

ARTEMIS Joint Undertaking

Dubbed the 'neural system of society', embedded systems pervade all areas of life, from mobile phones to space probes, and cars and planes to healthcare systems. ARTEMIS JU President **Klaus Grimm** relays how Europe is striving to become a world leader in their production

Firstly, can you outline the mission behind your organisation and how the ARTEMIS Industry Association links with the ARTEMIS Joint Undertaking (ARTEMIS JU)?

ARTEMIS aims to establish a new, holistic approach to research, technology development, innovation and skill creation by means of innovation ecosystems that are sustained by 'eco-alliances' and 'co-competition'. ARTEMIS will thus benefit from the advantages created by both cooperation and market competition, breaking the barriers that may exist in various other models, and redefining the value chain. This will increase the efficiency of technological development and, at the same time, enhance the competitiveness of the market in the supply of embedded systems technologies. Therefore, the ARTEMIS vision nurtures the ambition to strengthen Europe's position in embedded intelligence and systems and to ensure world-class leadership in this area by establishing an environment that supports innovation, stimulating the emergence of a new supply industry and avoiding fragmentation of investments in R&D.

The vision of the ARTEMIS Industry Association is one in which humankind will benefit from a major evolution in our society in a world widely supported by intelligent embedded systems. This is a world in which all systems, machines and objects become smart; have a presence in cyberspace; exploit the digital information and services around them; communicate with each other, with the environment and with people; and manage their resources autonomously. The ubiquitous presence of the Internet provides the communication infrastructure for smart objects to be connected. The ARTEMIS Industry Association mission is, through

European leadership, to help to realise this ARTEMIS vision. In particular, by participating in ARTEMIS JU, ARTEMIS Industry Association supports ARTEMIS's ambition to establish collaborative innovation ecosystems by stimulating the emergence of self-sustaining European groups of actors involved in embedded systems innovation. The pan-European projects in the Joint Undertaking give an enormous boost to achieving this.

As the first association of its kind, ARTEMIS JU brings together private-sector research actors, the European Commission and a large number of contributing Member States. What benefits has this technology platform brought to its members?

ARTEMIS is the first publicly-funded R&D programme to achieve a European footprint and critical mass large enough to create the environment necessary for true innovation in its domain. By assuring a focus on technological solutions for major societal concerns, the taxpayer gets a good return on his/her money. ARTEMIS is still a young programme but after three calls yielding 35 projects, we can already see the first successes. A few projects from ARTEMIS JU have been completed, and with the results from many others in the pipeline, we see clusters of transnational expertise growing, especially in those areas of affordable healthcare and wellbeing, green, safe and supportive transportation, smart buildings and communications of the future. These projects have already prompted ecosystem clusters to apply for the 'Centre of Innovation Excellence' label, which is awarded to those centres that fulfil the ARTEMIS



Industry Association's criteria as role models for European transnational eco-systems in Embedded Systems.

What are embedded systems are and where they can be found?

Embedded systems are electronic devices that invisibly bring together semiconductor technology and software to make real, working products. They enable such commonplace things as mobile communications such as GSM. They also enable the reduction of fuel consumption and pollution by cars; ensure the safe and efficient flight of aircraft; and manage our energy use to help reduce our carbon footprint. They can also be used to help keep us healthy, thereby reducing the cost burden of healthcare. The computer, software and the Internet, highly visible in the workplace, have fundamentally changed the way we work and do business. Now the same technological ideas are used invisibly to make better, cheaper, more interesting, more economical and safer products – these are embedded systems.

Putting electronic devices and software together is not trivial, especially when the end product must work faultlessly and continuously in often difficult and aggressive environments. If your office or home computer fails you, it's inconvenient at worst. If a computer in your car, aeroplane or factory were to fail, or if medical equipment were not to work, the consequences can be literally fatal, let alone very expensive. But these systems are now indispensable in our present world.

Could you explain how embedded systems will help make life healthier and more secure? What difficulties that we face in daily life do you hope these systems will address?

Internet-connected intelligent embedded systems will provide the core solutions for the big societal challenges like affordable healthcare and wellbeing, green and safe transportation, reduced consumption of power and materials, reduction of food waste, smart buildings and communities of the future, and a sustainable approach to use of natural resources. Such solutions to our pressing societal challenges will spur European competitiveness. Europe can address these challenges by using sophisticated embedded systems R&D resources in industry and research institutes if coordinated well and funded adequately. In the 2011 Strategic Research Agenda (SRA) we explicitly connected societal challenges to ARTEMIS research and innovation.

By enabling systems that monitor the health of people before they fall ill, individuals may actually be prevented from becoming ill in the first place, and the healing process can be enhanced for those that do become ill. Embedded systems will help the performance of systems in monitoring and reducing pollution, traffic congestion and energy consumption as well as monitoring food contamination and food logistics to ensure freshness. Many systems will be mobile and interconnected, and intelligent embedded systems will be part of our future traffic control system in cars and aeroplanes to ensure safety and reliability. Many applications and services will be enabled that are beyond the scope of our imagination of today.

Compared to the rest of the world, where does Europe stand in the development of embedded systems? Have ARTEMIS IA and JU served to advance this position?

Europe still has a relatively good position in the embedded systems domain: look, for instance, at the European automotive, aviation and communication industries. However, the products with all their embedded systems included are becoming so complex that no single company has all the necessary expertise for all the aspects relevant to its products and services. This means that there is an increasing

need to rely on the expertise of companies, institutes and universities in properly functioning ecosystems to manufacture state-of-the-art, competitive products and services. The JU projects are already a significant catalyst for achieving this, underlined by two new Centres of Innovation Excellence (ProcessIT.EU and EICOSE), which are consortia of cooperating organisations that focus on the R&D of embedded systems.

What is the economic impact of embedded computing technologies in terms of jobs and growth, and what kind of research is ARTEMIS JU seeing in the response to its calls for proposals?

Embedded systems are incorporated in many (sub)systems of complex products and services. Very often, the manufacturers of these products and services rely on those suppliers that are responsible for the functioning and testing of subsystems. In the automotive industry for example, 80 per cent of all product innovation comes from the development of embedded systems. ARTEMIS JU is involved in all aspects of pre-competitive R&D, as well as the search to find commonalities in approaches for cross-fertilisation between the various application areas.

ARTEMIS highlights two parallel sets of industrially-driven research objectives to help resolve the above: technical solutions that form the basis of developing the pre-competitive industrial goals by tackling the complexity of new systems through improved designs and implementation processes and tools; and research into technology that will offer completely new solutions to the technical barriers that hinder progress towards the goals of application context.

Are there any other aspects of the ARTEMIS mission, objectives or vision that you would like to discuss?

The last call for projects for ARTEMIS JU will be in 2013. We, the ARTEMIS Industry Association, are in discussion with the Commission and Member States for a follow-up programme/initiative that should organise a call for projects from 2014 onwards. We appreciate that a successor programme is essential if Europe is to achieve the level of competitiveness needed to keep apace in the global race for ICT-based solutions to societal challenges, as targeted by the European Digital Agenda. Embedded systems are a crucial technology for Europe's industrial and societal future. Although we might not be aware of the daily interactivity with embedded computing systems with which we surround ourselves all the time, they represent a key enabling technology that must not be underestimated at any time.

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