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March 1981
CP-81-12

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ABSTRACT

This paper describes the functions of the "IIASA Gateway"
as seen by a "typical user", IIASA's Hungarian National Member
Organization.

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INTRODUCTION

External computing at IIASA has a long history during
which a network of computer links to remote computer resources
has been built up [1]. IIASA now has access to extensive com-
puter resources, including some 200 host computers of the
TYMNET/TELENET network, the RPCNET in Italy, and computers in
Vienna, Frascati, Budapest, Moscow, etc. The new EURONET line
to come into operation soon through IIASA's leased line to the
Technical University of Vienna, will in principle make it pos-
sible to access some 30 other West European hosts (Figure 1).
The primary goal of all these connections, both to East and
West, is to provide a service for the research activities of
the Institute and for its National Member Organizations (NMOs).

A secondary goal of these East-West computer connections
is being met by an interesting "side effect" which has aroused
the interest of the scientific, political, and business com-
munity: the so-called "gateway function" of the Institute.
Working together with its partner institutions, IIASA is
presently the only organization in the world operating computer
connections between East and West solely for the purpose of
scientific research. The hardware and software environment of
this gateway, as well as its flexibility and reliability, make
it well suited for fulfilling its main purpose at IIASA: the
exchange of scientific information.

In a sense, the creation of the gateway represents a
"breakthrough" in East-West computer traffic for scientific
applications. While there exist East-West transborder computer
links transmitting other types of information, such as meteoro-
logical data, airline reservation data, and data from news

agencies' databanks, IIASA is the only operator of computer
links between East and West established solely for the purpose
of scientific research.

The first of IIASA's NMOs to reap the benefit of IIASA's
gateway function was the Hungarian Committee for Systems
Analysis. Since then, other NMOs have established computer
links with Laxenburg. In this paper, the case study of
Hungarian usage of the IIASA gateway will be briefly described.

STRUCTURE OF THE COMMUNICATION CENTER AT IIASA

The primary aim of IIASA's networking activities - as
mentioned above - it to provide for the Institute and its col-
laborating organizations a computer communications infrastructure
(software, hardware, communication lines) to support three basic
modes of communication:

1. interactive terminal-to-computer (to access TSO systems,
   e.g., databases, scientific application programs, elec-
   tronic message transfer, teleconferencing),

2. batch terminal-to-computer (the access to RJE systems),

3. computer-to-computer (file transfer, program-to-program
   communication).

The first two kinds of communication are required to supplement
and extend IIASA's information and computing facilities and those
of its cooperating organizations, in order to meet their R & D
demands. It should also be mentioned that there is a pressing
need for new methods of telecommunication to enable scientific
scholars at IIASA and outside to communicate with each other via
computer on joint research projects. Thus teleconferencing
constitutes an important part of IIASA's computer communication
activities.

Furthermore, IIASA users must be provided with a distributed
computer environment since the development of complex programs
for solving certain special problems requires simple file trans-
fer and the communication between programs operating on various
computers in different countries, it often being impossible to
transfer such programs onto a single computer.

To support communications, IIASA's center now uses a mixed
strategy: hardware multiplexing together with software switching
techniques. A time-division multiplexer, the T 96 [2], produced
by Racal-Milgo, allows a number of channels to be handled over a
particular data link. Similar multiplexers are used in other
nodes connected to IIASA's communication center, namely:
Institute for Systems Studies (ISS) in Moscow, International
Atomic Energy Agency (IAEA) in Vienna, European Space Agency
(ESA) in Frascati, National University Center for Electronic
Computation (CNUCE) in Pisa. The flexibility of these connections
is provided by the channel-switching facilities of the TPA 70

minicomputer [3], produced in Hungary. The communication soft-
ware of this gateway computer also performs all the other
necessary functions, such as emulation of various terminals,
conversion of protocols, changing of codes and formats, checking
user authorization, and so on. IIASA's gateway computer pro-
vides another facility, in that it can act as a host or termi-
nal to other nodes, allowing users to make a sort of file
transfer and program-to-program communication.

It should be mentioned that current development of IIASA's
communication center envisages the usage of packet-switching
technology both for multiplexing and switching purposes on the
basis of the X.25 protocol. This kind of software is being
implemented on both the computers installed at IIASA: the
TPA 70 and the SM 4-20 [4], the latter being produced in the
CSSR. Installation of similar computers at certain nodes
(Budapest, Moscow, Prague) connected with IIASA is in progress.
Implementation of the X.25 (X.75) protocol will also provide the
center with the necessary technical facilities to make connec-
tion with other existing packet-switched networks, such as
TYMNET/TELENET, EURONET, and the Austrian Packet Switching
Network.

FUTURE ROLE OF "IIASA'S GATEWAY"

IIASA's external data traffic can be divided into two main
types:

-- data communication with IIASA

-- data communication through IIASA ("third party" traffic).

Who actually uses the "IIASA gateway", and for what purpose?
At present, the gateway is used mainly by IIASA and its collab-
orating institutions as a tool for internal and joint research,
as mentioned above; other frequent users of the gateway include
those international organizations closely related to IIASA and
its NMOs, such as the IAEA and the International Patent Documen-
tation Center (INPADOC) in Vienna. Because these organizations
act as hosts for international database services, from the
Institute's standpoint, they generate the ideal type of computer-
ized, East-West data traffic used for scientific purposes: for
this reason, IIASA is striving to promote their activities.
Another type of "third party" traffic generated by scientific
research organizations, such as the Technical University of
Vienna and the Computer and Automation Institute (SZTAKI) of the
Hungarian Academy of Sciences in Budapest, involves scientific
computing: this, too, is welcomed by IIASA.

It should be noted here that "third party" traffic may con-
flict with the rules and regulations laid down by the PTTs in-
volved, and thus every effort is made to inform the PTTs of,
and involve them in, these experiments. Here we can say that
IIASA has close connections and relations with "Radio Austria",
with the Austrian Postal and Telecommunications Administration,

and with similar bodies in other countries. The industry (computer manufacturers, database producers, network service vendors and end-users) has also shown great interest in this experimental service, and has been supporting our activities both financially and in kind.

It is also planned to organize all the above-mentioned types of organizations into some sort of "East-West Networking Association", an informal, loosely structured, organization, with a core at IIASA, which would serve as a common forum for certain governmental bodies, the PTT administrations and communications carriers, network vendors and users, where they would discuss and seek solutions to the problems involved in East-West computer traffic. Working in an open, informal manner, such an organization would contribute to the "ultimate solution" to the question of East-West computerized traffic in the field of science and technology.

What might be this "ultimate solution"? It is only possible at this stage to make certain predictions. At present, two main trends can be distinguished in the development of computerized data traffic in Europe. The first is the trend toward the establishment of national public data networks. It now seems likely that in any given country the bulk of future computerized scientific information will go through this type of network rather than through private networks devoted to scientific data exchange. The second trend is toward the creation of international - and partly experimental - data networks and computer links, such as EURONET, the international sector of TYMNET and TELENET, or IIASA's East-West computer links. All these networks located in different geographical areas play, or have played, important "breakthrough" roles in the field of international computerized data traffic. It should be mentioned that, among the experimental networks, some - such as EIN - have already successfully completed their task and gracefully "retired"; within the next few years, it is expected that EURONET will be absorbed into an interlinked network of the national data networks of the European Communities. The same future would seem desirable for IIASA's dedicated computer links:

If the PTTs, both from East and West, were to develop and interlink their national networks into a highly reliable international network, this would relieve IIASA of much of its present financial and technical burden, and would allow the Institute, besides providing external computing services for IIASA and partner users, to fully concentrate its limited resources on further promoting and increasing the usage of these links in the field of science and technology. Within the framework of the above mentioned "East-West Networking Association", IIASA would keep close links with the vendor and user communities, governmental bodies, international organizations and associations, and maintain a forum for all kinds of "East-West"-related questions and problems in the field of machine-readable information exchange.

THE HUNGARIAN CASE STUDY

In order to promote cooperation with IIASA, the Hungarian Access System (HAS) has been planned in two phases:

In the _first phase_ of development, the objective was to set up a simple access system consisting of a display terminal with a hard copy unit in Budapest and a leased line to the TPA 70 node in Laxenburg. The TPA 70 gateway system makes the following remote facilities available to users in Budapest [5]:

-- IIASA's PDP 11/70 and VAX 11/780 (Laxenburg, Austria),

-- Technical University's Cyber 74 (Vienna, Austria),

-- ESA-ESRIN's ITEL 5 (Frascati, Italy),

-- IAEA's IBM 3033 (Vienna, Austria),

-- Hosts of the TYMNET/TELENET network (e.g., Lockheed, Dartmouth College).

In the _second phase_ of development, another TPA 70 is to be installed in Budapest to multiplex several terminals and to provide IIASA users with an access route to Hungarian resources, such as the Hungarian Academic Network. The operation of the HAS and the user services in Hungary are provided by the Computer and Automation Institute (CAI). The contracting is performed by a foreign trade company (METRIMPEX), while financial support and administrative control is in the hands of the Bureau for Systems Analysis of the State Committee for Technical Development - the Secretariat of IIASA's Hungarian NMO. This type of organizational structure is valid for the experimental operation only. The decision regarding the final arrangement for providing such services will be made after evaluating the results of the experimental period.

The objectives of the experimental period - which started at the beginning of 1980 - were the following:

-- to promote Hungarian scientific cooperation with IIASA,

-- to evaluate the users' interest in various information services connected with research related to IIASA,

-- to gain experience in operating an international network node,

-- to find the best organizational structure for future operation.

The first year of operation can be summarized according to the different fields of activity as follows:

- <u>Joint Research with IIASA</u>. Scientists, both at IIASA and cooperating Hungarian Institutions, have to work jointly on the solution of different models, preferably in the same computer environment. The UNIX systems installed on IIASA's DEC computers provide an excellent tool for joint computational work. One example that may be mentioned is the work on the modelling of the Hungarian shallow lake Balaton being carried out by IIASA's Resources and Environment Area in cooperation with different Hungarian Institutions, such as the Computer and Automation Institute and the Biological Center of the Hungarian Academy of Sciences in Tihany. In the last couple of months of 1980, more than 200 hours connect time were registered from Budapest to IIASA, and a set of simulation models has been successfully developed.

- <u>Hungarian Cooperation with International Organizations and Scientific Institutes</u>. On the basis of an agreement between the Hungarian and Austrian Academies of Science, Hungarian scientists of the Academy have succeeded in accessing the Cyber 74 Computer Center of the Technical University in Vienna, which is linked to IIASA's communication center.

  Another example has been the cooperation on sociological research between the KIEWIT Computational Center of Dartmouth College, Hannover, New Hampshire, USA, and the Sociological Institute of the Hungarian Academy of Sciences.

  The IAEA and its liaison offices in the IAEA's member countries have been building up and utilizing bibliographic databases, such as INIS and AGRIS. Through the Hungarian Access System, the Hungarian Technical Documentation Center (OMKDK) – the Hungarian liaison office for INIS – can access the IAEA's IBM 3031 computer on the above mentioned databases.

- <u>Access to Information Retrieval Services</u>. In order to encourage cooperation and free flow of scientific information, IIASA has been promoting experimental access for its cooperating institutions to systems, such as Lockheed and ESRIN, provided that all legal arrangements between hosts, communication carriers and users already exist.

  Database access has been made in the following main areas:

  -- Science
     (e.g., Biological, Chemical, Medical, Mathematical, Physical Abstracts),

  -- Applied Science and Technology
     (e.g., Pharmacology, Computer Science, Food and Agriculture, Electronics, Technical Sciences),

  -- Social Sciences and Humanities
     (e.g., Education, Psychology, Sociology),

-- Business/Economics
   (e.g., Economic Information Systems, Management
   Information),

-- Environment.

The usage of these systems has provided additional tools for
Hungarian scientists cooperating with IIASA, thereby broadening
the scope and coverage of the information sources available to
them. Similar experiments to permit IIASA's international usage
of Hungarian scientific databases (e.g., in the field of soci-
ology) are being implemented.

The experience gained from the first incomplete year of oper-
ation has been very encouraging. The operation of HAS proved to
be very stable in the first year. Hungarian cooperation with IIASA,
and in a broader sense the exchange of scientific information, has
been promoted significantly. It is planned to continue to expand
this activity by involving new computer systems and resources in
this experiment. Connection is also planned to the Hungarian
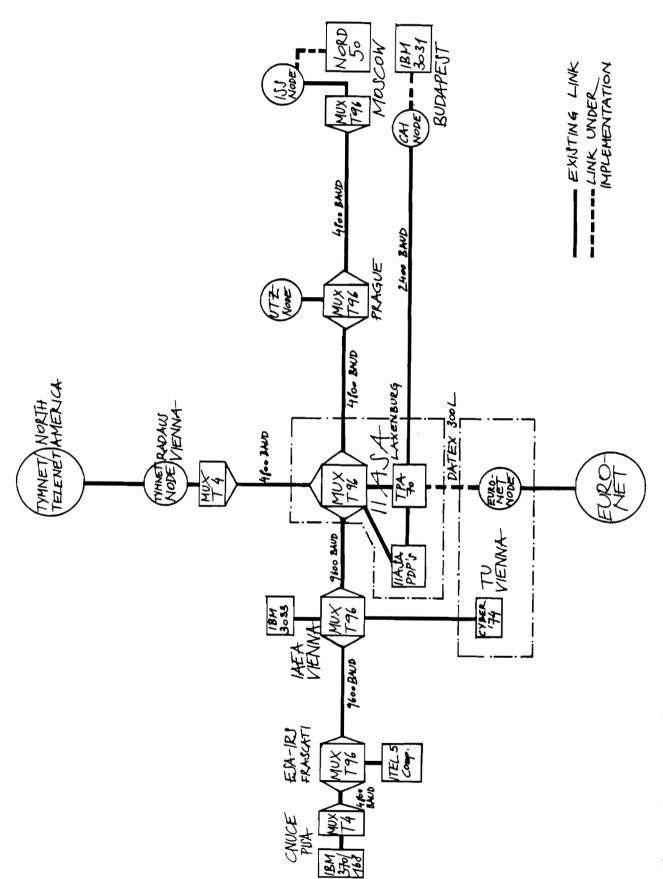Academic Network.

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Figure 1. IIASA's external computer links.

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