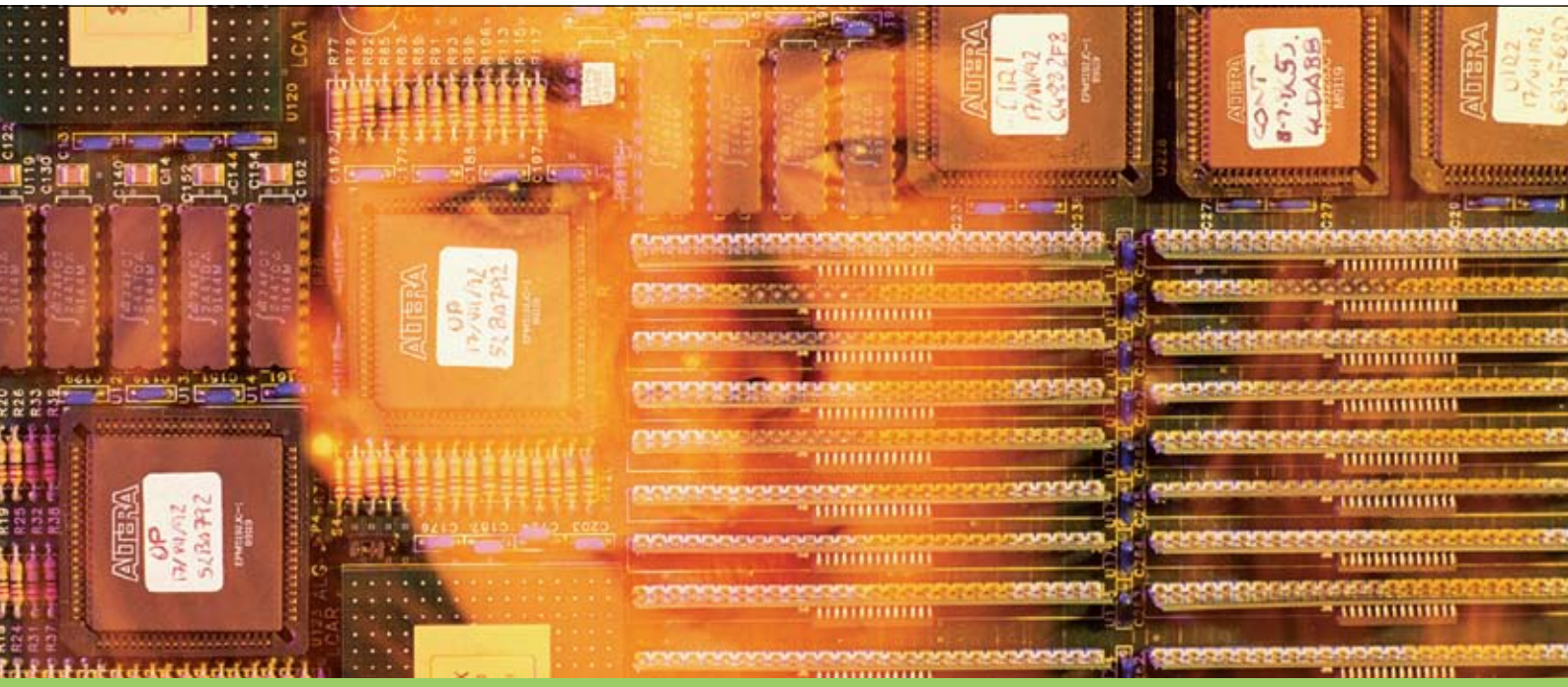
PROGRAMME SUCCESSES

MEDEA+

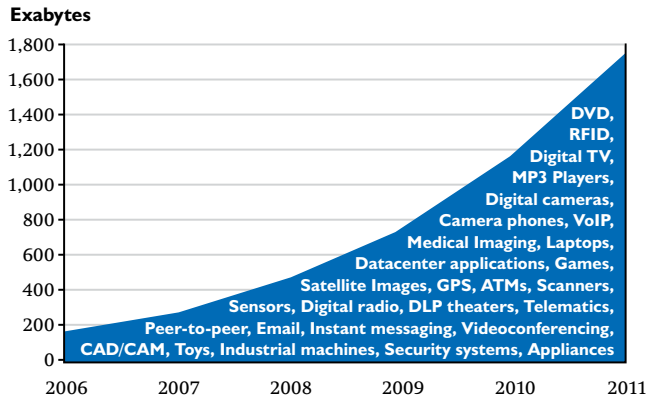


Broadband communications drive global change

EUREKA

Explosion in data handling

Major drivers such as the evolution of social networks and the Internet of services, the notion of seamless connection between devices, sensors, objects, machines and vehicles through the Internet of Things and the growth in mobile services such as TV broadcasts are leading to an explosion in the data being handled. The data-handling capacity of the Internet is expected to grow tenfold from 2006 to 2011. Next generation networks will therefore have to offer significantly higher speeds. And a major increase in bandwidth is required in the access network – leading to a move to fibre and wireless technologies.



Digital information created, captured and replicated worldwide from 2006 to 2011

Broadband communications drive global change

In a remarkably short time, broadband communications and particularly the high speed Internet have irrevocable changed our society and the global economy. The Internet now provides a worldwide web of knowledge sharing, creativity and collaboration that has been a major driver of globalisation. High-speed access and increased intelligence in all types of devices means the Internet will be increasingly pervasive, available anywhere and at any time. This is being driven by the widespread availability of low-cost wireless broadband and the merging of fixed and wireless networks. And it has been made possible in large part by collaboration between the European microelectronics industry and the many sectors using this technology through the EUREKA MEDEA+ and preceding MEDEA programmes.

Communications now represent some 40% of the information and communications technology (ICT) sector in Europe, according to the European Commission. It is one of the main areas of European strength in ICT and an obvious lead market for the European semiconductor industry.

In addition, the European Commission's i2010 information society policy strategy has focused on the need to ensure broadband for all to avoid the current digital divide leading to a future information exclusion of some members of society. This means increasing broadband penetration in Europe from the current average of around 20%.

Evolution in the communications sector is therefore forecast to continue to be impressive with fixed broadband networks increasing in speed as optical fibre penetration progresses, mobile broadband networks speeding up as fourth generation technologies become available and communications develop between different appliances, entertainment systems and man-machine interfaces within the home, creating a whole new market for residential networks.

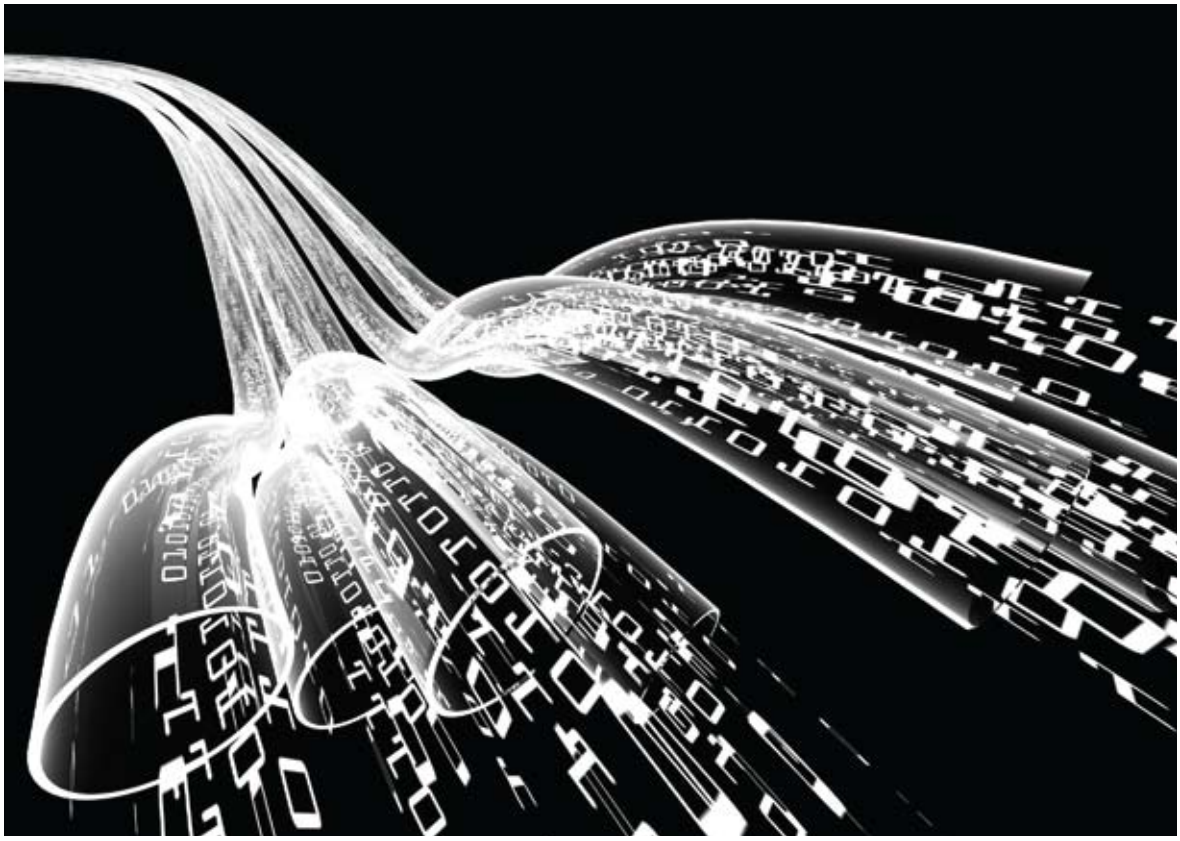
In fact, direct communication between objects – the so-called Internet of Things – is set to become a reality as more and more objects in our environment become intelligent and generate ever more data.

Currently, wireless terminals are seen as the main market driver in monetary terms in every area of semiconductors – including memory, analogue chips, digital signal processing (DSP), processors and discrete components. Both wireless and wired infrastructures are also growing rapidly, with the semiconductor content of wireless market set to reach €57 billion – 3.5 times that of the wired market in 2011.

	Growth 2003/06		Forecast 2006/10	
Broadband subscribers	+174 million	170%	+259 million	+94%
Mobile subscribers	+1215 million	+87%	+1191 million	+46%
Optical fibre subscribers	n.a.	n.a.	+53 million	+407%

Power-line communications

Ever greater use of broadband Internet has led to an explosion in domestic multimedia services such as multi-channel television as well as provision of high quality triple-play – voice, data and video – services. The MEDEA+ A110 MIDAS project set out not only to ensure availability of broadband consumer services but also to develop power-line communications (PLC) to simplify internal signal distribution. PLC uses a power-line carrier to enable fast transmission of signals over the domestic mains wiring rather than drilling holes in walls and pulling cables through. And it offers broadband distribution without the complexity of many current wireless technologies. MIDAS demonstrated the first in-home PLC network able to achieve speeds of up to 200 Mb/s with high-quality multistream video and data channels over the existing mains wiring in the home. These systems will be able to provide 100% coverage together with very high levels of security.



Boosting network access

MEDEA+ has been deeply involved in backbone- and access-network technology to increase massively the capacity of both legacy copper and future fibre fixed networks. And a wide range of projects have covered the development of all the elements required for ever faster mobile networks – from now classical mobile phone communications to body area networks for medical monitoring.

An early problem was the need to simplify connection and configurations to improve access to range of services such as telephony, web browsing, email and broadcasting were only accessible using service-specific networks – either terrestrial or by satellite.

The MEDEA+ A103 UNIACCESS project developed architectures for low-cost single-chip integrated access devices enabling cost-effective Internet access as well as realising a digital subscriber line access multiplexer (DSLAM) that handles the requirements of voice and data traffic at the telephone exchange. By simplifying connections and configurations, these devices helped boost the market for Internet-based communications in small or home offices as well as in the home.

While fibre to the home offers the highest possible access rates, a huge investment has been made over many decades to build the legacy copper-based local loop access network. Development of digital subscriber line technologies (xDSL) over the copper pairs provided a means of exploiting this resource for the delivery of innovative digital services. However, copper wires are prone to interference and losses; using them for high-speed data transfer posed a significant engineering challenge.

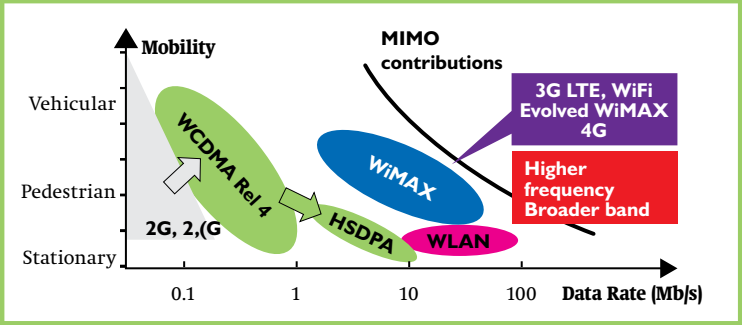
The MEDEA+ A106 INCA project developed and integrated high-performance asynchronous DSL (ADSL) and very high bitrate DSL (VDSL) systems, based on advanced digital-signal processing (DSP), system-on-chip (SoC) methodologies and silicon technologies. Developments included new physical layer components and systems for advanced DSL systems, and generic reusable systems and chipsets for ADSL, as well as contributing to the VDSL standard that is now becoming more widely available.

Multiple aerials a must

Multiple aerials in digital wireless transmitters and receivers offer significant improvements in data rates and quality of service with lower radiated power. Multiple-input multiple-output (MIMO) communications systems are now a crucial element in mobile phone and data systems in both the base stations and mobile terminals, creating multiple signal paths to either boost data throughput or reduce bit error rates

The MEDEA+ A111 MARQUIS project developed the essential building blocks for multi-antenna terminals for wireless local area networks. Algorithms in the handset – and base station – receivers recombine the separate signals, compensating at the same time for interference and fading resulting from signals reflecting from various objects between transmitter and receiver.

The MEDEA+ 2A103 MIMOWA project is now simulating, implementing and validating MIMO building blocks for different wireless interfaces in mobile and fixed applications. The MIMO approach is seen as a key technology for achieving the required data rates for the next generation of high speed WiFi, fixed and mobile WiMAX and 3G long term evolution (LTE) air interfaces.



MIMO is a must for all the air interfaces 3G, LTE, WiMAX and WiFi

Simplifying wireless communications

Wireless networks continue to expand. More and more public places, such as hotels, restaurants, airports, railway stations and even entire university campuses, now have wireless 'hot spots' where subscribers can use a wireless connection to access the Internet from their laptop or personal digital assistant (PDA). And, in the domestic market, households now use wireless networks to link their computers, printers and – increasingly – entertainment resources together and to the Internet.

The MEDEA+ A105 UniLAN project played an important role in developing chip architectures and radio frequency (RF) components to implement existing and future European-backed standards for wireless data communications. As a result, equipment for 3G mobile phone networks and company or domestic wireless LANs became widely available. This gave an immediate global advantage to European communications equipment manufacturers and to European consumer electronics suppliers as it increased worldwide markets.

Full mobile broadband however required the development of third and fourth generation mobile phone networks. This was driven by the need for a high performance communications system suited to all types of transmission – voice, data, video, etc. The MEDEA+ A104 SCUBA project defined and realised a time-efficient development environment for multi-standard/multi-carrier equipment to meet this need based on new processing architectures to handle the complex high speed signal/data processing and routing requirements involved.

The project involved both the radio interface for future base stations and the access multiplexer for the base-

station access network. By focusing on innovative concepts for advanced multi-carrier universal mobile telephone service (UMTS) base stations and related access networks, this project created a universal technology platform for the development of future-safe, cost-efficient communication systems, boosting European leadership in this major global market.

Handling network convergence

Current Internet access tends to be passive, with users selecting and downloading information. High speed Internet access needs have therefore been met principally by asymmetrical wireless and fixed-line systems. However, future users will need to upload much greater amounts of information in a more interactive world. New high speed, broadband Internet access will build on the convergence of current heterogeneous networks, including wireless access, wide area (WAN), local area (LAN) and mobile phone networks.

The MEDEA+ A121 PlaNetS project set out to provide cost-effective symmetrical broadband access for all European citizens based on convergence of current heterogeneous networks, including fixed and wireless systems, to ensure much greater user interactivity.

The project focused on the use of IPv6 – the next version of the Internet Protocol – and concentrated on specification, implementation and verification of all kinds of network delivery. It centred on the specification, implementation and verification of access network platforms, including the complete platform for the base station or terminal. The work encompassed fixed and wireless solutions based on DSL and WiMAX technologies but not mobile phone networks.

While wireless technologies have played an increasing role in local and wide area communications, a major barrier has been the range of different standards involved, served by single-standard terminals. Market research now predicts an enormous growth in the market share for multimode 4G mobile handsets to over 40% by 2010. This required the development of integrated analogue and digital solutions for highly reconfigurable current and future multifunction and multi-standard terminals in next-generation wireless communications systems.

The MEDEA+ A107 4G-RADIO project developed new architectures, circuits and technologies, including advanced CMOS silicon-on-insulator (SOI) expertise, as well as demonstrating their transfer into semiconductor technology design. Results of the work are already appearing in submicron CMOS and advanced BiCMOS devices – boosting the global competitiveness of key European players in chipmaking and communications.

Personal monitoring networks

Wireless personal (WPAN) and body area (WBAN) networks are set to play an increasing role in applications such as health, personal safety, secure wireless data exchange or home entertainment. The MEDEA+ A109 WITNESS project developed new technologies for such short-range communications using very low power while developing extensions to new and existing standards. It is also focused on data secrecy and safety – preventing attacks, corruption and/or loss of service – inherent in wireless communications.

Two main application domains were involved: medium data rate transmissions in personal communications for business and entertainment applications; and low data rate transmissions in medical and/or fitness applications – including telemedicine – at home and in hospitals. The personal health/fitness monitoring platform consists of sensor applications connected through a body area network to transmit body and environmental parameters to the fixed world. The platform is characterised by a moderate data rate and extremely low power consumption together with high reliability.

This work is being taken further in the MEDEA+ 2A105 SR2 project, which is focusing on novel and ultra low power radio components for WPAN and WBAN applications. Objectives include developing multi-standard SoC devices, assessing their coexistence performance and integrating them into home monitoring and automation applications.

Meeting future challenges

Communications is one of key lead markets to be tackled in the new CATRENE nanoelectronics Cluster. The ambitious vision is the development of technical support required for the provision of broadband access to telecommunications networks for every European citizen, regardless of life situation. Challenges include developing broadband wireless and fixed access linked to a powerful backbone network at a cost that is affordable for the vast majority of users. Work will focus on nanoelectronics components and subsystems for next-generation telecommunications networks, converging network and service platforms, and ubiquitous, secure network access to user-specific information.

CATRENE
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MEDEA+ ∑!2365 (2001 to 2008) was the industry-driven pan-European programme for advanced co-operative R&D in microelectronics. Its aim was to make Europe the global leader in systems innovation on silicon. Some 90 projects were labelled, covering challenges in microelectronics applications and enabling technologies, and involving 2500 scientists and engineers annually from 23 European countries. The more than 600 partners included major microelectronics manufacturers, systems houses, SMEs, universities and institutes.