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In the context of the RACE programme (Research and Development in Advanced Communications Technologies in Europe) the results of a market research on business broadband services led by the Commission of the European Communities and ETCO are presented, covering the EEC and EFTA countries.

Three possible scenarios for the evolution of broadband telecommunications services are analyzed.

For each scenario the forecasts in terms of users in 1996 are presented for the following services : videoconference, videotelephony, high speed data transmission, high speed facsimile, TV and high quality TV transportation, high quality sound transportation.

After the completion of the definition phase, the European Commission's RACE main programme was adopted in December 1987 and subsequently, as a result of a first call for proposals, about 50 projects for a global 3500 man years effort were signed.

Within the European Community 11 Telecommunications Administrations, more than 40 universities and Research Centers and over 110 companies were involved in RACE consortia.

The RACE programme is split into three main parts : strategy, technologies and applications of IBC (Integrated Broadband Communications).

The work already engaged in part I concerns a consensus of strategy on the evolution towards IBC. The 70 % of the Commission contribution concerned the R&D on key technologies for the most economic development of IBC equipments and terminals.

The application part of the RACE programme regarding functional integration and investigation of the characteristics of IBC networks and services was the main focus of the second call for proposals in the second half of 1988.

As a result of this call the number of retained projects allowed to double the RACE projects (around 100 globally).

The majority of the new projects started at the beginning of 1989 are application pilots. In the application projects all the industrial and service sectors are covered: manufacturing, retail & distribution, banking and insurances, publishing and entertainment, healthcare and services for people with special needs.

The Telecommunications Operators are deeply involved in the development of all the projects and they presented also expression of interest in joining a proposal for a European Broadband Infrastructure Trial (EBIT), able to support all the broadband applications of the RACE projects. The Memorandum of Understanding for EBIT was signed the

6th of April 1989 in London by the Telecommunications Administrations of Belgium, Denmark, France, Federal Republic of Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland and United Kingdom. They propose to start using both switched terrestrial and satellite links operated at 2Mbit/s and in longer term to reach a bit rate of 140Mbit/s.

With reference to the OSI layer architecture it has been proposed a service project for EBIT, covering the layers from 4 to 6, recognizing that the Telecommunications Operators provide the capabilities up to the layer 3 (transport) while the pilots are using mainly the layer 7(application). In this service project both Telecoms Operators and service providers as well as leading edge end users are involved.

Telecommunications is currently dominated by telephone and simple data transmission services. Only 4 % of the current telecommunications revenue is derived from the more complex and value added services.

By the year 2000, a much greater proportion of telecommunications revenues will derive from the provision of value added services.

However, this evolution has been driven, to date, by the emergence of services defined by individual providers rather than by the rational organization of a user driven market.

These trends have led to a European service domain characterised by its heterogeneity. Different types of services are offered by different providers using different techniques and implemented on different infrastructures.

Thus, a single user requiring a combination of services offered by different providers is unable to purchase an integrated solution to his service requirements. This problem remains the major constraint preventing the development of services on a transnational scale. The development of integrated services on a transnational scale has the potential to strengthen the whole of the industrial and business sector of the European economy. The RACE programme has, already in this early stage, demonstrated the ability to develop common functional specifications and common practices, and contributes to the Standards bodies in a coordinated approach.

A special project for consensus management has been established; in the project participate both the majority of network operators and equipment manufacturers. In this context a major study on achieving an early penetration of Broadband communications in the business sector has been completed by the European Commission and the European Telecommunications Consultancy organization group(ETCO). The study took place from June 86 to July 87, covering the 12 member states of the EEC as well as Austria, Switzerland, Finland, Norway and Sweden, with the main objective to conduct market research on demand and traffic development of new broadband services for business use (eg video conference, videophony, high-speed data, high-speed facsimile,

Table 1 : RACE - Application Pilots Projects

DIMUN - Distributed International Manufacturing Using Existing and Developing Public Networks
MULTIMED - Demonstration of Functional Service Integration in Support of Professional User Group
APPSN - Application Pilot for People with Special Needs
MERCHANT - Methods in Electronic Retail Cash Handling using advanced Network Technologies
RESAM - Remote Expert Support for Aircraft Maintenance
DIVIDEND
DIDAMES - Distributed Industrial Design and Manufacturing of Electronic Subassemblies
DIMPE - Distributed Integrated Multimedia Publishing Environment
MARIN ABC
Mobile Applications Pilot Schemes
Testing Pay-per-View in Europe
GEOTEL
ECHO electronic Case handling in Offices
TELEPUBLISHING
European Museums Network
CAR CAD/CAM for Automotive Industry in RACE
HDTV Experimental Usage
TELEMED

high-quality sound transportation and TV and high-quality TV transportation), including a study on the sensitivity of the market to the terminal costs and to the tariffs.

This is the first factual survey on the demand for broadband business communications carried out in the whole of the Community. The study differs from previous analyses with similar objectives not only in terms of size but also due to its specific methodology for the collection and assessment of data. The far-reaching study horizon of 10 years, users lack of experience with the new services - some of which are not even implemented on a trial basis - and the resulting lack of a historical background meant that neither direct questioning of potential customers nor extrapolation of past trends was possible. Consequently, a new approach had to be adopted. The study was thus based on the following major building blocks :

- A survey of large establishments' communication needs by means of 4186 interviews with more than 100 questions about their needs, equipment and short-term (3 years) plans related to telephony, facsimile, mail, meetings, EDP, vidotex and documentation.

- An analysis of the long-term evolution of these needs by means of a qualitative survey, consisting primarily of in-depth interviews with experts from different fields (telecommunication and television operators, manufacturers, etc.) and potential users and a workshop on the role companies give to visual images.

- An analysis of the developments in broadband telecommunications and television and the plans of network operators based on these operator's answers to a questionnaire, on the work of CEPT and GAP, and previous ETCO studies, and on discussions with telecommunications and television experts.

- The construction of possible scenarios for the development of costs for broadband telecommunication services and equipment by means of the aforementioned information sources.

- An exhaustive collection of sociodemographic data related in particular to large establishment from national statistics

institutes.

Within the framework of three contrasting scenarios for the evolution of services and equipment costs, and using data from the surveys, three models for the substitution of traditional communication media by new broadband telecommunication services have been constructed, including the additional communication volumes caused by the very existence of such services.

The parameters describing these scenarios together with the results of the sociodemographic analysis are stored in a computerized data base. This enables the calculation of the demand and traffic on different levels of regionalization to be made.

Research focused on large companies, which by 1996, will have an adequate telecommunications budget, self-evident needs for communications between their various establishments, and applications requiring high-speed services. In the course of the study, it was confirmed that through this approach the primary market was covered.

SURVEY RESULTS - The Universe of Establishment - The relevant socio-demographic data for the universe of establishments in 17 European countries (12 in the EEC plus 5 in the European Free Trade Association) were obtained from a number of statistical sources. These figures were broken down according to sectors (primary, industry and construction, services and administration) and the number of employees was separated into 16 categories. The figures were also broken down by regional distribution. The data were stored in the computerized data base for further calculation.

Establishment Survey - The purpose of the poll conducted among 4186 European establishments in 17 European countries was to obtain a description of potential customers by the horizon of the study (1996), their current communication needs, and their short- and medium-term plans. The necessary limitation on the number of establishments to be questioned led to the focus of the inquiry on establishments having more than 50 employees. The finding indeed confirmed that this criterion was a correct threshold since the volume of communications needs is generally linked to the size of the establishments and is fairly low for the smallest establishments in the sample.

According to this approach the results of the establishment survey relate to a universe of 307.000 units in the 17 countries, with 80 per cent having between 50 and 200 employees and 3 per cent having more than 1000.

Using specific questionnaires with more than 100 questions for the different sectors of activities, establishments were asked about their present communication needs and procedures and about their short- and medium-term plans in the fields of telephony, mail, meetings, data transmission and documentation. The results were then analysed and presented in a final report by a large number of tables, charts and figures, which formed the basis for the definition of the forecast models.

Qualitative Surveys - In parallel with the quantitative investigations in the framework of the establishments survey, qualitative investigations were carried out in order to identify: possible applications; the role of visual images in the companies; the specific interests in different sectors for the development of broadband communications; development of costs and tariffs; future plans of PTTS; demand sensitivity to costs and tariffs.

Taking into account the results of these investigations, three scenarios -pessimistic, most probable and optimistic- were developed for the possible evolution of broadband telecommunications services. These are shown in **Table 2**.

Table 2 : Possible scenarios for the evolution of broadband Telecommunications services.

The pessimistic Scenario

- Nothing special is done to develop broadband services demand
- High costs, low demand, few or no economies of scale
- Introduction of 565-Mbps systems from 1991 onwards
- Late development in the field of television (digital CODECs and optical-fibre local area networks)
- Individual connections to professional subscribers, cost of the local section of the broadband line = 10 x the local section of telephone lines
- Broadband service tariffs (over the whole period 1987-1996) :
 Rental charge = 20 x the normal telephone rate
 Calls charge = 10 x the cost of telephone conversations

The most probable Scenario

- Active marketing for the development of broadband services
- Costs already lower, professional demand (by the horizon year 1996), introduction of integrated workstations in large establishments
- Introduction of 565-Mbps systems from 1991 onwards and 2-Gbps systems from 1996
- Startup, from 1992 onwards, of the installation of optical-fibre cable television networks
- Development of a digital CODEC around 1990
- Economies of scale in the local network :
 Cost of the local broadband section = 4 x the cost of the local section of the telephone line
- Broadband service tariffs :
 Rental charge = 8 x telephone rental charge
 Call charge = 4 x telephone call

The optimistic (or Substitution) Scenario

- Supply-oriented approach for the development of broadband services
- Low costs, very high demand : substitution of ordinary telephone by videophones (at the 1996 horizon year, start of substitution among small-size professional establishments)
- Installation of 2-Gbps systems from 1991 and technological advance (implementation of the RACE programme) beyond these dates
- Speedy installation of numerous optical-fibre television distribution networks and rapid spread of high-definition video recorders and receivers using digital TV CODECs
- Substitution of twisted copper pairs by optical fibres in the local networks:
 Cost of the local broadband section little different from the cost of the local section of the telephone line
- Broadband service tariffs :
 Rental charge = 8 x telephone rental charge (1987-1991)
 4 x telephone rental charge (1992-1996)
 Call charge = 4 x telephone call (1987-1991)
 2 x telephone call (1992-1996)

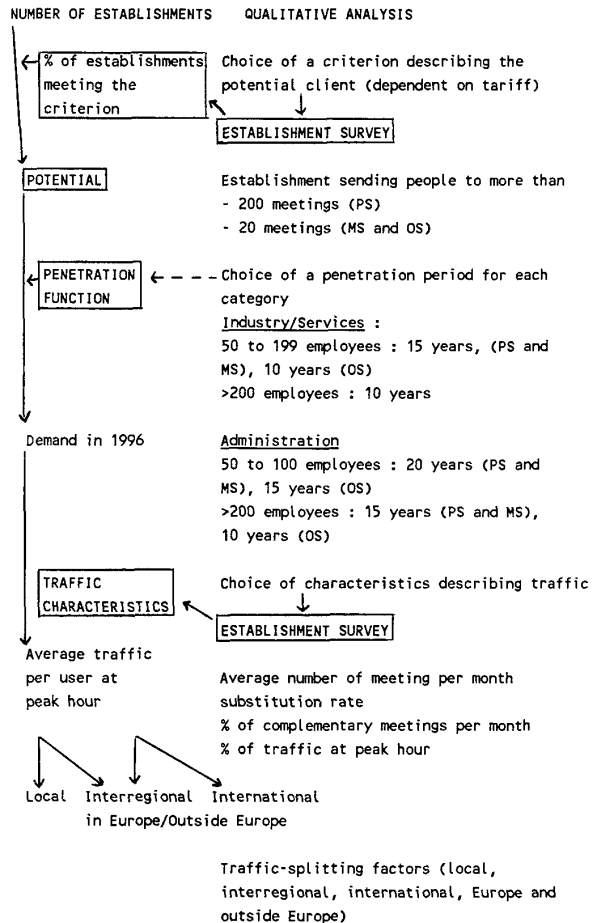
QUALITATIVE AND QUANTITATIVE RESULTS - The analysis of the information provided by the different surveys enabled market segments to be defined among establishments with more than 50 employees, depending on the degree of interest that they expressed, and to deduce from this a marketing strategy for an early offering of the various broadband services.

Mathematical models were drawn for the development of services demand for each scenario. With the help of the computerized data base, these models were transformed into

concrete figure for the number of users and the equivalent traffic for each service at the different levels of regionalization.

Videoconferencing - The methodology for the calculation of the demand and traffic for videoconferencing is given in **Figure 1**. Needs in this area are great since 75,000 European establishments with more than 50 employees send their personnel to more than 20 external meetings per month and have approximately the same number of internal meetings. The first interested enterprises belong to the research sector and to the large multinational groups of heavy industry (oil, chemicals, siderurgy, metallurgy, etc) and light industry (electronics, components, EDP manufacturers, car manufacturers, avionics, etc). In **Figure 2** a comparison of the results in terms of number of users in 1996 for the three scenarios are presented, splitted by country.

Figure 1 : Calculation of demand and traffic for videoconference in 1996.



VIDEOCONFERENCE - Users 1996

	Pessimistic scenario	Medium scenario	Optimistic scenario
BELGIUM	140	1.009	1.558
DENMARK	136	983	1.588
FRANCE	955	6.896	10.784
GERMANY	1.601	11.567	16.849
GREECE	46	335	457
IRELAND	39	287	383
ITALY	648	4.683	7.641
LUXEMBOURG	7	52	87
NETHERLANDS	219	1.586	2.268
PORTUGAL	164	1.187	1.784
SPAIN	453	3.270	4.881
UNITED KINGDOM	1.594	11.518	17.084
TOTAL EEC	6.002	43.373	65.364
AUSTRIA	122	881	1.266
FINLAND	115	856	1.107
NORWAY	136	927	1.340
SWEDEN	192	1.653	2.591
SWITZERLAND	135	975	1.337
TOTAL EEC + EFTA	6.702	48.865	73.005

(Fig 2)

Videotelephony - A workshop organized with potential users on the role of visual images in the company showed two views of image in communication between persons :

- viewing the correspondent improves the quality of contact.
To quote one of the participants: "Image is something natural."

- Image can also be utilized as a support in a complex discussion. Examples proposed were complex plans such as electronic schemes, coloured mock-ups or pictures.

What is required is image with colour, large format, good resolution, but generally no very fast movement. This leads to the idea of an integrated workstation including data terminal, videophone and microcomputer functions that will be a tool for medium- and high-level executives and not a prestigious game for directors. The videophone should not be a gadget used artificially, but the fruit of a trend in ways of working and the convergence of the fields of data processing, television, and telecommunications. Regarding the sensitivity of the potential users to the costs, it is difficult at this time to draw very precise conclusions for a non-existent service. In terms of user acceptance, the workshops revealed the following observations on pricing :

- In the case of a plain videophone, a price of 1.5 to 2 times that of a conventional telephone call was found to be acceptable, with a videophone terminal costing about 1.5 times more than the most sophisticated telephone terminal (1400 ECUs).

- In the case of videophony with the possibility of complex document transfer, the price of the call was found to be acceptable at up to 10 times that of a conventional telephone

call (apparently far too expensive), with a price of between 4200 and 5600 ECUs for a terminal including microcomputer functions.

From the survey's results, it was estimated that around 70,000 establishments having more than 50 employees would be potential candidates for videotelephony in 1996. The establishments have already reached a high degree of office automation and they work in industrial sectors requiring high-level technical knowledge in a competitive environment.

High-Speed Data Transmission - The survey of establishments with more than 50 employees showed that 81 per cent had at least one computer, that 10 per cent had CAD/CAM terminals and that 20 per cent intended to use moving images in an interactive mode within 3 years. Finally, it was established that a maximum of 81,000 establishments could be interested in 1996 by the broadband data transmission service. These companies belong to sectors such as research, EDP, software and service, heavy and light industries (design, office, factories), engineering, banking and finance (increasing needs of working in an international environment), etc.

High-Speed Facsimile - High-speed facsimile on the broadband network will probably not be commercially available in the near future, at least not until several years after the introduction of Group 4 facsimile. When Group 4 facsimile becomes available it will enable very large documents to be transmitted in black and white. High-speed facsimile will be used only by companies with a high enough volume of colour or oversize documents (including colour photographs, for example) to be transmitted. Approximately 43,000 establishments have 10 per cent of their mail oversize. While 58,000 establishments (21 per cent) send urgent colour mail, only half of them have a sufficient mail volume to justify the use of a high-speed facsimile. Specific sectors such as press and publishing and mail-order companies are interested in high-speed facsimile, but establishments in heavy industry and transport services having high colour mail volume also are interested.

TV and High-Quality TV Transmission - A limited number of television professionals need broadband links to acquire the images required for programme preparation; for example, 1128 cable network groupings broadcast their own programmes, and 185 local and 28 national channels will exist in 1996. Transportation of television channels for broadcasting was excluded from the scope of the work. On the other hand, companies use video transmission for prestigious events (the chairman's annual speech, semi-annual presentation of new models, etc) to transmit images on a large screen to several establishments where questions can be asked using a voice-return channel.

High-Quality Sound Transportation - This service will be used by cable networks to broadcast concerts. This will result in only a very small amount of traffic at the network peak hour.

CONCLUSION AND RECOMMENDATIONS - From the results obtained, ETCO drew several conclusions. Firstly, a potential professional demand for broadband telecommunications services exists under tariff conditions that enable network operators to achieve financial stability in the long term after a demand-stimulation phase. Secondly, potential demand for broadband telecommunications services exists because the services will enable companies under these tariff conditions to improve productivity. Finally, given the

high costs for broadband services during the launching stage and the inherent constraints in a new network implementation, large companies having several big establishments constitute the mainspring market segment:

-big establishments (there are 307,000 in Europe with more than 50 employees) are likely to be the source of nearly 90 per cent of the network operators' incomes coming from the broadband telecommunications services during their startup phase;

- in table 3 the estimated number of users in 1996 are shown for the three different scenarios;

- if we consider the medium scenario, as shown in table 4, one out of five of these large establishments could apply for a broadband connection by 1996.

Table 3 : Estimated number of users in 1996 (EEC + EFTA)

	Pessimistic scenario	Medium scenario	Optimistic scenario
VIDEO CONFERENCE	6.700	48.700	73.000
VIDEOPHONY	0	63.100	863.000(1)
HIGH SPEED DATA	21.600	51.200	80.800
HIGH SPEED FACSIMILE	3.800	9.800	407.500(2)
HIGH QUALITY SOUND (3)	1.100	1.100	1.100
HIGH QUALITY TV	5.500	10.400	19.200

(1) Comprising establishments with fewer than 50 employees and households.

(2) In the case of optimistic scenario, a substitution phenomenon begin to take place between the Group IV facsimile and the high speed facsimile.

(3) This service is not very sensitive to tariff variation.

Table 4 : Estimated number of establishments with more than 50 employees applying for a broadband connection in 1996.

(Most Probable Scenario)

	Number of Establishments	Perce- ntage
VIDEOCONFERENCE	48.700	16 %
VIDEOPHONY	63.100	21 %
HIGH-SPEED DATA	51.200	17 %
HIGH-SPEED COLOUR FACSIMILE	9.800	3 %
HIGH-QUALITY SOUND	1.100	-
TV TRANSPORTATION	10.400	3 %

Note : The second column represents the percentage of establishments applying a broadband connection among all the establishments having more than 50 employees.

The breakdown of the demand is approximately :

- 70 % for France, FR Germany, Italy, UK
- 20 % for the 8 other EC countries
- 10 % for the 5 EFTA countries

ETCO also made several recommendations. According to the figures given above, ETCO reported that a significant number of establishments with more than 50 employees (most probable scenario) could apply for a broadband connection in 1996 if an active marketing approach is adopted. If nothing special is done to develop broadband services demand (pessimistic scenario), only 6700 establishments will apply for videoconference connections in 1996 against 48,700 in the most probable scenario. Also 21,600 establishments will apply for a high-speed data link as opposed to 51,200 in the most probable scenario, and individual videotelephony and high-speed facsimile are unlikely to take off.

The launching strategy for broadband services must take into account the specific needs of the large companies, of the first interested clients, and particularly, the necessity to offer these services on an international basis from the start.

This demand will not, however, be realized unless an active marketing policy is implemented by telecommunications operators in order to stimulate the market during the startup phase of these services and to create the market impetus required to install a European broadband telecommunications network.

As for all new products, market tests co-ordinated at the European level must be performed, along with the market and services evaluation field trial for professional business communications. The results of these tests will provide better knowledge of demand characteristics and will help define service attributes. They will enable demand modelling to be further refined.

The parallel effort of RACE in this domain, developed as usual with a multilateral and multinational collaboration, will guarantee the coverage of all Europe (not only CEC, but also EFTA countries) with an integrated and flexible telecommunication network, allowing the diffusion of complex services.

Thus, large companies have a growing need for broadband telecommunications services, especially with regard to videoconferencing, data transmission, and videotelephony. Nonetheless, the other services should not be neglected since they enable companies working in specific sectors, such as the press, publishing, correspondence sales and television, to significantly increase productivity.