ARTEMIS Industry Association

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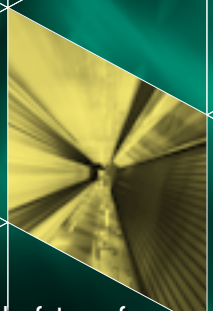
ARTEMIS Magazine - December 2015

Summary of the year



FOREWORD

Dear ARTEMIS friends,

We have again a lot of interesting reading material for you. I will highlight parts of the content.

We see growing activities of local ECSEL initiatives. We heard that Italy will start an ECSEL activity in December of this year; maybe we can report on that in our next issue. In this issue you will find an update of the activities of ECSEL Austria.

You will find a report of the ESCOP project that was part of the ARTEMIS-JU call 2012.

Alun Foster, ECSEL Head of Communication and Dissemination, gives a summary of the past year.

Interesting is the interview with Andrea Cuomo, Executive Vice President of STMicroelectronics, one of the founding fathers of the ARTEMIS ETP, who became in June of this year the chair of the ECSEL Governing Board. He makes various statements; one of them: "We have to have a strategic vision that can harness the potential synergies in the market".

ARTEMIS-IA launched the ARTEMIS Technology Conference in its first version (ATC 2015) in October this year in Turin, Italy. We got a lot of positive responses on this initiative and certainly will repeat this, if possible once a year. Ad ten Berg reports on this October event. One of the presentations on the ATC 2015 on Bootstrapping Cyber-Physical Systems is now an article in this Magazine.

The next theme is Roadmapping of Cyber-Physical Systems. Various viewing angles and focus areas are possible on this topic. Ad ten Berg gives an introduction on different 4 projects on roadmapping: CPSoS, Road2CPS, Road4FAME and Cyphers. Some projects are finished; others are still in progress. After the introduction of Ad, all four projects present themselves. I can recommend reading all of them. It is up to the reader to judge which approach is the best in relation to the type of work the reader is doing in his/her organization.

Finally Andreas Wild who served as Executive Director from the start of the ECSEL Joint Undertaking and who will retire on Nov. 30 of this year, looks back on this period. We thank him for all his efforts and I quote part of the last words in his article: " ECSEL can play the role of a catalyst in Europe at the forefront of technology progress in Electronic Components and Systems; as a European I cannot but whish that the ECSEL JU will succeed brilliantly".

I wish you a lot of reading pleasure.

Jan Lohstroh
Secretary General, ARTEMIS Industry Association

CONTENTS

UPDATE: WHAT'S HAPPENING IN AUSTRIA

by Josef Affenzeller

ECSEL-Austria is an industry-driven national research, development and innovation platform representing the technology areas of micro- and nano-electronics, embedded systems and systems integration. With a software development focus, academic research is strongly attuned to the needs of industry in terms of being competitive as well as ensuring it will have the educated personnel it requires for the future. This is a key raison-d'être for ECSEL-Austria, a public-private partnership (PPP) financed in equal measure by the government and the Austrian stakeholders, and successfully implemented in 2013. The budget for funding 2015 was €10 m annually. This level of funding is expected to remain intact.

Austria has a very good balance of collaboration and cooperation with academia, research and industry on the one side and with public authorities on the other. A good example of this close cooperation within ECSEL-Austria was the creation of the Austrian content for the annual working programme, the MASRIA. Following a series of workshops, the various partners agreed on the priorities and the areas of applications for Austrian focus:

> Smart Mobility
> Smart Society
> Smart Production
> Smart Energy

Furthermore, ECSEL-Austria is developing technology-oriented priorities for the three pillars of ECSEL (embedded software and software architecture, micro- and nano-electronics, systems and architectures) on a national level with the aim of tightening the cooperation between research centres, universities and enterprises for the joint development of cyber physical systems. Given that Austria's industry has a large proportion of electronics and CPS supply companies, ECSEL activities are vital to keeping the link to the OEMs and system integrators in Europe. In the first call, Austrian partners were successful in the areas of micro- and nano-activities, and production. For the second call, it is hoped that CPS will also succeed. Currently, the implementation of an electronics cluster, including both cyber physical systems and hardware, is under consideration.

One of the reasons for the early success of ECSEL-Austria can be attributed to communication and the fact that in Austria nano-materials and embedded systems come under the same ministry (Transport, Innovation and Technology represented by Michael Wiesmüller). Moreover, when proposing recommendations to the government, and thereby also the positioning of ECSEL-Austria in a public authority perspective, it is essential to have critical mass. The whole (ECSEL) is then greater than the sum of its constituent parts, speaking with one voice. Some other countries have recently shown interest in following the Austrian model.

For further information about ECSEL-Austria please refer to www.ecsel-austria.net.

eSCOP

A PROJECT OF ARTEMIS CALL 2012

by Johanna Rytkönen, Tampere University of Technology, Finland

With increasing globalisation, the competition in manufacturing is ever-increasing. There is talk about mass manufacturing moving from Asia to Africa in search of the cheapest production costs. European industry is striving to survive the pressure from low-cost competitors. Hence, it has become a necessity to work smarter and create new ways to enhance the competitiveness of the industry. European industry is currently standing at the dawn of a new era, integrating internet-based technologies and global industrial system. Mass production no longer serves the needs of all customers, and European producers cannot compete with price. Instead, the industry is moving towards mass customisation to satisfy the needs of customers who desire individualised products. Rapid new developments in this area can be expected. One of the new solutions responding to current challenges is being developed by ten European partners in the eScop project.

THE ESCOP APPROACH

The eScop approach brings together embedded systems, ontology-based knowledge management and service-oriented architecture. By combining these technological approaches the project creates a unique system called Open, Knowledge-Driven Manufacturing Executing System, or OKD-MES. In OKD-MES, knowledge about possible manufacturing system entities is stored as ontologies, allowing the user to incorporate new entities without the need to re-program the system. OKD-MES will automatically recognise the new entities and provide them both in the user interface and also inside the system for the purpose of manufacturing operations.

One of the main results for the project is a service-oriented framework that should allow factory and process control systems to be built and simulated. Current industrial solutions are generally based on proprietary and sometimes incompatible standards. However, the development of web standards has made it possible to use open and interoperable methodologies from other domains in the industrial context. Recent developments in the area of communication technologies have also increased the memory and processing capabilities of embedded devices, thus making it possible to implement new kinds of protocol stacks. This has permitted using web services as the user interface and means of controlling the system. Common standards allow interoperability between devices. Web-based solutions also free the controller from being tied to the location of the manufacturing unit.

The eScop platform provides a modular system. All MES functions are based on the shared knowledge model. This makes it possible for developers to easily create new functions based on the same model, without the need to have in-depth knowhow about other parts of the system. In addition to the software, the eScop project has developed hardware to match the system. Remote terminal units in which RESTful services are enabled have been developed in the project. They have been applied on the eScop pilots to monitor and control the factory shop-floor, and integrated into enterprise information systems. In addition to the introduction of this service-oriented physical interface, this approach also enables a rapid development cycle based on simulators. This means it is

possible to first try any developments on the simulator without the risk of damage or losses created by machine downtime, and after that to seamlessly replace the simulator with the real system.

TOPICAL ISSUES IN THE PROJECT

Currently the eScop solution is working on two pilots, with a third one being planned. The solution can also be run on three simulators. While the project consortium is aiming to provide a large part of the developed components with an open source license, a semantic toolkit and simulators can already be accessed online at the project website (www.escop-project.eu/tools). One of the simulators is used to demonstrate the assembly of mobile phones by drawing mobile phone's main parts. Another one simulates an oil circulation lubrication system, which is used to lubricate machines used in process industries like the pulp and paper industry. The third simulator, depicting a distribution centre and related control system, was created to facilitate the collaboration of a geographically dispersed development team.

Figure 1: Graphical User Interface of the Oil Lubrication Simulator visualises the parameters of simulated system, configured by the user.

The project has also created academic results. Besides numerous conferences and journal publications, the research activities by academic partners have recently led to the publication of a book titled Open Knowledge-Driven Manufacturing & Logistics: The eScop approach. The key topics of the book include MES functionalities and their development, methodologies and architectures for OKD-MES, representation on knowledge in ontologies and service-driven operations via web services. The book also discusses the future needs and requirements of production and logistics systems, with regard to the possible extensions of the eScop approach.

SERVING THE NEEDS OF SME'S

The main aim of the project has been to address current drawbacks in the industry and introduce new capabilities in MES. The technological approach of eScop allows easy re-configuration of the factory line, thus quickly responding to changing customer needs. This reduces time and cost of reaction and allows producers to bring new products to market more quickly.

The modular status of the eScop approach makes manufacturing execution systems cheaper, easier and more flexible. Companies are able to acquire only the components needed in their production. In addition, the openness of the solution allows users to develop their own components, thus creating an ecosystem around the solution.

The European manufacturing industry was valued 6.410 billion euros in 2010. It is the most important contributor to economic growth in Europe. For this reason improvements on MES level may have far-reaching consequences for the competitiveness of the whole continent.

Website: www.escop-project.eu

Source of the statistic: http://ec.europa.eu/eurostat/statistics-explained/index.php/Manufacturing_statistics_-_NACE_Rev._2

ECSEL: A SUMMARY OF THE PAST YEAR

by Alun Foster

For ECSEL JU, in addition to the many other in-house and public activities for getting ECSEL up and running in the fast lane, 2015 has been characterised by four major activities.

Firstly, all 12 projects selected by the JU's first round of calls in 2014 were contracted and work started has in the meantime. These projects will be represented at the European Nanoelectronics Forum in Berlin, where more information about their objectives will be explained.

Another major milestone was the launch of two Calls for proposals – concurrent Calls for the "RIA" and "IA" actions respectively. Unlike the accelerated single-phase procedure used in 2014, these were two-phase Calls, with a Project Outline phase that served as an excellent calibration point for the proposers, resulting in 62 Full Project Proposals for evaluation. At the time of writing, the funding decision is still in progress, but look out for the results of this Call in the coming weeks.

As announced on the ECSEL JU web-site, on 16 September 2015, Dr. Peter Kaiser (Governor of Carinthia), Dr. Gaby Schaunig (Vice Governor responsible for Innovation and Research) and DI Christian Benger (Regional Minister for SMEs and enterprises) together with the ECSEL JU's Executive Director Dr. Andreas Wild, signed a Memorandum of Understanding that will encourage extensive cooperation between the important electronics industrial players in the Carinthia region and their European partners, through coordinated activities in the context of the ECSEL JU. The representative of the responsible Austrian National ministry and lead-delegate for Austria on the ECSEL Governing Board, Michael Wiesmüller of BMVIT, was sadly unable to attend, but did forward a message that was read out at the ceremony. He welcomed the initiative and underlined its importance, showing how important it is for Austria to combine resources and to align regional development strategies with a (Federal) industrial policy based on technology innovation. This is also a significant step forward in the ECSEL JU strategy for incorporating regional focus and funding opportunities into the programme more generally, as outlined in the JU's founding act.

And lastly but not leastly, ECSEL JU held its first annual Stakeholders' Forum.

The first ECSEL Stakeholders' Forum took place in Graz, Austria, on 18 September 2015. The Forum was organised by the ECSEL JU's "Private Members Board" to ensure engagement of the stakeholders in ECSEL JU in an open and transparent way.

The event was preceded by a "working dinner", at the request of the new Governing Board chairman Andrea Cuomo. This was to do some preparatory thinking around "Flagships", a working title for some key elements of the programme that can provide clear guidance and inspiration to the RD&I community, on topics with direct industrial relevance and impact in the relatively short term.

High-level executives of some of Europe's leading companies provided visionary inputs on their specific domains (Health Systems, Automotive Electronics, Aerospace, Smart Grids for Energy and "Challenges of the Internet of Things"), giving clear confirmation of the importance of ECS for their businesses, and also that "Flagships" could address some of their expressed needs. They also clearly confirmed the relevance of the current Multi-Annual Strategic Plan (MASP) of ECSEL.

The European Commission and the Public Authorities board of ECSEL, through their chairman, also provided viewpoints from the public sector. They confirmed that the approach is fully in line with the Commission's Digital Single Market "digitisation of industry strategy", reminded ECSEL to take a clear message from the ELG roadmap and implementation plan (in particular, Supply-Demand interaction) and also to seek benefits from the EU investment packages, including structural funds, particularly bringing in users and SMEs. They emphasised the common aim to enhance the impact of ECSEL, while recognising the challenges of the mission to bring together competences, both in technology and applications, so as to remain at the forefront of global competition, stating that the "Flagships" should create the framework for a coherent set of project initiatives which ECSEL can accommodate.

The Stakeholders' Forum itself saw the presentation of some eight ideas for implementing "Flagships", leading to a lively discussion on both the content and the form they could take. The outcome of this discussion will be taken on board by the PMB in its further work on proposing the technical programme for ECSEL JU. The Forum finished with a presentation and interactive discussion around each of the chapters of the strategic programme to be proposed for the ECSEL JU Calls of 2016, already showing that the messages of the Working Dinner and suggestions around "Flagships" were inherent in the programme under preparation.

Presentations from the Forum are available to participants and members of the Private Members Board Associations via the following page (login required: please contact AENEAS, ARTEMIS-IA or EPoSS for more information).

A CONVERSATION WITH ANDREA CUOMO

Interview by Chris Horgan

This June, 2015, Milan-born Andrea Cuomo, Executive Vice President of Advanced Systems Technology and Special Projects at STMicroelectronics, became Chairman of the Governing Board of the ECSEL Joint Undertaking. Cuomo talks about his first impressions at the helm of this new organisation.

What are your first impressions of this funding programme and its complicated organisation?

Well, let me start off by saying that I don't think it is a complicated organisation per se. I would rather call it an organisation that has some complexity to deal with. Albert Einstein said once that any system should be reduced to its minimum level of complexity but not more. Of course, when you have about two and a half billion euros of public money belonging to 29 different Public Authorities to handle, you can't expect to avoid some formalities. On the other side, the Public Authorities and the European Union have been able to converge on their objectives, but the Industry has so far not been able to come to a unified position and speak with one voice. And this is what is making the programme somewhat complicated. As Industry, what we have to do is to arrive at a common vision. We need to identify which are the core technologies to fund, who can get what done and when, and that will give us a wider scope. If we want to have a strong European industry, we have to have a strategic vision that can harness the potential synergies in the market. An illustration is the huge impact of GSM on Europe. Starting with Nokia through Ericsson to Vodafone, just to mention the first names that come to mind. But how was this built? It started with a team on standardisation, governments that regulated the spectrum, companies that designed systems and components – all together with synergy to get to market first. If we can leverage the ECSEL community in this way, then I think we are doing something important. Remember, it is vital to have the right product at the right time for the right market. Of course, there will be market battles between manufacturers, providers, suppliers … but that's normal, it is called coopetition. And it is better to fight for leadership rather than fight to get a small share of the pie.

What in your view are the most important challenges Europe faces in the field of Electronic Components and Systems?

We need to build the ecosystem and ensure it cooperates in the right way. Also we have to target the right markets and gain a real understanding where the competitive advantage lies in markets like automotive, energy, healthcare, etc, to make sure we are funding the right stuff. Take mobile phones.

In the next generation, what is going to be the core component? Imagine for a minute it is power management. Then the question becomes how can we squeeze the last microwatt of energy out of a battery or away from a processor or a software programme? If that is the key component, then we should be funding that technology. We must be the most competitive player in those core components that make the difference. And, of course, I am talking about European competitiveness on the global stage. At the same time we should never forget, we have a huge asset in Europe – half a billion customers. If we can get our acts together, in terms of spending power only China has a similar market size.

Do you think that ECSEL can significantly contribute to tackling these challenges?
If we can bridge the institutional side and the industrial side, we can really fund the core technologies for the next generation. That is our mission. It's not simply a matter of funding: Horizon 2020 and many national programmes do that and there would be no reason to create a complex organisation like a JTI just to fund individual R&D Programmes. Our job and our reason for existing is to leverage the whole.

You introduced a possible Flagship approach in ECSEL; under what conditions could this approach take root and flourish in your opinion?
The Flagship is what I referred to earlier – it's the strategic approach. Take energy. If we can understand what the utilities need and which are the relevant core technologies, then we fund, standardise and ask the PA to regulate these core technologies. It's bringing all the bits and pieces together in a way that makes business sense, and builds markets and industrial leadership.

It is not funding a new area but with a strategic framework we can ensure that the funding goes to the right core technologies.

What are your short-term recommendations to get more balance between semiconductor, embedded systems and smart systems projects in ECSEL?
It's difficult to judge as I have not seen the past details, but essentially it boils down to the quality of the proposals. Since I trust the funding process is sound and fair, if one of the organisations brings high quality projects and another doesn't, there will never be a balance. Each proposal has to be judged on its own merits and the way to balance is to present the highest quality proposals. So the balance lies in ensuring that the proposals that are submitted are compelling and deserve to be funded. With the strategic framework in place we can ensure the strategic focus of a proposal, but the quality of each proposal is what will guarantee its success.

Do you have any other message – personal and/or professional – for the readers of the ARTEMIS Magazine?
Well, I have a sort of special attachment to ARTEMIS. I was there at its birth as one of the founding fathers. I feel it a little bit as my grown-up child and I'm very pleased that ARTEMIS is still alive and kicking. Now we need to go to the next level: we need to integrate the vision and the Industry and have a common strategy. The only way to be successful is through a coherent ecosystem: the future of embedded systems is clear, it is the integration in the winning ecosystems. Again, I cannot stress enough the need to unite and speak with one voice : we need systems to succeed in the market, software to make the systems work and components to run software. Missing one part means missing the whole or relying on competitive ecosystems and being fragile in the end. This will strengthen the whole industry. And it is what ARTEMIS was set to achieve in the beginning: reduce the fragmentation that existed in the European industry make it stronger. In ECSEL it should continue to support this aim.

" WE HAVE TO HAVE A STRATEGIC VISION THAT CAN HARNESS THE POTENTIAL SYNERGIES IN THE MARKET"

ECSEL MASRIA 2016

by Jan Lohstroh

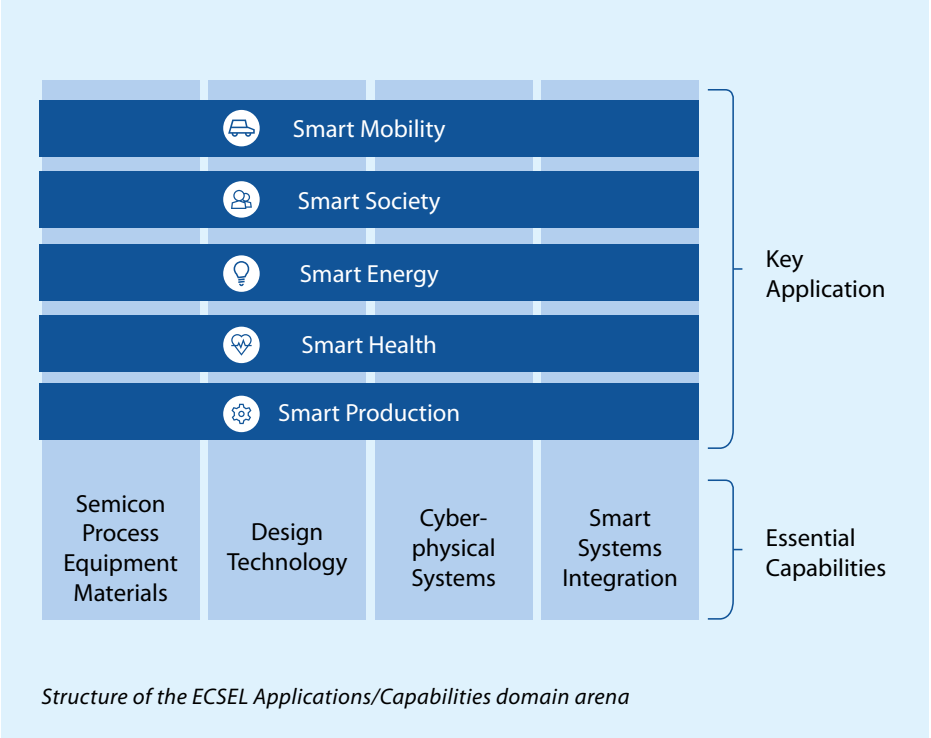
Each year the ECSEL Private Members Board (PMB) is obliged to produce a MultiAnnual Strategic Research and Innovation Agenda (MASRIA) as a basis for the ECSEL MASP (MultiAnnual Strategic Plan) and the next ECSEL calls. The MASRIA 2016 was sent to the Executive Director of ECSEL on 14 October 2015 by the PMB that consists of representatives from AENEAS, ARTEMIS-IA and EPoSS. The document can be downloaded from the websites of the three associations.

As the MASRIA document looks ahead for some 5 years, no dramatic changes are to be expected between the annual versions. The MASRIA 2016 follows the same structure as the MASRIA 2015 with the same applications and capability domains.

Chapter teams with experts from the three associations have updated the content description and roadmaps from the previous version of the MASRIA (MASRIA 2015). One topic has moved: Smart Production of Semiconductor Products is now in "Semicon Process Equipment" and no longer a subsection in "Smart Production".

This short article is not meant to be a summary of the very rich content of the MASRIA 2016. The reader can better download the full 80-page document from one of the association websites.
For the ARTEMIS community all five Application Areas are important as well as the technology areas Design Technology and Cyber-Physical Systems.

Although cyber-physical systems, as complete systems, are built to fulfil certain applications, many technological topics and issues in these systems are generic (application independent) and as such, cyber-physical systems can be regarded as enabling technologies.



Structure of the ECSEL Applications/Capabilities domain arena

ARTEMIS TECHNOLOGY CONFERENCE 2015

by Ad ten Berg

On 6-8 October, the first ARTEMIS Technology Conference (ATC) in the new set-up was held in Turin, Italy. Where the previous ATCs, some years ago, were organised by different ARTEMIS projects, this was the first ATC organised by the ARTEMIS Industry Association. As the Co-Summit 2015 had already been held in the spring, this conference was created to provide an extra event and network possibility for the ARTEMIS-IA community in the second half of the year.

Technical project presentations were given around several themes in parallel sessions. On 6 October, the themes "CPS for smart production and Industrial automation", "ARTEMIS Reference Platforms", and "Future CPS Industrial challenges" were tackled, while on 7 October, "CPS for Smart Mobility and automated driving" attracted together over 130 visitors.

ARTEMIS-IA members were invited to submit project presentations in these themes, not only on ARTEMIS/ECSEL projects, but also on Horizon 2020, FP7 and even national projects, in order to connect to these communities as well.

We were happy to welcome Werner Steinhögl of the European Commission at the ATC. His plenary speech, explaining the next series of ICT calls in Horizon 2020 in detail, attracted much attention. Supporting the forthcoming ICT call of Horizon 2020, an experimental project idea exhibition was held where in addition to the members, several other organisations, such as EFFRA, NESSI and ERTRAC, also active on CPS R&D, presented project ideas for the next calls in Horizon 2020.

Apart from the theme sessions and exhibition, separate workshops were held, back-to-back. CPSoS organised a CPS roadmap workshop on 6 October, the ARTEMIS Centre of Innovation Excellence ProcessIT.EU organised a road-mapping event on 7 October and Road2CPS organised its back-to-back workshop on 8 October. Several ARTEMIS Working Groups were active in parallel to the ATC programme: the Working Group Standardisation in cooperation with CP-SETIS organised a workshop on interoperability standardisation while the Working Group SRA held an interactive workshop on the SRA 2016 with the valuable support of Road2CPS.

From the first feedback we learned that many appreciated this formula for the ARTEMIS Technology Conference event and over 90% confirmed that they achieved their goals for this conference.

Looking back, this first "new" ATC was a successful and lively event in the beautiful centre of Turin.

BOOTSTRAPPING CYBER-PHYSICAL SYSTEMS VIA MICRO PLUG-AND-PLAY:

AUTO IDENTIFICATION, DISCOVERY & CONFIGURATION OF PERIPHERALS AT EXTREME LOW POWER

by Sam Michiels

Creating, deploying and configuring applications for Cyber-Physical Systems (CPS) still remains complex. Micro Plug-and-Play (µPnP) tackles this complexity problem by offering a near-zero configuration approach that empowers non-expert end-users to quickly take their CPS infrastructure online (*www.micropnp.com, @micropnp*).

INDUSTRIAL DEMAND FOR A PLUGGABLE CPS AT NEAR-ZERO CONFIGURATION AND ENERGY COST

Through long-term industry collaborations in the domain of transport & logistics, building management and industrial automation, researchers at iMinds-DistriNet/KU Leuven (distrinet.cs.kuleuven.be) learned that CPS technology providers and system integrators lack software management services and tools to integrate, configure and monitor a distributed CPS.

For example, the successful exploitation of a cold chain monitoring solution in trucks and trailers requires the CPS infrastructure to be seamlessly integrated and configured (e.g. every time a truck picks up a trailer), and that fleet management applications dynamically discover the available peripherals (e.g. different sensors, from different vendors, with different capabilities).

Integrating CPS peripherals is time-consuming; the developer must physically integrate the peripheral, manually configure all settings, write specific driver software, and deploy and manage the drivers installed on each CPS device. Mainstream approaches (e.g. USB for regular computing devices) are too heavyweight to apply on battery-powered and resource-constrained sensors or actuators.

Contemporary USB peripherals carry a type identifier that associates the device with a specific driver, which is automatically discovered, deployed and installed.

The question remains: how can this be achieved on battery powered and resource-constrained CPS devices?

µPNP SOLUTION IN A NUTSHELL

µPnP splits the sensing/actuating capabilities from the computing and communication platform; it automatically identifies all connected embedded peripherals on a CPS device and installs their corresponding driver

software over the air. µPnP offers a coherent hardware & software toolkit that provides:

> **Low-cost, low-power peripheral identification.** The identification approach is ultra low power, low cost, and does not require specialised peripheral hardware. µPnP automatically identifies connected embedded peripherals and installs their corresponding driver software. It utilises passive electrical characteristics to encode a unique 32-bit type ID on each sensing or actuation peripheral. Identifying a peripheral with µPnP consumes 1 million times less power than USB. Any existing IoT peripheral can immediately be repackaged as a µPnP-peripheral by using the standard physical connector (ADC, GPIO, I2C, SPI, or UART) and adding four resistors.

> **Remote peripheral discovery, deployment & usage via standard IPv6 Multicast.** µPnP connects IPv6 multicast addresses directly to physical phenomena to enable low-overhead peripheral discovery and remote access. Following the integration of a peripheral, µPnP auto-generates a corresponding unicast prefix-based IPv6 multicast address and joins the matching multicast group (e.g. for temperature, light or humidity sensors). Peripheral services can be remotely accessed using CoAP over both unicast and multicast, allowing for efficient and easy integration with third-party technologies. A domain-specific configuration language was created to achieve platform-independent and extremely compact driver modules (i.e. a few bytes); this minimises the energy overhead when deploying drivers over-the-air.

> **Global web access to configure all nodes remotely.** Global access to each µPnP network is provided through a JavaScript library that establishes a NAT-proof connection between clients and the µPnP gateway. This library defines the <pnp> HTML tag, which allows sensors to be embedded in a web page with a single line of HTML code. The library also defines PnP-Script, a rule-based language for non-experts. It can be written in a web browser, and executes on the gateway. This architecture achieves sub-second latency for actuation and control in tests with over 100 simultaneous web clients.

> **Ultra low power mesh networking.** The µPnP software stack is fully IETF standards-based (IEEE802.15.4e, IPv6 (6LoWPAN), CoAP, JSON), and therefore integrates easily with third-party solutions. In combination with Linear Technology's SmartMesh IP, for example, µPnP achieves 10 years of battery lifetime and 99.999% end-to-end reliability.

KEY DIFFERENTIATORS

> Ultra-low power (6 orders of magnitude lower than USB)
> Easy driver language (-50% Code, -90% RAM)
> IPv6 Multicast discovery (in 2KB of ROM)
> Extremely low cost (< 1¢ per peripheral)
> Tiny memory footprint (<10% of AVR/ ATMega128)

µPNP IN ACTION

µPnP was selected as semi-finalist for the IPSO Challenge 2015, which evaluates IoT prototypes on their innovation, breadth of applicability, marketability and ease of use (*http://challenge.ipso-alliance.org/challenge2015/meet-the-2015-semi-finalists/micropnp*). The ten semi-finalists will present their prototype for an industrial jury at the Designers of Things conference in Silicon Valley, California (2-3 December, 2015). Beyond the IPSO Challenge, iMinds-DistriNet is taking µPnP out of the lab and into industrial reality. The first step was to equip the Computer Science Department's server room with µPnP enabled devices. Currently, iMinds-DistriNet is preparing CPS prototypes in transport & logistics and e-healthcare in close collaboration with industry. Clearly, more opportunities are quickly emerging, for instance in industrial automation (monitoring machinery and robots on the factory floor).

IMINDS-DISTRINET TRACK RECORD IN INDUSTRY COLLABORATION

iMinds-DistriNet is an international research group with extensive expertise in secure and distributed software, including middleware. Embedded in the department of Computer Science at KU Leuven, iMinds-DistriNet has a headcount of over 75 researchers, including 10 professors and 20 senior researchers. iMinds-DistriNet is part of the iMinds Security Department, a de facto "one-stop-shop for ICT security research". More information: *https://distrinet.cs.kuleuven.be*.

iMinds-DistriNet has ample expertise in initiating, executing and delivering application-driven research, often in close collaboration with industry partners. Currently, iMinds-DistriNet is actively involved in about 35 regional and European projects, often in close collaboration with industry. The know-how of iMinds-DistriNet was at the basis of Ubizen, a spin-off company specialised in secure e-business and related security services (now part of Verizon). A second iMinds-DistriNet spin-off company, Qmedit, focuses on the development of medical workflow software (now part of Agfa).

CONTACT INFORMATION:

For more information on our R&D activities (e.g. on IoT security, software configuration management, resource management, and IoT-Cloud integration), contact Dr. Sam Michiels, Industrial Research Manager (*sam.michiels@cs.kuleuven.be*) or Prof. Danny Hughes (*danny.hughes@cs.kuleuven.be*).

ROADMAPPING THE FUTURE OF CYBER-PHYSICAL SYSTEMS

by Ad ten Berg

The ARTEMIS-IA Steering Board decided at its meeting in Berlin in March 2015 to update the SRA in 2016. When looking around in the CPS community for new inputs, apart from the inputs of the experts already involved in the Working Group SRA activities, a number of CSA projects were identified that also study roadmaps related to the domain of Cyber-Physical Systems.

To get a better picture on the what and how of these projects, the Working Group SRA invited several of these projects to present and discuss in the SummerCamp in Helsinki, in June. After very interesting discussions in the Summer Camp and the opportunity to cooperate with Road2CPS in organising an SRA workshop at the ARTEMIS Technology Conference in Turin, in October, we now bring their stories into the magazine.

In this edition of ARTEMIS Magazine, the focus is on CPSoS, Road2CPS, Road4FAME and Cyphers.

Each of these projects takes a different angle on a roadmap for CPS:

- Cyphers: ("Cyber-Physical European Roadmap and Strategy") aims at combining and expanding Europe's competence in embedded and mobile computing and in control of networked embedded systems. Cyphers studied a systematic classification of the CPS domain and the modelling of the markets and their players relevant for CPS.
- Road2CPS: assesses the impact of past and ongoing projects in CPSs and related fields, accompanied by raising awareness and disseminating programme achievements to support the timely uptake of novel approaches. These objectives will contribute importantly to tackling the non-technological challenges.
- Road4FAME: works to make ICT an enabler for innovation in the manufacturing industry, employing the right IT architecture and IT services. The central product of the project is a strategic research roadmap for IT architectures and services in manufacturing businesses that need to produce in a more agile and flexible way, to leverage the benefits of context-aware enterprises, ease interoperability and to operate more sustainably.
- CPSoS: provides a forum and an exchange platform for systems-of-systems related communities and ongoing projects, focusing on the challenges posed by the engineering and the operation of technical systems in which computing and communication systems interact with large complex physical systems. Its approach will be simultaneously integrative, aiming at bringing together knowledge from different communities, and applications driven.

Together, these projects generate a wealth of information for the important field of shaping the future of R&I in Cyber-Physical Systems. Enjoy reading about them!

ROAD2CPS

ROADMAPPING THE FUTURE OF CYBER-PHYSICAL SYSTEMS

by ROAD2CPS

Road2CPS is a 24-month coordination and support action, co-funded under the European Community's H2020 Research and Innovation Programme in the area of Smart Cyber-Physical Systems (CPS).

The project aims to carry out strategic action for future CPS through roadmaps, impact multiplications and constituency building. In Road2CPS, coordinated by Steinbeis-Europa-Zentrum, seven partners (Loughborough University, Newcastle University, CEA-Tech-List, Fraunhofer IPA, AnySolution, Atos) from four European countries are dedicated to:

> identifying the gaps in current research and bridging the efforts
> developing a roadmap and analysing future research priorities and business opportunities and
> bringing the relevant stakeholders together to facilitate mutually beneficial collaborations between them.

CPS can be applied in many domains with high societal impact: multi-modal transport, health, smart factories, smart grids and smart cities, to mention just a few. The inherent complexity of CPS (and related complexity management) as well as the need to deliver optimised performance and comply with essential requirements like safety, privacy and security raise many questions that are already beginning to be explored by the research community.

Although major successes are already achievable within specific areas, there is still a huge gap between theoretical concepts, technical developments, prototypes, successful implementation and industrial application. There are considerable differences with regard to the propagation and maturity of CPS within different application domains. Strategic action is therefore desired to bring the relevant stakeholders together to: i) enable application domains to benefit from state-of-the-art technological developments and ii) focus research efforts in those areas that will enable visions of future application scenarios to be realised.

The Road2CPS project has been conceived to respond to this situation by:

> analysing the impact from past and ongoing projects, identifying the gaps and bridging efforts towards impact multiplication
> developing technology, application and innovation strategy roadmaps for CPSs to serve as a catalyst for early adoption of CPS technologies
> building a CPS constituency by bringing together the key players (from academia and industry) from a broad range of application domains, and across the value chain, to contribute to the Road2CPS action plan
> enhancing CPS implementation and demonstrating business opportunities through case studies (particularly targeting SMEs in established CPS application domains as well as scouting for 'new domains')
> developing recommendations for future research priorities as well as implementation strategies.

The Road2CPS project will not only build a constituency united by the commonly faced challenges but will also create a joint action plan for the future development of CPS, with dedicated task forces to detail and implement recommendations from impact analysis and foresight activities (roadmapping).

Having started in February 2015, Road2CPS has already taken various steps to analyse the European roadmapping landscape in CPS and bring its actors together. On 24 June 2015 the project held a first workshop, gathering experts from industry, academia and policy-making, to discuss visions and priorities of recently produced roadmaps in the area of Cyber-Physical Systems. Present stakeholders

elaborated on specific CPS themes and detailed priority topics and strategies for implementation. Inter alia, experts presented results and perspectives from the ARTEMIS-IA SRA and other projects such as CPSoS, CyPhERS, Road2SoS, ProcessIT.eu, COMPASS, Road4FAME, T-Area SoS, TAMS4CPS as well as the ATOS Vison on CPS. By means of an interactive roadmapping process, participants ranked research priority themes with the following result:

1. Integration, Interoperability, Standards
2. Safety, Reliability, Resilience, Fault Tolerance
3. Modelling & Simulation
4. Requirements Engineering Verification
5. Demonstrators Pilots
6. Platforms & Reference Architectures
7. Education Training Skills & Raising Awareness
8. Community Building
9. Security, Privacy, Confidentiality, Trust
10. Business Models
11. Open Innovation Data

Apart from the prioritisation of research fields and crosscutting topics, discussions on main enablers, barriers and gaps as well as on strategies for implementation were initiated to be continued throughout the project's lifetime.

In terms of so called 'task forces' the project has identified some focal themes where Road2CPS conceives immediate action is required. These are i) CPS business models, regulations and service enablers, ii) CPS awareness and education, iii) CPS technology and platforms, iv) CPS connection, fostering interaction with and between relevant initiatives such as related ICT-1 CPS projects, Artemis/ECSEL, Industrie 4.0.

On 7 October a workshop on the future themes of the ARTEMIS-SRA was facilitated by Road2CPS at the ARTEMIS Technology conference in Turin. On 8 October a workshop on "Future Platforms" was held to discuss platform concepts and success stories in relation to industrial demand and customer needs, gathering about 35 experts from industry, academia and policy-making with knowledge and experience in Open Platforms and Architectures, both horizontal (cross-sectoral) and vertical (domain-oriented). The outcome clarified that on the one hand action is required to drive activities towards technically interoperable open platforms and, on the other hand, it is essential to build up the ecosystem, which will let European players, especially SMEs, benefit from such infrastructure in a sustainable way (presentations are available at /http://www.road2cps.eu).

www.road2cps.eu

ROAD4FAME

ROADMAPPING THE FUTURE OF CYBER-PHYSICAL SYSTEMS

by ROAD4FAME

Road4FAME was a 29-month roadmapping project, co-funded under the European Union's 7th Framework Programme in the area of 'Factories of the Future'. Under the coordination of Steinbeis-Europa-Zentrum (Germany), the partners Fraunhofer IPA (Germany), the IfM Education and Consultancy Services (UK), Critical Manufacturing (Portugal), THHINK Wireless Technologies Ltd (UK) and Atos (Spain) developed a strategic research and innovation roadmap for IT architectures and services in manufacturing along with relevant innovation strategies and business models.

In recent years, the manufacturing sector, in particular, has had to face increasing competition. In order to counter international competition, European firms need to be constantly innovating. For manufacturing companies, IT is a key innovation driver; it is expected that in the future, traditional factories will transform gradually to smart digital and networked manufacturing environments that successfully connect their machinery, storage systems and manufacturing resources all over the world. This is the spirit of the 'fourth industrial revolution', the technical integration of Cyber-Physical Systems (CPS), the Internet of Things (IoT) and the Internet of Services in industrial processes.

For entrepreneurs, these developments open up many opportunities. However, an alignment is required between the exact needs of European manufacturing companies and future research.

The Road4FAME Roadmap, combining a technology-push and market-pull approach, focused in particular on architectures and services, which facilitate agile and flexible manufacturing processes, ease interoperability in distributed manufacturing environments, support effective collaboration between different enterprises, and provide the foundations for sustainable manufacturing.

During the Road4FAME project, eleven key ICT solutions were identified as very important by the European manufacturing industry:

> Open data and system integration platform for an unstructured data environment that includes harmonised / standardised interfaces
> Customer and demand data gathering and analysis
> Information technology and operational technology convergence
> Product and service co-design with customers
> Big data analysis and use for quality control
> Joint cognitive systems for decision support (DSS)
> Flexible production equipment and interconnections
> Problem and context-centric display of crucial information to users
> Engineering platform for design/operations continuum
> Supply chain visibility and decision assistance
> Security solutions for collaborative networks.

However, implementation of these solutions, particularly for SMEs, is hampered by a highly heterogeneous manufacturing ICT landscape and lack of interoperability and high implementation costs. At the same time the requirements from customers for flexibility, customisation and track-and-trace capability are steadily increasing.

In order to match the current gap between manufacturing needs and demands, Road4FAME recommends enhanced research efforts in the following areas:

> Reference architectures / open

architectures
> System and information integration architectures
> Data capture, storage and analysis
> Data and information visualisation techniques
> Flexible and adaptable manufacturing
> New algorithms for distributed processing of data and systems in close-to-real time
> Information modelling and work domain modelling of socio-technological systems
> New or Improved low-cost, miniaturised smart sensors
> Interoperability and standards
> Security strategy for companies and standards to protect the networked supply chain
> Confidentiality and know-how protection throughout the supply chain
> Incorporation of psychology into ICT research
> Applied, multidisciplinary research with large-scale industrial collaboration
> CPPS-Cyber-Physical Production Systems
> Supporting education in the field of CPS
> Establishing demonstrators.

Regarding innovation strategies for manufacturing, there are several varied innovation initiatives including Competence Centres, Clusters, Regional Initiatives, National Initiatives, Flagship Projects, Demonstrators, Living labs, Lighthouse Projects and Large-Scale Pilots. However, the European innovation landscape is strongly fragmented. For that reason Road4FAME recommends using European Union funding to foster linkage between these fragmented initiatives to create a European critical mass in digital manufacturing to facilitate the transfer of technology and best practices from advanced industries, e.g. aerospace, automotive, etc., where Europe is a leader, to less advanced sectors.

The Road4FAME Consortium noted another important trend; non-manufacturing companies generate a large proportion of the value chain; so called platforms such as Google, Uber and Amazon are taking over markets. In order to sustain European competitiveness a pan-European platform is necessary to boost the adoption of emerging digital technologies. But, to get platforms up and running large and influential European companies need to be willing to commit to a common project whilst developing and supporting the ecosystems of SMEs and mid-caps.

In addition, Road4FAME recommends investing in digital entrepreneurship education and programmes that foster digital skills. Within that context, management and factory-floor level employees should be made aware of the need for sustainable manufacturing processes or so-called 'green' manufacturing, addressing pressing societal challenges, e.g. climate change. Finally, Road4FAME recommends promoting the social acceptance of digital manufacturing in cooperation with trade unions regarding the quality and quantity of employment, welfare, health and privacy.

As regards the exploitation of new business opportunities, there is a need for an innovative contract framework to deal with increasingly dynamic and flexible supply chains. Legislation governing the IT sector and the internet has been built up around this sector and this may not be appropriate for manufacturing. Road4FAME sees a need for legal support specific to manufacturing applications. Increased automation and co-working between robots and humans requires a "legal by design" framework and liability issues have to be tackled with respect to potential accidents related to new ICT.
A barrier to many SMEs offering services to companies is the risk introduced from liability for lost production so in this respect, too, a mechanism is also recommended to provide insurance to mitigate some of this risk. Finally, new service ideas based on data privacy need to be addressed with clear guidelines on data ownership, management and exploitation to provide a level playing field across Europe.

http://road4fame.eu/resources/

Web: www.road4fame.eu

CPSOS

ROADMAPPING THE FUTURE OF CYBER-PHYSICAL SYSTEMS

by Sebastian Engell, Michel Reniers, Haydn Thompson

THE SUPPORT ACTION CPSOS

The CPSoS project (*http://www.cpsos.eu*) is developing a European roadmap for future research activities in Cyber-physical Systems of Systems (CPSoS). Cyber-physical Systems of Systems are large complex physical systems that interact with and are controlled by a considerable number of distributed and networked computing elements and human operators and users. Examples are transportation systems (road, rail, air, water), electric grids, smart buildings and large production facilities.

To capture the views of different communities from industry and academia, the CPSoS project has established three Working Groups:

- Systems of Systems in Transportation and Logistics
- Physically Connected Systems of Systems
- Tools for Systems of Systems Engineering and Management.

The working groups currently comprise 36 members, leading specialists from industry and academia, and include delegates from ongoing EU-funded projects in the area of Systems of Systems to ensure that as many views as possible are represented. For a list of the members of the Working Groups see *http://www.cpsos.eu*.

Based upon input from the Working Groups, from public workshops and from consultations and interviews with over 100 experts in the field from large companies, mid-caps, SMEs and academics, the project has produced a comprehensive view of the state-of-the-art in transport and logistics, electric grids, smart buildings, industrial production systems and in supporting tools and techniques *http://www.cpsos.eu/state-of-the-art/*. The discussions in the Working Groups and the consultations have been summarised in a Working Paper on the Core Research and Innovation Areas (see *http://www.cpsos.eu/roadmap/*). Three key research challenges have been identified:

CHALLENGE 1: DISTRIBUTED, RELIABLE AND EFFICIENT MANAGEMENT OF CYBER-PHYSICAL SYSTEMS OF SYSTEMS

Due to the scope and the complexity of Cyber-physical Systems of Systems as well as ownership or management structures, the control and management tasks in such systems cannot be performed in a centralised or hierarchical top-down manner with one authority tightly controlling all subsystems. In CPSoS, there is a significant distribution of authority with partial local autonomy. The design of such management and control systems for reliable and efficient management of the overall systems poses a key challenge in the design and operation of Cyber-physical Systems of Systems.

The following sub-topics have been identified:

- Decision structures and system architectures
- Self-organisation, structure formation, and emergent behaviour in technical systems of systems
- Real-time monitoring, exception handling, fault detection and mitigation of faults and degradation
- Adaptation and integration of new components
- Humans in the loop and collaborative decision making
- Trust in large distributed systems.

CHALLENGE 2: ENGINEERING SUPPORT FOR THE DESIGN-OPERATION CONTINUUM OF CYBER-PHYSICAL SYSTEMS OF SYSTEMS

While model-based design methods and tools have been established in recent years in industrial practice for traditional embedded systems, the engineering of Cyber-physical Systems of Systems poses key challenges that go beyond the capabilities of existing methodologies and tools for design, engineering and validation. These challenges result directly from the constitutive properties of CPSoS, such as the fact that CPSoS are continuously evolving and the high degree of heterogeneity and partial autonomy of CPSoS.

The efficient design and operation of such systems requires new design support methodologies and software tools in the following areas:

> Integrated engineering of cpsos over their full life-cycle
> Modelling, simulation and optimisation of cpsos
> Establishing system-wide and key properties of cpsos.

CHALLENGE 3: COGNITIVE CYBER-PHYSICAL SYSTEMS OF SYSTEMS

Systems of Systems (SoS) by their very nature are large, distributed and extremely complex. Gaining an overview of the entire SoS is inherently complicated by the presence of decentralised management and control. The introduction of cognitive features to aid both operators and users of complex Cyber-physical Systems of Systems is seen as a key requirement for the future to reduce the complexity management burden from increased interconnectivity and the data deluge presented by increasing levels of data acquisition. This requires research in a number of supporting areas to allow vertical integration from the sensor level to supporting algorithms for information extraction, decision support, automated and self-learning control, dynamic reconfiguration features and consideration of the socio-technical interactions with operators and users.

The following subtopics have been identified as being necessary to support a move to Cognitive CPSoS:

> Situational awareness in large distributed systems with decentralised management and control
> Handling large amounts of data in real time to monitor the system performance and to detect faults and degradation
> Learning good operation patterns from past examples, auto-reconfiguration and adaptation
> Analysis of user behaviour and detection of needs and anomalies.

A public consultation process on the roadmap was undertaken in April-May 2015 (results: *http://www.cpsos.eu/public-consultation/*).
The research topics listed above provide a strategic long-range research agenda. The CPSoS project has complemented this strategic research agenda by general and sector-specific medium-term research and innovation topics that should be tackled by cooperative research projects in the near future:

Overarching topics:

> Overcoming the modelling bottleneck
> System integration and dynamic reconfiguration
> Robust distributed system-wide control and optimisation
> Resilience in systems of systems
> Humans in the loop
> Towards cognitive systems: data-based system operation.

Sector-specific topics:

> Integration of control, scheduling, planning and demand-side management
> New ICT infrastructures for adaptable, resilient, and reconfigurable manufacturing processes
> Data and information visualisation for decision support in manufacturing
> Development and exploitation of ICT to support multi-disciplinary, multi-objective optimisation of operations in complex, dynamic, 24/7 systems
> Safe, secure and trusted autonomous operations for systems with humans in the loop.

The CPSoS newsletter is available via *http://www.cpsos.eu/news-events/news/*.

The CPSoS project has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 611115.

CyPhERS

ROADMAPPING THE FUTURE OF CYBER-PHYSICAL SYSTEMS

by Bernhard Schätz (Fortiss), Holger Pfeifer (Fortiss)
and Martin Törngren (KTH Royal Institute of Technology)

Innovations in technological fields like embedded computing, communication, sensors and actuators, and informatics and control have enabled the implementation of complex systems that are able to control and coordinate physical and organisational processes on a local and a global scale via the use of information and communication technology. These systems provide the potential for revolutionary changes, bringing disruptive change to existing economic value chains and societal processes.

The potential of such Cyber-Physical Systems raises many questions – on a scientific, technical and economic as well as legal and ethical level. The CyPhERS Support Action was therefore initiated, co-funded by the European Commission, to develop a European strategic research and innovation agenda for CPS to ensure Europe's competitiveness in this emerging field. The CyPhERS project took place over 20 months ending in the spring of 2015. All key deliverables are available from the project homepage at *www.cyphers.eu*.

Different names have been coined for increasingly connected software-intensive systems, including Cyber-Physical Systems (CPS), Internet of Things (IoT), Industrie 4.0, Industrial Internet, Ubiquitous Computing, the Fog and the Swarm. We believe that they all share the same paradigm of immersive and distributed sensing and computing, but that these various terms mirror different perspectives of these systems. For example, communication is emphasised by IoT whereas system aspects are emphasised by CPS. This led the CyPhERS project to devote a special effort to characterising CPS with the intent to provide a way to describe different types of CPS, and as a complement to existing, rather generic, definitions. The CyPhERS characterisation covers dimensions of systems such as their degree of autonomy, adaptability, level of integration (technical, domains, life-cycle), technical emphasis (from deeply embedded to IT dominated), involvement of humans in the loop, and aspects of governance. These views reflect features of the evolving scope of CPS, from traditionally closed, single jurisdiction, limited adaptability and autonomy to increasing levels of capabilities and sophistication.

The central result of the CyPhERS project is an integrated research agenda and related comprehensive recommendations for action with regard to the development and promotion of CPS in Europe. To this end, five key areas of strategic importance to Europe – transport, energy, wellbeing, industry and infrastructures – were chosen to identify strengths, weaknesses, threats and opportunities for Europe, based on the current state and future technologies as well as the market potential of cyber-physical systems. CyPhERS analysed future scenarios in these key fields, where CPS provide solutions for Smart Mobility, Smart Energy, Smart Health, Smart Production and Smart Cities. Several challenges have to be addressed to enable these solutions.

- Science: integration of multiple paradigms affecting the construction of CPS systems by specially considering their socio-technical aspects, facilitating multidisciplinary collaboration, combining the related individual theories in a common systems theory, and establishing of a body of knowledge for multi-domain modelling
- Technology: up-scaling current engineering methods and technologies to the required level of complexity, by providing interoperable platforms/methods/tools, maturing the design and implementation of autonomous behaviour, eliminating deficits in data privacy, methodically integrating safety and security to ensure dependability, and establishing a systematic approach to deal with uncertain information
- Economy: support for the establishment of new business models and value networks in markets disrupted through cyber-physical systems by anticipating a shift from products to services, and being aware of the dominance of value-networks by new participants from the field of 'cyber'-technology
- Education: provision of the required competences to the stakeholders in CPS by preparing education/training systems for the transfer of evolving knowledge, balancing theory and practice, and counteracting the lack of availability personnel with the required skills and expertise
- Legislation: elimination of potential innovation barriers established by existing regulations that are inadequate for CPS by eliminating unclear interpretations or restrictive application of regulations, improving techniques and tools for the certification of systems, and the Europe-wide defragmentation of regulations
- Society: management of change/risk-aversion in stakeholders from the public, industry and politics by raising general public awareness concerning the consequences of installing CPS, and gathering support for acceptable risks during evolving these system from the public, industry and politics.

Consequently, CyPhERS recommends dedicated actions to be taken by academia, industry, governments and administrations as well as the public to strengthen key research fields, accelerate the maturation of technologies, facilitate the interoperability of technology, support open innovation, anticipate new business models, raise societal awareness and ensure the dependability of those systems.

Cyber-Physical Systems are influenced by several technological fields, and are of global strategic importance. Therefore, agendas compiled in specialised or neighbouring fields and other countries have been considered in the preparation of this Research Agenda and Recommendation for Actions. Because of the special importance of the field of embedded systems for CPS, in particular, extensive interactions with experts from that field including representatives from the ARTEMIS-IA have taken place.
As a main contrast to other agendas, CyPhERS had a socio-technical scope in investigating challenges and in deriving recommendations. This scope is reflected in several of the CyPERS recommendations including the emphasis on education, market considerations and the need to raise social awareness.

Further work is needed to take action based on the recommendations, and also to coordinate ongoing activities. Furthermore, providing a specific instantiation of the CyPhERS recommendations in fields like embedded systems would be helpful as a concretization for dedicated stakeholders.

The CyPhERS project was co-funded through the European Union's Seventh Framework Programme FP7 under grant agreement n° 611430. More information is available here: www.cyphers.eu

Motto:
HARMONY BRINGS PROSPERITY

Chinese proverb

A MESSAGE FROM THE DEPARTING EXECUTIVE DIRECTOR OF ECSEL JU

by Andreas Wild

Within sixteen months since its inception, ECSEL Joint Undertaking has engaged in 25 research and innovation projects with a total volume of eligible costs approaching 1.4 billion euros, attracting more than 550 million euros of public grants. They cover all the topics included in the multiannual strategic plan and put at work all the disciplines involved in our industry. At the same time, the organisation executed the first merger of two European institutions in the history of the Union, to continue and replace the two Joint Undertakings ARTEMIS and ENIAC and implement a part of the European Technology Platform EPoSS.

This is an undeniable success of all the stakeholders, who quickly overcame the starting difficulties:

> funding authorities succeeded in converging on procedures and agreeing on budget allocations in spite of the difficulties inherent to the three-way funding mechanism, like the mismatch between unified European funding rules on one side and the national variety in legislation and procedures on the other side;
> research and innovation actors found enough common ground to propose convincing collaborative projects in spite of differences in their needs to adequately protect competitive positions such as progress in the technology readiness level or the asynchronous expansion/recession cycles in the markets they serve;
> last but not least, the Programme Office quickly implemented the provisions of the new legal framework and executed calls while carrying on all the legacy activities in parallel; a daring endeavour, like changing the engines of an Airbus 380 in mid-flight.

In fact, a good start only sets the platform for the real work that is yet to be done.

The Commission communication from 2013 lays down the motivation and expectations for ECSEL JU, and the Council Regulation establishing ECSEL formulates its objectives and enumerates its tasks; these documents express implicitly a vision for the organisation, its mission and a framework for its strategy. However, not everybody participating in ECSEL seems to have the same understanding when spelling out what ECSEL should do. The stakeholders should come together and explicitly formulate a vision that can be embraced by all of them, while the mission should follow the requirements set forth in the Regulation.

The specificity of the ECSEL JU among the instruments implementing Horizon 2020 is contained in its ability to support rather large projects at higher technology readiness levels, so that it contributes to bridging the gap between discovery and economic valorisation. This is possible by bringing together a large number of funding authorities and is affordable when the expected impact overcompensates the complexity. Upon a suggestion by the Chairman of the Governing Board, the stakeholders are engaged in evaluating "flagship project" proposals and exploring the possibilities of implementation. This idea must be pursued and brought to fruition.

I do not doubt that ECSEL will succeed in embracing a shared vision and define impactful actions. This is the necessary condition that must be fulfilled before exploring the possibilities to increase the financial means beyond the strict budget allocated to the ECSEL JU by the European budgetary authority; this can be achieved by building upon synergies with the European Structural and Investment Funds, or by funding specific actions using contributions from more than one EU budget line, whereby ECSEL will be just one of the funding sources.

This way, ECSEL can play the role of a catalyst in keeping Europe at the forefront of technology progress in this area. And this will fulfil both strategic and systemic needs, given that this is the industry providing the "smart" solution for almost all products and services, and is essential for assuring the safety and security of citizens and nations. As a European, I cannot but wish that ECSEL JU will succeed brilliantly.

COLUMN

BATON BLUE(S)

Roberto Uribeetxeberria, Mondragon University

Dr Roberto Uribeetxeberria is currently the Head of Research of the Faculty of Engineering at Mondragon University whom he has represented in the ARTEMIS Industrial Association since 2007. He is currently a member of the Steering Board of Artemis-IA and in March 2014 he was also appointed to the Presidium by the Steering Board.

Being part of the ARTEMIS community is, according to Roberto, a logical step given the high industrial drive behind the Mondragon University. "Having an industry-linked research model, the university was attracted to the ARTEMIS community and the prospects to learn from its vast and varied experience so that we can transfer cross-sectoral technology research to our industrial partners. Becoming a member of the steering board was a way for me to get one step ahead, as it were, and get a different and broader perspective than you get as a member of a project. It's not just the technology or science you have to consider. You have another more political, administrative and policy-based brief. You also get to see the nature of the differences, such as the priorities of the various countries and their public authorities. It's not an easy job to align the different countries' agendas but it certainly helps you get a good overview of what's happening in the European landscape that provides the stage for the projects."

STRENGTH IN DIVERSITY

With the integration of ARTEMIS within the ECSEL JTI, Roberto does notice the differences that exist between the projects of the ECSEL members. For instance, the semicon-based projects have focus on R&D for semiconductor processes and production equipment and tend to be much closer to the market and are therefore very interesting for companies from the industry to invest in. Software, on the other hand, is different since research and development is not so downstream as a precompetitive nature is required to ensure participation of competitors. These projects focus typically on common architectures, framework, methods and tools. In this respect, funding is more important here since the revenue is not so directly related to immediate industry exploitation. "So, my advice to ECSEL would be to take these differences into account in the whole process of awarding projects. Accept them and work with not against them. But certainly there are many benefits to be gained in the additional critical mass ECSEL provides, especially for my own university and the students and businesses we serve in the Basque Country."

As project leader of MANTIS, which is the management of critical knowledge to support maintenance decision making, Roberto explains what this project, one of the very few CPS oriented projects funded in the first call of ECSEL, is about. "The idea is to develop a pro-active maintenance service platform architecture that allows future performance to be estimated, imminent failures predicted and pro-active maintenance scheduled in distributed processing chains that transform raw data into knowledge. If we can integrate machine data with information from people and form valuable knowledge for decision support, everyone can benefit, whether that's in the field of manufacturing, energy or transportation." Apart from the cross-sectoral nature of the project, the focus also lies on the service aspects because it is here that a competitive edge can be gained. "We refer to it as 'servitisation' – perhaps not a word in the Oxford dictionary yet but," as Roberto playfully suggests, "why not a new word to go with a new concept?"

GETTING KNOWLEDGE INTO INDUSTRY

Roberto is clearly driven by the link between academia and industry. "For me it is really gratifying to be involved in not only the development but especially the transfer of knowledge into industry and, ultimately, applications, whether products or services, or both. One of the ways of transferring this knowledge, of course, is through the projects we do with partners throughout Europe. But the other way is through people. So we try to get our students involved in such projects because these are also the young talents that will eventually end up working in the companies."

In terms of the future Roberto sees the biggest challenge being not so much the proliferation of smart devices but how they will all be interconnected and all the data stored. "The challenges of the Internet of Things and all it entails, for example, are not confined to technical aspects such as interoperability or bandwidth demand.

> " ACCEPT THE DIFFERENCES AND WORK WITH THEM NOT AGAINST THEM."

There are also ethics involved: Privacy, security, ownership and access to data… There's plenty to keep us busy."

In considering the question of who should take over the baton from him, Roberto is clear about his choice. Steering board colleague Daniel Watzenig. "I'm fascinated about his work on autonomous driving and I reckon he has some interesting things to say about his field. For example, I'd like to ask him about some of the dilemmas of autonomous driving, like intervention. At what point does the car override the driver's decision and vice versa. Both lives and insurance policies are at stake!"

"There are two songs that I am torn between for the music to go with this column. One of my all-time favourites is Van Morrison's 'Brown-Eyed Girl' but last year I heard a song that made a real impression on me, and that's 'Three White Horses' by Andrew Bird. It's a little bit sad but it's still a song that lingers in my mind."

ARTEMIS EVENTS CALENDAR

K4I - 7TH EUROPEAN INNOVATION SUMMIT

Date
07-09 Dec 2015
Location
EP, Brussels

HIPEAC 2016 CONFERENCE

Date
18-20 Jan 2016
Location
Prague, Czech Republic

ARTEMIS BROKERAGE EVENT FOR CALL 2016

Date
26-27 Jan 2016
Location
Strasbourg, France

ECSEL BROKERAGE EVENT 2016

Date
27-28 January 2016
Location
Strasbourg, France

EMBEDDED WORLD 2016

Date
23-25 Feb 2016
Location
Nuremberg, Germany

DATE 16

Date

14-18 Mar 2016
Location
Dresden, Germany

ARTEMIS SPRING EVENT 2016

Date

13-14 April 2016
Location
Vienna, Austria

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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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