PROJECT RESULT

High speed communications systems

MEDEA+

2AI03: Multiple-input multiple-output technologies for wireless access (MIMOWA)

Laying the foundations for high-quality mobile services

Mobile-phone users have been suffering from degraded call quality, especially in cities, at the same time as they look to their mobile devices to provide faster and more reliable broadband services. One approach to overcome this issue is use of multiple-input multiple-output (MIMO) systems, which employ additional radio paths to raise data rates. The MIMOWA project developed MIMO techniques for use in 3G mobile phone, WiMAX and WiFi communications, significantly enhancing European knowledge and capabilities in these areas, and ensuring that Europe maintains its lead in future mobile communications.

Mobile-phone users expect to be able to access mobile-broadband services wherever they are located. Mobile communication systems therefore need to offer reliable broadband radio access if emerging high-speed data and multimedia services are to take off. Yet the increasing take-up of mobile services is stressing mobile-phone network infrastructures, especially in cities, where high density of users as well as signal scatter and reflections can significantly affect perceived communications quality.

One of the most promising solutions to the problem consists in the exploitation of multiple-input multiple-output (MIMO) systems, which make use of multiple aerials and signal-processing elements in the mobile base station and user handset. MIMO techniques in mobile-phone systems offer either greatly increased data rate or an improved-quality signal by using additional channels to provide signal redundancy.

The MEDEA+ 2A103 MIMOWA project set out to make a major contribution to European knowledge on MIMO techniques in this area. Such technologies are thought to be essential for the next generation of wireless-communication standards. They will be needed both to manage many mobile users at the same time, and to underpin high data rates without using additional radio resources.

MIMO in mobile systems

MIMOWA focused on developing MIMO building blocks for communication systems in three areas:

1. 3G long-term evolution (LTE) mobile phones – the forerunner for full 4G mobile networks;
2. WiMAX – Worldwide Interoperability for Microwave Access – fixed and mobile broadband wireless access; and
3. WiFi wireless local area networks (WLANs).

The MEDEA+ project defined, evaluated and developed a range of MIMO building blocks that could be applied to a range of wireless interfaces. MIMOWA also examined the potential for cost reductions in networks and chips, more efficient production flows, enriched academic knowledge and improved workforce skills.

A key objective was to prove, by means of a set of real demonstrators and test-beds, that MIMO technologies are feasible for use in mobile communications systems from both technical and commercial points of view. A secondary target was to evaluate and propose advanced designs and techniques for future wireless standards.

By the end of the project, MIMOWA had developed working hardware demonstrators showing MIMO techniques in action.

Technologies demonstrated

After successful development of the technologies involved, the first demonstrators were shown in December 2008 during the MEDEA+/CATRENE European nanoelectronics forum in Paris, followed by the Mobile World Congress in Barcelona in February 2009. Both LTE and WIMAX demonstrations were given, in four different scenarios: MIMO switching in WiMAX; MIMO precoding in WiMAX; MIMO precoding in LTE; and aerial selection in WiMAX.

As well as the building blocks for the wireless interfaces, MIMO carried out extensive analysis of aerial design and layout. This is an important factor in mobile-handset design and has taken on more importance as handset designs shrink and the number of aerials in a single handset rises. The more sophisticated mobile-phone designs now coming onto the market typically employ three or more aerials, for services such as mobile communications, WiFi and global positioning systems (GPS).

Project partners also carried out dissemination and standardisation activities, as well as creating joint papers and a public website containing vision papers. The presentation at the Mobile Work Congress in February 2009 was a key event, as was the MEDEA+/CATRENE European nanoelectronics forum in November 2008.

Hot wireless standards

MIMO is currently a hot topic in the wireless communications world. The LTE and WiMAX standards are competing in a global marketplace with major business sponsors behind each. Both rely on MIMO technologies to provide the throughput and the quality of service that mobile users demand.

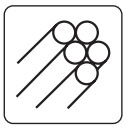
LTE seems to be the main standard for high mobility, while WiMAX appears to be gaining in the form of lower cost infrastructures for low-mobility or rural areas – particularly developing countries.

Over 100 mobile network operators, including most of the industry leaders, have announced their intention to migrate to the LTE standard from 2010 onwards. The first LTE terminals – USB-based data-card products – are already available, and the market is expected to take off around 2013 with a forecast volume of 45 million shipped LTE terminals.

For WiMAX, industry analyst Maravedis has estimated an accumulated 55 million WiMAX subscribers by the end of 2012, accelerating to 127 million by the end of 2014. WiMAX chipsets began to be embedded into laptops in the second half of 2008, and into handheld devices during 2009. Their incorporation into consumer electronics is expected in 2010, a key phase in the development of the market, since multimode devices will dramatically expand the WiMAX market.

Improved global competitiveness

MIMOWA project results represent a significant enhancement to European knowledge of MIMO technologies and their implementation in mobile communications systems. As this topic becomes more and more central to future wireless communications, the knowledge gained from this MEDEA+ project will strengthen the position of European industry. Other likely impacts include the reduction in development costs for networks and chips, enriched academic knowledge, lower costs for the end-user and improved competitiveness in the knowledge-based economy.



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