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ON SOME ASPECTS OF COMPUTERS AND THEIR APPLICATIONS

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Budapest, 1980.

CONTENTS

PRESENT STATUS AND FUTURE PLAN OF COMPUTERIZATION IN HUNGARY

M. Arató

In spite of the remarkable expansion of computers into every aspect of life we have to know that when a computer system is introduced into a working environment it is almost always the human ways of thinking, acting and communicating that must be altered, not the computer's. A short analysis of the future trends in the fields of applications in Hungary shows us that the organizational benefits of computerization will outweigh the human problem. But it is clear that there may be serious incompatibilities involved. The way the users wish to act in using computers to solve their problems may not be the same as the way the computer experts think they should act.

In many cases the users place more reliance on their traditional way of gathering information, than on the computer information. In Hungary the level of computerization is not so high as in the countries of western Europe and the problem of the so-called "man-machine interface" involve a wide range of human behaviour. I would like to focus my comment with respect to the users' behaviour on two points (or two extreme sides). One concerns the user who hopes to get much more than the computers can do for him. The other side is when the user does not use and does not want to use all the possibilities the computer has. Both of them are against the computerization. The first type of user, typically a manager, wants to be able to use a computer with a minimum of efforts. He usually places importance on the impact a new computer might have on the structure of his organization and on the style of work.

The second type of users always explains the effects of poorly designed systems, e.g. that he could not have the answers after a month which he had needed within a week. Such a user will not understand that a system can actually work badly.

In Hungary we are working on our own computerization program which is much slower, than e.g. in Japan. We are interested in having our own information data bases, working computer systems in enterprises, our own network, which will function only in Hungary. I think that in the way of computerization first come the financial problems, then the system problems, followed by the problems of law.

I wrote yet above that the greatest are the very human problems of culture and society, but I hope that in the last years they became clearer as they were gradually systematized.

I. SOME WORDS ON SZÁMKI

First of all I begin with our Institute, SZÁMKI (Research Institute for Applied Computer Sciences), which is a research and development institution and in its development work you can see almost the whole Hungarian computerization as the ocean in one drop of water.

Any organization with an interest in computing can approach SZÁMKI, which is closely related to industrial and governmental (administration) projects. We have at present contracts with academic establishments, research associations, government departments, software suppliers, hardware companies and of course many computer users, mostly from the industry. We employ more than 450 people, including about 300 research workers (mathematicians, engineers and economists). The annual budget is 100-110 million Forints in a year. We support the Government for the "Central development program in computerization" in the applications.

In Hungary we distinguish two main fields in applications of computer systems and information processing. The first one deals with applications in systems of State administration, realization of systems of different ministries and other higher authorities, statistical processing, financial account systems as well as planning and man-power control systems. The second field in our application consists of the computer supported information and management systems for enterprises.

Hungary, as the reader knows, is well known as one of the foremost countries in mathematics, but mainly in pure mathematics. Now we are working hard in applications for the success of applied mathematics. Our greatest interest is to handle, and to know how to handle data. The point is that in scientific institutions nobody likes bureaucracy or adminis-

tration management but we do not know what the information process means in such systems. We are mainly interested in such applications and of course, we cannot be so interested in physical or chemical processes and other applications of science. This is the job of academical institutions.

But to find the direct connection between mathematical models, methods and data handling, data processing in administration is not an easy job. And much work remains in other directions, too; for example on user and application oriented languages and input devices and technics e.g. intelligent "keyboards". There may well be too much research into "natural language" computer communications on the level of data handling.

The essential jobs of the SZÁMKI are the following:

1. *Business applications*

The Institute has a considerable number of industrial references in the field of computer application. The integrated complex and computer systems in IKARUS Car-body and Vehicles Factory and in Hungarian Electrical Works Trust, sub-system development in Chinoin Joint-Stock Co., VIDEOTON Computer Factory are worth mentioning. We are developing total system approach to the information and control requirements of manufacturing and distribution companies. We support functional managers throughout the business cycle of

- receiving an order obtaining materials,
- controlling the inventory,
- controlling the manufacturing (production) process,
- monitoring production costs,
- controlling financial tasks,
- planning.

Each system can be used alone but has the ability to be linked with any other.

The Management Modul (program system for business with small machines) developed in our Institute has at present about 10 references. The application program packages for ADAMS integrated control systems, packages for application program AGNES (fixed assets economy) and FORS (data processing program generator) have been widely applied in Hungary.

The operation research activity of the Institute is rendering important help in the field of business applications, mostly in analysing the inventory management, in forecasting and in performance and scheduling problems of production and resource planning.

In the Institute R-22, R-10 and RC 3600 machines are used for the above applications.

2. *State management applications*

A state decree set the aims of modernization of state management and rationalization of administration. Our Institute participates in designing computer systems for:

- state register of population,
- real estate register.

The tasks of the applications in state management, in addition to their importance, constitute an outstanding field of Institute research themes, e.g. to build up and use large data bases. Special project-teams have been formed to fulfil these tasks. The computer systems of State Computer Service Honeywell Bull 66/20 and 66/60 have obtained an outstanding part in solving these tasks, because of the volume of their auxiliary storage capacity, processing speed, network construction, batch and time sharing processing, as well as due to their being provided with suitable software. Concerning software, experience obtained in operation of IDS, IDSQ, MDQS data base management systems has to be emphasized.

Estimates of the price system, operation estimates substantiating branch policy, a short range prognostic of the economic activity may be emphasized here. These activities are closely related with econometric methods.

3. *Software development tasks*

Software development is a traditional field of prime importance in our activity.

The following may be mentioned among our basic and applied software developments based on RIAD computers:

- several years' succesful activities on VIDEOTON project system for development of task-oriented systems based on R-10 (their references development for application with the Hungarian State Railways and in the USSR),

- participation in developing a teleprocessing system based on RIAD computers of the Computing and Management Organization Services (SZÜV) of the Central Statistical Office, software development for preparations of processing the 1980 population census,

- implementation of PSL/PSA programming language for supporting system design (in the ISDOS project).

- development of a highly interactive programming environment on the first place for system programming - like activities and for general project management. This system called ANSWER, is intended to be used for the new RIAD machines, but the portability of the system has been ensured. The main components of the system are: the interactive supervisor; a file system with a tree structure; a language system based on CDL 2, an information system with modern on-line documentation.

Measurement methods and development of the efficiency of software construction and of computer use have been considered as an extraordinary important field of research. In this respect the solution of the following jobs was developed:

- methodology for investigating efficiency of computer applications in industry,
- methods of quality control of program.

II. HUNGARIAN RESULTS IN APPLICATION OF COMPUTERS

In the following I shall give some statistical data on Hungarian computerization. The data are from the book of "Statistical data of computerization, 1978" (in Hungarian). The reader can easely find out from these data that we do not have a sufficient number of computers and we have a lot of qualified people who are involved in computerization.

Another feature of our current situation is the relatively small number of microcomputers. One of the reasons is that we do not have process control applications, the other that we could not use the primary advantage of low prices in adopting microcomputers.

As it was mentioned earlier, in Hungary we have our Central Development Programme of Computerization in each Five-Year-Plan. Joining in the up-to-date meeting of information demands, the Hungarian application program is based mostly on

the computers of RIAD system. Hungary participates and works in the framework of computer cooperation among socialist countries, which produce the RIAD machines.

Hungary takes part in the

- development of basic program systems of the Unified Computer System (RIAD) and Unified Microcomputer System,
- production of R-10 and microcomputers,
- development of application program systems and data processing and information systems,
- development in the field of system analysis, business applications with reference systems.

To illustrate the computerization development in Hungary I should like to give some data in the following tables. First let us see the number of computers and their value.

Table 1

Year	1960	1965	1970	1975	1978
Number of computers	5	21	120	382	598
The value	-	-	2.10^9Ft	9.10^9Ft	$1,3.10^{10}$Ft

Table 2

In 1978 the computers had the following distribution with respect to their capacity

small:	382	
middle:	194	
middle-large:	20	(e.g.IBM 370/145, ICL 4/70)
large:	2	(Honeywell-Bull 66/60,IBM 370/155)
mini-micro: (1977)	330	

In 1977 the following branches of economy had computers

Table 3

	number	small	middle	middle-large	large
Industry	158	110	42	6	-
Building industry	23	15	8	-	-
Agriculture	2	-	-	2	-
Post, telegraph, railway	28	18	9	1	-
Commerce	26	15	11	-	-
Service (banks)	91	31	57	3	-
Watersupplies	8	6	1	1	-
Health, education	68	43	23	1	-
Science (Academy)	70	62	6	2	-
Budget service and administrat	47	22	20	3	2
Alltogether	521				

The distribution of various works in computer hours in Hungary is given in Table 4.

Table 4

	1970	1977
	%	
Scientific calculations	8,6	8,3
Planning, operation research	4,3	3,4
Technical calculation	10,7	3,6
Resource control	5,0	13,2
Production control	3,0	7,2
Statistics	14,4	6,7
Management, account, payroll	22,4	26,5
Documentation, registration	1,9	4,8
Process control	-	3,6
Education	1,0	3,3
Others (e.g.software technology)	-	19,4

The income in Hungarian service computing centers is the following:

machine	intellectual activity	data entry
78,2%	13,7%	8,1%

The costs of service in Hungarian computing centers are the following:

Table 5

materials	6,9%
wages	9,4%
amortization and other costs	29,1%
general costs	14,6%
central management	19,2%
drawing away	2,3%
result (with taxes)	32,1%

The price of a machine hour is very high, for example IBM 370/145 hour costs 10.000 Forints, RIAD 22 hour costs 3.000 Forints.

The number of workers in computerization: 5.700 (in 1970) and 17.700 (in 1977).

Table 6

	1970	1977	mean (wage month) (in 1977)
Engineers (technicians)	452	1343	4.000
Leaders	257	851	7.000
Programmers, system organizers	1563	4819	4.000 - 4.800
Technical staff	3413	10709	2.700 - 3.800
all	5685	17722	

The mean salary in a month in the Hungarian industry is 3512 Forint.

If we accept that there are 5 generations for software and processing mode:

1st generation: Manual processing. Assembler and FORTRAN programming.

2nd generation: Local batch. ALGOL, COBOL programming, 1/O control.

3rd generation: Multiprogramming. PL/I programming, time-sharing, concurrent processing.

4th generation: On-line. Virtual memory, on-line administration.

5th generation: Integrated, distributed processing. Network administration, data base administration, ultra-high-level language processing,

then in Hungary we are between the 2nd and the 4th generation.

The main tendencies are in administrative information processing towards larger-size models and a conversion to on-line operations and in business information processing towards on-line operations and interactivity.

We hope, that computerization is making a great contribution to rationalization of processing the government business. A major emphasis will be laid on the following things while carrying out the work:

1. Raising the level of efficiency of computer utilization,
2. Joint utilization of computers by governmental agencies,
3. Rationalization of administrative data communication.

In enterprises emphasis will be laid on the following works:

1. Development of data base utilizing technologies,
2. Development of data processing technologies,
3. Use of data communication languages,
4. Development of character information network and interactive systems.

In Hungary we have hardware industry too, the firm which produces the R-10 computer, microcomputers and peripherial

equipment is the VIDEOTON. In other enterprises (as MOM, GAMMA etc.) the peripherial equipment and application systems, as e.g. scintillographical pattern recognition system, are produced. As I am not involved in these works, I am interested only in applications, I can give only some comment about these works.

I am going to say a few words about our university education. In Hungary informatics is widely taught only from the early 7oth. The computers are not the best and newest in this field. The students are more connected and interested in mathematics or physics than in informatics. But the universities are gearing their programmes closer to "life", with less hobbism, more techniques, disciplines immediately applicable when the graduates enter the industry.

III. HUNGARIAN RESULTS AND PROBLEMS IN DEVELOPMENT AND RESEARCH

Our main interests and research works will be the following in the above mentioned directions in the next years, i.e. in the eighties.

We think that a considerable reduction of the internal administration of computers and computer systems, software systems must be done; this includes overhead time; handling of input, output and so on. Measurements show that about 50 to 60 p.c. of machine time is spent allowing all the maintenance and failure on self administration. This is the reason why we are interested in this field.

The second direction we are interested in is the efficiency of computer systems. It is known that the turnover and the response time are contradictory. In the solutions of tasks, occuring in practice, the balance of suitable dimensions and suitable processing times has to be developed. This means, that in case of simple data processing systems depending on different types of task oriented special systems have to be developed. Such task oriented systems can be e.g. data systems of order of several millions, or the reliability of data handling. In the latter case, automatic control systems have a greater importance than earlier, because the data control is imaginable only with the use of human intervention.

The third direction is the description of information processes. Here we are involved in the exact description because the model of such a phenomenon is not developed yet. We think, that mathematical models are needed in this field,

too. They will not be optimal models, but stable, reliable models. Beside the verbal and logical description of these processes, the analysis of their dynamical behaviour has to be aimed. The description of physical processes, the theory of the different branches of the differential equations play a first-rate part; in communication technique the description of analysis of stationary processes is most important.

In control theory of information processes the solution of stochastic differential equations has priority. In description of information processes the multidimensional analysis and its generalization for random processes will play a considerable role.

The reliable data communication, recording and control raise the greatest difficulty and they take most time in processing and understanding information processes. The exact examination of these processes, its acceleration with technical tools require however, not only technical, but new software devices as well. As in communication technique the use of different filters has become universal, so in computers there should be filters which will correct systems and will give different types of data recording and control.

I must stress two directions of our research. Our applications are becoming increasingly dependent upon the *reliability* and *integrity* of both hardware and software. A great deal of research is still required for establishing reliable, fault-free systems and for error detection and correction techniques. We have only to consider the cascade effect of an error in a data base or in a distributed system and the problem of detecting or correcting it.

In order to establish the reliability and integrity of systems there will be an increasing need for testing facilities. New techniques have to be developed for such testing and for establishing the criteria and adequacy of the tests undertaken. Maintenance and diagnostic routines for software systems are going to be vital. These activities of testing and subsequently monitoring and maintaining the level of performance increase in importance.

1. *Hungarian institutes engaged in research*

In the field of computerizing technical and manufacturing processes the most significant work is done by the Computer and Automation Research Institute of the Hungarian Academy of Sciences. Both in electronic and in engine industries systems have been realized that permit high automatization.

In this institute research is carried out to develop algorithms for economic calculations, and graphic software.

The Institute for Coordination of Computerization and the Central Institute of Physical Research of the Hungarian Academy of Sciences have achieved important results in the field of computer manufacturing and technical designing. The latter one has realized several process control systems on a machine of its own production, TPA machines, in different factories. VIDEOTON Institute for Development carried out development and research first of all in applying RIAD 1010 and RIAD 1012 computers.

In developing application software systems, an important research work remains still to be done in the field of realizing standardization and unification of systems. This solution depends also on determination of the users' circle and its suitable modelling. The standardization and unification of systems depends also on the generally formulated scope of works and its simplified models, where the software elements are being built in and/or used according to the users' demands. As in Hungary earlier individual software was ordered for every application, the efforts in this new direction of typified solutions of tasks has been accompanied with serious difficulties.

The advantages and drawbacks of individual software manufacture are well-known nowadays, but from this does not follow any automatic change to the application of standardized and unified systems.

2. *Most important tasks of the next period*

Solution of applications in enterprises will belong to the fundamental goals of the 6th Five Years' Plan. Research and organization institutes of the different ministries are to have a great share in this field. As the objective is to develop a computerized integrated control system at the 20-30 most important big enterprises in Hungary, it is necessary to acquire not only system organizing knowledge and programming device from abroad but also to carry out developing and research work.

It should be noted here that the backward state of the technical basis in Hungary in the field of development and research of teleprocessing systems is due, above all, to the backward state of the technical basis. The introduction of teleprocessing systems in applications both in enterprises and in state management permits realization of operative control when solution in computing technique will not only

be directly profitable, but permits also solutions which are inconceivable without computing technique (fast answering to orders, daily maintenance of stores etc.).

3. *Application systems and their models*

Development of suitable models and control of their correctness are necessary for good operation of application systems. In addition to verbal description also mathematical descriptions and models are being utilized, as it was the case with some software devices (elements of operation system, scheduling procedures). Development of stochastic models and mathematical logical models has already started also in computerized technical applications. Utilization of mathematical methods is specially difficult in this direction as a further development of recent results is necessary in the fields of reliability theory, those of error detection and error correction. In the course of the fast development of computer devices, analysis of models of data basis and of information retrieval systems was a fundamental objective of Hungarian research in the seventies. In connection with these researches, the positive experience should be noted that the complexity of application systems cannot justify the failing in the endeavour to formulate our tasks in an accurate, mathematical manner. It is an important remark, that the mathematical models help summing up and describe intricate system of tasks and search for optimal solutions.

A fundamental peculiarity of information systems is that we postulate reliable operation of data processing, i.e. automatic correction of errors. We may mention good research results achieved in our country in this field as well as in the field of developing mathematical models related to performance evaluation of operation systems.

Research was carried out also concerning realization of manufacture of software and analysis of programming methodology. These researches call our attention to the fundamental problems of software production, no efficient application is imaginable without solving this.

In connection with the theoretical research of program systems, the model theoretical treatment has to be mentioned and concerning application results obtained in data representation are important.

Creation of the necessary machine facilities, establishment of the software tools are the most important facilities of direct access. Development of these systems demands not only creation of new program systems but also support of the

organization with programming tools. Programming tools necessary for organizing works (ISDOS, PROTEE) are rather limited nowadays, their greatest drawback being their demand for large main storage and auxiliary storage.

Summing up what has been said with respect to research, it may be noted, that in the present period we have a vast number of information and knowledge about behaviour, complexity mechanism and automatic elements of information processes occuring in application systems. Their summing up, and thorough study, however, demand still a considerable amount of work. In the framework of a short survey there is no possibility of analysing deep and essential details, according to my own experience, only for which I am apologizing to the readers.

SOFTWARE DEVELOPMENT IN HUNGARY

T.Bakos

1. *Background*

Computer applications in Hungary began 20 years ago with first generation machines and in ten years time - due to mainly spontaneous, loosely co-ordinated actions - there was hardly any big computer manufacturer not being represented in the Hungarian computer spectrum.

An important milestone occured in the early 70's when the Hungarian Government started the Central Development Program for Computing, aiming to co-ordinate all efforts connected with computer production and applications. One of the most important decisions of the program - which determines the topic of this overview - was that computer production in Hungary would be oriented to small computers; to support this production licences were bought from CII (France).

Since that time software development has been mainly connected to small computers manufactured in Hungary, and due to their availability, they are used not only for the traditional minicomputer applications, but for a much wider range of applications, including business data processing too. In the last years this area of applications was extended further by the fact that LSI and other advanced techniques increased tremendeously the capacity and performance of the minicomputers, thus many so called small computer compares favourably with the medium size machines of the third generation.

Another important feature of the Hungarian software development (and computer production) is its strong connection with the RIAD and Mini-RIAD project, which is a joint effort of East-European countries in the computer field. Hungary undertook the production of the smallest member of the RIAD series, and machines for the Mini-RIAD family are also being developed and produced.

2. *Computer production*

From the point of view of software development the following Hungarian-made computers are or were important:

VT 1010B, produced under French licence, mainly for process control - like applications.

TPA and TPA-i, second and third generation, instruction level compatible to PDP-8.

R-10, produced under French licence, developed from the prototype MITRA-15. Mainly for real-time applications, but used successfully for business data processing as well.

R-12, a more developed version of R-10 with extended instruction set and backing store supporting the data processing applications.

VT-50, an office computer with the usual applications.

TPA 11/40, intended for the Mini-RIAD family, it was developed in Hungary, but fully compatible with the PDP-11.

VT-60; VT-600, the newest development under French licence with advanced design and technology, the most powerful product in Hungary.

3. *Institutions dealing with software development*

Software for minicomputers is developed both by the manufacturers and various research institutes. Minor development projects are also worked upon at large users and at educational bodies. The following list contains only the most important software developers.

- VIDEOTON Computer Factory, the manufacturer of R-10, R-12, VT-50, VT-60 and VT-600.
- Institute for Coordination of Computer Techniques (SZKI) developing hardware and software for R-10, R-12, the main co-ordinator of the Hungarian participation in the RIAD project.
- Research Institute for Applied Computer Sciences (SZÁMKI), developing software for all VIDEOTON computers, with main research interest in software methodology.

- Computer and Automation Institute of the Hungarian Academy of Sciences (SZTAKI), interested mainly in process control, networks and graphics software.

4. *Software products*

A very concise list of software products, covering only the most important fields of development:

a) Operating systems

Among the early developments the operating systems developed for VT 1010B (VIDOS), for R-10 (OS-10) and R-12 (OS-12) are worth mentioning. In addition a relatively simple timesharing monitor (TSM) and an interactive program development system (IDOS) have been produced.

Other operating systems has been developed for the TPA machines, although the latest model (TPA 11/40) works under PDP systems.

b) Language processors

There are a number assemblers and macro assemblers for all Hungarian machines with the usual features. With respect to higher level languages the following more important implementations exist:

- FORTRAN for all machines
- COBOL for 1010B, R-10, R-12, VT-60 VT-600 and TPA;
- BASIC for 1010B, R-10 and TPA;
- LISP 1.5, for R-10;
- CDL (Compiler Description Language), a systems programming language for R-10, IBM 370, SIEMENS 4004, R-22, CDC 3300, ICL-1900; it is being developed for VT 600;
- PROLOG for Honeywell 6600, SIEMENS 4004, ICL-1900;
- PASCAL (subset) for R-40.

c) Application oriented software

- In the field of telecommunications a Data Transmission Monitor was developed first for the R-10 to support several different line protocols. As a second step, the

Videoton Network System (VNS) is being developed which involves the new VIDEOTON models VT-60 and VT-600.

Another project is an intelligent terminal emulator, allowing connection of R-12 as a remote batch terminal to IBM and RIAD machines and at the same time the execution of local jobs in background partitions.

- Process control software, including a Process Control Monitor (PCM) for the R-10 and a collection of routines to handle real-time devices, called PROCESS.

- Business application software, including a Management Modul (MM) System for R-10, R-12 and a report generator called FORS for the larger RIAD mechines.

  A new version of FORS, called FORS/2 is being developed as a general PL/I program generator and decision table processor.

5. *Methodology*

In the implementation of theoretical results in order to support the software production two major directions have been followed:

- Development of an up-to-date, highly interactive programming environment for system programming activities and for general project management.

  This system, called ANSWER, was intended for the new Hungarian machines and for the new RIAD machines; but ensuring the portability of the system, porting it to other computers is a relatively simple task.

  The main components of the system are:

  - an interactive supervisor;

  - a file system with a tree structure;

  - a language system based on CDL2, a powerful system programming language with strong support for structured programming, program construction and debugging. The ANSWER system itself is written in this language;

  - an information system with modern on-line documentation-, text-processing and project-management facilities.

- Elaboration of methods and programming tools to support application software development, including:

  - A collection of programming suggestions for PL/I;

  - A detailed handbook and case studies for Jackson's structured design;

  - Different code inspection techniques;

  - Program generators for structured COBOL and PL/I programs;

  - Performance evaluation and test environment packages for application software.

6. *Software cooperation with foreign companies*

Besides the international cooperation in the RIAD project there is a continuous contact with SEMS (the now independent small computer branch of CII.) of France and with SIEMENS.

The other form of cooperation is software export. In the last six years the following more important developments took place:

- Macro Assembler for FUJITSU Ltd (Japan),

- COBOL compiler for MITRA 125 (France),

- DIL (a bank terminal control language) compiler for DATASAAB (Sweden),

- etc.

TELEPROCESSING IN HUNGARY

T. Szentiványi

DATA COMMUNICATION AND TELEPROCESSING

Investigation of data communication problems started comparatively early, already in the mid sixties in Hungary. (The post administrations in Western Europe, too, were taking their first steps for preparation of data communication services at the same time). As the actual demands were but slow in developing the efforts expended on it were not excessively large either. This fact may be attributed to the special circumstances in Hungary (e.g. geographical situation, inhomogeneous computer pool, different economic system, and applications). Nowadays the data transmission characteristics of the services offered by the Hungarian Post Administration are on the same level as in other parts of Europe, their utilization keeps spreading. In the following we are investigating the technical basis/resources of teleprocessing, the services afforded by the Postal Administration.

TECHNICAL BASIS (HARDWARE FACILITIES) OF TELEPROCESSING

Beside development of larger size computers, also development and production of medium to small computers took place in the countries of Eastern Europe. So in Hungary TPA, VIDEOTON, RIAD 10/12/15 computers and/or machine families are being produced. These mini computers are suitable for carrying out data transmission between large computers, control of communication but they are being used also for carrying out multiplex functions in several systems. They can be well used also as intelligent terminals, among others, two such systems have been developed, built around a RIAD-10 computer. VTS 56100 device is a display oriented terminal designed for asynchronous and synchronous data

transmission. VT 54010 system working on lines of 100/2400 Baud speed and can be used the basic device in different configuration (either in display oriented systems - equipped with 16 CRT, or serving as remote batch terminal).

In addition to the above mentioned ones, a great number of terminals have been developed and produced in Hungary, e.g. TAP 3 and TAP 70 data stations which, furnished with paper tape peripheries and console typewriters, as well as with different error protection-control device, are capable of data transmission of different speeds. A great number of the mentioned devices are in operation already in Hungary, other countries of Eastern Europe and in Europe, in general. The bankterminal type TAP 34 suitable for financial transactions cooperating with a central computer, has been developed, too. Great many modem types with transfer speed in the range of 75 Baud to 48 kB have been developed for interfacing data transmission lines. Each of these devices meets the CCITT recommendations that were considered suitable also by an international test procedure and approval, carried out in Vienna (Austria).

HUNGARIAN POSTAL ADMINISTRATION

Hungarian Postal Administration puts its existing telecommunication network and/or its circuits for data transmission objectives at the users' disposal.

In the framework of the service, circuits

- telegraph type,
- telephone type,
- broad band circuits and
- physical circuits (local, direct connections)

are put to the users' disposal.

In the first group there are operating 50 B speed telex and 200 B speed DATEX networks (the latter will be enhanced later to 2400 B speed). Error rate experienced: 2×10^{-5} to 2×10^{-6} or in the case of a DATEX hired line: 7×10^{-7}.

An error rate of 10^{-4} to 10^{-5} may be taken into consideration with 200 B speed, 4×10^{-4} to 4×10^{-5} with 600 B speed, and 8×10^{-4} to 8×10^{-5} with 1200/2400 B. Somewhat better error rate con be achieved on hired lines. Circuits with improved voice circuits also can be hired to max. 9.6 kB. Broad band circuits can be used only with restrictions. In local conditions, for signal transmission on base band,

galvanic circuits are available (depending on distance max. to 20 kBaud rate).

COMPUTER NETWORKS

Inter-connection of computers took place also in Hungary some time ago and its realization has been attempted in most Eastern European countries. The existing systems, however, with but few exceptions, consist of terminals dispersed around a central computer. Two or more host computers are seldom being interconnected. Consequently, the greater part of the networks are star shape and terminal oriented. During the last ten years or so numerous attempts were made at realizing connections with systems over the border, and on the other hand efforts were made to achieve that the central device - the system affording service - should be a small computer.

As we mentioned earlier, different small computers are being produced in the country, so there has been an obvious occasion for their use. Therefore, among other things, a time-sharing monitor able to serve simultaneously 16 displays or terminal types of similar character was developed, based on a small computer of Hungarian make (TKI).

Concerning network systems, in the first palce we have to mention the system operating with low rate transmission speed but handling numerous terminals, that meets demands of industrial enterprises (e.g. in the sugar industry). One of these systems cooperates with 13 remotedly located terminals working at 600 Baud. The diverse enterprises in the field of communication and transport have different character. The large main frame computer operating in a centre cooperates with both "passive" terminal (capable of providing RJE) and with intelligent terminal (RIAD-10 small computer). (For example the networks of the railways and that of the enterprise for lorry transports on highroads.)

The Computer Services of State Administration operating since about 3 years, belongs to the most extensive networks, being destined to meet the demands of seven ministries and governmental authorities concerning information processing.

Medium-size computers installed with the mentioned users, connected with a central large-size twin computer cooperate with an extensive terminal system. The central computer is a large Honeywell-Bull 66/60 and 66/20 type computer, the terminals are both RIAD-10 small computers, and INTERSCAN and/or REDIFON terminals. Each of the former are capable of local batch processing, too.

For scientific and educational purposes, too, operate several networks in Budapest. The network of the Hungarian Academy of Sciences built around a centrally located CDC 3300 computer serves on leased lines (with 2400 Baud speed and BSC procedure) 3 pcs UT-200 terminals and on lower speed DATEX lines further 3 large users are connected to the machine. (Terminals operating locally are not considered here.)

A similar users' system operates in the Coordination Institute of Computing Technique with connection of an IBM 370 and a Siemens 4004 computer completed by RIAD-10/12/15, and other small computers of similar performance that carry out several communication functions. The network serves very many medium speed terminals, located in the capital.

The network of the Central Planning Office is worth mentioning, too, where an ICL System 4/72 computer and RJE batch terminals and CRT terminals operate located around the computer.

An bureau providing computer services in the whole country called: Computing and Dataprocessing Enterprise (SZÜV) with a network of computing centers all over the country has 28 pcs RIAD-20/22 and RIAD-30 type computers. They are soon to be connected with Hungarian make small computers which will carry out the communication tasks. Likewise, an international EDP training institution (SZÁMOK) is preparing packet broadcasting connection between an IBM 370 system and remote terminals. The networks cited as examples are destined, first of all, to realize cooperation of remote systems within the country but several plans are being prepared according to which also connection over borders is to take place, e.g. preparation of a common network with the International Institute for Applied Systems Analysis (IIASA). The PDP 11/45 computer operating in the institute in Laxenburg (Austria) is to be connected with computing centers in the German Federal Republic, in Vienna, as well as with a Czech Research Institute, and centers in Budapest and Moscow. In the future connection also will be realized with computing centers of other countries, constituting a network - for scientific purpose - on the packet switching principle.

Now, a few words about a planned network system in the framework of the Hungarian Academy of Sciences. In the system four medium to large computers (typ. TPA 1140, RIAD-35 and CDC 330) will be connected with a communication subnetwork on the packet switching principle, in which the node functions will be carried out by RIAD-10 devices. Elements of this system are already in experimental stage. Starting up will take place next year.

SUMMARY

Summing up it can be stated that use of data transmission and on-line connection of computers and especially with numerous terminals are rapidly spreading in Hungary lately. Though the quantity of computers is not too high in proportion to the population of the country (60-65) for each one million inhabitants (the proportion of the computers participating in teleprocessing is constantly rising, will soon approach 30 p.c.).

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