TECHNOLOGY FOR ATD

A	T	M					
BELL	SESA	TRT	MBLE	CNET	TID	ASCOM	NTUA
CIT	FACE	VALVO	RTT	BTRL	NTA	NOKIA	IMEC
SEL	PKI	PTDSN	DNL	CETI-	KTAS	STC	UST
STK	APT	PRLB	FIDBP	NESC	JTAS	ACEC	QMC

RACE PROJECT R1022

★ THE RACE PROGRAMME

For these reasons, Europe's telecommunications operators, users and industries have joined forces in research and technology development, with the objective to offer advanced services as soon as possible at an acceptable cost. The framework for this joint effort is the RACE programme (R&D in Advanced Communications technologies for Europe).

The RACE programme is an integral part of the telecommunications and standardisation activities of the European Community leading towards completion of the internal market. It is focused on Integrated Broadband Communications (IBC) and the development of advanced communication technologies for commercial introduction of advanced services in 1995. The first phase of the programme was launched in January 1988. Within its framework telecommunications network operators in the Community and EFTA countries, all major European telecommunications and information technology equipment manufactures, most major research establishments, and numerous universities are collaborating in joint teams, sharing work, experiences and results.

★ ABOUT INTEGRATED BROADBAND COMMUNICATIONS

The concept of Integrated Broadband Communications (IBC) is inherently multi–service. The integration of present day telecommunication, broadcast, and personal computer services will create the evolution space for a vast array of possible new multi–media services. This so called Image Communication space gives birth to the synergetic developments of services more tuned to the totality of human senses such as visual communications, interactive television and multi–media distributed data base access.

The coming generation mobile telecommunication system intended to realise true personal mobile communications from anywhere within Europe, will allow people to communicate freely with each other from homes or offices, fixed locations or moving vehicles. This third generation mobile telecommunication system is designed to be a universal multi–function multi–service digital system. The sharing of the IBC transport infrastructure and functionality will allow the deployment of enhanced and personalised services in all environments, and will allow mobile communications to be indistinguishable from fixed communications.

The introduction of a new generation of innovative services, and improved quality and cost–effectiveness of traditional services will be supported by a single universal network: the IBC Network. This network will have to satisfy the huge growth in demand for fast data transmission and the imposed new challenges as flexibility, and fast response to changing service requirements and user needs.

★ BASED ON ATM

For the purpose of handling traffic resulting from the IBC services, the Asynchronous Transfer Mode (ATM) is the ITU–TS standard adopted as the IBC transfer mode.

- ATM is a method for transferring digital information in the form of fixed size cells. Each cell consisting of a 48 octet information field and a 5 octet header field.

- ATM is a connection–oriented technique, two address fields in the header, the Virtual Channel Identifier (VCI) and the Virtual Path Identifier (VPI), completely identify a particular virtual connection in a multiplexed cell stream. A virtual connection is the concatenation of virtual channels and provides transport of ATM cells between endpoints for the information transfer.

  A Virtual Channel is a communication channel between the endpoints of an ATM network link. A Virtual Path carries a group of virtual channels all sharing the same VPI value over a particular ATM network link.

- ATM is asynchronous in the sense that cells are not associated with a regular position in time within a multiplexed cell stream as is the case for the Synchronous Transfer Mode (STM).

★ THE PROJECT RACE 1022

▶ General

RACE Project 1022, Technology for ATD, is a major system project and one of the largest projects in the RACE programme. It has been executing pre–competitive R&D on key technologies for the realisation of IBC equipment. The application of these advanced technologies to system integration resulted in the RACE 1022 ATM Technology Testbed (RATT) now integrated in Basel, Switzerland. The RATT is a laboratory–sized basic ATM network containing a representative of all main network elements from within the customer premises network and from within the public network. The result of six–years work by the project team, this testbed provides a vehicle for advanced experiments that will lead to a greater understanding of the properties of large ATM systems.

The development work has been complemented by studies into traffic and telecommunications management network issues. Studies on evolution and introduction planning produced scenarios, techno–economic analysis and planning guide–lines for the introduction of ATM networks.

In total 24 partners participate in the ATD consortium, comprising a wide range of public network operators, industrial companies and universities from across Europe.

Advanced communications infrastructures will be essential for the European information based industries of the 21th century. However, the large research effort involved is only possible through concerted action by all concerned. The cost of essential, pre–competitive R&D must be shared amongst European countries. The continued drive towards IBC networks is only made possible through advanced studies as carried out in RACE 1022, and the construction of experimental networks such as the RATT.

▶ Project Activities

The project consist basically of four concurrent superworkpackages (SWPs) :

SWP 0/1 : study of ATM specific aspects :

Although all ATM aspects were within the remit of the project. Activities have been concentrated in those areas thought to be the key issues for the introduction of the IBC network. The results of these activities are available through numerous publications in the public domain and proceeding from workshops organised regularly throughout the duration of the project.

A concise overview gives a flavour of the main activities undertaken by SWP0/1.

Support of connectionless services :

To become a truly integrated services network the IBC network will have to support the connectionless service as this technique is very widespread in the LAN and MAN area for the purpose of data communications. Two ways for providing the connectionless service on top of the connection oriented ATM transfer mode have been analysed. The so called indirect method being a transparent connection at the ATM layer, either permanent, reserved or on demand; or the direct method being a connectionless server function within the B–ISDN itself.

New signalling needs :

The IBCN offers new possibilities to introduce the multi–connections, multi–media, multi–party and multi–service aspects of telecommunication. At the same time the work on such concepts as the intelligent network (IN) and Universal Mobile Telecommunication System (UMTS) continues. To better support the future services by the underlying IBCN the close co–operation between these areas will be necessary.

Overall requirement for signalling functions of call control and connection control have been analysed and proposals for interface protocols and signalling specific for an ATM network elaborated. Important issues as the impacts from call and connection separation and multi–parti multi–connection on signalling architectures were explored, together with the use of protocols based on the OSI model in order to achieve terminal portability.

SWP 2/3 : Realisation of the RATT subsystems :

Together these two superworkpackages have been responsible for the realisation of the RATT subsystems.
SWP2 related to Terminal Adapters and the Customer Premises Network, SWP3 related to the Network Operator's domain.

The RATT is composed of the following subsystems :

- *Terminal Adapters* : Terminal adapters for the N–ISDN S0 interface, Multi–Media Terminal, PC, SUN workstation and for TV distribution services have been developed in order to demonstrate a number of application on the RATT network.

- *Residential-NT2 :* The R–NT2 is aimed at a residential environment, intended to support mainly distributive services. It is based on a shared medium, point to multipoint configuration. In downstream direction, traffic is broadcast to all terminals via a folded bus, another bus is used for the upstream traffic. The terminals are connected by means of a terminal medium adapter for handling contention resolution. The implemented access protocol can be a gated, exhaustive or fixed polling mechanism.

- *Business–NT2* : An ATM PBX based on the same multi–path selfrouteing switching principle as the ALEX system. It is implemented as a pure star configuration. The B–NT2 is aimed at a business environment which will support mainly interactive and multi–media services.

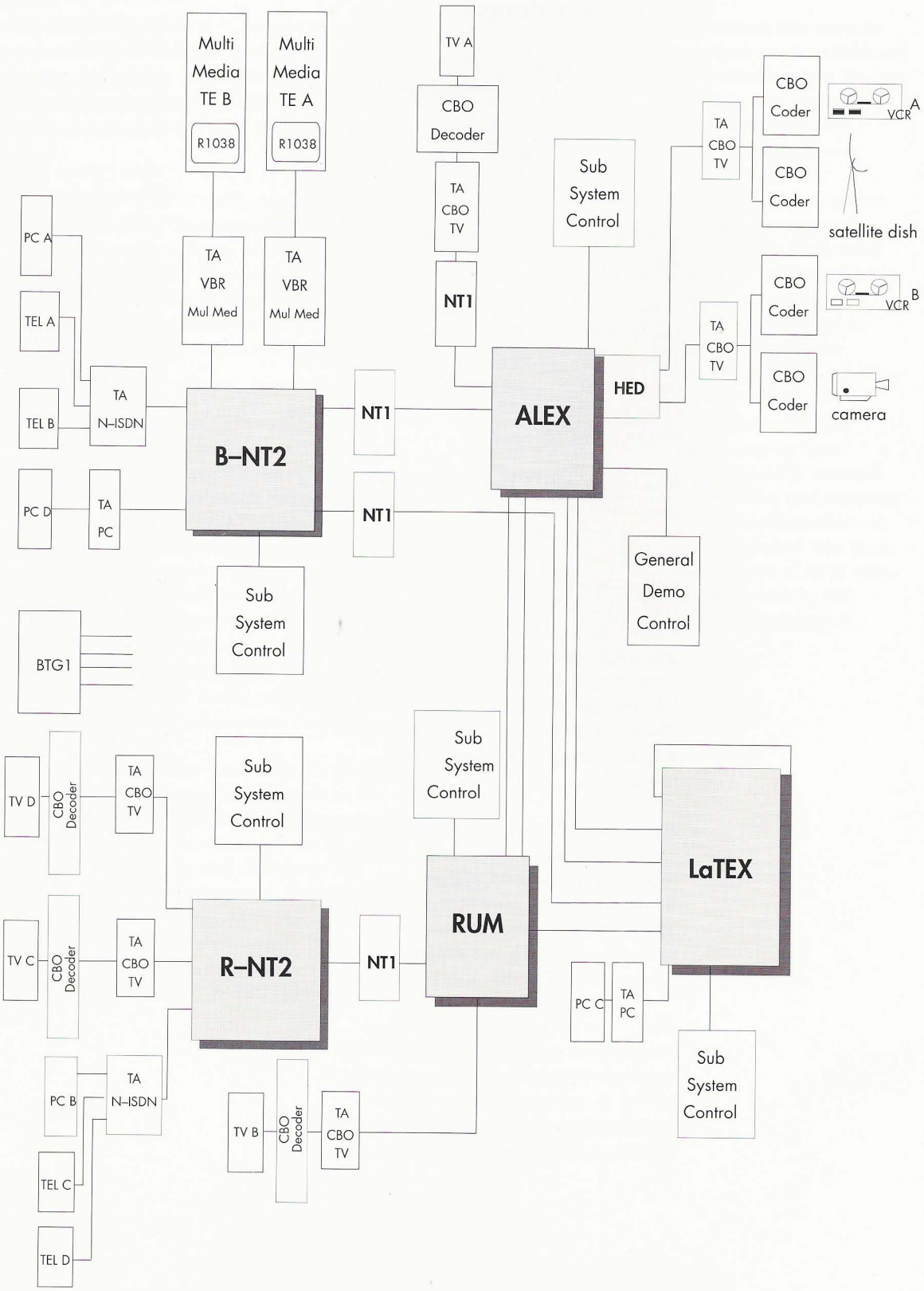
- *NT1* : The NT1 subsystem has been developed to be independent of the type of customer (business or residential) that is serves. It contains the minimal set of functions necessary to terminate the public ATM network at the customer's premises.

- *ALEX :* ATM Local Exchange and cross(X)connect based on a multi–path selfrouteing principle with the following characteristics :
  - selfrouteing: Routeing information is appended to the cell at the entrance of the switching fabric
  - multi–path: Traffic is distributed on a cell by cell base across the different alternative paths between source and destination.

- *LaTEX :* A Local And Transit EXchange based on a preset path selfrouteing principle.
  - preset–path: For each connection a unique path is determined amongst the different alternative paths through the network.
  - selfrouteing: A routeing tag is added at the entrance of the switching network, the tag preceding the ATM cell on an extra serial tag line.

- *RUM :* The Remote Unit acts as an ATM customer concentrator, the remote unit was developed with a specific local network topology in mind in which remote units are connected to each other and to the exchange via two high speed counter rotating rings. The switching principle is preset path selfrouteing as for the LaTEX system.

- *Generic Control functions :* A common approach was taken with the development of generic software intended to be used on all of the systems. The generic part of the software handles signalling, call control, connection admission control and resource management such as bandwidth allocation and general database functions.



RATT configuration

CONCLUSION

The work in RACE 1022 has been of great importance in bringing together people from manufacturers, universities and network operators. All of the partners considers the RACE programme and especially RACE 1022 as a very important way to gain and exchange knowledge. Participation in the RACE 1022 project has given them valuable insight into the potential of ATM technology. For many of them it would have been difficult and expensive to reach the same level of knowledge as they have today without being involved in the RACE 1022 collaborative research project.

Developments from within RACE 1022 will eventually be used in a variety of commercial products. Moreover the expertise gained throughout the co-operation of the project is an investment for future developments. The development of technology within RACE 1022 forms in general a part of larger technology development programmes in the corporations.

Work initiated in RACE 1022 is further used and elaborated in a number of RACE II projects, in particular the EXPLOIT project which further focuses on aspects related to the introduction of ATM equipment, applications and services to demonstrate the feasibility of IBC

★ PARTNERS

Alcatel Bell Telephone Mfc. (Coordinating Partner)	Belgium
Alcatel SEL	Germany
Alcatel SESA	Spain
Philips Kommunikations Industrie	Germany
Philips Communication Systems	Netherlands
Télécommunications Radioelectriques et Téléphoniques	France
AT&T Network Systems Nederland	Netherlands
NOKIA	Finland
Ascom Tech	Switzerland
Belgacom	Belgium
British Telecom Labs	Great Britain
Norwegian Telecom	Norway
Kjobenhavns Telefon Aktieselskab	Denmark
Forschungsinstitut Der Deutsche Bundespost Telekom	Germany
Jydsk Telefon Aktieselskab	Denmark
France Télécom, Centre National d'étude de Télécommunications	France
Telefonica Investigaçion y Desarollo	Spain
Centro de Estudos de Telecomunicações	Portugal
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University of Stuttgart	Germany
Queen Mary and Westfield College	Great Britain
Instituto de Engenharia de Sistemas e Computadores	Portugal

Subcontractors

SGS - Thomson	France
Univ. Politecnica de Cataluna	Spain

★ HOST

The host for the R1022 Technology Testbed is the Association Swiss–PTT/Ascom (ASPA). ASPA was formed specially for this purpose. The site compises 800 m2 in a modern PTT building in Basel, Switzerland with access to the latest telecommunications infrastructure.

★ CONTACT

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