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COMPUTER ASSISTED TELEPHONE APPLICATIONS

ABSTRACT

Computer resources represent a significant factor in the development of a society. Their distribution to users' locations and direct connections through telecommunication systems substantially increase their significance and role.

Modern telecommunication systems are integral systems for voice and data transmission. This paper studies data transfer from the technical, technological and organisational aspect. Due to the wide scope of the topic, only some relevant data are mentioned that determine the characteristics of certain data transfer systems.

KEY WORDS

computers, telephone applications, data transfer services, information exchange, networks

1. INTRODUCTION

The significance of a timely and reliable information exchange in the office work is today greater than ever. Voice is still the most frequently used method of information transfer in an office, and the infrastructure related to the transfer is most developed. However, modern office work is unthinkable without electronic and software devices for receiving, sending, storing and processing of information. Depending on the wishes and needs of the users there are two basic concepts of office communication development.

- separated system for voice and data transfer,
- integrated system for voice and data transfer.

Apart from the always present system for voice transmission, an independent system for data transfer was needed for transmitting large amounts of data, either between computers or for data exchange between computers and extremely fast terminals. For those groups of user terminals which operate at much lower speeds, i.e. only occasionally need connection to the host computer or network, the integrated system for voice and data is more suitable and economic.

Since the data transfer uses the same wiring that is used for telephone lines, no additional cabling is needed, so that data transfer network becomes less expensive even for relatively low levels of traffic.

2. DATA TRANSFER SERVICE DEVELOPMENT

Telephony dominates among various telecommunication services with about 90%, but it is developing quite slowly (2 - 4 % annually), and the data transfer services show the greatest growth (10 - 20% annually). Data transfer between electronic computers is realised by means of two types of connections. The first type is direct connection for data transfer along leased (rented) cables, and the second type for data transfer are the commuted lines, which can be realised in several ways. The simplest data transfer connection is the direct connection along a leased cable and it can be physically realised in several ways depending on the length of the connection. The most commonly used data transfer speed that can be achieved per rented physical cable is 64 kbit/s.

The second type of data transfer connection is the commuted connection and it can be realised in several ways depending on the type of commutation network.

Today, the usual speed of digital transmission using coaxial tube, waveguides or mono-mode optical fibres amounts to 560 Mb/s. In 1987, a special network was constructed in Zagreb for transfer of data for the needs of *Univerzijada* (Students' Olympic Games), based on the ERIPAX system, and it used the speed of

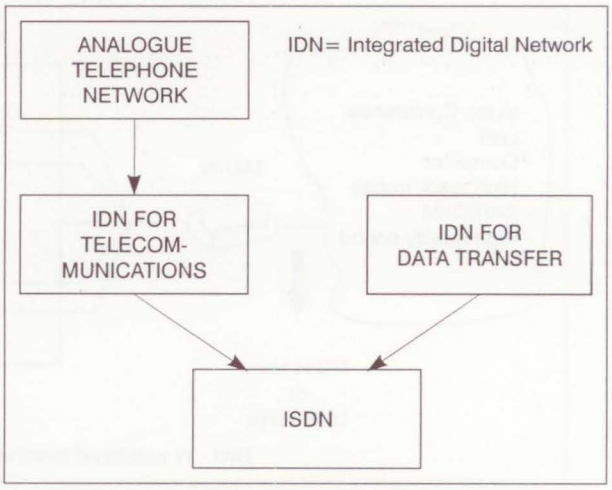

Figure 1 - Development according to ISDN

up to 64 kbit/s for connecting four nodes. In 1990, all the existing data transfer networks were united into an integral network CROAPAK. The telecommunications development is oriented towards an Integrated Services Digital Network (ISDN), and in some countries it is already being commercially used. During 1991, a pilot ISDN node was designed and realised in Zagreb. This node was done in AXE-10 technique.

3. DATA TRANSFER EQUIPMENT

For connecting workstations, terminals, PCs and computer equipment, an adapter from a series of Terminal Adapter Units (TAU) is used. Each of the terminal adapters covers a certain application area and they have been developed in order to provide optimal combinations of voice and data traffic. TAU - terminal adapters are available for a wide range of applications and the data transfer intensity varies from occasional to constant. The basic purpose of terminal adapters is to adapt the computer equipment codes to the system-related codes. Common characteristics of the terminal adapters TAU are the following:

- to simplify the establishing of data connection,
- to convert data at the interface circuit level,
- to format data into the format used by data channels,
- to transmit formatted data, including control information, towards transmission circuits,
- auxiliary functions of the type of the state of the call and analysis.

3.1. Terminal Adapters

Further, various terminal adapters used for data connections are described:

TAU-S (Terminal Adapter Unit - Stand alone) is a standalone adapter for connecting data terminals where no voice connection is needed, which means no digital telephone. It is especially suitable for connecting printers, computer inputs and isolated terminals, since no personnel intervention is needed for incoming calls. Adapter has four keys that enable the user to select the destination of the call and/or some previously defined function. Synchronous and asynchronous connections are possible with standard transmission speed up to a maximum of 48 kbit/s. It is connected to a user digital line interface.

TAU-A (Terminal Adapter Unit - Auto dial) is a standalone terminal adapter (not connected to a digital telephone device) with keyboard dialling. The maximum of a range of standard speeds provided by this adapter is 48 kbit/s.

TAU 2520 is a standalone terminal adapter for connecting synchronous and asynchronous computer equipment. If necessary it can be used also in combination with the digital telephone and then it is used for data transfer at speeds of up to 9600 bit/s, and if used independently, then it allows transmission at speeds of up to 19200 bit/s.

TAU 2620 is a standalone terminal adapter for connecting synchronous and asynchronous computer equipment. If necessary, it can be used in combination with digital telephones. It is connected to 2B+D cable, and in case of simultaneous voice connection, it allows data transfer at speeds of up to 38.4 kbit/s.

DLU 20 (Data Line Unit 20) is data digital line interface. It is intended for applications which need several inputs for computer connection.

DLU 30 is data digital line interface replacing one user digital interface circuit and six terminal adapters TAU-S. It uses exclusively channel 64 kbit/s and provides synchronous traffic at speeds of up to 48 kbit/s.

TAU-W (Terminal Adapter Unit - Wideband) is a terminal adapter for connecting units that exchange data at high speeds or exchange large amounts of data thus

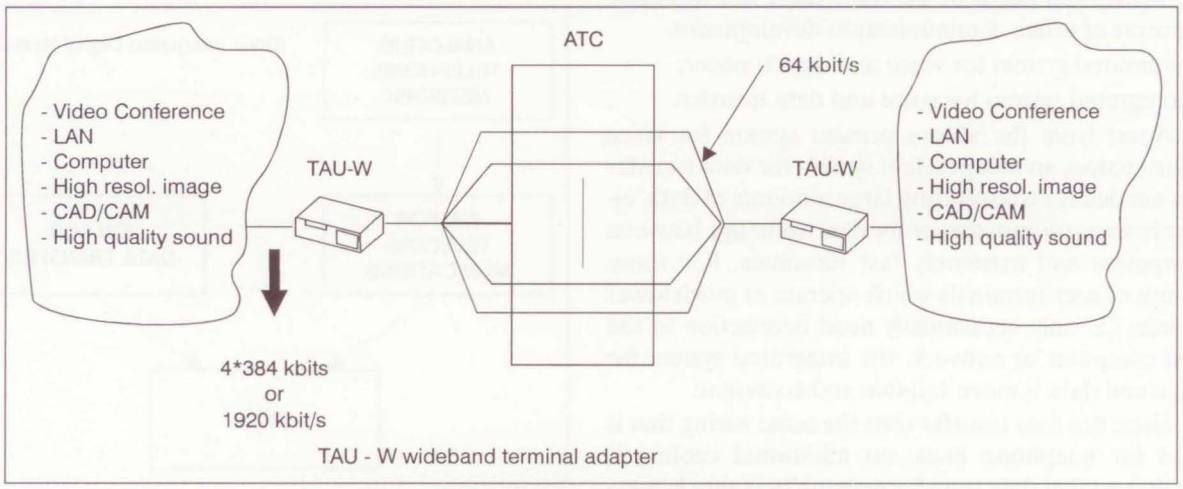

Figure 2 - TAU-W operating principle

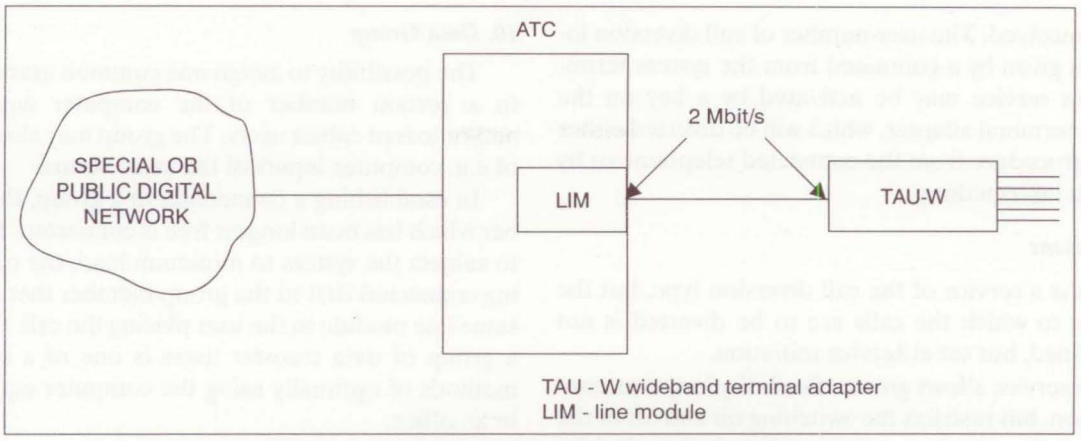

Figure 3 - Method of connecting TAU-W to ATC

requiring commuted wideband services of the private or public network. It is intended first of all to establishing connection between local communication and wide area communication, by using narrowband network in order to realise possibilities provided by the wideband network. The equipment is connected to TAU-W through two or maximum four interfaces, i.e. depending on the necessary speed, it is possible to establish either one link at a speed of 1920 kbit/s (30 x 64 kbit/s) or maximum 4 independent simultaneous links at speeds of 384 kbit/s (6 x 64 kbit/s). The basic application is in connecting two TAU-Ws through a commuted network. This results in savings compared to rented cables, joint data transfer networks or wideband services.

The main thing for any data connection is that both parties, the one that is placing the call and the one that is receiving it, should be compatible. The system checks both parties and if they are compatible, the connection is established.

4. DATA TRANSFER THROUGH NETWORKS

Private networks of fixed cables (private and leased), telephone network, data transfer network with cable commutation, packet commutation network, network for message commutation and frames commutation are used for data transfer. Single types of networks offer certain advantages and drawbacks and none solves optimally all the requirements of all the data transfer users.

Fixed cables are economic for transmission of large amounts of data. Because of the high price of the communication cables, devices are used to make their operation as efficient as possible (multiplexers, concetrators, etc.). Even the usage of such devices cannot meet the users' requirements, so that the construction of complex, specialised networks was started. Public telephone network may be suitable if small amounts of data are transmitted occasionally at relatively small distances, and no large transmissions are required. Data transfer networks with cable commutation are especially suitable for transmitting larger amounts of data at shorter time intervals, as well as for all kinds of transmissions in case of a large number of necessary connections in a certain geographic area. Data transfer networks using packet commutation are suitable for transmission of smaller amounts of data at greater time intervals (interactive operation). Message commutation networks are mainly used in telegraph traffic, and in public and private message transfer systems (e.g. electronic mail). They are suitable for transmitting larger amounts of data, when the response time is not important.

5. DATA TRANSFER SERVICES AVAILABLE TO USERS

The system assigns certain traffic characteristics to every user of the transfer service at initialisation, and to make the system easier to use, it is possible to add a number of services to:

- improve the basic communication services
- simplify the usage of network
- eliminate or minimise unauthorised usage or misuse of the system and/or services

Some of the services are the same as in voice communication, and some are specific for data transfer.

1. Account Code

It is possible to calculate the cost of a data call to a certain account, instead to the user himself. This service is used when costs need to be calculated for certain projects or groups.

2. Call Diversion

In case the user is not available over a certain time (e.g. due to maintenance), it is possible to automatically divert his calls to another location where these

can be received. The user number of call diversion location is given by a command from the system terminal. This service may be activated by a key on the TAU-S terminal adapter, which will be diverted either by the procedure from the connected telephone or by using an intermediary.

3. Follow me

This is a service of the call diversion type, but the location to which the calls are to be diverted is not pre-defined, but set at service initiation.

This service allows greater flexibility in system configuration, but restricts the switching on and off of the service to the telephone connected to the location for data transfer and intermediary.

4. Direct In-dialling

The possibility of modern telecommunication systems provides direct access to public network users, i.e. without an intermediary.

5. Last Number Re-dialling

The capability of the system to memorise for each user the last dialled outgoing number can be used by the simple procedure from the telephone connected to the data transfer location or keyboard.

6. Hot Line

The possibility of dial-free connecting to a pre-defined user.

7. Abbreviated Dialling

The possibility of assigning the whole or part of the number (including the group number or at band access) to one function key, either on terminal adapter, or on the digital telephone, if used in configuration jointly with the terminal adapter.

8. Connect when Free

This possibility allows initialising of the data transfer user, leased cable or data transfer user group, at only one call in order to establish the connection.

If, in trying to establish the contact, these users are busy, the system controls the called user and establishes the desired connection the moment they are free.

In case when several callers place their calls to the same destination, a waiting list is created and the first call is connected to the user who has been waiting longest. There is no restriction as to the waiting duration.

9. Automatic Answer

Calls received by the computer units are, in principle, answered automatically. Computer equipment shows that it is ready to receive the data by DTR signal (Data Terminal Ready).

10. Data Group

The possibility to assign one common user number to a certain number of the computer equipment and/or leased cables users. The group may also consist of e.g. computer inputs of the same status.

In establishing a connection to a group, the member which has been longest free is connected. In order to subject the system to minimum load, the call is being connected first to the group member that is in the same line module as the user placing the call. Forming a group of data transfer users is one of a series of methods of optimally using the computer equipment in an office.

11. Voice/Data Transfer

In case of data connections with modems using public network, in some situations it may be better to establish the voice connection first (in order to set the communication parameters, etc.).

After the voice connection has been established, the call can be switched to the user's data transfer cable using the transfer key. The required modem is automatically selected during transfer.

12. Trunk Call Discrimination

Due to economic reasons, the system gives the possibility of checking whether the user is permitted access to the public network, and the analysis of the dialled number regarding the call destination. It is possible to define sixteen groups for which restrictions / permissions may be set for various destinations in the public network.

13. Call Metering/Station Message Detail Recording

Modern telecommunication systems offer also the possibility of recording tariff impulses per user and call.

14. Local Mode

Data transfer users can change to local mode by pressing a programmed function key, when they want certain activities on the terminal without involving the environment. In local mode, the traffic towards and from the user is not possible. If a connection is on when this function is activated, the function is activated after the connection closes.

15. Test Mode

Testing services which can be initiated at any moment are available to data transfer users who use TAU terminal adapters. If the connection is on, it is disconnected. The connection is checked towards the equipment connected to the terminal adapter and the connection from the terminal adapter towards the system.

16. Programming Mode

In order to increase the system flexibility, the users can change the configuration and transfer characteris-

tics for the user interface. These possibilities are available to the users that have terminal adapters connected by means of telephones. In this mode it is possible to assign certain services (e.g. call diversion) to a telephone button, choose the indication of incoming calls and define the data transfer parameters (speed, characters format and whether it is synchronous or asynchronous communication).

17. Semi-permanent Connections

The possibility of using semi-permanent connections was introduced as the possibility to establish an equivalent to the leased intern lines within a certain system. At one end of such a connection there is always the data transfer unit, and on the other end there may also be a data transfer unit or a leased line. Semi-permanent connection is established so that the data transfer unit is assigned the possibility of automatic calling, by using the dial-free connection service. The unit assigned the dial-free connection service establishes the connection with the data transfer unit with automatic answering or with the leased line. The connection is established the moment both sides are activated. If the connection cannot be established, either due to system overload or because the destination is busy - or the connection breaks up - a number of attempts to re-establish the connection will follow. A maximum of ten users per one line module can have the possibility of semi-permanent connection.

18. Name Selection

In order to simplify the manual dialling procedure, it is possible to assign the data transfer destination number a certain name. The destination number is assigned to the programmable function key of a digital telephone or TAU. The name of the key is selected so that it contains the datum about the application or service provided by the equipment of the destination number. The destination number is programmed by the user on the digital telephone or adapter (TAU) from the administration terminal.

When the key for name dialling is pressed, the system automatically dials the numbers assigned to this key.

19. Emergency Service

If the power supply from the network is discontinued, and the system depends on the battery supply, it is important to reserve the limited power supply for outgoing calls of highest importance. The emergency service can place a certain system into "emergency" by entering the access code from the intermediary device.

While the system is under "emergency", only certain pre-determined users are allowed to place outgoing calls. All the other users in the system can place or receive internal calls and receive incoming outer calls as usual. This restriction is equally applicable to the voice and to the data transmission. Further, the data transfer users may be among those who can place outgoing calls while the system is under "emergency".

20. Commonly Dialled Connection

Data transfer connection is established by pressing a key for data transfer and then by dialling the desired destination on the phone. Data transfer calls can be directed towards the data transfer user, a group of data transfer users, outer data transfer user through the commutation connecting line or leased (rented) line.

21. Extending

Incoming call for data transfer from the external network answered by the intermediary, can be extended towards the data transfer user in a similar way as the incoming call for voice transmission. The call is processed in the same way as any incoming call to the data transfer user.

22. Data Transfer Users

They may be assigned data transfer functions such as call diversion by certain function keys, it is possible to select the type of sound indication for incoming calls, and input the data transfer parameters such as the rate of transmission, synchronous and asynchronous mode, and character format.

6. CONCLUSION

It has been obvious for a long time now, that efficient voice communication is necessary in everyday business activities of all the organisations. Apart from voice communication, an increased need for information access, necessary for efficient functioning of an organisation, has led to the introduction of data terminals or workstations on the desk of almost every employee.

Regarding these facts, modern business communication systems are developing, which, by using various interfaces, enable communication of various units of equipment for data transfer, available on the market. Modular concept of the system design, geographical distribution of the systems and the construction of special networks, makes it possible to establish data connections in a wide area.

The acceptance of new technologies leads towards the support of sophisticated telecommunication systems by multimedia applications.

Modern telecommunication systems offer the strategy of business communication for the future. It includes all the facilities that make business easier and more convenient: high quality, adaptability, reliability,

together with the innate capability to change, i.e. to introduce new services.

SAŽETAK

TELEFONSKE APLIKACIJE PODRŽANE RAČUNALOM

Informatički resursi predstavljaju bitan faktor razvoja društva. Njihovo distribuiranje na lokacije korisnika i direktno povezivanje putem telekomunikacijskih sustava znatno su povećali njihov značaj i ulogu.

Suvremeni telekomunikacijski sustavi integralni su sustavi za prijenos govora i podataka. U ovom radu obuhvaćen je prijenos podataka s tehničkog, tehnološkog i organizacijskog aspekta. Zbog širine područja razmatranja, navedeni su samo neki relevantni podaci koji određuju karakteristike određenih sustava u svezi s prijenosom podataka.

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