Publishable Summary

of the Multi-Base project

Project number:	216541
Project acronym:	Multi-Base
Project title:	Scalable Multi-tasking Baseband for Mobile Communications
Start date of the project:	January 1, 2008
Funding scheme:	FP7 ICT STREP

Date of the reference Annex I:	October 16, 2007
Deliverable:	Publishable Summary of the 1st period of the Multi-Base Project (as part of the "1st Periodic Report of the Multi-Base project")
Period covered:	01.01.2008 – 31.12.2008 (M01-M12)
WPs contributing to the deliverable	All
Due date	31st December 2008 (M12)
Actual submission date	13th February 2009

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1 Publishable summary

Overall flexibility and the ability to address a multitude of segments with a general architecture and design approach in the area of mobile communications is the major focus of the Multi-Base project.

In order to strengthen Europe's leading position in high-speed, end-to-end, mobile network systems technology, the Multi-Base consortium identified three main areas where research will have a major impact on the advancement of state-of-the-art technology of handheld terminals and the emergence of a sound competitive and innovative environment for the European communications and services industry:

A) multi-tasking radio – capable of supporting the reception/transmission of several communication standards concurrently as well as with dynamic reconfigurations.

B) scalable reconfigurable multi processor technology – an architecture allowing for both high bit-rate use cases and low bit-rate use cases with similar performance as low complex implementation specifically targeting only these use cases.

C) algorithm/architecture co-design for maximum energy efficiency – from the early developmental stages of algorithms both maximum and average power consumption will be taken into account.

The Multi-Base project objectives target the elimination of key technical and commercial barriers to ubiquitous broadband access by enabling efficient and sustainable disposition of operation and production factors as spectrum, power engineering cost and silicon process technology.
Drawing on project research in these three areas, the Multi-Base consortium will demonstrate new handset baseband architectures that enable end-to-end interconnection of humans and devices, with ability to support tenfold scaling in the number of interoperating connectivity links at the same cost and power consumption as today's technology.

Motivation for the project

Cellular access technology has become the technology of choice for distribution of a widening spectrum of mobile services as interpersonal communication (voice, video, chat, SMS and MMS), mobile broadband Internet access, mobile TV, other multimedia content distribution and entertainment services. To the extent these services and evolutions thereof are not conveniently terminated in the mobile handsets themselves, these will serve as personal hubs or gateways for connection of the proper peripherals, e.g., displays, projectors, HIFI equipment, as well as more advanced graphical and mechanical user interfaces.
The development can be extrapolated to include virtually all electrical equipment present in, mainly, the private living spaces but also in public areas. In order to support and capitalise on the innovation centred on mobile terminal platforms, further advances are needed in the implementation technology for both cellular and connectivity scheme's baseband processing in order to enable the emerging eco-system of service access.
Such implementation technology includes flexible radio front-ends (RF), re-configurable digital basebands (DBBs), as well as application and protocol processors. The focus in this project is on the baseband processor - a corner stone of any digital communication system.
The processing is dominated by streaming signal processing features. Special characteristics and requirements for such processing include low-power and hard real-time computing, relatively regular algorithms, ultra-high computing costs, ultra-low computing latency, as well as high dynamic range. Because of these challenging characteristics, practical implementations of streaming signal processing, for leading edge applications, in mobile handsets have mostly relied on non-programmable ASIC technology with its well-known limitations with regard to flexibility and performance scaling.
To support our vision of ICT and therefore the provisioning of an increasing variety of services and applications in different user scenarios and channel environments, mobile handsets will need to concurrently support a variety of air interfaces.
For instance, feature phones with support for GSM/GPRS/EDGE, WCDMA, CDMA2000, Bluetooth, WLAN, WiMAX, DVB-H, DAB and GPS may soon become fairly common in the market. A key barrier for the support of end-to-end connectivity lies in the difficulty to implement cost-efficient baseband chips that concurrently support different blends of these standards. This technology will, in the sequel, be

referred to as multi-tasking radio. The technical challenges in interoperating two or more air interfaces should not be under-estimated and little research is available in the area. This development, towards more converged and convenient end-to-end connectivity, makes traditional implementations, in which each radio standard is handled by separate modules, cost-ineffective and risky to develop. In order to reconfigurable digital baseband technology to emerge as a competitive alternative for use in commercial mobile terminals, other key performance areas include low-power processing (chipsets decreasing power requirements per functionality unit), support for more flexible spectrum allocation and shortening development lead times and more efficient reuse of existing IPs; as the product life cycles are shortening, bottlenecks will have to be identified earlier and methodology for more efficient mapping of algorithms onto hardware/software implementations is needed.

Description of the work done and the results in the first project year

There were two general objectives for the first project year that were pursued collaboratively across the work package boundaries. First, our main aim was to drive the development in the digital baseband (DBB) domain and focus on the requirements of two main concurrent communication modes (multi-tasking radio) by creating a European leading-edge solution for multi-standard communication on multi-core processors and thus providing hardware-accelerated multi-standard communication on a single core processor. Beyond this, we aimed at identifying an architecture that enables a reconfigurable transceiver baseband processing chain with shared building blocks for simultaneous multi-standard communication. This architecture will provide throughput up to 100Mbps in mobile cellular scenarios and up to 1Gbps in stationary connectivity scenarios under the constraints of power, cost and area required by commercial terminal units. We aimed at creating a modular platform enabling long-term scalable use. This requires a unified interface, a scalable interconnection subsystem and interface protocols, heterogeneous modules and selection of efficient programming tools for stream signal processing.

The Multi-Base project started in January 2008 and it is going to run for 36 months. During the first project phase corresponding to the first project year the focus was put on the analyses of requirements and the specification and the selection of the overall functional architecture. All work packages started their work and produced altogether eight deliverables spread throughout the first project year. At the beginning of the project a public project website with internal IT communication functionalities was published and a dissemination plan for the entire project duration was compiled. The technical work packages also started and all partners participated in the definition of specification and requirements for the Multi-Base system from the beginning of the project. The first version of the specifications and requirements was provided by WP1 after the first six months and at the end of the first year a further iteration of the deliverable was finalised based on the outcomes of the project work and new findings for the multi-stream scenario, the impact of the chosen standards on the functional architecture and further specified system requirements in terms of information transmission and reception and energy and complexity constraints. In the next step work package 4 provided specifications for the functional architecture considering also the hardware/software co-design and presenting the partitioning of the baseband part of the receiver into a set of functional blocks. Some of these blocks could already be considered as relatively mature while others are expected to pose a challenge for the project.

At the end of the first project year the key building blocks for the implementation were identified in WP4 innovative architectures for these blocks were suggested. After describing the different concepts and methodologies Matlab was chosen as the preferred methodology for algorithm development by WP2, which will allow for simple sharing of code and results by the partners. WP2 already identified the different algorithms that need to be explored further, offering a good starting point for the final decision on what will be implemented even if work still remains. The proof-of-concept work package started in the second half of the first project period and the preliminary version of the process design kit was launched at the end of the first project period.

Multi-Base project partners

The Multi-Base consortium consists of two leading European mobile communications chip and platform developers together with three universities and a large applied research institute in the area of telecommunications. The seven project partners come from three different European countries.
The consortium guarantees the fundamental innovative character of the research and the applicability in further industrial applications, initiating a major technical leadership in the design and implementation of digital baseband processors for mobile platforms. The knowledge is stretching from basic research to the design and marketing of products, including the production, evaluation and standardisation of all parts targeted by the project as well as intimate knowledge of the end-user market. The project partners are: Technikon Forschungs- und Planungsgesellschaft mbH (AT), Infineon Technologies Austria (AT), Ericsson AB (SE), Lunds universitet (SE), Linköpings universitet (SE), Interuniversitair Microelectronica Centrum VZW (BE) and Katholieke Universiteit Leuven (BE).

The Multi-Base consortium

The total volume of the project is going to be € 4.9 Million Euro, with the funding of €3.25 Million by the EC. For more information about the Multi-Base project please visit the project's website www.multibase-project.eu or contact:

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Figure 1: The Multi-Base consortium

The Multi-Base logo

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