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I+D en Tecnologías de Comunicaciones Avanzadas para Europa

RACE

Informe final sobre la Fase I (1988-1992)

del programa decenal RACE

(presentado por la Comisión de conformidad con el apartado 3 del artículo 6 y del artículo 9 de la Decisión del Consejo 88/28/CEE sobre el Programa RACE)

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Síntesis

Las telecomunicaciones están actualmente en la base de la mayoría de las actividades industriales y son esenciales para el funcionamiento del sector europeo de servicios. La competitividad empresarial necesita buenas telecomunicaciones. El Espacio Económico Europeo, con la desaparición de todas las barreras interiores al comercio, brindará nuevas oportunidades y, al mismo tiempo, generará una nueva presión competitiva; en estos momentos, la creciente importancia de las telecomunicaciones en el comercio internacional está modificando el comportamiento de las empresas. Las comunicaciones serán un factor determinante de la prosperidad de Europa en el presente decenio.

Los sectores de las telecomunicaciones, la informática y la radiodifusión mueven una cifra de negocios superior a 500.000 millones de ecus anuales en todo el mundo. En el año 2000, el sector de las telecomunicaciones será el tercero de Europa, tras el alimentario y el químico. Las infraestructuras de telecomunicaciones serán económicamente más importantes que las del transporte físico. En consecuencia, dominar las opciones tecnológicas se ha convertido en una clave del crecimiento económico y la creación de empleo. En la actualidad, más del 50% de los puestos de trabajo dependen del uso de sistemas de información y telemáticos, y las tasas más elevadas de crecimiento del empleo se registran en el sector de la información.

La demanda de servicios está evolucionando rápidamente. Las empresas necesitan servicios más flexibles, mayor capacidad de transmisión rápida de datos e imágenes y precios más competitivos. El crecimiento de los servicios de valor añadido en las redes digitales de gran velocidad se aproxima hoy al 40% anual, habiéndose registrado 40 millones de combinaciones servicio-usuario en 1987, 180 millones en 1989, y más de 300 millones en 1991. Se prevé que, en el año 2000, el 30% de los ingresos del sector de las telecomunicaciones estará relacionado con estos servicios de valor añadido. En unos pocos años, la mayoría de las empresas europeas importantes precisarán sistemas de comunicación rápida de datos entre sus actividades de diseño, fabricación, gestión y ventas. La demanda de tales servicios es ya muy fuerte en los Estados Unidos: todos los grandes institutos de investigación pueden utilizar sistemas de comunicación de datos a gran velocidad, y el 60% de las 500 empresas más importantes emplean enlaces de transmisión digital de alta velocidad.

La observación de estas tendencias motivó la puesta en marcha de una "fase de definición" del programa RACE en 1985, a iniciativa de los ministros europeos de industria. De este modo se determinó que era posible y necesario un marco europeo de colaboración en el terreno de la I+D. En 1987, el Consejo de Ministros aprobó una Decisión en la que se disponía el inicio de la primera fase del Programa RACE (Investigación y Desarrollo en Tecnologías de comunicaciones Avanzadas para Europa). La Decisión establecía la línea política y fijaba la asignación presupuestaria para un período inicial de cinco años que concluiría en 1992, dentro del segundo Programa marco de investigación y desarrollo tecnológico. El Programa RACE, de diez años de duración, "fomentará la competitividad de la industria de telecomunicaciones, de los operadores y de los proveedores de los servicios de la Comunidad, a fin de poner a disposición del usuario final los servicios que apoyarán la competitividad de la economía europea y contribuirán al mantenimiento y la creación de puestos de trabajo en Europa".

El artículo 9 de la Decisión establece que "*una vez transcurrido el primer período de cinco años del programa, la Comisión, previa consulta al comité, enviará a los Estados miembros y al Parlamento Europeo un informe sobre la realización y los resultados del programa*". El presente documento es el informe aludido, y en él se actualiza la evaluación de los 30 meses presentada en 1990.

Principales logros

Gracias al trabajo llevado a cabo en el primer quinquenio de RACE, Europa goza de una nítida ventaja en el desarrollo conceptual de redes y servicios de comunicaciones avanzados. Por primera vez, los operadores de telecomunicaciones, la industria de la telemática y los usuarios más adelantados de la mayoría de los sectores de aplicación más importantes han aunado esfuerzos para desarrollar las tecnologías de comunicaciones avanzadas necesarias para ofrecer unos servicios innovadores y de bajo coste. El programa RACE ha supuesto un entorno único para la concertación de dichos esfuerzos.

RACE ha impulsado la armonización de la infraestructura europea de telecomunicaciones; la elaboración de especificaciones funcionales comunes ha brindado un "marco de desarrollo" para las comunicaciones integradas de banda ancha. El Programa ha impulsado una estrecha colaboración entre las regiones centrales y periféricas de la Comunidad, contribuyendo así a su cohesión económica y social. En lo tocante al progreso tecnológico, el desarrollo del modo de transferencia asíncrono para la conmutación a gran velocidad de las comunicaciones digitales ha colocado a la industria europea en una situación aventajada en la competencia internacional; las investigaciones sobre gestión de redes han motivado que, en la actualidad, se reconozcan internacionalmente los méritos de los sistemas europeos de gestión de redes; los trabajos sobre vídeo y televisión digital han producido normas internacionales de codificación, sistemas de distribución de señales de varios gigabit y especificaciones para la grabación digital en vídeo. Por lo que respecta a la normalización, RACE ha contribuido con 596 proyectos de normas a las actividades de los organismos competentes europeos e internacionales: ETSI, CCITT y CCIR (véase el Anexo II). Añadamos que se ha conseguido un excelente nivel de complementariedad con las actividades de Eureka, y que se han publicado más de 1.700 artículos científicos y técnicos (véase el Anexo III).

Los resultados de RACE brindan a las organizaciones y proveedores de servicios de telecomunicaciones europeos una ventaja competitiva estratégica. El Programa ha sensibilizado a la industria con respecto a las oportunidades comerciales que supondrá la introducción de la próxima generación de servicios de telecomunicaciones en Europa. Ha demostrado las ventajas de la colaboración europea en la I+D precompetitiva y reforzado sustancialmente la normalización europea en el sector de las telecomunicaciones.

Gestión y evaluación del programa RACE

RACE constituye un caso único dentro del segundo Programa marco de la CE; a diferencia de los demás programas, ha sido gestionado como un conjunto de tareas plenamente integradas; cada proyecto ha abordado una actividad o conjunto coherente de actividades de I+D, en torno a un mismo objetivo:

"Introducción de la Comunicación Integrada de Banda Ancha (CIBA),
teniendo en cuenta el desarrollo de la red digital de servicios integrados (RDSI),
con el fin de llegar a unos servicios de alcance comunitario en 1995"

El Plan de trabajo, aprobado en 1987, estableció las grandes líneas a seguir por los proyectos, así como la interacción entre ellos. Dicha interacción se benefició asimismo de la "concertación", que exigió la participación de todos los proyectos en debates técnicos celebrados a intervalos de 6 a 8 semanas. La coordinación de los resultados técnicos de los diferentes proyectos se intensificó más aun mediante un proyecto central de desarrollo de planes de implantación de las CIBA, modelos funcionales de referencia, funciones de servicio al cliente y configuraciones de referencia. Además, se aseguró una interacción intensa y coherente con los organismos europeos de normalización por medio de un segundo proyecto clave de formación de consenso y desarrollo de especificaciones funcionales comunes.

La evaluación y la auditoría de las actividades de RACE han estado en consonancia con el carácter muy integrado del Programa.

En 1989 se efectuó una auditoría estratégica de conjunto para evaluar la relación entre las actividades de RACE y los objetivos estratégicos y políticos de la Comunidad. De la evolución de los trabajos se informó al Consejo de Ministros y al Parlamento Europeo en la "evaluación de los 30 meses" prevista en la Decisión del Consejo. Siguió, en 1990, una reevaluación de las nuevas necesidades de I+D, a cargo de una Comisión independiente de altos directivos y funcionarios de los Estados miembros (TELECOM 2000). En 1991 y a principios de 1992, un Grupo de expertos independiente evaluó los trabajos en el contexto de los otros grandes programas de aplicación del segundo Programa marco en el área de la TI y la telemática (ESPRIT y DRIVE)[1]. En fin, en 1992 la Comisión presentó un informe sobre el programa en su Evaluación del segundo Programa marco[2], mientras que, por su parte, el Comité de Gestión de RACE ultimó su propia evaluación a petición del CREST[3].

El desarrollo de las actividades de investigación y desarrollo tecnológico del Programa ha ido acompañado de una evaluación periódica de las repercusiones económicas y sociales del desarrollo de las comunicaciones avanzadas[4]. La evaluación más reciente se efectuó en 1991, y sus resultados se difundieron en 1992. La mayor parte de esta actividad está integrada actualmente en la Fase II de RACE, según lo dispuesto en la Decisión del Consejo sobre un programa específico en el ámbito de las tecnologías de comunicación.

En 1989, los métodos de gestión aplicados a RACE por los servicios de la Comisión fueron objeto de una "Auditoría de la gestión del programa", asimismo independiente, que aprobó sin reservas el enfoque de la Comisión.

Todos los proyectos fueron sometidos a "auditorías técnicas" anuales a cargo de expertos independientes, especialistas en las correspondientes áreas. La primera se llevó a cabo en octubre de 1988, y la última, en octubre de 1992. Sus resultados se utilizaron para reorientar o concluir los proyectos cuando se consideró necesario.

Todas estas evaluaciones y auditorías demostraron los buenos resultados de RACE en relación con sus objetivos originales.

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[1] Informe del Grupo de evaluación de las tecnologías de la información y las comunicaciones, presidido por D. W. Dekker, junio de 1992.

[2] Comunicación de la Comisión sobre "Evaluación del segundo Programa marco de investigación y desarrollo tecnológico, (SEC(92)675 (final), julio de 1992.

[3] Reproducida en el punto 3.2.1. del presente informe.

[4] Los informes que contienen dichas evaluaciones han sido publicados y ampliamente difundidos en la serie "Perspectives for Advanced Communications in Europe: PACE".

Los trabajos de la primera fase de RACE se han complementado y ampliado con proyectos de I+D del nuevo programa específico de IDT en el ámbito de las tecnologías de comunicación, es decir, la segunda fase de RACE. Este programa específico forma parte del tercer Programa marco, y en él se prevé que la CE financiará parcialmente la I+D hasta fines de 1994. Los correspondientes proyectos se iniciaron en enero de 1992, y su solapamiento con los de la primera fase en dicho año permitió garantizar la continuidad de las actividades. RACE seguirá contribuyendo en gran medida al desarrollo económico y la integración socioeconómica de Europa. Va acompañado de actuaciones nacionales[5] e internacionales, como las de EURESCOM[6], con las que la actividad comunitaria mantiene una relación de mutuo fortalecimiento. El Programa se ha convertido en un marco incomparable de cooperación entre los operadores de redes de telecomunicaciones, la industria y los usuarios.

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[5] Ensayos de Comunicaciones de Banda Ancha en B, D, DK, F, Irl, P y UK.

[6] Instituto Europeo de Investigación y Estudios estratégicos de Telecomunicaciones GmbH.

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I+D en Tecnologías de Comunicaciones Avanzadas para Europa

RACE

Informe final sobre la Fase I (1988-1992)

del programa decenal RACE

1. Introducción

Las telecomunicaciones integran el sector industrial europeo más dinámico y de evolución más rápida. Los servicios de telecomunicación generan una cifra de negocios superior a los 300.000 millones de ecus anuales en Europa, y la inversión en redes y servicios de telecomunicación se aproxima a los 30.000 millones anuales. La mayor parte de los ingresos sigue procediendo de la telefonía vocal, pero la mayoría de las inversiones se dirigen hoy a las nuevas generaciones de equipos digitales, que permiten la comunicación integrada de voz, datos e imágenes. Hacia el año 2000, el 30% de los ingresos del sector pueden estar vinculados a servicios de valor añadido que utilizan comunicaciones avanzadas de datos.

En el mundo entero, todas las esferas de la vida están afectadas por la convergencia de la tecnología de la información, la radiodifusión y las telecomunicaciones. La combinación de las técnicas de proceso de datos con determinadas ideas innovadoras de las telecomunicaciones ha conducido a la implantación de redes digitales de servicios integrados, que, no obstante, son sólo un primer paso en la rápida evolución hacia una gama mucho más amplia de servicios multimediales que precisarán nuevas tecnologías, sistemas de gestión de redes y servicios, y nuevos regímenes reguladores. La combinación de la integración de servicios y la fibra óptica, que permite transmitir a bajo coste y gran velocidad (un millón de veces superior a la del hilo de cobre), brinda la base tecnoeconómica para una reestructuración fundamental de todos los sectores por intermedio de las Comunicaciones Integradas de Banda Ancha (CIBA). El desarrollo de este concepto constituye el objetivo del Programa RACE.

En el presente informe se resumen y documentan los resultados obtenidos en la primera fase de Programa RACE. La duración del Programa es de diez años, y esta primera fase transcurrió entre 1988 y 1992.

En la sección 2ª se describen el contexto, organización y resultados del Programa; en la sección 3ª se abordan la organización y resultados de las evaluaciones y auditorías. Las relaciones con otras actuaciones comunitarias y europeas se tratan en la sección 4ª. Los resultados de la I+D de la Fase I han sido ya ampliamente explotados, tanto en la elaboración de normas y el desarrollo de nuevas redes y servicios, como en cuanto base de futuros trabajos en la Fase II. La explotación de los resultados de la Fase I de RACE es objeto de la sección 5ª, y la transición a la Fase II se examina en la sección 6ª. En la sección 7ª se consideran las futuras necesidades y posibilidades de trabajo a nivel europeo.

En el Anexo I se resumen pormenorizadamente los resultados de los proyectos de I+D. Las aportaciones a la normalización se enumeran en el Anexo II, y en el Anexo III se recogen todas las publicaciones científicas y técnicas derivadas del Programa. La relación de las solicitudes de registro de patentes figura en el Anexo IV; el Anexo V contiene un glosario de términos técnicos, y el Anexo VI, una lista de referencias de las Decisiones del Consejo de Ministros y de las Comunicaciones de la Comisión. Los proyectos financiados en la Fase I se enumeran en el Anexo VII; las organizaciones participantes son enumeradas en el Anexo VIII, y los datos estadísticos financieros y de participación se sintetizan en el Anexo IX.

2. Contexto y organización del Programa RACE

2.1 *La I+D en la política comunitaria de telecomunicaciones*

El Programa RACE es una parte esencial de la política de telecomunicaciones de la CE. Vinculado a las políticas de normalización y del mercado de la información, se apoya en el desarrollo de la tecnología de la información que se lleva a cabo en el marco de ESPRIT y, por primera vez, cuenta con una importante participación de los operadores de redes europeas de telecomunicación en el desarrollo en colaboración de tecnologías y servicios. Incidiendo en la futura relación coste-prestaciones de las infraestructuras de comunicaciones europea, el Programa RACE ha contribuido al desarrollo del mercado único, la competitividad internacional de la industria europea y la cohesión social y económica de la Comunidad.

Los principales objetivos de la política comunitaria de telecomunicaciones, según se formulan en la Resolución del Consejo de junio de 1988[1)], son los siguientes:

- asegurar o crear la integridad de una red de dimensiones comunitarias, tomando como punto de partida el principio de la total interconectabilidad de todas las redes públicas afectadas,
- crear progresivamente un mercado común abierto de servicios de telecomunicación,
- fomentar la creación de servicios de dimensión europea conforme a las exigencias del mercado y las necesidades sociales,
- proseguir el desarrollo a nivel comunitario de un mercado abierto para equipos terminales,
- desarrollar un mercado común en el que las administraciones de telecomunicaciones y otros proveedores puedan competir en pie de igualdad,
- seguir adoptando medidas comunitarias en materia de normas comunes,
- reforzar la cooperación europea en todos los niveles, especialmente en el campo de la investigación y el desarrollo de las telecomunicaciones,
- crear condiciones sociales para el futuro desarrollo de las telecomunicaciones e,
- integrar totalmente a las regiones menos favorecidas de la Comunidad en el naciente mercado común.

Estos objetivos brindan un marco claro para la definición del desarrollo futuro de la tecnología, los servicios y las aplicaciones.

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1) Resolución del Consejo de 30 de Junio de 1988 sobre el desarrollo del mercado común de servicios y equipos de telecomunicación hasta 1992; 88/C 257/01; DO C 257/1; 4.10.1988.

2.2. Objetivos de RACE

El objetivo principal del Programa RACE es contribuir a la

"Introducción de las CIBA[2] teniendo en cuenta el desarrollo de la RDSI y las estrategias de introducción a escala nacional, con el fin de llegar a unos servicios de alcance comunitario en 1995[3]"

Para la Fase I se establecieron los siguientes objetivos:

- fomentar la industria de las telecomunicaciones de la Comunidad
- permitir a los operadores de redes europeos competir en las mejores condiciones posibles
- permitir a un número sustancial de Estados Miembros la introducción de servicios de CIBA económicamente viables en 1995
- permitir a los proveedores de servicios optimizar costes e introducir nuevos servicios a un coste y en un plazo al menos tan favorables como en cualquier otro lugar,
- contribuir a la formación de un mercado comunitario único de equipos y servicios de telecomunicación y
- contribuir al desarrollo regional permitiendo que las regiones menos desarrolladas puedan beneficiarse plenamente del desarrollo de las telecomunicaciones.

Por otra parte, en el Anexo I de la Decisión se formulan una serie de objetivos técnicos. La contribución de los proyectos de I+D de RACE al logro de dichos objetivos se recoge en el Cuadro I.

Durante el desarrollo y aplicación del programa, la interpretación del concepto de comunicaciones integradas de banda ancha ha venido evolucionando en respuesta a los cambios que se han producido en los mercados y la reglamentación. La definición propuesta abajo refleja el consenso alcanzado en el Comité de Gestión de RACE en 1990.

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2) "C""Comunicaciones" significa no solamente las funciones "convencionales" de conmutación/transmisión/redes en dependencias del cliente, sino que incluye también los rasgos más avansados para que la prestación de servicios resulte sencilla para el usuario, eficaz y rentable.

"I" "Integradas" no sólo significa "servicios integrados" (a nivel del usuario y a los niveles de red adecuados), sino que apunta también a la "integridad" de toda la red y, por tanto, al debido interfuncionamiento de todos sus componentes esenciales, incluyendo los ya existentes y los nuevos: Telefonía, paquetes, RDSI, satélites, móviles.etc

"BA" "Banda Ancha" no sólo significa el segmento "superior" (en velocidad) de los servicios, sino que designa también la combinación total de servicios que deben considerarse, empezando por los superiores de la RDSI (p.ej., incluyendo sin duda los accesos a 2 Mb/s y acaso incluso a 64 Kb/s en determinadas áreas de aplicación) y concluyendo con lo que exigiría una introducción realista de los servicios de vídeo, tanto interactivo como distributivo (p.ej., 140 Mb/s).

3) Decisión del Consejo de 14 de Diciembre de 1987 relativa a un programa de la Comunidad en el campo de las tecnologías de las Telecomunicaciones - I+D en Tecnologías de Comunicaciones Avanzadas para Europa (RACE); 88/28/EEC; DO L 16/35; 21.1.1988

Cuadro 1

Objetivos técnicos	Cómo aborda RACE estos objetivos	Repercusiones del trabajo de RACE
Objetivos de la Parte I: estrategias de desarrollo y aplicación de las CIBA		
Entendimiento común de la evolución de las CIBA y sus repercusiones	Creación de un marco de colaboración entre operadores, industria y usuarios Investigaciones estratégicas tecnoeconómicas comunes que tengan en cuenta la demanda y las opciones tecnológicas	Desarrollo de un enfoque común de "ingeniería de sistemas" para la planificación de la evolución de redes Definición de las condiciones óptimas para la introducción de las CIBA Determinación común de las principales cuestiones técnicas Posición coherente de la CE en actividades internacionales exteriores a RACE
Definición común de sistemas y subsistemas de CIBA	Desarrollo de una Configuración de Referencia para definir los sistemas y subsistemas de las Redes de Comunicaciones Integradas de Banda Ancha Desarrollo de tecnologías y opciones de implantación apropiadas	Fortalecimiento de la normalización europea Acuerdo sobre una estrategia europea común en el ámbito de las especificaciones ATM
Orientaciones para la especificación funcional de sistemas y servicios integrados de CIBA	Desarrollo de un Modelo de Referencia Funcional, con una estructura lógica de funciones e interfaces	Acuerdo sobre especificaciones funcionales comunes Acuerdos sobre conceptos y protocolos de "integración de redes" Acuerdos sobre opciones a corto y medio plazo para el acceso del cliente a la banda ancha
Determinación de los requisitos tecnológicos y de I+D	Elaboración particiativa de un Modelo de Referencia del Usuario para vincular las necesidades del usuario y las opciones técnicas Evaluaciones conjuntas y comunes de los avances tecnológicos	Focalización y concentración de la I+D europea en las tecnologías clave y las nuevas necesidades de los usuarios

Cuadro 1

Objetivos técnicos	Cómo aborda RACE estos objetivos	Repercusiones del trabajo de RACE
Estudio de la rentabilidad de otras posibilidades de implantación	Desarrollo de herramientas comunes para la evaluación tecnoeconómica y operativa	Se han desarrollado herramientas comunes para el análisis tecnoeconómico, y para la planificación y gestión de redes avanzadas
Análisis de las necesidades de normalización	Reuniones periódicas con los organismos de normalización; coordinación entre el Proyecto de gestión del consenso y el ETSI, e investigaciones conjuntas sobre los requisitos de normalización derivados de la evolución de las necesidades de los usuarios de todo el mundo	596 aportaciones a los organismos de normalización (Anexo II)
Objetivos de la parte II: Tecnologías de las CIBA		
Utilización de tecnologías avanzadas para la implantación rentable de las CIBA	I+D sobre componentes, subsistemas y sistemas ópticos críticos para los costes tanto para la transmisión en banda ancha a las dependencias del cliente como para la conmutación	Especificación y desarrollo de prototipos de conectores, láseres y elementos de conmutación para redes locales, CPN, etc. Demostración de prototipos y métodos de producción de bajo coste
	Investigaciones sobre posibilidades a corto plazo de reducciones de costes inmediatas	Desarrollo de tecnologías de detección "directas" y "coherentes". Desarrollo de tecnologías ATM para un uso rentable de la banda ancha
	Investigaciones sobre las posibilidades a medio y largo plazo de reducir sensiblemente los costes y mejorar los servicios	Desarrollo de algoritmos compatibles de compresión de la velocidad para servicios de TVAD digital y vídeo de alta calidad, y desarrollo de codec de bajo coste

Cuadro 1

Objetivos técnicos	Cómo aborda RACE estos objetivos	Repercusiones del trabajo de RACE
Software de telecomunicaciones para sistemas integrados complejos	Desarrollo de una nueva arquitectura para prestación de servicios: una arquitectura de sistemas abiertos Investigación sobre las técnicas avanzadas de tratamiento de la información para funciones CIBA Investigación de nuevas tecnologías de software para especificación, diseño, realización, verificación y mantenimiento de sistemas de telecomunicación	Desarrollo de una programación "orientada al objeto" para sistemas de telecomunicación. Validación de prototipos de herramientas de ingeniería integrada de software Desarrollo de prototipos y arquitecturas TMN para gestión de tráfico, mantenimiento, control de la calidad del servicio, administración de clientes y redes y comunicaciones seguras Métodos de especificación, entorno de desarrollo y apoyo en línea a los sistemas de telecomunicación. Determinación de conceptos de integridad para servicios de CIBA, y un conjunto de primitivas de integridad
Avances en las prestaciones ergonómicas y cognitivas de los equipos de CIBA	Investigaciones sobre los factores de utilizabilidad del diálogo, distribución, recuperacion y servicios integrados y de utilizabilidad de las CPN domésticas Investigación de los factores de utilizabilidad en relación con las personas con necesidades especiales (personas de edad y discapacitadas) Desarrollo de objetivos de diseño para la utilizabilidad Incorporación y evaluación de las cuestiones relacionadas con la utilizabilidad en las aplicaciones piloto	Taxonomía de la ingeniería de la utilizabilidad Introducción de rasgos que facilitan la utilizabilidad en experimentos de comunicaciones avanzadas, incluso a personas con necesidades especiales Mejora de la interacción entre investigadores de la utilizabilidad, usuarios y diseñadores de equipos Detección y análisis sistemático de los temas comunes relacionados con la utilizabilidad en los proyectos piloto de aplicaciones

Cuadro 1

Objetivos técnicos	Cómo aborda RACE estos objetivos	Repercusiones del trabajo de RACE
Realización de redes y subsistemas evolutivos	Definicion y demostración de arquitecturas genéricas para sistemas y subsistemas de CIBA, incluida la reducción del número de bits para vídeo	Definición de especificaciones funcionales y de diseño para redes locales, CPN y terminales (multiservicio, multimedia, con grabación digital en vídeo y pantalla plana)
	Desarollo de conceptos y marcos para las redes en las dependencias del cliente, para satisfacer las necesidades domésticas y empresariales	Demostración de una pantalla plana monocroma y un controlador
	Desarrollo de prototipos de terminales	Diseños de componentes y subsistemas para CPN domésticas y para la empresa en un entorno ATM
	Adaptación de sistemas que permita una evolución sin sobresaltos hacia las CIBA	Especificaciones para sistemas integrados, y validación mediante demostradores
	Desarrollo de sistemas integrados que abarquen redes locales, redes en las dependencias del cliente y terminales, mediante interfaces homologadas	
Objetivos de la parte III: Desarrollo de esquemas de aplicación CIBA		
Desarrollo de herramientas de verificación, verificación de conceptos de diseño, grupos funcionales o protocolos	Desarrollo conjunto de herramientas y métodos de prueba para elementos y subsistemas de red de CIBA	Verificación de herramientas y funciones de CIBA en terminales, redes en las dependencias del usuario y conmutadores en centrales locales y de sector
	Verificación de protocolos en puntos de referencia CIBA críticos	Identificación de los puntos de acceso y protocolos de prueba. Recomendaciones para comprobación de conformidad de protocolos
Refinamiento de las especificaciones funcionales y/o verificación de las propuestas de normas	Integración de sistemas piloto para ensayar los protocolos de interfuncionamiento	Especificaciones de sistemas y subsistemas en entorno multiservicio
	Verificación prenormativa de temas críticos de normalización y especificación	Validación de mecanismos para demostrar la interoperabilidad y la conformidad con normas

Cuadro 1

Objetivos técnicos	Cómo aborda RACE estos objetivos	Repercusiones del trabajo de RACE
Desarrollo de situaciones experimentales donde los proveedores de servicios, operadores de red y usuarios puedan ensayar productos experimentales de CIBA y comprender el potencial de explotación comercial de las CIBA	Definición de las futuras necesidades de servicios en colaboración con los usuarios más avanzados para todos los principales sectores empresariales Realización de un banco de pruebas de CIBA en varios lugares de Europa Examen de cuestiones de interconexión e interfuncionamiento	Realización de aplicaciones piloto en todos los sectores importantes, a saber, banca y finanzas, seguros, medios de comunicación y publicidad, fabricación, sanidad, personas con necesidades especiales, transporte y distribución, y uso experimental de la TVAD Definición de requisitos y acuerdo sobre ensayos de interconexión en banco de pruebas

2.3 Aplicación del programa

Vista la rápida evolución del sector de las telecomunicaciones en Europa, se tomó la decisión de aplicar RACE en varias fases. Se inició con una fase de definición[4] en 1986. Siguió la Fase I, objeto del presente informe, que dio comienzo oficialmente en junio de 1987 y concluyó en diciembre de 1992.

Los trabajos de la Fase I se dividieron en tres partes:

Parte I - Estrategias de desarrollo y aplicación de las CIBA

Los proyectos de la Parte I abordaron el desarrollo de especificaciones funcionales, sistemas y operaciones, para la definición de propuestas de normas, conceptos y convenios CIBA según un enfoque de sistemas abiertos, y el análisis sobre interoperabilidad de equipos y servicios de CIBA. Sus resultados son del dominio público y constituyen una aportación importante al trabajo de los organismos internacionales de normalización.

Parte II - Tecnologías de las CIBA

Los proyectos de la Parte II se ocuparon de los problemas técnicos relacionados con la aplicación de las CIBA. Han supuesto una importante contribución al desarrollo de la tecnología necesaria para la realización a bajo coste de equipos y servicios de CIBA.

Parte III - Integración funcional prenormativa

Para los proyectos de la Parte III se establecieron objetivos prenormativos vinculados a la creación de un "entorno de verificación abierto" concebido para evaluar funciones y conceptos operativos. Veinte de los proyectos incluyeron aplicaciones piloto de comunicaciones avanzadas en diversos entornos empresariales y de prestación de servicios. En ellos se comprobaron equipos y aplicaciones experimentales en situaciones reales, según especificaciones funcionales y propuestas de normas derivadas de los trabajos de los proyectos correspondientes a la Parte I.

El Programa RACE se llevó a cabo en dos etapas. Con el primer conjunto de proyectos, iniciado en enero de 1988, se abordaron la ingeniería de sistemas (Parte I) y la tecnología (Parte II)[5]. El segundo -investigación de futuros servicios, integración de sistemas y verificación (Parte III)- fue objeto de una convocatoria de propuestas en julio de 1988, y los proyectos comenzaron en enero de 1989.

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[4] Decisión del Consejo de 25 de junio de 1985 relativa a una fase de definición de una acción comunitaria en el sector de las tecnologías de la comunicación. Programa de I+D de tecnologías avanzadas para Europa (RACE), 85/372/CEE; DO L 210/24; 7.8.1985.

[5] Comunicación de la Comisión al Consejo y el Parlamento:En marcha hacia TELECOM 2000: Lanzamiento del programa RACE, COM(88) 240 final II de 31.5.88.

Durante los procesos de selección de proyectos y puesta en práctica del Programa se modificó la importancia relativa concedida a las tres partes. Los recursos dedicados a la Parte I se incrementaron desde el 11,9% previsto al 18%; los destinados a la Parte II se redujeron desde el 66% al 55%, y los de la Parte III pasaron del 22,4% al 27%. Esta evolución reflejaba, por una parte, un desplazamiento del núcleo de interés desde el desarrollo de tecnologías al de servicios e investigación de la demanda y, por otra, la calidad de las propuestas presentadas correspondientes a las partes I y III del programa.

La distribución de los recursos económicos del Programa se resume en el cuadro 2

CUADRO 2

RESUMEN DE LA UTILIZACION DE LOS RECURSOS ECONOMICOS DE LA FASE I DEL PROGRAMA RACE

PROGRAMA	DECISION millones de ecus	DECISION (%)	REAL (%)
Parte I	60	11,9	18,0
I.1 Estrategias de CIBA	14	2,8	
I.2 Realización de CIBA	28	5,5	
I.3 Uso de CIBA	10	2,0	
I.4 Entorno operativo común	8	1,6	
Parte II	332	65,7	55,0
II.1 Funciones de sistemas de CIBA	94	18,6	9,0
Infraestructuras de programación de CIBA	49	9,7	25,0
Ingeniería de la utilizabilidad	12	2,4	11,0
Evolución de la red	177	35,0	10,0
Parte III	113	22,4	27,0
III.1 Herramientas de verificación	63	12,5	6,0
III.2 Aplicaciones piloto de CIBA	50	9,9	

En los 92 proyectos de I+D participaron 306 empresas, incluidos los principales organismos, entidades y empresas de telecomunicaciones europeas, así como 27 organizaciones de los países de la AELC (Austria, Finlandia, Noruega, Suecia y Suiza).

2.4 *Resultados más importantes*

El programa RACE ha contribuido a la armonización de la infraestructura de telecomunicaciones europea, que es una condición necesaria para el mercado único. Las especificaciones funcionales comunes prefiguran las comunicaciones integradas de banda ancha europeas. Este logro ha sido posible gracias a la colaboración de los operadores de redes, la industria de las telecomunicaciones, las entidades de radiodifusión y los usuarios avanzados más importantes; esta colaboración ha sido la impronta del Programa RACE.

Fomentando la sensibilización y la reacción rápida a los cambios, RACE ha contribuido a brindar a los sectores europeos de las telecomunicaciones y los servicios una ventaja competitiva estratégica en un mercado de equipos y servicios de telecomunicación que posee un carácter cada día más mundial.

Los resultados de los distintos proyectos se recogen pormenorizadamente en el Anexo I del presente informe, así como en los informes anuales de 1988, 1989, 1990, 1991 y 1992. Los logros más importantes en las diversas áreas se indican a continuación.

Resultados más importantes de la Parte I: Estrategias de desarrollo y aplicación de las CIBA

Se ha alcanzado una interpretación común de la evolución e implicaciones de las CIBA y se ha logrado una eficaz colaboración entre operadores, industria y usuarios tanto en el desarrollo de especificaciones funcionales comunes para las CIBA como en una serie de investigaciones tecnoeconómicas comunes de carácter estratégico.

Se ha establecido una estrecha relación de trabajo con los organismos europeos e internacionales de normalización. En 1989 se creó un grupo de coordinación entre el Proyecto de gestión del consenso y el Instituto Europeo de Normas de Telecomunicación (ETSI). Los trabajos sobre el modo de transferencia asíncrono (ATM) han contribuido directamente, en primer lugar, a que se alcance un acuerdo sobre una estrategia europea común en dicho ámbito y, por otro lado, a la aparición de normas internacionales.

Se han acordado definiciones comunes de sistemas y subsistemas de CIBA y se han desarrollado configuraciones de referencia que definen la estructura sistémica de la red de comunicaciones integradas de banda ancha. Se ha aprobado una especificación funcional de servicios integrados y sistemas de CIBA y existe ya un modelo de referencia funcional. Dicho modelo define una estructura lógica de las funciones e interfaces de las CIBA, que constituye el núcleo de todos los requisitos funcionales de implantación. Las especificaciones funcionales comunes (CFS) fueron ampliamente difundidas en 1990.

Se han establecido las definiciones de interfaz en puntos de referencia clave de las redes de banda ancha, y determinado los requisitos tanto a nivel de componente como de sistema.

Se ha desarrollado un "modelo de referencia de uso" para proporcionar un marco conceptual que vincule las necesidades del usuario y los requisitos funcionales.

Se han llevado a cabo evaluaciones sistemáticas de opciones tecnológicas y operativas, incluidas comunicaciones ópticas, comunicaciones móviles, satélites, CPN, nuevas técnicas de conmutación y TVAD.

Se han elaborado herramientas para evaluar vías alternativas de implantación rentables: un primer conjunto se relaciona con el análisis económico, y otro con las normas y la planificación de redes. Estas herramientas permiten realizar comparaciones internacionales de opciones y estrategias en relación con determinadas características técnicas y económicas y necesidades de normalización.

Resultados más importantes de la Parte II: Tecnologías de CIBA

La I+D se ha enfocado hacia los componentes, subsistemas y sistemas ópticos críticos para los costes tanto para la transmisión en banda ancha a las dependencias del usuario como para la conmutación, tratando de encontrar soluciones rentables para las aplicaciones de todos los campos importantes.

Se han definido y desarrollado tecnologías MTA como medio de facilitar una implantación flexible y "a prueba de futuro" de las comunicaciones de banda ancha. Se han realizado y comparado diferentes opciones de MTA, y desarrollado especificaciones de requisitos para sistemas de conmutación MTA.

Se han desarrollado técnicas compatibles de codificación de vídeo para TV(AD) y videotelefonía que garantizan un uso rentable de la banda. Se ha simulado la utilización de algoritmos de compresión del número de bits para servicios de vídeo de alta calidad (televisión y videoteléfono), y el desarrollo de codec ha repercutido de manera importante en la normalización y la introducción comercial de videoconferencias menos costosas.

Se han efectuado avances importantes en conmutación fotónica y sistemas de comunicación óptica de varios gigabit. Se han elaborado especificaciones para sistemas, subsistemas y componentes (conectores, láseres, elementos de conmutación, etc.), teniendo presentes, en particular, los aspectos relacionados con el coste en diferentes áreas de aplicación (redes locales, CPN, etc.). Se han producido y demostrado prototipos de componentes y subsistemas.

En el ámbito del software de telecomunicaciones para sistemas integrados complejos, se han creado modelos orientados al objeto; arquitecturas y prototipos para gestión del tráfico, mantenimiento y administración de la red y los clientes; métodos de especificación y un "entorno de desarrollo" para apoyo en línea a sistemas de telecomunicación. Se ha definido una arquitectura para la comunicación segura.

En el área de la investigación ergonómica y cognitiva, se ha establecido una taxonomía de la ingeniería de la utilizabilidad, y determinado los requisitos de ingeniería de la utilizabilidad en comunicaciones avanzadas, incluidos los relativos a las personas con necesidades especiales.

Se han desarrollado arquitecturas genéricas y técnicas y tecnologías adecuadas para sistemas y subsistemas de CIBA, incluida la reducción del número de bits para vídeo, que sirven de marco para satisfacer las necesidades domésticas, empresariales y otras en una diversidad de aplicaciones.

Se han comprobado y adaptado varios tipos de terminales con integración de pantallas planas para uso con servicios de CIBA. Se han utilizado sistemas integrados (que comprenden redes locales, redes en las dependencias del cliente y terminales, interconectados mediante interfaces convenidas en los puntos de referencia S y T) para validar tecnologías y especificaciones funcionales.

La investigación sobre "comunicaciones móviles" ha establecido el marco conceptual para la tercera generación de radiocomunicaciones celulares. El resultado ha sido la definición de las Telecomunicaciones Móviles Universales (UMTS), que satisfarán la demanda más importante del mercado europeo a mediados de los años noventa.

Resultados más importantes de la Parte III: Desarrollo de planes de aplicación de las CIBA.

Los trabajos se han centrado en el desarrollo de herramientas de verificación y en la verificación de conceptos de diseño, grupos funcionales o protocolos. Ingenieros de sistemas y diseñadores de herramientas de comprobación han sometido a procedimientos de prueba terminales, redes en las dependencias del cliente, sistemas de acceso del cliente, conmutadores (en centrales locales y de sector) y sistemas de transmisión. Se han definido puntos de acceso y protocolos de prueba.

Para las aplicaciones piloto de CIBA se ha recabado la participación de proveedores de servicios, operadores de redes y usuarios en las pruebas de productos CIBA experimentales, a fin de determinar más rápidamente las características de la explotación comercial de este tipo de comunicaciones. Se han efectuado aplicaciones piloto en todos los sectores importantes: banca y finanzas, seguros, medios de comunicación y publicidad, fabricación, sanidad, personas con necesidades especiales, transporte y distribución, y uso experimental de la TVAD. Han participado más de 100 usuarios avanzados.

Para la Parte III y algunas actividades complementarias de las Partes I y II se vio que era necesaria una infraestructura de pruebas de dimensión europea. En 1989, las principales administraciones de telecomunicaciones europeas presentaron una propuesta de red preliminar de banda ancha de carácter experimental, basada en un acuerdo para poner en marcha un Ensayo europeo de interconexión en banda ancha (EBIT) a 2 Mb/s, con idea de llegar a 140 Mb/s, para conexiones transnacionales. Los principales operadores de redes participantes firmaron una declaración de intenciones y se constituyó un equipo multinacional para asesorar a las aplicaciones piloto sobre sus necesidades de redes y software a fin de garantizar la interoperabilidad de los sistemas de usuario final. Este proyecto de explotación y apoyo dentro de RACE contribuyó a orientar las diferentes "aplicaciones piloto". Sin embargo, ante la dificultades para establecer enlaces transnacionales eficaces con respecto al coste con fines de investigación, ésta se ha limitado hasta hoy, en su mayor parte, a la experimentación en bancos de ensayo nacionales. Sólo ahora, en 1993 y 1994, el ensayo transeuropeo de banda ancha, capaz de ofrecer el ancho de de banda que se solicite, permitirá una relación eficacia-coste aceptable, gracias a la posibilidad de utilizar experimentalmente sistemas MTA.

No obstante lo anterior, las aplicaciones piloto han cumplido su función de facilitar la retroalimentación desde los entornos de utilización real hacia el desarrollo tecnológico y la elaboración de especificaciones.

2.5 *Participación de las PYME*

A pesar de los altos costes de la I+D sobre telecomunicaciones avanzadas, la Fase I de RACE atrajo una participación importante de pequeñas y medianas empresas (PYME): un 28% en el conjunto de los proyectos, cifra significativamente superior al 16,5% global registrado en el segundo Programa marco[6]. Empresas y centros de investigación de pequeño tamaño participaron en más del 60% de los proyectos.

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[6] Evaluación del segundo Programa Marco de IDT: Informe de CREST al Consejo, Septiembre de 1992. CREST/1212/1/92.

2.6. Contribución a la cohesión económica y social

Con sus investigaciones y desarrollo de estrategias para la introducción de las CIBA en todas las regiones de la CE, incluidas las regiones menos favorecidas, el Programa ha preparado el camino para la realización de las redes de comunicaciones de banda ancha transeuropeas, según lo previsto en el Capítulo XII del Tratado de la Unión Europea. Se ha dedicado especial atención a la necesidad de enlazar las zonas insulares, sin litoral y periféricas con las regiones centrales de la Comunidad.

Con un importante número de medidas complementarias, seminarios y escuelas de verano, la I+D se ha puesto a disposición de los científicos e ingenieros de toda la Comunidad Europea; se ha realizado un esfuerzo especial para organizar seminarios y cursos en las zonas menos favorecidas. En el Anexo I se enumeran todas estas actividades.

53 proyectos (60%) han contado con la participación de organizaciones de las regiones menos favorecidas de la Comunidad y, mediante esta participación, han contribuido a la transferencia de tecnología y conocimientos a dichas regiones.

3. Evaluación y auditorías del Programa RACE

3.1 La evaluación como proceso permanente

Como consecuencia de la rápida evolución de las tecnologías y servicios de comunicaciones, la evaluación se ha entendido como un proceso permanente aplicable a la preparación, puesta en marcha y ejecución del Programa. Por otra parte, se han evaluado todos los niveles: orientación estratégica y gestión operativa del programa, y dirección técnica de cada uno de los proyectos.

Los actores de las telecomunicaciones colaboraron ampliamente en la planificación del programa y el desarrollo del plan de trabajo. La colaboración permanente con la industria y los operadores de telecomunicaciones permitió actualizar todos los años el plan de trabajo del Programa y los de todos los proyectos. Además, se celebraron reuniones periódicas entre los consorcios participantes en el programa (reuniones de concertación), lo que permitió un proceso informal permanente de seguimiento y reorientación de todos los proyectos. El Proyecto de gestión del consenso garantizó la coherencia del programa y estableció estrechas relaciones con los organismos europeos de normalización.

El desarrollo de las actividades del Programa fue objeto de un informe al Consejo de Ministros y al Parlamento Europeo -el examen de los "30 meses"- que se presentó en 1990, de conformidad con la Decisión del Consejo[7)].

El presente informe final se ha elaborado en cumplimiento del artículo 9 de la citada Decisión, que dispone que, una vez transcurridos los primeros cinco años del Programa, *la Comisión, previa consulta al comité, enviará a los Estados miembros y al Parlamento Europeo un informe sobre la realización y los resultados del programa*, y actualiza y sustituye el examen de los 30 meses presentado en 1990.

[7)] Este informe se presentó de conformidad con el artículo 9 de la Decisión del Consejo, que establecía que "El programa se revisará al cabo de 30 meses, basándose en la valoración de los resultados alcanzados en relación con los objetivos precisos que se enumeran en el Anexo II de la presente Decisión. La Comisión informará al Consejo y al Parlamento Europeo sobre los resultados de dicha revisión".

De conformidad con el guión 3 del apartado 4 del artículo 6, la Comisión remitió el presente informe al Comité de Gestión para recabar su dictamen favorable.

3.2 Auditorías y evaluaciones del Programa

Los trabajos de RACE en el área de las comunicaciones integradas de banda ancha han sido adaptados periódicamente para responder a la rápida evolución de las condiciones tecnoeconómicas y las oportunidades de servicios. Así, se han efectuado exámenes críticos anuales (auditorías), centrados en dos dimensiones:

- **Aspectos estratégicos**: evaluación de los resultados generales de RACE en relación con los objetivos estratégicos y de política comunitaria en el contexto internacional

- **Aspectos técnicos**: evaluación de los resultados de los proyectos de RACE en relación con los objetivos del propio programa.

Además, se llevó a cabo una auditoría de **gestión del programa**, que permitió evaluar el cumplimiento por parte de los servicios de la Comisión de sus responsabilidades de gestión del Programa.

3.2.1 *Auditorías estratégicas y evaluaciones del programa*

En 1989 se realizó una auditoría estratégica independiente para evaluar el trabajo en relación con los objetivos estratégicos y de política comunitaria en el contexto internacional. Las principales conclusiones fueron las siguientes:

- Los objetivos básicos de RACE seguían siendo válidos; el desarrollo de las CIBA era apropiado y necesario para Europa, y el objetivo de 1995 era coherente con las necesidades y con la evolución mundial.

- La importancia relativa concedida en RACE a las distintas áreas del Programa era acertada.

El equipo de auditores recomendó también que, en la fase siguiente, se hiciera más hincapié en las instalaciones en las dependencias del cliente, las aplicaciones móviles, la TVAD digital y la verificación y ensayo, para lo cual, el MTA debería considerarse la tecnología de red fundamental.

En línea con el principio de subsidiariedad, la auditoría estratégica destacó las actuaciones que deberían emprender fuera del programa RACE las organizaciones de los Gobiernos nacionales y los agentes del sector para que lo conseguido por la I+D tuviera aplicación práctica. Estas recomendaciones se recogen en el cuadro 4.

Se adoptaron una serie de medidas en respuesta a algunas recomendaciones: la recomendación de que las administraciones de telecomunicaciones redactaran una declaración de intenciones sobre colaboración en sus enlaces y operaciones de larga distancia intraeuropeos se materializó en la declaración METRAN y los acuerdos GEN, así como en la creación de EURESCOM; se amplió el ámbito de la I+D, se redoblaron los esfuerzos de normalización del MTA y, en la actualidad, se está desarrollando un MTA experimental. Sin embargo, otras recomendaciones no han sido atendidas en los plazos propuestos: el marco reglamentario europeo no ha permitido la convergencia de intereses de las administraciones de telecomunicaciones, radiodifusión y televisión por cable según se esperaba, y el desarrollo de la TVAD ha resultado más lento de lo previsto.

La auditoría estratégica fue seguida en 1990 por una investigación prospectiva sobre futuras necesidades y opciones, en la que colaboraron importantes expertos en estrategia, políticas y tecnología. Las recomendaciones de este denominado Grupo de estudio de necesidades aparecen en el informe "*Telecom 2000*" y sirvieron de base para la redacción del plan de trabajo de la Fase II de RACE.

En 1991 y 1992, RACE fue evaluado de nuevo, desde la perspectiva de otros grandes programas de aplicación de la TI y la telemática integrados en el segundo Programa marco (ESPRIT y DRIVE). La evaluación la llevó a cabo un grupo independiente presidido por el Sr. Dekker[8]. La Comisión respondió en otra publicación a las recomendaciones de dicho Grupo[9].

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[8] Informe del Grupo de evaluación de las tecnologías de la información y las comunicaciones, presidido por D. W. Dekker, junio de 1992.

[9] Respuesta de la Comisión al Informe Dekker, enero de 1993.

Recomendaciones del Grupo encargado de la auditoría estratégica en 1989

A) Los gobiernos nacionales deben colaborar para definir antes de 1992 las condiciones y disposiciones reglamentarias que deben aplicarse para la introducción de servicios de comunicación avanzados paneuropeos.

B) Las administraciones de telecomunicaciones, radiodifusión y televisión por cable deben proponer, a mediados de 1989, un enfoque concertado y un calendario para el desarrollo y utilización de infraestructuras CIBA para servicios de telecomunicación y entretenimiento, incluida la TVAD, aprovechando al máximo las iniciativas inversoras del sector privado cuando ello sea aconsejable.

C) En 1990, las administraciones de telecomunicaciones deben elaborar una declaración de intenciones preliminar sobre una colaboración mas estrecha en los enlaces y operaciones intraeuropeos de larga distancia.

D) A fines de 1990, los proveedores de servicios deben definir un primer grupo de necesidades de servicios, condiciones comerciales y disposiciones reglamentarias que favorezcan un uso pronto y amplio de los servicios CIBA.

E) A mediados de 1989 las administraciones de telecomunicaciones, radiodifusión y televisión por cable, los proveedores de servicios y la industria telemática deben acordar una declaración de intenciones para complementar la I+D cooperativa de RACE con la implantación piloto de algunos servicios CIBA a escala europea, con vistas a una primera introducción de este tipo de comunicaciones en las empresas en 1992.

F) La I+D cooperativa debe ampliarse para incluir la ingeniería de servicios integrados, las aplicaciones fijas y móviles y las técnicas de verificación y ensayo de equipos de comunicaciones y funciones de servicios hacia finales de 1989.

G) Los organismos europeos de normalización deben redoblar sus esfuerzos y coordinarlos con vistas a la normalización internacional de las CIBA y los servicios avanzados. A mediados de 1989 deberá estar preparado un calendario de normalización, particularmente para el MTA.

H) Los Estados miembros deben abordar el problema de la atribución de frecuencias en Europa en toda la gama de frecuencias y aplicaciones. En 1992, deben permitir una racionalización de las atribuciones de frecuencias que refleje las necesidades y prioridades cambiantes.

Por último, en 1992 la Comisión facilitó información sobre el programa dentro de su evaluación del segundo Programa marco[10]. El Consejo pidió al Comité de Investigación Científica y Técnica (CREST) que formulara sus observaciones acerca del informe de la Comisión. El CREST transmitió dicha petición al Comité de Gestión del Programa RACE (RMC), que presentó el siguiente informe en julio de 1992:

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[10] Comunicación de la Comisión "Evaluación del segundo Programa marco para la investigación y el desarrollo tecnológico (SEC(92)675 final, julio de 1992.]

Calidad de los resultados y repercusión en la competitividad

En términos generales, los resultados de RACE se han situado, como mínimo, entre los más avanzados y, en numerosos casos, han supuesto grandes avances (p.ej. el MTA, o modo de transferencia asíncrono, las comunicaciones móviles [UMTS, o Sistema Universal de Telecomunicaciones Móviles], y los dispositivos y tecnologías ópticas).

Europa se encuentra en mejor situación que si no hubiera existido RACE. Otros países tal vez sigan por delante de Europa, pero la diferencia en el campo de las telecomunicaciones se ha reducido apreciablemente con respecto tanto a los Estados Unidos como a Japón.

En el quinquenio del segundo Programa marco, RACE ha alcanzado en gran medida sus objetivos técnicos, formulados en la Decisión del Consejo. No obstante, ha sido tal el ritmo de cambio experimentado en el sector de las telecomunicaciones (p.ej., nuevas necesidades de servicios, nuevas tecnologías, aumento de la competitividad entre los operadores) que los objetivos y prioridades del propio Programa tuvieron que ajustarse en el transcurso de los cinco años de duración de la Fase I. Los nuevos objetivos suplementarios y prioridades (como los experimentos de comunicaciones y las infraestructuras de ensayo y verificación) han sido asumidos por programas posteriores, como RACE II (la segunda fase del Programa RACE, que cubre diez años en total).

RACE ha estimulado la cooperación entre los operadores públicos de redes de telecomunicación (PNOs) (planificación estratégica: EURESCOM); entre industrias (formación de un consorcio industrial: el RIC); y entre éstas y aquéllos (p.ej., en organismos de normalización como el ETSI). Sin embargo, es necesario desarrollar en mayor medida la escala y el ámbito de esta cooperación.

Además de sus numerosos resultados científicos y técnicos, RACE I ha realizado hasta la fecha de Junio de 1992, 470 aportaciones a los organismos de normalización (principalmente, el ETSI), a partir del desarrollo de sus Especificaciones Funcionales Comunes.

En lo que atañe al sector de las telecomunicaciones, la colaboración en el seno de RACE ha acrecentado su competitividad en el mercado mundial. Para la industria europea en su conjunto, la influencia positiva de RACE debe hacerse más patente a largo plazo, con la difusión de las comunicaciones avanzadas. La ulterior I+D sobre aplicaciones puede demostrar a los potenciales usuarios la ventaja competitiva que ofrecen estas comunicaciones.

Gestión y relación eficacia-coste

Dentro del Programa marco, RACE es un programa coherente que asigna objetivos específicos comunes a todos los proyectos en un calendario general de diez años. Durante el desarrollo de RACE I, los mayores progresos se realizaron en las áreas del MTA, los componentes y tecnologías ópticas, los móviles (UMTS) y los experimentos de banda ancha. A consecuencia de ello, las últimas dos categorías han recibido una atención mucho mayor en RACE II. Los ámbitos en los que se ha avanzado menos son la seguridad y el diseño de utilizabilidad, en los que hubo que rebajar los objetivos originales.

Uno de los principales factores que explican el nivel de colaboración alcanzado en RACE es el denominado mecanismo de concertación. En general, la colaboración europea lograda en RACE es eficaz con relación a sus costes, ya que genera un factor multiplicador de las inversiones realizadas por cada socio en los resultados conseguidos por todos.

Los métodos de evaluación aplicados en licitaciones y auditorías funcionaron bien: por ejemplo, el procedimiento de la "bandera roja" hizo posible reorientar y revitalizar proyectos que, de otro modo, no habrían alcanzado sus objetivos, y detener a tiempo otros, evitando un desperdicio de recursos.

Sin perjuicio de que la estructura y la gestión del programa sean buenas en general, es posible introducir mejoras en determinados ámbitos:

- *La cooperación-colaboración con otros programas de investigación europeos y multinacionales no ha sido suficientemente satisfactoria.*

- *Debe existir un compromiso de apoyo al programa y sus objetivos entre la Comisión, los operadores públicos de redes de telecomunicación y la industria antes de la aprobación del plan de trabajo.*

- *Se deben redoblar los esfuerzos para mantener la calidad general del programa, que no debe confundirse con la de los proyectos concretos. Por ejemplo, son demasiados los participantes clave que no permanecen en el Programa durante todo el desarrollo de éste.*

- *Es necesario optimizar en mayor medida la relación eficacia-coste de las reuniones de concertación.*

- *El proyecto de gestión del consenso debería idealmente ser el primero en ponerse en marcha, para garantizar así unas relaciones satisfactorias con los demás proyectos.*

- *Deben adoptarse medidas para fomentar el papel activo y la participación de las PYME en futuros programas.*

- *Debe hacerse más uso de acciones concertadas y medidas complementarias.*

Coherencia con los políticas y principios de la CE

Los criterios de selección técnica aplicados tanto en la evaluación de las licitaciones como en las auditorías de los proyectos han demostrado ser satisfactorios.

En la selección de proyectos para RACE I no se tuvieron en cuenta expresamente los criterios sociales y económicos. Sin embargo, un programa de telecomunicaciones como RACE es, en general, coherente con las políticas predominantes de medio ambiente y conservación de la energía.

En lo tocante a la subsidiariedad, son evidentes las ventajas que puede reportar la colaboración europea en investigación prenormativa sobre telecomunicaciones. No obstante, se debe fomentar también una relación de trabajo más estrecha con los programas y experimentos nacionales.

Conclusiones

No es sensato que 1995 suponga el punto final de los programas de investigación sobre telecomunicaciones en Europa. Es necesario otro programa después de RACE.

La investigación y desarrollo es una condición necesaria, pero no suficiente, para alcanzar una buena posición en los futuros mercados de las telecomunicaciones. El presente documento no recoge la opinión del Comité de Gestión de RACE con respecto a las medidas complementarias precisas para tal fin. El cambio de acento de la I+D en el ámbito de las telecomunicaciones hacia los servicios y las aplicaciones deberá repercutir en la estructura y organización de futuros programas.

Los resultados de RACE deben ser incorporados y utilizados más ampliamente en Europa. Es posible que las iniciativas necesarias para esta transferencia deban ser adoptadas por los agentes del sector".

En el informe que acaba de resumirse se basó el CREST en octubre de 1992 para presentar su propio informe al Consejo sobre el segundo Programa marco.

3.2.2 Valoración de repercusiones y previsiones

Durante los cinco años de duración de la primera fase del Programa, la investigación y desarrollo tecnológico han ido acompañados de evaluaciones periódicas sobre la repercusión económica y social del desarrollo de las comunicaciones avanzadas. Los informes donde se recogen dichas evaluaciones han sido publicados y ampliamente difundidos en la serie "*Perspectives for Advanced Communications in Europe: PACE*". La más reciente de dichas evaluaciones se efectuó en 1991, y sus resultados se hicieron públicos en 1992. Esta actividad evaluadora revela un contexto fáctico que se tiene en cuenta para la actualización anual de los trabajos del programa y para la introducción de modificaciones menores durante el año. En su mayor parte, se ha integrado plenamente en la Fase II de RACE, de conformidad con lo dispuesto en la Decisión del Consejo sobre el Programa específico de tecnologías de la comunicación.

3.2.3 Auditoría de la gestión del Programa

Los métodos de gestión seguidos por la Comisión en el Programa RACE fueron objeto de una "auditoría de la gestión del programa" realizada por un equipo independiente en 1991.

Las conclusiones principales fueron que el estilo de gestión industrial adoptado por los servicios de la Comisión era, en general, adecuado para los objetivos y los socios del Programa, y que las auditorías técnicas anuales y las reuniones de concertación periódicas habían demostrado su eficacia para la gestión.

3.2.4 Auditorías técnicas de los proyectos de RACE

Para adaptar el Programa a la evolución de la tecnología y los cambios en la percepción de la demanda, la Decisión sobre RACE dispuso que se efectuasen revisiones anuales del plan de trabajo.

Ello exigía examinar anualmente el grado de cumplimiento de los objetivos de todos los proyectos y cotejar las actividades de éstos con las nuevas necesidades. A tal efecto, los proyectos fueron sometidos a "auditorías técnicas" anuales a cargo de expertos independientes en las diversas áreas. La primera se llevó a cabo en octubre de 1988, y la última, en el mismo mes de 1992. Sus resultados se utilizaron para reorientar o poner fin a un proyecto cuando se consideró necesario.

En esencia, las auditorías técnicas se componían de los siguientes elementos:

a) Los socios de cada uno de los proyectos efectuaban una "autoevaluación" de todos los aspectos fundamentales de su trabajo y presentaban sus resultados en un denominado Informe anual.

b) Los Informes anuales eran evaluados por expertos independientes del exterior (auditores) seleccionados con ayuda del RMC. Tras dicha evaluación, los representantes de los proyectos eran invitados a una "audiencia" presidida por la Comisión. En ella podían poner de relieve sus logros y presentar un plan general de actividades futuras; a continuación, los auditores, distribuidos en grupos especializados, podían hacer preguntas para completar los datos del Informe anual y la Presentación.

c) Los grupos de expertos elaboraban una síntesis de sus conclusiones y recomendaciones, que presentaban en los Informes del grupo de auditores al RMC y a la Comisión.

d) Los informes de la auditoría se completaban con una evaluación de los productos o resultados contractuales, efectuada por los funcionarios de proyectos de la Comisión. (En general, dichos resultados contractuales son considerados confidenciales y no se ponen en conocimiento de los auditores).

Este procedimiento ha demostrado su equidad y eficacia. Los informes de las auditorías han sido una excelente base para la negociación de los contratos correspondientes a los planes de trabajo anuales de cada proyecto.

4. Relaciones con otras actuaciones comunitarias y europeas

4.1 Relaciones con la CEPT

Las relaciones con la CEPT y sus organismos subsidiarios se ha modificado en buena medida durante el desarrollo y aplicación de RACE.

En la fase de definición, el Grupo especial de comunicaciones de banda ancha (GSLB), creado por la CEPT, realizó una aportación importante al plan de trabajo de la Fase I. En 1987 y 1988, la coordinación con las actividades de la CEPT estuvo garantizada por el Grupo Mixto RACE (GMR), constituido para ese fin en septiembre de 1987.

En 1988, la colaboración con la CEPT dio como fruto la firma, por parte de 13 administraciones europeas de telecomunicaciones, de una declaración de intenciones para introducir un banco de pruebas generalizado para CIBA (EBIT).

La nueva regulación de las telecomunicaciones, en consonancia con la nueva Política europea de telecomunicaciones, indujo a la CEPT a crear una serie de organismos independientes, dos de los cuales han establecido intensas relaciones con las actividades de RACE: en ETNO, el grupo de operadores europeos de redes de telecomunicación, los operadores de red debaten las cuestiones suscitadas por el interfuncionamiento; por su parte, EURESCOM brinda un foro para la investigación estratégica conjunta. Aunque no todos los operadores públicos de redes de telecomunicación europeos importantes participan en EURESCOM, éste es un valioso intermediario entre la Comisión, los proyectos de RACE y la mayoría de los operadores de redes.

4.2 *Relaciones con los organismos de normalización europeos e internacionales*

En el marco de la aplicación de la política europea de telecomunicaciones, en 1988 se creó el ETSI (Instituto Europeo de Normas de Telecomunicación), que se ha convertido en el principal ámbito europeo de elaboración de especificaciones técnicas. Los trabajos prenormativos de RACE han supuesto 596 aportaciones a la actividad normalizadora del ETSI, el CCITT y el CCIR.

Además, se han celebrado reuniones periódicas con representantes del CEN/CENELEC, la UER y el SPAG.

4.3 Relaciones con otros programas comunitarios y actividades europeas

Los proyectos de RACE aprovechan los resultados de los proyectos de desarrollo de tecnologías genéricas, p.ej., ESPRIT (componentes microelectrónicos, herramientas de software, tratamiento avanzado de la información para gestión de redes, etc.); además, las técnicas que se investigan en los actuales proyectos de RACE son muy utilizadas para satisfacer las necesidades de telecomunicaciones de las aplicaciones telemáticas (DRIVE, DELTA y AIM).

La colaboración con COST se ha establecido gracias a los estrechos vínculos creados entre trabajos afines y a las reuniones periódicas de los responsables del programa.

Con la iniciativa EUREKA, la interacción más intensa se ha producido en el campo de las tecnologías audiovisuales. Parte del trabajo relacionado con la promoción de la TVAD (Proyecto 95 de EUREKA) se llevó a cabo mediante un contrato de RACE; y el proyecto 256 de EUREKA sobre codificación de vídeo se incorporó a las actividades de integración de RACE.

4.4 Relaciones con las organizaciones de los países de la AELC

Participan en RACE organizaciones de Austria, Finlandia, Noruega, Suecia y Suiza. 27 de ellas participan en 72 consorcios (en más del 80% del trabajo).

5. Explotación de los resultados de RACE

Las oportunidades que ofrecen las nuevas tecnologías de la comunicación tendrán importantísimas repercusiones tanto en el futuro crecimiento económico de la Comunidad como en la división internacional del trabajo en todo el mundo. Se observan tres procesos distintos, aunque interrelacionados:

- el acceso más fácil a una información mejor acrecienta la productividad en todos los sectores económicos;

- la mejora de las comunicaciones hace aumentar la utilidad y, por consiguiente, las posibilidades de comercialización de servicios nuevos o ya conocidos, y propicia su expansión;

- la transición a la nueva economía basada en la información y orientada por los servicios exige fuertes inversiones públicas y privadas en nuevas infraestructuras, tanto físicas - cables, conmutadores, terminales- como humanas, para el desarrollo de servicios de telecomunicación de valor añadido.

Por ello, la calidad técnica y organizativa de las comunicaciones constituirá un factor primordial para el futuro desarrollo económico, pues determinará la capacidad de la economía para generar y utilizar eficazmente el factor más importante de la "producción" moderna: el conocimiento. La organización geográfica de las infraestructuras influirá decisivamente en el espacio social, económico y cultural del mañana, al igual que los ferrocarriles en el siglo XIX.

Por las razones antedichas, los resultados de la I+D sobre telecomunicaciones deben explotarse rápidamente y con eficacia. En consecuencia, deberá prestarse una atención especial al aspecto de la explotación de dichos resultados en el conjunto de RACE.

5.1 El plan de explotación de RACE

Para estimular y evaluar de la explotación de los resultados de RACE por los participantes, se ha actualizado periódicamente un "Plan de explotación de RACE" en el período 1988-1992. Este Plan brinda una visión de conjunto de la explotación por los participantes de los resultados del Programa.

Las aportaciones a la normalización se enumeran en el Anexo II, y los títulos de las publicaciones científicas y técnicas se enumeran en el Anexo III. Con más de 1.700 publicaciones científicas y técnicas resultado de sus trabajos, RACE ha realizado una importante contribución a la bibliografía científica.

Los resultados del desarrollo de tecnologías se han protegido con solicitudes de patente cuando se ha considerado oportuno. Se han registrado ya 73 de dichas solicitudes relacionadas con las actividades de RACE, que se enumeran en el Anexo IV.

5.2 El plan de implantación de RACE

La explotación de la I+D sólo es posible cuando todos los agentes comparten una concepción coherente de la dirección y ritmo de la evolución comercial. En consecuencia, la I+D del Programa RACE se ha especificado y secuenciado según un calendario indicativo de implantación de las comunicaciones integradas de banda ancha, que se actualiza periódicamente. Dicho calendario contempla la introducción progresiva de servicios avanzados, comenzando por aquéllos para los que existirá demanda empresarial y profesional a partir de 1992-93. El actual calendario de implantación indicativo, según figura en el informe anual de RACE correspondiente a 1992, consta de las siguientes etapas:

1992-93:

- Primera introducción de aplicaciones empresariales y profesionales,
- experimentos en comunicaciones avanzadas para probar nuevos servicios y sistemas de gestión de redes: MTA, MAN y CIBA en redes en las dependencias del cliente.
- decisiones de compra e inversión para la futura RCIBA paneuropea y servicios CIBA completos,
- finalización de las normas principales.

1994:

- Ultimación de la interconexión de todas las capitales comunitarias y de los países vecinos basada en la ampliación de las actuales redes ópticas de sector existentes, que, no obstante, deberán permitir la transmisión de voz, datos e imágenes tanto separadamente como en servicios integrados.

1995:

- Implantación inicial de la red CIBA y ultimación del acceso de clientes (empresas) en centros de actividad económica e industrial: al menos 50.000 usuarios empresariales de servicios avanzados.
- ensayos de aplicación sobre el terreno para comprobar toda una gama de servicios CIBA (incluidos particulares con vídeo bidireccional y TVAD digital) con equipos comerciales.

1996:

- Oferta comercial de servicios de banda ancha básicos, con enlaces de 2, 34 y 155 Mb/s, incluidas la transmisión rápida de datos inter-LAN, vídeoconferencia de sobremesa, vídeotratamiento, CAD/CAM y aplicaciones de trabajo a distancia.
- interfuncionamiento de redes de banda ancha fijas con redes móviles, vía satélite y otras.

1997:

- Oferta de servicios a empresas en poblaciones de más de 500.000 habitantes e inicio de la implantación a gran escala de la "fibra al domicilio".

2005-2010:

- penetración de los servicios CIBA en un 50%.

Este calendario se revisará de nuevo en 1993 en el contexto de las directrices para el desarrollo de las redes transeuropeas de banda ancha, según lo previsto en los artículos 129B y 129C del título XII del Tratado de la Unión Europea.

6. Aplicación de la Fase II de RACE

RACE es un programa previsto desde un principio para diez años que se aplica en dos fases. Para garantizar su continuidad, la segunda fase se aprobó en junio de 1991 como programa específico dentro del tercer Programa marco de investigación y desarrollo tecnológico de la CE.

Sin embargo, en 1991 se había producido un cambio de perspectiva importante. Lo que parecía una visión ambiciosa y casi futurista al comienzo del Programa, había madurado hasta convertirse en una posibilidad real. En la actualidad, se tienen fundadas esperanzas de que las comunicaciones integradas de banda ancha se introducirán comercialmente dentro de cuatro años. Por otra parte, se ha hecho incluso más evidente que las telecomunicaciones y los servicios de información avanzados desempeñarán una función crucial en el desarrollo socioeconómico mundial a medida que nos aproximemos al siglo XXI.

Dichos cambios motivaron que el Parlamento Europeo y el Consejo de Ministros concedieran prioridad a la adopción del nuevo Programa específico. De hecho, éste fue el primero en ser aprobado[11] de todos los del tercer Programa marco, y su plan de trabajo recibió inmediatamente el dictamen favorable del Comité de Gestión. En junio de 1991 se publicó una convocatoria de propuestas, que fueron evaluadas en septiembre y octubre de 1992. Se evaluaron más de 200 propuestas, y 95 proyectos iniciaron sus actividades a principios de 1992. De acuerdo con las actuales previsiones presupuestarias, se estima que los trabajos habrán concluido hacia finales de 1994.

Mientras que los proyectos de la Fase I de RACE se concentraron en la evaluación de opciones, los de la Fase II preparan la introducción de las CIBA. Estos proyectos intensificarán la colaboración y los compromisos de los usuarios industriales, el sector de la telemática y los operadores de telecomunicaciones, ya existentes en RACE I. La nueva I+D se centrará en las aplicaciones, los servicios, el funcionamiento y la gestión, pero mantendrá un elevado nivel de desarrollo tecnológico para consolidar y ampliar las áreas clave necesarias para la prestación rentable de los servicios CIBA.

El trabajo cubre las ocho áreas prioritarias definidas en el Anexo de la Decisión del Consejo:

AREA 1: I+D sobre CIBA (comunicaciones integradas de banda ancha)
AREA 2: Inteligencia de las redes/gestión flexible de los medios de comunicación
AREA 3: Comunicaciones móviles y personales
AREA 4: Comunicaciones de imágenes y datos
AREA 5: Tecnologías de servicios integrados
AREA 6: Tecnologías de seguridad de la información
AREA 7: Experimentos sobre comunicaciones avanzadas
AREA 8: Infraestructura de pruebas y compatibilidad (área de I+D común a todas las demás áreas prioritarias)

En los informes anuales de 1992 y 1993 se describen exhaustivamente los nuevos proyectos de I+D de la Fase II y sus relaciones con los de la Fase I.

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[11] Decisión del Consejo 91/352/CEE de 7 de Junio de 1991; DO L 192/8; 16.7.1991.

7. Futuras necesidades y opciones de la I+D sobre tecnologías de las comunicaciones a nivel europeo

En junio de 1992, el Comité de Gestión de RACE creó un grupo especial encargado de establecer las prioridades de la futura I+D europea en el ámbito de las telecomunicaciones. El informe de dicho grupo se reproduce a continuación.

Gran parte de estas ideas y temas para la futura I+D comunitaria aparecen reflejados ya en el documento de trabajo de la Comisión para el cuarto Programa marco, especialmente en los temas "Tecnologías de la imagen", "Computación y redes de alto rendimiento", "Integración funcional en la fabricación" y "Comunicaciones avanzadas". En 1993, la Comisión presentará sus propuestas de programas específicos dentro del cuarto Programa marco, tras examinar todas las aportaciones.

Justificación de una I+D comunitaria

El RMC sigue considerando que una I+D sobre telecomunicaciones a escala europea ofrece ventajas importantes. En general, la investigación (y, en particular, la investigación sobre telecomunicaciones) es un proceso permanente. Para mantener la buena posición alcanzada por los agentes del sector gracias a su participación en iniciativas comunitarias como RACE, es necesario proseguir la investigación cooperativa, sobre la base de los resultados obtenidos hasta la fecha.

Es preciso reunir los fragmentados sistemas de telecomunicaciones comunitarios, tanto para garantizar el buen funcionamiento del mercado único como para afianzar la ventaja competitiva europea en el mercado mundial. Organismos de normalización como el ETSI han valorado positivamente las aportaciones técnicas derivadas directamente de las actividades de RACE. En los programas futuros, deberá continuar e intensificarse el proceso de "gestión del flujo" de los resultados desde la I+D comunitaria hacia los organismos de normalización.

Las telecomunicaciones avanzadas revisten una importancia cada vez mayor para la buena marcha de las economías nacionales, hasta el punto de que sus elementos constitutivos (la "información" y la capacidad de "comunicar" dicha información) son considerados recursos estratégicos. Esto se puede medirse desde la perspectiva de:

- *la importancia cuantitativamente creciente de la inversión en telecomunicaciones en las economías nacionales, y*

- *la repercusión cada día mayor de los servicios avanzados de telecomunicación en otros sectores económicos.*

Estas tendencias se han reconocido en el Acta Unica y en los esfuerzos hacia la realización del mercado interior de la Comunidad Europea. El Tratado de Maastricht prevé la creación de redes transeuropeas (que incluyen la telecomunicación). La creación a nivel europeo de infraestructuras y servicios de telecomunicación precisará el compromiso a largo plazo de todos los agentes del sector implicados.

La sincronización de la evolución (una vez más, a nivel europeo) hacia el establecimiento de una infraestructura de comunicaciones de banda ancha brinda una ventaja económica clara en términos de rentabilidad de las inversiones. Esta sincronización facilitaría la introducción de las nuevas aplicaciones en todas las regiones europeas, y permitiría alcanzar rápidamente la "masa crítica" necesaria para un crecimiento autónomo de la utilización de los servicios avanzados. Por otra parte, es indudable que las redes de telecomunicación, así como un número progresivamente mayor de servicios comunitarios, tienen un alcance cada vez más internacional. En consecuencia, podría fomentarse una cooperación más amplia fuera de las fronteras europeas.

Por todo lo anterior, el RMC entiende que todo futuro programa marco debe contener una actuación específica de I+D comunitaria en el campo de las telecomunicaciones. Para ello, se debe partir de los importantes resultados obtenidos en programas precedentes. No obstante, la investigación y desarrollo sobre telecomunicaciones que será necesaria después de 1995 deberá hacer hincapié en aspectos significativamente distintos a los que hasta ahora han recibido más atención en el marco de RACE.

Objetivos para la I+D futura en el campo de las telecomunicaciones

La materialización del gran objetivo de la denominada "visión de las comunicaciones avanzadas", según el cual "todos podrán comunicarse en cualquier lugar y momento, mediante texto, sonido e imágenes" precisa nuevas iniciativas europeas de I+D.

Los programas existentes, como RACE y ESPRIT, han contribuido ya de manera importante a la viabilidad técnica fundamental de dicha visión. El elemento impulsor de un nuevo programa de I+D comunitaria sobre telecomunicaciones debe radicar en las necesidades de las aplicaciones. En principio, éstas deberán definir también las actuaciones y prioridades necesarias para ulteriores investigaciones sobre las tecnologías básicas sustentadoras.

De lo anterior se infiere que todo nuevo programa debe fijarse un doble objetivo:

- *Fomentar los "ensayos de funcionamiento" de servicios avanzados para mejorar su utilizabilidad y garantizar que sus resultados finales son lo bastante atractivos para que se difunda el empleo de dichos servicios en la vida cotidiana de los europeos.*

- *Seguir investigando en las "futuras tecnologías" necesarias para las comunicaciones avanzadas, a fin de reducir el coste de los componentes clave y permitir una prestación de servicios avanzados económicamente más viable.*

Ambos aspectos son especialmente importantes para la realización comercial paneuropea de las redes y servicios de comunicaciones avanzadas, aunque dicha "realización" depende también de otros factores. Para aproximarse más aun a la "visión de las comunicaciones avanzadas", es esencial basarse en el cada vez más intenso proceso de consultas entre los agentes del sector, a fin de alcanzar un consenso en torno a:

- *la manera óptima de mejorar el rendimiento de los servicios y las correspondientes tecnologías sustentadoras*

- *las oportunidades que genera la convergencia de las telecomunicaciones, la radiodifusión y la tecnología de la información, que pueden servir de base para una rápida evolución hacia las comunicaciones avanzadas.*

En resumen, la continuación de la I+D comunitaria en el campo de las telecomunicaciones avanzadas fomentará la cooperación y la armonización europeas, fortaleciendo la competitividad de Europa en los mercados internacionales y, por ende, la economía europea en su conjunto.

Bases de colaboración (modus operandi)

Para hacer más atractivas las comunicaciones avanzadas en sectores progresivamente más amplios y favorecer la "viabilidad económica" de las tecnologías, es preciso contar con la participación de todos los interesados: usuarios, operadores de redes, proveedores de servicios, industria, centros de investigación y universidades. La intervención de todos ellos debe asegurarse desde el principio haciendo que participen en la definición negociada de un plan de trabajo. En particular, se debe fomentar la colaboración activa de los operadores de redes públicas en apoyo de los experimentos de comunicaciones, aprovechando las posibilidades de las estructuras ya existentes o previstas para el futuro.

En el próximo programa de I+D deberá reservarse un mayor papel a las PYME, muchas de las cuales poseen valiosos conocimientos en el desarrollo de aplicaciones y servicios, conocimientos que son de enorme utilidad para abordar este nuevo ámbito de investigación comunitaria. La necesidad de reforzar el papel de las PYME en la futura I+D sobre comunicaciones invita a adoptar medidas concretas para facilitar su participación activa. Por ejemplo, la Comisión podría utilizar procedimientos contractuales más favorables, como el mecanismo CRAFT aplicado en BRITE/EURAM, u otros enfoques nuevos.

A pesar de los excelentes resultados generales cosechados por RACE, convendría estudiar algunos procedimientos nuevos para el próximo programa de I+D sobre comunicaciones o reflexionar sobre una mejora de los ya existentes. Los proyectos deberían formularse dentro de un marco bien estructurado, definirse en el plan de trabajo y dirigirse específicamente hacia el logro de los objetivos del programa. Será necesario también potenciar el mecanismo de concertación utilizado ya satisfactoriamente en RACE.

Siempre que se pueda, deberá fomentarse una mayor coordinación de los programas comunitarios, una colaboración más próxima con otros programas de investigación europeos o multinacionales, y unas relaciones más estrechas con los programas y experimentos nacionales. Asimismo podrían considerarse actuaciones concertadas con EUREKA, COST y otros proyectos nacionales.

Entre las medidas complementarias del programa debe figurar una buena publicidad de los proyectos durante su ejecución y una promoción de sus resultados (y de sus posibles aplicaciones y ventajas) con destino a todos los agentes del sector y, en especial, a los usuarios potenciales de las comunicaciones avanzadas.

Ensayos de funcionamiento y desarrollo de servicios

Las experiencias adquiridas con la introducción de nuevas tecnologías y servicios de red han demostrado que el desarrollo e implantación de nuevas aplicaciones precisa una validación bien organizada, preoperativa y práctica (ensayos de funcionamiento) en la que participen todos los agentes del sector. El auténtico desafío para estas próximas generaciones de ensayos de funcionamiento europeos estriba, por lo tanto, en mostrar la manera de reunir (en condiciones de libre mercado) posibles servicios a fin de atender las necesidades de los sectores clave del mercado.

La I+D aplicada a los ensayos de funcionamiento y el desarrollo de servicios debe centrarse en aspectos genéricos que permitan la evolución de los servicios avanzados. Aun basándose en la tecnología existente, los ensayos deben apuntar hacia las aplicaciones, conforme las redes se vuelven más inteligentes, y los servicios, más flexibles. Sus principales objetivos deben comprender la formulación y aportación de propuestas de normalización y la propuesta de plataformas que engloben todos los puntos de vista sobre la aplicación en un sector:

- *la empresa (incluidas organización, interacción, información al usuario, políticas de gestión y de seguridad, análisis de costes/beneficios, cuestiones jurídicas, éticas y sociales),*
- *la información per se (incluida la definición de los elementos de información, su calidad, flujo y presentación al usuario),*
- *las funciones telemáticas (incluidas las de comunicación y tratamiento y los tipos de representación de datos),*
- *las tecnologías (incluidos hardware y software).*

Así, los ensayos de funcionamiento deben tener en cuenta los cambios de la legislación, las políticas de gestión y seguridad, el acceso del usuario y las interfaces persona-maquina, y facilitar análisis de rentabilidad y definiciones sobre la calidad de la información.

El desarrollo de servicios genéricos precisa herramientas de creación de servicios, incorporación de terminales y teleservicios multimediales y aportación de capacidades avanzadas para servicios, su gestión y su ingeniería. Como consecuencia, las futuras aplicaciones deberán cumplir los requisitos siguientes:

- *tener definiciones específicas para el sector, determinadas por proveedores y usuarios,*
- *estar basadas en servicios genéricos y ser compatibles con la oferta de red abierta,*
- *estar definidas según objetivos claros de rentabilidad,*
- *tener un potencial comercial internacional*
- *poder atender a corto plazo necesidades nuevas, como la movilidad y ubicuidad personal, los servicios multimediales de banda ancha y las redes cooperativas o inteligentes.*

A partir de los programas de la Comisión (RACE, Sistemas telemáticos, ESPRIT) y nacionales, se puede formar una base empírica para determinar cuáles deben ser estas aplicaciones. El punto de convergencia esencial de los futuros programas de I+D será llevar a cabo ensayos preoperativos y demostrar la validez europea de las aplicaciones. En opinión del RMC, el desarrollo de los siguientes servicios debe incluirse en un futuro programa de I+D para satisfacer mejor las necesidades de los usuarios:

- *perfeccionamiento de la videoconferencia y servicios multimediales interactivos,*
- *trabajo a distancia y presencia virtual,*
- *movilidad, ubicuidad y seguridad de la información,*
- *servicios de difusión amplia y restringida,*
- *gestión de servicios y servicios de red inteligentes.*

Investigación sobre tecnologías sustentadoras

Todo nuevo programa de investigación en el campo de las telecomunicaciones debe partir de la importante base tecnológica creada en programas anteriores. Actualmente se necesita una investigación estratégica que permita la reducción de costes mediante el empleo de las tecnologías de la nueva generación. Los objetivos generales podrían formularse así:

- *Proporcionar las tecnologías necesarias para la creación de redes y servicios europeos competitivos en los costes y que se mantengan por delante de los bloques económicos competidores, como contribución importante al fortalecimiento de la economía europea.*

- *Sentar las bases para una evolución de la red de telecomunicaciones técnicamente viable y justificable económicamente, asimismo -respecto de la normalización- con el objetivo de fortalecer la economía europea.*

Los conocimientos adquiridos en estas áreas generales de investigación pueden exigir una modificación de los objetivos y prioridades de otras áreas del programa. Por ejemplo, la evolución de la tecnología de servicios puede aportar elementos a la investigación sobre tecnología de componentes y redes. Sin embargo, debe seguir haciéndose hincapié en los nuevos servicios al usuario a través de la red de telecomunicación. Dado que una de las características de tales servicios será el alto grado de personalización, es necesaria una interacción directa entre la evolución de las redes y el desarrollo de los servicios. El RMC considera que las siguientes áreas concretas de investigación deberán figurar en un futuro programa:

Evolución de la red para sentar las bases de unas comunicaciones avanzadas técnicamente viables y justificables económicamente

- *integración de medios y sistemas de transmisión existentes y nuevos (hilo de cobre, fibra óptica, radiocomunicación terrenal, satélites), incluso en las redes de distribución y acceso (fibra en el bucle de abonado, etc.); integración de redes móviles y fijas;*
- *Evolución de las jerarquías de transmisión gestionadas y mejora de los sistemas de gestión de redes.*
- *Sistemas de transmisión óptica de ultracapacidad, y arquitecturas de redes fotónicas;*
- *Nodos gestionados para RDSI-BA (ATM) y señalización mejorada;*
- *Redes inteligentes, arquitecturas de redes de información avanzadas (que combinan IN y TMN), y arquitecturas lógicas avanzadas.*

Evolución de las tecnologías basadas en los resultados de RACE y otros programas comunitarios y, en particular, evolución de los terminales hacia una mejor relación coste/rendimiento y mayor facilidad de empleo

- *Estaciones de trabajo multimediales y videotelefonía;*
- *tratamiento avanzado de imágenes y sonido;*
- *televisión digital (SDTV, EDTV, TVAD)*
- *control de la voz en lenguaje natural;*
- *Dispositivos ULSI para circuitos de conmutación y transmisión;*
- *circuitos integrados para aplicaciones avanzadas de microondas basados en Si y materiales III-V, y*
- *materiales y dispositivos optoelectrónicos para aplicaciones de telecomunicación.*

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 I.320	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	
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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
Proposal for Physical Layer Transmission Parameter	ETSI	NA 5	1990/04	Portugal
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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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Stage 2 studies on Multimedia Services	ETSI	NA 5	1989/10	Denmark
Support of Broadband Distributive Services	ETSI	NA 5	1989/11	UK
Surface Transfer Impedance in the specification of the TB interface	ETSI	NA 5	1990/09	Spain
Target IBCN Reference Configurations	ETSI	NA 5	1990/03	Italy
Termination of the section and path overhead (POH) at the UNI	ETSI	NA 5	1989/10	Denmark
Termination of the SOH and POH at the UNI	ETSI	NA 5	1989/09	France
Terminology Lifecycle	ETSI	NA 5	1990/09	Netherlands
Terminology (related to Connectionless Data Service)	ETSI	NA 5	1990/09	Spain
Terminology Related to connectionless Services	ETSI	NA 5	1990/06	Finland
Terminology Update	ETSI	NA 5	1990/10	Sweden
The Branching Functional Group with Functions and Reference Points in the Customer Access Network	ETSI	NA 5	1992/01	France
The Coding of the Sequence Number (SN) in SAR class 2	ETSI	NA 5	1990/04	Portugal
The messages used by the AAL protocol for B-ISDN signalling and connection oriented data services	ETSI	NA 5	1990/09	Spain
The OLI/OLO concept	ETSI	NA 5	1991/02	Belgium
The Optical Line Outlet Concept	ETSI	NA 5	1989/10	Denmark
The Optical Line Outlet Function	ETSI	NA 5	1990/10	France
The way ahead on Broadband numbering within NA2	ETSI	NA 5	1991/09	Belgium
Third-Party-Charging	ETSI	NA 5	1991/09	Belgium
Traffic aspects	ETSI	NA 5	1991/02	Belgium
Transmission aspects in the core network	ETSI	NA 5	1991/02	Belgium
Transmission Range for a Coaxial Interface	ETSI	NA 5	1989/08	France
Transmission ranges for an optical fibre interface	ETSI	NA 5	1989/11	UK
Units for Traffic Capacity in ATM Networks	ETSI	NA 5	1990/04	Portugal
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
Liaison Report from RACE	ETSI	NA 6	1990/02	UK
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	ETSI	NA 4	1991/07	France

R1089 Low Cost Optimized Optical Passive Components

"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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List Of Publications

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

Development of Advanced Thin-Film Electroluminescent Displays
1990 Proceedings of Eurodisplay 1990

Evaluation of a 64x64 CdSE TFT Addressed ACFTEL display demonstrator
1991/10 91 International Display Research Conference

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

Modeling & Simulation of an ACTFEL Display
1990 SID 1990 DIGEST

Modeling the Luminescence of the ACTFEL Display
1990/06 5th International Workshop on Electroluminescence

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

Multicolour Electroluminescent Displays
1990 Proceedings of 14th Nordic Semiconductor Meeting

The realization and evaluation of poly-CdSe TFT driving circuits
1988/10 Proceedings of the International Display Research Conference

Thin-Film Electroluminescent Displays
1989/05 Society for Information Displays,Seminar Lecture Notes,volume I

R1005 NEMESYS - Traffic and QOS Management for IBC

A Model of the TMN Workstation Function
1991/11 5th RACE TMN Conference - London

AIP Utilisation in Traffic and Quality of Service Management Systems
1992/09 6th RACE TMN Conference - Madeira

An Approach to Distributed O-o databases
1991/06 2nd Workshop of the Object Modelling Special Interest Group

An Architecture for Distributed Network Management
1991/11 5th RACE TMN Conference - London

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
1992/09 6th RACE TMN Conference - Madeira

Generic Management Browser
1992/05 IFIP Conference on Upper Layer Protocols, Architecture and Applications - Vancouver

HCI Consideration in TMN Systems
1992/09 6th RACE TMN Conference - Madeira

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
1990/11 GUIDELINE 2nd TMN Implementation Workshop

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

Quality of Service Management in IBC : an OSI Management Based Prototype
1991/11 5th RACE TMN Conference - London

Service and Traffic Management for IBCN
1992 IBM Systems Journal 4Q.1992

Service Management for IBC
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
1990/11 GUIDELINE 2nd TMN Implementation Workshop

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1992/09 6th RACE TMN Conference - Madeira

Traffic Management for IBC Networks
1991/11 5th RACE TMN Conference - London

Using Neural Computing Methods to Build an Adaptive Distributed Routing Algorithm
1990/11 2nd TMN Workshop

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1992/09 6th RACE TMN Conference - Madeira

Virtual Path and Call Acceptance Management for ATM Networks
1992/09 6th RACE TMN Conference - Madeira

R1006 AIM-AIP Application to IBC Maintenance

A design of the Operation, Maintenance and Construction of an Intelligent Management Information Base
1991/11 Proceedings of the Fifth RACE TMN Conference

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
1991/11 RACE TMN 5 Conference

Advanced Information Modelling for Integrated Network Management Applications
1992

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

Computing beliefs according to Dempster-Shafer and Possibilistic Logic
1990/07 3rd Int Conference Information Processing & Management of Uncertainty in Knowledge Based

Computing Numerical Beliefs Using Propositional Inference as a Basis
1990/07 Conference -3rd International Conference on Information processing & the Management of

Conclusions from the BERKOM Maintenance Prototype and Recommendations for future Maintenance Systems
1991/11 Proceedings of the Fifth RACE TMN Conference

Design of the Resource Scheduler
1990/11 RACE TMN conference

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
1992/02 International Congress FAIR ONLINE'92 for Technical Communications

Inference & Control in a GMS for IBCN
1990/11 RACE TMN conference

Integrating Repair into the IBCN Maintenance Strategy
1991/11 Proceedings of the Fifth RACE TMN Conference

Knowledge representation of networks in the RACE project AIM
1990/11 RACE TMN conference

OBSIL: A simple object oriented query language as a basis for TMN systems interactions
1991/11 RACE TMN 5 Conference

Open University (UK) - Contributions to the course on data/knowledge bases.
1990/09 Preliminary Script on the Open University Interview on Object Modelling

Representation of generic structure and behaviour of networks for model based diagnostic applications
1991/07 British Telecom Technol J. Vol. 9 No 3

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1990/11 RACE TMN conference

The application of information modelling in the telecommunications management network
1991/07 Br Telecom Technol J. Vol 9, No 3

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1991 TINA (Telecom Information Network Architecture) Conference

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1991/11 RACE TMN Conference

The use of AIP techniques in Maintenance Systems for Integrated Broadband Networks
1990/10 Proceedings of International Conference on Integrated Broadband Services and Networks

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

R1008 Silicon-based low-cost passive optical components

16-channel optical wavelength multiplexer/demultiplexer integrated on silicon substrate
1991/06 Proceedings EFOC'91

Birefringence control and dispersion characteristics of silicon oxynitride optical waveguides
1991 Electronics Letters 27

Fiber Pigtailed Wavelength Multiplexer/Demultiplexer at 1.55 microns ntegrated on silicon substrate
1990/06 Proceedings of EFOC '90

Fibre pigtailed silicon based low cost passive optical components
1990/09 Proceedings of ECOC'90

Integrated Photonic Circuits on Silicon
1989/07 NATO Advanced Study Institute

Low cost silica on silicon single mode 1:16 optical power splitter for 1550 nm
1990/06 Proceedings of EFOC'90

Low-loss PECVD silica channel waveguides for optical communications
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

Nouvelle methode de connexion entre circuit integre sur Silcium et fibre optique monomode
1990/10 11èmes Journees Nationales d'Optique Guidee (JNOG)

Precision prism coupling setup applied to measure silica planar optical waveguides on silicon
1992/05 University Report; General Report CV in physics.

Self-aligned multiple coupling for silica on silicon integrated optics
1991/06 Proceedings EFOC'91

Silica on silicon optical waveguide technology : results on 3 dB coupler realisation
1991/01 Proceedings of OCTIMA'91

Silicon based integrated optics : a suitable technolgy for a hybrid approach to optoelectronics
1991/01 Proceedings of OCTIMA' 91

Silicon oxinitide 3dB coupler for 1540 nm single mode applications
1991 Proceedings ECOC '91

Wide pass band wavelength multi/demultiplexer at 1.3/1.55 μm based on etched Fresnel mirror
1992/06 IEE Proc. J. Optoelectronics

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
1991/11 Fifth RACE TMN Conference

A KBS for Mobile Cell Configuration
1990/11 4th RACE TMN conference

A Methodology for developing NCAS user interfaces
1991/11 Fifth RACE TMN Conference

A Model of a broadband session and of the corresponding charging record
1990/10 International Conference on Integrated Broadband Services and Networks

A Service Model for Network and Customer Administration Systems
1991/11 Fifth RACE TMN Conference

A specification of a distributed heterogeneous systems administration
1988/09 Workshop IEEE of future trends of distributed computing systems in 1990's

AIP architecture in R1009 ADVANCE
1989/04 TCG1 Workshop Laboratory de Marcoussis

An approach to Transparent Communication Handling in NCAS
1990/11 4th RACE TMN conference

An Architecture for the Implementation of an Integrated Management System
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1990/05 XIII International Switching Symposium

An Implementation Architecture for Network and Customer Admnistration Systems
1991/11 Fifth RACE TMN Conference

Applying artificial intelligence techniques to heterogeneous network management
1989/09 Network Management and Control Workshop

Article on Portugese work in RACE
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1991/07 BT Technology Journal, VOL. 9, NO. 3

Evaluating the combination of Logic and Object Oriented techniques in support of TMN
1991/11 Fifth RACE TMN Conference

Extending Database Technology
1991/01 AXIOM, Journal of LMERCSSON LTD. IRELAND, Issue 2

Generic Message Set - An Information Based Interaction Language
1990/11 4th RACE TMN Conference

Management of Open Networks in Heterogeneous Context
1990/09 International Symposium on Local Communications Systems Management - IFIP TC6

Model-based Network management
1990/11 4th RACE TMN Conference

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1991/11 Fifth RACE TMN Conference

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1991 Telecom Eireann Technical Journal, Issue 8

Service Behavioural Modelling
1991/11 Fifth RACE TMN Conference

Techniques for resolving hetrogeneity & masking complexity in TMN systems
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The application of object oriented distributed systems for Integrated Network Management Systems in IBCN
1990/11 4th RACE TMN conference

Unification of Heterogeneous Management by a Generic Object Oriented Agent
1990/11 4th RACE TMN conference

Will the Real Managed Objects Please Stand up
1991/10 6TH World Telecommunications Forum

R1010 Subscriber Coherent Multichannel System

100 kHz linewidth external cavity DFB laser assembly employing standard packaging methods
1989 Proceedings 15th ECOC - paper TuB10-5

140 Mb/s and 560 Mb/s FSK heterodyne polarisation diversity receiver using nearly perfect square-law
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3.8 nm continous tuning range of a low threshold distributed Bragg reflected laser
1990/09 IEEE International Semiconductor Laser Conference

A 2.3 GHz low noise balanced receiver for FSK heterodyne reception, using commercially available
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1991 ECOC 91

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A Bidirectional 1.5/1.3 μm Gbit/s direct detection system overlayed by a coherent 1.5 μm T-distribution system
1991 Proceedings EFOC/LAN 91

A coherent multi-bitrate multi-channel system for simultaneous transmission of 140 Mb/s TV and 560 Mb/s
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A linewidth and bitrate flexible FSK heterodyne system, using a frequency discriminator and biphase linecoding
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A new DFB-laser diode with reduced spatial hole burning
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A polarization Diversity Circuit in Lithium Niobate for Coherent Optical Transmission
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A self-routing ATM switch for small customer premises networks
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An Experimental Investigation into the Continuous Tunability of DBR Lasers
1988 Proceedings ECOC - Vol. 1

Analysis of Gain Coupled DFB lasers
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Analytical expressions for the sensivity penalty by large IF bandwidth in coherent optical ASK receivers with
1991 Elect. Lett., Vol. 26, No. 17

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1991/05 IEEE Photonics Technology Letters

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1990/03 Topical Meeting on Integrated Photonics Research

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1989 Plessey Research and Technology Review 1989

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Compact and low feedback optical polarisation diversity device
1989 IOOC 1989

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1990 OFC 1990

Comparison of polarization handling methods in coherent optical systems
1991 J. Lightwave Techn. LT-9

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Coupling coefficients in gain coupled DBF lasers: Inherent compromise between coupling strength and loss
1991/05 IEEE Photonics Technology Letters

Dependence of mode stability and linewidth of DFB lasers on facet reflectivity and coupling coefficient
1991 Elect. Letters 27

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1991 Electron. Letters 27

Fully engineers transmitter laser units implemented in a coherent multi-channel demonstrator system
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1991 Electronics Letters 27

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High performance PIN photodiodes on waveguide for coherent communications
1990 ECOC 90, paper TuG4.2

High-performance, 2 channel FSK heterodyne system with polarization diversity receiver
1990 ECOC '90, paper WeG2.5

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1991 Proceedings OFC 91, Paper no. TuH5

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1991/09 European Conference on Optical Communications (ECOC)

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1992/08 HFT, Darmstadt, 1993

The Usage Reference Model
1991 The Enabling States Approach : designing usable telecommunications services.

Usage oriented service design
1992/06 HFT, Darmstadt, 1993

Usage oriented service engineering
1992/08 International Symposium on subscriber loops and services, Vancouver, 1993

Usage Reference Model for Integrated Broadband Communications
1990/10 Proceedings of the IEE conference

R1079 CAR - CAR/CAM for Automotive Industry in RACE

A generic model for the use of high speed communications and CAD/CAM for design and manufacturability
1991/07 International Ergonomics Association, 11th Congress

A user-centred approach to define high-level requirements for next generation CAD systems for mechanical
1989/12 IEEE Transactions and Engineering Management Special Issue

An investigation into control protocols and use of video in a MULTIMEDIA task environment
1991/04 Ergonomics Society Annual Conference

An investigation into control protocols and use of video in a MULTIMEDIA task environment
1991/07 International Ergonomics Association, 11th Congress

An Investigation of User Requirements for Broadband Communications in the Automotive Industry
1990 Human Computer Interaction, Interact '90, Elsevier

An investigation of user requirements for broadband communications in the automotive industry
1990/08 Interact '90

Assimilating IBCN into CIM - some Human Factors aspects
1990/08 Human Factors in Design for Manufacturability in Process Planning (Hellander conference)

Communication and Interaction Issues in a Multi-Media Customer Facing System
1991/03 British Telecom FCTS Technical Workshop

Communications in the concurrent engineering paradigm - a European perspective invited paper in session,
1991/12 ASME 1991 Winter Meeting

Cooperative graphical applications in high speed networks
1991/10 Proceedings of the GI Conference - Darmstadt, Germany

Cooperative Sketching in a Network Environment for the Automotive Industry in Europe
1992 Eurographics '92 - Vienna, Austria

Design by Optimisation : Addressing Usability Problems in Multimedia Conferencing Systems
1993/04 Inter CHI 93, Amsterdam

Design to Product. A prototype of a system to enable Design for Manufacturability
1992/05 Chapter in "Human Factors in Design for Manufacturability", ed M. Helander and Mitsuo

Evaluating complex systems: the application of Heisenberg's uncertainty principle
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 fÁr zukÁnftige 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 pediŧtrico con integracięn 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 fo. 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 fÄr 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	I	
	- Brevetti Ericsson		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	Fundaciòn General de la Universidad Politècnica de Madrid	E	R1023
UPMC	DNAC - Université Pierre et Marie Curie	F	R1009
UST	Stirling University	UK	R106[illegible]

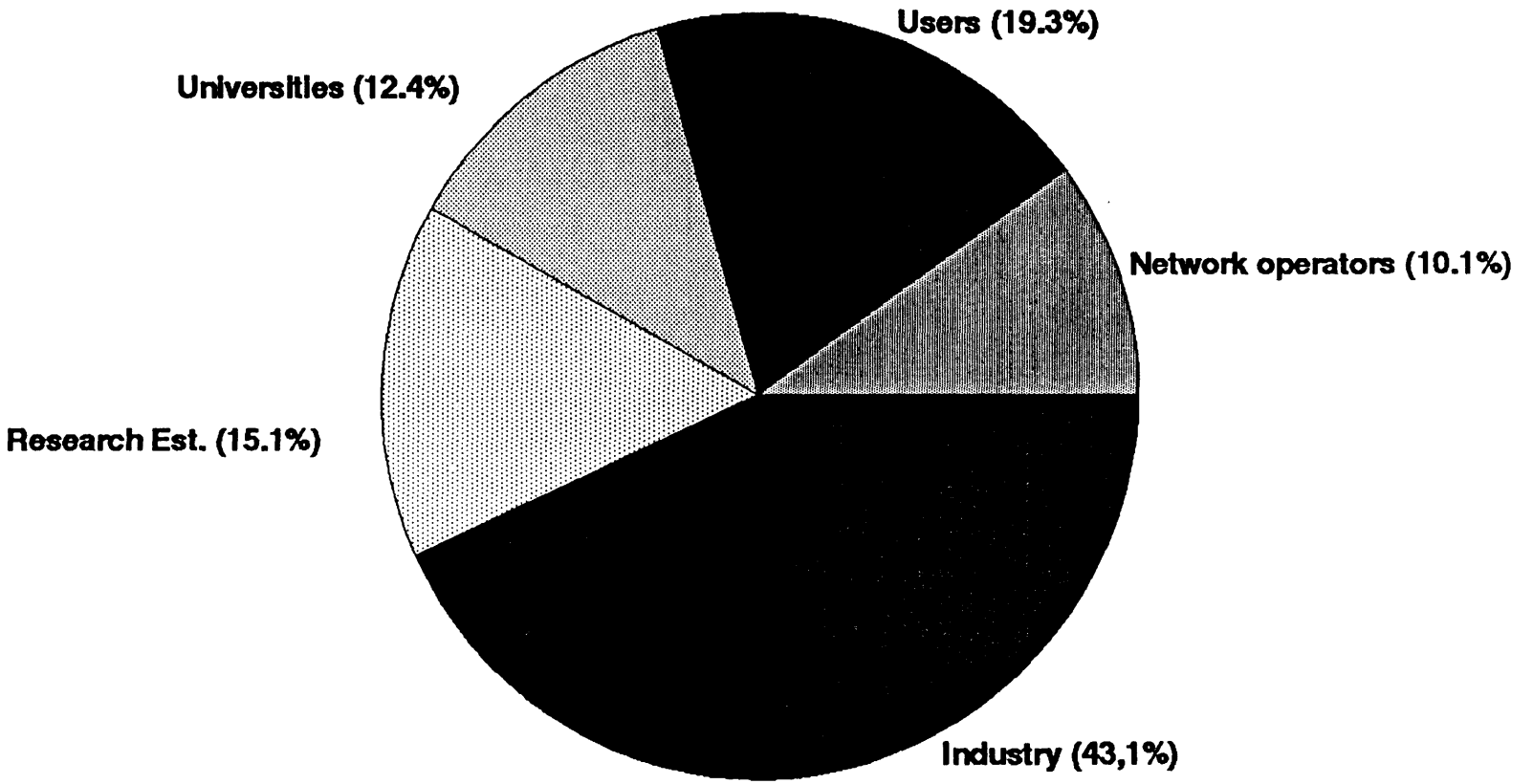
USTL	Université de Sciences et Techniques du Languedoc	F	R1029
UVA	University of Aarhus	DK	R1040
UVD	University of Durham	UK	R1084
UVL	University of Leuven	B	R1040
UVS	University of Surrey	UK	R1023
VERITAS	Det Norske Veritas	N	R1062
VITEC	VITEC	F	R1079
W&G	Wandel & Goltermann GmbH & Co	D	R1083*
WRC	Work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

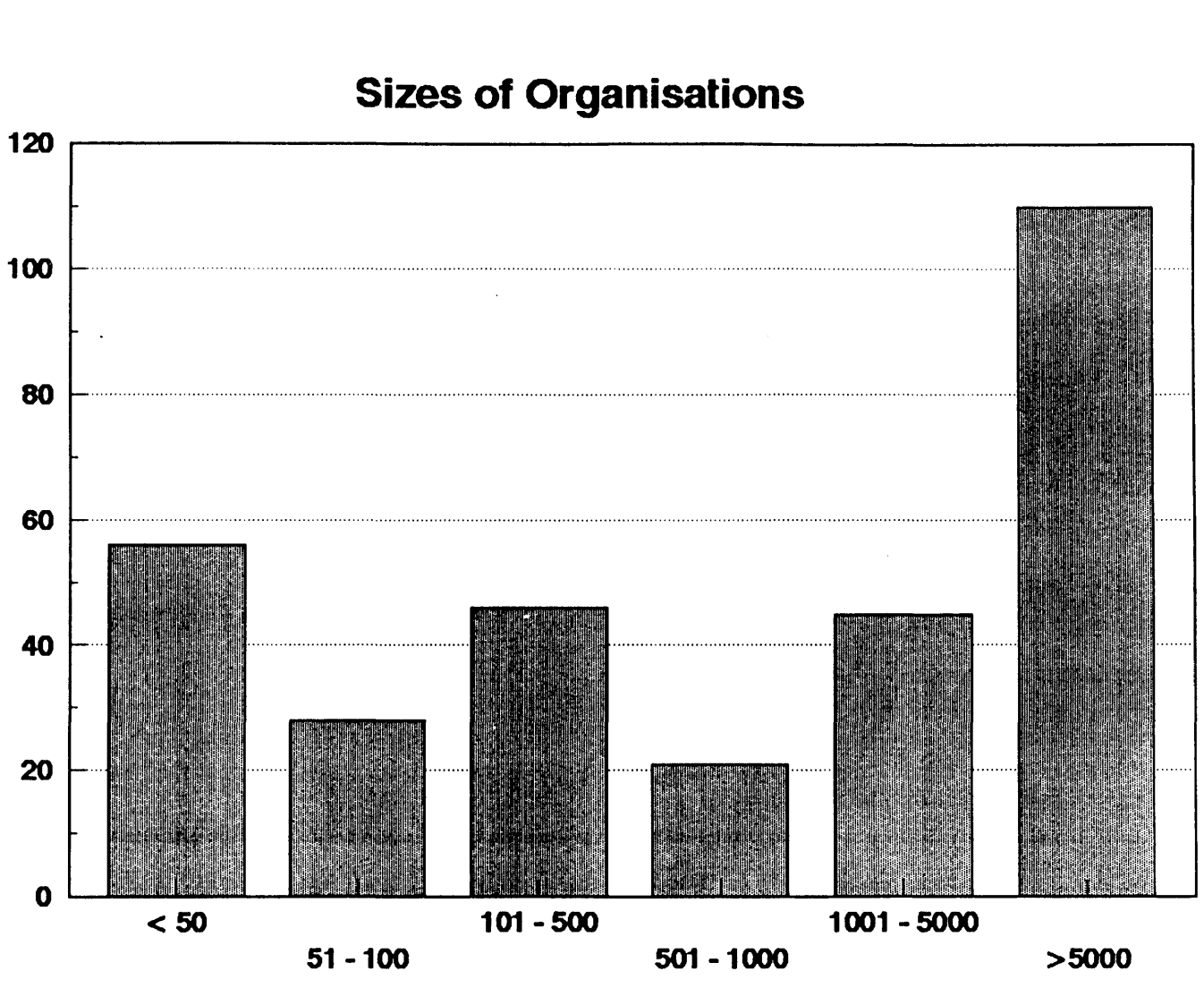
*** Prime Contractor for Project**

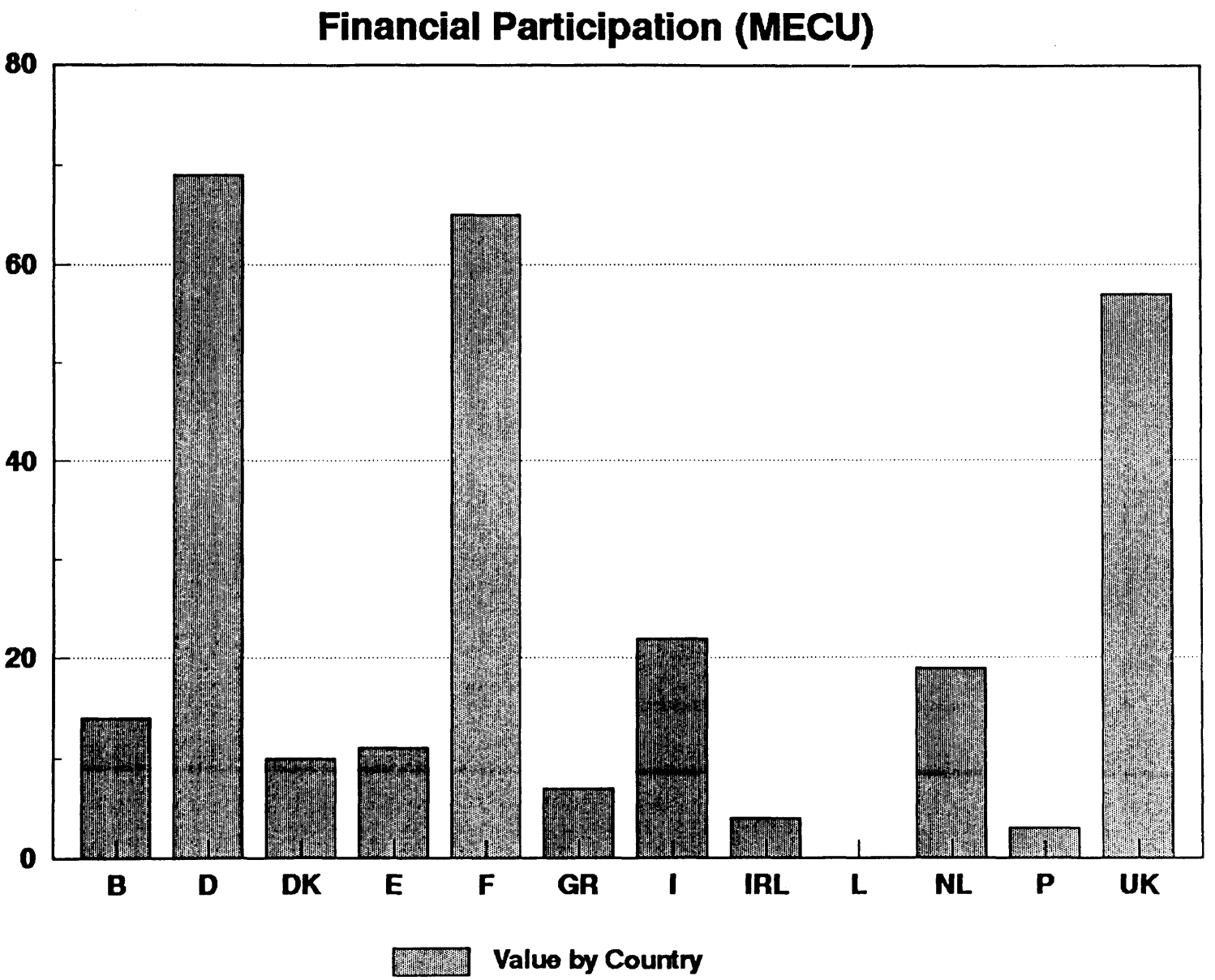
Annex IX

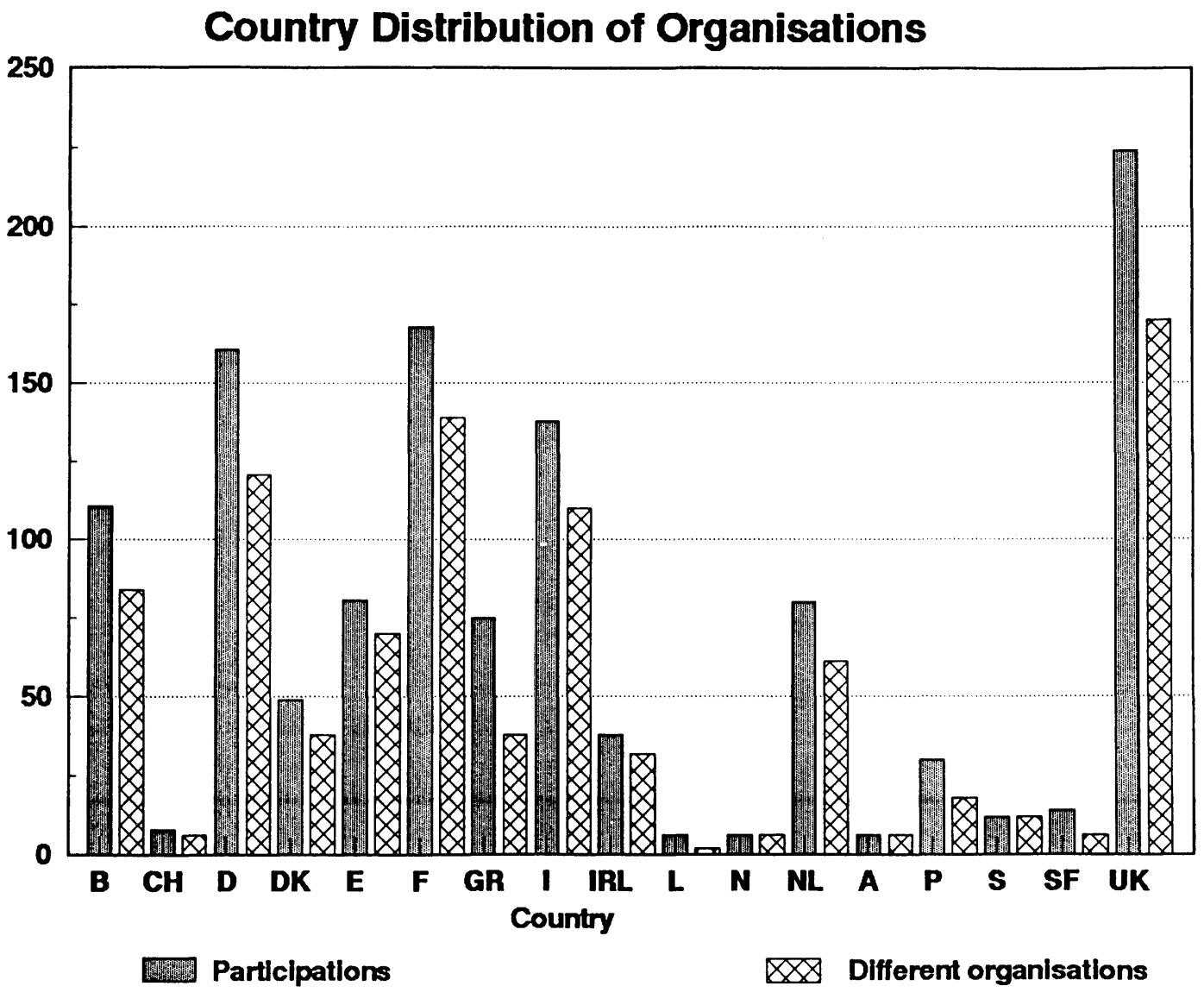
Financial and participation statistics

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)
80
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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