

# Economic growth through sustainable R&D

Research & Development is misjudged. Yes, the money spent for R&D shows statistical significance to economic growth. But, objectives of R&D change like fashions: now this, now that, whether nano- or biotechnology, alternative automotive drives or just Green-IT. Embedded systems are misjudged, too. The field is considered as an important growth engine. But, embedded systems are hidden in the vertical industries.

Cross market trends and potentials for synergies are not identified. This inhibits the convergence and exchange of technologies we all experience in the IT world. Here, for example, new developments in the IP technology lead to new applications in telecoms or home entertainment almost immediately. Similar advancements are about to happen in embedded industries in the near future. In 2000 the heads of state and government of the European Union defined the Lisbon Strategy to foster economic growth by innovation, a joint effort of the EU and the Member States. This strategy led to the Seventh Framework Program (FP7). Its main goal is to strengthen the competitiveness of the European industries by embedded technology.

## Embedded technology in the FP7

The FP7 defines ten areas of technology to invest in: 28% of the budget is reserved for Information and Communication Technology, 13% for Transport incl. Aeronautics, Security and Space are as well targets of the program with a budget of EUR 50 521 million in total. Embedded technology is seen as a great chance for Europe's economy. "The major potential of embedded technology to foster the competitive development of systems with innovative and high-quality functionality is the integration of highly specialized domain-specific technology and know-how with flexible, general-purpose IT solutions and methods.", is stated in the fundamental "Study of worldwide trends and R&D Programmes in Embedded Systems in View of Maximising the Impact of a Technology Platform in the Area" which was assigned by the European Commission in preparation for the FP7.

## How the new EU R&D approach concerns SYSGO research efforts

Since the late nineties SYSGO invested into COTS (Commercial-Off-The-Shelf) products to ease the development of embedded systems. In 1999 ELinOS came on the market allowing industrial developers to use for the first time Linux for embedded systems. 2005 SYSGO released PikeOS, a completely new operation system approach bringing

together virtualization, the latest IT technology, and the requirements of embedded real-time systems. When FP 7 was launched in 2007 PikeOS was ready to serve as a backbone for several EU- as well as national research projects. PikeOS is deployed as the foundation for innovative products to be developed from scratch, to integrate new technology into existing machinery, to improve efficiency, to reduce development cost, and fasten time-to-market.

## What PikeOS brings in

The commercial success of embedded devices is relative to innovation skills in proportion to development costs. Instead of providing a one-shot solution hardly to extend, PikeOS enables a new concept of embedded systems development that includes adaption to and integration of emerging technologies across markets: PikeOS brings virtualization to embedded systems, the latest hot technology in the IT sector. PikeOS offers all the advantages of the virtualization concept but adapted it to embedded systems needs, such as real-time capability, safety, and security, thus making innovative products flexible for future changes. In several FP7 projects PikeOS is the platform of choice allowing to create synergies across vertical markets and to leverage development costs of embedded devices.



**EU-Project: SCARLETT**

SCAlable ReconfigurabLe Electronics plAtforms and Tools

**Time frame:** 2009 - 2011

**Website:** <http://www.scarlettproject.eu/>

**Partners:** Thales-Avionics, Arttic, Airbus Franc, Airbus Germany, Airbus UK, Diehl Aerospace, GE Aviation Systems, AcQ InduCom, Alenia Aeronautica, Arion, Barco, Dassault Aviation, EADS Germany, Galileo Avionica, GosNIIAS, Hellenic Aerospace Industry, Instituto de Soldadura e Qualidade, Messier-Bugatti, Naturen, National Aerospace Laboratory, SYSGO, ONERA, QinetiQ, Saab, Sagem Defense Sécurité, SkySoft Portugal, Sydera, Thales Avionics Electrical Systems, TTech, Unis, University of Bremen, TU Hamburg-Harburg, Rzeszow University of Technology, Yamar Electronics, TELETEL, University of Nottingham, Thales Research&Technology, AOA apparatusbau gauting, Safety System Research Center of the University of Bristol

**Goals:** The SCARLETT project is based on a shared analysis made by the European Aerospace Community, which has identified the need to undertake research leading to a new generation of IMA, defining a scalable, adaptable, reconfigurable fault-tolerant driven and secure avionics platform, namely the DME: Distributed Modular Electronics.

**Results:** PikeOS will serve as the basic platform for next generation IMA

**BMFT-Project: Verisoft XT**

**Time frame:** 01.07.2007 – 30.06.2010

**Website:** <http://www.verisoftxt.de/StartPage.html>

**Partners:** AbsInt, Audi, Bosch, Concept of Truth, DFKI, Microsoft, ESG, Infineon, OneSpin Solutions, Sirrix, SYSGO, TÜV Süd, TU Kaiserslautern, TU München, Universität Bremen, Universität Koblenz-Landau, Universität des Saarlandes, Albert-Ludwig Universität Freiburg.

**Goals:** The main goal of the project is the pervasive formal verification of computer systems. The correct functionality of systems, as they are used, for example, in automotive engineering, in security technology and in the sector of medical technology, is to be mathematically proved. The proofs are computer aided in order to prevent human error by the scientists involved. The knowledge and progress obtained are expected to assist German enterprise in achieving a stable, internationally competitive position in the professional areas mentioned above.

**Results:** PikeOS will be formally verified after Common Criteria EAL 7

**EU-Project: TECOM**

**Time frame:** 01.01.2008 – 31.12.2010

**Website:** <http://www.tecom-project.eu/>

**Partners:** Technikon, Infineon, Amtec, TU Dresden, SYSGO, Sirrix, EADS Dense and Security, Aonix, Mixed Mode, Trusted Logic

**Goals:** The Trusted Embedded Computing (TECOM) project, an EU-funded consortium of eleven partners, aims at developing trusted computing solutions for embedded platforms, which means, that TECOM ensures especially the security and safety of embedded computing systems and infrastructures.

**Results:** PikeOS will serve as safe and secure virtualization platform

**EU-Project: JEOPARD**

Java Environment for Parallel Realtime Development

**Time frame:** 01.01.2008 – 30.06.2010

**Website:** <http://www.jeopard.org/>

**Partners:** aicas, EADS Deutschland, FZI Karlsruhe, SkySoft Portugal, Technical University Cluj-Napoca, University of York, RadioLabs Rome, SYSGO, TU Vienna, The Open Group.

**Goals:** The strategic objective of the JEOPARD project is to provide the tools for platform-independent development of predictable systems that make use of SMP multicore platforms. These tools will enhance software productivity and reusability by extending processor technology already established on desktop systems for the specific needs of multicore embedded systems. The project will actively contribute to standards required for the development of portable software in this domain, such as the Real-Time Specification for Java (RTSJ).

**Results:** PikeOS will be ported to multicore platforms.

**EU-Project: INTERESTED**

INTERoperable Embedded Systems Toolchain for Enhanced rapid Design prototyping and code generation

**Time frame:** 01.01.2008 – 31.12.2010

**Website:** <http://www.interested-ip.eu/index.html>

**Partners:** AbsInt, Airbus SAS, Artisan Software Tools, CEA LIST, Esterel Technologies, Evidence, MagnettiMarelli, Siemens, Symtavision, SYSGO, Thales, TTech, Unis spo

**Goals:** INTERESTED is focused on the creation of the first-ever European-wide, integrated and open reference tool chain covering the full spectrum of embedded systems and software development. INTERESTED's aim is to realize a reference tool chain that is highly dependable, safe and efficient while also reducing the cost of deployment and maintenance by 50%. Delivery of the complete, integrated reference tool chain is expected by the end of 2010.

**Results:** PikeOS will be integrated into a seamless tool chain

**About PikeOS**

PikeOS is an innovative product providing an embedded systems platform where multiple virtual machines can run simultaneously a secure environment. The Safe and Secure Virtualization technology allows multiple operating system APIs to run concurrently on one machine, such as an ARINC-653 application working together with full user-mode Linux.

The PikeOS separation microkernel architecture allows it to be used in cost sensitive, resource constrained devices as well as large, complex systems. The simplicity and compactness of the PikeOS design results in real-time performance that competes head-to-head with conventional proprietary RTOS solutions. PikeOS is certifiable to the DO-178B standard, and is also MILS compliant. PikeOS is hardware independent, allows legacy code reuse and has the largest set of supported APIs (called Personality) in the market.

**About SYSGO**

SYSGO provides operating system technology, middle ware, and software services for the real-time and embedded market. A differentiating capability of SYSGO is the secure PikeOS paravirtualization operating system which is built upon a small, fast, and safe micro kernel. It supports the co-existence of independent operating system personalities on a single platform, including ELinOS, SYSGO's embedded Linux distribution. SYSGO supports international customers with services for embedded Linux, real-time capabilities and certification for safety-critical applications. Markets include Aerospace & Defense, Industrial Automation, Automotive, Transportation and Network Infrastructure. Customers include Airbus, Honeywell, Thales, Daimler, Raytheon, Rheinmetall, Rockwell-Collins, Siemens, and Rohde & Schwarz. SYSGO has six facilities in Europe, including Germany, France, and The Czech Republic and offers a global distribution and support network, extending to North America and the Pacific Rim.