infrastructure for society in the future, for it to be introducted smoothly, it will be necessary to clarify its meaning for users.

1. QUESTIONNAIRE RESULTS

(1) B-ISDN Research Study Group

In 1991, the B-ISDN Study Committee of the Ministry of Posts and Telecommunications distributed questionnaires to companies listed on the Tokyo Stock Exchange. An investigation of the replies shows that while many of the companies wish to use B-ISDN, many do not know how to use it.

For applications that offer an extended version of a current service, companies can get a concrete idea of what the applications have to offer. Therefore, companies are eager to introduce these future applications. However, they hope that the prices of these future applications will be less than or equal to those of the current applications.

On the other hand, when it comes to the new applications, specific to B-ISDN that will be available for video transmission and multimedia, etc., it is difficult for companies to form a concrete picture of what can be done with these applications. They cannot familiarize themselves with these applications without trial and error, and as a result, they are relatively unwilling to purchase them.

Therefore, NTT may well promote installation of B-ISDN by focusing on applications designed to offer an extended version of current services. If this is the case, it is evident that the pricing of these applications will be of great importance.

(2) JIPDEC investigation

In 1990, JIPDEC investigated the companies listed on the Tokyo Stock Exchange. The results indicate that 23.6% of these companies wish to use B-ISDN as a new information/communication media, and that next to optical disks and IC cards (storage media), the next greatest need is for wireless media such as satellite communications and wireless LAN, etc., which feature broadcasting capability or ease of use (see Figures 1 and 2).

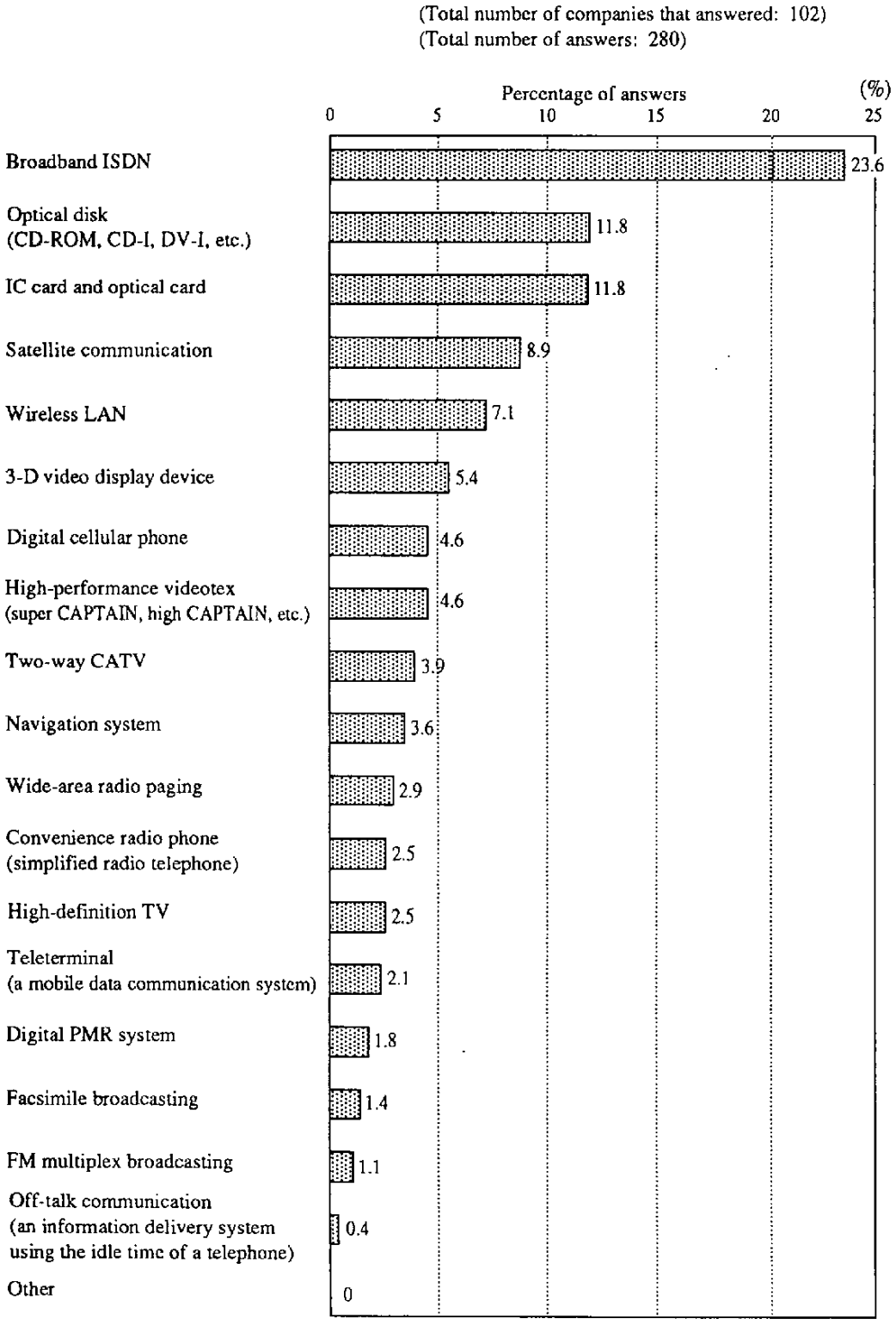

Figure 1 New Media that General Industries Wish to Use

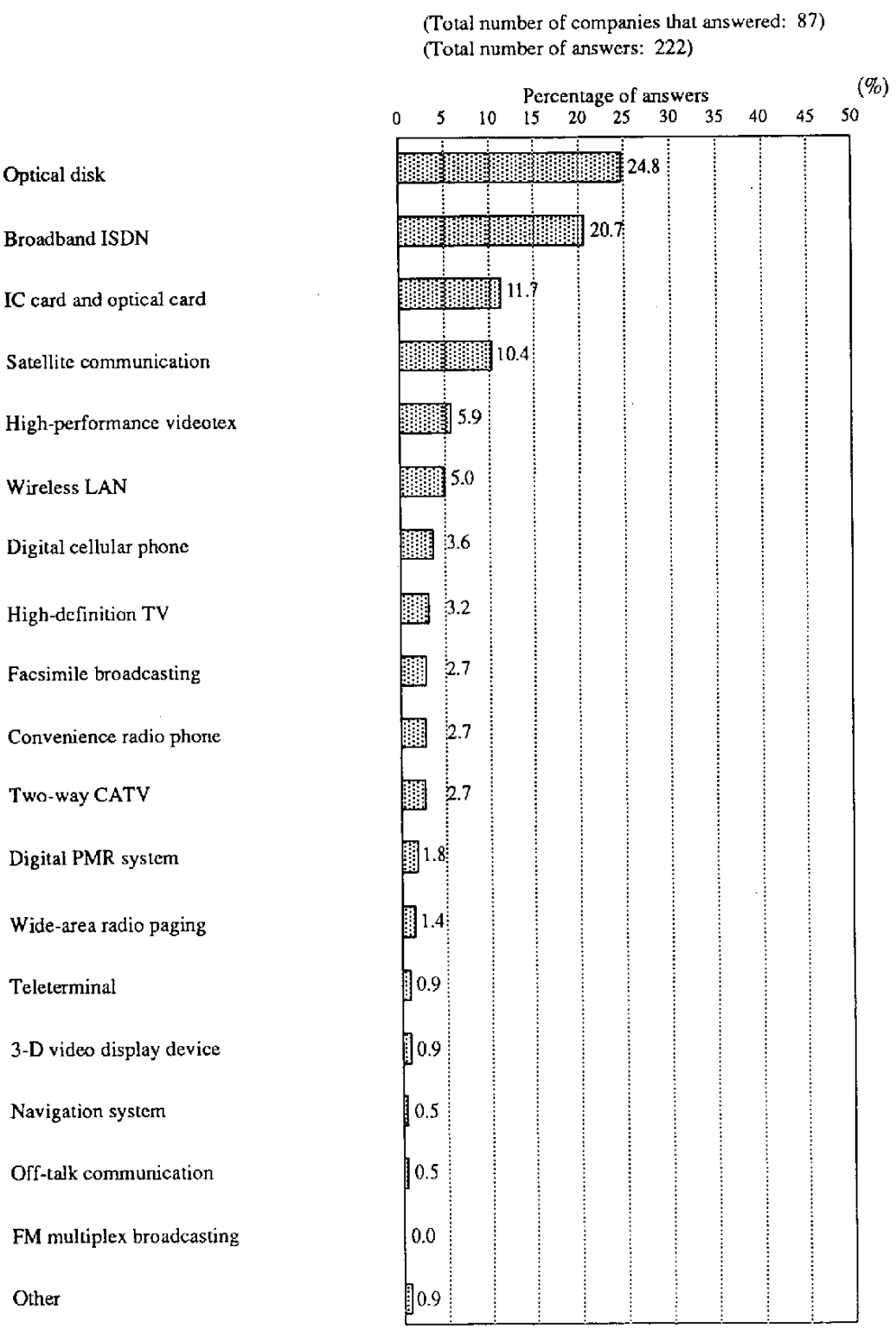

Figure 2 New Media that Information Vendors Wish to Use

Investigation into what type of new media are desirable shows that the answers from general industries are more abstract than those from the information service industry. The information service industry is keenly interested in multimedia services, and the expectations of the information service industry for multimedia services seem to be quite high (see Figures 3 and 4).

Naturally, general industries hope that new media will be user-friendly and inexpensive.

ISDN is not the only method available for solving the problems that confront companies. Companies need not rely on B-ISDN to solve all their problems. Instead, users would use different media, or combined media, for separate applications.

If services of the same quality are offered by various media, those media will compete with each other. As a result, the most cost-effective medium will be the one that survives in the application area.

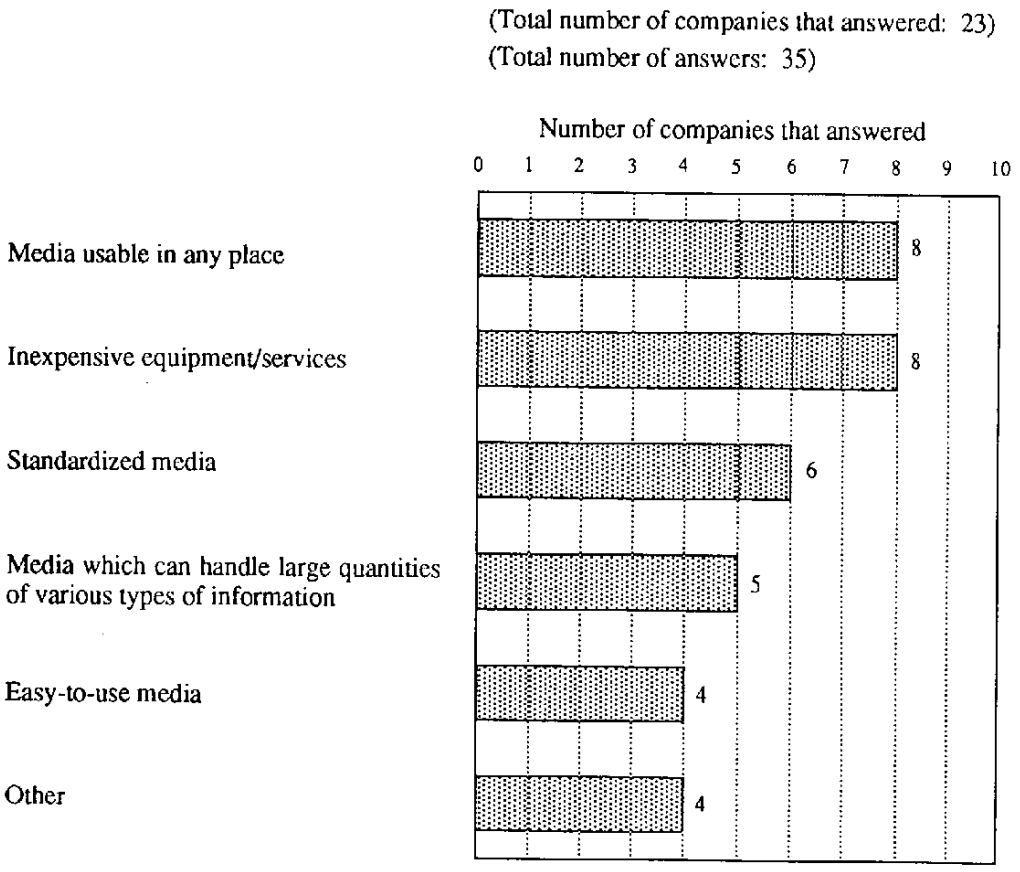

Figure 3 Kinds of New Media that General Industries Would Like to Have Available

(Total number of companies that answered: 25)
(Total number of answers: 31)

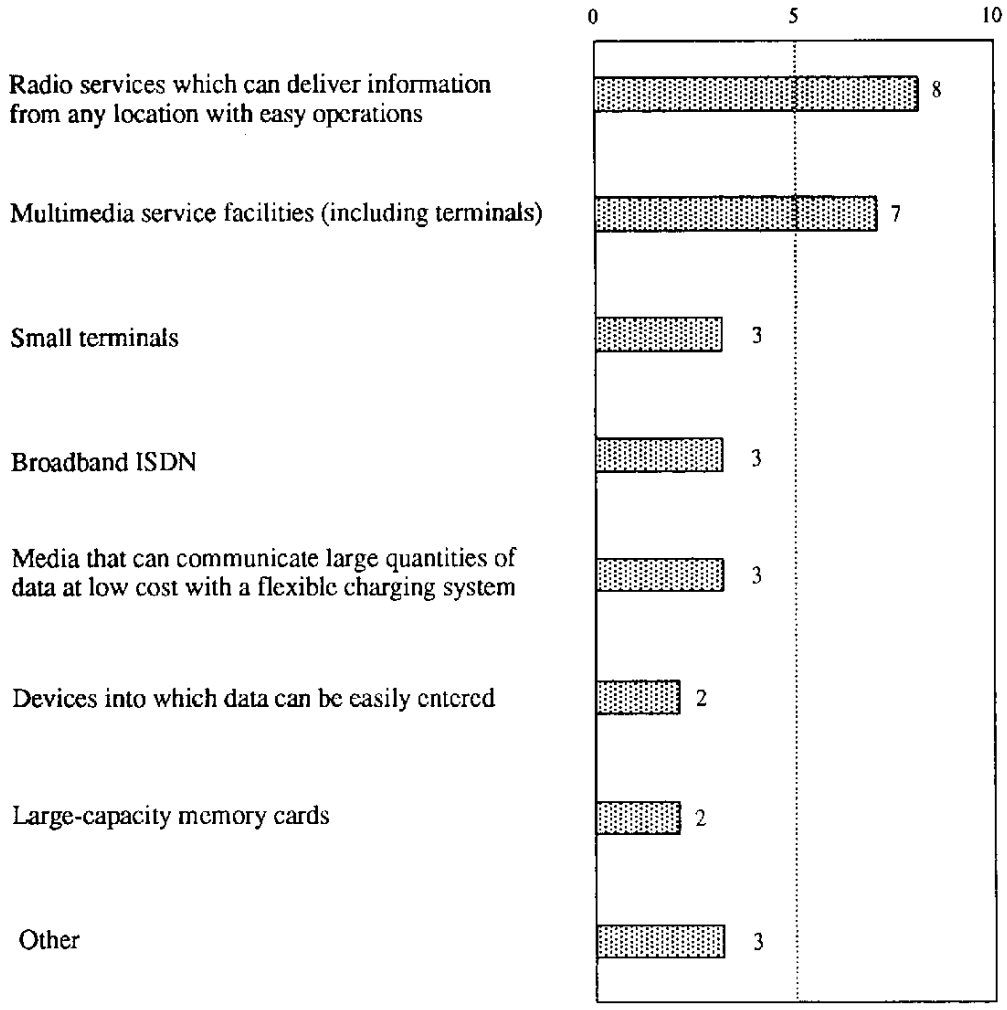

Figure 4 Kinds of New Media that the Information Service Industry Would Like to Have Available

Although it is certain that B-ISDN has diverse possibilities technically, there will still be a medium best suited to each application. For example, B-ISDN enables HDTV broadcasting. However, radio transmission costs much less than transmission via cable. In addition, transmission via cable becomes less efficient as the number of users, to which information is sent simultaneously, increases.

Therefore, it is necessary to think about the most economical, effective usage of information and communications media from the applications viewpoint, rather than discuss the situ-

ation only from the media side. It will be interesting to see what will happen to B-ISDN and the other media in the separate application areas.

3. DEMAND

Everybody will want to use a thing if it looks useful. If you ask people "Would you like to use this?," they will answer "I would like to use it." However, when it comes to actually using something, the real issue is cost effectiveness.

A rough idea of what kinds of applications will utilize large-capacity lines can be gained by looking at LAN applications.

Therefore, it is more important to specify what the approximate costs will be than to define the applications.

There has been some discussion on who will bear the construction cost of B-ISDN . However, newspapers and magazines seldom discuss what the usage charges will be or what they should be. If the prices for applications are unreasonable, it will be impossible for the technology to evolve normally.

It will not necessarily be the case that all of the possible applications will have already been developed at the point when B-ISDN services are first started. As B-ISDN use is extended, more applications will be added, including unexpected ones. Therefore, the vendors should make it a first priority to offer the users B-ISDN as a tool at a reasonable charge.

4. CORPORATE ACTIVITIES

In August 1992, the Japan Telecommunication Industries Federation submitted to the Minister of Posts and Telecommunications the following recommendations with regard to reformation of the telecommunications infrastructure:

1) If B-ISDN cannot be implemented by the private sector alone, governmental support will be required. Therefore, the government should lay down guidelines on its long-term policy for reform of the telecommunications infrastructure.

2) The government should give investment incentives for the construction of subscriber fiber networks.

3) The government should review the legal framework of telecommunication and broadcasting, etc.

4) The government should finance projects and reform the taxation system for such purposes as installing underground transmission cables and promoting the uniformity of services on national level. The government should also study the feasibility of establishing a reserve fund and a consolidation fund for portions of the infrastructure which will be difficult to provide through open competition.

Meanwhile, the Association for the Promotion of New Generation Network Services was established in 1992. It consists mainly of common carriers and electronic device manufacturers. The association has two purposes: to promote experiments that are needed for the realization of B-ISDN; and to develop technologies for utilizing B-ISDN. In August, an outline of their experimental projects was summarized as follows:

1) 1st term (1994 -)
Execution of such experiments and activities as promote public awareness.

2) 2nd term (around 1996 -)
Execution of application usage experiments, mainly specific-user-oriented applications, such as for business use. These experiments will be at the stage where the ATM switching technology, based on the CCITT Recommendation, can be provided to dedicated networks and enterprise networks.

3) 3rd term (around 1998 -)
Execution of full-scale experiments including general users. These experiments will be at the stage where network services, using the ATM switching technology based fully on the CCITT Recommendation, are provided.

It is expected that about 50 companies, such as electrical equipment manufacturers, NTT and other telecommunications enterprises, gas companies, power companies, printing companies, and broadcasting companies, including the Ministry of Posts and Telecommunications, will participate in these experiments.

Current News

*** Foreign-affiliated computer makers strengthen R&D activities in Japan.**

One after the other, various foreign-affiliated computer makers have been moving to strengthen their R&D systems in Japan. These activities are based on the judgement that Japanese manufacturers' hardware technology must be utilized in order to develop products that meet the new requirements of the market for downsizing and multi-media.

Japan Olivetti has invested ¥8.5 billion to establish a new R&D center in Yokohama. This center will engage in software development for the Japanese market. At the same time, they will evaluate Japanese manufacturers' commercialization techniques and size reduction technologies in close cooperation with the R&D organizations at Olivetti.

Sun Microsystems Computer Co. (SMCC), the American subsidiary of Sun Microsystems (U.S.) in charge of manufacturing and development, has opened a technological development center in the Kawasaki Science Park. The center is under the company's direct control, and is the first establishment of this type established outside the U.S. Sun is researching multimedia applications, mainly for WSs. They will now study the possibilities of forming tie-ups with Japanese enterprises in such fields as input devices (keyboards and pen input devices), displays, peripheral equipment, portable products, and household electrical appliances.

*** MITI announces results of computer installation survey.**

According to the results of a computer installation survey conducted by MITI, 2.72 million computer systems were installed by 39 enterprises in 1991, including foreign-affiliated enterprises, amounting to a total of ¥4.2148 trillion. This figure includes both domestic shipments and exports. Due to the downsizing trend, small machines such as personal computers and workstations accounted for 30.5% of the total in monetary terms. MITI predicts that the small computer share of the market will continue to increase gradually.

Previously, MITI's "Computer Installation and Trade-in Survey" covered only general-purpose computers. However, coverage was expanded to include personal computers, WSs and office computers because of the increasing demand for small machines. At the same time, enterprise coverage was expanded from 12 to 39 manufacturers, comprising 28 Japanese and 11 foreign-affiliated makers.

According to this survey, exports accounted for 5.4% of total installation. When installations are classified by user, the public sector, such as

central and local governmental offices, accounted for 18% of general-purpose computer installations, but only made up slightly less than 7% of mini computer, office computer, and WS installations.

MITI plans to perform the survey using the new method every quarter and will announce the results.

*** Canon and IBM tie up in the small computer field.**

Canon and IBM have reached an agreement for a comprehensive tie-up in the field of small computers such as personal computers and WSs. As a first step, they will jointly develop notebook-size personal computers with built-in ink jet printers having very small print heads, by combining Canon peripheral equipment technology (printers, color copy machines, etc.) and IBM computer technology. Initially, Canon will assemble the products at plants in Asia in order to lower production cost. The possibility that machines will be manufactured in the U.S. by licensing the original Canon "bubble jet" ink jet method to IBM is under review. The developed products will be marketed worldwide under both the Canon and IBM names.

Original technologies by Canon include high dielectric LCDs (liquid crystal displays), a promising technology for next-generation computer displays, and opto-magnetic disks for external storage. Canon and IBM will jointly develop small computers, such as PCs, through mutual disclosure of technology.

IBM is promoting restructuring through the formation of tie-ups with other enterprises. Canon currently dominates the world market for small ink jet printers and is aiming at computer business expansion through utilization of this printer technology advantage. Shared interests between the two companies led to the tie-up.

*** IDO and Cellular Group agree to connect communication networks.**

Nippon Ido Tsushin Corporation (IDO), a new common carrier engaged in the car and portable telephone business, and the eight companies in the Cellular Group have agreed to connect their communication networks.

Since the liberalization of telecommunications in 1985, all new entrants into the mobile telephone arena other than NTT (currently under the name NTT Do Co Mo) have divided the market on a regional basis, under the administrative guidance of the Ministry of Posts and Telecommunications. At present, IDO, which is affiliated with Toyota Motors, covers Tokyo and 12 prefectures in the Kanto area and a part of the Chubu region, while the Cellular Group (affiliated with Daini-Denden Inc.) has divided the remainder of Japan into eight areas, one for each of the eight enterprises in the group.

Up until now, calls from IDO or Cellular Group telephones have been able to connect to the telephones of the same carrier and to NTT telephones, but not to telephones based on one of the other new common carriers. When a portable telephone was taken outside of the company's marketing area, calls could be connected to NTT, but connections could not be made to other common carriers. However, the new common carriers are rapidly increasing their share of the car and portable telephone market. They accounted for nearly 40% of the 1.37 million portable telephones as of the end of March, 1992. In view of this increase in users,

the new common carriers have been considering connecting their networks in order to expand and improve service. After reaching an agreement on necessary items including connection charges, they decided to execute connections before the end of 1992. As a result, IDO subscribers and Cellular group subscribers will soon be able to communicate with each other. Some telephone models will operate even when taken into other marketing areas.

*** NEC and Sony WS software protocol adopted by three makers**

Olivetti, Silicon Graphics (SGI), and Sumitomo Electric Industries have decided to adopt the software protocol jointly drawn up by NEC and Sony in May, 1992, thus in effect creating an enterprise group with the aim of sharing WS application software in the Japanese WS market.

The protocol produced by NEC and Sony is called the Japanese Common Application Binary Protocol (OCMP). It specifies procedures for guiding operations with pictures and graphics, based on the "SVR4", a typical UNIX OS, as well as Japanese language conversion procedures. Olivetti, SGI, and Sumitomo Electric Industries will adopt this protocol for WSs sold in Japan. As a result, any application software developed in compliance with this protocol will be usable on any WS series by the five manufacturers.

Olivetti and two other makers use the MIPS (U.S.) RISC (reduced instruction set computer) as the CPU for their WSs, as do NEC and Sony. Therefore, these companies have been studying the adoption of this protocol to promote the development of applicable software.

Sun Microsystems has sold about 30,000 units in the Japanese WS market, including OEM sales to Fujitsu and Toshiba. The five enterprises which form the new group have altogether sold about 35,000 units, accounting for 30% of the market. Thus they will now surpass Sun, becoming the leading market power.

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Total: ¥ _____

○ **I will make a payment as follows:**

☐ Bank funds transfer
Bank Account: Mitsubishi Bank, Toranomon Branch
Account Number: Futsu Yokin 0000739
Account Holder : (Zaidan Hojin)
Japan Information Processing
Development Center (JIPDEC)

☐ Check enclosed

Signature: _____ Date: _____

Name: _____

Position: _____

Company: _____

Address: _____

Tel: _____ Fax: _____

Japan Information Processing Development Center