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

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IIASA Working Paper

WP-83-020

February 1983



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**DATA COMMUNICATION IN HUNGARY —
THE TELECOMMUNICATION INFRASTRUCTURE AND
RELEVANT ADMINISTRATIVE PROCEDURES**

I. Sebestyen

February 1983
WP-83-20

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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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0. INTRODUCTION

In what follows, a description is provided of the data communication and telecommunication infrastructure in Hungary together with all the relevant administrative procedures. First, on a historical basis, the general status of telecommunication, information processing, and data communication is given. This is followed by a description of all the data communication services of the telegraph, telex, telephone, and dedicated data networks and the corresponding administrative procedures. Special emphasis is given to the public digital data network NEDIX, which is the first such service in Eastern Europe. Last but not least the legal basis for transborder data flows is outlined and a short overview of the present transborder data flow applications is described.

1. GENERAL STATUS OF INFORMATION PROCESSING AND DATA COMMUNICATION

The most frequently used physical carriers for data communication are the different telecommunication networks: the telegraph, the telex, the telephone, and the digital data networks. In order to understand the present status of data communication in Hungary it is impossible to ignore the history of these carriers, since their present state has evolved during the past decades, especially in the field of wired telecommunication. In addition, due to the complexity and "heaviness" of the system no rapid change can be expected. Thus, if one wants to predict where the Hungarian telecommunication service is moving, one should look back at its origins and compare with where it is now.

As to the telegraph network, which is also suitable for carrying low speed data traffic although its importance for this purpose is insignificant, the development in Hungary started well back in the last century. The first Hungarian cities were actually served by the Austrian telegraph network and it was only after 1867 when the Austro-Hungarian Monarchy came into life that the situation changed. One of the first steps of the new Hungarian government was to take over the telegraph network and to rebuild it within the frame of the new political borders of Hungary. First the center of the telegraph network, which was until 1867 in Vienna, was moved to Budapest and new lines were established between this new center and other major cities of the country. Due to the rapid industrial development in Europe, international connections had soon to be built also. On some heavily used lines starting from 1861 so-called Hughes-type of telegraph systems were introduced. These transmitted alphanumerical

characters. The first Hughes-type of system was put into service in Hungary for the connection between Vienna and Budapest in 1867. These Hughes-type systems were generally generally introduced in the country later and were used widely in a mixed way together with the old morse-type systems. In 1887 the telegraph and postal services were united; an important steps towards the type of PTT we know today. In 1876 Graham Bell put his new invention, the telephone, on exhibition at the World Fair in Philadelphia. In 1877 a Hungarian engineer Tivadar Puskás, who worked one of Thomas A. Edison's teams, suggested that switching exchanges should be introduced for the telephone service, which would allow flexible connections among all telephone subscribers. This idea was at that time revolutionary, since even Edison first thought that the telephone would not be more than a new type of point to point telegraph. The first telephone exchange on this basis was built in London. Puskás as a co-worker of Edison had the task to build telephone exchanges in a number of European countries. The first telephone exchange in Hungary was opened in Budapest on May 1, 1881, about five years after the telephone was introduced by Bell. On February 1, 1882 the first telephone directory of Budapest appeared, which reported about 240 telephone subscribers. Thus in Budapest there was considerable interest for this new service from the beginning. This was in slight contradiction to the general European view, which did not really believe in the viability of the telephone and did not recognize its economic importance. For example, the German Imperial PTT did not think at that time that the telephone was a useful invention, they only claimed that should it become so and they wanted to have a monopoly on it.

After the inauguration of the Budapest telephone exchange, telephone exchanges were also built in the major cities of the country also - Temesvár, Bratislava, Zagreb, Arad, Pécs, Sopron, Győr, Debrecen, Nagyvárad, Miskolc, Rijeka. The first international line was opened, allowing three parallel connections at the same time in 1890, obviously between Vienna and Budapest. Until 1897 the Telephone company of Budapest was in private hands, when according to the governmental law No. XVI the telephone company was taken over by the Hungarian Royal PTT. The legal basis for the takeover was actually laid in 1888 when the law No. XXXI declared that only the government had the monopoly to build telegraph and telephone networks in the country. Already at the time of the introduction of these new services the first Hungarian companies supplying telecommunication equipment were founded, for example, the predecessor company of the Telefongyár (TRT), which is today one of the main producers of Hungarian-made modems, multiplexers and terminals, was founded in 1876. As a recognition of the advancement of telecommunication in Hungary in 1896 the International Telecommunication Union (ITU) held, with the participation of 16 countries, its second conference on telegraphy in Budapest. Hungary's advance in the field of telecommunication shows that already in 1899 new experimental telegraph systems were introduced between Budapest-Temesvár and Budapest-Berlin with a speed of about 100 character/sec (!). The experimental service was later discontinued because at that time there was no need for such a high speed of communication.

In 1922, after World War I, when the telephone and telegraph service practically collapsed a ministerial decision was taken to build the first automatic telephone exchange in Hungary. The first such exchange was actually only installed in 1928 in Budapest. The first interurban connection without manual switching was introduced in Hungary in 1938.

At the turn of the century the telephone service of Budapest already had 5,300 subscribers. Since the telephone exchange operators could not keep all these numbers in their heads any more, in 1901 it became compulsory for the subscribers to give the name *and number* of the person they wished to call. It is interesting to note that at that time this step proved to be most unpopular within the subscriber community and was a major source of dissatisfaction with the service. Later on the introduction of dialling to select a subscriber by its telephone number became daily practice and was generally accepted by the public. Strangely enough we will now be in a position to return to the original stage. By putting more local intelligence into the telephone sets and the main exchanges, we could move back to the old principle of dialling in a more "forgiving" way: e.g., by names, or "the doctor in the High Street"; the computer either in the set or in the exchange could find out the exact number and could do the dialling automatically.

The first public telephone booth was installed in Budapest in 1901, at the Eastern Train station. By 1911 Budapest already had 18,000 telephone subscribers. After World War I the international link between Hungary and Austria was extended from 8 to 18 circuits in 1927. With this upgrade Austria also handled a considerable amount of transit traffic between Hungary and Western Europe. By this time all Hungarian

exchanges could be reached from all Austrian exchanges and vice versa. In a similar way connections were opened between Czechoslovakia and Hungary in 1928 with the transit possibility of three circuits to Berlin. The link between Belgrade and Budapest was opened in 1924 and through this also in a rather limited way transit to Greece and Turkey. A limited link between Hungary and Rumania was only opened in 1929, due to political difficulties; the problem of international information flow is thus not a new issue at all.

The penetration of the telephone network between the two world wars was slow. In 1940 in Hungary the number of telephone stations per 100 of population was 1.76. At the same time the same indicator for the USA was already about 15, however, among the neighboring countries it was still a "remarkable" position (Greece 0.76, Yugoslavia 0.45, Rumania 0.51). As a result of the destruction of World War II, the pre war indicator of 1.76 could only be reached again in 1950. In the war, 40% of the capacity of the Budapest telephone exchanges was lost and the rest seriously damaged. 70% of the wires were destroyed from the network itself. Also, the telegraph and broadcasting network was completely demolished.

By the end of 1981, according to [2], the number of main stations telephone in the country was 636,600, from which only about one-third was installed in homes, the rest in business. The number of telephone stations per hundred of population grew from 1.76 in 1950 to 12.1 in 1981, impressive progress in itself, but in comparison with other countries it is only moderate; e.g., [3] USA 79.1, Austria 36.6, Greece 28.2. All in all Hungary's international position in telephone population corresponds to its GDP/capita indicator. It is a well known fact that there is a direct

relationship between number of telephones in a given country and the GDP/capita. There is an interesting lesson for other countries here, in particular for the developing countries, since although Hungary was one of the first countries in the world to introduce this service and although it has been in the forefront of research and technological development in this field since then, the telephone infrastructure of the country due to its economic potential does not properly reflect its advanced knowhow in this field. There is certainly a positive feedback from a well developed telephone infrastructure to the economy, but first there must be an initial investment to build up the critical mass needed for such a feedback. Due to the present telephone infrastructure unlike other countries the telegraph network still plays an important role in the country. In Hungary one telegraph message/year/person is sent, which is worldwide an extremely high figure.

The telex network (partly used for data transmission - such is the case with meteorological data) was introduced in Hungary in 1942. This network had at that time only 26 subscribers and one center, operated manually. The number of subscribers grew relatively slowly, in 1944 it reached only 67 and, this value could only be reached again in 1948, after the telex network was restored. It was only in 1953 that the system became automated; at this time a Hungarian made telex network with one control exchange in Budapest and five exchanges in other major towns was put into operation.

International connection through telex became possible from the outset of this service back in the forties (this was actually one of the main reasons to introduce this service); from 1963 automatic international

calling became available. In 1974 the number of subscribers reached 5,000 and there is still a very high demand for becoming telex subscribers in the country; the waiting list is still rather long. In 1976 the density of the telex network was 6 subscribers/10,000 population, a relatively low figure; in some countries the telex density is over 20/10,000.

The Hungarian PTT has made data transmission both technically and legally possible since 1967. The number of subscribers with data transmission needs was relatively low during the first decade of data transmission, but this was also the case with the telex network. During the first years of service data transmission was provided through the telegraph and the telephone network on both switched and leased lines. In 1971 the Hungarian PTT opened its first dedicated data network called DATEX, which is built on a separate, independent telegraph type of network with one central exchange in Budapest. This network allowed data transmission up to 200 bit/sec in an asynchronous mode. The DATEX network was superseded in 1981 by the NEDIX data network.

In 1960 in Hungary there were only five computers in the country. By 1965 there were already 21 and by 1979 646; this does not include mini and microcomputers [4] (Figure 1). For this computer population in 1979 the number of data communication hardware processors (multiplexers as a part of the computer configuration) was 82, the number of line interfaces to these 390, the number of linked on-line terminals 274. The total number of network terminating points in 1980 was about 600. This gives 0.12 NTPs per ten thousand working population, which is considerably lower than the West European average (between 1 and 5), but is about the same range as the neighboring countries in Eastern Europe.

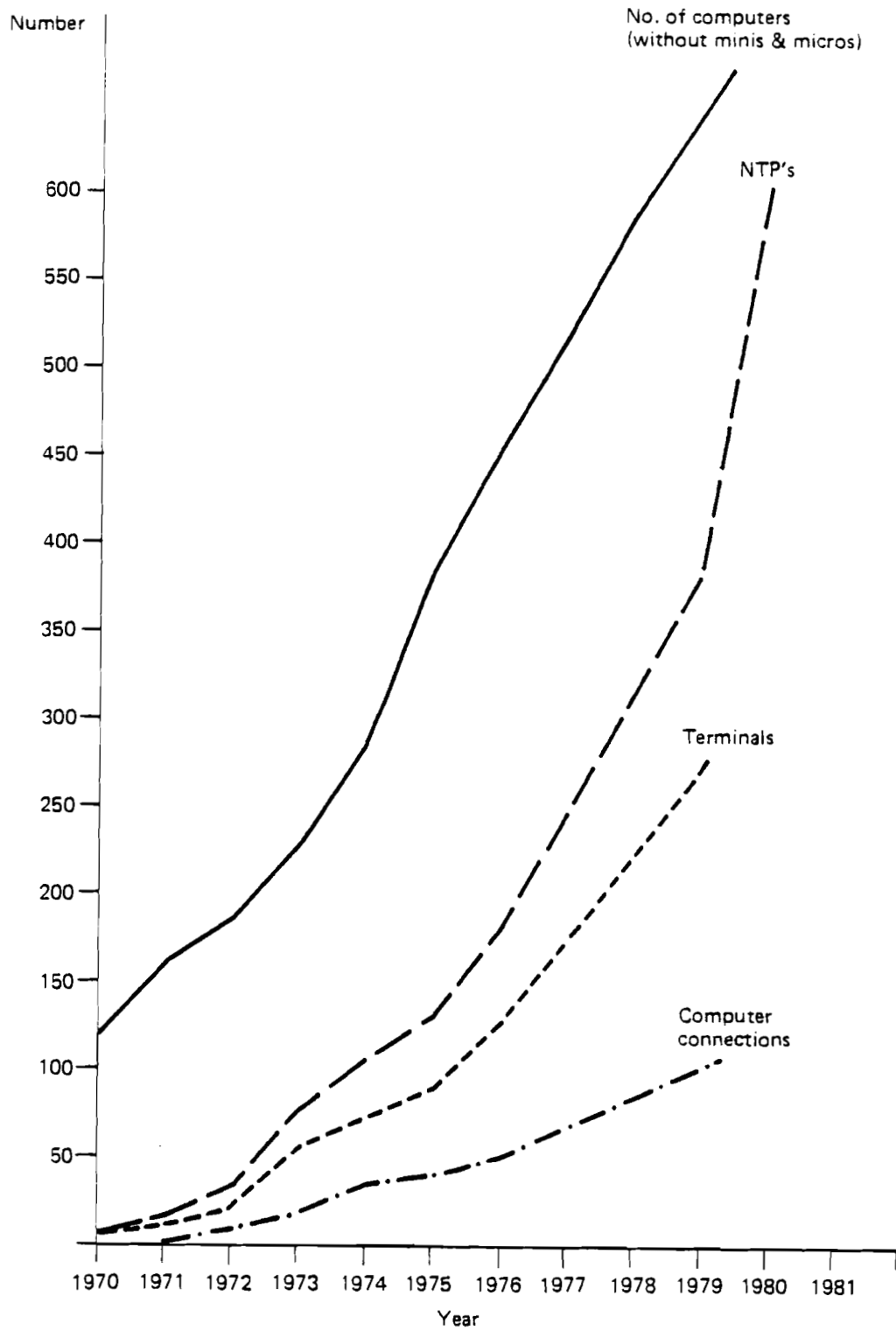


Figure 1. Number of subscribers for data services in Hungary [1, 4].

Figure 2 shows the distribution of NTPs by line use between 1970 and 1980.

It can be seen that the telephone network played the most important role for data communication in Hungary during the seventies; however the dedicated data network DATEX was also of major significance. The values in Figure 2 do not yet include data of the NEDIX network, which after a few months of its installation, i.e., at the beginning of 1982, had about thirty subscribers and a waiting list of over 60, due to the growing demand for data communication. More characteristic figures for the use of NEDIX can be expected in our view only around 1985, since each network needs a kind of introductory period.

Looking at the figures and demands for data communication it becomes evident, and this is also the expectation of the Hungarian PTT, that with the introduction of the new NEDIX network in 1981 basically all data communication needs for the first half of the eighties will be satisfied.

The relatively low use of data communication during the seventies can be explained because of the small number of computers with data communication facilities and the small volume of international data traffic, which during the seventies was confined practically to access to the SITA network. Other international network access projects were only in their experimental phase in the seventies.

With regard to computer hardware the seventies were dominated by mainframes of the RYAD I series, with limited or no data communication capabilities. This is one of the main reasons for the low figures in data

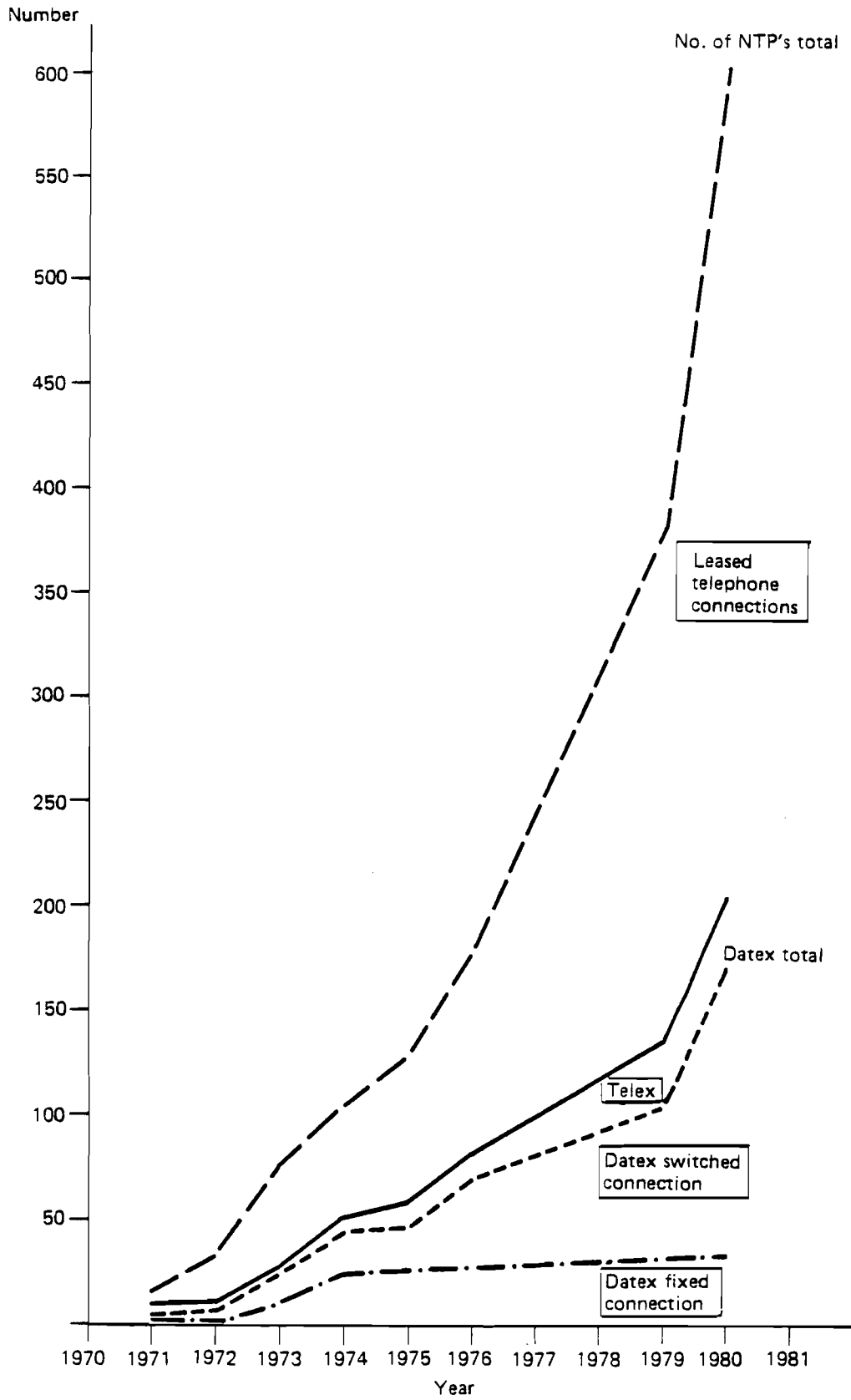


Figure 2. Distribution of NTPs by line use.

communication. The RYAD II series computers, which were introduced in 1979, however, do already support data communication and from the computer mainframe point of view it will certainly solve this problem. Another hardware difficulty lies in the interface of the present generation of RYAD terminals and data communication equipment that only support connections to analog carriers (CCITT V. interfaces), but not to digital circuits (CCITT X. interfaces). Along this line, e.g., no RYAD computer can be directly connected yet through a standard CCITT X. 25 interface to a packet switching network or the production of terminals with CCITT X. 20, X. 21 interfaces has only just started. For this reason the Hungarian PTT has also to support in its digital network NEDIX the V. interfaces by providing connection equipment according to CCITT X. 20 bis and X. 21 bis. On a research and experimental basis obviously various direct X. 20, X. 21, and X.25 interfaces for computer, telecommunication processors do exist, but not on a mass production basis yet, which is just about to start.

Concerning the necessity of introducing the digital data network NEDIX for Hungary the average annual growth rate of data terminals in the last couple of years reached 40-50%. Not only the growth of data terminal equipment but also the rapid development of teleprocessing earmarked the end of the seventies and the beginning of the eighties in Hungary. On the one hand the equipment and software components needed for teleprocessing is considerably improving, and on the other hand the demand for such applications is growing. For more and more users teleprocessing is becoming a necessary tool in order to satisfy their data processing demands.

In this new situation the Hungarian PTT had to respond accordingly, which it did with the introduction of its new data network service NEDIX.

As mentioned above, the Hungarian PTT first started its data service more than a decade ago, and since then it has been providing data link facilities over direct links and switched connections of the telephone and telegraph network. According to the PTT--from the line quantity point of view--there is no bottleneck to using these analog networks for data communication purposes in the short run. However, both the telephone and the telegraph network were not originally designed to carry data traffic, i.e., on the one hand it often brought about the problem of inadequate transmission quality and limited data services to the users, and on the other hand the way these services were provided in the long run seemed to be unfavorable for the PTT itself. For these reasons it seemed advisable to speed up the development and installation of a PTT network that is solely designated to serve the data communication needs of the users. The design of this new network responds to the following new philosophy adopted by the PTT.

A hierarchy of networks should provide for high quality performance in services, such as data services, teletex, telex, and telegraph. On the first level of hierarchy, a common, integrated, basic network should provide for the principal transmission of signals. The different type of value-added services for data, telex, teletex, etc. are provided on the second level.

Since public PTT networks are designed to provide services for several decades, when making the planning the actual situation of a given country and the future trends in development have to be taken into

consideration. In addition, international recommendations and standardization efforts, such as those of CCITT (within ITU) and ISO have to be taken into account. The Hungarian PTT, which is closely following all developments of CCITT and ISO, in addition follows the guidelines of the CMEA Permanent Commission on Postal and Telecommunication matters, and they are also actively participating in the work of that body. One of the present activities is to define the basic requirements for interlinking the present and future national data networks of the socialist countries. This work should aim to establish similar types of data networks and data service classes in the socialist countries. The technical specifications of the CMEA Permanent Commission fully harmonizes with the recommendations of CCITT, therefore in what follows only references to the original CCITT recommendations will be made.

After a specific tender for the new Hungarian telex and data network--after thorough technical and economic consideration--the offer from the Nippon Electronic Company (NEC) of Japan was finally accepted.

The new telex and data network (Type NEDIX 510 a) with one central switching center in Budapest and with multiplexers in major country towns was put into operation early in 1981. The use of the network is rapidly expanding, and in a couple of years the Hungarian PTT plan to upgrade their NEDIX network both in its capacity and in the scope of its services.

2. SERVICE STRATEGY OF THE HUNGARIAN PTT

The choice of whether to use the new NEDIX network or other PTT data communication services is left to the users. The Hungarian PTT itself, however, has a preference towards the new network, since the quality for data services can be easier fulfilled by NEDIX than by the analog telephone network. Nevertheless, the PTT does not plan to discontinue its earlier services; data communication over analog telephone and telegraph connections will still be provided in the future.

The technical parameters and the new tariff structure of the new system enable most data communications demand to be satisfied in an economical way. In some cases, however, it might happen that the technical parameters of the DTE or the software data processing system do not make the use of the NEDIX data network really economical. In such special cases it is best to rely on the traditional PTT data services.

The general policy of the PTT towards NEDIX is that through this data network all equipment needed for telecommunication are provided by the PTT on a lease basis. However for data communication over traditional telephone and telegraph lines, all telecommunication equipment, such as modes, and multiplexers, have to be made available by the user. Therefore the new policy--applied only for the NEDIX network--makes life both easier for the subscribers and for the PTT, which now can organize in an effective way the maintenance of all of the telecommunication equipment. The local connections to the NEDIX network or to its concentrators are provided in most cases through local analog telephone links. Only telecommunication equipment provided by the Hungarian PTT may be operated on these lines.

The NEDIX network and its services are such that they can be extended according to user demand. The extension can include, for example, new subscriber services, new special services, new subscriber interfaces, and new switching technologies. From this point of view it is of major importance that at a later date the Hungarian packet switching PTT network can be built on to NEDIX, because this network with its circuit switching capabilities takes fully into consideration those recommendations of the CCITT, which make provision for the introduction of packet switching services. The X.21 interface--used in synchronous services--represents also in the CCITT X.25 recommendation the lowest (the physical) level of the three levels defined. From the NEDIX's and PTT's point of view it is completely unimportant whether the synchronous channels of NEDIX are used by the subscribers for simple synchronous type of transmission or for a "user owned" packet switched subnetwork. For this reason the PTT does not object to the introduction of "user designed and serviced" private packet switched subnetworks, which the PTT itself does not yet support. According to PTT sources, for the next couple of years--at least until 1984/85--no PTT packet switched service is planned, mainly due to economic and technical considerations. The PTT seems to be confident that at this point practically all present and future user demands can be satisfied. As to the introduction of PTT packet switching services their standpoint is that the investment in hardware and software is not justified by the present and predicted user demand. If, however, users want to build their own packet switched subnetwork on NEDIX synchronous services, they may do it.

Data transmission over the analog telegraph and telephone network will be also possible in the future. The PTT, however, does not plan any major reconstruction of these networks in order to accommodate better data transmission services.

3. LICENSING PROCEDURE OF DATA COMMUNICATION EQUIPMENT BY THE HUNGARIAN PTT [5]

As outlined earlier, for the establishment of teleprocessing and remote computing systems there are at present three different telecommunication media available in Hungary:

- the telex/telegraph network
- the telephone network
- the circuit switched public data network NEDIX.

For the NEDIX network the Hungarian PTT provides all means and equipment for data communication between the telecommunication interfaces of the data terminal equipment. For the telephone network, the Hungarian PTT only provides the necessary transmission routes; therefore the users have to provide the data connection equipment, such as modems and multiplexers, needed for the remote data connection.

According to the present Hungarian Postal law (law No. 2 in 1964), the Hungarian PTT requires that only those types of equipment may be connected to any of the telecommunication networks of the Hungarian PTT that have been tested and approved by the PPT from the point of view of technical and safety requirements. On this same legal basis, all data connection equipment (modem, multiplexers, etc.) have to be licensed by

the Hungarian PTT.

The licensing procedure can be initialized either by the manufacturer of the equipment in question, by the distributor or by the end-user himself. The application for licensing should be submitted to the Central Telegraph Office of the Hungarian PTT (Posta Központi Távíró Hivatal--PKTH, Budapest, V., Városház u. 18. Mailing address: 1365, Budapest, Pf. 1).

There are three different types of licenses granted by the PTT:

- individual licenses (so-called "egyedi engedély")
- temporary type-licenses ("ideiglenes típusengedély")
- type licenses ("típus engedély").

The *individual licenses* are granted only for the piece of equipment that has been actually tested and it can be applied only for a specific application. The so-called *temporary type-license* is issued by the Hungarian PTT as a result of the PTT test of a prototype telecommunication equipment in question. This temporary license is only valid for the piece of equipment that has been tested and the aim of the license is to inform the manufacturer about the standpoint of the PTT before launching mass production. Application for a *type-license* can only be submitted for equipment that can be mass produced through the same technology and where it is secured that all equipment coming from the production line is identical in their technical parameters and quality. Therefore the validity of the *type-license* is extended to all equipment that is identical in parameters and quality to the piece of equipment that was subject to the PTT test. Furthermore, it is a necessary precondition for any *type-*

license that the equipment to be licensed has to comply with the corresponding CCITT recommendations and with the general requirements and regulations for provision of healthy and safe working conditions.

The Hungarian PTT keeps at the PKTH an open register on the licensed equipment and provides information on them and on the range of permitted applications.

A full list of data connection equipment as of February 1982 is provided in Table 1. In principle both Hungarian and non-Hungarian equipment can be submitted for application.

It should be noted that Table 1 only contains information on licenses that include information about equipment presently in use. Thus, for example, equipment with early licensing dates, and that is technically obsolete and neither in use nor in continued usage, is not included in the table.

In addition to the up-to-date register maintained by the PKTH--where information can be provided any time upon request--the journal "Számítástechnika" is planning to publish the updated list of PTT licensed equipment once or twice annually.

Costs incurred for testing and licensing of any telecommunication equipment are to be met by the applicants according to the actual expenses.

Table 1. List of data connection equipment (modems) tested and approved by the Hungarian PTT.

Type	Manu- facturer	PTT license number	Data transmission speed (bit/sec)	Type of Application
VT-60200	VIDEOTON	VT-6-0040	600/1200	<ul style="list-style-type: none"> - for direct telephone connection with two and four wires, - for switched telephone network with or without. <p>The license is also valid for modems which are built into the terminals VT-56191, VT-60291, VT-60292.</p>
24 LSI	RACAL- MILGO (UK)	VT-6-0041	1200/2400	<ul style="list-style-type: none"> - for direct two and four wired telephone connection - for switched telephone network in connection with an LA III. Call handling device.
MPS 48	RACAL- MILGO (UK)	VT-6-0048	4800/3200	<ul style="list-style-type: none"> - for two and four wire direct telephone connection.
AM-1200	ORION (HUNGARY)	VT-6-0051	600/1200	<ul style="list-style-type: none"> - for two and four wire direct telephone connection. - for switched telephone connection. <p>The modem family is produced in the following models:</p> <p>AM-1200/E</p> <ul style="list-style-type: none"> - without supervisory channel and calling/answering capability <p>AM-1200/F</p> <ul style="list-style-type: none"> - with calling/answering capability but without supervisory channel <p>AM-1200/G</p> <ul style="list-style-type: none"> - with supervisory channel but without calling/answering capability <p>AM-1200/H</p> <ul style="list-style-type: none"> - with supervisory channel and calling/answering capability.
AM-2400	ORION (HUNGARY)	VT-6-0057	1200/2400	<ul style="list-style-type: none"> - for direct two and four wire connection <p>The validity of the license includes the models AM-2400/F and AM-2400/L as well, but the latter can only be applied for local telephone networks.</p>
VT-60300	VIDEOTON (HUNGARY)	VT-6-0059	1200/2400	<ul style="list-style-type: none"> - for direct two and four wire connection - for switched telephone network but with manual calling initiation and manual call receipt. <p>The license does not include the multipoint option provided by the modem.</p>
VT-61400	VIDEOTON (HUNGARY)	VT-A-0060	600/1200/2400/ 4800/9600	<ul style="list-style-type: none"> - for galvanic two and four wire connections.
TAM-601	TERTA (HUNGARY)	VT-5-0061	600/1200	<ul style="list-style-type: none"> - for direct two wire telephone connection - for switched telephone connection <p>Application valid for modems with TMM-600 monitoring device too.</p>
SENA- TRANS 4302	TRT (FRANCE)	VT-6-0063	4800	<ul style="list-style-type: none"> - for four wire direct telephone connection, in duplex and half duplex, with manual balance without replay channel.
3863/1	IBM (USA)	VT-6-0064	1200/2400	<ul style="list-style-type: none"> - for direct four wire telephone connection in point-to-point or multipoint mode. <p>The device cannot work together with other type of V.26 type of modems.</p>

TAM-201	TERTA (HUNGARY)	VT-2-0065	200/300	- for two wire direct telephone connection - on switched telephone network, also with TMM 200 type of monitoring device.
AM-12TD	ORION (HUNGARY)	VT-6-0066	600/1200	Modem built according to the V.22 recommendation of CCITT. In synchron or start-stop mode - for two wired, direct telephone connections - for switched telephone network.
3864/1	IBM (USA)	VT-6-0067	1200/2400	- for four wire direct telephone connection in point-to-point or multipoint mode. Because of the applied modulation the modem cannot work together with other type of v.27 type of modem.
2200/24	RACAL- MILGO (UK)	VT-6-009	1200/2400	- for four wire direct telephone connection
SZAM-32	MTA SZTAKI (HUNGARY)	VT-6-0022	Maximum 3200	- for two- and four wire direct telephone connection, - on switched public telephone network (with restrictions)
S 8351	SIEMENS (FRG)	VT-A-0025	1200/2400/4800	- for two- and four wire galvanic connection. In case of four wire connection up to 10 Km length it can be run also on 9600 bit/sec speed.
TAM-200	TERTA (HUNGARY)	VT-2-0026	200	- for two wire direct telephone connection, - over switched telephone network
TAM-600	TERTA (HUNGARY)	VT-2-0027	600/1200	- for two wire direct telephone connection, - over switched telephone network
GH-2052	ITT-SRT	VT-6-0028	600/1200	- for two and four wire direct telephone connection - for switched telephone network The modem does not comply exactly ^{with} the CCITT regulations, therefore for the switched telephone network it can be used only according to given conditions.
FM-200	VILATI (HUNGARY)	VT-2-0030	200	- for two wire direct telephone connection
5979	IBM	VT-A-0032	2400/4800/9600	- for four wire galvanic connection
3872	IBM	VT-6-0033	1200/2400	- for two and four wire direct telephone connection
SEMATRANS 1203	TRT (FRANCE)	VT-6-0049	600/1200	- for two and four wire direct telephone connection - for switched telephone network with manual calling/answering
SEMATRANS	TRT (FRANCE)	VT-6-0050	1200/2400/4800/ 9600/19200/ 38400	- for two and four wire galvanic connection
MK-600	MIKI (HUNGARY)	VT-6-0053	600/75	- for two and four wire direct telephone connection. In simplex mode, the data channel is 600 baud. The PTT permission is given for a modem card with the understanding, that it has to be applied in "telematics" equipment manufactured by MIKI. The mode of application has to be provided by the user before installation.
MK-75	MIKI (HUNGARY)	VT-6-0054	75/600	Simplex modem, 600 baud data channel, 75 baud reverse channel. Procedures for application similar to MK-600.
26 LSI	RACAL- MILGO (UK)	VT-6-0070	1200/2400	- for two and four wire direct telephone connection in point-to-point or multi-point mode with reverse channel, CCITT B type of communication. To the modem a voice adapter type RACAL-MILGO VA-100 can be connected.

4. DATA COMMUNICATION OVER ANALOG TELECOMMUNICATION NETWORKS — TECHNICAL CHARACTERISTICS AND TARIFFS

4.1. Technical Characteristics

Data communication over analog telecommunication networks, i.e., the telegraph, the telex, and the telephone network will also remain in use for a long period in the future. The significance of the telegraph and the telex network, because of its low speed and limited character sets, will, however, be minimal. The analog telephone network, on the other hand, will keep its role in data communication for a long time.

From the technical point of view, as in other countries, for speed half duplex is generally possible for the public switched telephone network up to 2400 bit/sec; higher speeds are only possible in a limited way, depending on the actual technical status of the line used and of the telephone exchanges, which are in some regions hopelessly overloaded and outdated. Higher speeds are possible on the new generation exchanges and lines, which are gradually taking over the function of old equipment and lines

Leased telephone lines with line quality according to CCITT M 1040 (and if needed M 1020) with speeds up to 9600 bit/sec are in use, but actually the quality of the leased lines basically corresponds to the average Western European standard. With regard to line quality and speeds it is the modem that is decisive. According to the CCITT recommendations each modem has a certain requirement towards line quality (e.g., CCITT M 1020; M 1025 or M 1040) and the PTT automatically - when it provides the permission to connect the modem to the line - measures the quality of the connection. The requirements for M 1040 (characteristics of ordinary

quality international closed circuits) are no problem, since the network basically provides this quality. M 1020 - the special band with conditioned connection - however, cannot always be assured. The PTT nonetheless does not see the line quality as a bottleneck, since according to the general tendency adopted by the manufacturers of modern modems, more local intelligence is put into the modems itself, which allows them to work with higher speeds even on lower quality lines. In this way modems with speeds up to 14400 and 16000 bit/sec are already on the world market. The usual practice is that when the CCITT recognizes that such new equipment can be mass produced by a manufacturer in a reliable way, then it is ready to take over the specification of the modem as a CCITT recommendation.

4.2. Tariffs

Tariffs for data communication in Hungary are regulated by the Ministry for Transport and Post in accordance with the National Bureau of Materials and Prices. The legal basis for tariffs was laid down in the postal and telecommunication law of 1964 (II. law No. 6, phrase 1c) and in the 41/1979 (XI.1) regulation of the Council of Ministers (No. 2, phrase 1). The actual tariffs are then defined and modified according to needs on this basis by the Ministry for Transport and Post. The latest modifications of the telex and data communication tariffs for analogue networks were issued by the Ministry on April 9, 1982 (Regulation No. 3/1982 (IV. 6) KPM, VI. 5/1982 (AT 15), and VI/4/1982 (AT 15) modified the previous regulation issued in early 1981: VI/4/1981 (AT2), and VI/2/1981 (AT2)).

4.2.1. Telex Tariffs

Although the role of telex is not too important for data communication, some basic figures are given below.

I) Installation Fee

In addition to the installation costs needed for a telex terminal and for becoming a subscriber of the telex service, for the licensing procedure of a telex data terminal 500 Ft per data station has to be paid.

For the actual installation of the telex data terminal the Hungarian PTT charges the customers according to the real costs of installation.

II) Monthly Charges

- a). Monthly subscription fee to the telex network: 1200 Ft/telex station.
- b). Rental fee for data communication equipment leased from PTT is 2% of the gross price of the apparatus.
- c). Maintenance fee for data communication equipment leased from PTT is 1% of the gross price of the apparatus.
- d). Maintenance fee for the telex network.
- e). Message charges:
 - 1). Direct telex data connection
 - a). Line fee: 50% of a corresponding telephone line fee between the locations of the telex stations.

- 2). Switched telex data connection
 - a). cost of messaging between telex stations belonging to the same telex exchange centers: 1.50 Ft for every three minutes.
 - b). cost of messaging between telex stations of different exchange centers
 - between 8-19 o'clock 1.50 Ft/36 sec
 - between 19-8 o'clock 1.50 Ft/54 sec

4.2.2. Tariffs for Data Communication through the Telephone Network

1). Connection fee both for direct and switched telephony.

A connection fee--in addition to the actual installation costs--for a telephone station is 6000 Ft for residential users and 30000 Ft for business users. This relatively high additional cost is aimed as a subsidy for the development investment of the telephone network. According to this, a fee of 30000 Ft is charged for establishing data terminal equipment access to the public switched telephone network pro two wire access point.

Thus for direct point to point connection over a two wire link an installation fee of 60000 Ft is opted for, and for a four line direct point to point connection 120000 Ft.

2). Public Switched Telephone Network

I). Installation Changes

In addition to the connection costs for the licensing procedure of connecting data communication equipment to the telephone network, 500 Ft has to be paid. For the actual installation costs the PTT bills the applicants according to the real costs of installation.

II). Monthly Charges

- a). The usual monthly subscription charges, as for any telephone station obviously apply.
- b). For data communication equipment rented from the PTT 2% of its gross price has to be paid.
- c). For the maintenance of these PTT owned data communication equipment 1% of its gross price is charged.

III). Service Charges

For data traffic on the PSTN the usual telephone charges apply, which is time and distance dependent. Basically the user has to pay for any telephone impulse consumed. The duration between two telephone impulses depends on the time of day, e.g., in cities it is 1.50 Ft for every 3 minutes between 6:00 and 18:00 and for every 6 minutes between 18:00 and 6:00.

Interurban charges vary according to the distance and time of day between 15 and 60 seconds telephone time for 1.50 Ft.

Charges of calls to other countries depend basically on time, distance, and technical possibilities. As an example, a 1-minute

direct call from Hungary to Austria costs 13.20 Ft, to the FRG 19.50 Ft, to Italy 27.00 Ft, to the UK 31.80 Ft to Poland 17.40 Ft, to the GDR 19.40 Ft, and to the USSR 34.10 Ft.

3). *Direct Data Communication Links*

I). *Installation Charges*

In addition to the connection and telephone installation charges mentioned above 500 Ft is charged for the licensing procedure for the connection of data communication equipment to the telephone network. For the actual linkage of the data communication equipment to the telephone network, the PTT bills the applicants with the real costs of installation.

II). *Monthly Traffic Charges*

a). For local direct data connection the monthly charges for each subscriber and interexchange line per circuit are the following:

- 2-wire connection 1200 Ft
- 4-wire connection 2400 Ft

b). For long distance direct data communication links the monthly charges are the following:

1). For telegraph and telex types of connection

- up to 50 baud 50%
- up to 110 baud 60%
- up to 200 baud 70%

of the costs of a direct telephone line between the two end points of the connection.

- 2). For telephone type of connection the monthly costs are equal to the monthly costs of a direct telephone line, unless time division multiplexing by the user is used, in this case it is increased by 30%, but no third party traffic is allowed on the line.

Cost of Long Distance Direct Telephone Connection:

in zone I

- up to 5 km 4000 Ft/month
- up to 10 km 7000 Ft/month
- up to 25 km 13000 Ft/month

in zone II

- up to 100 km 26000 Ft/month

in zone III

- over 100 km 39000 Ft/month

5. THE DIGITAL DATA NETWORK NEDIX

5.1. The Main Functions of the NEDIX Network

The NEDIX network is built upon the recommendations of CCITT (of ITU) for public data networks. Its basic principle is *circuit switching*, but the applied technical solutions do not prevent the introduction of new services (such as *packet switching*). On the contrary they make provisions for extensions those.

The NEDIX data network of the Hungarian PTT supports data transmission services of different speeds and types. The first NEDIX electronic data exchange and switching center was installed at the Central Telegraph Office of the PTT in Budapest in early 1981. At this stage the system was a star-shaped network, but the services of this network could be utilized nationwide.

In five major rural towns of Hungary (Miskolc, Debrecen, Szeged, Pécs and Győr) multiplexers were installed in order to collect and distribute traffic from and to data terminal equipment.

It is planned--according to the traffic growth--to upgrade the NEDIX network by installing electronic switching centers--similar to the one in Budapest--in the above major rural towns of Hungary.

The data terminal equipment of the subscribers which can be a data terminal or a host computer, are connected by so-called *unified digital interfaces* to the data network. The physical connection between the network and the *data terminal equipment (DTE)*, is provided by a so-called *Data-circuit Terminating Equipment (DCE)*, which fulfills all functions of initiating, upkeeping, and terminating data communication calls. The DCE provides for all necessary coding and signal transformation. The *Data-circuit Terminating Equipment* of NEDIX is--on an exclusive basis--rented from the PTT, and users have to pay for their lease and maintenance.

The connection principle of DTEs to the network is based upon the CCITT recommendations X.20 and X.21. The primary aim of the NEDIX data network is to serve "X-type" of DTEs, which at present only represent

the minority of the terminal population. For this reason the Hungarian PTT also supports the connection of CCITT "V-type" data terminal equipment, which was mainly designed for data transmission on analog telephone networks. For subscribers with "V-type" data terminals the PTT provides a special device that performs the necessary V/X conversion. This device will be installed at the user's site and will be connected to the above mentioned DCE, also provided by the PTT. Using this solution, the "X-type" of equipment can call or receive calls automatically while the "V-type" of DTEs can call the network only through manual operation—although incoming calls can be received either manually or automatically.

The data terminal equipment can be connected to NEDIX either directly through separate direct connection or through multiplexers, which are located, as mentioned before, in the main telephone exchanges.

The Data-circuit Terminating Equipment at the users' end can according to the physical parameters of the connection to the network be connected through a modem (if the carrier is voice frequency) or through so-called baseband transmitters (if the carrier of information is digital, without modulation).

All subscriber connections have to be 4-wire lines. The NEDIX network does not provide any speed and protocol conversion, therefore only those connections are technically feasible where data terminal equipments with the same protocols (synchronous or asynchronous) is to be interconnected.

Connections between DTEs are established on the basis of the *call number* of the DTE to be called. All stations of NEDIX are identified by a six digit call number. The numbering system is such that the same station can be addressed by all subscribers through the same identification number.

On NEDIX the following subscriber service classes (according to CCITT X.1) are supported:

- the asynchronous low-speed services class 1 and 2 and
- the synchronous medium speed services class 4 and 5.

All NEDIX services enable duplex type of data transmission. During establishment of calls in all CCITT X.1 type of service classes the CCITT No. 5 code set is used, and the character structure is identical with the one used during the data transmission phase.

Special NEDIX Services

The basic function of the network is to provide concurrent connections between data termination equipment belonging to the same service classes.

Apart from this basic service some special services are also at the disposal of the users. Along this line the NEDIX network offers the following special services according to the X.2 recommendation of CCITT:

1) *Direct Calling*

This service enables the network to connect the calling stations--after having received the call request signal--directly to the predefined called station without dialing the number of

the called station.

2) *Closed User Group*

Closed User Groups enable the subscribers of a predefined group of DTEs to make connections only among themselves. DTEs outside the Closed User Group may not call any member of the group. One DTE may be a member of a maximum of two groups.

3) *Closed User Group with the Right of Establishing Outgoing Calls*

Specified members of a Closed User Group may establish outside calls to DTEs belonging to the same service classes.

4) *Call Restrictions within a Closed User Group*

- a) Specified members of Closed User Groups may not be called from even other members of their own groups.
- b) Specified members of Closed User Groups may not call other members of their groups.

5) *Identification*

- a) At the time of call initiation the network may send the number of the calling part to the called DTE.
- b) At the time of call initiation the network may send the number of the called partner to the calling DTE.

In addition to the above CCITT recommended services the following value added services are available on NEDIX:

1) *Group-Switching*

The option of group-switching enables several DTEs of the same service class linked to the same center to be called by one common number; the network selects a free line and DTE according to a predefined chain of data terminals.

2) *Call/Receive- Only Stations*

Any data terminal of the network can be turned into "call" or "receive-only" types.

5.2. Technical Characteristics of the NEDIX Network and its Services [6]

At this point no attempt is made to describe the technical details of NEDIX fully, which has been done, for example, by [7, 8, 9, 10]; only some of important aspects for users are outlined here.

5.2.1. Subscriber Service Classes of the Data Network

Subscriber service classes of public data networks are defined by the X.1 recommendation of CCITT. According to this, circuit switching data networks support *start-stop* and *synchronous* type of Data Terminal Equipment (DTE).

a) Start-stop (asynchronous) services

From the service classes listed in the CCITT recommendation, the following are available on NEDIX:

Class 1: With bound address selection and data transmission speed (both 300 bauds) and predefined character structure (1 start-, 8 information-, 2 stop bits). During the phase of call establishment both DTE and network use the

code set CCITT No. 5.

Class 2: Into this class belong all data stations working with 11 bit character structure and 200 baud speed. The same data transmission speed and character structure are used during both the phase of call establishment and data transmission.

The above *start-stop* type of subscriber categories are code- and speed-dependent. However, taking into account that at present there is a strong demand by several users to continue the speed- and code-independent service of the *old DATEX* network as well transmission up to 200 baud speed is provided within class 2 services of the new NEDIX network--in addition to the CCITT X.1 recommendations--as class 2' service code and speed-independent data. Subscribers of the class 2' use number dialing (10 impulses/sec)--according to CCITT U.1.B--and use single- or double-current telegraph interfaces.

b) Synchronous type of services

According to CCITT classes 3-7 are provided for synchronous data terminal equipment (Table 2). These classes utilize the CCITT No. 5 code during the call establishment phase. The NEDIX network supports only the synchronous classes 4 and 5 in its present configuration.

The network is provided for duplex transmission in all application classes.

In the first phase of interconnections to other national data networks it is planned to link NEDIX to Austrian data networks, i.e., to the DATEX circuit switching network of the Austrian PTT, and to the network

Table 2. Subscriber Service Classes of the Hungarian PTT Data Network NEDIX

Service class	call establishment			data transmission		Type of DTE
	Speed /bit/s/		Character-structure	speed /bit/s/	Character-structure	
1.	300	No.5	11 bit	300	11 bit	start-stop
2.	110	No.5	11 bit	110	11 bit	start-stop
	200	No.5	11 bit	200	11 bit	start-stop
2' / DATEX /	Number dialing, 10 imp/sec			max. 200	free	start-stop
4.	2400	No.5	-	2400	-	Synchronous
5.	4800	No.5	-	4800	-	Synchronous

Subscriber Service Classes of the Hungarian PTT Data Network NEDIX

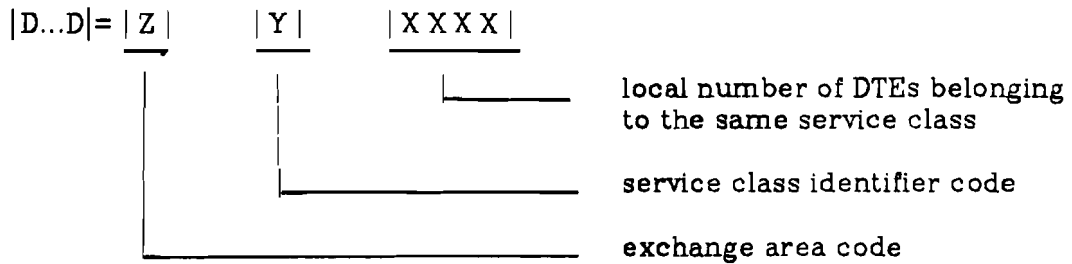
node of Radio Austria in Vienna . The latter was actually put into operation in July 1982. As to the connection to the Austrian DATEX system, the asynchronous type of services in class 1 and 2 can be interconnected without any technical difficulties. The synchronous services for class 4 and 5 do differ for the two networks in the so-called envelope structure. The NEDIX has a 6+2 envelope structure according to CCITT recommendation X.50, the Austrian DATEX has a 8+2 envelope structure according to

CCITT recommendation X.51. Thus, in order to interlink the service classes 4 and 5 of the two systems, an X.51/50 converter has to be installed, which has to be provided according to CCITT recommendations by the Austrian PTT.

5.2.2. Numbering System of the Data Network

Data stations of NEDIX are identified by a six digit so-called network terminal number (NTN). The numbering system is closed, thus, any particular terminal can be reached by all other terminals belonging to the same service class by the same network terminal number. The numbering system will not be changed when the network gets upgraded and it also allows the introduction of new service classes.

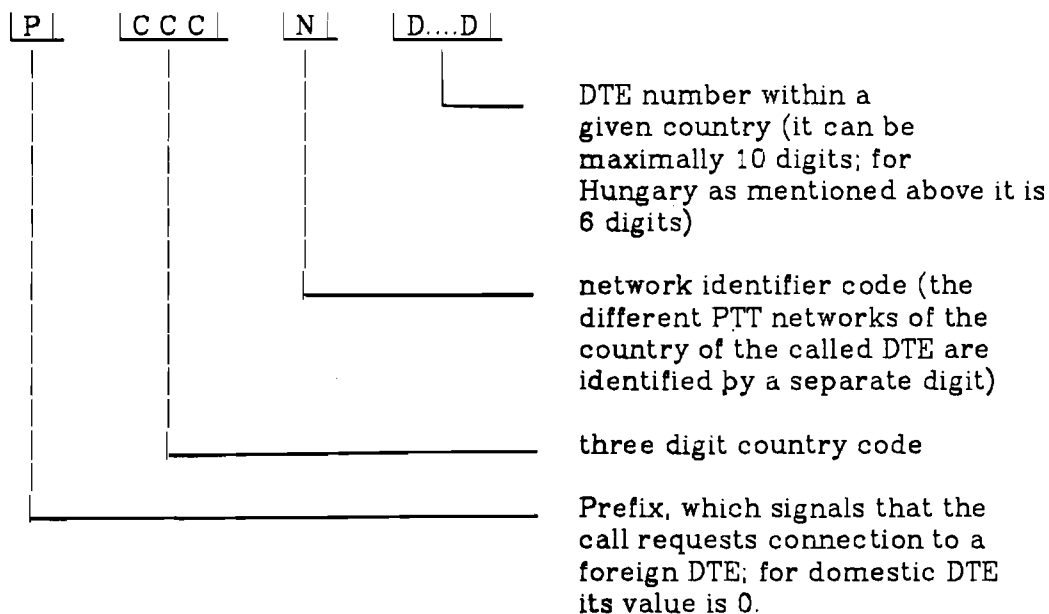
Structure of the 6-digit Numbering System



International Calls

International calls from and to Hungary through the NEDIX network can be made according to the X. 121 recommendation of CCITT: according to this CCITT recommendation, Hungary, for example, has the country code "216", which would be used by the caller from abroad.

General Structure of International Calls



Thus a call to Hungary:

P 2160 D₁ ... D₆

5.2.3. The Topology and Systems Technology of the NEDIX Network

The present NEDIX network incorporates in its present topology all elements needed for future upgraded network based upon many switching centers. The network supports even in its present star-like form the connection of DTEs country-wide. The network performs all digital switching and all network multiplexing functions on the basis of time division. The principle of time division enabled the optimization of the switching and data transmission functions of the system. At remote locations of the system in five major cities of Hungary time division multiplexers were installed, as their counterpart in the central data switching center in Budapest is a joint multiplexer, a so-called transmultiplexer. The synchronous data channels are collected according to CCITT X.50 by digital

time multiplexer devices.

These digital multiplexer devices, which operate with a group carrier rate of 64 kbit/sec, are connected locally (within a given local network) either by baseband or by PCM transmission devices.

Subscribers may connect their DTEs through DCEs directly to the network switching center or to the multiplexers installed in the country towns. The signal transformer at the user side is built in the DCE. Up to a maximum of 20-30 km--provided physical connection is given--baseband transformer has to be used, beyond this limit a modem should be applied connected to analog telephone channels. Figure 3 lists all options for connections to the NEDIX network.

The multiplexers--at least at the beginning of the NEDIX service--are installed in PTT buildings. It is, however, quite clear that in certain cases it would be of major advantage (both for the subscribers and the PTT) if multiplexers could also be placed at the user's location. This opportunity has been looked at recently by CCITT and resulted in a recommendation for synchronous multiplexer-DCE specification. This new recommendation could not be taken into consideration in NEDIX, but the PTT is examining how it might be introduced.

The synchronous DTEs are connected to the network on the software principle of enveloping. Enveloping means that the bit stream coming from the DTE is divided into 6-bit groups, and each group has two additional bits to indicate the status of envelope synchronizing and control interface wires. As a result of the enveloping the actual transmission speed of the network is 33% higher than the speed available for sub-

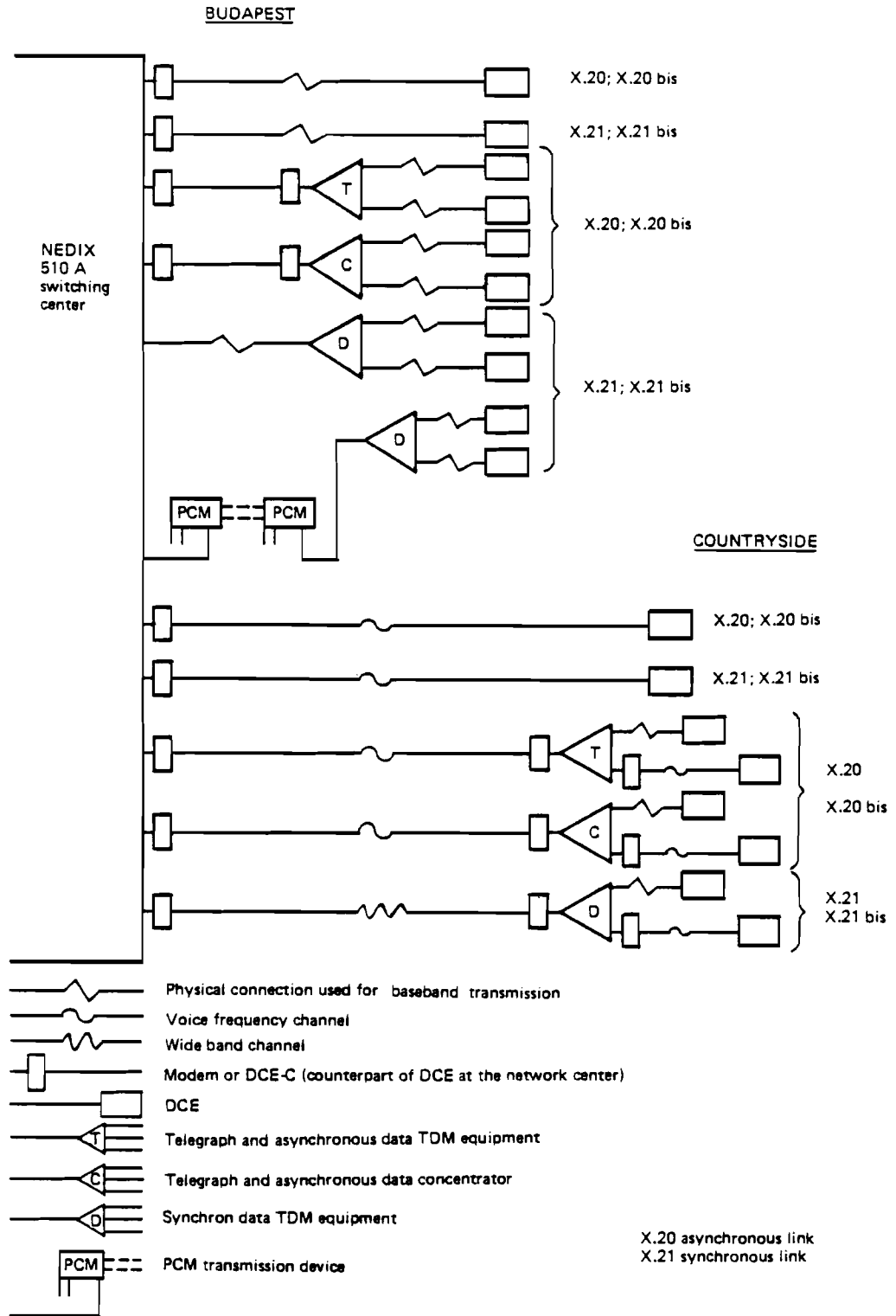


Figure 3. Connection options to the NEDIX network

scriber services. As a result of the enveloping the carrier rate is 3200 and 6400 bit/sec, respectively, for class 4 (2400 bit/sec) and class 5 (4800 bit/sec) services (Figure 4).

5.2.4. Quality Parameters of Subscriber Services

- The bit-error rate between two NEDIX DTEs of the same service class cannot be worse than 10^{-5} .
- The time limits for call establishment and call termination are the following (Table 2a).
- On the data network not more than one unsuccessful connection attempt is allowed for every thousand call requests. The reasons for this can be traffic congestion on the network, or disability of handling the call request, or hardware errors.
- On the basis of calculations it is expected that on average that only once in every 100 days will subscribers have to restart their data transmission due to network errors of NEDIX. In such cases the network center will not accept new call requests, but existing data connections will be still served. The restart process and the duration of such "disturbances" is expected to be in each case about 20 seconds. The disruption of existing connection is expected to happen even more rarely.

5.3. NEDIX Tariffs

All NEDIX tariffs for installation of DTEs and their operation are also governed by the Regulation of the Ministry for Transport and Telecommunication (Közlekedés és Postaügyi Minisztérium) on the Tariffs of Data

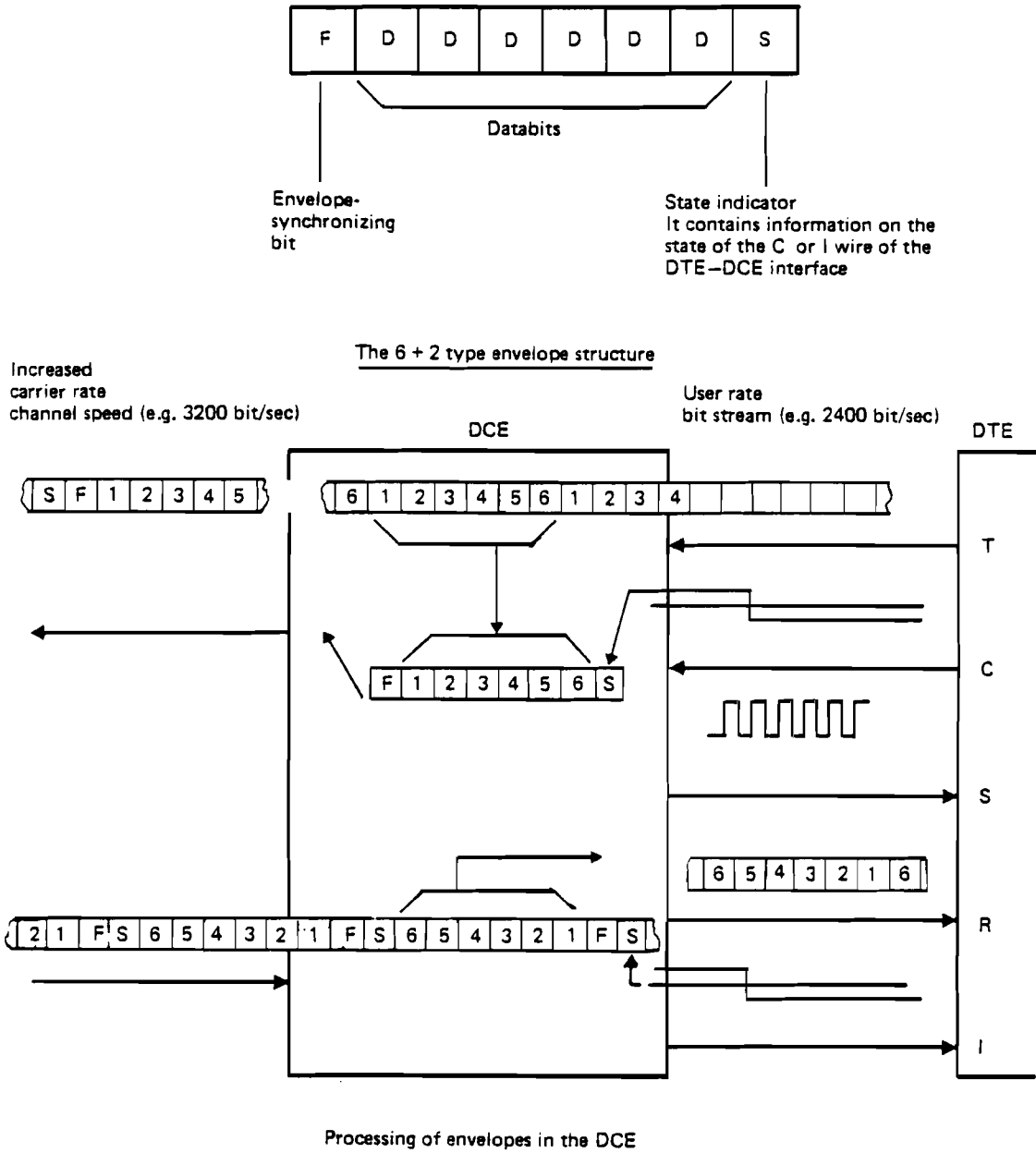


Figure 4. Processing of envelopes by the DCE

Table 2a.

	Between call and call request	Between call termination request and actual termination
Asynchronous service classes	150 msec	490 msec
Synchronous service classes	50 msec	100 msec

Communication Services (No. VI/4/1981/AT 2). The tariffs fall basically into two major categories; cost of service initiation and costs of service use.

I. Tariffs for Service Initiation

These tariffs are to paid when users subscribe to NEDIX:

- 1) The connection fee is 500 Ft and has to be paid for the administration and licensing procedure before installation.
- 2) All costs in connection with the establishment of lines and installation of DTE. Subscribers have to pay for the installation according to the number of working hours and materials used. This usually does not exceed 2000-5000 Hungarian Forints. Higher costs, however, can be expected if the required 4-wire connection has to be provided through the installation of a separate line or by the provision of some special devices. In such cases the subscriber will be notified separately, and the PTT only starts installation upon acceptance of extra costs by the subscriber.

II. Monthly Payments

For the use and operation of the network, monthly payments have to be made. These payments are *fixed* and *traffic dependent*.

a) Fixed Charges

1) Monthly subscription fee

A monthly subscription fee--independent from the traffic--has to be paid for each DTE connected to the network:

class 1 (300 bit/s)	1200 Ft
class 2 (200 bit/s)	1200 Ft
class 4 (2400 bit/s)	3000 Ft
class 5 (4800 bit/s)	4000 Ft
class 6 (9600 bit/s)	4800 Ft

2) Equipment rental

(see Table 3).

Table 3. Monthly equipment rental

Equipment	Service Classes				
	1	2	4	5	6*
Forint					
Data circuit terminating equipment (DCE)					
- for digital connection (X.20/X.21)	800	800	1200	1200	1200
- for analog connection (X.20 bis/X.21 bis)	800	800	5000	1100	13000
Network controller	700	700	700	700	700
Other equipment	2% of the gross price of equipment				

* This service is not offered yet on NEDIX, only prices are defined.

3) *Equipment maintenance charges*

(see Table 4).

Table 4. Monthly maintenance charges of equipment

Equipment	Service Classes				
	1	2	4	5	6*
	Forint				
Data Circuit terminating equipment (DCE)					
- for digital connection	400	400	600	600	600
- for analog connection	400	400	2500	5500	6500
Network controller	350	350	350	350	350
Other equipment	1% of the gross price of equipment				

* Service not offered yet on NEDIX

4) *Line Maintenance Charges*

If the DTE and the data switching center is connected to the same local telephone network, maintenance of lines is without charges. If the DTE is connected by long-distance line to the data switching center, then 2 Ft maintenance charges for every 100 m of the long-distance line have to be paid by the subscribers.

All monthly fixed charges have to be paid independent of the amount of traffic between the DTE and the NEDIX network.

b) Traffic Dependent Usage Charges1) *Local traffic*

(between DTEs connected to the same data switching centers)

Day fares (between 8:00 - 19:00 hours)	Minute charges (Ft)
---	------------------------

Class 1	1
Class 2	1
Class 4	2
Class 5	4
Class 6*	8

Night fares (between 19:00 - 8:00 hours)	Minute charges (Ft)
---	------------------------

Class 1	0.75
Class 2	0.75
Class 4	1.50
Class 5	3
Class 6*	6

2) *Long- distance Usage Charges*

(between DTEs connected to different data switching centers)

Day fares (between 8:00 - 19:00 hours)	Minute charges (Ft)
---	------------------------

Class 1	3
Class 2	3
Class 4	3
Class 5	6
Class 6*	12

Night fares (between 19:00 - 8:00 hours)	Minute charges (Ft)
---	------------------------

Class 1	2.25
Class 2	2.25
Class 4	2.25
Class 5	4.50
Class 6*	9

At present there is only one data switching center in operation, i.e., in Budapest. As mentioned before multiplexers have been installed for

* This service is not provided yet on NEDIX.

collecting synchronous traffic in five major cities of Hungary (Miskolc, Debrecen, Szeged, Pécs and Győr). DTEs within the reach of these five multiplexers may use through this equipment the NEDIX network at local charges.

The duration of the actual traffic between DTEs is measured by the PTT with 0.1 minute accuracy.

A minimum charge for all successful calls both local and long-distance, has to be paid, even if the actual connection time was below the above minimum limits, i.e.:

- 60 sec for classes 1 and 2
- 30 sec for classes 4, 5 and 6.

The traffic dependent charges are billed monthly.

All above charges are valid for all DTEs connected to the data network. The charges for the DTEs of the old DATEX network (class 2'), which has been operational since the beginning of the seventies, are equal to the NEDIX class 2 charges.

III. International Charges

It was planned from the outset to connect the NEDIX network to public data networks of other countries. The first such connection was made in July 1982 to Radio Austria, which maintains in Austria international links overseas on a permanent basis, such as to TYMNET, TELENET and DATAPACK in North America and on a temporary basis to some European PTT networks, such as DATEX-P in the FRG, TRANSPACK to France, CTNE the PTT network in Spain, PSS in the UK and SCANNET in Scandinavia.

Dedicated links to Italy (ESA) and Switzerland (Radio Swiss) are also available. The Radio Austria link, however, is only permitted by the Austrian PTT to transit to overseas and vice versa, transit to other European networks has to go through the Austrian DATEX networks. Traffic both from Hungary through NEDIX to international networks are provided, and vice versa: the Hungarian PTT aims for a balance between in and out calls to and from Hungary in order to outweigh the amount of convertible currency spent on foreign data links and that earned on calls to Hungary from foreign locations. Hungarian users pay--as for international telephone and telegraph services--for international data calls through NEDIX in Hungarian Forints, for connection to North America through the Radio Austria node Hungarian users pay 25 Ft per minute. No traffic charges are paid separately. The next step in international connection will be to the DATEX 300 L network of the Austrian PTT.

IV. Fees for Special Services

Some outlined special services are provided by the Hungarian PTT against separate charges. All charges for special services belong to the category of so-called free charges, which means that they do not have to be approved by the Hungarian Price and Material Office (Országos Anyag és Árhivatal).

For the administrative preparation of any of the chargeable special services 500 Ft have to be paid separately for each service as *service preparation fee*. For modification of any of these services 250 Forints are charged. In addition a *monthly fixed usage charge* has to be paid, which is independent of the frequency of usage.

Table 5. The charges for the special services per DTE

Special service	Charges (Ft) per DTE
Closed User Group	
- with 2 DTEs	2000
- with 3-5 DTEs	800
- with 6-10 DTEs	400
- with more than 10 DTEs	200
Direct calling	750
Identification of calling DTE	150
Identification of called DTE	150
Restriction in call initiation	500
Restriction in call acceptance	free

V. Charges for Temporary Data Stations

Temporary data stations can be established by the PTT on the request of the user, for a maximum of 2 months. For the installation and use of a temporary data station the same tariff structure is applicable as for permanent data stations. For temporary data stations in use for less than a month, charges for one month have to be paid.

5.4 Contact Points — How to Make an Application to Subscribe to NEDIX

Enquiries and information on data transmission services of the Hungarian PTT can be obtained from the Central Telegraph Office of the PTT (PKTH), and all requests for satisfying data transmission needs have to be directed to the same office (Address: Budapest, V. Városház utca 18. Mailing address: 1364 Budapest, Pf. 1. Telephone: 184-811).

All applications for services have also to be sent to the Central Telegraph Office of the Hungarian PTT. Applications can be made in letters, but separate printed forms are available as well.

Applications to NEDIX have to include:

- Name of subscriber, address, bank account number,
- Name of the responsible person at the subscriber's organization, telephone number,
- Location of DTE, where the NEDIX port has to be installed,
- Service category of the DTE (in class 2, also speed has to be given) in case of "V" type interface also the planned mode of service has to be described,
- Is "V" or "X" type of interface available at the DTE? Make of DTE has to be provided,
- Special services required,
- Name and telephone number of responsible person at the subscriber's organization for technical questions.

For further information on the application and NEDIX services the Data Communication Division (Adatátviteli Csoport) of PKTH in Budapest can be contacted (Tel: 01/175-313). Forms for applications can be obtained from the same group.

Where to Report in Case of Trouble or Technical Defects?

Technical defects of DTEs and of NEDIX have to be reported twenty-four hours a day to the operating center of PKTH (PKTH Hibafelvévő Szolgálat, Tel: 01/175-415, 01/175-619 and Telex:22-1171) in Budapest.

6. TRANSBORDER DATA FLOW APPLICATIONS

6.1. The Legal Basis for Transborder Data Flow Communication

In Hungary there are several governmental and ministerial regulations in force, which on the whole regulate the generation, processing, storage and transfer of computer readable information both domestically and internationally. Some of the regulations deal with the handling and protection of so-called "state secrets" and "office secrets" such as the governmental regulation No. 14/1971 (IV. 15), the ministerial regulation No. 3/1971 (IX. 23) issued by the Minister for Internal Affairs and the Penal Code IV./1978 of the Hungarian Parliament. For more technical type of matters in connection with data processing the following regulations are in force: The ministerial regulation No. 2/1977 (VII. 30) issued by the Chairman of the Central Statistical Office (KSH) about data processing and storage of statistical data; technical guidelines and safety standards (M1 - 02102) issued by the National Fire Department for the fireprotection of computer centers; the construction standards 12/1980 (III. 14) issued by the Ministry for Building and Town planning for computer centers; the ministerial regulation No. 4/1800 (IX. 5) issued by the Minister for Internal Affairs on National Fireprotection Standards; the ministerial regulation No. 1/1981 (I. 27) issued by the Minister for Internal Affairs on the security, safety and fireprotection of computer systems, and in connection with it the guidelines issued by the Chairman of the Central Statistical Office on the implementation of the above regulations.

Concerning privacy of individuals--a frequently discussed issue lately in the literature and at many conferences--in Hungary the Civil Code (No. IV./1959 modified by IV./1977) is of guiding importance. This law is the basis for personal privacy, it regulates on how personal privacy should not be affected by computer supported data processing methods and what the consequences are if personal privacy is offended.

In the field of transborder data flow the first ministerial regulation No. 3/1974 issued by the Minister of Finance regulates the way official documents can be taken abroad or can brought into Hungary. Certainly the off-line and on-line transfer of machine-readable information is one category of official documents.

The most important step in regulating transborder data flow was within the framework of the new Hungarian Data Regulation N. 1/1981 (I. 27) signed by the Minister for Internal Affairs, which came into force on 1 July 1981.

The regulation was formulated at the request of the Council of Ministers in close cooperation with the Central Office of Statistics and other responsible ministries.

This new regulation, which is published in the official Hungarian Law Gazette (Magyar Közlöny, Issue 5/1981, pp 130-136), is a result of pioneering efforts in the very difficult and complex field of data legislation. Similar to the existing Western Data Protection Acts, the law is a "first generation" regulation, although the model it represents obviously reflects the philosophy and constitution of a socialist country.

The new regulation deals among other things with the handling and protection of computerized data; the regulation of fire and property security; the security aspects of data communications; and the regulation of international data transfer.

With regard to transborder data flow, the law does not restrict the free flow of "open data", unless it falls into the so-called "state secret" or "office secret" category. Information under the latter two categories can also be transmitted according to a well-defined procedure described in the law.

The protection of privacy, an issue of considerable interest to many countries, is described in paragraph 21 of the law: it begins by classifying all personnel information under the "office secret" category, with the exception of information intended primarily for public usage (e.g., the computerized "Who's Who?" database) or in the case where no link to the "owner" of the data can be established.

Data collection, data communication, data processing of information on persons having working or legal relations with a given entity (organization, firm, etc.) can only be carried out in accordance with the primary purpose and function of the organization, subject to the permission of the director. All other categories of collection, transmission, processing of personnel data can only be initiated by separate law, upon the instruction of the Council of Ministers or by the responsible Minister.

Although possible in principle, transborder data flow of personnel data nonetheless falls under the category of high security control since, as mentioned above, all personnel data is classified as "office secret".

This regulation, we believe, equips Hungary from a legal point of view to accept and participate in increasing international computerized data traffic.

There is also a special regulation that has also some connection to transborder data flow issues related to the service on remote serving data--especially processing and responsibility for such services (Regulation 13/1980 (VI. 11) issued by the Ministers for Agriculture and Defense).

6.2. Some Transborder Data Flow Applications

Online transborder data flow applications have at present a relatively small share of the total flow of data crossing the borders of the country. With regard to databases the off-line exchange of machine-readable data still exceeds the online form of flow. Nonetheless the on-line access to databases and other host services from and to Hungary started at the beginning of the eighties. First it was experimental dedicated connections, such as various links between Hungarian research institutions and similar institutions both East and West. In 1982 after the introduction of the NEDIX public data network the first international link to Radio Austria was opened allowing international public on-line transborder data flow traffic for the first time.

Only references are made here to present individual transborder data flow applications, since they are described to a great extent in other papers and chapters: access to public databases as a special form of transborder data flows in [11], flow of meteorological data to and from Hungary in [12], data network of the international news agencies in [13], SITA the data network of airlines in [14], and the private data network of

IIASA and other Hungarian research institutions--used for exchange of scientific data for the promotion of IIASA's research in [15] and [11].

In addition to these present transborder data flow applications what can be expected for the future?

In the domain of public networks and services the number of international connections will continue to grow. During the eighties we will witness the emergence of public PTT data services in most European countries. As soon as these new services become available PTTs will interconnect them either directly or where this is not possible through gateways. The emergence of such networks in most Western European countries will be completed by 1985. It is expected depending on demand, that they will be interconnected and intermeshed with the Hungarian PTT data services in one way or another. With regard to Eastern European PTT networks the Hungarian NEDIX network is the first public digital data network in this region. In some other countries, such as Bulgaria and Yugoslavia, PTT data networks are expected to emerge before or around 1985, but on a global basis for Eastern Europe the emergence and interconnection of public digital data networks for this part of the continent is only expected for the second half of the eighties, when both demand for such services and technical capabilities, especially in computer hardware and data communication equipment, justify the creation of such a public international data network.

The situation with dedicated private network is different. Not only have they already been operational for a couple of years, they will also grow both in number and in their technical capabilities throughout the eighties.

From the presently known major networks it is expected that the interbank network SWIFT will be extended also to Hungary within the next few years.

In the field of science and technology there are plans for a dedicated computer network to interlink, with UN assistance, Hungarian research institutes already interlinked to similar institutions in Austria and the Soviet Union also to institutions in Yugoslavia, Bulgaria and perhaps Rumania, Turkey, and Greece.

All in all--although with the usual time delay of a few years--the role of transborder data flow in Hungary will be as significant as in any European countries with an open economy.

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