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Data Communication in Bulgaria - The Telecommunication Infrastructure and Relevant Administrative Procedures

Arabadjian, K., Brakalova, P., Sebestyen, I., Tasheva, E. and Todorov, T.

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K. Arabadjian
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T. Todorov

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INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS
2361 Laxenburg, Austria

PREFACE

This working paper is part of the IIASA study "Experimental and Operational East-West Computer Connections: The Telecommunication Hardware and Software, Data Communication Services, and Relevant Administrative Procedures". This work is supported both by the Control Data Corporation in Minneapolis and the Austrian Ministry for Science and Research in Vienna.

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K. Arabadjian, P. Brakalova, I. Sebestyén, E. Tasheva and T. Todorov

0. INTRODUCTION

In a small country with an open economy such as Bulgaria the potential role of transborder data flows is enormous. In what follows the present and future data communication infrastructure of Bulgaria will be described and the relevant administrative procedures outlined. Special emphasis will be given to the present transborder data flow applications of the country, which are characterized, in addition to the "classical" flow of data for civil aviation, information, news agencies' data, and meteorological data networks, by an emerging data base production and service industry.

1. STATE OF THE TELE AND DATA COMMUNICATION NETWORK IN BULGARIA

1.1 The Telephone and Telegraph Network

At present the backbone of Bulgaria's data communication infrastructure is its telephone network. According to [1] in 1978 in Bulgaria there were 1,032,000 telephones in use, or in other terms the number of telephones per 100 inhabitants was 11.6; higher than in Hungary, Yugoslavia, or Turkey, but lower than in Czechoslovakia or Austria. The development of the telephone network has been especially rapid since World War II, and in particular during the last couple of years. Between 1970 and 1978 for example, the number of telephones more than doubled (from 473,000 to 1,032,000). The yearly development rate between 1977 and 1978 was 8.4%, a relatively high figure international standards.

By the end of 1982, there was still no public data communication network in service in Bulgaria. As will be described in what follows, however, in 1984-1985 the introduction of the public packet switching data communication network — called BULPAC — is planned.

The present data communication users of the country use primarily switched or leased telephone lines. The characteristics of the lines are maintained according to the recommendations of CCITT. In Bulgaria, the Ministry of Telecommunications and the PTT guarantee — according to CCITT recommendations — the following speeds for data transmission:

- for data transmission on leased telephone lines up to 9600 bit/sec transmission speed;

- for data transmission on public switched telephone lines speeds up to 1200 bit/sec;
- for data transmission on leased and switched telegraph lines up to 50 bauds speed.

1.2 Basic Principles for Building up the National Data Communication Network BULPAC [3]

The Ministry of Telecommunications has been working on the project of a National Data Communication Network since 1975. Till the finalization and ratification of the relevant CCITT recommendations, the Ministry directed its main efforts towards extension of the existing telephone network so that it was able to carry low and medium speed data traffic.

First, new normatives and methodology documents were prepared. Then modems, channel measuring devices and other basic equipment for data communications were developed and implemented. In addition, systematic and complex measurements of the whole telecommunication network were carried out. As a result — as mentioned above — at present the telephone network ensures data transmission up to a speed of 9600 bits per second.

According to the new conception for the future Bulgarian public data communication network BULPAC, it is to be implemented according to the ISO model for open system architecture. It will be built up containing several levels, the first three forming the so-called transmission subnetwork, which will entirely correspond to the CCITT X.25 interface, namely:

- level 1: electrical and physical interface according to recommendation X.20 bis and X.21 bis (in a longer-term aspect according to X.20 and X.21);
- level 2: X.25 LAP-B and X.75 of CCITT;
- level 3: X.25/3 and X.75 of CCITT.

At the fourth, the so-called "transport" level of the network, the protocol must comply with the emerging international standards in this field.

1.2.1 Basic Requirements and Design of the Data Communication Network BULPAC

The BULPAC data communication network will be a public network accessible to both computer hosts and terminals, the latter operating in either synchronous or asynchronous mode. The switching nodes of the network have to support host and terminal access according to the CCITT "packet" protocol version issued in 1980 as well as user access according to the 3rd to 6th user classes of service (Recommendation X.1 of the CCITT) and operating in accordance with Recommendations X.3, X.28, and X.29 of the CCITT.

For international connections, a separate switching host, likely in Sofia, will provide for the interaction with other national packet switching networks according to Recommendations X.75, X.121, X.180, X.87, X.96, X.110, and X.150 of the CCITT.

Each of the seven switching node of BULPAC will be connected to three other nodes of the network in order to provide alternative routing (Figure 1). The system of packet routing will be adaptive, taking into

account the criteria of shortest physical route, traffic load of the switching node to which the packets are being routed while setting up a given virtual connection, and length of the outgoing queues at this node.

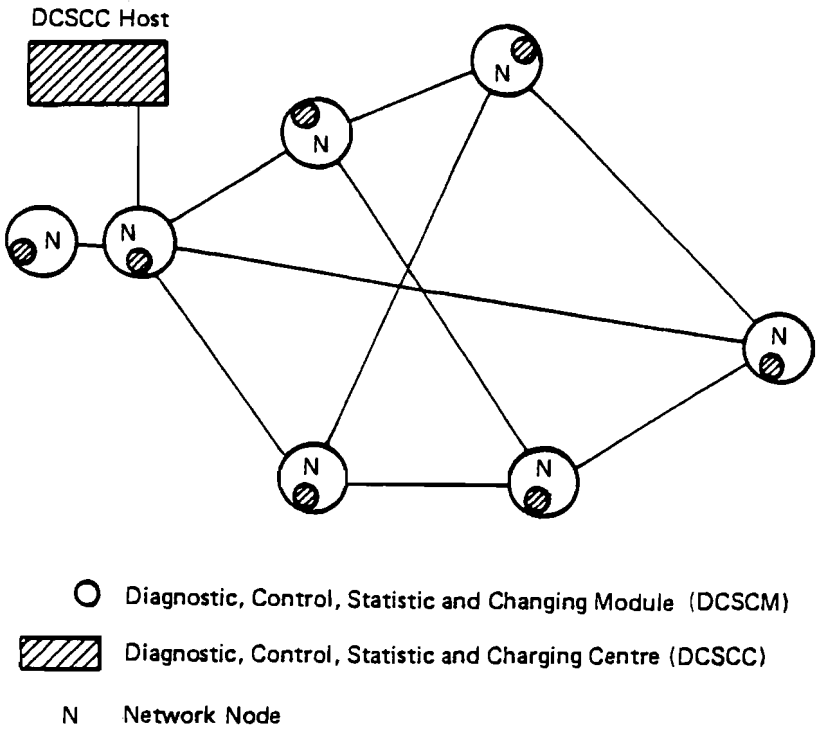

Figure 1. Functional structure of the diagnostic, control, statistic, and charging system of BULPAC network.

The incoming subscriber's line capacity will be from 24 to 70 subscriber lines per node. The subscriber lines of the node will enable information interchange between users and network at the maximum user

speed of 9600 bits per second. If however baseband modems are to be used over physical lines up to a distance shorter than 35 km, even higher speeds are possible. The information interchange of 64000 bits per second between the network nodes will be carried out over wide-band telephone channels structured in so-called carrier primary groups of 60-108 kHz.

Each switching node will in addition perform the functions of a packet assembly/disassembly (PAD). The PAD module has to comply with Rec.X.28 and X.29; and its operational characteristics with the Rec.X.3 of the CCITT.

Each switching node will have a local module for control, diagnostics, statistics, and charging. This module, however, has to be part of the overall system of control, diagnostics, statistics, and changing, which must perform: diagnostics and statistics of its own node's traffic flows, as well as of those of the neighboring nodes; control and routing of incoming/outgoing user information flows; statistics of its users' requests for both established and unsuccessful connections; identification of both calling and called party; identification of the accessibility to the data communication network for a given user; permission for a given user to use optional facilities; billing of all established virtual connections; regular connection with the so-called Diagnostics, Control, Statistics, and Charging Center (DCSCC) for information interchange. The functions of the network have to comprise the logical levels 1 to 4 of the ISO model of open network architecture.

The DCSCC is to be connected to the other switching nodes of the network as a packet type remote host computer by means of dedicated permanent virtual channels (duplex operating a speed of 9600 bits per second). Functionally it must provide for:

- the control and routing of network information flows on the basis of data received from the different nodal modules of control, diagnostics, and charging;
- the centralized supervision and statistics of all the network parameters and grade of service, based on both data received from the nodal modules and its own;
- regular (once in every 30 seconds) supervision through the normal operation of all nodal modules of control;
- the function of a network databank containing data for: number of users registered as network subscribers; facilities offered to each of them; number and composition of closed user groups; number and duration of faults in the network; network trafficability and traffic statistics, etc.

1.2.2 Network Facilities

The BULPAC data communication network will provide for the following services according to Recommendation X.2 of the CCITT:

- switched virtual connection (VC);
- permanent virtual channel (PVC);
- closed user group;

- closed user group with incoming access;
- closed user group with outgoing access;
- possibility for a user to take part in up to three different closed user groups;
- both calling and called party identification;
- reverse charging;
- priority in servicing the users at three levels;
- circular transfer;
- possibility of operation with a length of the packet information field of 16-32-64 octets;
- possibility of requesting the network for a different window length at level 2 and level 3;
- possibility of choosing the class of efficiency for a given virtual connection.

With regard to the implementation of BULPAC, it is planned to put the network in operation by 1985-1986 [3].

2. THE RELEVANT ADMINISTRATIVE PROCEDURES AND TARIFFS FOR DATA COMMUNICATION

As mentioned earlier, the Ministry of Telecommunications laid down a number of so-called normative documents relating to data communication on subjects such as:

(a) the order of requesting and issuing licenses to Bulgarian and foreign data communication equipment manufacturers for delivery and connection of data transmission and teleprocessing

equipment to the Bulgarian telecommunication network;

(b) techniques for carrying out basic, operational, and diagnostic measurements of telegraph and telephone circuits for data transmission and modems operating at speeds up to 9600 bit/sec;

(c) the order of how to connect new subscribers to the telecommunication network;

(d) tariffs for connection rights and utilization of data transmission communication circuits.

2.1 Normative Rules on Request for Permission for Connection of Subscriber Equipment to the Bulgarian Communication Network for Data Transmission

When a given piece of equipment has to be connected to a communication circuit for digital information transmission, the subscriber has to apply to the Data Transmission Laboratory of the Bulgarian Ministry of Telecommunications (Address: Sofia 1000, 6, Gourko str., Bulgaria). The order for submission of the application and the granting of permission for the subscriber is regulated by the document: "*Rules and Normatives for Connection of Data Transmission Equipment to the Domestic Telecommunication Network*," which was ratified as a second normative document by the Ministry of Telecommunications in 1973 and published (in Bulgarian) in the State Newspaper No. 31 from 17 April 1973.

According to the regulations, to get permission for connection of a given device (computer, subscriber station, terminal concentrator, modem or other equipment) the manufacturer or the user of the device is

obliged to submit to the Data Transmission Laboratory at the Ministry of Telecommunications two pieces of the equipment accompanied by a complete set of technical documentation. The Laboratory checks, according to the approved techniques, whether the technical parameters are in line with the appropriate CCITT recommendations. If the test results are positive, the Laboratory issues permission to connect the type of equipment to the domestic telecommunication network for an unrestricted time period. The detailed description of the technical requirements for data transmission equipment and devices are contained in a document ratified in 1972, entitled "*Uniform Requirements for Data Transmission Equipment*" issued by the Ministry of Telecommunication. This document is based on the appropriate CCITT recommendations for data transmission and is periodically updated and supplemented according to changes or new CCITT recommendations.

2.2 Testing Techniques of Data Transmission Equipment and Circuits

In 1974 the *Scientific Institute for Research in Telecommunications* in Sofia, Bulgaria developed a variety of relevant methodic normative documents:

- "Techniques for telegraph and telephone (permanent and switched) circuit measurement for data transmission";
- "Techniques for measurement of signal conversion equipment, operating at 9600 bit/sec speed";
- "Techniques for measurement of data transmission equipment".

These documents have been approved by the Ministry of Telecommunications as obligatory methodic guidelines, according to which operational measurements of the communication circuits and the "Type" and "Check" measurements of the user devices are to be made.

Regarding the results of the checked characteristics in the above document, the CCITT recommendations were fully taken into account. In determining the ways to connect the measuring sets to the HF multiplex equipment of the telephone lines (and their adjustment), the specific characteristics of the Bulgarian multiplexing systems were considered. Other specific peculiarities of the structure and equipment of the Bulgarian communication telephone network are also considered, these have to be taken into account when performing the measurements, but they do not affect the qualitative parameters of the objects measured.

According to these guidelines, a 3-year measurement of the domestic communication network was performed in order to check its ability for digital data transmission at different speeds. The following parameters were checked: reliability of transmission, telegraph distortion factor, pulse noise level, residual attenuation of the circuit, amplitude-frequency characteristics and characteristics of signal propagation group time, stability of the carrier frequency on the data transmission circuit, and the impact of the kind of the physical telephone route (cable, radio-relay and telephone) and the kind of HF multiplex system on the enumerated parameters. As a result of the tests, several measures have been adopted for improving the transmission quality in some sections of the Bulgarian telecommunication network.

2.3 Permission and Tariffs of Connection and Utilization of the Telegraph and Telephone Circuits for Data Transmission

The appropriate normative documents developed and applied by the Bulgarian Ministry of Telecommunications were ratified by the Council of Ministers (20 May 1972) and the Committee for Economic Coordination. These documents have been supplemented and corrected by an order of the Ministry of Telecommunications — Central Board on Prices, dated 26 June 1979.

According to these documents, the tariffs included in any data transmission equipment (computers, multiplexers, modems, terminals subscriber stations, terminal concentrators, etc.) are determined by the sum of several components. These components are given below:

1. Services for supply of technical devices for connection, installation, and control:

   These rates have to be considered during the phase of service initiation; they do not significantly influence the network charges in everyday operation.

   a) Item *II.64**: for the investigation of the technical possibilities to install new data transmission equipment (DTE) 14.00 lv. is to be paid.

   b) Item *II.65*: for installation of a permanent (or temporary) DTE, the subscriber must pay:

* The numbering of each tariff component here corresponds to the numbering of the normative documents: "Data transmission network: Tariffs."

— 20.00 leva for an installation within 40 m from a PABX or the communication station;

— 5.00 leva for every additional 10 m (or part of 10 m) above 40 m;

— 6.00 leva when a telephone circuit is available for the DTE.

c) *Item II.66*: 45.00 leva have to be paid for measurement of data transmission equipment or correction modules which the data transmission subscriber wants to connect to the transmission network with the purpose of getting permission for upgrading of that connection.

2. Monthly subscription rates for the use of the data transmission network:

a) *Item II.67*: subscription rate for the use of the communication line, depending on its speed (see Table 1)

b) *Item II.68*: Telex network subscribers who operate equipment provided by the Ministry of Telecommunications for increase of transmission reliability pay additionally every month — 30.00 leva

c) *Item II.69*: For periodical utilization of the data transmission circuit the subscriber pays:

— for utilization up to 10 days — 40% of the corresponding monthly charges;

Table 1. Subscription rate for the use of the communication line.

Operation speed of data transmission equipment in bit/sec	Monthly charges in leva
up to 50	40.00
up to 100	60.00
up to 200	120.00
up to 300	140.00
up to 600/1200	200.00
up to 2400	400.00
up to 4800	750.00
up to 7200	1,600.00
up to 48000	7,000.00

— for utilization within 11-20 days — 70% of the corresponding monthly tariff; and

— for utilization of more than 20 days monthly — the total monthly charge.

d) *Item II.70*: A monthly charges of 0.80 leva is envisaged for each 100 (or part of 100 m) for data transmission circuits beyond the "boundaries" of a given place, in order to implement the so-called operational diagnostics and to guarantee that the quality of data transmission be not worse than that recommended by the CCITT.

e) *Item II.71*: No additional charge is required for utilization of switched telephone communication circuits for data transmission

f) *Item II.72*: The minimal monthly tax for the right of data transmission on the switched or permanent communication network should not be less than 120.00 leva.

g) *Item II.74*: If a few more subscribers are connected to a leased circuit, the first subscriber (leasing the circuit) pays the total tariff and all the rest — 1/12 of the total tariff.

3. Rates for data transmission (see Table 2) [4].

Table 2. Rates for data transmission.

Zone (according to Item II.71)	Line length	Switched Lines (Item II.71)		Leased Lines (Item II.73)		Price reduction for temporary use		
	km	leva/min		leva/month		%		
Zone		Time of operation 7-21 h	Time of operation 22-6 h	Telephone	Telex	10 days	20 days	30 days
I.	0- 60	0.20	0.15	1,300	325			
II.	60-160	0.40	0.30	1,730	430	60	30	0
III.	above 160	0.50	0.40	2,160	540			

4. Other charges

a) *Item II.75*: The subscriber will not pay the respective tariff sums during the period when he has handed over the line to the PTT for trouble shooting, provided the trouble lasts more than a day. In this case the monthly subscriber charge is reduced by 1/30 for each day.

b) *Item II.77*: For making test measurements of a piece of equipment (or device) for data transmission under laboratory conditions, and in agreement with the requirements of so-called state standards or specialized norms, the subscriber must pay 150.00 leva.

c) *Item II.79*: If the subscriber leases a modem owned by the ministry of Telecommunications, for each day of the modem utilization the subscriber will pay:

- 3.00 lv for modem at 200/1200 bit/sec speed
- 5.00 lv for modem at 2400 bit/sec speed
- 6.00 lv for modem at 4800 bit/sec speed
- 8.00 lv for modem at 7200 bit/sec speed
- 12.00 lv for modem at 9600 bit/sec speed
- 25.00 lv for modem at 48000 bit/sec speed

Payment for temporary usage is not allowed.

There are also some other items of lesser importance included in the tariff document, but these are not listed here.

2.4 Administrative Organization of Operation of the Data Transmission Network

To serve subcribers and equipment for data transmission, the Ministry of Telecommunications introduced two types of Data Transmission Services (DTS); the so-called central DTS and the regional DTS.

The data communication system will be operated by the Central Data Transmission Laboratory in Sofia and by the Regional Groups for operational servicing of the data transmission circuits. Such regional groups have been formed since 1974 in each of the 27 regional communication administrations. They are obliged to make everyday and periodical to ensure the data transmission circuits are in good condition, and also to provide free circuits when new subscriber DTEs have to be connected to

the network.

The competence of the Data Transmission Laboratory (towards 1984 it will move to the central DTS) includes: processing of applications for "type" or check tests of the equipment and communication circuits; development of new DTEs; building up of international routes for data transmission; permanent and periodical servicing of the communication circuits offered to the subscribers for data transmission (Communication circuit plus data transmission equipment on the part of the communication station). DTEs however are served by their manufacturers, only the communication part of DTEs being examined in the PTT Laboratory tests.

3. TRANSBORDER DATA FLOW APPLICATIONS —PUBLIC DATA BASES IN BULGARIA

There are a number of transborder data flow applications in daily use in Bulgaria, such as the dedicated computer network SITA to carry civil aviation information, the GTS network of the WMO to carry meteorological information, or the dedicated data network of the world leading news agencies. All these applications are discussed in other papers at length, e.g., in [5, 6, 7, and 8]; therefore, in what follows only the service and use of public databases in Bulgaria will be described in a more detailed way [9].

The central technical information and documentation body in Bulgaria, the Bulgarian National System for Scientific and Technical Information (NSSTI), was established during the 1960s. It was formed on three levels: with a central body — The Central Institute for Scientific and Technical Information (CISTI), in Sofia — on the first level; information branch offices on the second level; and local information groups or offices

at the institutes, plants, agricultural and industrial complexes, etc. on the third. Until 1976, only traditional methods of information activities were used in the NSSTI and also CISTI. During 174-1976, a so-called National Computer Center was established within CISTI by the integrated efforts of the Bulgarian government — in particular CISTI — and UNESCO. Its basic goals were to satisfy, to the possible greatest extent, the users' requirements for scientific and technical information, to provide the necessary information for the advancement of science and technology in Bulgaria, to establish new ways and methods of providing and getting valuable and flexible information services.

It is well known that computerized information systems — basically databanks — are characterized by a great variety of their subject coverage, record structure, availability of information searching guides (languages) — such as Thesaury, controlled dictionaries and/or classification schemes, keywords, etc. — by the variety of working languages — English, French, German, Russian, etc. — and the hardware and software methods used in processing (i.e., availability of different apparatus and programming means).

To satisfy all requirements while taking into consideration the experience of the Information Centres abroad and the local conditions, the National Computer Centre was equipped with an IBM 370/135 computer working with the information retrieval program package STAIRS. The

system VIDEO is used for the data input and both systems work under the control of the IBM program package CICS under OS/VS. The computer has a main storage of 512K, external disk storage of 1074 MB and a virtual

storage of 3.5 MB. The computer is also furnished with an integral communication adapter for connecting eight remote terminal lines. At present, there are ten local terminals and ten remote terminals linked to the IBM 370/135. Five of the local terminals are used for data input and the rest for information retrieval services. The local terminals are all placed in a central terminal room at CISTI, the remote terminals, at other acting branch information bodies (i.e., such as at the Bulgarian Academy of Sciences, at the National Agrarian-Industrial Union, at the Medical Academy, at the Institute for Computer Techniques, etc.).

With regard to computer equipment, both IBM and Bulgarian made hardware are used (Figure 2). To extend the external storage capacity of the system, 29 MByte Bulgarian ES 5061 disc drives were connected to the system. A Bulgarian ES 8401 multiplexer, running under the ESTEL 2.1 system with different ES terminals was connected for data communication purposes.

To satisfy the information needs of Bulgaria, and to foster the development of science and technology in the country, the National Computer Information Centre runs the following databases:

— INSPEC, subject scope: physics, electrical and electronics engineering, computer science and control engineering. Time span: 1976 to present. File update: approximately 180,000 documents per year. To assure a more effective information processing and user service, the database is split into three independent subsystems: INSPEC-A — physics, INSPEC-B — electrics and electronic engineering, and INSPEC-C — computer and control engineering. The above mentioned subsystems are

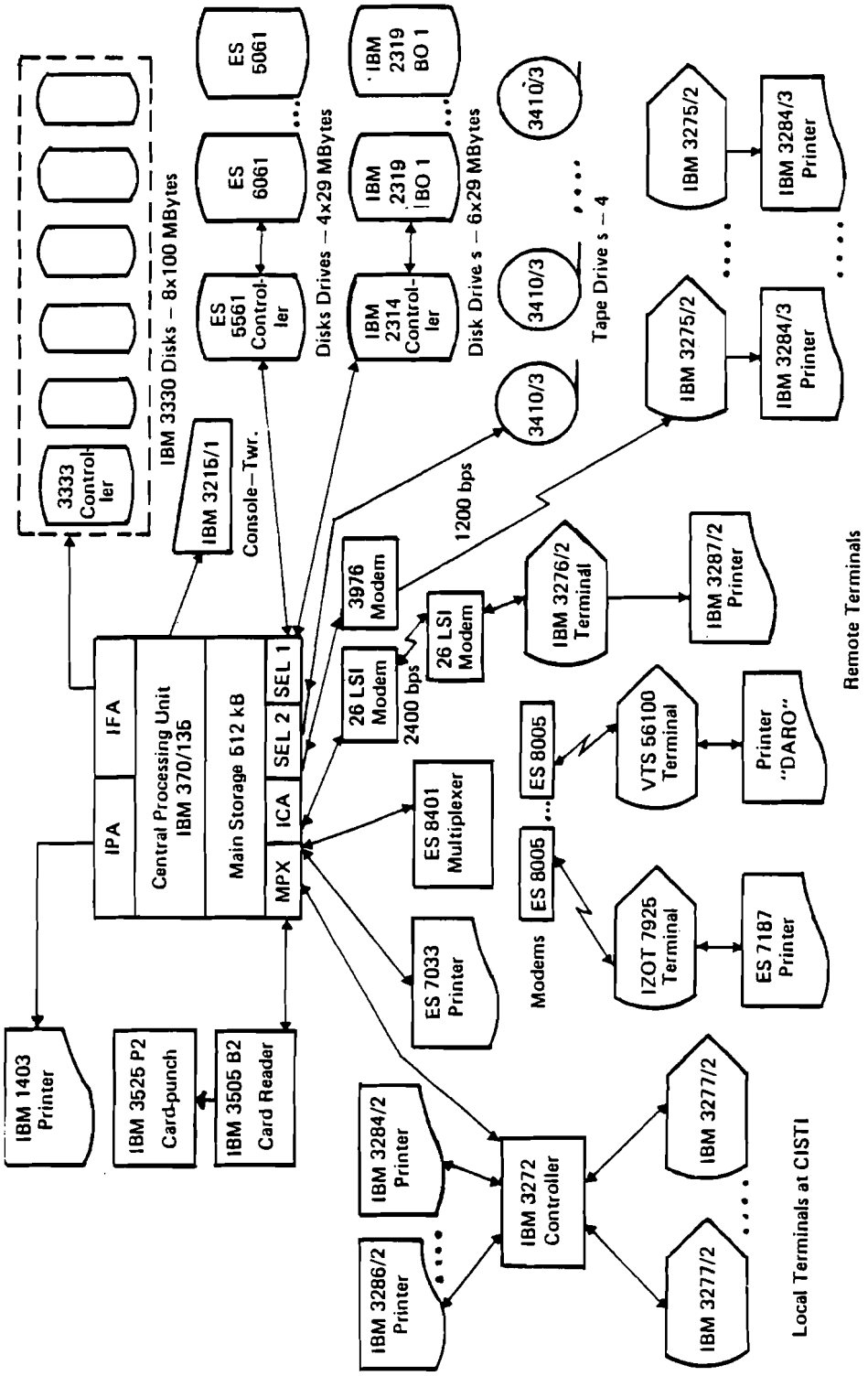

Figure 2. The CISTI Database Service Center in Sofia.

searched in both forSelective Dissemination of Information (SDI) and retrospective (on-line) mode.

— BIOSIS, subject coverage: biology and all related subjects such as botany, zoology, microbiology, pharmacology, plant-growing, and others. The magnetic tapes of BIOSIS have been processed in CISTI since 1978. File update: approximately 300,000 documents per year. The system is used in both SDI and retrospective (on-line) mode.

— COMPENDEX: engineering (multidisciplinary). The main subjects of interest are mechanical engineering, pollution, civil engineering, architecture, environmental engineering, pollution, etc. Time span: from 1977 to present. File update: 90,000-100,000 documents per year. Users are serviced in both SDI and retrospective (on-line) mode.

— AGRIS: international system relating to agriculture and food production. The magnetic tapes of AGRIS have been processed in CISTI since 1975. File update: approximately 100,000 documents per year. The system is searched in both SDI and retrospective (on-line) mode.

— INIS: international system for peaceful applications of nuclear energy. Time span: 1976 to present. File update: approximately 70,000 documents per year. The system is searched only in SDI mode, since retrospective searches are performed in an on-line regime by the International Atomic Agency in Vienna. Through remote network connections it is possible to access this

service from CISTI.

- MSIS-NIR: international specialized information system for research projects and dissertations in the CMEA countries. Subject coverage: human sciences, basic sciences, applied sciences, aviation, medicine, economics, engineering, etc. Time span in CISTI: since 1976. File update: approximately 25,000-30,000 documents per year. The system is searched in both SDI and retrospective (on-line) mode. Source documents are available on microfilms. Language of database: Russian.
- VINITI: automation and electronics. A database provided by VINITI in Moscow is run under this service. Subject coverage of the database: automation control, computers, electronics, communications. Time span in CISTI: 1978 to present. Annual increase is about 35,000 documents per year, in total 200,000. The language of the database is Russian. The system is searched in both SDI and retrospective (on-line) mode.
- VINITI: information. This database is the machine readable version of the *"Referativny Journals"* of VINITI. Magnetic tape entry in CISTI contains information starting from 1981 and the system is searched in both SDI and retrospective mode. The annual increase in number of documents is 5,000.
- MEDIC (Medinform): international bibliographical database in medicine of the CMEA countries. It has been in operation since 1981. File update: 15,000-20,000 documents per year. The system is searched only in retrospective (on-line) mode.

Besides the above mentioned systems, some Bulgarian databases are in service as well, such as:

- HORIZONT: bibliographical-documental database with economic and industrial prognosis information. It is aimed for use by government agencies and indutrial managers. The yearly additions of HORIZONT are 7,000-8,000 documents. The system is searched in both SDI and retrospective (on-line) mode. The language of the database is Bulgarian.
- SYRENA: Bulgarian bibliographical database for Bulgarian and CMEA research projects and dissertations in all branches of science and technology. The yearly additions are 8,000 documents. It is searched only in retrospective (on-line) mode.
- LIDA: Subject coverage: information on public computer information systems available worldwide. It is searched only in retrospective (on-line) mode. The language of the system is English.

From these databases, HORIZONT, SYRENA, and also LIDA might be of international interest.

The philosophy behind the processing of the computerized information systems and service of the users at CISTI is to aim to service databases in retrospective (on-line) and SDI mode. Because of the limited external storage of the computer, depending on the annual increase of the database, however, there is a limit for the time span on retrospective (on-line) searching. For example, BIOSIS has one year retrospective search time span, COMPENDEX, two years, AGRIS, INSPEC (A,B,C), three

years, etc. For searching beyond these time limits, the off-line (batch) mode is used. The external storage capacity for simultaneous on-line search is about 300,000-400,000 documents, but the basic stock of all documents is well above 4,000,000. The service is performed according to a weekly timetable. In order to prevent the disc storage shortage problem, each system is available for on-line mode search half a day per week.

For the selective dissemination of information (SDI) the systems are searched only in off-line mode (batch) during the night.

In 1982, approximately 8,000 profiles (queries) in SDI mode were regularly searched. In on-line-retrospective mode, approximately 7,000 queries were requested.

The greatest number of profiles and retrospective queries have been performed for the Bulgarian Academy of Science, the Higher Education Institutes, the National Agrarian-Industrial Union, and the Ministry of Mechanical, Electrical and Electronics Engineering.

The National Computerized Information Centre gives an opportunity to satisfy the needs for computerized information service of thousands of scientific workers and specialists easily and quickly. Moreover, the difficulty of a centralized information service lies in the great variety of subjects and thousands of users that have to be served by one information center, far from users and of their problems. This is the reason why the different information branch offices also cooperate in the joint work on servicing scientific and technical information. They help to identify the information interests of every customer. They form subject profiles, submit their requests to the computerized information center, receive and

disseminate the results, check for the completeness and relevancy of information, and provide copies of original sources to the users. In fact, they function as virtual connections between users and the computer center.

The increasing demand for information by a growing user community calls for increased performance and improved computerized information service. To satisfy this growing demand is not an easy task and it is worthwhile to list some of the present difficulties.

First, as is well known, the number of databases offered on the world market is increasing rapidly. As a result, some of them are seemingly formed incidentally, others are not complete enough and quite often the information in databases is duplicated. Besides, databases most often represent only the national original sources completely, although they also include those that are difficult to access in their source format. For this reason searches have to be made in different databases, which makes information retrieval more expensive.

Second, the central issue for usage of a computerized information systems is the language barrier. Many poliglot thezauri have appeared recently, for example, the TITUS system became popular, providing possibilities for four language services, but all this is not enough concerning the end user. The question for machine translation stands open.

Third, one of the greatest disadvantages of most databases is the difficulty of accessing their primary sources; this decreases the effectiveness of their use a great deal. There are few information systems that are ready to provide microcopies of their original documents together

with the magnetic tapes.

Fourth, the databases, except those prepared by international organizations, are mostly commercial products, and countries with limited financial resources like Bulgaria find it difficult to pay more and more to buy them or to use them abroad on network hosts (through remote access). The reality is is that such countries lack the possibility to reach equivalent exchange with developed countries because of the smaller amount of their own information.

Fifth, the commercial and also political aspects of database supply force many countries to create their own databases. In the end, as a result of their twofold or threefold input, the preparation of the input for the databases created is at lease twice as expensive as it could be.

Sixth, the main purpose of the presently offered databases in Bulgaria is to satisfy the information needs of scientific workers and research scholars. There is, however, a great need for information by the industry. There is great interest especially in factographic information for the introduction of new products technologies and production. The existence of about 1,000 factographic databases is known worldwide, but only a few of them are of international interest and some of them are not accessible for all users.

Thus, in spite of the achievements in the development of computerized information services, there are still many daily problems to be solved.

In order to reply to the users' needs, as well as to speed up the processes of computerized information services, CISTI launched a

number of activities in the following directions:

1. Expanding the range of the processed and serviced foreign databases in Bulgaria. This will be realized mainly in the near future through new databases received on magnetic tapes from VINITI, Moscow. There is an agreement between CISTI and VINITI for distributed processing and servicing of the VINITI databases in an on-line mode between the two organizations. In other words, part of the databases created in VINITI will be serviced on-line at CISTI in Sofia.

2. VINITI in Moscow and CISTI in Sofia are at present interlinked by a dedicated 600 bit/sec telecommunication line via the node of the line of the All Union Scientific and Research Institute for Applied Computerized Systems (VNIIPAS) in Moscow. At present this line between CISTI and VNIIPAS is being upgraded to higher speeds and more logical channels. In 1980, successful experiments were carried out for the realization of terminal connection between CISTI and VNIIPAS. Thus it was possible to access from CISTI through VNIIPAS

   — the International Atomic Agency in Vienna,

   — the All Union Institute for Scientific and Technical Information (VINITI) in Moscow, and

   — the Central Institute for Scientific, Technical and Economic Information in Prague (Figure 3).

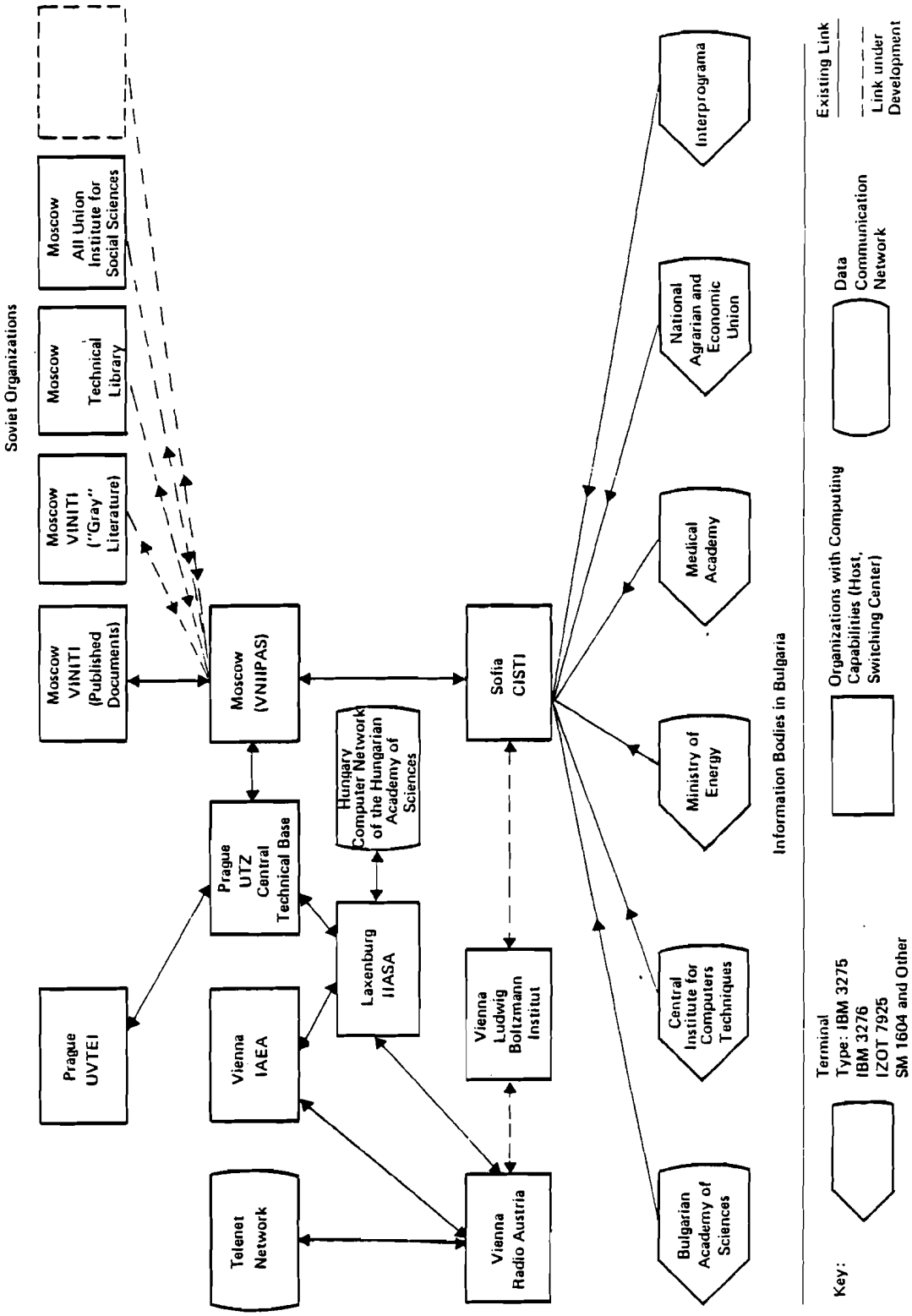

Figure 3. Scheme of the telecommunication links of CISTI (Bulgaria) [9].

At present the most frequently searched databases via the VNII-PAS node are INIS and AGRIS serviced by the International Atomic Agency in Vienna. Next year, CISTI expects to launch regular service with the Central Institute for Scientific, Technical, and Economic Information in Prague and with VINITI in Moscow.

Some experiments are also being carried out for information retrieval by foreign users in CISTI databases via VNIIPAS. In 1982, mainly experimental access from VINITI and VNIIPAS was carried out. In 1983, it is also expected that through a new line between the Ludwig Boltzmann Institute in Vienna and CISTI, Austrian users would be served by CISTI.

Computer connection between CISTI and IIASA in Laxenburg, Austria, will also be feasible on a regular basis in 1983. There will be two routes available to do this, first through the VNIIPAS node in Moscow, and the UTZ node in Prague, second through the Ludwig Boltzmann Institute and the Radio Austria node in Vienna.

Experimental interconnection of CISTI and the computer network of the Hungarian Academy of Sciences will also be possible through the IIASA node.

3. Increasing the possibilities of CISTI's Computerized Information Centre by new and more powerful computer hardware.

4. Provision of conditions for mutual cooperation and integration of the efforts of the Peoples' Republic of Bulgaria and her neigh-

boring Balkan countries to expand and improve the information services. This effort will be greatly promoted by an ongoing UNESCO/UNDP supported regional project "Crossborder Computerized Data Exchange in Science and Technology." Within the framework of this project it is expected that information centers in Yugoslavia and perhaps from other Balkan countries will be linked to the CISTI computer center.

4. SUMMARY

Data communication in Bulgaria is at the beginning of its potential. At present, data transmission is carried out primarily through switched and leased telephone lines. At the end of 1982 no separate digital data communication services were provided by the PTT. However, preparations for the introduction of a nationwide public packet switched computer network (BULPAC) are being made. Introduction of this new PTT service is expected around the middle of the 1980s. It is also expected that at that time the present administrative procedures for data communication will change slightly. The present and future administrative procedures, however, are following the respective recommendations of the CCITT as closely as possible.

With regard to transborder data flow applications, besides the classical dedicated data networks such as SITA, WMO-GTS, and news agencies network, one of the strongest applications in Bulgaria is database services. The organizational structure for scientific-technical information in Bulgaria is centralized, the Central Institute for Scientific and Technical

Information (CISTI) in Sofia playing a key role in providing both domestic and foreign services to Bulgarian users. CISTI itself operates its own database center in both on-line (retrospective searches) and batch (SDI searches) mode. The databases installed at the CISTI center are partly of foreign origin, from both East and West, but CISTI also operate some Bulgarian databases. Experiments for on-line access abroad from Bulgaria and access to the CISTI center by foreign users were successfully completed and in the future the introduction of such services on a regular basis can be expected.

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