COMPUTERIZED MESSAGE SENDING AND TELECONFERENCING IN AN INTERNATIONAL ENVIRONMENT: PRESENT AND FUTURE

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RR-82-12
March 1982

Reprinted from *Electronic Publishing Review*, volume 1(3) (1981)

INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS
Laxenburg, Austria

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FOREWORD

In 1981 the International Institute for Applied Systems Analysis began a program of research on the impacts of information technology. This work was planned as a cluster of related rasks, rather than a unitary whole; and, indeed, the various activities were intended to explore various possibilities, and therefore were not necessarily predicated on the same set of technological and societal assumptions.

One of these tasks dealt with the potential uses of computer-based messaging and teleconferencing systems, an aspect of communications technology in which the Institute has had substantial practical experience, since we use both EIES (an electronic information-exchange system developed at the New Jersey Institute of Technology) and our own TELECENTER systems routinely in our work. The author of this report, Istvan Sebestyen, has played an important role in these activities. He is also a member of the three-man team that has been studying the applications and social impacts of Viewdata (Videotex) systems, including their potential for teleconferencing.

The potential social impacts of both Viewdata and computer-based messaging systems are immense – the basis for the inquiry whose results are reported here.

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Computerized message sending and teleconferencing in an international environment: present and future

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Abstract: Computerized message sending and teleconferencing techniques are presently widely used in an international environment. The paper describes the present status (experience, problems, solutions) of electronic message exchange activities at an international research organization, the International Institute for Applied Systems Analysis (IIASA), and gives a short outline of some of the future prospects in this field.

1. Introduction

Computerized message sending and teleconferencing are closely related techniques of electronic information exchange. In fact, in many systems, both techniques are implemented at the same time, computerized teleconferencing being regarded as a special type of message sending. In this paper, therefore, it is not intended to draw a clear distinction between these two functions.

Teleconferencing is a term which has different meanings. Here, computerized teleconferencing is used to refer to computerized message sending and storage systems which enable text communication by terminals and computers through a computer network among participants in widely distributed geographical locations. The basic principle of computerized message sending and teleconferencing is as follows: a so-called 'mailbox' is assigned to each user or conference participant; messages or comments on the conference made by any user of the system are automatically put into the 'mailboxes' of the other users; these messages are then 'picked up' individually, but, of course, at different times. One characteristic of these teleconferencing systems is that the exchange of messages does not usually have the fairly limited duration — say, two hours — typical of 'real' conferences: computerized teleconferences on certain subjects last, as a rule, for several weeks, or even months. Another characteristic of these systems is the 'mailbox' principle, which brings alongside both advantages and disadvantages. One disadvantage is that the message recipients — normally the passive side, if one considers the traditional communication media, such as mail, cable, telex, telephone — now have to assume an active role in order to 'pick up' the messages or conference comments from the mailbox. "If access to the mailboxes is not gained regularly, senders of messages/conference comments often become frustrated and lose interest in using the system." However, an advantage of the mailbox principle is that only the 'geographical' location of the mailbox is fixed, in the sense that it resides within a particular host computer. The recipient in

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the system may access the mailbox through the telecommunication network from any location he desires.

A computerized message sending and teleconferencing system can be regarded as a kind of new telecommunications medium which does not, however, replace the 'old' well known communication media; rather it adds a new dimension to them. This can be advantageous under certain circumstances, e.g. when documents are drafted by a group of authors in different and remote geographical locations. As communication media, computerized message sending and teleconferencing systems are perhaps most closely related to telex-type systems, the basic difference between them being the 'mailbox' principle of the former, and the fact that it also provides additional services to those of the basic telex-type functions (i.e. transmission of text to selected addresses over long distances through telex channels), such as:

(a) text preparation and modification;
(b) automatic message filing;
(c) database-like message retrieval;
(d) management of text or message flow: keeping a record of incoming and outgoing messages;
(e) special teleconferencing services (voting, handling of questionnaires, 'moderator' functions, and so on).

It is therefore, possible to make the following, rather oversimplified, statement: a computerized message sending and teleconferencing system is the combination of an 'upgraded', more complicated and reliable high-speed telex system, and a so-called office automation system. The latter type of system, based mainly on minicomputers, is currently expanding worldwide.

The function of the 'upgraded' telex service is carried out by computer networks, such as the Tymnet or Telenet packet-switching networks. It should be added that computerized message sending and teleconferencing can now be regarded as among the most important applications of computer networks. The fact that not all PTTs sufficiently appreciate this function of computer networks should also be mentioned. For example, the British PTT only recently allowed selected British users to use the EIES teleconferencing system [1], provided that they made a formal application to the British PTT.

Technically, such message sending and teleconferencing systems are built around computer programs and files located on any computer connected to the networks as a so-called 'host'. Users of such systems, namely conference participants, can access the network via terminals, such as alphanumerical displays, teletypes or even computers, and having established links to these 'hosts', the users gain access to the computer programs and files used for teleconferencing. From a design point of view, it is easiest to put all teleconferencing computer program components and data files ('mailboxes' and the database containing messages) onto one central host computer in order to gain wide terminal access throughout the computer network. This solution has been chosen by the majority of the presently running message sending and

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teleconferencing systems, such as the EIES (Electronic Information Exchange System) of the New Jersey Institute of Technology, or the Planet and Notepad systems of the Infomedia corporation [2], both located in the USA. One major disadvantage of such systems is that all the functions of the system are carried out centrally, which means, of course that, if the central computer ('host') is not operational (for instance, due to a technical failure), then access to the messages and programs is not possible. Furthermore, centralization of the normal 'office automation functions' (such as text preparation and modification) into a central computer system leads to increased data traffic between terminals and the host, and thus to an increase in total data communication rates.

At present, the 'second generation' of computerized message sending and teleconferencing systems is under development (such as the Komex system [3] of the Gesellschaft für Mathematik und Datenverarbeitung in the FRG). These systems distribute the above-mentioned functions among various computer systems in the computer network. In such systems, the datafiles (such as 'mailboxes' and the databases containing messages), and also all those functions (such as text editing and text formatting) that can be performed near to the location of the user, are first of all distributed. One characteristic of these systems is that they are more resistant to any kind of technical failure, since in such cases, only a part of the total system 'goes down' while the rest of the system, running on other computers, can continue to function and even take over partly the job of the malfunctioning computer. The telecommunication charges incurred as a result of the increased amount of local work will be less than those relating to systems of the first generation.

2. Teleconferencing in an international setting: the IIASA case

The International Institute for Applied Systems Analysis [4], located in Laxenburg near Vienna (Austria), is supported by 17 so-called national member organizations (NMOs) in Western and Eastern European and North American countries. These countries are thus widely distributed throughout the globe, thereby 'providing ideal conditions' for teleconferencing activities. In order to coordinate the Institute's research activities with those of its collaborators, i.e. national institutes or individual scientists, it is necessary to have a broad communication system between IIASA and the outside world. This function is partly based on traditional communication media (such as mail, telexes and telephones) which, equally traditionally, work badly, as a result of the 'reliable service' provided by the PTTs. The above-mentioned communication requirements of the Institute are also partly fulfilled by computers and computer networks. At IIASA, there are different types of computer communications: e.g. remote usage of computational programs, exchange of datafiles for model runs and text communication (such as message sending and teleconferencing).

Different systems for text communication have been used throughout the history of the Institute, such as the Forum system of the Institute for the Future (IFF) [5], the Planet system on the computer of the USGS (US

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Geological Survey) in Denver, Colorado, and of course the EIES system of NJIT in Newark, USA. A simplified, EIES-type, teleconferencing system called Telecenter [6] is also in operation on IIASA's in-house PDP 11/70 computer. The Institute also works in close cooperation with the 'Gesellschaft für Mathematik und Datenverarbeitung' (GMD) in Sankt Augustin near Bonn, FRG. There are plans to use GMD's distributed computer conferencing system, Komex, for a field experiment at IIASA.

As mentioned above, the EIES system of NJIT is at present the most frequently used system at IIASA for teleconferencing purposes. The current teleconferencing activities at IIASA are not always of the 'classical' type, which means that the various small groups of people communicating with one another rather seldom solve problems by computer teleconference-based discussion, as was the original idea of teleconferencing: IIASA, rather, exploits the fast and reliable telecommunication and office-automation facilities of such systems.

2.1 The following types of message sending and teleconferencing application proved to be most successful at IIASA

(a) *Simple message sending*

This 'telex-type' function, supported by smart office-automation facilities, such as text editing (entering and modifying text) and organizing, storing and filing information, proves to be most useful when access through other means of communication (telephone, telex) is at times more difficult or slower. The computer has been used for message sending, especially for our connections to Italy, USA, the Soviet Union and Hungary, at those times when no quick connection could be established through the normal channels of telephone and telex. We are fully aware that this kind of usage of remote computer lines is not very favourably looked upon by the PTTs, but sometimes we are forced to do this. We would promise to discontinue this type of usage of computer lines if the PTTs were to provide us with a reliable and quick telephone and telex service to these countries.

(b) *Joint manuscript writing*

"The writing of joint manuscripts by a small group of geographically dispersed people proved to be one of the most successful message sending and teleconferencing applications." The quick and reliable message sending capability of computer networks, and the built-in office automation capabilities of the central computer allow the joint manuscript writing process to be most effective. In the summer of 1979, for instance, a joint 'working paper' of around ten pages was prepared by A. Gruebler of IIASA and R. Sheldon of EWRSI in Honolulu (Hawaii) within two weeks. The Survey Project at IIASA is at present broadly discussing manuscripts, as well as transmitting and modifying sections of them for chapters of the *Handbook of Applied Systems Analysis* and for volumes of the *International Series on Applied Systems Analysis* published by John Wiley & Sons. The 'office-automation' functions that proved to be most successful when preparing joint manuscripts were text editing and text formatting (formatting material which has been entered or modified by text editing).

(c) *Administrative management of joint projects*

Very positive experience has been gained at the Institute in the field of administrative

management of joint projects by computerized teleconferencing systems. Not only do these systems allow quick information exchange among many participants, but also through the capabilities of these systems, e.g. filing, keeping records of information (such as letters, protocols, text, documents, addresses etc.) and their more specialized 'office-automation' functions (such as maintaining appointment calendars, action notices, scheduling aids etc.), a set of useful management tools has been established in addition to the basic message sending functions.

The decision-making process relating to projects carried out by international organizations is generally very long as these decisions, being made not only by one person or one central organ, are usually of a very democratic nature; therefore it takes much longer to arrive at final decisions. The wide geographical distribution of the decision makers leads to fuirther long delays. This is not meant to be a complaint, but rather a fact. For instance, in order to initiate a UNDP, UN specialized agencies (e.g. UNESCO), the UNDP country representative and the governments and governmental agencies involved. We believe that the management of such projects can be improved significantly with the support of computerized message sending and teleconferencing systems.

One successful experiment of this kind using teleconferencing was the preparation of the large IIASA-RSI Conference [7] early in 1979. For this experiment, scientists from EWRST, Hawaii and from our resources and environment area, using a teleconferencing system on the computer at the US Geological Survey in Denver, Colorado, made all the necessary preparatory managerial arrangements for a large conference on mineral resources, which was later held at IIASA with great success. Similar projects of this kind are at present being carried out.

One interesting application of teleconferencing presently used at IIASA is associated with the operation of the Institute's external computer links. The Telecenter teleconferencing system on the inhouse PDP 11/70 computer is used for exchanging and filing messages relating to the operation of IIASA's network. A special conference on Telecenter has been set up for this purpose and all operators of IIASA's network nodes, including Moscow, Prague, Budapest, and IIASA itself are participants in this conference. The exchange of daily messages, such as: 'IIASA's PDP computer will not be operational on the afternoon of Friday 13th January', or the scheduling of remote computer resources for the following week, are typical applications.

(d) *Teleconferencing in the 'classical' sense*

Surprisingly, our experience of 'classical' teleconferencing activities, i.e. discussions by a group of geographically dispersed experts on a certain problem and contributions by these decision-makers toward its solution, is rather limited in comparison with other types of message exchange applications. One of the reasons for this is that the 'telecommunications infrastructure' at IIASA is still expanding. It is hoped, however, that the number of future teleconferencing activities of a 'classical' nature will increase.

2.2 Problems connected with, and deficiencies in, the usage of present teleconferencing systems

In the preceding sections, the advantages of computerized message sending and teleconferencing systems were shown. Although the picture is in general optimistic, the various problems we encountered when using these systems should be pointed out at this stage:

(a) *Lack of standards*

Lack of standardization of the routine functions relating to message sending and teleconferencing systems has led to the necessity of learning as many different text editing, text formatting, message sending, and text retrieval languages as there are systems to be used. One of my colleagues recently complained that he was 'sick and tired' of learning five different text editing, text formatting and

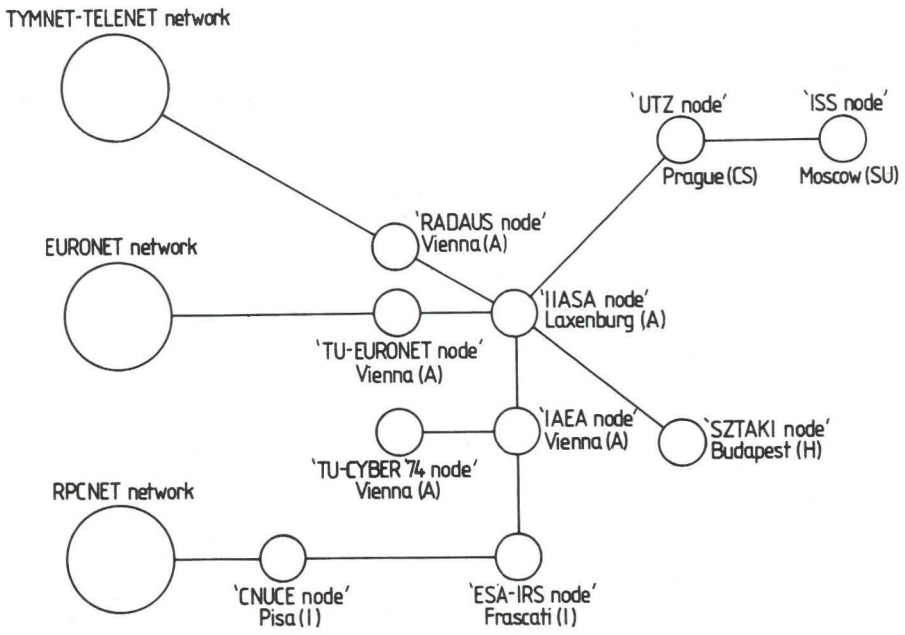

Fig. 1. *IIASA's external computer links.*

message sending systems with the same functions. A lack of standards also makes it more difficult to link local text editing systems to remote message sending and teleconferencing systems. No standard for file transfer exists, which should be one of the most essential and important functions. Much has still to be done in this field.

(b) *Insufficient geographical coverage of computer networks*

One of the most serious problems IIASA faces with regard to teleconferencing is insufficient geographical coverage of the computer networks available at present for this purpose. This is the reason why IIASA does not at present operate its own teleconferencing system worldwide, using mainly the EIES teleconferencing system of the NJIT in the USA. Today the widest geographical coverage of computer networks is obtained if a US host computer with appropriate teleconferencing software is chosen. In this case, 14 out of the 17 national member organizations of IIASA may access the host. Under this arrangement, North America, Japan and Western Europe are fully covered; Eastern Europe may have access to the Austrian node of Tymnet/Telenet through the so-called 'IIASA gateway'. The necessary arrangements with the selected host, the telecommunication carrier and IIASA must, of course, be arranged previously. It is hoped that Eastern European coverage through existing lines to the USSR, Hungary and Czechoslovakia, and through the establishment of the planned new computer line to Bulgaria, will bring almost all IIASA's national member organizations together in a common teleconferencing system (Fig. 1).

"There are many systems available and many under development."

IIASA also hopes to run its own 'Teleconferencing Center'. For this purpose, we are now successfully experimenting with teleconferencing software systems on the inhouse PDP computers, such as Telecenter, and are planning to carry out field experiments with the GMD teleconferencing system, Komex. However, the geographical coverage of a host computer at IIASA in Laxenburg is at present limited: Eastern Europe, with its existing (Budapest, Moscow, Prague) and future (Sofia) computer lines, is more or less covered, or will be covered; North America is also covered; however, Western Europe is not, since as a result of the PTT's restrictions, access from a European terminal to a European host via Tymnet/Telenet is not permitted, although technically feasible, and although the IIASA computer centre is a host on the Tymnet/Telenet network. In order to cover a substantial part of Western Europe, it is necessary to wait until there is the possibility of Austrian host connection to Euronet, the computer network of the European Communities. This, we hope, will take place in the summer of 1982. Therefore if Telecenter is used, only 8 out of IIASA's 17 member countries will be able to have access to our inhouse computer. A further problem is also the fact that Euronet, in its present phase, is restricted to database applications; it is hoped, however, that within the framework of an experiment, IIASA will obtain the permission of the Communities to use Euronet for teleconferencing purposes. It is generally to be expected that, in the next couple of years, the situation with regard to insufficient geographical coverage will improve.

(c) *Lack of appropriate teleconferencing software*

As mentioned earlier there are many systems available and many under development. Most of the systems with good message sending capabilities have only primitive 'office automation' facilities, or vice versa. At present, in our opinion, the most advanced operational teleconferencing software systems accessible from IIASA are the EISE system of NJIT and the Notepad system of the Infomedia corporation. Nonetheless, there is ample room even for their improvement: first and foremost, there is a need for more decentralization and better file transfer facilities. It is hoped that the 'second-generation' computer software mentioned earlier will fill these gaps.

(d) *Problems of man-computer communication*

As IIASA is a scientific institution, most scientists using the computer to communicate are already experienced computer users. Thus the 'conference participants' fear of the computer is not really an IIASA problem, but it definitely is so in a less scientific environment. The scientists at IIASA using, for example, the EIES system have to be familiar with the UNIX operating system of the inhouse PDP computer, or the DOST system of IIASA's TPA 70 computer [8], since connection to the Tymnet/Telenet network can only be made from IIASA through these computers. The command language of the Tymnet/Telenet network then has to be mastered in addition; this is not very complicated, but still a new 'language environment'. In addition to the two languages previously mentioned, the final step is the mastery of the complex command language of the EIES host system in Newark. For users who are not experienced, the need to acquire this basic computer knowledge is certainly a burden.

(e) *Legal problems*

Nowadays computerized message sending and teleconferencing systems have become a reality whether some of the PTTs like it or

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not. Their legal status is still, however, under discussion. Do they provide services which interfere with the interests and monopoly of the PTTs? And, if so, can and should the service simply be forbidden? If their usage is not permitted, who will control it, and how? There is probably no way of controlling this.

At present the attitude of the PTTs toward computerized message sending and teleconferencing varies considerably: some of them seemingly take no notice of it, and have no objection to these kinds of activities; others, like the British Post Office are more strict about it. It seems to be most difficult to filter, out of the mass of different sorts of computerized data traffic flowing over computer networks, those parts which carry the text of messages or conference comments. In some countries, however, computer-network-based message-sending services are receiving the 'blessing' of the telecommunication authorities. The US Federal Communication Commission (FCC) has just recently licensed the message sending services of the GTE Telenet network (Telemail) [9], and of the Tymnet network (Ontyme-II). Both services offer message-sending, text editing and other facilities, partly similar to those of the well known teleconferencing systems. It is probably only a matter of time until these network operating companies will include teleconferencing and other 'office automation' facilities in their normal services. It is my personal belief that, sooner or later, the different PTTs will themselves offer high-quality computerized message sending and teleconferencing facilities on a large scale over their public networks, and this might replace the role of the present 'private host-based' teleconferencing systems.

International teleconferencing is, from a legal point of view, even more complicated: the usual questions relating to transborder data flow, such as interdependency, vulnerability, privacy etc., only complicate the legal framework around this new medium. It is the author's personal belief that, for example, if a foreign host-based teleconferencing system were to be used for a conference of particular importance in a given country, this would be viewed with great concern by many governments. It is also not quite clear in what form these teleconferencing comments can be processed further. Is there a copyright on these comments and, if so, who would be the copyright holder, the author of the comment or the conference moderator? These questions are not of the purely theoretical type, but problems that have been encountered at IIASA while using these systems. These problems will certainly be solved, but it will take a long time and much effort.

2.3 Summary of current teleconferencing activities in an international environment

In the preceding sections, the pros and cons of international message sending and teleconferencing have been outlined, based mainly on the experience gained at the International Institute for Applied Systems Analysis.

The capability of this new communication medium to improve telecommunications between the outside world and IIASA provides solid ground on which to build future computer-based message sending and teleconferencing activities at the Institute, especially in our international setting. Through this new medium, we have already established new links to geographical areas which — 'thanks to' the PTTs — are less reliably accessible through normal telephone or telex connections, and the sending of mail also takes too long.

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An additional capability of computerized message sending and teleconferencing systems, i.e. to combine the advantages of computer-supported 'office automation' systems and telecommunications systems, adds new horizons to this communication medium.

Computerized message sending and teleconferencing activities will certainly achieve a breakthrough in this decade. They will be widely used by the international organizations for promoting cooperation between nations. The present technical and legal difficulties will be solved, hopefully soon; however, in order to achieve this, the PTTs and similar bodies will have to carefully assess the role of these systems.

3. Prospects for message sending and teleconferencing via computer

It has also been recognized, however, that the present types of computerized message sending and teleconferencing systems, such as EIES or Notepad, represent only first generation systems in the area of computerized text communication media. As mentioned earlier, it is well known that serious efforts are currently being undertaken to improve the present systems and to develop second-generation systems for the purpose of satisfying the needs of the next few years to come. However, also in a long term perspective, a revolution of the present telecommunication media can be expected. Signs of this revolution are already with us now, for example:

(i) in the field of *telex communication*, new telex network installations are already being equipped with computer-based switching nodes. In addition, a new type of telex station, with built-in text processors and secondary (e.g. diskette, cassette) storage capacity are available on the market, as the old telex system gradually becomes a more computerized medium. *Teletex*, the 'fast-telex' recently standardized by CCITT enables A4 pages of 'correspondence quality' to be transmitted in about 10 seconds. In addition to message handling, textstations — the terminal equipment for teletex — can be used, in the same way as normal typewriters with text storage capacity and built-in intelligence, for text editing and text formatting. It is expected that this service will be introduced and interlinked with the telex networks on a worldwide basis in the first half of the 1980s.

(ii) the 'good old', but unfortunately increasingly expensive and unreliable, *mail postal service* is also moving in the direction of computerized 'mass mail services'. For example, the United States Postal Service (USPS) has launched an experiment known as EMSS (Electronic Message Service System). A limited version of this system linking up to 10 post offices within the USA is planned for 1981; a nationwide system should become operational in 1990. Conventional letter mail would be fed into high speed facsimile equipment and would then be routed via terrestrial or satellite circuits to a destination post office. Here the message would be converted back to hard copy for delivery by the traditional postman. In addition to this service, plans are being made for online input and output via computer, magnetic tape units, and keyboard terminals and printers to be located on sender and receiver premises. This last function resembles those of the present computerized mesage sending systems. In Europe, the French PTT has similar plans; preparations are now underway for experiments on the international level through satellite.

(iii) *new types of communication networks* are currently being developed. By way of example, in the US three new networks are now under development and will become available

in the next couple of years:

(a) SBS — Satellite Business Systems, a total communications network proposed by a joint venture of IBM, Comsat, and Aetna Life and Casualty.
(b) XTEN — Xerox Telecommunications Network.
(c) ACS — Advanced Communication Service, the data communications networks planned by the Bell System.

All of these planned networks will support large scale electronic message sending and teleconferencing in one of several ways: IBM projects that 75% of the traffic on their SBS system will carry voice and 25% will be used for facsimile, multipoint distribution of digital data including document distribution, and video teleconferencing.

XTEN of Xerox will be primarily an electronic message service, but in addition, will support new applications such as document processing and distribution, data transmission and copmputerized and video teleconferencing.

ACS of Bell (AT & T) is closely related to the present US packet switched computer networks Tymnet and Telenet. It is to be implemented using minicomputers at the network nodes to add intelligence to existing AT & T intercity digital facilities. Among the facilities which are to be offered by ACS, there is one allowing users to customize their virtual subnetworks to their particular way of data handling. Other facilities include message preparation aids, editing capabilities, and message handling functions, such as storage and retrieval of messages, sending messages, building messages for records etc. Message sending similar to Ontyme-II and Telemail could easily be installed.

Similar networks are being discussed or are in preparation in other countries too. One must recognize that all of these systems support electronic message sending functions at a high level.

(iv) *Videotex* [10], another new telecommunication medium, is said to be the most radical invention in consumer electronics since television itself. Through videotex, electronic message sending systems will go 'public'; not only database accessing, but also electronic messaging will become publicly available by means of inexpensive terminal devices, provided the PTTs allow it. In the basic versions, such as Prestel of the British Post Office, this is achieved by transforming the home television receiver into a home information retrieval terminal, and important for us, into a home telex-electronic mail system. In the French (Télétel) version, inexpensive facsimile terminals are being planned in addition for a mass consumer market. All types of 'terminals' will provide subscribers to telephone and videotex services with easy mass access through normal telephone lines to databases located on PTT and, in some countries, on non-PTT computers which contain information about daily life or which are of general public interest. The terminals will also allow electronic-mail messages to be sent from one terminal to another by an electronic-computer-based mailbox system provided by the PTTs.

These seemingly independent developments mentioned above will certainly lead to a more advanced communications age, with broad overlapping of the functions of the various telecommunications media. When this stage is reached, the present 'cottage-industry-like' message sending and telecommunications activities will be phased out and will be replaced by the 'mass production methods' of the future communication networks.

What effect will these new developments in telecommunication media have on IIASA's electronic message exchange activities?

The telecommunication environment will not remain untouched by the developments outlined above. In Austria — the host country of the Institute — teletex will be introduced in 1982. It is also of significance that the DATEX circuit switching network owned by the domestic PTT already provides 300 baud asynchronous connections; 2400, 4800 and 9600 synchronous Datex channels will also be available later this year or in early 1982. The national Datex-P packet switching service will also become operational in 1982. Moreover, the Austrian Datex network will

be linked to foreign PTT networks, such as the West German Datex networks. This is expected to happen during the summer of 1981.

The Austrian interactive videotex system, 'Bildschirmtext', planned to start an experimental service with 300 subscribers on 1st March 1981. The British Post Office started a market trial of its 'Prestel International' service in 1980 in certain selected countries; an experimental worldwide service is planned, starting from the summer of 1981. It is foreseen that the 'Prestel International Host' in England will be made available from Austria through the Euronet network. IIASA proposes to establish links to both Prestel systems. The advantage to IIASA of using Prestel International would be its broader geographical coverage, whereas the Austrian 'Bildschirmtext' system, being closer to IIASA, would be cheaper and more suitable for in-house purposes.

It is hoped that a certain amount of the computerized information exchange traffic will be handled by both systems. IIASA, in its role as an 'information provider' (to quote the videotex jargon), plans to set up pages for wide public access on IIASA's current activities in general and also some pages for IIASA's 'closed user groups', comprising the Institute's national member organizations and some collaborating research institutes. These systems would serve basically two main purposes:

(a) Performing a kind of 'broadcasting' function, information about IIASA would flow from IIASA to the 'outside world' by means of the Prestel database system.
(b)'interactive message exchange' would allow a certain kind of exchange of messages between IIASA and outside users.

The latter purpose would be served by Prestel's 'replay-page' option [11] which permits the members of IIASA's closed user groups to have full exchange of text information with IIASA, through the use of alphanumerical keyboarding. One limiting factor is that messages between two members of a closed user group cannot be exchanged using Prestel's present version. Special 'short' messages, such as those containing names, addresses and telephone numbers, can be sent by any user of Prestel using any sort of keyboard; this function would be utilized, for example, when handling online orders for IIASA publications.

4. Summary

As pointed out earlier, computerized text communication in an international environment is even now viable and useful. It can only be hoped that, when the present more or less 'experimental' service becomes standard (like telex, telephone and mail) and available on future, large telecommunication networks, its quality will not suffer, and may even improve.

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