ITEA

Information **T**echnology for **E**uropean **A**dvancement

ITEA Full Project Proposal

This document will be treated in strict confidentiality.
It will be seen only by persons who have signed the Declaration of non-Disclosure
(see http://www.itea-office.org button "documents").

Real
Time
Internet
Platform
Architectures

ITEA COMPETENCES involved:
Complex SE, Communications,
Distributed Inf. & services

May 31, 1999

ITEA Title: Real Time Internet Platform Architectures

1. Elaborate Project description

General goals

The use of Internet is rapidly increasing in business as well as home applications. The Internet growth rate is roughly doubling in size each year. Deployment of streaming media is growing even faster, twice as fast as the Internet itself.

One can recognise not only a convergence of data, voice and broadcast networks on wired, wireless and satellite infrastructures which form a closed or an open network but also from computer, telephony and entertainment services. Moreover, the nature of data transported on the Internet will change from more or less static data (text, pictures or even some scripts) where timely delivery of information is less important or critical, to data which put heavy requirements on timely delivery, such as video and data streaming, multicasting and Voice over IP applications.

Internet protocols are going to be used by a variety of players on the market. A simple consumer oriented model could be described with the following players:

- <u>Content providers</u> (news, sports, music, broadcasters, even finance) believe streaming content (mostly audio and video) to be more attractive than static content like pictures and text. In the long term, this development implies that the Internet may evolve into another broadcast medium, complementing/challenging the established value chains of TV and radio. New kinds of operating systems, middle-ware, store and retrieve mechanisms will be needed to support these capabilities.

- <u>Internet or Intranet service providers</u> have to supply a complete set of generic services including:
  - Technical services needed to assure information transportation with an associated Quality of Service (QoS) and the access to common services such as directory, management, security (authentication and confidentiality).
  - New functionality's within the routing devices needed to guarantee an end to end provision of these services
  - Customer services including in particular:
    - Internet based telephony services with new smart features like voice servers, translators, intelligent and cost effective routing of the communication through a panel of telecommunication operators.
    - Audio and video conference systems, and collaborative working environments,
    - Personal toolkit environment.

- <u>End-users</u> with their appropriate terminals such as personal computers, TV, radio sets, handsets and appliances will access to these services through new kinds of access points to the network (Edge Device concept), providing the negotiation/configuration needed to use efficiently the new capabilities.

This model can also be applied in a business environment to a corporation where the Internet service provider would be an internal department (the Intranet service provider). These new Internet services must be build to interconnect smoothly Intranets and Internets service providers or Intranets through an Internet.

All this will put new requirements on the timely communication performances of IP networks, the management and protection of intellectual property (including billing and payment) as well as applications.

Accomplishing multimedia communications over IP implies a paradigm shift for the communications world and involves many aspects. To accommodate the needs for the next generation of services the future Internet has to take the nature of the transported data into account and should offer greater flexibility (smart networks). The goals of the project are to investigate new architectures, protocols and services to fulfil these needs. New classes of applications will be the driving factor for these new communication facilities. Applications in a large network (Internet) and in a closed network (Intranet) will be used to demonstrate the new communication facilities.

Tasks

The purpose of the RTIPA project is to build a European workforce able to develop and deploy novel

IP networks and services. Many of the technologies involved in this project are already available (products or prototypes) within the project partners, but many have also to be specified in relationship with standardisation organisations and forums and then develop, implement and experiment.

The tasks defined in the project will lead:
- to identify the requirements expressed by the customers and different providers,
- to analyse products available on the market and appropriate international standards,
- to define a novel IP Network architecture covering the requirements,
- to specify and propose missing standards or standards evolutions,
- to develop middle-ware to demonstrate feasibility and the accuracy of the proposed solutions,
- to set up an European platform that should integrate most of the technological bricks that should be part of the future IP Networks.

To achieve this the following work packages have been defined.

Work package 1: Protocols and generic services
- First, this task will identify and analyse the future Internet services that could be provided by the technology advancement and the new users requirements.
- Second, this task will include the definition and specification of:
  - An extension of the current Internet architecture to provide the identified new services.
  - A new generation of Internet protocols and communication architectures compatible with the current Internet infrastructure, but implementing a configurable and scaleable Quality of Service (QoS) to reach higher performances, security and manageability in order to provide Virtual Private Network services. Software architecture and implementation of new routing and resource allocation mechanism is key issue to QoS. Traffic prediction and measurement program can greatly improve efficiency. New fast software architecture for protocol processing on parallel machines. Real time routing included.
  - An architecture for an end-to-end approach of broadcasting and multicasting multimedia streaming across the Internet. Caching protocols, algorithm and architecture for the Web reduce access delays and load but raise many technical problems.
  - New routing capabilities to ensure an easy and manageable implementation of the new services.
  - New middle-ware capabilities to extend commonly available IP services to IP multimedia applications taking into account, in particular, the Intellectual Property Management and Protection.
- Third, this task will lead to the implementation, demonstration and validation of a set of promising services on an experimental IP new generation (IPv6) platform including WAN, Subscriber loops (DSL) and LAN infrastructure.

Work package 2: Validation in a wide area network
- Identification of new IP telephony services and definition of the IP Telephony architecture fitting the generic services defined in task 1.
- Identification of an architecture based upon Intelligent Network architecture to provide advanced services (Virtual Private Network, Call routing, Unified messaging)
- Design & implementation of integrated control between telephony services and network quality of service mechanisms.
- Design & implementation of scaleable directory services for IP telephony
- Design, implementation and validation of a new generation telephony system for business environments, which can evolve into a solution for consumer environments.
- Validation of interoperability of the new IP telephony system with legacy systems, in accordance with open standards set by ECTF, IETF and ETSI-Tiphon.
- Validation of interoperability of the new IP telephony system with legacy systems, using CTI interfaces, for advanced systems.
- Integration of the telephony services into the experimental Internet platform built in task 1.

Work package 3: Validation in a dedicated network infrastructure
An architecture for an end-to-end approach of broadcasting and multicasting multimedia streaming across the Internet.

ITEA Title: Real Time Internet Platform Architectures

- Identification of new video based services and definition of the related architecture fitting the generic services defined in task 1. Two categories of video services will be considered in particular: Video streaming and Collaborative Work
- Design, implementation and validation of multimedia platforms for video Internet based applications, paying attention to strong requirements on availability, quality, response, security and timely delivery: Video server for corporation (teaching, information, conferencing centers, security systems), Video broadcasting and Internal broadcast, using multicast network services, and Videoconferencing
- Validate the architecture mentioned above in a multimedia communication environment, including caching issues
- Integration of the multimedia demonstrator into the experimental Internet platform build in task 1, including ADSL-connected terminal and a broadcaster Intranet.
- Interactive synthetic 3D contents for teaching, gaming or e-commerce

Technical and strategic relevance for European software technology

The convergence of voice and data networks and the convergence of computing and communication applications create a new kind of services and applications which will have a large impact on the community and offer new opportunities for European industry. To a large extent these new applications are based on interoperability between services traditionally used in different sectors (Industry, education, entertainment…). The access to all the industrial, financial, cultural and scientific content through a universal Internet network requires the use of standard protocols and intelligent functions. Most of these services and applications will be network oriented starting on IP based networks. To secure the competitive power the European industry needs:
- track and influence the development of the appropriate Internet protocols
- develop added values functions that should be integrated in network equipment.
- participate in the standardisation activities around IP based telephony
- develop middle-ware which can be used across application domains
- develop and evaluate architectures for these new services and applications
- develop and evaluate architectures for streaming different media over the Internet in a multicasting fashion, thus being able to face also in Europe the trend towards webcasting that is leading in the US to huge investments

To achieve this, involvement in the development and evolution of at least the following underlying technologies will be needed:
- IPv4 and IPv6 protocols suite including at least UDP, TCP, RTP, RTCP, IP, ICMP, ARP, NDP, IPsec, Mobile IP, IGMP.
- IPv4 and v6 inter and intra domain routing protocols including new multicast ones.
- Multicasting and broadcasting protocols and session initiation and management.
- QoS mechanisms including filtering, scheduling, buffer management, policing and shaping, resource management
- Security mechanisms including authentication, confidentiality, watermark, access control
- Policy management functions allowing the definition and instantiation of coherent rules for the QoS, the security and the administration of the network.
- New proposed active network standards
- Network and system management protocols and functions.
- Real time behaviour of operating systems like Windows-NT and middle-ware software technologies like JAVA and CORBA.
- Web related standards as HTML, XML, DHTML, VRML/WEB3D, SMIL, MHEG.
- Streaming data formats as MPEG, SDP, DVB-SI, meta-data
- Network interfaces and telephony interfaces as TAPI, JTAPI.
- New standards developed by ECTF, IETF, ETSI Tiphon: as H.323 evolutions, MGCP, etc.

Within this project major contribution are given to the ITEA core competence "Communication" (protocols, security, network management), "Complex System Engineering" (architectures of distributed systems and implementation technology) and "Distributed Information and Services" (Multi Media databases, remote access to databases, distributed applications).

Market relevance and timing

The reduction of fragmentation in the marketplace for Internet based multimedia goods and services will have a significant and widespread beneficial effect on the industrial sector in Europe. It will also benefit other areas of the European economy as the standardised infrastructure will then enable new market opportunities for new and additional content and service providers.

In general terms, the suppliers of the equipment to support such services will be the first to experience increased demand from their customers. As the market becomes more homogenous, those suppliers with compliant products would find that they were able to supply their equipment into an increasing number of new investments being made to create interactive multimedia services. The types of product that would be in demand would be servers, compliant terminal equipment, routers, switches and other related telecommunications equipment. However we should realise that these products contains a lot of software and will require complementary software on more generic equipment as computers, phones and PDA's.

Another area of economic activity to benefit from a more active market in multimedia would be that of service and content provisioning. Internet represents a new medium for distributive and interactive audio and video which offers immense possibilities for providing users with new services as well as existing services in new and more convenient and useful ways. As such services become more standards compliant and hence prevalent, these companies will find that there is a growing demand for their expertise and services.

Thirdly, the pervasive use of services such as home shopping, home banking and home study via the medium will help to stimulate the level of activity in the companies which provide these services. There will be a degree of substitution because less activity will take place via the conventional means, but the increased convenience will almost certainly generate higher revenues for the companies involved.

In conclusion, it can be seen the industrial relevance of building a comprehensive Platform Architecture for Real Time Internet as part of the drive to make the Internet multimedia communications less heterogeneous and more efficient. As the demand for Real-Time Internet services grows, this increased demand will be reflected across a number of sectors of the European economy which will help to preserve and create jobs as well as generally to create wealth in the Union.

Exploitation and Dissemination of Results

The results will be disseminated within the project in the following manner:
- Project internal workshops,
- papers at conferences (ITEA organised as well as others).

External exploitation will be through:
- Thomson-CSF Detexis, France Télécom, LIP6, INRIA, Telebit are already involved in the IETF standardisation process and will work actively to disseminate the project results within the relevant working groups.
- Thomson-CSF Detexis, Telebit will be leaders of the new IPv6 Forum that should be officially created in 1999.
- Philips takes part at the ETSI Tiphon and ECTF standardisation process and will contribute with result of this project within these standardisation activities.
- Philips, Thomson CSF Communications play also an active role in the MPEG-4 standardisation.
- Philips, CWII and INRIA play a role in the W3C activities related to SMIL.

Influence on employment

The project secures the competitive power in the following European industry sector(s) by improved communication and middle-ware services to be used by:

- Communication industry: networking equipment as well as new software based systems Consumer electronics: PC add-on, enhanced STB's, enhanced TV
- Business electronics: new kind of distributed multi-media systems
- Professional electronics: collaborative design, distributed interactive simulation, tele-monitoring and control…

In this way the project contributes in a positive way to employment by:

- Creating new application domains which needs a high qualified engineering staff for realisation, further development and maintenance of products in these domains.
- Identifying new communication pieces of equipment included added values functions. The design of theses new equipment should give the opportunity to Europe to build an Internet technology based industry, and so to create new production lines.
- Developing new services that will lead to the creation of new employment to support the users, to install and maintain the services.
- Offering world wide accesses to added values services that will give the opportunity to non-European customers to use European services.

So, the project should lead to the creation of direct and indirect jobs in the industry and in the services sectors.

Complementarity to other programmes

There are some actions lines within the 5th framework programme. The consortium will be open for collaboration with projects in the 5th framework when the opportunities arise.

2. Consortium overview (full description of capabilities in Appendix).

In this project a competent consortium consisting of industrial research groups, academic and independent research institutes as well as SME's works together .

Italtel SpA (Italy), Politecnico di Milano (Italy)
Philips (France, Netherlands), Centrum voor Wiskunde en Informatica (Netherlands), Eindhoven University of Technology (Netherlands), *Oratrix B.V. (Netherlands), and EolrinG International (France)*
Thomson-CSF Communications (France), Thomson-CSF Detexis (France), INRIA (France), France Telecom (France)*, GIP Renater (France), LIP6 (France)*,
Telebit (Denmark)

(Italics means SME, underline means academic or research institute)

When you take into account the number of SME's and academic partners the consortium is rather complex. The structure of sub consortiums with strong partners as leaders allows us to set up an effective project management structure.

3. Full description of work

Work package 1: Protocols and generic services

Italtel SpA
- identification of new Internet with varying real-time constraints
- definition and validation of an end-to-end communication architecture for the support of advanced multimedia services over Internet-based platforms
- investigation and validation of emerging Web technologies, such as XML, DHTML, VRML/WEB3D, SMIL; analysis of their impact in relation with the support of real-time applications
- definition and integration of a comprehensive Internet-based application development environment based on standard and emerging programming interfaces available in the Web environment, as well as emerging Java-CORBA distributed platforms
- definition and validation of a Java-CORBA middle-ware architecture for the support of real-time communications of type client-server, server-server, server-database
- definition and system specification of an architecture for the dynamic support of QoS in a real-time IP platform scenario
- investigation and validation, in co-operation with Politecnico di Milano, of adaptive QoS techniques that can effectively respond to time-varying conditions in the network operation; the aim of this activity is to define and develop a programmable middle-ware platform that allows services to be dynamically created and modified
- analysis of alternative IP multicasting strategies and definition of necessary protocol enhancements in a real-time Internet platform with different QoS requirements
- definition, implementation and validation of a flexible, high throughput, multi-service access system., based on:
  - Multiple access type, including Asymmetrical Digital Subscriber Loop (ADSL)
  - IP forwarding and routing capabilities
  - Advanced QoS oriented bandwidth reservation functionality
- definition, implementation and validation of service selection capabilities, allowing users to access a multiplicity of service providers through the same network interface; emerging IETF specifications will be considered.
- feasibility study for a possible implementation of a system that transparently supports mobility without modifying the IP address, based on IPv6

Philips Research with CWI, Oratrix and TUE:
will concentrate on an end-to-end solution which offers the following service: the generation of a Web-EPG to select data or to join active sessions under the condition of safe guarding the intellectual property rights of the data involved and to take the constraints of available bandwidth, terminal characteristics and user preferences into account. In particular, the information transmitted in the Web-EPG can be tailored to the individual user. Activities with respect to coding efficiency and quality recovery in case of net work congestion will take place in this context as well as solutions for QoS and IPMP will be investigated and evaluated.

Politecnico di Milano
- Definition of application models and program interfaces that allow to account for Adaptive QoS services, i.e. services with the capability to adapt to time-varying network operation conditions.
- Design of resource sharing algorithms that account for adaptive QOS requirements.
- Definition and performance evaluation of routing techniques to manage the terminals mobility in a multicast group.
- Delay and time jitter evaluation for strict real time applications.
- Feasibility study for a possible implementation of a system that transparently supports mobility without modifying the IP address, based on IPv6

Telebit

- Contribution to Study and Analysis of future Internet services
- Contribution to Definition of new Internet Architecture, including secure QoS based multicasting for IP telephony and videoconferencing in mobile networks with seamless hand-over between multiple service providers.
- Develop the identified needed router functionality for the edge and the backbone routers.
- Development of the required management tools to support the new services in the network
- Participate in the demonstration and validation of a selected set of services.

Thomson-CSF

Thomson-CSF Communications and Detexis will work together to the definition, development, implementation and experimentation of the proposed new IP Network architecture. The major activities will be:
- specification of the infrastructure services,
- development of the software functions in the Access Devices that will allow to manage IPv4-IPv6 transition, QoS, security, mobility, multicast accesses and the service providers policies,
- development of policy servers that will allow to set up coherent policies (QoS, security…) in all the network devices (AD, routers, servers…),
- development of call centre functions allowing to manage the infrastructure services and to provide smart interfaces to the users,
- set up of a trial platform allowing to experiment the new IP Network architecture,
- participation in standardisation activities (IETF) and dissemination activities (IPv6 Forum),
- management of the Thomson-CSF sub-consortium and relationship with the other partners.

France Telecom

The France Telecom activities will cover three major topics of interest:
- The QOS-based routing:
  - allowing to share end-to-end QoS objectives between participating entities (namely networks and routers),
  - designing the appropriate routing and forwarding algorithms which will guarantee that each participating entity has reached the objective it has been assigned.
- The storage servers technology, including:
  - the specification of architecture for storage server distribution & management,
  - the specification of storage server protocols.
- Application services enhancement, including:
  - quality Enhancement of VOIP and videoconference services,
- MPEG-4 video, audio and 3D coding, decoding and handling.

GIP Renater

GIP Renater will provide the French partners with a high performance WAN backbone delivering high quality access. On top of this backbone, it will be possible to set up an IP Network infrastructure implementing the services developed during the project.

Connection of other European partners should be possible using interconnection of the Renater infrastructure to the other European research networks.

INRIA

The INRIA activities will cover three major topics of interest:
- the QoS management based on the Differentiated Services model defined by the IETF and the cache mechanisms that duplicate the contents near the customers,
- the IPv4 to IPv6 transition,
- the access control to secure the IP network and the access to services.

INRIA is the European leader for the deployment of the IPv6 technology and more generally in the

---

domain of Internet technology. INRIA will have a key role in the standardisation activity during the project and will set a bridge between the IETF working groups and the RTIPA consortium.

LIP6

The challenge to handle multicast services is to avoid the network to be overloaded. Using these services, users will belong to a group of users developing the same task/objective and will register to various form of data in a dynamic manner. Therefore, the traffic will flow from a server to a group of end-users whose number and nature will vary in time. The traffic will then need some mechanisms to shape the route and resources that it will take to reach the end-users.

The purpose of the LIP6 activity is to study the group communication/multicast paradigm and to propose solutions based on algorithms and mechanisms able to support multicast services in the IP network architecture of the project. These proposals will be studied in relationship with Thomson-CSF, the results of this R&D activity will be used by Thomson-CSF to develop the functions that will support the infrastructure services.

	Workpackage 1			
Manpower	**1999**	**2000**	**2001**	**total**
CWI	2	3	2	7
France Telecom CNET	4	5	2	11
GIP Renater		1	1	2
INRIA	2	3	1	6
ITALTEL	4	12	2	18
LIP 6	1	2	1	4
ORATRIX	2	4	2	8
Philips	5	9	5	19
Politecnico Milano	0.5	2	0.5	3
Telebit	1	2	1	4
Thomson CSF	4	18	14	36
TU Eindhoven	1	2	1	4
Totals	26.5	63	32.5	122

Work package 2: Validation in a wide area network

Italtel SpA

- in co-operation with other partners, implement a prototype demonstrator system, covering the provisioning of both IP-based asymmetric services (multimedia on demand/ multicasting/ broadcasting), and symmetric services (e.g. multimedia conversational, collaborative work, …)
- implementation of the demonstrator will include procedures (as defined in Work package 1)
  - to demonstrate the effectiveness of new approaches aimed to guarantee QoS over IP networks, based on priority schemes in the switches and call admission control in a DiffServ scenario, without affecting the datagram structure of the core IP network
  - to efficiently support enhanced IP multicasting functionalities, properly interworking with the selected QoS approaches
- development of advanced applications, making use of emerging Web technologies, spanning a range of different timing and bandwidth requirements
- validation of the overall proposed system architecture and specifically of the adopted QoS techniques in a complete test-bed, with applications integrated and offered to sample users and with differently encoded/produced digital content streamed across the end-to-end delivery chain from servers to clients
- the generic multi-service access platform, as defined, implemented and validated in WP1, will integrated into the selected Multimedia Service scenario.
- testing and measurements on the prototype demonstrator to validate the effectiveness of the adopted solutions

Philips Research:

Define an open domain architecture for business communication systems based on IP technology and to validate business communications functionality based on IP protocol. The architecture has to cover the integration of voice processing with IP based multi-media communications on internet/intranet. Hence, a number of activities are required: domain modelling, architecture definition, constructing an IP voice processing validator.

Philips Business Communications:

In this task an architecture definition and implementation for the use of PBX Call Control and Telephony functions software on an open systems and IP platforms, will be achieved.
- The architecture definitions of IP Telephony clients, gateways, gatekeepers and networks for the application of IP Telephony in business communications networks.
- After the architecture definition the concepts will be validated on an open Windows NT based platform together with private and public Intra- en Internet work providers.
- Design and validate the concepts of new value added IP Telephony features: Private Networking, Teleworker functionality, and Web Call Centres.

Philips DVS/DR:

Definition of architecture for use of telephony services on a Set top Box in IP infrastructures (using cable and PSTN modems) as well as the building of a platform to validate the functionality.

Adapt a current Set Top Box platform to support a wireless communication link. Use this link for communication services (the Set Top Box being a bridge between a mobile terminal and the cable or PSTN modems). Different steps are:
- Design of a local wireless link and its own interconnection with IP
- Validating the architecture with a mobile terminal
- Integration in a Set Top Box and functionality demonstration

Politecnico di Milano

- Definition of a scalable transport architecture to support QoS guarantee over IP networks based on priority schemes and call admission control in a DiffServ scenario.
- Definition and implementation of prototype protocols needed in the above architecture oriented

to support telephony with different QoS
- Development of an IP intranet test bed in co-operation with other partners
- Testing and measurements on the prototype

Telebit
- Contribution to Study and Analysis of future Internet Telephony services and Architectures.
- Participate in the design and implementation of support for IP Telephony in a router with gateway capabilities to legacy systems.
- Participation in the integration of the IP Telephony services into the trial network.

Manpower	Workpackage 2			
	1999	**2000**	**2001**	**total**
ITALTEL	1	12	5	18
Philips	13	26	13	52
Politecnico Milano	0.5	2	0.5	3
Telebit		1	1	2
Totals	14.5	41	19.5	75

Work package 3: Validation in a dedicated network infrastructure

EolrinG
has it's focus on optimising all the IP flow traffic in terms of QoS over a distributed (ring) architecture based on ATM and Ethernet. Classical telephone, Voice/IP and (industrial) multi media application as described above will be able to merge on the same infrastructure.
Main activities:
- Identify the basic management features for heterogeneous application on an (ATM) distributed network
- Realisation of integral voice on IP and video over ATM and IP based distributed network
- Validation of these elements in a real environment

France Telecom
In addition to this, CNET will provide an Intranet TV-broadcasting system relaying air TV broadcasting over Intranet to end-users over medium-speed access network (e.g. ADSL).

Philips CSS
focus is on identifying and taking care of the critical requirements that are typically related to business applications in industrial environments, conference halls, public area's, campus environments. These aspects are extremely relevant because these application areas will move from analogue, proprietary solutions, towards an open digital environment. Typical aspects are:
- timing constraints: switching delay, latency, timely delivery
- guaranteed QoS
- multi-point and broadcasting possibilities
- availability
- security, especially in an open network environment
Main activities:
- Identification of industrial requirements and definition of the streaming architecture. This architecture should be layered and enable the possibility of using a number of different communication links
- Identification of solutions for the problems with respect to timing constraints, guaranteed QoS, multi-point and broadcasting and availability.
- Investigate the possibilities to guarantee the security aspects in the chosen IP based architecture
- Validation of the chosen methods / solutions

Telebit:
- Contribution to Study and Analysis of future video based services and Architectures.
- Participate in the design and implementation of support for video services in a router.
- Participation in the integration of the video services into the trial network.

	Workpackage 3			
Manpower	**1999**	**2000**	**2001**	**total**
EOLRING	5	10	5	20
France Telecom CNET		6	4	10
Philips	13	25	12	50
Telebit		1	1	2
Totals	18	42	22	82

ITEA Title: Real Time Internet Platform Architectures

4. Overall effort (person years and financial) information.

(Remark for all tables, including appendices: the last digit may be different in the sums due to round ups)

Effort per year for the total project in person years and financial per partner, split over countries.

Person years per partner, split over countries
Total project

Person years	SME *)	Univer-sity*)	Country	1999	2000	2001	total
EOLRING	✔		FR	5	10	5	20
CWI		✔	NL	2	3	2	7
France Telecom CNET			FR	4	11	6	21
GIP Renater		✔	FR	0	1	1	2
INRIA		✔	FR	2	3	1	6
ITALTEL			I	5	24	7	36
LIP 6		✔	FR	1	2	1	4
ORATRIX	✔		NL	2	4	2	8
Philips			NL	25	47	22	94
Philips			FR	6	13	8	24
subtotal Philips				31	60	30	118
Politecnico Milano		✔	I	1	4	1	6
Telebit	✔		DK	1	4	3	8
Thomson CSF			FR	4	18	14	36
TU Eindhoven		✔	NL	1	2	1	4
Total				59	146	74	276

*) check if appropriate (SME is less then 250 employees)

Financial effort in thousand Euro per partner, split over countries [rounded off at 2 decimals]
Total project

Effort in thousand Euro		1999	2000	2001	total
EOLRING	FR	700.00	1400.00	700.00	2800.00
CWI	NL	220.00	330.00	220.00	770.00
France Telecom CNET	FR	660.00	1815.00	990.00	3465.00
GIP Renater	FR	0.00	130.00	130.00	260.00
INRIA	FR	260.00	390.00	130.00	780.00
ITALTEL	I	720.00	3456.00	1008.00	5184.00
LIP 6	FR	130.00	260.00	130.00	520.00
ORATRIX	NL	240.00	480.00	240.00	960.00
Philips	NL	3379.00	6357.00	2978.00	12714.00
Philips	FR	990.00	2145.00	1320.00	3960.00
subtotal Philips		4369.00	8502.00	4298.00	17169.00
Politecnico Milano	I	100.00	400.00	100.00	600.00
Telebit	DK	140.00	560.00	420.00	1120.00
Thomson CSF	FR	660.00	2970.00	2310.00	5940.00
TU Eindhoven	NL	95.00	190.00	95.00	380.00
Total		8294.00	20883.00	10771.00	39753.00

Effort per year for the project in person years per country

Manpower	1999	2000	2001	totals
Denmark	1	4	3	8
France	21.5	56	35.5	113
Italy	6	28	8	42
The Netherlands	30	56	27	113
Total	58.5	144	73.5	276

Yearly financial effort for the project in million Euro per country

Million Euro	1999	2000	2001	totals
Denmark	0.14	0.56	0.42	1.12
France	3.32	8.78	5.63	17.73
Italy	0.82	3.86	1.11	5.78
The Netherlands	4.01	7.51	3.60	15.12
Total	8.29	20.70	10.76	39.75

5. Project duration (start, end)

Start: 01.07.1999 (T0)
End: 30.06.2001

6. Master milestones/deliverables

The timing indications for deliverables are months elapsed since the starting date (T0).

T0+	Deliverable
6	Identification of the architecture and protocol requirements
6	Domain model for advanced IP based telephony services
6	Architecture to support QoS guarantee over IP networks
9	Requirement Specifications for Implementation
9	Final specification of the end-to-end platform for the support of real time MM IP applications
9	Architecture for advanced IP based telephony services
12	First set of generic IP services
12	Architecture for a high quality multimedia communication system
15	Definition and analysis of a modified multicast protocol for transparent mobility support through network agents
15	Validation report QoS management in heterogeneous networks
15	First validation report on new IP based telephony services
18	Second set of generic IP services
18	API for platform of a multimedia communication system
18	Implementation and testing of multicast mobility protocols on IPv4 and IPv6
21	Validation report on active networks
22	Validation report of advanced IP based telephony service layer
22	Validation report on a high quality multimedia communication system
24	Testing and Measurements Report

7. Organisational information.

	WP structure:	
Project Manager	Mr. G van den Broek	Philips Research
WP 1	M. Riguidel	Thomson-CSF
WP 2	S. Dijkstra	Philips Business Communications
WP 3	M. van Dam	Philips Communications and Security Systems

8. Rationale for funding.

The knowledge and skills contributed by the partners are absolutely complementary and cannot be found within one European nation. Thereby Trans-European co-operation is a prerequisite for the successful completion of this project.

A new challenge for Europe is to set up a new generation of communication (wireless and wired), upward compatible with Internet, more efficient, more versatile and more adapted to the various new services and the new data formats. Within the Information Age Europe must master the transport of its information. The European industry needs to have a significant part of the market for routers, network equipment, and for new categories of applications. These new communication networks will lead to a new class of multi-media applications with strong real-time requirements open for consumer and business applications. These new applications will evolve in a number of different domains but can take advantage of working together and sharing the underlying protocols and middle-ware services.

Contact person:

Mr. G. van den Broek
Philips Research
Building WL-p
Prof. Holstlaan 4
NL-5656 AA Eindhoven
The Netherlands

Company responsible persons:

Partner	Name	Telephone	Fax	e-mail
CWI	Fr. Snijders	+31 20 592 4171	+31 20 592 4199	Franss@cwi.nl
EOLRING Int.	D. Le Norcy	+33 2 31061975	+33 2 31061976	d.lenorcy@eolring.fr
France Telecom	Christian Bertin	+33 2 99 12 40 16	+33 2 99 12 40 98	Christian.Bertin@cnet.francetelecom .fr
GIP Renater	Dany Vandromme	+33 1 53 94 20 33	+33 1 53 94 20 31	Dany.vandromme@renater.fr
INRIA	Gerardo Rubino	+33 2 99 12 70 26	+33 2 99 12 70 30	Gerardo.Rubino@enst-bretagne.fr
Italtel SpA	M. Di Concetto	+39 02 43885726	+39 02 43887989	Marco.Diconcetto@italtel.it
LIP6	Serge Fdida	+33 1 44 27 30 58	+33 1 44 27 62 86	Serge.fdida@lip6.fr
Oratrix	D. Bulterman			Dick.Bulterman@cwi.nl
Philips CSS	M. van Dam	+31 40 2782317	+31 40 2786668	Martijn.vanDam@nl.ccmail.philips.com
Philips DVS/DR	I. Rakhodai	+33 1 47286373	+33 1 47286350	Rakhodai@ditv-philips.fr
Philips Natlab	G. van den Broek	+31 40 2744596	+31 40 2743741	Vdbroek@natlab.research.philips.com
Philips PBC	S. Dijkstra	+31 35 6894012	+31 35 6891030	S.Dijkstra@pbc.be.philips.com
Politecnico di Milano	L. Fratta	+39 02 2399-3578	+39 02 23993413	fratta@elet.polimi.it
Telebit	Latif Ladid	+352 30 71 35	+352 30 53 64	Lla@tbit.dk
Thomson-CSF Detexis	Patrick Cocquet	+33 1 34 81 65 90	+33 1 34 81 60 70	Patrick.cocquet@detexis.thomson-csf.com
Thomson-CSF Communications	Michel Riguidel	+33 1 46 13 20 89	+33 1 46 13 26 86	Michel.riguidel@tcc.thomson-csf.com
TUE	P. de Bra	+31 40 2472733	+31 40 2463992	Debra@win.tue.nl

9. Appendices

Consortium description

Philips Electronics

Philips employs about 262,500 (end 1997) people all over the world, of which about 130,000 in Europe, and had sales of US$ 39.2 billion in 1997. We have production sites in over 40 countries and sales and service outlets in 150 countries. Research laboratories are located in six countries, staffed by some 3,000 scientists. A global network of some 400 designers is spread over 25 locations.
Philips is active in about 100 businesses, varying from consumer electronics to domestic appliances, and from security systems to semiconductors. We are among the world's top three producers in many of our businesses, including lighting, monitors, shavers, and colour picture tubes for TVs and monitors.

The participation of Philips in the ITEA project Real Time Internet Applications comes from the product division Philips Business Electronics and from Philips Research.

Philips Business Electronics
The scope of our business categories covers: The digital information distribution market (including digital video systems, broadband networks, business communications, speech processing). The intelligent infrastructure business (including communication and security systems, turnkey solutions). The semiconductor and microelectronics equipment field (including analytical systems, field electron and ion technology, and electronic manufacturing technology). And small office/home office equipment [SOHO] (including fax and video conferencing systems) new market opportunities are created through drawing on the synergy of our knowledge and by harnessing the right technology platforms, marketing and sales channels.

Philips Business Communications (Hilversum, NL)
Philips Business Communications is a niche player in the global business communications market. The company serves its business partners' needs for efficient and effective communications with open PABX switching systems, added value applications and services. The services provided offer innovative and improved ways of voice, video and data business communications, increased mobility for people and efficient networking. Philips Business Communications develops, manufactures and markets products that include (cordless) telephones, base stations, voice response and voice message systems, SOPHO networking solutions

Philips Communications and Security Systems (Eindhoven and Breda, NL)
Philips Communication & Security Systems (CSS) specifies private communication and security systems. To do this, Philips CSS has at its disposal a balance of expertise, experience and common sense, but also quality products that are designed and manufactured with the same sense of degree and expertise. The experience that is present within the company is applied in all aspects of private communication and security, from integrated installations to stand-alone equipment. Philips CSS provides compatible CCTV, congress, intercom, nurse call, on-site paging and public address products that work together in systems.

Philips DVS/DR (Suresnes, FR)
Philips Digital Video Systems manufactures, sells and services a comprehensive line of professional video systems for broadcast facilities, post-production houses and corporate applications. Every link in the digital chain, from camera to home reception, is covered. Philips is an important player in the emerging markets of digital broadcast, digital film/video production and digital video archiving systems, providing core systems products and system integration services to a worldwide customer base. From the original 1993 three-member team the company has since grown to more than 2,000 people. The scope of activity includes marketing and product development as well as installation and servicing at the customer site. The move to also incorporate Philips' other broadcast-related activities stems from the success of past co-operative ventures. Philips Digital Video Systems' client list of more than 60 major broadcasting organisations world-wide reads like a "Who is Who" of international television and will only grow as digital broadcast services expand into virtually all aspects of home

entertainment.

Research and Development
Philips Research is the corporate international research organisation of Royal Philips Electronics N.V., Eindhoven, The Netherlands. It consists of six laboratories - situated in the Netherlands, Germany, the United Kingdom, France, the United States and Taiwan - at which about 3000 people are employed. The laboratories involved within the project are located in Eindhoven (NL), Paris (F) and Monza (I).
The annual research budget is slightly less than 1% of Philips Electronics' annual sales. Roughly two-thirds of the corporate research work is geared to the activities of the Product Divisions of Philips Electronics, with contractual agreements about programmes and costs. The remainder is research of a more exploratory nature.
Scientists from a wide range of disciplines, from electrical engineering and physics to chemistry, mathematics, mechanics, information technology and software, work in close proximity, influencing and broadening each other's views. This implies that Philips Research reaps the benefits of synergy and cross-fertilisation of ideas.
In close co-operation with the Product Divisions, the research organisation generates options for new and improved products and processes and produces important patents in many fields. These patents are important, because they protect technological achievements and enable Philips to gain access to the knowledge of others. Philips Research also provides a window on the scientific and technological world.
The research groups involved in this project are located in Eindhoven and have co-operated in the past with other companies in for instance Esprit, ACTS, RACE projects but also in W3C.

Centrum voor Wiskunde en Informatica

CWI is the research institute of the Stichting Mathematisch Centrum - SMC. SMC is a private, non-profit organisation. Founded in 1946, SMC aims at fostering mathematics and computer science research in The Netherlands. CWI receives a subsidy from the Netherlands Organisation for Scientific Research NWO, amounting to about 70% of the institute's total income. The remaining 30% are obtained through national research programmes, international programmes and contract research commissioned by industry.

CWI's mission is twofold: to perform frontier research in mathematics and computer science, and to transfer new knowledge in these fields to society in general and trade and industry in particular.

CWI's mission is realised by several means. In addition to the standard ways of disseminating scientific knowledge, for example through publications, presentations at conferences, organisation of workshops and exchange of researchers, CWI actively pursues joint projects with external partners, provides consulting services and actively stimulates the creation of spin-off companies. A technology transfer event is organised annually to promote this side of CWI's activities. Also special efforts are made to make research results known to non-specialist circles, ranging from researchers in other disciplines to the public at large. CWI has many contacts with national organisations for applied research with wide experience in turning research results directly into practical applications. Its researchers are supported by state-of-the-art computing facilities and a library of national importance.

CWI has always been very successful in securing a considerable participation in European research programmes (ESPRIT, ACTS, TELEMATICS, BRITE, TMR and others) and has extensive experience in managing these international collaborative research efforts. CWI is also strongly embedded in Dutch university research: about twenty of its senior researchers hold part-time positions as university professors and several projects are carried out in co-operation with university research groups. Annually CWI hosts some 200 visiting scientists from abroad.

CWI has a staff of 210 fte (full time equivalent), 160 of whom are scientific staff. In addition, there are seconded researchers and visitors (totalling to about 50 fte). CWI operates on an annual budget of NLG 25M (Euro 12M).

CWI's research is carried out in four clusters of related research themes:
- Probability, Networks and Algorithms

- Software Engineering
- Modelling, Analysis and Simulation
- Information Systems

Oratrix Development BV

Oratrix Development b.v. produces and markets authoring tools for creating and maintaining complex Internet-based multimedia presentations. The authoring tool is based on a proprietary internal model that allows export to several standard formats (such as SMIL). Presentations created by Oratrix tools can be played on Oratrix's own player or they can be played on any SMIL-compliant player.

Oratrix Development was formed in December 1998 as a spin-off company from CWI (Centrum voor Wiskunde en Informatica) in Amsterdam, the Netherlands.
The founders of Oratrix have been intimately involved with the development of the W3C's SMIL standard (Synchronized Multimedia Integration Language). W3C (World Wide Web Consortium) is the world wide organisation which co-ordinates and controls the development of new Web standards.

The company has been set up to exploit the research that has been carried out at CWI in the previous 8 years on adaptive networked-based multimedia presentations. In the first instance, the company will concentrate on the SMIL authoring system GRiNS, allowing novice and intermediate authors to create complex SMIL presentations with a minimum of effort.

Eindhoven University of Technology (TUE)

The research group Databases and Hypermedia is part of the Computing Science Department of the Eindhoven University of Technology. The group is headed by prof. dr. P.M.E. De Bra.

The research focuses on the dissemination and communication of hypermedia information. Specific research topics being investigated in current research projects are:

- The automatic generation of hypermedia user-interfaces for multimedia database information. This includes the development of a design methodology, heuristics for the generation of presentation and navigation structures for query output, and extensions to query languages.
- The use of adaptivity in hypermedia. Environmental factors (such as time, location, computing environment, network, physical handicaps, etc.) and the browsing behaviour of a user are taken into account when generating and adapting the information presentation and navigation structure of a hypermedia application.
- Task-based information searching and filtering. This research attempts to improve information retrieval by not only incorporating user-specific profiles into the process but also information about the user's task, as determined through a workflow system.
- Safe protocols for electronic commerce. In this research projects properties of communication-models and -protocols are studied. In order to use a protocol in critical applications one must be able to formally verify that it terminates and that the final state is well defined.
- Database and authoring environments for co-operative hypermedia applications. Through object-oriented database structures and shared workspace environments an authoring environment is being developed which not only supports collaborative authoring but also ensures that information is represented in such a way that it can be searched and retrieved not only based on its textual or multi-media content, but also based on its structure.

Eol*rinG* INTERNATIONAL

EolrinG INTERNATIONAL is an Incorporated Company with Supervisory Board and Board of Directors created in December 1996 by Frédéric BAROIN, C.E.O.
EolrinG INTERNATIONAL is a constructor of Multimedia network products based on a distributed switch (ATM and IP Technologies). EolrinG INTERNATIONAL is launching its 1st generation of products: the DStack Family. For the 1st time, PC and telephone on the same switch.
Competence and experience:
Composed of 8 persons in 1997, EolrinG's team counts today 21 employees. This number is expected to double in 1999. All the employees are engineers.

Indeed, EolrinG needs a complementary, skilled and well-knit team in order to reach its ambitious goal: become one of the leaders of the international switching market.
The company's managing team has over 10 years' experience in common in telecommunications.

Location:
The proximity of Rennes, major telecommunication research center, the presence of a university, of the ISMRA (Institute for Material Sciences and Radiation), and of the CNET (National Center for Telecommunication Studies) have played a significant role in the choice of the city of Caen (Normandy) as the location for EolrinG's registered office and R & D department: these factors allow our company to have an efficient partnership policy in the field of high technology.

Partners:
EolrinG is a privately held company that follows a technological, financial and trading partnership policy. EolrinG has signed two partnership agreements in November 98: the first one with the French integrator SPIE TRINDEL; the other with 2ICF… a French company specialized in low power equipment.

EolrinG INTERNATIONAL, located in CAEN (France), is an incorporated company with Supervisory Board and Board of Directors. The company has been created at 31st of December 1996 and has a total equity financing of 30 million francs. The company employs 21 persons, which is expected to double next year.
The activities of the company are in distributed switching technology for ATM systems aiming at: simplicity and flexibility, security, high throughput interconnection while securing long term investment.

Italtel

Italtel has always been an absolute leader in one of Europe's and the world's most competitive markets - Italy. That's why the company's name is the synonym for "Italian technology world wide". Italtel is present in over 100 countries, and in 1997 exports were valued in more than 2,200 billion lire, equal to approximately half of total revenues, representing an increase of 48% over the 1996 figure. Today the company is among the foremost suppliers of fixed and mobile networks in the Russian Federation and the People's Republic of China, in Iran, the Philippines and many Latin American countries. Its transmission systems are widely installed, from Eastern Europe to the Far East and to South Africa. In the Old Continent, and apart from Italy, Italtel has been selected as partner in Spain, Ireland, UK, the Netherlands, Austria, Greece and Malta.

Research and Development
At the basis of Italtel's offer are its research and innovation capabilities. A total of over 3,500 persons are engaged in these activities in Italtel - equivalent to 21% of the personnel. Each year the company invests some 12% of its revenues in R&D activity. This area is divided into four principal lines: broadband networks, networks for interactive multimedia services, networks for mobile personal communication, and optical transport networks. With a commitment equivalent to 100 man-years per year, Italtel participates in more than 30 projects in the framework of the research programmes financed by the European Union, often as project leader for groups of companies and research institutes.

Sectors of activity
If, until a short while ago, it seemed that the mission of a telecommunications company was to supply advanced technology, today it is no longer sufficient. In the scenarios dominated by the integration of Information Technology, Telecommunications and Media, the telecom supplier has to become an actual partner of his customer. He must be able independently to identify the services and development paths to be followed for all his products. He must be a "problem solver", promoting the progress of his customers. On this basis, Italtel today is a partner with world-scale telecommunications operators for front-line technologies, for the design and development of new networks, for the offer of new services, and for total assistance. Italtel is a widespread, continuous presence, company at work in over 100 countries.
Italtel today, world-wide, means narrow-band communication networks (N-ISDN) for normal voice and data services and broadband networks (B-ISDN) for multimedia/interactive applications; wired and wireless access networks; transport networks over cable and radio link; 900/1800 GSM standard mobile networks; data networks; systems to provide cordless mobility (DECT standard); TMN

(telecommunications management network) systems; "service" in all sectors.

Dipartimento di Elettronica e Informazione – Politecnico di Milano

DEI is one of the Departments of Politecnico di Milano, one of the largest Engineering school in Italy. The number of students that achieve the Laurea degree, equivalent to MS degree, on Computer Engineering, Electronic Engineering and Telecommunication Engineering, is approximately 900 per year. Two PhD programs are also offered on Computer engineering and Automatica and Electronics and Communication Engineering. The wide spectrum of educational aspects covered by DEI arises from a wide range of research interests that are carried out under the sponsorship of the Italian Research Agencies (MURST, CNR, ASI), European Research Agencies (ESA, ACTS, ESPRIT, COST), and several private organisations.

These activities are grouped in four large areas: Automatica, Electronics, Computer, and Telecommunications.

R&D competence

The researchers that will participate to the ITEA project are part of the Telecommunication Network Group (4 full professors, 5 associate professors, 3 assistant professors) which is one of the 5 groups of the Telecommunication Section of DEI.

The major research topics addressed are:

High speed Networks, Wireless Networks, Traffic Management and Control, ATM Switching Networks, Internetworking Gateways, Network Management, Network Services and Applications, IP Networks. The results have produced a large number of papers in archival journals and international conferences, several patents and a few prototypes.

Well-established co-operation activities involve members of the group, foreign Universities (UCLA, UCSD, STANFORD University, COLUMBIA University, University of Minnesota), and Research Centers (IBM Yorktown Heights, San Jose', AT&T Bell Labs, BELCORE, NEC Research Lab).

Research activities have been sponsored by several National Organisations (CNR, MURST, CSELT, CEFRIEL, ITALTEL, ALCATEL, SIEMENS, TELECOM ITALIA, OMNITEL), and International Organisations (NSF, IBM, AT&T, BELCORE, NEC, NATO, EEC).

Thomson-CSF Group

THOMSON-CSF is the world's leading exporter of professional and defence electronics.

OUR BUSINESS**:** harnessing advanced technology to develop cost-effective solutions and high-quality services that meet security, communication and transportation requirements world wide.

OUR STRATEGY**:** pursue our international development path, play a pivotal role in European industry consolidation, keep return on revenue high.

OUR COMMITMENT**:** teams of Thomson-CSF people around the globe are united in the pursuit of excellence and dedicated to serving our customers, our partners and our shareholders.

In 1997, Thomson-CSF's defence businesses generated close to FF 55 billion (64% of consolidated revenues). At the same time, Thomson-CSF's business development strategy has expanded its role in non-defence markets, which accounted for FF 13.7 billion (36% of consolidated revenues) and had an average workforce of some 47.000 people.

The participation of Thomson-CSF in the ITEA project comes from Thomson-CSF Communications (TCC) and Thomson-CSF DETEXIS (DEX) and the benefit of the Partnership Agreement with Alcatel and Dassault Industries.

Shaping the Large-Scale Systems of the Future

Over the last few years, the defence and aerospace electronics industry has undergone deep-seated restructuring in the United States, and, to a lesser extent, in Europe.

The global companies that have emerged from this restructuring cover the entire spectrum of business and technologies involved in the industry.

Thomson-CSF ranks third world wide in this sector today- and is poised to play a pivotal role in European industry consolidation tomorrow- because it already has this breadth of involvement.

And the ability to harness all the critical technologies in virtually all its areas of business underpins Thomson-CSF's future competitiveness. Thomson-CSF has invested heavily for many years to keep its technology expertise on the cutting edge, and **R&D** expenditures reached **21%** of revenues in

1997, one-third of which was company-funded.

Some of this technologies have both military and commercial applications, and they bring Thomson-CSF a competitive advantage in non-defence markets such as Simulation, Air Traffic Management, Avionics and Computer Services. Similarly, through the technological Partnership Agreement with **Alcatel,** military **R&D** Programs will benefit from the latest advances in civil technologies. Thomson-CSF really wants to derive maximum benefit from the Partnership Agreement they have just concluded with **Alcatel, Aerospatiale, Dassault** Industries and the **French Government,** an alliance which makes Alcatel and Dassault Industries our strategic partners and takes Thomson-CSF into the private sector. This partnership also brings us a very appreciable stake in a new satellite company with Alcatel, which will provide us with a solid foothold in the fast-growing space sector and open up a vast array of technical and technological opportunities by providing mutual access to the combined R&D potential of both partners.

THOMSON-CSF COMMUNICATIONS

THOMSON-CSF COMMUNICATIONS ENTERPRISE employs 5700 persons and achieved in 1997 a turnover of 5.3 billion Francs. The Enterprise, which includes several subsidiaries, is one of the world's top suppliers in military communications and command systems, and in some civil markets.

Digital technologies, mobile communications, integrated services and the explosion of the Internet offer exciting new business opportunities and are completely changing the face of Telecommunications. Thomson-CSF has been one of the driving forces behind these changes, and the features and functions that are now available are already part of the company's product offering for armed forces, government agencies and major organisations.

Immediate access to critical data across dependable, high-security communication systems, and the ability to process and analyse that data in a timely fashion, will always be key to a country's defence capability. Drawing on its own extensive experience, and further strengthened by Alcatel's expertise in these areas, Thomson-CSF is set to consolidate its world wide leadership position in the communication and command systems sector.

THOMSON-CSF Communications (TCC) is a fully-owned subsidiary of THOMSON-CSF and, through its SBU (Strategic Business Unit) chart, addresses any activity related to telecommunications: mobile radio-communications, ATM networks development, satellite, aeronautical and naval communication, network administration , identification and radio navigation, information and command systems offering intelligence collection, and ground stations for satellite communications systems. Though the core business of the enterprise lies in military communications and commands markets, the company also develops its activities in some civil markets such as civil aviation, radio spectrum control and information technology security. TCC co-operates with many SMEs and research centres in National Programs (RNRT) or European Programs (ESPRIT, ACTS, INCO).

THOMSON-CSF DETEXIS

On January 1, 1999, the merging of three companies, Dassault Electronique, Thomson-CSF Radars et Contre Mesures and Thomson-CSF Missile Electronics, gave birth to **Thomson-CSF DETEXIS** which is now a public limited company 100% held by Thomson-CSF.

Thomson-CSF DETEXIS and its subsidiaries gather approximately 7,200 employees, with over 75% engineers and technicians. Its turnover exceed FRF 8 billions. Its R&D capacity in the field of high-tech electronic systems is unrivalled in Europe. The Company will now develop its international leadership with its European partners in the fields of electronic warfare, airborne radar, missile electronics, as well as information technology and systems. Through its subsidiaries, and as part of its own development, it will pursue the civil activities already undertaken by its constitutive companies, especially in the field of telecommunication, aeronautics, transportation and electronic fund transfer.

Information Technology and Systems, one of the Strategic Business Units of Thomson-CSF DETEXIS, inherited Dassault Electronique leadership in the field of real-time networks on avionics, aerospace and defence markets. Thanks to this experience, it has succeeded a diversified activity in the industrial field with its expertise and involvement in the provision of Information Systems for various kinds of applications: Defence, Healthcare, Police department, ... More and more, these systems are based upon standard communication protocols and especially on the fashionable

INTERNET stacks. This led Dassault Electronique and now Thomson-CSF DETEXIS to build an important Internet activity.

The network software specialists of the Strategic Business Unit **Information Technology and Systems** are currently developing a new generation of software based on the last IETF specifications that they plan to operationally implement in various kinds of equipment. In particular, they are developing IP Edge Devices allowing to provide VPN services with bandwidth reservation. For this matter, a partnership policy with research labs, network and computer manufacturers and engineering companies has been set up. The company participates to national and international R&D projects that intend to develop the new capabilities currently under specification within the IETF: Quality of Service, Mobile IP…The company is involved in the IETF standardisation process for more than three years now and intents to increase its role in the deployment of the new IPv6 standards suite with the creation of a new international IPv6 Forum.

France Telecom (CNET)

France Télécom core busyness is telecommunication services, data transmission. Providing innovative new services to customers is the core of FRANCE TELECOM world-wide strategy, particularly all over Europe and. FRANCE TELECOM group workforce is around 150000 people.
CNET is France Telecom Research and Development Centre in charge of innovation and services creation. Currently it employs 4250 people including 3600 engineers, scientists, and technicians and 150 scientists or doctoral candidates from other organisations. Its annual budget amounts to 3 billion francs.
With headquarters in Issy-les-Moulineaux, CNET is comprised of nine sites (Issy-les-Moulineaux, Lannion, Rennes, Grenoble, Caen, Bagneux, Belfort, Sophia-Antipolis and La Turbie) and one laboratory recently established in California.
The tremendous impact of telecommunications on economic development has intensified efforts at the European level to aid and promote R & D in this sector. CNET is thus willing to work with numerous partners including academics and manufacturers from all over Europe on over 100 co-operative research projects which are partially financed by the European Union. These projects are part of the ACTS, ESPRIT and TELEMATICS programmes.
The activities of CNET are distributed among 9 R&D divisions units focused on France Telecom's major strategic targets and critical technical areas. Software technologies are nowadays a major activity in any new product that FRANCE TELECOM develops. Information systems play a key role putting new services at work. Huge systems and date bases must be managed, response time are short and real time is a key point. Network control require world-wide systems providing a high level of software reliability, security and real time properties. Users are requesting more friendly and customised interfaces.
To face to the current technological challenges CNET develop particularly expertise and technologies in the following fields:
- multimedia technology, compression, coding,
- end user interfaces: IHM, voice processing, advanced interfaces,
- systems: real-time kernels, distributed systems, embedded systems,
- software design: object technology, reusable software design, software management and reuse, mobile agent, software formal design, software proof, software testing, platforms for services development,
- systems security, encryption, access control,
- networking: network management, quality of service control, intelligent networks, future Internet networks (new protocols, multicasting, high speed network, giga routers, ...) and services, advanced mobile networks and services, networks optimisation, routing algorithms.

GIP RENATER

GIP RENATER is a non profit organisation in charge of the national Research and Education network in France. The board of GIP RENATER is made of the Ministry of Education, Research and Technology (MENRT), the National Centre for Scientific Research (CNRS), the Atomic Energy Agency (CEA), the National Space Agency (CNES) and the National Institute for Research in Applied Sciences and Automatics (INRIA). Its main objective is to provide its community (Technology, Research and Education) with a high performance backbone delivering high quality Internet access together with advanced services such as those described in the technical part of the

project.

Following a classical IP network, in operation since 1992, a brand new infrastructure will be installed in 1999 to interconnect all metropolitan and regional networks and provide them with the international connectivity. This new infrastructure will be based on a broadband ATM interconnect (34-155 Mb/s to start with) with an upper layer based on IP protocol. Available services will range from the standard IP Internet access to on-demand VP, Virtual Private Networks, and full Switched Virtual Circuit service. Above that, multicast protocol, IPv6 VPN, distributed caching systems will be implemented..

Concerning the international connectivity, RENATER is member of QUANTUM project which supports the TEN155 European interconnection network. RENATER has also subscribed a 155 Mb/s link to US, which is used for commodity Internet and peering with North American research network, in particular the Internet2 infrastructure such as Abilene and vBNS

The relevance of the RENATER participation to this project is twofold: First, its mission is to support R&D project in the field of information technologies; Second, most of the Internet services to be developed or validated in the project are of primary importance for the evolution of the RENATER network

Information can be found on the web site: http://www.renater.fr

LIP6

LIP6 is the CNRS laboratory of Computing Science of the Paris University Pierre et Marie

INRIA

INRIA (National Institute for Research in Computer Science and Control) is a French public-sector scientific and technological institute under the dual authority of the Ministry of Research and the Ministry of Industry.

Headquartered at Rocquencourt near Versailles in France, **INRIA** has five research centres at: Grenoble, Nancy-Metz, Rennes, Rocquencourt, and Sophia-Antipolis (near Nice).

INRIA' s missions are to undertake basic and applied research, to design experimental systems, to ensure technology and knowledge transfer, to organise international scientific exchanges, to carry out scientific assessments, to contribute to standardisation.

Over 2 000 persons work in the five INRIA's research centers, including 1 700 scientists, among which 715 permanent positions.

The research carried out at **INRIA** is mainly concerned with software and control engineering. This research brings together experts from the fields of applied mathematics, control, signal processing and computer science within the framework of the following research areas: Networks and Systems; Software Engineering and Symbolic Computing; Man-Machine Interaction; Image Processing, Data Management, Knowledge Systems; Simulation and Optimisation of Complex Systems. The scientific teams are organised in *research projects* (currently 73) that are periodically submitted to a strong evaluation procedure.

Its budget is roughly 82 MEuro, 20% of which comes from research and development contracts, royalties and sales. Industrial relations are strategic for **INRIA**. The Institute's initiatives are directed towards:

- Designing tomorrow's products through collaborative research contracts with industrial partners: more than 200 contracts with French industry and potential users each year, a very important participation in the EU Framework Programmes (260 EU projects since 1984) and 6 EUREKA projects. The Institute has participated in 113 European 4th Framework-Programme projects (from 1995 to 1999). Of these 60 were ESPRIT, 10 TELEMATICS and 4 ACTS projects. It has coordinated 24 of them, in particular the Commission's support to the European branch of the World-Wide Web Consortium and an HPCN-TTN, the PRO-HPC.
- Getting the products onto the market through software houses and technology companies (LE-LISP, ESTEREL, CAML, CHORUS, GRIF, SMECI,...) . See http://www.inria.fr/Information/logiciels-eng.html for more information.

- Promoting the transfer of advanced knowledge (receiving engineers from industry and encouraging the movement of researchers towards industry).
- Stimulating the creation of spin-off companies by former **INRIA** researchers and engineers. Twenty-four spin-off companies have been created since 1984. Three of them have been subsidiaries for some time: ILOG, SIMULOG, O2-Technology. Nowadays only SIMULOG keeps a minority capital participation from the Institute.

INRIA strongly believes in the necessity of a strong European Scientific Community. In that spirit, INRIA is a member of ERCIM EEIG, European Research Consortium for Informatics and Mathematics, together with other institutes totalling a participation of 14 countries (including Central European ones). Outside Europe, multiple relations exist, involving the United States, Japan and many more countries.

TELEBIT

TELEBIT develops and markets high performance, reliable, state-of-the-art networking solutions to research and government organisations, telecommunication carriers, Internet Service providers, ATN Service Providers, and private corporations using cost effective communication platforms that integrate diverse technologies such as Frame Relay, ATM, LAN, X25, ISDN and INTERNET.
TELEBIT's products are marketed under the name of "The PAXNET Solution". These products incorporate the very latest IP technologies including IPv6 updated routing protocols (RIPv6, OSPFv6, BGP4+, IDRPv6…).