1 通信分野における日本の国際協力の取り組みについて

Japan's Current International Cooperative Efforts in the Telecommunications Field

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1. Cooperation with International Organizations

I would now like to touch on the types of cooperation Japan offers to international telecommunications organizations. As you are aware, the two leading international telecommunications organizations are the ITU, headquartered in Geneva and the APT, which oversees Asia.

As for our relationship with the APT, since its establishment, Japan has continued to actively support APT projects through the reception of researchers and trainees, the dispatch of specialists, and the hosting of various seminars. Japan intends to maintain its high level of support for APT activities on various levels.

And, as we all know, the ITU plays an important role through such facilities as the CCIR and CCIT.

As Director-General Shioya mentioned in his talk, Japan would like to lend the ITU telecommunications development center various forms of assistance. In 1986, Japan donated an unprecedented 200 thousand US dollars, the largest contribution ever by any affiliated country. We are making efforts to meet that donation again in 1987. In addition to providing aid for the management of the center, we see the need to help assist in developmental projects, and are currently in the process of solidifying our domestic framework to handle this.

2. Basic Research Preceding the Promotion of International Cooperation

In order to promote the most efficient forms of financial and technical cooperation, the Ministry of Posts and Telecommunications undertakes various pre-initiative surveys and research. Today I will outline these surveys in brief. First I would like to touch on our rural telecommunications.

(1) Fortifying Telecommunications Networks in Rural Regions

There are approximately 600 million telephone subscribers throughout the world, three-quarters of whom are concentrated in nine developed countries. This reflects the substantial gap between developed and developing countries in terms of the dissemination of telecommunications services. At the same time, in many developing countries, telecommunications services are centered in urban districts, leaving rural regions, which account for an average of 70 percent of national land space, without the benefits of telecommunications.

The lack of full-fledged demand in the rural districts of most developing countries makes it difficult for the telecommunications business to be profitable. And the harsh climatic and geographical conditions and the absence of sufficient electrical power supplies simply make matters worse. Thus, the establishment of

telecommunications network projects in these regions entail many problems.

To cope with the growing demand for telecommunications network systems in rural districts, Japan has begun to tackle problems related to this issue by clarifying local needs accurately and developing low-cost systems suited to specific conditions in rural regions. As part of this effort, the Ministry of Posts and Telecommunications convened sessions of the study group on rural telecommunications systems in developing countries for two years from March of 1984.

After a series of discussions on ways of introducing and disseminating telecommunications in rural regions, the study group recommended a low-cost and easy-maintenance digital multiple-access system (MAS). This recommendation and the results of the discussions were compiled into a report in March of 1986. These results were also announced at such international organizations as CCITT GAS 7 and APT SG II. The Ministry is ready to exchange views with other groups and organizations at home and abroad on the implementation of pilot projects and prospects for Japanese cooperation.

(2) Implementation of Long-term, Comprehensive Guidelines for International Cooperation in Telecommunications

Today, Japan and other advanced countries are rapidly shifting toward advanced information societies which offer diversified communications services. In contrast, many people in developing countries do not even have access to telephones, the basic means of communication. Such delays in telecommunications pose a large bottleneck to economic and social developments in developing countries and also block the smooth flow of information on a global scale.

Under these circumstances, it is necessary to build up necessary hardware and software; that is, telecommunications networks and the experts and engineers needed to maintain and operate them.

Nonetheless, many developing countries face difficulties in obtaining funds and the technological expertise required for the build-up of the telecommunication infrastructures. From this viewpoint, Japan and other advanced countries are looked to to provide both financial and technological cooperation. As far as Japan is concerned, further discussions on ways of expanding international cooperation in telecommunications are in order.

From this standpoint, last July the Ministry established the "Study Committee on International Cooperation to Telecommunications Projects in Developing Countries" which discussed major problem areas. The committee compiled a report this June.

The report made a number of recommendations: first, the importance of international cooperation in telecommunications should be publicized at home and overseas through intensive PR activities. Second, policy-making guidelines must be set on intra-regional or international cooperation and the scope Japan can cooperate in developing advanced telecommunications networks such as local / long distance telephone networks, rural community telephone networks and the ISDN. Third, technical cooperation in networks and innovatative projects should be maximized, and financial cooperation, including staff training and domestic production in the developing countries, should be raised. Regarding staff training in particular, the need to establish special training centers in Japan to accept trainees and researchers in the field of telecommunications technology from developing countries was raised. In addition, the Committee suggested greater cooperation with world institutions (like the Workd Bank) and more opportunities for discussions on policy matters with other international bodies such as regional telecommunications federations.

The Ministry is determined to continue its efforts in developing and consolidating international cooperative activities based on those suggestions in the years to come.

(3) Joint International Research on ISDN

Some North American and Western European countries predict that ISDN will become the fundamental framework of the advanced information society, and are actively examining its introduction. Certain Asian countries are also interested in constructing ISDN and are already using it on a trial basis or examining pilot projects.

Internationalization of information and communication networks is proceeding apace with the rapid internationalization of the social and economic spheres. In introducing ISDN, it will be necessary to conduct mutual joint research with related countries so as it construct internationally adjusted communication systems.

For this reason, Japan believes it is necessary to promote joint international research on ISDN. It would also like to announce the results of such research at ATP and other comparable bodies, so as to contribute the development of the telecommunications technology in the Asian and Pacific regions.

(4) Feasibility Studies of Mobile / Radio Telephone Systems for Developing Countries

While the developing countries have urgent needs and interests in establishing such efficient telecommunications networks as intra-city and inter-city networks or rural telecommunications networks, the numbers of projects have not met the growing demand due to limitations in the foreign reserve and the number of qualified staff.

As a result, some developing countries have begun to introduce or consider the possibility of establishing mobile radio telephone networks, which are less costly and time consuming, as a supplement to large-scale city telephone networks which are bound to require a huge amount of funding and time.

In addition to the advantages of less cost and time, this type of telephone network system also boasts greater accessibility, since the user can communicate anywhere and anytime. With such accessibility, the future demand for this service is expected to grow rapidly in the developing countries.

Meanwhile, about a hundred thousand automobile telephone or mobile radio telephone units are in operation at present in

Japan. And another type of mobile telephone system with lower fees is currently under development.

It seems, therefore, mutually beneficial to collaborate in the introduction of mobile radio telephone systems by making best use of our R&D experience to grasp and meet the needs of those countries.

From this point of view, the Ministry established the "Committee on Mobile Radio Telephone Systems for Developing Countries" this June to investigate the technical and economical feasibility of establishing mobile radio telephone networks in the developing countries. A report is due this coming November.

3. Conclusion

As I have explained briefly, Japan holds itself responsible for taking the initiative in a wide range of international cooperative activities in telecommunications. As such, the Ministry of Posts and Telecommunications is prepared to collaborate continuously and extensively in this field.

Regrettably, however, telecommunications is not always given a high priority among international cooperative matters. I hope all participants in the Seminar encourage your own governments to

grant telecommunications a higher priority. In Japan, the Ministry of Posts and Telecommunications will try to convince related ministries, agencies and institutions of the importance of international cooperation in telecommunications. And last, but not least, the ministry will make continued efforts to obtain more government funds for overseas telecommunications assistance.

Thank you for your kind attention.

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2 ISDNについて

ISDN (Integrated Services Digital Network)

- New Horizon of Advanced Telecommunications -

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Introduction

So far, different communication networks have been provided for different services such as telephone, telex and data communication. That is, networks have been constructed to fulfil their specific purposes. However, the concept of ISDN is completely different from that of existing networks.

As its name suggests, ISDN can provide customers with a variety of services such as telephone, telex and data communication in the same network. ISDN can be said to be an economical and flexible approach to implementing various communication services by means of a digital transmission network.

1. What is ISDN?

There are three major features which distinguish ISDN from other existing networks; end-to-end digital connections, common signalling channel, separate from information channels and standardized user-network interface.

First of all, ISDN is a digital network which can provide end-to-end or customer-to-customer digital connection at a basic rate of 64 Kbps.

It means all the exchanges and the transmission lines including those between customers and local exchanges in a network are digitalized. Digitalization of a network results in producing a capability of handling high-speed signals. Further, all signals used in the network are digital, so that signal processing is much easier. Once voice signals are converted into digital signals, they can be processed in the same way as other digital signals such as data signals.

Therefore, the end-to-end digital connection enables customers to use the network not only for voice but also for non-voice applications such as data, facsimile and video signals. Integration of services can be achieved.

Second, ISDN is a network supported by common signalling channels. D channels are provided between customers and local exchanges separately from information channels and is dedicated to transmitting signalling information. A No.7 signalling system which is a common signalling system is adopted between exchanges. This feature gives the network a variety of supplementary services. Indication of calling line number at the called terminal before answering to the call is an example of such supplementary services. This kind of service is made available by means of separate signalling channels, that is D channel.

Third, ISDN is a network which has standardized user-network interface. An user-network interface is a point where access condition between the network facilities and the terminal facilities in customer's premises is defined.

A limited set of interface are specified e.g.,

basic interface,
primary rate interface for both 1.5M and 2M systems,
primary rate H0 interface for both 1.5M and 2M systems,
primary rate H1 interface for both 1.5M and 2M systems.

Terminals which conform to the standardized interface are all compatible with each other and can communicate with any places in the world where the ISDN network is implemented.

2. Why is ISDN needed?

The largest motivation is, of course, requirement of the society. Recently information has become a key for successful business. The transfer, storage and retrival of information are essential activities to the business. Telecommunication networks currently available are not able to satisfy such requirements, because most of today's telecommunication networks have been designed, constructed and operated to cater for analogue voice transmission.

Business users tend to implement their own private networks to support their activities. ISDN is expected to meet their requirements, because it can support sophisticated customer applications over a single network in a cost effective manner.

The motivation toward ISDN also exists in the service providers (or network providers) side. Today, telecommunication services are being provided through a variety of networks tailored to each of services. Exchanges and transmission equipment are implemented for each service network. Human resources may have to be located to each service, though some of the equipment have very similar functions. If the networks currently implemented separately can be integrated into a single network, service-providers would be able to enjoy the benefit of very cost effective operation and maintenance. Another benefit which service-providers can enjoy is that they can easily accommodate new services without huge initial investment. In other words, ISDN is an basic instrument (or infra-structure) on which a variety of telecommunication services can be offered with very small incremental investment.

Users will benefit from ISDN as well. They no longer have to separately apply for each service and wait for the implementation work by the communication company. Any terminal which they want to use can be plugged into the network, as far as the terminal conforms to the standards of interfaces.

Terminal manufacturers may take the largest benefit from ISDN. Unlike the current analogue telephone network, a wide range of terminals can be supported by ISDN, using end-to-end digital connection and supplementary capabilities of the network. A big market is envisaged for terminal manufacturers.

3. How will the current networks evolve into ISDN?

Situation in developed countries and in developing countries may be different.

In developed countries, digital exchanges and digital transmission links are widely being implemented and therefore the basis for ISDN implementation will be ready nationwide. In practice, ISDN will be implemented in major cities in order to meet the requirements of large business users. Eventurely, ISDN will be expanded to residential customers, first in urban areas and gradually in rural areas later on. Evolution into ISDN would be done rather smoothly, keeping pace with conversion of the telephone network into digital ones.

In developing countries, implementation of digital exchanges and digital transmission links may not be well in progress, and therefore the basis for the ISDN has not matured yet. However, large business customers would need such an enhanced network as ISDN, in order to have successful business in the competitive business world. They may move their business activity center from a country, if the country does not provide them with such an enhanced network connected worldwide. It means that even

though a country does not have digitalized telephone network which can be easily enhanced to ISDN, it may have to construct ISDN in order not to be behind the world economy. In that case, ISDN will be implemented like an island independent of the current telephone network. The island of ISDN will eventurely expand as digitalization of the telephone network proceeds. In rural areas of developing countries, the most urgent thing may be the expansion of the conventional telephone service. Even in such a case, the expansion should be based on digital exchanges taking account of future evolution into ISDN and cost-effectiveness. Please remember that one of the reasons why developed countries are under taking digitalization of the telephone network is the cost-effectiveness.

4. Technical explanation of ISDN

4-1 CCITT Recommendations

First I will take up the status of CCITT (International Telephone and Telegraph Consultative Committee) activities in making Recommendations.

As is seen in this figure, CCITT I-series Recommendations on ISDN are divided into 6 categories; general aspects, service aspects, network aspects, user-network interface aspects, internetwork interfaces and maintenance principles.

The CCITT has been working to draft the international standards on ISDN for more than 10 years. The first I-series Recommendations were published in 1984 as a CCITT Red Book describing the reference configurations, the foundamental principles and functionality of ISDN. Currently, the CCITT is updating these existing recommendations to incorporate the detailed specifications of ISDN functions such as those of D channel protocol and of common channel signalling system No.7.

Among these categories, my explanation from now will cover general aspects of ISDN, user-network interface aspects and service aspects.

Recommendation I.120 gives the conceptual principles on which an ISDN should be based as follows:

(1) The main feature of the ISDN concept is the support of a wide range of voice and non-voice applications in the same network. A key element of service integration for an ISDN is the provision of a wide range of services using a limited set of multipurpose user-network interface arrangements.

(2) ISDN supports a variety of applications including both switched and non-switched connections. Switched connections in an ISDN include both circuit-switched and packet-switched connections.

(3) As far as practicable, new services introduced into an ISDN should be arranged to be compatible with 64 Kbps switched digital connections.

(4) An ISDN will contain intelligence for the purpose of providing service features, maintenance and network management functions.

(5) An ISDN may be implemented in a variety of configurations according to specific national situations.

4-2 User-Network Interface

A user-network interface defines the specification of data transfer between the network and user terminal. If this specification is determined exactly, the customer can use the multipurpose terminal which satisfies the condition by means of a single interface.

Concepts of the user-network interface are as follows:

(1) As stated in Recommendation I.120, a key element of service integration for an ISDN is the provision of a limited set of standard multipurpose user-network interfaces.

(2) An objective of ISDN is that a small set of compatible user-network interfaces can economically support a wide range of user applications, equipment and configurations.

(3) Another objective is to have the same interfaces used even though there are different configurations or different national regulations.

User-network interfaces are standardized on the premise where various services, such as telephone, facsimile and data communication, can be achieved. Major features of ISDN user-network interfaces are as follows:

(1) Users can select a desired service, information transfer rate, connection type, etc., on a per call basis.

(2) Using standardized sockets, multiple terminals can be connected to an interface.

This slide shows a socket expected to be employed at a standard ISDN terminal.

Users can readily use ISDN services by purchasing an ISDN terminal furnished with this socket and connecting the socket to the connector at home. Every ISDN terminal having this socket, whether it may be a telephone set or a facsimile machine, can be used everywhere so far as the connector is provided, so that a complete terminal portability is assured.

As can been seen in this figure multiple terminals can be connected to a single ISDN interface maximum 8 terminals are available.

On the other hand, in existing dedicated network such as telephone network or telex network, the terminal and interface are interconnected on a 1:1 basis.

This diagram shows a reference configuration for an ISDN user-network interface set out by CCITT Recommendation I.411. A block represents a functional group necessary for the procedure for access of the user to the network. Points S, T and R are reference points which are conceptual interface located between functional groups.

NT1 stands for Network Termination 1 and represents subscriber termination. NT2 represents switching and concentration functions of PABX, LAN, etc. TE1 stands for Terminal Equipment Type 1 and TE2 Terminal Equipment Type 2. TE1 is a standard ISDN terminal and TE2 is a non-standard ISDN terminal, or an existing terminal. TA is a terminal adapter intended for converting the interface of non-standard terminal TE2 into an ISDN interface.

In this diagram, the so-called ISDN interface points are points S and T. That is, TE1 is a standard ISDN terminal and supports the ISDN interface at point S or T.

ISDN interface points S and T are important not only because they are points which provide ISDN services as mentioned so far, but also because they are points at which the responsibility of the network operating organization is discriminated from the responsibility of the user in construction, maintenance, etc.

NT and TE are functional groups and do not necessarily have a 1:1 correspondence with actual equipment. NT1 and NT2 are often implemented by one NT equipment, and a coincident reference point S/T is generally placed between the user and network.

This figure shows an application of using one NT in place of NT1 and NT2. At an ordinary home, the ISDN interface is provided by reference point S/T in this way.

4-3 Channel Type and Interface Structure

Channel Type

Specified portion of the information-carrying capacity of a user-network interface is called a channel. Information is transmitted in the form of multiplexed digital signal through multiple channels on an ISDN interface. Channel can be classified into some types each having a common feature or features: B channel, D channel and H channel.

Among these channel types, the most basic one is B channel.

The most impotant objective of B channel is to transmit digital information at high fidelity between a user terminal and the network. B channel is a channel dedicated for transfer of user information at a rate of 64 Kbps.

Examples of user information streams on B channel are 64 Kbps voice signal and data information corresponding to circuit or packet-switching user classes of service.

D channel is a channel intended mainly for transfer of a signalling information for circuit switching.

As is mentioned before, this signalling channel provided between terminals and local exchanges give the network a variety of supplementary capabilities. D channel can also be used for data transmission through packet switching as well as for signalling information transfer.

As for H channel, 3 types of channels are defined, H0, H11 and H12 channel. Those signal bit rates are 384 Kbps, 1536 Kbps and 1920 Kbps respectively. Examples of user information streams on H channel are high-speed facsimile, high-speed data and high quality audio or sound programme material.

Interface structure

On an ISDN interface, multiple channel types can be used in combination.

The combination of channels is called the interface structure. The interface structure represents the channel structure of the maximum multiple channels across a physical interface at points S and T. In other words, it represents the access capability.

This table lists user-network interfaces to be standardized. Of these interfaces, the interface having the most basic structure is the so-called basic interface which has a channel configuration incorporating two B channels and one D channel, that is, 2B+D.

This figure shows a schematic functional diagram of a basic interface structure of 2B+D.

The two B channels are used independent from each other and can transmit such digital information as voice signals, facsimile images and data at a transfer rate of 64 Kbps. D channel is a signal link with a transfer rate of 16 Kbps and performs control of the two B channels in common. It should be noted that this figure only shows a conceptual diagram for the functions of B and D channels and does not indicate the real physical configuration.

From this table you can see that there are two types of primary interface: Primary B channel interface and primary H channel interface.

The primary B channel interface transfers information by using multiple B channels and is called a multiple interface. For the channel structure of the primary B channel, two types of channel structure are set out: 23B+D and 30B+D. This is because two types of transmission system are used as the international standard systems: the 1544 Kbps system used in Japan, North America, etc., and the 2048 Kbps system employed mainly in European countries.

The primary H channel interface is called a high-speed interface, because H channel with as high a speed as 384 Kbps or 1536 Kbps, etc., is used. For the channel structure of the primary H channel interface, two types of system are set out as is the case with the primary B channel interface: 1544 Kbps system and 2048 Kbps system.

While the basic interface is intended for use by an ordinary subscriber, these primary interfaces are intended for PABX, or high-speed transmission such as high-speed facsimile and TV conference. The transfer rate of the D channel of the basic interface of 2B+D is 16 Kbps, but that of a primary interface is 64 Kbps.

4-4 Services supported by ISDN

An ISDN is a network which can support various services such as telephone, telex and facsimile at different transfer rates in different modes. Therefore, new service concepts and specifications, which are quite different from the conventional ones, are required to define ISDN services.

Services supported by ISDN can be roughly divided into basic service and supplementary service. Basic service includes bearer service and teleservice.

Supplementary services which support higher-level capabilities are also available by using the bearer service and teleservice in combination.

Bearer Service

The bearer service is defined as "a type of telecommunication service which provides the capability for the transmission of signals between user-network interfaces." That is, the bearer service is intended to transfer user information between two user-network interfaces.

This figure shows a conceptual diagram of the scope of the bearer service. The bearer service is a basic service to transfer and switch information, irrespective of terminal function, without information processing. In more detail, the bearer service can be said a service that transfers and switches information sent from terminals between two user-network interfaces, that is, between reference points S/T, regardless of the terminals.

Please take a look at Reference No.1. This table gives some examples of bearer services. As stated so far, a number of bearer services are available by properly combining the attribute values of bearer services. Of these bearer services, ten bearer services given in this table has been specified by the CCITT. The bearer services to which "E" is given in the "Remarks" column are essential services to be supported by every ISDN.

For example, in circuit mode 64 Kbps digital service, 64 Kbps digital pipe is provided and user information is passed to B channel and the signalling to D channel.

In circuit mode 64 Kbps speech service, A-law or u-law coded voice is transmitted and the network undergoes voice processing of echo control, etc.

In circuit mode 64 Kbps 3.1 kHz band audio service, modem signal or facsimile signal having a 3.1 kHz band is transmitted. In packet mode virtual call or permanent virtual circuit services, packet-mode data is transmitted.

Teleservice

Teleservice is defined as "a type of telecommunication service that provides the complete telecommunication capability, including terminal equipment functions for communication between users."

This shows a conceptual diagram to define the scope of teleservice. Teleservice is an end-to-end service provided by the network including both terminals. In more detail, the teleservice is a type of service provided by adding high-level capabilities provided by the network, terminals and others on the basis of the bearer service.

Some examples of teleservices are telephony, videotex, teletex, telefax-4 (G-4 facsimile), Mixed-mode (In this terminal, characters portion and picture portion of a text are transmitted in different manner.), TV phone (e.g. INVITE 64), and Telex.

Supplementary Services

A supplementary service modifies or supplements a telecommunication service by using a bearer service and a teleservice in combination. A supplementary service cannot be offered to a customer as a stand-alone service.

Please take a look at Reference 3. This reference lists all the supplementary services which are now defined by CCITT. I will take up some examples and make a brief comment on them:

- Calling line identification by which the calling number can be indicatred at the called terminal before answering the call.

- Closed user group which allows to meet various security requirement. In closed user group, only CUG members can communicate exclusively among themselves.

- User-to-user signalling which allows ISDN users to transmit user signalling information between them.

- Call completion of busy subscriber (CCBS) by which when the called subscriber is busy, both the calling and called subscribers are called up by a network as soon as the busy subscriber completes the call.

- Call Forwarding by which a subscriber can have the network send incoming calls to another number. There are several Call Forwarding depending on the condition of the terminal.

- "Malicious call identification" service is also available to specific called subscribers in which the police surveys the number of the calling subscriber and the date and time of such a malicious call by request from the called subscriber.

Combinations of various services can be accessed through ISDN user-network interfaces. This is an example of standard ISDN terminals using the special features of an ISDN. With this terminal, file transfer, text transfer, etc., are achievable for digital data while using the telephone service.

To finish up my presentation, I'd like to review the key elements of ISDN.

4-5 Key elements of ISDN in a ultimate stage

The key elements in a ultimate stage may be as follows:

- provision of a limited set of multipurpose user-network interface arrangements

- Support of integrated and enhanced multi-service terminal equipment as well as many existing terminals

- End-to-end digital connectivity at 64 Kbps and higher bit rates

- Inplementation of D channel and No.7 signalling protocols at user-network and inter-office interface points, respectively

- Provision of integrated ISDN Numbering Plan

- Interworking between ISDNs and existing non-ISDN networks such as public switched telephone networks and public data networks.

Conclusion

ISDN is an epock-making telecommunication system.

It is not a simple technological innovation but it has a great impact on our society in terms of social, economic, cultural and even political implications.

ISDN offers versatile network facilities with the maximum freedom for user application through which the global information network can be established.

The development of ISDN on a global basis is a milestone of advanced information society where human beings will be able to enjoy more creative and cultural life.