ReCaM
Rapid Reconfiguration of Flexible Production Systems

Welcome to the fourth issue of ReCaM newsletter!

This issue includes a special session about the SMEs within ReCaM, together with the description of WP3. The description of some exploitable results closes this issue.

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➢ ReCaM partners describe how to exploit results

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➢ WP3: "Capability and resource modelling"

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Latest news and events of ReCaM
Mid-Term Review Meeting: Milan, Italy

The ReCaM project consortium held its Mid-Term Review Meeting on 4th May, 2017 in Milan, with the participation of the project officer and the technical advisor at Politecnico di Milano. This meeting covered various milestone developments, and the results achieved in different work packages and deliverables of the project.

Upcoming!
Technical Meeting in Spain

Part of the ReCaM consortium will conduct a technical meeting in September, in Spain. The meeting focuses on describing the capabilities of modules related to the CESA demonstrator. Mainly partners from CESA, TECNALIA and TUT will collaborate to carryout an extensive description of the planned solutions.

The Consortium partners

The ReCaM Consortium is composed of nine partners from industrial end users, technology providers and research institutions.

ReCaM until its Mid-Term and Beyond

After a collaborative development efforts of the first 18 months of the ReCaM consortium, the Mid-Term meeting has summarised and presented the significant results accomplished during this period. In this meeting, the consortium has presented the six milestones which were achieved successfully, and the progresses made during the first half of the project.

Valuable feedback has been given by the project officer and the technical advisor, to maintain the progresses made so far and to strengthen the opportunities for future improvements. The reviewers offered directions on the key aspects to be taken during the second-half of the project and suggested several priority actions for facilitating a successful conclusion of the project.

Outlining the Future of ReCaM

The second half of ReCaM will focus on validating the prototypes developed in the Lab demonstrator, with particular attention to their integration and implementation for the two industrial cases. In this phase the ReCaM consortium will release fine-tuned and tested versions of these tools.

As the ReCaM tools mature and their impact becomes visible through the demonstrators, Dissemination and Exploitation activities will follow accordingly. With the expected concrete results in this stage, proper patenting and exploitation strategies will be clearly defined. Strategies to standardisation and opening the project to the wider industry community is planned to synergise the impact of ReCaM with other similar European level initiatives.

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Opportunities for SMEs in ReCaM

Cosberg S.p.A. is going to benefit from the opportunities offered by the ReCaM project, in terms of innovation strategy, advanced solutions and competitiveness. First of all, ReCaM represents a foundation for improving the innovation network, through current and future collaboration with some of the project players. This innovation network enables to consolidate the Cosberg brand as strictly related to innovative ideas. With ReCaM Cosberg expects to strengthen the innovation leader position in the market, also thanks to the future synergy with other ReCaM players.

"What are the important solutions Cosberg aims to provide, with respect to the ReCaM approach?"

1. The first solution **is a wider range of single Mechatronic Objects**, relative to the current state of the art, conceived according to a modular approach. The goal is to extend the MOs to a higher and more efficient level of mechanical reconfiguration, so that each of them can be potentially proposed to the market, with strong features of standardisation (quality) and easy customisation (flexibility). By following this direction, Cosberg is able to extend its own products, customer portfolio and business model. These efforts will be initiated very early at the end of the project.

"ReCaM represents a foundation for improving the innovation network"

2. The second solution aims to develop **an overall system of semi-automatic production for assembly processes, composed by a federation of Mechatronic Objects.** The federation is an interconnected system of MOs interacting with each other and with the high level production management system. This requires a more inclusive approach, which is currently already in use to build the final demonstrator, including diverse software tools, controls, and the System Engineering Platform. This solution is targeted at manufacturers of several sectors, especially automotive and electromechanical one.

Enginsoft is well positioned to exploit the opportunity from ReCaM by developing innovative services. In fact, a relevant part of EnginSoft revenue comes from B2B simulation and optimisation services, supported by the competencies of more than 200 engineers and mathematicians and a comprehensive technology stack.

"What are the top state-of-the-art issues ReCaM can offer to industries?"

Currently, manufacturing system producers and system integrators work together with OEM companies to guarantee the required systems performances. However they are facing growing pressure from customers that are looking for increased production flexibility while preserving efficiency and control over costs. A key solution to address these requests are Reconfigurable Manufacturing Systems. However, designing such systems is a daunting task because of the need to identify optimal designs under conflicting objectives, such as operative and equipment costs, throughput, work in progress, setup and reconfiguration costs etc., taking into account changes of production requests at the different time scales.

"How an SME like EnginSoft can exploit the ReCaM results?"

The tools developed within ReCaM offer a comprehensive and effective solution for helping companies designing and optimal Reconfigurable Manufacturing Systems. The outcomes of the ReCaM project further expand EnginSoft competencies and toolset, allowing to address innovative manufacturing system design challenges for current and prospective customers. EnginSoft is actively working to embed ReCaM results into its strategy and roadmap for Industry 4.0 products and services. To this end, a partnership within the Consortium is envisioned. EnginSoft main challenges are to provide a comprehensive solution to the different requests of potential customers, and to bring results to market faster.

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Opportunities for SMEs in ReCaM

nxtControl is an SME which delivers state-of-the-art know-how to its customers, and it is perceived as being ahead in its field of activity. This is also proved by the recent merger with Schneider Electric, a result of constantly leading know-how in control technology, staying ahead and finding always quick solutions for the changing needs of a dynamic market.

"How can ReCaM support to improve the value offer of SMEs like nxtControl?"

The ReCaM project helps to advance the know-how in the area of production process and requirements, in re-configuration and in the field of Cyber Physical Systems (CPS). nxtControl is positioned as partner and consultant for companies preparing for digitalisation and more specific for CPS. The developments made and the possibility to present these advancements create request for prototyping, demonstrators and evaluation studies. With the developments and increased know-how it is much easier to help end-customers (manufacturers) to reach business targets as well. Moreover, it has more value if such results are created together with other companies well known for their know-how and success, such as the ReCaM partners.

"ReCaM can help SMEs to adapt very quickly to market trends"

Beside the extended know-how, it is very valuable for SMEs to discuss and challenge their ideas and concepts with different kind of companies/partners in the framework of such a project. It helps to prevent mistakes, to take into account different views of customers covering the whole value chain. Furthermore, it helps to keep in advance when it comes to new technologies and market trends. ReCaM can help a SME to adapt very quickly to market trends as it can get support from partners within the project network.

DGH expects to create new business opportunities by implementing the ReCaM concepts, in the diverse business sectors in which it usually works, such as automotive, food and beverage, aeronautics, energy etc.

"Which types of future DGH solutions can exploit ReCaM results?"

System integrators like DGH are currently required to implement all the necessary capabilities to meet with the challenges that "Industry 4.0" is facing, by offering turn-key solutions to companies from all over Europe and even worldwide. In this context, the knowledge gained in ReCaM will enable DGH to get expertise in concepts such as versatility and flexibility, which is one of the most important pillars of DGH's growth strategy in next years. In particular, the concepts of versatility, flexibility, reconfiguration of tools, and easy reprogramming will have a big impact for growth. The biggest impact that DGH is expecting will be mainly related to: Multi-Capabilities, communications systems, easy re-programming, flexible configurations etc.

"the concepts of versatility, flexibility, reconfiguration of tools, and easy reprogramming will have a big impact for growth"

By developing these key elements, DGH aims to implement new innovative ideas of manufacturing lines for different production processes that could be introduced through marketing actions to headquarters and key stakeholders in sectors known by DGH such as automotive, food & beverage and aeronautical and in new ones like consumer goods . One of the main goals of this strategy would be to allow DGH find out new potential market niches either on existing customers or new ones.

Another important benefit for DGH as being part of ReCaM is looking for new ways of collaboration with the partners, networking with top institutions and companies involved in the project is a valuable asset to support future innovation.

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A closer look at the project: WP3

What is the main goal of WP3?

WP3 is all about building digital, both human- and computer interpretable representations of manufacturing resources, their capabilities and other characteristics, as well as product requirements. The objective is to enable semi-automatic match-making between product requirements and resource capabilities, and thus to support rapid design and reconfiguration of versatile production systems. The capability model needs to allow automatic aggregation of lower level simple capabilities of individual resources into combined capabilities of multiple co-operating resources.

Furthermore, rules to calculate the combined capability parameters, and to make the match between the product requirements and resource capabilities are required. The work package produces the needed formal information models, as well as the associated software for product and resource descriptions, and automatic match-making.

Results after the first Half of the Project

During the first half of the project, an ontology-based Capability Model and XML-based Resource Description concept have been developed. These models together can capture the relevant functional characteristics (capabilities) of resources, as well as other relevant information such as interface specifications, basic characteristics and business information. The Capability Model casts associations between simple and combined capabilities, and therefore facilitates the building of functional configurations of combined resources (e.g. gripper and robot, or feeder base and part magazine). This will support the reconfiguration of existing system configurations, as the proposed concept can automatically suggest alternative resource combinations for different product requirements. Moreover, the Resource Description contains additional definitions, like the control interfaces and parameters, which can be applied later during the phases of system commissioning and execution.

Currently, the WP3 partners are finalising the Graphical User Interface (GUI) intended for editing the Resource Descriptions. This will be an easy-to-use interface for the resource providers to describe their resource offerings and to save these descriptions to resource catalogues.

Furthermore, a formal information model for representing the product requirements, i.e. the Product Requirement Description (PRD), has been developed. This requirements representation, together with the resource descriptions, will be utilised as an input for the capability matchmaking algorithms, rules and software, which will be developed during the remaining months of the work package.
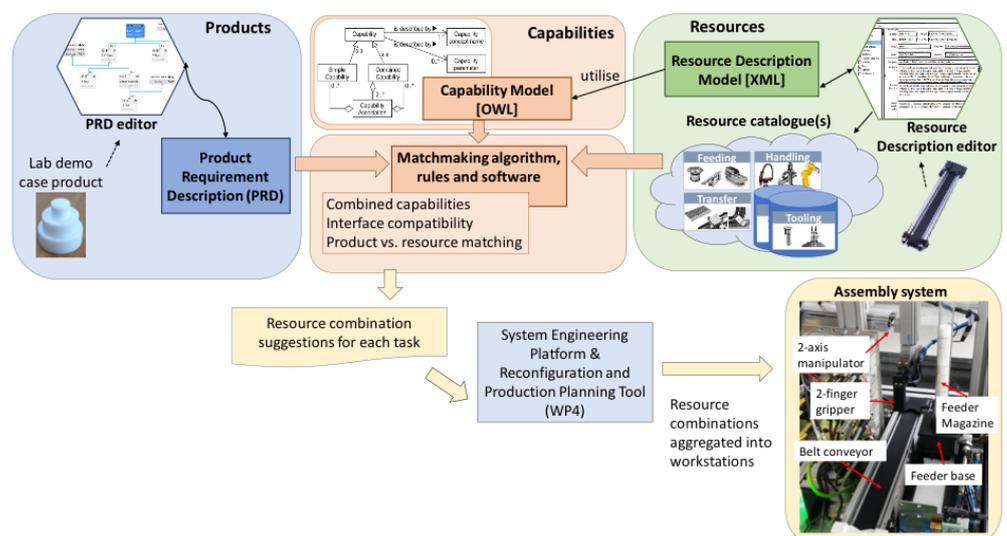

Fig. 1 - Schematic figure of how WP3 results interact with each other and with other WPs.

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Applied ReCaM: Exploitable results

Section focus:

ReCaM exploitable results:

➡ Flexible programming for semi-automatic production

➡ SW-tools for flexible System Engineering and visualisation

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Exploitable results within the "Capability and Resource Management Platform"

Three exploitable results are described in this section: the Resource Description concept as well as associated Editor GUI SW to produce such descriptions; Capability Model and Catalogue as well as the methods and tools for capability match-making; a Web-based information sharing platform for publishing the resource descriptions. A set of open software API libraries are used for implementing the previous results and these are offered also for other purposes.

The developed Capability Model, Resource Description model and associated Resource Description Editor (Figure 2) allow the production resources to be formally described based on their capabilities and other important characteristics. They provide the resource vendors a standardised way to describe their offerings and to publish these descriptions in global Resource Catalogues and digital e-marketplaces. System integrators and end-users can browse these catalogues to find alternative candidate resources for their specific needs. The same catalogue platform can also be used to build resource catalogues for in-house use, in order to support re-configuration and re-use of the existing in-house resources.

The search from the catalogues is facilitated by the capability-based matchmaking software, which allows automatic search and filtering of potential resources to specific product requirements from large search spaces.

The Capability Model provides an ability to automatically derive the combined capabilities of resource combinations, which eliminates the need to describe them manually. These combinations can be dynamically created for certain needs based on the individual resource descriptions. Similarly, automatic reasoning methods can provide suggestions for the reconfiguration of the existing system. Thus, the capability matchmaking approach supports both greenfield and brownfield configuration scenarios. These exploitable results are expected to fasten the design, reconfiguration and set up of production systems, and thus to help the European manufacturing companies to react faster to the ever changing requirements.
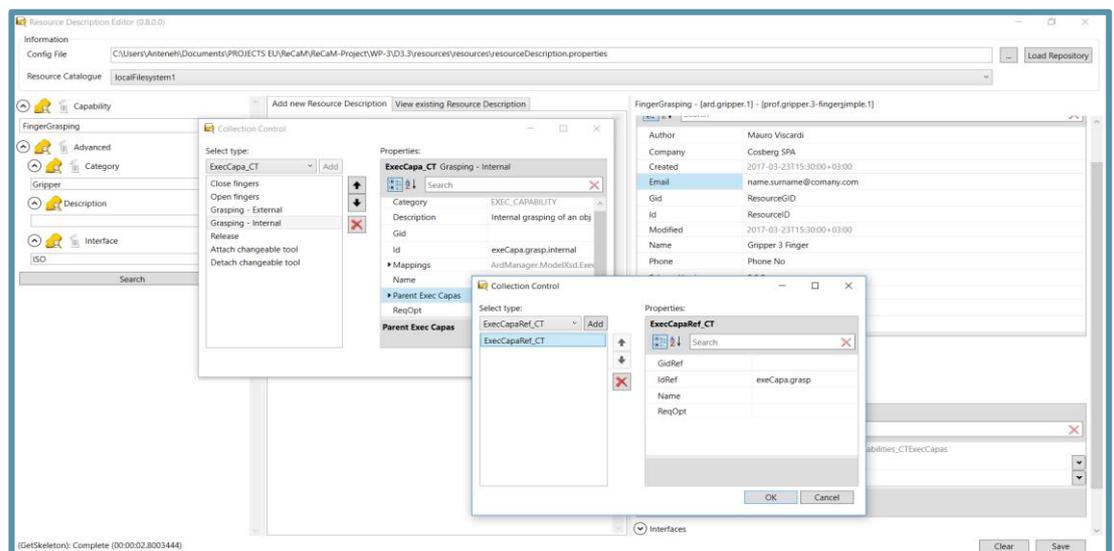

Fig. 2 - Resource Description Editor (First Release Prototype)
The current prototype provides two main functionalities: (1) adding the description of new resources to the Mechatronic Object Catalogue; (2) to visualise the existing resource descriptions in the catalogue.

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