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**Autor:** Lässer, Pierre / Lutz, Hans-Peter

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# Status of the Data Transmission Networks in Switzerland<sup>1</sup>

Pierre LÄSSER and Hans-Peter LUTZ, Berne

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## 1 Existing Technology

### 11 Possibilities of Data Transmission

Basically, data can be transmitted nationally and internationally over the public switched telecommunications network or over leased circuits. There are two kinds of switched networks, the telephone network that can be used for data by addition of a special equipment (modem) and the other network that can be technically adapted to the special data transmission requirements. Among the leased circuits the following can be differentiated:

- telegraph circuits such as for the press service
- voice band and digital circuits such as for data circuits and networks
- wideband circuits such as for inter-office connections

The leased circuits can be realized through analogue technique (carrier frequency system) or digital technique (PCM system). There were about 19,000 data circuits installed, 40 pc of which were in switched telephone circuits and 60 pc of which in leased circuits at the end of 1981. The yearly increase amounts to 25 to 30 pc for several years.

3570 leased trunk circuits are in operation at the end of 1981. Their length of 350,000 km corresponds to about nine times the earth's circumference. About one fifth of these circuits are leading to the European or the overseas countries.

The transmission rate up to 4,800 bit/s is possible with the corresponding modem in the switched telephone network and up to 72,000 bit/s is possible in the leased circuits.

The leased circuits can be realized with the analogue technique (carrier frequency system) or with the digital technique (PCM system).

### 12 Data Service

#### 121 Telex

The telex network with its worldwide connections and extensive automation transmits data at a rate of 50 baud. Additional services such as abbreviated dialling, direct calling and multiple addressing are possible with the processor-controlled switching system EDWA (electronic data dialling system for asynchronous terminals).

#### 122 Telefax and Public Facsimile

Both of these services are based on the facsimile or telecopy technique. They use exclusively the public switched telephone network. Each subscriber possesses his own transmitting and receiving equipment in the telefax service, whereas public facsimile service equipment is installed in the telephone and telegraph offices of big cities. The present equipment can transmit a typed page (black and white, A4 format) in just three minutes. Future equipment will reduce the transmission time to one minute.

The facsimile equipment can also be employed with the leased circuits. It is then considered a general data service and not a telefax or public facsimile service.

#### 123 Euronet

The Euronet is a European information network which is maintained by the PTT administrations of the European Economic Community, Switzerland and Sweden. The network is based on packet switching technique for data communications and it is mainly used for data retrieval of scientific-technical information which are stored in over 290 data banks in western Europe. Also other retrieval applications are possible. Since 24 November 1980 the Swiss information users have been connected to this network through a switching node center in Zurich.

#### 124 Datac

The Datac service is offered by the Radio Suisse Ltd. It allows access to data banks and computer centers in the USA, similar to Euronet in Europe.

#### 125 Message Switching

The automatic message switching (SAM) service offers to transmit primarily over the telex network several job orders for the customers. This service is realized on the same processor equipment as that for the Ateco (automatic telegram switching with computer) service. The number of processed messages is increasing rapidly. The SAM service is mainly used for fast delivery of a message to several addressees.

## 2 Terminal and Equipment

The data terminal station comprises in general the user's equipment, known as the data terminating equipment (DTE, terminal) and the common-carrier based equipment, known as the data circuit-terminating equip-

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ment (DCE, modem). Both are connected through interface circuits which are standardized internationally so as to transmit data, clock, control and acknowledgement signals between the above mentioned equipment.

## 21 Teleprinter

The teleprinter, the perforated type apparatus, etc. can be employed also for the data transmission with higher speed besides their usual application to the public network with 50 baud. However, the data must be transmitted in a fixed code or transformed into this code to this purpose.

## 22 Modem

Modems are differentiated by their modulation characteristics and their speed range. A wide variety of performance characteristics is available, which corresponds to the international standard. Besides, there are also many custom-made modems with different transmission speeds and characteristics.

In Switzerland, the regulations in principle state that the modems for the public telephone network shall be rented out from the PTT, whereas the modems for the leased circuit can be independently selected provided the corresponding type has been tested and certified by the PTT. The baseband modem is the exception as it will be supplied by the PTT.

Today, the PTT can offer its customers several types of modems which can cover the transmission speeds to 4,800 bit/s or to 19,200 bit/s, respectively.

The modem *FM 300* permits asynchronous duplex operation up to 300 bit/s. This is especially suited to dialogue traffic, for example, between a typewriter terminal and a processor.

The modems *FM 1201* and *PM 2401* can transmit selectively 600, 1,200 and 2,400 bit/s, whereby a control channel of 75 bit/s can be used in the reverse direction. Both these modems are suited to the swift application such as in the operation of a data display terminal.

The modem *PMD 1200* allows duplex transmission of 1,200 bit/s. This is used for the dialogue traffic with duplex procedures, particularly for HDLC (high-level data link control).

The modems *PM 4800* and *PM 9600* permit transmission speeds of 4,800 and 9,600 bit/s. They are suited to speedy applications in leased circuits.

The modem *BB 19200* is foreseen for application in local networks. It transmits duplex data signals selectively 2,400, 4,800, 9,600 or 19,200 bit/s in baseband.

The *speechband modems* can be used unattended on the public switched telephone network due to automatic response equipment. They are capable of practical testing for rapid fault isolation in case of malfunctioning and they can be used in the switched telephone network as well as in the leased circuit.

## 23 Acoustic Coupler

An economical approach to the data transmission with the use of the public telephone network is the electro-acoustic coupling of a simple portable terminal to the usual telephone set. The application of this technique is yet problematic. Such equipment can bring

considerable interference to the telecommunications network if the requirements of transmit power, frequency range and noise level cannot be maintained steadily. Compared to the direct connected modems the acoustic coupler produces a higher error rate. Therefore, the PTT has allowed only some acoustic couplers on its telecommunications network and it has specified the conditions with respect to the reliability and the quality of the data transmission.

## 24 Equipment for Automatic Selection and Response

The automatic selector is commanded by the processor of the connected data terminal via the interface. The selector must fulfill all those functions which are required for setting-up and releasing a connection in the public switched telephone network. These are

- to seize a subscriber line
- to dial the calling number of the subscriber
- to receive and to evaluate the calling and answering tones
- to switch over the established connection to the modem or eventually release the connection in case of unsuccessful dialling or occupation

The equipment for automatic response can be inserted into the PTT modem in the form of a plug-in circuit card. The purpose of this equipment is to recognize an incoming call for the unattended data terminal station, to transmit an answer tone of 2,100 Hz for switching off the echo suppressor or for identification and for connecting the modem to the line. Selection and response equipment allow together an automatic operation of the data transmission with intelligent data terminals without any human assistance and, thereby, the rationalization of the operation becomes possible, in particular, during the night.

## 3 Future Perspectives

### 31 Prognosis

Several European PTT administrations commissioned a Eurodata study on the development of data transmission in 1976. The study foresaw a yearly increase of 20 pc and 35,800 data terminals in the year 1985 for the telecommunications network in Switzerland. So far the development has been proven true in our country. Besides, in some areas a part of the prognoses has been widely surpassed.

Since a few years the PTT has been studying intensively the problem of this development. A data concept was derived in order to introduce the new services of the teleinformatics considering the needs of the customers, as well as the realities of finance and of personnel. The required extension of the existing technical infrastructure of the telecommunications networks has already been started.

### 32 Future New Services

In accordance with the basic policy guidelines, the PTT shall offer those services which meet the general needs of the public. Therefore, some important projects are being realized at present in the area of teleinformatics on the basis of proven customers' requirements.

### 321 Videotex, Teletext

The possibility of access to information data banks via the telecommunications network shall not be reserved to business users only (e.g. Euronet). Instead, Videotex (interactive telephone-based videotex) will offer information from data banks on TV sets at home over the telephone network.

Since 15 November 1979 a pilot trial has been in progress. It is based on videotex exchange with integrated data banks in Berne and around 150 participants, mostly information providers. The purpose of this pilot trial, lasting till 1983, is to win information providers and to gather experience in the new medium.

An operational trial, beginning in 1984, shall examine the acceptability of such a service before any decision will be taken on the introduction of a public videotex service. The operational trial will include around 2,000 participants with two videotex exchanges in Zurich and Berne. It will be in three languages and its main characteristic will be the so-called processor connection, that is, the external data banks of the information providers will be connected to the videotex exchanges.

The possible public videotex service will be introduced in such a way as to correspond to 10 pc of the present telephone subscribers, ie. to around 250,000 subscribers till 1990.

In the teletext (broadcast videotex) service, the information is multiplexed with the normal TV programme and it is transmitted cyclically over the TV network. The Swiss Broadcasting Corporation is also conducting an operational trial at present. It can offer 60 pages of current information. The main difference between the videotex and the teletext system is that teletext is purely a broadcast system without any interactive dialogue between the participant and the data bank.

Both systems are not yet matured enough for regular operation and they require an extensive standardization so as to be compatible (transmission code, information presentation, utilization procedures).

### 322 Teletex

The teletex (office teletypewriter terminal) belongs to the area of text communications, which allows to transmit directly office correspondence over the telecommunications network. The new developments in business machines (electronic typewriter, word processing systems) have favoured or even forced this development.

Since autumn 1981 the PTT has been conducting an operational trial with 20 subscribers. This is in close cooperation with the PTT of the Federal Republic of Germany, where the subscribers are connected to the Munich Teletex exchange. On the basis of these results and the experience gained in this operational trial, a decision will be made on whether to introduce a public teletex service and when to introduce it. However, the realization will not be earlier than 1983.

### 323 Telepac

The PTT wants to establish a universal data transmission system with the telepac. This will be a nationwide transport system for different data services, in the first place naturally for the transmission services of the

switched network. This transport system takes special account of the requirements of a modern data transmission and it realizes essential innovations in the network management such as the traffic flow control, supervision, fault clearance and redundancy configuration, functions that cannot be realized in the switched telephone network.

The data transmission service telepac can cover all those requirements which make allowances for an internal network delay of a few hundred milliseconds. These are all the interactive systems such as seat reservation, time-sharing computer service and data bank service. In addition, the network is suited to other definite applications such as batch and file data transfer services where the time factor is not of critical importance.

The main characteristics of the telepac are

- user-packet interface X.25 (2,400, 4,800, 9,600, 48,000 bit/s)
- access to the telephone network via PAD (packet assembler/disassembler) X.28, 300 and 1,200 bit/s
- selected virtual circuit
- permanent virtual circuit
- closed user groups
- terminal identification
- tariffs depend essentially on volume but not on distance

At present, the telepac is in a state of operational trial which is being carried through together with the manufacturer of data processing equipment. The basic network consists of three exchange nodes in Zurich, Berne and Geneva. After different technical modifications the telepac can be taken into commercial operation at the end of 1982 according to the current plan. Thus, the telepac will be the foundation for the realization of different new services, partly also in cooperation with other national telecommunications networks (eg. videotex, teletex).

### 324 Datex 300

With the introduction of the new processor-controlled switching exchange in the telex network (EDWA) the possibility exists of switching and transmitting data in character mode at 300 bit/s. On 1 July 1982 an operational trial starts for six months. The PTT will provide the terminal (SP 300). At the beginning of the trial only the Swiss subscribers are reachable but later also the West German and the Austrian subscribers. These subscribers will receive similar additional services as the new EDWA network for the telex subscribers. The purpose of this operational trial is to clarify the question of needs for an eventual public service.

## 4 Documentation and Information

A documentation on all the existing and the future services of the PTT is in preparation. Documents have been already prepared for some services such as telex, SAM, Euronet and videotex.

The PTT informs on its services and projects at any time. It gives freely advice to its customers and interested parties. All the PTT District Offices (Tel. No. 113) provide information on the existing services and the division for telematics of the PTT General Directorate on new projects.