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I&D em Tecnologias Avançadas de Comunicações para a Europa (RACE)
Relatório Final sobre a Fase I (1988-1992) do programa de 10 anos RACE

(Apresentado pela Comissão nos termos do nº 3 do artigo 6º e do artigo 9º da Decisão 88/28/CEE do Conselho relativa ao programa RACE)

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Resumo

Actualmente, as telecomunicações estão na base da maioria das actividades industriais e têm um papel central no funcionamento do sector dos serviços na Europa. A existência de boas telecomunicações é crucial para a competitividade das empresas. A realização do Espaço Económico Europeu sem barreiras internas ao comércio abrirá novas oportunidades e produzirá uma nova pressão concorrencial. A importância crescente das telecomunicações no comércio internacional está já a mudar a face do mundo dos negócios. A prosperidade da Europa nos anos 90 dependerá vitalmente da existência de boas comunicações.

Os sectores das telecomunicações, da informática e da radiodifusão representam já um volume de negócios anual superior a 500 000 MECU em todo o mundo. No ano 2000, o sector das telecomunicações será o terceiro maior na Europa, atrás dos produtos alimentares e dos dos produtos químicos. As infra-estruturas das telecomunicações serão, de um ponto de vista económico, mais importantes do que as infra-estruturas físicas dos transportes. Assim, o domínio das opções tecnológicas tornou-se um factor essencial do crescimento económico e da criação de novos empregos. Mais de 50% dos postos de trabalho dependem já da utilização de sistemas informáticos e telemáticos e o maior crescimento no emprego regista-se no sector da informação.

A procura de serviços está a mudar rapidamente. As empresas necessitam de serviços mais flexíveis, de maior capacidade de transmissão, para disporem de uma transmissão rápida de dados e imagens e de tarifas mais competitivas. A taxa de crescimento nos serviços de valor acrescentado através de redes digitais de elevado débito aproxima-se actualmente de 40% ao ano, com 40 milhões de combinações serviços-utilizadores em 1987, 180 milhões em 1989 e mais de 300 milhões em 1991. No ano 2000, cerca de 30% das receitas das telecomunicações poderão estar associadas a estes serviços de valor acrescentado. Dentro de poucos anos a maioria das grandes empresas europeias irá exigir comunicações de dados rápidas entre as suas actividades de projecto, fabrico, gestão e retalho. A procura destes serviços já é grande nos EUA: todos os grandes institutos de investigação têm acesso a comunicações de dados de débito muito elevado e 60% das 500 maiores empresas fazem uso de ligações para transmissão digital de elevado débito.

Reconhecendo-se esta tendência, foi lançada em 1985 uma "fase de definição" do programa RACE, por iniciativa dos Ministros da Indústria Europeus. Dela se concluiu que havia a possibilidade e a necessidade de um quadro europeu de colaboração em I&D. A decisão relativa à primeira fase de um programa RACE (Research and development in Advanced Communications technologies in Europe) com a duração de 10 anos foi adoptada pelo Conselho Europeu de Ministros em Dezembro de 1987. Esta decisão estabeleceu a orientação política e as dotações orçamentais para um período inicial de 5 anos, até 1992, no âmbito do 2º programa-quadro comunitário de investigação e desenvolvimento tecnológico. O objectivo era promover a competitividade da indústria, dos operadores e dos prestadores de serviços comunitários de telecomunicações, a fim de tornar acessíveis aos utilizadores finais, com um custo mínimo e num tempo mínimo, os serviços que sustentarão a competitividade da economia europeia e contribuirão para manter e criar empregos na Comunidade.

O artigo 9º da decisão estipula que "depois de terminado o primeiro período quinquenal de realização do programa, a Comissão, após consulta do Comité, enviará aos Estados-membros e ao Parlamento Europeu um relatório sobre a aplicação e os resultados do programa ". O presente relatório é o atrás referido e vem actualizar o exame de 30 meses apresentado em 1990.

Principais realizações

Como resultado dos trabalhos realizados nos primeiros cinco anos do programa RACE, a Europa adquiriu um avanço nítido no desenvolvimento conceptual de redes e serviços avançados de comunicações. Pela primeira vez, operadores de telecomunicações, indústria telemática e utilizadores de vanguarda na maioria dos principais sectores de aplicação juntaram forças no desenvolvimento das tecnologias avançadas de comunicações necessárias para serviços inovativos e de baixo custo. Foi criado um ambiente único no programa RACE para a concertação de esforços.

O programa RACE reforçou a harmonização da infra-estrutura europeia de telecomunicações; o desenvolvimento de especificações funcionais comuns proporcionou uma base para as comunicações integradas em banda larga. O programa promoveu uma cooperação estreita entre regiões centrais e periféricas, tendo assim contribuido para a coesão económica e social da Comunidade. Em termos de desenvolvimento tecnológico, o desenvolvimento do modo de transferência assíncrona para a comutação de alta velocidade em comunicações digitais deu à indústria europeia uma posição de vanguarda na concorrência internacional. A investigação em gestão de redes conduziu ao reconhecimento internacional dos sistemas europeus de gestão de redes. Os trabalhos relativos ao vídeo e à televisão digitais deram origem a normas internacionais de codificação, sistemas de distribuição de sinais multigigabit e especificações para registo vídeo digital. Na área da normalização, o programa contribuiu com 596 projectos de especificações para os organismos europeus e internacionais - ETSI, CCITT e CCIR (ver Anexo II). Desenvolveu-se uma complementaridade excelente com as actividades EUREKA, tendo sido publicados mais de 1700 documentos científicos e técnicos com difusão pública (ver Anexo III).

Os resultados do programa RACE dotaram as organizações e prestadores de serviços europeus de telecomunicações de uma vantagem concorrencial estratégica. O programa sensibilizou a indústria para as oportunidades de mercado que acompanharão a implementação da próxima geração de serviços de telecomunicações na Europa, demonstrou as vantagens da colaboração à escala europeia na I&D pré-competitiva e reforçou substancialmente a normalização europeia no sector das telecomunicações.

Gestão e avaliação do programa RACE

O programa RACE é um caso único no 2º programa-quadro comunitário: foi o único programa gerido como um conjunto plenamente integrado de tarefas. Cada projecto abordou uma ou mais tarefas de I&D dentro dum conjunto coerente, contribuindo cada uma delas para um único objectivo:

"Introdução das comunicações integradas em banda larga, tendo em conta a evolução da RDIS e as estratégias nacionais de introdução, com vista a serviços à escala comunitária em 1995"

O plano de trabalho do programa, adoptado em 1987, estabeleceu o quadro para os trabalhos de cada projecto e para a sua interacção. Esta interacção foi ainda reforçada através de uma concertação regular entre projectos, por meio de debates técnicos com intervalos de 6 - 8 semanas nos quais deviam participar todos os projectos. Os resultados técnicos dos projectos foram ainda consolidados por um projecto-núcleo responsável pelo desenvolvimento das estratégias de implementação das IBC, dos modelos funcionais de referência, das funções de cliente do serviço e das configurações de referência. Foi também assegurada uma interacção forte e coerente com os organismos europeus de normalização através de um segundo projecto central responsável pelo desenvolvimento de consensos e pelo desenvolvimento de especificações funcionais comuns.

A avaliação e auditoria dos trabalhos do programa reflectem o carácter de grande integração do programa.

A nível do programa, foi efectuada uma auditoria de estratégia em 1989, para avaliar os trabalhos no que respeita aos objectivos estratégicos e políticos da Comunidade. O avanço dos trabalhos foi comunicado ao Conselho de Ministros e ao Parlamento Europeu em 1990 no exame de 30 meses previsto na Decisão do Conselho. Seguiu-se, em 1990, uma reavaliação à luz das novas necessidades de I&D, efectuada por uma comissão independente de quadros e funcionários nacionais (Telecom 2000). Em 1991 e princípios de 1992 foi feita uma avaliação dos trabalhos por um painel independente[1)], no contexto dos outros grandes programas de aplicação das TI e Telemática do 2º programa-quadro (ESPRIT e DRIVE). Finalmente, em 1992, a Comissão apresentou um relatório sobre o programa no contexto da avaliação do 2º programa-quadro[2)] e o comité de gestão do RACE efectuou a sua própria avaliação a pedido do CREST[3)].

A investigação e desenvolvimento tecnológico do programa foi acompanhada de avaliações regulares do impacto económico e social dos desenvolvimentos nas comunicações avançadas[4)]. A mais recente destas avaliações foi efectuada em 1991 e divulgada em 1992. A maior parte destas actividades foi plenamente integrada na 2ª fase do RACE, na sequência do disposto na Decisão do Conselho relativa ao programa específico para as tecnologias das comunicações.

Os processos de gestão do programa adoptados pelos serviços da Comissão para o programa RACE foram sujeitos a uma "auditoria de gestão de programa" independente em 1989, que teve como resultado uma clara aprovação da abordagem da Comissão.

A nível de projectos, cada projecto foi sujeito anualmente a uma "auditoria técnica" efectuada por peritos independentes no domínio de investigação em causa. A primeira destas auditorias técnicas teve lugar em Outubro de 1988 e a última em Outubro de 1992. Os resultados destas auditorias anuais foram utilizados para reorientar ou dar por terminados os trabalhos dos projectos, quando necessário.

Estas avaliações e auditorias mostraram, no seu conjunto, que o programa RACE foi coroado de êxito em relação aos seus objectivos iniciais.

Os trabalhos iniciados no âmbito da primeira fase do RACE foram continuados e alargados em projectos de I&D no âmbito do novo programa específico de IDT para as tecnologias das comunicações, a segunda fase do RACE. Estes projectos integram-se no 3º programa-quadro comunitário e materializam o financiamento parcial pela Comunidade de I&D até Dezembro de 1994. Os trabalhos daqueles projectos tiveram início em Janeiro de 1992 e a sobreposição com projectos RACE da fase I em 1992 garantiu a continuidade dos trabalhos. O programa continuará a dar um contributo significativo para o desenvolvimento económico e a integração sócio-económica da Europa. É acompanhado de actividades nacionais[5)] e de acções internacionais, como as do EURESCOM[6)], que reforçam a actividade na Comunidade e que são por ela reforçadas. O programa RACE constitui um quadro único no qual operadores de redes, indústria e utilizadores de telecomunicações cooperam em conjunto.

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1) Relatório da comissão de exame para as tecnologias da informação e comunicações presidida por W. Dekker, Junho de 1992.
2) Comunicação da Comissão relativa à avaliação do 2º programa-quadro de investigação e desenvolvimento tecnológico (SEC(92)675 Final, Julho de 1992.
3) Reproduzida na secção 3.2.1 do presente relatório.
4) Os relatórios destas avaliações foram publicados e largamento divulgados como a série de relatórios sobre "Perspectivas para as comunicações avançadas na Europa: PACE".
5) Estão em curso experiências de comunicações em banda larga na Bélgica, Alemanha, Dinamarca, França, Irlanda, Portugal e Reino Unido.
6) Instituto Europeu de Investigação e Estudos Estratégicos em Telecomunicações

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1. Introdução

De todos os sectores industriais na Europa, as telecomunicações são o mais dinâmico e de evolução mais rápida. Os serviços de telecomunicações geram um volume de negócios anual superior a 300 000 milhões de ECU na Europa. Os investimentos nas redes e serviços e telecomunicações estão próximos de 30 000 milhões de ECU por ano. As receitas estão ainda largamente associadas à telefonia vocal, mas a maioria dos actuais investimentos em capital incide nas novas gerações de equipamentos digitais, que podem servir de suporte à integração de comunicações de voz, dados e imagens. Por volta do ano 2000, cerca de 30% das receitas das telecomunicações poderão estar associadas aos serviços de valor acrescentado que utilizam comunicações avançadas de dados.

A nível mundial, todas as esferas da vida estão a ser afectadas pela convergência das tecnologias da informação, da radiodifusão e das telecomunicações. A combinação das técnicas de tratamento de dados com ideias inovadoras nas telecomunicações originou já a implementação de redes digitais com integração de serviços, que constituem um primeiro passo num processo rápido que se encaminha para uma gama muito mais vasta de serviços multimedia que exigirão novas tecnologias, novos sistemas de gestão de redes e serviços e novos sistemas de regulamentação. A combinação da integração de serviços com as fibras ópticas, que oferecem um elevado débito de transmissão a baixo custo (velocidades um milhão de vezes maiores que nos condutores de cobre) proporciona a base técnico-económica para uma reestruturação fundamental de todos os sectores, através das comunicações integradas em banda larga (IBC). O desenvolvimento deste conceito é o objectivo do programa RACE.

O presente relatório resume e documenta os resultados da primeira fase do programa de 10 anos RACE, de 1988 a 1992.

A secção 2 descreve o contexto, a organização e os resultados do programa. A secção 3 resume a organização e resultados das avaliações e auditorias do programa. As ligações com outras acções comunitárias e europeias estão descritas na secção 4. Os resultados da I&D da primeira fase do RACE foram já largamente explorados no desenvolvimento de normas, no desenvolvimento de novas redes e serviços e utilizados como base para novos trabalhos na fase II do programa. A exploração dos resultados da fase I do RACE vem descrita na secção 5, enquanto a transição para a fase II é descrita na secção 6. As futuras exigências e opções para os trabalhos a nível europeu são descritas na secção 7.

O Anexo I apresenta informações pormenorizadas sobre as realizações dos projectos de I&D. Os contributos para a normalização vêm enumerados no Anexo II e todas as publicações científicas e técnicas resultantes dos trabalhos vêm indicadas no Anexo III. Os pedidos de registo de patentes são enumerados no Anexo IV; o Anexo V contém um glossário de termos técnicos e o Anexo VI apresenta uma lista de referências às decisões formais do Conselho de Ministros e às comunicações da Comissão. Os projectos de I&D financiados no âmbito da fase 1 do programa RACE são enumerados no Anexo VII; as organizações participantes vêm indicadas no Anexo VIII e as estatísticas financeiras e de participação constam do Anexo IX.

2. Contexto e organização do programa RACE

2.1 A I&D como parte integrante da política comunitária de telecomunicações

O programa RACE faz parte integrante da política de telecomunicações da Comunidade. Ligado à política de normalização e à do mercado da informação, complementa os trabalhos no domínio das tecnologias da informação no âmbito do ESPRIT e, pela primeira vez, conta com a importante participação dos operadores europeus de redes de telecomunicações no desenvolvimento em colaboração de tecnologias e serviços. Incidindo na futura relação custo/desempenho das infra-estruturas de comunicações na Europa, o programa RACE contribuiu para o desenvolvimento do mercado único, a competitividade internacional da indústria europeia e a coesão económica e social da Comunidade.

Os principais objectivos da política comunitária de telecomunicações constam da Resolução do Conselho de Junho de 1988[1)] e são os seguintes:

- criar ou garantir a integridade de uma rede de dimensão comunitária, com base no princípio de uma total interconectividade de todas as redes públicas em causa;

- criar progressivamente um mercado comum aberto dos serviços de telecomunicações;

- incentivar a criação de serviços à escala europeia, em conformidade com as exigências do mercado e as necessidades sociais;

- prosseguir o desenvolvimento de um mercado aberto e de dimensão comunitária dos equipamentos terminais;

- desenvolver um mercado comum no qual as administrações de telecomunicações e outros prestadores de serviços possam concorrer em igualdade de circunstâncias;

- prosseguir a execução das medidas tomadas pela Comunidade no domínio das normas comuns;

- reforçar a cooperação europeia a todos os níveis, nomeadamente no domínio da investigação e desenvolvimento das telecomunicações;

- criar um ambiente social para o futuro desenvolvimento das telecomunicações e

- integrar plenamente as regiões menos favorecidas da Comunidade no mercado comum em vias de criação.

Estes objectivos constituem um quadro claro para a definição do futuro desenvolvimento das tecnologias, dos serviços e das aplicações.

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1) Resolução do Conselho de 30 de Junho de 1988 relativa ao desenvolvimento do mercado comum de serviços e equipamentos de telecomunicações até 1992, 88/C 257/01, JO nº C 257 de 4.10.88, p. 1.

2.2 Objectivos do RACE

O grande objectivo do RACE é contribuir para a:

"Introdução das IBC[2)], tendo em conta a evolução da RDIS e as estratégias nacionais de introdução, com vista a serviços à escala comunitária até 1995[3)]"

Os objectivos específicos da fase 1 eram:

- promover a indústria comunitária das telecomunicações;
- permitir que os operadores europeus de rede concorram nas melhores condições possíveis;
- habilitar um número mínimo de Estados-membros a introduzir serviços IBC comercialmente viáveis em 1995;
- permitir que os prestadores de serviços melhorem a relação custo/desempenho e introduzam novos serviços; promover a oferta de novos serviços com custos e prazos no mínimo tão favoráveis como noutras zonas;
- apoiar a criação de um mercado único europeu dos equipamentos e serviços de telecomunicações e
- contribuir para o desenvolvimento regional, permitindo que as regiões menos desenvolvidas beneficiem plenamente dos progressos nas telecomunicações.

O Anexo I da decisão apresenta ainda um conjunto de objectivos técnicos. O contributo dos projectos RACE de I&D para a consecução destes objectivos é descrito no Quadro I.

Durante o desenvolvimento e execução do programa a interpretação do conceito de comunicações integradas em banda larga evoluiu em resposta às mudanças nas condições regulamentares e de mercado. A definição abaixo reflecte o consenso desenvolvido no Comité de Gestão do RACE durante 1990.

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2) "I" "Integrated" não só significa "serviços integrados" (a nível do utilizador e nos níveis respectivos da rede), como aponta ainda para a "integridade" de toda a rede e, consequentemente para o interfuncionamento correcto de todos os seus componentes essenciais, incluindo os existentes e os que estão a surgir: telefonia, pacotes, RDIS, satélite, móveis, ...

"B" "Broadband" não só significa segmento superior (em termos de débito) dos serviços, como designa também a combinação total dos serviços em causa, desde o extremo superior da RDIS (p.ex., acessos a 2 Mbit/s e eventualmente a 64 Kbit/s em áreas específicas de aplicação) até às necessidades de uma introdução realista de serviços (p.ex., 140 Mbit/s) vídeo (interactivo e de distribuição).

"C" "Communication" abarca não só as funções tradicionais comutação/transmissão/CPN, mas também as características mais avançadas que conferem à oferta de serviços maior facilidade de utilização, nível de desempenho mais elevado e maior solidez económica.

3) Decisão do Conselho de 14 de Dezembro de 1987 relativa a um programa comunitário no domínio das tecnologias das telecomunicações - I&D em tecnologias avançadas de comunicações na Europa (Programa RACE), 88/28/CEE, JO nº L 16 de 21.1.88, p. 35.

QUADRO 1

Objectivos técnicos	Forma como o RACE trata esses objectivos	Impacto do trabalho do RACE
Objectivos da Parte I: Estratégias de Desenvolvimento e Implementação das IBC		
Compreensão comum da evolução das IBC e suas implicações	Estabelecimento de um quadro de colaboração entre operadores, indústria e utilizadores	Desenvolvimento de uma abordagem comum do planeamento da evolução das redes do ponto de vista da engenharia de sistemas
	Estudos estratégicos técnico-económicos tendo em conta a procura e as opções tecnológicas	Estudo das condições óptimas para a introdução das IBC
		Identificação comum das principais questões técnicas
		Posição comunitária coerente em actividades fora do âmbito do RACE
Definição comum de sistemas e subsistemas IBC	Desenvolvimento de uma configuração de referência para definir os sistemas e subsistemas em redes de comunicações integradas em banda larga	Reforço da normalização europeia
		Acordo sobre uma estratégia comum europeia no domínio das especificações ATM
	Desenvolvimento de opções e tecnologias de implementação adequadas	
Linhas mestras para as especificações funcionais dos sistemas e serviços integrados das IBC	Desenvolvimento de um modelo funcional de referência com uma estrutura lógica das funções e interfaces	Acordo sobre especificações funcionais comuns
		Acordos sobre conceitos e protocolos de "integração de redes"
		Acordos sobre opções de médio e longo prazo para acesso do cliente à banda larga
Identificação das necessidades em tecnologia e I&D	Desenvolvimento em cooperação de um modelo de utilização de referência que associa os requisitos dos utilizadores às opções técnicas	Incidência e concentração da I&D europeia em tecnologias-chave e novas necessidades dos utilizadores
	Avaliações em comum dos desenvolvimentos tecnológicos	
Compreensão da relação custo/desempenho de vias alternativas de implementação	Desenvolvimento de instrumentos comuns de avaliação técnico-económica e operacional	Foram desenvolvidos instrumentos comuns de análise técnico-económica e de planeamento e gestão avançados de redes
Análise dos requisitos de normalização	Reuniões regulares com os organismos de normalização; coordenação entre o projecto de gestão *por consensos* e o ETSI; estudos conjuntos das necessidades de normalização resultantes da evolução das exigências dos utilizadores em todo o mundo	596 contributos para os organismos de normalização (Anexo II)

QUADRO 1

Objectivos técnicos	Forma como o RACE trata esses objectivos	Impacto do trabalho do RACE
Objectivos da parte II: Tecnologias IBC		
Utilização de tecnologias avançadas para uma implementação rendível das IBC	I&D em sistemas, subsistemas e componentes ópticos críticos em termos de custo para transmissão em banda larga para as instalações do cliente e para a comutação	Especificação e desenvolvimento de protótipos de conectores, lasers e elementos de comutação para redes locais, CPN, etc. Demonstração de protótipos e de processos de produção de baixo custo
	Estudos sobre oportunidades no curto prazo com vista a reduções de custo imediatas	Desenvolvimento de tecnologias "directas" e "coerentes" de detecção. Desenvolvimento de tecnologias ATM para uma utilização rendível da largura de banda
	Estudos sobre oportunidades no médio/longo prazo com vista a importantes economias de custos e *aperfeiçoamentos nos serviços*	Desenvolvimento de algoritmos compatíveis de compressão do débito para TVAD digital e serviços vídeo de alta qualidade; desenvolvimento de um CODEC de baixo custo
Suporte lógico de telecomunicações para sistemas integrados complexos	Desenvolvimento de uma nova arquitectura para a oferta de serviços: uma arquitectura aberta de serviços	Desenvolvimento de programação orientada para objectos para sistemas telecom. Validação de protótipos de instrumentos de engenharia do suporte lógico integrado
	Estudos sobre técnicas avançadas de tratamento da informação para funções IBC	Desenvolvimento de arquitecturas e protótipos TMN para gestão de tráfego, manutenção, controlo da qualidade do serviço, administração de *clientes e redes e comunicações seguras*
	Estudos *sobre novas tecnologias do suporte* lógico para especificação, concepção, implementação, verificação e manutenção de sistemas de telecomunicações	Métodos de especificação, ambiente de desenvolvimento e suporte em linha para sistemas telecom
		Estabelecimento de conceitos de integridade para serviços IBC e de um conjunto de primitivas da integridade
Avanços em opções orgonómicas e cognitivas do equipamento IBC	Estudos de utilizabilidade para diálogo, distribuição, recuperação, serviços integrados e CPN domésticas	Uma taxinomia para a engenharia da utilizabilidade
	Estudos de utilizabilidade para pessoas com necessidades especiais (idosos e deficientes)	Implementação de características para uma fácil utilização em experiências de comunicações avançadas, nomeadamente para pessoas com necessidades especiais
	Desenvolvimento de metas para a concepção orientada para a utilizabilidade	Melhoramento da interacção de investigadores da utilizabilidade, utilizadores e conceptores de equipamentos
	Incorporação e avaliação da utilizabilidade em aplicações-piloto	Identificação e análise sistemática de questões comuns de utilizabilidade em projectos-piloto de aplicação

QUADRO 1

Objectivos técnicos	Forma como o RACE trata esses objectivos	Impacto do trabalho do RACE
Realização de subsistemas e redes evolutivos	Definição e demonstração de arquitecturas genéricas de sistemas e subsistemas IBC, incluindo a redução do débito vídeo	Definição de especificações funcionais e de projecto para redes locais, CPN e terminais (multisserviços e multimedia, com registo vídeo digital e visores de painel plano)
	Desenvolvimento de conceitos e quadros para redes nas instalações do cliente que satisfazem necessidades domésticas e empresariais	Demonstração de um visor de painel plano a cores EL e respectivo controlador
	Desenvolvimento de protótipos de terminais	
	Adaptação de sistemas com vista a uma evolução suave para as IBC	Concepção de componentes e subsistemas para CPN domésticas e empresariais em ambiente ATM
	Desenvolvimento de protótipos de sistemas integrados, incluindo redes locais e redes e terminais nas instalações do cliente *interconectados através de interfaces* aprovados	Especificações de sistemas integrados e sua validação através de demonstradores
Objectivos da parte III: Desenvolvimento de modalidades de aplicação das IBC		
Desenvolvimento de instrumentos de verificação, análise dos princípios de concepção, grupos ou protocolos funcionais	Desenvolvimento conjunto de instrumentos e processos de ensaio para elementos e subsistemas da rede IBC	Verificação de instrumentos e de funções e terminais IBC em redes nas instalações do cliente e em equipamento de comutação em centrais locais e de trânsito.
	Verificação de protocolos em pontos críticos de referência IBC	Identificação dos pontos e protocolos de ensaio de acesso. Recomendações de ensaios de conformidade de protocolos
Aperfeiçoamento das especificações funcionais e/ou verificação de propostas de normas	Integração de sistemas-piloto para ensaio de protocolos de interfuncionamento	Especificações de sistemas e subsistemas em ambiente multisserviços
	Verificação pré-normativa de elementos críticos de normalização e especificação	Validação de mecanismos de demonstração de interoperabilidade e conformidade com normas
Desenvolvimento de situações experimentais em que prestadores de serviços, operadores de rede e utilizadores podem ensaiar produtos experimentais IBC, a fim de clarificar as possibilidades de exploração comercial das IBC	Definição dos futuros requisitos dos serviços em colaboração com utilizadores de vanguarda dos principais sectores comerciais	Realização de aplicações-piloto nos principais sectores: banca e finanças, seguros, media e editores, indústria, serviços de saúde, pessoas com necessidades especiais, transportes e distribuição, utilização experimental da TVAD
	Implementação de um banco de ensaios IBC em vários locais na Europa	Definição de requisitos e acordo quanto a experiências de interconexão em banco de ensaios
	Exploração de questões ligadas à interconexão e interfuncionamento	

2.3 Execução do programa

Dada a rápida evolução do sector das telecomunicações na Europa, foi adoptada uma execução por fases do programa RACE. O programa teve início com uma fase de definição[4] em 1986. Seguiu-se a fase I, objecto do presente relatório, que teve formalmente início em Junho de 1987 e terminou em Dezembro de 1992.

Na fase I os trabalhos foram estruturados em três partes:

Parte I - Estratégias de desenvolvimento e implementação das IBC

Os projectos da parte I incidiram no desenvolvimento de especificações funcionais, sistemas e investigação de operações orientado para a definição de propostas de normas, conceitos e convenções IBC em conformidade com uma abordagem de sistemas abertos, tendo os trabalhos de análise incidido na interoperabilidade dos equipamentos e serviços IBC. Os resultados dos projectos da parte I são do domínio público e representam uma importante contribuição para os trabalhos dos organismos internacionais de normalização.

Parte II - Tecnologias IBC

Os projectos da parte II incidiram nos desafios técnicos da implementação das IBC. Deram importantes contributos para o desenvolvimento das tecnologias necessárias à realização, com baixos custos, de equipamentos e serviços IBC.

Parte III - Integração funcional pré-normativa

Os projectos da parte III incidiram em objectivos pré-normativos relacionados com a realização de um "ambiente aberto de verificação" destinado a avaliar funções e conceitos operacionais. Vinte dos projectos desta parte do programa envolveram aplicações-piloto de comunicações avançadas em diversos ambientes comerciais e de oferta de serviços. Estes projectos ensaiaram equipamentos e aplicações experimentais face a propostas de especificações funcionais e de normalização para o mundo real, resultantes dos trabalhos dos projectos da parte I.

O programa RACE foi executado em duas fases. O primeiro conjunto de projectos teve início em Janeiro de 1988 e incidiu em engenharia de sistemas (parte I) e trabalhos tecnológicos (parte II)[5]. O segundo, que incidiu no estudo de futuros serviços e da integração e verificação de sistemas (parte III), foi objecto de um convite para apresentação de propostas em Julho de 1988. Estes projectos tiveram início em Janeiro de 1989.

Ao longo dos processos de selecção dos projectos e de execução de programa houve uma evolução na importância atribuída a cada parte do programa. Os recursos dedicados à parte I sofreram um aumento, dos 11,9% previstos para 18%. Na parte II houve uma diminuição de 66% para 55% e na parte III houve um aumento de 22,4% para 27% dos recursos. Isto foi o reflexo de uma mudança nas áreas privilegiadas (inicialmente o desenvolvimento tecnológico e mais tarde o desenvolvimento de serviços e estudos sobre a procura) e na força das propostas de trabalhos para as partes I e II do programa.

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4) Decisão do Conselho de 25 de Julho de 1985 relativa a uma fase de definição de uma acção comunitária no domínio das telecomunicações - programa de I&D para as tecnologias avançadas no domínio das telecomunicações para a Europa (RACE), 85/372/CEE, JO nº L 210 de 7.8.1985, p. 24.

5) Comunicação da Comissão ao Conselho e ao Parlamento "Rumo às telecomunicações dos anos 2000 (TELECOM 2000) - Lançamento do programa RACE - COM(88) 240 final II de 31.5.88.

A distribuição dos recursos financeiros do programa é resumida no quadro 2.

QUADRO 2

RESUMO DA UTILIZAÇÃO DOS RECURSOS FINANCEIROS NA FASE I DO PROGRAMA RACE

PROGRAMA	DECISÃO (MECU)	DECISÃO (%)	EFECTIVO (%)
Parte I	60	11,9	18,0
I.1 Estratégias para as IBC	14	2,8	
I.2 Realização das IBC	28	5,5	
I.3 Utilização das IBC	10	2,0	
I.4 Ambiente operacional comum	8	1,6	
Parte II	332	65,7	55,0
II.1 Funções dos Sistemas IBC	94	18,6	9,0
Infra-estrutura de Programação IBC	49	9,7	25,0
Engenharia da utilizabilidade	12	2,4	11,0
Evolução da Rede	177	35,0	10,0
Parte III	113	22,4	27,0
III.1 Instrumentos de verificação	63	12,5	6,0
III.2 Aplicações-piloto das IBC	50	9,9	

Os projectos de I&D de 92 envolveram a participação de 306 empresas, incluindo os grandes intervenientes nas telecomunicações europeias. Participaram ainda nos trabalhos 27 organizações dos países da EFTA (Áustria, Finlândia, Noruega, Suécia e Suíça).

2.4 Resultados essenciais

O programa RACE reforçou a harmonização da infra-estrutura das telecomunicações europeias, o que constitui um pré-requisito para a realização do mercado único. As especificações funcionais comuns são a base das comunicações integradas em banda larga europeias. Esta realização só foi possível através da cooperação de todos os operadores de rede, indústria das telecomunicações, empresas de radiodifusão e principais utilizadores de vanguarda europeus, cooperação que foi a marca distintiva do programa RACE.

Desenvolvendo, desde cedo, uma sensibilização e reacção à mudança, o programa RACE contribuiu também significativamente para que os intervenientes nas telecomunicações e serviços europeus obtivessem vantagens concorrenciais estratégicas no mercado cada vez mais global dos equipamentos e serviços de telecomunicações.

O Anexo I do presente relatório e os relatórios anuais de 1988, 1989, 1990, 1991 e 1992 apresentam informações sobre as realizações de cada projecto. Indicam-se a seguir as realizações essenciais em cada área do programa.

Realizações essenciais da parte I: Estratégias de desenvolvimento e implementação das IBC

Os trabalhos conduziram a uma compreensão comum da evolução das IBC e das suas implicações e a uma colaboração efectiva entre operadores, indústria e utilizadores no desenvolvimento de especificações funcionais comuns para as IBC e em estudos comuns de estratégia técnico-económica.

Foram estabelecidas relações estreitas de trabalho com os organismos europeus e internacionais de normalização. Em 1989 foi criado um grupo de coodenação entre o projecto de gestão por consensos e o Instituto Europeu de Normalização das Telecomunicações (ETSI). Os trabalhos sobre o modo de transferência assíncrona (ATM) contribuiram directamente para um acordo sobre uma estratégia comum europeia neste domínio e para a produção de normas internacionais.

Foram acordadas definições comuns de sistemas e subsistemas IBC e foram desenvolvidas configurações de referência que definem a estrutura de sistema da rede de comunicações integradas em banda larga. Foram adoptadas especificações funcionais de sistemas e serviços integrados IBC, existindo já um modelo funcional de referência que define uma estrutura lógica para as funções e interfaces das IBC, funcionando como uma agência central para todos os requisitos funcionais relativos à implementação. As especificações funcionais comuns (CFS) foram largamento divulgadas em 1990.

Foram definidas interfaces em pontos essenciais de referência nas redes de banda larga, tendo sido estabelecidos requisitos a nível de componentes e de sistema.

Foi desenvolvido um "modelo de utilização de referência" destinado a fornecer um quadro conceptual que associa requisitos de utilizador e requisitos funcionais.

Foram concluídas avaliações sistemáticas de opções tecnológicas e operacionais, incluindo comunicações ópticas, comunicações móveis, satélites, CPN, novas técnicas de comutação e TVAD.

Foram desenvolvidos instrumentos de avaliação da relação custo/eficácia de vias alternativas de implementação: um primeiro conjunto relaciona-se com uma análise económica e um segundo com o planeamento e normas de redes. Estes instrumentos constituem a base de comparações transnacionais de opções e estratégias relacionadas com características técnicas e económicas e ainda de necessidades de normalização.

Realizações essenciais da parte II: Tecnologias IBC

A I&D centrou-se em componentes ópticos, subsistemas e sistemas de custo crítico tanto de transmissão em banda larga para as instalações do cliente como de comutação, com o objectivo de obter soluções rendíveis para aplicações em todos os grandes domínios.

As tecnologias ATM foram definidas e desenvolvidas de modo a proporcionarem uma implementação flexível e duradoura de comunicações em banda larga. Foram concluídas realizações e comparações de diferentes opções ATM e foram desenvolvidas especificações de requisitos para sistemas de comutação ATM.

Foram desenvolvidas técnicas de codificação vídeo compatível para TV(AD) e videotelefonia, que asseguram uma utilização eficiente em termos de custo dos recursos em largura de banda. Foi simulada a utilização de algoritmos de técnicas de compressão de débito para serviços vídeo de alta qualidade (TV e videotelefone) e o desenvolvimento de CODEC teve já um impacto significativo na normalização e introdução comercial de videoconferências mais baratas.

Foram efectuados grandes progressos em sistemas de comunicação óptica multigigabit e em comutação fotónica. Foram desenvolvidas especificações para sistemas, subsistemas e componentes (conectores, lasers, elementos de comutação, etc), tendo especialmente em atenção os aspectos relacionados com os custos de diferentes áreas de aplicação (rede local, CPN, etc). Foram produzidos e demonstrados protótipos de componentes e subsistemas.

Na área do suporte lógico de telecomunicações para sistemas integrados complexos, foram desenvolvidos modelos orientados para objectos e foram definidas arquitecturas e protótipos para gestão de tráfego, manutenção e adminsitração de clientes e redes. Foram desenvolvidos métodos de especificação, bem como um ambiente de desenvolvimento para apoio em linha em sistemas de telecomunicações. Foi definida uma arquitectura para comunicações seguras.

Na área da investigação ergonómica e cognitiva foi estabelecida uma taxinomia para a engenharia da utilizabilidade e foram identificados requisitos da engenharia da utilizabilidade em comunicações avançadas, incluindo os relativos a pessoas com necessidades especiais.

Foram desenvolvidas arquitecturas genéricas e técnicas e tecnologias adequadas para sistemas e subsistemas IBC, incluindo redução do débito vídeo. Estas realizações funcionam como um quadro destinado a satisfazer necessidades domésticas, comerciais e outras, numa vasta gama de aplicações.

Foram ensaiados e adaptados, para utilização em serviços IBC, diversos tipos de terminais que integram visores de painel plano. Foram utilizados sistemas integrados (incluindo redes locais e ainda redes e terminais nas instalações do cliente interconectados através de interfaces aprovadas nos pontos de referência S e T) para validação de especificações funcionais e tecnologias.

A investigação no domínio das comunicações móveis estabeleceu o quadro conceptual para uma 3ª geração de radiocomunicações celulares. Teve como resultado a definição de telecomunicações móveis universais (UMTS), que poderão responder às principais exigências do mercado europeu no meio da década de 90.

Realizações essenciais da parte III: Desenvolvimento de modalidades de aplicação das IBC

Estes trabalhos incidiram no desenvolvimento de instrumentos de verificação e na verificação de princípios de concepção, de grupos funcionais ou de protocolos. Terminais, redes nas instalações do cliente, sistemas de acesso do cliente, comutação (em centrais locais e de trânsito) e sistemas de transmissão foram, todos eles, sujeitos a processos de ensaio desenvolvidos em conjunto por engenheiros de sistemas e conceptores de instrumentos de ensaio. Foram definidos pontos de acesso para ensaio e protocolos.

As aplicações-piloto das IBC implicaram a participação de prestadores de serviços, operadores de rede e utilizadores em ensaios de produtos experimentais para as IBC, de modo a tornar mais rápida a compreensão das características da exploração comercial das IBC. Foram desenvolvidas aplicações-piloto para os principais sectores: banca e finanças, seguros, media e editores, indústria, serviços de saúde, pessoas com necessidades especiais, transportes e distribuição e utilização experimental da TVAD. Estes trabalhos contaram com a participação de mais de 100 utilizadores de vanguarda.

Para a implementação da parte III e de alguns trabalhos complementares das partes I e II, foi reconhecida a necessidade de uma infra-estrutura de ensaio à escala europeia. Em 1989, foi apresentada pelas principais administrações de telecomunicações europeias uma proposta destinada a proporcionar uma primeira rede de banda larga numa base experimental. Esta proposta baseava-se num acordo de implementação de uma experiência europeia de interconexão em banda larga (EBIT) a 2 Mbit/s, com uma evolução para 140 Mbit/s para as conexões transnacionais. Os principais operadores de rede participantes assinaram um memorando de acordo, tendo sido criada uma equipa multinacional de apoio consultivo às aplicações-piloto no que respeita às suas necessidades de rede e suporte lógico, de modo a garantir a interoperabilidade dos sistemas de utilizador final. Este projecto de exploração e apoio no âmbito do RACE contribuiu para uma melhor orientação das diversas aplicações-piloto. No entanto, devido a dificuldades no estabelecimento de ligações transnacionais rendíveis para actividades de investigação, a maioria limitou-se, até ao momento, a experimentação em bancos de ensaios nacionais. Só agora, em 1993 e 1994, com a possibilidade da utilização experimental de sistemas ATM, se vai tornando rendível uma experiência transeuropeia em banda larga com largura de banda a pedido.

Contudo, as aplicações-piloto cumpriram plenamente a sua função, fornecendo reacções de ambientes de utilização real ao desenvolvimento tecnológico e ao desenvolvimento de especificações.

2.5 Participação de PME

Apesar dos elevados custos da I&D em telecomunicações avançadas, a primeira fase do RACE atraiu uma forte participação de pequenas e médias empresas (PME). Estas representaram 28% das participações nos projectos RACE, o que é bastante mais do que os 16,5% registados no 2º programa-quadro no seu conjunto[6]. As pequenas organizações, empresas ou organismos de investigação, participaram em mais de 60% dos projectos.

6) Avaliação do 2º programa-quadro de IDT: relatório do CREST ao Conselho, Setembro de 1992. CREST/1212/1/92.

2.6 Contributo para a coesão económica e social

Através do estudo e desenvolvimento de estratégias de introdução das IBC em todas as zonas da Comunidade, incluindo as regiões menos favorecidas, o programa criou alicerces para a realização de redes transeuropeias de comunicações em banda larga, previstas no capítulo XII do Tratado da União Europeia. Foi prestada especial atenção à necessidade de ligar regiões insulares, encravadas e periféricas às regiões centrais da Comunidade.

Diversas medidas de acompanhamento, seminários e cursos de verão garantiram a acessibilidade da I&D efectuada a cientistas e engenheiros de todas as áreas da Comunidade Europeia, tendo sido feito um esforço especial para organizar reuniões e seminários nas áreas menos favorecidas. O Anexo I inclui uma lista completa destas actividades.

53 projectos (60%) contaram com a participação de organizações das regiões menos favorecidas da Comunidade, tendo esta participação contribuído para a transferência de tecnologias e conhecimentos para estas regiões.

3 Avaliação e auditoria do programa RACE

3.1 A avaliação como processo contínuo

Dada a rápida evolução das tecnologias e serviços de comunicações, a avaliação foi encarada como um processo contínuo ao longo da preparação, lançamento e execução do programa. Foi também um processo que afectou todos os níveis: orientação estratégica do programa, gestão operacional do programa e direcção técnica de cada projecto.

O processo de avaliação teve início com a extensa colaboração de intervenientes nas telecomunicações no planeamento do programa e no desenvolvimento do plano de trabalho. A colaboração contínua com a indústria e os operadores de telecomunicações permitiu a actualização anual do plano de trabalho do programa e dos planos de trabalho de cada projecto. Realizaram-se ainda reuniões regulares entre os consórcios que estão na base do programa (reuniões de concertação), que asseguraram um processo contínuo informal de acompanhamento e ajustamento dos progressos por todos os projectos. A consistência dos trabalhos foi assegurada pelo projecto de gestão por consensos, que estabeleceu estreitas relações com os organismos europeus de normalização.

O progresso dos trabalhos foi comunicado ao Conselho de Ministros e ao Parlamento Europeu em 1990 no exame de "30 meses" previsto na Decisão do Conselho[7)].

O presente relatório final foi elaborado nos termos do artigo 9º da Decisão, segundo a qual, depois de terminado o primeiro período quinquenal do programa, "a Comissão, após consulta do Comité, enviará aos Estados-membros e ao Parlamento Europeu um relatório sobre a aplicação e os resultados do programa". O presente relatório actualiza e substitui o exame de 30 meses apresentado em 1990.

Nos termos do nº 4, terceiro travessão, do artigo 6º, a Comissão submeteu o presente relatório à apreciação do Comité de Gestão.

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7) Este relatório foi elaborado nos termos do artigo 9º da Decisão do Conselho, que estipulava: "O programa deve ser revisto depois de decorridos 30 meses, com base numa avaliação dos resultados obtidos relativamente aos objectivos específicos definidos no Anexo II da presente decisão. A Comissão informará o Conselho e o Parlamento Europeu dos resultados dessa revisão."

3.2 Auditorias e avaliações do programa

Os trabalhos sobre as comunicações integradas em banda larga (IBC) do RACE foram periodicamente ajustados para dar resposta às condições técnico-económicas e oportunidades de serviços em evolução rápida. Assim, no âmbito do programa, foram efectuados exames críticos (auditorias) anuais no que se refere a:

- **aspectos de estratégia**, para avaliação do desempenho do RACE no seu todo e no que respeita aos objectivos estratégicos e políticos da Comunidade no contexto internacional;

- **aspectos técnicos**, para avaliação do desempenho dos projectos RACE no confronto com os objectivos do RACE.

Foi ainda efectuada uma auditoria à gestão do programa. Esta auditoria forneceu uma avaliação independente do desempenho dos serviços da Comissão no cumprimento das suas tarefas de gestão do programa.

3.2.1 Auditorias de estratégia e avaliações do programa

Foi efectuada em 1989 uma auditoria de estratégia independente para avaliar os trabalhos no que se refere aos objectivos estratégicos e políticos da Comunidade no contexto internacional. As principais conclusões foram:

- o objectivo básico do RACE manteve-se válido; o desenvolvimento das IBC é pertinente e necessário à Europa; a meta de 1995 mostrou-se consistente com as necessidades e com a evolução a nível mundial;

- o destaque dado no RACE às diversas áreas abrangidas foi correcto.

O painel da auditoria recomendou também que, na fase seguinte, fosse dada mais atenção aos recursos nas instalações do cliente, às aplicações de comunicações móveis, à TVAD digital e à verificação e ensaio, tendo considerado o ATM como a tecnologia-chave de redes.

Em consonância com o princípio da subsidariedade, a auditoria de estratégia pôs também em relevo as acções que os intervenientes nas telecomunicações e as organizações nacionais deveriam empreender, fora do âmbito do programa RACE, para garantir que as realizações da I&D sejam efectivamente seguidas da implementação das IBC. Estas recomendações estão indicadas no quadro 4.

Algumas das recomendações tiveram seguimento. A recomendação de que as administrações de telecomunicações preparassem um MA sobre uma colaboração estreita nas suas ligações e operações intra-europeias de longa distância foi retomada no MA METRAN, na elaboração dos acordos GEN e no estabelecimento do EURESCOM; a extensão do âmbito da I&D foi realizada, o esforço de normalização do ATM foi intensificado e está em curso o desenvolvimento de uma implementação experimental do ATM. No entanto, outras recomendações não foram seguidas dentro do calendário proposto: o ambiente de regulamentação na Europa não permitiu a convergência de interesses das administrações de telecomunicações, de radiodifusão e de TV por cabo da forma prevista e o desenvolvimento da TVAD foi mais lento do que o previsto.

À auditoria de estratégia seguiu-se em 1990 um estudo prospectivo sobre as futuras opções e exigências, no qual colaboraram grandes peritos em estratégia, política e tecnologia. As recomendações desta Comissão de Requisitos constam do relatório "Telecom 2000" e foram a base para o desenvolvimento do plano de trabalho da 2ª fase do RACE.

Em 1991 e no início de 1992 o programa RACE foi novamente avaliado no contexto dos outros grandes programas de aplicação das TI e Telemática do 2º programa-quadro (ESPRIT e DRIVE) por um painel independente presidido pelo Senhor Dekker[8]. A Comissão respondeu separadamente às recomendações deste painel[9].

Recomendações do Painel da Auditoria de Estratégia em 1989

A) Os governos nacionais devem colaborar na definição, até 1992, das condições e disposições regulamentares que devem ser aplicadas à introdução de serviços pan-europeus avançados de comunicações;

B) As administrações de telecomunicações, radiodifusão e TV por cabo devem propor, até meados de 1989, uma abordagem concertada, com calendário, do desenvolvimento e utilização de infra-estruturas IBC para serviços de telecomunicações e lazer incluindo TVAD, explorando plenamente, sempre que se justifique, as iniciativas de investimento do sector privado;

C) As administrações de telecomunicações devem preparar um memorando de acordo, até 1990, sobre uma colaboração estreita nas suas ligações e operações intra-europeias de longa distância;

D) Os prestadores de serviços devem especificar, até final de 1990, um primeiro conjunto de requisitos, condições comerciais e disposições regulamentares relativos a serviços que favoreçam uma utilização rápida e generalizada dos serviços IBC;

E) As administrações de telecomunicações, de radiodifusão e de TV por cabo, os prestadores de serviços e a indústria da telemática devem chegar a um memorando de acordo até meados de 1989, de modo a complementarem a I&D em colaboração no RACE com a implementação experimental de alguns serviços IBC à escala europeia, com vista a uma introdução comercial das IBC até 1992;

F) A I&D em colaboração deve ser alargada, de modo a incluir a engenharia dos serviços integrados, aplicações fixas e móveis e técnicas de verificação e ensaio de funções dos equipamentos e serviços de comunicações até final de 1989;

G) Os organismos europeus de normalização devem intensificar e coordenar os seus esforços com vista a uma normalização internacional das IBC e dos serviços avançados. Deve ser estabelecido um calendário de normalização até meados de 1989, em especial para o ATM;

H) Os Estados-membros devem abordar o problema das atribuições de frequências na Europa, em toda a gama de frequências e de aplicações. Deste modo, deve ser possível, até 1992, racionalizar as atribuições de frequências em consonância com a evolução das necessidades e prioridades.

8) Relatório da comissão de exame para as tecnologias da informação e comunicações, presidida pelo Sr. W.Dekker, Junho de 1992.

9) Resposta da Comissão ao relatório Dekker, Janeiro de 1993.

Finalmente, em 1992, a Comissão apresentou um relatório sobre o programa no contexto da avaliação do 2º programa-quadro[10]. O Comité da Investigação Científica e Técnica (CREST) foi convidado pelo Conselho a apresentar comentários aos relatório da Comissão. O referido comité passou o convite ao Comité de Gestão do RACE (CGR), que apresentou o seguinte relatório em Julho de 1992:

Qualidade dos resultados e impacto na competitividade

Em termos gerais, os resultados do RACE estão, no mínimo, ao nível do estado da técnica e, em muitos casos, houve realizações de vanguarda (p.ex., ATM (modo de transferência assíncrona), comunicações móveis (UMTS: sistema universal de telecomunicações móveis) e tecnologias e dispositivos ópticos).

Actualmente a Europa está em melhor posição do que estaria sem o RACE. Poderá ainda haver outros países mais avançados que a Europa, mas o fosso tecnológico diminuiu significativamente entre as telecomunicações europeias e as dos EUA e Japão.

Durante os cinco anos do 2º programa-quadro, o RACE cumpriu largamente os seus objectivos técnicos previstos na Decisão do Conselho. No entanto, o ritmo a que evoluiu o sector das telecomunicações (p.ex., exigências de novos serviços, novas tecnologias e competitividade crescente entre operadores) foi tal que os próprios objectivos e prioridades do programa tiveram que ser ajustados durante o período de cinco anos da sua realização. Surgiram novos objectivos com novas prioridades (como as experiências de comunicações e as infra-estruturas de ensaio e verificação), que foram retomados em programas subsequentes, como o RACE II (segunda fase do programa RACE de 10 anos).

O programa RACE incentivou a cooperação entre OT (em planeamento estratégico, como no caso do EURESCOM), entre indústrias (na formação de um consórcio industrial - RIC) e entre OT e indústrias (p.ex., nos organismos de normalização como o ETSI). No entanto, é necessário continuar a desenvolver a dimensão e o âmbito deste tipo de cooperação.

Para além dos numerosos resultados científicos e técnicos, o RACE I produziu 470 contributos para os organismos de normalização (principalmente o ETSI) com base no desenvolvimento das suas especificações funcionais comuns.

No que toca à indústria das telecomunicações, a colaboração no âmbito do RACE fez aumentar a sua competitividade nos mercados mundiais. Para o conjunto da indústria europeia, a influência positiva do RACE deve tornar-se mais visível a longo prazo, com a adopção generalizada de comunicações avançadas. O prosseguimento da I&D em aplicações pode demonstrar aos potenciais utilizadores as vantagens concorrênciais que podem obter através de comunicações ao nível do estado da técnica.

10) Comunicação da Comissão relativa à avaliação do 2º programa-quadro de investigação e desenvolvimento tecnológico, SEC(92) 675 Final, Julho de 1992.

Gestão e rendibilidade

No âmbito do programa-quadro, o RACE é um programa coerente com objectivos específicos comuns a todos os projectos, com um horizonte temporal de dez anos. Durante o RACE I, os maiores progressos foram feitos nas áreas do ATM, componentes e tecnologias ópticas, comunicações móveis (UMTS) e experiências em banda larga. Como resultado, as duas últimas categorias receberam um destaque muito maior no RACE II. As áreas em que se realizaram menos progressos foram as da segurança e da concepção da utilizabilidade, que obrigaram a uma redução dos objectivos iniciais.

O mecanismo de concertação teve um papel central na colaboração efectuada no âmbito do RACE. Em geral, uma colaboração à escala europeia como a realizada no RACE é rendível, na medida em que conduz a um factor de multiplicação nos resultados alcançados pelos parceiros para o investimento que efectuaram individualmente.

Os processos de avaliação de concursos e de auditoria técnica funcionaram bem: por exemplo, o processo "bandeira vermelha" reorientou e revitalizou com êxito projectos que de outro modo não teriam cumprido os seus objectivos, ou fez parar projectos a tempo, evitando desperdício de recursos. Ainda que o programa tenha sido globalmente bem estruturado e bem gerido, é possível introduzir melhoramentos em certas áreas:

* a cooperação/colaboração com outros programas multinacionais europeus de investigação não foi suficientemente eficaz;

* deve haver um empenho mútuo, por parte da Comissão, dos PTO e da indústria, no apoio ao programa e aos seus objectivos, antes da adopção do plano de trabalho;

* deve intensificar-se o esforço para manter a qualidade do programa no seu conjunto, distinta da dos seus projectos. Por exemplo, um número excessivo de participantes importantes não mantem a sua participação ao longo do tempo de vida do programa;

* é necessário optimizar a rendibilidade das reuniões de concertação;

* o projecto de gestão por consensos deve, idealmente, ser o primeiro projecto a avançar, de modo a assegurar relações efectivas com os outros projectos;

* devem ser tomadas medidas para aumentar o papel activo e a participação de PME em futuros programas;

* deve recorrer-se mais a acções concertadas e a medidas de apoio.

Coerência com as políticas e princípios comunitários

Os critérios de selecção técnica utilizados na avaliação dos candidatos e na auditoria dos projectos provaram ser satisfatórios.

Na selecção dos projectos para o RACE I não foram tomados explicitamente em conta critérios sociais e económicos. No entanto, em termos gerais, um programa de telecomunicações como o RACE é coerente com as políticas vigentes de ambiente e de poupança de energia.

No que respeita à subsidiariedade, é evidente que uma colaboração a nível europeu em investigação pré-normativa no domínio das telecomunicações oferece benefícios. Contudo, deve ser incentivada uma interacção mais estreita com programas e experiências nacionais.

Conclusões

1995 não pode ser o ponto final para os programas de investigação em telecomunicações na Europa. É necessário um novo programa que dê continuação ao RACE.

A investigação e desenvolvimento é necessária mas não suficiente para se obter uma boa posição nos futuros mercados das telecomunicações. O CGR não especifica neste documento quais as medidas necessárias à consecução deste objectivo. O facto de a I&D em telecomunicações se centrar cada vez mais nos serviços e aplicações deve ter influência na estrutura e organização dos futuros programas.

Há que alargar a utilização e prossecução dos resultados do RACE na Europa. Para que estas transferências tenham lugar, poderão ser necessárias iniciativas dos intervenientes neste sector.

Este relatório constituiu uma parte da base sobre a qual o CREST apresentou ao Conselho um relatório relativo ao 2º programa-quadro, em Outubro de 1992.

3.2.2 Avaliações de impacto e previsões

A investigação e desenvolvimento tecnológico no âmbito do programa foi acompanhada ao longo dos cinco anos através de avaliações regulares do impacto económico e social dos desenvolvimentos nas comunicações avançadas. Os relatórios destas avaliações foram publicados e largamente divulgados numa série de relatórios sobre "Perspectivas para as comunicações avançadas na Europa PACE (Perspectives for Advanced Communications in Europe)". A mais recente destas avaliações foi efectuada em 1991 e divulgada em 1992. Esta actividade fornece um quadro factual para a actualização anual dos trabalhos no âmbito do programa, bem como para pequenos ajustamentos no decurso do ano. A maior parte desta actividade está agora integrada na 2ª fase do RACE, em consonância com o disposto na Decisão do Conselho relativa ao programa específico para as tecnologias das comunicações.

3.2.3 Auditoria à gestão do programa

Os processos de gestão do programa adoptados pelos serviços da Comissão para o programa RACE foram sujeitos a uma "auditoria de gestão de programa" independente, em 1989.

As principais conclusões são: o estilo industrial de gestão do programa adoptado pelos serviços da Comissão foi, globalmente, adequado aos objectivos e aos parceiros do programa e as auditorias técnicas anuais, bem como as reuniões periódicas de concertação, demonstraram constituir uma abordagem eficaz da gestão do programa.

3.2.4 Auditorias técnicas dos projectos RACE

Para que o programa pudesse ser adaptado ao desenvolvimento da tecnologia e à evolução da percepção da procura, a decisão RACE previa uma revisão anual do plano de trabalho.

Tal implicava que os progressos de todos os projectos em curso fossem revistos anualmente no que respeita aos objectivos e fossem ainda postos em confronto com novas necessidades. Por esta razão, cada projecto foi sujeito a uma auditoria técnica anual efectuada por peritos independentes no domínio de investigação em causa. A primeira auditoria técnica teve lugar em Outubro de 1988 e a última em Outubro de 1992. Os resultados destas auditorias anuais foram utilizados para reorientar ou pôr fim aos trabalhos dos projectos, sempre que necessário.

Os principais elementos constituintes da auditoria técnica eram os seguintes:

(a) Anualmente, os parceiros em cada projecto procediam a uma auto-avaliação através dum exame do projecto nos seus aspectos essenciais e registavam os resultados num relatório de exame anual.

(b) Estes relatórios eram avaliados por peritos externos independentes (auditores) seleccionados com a ajuda do CGR. Após a avaliação destes relatórios, procedia-se a uma audição sob a presidência da Comissão. Os responsáveis dos projectos tinham a oportunidade de sublinhar as suas realizações e delinear os futuros trabalhos. Os auditores, agrupados em painéis de acordo com o respectivo domínio de competência, puderam questionar os projectos de modo a completar a imagem dada pelo relatório anual e pela exposição.

(c) Os painéis consolidavam as suas conclusões e recomendações e registavam-nas nos relatórios dos painéis de auditoria que eram apresentados ao CGR e à Comissão.

(d) Os relatórios de auditoria eram complementados com uma avaliação dos resultados previstos em contrato efectuada pelos funcionários da Comissão ligados ao projecto (em geral os resultados previstos são considerados confidenciais e não são divulgados aos auditores).

Estes processo provou ser equilibrado e eficaz. Os relatórios de auditoria funcionaram como uma excelente base para a negociação anual dos contratos relativos aos planos de trabalho pormenorizados de cada projecto.

4. Ligações com outras acções europeias e comunitárias

4.1 Ligações com a CEPT

As relações com a CEPT e os seus órgãos subsidiários alteraram-se substancialmente durante o desenvolvimento e aplicação do RACE.

Durante a fase de definição, o grupo especial para as comunicações em banda larga (GSLB) criado pela CEPT contribuiu grandemente para o plano de trabalho da fase I do RACE. Nos anos de 1987 e 1988, a coordenação com os trabalhos na CEPT foi assegurado pelo GMR (grupo misto RACE) criado para esse efeito em Setembro de 1987.

Em 1988, a colaboração com a CEPT resultou também na assinatura, por 13 Administrações Europeias de Telecomunicações, de um MA para introdução de um banco de ensaios para os trabalhos sobre as IBC (EBIT).

A reformulação da regulamentação sobre as telecomunicações, de acordo com a nova política europeia de telecomunicações, levou a CEPT a criar um conjunto de organismos separados, dois dos quais estabeleceram fortes ligações com as actividades do RACE: o ETNO, Grupo de Operadores de Redes Europeias de Telecomunicações que constitui actualmente o fórum de discussão entre os operadores de rede sobre as questões relacionadas com o interfuncionamento de redes e o EURESCOM que constitui um fórum de investigação estratégica conjunta. Nem todos os grandes OT europeus participam no EURESCOM, todavia este organismo não deixa de funcionar como uma interface útil entre a Comissão, os projectos RACE e a maioria dos operadores de rede.

4.2 Ligações com organismos europeus e internacionais de normalização

A criação do ETSI , Instituto Europeu de Normalização das Telecomunicações, em 1988 inscreveu-se na política europeia de telecomunicações. É actualmente o grande fórum europeu para o desenvolvimento de especificações técnicas. Os trabalhos pré-normativos no RACE deram origem a 596 contribuições separadas para os trabalhos de normalização do ETSI, CCITT e CCIR.

Foram ainda realizadas reuniões periódicas com os representantes do CEN/CENELEC, UER e SPAG.

4.3 Ligações com outros programas comunitários ou actividades europeias

Os projectos RACE apoiam-se nos resultados de projectos que desenvolvem tecnologias genéricas, i.e., ESPRIT (componentes microelectrónicos, ferramentas de suporte lógico, AIP para gestão da rede, etc.); do mesmo modo, as exigências em telecomunicações dos programas de aplicação DRIVE, DELTA e AIM correspondem em larga medida às técnicas abordadas pelos actuais projectos RACE.

A colaboração com o COST foi instaurada através de estreitas ligações entre os trabalhos afins e de reuniões periódicas a nível da gestão do programa.

Com a iniciativa EUREKA, a maior interacção verificou-se no domínio das tecnologias audiovisuais. Parte do trabalho relacionado com a promoção da TVAD (projecto EUREKA 95) foi complementado com trabalhos no âmbito de um contrato RACE; o projecto EUREKA 256 sobre codificação vídeo foi associado às actividades de integração RACE.

4.4 Ligações com organizações dos países da EFTA

Estão envolvidas no RACE organizações da Áustria, Finlândia, Noruega, Suécia e Suíça. 27 organizações destes países participaram em 72 projectos (em mais de 80% dos trabalhos).

5. Exploração dos resultados do RACE

As oportunidades oferecidas pelas novas tecnologias de comunicação terão um impacto muito importante no futuro crescimento económico da Comunidade e na divisão internacional do trabalho à escala mundial. Observam-se três processos de crescimento distintos, porém interligados:

- o aperfeiçoamento do acesso a melhor informação aumenta a produtividade em toda a economia,

- os melhoramentos nas comunicações aumentam a utilidade e, por conseguinte, o grau de aceitação pelo mercado tanto dos antigos como dos novos serviços, conduzindo à sua expansão,

- a transição para a nova economia dominada pelos serviços e baseada na informação exige um enorme investimento público e privado em novas infra-estruturas físicas - cabos, comutação, terminais - e humanas, para o desenvolvimento de serviços de telecomunicações de valor acrescentado.

Assim, a qualidade - técnica e de organização - das comunicações será fundamental para o futuro crescimento económico, na medida em que determina a capacidade da economia para gerar, e usar eficazmente, o mais importante dos factores da moderna "produção": o conhecimento.
A organização geográfica das infra-estruturas influirá fortemente no espaço social, económico e cultural de amanhã, tal como sucedeu com os caminhos de ferro no século XIX.

Por esses motivos, os resultados da I&D relacionada com as comunicações devem ser rápida e efectivamente explorados. Deste modo, tem sido dada especial atenção à exploração dos resultados RACE em todo o programa.

5.1 Plano de exploração do RACE

Por forma a incentivar e a avaliar a exploração dos resultados do RACE pelos participantes, tem sido regularmente actualizado um **"Plano de Exploração do RACE"** entre 1988 e 1992. Este plano fornece uma visão geral da exploração dos resultados pelos participantes.

Os contributos para a normalização constam do Anexo II, os títulos das publicações técnicas e científicas figuram no Anexo III. Com mais de 1700 publicações técnicas e científicas, fruto dos trabalhos realizados, o programa RACE contribuiu em larga escala para a literatura científica de divulgação pública.

Os resultados do desenvolvimento de tecnologias foram igualmente protegidos por pedidos de registo de patentes sempre que necessário. Já foram registados 73 pedidos de patentes referentes aos trabalhos do RACE que figuram no Anexo IV.

5.2 Plano de aplicação das IBC

Uma verdadeira exploração da I&D só é possível se todos os intervenientes possuírem uma visão coerente do ritmo e orientações dos desenvolvimentos comerciais. Neste sentido, a I&D do programa RACE foi sempre calendarizada e especificada de acordo com um plano indicativo de aplicação das comunicações integradas em banda larga que tem vindo a ser regularmente actualizado. Esse plano envolve uma introdução faseada de serviços avançados, iniciando-se com aqueles que revelam uma procura comercial e profissional desde 1992/1993. O actual calendário indicativo de aplicação, tal como descrito no relatório anual RACE para 1992 (RACE 92), prevê as seguintes etapas:

1992/1993:

- Introdução desde a fase inicial de aplicações comerciais e profissionais.
- Experiências no domínio das comunicações avançadas para ensaio de novos serviços e de sistemas de gestão de rede: ATM, MAN e IBC em redes nas instalações do cliente.
- Decisões de aquisição/investimento relativamente aos futuros IBCN e serviços 100% IBC pan-europeus.
- Conclusão de importantes normas.

1994:

- Conclusão da interconexão de todas as capitais da Comunidade e países vizinhos, com base no alargamento das actuais redes ópticas de trânsito, mas com suporte de tráfego vocal, de imagens e de dados, separadamente ou como serviços integrados.

1995:

- Implementação inicial da rede IBC e conclusão do acesso do cliente para o sector comercial em centros de actividade económica e industrial: pelo menos 50 000 empresas utilizadoras de serviços avançados.
- Experiências de campo em aplicação, para ensaio de uma gama completa de serviços IBC (incl. clientes domésticos com vídeo bidireccional e TVAD digital) que utilizem equipamento comercial IBC.

1996:

- Oferta de serviços comerciais básicos em banda larga, com base em ligações 2, 34 e 155 MBit/s, incluindo transmissão rápida de dados inter-RL, videoprocessamento CAD/CAM e aplicações de trabalho à distância.
- Interfuncionamento de redes fixas de banda larga com redes móveis, por satélite ou outras.

1997:

- Disponibilidade dos serviços IBC junto dos utilizadores comerciais em cidades com mais de 500 000 habitantes e início da instalação generalizada de fibras nas habitações.

2005-2010:

- 50% de penetração dos serviços IBC.

O calendário indicativo será de novo revisto em 1992, no âmbito da elaboração de directrizes para o desenvolvimento de redes transeuropeias de banda larga, tal como previsto no artigo 129º-B e C, do Título XII do Tratado da União Europeia.

6. Implementação da fase II do RACE

Desde sempre o programa RACE esteve previsto para um período de 10 anos com a sua implementação dividida em duas fases. A fim de garantir a continuidade, foi adoptada, em Junho de 1992, a segunda fase enquanto programa específico, no âmbito do terceiro Programa-quadro de investigação e desenvolvimento tecnológico.

Contudo, em 1991, verificou-se uma importante alteração a nível de perspectiva. O que no início do programa parecia uma visão ambiciosa, quase futurista, transformou-se numa oportunidade realista. A introdução comercial das comunicações integradas em banda larga era optimisticamente aguardada dentro de quatro anos. Além disso, tinha-se tornado ainda mais evidente que as telecomunicações e os serviços avançados de informação desempenhariam um papel fulcral no desenvolvimento sócio-económico a nível mundial à medida que nos aproximávamos do século XXI.

Estas alterações levaram o Parlamento Europeu e o Conselho de Ministros a dar prioridade à adopção do novo programa específico[11], tendo sido o primeiro do terceiro Programa-quadro a ser adoptado e o seu plano de trabalho recebeu de imediato o parecer favorável do Comité de gestão. Em Junho de 1991 foi publicado um convite para apresentação de propostas cuja apreciação teve lugar em Setembro e Outubro do mesmo ano. Foram apreciadas mais de 200 propostas, tendo arrancado 95 projectos no início de 1992. A sua conclusão está prevista para o final de 1994, no âmbito das actuais disposições orçamentais.

Se durante o fase I do RACE os projectos visam a avaliação de opções, durante a fase II preparam a introdução das IBC. Os projectos RACE II reforçarão a colaboração e os compromissos já assumidos no RACE I pelos utilizadores industriais, o sector da telemática e os operadores de telecomunicações. A nova I&D está orientada para as aplicações, serviços, gestão e funcionamento, mantendo, porém, um nível elevado de desenvolvimento tecnológico por forma a consolidar e alargar as áreas-chave necessárias para materializar a oferta de serviços IBC economicamente eficientes.

Os trabalhos abrangem as oito áreas prioritárias identificadas no Anexo da Decisão do Conselho:

ÁREA 1 I&D no domínio das IBC (Comunicações Integradas em Banda Larga)
ÁREA 2 Inteligência nas redes/gestão flexível dos recursos de comunicações
ÁREA 3 Comunicações móveis e pessoais
ÁREA 4 Comunicações de imagens e de dados
ÁREA 5 Tecnologias de serviços integrados
ÁREA 6 Tecnologias da segurança da informação
ÁREA 7 Experiências de comunicações avançadas
ÁREA 8 Infra-estruturas e interfuncionamento de ensaios (área horizontal I&D de apoio a outras áreas prioritárias)

Os relatórios anuais 1992 (RACE 92) e 1993 (RACE 93) contêm uma descrição completa dos novos projectos I&D da fase II e das suas relações com os projectos da fase I.

11) Decisão 91/352/CEE do Conselho de 7.6.91: JO nº L 192 de 16.7.91, p. 8.

7. Futuros requisitos e opções para a I&D no domínio das tecnologias das comunicações a nível europeu

Em Junho de 1992, o Comité de Gestão RACE criou um grupo ad hoc, tendo em vista a identificação de prioridades relativamente à futura I&D europeia no sector das telecomunicações. Abaixo reproduz-se o relatório do grupo:

Muitas destas ideias e temas relacionados com a futura I&D comunitária já se reflectem no documento de trabalho da Comissão relativo ao 4º programa-quadro, nomeadamente nos temas propostos, como "tecnologias da imagem", "computação e redes de elevado desempenho", "integração de funções a nível do fabrico" e "comunicações avançadas". A Comissão apresentará as suas propostas de programas específicos no âmbito do 4º programa-quadro, após análise de todas as contribuições, no decurso de 1993.

Argumentos que justificam o desenvolvimento da I&D a nível comunitário

O CGR é de opinião que inúmeras vantagens e benefícios poderão advir do desenvolvimento da I&D no sector das telecomunicações a nível comunitário. Numa perspectiva global, a investigação (e, em especial, a investigação no domínio das telecomunicações) é um processo contínuo. Os intervenientes no sector, a fim de manterem a posição privilegiada já adquirida através da sua participação em acções comunitárias, como o programa RACE, deverão dar continuidade ao seu esforço conjunto de investigação, continuando a apoiar-se nos resultados alcançados até à presente data.

É necessária uma maior consolidação dos sistemas fragmentados de telecomunicações da Comunidade, a fim de garantir que o mercado único funcione efectivamente e de reforçar a margem competitiva das organizações europeias nos mercados mundiais. Os organismos de normalização, como o ETSI, conseguiram valorizar as contribuições técnicas recebidas como resultado directo das actividades RACE. O processo de "gestão do fluxo" de resultados da I&D comunitária para os organismos de normalização necessita de ser continuado - e reforçado, como parte de programas subsequentes.

As telecomunicações avançadas são de importância crescente para o bem-estar das economias nacionais, na medida em que os seus elementos constituintes ("informação" e capacidade de "comunicar" essa informação) são considerados recursos estratégicos. Esta realidade pode ser avaliada em termos:

- da parte crescente das economias nacionais afectada ao investimento em telecomunicações e

- do impacto crescente dos serviços avançados de telecomunicações noutros sectores de actividade económica.

Estas tendências foram reconhecidas no Acto Único e nos actuais esforços tendentes a completar o mercado interno da Comunidade Europeia. O Tratado de Maastricht prevê a criação de redes transeuropeias (o que inclui redes de telecomunicações). A criação a nível europeu de infra-estruturas e serviços de telecomunicações exigirá o envolvimento a longo prazo de todos os intervenientes no sector interessados.

A sincronização da evolução (a nível europeu, de novo) no sentido da criação de uma infra-estrutura de comunicações em banda larga proporciona uma vantagem económica evidente, em termos de rendibilidade dos investimentos efectuados. Esta sincronização facilitaria igualmente a adopção de novas aplicações em todas as regiões europeias, permitindo obter rapidamente o nível crítico necessário a um crescimento auto-sustentado da utilização de serviços avançados. É indubitável que as redes de telecomunicações e um número crescente de serviços comunitários estão a adquirir uma dimensão internacional cada vez maior. Deveria igualmente ser estimulada uma cooperação mais vasta fora das regiões europeias.

Por todas as razões acima invocadas, O CGR considera que, como parte de qualquer futuro programa-quadro, deveria ser incluída uma acção específica de I&D comunitária no domínio das telecomunicações, o que reforçaria as bases substanciais adquiridas através de programas anteriores. Porém, a natureza da I&D no sector das telecomunicações exigida para além do horizonte temporal de 1995 é significativamente diversa, em termos de importância, da da I&D que tem sido desenvolvida no âmbito do programa RACE até à presente data.

Objectivos da futura I&D no sector das telecomunicações

A concretização da Visão das Comunicações Avançadas em que "qualquer um de nós pode comunicar com quem quer que seja em qualquer lugar e a qualquer hora utilizando texto, som e imagens" exige que a Europa tome novas iniciativas a nível de I&D.

Os programas existentes, como o RACE e o ESPRIT, concederam já um contributo significativo para a exequibilidade técnica de base desta visão. A força motriz de um novo programa de I&D comunitária no sector das telecomunicações deverá agora provir das necessidades em termos de aplicações. Em princípio, estas deverão igualmente definir as acções e prioridades necessárias para dar continuidade à investigação no domínio das tecnologias básicas de apoio.

Donde resulta que qualquer novo programa deverá incidir nos dois objectivos seguintes:

- promover "ensaios operacionais" de serviços avançados, a fim de melhorar a sua utilizabilidade e garantir que o resultado final seja suficientemente atraente para ser utilizado, de forma generalizada, na vida quotidiana dos europeus,

- prosseguir a investigação a nível de "tecnologias futuras" necessárias em apoio das comunicações avançadas, obter uma redução de custos dos componentes de base e, consequentemente, conseguir que a prestação de serviços avançados se torne mais viável, economicamente falando.

Estas duas questões são especialmente significativas para a concretização comercial pan-europeia de redes e serviços de comunicações avançadas, embora essa "concretização" dependa igualmente de uma série de outros factores. A fim de aproximar esta Visão das Comunicações Avançadas da realidade, é necessário basearmo-nos no aumento da consulta mútua por parte dos intervenientes no sector, obtendo, consequentemente, um consenso relativamente aos seguintes pontos:

- melhor forma de conseguir a melhoria necessária do desempenho de serviços e das tecnologias de apoio que se lhes encontram associadas,

- criação de oportunidades-meta através da convergência das tecnologias de telecomunicações, radiodifusão e informação, nas quais se possa basear uma evolução rápida rumo às comunicações avançadas.

Em resumo, a continuidade da I&D comunitária no domínio das comunicações avançadas, por si só, favorecerá a cooperação e a harmonização europeias, o que conduzirá ao reforço da competitividade europeia nos mercados internacionais e, consequentemente, ao reforço da economia europeia no seu conjunto.

Base de cooperação (modus operandi)

Para que as comunicações avançadas se tornem mais atraentes e as tecnologias mais "viáveis economicamente", é necessária a participação de todos os intervenientes interessados: utilizadores, operadores de redes, prestadores de serviços, indústria, centros de investigação e universidades. A participação de todos estes intervenientes no sector deverá ser garantida desde o início, através da sua implicação na definição de um plano de trabalho aprovado. Deveria ser estimulada, em especial, a colaboração activa dos Operadores de Redes Públicas (ORP) em apoio das experiências de comunicação, retirando eventuais vantagens das infra-estruturas existentes ou previstas.

No próximo programa de I&D, deverá ser reservada uma função mais importante às PME, muitas das quais dispõem de competências inestimáveis no domínio do desenvolvimento de aplicações e serviços. Essas competências são fundamentais para as necessidades da Comunidade, de modo a poder ocupar-se deste novo domínio de investigação. A necessidade de reforçar a função das PME na futura I&D no sector das comunicações sugere que se devam adoptar medidas específicas, que facilitem mais a sua participação activa. Por exemplo, a Comissão poderá ter de recorrer a procedimentos contratuais que proporcionem maior apoio (e.g., o mecanismo CRAFT utilizado a nível do programa BRITE/EURAM ou outras abordagens inovadoras).

Embora o programa RACE, no seu conjunto, tenha sido um êxito, deverão considerar-se novos procedimentos, ou uma melhoria dos procedimentos existentes, tendo em vista a gestão do próximo programa de I&D no sector das comunicações. Os projectos individuais deverão ser formulados num contexto bem estruturado, definidos no plano de trabalho e especificamente orientados no sentido de alcançar os objectivos do programa. O mecanismo de concertação utilizado com êxito a nível do programa RACE deverá igualmente ser objecto de maior reforço.

Sempre que possível, deverá ser estimulada uma maior coordenação dos programas comunitários, uma melhor cooperação com outros programas europeus ou multinacionais de investigação e uma interacção mais estreita com programas e experiências nacionais. Poderão igualmente considerar-se acções concertadas com os programas EUREKA, COST e outros projectos a nível nacional.

As medidas de apoio ao programa deverão incluir uma publicidade adequada dos projectos durante a sua execução e a promoção de resultados (e vantagens/aplicações potenciais desses resultados) a todos os intervenientes no sector e, em especial, a potenciais utilizadores de comunicações avançadas.

Ensaios operacionais e desenvolvimento de serviços

A experiência passada, com a introdução de novas tecnologias e serviços de redes, demonstrou que o desenvolvimento e a implementação de novas aplicações exigem uma validação bem organizada, pré-operacional e prática (ensaios operacionais), que abranja todos os intervenientes no sector. O verdadeiro desafio destas próximas gerações de ensaios operacionais europeus consiste, por conseguinte, em indicar modos e formas de agregar (em condições de mercado livre) serviços potenciais que satisfaçam as necessidades de sectores fundamentais do mercado.

A I&D no domínio dos ensaios operacionais e do desenvolvimento de serviços deverá incidir em questões genéricas, que permitirão a evolução dos serviços avançados. Embora se baseiem na tecnologia existente, os ensaios deverão apontar para concretizações adequadas das aplicações, à medida que as redes se tornam mais inteligentes e os serviços mais flexíveis. Os principais objectivos dos ensaios operacionais deverão incluir a formulação e apresentação de propostas para o processo de normalização e propostas de plataformas que abranjam todas as perspectivas de aplicação do sector:

- a iniciativa (incluindo organização, interacção, informação do consumidor, políticas de gestão e de segurança, análise de custos/benefícios, perspectiva jurídica, ética e social),
- a informação em si (incluindo a definição de elementos de informação, a sua qualidade, fluxo e apresentação aos utilizadores),
- as funções telemáticas (incluindo funções de comunicação e processamento, tipos de representação de dados),
- as tecnologias (incluindo equipamentos e suportes lógicos).

Deste modo, os ensaios operacionais deverão ter em conta alterações de legislação, as políticas de gestão e de segurança, o acesso dos utilizadores e as interfaces homem-máquina, bem como proporcionar análises de custos/benefícios e definições da qualidade da informação.

O desenvolvimento de serviços genéricos exige instrumentos de criação de serviços, a incorporação de telesserviços e terminais multimedia e a oferta de capacidades avançadas tendo em vista os serviços, a sua gestão e a engenharia de serviços. Consequentemente, as futuras aplicações deverão reunir as seguintes condições prévias:

- dispor de definições específicas do sector, determinadas pelos fornecedores e pelos utilizadores;
- basear-se em serviços genéricos e compatíveis com a oferta de rede aberta;
- ser definidas por objectivos claros de custos/benefícios;
- possuir potencialidades de mercado internacionais;
- ter a capacidade de incluir, a curto prazo, novos requisitos, como mobilidade pessoal e ubiquidade, serviços multimedia em banda larga, redes de cooperação ou inteligentes.

Os actuais programas nacionais e da CCE (e.g., RACE, Sistemas Telemáticos, ESPRIT) poderão constituir uma base empírica de identificação destas aplicações. O núcleo essencial dos futuros programas de I&D reside na realização de ensaios pré-operacionais e na demonstração da validade europeia das aplicações. Na opinião do CGR, os seguintes "desenvolvimentos de serviços" específicos deverão ser incluídos num futuro programa de I&D, de modo a satisfazer melhor as necessidades dos utilizadores:

- aperfeiçoamento das videoconferências e dos serviços multimedia interactivos;
- trabalho à distância e presença virtual;
- mobilidade, ubiquidade e segurança das informações;
- serviços de radiodifusão de banda estreita/larga;
- gestão de serviços e serviços de redes inteligentes.

Investigação no domínio das tecnologias de apoio

Qualquer novo programa de investigação no domínio das telecomunicações deverá continuar a fundamentar-se na base tecnológica substancial criada através de programas anteriores. É necessária actualmente uma investigação estratégica, que permita obter vantagens em termos de custos a partir das tecnologias da próxima geração. Os objectivos globais desta investigação podem enunciar-se do seguinte modo:

- oferta das tecnologias necessárias à evolução de redes e serviços competitivos, em termos de custos, na Europa, antes de os blocos económicos concorrentes o fazerem, de modo a contribuir de forma significativa para o reforço da economia europeia,

- criação dos fundamentos necessários a uma evolução tecnicamente viável e economicamente razoável da rede de telecomunicações - igualmente no domínio da normalização -, tendo por objectivo o reforço da economia europeia.

Os conhecimentos adquiridos através destes domínios gerais de investigação poderão exigir uma alteração dos objectivos e prioridades noutras áreas do programa. Por exemplo, a evolução da tecnologia de serviços poderá conceder determinados elementos à investigação, a nível das tecnologias quer de componentes quer de redes. Porém, o conceito dominante deverá permanecer centrado nos novos serviços que poderão ser prestados aos utilizadores através da rede de telecomunicações. Atendendo a que uma das características destes serviços passará a ser um nível elevado de personalização, é necessária uma interacção permanente da evolução da rede com o desenvolvimento de serviços. Na opinião do CGR, deverão ser incluídas num programa futuro as seguintes áreas específicas de investigação:

Evolução da rede a fim de ser criada a base para comunicações avançadas tecnicamente viáveis e economicamente razoáveis

- Integração dos actuais e novos meios e sistemas de transmissão (cabo de cobre, fibra óptica, radiocomunicações terrestres, satélites), nas redes de distribuição e acesso (fibra na linha de assinante, PON, etc); integração de redes móveis e fixas;
- Evolução das hierarquias de transmissão gerida e aperfeiçoamento dos sistemas de gestão de rede
- Sistemas de transmissão óptica de capacidade muito elevada e arquitecturas de redes fotónicas;
- Nós geridos da RDIS-B (ATM) e aperfeiçoamento da sinalização;
- Redes inteligentes avançadas, arquitecturas de redes de informação (com combinação de IN e TMN) e arquitecturas avançadas de suporte lógico.

Evolução das tecnologias com base nos resultados do RACE e de outros programas comunitários, nomeadamente a evolução dos terminais para uma melhor relação custo/desempenho e facilidade de utilização

- Estações de trabalho multimedia e videotelefonia;
- Tratamento avançado de imagens e sons;
- TV digital (SDTV, EDTV, TVAD);
- Controlo vocal em linguagem natural;
- Dispositivos ultra LSI para circuitos de comutação e transmissão;
- CI avançados de hiperfrequências baseados em Si e em materiais III - V;

e

- Materiais e dispositivos optoelectrónicos para aplicações de telecomunicações.

Annex I

Project contributions to the RACE objectives

Annex 1

PROJECT CONTRIBUTIONS TO RACE OBJECTIVES

1. PART I : IBC Development and Implementation Strategies

1.1 Consensus Management and Synthesis

Project	Main Deliverable(s)	Impact
R1045 Consensus Management	Consensus management across all RACE projects, leading to the publication of Common Functional Specifications (CFS) for IBC. Workplan for, and organisation of the Technical Groups which undertook the drafting of the CFSs (staffed by other projects' participants).	Secured the "overall" results of the RACE programme, through co-operation between Industry and Operators within the project. Formal conduit for coherent transfer of RACE results to ETSI. Exploitation of results through standardisation, and by widespread distribution of CFS to organisations participating in RACE.
R1044 IBC Development & Implementation Strategies	Provided a consistent view of IBC systems options, based on own work and that of all other RACE projects. Functionally separated service definitions into service components and service control elements. Developed reference configurations for specific network implementations, and used these to identify and evaluate evolution steps towards IBC. Developed a series of detailed specifications defining the UNI at the "T" reference point (the termination interface for public networks).	Core project to the systems study of RACE. The largest source of RACE contributions to standardisation bodies. Many publications. Active in the detailed transfer of results to and from RACE usage projects, (via R1077) and all other systems projects. Provided the backbone of support offered to R1045 for development of the CFS.
R1077 URM	Compilation of operational requirements based on results of usage projects. Results captured in a usage database. Methodology for, and examples of the derivation of generic service definitions from usage requirements. Wide ranging contributions to CFSs and consensus formation.	Concepts relevant to service designers working in a market driven environment. Core project of the usage area of RACE. Impact mainly felt within the programme, transferring results to and from the systems projects.

1.2 Functional Specification

Project	Main Deliverable(s)	Impact
R1023 BEST	Functional Specification Methodology. Handbook and consultation support given to other RACE Projects.	Harmonised approach to functional specification work.
R1024 NETMAN	Models and Methods for TMN functional specifications (eg. Cube Model, QoS Methodology). The actual specification of TMN Functions. Animated Simulation (Hypermedia tool) of the behavioural aspects of TM Functions.	Significant impact on Standards (CCITT SG IV and ETSI NA4). Results exploited by EURESCOM and RACE II Projects.
R1025 SECURITY	Definition of basic security services (authentication, integrity, confidentiality, non repudiation and denial of service detection). Concepts for a functional architecture for IBC security and security policy guidelines.	Integration of security aspects within IBC specifications.
R1040 RIPE	Recommended Portfolio of Integrity Primitives. Specified modes of use for these.	Implementation of secured network systems. Improved understanding of integrity primitives (statistical tests and simulation tools).
R1047 TIMI	Development of integrity concepts within IBC services, to support legally binding procedures for data exchange.	Introduction of low cost, reliable and easy to operate security measures in IBC.

1.3 Reference Configurations

Project	Main Deliverable(s)	Impact
R1002 Satellite communication for IBC	Specification of satellite system capabilities with respect to their utilisation in evolutionary scenarios towards IBC	Identification of the role of satellite communications in IBC. Contribution to elaboration of IBC standards, identification of role of satellite technology within IBC
R1026 International Radio and TV	Identification of requirements and scenarios for the integration of the Eurovision network into IBC.	Eurovision and Euroradio network digitalisation, ensuring Europe remains in the forefront of technical excellence and programme quality. Essential step towards full digitalisation of TV media.
R1028 REVOLVE	Evolution Scenarios most likely to be implemented within Less Favoured Regions (LFRs) were identified and assessed. Platforms for co-operation of Sector Actors established in Portugal and Greece	Tools for strategic planners responsible for LFRs, in their preparation of business plans and justification for further investment in infrastructure
R1041 FUNCODE	Techno-economic studies to determine optimal locations for video codecs. Contributions to image and voice coding standards.	Standardisation and strategic network planning of audio-visual services.
R1049 ATM Concept	Contributions to the specification of the ATM layer, ATM signalling protocol and Connectionless Services in B-ISDN.	Contributions to ETSI NA5 and CCITT SG I, XI, XIII, XVIII Recommendations on B-ISDN.
R1052 SPOT	Simulation and optimisation of sub-carrier multiplexing systems for the CAC network	Exploitation, development and assessment of signal processing techniques in a CAC environment
R1053 TERRACE	TMN Reference Configurations at three levels of detail. Methods and criteria to design, describe and evaluate Reference Configurations. Concept of GAMS - Gradual Automation of Management Systems, used internally by the project to define the evolution of the TMN. Surveys and case studies (SDH, MAN and ATM)	Means of implementing TMN now understood in detail. Results exploited by EURESCOM, and are influencing ONP studies. Also exploited by RACE II projects addressing Reference Configurations for IBC Services. Significant contributions to Standards (CCITT & ETSI).
R1085 TET Adapt	Provision of tools for techno-economic analysis	Tools widely used for evaluation of IBC scenarios by RACE systems projects

1.4 Usage Reference Model

Project	Main Deliverable(s)	Impact
R1037 User criteria for the realisation of opportunities afforded by IBC	Development of a methodology to identify and quantify user requirements	Contribution to further work under R1071 (IBC Applications Analysis)
R1071 (1050) IBC Applications Analysis	Based on 126 case-studies in 102 organisations, the project has identified eleven generic IBC services and implemented a formalised methodology for description of IBC market developments	Market entry strategies for IBC. Improved understanding of factors affecting service take-up and delivered substantive usage data for the definition of IBC services.
R1076 REMUS	Requirements for Usability Design Targets Database	Method for making end-user requirements available to designers

PART II : IBC Technologies

2.1 Networks and Switching

Project	Main Deliverable(s)	Impact
R1012 BLNT	2 major demonstrators: an ATM switch model and a Customer Access Connection (CAC), based on SDH and an optical link, using OEICs. Definition of performance parameters for the ATM switch, based on traffic studies. VLSI produced to implement the switch. 4 patents filed relating to CAC and ATM.	Low cost local loop and ATM switch , able to support a wide range of broadband services in a flexible and cost effective manner. Demonstrated incorporation of new OEIC techniques and technologies. Contributions to standardisation of ATM/SDH mapping and broadband interfaces for the access network.
R1013 HDTV switching	Switch matrix chip operating in synchronous time division multiplex mode at speeds up to 1.25 Gbit/s.	Key technology for support of digital (HD)TV services using ATM switching networks.
R1014 Atmospheric	Network configurations and solutions to accommodate uncertainties in the growth and mix of services during network transitions towards a full ATM-based IBC. Flexible and economic network & system architectures to maintain compatibility with existing public / private networks and terminals, as advanced networks evolve. Solutions evaluated in a demonstrator.	Evolutionary network architectures and contributions to the standardisation of new transmission and switching techniques, and of interworking. Extended Stratified Reference Model (ERM) now adopted by ETSI allowing a more flexible use of the lower three layers of the OSI model.
R1022 ATD	Defined generic ATM components. Implemented RATT (R1022 ATD Technology Testbed), a laboratory network integrating several models of ATM subsystems. Introduction scenarios and techno-economic evaluation for ATM - consolidated in a Network Planning Guide. Other results include architectures and interfaces, ATM traffic engineering methods, performance evaluation of ATM traffic control, traffic source models, and signalling.	Major impact on the development of ATM Standards by ETSI & CCITT. Results further by exploited consortium members in RACE II (the laboratory testbed), and in national field trials. Commercially available products based on project prototypes (components and subsystems).
R1043 Mobile Telecommunications Project	Provided the foundation for the work now undertaken by RACE II projects in UMTS and MBS. Preparation of CFSs for UMTS	Definition of the spectrum requirements for UMTS. Prime-mover for the establishment of ETSI SMG5.

2.2 Optical Communications

Project	Main Deliverable(s)	Impact
R1008 Silicon-based Low-cost Passive Optical Components	Low cost passive optical components including very low loss waveguides, 3dB directional coupler, fibre pigtailed power splitter, 1:4 WMUX/DMUX devices	Components for the realisation of an economic and & flexible architecture of the Customer Access
R1010 Subscriber Coherent Multi-channel System	Demonstrator of a CMC network with a transmission rate of 140 Mbit/s on each of ten channels. Coherent optical devices evaluated on 3 testbeds: 622 Mbit/s CPFSK, 565Mbit/s DPSK, and 565 Mbit/s FSK	"Path-finder" technology, having strong economic potential to meet requirements of domestic customers for non-switched services in the longer term .
R1019 Polymeric Optical Switch	Optically non-linear polymers and devices, such as electro-optical modulators and 2x2 electro-optical switches	Progress towards low cost optical switching matrices
R1020 HYBRID	Integrated ultra-fast all-optical switching devices; technologies for low cost polymers	Low cost devices for all optical communication systems
R1027 Integrated Opto-electronics towards the Coherent Multi-Channel IBCN	Components for HDWDM: 3-channel DM-DPSK heterodyne transmission experiment using DFB lasers, state-of-the-art receiver preamplifier, InP integrated polarisation modulator, uniform grating DFB lasers with narrow spectral line width, multi-electrode DFB laser as FSK transmitter, continuous tuneable narrow line width DBR lasers, GSMBE amplifiers for coherent multi-channel systems, OEIC receivers (4 and 8 channels)	High bandwidth services through HDWDM using optical frequency multiplexing with coherent detection. Project results exploited commercially include : a grating, coherent transmitters and receivers and state-of-the-art fabrication techniques.
R1029 Improved InP Substrate Material for Opto-electronic Device Production	Semi-conducting Sn-doped and semi-insulating Fe-doped InP-substrates fabrication; method of routinely testing Fe-doped "Epi-ready" substrates	European InP- substrates, Sn- and Fe- doped, commercially available and competitive in world markets.

Project	Main Deliverable(s)	Impact
R1030 ACCESS	Flexible Customer Access Connection (CAC) for 622 MBit/s services in the future IBC (interactive services, plus analogue CaTV). CAC systems and architectures using TDMA/SCM 2 Mbit/s. Design and evaluation of key components and modules (Flexible multiplexers, broadband switches, EDFA-modules optimised for AM-TV distribution). Cost analysis has shown that fibre solutions are often cheaper than copper.	Cost optimisation of the Customer Access. Inherent flexibility in service provision to residential and small business users through use of optical network topologies. Realisation of corresponding Opto-electronic components.
R1031 Low Cost Opto-electronic Components	Integrated transceiver modules, high speed detector. Coaxial packages of lasers, micro-optics and detectors. 1.5 μm all MOVPE grown SIPBH lasers. Wafer testable 1.5 μm DFB-lasers Alignment and fixing of fibre and lenses, package material costs, hybrid integration of the opto-electronic and electronic functions.	Low cost active opto-electronic devices made commercially available for early implementation of IBC:
R1032 Optical Components for Subscribers Networks	Key components, technologies and test equipment required for introduction of optical fibres in customer premises	Low cost, rugged devices for use in Customers Premises. Complementary perspective to related projects addressing public networks
R1051 Multi-Gigabit Transmission in the IBC Subscriber Loop	10 Gbit/s optical transmission system distributing 64 TV-channels (each at 155 Mbit/s) to over 8 million different terminals	Technology for distributing digital (HD)TV now capable of supporting more subscribers than are likely to be connected to a single network node under any network architectures currently envisaged.
R1057 AQUA	High speed (up to 10 Gbit/s) and high power Quantum Well lasers	Europe now manufacturing high speed components for direct detection multi-gigabit transmission systems
R1064 MIOCA	Monolithically integrated, laser diode-monitor chip, and optical switch & amplifier chip with ridge waveguide structures.	Monolithic optical integration on InP substrates is a key technology for cost effective manufacturing of essential IBC components
R1069 EPLOT	Optical lasers for coherent systems, high speed devices for multi-gigabit systems, integration of amplifiers with DFB lasers	High density coherent systems and very high speed components made feasible, as a result of narrower spectral line-width and better control of wavelength.
R1089 LOOP	Realisation of superior quality passive optical components-better than any other commercially available devices. A low cost optical connector, de-mountable, achieving reflection-free 30% coupling to DFB lasers. A prototype connector-mounting machine for factory use. A fan-out connector (multi-way to single-way) equipped with optional monitoring functions.	The "Euro-Connector" now launched commercially, and adopted by most manufacturers and operators in Europe. Vigorous standardisation efforts ongoing, within international IEC and European CEN / CENELEC. Such components facilitate the earliest implementation of optical communications throughout Europe. Being truly transparent devices, evolution from multimode, to single mode and in future, to coherent transmission can be supported.

2.3 Advanced Information Processing

Project	Main Deliverable(s)	Impact
R1003 GUIDELINE	Synthesis of TMN Architecture based on experimental results and prototypes of other RACE I projects. Guidelines on the Application of AIP techniques to network management	Results exploited by RACE II and EURESCOM Projects. Potential harmonisation and reduction of risks in the commercial development of TMN systems. Significant contribution to Standards (CCITT and ETSI).
R1005 NEMESYS	3 major testbeds for the evaluation of AIP techniques for Traffic and QoS Management. Corresponding simulators for Network, ATM traffic, Services & Users. Practical verification using case studies on Call acceptance & Virtual path.	Reduction of risks in the commercial development of Traffic Management and QoS related TMN systems. Specific results (Simulators, Platform, testbeds) used by RACE II and ESPRIT Projects.
R1006 AIM	Prototypes of maintenance applications for BERKOM, System X and Interconnected MANs. Specification of corresponding IBC maintenance functions. Development of AIP based Generic Maintenance System (GMS) in 11 modules Evaluation of applicability.	Significant increase in the reuse of system components when developing new applications. Larger scale prototype GMS applied to real networks in RACE II (R2002 GEMA) and ESPRIT projects. Development of commercial products based on GMS.
R1009 ADVANCE	Prototypes for Network and Customer Administration Systems (NCAS). Evaluation of the applicability of AIP techniques .	Reduction of risks in the commercial development of NCAS. Results used by RACE II and ESPRIT Projects.
R1017 IOLE	On-line environment (operating system) to support the execution of applications within IBC. Prototype tools for on line software extension, fault tolerance, testing, monitoring and HMI.	An Open Services Architecture for IBC Applications. Exploited by project consortium (embedded in products) and RACE II projects.
R1021 ARISE	Prototype integrated software engineering environment, specifically tailored for Telecommunications. Methods for software reuse. More than 20 tools for use within the environment. Applied to ISDN and IN software development.	Improvements in the cost and time required to develop software. Results exploited by RACE II and ESPRIT Projects and consortium members. Products now being based on tools produced by the project.
R1046 SPECS	Method providing maximum automation in the production, execution and maintenance of telecommunications software, based on the use of FDTs - Formal Description Techniques. Ability to handle and incorporate less formal specifications. Open tool architecture to support the method. Prototype tool set used in pilot case studies.	Facilitated the application of Formal Description Techniques in industrial environments. Significant contribution to Standards (CCITT SG X and ISO). Results exploited by RACE II and ESPRIT Projects and consortium members.
R1068 ROSA I (see also R1093)	Feasibility study for an Open Services Architecture. Identification of requirements and development of the essential concepts to be incorporated.	Leading-edge technology and concepts for service provision. Justified increased RTD in this field.

Project	Main Deliverable(s)	Impact
R1093 ROSA II (See also R1068)	Architectural framework for the provision of IBC services - this a fundamental step towards the definition of an Open Services Architecture. Developed an object model (ROOM), compatible with the ODP standard, and incorporating the characteristics required in a Telecommunications Open Architecture and for IBC service specifications. Methodology for Service analysis, specification and implementation..	Major benefits in terms of cost and time for the development of advanced IBC services. Significant contribution to world-wide research initiatives (TINA-C). Results are exploited by EURESCOM and various RACE Projects.

2.4 IBC Customer Systems

Project	Main Deliverable(s)	Impact
R1001 DVT	Video codec and scanner assembly for 100 Mbit/s HDTV digital recorder on very high density ME tapes.	High density digital video recorder for the consumer electronics market.
R1004 Electro-luminescent Flat panel Display	1st European electro-luminescent (EL) flat panel display and corresponding driver developed and launched commercially.	World leadership in multicolour EL displays. Technology essential for multi-service terminal and high quality displays.
R1011 B-CPN	B-CPN demonstrator, validating a framework architecture covering business requirements across many applications and network sizes.	Economically viable evolution steps from current installations in customer premises, towards the future IBC.
R1015 D-CPN	D-CPN demonstrator, validating a concept which supports services and applications offered by pre-existing systems (e.g. EUREKA IHS) as well as new advanced services like switched high quality sound and video, using low cost technology.	Definition of services and technical/technological developments to facilitate the introduction of IBC in the domestic environment.
R1018 HIVITS	HDTV codec for use by the EBU during WARC 92 for HDTV broadcasting around 20GHz. (Digital video codecs for video telephony, TV and HDTV.) Successful demonstration that current low-bitrate coding standards can be significantly improved by means of advanced image analysis techniques. Significant advances in VLSI technology for video encoding.. Complete study of video transportation over ATM networks. Adaptation of current coding schemes for ATM.	World leadership in devising hierarchical multi-resolution coding techniques which will play a key role in the ongoing definition of digital TV standards. Central contribution to the development by ETSI of the 34Mbit/s standard for contribution codecs. Hierarchical coding is an essential element for the compatibility of different terminal types where video interworking will be required under future MPEG (& multimedia) standards. Products based on HIVITS technology are already being marketed. Basis for further analysis/coding projects in Race II.
R1035 CPN Part I	Specification of the terminal-CPN interface (at the S reference point), including medium adapters. Definition of CPN architectures suitable for business and domestic environments. Evaluation of options these provide, for evolution from present diverse implementations towards IBC.	Provided customers perspective on public-network termination requirements. Strong contributions to standards bodies (ETSI and CCITT). Results exploited within RACE Part II Projects.
R1036 WTDM Broadband Customer Premises Network	Broadband Customer Premises Network suitable for digital (HD)TV contribution services and for a wide range of applications up to 40 Gbit/s. Uses 16 WDM channels (at 2.5 Gbit/s each). Mux/Demux: 16 STM-1 to STM-16 and vice-versa. All-fibre 16x16 star coupler. Node controller for internal CPN routing. Wavelength demultiplexer with wavelength tracking. 2.5 Gbit/s silicon ASICs (interleaver/disinterleaver, 12x12 expandable cross-point switch matrix). Project has proven interworking of a WTDM CPN and a public B-ISDN through a protocol converter.	A practical solution for routing of studio quality digital video and HDTV signals within private domains. Can also support interworking across public networks : The viability of early IBC implementations depend on an ability to support a rapidly expanding demand for video services. Expectation that this technology will be increasingly exploited as HDTV is introduced. Contributions to ETSI TM3 on the use of SDH for studio quality video and audio services.

2.5 Usability Engineering

Project	Main Deliverable(s)	Impact
R1034 Usability Engineering Requirements for IBC	An overview of usability issues for IBC.	Contribution to IBC requirements in the area of Usability Engineering.
R1065 ISSUE	Usability requirements and design recommendations for videophone and multi-media retrieval services	Guidelines for embedding user requirements in the design process for IBC equipment and services
R1066 IPSNI	Functional specification of requirements for input/output media at the man-machine interface of a generic IBC terminal	Full incorporation of people with special needs within the population using IBC services and equipment
R1067 GUIDANCE	Design method and recommendations for distributed multi-author multi-media co-operative system	Guidelines for embedding user requirements in the design process for IBC equipment and services
R1088 TUDOR	Usability requirements, market data and design recommendations regarding elderly and/or handicapped people	Full incorporation of people with special needs within the population using IBC services and equipment

PART III Pre-normative Functional Integration

3.1 Demonstrators and Verification

Project	Main Deliverable(s)	Impact
R1007 ITIS	Multi-service, multi-media IBC terminal demonstrator on a PC platform with ISDN and TV interfaces	Initial implementation of functional design, modular architecture and user interface for multi-service terminals.
R1016 Test Tools and Equipment	Specific hardware, software and ancillary requirements for an IBC testbed.	Availability of tools for verification of Subscriber Network functionality
R1033 OSCAR	3 photonic switching demonstrators: Access Cross-Connect for fully transparent optical switching, space packet-switching at 622 Mbit/s and VHSOL with a ring structure New packaging techniques for low cost mass-manufacture of OEICs	Photonic switching components (optical switches, optical amplifiers, detectors and electronics) complete the realisation of systems employing all-optical transmission / switching .
R1038 MCPR	IBC terminal demonstrator on workstation platform, having multimedia, hypermedia, and ATM handling functions	Architecture for multi-media information access on IBC facilities
R1048 RSVP	Initial studies towards a common methodology for Verification	Identification of an approach for the development of common verification techniques
R1056 BIPED	A business IBC demonstrator integrating multi-service-terminals, CPN, customer access network and ATM switch with a gateway to ISDN	Assessment of the relationship between QoS and Network Performance within selected network configurations
R1072 ITACA	Protocol Conformance test specification and automation	Protocol specification and testing methodologies.
R1080 HDTV Experimental Usage	Complete chain of HDTV production, transmission, and consumer equipment according to HD-MAC.	Operational experience in HDTV production and distribution. Raised public awareness of HDTV, within Europe.
R1081 BUNI	IBC Demonstrator constructed as two separate sub-systems, each comprising multi-service terminals, customer premises network, customer access and broadband switch. One demonstrator addresses the broadcasters studio environment, the other, domestic needs. These were later integrated together as a final, 3rd demonstrator.	Major contribution to the agreed T-interface specification in Europe. Verification of IBC system design concepts. Feedback on the application of test tools to the demonstrator, to improve both future network performance and the tools themselves.
R1082 QOSMIC	Methods and Models for the verification of Quality of Service (QoS). 2 prototype tools for verification of QoS. Physically connected to the hardware test environment via the UNI. 4 Case studies evaluated. Animated presentation of project results.	Prototypes of future commercial test equipment. Significant contributions to standards formation in ETSI.
R1083 PARASOL	ATM traffic generator and analyser tools for network verification	Support of network integration projects with tools for testing and verification
R1084 MIME	Emulator/Simulator hybrid systems for ATM networks	Provision of tools to support design, verification and testing of methods, protocols and functions of IBC (including TMN prototypes)
R1087 PROVE	Development of a series of verification and testing modules as an integrated tool set : cell generator/analyser, testing of signalling protocols using test scripts, analysis of signalling and call handling	Verification, test and maintenance strategies for IBC. Contributions to ETSI (e.g. Computer Aided Test Generation). User interface design for test tools. Assessment of ATM signalling.
R1092 DIRAC	Definition of a structured data collection procedure targeted on an innovative analysis method for reliability data. Calculation of reliability of telecommunication systems.	Production of a specification on reliability prediction and measurement. Potentially a European standard.

3.2 Applications Pilots

Project	Main Deliverable(s)	Impact
R1039 DIMUN	Development and testing of new 'intelligent' applications & services to support distributed design and manufacture	A multimedia communications facility proven in an international manufacturing environment. Yielded increased efficiency, reduced costs and reduced time for the order-design-manufacture cycle
R1042 MULTIMED	Definition and development of a prototype multimedia environment for the health-care sector	Improvement in the accessibility and usability of multimedia health-care information.
R1054 APPSN	Six videophone service trials for (social care of) elderly and/or handicapped people	Service models for applications of videophone in social care; user requirements for elderly and handicapped people
R1055 MERCHANT	Definition of a general architecture for a pan-European ERP (Electronic Retail Payment) system. Implementation of a laboratory demonstrator. Validation of technical options for wider-scale implementation.	A new generation of ERP systems that respects the role, independence and responsibility of each existing ERP actor.
R1058 RESAM	Field trials have shown that real demand exists for broadband applications in the airline industry, supporting unscheduled aircraft maintenance. These applications involve video, still picture and broadband data transmissions, supporting aircraft maintenance . Users, their needs and business functions, application domains and system requirements were each identified or defined.	Meets the need for multimedia, distributed problem-solving applications within airlines, aircraft manufacturers and shipping companies. Potential applications in many other sectors identified, e.g. design, health care, crisis management, marketing and sales.
R1059 DIVIDEND	Production of functional requirement specifications for the use of advanced communications within the banking sector, and a multimedia terminal based on these.	Raised awareness of users re the potential offered by advanced services in banking sector. User interest triggered.
R1060 DIDAMES	Demonstration of collaborative work in manufacturing, using local and wide area broadband communications, supporting PC-integrated video conferencing.	Resulted in commercial tools, applications and telecommunications products. with emphasis on standards, (eg. for workstation interface cards and video codecs).

Project	Main Deliverable(s)	Impact
R1061 DIMPE	Pilot of Distributed Multimedia Publishing Environment between major publishing sites.	An understanding of publishers requirements, to realise commercial viability of the application. Development of an open, flexible application architecture and agreement on standards.
R1062 MARIN ABC	Demonstration of IBC application in the maritime industry: non-routine maintenance and repair of a ship at sea, with assistance of shore-based expertise.	Demonstrated feasibility and cost effectiveness of ship-to-shore video communications via satellite, to prevent/solve maintenance problems as they arise.
R1063 MAPS	Specification of four application pilot schemes for mobile communications	Focus and approach better defined for subsequent projects in RACE II
R1070 Testing pay-per view	Pilots for pay-per view television in three separate, existing CaTV networks. Specialised software for traffic modelling and evaluation tools.	Requirements for the man-machine interface. Strategy for the transition to IBC.
R1073 GEOTEL	Multinational pilot implementation of a library service for petrochemical and related industries	An effective commercial image library accessible from all over Europe (initially by ISDN)
R1074 ECHO	Installation of an IBC-based, electronic case handling system within insurance companies.	Increase in effectiveness and productivity of clerical and professional personnel in the insurance sector by the use of a distributed system of workstations and servers.
R1075 Telepublishing	2 Application Pilots : An individualised electronic newspaper The designing, printing and publishing of catalogues.	Scenario of a broadband working environment, providing easy, time shared interaction between separate locations in the printing and publishing industry.
R1078 European Museums Network	A full digital multimedia system with as applications, an authoring tool for museum staff and a "discovery machine" for navigation of the museum by visitors	Identification of requirements for workstations and man-machine interface.
R1079 CAR	A conference demonstrator to support design engineers at different sites in their decision-making. A remote surveillance system relevant to the manufacturing sector. A multimedia messaging system between the various actors in manufacturing design. New methodologies for requirements capture and evaluation	Provided an understanding of the implications of introducing IBC services in the automotive industry. Established knowledge base for future service design.
R1086 TELEMED	Demonstration of the potential for medical image and data transmission in an IBC environment	Stimulation of the development of medical applications such as remote expert consultation and diagnosis, co-operative research and teaching
R1091 ESP	Assessment of a common strategy for implementation of the communication links required to support RACE Application Pilots. Assisted in the Pilots' own assessment of requirements for end-systems, software protocols and network provision.	Focused the on-going discussions amongst Sector Actors, and acted as a catalyst for further network provision initiatives. Results & synergies achieved now exploited in RACE II.

Concerted Actions and Accompanying Measures

Date	Event / Workshop	Impact
1988 (7 Dates)	**RACE Concertation Meetings**	Established working relationships amongst RACE projects, with appropriate links to other CEC programmes (Esprit, COST and Eureka). Technical approaches and systems concepts pooled, to mutual advantage.
1989 (7 Dates)	**RACE Concertation Meetings**	Integration of application pilots, usage and verification projects within the on-going programme. Extensive work supporting the development of Common Functional Specifications (CFS)
6 & 14 June 1990	**User Meeting on Advanced Communications in Europe**	Raised awareness of the potential for application of advanced communications in different business sectors. Generated the interest of user organisations to respond to possible future call for application pilots.
20 June 1990 (in Dublin)	**IBC Islands Workshop**	Highlighted the extent to which broadband communications already existed, and showed how interconnection of such "islands" could feasibly be achieved in the shorter term
26 June 1990	**Fibre to the Home**	Examined the economics of deploying optical fibre in the Customer Access network, and highlighted the most promising technical approaches, for further development.
2 July 1990	**Mobile Communications in IBC**	Determined the relationship between systems supporting broadband and mobile communications. Intelligence in Networks and "Mobility in the fixed network" amongst the common factors.
10-12 July 1990 (in Aveiro)	**Optical Communications Summer School**	Strengthening of links with peripheral countries. Dissemination of optical RACE results to engineers expecting to begin research in this field.
15 October 1990 (in London)	**International IBC Conference**	Single conference giving the broadest coverage of RACE I results, and progress made in the functional specifications of IBC. Wide dissemination achieved.
23 October 1990	**Impact Assessment and Forecasting**	A review of socio/political issues pertinent to the development of IBC. An indication of the priorities for future RTD in the area.
24 October 1990	**Intelligent Network, Service Engineering and Usability**	Raised awareness of the potential for separation of service provision from network operation. Technological basis for a faster, more effective approach to service design, based on combinations of discrete service components.
26 October 1990	**IBC Implementation Framework**	Communication with the sector actors concerned. Examined the feasibility of implementing evolutionary scenarios developed within RACE.
30 October 1990	**Image Communications**	Identification of priority areas for RTD to meet emerging IBC requirements, based on a review of the state-of-the-art in image communications.
13 December 1990	**Intelligent Cities**	Development of co-operation between City authorities , in applying informational resources and communications links to find solutions to urban problems. Identified requirements for RTD, which led to the establishment of the ENS Action.
1990 (6 Dates)	**RACE Concertation Meetings**	Mid-Term results collated and fed into planning process for RACE II. First draft of CFSs fed back to projects.
10 September 1991	**Fibre to the User (International Audit)**	Comparison of roll-out strategies in Japan, USA, Canada and Europe, for introduction of optical fibre in the customer access. Factors determining the technical and economic suitability of the different approaches examined in detail
1991 (6 Dates)	**RACE Concertation Meetings**	Highlighted issues of common interest, for further examination. Second consolidation of CFS.
1992 (6 Dates)	**RACE Concertation Meetings**	Transfer of RACE I results to newly launched RACE II projects. Assured continuity of momentum and links between RACE Projects & other Programmes.

Annex II

Contributions to Standards

RACE
CONTRIBUTIONS TO STANDARDS

R1003 AIP and Standards for TMN

Taxonomy of Reference Points (Re view of M.30)	CCITT		1991/03	UK
Mediation function definition	ETSI	NA 4	1990/03	UK
Taxonomy of Reference Points (Review of M.30)	ETSI	NA 4	1991/03	UK
The workstation function	ETSI	NA 4	1990/03	UK
TMN reference point definition	ETSI	NA 4	1990/09	UK
Taxonomy of Reference Points (Re view of M.30)	ETSI	NA4	1991/03	UK

R1014 Atmospheric

Distributed Bit Scrambling Method for ATM Cells	ANSI	T1S1.1.	1989/09	Canada
The Distributed Bit Scrambling Method for ATM Cells	ANSI	T1S1.5	1990/02	USA
New questions on string mode for the next CCITT period	CCITT		1992/06	
Distributed Sample Scrambler : State Transition Machine	CCITT	SG	1991/06	Switzerland
Mapping of ATM cells into lower-order VCs	CCITT	SG	1992/03	
On the Equivalence Between two Proposed Network Architectures	CCITT	SG	1991/06	Switzerland
On the harmonisation of two proposed network architectures	CCITT	SG	1991/12	Australia
The Distributed Bit Scrambling Method for ATM Cells	CCITT	SG	1990/01	Switzerland
The Stratified Concept - an extension to ISDN PRM L320	CCITT	SG	1990/01	Italy
Distributed Sampler Scrambler : Technical Description	CCITT	SG	1990/12	Japan
Cell Delineation with the Distributed Sample Scrambler	CCITT	SG	1990/10	Japan
Distributed Sample Scrambler : Synchronisation Confidence Limits	CCITT	SG	1990/12	Japan
Introduction of the Stratified Reference Model	ETSI	NA4	1989/11	
Signalling and Management in the SRM	ETSI	NA4	1992/09	
Stratified Reference Model	ETSI	NA4	1992/03	
31st Order Distributed Sample Scrambler	ETSI	NA5	1990/10	France
600 Mbit/s structure at T	ETSI	NA5	1989/03	Germany
Allocation of PTI Values	ETSI	NA5	1991/04	Netherlands
ATM Cell Format	ETSI	NA5	1989/03	Germany
ATM header error control cell delineation combined with scrambling	ETSI	NA5	1989/05	France
ATM Information Field Size	ETSI	NA5	1989/03	Germany
ATM Routing Field	ETSI	NA5	1989/03	Germany
ATM Routing Field	ETSI	NA5	1989/05	France
Distributed Bit Scrambler with 8-bit HEC	ETSI	NA5	1990/03	Italy
Distributed Bit Scrambling Method for ATM Cells	ETSI	NA5	1989/09	France
Distributed Scrambler with 31st order Polynomial	ETSI	NA5	1990/09	Spain
Frame Synchronisation	ETSI	NA5	1989/04	Netherlands
Layer Stamping	ETSI	NA5	1990/10	France
Mapping the ATM UNI into the SDH UNI	ETSI	NA5	1989/03	Germany
Media Adaptors at T	ETSI	NA5	1989/03	Germany
Multi-link protocols for ATM	ETSI	NA5	1991/09	Turkey
NT1 Functionality	ETSI	NA5	1989/04	Netherlands
Proposed Structure of CCITT B-ISDN Rec.	ETSI	NA5	1989/05	France
Service Requirements for ATM Priority and Layering	ETSI	NA5	1989/03	Germany
Service Requirements for ATM Priority and Layering	ETSI	NA5	1989/03	Germany
String Mode	ETSI	NA5	1991/09	Turkey
String Mode Protocol for ATM Network	ETSI	NA5	1991/04	Netherlands
Synchronisation	ETSI	NA5	1988/10	Netherlands
The Distributed Bit Scrambling Method for ATM Cells	ETSI	NA5	1989/10	Sweden
The Distributed Bit Scrambling Method for ATM Cells	ETSI	NA5	1989/11	UK
The Distributed Byte Scrambling Method for ATM Cells	ETSI	NA5	1990/04	Portugal
The resilience of the distributed bit scrambling method to Random or Malicious Interference	ETSI	NA5		
Transmission aspects - Virtual Bandwidth	ETSI	NA5	1992/09	
Transmission Format	ETSI	NA5	1988/10	Netherlands
Transmission Format for ATM	ETSI	NA5	1988/10	Netherlands
Transmission System on the Line Side of NT1	ETSI	NA5	1989/03	Germany
Virtual Network Concept	ETSI	NA5	1988/10	Netherlands
Virtual Path Identifier	ETSI	NA5	1988/10	Ireland

VPI Field Size at the UNI	ETSI	NA5	1989/11	UK
Proposal for definition of the Service Profile Concept for B-ISDN and its use for customer/access/terminal	ETSI	SPS3	1991/05	Germany
Mapping ATM into lower order VCs	ETSI	TM1	1990/10	Germany
The Distributed Bit Scrambling Method for ATM Cells	ETSI	TM3	1989/10	Portugal
Signalling at the UNI and NNI. Introductory Remarks	RACE	ARG	1990/06	Norway
Naming and Addressing within the Stratified Reference Model	RACE	STG 1.1	1992/05	
The Extended Stratified Reference Model	RACE	STG 1.1	1991/09	
Contribution to D410 CFS : Signalling Protocols	RACE	STG 3.1	1990/05	Belgium
Contribution to the Functional Model for IBC Basic Service	RACE	STG 3.1.	1991/02	Belgium

R1015 Domestic Customer Premises Network

Comments on Draft Recommendation I.363	ETSI	NA 5	1990/04	Portugal

R1018 High Quality Videotelephone and (High Definition) Television

Impact of digital transmission on HDTV sampling parameters	CCIR	IWP-11/	1990	
Hardware realisation of a 140/155 Mbit/s HDTV-codec progress report	CCIR	TG11-2	1991/02	France
ATM cell loss experiments with TM1	CCITT	IEC	1992/07	Netherlands
ATM cell loss experiments with TM1	CCITT	ISO	1992/07	Netherlands
H 261 compatible 2-layer video codec with high cell loss resiliance.	CCITT	SG XV	1991/05	France
Simulation of random cell loss	CCITT	SG XV	1992/01	UK
Two Remarks to the text of the Flexible Hardware specification	CCITT	SG XV	1989/11	Germany
Two Remarks to the text of the Flexible Hardware specification	CCITT	SG XV	1989/11	France
Two Remarks to the text of the Flexible Hardware specification	CCITT	SG XV	1989/11	Italy
Two Remarks to the text of the Flexible Hardware specification	CCITT	SG XV	1989/11	Netherlands
Two Remarks to the text of the Flexible Hardware specification	CCITT	SG XV	1989/11	Sweden
Two Remarks to the text of the Flexible Hardware specification	CCITT	SG XV	1989/11	UK
ATM cell loss experiments with TM1	CCITT	SG XV/1	1992/07	Netherlands
Error sensivity of the TM1 syntax	CCITT	SG	1992/07	Netherlands
Normes pour les systèmes de distribution secondaire	CMTT		1989	France
Rewording of annex A of report AD/CMTT	CMTT		1990/03	
Comparison of the two VLC and videomultiplier proposals according to report AD/CMTT	CMTT/2		1989/12	
Contribution codec VLC parameters	CMTT/2		1989/10	
Contribution to the adhoc group on 34 Mbit/s DCT coding	CMTT/2		1988/03	
Contribution to the specification writing	CMTT/2		1988/08	
Corrections and rewording to the draft recommendation AT/CMTT	CMTT/2		1990/03	
Criticality and Quantisation	CMTT/2		1989/09	
Hardware realisation of the 34/45 Mbit/s 4:2:2 codec and of the 140 Mbit/s HDTV codec	CMTT/2		1990/03	
Performances of the VLC based on ACVLC	CMTT/2		1989/10	
Proposal for an amendment to CMTT DCT ad hoc group document No 1	CMTT/2		1988/04	
Scanning standard to be used on the secondary distribution channels	CMTT/2		1990/02	
Specification of a variable length coding	CMTT/2		1989/09	
The issue of VLC and videoframing	CMTT/2		1989/10	
Variable length coding	CMTT/2		1989/08	
Videoframing	CMTT/2		1989/09	
VLC and videomultiplex proposal	CMTT/2		1988/06	
Hardware realisation of a 140/155 Mbit/s HDTV-codec Progress Report	CMTT/2	WB11	1991/02	France
34/45 Mbit/s videocodec - The issue of VLC and videoframing	ETSI	NA	1990	
Introduction to the project HIVITS	ETSI	NA	1990	
Status of the 34/45 Mbit/s contribution codec standard	ETSI	NA	1990	
H 261 compatible 2-layer video codec with high cell loss resiliance.	ETSI	NA 5	1991/04	Netherlands
Specification for CCITT H.261 comatible video coding for ATM networks	ETSI	NA 5	1992/02	UK
A draft proposal for ALL Type 2	ETSI	NA5	1992/05	UK

R1022 Technology for ATD

AAL-PDU Structure for CBR audio and video services	CCITT	SG	1990/01	Portugal
Sequence number protection for AALL Class 1 services	CCITT	SG	1990/05	Portugal
VCI Management For A Signalling Link	CCITT	SG		USA
"VPI/VCI pastition at UNI and ""active bits"" restriction"	CCITT	SG	1990/01	Germany
Compatibility Between S and T Interfaces In The Subscriber Premises Network	CEPT	NA5	1988/10	Portugal
Echo in the Finnish PSTN	CEPT	NA5	1988/10	Portugal
Bit Error Bursts At 139 264 kbit/s	CMTT	IWP		
Monitoring Of The Quality Of Digital Circuits Using ATM	CMTT	IWP		
On The Necessity Of Protection Against Cell Losses For High-Quality Audio And Video Services	CMTT	IWP		

Synchronization Aspects In A Pure ATM-Based Broadband Network	CMTT	IWP		
Treatment Of Cell Losses In An ATM-Based Broadband Network	CMTT	IWP		
AAL Sequence number synchronization algorithm	ETSI	NA 5	1990/09	Portugal
Application Of Maintenance Principles To B-ISDN Basic Customer Access	ETSI	NA 5	1989/03	
Impact of ATM Cell Size on Mobile Communications	ETSI	NA 5	1989/05	
Priorities In An ATM Network	ETSI	NA 5		Germany
ROS subattributes in I. 2XX	ETSI	NA 5	1989/11	
Sequence number protection for AAL Class 1 Services	ETSI	NA 5	1990/04	Portugal
Sequence number protection for AAL type 1	ETSI	NA 5	1990/10	Portugal
Service Bit Rates Amendments to Draft Rec. I. 2XX	ETSI	NA 5	1989/11	
Considerations on the ATM Layer Functions	ETSI	SPS 3	1990/04	
Considerations on the Cell Header Translation Function	ETSI	SPS 3	1990/04	
Considerations on the Physical Layer Functions	ETSI	SPS 3	1990/04	
Considerations on Virtual Channel	ETSI	SPS 3	1990/04	
Functions of ATM Network Nodes	ETSI	SPS 3	1990/04	
General Characteristics of ATM Network Nodes	ETSI	SPS 3	1990/04	
INTERFACES	ETSI	SPS 3	1989/10	
"Introduction, Scope and Field of Application (for Rec. on Broad-Bandswitching)"	ETSI	SPS 3	1990/04	
New Structure for Recommendation on Broadband Switching	ETSI	SPS 3	1990/04	
Some Considerations on Overload Handling	ETSI	SPS 3	1989/10	
ATM-Related Functions	ETSI	STG 3.2	1990/06	Netherlands
Connection Acceptance Control	ETSI	STG 3.2	1990/08	Netherlands
Connections through an Exchange	ETSI	STG 3.2	1990/06	Netherlands
Maintenance aspects of an ATM Exchange	ETSI	STG 3.2	1990/06	Netherlands
Performance of established connections	ETSI	STG 3.2	1990/07	Netherlands
Service specific functions in an ATM Exchange	ETSI	STG 3.2	1990/06	Netherlands
Traffic Characterization	ETSI	STG 3.2	1990/08	Netherlands

R1024 Functional Specifications for IBC System Requirements

QOS Methodology	ETSI	NA	1990/03	UK
Analysis of Network Management Requirements	ETSI	NA 4	1990/09	

R1030 Advanced Customer Connections, an Evolutionary System

Consideration concerning loopback in CAC	ETSI	NA 5	1991/06	Sweden

R1031 Low Cost Optoelectronic Components

Measurement Techniques for Essential Ratings and Characteristics of Components	CCITT	IEC		
"Blank detail specification: ""Coaxial laser"""	CENELEC	CECC	1989/04	Germany

R1035 Customer Premises Network

Physical Layer OAM for cell based option.	ETSI	NA 5	1991/09	
Cost and performance of different coaxial cable and receiver types.	ETSI	TM 3	1991/04	
Definition of terminal failure voltage for the coaxial interface at 155.52 Mbps.	ETSI	TM 3	1991/04	
"Input to the ""Living List"" for Rec. I.432."	ETSI	TM 3	1991/04	
Line code for Interfaces at TB- and SB reference points.	ETSI	TM 3	1991/04	

R1041 Functional Specifications of Codes

Principle of Functional Modelling	ETSI	NA 4	1990/09	France

R1044 IBCN Development of the Functional Reference Model

UK Contribution on Protocol Reference Models	CCITT	SG	1988	
UK contribution on Signalling Channel Structures	CCITT	SG	1988	
Optical CATV User-Network-Interface Based on a High-speed WDM	ETSI	NA 3	1990/02	Germany
Optical CATV-User-Network-Interface b.opt.	ETSI	NA 3	1990/02	Germany
Impact of intelligent Networks on TMN	ETSI	NA 4	1989/10	Denmark
A formal stage I description of Multi-Media services	ETSI	NA 5	1989/10	Denmark
AAL messages	ETSI	NA 5	1990/09	Belgium
AAL primitives for non-assured operation without flow control	ETSI	NA 5	1990/09	Belgium
AAL primitives for operation with flow control	ETSI	NA 5	1990/09	Belgium
AAL protocol model and peer-to-peer procedures	ETSI	NA 5	1990/09	Belgium
AAL type 3 functional model (allocation AAL)	ETSI	NA 5	1991/09	Belgium
An adaptation convergence sub-layer (CS) and protocol for connectionless services	ETSI	NA 5	1990/03	

An adaptation layer protocol model for signalling packet-mode connection oriented service and	ETSI	NA 5	1989/10	
An ATM Adaption Layer Protocol Model for IEEE LAN Interconnects	ETSI	NA 5	1989/11	Belgium
An ATM Adaption Layer Protocol Model for packet mode services	ETSI	NA 5	1989/11	Belgium
Analysis of Multi Media Aspects of Broadband Services	ETSI	NA 5	1989/10	Denmark
Answer to CCITT XI/4 open questions on meta-signalling	ETSI	NA 5	1990/09	Belgium
ATM adaptation layer for VBR service	ETSI	NA 5	1989/10	
ATM adaptation model layer service classification for non-time-related services	ETSI	NA 5	1990/03	
ATM signalling channel allocation and meta-signaling issues	ETSI	NA 5	1989/10	
Attributes classification	ETSI	NA 5	1990/09	Belgium
B-ISDN Arch.Prin.for Interactive and Non-Switch.Distribn.Services	ETSI	NA 5	1990/07	UK
B-ISDN Arch.Prin.for Interactive and Non-Switch.Distribn.Services	ETSI	NA 5	1990/07	Germany
B-ISDN bearer service definition	ETSI	NA 5	1990/09	Belgium
B-ISDN Connection Types and their attributes	ETSI	NA 5	1992/01	Belgium
Basic Requirements and Principles for MANs	ETSI	NA 5	1990/01	Belgium
Benefits of activation/deactivation at the TB reference point	ETSI	NA 5	1990/09	Belgium
Categorization of B-ISDN Connection Types	ETSI	NA 5	1992/01	Belgium
Clarification of channel associated signalling (CAS) at the access	ETSI	NA 5	1991/01	Belgium
Clarification of the ATM adaptation service classification model	ETSI	NA 5	1990/03	
Comments on ATM header functions	ETSI	NA 5	1990/10	
Comments on NA5 Draft Rec.1413 (UNI)	ETSI	NA 5	1989/11	
Comments on SG XI meta-signalling document	ETSI	NA 5	1991/01	Belgium
Common channel signalling (CCS) for B-ISDN	ETSI	NA 5	1991/01	Belgium
Contribution on Short term IBCN	ETSI	NA 5	1989/03	
Cost comparison of the coaxial with the fibre optical interface at UNI	ETSI	NA 5	1989/11	
Cost figures of a coaxial interface at UNI	ETSI	NA 5	1989/11	
Cost figures of a fibre optical interface at UNI	ETSI	NA 5	1989/11	
Error detection for PO services	ETSI	NA 5	1989/11	
Estimate of activation times for an activation/deactivation procedure at the TB reference point	ETSI	NA 5	1990/09	Belgium
Evolution of Optical Multi-Customer Access Links in the IBCN	ETSI	NA 5	1990/03	Germany
Guidelines for dynamic description of Multi-Media services using SDL diagrams	ETSI	NA 5	1989/10	
Implications of the introduction of the P bit for AAL type 3 and 4 (allocation AAL)	ETSI	NA 5	1991/09	Belgium
Information type related attributes for service components	ETSI	NA 5	1989/03	Germany
Introduction IBCN Reference Configuration	ETSI	NA 5	1990/03	
Introduction of the BRAN and LIT functional groups into the functional architectural model (allocation	ETSI	NA 5	1991/09	Belgium
Introduction to the static description of multimedia services	ETSI	NA 5	1989/03	Germany
Introductory description of multimedia services	ETSI	NA 5	1989/03	
List of parameters for the physical medium dependent layer of an electrical interface at the Tb reference	ETSI	NA 5	1989/09	
Location of meta-signalling in the B-ISDN FRM	ETSI	NA 5	1991/01	Belgium
Meta-signalling	ETSI	NA 5	1990/03	Italy
Meta-signalling message transport	ETSI	NA 5	1989/11	
Meta-signalling states description	ETSI	NA 5	1989/11	
Multi-media structure	ETSI	NA 5	1990/09	Belgium
Notes on Access Network MAN Architecture 5	ETSI	NA 5	1990/03	Italy
Open questions on meta-signalling raised at Brussels meeting of CCITT SG XI/4	ETSI	NA 5	1991/01	Belgium
Optical CATV User-Network-Interface Based on a High-speed WDM	ETSI	NA 5	1990/02	Germany
Optical CATV-User-Network-Interface b.opt.	ETSI	NA 5	1990/02	Germany
Optical Multicustomer Access Networks and its Evolution	ETSI	NA 5	1990/03	Germany
Optical Multicustomer Access Networks and its Evolution	ETSI	NA 5	1990/03	Germany
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Proposal for a cyclic counting in the AAL sequence number field	ETSI	NA 5	1990/03	
Proposal for a data-link protocol as part of AAL Convergence Sub-layer (CS) protocol for non-time-related	ETSI	NA 5	1990/03	Italy
Proposal for basic primitives between the ATM adaptation layer (AAL) and the ATM layer	ETSI	NA 5	1990/03	
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Proposal for data-link protocol as part of AAL Convergence Sublayer (CS) protocol for non-time related	ETSI	NA 5	1990/03	Italy
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Proposal for text on AAL Type 3 primitives for AAL operations to be inserted in I.363	ETSI	NA 5	1990/09	Spain
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Use of Generic Layering Architecture to structure the Broadband User - Network Signalling Interface	ETSI	NA 5	1989/10	Denmark
Use of the PRM for User Plane and Control Plane connection establishment	ETSI	NA 5	1991/09	Belgium
"Use of unused octets in metasignalling message, and identification"	ETSI	NA 5	1991/01	France
User Network Interface based on SDH	ETSI	NA 5	1989/10	Denmark
Vocabulary - Abbreviations	ETSI	NA 5	1989/09	France
Working procedures for ETSI/NA5	ETSI	NA 5	1990/09	Spain
Workprogramme for ETSI/NA5	ETSI	NA 5	1990/09	Spain
Execution of Service on a Functional IN Model	ETSI	NA 6	1989/11	Germany
Intelligent Network Terminology Definitions	ETSI	NA 6	1989/11	Germany
Liaison Report from RACE	ETSI	NA 6	1989/11	Germany
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Proposal for a functional Plane Architecture	ETSI	NA 6	1990/02	UK
Proposal for further Definition	ETSI	NA 6	1990/02	UK
Broadening of the User Concept in UPT	ETSI	NA 7	1990/09	Netherlands
Requirements for User Profiles in UPT	ETSI	NA 7	1990/09	Netherlands
UPT Numbering Plan Requirement related to the ACCESS of the UPT Service Centre	ETSI	NA 7	1990/09	Netherlands
UPT Numbering Plan Requirements related to Distinguishing between UPT - and ohter numbers	ETSI	NA 7	1990/09	Netherlands
UPT Numbering Plan Requirements related to Location Information included in the Number	ETSI	NA 7	1990/09	Netherlands
UPT Terminology	ETSI	NA 7	1990/09	Netherlands

UPT User Requirements related to Charging	ETSI	NA 7	1990/09	Netherlands
UPT User Requirements related to Information Feedback at Call Set-up Time	ETSI	NA 7	1990/09	Netherlands
Numbering and Addressing Requirements Architectural Requirements	ETSI	NA2	1990/10	Denmark
Numbering and Addressing Requirements : Concepts of addressing	ETSI	NA2	1990/10	Denmark
Numberings and Addressing Requirements : Requirements from customers and B-ISDN	ETSI	NA2	1990/10	Denmark
Numberings and Addressings Requirements : Requirements from services with special addressing needs.	ETSI	NA2	1990/10	Denmark
Medium Term Evaluation on Codec location in B-ISDN	ETSI	NA3	1989/10	UK
TV Picture frequencies used in picture coding for transmission	ETSI	NA3	1990/05	Sweden
Comments on SG XI metasignalling baseline document	ETSI	SPS	1991/01	France
Connection Acceptance Control	ETSI	SPS 3	1990/10	Italy
Definition of Call and Connection in the B-ISDN	ETSI	SPS 3	1990/10	Italy
Performance of Established Connections	ETSI	SPS 3	1990/10	Italy
Requirements for the separation of Call and Connection Control	ETSI	SPS 3	1990/10	Italy
Traffic Characterization	ETSI	SPS 3	1990/10	Italy
Spectrum Allocation in the Optical Local Network	ETSI	TM 1	1989/10	France
CMI coding on the 155.520 Mbit/s optical interface	ETSI	TM 3	1991/04	Belgium
Cost benefits of utilising the 800 nm optical window for transmission at the UNI	ETSI	TM 3	1991/04	Belgium
EMC aspects of CATV cable at the B-UNI: spectral considerations	ETSI	TM 3	1991/04	Belgium
Functional Architecture Model & Realisation of an Optical Access Network (OAN) with OLI/OLO	ETSI	TM 3	1991/04	Belgium
Improved Wavelength Allocation in OAN's	ETSI	TM 3	1991/10	Belgium
Optical Interfaces for the Customer ACCESS Network	ETSI	TM 3	1990/04	Germany
Optical Interfaces for the Customer Access Network	ETSI	TM 3	1991/03	Belgium
Optical Transmission of the OAN - Architecture and Evolution	ETSI	TM 3	1991/03	Belgium
Proposal for Physical Layer Transmission Parameters	ETSI	TM 3	1990/04	Austria
Quality of Services and Netw. Performance Requirements in ATM Networks	ETSI	TM 3	1989/10	Portugal
Specification of Surface Transfer Impedance to Tb interface cabling and connectors	ETSI	TM 3	1991/04	Belgium
Utilisation of the 800 nm optical window for transmission at the UNI	ETSI	TM 3	1990/10	
Evolution towards UMTS	ETSI	UMTS	1990/11	Belgium
Status of the RACE Mobile Project	ETSI	UMTS	1990/11	Belgium
Study items for the network aspects of UMTS	ETSI	UMTS	1991/03	Belgium
UMTS at the Turn of the Century	ETSI	UMTS	1990/08	Belgium
UMTS Requirements to B-ISDN	ETSI	UMTS	1990/11	Belgium
UMTS Services - Environmental Considerations/Potential Usage Characteristics	ETSI	UMTS	1990/11	Belgium

R1046 Specification and Programming Environment

"Extension of SDL to support Object-Orientation, Generic Parameter and Libraries"	CCITT	SG X	1990/06	Finland

R1053 TMN Evolution of Reference Configuration for RACE

A TMN Functional Hierarchy	ETSI	NA 4	1990/03	UK
Contribution to the Definition of Reference Configurations (RCs) for the Telecommunication Management	ETSI	NA 4	1990/03	UK

R1054 Application Pilot for People with Special Needs

Specifications of terminals for disabled users with respect to standards for user-system interface	ETSI	NA3.2	1991	

R1060 Distributed Industrial Design and Manufacturing

"Structural Walkthrough of the IPC Standard and Electrical Conceptual Model, STEP"	CCITT	ISO	1990/09	Germany

R1077 Usage Reference Model for IBC

Engineering IBC Services. Joint URM/CSF/RCD Position Paper	ETSI	HF-1008	1991	

R1079 CAR-CAR/CAM for Automotive Industry in RACE

Appraisal of M-IT-04	CEN	TG 11-2	1992/06	UK

R1080 HDTV Experimental Usage

Progress on development of studio equipment for progressively scanned HDTV	CCIR		1991/02	
Progress on HDTV standards conversion	CCIR		1991/02	
Progress report on the 1250/50/2 system	CCIR		1991/01	

R1082 Quality of Service (QoS) Verification Methodology and Tools

"Relationship between Qos terms such as Planned, Achieved, Inferred, Qos etc."	ETSI			
"Qos and NP, Relationship between related terms."	ETSI	NA 4	1991/07	France

The Timeline Model

R1089 Low Cost Optimized Optical Passive Components

	ETSI	NA 4	1991/07	France
"Sectional Specification, Connectors sets type CF08"	CCITT	IEC	1990/07	France
"Sectional specification, connectors sets type CF08"	CENELEC	CECC	1990/10	France

Annex III

List of Publications

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R1001 Digital Video tape Recording Terminal for HDTV

A new single-table assignment technique for transform coded images
1990/04 Paper for 8th Conference on Video, Audio & Data Recording

A Simple Recursive Motion Estimation Technique for Compression of HDTV Signals
1992/04 IEEE proceedings 4th Int. Conf. Image Proc. & its Applications (IPA 92), Conf. Publ. No 354 -

Characterisation and measurements of non-linear bit shifts in digital magnetic tape recording
1990/04 8th conference on Video, Audio & Data Recording

CoCr double-layered media with NiFe and CoZrNb soft-magnetic layers
1988 Journal of Applied Physics, vol 63(8)

Data Compression System for Home-Use Digital Video Recording
IEEE Journ. Sel. Areas Commun, Spec. Issue on Digital Rec.

Digital Consumer HDTV Recording based on Motion Compensated DCT Coding of Video Signals
1992/06 Signal Processing and Image Communications, Vol 4, No 3

Electronics for reading and writing
1991/06 Digest of the Magnetic Recording Conference 1991 (TMRC 91)

Error detecting run-length limited sequences
1990/04 8th Conference on Video, Audio & Data Recording

Full-Search versus Tree-Search Vector Quantization of Discrete Cosine Transform Coefficients
1990/09 Proceedings of the European Signal Processing Conference

Head-to-tape spacing and recording process evaluated from modulation noise spectra
1988/11 Intermag 88, IEEE Trans. Magn.

High-performance metal-in-gap heads with very small track widths
1990 J. Magnetism and Magnetic Material (jmmm) 83

High-performance small-track-width metal-in-gap heads made by reactive-ion etching
1990 J. Magnetism & Magnetic Materials (JMMM)

Implementation of TV and HDTV in B-ISDN
1990/09 Invited paper for 16th ECOC conference

Magnetic recording trends: media developments and future (video) recording systems
1990/01 MRM'89, published in IEEE Trans Magn, vol 26

Modelling of electromagnetic systems
1991/11 IEEE Transaction on Magnetics, Vol. Mag-27, No. 6

Motion adaptive intraframe transform coding of video signals
1989 Philips Journal of Research, vol 44 Nos 2/3

On the Construction of High-Performance Self-Synchronizing Codes
1990/10 Proceedings 11th Benelux Symposium Information Theory, Noordwijkerhout 1990

On the interpretation of tape friction
1990 IEEE Trans Magn., vol 26

Perpendicular recording with a one-sided MIG-head on SL Co-Cr
Intermag'90

Source Coding of HDTV with Compatibility to TV
1990/10 SPIE Vol. 1360, Proc. 5th Visual Communications & Image Processing '90

Sputtered sandwich heads for high-density digital video recording
1990/04 INTERMAG Conference

Structural Inhomogenities in Co-Cr layers and the influence on the magnetic properties
1989 PMRC'89, Journal Magn. Soc

Transform Coding of Digital TV Signals using Vector Quantization
1990 Image Communication

Transform Coding of Images using Adaptive Tree-Searched Vector Quantization
1988/09 Abstract in Proceedings Picture Coding Symposium

Transform Coding of Images using Directionally Adaptive Vector Quantization
1988/04 Proceedings International Conference on Accoustics, Speech and Signal Processing

R1002 Satellite Communication for IBC

Satellite links and integrated broadband communication networks
1990/10 Int. Conf. on Integrated Broadband Services & Networks

R1003 AIP and Standards for TMN

A Model of the TMN Workstation Function
1991/11 Proceeding of the Fifth RACE TMN Conference.

A Proposal for an Integration Methodology for a TMN
1991/11 Proceedings of the Fifth RACE TMN Conference

An architecture for the management of a Broadband Multi-service network
1990/05 XIII International Switching Symposium Proceedings

Broadband Communications Management the RACE TMN Approach
1990/10 IEEE Broadband Conference on Broadband TELECOM

Network Management for RACE
1991/11 British Telecommunications Engineering Journal, to be pub. later this year.

Synergies Between ESPRIT and RACE
1990/08 European conference on Artificial Intelligence (ECAI - 90)

Telecommunications Management Network Concepts
1990/01 IEE Electronics division colloquium organised by professional group E7 (Telecom Networks &

The application of information modelling in the telecommunication management network (TMN)
1991/03 Telecommunications Information Networking Architecture Workshop (TINA '91)

R1004 Electro-Luminescent Flat Panel Display for Terminal Applications

A 9 inch diagonal Compact, Multicolor TFEL Display
1991 SID 1991

Active matrix CdSe TFT addressed electroluminescent displays
1988/10 Proceedings of the International Display Research Conference

Aspects on Thin-film Electroluminescence
1990 Acta Polytechnica Scandinavica, Vol. Ph. 170

Bildschirme Flache Flundern
1989/03 Techno-Tip Nr. 3

Brightness and light conversion Efficiency in High Field AC Electroluminsescence
1990 Acta Polytechnica Scandinavica, vol Ph 170

Design of a prototype active matrix CdSe TFT addressed EL display
1990/09 Eurodisplay '90

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1990 Proceedings of Eurodisplay 1990

Evaluation of a 64x64 CdSE TFT Addressed ACFTEL display demonstrator
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Green Emitting Thin-Film Electroluminescent Device grown by Atomic Layer Epitaxy
1990 SID 1990 DIGEST

High-voltage polycrystalline CdSe TFT's
1990 IEEE Transactions on Electron Devices, ED-37.

Large Area VGA-Compatible EL-Display with 16 Gray Shades
1989/06 ED 89 Electronic Displays Conference Proceedings

Low-Power Thin-Film Electromuniscent Display
1991 SID International Symposium, Digest of Technical Papers, Vol. XXII

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1990/06 5th International Workshop on Electroluminescence

Multi-colour Thin-Film Electroluminescent Displays
1992 6th Int. Workshop on Electroluminescence - El Paso

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1990 Proceedings of 14th Nordic Semiconductor Meeting

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An Experimental Evaluation of Call Acceptance Management Algorithms in ATM Based Networks
1992/09 Canadian Conference on Electrical and Computer Engineering - Toronto

ATM Network Simulator
1990/11 GUIDELINE 2nd TMN Implementation Workshop

Constraint Logic Programming for a Virtual Path Bandwith Management
1990/11

Experience Design TMN Computing Platforms for constraining TMN Management Applications
1992/09 6th RACE TMN Conference - Madeira

Experience of Modelling and Implementing a Quality of Service Management System
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Generic Management Browser
1992/05 IFIP Conference on Upper Layer Protocols, Architecture and Applications - Vancouver

HCI Consideration in TMN Systems
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HCI in TMN : Issues and Technology
1991/11 5th RACE TMN Conference - London

Inference and Control in a Generic Maintainance System
1990 International Switching Symposium Stock

Integration in TMN Systems
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NEMESYS and WINER: a comparison of two QoS Network Management Experiments
1990/11

ODP Viewpoint of IBCN Service Management
IBM Technical Report No 439104

OSI Management and UNIX - the OSIMIS Platform
1992/05 Dansk Data Conference - Copenhagen

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1991/11 5th RACE TMN Conference - London

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1992 IBM Systems Journal 4Q.1992

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1992/10 IFIP/IEE International Workshop on Distributed Systems, Operation and Management - Munich,

Service Modelling in the NEMSYS Project
1991/11 5th RACE TMN Conference - London

TeleUSE UIMS Evaluation Report
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R1006 AIM-AIP Application to IBC Maintenance

A design of the Operation, Maintenance and Construction of an Intelligent Management Information Base
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A knowledge based resource scheduler for network maintenance
1991/07 British Telecom Technol. Journal, Vol. 9, no. 3

A Model-Based Reasoning System for the Maintenance of Telecommunication Networks
1991/05 Eleventh Workshop on Expert Systems & Their Applications, Avignon '91 Conference

A Proposal for an integration methodology for a TMN
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Advanced Information Modelling for Integrated Network Management Applications
1992

An architecture for the management of a Broadband Multiservice Network
1990/06 13th ISS

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Computing Numerical Beliefs Using Propositional Inference as a Basis
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Conclusions from the BERKOM Maintenance Prototype and Recommendations for future Maintenance Systems
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Ein Modellbasiertes Expertensystem fur die Wartung von Telekommunikationsnetzwerken
1991/10 GI Jahrestagung Conference

Fault Management within Broadband Communication Networks by using a Knowledge Based System
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Open University (UK) - Contributions to the course on data/knowledge bases.
1990/09 Preliminary Script on the Open University Interview on Object Modelling

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Towards a logical basis for communication in network management
1991/07 British Telecom Technol. J., Vol 9 No 3

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1991/06 Proceedings EFOC'91

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Low cost silica on silicon single mode 1:16 optical power splitter for 1550 nm
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1990/12 Electronics Letters

Microguides de lumière à très faibles pertes en technologie OIS pour communications optiques
1990/10 Journees Nationales d'Optique Guidee (JNOG)

New method for low cost and efficient optical connections between single mode fibres and silica guides
1991/01 Electronics Letters

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1991/06 Proceedings EFOC'91

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Silicon based integrated optics : a suitable technolgy for a hybrid approach to optoelectronics
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1991 Proceedings ECOC '91

Wide pass band wavelength multi/demultiplexer at 1.3/1.55 μm based on etched Fresnel mirror
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R1009 ADVANCE - Network and Customer Administration Systems for IBC

A Decision Support System for Planning GSM Radio Coverage
1991/01 IEE Colloqium GSM and PCN enhanced mobile services

A Framework for Computing Platforms to support TMN systems
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A Methodology for developing NCAS user interfaces
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A Model of a broadband session and of the corresponding charging record
1990/10 International Conference on Integrated Broadband Services and Networks

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A specification of a distributed heterogeneous systems administration
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An approach to Transparent Communication Handling in NCAS
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An Implementation Architecture for Network and Customer Admnistration Systems
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A 2.3 GHz low noise balanced receiver for FSK heterodyne reception, using commercially available
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1991 Electron. Letters 27

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1990 ECOC 90, paper TuG4.2

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R1060 Distributed Industr. Design & Manufacturing of Elect. Subassemblies

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R1061 Distributed Integrated Multimedia Publishing Environment

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R1062 MARIN - ABC

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R1065 ISSUE - IBC Systems and Services Usability Engineering

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R1066 IPSNI - Integration of People with Special Needs by IBC

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1991/07 International Ergonomics Association, 11th Congress

First computer vision symposium
1991/06 ESA

Formal Specification and Design of an On-line Product Catalogue
1991/09 Journal of Computer and Software Engineering

Formal Specification and Design of an Online Product Catalogue
1992/04 Journal of Computer and Software Engineering

Future Communications Services in the Automotive Industry
1993 BT Technology Journal

Human Factors Implications of the 'Distributed Enterprise'
1992/05 Journal of Engineering Computers

Human factors in concurrent engineering
1991/07 International Ergonomics Association, 11th congress

IBC and Co-operative Working in the Automotive Industry
1990/09 Computer Supported Co-operative Work, Multi-User Interfaces and Applications

IBC Networks: Security from the users view
1990/10 International Conference on Integrated Broadband Services and Networks

Kooperative graphische Anwendungen in Hochgeschwindigkeitsnetzwerken
1991 Proceeding GI '91 - Darmstadt

Management of Technical and Organisational Change in large scale CIM systems
1990/08 Human Factors Aspects of Advanced Manufacturing & Hybrid Automation

Managing Screens and Interactions : Observations on the use of Multimedia Conferencing
1992/11 ACM Conference on CSCW - Toronto

Managing the organisations knowledge resources
1989/09 Proceedings of 3rd International Conference on Human-Computer Interaction

Module for the DTI Awareness Programme for Strategic Manufacturing - Man Machine Interfacing
1992/03 HCI and User Interface Design - Institute for Electrical Engineers

Multi media interactive working in design to manufacture
1990/05 Proceedings of 22nd International Symposium on Automotive Technology and Automation

Multi-Media Collaborative Working in the Automotive Industry - The role for Broadband Communications
1992/04 Ergonomics and Design Colloquium - East Midlands Ergonomics Group of the Ergonomics Society

Multimedia Collaborative Working in the Automotive Industry - The Role for Broadband Communication
1990/05 Proceedings of the CIM Europe Conference

Multimedia Conferencing as a Tool for Collaborative Writing : A case study
1991/11 Proceedings of the CSCW SIG Seminar on Collaborative Writing

Multimedia Conferencing : From Prototype to National Pilot
1992/06 Proceedings of INET '92 Conference - Kobe

Multimedia interactive working in design to manufacture
1991/09 4th IFIP Conference on computer applications in production and engineering

New Applications in High Speed Networks for the European Automotive Industry (in German)
1991/10 Annual GI Conference 91 - Darmstadt, Germany

Problems of Designing Task-Based User Interfaces for large-scale CIM systems
1992/05 Computer-Integrated Manufacturing Systems, Butterworth-Heinemann Ltd, Vol 5 No 2, 91-96

RACE CAR - New applications in High Speed Networks for the European Automotive Industry
1991/10 Proceedings of the GI Conference 91 - Darmstadt, Germany

Some Multimedia Traffic Characterisation and Measurement Results
1992/04 Networks '92 - Trvandrum, India

The Open Multimedia System Architecture : An overview
1992/05 The Computer Journal

User requirements specifications for workstations incorporating high speed broadband communications links
1990/08 Human Factors Aspects of Advanced Manufacturing & Hybrid Automation

R1080 HDTV Experimental Usage

HD tape to film transfer
1992/02 SPIE/IS & T - San Jose, US

HDP/HDQ processing in an Experimental Digital HDTV studio
1992/06 Les assises des jeunes chercheurs - Tokyo

HDTV production and postproduction : an original compatible digital approach
1992/06 FKTG Berlin

Progress on development of studio equipment for progressively scanned 1250/50 HDTV
1991/02 Document TG 11/1, Document TG 11/2

Progress on HDTV standard conversion
1991/02 Document TG11/1. Document WP11/A

Progress report on the 1250/50/2 system
1991/01 Document : TG 11/1

Transferring to film
1991/09 HDTV Dublin

Vision 1250, A European economic interest grouping
1991/02 Document TG 11/1

R1081 BUNI - Broadband User/Network Interface Demonstrator

An European Demonstrator and Test-bed for the Broadband User/network Interface
1993/01 BT Technical Journal

Broadband User-Network Interface Projects in RACE
1990/10 International Conference on Integrated Broadband Services and Networks, IEE

R1082 Qual. of Serv. Verif. Method. & Tools for Integr. Broadband

ATM technology
1990/10 7th Congress de Nouvelles Architectures pour les Communications

QoS in Broadband Networks
1990/06 NETWORKS '90 conference

Some aspects of quality of service
1991 13th ITC Conference

R1083 PARASOL - ATM Specific Measurement Equipment

A Model for Real-Time Generation of ATM Traffic from a Large Number of Sources
1990/08 9th Nordic Teletraffic Seminar

ATM Measurement Tool
1990/08 9th Nordic Teletraffic Seminar

ATM Traffic Processes: A Model for Real-Time Generation
1990/09 Technical Seminar on B-ISDN

Bitfehlerstrukturanalyse in der Breitband-ISDN-Me-technik
1991 Nachrichtentechnische Zeitschrift 44

Correlation in ATM traffic streams
1991/06 Queuing Performance & Control in ATM

Guaranteeing B-ISDN transmission quality internationally
1991 Telcom Report International 14, No 2

Me-prezision auf breitem Band
1991 Telcom Report 14, Heft 2

Measurement precision over broadband
1991 Telcom Report 14, No 3

Messtechnik fÄr zukÄnftige Breitbandsysteme
1990/12 Nachrichtentechnische Zeitschrift ntz.

Network performance measurements in ATM systems
1991/08 Telecommunications

Testing in the ATM environment
1991/10 Communications International

Traffic generation for ATM systems testing environment modelling and feasibility studies
1991 ITC-13

Uebertragungsqualitaet im B-ISDN international sicherstellen
1991 Telcom report 14

R1084 MIME - Development of Emulators and Simulators

A high speed parallel simulator for ATM networks
1990/11 Proceedings of 4th RACE TMN conference

A high speed simulation engine for B-ISDN
1991/05 3rd Bangor Communications Symposium

A modular simulator for ATM based B-ISDN communication
1991/04 IEE conference

An ATM parallel simulator
1991/06 4th Greek National Confeence of Informatics

ATM Network Simulation Emulation Hybrid Systems
1990/11 2nd TMN Implementors Workshop

Broadband Network Simulation Using Parallel Transputer Technology
1990/10 RACE/IEE Conference - Publication No 329

Conservative parallel simulation of ATM networks
1991/11 5th TMN Conference

Contribution à la realisation d'un simulateur de reseaux ATM
1992/09 Thèse de Doctorat Un. de NICE-SOPHIA ANT

MEM for arbitrary exponential open network with blocking and multiple job classes
1991 Performance Engineering Workshop '91

Modelling of ATM networks
1991/11 5th TMN conference

Queueing Models of Packet-Sqitched Networks with Locally Adaptive Routing
1991 Performance Engin. Workshop '91

Simulation support for the Management Network
1992/09 6th TMN Conference

Switch Models for TMN applications
1992/09 6th TMN Conference

Unified representation of different Flow Control Methods
1991/11 5th TMN conference

R1086 TELEMED

Anwendung neuer Kommunikationskonzepte zur kooperativen Bearbeitung unterschiedlich strukturierter
1990/06 Berliner Herzkonferenz

Bridging the Gap: Using a Summary Primary Health Care Patient Record in Secondary Health Care
1990/12 Second European Conference on Health Services Research & Primary Health Care

Communication aspects in the RACE TELEMED Project
1990/11 12th International Conference

Communications between Hospitals and Remote Users
1990/04 IMIA working conference

Creation d'une banque de donnees europeenne inter-universitaire d'Imagerie Medicale

Design of a Cost-Effectivesness Analysis Study in Teleradiology
1991/07 CAR '91, 5th International Symposium & Exhibition

Design of a Portable software on X-Window for Interactive Image Analysis PACS Workstations
1990/06 EuroPACS 90

Experiences in picture communications in the medical field
1990/11 IDATE 12th International Conference: Key Technologies, Experiments, New Concepts

High Speed Medical Applications
1989/05 Proceedings of EARN 89. An International Conference of Technical Aspects of networking and

Integration und Kommunikation von Patientenbefunddaten am Deutschen Herzzentrum Berlin
Einsatz der EDV im Gesundheitswesen S.164

Laboratory results - Reporting to General Practitioners
1990 Current Perspectives in Health Computing

Perspectives in Teleradiology
1991/06 IV Congr. Naz. Ass. Ital. Fisica Biomedica

Presentation of the TELEMED project
1990/10 RACE seminar (organised by Swedish Telecom)

Proposal of a Relational Model for a Radiological Scientific Data Base
1990/05 EuroPACS 90

Proyecto de una PACS en un Hospital pedi?trico con integracion en el proyecto TELEMED
1990/11 XX Congresso Nacional de Radiologia

RECPHONE: A new environment for medical remote expert consultation
1991/07 EuroPACS '91, 9th International Meeting

Scientific and Technological Experiences and Tendency of Medicine in Italy
1991/02 Teleradiology

Specifications for the Development of a Programming Environment for Remote Expert Consultation in Medicine
1991/05 3rd Panhellenic Conference on Computer Technology

TELEMED: First results from Europe's largest Broadband Communications Project in Telemedicine
1990/05 EuroPACS 90

Telemed: il ruolo della tecnologia fiorentina in un programma europeo di ricerca applicata
1991/03 Rotary Club Firenze Sud

Telemed: project within telemedicine
1990/02 2nd Information Technology Conference

Telemed: un progretto Applicativo
1991/01 Assolombarda

Teleradiology in Europe, EEC project TELEMED
1991/05 PACS and Teleradiology Conference

The RACE TELEMED Project R1086
1989/10 AIM Concertation Meeting

The robusness of communication of emotion via facial expression
1991 European Journal of Social Psychology

The TELEMED approach to terminology standardisation
1991/03 Workshop ECR-SCDI

The TELEMED project
1990/12 AIM Euroforum

The Teleradiology in Europe
1991/03 Milano Europa

Value Added and Data Services in Health
1990 Medical Informatics in Europe

Videoconference
1991/06 Informatica in Radiologia

R1087 PROVE - Provision of Verification

Architecture Modulaire de Test pour Reseaux ATM Large-Bande
1991/09 L'Onde Electrique - Vol 71 No 5 pp 34-39

Assynchroner Transfer-Modus : Grundbaustein fuer das Breitband-ISDN
1992 Nachrichtentechnik, Elektronik - Berlin - Vol 2-3-4

Modulare Testarchitektur fuer Breitbandige ATM-Netze
1992/02 NTZ : Nachrichtentechnische Zeitschrift - Helft 2, 45 Jahrgang, pp 88-97

Provision of Verification in RACE
1993/01 BT Technology Journal, Vol 11, No 1

RACE Partners all over Europe
1992/09 Clemessy "News Magazine" - No 2

Test architecture for Broadband Network
TE&M magazine (Geneva exhibition issue)

Test derivation for SDL based on ACTs
1992 FORTE 92 - 5th International Conference on Formal Description Techniques

The RACE to Test Broadband Nets
1991/09 TE&M : Telephone Engineer & Management - Vol 95 No 17 pp 68-72

R1088 TUDOR - Usability Issues for People with Special Needs

Attitudes and acceptance
1991 Chapter in Issues in Telecommunications for People with Disabilities, COST 219

Concerns of elderly consumers and their attitudes towards new technologies
1990/09 13th HFT Conference

Domestic Terminals
1991 Future Telecommunications and Teleinformatics for Disabled People. Final report of COST 219

Elderly people in a new world: Attitudes to advanced communications
1991/08 Gerontechnology: First International Conference on Technology and Ageing

Picture Communication
1991/10 6th World Telecommunications Exhibition and Forum

Pilot Applications for Advanced Communication Technology in Care for the Elderly in Europe
1991/08 1st Internationa Conference on Technology and Ageing

RACE projects: APPSN and TUDOR
1990/06 Telematics '90 - Proceedings of the Conference held at Bremen

Remote Working in the United Kingdom
1991 Future Telecommunications and Teleinfomatics for Disabled People. Final report of COST 219

Telecommunications needs as expressed by elderly people and people with disabilities
1991 Chapter in Issues in Telecommunications for People with Disabilities, COST 219

The interface between the elderly and new technology
1990/04 BPS Annual Conference

The Role of Human Factors in Designing for Special Needs
1990/05 Belgium Ergonomics Society Journal

Uability Issues for People with Special Needs with Regards to IBC
1990/04 Institute of Electrical Engineers

R1089 LOOP - Low-cost Optimised Optical Passive Components

Achievements of Both Low Cost, Low Loss and Very Low Reflection for a New European Connector
1991/03 French-German Workshop on Optical Measurements Techniques and Fibre Optics Conference

Connecteur monomode à hautes performances et à faible cout = Application au Reseau Large Bande
1991/03 OPTO '91

High performance and low cost passive optical components for the subscriber loop
1991 IWCS 1991

Low cost wavelength independent 1 x N and N x N Branching Components
1991 ECOC 91 Proceedings

Low Reflection Receptacles for Active Devices
1992/05 42nd Electronic Components and Technology Conference - San Diego, CA - USA

Passive components for multichannel networks
1991/02 Technical Digest of OFC 91

Silicon-based fibre-pigtailed 1x16 and 2x16 power splitters
1992/09 ECOC 92 - Berlin

R1091 ESP - Exploitation and Service Project

Contributions to the integration of advanced applications with high-speed protocols - RACE 1091 ESP
1991/05 RARE 2nd European Networking Conference

ESP - Exploitation of RACE I Application Pilots
1991/06 Networks 91

Perspektiven zu einem europNischen IBC
1990 TUBKOM-Kolloquium Breitbandtechnik

Prototyping Multimedia Tele-Services
1991/06 R1022 Technical Committee Workshop

Transportprotokoll Profile und erweiterte Transport Service fÁr integrierte Breitbandnetze
1990 Vorschlag des RACE Projectes 1091 ESP, TUBKOM-Kolloquium Breitbandtechnik

What Infrastructure do the RACE Advanced Communication Experiments Need
1990/06 RACE Broadband Islands Workshop

R1092 DIRAC - Database for Reliability Calculations

DIRAC - A Component Reliability Database
1991 Proceedings of ESREF 91

European Database for Component Reliability in Telecommunications
1990/06 Proceedings of 7th International Conference on reliability and maintainability

R1093 ROSA - RACE Open Services Architecture

Introduction to Algebraic Specifications based on ACT ONE
1989/12 GMD Technical report

Object-Oriented Service Descriptions in ROSA
1991/04 Proceedings of the TINA Workshop

Platform Modelling Requirements from the ROSA Project
1992/01 Proceedings of the TINA Workshop

ROSA: An Object Oriented Architecture for Open Services
1990/10 British Telecom Technology Journal

ROSA: An Object-Oriented Architecture for Integrated Broadband Communication Services
1990/06 Proceedings of the TINA workshop

ROSA: From the service to the Architecture
1991/06 Proceedings of the TINA Workshop

ROSA - RACE Open Services Architecture
1989/07 Proceedings of SETSS '89

Suggestions for Object Oriented Modelling form ROSA
1992/01 Proceedings of the TINA Workshop

The ROSA Object Model
1991/10 Proceedings International Workshop on Open Distributed Processing

Towards a Convergence between Telecommunication Services Architectures and ODP
1991/10 Proceedings International Workshop on Open Distributed Processing

Annex IV

RACE Patents Registered

RACE PATENTS REGISTERED

PROJECT :	R1010
PAT-TITLE :	Modulierbare Laserdiode für hohe Frequenzen
PAT-AUTHOR :	Siemens
DATE :	1992/07/08
COUNTRY :	Germany
OBSERVATIONS :	German Patent Application P 42 22 466.7 - GR 92 P 1393 DE

PROJECT :	R1010
PAT-TITLE :	Abstimmbarer Halbleiterlaser
PAT-AUTHOR :	Siemens
DATE :	1989/02/15
OBSERVATIONS :	European Patent Application 89 10 25 96.7 - GR 89 P 1075.E. Corresponding applications in Japan and USA.

PROJECT :	R1010
PAT-TITLE :	Doppel-PIN-Photodiode mit sperrendem p-n-Übergang zwischen Substrat und Absorptionsschicht
PAT-AUTHOR :	Siemens
DATE :	1989/03/17
COUNTRY :	Germany
OBSERVATIONS :	German Patent Application P 39 08 886.3 - GR 89 9 1181 DE

PROJECT :	R1010
PAT-TITLE :	Monolitisch integrierte Photodiode-FET-Kombination
PAT-AUTHOR :	Siemens
DATE :	1990/15/16
COUNTRY :	Germany
OBSERVATIONS :	European Patent Application 0 400 399 - GR 89 P 1457 E. Corresponding applications in Japan and USA.

PROJECT :	R1010
PAT-TITLE :	pin-FET-Kombination mit vergrabener p-Schicht
PAT-AUTHOR :	Siemens
DATE :	1990/06/11
COUNTRY :	Germany
OBSERVATIONS :	European Patent Application 0 405 214 - GR 89 P 1525 E. Corresponding applications in Japan and USA.

PROJECT :	R1010
PAT-TITLE :	Verfahren zur Herstellung eines dotierten Bereiches in einer Halbleiterschicht
PAT-AUTHOR :	Siemens
DATE :	1989/09/15
COUNTRY :	Germany
OBSERVATIONS :	European Patent Application 0 417 348 - GR 89 P 1770 E. Corresponding applications in Japan and USA.

PROJECT :	R1010
PAT-TITLE :	Verfahren zur Herstellung von FETs
PAT-AUTHOR :	Siemens
DATE :	1989/10/19
COUNTRY :	Germany
OBSERVATIONS :	German Patent Application P 39 864.4 - GR 89 P 1918 DE

PROJECT : R1011
PAT-TITLE : Verfahren zur Übertragungstechnischen Integration von ISDN-Kanälen mit einem breitbandigen asynchronen Zeitmultiplex-Kanal für digital betriebene Kommunikations-Vermittlungsanlagen

PROJECT : R1012
PAT-TITLE : Koppelnetz, bei dem Kurzwege schaltbar sind
PAT-AUTHOR : Siemens
DATE : 1992/08/06
COUNTRY : Germany
OBSERVATIONS : Patent No 92 11 34 50.8 - GR 92 P 1477 E

PROJECT : R1012
PAT-TITLE : Monolithisch integrierte Laserdiode-Wellenleiter-Kombination
PAT-AUTHOR : Siemens
DATE : 1989/05/24
COUNTRY : Germany
OBSERVATIONS : German Patent Application P 39 16 962.6 - GR 89 P 1404 DE

PROJECT : R1012
PAT-TITLE : Verfahren und Schaltungsanordnung für die Aufnahme und Weiterleitung nach einem asynchronen Transfermodus übertragen
PAT-AUTHOR : Siemens
DATE : 1990/08/10
OBSERVATIONS : Corresponding applications in Canada, Japan and USA. European Patent Application 90 11 54 17.9 - GR 90 P 1488 E.

PROJECT : R1012
PAT-TITLE : Verfahren zur Überwachung und Glättung von Datenströmen, die nach einem asynchronen Übertragungsverfahren übertragen worden
PAT-AUTHOR : Siemens
DATE : 1991/02/01
OBSERVATIONS : European Patent Application 91 30 08 07.4 - GR 91 P 8002 E (Coapplicant Plessey Research Roke Manor Ltd. Corresponding)

PROJECT : R1013
PAT-TITLE : Circuitry for regeneration and synchronization of a digital signal (P4025 004)
ABSTRACT : The invention describes a way to perform bitsynchronization of a data stream with respect to a local or masterlock in a mesochronous or plesiochronous environment (jitter, wander, static phase arbitrary).
The principle can be used from DC up to slightly above 1 Gbit/s, using available semiconductor technologies. It can be monolictically integrated, no chip-external components are needed.
This is done by oversampling (for medium frequencies) or tapped delay lines (for 1/TB>300 Mbits).
The correlation of subsequent samples (spaced < = TB/4) of the input signal used to evaluate the eye opening.
The eye opening is catched and tracked in a way that data are sampled in its middle.
In a first stage jitter and wander are overcome up to 1.5 bitlenghts; a second stage, working with bit clock, overcomes bigger jitter and wander, only limited by chip size, not by principle. The second stage is realized with FIFO, RAM or shift register structures.
A control clock, which processes the algorithm for catching and tracking, organizes a coordinated step of the two stages, if the first stage is going to reach its range limits. This is done without slips or biterrors --> Bit slip compensation.
PAT-AUTHOR : K.-D. Menk and H. Preisach - SEL ALCATEL ZFZ/NV
DATE : 14990/08/dd
COUNTRY : Germany

PROJECT : R1015
PAT-TITLE : Procédé et dispositif pour contrôler le débit de données d'un terminal couplé à un réseau de transmission de l'information
DATE : 1990/12/27
OBSERVATIONS : Registration No (France) : 90 16330

PROJECT : R1015
PAT-TITLE : Procédé et dispositif de protection contre les erreurs bits et les pertes de cellules dans un reseau temporel asynchrone
ABSTRACT : The ATM Adaption Layer of the Protocol Reference Model of the B-ISDN aims at ensuring the Time Transparency and the Information Transparency for the services,
This patent describes a mechanism which deals with the Information Transparency. Based on an interleaving mechanism gathered with a Reed-Solomon error correcting code this patent provides a Convergence Sublayer format, the originality of zhich is the splitting of one cell payload on two rows of the interleaving array used together with the capacity of correcting errors and erasures.
PAT-CATEGORY : IBC Customer Systems
PAT-AUTHOR : Mr B. Guilbaud
DATE : 1991/06/25
COUNTRY : France
OBSERVATIONS : Registration No 91 07 797

PROJECT : R1015
PAT-TITLE : Procédé et dispositif pour le multiplexage asynchrone de donnéées sur des réseaux à support partagé
ABSTRACT : Thanks to a flow control mechanism installed inside data sources connected on a small multiplexer, a file dimensioning is possible for both data source and multiplexer without assumptions on the other party, This mechanism is based on a counter inside the sourcem increased when data are sentm decreased at a regular rate. Further data can be sent only if the counter value is below a given threshold. This is an original application of the "leaky bucket" mechanism.
PAT-CATEGORY : IBC Customer Systems
PAT-AUTHOR : F. Adam
DATE : 1991/02/01
COUNTRY : France
OBSERVATIONS : Registration No (France) : 91 01171

PROJECT : R1020
PAT-TITLE : Bistable optic device utilising the thermo-optic effect in a polymer
PAT-AUTHOR : D.J. Westland, V. Skarda, W. Blau, L. Costa

PROJECT : R1020
PAT-TITLE : Non-linear optical switch utilising organic conjugated materials and four wave mixing techniques
PAT-AUTHOR : D.J. Westland, V. Skarda, W. Blau, L. Costa
OBSERVATIONS : Ultra-fast all-optical switch

PROJECT : R1027
PAT-TITLE : A method for adjusting the operation on integrated optic devices
ABSTRACT : A method for the adjustment of operation characteristics of integrated optical devices, which allows the recovery of a considerable fraction of devices, being initially out of tolerance, by depositing on the surface of the waveguide material, after the final processing step of the device, a suitable layer of transparent material.
PAT-CATEGORY : Optical Communiation
PAT-AUTHOR : C. Caldera, S. Morasca, C. de Bernardi
DATE : 1991/03/07
COUNTRY : Italy, USA, Canada, Japan, GB, F, D, NL and Sweden
OBSERVATIONS : Applicant : CSELA - It will be extended by March 1991 to USA, Canada, Japan, GB, F, D, NL and Sweden.

PROJECT : R1027
PAT-TITLE : Fabrication procedure for an integrated semiconductor structure
ABSTRACT : The fabrication of a butt-coupled integrated photodectector-waveguide with high efficiency of the detector, is usually prevented by the poor quality of the regrown interface. To overcome this limitation, a special structure is proposed, with the photosensitive material grown on a double stepped waveguide/substrate surface; this structure is also made suitable the high optical power thanks to the insertion of a beam spreading region between the waveguide and the detector.
PAT-CATEGORY : Optical Communication
PAT-AUTHOR : L. Menigaux, A. Carenco, A. Scavennec
DATE : 1990/05/21
COUNTRY : France
OBSERVATIONS : Applicant : CNET

PROJECT : R1031
PAT-TITLE : High Speed Submount
PAT-AUTHOR : H.P. Mayer, G. Luz
OBSERVATIONS : German Patent No P4110378

PROJECT : R1031
PAT-TITLE : Laserwafer und Verfahren zu seiner Herstellung (Laser wafer and method for fabrication)
PAT-AUTHOR : K. Dutting, K. Wünstel
COUNTRY : Germany
OBSERVATIONS : German Patent OE 3934748 and European Patent EP 423513

PROJECT : R1031
PAT-TITLE Dispositif semiconducteur intégré incluant un élément optoélectronique de commutation en forme de Y
PAT-AUTHOR : Ph. Authier, M. Erman. LEP
DATE : 1988/06/27
COUNTRY : UK, F, D, I, SW, NL
OBSERVATIONS : Filed with the US, Japan and South Korea Patent Office and under the European Patent Convention

PROJECT : R1031
PAT-TITLE : Method for testing edge emitting semiconductor devices
PAT-AUTHOR : K.H. Bihler, H. Hauer, B. Schwaderer
COUNTRY : Germany
OBSERVATIONS : Applied for German Patent under No P3916924

PROJECT : R1033
PAT-TITLE : Dispositif semiconducteur intégré incluant un commutateur optoélectronique
PAT-AUTHOR : J.A. Cavailles, LEP
DATE : 1989/06/09
COUNTRY : UK, F, D, I, NL, SW
OBSERVATIONS : Filed with the US, Japan and South Korea Patent Office and under the European Patent Convention

PROJECT : R1033
PAT-TITLE : Dispositif semiconducteur intégré incluant un élément optoélectronique de commutation
PAT-AUTHOR : M. Erman, LEP
DATE : 1988/11/28
COUNTRY : UK, F, D, I, SW, NL
OBSERVATIONS : Filed with the US, Japan and South Korea Patent Office and under the European Patent Convention

PROJECT : R1033
PAT-TITLE : Optical Devices (HBT Waveguides)
PAT-AUTHOR : GEC
DATE : 1988/06/16
COUNTRY : F, D, I, NL, SW
OBSERVATIONS : Filed with the US Patent Office and under the European Patent Convention

PROJECT : R1033
PAT-TITLE : Verfahren und Vorrichtung zum dezentralen Aussenden von Information auf eine Uebertragungsstrecke
PAT-AUTHOR : S. Rao, M. Potts, R. Beeler, ASCOM TECH AG
OBSERVATIONS : Filed with the Swiss Patent Office (No 04 093/88-4)

PROJECT : R1033
PAT-TITLE : Dispositif semiconducteur comprenant un guide de lumière intégré qui présente au moins une partie rectiligne
PAT-AUTHOR : Ph. Autier, M. Erman, J.M. Auger, LEP
DATE : 1988/06/27
COUNTRY : UK, F, D, NL
OBSERVATIONS : Filed with the US, Japan and South Corea Patent Office and under the European Patent Convention

PROJECT : R1033
PAT-TITLE : Dispositif semiconducteur incluant un coupleur directionnel pour les composantes TE, TM
PAT-AUTHOR : J. Angenent, J.A. Cavailles, LEP
DATE : 1989/07/28
COUNTRY : UK, F, D, I, SW, NL

PROJECT : R1033
PAT-TITLE : Uebertragungseinrichtung mit einer optischen Uebertragungsstrecke
PAT-AUTHOR : P. Vogel, Th. Martinson, Ascom Tech AG
DATE : 1989/12/12
OBSERVATIONS : Filed with the Swiss Patent Office

PROJECT : R1033
PAT-TITLE : Bit- und Rahmensynchronisiereinheit für einen Zugriffseinheit einer optischen Uebertragungseinrichtung
PAT-AUTHOR : P. Vogel, Th. Martinson, ASCOM TECH AG
DATE : 1990/04/09
OBSERVATIONS : Filed with the Swiss Patent Office (No 01 192/90-3)

PROJECT : R1033
PAT-TITLE : Code-Erkennungseinheit und Verwendung derselben
PAT-AUTHOR : P. Vogel, Th. Martinson, ASCOM TECH AG
DATE : 1990/05/23
OBSERVATIONS : Filed with the Swiss Patent Office (No 01 769/90-0)

PROJECT : R1033
PAT-TITLE : Optoelectronic assemblies (SiTHRU packaging)
PAT-AUTHOR : I.R. Crostonm S.G. Tyler, GEC-Marconi
DATE : 1991/06/26
OBSERVATIONS : Filed with the UK Patent Office

PROJECT : R1035
PAT-TITLE : Connectionless ATM Data Services
OBSERVATIONS : Official publication of the application did not occur yet

PROJECT : R1038
PAT-TITLE : Vermittlungsunabhängiges Konferenzsystem (Audio/Video)
OBSERVATIONS : Application submitted by Alcatel SEL

PROJECT : R1038
PAT-TITLE : Videophone bei Multimedia mittels Umlenkspiegelanordnung
OBSERVATIONS : Application submitted by Alcatel SEL

PROJECT : R1038
PAT-TITLE : Videophone bei Multimedia - "Periskoplösung"
OBSERVATIONS : Application submitted by Alcatel SEL

PROJECT : R1041
PAT-TITLE : Hybrid-Codierer für Videosignale
PAT-AUTHOR : J. Speidel, P. Vogel
OBSERVATIONS : Patent No EP 0 244 01

PROJECT : R1041
PAT-TITLE : Verfahren u. Schaltungsanordnung zur Bitratenreduktion
PAT-AUTHOR : P. Vogel
OBSERVATIONS : Patent No DE 3631252 - EP 0 260 748

PROJECT : R1041
PAT-TITLE : Quellcodierer für Videobilder
PAT-AUTHOR : P. Vogel
OBSERVATIONS : Patent No DE 3710119 - EP 0 284 161

PROJECT : R1041
PAT-TITLE : System zur Übertragung von Videobildern
PAT-AUTHOR : P. Vogel
OBSERVATIONS : Patent No DE 3726520 - EP 0 290 085

PROJECT : R1041
PAT-TITLE : Verfahren zur Bestimmung von Bewegungsvektoren
PAT-AUTHOR : P. Vogel
OBSERVATIONS : Patent No DE 3727530

PROJECT : R1041
PAT-TITLE : System zur Übertragung von Videobildern
PAT-AUTHOR : P. Vogel
OBSERVATIONS : Patent No DE 3744280

PROJECT : R1041
PAT-TITLE : Schaltungsanordnung zur Auswertung eines Videosignals
PAT-AUTHOR : M. Riegel
OBSERVATIONS : Patent No DE 3809076 - EP 0 333 274

PROJECT : R1041
PAT-TITLE : Steuersignalgenerator für die Verarbeitung eines Videosignals
PAT-AUTHOR : M. Riegel
OBSERVATIONS : Patent No DE 3809075 - EP 0 333 275

PROJECT : R1041
PAT-TITLE : Prädiktiver Standbildcodierer
PAT-AUTHOR : K. Hienerwadel & G. Weth
OBSERVATIONS : Patent No DE 3811536 - EP 0 336 510

PROJECT : R1041
PAT-TITLE : Hybrid-Codierer für Videosignale
PAT-AUTHOR : K. Hienerwadel & G. Weth
OBSERVATIONS : Patent No DE 3811535 - EP 0 336 535

PROJECT : R1041
PAT-TITLE : Verfahren zur Speicherung und Wiedergabe von Videosignalen
PAT-AUTHOR : G. Weth
OBSERVATIONS : Patent No DE 38731277

PROJECT : R1041
PAT-TITLE : Speicher für Videosignale
PAT-AUTHOR : M. Riegel
OBSERVATIONS : Patent No DE 3838171 - EP 0 365 069

PROJECT : R1041
PAT-TITLE : Verfahren zur Bestimmung der Bewegungsvektoren einer Sequenz von Videobildern
PAT-AUTHOR : K. Hinerwadel
OBSERVATIONS : Patent No DE 3839502

PROJECT : R1041
PAT-TITLE : Schaltungsanordnung zur Filterung eines Videosignals
PAT-AUTHOR : K. Hinerwadel
OBSERVATIONS : Patent No DE 3917085

PROJECT : R1041
PAT-TITLE : Codierer für blocksweise Codierung von Videobildern
PAT-AUTHOR : P. Vogel
OBSERVATIONS : Patent No DE 3929280

PROJECT : R1041
PAT-TITLE : Schaltungsanordnung zur Bestimmung der Lage von extremalen Werten einer Ähnlichkesf
PAT-AUTHOR : K. Hinerwadel
OBSERVATIONS : Patent No DE 4009610 - EP 0 449 363

PROJECT : R1041
PAT-TITLE : Vorrichtung zur Steuerung einer Videokamera
PAT-AUTHOR : W. Demmer & G. Weth
OBSERVATIONS : Patent No DE 4012846

PROJECT : R1041
PAT-TITLE : Adaptives Filter zur Reduktion von Codierartefakten
PAT-AUTHOR : W. Demmer
OBSERVATIONS : Patent No 4017375

PROJECT : R1041
PAT-TITLE : Schaltungsanordnung zum Erkennen eines menschlichen Gesichts
PAT-AUTHOR : E. Badiqué
OBSERVATIONS : Patent No DE 4028191 - EP 0 474 304

PROJECT : R1041
PAT-TITLE : Anordnung zur Speicherung digitaler Farbbildsignale
PAT-AUTHOR : B. Friedrich
OBSERVATIONS : Patent No DE 4041821

PROJECT : R1044
PAT-TITLE : Multi-user Optical line Outlet
PAT-AUTHOR : Fussgänger (SEL)
DATE : 1990
COUNTRY : Germany
OBSERVATIONS : Exploitation of this patent will be "free of charge" to all participants in RACE Programme

PROJECT : R1044
PAT-TITLE : Optical Communication System for the Multi-Customer Access Area
ABSTRACT : Multi-Customer Optical Line Inlet/Multi-Customer Optical Line Outlet (MC-OLI/MC-OLO); Threefold WDM :
- High Density WDM (eg. 2-5 nm) for multi-customer signal transmissions
- Medium-Density WDM (eg. 65-85 nm) for bidirectional signal transmissions, and
- Low-Density WDM (eg. 185-235 nm) for optical integration of interactive (B)ISDN and distributive CATV service signals

PAT-CATEGORY : IBC Customer Systems
PAT-AUTHOR : Dr. Kurt Fussgaenger, SEL
DATE : 1989/90
COUNTRY : Germany, EC

PROJECT : R1064
PAT-TITLE : Integrierte optische Anordnung mit wenigstens einem auf einem Substrat aus Halbleitermaterial integriertem optischem Wellenleiter
DATE : 1989/09/01
COUNTRY : Germany
OBSERVATIONS : German Application P 39 29 131.6 - GR 89 P 1730 DE

PROJECT : R1064
PAT-TITLE : Monolithisch integrierter Schaltkreis mit einer DDB-Laserdiode, optischem Schalter und Wellenleiterverbindungen
DATE : 1990/05/03
COUNTRY : Germany
OBSERVATIONS : German Application P 40 14 234.5 - GR 90 P 1231 DE

PROJECT : R1064
PAT-TITLE : Steuerbarer integrierter optischer Richtkoppler
DATE : 1990/09/28
COUNTRY : Germany
OBSERVATIONS : German Application P 40 30 754.9 - GR 90 P 1725 DE

PROJECT : R1064
PAT-TITLE : Steuerbarer integrierter optischer Mach-Zehnder-Interferometer
DATE : 1990/09/28
COUNTRY : Germany
OBSERVATIONS : German Application P 40 30 755.7 - GR 90 P 1726 DE

PROJECT : R1064
PAT-TITLE : Passiver integrierter optischer Richtkoppler
DATE : 1990/09/28
COUNTRY : Germany
OBSERVATIONS : German Application P 40 30 756.5 - GR 90 P 1727 DE

PROJECT : R1083
PAT-TITLE : Method and Circuit Arrangement for Data Block Synchronisation in TDM Communiation System, particularly in an ATM
PAT-AUTHOR : S. Wahl, B. Cesar
DATE : 1991/07/12
OBSERVATIONS : (EP 91 111 615.0 12.07.91)

PROJECT : R1089
PAT-TITLE : Verfahren zum Absetzen von Kabeln, insbesondere Lichtwellenleiterkabeln
ABSTRACT : Cutting of aramid yarns for cable end preparation
PAT-AUTHOR : H. Deharde, J. Rogalla, J. Schulte
DATE : 1989/0
COUNTRY : Germany
OBSERVATIONS : Application Submitted

PROJECT : R1089
PAT-TITLE : Verfahren zum zugfesten Verbinden eines Steckers mit einem Lichtwellenleiterkabel
ABSTRACT : Procedure for the mounting of the crimp sleeve of an optical connector
PAT-AUTHOR: H. Deharde
DATE : 1990/01
COUNTRY : Germany
OBSERVATIONS : Application submitted

PROJECT : R1089
PAT-TITLE : Connecteurs pour fibres optiques à verrouillage et déverrouillage rapide
ABSTRACT : Design of the housing for a push-pull operating fibre optic connector
PAT-AUTHOR : E. Grassin d'Alphonse, S. Dubois, N. Valade
DATE : 1990/06/21
COUNTRY : France
OBSERVATIONS : Application submitted, extension to foreign countries planned

PROJECT : R1089
PAT-TITLE : Connecteur pour fibres optiques
ABSTRACT : Silicone-based membrane fixed inside the adaptor connecting 2 optical fibres
PAT-AUTHOR : L. Boillot, S. Boudard
DATE : 1990/01/29
COUNTRY : France
OBSERVATIONS : Application submitted, extension planned for European cointries and the US

PROJECT : R1089
PAT-TITLE : Oblique Fibre Cleaving
OBSERVATIONS : Application submitted

PROJECT : R1089
PAT-TITLE : Singleway re-enterable splice
OBSERVATIONS : Application submitted

PROJECT : R1089
PAT-TITLE : Design of compact fan-out with splitters
OBSERVATIONS : Application submitted in April 1992

Annex V

Glossary of technical terms

ATM - Asynchronous Transfer Mode.
CEPT - Conference of European Post and Telecommunications Organisations
CCIR - Comite Consultatif International des Radiocommunications of ITU
CCITT - Comite Consultatif International des Telegraphique et Telephonique - International Telephone and Tele
CFS - Common Functional Specifications
CODEC - Coder/Decoder
COST _ Co-operation in Science and Technology: A European multi-national framework for R&D co-operation.
CPN - Customer Premises Network
CREST - EC Committee on Research, Science and Technology.
DRIVE - EC R&D on Telematic systems in the area of Transport
EBIT - European Broadband Interconnection Trial
ECU - European Currency Unit
EDTV - Enhanced Definition Television
EFTA - European Free Trade Association
EL - Electro-luminescent
ESPRIT - European Strategic Programme of Research in Information Technologies
ETSI - European Telecommunications Standards Institute
EURESCOM - European Institute for Research and Strategic Studies in Telecommunications GmbH
GEN - General European Network: A 34 MBit/s fibre transmission Backbone
IBC - Integrated Broadband Communicatons
IC - Integrated Circuit
IN - Intelligent Networking
ISDN - Integrated Services Digital Network
ITU - International Telecommunications Union
HDTV - High Definition Television
LSI devices - Large-Scale Integrated devices
METRAN - Managed European Transport Network
MOU - Memorandum of Understanding
PNO - Public Network Operator
RACE - Research on Advanced Communications technologies for Europe
RMC - RACE Management Committee
SME - Small and medium-sized Enterprise
TMN - Telecommunications Management Network
UMTS - Universal Mobile Telecommunications System

Annex VI

Key references

Council Decision of 25th July 1985 on a definition phase for a Community action in the field of telecommunications technologies - R&D programme in advanced communications technologies for Europe (RACE): 85/372/EEC; O.J. No L 210/24; 7.8.1985

Council Decision of 14 December 1987 on a Community programme in the field of telecommunications technologies - R&D in advanced Communications technologies in Europe (RACE programme); 88/28/EEC: O.J. No L 16/35, 21.1.88.

Council resolution of 30th June 1988 on the development of the common market for telecommunications services and equipment up to 1992; 88/C 257/01: O.J. No C 257/1, 4.10.88.

Communication from the Commission to the Council and Parliament "Working towards Telecom 2000 - Launching the Programme RACE - COM(88) 240 final II of 31.5.88

Report of the IBC strategic Audit: "Establishing advanced communications in Europe". February 1989.

Communication of the Commission to the Council concerning R&D in Advanced Communications technologies for Europe (RACE) - Progress report '89 and 30-month review, SEC(89) Final, July 1989.

Annual technical reports on the RACE programme - RACE '88; RACE '89; RACE '90; RACE '91, and RACE '92 - Available on request from the RACE central office, DG XIII, Direction B.

Perspectives for Advanced Communications in Europe: PACE '89; PACE '90; and PACE '92, January 1992 - Available on request from the RACE central office, DG XIII, Direction B.

Council Decision 91/352/CEE of 7th June 1991 adopting a Specific Programme of research and technology development in the field of Communications technologies: O.J. No L 192/8, 16.7.91

The report of the information and communications technologies review Board, Chaired by Mr. W. Dekker, June 1992.

Communication from the Commission on "Evaluation of the second Framework Programme for research and technological development (SEC(92)675 Final), July 1992.

Evaluation of the second Framework Programme of RTD: **Report from CREST to the Council**, September 1992. CREST/1212/1/92.

Annex VII

Listing of Projects

1001 DVT:Digital video-tape recording terminal for HDTV
1002 Satellite communications for IBCN
1003 GUIDELINE:AIP and standards for TMN
1004 Electro-luminescent flat-panel display for terminal applications
1005 NEMESYS:Traffic and QOS management for IBCN
1006 AIM: AIP application to IBCN maintenance
1007 ITIS: IBC terminal for interactive services
1008 Silicon-based low-cost passive optical components
1009 ADVANCE: Network and customer administration systems for IBCN
1010 Subscriber coherent Multi-channel system
1011 Business CPN
1012 BLNT: Braodband local network technology
1013 HDTV-Switching
1014 ATMOSPHERIC
1015 Domestic CPN
1016 Test tools and equipment
1017 IOLE: IBC on-line environment
1018 HIVITS: High-quality video-telephone and hihg-definition television system
1019 Polymeric optical switching
1020 All-optical switching and bi-stable devices based on semi-conducting polymers
1021 ARISE: A resuable infrastructure for software engineering
1022 Technology for ATD
1023 BEST: A methodological approach to IBC system requirements specifications
1024 NETMAN: Functional specifications for IBC TNM
1025 Functional specification of security and privacy in IBC
1026 International transmission of digital radio and television
1027 Integrated opto-electronics towards coherent multi-channel IBCN
1028 REVOLVE: Regional evolution planning for IBC
1029 Development of improved InP substrate material for opto-electronic devices
1030 ACCESS: Advanced customer connections, an evolutionary systems strategy
1031 Low-cost opto-electronic components
1032 Development and testing of optical components for subscriber networks
1033 OSCAR: Optical switching systems, components and architecture research
1034 Usability engineering requirement for IBC
1035 Customer premises network (CPN)
1036 WDTM broadband customer premises network
1037 User criteria for the realisation of opportunities afforded by IBC
1038 MCPR: Multi-media communication, processing and representation
1039 DIMUN: Distributed international manufacturing
1040 RIPE: RACE integrity primitives evaluation
1041 FUNCODE: Functional specification of codes
1042 MULTI-MED: Functional service integration in support of professional users
1043 Mobile telecommunications project
1044 IBCN development and implementation strategies

1045 Consensus management project
1046 SPECS: Specification and programming environment for comms software
1047 Techniques and integrity mechanisms in IBCN
1048 RSVP: RACE strategy for verification
1049 ATM concept
1050 IBC applications analysis
1051 Multi-gigabit transmission in IBCN subscriber loops
1052 SPOT: Signal processing for optical and cordless transmission
1053 TERRACE: TMN evolution of reference configurations for RACE
1054 APPSN: Application pilot for people with special needs
1055 MERCHANT: Methods in electronic retail cash handling
1056 BIPED: Basic business IBC demonstrator
1057 AQUA: Advanced quantum-well lasers for multi-gigabit transmission
1058 RESAM: Remote expert support for aircraft maintenance
1059 DIVIDEND: Dealer interactive video
1060 DIDAMES: Distributed industrial design and manufacturing of electronic subassemblies
1061 DIMPE: Distributed integrated multi-media publishing environment
1062 MARIN: Marine industry applications of broadband communications
1063 MAPS: RACE mobile applications pilot scheme
1064 MIOCA: Monolithic integrated optics for customer access applications
1065 ISSUE: IBCN systems and services useability engineering
1066 IPSNI: Integration of people with special needs by IBC
1067 Usability design information support
1068 ROSA: RACE open services architecture
1069 EPLOT: Enhanced performance lasers for optical transmission
1070 Testing Pay-per-view in Europe
1071 Applications analysis
1072 ITACA: IBCN testing architecture for conformance assessment
1073 GEOTEL: Application pilot in the petroleum and chemicals industry
1074 ECHO: Electronic case-handling in offices
1075 Telepublishing
1076 REMUS: Reference models for useability specifications
1077 Usage reference model for IBC
1078 European museums network
1079 CAR: CAD/CAM for the automotive industry in Europe
1080 HDTV experimental usage
1081 BUNI demonstrator
1082 QOSMIC: QOS verification methodology and tools for integrated communications
1083 PARASOL: ATM specific measurement equipment
1084 MIME: Development of emulators and simulators
1085 TET-ADAPT: Adaptation of techno-economic evaluation tools for RACE
1086 TELEMED
1087 PROVE: Provision of verification
1088 TUDOR: Usability issue for people with special needs
1089 LOOP: Low-cost optical components
1091 ESP: EBIT service project
1092 DIRAC: Database for reliability calculations

Annex VIII

Organisations involved in RACE Projects

ANNEX B - Alphabetical List of Participating Organisations

	Organisation	Country	Project(s)
01-PLIRO	01-PLIROFORIKI	GR	R1075
AAS/TAU	Austrian Academy of Sciences Technology Assessment Unit	A	R1037
ACEC	ACEC SA	B	R1018, 22, 41
AEG	AEG Aktiengesellschaft	D	R1018, 39
AEG	AEG Forschungsinstitut	D	R1041
AEG	AEG Kabel AG	D	R1030, 44, 56
AEG	AEG Olympia AG	D	R1063
AET	Applicazioni Elettrotelefoniche A.E.T. Spa	I	R1044
AIB	Allied Irish Bank Plc	IRL	R1059
AKZO	AKZO International Research BV	NL	R1019*
ALCASP	Alcatel Espace SA	F	R1002*, 86
ALGO	Algotech Sistemi	I	R1076*
ALPHA	ALPHA SAI	GR	R1016, 84
AMPER	Amper SA	E	R1044, 45, 81
ANALYSIS	Analysis Ltd	UK	R1028
ANDUS	ANDUS GmbH	D	R1060
ANITRA	Anitra Medienprojekte	D	R1070*
ANT	ANT Nachrichtentechnik GmbH	D	R1002, 30, 31, 44, 47*, 51
APD	Grupo de Empresas A.P.D.	E	R1042
APM	Architecture Projects Management	UK	R1068
APSIS	APSIS	F	R1042
APT	AT&T en Philips Telecommunicatie Bedrijven BV	NL	R1022, 31, 33, 44, 51, 81, 83
ASCOM	Ascom Tech AG	CH	R1053, 83, 87
AT&T NSI	AT&T Network Systems International BV	NL	R1045, 77
ATEA	ATEA	B	R1044
ATR	ALCATEL Radiotelephone	F	R1043
AXI	AXION A/S	DK	R1009
B&S	Barr & Stroud Ltd (Pilkington)	UK	R1019
B3i	Bureau International d'Ingénierie Informatique	F	R1083
BALT	Baltimore Technologies (Subcontractor)	IRL	R1021
BARCO	Barco Industries N.V.	B	R1044
BED	BED	D	R1015
BBC	British Broadcasting Corporation	UK	R1018, 36*,43, 63, 77, 81
BC	Bertin & Cie.	F	R1092
BCOM	Broadcom Eireann Research Ltd	IRL	R1003, 09*, 21*, 23, 24*, 28, 53, 91
BELSER	Belser Verlag	D	R1078
BIBA	Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft an der Universität Bremen	D	R1039*, 62, 85
BICC	BICC Cables Plc	UK	R1032*, 39, 60
BNP	Banque Nationale de Paris	F	R1059
BOSCH	Robert Bosch GmbH	D	R1043, 44, 54

BT	British Telecommunications Plc	UK	R1003*, 06, 09, 18, 22, 23, 24, 25, 28, 30, 32, 33, 34, 37*, 41, 43, 44, 45, 48, 55, 59, 67, 68*, 77, 79, 81*, 87, 91, 92*
BT/NoI	British Telecommunications Plc (Northern Ireland)	UK	R1028
BT/NoS	British Telecommunications Plc (North of Scotland District)	UK	R1028
BTM	Alcatel/BTM	B	R1002, 22*, 44, 45, 46, 83
BTS	Broadcast Television Systems GmbH	D	R1080
BURDA	Burda GmbH	D	R1061
CAP	CAP SESA Régions	F	R1087
CAP	CAP Sesa Telecom	F	R1021
CAP	CAP SOGETI Innovation	F	R1016, 17
CASE	Case Communications Ltd	UK	R1003, 05*, 53, 79, 82
CCETT	Centre Commun d'Etudes de Télédiffusion et Télécommunications	F	R1018
CEA	Commissariat à l'Energie Atomique	F	R1008
CEL	Crosfield Electronics	UK	R1061
CERDA	Institut Cerda	E	R1037, 71
CET	(Centro de Estudos de Telecommunicações) Correios & Telecomunicações de Portugal	P	R1009, 21, 23, 24, 28*, 54,
CIRU	Computer Industry Research Unit	UK	R1055, 59
CIT	Alcatel CIT SA	F	R1022, 44, 45
CLEM	Clemessy SA	F	R1016, 82, 87
CNET	Etat Français - Ministère des PTT Centre National d'Etudes des Télécommunications	F	R1015, 18, 22, 27, 30, 32, 5, 41, 44, 46, 48, 57, 68, 3, 87, 92
CNR	Consiglio Nazionale Delle Ricerche	I	R1066*
CNRG	Communication Networks Research Group	GR	R1083
CNUSC	C.N.U.S.C.	F	R1086
CONTEL	Contel IPC (UK) Ltd	UK	R1059
CORNEL	Cornelsen Verlag	D	R1075
COSI	Consorzio per l'OSI in Italia	I	R1044, 72*
CPR	Consorzio Pisa Ricerche	I	R1091
CPS	Condatec Projekt Software GmbH	D	R1075
CSATA	CSATA - Tecnopolis (Centro Studi e Applicazioni in Tecnologie Avanzate)	I	R1028, 38, 92
CSELT	C.S.E.L.T. - Centro Studi e Laboratori Telecomunicazioni Spa	I	R1018, 27, 44, 46, 48, 53*, 54, 57, 68
CT	Compagnie Technicon	F	R1042
CTE	Centro de Textos Electronico SA	E	R1061
CTT	Correios e Telecomunicações de Portugal	P	R1022, 91
CU	Commercial Union Assurance Company	UK	R1074
CWI	Stichting Mathematisch Centrum - CWI	NL	R1040*
DANAOS	Danaos Shipping Co.	GR	R1062

DANET	DANET GmbH	D	R1006
DBP	Bundesministerium für das Post und Fermeldewesen	D	R1045
DBP	Deutsche Bundespost	D	R1051, 92
DEA	Danish Engineering Academy	DK	R1092
DETECON	DETECON GmbH	D	R1075*, 86*, 91*
DEUTSCH	Compagnie Deutsch	F	R1031
DHL	DHL Worldwide Express	B	R1063*
DHZ	Deutches Herzentrum	D	R1086
DIT/UPM	Departamento de Ingenieria Telemática Universidad Politecnica de Madrid	E	R1072
DLV	Delta Lloyd Verz.	NL	R1074
DORNIER	Dornier System GmbH	D	R1002
DTB	Deutsche Thomson-Brandt GmbH	D	R1001, 18
EBT	EB Teknologi Ltd	N	R1039, 43, 46
EBU	Technical Centre of the EBU	B	R1026*
ELBASA	ELBASA	E	R1060
ELCENT	ElektronikCentralen	DK	R1016, 84, 87
ELCOMA	Philips International BV. Elcoma Division	NL	R1022
ELEC	Electricity Council	UK	R1063
ELIN	Alcatel Austria Elin Forschungcentrum GmbH	A	R1046
ELSYP	ELSYP	GR	R1075
EMI	EMI Electromagnetics Institute	DK	R1014
EMP	Empirica GmbH	D	R1054
ENI	Enichem Synthesis Spa	I	R1020
EOLAS	The Irish Science and Technology Agency	IRL	R1087
EPFL	EFPL	CH	R1057
ERA	ERA Technology Ltd	UK	R1020
ERC	Alcatel Austria - ELIN Research Center	A	R1017
ERICSSON	Ericsson Radio Systems AB	S	R1043
ERICSSON	Ericsson Telecom	S	R1056*, 68, 81
ESTTO	ESTTO SA	GR	R1061
FACE	Industrie FACE Standard Spa	I	R1002, 06, 08, 13, 17, 22, 38, 44, 45, 66
FATME	Fabbrica Apparecchiature Telefoniche e Materiale Elettrico - Brevetti Ericsson	I	R1011*, 15, 35*, 44, 45, 56, 72, 81
FCR	France Cable & Radio	F	R1059, 87
FCRE	F.C.R. Entreprises	F	R1091
FI/DBP	Forschungsinstitut der DBP TELEKOM beim Fernmeldetechnischen Zentralamt	D	R1018, 22, 25*, 32, 41
FIAR	Fabricca Italiana Apparecchiature, Radioelettriche SpA	I	R1009
FINTEL	Post and Telecommunications of Finland	SF	R1039, 44
FIT	Swiss Federal Institute of Technology, Zurich	CH	R1033

FHG	Fraunhofer Abbeitsgruppe für Graphische Datenverarbeitung	D	R1079
FLZ	Fischer-Madsen & Lorenz Petersen Data Communications Consultants A/S (Fischer and Lorenz)	DK	R1005
FMH	Universidade Tecnica de Lisboa, Faculdade de Motricidade Humana, Departamento de Educaçao Especial e Reabilitaçao, (FMH-DEER)	P	R1054, 88
FOKKER	Fokker Aircraft BV	NL	R1058
FORD	User 2 - Ford (Europe)		R1079
FORTH	Foundation for Research and Technology - Hellas	GR	R1005, 66
FTZ	Deutsche Bundespost TELEKOM - Fernmeldetechnisches Zentralamt	D	R1044, 48, 53, 87
FUB	Fondazione Ugo Bordoni	I	R1043, 65, 68, 72
GEC	GEC-Marconi Research Ltd.	UK	R1043, 92
GEC	GEC Research Ltd (Subcontractor)	UK	R1011
GEC	The General Electric Company Plc (GEC Research Ltd, Marconi Research Centre)	UK	R1002
GEC	The General Electric Company Plc	UK	R1014, 18, 24, 30, 33, 35, 36
GEOSTOCK	Société Francaise de Stockage Géologique	F	R1073*
GMD	Gesellschaft für Mathematik & Datenv.	D	R1068, 72, 75
GPT	GEC-Plessey Telecommunications Ltd.	UK	R1005, 44, 45, 46, 51 56, 81
GRUNDIG	Grundig AG	D	R1001
HAI	Hellenic Aerospace Industry	GR	R1044
HAMBURG	Museum Hamburg	D	R1078
HASLER	Research & New Technologies Division of Ascom Holding Ltd (Hasler AG)	CH	R1016, 33
HELL	Dr. Ing. Rudolf Hell GmbH	D	R1061
HHI	Heinrich Hertz Institut	D	R1010
HIDB	Highlands & Islands Development Board	UK	R1028
HP	Hewlett-Packard Ltd	UK	R1016, 83
HUSAT	Husat	UK	R1063, 65*, 76, 79
HUT	Helsinki University of Technology	SF	R1039, 62
IAD	International Automotive Design	UK	R1079*
IBM	IBM France SA	F	R1005, 46, 53, 68, 79, 82*, 84
ICOM	International Council of Museums	F	R1078
ICOM	Intracom SA	GR	R1009, 21, 24
IDATE	IDATE	F	R1050, 71, 77, 86
IFC	IFC Research Ltd	UK	R1050*, 71*, 77
IMEC	Inter-universitair Mikro-electronika Centrum vzw	B	R1010, 19, 22, 33, 69
IMS	Irish Medical Systems	IRL	R1086
INESC	Instituto de Engenharia de Sistemas e Computadores	P	R1011, 22, 46
INET	I-NET Limited	UK	R1053

INMARSAT	Inmarsat	UK	R1062
INST	Instruments SA	F	R1032, 36
INSTM	Institut Montpellier	F	R1086
INTECS	INTECS Sistemi Spa	I	R1017, 21
INTELSA	Industrias de Telecomunicacion SA	E	R1023, 44, 48
INTERCAI	INTERCAI	NL	R1070
INTRACOM	Intracom SA	GR	R1053, 60, 61
IPSYS	IPSYS Plc	UK	R1021
IROE	Instituto di Recerca sulle Onde - Electromagnetiche del Consiglio Nazionale dell Recerche	I	R1020
IRR	Institute for Rehabilitation Research	NL	R1066
ISI	ISI-Fraunhofer GmbH	D	R1050, 71, 75, 78*
ISL	Institut für Seeverkehrswirtschaft und Logistik	D	R1062
ISOFT	Intrasoft (Subcontractor)	GR	R1009, 21
ISR	Alcatel/ISR	F	R1053, 55, 60, 63
IST	Instituto Superior Tecnico	P	R1051
ITALTEL	Societa Italiana di Telecomunicazioni SpA	I	R1012, 44, 45, 49, 81
ITEC	Reading ITEC (Information Technology Centre)	UK	R1066
JTAS	Jutland Telephone Aktieselskab	DK	R1022, 44, 72, 81
KME	Kabelmetal Electro GmbH	D	R1032, 44, 89
KONE	Kone Belgium SA	B	R1039
KTAS	Kjobenhavns Telefon Aktieselskab	DK	R1005, 09, 22, 44, 53, 58, 82, 83, 84, 91
KUL	Katholieke Universiteit Leuven	B	R1066
L-CUBE	L-CUBE Information Systems SA	GR	R1061
LABEIN	Labein	E	R1072
LC	Lohja Corporation Electronic Industries	SF	R1004*
LDM	Laboratoires de Marcoussis	F	R1006, 19, 27, 46, 57
LEP	Philips - LEP (Laboratoires d'Electronique Philips)	F	R1010, 18, 33*
LER	Thomson-CSF	F	R1080*
LME	L.M.Ericsson Ireland	IRL	R1009
LME	Telefonaktiebolaget L M Ericsson	S	R1014, 21, 30, 33
LOEWE	Loewe Opta GmbH	D	R1007*
LOHJA	Lohja Corporation	SF	R1081
LUT	Loughborough University of Technology Dept of Electronic & Electrical Engineering	UK	R1042
LWB	Lloyd Werft Bremerhaven GmbH	D	R1062*
MARCONI	Marconi Italiana Spa	I	R1044
MARI	MARI Advanced Microelectronics Ltd	UK	R1007, 09, 21, 23*, 81
MATRA	MATRA Communication	F	R1004, 07, 18, 41, 81
MATRA	SA Matra-Space	F	R1014
MBLE	MBLE N.V./ S.A.	B	R1022
MCC	Maxwell Communication Corporation Plc	UK	R1061*

MCS	(Marconi Communication Systems) The Marconi Company Limited	UK	R1002
MCP	MCP Wafer technology	UK	R1029*
MECF	Medical Computers France	F	R1042
MET	Matra-Ericsson Télécommunications	F	R1014*, 44, 56, 83
METATYPE	Metatype SA	GR	R1061
MM	Midland Montagu	UK	R1059
MONOTYPE	Monotype Corporation Plc	UK	R1061
MSS	Marconi Space Systems The Marconi Company Limited	UK	R1002
NAH	Nassauisches Heim	D	R1054
NAVICON	Navicon SA	E	R1062
NCC	National Computing Centre Ltd.	UK	R1048
NCI	Norcontel (Ireland) Ltd	IRL	R1059
NEDPTT	Centraaldirectie Nederlandse PTT	NL	R1088
NEWPOL	Newcastle Polytechnic	UK	R1088
NIHE	The National Institute for Higher Education	IRL	R1046
NKT	Aktieselskabet Nordiske Kabel & Traadfabriker Denmark	DK	R1014, 30*, 45, 51, 56
NMRC	National Microelectronics Research Centre	IRL	R1020, 43
NOKIA	NOKIA Corporation	SF	R1011, 22, 35, 43, 44
NSDD	Telecom Eireann NSDD	IRL	R1059
NTA	Norwegian Telecommunications Administration	N	R1022, 44, 53, 68, 83, 86, 91
NTA	Research Department (Teledirektorat) of Norwegian Telecommunications Administration	N	R1023
NTE	NTE GmbH	D	R1075
NTUA	National Technical University of Athens	GR	R1014, 22, 24, 62
NTUA	National Technical University of Athens (Subcontractor)	GR	R1009
ORT	Offset Repro Technik	D	R1075
OTE	Hellenic Telecommunications	GR	R1028, 43
OTTO	Otto Versand	D	R1075
OXC	Oxford Consultants (Europe)	UK	R1042
OXP	Oxford Polytechnic Dept of Computing And Mathematical Science	UK	R1042
PEUSA	Peugeot SA	F	R1079
PHILIPS	Nederlandse Philips Bedrijven BV	NL	R1001, 10*, 31, 64, 69, 80
PHILIPS	Philips SA	B	R1022
PHILIPS	Philips Telecommunicatie en Data Systemen, Nederland BV	NL	R1022, 45
PHILIPS	Philips USFA	NL	R1040, 47
PHILIPS	Philips International BV	NL	R1074*
PKB	PK Berlin	D	R1078
PKI	Philips Kommunikations Industrie AG	D	R1015, 18, 22, 35, 41, 43, 44, 58, 74, 78, 83
PLANET	Planet SA	GR	R1061, 73
PLES	Plessey Research, Roke Manor Ltd	UK	R1009, 11, 12*, 15, 35, 49*

PLES	Plessey Research (Caswell) Ltd	UK	R1010, 18, 64, 69*
PLESSEY	Plessey UK Ltd	UK	R1043, 67, 68
PRC	Philips Radio Communication Systems Ltd	UK	R1043*, 63
PRENSA	PRENSA	E	R1075
PROMAR	Proyectos Marinos	E	R1062
PRL	Philips Research Labs	UK	R1043
PTT	Swiss PTT	CH	R1045, 86
PUM	Philips Universitaet Marburg	D	R1057
QMC	QMC Instruments Ltd	UK	R106
QMC	Queen Mary College, London	UK	R1022
QMW	Queen Mary & Westfield College (University of London)	UK	R1083
RADI	Radiall SA	F	R1032, 89*
RAL	Rutherford Appleton Laboratory of the Science and Engineering Research Council	UK	R1042
REFER	Refer BVBA	B	R1076, 87
RIC	RIC Association Internationale	B	R1044*, 45*
RKL	Regio Kabel Limbourg	NL	R1070
RNL	Research Neher Laboratories of the Netherlands PTT	NL	R1015, 18, 19, 22, 25, 33 35, 36, 40, 41, 43, 44, 46, 48, 54, 65, 68, 81, 91
RTC	RTC-Compelec	F	R1031
RTT	Régie T.T.	B	R1022, 44, 45
SACM	SACM	F	R1062
SAGEM	Sagem Sa	F	R1047
SAIT	SAIT S.A. (Subcontractor)	B	R1041
SARDE	Sarde S.A.	F	R1073
SARIN	Sarin	I	R1065
SAS	SAS Denmark	DK	R1058*
SAT	Société Anonyme de Télécommunications	F	R1030, 44, 45, 56
SEB	S-E-Banken, SEB Data	S	R1059
SEC	SOURIAU & Cie.	F	R1089
SEL	Alcatel/SEL AG	D	R1003, 06*, 13*, 15, 16*, 17*, 22, 31*, 32, 33, 34*, 35, 38*, 44, 45, 51*, 53, 54*, 57*, 60, 67*, 77*, 81, 83, 86, 87, 88*
SEPT	Service d'Etudes communes des Postes et Télécommunications	F	R1025
SES	Scitex Europe Sa	B	R1061
SESA	Alcatel/SESA	E	R1002, 06, 11, 17, 18, 22, 35, 36, 38, 43, 44, 46, 48, 56
SFI	Senter for Industrieforskning	N	R1039
SGS	SGS Microelletronica SpA	I	R1004, 14, 44
SGS	SGS-Thomson Microelectronics SA	F	R1030, 36
SIBS	Sociedade Interbancaria de Servicos	P	R1055
SID	Synergie Informatique et Developpement	F	R1068
SIE	Sistemas Expertos	E	R1042,

SIEMENS	Siemens AG	D	R1010, 12, 31, 40, 44, 45, 47, 49, 53, 64*, 69, 81, 83, 92
SIETEC	SIETEC	D	R1075
SIETTE	SIETTE	I	R1086
SIGOS	SIGOS	D	R1074
SINTRA	Thomson - SINTRA	F	R1033
SIP	Società Italiana per le Telecomunicazioni	I	R1053
SIRTI	SIRTI SpA	I	R1032, 89
SIXCOM	Sixcom (Olivetti Group)	I	R1055
SLIGOS	Sligos	F	R1055*
SNS	Sloman Neptun Schiffahrts AG	D	R1062
SOFREC	SOFRECOM	F	R1070
SOGITEC	SOGITEC	F	R1075
SOPHA	Sopha Medical	F	R1042
SOURIAU	Souriau et Cie.	F	R1030
SPAG	SPAG Services S.A.	B	R1048*, 87*
SPECTRUM	Spectrum Energy & Information Technology Ltd	UK	R1073
STAL	Televerket (Swedish Telecommunications Administration)	S	R1009, 11, 14, 18, 21, 23, 24, 25, 30, 33, 35, 41*, 43, 44, 45, 53, 56, 59, 67, 83, 86, 87
STAT	STAT SA	GR	R1075
STC	Alcatel STC Plc	UK	R1014, 22, 24, 27*, 31, 36, 44, 45, 53, 56, 57, 59*, 68, 83, 86, 89
STK	Alcatel/STK	N	R1022, 38, 86
STL	STC Technology Ltd	UK	R1036
STL	STC Plc, STC Technology Ltd	UK	R1008*
STOLL	Stollmann GmbH	D	R1060
SUS	SUS Research Ltd	IRL	R1028
SWIFT	S.W.I.F.T.	B	R1055
SWIN	(Swedish Institute for the Handicapped	S	R1088
SYD	Synergie Informatique et Developpement	F	R1009
T&T	Thrane & Thrane	DK	R1062
TCD	University of Dublin, Trinity College	IRL	R1009, 20*
TCE	Thomson Consumer Electronics	F	R1080
TCSF	Thomson-CSF	F	R1015*, 18*, 29, 33, 35, 36, 47, 57, 81
TECHNI	Technisystems	GR	R1062
TECHNO	TechnoPlan	D	R1060
TECSI	GSI-Tecsi SA	F	R1005, 46*, 59, 82, 84
TEE	Telecom Eireann (Subcontractor)	IRL	R1020
TEKNON	Teknon Gesellschaft für Wissenbasierte Systeme GmbH	D	R1017
TELE-S	Telematic Services GmbH	D	R1060*

TELEFON	Telefónica de España SA	E	R1014, 18, 22, 24, 27, 28, 30, 41, 44, 48, 51, 53, 55, 72,
TELENORMA	Telefonbau & Normalzeit GmbH	D	R1011, 35, 38, 44, 45, 56
TELES	Télésystèmes SA	F	R1061, 65, 73, 74, 77, 86
TELETTRA	Telefónica Elettronica e Radio Spa	I	R1027, 44
TELINDUS	Telindus N.V.	B	R1044
TELSI	Telefónica Sistemas	E	R1009, 42*, 78, 86, 91
TELSPACE	Telspace S.A.	F	R1002
TESA	Telettra Espanola S.A.	E	R1043, 44, 45, 81
TFL	Teleteknisk Forskningslaboratorium	DK	R1046, 68
THEM	Thomson Hybrides et Microondes SA	F	R1029, 30, 43
THOMSON	Thomson SA	F	R1044, 45
THORN	Thorn EMI Central Research Labs	UK	R1015, 43
TITN	T.I.T.N.	F	R1044, 61
TL	TeleLOGIC AB	S	R1021, 24
TLP	Telefones de Lisboa e Porto	P	R1053, 78
TNC	The Networking Centre Ltd	UK	R1083
TRCF	Technical Research Centre of Finland	SF	R1008, ,42, 54, 65, 66
TRICOM	Konsortium TRICOM	CH	R1022, 44
TRT	Telecommunications Radioélectriques et Téléphoniques	F	R1018, 22, 43, 63
TST	Telefunken System Technik and Logistics	D	R1062
TUB	Technische Universität Berlin	D	R1075
TUD	Technical University of Denmark	DK	R1013, 27
TVE	Thomson Video Equipment	F	R1080
UCL	University College London	UK	R1005, 54, 67, 79
UCW	University College of Wales (Subcontractor)	UK	R1021
UDOR	Universitat Dortmund	D	R1033
UNIBIT	UNIBIT (Holdings)	UK	R1006
UOA	University of Athens	GR	R1027, 51
UOA	University of Aveiro	P	R1052*
UOB	University of Bremen	D	R1062
UOC	University of Cambridge	UK	R1042
UOD	University of Dundee	UK	R1066
UOF	University of Florence	I	R1086
UOG	University of Ghent	B	R1004
UOH	University of Heidelberg	D	R1086
UOL	University of London	UK	R1086
UOM	University of Manchester	UK	R1088
UOMU	University of Mulhouse	F	R1087
UOS	University of Strathclyde	UK	R1043
UOS	University of Stuttgart	D	R1022, 57
UPM	Fundación General de la Universidad Politècnica de Madrid	E	R1023
UPMC	DNAC - Université Pierre et Marie Curie	F	R1009
UST	Stirling University	UK	R106[illegible]

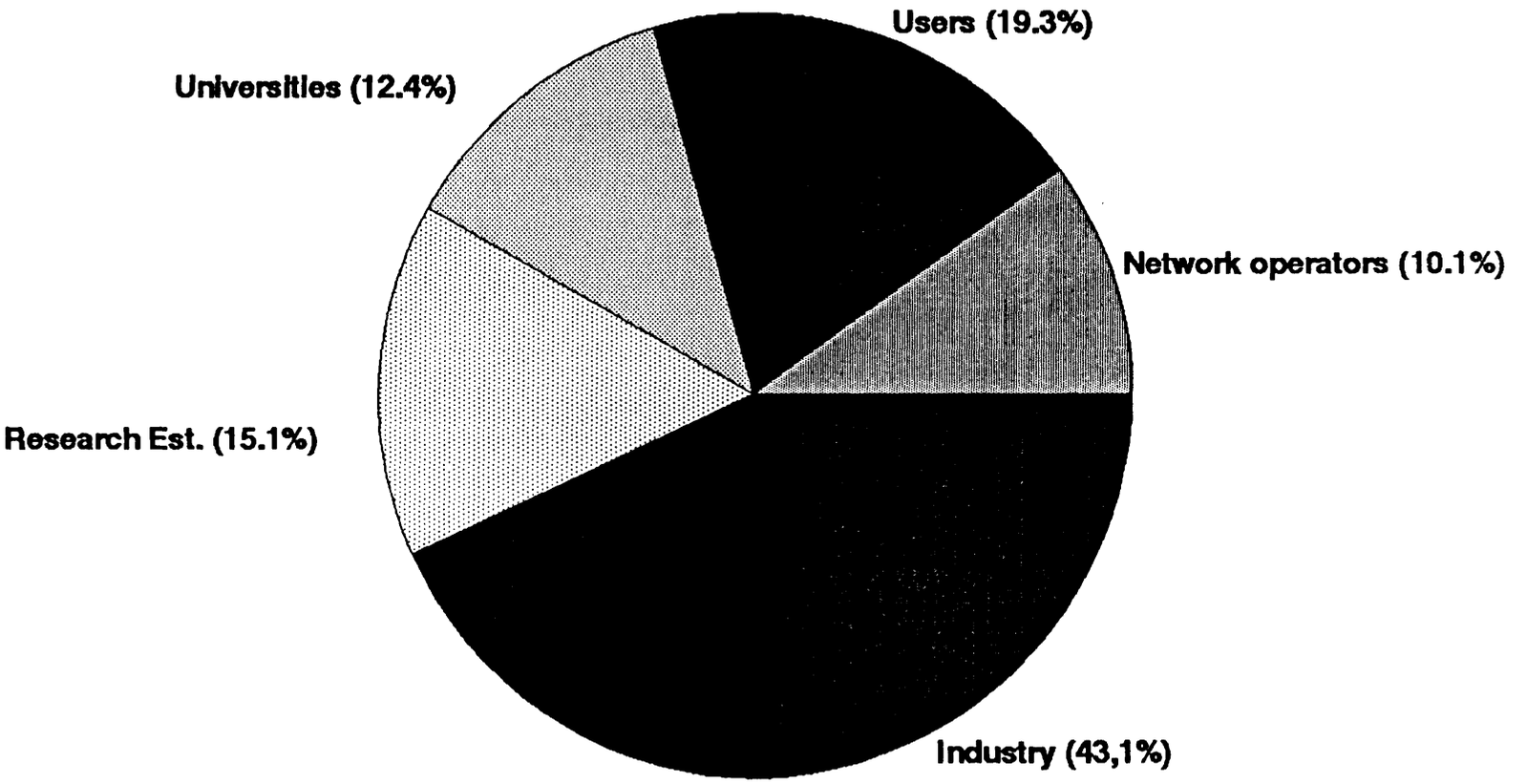
USTL	Université de Sciences et Techniques du Languedoc	F	R1029
UVA	University of Aarhus	DK	R1040
UVD	University of Durham	UK	R1084
UVL	University of Leuven	B	R1040
UVS	University of Surrey	UK	R1023
VERITAS	Det Norske Veritas	N	R1062
VITEC	VITEC	F	R1079
W&G	Wandel & Goltermann GmbH & Co	D	R1083*
WRC	Work Research Center Ltd	IRL	R1034, 77
WSD	Wärtsilä Diesel	SF	R1062
ZMF	ZMF	D	R1078

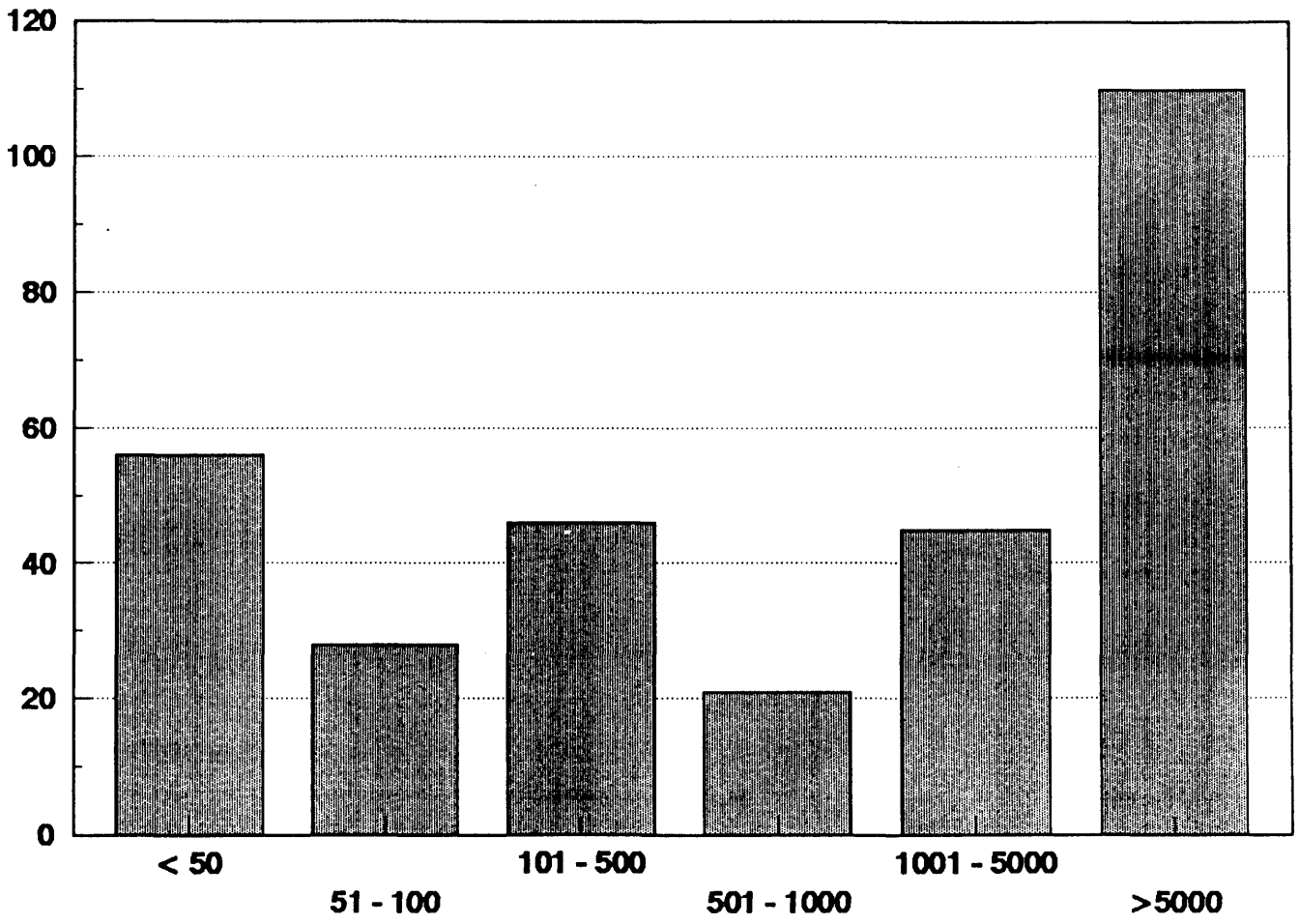
* **Prime Contractor for Project**

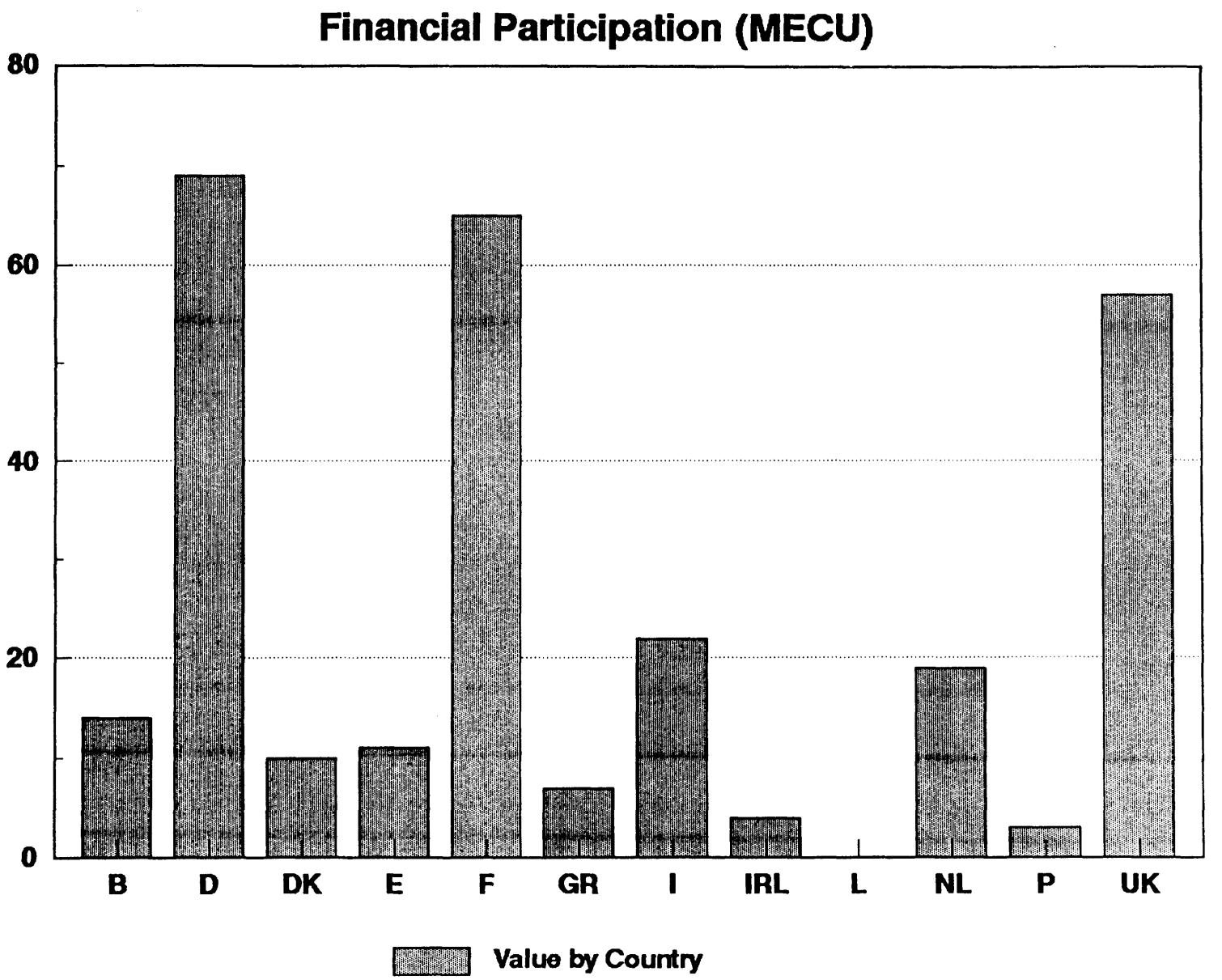
Annex IX

Financial and participation statistics

Types of Organisations




Sizes of Organisations
120
100
80
60
40
20
0
< 50
51 - 100
101 - 500
501 - 1000
1001 - 5000
>5000


Financial Participation (MECU)
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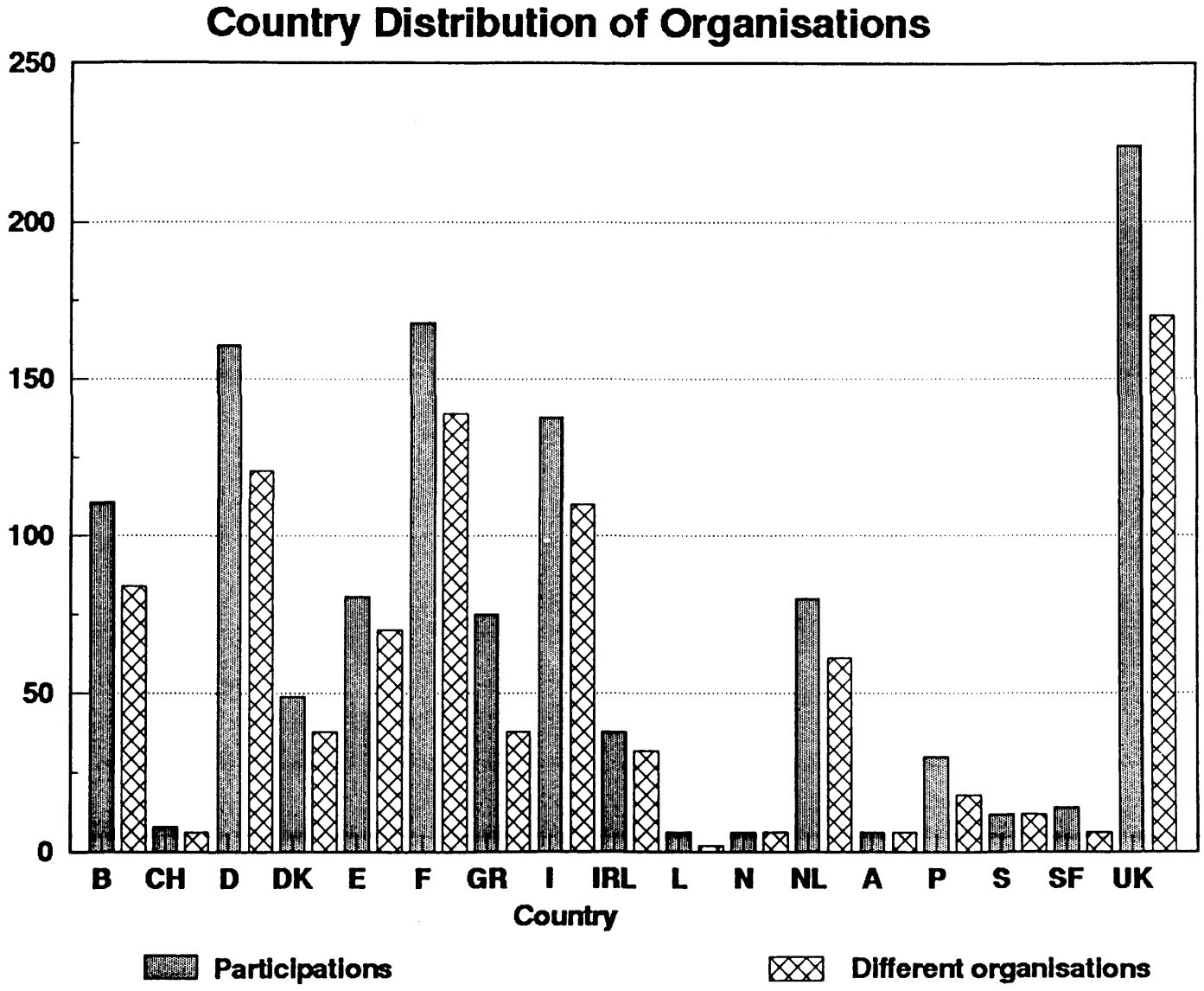
60
40
20
0
B
D
DK
E
F
GR
I
IRL
L
NL
P
UK
Value by Country


Country Distribution of Organisations
250
200
150
100
50
0
B
CH
D
DK
E
F
GR
I
IRL
L
N
NL
A
P
S
SF
UK
Country
Participations
Different organisations

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