ITEA 2

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

Project Results

MANY

More efficient reuse of software code

The practice of reusing existing software coupled with the arrival of many-core semiconductor architectures poses the problem of how to rewrite software applications to exploit the increased parallel processing available. The ITEA 2 MANY project responded with an improved programming environment for embedded systems to facilitate the faster development of applications for a variety of hardware platforms. By focusing on the legacy code of the software already developed and the possibility of automatically reusing code, potentially huge savings are created and tools provided that solve the issues and enable better utilisation of the technology. MANY not only solves some dead ends by providing better operating software but also optimises the quality of the output and, thus, performance.

KEY APPLICATIONS

There are three main applications of MANY: a software source that enables parallelised software that runs faster (optimised) and uses the higher-performance that multi-core hardware provides for speed and power; interactive support tools by providing extensive analysis and pinpoint with mark-up, leaving the decision to developer where to make the actual changes as well as helping them to understand and learn; the capability to change the actual code during execution rather than pre-runtime in order to provide a virtualisation platform on which to run the application. This effectively serves as the layer between the actual hardware and the application, and so enables all concepts to be combined.

The major beneficiaries of the tools are software developers since the tools solve two basic issues that are considered almost impossible to do manually: to run legacy software (single core software) on new advanced high-performance hardware (multi-core hardware) and to parse and transform source-to-source legacy code (single core software) into optimum high-performance application (multi-core software, or parallel software code). The benefit of reusing historical investments on software and automatically transform it to high-performing applications, is the nil or at least the negligible cost.

BREAKTHROUGH

This parsing of legacy code represents a major breakthrough; it is a complex technology with great expectations and huge potential at low investment. Estimates of the project results show important and significant savings in development costs while some of the consortium partners have begun to generate income. No other similar technologies have yet matured or exist and having no tool is tantamount to entering a 'black hole' of a never-ending development cost.

High-performance, low-power computing is particularly important in the embedded systems market in which video recognition, streaming media and complex algorithms are typical applications in the telecom and radio communication domain as well as increasingly in the automotive domain. Some examples of benefits for the final customers of high performance products can include faster mobile phones or devices, longer lifetime on handheld devices, potential for increased performance. Advanced and complex algorithms make it possible to take full advantage of the hardware performance.

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Partners

Alten Stockholm/XDIN
Caps Entreprise
Eindhoven University of Technology
Ericsson
ETRI
INRIA Saclay Île-de France
Institut Mines-Télécom SudParis
SevenCore Co., Ltd.
TestMidas Co., Ltd
Thales Communications and Security
Universitat Autònoma de Barcelona (UAB)
Université de Mons Faculty of Engineering
Vector Fabrics B.V.

Countries involved

Belgium
France
Korea, Republic of
Netherlands
Spain
Sweden

Project start

July 2011

Project end

June 2014

Contact

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ADDED VALUE OF THE RESULTS

There are two distinct areas in which the project achieved results: development tools and code analysis and transformation. The development tools derive from the need of high performing software applications and the associated software support whereby sequential software migration enables parallel programming to harness multi-core architectures and address multi-core architecture requirements. Standards ensure the portability of application and performance while runtime mechanisms facilitate program efficiency. The added value of MANY in code analysis and transformation is evident in finding hotspots (static analysis, hotspot region isolation), dynamic dependence analysis (less target specific, cross-platform analysis), automatic parallelisation (broader coverage of codes and target architectures, extended parallelisation and optimisation capability) and last, but not least, unique integration of the tools.

TANGIBLE BENEFITS

Project coordinator and industrial partner, Alten, provided software algorithms (scheduling and communication), tools and industrial validation, resulting in a partly open source outcome and transferable skills that benefit both partners and customers within the NG automotive and energy aware ICT. Another industrial partner, TCS, which contributed a radio software application, gained significant acceleration and power-saving using MANY methodology and tools. Collaboration with South Korean partners has generated mutual and beneficial outcomes, benefiting the technology as well as opening up business opportunities. One example is the SME Vector Fabrics in the commercialisation of the Pareon tool, which smoothens multi-core software optimisation and is being used in a few dozen locations, and where negotiations are ongoing with among others a major Korean company in the mobile domain. SevenCore's hypervisor tool, which provides a dynamic guarantee of system reliability in reliable and resilient embedded systems (including automotive, defence and medical systems as well as unmanned control vehicles), has been selected by Hyundai Heavy Industry for its new HP robot controller. Finally, there is a positive impact on the academic environment in the incorporation of improved techniques for scheduling time-division multiplexing that are now also part of the Quantitative Evaluation of Embedded Systems course in the Embedded Systems Master's curriculum at all three Dutch universities of technology. The ultimate gain, however, will be a stronger European industry that will see not only accelerated time to market but also a reduction in the need for upfront investments.

Major project outcomes

DISSEMINATION

- 2 journal papers: Performance Analysis Techniques for Multi-Soft-Core and Many-Soft-Core Systems," International Journal of Reconfigurable Computing (vol. 2012), Predictive modeling in a polyhedral optimization space. International Journal of Parallel Programming (2012)
- 4 conference papers: Journal of Parallel and Distributed Computing (Aug 2013), Heterogeneous Multi-device Architectures IEEE International Conference on High Performance Computing and Communications (Nov 2013), Compas'13, Contributions to High-Level Program Optimization. Habilitation Thesis. Paris-Sud University, France (December 2012)
- 3 presentations at fairs: HiPEAK: Project hosted a workshop 'HiP3ES' (2013, 2014 & 2015), Co-summit: Exhibition booth (2011, 2012 & 2013) and Ko-Summit: Project presentation (2014)

EXPLOITATION (SO FAR)

- PAREON - Anaylisis tool for paralisation
- CodeletFinder - Identifying code for parallelisation
- PyLINX - Low level HP communication package
- PoCC - Code paralisation tool
- STEP - Code tranformation tool
- LLWM extention for Code parallelisation tool
- Virtualization platform with online paralisation
- Monitoring for the virtualisation platform

STANDARDISATION

- The work is aligned with a variety of standards and defacto standards, such as MCAPI, MPI, OpenMP, POSIX, OPENCL, OpenACC, MTAPI, Linux

SPIN-OFFS

- Commercial negotiation is ongoing with several customers

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ITEA 2 – Information Technology for European Advancement – is Europe's premier co-operative R&D programme driving pre-competitive research on embedded and distributed software-intensive systems and services. As a EUREKA strategic Cluster, we support co-ordinated national funding submissions and provide the link between those who provide finance, technology and software engineering. Our aim is to mobilise a total of 20,000 person-years over the full eight-year period of our programme from 2006 to 2013.

ITEA 2-labelled projects are industry-driven initiatives building vital middleware and preparing standards to lay the foundations for the next generation of products, systems, appliances and services. Our programme results in real product innovation that boosts European competitiveness in a wide range of industries. Specifically, we play a key role in crucial application domains where software dominates, such as aerospace, automotive, consumer electronics, healthcare/medical systems and telecommunications.

ITEA 2 projects involve complementary R&D from at least two companies in two countries. We issue annual Calls for Projects, evaluate projects and help bring research partners together. Our projects are open to partners from large industrial companies and small and medium-sized enterprises (SMEs) as well as public research institutes and universities.

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