PROJECT RESULT

Networked
ICE terminals

MEDEA+

2A202: Universal platforms for power efficient reconfigurable mobile systems and terminals (UPPERMOST)

Software-defined radio system technology ready to meet global challenges

Development of software-defined radio systems and software-like architectures in the UPPERMOST project offers flexibility and efficiency in the development of highly integrated, reconfigurable multimode mobile systems and equipment. The results of this highly innovative project are already influencing the evolution of multimode and multistandard mobile terminals towards heterogeneous wireless network environments from cell phones to mobile television, supporting new standards and keeping Europe in the vanguard of global advances in wireless communications against tough US and Asian competition.

Fast growth in the number of standards and applications for mobile terminals – be it for wireless networking, cell phones or mobile TV – is increasing demand for multimode devices. Some terminals already offer a limited mixture of short-range wireless connectivity possibilities, but are bulky and power hungry. True multimode devices need fuller integration with greater reuse of individual elements and easy reconfiguration for different modes to reduce size, cut production costs and use less energy.

The MEDEA+ 2A202 UPPERMOST project set out to demonstrate cost-effective, low-power, highly adaptive and reconfigurable technical solutions for future mobile terminals. The consortium brought together terminal manufacturers, chipmakers, test equipment designers and research institutes to investigate, build and demonstrate advanced technical solutions, tools and architectures, and to design building blocks for reconfigurable multistandard and multimode mobile terminals.

Some eight different standards were studied. The principal ones were: the IEEE 802.11n wireless networking standard; the increasingly important IEEE 802.16e WiMAX broadband wireless standard and a particular focus of the project; 3GPP-LTE (long term evolution) for mobile phones; high-speed downlink packet access (HSDPA) for 3G mobile phones; and the DVB-H handheld mobile TV standard.

Focus on network access

UPPERMOST investigated three major elements for network access: the radio front end, baseband processing and the protocol low layer. Work was split into four packages:

- Terminal requirements and architecture-level studies;
- Reconfigurable architecture and building;
- Demonstrators; and
- Standardisation and dissemination.

The first package identified how innovative and existing solutions for silicon integration, processing and interconnect fabric could be put together to achieve multiple modes and multiple standards functionalities in mobile terminals.

Two approaches were developed for reconfigurability:

1. Building tunable blocks taking advantage of standard commonalities – not only baseband blocks but also innovative reconfigurable radio components; and
2. Building generic computing blocks able to perform the most common operations included in the different access layers.

The global architecture proposed for low layer protocol and baseband processing uses a heterogeneous multiple processors structure. This embeds the proposed specific reconfigurable components, allowing close mapping between the hardware and the application. It also

offered the best power efficiency compromise.

Experimental validation of the tools, methodologies and architectures was an important achievement. Two major developments in Europe regarding baseband processing for software-defined radio (SDR) – ADRES from IMEC and FAUST from CEA-LETI – were brought into UPPERMOST. Other key architecture elements include application-specific instruction set processor and reconfigurable radio-frequency (RF) front-end blocks.

A high degree of flexibility was also applied to test and measurement, allowing single instruments to provide signal generation and analysis capabilities for multiple air interfaces.

Driving standardisation

There was extensive involvement in standardisation. A specific example was advancement of the DigRF standard, to which chipmaker and test and measurement partners contributed significantly. This interface standard enables more efficient development of baseband and RF chipsets for wireless communications. Uniformity in interfaces between the baseband and RF application-specific integrated circuits provided easier ways of testing and debugging, and opened new test possibilities.

Several partners were involved in the standardisation processes for 3GPP LTE, IEEE802.11n, WiMAX and mobile TV. The P1900.4 standard effort, which aims at a more efficient spectrum usage, was actively supported as well.

The evolution of mobile terminals towards a heterogeneous wireless network environment has now started. 3GPP LTE wireless transmission was demonstrated as one of the air interfaces executed on the SDR architecture. Another real-time demonstration showed DVB-H video transmission, reception, visualisation and real-time analysis. These early demonstrations provided proof of concept and confirmed the project's pioneering role for European leadership in future wireless communications approaches.

UPPERMOST also increased its semiconductor partners' confidence regarding the feasibility of highly integrated flexible architecture. For example, use of 65 nm CMOS technology made it possible to introduce reconfigurability into the RF converters in the transmitter side, not possible a decade ago.

Commercial development

Both STMicroelectronics and NXP have started commercial development of SDR chips as a result of this project. STMicroelectronics expects to have a chip in production by mid 2009 that supports WiMAX, WiFi and CDM on the same die, and is planning a mobile TV chip for 2010/11. Motorola is also looking at developing such circuits. And UPPERMOST allowed development of a very small 3G HSPDA transceiver already in production.

MEDEA+ support for this project was important because the specific demonstrators could not be defined at the start – it took 12 months to draw up a strong demonstration plan. MEDEA+ enabled sharing of information and some retargeting.

As a result, Europe is now ready to meet global challenges, particularly in WiMAX which is forecast to develop strongly in 2009. And the consortium has already started work on a new project for chips working at 60 GHz.

Networked
ICE terminals

2A202: Universal platforms for power efficient reconfigurable mobile systems and terminals (UPPERMOST)

PARTNERS:

Agilent Technologies
CEA-LETI
IMEC
IMS
Motorola
NXP Semiconductors
STMicroelectronics
Target Compiler Technologies
Uni Leuven (KUL)

PROJECT LEADER:

Eugene Mackowiak
STMicroelectronics

KEY PROJECT DATES:

Start: January 2005
End: December 2007

COUNTRIES INVOLVED:

Belgium
France

MEDEA+

MEDEA+ Office
140bis, Rue de Rennes
F-75006 Paris
France
Tel.: +33 1 40 64 45 60
Fax: +33 1 40 64 45 89
Email: medeaplus@medeaplus.org
http://www.medeaplus.org

EUREKA Σ!

MEDEA+ Σ!2365 is the industry-driven pan-European programme for advanced co-operative R&D in microelectronics to ensure Europe's technological and industrial competitiveness in this sector on a worldwide basis.

MEDEA+ focuses on enabling technologies for the Information Society and aims to make Europe a leader in system innovation on silicon.