

5. Services

Remarks of editor

The chapter 5 has a particular role in the structure of this wide scope book.

The networks have traditionally a technical oriented discussion mode because networks are very sophisticated systems utilising the latest results of technology sciences. Applications also have important role by giving reason to use networks and services. The issues of network operation and service provision based on the general telecom regulation system also have extreme importance to establish the general rules on the telecom market including technical and competition aspects.

Service provision is particular because this is the activity forming basis to send bills to the customers. The incomes from services are shared among the members of the whole activity chain including network operators, service resellers, system suppliers, construction companies, system developers, investors, researchers, regulation staff, etc. Dear reader! Please do not hope an economic discussion in this chapter! Detailed market analysis or price calculations are not involved in this part. Authors of this chapter are engineers and the target readers are engineers as well.

The services are discussed in the first part focusing on the roles in the activity chain, The second part systematically describes services as there were designed based on service capabilities of networks. A separate part of this chapter discusses a big sort of other services as products of innovative operation of networks beyond the original intention of system designers. The daily network operation can produce even richer and more beneficial services overperform the goals of technology-oriented researchers and developers. The questions of information content provision are not in the scope of this book. The access issues of content oriented services have so high importance so one part of this chapter discusses the main questions.

The network services are emphasised in a separate part because aspects of network interconnection, service provision to an other network operator or to big users having their own private networks form a specific set of service issues.

Terminal equipment are inherent part of networks but we discuss some terminal issues here because implementation of the higher and higher portion of

services is involved in the very intelligent terminal equipment due to the technology development.

The last part of this chapter discusses aspects of service and application interfaces. Application Programming Interfaces offer efficient and standardised solutions to harmonise services and applications.

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5.1. SERVICE PROVIDER AND USER ROLES

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In case of general treatment of the services - from both statistical and regulatory point of view - it is important to determine the activity area of the service provision; who the service provider is and whom it provides the service. By *service* we usually mean that somebody or a company is being paid for its activity carried out in favour of somebody else without any change in the ownership of facilities concerned. While examining the definition in general, we analyse the telecommunications activity itself together with its attributes and conditions, then its form in which the activity is done as a service provision.

Later on, we will examine the participants of the service activity who form three groups: those who provide the service, i.e. service providers (SPs), those whom the service is provided and those who are the beneficiaries of the service. The third group does not always correspond to those whom the service is provided.

5.1.1. Telecommunications activity

The word *telecommunication* itself does express some kind of activity. According to the usual formulation, telecommunication means message or data transmission in form of electromagnetic signals (hereafter we consider data as message, i.e. "datamessage"), which may include text, drawing, static or motion picture, speech, music, data bulk, computer program etc..

The first question to raise is the distance of the transmission: what distance can be considered to be a "real" *telecommunication*? Is the signal transfer happening inside a computer or between computers or a computer and its peripherals, a kind of telecommunication? It seems to be evident that a long distance telephone call is made by means of the telecommunication activity but if at a meeting, the signals of a microphone are transmitted to the amplifier and further on, to the loudspeakers may be categorised as telecommunication? What is the meaning of the prefix "tele-"?

This is no means an academic question since the enormous effect of telecommunications activity on the society makes it necessary to define rules and legal obligations. It can be declared that there is no given distance beyond which the activity would be defined as telecommunication and below which it could be qualified as a simple signal or data management. E.g.: if two persons working at the same company are talking in two neighbouring rooms through a telephone exchange, it is telecommunication, but receiving some radio signals from a far nebula trillions of kilometres away in the space, is usually not considered to be a telecommunication.

Telecommunication should be differentiated from other usage of electromagnetic signals. In the telecommunication the signal is put on a telecommunications network (in a simple case, on a telecommunications circuit) in a transformed appearance compared with their original form due to the nature of transmission. The primary aim of this transformation is to retain the original content of transmitted message while the transmission medium cause the minimum distortion, noise, bit error or other deterioration.

Thus, the transmission of signals by means of radio waves is always a telecommunications activity, happening either between the Earth and a spaceship or a driver and the central lock equipment of his car, parking 1-2 meters away from him. It can be observed that the radiocommunications network makes such transformation always necessary; namely radio waves are processed by modulation from electric signal current or voltage appearing in the metallic conductor which signals convey information to be transmitted.

Telecommunication is the transmission of speech information acoustic signals in electromagnetic form through the subscriber's line where. among other factors, their symmetrical transmission, their amplification by the Central Battery power, the matching between the telephone xchange and telephone set, all serve for bridging the distance between the subscriber and the telephone exchange with the minimum of deterioration. A typical implementation of electroacoustic system when the amplifier sends signals with increased voltage to the loudspeakers in order to decrease the transmission losses (so called 100-Volts system) can also be called telecommunication.

Naturally, beside this essential element there are other characteristics of telecommunications activity. The direction of signals also plays an important role in

certain forms of telecommunications. We can talk of addressed and unaddressed telecommunications; an example for the first can be the telephone service or the Internet while another example for the last one is the (uncoded) radio broadcasting. The whole procedure of addressing, including the reception, handling and usage of the address for routing the message towards the destination, is another part of the telecommunications activity. Similarly, establishing a virtual or real connection, its maintaining, modification or clearing, likewise - if necessary - settling the tariffs, also contribute to this activity. Temporary storage, coding of the signals with the content unchanged are belonging to the same area.

Here we have to mention some important definitions related to telecommunications as an activity. Their detailed discussion can be found in other chapters; here we are confined to a brief summary only. One of them is the telecommunications network which incorporates a set of transmission, switching, repeater, router, storage, gateway etc. facilities which serve for transmission and/or reception of messages to and from any network termination point in accordance with pre-determined, unified rules within the physical space or territory limited by their capabilities. The devices can be both hardware and software elements and the former in almost all practical cases are programme controlled. In addition, there are scarce resources belonging to the network such as frequency bands used by the network as well as finite stacks of addresses i.e. names. In the opinion of many experts, the public territory occupied by the telecommunications paths belong to those scarce resources too.

There is another important definition: telecommunications infrastructure. Besides the network itself, it includes the terminal equipment used by the customers and human and machinery resources of maintenance, repair as well as the telecommunications buildings.

It is a commonplace, that convergence can be observed in the field of the telecommunications. In relation of the network usage, earlier the public and the private networks were sharply separated; however, today those are merging in numerous cases so that the same network can serve public, business or private telecommunications activity at the same time. On the other hand, the borders between the previously defined sectors of the telecommunications such as telephony, data transmission and broadcasting are fading away and the primary sectorial

purpose of the network does not exclude other kinds of telecommunications activity. We discuss it in the next chapter.

Convergence can be also observed in the area where the telecommunications activity is tightly interwoven with the information technology. Databases of very large volume are built in the networks, computers with sophisticated operation systems are connected to the switching equipment for enhancing the network management and the maintenance.

5.1.2. Telecommunications services

The telecommunications activity appears in the form of services when the activity is performed for other people in return of a fee. The telecommunications activity appears rarely as a standalone service. In most cases the telecommunications service is a common result of several activities. An important question whether the service could appear as a standalone service when the telecommunications were extracted? We consider those services as telecommunications ones which can be used only together with or by using the telecommunications activity. Thus the telecommunications service has an including concept.

Here we must stop for a while because in the Hungarian language a common word is used for the *service* and the *service provision*. On the field of frequency management which is aimed at the activity instead of the service provision, a long time used word for the utilisation of radio frequencies for different purposes - the *radio service*. In the legal framework of the telecommunications this Hungarian word is used only in the formulation of *emergency services*. However, in the context of technology primarily in the field of standardization, the interpreters are frequently using the same word for description of technical capabilities of a certain infrastructure in the text of a standard. For example, The standards of Integrated Services Digital Network (ISDN) describe the technical capabilities i.e. requirements of that network while the Code of Practice of telecommunications companies is talking of Integrated *Service provisioning* Digital Network.

Further, in the Hungarian language those concepts expressed in English by words *service*, *facility*, *feature* are also attributed by the single word *service*. (English

language documents are not consequent in usage of those words, too. Recently in the European *acquis communautaire* the use of expression *service provision* is spreading.)

Therefore, it is reasonable to differentiate the *basic services* and the *supplementary services* relying upon the former ones. The basic services are a set of services which, when omitting any element of it, the minimum criteria included in the relevant decree or it does not comply any more with the standardised or broadly accepted definition of the service. The network is capable to provide this service together with the simplest type of terminal equipment attached. In the case of connection-oriented telecommunications, usually the origination of establishing the connection path, its maintaining, clearing, modification; in the case of connectionless telecommunications, the acceptance, routing and termination of messages belong to the category of basic services, together with the charging functions related to those activities.

The supplementary services, called often as additional services, as a rule, enhance the value of services provided for the users, therefore the service providers are collecting some additional fee for their usage. It is accepted to define them as *value-added services*. Characteristic examples of those are the telephone calls with number and/or tariff translations such as the "blue number" (numbers to be called nation-wide with local tariff), the "green number" (the call is paid by the called party), the call diversion etc.. Certain informatics and/or content services are also called value added services which enable the caller to get information, entertainment, transaction opportunities (e.g. remote polling, usage of banking, commercial services etc.).

In general, the basic services can be categorised, as a rule, in two classes: access services and traffic services. The access service is that part of the telecommunications services which provides the user, as a matter of principle, an opportunity for the usage of the network. The traffic service is the real usage of the network for conveyance of messages. The fees charged by the service provider reflect this duality: the installation and subscription fee is paid for the access while the connection and per-minute fee is charged for the traffic.

There is a case when the user pays only access fee: such case is the leased line service related to a particular circuit as well as the flat-rate services (e.g. cable

TV subscription, Internet access without any restriction related to data volume). Virtually, only traffic access fee is to be paid for the use of a public payphone, however, a part of the fee paid covers the expenses of installation and the maintenance of operability and on this account the per-minute charge is higher than that for the residence telephones.

As it is mentioned above, there is a decisive issue whether the service provided through the telecommunications network and including elements of informatics and content can be utilised without the use of telecommunications network? An indispensable part of radio broadcasting is the real-time programme transmission; the news or the weather forecast in the form of book or compact disk make sense likely as a historical record. However, in another case, a commercial purchase to the debit of the telephone card does not require the telecommunications network as a prerequisite since that transaction may also take place by the use of a normal credit card or cash.

It is worthy to investigate from this aspect the Internet where the role of telecommunications is relatively small. Even the Internet service providers are using such an expression that they are access providers. This opinion is reflected by the fact that the Internet, which is called popularly but not too properly "network of networks", performs only the maintaining its integrity and conveying it to the destination, however, the well-known Internet services such as surfing, electronic mail, file download, chatting are the merits of the servers which are connected, as a matter of fact, as terminals to the network. At the same time, the services of those servers cannot be utilised without the Internet network compiled of local area computer networks (LANs) and routers. Here we meet a case when the basic telecommunications service is scarcely used and the value-added services are dominating.

Another way of classification of services is to divide them to *bearer services* and *teleservices*. More detailed description is to be found in other chapters.

A further manner of classification is based on whether the transmission is realised in real-time or with intermediate storage. The service considered real-time means that the information is conveyed *in statu nascendi*, in the moment of its birth or with the original time relations of the event to the user. Here a storage for a short time interval occurs, of course, too (e.g. in the time-division switching stage of the

modern digital telephone exchanges) but it is negligible enough for the user could feel to be virtually on the site, i.e. the changes conveyed by the transmitted signals seem to be natural occurrences. Those classes are shown - in a very comprehensive, technology-dependent categorisation - in the following table.

Class of telecommunication	Real-time	With intermediate storage
Addressed duplex	Speech (telephony, mobile radiotelephony), teleconference, voice and data bearer services, interactive audiotext	X.25, facsimile, Internet surfing, chatting, e-mail, file download
Addressed simplex	Subscribed and/or coded broadcasting, news gathering (SNG)	SMS, paging, propriety protection systems, voice mail services
Unaddressed	Non-coded broadcasting, SRD devices	-

It should be noted, that there is a definition of the telecommunications services which excludes the broadcasting service [5.1.1]. This is unacceptable due to the fact that the broadcasting is a telecommunications activity and Hungarian statutes have considered them for the past decades in a similar way.

5.1.3. The service provider

The service provider may be an undertaking, but not necessarily is an operator or an owner at the same time. In the everyday economic life these roles are often separated. In many developed countries one makes a difference between the network operator and the service provider and a separate licence is issued for the one or the other. The latter one (SP) is handled as an undertaking which enters the marketplace without own infrastructure and the expression sometimes receives a pejorative stress. On the other hand, the word "public" has a peculiar history; in the beginning it had been used for characterising not the group of users but for the ownership of the network ("state-owned network") and this fact retained the Hungarian legislators from using this word for the networks.

The service provider can be a natural person or a legal personality or an organisation without legal personality providing its services on the basis of its fundamental act and the registration of its firm. A precondition of its operation is to have in a checkable way those material and human resources which are necessary for the provision of services. The material resources include its own or hired network, with the licences for the telecommunications lines running on others territories, the

licences of radio stations operated or hired (which is based on valid frequency assignment), the usage permission of the telecommunications buildings as well as the right of use of scarce resources needed for the operation of its own network or service.

The service providers may carry on their activity upon notification, licence or concession contract. Details are to be found in the Chapter 8 on the regulation.

The designation and the content of each service should have an unambiguous linkage in order to exact understanding between the service provider, the regulator and the user. This is contributed by the code numbers of the List of Products (SZJ) of the Hungarian Central Statistical Office (KSH). The code numbers for the telecommunications services are based upon those of the European regulation [5.1.2] while it should be noted that the assortment of the codes is rather narrow and the designations are too general.

5.1.4. The users of the services

An important attribute of the telecommunications services is the subject for whom the service is provided. The expression "for whom" has two points:

- who pays for it?
- who is the beneficiary?

The objective of the telecommunications regulation is primarily the service provided for a broad circle of the society, to the benefit of the public. This kind of service is called publicly available service or shortly, public service. (The Telecommunications Act No. LXXII of 1992 had stipulated this kind of service as a "service for the purpose of the community" and the "public" word had been reserved for the payphones only. The Communications Act No. XL of 2001 does not use neither the "for the purpose of the community" nor the "public" expression.)

The public service can be characterised by the feature that the service provider is obliged to enter a so called subscriber's contract with his regular user, that is, the subscriber pays for the service. There are exceptions because some public services can be used without contract (e.g. use of a payphone, use of Internet in an Internet café etc.). Considering that the subscriber's contract is composed, according to a statute [5.1.3], of two parts: of the general conditions of undertaking (code of

practice) of the service provider and of the individual subscriber's contract; in the cases mentioned above only the written individual contract is missing but the user by means of the usage has recognised the general conditions of undertaking as binding for himself.

In principle, the public service can be used by anybody: private person or any kind of associations. If the service provider does not advertise his service publicly, does not publish its conditions, but he defines the circle of customers for which he wishes to provide the services, in reward of a fee, so this is a non-public service.

One of the public services is the telephone service when anybody can subscribe it, but it is a non-public service, when the telecommunications activity is carried out only for the workers of a certain company by operation of the company private branch exchange.

In some cases the service appears in a "public habit" but, having investigated who pays for the service, it can turn out that appearances are deceptive. One example is the broadcasting which is often classified improperly as a public service since the radio programme, the civil service TV programmes can be received by anybody within the area of reception. However, the situation is not so simple. The TV set operational fee which is collected by the state as a tax from the users of the TV sets has the purpose of supporting the programme production which is, in turn, not a telecommunications service. In the chain of *programme production - broadcasting - receiving* the programme producer pays for the broadcasting as for a telecommunications activity, consequently here a non-public service takes place. If anybody applies for broadcasting his programme, in vain, nobody would accept it because it belongs to the competence of the National Radio and TV Body.

Another, similar example is the interconnection service which takes place at the interoperation of different networks. In spite of the fact that in the case of telephony, the beneficiary of this service is the telephone subscriber, his local operator pays for the interconnection service. Although the statute on revenue sharing defines a certain part of the charges collected from the subscriber, which should be transferred to the interconnection service provider, however, this money flows to the local telephone service provider in the framework of the legal relationship of the subscriber in exchange for the national and international long distance calls.

Legal relationship is established only between the service providers, thus this service is non-public. In this category falls as well the call termination service.

The previous legal regulation has made a difference between the users of the public telecommunications services whether the user is a private person or an undertaking. Even the telephone tariffs have matched this difference; based upon socio-political considerations the residential subscribers paid lower installation and subscription fees than the business subscribers. However, this difference is essentially disappeared in 2002.

In certain cases the fee for the service is paid not by the real beneficiary of the service. One of characteristic examples is the "green number" service, charges of which is paid by the called party. Another example is the paging service. When somebody sends a message to his friend's pager receiver, the price of this service is paid not, or not only by him, but the subscription fee is charged to the person who bears the receiver on his belt or in his portfolio. The latter person pays for it even in the case when the message does not serve his interest. The sender of the message is charged only with the access fee by his telephone operator.

There is a curious mixture of public and non-public services when a non-public service is provided via a network used for the provision of public services. Three designations are used for this case.

First is the Closed User Group (CUG) which means a user's group formed among the users of a GSM or ISDN network. Its members are calling each other with non-public shorter numbers, have no legal relationship with the public service provider and the charges are paid, instead of them, by the undertaking they are working at. They can originate calls toward the public network by individual authorisation, dialling a prefix.

The second is a version for the PSTN: the Centrex service (if the members of the group served by Centrex belong to the same local exchange) or the Wide Area Centrex (if they may belong to different exchanges).

The third designation is the Virtual Private Network (VPN) which is a generalisation of previous two concepts. For the connection of the users of VPN can be used many kinds of networks (fixed, mobile, PABX). The VPN service provider translates the interim numbers dialled by the members of the group into public

network addresses and conveys the calls in such a way toward their destination. At the same time, addresses used by calls arriving from the public network are included into a special numbering field reserved for the VPNs.

An opposite case occurs when a broadcasted sideband is utilised (RDS - Radio Data System) for a purpose quite different from the original service, e.g. for paging. In this case an infrastructure aimed for non-public service is used for a public one.

As is it obvious from above, that the continuously enlarging circle of the services includes also elements of informatics and content. This fact has an effect on the legal relations of the services, too. In the content transmitted by the telecommunications - especially in the case of radio and TV broadcasting - the proportion of the real information to reclame can turn the legal relation upside down. In some forms of telecommunications, e.g. cable TV services, the service provider has to pay for the intellectual rights of the programmes while in other instances the programme producer may pay for the transmission (as it is always the case even at the broadcasting of the civil service programmes).

Some years before a service provider experienced with charge-free telephone calls when mixing advertising text into the conversation in defined regular times. Calls arriving at his "green number" were diverted back into the public network via an "advertisement-mixer" device. This procedure changed not only the direction of cash-flow but also inserted a non-public element into the public service, because the reclame provider paid for this part of the service.

This case demonstrates the significance which certain services may have for the society. It is not a neutral thing for the society that the broadcasting stations are operated at a high level of quality, including the operation of "advertisement-mixers" ensuring free of charge telephone calls, the undisturbed and secure operation of the telecommunications networks serving for the Automatic Teller Machines (ATM) with growing usage rates, since the benefits of those services can be enjoyed by any citizen who can enforce his/her interest only in a very complicated way. The future regulation certainly will not differentiate so sharply the public and non-public services.

References

[5.1.1] Directive 97/33/EC of the European Parliament and of the Council of 30 June 1997 on interconnection in Telecommunications with regard to ensuring universal service and interoperability through application of the principles of Open Network Provision (ONP), OJ No L268, pp. 37-62 (3.10.1998)

[5.1.2] Council Regulation (EEC) No 3696/93 of 29 October 1993, as amended by Commission Regulation (EC) No 1232/98 of 17 June 1998 on the statistical classification of products by activity (CPA) in the European Economic Community

[5.1.3] Governmental decree No 243/1997. (XII.20.) on the subscriber contracts in the telecommunications

5.2. Dialog Based Services

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Dialog is one of the most common forms of communications. Telecommunications give capabilities to communicate persons having any distances in between them. The most common telecom services supporting dialog are:

- telephone services transmitting human speech
- video telephone services transmitting human speech and moving picture simultaneously.

Nowadays the spreading of video telephone services has low level but the traditional telephone service seems to be the most frequently used service. Methods and principles elaborated for telephone services can be applied for video telephone service also, because the call set-up and transmission functions are similar and the networks used are partly common. The details of video telephone services will not be discuss below.

In this section the general characteristics of telephone services, the network requirements, and the supplementary services will be discussed in details.

5.2.1. Telephone Service

The telephone service provides two-way, symmetric, real-time speech transmission on the connection of telecommunications network between two users. The connection has been set-up for the duration of telephone call and has been initiated by dialling the phone number.

A telephone service can be characterized from technical and regulatorial point of view. The applied technology is in the focus of technical discussions. So telephone services can be provided in wire line and mobile telecom networks as well, within analogue and digital transmission techniques and circuit or packet switching solutions are also applicable. The service-oriented characteristics of different telecom networks will be discussed in point 5.2.4.

The telephone service can be characterised from the aspect of regulation by the possibilities and functions of service provision, with the relation of service provider and user, and the conditions of using services, independently from the telecom networks and the applied technology.

One of the most important features of services is the group of users who are able to reach the service. Regulation aspects differentiate:

- Public telephone services (introduced in point 5.1.4) give the possibility for anyone to access services.
- Private telephone services providing communications between the members of a company or an organisation.

The provision of private telephone service is based on individual contract between the service provider and user organisation. Regulation for this activity is not needed. The partners can make an agreement about the legal, commercial and technical details of services. The private telephone services have individual elements so they are not uniform.

The importance of public telephone services has reached very important level in the society so the regulation is needed. First of all, for the users have to be granted the possibility to access the services. Secondly, the fair competition for the service providers needs also specific regulations. The mandatory elements of telephone services for service providers and the minimal quality requirements need detailed specifications. The public telephone services are discussed in detail in point 5.2.2 below.

5.2.2. Public Telephone Service

Public telephone services can be provided using both wireline and mobile telecom networks. Concerning services the user can access to the network, make call set-up, communicate with the partner, and pay the bill.

The service providers have additional obligations beyond the basic activities based on legal regulations. These additional obligations are part of the services and will be discussed below. The users can select supplementary and value added services according to the offer of service providers.

So the component of public telephone service can be separated in the following subsets:

- Basic mandatory elements
- Additional obligations
- Optional elements

5.2.2.1. Basic Mandatory Elements

The following elements are needed for basic activity of service providers:

- Call set-up of national and international calls to any telephone subscriber or any other telecom services (e.g. directory service, voice mail service) or value added services (e.g. speaking clock, time-table, account balance) initiated by telephone number.
- Emergency calls with short numbers and special call handling terminated in the special call centers of the ambulance, fire brigade, and police including the European harmonized emergency call number 112.
- Customer care service for any kind of administrative contact between the service provider and the customers including personal, telephone-based, e-mail, mail, telefax, etc. contact.
- Fault reporting for registration of any customer complain concerning the services or networks.
- Directory services (information on name, directory numbers, address of subscriber) by phone or phone book (paper or CD form).
- Billing: accumulated value of fees for used services. This sum can be sent to the customer in bill form or can be subtracted from a pre-paid account. Bill contains the subscription fee, and fees of the initiated calls and supplementary and value added services.
- Network management including operation, maintenance, fault clearing and development of network.

5.2.2.2. Additional Obligations

The most important additional obligations for service providers based on legal documents are:

- Public phones: operation of public phones (coin-boxes or card phones) in places of public access to initiate calls by any user, usually in the PSTN/ISDN.
- Legal interception for the security services.
- Carrier selection: possibility for customers to select a service provider to be involved for access to the called subscriber or service in form of *Carrier pre-selection* (the subscriber selects the involved service provider in the contract

and no carrier selection prefix is used for calling) or *Call-by-call carrier selection* (the subscriber can select for each call the service provider to be involved in the given call - other than the pre-selected service provider - by dialling a carrier selection prefix).

- Number portability: possibility for customers to resign their subscription with a service provider and to contract another subscription with another service provider without changing their number, and without changing the nature of the service offered.

5.2.2.3. Optional Elements

Supplementary and value added services are provided by telecom companies to make more attractive the services and fulfil the needs of customers. The subsets below select the services based on the character of services and the method of implementation:

- Subscriber supplementary services concerning the implementation and provision of services which are part of subscriber contract or other individual contract (see 5.2.3. below).
- IN services: usually special numbering schemes for special tariff schemes, pre-paid services, personal numbers, etc. The IN services are implemented with implementation of centralised intelligence integrated in the network (see 5.2.4.2 and 5.2.7 below). The service provider of IN services might be different from the normal telephone service provider.
- Value added services: beyond the telecommunication these services provide other services, e.g. information, bank transactions, access to services of other networks (e.g. Internet, paging, X.25). The telephone service provider gives access to the value added services.

5.2.3. Telephone Subscriber Services

The customer oriented definitions of subscriber services are the offered possibilities, capabilities, functions or operations provided by the telecom companies.

The public telephone services described in point 5.2.2 above can be used by the customers on the bases of customer contract except the usage of public phones. The general conditions of the subscriber contract contain the subscriber services, the mode of usage and the fees.

The subscriber might be a natural person or legal entity or enterprise without legal personality in a contractual relationship with a service provider. The subscriber pays the bill.

The user is the person who uses the telephone service and might be different from the telephone subscriber.

One part of the services is included in the subscriber contract so the subscriber can use them without extra procedure. The supplementary services have to be ordered from the service provider.

Basic service

The set of public telephone services including call set-up, emergency calls, directory services, phone book, customer care services, billing services, customer complains.

Subscriber supplementary services

The set of public telephone services provided on the request of the subscriber concerning call set-up, charging and operation and characterized by the following items:

- Supplementary services concerning call set-up are for the higher comfort of the users. The set of such services are highly determined by the switching systems and the capabilities of the networks.
- Supplementary services concerning charging might be special price packages or temporary actions depend mostly on the marketing strategy of the service provider. The technical aspects are not so crucial in this set of services
- The operational services like transfer the location of service, the change of subscriber on the same location, modification of contract cover mostly administrative task and less technical part.

The subscriber supplementary services concerning call set-up are discussed below.

The set of subscriber supplementary services may show high level of variety for different reasons. The set of services extended continuously by the development of technology and the market driven demands but their implementation in networks might be in different time-schedule and mode. A subscriber in a given moment is connected to the telecom network by a well-defined mode. The available set of supplementary services is influenced by:

- The network capabilities and the technology of the subscriber access (e.g. access to analog or digital network, or access to wireline or mobile network);
- The capabilities of the terminal equipments.

The telephone service can be implemented usually by the network (including the switching systems) and the terminal equipment together. Some services need special functions only in the network or only in the terminal equipment. The supplementary services based on terminal equipment functionalities like loud speaking operation, displays, or memories will be discussed in point 5.6. In this part will be discussed supplementary services based on network features and abilities.

5.2.4. Services Characteristics of Voice Oriented Networks

The call set-up and voice transmission functions are implemented by interconnection of global networks especially planned for voice transmission. Details of transmission networks can be found in Chapter 4. Here you can find only the summary of the characteristics that are relevant in the services.

The main forms for the voice oriented narrow-band circuit-switched networks are the PSTN/ISDN and the PLMN networks. These networks have unified numbering schemes without problems of interworking. The IN, which is connected to the PSTN/ISDN and PLMN networks, is able to introduce a big set of services based on centralised service control functionalities.

By the end of nineties the voice transmission on the packet-switched networks has fast rollout. The results of VoIP development have some feedback to the traditional telephone services as well.

5.2.4.1. Wireline Telephone Network

The PSTN - Public Switched Telephone Network and the ISDN – Integrated Services Digital Network are the main element of the global telephone services. Generally the PSTN was developed for the voice transmission but step-by-step its usage for data transmission increasing (telex, modem based Internet access, etc.). The ISDN was generally developed for supporting different services based on ITU-T – International Telecommunication Union recommendations and ETSI – European Telecommunication Standardization Institute standards. However the telephone services seems to be the most common application of ISDN even in 2002. The ISDN standardised bearer and teleservices are discussed in point 5.3 below.

The PSTN and the ISDN networks are not separable because the ISDN switches and the digital interconnection of the switches transport the ISDN and PSTN traffic together. The main difference is the mode of subscriber access. The subscriber terminal equipment is different and supplementary services are different also. The PSTN supplementary services are listed in 5.2.5. and ISDN supplementary services in point 5.2.6.

The hunting group lines connecting PBX equipment are different to the individual line access concerning the services as well. The hunting group can be implemented using analog loops or ISDN access. The users of telephone sets connected to PBX lines can utilise only one part of the public switch telephone services and some cases with modified procedure. There are specific PBX features like direct-dialling-in. The PBXs provide special services also like abbreviated dialling, call transfer, call forwarding, call completion on busy, call pick-up etc.

The Centrex provides function like a PBX but is implemented in public network switches. The Centrex provides services for both analog and ISDN access and also mixed access if necessary. Concerning services the services the Centrex is similar to a PBX with direct-dialling-in. The users practically could not sense whether Centrex or PBX implements the functions.

5.2.4.2. Intelligent Networks

The IN – Intelligent Network is based on PSTN/ISDN and PLMN networks. One of its main principals is that controlling the intelligent network services is implemented in a separated element named SCP – Service Control Point. The database for the control functions is connected to the SCP. The switching functions are implemented in the ditital exchanges with and extended switching functionality named SSP – Service Switching Point. The voice path is always switched through the SSP switches of PSTN/ISDN or PLMN, but the call set-up is controlled by the SCP. Most common IN services are listed in point 5.2.7.

5.2.4.3. Public Land Mobile Networks

The most important characteristic feature of the PLMN systems is that the users can use the service from anywhere even when move on with their wireless terminal equipment where the network has coverage.

The mobility functions are supported by the following functions beyond the radio transmissions:

- Location: the ability of the terminal equipment to detect and decide by different measurements the appropriate radio cell where the terminal is.
- Roaming: the capability of the system to use services at locations where only a partner service provider has coverage
- Registration of position and individual data of terminal equipment and user in the system by the HLR (Home Location Register) and VLR (Visitor Location Register) to have full accessibility.
- Hand-over: maintaining the connection during the telephone conversation without interruption and quality degradation in cases when the user changes his position from one cell to other.

The number and importance of the first generation analog systems decreasing by 2002. In Europe the second generation GSM – Global System for Mobile Communication digital system has practically full geographic coverage and very high user penetration.

The GSM has been developed to support different services. ETSI standards describe very precisely the tele, bearer and supplementary services. The GSM supplementary services are very similar to ISDN supplementary services. The GSM supplementary services are listed in 5.2.8.

5.2.4.4. IP Networks

The Internet Protocol (IP) based packet switched networks were originally developed for data transmission. The results of the development make it suitable for voice transmission as well using the VoIP – Voice over Internet Protocol. The target of the developments is the integrated communications and multimedia communication and several organisations in the field of telecommunications standardisation has resources to solve the problems in the frame of IETF – Internet Engineering Task Force,

ETSI, ITU-T together with manufacturers.

Interworking of narrow-band circuit switched and IP based packet switched networks concerning telephone services has step-by-step development. The simplest scenario when the call originated and terminated in circuit switched network and IP based network is used only for transparent transmission of voice signal has widely used solution in the daily practice.

The full transparency of the two types of networks needs the voice signal transcoding but the most interesting task is the addressing scheme and transcoding of signals of call set-up.

The ITU-T has elaborated Recommendations for IP network based multimedia communication under the umbrella of Recommendation H.323. This Recommendation involves the call set-up and voice transmission between users having IP addresses and also communications between one user and the gateway having connections towards the PSTN/ISDN networks. The implementation of subscriber services (well-known in PSTN world) has been started in IP based environment and elaboration of interworking has been started as well.

The TIPHON project in the frame of ETSI has studied the interworking of PSTN and IP based networks concerning telephone services based on ITU-T Recommendations.

The IETF has elaborated a new protocol for call set-up in the IP world: SIP - Session Initiation Protocol. This protocol needs further development to support the full set of services.

The transparency of addressing procedure seems to be an important task, too. The ENUM is a protocol and domain name system making possible the access of IP networks users from PSTN network dialling an ordinary phone number. The ENUM has a protocol mapping the phone number into a domain name and look for the URL of the user having the given phone number. So the location and the mode of availability can be determined for the called subscriber.

The voice coding and the implementation of signalling protocols has now critical issues concerning telephone services in the cases exceeding a quality limit and do not touch the main features of the services. In the field of public services the subscribers connected to IP based networks needs practically the same set of basic

and supplementary services which are common in the traditional telephony: dialling by phone number from the IP network, accessibility of emergency services, possibility of legal interception, directory services, phone books, customer care and handling of customer complains (see 5.2.2).

5.2.5. PSTN Subscriber Supplementary Services

The supplementary services provided by the switches and the network for PSTN subscriber can be used with different telephone sets with different comfort level. The main enabling factor is the transmission of signals on the analog wires so we discuss first of all the different solutions in signal transmissions.

5.2.5.1. Signals on Analog Subscriber Loop

Traditionally the analog subscriber loop is a twisted pair of copper wires so this loop is suitable for transmission of voice band (300-3400 Hz), DC and out of band signalling.

DC signalling: Closing the loop initiated by off-hook of handset means the intention of user to start a call or other cases during the ringing signal means the intention of user to answer the incoming call. The on-hook the handset means the intention for ending the call. The pulse dialling means a special coding of telephone numbers with staggering the DC current. For supplementary services the Flash function, which generate a short interruption of loop DC current, is used.

Out of band signalling: Ringing the bell the telephone switch provide ringing current on the loop. The frequency of ringing current is usually 25 Hz. Different cadences can be used for supplementary services differentiate calls, e.g. call-back, held calls, and identification of call number at multiple subscriber number service. Out of band signal is used to indicate the start of charging in the form of 12 kHz pulses.

In-band signalling: DTMF – Dual Tone Multiple Frequency signals are used in the „tone dialling” of the telephone sets to send called digits to the switch or to provide additional information during the dialog with automatic systems. In-band signals are the feedback information for the users like dial tone, ringing tone, busy tone and speech announcements. In-band signalling protocol has been developed for display information on the telephone sets based on FSK Frequency Shift Keying

signal. The display can show the number of the calling subscriber, signal for indicating waiting messages in the Voice Mail System and even short messages like SMS in the GSM system.

5.2.5.2. Supplementary Services on Analogue Subscriber Loop

PSTN supplementary services has no detailed standards so different suppliers offer different set of services and controlling procedures. The list below is a summary of frequently used PSTN supplementary services.

- Call forwarding unconditional/ on busy/ on no reply
- Call waiting
- 3 party conference call
- Call forwarding to individual announcement
- Do not disturb / call rejection
- Call restriction permanent/ with password
- Abbreviated dialling
- Hot line
- Multiple number with different ringing
- Calling line identification presentation
- Calling line identification restriction
- Calling line identification at call waiting
- Voice mail message waiting indication
- Anonymous call rejection
- Completion of call to busy subscriber
- Completion of call on no reply
- Selective ringing / call waiting / call forwarding / call acceptance
- Wake up call single / regular
- Carrier selection call-by-call / preselection
- Call back to last no answered call

5.2.6. ISDN Supplementary Services

5.2.6.1. ISDN Basic and Primary Access

At the digital connection from the ISDN user to the ISDN local exchange the organization of ISDN interface channels (B – speech channel, D – signalling channel) may be:

- Basic access: 2 B + D (B = 64 kbit/sec, D = 16 kbit/sec)
- Primary access: 30 B + D (B = 64 kbit/sec, D = 64 kbit/sec)

The very big set of supplementary services supported by the ISDN utilizes the DSS1 common channel signalling transmitted by the D channel and the intelligence implemented in the ISDN terminal equipment.

The ISDN basic access supports two kinds of configurations. The point-multipoint configuration enables connection of several individual equipment even with different call number like ISDN telephone, fax, and computer. The point-point configuration enables connection of ISDN PBXs. The ISDN primary access usually means point-point configuration.

5.2.6.2. User Control of ISDN Supplementary Services

Two kinds of procedures can be used for controlling the ISDN supplementary services:

- Keypad protocol: the user applies digit codes in between * and # codes like in PSTN supplementary services. The terminal equipment has no intelligence so it is not able to recognize type and status of services.
- Functional protocol: standardised messages are sent and the intelligence is shared in between the terminal equipment and the local exchange. Both parties have to know the type and status of services and have to support functions concerning the required service.

5.2.6.3. List of ISDN Supplementary Services

Standardised and individual supplementary services can be offered to ISDN subscribers. The most frequently used services standardised by ITU-T and ETSI are listed below:

- Calling Line Identification Presentation (CLIP)

- Calling Line Identification Restriction (CLIR)
- Connected Line Identification Presentation (COLP)
- Connected Line Identification Restriction (COLR)
- Terminal Portability (TP)
- User-to-user signalling (UUS)
- Closed User Group (CUG)
- Sub-addressing (SUB)
- Malicious Call Identification (MCID)
- Conference Call (CONF)
- Call Forwarding Unconditional (CFU)
- Call Forwarding on Busy (CFB)
- Call Forwarding on No Reply (CFNR)
- Call Deflection (CD)
- Call Hold (HOLD)
- Call Waiting (CW)
- Three Party Service (3PTY)
- Message Waiting Indication (MWI)
- Completion of Call to Busy Subscriber (CCBS)
- Completion of Call on No Reply (CCNR)
- Advice of Charge (AOC)

5.2.7. IN Services

In the description of IN concept is stated that the services has to be created quickly and flexibly and easily adapted to the user. However the implemented systems usually have pre-programmed services and the flexibility and user options are limited to selection of parameters of services.

The most frequently used IN services are:

- Freephone services: the call is free of charge for the caller; fees are covered by the called party.
- Shared cost services: the caller parties pay a lower level e.g. local tariff; the rest of the actual fee is covered by the called party.
- Premium rate services: the caller parties pay a higher-level fee and one part of the fees is forwarded to the called party.

The 3 services listed above have some common features. One is that a specific NDC – National Destination Code is assigned to the services, actually in Hungary the NDC for freephone is 80, for shared cost service is 40 and for premium rate service is 90. The charging principle of calls is completely different from the ordinary calls. The termination of calls might depend from the calendar, time of day, or the origin of the call.

- Virtual card: the users cover the fees of the initiated calls by his own normal telephone bill. The actual call has not charged to the line from the call is originated.
- Prepaid card: the user buys an account with a given value. The fees of the actual call are charged to this account. The card is used to identify the account. The card can be refilled.
- Virtual private network: the defined public and PBX lines can form a virtual private network. The calls within the network can be initiated by short numbers and the fees are adapted to the internal tariff schemes.
- Universal personal number: a special number is assigned to the subscriber and the subscriber can program by control function the lines where the actual calls are terminated depending of time of day, etc. The initiated calls using the account of the universal personal number are free of charge for the line from where the call is originated.

5.2.8. GSM Supplementary Services

5.2.8.1. Customized Services

An important feature of the GSM services that the terminal equipment and service provision can be assigned to a given user. The traditional PSTN/ISDN terminal however can be used by several persons who can access to the telephone set. The intelligent mobile terminal equipment can be programmed according to the individual needs of the user.

5.2.8.2. Prepaid Services

Among the GSM services very popular is the prepaid system beside the traditional subscriptions (paying the bill monthly). The fees of the calls are charged to the prepaid account. The calls can be received even in cases of 0 account. In this system the account balance have to be managed even during the call so the set of services is usually limited e.g. international roaming due to technical difficulties of real time account management.

5.2.8.3. . CAMEL - Customised Applications for Mobile network Enhanced Logic

The international standardisation has targeted this very special intelligent network function. With CAMEL the customer roaming in foreign network can sense just the same service environment which is programmed in home conditions including the non-standardised individual supplementary services like call filtering, selective call forwarding, announcements and interactive information retrieval.

5.2.8.4. GSM Supplementary Services

- Calling Line Identification Presentation (CLIP)
- Calling Line Identification Restriction (CLIR)
- Connected Line Identification Presentation (COLP)
- Connected Line Identification Restriction (COLR)
- Call Forwarding Unconditional (CFU)
- Call Forwarding on Mobile Subscriber Busy (CFB)
- Call Forwarding on No Reply (CFNRy)
- Call Forwarding on Mobile Subscriber Not Reachable (CFNRc)
- Call Deflection (CD)
- Call Hold (HOLD)
- Call Waiting (CW)
- Multi Party Service (MPTY)
- Barring of All Outgoing Calls (BAOC)
- Barring of Outgoing International Calls (BOIC)
- Barring of All Incoming Calls (BAIC)
- Barring of Incoming Calls when Roaming Outside the Home PLMN Country (BIC-Roam)
- Closed User Group (CUG)
- Advice of Charge (AOC)
- User-to-user signalling (UUS)
- kbit/sec, D = 64 kbit/sec)
- The very big set of supplementary services supported by the ISDN utilizes the DSS1 common channel signalling transmitted by the D channel and the intelligence rding on Busy (CFB)
- Call Forwarding on No Reply (CFNR)
- Call Deflection (CD)

- Call Hold (HOLD)
- Call Waiting (CW)
- Multi Party Service (MPTY)
- Barring of All Outgoing Calls (BAOC)
- Barring of Outgoing International Calls (BOIC)
- Barring of All Incoming Calls (BAIC)
- Barring of Incoming Calls when Roaming Outside the Home PLMN Country (BIC-Roam)
- Closed User Group (CUG)
- Advice of Charge (AOC)
- User-to-user signalling (UUS)

5.3. Using of the Dialog Based Service Networks for Other Purposes

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The traditional telephone service is a typical two-way symmetric real time dialog based service as it is described in the point 5.2. As results of telecom development, new services and applications have appeared bringing new networks or new way using of the existing networks. The real bottleneck in the introduction of new services is the network.

The global telephone network has extremely high benefit based on the well established and fully interworking system of connected networks. The system of networks developed for telephone services is suitable for quite different services than original telephony. In developed countries practically the full population has access to the telephone networks. The global telephone network is a really big asset, so its extended utilisation has good reason in economic point of view as well.

The basic ability of the telephone system to connect the termination points quickly and transfer any kind of information in between servers and users suggests introduction of new services and applications. The range of potential new applications seems to be extremely wide so we list here examples only. First of all here we sum up the network features having importance in the introducing new services and applications.

5.3.1. Dialog Oriented Networks

The telephone networks are traditionally circuit switched networks with analogue or digital access part based on wire-line or mobile technologies.

5.3.1.1. Wire-line and Mobile Networks

In the PSTN the voice band transmission possible in the frequency band 300-3400 Hz by the traditional technologies. The digital transmission and switching are spreading however users need access through cheap analogue sets. The analogue line interfaces and sets limit very often the capabilities of networks. The digital technologies like ISDN support functional developments as well. The integrated service means, that the whole system generally supports bearer and teleservices.

The PSTN/ISDN networks have both analogue and digital access parts but the switching part, transmission network part and the signalling systems are common. The interconnected global networks have different level of technology and different level of capabilities in the subnetworks, so the global network is not homogenous. This is a limit in spreading of unified services.

The mobile telephone networks are separated systems interconnected with each other and with the PSTN/ISDN world by well defined interfaces in the gateway exchanges. The first generation mobile systems were developed purely for voice communication. However the second generation digital GSM systems were developed to support several teleservices and bearer services.

5.3.1.2. Teleservices and Bearer Services

Teleservices are defined at the user interfaces but the bearer services at the network interfaces of the terminal equipment as can be seen in figure 5.3.1.:

- teleservices are telecommunication services which provide full communication in between users according to the agreed protocol of network operators including the terminal equipment functions
- bearer services are telecommunication services providing the signal transmission capabilities in between network access points

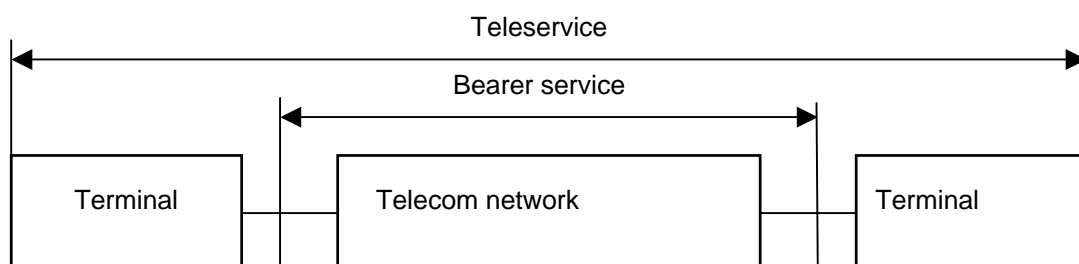


Fig 5.3.1 Definitions of teleservices and bearer services

Bearer services have not direct connection to the end users, but have importance to connect correctly terminal equipment. So concerning applications the barrier services have only secondary importance and there will be presented by some examples.

The ISDN bearer services include:

- 64 kbit/s, unrestricted, 8 kHz, structured circuit-mode bearer service,
- alternate speech and 64 kbit/s, unrestricted, 8 kHz, structured, circuit-mode bearer service,
- virtual call and permanent virtual circuit packet-mode bearer service

Teleservices are directly used by end users. The benefits of standardised teleservices are the smooth interworking of network operators, economy of scale in manufacturing and selling terminal equipment which means safe and cheap communication.

The widely spread ISDN teleservices are:

- telephony - providing two-way real time conversation on the network in between users,
- teletex – transmission of documents as teletex coded information from memory to memory on the network,
- G4 telefax - transmission of documents using Group 4 faximile coding on ISDN
- videotex – access and downloading text and graphical information extended with mailbox functions,
- 7 kHz telephone - good quality two-way real-time voice transmission using 50-7000Hz bandwidth on ISDN

The most popular standardised GSM teleservices:

- telephony
- emergency calls
- short messages – terminated in the handset (SMS MT/PP)
- short messages – initiated by handset (SMS MO/PP)
- short messages – broadcasted within the cell (SMS CB)
- alternated voice and telefax G3
- automatic telefax G3

Some details concerning the teleservices listed above are the followings.

5.3.2. Telefax

The telefax services are developed for transmission data instead of voice on the network in between the terminal equipment. The data transmission needs only one way communication and the necessary other communications are managed by the terminal equipment. The terminal equipment scan the document, the scanned signals are coded into digital form and transmitted over the network using the standardised protocols. The receiving terminal decodes the information and produces the copy of the original document (faximile).

The telefax was used in the PSTN at the beginning but had so quick success so had to be implemented in ISDN and GSM as well. The key issue of the success was that developments in the network were not needed to introduce telefax services but only connection of new terminals to the existing network. The faxed documents can be handled as real copies of the original documents. The business and administrative world have accepted as real documents. Faxes are faster and cheaper than postal delivery of documents.

Interworking of telefax terminals are based on standardised protocols. The G3 (Group3) terminals use analogue PSTN line interfaces. The digital codes are presented on the transmission lines in the form of modulated audio frequency signals. The G4 terminals transmit the digital signal more efficient mode on ISDN to communicate with an other G4 terminal. The G4 terminals can forward faxes in G3 mode as well if the destination terminal can use only G3 protocols.

The telefax teleservice standardised in GSM support G3 protocols only. In the GSM systems the automatic telefax is a separated teleservice because the voice transmission has compressed speech coding which does not support fax code transmission. The air interface has no speech coding in automatic telefax mode. The alternative speech/fax mode is a special one and the coding can be controlled during a call.

The telefax transmission has the following steps:

- Call setup – like as normal calls using the telephone number of the called terminal.

- Negotiation of modem transmission mode – using standardised protocols the terminals fix the mode and the appropriate transmission speed adapted to the actual network performance.
- Data transmission – the scanned information is transmitted using the agreed mode. In cases of changes in the network performance during the call the data rate can be adapted.
- Acknowledgement – feedback data from the receiving terminal on the successful transmission or on the errors. The results are indicated or printed on the sending terminals.

5.3.3. Voice Mail

The basic function of voice mail services is recording messages. This is a typical on-way non real time service to provide recorded messages from the caller users to the called users.

The voice mail system is a centralised message recorder. The callers leave messages and the called users can listen them, and message delete function and archivation are also available. The mailboxes can be subscribed and the complex system can manage thousand of boxes. The boxes can be assigned to existing lines or might be individual boxes.

Messages can be recorded in the mailbox assigned to a given telephone number if the conditions defined by the user are valid, e.g. busy line, no answer. Such boxes have no own phone numbers, calls and messages are identified on the basis of called number. An important task of the voice mail system to inform the user on the received messages. The first step is transferring indication on recorded messages from the mailbox system to the telephone switch. The second step is to transfer the message waiting information from the telephone exchange to the subscriber:

- Initiating calls to inform the users. This solution is simple but generates traffic load with low chance of success.
- Modified dial tone. This solution needs modifications in the telephone exchanges and the user can detect waiting messages only cases of picking up the handset.
- Display waiting messages with a lamp on the telephone sets. This solution needs considerable extension in the signalling system but can be combined with other services like display of calling number or SMS.

Listening messages can be managed easily from the assigned telephone sets but remote retrieval can be possible as well.

The individual mailbox has its own phone number and the mailbox system is connected immediately to announce that ready to record messages. It is impossible to indicate waiting messages. The recorded messages can be listened from any telephone set.

The fax mailbox service can store faxes. Its working principles are similar to voice mail systems and voice mail and fax mail can be integrated. The fax mailbox service might be very useful to manage intensive and bursty fax traffic. Circular faxes can be managed easily by fax mailbox systems.

5.3.3.1. Application of voice mail in different telephone systems

The voice mail systems were introduced in PBX systems in the first period. A closed and limited network can be managed relatively easily. The next successful field of its application was in the mobile telephone systems. The switched-off handsets and the limited coverage suggest the application of mail boxes. The implementation has been relative easy because of the direct support of the signalling system. The indication of received messages has several excellent solutions e.g. by SMS.

In the ISDN/PSTN networks the message recording appeared in the first period as a special terminal equipment combining telephone sets with a small magnetic tape recorder. The real voice mail systems were introduced in mid nineties. The indication of waiting messages are listed above.

A new line in the service development is the universal messaging where messages received in different form and handled by the same way. The messages can be converted into other form e.g. automatic reading of e-mails, forwarding voice and fax messages by e-mail, forwarding the header of e-mail by SMS.

5.3.4. SMS – Short Message Service

The SMS seems to be the most successful non-voice service in the GSM networks. The SMS enables sending text messages from one handset to an other handset. The sending a message has two phase:

- Message transfer from handset to the SMS service system (MO/PP – Mobile Originated/Point to Point). The message might be maximum 160 text character. The destination might be a mobile subscriber defined by its call number. Special agreement of network operators can support forwarding the message to a pager or to a PSTN/ISDN terminal.
- Message transfer from the SMS service system to the handset. (MT/PP – Mobile Terminated/Point to Point). The origin of messages are generally handsets but operators and other systems (e. g. Internet, unified message systems) can generate messages as well. Acknowledgement on delivery of SMS can be managed.

The third GSM teleservice concerning the SMS is the message broadcasting within cells (CB – Cell Broadcast). This teleservice enables sending messages containing maximum 93 characters. Concatenating such messages longer message can be composed. All of subscribers in the area of the cell can receive the broadcasted message. The handsets can filter the messages having already been received on the basis of message identifier. The message broadcasting has importance in propagation urgent local information.

The SMS applications have continuous development. Some examples are listed below:

- Personal messages between mobile subscribers – this is the most popular application of SMS. Their number is comparable to the voice calls.
- Subscription for regular information provision using a content provider e.g. exchange rates, stock rates, lottery results
- Case-by-case SMS messaging based on pre-defined events e.g. transaction with credit card.

The success of SMS in the GSM networks raised the demand of PSTN users to apply similar system in the network. The necessary technical developments have started. The critical part is the signalling system supporting fully the SMS. The ISDN seems to be easier task due to its signalling features. The analogue system needs further development of calling number display protocols and functions.

5.3.5. Internet Access

The PSTN/ISDN system offer an access to the services of the global Internet systems as well. The Internet service providers (ISP) have to install gateways for interconnection of ISDN/PSTN and Internet systems. The gateways handle IP addresses on the Internet side interfaces and telephone numbering schemes on the telephone side interfaces. The connection to the Internet can be set up by dialling phone number to reach the gateway and the data transfer uses modems managing line coding.

The ISP has service agreement with the customers defining the conditions to use Internet services. The ISP manage the authorisation and authentication procedures. The billing system store the usage records and assemble the bills. Internet access through PSTN has no limitation in using services e. g. www, e-mail, FTP, CHAT but the data rate on the PSTN lines can limit the download speed.

5.3.6. WAP

The WAP (Wireless Application Protocol) is a special browser with adapted functions to mobile networks and content is adapted as well. The air interface limits the downloading speed and the displays of handsets are usually small so the WAP based information management need specific structure and presentation.

The content on WAP based portals are growing and the GSM service providers usually develop their own portals.

5.3.7. Telephone based information retrieval and administration

Information and entertainment

Broadcasting of sound programs using wireline systems seems to be as old as public telephony. Even nowadays a big sort of information can be received by telephone systems.

Services can be classified on the character of information.

- Public interest information (e. g. speaking clock, weather forecast, time tables, travelling information, mental aids)
- Commercial information (e. g. exchange rates, tax tips)
- Entertainment (e. g. games, tales horoscope)

The mode of information provision might be pre-recorded speech, selection from menu points with defined structures, leaving messages, real personal contact with operator or a combined form.

Another classification might be on the basis of tariff schemes.

- Some information can be retrieved charging by normal telephone tariff.
- Other kind of information available on case based charging (e.g. directory services)
- Special schemes can be organised also like free calls, shared rate charging, premium rate charging.

Call centres, Contact centres

Customer services can be supported high level with new applications of telephone systems. The full availability of telephones, the integration with information technologies give nice possibility to serve customers quickly, and with high comfort and reliability. The competition in services also accelerate the application of call centres in several fields of the life.

The main function of call centres to receive phone calls and forward the calls to the relevant person to serve the customer providing information on products or services, receive the data of customer, receive orders.... Commercial and service companies where the customer contact are crucial (e. g. banks, assurance companies, telecom companies, airline companies, department stores, ticket offices) can utilise the benefit of call centres. Call centres manage the front line activities of such companies so correct handling of the incoming calls have high importance in the customer satisfaction. This goal can be reached by optimal combination of high technology and the well trained staff. Call centres are good tools in managing and monitoring of the business activities.

The technology applied in the call centres has continuous development in integration of telecom and IT systems to have better and better adaptation to administrative processes and customer handling. The Automatic call Distributor (ACD) and Interactive Voice Response (IVR) systems enable the correct and quick

handling of customer calls and the further development can manage beside phone calls telefax and Internet contacts. The Internet call centre can send e-mail from the customer with a singly click on the home page or initiate a phone call. The VoIP features in the Internet computer can initiate VoIP calls by a singly click. The customer and the agent can see synchronised web pages and fill the ordering form with parallel verbal discussion. The continuous help of agent can result successful ordering or electronic transactions.

Contact Centre is a new generation of call centres supporting the professional and well-qualified agent staff in customer oriented activities to answer the requests of customer in one or a few steps. The key elements of contact centres are the Customer Relationship Management (CRM) systems to integrate the call handling with business processes and databases to support the agents.

5.3.8. Other Applications

The possibilities in dialog based service networks for innovative applications have no strict limits. The summary below lists only a few applications in a short form.

Conference Call

Conference calls connect more than two terminal equipment for multilateral communications and a special technical solution is needed to implement conference services.

Setting up conference calls can be managed by one subscriber or by an authorized operator to enter the conference members into the conference call step-by-step.

Other solution for conference calls when conference member can enter into the service dialling a pre-defined phone number. This type of conference call can be used in two forms. Closed user application is possible if the phone number of the conference call is not published only the selected persons know it and call the conference system in a pre-agreed time. Public service can be provided with publishing the conference call number and the topic of conference. Such chatting applications are more and more popular and the most favourite topic is the partner hunting.

Beyond voice conferences video conferences can be provided on ISDN. Video conference terminals and controlling functions have to be installed on the spots of the conferences. Companies and organizations utilize the benefit of conference calls for discussions reducing travel cost and time of staff.

Location oriented services

One of the special content provision is when the exact location of the user is an important selection parameter in information. The position of customer is determined automatically based on location server function. In PSTN/ISDN the location function can be determined by IN functionality to detect the geographic location from the origin of call. In the GSM system based on base stations the geographic locations are available.

Big department stores and chains of service points can transfer the customer orders to the nearest service point (e.g. pizza service) both in wired and mobile networks and location specific information can be also provided like local transport, local weather, stores, restaurants.

Televoting

Televoting services can collect and count of votes produced by phone calls. The actual number of calls can be monitored and final result also. Selection among possible choices might be calling different numbers.

Televoting can be used to select the predefined order number of callers and forward the selected caller to operator. Separated counting of different geographic origin can be managed also. Rejection of repeated votes is also possible.

Donation by calls

The telephone network can be used for charity purposes also. The published phone numbers assigned to charity usually are charged with premium rate. The given portion of fees are transferred to the organization ordering the service.

Burglar alarm services

The telephone system is very suitable to transmit the alarm signals in case of burglary, fire etc. to disaster management centres or the pre-defined subscriber. The alarm services are popular among companies, offices and residential users.

5.4. Content services

Házkötő Béla, author

Sándor Stefler, reviewer

During cultural history of the mankind information had always a great significance. At first conveyance of information was only verbal expanded with several signals or marks. There was a hard disadvantage, that this information could be developed only in the moment of conveyance, but in the next moment it disappeared and could be not reproduced only with loss or distortion. Therefore mode of storage was soon be looked for and found. At the very start primitive figures and signals scratched or engraved on rocks, on woods, or on bone spread information for some limited persons or little groups. Later on discovery of different sorts of writing resulted further and durable possibilities. Development of various writing technologies (by characters, pictures, runes etc.) on isolated districts of the World at about equal time proved the stark claim for the storage of information. The invention of typography has brought a significant change. It has given the possibility for reproducing information in theoretical by unlimited amount, quite cheaply and suitable for distribution in big masses. Newspapers have appeared. By this time preparation of the content (editorial office) and distribution (publisher) were separated, and representational carriers (e.g. encyclopaedias) appeared. In practice theoretical grounds of information's content services have been developed.

Possibility of the explosion-like evolution was given by the technical development, electrical engineering, and later by the development of electronics and propagation of telecommunication. At first the telegraph was only a technical expedient for journalism, but the telephone provided shortly original possibilities.

Just some years after inventing the telephone in 1881 Tivadar Puskas presented the „Telefonhírmondó” (telephonograf) on the world exhibition, in Paris, which became the first program distribution system on the world after its premier in Budapest in 1882. It was broadcasting varied programs day to day 14,5 hours long for several thousands of subscribers. After about 30 years of functioning it gave up its place for a new „pretender”: the radio. From that time the „milestones” of the

evolution followed each other faster and faster. After about 10 years started the first wing-beats of the TV which, first with black and white, then with colour technology - created a new form in the media. In the meantime the computer has appeared and informatics started a stormy evolution, too. Diverse forms of telecommunication with greater and greater output have been evolved and the two fields began converge. A world-wide computer network has been built up and the Internet captured the world by a never learnt speed providing invaluable perspectives for the mankind. A new period of the informational revolution has arrived: accessibility to information has become a fundamental right of the human being, and establishing of the information's society has started.

5.4.1. Content

In this chapter services providing information content are surveyed. The content as the subject of certain services represents some similarity but it differs, too, dependent upon technologies and other factors. The free flow of information and access to information are parts of fundamental human rights. [5.4.1]

Information can contain materials that are illegal or harm interests, moral, or religious conviction of other people or groups of people and may be harmful for development of children and minors. The European Convention on Human Rights authorises governments to take bans and restrictions concerning undesirable contents without violation of the human right.

Undesirable contents can be divided into two major parts: illegal and legal, but harmful especially for minors. Estimation of the first group is unambiguous and homogeneous; the second's may vary depending on the country.

Representation of violence in media.

Let us look over some possible aspects of the relationship of media and violence concerning the complexity of the problem.

The public and its access to the electronic media

a.)Television

- free access (unencrypted)
- fee-paying access (encrypted)

- "professional" access (medical pay TV)
- interactive television (using for example video games, CD Rom or Internet)
- programming time (children's programming time / prime time / programming time after watershed).

b.) Other

- Internet
- video (free or conditional access).

Types of programmes

a.) Television programmes: news, current affairs, documentaries, science programmes reality shows, light entertainment, music, video-clips, game-shows, contests, sport, religion, children's programmes, films, drama, advertising, teleshopping, trailers.

b.) Radio programmes: news, current affairs, light entertainment, music, sport, religion, youth, and advertising.

c.) Other: video-cassettes, trailers video games, multimedia.

Acts of violence portrayed:

- physical violence, sexual violence, psychological violence, verbal violence, implied violence, threats, act in itself (e.g.: physical aggression), result only (e.g.: injury or death, material damage), act and result.

Context of portrayal of violence:

- information, education, awareness-raising (charity), artistic expression, entertainment, social criticism, irony, humour, audience attraction/sensational, unintentional.

Form in which violence is portrayed:

- realistic, naturalistic, hedonistic, esthetic, aggressive, raw material, picture and comment/value judgments, positive/negative (violent act of the hero/anti-hero).
[5.4.2]

Protection of minors and human dignity

Human dignity and protection of minors against harmful influences are fundamentally important parts in providing audio-visual and information services. This kind of materials can be divided in two parts:

1. contents, publication of which is illegal and as a crime, it is punishable, e.g. child pornography, violent pornography, extreme gratuitous violence and incitement to racial or other hatred, discrimination. The most countries have prohibitions on this kinds of materials on producing, distributing, importing and

advertising, too. Like it, are prohibited publication such as material that is obscene, contrary to sound morals or indecent.

2. contents, lawfully publicized to adults are available also to children, but may be harmful to the latter's mental and moral development. There are some problems on this field. Globalisation of services, audio-visual services without frontiers, very speedy growing of the Internet reveal the differences of diverse cultural and moral traditions in certain countries which influence estimation of concrete forms and identification of undesirable contents. The newer and newer technical facilities also change the character of the services, too. Previously the choice of a subscriber was limited to the question „watch or not to watch TV?." Today the choice has grown very wide, even with utilisation of video-on demand (VOD) or similar possibilities and every user may become a potential program-editor. [5.4.3]

According to the former mentioned facts, different technical and administrative means may play an important role in protection of children. One of them may be the controlled access. Simple methods in the broadcasting are sending programs late in the evenings or labelling the programs with conventional symbols according to content's categories. Both methods shift the responsibility upon parent's control.

New services generally include a restricted access for children e.g. by the existence of subscription, by using an identification code or simply by the contact between the provider and the subscriber.

Possibilities of protection

Canada has been a pioneer in protection of minors. In the 1990s launched a strategy for fundamental frameworks of protection:

- collaboration based on the principle that violence on television is a cause of psychological problems among children;
- protection of children and not censorship of adults;
- concentration on gratuitous or idealized violence without involving eroticism or other moral considerations;
- involvement of all those concerned: broadcasters, advertisers, producers, parents, teachers and specialists in mental health;
- adoption of a dual perspective, one short-term and one long-term;

The most important things to be done are the follows:

- codes of conduct worked out with the industry;
- classification of programmes;
- anti-violence or „V" chip;

- information campaign to increase public awareness, and media education programme. [5.4.3]

Note: the „V” chip is a technical device incorporated in a television set, with it is impossible to view programmes, classification by a provider’s code, if it is not derestricted (for example by parents). It is possible to restrict different kind of programmes with different codes. Application of this method grows slowly.

Canadian model constitutes the basis of protection today all over the World.

The simplest method is the controlled access. On field of broadcasting the simplest methods are sending programs late in the evenings or labelling the programs by conventional symbols according to their content’s categories. Both methods throw the responsibility upon parent’s control.

Control

In Hungary propagation of programs concerning radio and TV Act No. 1 of 1996 on radio and television services controls broadcasting fundamentally.

„Article 3 (1) In the Republic of Hungary broadcasting may, within the framework of this Act, be freely exercised, information and opinion may freely transmitted through broadcasting, and Hungarian as well as foreign programmes intended for public reception, may be freely received. The broadcaster, within the framework of this Act, defines the content of broadcasting by itself and is responsible for it.

(2) The broadcaster shall respect the constitutional order of the Republic of Hungary, its activity may not violate human rights or encourage hatred against individuals, genders, peoples, nations, national, ethnic, linguistic and other minorities, and church or religious groups.

(3) Broadcasting may not aim, openly or implicitly, at insulting or segregating any minority or majority. Nor may it present or judge them from racial points of view.”

„Article 5 (3) No images or sounds presenting violent conduct as exemplary may be broadcast in programmes for minors.

(4) Programmes that may have an adverse effect upon the development of the personality of minors, particularly programmes presenting the gratuitous use of violence as an exemplary conduct and programmes presenting gratuitous sex may

only be broadcast between 11:00 p.m. and 5:00 a.m. The attention of the audience shall be drawn to the nature of such programmes prior to broadcasting.

(5) It is forbidden to broadcast any programmes that could have a seriously adverse effect upon the development of the personality of minors.”

By this Hungary satisfied the European agreement concerning „television without frontiers”, Strasbourg 5. May 1989 [5.4.5], which was pronounced by Act No. 49 of 1998 [5.4.6].

5.4.2. Services

Nowadays we are witnesses of the enormous and speedy transformation of the content services. The development of digital technologies, the continuous appearance of newer and newer services and the convergence of telecommunication and informatics fundamentally change accustomed and existing structures. Therefore statements, according to actual regulations, are not durable. The legal environment is forced to continual evolution, too. Programme transmission as an independent service will presumably be left out from programme delivery and this function will be changed by simple leased line services. Cable networks are prior a big development especially after liberalisation. Interactive wideband networks of a good quality being under construction will provide an enormous assortment of content services for the subscribers. With reliably solution of downlink channels satellite programme distribution will also find place in the competition of the technologies. Developed services „tailored” for mobile communication supported by UMTS Universal Mobile Telecommunications System (UMTS) will bring hardy estimable changes in the application of the information.

What can this „information supermarket consist of”? By a vision, for example of the followings:

Information, i.e.

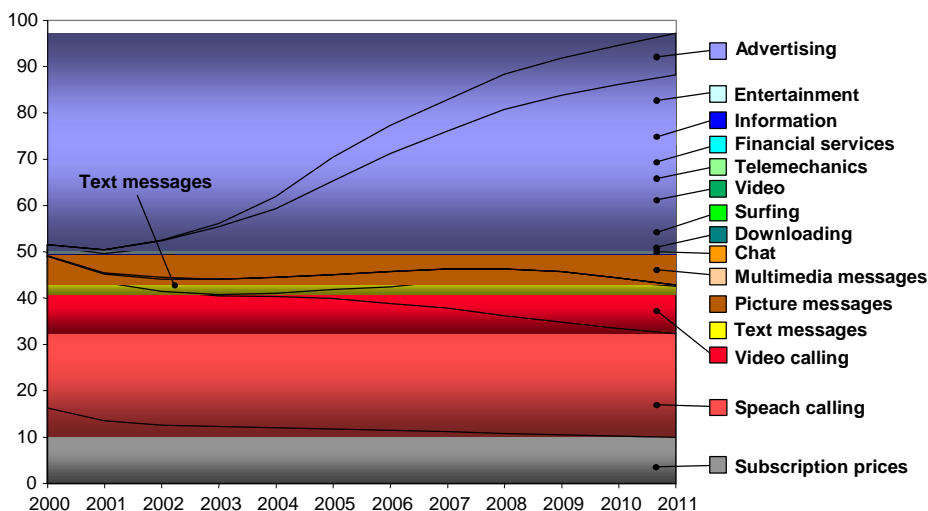
- news, summaries, business and finance, politics, culture and entertainment, sport, gambling, etc.
- financial services: stocks, stock-market, current rates, charge accounts, credit cards, money transfers, statement of accounts, etc
- localised services: restaurants, theatre-cinema-concerts, inquiry offices, correct time, pharmacies, supplication, weather forecast, etc.

- commerce: categorised (property, car, employment), shopping (daily, actions), tickets, etc.
- travel: travelling information, orientation, time-tables, hotels, holiday-offers,
- private interest: Internet, computer technique, car, antiques, etc.
Communication, i.e.
- messages: SMS, postcards, multimedia-messages,
- E-mail: sending/receiving, dictaphone,
- group communication
Power, i.e.
- organisation: task-lists, address lists, agenda, memos,
- personal assistance: registers, translation, etc.
- resources: calculator, dictionary, translator, etc.
- mixed: control of domestic machines, automatics, identification of persons and places, home networks, etc.
Entertainment, i.e.
- music, TV, lifestyle (hobby, mode, company), stories, chat, pictures, games, astrology, biorhythm, first experiences of somebody, etc.

Source: Nokia

There should be an estimation of a service provider concerning the trend of an average monthly receipts pro subscriber in the next 10 years.

Average revenue per user (ARPU) Estimation



Source: Nokia

Broadcasting

„(32) Free-to-air broadcasting: one-way radio communication procedure carried out with a terrestrial or satellite system and intended for a theoretically unlimited number of users with suitable receiving equipment, for the transmission of sounds, images or signals of other nature.” [5.4.4]

Detailed rules of radio and TV broadcasting can be found in the Act No. 1 of 1996. [5.4.4]

Special forms of broadcasting are the public service broadcasting and the public broadcasting. The aim is to supply the general public with public service programmes with respect of the dignity and other interests of the national, ethnical, lingual and other minorities without injuring other nation's dignity. It provides regular, overall, unprejudiced, authentic and correct information about local and foreign events, supplies information, counting on public interest with typical and contrary opinions. It attends to make communications of general interest public. Its mission is to satisfy interest of the public variegated and on a high level. It gives curious attention to present and preserve cultural values included also religious, national, and ethnical and other minority cultures. Additional mission is to send programmes, in prime time that serve development and knowledge of minors and spread important information for disadvantageous groups especially regarding to services that introduce to rights of minors serve their defence and give information on available services.

From the above-mentioned follows the need of the economical, political and other independence of public broadcasters. This is suggested both by national and international right. The most important question is: how to ensure the economical independence.

The funding schemes for public service broadcasting are fundamentally different from the funding schemes of other services of general interest (such as „universal service funds” in telecommunications).

There is a consensus in Europe that public service broadcasting needs an appropriate, secure funding framework, and that public funding is an integral part of public service broadcasting systems.

What are the terms „public“ and „commercial“ financing? Revenue, which comes from the state budget or other public funds, or from mandatory fees paid by viewers and listeners (broadcasting license fees), is generally referred to as "public revenue". In contrast, income from contractual transactions on the market (advertising, sponsorship, programme sales, etc.) is generally referred to as "commercial revenue".

In Europe and in Hungary too, the mixed model is used, where a combination of public and commercial revenue is used to fund the public service activities. But we must allow that "commercial revenue" may contribute to the funding of public services, but "public revenue", which has been granted for the fulfillment of public services, must not be used to fund services outside the public service remit, they must operate a strict separation of accounts, as it is prescribed in the recent European Directive on financial transparency.

The predominance of mixed funding in Europe may be explained by the following consideration:

- In many countries, a single source funding would not provide sufficient revenue to guarantee the fulfillment of the public service remit;
- Reliance on one particular source of funding creates dependencies, which run the risk of undermining the independence of the broadcaster and the effective fulfillment of the remit;
- Mixed funding systems may be considered more robust in a rapidly changing environment, where certain sources may suddenly dry up while others grow and new ones emerge.

The funding of public service broadcasting is more than a financial issue. Although the rule „Who pays commands“ cannot automatically be applied to broadcasting, the way funding is provided is likely to influence broadcasting output. Broadcasting journalists and managers are well aware of who ultimately pays their salaries: viewers and listeners, the government, or the advertising industry. Apart from the psychological links and affinities there may also be hard economic pressures linked to particular sources of funding. For example, the more dependent a broadcasting organization is on advertising/sponsorship revenue the more it will be under pressure to achieve high audience rating with regard to those sections of the population which are of primary interest to advertisers. This leads to a typical „deformation“ of programme schedules, with preference being given to popular or

relatively cheap mainstream programmes, avoiding difficult, controversial or experimental programmes, and neglecting the interests of certain age-groups and minorities. The result is „commercialization”.

On the other hand, where a broadcaster has to rely primarily on direct State funding, there is the risk that the public authorities or political parties will use this „leverage” to gain influence over editorial policy. Even without such interference, broadcasting organizations may be inclined to „please” bodies, which have decision-making power over their funding. They may be tempted to hold back „negative” information, avoid programmes which are critical of the government, etc.

The funding schemes by different sources have one by one any advantages and disadvantages. Ratio of different funding schemes, which is chosen suitably, is optimized without risk of independence and is adjustable effortlessly to different nature of countries.

In Hungary foundations, managed by advisory boards, ensure function of public broadcasting.

The National Radio and Television Body govern the broadcasting-related rules. The most important responsibilities of the Body are the followings:

- the Body fulfils the responsibility of inviting tenders for broadcasting rights and satellite channels provided for the purpose of Government-controlled broadcasting, and it is also responsible for accessing the bids that are received,
- the Body fulfils the supervisory and inspection responsibilities stipulated by the Act,
- the Body operates a Complaints Committee for investigating case reports,
- the Body operates a programme monitoring and analysis service.

All questions related with legal status, function of National Radio and Television Body, foundations and his advisory boards together with subvention system of broadcasting can be found in Act I of 1996. [5.4.4]

Nation-wide and regional broadcasting of radio and television programmes may be provided only by a concession company or by an economic organisation established for this purpose. [5.4.8]

Program transmission

„(29) Programme transmission: the simultaneous transmission, without any alteration of the contents, of signals produced by a broadcaster by means of a wire (cable) network or a terrestrial or satellite non-broadcasting radio communication system to radio and television broadcasting stations or programme distribution networks.” [5.4.4]

Service classification of programme transmission in Hungary corresponds with broadcasting. [5.4.8] After liberalisation of the communication it will probably leave off as a separate service and will be reckoned among the leased line services.

Programme distribution

„(26) Programme distribution: the simultaneous transmission of signals produced by a broadcaster without any alteration by means of a wire (cable) network; or by a non-free-air radio telecommunication system from the broadcaster's premises, or from the end point of the program transmission network, by inserting a distinct organization, to the receiving equipment of entitled users, with the exception of transmitting signals by a network suited to connect less than ten receivers. A cable system within the boundaries of a real estate is not considered to be programme distribution.” [5.4.4]

Programme distribution is the most hopeful service of all services, providing access to information already in these days but especially in the future. In consequence of the technical development services utilizing possibilities of the digital technique has become reality, soonest evidently on TV-program distribution networks. In favour of these services two basic requirements must be fulfilled: creating of downlink channels and selective accessing of subscribers. The first requirement is needed for the provision of interactive services (they have been just started). The second has already been realised on many places for forwarding packs of programs according to claims of subscribers having different interests or solvency (or according to simply business interests of service providers).

The most important programme distribution services are the followings:

- distribution of analogue TV and radio programmes. This is the classical service of programme distribution.

- digital broadcasting. It is creation of programmes in a new form, in which the content (sound, picture, and other information) appears as digital data during the production, transmission and processing, as well. Compression of data stream by a special algorithm greatly narrows the bandwidth needed for its transmission. Digital technique in itself does not mean a great change from the side of the programme distribution service, significant difference is the claim to interactivity, which is linked with the most important attribution of the digital TV: the electronic programme guide.
- pay-per-view (PPV) service offers viewers the possibility of selection from the contents of a broadcasting schedule who have to pay only for what they actually view. These are broadcasting services whose distribution is triggered by a universally available service. Wanted programmes may be accessible by viewers possessing the requisite receiving equipment. The viewer's decision is technically confined according to the portions of the encrypted programmes he is able to decode and to view actually.
- near video-on-demand (NVOD): the principle of NVOD is similar to PPV, but the selection of the consumer is extended by distributing the material in parallel at short intervals.
- video-on-demand (VOD) offers consumers a whole range of transactional services from films on demand via tele-banking to tele-shopping. Consumers can make their choice from a catalogue of permanently available programmes. As a truly interactive service, the chosen telecommunications service will be triggered to the viewer's individual connection.
- videotext: the most typical service is the Teletel network having been launched in France in 1984 and being today the most highly developed videotext system in the world. Over two-thirds of the French population has access to the network via a specific terminal (Minitel). It has been started as an "on line telephone-directory", but now it offers some 25 000 different services, many of them transactional.
- Internet: the bigger bandwidth of programme distribution networks offers possibility to high-speed Internet access. Later on there will be the possibility to voice-telephone via Internet, too.

Video on demand

As described, interactive services give possibility for subscriber to choose a program or other content attending as video-signal, that he would like to use. By a definition: [5.4.9]

Video On Demand (VOD): A VOD application provides residential users with the ability to select among a catalogue of pre-recorded programmes (films, news bulletins, sport events, music clips, documentaries, previews, etc.) to receive the chosen programme on a TV set and navigate through it, using control commands.

When considering services such as VOD, a number of roles can be identified:

customer: Customers may rent or own the device that allows access to the different services: typically the device will consist of a television set and a set-top-box, or a Personal Computer (PC), or a work-station. Customers may get access to a service either by subscription, or on per call basis, or even by means of a combination of the two.

service provider: Service providers own and control a number of video servers from which the programmes are distributed to the customers. Service providers may be contacted by the customers directly, or through a broker. Service providers are related to content providers from which they buy the rights to distribute a certain programme. Service providers also have the responsibility of updating the video servers. Service providers may have relationship with one or more brokers.

brokers: Brokers offer a customer an access service to different service providers with which they have an agreement. They allow the Customer to choose among different service providers based on the specific user request on a call by call basis. Brokers have no direct relationship with the content providers.

content provider: Content providers own certain programmes and are able to sell the rights of distribution to one or more service providers.

network provider: The network provider offers the communication support (infrastructure) to all the parties mentioned above. It is assumed that communication will always take place through the network. It is important to note that the role of the network provider is infrastructural in the information service provision, while the other roles are of structural type. This implies that the network provider is not part of the direct chain that links the information producer (referred to as "content provider") to the information consumer (referred to as "customer"). It is expected that the network provider will provide fair and equal access to all services providers. [5.4.9]

World Wide Web (www)

The World Wide Web is a system of Internet servers that supports hypertext to access several Internet protocols on a single interface. The World Wide Web is often abbreviated as the Web, WWW, or W3.

The World Wide Web was developed in 1989 by a scientist of CERN (European Particle Physics Lab) Tim Berners-Lee. The initial purpose of the Web

was to use networked hypertext to facilitate communication among its member, than it was developed rapidly, his application grew and began to incorporate graphics, video and sound. In recent years, the use of the Web has now reached global proportions helping with this considerably to spread of Internet.

Many protocols are accessible on the Internet. The major protocols are as follows:

- E-mail (SMTP; Simple Mail Transport Protocol)
- Telnet (Telnet Protocol)
- FTP (File Transfer Protocol)
- Usenet (NNTP; Network News Transfer Protocol)
- VoIP (Voice over Internet Protocol)
- HTTP (HyperText Transfer Protocol),.

The Web provides a single interface for accessing all these protocols. This creates a convenient and user-friendly environment. Because of this, the Web's ability to work with multimedia and advanced programming languages, the Web is the fastest-growing component of Internet.

A HyperText document containing words that connect to other documents. The words are the links, which the user can select. A single hypertext document can contain links to many documents. In the context of the Web, words or graphics may serve as links to other documents, images, video and sounds. Links may not follow a logical path. The hypertext is a standardized protocol. The application of hypertext is supported by much software.

The World Wide Web contains files, called pages, containing information and additional links. Access to pages may be accomplished by:

- entering an address directly
- browsing through pages and selecting links to move from one page to another
- searching through subject directories linked to organized collections of pages
- entering a search statement at a search-engine to retrieve pages on the topic of your choice.

To find a page is possible using its address. At the beginning these addresses named URL's (Universal Resource Locator) were numerical codes translated by DNS (Internet Domain Name System). Since numeric strings are difficult for humans to use, they were changed by alphanumeric addresses. This is the format of the URL:

- protocol://host.domain/filename

The domain-name can be a multi-level one, in the beginning the second level contained the type of institution, for example .com→commercial, .edu→educational, .gov→government, etcetera. They are used now mostly in USA. In other countries of the World the two-letter country codes according to ISO 3166 are used.

To access the Web you must use a Web browser. This is a software, that allows users to access and navigate the Web. There are two types of browsers: graphical browser (the best known are Netscape and Microsoft Internet Explorer) and text browser (Lynx). Lynx is now available only for special application.

Browsers are being developed in interest of utilisation of newer and newer applications and possibilities. Little programs (applets) provide possibility to insert animated pictures in pages, multimedia applications represent of audio and video materials, real-time programs already realise Internet-TV and -radio.

Beside the problems discussed in the first part of this chapter, contents founded in the Internet propose possibility of abuse. If we set a glance over the different sorts of problems, we can see the list very extended. It is as follows:

- national security (instructions on bomb-making, -illegal drug production, terrorist activities);
- protection of minors (abusive forms of marketing, violence, pornography);
- protection of human dignity (incitement to racial hatred or racial discrimination);
- economic security (fraud, instruction of pirating credit cards);
- information security (malicious hacking);
- protection of privacy (unauthorized communication of personal data, electronic harassment);
- protection of reputation (libel, unlawful comparative advertising);
- intellectual property (unauthorized distribution of copyrighted works, e.g. software or music). [5.4.10]

Defence in this case is more difficult than in the case of other services, because the World Wide Web is global. Difficulties are generating from the „freedom” of the Internet, than to banish a given material is practically impossible, because a kind of „solidarity” prevents it. There have been and are today some attempts to control the Internet, but a truly successful model is not known. There has been spoken about self-control up to the present time. Because of convergence however,

this branch penetrates into areas that are controlled particularly. More and more outlines of complex control have been developed. Areas are to be determined where central control is possible and desirable and where self-control is needed. The first concrete results probably will appear in controlling of the E-signing and the E-commerce.

Portals

Growth of volume of information made increasingly difficult to find a theme or material from any source. A claim has arisen in a short time to facilitate the search, to sort the content by theme or by other points of view. For this purpose portals were created. Audiotext services using also menu systems for orientation, function as portals, but the most characteristic portals are located in Internet in consequence of much bigger information content.

Portals have been developed, too. First portals were intended to glean and accumulating information. They were organised firstly around the big browsers only for simply search (horizontal portal), then aggregated the different personal materials (vertical portal). Currently different services can also be found in the offer; in the future even software will have run by portals. There is a custom to call these development stations (like other devices) "generations" (Gen 0, Gen 1, 2 etc.).



Typical Internet portal

Different technologies require different portals because of the variety of information. Therefore also with the appearance of mobile (wap) and palm-top portals may be reckoned. Today we can speak about global portals serving different technologies according to the above-mentioned facts.

A special field of portals is the voice portal. It can make access to Internet in the form of a talk. Its technical realisation has been given by the large-scale development of speech recognition and by the speech-processing techniques. It was born also in the USA as near by all Internet applications. The idea originates from the recognition, that about 250 million computers are connected with Internet (in 2000), but about 1,3 billion phone-lines are used all over the world! Some experts estimate the growing rate of the voice-portal market 54% in next 6 years and 7 billion USD revenue with 45 million subscribers in USA (2005).

Audiotex

Audiotext service has been got known as a „value added telecommunication service“. Added value of the service, accessed with a call number on normal phone-line (reserved in a number block set apart for this purpose) is given by the accessible information. Information may be either conserved or live speech and combination. The service may be interactive or not. In case of an interactive service the user signals the code of the needed direction by pushing buttons of his telephone, according to the commands or information he has got. Information may be accessible by a menu-system. This system may be simple or multi-level. Use of the service does not need a special terminal.

This service provides the most different information e.g.: weather forecast, timetable, evening tale, speaking clock, cure of souls etc. Services with erotic content are widespread. Because of this all problems analysed above have been arisen. Therefore service providers give possibility for certain or selective prohibition in calling of audiotext services in accordance of the subscriber. There is growing self-regulation of audiotext suppliers in many countries both on national and on international level.

In general the telecommunications service provider collects the charge of service and shares it with the audiotext service provider according to their contract, but it is possible to use a pre-paid card or a subscription.

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5.5. Network Services

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Network services are provided to operators by carriers throughout network agreements. Occasionally network services are provided to subscribers using network parts. Considering economic aspects, the most important types of network services are leased line, interconnection, network access, and virtual private network. There are supplementary network services such as support for billing and Centrex service.

To provide network services signal transmission and processing are implemented between different products. There is a choice of standard interfaces to define the most important network services. Relevant inter-network interfaces provide for physical and logical levels of interconnection to maintain interoperability at network border. Communication services between terminal equipment used over interconnected networks are provided by interconnection traffic services. Network services for subscribers apply network-user interfaces that determine the characteristics of the communication services provided in the network to use by terminal equipment.

5.5.1. Leased Line Services

Leased line is composed of dedicated transmission circuits to use by a customer that provides for transparent transmission capacity between fixed network terminating points. It does not contain switching functions controlled by the user.

Leased line service consists in the provision of transmission capacity in the backbone network, or between customer site and backbone network of the carrier. Leased line services are often used by other operators for their network build out. In another usual application, a carrier connects the customer throughout a leased line rented from the other carrier, and provides subscriber services this way. In some cases mobile network operators use leased line as well to connect their base station

to the network. Business customer uses leased line services of different bandwidth to deploy its private network primarily for computer network or private branch exchange network applications. Access to the internet is provided to business customers by leased lines and can get internet connectivity of demanded speed.

Open standards for leased line services determine both internetwork interface and connection characteristics. These standards set the interface presentation, connection characteristics, and equipment interoperability requirements between network termination points. There are requirements for terminal equipment to be connected the leased line and related attachment conditions are standardised. Following tables show open standards for the most important analogue and digital leased line service offerings accepted in the European international practices and applied in Hungary as well.

	Technical Features	
Type of Leased Line	Interface Presentation	Connection Characteristics
64 kbit/s	ETS 300 288, ETS 300 288/A1	ETS 300 289
2 048 kbit/s – E1 unstructured	ETS 300 418	ETS 300 247, ETS 300 247/A1
2 048 kbit/s – E1 structured	ETS 300 418	ETS 300 419
34 368 kbit/s – E3	ETS 300 686	ETS 300 687
139 264 kbit/s – E4	ETS 300 686	ETS 300 688
N x 155 520 kbit/s – STM-N	ETS 300 299	Not available

Table 5.5.1 Digital Leased Lines

	Technical Features	
Type of Leased Line	Interface presentation	Connection Characteristics
Ordinary quality 2 wire	ETS 300 448	ETS 300 448
Ordinary quality 4 wire	ETS 300 451	ETS 300 451
Special quality 2 wire	ETS 300 449	ETS 300 449
Special quality 4 wire	ETS 300 452	ETS 300 452

Table 5.5.2 Analogue Voice Band Leased Lines

- Ordinary quality 2 wire leased line is previously provided in accordance with CCITT M.1040 Recommendation. The associated standard for terminal equipment is ETS 300 450. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 15 (CTR 15).
- Ordinary quality 4 wire leased line is previously provided in accordance with CCITT M.1040 Recommendation. The associated standard for terminal equipment is ETS 300 453. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 17 (CTR 17).

- Special quality 2 wire leased line is previously provided in accordance with CCITT M.1020 and M.1025 Recommendations. The associated standard for terminal equipment is ETS 300 450. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 15 (CTR 15).
- Special quality 4 wire leased line is previously provided in accordance with CCITT M.1020 and M.1025 Recommendations. The associated standard for terminal equipment is ETS 300 453. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 17 (CTR 17).
- For 64 kbit/s leased line the associated standard for terminal equipment is ETS 300 290 as amended by ETS 300 290/A1. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 14 (CTR 14).
- For 2 048 kbit/s unstructured leased line the market denomination is E1. ETSI has developed the ETS 300 418 that replaces the ETS 300 246. The associated standard for terminal equipment is ETS 300 248 as amended by ETS 300 248/A1. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 12 (CTR 12).
- For 2 048 kbit/s structured leased line the market denomination is E1. Previously provided in accordance with CCITT G.703, G.704 (excluding section 5) and G.706 (cyclic redundancy checking) instead of ETS 300 418 and previously provided in accordance with relevant CCITT G.800 series instead ETS 300 419. The associated standard for terminal equipment is ETS 300 420. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 13 (CTR 13).
- For 34 368 kbit/s leased line the market denomination is E3. The associated standard for terminal equipment is ETS 300 689. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 24 (CTR 24).
- For 139 264 kbit/s leased line the market denomination is E4. The associated standard for terminal equipment is ETS 300 690. The attachment requirements for terminal equipment to be connected to these leased lines are described in ETSI Common Technical Regulation 25 (CTR 25).
- For N x 155 520 kbit/s leased line the market denomination is STM-N in case of SDH VC based leased line bandwidth. The associated standard for terminal equipment is ETS 300 299. ETSI is currently revising ETS 300 299 and working on standards for this type of facility, they are preliminary specifications of prEN301 164 and prEN 3001 165.

In particular cases more than over one network and single operator provides the leased line service considering geographic extent of demanded service. Such case is the border crossing private network or a multisite company demanding leased line services from network operators over separated geographical areas. One stop

service provisioning is contracted by the customer and selected operator for the whole service demanded. For such service transactions leased line networks of the operators are physically interconnected. Service provision, fault clearance, customer care and billing are arranged by agreements among appropriate network operators.

5.5.2. Interconnection Services

Network interconnection is implemented by network operators' agreements to arrange provision and use of the network services over their networks. Implementing network interconnection, telecommunications network of the same or different network operators are physically and logically connected under defined conditions to allow the users of one network operator to communicate with users of the same or another network operator, or to access services provided by another organisation.

The largest network of extent is the internet and it works as global network of networks formed by a lot of interconnected networks. Interconnection of voice telephony and mobile radiotelephone networks is the most important for the public and from economic point of view. Networks of discrete telephony network operators, networks of mobile network operators, and furthermore voice telephony and mobile radiotelephone networks are interconnected. The reason is to allow making calls from any telephone network to any mobile network subscriber and vice versa, so subscribers of telephone network can be called from the mobile network. Network operators provide interconnection traffic services to each other in order to allow completing calls and using subscriber services between terminating points.

Network operators bill the calling party for originated traffic, and furthermore, they settle each other for measured interconnection traffic services. Characteristics of interconnected networks and telecommunication services offered to customers of different networks are of economic importance and determined by network architecture, traffic volume and distribution. Design of telecommunication services offered to customers over interconnected networks is based on cost calculation. The major part of operator costs comes from interconnection charges. In case of given traffic volume and distribution the structure and level of interconnection charge elements determine the economy of network architecture.

Interconnected network architecture can be economic in a case where the largest network of a geographical area is interconnected with all other smaller networks and customers of different networks communicate throughout the interconnection point of this largest network. In a different network environment and network deployment a different arrangement can be advantageous for network operators, this is the direct interconnection between networks and based on expected traffic distribution. Customers of different networks directly communicate each other throughout an interconnection point of the relevant two networks. Aim of regulation network interconnection and specially regulating the interconnection charges is to give measures for conditions of complete geographic and service coverage considering economic requirements as well.

Regulated interconnection traffic services are call origination or indirect access, call termination, transit, and number translation service. Overall technical description of these service provisions is as follows.

Call origination or indirect access service is used by carrier "A" when a subscriber of network "A" uses a selected subscriber service of this carrier and billed accordingly although call is originated in network "B". In the practice network "A" is an alternative network and network "B" a former monopoly operator's network. The subscriber of network "B" uses a short usually four digit carrier selection code to make call on network "A". Such call originates on network "B" and handed over to network "A" at the nearest interconnection point to the selected network.

Call termination is used by interconnected carrier when it hands over an originated call to the other carrier to reach the called party or service at network termination point on the other network and allow for communication.

Transit is used by an interconnected carrier to hand over a call from its interconnection point to reach another interconnection point. In this traffic case there is a need for a third network operator as well to terminate the call in its network. Specialised network operators provide transit services over long distance intercontinental paths.

Number translation service directs a call originated to a non-geographic number to a specific network terminating point where it is translated to geographic or mobile subscriber number for call completion purposes. To complete a call needs to

direct the call to a terminal equipment of specific geographic location or a mobile equipment of specific subscriber identification module.

Peering is non-regulated, initial interconnection form with simplified settlement where traffic exchange between networks is based on barter arrangement. This form is primarily used in equal traffic distribution and where the traffic termination cost is less than costs of traffic measurement and billing. Number of customers, or network computers and applications can be further considered for setting conditions of peering agreements. Today this form is used for internet services.

Open standards for inter-network interfaces applied for interconnection shown by following table.

Table Interconnection interfaces for PSTN telephony, ISDN, and GSM networks

Technical Characteristics	
Interface	SS7 Signalling System
ETS 300 356-1 to ETS 300 356-12	ISUP version 2
ETS 300 356-14 to ETS 300 356-19	
ETS 300 356-19/C1	
ETS 300 356-31 to ETS 300 356-36	
ETS 300 009-1, ETS 300 009-2	SSCP
ETS 300 008-1, ETS 300 008-2	MTP
ETS 300 646-1 to ETS 300 646-4	Application if ISUP version 2 for the ISDN-GSM signalling interface

ISUP is the user part of Signalling System No. 7 (SS7). SS7 provides common channel signalling for use in circuit switched networks: PSTN, ISDN and GSM. It has been designed first at an international boundary, but also appropriate for the interconnections of different operators' network in the same country. ISUP uses the layers 1 to 3 protocols (MTP) and may also use SCCP. International organisations adopt new versions of these standards for general applications to meet developing demands of network operators.

5.5.3. VPN Virtual Private Network Services

VPN virtual private network service is a network service for business customers, primarily for voice transmission and computer network applications. Nowadays it is used for combined voice and data applications as well.

Private voice network service is a VPN made of private telephone branch exchange network and specialised to specific traffic distribution of the customer therefore its usage is cost-effective. Cost savings come from network provision over software based networking equipment instead of using dedicated cable pairs or radio channels. The customer has a subscription agreement with the network operator for implementation and operation of the virtual private network, and for the outgoing voice calls. Calls within the VPN network are free to the customer.

For data communications specifically computer network applications VPN virtual private network is deployed over the infrastructure and make it secure for customer's business critical applications as required. Using this service the customer is allowed to connect new service nodes to or disconnect existing service nodes from its VPN virtual private network on demand. Furthermore, customer can set temporary or permanent connection points. These networking functions can be extended also to third party, for example, its vendor and customers as well. Growth of internet and global development of telecom operators' managed IP networks have leveraged new VPN network type so called IP VPN. IP-VPN network operates as coded IP tunnel over managed IP-based private networks and of course throughout the internet.

Data security is provided fro customer by four functional elements of the VPN virtual private network:

- Authentication is ensuring that the data originates at the source that it claims, usually using user name and password
- Access control is restricting unauthorised users from gaining admission to the virtual private network
- Confidentiality is preventing anyone from reading or copying data as it travel across the internet or IP-VPN
- Data integrity is ensuring that no one alter data as it travels across the internet or IP-VPN

Customers prefer buying IP-VPN private network for business communication solution when the cost savings reach during two-three years typically thirty-eighty per cent. Buying decision is mostly based on service level agreement, such as network availability ratio, IP packet latency, and packet loss ratio.

5.5.4. Network Access Services

Network access includes the notion of interconnection although they are distinct service types in network operators' business practice and in telecommunication regulation. Network access provision is physically and logically connecting a telecommunication network to another one to allow the service provider to use services for providing services to its customers. Network access service in general means the making available of network elements and associated facilities, under defined conditions, on either an exclusive or non-exclusive basis. This may involve the connection of equipment, access to physical infrastructure including buildings, ducts and masts. The service may mean access to relevant software systems including operational support systems, access to number translation or systems offering equivalent functionality. Network access service may include access to fixed and mobile networks, in particular for roaming, access to conditional access systems for digital television services, and access to virtual network services.

Special network access provided over voice telephony network means the making available the connection of equipment to specific network termination points for the purpose of providing telecommunications services. These access points are different from subscriber network termination points. Such network access point, for example, maybe at a tandem switch in the voice telephony network under defined conditions of the access agreement. In this case IP-based services are made available for telephone subscribers on market demand and based on a specific service agreement.

Using transport facilities of the voice telephony network a network access service may be provided to use the transport and control capabilities of an IP-based network . For example, this is the case of remote access to the internet or an IP-WAN by using dial up access. Holding time of calls to the internet is longer then voice calls so the high growth internet traffic can overload tandem exchanges and cause damage of quality or even often call drops. Consequently, it may be necessary to change the existing architecture of voice telephony network, furthermore to divert a part of internet traffic from tandem network.

Another network access service provides for interoperability of voice telephony and managed IP-based private network (or the internet network) at transport and

control layer. Such converged network service is IP voice between telephone equipment, so called voice over IP (VoIP).

Open standards for network access interfaces are not available yet. Preliminary technical specifications are available for service provider access to network functions in third generation mobile networks, VPN virtual private networks, broadband bearer services, specific multimedia and internet services.

5.5.5. Network Service for Billing Support

Because of telecommunication service liberalisation there are many services available over networks demanding billing and customer care functionalities as well. Network operators of interconnected networks need co-operation in tariffing and charging calling party. Further processes of billing, like printing and issuing the account, furthermore collection and billing claims are the operator's job.

Network service for billing support may include information provision of call records from mediation system of the network operator. Another network service is charging and tariffing either for interconnection settlement between network operators or for subscriber charging using list prices. Subscriber price plan, discounts and promotion are taken into consideration by the carrier who has concluded subscriber contract.

5.5.6. Centrex Service

This service is named after private in-house telephone system services provided by telephone carrier by means of facilities of local telephony exchange. Traditional Centrex service is used by specific, consequently costly terminal equipment and all users need it similarly to programmed telephone equipment of private in-house telephone system. Another consequence of the service structure and operation is all calls set up and directed over main lines of the voice telephony operator and two main lines is used for in-house calls. These conditions prove economic only in case of specific traffic pattern. Particular customers, like university campuses, make practically long distance and international calls from in-house telephone system, and not in-house calls, so Centrex can be cost effective for them.

New development opportunity for implementing Centrex is IP-Centrex. Similarly to other IP-based telecommunications, due to service quality and security requirements, it can be provided not only over the internet but also over managed IP-based network of the operator. On the contrary to the port-based analogue and digital voice telephony services, software-based facilities are dominant in the unit cost of Centrex service provisioning, and hardware costs attached to the number of user are much less.

Service is implemented by network operator to meet service quality characteristics required by subscriber. Traditional voice quality and dialog characteristics can be set by gateway facilities and IP bandwidth. Both calls to the voice telephony network and between IP networks call forward, call waiting, voice mail, call center and other value added features are available for users. As system design, IP-Centrex can be considered as a specific IP-VPN specialised to voice service provisioning only. IP-based global networks provide IP Centrex services for employees, clients and suppliers of the organisation using this service as they would use it at the headquarters. This is a kind of telecommunications mobility and can be limited by user organisation by setting service security elements accordingly.

Abbreviations:

ITU-T

SDH

References

Further readings are offered for readers who interested in details:

[5.5.1] Darryl P. Black: Building Switched Networks; Addison-Wesley, 1999

[5.5.2] Igor Faynberg - Lawrence Gabuzda - Hui-Lan Lu: Converged Networks and Services; Wiley Computer Publishing, 2000

5.6. Terminal equipment, services implemented in terminal equipment

Lajos Pomázi, author

Erika Madarász, reviewer

The subscriber telephone sets of wired telephone networks can be considered as mature and settled among terminal equipment. Continuous changing, modification and renewal characterise the terminal equipment of mobile telephone networks that are integrant part of the system and can be hardly handled independently from the other parts of the system. Therefore this chapter contains the relevant elements that are essential on the fields of services offered by terminal equipment and subscriber sets and shows their application examples via traditional telephone sets.

5.6.1. Subscriber interface

Different kinds of terminal equipment are connected to the exchange via subscriber interface. The main circuitry functions of subscriber interfaces can be summarised by “BORSCHT”, where the meaning of these letters is the following:

B: Battery supply, Battery Feed; Supply of the subscriber loop

O: Overvoltage protection;

R: Ringing; Ringing signal applied to subscriber line

S: Supervision, Signalling; Checking/Monitoring of the status of subscriber loop

C: Coding; A/D, D/A conversation (coding, decoding)

H: Hybrid, 2-wire to 4-wire/4-wire to 2-wire conversation

T: Testing; Testing of the subscriber interface

Feeding of the subscriber loop: Feeding bridge supplies terminal equipment with direct current via subscriber line. The feeding impedance is sufficiently high to

ensure only a small loss, and thus feeding bridge has little or no effect on transmission.

Because of traditional reasons the DC parameters of conventional resistance feeding bridges can differ for each country [5.6.1], moreover for the different types of telephone exchanges established in the same country. The most frequent DC parameters of telephone exchanges in Hungary are 48V, 2x250 ohms, 48V, 2x300 ohms and 56 V, 2x220ohms. Depending on the parameters of the terminal equipment the maximal line current can reach 75 mA – 100 mA at very short subscriber line length, therefore some Watts of power can also dissipate on the feeding bridge.

In order to reduce the energy requirements, optimised constant current feeding bridges have been introduced. The maximal feeding current is limited to a lower value (i.e. 22 mA, 30 mA) that can be maintained in a given range of the subscriber loop resistance. When the loop resistance is out of this range, it works as a conventional resistance feeding bridge.

Due to the line current attenuation, depending on the type of the feeding bridges the maximal loop resistance of the subscriber line is in the range of 1600 ohms and 2200 ohms.

Overvoltage protection: Its task is to protect the sensitive electronic circuits against the damaging effect of overvoltages coming from the subscriber line (i.e. induction of alternative voltage derived from power-supply system, surges due to lightning, electrostatic discharges). The protection has to come into action within some nanosecond when the voltage reaches the specified level. Protection against overvoltages shall fulfil the relevant ETSI standard [5.6.2] and ITU-T Recommendation [5.6.3].

*Ringin*g: During incoming calls the ringing circuit gives ringing signal to the subscriber line. The ringing signal can be characterised with its voltage (typical value: 75 V – 90 V), frequency (typical value: 25 Hz) and cadence (on: 1250 ms, off: 3750 ms). After the incoming call has been answered, the ringing has to be tripped within some ten milliseconds.

Coding - decoding: The coding and the decoding circuits are placed in the 4-wire path. The encoding circuit established in sending direction takes sample in every

125 μ s from the analogue signal gone through a low-pass filter and digitises this sample into 8-bit PCM code using a special encoding technique in accordance with A-law [5.6.4]. The decoding circuit established in receiving direction converts the 8-bit PCM encoded digital words into analogue signal, that arrives at the hybrid circuit via a low-pass filter.

2-wire to 4-wire conversation: Primary use of hybrid circuit to convert between 2-wire and 4 wire operation in concatenated section of a telecommunication circuit. The appropriate impedance matching between the balance network and the terminated impedance of 2-wire port reduces the signal level returned via hybrid, the echo. The requirements for 2-wire analogue interface are given in ITU-T Recommendation Q.552 [5.6.5]

Testing of the subscriber line: From the point of view of operation and maintenance it is desirable that the different circuits of subscriber interface and the subscriber line can be tested independently of each other.

Requirements for the interworking and equipment connected to an analogue subscriber interface can be found in [5.6.1].

5.6.2. Handset requirements

Handset is a standard telephone component, that includes a telephone microphone and a telephone receiver. User holds it in hand close to the head during telephone conversation.

The profile and the dimension of the handset must be such that

- the earpiece shall fit comfortably to the user's ear and the mouthpiece must be close in front of the user's lip;
- the handgrip shall be convenient to hold it and shall allow sufficient room for fingers to wrap and clearance for cheek.

The shape and the dimension of the handset influence the sending and receiving levels of the telephone sets. Based on the information gained by mass measuring the ITU-T recommended the size and the shape of handsets according to Figure 5.6.1. [5.6.6] [5.6.7]. The investigations show that, for convenience in use, the mouthpiece should be 10-12 mm far from the circle X enclosing the centre of the lip of 80 % of the subjects tested (over 4000). Mouthpiece should touch the circle Y in

such a way that the tangent line should be greater than 30° to the speech direction. A handset conforming to Figure 5.6.1 is acceptable to more than 90% of users.

The majority of manufacturers takes this recommendation into consideration to design handsets harmonising with telephones. However in some special cases their function and/or appearance are the major consideration such as mobile phone or telephones shaped as banana, shoe, hamburger, etc.

The casework should be robust and rigid and not susceptible to flexing and creaking when handled. Split lines (the join between the sections of the casework) within the handset moulding do not cause sharp edges or skin pinching.

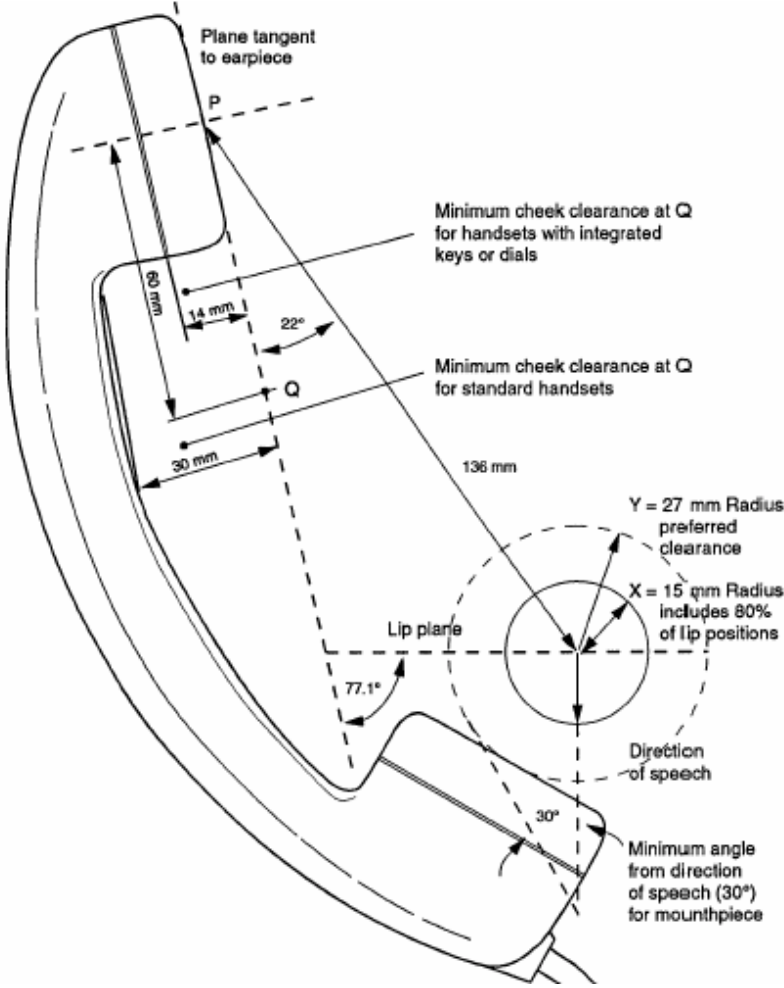


Figure 5.6.1. Preferred handset profile dimensions according to ITU-T Recommendation P.35

5.6.3. Hands-free telephone

Hands-free telephone is a telephone set using a loudspeaker associated with an amplifier as a telephone receiver and a built-in microphone in the telephone house associated with an amplifier as a telephone microphone and which makes it possible to make a telephone call without having to hold the handset during the call. When the handset is picked up during hands-free mode, the telephone has to switch off the hands-free operation mode automatically and has to switch over to handset mode.

According to the subjective expectation

- hands-free telephones shall have adequate sending and receiving sensitivity;
- singing through acoustic feedback between microphone and loudspeaker has to be avoided;
- the degradation of the speech quality due to the voice switching shall be negligible.

Similarly to handset telephones the sending and the receiving sensitivity of hands-free telephones can be expressed in terms of Loudness Rating. Because distributing LR values between the telephone sets and the network is within the competence of the national transmission plan existing in most countries, ITU-T does not issue an international recommendation stating LR values of telephone set alone – whether these are handset or hands-free telephone. However it is possible to recommend the sending and receiving sensitivity for hands-free telephone relative to the standard handset telephone set used nationally, having regard to the physical difference between handset and hands-free telephones and the effects of different user behaviour [5.6.8] [5.6.9].

The sending loudness rating (SLR) of a hands-free telephone should be about 5 dB higher than the SLR of a handset telephone.[5.6.8] The difference of 5 dB has several components:

- the average speaking level is about 3 dB higher for hands-free telephone than for handset telephone;
- the output level from a handset telephone in conversational use, which is about 1-2 dB lower than what is obtained in the speaking position specified for loudness rating measurements;
- the different frequency responses of the microphones cause significantly smaller differences than the components mentioned above.

It should not be possible for the user to adjust the sending sensitivity [5.6.8].

For the objective evaluation of the sending loudness of hands-free telephone

- measure the sending frequency sensitivity curve of the hands-free telephone placed in the physical test arrangement described in §6 of ITU-T Recommendation P.34, then
- calculate the sending loudness rating according to the method described in ITU-T Recommendation P.79 [5.6.10].

According to the ITU-T Recommendation P.34 the receiving sensitivity of a hands-free telephone without automatic gain control should be adjustable within a range of 15 to 30 dB. This range should include the value of the receiving loudness rating (RLR) which

- is equal to the nominal RLR of the corresponding handset telephone, and
- is 10 dB better than the nominal RLR of the corresponding handset telephone.

10 dB lower receiving LR than the nominal RLR of the standard handset telephone is necessary to compensate the impact of up to medium high background noise level. The preferred listening level depends on the background noise level. According to the subjective opinions test in case of background noise higher listening level is required for hands-free telephones than for handset telephones in order to get the preferred listening level. [5.6.8] [5.6.9]

The maximal receiving amplification has to be limited in order to avoid the overhearing of other telephone conversations due to crosstalk.

For the objective evaluation of the listening loudness of hands-free telephone

- measure the receiving frequency sensitivity curve of the hands-free telephone placed in the physical test arrangement described in §6 of ITU-T Recommendation P.34,
- calculate the receiving loudness rating according to the method described in ITU-T Recommendation P.79 [5.6.10], and
- subtract 14 dB from the computed loudness rating. This correction factor contains the appropriate correction for the difference between one-ear and two-ears listening (12 dB) and the difference of about 2 dB caused by loudspeaker listening versus binaural earphone listening, due to the diffraction effect of the listener head [5.6.9].

Most hands-free telephones contain voice-switched circuit, whose main purpose is to avoid the singing through the acoustic feedback that can be arisen between microphone and loudspeaker. Such circuits insert a loss in either the sending or receiving direction. Switching from one direction to the other one occurs

- when signal above a given threshold is applied from the opposite direction, or
- when the control circuit, taken into account the relative levels and the nature of the signals in both direction, allows the switching.

By a suitable choice of the thresholds and the switching times, the degradation of speech quality (i.e. clipping effects and loss of initial or final consonants in the transmitted speech) that is introduced by voice switching can be made negligible. [5.6.9]

A possible circuit description can be found in [5.6.11] gives the details

- how the gain of the sending and receiving amplifiers is controlled depending on the signal and the noise levels in both directions, in order to avoid the singing;
- how the switching times are set in order not to worsen the subjective opinion of speech quality by voice switching.

5.6.4. Keypad/pushbutton requirement

Telephone keypads and keyboards are the basic means for providing access to telecommunication services in the most telecommunications equipment. Keypads consist of keys arranged according to certain principle. Keys are labelled with digits and/or letters and maybe symbols indicating their function.

According to ITU-T Recommendation E.161 [5.6.12] the recommended minimal keypad of terminal equipment includes 12 keys, the numeric keys 0 - 9, star (*) and square (#). ITU-T gives some possible versions for the keypad arrangement, but the layout can be seen in Figure 5.6.2. is considered as the preferred solution. ETSI takes a strong stand for the standard 4x3 keypad array. [5.6.7]

Un sighted navigation on the keypad is helped when one of the buttons can be discernible from the others by touching. The preferred form of the tactile identifier in the middle of the key “5” is a distinct raised round dot. The recommended dimension of the raised round dot is 0.6 mm (± 0.2 mm) high and with a diameter of 1.5 mm (± 0.2 mm) [5.6.13].

In general it is advantageous when the keys can not be pressed below the surface of the keypad. Key should have a minimum surface of 113 mm² with a minimum the dimension on any direction of 12 mm. The key travel should be in the

range of 1 mm and 8 mm. The pressure necessary to activate the keys should be 0.25 N - 1,5 N.

It is advantageous for users if suitable key feedback is given in not only tactile but also acoustic form, i.e. when the key is activated, a noticeable click can be felt and heard from it. The preferred pith (distance from key centre to key centre) on the keypad is 19 mm ± 1 mm. If this parameter is less than 15 mm then it can lead to significant increases in miskeying [5.6.7].

It can be helpful in memorising telephone numbers or supplementary service codes if also letters are assigned to the numeric keys on the keypad. ETSI defined the assignment of alphabetic letters to digits in a standard telephone keypad array are shown in Figure 5.6.2. [5.6.14] The legibility of the numeric digits should not be impaired by alphabetic letters. If the keypad is used for entering of letters as well (i.e. processing of names in case of electronic telephone book) then visual feedback is strongly advisable. The user should never be expected to key data “blind”.

Depending on the services of terminals the standard 4x3 keypad can be supplemented by additional function keys. It is advisable to separate the additional function keys from the keys of standard keypad. Function keys should be labelled with the full function name in the national or preferred language and/or with well-known symbols. ITU-T gives the symbols for the most frequently used services and functions in [5.6.15]

In order to reduce the numbers of function keys in complex devices, softkeys can be applied. They are physical or software displayed keys whose functions are

1	2	3
4	5	6
7	8	9
*	0	#

1	ABC 2	DEF 3
GHI 4	JKL 5	MNO 6
PQRS 7	TUV 8	WXYZ 9
*	0	#

Figure 5.6.2. Numeric layout and layout for alpha characters on telephone keypad

determined by the application software currently running on the terminal. Soft keys labels shall be as physically close to the key as possible. These labels should be explanatory, as far as possible avoiding abbreviations.

5.6.5. Display requirements

The visual display is an essential element in the design of user interface and the most flexible medium ranging from simple light signals used to give status and warning information, through alphanumerical character displays to extensive text and live pictures shown on large CRT (Cathode-Ray Tube) and LCD (Liquid Crystal Display) graphic displays [5.6.7]. Visual displays are used to provide feedback to control input and data entry, to give prompts and system messages and to show text, graphics and pictures.

During the design of terminal equipment the choosing of displays should be influenced by amount and nature of information, size and legibility of displayed characters and viewing distance. Taking account of the degree of importance of displayed data as well, the recommended minimum character height in function of the viewing distance is given in [5.6.16].

Character displays have typically from 1 to 8 lines by max. 24 characters per line. LCD displays are mostly selected, that are used in a wide variety of products for displaying of numbers, alphanumeric characters and symbols indicating set-up and/or status information (i.e. dialling mode, battery charge, field strength, message arrived) of terminals. The simplest 7 or 9 segment displays are acceptable for display of numeric information. Dot –matrix is necessary where alphanumeric information is required. As a minimum, a matrix of 7x5 shall be used for capital letters. Dot matrix of 9x7 with the addition of four rows to accommodate line spacing, lower case ascenders and descenders and accents is more advantageous (i.e. “g”).

Graphical displays provide a dot-matrix or similar technology to display static or dynamic images, including text, graphics, symbols and pictures.

In favour of legibility the character/background contrast ratio should be 3:1 minimum, 10:1 recommended [5.6.16]. Light weight, extra bold or condensed typefaces should be avoided. Adjustability of the contrast depending on the

environmental temperature and light is advantageous feature. Backlighting function for LCD used in low ambient light should be provided.

Icons (possibly standardised) should be used whenever possible for identifying common functions or objects on the display. Good icons are easier to understand and remember by most users, and can be recognised also by people with reading difficulties.

5.6.6. Requirement for automated dialogue services

A user interface or a Man-Machine interface is the bi-directional interface through which a user communicates with a telecommunication terminal or via a telecommunication terminal to a telecommunication service provider. ETS 300 738 describes the requirements of the minimum user interface for use to gain access to and control of supplementary services within public telecommunication networks [5.6.17].

A variety of supplementary services (i.e. voice mail, telebanking, information retrieval, shopping) are available that are accessible via public telecommunication network, that users can control with DTMF signalling from the standard telephone keypad and where the system informs the user about the system status and the result of control functions with stored voice announcements. The ETSI Technical Report of ETR 329 contains the guidelines for procedures and announcements in the Stored Voice Services [5.6.18]

Depending on the format in which a service requires the data input from the user, the dialogue between the user and the system can be

- command dialogue
- interactive dialogue

In a command dialogue the user control a service by entering a complete sequence of digits and symbols that includes all the necessary information without any prompt or interaction with the service. The user shall know the syntactic of command, as he/she is informed about the result only after the entering of the last character whether the command is accepted or refused by the system.

In an interactive dialogue no prior knowledge of the service or its command syntax is required for the user to use the service, as the interactive dialogue guides

him/her through all the steps. Each time the user reaches a new service state or stays idle, the service prompts for the next user actions.

The choice between two dialogue types depends on the complexity of the service and the tasks the user expecting to carry out. If the service only offers a single option and requires only some input information from the user, a command dialogue is appropriate. When a variety of options is available (i.e. banking service), the system requires a lot of input information from the user (i.e. card number, PIN code) or users' guide among menus is recommended, an interactive dialogue is preferred.

From the point of view of users the stored voice services should fulfil the following requirements:

- the user should feel that it has been satisfying and have confidence in the outcome;
- private data cannot be accessed by unauthorised person;
- services should be easy to learn and handle, the users should not be expected to learn lengthy, unstructured command strings;
- user shall get enough information about the actual state of service, its control feasibility and the result of the previous control action (i.e. instructions, prompts, feedback, error cue, etc.);
- error handling and correction shall be possible without detriment to the service and without feeling it necessary to hang up and start again;
- the most frequently used option should be accessible in the higher levels reducing the time spent in the system.

General design principles of stored voice services are the following:

1. Design of the structure of a dialogue

- collect default information from all available sources. Methods, that minimise the number of manual input operations to be performed, are preferred. (i.e. Calling line identification);
- user identification and/or authorisation;
- facility for language selection;
- choice of the structure of menus depending on the complexity of service;
- building-up of menus.

2. Design of user control over a dialogue

- use of the principle of "Indicate - Control – Indicate". User shall be informed about the actual state of service before control action, he/she shall knows the

control commands available in that state and he/she has to get feedback indication after his/her control action about the changed state of the system;

- “cut-through” announcement. The system should provide an opportunity for users to enter the command as well while an announcement is being played. When a valid command is entered during an interruptible announcement, the announcement should be interrupted and the system should go to the same state as if the command had been entered at the end of the announcement. The “cut-through” technique can not be used for the announcements, which inform the user of unexpected occurrences. (i.e. access to the mailbox N is not possible, since mailbox N does not exist);
- “dial-ahead” function. Dial-ahead allows the experienced user to enter ahead of time several commands in a sequence and the system should bring the user directly to the corresponding state;
- choice of system response time. The delay from the receipt of a user input to the audible start of the corresponding system response should be in the range of 500 ms and 1 s;
- handling of illegal control code. (i.e. the system responds as if no key had been pressed at all or error announcement);
- error management;
- choice of time-outs (from 2 s to 8 s) and the handling method of time-outs (i.e. repeat of the announcement of the actual service state);
- asking for confirmation when an action is going to change the system in an irreversible way (i.e. stored data will be erased, execution of transaction);
- design of data entry;
- design of general function (help, repeat, pause, go back to the main menu, etc.).

3. Design and wording of announcements used in stored voice services

- the words used for all announcements should be quickly and easily understood by all possible users of the service;
- (technical) jargon, words with double/unclear meaning and homonyms (words which sound similar) should be avoided;
- when giving instructions to the user, the imperative form of the verb should be used;
- important information should be given early in an announcement. In a menu item, the anticipated result should be indicated before the command. When presenting a list of related items, “or” should be used before the last item in a list;
- sequences of actions presented in announcements to the user should follow the order in which the user is expected to carry them out;
- feedback announcements should be short and explicit;
- numbers should be announced according to its natural spoken form;

- tones used in stored voice services should fulfil the relevant ITU-T Recommendations [5.6.19] [5.6.20].

4. The characteristics of the speaker recording the voice announcements should:

- speak clearly and rhythmical, articulate well,;
- be assertive and agreeable, be practised at microphone speech;
- be female voice preferably.

5. At recording of announcements the following aspects should be observed:

- ensure sufficient technical background (adequate bandwidth, minimal frequency distortion and background noise);
- ensure the speech speed (words per minute) is acceptable for high levels of comprehension;
- ensure the speed, volume and intonation of separate blocks are such that they sound “natural” when put together;
- avoid combining artificial and recorded speech in the same sentence, if it can not be avoided insert a short pause (1 to 2 s) between the two forms of speech;
- when combining recorded messages and recorded announcements (i.e. voice mail), ensure there is a short pause (1 to 2 s) between the two forms to emphasise the different sources of the material;
- preferred listening level for announcements should be $-10 \text{ dBPa} \pm 5\text{dB}$ [5.6.20].

5.6.7. Device intelligence

Users can choose from a wide variety of equipment taking account of design, services and price. Sorting by their functions, the following services can be highlighted:

Services related to dialling:

- Flash;
- pause inserting between digits;
- last number redial;
- automatic redial of the last calling number by pushing of a dedicated button (auto redial);
- redial of a number selected from the last “n” telephone numbers dialled;
- call from memory;
- voice controlled dialling.

Storing of calling numbers

- storing of calling numbers to short codes;
- storing of calling numbers to direct memories;
- storing of calling numbers with names (telephone book function);
- noting of telephone number during conversation.

Functions related to call restriction

- restriction of calling number(s) or calling direction(s) with key or PIN code;
- calling a pre-programmed calling number by pushing of any button;
- locking of keypad.

Services related to speech

- microphone muting;
- volume control of receiving loudness;
- loud-speaking of receiving direction;
- hands-free telephone;
- holding of the telephone conversation;
- inform the other party about holding of the line with music.

Services related to call indicator

- setting of the loudness, the tonality and the cadence of incoming call indicator;
- visual display of incoming call.

Services related to display (calling line identification is mentioned in other section)

- visual display of the active status of telephone;
- display of called number;
- display of the call duration;
- display of the tariff charge for actual call;
- display of total tariff charge for calls have been made;
- display of date and time;
- language selection option;
- display of the status of telephone set (i.e. accumulator charging level, field intensity, dialling mode);
- backlighting of display.

Data protection with PIN code

Services related to answering machines

- recording or “announcement only” mode;
- recording and checking the outgoing message, measuring of recording time;
- setting the number of rings before activation of the answering machine;
- setting the recorded message length with or without time limit;
- monitoring of incoming messages;
- stamping of incoming messages with day and time during recording and its indication with artificial speech at listening of incoming messages;
- displaying the number of new messages and the recording time remaining;
- listening to the messages, stop and restart of the play-back, repeated play-back, skip to previous message, skip to the following message, storing/deleting message(s), deleting all the messages;
- remote retrieval with PIN code;
- recording the current telephone conversation.

Some special services of DECT cordless phones

- registration of max. 6 handsets to base unit;
- possibility of external and internal (intercom) conversation in the system in the same time;
- transferring a call from one handset to another;
- conference call;
- calling party identification based on stored voice announcement;
- baby-sitter function (unrepresentative service). When the background noise level overpasses the threshold adjusted, the handset calls automatically the destination handset within in the system. the destination handset answers this call automatically.

Some typical services based on calling line identification presentation (CLIP)

[5.6.21][5.6.22]

- calling party identification based on the caller’s telephone number;
- calling party identification based on the caller’s name attached to the phone number. Precondition of this service is that the telephone number together with the name have to already be stored in the telephone-book of the device;
- getting information about the cause of missing telephone numbers (caller prevents the displaying of his name and number or caller calls from an area where this service is not offered);
- calling list with the entries of the last “n” unanswered call. A calling list entry contains the call number, maybe also the number of calls from the relevant call number, date and time;

- calling list with the entries of the last “y” answered call. A calling list entry contains the call number, maybe also the number of calls from the relevant call number, date and time;
- differentiation of callers or categories by different specific ringing tones (i.e. VIP call);
- connecting caller-ID device to computer. Caller-ID device sends the received data to the computer via serial port. Based on this information the computer can display also the caller’s detailed data.

5.6.8. Special needs of elderly and disabled people in relation to telecommunications

Telecommunication services have to be made accessible to as many people as possible including people with innate or acquired deficiency. Deficiency can be caused by physical, mental or sensory impairment, physical conditions or distemper [5.6.23]. New products and services should meet also the special needs of elderly or disabled people not to exclude them from taking part in society on equal terms with the rest of the society.

ETSI [5.6.24][5.6.25][5.6.26] propose to

- identify some of the main factors that can be inhibit the access to and use of telecommunication services for people with special needs;
- work out recommendations that take into consideration these special needs in order to make basic telecommunication services accessible to as many people as possible.

This chapter can offer only a brief survey of this very extensive field.

Visually impaired people can be divided into three category:

- people who are blind or seriously visually impaired;
- people who are partially sighted and who cannot read;
- people with reduced vision but who read with aid.

With regard to telecommunication, visually impaired people especially belonging to the first two group may have great difficulties in locating a terminal in unfamiliar surroundings or handling of unknown equipment.

Locating of public payphones can be facilitated by showing their position on direction boards or floor plans or by specially patterned pavement or floor surfacing which can be easily perceived by blind people. Insertion slot(s) for coins/cards must

be fashioned in a tactile manner for easy identification. Card based means of payment should be tactilely marked to identify easily the position and the direction of the card.

Beyond the visual display messages there should be some form of acoustic feedback that can also i.e. indicate the acceptance of means of payment inserted or give warning tone for the user in time when coin(s)/card in the payphone will be expired in a short time and new coin/card has to be inserted to maintain the existing conversation.

Preliminary condition of the faultless data entry is that the digits on the dial are laid out in standardised way [5.6.7] [5.6.12] [5.6.14], a tactile raised “dot” on the touching surface of the centre key “5” should be provided to help unsighted navigation of the keypad [5.6.13]. Sufficient space should be between the keys. The height of the characters on keys should preferably be over 7.5 mm. Clear visual contrast should be as high as possible between the keys and the legend of the keys. [5.6.26]

Between 7% and 10% of all males in the normal population are colour blind or have deficient colour vision. Many visually disabled people also have reduced or no colour vision. It is, therefore, recommended that colour should never be used alone to indicate vital functions and messages, but always in addition to other modes of information. If colours are used to identify or separate keys and information on displays, the colours should be chosen so that they are easy to separate into distinct grey-tones.

Approximately 10% of Hungary’s population have some short of degree of hearing impairment. Around 300,000 of them are seriously hard of hearing, besides there are 60,000 people who are deaf [5.6.23] [5.6.27]. People with impaired hearing can be divided into two main categories according to the seriousness of the hearing loss in relation to telephone communication:

- people who are hard of hearing;
- people who are profoundly deaf.

Depending of the seriousness of hearing impairment various solutions and devices can be needed providing access to telecommunication services for a large range of disabled people as well.

Even a moderate hearing loss can make it difficult to hear a ringing telephone. Amplification of the ringing signal, combining remote bells, and alerting lights on the telephone or remote from it can be useful.

The communication ability of deaf people depends on several factors [5.6.23]. These factors can be the time of the onset of deafness, the hearing has been lost before or after they have learnt to speak (pre-lingually or post-lingually deaf), faculty of speech, degree of retained hearing, ability of lip-reading, personality, education, etc.

Deaf people with no or unintelligible speech can use the written communication. After set up of a modem connection between the parties, they can change messages via text telephones provided with alphanumeric keypad and display or computers operating with applicable communication software. Facsimile, SMS and electronic mail can also be used for providing information, however the information quantity, that can be considered as a logical unit, has to be sent in the scope of new address. Video telephone for manual sign language communication and lip reading support may soon offer good help.

The precondition of communication in the cases mentioned above is to have the same or compatible technical platform at both parties. By the help of special operator service it is available for the people with hearing or speech impairments to communicate with anybody via operator assistance, independently of the fact, that who has originated the call [5.6.28].

The communication of the people who are hard of hearing via telephone can be helped by telephone sets providing for

- inductive coupling to hearing aids;
- adjustable, additional acoustical amplification.

The recent hearing aids are equipped with induction pick up coils, wherewith can detect the alternating magnetic field with special characteristics generated by the magnetic induction systems incorporated in telephone handset. Hearing aids amplifies this induced signal and converts it into acoustical signal. In order to obtain proper interworking between telephone receivers and hearing aids via inductive coupling, the alternating magnetic field strength generated around the telephone earphone capsule shall fulfil the relevant ITU-T Recommendation and ETSI standard

[5.6.29] [5.6.30]. This magnetic field strength shall be high enough to produce an acceptable signal to noise ratio but not so high as to cause overloading of the hearing aid.

Telephone sets that provide additional receiving amplification can be suitable for the people who are hard of hearing. With the maximum additional receiving amplification selected, the receiving sensitivity should be at least 20 dB higher compared with the receiving sensitivity of normal telephone sets [5.6.29]. As hearing impaired people do not necessarily have elevated threshold of loudness discomfort, some form of output limitation is required. Automatic Gain Control may provide a better means of limitation than peak clipping. The acoustical howling can be avoided by the methods used at speakerphones.

Where the telephone is used by persons with a range of hearing acuity, it is preferable to reset the gain of receiving amplification to the nominal level automatically when the handset is replaced. Where the telephone is to be used mainly by a hearing impaired person, it is advantageous to maintain the receive amplification when the handset is replaced.

The main problem for mobility impaired people is actually getting to the telephone so that they can use it. Physical access to telephones in the homes or the workplaces of mobility impaired people can usually be arranged in such a way that it is no great problem to reach the telephone, nevertheless the answering of incoming calls may need some time. The cordless telephone or even the mobile telephone is of great help to these people.

Public telephones and telephone booths must be designed for full accessibility to people in wheelchairs and people who can only walk with help. There must be no steps which prevent the access to the public phones. Doors must be easy to open and close by the people sitting in the wheelchair. The width of the booth and its door must allow entry of a standard wheelchair. The telephone must be placed at a height, where all controls (handset, dialling and function key, coin/card insertion slot, coin refund slot, etc.) can be operated from wheelchair and display messages of the terminal can also be read from this position.

The payphone location described above can be suitable for children and the people of shorter than the average stature. It is obvious that the optimal payphone

location for the people who are much taller than the average is different from the previous one. If several payphones are installed close to each other, they should be placed in such a way that people who are shorter or taller than the average can also find a suitable terminal.

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5.7. Application Programming Interfaces, API-s

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The abbreviation API is very widely used in the world of IT/telecommunication. More than 1000 APIs are implemented in different practical applications, and what is obvious in such a broadly used term, there is more than one interpretation to this abbreviation. ISO, IEC, and the Internet-society defines it as “application program interface” or “application programming interface”. In the ITU usage API appears as “application programming interface” or “application programmatic interface”. Within this suite of interfaces other interfaces can be included, for example the “programming communication interface”. From now on we are discussing the mostly wide-spread “application programming interface”.

The application programming interface forms the interface between the software applications and the telecommunication networks, the CTI (Computer Telephony Integration) is realised through the API. The integration is done at layer 7 of the OSI model. There are a lot of standards in this field, which allow the interoperability among various products made by different manufacturers.

Although ITU-T has developed a lot of relevant standards (e.g. F.581, H.324, I.312, T.171 ... T.176, T.180, T.611, Q.1201, Q.1300 ... 1303, V.130, X.638, X.446, Y.110, etc.), nowadays mostly other standards are used for interoperability purposes in the practice.

We summarise briefly the evolution of the different standards used in practice:

- ECMA has overseen the CSTA (Computer Supported Telecommunications Applications) standard since 1988, and then the whole family of standards in this area. This standard specifies the operation of switching and computing environments.
- ECTF specified SCSA (Signal Computing System Architecture) in 1993. SCSA specifications apply to voice, fax and data processing boards for PCs.
- Intel and Microsoft developed TAPI specifications for the CTI application programming interface in 1993.
- Novell and Lucent initiated TSAPI development in 1993.

- JTAPI was developed by Sun Microsystems in 1997. Today, JTAPI has become a “de-facto” standard, as well as TAPI or TSAPI.
- ISO/IEC JTC1 working group specified Telecommunication Application for Switches and Computers (**TASC**) at an ITU-T SG11 working group responsible for Intelligent Networking in 1994. The specifications include a TASC general overview, architecture, functional services and management. ITU-T Q.1300...1303 standards are referring to this.

CTI functions

The main CTI functions to which these standards refer and which are realised with the help of these APIs can be classified into three categories: call control, media processing, and customer data management functions.

Call control functions include:

- Call setup and release-related services such as dialing services.
- Routing-related services such as automatic attendant services and alternative routing services.
- Network interfacing services such as tone detection/generation, call setup/release detection, and in-band signalling detection.

Media processing functions includes:

- Voice/fax processing such as voice recording/announcement, voice and fax sending, storing and forwarding.
- DTMF (dual tone multi-frequency) digit processing, text-to-speech synthesis and speech recognition (such as spoken command recognition, speaker verification, etc.).
- Call logging such as on-line recording, monitoring and call accounting.

Customer data management provides personal information management for call parties. This management utilises calling/called identifications to retrieve the calling/called party information from the database and associate the information with the call during its life so the call can be processed in an efficient manner.

In practice the following API standards become the most widespread standards: CSTA, TAPI, TSAPI and JTAPI, that is why we are reviewing them. The other standards are not (yet or already) of such a great importance.

There are two methods of physical and logical connection between a switch and a computer: the so-called “first party call control” and the “third party call control”.

“First party call control” (called as “first party CTI”, too) means an individual solution, when a connection is established at every working place (phone station)

between the switch and the computer. The mapping between the switch and the computer is unambiguous and unique. The CTI software controls only one single phone station.

“Third party call control”, (or “third party CTI” in other words) first of all is meant for working groups. Computers are normally connected to a central CTI-server through the LAN network. The connection between the telephone switching system and the LAN workstations is realised by this CTI-server. The CTI-server controls the switch and not a telephone station.

5.7.1. Standards Review

CSTA

(ECMA TC32-TG11 - Computer Supported Telecommunications Applications)

CSTA is a computer-telephony interface standardised by ECMA (European Computer Manufacturers Association), which defines a “third party” communication between the computer applications and the telecommunication network. CSTA - Computer Supported Telecommunications Applications –standard is specified in a series of documents released by ECMA. The specification concentrates on the demands of the private telephone networks, but it also takes into account the requirements of other private and public networks.

The standard describes the application interface between the switching function and the computing function. The description is abstract, it does not apply directly to the user-network interface or to the network-network interface. Because of it has only an indirect connection with real telecommunication interfaces, it can be used in any environment, the differences among the different existing interfaces are hidden from the CSTA applications. The interface between the user and the network is not subject for CSTA.

ECMA 179 standard (CSTA Phase I)

ECMA 180 standard (CSTA Phase I)

This pair of standards define how the communication at layer 7 of the OSI model is done by the computer supported telecommunication applications (CSTA) between the computer network and the telecommunication network.

ECMA 217 standard (CSTA Phase II)

ECMA 218 standard (CSTA Phase II)

This pair of standards defines the second phase of the computer supported telecommunication applications (CSTA) protocol at layer 7 of the OSI model between the computer network and the telecommunication network.

ECMA 269 standard (CSTA Phase III)

Standard ECMA 269 defines the third phase of the computer supported telecommunication applications (CSTA) services at layer 7 of the OSI model between the computer network and the telecommunication network. This standard is a part of the set of CSTA Phase III standards and technical reports.

All the standards and reports of this set reflect the practical experience of the ECMA members and are based on a pragmatic, common agreement.

The development of this collection began with CSTA Phase I, which contained the CSTA services and protocol standards (ECMA-179 and ECMA-180). In Phase II the collection was completed with ECMA TR/68 Technical Report. This report shows how the CSTA services and events can be used in typical calling situations.

CSTA Phase III complements the Phase II standards (ECMA-217 and ECMA-218) with some major subject and numerous details. This includes the technology based on Versit CTI Encyclopedia (Version 1.0), put to the disposal of ECMA by Versit. Major subjects are the following:

- new services and events categories, such as exchange of skills, call accounting, media processing services, calling data records (CDR), etc.,
- • supplementary call control and device control services and events,
- • enhancement and correction of the existing services and events,
- • organising the services and events in order to reflect the function based grouping (call control, device control, etc.),
- • use of consistent models for services and events; these models include the connection start and end state, the connection state transitions, the event monitoring sequences, etc.

First version of ECMA-269 standard was released in December 1997, the second version in June 1998. This release complements the CSTA services planned in Phase II with the following:

Modelling an ACD and an agent connected to an ACD, call related services, calling data recording services, skill exchange services, data collection services, I/O services, logical device services, physical device services, media processing services, operation events, vendor-specific developments, voice services.

The CSTA Phase IV elaboration has begun in 1999. This phase will support the IP based functions such as VoIP.

TAPI

(Telephony Application Programming Interface)

Microsoft's Telephony Applications Programming Interface (TAPI) was developed for Windows based PCs. First version (TAPI 1.3) was released in November 1993. This version was designed for the „first-party“ call control configuration running on a 16-bit processor. An enhanced version TAPI 1.4 was released as part of Window 95. These versions do not support a call model such as the one defined in ITU-T Q.931. TAPI enables a speech/data application to set up and release of calls, monitor progress, detect CLID (calling line identification), perform identification, and activate features such as hold, transfer, conference, park and pickup. It can redirect and forward calls, answer and route incoming calls, and generate and detect DTMF signals. TAPI enables multiple applications to share a single phone line. For example, different types of incoming calls (e.g., voice mail and fax) can be accepted on the same line. TAPI provides access to various telephone network services:

- Plain old telephone service, which supports one type of information (voice or data) per call and one channel per line.
- ISDN, which supports simultaneous voice/data per call and multiple channels per line.
- Digital network services, which support data communications.
- Other services such as Centrex, PBX and KTS (key telephone system).

The later versions of Microsoft TAPI (TAPI 2.0 and TAPI 2.1) have moved from the “first-party“ call control configuration to “third-party“ call control configuration. The latest version TAPI 3.0 provides a much more friendly and powerful telephony environment. The TAPI 3.0 Component Object Model allows developers to write TAPI-enabled applications in various languages including Java, Visual Basic, and

C/C++. TAPI 3.0 supports IP telephony services that comply to the ITU-T H.323 standard.

With the services provided by Windows TAPI an application developer can complement the applications developed for operation systems supported by Microsoft Win32 (such as Windows NT or Windows 95) with telephone communication. TAPI, the Windows platform, Windows APIs used for other communications and ActiveX drivers forms an ideal base for development and use of telephony applications.

TSAPI

(Telephony Services Application Programming Interface)

Was developed by AT&T and Novell. TSAPI is a Netware-loadable module (NLM) that resides in a Novell server. The software developers implement the applications by using the TSAPI specification so they do not need to directly access the various manufacturers' switch-to-host interfaces. The TSAPI-based switch services are typically created on top of the CSTA switch-to-host interface. Although TSAPI was designed for both "first-party" call control and "third-party" call control, most of its applications focus on third-party call control.

JTAPI

(Java Telephony Application Programming Interface)

JTAPI was developed by Sun Microsystems. First version of it was released in 1997. The actual version JTAPI 1.3 came out in 1999. This standard is spreading rapidly.

JTAPI adds telephony functions to Java programming language. With the help of JTAPI the applications can run on different operation systems and on different hardware platforms.

JTAPI was meant to be just a simple API. It requires of the application developer to know the telephone network, but there is no major need for the implementation-specific knowledge needed for application development.

JTAPI can be used for "first-party" and "third party" call control and media stream control.

JTAPI is not a new telephony API in fact, though it can be implemented without an existing telephony API. It is meant to be built on top of other existing telephony APIs (for ex. TAPI, TSAPI), and so new applications can be developed with it.

5.7.2. Other institutions

Versit

Versit is an initiative launched by Apple Computer, AT&T, IBM and Siemens. These companies developed a series of specifications for computer communication, including CT. The Versit projects include the TSAPI development, the CTI Encyclopedia of specifications (it offers service definitions, protocols, and the TSAPI-based APIs), and the definitions of the vCard Electronic Business Card. The Versit founders joined ECTF in 1995. At the end of 1996 Versit finished its activity, and it is not developing any interoperability specifications, but it is working in other subject.

ECTF

(Enterprise Computer Telephony Forum)

ECTF is an open organisation, established to support and to realise computer-telephony implementations based on “de facto” and “de jure” standards. ECTF defines two types of servers: application servers and CT servers. The application servers execute telephone and media applications in a shared network. CT servers supply the telephone and media resources (lines, speech recognition, fax) needed for the applications. Taking some key-interfaces from the primary system elements and defining them very carefully, it is possible to achieve interoperability in a very wide area. ECTF defined the following interfaces:

- S.100 media and switch services interface
- S.200 transport protocol interface
- S.300 service interface
- H.100 hardware compatibility interface
- M.100 administrative services interface

Call control and other interfaces providing application interoperability are under development.

For example ECTF has been dealing with JTAPI development since 1997, too.

