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F&U inden for avanceret kommunikationsteknologi i Europa (RACE)

Endelig rapport om fase 1 (1988-1992)
af det tiårige RACE-program

(forelagt af Kommissionen i henhold til artikel 6, stk. 3, og artikel 9 i Rådets beslutning 88/28/EØF vedrørende RACE-programmet)

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Sammenfatning

Telekommunikation er blevet et uundværligt element i produktions- og servicesektoren i Europa, og velfungerende teletjenester er en forudsætning for erhvervslivets konkurrencevne. Det grænsefrie Europæiske Økonomiske Samarbejdsområde vil ikke blot åbne nye muligheder, men også skabe nye konkurrencemæssige udfordringer. Efterhånden som telekommunikation bliver stadig vigtigere i international handel, er måden erhvervslivet opererer på under forandring. Europas succes i 1990'erne er kritisk afhængig af velfungerende kommunikation.

Den årlige omsætning i tele-, computer- og radio/tv-sektoren udgør allerede mere end 500 mia. ECU på verdensplan. I år 2000 vil telekommunikation være den tredjevigtigste sektor i Europa, kun overgået af levnedsmiddelsektoren og den kemiske industri. Infrastrukturen inden for telekommunikation vil være økonomisk vigtigere end de fysiske transportinfrastrukturer. Væksten inden for økonomi og beskæftigelse kommer således i høj grad til at afhænge af, om der er styr på teknologien. I dag baserer mere end halvdelen af beskæftigelsen sig på informations- og telematiksystemer, og størstedelen af væksten i beskæftigelsen foregår i informationssektoren.

Efterspøgslen efter tjenesteydelser ændrer sig hastigt. Virksomhederne har brug for mere fleksible tjenester, højere data- og billedtransmissionskapacitet og mere konkurrencedygtige priser. Den årlige tilvækst for tillægstjenester via digitale net med høj transmissionshastighed ligger nu på ca. 40%, med 40 mio. kombinationer af tjenester og brugere i 1987, 180 mio. i 1989 og mere end 300 mio. i 1991. Det ventes, at helt op til 30% af omsætningen inden for telekommunikation i år 2000 vil stamme fra tillægstjenester. Inden for de næste år vil de fleste større europæiske virksomheder have behov for at sammenkæde design, produktion, ledelse og distribution via hurtige kommunikationsforbindelser. Denne tendens tegner sig allerede kraftigt i USA, hvor alle større forskningsinstitutter har adgang til meget hurtig datakommunikation, og 60% af de 500 største virksomheder overfører data via digitale net med høj transmissionshastighed.

I erkendelse af denne udvikling blev der i 1985 iværksat en "definitionsfase" som led i RACE-programmet på initiativ af Ministerrådet (industri). Her blev det slået fast, at det ville være muligt og nyttigt at etablere en europæisk ramme for samarbejde på F&U-området. Ministerrådet vedtog i december 1987 en beslutning om første fase af det 10-årige program RACE (Research and development in Advanced Communications technologies in Europe). Heri fastlagde man en politik og et budget for den første periode på fem år, indtil 1992, som led i EF's 2. rammeprogram for forskning og teknologisk udvikling. Det var tanken at "gøre Fællesskabets telekommunikationsindustri, teleoperatører og teletjenesteleverandører mere konkurrencedygtige med henblik på hurtigst muligt og med de lavest mulige omkostninger at give slutbrugerne adgang til tjenester, der kan opretholde den europæiske økonomis konkurenceevne i de næste årtier og bidrage til at bevare og skabe beskæftigelse i Fællesskabet".

I beslutningens artikel 9 bestemmes følgende: "Ved afslutningen af programmets første femårsperiode tilsender Kommissionen, efter høring af Komitéen, medlemsstaterne og Europa-Parlamentet en rapport over udviklingen og resultaterne af programmet". Nærværende dokument udgør den omtalte rapport. Den ligger i forlængelse af 30-måneders-rapporten fra 1990.

De vigtigste resultater

Det arbejde, der er blevet gjort i løbet af RACE-programmets første fem år, har givet Europa en klar føring i forbindelse med den overordnede udvikling af avancerede telenet og -tjenester. For første gang er teleoperatører, telematikindustrien og førende brugere i de fleste anvendelsessektorer gået sammen om at udvikle avanceret teknologi, som er en forudsætning for billige og nyskabende tjenester. RACE-programmet har skabt et enestående miljø, hvor parterne trækker på samme hammel.

RACE-programmet har styrket harmoniseringen af den europæiske infrastruktur på teleområdet; med udarbejdelsen af EF-dækkende funktionsspecifikationer er der etableret en "skabelon" for integreret bredbåndskommunikation. Programmet har skabt et nært samarbejde mellem kerneområder og randområder, hvilket har styrket den økonomiske og sociale samhørighed i EF. På teknologiudviklingsområdet har udviklingen af ATM inden for højhastighedskobling af digital kommunikation givet den europæiske industri et forspring i den internationale konkurrence; europæiske systemer til styring af net er internationalt anerkendte på grund af den forskning, der udføres på dette område; arbejdet med digital video og tv er mundet ud i internationale kodningstandarder, systemer til fremføring af multigigabittransmissioner samt specifikationer for digital video. På standardiseringsområdet er der som led i programmet forelagt 596 udkast til specifikationer for europæiske og internationale organisationer - ETSI, CCITT og CCIR (se bilag II). RACE og EUREKA er kommet til at supplere hinanden på en meget positiv måde, og der er offentliggjort over 1700 videnskabelige og tekniske dokumenter (se bilag III).

RACE-programmets resultater giver de europæiske teleorganisationer og -tjenesteleverandører en strategisk konkurrencefordel. RACE har gjort erhvervslivet mere opmærksom på, hvordan den næste generation af teletjenester i Europa vil forøge markedsmulighederne. Programmet viser tydeligt, at det er en fordel at samarbejde på europæisk plan om konkurrenceforberedende F&U, og den europæiske standardisering er således blevet styrket betydeligt inden for teleområdet.

Forvaltning og evaluering af RACE-programmet

RACE-programmet er noget enestående inden for EF's 2. rammeprogram: det er det eneste program, som forvaltes som et samlet sæt opgaver; hvert enkelt projekt har sigtet mod en eller flere af et sammenhængende sæt F&U-opgaver, som hver især har bidraget til den fælles målsætning:

"Indførelse af integreret bredbåndskommunikation under hensyntagen til det tjenesteintegrerede digitalnet (ISDN), der er under udvikling, og de nationale introduktionsstrategier med gradvis udbygning til EF-dækkende tjenester frem til 1995."

I programmets arbejdsplan, som blev vedtaget i 1987, fastlagdes det, hvordan arbejdet i og mellem de forskellige projekter skulle foregå. Den vekselvirkning, man her søgte at opnå, er yderligere blevet styrket ved regelmæssig "samordning" af projekterne, i form af tekniske møder med intervaller på 6 – 8 uger, hvor samtlige projekter skulle være repræsenteret. De tekniske resultater af projekterne er endvidere cementeret ved et nøgleprojekt, hvor man skulle udforme strategier for indførelse af integreret bredbåndskommunikation (IBC), funktionsreferencemodeller, kundeservicefunktioner og referencekonfigurationer. Det stærke samspil med de europæiske standardiseringsorganisationisationer er fortløbende blevet sikret via en andet nøgleprojekt, som skulle sikre opbakning bag standarder og udarbejdelse af EF-dækkende funktionsspecifikationer.

Den høje grad af integration i programmet har også afspejlet sig i evalueringen og revisionen af arbejdet.

Der blev foretaget en strategisk revision af det samlede program i 1989, hvor man evaluerede arbejdet på baggrund af strategiske og politiske målsætninger for EF. I henhold til den tidligere omtalte beslutning blev der i "30-måneders-rapporten" aflagt rapport til Ministerrådet og Europa-Parlamentet om, hvordan arbejdet skred frem. I 1990 foretog et uvildigt panel af højtstående personer inden for industrien og medlemsstaternes administrationer en nyvurdering af behovene i forbindelse med F&U (Telecom 2000). I 1991 og i starten af 1992 blev arbejdet evalueret, sammenholdt med det 2. rammeprograms andre store programmer vedrørende informationsteknologi og telematik (ESPRIT og DRIVE), af et uafhængigt panel[1]. Endelig fremlagde Kommissionen i 1992 en rapport om programmet som led i evalueringen af det 2. rammeprogram[2], ligesom forvaltningskomitéen for RACE på opfordring af CREST selv foretog en evaluering[3].

Sideløbende med den FTU, der er udført i programmet, er der foretaget regelmæssige vurderinger af de økonomiske og sociale følgevirkninger af udviklingen af avancerede kommunikationsmidler[4]. Den seneste af disse vurderinger foregik i 1991, og resultaterne blev offentliggjort i 1992. Størstedelen af resultaterne er fuldt integreret i den anden fase af RACE i henhold til bestemmelserne i Rådets beslutning om særprogrammet for kommunikationsteknologi.

De programforvaltningsmetoder, som Kommissionen har fastlagt for RACE, blev underkastet en uvildig "programforvaltningsrevision" i 1989, som til fulde støttede Kommissionens holdning.

Hvad angår de enkelte projekter, udsættes de hvert år for en "teknisk revision", som foretages af uvildige tekniske eksperter inden for de pågældende forskningsområder. Den første af disse kontrolforanstaltninger fandt sted i oktober 1988, og den sidste i oktober 1992. Resultaterne heraf har tjent som beslutningsgrundlag for at tilpasse eller om nødvendigt afslutte forskellige projekter.

Samtlige vurderinger og revisioner har vist, at RACE-programmet har fungeret godt på baggrund af de oprindelige målsætninger.

Det arbejde, der blev sat i gang i første fase af RACE, er nu blevet fulgt op og udvidet med F&U-projekter i det nye særprogram for FTU inden for kommunikationsteknologi, som udgør anden fase af RACE. Den indgår i EF's 3. rammeprogram, hvorunder der blandt andet ydes delstøtte til F&U frem til december 1994. Disse projekter begyndte i januar 1992, og kontinuiteten er blevet sikret gennem de overlappende fase 1-projekter i 1992. Programmet vil fortsat spille en væsentlig rolle for den økonomiske udvikling og den sociale og økonomiske samhørighed i Europa. Det bakkes op af nationale tiltag[5] og internationale foranstaltninger, såsom EURESCOM's[6], som forstærker og forstærkes af EF-foranstaltningerne. RACE-programmet er en enestående ramme, inden for hvilken netoperatører, industrien og brugerne samarbejder.

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1) Rapporten fra revisionspanelet for informations- og kommunikationsteknologier med W. Dekker som formand, juni 1992.
2) Meddelelse fra Kommissionen: Evaluering af det andet rammeprogram for forskning og teknologisk udvikling (SEK(92)675 endelig udg.), juli 1992.
3) Se punkt 3.2.1 i nærværende rapport.
4) Rapporterne herom er blevet udsendt til vide kredse under titlen "Perspectives for Advanced Communications in Europe: PACE"
5) Forsøg med bredbåndskommunikation er under etablering i B, D, DK, F, IRL, P og UK.
6) Det europæiske institut for telekommunikationsforskning og strategiske studier GmBH.

F&U inden for avanceret kommunikationsteknologi i Europa (RACE)

Endelig rapport om fase 1 (1988-1992)

af det tiårige RACE-program

1. Indledning

Telekommunikation er den mest dynamiske og ekspanderende af samtlige industrisektorer i Europa. Teletjenester skaber en omsætning på mere end 300 mia. ECU pr. år i Europa, og den årlige investering i telenet og -tjenester beløber sig til nær ved 30 mia. ECU. Hovedparten af omsætningen stammer stadig fra taletelefoni, men investeringerne retter sig nu først og fremmest mod de nye generationer af digitalt udstyr, hvormed man kan integrere tale-, data- og billedkommunikation. I år 2000 ventes helt op til 30% af indtægterne på telekommunikation at stamme fra tillægstjenester, som anvender avanceret datakommunikation.

Over hele verden påvirker det stigende sammenfald mellem informationsteknologi, radiospredning og telekommunikation alle aspekter af samfundet. Kombinationen af databehandlingsteknikker og nyskabelser inden for telekommunikation har allerede ført til ISDN (det tjenesteintegrerede digitalnet), men det er kun første skridt i en hastig udvikling henimod et langt bredere udvalg af multimedietjenester, som vil forudsætte ny teknologi og nye net- og tjenesteforvaltningssystemer og ny lovgivning. Kombinationen af tjenesteintegration og lyslederkabler, som muliggør omkostningseffektiv transmission med høj hastighed (en million gange hurtigere end via kobberkabler), giver teknisk og økonomisk grundlag for en fundamental omlægning af alle disse sektorer via integreret bredbåndskommunikation (IBC). Udviklingen heraf er målet for RACE-programmet.

I nærværende rapport gives en oversigt over samt dokumentation for resultaterne af første fase af det ti-årige RACE-program, dvs. perioden fra 1988 til 1992.

I anden del redegøres for, hvordan programmet er udformet og hvilke resultater det har givet, samt hvilken sammenhæng det indgår i, mens det i tredje del beskrives, hvordan programevaluering og -revision er udformet, samt hvilke resultater disse aktiviteter har givet. Forbindelserne til andre EF-foranstaltninger og europæiske foranstaltninger beskrives i fjerde del. Resultaterne af F&U i første fase af RACE er allerede i vidt omfang blevet udnyttet, både i forbindelse med udarbejdelse af standarder og idriftsætning af nye net og tjenester samt som grundlag for yderligere arbejde i programmets fase II. I femte del beskrives det, hvordan man har udnyttet resultaterne af fase I af RACE, og overgangen til fase II beskrives i sjette del. I syvende del redegøres der for, hvilket arbejde man bør og kan udføre på europæisk plan.

I bilag I findes en detaljeret oversigt over, hvilke resultater der er opnået ved F&U-projekterne. Bilag II indeholder en fortegnelse over bidrag til standardiseringsfremmende arbejde, og bilag III er en liste over samtlige videnskabelige og tekniske publikationer, som arbejdet har givet anledning til. Bilag IV indeholder en liste over patentansøgninger; bilag V er en ordliste over tekniske termer, mens der i bilag VI henvises til formelle ministerrådsbeslutninger og -afgørelser samt meddelelser fra Kommissionen. Bilag VII er en liste over F&U-projekter, som har modtaget støtte i fase I af RACE; I bilag VIII angives det, hvilke organisationer, der har deltaget, og sluttelig indeholder bilag IX statistiske oplysninger om finansiering af og deltagelse i projekterne.

2. RACE-programmets kontekst og udformning

2.1 F&U som led i EF's politik for teleområdet

RACE-programmet udgør en integrerende del af EF's politik for teleområdet. Det hænger nært sammen med den politik, der føres i forbindelse med standardiseringsområdet og informationsmarkedet, ligesom det bygger videre på nyskabelser inden for informationsteknologi i forbindelse med ESPRIT. Programmet er ligeledes nyskabende derved, at man inddrager de europæiske telenetoperatører som væsentlige deltagere i et nært samarbejde om udviklingen af teknologi og tjenester. Eftersom omkostningsniveauet i Europas fremtidige kommunikationsinfrastruktur spiller en væsentlig rolle i RACE, har programmet medvirket til at virkeliggøre det indre marked samt til at øge den europæiske industris konkurrencedygtighed og den sociale og økonomiske samhørighed i Fællesskabet.

De vigtigste målsætninger i EF's politik for teleområdet er, som omhandlet i Rådets resolution af 30. juni 1988[1]:

- at sikre netintegriteten i hele Fællesskabet, jævnfør princippet om fuld interkonnektivitet mellem alle berørte offentlige net
- gradvis at skabe et åbent fælles marked for teletjenester
- at fremme skabelsen af Europa-dækkende tjenester i overensstemmelse med markedsbehov og samfundsmæssige behov
- at videreudvikle et åbent EF-dækkende marked for terminaludstyr
- at udvikle et fælles marked, hvor teleadministrationer og andre televirksomheder kan konkurrere på lige fod
- at videreføre Fællesskabets foranstaltninger for fælles standarder
- at stimulere til europæisk samarbejde på alle niveauer, specielt inden for forskning og udvikling på teleområdet
- at skabe et socialt miljø for den fremtidige udvikling af teleområdet, og
- fuldt ud at integrere Fællesskabets mindre gunstigt stillede områder i det fremvoksende fælles marked.

Med disse målsætninger er der udstukket en klar ramme for, hvordan teknologi, tjenester og anvendelsesområder kan udvikle sig fremover.

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1) Rådets resolution 88/C 257/01 af 30. juni 1988 om etablering af et fælles marked for teletjenester og -udstyr inden 1992 (EFT nr. C 257 af 4.10.1988, s 1).

2.2 Målsætningerne for RACE

Det er først og fremmest meningen, at RACE skal medvirke til

"Indførelse af integreret bredbåndskommunikation (IBC)[2] under hensyntagen til det tjenesteintegrerede digitalnet (ISDN), der er under udvikling, og de nationale introduktionsstrategier med gradvis udbygning til EF-dækkende tjenester frem til 1995.[3]"

Fase I havde følgende specifikke målsætninger:

- at fremme EF's teleindustri
- at give de europæiske netoperatører mulighed for at konkurrere på bedst mulige vilkår
- at gøre en tilpas stor del af medlemsstaterne i stand til at indføre økonomisk levedygtige IBC-tjenester inden udgangen af 1995
- at give tjenesteleverandørerne mulighed for at øge omkostningseffektiviteten og tilbyde nye tjenester til mindst lige så lave priser og lige så hurtigt som andre steder
- at støtte dannelsen af et indre europæisk marked for teleudstyr og -tjenester, samt
- at medvirke til regionaludviklingen ved at lade de mindre gunstigt stillede regioner drage den fulde nytte af udviklingen på teleområdet.

Derudover opstilles der i bilag I til beslutningen en række tekniske målsætninger. I tabel 1 beskrives det, hvordan F&U-projekter under RACE har medvirket til at virkeliggøre disse målsætninger.

Under udarbejdelsen og gennemførelsen af programmet har der været en ændring i, hvordan man forstår udtrykket "integreret bredbåndskommunikation" som følge af nye markedsmæssige og lovmæssige forhold. Nedenstående definition afspejler de konklusioner, man nåede frem til i forvaltningskomitéen for RACE i 1990.

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2) "I" for "integreret" betyder ikke kun "integrerede tjenester" (på brugerniveau og i de relevante netlag), men også, at der er sammenhæng i hele nettet, dvs. at der kan etableres samtrafik mellem alle dets dele, både eksisterende og kommende: telefoni, pakkekobling, ISDN, satellit- og mobiltjenester osv.

"B" for "bredbånd" henviser ikke blot til den "øvre ende" (m.h.t. bithastighed) af tjenesterne, men også til det samlede udvalg af tjenester, der kommer i betragtning, begyndende med den "øvre ende" af ISDN (i hvert fald fra og med tilslutninger på 2 Mbits/s og inden for bestemte anvendelsesområder muligvis endda 64 Kbits/s) og op til det, som det realistisk set vil kræve at indføre interaktive og distributive videotjenester (f.eks. 140 Mbit/s).

"C" for (eng.) "communication" henviser ikke kun til "gammeldags" opkoblings- og transmissionsfunktioner og abonnentnetplacerede net, men også til de mest avancerede funktioner, der skal gøre tjenesteudbuddet brugervenligt, ydedygtigt og økonomisk bæredygtigt.

3) Rådets beslutning af 14. december 1987 om et fællesskabsprogram inden for telekommunikationsteknologi - forskning og udvikling inden for avanceret kommunikationsteknologi i Europa (RACE-programmet) (EFT nr. L 16 af 21.1.88, s. 35)

Tabel 1

Tekniske målsætninger	Måder hvorpå målene søges nået i RACE	Virkninger af RACE-arbejdet
Målsætninger i del I: Strategier for udvikling og implementering af IBC		
Fælles opfattelse af IBC-udviklingen og dens betydning	Etablering af samarbejde mellem operatører, industri og brugere Fælles strategisk teknisk-økonomisk analyse, som bl.a. omfatter efterspørgsel og teknologiske muligheder	Udarbejdelse af en fælles metode for "systemkonstruktion" i forbindelse med planlægning af netudvikling Fastlæggelse af, hvordan IBC bedst kan indføres Fælles fastlæggelse af de vigtigste tekniske emner Konsekvent EF-holdning til internationale aktiviteter uden for RACE
Fælles definition af IBC-systemer og -delsystemer	Udarbejdelse af en referencekonfiguration til brug ved fastlæggelsen af systemstrukturen i det integrerede bredbåndskommunikationsnet (IBCN) og af anvendelige implementeringsmåder og teknologiske muligheder	Styrkelse af europæisk standardisering Enighed om en fælles europæisk strategi for ATM-specifikationer
Retningslinjer for funktionsspecifikationer for IBC-systemer og integrerede tjenester	Udarbejdelse af en funktionsreferencemodel, herunder en logisk struktur for funktioner og grænseflader	Enighed om fælles funktionsspecifikationer Enighed om koncepter og protokoller for "netintegration" Enighed om muligheder for opbygningen af abonnentnettet for bredbåndskommunikation på mellemlang og lang sigt
Bestemmelse af teknologi- og F&U-behov	Fælles udarbejdelse af en brugsreferencemodel med henblik på at sammenholde brugernes behov med de tekniske muligheder Fælles vurdering af teknologiske nyskabelser	Europæisk F&U-fokusering på nøgleteknologier og nye brugerbehov
Bedømmelse af omkostningseffektivitet ved alternative implementeringsmåder	Udarbejdelse af fælles metoder til vurdering af teknisk-økonomiske og driftsmæssige faktorer	Der er udviklet fælles metoder til teknisk-økonomisk analyse samt avanceret netplanlægning og -forvaltning
Behovsanalyse i forbindelse med standardisering	Regelmæssige møder med standardiseringsorganisationer; samordning mellem konsensusforvaltningsprojektet og (ETSI), og fælles analyse af standardiseringsbehov, som følger af udviklingen i brugernes behov på verdensplan	596 bidrag til standardiseringsorganisationer (bilag II)

Tabel 1

Tekniske målsætninger	Måder hvorpå målene søges nået i RACE	Virkninger af RACE-arbejdet
Målsætninger i del II: IBC-teknologi		
Anvendelse af avanceret teknologi til omkostningseffektiv iværksættelse af IBC	F&U i komponenter, delsystemer og systemer, hvor omkostningskritiske optiske komponenter, både til bredbåndstransmission frem til abonnenterne og til centraler Analyse af mulighederne for omkostningsreduktioner på kort sigt Analyse af mulighederne for væsentlige omkostningsreduktioner og forbedring af tjenester på mellemlang/lang sigt	Specificering og prototypeudvikling af konnektorer, lasere og koblingselementer til lokalnet, abonnentplacerede net og lign. Demonstration heraf og forslag til billige produktionsprocesser Udvikling af "direkte" og "kohærente" detekteringsteknikker. Udvikling af ATM-teknologi med henblik på omkostningseffektiv brug af båndbredderessourerne Udvikling af kompatible algoritmer til bitkompression i forbindelse med digital HDTV og højkvalitetsvideotjenester samt udvikling af billige KODEK
Telekommunikationsprogrammel til komplekse integrerede systemer	Udvikling af en ny arkitektur for tilrådighedsstillelse af tjenester: Open Service Architecture Analyse af muligheder for at anvende avancerede informationsbehandlingsteknikker til at implementere IBC-funktioner Analyse af nye programmelteknologi til specifikation, design, implementering, verifikation og vedligeholdelse af telesystemer	Udvikling af "objektorienteret" programmering til telesystemer. Validering af integrerede programmelkonstruktionsmetoder på prototypeplan Udvikling af TMN-arkitekturer og prototyper til trafikforvaltning, vedligeholdelse, kvalitetskontrol for tjenester, abonnent- og netforvaltning samt sikkerhed i kommunikationen Specifikationsmetoder, udviklingsmiljø og on-line assistance for telesystemer Fastlæggelse af integritetskoncepter for IBC-tjenester, samt en fortegnelse over grundprincipper for integritet
Fremskridt med hensyn til IBC-udstyrets ergonomi og kognitive muligheder	Analyse af, hvilke faktorer der påvirker brugsegnetheden af dialog-, distibutions- og genfindingtjenester samt integrerede tjenester og abonnentplacerede net Analyse af brugsegnethedsspørgsmål for mennesker med særligt behov (f.eks. ældre og handicappede) Udarbejdelse af designmål i forbindelse med brugsegnethed Inddragelse og evaluering af brugsegnethedsforsøg i praktiske forsøg	En taksonomi for teknisk udvikling i forbindelse med brugsegnethed Anvendelse af brugeregnede tjenester i forsøg med avanceret kommunikation, herunder også for mennesker med særligt behov Større samspil mellem brugsegnethedsforskere, brugere og udstyrskonstruktører Fælles plan for indkredsning og analyse af almindelige brugsegnethedsproblemer i pilotprojekter for anvendelsesområder

Tabel 1

Tekniske målsætninger	Måder hvorpå målene søges nået i RACE	Virkninger af RACE-arbejdet
Realisering af fremtidssikrede delsystemer og net	Definition og demonstration af generiske arkitekturer for IBC-systemer og -delsystemer, herunder reduktion af bithastigheder ved video	Specifikation af funktions- og designkrav til lokalnet, abonnentplacerede net og terminaler (multi-service, multimedia, herunder også digital video og tynde skærme)
	Etablering af principper for abonnentplacerede net med henblik på at opfylde behov i boligen og erhvervslivet	Demonstration af tynde EL-farveskærme og drivere
	Prototyper af forskellige terminaler	Designs for komponenter og delsystemer til abonnentplacerede net i ATM-miljø i boligen og erhvervslivet
	Tilpasningsdygtige systemer, som muliggør glidende udvikling fra de nuværende systemer til IBC	Specifikationer for integrerede systemer og validering af disse ved demonstration
	Integrerede systemer, der omfatter lokalnet, abonnentplacerede net og terminaler, indbyrdes forbundet gennem vedtagne grænseflader	
Målsætninger i del III: Forsøgsordning for anvendelse af IBC		
Udvikling af afprøvningsmetoder, afprøvning af konstruktionsprincipper, funktionsgrupper eller protokoller	Udvikling af værktøjer og procedurer til prøvning af netelementer og delsystemer til IBC	Indkredsning af metoder og IBC-funktioner i terminaler og abonnentplacerede net samt i koblingselementet på lokal- og hovedcentraler
	Afprøvning af protokoller ved kritiske IBC-referencepunkter	Identifikation af tilslutningspunkter og -protokoller for prøvning. Anbefalede metoder til afprøvning af, hvorvidt protokollerne overholdes
Forbedring af funktionsspecifikationer og/eller afprøvning af standardforslag	Integration af pilotsystemer med henblik på afprøvning af samtrafikprotokoller	Specifikation af systemer og delsystemer i multiservicemiljø
	Standardforberedende afprøvning af kritiske punkter for standardisering og specificering	Validering af ordninger til påvisning af driftskompatibilitet og overholdelse af standarder og specifikationer
Udvikling af forsøgssituationer, hvor tjenesteleverandører, netoperatører og brugere kan afprøve IBC-forsøgsprodukter med henblik på at afgøre, hvorvidt der er basis for kommerciel udnyttelse	Definition af fremtidige tjenestebehov i samarbejde med førende brugere i alle større erhvervsbrancher	Praktiske forsøg i alle større sektorer: bankvæsen og finansiering, forsikring, medie- og udgivelsesvirksomhed, fremstillingsvirksomhed, sundhedsvæsen, mennesker med særligt behov, transport og distribution, forsøg med højopløsnings-tv
	Etablering af IBC-pilotprojekter på forskellige steder i Europa	
	Udforskning af forhold vedrørende sammenkobling og samfunktionalitet	Aftaler om sammenkobling af pilotprojekter og fastlæggelse af, hvad dette forudsætter

2.3 Gennemførelsen af programmet

Som følge af den europæiske telesektors hastige udvikling besluttede man at gennemføre RACE-programmet i flere faser. Programmet indledtes med en definitionsfase[4] i 1986. Derefter fulgte fase I, som denne rapport omhandler. Den begyndte formelt i juni 1987 og sluttede i december 1992.

I fase I foregik arbejdet i tre dele:

Del I - udviklings- og gennemførelsesstrategier for IBC

Projekterne i Del I beskæftigede sig med udvikling af funktionsspecifikationer, systemer og driftsanalyse med henblik på at opstille forslag til IBC-standarder, koncepter og konventioner som led i tilrådighedsstillelse af åbne systemer, samt med analyse af interoperabilitet mellem IBC-udstyr og -tjenester. Resultaterne af projekterne i Del I er offentligt tilgængelige og udgør et vigtigt bidrag til arbejdet i de internationale standardiseringsorganisationer.

Del II - IBC-teknologi

Projekterne i Del II beskæftigede sig med de tekniske problemer ved at indføre IBC. Dette arbejde har spillet en stor rolle i forbindelse med udviklingen af den teknologi, der er nødvendig for at indføre IBC-udstyr og tjenester til en realistisk pris.

Del III - standardforberedende funktionel integration

Projekterne i Del III beskæftigede sig med standardforberedende målsætninger i forbindelse med indførelsen af et "åbent verifikationsmiljø", beregnet til at vurdere funktioner og driftsprincipper. I tyve af projekterne i denne del af programmet anvendtes pilotapplikationer af avanceret kommunikation til forskellige anvendelser i erhvervs- og servicesektoren. I disse projekter afprøvede man, hvorvidt nyt udstyr og nye anvendelser levede op til de funktionsspecifikationer og standardiseringsforslag, der var opstillet i projekterne i Del I.

RACE-programmet blev gennemført i to trin. Det første sæt projekter, som begyndte i januar 1988, drejede sig om systemudvikling (Del I) og teknologiarbejde (Del II)[5]. Det andet, som drejede sig om analysering af fremtidige tjenester samt systemintegration og -verifikation (Del III) dannede grundlag for en indkaldelse af forslag i juli 1988. Disse projekter blev sat i gang i januar 1989.

Vægtningen af de forskellige dele af programmet udviklede sig under udvælgelsen af projekter og under gennemførelsen af programmet. De midler, der var afsat til Del I, blev forøget fra de forventede 11,9% til 18%, mens Del II blev reduceret fra 66% til 55% og Del III steg fra 22,4% til 27%. Denne udvikling afspejlede, at vægten flyttede sig fra teknologiudvikling til tjenesteudvikling og efterspørgselsanalyse, ligesom kvaliteten af forslagene i Del I og II af programmet medvirkede til udviklingen.

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4) Rådets afgørelse 85/372/EØF af 25. juli 1985 om en definitionsfase for en fællesskabsaktion inden for telekommunikationsteknologi - F&U-program inden for avanceret kommunikationsteknologi for Europa (RACE) (EFT nr. L 210 af 7.8.1985, s. 24)

5) Meddelelse fra Kommissionen til Rådet og Parlamentet: På vej mod Telekom 2000: iværksættelse af RACE-programmet (KOM(88)240 endelig udg. af 31.5.88)

Denne fordeling af de finansielle midler fremgår også af Tabel 2.

TABEL 2

OVERSIGT OVER ANVENDELSEN AF DE FINANSIELLE MIDLER I RACE-PROGRAMMETS FASE I

PROGRAM	AFSAT (mio. ECU)	AFSAT (%)	REELT BRUGT (%)
Del I	60	11,9	18,0
I.1 Strategier for IBC	14	2,8	
I.2 Indførelse af IBC	28	5,5	
I.3 Anvendelse af IBC	10	2,0	
I.4 Fælles driftsmiljø	8	1,6	
Del II	332	65,7	55,0
II.1 Systemfunktioner for IBC	94	18,6	9,0
Programmeringsinfrastruktur for IBC	49	9,7	25,0
Brugsegnethedsprogrammering	12	2,4	11,0
Netudvikling	177	35,0	10,0
Del III	113	22,4	27,0
III.1 Verifikationsmetoder	63	12,5	6,0
III.2 Pilotprojekter for anvendelse af IBC	50	9,9	

De 92 F&U-projekter har haft deltagelse af 306 virksomheder, heriblandt samtlige større europæiske televirksomheder. Derudover også 27 organisationer fra EFTA-landene (Finland, Norge, Schweiz, Sverige og Østrig).

2.4 De vigtigste resultater

RACE har styrket harmoniseringen af den europæiske infrastruktur på teleområdet: dette er en forudsætning for virkeliggørelsen af det indre marked. De fælles funktionsspecifikationer kan ses som en model for europæisk bredbåndskommunikation. Det har kun været muligt at nå så vidt, fordi samtlige europæiske netoperatører, teleindustrien, radio/tv-organisationer og førende brugere har samarbejdet. Samarbejde har været en hjørnesten i RACE.

RACE har ligeledes skabt øget opmærksomhed om de ændringer, der sker inden for teleområdet, og dette har i høj grad været medvirkende til at give den europæiske teleindustri og tjenesteleverandørerne et strategisk forspring i konkurrencen på det stadig mere verdensomspændende marked for teleudstyr og –tjenester.

Ønsker man mere detaljerede beskrivelser af, hvilke resultater der er opnået i de enkelte projekter, henvises til nærværende rapports bilag I samt årsrapporterne for 1988, 1989, 1990, 1991 og 1992. I det følgende opsummeres de vigtigste resultater inden for programmets forskellige områder.

De vigtigste resultater i Del I: Strategier for udvikling og indførelse af IBC

Dette arbejde er mundet ud i en fælles opfattelse af, hvordan IBC bør udvikles, og hvad det vil forudsætte: et effektivt samarbejde mellem operatører, industri og brugere om udvikling af fælles funktionsspecifikationer for IBC og om fælles strategiske teknisk-økonomiske undersøgelser.

Der er etableret nære forbindelser til europæiske og internationale standardiseringsorganisationer. I 1989 blev der oprettet en gruppe, som skulle sikre samordning mellem konsensusforvaltningsprojektet og Det Europæiske Institut for Telestandarder (ETSI). Arbejdet med asynkron transmission (ATM) har direkte medvirket til at skabe enighed om en fælles europæisk strategi for dette område, ligesom det har sat skub i udarbejdelsen af internationale standarder.

Der er udarbejdet fælles definitioner af IBC-systemer og -delsystemer samt referencekonfigurationer, hvori man definerer systemstrukturen i IBCN-nettet. Der er vedtaget funktionsspecifikationer for IBC-systemer og integrerede tjenester. Der er opstillet en funktionsreferencemodel, som udstikker en logisk struktur for IBC-funktioner og -grænseflader. Den giver at fast holdepunkt, når det ved implementeringen skal fastlægges, hvilke krav og behov funktionerne skal opfylde. Der blev i 1990 udsendt fælles funktionsspecifikationer (CFS - *Common Functional Specifications*).

Der er opstillet definitioner for grænseflader ved de vigtigste referencepunkter i bredbåndsnet, ligesom komponent- og systemkrav er blevet defineret.

Der er udviklet en "brugsreferencemodel", som skal fungere som en model for, hvordan brugernes behov skal kobles til de funktionelle krav.

Der er foretaget systematiske vurderinger af de teknologiske og driftsmæssige muligheder, herunder optisk kommunikation, mobilkommunikation, satellitter, abonnentplacerede net, nye koblingsteknikker og HDTV.

Der er udviklet metoder til at bedømme omkostningseffektiviteten i alternative implementationsmåder: én af disse har at gøre med økonomisk analyse, en anden med netplanlægning og -standarder. Ved hjælp af disse metoder kan man sammenligne muligheder og strategier i de forskellige lande og sammenholde dem med tekniske og økonomiske forhold samt standardiseringsspørgsmål.

De vigtigste resultater i Del II: IBC-teknologi

F&U har hovedsagelig beskæftiget sig med omkostningskritiske optiske komponenter, delsystemer og systemer til bredbåndstransmission både til abonnenter og til centraler. Målet har været at finde omkostningseffektive løsninger til brug inden for alle vigtigere områder.

Tanken med ATM-teknologi er at indføre bredbåndskommunikation på en fleksibel og "fremtidssikret" måde. Man har udviklet og sammenlignet forskellige ATM-teknikker, og der er opstillet kravspecifikationer for ATM-koblingssystemer.

Der er udviklet kompatible videokodningsteknikker for (højopløsnings-)tv og videotelefoni, hvormed man kan sikre, at båndbredderessourcerne udnyttes på en omkostningseffektiv måde. Der er foretaget simuleringer for anvendelse af algoritmer til kompression i forbindelse med videotjenester af høj kvalitet (tv & videotelefon), og udviklingen af KODEK har allerede spillet en stor rolle i forbindelse med standardisering og kommerciel indførelse af billigere videokonferencer.

Der er sket store fremskridt inden for optiske kommunikationssystemer til fremføring af multigigabittransmissioner samt inden for fotonisk switching. Der er udarbejdet specifikationer for systemer, delsystemer og komponenter (konnektorer, lasere, koblingselementer og lignende) med særlig hensyntagen til prisniveauer på forskellige anvendelsesområder (lokalnet, abonnentplacerede net osv.). Forskellige komponenter og delsystemer er blevet fremstillet og demonstreret som prototyper.

Hvad angår software til integrerede komplekse telesystemer, er der udarbejdet objektorienterede modeller og defineret arkitekturer og prototyper for trafikforvaltning, vedligeholdelse og abonnent- og netforvaltning, ligesom der er etableret specifikationsmetoder og "udviklingsmiljø" for on-line assistance til telesystemer. Der er defineret en arkitektur for kommunikationssikkerhed.

Inden for ergonomisk og kognitiv forskning, er der opstillet en taksonomi for systemkonstruktion med henblik på brugsegnethed, der er fastlagt retningslinjer for konstruktion med henblik på brugsegnethed i forbindelse med avanceret kommunikation, herunder også for mennesker med særligt behov.

Der er udviklet generiske arkitekturer og hensigtsmæssige teknikker og teknologi for IBC-systemer og delsystemer, herunder videokompression. De fungerer som en model for, hvordan man kan opfylde privat- og erhvervssektorens og andre sektorers behov for en lang række forskellige anvendelser.

Der er foretaget afprøvning af forskellige typer terminaler med tynde skærme, som herefter er blevet tilpasset til anvendelse i IBC-tjenester. Funktionspecifikationer og teknologiske udviklinger er blevet valideret ved forsøg med integrerede systemer (som omfatter lokalnet, abonnentplacerede net og terminaler, sammenkoblet via fælles grænseflader ved S- og T-referencepunkter).

Forskningen i mobilkommunikation har fungeret som skabelon for 3. generation af cellebaserede radiokommunikationssystemer. Dette har ført til udarbejdelsen af UMTS (Universal Mobile Telecommunications), som forventes at opfylde efterspørgslen på det europæiske marked i midten af 90'erne.

De vigtigste resultater i Del III: Udarbejdelse af gennemførelsesordninger for IBC

Arbejdet på dette område har først og fremmest drejet sig om verifikationsmetoder og verifikation af designkoncepter, funktionsgrupper eller protokoller. Systemkonstruktører og testdesignere har i fællesskab udviklet metoder, hvormed der er foretaget afprøvning af terminaler, abonnentplacerede net, abonnenttilkoblingssystemer, lokal- og hovedcentraler og transmissionssystemer. Der er etableret netprøvningscentre og -protokoller.

I de pilotprojekter, der er igangsat vedrørende IBC, har tjenesteleverandører, netoperatører og brugere afprøvet IBC-forsøgsprodukter, så man hurtigere kunne fastlægge, hvad der er vigtigt i forbindelse med kommerciel udnyttelse af IBC. Der er gennemført forsøgsapplikationer inden for alle vigtigere sektorer: bankvæsen og finansiering, forsikring, medier og udgivelsesvirksomhed, fremstillingsvirksomhed, sundhedsvæsen, mennesker med særligt behov, transport og distribution samt forsøg med HDTV. Mere end 100 førende brugere har deltaget heri.

I forbindelse med gennemførelsen af Del III og visse supplerende opgaver under Del I og II stod det klart, at der var behov for en Europa-dækkende infrastruktur for afprøvning. I 1989 fremlagde de største europæiske teleadministrationer et forslag om at stille et foreløbigt bredbåndsnet til rådighed på forsøgsbasis på grundlag af en aftale om tværeuropæisk sammenkobling af bredsbåndsnet - European Broadband Interconnection Trial (EBIT) - med en kapacitet på 2 Mbits/s, som gradvis skulle udvides til 140 Mbits/s. De største deltagende netoperatører underskrev et aftalememorandum, og der blev sammensat en multinationalt panel, som i forbindelse med pilotprojekterne skulle rådgive om, hvad der ville kræves af net og software for at sikre interoperabiliteten i slutbrugernes systemer. Dette projekt til udnyttelse og understøtning af RACE-resultater gav assistance til de forskellige pilotprojekter. Men da man har haft svært ved af etablere omkostningseffektive forbindelser udenfor de enkelte landes grænser til forskningsaktiviteter, har de fleste projekters eksperimenter indtil nu kun været af nationalt omfang. Det er således først nu i 1993 og 1994, hvor man har mulighed for at lave forsøg med ATM-systemer, at der er økonomisk fornuft i tværeuropæiske bredbåndsforsøg hvor båndbredden fastlægges efter behov.

Ikke desto mindre må man sige, at pilotprojekterne for nye anvendelser har opfyldt deres mission, eftersom de har givet resultater - i reelle anvendelsesmiljøer - som nu kan inkorporeres i udarbejdelsen af teknologi og specifikationer.

2.5 Deltagelse af små og mellemstore virksomheder

Selvom F&U i avanceret telekommunikation er temmelig dyrt, deltog en del små og mellemstore virksomheder i første fase af RACE. De udgjorde 28% af deltagelsen i RACE-projekter, hvilket er betydelig mere end det tilsvarende tal i det 2. rammeprogram under ét, nemlig 16,5%[6]. Små organisationer, såvel virksomheder som forskningsorganisationer, deltog i mere end 60% af projekterne.

6) Evalueringen af det andet rammeprogram for forskning og teknologisk udvikling: Rapport fra Udvalget for Videnskabelig og Teknisk Forskning til Rådet, september 1992, CREST/1212/1/92

2.6 Fremme af den økonomiske og sociale samhørighed

Da man i programmet udforsker og udvikler strategier for at indføre IBC i alle områder af EF, herunder de mindre gunstigt stillede områder, fungerer programmet som en forløber for tværeuropæiske bredbåndsnet, som omhandlet i afsnit XII af traktaten om den europæiske union. Der er blevet lagt særlig vægt på, at øer, indlandsområder og randområder skal forbindes med EF's centrale områder.

Der er iværksat en lang række ledsageforanstaltninger, workshops og kurser for at sikre, at forskere og ingeniører fra hele EF kunne få adgang til resultaterne af den F&U, der blev foretaget. Der er især blevet lagt vægt på at organisere workshops og seminarer i de mindre gunstigt stillede områder. Bilag I indeholder en komplet fortegnelse over disse aktiviteter.

53 projekter (60%) havde deltagelse fra mindre gunstigt stillede områder i Fællesskabet, og de medvirkede således til at øge den teknologiske viden og ekspertise i disse områder.

3. Evaluering og revision af RACE-programmet

3.1 Evaluering som en løbende proces

På baggrund af den hastige udvikling i kommunikationsteknologi og -tjenester er der foretaget en løbende evaluering under programmets udarbejdelse, iværksættelse og gennemførelse. Det har også været en proces, der har omfattet alle niveauer: de strategiske retningslinjer for programmet, programmets praktiske forvaltning og den tekniske styring af hvert projekt.

Evalueringsprocessen begyndte med telekommunikationsaktøreres omfattende deltagelse i planlægningen af programmet og i udarbejdelsen af arbejdsplanen. Gennem et løbende samarbejde med industrien og telenetoperatørerne har både arbejdsplanen for selve RACE-programmet og arbejdsplanerne for hvert projekt kunnet ajourføres årligt. Desuden har regelmæssige møder mellem de konsortier, der har udarbejdet programmet (*concertation meetings* - samrådsmøder) sikret, at der løbende foregik en uformel kontrol og justering af fremdriften af alle projekter. Sammenhængen i arbejdet er blevet sikret gennem konsensusforvaltningsprojektet, der har knyttet nære forbindelser med europæiske standardiseringsorganer.

Der blev aflagt rapport om fremskridtene til Ministerrådet og Europa-Parlamentet i 1990 i 30-måneders-rapporten i henhold til Rådets beslutning[7)].

Den endelige rapport er udarbejdet i henhold til beslutningens artikel 9, hvorefter Kommissionen efter afslutningen af programmets første femårsperiode *"efter høring af Komitéen (tilsender) medlemsstaterne og Europa-Parlamentet en rapport over udviklingen og resultaterne af programmet"*. Den ajourfører og erstatter den 30-måneders-rapport, der blev forelagt i 1990.

I henhold til artikel 6, stk. 4, tredje led, har Kommissionen forelagt denne rapport for forvaltningskomitéen og anmodet om positiv udtalelse.

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7) Denne rapport blev aflagt i henhold til artikel 9 i Rådets beslutning, der er affattet således: "Programmet revideres efter 30 måneder på baggrund af en vurdering af resultaterne sammenholdt med de præcise målsætninger i bilag II til denne beslutning. Kommissionen underretter Rådet og Europa-Parlamentet om resultatet af denne revision."

3.2 Programrevision og -evaluering

Arbejdet med integreret bredbåndskommunikation (IBC) i RACE er periodisk blevet tilpasset, således at det stemte overens med de teknisk-økonomiske forhold og tjenestemuligheder, der undergår en hastig og konstant udvikling. Inden for programmet er der derfor foretaget en årlig kritisk behandling (revision) af to aspekter, nemlig

- **Det strategiske aspekt**, som omfatter en evaluering af RACE-programmets gennemførelse som helhed for så vidt angår Fællesskabets strategiske og politiske mål i international sammenhæng

- **De tekniske aspekter**, dvs. en evaluering af RACE-projekternes gennemførelse for så vidt angår RACE-målene.

Desuden blev der foretaget en revision af **programforvaltningen**. Dette har givet en uafhængig evaluering af, om Kommissionens tjenestegrene har forvaltet programmet, som de skulle.

3.2.1 Strategisk revision og programevaluering

Der blev foretaget en uafhængig strategisk revision i 1989 for at evaluere arbejdet med hensyn til Fællesskabets strategiske og politiske mål i international sammenhæng. De vigtigste konklusioner var,

- at det grundlæggende mål for RACE fortsat var gyldigt, idet udvikling af IBC er relevant og nødvendig for Europa, og 1995 var en måldato, der var forenelig med kravene og med udviklingen på verdensplan.

- at den vægt, der er lagt på de forskellige områder i RACE, var passende.

Revisionspanelet anbefalede også, at der i næste fase lægges større vægt på abonnentplacerede faciliteter, mobile applikationer, digital-HDTV samt afprøvning og testning, idet ATM ansås for at være den centrale netteknologi.

I overensstemmelse med subsidiaritetsprincippet blev det også fremhævet i den strategiske revision, hvilke aktioner der skulle gennemføres uden for RACE-programmet af nationale offentlige organisationer og af telekommunikationsaktørerne for at sikre, at de resultater, der opnås med F&U, følges op med implementering af IBC. Disse henstillinger findes i tabel 4.

Nogle af henstillingerne blev efterkommet: Henstillingen om, at teleadministrationerne skulle udarbejde et aftalememorandum om nært samarbejde i deres fjernforbindelser og drift i Europa blev fulgt i METRAN-aftalememorandummet og i udformningen af aftalerne mellem store nationale virksomheder samt i etableringen af EURESCOM. Udvidelsen af F&U's rækkevidde blev gennemført, indsatsen for standardisering af ATM blev øget, og en forsøgsimplementering af ATM er nu under udvikling. Andre henstillinger er derimod ikke blevet fulgt inden for den foreslåede tidsplan: De regler, der gælder i Europa har ikke muliggjort den forventede indbyrdes tilnærmelse mellem tele-, radiospredningss- og kabel-tv-administrationernes interesser, og udviklingen af HDTV er gået langsommere end forventet.

Efter den strategiske revision fulgte i 1990 en fremadrettet undersøgelse af de fremtidige behov og muligheder, hvori ledende strategiske, politiske og tekniske eksperter deltog. Henstillingerne fra dette behovspanel er omhandlet i "Telecom 2000"-rapporten og dannede grundlag for udarbejdelsen af arbejdsplanen for anden fase af RACE.

I 1991 og begyndelsen af 1992 blev RACE-programmet igen evalueret i forbindelse med de andre større programmer vedrørende informationsteknologi og anvendelse af telekommunikation under det 2. rammeprogram (ESPRIT og DRIVE) af et uafhængigt panel med W. Dekker som formand[8]. Kommissionen har svaret særskilt på dette panels henstillinger[9].

Henstillinger fra Det Strategiske Revisionspanel i 1989

A) Medlemsstaternes regeringer bør samarbejde om senest i 1992 at fastlægge de betingelser og bestemmelser, der skal gælde for indførelsen af fælleseuropæiske avancerede kommunikationstjenester,

B) Tele-, radiosprednings- og kabel-tv-administrationerne bør senest i midten af 1989 foreslå en samordnet fremgangsmåde og en tidsplan for udvikling og brug af IBC-infrastrukturer for både tele- og underholdningstjenester, herunder HDTV, idet den private sektors investeringsinitiativer udnyttes fuldt ud, når dette er hensigtsmæssigt,

C) Teleadministrationerne bør inden udgangen af 1990 udarbejde et foreløbigt aftalememorandum om et nærmere samarbejde i deres fjernforbindelser og drift i Europa,

D) Tjenesteleverandører bør inden udgangen af 1990 fastsætte et første sæt tjenestekrav, kommercielle betingelser og bestemmelser, der kan fremme hurtig og udbredt brug af IBC-tjenester,

E) Tele-, radiosprednings- og kabel-tv-administrationer, tjenesteleverandører og dataindustrien bør vedtage et aftalememorandum senest i midten af 1989, således at F&U-samarbejdet i RACE suppleres med pilotimplementering af nogle IBC-tjenester på europæisk plan med henblik på en kommercielt drevet indførelse af IBC i 1992,

F) F&U-samarbejde bør udvides til også at omfatte integreret tjenesteteknik, faste og mobile applikationer og teknikker for afprøvning og testning af kommunikationsudstyr og tjenestefunktioner inden udgangen af 1989,

G) Europæiske standardiseringsorganisationer bør øge og samordne deres indsats for international standardisering af IBC og avancerede tjenester. Der bør senest i midten af 1989 opstilles en tidsplan for standardiseringen, navnlig for ATM,

H) Medlemsstaterne bør behandle problemet vedrørende frekvenstildeling i Europa for så vidt angår alle frekvenser og anvendelsesområder. De bør senest i 1992 muliggøre en rationalisering af frekvenstildelingen, der afspejler de nye behov og prioriteter.

8) Rapporten fra revisionspanelet for informations- og kommunikationsteknologier med W. Dekker som formand, juni 1992

9) Kommissionens svar på Dekker-rapporten, januar 199.

Sluttelig aflagde Kommissionen i 1992 rapport om programmet i forbindelse med sin evaluering af det 2. rammeprogram[10]. Rådet opfordrede Udvalget for Videnskabelig og Teknisk Forskning (CREST) til at kommentere Kommissionens rapport. CREST lod opfordringen gå videre til forvaltningskomitéen for RACE, der aflagde følgende rapport i juli 1992:

Resultaternes kvalitet og indvirkning på konkurrenceevnen

Generelt har RACE-resultaterne som minimum været state-of-the-art, og der er i mange tilfælde sket gennembrud [f.eks. ATM: Asynchronous Transfer Mode, mobilkommunikation (UMTS: Universal Mobile Telecommunications System), optiske teknologier og udstyr].

Europa står bedre nu, end det ville have gjort uden RACE. Andre lande er måske stadig længere fremme end Europa, men det teknologiske efterslæb i europæisk telekommunikation er blevet reduceret betydeligt i forhold til både USA og Japan.

I de fem år, der er gået af det 2. rammeprogram, har RACE stort set nået sine tekniske mål som fastsat i Rådets beslutning. Ændringerne er imidlertid sket så hurtigt i telekommunikationssektoren (f.eks. nye tjenestebehov, ny teknologi, øget konkurrence mellem operatører), at målene og prioriteterne for selve programmet har måttet justeres i løbet af de fem år. Andre mål med nye prioriteter er opstået (såsom kommunikationsforsøg og test- og afprøvningsinfrastrukturer), der er taget op i senere programmer som RACE II (anden fase af det tidrige RACE-program).

RACE-programmet har stimuleret samarbejdet mellem offentlige netoperatører (om strategisk planlægning såsom EURESCOM), mellem industrier (om oprettelsen af et industrikonsortium - RIC) og mellem offentlige netoperatører og industrier (f.eks. i standardiseringsorganisationer såsom ETSI). Både omfanget af og arbejdsområdet for denne type samarbejde skal dog udvikles yderligere.

Foruden talrige videnskabelige og tekniske resultater har RACE I givet 596 bidrag (status pr. 6/92) til standardiseringsorganisationer (hovedsagelig ETSI) på grundlag af udviklingen af de fælles funktionsspecifikationer.

For telekommunikationsindustrien har samarbejdet med RACE øget konkurrenceevnen på globale markeder. For den europæiske industri som helhed skulle RACE's positive indflydelse blive tydeligere på længere sigt med en udbredt indførelse af avanceret kommunikation. Yderligere F&U inden for applikationer kan vise de potentielle brugere, hvilken konkurrencefordel de kan opnå gennem state-of-the-art kommunikation.

10) Meddelelse fra Kommissionen: Evaluering af andet rammeprogram for forskning og teknologisk udvikling (SEK(92) 675 endelig udg.), juli 1992

Forvaltning og omkostningseffektivitet

Inden for rammeprogrammet er RACE et sammenhængende program med specifikke mål, der er fælles for alle projekter, og med en samlet løbetid på ti år. Under RACE I blev der gjort størst fremskridt inden for ATM, optiske komponenter og teknologier, mobilkommunikation (UMTS) og bredbåndsforsøg. Som følge heraf er der lagt meget større vægt på de to sidstnævnte kategorier i RACE II. Områder, hvor der er gjort mindre fremskridt, er sikkerhed og brugsegnethed, hvor de oprindelige mål måtte reduceres.

I det samarbejde, der er opnået inden for RACE, er samrådsmekanismen central. Generelt er et europæisk samarbejde som det, der er gennemført under RACE, omkostningseffektivt, da det virker som en multiplikationsfaktor for de resultater, som parterne opnår af den investering, som de hver især har foretaget.

Procedurerne for evaluering af forslag og teknisk revision har fungeret godt: f.eks. har proceduren med "det røde flag" givet mulighed for at omlægge og give nye impulser til projekter, der ellers ikke ville have nået deres mål, eller for at standse projekter på et tidligt tidspunkt og dermed undgå ressourcespild.

Programmet var som helhed godt struktureret og forvaltet, men der kan stadig ske forbedringer på følgende områder:

- *Samarbejdet med andre europæiske, multinationale forskningsprogrammer har ikke været effektivt nok.*
- *Kommissionen, de offentlige netoperatører og industrierne bør give hinanden tilsagn om støtte til programmet og dets mål, inden arbejdsplanen vedtages.*
- *Der bør gøres en større indsats for at opretholde kvaliteten af det samlede program til forskel fra de enkelte projekter. F.eks. er der for mange nøgledeltagere, der ikke medvirker i hele programmets løbetid.*
- *Samrådsmøderne skal gøres mere omkostningseffektive.*
- *Konsensusforvaltningsprojektet skulle helst være det første projekt, der påbegyndes, således at effektive forbindelser med de andre projekter kan sikres.*
- *Der bør træffes foranstaltninger til at øge små og mellemstore virksomheders aktive rolle og deltagelse i fremtidige programmer.*
- *Samordnede aktioner og støtteforanstaltninger bør i højere grad anvendes.*

Overensstemmelse med EF-politikker og -principper

De tekniske udvælgelseskriterier, der anvendes for både evalueringen af forslag og revisionen af projekterne, har vist sig at være tilfredsstillende.

Der blev ikke specielt taget hensyn til sociale og økonomiske kriterier ved udvælgelsen af projekter under RACE I. Generelt er et telekommunikationsprogram som RACE dog foreneligt med den gældende politik for miljø og energibevarelse.

Med hensyn til subsidiaritet er det klart, at der vil være fordele ved et samarbejde på europæisk plan inden for standardforberedende forskning i telekommunikation. Et større samspil med nationale programmer og forsøg bør dog også fremmes.

Konklusioner

Forskningsprogrammer vedrørende telekommunikation i Europa må ikke slutte i 1995. Der må gennemføres endnu et program efter RACE.

Forskning og udvikling er nødvendige, men ikke tilstrækkelige til at opnå en god position på de fremtidige telekommunikationsmarkeder. Forvaltningskomitéen anfører ikke i dette dokument, hvilke yderligere foranstaltninger der er nødvendige for at nå dette resultat. Det forhold, at vægten i F&U inden for telekommunikation flyttes over på tjenester og applikationer bør have indflydelse på fremtidige programmers struktur og tilrettelæggelse.

Resultaterne af RACE bør i større udstrækning tages op og udnyttes i Europa. De nødvendige initiativer til denne overførsel skal tages af sektoraktørerne.

Denne rapport udgjorde en del af grundlaget for CREST's rapport til Rådet om det 2. rammeprogram i oktober 1992.

3.2.2 Vurdering af virkningerne og prognoser

Forskningen og den teknologiske udvikling under programmet er i løbet af de fem år blevet ledsaget af regelmæssige vurderinger af de økonomiske og sociale virkninger af udviklingen i avanceret kommunikation. Rapporterne om disse vurderinger er offentliggjort og udsendt i vide kredse under titlen "Perspectives for Advanced Communications in Europe: PACE". Den seneste vurdering blev foretaget i 1991 og udsendt i 1992. De oplysninger, der fremkommer ved disse vurderinger, danner grundlag for den årlige ajourføring af programarbejdet og mindre tilpasninger i årets løb. Størstedelen af dette arbejde er nu blevet helt integreret i anden fase af RACE i henhold til bestemmelserne i Rådets beslutning om særprogrammet inden for kommunikationsteknologi.

3.2.3 Revision af programforvaltningen

De programforvaltningsprocedurer, som Kommissionens tjenestegrene har vedtaget for RACE-programmet, blev underkastet en uafhængig programforvaltningsrevision i 1989.

Hovedvurderingen var, at den industrielle forvaltningsmåde, som Kommissionens tjenestegrene har anvendt, i det store og hele passede til programmets mål og partnere, og at årlige tekniske revisioner og de periodiske samrådsmøder havde vist sig at være en effektiv måde at gennemføre programforvaltningen på.

3.2.4 Teknisk revision af RACE-projekterne

For at kunne tilpasse programmet til den teknologiske udvikling og til ændringer i opfattelsen af efterspørgslen skulle arbejdsplanen revideres årligt i henhold til RACE-beslutningen.

Dette indebar, at fremdriften i alle de igangværende projekter skulle revideres årligt i forhold til målene og til nye behov. Derfor har uafhængige eksperter på de pågældende forskningsområder hvert år foretaget en teknisk revision af hvert projekt. Den første tekniske revision fandt sted i oktober 1988, og den sidste i oktober 1992. Resultaterne af disse årlige revisioner er blevet brugt til at omlægge eller standse projekterne i nødvendigt omfang.

Den tekniske revision har især omfattet følgende:

a) Hvert år har partnerne i hvert projekt gennemført en "selv-evaluering" ved at gennemgå alle væsentlige aspekter af projektet, hvorefter de har beskrevet resultaterne i en årlig revisionsrapport.

b) Disse er blevet gennemgået af uafhængige eksterne eksperter (revisorer), der er udpeget med hjælp fra forvaltningskomitéen. Efter gennemgangen af rapporterne er der foretaget en "høring" af projekterne under forsæde af Kommissionen. Projektdeltagerne har lejlighed til at fremhæve resultater og skitsere det fremtidige arbejde. Revisorerne, der er grupperet i paneler efter ekspertområder, kan stille spørgsmål om projekterne som supplement til de oplysninger, der er givet i årsrapporten og præsentationen.

c) Panelerne har konsolideret deres konklusioner og henstillinger og har gjort rede herfor i deres revisionsrapporter til forvaltningskomitéen og Kommissionen.

d) Revisionsrapporterne er suppleret med en vurdering af projektleverancerne i henhold til kontrakterne; denne vurdering foretages af de projektansvarlige i Kommissionen (generelt betragtes projektleverancerne som fortrolige og meddeles ikke revisorerne).

Denne procedure har vist sig at være både retfærdig og effektiv. Revisionsrapporterne har været et udmærket grundlag for de årlige forhandlinger af kontrakter om de detaljerede arbejdsplaner for hvert projekt.

4. Forbindelserne med andre EF-aktioner og europæiske aktioner

4.1. Forbindelserne med CEPT

Forbindelserne med CEPT og dets underorganer har ændret sig betydeligt under udarbejdelsen og gennemførelsen af RACE.

I definitionsfasen kom den særlige gruppe vedrørende bredbåndskommunikation (GLSB), som CEPT har oprettet, med vigtige bidrag til arbejdsplanen for fase I af RACE. I løbet af 1987 og 1988 blev samordningen med arbejdet i CEPT varetaget af GMR (en blandet gruppe for RACE), der blev oprettet med dette formål i september 1987.

I 1988 førte samarbejdet med CEPT også til, at 13 europæiske teleadministrationer undertegnede et aftalememorandum om indførelse af en generel forsøgsstruktur for IBC-arbejde (EBIT).

I forbindelse med omlægningen af reglerne for teleområdet - i overensstemmelse med den nye europæiske telekommunikationspolitik - oprettede CEPT en række særskilte organer, hvoraf to har etableret nære forbindelser med RACE-arbejdet: ETNO (European Telecommunications Network Operators Group) er nu forum for drøftelser mellem netoperatører om interoperabilitet, og EURESCOM er forum for fælles strategisk forskning. Ikke alle store europæiske offentlige netoperatører deltager i EURESCOM, men det fungerer alligevel som et værdifuldt kontaktpunkt mellem Kommissionen, RACE-projekterne og de fleste netoperatører.

4.2 Forbindelserne med europæiske og internationale standardiseringsorganisationer

Som led i gennemførelsen af den europæiske telekommunikationspolitik blev ETSI, Det Europæiske Institut for Telestandarder, oprettet i 1988. Det er nu etableret som det vigtigste europæiske forum for udvikling af tekniske specifikationer. Det standardforberedende arbejde i RACE har frembragt 596 separate bidrag til standardiseringsarbejdet i ETSI, CCITT og CCIR.

Desuden er der holdt regelmæssige møder med repræsentanter for CEN/CENELEC, EBU og SPAG.

4.3 Forbindelserne med andre EF-programmer og europæiske aktiviteter

RACE-projekterne nyder godt af resultaterne af projekter, der udvikler generiske teknologier, dvs. ESPRIT (mikroelektroniske komponenter, programmelværktøjer, AIP til netstyring osv.); tilsvarende trækker de applikationsorienterede programmer DRIVE, DELTA og AIM i vid udstrækning på de teknikker, der udvikles i igangværende RACE-projekter, til deres kommunikationsbehov.

Der er gennemført samarbejde med COST ved tætte kontakter mellem beslægtede projekter og regelmæssige møder på programforvaltningsniveau.

Med EUREKA-initiativet har samspillet været stærkest inden for audiovisuel teknologi. En del af arbejdet vedrørende fremme af HDTV (EUREKA-projekt 95) blev suppleret med arbejde under en RACE-kontrakt, og EUREKA-projekt 256 om videokodning var knyttet til RACE-integrationsarbejdet.

4.4 Forbindelser med organisationer i EFTA-lande

Organisationer fra Finland, Norge, Schweiz, Sverige og Østrig deltager i RACE. 27 organisationer fra disse lande har deltaget i 72 projekter (dvs. over 80% af arbejdet).

5. Udnyttelsen af RACE-resultaterne

Mulighederne i den nye kommunikationsteknologi vil få meget store virkninger for fremtidens økonomiske vækst i EF og for den internationale arbejdsfordeling på verdensplan. Der er tre forskellige, men indbyrdes forbundne vækstprocesser, som gør deres indflydelse gældende, nemlig følgende:

- Bedre adgang til bedre informationer øger produktiviteten i hele økonomien,
- Forbedringer i kommunikationsmulighederne øger nytten og dermed markedsføringsmulighederne for både gamle og nye tjenester, så de ekspanderer,
- Overgangen til den nye og informationsbaserede økonomi, hvor tjenesterne er drivkraften, kræver meget store offentlige og private investeringer i ny infrastruktur til udvikling af tillægstjenester, både fysiske - kabler, centraler, terminaler - og menneskelige.

Kommunikationens kvalitet - både teknisk og organisatorisk - bliver af central betydning for fremtidens økonomiske vækst, fordi den bestemmer økonomiens kapacitet til både at frembringe og effektivt udnytte den helt afgørende faktor i moderne "produktion", nemlig viden. Infrastrukturernes geografiske organisation vil få en meget stærk indflydelse på de sociale, økonomiske og kulturelle forhold, ligesom jernbanerne fik det i det 19. århundrede.

Derfor må resultaterne af F&U inden for kommunikation straks udnyttes effektivt. Der er af samme grund lagt særlig vægt på udnyttelsen af resultaterne under hele RACE-programmets forløb.

5.1 Udnyttelsesplanen for RACE

For at fremme og vurdere deltagernes udnyttelse af RACE-resultaterne er udnyttelsesplanen for RACE regelmæssigt blevet ajourført i perioden fra 1988 til 1992. Den giver et samlet overblik over deltagernes udnyttelse af resultaterne.

Bilag II indeholder en liste over bidragene til standardisering, og titlerne på videnskabelige og tekniske publikationer findes i bilag III. RACE-programmet har givet anledning til over 1700 videnskabelige og tekniske publikationer og har dermed ydet et betydeligt bidrag til den offentligt tilgængelige videnskabelige litteratur.

Resultaterne af den teknologiske udvikling er også blevet beskyttet med patentansøgninger, når dette har været relevant. 73 patentansøgninger i forbindelse med RACE-arbejdet er allerede registreret. De er angivet i bilag IV.

5.2 Planlægning af IBC-implementering

En effektiv udnyttelse af F&U er kun mulig, hvis alle parter har et ensartet syn på, hvordan den kommercielle udvikling skal styres, og hvor hurtigt den skal gå. F&U i RACE-programmet er derfor altid blevet planlagt og specificeret i forhold til en vejledende implementeringsplan for integreret bredbåndskommunikation, der er blevet ajourført med jævne mellemrum. Den omfatter en trinvis indførelse af avancerede tjenester begyndende med dem, som der er efterspørgsel efter i erhvervslivet allerede i 1992/1993. Den nuværende vejledende implementeringsplan som beskrevet i RACE-årsrapporten for 1992 (RACE'92) omfattede følgende milepæle:

1992/1993:

- Tidlig indførelse af erhvervsmæssige applikationer
- Avancerede kommunikationsforsøg til afprøvning af nye tjenester og netstyresystemer: ATM, MAN og IBC i abonnentplacerede net
- Beslutninger om anskaffelse af og investering i fremtidige fælleseuropæiske IBCN-net og fuldt udviklede IBC-tjenester
- Færdiggørelse af de vigtigste standardiseringsarbejder.

1994:

- Færdiggørelse af forbindelsen mellem alle EF-hovedstæderne og med nabolandene. Forbindelsen skal baseres på de bestående optiske hovedforbindelser, men skal kunne understøtte tale-, data- og billedoverførsel, enten hver for sig eller som integrerede tjenester.

1995:

- Første implementering af IBCN-net og fuldførelse af abonnenttilslutningen for erhvervsvirksomheder i centre for økonomisk aktivitet og produktion: mindst 50 000 erhvervsbrugere af avancerede tjenester.
- Praktiske feltforsøg til afprøvning af alle IBC-tjenester (herunder private abonnenter med tovejsvideo og digital-HDTV), der anvender kommercielt IBC-udstyr,

1996:

- Levering af kommercielle basisbredbåndstjenester baseret på forbindelser med 2, 34 og 155 MBit/s, herunder hurtig inter-LAN datatransmission, desk-top videokonferencer, videobehandling, CAD/CAM og terminalapplikationer.
- Samtrafik mellem faste bredbåndsnet og mobile net, satellitnet og andre net.

1997:

- Tilrådighedsstillelse af IBC-tjenester for erhvervsbrugere i byer med over 500 000 indbyggere og påbegyndelse af en omfattende implementering af lyslederforbindelser til husstandene ("fibre-to-the-home").

2005-2010:

- IBC-tjenester skal dække 50% af markedet.

Denne vejledende tidsplan vil blive revideret igen i 1993 i forbindelse med udarbejdelsen af retningslinjerne for udviklingen af transeuropæiske bredbåndsnet som fastsat i afsnit XII, artikel 129 B og C, i traktaten om den europæiske union.

6. Gennemførelse af fase II af RACE

Det har hele tiden været meningen, at RACE-programmet skulle løbe i ti år og gennemføres i to faser. For at sikre kontinuitet blev anden fase vedtaget i juni 1992 som et særprogram under Fællesskabets 3. rammeprogram for forskning og teknologisk udvikling.

Da man nåede til 1991, havde opfattelsen imidlertid ændret sig væsentligt. Det, der havde forekommet at være en ambitiøs, næsten futuristisk vision ved programmets begyndelse, havde udviklet sig til en realistisk mulighed. Kommerciel indførelse af integreret bredbåndskommunikation forventedes nu med sikkerhed inden for fire år. Desuden var det blevet endnu tydeligere, at telekommunikation og avancerede informationstjenester ville spille en central rolle i verdens sociale og økonomiske udvikling frem mod det 21. århundrede.

Disse forandringer fik Europa-Parlamentet og Ministerrådet til at prioritere vedtagelsen af det nye særprogram. Det var det første af programmerne under det 3. rammeprogram, der blev vedtaget[11], og forvaltningskomitéen afgav straks positiv udtalelse om arbejdsplanen. En indkaldelse af forslag blev offentliggjort i juni 1991, og forslagene blev evalueret i september og oktober 1991. Over 200 forslag blev evalueret, og 95 projekter blev indledt i begyndelsen af 1992. De skal med de nuværende budgetbevillinger være afsluttet ved udgangen af 1994.

Medens projekterne i fase I af RACE var koncentreret om evaluering af valgmuligheder, skal projekterne i fase II forberede indførelsen af IBC. RACE II-projekterne vil styrke det samarbejde, der allerede foregår mellem industrielle brugere, dataindustrien og teleoperatørerne, og de forpligtelser, som de har indgået i RACE I. I den nye F&U er der sat fokus på applikationer, tjenester, drift og forvaltning, men teknologisk udvikling opretholdes på højt niveau for at konsolidere og udvide de nøgleområder, der er nødvendige for en omkostningseffektiv levering af IBC-tjenester.

Arbejdet omfatter de otte prioriterede områder, der er fastsat i bilaget til Rådets beslutning, nemlig

OMRÅDE 1	F&U inden for IBC (Integrated Broadband Communications)
OMRÅDE 2	Intelligens i netværk/fleksibel styring af kommunikationsressourcer
OMRÅDE 3	Mobilkommunikation og personlig kommunikation
OMRÅDE 4	Billed- og datakommunikation
OMRÅDE 5	Teknologi til integrerede tjenester
OMRÅDE 6	Teknologi til informationssikkerhed
OMRÅDE 7	Avancerede kommunikationseksperimenter
OMRÅDE 8	Testinfrastrukturer og sammenkobling (tværgående F&U til støtte for de øvrige prioriterede områder).

En fuldstændig beskrivelse af de nye F&U-projekter i fase II og deres forbindelse med fase I-projekterne findes i årsrapporterne for 1992 (RACE'92) og 1993 (RACE'93).

11) Rådets beslutning af 7. juni 1991 om et særprogam for forskning og teknologisk udvikling inden for kommunikationsteknologi (1990-1994) (91/352/EØF) (EFT nr. L 192 af 16.7.1991, s. 8)

7. Fremtidige behov og valgmuligheder i F&U inden for kommunikationsteknologi på europæisk plan

I juni 1992 oprettede forvaltningskomitéen for RACE en ad hoc-gruppe, der skulle fastlægge prioriteterne for den fremtidige europæiske F&U inden for telekommunikation. Gruppens rapport er gengivet nedenfor.

Mange af disse idéer til og emner for EF's fremtidige F&U er allerede afspejlet i Kommissionens arbejdsdokument om fjerde rammeprogram, navnlig i de foreslåede emner "billedteknologi", "databehandling og netværksforbindelser med høj ydeevne", "funktionsintegration i produktionen" og "avanceret kommunikation". Kommissionen vil fremsætte sine forslag til særprogrammer under fjerde rammeprogram i 1993 efter gennemgang af alle bidragene.

Begrundelsen for F&U på fællesskabsplan

Det er fortsat forvaltningskomitéens opfattelse, at der kan opnås klare fordele ved at gennemføre F&U inden for telekommunikation på fællesskabsplan. Generelt betragtet er forskning (navnlig telekommunikationsforskning) en løbende proces. For at opretholde den forbedrede stilling, som sektoraktørerne allerede har opnået gennem deltagelse i EF-aktioner som RACE, må de fortsat samarbejde og bygge videre på de resultater, de hidtil har opnået.

En yderligere konsolidering af de opsplittede telekommunikationssystemer i Fællesskabet er nødvendig, både for at sikre, at det indre marked fungerer effektivt, og for at øge europæiske organisationers konkurrencefordel på de globale markeder. Standardiseringsorganisationer som ETSI er kommet til at sætte pris på de tekniske bidrag, de har modtaget som et direkte resultat af RACE-arbejdet. Strømmen af resultater fra Fællesskabets F&U til standardiserings-organisationerne skal fortsat styres - og øges - som en del af kommende programmer.

Avanceret telekommunikation får stadig større betydning for de nationale økonomier i takt med, at grundelementerne (information og muligheden for at kommunikere informationen) betragtes som strategiske ressourcer. Dette kan måles i

- den stigende del af de nationale økonomier, der går til investeringer i telekommunikation, og

- avancerede teletjenesters øgede indvirkning på andre økonomiske sektorer.

Der er taget hensyn til disse tendenser i både Fællesakten og i de igangværende bestræbelser på at gennemføre EF's indre marked. Maastricht-Traktaten omhandler etableringen af transeuropæiske net (der omfatter telenet). Oprettelsen af telekommunikationsinfrastrukturer og -tjenester på europæisk plan vil kræve langsigtede forpligtelser fra alle berørte aktører i sektoren.

Samordningen af udviklingen (igen på europæisk plan) hen imod oprettelse af en infrastruktur for bredbåndskommunikation giver en klar økonomisk fordel med hensyn til afkast af investeringer. Samordningen ville også lette indførelsen af nye applikationer i alle europæiske regioner og gøre det muligt hurtigt at opnå den kritiske masse, der er nødvendig for en selvbærende vækst i brugen af avancerede tjenester. Der er ingen tvivl om, at telenettene og et stigende antal EF-tjenester får en voksende international rækkevidde. Et større samarbejde uden for de europæiske regioner kunne også opmuntres.

Af alle disse grunde mener forvaltningskomitéen, at en særlig EF-aktion for F&U inden for telekommunikation bør medtages som en del af ethvert fremtidigt rammeprogram. Dette bør desuden bygge på det betydelige grundlag, der er etableret under tidligere programmer. Der bliver dog efter 1995 brug for en telekommunikations-F&U, hvor vægten ligger væsentligt anderledes end hidtil i RACE-programmet.

Mål for fremtidig F&U inden for telekommunikation

Gennemførelsen af den avancerede kommunikationsvision om, at alle kan kommunikere med alle hvor som helst og når som helst ved brug af tekst, lyd og billeder, kræver, at Europa tager nye F&U-initiativer.

De igangværende programmer som RACE og ESPRIT har allerede ydet et væsentlig bidrag til etablering af det tekniske grundlag for denne vision. Drivkraften i et nyt program for Fællesskabets F&U inden for telekommunikation må nu komme fra behovene for nye anvendelser. I princippet bør disse også være bestemmende for, hvilke aktioner og prioriteter der er nødvendige for yderligere forskning i de grundlæggende støtteteknologier.

Nye programmer bør derfor centreres om følgende to mål:

- at fremme driftsforsøg med avancerede tjenester for at forbedre deres brugsegnethed og sikre, at slutresultatet er attraktivt nok til udbredt brug i europæernes dagligdag.

- at fremme den forskning i fremtidsteknologier, der er nødvendig for at støtte avanceret kommunikation og for at reducere omkostningerne til nøglekomponenter og dermed gøre det mere økonomisk tilgængeligt at stille avancerede tjenester til rådighed.

Disse to spørgsmål er særligt afgørende for den fælleseuropæiske kommercielle indførelse af avancerede kommunikationsnet og -tjenester, selv om denne indførelse også er afhængig af en række andre faktorer. For at komme nærmere en virkeliggørelse af den avancerede kommunikationsvision er det nødvendigt at bygge på sektoraktørernes voksende gensidige samarbejde og dermed opnå enighed om

- hvordan man bedst kan styrke tjenesternes og de tilknyttede støtteteknologiers funktion.

- hvilke muligheder der kan sigtes efter på grundlag af konvergensen i tele-, radiospredningsog informationsteknologien, som kan danne grundlag for en hurtig udvikling hen imod avanceret kommunikation.

Fortsat F&U inden for avanceret kommunikation i Fællesskabet vil altså i sig selv fremme europæisk samarbejde og harmonisering og føre til en styrkelse af Europas konkurrenceevne på internationale markeder og dermed til en styrkelse af de europæiske økonomi som helhed.

Samarbejdsgrundlaget (Modus Operandi)

For at gøre avanceret kommunikation attraktiv i vide kredse og gøre teknologierne mere økonomisk tilgængelige er det nødvendigt at inddrage alle berørte parter, dvs. brugere, netoperatører, tjenesteleverandører, industri, forskningscentre og universiteter. Det skal sikres fra starten, at alle disse aktører kommer med ved at inddrage dem i fastlæggelsen af en aftalt arbejdsplan. Navnlig bør offentlige netoperatørers deltagelse til støtte for kommunikationsforsøg fremmes, idet nuværende eller planlagte infrastrukturer udnyttes i muligt omfang.

I det næste F&U-program bør små og mellemstore virksomheder spille en større rolle, da mange af dem har en værdifuld ekspertise inden for udvikling af applikationer og tjenester. Denne ekspertise er central i Fællesskabets behov for at tage fat på dette nye forskningsområde. Behovet for at styrke små og mellemstore virksomheders rolle i den fremtidige kommunikations-F&U peger på, at der bør træffes særlige foranstaltninger for at lette deres aktive deltagelse yderligere. F.eks. skal Kommissionen måske benytte kontraktsprocedurer, der i højere grad understøtter SMV'erne (f.eks. CRAFT-mekanismen, der er brugt i BRITE/EURAM, eller andre nye fremgangsmåder).

Selv om RACE alt i alt har været en succes, bør der overvejes nogle nye procedurer eller forbedringer af de nuværende procedurer for forvaltningen af det næste F&U-program inden for kommunikation. De enkelte projekter bør fastlægges inden for en velstruktureret ramme, der er defineret i arbejdsplanen og specielt beregnet på at nå programmålene. Samrådsmekanismen, der med godt resultat er brugt i RACE, skal også styrkes yderligere.

En øget samordning af EF-programmer, bedre samarbejde med andre europæiske eller multinationale forskningsprogrammer og et nærmere samarbejde med nationale programmer og forsøg skal alle fremmes, når det er muligt. Samordnede aktioner med EUREKA, COST og andre projekter på nationalt plan kan også overvejes.

Foranstaltninger til støtte for programmet skal omfatte en passende reklame for projekterne under gennemførelsen og udbredelse af resultaterne (og disse resultaters potentielle fordele/anvendelsesmuligheder) til alle sektoraktørerne, navnlig de potentielle brugere af avanceret kommunikation.

Driftsforsøg og udvikling af tjenester

Erfaringer med indførelse af nye netteknologier og -tjenester har vist, at udvikling og gennemførelse af nye applikationer kræver velorganiseret, praktisk førdriftsvalidering (driftsforsøg), der omfatter alle aktører i sektoren. Den egentlige udfordring for de næste generationer af europæiske driftsforsøg er derfor at vise, hvordan potentielle tjenester kan grupperes (under frie markedsforhold), således at de opfylder centrale markedssektorers behov.

F&U inden for driftsforsøg og udvikling af tjenester bør koncentreres om ikke-brugsspecifikke forhold, idet det derved vil blive lettere at udvikle avancerede tjenester. Selv om forsøgene bygger på bestående teknologi, bør de sigte mod passende applikationer, efterhånden som nettene bliver mere intelligente og tjenesterne mere fleksible. De vigtigste mål for driftsforsøg bør omfatte udformning og indgivelse af forslag til standardiseringsprocessen og forslag til sektorprofiler, der tager hensyn til alle aspekter af sektorens applikation, dvs.

- *virksomheden (herunder organisation, interaktion, information til brugeren, forvaltnings- og sikkerhedspolitik, cost-benefit-analyse samt juridisk, etisk og social fremgangsmåde),*
- *selve informationen (herunder definition af informationselementer, kvalitet, strøm og præsentation for brugerne),*
- *telematikfunktionerne (herunder kommunikations- og behandlingsfunktioner og datarepræsentationstyper),*
- *teknologierne (herunder hardware og software).*

På denne måde skal der i driftsforsøg tages hensyn til ændringer i lovgivnings-, forvaltnings- og sikkerhedspolitikkerne, brugeradgang og grænseflader mellem menneske og maskine, og de skal indeholde cost-benefit-analyser og definitioner af informationskvaliteten.

Udvikling af generiske tjenester kræver værktøjer til tjenesteetablering, indarbejdelse af multimedie-teletjenester og -terminaler og levering af avancerede tjenester, styring og tjenesteteknik. Som følge heraf skal fremtidige applikationer opfylde følgende forudsætninger: De skal

- *have sektorspecifikke definitioner, der er fastlagt af tjenesteleverandører og brugere*
- *være baseret på generiske tjenester og opfylde ONP-vilkårene*
- *være defineret ved klare cost-benefit-mål*
- *have verdensmarkedspotentiel*
- *på kort sigt kunne opfylde nye behov, f.eks. at den enkelte skal kunne kontaktes overalt, bredbåndsmultimedietjenester og brugervenlige eller intelligente net.*

Et empirisk grundlag for fastlæggelsen af applikationerne kan uddrages af igangværende nationale programmer og EF-programmer (f.eks. RACE, telematiksystemer og ESPRIT). Fremtidige F&U-programmer skal først og fremmest tage sigte på førdriftsforsøg og på at godtgøre, at applikationerne kan anvendes på europæisk plan. Den efterfølgende specifikke "tjenesteudvikling" bør efter forvaltningskomitéens mening medtages i et fremtidigt F&U-program for bedre at opfylde brugernes behov for

- *Forbedrede videokonferencer og interaktive multimedietjenester*
- *Distancearbejde og "virtual presence"*
- *Mulighed for at kontakte den enkelte hvor som helst og informationssikkerhed*
- *Distributionstjenester for større eller mindre modtagerkredse*
- *Tjenestestyring og intelligente nettjenester.*

Forskning i støtteteknologier

Ethvert nyt forskningsprogram inden for telekommunikation bør bygge videre på det betydelige teknologigrundlag, der er etableret gennem tidligere programmer. Strategisk forskning er nu nødvendig for, at der kan opnås omkostningsfordele ved brug af næste generations teknologier. De overordnede mål herfor er følgende:

- *Levering af de teknologier, der er nødvendige for udvikling af net og tjenester i Europa, der er konkurrencedygtige på priserne, forud for de konkurrerende økonomiske blokke for at yde et vigtigt bidrag til styrkelsen af den europæiske økonomi.*

- *Etablering af et grundlag for en teknisk mulig og økonomisk rimelig udvikling i telenettene - med hensyn til standardisering - med henblik på at styrke den europæiske økonomi.*

Den viden, der er opnået på disse forskningsområder, kan kræve en ændring af målene og prioriteterne på andre områder af programmet. F.eks. kan udviklingen i tjenesteteknologien yde nogle bidrag til forskningen inden for både komponent- og netteknologi. Hovedvægten bør dog fortsat lægges på de nye tjenester, der kan tilbydes brugerne gennem telenettene. Da disse tjenester vil være karakteriseret ved en høj grad af tilpasning til personlige behov, er der brug for en tæt interaktion mellem netudvikling og tjenesteudvikling. Følgende specifikke forskningsområder bør efter forvaltningskomitéens opfattelse medtages i et fremtidigt program:

Udvikling af nettet for at etablere et grundlag for teknisk mulige og økonomisk rimelige avancerede kommunikationsformer

- *Integrering af bestående og nye transmissionsmedier og -systemer (kobberkabler, optiske fibre, jord- og satellitbaseret radiospredning), også i distributions- og tilslutningsnet (fibre i lokal sløjfe og lign.); integrering af mobile og faste net;*
- *Udvikling af styrede transmissionhierarkier og forbedrede netstyresystemer;*
- *Optiske transmissionssystemer med ultrahøj kapacitet og fotoniske netarkitekturer;*
- *Styrede knudepunkter til B-ISDN (ATM) og forbedret signalering*
- *Avancerede intelligente net, informationsnetarkitekturer (kombination af IN og TMN) og avancerede software-arkitekturer.*

Teknologiudvikling på grundlag af resultaterne fra RACE og andre EF-programmer, navnlig udvikling af terminaler hen imod et bedre pris-ydeevneforhold og større brugervenlighed

- *Multimediearbejdsstationer og billedtelefoni*
- *Avanceret billed- og audiobehandling*
- *Digital-tv (SDTV, EDTV, HDTV)*
- *Talestyring i naturligt sprog*
- *Ultra-LSI-chips til opkoblings- og transmissionskredsløb*
- *Avancerede mikrobølge-komponenter baseret på Si, III-V-materialer*
- *Opto-elektroniske materialer og anordninger til telekommunikationsapplikationer*

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	
Estimate of activation times for an activation/deactivation procedure at the TB reference point	ETSI	NA 5	1990/09	Belgium
Evolution of Optical Multi-Customer Access Links in the IBCN	ETSI	NA 5	1990/03	Germany
Guidelines for dynamic description of Multi-Media services using SDL diagrams	ETSI	NA 5	1989/10	
Implications of the introduction of the P bit for AAL type 3 and 4 (allocation AAL)	ETSI	NA 5	1991/09	Belgium
Information type related attributes for service components	ETSI	NA 5	1989/03	Germany
Introduction IBCN Reference Configuration	ETSI	NA 5	1990/03	
Introduction of the BRAN and LIT functional groups into the functional architectural model (allocation	ETSI	NA 5	1991/09	Belgium
Introduction to the static description of multimedia services	ETSI	NA 5	1989/03	Germany
Introductory description of multimedia services	ETSI	NA 5	1989/03	
List of parameters for the physical medium dependent layer of an electrical interface at the Tb reference	ETSI	NA 5	1989/09	
Location of meta-signalling in the B-ISDN FRM	ETSI	NA 5	1991/01	Belgium
Meta-signalling	ETSI	NA 5	1990/03	Italy
Meta-signalling message transport	ETSI	NA 5	1989/11	
Meta-signalling states description	ETSI	NA 5	1989/11	
Multi-media structure	ETSI	NA 5	1990/09	Belgium
Notes on Access Network MAN Architecture 5	ETSI	NA 5	1990/03	Italy
Open questions on meta-signalling raised at Brussels meeting of CCITT SG XI/4	ETSI	NA 5	1991/01	Belgium
Optical CATV User-Network-Interface Based on a High-speed WDM	ETSI	NA 5	1990/02	Germany
Optical CATV-User-Network-Interface b.opt.	ETSI	NA 5	1990/02	Germany
Optical Multicustomer Access Networks and its Evolution	ETSI	NA 5	1990/03	Germany
Optical Multicustomer Access Networks and its Evolution	ETSI	NA 5	1990/03	Germany
Optical Network Architecture for a Combined B-ISDN & CATV Multicustomer Access Link in IBCN	ETSI	NA 5	1990/04	Switzerland
Optical Network Architecture for a Combined B-ISDN & CATV Multicustomer Access Link in IBCN	ETSI	NA 5	1990/04	Germany
Optical Reference Configuration of Multigigabit CATV Customer Access Network (R.1051)	ETSI	NA 5	1990/02	Germany
Physical layer of the cell-based UNI	ETSI	NA 5	1990/09	Belgium
Power feeding accross the interface at the Tb reference point	ETSI	NA 5	1989/09	
Preliminary Network Architecture for the IBCN	ETSI	NA 5	1989/10	
Principles on Interworking	ETSI	NA 5	1989/10	UK
Proposal for a cyclic counting in the AAL sequence number field	ETSI	NA 5	1990/03	
Proposal for a data-link protocol as part of AAL Convergence Sub-layer (CS) protocol for non-time-related	ETSI	NA 5	1990/03	Italy
Proposal for basic primitives between the ATM adaptation layer (AAL) and the ATM layer	ETSI	NA 5	1990/03	
Proposal for primitives between the ATM adaptation layer and the ATM layer	ETSI	NA 5	1990/03	
Proposal for single BASIC ATM Adaptation (SAR) sub-layer for all Packet Oriented (PO) services	ETSI	NA 5	1989/11	
Proposed Document Structure for MAN Standards	ETSI	NA 5	1990/01	Belgium
Proposed Structure for ETSI draft ETSI on MANs	ETSI	NA 5	1990/03	
Prose description and definition of multimedia services	ETSI	NA 5	1989/03	Germany
Protocol Architecture for AAL type 3 and type 4 (allocation AAL)	ETSI	NA 5	1991/09	Belgium
Reference Configuration for TMN	ETSI	NA 5	1989/03	

Reference Configurations Construction Rules	ETSI	NA 5	1990/09	Belgium
Service Component Concept	ETSI	NA 5	1988/03	Germany
Service primitives exchanged between the ATM Layer Entity and the AAL Layer Entity (allocation PRS)	ETSI	NA 5	1991/09	Belgium
Service Requirements for MANs	ETSI	NA 5	1990/01	Belgium
Signalling requirements for multiparty calls	ETSI	NA 5	1990/09	Belgium
Specification of the Physical Characteristics for an electrical interface of 155.52 MBit/s	ETSI	NA 5	1989/11	Belgium
Stage 2 studies on Multi-Media Services	ETSI	NA 5	1989/10	Denmark
Support of Broadband distributive services	ETSI	NA 5	1989/10	
SVCI management protocol SDL	ETSI	NA 5	1990/09	Belgium
Target IBCN Reference Configuration	ETSI	NA 5	1990/03	
Target IBCN Reference Configurations	ETSI	NA 5	1989/03	
The BRANching functional group in the CAN	ETSI	NA 5	1992/01	Belgium
The Optical Line Outlet concept	ETSI	NA 5	1989/10	
The use of selective broadcasting	ETSI	NA 5	1990/09	Belgium
Transmission range for coaxial interface	ETSI	NA 5	1989/09	
Transmission ranges for an optical fibre interface	ETSI	NA 5	1989/11	
Use of generic layering architecture to structure the broadband user-network signalling interface	ETSI	NA 5	1989/10	
Use of unused octets in meta-signalling messages and indication	ETSI	NA 5	1991/01	Belgium
User network interface based on SDH	ETSI	NA 5	1989/10	
Utilisation of the 780 nm optical window for transmission at the UNI	ETSI	NA 5	1990/09	Belgium
A framework for the TSI TC/TR on "Signalling protocol requirements for B-ISDN services"	ETSI	NA5	1991/11	Finland
A proposal for S-AAL protocol architecture	ETSI	NA5	1992/05	Sweden
AAL functional models for class D services	ETSI	NA5	1991/10	Greece
AAL SSCP protocol model for B-ISDN signalling and CO Data Service	ETSI	NA5	1992/05	Sweden
AAL SSCP protocol model for B-ISDN signalling & (high speed) conection oriented data services	ETSI	NA5	1992/01	France
AAL type 3 functional model	ETSI	NA5	1991/09	Turkey
AAL type 4 functional model	ETSI	NA5	1991/09	Turkey
Application of the Service Component - Concept to stage 2 and 3 of I.130	ETSI	NA5	1991/04	Turkey
B-ISDN Connection Types and their attributes	ETSI	NA5	1992/01	France
Categorization of B-ISDN Connection Types	ETSI	NA5	1992/01	France
Cell delineation for burst & continuous ATM, cell based option	ETSI	NA5	1991/09	Turkey
Clarification of the PRM information flows	ETSI	NA5	1992/01	France
Comments on pr ETS DE/NA-52511 par. 13 "Operational Functions"	ETSI	NA5	1992/09	Sweden
Comparison of the BRAN FG Concept for the Optical Access Network as an addition to the liaison statement	ETSI	NA5	1992/04	Italy
Editorial amendment for paragraph 4.4 in I.432	ETSI	NA5	1991/10	Greece
Functional ATM Layer Model for service primitives definitions	ETSI	NA5	1991/09	Turkey
General NNIs and Interworking	ETSI	NA5	1992/09	Sweden
Identifiers for B-ISDN signalling	ETSI	NA5	1991/11	Finland
Impact of service component concept on stage 2 & stage 3 of CCITT Rec. I.130	ETSI	NA5	1991/10	Greece
Implication of the introduction of the P bit for AAL type 3 & 4	ETSI	NA5	1991/09	Turkey
Improved wavelength allocation	ETSI	NA5	1991/10	Greece
Introduction of BRAN into the Generic RC of CE; Introduction of BRANs into the FAM of a PL	ETSI	NA5	1992/09	Sweden
Introduction of the BRAN and LIT functional groups into the functional architecture model	ETSI	NA5	1991/09	Turkey
Loss priority parameter in AAL Primitives	ETSI	NA5	1991/10	Greece
Maintenance for cell based UNI	ETSI	NA5	1991/09	Turkey
Mapping of service components into bearer components for multimedia services	ETSI	NA5	1991/10	Greece
Naming conventions for primitives related to the association between VCI/VPI & CEI	ETSI	NA5	1992/01	France
No need for a Fast Reservation Protocol	ETSI	NA5	1991/09	Turkey
Physical layer functional model for service primitives definition	ETSI	NA5	1991/10	Greece
Physical Layer OAM for cell based option	ETSI	NA5	1991/09	Turkey
Physical layer OAM for cell based option	ETSI	NA5	1991/10	Greece
Primitives definition related to local monitoring functions : M-ATM CONGESTION-INDICATION	ETSI	NA5	1992/09	Sweden
Primitives definition related to local monitoring functions : M-ATM MONITOR-INVOKE	ETSI	NA5	1992/09	Sweden
Primitives definition related to local monitoring functions : M-ATM MONITOR-REMOVE	ETSI	NA5	1992/09	Sweden
Primitives definition related to local monitoring functions : M-ATM MONITOR-INDICATION	ETSI	NA5	1992/09	Sweden
Primitives exchanged between the PMD sublayer entity & the TC sublayer entity	ETSI	NA5	1991/10	Greece
Proposal for a Concept of multiparty	ETSI	NA5	1991/09	Turkey
Proposal for burst ATM transmission	ETSI	NA5	1991/09	Turkey
Proposed Structure for MANs	ETSI	NA5	1990/03	Italy
Protocol architecture for AAL type 3 & type 4	ETSI	NA5	1991/09	Turkey
Revision of ATM layer functional model	ETSI	NA5	1992/01	France
Revision of service primitives exchanged between the ATM Layer Entity & the AAL Layer Entity	ETSI	NA5	1992/03	Portugal
Service primitives exchanged between the ATM Layer Entity and the ATM Layer Management Entity	ETSI	NA5	1991/09	Turkey
Service primitives exchanged between the ATM Layer Entity and the ATM Layer Management Entity	ETSI	NA5	1991/09	Turkey
Service primitives exchanged between the ATM Layer Entity and the AAL Layer Entity	ETSI	NA5	1991/09	Turkey

Service primitives exchanged between the ATM Layer Entity and the SAR Sublayer Entity	ETSI	NA5	1991/09	Turkey
Service primitives exchanged between the ATM layer Management Entity related to data transfer	ETSI	NA5	1991/09	Turkey
Service primitives exchanged between the PH layer entity & the ATM layer entitiy	ETSI	NA5	1991/10	Greece
State matrix at TB interface for cell based option	ETSI	NA5	1991/10	Greece
The BRANching functional group in the Customer Access Network	ETSI	NA5	1992/01	France
The way ahead on broadband numbering within NA2	ETSI	NA5	1991/09	Turkey
Use of the PRM for user plane and control plane connection establishments	ETSI	NA5	1991/09	Turkey
Comments on SG XI meta-signalling document	ETSI	SPS 3	1991/01	Belgium
Comments on the CCITT SG XI metasignalling protocol working document WD4-33	ETSI	SPS 3	1990/04	Belgium
Global messages for remove and check procedures	ETSI	SPS 3	1990/10	Belgium
Global primitives for remove and check procedures	ETSI	SPS 3	1990/10	Belgium
Initialisation of Meta-signalling and SVCI assignment procedure	ETSI	SPS 3	1990/10	Belgium
Location of meta-signalling in the B-ISDN FRM	ETSI	SPS 3	1991/01	Belgium
Metasignalling protocol functions and limitations	ETSI	SPS 3	1990/04	Belgium
Open questions on meta-signalling raised at Brussels meeting of CCITT SG XI/4	ETSI	SPS 3	1991/01	Belgium
Point-to-point signalling channel management procedures and SDLs	ETSI	SPS 3	1990/10	Belgium
Signalling Virtual Channel Bandwidth	ETSI	SPS 3	1990/10	Belgium
Use of unused octets in meta-signalling messages and indication	ETSI	SPS 3	1991/01	Belgium

R1045 Consensus Management

UK contribution on the Service Component Concept for the definition of Multi Media Services	CCITT		1988	UK
UK contribution to CCITT SG XVIII on Protocol Reference Models	CCITT		1988	UK
UK contribution to CCITT SG XVIII on Signalling Channel Structures	CCITT		1988	UK
Overview of the current status of the CM0 activities I	CEPT	GMR	1990/11	Portugal
Presentation of RACE projects to GMR	CEPT	GMR	1990/01	
R1022 Initial Network Planning Guideline	CEPT	GMR	1989/12	Portugal
RACE Application Analysis R1071	CEPT	GMR	1990/09	
RACE Atmospheric R1014	CEPT	GMR	1990/09	
RACE Concertation Meeting Technical Workshops	CEPT	GMR	1990/01	
RACE Mobile Project R1043	CEPT	GMR	1990/01	
RACE Satellite Communication for IBCN R1002	CEPT	GMR	1989/07	Portugal
RACE: Spectrum Requirements for the 1-3 GHz	CEPT	GMR	1989/10	Italy
Request for support the RACE Workpackage EPF	CEPT	GMR	1989/03	Germany
Testbed Infrastructure for RACE Operation 92	CEPT	GMR	1989/03	Germany
Long Distance Network : Preliminary Results	CEPT	PSR	1989/12	Germany
Optical Interfaces for the Customer Access Network	ETSI		1991/01	Denmark
"Optical Transmission in the OLN, Architecture and Evolution"	ETSI		1991/01	Denmark
The Optical Line Outlet concept	ETSI		1989/10	France
Acronyms and abbreviations related to specificaiton and testing of communication systems	ETSI	ATM	1990/09	Netherlands
Draft report: State of research and standardisation in the area of analytical/formal test specification methods	ETSI	ATM	1991/06	Belgium
Draft Specification RACE B410: Protocol Conformance Testing	ETSI	ATM	1990/09	Belgium
Proposal for a new work item : Study of the Scope for interoperability testing	ETSI	ATM	1990/04	France
Requirements on methodology for conformance testing of lower layers in advanced digital networks	ETSI	ATM	1991/06	Sweden
Standardisation opportunities in the area of formal test methods	ETSI	ATM	1991/06	Sweden
Technical Specifications of the IBC PCT Service	ETSI	ATM	1990/09	Netherlands
Vocabulary	ETSI	ATM	1990/04	France
Vocabulary of interims terms	ETSI	ATM	1990/09	Netherlands
Vocabulary of stable terms	ETSI	ATM	1990/09	Netherlands
Proposal for extending the terms of references of ETSI/TC-HF	ETSI	HF	1989/10	Germany
ISDN Videotelephony Requirements for the Deaf	ETSI	HF 3	1990/07	UK
A comparison of the Layered Network models used in draft CCITT Recs. M.gnm and Gsna.1	ETSI	NA 4	1991/03	Belgium
A Stratified Reference Model - an Extension to ISDN PRM	ETSI	NA 4	1989/11	France
Contribution to the Definition of Reference Configurations (RCs) for the Telecommunications Management	ETSI	NA 4	1990/03	UK
Definition of QoS and NP	ETSI	NA 4	1990/09	France
Deletion of F Reference Point	ETSI	NA 4	1990/03	UK
Draft text for ETR on TMN vocabulary	ETSI	NA 4	1991/03	Belgium
Functional Scope of TMN	ETSI	NA 4	1990/09	France
Impact of Intelligent Network on TMN	ETSI	NA 4	1989/10	Germany
Mediation Function Definition	ETSI	NA 4	1990/03	UK
"QoS and NP, relationships between related terms"	ETSI	NA 4	1991/07	Belgium
Quality of Service Methodology	ETSI	NA 4	1990/03	UK
Reference Configuration Construction Rules	ETSI	NA 4	1990/09	France
Requirements Capture Methodology	ETSI	NA 4	1990/09	France
Revised Vocabulary of Terms for TMN	ETSI	NA 4	1990/09	France

Some comments on draft CCITT Recommendation I.35B	ETSI	NA 4	1990/09	France
Taxonomy and Naming of Reference Points	ETSI	NA 4	1991/03	Belgium
Telecommunications Management Specification Method	ETSI	NA 4	1991/03	Belgium
The Layering of OSFs	ETSI	NA 4	1990/03	UK
The timeline model	ETSI	NA 4	1991/07	Belgium
TMN Reference Point Definition	ETSI	NA 4	1990/09	France
A Formal Stage 1 Description of Multimedia Services	ETSI	NA 5	1989/10	Denmark
AAL protocol model and high level description of the AAL peer-to-peer procedures for B-ISDN signalling	ETSI	NA 5	1990/09	Spain
Addressing Requirements in MAN	ETSI	NA 5	1990/04	France
All functional Models for Class O Services	ETSI	NA 5	1991/10	Belgium
An Adaptation Convergence Sublayer (CS) Protocol for Connectionless Services	ETSI	NA 5	1990/03	Italy
"An Adaption Layer Protocol Model for Signalling, Packet Mode-Connection oriented and Connectionless	ETSI	NA 5	1989/10	Belgium
An Application Layer Protocol Model for Signalling - Packet Mode-Connection oriented and	ETSI	NA 5	1989/10	Denmark
Analysis of Multimedia Aspects of Broadband Services	ETSI	NA 5	1989/10	Denmark
Answer to liaison statement from NA5 concerning Activation/Deactivation Procedures in B-ISDN	ETSI	NA 5	1990/03	Italy
Application of the Service Component concept to stage 2 and 3 of I.130	ETSI	NA 5	1991/09	Belgium
Assumptions on the Dynamic Behaviour of Multimedia Services	ETSI	NA 5	1990/03	Italy
ATM Adaptation Layer for VBR Services	ETSI	NA 5	1989/10	Denmark
ATM Adaptation Layer Service Classification for non-time related services	ETSI	NA 5	1990/03	Italy
ATM based Broadband ISDN	ETSI	NA 5	1989/03	Germany
ATM cell format	ETSI	NA 5	1988/12	Ireland
ATM Cell Header Error Protection	ETSI	NA 5	1989/04	Netherlands
ATM Header Functionalities and Size	ETSI	NA 5	1989/03	Germany
ATM Signalling Channel Allocation and Meta-signalling issues	ETSI	NA 5	1989/10	Denmark
ATM signalling channel structure and allocation	ETSI	NA 5	1989/04	Netherlands
Attributes and possible values for B-ISDN	ETSI	NA 5	1992/01	France
B-ISDN Architectural Principes for interactive and non-switched distribution services	ETSI	NA 5	1990/09	Spain
B-ISDN Connection Types and Attributes Values	ETSI	NA 5	1990/10	France
B-ISDN Reference Configuration with MAN and MSS	ETSI	NA 5	1990/04	France
Basic Concept of B-ISDN Connection Types	ETSI	NA 5	1990/10	France
Basic Requirements and Principles for MANs	ETSI	NA 5	1990/01	Germany
Benefits of activation/deactivation at the TB reference point	ETSI	NA 5	1990/09	Spain
Bit Timing for the Likely Solution	ETSI	NA 5	1989/04	Netherlands
Business customers where MAN facilities do not exist	ETSI	NA 5	1991/02	Belgium
Categories of B-ISDN Connection Types	ETSI	NA 5	1992/01	France
Clarification of Channel Associated Signalling (CAS) at the access	ETSI	NA 5	1991/01	France
Clarification of the ATM Adaptation Service Classification Model	ETSI	NA 5	1990/03	Italy
Comments on ATM Header Functions	ETSI	NA 5	1989/10	Denmark
"Comments on DETS ""Connectionless Broadband Data Service"""	ETSI	NA 5	1991/02	Belgium
Comments on NA5 Draft Rec. I413	ETSI	NA 5	1989/11	UK
Comments on SG XI metasignalling baseline document	ETSI	NA 5	1991/01	France
Comments on the NA4 liaison related to SAP location	ETSI	NA 5	1991/04	Belgium
Comments on the suitability of an activation/deactivation procedure of B-ISDN	ETSI	NA 5	1991/02	Belgium
Comments to draft Rec. I.311	ETSI	NA 5	1990/04	Portugal
Comments to draft Rec. I.363	ETSI	NA 5	1990/04	Portugal
Common Channel Signalling (CCS) for B-ISDN	ETSI	NA 5	1991/01	France
Commonality between SNI and T interfaces	ETSI	NA 5	1990/06	Finland
Congestion Control for CL Services	ETSI	NA 5	1990/04	France
Congestion control for MAN Networks	ETSI	NA 5	1990/09	Spain
Congestion Control of Connectionless Services	ETSI	NA 5	1990/06	Finland
Considerations on the use of physical layer maintenance signals for fault location indication	ETSI	NA 5	1990/09	Spain
Considerations on VPI/VCI Allocation for Physical Layer OAM Flows	ETSI	NA 5	1990/04	Portugal
Coordination of RACE Contributions	ETSI	NA 5	1990/04	France
Core network and interworking aspects	ETSI	NA 5	1991/02	Belgium
Cost comparison of the coaxial with the fibre optical interface at UNI	ETSI	NA 5	1989/11	UK
Cost figures of a coaxial interface at UNI	ETSI	NA 5	1989/11	UK
Cost Figures of a Fibre Optical Interface at UNI	ETSI	NA 5	1989/11	UK
Customer Network Evolutionary Aspects	ETSI	NA 5	1991/02	Belgium
"Description of the Convergence Sub-layer (CS) Protocol for UNI Access Signalling,Broadcast	ETSI	NA 5	1990/04	Portugal
DQDB Performance Enhancements	ETSI	NA 5	1990/04	France
Editorial amendment for par. 44 in I432	ETSI	NA 5	1991/10	Belgium
Error detection for PO services	ETSI	NA 5	1989/11	UK
Estimate of motivation time for activation/deactivation procedure for broadband ISDN	ETSI	NA 5	1990/09	Spain
Evolution of MANs	ETSI	NA 5	1991/02	Belgium
Evolution of mobile	ETSI	NA 5	1991/02	Belgium

Evolution of satellites	ETSI	NA 5	1991/02	Belgium
Evolution of the residential area	ETSI	NA 5	1991/02	Belgium
Evolutionary graph	ETSI	NA 5	1991/02	Belgium
First revision of I.140 attributes	ETSI	NA 5	1990/09	Spain
Functional ATM Layer Model for service primitive definitions	ETSI	NA 5	1991/09	Belgium
Handling of Distributed Databases	ETSI	NA 5	1991/09	Belgium
Impact of Deactivation on Metasignalling and Signalling	ETSI	NA 5	1991/03	Belgium
Impact of Service Components into Bearer Components for multi media services	ETSI	NA 5	1991/10	Belgium
Impact of the OLI/OLO concept on the evolution of services and of the optical access network	ETSI	NA 5	1991/02	Belgium
Inclusion of the OLI/OLO concept in CCITT Rec. I.327	ETSI	NA 5	1990/10	France
Indentifiers for B-ISDN Signalling	ETSI	NA 5	1991/10	Greece
Information Field Size	ETSI	NA 5	1989/03	Germany
Initialisation of metasignalling and SVCI assignment procedure	ETSI	NA 5	1990/09	Spain
Introduction of the BRAN and LIT functional groups into the functional architectural model	ETSI	NA 5	1991/09	Belgium
Introductory IBCN Reference Configurations	ETSI	NA 5	1990/03	Italy
List of Contributions	ETSI	NA 5	1990/09	Spain
List of contributions from RIC	ETSI	NA 5	1989/09	France
List of contributions from RIC	ETSI	NA 5	1989/10	Denmark
List of Contributions from RIC	ETSI	NA 5	1990/01	Germany
List of contributions from RIC	ETSI	NA 5	1990/03	Italy
List of contributions from RIC	ETSI	NA 5	1990/04	Portugal
List of parameters for the PMD layer of an electrical interface at the T-reference point	ETSI	NA 5	1989/11	France
Location of metasignalling in the B-ISDN PRM	ETSI	NA 5	1991/01	France
Loss Priority Parameters in AAL primitives	ETSI	NA 5	1991/10	Greece
MAN ACCESS Facility	ETSI	NA 5	1990/06	Finland
Management Issues related to MAN Architecture	ETSI	NA 5	1990/06	Finland
Mapping of Service Components into Bearer Components for multi-media Services	ETSI	NA 5	1991/10	Greece
Meta-signalling assignment procedure	ETSI	NA 5	1990/03	Italy
Meta-signalling message transport	ETSI	NA 5	1989/11	UK
Meta-signalling states description	ETSI	NA 5	1989/11	UK
Metasignalling Protocol Functions and Limitations	ETSI	NA 5	1990/04	Portugal
Metasignalling Protocol Issues	ETSI	NA 5	1990/04	Portugal
Model	ETSI	NA 5	1990/11	Germany
MSS Functional Model	ETSI	NA 5	1990/06	Finland
Multimedia service structure	ETSI	NA 5	1990/09	Spain
No need for a Fast Reservation Protocol	ETSI	NA 5	1991/09	Belgium
Notes on Access Network MAN Architectures	ETSI	NA 5	1990/04	France
On traffic and service evolution in TR in evolution onwards B-ISDN	ETSI	NA 5	1991/10	Belgium
Open questions on metasignalling raised at the Brussels meeting of CCITT SG XI/4	ETSI	NA 5	1990/09	Spain
Open questions on metasignalling raised at the Brussels meeting of CCITT XI/4	ETSI	NA 5	1991/01	France
Performance measurement aspects of the cell based interface	ETSI	NA 5	1991/02	Belgium
Physical Layer OAM for cell based option	ETSI	NA 5	1991/09	Belgium
Physical Medium Dependent Sublayer for the Broadband S Interface	ETSI	NA 5	1989/09	France
PL-OAM cells and rate-adaptation of the cell-based UNI	ETSI	NA 5	1990/09	Spain
Point-to-point signalling channel management procedures and SDLs	ETSI	NA 5	1990/09	Spain
Possible conflicts in CUG membership	ETSI	NA 5	1991/02	Belgium
Possible options for multiparty cells	ETSI	NA 5	1990/09	Spain
Power Feeding across the interface at the T-reference point	ETSI	NA 5	1989/09	France
Preliminary considerations of the early stages network evolution towards the B-ISDN	ETSI	NA 5	1990/09	Spain
Preliminary Network Architecture for the IBCN	ETSI	NA 5	1989/10	Denmark
Primitives between ATM and ATM LME for Meta-signalling	ETSI	NA 5	1991/03	Belgium
Primitives between ATM LE and ATM LME connection establishment/release	ETSI	NA 5	1991/09	Belgium
Principles of Interworking	ETSI	NA 5	1989/11	UK
Proposal for a cyclic counting in the Sequence number field	ETSI	NA 5	1990/03	Italy
Proposal for a new recommendation on Adaptation Protocol for Signalling	ETSI	NA 5	1990/04	Portugal
Proposal for a single BASIC ATM Adapt. (SAR) sublayer for all Packet Oriented (PO)Services	ETSI	NA 5	1989/11	UK
Proposal for Basic Primitives Between the ATM adaptation Layer and the ATM layer	ETSI	NA 5	1990/03	Italy
Proposal for cell delineation at S reference point	ETSI	NA 5	1989/10	Denmark
Proposal for Characterization of Broadband Traffic	ETSI	NA 5	1990/09	Spain
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
Proposal for Primitives Between the ATM adaptation Layer and the ATM layer	ETSI	NA 5	1990/03	Italy
Proposal for text on AAL Type 3 primitives for AAL operations to be inserted in I.363	ETSI	NA 5	1990/09	Spain
Proposal for text on AAL Type 3 primitives for non-assured operation without flow control to be inserted in	ETSI	NA 5	1990/09	Spain
Proposal for text on ATM Layer Primitives to be inserted in I.321	ETSI	NA 5	1990/04	Portugal

Proposal for the use of Terms in I.311	ETSI	NA 5	1990/03	Italy
Proposal of a new recommendation on a Metasignalling Protocol	ETSI	NA 5	1990/04	Portugal
Proposed Document Structure for MAN Standards	ETSI	NA 5	1990/01	Germany
Proposed structure of draft ETSs for MANs	ETSI	NA 5	1990/03	Italy
Qos Principles for CL Services	ETSI	NA 5	1990/04	France
Reference Configuration Construction Rules	ETSI	NA 5		Spain
Reference Configurations for the SB interface	ETSI	NA 5	1989/09	France
Reference Configurations (RC) and their Implementation Options	ETSI	NA 5	1989/11	UK
Section and Path Overhead Functions Required for Performance Monitoring at the UNI	ETSI	NA 5	1989/09	France
Selective broadcastsignalling channel (SBSVC) management	ETSI	NA 5	1990/09	Spain
Service Component Concept	ETSI	NA 5	1989/03	Germany
Service primitives between the ATM LE and the ATM LME for error reporting	ETSI	NA 5	1991/09	Belgium
Service primitives between the ATM LE and the SAR SLE	ETSI	NA 5	1991/09	Belgium
Service primitives exchanged between the ATM LE and the ATM LME for data transfer	ETSI	NA 5	1991/09	Belgium
Service Primitives exchanged between the PM Layer Entity and the ATM Layer Entity	ETSI	NA 5	1991/10	Belgium
Service Primitives for the Connectionless Data Service	ETSI	NA 5	1991/04	Belgium
Service Requirements for MANs	ETSI	NA 5	1990/01	Germany
Signalling Virtual Channel bandwidth	ETSI	NA 5	1990/09	Spain
Specification of different functionality	ETSI	NA 5	1989/11	UK
Specification of the self-synchronizing scrambler in Recommendation I.432	ETSI	NA 5	1990/09	Spain
Specifications of B-ISDN addressing functions - first draft	ETSI	NA 5	1991/02	Belgium
Stage 1 Description of CL Service (1)	ETSI	NA 5	1990/06	Finland
Stage -1 Description of CL Service (2)	ETSI	NA 5	1990/06	Finland
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

RACE
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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1991/11 5th RACE TMN Conference - London

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Virtual Path and Call Acceptance Management for ATM Networks
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R1006 AIM-AIP Application to IBC Maintenance

A design of the Operation, Maintenance and Construction of an Intelligent Management Information Base
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

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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

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The Application of Information Modelling in the Telecommunications Management Network (TMN)
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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

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1990/10 3rd International Workshop on Protocol Test Systems (IWPTS)

IBCN Conformance Testing: the ITACA approach
1991 Proceedings IFIP TC 6, 3rd International workshop on Protocol Test Systems

Open Subsystems Testing
1990 Protocol Test Systems

Presentation of RACE project R1072 ITACA
1989/10 2nd International Workshop on Protocol Test Systems (IWPTS)

R1073 GEOTEL

GEOTEL
1990/06 The USER (Newsletter for Usage projects in RACE)

GEOTEL and Drawings Management
1991/10 Autocad Magazine

GEOTEL branche sur NUMERIS
1990/01 L'Ordinateur Individuel

GEOTEL, des banques de donnees en reseau pour le secteur petrolier et chimique
1989/10 INFOTECTURE

GEOTEL, les normes AFNOR
1990/11 Industries et Techniques

GEOTEL, les normes françaises dans leur version integrale
1990/09 AFNOR (The French Standard organisation)

GEOTEL, les normes Françaises en ligne
1990/05 ENJEUX (Afnor Newsletter)

The GEOTEL Human Interface
1990/11 The User Newsletter

The GEOTEL Interworking architecture
1991/03 The User Newsletter

R1075 TELEPUBLISHING

Anwendung des BERKOM-Referenzmodells fuer das RACE Projekt TELEPUBLISHING
1991/05 Workshop BERKOM Reference Model II

Applications in publishing
1991/11 Broadband Communications : Market Strategies - OVUM Report, Ovum Ltd. - London, UK

Aspekte und Trends des elektronischen Publizierens
1990/04 Informationstechnik : Computer, Systeme und Anwendungen, Ausgabe 4/90

Beschleunigung fuer Organvermittlung
1992/07 Interview with V. Reible, A. Kindt in "Der Tagesspiegel", No 14 251, Berlin - Germany

Breitband Inseln fuer Multimedia Anwendungen
1991/10 GI 91 Annual Conference "Telekommunikation und Multimediale Anwendungen der Informatik" -

Breitbandkommunikation im Publishing-Umfeld
1991/05 Deutscher Drucker, No 20

Broadband and integrated services in distributed working environments
1991/04 Proceedings COSTEL Multimedia Workshop

Distributed Publishing of Electronic Newspapers and Mailorder Catalogues
1991/10 GI '91 Annual Conference Telekommunikation und Multimediale Anwendungen der Informatik

Elektronisches Publizieren auf dem Weg zur Telekommunikation
1991/06 Forschung Aktuell, No 33-35

Global Telecommunications for the publishing and printing industry : Technology, research and pilot projects
1992/02 IMPRINTA 92, International Congress, Duesseldorf, Germany

Hypermedia Standards
1991/06 OII-Workshop, CEC DG XIII B

Individuelle elektronische Zeitung (Individualized Electronic Newspaper)
1990/11 3. DTP-Kongress in Berlin (Desktop Publishing Congress)

Innovative Telepublishing Anwendungen
1990 Proceedings of 3.DTP-Kongre· 1990.

Key broadband Technologies
1992/05 Dataquest, Interview, London - UK

Knowledge-based Cooperative Publication System
1991/10 4th International GI Conference

Konzepte zur Versionenverwaltung fÄr die Hyperdokumentenerstellung in einer hypertextbasierten
1991/05 Proceedings Gi/SI/OCG Conference Hypertext/Hypermedia '91

Konzeptionelle AnsNtze fÄr kooperative Applikationen
1990/04 Informationstechnik it: Computer, Systeme und Anwendungen, Ausgabe 4/90

Layoutplanung und hochauflisende Bildkommunikation
1989/10 Proceedings GI-Fachseminar Elektronisches Publizieren Systems 89

Opportunities using new media storage methods
1991/10 International Conference Prepress '91

Probieren geht ueber Studieren
1992/01 PC Woche, Special Desktop Publishing, IDG VErlag, Munich, Germany

Publishing as a broadband application
1990/10 IEE Conference Integrated Broadband Services & Networks

Publishing Tools Need Both: State-Oriented Version Support
1991/09 Proceedings 15th Annual International Computer Software & Applications Conference COMP-SAC

RACE Telepublishing
1990/11 Workshop Bundesverband Druck, Working Group Reproduction Techniques

RACE - Telepublishing
1991/10 BERKOM - Breitbandkommunikation im Glasfasernetz

Telepublishing
1990/01 Forschungsfuehrer, Technische Universitat Berlin

Telepublishing
1989/11 Telematikbrief Nr 3, FhG/ISI

Telepublishing, an application oriented broadband project
1990 IDATE conference 1990 - Proceedings

Telepublishing - an application oriented IBC project
1991/06 OII-Workshop CEC/DG XIII B

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1990/11 Proceedings 12th International Conference Key Technologies, Experiments, New Concepts

Telepublishing- ein Anwendungsprojekt im Breitbandumfeld
1991/10 GI '91 Annual Conference Telekommunikation und Multimediale Anwendungen der Informatik

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1991/03 IEEE Review

The Individualized Electronic Newspaper : An Application Challenging Hypertext Technology
1992/09 Conference "Hypertext und Hypermedia 1992 : Konzepte und Anwendungen auf dem Weg in die

The RACE Telepublishing Project
1989/10 Proceedings of International Press Telecommunication Council (IPTC), Working Party

The use of co-operation models for specification and design of user interface
1991/09 Proceedings of the Fourth International Conference on Human-Computer Interaction Human

Uebersicht Pilotprojekte : Einordnung, Technik und Bedeutung
1991/11 4th DPT Congress - Berlin, Germany

Verteilte Produktion und Seitengestaltung von individualisierten Publikationen
1990/11 GI-Workshop Multimediale elektronische Dokumente

R1076 REMUS - Reference Models for Usability Specifications

Designing for Usability - The development of the REMUS Database
1990/09 Human Factors in Telecommunications, 13th International Symposium

Usability Issues and Solutions in IBC
1991/10 TELECOM 91

R1077 Usage Reference Model for IBC

A Unified Method for the Design of Telecommunication Services
1992/08 Ergonomics Special Issue, Telecommunication Industry

Applications Analysis : Case-Study Results for European Organisations
1992/03 Elsevier - North Holland

Applications Analysis : The RACE Application Pilots
1992/03 Elsevier - North Holland

Commercial Issues in the Definition and Marketing of Broandband Services
1992/03 Elsevier - North Holland

Conceptual Framework for Usage of Telecommunication Services
1992/03 Elsevier - North Holland

Designers Requirements for Usage information in the development of a Usage Reference Model for IBC
1990/10 Proceedings of the IEE conference on Integrated Broadband Service and Networks

Designers Requirements in the development of a usage reference model for IBC
1990 Proceedings of Human Factors in Telecoms Conference

From ISDN to Broadband Services: First experiences from the RACE programme
1991/05 Proceedings of the Teleconference Europe '91

Generic User Services Defined
1992/03 Elsevier - North Holland

Glossary : A Guide to IBC Terminology from a Usage Perspective
1992/03 Elsevier - North Holland

IBC - Views from Usage
1991 Integrated Broadband Communications: Views from RACE Network and Engineering Aspects

Integrated Broadband Communications : Views from RACE : Usage Aspects
1992/03 Elsevier - North Holland

Integration of Services for Applications
1992/03 Elsevier - North Holland

Integration of Services for Human End-Users : Design Principles, Enabling States Analysis, and a Design
1992/03 Elsevier - North Holland

Modelling Advanced Communication Services
1991/04 The International Symposium on Subscriber Loops and Services

Modelling Broadband Services from a Usage Perspective
1990 Proceedings of Human Factors in Telecoms Conference

Multimedia Communications in CSCW
1991/07 Proceedings of Seminar:Computer Supported Cooperative Work

Piloting New Services
1992/03 Elsevier - North Holland

Public Infrastructure Design from a Usage Viewpoint
1992/03 Elsevier - North Holland

Stored programme controlled telecommunication services
1990 International Conference on Communications

Telecommunications from the usage point of view
1991 Integrated Broadband Communications: Views from RACE. Network and Engineering Aspects

The Implications of Human Factors Recommendations for Network Infrastructure Design
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 pediŧrico con integraciŧn en el proyecto TELEMED
1990/11 XX Congresso Nacional de Radiologia

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

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

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

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

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

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

Telemed: un progretto Applicativo
1991/01 Assolombarda

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

The RACE TELEMED Project R1086
1989/10 AIM Concertation Meeting

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

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

The TELEMED project
1990/12 AIM Euroforum

The Teleradiology in Europe
1991/03 Milano Europa

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

Videoconference
1991/06 Informatica in Radiologia

R1087 PROVE - Provision of Verification

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

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

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

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

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

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

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

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

R1088 TUDOR - Usability Issues for People with Special Needs

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

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

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

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

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

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

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

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

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

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

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

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

R1089 LOOP - Low-cost Optimised Optical Passive Components

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

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

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

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

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

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

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

R1091 ESP - Exploitation and Service Project

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

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

Perspektiven zu einem europNischen IBC
1990 TUBKOM-Kolloquium Breitbandtechnik

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

Transportprotokoll Profile und erweiterte Transport Service 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 : Gennany

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Annex V

Glossary of technical terms

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

Annex VI

Key references

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

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

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

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

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

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

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

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

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

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

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

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

Annex VII

Listing of Projects

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

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

Annex VIII

Organisations involved in RACE Projects

ANNEX B - Alphabetical List of Participating Organisations

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

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

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

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

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

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

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

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

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

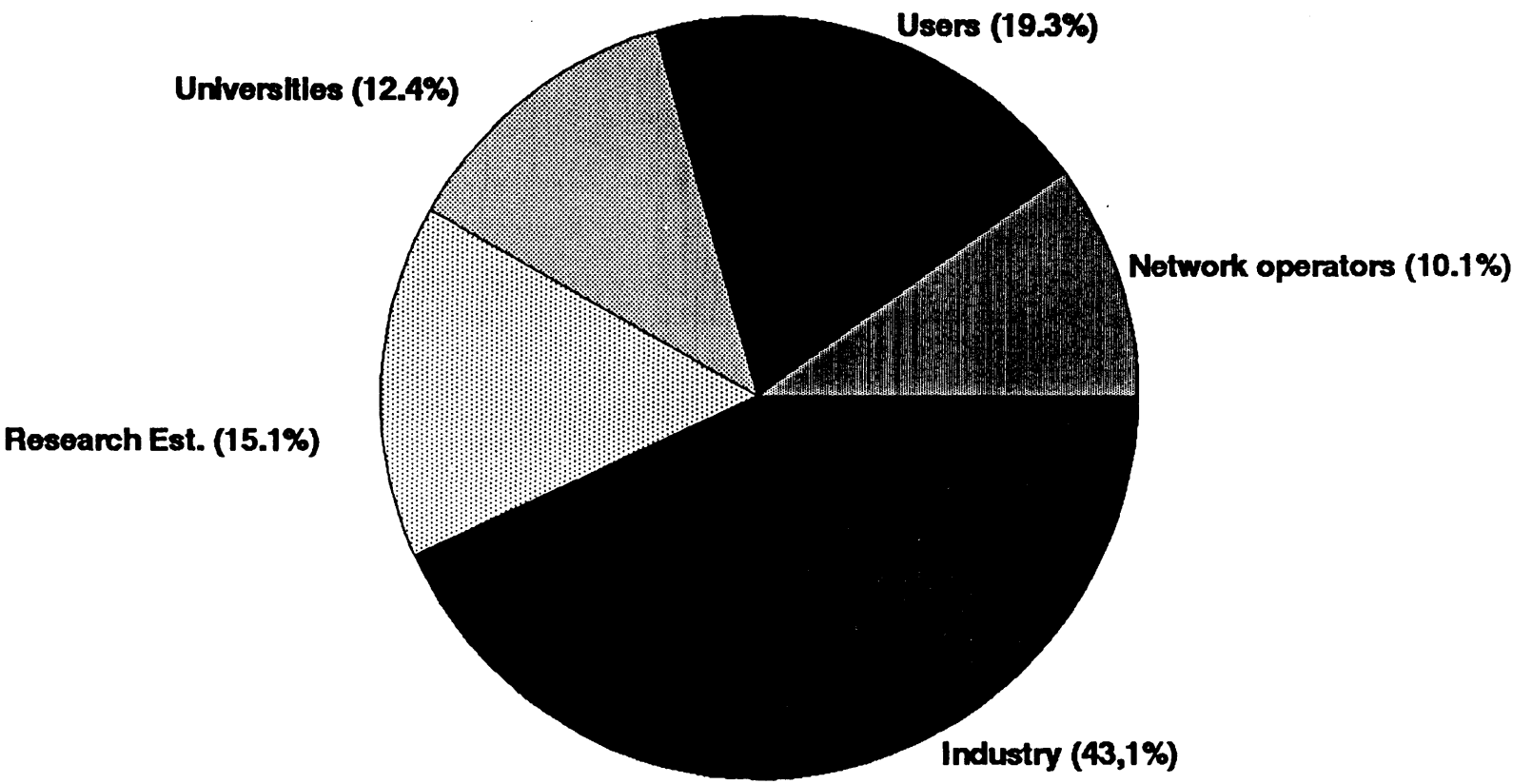
USTL	Université de Sciences et Techniques du Languedoc	F	R1029
UVA	University of Aarhus	DK	R1040
UVD	University of Durham	UK	R1084
UVL	University of Leuven	B	R1040
UVS	University of Surrey	UK	R1023
VERITAS	Det Norske Veritas	N	R1062
VITEC	VITEC	F	R1079
W&G	Wandel & Goltermann GmbH & Co	D	R1083*
WRC	Work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

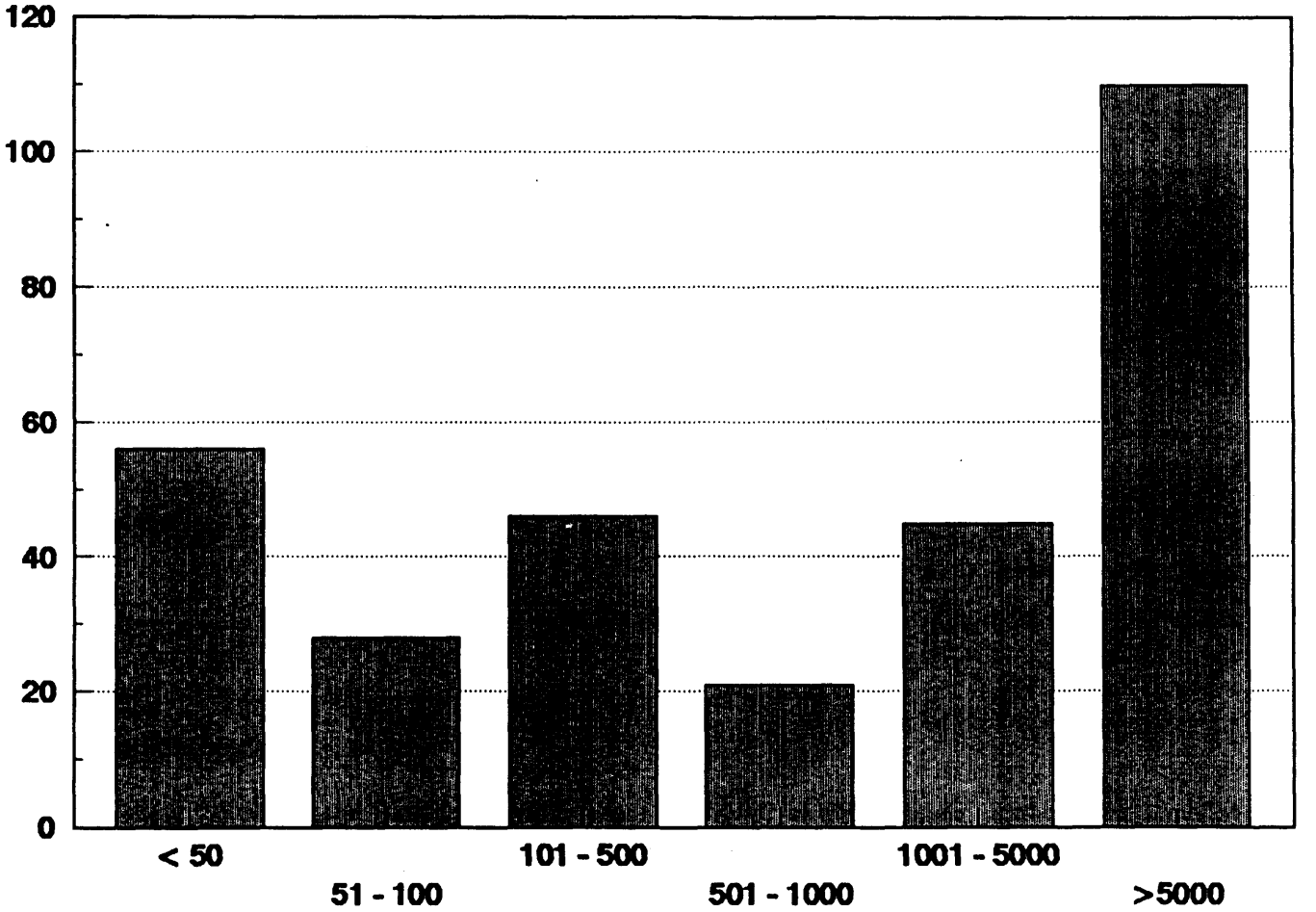
* Prime Contractor for Project

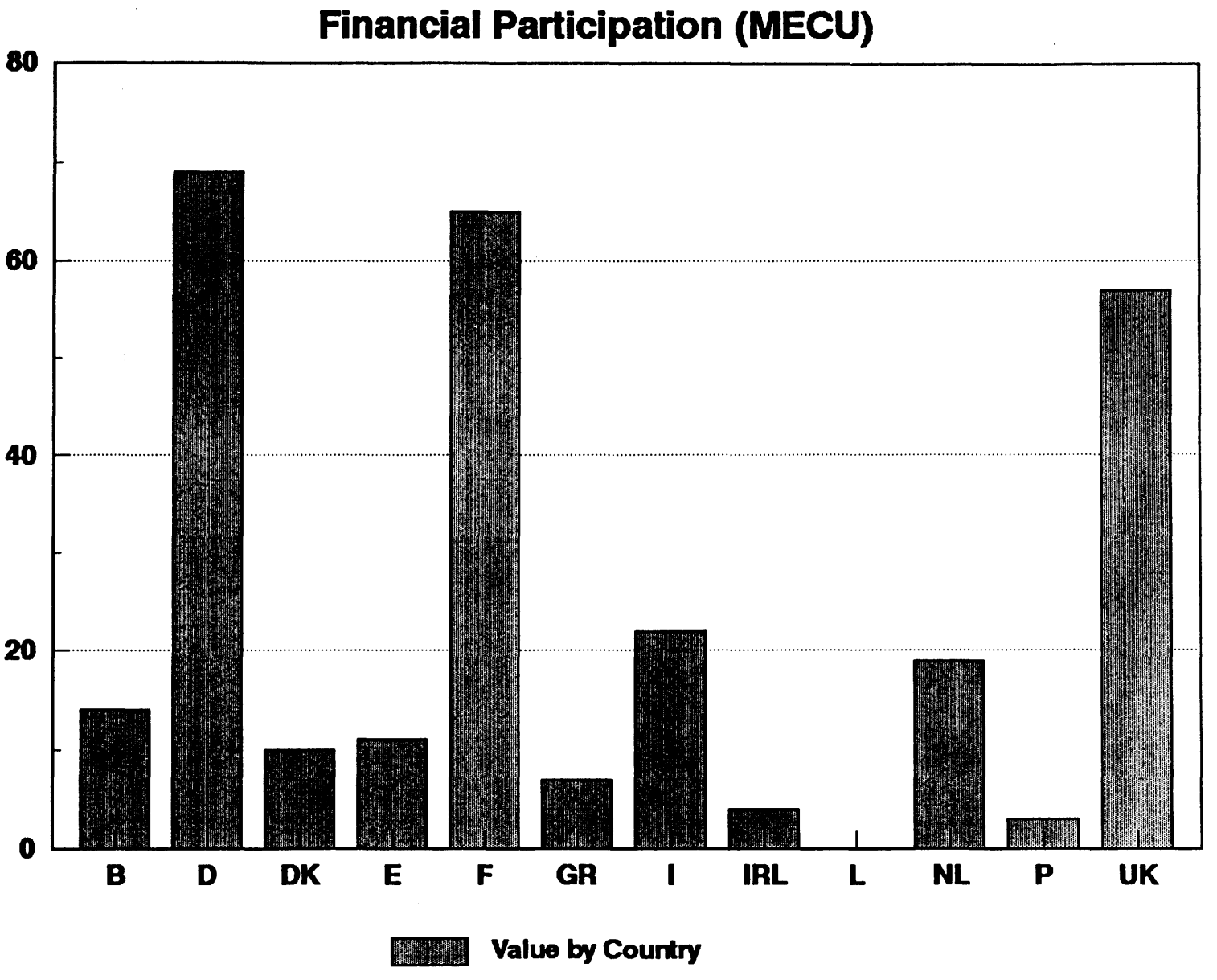
Annex IX

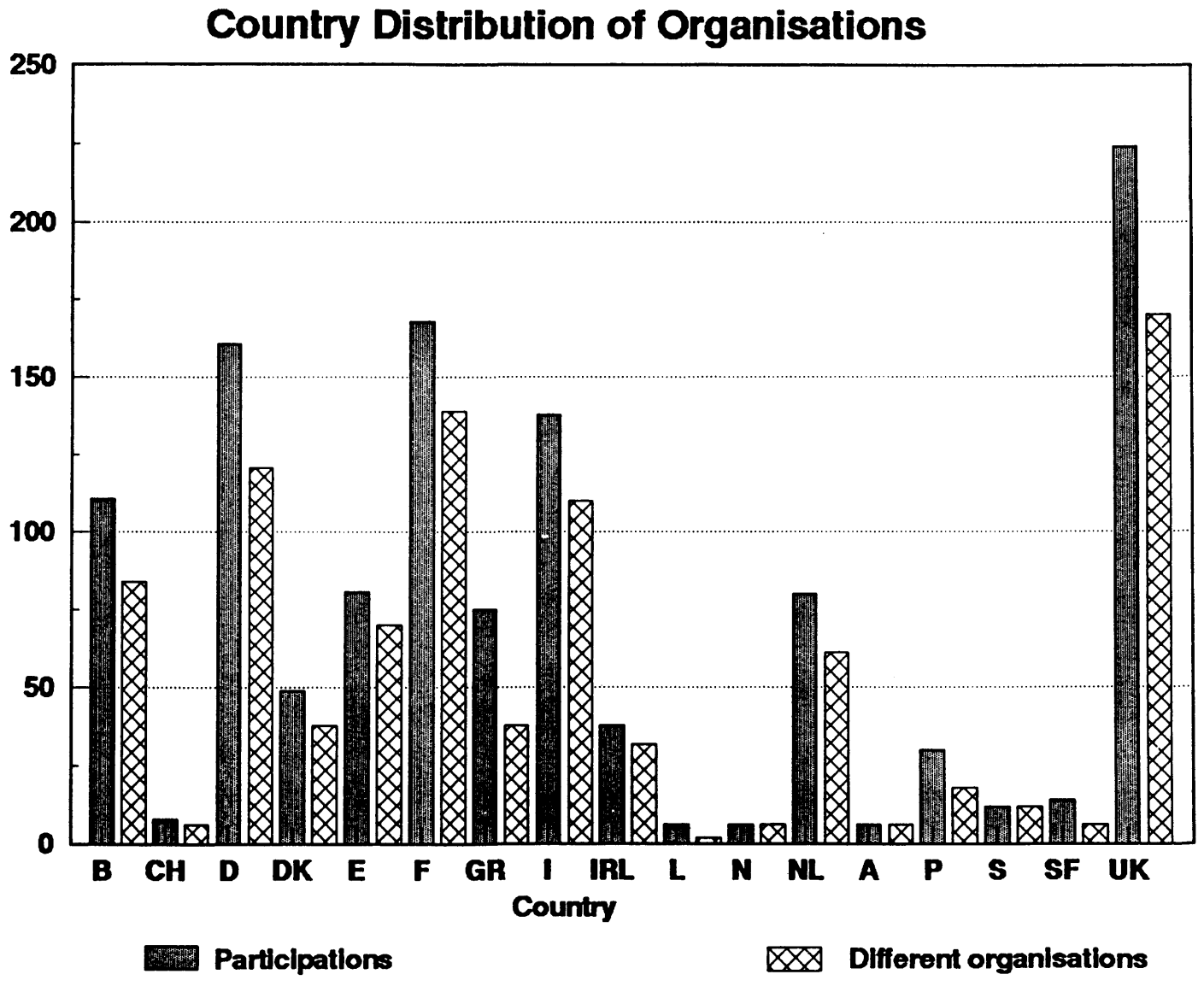
Financial and participation statistics

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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