European Third Generation Mobile Systems

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Abstract: *Vast importance is being placed in Europe on the development of Third Generation Mobile Telecommunications Systems, since it is expected that that mobile and personal communications will become a key driver for growth and innovation in the next millennium as well as being a necessary building block of the Wireless Information Society. Significant progress has been made since 1988, by a number of European Union funded R&D projects working towards the development of future generations of mobile communication concepts, systems and networks. The recently launched ACTS (Advanced Communications Technologies and Services) programme will offer, in the period 1995-1998, service providers, communications operators and equipment manufacturers, greater opportunities to master and trial mobile and personal communications services and technologies. From the user's perspective the ACTS programme will strive to ensure that current mobile services are extended to include multi-media and broadband services, that access to services are made without regard to the underlying networks and that convenient, light weight, compact and power efficient terminals adapt automatically to whatever air-interface parameters are appropriate to the users location and desired services.*

Introduction

The unprecedented growth of world-wide mobile wireless markets, coupled with advances in communications technology and the services developments taking place in fixed networks, point to the introduction of a flexible and cost effective Third Generation Mobile Communications System. In this context, UMTS (*U*niversal *M*obile *T*elecommunications *S*ystem) and MBS (*M*obile *B*roadband *S*ystem), as such systems are commonly referred in Europe, have been the subject of extensive research carried out primarily in the context of the European Community Research Programmes such as RACE and ACTS. The strategic importance of R&D in mobile telecommunications, is indeed recognised as a major driving force of socio-economic progress and is crucial for fostering the European industrial competitiveness and for its balanced economic, social and cultural development.

In the context of the ACTS programme, R&D in advanced mobile and personal communications services and networks, is called upon to play an essential role. The specific objectives that are addressed by the current ACTS Projects, include the development of third-generation technological platforms for the transport of cost/effective broadband services and applications and aim at responding to the needs of seamless services provision across various radio-environments and under different operational conditions. Since full richness of future mobile communication depends on multi-media presentation which is at present beyond the performance of current mobile/wireless communication systems, the objective is to progressively extend mobile communications to include multi-media and high performance capabilities and permit their natural integration and interworking with future wired networks.

European regulatory framework for mobile communications

In response to the imperatives of the internal European market, specific measures were taken as early as 1987 to promote the Union-wide introduction of GSM (Global System for Mobile communications), DECT (European digital cordless communications) and ERMES (European digital radio-messaging system). European Council Directives were adopted to set out common freuency bands to be allocated in each Member State to ensure pan-European operation together with European Council Recommendations promoting the co-ordinated introduction of services based on these systems.

In 1994 the European Commission adopted a Green Paper on Mobile and Personal Communications [1] with the aim to establish the framework of the future policy in the field of mobile and personal communications. The Green Paper proposed to adapt, where necessary, the telecommunications policy of the European Union to foster a European-wide framework for the provision of mobile infrastructure and to facilitate the emergence of trans-European mobile networks, services, and markets for mobile terminals and equipment.

On the basis of the consultation on the Green Paper, the European Commission set out general positions on the future development of the mobile and personal sector and defined an action plan which included actions to pursue the full application of competition rules; the development of a Code of Conduct for service providers; the agreement on procedures for licensing of satellite-based personal communications. The action plan also advocated the possibility of allowing service offerings as a combination of fixed and mobile networks in order to facilitate the full-scale development of personal communications; the lifting of constraints on alternative telecommunications infrastructures and constraints on direct interconnection with other operators; the adoption and implementation of Decisions of the European Radio Communications Committee on frequency bands supporting DCS-1800 and TETRA (Trans European Trunk Radio System); the opening up of a Europe-wide Numbering Space for pan-European services including personal communications services; and continuing support for work towards the Universal Mobile Telecommunications System (UMTS).

The combination of these regulatory changes will contribute to a substantial acceleration of the Union's mobile communications market and speed the progress towards Third Generation mobile/personal communications. It will however be necessary to encourage potential operators and manufacturers to invest in the required technology, by setting out a clear calendar for the adoption of the required new standards and to trigger the in time release of the necessary spectrum. The applicable licensing regimes and rules for flexible sharing of the available spectrum need also to be adopted at an early stage so as to permit the identification of novel market opportunities commensurate with the broadband multimedia requirements of the Third Generation Mobile Telecommunications Systems.

In light of the above and in accordance with the political mandate given by the European Parliament and the European Council, the major actors in the mobile and personal communications sector have been brought together as a task force which has lead to the setting up of the UMTS Forum. The main objective of the Forum will then be to contribute to the elaboration of a European policy for mobile and personal communications based on an industry wide consensus view and pave the way for ensuring that mobile communications will play a pivotal role in the global Information Society.

From Second to Third Generation Systems

As indicated above, Europe has witnessed in recent years a massive growth of mobile communications (see Figure 1), ranging from the more traditional analogue based systems to the current generation of digital systems such as GSM, DCS1800, DECT, TETRA, ERMES etc. The GSM family of products which represent the first large scale deployment of commercial digital cellular system enjoys a world wide success, having been already adopted by over 190 operators in more than 80 countries. At current growth and penetration rates (in some Nordic European countries the penetration has already exceeded 25% of the population) it may be envisaged that the total number of subscribers will reach some 200 Million, in Europe only, by the turn of the century. Other systems catering for more specialised applications or markets, such as radio local loop, private mobile radio for police and safety systems and paging are also called upon to contribute very strongly to the development of the market and the economic growth of Europe. It may also be noted that while the telephones/population density for fixed telephones may not exceed an average of 50%, personal mobile communications, in all forms, promises to reach nearly 80% of Europe's population.

In this context but also in a world wide perspective, with many competing mobile and personal communications technologies and standards being proposed to fulfil the needs of today's users, the essential question, to which no immediate conclusive and firm answer can now be given, remains however "to what extent and how fast will the requirements of the users evolve beyond the need for voice and low data rate communications" and "which will be the technologies that will meet the

requirements for mobile and personal communications services and applications beyond the year 2000". These Third Generation technologies and systems, are being actively researched world-wide. In Europe such systems are commonly referred under the name UMTS (Universal Mobile Telecommunications Systems) and MBS (Mobile Broadband Systems) while internationally and particularly in the ITU context they are referred to as FPLMTS (Future Public Land Mobile Telecommunications Systems) or more recently IMT 2000.

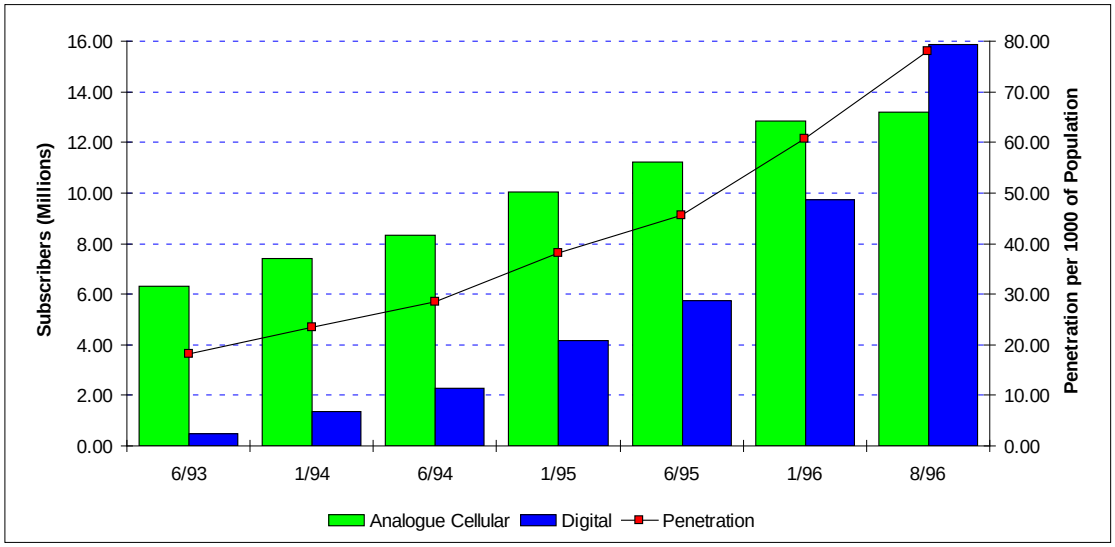

Figure 1: Mobile Cellular subscribers/penetration (European Union)

The ground work for UMTS and MBS [3] has started in 1990, and some early answers can already be provided regarding its requirements, characteristics and capabilities, with the initial standards development process already taking place within the European Telecommunications Standards Institute. The basic premise upon which work is being carried out, is that by the turn of the century, the requirements of the mobile users will have evolved and be commensurate with those services and applications that will be available over conventional fixed or wireline networks. The citizen in the third millennium will wish to avail himself of the full range of broadband multimedia services provided by the global information highways whether these are wired or wireless.

The rapid advance of component technology; the pressure to integrate fixed and mobile networks; the developments in the domains of service engineering, network management and intelligent networks; the desire to have multi-applications hand-held terminals; but above all the increasing scope and sophistication of the multi-media services expected by the customer; demand performance advances beyond the capability of second-generation technology. The very success of second-generation equipment in becoming more cost-effective and increasingly cost-attractive raises the significant prospect that it will reach an early capacity and service saturation in Europe's major conurbation's. These pressures will lead to the emergence of third-generation systems representing a major opportunity for expansion of the global mobile marketplace rather than a threat to current systems and products.

Various international fora have raised the issue of Third Generation technologies migrating towards Third Generation with a spectrum allocation in the FPLMTS/UMTS bands. This may result in the spectrum being allocated, in some parts of the world, in an inefficient piecemeal fashion to evolved Second Generation technologies and potentially many new narrow-application systems, thereby impeding the development of broadband mobile multimedia services.

Terminal, system and network technology as researched within the EU funded ACTS projects, may alleviate to a large extent the complexity of the sharing of the spectrum between the two technological

and service generations. Finding the solution to the issue of evolution and migration path (see Fig. 2) from Second (GSM, DCS1800, DECT, PCS) to Third Generation (UMTS/FPLMTS), particularly from a service provision point of view, is also the subject of intense research carried out in the context of ACTS trials. Some of the key questions that are addressed include a detail consideration of the feasibility of the evolution as well as its cost effectiveness and attractiveness. In this context, the ACTS projects will develop a set of guidelines aiming at reducing the uncertainties and associated investment risks regarding the new wireless technologies, by providing the sector actors and the investment community with clear perspectives of the technological evolution and the path to the timely availability to the user of advanced services and applications.

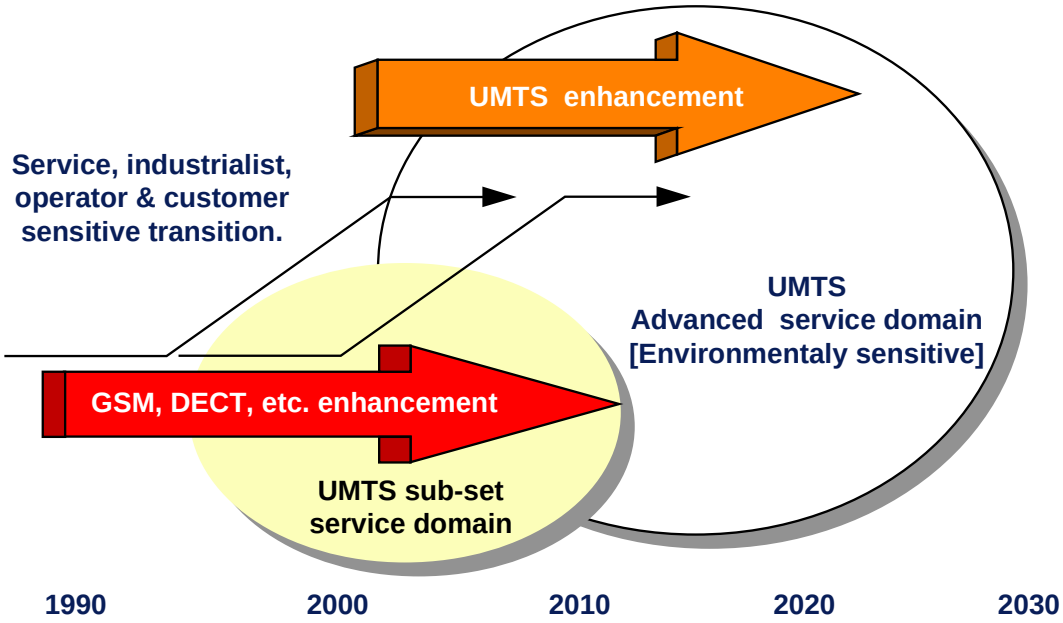

Figure 2: Evolution from Second to Third Generations

The Road Ahead

Third Generation mobile communication systems aim to integrate all the different services of second-generation systems, provide a unique opportunity for competitive service provision of over 50% of the population, and cover a much wider range of broadband services (voice, data, video, multi-media) consistent and compatible with the technology developments taking place within the fixed telecommunications networks. The progressive migration from Second to Third Generation systems, expected to start at the turn of the century, will therefore encourage new customers while ensuring that existing users will perceive a service evolution that is relatively seamless, beneficial, attractive and natural.

Fig. 3 illustrates the range of service environments, from in-building to global, in which the Third Generation of personal mobile communication systems will be deployed while Fig. 4 portrays the technological capabilities of Third Generation systems, measured in terms of terminal mobility and required bit rates as compared to those of Second Generation platforms such as GSM.

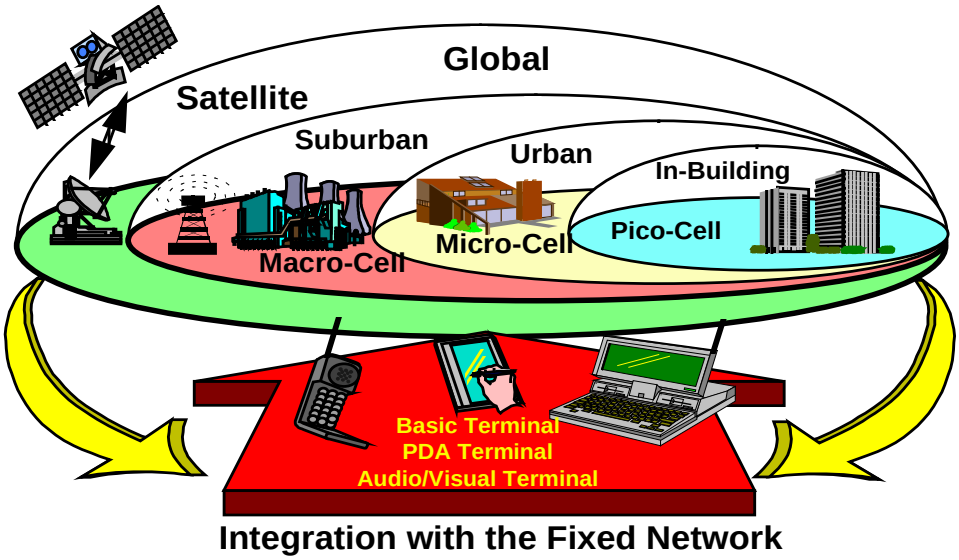

Figure 3: System environments

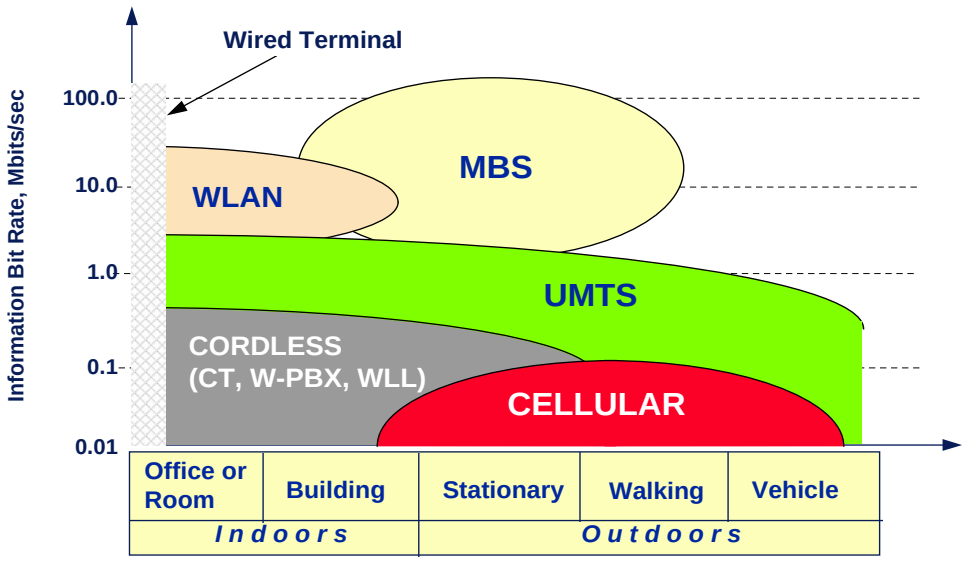

Figure 4: Mobility versus bit rates

At the global level, the work carried out within the ITU and particularly within TG8/1, has been instrumental in the definition of FPLMTS/IMT2000 (Future Public Land Mobile Telecommunications Systems). In Europe, R&D on Third Generation technology, commonly referred to as UMTS and MBS, falls under the European Community RACE and ACTS Programmes. Responsibility for co-ordinating European technical specifications for UMTS belongs, however, to the ETSI SMG5 (Special Mobile Group 5).

UMTS is conceived as a multi-function, multi-service, multi-application digital mobile system that will provide personal communications at rates ranging from 144 Kbit/s up to 2 Mbit/s according to the specific environment, support universal roaming, and offer broadband multi-media services. UMTS is designed to have a terrestrial and a satellite component with a suitable degree of commonality between them, including the radio interfaces. The R&D effort concentrates on the development of technical

guidelines regarding in particular, the level of UMTS support of ATM transmission technology of IBC networks, the compatibility of UMTS and fixed-network architecture, the allocation of intelligent functionality (UPT and IN), the level of integration of the satellite component of UMTS, and the multi-service convergence philosophy of the UMTS radio air-interface.

MBS systems including their local area network dimensions are an extension to the B-ISDN with the ability to provide radio coverage of an area (e.g. sports arenas, factories, television studios etc.) with communications between MBS mobile terminals with terminals directly connected to the B-ISDN at rates up to 155 Mbit/s. Mobility and the proliferation of portable and laptop computers together with potential cost savings in the wiring or re-wiring of buildings are also driving forces for the introduction of broadband wireless customer premises networks in a picocell environment supporting the requirements for high-rate local data communication up to and exceeding 155 Mbit/s.

Some 24000 person-months of effort will be devoted, until 1998, to R&D in personal/mobile communication in the context of the EU funded ACTS Programme. The activities of the ACTS projects relate to services, network platforms and terminals and technologies. The demonstration and proving of new novel services and applications take into account the full implications of user environment, system characteristics and service provision and control. Projects aim at proving the validity of new, or novel, components or sub-system technologies, including multi-mode transceivers as well as tools for network planning. The common factor for all projects is that they contain a strong and clearly addressed thread of user involvement and innovative technology and that the R&D effort is undertaken in the context of technology, service and application trials. A brief synopsis of the current ACTS projects [4] whose objectives relate to the field of mobile and personal communications is given in the Annex to this paper. Regarding the now terminated RACE Programme and in particular its mobile dimension the reader is directed to the proceedings of the annual RACE conference [5,6,7].

UMTS System

The vision of UMTS as it has emerged from work undertaken within RACE [2], calls for UMTS to support all those services, facilities and applications which customers presently enjoy and have the potential to accommodate, yet undefined, broadband multimedia services and applications with quality levels commensurate to those of the contemporary fixed IBC networks. In this context, projects will identify the cardinal services that UMTS must support, the "future-proofing" UMTS bearer requirements in macro, micro and picocell environments, and the applications likely to be supported from UMTS. A considerable effort will be devoted to determining how best to ensure that UMTS will be designed so as to be perceived by the customers as a broadband service evolution of second generation technologies, while ensuring a competitive service provision in a multi-operator environment.

The UMTS is the realisation of a new generation of mobile communications technology for a world in which personal services will be based on a combination of fixed and wireless/mobile services to form a seamless end-to-end service for the user. To bring this about will require, provision of a unified presentation of services to the user in wireless and wired environment, mobile technology that supports a very broad mix of communication services and applications, on-demand flexible bandwidth allocation and in a wide variety of applications, and standardisation that allows full roaming and interworking capability, where needed, but is also responsive to proprietary, innovative and niche markets. In particular UMTS will support novel telematics applications especially for road transport informatics and high speed train communications such as dynamic route guidance, fleet management, freight control and travel/ tourism information etc. For applications where there is a very large degree of asymmetry in the down stream and upstream traffic channels, UMTS in combination with Digital Audio Broadcasting techniques can provide cost effective solutions.

With UMTS exploiting its full capability as the integral mobile-access part of B-ISDN, telecommunications will make a major leap forward towards the provision of a technically integrated, comprehensive and consistent system of personal communications supported by both fixed and mobile terminals. As a result mobile access networks will begin to offer services that have traditionally been

provided by fixed networks, including wideband services up to 2Mbit/s. UMTS will also function as a stand-alone network implementation.

Mobile satellite systems are a solution to the problem of covering large areas economically, and serving widely scattered or remote subscribers in both developing and developed countries as well for ship and aircraft communications and rural areas. It is proposed that the satellite component of UMTS is integrated with its terrestrial component. To keep the interworking between the two, transparent to the end user, three levels of integration are identified as follows; network integration where the space and terrestrial networks can operate as separate entities, equipment integration that requires common service standards and with consistent transmission parameters and radio interface between satellite and terrestrial implementations, system integration in which the satellite is an integral part of the terrestrial network and able to support handovers between terrestrial and satellite cells, the satellite effectively provides a large terrestrial cell. Clearly the satellite component of UMTS raises technical and economic issues that could impinge on the performance of the UMTS terrestrial service and consequently convergence must be carefully weighed.

At the time UMTS reaches service, ATM will be an established transmission technique hence the UMTS environment must support ATM-cell transmission through to the user's terminal. This compatibility will enable service providers to offer a homogeneous network, where users can receive variable bit-rate services regardless of their access media (mobile or fixed including radio local loops). Flexibility of service provision across Europe and in multi-operator environments also demands close attention to spectrum-sharing technique, charging, billing and accounting, numbering, network security, privacy, etc. all of which may have a regulatory implication. To these questions must be added the degree of compatibility between UMTS and fixed network functionality, and the form of the multi-service capability at the radio interface.

The 230 MHz of spectrum identified by WARC-92 (World Administrative Radio Conference-92) for global high quality mobile services (1885-2025 MHz and 2110-2200 MHz) is associated in Europe with Third Generation, UMTS, technology. Such technology will require a revolution in radio air-interface design and evolution of intelligent network principles. The arrival of a fully capable UMTS does not preclude such economical developments when applied in those bands currently open to Second Generation technology. The resulting parallel process of UMTS design and Second Generation enhancement will call for careful market management and compatibility between UMTS and Second Generation service standards to ensure a smooth, customer sensitive, transition at the appropriate time. Indeed multi-mode transceiver technology may be used to provide multi-standard terminal equipment; particularly between UMTS, GSM, DCS1800 and DECT.

MBS & WLAN System

The strategic importance of mobile broadband communications systems catering for different mobility requirements ranging from stationary (for local loops), through quasi stationary (office and industrial environments) to fully public mobile cellular terminals, was recognised at an early stage in the context of RACE. The objectives of the work were namely to develop a quasi-mobile wireless system for bit-rates of up to 155 Mbit/s throughput (in the 40 or 60 GHz band) and to create the industrial capacity to produce the necessary system components (RF, IF and baseband systems, antennas, terminals). In the context of MBS applications the investigation and definition of system aspects, radio access schemes, network management issues, integration with IBC, etc. is extremely relevant. MBS systems will cater for novel multi-media and video mobile telecommunication applications, including those appropriate to Wireless Local Area Networks (WLAN) and wireless local-loop broadband systems.

As wireless terminal extensions to the B-ISDN, MBS systems concepts are being actively researched in the context of ACTS with emphasis being given to specific objectives. These include, the demonstration of mobile broadband applications, the demonstration of distribution video, interactive video, audio and data communication service at bit-rates up to 155 Mbit/s on a mobile terminal connected to an IBC network, the demonstration of ATM compatibility at and between mobile and fixed with implementation of the necessary mobility management-functions (especially for handover) and the required signalling, control and service-provision protocols, and finally the validation of

quality-of-service parameters corresponding to the evaluated application. As with UMTS, a satellite component of MBS will be investigated with research to determine the optimum frequency band (Ka-band, 20-30 GHz or 60 GHz region).

The wider availability of portable and laptop computers dictated the need for third-generation mobile systems that incorporate an integrated WLAN capability to maintain their "universality". Application areas include mobile systems for offices, industrial automation, financial services, medical and hospital systems, education and training, with network connection for portable computers and personal digital assistants as well as ad hoc networking. The specific nature of each of the above related environments do, however, influence security, range, defined working area, transmission rate, re-using of frequencies, cost, maintenance, penetration ability, etc.

In creating a high-rate (up to 155 Mbit/s) local data communication link significant research is required to identify a suitably reliable system and associated air interface. Important issues include frequency allocation and selection, choice of bandwidth efficient coding schemes, specification of medium access procedures, definition of link control protocols as well as connectivity aspects related to connection to other wired or wireless communications networks. In brief, the WLAN R&D activities seek for solutions that recognise, application, environment, cost, performance, networking and system architecture requirements.

A Brief Synopsis of ACTS Mobile Projects

AC002: MOMENTS

The project objective is to demonstrate the technical feasibility and business viability of a wireless media highway for the distribution of advanced multimedia products. The project will contribute to the understanding of users' perception of the value of wireless multimedia services, identify how commercial exploitation of the services using third generation systems can be accelerated, create new enabling technologies, in particular for the presentation of visual material, assess by qualitative and quantitative means the feasibility and increased efficiency of electronic money transfers during the trials, make contributions to standardisation. Based on the studies of user requirements, service platform architectures, compression and presentation technologies, a client-server based service platform will be implemented and tested in genuine end-user trials. The APIs for the service feeding and electronic payment functions will be included in the implementation. System enhancements will be developed and demonstrated in the Technical Demonstrator to assess the benefits of wider band user channels and determine how they can be incorporated into UMTS. The following new technologies will be investigated and applied in the project:

- presentation technologies, optimised for the inherently narrow cellular user channels;
- for optimal server connectivity, an enhanced direct LAN access solution allowing the distribution platform to access the wireless network on a LAN-to-LAN basis;
- electronic payment techniques allowing automatic charging for information downloaded by the user with minimum financial overhead;
- wide band user channels allowing transmission rates of the third generation mobile systems (n x 9600 bit/s, n >= 2).

AC004: SECOMS/ABATE

Project SECOMS/ABATE aims to define the system elements and to develop the related technologies for the future advanced satellite mobile service operating at Ka and EHF frequency bands and capable to provide the widest class of *broadband mobile services* also in hostile environment such as the land mobile and aeronautical ones. The 20/30 GHz and 40/45 GHz bands will be considered for *first* and *second* generation service respectively. Satellite trials are envisaged to validate the system choices and the developed technologies. Contributions to standards definition and frequency co-ordination will be elaborated. The payload, allocated on geostationary satellites, adopt on-board processing and

multibeam antennas, to achieve efficient use of the satellite resources by using small aperture terminals. The technology developments are aimed at investigating the feasibility, in the framework of the future (second generation) enhanced system and at specifying, designing, developing and testing two user terminal prototypes, for vehicles and planes respectively, to be used in the framework of the first generation system. The developed technology could be exploited for non-GEO scenarios also.

SECOMS/ABATE trials aim to demonstrate mobile multimedia service, supporting video coded sequences and to verify that the technological developments are fulfilled. SECOMS/ABATE is organised in different layers: the first layer is devoted to *basic system definition studies,* the second layer is devoted to *satellite system feasibility studies* and the third layer is devoted to *terminal technological developments.* The last layer is devoted to the *definition and assembly of terminal prototypes and demonstrators.*

SECOMS/ABATE considers a limited number of geostationary satellites. Compact terminals, of various sizes and capacities (in the range 64 to 2048 Kbps) using ultra small antennas are envisaged: *portable terminals,* i.e. palmtop, laptop, briefcase types and *mobile terminals* for utilisation on cars, trains, planes for individual as well as collective utilisation. Moreover high capacity (32 Mbps links) gateways and service provider terminals allow to interface and interwork with any kind of terrestrial network. Finally a network control centre performs the system management, control and supervision.

AC005: FIRST

It is the fundamental objective of the project to demonstrate that it is feasible and cost effective to develop and deploy Intelligent Multimode Terminals (IMT) capable of operation with multiple standards such as UMTS, and with the ability to deliver muti-media services to mobile users. A three year programme is being undertaken that contains a balanced mix of requirements definition, system design, technology innovation, equipment manufacture and field trials. User requirements and economic justification of the technical approach are being validated through a requirements capture and business case definition led by a mobile operator.

In order to take advantage of knowledge within the FIRST consortium, mobile multimedia work previously undertaken by the RACE MAVT project and the current ACTS MOMUSYS project is being employed. Novel technological developments in the areas of multimode radiofrequency and digital signal processing sub-systems for interfacing to the air-interface are currently being performed. A joint third-generation system field trial is being planned that should seamlessly integrate together an intelligent mobile terminal running a multimedia application, to a third generation-type base station and a network interface at ATM level.

AC006: MEDIAN

The main objective of the project is to evaluate and implement a high speed wireless customer premises local area network (WCPN/WLAN) pilot system for multimedia applications and demonstrate it in real-user trials. The pilot system relies on a multicarrier modulation scheme such as OFDM (Orthogonal Frequency Division Modulation) which is adaptive to the transmitted data rates and channel characteristics and supports wireless ATM network extension. The system, connected to 3rd and further generation mobile systems via the ATM interface, utilises the 60 GHz frequency band. The project identifies WCPN service requirements. It investigates multi-carrier modulation schemes (OFDM), demodulation, pulse shaping, synchronisation, channel coding, time and frequency interleaving schemes, power control, medium access strategies, interworking functions with high speed data transmission (totally up to 155 Mbit/s) in a multipath propagation environment, connectivity aspects related to 3rd and further generation mobile systems, 60 GHz technology and VLSI technology. A pilot system demonstrator will be build which will be used for the field trials and to support standardisation work.

AC007: MULTIPORT

MultiPort will develop a UMTS capable multimedia portable digital assistant for its immediate application in the healthcare environment. UMTS trials will be carried out in co-operation with FRAMES, FIRST and RAINBOW projects. Intermediate stages will incorporate wireless LAN and

GSM trials. The project will build upon existing expertise within the consortium in mobile communications; heterogeneous distributed databases; PDA design, firmware, and manufacture; and multimedia systems. The partners will develop a user-transparent multidatabase interface, demonstrating this in the area of patient records and connection between sanitary levels (primary healthcare centres and hospitals) to support for diagnosis and consultation. The PDA will be, additionally, provided with a friendly user interface. Communication must be adaptable to cope with varying circumstances. For example, within a hospital the communication could be via wireless LAN, while visits to patients outside the hospital could rely upon GSM. The intention is to develop, or incorporate PCMCIA based communication interfaces which would allow the seamless adaptation of the PDA for different environments and prevailing standards as UMTS develops. If PCMCIA format is found to be insufficient, or too constraining, interfaces will be developed in line with any new or emerging standards. The architecture of the PDA will be adapted to the specific UMTS requirements and on the network side an access of the databases to B-ISDN will be realised for the connection to the UMTS Base Station. This work will be undertaken in close co-operation with the FRAMES project.

AC013: EXODUS

This project seeks to identify a smooth transition path from second generation mobile systems towards UMTS, focusing on the evolution of core network capabilities supporting both terminal and personal mobility. In this context its objectives are to: i) demonstrate terminal and personal mobility, spanning both public and private operating environments, using systems which support voice, data and image applications; ii) identify, implement and demonstrate IN functionalities to meet UMTS requirements; iii) identify, implement and demonstrate enhancements on ATM-based B-ISDN to support mobility management.

The project starts from a platform, based on IN-CS1, providing personal and terminal mobility for voice and data services in the public, private and residential domains. The access network is DECT radio access. In a further phase, the evolution of this platform towards UMTS will be addressed to determine the relevant impact on the Core Network, INAP and UNI interfaces. In particular, evolution of the ATM switch and the Service Control Point will be defined addressing IN CS2 and CS3 standard, specifying and implementing the functionalities needed to provide terminal and personal mobility.

The transition path to UMTS will be demonstrated using an evolving experimental platform with real users, covering strategically important application sectors (e.g. health care, travelling business users). There are three experimental islands, providing ATM functionality for following applications: 1) data and voice services for Cordless Terminal Mobility; 2) remote networking on broadband wireless access; 3) mobile multimedia services in health care; 4) personal multimedia services for travelling users.

AC015: RAINBOW

The most qualifying objective of the RAINBOW (Radio Access Independent Broadband on Wireless) Project consists in investigating architectural and integration issues through a laboratory implementation of the transport and mobility control functions expected for UMTS. The implementation is based on a conceptual design effort that is part of the Project.

The radio access part of UMTS is implemented in order to study a “generic” UMTS access infrastructure, able to cope with different innovative radio access techniques (long term view) and, at the same time, to guarantee a soft migration from second to third generation systems (short term view).

On the radio side, all the local transport and control functions tied to the terminal mobility (e.g. handover) are implemented on a platform emulating the radio behaviour of the adopted radio access techniques. The infrastructure is integrated with the B-ISDN context and realises all the IN based service functions needed to control the upper layer mobility procedures.

The above objectives are pursued through a test-bed implementation of the UMTS access infrastructure with relevant transport and control functions. The integration/interworking with IBC is

achieved by using National Host facilities, to provide B-ISDN Call Control capabilities and ATM transport in the Core/Access Network. The test bed is working in real time in order to allow for explicit laboratory trials to be performed with voice and data traffic. In order to reflect the real environment, the integrated test bed is built-up on an emulated platform, modelling the radio, traffic and user mobility contexts.

Migration requirements are dealt with by relevant architectural solutions and implemented by carrying-out specific laboratory demonstrations adopting second generation systems (GSM and DECT are addressed) on the UMTS access infrastructure. Specific outcomes of RACE II Projects concerning the UMTS network functions and the emulated radio environments, will be extensively used as specification inputs for the experimental tasks of the Project. With respect to the radio segment, the RAINBOW demonstrator is defined in such a way that innovative radio access techniques developed by other Projects in the ACTS framework can also be managed by the generic mobility control functions.

AC016: STORMS

The most qualifying objective of the STORMS (Software Tools for the Optimisation of Resources in Mobile Systems) Project consists in the definition, implementation and validation of a software tool supporting the planning of the UMTS network. The validity domain of the reference model, and the consequent applicability of the tool itself, will be very extended so that potential new services, not yet consolidated in the UMTS context, or innovative models (radio, propagation, traffic and mobility) can be incorporated into and dealt with the software product. The set of reference environments will be very wide ranging from the Domestic to the Public arrangement as defined in former RACE II projects; furthermore satellite systems will be included in the overall optimisation process. In analogy, also the set of spatial traffic distributions and traffic intensities will range from typical office/business to residential in rural and low density areas. The design stage will be constrained by Quality of Service (QoS) targets and addressed/guided by cost optimisation criteria, especially concerning the size, capacity and number of Network Elements, the interconnection network(s), the distributed data base allocation, the signalling traffic, the positioning of current mobile networks in the UMTS perspective and other potential cost elements. QoS constraints are used as input to the whole engineering part of the planning process and to validate the resulting network configuration.

AC020: TSUNAMI(II)

It is the objective of the project to demonstrate that it is feasible and cost effective to deploy adaptive antennas within the infrastructure of third generation mobile systems such as UMTS. A 3 year programme is undertaken that builds on the work of the earlier TSUNAMI project. The project is based around performing field trials of adaptive antennas, using prototype equipment in a real mobile network. The first few months were spent addressing the first logical activity of the project, that of defining requirements. Mobile operators requirements and the groundwork of the field trial including the system design choices in relation to the SDMA (Space Division Multiple Access) were performed. Experiments and simulations are carried out to allow architectural decisions to be made and the top level system design will be performed. Field trials will be conducted in the network of a mobile National Host and will be focused on validating the performance of the Adaptive Antenna technology in a realistic deployment. In order to achieve all the SDMA capabilities, studies are based on the information pertaining to efficient resource allocation and additional signalling needed to complete all the process. Important requirements set by SDMA on the UMTS BSS using the present wireless systems are determined. Joint multi-user detection techniques for the seamless incorporation into GSM and DCS are studied such that the maximum performance mainly in terms of capacity increase is attained.

AC027: UMPTIDUMPTI

The primary objective is to verify that emerging broadband and mobile services and equipment are useable by all. By taking account of the needs of users with disabilities, the usability requirements of the population as a whole can be accommodated. The rationale for the project is based on the fact that every user of telecommunications services has individual special needs. The deaf, blind, non-speaking

and motor-impaired depend on having their requirements met all the time as well as needing certain specific facilities and that the range of services and quality of these services offered in telecommunications networks is limited, and particularly so for the impaired. Indeed one in four of the EU population has a disability of some kind: There is an ageing population with developing demands and there is as well a new generation of handicapped children with great expectations of new technologies.

The project goals will be achieved by three linked trials consisting of 1) initial exploratory trials to consolidate requirements, 2) interim trials with expert users from the handicapped and able bodied communities and 3) full trials with all levels of user skills. The baseline has been established by RACE projects, including functional specifications, models and prototypes of applications and services. This project extends this baseline by delivering high quality implementations of a range of services over a range of infrastructures; by implementing trials of the equipment involving participation of people with and without disabilities; and by contributing to standards bodies to ensure that the needs of the disabled are catered for in the base standards and not retrospectively.

AC031: COBUCO

COBUCO´s main objective is to deliver a fully operational example for system migration from 2nd generation to 3rd generation and beyond by building of a UMTS system demonstrator and conducting tests, experiments and user assessments to validate the UMTS concepts as well as the usability of multi media services and applications in a business environment. This target will be supported by the following sub-objectives:

- establishing clear routes from present 2nd generation technologies to full UMTS 3rd generation and identification of all key elements involved;
- identification and investigation of critical transmission and signalling aspects, in particular with respect to the UMTS features;
- carrying out tests, measurements and user assessments and verify QoS, in particular offering the COBUCO infrastructure to third ACTS-parties for scientific work, tests, investigations and demonstrations;
- delivering agreed working results to standardisation bodies, study groups, etc. and, vice versa, following their tendencies, recommendations and ends.

AC034: ON THE MOVE

Today, mobile networks provide only a small range of simple services, leaving multimedia out of reach. In stark contrast, the volume and richness of information services on fixed networks is growing at an accelerated pace. In the near future, wherever they are, people will want to use multimedia information services, whether global or local to a particular area, on fixed or mobile networks. Many different types of computers, including laptops, palmtops, personal assistants, but also mobile telephones, will help users access the networks and services. OnTheMove addresses this issue by defining a Mobile Application Support Environment (MASE). The architecture includes a mobile application programming interface, Mobile API, that hides the heterogeneity of underlying networks and user equipment. New "mobile-aware" applications benefit from the Mobile API as it allows them to adapt, e.g., to changes in quality of service and user location. Legacy applications will also be able to benefit from some of the services being developed for the MASE. MASE hides the complexity of the network from the application wherever possible and desirable. The MASE attempts to make different wireless networks appear to applications and therefore to the user as a seamless and homogeneous communication medium.

Differences between networks only surface as differences in communications Quality-of-Service (QoS). In order to enable mobile-aware applications to optimise their services, based on the characteristics of both the terminals and the networks, the MASE offers applications the capability to both control QoS and react to its variations. The MASE provides applications with information on the location of the mobile client so that application services can adjust accordingly. In addition to mobile-

specific functions, the MASE offers support for multimedia conversion, transactions, agent technology, accounting, security, and system management. An new activity investigates the use of CORBA (Common Object Request Broker Architecture) upon mobile devices with limited capabilities and new strategies which enable CORBA based applications to cope with the mobile channel.

AC054: MEMO

The development, implementation and pilot operation of multimedia broadcasting services with high data rate, is triggered by the requirements of electronic publishing and building construction industries. In this context applications for these industries involve asymmetric channels handling of large amounts of data: text/pictures and multimedia data sets (e.g. construction plans) on the down link and limited data transmission capabilities in the up link.

In this project, the Digital Audio Broadcasting System (DAB: wide band system [1.5 MHz] with data rates up to 1.7 Mbit/s, convolutional coding and OFDM modulation for reliable mobile reception) will be used for downloading of data and GSM will be used for the return channel. Data terminals will be based on PCs/Laptops/PDA and application programme interfaces will allow for easy adaptation to other application fields. Pilot services will be installed based on user requirements and on evaluation of the first year demonstrators. Actual experimental DAB networks in several European countries will be used in the trials and laptop/PC-based terminals will be integrated with DAB receivers and GSM mobile terminals.

AC083: FRANS

This project is concerned with field trials demonstrating an optically supported millimetre wave radio link as a final drop to provide rapid, flexible deployment of broadband interactive services. It merges existing Passive Optical Networks (PONs) with a photonic technique for generation, modulation and transmission of information bearing milli-metre wave signals to a hybrid fibre radio customer access system. Two trials are planned, using different bit rates and based on different multiple access techniques in the up link.

Two different system approaches will be realised: 1) A 622 Mbit/s down link with 40 Mbit/s aggregate TDMA up link (~2 Mbit/s per user), both with milli-metre wave radio part working in the 30 GHz range; 2) 155 Mbit/s down link with millimetre wave radio inter-face at ~30 GHz and CDMA up link (1-5 x 2 Mbit/s per user) with a microwave radio part at ~2.5 Ghz.

The down link is based on a principle developed in an earlier RACE project. Two optical spectral components, separated by the required milli-metre wave frequency, are generated and modulated in a central unit and distributed via a PON to antenna sites close to the users, where the two components mix in a PIN photodiode and a modulated millimetre wave signal is generated and radiated. The TDMA up link uses a different millimetre wave frequency, remote down conversion in the antenna unit and microwave transport over the PON to the central unit. The CDMA uplink uses a microwave carrier frequency transmitted directly to the central unit or over a fibre-optically remoted antenna. The work is split into: 1) Enabling technologies and sub-modules: optical generation and detection of millimetre waves, MMICs, MICs, antenna unit and CDMA processing. 2) Network development: millimetre wave up- and down-link, radio/fibre microwave links, access adaptation. 3) Customer premises equipment: millimetre wave and microwave subsystem, modulation, demodulation, signal conditioning, network termination. 4) Field trials: integration with host, service deployment.

AC085: WAND

The project has three main objectives; (1) to specify a wireless, customer premises, access system for ATM networks that maintains the service characteristics and benefits of the ATM networks to the mobile user; (2) to promote the standardisation, notably in ETSI, of wireless ATM access as developed in this project; and (3) to demonstrate and carry out user trials with the selected user group and test the feasibility of a radio based ATM access system. The Magic WAND project (Wireless ATM Network Demonstrator) covers the whole range of functionality from basic (wireless) data transmission to shared multi-media applications. The primary goal of the project is to demonstrate that wireless access to ATM, capable of providing real multi-media services to mobile users, is technically

feasible. The project partners have chosen to use the 5 GHz frequency band for the demonstrator and perform also studies on higher bit rate operation [>50 Mb/s] in the 17 GHz frequency band.

This project will consist of three major phases. In the first phase, system and component design will be undertaken. In the second phase an implementation of the design will be produced. The implementation, using mobile terminals based on the portable computers in combination with Access Points serviced by an ATM switch located at a National Host, will be as close as possible to the targeted functionality defined in the design phase. In the final phase, wireless ATM access system will be tested out with real end users to verify the system operation.

AC088: MICC

MICC aims to bring to construction site workers completely new communications capabilities through mobile communication. It is considered by the construction sector as a mandatory step towards more quality and more efficiency on building sites. It will define a Europe wide solution to bring to the construction site production people new integrated communication services. They will help them to contribute to site management through the real time update of local data bases. This equipment and the associate communication backbone should be used by all companies working on site through wired and wireless networks. After laboratory and site experimentation of existing technology, it will perform advanced sample application experiments on four construction sites to demonstrate the architecture and the improvement of the long-term economic efficiency of the European construction industry in competing in the international marketplace. The project is user-led and takes its direction from the fundamental requirements of the construction industry. The partners are already in contact with National Hosts. The Consortium has set up a Project Industry Forum to co-operate closely with vendors and communication network operators. Specific industry goals include :

- Integration of construction site wired and wireless networks (voice and data).
- Integration of site networks with public communication network through a movable «communication container» providing systems to manage private communication network for the many companies working in the same construction site.
- Definition of a European wide functional architecture to allow construction companies to use its own information systems on every European construction site.
- Definition and site test of a ganger mobile personal telecommunication device allowing him to use basic services (walkie-talkie, telephone, e-mail, pager, ...) and advanced services (update in real time of local data bases). This will allow to integrate blue collar people in corporate information systems.

AC090: FRAMES

The overall objective of FRAMES (Future Radio Wideband Multiple Access Systems) is to define a specification for a UMTS air interface, and will serve as an input towards the Standardisation process taking the backward compatibility to 2nd Generation into consideration.

The Project will concentrate on the air Interface definition, validation and demonstration to meet different operating environments and wideband service needs. The Project will build a pair of BS demonstrators and Mobile Terminals. The project is structured into two technical core tasks, addressing system specification and demonstrator. The core task System will address the System Specification which includes requirements and synthesis by means of liaison with potential UMTS operators. In addition it defines the air interface, radio network functions and implications upon the access networks, undertaking validation by simulation. The core task Demonstrator will build a platform to validate the defined air Interface scheme and performance. An upgrade will serve the purpose of carrying out demonstrations and trials with other ACTS projects. FRAMES has already investigated a number of different hybrid multiple access candidates. After extensive simulations and a evaluation process, two hybrid schemes have evolved namely:

- Slotted Multiple Access (SMA) scheme, a flexible hybrid TDMA/CDMA scheme with a FDMA inherent.

- Code and Time Division Access Scheme (CATS) , a CDMA, Multi-user detection scheme with OFDM option.

The two will than merge to provide the final Hybrid Multiple Access Scheme to be proposed as the UMTS air Interface.

AC095: ASPECT

The general objectives of this project are: 1) to study the feasibility and acceptability of new and advanced security features in existing and future personal communications networks, based on trials and demonstrations, 2) to investigate, implement and trial solutions in the areas of migration from existing mobile systems to UMTS, fraud detection in UMTS, trusted third parties for end-to-end services in UMTS, capabilities of future User Identity Modules and security and integrity of billing in UMTS. The project will focus on the security aspects related to UMTS and will provide useful input to the standardisation process. The technical work in the project will be carried forward in five parallel strands, each involving a trial of security features and facilities. The five strands are as follows: 1) migration of security features from those in existing mobile networks (GSM) to those for future networks (UMTS, FPLMTS); 2) a detailed analysis and trial of techniques for detecting fraud in mobile telecommunications networks; 3) provision of end-to-end security services through trusted third parties; 4) security functionality required of future UIMs; 5) services supporting the security and integrity of billing in UMTS.

AC098: MOMUSYS

This project aims to develop and validate the technical elements necessary to provide new audio-visual functionalities for mobile multimedia systems. Such functionalities are being identified in the context of ISO MPEG-4 which will become the standard for coding of audio-visual information in multimedia systems. Most of these functionalities are not or insufficiently supported by available standards. Particularly the main objectives are: 1) New Multimedia Communications System with full conversational possibilities and totally new functionalities described by a Syntactic Descriptive Language; 2) Global field trial with 20 to 60 real terminals and real users for symmetric and asymmetric Multimedia over wireless networks (8 kbit/s to 1 Mbit/s); 3) European MPEG-4 platform addressing all MPEG-4 functionalities.

New audio-visual functionalities, which include content manipulation, content scalability and content based access, must be achieved with algorithms that provide very efficient compression on the one hand and robustness against transmission errors on the other. For this purpose, new ways of communicating data and even coding methods between terminals will be developed, going away from simple syntax definitions to a more generic language. A world-wide field trial with real time Mobile Audio-Visual Terminals will be used to demonstrate and test the solutions identified in collaboration with international standardisation efforts, in particular MPEG-4.

Techniques to be developed include a generic and flexible data stream syntax, concepts and methods for content-based audio coding, and robust tools and algorithms for content-based video coding. The syntax must provide a robust interface to mobile transmission channels and data rates for the coded data streams must address the abilities of current (e.g. DECT) and future (UMTS) mobile networks. In order to realise the units that are needed for the field trials, hardware will as far as possible rely on available components, including hardware earlier developed in RACE.

AC104: MOSTRAIN

This project aims to further the development of third generation mobile communications technologies by focusing on the demanding communications environment concerned with the delivery of mobile services to and from high speed trains. This project aims to ensure that these high speed rail aspects are introduced at the early stages of the development programme for third generation systems and not when standardisation has been completed. The project aims to ensure that new technologies (UMTS and MBS) are able to deliver the services required by passengers, public and railway operators, and other transport and professional radio users in general. Particular attention is given to the radio channel so as to ensure that the characteristics of the high speed railway radio channel are fully taken into

account in the development of new technologies such as UMTS. This project will also address the issue of the multi-service/multi-operator environment and study how the separate business needs of railway and public operators can be met by common technology to deliver services to their user bases of railway staff, systems and passengers.

A final aim of the project is to demonstrate to users and operators the benefits which new mobile communications technology can bring and the way in which the technology can be shaped to meet their needs. Particularly for railway operators which need to take account of many safety and integrity aspects, the ability to build confidence in the technology through practical trials and demonstrators is important.

AC201: TOMAS

The overall objective of TOMAS is to define, perform and evaluate trials related to the development and application of S-UMTS. Based on the Asymmetric High Speed Data Pilot System developed in the RACE II Project MOEBIUS, a trial platform will be offered to projects open for the integration and testing of S-UMTS components and applications under development. Configurable communication channels supporting ISDN and ATM mode with ransfer rates up to 2 Mbps are envisaged. The objectives in detail are:

- Realisation of a trial platform based on the satellite universal mobile telecommunication system (S-UMTS) concept for application in various domains.
- Establishment of inter-trial links and integration of individual project results according to the requirements of the trials. The practical implementation of advanced communication technology and mutual usage of R&D results, developed in RACE and existing ACTS as well as ESA (European Space Agency) activities will be stimulated by the inter-trials.
- Performance of trials on real business cases.
- Identification of generic requirements for the implementation of S-UMTS services and the development of consolidated technical guidelines in the context of Integrated Broadband Communication (IBC).
- Cost-Benefit Analysis of S-UMTS according to the requirements, particularly of small and medium sized enterprises (SME).
- Workshops and training courses for the promotion, exploitation, diffusion and exchange of experience in the context of S-UMTS.

The Asymmetric High Speed Data Pilot System for broadband mobile satellite communications will be used as the basic infrastructure. It is providing transparent space segment capacity in L-Band via geostationary satellites. The coverage extends from China and parts of Japan in the East via the whole of Europe up to the West Coast of the USA. Mobile AHSD satellite terminals consist of a modified Inmarsat Standard-A Mobile Earth Station (MES).The multimedia functionality builds on H.320 compatible audio/video codec components and H.221 framing and signalling schemes. The H.320/H.221 system is PC-based and is providing standard interfaces for the user interaction devices, such as cameras, monitors and data equipment. Asymmetric information rates of n x 64 and m x 64 Kbps are provided, respectively. Channel rates up to about 2 Mbps will be feasible by increasing the MES and LES E.I.R.P. High speed transmissions can also be combined with voice-band channels in the other direction. The mobile satellite link is interconnected to world-wide switched networks via multiplexed ISDN basic rate lines. Inverse multiplexing using a proprietary protocol or BONDING is applied to connect the fixed earth stations to the terrestrial network. The linking to ISDN and the almost global coverage with the transparent space segment makes the existing pilot system particularly suitable to serve as inter-trial platform under the different programs. The existing AHSD infrastructure and pilot services will enable application-oriented projects to test mobile high quality multimedia satellite communications even in the early stage of the project.

AC202: NEWTEST

The aim of this project is to propose new Neural Network based methods for adaptive equalisation of the satellite UMTS transmission channel .Also, the same method will be applied to adaptive antennas for Satellite segment of UMTS systems. Objectives are to evaluate the performance issues related to the use of Neural Networks equalisation techniques as well as to assess the technical feasability of the implementation, especially at UMTS terminal level. For adaptive equalisation of non-linear satellite channels, artificial Neural Networks (NN) have shown their ability to solve various problems encountered in the related topics: non-linearity arising in satellite data links, equalisation of rapidly time varying and multipath channels, adaptive antennas. The project aims at developing a demonstrator system for UMTS Satellite links and to carry out the feasibility study of ASIC based subsystems, up to but not including the foundry level. To this end, the NN based equalisation will be studied, together with the application to Adaptive Antenna. The medium-bit rate of the UMTS satellite application (around 64KBits/s) allows the implementation of a real-time prototype, with todays available subsystems. When NN algorithms are validated on the prototype, the complete design study and simulation of an ASIC for a non-linear satellite link equaliser will be achieved. ASIC design will be carried out up to the edge of the foundry process. The last step of the project is devoted to the demonstration of the performance of adaptive NN equalisation through technology trials.

AC204: SAMBA

The main objective of the SAMBA project is to promote the development of a broadband cellular radio extension to the IBC, thus allowing the use of broadband multimedia services by mobile users. The work to be carried out focuses on a trial platform providing transparent ATM connections and supporting bearer services at up to 34 Mbit/s in a cellular radio environment at 40 GHz. SAMBA will design and implement the appropriate system and test its performance in a trial, which will demonstrate the applicability of the Mobile Broadband System to user applications. In support of the trials the key objectives for the SAMBA project are to demonstrate mobile user applications at up to 34 Mbit/s, design and realise reliable radio transmission for ATM cells for mobiles. specify and implement medium access, handover and radio resource management for a cellular system, develop a portable millimetrewave transceiver including antennas and advance the MBS evolution and promote its standardisation.

AC212: SINUS

The objectives of the SINUS project are to define techniques for critical aspects of the satellite Air Interface (propagation, access methods, inter-satellite handover, ...) and of network procedures (call routing, inter-segment handover, ...), to consolidate S-UMTS technology, to define reference models for the UMTS satellite component for interworking with the UMTS terrestrial component and B-ISDN, to estimate performance in a range of environments (suburban, rural, etc...), to assess the economic and technical feasibility of providing services through the UMTS satellite component, to support standardisation activities and make recommendations.

SINUS will build a system demonstrator for validation of the system concept and for development of novel application concepts. SINUS will define and demonstrate an end-to-end communications network. This will incorporate a remote user terminal based on existing equipment, satellite and terrestrial channels and an access network connected to a National Host. All elements will be defined including satellite and terrestrial interfaces, and network procedures. SINUS will emulate a fully representative satellite channel, avoiding the risk of physical satellite non-availability within a suitable timeframe. As no In-Orbit satellite constellation will be available, satellite constraints will be evaluated through adaptive simulation. Implementation of a laboratory test-bed, apart from allowing ready access for trials, enables a range of satellite orbits to be investigated. Major emphasis is planed on breadth of coverage in terms of satellite and terrestrial segments not limited to one particular system or orbital type, but encompassing CDMA, TDMA and all other appropriate access methods.

AC217: EMIGRATE

The overall goal of the EMIGRATE project is to contribute to the development of third generation mobile communications (**U**niversal **M**obile **T**elecommunication **S**ystem) in Europe and world-wide. The main objective, to be realised on the basis of a industry-wide consensus view, is to generate, collect and disseminate information to and from the UMTS Forum, ETSI, ERO (European Radiocommunications Office) in order that all ACTS Projects in the Mobile Domain (and relevant chains) can be kept abreast of market and regulatory developments, standards issues, spectrum issues and technological trends It is the purpose of the UMTS Forum to provide strategy guidance to the standardisation work, aiming for a global UMTS system outline by 2000, with pilot system introduction starting in 2002 and full scale deployment by 2005. The project will make recommendations and develop guidelines relating to the following issues:

- The definition and implementation of a personal communications concept based on the opportunities created by evolving and possibly combining GSM/DCS1800 and DECT technologies, which can then serve as a viable platform until well beyond the year 2005.
- The development of a common view for the implementation of UMTS, which builds on the GSM/DCS- 1800/DECT footprint.
- The development of guidelines relating to the future of mobile and personal communications systems which will provide the sector actors with an information base for strategic decisions on network and service deployment with reasonable expectations on return on investment.

AC228: AWACS

The goals of the ATM Wireless Access Communication system (AWACS) project are the development of a system concept and testbed demonstration of tetherless public access to B-ISDN services. The system will offer low mobility terminals operating in the 19GHz band with a support of user bit rates up to 34Mbit/s with radio transmission ranges of up to 100m. The demonstrator of ATM Wireless Access (AWA) pre-prototype equipment will immediately provide propagation data, BER and ATM performance at 19GHz band and based on these information, enhancement techniques for AWACS will be investigated to support cellular like mobility, as well as spectrum and power efficient radio access technologies associated with HIPERLAN (HIgh PERformance LAN) type 4 specifications. AWACS technical approach will be centred around a testbed and associated trial campaign programme. Trials will be conducted using the existing ATM Wireless access platform made available to the project by one of its partners. Associated program of work will then be directed on enhancing this current state-of-art system towards the final target features of the emerging ATM wireless specifications, in particular HIPERLAN type 4 as currently being defined by ETSI-RES10. Enhancements to the existing demonstrator will consider the application of source/channel coding and intelligent antennas, the optimisation of link layer protocols to match ATM bearer types, the feasibility of 40GHz RF technology for ATM wireless LAN applications, and mobility management techniques together with the impact on the radio bearer appropriate for high bit rate communications.

AC229: INSURED

The objectives of the INSURED project are to define a Satellite-UMTS (S-UMTS) Reference Model validated through trials and simulations, to demonstrate integrated S-UMTS services functionality in the context of a system demonstrator, to define and develop a S-UMTS system Demonstrator and to perform trials using real environment for both satellite (IRIDIUM) and terrestrial (GSM) networks.

The INSURED project is composed of four main phases including the definition and validation of a comprehensive S-UMTS Reference Model, the definition of the Demonstrator Architecture to be utilised for the System Trials, the implementation of the Demonstrator, and the planning and execution of System Trials. The reference model to be developed within the INSURED project will state the characteristics and performance requirements of the procedures to be demonstrated. It is a high level specification concerned with services, interworking, mobility management and radio interface aspects aimed not only at serving during the phase of the INSURED projects but well beyond for future

evaluation of S-UMTS systems and applications. In parallel with the Reference Model development, the objectives of the demonstration activities will be identified, i.e. the functionalities which will be tested through trials, taking into account the limitations imposed by the use of existing non-UMTS compliant networks.

Conclusions

This paper has presented the current perspective of the European mobile and wireless telecommunication sector insofar future developments are concerned. Supported by telecommunications operators, equipment manufacturers, service providers, research institutes, universities and leading-edge users a number of EU funded R&D projects have proved to be instrumental in development of future Third Generation advanced personal mobile communications systems. The participation of leading edge users reflects the policy that R&D must be demand-driven to ensure that the developed technologies, services and applications are responsive to market requirements. Given the global nature of the mobile communications markets, the EU sponsored ACTS R&D Programme has been open to international co-operation and project participation on a mutual benefit basis. Indeed different world regions need to co-operate, particularly in the area of standards development and frequency allocations to ensure the widespread availability of advanced and affordable wireless services and applications. National and regional borders must be transcended, interconnection of networks and interoperability of services and applications must be encouraged, all with the objective of ensuring through the convergence of the telecommunications, computer and audio-visual industries, the enhancement of the quality-of-life in the mobile and wireless information age.

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