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BASKOM – A Pilot Network of the Swiss PTT for Broadband Communication

Urs HALLER, Basle

1 Introduction

Technically the term 'Broadband' is not defined. For the Swiss PTT, the use of signals with a data rate in excess of 2 MBit/s at all layers of the OSI model is understood. Broadband networks allow for the transport of information at high speed to the subscriber.

Broadband services have been discussed for quite some time and extensive relevant studies have been carried out [1, 2, 3, 4]. BASKOM enables the PTT to test interesting applications of broadband communication jointly with the subscribers and to accustom the people involved to the use of broadband communication. A test

network similar to BASKOM but with other scopes of application is operating in Berlin [5].

2 Broadband Networks

Broadband networks (Fig. 1) master high bandwidth as well as maximum interactivity up to dialogue services. Swissnet, on one hand, covers the full scope of interactivity but foreseeably only up to $n \times 64$ WkBit/s (with $n \leq 30$). On the other hand, cable television networks offer high bandwidths, but only for distribution services.

3 Broadband Communication

Two-way communication satisfies new, so far unfulfilled wishes in the broadband area (Tab. I): picture phone and video conference in TV quality or even better, data transfer for computer-aided development and manufacturing (CAD, CAM) which require high bit rates, as well as general interconnections between local area networks (LAN). Also new forms of retrieval services can be realized: Broadband vidotex or the retrieval of movie films on request become possible.

Broadband one-way communication (Tab. II) already enables the distribution of TV programs today and will be the future basis for high resolution TV and electronic newspapers.

The services mentioned in Tables I and II are structured according to [6] and [7].

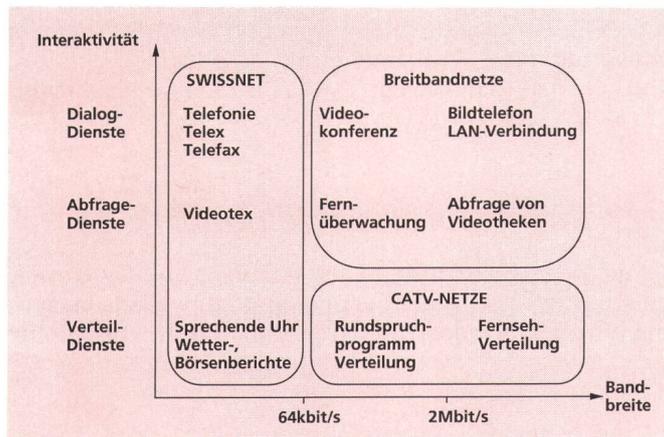


Fig. 1 Broadband Networks

- Interaktivität – Interactivity
- Dialogdienste – Dialogue services
- Abfragedienste – Retrieval services
- Verteildienste – Distribution services
- Telefonie – Telephony
- Telex – Telex
- Telefax – Facsimile
- Videotex – Videotex
- Sprechende Uhr – Time announcement, Speaking clock
- Wetterberichte – Weather reports
- Börsenberichte – Stock reports
- Breitbandnetze – Broadband networks
- Videokonferenz – Videoconference
- Bildtelefon – Picture phone
- LAN-Verbindung – Interconnection with a local area network
- Fernüberwachung – Remote monitoring
- Abfrage von Videotheken – Video library retrieval
- CATV-Netze – Cable television networks
- Rundspruch-Programmverteilung – Distribution of broadcast programs
- Fernseh-Verteilung – TV distribution
- Bandbreite – Bandwidth

4 BASKOM

4.1 Aim

The aim of BASKOM is to test new applications with highest bit rate requirements. The Videophone and video library retrieval services are to be offered first (see Fig. 2 for a general overview). Since the beginning of 1991, the first subscribers have been interconnected by means of a broadband switch set-up for this purpose. The project is scheduled to last five years.

4.2 Technique of BASKOM

The BASKOM pilot network, to which 30 subscribers are connected, is an independent network, not connected to

Table I. Two-way communication

Communication Mode	Transmitted Information	Application
Dialogue	Motion Picture	Picture-phone (VIDEOPHON) Point-to-point video-conference Multipoint-video-conference Monitoring with motion pictures
	Data	Fast data transmission Transfer of large data files Computer aided construction and manufacturing (CAD, CAM) Fast process control and telemetry LAN-LAN interconnections
	Documents	Fast Telefax Transfer of documents (for mixed documents containing text, graphics, still pictures and sound)
Storage	Motion picture	Picture storage service (Picture Mail)
	Documents	Document Mail Service (mixed documents)
Retrieval	Motion Pictures	Broadband-Videotex Movie Film Retrieval (Video Library)
	Text, Data, Graphics	Retrieval of still pictures with high resolution
	Still Pictures, Sound	Retrieval of documents (mixed documents) Sound retrieval

other PTT networks. 29 subscribers are found within the metropolitan area of Basle. Since not all optical fibre links within the inter-exchange network are available in monomode technique, three subscribers are still connected with multimode cables. One subscriber is located in Lausanne and is connected by the trunk network to the Basle switch. More details to the technique of BASKOM are given in [8] from which the slightly modified Figure 3 is taken as well.

421 Switching and Transmission

The BASKOM switch represents a line switched system. It consists of an ISDN part (System 12 from Alcatel)

which controls the broadband switching matrix. The switch allows for setting up closed user groups.

The local subscribers are connected to the exchange by means of an optical fibre. The transmission is bidirectional and no amplifiers are used up to a distance of 20 km. The wavelength for the direction from the exchange to the subscriber is 1300 nm and 1550 nm in the opposite direction. The gross bit rate is 153.6 Mbit/s. An H4 channel (according to CCITT G.702 139.264 Mbit/s) is used for video transmission, H1 channels (2.048 Mbit/s) for data transmission as well as two B+D channels for telephony and for setting up the connection.

Special one-way transmission equipment complying with the CCITT hierarchy is used for the connection of remote subscribers as well as for subscribers who are still connected to the local network by means of multimode cables.

422 Video library

The video library, a mass storage for motion pictures, is equipped with 28 video disk players (Laservision) and 20 videotape units (U-matic). A special data base is available for still pictures, graphics and for menu advice. At the editing desk, the system manager can assemble the contents according to the instructions of the information providers and integrate them in a tree-like search structure. The composite colour signal of the replay units is converted into a RGB signal (red, green, blue), digitized and supplied to the switch by means of ten H4 channels.

423 Terminals and additional units

Three models of picture phone terminals are made available to the subscribers depending on their particular requirement: the indesk model (Fig. 4), the desktop model

Table II. One-way communication

Communication Mode	Transmitted Information	Application
Distribution (without user-control)	Video pictures	Distribution of TV programs Pay-TV HQTV, EDTV, HDTV
	Audio	Distribution of radio broadcast programs
	Documents, Data	Data distribution Electronic newspaper
Access	Text, Graphics, Still Pictures	Broadband-Teletext

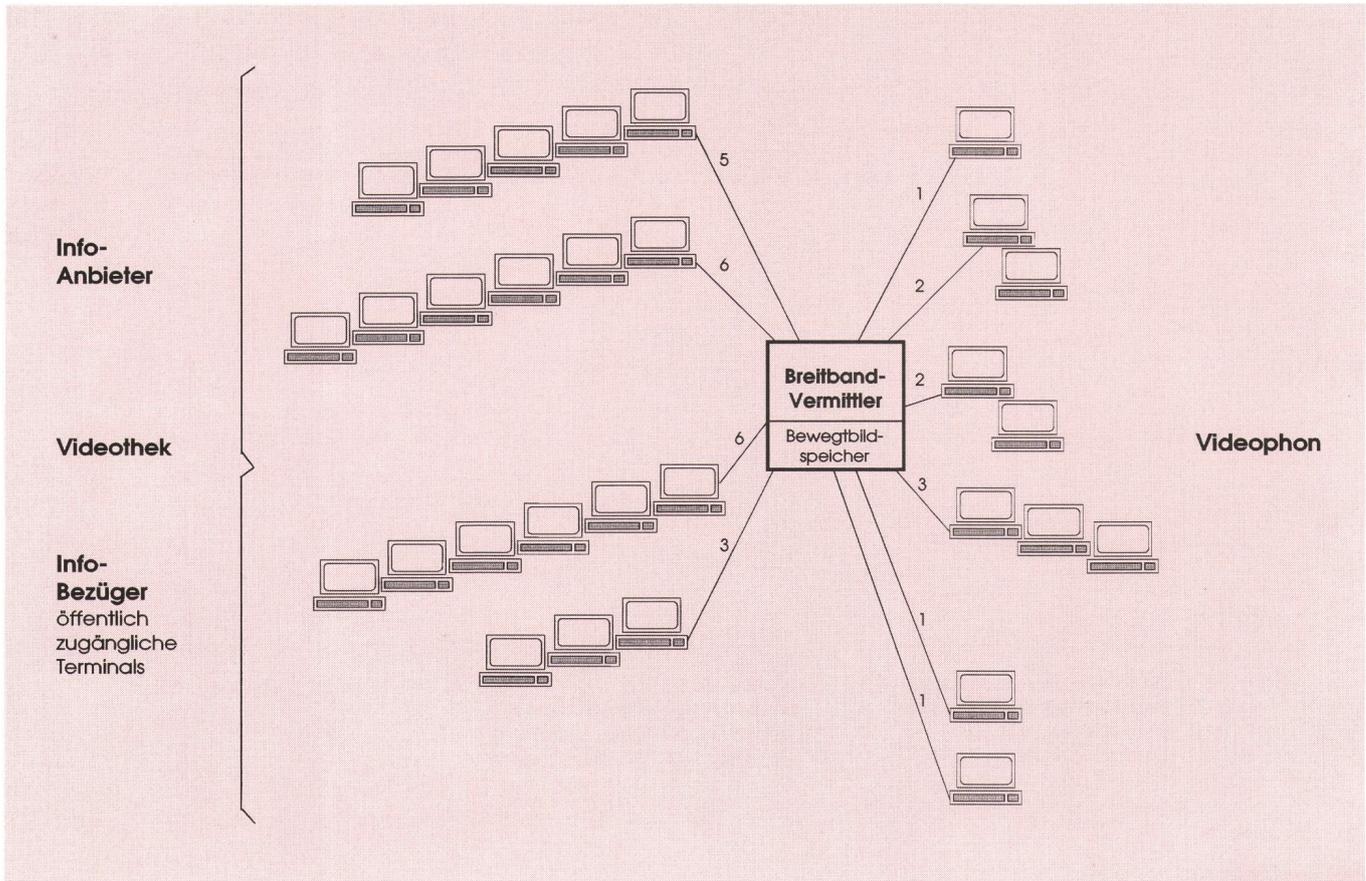


Fig. 2 BASKOM-Overview

Info-Anbieter – Information provider
 Videothek – Video library
 Info-Bezüger – Information user
 Öffentlich zugängliche Terminals – Publicly accessible terminals

Breitbandvermittler – Broadband switch
 Bewegtbildspeicher – Motion picture memory
 Videophon – Videophone, Picture phone

(Fig. 5), and a public terminal (Fig. 6). All three terminals enable the user to make videophone calls as well as to retrieve information from video libraries.

The desk shown in Figure 4 allows for the transmission of pictures, drawings, symbols, photos, films, tables, diagrams, statistical material, circuit diagrams, tree flow charts, system plots and technical drawings as well as three dimensional models, tools, objects and functional models. For the videophone service in colour TV quality, the optical beam path of the screen and from the camera is split with a semi-transparent mirror in order to establish direct visual contact with the partner (Fig. 7).

The public terminal is equipped with a loudspeaker, the others with loudspeaker and hands-free microphone. The picture to the partner is not transmitted immediately as the connection is established, but must be manually activated. Privacy is maintained with a limited screen size when using the public picture phone.

The video library can be called from any terminal. Communication is established by entering the access number or by pushing a pre-programmed target key. The contents of the video library are reached by following the menu instructions or by directly selecting the desired pages (Fig. 8).

Input to the public terminal is provided by means of the built-in numeric keypad, including the * and #. For other terminals, the keypad of the attached telephone set is used.

When the public terminal is not in use, an animation sequence is played in addition to an attractive environment in order to attract public interest. A handset enables a reliable speech connection, even in a noisy environment.

The additional equipment provided with the terminal as well as optional equipment to be connected are shown in Figure 9. The additional equipment consists of a document camera for recording drafts, plans, graphics or models as well as of a video printer for hardcopies of any picture content. The public terminal can also be equipped with a monitor or a video projector. For the desktop and indesk versions, a RGB interface is provided which allows for the transfer of films from a video recorder or for their input into a broadband local area network by means of a modulator. The individual video sources (picture of the partner, own picture, external source) can be presented sequentially or simultaneously by splitting the monitor screen.

BASKOM desks are also equipped with telewriters in order to make the terminals of the communication partners as complete as possible. A pen can be used for

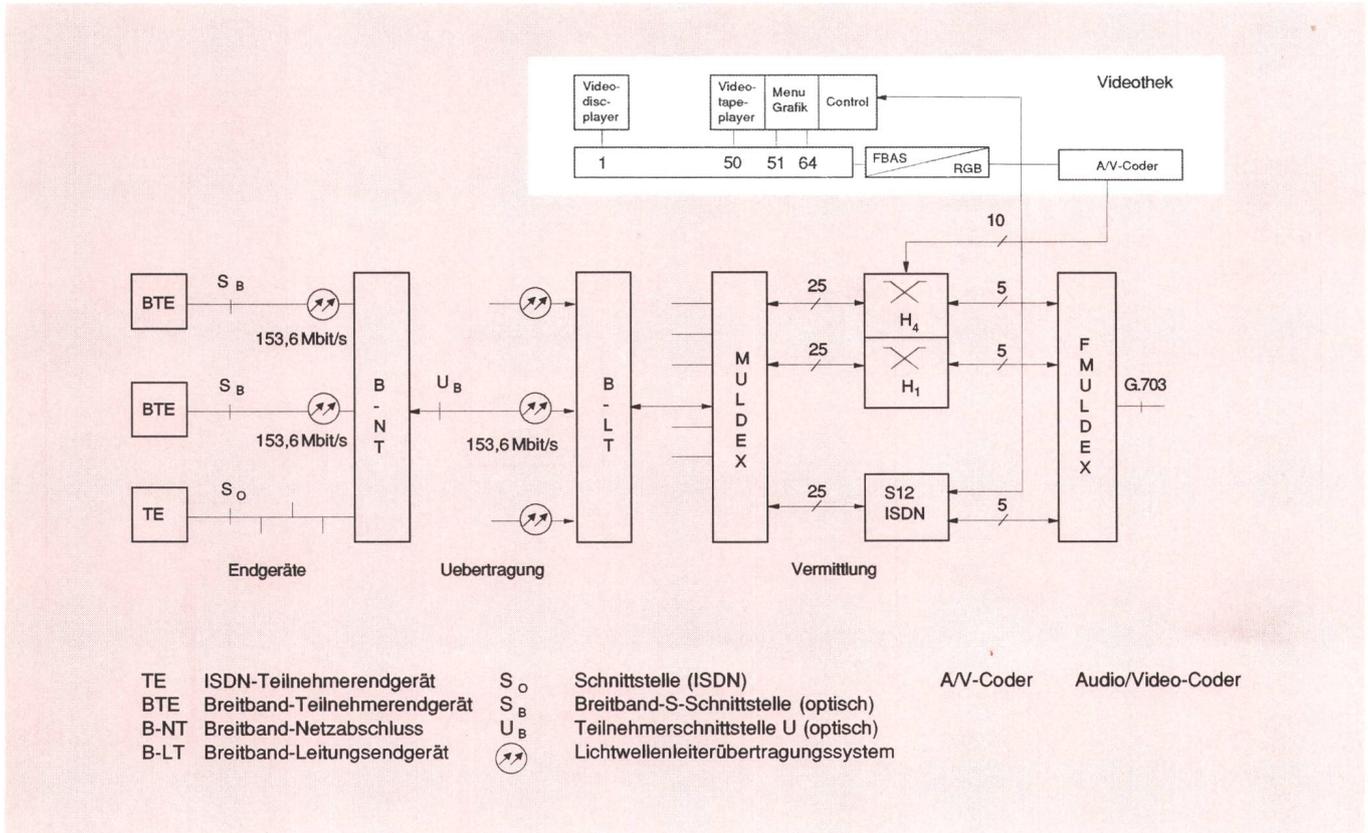


Fig. 3 System Overview

Endgeräte – Terminals
 Übertragung – Transmission
 Vermittlung – Switching
 ISDN-Teilnehmerendgerät – ISDN subscriber terminal
 Breitband-Teilnehmerendgerät – Broadband subscriber terminal
 Breitband-Netzabschluss – Broadband network termination
 Breitband-Leitungsendgerät – Broadband line terminal

Schnittstelle (ISDN) – Interface (ISDN)
 Breitband-S-Schnittstelle (optisch) – Broadband S interface (optical)
 Teilnehmerschnittstelle (optisch) – Subscriber interface (optical)
 Lichtwellenleiterübertragungssystem – Fibre optical transmission system

writing or drawing on a board with the signs displayed at the partner's screen.

43 Subscribers and their applications

Examples of applied BASKOM communication facilities are shown in Table III. The scrolling facility is a subfunc-

tion of the video library service. A BASKOM Terminal is equipped with a modulator which inserts the received video signal into a special CATV channel of the radio and TV cable network. This allows the review of specially assembled sequences from video libraries by Basle television subscribers.



Fig. 4 Indesk Terminal

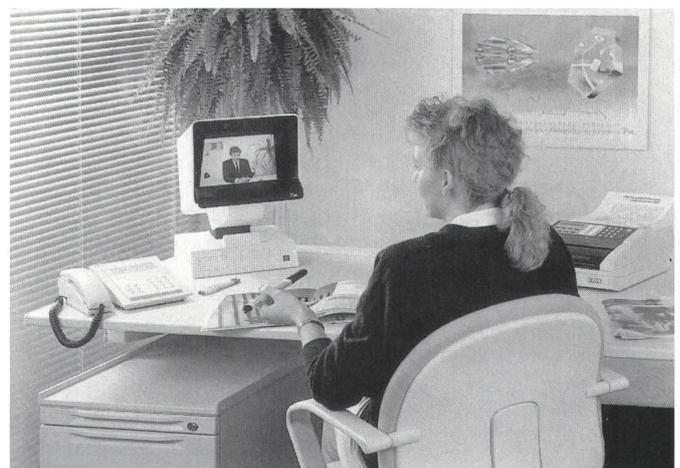


Fig. 5 Desktop Terminal

Table III. Communication modes of BASKOM with examples for applications

Service	Communication mode	Information carrier					
		Conversation (Picture and Sound)	Video motion picture	Video still picture	Documents	Graphics	Texts
Videophone (Picture-phone)	Dialogues	Meetings Spontaneous discussions Correspondence education	Educational films Demonstration films	Models	Construction plans Layouts	Statistical material Drafts Diagrams	Text processing Drafting of text
	Information	Product advising Bookings, Reservations Teleconsulting	Instruction on tools, materials	Demonstration pictures	City maps	Computer graphics	Job offer Description of appliances
Video Library	Public contents		City information Museums Exhibitions Shows Continuing education	Regional guide Careers' advice Medical advice	Agenda Timetables	Situation plans	Short messages Newspaper
	Private contents of public interest		Commercials Services	Housing market	Annual reports	Statistical material Access plans	Recipes Shopping lists Material lists Stock reports
	Application specific contents in closed user groups		Staff education	Archives	Orders	Flow charts Controlling Organigrams	Instructions Inhouse news
Scrolling service via interface to the radio- and TV distribution network	Public contents		Today in Basle	Art objects	Environmental data	Weather map	Road conditions

The other 29 terminals are used as follows:

- Eight terminals for a wholesale distributor where three terminals are equipped with video printers and are located at retail stores. They are used to interrogate video disks containing diet consultation, recipes, instructions for the use of power tools as well as questions about environment and health. The sets can also be used to retrieve video tapes containing the current week's specials or for a personal picture phone briefing about cosmetics, meat and flowers. The five desktop and indesk models are used as advisory desks as well as for internal communication, e.g. for the joint drafting of common documents.

- Three terminals at an insurance company, one of which is remotely connected, are used for staff instruction. With videophone, instructors can bring specialists of the general directorate into the classroom in the French part of Switzerland at short notice. Instruction films, retrieved from the video library, can be replayed to the students.
- Two terminals at a large chemistry plant are used to transfer commercials and archive films from the company owned audiovisual studio to the head office where the signal is inserted into the broadband local area network by means of a modulator. Thus the video signal is available throughout the entire plant and can



Fig. 6 Public Terminal

e.g. be used for presentations and education. This configuration is also used for making films. The individual steps of a production phase can be shown and discussed with the contracting department.

- Two terminals are installed at institutions for the hard-of-hearing. Motion pictures enable deaf people to make telephone calls by reading lip movements. BAS-KOM will present a high motion, high resolution picture. After this pilot trial it will be possible to tell whether such a high picture quality is essential or whether less expensive picture phone terminals using telecommunication networks with a narrower bandwidth are also adequate for the requirements of the deaf.
- Two mobile terminals are used for providing information to visitors at the Basle exhibition centre. Based on a fibre network, the terminals can be installed at various points as required for the particular event.
- A department store informs its customers about its mail order stock of fashion and textiles by means of a public terminal. The video library contents are updated regularly and the latest prices are introduced in short intervals.
- Further terminals for retrieval and consulting services are publicly accessible at banks, libraries, the Media House and at a communal administration.
- It is planned to equip a terminal with a mobile radio link for fast and easy installation in particular cases.

5 Outlook

51 Development of the networks

Various new techniques are being developed or are already introduced in view of the increasing importance of broadband communication, such as: the synchronous digital hierarchy (SDH) [9, 10], the new generation of transmission systems with bit rates in the Gbit/s range and the Asynchronous Transfer Mode (ATM) [6, 11], a cellular transmission and switching system which, in a skilled way, takes the ratio of peak to average load of data exchange (burstiness) into account and which is

likely to dominate the broadband technique in the long run.

For the intermediate future, regional networks, so called *Metropolitan Area Networks* (MAN) [12] according to the IEEE standard 802.6 are likely to be used for interconnecting local area networks.

Figure 10 shows how the evolution of the networks progresses and which services are offered at each stage. The ultimate aim is to build up an integrated optical network (or an Integrated Broadband Communications Network, IBCN) which can offer all services including the distribution of radio and TV programmes.

Quantitative and qualitative requirements of future networks [13] have been investigated and will, in addition to the general conditions of the investment behaviour of consumers, be the dominant factor for the introduction of new broadband techniques.

52 A wide field of applications

It is a fact that facial expressions and gestures are, apart from the language, important means of expression in communication. From cognitive psychology it is well known that the visual impressions pass the major part of information to the brain. Therefore it is appropriate to equip a desk with picture phone and video retrieval facilities. A wide field for applying broadband transmission techniques is opened up in the whole office domain, in

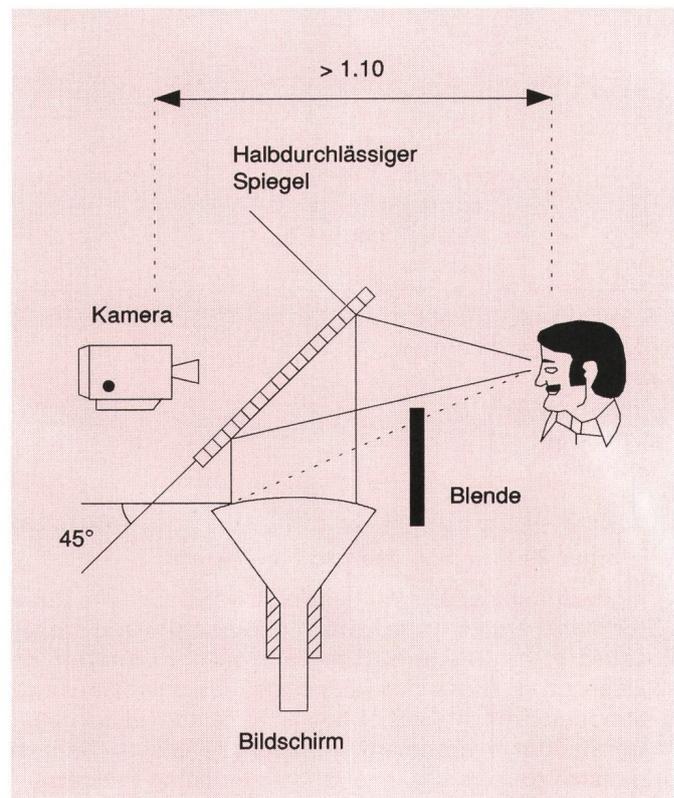


Fig. 7 Arrangement of picture phone components
Halbdurchlässiger Spiegel – Semi-transparent mirror
Kamera – Camera
Blende – Shade
Bildschirm – Screen

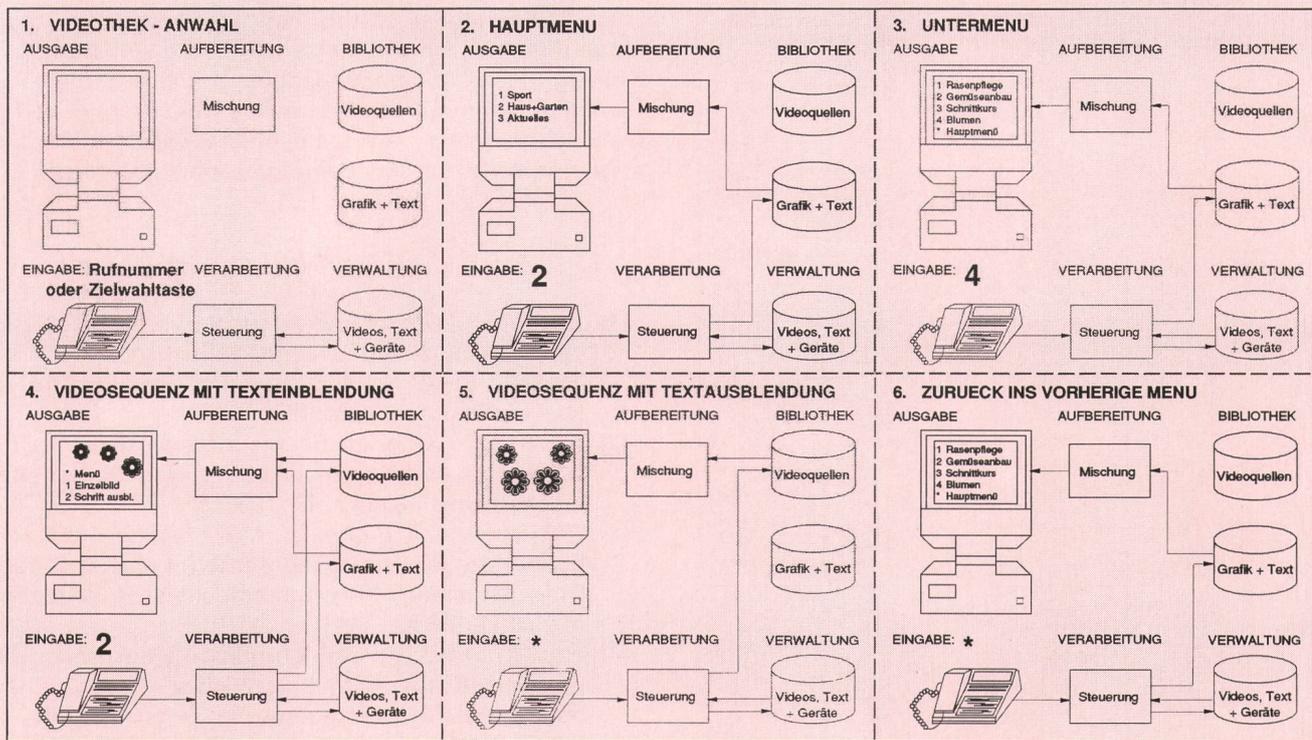


Fig. 8 Functional procedure for the video library request

Video-Anwahl – Video selection
 Ausgabe – Display
 Aufbereitung – Composition
 Bibliothek – Library
 Mischung – Mixing
 Videoquellen – Video sources
 Grafik + Text – Graphics and text
 Eingabe – Input
 Rufnummer oder Zielwahltaste – Calling number or target keys
 Verarbeitung – Processing
 Verwaltung – Administration
 Steuerung – Control
 Videos, Text und Geräte – Videos, text and equipment
 Hauptmenu – Main menu
 Sport – Sports

Haus und Garten – House and garden
 Aktuelles – News
 Untermenu – Submenu
 Rasenpflege – Lawn care
 Gemüseanbau – Vegetable gardening
 Schnittkurs – Flower arrangement course
 Blumen – Flowers
 Videosequenz mit Texteinblendung – Video sequence with text captures
 Einzelbild – Single picture
 Schrift ausblenden – Blank text
 Videosequenz mit Textausblendung – Video sequence with text blanking
 Zurück ins vorherige Menu – Back to the previous menu

particular if the terminals can share various communication services and can be used as a video display desk. For this purpose, however, clearly designed and easy to use operating systems still have to be developed whereby great importance must be devoted to the man-machine interface [3].

Research and development, but also applied sciences such as medicine provide further potential fields of application for BASKOM services, e.g. for the establishment of teleconferences or for setting up video archives.

Broadband networks allow for realizing all communications services provided by local area networks, such as data transfer for CAD, etc., over a wider area. Interactive electronic systems can be meshed by means of the broadband technique. The combination of computer, communications and video techniques enables a new way of composing information, documentation, consulting, ordering, etc. For education, the systems can be adapted to the individual learning speed of the student. Applications with details about usage are listed in [14].

A fast exchange of data and information is essential for banks and insurance companies, allowing information updating at remote branches and at the partner's premises. Broadband networks combined with intelligent multiplexers enable extremely versatile communication, e.g. for service networks of industrial companies. Systems for private subscribers connected to broadband networks have been presented in [15]. They allow interconnection of subsystems for communication, entertainment, education as well as external and home employment.

53 Further development of the videophone and video library service

An essential part of business communication in medium and large companies occurs internally. Thus it seems to be the obvious answer for the videophone service to switch broadband subscriber loops by means of a

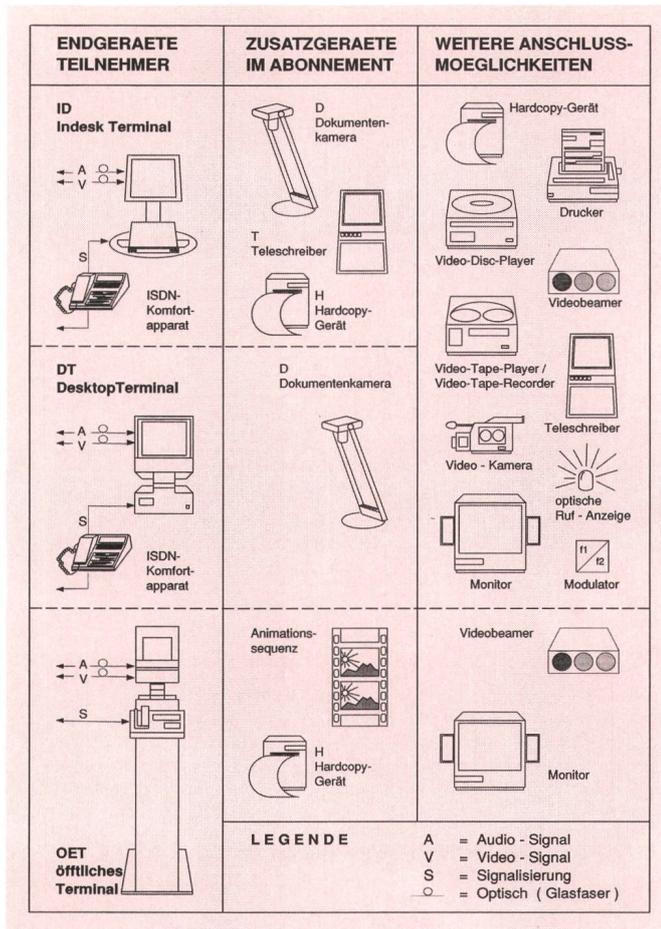


Fig. 9 BASKOM-Terminals

Endgeräte, Teilnehmer – Subscriber, Terminals
 Komfortapparat – Enhanced functions set
 Öffentliches Terminal – Public terminal
 Dokumentenkamera – Document camera
 Teleschreiber – Teletype
 Animationssequenz – Animation sequence
 Drucker – Printer
 Video-Kamera – Video camera
 optische Rufanzeige – Visual calling indication
 Signalisierung – Signalling
 optisch – optical
 Glasfaser – Optical fibre
 Legende – Capture

broadband PABX. This allows the establishment of point-to-multipoint connections. Several partners can view the information simultaneously on their screen («Split screen» mode, partitioned screen content). Special consideration must be given to dialling and set-up procedures and to the display of the state of connection.

With motion pictures, videotex can be extended to a video library service [16]. Eventually it is planned to provide service with broadband networks for private subscribers as well. Interactivity is then guaranteed for every household and can e.g. be used for teleshopping.

6 Final remarks

It is hardly predictable how fast and to which extent the broadband technique is likely to establish itself. Not only purely economical, but also technical, organisational

and psychological factors can be the basis for a forecast. The potential of this new communication technique does not remain exclusively in the substitution of existing means of communication, but also in the satisfaction of communication demands which cannot be fulfilled without this new technique. BASKOM is a first step on the way to new communication structures.

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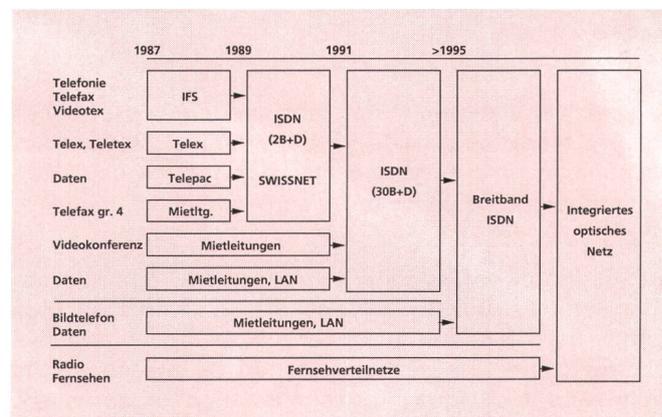


Fig. 10 Development of the networks

Mietleitung – Rented line
 Integriertes optisches Netz – Integrated optical network
 Radio, Fernsehen – Radio broadcast, Television
 Bildtelefon, Daten – Picture phone, Data

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Zusammenfassung

BASKOM – Ein Pilotnetz der PTT für Breitbandkommunikation

BASKOM, ein leitungsvermittelttes, anwendungsorientiertes 140-Mbit/s-Versuchsnetz mit 30 Teilnehmeranschlüssen wurde Anfang 1991 in Betrieb genommen. Es bietet zwei Dienste an: Videophonie (Bildtelefon in Farbfernsehqualität) und Videothek (Filmabruf aus zentralem Bewegtbildspeicher).

Résumé

BASKOM – un réseau pilote des PTT pour la communication à large bande

Le réseau expérimental BASKOM à 140 Mbit/s et 30 raccordements d'abonnés – un système à commutation de circuits orienté applications – a été mis en service au début de 1991. Il offre deux services: la visiophonie (téléphone avec écran en qualité TV) et le service de vidéothèque (appel de films d'une mémoire d'images animées).

Riassunto

BASKOM – una rete pilota delle PTT per la comunicazione a larga banda

All'inizio del 1991 è stata messa in esercizio la rete di prova a 140 Mbit/s BASKOM, a commutazione di circuito, destinata a diverse applicazioni e dotata di 30 collegamenti per utenti. Questa rete offre due servizi: la videofonia (videotelefono con qualità della televisione a colori) e la videoteca (richiesta di film da una banca centrale di immagini in movimento).

Summary

BASKOM – a Pilot Network of Swiss PTT for Broadband Communications

BASKOM, a circuit switched experimental network is centered on practical applications at 140 Mbit/s, has 30 broadband subscriber lines and is operational since the beginning of 1991. Two services are offered: Videophone (in colour TV quality) and video library (request call from central movie bank).

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