ARTEMIS Industry Association

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Co-summit 2015 summary

FOREWORD

Dear ARTEMIS friends,

In March of this year we had our 7th Co-summit with ITEA, this time in Berlin and for the first time in the spring of the year. The amount of participants, being 719, was an all time high, proving that our combined Community of Embedded Systems and Software Innovation is continuously increasing. No surprise of course, because new products in whatever application area seldom do without Embedded Systems and software.

During the Co-summit ARTEMIS-IA and ITEA had a meeting with the public authorities in which the importance of the Co-summit with its exhibition of funded projects was confirmed; in this meeting ARTEMIS-IA and ITEA indicated that the yearly Co-summit will be continued in the spring, most probably with a new name starting in 2016.

You will find several articles in this magazine about the topics that got attention during the Co-summit, and you will find an interview with Jutta Schneider from Daimler, who gave a keynote speech at the Co-summit. She underlines the importance of Embedded Systems and software for her company and her plea is that for the funded projects in ECSEL there should be a proper balance of Embedded Systems projects against Nano-electronics projects reflecting the revenues and employment in the automotive industry.

Important for ARTEMIS-IA as European association is to monitor activities on Embedded and Cyber-Physical Systems in the various European countries. After highlighting the activities in Germany and Austria (by their ECSEL Germany and ECSEL Austria communities) in previous magazines this time you will find a contribution of Spain.

In the 2015 ARTEMIS Summer Camp, to be held in June of this year, a start will be made with an update of the ARTEMIS SRA, our important ETP document on Embedded and Cyber-Physical Systems. Of course we will take into account many inputs from adjacent technology areas. One of them is HiPEAC (High Performance and Embedded Architecture and Compilation), a FP7 European Network that issued its Vision 2015 earlier this year. You will find an article about their activities in this magazine.

Recently our Working Group "Business Impact & Metrics" published its 3rd report on the impact of the ARTEMIS-JU projects, of which the majority of projects came to an end. You will find an article about this topic that reveals as significant impact: improved product maturity, increased productivity, higher competitiveness, faster time to market and new business opportunities.

I wish you a lot of reading pleasure.

Jan Lohstroh
Secretary General, ARTEMIS Industry Association

CONTENTS

Spanish update: WHAT'S HAPPENING IN SPAIN?

by Roberto Uribeetxeberria

The productive fabric of Spain is characterised by: (a) the significant predominance of SMEs; (b) a strong presence of traditional sectors with low incorporation of R&D in their processes and products along with predominantly non-industrial activities that essentially corresponds to a service economy and, (c) a still considerable volume, in the industrial sector, of manufacturing oriented activities.

Despite these limitations, Spanish companies have acquired certain international leadership skills by introducing both multiple technological and non-technological innovations. However, global competitive pressure, a deterioration in the position of the Spanish economy and the negative development of effort and investment in R&D&I indicate that the future growth of the Spanish economy and employment are directly associated with capacity of enterprises and especially SMEs to innovate. Companies should grow in size and technological skills, incorporating innovation as an essential part of their business model.

The Spanish strategy of science, technology and innovation 2013-2020 (developed by the Spanish Ministry of Economy and Competitiveness) is a tool to enhance the overall capabilities of Spanish science, technology and innovation, with special attention to enhancing industrial leadership in R&D&I. One of the main goals is to increase the number of companies that innovate to improve their competitiveness and sustainable development.

On the other hand, the Spanish strategy is also aligned with the objectives of "Horizon 2020". It addresses the universal challenges of our society's search for solutions capable of responding to both present and future demands as well as promoting scientific, technological and business leadership of the country in all those segments in which there is high potential for global growth: (1) Health, demographic change and wellbeing, (2) Food safety and quality; productive and sustainable farming; sustainability of natural resources, marine and maritime research, (3) Secure, sustainable and clean energy, (4) Smart, sustainable and integrated transport, (5) Action on climate change and efficient use of resources and raw materials, (6) Social changes and innovations, (7) Digital economy and society and, (8) Security, protection and defence.

In a digital and interconnected world, software, embedded intelligence and connectivity are key. The Embedded and Cyber-Physical Systems sector contributes to the digital world by creating technological solutions with high impact on production sectors and the whole of society.

In a globalised economy, Embedded and Cyber-Physical Systems are one of the key areas for a country's international competitiveness. Spain is a strong competitor with global relevance in Embedded and Cyber-Physical Systems in sectors such as energy production/management, health or industrial automation, and has significant interests in sectors such as multimedia, avionics or aerospace. The wide applicability of Cyber-Physical Systems in different sectors as well as the added value they bring, makes the R&D&I on these systems a preferred strategic area for Spain and Spanish companies seeking competitiveness. This is a vision also shared by ARTEMIS-IA.

Consequently, in accordance with the relevance of Cyber-Physical Systems within its strategy, Spanish authorities have supported ECSEL-JU (and ARTEMIS-JU before) allocating a significant budget despite the difficulties of the country during this enduring economic crisis.

In order to improve the effectiveness of investment, encourage diversification and create new areas of opportunity, we should concentrate resources and investment in R&D&I in technologies where there are clear synergies with the production capacity of the regions in line with European research and innovation strategies. In pursuit of this objective it will especially be relevant to have the scientific and technological talent needed in priority areas like the Embedded and Cyber-Physical Systems. The Strategic Research and Innovation Agenda 2015–2020 that Planetic (www.planetic.es) is preparing defines a map of ICT technology domains of interest to Spanish industry. This strategic agenda will constitute an important reference document and will focus on the technological challenges for the three dimensions identified: digital interaction, integrated intelligence and ubiquitous software, all of which are aligned with the ARTEMIS-IA objectives.

CO-SUMMIT BERLIN 2015

SMART INDUSTRY: IMPACT OF SOFTWARE INNOVATION

by Chris Horgan

The Berlin Congress Center, bordering the iconic Alexanderplatz and its television tower, played host to the ARTEMIS Industry Association-ITEA 3 Co-summit, an event that showcased the impact of Cyber-Physical Systems and software innovation on Smart Industry. The projects that provided evidence of this impact and which filled the exhibition floor ranged from the autonomous ambulant WALL•E-looking robot (R5-COP), a smart solution for dirty and dangerous jobs, to a group of men in hardhats and hazard warning vests (BaaS) promoting the use of novel value-added services and applications for smart commercial buildings (both, coincidentally, winners of the Exhibition Award).


BUSINESS
IMPACT
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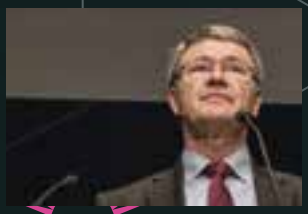


But this two-day event was not about gimmicks, even though the range and diversity of the projects captured the imagination of the more than 700 participants and visitors. In an event that highlights the impact of the two programmes on business, industry and society, this Co-summit in particular demonstrated the key role of ARTEMIS and ITEA projects in the creation of new, smart manufacturing and processing.

THE BACKBONE OF SMART INDUSTRY

In the keynote addresses that opened the Co-summit, prominent speakers from the German government, the European Commission and industry all stressed the irreversible progress of Smart Industry, or Industrie 4.0. Herbert Zeisel, head of the German government directorate for Key Technologies for Growth, pointed out that "Cyber-Physical Systems are the backbone of Industry 4.0." Khalil Rouhana, the European Commission's Director for Components & Systems at the DG CONNECT, was forthright in his conviction that "large digital opportunities lie ahead of us in areas where Europe is strong", but added that "our big challenge is to develop a common strategy for software with complementary implementation mechanisms." Finally, Jutta Schneider, Director of eDrive and Software Technologies at Daimler AG, underlined the importance of "software innovation as a key driver for a green, connected and autonomous mobility."

In the theme speech that followed the keynote addresses, Heinrich Daembkes, President of ARTEMIS Industry Association, referred to the increasing influence that software is having on the entire value chain, "even defining the features of products and thus their competitiveness – it determines whether or not you will succeed in the marketplace." He added: "ARTEMIS Industry Association is actively supporting the industry to address the public authorities with their insights to ensure priority is given to investments in Cyber-Physical Systems." Rudolf Haggenmüller, ITEA Chairman, reiterated the role of projects "at the heart of business, one in which software innovation has a huge impact."

THE EVOLUTIONARY PROCESS THAT IS REVOLUTIONISING INDUSTRY

The panel discussion on the Co-summit theme on the Wednesday morning, moderated by Speak-Easy's Cathy Smith (former BBC correspondent), featured Thomas Lagerberg (ABB), Egbert-Jan Sol (TNO), Mürzel Yildiz (KaTron, an SME) and Carsten Rossbach (Roland Berger). While acknowledging the crucial role of software innovation and Cyber-Physical

Systems in Smart Industry, Egbert-Jan Sol, who is leading the Dutch Smart Industry programme, suggested that we should be looking "not simply at software innovation, but also at business innovation and social innovation" if we are to both understand and facilitate the evolutionary process that is revolutionising industry. Thomas Lagerberg of ABB went further when he claimed that it is all well and good to have "all this big data and connectivity, but it is important to ask: what's in it for me, how can I make

money out of it? We have to demonstrate the benefits to people." And Mürzel Yildiz was quick to point out that the Smart Industry engineers of the future will need to have a multidisciplinary perspective – hardware, software, customer demand, aesthetics, business contexts – while Thomas Lagerberg echoed the need to understand what drives young people to spend so much time playing computer games and utilise that human potential for employment in the Smart Industry." A new type of manufacturing, driven by software innovation, but also requiring different business models and a different skills package. On top of this, "for Europe to be competitive in the Smart Industry domain," suggested Carsten Rossbach, "standardisation, financing and cooperation are essential." In the afternoon, the ARTEMIS Community Session also featured a panel discussion, focusing on what had to be done to strengthen R&I in the domain of Embedded and Cyber-Physical Systems in Europe in order to implement the recommendations of Vision 2030 (see Community Session article).

Speakers corners offered insight into Smart Industry trends, such as the future of automated driving with a focus on secure connectivity and the role of Cyber-Physical Systems as a key technology in the connectivity. Or the dilemma of financing healthcare, in which Philips believes that the clever linking of Cyber-Physical Systems could reduce the costs of realising requirements, met by a holistic approach to the healthcare system chain.

DEMONSTRATING THE IMPACT

This Co-summit set its sights firmly on demonstrating the impact – technological, business and societal – of the seventy-plus projects exhibited. In the ARTEMIS and the ITEA Community sessions, the excellence and achievements of the projects were highlighted. Alun Foster, Head of Dissemination for ECSEL Joint Undertaking, paid tribute in the ARTEMIS Community Session to the many completed diverse projects whose industrial and societal impact has been considerable. As an example he cited the Reference Technology Platform developed by the MBAT project that helps Europe gain a leading edge in affordable and effective validation and verification technology. He also made special mention of IoE, whose focus was connecting the internet to energy grids to create an electric mobility infrastructure, and High Profile, where better imaging of the central nervous system and the head/neck area will improve diagnostic treatment of neurological diseases and be extendable to the whole field of advanced medical imaging. Philippe Letellier, Vice-Chairman of ITEA, reflected not only on the exceptional standards achieved in the past year, but also on the significant and tangible business impact generated by the projects, three in particular: EASI-CLOUDS (federated cloud-computing), MEDIATE (image-guided intervention techniques) and SAFE (functional safety in the automotive industry).

In his address at the closing of this Co-summit, Heinrich Daembkes, President of ARTEMIS Industry Association, reflected on the past two days, confirming that "the combined community of ARTEMIS-IA and ITEA is very much alive with a lot of good ideas that are being transformed into applications." This also signals the beginning of a new phase of impactful projects that will help support European industry and benefit society worldwide.

PROJECT HIGHLIGHTS CO-SUMMIT

by Chris Horgan

Among the virtuous circle of impressive ARTEMIS projects at the Co-summit in Berlin was a trio that highlighted the depth, variety and impact that consortia are having on the Embedded and Cyber-Physical Systems community, as well as providing fellow participants and visitors of the Berlin Congress Center with plenty of food for thought and inspiration.

MAKING THE LIFE OF WSN DESIGNER EASIER

Stand 10 featured a Wall of Fame inductee in **WSN DPCM** and recipient of the ARTEMIS-JU Recognition Award during the closing session when Daniel Rodriguez of MTP, the Spanish SME that coordinated the 42-month long project, received the commemorative plaque from Alun Foster, ECSEL Joint Undertaking's Head of Dissemination.

The stand attracted many visitors who were intrigued to find out more about the WSN DPCM toolset platform. And they were not disappointed as a live demo of a set of tools showed people some of the current capabilities of the platform accessible from a web interface. The WSN DPCM toolset platform has been created for use in the design, planning and simulation, deployment and commissioning phases of the WSN building and set-up processes.

It is a methodology that is software-assisted and supported by a variety of engineering tools, simulators, web services and applications provided by the platform plus embedded support provided by a service middleware installed into the WSN nodes. The demonstrators empirically validate the integrated toolset and measure the contribution of this project to ARTEMIS targets, as well as analysing costs, development cycles, skills, effort, risks and time to develop the proposed demonstrators using the design platform.

Those who witnessed this live demo became convinced of the virtues of the DPCM toolset in being able to make the life of WSN designer easier. Moreover, the project's representatives gained invaluable feedback by talk and interacting with other participants and exhibition visitors.

Projects like DEWI and SITAC, along with representatives from academia and private companies like Polar, showed interest in the project's achievements, as well as the platform's future developments and extensions. All in all, then, a highly successful exercise.

LOW-POWER, HIGH-PERFORMANCE COMPUTING

The main focus of the neighbouring **stand 16** was the development of a new, many-core programmable accelerator platform for smart cameras and gateways. **COPCAMS**, an acronym for COgnitive & Perceptive CAMeraS, leverages recent advances in embedded computing platforms to develop large-scale, integrated vision systems, aiming to exploit new programmable accelerators, particularly many-cores, to power a new generation of greener, low-power smart cameras and gateways.

With vision systems that analyse images from multiple cameras increasingly


DAIMLER
COMPLETED
ASAM

becoming the norm, be it in large-scale surveillance, advanced manufacturing or traffic monitoring, visitors were treated to early technology demonstrators of the project's three main target domains: large area surveillance, advanced manufacturing applications and indoor and outdoor surveillance. The COPCAMS vision is to push low-power, high-performance computing to the edge of the system and in the distributed aggregators. These "smart cameras" and "smart aggregators" will process video streams, extract significant semantic information and decide locally whether or not the streams' content is of interest and is worth propagating. The decentralised, distributed decision-making will save both energy and bandwidth, while opening up opportunities for new distributed applications.
With a rich and open ecosystem fostering the growth of a community of users able to easily share research efforts and, through composability and re-use of standardised components, allow for a dramatic reduction of development times and enable wide cross-domain deployment, the COPCAMS team offered plenty of attractive propositions across the whole value chain. Visitors and fellow participants, both academia and SMEs, were pleased to discover that they will soon have advanced many-core platforms to test and optimise innovative vision, coding and cognitive algorithms. And with the ecosystem of users, the possibility to explore new market opportunities will also be boosted, while system integrators will benefit from the powerful platforms being developed in COPCAMS by being able to offer a new generation of vision-related products. And last, but not least, service providers will be able to capitalise on the COPCAMS system to provide value-added services to end users, way beyond what can be offered today. Something for everyone, then, at stand 16.

RESPONDING TO A MAJOR INDUSTRIAL NEED

Finally at **stand 13**, just around the corner from both stands 10 and 16, the **VARIES** project displayed its wares, a platform to enable Embedded Systems developers to maximise the full potential of variability in safety-critical Embedded Systems. With the focus on safety-critical, it was hardly surprising that the booth drew the attention of other Co-summit participants.

The main goals of this project centre on delivering a complete reference platform for managing variability in safety-critical Embedded Systems and particularly the creation of safety-critical systems through a Product Line approach. By building on existing standardisation efforts in the area of product lines, VARIES will boost interoperability and industrial impact. The ability to deliver new products with speed, diversity, high quality and at an acceptable cost is essential to manufacturers and system integrators if they are to succeed or even survive. So in facilitating the management of increasingly complex products and processes with a reduced effort and dealing with uncertainty while maintaining an independent hardware and software upgradability all along the life cycle, VARIES is really responding to a major industrial need.

In addressing this very concrete demand in the domains of automotive, healthcare, industrial automation, security and telecommunication applications, the VARIES Platform comprises a complete, cross-domain, multi-concern, state-of-the-art reference platform for managing variability in safety critical Embedded Systems. With respect to the safety-critical aspects, special attention is also being paid to the impact of reuse and composition on certification. In this platform, different tools support the *process flow* of development for Embedded Systems product variants, over the whole product lifecycle, tailored to the specific context of a given company. Finally, the establishment of a Centre of Innovation Excellence will support the European Embedded Systems industry. No wonder that this stand had a busy two days.

CO·SUMMIT 2015

SMART INDUSTRY: IMPACT OF SOFTWARE INNOVATION

With over 700 registered attendees – participants, guests and visitors – the Berlin Congress Center proved fertile soil for all the projects represented at the exhibition. The three projects highlighted here – WSN DPCM, COPCAMS and VARIES – exemplified the strength and synergy of collaborative effort between academia and industry, between large organisations and SMEs, in taking on the challenges faced by European industry in the Embedded and Cyber-Physical Systems domain. They also highlight how much positive impact can be achieved in terms of knowledge, business and society. What was evident throughout the exhibition floor was the tremendous enthusiasm shown at all the stands, as well as the willingness to listen and engage in conversation, to also speak in the language of the layman so that the complexities inherent in many of the projects were explained in a straightforward way.
All this fostered a high level of interaction, networking and, not to put too fine a point on it, pleasure.

PROVIDING AN ENVIRONMENT FOR TECHNOLOGICAL INNOVATION

INTERVIEW WITH JUTTA SCHNEIDER

by Chris Horgan

Europe has a spearhead in delivering advanced high-tech products in several domains, including automotive. ICT and Embedded Systems or Cyber-Physical Systems play a key role in high-tech products. In her keynote address at this year's Co-summit in Berlin, Director of eDrive and Software Technologies at Daimler AG, Jutta Schneider, underlined the importance of "software innovation as a key driver for a green, connected and autonomous mobility" that represents the key future-oriented focuses of R&D work at Mercedes-Benz. In an interview, she considered a number of Cyber-Physical Systems issues that are relevant to Daimler and the European automotive industry.

What is in your opinion the level of the Research & Innovation on Embedded Systems and Cyber Physical Systems (ES-CPS) in Europe in relation to ASIA and the US? Is the EU front-running, is Europe on-par, or is Europe lagging behind?

While Europe may be lagging behind in the more traditional industries, the embedded systems market is certainly a strength and for my particular sector, the automotive industry, we are certainly in a good position, especially the software element. That is not, of course, to say that we must not keep on our toes and do our homework – there is still a lot to be done to keep ahead. And in terms of research and development, we need to keep investing time, money and resources in Europe to allow the kinds of collaborative programmes between academia and industry to flourish and provide an environment for technological innovation.

What are for Daimler the most important priorities in Embedded Systems and Cyber-

Physical Systems research and innovation?
We need multicore architectures for features like the driving and safety, so embedded software in vehicles is one of the major topics at Daimler. What we also need from a European standpoint is integration standards for model-based engineering so we need to get a better descriptional interface between tools and process steps. In terms of prototyping, we need to strengthen modelling to get a good notion of the product at the earliest possible stage from various viewpoints – functions, software cabling – and improve this for the future. And it is through projects like CESAR and MBAT, in which we are involved, also in a coordinating role, that we are making progress.

What are the strong points of existing collaborative R&I programmes (ECSEL, ITEA3, Horizon2020) for Daimler? What aspects of these R&I programmes need improvement?
The European context of these collaborative R&I programmes is important but equally we need to ensure that the focus on software innovation is not allowed to diminish. We are seeing a shift away from this focus in the early phase of the ECSEL joint undertaking, so that is a disappointment as far as we are concerned. If the future direction is semiconductors, then there will not be enough scope for software projects. As a member of the ARTEMIS Steering Board, we are putting a lot of effort into steering ECSEL towards a better direction. It is important that the funding and resources of the programmes in automotive-related development are proportionate to the revenues and jobs generated by the value chain of the automotive industry. So this is something we have to work on. From my point of view, we need to make sure the level of investment – through these European programmes – continues in order for us to stay competitive.

Daimler is a global player. Should collaborative research and innovation projects such as in ARTEMIS and ECSEL in the Embedded and Cyber-Physical domain stick to a European scope, or is a more global approach needed in your opinion?
We are essentially a global company and therefore have a global perspective. And I am in favour of using the developments that are happening globally, but then in favour of the European industry and competitiveness. We need to use European tax revenues to ensure that our industry is strong and that jobs in Europe are secured. We have to be conscious, of course, that other global economic giants, like China, are also addressing their technology challenges, so we have to be at our best to compete in this global arena, and be quick about it. Which is why collaborative R&I projects that focus on Embedded and Cyber-Physical Systems can be so important in helping to generate the technology edge we need.

What are your recommendations to maintain and strengthen the research and innovation in Embedded and Cyber-Physical Systems in Europe? What role should the European Commission take in this?
I think we have very strong industry capabilities in terms of product engineering, and that is something we have to maintain, coupled with cost effectiveness in the future so that we can attract customers with lower prices and a high level of quality at the same time. And this affordable high quality is something we have in terms of hardware and software, so that's a real asset for European industry. And, as I mentioned in my Co-summit address, in meeting the challenge of future green and connected technologies, there is still a lot of work to be done to ensure we have those industrial capabilities in Europe that can compete worldwide. But apart from the industrial capabilities of building and producing cars, it is vital that we strengthen our automotive research and development, which is a special industry in itself. We also need to foster and strengthen capabilities to fuse with the connected world, with the world of Big Data, in a way that maybe also a Google Car would try to do that, for example. I think the automotive industry is not as software driven as it should be and we need a fundamental shift in thinking, if we are to achieve this. This is a change that applies within the whole industry's value chain. To have a European platform is really essential. So what the European Commission could do here, is to support this shift in emphasis, set priorities and provide the right setting for and with these European programmes to improve, for example, the software focus.

ARTEMIS COMMUNITY SESSION

A CALL TO ARMS

by Chris Horgan

In opening the ARTEMIS Community session, Heinrich Daembkes, President of ARTEMIS Industry Association, referred to the newly published metrics report and its focus on the KPIs (key performance indicators) and the increasingly shorter timeframe in which business impact is happening. Another major change since the last Co-summit is the emergence of the new ECSEL Joint Undertaking, of which ARTEMIS is part. Andreas Wild, Executive Director of ECSEL Joint Undertaking, was on hand to give an update on the first year to date, during which the first six months had been devoted to getting the framework and procedures in place, although full alignment of the programmes is not quite there yet. Andreas Wild referred to the impact of Cyber-Physical Systems on European industry and the consumer as "astonishing" and issued a kind of call to arms. "We see the investment in software innovation paying off in terms of operating systems, Internet of Things – big opportunities exist that require big investment. But can we do this on a European level? We should. For the sake of smart industry, smart society, smart energy, smart production."

In the panel session that followed on "How to strengthen the R&I in the domain of Embedded & Cyber-Physical Systems in Europe to implement the recommendations of Vision 2030", a familiar and well-loved face took on the role of moderator: former ARTEMIS-IA President, Klaus Grimm. He introduced the panellists, Kees van de Klauw of Philips Research, Christian Hahner of Daimler AG, Max Lemke of the European Commission and Jean-Marie Dautelle of Airbus.

BELIEVE IN OURSELVES IN EUROPE

Kees van de Klauw suggested that while European industry was in an excellent starting position to exploit developments in CPS, past performance could not be a guarantee for the future. "We have to stimulate collaborative platforms," he said, but at the same time, "we must embrace the concept of separation of concerns – a nice way of saying 'mind your own business' – both technically and culturally. By doing everything together I think we hold ourselves hostage. We have to believe in self-fulfilling prophecies and in ourselves in Europe. The US and China are exploiting monolithic markets so we have to be clever in our highly diverse market. And this is where these collaborative research and innovation communities can really make a difference. But R&D is not the same as innovation. You really need end users to become involved in your process."

SOFTWARE CRUCIAL TO THE FUTURE OF MOBILITY

Christian Hahner picked up the baton and ran with the automotive theme, looking at the future automobile and automobility. Taking the Google Car business case as an example, mobility can be considered as a service, while the Daimler concept car [introduced the previous day in Jutta Schneider's address] "gives you a choice: to drive yourself or be driven. But whatever the choice, software is crucial to

the development." Hahner's clear message was that to stay ahead in the automotive industry, R&D in Europe has to be strong to generate the software needed to be competitive in production. And he exclaimed his surprise that the figures presented by Andreas Wild revealed that "more than 50% of funding goes into in semiconductors but only 4% in smart mobility and 2% in smart production. If I compare that with the added value of these two sectors in Europe today, there is a huge discrepancy and we have to run with it."

BUILDING AND INTEGRATING PLATFORMS

Max Lemke of the European Commission, responsible for directing R&D policy, urged all industry from high-tech to low-tech to seize digital technologies whereby research and innovation facilitate the implementation. "We see three dimensions of digital value: ICT, processes & production, and business cases. And there are several challenges we face in this regard, including fragmentation – a diversity of companies, industries, nations, production scattered all over the world – and the need for standardisation and interoperability of technology platforms. Arrowhead is a good example of platform integration. And the skills workers of the future will need to work with digital technology. As the European Commission, we have to try to facilitate the widespread adoption of digital technology in all sectors. ECSEL programmes are the key instruments in building platforms for Cyber-Physical Systems or Factories of the Future, and these must be European platforms that transcend all member states."

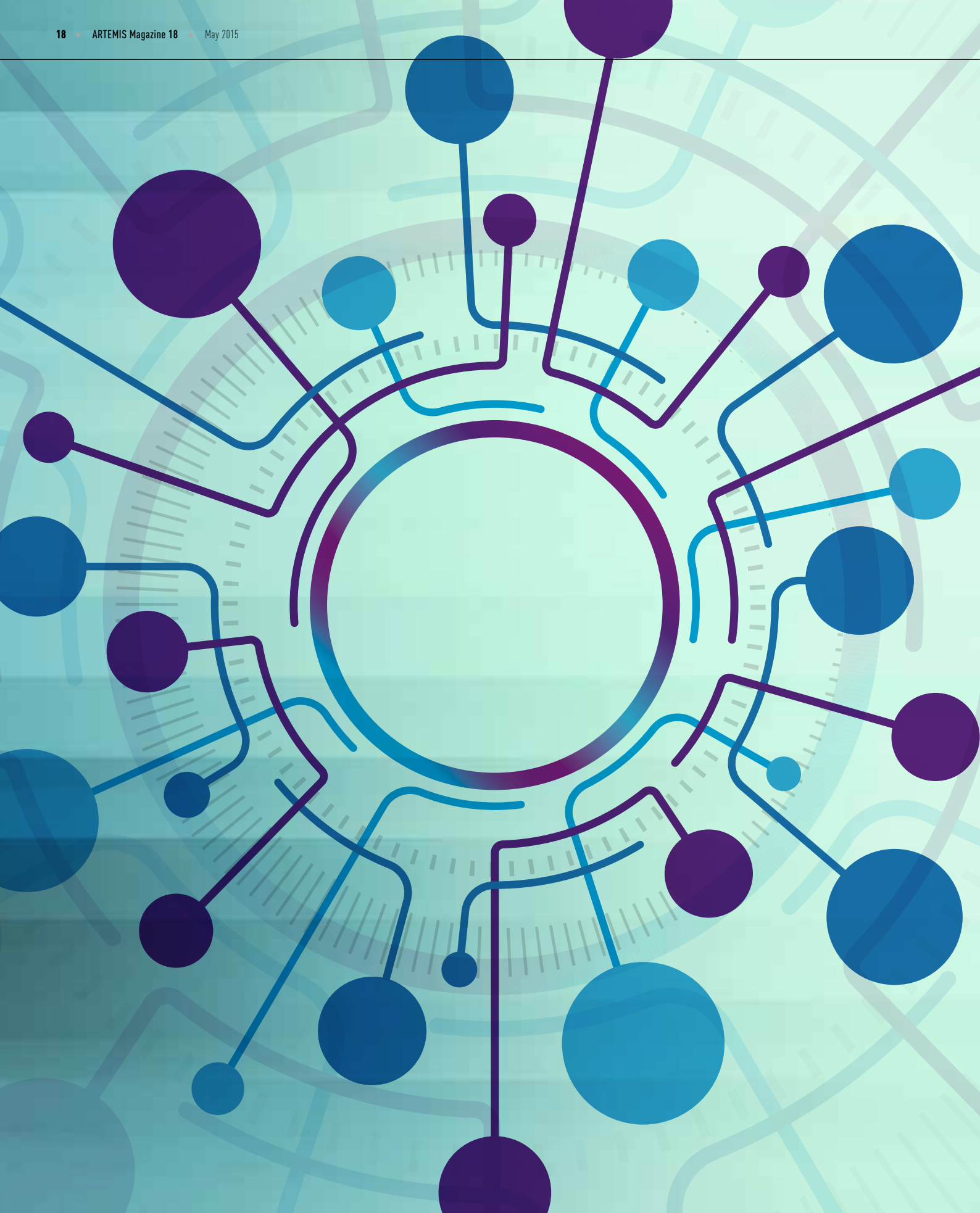
LEVERAGING RESEARCH, DEVELOPMENT AND INNOVATION

Finally, it was the turn of Jean-Marie Dautelle, who had spent some time working in the US and compared the strengths and weaknesses of Europe and the US in R&I in Embedded & Cyber-Physical Systems. He saw the strengths of the communities in Europe particularly in the domains of telecommunications and transport, especially in terms of open standards and diversity of the market, "which can help to leverage research, development and innovation. In addition, the European transfer of research knowledge into products is not hampered by the problems faced in the US, where the technology often has to be transferred from a military research to a civilian application domain." However, Dautelle echoed weaknesses similar to those Kees van de Klauw has pointed to earlier.

REACH OUT TO OTHER ACTORS

Indeed Van de Klauw responded by suggesting that in the US and China, there is much more scope for tolerance – you learn by doing, and mistakes are part of that process – while in Europe the low-risk strategy can slow things down, "so in terms of entrepreneurship and speed, we can learn from that." While admitting that in the US, technology gets to market faster, Christian Hahner suggested that "we should concentrate on what we do best, which is mastering complexity. So not just for the quick and dirty business model, but to enable flexible development year by year, but focused on the market." In a final reflection, Max Lemke looked at a broader, strategic perspective: "We are, in a way, pushing technologies, so we have to see where our centre of gravity is, broaden our community and reach out to other actors, IoT and Big Data for example, across the technology silos and try to create value across the whole value chain."

Following this dynamic and very informative panel discussion, the Community session ended appropriately with the presentation of awards to a number of the completed ARTEMIS projects that had already made their own contributions to strengthening research and innovation in the domain of Embedded & Cyber-Physical Systems in Europe.



CYBER-PHYSICAL SYSTEMS

A BRIEF ANALYSIS OF THE APPROACHES TAKEN IN EUROPE AND THE US

by Alberto Sangiovanni Vincentelli

HISTORICAL REMARKS

The original definition dates back approximately 8 years when a group of academics in the United States realised that *Embedded Systems were evolving* into systems where physical aspects played a fundamental role. The interaction between the intelligence provided by distributed processors that were interconnected with networks of growing complexity AND the physical world where they were immersed could not be ignored or considered of secondary importance.

THE US INITIATIVE

The definition of the research field described by the term Cyber-Physical Systems (CPS) came from a series of discussions of Berkeley and Vanderbilt faculty (Henzinger, Lee, Sangiovanni-Vincentelli, Sastry, Sztipanovits, and Tomlin) who were the PIs for the Center of Hybrid and Embedded Software Systems (CHESS) funded for five years by NSF. The actual name is due, to the best of our knowledge, to Dr. Helen Gill, program director at DARPA first and then responsible for CPS at NSF, and Professor Shankar Sastry. A steering group was formed in 2006 to provide CPS strategic directions for funding agencies of the United States and to the White House. The initiative yielded an Executive Summary sent to the President's Council of Advisors on Science and Technology (PCAST). This action resulted in the introduction of CPS in the agenda of PCAST (see the 2007 PCAST report [Fed07] submitted to the National Coordination Office that highlights CPS as the "number one" Priority for Federal Investments in Networking and Information Technology) and of NSF. The group included (in alphabetical order): Helen Gill, National Science Foundation (NSF), Bruce H. Krogh, Carnegie Mellon University, Edward Lee, UC Berkeley, Insup Lee, University of Pennsylvania, Scott Midkiff, NSF, Al Mok, UT Austin, George Pappas, University of Pennsylvania, Raj Rajkumar, Carnegie Mellon University, Alberto Sangiovanni Vincentelli, UC Berkeley, Lui Raymond Sha, UIUC, Kang Shin, University of Michigan, Jack Stankovic, University of Virginia, Janos Sztipanovits, Vanderbilt University, Wayne Wolf, Georgia Institute of Technology and Taieb B. Znati, NSF. The group had participants coming from a rather diverse background: from real-time systems to control, from design methodology and tools to computer architecture and networking. In 2008 a letter was sent to The Honorable Bart Gordon Chairman Committee on Science and Technology outlining the relevance of the field for the interest of the United States. The definition used in the report was simple to make sure the message could be delivered to the policy makers with great strength: "The integration of physical systems and processes with networked computing has led to the emergence of a new generation of engineered systems: Cyber-Physical Systems (CPS). Such systems use computations and communication deeply embedded in and interacting with physical processes to add new capabilities to physical systems. These CPS range from minuscule (pacemakers) to large-scale (the national power-grid)."

THE EUROPEAN INITIATIVE

The European Community has been somewhat slow in following up on the US initiative focusing on the evolution of Embedded Systems into Systems of Systems and Internet of Things. Only in 2010, acatech (German National Academy of Science and Engineering) started the development of an Integrated Research Agenda for Cyber-Physical Systems that was published in 2011. The definition provided there is more detailed and encompassing compared to the US counterpart; "A Cyber-Physical System (CPS) is a system with embedded software (as part of devices, buildings, means of transport, transport routes, production systems, medical processes, logistic processes, coordination processes and management processes), which:

> Directly records physical data using sensors and affect physical processes using actuators;
> Evaluates and saves recorded data, and actively or reactively interacts both with the physical and digital world;
> Is connected with other CPS and in global networks via digital communication facilities (wireless and/or wired, local and/or global);
> Uses globally available data and services;
> Has a series of dedicated, multi-modal human-machine interfaces."

This document has spurred a strong, positive reaction in the European Community research and industrial communities and the research investments on the two sides of the Ocean tend to balance each other offering important opportunities for collaboration.

INDUSTRIAL INITIATIVES

The interactions between the themes across the Ocean are remarkable: if the interests in CPS originated in the US, recently there has been a very strong interest in the US industry in the Internet of Things domain. Countless initiatives aiming at defining standards for the interactions among sensing, computing and actuating devices over a distributed network have been launched; IC companies such as Intel, TI, Freescale and NXP have invested in defining devices for Internet of Things, system companies such as GE, IBM, and Cisco have invested in defining infrastructures, products and services. In comparison, the European industry has been less bold in investing in this concept taking a more conservative approach. The jury is still out to determine when the market will evolve along the lines of the predictions made by economists and market experts but it is certainly true that the potential for this domain is enormous, touching all aspects of industry.

In the world of CPS, the US industry has been less enthusiastic about adopting the CPS definition but has worked with intensity on preparing for a rather large set of CPS-related devices. Indeed we could make the case the boundaries between Internet of Things and CPS are rather blurred. Among the most interesting moves in what we have defined as CPS, Google has invested in acquiring companies that add physical dimensions to their offering. For example, the 2014 acquisitions of NEST (a thermostat company) and of Boston Dynamics (a robotic company) as well as the development of the autonomous Google car followed by a number of interactions with the automotive supply chain to deliver to the marked this product clearly indicates a strategy that aims at merging the physical and the cyber world.

AUTONOMOUS DRIVING CARS AS AN EXAMPLE OF CPS

To witness this shift in companies known for their presence in communication and Internet, Apple has recently announced its interest in producing an autonomous electric car and has started staffing a design group in this domain. This shift creates a potential disruption in traditional markets where new players with totally different background are making their entry. The reaction to this movement in the CPS domain in the European automotive industry has been quite remarkable. Audi has announced a series of components for autonomous driving and has demonstrated autonomous driving capabilities on the road with impressive results aiming at a commercial car by 2017. BMW and Mercedes have also programs in this domain albeit less aggressive. The response of Dr. Zetsche, Chairman of Mercedes-Benz, to the US threat posed by Apple was: "If there were a rumor that Mercedes or Daimler planned to start building smartphones then they (Apple) would not be sleepless at night. And the same applies to me. And this is full of respect for Apple." The European angle here is that it takes long many years and a strong expertise to develop a car that can be sold in the market. However, Apple has been quite successful entering in a new market completely displacing European leadership in cell phones. In any case, the movement towards autonomous driving has created a number of interesting new devices that can radically change the way we drive cars. NXP has announced that a focus of the merged entities NXP-Freescale will be in inexpensive integrated CMOS radars that will make the necessary sensors for automotive application decrease rather dramatically in price and dimensions.

CONCLUSIONS

This example demonstrates the different approaches taken by the US and Europe in CPS and Internet of Things: a speedier development program in the US, a more cautious but more solid approach from Europe. I believe the opportunities for cooperation are immense since the development of autonomous driving cars and traffic control approaches, of a new breed of medical devices, of a new manufacturing plant architecture, of new infrastructures, of new services, of a new way of life enabled by CPS and Internet of Things does require a world-wide coalition to ensure safety and security for the citizens beyond 2020.

C O L U M N

BATON BLUE(S)

Claude Le Pape, VP Technology Portfolio and Partnerships

From a hotel room in Finland, where he is preparing for an Arrowhead project meeting, Claude Le Pape, VP Technology Portfolio and Partnerships - Optimisation and Analytics Domain Leader - at Schneider Electric, takes over the baton from Jerker Delsing and talks about his involvement with ARTEMIS.

IN THE LIFT

"I first became acquainted with ARTEMIS when I joined my present company some eight years ago where I started doing work on Embedded Systems," Claude recalls. "And if I now look at our involvement in such a major project like Arrowhead, I can see the impact that we can have through such involvement." As Schneider Electric is a leading global specialist in energy management, current European issues like energy control in buildings and industry are particularly important. This was a very good reason for Claude to take the lead in Work Package 1 that focuses on industrial asset and energy optimisation using sensors, analytics and coordination. "For us it is very important to get data from the field, often in very difficult circumstances, which we can then use to detect and resolve problems, improve system efficiency and reduce costs. Let me give you an example. One of the Arrowhead pilot demonstrators aims at optimising the cost of using energy in a lift. We are trying to gather data related to both the energy consumption and use of the lift, recording all the journeys made by the lift – for example, at 8.01 am the lift goes from the ground floor to the fourth floor with a number of people and a total weight of 283 kg, continuing to the sixth floor with 119 kg, and so on. When the counterweight of the lift is less than the weight of the occupants, the lift has to use energy to go up. Going down, the reverse is true. By acquiring enough data on the occupancy patterns, you can develop an energy use scenario and rely on it to manage the energy needs during the day and in the future. This includes storing energy at the right time, optimising the use of green energy, and negotiating terms with the energy supplier."

SYNERGY OF INDUSTRY AND ACADEMIA

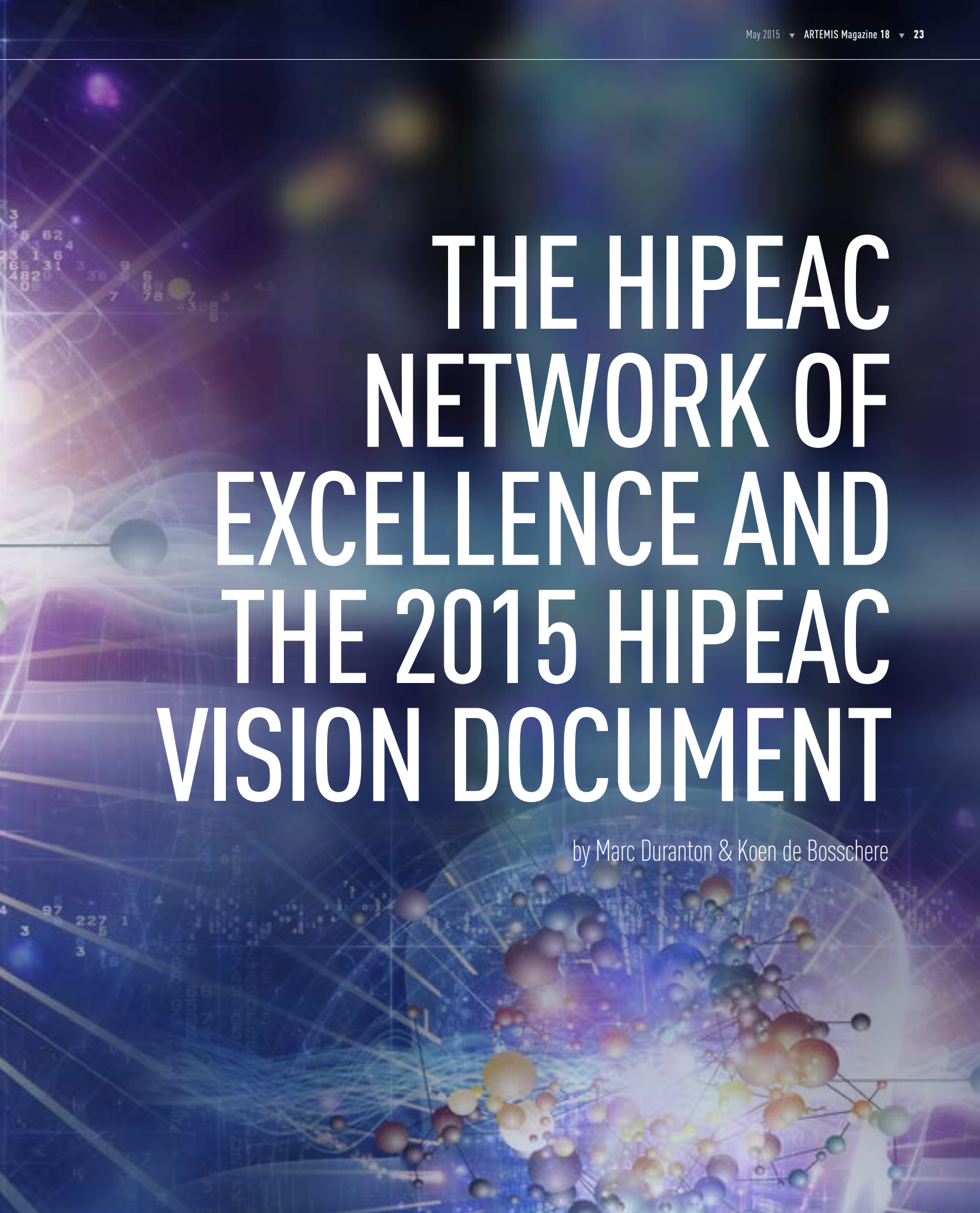
"In a project like Arrowhead I think you see the real value of ARTEMIS – building a community. Such projects get off the ground first and foremost because people have an opportunity to get together, share and exchange ideas, and meet regularly. It is important to share a strategy so that we can altogether make effective progress in Embedded and Cyber-Physical Systems." Turning to the question of making the best use of academic competence within the ARTEMIS industry-driven approach, Claude suggests that "industry has difficult problems that it wants to solve and the research community is used to digging deep to understand the nature of the problem. We, as industry players, need to present the research community with such problems – we cannot solve them on our own and we tend not to have the time that our research counterparts have to work on them. Let me take the example of the quality and integrity of data. This is a topic that is here to stay. We are not going to solve the problem of how to guarantee that the data we use in our systems has not been corrupted or compromised overnight. This really is a crucial issue and we need people in academia to partner industry in solving such problems. And the academics that work on these issues in projects can also use industry to train their efforts on the real practical needs at the sharp commercial end. In the Arrowhead project, this combination of industrial and academic competencies gets a lot of ideas flowing and creates a good balance and two-way benefits."

PROBLEM SOLVER

"I am motivated by solving problems –overcoming complexity to achieve results, whether that is making a building, a system or a process safer, more comfortable or cost-effective. In essence, improving the activity or process I am working on. Optimisation and Analytics are often needed for this purpose. But these can work only if we also make progress in one of the areas I referred to earlier – the quality and integrity of data coming from the field, because the availability of these data is going to be an increasingly vital aspect of our lives in the coming years. It is one of the main challenges faced by R&D in Embedded and Cyber-Physical Systems."

Claude is intrigued to find out more about the role that virtual models and simulations can play and, with this in mind, he invites Marc Frouin of 3DS to pick up where he leaves off.

Claude's music to accompany this column is the music of Morton Feldman, a 20th century composer, whose characteristic sound follows from the use of recurring patterns and rhythms that seem to be free and floating. "The compositional concentration is solely on which pattern should be reiterated and for how long ..." Feldman said. So, in the Internet of Things, which patterns should you rely on, and how long will they remain valid?



THE HIPEAC NETWORK OF EXCELLENCE AND THE 2015 HIPEAC VISION DOCUMENT

by Marc Duranton & Koen de Bosschere

HiPEAC is an FP7 European Network of Excellence on **Hi**gh **P**erformance and **E**mbedded **A**rchitecture and **C**ompilation. Created in 2004, HiPEAC gathers over 370 leading European academic and industrial computing system researchers from nearly 140 universities and 70 companies in one virtual centre of excellence of 1500 researchers. Technically, the current HiPEAC is the third instance of the network. Its mission is to encourage computing innovation in Europe by providing the following instruments:

> collaboration grants, internships,
> the semi-annual Computing Systems Week,
> the ACACES summer school,
> the annual HiPEAC conference that now gathers more than 600 participants,
> actions to reach out to new member states,
> ….

One of the tasks of HiPEAC is to deliver the "HiPEAC vision" which is a bi-annual document that presents the trends that have an impact on the community of High Performance and Embedded Architecture and Compilation.

It focuses on challenges that should be tackled in the coming years – and they are formalised in concrete recommendations in the context of HORIZON 2020. The current document is the 5th since the beginning of HiPEAC. The "HiPEAC vision 2015" is a community document based on information collected through different channels, such as dedicated workshops and meetings, some of them being organised during the HiPEAC summer school (ACACES) or during major HiPEAC events such as the Computing Systems Weeks or the conference, and also from direct feedback from the members.

For the first time in the process of making this document, we have noticed that the community has really *started looking for disruptive solutions, and that incrementally improving current technologies is considered inadequate to address the challenges that the computing community faces*. Even if there is a clear trend towards looking for potentially disruptive solutions, they do not offer short-term solutions. First, there is no consensus regarding which technology is most promising and, second, a promising technology will take years to become mainstream. We nevertheless have to explore various potential solutions and (industrial) champions to push them into commercial products. In the meantime, we will have to manage the ever-increasing application demands with the current technology, which is now evolving more slowly than a decade ago. Secondly, the major challenges identified by the previous vision document such as energy efficiency, dependability and managing sytem complexity are still present, and they have become increasingly important.

More precisely, the document considers that growth will slow down due to the fundamental laws of physics, and that an increasing number of people are getting worried about the adverse effects of the progressively omnipresent use of information technology: loss of privacy, the impact on the job market, security and safety. Devices will be more and more connected, physically entangled, cognitive and smart, and require more and more computational storage and communication resources. To ensure the further growth of information technology and to address these concerns, several key challenges need to be tackled, such as (in no particular order):

DEPENDABILITY, SECURITY: Cyber-Physical Systems and the Internet of Things require the highest possible levels of security, safety and reliability for their adoption. In particular, security has to become one of the primary design features of whole systems. Systems have to be dependable by design.

MANAGING SYSTEM COMPLEXITY: In information science, we are entering the era of systems of systems, with the accompanying exponential growth in

Figure 1

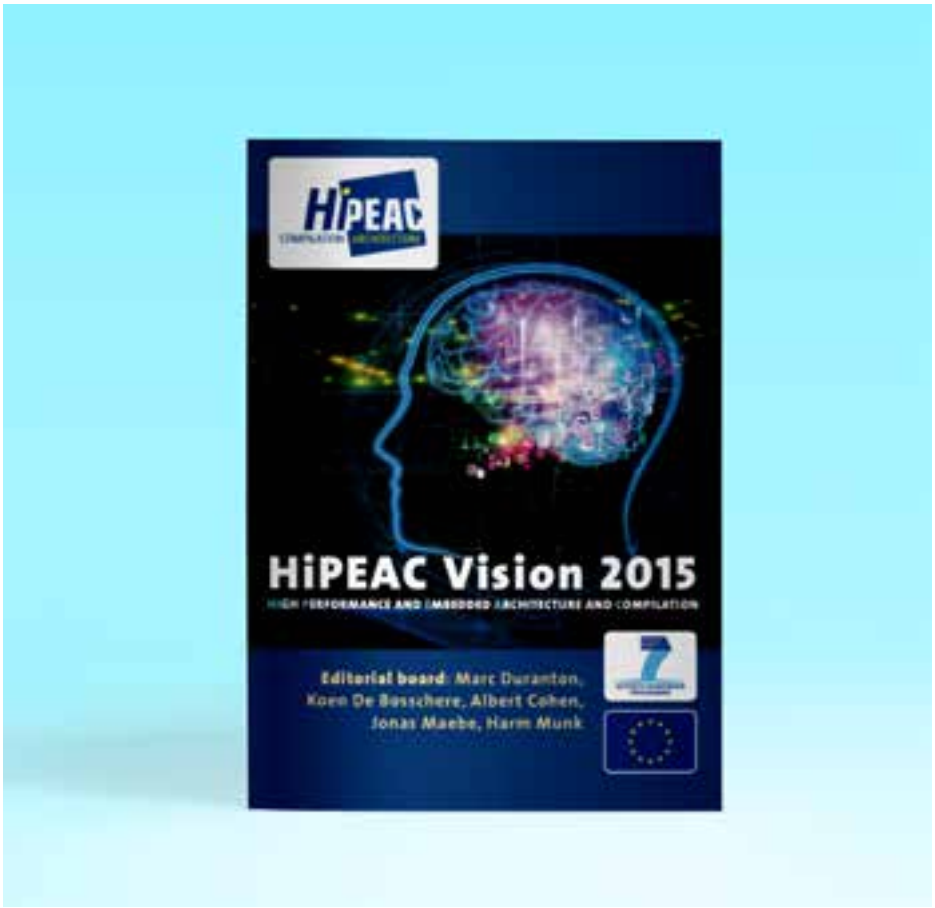
complexity. We need new system paradigms, such as reactive systems and feedback systems to manage this increase in overall complexity.

POWER AND ENERGY EFFICIENCY: We need to overcome energy as the limiting factor for increasing system performance. Instead of over-designing systems and targeting best effort, we need to design methodologies and tools that allow for systems to scale to the desired Quality of Service. We need to investigate methods that allow for information flow and optimisation across system layers. Instead of being locked in silicon-based Von-Neumann architectures, we need to investigate other architectures based on alternative technologies, such as neuromorphic architectures, Bayesian systems, etc.

ENTANGLEMENT BETWEEN THE PHYSICAL AND VIRTUAL WORLD: Information systems will sense, monitor, and even control the physical world via Cyber-Physical Systems and the Internet of Things. Dealing with large amounts of unstructured data will require new approaches to bridge the gap between the physical world and computer systems. As these systems also exercise control over the physical world, safety is a fundamental concern and becomes a primary design constraint.

MULTIDISCIPLINARY: Information systems have moved out of the realm of computer science and moved into the hands of experts in other disciplines. Yet many systems still need to be adapted to the human-in-the-loop paradigm, letting knowledgeable experts concentrate on the what-to-solve instead of the how-to-solve. This requires a multidisciplinary approach to application development.

HOLISTIC: Systems are becoming distributed systems-of-systems of heterogeneous architectures with a wide variety of applications and communication infrastructure. To make effective and especially efficient use of such complex architectures, we have to develop holistic approaches to system design, allowing for non-functional information flow to enable (dynamic) optimisations.

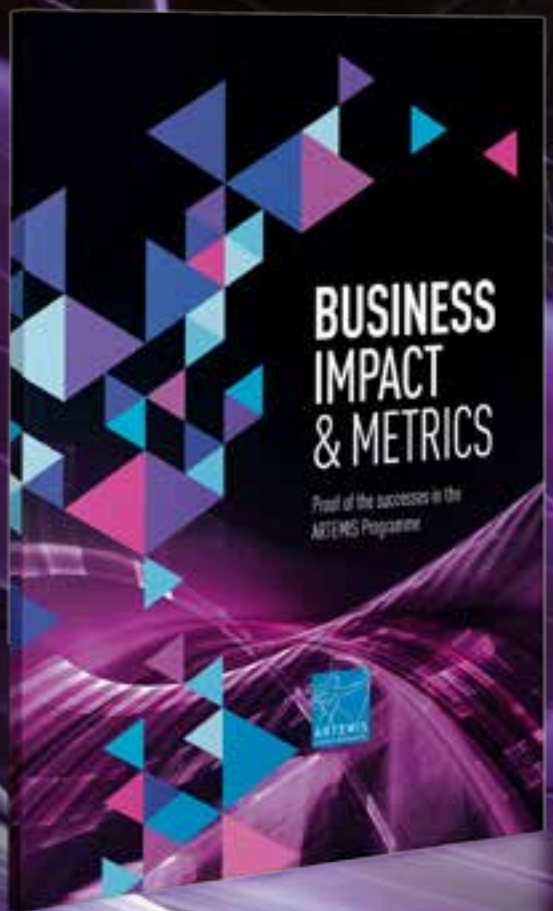


TECHNOLOGICAL EVOLUTION: Several technologies that have fuelled the exponential performance growth of computer systems in the past decades are facing physical barriers. We need to develop new, disruptive technologies for efficient data storage, for information processing, and for communication, to sustain this exponential growth. They will, however, need quite some time to become mainstream, so we need to prepare for a period with performance stagnation.

All these ideas are summarised in figure 1.

For more details about the rationale and analysis, the electronic version of "HiPEAC vision 2015" is available at http://www.hipeac.org/publications/vision/. For further dissemination of the highlights of the document, a short two-minute introduction movie was created and can be seen at http://www.youtube.com/watch?v=tE61lqlVtb8 .

BUSINESS IMPACT & METRICS



3RD METRICS REPORT REVEALS THAT THE BUSINESS IMPACT OF THE ARTEMIS PROGRAMME IS GROWING STEADILY!

by Patrick Pype

During the Co-summit in Berlin, the third "Business Impact & Metrics" report was launched, a major milestone for a programme that has already run for more than six years. This report reveals the bottom-up successes of the different projects and consortia that were formed in the scope of ARTEMIS. During the Co-summit, the report was presented to Andreas Wild, Executive Director of the ECSEL programme, to the members of the Public Authorities Board and to all the participants at the conference.

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In 2010 a first questionnaire round was launched in order to measure the success and the impact of the ARTEMIS programme. Whereas this was still small-scale and could be considered as a ''dry run", the second round in 2012 and third round in 2014 reached a larger audience (more than 150 respondents) and obtained more relevant results. The questionnaire was built around three themes:

> Focusing on common R&D agendas
> Significant economic and societal benefits
> Successful results in the market

The metrics results of 2012 are almost all confirmed and even improving in 2014. Furthermore, in 2014 an additional qualitative interview was taken of nine project consortia in order to get more insight in the true business impact, on top of the results of the quantitative questionnaire. In terms of business impact, the main outcome and common denominator were the following:

> Improved Product Maturity
> Increased Productivity
> Higher Competitiveness
> Faster Time-To-Market
> New Business Opportunities

Overall, the main interest of the stakeholders to get involved in the ARTEMIS programme is the industrial relevance of the work done. ARTEMIS is considered as a real industry-driven programme and this is what is appreciated the most by the participants. Whereas ''higher re-usability of components" was an important asset in 2012, this has been replaced by the ''generation of new products". In addition, more than 50% of the business results are estimated to come after three to five years of the project, a slight decrease of 5% compared to 2012. This decrease resulted in an increase of 5% of the business within one to two years after the project. The ARTEMIS projects are getting closer to the market and generating business much faster than in the first years of the programme. More than 90% of the respondents indicated that they have formed new partnerships. Even more important is that these partnerships involve more than 70% SMEs. The Centres of Innovation Excellence (CoIEs) are still a valid and visible instrument within the ARTEMIS community, but have lost a little momentum since the launch and big initial successes in 2012.

Some items for attention remain the same; in particular the administrative burden and uncertainty of funding for all partners in the consortium remain the #1 and #2 concern. The alignment between EU and local authorities is perceived as getting worse (moved from #6 concern to #3 concern).

As a conclusion, we can state that ARTEMIS should keep its identity and continue as the key European "Smart Cyber-Physical Systems" community within the ECSEL programme, positioned between the equally important IC community and the overall application areas and societal challenges.

THE PROFILE OF THE CO-SUMMIT 2015 PARTICIPANT

by Nicolás González-Deleito and Tom Ruette

Out of the (informal) survey performed at the ARTEMIS WITH-ME project booth, we could conclude that about 80% of the participants do not drink enough throughout the day. Although there are no golden values prescribing how much we should drink which are applicable to all circumstances and types of persons, the prestigious Mayo Clinic recommends to drink at least about 2,2 liters of water for women and about 3 liters for men [1].

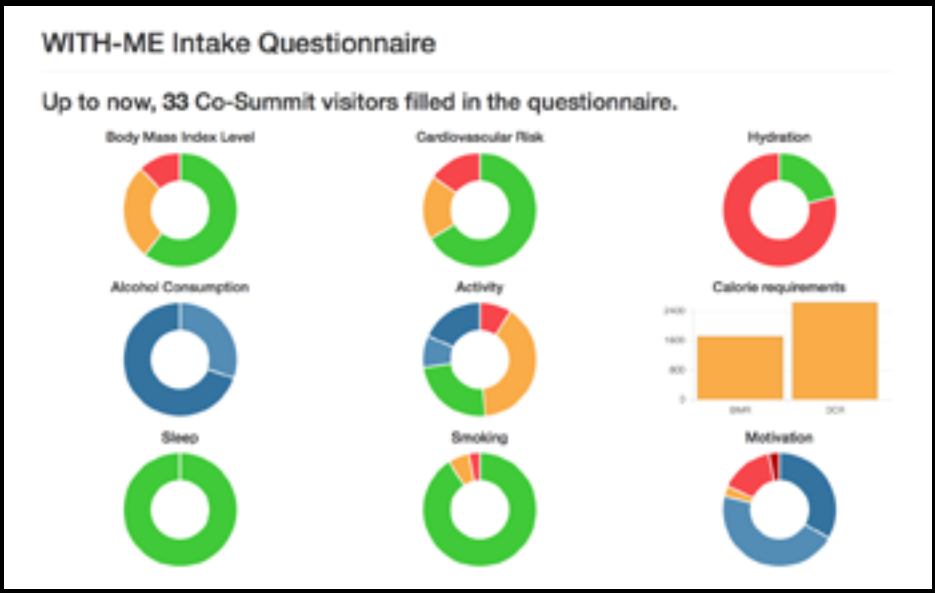

Figure 1. Results from the Sirris Initial Profiler during the ARTEMIS-ITEA Co-summit 2015

From this survey (see figure above), it also appears that 40% of the participants are to some extent overweight and that a third of the participants have a medium or high cardiovascular risk. On the upside, however, most participants are not at risk when it comes to alcohol consumption and an impressive half of the participants report performing regular and moderately intense physical activities throughout a week. Almost all participants report to sleep enough, and the vast majority of participants does not smoke. Finally, 80% of the participants are intrinsically motivated, which means that they need no or few external incentives to reach an objective.

Despite most figures are positive, the relatively low number of persons who filled in the questionnaire (i.e. 33) does not allow to extrapolate them to the whole Co-summit 2015 participants.

This survey was part of the demo that Sirris and the Belgian partners in WITH-ME gave during the Co-summit.

WITH-ME is an ARTEMIS project that aims to provide a digital coaching platform that continuously monitors, advises and interacts with users to help them acquire and maintain a healthier lifestyle. It does so through the WITH-ME ecosystem, a collection of embedded devices including multi-purpose consumer electronics (e.g. mobile phones, computers, TVs, media centres), dedicated health equipment for personal or shared use (e.g. HR monitors, activity sensors, environment sensors, exercise equipment, blood pressure meters, glucose analysis devices), external information sources providing sensor input from the environment, general information, and personal feedback, and servers providing the necessary computational environment for services and applications."

The Belgian partners in WITH-ME focus on coaching persons who are overweight and have a high cardiovascular risk, in order to help them lose weight.

Sirris was demonstrating their Initial Profiler. This tool provides an initial profile of a user, based on the answers to a questionnaire that is filled in with a personal coach during their first session. Technically, the answers to this questionnaire are used to create a user model in an ontology. Thanks to a reasoner and a set of rules capturing domain knowledge, this user model is extended with additional information which is used to build the resulting profile. This profile is then used by the coach to determine the best strategy for helping the user lose weight.

For more information, please contact Nicolás González-Deleito (nicolas.gonzalez@sirris.be) website : http://www.with-me-project.eu/

[1] *http://www.mayoclinic.org/healthy-living/nutrition-and-healthy-eating/in-depth/water/art-20044256*

Figure 2. The WITH-ME booth at the ARTEMIS-ITEA Co-summit 2015

ARTEMIS EVENTS CALENDAR

ROAD4FAME EU-CONSULTATION MEETING

The theme for this full-day event is: "Digital Revolution in Europe: Converging Visions for a Smarter World." The event will gather high-level speakers from the European Commission, as well as academia and relevant industries and gives you the opportunity to build ground for cooperation.
http://de.amiando.com/road4fame-consultation.html

Date
22 May 2015
Location
Brussels, Belgium

EURONANOFORUM 2015

EuroNanoForum 2015 will be showcasing and discussing the latest progress in nanoscience and nanotechnologies, and their contribution to innovation in manufacturing across all industrial sectors. The conference is organised as a part of the Latvian presidency of the Council of the European Union.
http://euronanoforum2015.eu/

Date
10-12 Jun 2015
Location
Riga, Latvia

BITS & CHIPS SMART SYSTEMS

More information
http://www.bc-smartsystems.nl/en
Date
01 Oct 2015
Location
's Hertogenbosch, The Netherlands

INTERNET OF THINGS EVENT

On June 2nd the Internet of Things Event will take place at High Tech Campus Eindhoven, the Netherlands. The conference gives insights in the rapidly developing market, in new technologies and in how other businesses apply the new opportunities that the IoT brings.
http://iotevent.eu/

Date
02 Jun 2015
Location
Eindhoven, Netherlands

ARTEMIS SUMMER CAMP 2015

The ARTEMIS Summer Camp 2015, which is a members-only event, will focus on the topics SRA 2016 and MASRIA 2016.

Date
10-11 Jun 2015
Location
Helsinki, Finland

ICT 2015 INNOVATE, CONNECT, TRANSFORM

ICT 2015 - the biggest event in the EU Calendar is back to network, follow interesting debates in the conference, hear the latest news on the new European Commission's policies and initiatives with regard to R&I in ICT, find information about funding opportunities and much more!

http://ec.europa.eu/digital-agenda/en/ict2015-innovate-connect-transform-lisbon-20-22-october-2015

Date
20-22 Oct 2015
Location
Lisbon, Portugal

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Submissions:
The ARTEMIS-IA office is interested in receiving news or events linked to the aim of ARTEMIS-IA, related projects or in general: R&D in the field of Embedded and Cyber-Physical Systems area.
Please submit your information to info@artemis-ia.eu

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