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COMMUNICATION FROM THE COMMISSION

TO

THE EUROPEAN PARLIAMENT AND THE COUNCIL

on

the Final Report concerning preparatory actions in the field of Trans-European Networks : Integrated Broadband Communications

launched in 1993 within the framework of the Communication from the Commission on the subject, dated July 22nd, 1993

(Presented by the Commission in accordance with its Communication to the European Parliament and the Council on preparatory actions in the field of TEN-IBC, (COM(93) 372 final, 22.7.1993, p. 11)

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1. Executive Summary

On 22 July, 1993, the European Commission made a Communication[1] to the European Parliament and the Council on the Preparatory Actions in the field of Trans-European Networks: Integrated Broadband Communications (TEN-IBC). In this communication, the Commission identified the need for a preparatory action to help developing a framework of action in broadband communications.

This Action has developed in three phases between the end of 1993 and early 1997. Fourteen projects developed specifications for broadband trials that led to the actual implementation of eleven trials. Nine trials were later extended in scope and duration.

The projects covered a wide but not exhaustive range of sectors. They include tourism and travel retailing, medicine, engineering, design, publishing, cultural archives and citizen communications and excluded banking, finance and insurance, manufacturing, the liberal professions and public administrations. The strong body of common findings, developed by different teams working in separate industries is likely to apply to a wide range of environments. It should be considered alongside the results of other EC initiatives in the sectors which TEN-IBC initiative has not addressed.

Technical issues uncovered by the TEN-IBC projects are now close to resolution, and most of the remaining issues require some support and coordination actions. These are related to finding solutions for the technical and legal problems involved in copyright and handling of confidential information, to promote the user awareness on the role and the value of information and communication technologies, and to increase the critical mass on information content.

The provision of broadband communications, at affordable prices can be a viable business in tourism and travel, high performance computing services, design, engineering, and in publishing/news information. As the Commission stated in its Communication[2] on "Services of General Interest in Europe", universal services are a dynamic concept where broadband services should gradually be included for reaping the benefits of the technology introduction. The introduction of these services must be regarded as an opportunity for job creation.

The experience and knowledge acquired during the Preparatory Action will allow actors to develop business plans on broadband services, and to implement them in a cost-effective manner. Some participants have already followed that path. Having heavily participated in the experimentation of a new broadband technology named ATM (Asynchronous Transfer

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[1] COM(93) 372 Final, 22 July 1993.

[2] COM(96) 443 Final, 11 September 1996.

Mode, a broadband networking protocol), they will in particular benefit from its deployment by the network operators in the early part of 1998.

Projects in the ACTS Programme (Advanced Communications Technologies & Services) are addressing some of the remaining technical deficiencies uncovered by the Preparatory Action. The Commission will soon issue the TEN-Telecom work programme where projects of common interest are sought in the "Development and Interoperation of Broadband Networks" area, a topic of direct concern for actors having participated in the TEN-IBC initiative.

2. TEN-IBC Preparatory Action

2.1. The Rationale for Preparatory Action

Advanced communications are of increased importance for the well-being of European national economies and of the Community as a whole. Much of national wealth is taken up by investment in telecommunications, and services so enabled have an ever-larger impact on other economic sectors and on quality of life.

The Maastricht Treaty, Title XII Article 129c, calls for the establishment of Trans-European Networks. This implies the preparation of guidelines for the introduction of Broadband Networks in the Community. The Treaty foresees actions favouring the interconnection and interoperation of the national networks and the access to these networks, taking into account the necessity to link the peripheral regions with the central regions of the Community.

Evidence suggests that advanced communications applications are becoming increasingly multi-media, requiring an increased bandwidth and higher degree of service integration. A thorough understanding of broadband applications and services was required for deploying the advanced communications component of the Trans-European Networks.

2.2. The Objectives

On 22 July, 1993, the European Commission made a Communication to the European Parliament and the Council on the Preparatory Actions in the field of Trans-European Networks: Integrated Broadband Communications (TEN-IBC).

In this Communication, the Commission identified as specific objectives for the preparatory action to help developing a framework of action for sector actors involved in broadband communications. The intent was for sector actors to participate in the development of consensus guidelines on techno-economic feasibility of broadband applications.

2.3. The Implementation

The TEN-IBC Preparatory Action has been implemented in three phases:

Phase I: Development of specifications for Integrated broadband Communications Trials. On 24 July, 1993, the Commission issued a call for proposal[3] for sector actors to participate in the Preparatory Action. In December 1993, the European Commission awarded 14 contracts for projects. Projects committed to help, in the context of broadband trials, identifying gaps and roadblocks for broadband communications deployment in Europe. In this phase, the projects developed specifications for the

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[3] OJ N° C200, 24.7.1993, p. 22.

broadband trials. For this purpose, they assembled Common Interest Groups of potential users, and gathered technology building blocks suitable for conducting broadband trials of high interest for their intended users.

Phase II: Implementation of a limited number of broadband trials, based on these specifications. In July 1994, the Commission awarded contract extension for conducting eleven trials based on the specifications previously established. The trials started during the last quarter of the year 1994 and extended until May 1995.

During the first quarter of the year 1995, projects engaged in a series of workshop for gathering a common understanding on broadband communications technology, standards, and market deployment. In addition, a Strategic Audit was carried out in July 1995 by three outside experts for ensuring that further project extensions would properly address roadblocks to broadband communications.

Phase III: Broadening and enlargement of the trials. Following the Strategic Audit and the workshops findings, projects adjusted their plans for covering the shortcomings identified and obtaining a wider understanding of broadband communications in Europe. In September 1995, the Commission awarded extension to nine projects. These projects have ended between December 1996 and April 1997.

The TEN-IBC Preparatory Action was closed by a Final Strategic Audit performed in June 1997.

The total Community contribution to the TEN-IBC Preparatory Action has been 1,856,918 Ecus for phase I, 7,878,138 Ecus for phase II, 8,277,450 Ecus for phase III, for a total of 18,012,506 Ecus.

3. Integrating the Preparatory Action in a Broader Context

The TEN-IBC Projects participated in a Concertation process in conjunction with projects from the ACTS (Advanced Communications Technologies and Services) Programme. The Concertation was bringing together researchers working in ACTS and people working in TEN-IBC to profit from each others' knowledge and experience. The participants were able to coordinate and encourage the convergence of ongoing work on the most important issues, and to build a broadly based consensus for realizing advanced communications in Europe. Concertation was a key ingredient to ensure that the value of the TEN-IBC preparatory action as a whole exceeded that of the individual projects taken in isolation.

The Concertation Process was structured around two sets of activities running concurrently, namely Domain and Chain activities. The domains were technology based and provided a forum for progress review by peers and cooperation between projects working on similar issues.

The Chains were object driven and provided the potential for adding the greatest value to individual Projects. Chains cut across boundaries of technical domains, and provided a

continuous delivery path, from enabling technology to end application and social impact and vice versa. A major output of the chains was to participate to the development of the ACTS Programme Guidelines that are documents of strategic or technical nature, with recommendations concerning to a variable degree the practical implementation and use of telecommunications in Europe.

The TEN-IBC projects results have also been reflected in the proposal that led to the adoption on 17 June 1997 of a European Parliament and Council decision concerning a series of guidelines for the Trans-European Telecommunications Networks[4] .

This decision places the Community action in the field of Trans-European Networks in the more general context of the Information Society. It establishes priorities and identifies projects of common interest for each of the three levels belonging to the Trans-European Networks infrastructure model, that are the applications level, the generic services level, and the network level.

The identified projects of common interest will be further specified by a work programme adopted by the Commission, who will then regularly issue calls for proposals inviting sector actors to submit individual proposals in the concerned fields.

4. Evaluation and Auditing of the TEN-IBC

During the Preparatory Action, a number of evaluations and audits took place. Three technical audits were performed for each project and two Strategic Audits of the Preparatory Action as a whole.

4.1. Evaluations

For each phase, an evaluation of proposals has been performed by outside experts selected on a list provided by the RACE Management Committee (RMC), and later by the ACTS Management Committee (AMC).

- The European Commission issued the Call for Proposals in July 1993. A total of 53 proposals was received. Fourteen proposals were retained by the evaluators[5]. Subsequent negotiations led to the same number of projects.
- Existing projects proposed an extension in March 1994. Thirteen proposals were received. Eleven proposals were retained by the evaluators[6]. Subsequent negotiations led to the same number of projects' extensions.

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[4] OJ N° L183, 11.7.1997, p.12.

[5] Commission decision of 19.11.1993 (written procedure E/1951/93).

[6] Commission decision of 19.7.1994 (written procedure E/1212/94).

- Existing projects proposed a further extension in April 1995: Ten proposals were received. Nine proposals were retained by the evaluators[7] . Subsequent negotiations led to the same number of projects' extensions.

The RMC, and later the AMC have received the evaluation reports.

4.2. Technical Audits

The TEN-IBC projects were assessed by independent Auditors selected with the same procedure as the one used for evaluators' selection. The Auditors verified the projects technical quality and contribution to the action objectives. The Technical Audits included the following major elements:

- Projects provided a "self-evaluation" by reviewing their work in all its essential aspects, and documented the results of this evaluation in the project review report.
- Project review reports were evaluated by the Auditors. Following the evaluation of the reports the projects were attending a hearing under the chairmanship of the Commission. The projects had the opportunity to highlight achievements and to outline their future plans to disseminate their results to potential users and how to involve these potential users. Following the presentations, the Auditors had the opportunity to question the projects for completing the picture given by the projects' review reports and presentations.
- The panel of Auditors provided its conclusions and recommendations to the Commission and documented them in the Audit Panel Reports.
- The audit results are classified "Confidential"; their use was restricted to the RMC and AMC and the Commission staff directly concerned.

Technical Audit took place as follows:

- March 1995 for TEN-IBC projects only.
- March 1996 in conjunction with the Audit of the ACTS Projects.
- January 1997 in conjunction with the Audit of the ACTS Projects

4.3. Strategic Audits

Programmes and initiatives launched by the Commission were audited at a strategic level. In this case the intent is to ensure that the programme or the initiative:

- has achieved its stated purpose and objectives, and
- has been conducted in the most efficient manner, as compared to the conditions and constraints imposed by its mandate and the outside environment.

In addition, the strategic audit was conducted with the intent of making recommendations on the possible corrective actions, in case deficiencies or gaps are identified, and on further

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[7] Commission decision of 14.9.1995 (written procedure E/1593/95).

actions, in case the environment outside the initiative warranted to leverage the achieved results.

Strategic Audits took place as follows:

- July 1995 for reviewing the achievements and the need for possible extension.
- June 1997 for reviewing the pertinence of the work performed for fulfilling the objectives of the TEN-IBC Preparatory Action.

5. The TEN-IBC Findings and Achievements

The Final Strategic Audit found that the TEN-IBC Preparatory Action continued to improve the visibility of IBC and provided valuable contributions to the methodology for the implementation of Information Society Applications. Placing trials in a market environment has resulted in two projects establishing full commercial services as a valuable outcome. Despite delays and unexpected problems in establishing end-to-end international connections, projects overcame these difficulties and did carry out their trials; indeed the projects allowed realistic experiment of the ATM network.

5.1. Key Findings

- The consolidation work performed by the Preparatory Action provided a clear, overall view of the achievements of all projects with a welcome emphasis on presenting business cases on a project by project basis and valuable information on the cost benefit implications of IBC. Some business cases, such as in travel industry, were directly used by actors for analysing their market requirements and technology needs
- Setting up commercial services was a direct outcome of at least two projects; however in other projects there was still evidence of difficulties in transposing the results into commercial products and services;
- The evaluation, testing and real exercising of the experimental ATM network offered by 18 network operators was a major result of the TEN-IBC Preparatory Action;
- Even if the timetable for the TEN-IBC Preparatory Action was over-optimistic and faced delays due to the very late start of the ATM network, availability improved considerably from during the projects life span, allowing them to overcome the difficulties and carried out trials, sometimes in a more "laboratory" type environment than they would have expected;
- A number of factors still inhibit the appeal of IBC: high and inflexible tariffs reflecting in part subcritical user levels; appropriate or specific content not always available, acceptable payment structures for data base information, security of data transfer and payments, copyright protection and other legal issues; these factors result in the users inability to fully appreciate the added value of broadband communications in social, education, entertainment and business contexts.
- There are still many unresolved issues regarding compatibility and interoperability of software applications which cannot be resolved by the network and which effectively block the desired user interconnection.

- Broadband applications and services still lack the simple human interface present in other telecommunication networks. Users are still baffled by the technicalities and the complexities involved and do not always perceive the benefits of advanced broadband services.

5.2. Achievements

During their operation, projects have developed a better understanding of broadband communications needs and roadblocks. They have analyzed the issues that still hamper the deployment of advanced services. Most of the technical issues are either resolved, or close to resolution. The remaining issues are non technical. One must note, for example, the legal issues related to intellectual property rights, security, confidentiality and billing, and the reengineering of activity sectors required to fully benefit from the Information Society.

The experience and knowledge acquired during this TEN-IBC Preparatory Action will allow new actors to develop business plan, and to implement them in a cost-effective manner. Some market segments are already ripe for advanced services, providing the legal issues mentioned above are addressed.

TEN-IBC Projects have also heavily participated in the testing of the experimental ATM infrastructure offered by the JAMES project. Eighteen European network operators participated in the JAMES project within the specific research programmes ACTS, Telematics, and Esprit. In this project the operators developped and implemented ATM interconnection scenarios by offering to European co-financed R&D projects the ATM services required for performing broadband trials. The TEN-IBC Projects contribution has been instrumental for ironing-out issues in ATM interoperability.

5.3. Recommendations

During the Strategic Audit, the auditors made a number of recommendations related to the support and the coordination actions to undertake for promoting the implementation of Trans-European generic services on broadband communications. These recommendation where addressed to sector actors and were based on technical considerations. These recommendations are:

- Performing conformance testing of networks, services, terminals and applications, making use of "Interoperability Labels" to be developed. Users would achieve interoperability and interconnectivity when using "Interoperability Labels" networks, services, terminals and applications;
- Finding solutions for the remaining technical problems involved in copyright and handling of confidential information;
- Devising and promoting new charging models for advanced communications, including items such as quality of service, flexible tariffs, and bandwidth on demand;
- Promoting facilitation, to help users to become more aware of the influence, the role and the value of information and communication technologies in their own activity and to bridge the gaps between applications, computers and network and to engage the user in a more creative process.

- Taking initiatives, with attractive terms and conditions, to generate start up companies in the new fields open by the introduction of advanced broadband communications;
- Assisting content provision and multimedia database browsing and access, particularly in the newer areas where available material and techniques are very scarce.

Some of these recommendations are already addressed by projects in ACTS. Other recommendations are addressed in other instances or directly by the market.

6. Conclusions : Towards Trans-European Broadband Communications

While the TEN-IBC Preparatory Action has highlighted some deficiencies in the broadband technologies and their use, it has paved the way for their deployment as broadband applications and services for what will soon become the Information Society. This evolution, from IBC (Integrated Broadband Communications) that are a technology oriented concept towards the Information Society, that is market and user oriented, must be regarded as an opportunity for job creation that should not be missed.

Among the technical issues close to resolution before a widespread use, one must note the signalling, the bandwidth on demand, copyright, confidentiality related aspects, and the easy end-to-end user set-up connections issues. There are legal and organisational issues regarding handling of confidential data, security of payments, protection of content and transmission of personal or ciphered data across Member State borders. While clearly identified by the TEN-IBC projects, addressing these issues was not in the scope of the Preparatory Action and are addressed by the sector actors

For broadband applications to become common place, they must follow the computer trail. They must cease to be thought as being of interest only for centralised facilities for large business and they should be pervasive to the desktop, as computers have done. This requires tariffs to fall and ease of use as simple as the plain old telephone. Broadband applications and services are most likely to be subject to the avalanche effect observed with fax whereby they become more attractive every time new users join in.

Following the adoption on 17 June 1997 of a European Parliament and Council Decision[8] concerning a series of guidelines for the Trans-European Telecommunications Networks, the Commission will soon issue the TEN-Telecom work programme where projects of common interest are sought in the "Development and Interoperation of Broadband Networks" area. The TEN-IBC initiative has paved the way for actors to further participate in this work programme and start deploying projects of common interest in the broadband area.

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[8] Decision of the European Parliament and the Council 1336/97/EC of 17.6.1997 (OJ n° L 183/12 of 11.7.1997).

7. References

As the TEN-IBC Preparatory Action progressed towards its objectives, the following documents have described the status at each phase and detailed the specific objectives of each project:

- TEN-IBC - Draft Guidelines: European Commission, RA933510, June 10, 1993
- TEN-IBC'94: European Commission, January 1994
- TEN-IBC'95: European Commission, RA947242, November 1994
- TEN-IBC: Findings of the TEN-IBC workshops and conference January - March 1995. European Commission, TI95/0004, March 1995
- TEN-IBC'96: European Commission, TI96/0015, June 1996
- TEN-IBC'97: European Commission, T11997/0000000006, July 1997

8. Annex I: Summary of Projects Description

All projects that have been involved in the Preparatory Action are listed in alphabetic order. Some projects participated only to Phase I or to Phase I and Phase II and did not submit requests for the next phase or were not retained by the technical evaluators for the next phase. Information provided is dated at the time the projects were active.

8.1. ARTLINE

The overall goal of the ARTLINE project was to build on an existing prototype art information platform to produce a multimedia service demonstrator operating at a national and international level, with a wide user base and to develop and promote a viable commercial service for art dissemination and marketing. The ARTLINE service was composed of networked multimedia databases containing regional information on contemporary artists and broader categories of multimedia information for publishers. The information consisted of detailed texts, high quality images, full motion video and CD quality audio representations of the complete spectrum of the many fields of artistic works carried out in the sector. The users were from a wide representative group of educators, designers and publishers.

8.2. CityTEN

The CityTEN project intended to:

- identify applications in need of Trans European Integrated Broadband Communications that offer the greatest potential benefit in the field of residential services for citizens.
- identify the evolving service infrastructures and public bearer networks (especially residential networks owned by local communities), e.g. cable networks and overlay networks.

CityTEN established a Trans-European Network of local CATV networks with Broadband Communications capabilities to allow citizens on to CATV networks to communicate by videotelephony with each others. It extended the application exposure to citizens in their own homes through re-broadcasting over local CATV networks and real-time video-conferencing between the CATV islands. Multi-site trials were performed with new applications suitable for Citizen's Networks in the education, public administrations, SME, travel, social (visual communications for the deaf) domains and supporting relationships between the citizen and administrations.

8.3. Evident

Evident aimed at specifying a trial for video-on-demand applications. Video-on-demand was considered to be one of the possible trigger applications for broadband networks. This service allows all kinds of residential and business users to view "television" at any time. This flexibility in time, in combination with an enhanced user interface (e.g. to search for a

particular desired programme) could greatly influence the way television is used in the future.

The project involved a telecommunications users association to provide information on users requirements. Other participants were a telecommunications equipment manufacturer, an established telecommunications network operator, and a consultants in telecommunication strategy and economics.

8.4. E=MC2

The overall objective of the E=MC2 project was to evaluate the impact of Europe-wide broadband network availability for research agencies and commercial users using high performance computing and networking. This community of users is now offered the possibility of a unified trans-national network using ATM that can resolve network bottlenecks. E=MC2 has exploited the opportunity for applications that demand high network performance. The project ran three categories of trials using the European ATM pilot network:

- Meteorological simulation using coupled computing of the atmospheric and oceanographic models;
- Several distributed cluster applications in engineering and databases;
- Remote execution and wide area load-balancing.

8.5. Fashion-Net/Temin

The project has implemented trials in the domain of the Industry Network and the Media Network with the following main objectives:

- To consolidate the component services to support identified usage scenarios, and to provide a system supporting a diverse range of Fashion/Textile Design tasks.
- To verify and further enhance models of the organisation impact and costs/benefits of introducing teleservices on the Fashion/Textile Design domain.
- To exploit and disseminate the results of the project through consolidation with the ACTS Chain mechanism and enlargement of the Common Interest Groups.
- To produce a Business Plan of a future commercial teleservice for Fashion/Textile Design support at the European level.

8.6. Him

The objectives of the HIM project were to validate the requirements, and to examine the potential of broadband telematics services in health-care with special attention on the needs and demands of the health-care community. It investigated the synergy with other application domains, to benefit from the use of generic services and benefit from the economies of scale, scope and integration. The HIM project also aimed at demonstrating the intrinsic need for further and stable cooperation among health care actors. The project also helped develop guidelines for health-care telematic applications. The HIM project

investigated issues concerning scalability, operational questions such as security and open systems, and performed user centred trials that demonstrate to the user community at large their potential.

8.7. Idea

The user industry addressed by the IDEA project was constituted by design centres operating in the automotive field. The need for car development lead-time reduction and the introduction of concurrent engineering methodologies had led to the necessity for a closer integration between customers and suppliers, requiring frequent exchange of information and meetings.

The IDEA project has analyzed the design cycle of a car and the impact of communications on each phase of the design activity has been focused. The project identified and specified a cooperative working application environment for helping remote co-operation among industrial designers.

The project set-up, performed and evaluated a specified trans-national trial in the normal working environment of the users represented in. In the context of emerging broadband network technologies such as ATM, the IDEA trial has assessed network services and application tools to satisfy the user requirements in the field of industrial design. In particular the specific services required in the various design phases of the car design were assessed, judged and evaluated from the quality of service, the usability, the efficiency, the effectiveness and the time and cost reduction potential points of view.

8.8. Mat

The MAT project performed ATM services trial using tourism applications developed within RACE. This is a market place application that enables points-of-offer to create multimedia product descriptions and to place these on a pan-European distributed database. Points-of-sale were able to view the product descriptions and create holiday packages. The contents of the market place are the results of individual user behavior in distributing and retrieving multimedia data in the context of marketing and selling. The use of ATM services for the transmission of multimedia demonstrated application performance in a realistic environment close to market requirements. The network consisted of TCP/IP over a hybrid network of Ethernet LANs and ATM/ISDN and Internet WANs.

The MAT Project has developed business case for the regional service providers and for the international service providers.

8.9. MBH

The project has identified the potential of a multifunctional broadband access for private users. It has developed a set of scenarios about the usage of the broadband, and identified and produced the functional requirements for the end users regarding the access technology and interfaces. It has also identified and produced the functional requirements

for the bearer network and described a potential transition from actual to future installations of communication networks.

8.10. Mediator

The objective of Mediator was to investigate new opportunities in the news and multimedia information and distribution chain by using high speed network as an integrated part of the normal working procedure.

The Mediator project performed realistic trials involving major actors in news production. The trials investigated some time-critical and communication-intensive bottlenecks and new opportunities in the news information and distribution chain. New collaboration opportunities between the actors were developed, and special attention was paid to the exploitation of information made possible by the appearance of a global digital infrastructure for media-related information. Four applications were part of the trials:

1. The News agency of the future, where the products were distributed via the WWW.
2. On-line picture library.
3. Creation of electronic ads and distribution via the WWW.
4. Creation and distribution of electronic news and magazines yia the WWW.

An essential ingredient in the working process was an integrated environment where on-line search, browsing in picture libraries, and receipt of constant news material (text and pictures) could easily be combined into an electronic document, irrespective of origin (country, required network, capacity, protocol, etc.).

8.11. Ramp

Ramp developed trial specifications for a Europe-wide distributed high performance communication platform for multimedia production with special focus on CD-I and CD-ROM producers. This comprised the set-up of application scenarios, identification of detailed business work flow and cooperation needs, and the detailed specification of the corresponding telecommunications applications. It also included the investigation of technology in usage and verifiable technological trends, for specifying necessary hard-, soft- and netware components during the elaboration of trial plans along the value-chain of media production.

Sector actors in Ramp were a digital media developers (e.g. for CD-ROM or CD-I products), their suppliers and sub-suppliers, like audio- and video studios, and software houses in the media business value chain.

8.12. Retain

The main objective of the RETAIN Project was to follow up and estimate the impact in the medical imaging field by carrying on and enlarging teleradiology trials for producing guidelines for the introduction of broadband communications in this domain. The project

consisted of validating a teleworking application between two ATM connected clinical sites (Rennes and Barcelona) and two N-ISDN connected sites (Rennes and Oldenburg).

8.13. STEN

The project has used existing applications running on ATM for:

- verifying the completeness of the scientific users requirements for broadband networks.
- implementing trials to demonstrate the approach used and to validate results.
- evaluating the behavior of protocols taking into account the high bandwidth and the quality of today's networks, mainly in interactive multimedia applications.
- integrating users in broadband networking environments for harmonising services and applications with technology developments and network evolution scenarios.

8.14. Visinet

The project has demonstrated the advantages of working collaboratively on designs by connecting virtual reality and CAD systems in different locations via advanced high-speed networks (from 2 Mbit/s ISDN to 155 Mbit/s ATM). The purpose of VISINET was to investigate the extent to which collaboration using virtual representation improves the time to market and increases overall quality and user effectiveness. The consortium consisted of industrial designers, product developers and architects. The large number of users was managed and organised on a country basis. At a later stage these development organisations have provided financial resource to support companies taking up the new technology.

Network-based virtual environments have allowed users of remote applications to obtain full interaction at a distance from advanced computing equipment.

9. Annex II: List of participants

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MAT - Multimedia Marketing Via IBC Networks

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MBH - Multifunctional Broadband at Home

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MEDIATOR -Mediated Media Network Trial

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RAMP - Rapid Multimedia Production

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RETAIN - Radiological Examination Transfer Over ATM

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STEN - Scientific Trans-European Network

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VISINET - 3-D Visualisation Over Networks

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