Underscoring the importance of improving interoperability in industrial engineering environments, **Horizon 2020 Projects** speaks to **Dr Christian El Salloum,** the co-ordinator of the ARTEMIS CRYSTAL project

Crystal

Since May 2013, the ARTEMIS project CRYSTAL has been working with the goal of promoting interoperability when it comes to industrial engineering environments. In advancing interoperability technologies, the project is working to develop so-called 'technology bricks' – tools in system engineering, standards and methodologies.

The project promises to advance and support developments in the industrial domains of aerospace, automotive, rail and healthcare.

In this interview the project's co-ordinator, Dr Christian El Salloum, speaks to Horizon 2020 Projects about CRYSTAL's ambitions and where efforts can have a major impact on industry.

Dr Christian El Salloum

What are the aims and ambitions of the CRYSTAL project, and what has been achieved thus far?

CRYSTAL is about system engineering environments for safety critical embedded systems. Today, the engineering environments for developing critical systems such as those needed in an aeroplane or a modern car are comprised of a lot of tools that support the different activities at the different stages in the development process.

Not only are developers part of this process, but also engineers, designers, testers: all the stakeholders that are involved in bringing such a product to the market.

The big problem is that this landscape of tools is typically comprised of individual tools that do not interact and do not collaborate with each other. They don't understand each other. So very often the stakeholders have to manually transfer data from one to the other.

This is very time consuming, it's very costly and it leads to a lot of inconsistencies which can also have, in the worst case, a negative impact on the safety of the product.

What we are doing in CRYSTAL is developing an open interoperability specification. You can look at this as a common language, a common way to understand each other for these tools.

The idea is that, if all these tools agree, and the users agree to adopt this; the tools are capable of understanding and speaking this language, therefore you have an 'interoperability specification'.

Just to give a concrete example of what we mean, sometimes you have one tool for managing requirements, one for creating and managing system designs and another for testing. For years, you have been developing a series of cars according to a given set of requirements, but at a point in time some requirements can change.

For example there is a new law regulating the emissions of the cars – the new generation of cars have to emit less CO_2. You therefore want to put the question to the system: a specific requirement has changed – what are the impacts, which implementations might require a change, and which tests need to be redone? The system can only provide an answer if the involved tools are able to co-operate.

All this management work, this integration work of the different stakeholders, this is what we want to solve.

We want to enable seamless collaboration of all stakeholders in the development of a critical embedded system.

This is a problem across the world. Are there global competitors who are working in the same space as you?

We really don't think in competitive terms. Our mission is to co-operate with other running European projects, and to reuse the results of the projects that are already finished. We bring things together and harmonise them.

The aim is to bring these results to maturity and to a state where they can be taken for adoption in the industry.

The CRYSTAL interoperability standard is also not necessarily a competitor to other standards. Instead of developing everything new, we analyse existing standards in the different areas, and incorporate successful elements whenever appropriate.

The focus of CRYSTAL is not on replacing other standards, but on providing added value.

Co-operation is also the major driver within the project. CRYSTAL is a large project with 71 partners all over Europe. Our consortium includes the major tool providers as well as the major tool end users like large original equipment manufacturers (OEMs).

Naturally, many of these companies are competitors in their daily business, but in CRYSTAL they are collaborating towards a common goal; a unified and open interoperability standard. It is obvious that a unified standard can only be successful if the involved stakeholders are committed to working together.

How far down the path are you in achieving your ambitions, and how successful has your work been so far?

CRYSTAL is a three-year project, and we started in May 2013, so we are now at the beginning of the project. We are following an iterative development process, meaning that we are not capturing the requirements in the first year, doing the design in the second, and implementation in the third. We are working with fast iterations; where the first one will take a little longer than the subsequent ones since we have to set up the entire process.

At this point in time, the first iteration is already completed with the first specifications, the first prototypes and the first tool chains.

On the issue of partners, are you looking to work with researchers, organisations more in the newer EU member states towards central and Eastern Europe? Or do you find that most of your partners are in the Western European area?

In the proposal phase we were open to all the European Union member states. The actual project consortium includes organisations from Belgium, the Netherlands, Sweden, Germany, the Czech Republic, Austria, Italy, Spain, France and the UK. Of course many of these organisations also have associates in the newer EU member states which will also benefit from the CRYSTAL results.

Running from May 2013 to April 2016, the CRYSTAL project is funded by the EU's ARTEMIS Joint Technology Initiative. The JTI, a partnership funded by the EU and industry, was one of the first such public private partnerships to be established in 2008.

ARTEMIS seeks to "define and implement the Research Agenda for the development of key technologies in the field of embedded computing systems".

Under Horizon 2020, the Commission has proposed the merger of the ARTEMIS and ENIAC (a JTI focusing on nano-electronics) PPPs to form the new Electronic Components and Systems for European Leadership (ECSEL) JTI. The JTI is expected to receive funding worth €4.8bn, with EU member states matching the European Commission's contribution of €1.2bn. Industrial partners will contribute at least half of the total costs.

According to the Commission, creating the ECSEL JTI will build on the individual strengths of ARTEMIS and ENIAC, whilst unlocking additional synergies. The new PPP will support an integrated European strategy in electronic components and systems allowing the development of a sustainable electronic components and systems industrial ecosystem. It will also provide effective means for European stakeholders to keep pace with technology, to gain access to advanced components, and to consolidate their leadership in electronic systems for key economic sectors.

Getting a sense of the wider developments in the sector as regards the European Union funding, do you feel that enough support is being given to your sector? Do you feel that Brussels has got the priorities right when it comes to funding future innovative projects that hold a lot of potential for the success of Europe?

At this point in time, CRYSTAL is the largest funded ARTEMIS project with a budget of €83m. We are very happy with the resources we received and consider them as absolutely necessary.

Creating and establishing a new standard on a large scale in an already consolidated market cannot be achieved by small individual organisations. The funding that we received enabled us to get all the required stakeholders onboard. Otherwise if you don't build the critical mass you cannot even start pushing for change. I think we can be very thankful that the European Union made it possible with their funding, to initiate such an endeavour as the CRYSTAL project.

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