COMMISSIONE DELLE COMUNITA' EUROPEE

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PROGRAMMA DI R&S

sulle tecnologie di comunicazione avanzate in Europa (RACE)

Relazione finale
sulla prima fase (1988-1992) del programma decennale RACE

(Presentata dalla Commissione in base all'articolo 6, paragrafo 3
e all'articolo 9 della decisione del Consiglio 88/28/CEE
sul Programma RACE)

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Sintesi

Al momento attuale, le telecomunicazioni costituiscono la base della maggior parte delle attività industriali e influenzano in modo preponderante le prestazioni del settore dei servizi in Europa. L'efficienza delle telecomunicazioni è decisiva per la competitività del settore economico. Con il completamento dello Spazio economico europeo, privo di barriere interne, si apriranno nuove opportunità e si registreranno nuove pressioni concorrenziali: la crescente importanza delle telecomunicazioni nel commercio internazionale sta già cambiando il modo di agire delle imprese. La prosperità in Europa negli anni Novanta dipenderà in modo cruciale dall'efficienza delle telecomunicazioni.

A livello mondiale, i settori delle telecomunicazioni, dell'informatica e della radiodiffusione rappresentano già un fatturato annuo di più di 500 miliardi di ECU. Nel 2000 il settore delle telecomunicazioni sarà il terzo per ordine d'importanza in Europa, dopo quelli degli alimentari e delle bevande e dei prodotti chimici. Le infrastrutture di telecomunicazione saranno più importanti, sul piano economico, delle infrastrutture fisiche dei trasporti. La capacità di padroneggiare le opzioni tecnologiche è pertanto divenuta un fattore chiave della crescita economica e della creazione di nuovi posti di lavoro. Più del 50% dei posti di lavoro dipendono già dall'impiego di sistemi informatici e telematici, e il principale incremento dell'occupazione si verifica proprio nel settore dell'informazione.

La domanda di servizi è in rapido mutamento. Le imprese hanno bisogno di servizi più flessibili, di capacità di trasmissione più elevate per poter trasmettere velocemente dati ed immagini, nonché di tariffe più competitive. Attualmente, i servizi a valore aggiunto sulle reti digitali ad alta velocità mostrano una crescita del 40% annuo: 40 milioni di transazioni servizio/utente nel 1987, 180 milioni nel 1989 e più di 300 milioni nel 1991. Nel 2000, tali servizi a valore aggiunto potrebbero equivalere al 30% delle entrate nel settore delle telecomunicazioni. Nel giro di pochi anni, la maggior parte delle imprese europee avrà bisogno di sistemi veloci di comunicazione dati che colleghino i vari settori dell'azienda: progettazione, produzione, gestione e vendita al dettaglio. Negli Stati Uniti vi è già una forte domanda di tali servizi: tutti i principali istituti di ricerca hanno accesso a sistemi di comunicazione dati ad alta velocità, e il 60% delle 500 imprese più importanti utilizzano canali digitali di trasmissione dati ad alta velocità.

Nel 1985, preso atto di queste tendenze, su iniziativa dei ministri dell'industria europei è stata avviata una "fase di definizione" del programma RACE, che ha stabilito la necessità di un quadro europeo di collaborazione per la R&S e individuato il campo d'applicazione. Nel dicembre 1987 il Consiglio dei ministri europei ha adottato la decisione relativa alla prima fase del programma decennale RACE (Ricerca e sviluppo sulle tecnologie di comunicazione avanzate in Europa) in cui si definivano gli orientamenti delle politiche e gli stanziamenti di bilancio per un periodo iniziale di cinque anni, fino al 1992, nel contesto del secondo programma quadro comunitario di ricerca e sviluppo tecnologico. L'obiettivo era di "promuovere la competitività dell'industria comunitaria delle telecomunicazioni, nonché degli enti di gestione e dei fornitori di servizi comunitari, affinché mettano a disposizione dell'utente finale al minimo costo ed entro breve termine servizi in grado di assicurare la competitività dell'economia europea nei prossimi decenni e di contribuire al mantenimento e alla creazione dell'occupazione nella Comunità".

L'articolo 9 della decisione stabilisce che "*al termine del primo quinquennio del programma, dopo aver consultato il comitato di gestione, la Commissione presenta agli Stati membri e al Parlamento europeo una relazione sull'andamento e i risultati del programma*". Il presente documento costituisce appunto tale relazione, che aggiorna quella presentata nel 1990, sullo stato di avanzamento dei lavori dopo trenta mesi.

I principali risultati

Come risultato delle attività realizzate nel primo quinquennio del programma RACE, l'Europa detiene una posizione di punta nello sviluppo della concezione di reti e servizi di comunicazione avanzati. Per la prima volta gli operatori delle telecomunicazioni, l'industria telematica e gli utenti di punta di quasi tutti i principali settori di applicazione hanno riunito i propri sforzi per sviluppare le tecnologie di comunicazione avanzate necessarie per servizi innovativi e a basso costo. Grazie al programma RACE si è creato un contesto unico per la concertazione degli sforzi dei partecipanti.

Il programma RACE ha potenziato l'armonizzazione dell'infrastruttura europea di telecomunicazioni; l'elaborazione di specifiche funzionali comuni ha costituito la falsariga su cui impostare le comunicazioni integrate a larga banda (IBC). Il programma ha promosso la stretta cooperazione delle regioni centrali e periferiche, contribuendo in tal modo alla coesione economica e sociale della Comunità. In termini di sviluppo tecnologico, lo sviluppo della modalità di trasferimento asincrono (ATM) per la commutazione ad alta velocità delle comunicazioni digitali ha conferito all'industria europea un ruolo dominante nella concorrenza internazionale. Grazie alla ricerca sulla gestione delle reti, i sistemi europei di gestione di rete hanno ricevuto riconoscimenti a livello internazionale; le attività sui sistemi video e televisivi digitali hanno consentito la definizione di norme internazionali concernenti la codifica e i sistemi di distribuzione del segnale multi-gigabit, nonché di specifiche per la registrazione digitale del segnale video. Per quanto riguarda la normalizzazione, il programma ha trasmesso 576 progetti di specifica agli enti europei e internazionali - l'ETSI, il CCITT e il CCIR (cfr. Allegato II). Tali attività hanno costituito un efficace complemento delle attività EUREKA; sulla stampa specializzata sono stati pubblicati più di 1700 articoli scientifici e tecnici (cfr. Allegato III).

I risultati del programma RACE conferiscono agli organismi di telecomunicazione e ai fornitori di servizi europei un vantaggio competitivo d'importanza strategica. RACE ha reso consapevole l'industria delle opportunità di mercato legate alla realizzazione della prossima generazione di servizi di telecomunicazione in Europa; ha dimostrato i vantaggi della collaborazione nella R&S su scala europea ed ha sostanzialmente potenziato la normalizzazione europea nel settore delle telecomunicazioni.

Gestione e valutazione del programma RACE

Nell'ambito del secondo programma quadro comunitario, RACE ha una tipologia unica: è stato l'unico programma gestito come un insieme di attività pienamente integrato. Ciascun progetto ha affrontato una o più attività di R&S facenti parte di un insieme coerente, ciascuna delle quali ha contributo ad un unico obiettivo:

"Introduzione delle comunicazioni integrate a larga banda (IBC), tenendo conto dell'evoluzione della rete digitale di servizi integrati (ISDN) e delle strategie nazionali di introduzione, per disporre di servizi comunitari entro il 1995".

Il programma di lavoro, adottato nel 1987, ha definito il quadro delle attività di ciascun progetto e le relative interazioni. Queste ultime sono state ulteriormente potenziate grazie alla "concertazione" tra i progetti e a discussioni tecniche su tutti i progetti a intervalli di 6-8 settimane. I risultati tecnici dei progetti sono stati ulteriormente integrati da un progetto centrale concernente lo sviluppo delle strategie di realizzazione delle comunicazioni integrate a larga banda (IBC), i modelli funzionali di riferimento, le funzioni dei servizi per il consumatore e le configurazioni di riferimento. E' stata inoltre garantita una stretta e coerente interazione con gli enti europei di normalizzazione grazie ad un secondo progetto-chiave, per promuovere il consenso ed elaborare specifiche funzionali comuni.

La valutazione e la verifica delle attività del programma hanno riflesso il carattere fortemente integrato del programma stesso.

A livello di programma, nel 1989 è stata effettuata una verifica strategica, per valutare le attività rispetto agli obiettivi strategici e politici della Comunità. Nel 1990, la Commissione ha presentato al Consiglio dei ministri e al Parlamento europeo una relazione sui progressi compiuti dopo 30 mesi, come previsto dalla decisione del Consiglio. A cio' ha fatto seguito, nel 1990, una rivalutazione delle nuove esigenze in materia di R&S da parte di un gruppo indipendente di alti dirigenti e funzionari governativi (Telecom 2000). Nel 1991 e agli inizi del 1992, le attività sono state valutate da un gruppo indipendente, alla luce degli altri principali programmi di tecnologie dell'informazione e di applicazioni telematiche del secondo programma quadro (ESPRIT e DRIVE)(1). Infine, nel 1992 la Commissione ha riferito in merito al programma RACE nel contesto della valutazione del secondo programma quadro(2), e il comitato di gestione RACE ha effettuato la propria valutazione su richiesta del CREST (Comitato della ricerca scientifica e tecnica)(3).

La ricerca e lo sviluppo tecnologico nell'ambito del programma sono stati accompagnati da periodiche valutazioni dell'impatto economico e sociale degli sviluppi delle comunicazioni avanzate(4). L'ultima è stata effettuata nel 1991 e diffusa nel 1992. La maggior parte di tali attività è ora pienamente integrata nella seconda fase di RACE, secondo quanto disposto nella decisione del Consiglio relativa al programma specifico sulle tecnologie della comunicazione.

Nel 1989, le procedure di gestione adottate dai servizi della Commissione per il programma RACE sono state oggetto di una "verifica di gestione del programma" indipendente, che ha approvato pienamente l'approccio seguito dalla Commissione.

Ogni anno, ciascun progetto è stato sottoposto ad una "verifica tecnica" da parte di esperti indipendenti del settore di ricerca pertinente. La prima di tali verifiche tecniche è stata effettuata nell'ottobre 1988 e l'ultima nell'ottobre 1992. I risultati di queste verifiche annuali hanno servito a riorientare o a completare, a seconda dei casi, i lavori dei progetti.

Tutte le valutazioni e le verifiche hanno dimostrato che il programma RACE ha efficacemente conseguito gli obiettivi originari.

Le attività avviate nella prima fase del programma RACE sono state proseguite ed ampliate da progetti di R&S nell'ambito del nuovo programma specifico di R&ST sulle tecnologie della comunicazione, la seconda fase di RACE, che fa parte del terzo programma quadro comunitario e prevede un finanziamento comunitario parziale delle attività di R&S fino al dicembre 1994. I progetti sono stati avviati nel gennaio 1992: nel corso del 1992, la continuità delle attività è stata garantita dalla parziale sovrapposizione dei progetti della prima fase di RACE. Il programma RACE continuerà ad arrecare un significativo contributo allo sviluppo e all'integrazione socio-economica europea. E' affiancato da attività a livello nazionale(5) e da azioni internazionali, come quelle dell'EURESCOM(6), che consolidano quelle comunitarie e ne sono a loro volta potenziate. Il programma RACE rappresenta un contesto unico nel quale cooperano attivamente gli operatori delle reti di telecomunicazione, l'industria e gli utilizzatori.

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(1) apporto del comitato di esperti delle tecnologie dell'informazione e della comunicazione, presieduto da W. Dekker, giugno 1992.

(2) Comunicazione della Commissione - Valutazione del secondo programma quadro per la ricerca e lo sviluppo tecnologico (SEC(92)675 def., luglio 1992).

(3) Riportato al punto 3.2.1. della presente relazione.

(4) I rapporti di valutazione sono stati pubblicati e ampiamente diffusi nella serie "Perspectives for Advanced Communications in Europe: PACE".

(5) Gli esperimenti della BERKOM in Germania; quelli della British Telecom nel Regno Unito; il banco di prova "Mangualde" della CET in Portogallo; il ... (elenco completo dei banchi di prova per le comunicazioni a larga banda nella CE).

(6) EURESCOM : European Institute for research and strategic studies in telecommunications GmbH.

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PROGRAMMA DI R&S

sulle tecnologie di comunicazione avanzate in Europa (RACE)

Relazione finale
sulla prima fase (1988-1992) del programma decennale RACE

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1. Introduzione

Le telecomunicazioni rappresentano il settore più dinamico e in rapida evoluzione dell'industria europea. In Europa, i servizi di telecomunicazione generano un fatturato di più di 300 miliardi di ECU l'anno; l'investimento nelle reti e nei servizi di telecomunicazioni equivale a circa 30 miliardi di ECU l'anno. Le entrate derivano ancora in gran parte dal servizio di telefonia vocale, ma la maggior parte degli attuali investimenti di capitale riguarda le nuove generazioni di apparecchiature digitali, che consentono di integrare la comunicazione di voce, dati e immagini. Nel 2000, si stima che circa il 30% delle entrate del settore delle telecomunicazioni potrebbe derivare dai servizi di valore aggiunto che impiegano tecniche avanzate di comunicazione dati.

A livello mondiale, tutti gli aspetti della vita quotidiana sono influenzati dalla convergenza delle tecnologie dell'informazione, della radiodiffusione e delle telecomunicazioni. L'abbinamento delle tecniche di elaborazione dati e di concezioni innovative nelle telecomunicazioni ha già condotto alla realizzazione delle reti digitali di servizi integrati (ISDN): si tratta comunque solo di una prima tappa della rapida evoluzione verso un'assai più vasta gamma di servizi multimediali, che richiederanno nuove tecnologie, nuovi sistemi di gestione di rete e dei servizi e nuovi sistemi di regolamentazione. L'integrazione dei servizi abbinata all'impiego delle fibre ottiche, che consentono una trasmissione ad alta velocità (un milione di volte superiore rispetto ai cavi di rame) e a basso costo, fornisce la base economica per una ristrutturazione radicale di tutti i settori interessati, grazie alle comunicazioni integrate a larga banda (IBC). Lo sviluppo di tale impostazione costituisce l'obiettivo del programma RACE.

La presente relazione riassume e documenta i risultati della prima fase del programma decennale RACE, nel periodo 1988-1992.

Il capitolo 2 della relazione esamina il contesto, l'organizzazione e i risultati del programma, mentre l'organizzazione e i risultati delle valutazioni e delle verifiche del programma sono descritti nel capitolo 3. Nel capitolo 4 sono descritti i collegamenti con altre azioni comunitarie ed europee. I risultati della R&S della prima fase di RACE sono già stati ampiamente utilizzati per l'elaborazione di norme, per lo sviluppo di nuove reti e servizi e come base di ulteriori attività previste nella seconda fase del programma. Il capitolo 5 descrive come sono stati impiegati i risultati della prima fase di RACE, mentre il capitolo 6 descrive la transizione alla seconda fase. Il capitolo 7 descrive le esigenze future e le alternative per attività a livello europeo.

L'allegato I riporta una sintesi dei risultati dei progetti di R&S. L'allegato II elenca i contributi alla normalizzazione, l'allegato III elenca tutte le pubblicazioni scientifiche e tecniche derivanti dalle attività dei progetti. L'allegato IV elenca le applicazioni per cui è stata richiesta la registrazione di un brevetto; l'allegato V riporta un glossario dei termini tecnici, l'allegato VI un elenco di riferimenti alle decisioni ufficiali del Consiglio dei ministri e alle comunicazioni della Commissione. L'allegato VII elenca i progetti di R&S finanziati nella prima fase del programma RACE; l'allegato VIII elenca gli organismi partecipanti, l'allegato IX riassume le statistiche finanziarie e quelle relative alla partecipazione.

2. Il contesto e l'impostazione del programma RACE

2.1 La R&S come parte della politica comunitaria nel settore delle telecomunicazioni

Il programma RACE costituisce parte integrante della politica comunitaria in materia di telecomunicazioni. In collegamento con la politica di normalizzazione e con la politica del mercato dell'informazione, il programma si avvale degli sviluppi delle tecnologie dell'informazione realizzati nel quadro di ESPRIT, e per la prima volta coinvolge gli operatori europei delle reti di telecomunicazione, quali attori principali, in tecnologie realizzate in cooperazione e nello sviluppo dei servizi. Affrontando il problema del futuro rapporto costi/rendimento delle infrastrutture di comunicazione in Europa, il programma RACE ha contribuito allo sviluppo del mercato unico, della competitività internazionale dell'industria europea e alla coesione sociale ed economica della Comunità.

Gli obiettivi principali della politica comunitaria in materia di telecomunicazioni, definiti nella risoluzione del Consiglio del 30 giugno 1988[1] , sono riassunti qui di seguito:

- creare e garantire l'integrità delle reti a livello comunitario, in base al principio della completa interconnettività tra tutte le reti pubbliche interessate;
- creare gradualmente un mercato comune aperto dei servizi di telecomunicazione;
- favorire la creazione di servizi europei, conformemente alle esigenze del mercato e alle necessità sociali;
- potenziare ulteriormente un mercato comunitario aperto delle apparecchiature terminali;
- promuovere un mercato comune entro il quale le amministrazioni delle telecomunicazioni e altri fornitori di servizi di telecomunicazione possano competere su un piano di parità;
- proseguire l'attuazione delle misure comunitarie in materia di norme comuni;
- incentivare la cooperazione europea a tutti i livelli, soprattutto nel settore della ricerca e dello sviluppo delle telecomunicazioni;
- creare un contesto sociale per il futuro sviluppo delle telecomunicazioni;
- integrare pienamente le regioni comunitarie meno avvantaggiate nel nuovo mercato comunitario.

Tali obiettivi costituiscono un contesto ben preciso per definire lo sviluppo delle future tecnologie, servizi e applicazioni.

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(1) Risoluzione del Consiglio del 30 giugno 1988 sullo sviluppo del mercato comune dei servizi e delle apparecchiature di telecomunicazione entro il 1992 (88/C 257/01, GU C 257 del 4.10.1988, p. 1)

2.2 Gli obiettivi di RACE

Il principale obiettivo del programma RACE consiste nel contribuire alla

"Introduzione delle comunicazioni integrate a larga banda (IBC)[2]*, tenendo conto dell'evoluzione della rete digitale di servizi integrati (ISDN) e delle strategie nazionali di introduzione, per disporre di servizi comunitari entro il 1995*[3]*".*

Gli obiettivi specifici della prima fase erano i seguenti:

- promuovere l'industria comunitaria delle telecomunicazioni;
- consentire agli operatori di rete europei di competere nelle migliori condizioni possibili;
- consentire ad un numero critico di Stati membri di introdurre nel 1995 servizi IBC commercialmente redditizi;
- consentire ai fornitori di servizi di migliorare il rapporto costo/rendimento e di introdurre nuovi servizi; rendere disponibili i nuovi servizi a costi e entro scadenze almeno altrettanto vantaggiosi di quelli di altri paesi;
- sostenere la formazione di un mercato unico europeo delle apparecchiature e dei servizi di telecomunicazione;
- contribuire allo sviluppo regionale consentendo alle regioni meno favorite di trarre pieni vantaggi dagli sviluppi nel settore delle telecomunicazioni.

Nell'allegato I alla decisione sono stati inoltre definiti numerosi obiettivi tecnici. Il contributo dei progetti di R&S di RACE al conseguimento di tali obiettivi è descritto nella Tabella I.

Nel corso dello sviluppo e della realizzazione del programma, l'interpretazione del concetto di comunicazioni integrate a larga banda (IBC) si è evoluto per rispondere ai mutamenti del mercato e del contesto regolamentare. La definizione qui sotto riportata in nota esprime il consenso sviluppato nell'ambito del comitato di gestione di RACE nel corso del 1990.

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(2) **"I", cioè "integrato", non significa soltanto "servizi integrati" (a livello di utente e ai vari livelli di rete), ma riguarda anche l'"integrità" di tutta la rete e pertanto la corretta interazione di tutti i componenti essenziali, compresi quelli già esistenti e i nuovi: telefonia, pacchetto, ISDN, satelliti, radiomobili...**
"B", cioè "banda larga", non significa soltanto la parte "high-end" (in termini di velocità di trasmissione) dei servizi, ma designa anche l'insieme dei servizi da prendere in considerazione, dalla "upper end" dell'ISDN (certamente, per esempio, quella comprendente accessi a 2 Mbit/s ed eventualmente anche a 64 Kbit/s, in settori specifici di applicazione) fino alle caratteristiche richieste per l'introduzione vera e propria di servizi video (interattivi e distributivi) (ad esempio, 140 Mbit/s).
Con "C", cioè "comunicazione", non si intendono soltanto le funzioni "tradizionali" di commutazione/trasmissione/rete d'utenza, ma anche le caratteristiche più avanzate, per fornire un servizio di facile impiego, efficiente ed economicamente valido.

(3) **Decisione del Consiglio del 14 dicembre 1987, concernente un programma comunitario nel campo delle tecnologie delle telecomunicazioni - Programma di ricerca e sviluppo sulle tecnologie di telecomunicazioni avanzate per l'Europa (Programma RACE) (88/28/CEE; GU L 16 del 21.1.1988, pag. 35.**

Tabella 1

Obiettivi tecnici	Modalità per il conseguimento di tali obiettivi da parte di RACE	Impatto dell'attività RACE
Obiettivi della parte I: Strategie di sviluppo e di implementazione dei sistemi IBC		
Comprensione generale dell'evoluzione dei sistemi IBC e relative implicazioni.	Creazione di un quadro di collaborazione tra operatori, industria e utilizzatori.	Sviluppo di un approccio comune di "ingegneria dei sistemi" per la pianificazione dell'evoluzione della rete.
	Analisi strategiche comuni sotto il profilo tecnico-economico che tengano conto della domanda e delle alternative tecnologiche.	Definizione delle condizioni ottimali per l'introduzione delle IBC. Individuazione comune dei principali problemi tecnici. Posizione coerente della CE nelle attività internazionali al di fuori di RACE.
Definizione comune di sistemi e sottosistemi IBC.	Sviluppo di una configurazione di riferimento per definire i sistemi e i sottosistemi nelle reti di comunicazione integrate a larga banda. Sviluppo di alternative di implementazione adeguate e delle relative tecnologie.	Potenziamento della normalizzazione europea. Accordo su una strategia europea comune nel settore delle specifiche ATM.
Orientamenti per specifiche funzionali dei sistemi e dei servizi integrati IBC.	Sviluppo, a livello cooperativo, di un modello funzionale di riferimento con una struttura logica di funzioni e di interfacce.	Accordo su specifiche funzionali comuni. Accordo su concetti di "integrazione di rete" e relativi protocolli. Accordo su opzioni a medio e lungo termine per l'accesso a larga banda degli utenti.
Individuazione dei requisiti tecnologici e della R&S.	Sviluppo, in cooperazione, di un modello d'uso di riferimento, per collegare le esigenze degli utilizzatori alle alternative tecniche. Valutazione congiunta e comune degli sviluppi tecnologici.	Messa a fuoco e concentrazione della R&S europea sulle tecnologie chiave e sulle nuove esigenze degli utilizzatori.

Tabella 1

Obiettivi tecnici	Modalità per il conseguimento di tali obiettivi da parte di RACE	Impatto dell'attività RACE
Apprezzamento dei vantaggi economici di percorsi di implementazione alternativi.	Sviluppo di strumenti comuni per valutazioni di carattere tecnico-economico ed operativo.	Avvenuto sviluppo di strumenti comuni di analisi tecnico-economica, di pianificazione e gestione avanzata delle reti.
Analisi dei requisiti in materia di normalizzazione.	Incontri periodici con gli enti di normalizzazione; coordinamento con il progetto di "gestione del consenso" (e con l'ETSI); indagini comuni dei requisiti in materia di normalizzazione a seguito di nuove esigenze degli utenti su scala mondiale.	596 contributi agli enti di normalizzazione (Allegato II).
Obiettivi della Parte II: tecnologie IBC		
Impiego di tecnologie avanzate per un'implementazione economicamente vantaggiosa dei sistemi IBC.	R&S per componenti, sottosistemi e sistemi in fibre ottiche critici in rapporto ai costi, sia per trasmissione a larga banda sia per sistemi di utente sia per commutazione.	Specifica e sviluppo di prototipi di connettori, laser ed elementi di commutazione per reti locali, reti d'utente (CPN), ecc. Dimostrazione di prototipi e di processi produttivi a basso costo
	Analisi delle alternative a breve termine in vista di un'immediata riduzione dei costi.	Sviluppo di tecnologie di rivelazione "diretta" e "coerente".
	Analisi delle alternative a medio/lungo termine per realizzare ingenti risparmi sui costi e miglioramenti dei servizi.	Sviluppo di tecnologie ATM per un impiego della larghezza di banda efficace in rapporto ai costi.
		Sviluppo di algoritmi compatibili per la compressione della velocità di trasmissione binaria, destinati alla HDTv digitale e a servizi video di alta qualità, nonché allo sviluppo di CODEC a basso costo.

Tabella 1

Obiettivi tecnici	Modalità per il conseguimento di tali obiettivi da parte di RACE	Impatto dell'attività RACE
Software di telecomunicazioni per sistemi complessi integrati.	Sviluppo di una nuova architettura per la fornitura di servizi: un'architettura di servizi aperta.	Sviluppo di programmazione "orientata agli oggetti" per sistemi di telecomunicazione. Convalida di prototipi di strumenti di ingegneria integrata del software.
	Esame di tecniche avanzate di trattamento delle informazioni per le funzioni IBC.	Sviluppo di architetture e prototipi di gestione di reti di telecomunicazione (TMN) destinati alla gestione, alla manutenzione, al controllo della qualità del servizio, alla gestione degli utenti e della rete e a garantire la sicurezza delle comunicazioni.
	Analisi delle nuove tecnologie di software per specifica, progettazione, implementazione, verifica e manutenzione di sistemi di telecomunicazione.	Metodi di specifica, ambiente di sviluppo e supporto on-line per sistemi di telecomunicazione.
		Definizione di concetti di integrità per servizi IBC e di una serie di primitive di integrità.
Progressi nelle funzioni ergonomiche e conoscitive delle apparecchiature IBC.	Analisi dei problemi di utilizzabilità per sistemi di dialogo, distribuzione e reperimento, servizi integrati e reti d'utenza domestica.	Tassonomia per ingegneria dell'utilizzabilità
		Implementazione di tipologie di agevole utilizzabilità negli esperimenti di comunicazioni avanzate, compresi quelle per persone con esigenze particolari.
	Esame dei problemi di utilizzabilità per persone con esigenze particolari (anziani e disabili).	Miglioramento dell'interazione del campo dell'utilizzabilità, tra ricercatori, utilizzatori e progettisti di apparecchiature.
	Sviluppo di obiettivi in materia di progettazione dell'utilizzabilità	Reperimento e analisi sistematica di problemi di utilizzabilità comuni nei progetti delle applicazioni pilota.
	Inserimento e valutazione dei problemi di utilizzabilità nelle applicazioni pilota.	

Tabella 1

Obiettivi tecnici	Modalità per il conseguimento di tali obiettivi da parte di RACE	Impatto dell'attività RACE
Realizzazione di sottosistemi e di reti evolutive.	Definizione e dimostrazione di architetture generiche per sistemi IBC, compresa la riduzione della velocità di trasmissione binaria del segnale video.	Definizione di specifiche funzionali e di progettazione per reti locali, reti d'utente (CPN) e terminali (multiservizio e multimediali, compresa la registrazione video digitale e i visualizzatori piatti).
	Sviluppo di concetti e contesti per reti d'utenza (CPN), per soddisfare esigenze di tipo domestico e commerciale.	Dimostrazione di un visualizzatore piatto a elettroluminescenza e del relativo driver.
	Sviluppo di terminali prototipo.	Progetti di componenti e sottosistemi per reti d'utenza domestica e commerciale in un ambiente ATM.
	Adattamento di sistemi che consentano un'armonica evoluzione verso i sistemi IBC.	Specifiche per sistemi integrati e relativa convalida tramite dimostratori.
	Sviluppo di prototipi di sistemi integrati comprese le reti locali, le reti d'utenza e i terminali, interconnessi attraverso interfacce approvate.	

Tabella 1

Obiettivi tecnici	Modalità per il conseguimento di tali obiettivi da parte di RACE	Impatto dell'attività RACE
Obiettivi della parte III: sviluppo di progetti per applicazioni IBC		
Sviluppo di strumenti di verifica, verifica dell'impostazione della progettazione, di gruppi funzionali o protocolli.	Sviluppo congiunto di strumenti e procedure di prova per gli elementi e i sottosistemi della rete IBC.	Verifica di strumenti e funzioni IBC nei terminali, nelle reti d'utenza e nei punti di commutazione delle centrali urbane e interurbane.
	Verifica dei protocolli ai punti di riferimento critici IBC.	Individuazione dei punti di d'accesso e dei protocolli di prova. Raccomandazioni relative alle prove di conformità dei protocolli.
Perfezionamento delle specifiche funzionali e/o verifica delle proposte di normalizzazione.	Integrazione di sistemi pilota per verificare i protocolli di interfunzionamento.	Specifica di sistemi e sottosistemi in un ambiente multiservizio.
	Verifica prenormativa di elementi critici di normalizzazione e di specifica.	Convalida dei meccanismi per la dimostrazione dell'interoperabilità e della conformità alle norme.
Sviluppo di contesti sperimentali in cui i fornitori di servizi, gli operatori di rete e gli utilizzatori possano provare i prodotti sperimentali IBC, per chiarire il potenziale di sfruttamento commerciale dei sistemi IBC.	Definizione dei futuri requisiti dei servizi, in collaborazione con gli utilizzatori di punta di tutti i principali settori commerciali.	Realizzazione di applicazioni pilota in tutti i principali settori: banche e finanza, assicurazioni, mezzi di comunicazione ed editoria, industria manifatturiera, sanità, persone con esigenze particolari, trasporti e distribuzione, uso sperimentale della HDTV.
	Implementazione di un banco di prova IBC in varie località in Europa.	Definizione di requisiti e accordo relativo agli esperimenti di prova di interconnessione.
	Indagine sui problemi di interconnessione e di interfunzionamento.	

2.3 Attuazione del programma

Data la rapida evoluzione del settore delle telecomunicazioni in Europa, si è deciso di attuare il programma RACE per fasi progressive. Il programma è iniziato nel 1986 con una fase di definizione[4] ; ad essa è seguita la prima fase, ufficialmente avviata nel giugno 1987 e conclusasi nel dicembre 1992, che costituisce l'oggetto della presente relazione.

Nella prima fase, le attività sono state strutturate in tre parti:

Parte I - Strategie di sviluppo e di attuazione IBC

I progetti della prima parte riguardavano lo sviluppo di specifiche funzionali, sistemi e ricerca operativa miranti alla definizione di proposte di norme, concetti e convenzioni IBC conformi ad un approccio a sistemi aperti, nonché attività di analisi dell'interoperabilità delle apparecchiature e dei sistemi IBC. I risultati del progetti della Parte I sono di pubblico dominio e costituiscono un importante contributo alle attività degli enti di normalizzazione internazionali.

Parte II - Tecnologie IBC

I progetti della parte II riguardavano la problematica relativa alla realizzazione IBC; essi hanno recato un significativo contributo allo sviluppo della tecnologie necessarie per la realizzazione a basso costo delle apparecchiature e dei servizi IBC.

Parte III - Integrazione funzionale prenormativa

I progetti della Parte III riguardavano la realizzazione di un "ambiente aperto di verifica", progettato per valutare le funzioni e i concetti operativi. Venti dei progetti di questa parte del programma prevedevano applicazioni pilota di comunicazioni avanzate in vari contesti commerciali e di fornitura dei servizi. Nel corso dei progetti, le apparecchiature e le applicazioni sono state sottoposte ad una serie di prove in rapporto alle specifiche funzionali dell'ambiente reale e alle proposte di normalizzazione derivate dai lavori della parte I.

Il programma RACE è stato attuato in due tappe. Il primo gruppo di progetti, avviato nel gennaio 1988, riguardava l'ingegneria dei sistemi (parte I) e le attività tecnologiche (parte II)[5]. Il secondo, riguardante l'esame dei servizi futuri, l'integrazione e la verifica dei sistemi (parte III), è stato oggetto nel luglio 1988 di un invito a presentare proposte e i lavori sono iniziati nel gennaio 1989.

Durante la selezione dei progetti e l'attuazione del programma, ogni parte è stata meglio delineata. Le risorse devolute alla parte I sono aumentate dall'11,9% previsto al 18%; quelle per la parte II sono scese dal 66% al 55%, e quelle per la parte III sono aumentate dal 22,4% al 27% delle risorse. Tale evoluzione ha riflesso uno spostamento d'accento, dallo sviluppo di tecnologie verso lo sviluppo di servizi e di indagini sulla domanda, nonché l'efficacia delle proposte relative alle attività delle parti I e III del programma.

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(4) Decisione del Consiglio del 25 luglio 1985, su una fase di definisione per un'asione comunitaria nel settore delle tecnologie delle telecomunicasioni - programma di R&S sulle tecnologie di comunicasione avansate in Europa (RACE) (85/372/CEE, GU L 210 del 7. 8.1985, pag. 24.

(5) Comunicasione della Commissione al Consiglio e al Parlamento europeo: "Working towards Telecom 2000 - Launching the Programme RACE" (COM(88)240 def. II del 31.5.1988.

La distribuzione delle risorse finanziarie del programma è riassunta nella Tabella 2.

TABELLA 2

SINTESI DELL'IMPIEGO DELLE RISORSE FINANZIARIE NELLA FASE I DEL PROGRAMMA RACE

PROGRAMMA	DECISIONE (Mio di Ecu)	(%)	EFFETTIVA (%)
Parte I	60	11,9	18,0
I.1 Strategie IBC	14	2,8	
I.2 Attuazione IBC	28	5,5	
I.3 Impiego IBC	10	2,0	
I.4 Ambiente operativo comune	8	1,6	
Parte II	332	65,7	55,0
II.1 Funzioni dei sistemi IBC	94	18,6	9,0
Infrastruttura di programazione IBC	49	9,7	25,0
Progettazione dell'utilizzabilità	12	2,4	11,0
Evoluzione delle reti	177	35,0	10,0
Parte III	113	22,4	27,0
III.1 Strumenti di verifica	63	12,5	6,0
III.2 Applicazioni pilota IBC	50	9,9	

I progetti di R&S 1992 hanno coinvolto di 306 imprese, compresi tutti i principali attori europei del settore delle telecomunicazioni. Ai lavori hanno inoltre partecipato 27 organismi dei paesi dell'EFTA (Austria, Finlandia, Norvegia, Svezia e Svizzera).

2.4 Principali risultati

Il programma RACE ha potenziato l'armonizzazione dell'infrastruttura europea di telecomunicazioni, che costituisce un prerequisito per il completamento del mercato unico. Le specifiche funzionali comuni costituiscono la falsariga su cui impostare le comunicazioni integrate a larga banda (IBC). Tale risultato è stato reso possibile solo grazie alla cooperazione di tutti gli operatori di rete, dell'industria delle telecomunicazioni, degli enti e società di radiodiffusione e dei principali utenti di punta in Europa, ed è il tratto distintivo del programma RACE.

Sviluppando una precoce consapevolezza e una reazione al cambiamento, il programma RACE ha inoltre consentito agli attori economici europei del settore delle telecomunicazioni e dei servizi di ottenere un vantaggio competitivo strategico nel mercato delle apparecchiature e dei servizi di telecomunicazione, che va sempre più assumendo dimensioni mondiali.

I dettagli dei risultati conseguiti da ciascun progetto sono riportati nell'allegato I della presente relazione e nelle relazioni annuali 1988, 1989, 1990, 1991 e 1992. I principali risultati di ciascun'area del programma sono illustrati qui di seguito.

Principali risultati della parte I: Strategie di sviluppo e di attuazione IBC

Le attività hanno consentito una comprensione comune dell'evoluzione IBC e delle relative implicazioni, come pure un'efficace collaborazione tra gli operatori, l'industria e gli utilizzatori nello sviluppo di specifiche comuni per IBC e in indagini strategiche comuni di carattere tecnico/economico.

Sono state istituite strette relazioni di lavoro con enti di normalizzazione europei e internazionali. Nel 1989 è stato istituito un gruppo di coordinamento tra il progetto di gestione del consenso (Consensus Management Project) e l'ETSI (Istituto europeo delle norme di telecomunicazione). Le attività sull'ATM (Asyncronous Transfer Mode, modalità di trasferimento asincrona) hanno contribuito direttamente ad un accordo su una strategia europea comune nel settore, come pure alla progressiva definizione di norme internazionali.

Sono state concordate definizioni comuni dei sistemi e dei sottosistemi IBC, ed elaborate configurazioni di riferimento che definiscono la struttura del sistema della rete IBC. Sono state adottate specifiche funzionali dei sistemi e dei servizi integrati IBC: esiste ora un modello funzionale di riferimento, che definisce una struttura logica delle funzioni e interfacce IBC e funziona come punto di riferimento per tutti i requisiti funzionali di attuazione. Le specifiche funzionali comuni (CFS - Common Functional Specifications) sono state ampiamente diffuse nel 1990.

Sono state precisate le definizioni delle interfacce nei punti chiave di riferimento nelle reti a larga banda, e definiti i requisiti dei componenti e dei sistemi.

E' stato elaborato un "modello d'uso di riferimento", che costituisce un quadro concettuale di collegamento tra esigenze degli utilizzatori e requisiti funzionali.

Sono state completate valutazioni sistematiche delle opzioni tecnologiche e operative, comprese le comunicazioni in fibra ottica, le comunicazioni mobili, i satelliti, le reti per sistemi di utente (CPN - Customer Premises Networks), le nuove tecniche di commutazione e la televisione ad alta definizione (HDTV).

Sono stati elaborati strumenti per la valutazione del rapporto costo/efficacia di percorsi d'attuazione alternativi: un primo gruppo riguarda l'analisi economica, un secondo la pianificazione e le norme per le reti. Questi strumenti consentono di effettuare confronti transazionali tra le varie alternative e strategie in rapporto alle caratteristiche tecniche ed economiche e ai requisiti di normalizzazione.

Principali risultati della parte II: tecnologie IBC

La R&S si è concentrata su componenti, sottosistemi e sistemi critici in rapporto ai costi, per la trasmissione a larga banda nella sede del cliente e per la commutazione, miranti a soluzioni efficaci rispetto ai costi per applicazioni in tutti i settori principali.

Le tecnologie ATM sono state definite e sviluppate per poter implementare le comunicazioni a larga banda in modo flessibile e valido nel futuro. E' stata portata a termine la fase di realizzazione e confronto tra le varie alternative ATM e si sono elaborate specifiche per i sistemi di commutazione ATM.

Sono state elaborate tecniche di codifica compatibili del segnale video per la televisione (ad alta definizione) e la videotelefonia, che garantiscono un impiego efficace, in rapporto ai costi, delle risorse a larga banda. Si è simulato l'impiego di algoritmi per tecniche di compressione della velocità di trasmissione per servizi video di alta qualità (TV e videotelefonia); lo sviluppo di CODEC ha già esercitato un rilevante impatto sulla normalizzazione e sull'introduzione commerciale di sistemi meno costosi di videoconferenza.

Si sono effettuati progressi sostanziali nei sistemi di comunicazione ottica multi-gigabit e nella commutazione fotonica. Sono state elaborate specifiche per sistemi, sottosistemi e componenti (connettori, laser, elementi di commutazione), in particolare tenendo conto del fattore costo nei diversi settori di applicazione (reti locali, reti di utente (CPN), ecc.). Sono stati prodotti e dimostrati prototipi di componenti e di sottosistemi.

Nel settore del software di telecomunicazione per sistemi integrati complessi, si sono elaborati modelli orientati all'oggetto, definendo architetture e prototipi per la gestione del traffico, la manutenzione, la gestione dei clienti e delle reti; sono stati elaborati metodi di specifica e un "ambiente di sviluppo" per il supporto on-line dei sistemi di telecomunicazione ed è stata definita un'architettura di sicurezza delle comunicazioni.

Nel settore della ricerca ergonomica e conoscitiva, si è definita una tassonomia di tecniche per facilitare l'impiego delle comunicazioni avanzate ("ingegneria dell'utilizzabilità" delle comunicazioni avanzate), individuandone i relativi requisiti, compresi quelli delle persone con esigenze particolari.

Si sono elaborate architetture generali, nonché tecniche e tecnologie appropriate per i sistemi e sottosistemi IBC, compresa la riduzione della velocità di trasmissione del segnale video: in tale contesto sarà possibile soddisfare le esigenze dell'utenza domestica, commerciale e di altro tipo in una vasta gamma di applicazioni.

Sono stati sottoposti a prova e adattati all'impiego con i servizi IBC vari tipi di terminali con visualizzatori piatti. I sistemi integrati (comprese le reti locali, le reti d'utente (CPN) e i terminali d'utente, interconnessi tramite le interfacce approvate ai punti di riferimento S e T) hanno consentito di convalidate una serie di specifiche funzionali e di tecnologie.

La ricerca sulle "comunicazioni mobili" ha definito il quadro concettuale di una terza generazione di sistemi di comunicazione cellulari radiomobili. Grazie a cio' è stato definito il concetto di UMTS (*Universal Mobile Telecommunications System*, cioè sistema universale di telecomunicazioni mobili), che consentirà di soddisfare gran parte della domanda di mercato in Europa alla metà degli anni Novanta.

Principali risultati della Parte III: Sviluppo di piani per applicazioni IBC

Le attività si sono concentrate sulla messa a punto di strumenti di verifica, come pure sulla verifica dell'impostazione della progettazione, di gruppi funzionali o protocolli. I terminali, i sistemi d'accesso utente, la commutazione (su centrali locali e interurbane) e i sistemi di trasmissione sono stati tutti sottoposti a procedure di prova elaborate in modo congiunto da esperti dell'ingegneria dei sistemi e della progettazione di strumenti di verifica. Si sono definiti i punti d'accesso e i protocolli da impiegare nelle prove.

Per quanto concerne le applicazioni pilota IBC, alle prove dei prodotti sperimentali IBC hanno partecipato i fornitori dei servizi, gli operatori di rete e gli utilizzatori: lo scopo era di diffondere una più rapida comprensione delle tipologie IBC sfruttabili a livello commerciale. Si sono realizzate applicazioni pilota in tutti i principali settori - banche e finanza, assicurazioni, mezzi di comunicazione ed editoria, industria manifatturiera, sanità, persone con esigenze particolari, trasporti e distribuzione ed impiego sperimentale della televisione ad alta definizione (HDTV) - con la partecipazione di più di cento utilizzatori di punta.

Per la realizzazione della parte III e alcune attività complementari delle parti I e II, è stata riconosciuta l'esigenza di un'infrastruttura di prova su scala europea. Nel 1989 le principali amministrazioni europee delle telecomunicazioni hanno presentato una proposta intesa a fornire in via preliminare una rete a larga banda a livello sperimentale. La proposta si è basata su un accordo in merito alla realizzazione di EBIT, una rete sperimentale europea a larga banda (*European Broadband Interconnection Trial*) a 2 Mbit/s, aumentabile fino a 140 Mbit/s per le connessioni transnazionali. I principali operatori di rete hanno firmato un Memorandum d'intesa; è stata formata un'équipe multinazionale con funzioni di consulenza per applicazioni pilota in merito a tutte le esigenze di rete e di software, al fine di garantire l'interoperabilità dei sistemi dell'utente finale. Questo progetto di utilizzazione e di supporto nell'ambito di RACE ha contribuito ad orientare le varie applicazioni pilota. Date comunque le difficoltà di istituire, per le attività di ricerca, collegamenti transnazionali efficaci rispetto ai costi, la maggior parte di tali applicazioni pilota si è finora limitata a sperimentazioni su banchi di prova nazionali. Solo ora, nel 1993 e nel 1994, con l'opportunità di utilizzare in via sperimentale i sistemi ATM, si potrà disporre di un banco di prova di connessione transeuropea a larga banda con larghezza di banda a richiesta ed efficace in rapporto ai costi.

Le applicazioni pilota hanno comunque assolto la loro funzione, cioé fornire feedback per lo sviluppo tecnologico e la definizione delle specifiche a partire dagli ambienti d'utilizzo reali.

2.5 Partecipazione delle PMI

Malgrado l'elevato costo della R&S nelle telecomunicazioni avanzate, la prima fase di RACE ha visto una massiccia partecipazione delle PMI (piccole e medie imprese), che hanno costituito il 28% dei partecipanti ai progetti RACE: una percentuale molto superiore al 16,5% che aveva caratterizzato l'intero secondo programma quadro [6] . Più del 60% dei progetti ha visto la partecipazione di strutture di piccole dimensioni, sotto forma di piccole imprese o di piccoli organismi di ricerca.

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(6) **Valutazione del secondo programma quadro di R&S tecnologico: Relazione del CREST al Consiglio, settembre 1992, CREST/1212/1/92.**

2.6 Contributo alla coesione economica e sociale

Esaminando e sviluppando strategie per l'introduzione delle IBC in tutto il territorio comunitario, comprese le regioni meno favorite, il programma RACE ha aperto la via alla realizzazione delle reti di comunicazione transeuropee a larga banda previste nel titolo XII del Trattato sull'Unione europea. Particolare attenzione è stata rivolta alla necessità di collegare alle regioni centrali della Comunità le regioni insulari, prive di sbocchi al mare e periferiche.

Numerose misure di accompagnamento, convegni e corsi estivi hanno consentito agli scienziati e ai tecnici di tutto il territorio comunitario di accedere alla R&S effettuata: un particolare impegno è stato devoluto all'organizzazione di convegni e seminari nelle zone meno favorite. L'allegato I riporta un elenco completo di tali attività.

53 progetti (cioè il 60%) hanno visto la partecipazione di imprese delle regioni meno favorite della Comunità, che hanno in tal modo contribuito al trasferimento in tali regioni di tecnologie e di conoscenze specialistiche.

3. Valutazione e verifica del programma RACE

3.1 Valutazione come processo continuo

Data la rapida evoluzione delle tecnologie e dei servizi di comunicazione, la valutazione è stata considerata come un processo continuo durante tutta la fase di preparazione, realizzazione ed esecuzione del programma. Il processo di valutazione ha influenzato tutti i livelli: l'orientamento strategico del programma, la sua gestione operativa e le finalità tecniche di ciascun progetto.

Il processo di valutazione è iniziato con l'ampia collaborazione degli attori economici del settore delle telecomunicazioni nella fase di pianificazione e d'elaborazione del programma di lavoro. Grazie alla continua collaborazione con l'industria e gli operatori delle telecomunicazioni, il programma di lavoro generale di RACE e i piani di lavoro di ciascun progetto sono stati aggiornati una volta all'anno. Inoltre, le riunioni periodiche tra i consorzi del programma (riunioni di concertazione) hanno garantito per tutti i progetti un processo informale continuo di monitoraggio dei progressi ottenuti e di adattamento. La coerenza delle attività è stata garantita dal progetto di gestione del consenso (Consens Management Project), che ha avviato strette relazioni con gli enti europei di normalizzazione.

I progressi delle attività sono stati comunicati al Consiglio dei Ministri e al Parlamento europeo nel 1990 nella relazione di valutazione intermedia dopo trenta mesi, prevista dalla decisione del Consiglio[7].

La presente relazione finale è stata redatta ai sensi dell'articolo 9 della decisione, che prescrive: *"Al termine del primo quinquennio del programma, dopo aver consultato il comitato di gestione, la Commissione presenta agli Stati membri e al Parlamento europeo una relazione sull'andamento e i risultati del programma"*. La presente relazione aggiorna e sostituisce quella di valutazione intermedia dopo 30 mesi inviata nel 1990.

Ai sensi dell'articolo 6, paragrafo 4, terzo trattino, la Commissione ha trasmesso la presente relazione al Comitato di gestione richiedendone il parere favorevole.

3.2 Verifiche e valutazioni del programma

Le attività sulle comunicazioni integrate a larga banda (IBC) nell'ambito di RACE sono state periodicamente adeguate alla rapida evoluzione delle condizioni tecnico-economiche e delle opportunità nel settore dei servizi. Pertanto, nell'ambito del programma è stato effettuato ogni anno un esame critico concernente due aspetti:

- **gli aspetti strategici**, ossia una valutazione dei risultati complessivi di RACE in rapporto agli obiettivi stategici e politici della Comunità in un contesto internazionale;

- **gli aspetti tecnici**, ossia una valutazione dei risultati conseguiti dai progetti RACE in rapporto agli obiettivi del programma stesso.

E' stata inoltre realizzata una verifica in termini di **gestione del programma**, che ha consentito una valutazione indipendente dell'operato dei servizi della Commissione come responsabili della gestione del programma.

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(7) L'articolo 9 della Decisione del Consiglio prescriveva: "Dopo trenta mesi il programma viene riesaminato sulla base di una valutazione dei risultati raggiunti rispetto agli obiettivi precisamente definiti nell'allegato II della presente decisione. La Commissione informa il Consiglio e il Parlamento europeo sui risultati di tale esame".

3.2.1 Verifiche strategiche e valutazioni del programma

Nel 1989 è stata effettuata una verifica strategica indipendente per valutare i risultati in rapporto agli obiettivi strategici e politici della Comunità in un contesto internazionale. Le conclusioni principali sono state le seguenti:

- l'obiettivo fondamentale di RACE resta valido: lo sviluppo delle IBC è adeguato e necessario per l'Europa e la data obiettivo del 1995 è conforme alle esigenze e all'evoluzione a livello mondiale;

- resta valida la scelta dei vari settori su cui si sono concentrate le attività di RACE.

Il gruppo di verifica ha inoltre raccomandato che nella prossima fase si dedichi particolare impegno ai sistemi di utente, alle applicazioni mobili, alla HDTV digitale nonché alle verifiche e alle prove, tenendo conto del fatto che l'ATM costituisce ora la più importante tecnologia di rete.

Conformemente al principio di sussidiarietà, la verifica strategica ha inoltre evidenziato le azioni che sarebbe opportuno intraprendere al di fuori del programma RACE, ad opera degli organismi dei governi nazionali e degli attori economici del settore delle telecomunicazioni, per garantire che i risultati della R&S siano effettivamente seguiti dalla realizzazione delle IBC. Tali raccomandazioni sono sintetizzate nella tabella 4.

Alcune delle raccomandazioni sono state applicate nella pratica. La raccomandazione che invitava le amministrazioni delle telecomunicazioni a preparare in stretta collaborazione un Memorandum d'intesa sui rispettivi collegamenti e operazioni intraeuropei a lunga distanza è stata attuata con la stesura del Memorandum d'intesa METRAN, con la definizione degli accordi GEN e con la creazione dell'EURESCOM. Si è definita la portata delle attività di R&S, si sono potenziati gli sforzi di normalizzazione per quanto concerne l'ATM ed è ora in corso di realizzazione un'ATM sperimentale. Altre raccomandazioni non sono state invece applicate secondo il calendario previsto: il contesto regolamentare in Europa non ha consentito la convergenza degli interessi delle amministrazioni delle telecomunicazioni, della radiodiffusione e della teledistribuzione via cavo secondo le modalità previste, e lo sviluppo della HDTV è stato più lento del previsto.

Alla verifica strategica ha fatto seguito, nel 1990, un'indagine prospettiva delle esigenze e opportunità future, cui hanno collaborato esperti in campo strategico, politico e tecnico. Le raccomandazioni di tale comitato sono state riportate nella relazione "Telecom 2000" e hanno costituito le basi per l'elaborazione del programma di lavoro per la seconda fase di RACE.

Nel 1991 e agli inizi del 1992, il programma RACE è stato di nuovo valutato da un gruppo di esperti indipendenti, presieduto da W. Dekker[8], in rapporto agli altri principali programmi nel campo delle tecnologie dell'informazione e delle applicazioni telematiche del secondo programma quadro (ESPRIT e DRIVE). In risposta alle raccomandazioni di tale gruppo, la Commissione ha redatto un documento distinto[9].

Raccomandazioni del gruppo di verifica strategica nel 1989

A) I governi nazionali devono collaborare per definire entro il 1992 le condizioni e le disposizioni regolamentari da applicare all'introduzione dei servizi di comunicazione avanzati paneuropei.

B) Le amministrazioni delle telecomunicazioni, gli enti e le società di radiodiffusione e quelli responsabili della teledistribuzione via cavo devono proporre entro la metà del 1989 un approccio concertato e una scadenza per lo sviluppo e l'impiego delle infrastrutture IBC, per servizi di telecomunicazione e di tipo ricreativo, compresa la HDTV, per trarre pieni vantaggi, laddove possibile, dalle iniziative di investimento del settore privato.

C) Le amministrazioni delle telecomunicazioni devono redigere in stretta collaborazione, entro il 1990, un primo Memorandum d'intesa concernente i rispettivi collegamenti ed operazioni intraeuropee a lunga distanza.

D) I fornitori di servizi devono specificare entro la fine del 1990 un primo gruppo di requisiti, condizioni commerciali e disposizioni regolamentari intese ad agevolare un impiego anticipato e su larga scala dei servizi IBC.

E) Entro la metà del 1989 le amministrazioni delle telecomunicazioni, i responsabili della radiodiffusione e della teledistribuzione via cavo, i fornitori dei servizi e l'industria telematica devono concordare un Memorandum d'intesa per integrare la R&S svolta in collaborazione nell'ambito di RACE con la realizzazione pilota di alcuni servizi IBC su scala europea, per un'introduzione delle IBC entro il 1992 in cui l'aspetto commerciale assuma un ruolo trainante.

F) Le attività di R&S svolte in collaborazione devono essere estese per includere l'ingegneria dei servizi integrati, le applicazioni fisse e mobili e le tecniche di verifica e prova delle apparecchiature di comunicazione e delle funzioni dei servizi entro la fine del 1989.

G) Gli enti europei di normalizzazione devono potenziare e coordinare i rispettivi sforzi di normalizzazione a livello internazionale per le IBC e i servizi avanzati. Entro la metà del 1989 deve essere definito un calendario di normalizzazione, soprattutto per quanto concerne l'ATM.

H) Gli Stati membri devono affrontare il problema dell'assegnazione delle frequenze in Europa per tutta la gamma di frequenze e di applicazioni e rendere possibile, entro il 1992, una razionalizzazione dell'assegnazione delle frequenze che rispecchi le nuove esigenze e priorità.

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(8) Rapporto del comitato di esperti delle tecnologie dell'informazione e della comunicazione, presieduto da W. Dekker, giugno 1992.

(9) Risposta della Commissione al rapporto Dekker, gennaio 1993.

Nel contesto della valutazione del secondo programma quadro[10], la Commissione ha presentato nel 1992 una relazione sul programma RACE sulla quale il CREST è stato invitato dal Consiglio a esprimere un commento. Il CREST ha trasmesso l'invito al comitato di gestione di RACE (RMC), che ha presentato nel luglio 1992 la seguente relazione.

Qualità dei risultati e impatto sulla competitività

In generale, i risultati di RACE sono stati come minimo all'altezza dei più recenti progressi della ricerca: in molti casi sono stati realizzati importanti progressi [ad es., ATM, comunicazioni mobili (UMTS, Universal Mobile Telecommunications System), tecnologie e dispositivi ottici].

L'Europa detiene ora una posizione più favorevole di quella che avrebbe avuto senza RACE. Anche se altri paesi possono essere più avanzati, il divario tecnologico di cui soffriva il settore europeo delle telecomunicazioni è diminuito in modo apprezzabile rispetto agli Stati Uniti e al Giappone.

Nel primo quinquennio del secondo programma quadro, RACE ha conseguito gran parte degli obiettivi tecnici, prescritti dalla decisione del Consiglio. Data pero' la rapida evoluzione del settore delle telecomunicazioni (ad es., nuovi requisiti per i servizi, nuove tecnologie, crescente competitività tra gli operatori), nel quinquennio di attività del programma è stato necessario adeguarne gli obiettivi e le priorità. Nei programmi successivi, quali RACE II (la seconda fase del programma decennale RACE), sono stati inseriti altri obiettivi con nuove priorità (quali gli esperimenti e le infrastrutture di prova e verifica nel settore delle comunicazioni).

Il programma RACE ha stimolato la cooperazione tra gli organismi delle poste e telecomunicazioni (PTO) (nella pianificazione strategica quale EURESCOM); tra le industrie (nella formazione di un consorzio industriale - RIC), e tra i PTO e le industrie (ad esempio negli organismi di normalizzazione come l'ETSI). Le dimensioni e la portata di questo genere di cooperazione vanno comunque ulteriormente sviluppate.

Oltre a numerosi risultati scientifici e tecnici, RACE I ha apportato 470 contributi agli enti di normalizzazione (soprattutto l'ETSI) basati sullo sviluppo delle proprie specifiche funzionali comuni (fine giugno 1992).

La collaborazione all'interno di RACE ha aumentato la competitività dell'industria delle telecomunicazioni nei mercati mondiali. Per l'industria europea in generale, l'influsso positivo di RACE dovrebbe risultare più evidente a lungo termine, con la più diffusa adozione delle comunicazioni avanzate. Proseguendo la R&S sulle applicazioni, si puo' mostrare ai potenziali utilizzatori il vantaggio competitivo ottenibile grazie a sistemi di comunicazioni corrispondenti agli ultimi progressi tecnici.

(10) Comunicazione della Commissione - Valutazione del secondo programma quadro per la ricerca e lo sviluppo tecnologico (SEC(92)675 def., luglio 1992).

Gestione e efficacia in rapporto ai costi

Nell'ambito del programma quadro, RACE costituisce un programma coerente con specifici obiettivi comuni a tutti i progetti, articolato su dieci anni. Durante la prima fase di RACE si sono compiuti rilevanti progressi nei settori dell'ATM, dei componenti e delle tecnologie ottiche, delle comunicazioni mobili (UMTS) e degli esperimenti a larga banda. Gli ultimi due settori di ricerca hanno ricevuto un maggiore risalto nel corso della seconda fase di RACE. I settori dove vi sono stati minori progressi comprendono la sicurezza e la progettazione dell'utilizzabilità, in cui si sono dovuti ridimensionare gli obiettivi originari.

Il meccanismo di concertazione ha un ruolo determinante per la collaborazione raggiunta nell'ambito di RACE. In genere, la collaborazione su scala europea quale quella attuata da RACE è efficace in rapporto ai costi, dato l'effetto di moltiplicazione dei risultati conseguiti dai partner rispetto agli investimenti effettuati da ciascuno di essi.

La valutazione delle offerte e le procedure di verifica tecnica sono state efficaci: ad esempio, grazie alla cosiddetta procedura di "allarme rosso" è stato conferito un nuovo orientamento e slancio a progetti che non avrebbero altrimenti conseguito i loro obiettivi, oppure sono stati arrestati altri progetti nelle prime fasi evitando uno spreco di risorse.

Poiché il programma era nel complesso ben strutturato e ben gestito, sono ancora possibili miglioramenti in numerosi settori:

- *La cooperazione/collaborazione con altri programmi europei e multinazionali non è stata abbastanza efficace.*

- *La Commissione, i PTO e l'industria devono assumere un impegno comune a supporto del programma e dei suoi obiettivi prima dell'adozione del programma di lavoro.*

- *E' opportuno incrementare gli sforzi tesi a mantenere la qualità del programma nel suo complesso, distinto dai singoli progetti al suo interno. Ad esempio, troppi partecipanti d'importanza decisiva non sono coinvolti per tutta la durata del programma.*

- *E' necessario ottimizzare ulteriormente l'efficacia in rapporto ai costi delle riunioni di concertazione.*

- *Idealmente, il progetto di gestione del consenso dovrebbe essere attuato per primo, per garantire efficaci relazioni con gli altri progetti.*

- *Si dovrebbero adottare misure per accrescere il ruolo attivo e la partecipazione delle PMI ai programmi futuri.*

- *Si dovrebbero utilizzare maggiormente le azioni concertate e le misure di supporto.*

Coerenza rispetto alle politiche e ai principi comunitari

I criteri tecnici di selezione seguiti nella valutazione delle offerte e nella verifica dei progetti si sono rivelati soddisfacenti.

Nella selezione dei progetti per la prima fase di RACE non si è tenuto esplicitamente conto di criteri sociali ed economici. Comunque, in termini generali, un programma di telecomunicazioni come RACE è coerente con le politiche prevalenti in materia di protezione dell'ambiente e di risparmio energetico.

Per quanto concerne le sussidiarietà, è chiaro che la collaborazione europea per la ricerca prenormativa nel campo delle telecomunicazioni è destinata ad arrecare una serie di vantaggi. Occorre comunque incoraggiare anche una più stretta intercomunicazzione con i programmi e con gli esperimenti nazionali.

Conclusioni

I programmi di ricerca nel campo delle telecomunicazioni in Europa non possono esaurirsi nel 1995. Dopo RACE è necessario un altro programma.

La R&S è necessaria ma non sufficiente per conquistare una posizione vantaggiosa nei futuri mercati delle telecomunicazioni. Nel presente documento, il Comitato di gestione RACE (RMC) non specifica le ulteriori misure necessarie per conseguire tale risultato. Lo spostamento d'accento della R&S nelle telecomunicazioni verso i servizi e le applicazioni dovrebbe influire sulla struttura e sull'organizzzione dei futuri programmi.

I risultati di RACE dovrebbero essere maggiormente apprezzati ed utilizzati a livello europeo. I responsabili economici del settore dovrebbero adottare le iniziative necessarie per realizzare questo trasferimento di conoscenze.

La relazione sopra riportata è parte del documento di base trasmesso dal CREST al Consiglio nell'ottobre 1992 in merito al secondo programma quadro.

3.2.2 Valutazioni di impatto e previsioni

Per tutto il quinquennio, lo sviluppo della ricerca e della tecnologia nell'ambito del programma è stato accompagnato da periodiche valutazioni dell'impatto economico e sociale degli sviluppi delle comunicazioni avanzate. Le relazioni in merito a tali valutazioni sono state pubblicate e ampiamente diffuse nella serie "Prospettive delle comunicazioni avanzate in Europa: PACE". La valutazione più recente è stata effettuata nel 1991 e diffusa nel 1992. Tale attività costituisce l'antefatto ai fini dell'aggiornamento annuale dei lavori del programma, nonché di adattamenti più ridotti nel corso dell'anno. Gran parte di queste attività è stata ora pienamente integrata nella seconda fase di RACE, ai sensi della decisione del Consiglio su un programma specifico sulle tecnologie della comunicazione.

3.2.3 Verifica di gestione del programma

Nel 1989, le procedure di gestione del programma adottate dai servizi della Commissione per il programma RACE sono state sottoposte ad una "verifica di gestione del programma" indipendente.

Nelle conclusioni si affermava che lo stile di gestione di tipo industriale adottato dai servizi della Commissione era risultato nel complesso rispondente agli obiettivi e ai partner del programma, e che le verifiche tecniche annuali e le riunioni periodiche di concertazione si erano rivelate un approccio efficace alla gestione del programma.

3.2.4 Verifiche tecniche dei progetti RACE

Per poter adattare il programma agli sviluppi tecnologici e ai mutamenti della domanda, la decisione relativa al programma RACE prevedeva una revisione annuale del programma di lavoro.

Cio' comportava un riesame annuo dei progressi compiuti da tutti i progetti in corso rispetto agli obiettivi, e a nuove esigenze. Ciascun progetto è stato pertanto sottoposto ogni anno ad una "verifica tecnica" da parte di esperti indipendenti in materia. La prima verifica tecnica è stata effettuata nell'ottobre 1988, l'ultima nell'ottobre 1992. I risultati di queste verifiche annuali hanno servito a riorientare o sospendere definitivamente i lavori dei progetti.

Qui di seguito sono elencati gli elementi principali della verifica tecnica.

a) Ogni anno, i partner di ciascun progetto hanno effettuato un'"autovalutazione", passando in rassegna tutti i principali aspetti del progetto e documentandone i risultanti in una relazione annuale.

b) I risultati sono stati valutati da esperti esterni indipendenti individuati con l'assistenza del comitato di gestione di RACE (RMC). Dopo la valutazione delle relazioni, ha avuto luogo un "hearing" sotto la presidenza della Commissione, perché i responsabili dei progetti potessero evidenziare i risultati ottenuti e delineare le attività future. Gli esperti incaricati della verifica, riuniti in gruppi a seconda della rispettiva specializzazione, hanno potuto interrogare i responsabili dei progetti per completare il quadro riportato nella relazione e nella presentazione annuale.

c) I gruppi di esperti hanno riunito le loro conclusioni e raccomandazioni nelle proprie relazioni annuali *(Audit Panel Reports)* al comitato di gestione Race e alla Commissione.

d) Le relazioni sono state completate da una valutazione, da parte dei funzionari della Commissione responsabili del progetto, dei *deliverables* definiti nel contratto (in genere, i *deliverables* sono considerati segreti e non sono rivelati agli esperti incaricati della verifica).

Questa procedura si è rivelata equa ed efficace. Le relazioni di verifica hanno costituito un'eccellente base per negoziare ogni anno i programmi di lavoro dettagliati di ciascun progetto.

4. Collegamenti con altre azioni comunitarie ed europee

4.1 Collegamenti con la CEPT

I collegamenti con la CEPT e i suoi enti sussidiari sono sostanzialmente mutati nel corso dello sviluppo e dell'attuazione di RACE.

Nella fase di definizione, il gruppo speciale sulle comunicazioni a larga banda (GSLB) istituito dalla CEPT ha dato un rilevante contributo al programma di lavoro della prima fase di RACE. Nel 1987 e nel 1988, il coordinamento con le attività della CEPT è stato garantito dal gruppo misto RACE (GMR), creato a tale scopo nel settembre 1987.

Nel 1988, grazie alla collaborazione con la CEPT, tredici amministrazioni europee delle telecomunicazioni hanno firmato un Memorandum d'intesa (MoU) per l'introduzione di un banco di prova generalizzato per le attività IBC, denominato EBIT (*European Broadband Interconnection Trial* o rete sperimentale europea a banda larga).

Il nuovo assetto regolamentare delle telecomunicazioni, in linea con la nuova politica europea in materia di telecomunicazioni, ha indotto la CEPT a creare numerosi enti distinti, due dei quali hanno istituto stretti collegamenti con le attività di RACE: ETNO, il gruppo degli operatori europei delle reti di telecomunicazione, è ora la sede di dibattiti tra gli operatori di rete sui problemi relativi all'interfunzionamento delle reti, ed EURESCOM costituisce un forum per la ricerca strategica comune. Non tutti i principali operatori europei delle telecomunicazioni fanno parte di EURESCOM che costituisce comunque una valida interfaccia tra la Commissione, i progetti RACE e la maggior parte degli operatori di rete.

4.2 Collegamenti con gli enti di normalizzazione europei ed internazionali

Come parte dell'attuazione della politica europea nel campo delle telecomunicazioni, nel 1988 è stato creato l'ETSI, l'Istituto europeo delle norme di telecomunicazione, che costituisce ora la principale sede europea per l'elaborazione delle specifiche tecniche. Le attività prenormative condotte nell'ambito di RACE hanno fornito 576 contributi distinti ai lavori di normalizzazione dell'ETSI, del CCITT e del CCIR.

Si sono inoltre svolte riunioni periodiche con rappresentanti del CEN/CENELEC, dell'Unione europea di radiodiffusione e dello SPAG (Gruppo di promozione e di applicazione delle norme).

4.3 Collegamenti con altri programmi comunitari ed attività europee

I progetti RACE prendono come punto di partenza i risultati di progetti che sviluppano tecnologie generiche, ad esempio ESPRIT (componenti microelettroniche, strumenti di software, AIP (trattamento avanzato delle informazioni) per la gestione di rete, ecc.); analogamente, le esigenze in materia di telecomunicazione dei programmi di applicazioni telematiche (DRIVE, DELTA e AIM) si sono basate in grande misura sulle tecniche sperimentate negli attuali progetti RACE.

La collaborazione con COST è stata attuata con stretti collegamenti tra le attività correlate e riunioni periodiche sul piano della gestione del programma.

Con l'iniziativa EUREKA, l'interazione più efficace si è sviluppata nel settore delle tecnologie audiovisive. Parte delle attività connesse alla promozione della televisione ad alta definizione (progetto EUREKA 95) sono state integrate da attività svolte nell'ambito di un contratto RACE; e il progetto EUREKA 256 sulla codifica del segnale video è stato associato alle attività di integrazione di RACE.

44 *Collegamenti con organismi nei paesi dell'EFTA*

Nel programma RACE sono coinvolti organismi dell'Austria, della Finlandia, della Norvegia, della Svezia e della Svizzera: 27 organismi di tali paesi hanno partecipato a 72 progetti (cioè a più dell'80% delle attività).

5. Valorizzazione dei risultati di RACE

Le opportunità aperte dalle nuove tecnologie delle comunicazioni eserciteranno un importante impatto sulla futura crescita economica nella Comunità e sulla divisione internazionale del lavoro su scala mondiale. Sono in atto tre processi di crescita distinti ma correlati:

- un migliore accesso a un'informazione di migliore qualità accresce la produttività di tutta l'economia;

- i miglioramenti delle telecomunicazioni accrescono l'utilità e, di conseguenza, le opportunità di commercializzazione dei vecchi e nuovi servizi, provocandone l'espansione;

- il passaggio alla nuova economia trainata dai servizi e basata sull'informazione richiede un rilevante investimento pubblico e privato in nuove infrastrutture, sia dal punto di vista delle apparecchiature - cavi, centrali di commutazione, terminali - sia dal punto di vista delle risorse umane, per lo sviluppo di servizi di telecomunicazione a valore aggiunto.

Pertanto, la qualità tecnica e organizzativa delle comunicazioni avrà un'importanza decisiva per la futura crescita economica, in quanto determina la capacità dell'economia di generare e di impiegare in modo efficiente l'unico e più importante fattore della moderna "produzione": la conoscenza. L'organizzazione geografica delle infrastrutture influenzerà fortemente lo spazio sociale, economico e culturale del futuro, come era successo con le ferrovie nell'Ottocento.

Per tali motivi, è necessario sfruttare rapidamente e in modo efficace i risultati della R&S attinente alle comunicazioni. Durante tutto il programma, si è percio' prestata una particolare attenzione alla valorizzazione dei risultati di RACE.

5.1 Il piano di valorizzazione dei risultati di RACE

Per stimolare e valutare il grado di valorizzazione dei risultati di RACE da parte dei partecipanti, nel periodo 1988-1992 è stato regolarmente aggiornato un "Piano di valorizzazione dei risultati di RACE", che fornisce una panoramica completa in materia.

I contributi alla normalizzazione sono elencati nell'Allegato II, e i titoli delle pubblicazioni scientifiche e tecniche sono elencati nell'Allegato III. Con più di 1.655 pubblicazioni scientifiche e tecniche prodotte grazie alle sue attività, il programma RACE ha recato un importante contributo alla letteratura scientifica.

Nei casi appropriati, i risultati dello sviluppo tecnologico sono stati protetti domandando la registrazione di un brevetto. Sono già stati registrati 73 brevetti connessi alle attività di RACE elencati nell'Allegato IV.

5.2 Piano di attuazione IBC

La R&S puo' essere efficacemente sfruttata solo se tutti gli attori economici hanno una visione coerente della direzione e del ritmo degli sviluppi commerciali. La R&S nel programma RACE è stata pertanto sempre programmata e definita in relazione ad un piano di attuazione indicativo per le comunicazioni integrate a larga banda (IBC), che è stato regolarmente aggiornato. Tale piano comprende un'introduzione per tappe successive dei servizi avanzati, a partire da quelli sollecitati dal settore commerciale e professionale già nel 1992/1993. L'attuale calendario indicativo di attuazione, descritto nella relazione annuale RACE per il 1992 (RACE '92) comprende le seguenti tappe:

1992/1993:

- prima introduzione di applicazioni di tipo commerciale e professionale;
- esperimenti di comunicazioni avanzate per valutare i nuovi servizi e i nuovi sistemi di gestione della rete: ATM, MAN (reti per area metropolitana) e IBC nelle reti d'utente (CPN);
- decisioni di acquisto/investimento per la futura rete paneuropea di IBC e servizi IBC completi;
- stesura definitiva delle principali norme.

1994:

- completamento dell'interconnessione di tutte le capitali della Comunità e con i paesi confinanti, basata sull'estensione delle reti ottiche interurbane esistenti, ma in grado di fornire supporto al traffico di voce, dati e immagini, in modo separato o come servizi integrati.

1995:

- fase iniziale d'attuazione della rete IBC e completamento dell'accesso utente nei centri di attività economica e manifatturiera: almeno 50.000 imprese utenti di servizi avanzati;
- banchi di prova di applicazioni cui sottoporre una gamma completa di servizi IBC (compresa l'utenza residente con video bidirezionale e HDTV digitale) che impiega apparecchiature IBC commerciali.

1996:

- offerta di servizi di base commerciali a banda larga, basati su collegamenti a 2, a 34 e a 155 Mbit/s, compresa la trasmissione di dati veloce tra LAN, la videoconferenza da desktop, l'elaborazione del segnale video, il CAD/CAM e le applicazioni per il telelavoro.
- interfunzionamento di rete fisse a banda larga con i mezzi mobili, i satelliti e altre reti.

1997:

- disponibilità di servizi IBC all'utenza commerciale in città con più di 500.000 abitanti, e avvio dell'applicazione generalizzata del sistema "fibre-to-the-home".

2005-2010:

- penetrazione al 50% dei servizi IBC.

Questa tabella indicativa verrà di nuovo aggiornata nel 1993, nel contesto della definizione degli orientamenti per lo sviluppo delle rete transeuropee a larga banda, come previsto al Titolo XII, articolo 129, lettere b) e c) del Trattato dell'Unione europea.

6. Attuazione della seconda fase di RACE

RACE è stato sempre inteso come un programma di lavoro decennale, da attuarsi in due fasi. Per garantire la continuità, la seconda fase è stata adottata nel giugno 1991 come programma specifico nell'ambito del terzo programma quadro comunitario di ricerca e sviluppo tecnologico.

Nel 1991 vi è stato comunque un radicale mutamento di percezione: quella che era sembrata una visione ambiziosa, quasi futuristica, agli inizi del programma, si è trasformata in un'opportunità realistica. Si prevede con fiducia un'introduzione delle comunicazioni integrate a larga banda a livello commerciale nel giro di quattro anni. Con l'approssimarsi del secolo XXI, risulta sempre più chiaro che le telecomunicazioni e i servizi d'informazione avanzati svolgeranno un ruolo chiave nello sviluppo socio-economico mondiale.

Questi cambiamenti hanno indotto il Parlamento europeo e il Consiglio dei ministri a conferire priorità all'adozione del nuovo programma specifico. Tra quelli del terzo programma quadro, esso è stato il primo ad essere adottato[II] e il programma di lavoro ha immediatamente ricevuto il parere favorevole del comitato di gestione. Nel giugno 1991 è stato pubblicato un invito a presentare proposte e la valutazione ha avuto luogo nel settembre - ottobre 1991. Le proposte valutate erano più di 200 e agli inizi del 1992 sono stati avviati 95 progetti, che dovrebbero essere completati, secondo le attuali previsioni di bilancio, entro la fine del 1994.

Mentre i progetti della prima fase di RACE si sono concentrati sulla valutazione delle opzioni, quelli della seconda fase costituiscono i preliminari all'introduzione delle IBC. I progetti di RACE II rafforzeranno la cooperazione e gli impegni già assunti da parte degli utilizzatori industriali, dell'industria telematica e degli operatori delle telecomunicazioni nell'ambito di RACE I. Le nuove attività di R&S si concentrano sulle applicazioni, i servizi, il funzionamento e la gestione, ma conservano un elevato livello di sviluppo tecnologico onde consolidare ed ampliare i settori chiave necessari per attuare una fornitura di servizi IBC efficace in rapporto ai costi.

Le attività comprendono gli otto settori prioritari individuati nell'Allegato II alla decisione del Consiglio:

Settore 1 Ricerca e sviluppo di IBC
Settore 2 Intelligenza nelle reti/gestione flessibile delle risorse di comunicazione
Settore 3 Comunicazioni mobili e personali
Settore 4 Comunicazioni di immagini e di dati
Settore 5 Tecnologia per servizi integrati
Settore 6 Tecnologie per la sicurezza dell'informazione
Settore 7 Esperimenti nel campo delle comunicazioni avanzate
Settore 8 Infrastrutture di verifica e interfunzionalità
(Ricerca e sviluppo di supporto per i settori prioritari sopraddetti).

Una descrizione completa dei nuovi progetti di R&S della seconda fase, e delle loro interrelazioni con i progetti della prima fase, è disponibile nelle relazioni annuali 1992 (RACE '92) e 1993 (RACE '93).

(II) Decisione del Consiglio 91/352/CEE del 7 giugno 1991 : G.U. n. 192/8, 16.7.91

7. Requisiti e opzioni future per la R&S sulle tecnologie della comunicazione a livello europeo

Nel giugno 1992, il comitato di gestione di RACE ha istituito un gruppo ad hoc incaricato di individuare le priorità per la futura R&S europea nel settore delle telecomunicazioni. Qui di seguito il rapporto del gruppo.

Molti di questi concetti e tematiche per la futura R&S europea sono già stati recepiti nel documento di lavoro della Commissione relativo al quarto programma quadro, soprattutto per quanto concerne le tematiche proposte di "Tecnologie dell'immagine", "Elaborazione e reti ad alte prestazioni", "Integrazione funzionale nella produzione" e "Comunicazioni avanzate". Nel 1993, dopo aver valutato tutti i contributi, la Commissione avanzerà proposte di programmi specifici nell'ambito del quarto programma quadro.

Filosofia della R&S a livello comunitario

Il comitato di gestione RACE (RMC) è persuaso che l'intraprendere attività di R&S nel campo delle telecomunicazioni a livello comunitario produca chiari vantaggi e benefici. In senso globale, la ricerca (e in particolare la ricerca nel campo delle telecomunicazioni) è un processo continuo. Gli attori economici del settore, per conservare la posizione più vantaggiosa conquistata partecipando alle azioni comunitarie quali RACE, dovranno proseguire gli sforzi di ricerca in collaborazione, approfondendo ulteriormente i risultati finora conseguiti.

E' necessario consolidare ulteriormente i sistemi di telecomunicazione frammentati della Comunità, sia per garantire un efficace funzionamento del mercato unico, sia per rafforzare il vantaggio competitivo delle imprese europee sui mercati mondiali. Gli enti di normalizzazione, come l'ETSI, hanno valorizzato i contributi tecnici frutto delle attività di RACE. Si deve proseguire e potenziare, come parte di ulteriori programmi, il processo di "gestione del flusso" dei risultati della R&S comunitaria in direzione degli enti di normalizzazione.

Le telecomunicazioni avanzate assumono un'importanza crescente per la prosperità delle economie nazionali, nella misura in cui i loro elementi costitutivi (le "informazioni" e la capacità di "comunicarle") sono considerati risorse strategiche. Cio' si puo' misurare in termini di:

- *crescente percentuale di economie nazionali migliorate grazie agli investimenti nel campo delle telecomunicazioni, e*

- *crescente impatto esercitato dai servizi di telecomunicazione avanzati sugli altri settori dell'attività economica.*

Queste tendenze sono state riconosciute nell'Atto unico e negli attuali sforzi di completamento del mercato interno della Comunità europea. Il Trattato di Maastricht prevede la creazione di reti transeuropee (comprese le reti di telecomunicazione). La creazione di un livello europeo di infrastrutture e servizi di telecomunicazione richiederà un impegno a lungo termine di tutti gli operatori economici del settore.

Sincronizzando (ancora una volta a livello europeo) l'evoluzione verso la creazione di un'infrastruttura di comunicazioni a larga banda si otterranno, in cambio degli investimenti effettuati, chiari vantaggi economici. La sincronizzazione faciliterebbe inoltre l'avvio di nuove applicazioni funzionanti in tutte le regioni europee, e consentirebbe di raggiungere rapidamente la massa critica necessaria per un incremento autonomo dell'impiego dei servizi avanzati. Senza dubbio le reti di telecomunicazione e un crescente numero di servizi comunitari hanno una portata sempre più internazionale. Sarebbe inoltre opportuno incoraggiare una più ampia cooperazione nelle regioni extraeuropee.

Per tutti questi motivi, il comitato di gestione di RACE ritiene necessario includere, in qualsiasi futuro programma quadro, un'azione specifica di R&S comunitaria sulle telecomunicazioni che dovrebbe basarsi sugli importanti risultati conseguiti grazie ai programmi precedenti. Tuttavia, la natura delle attività di R&S nel campo delle telecomunicazioni necessarie dopo il 1995 è molto diversa da quanto finora intrapreso nell'ambito di RACE.

Obiettivi della futura R&S nel campo delle telecomunicazioni

Per realizzare il concetto di comunicazioni avanzate, che consenta ad "ogni soggetto di comunicare con ogni altro soggetto indipendentemente dal luogo e dal momento, utilizzando testo, suono e immagini", l'Europa deve intraprendere nuove iniziative di R&S.

I programmi esistenti, come RACE ed ESPRIT, hanno già recato un sostanziale contributo alla fattibilità tecnica di base di tale concetto. La forza trainante di un nuovo programma di R&S comunitario nel settore delle telecomunicazioni deve ora derivare dalle esigenze in materia di applicazioni. In linea di principio, queste ultime devono anche determinare le azioni e le priorità necessarie per l'ulteriore ricerca nelle tecnologie che ne stanno alla base.

Ogni nuovo programma dovrebbe pertanto concentrarsi sui due obiettivi seguenti.

- *Promuovere "banchi di prova operativi" dei servizi avanzati, per migliorarne l'utilizzabilità e garantire che il risultato finale sia tale da poter essere ampiamente utilizzato dai cittadini europei nella vita quotidiana.*

- *Continuare la ricerca sulle "tecnologie del futuro", necessarie come supporto delle comunicazioni avanzate, per ridurre il costo dei componenti chiave e rendere percio' più fattibile, sul piano economico, la fornitura di servizi avanzati.*

Questi due aspetti sono particolarmente significativi ai fini di realizzare reti e servizi di comunicazione avanzati paneuropei di tipo commerciale, malgrado tale "realizzazione" dipenda anche da numerosi altri fattori. Il concetto di comunicazioni avanzate, per diventare più concreto, presuppone un incremento della reciproca consultazione tra gli attori del settore, in vista di un consenso sui seguenti punti.

- *Concordare il modo migliore per conseguire il necessario potenziamento delle prestazioni dei servizi e delle relative tecnologie di supporto.*

- *Concordare, come obiettivo, una serie di opportunità create dalla convergenza dei settori delle telecomunicazioni, della radiodiffusione e delle tecnologie dell'informazione, che possano costituire la base di una rapida evoluzione verso le comunicazioni avanzate.*

In breve, proseguendo le attività di R&S comunitaria nel settore delle comunicazioni avanzate, si promuoveranno anche la cooperazione e l'armonizzazione su scala europea, rafforzando la competitività europea sui mercati internazionali e pertanto potenziando l'economia europea nel suo complesso.

Basi della cooperazione (Modus operandi)

Perché si possa diffondere la consapevolezza degli aspetti positivi delle comunicazioni avanzate e per rendere le tecnologie in questione più "fattibili" sul piano economico, è necessario coinvolgere tutti gli attori economici interessati: utilizzatori, operatori di rete, fornitori dei servizi, industria, centri di ricerca e università. Il coinvolgimento di tutti questi attori del settore dev'essere garantito fin dall'inizio, rendendoli collettivamente responsabili della definizione di un programma di lavoro concordato. In particolare, è opportuno incoraggiare l'attiva collaborazione degli operatori della rete pubblica (PNO) a supporto degli esperimenti di comunicazione, per poter trarre il massimo vantaggio dalle infrastrutture già esistenti o previste.

Nel prossimo programma di R&S, un ruolo crescente dev'essere riservato alle PMI, molte delle quali possiedono una notevole esperienza nello sviluppo dei servizi e delle applicazioni. Per poter affrontare questo nuovo settore di ricerca, la Comunità ha assolutamente bisogno di tale esperienza. Per rafforzare il ruolo delle PMI nelle future attività di R&S sulle comunicazioni occorre adottare misure specifiche in proposito. Ad esempio, la Commissione dovrà forse applicare procedure contrattuali in grado di fornire maggiore supporto (ad esempio, il meccanismo CRAFT utilizzato nel contesto BRITE/EURAM o altri approcci innovativi).

Malgrado RACE sia risultato nel complesso soddisfacente, per la gestione del prossimo programma di R&S nel campo delle comunicazioni sarebbe opportuno prevedere alcune nuove procedure o qualche miglioramento a quelle esistenti. I singoli progetti dovrebbero essere formulati entro un quadro ben strutturato, definito nel programma di lavoro e impostato per conseguire gli obiettivi del programma. Anche il meccanismo di concertazione utilizzato con successo in RACE dovrà essere ulteriormente potenziato.

Ogniqualvolta possibile, si deve incoraggiare un maggiore coordinamento dei programmi comunitari, una più efficace collaborazione con altri programmi di ricerca europei o multinazionali e una stretta intercomunicazione con i programmi e gli esperimenti nazionali. Si puo' considerare anche l'eventualità di azioni concertate con EUREKA, COST e altri progetti a livello nazionale.

Le misure di supporto per il programma dovranno comprendere un'adeguata campagna d'informazione sui progetti nel corso dell'esecuzione e la promozione dei risultati (compresi i potenziali vantaggi/applicazioni) diretta a tutti gli operatori del settore, in special modo i potenziali utilizzatori delle comunicazioni avanzate.

Banchi di prova operativi e sviluppo dei servizi

La passata esperienza in merito all'introduzione delle nuove tecnologie e servizi di rete ha mostrato che lo sviluppo e l'attuazione delle nuove applicazioni rende necessario un processo di convalida ben organizzato, preoperativo e pratico (denominato "banco di prova operativo"), con la partecipazione di tutti gli attori del settore. La sfida per le prossime generazioni di banchi di prova operativi europei è quella di mostrare le modalità e i mezzi pratici di raggruppare (in condizioni di libero mercato) i potenziali servizi, per soddisfare le esigenze dei settori chiave del mercato.

La R&S concernente i banchi di prova operativi e lo sviluppo dei servizi dovrebbe concentrarsi su problemi generici, che consentiranno l'evoluzione dei servizi avanzati. Benché basati sulla tecnologia esistente, i banchi di prova dovrebbero indicare la tipologia più adatta di realizzazione delle applicazioni, man mano che le reti diventano più "intelligenti" e i servizi più flessibili. I principali obiettivi dei banchi di prova operativi dovrebbero comprendere la formulazione e l'apporto di proposte al processo di normalizzazione, nonché di proposte di piattaforme comprendenti tutti gli aspetti dell'applicazione nel settore, vale a dire:

- *l'impresa (comprese le politiche di organizzazione, di interazione, di informazione all'utenza, di gestione e di sicurezza, l'analisi costi/benefici, l'approccio giuridico, etico e sociale);*
- *le informazioni in senso stretto (compresa la definizione degli elementi informativi, la qualità, il flusso e la presentazione all'utenza degli stessi);*
- *le funzioni telematiche (comprese le funzioni di comunicazione e di elaborazione e le tipologie di presentazione dei dati);*
- *le tecnologie (compreso l'hardware e il software).*

In tal modo, i banchi di prova operativi dovrebbero tener conto delle modifiche a livello legislativo, di politiche di gestione e di sicurezza, di interfacce d'accesso utente e di interfacce uomo/macchina, nonché riportare analisi costi/benefici e definizioni della qualità delle informazioni.

Lo sviluppo di servizi generici richiede la creazione di strumenti, l'incorporazione di teleservizi e terminali multimediali, la fornitura di capacità di servizi avanzate, la gestione e l'ingegneria degli stessi. Pertanto, le future applicazioni dovranno soddisfare una serie di requisiti preliminari. Esse dovranno

- *avere definizioni specifiche di settore ed essere determinate dai fornitori e dagli utenti;*
- *basarsi su servizi generici e coerenti con il concetto di fornitura di una rete aperta;*
- *essere definite in base a chiari obiettivi costi/benefici;*
- *avere un potenziale di mercato internazionali;*
- *poter soddisfare, a breve termine, nuovi requisiti come la mobilità personale e l'ubiquità, i servizi multimediali a larga banda, il collegamento in rete di tipo cooperativo o intelligente.*

Gli attuali programmi nazionali e della CCE (ad esempio RACE, sui sistemi telematici ed ESPRIT) forniscono una base empirica per individuare tali applicazioni. L'obiettivo fondamentale dei futuri programmi di R&S consiste nell'effettuare prove preoperative e dimostrare la validità delle applicazioni a livello europeo. Secondo il comitato di gestione di RACE (RMC), per meglio soddisfare le esigenze degli utenti, un futuro programma di R&S dovrebbe comprendere lo "sviluppo di servizi" specifici nei seguenti ambiti:

- *servizi di videoconferenza e servizi multimediali più perfezionati;*
- *telelavoro e presenza virtuale;*
- *mobilità, ubiquità e sicurezza delle informazioni;*
- *servizi di radiodiffusione e di narrowcasting (offerta di servizi informativi a classi limitate di utilizzatori in area locale con diversi gradi di interattività);*
- *servizi di gestione e servizi di rete "intelligente".*

Ricerca delle tecnologie di supporto

Qualsiasi nuovo programma di ricerca nel campo delle telecomunicazioni deve fondarsi sulla base tecnologica resa disponibile grazie ai programmi precedenti. Attualmente è necessario un tipo di ricerca strategico, che consenta risparmi sui costi grazie alle tecnologie della prossima generazione; gli obiettivi generali possono essere formulati come segue:

- *fornire le tecnologie necessarie per l'evoluzione in Europa di reti e servizi a costi competitivi, in posizione di vantaggio rispetto alle potenze economiche concorrenti, per contribuire efficacemente a rafforzare l'economia europea;*
- *creare le basi per un'evoluzione tecnicamente fattibile e ragionevole, sul piano economico, delle reti di telecomunicazione, ai fini di rafforzare l'economia europea anche sul versante della normalizzazione.*

Le conoscenze ottenute in questi settori più generali di ricerca possono rendere necessaria una modifica degli obiettivi e delle priorità in altri settori del programma. Ad esempio, l'evoluzione della tecnologia dei servizi puo' contribuire alla ricerca sulle componenti e sulla tecnologia di rete. Il concetto dominante deve comunque concentrarsi ancora una volta sui nuovi servizi da offrire all'utenza tramite la rete di telecomunicazione. Dato che tali servizi saranno fortemente personalizzati, è necessario avviare un processo interattivo di azione e retroazione tra l'evoluzione delle reti e lo sviluppo dei servizi. Secondo il comitato di gestione di RACE (RMC), un programma futuro dovrebbe comprendere i seguenti settori di ricerca specifici:

Evoluzione della rete per creare le basi di un sistema di comunicazioni avanzate tecnicamente fattibile e ragionevole sul piano economico

- *Integrazione dei mezzi e sistemi di trasmissione già esistenti e di nuovo tipo (cavo di rame, fibra ottica, segnali radio su rete terrestre, satelliti), comprese le reti di distribuzione e di accesso (sostituzione di fibre ottiche al doppino telefonico locale, PON (rete ottica passiva), ecc.); integrazione delle reti mobili e delle reti fisse.*
- *Evoluzione delle gerarchie di trasmissione gestite e migliori sistemi di gestione di rete.*
- *Sistemi di trasmissione ottici ad elevatissima capacità e architetture di rete fotoniche.*
- *Gestione di nodi per la B-ISDN (ATM) e sistemi di segnalazione più perfezionati.*
- *Reti intelligenti avanzate, architetture di rete informative (che combinino IN, cioè reti intelligenti, e TMN, cioè sistemi di gestione di reti di telecomunicazione) ed architetture di software avanzate.*

Evoluzione delle tecnologie basate sui risultati di RACE ed altri programmi comunitari, in particolare evoluzione dei terminali verso un miglior rapporto costi/rendimenti e una maggiore facilità d'uso per l'utente

- *Stazioni di lavoro multimediali e videotelefonia*
- *Elaborazione avanzata delle immagini e del segnale sonoro*
- *Televisione digitale (SDTV, EDTV (Enhanced Definition Television), HDTV)*
- *Controllo del segnale vocale in linguaggio naturale*
- *Componenti integrati su larghissima scala (ultra LSI) per circuiti di commutazione e di trasmissione*
- *Circuiti integrati a microonde avanzati basati sul silicio (Si) e sui materiali III-V*
- *Materiali e dispositivi per applicazioni di telecomunicazione*

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
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Proposal for a functional Plane Architecture	ETSI	NA 6	1990/02	UK
Proposal for further Definition	ETSI	NA 6	1990/02	UK
Broadening of the User Concept in UPT	ETSI	NA 7	1990/09	Netherlands
Requirements for User Profiles in UPT	ETSI	NA 7	1990/09	Netherlands
UPT Numbering Plan Requirement related to the ACCESS of the UPT Service Centre	ETSI	NA 7	1990/09	Netherlands
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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
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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
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An Approach to Distributed O-o databases
1991/06 2nd Workshop of the Object Modelling Special Interest Group

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

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

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

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

Experience of Modelling and Implementing a Quality of Service Management System
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
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NEMESYS and WINER: a comparison of two QoS Network Management Experiments
1990/11

ODP Viewpoint of IBCN Service Management
IBM Technical Report No 439104

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

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

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1992 IBM Systems Journal 4Q.1992

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

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1991/11 5th RACE TMN Conference - London

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

A design of the Operation, Maintenance and Construction of an Intelligent Management Information Base
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
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1990/11 RACE TMN conference

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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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The use of AIP techniques in Maintenance Systems for Integrated Broadband Networks
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Towards a logical basis for communication in network management
1991/07 British Telecom Technol. J., Vol 9 No 3

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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
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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 fAr die Hyperdokumentenerstellung in einer hypertextbasierten
1991/05 Proceedings Gi/SI/OCG Conference Hypertext/Hypermedia '91

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

Layoutplanung und hochauflsende Bildkommunikation
1989/10 Proceedings Gl-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

Telepublishing as a Broadband Application
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

The BERKOM Project
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 fÄr zukÄnftige Breitbandsysteme
1990/12 Nachrichtentechnische Zeitschrift ntz.

Network performance measurements in ATM systems
1991/08 Telecommunications

Testing in the ATM environment
1991/10 Communications International

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

Uebertragungsqualitaet im B-ISDN international sicherstellen
1991 Telcom report 14

R1084 MIME - Development of Emulators and Simulators

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

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

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

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

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

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

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

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

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

Modelling of ATM networks
1991/11 5th TMN conference

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

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

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

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

R1086 TELEMED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Proyecto de una PACS en un Hospital pediátrico con integración 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 Teleinformatics for Disabled People. Final report of COST 219

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

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

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

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

R1089 LOOP - Low-cost Optimised Optical Passive Components

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

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

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

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

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

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

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

R1091 ESP - Exploitation and Service Project

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

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

Perspektiven zu einem europNischen IBC
1990 TUBKOM-Kolloquium Breitbandtechnik

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

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

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

R1092 DIRAC - Database for Reliability Calculations

DIRAC - A Component Reliability Database
1991 Proceedings of ESREF 91

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

R1093 ROSA - RACE Open Services Architecture

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

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

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

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

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

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

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

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

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

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

Annex IV

RACE Patents Registered

RACE PATENTS REGISTERED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Annex V

Glossary of technical terms

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

Annex VI

Key references

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

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

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

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

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

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

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

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

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

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

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

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

Annex VII

Listing of Projects

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

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

Annex VIII

Organisations involved in RACE Projects

ANNEX B - Alphabetical List of Participating Organisations

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

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

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

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

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

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

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

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

TELEFON	Telefónica de España SA	E	R1014, 18, 22, 24, 27, 28, 30, 41, 44, 48, 51, 53, 55, 72,
TELENORMA	Telefonbau & Normalzeit GmbH	D	R1011, 35, 38, 44, 45, 56
TELES	Télésystèmes SA	F	R1061, 65, 73, 74, 77, 86
TELETTRA	Telefónica Elettronica e Radio Spa	I	R1027, 44
TELINDUS	Telindus N.V.	B	R1044
TELSI	Telefónica Sistemas	E	R1009, 42*, 78, 86, 91
TELSPACE	Telspace S.A.	F	R1002
TESA	Telettra Espanola S.A.	E	R1043, 44, 45, 81
TFL	Teleteknisk Forskningslaboratorium	DK	R1046, 68
THEM	Thomson Hybrides et Microondes SA	F	R1029, 30, 43
THOMSON	Thomson SA	F	R1044, 45
THORN	Thorn EMI Central Research Labs	UK	R1015, 43
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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]

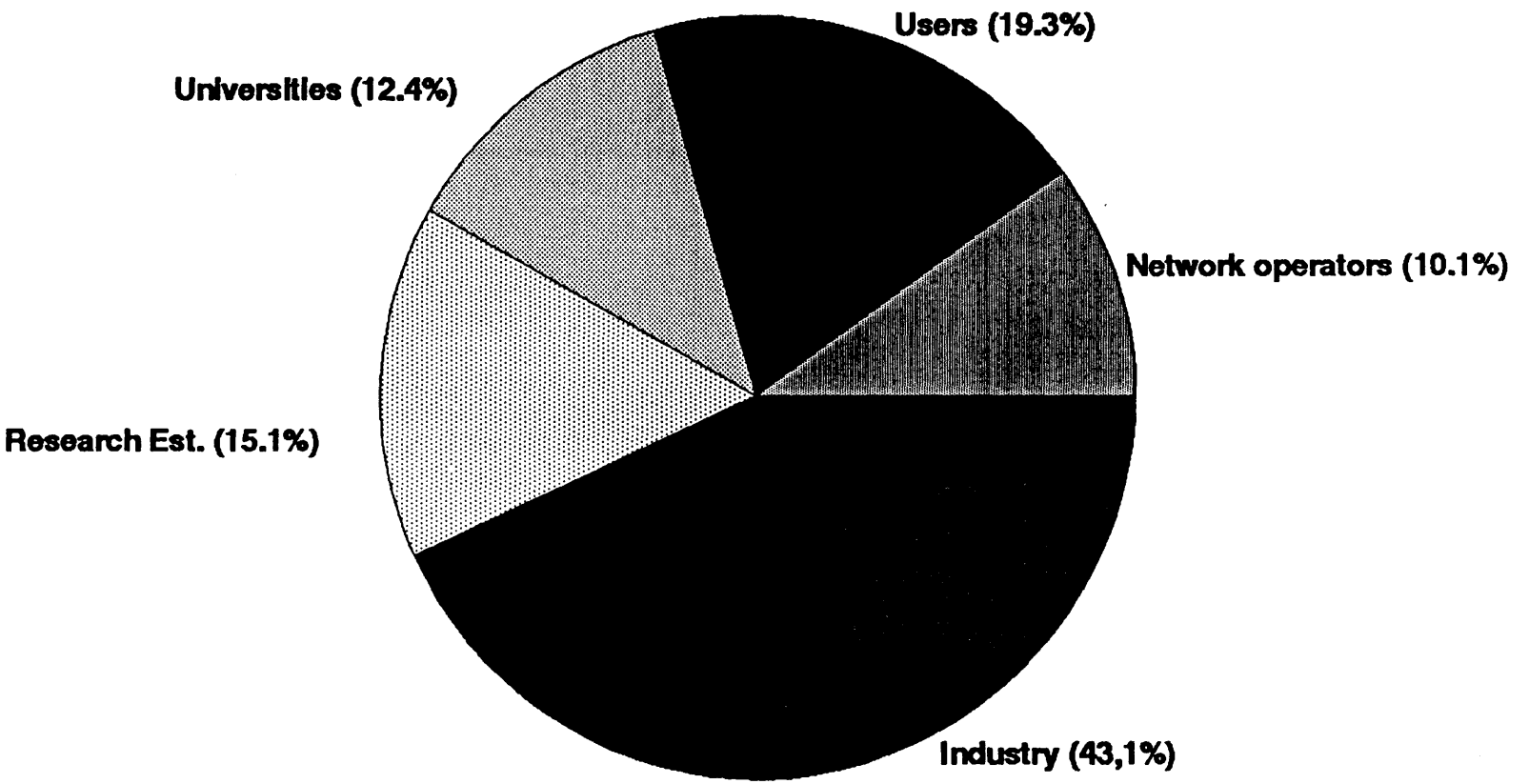
USTL	Université de Sciences et Techniques du Languedoc	F	R1029
UVA	University of Aarhus	DK	R1040
UVD	University of Durham	UK	R1084
UVL	University of Leuven	B	R1040
UVS	University of Surrey	UK	R1023
VERITAS	Det Norske Veritas	N	R1062
VITEC	VITEC	F	R1079
W&G	Wandel & Goltermann GmbH & Co	D	R1083*
WRC	Work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

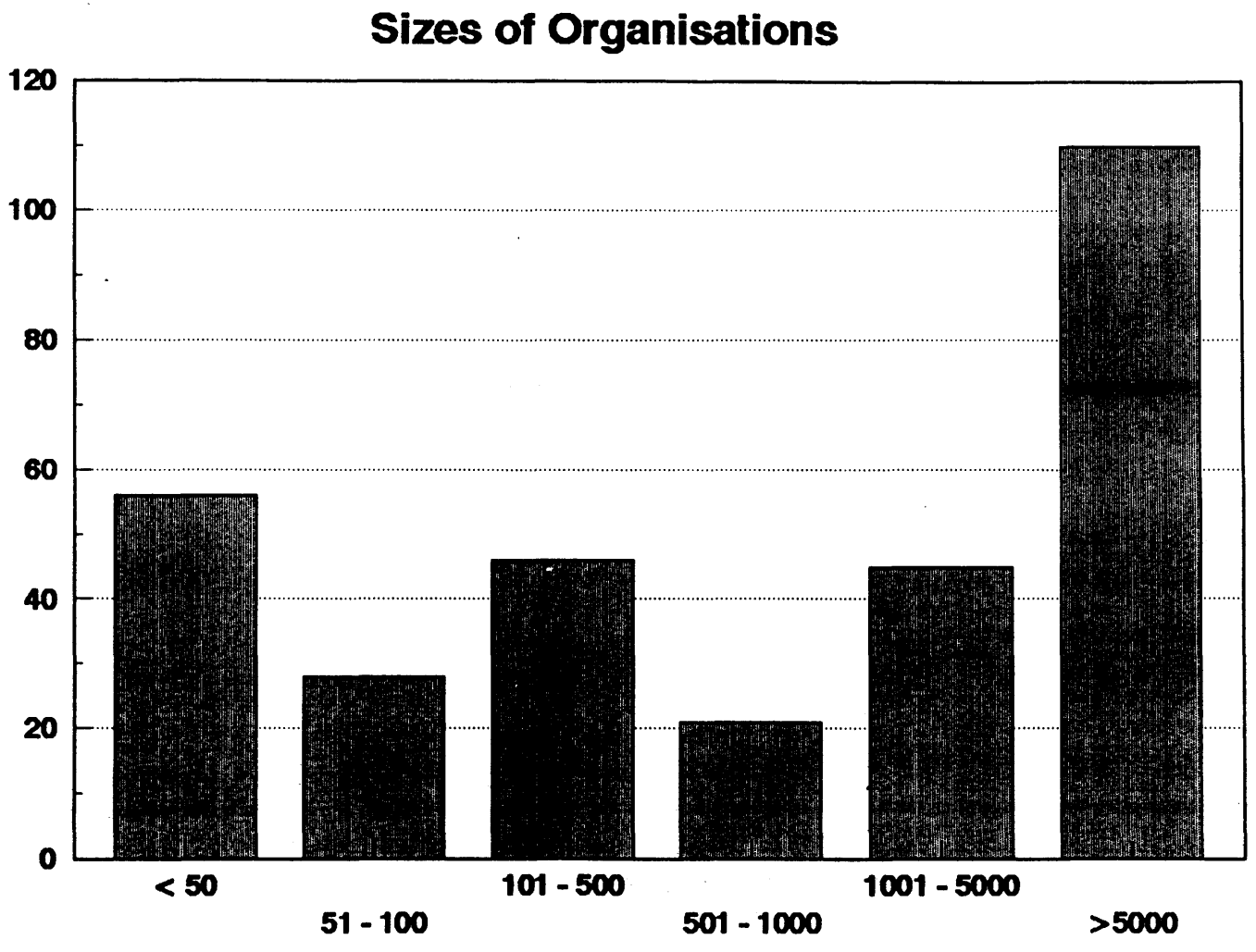
* Prime Contractor for Project

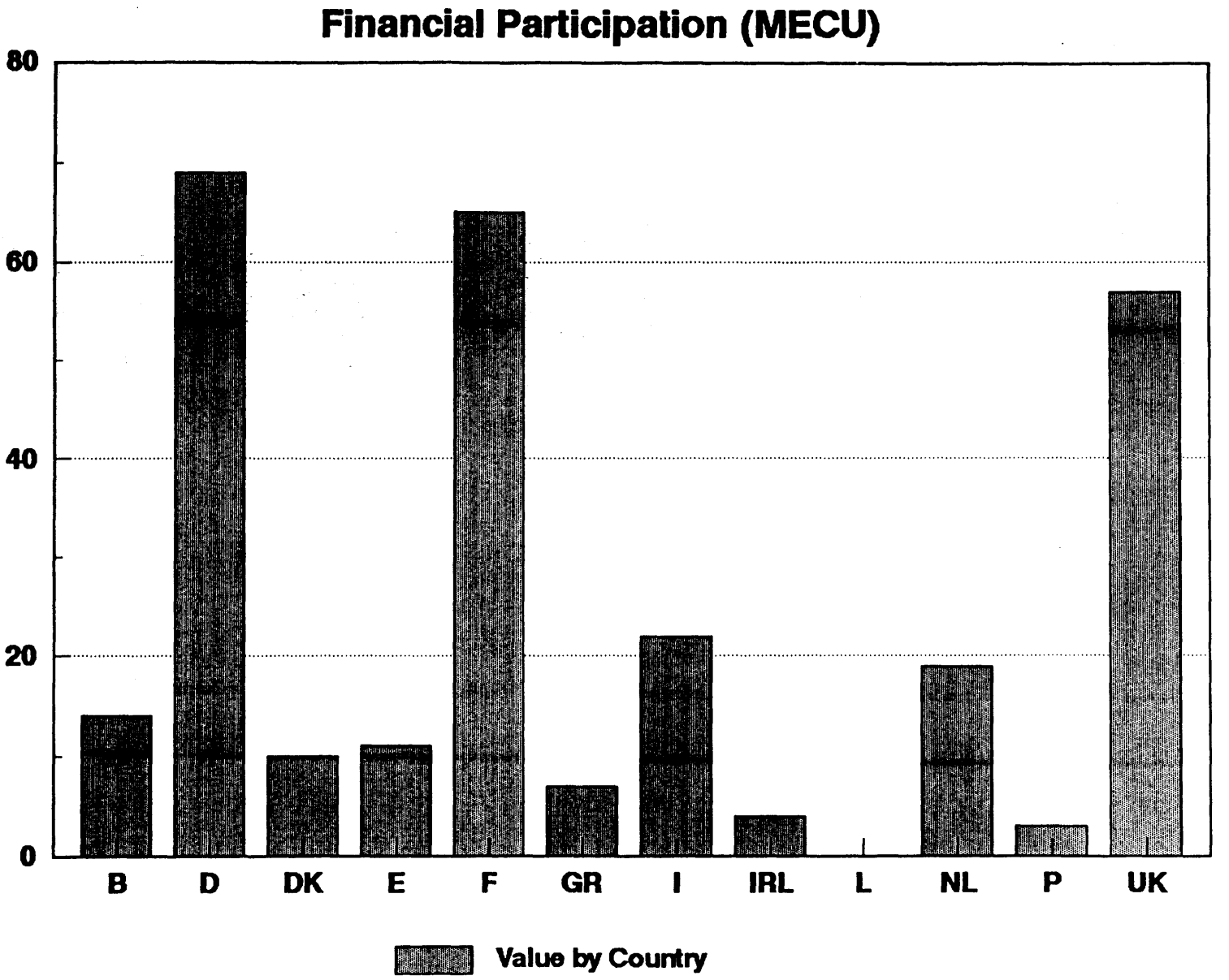
Annex IX

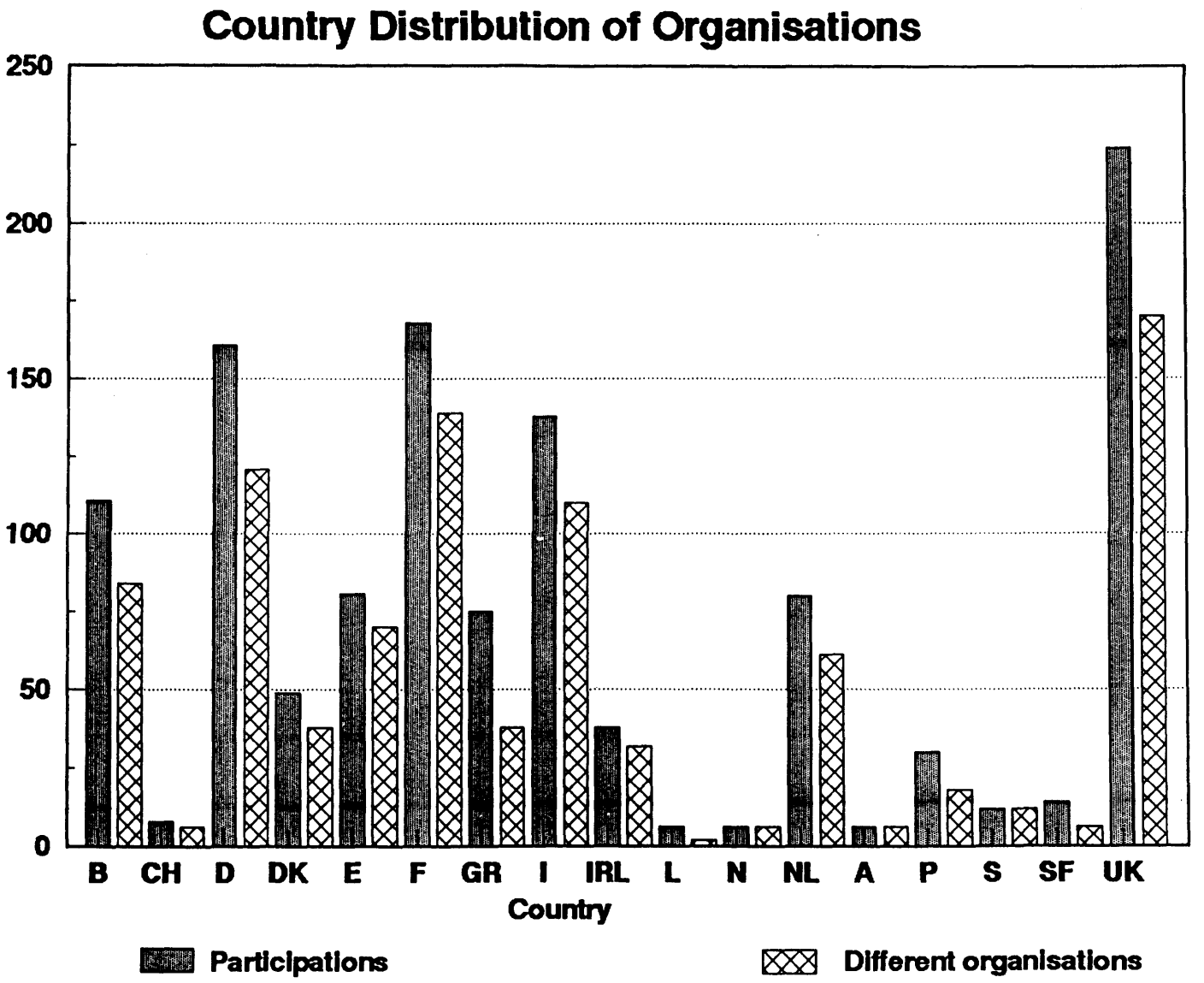
Financial and participation statistics

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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