



# I4MS

TECH4CORPORATES SESSIONS

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MOBILE WORLD CONGRESS

2019



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This document provides an overview of technologies developed, in the context of the particular Innovation Actions, under the strategy created by the I4MS initiative to ensure the liaison with Global Corporations and Industry Associations. The goal of this strategy is to help maximising the impact of the project by portraying the developed technologies and providing examples of new business models, transforming specific industrial challenges into business opportunities that might be beneficial for the ecosystem.

One of the main challenges of the I4MS initiative is to create a lasting and valuable environment for SMEs and other stakeholders that are part of the I4MS community. Therefore, in order to succeed, it is fundamental to foster a strong network among them with sustainable inter-relationships.

Manufacturing SMEs, Digital Innovation Hubs, Competence Centres and Technology Providers find increasing difficulties to transform a successful pilot into a successful product or service for the general market. Whether they have or not real means to reach a bigger market share or the funds for replicating a pilot on large scale, the conversion to a market product or service is not difficult to complete. This report builds on getting these technologies closer to the market through engaging external actors. We hope this report will play a key role into bringing together SMEs and potential corporate clients or corporate sponsors and exploit further the capabilities of the technologies developed under the I4MS initiative.

In this sense, the Engagement Meetups “Tech4Corporates Sessions” combines different tools like in-person workshops, elevator pitches and seminars in order to take advantage of the strengths of personal communication to reach the target audience and communicate the benefits of becoming a part of the I4MS environment. Particular attention is given to the organisation of one-to-one match-made meetings (brokerage activities) as a stimulus for new alliances and collaborative projects between Manufacturing SMEs, Technology Providers, Sponsors, and Corporates.

## I4MS Most Valued Features

**+ ACCESS TO FUNDING +**  
opportunities and to cutting-edge technology to be ready for the real challenges of the industry in the Digital Era.

**+ GUIDANCE +**  
to learn about the latest trends, find out new business opportunities and bring value to your ecosystem.

**+ VISIBILITY +**  
by participating in experiments, share your best practices, meeting the ecosystem and joining the discussion.

## Additional Added Value received by Application Experiments funded under I4MS



Disruptors awards to select the best experiments



Best practices to get inspiration by from previous participants to become an Successful and Innovative Smart SMEs



Skills catalogue to access information about the most demanded skills and training materials



Acceleration program offering I4MS experiments training on raising funds and networking

## I4MS to the date

**84%**

of the industrial partners are SMEs

**70%**

of the experiments have a relevant European dimension

**€34**

million funding allocated for 2018-2020

# 1. About I4MS

**I4MS, ICT Innovation for Manufacturing SMEs**, is a European initiative supporting manufacturing SMEs and mid-caps in the widespread use of information and communication technologies (ICT) in their business operations. Under I4MS, SMEs can apply for technological and financial support to conduct small experiments allowing them to test digital innovations in their business via open calls. The I4MS project is now in its third phase with each phase having complementary objectives.

**Phase 1** - launched in July 2013 focusing on creating Digital Innovation Hubs (DIHs) and establishing a core I4MS community/ecosystem.

**Phase 2** - launched in Fall 2015, with the aim of growing further of the core I4MS community/ecosystem.

Of the nearly €110 million funding made available during Phases 1 and Phase 2, more than €26million was distributed to SMEs and Mid-caps through 15 open calls.

**Phase 3** - launched in September 2017, and aimed at reinforcing the I4MS ecosystem. During this phase, European SMEs and mid-caps are exposed to new approaches and methodologies on business models, access to financing, and training opportunities to re-skill staff. A total funding of €34 million is made available under Phase 3 by the participating Innovation Actions. This funding is meant to support technology transfer from the Innovation Actions to SMEs interested in adopting Industry 4.0 technologies.

Phase 3 targets four technology areas, namely, cloud computing, robotics, cyber physical systems & IoT, and additive manufacturing. These solutions can significantly contribute to boost the competitiveness of SMEs and ease the access to global markets and new digital business models.

## WHAT DOES I4MS OFFER?

I4MS platform gathers information on services and opportunities available for SMEs and mid-caps to reap the rewards of digital transformation. We are speaking about information on how digital technologies, such as cloud-based simulation, additive manufacturing, robotics, CPS and IoT can improve business processes.

Besides, I4MS also gives access to advice and cutting-edge technology services offered by DIHs and the Innovation Actions to facilitate the digital transformation of SMEs. Funding opportunities for digital transformation of the manufacturing industry are also available, so SMEs and mid-caps can experiment with new technologies. In Phase 3, funding ascends to 34 million Euros.

Information on digital skills key to the industry's success and access to training materials will also be offered through the Skills Observatory, as well as an acceleration program with matchmaking opportunities. Moreover, the Disruptor Awards will reward and recognise the best digital transformation experiments of SMEs and mid-caps.

Last, but not least, I4MS has created an online community for the EU manufacturing industry to foster working, learning and connecting. To find new synergies and invigorate the ecosystem. This means that I4MS will bring the smart manufacturing ecosystem together by offering information on leading-edge technologies and funding opportunities, but also inspiring and offering support to facilitate the digital transformation.

Find more information at: <https://i4ms.fundingbox.com/>

## 2. Engagement Meetups Objectives

**The main Tech4Coporates Engagement Meetup** objective is to promote the sustainable life for the I4MS ecosystem after the end of I4MS initiative and create a reliable networks between corporates and the rest of the ecosystem at the European level.

This includes:

- Building a reliable and durable relationship between all the stakeholders involved in the I4MS environment
- Strengthening existing manufacturing networks and incorporating them to the I4MS environment
- Catalysing an active, diverse and well-connected community of stakeholders around I4MS
- Creating tailored-made events for the engagement meetups strategy according to the type of session (seminar, workshop, one to ones, pitching events etc) and the requirements of the participant stakeholders
- Establish the best practices derived from the engagement strategies and communicating them to the community for them to integrate that knowledge into their day-to-day strategy
- Facilitating conversation and collaboration between the community in order to foster the development of projects or other possibilities
- Identifying new valuable actors for the I4MS environment and stimulate organic growth and wider coverage of stakeholders
- Leveraging further investment by creating linkages with industry and with regional/national initiatives



# 3. Target Audience

Regarding the different members of the environment, the I4MS audience is composed by a diverse group of stakeholders from the private and public spheres and also with a diverse range of backgrounds, needs and objectives.

Concerning the overall Engagement Meetups strategy, we will bring into focus four main audience groups: **Manufacturing SMEs, Corporates, Technology Providers, and Digital Innovation Hubs and Competence Centres**. A tailored strategy for each target group has been developed within the general communication strategy in order to attain an enduring performance and outcome.

Moreover, this target audience selection relies on these 4 groups since the I4MS initiative has identified them as the stakeholders more likely to benefit from the interaction and interconnection activities that the engagement meetups represents

## a) Manufacturing SMEs

As the main target of the I4MS initiative, Manufacturing SMEs are the largest beneficiary of the Engagement Meetups. Generally, the access to key industry players like Corporates for SMEs is difficult to achieve, and, consequently, SMEs are not able to develop an interrelation with corporates stakeholders.

Creating the right environment and momentum for fostering direct communication between SMEs, corporates and sponsors, and the rest of stakeholders will represent an opportunity for SMEs to get in contact with key manufacturing industry players.

Moreover, SMEs will be supported by all the know-how and high reputation of an European Union initiative such as I4MS, giving an additional credibility to the SMEs value proposal and facilitating new the establishment of new projects and business deals.

## b) Corporates

As stated in the introduction, getting corporates involved in the I4MS initiative is a key point for creating a reliable environment and being able to develop linkages with the manufacturing industry. As a manufacturing industry player, corporates can become an eventual sponsor or client for I4MS SMEs and Technology Providers and also corporates can foster the applicability of the potential products or services in different institutional and non-institutional context.

In that sense, corporates represent the most challenging stakeholder to attract but also a key group in order to produce a viable and enduring ecosystem because it is highly complex to showcase the benefits of I4MS since part of the value proposition is not tangible and corporates can find difficult to understand how they can take profit of it. Consequently, to find the right channel and momentum in order to reach them is the main challenge for the I4MS initiative.

For that matter, the strategy developed through the Tech4Corporate's events relies on creating long-lasting and meaningful engagement with corporates, and even a matchmaking development in order to make the I4MS initiative public and achieve greater use and uptake. So as to create the engagement, we consider the best way was through Engagement Meetups that not only would provide the corporates the key messages of the initiative, but also a real contact with the other stakeholders involved like DIH and SMEs in order to get to know ecosystem.



### c) Technology Providers

Technology providers are technological companies that are specialised in providing with technological services their clients. Within the I4MS initiative framework, most of the cases the technology providers are small and medium size companies.

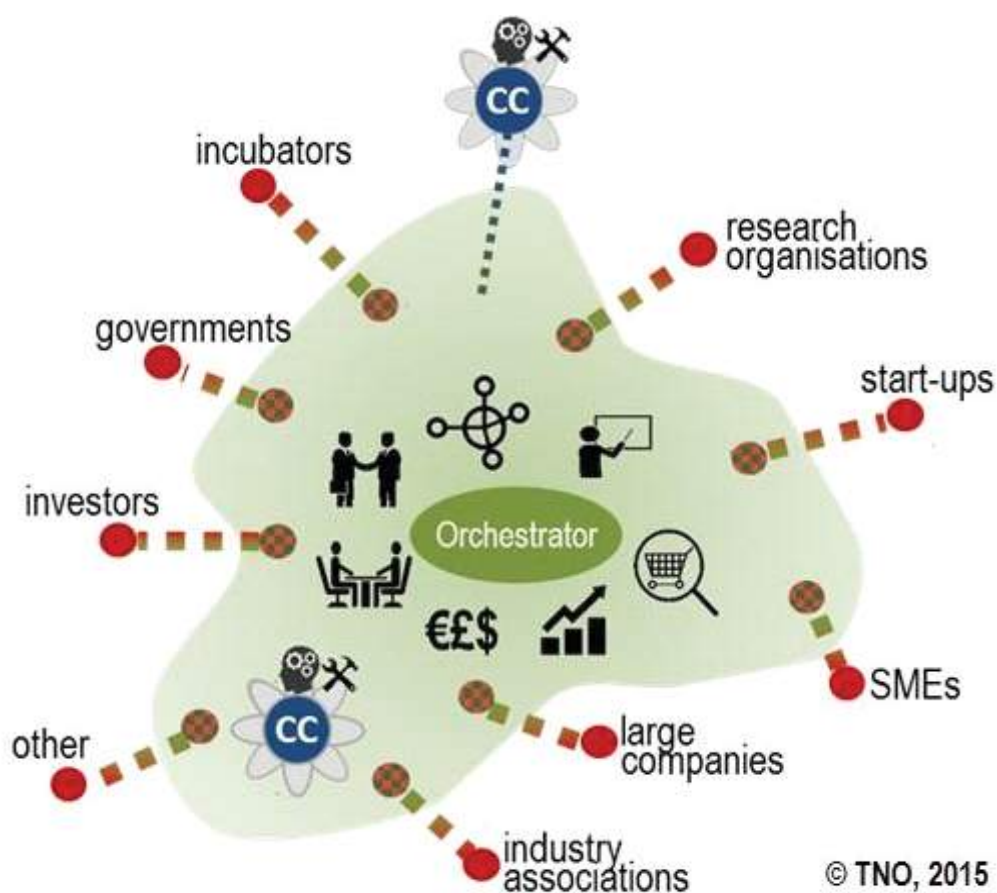
As well as the Manufacturing SMEs, the technology providers have difficulties to reach the corporate or sponsors scene due to their difficulty in gaining access to it. The engagement meetups will enable a direct contact and relation with potential clients and sponsors within a European Union initiative framework.

### d) Digital Innovation Hubs and Competence Centres

According to the Digital Innovation Hub Catalogue of the European Commission, "Digital Innovation Hubs are one-stop-shops that help companies to become more competitive with regard to their business/production processes, products or services using digital technologies.

They are based upon technology infrastructure (Competence Centre) and make available access to the latest knowledge, expertise and technology to support their customers with piloting, testing and experimenting with digital innovations. DIHs also provide business and financing support to implement these innovations, if needed across the value chain".

In that sense, Digital Innovation Hubs are a doorway to manufacturing market and they rely their success on cooperation between different public and private partners of their reach (RTOs, universities, industry associations, chambers of commerce, incubator/accelerators, regional development agencies and even governments).



## 4. I4MS at MWC 2019

The Tech4Corporate 2019 Event will take place at the MWC 2019 (Mobile World Congress 2019). This is “the world’s largest exhibition for the mobile industry, incorporating a thought-leadership conference that features prominent executives representing mobile operators, device manufacturers, technology providers, vendors and content owners from across the world”. It brings together the latest innovations and leading-edge technologies from more than 2,400 leading companies, with a highly-rated conference programme assembling today’s visionaries to explore the hottest topics influencing the industry.

During the 2019 edition of MWC to be held in Barcelona (Spain) on the last week of February, I4MS, supported by the Mobile World Capital Barcelona Foundation, will grant visibility with a permanent space at the centre of the MWC Capital Barcelona Stand where the highlights of the I4MS project will be featured. This space allows to create different industry-driven activities in order to promote the initiative and to make known the opportunities and possibilities to the Mobile World Congress audience.

In addition, tailor-made tours organised within the programme Going Digital, are organized to reach a more specific audience interested in 4.0 industry developments. In this tour a wide range of Industry exhibitors will showcase their projects and initiatives. The tour aims to visit relevant exhibition stands to provide insight into the latest technology and facilitate direct contact between exhibitors and participants. Tour participants will also be informed about the different opportunities I4MS has to offer them.

Moreover, in order to foster networking, one-to-one meetings with different actors interested in the I4MS industries will take place. It will be done in order to establish proactive visit to other stands to produce synergies with the ecosystem and present I4MS in smaller groups taking advantage of MWC being one of the partners of the project.

I4MS will be located in the European Project Booth at the Mobile World Capital stand. It will be shared with the innovation action L4MS. The address is Congress Square, 40 (CS40), in a space between Hall 4 and Hall 5.





# 5. I4MS Innovative Actions

**34 millions to support European manufacturing SMEs on the following technological domains, through their respective Innovative Actions**



## HPC Cloud-Based Simulation



CloudiFacturing project helps to optimize production processes using Cloud/HPC-based modelling and simulation, leveraging online factory data and advanced data analytics.

<https://www.cloudifacturing.eu>  
[contact@cloudifacturing.eu](mailto:contact@cloudifacturing.eu)



## Robotics



L4MS provides a complete virtualization of logistics automation (Open Platform for Innovations in Logistics + 3D simulator) to enable cost-effective deployment of logistics solutions

<http://www.l4ms.eu>  
[ali.muhammad@vtt.fi](mailto:ali.muhammad@vtt.fi)



## Cyber Physicals Systems



MIDIH project supports the ICT Innovation for Manufacturing SMEs by developing a "one-stop shop" of services with access to advanced digital solutions and financial opportunities.

<http://www.midih.eu>



## Additive Manufacturing



AMable provides assistance and services to SMEs and mid-caps for their individual uptake of additive manufacturing to support the evolution of a product idea at all stages of the product creation process.

<http://www.amable.eu>



## Laser-based equipment assessments



LASHARE conducts assessments of laser-based equipment to advance new innovations, providing a robust evaluation Framework, which aids assessments to rapidly complete the analysis Circle.

<http://www.lashare.eu>  
[ulrich.thombansen@ilt.fraunhofer.de](mailto:ulrich.thombansen@ilt.fraunhofer.de)



## Cyber Physical Systems



BeinCPPS targets innovative experiments in CPPS-based manufacturing facilities, based on HW/SW components of the BEinCPPS reference architecture.

<http://www.beincpps.eu/>  
[sergio.gusmeroli@gmail.com](mailto:sergio.gusmeroli@gmail.com)



## HPC-Cloud Applications



Fortissimo 2's objective is to promote the uptake of advanced modelling and simulation of coupled physical processes and high-performance data analytics (HPDA) by European SMEs in the manufacturing sector.

<http://www.fortissimo-project.eu/>



## Robotics



HORSE aims to develop new flexible models of smart factory involving collaboration of humans, robots, AGV's and machinery to realize industrial tasks in an efficient manner.

<http://www.horse-project.eu/>  
[anastasia.garbi@eurodyn.com](mailto:anastasia.garbi@eurodyn.com)  
[george.boultadakis@eurodyn.com](mailto:george.boultadakis@eurodyn.com)

# 5. I4MS Innovative Actions



## Robot Assembly in Reconfigurable Workcell



Reconcell aims at supporting robot assembly experiments in a reconfigurable workcell, in large production lines but also in few-of-a-kind production, which often takes place in SMEs

<http://www.reconcell.eu/>  
[ales.ude@ijs.si](mailto:ales.ude@ijs.si)



## CloudSME HPC Cloud-Based Applications



The CloudSME project will develop a cloud-based, one-stop-shop solution providing a scalable platform for small or larger scale simulations, and enable the wider take-up of simulation technologies in manufacturing and engineering SME's.

<http://www.cloudsme.eu>  
[T.Kiss@westminster.ac.uk](mailto:T.Kiss@westminster.ac.uk)



## Cloudflow HPC Cloud-Based Applications



The aim of CloudFlow is to enable engineers to access services on the Cloud spanning domains such as CAD, CAM, CAE (CFD), Systems and PLM, and combining them to integrated workflows leveraging HPC resources

<http://www.eu-cloudflow.eu>  
[Andre.Stork@igd.fraunhofer.de](mailto:Andre.Stork@igd.fraunhofer.de)



## Euroc Robotics



EuRoC will be focused on defining a common framework to empower robotics platforms and related benchmark infrastructures towards the development of new products and services, and developing sustainable solutions to be benchmarked and customised to different end users, so as to enable future manufacturing and carry out further comparative challenges

<http://www.euroc-project.eu>



## Appolo Laser-Based Equipment Assessments



The APPOLO project seeks to establish connections between the end-users, which have demand on laser technologies for (micro)fabrication, knowledge accumulated in the application laboratories of the research institutes and universities and the laser equipment manufacturers (preferable SMEs) for novel lasers, beam control and guiding, etc. and their integration.

<http://www.appolo-fp7.eu>



## Intefix Cyber-Physical Systems



INTEFIX aims to increase the performance of the machining processes by the use of intelligent fixture systems, allowing the monitoring, control and adaptation of the process to obtain suitable results according to precision, quality and cost requirements.

<http://www.intefix.eu>

Under the I4MS umbrella, acting as Collaborative and Supporting Action, these projects have been the incubators where the featured technologies have been developed. Today they have impacted in some specific industrial ecosystems producing multiple business strategic advantages and societal benefits. Hereby, there is a brief selection of I4MS Success Cases to illustrate the technologies abilities to disrupt the market whilst leading the digital transformation 4.0:

## 6. I4MS Project Technologies

### FORTISSIMO MARKETPLACE

<http://www.fortissimo-project.eu/>



Developer	FORTISSIMO 1 &2 Innovation Actions and its partners.
I4MS Tech Sector:	High Performance Computing (HPC) & Cloud-based simulations.
Service offered:	Marketplace for cost-effective and simple access to HPC for simulations

The Fortissimo Marketplace offers European businesses, particularly Small & Medium Enterprises (SMEs), permanent, simple and cost-effective access to the necessary hardware, software, and expertise required for computationally intensive simulations, via an on-demand, pay-per-use, one-stop-shop model.

Benefits resulting from the Fortissimo Marketplace approach are manifold, including: better and more precise design of complex components and systems; acceleration of time-to-market; and cost savings in development, production and operation.

The Fortissimo Marketplace brokers novel solutions to industrial challenges, enabling the discovery of new opportunities and bringing together all the necessary actors to construct a solution that matches the user's business requirements.

#### Target users

Both HPC simulation service providers as well as companies interested in adopting these technologies can access the marketplace through its main webpage: <https://www.fortissimo-project.eu/>

For service providers, the platform offers the possibility to offer simulation and HPC capabilities to manufacturing users. Customized services can be configured as well to cope with specific market needs. The application case developed by Compass is an example hereof.

For manufacturing users, the platform offers the possibility to gain access to simulation and HPC in a pay-per-use way, opening the possibility to improve their design and engineering processes without having to acquire expensive software applications and hardware capabilities.

## Demonstration case: HPC-Enabled system for enhanced seakeeping and station-keeping design

Service Provider: Compassis. Winner of the I4MS Disruptor Award 2019, Spain

CompassIS is a consulting services company specialized in engineering design, as well as in development of software for engineering analysis and information management in technology. Civil and industrial engineering, naval architecture and ICT areas are the main focus of Compass IS activities.

Summary Challenge Objectives Solution Benefits

The HPC-Sheaks project aimed at developing a HPC -Cloud based simulation environment integrating several simulation tools for increasing the efficiency of the design, engineering and building processes of marine structures.

Summary Challenge Objectives Solution Benefits

The challenge addressed in this project was to demonstrate the use of advanced simulation in seakeeping design. Such simulations require large amounts of computing power to realize viable calculation times. This requires the use of computing resources from an HPC provider.

Summary Challenge Objectives Solution Benefits

The objective of this project was to adapt seakeeping software to run on remote HPC resources, to demonstrate the benefits of advanced simulation using Cloud-based HPC, to study the resultant performance of the simulations and to demonstrate their potential economic impact. A further aim was to develop a service for seakeeping studies available within the Fortissimo Marketplace. Realizing such aims would give WAVEC and VICUSDT a powerful design tool and a significant competitive advantage.

Summary Challenge Objectives Solution Benefits

An overall simulation solution was developed by integrating relevant software tool packages and then porting them to the HPC-Cloud-based system. An effective interface between the end-user and the HPC resources was also implemented, which enables the simulations to be run from a familiar desktop system whilst using the full capabilities of the HPC system. The simulations running on the HPC system have been benchmarked using a model of an off-shore floating wind platform (WavEC) and a model of a stern trawler (VICUSdt). This solution allowed improving the simulation time by a factor of 45.

Summary Challenge Objectives Solution Benefits

The use of Cloud-based-HPC simulations enables cases to be analyzed more quickly. It also allows previously infeasible cases to be analyzed.

Over the next four years, from 2017 to 2020, WAVEC expects an increase in its total profit of ~€550K, based on a revenue of €1.8M, due to an increase in its consultancy activities. Over the same four-year period, VICUSDT expects an increase in its total profit of €480K, based on a revenue of €1.4M, due to an increase in its consultancy activities. Over the same four-year period, COMPASSIS expects an increase in profit of €2M based on an increase in its license sales of €4.5M.

## Partnership

### End User 1: WavEC, Portugal

WavEC provides professional engineering services and RD&I support in the marine renewable energy sector and related areas. Services range from consulting to engineering support.

### HPC Provider: CESGA, Spain

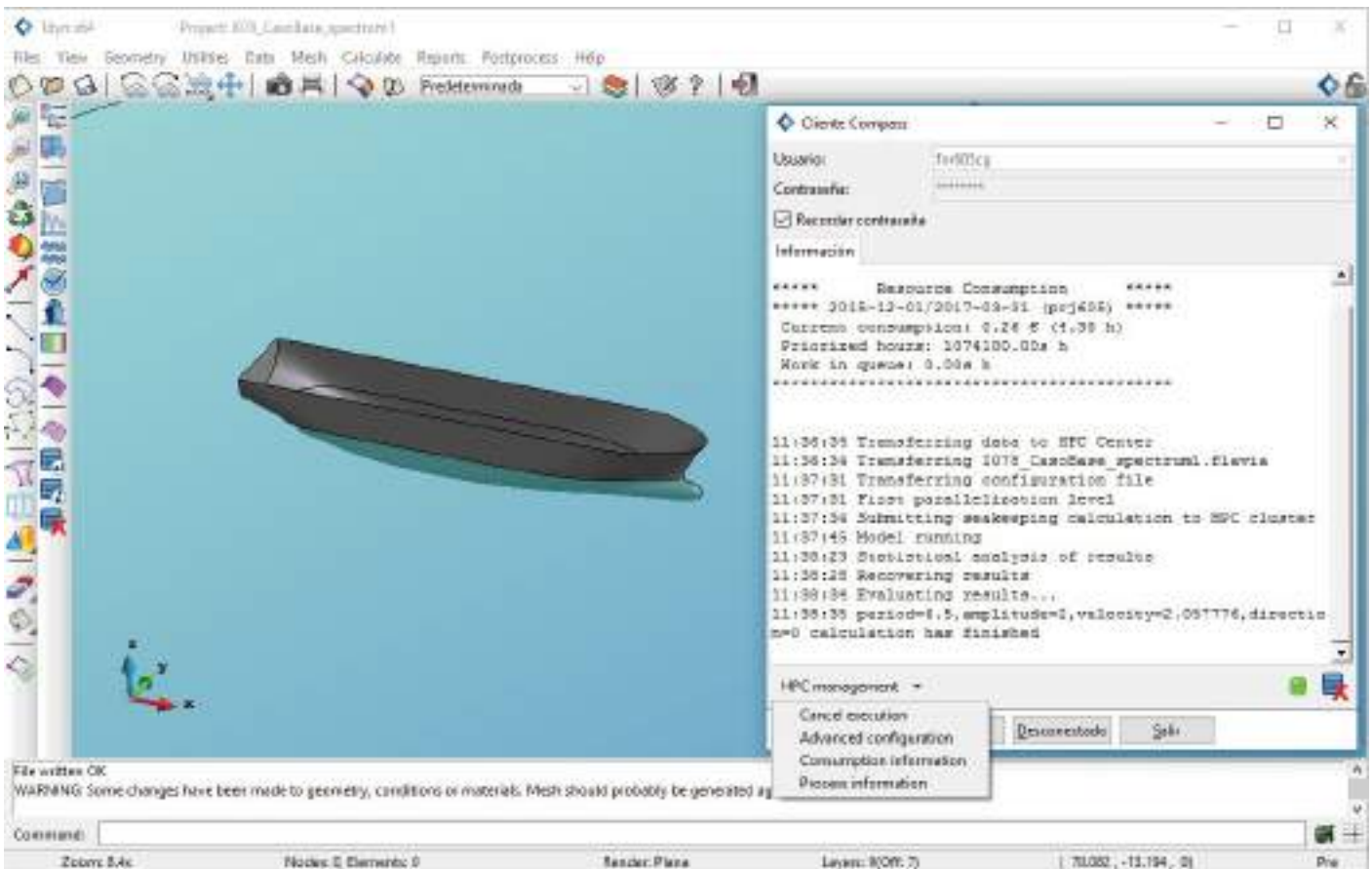
VICUSdt is an engineering design and analysis service company that allows costumers easy access to a highly skilled engineering capability within shipbuilding, shipping, offshore and energy industries.

### Domain Expert: CIMNE, Spain.

The International Centre for Numerical Methods in Engineering (CIMNE) is a research organization at the heart of the Technical University of Catalonia (UPC) as a partnership between the Government of Catalonia and UPC, in cooperation with UNESCO. The aim of CIMNE is the development of numerical methods and computational techniques for advancing knowledge and technology in engineering and applied sciences.

### HPC Provider: CESGA, Spain.

Fundación Pública Galega Centro Tecnolóxico de Supercomputación de Galicia (CESGA) is the centre of computing, high performance communications systems, and advanced services of the Galician Scientific Community, the University academic system, and the National Scientific Research Council (CSIC).



User Interface of HPC-Cloud based simulation solution



## Demonstration case: HPC-Enabled system for enhanced seakeeping and station-keeping design

### Simulation service provider: RBF Morph, Italy

RBF Morph is a unique mesh morphing technology that combines a very accurate control of the geometrical parameters with an extremely fast mesh deformation, fully integrated in the solving process. RBF Morph has the mission of developing and applying simulation technology to synthesize and optimize designs, processes and decisions.

#### Summary Challenge Objectives Solution Benefits

An HPC solution for automatic shape optimization of industrial components based on the RBF-Morph Fluent Add-on was cloudified with the goal of optimizing and making more time efficient the design for additive manufacturing process.

#### Summary Challenge Objectives Solution Benefits

Despite the clear advantages of Additive Manufacture, current design tools that have been developed for traditional manufacturing processes are not flexible enough. This limits the potential of 3D printing. CAE tools are able to suggest new shapes and accurately predict the behavior of components making them a natural choice in the design chain. However, and especially when dealing with complex Computational Fluid Dynamic (CFD) simulations, shape optimization can be a prohibitively expensive task for SMEs.

#### Summary Challenge Objectives Solution Benefits

The objective of this case study is the development of an optimization service. The goal is to demonstrate the validity of such a service by optimizing a prospective industrial artefact, a Lamborghini 12-cylinder airbox.

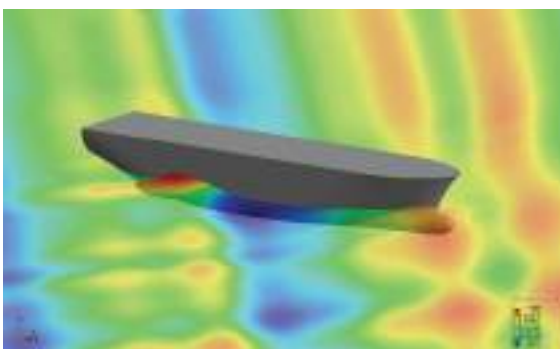
#### Summary Challenge Objectives Solution Benefits

Numerical grid parameterization using a mesh morpher avoids the time-consuming task of mesh generation (that can take up to 70% of the total analysis cost). Access to CFD simulation through the Fortissimo HPC Cloud allows a further speed-up in calculation times reducing the time to market and to return on investment. Using a collaborative, interactive, cloud interface helps analysts and clients to work together and to be integrated in the value chain, increasing customer satisfaction and building better products more effectively. The solution was used to design the intake airbox of the Lamborghini Aventador engine.

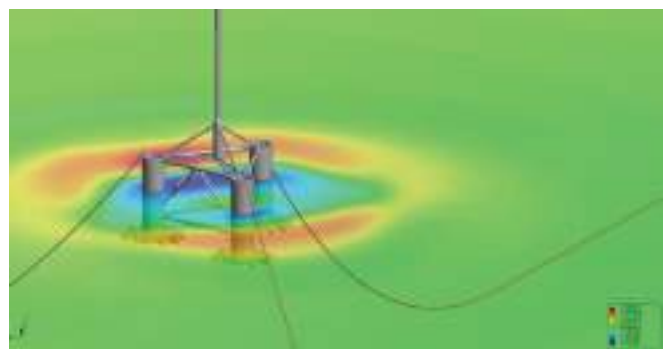
#### Summary Challenge Objectives Solution Benefits

For HSL, having access to the RBF Morph morphing tool combined with CFD analysis powered by HPC opens a wide range of business opportunities. In parallel with existing rapid prototyping services, HSL can now propose to its client's alternative component designs corresponding to appropriate performance indicators. For HSL, offering a shape optimization service in parallel with its existing core business of rapid prototyping activities, represents an opportunity to establish customer activity over a range of key R&D areas.

For the specific design case, the development cost of a new air-box, estimated as 250k€ using a standard approach, can be reduced to 75k€ using the HPC cloud service. Based on a forecast that, over the next two years, HSL will undertake three new air-box optimizations each year and that, compared with traditional CAD methods, there is a cost saving of 175k€ per optimization, the annual saving is equivalent to 525k€.



Simulation of stern trawler



Simulation of off-shore floating wind platform



## Partnership

### End User: HSL Rational Product Development

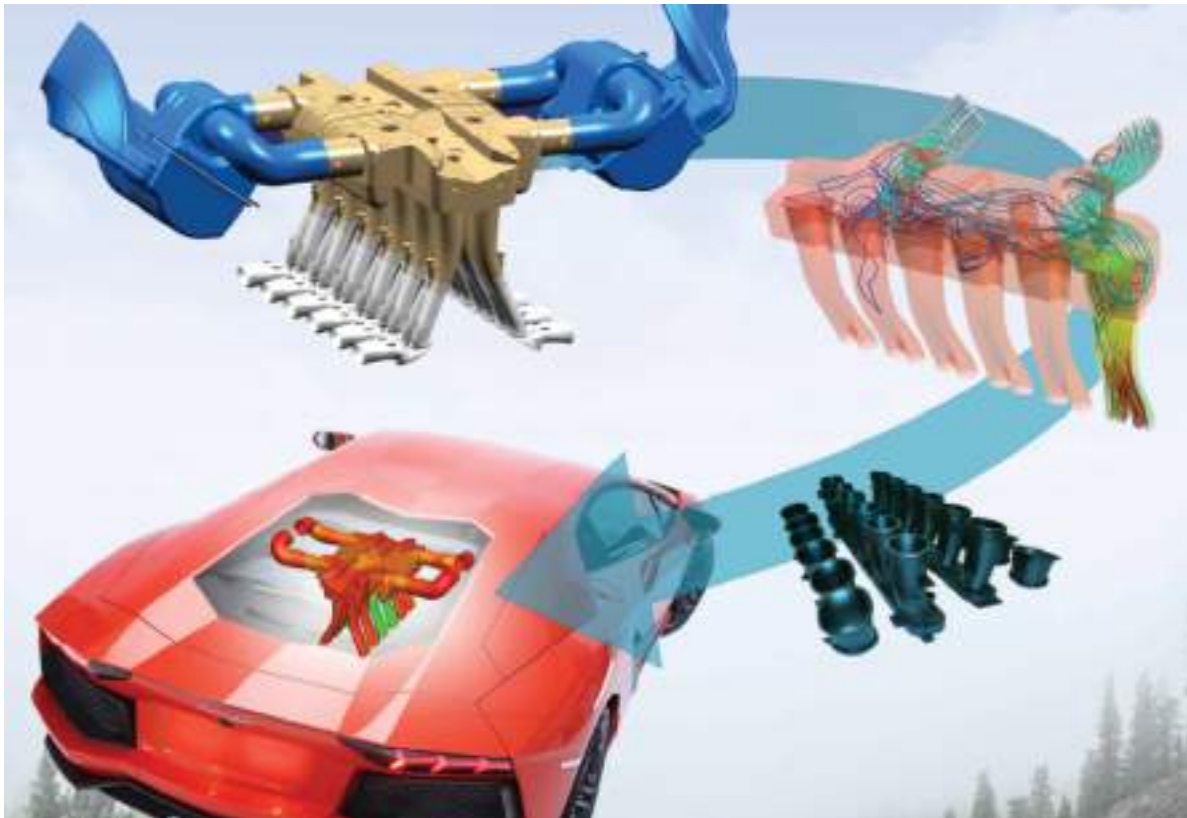
HSL is a hi-tech centre for the development of new products. With hundreds of products handled over the years, the company has developed experience with materials, traditional and innovative manufacturing technologies, prototyping, dies and moulding. HSL is an SME and a market leader in both Additive Manufacturing and the rapid production of prototypes.

### Domain Expert: University of Rome Tor Vergata (UTV), Italy

University of Rome Tor Vergata was established in 1982 and is therefore a relatively young University. It was designed on the model of Anglo-Saxon campuses: it stretches on 600 hectares and hosts important research institutions, such as National Research Council – CNR and the Italian Space Agency – ASI.

### HPC Provider: CINECA, Italy

CINECA, the Italian supercomputing center, is equipped with the most advanced hardware resources, used by academic and industrial research. CINECA's mission is to provide computational resources satisfying the present and future research needs, and to stay tuned with technology advances.



## 6. I4MS Project Technologies

### CloudFlow Portal

<https://eu-cloudflow.eu/>



Developer:	CloudFlow Innovation Actions and its partners.
I4MS Tech Sector:	Cloud Computing, High Performance Computing (HPC).
Service offered:	Online portal to enable interoperability among different simulation packages

The CloudFlow Portal aims at providing an independent platform for engineering workflows, leveraging both cloud and high-performance computing. Each workflow can combine software from different vendors, promoting interoperability through open standards, and easy access to data and compute resources.

The CloudFlow Infrastructure is not only attractive for end users, but also allows software vendors to reach new customers through a pay-per-use distribution channel for their existing or new software solutions.

#### Target users

Both HPC simulation service providers as well as companies interested in adopting these technologies can access the portal by contacting the CloudFlow project directly. The portal is available upon request.

For service providers, the platform offers the possibility to interconnect different simulation software in a logic workflow. Customized services can be configured as well to cope with specific market needs.

For manufacturing users, the portal offers the possibility to gain access to simulation and HPC in a pay-per-use way, opening the possibility to improve their design and engineering processes without having to acquire expensive software applications and hardware capabilities.

## Success Case: Optimizing Moulds and Stamping Processes for Bipolar Plates used in Fuel Cells

Simulation service provider: Noesis Solutions N.V., Belgium

Noesis Solutions is an engineering innovation partner to manufacturers in engineering-intensive industries. It specializes in solutions that enable Objectives Driven Draft-to-Craft Engineering processes. Their software products and services help customers adopt a targeted development strategy that resolves multi-disciplinary engineering challenges.

Summary Challenge Objectives Solution Benefits

Optimizing tools for stamping processes, finding the right process parameters and ramp-up forming production of sheet metals is a big topic in manufacturing industry, especially for those segments heavily handling sheet metals. This project improves the engineering and manufacturing process efficiency of bipolar plates for fuel cells, an emerging market contributing to renewable greener energy supply, e.g. for Fuel Cell Electric Vehicles (FCEV).

Summary Challenge Objectives Solution Benefits

The process at Borit currently implemented does not involve simulation software for the forming process. Borit starts with creating the geometry of the bipolar plates in CAD. The corresponding tool geometry is also created using CAD software. The tool is then manufactured based on the CAD design. The mould is tested 'on press' and the design is iteratively altered until the plates have the intended nominal shape. This iterative process can take up to 6 to 8 weeks for just one plate depending on the plate complexity.

The manufacturing challenges are related to the quality of the resulting bipolar plates, e.g. not fully formed plate features and/or local rupture of the plate material. The simulation challenges are related to the accuracy of the model. A high-fidelity simulation tool that can cut down the number of iterations needs to be found that responds in reasonable time using affordable compute resources. In addition, a simulation model needs to be defined that captures the plate behavior with high enough resolution representing features like small radii and narrow channels.

Summary Challenge Objectives Solution Benefits

The goal of this project was to reduce development cost and time-to-market for new bipolar plates for fuel cells by accelerating engineering and manufacturing processes through cloud-based optimization technology. Technically, it is expected to lower barriers for SMEs to access engineering design workflows and computational resources.

Summary Challenge Objectives Solution Benefits

The approach in this experiment is to introduce a combination of forming simulation software and the optimization tool Optimus by Noesis using HPC resources. Optimus defines the simulation strategy and launches the HPC service. Optimus acquires the results and builds a surrogate model from these simulation results using machine learning. The surrogate model is returned to the user to be implemented as process control.



Plates designed without simulations



Plates designed with simulations

Faster engineering based on better simulations allow the end user Borit to reduce the design time (value 10 k€/iteration). Based on the product complexity, up to 8 iterations are required for a new product. Reducing this by 25 percent, adds up to € 70,000 to € 100,000 per year for five new products, to reduce the amount of non-productive (test-)time on the press (100 €/h). Virtual testing reduces the test hours on press (8 hours/test) also by 25 percent - a total reduction of 7 to 10 days can be achieved which equals € 6,000 to €8,000 per year, to reduce the number of tools to be produced (value up to € 20,000 per tool). For five new products (average complexity) Borit expects a reduction of 5 to 7 test tools and to reduce time to market (value for the fuel cell manufacturer). Moreover, quality-improved forming capabilities and increased customer satisfaction will attract additional customers. This may create additional revenue of several hundreds of thousands of € per year. The reduction in design time and total time to market will allow the existing employees to handle more projects per year.

For Noesis, the ISV, the CloudFlow-powered engineering workflows are expected to lead to 2-3 users to join the platform during the first year: this quantifies to about to about € 120,000 per year initially and increase with time to € 400,000 per year as the user-base grows. These revenues accounts for all the items in the ManuCloud service subscription, that includes the Optimus optimizer deployed on the CloudFlow infrastructure as well as the tools for the workflow preparation and post-processing that are made available to the user

## Partnership

### End User 1: Borit, Belgium

Borit NV manufactures and markets sheet metal products and assemblies in Belgium. It provides flow plates for use in fuel cells, electrolyzes, heat exchangers, and solar boiler systems; and structural panels for use in transportation, construction, furniture, packaging, and general industrial applications.

### HPC Provider: Arctur d.o.o., Slovenia

Arctur d.o.o. is a leading provider of supercomputing services in Central Eastern Europe. Following the XaaS model, the lease the supercomputer along with the services of system administration, optimizing codes and parallelization.



## Success case: Optimizing heat exchanger design of biomass boilers through CFD simulation

### Simulation service provider: NablaDot, Spain

NablaDot are a team of engineers with 50+ person-years of expertise in the application of Computational Fluid Dynamics (CFD) techniques to the solution of problems involving fluid flow, heat transfer and chemical reaction, in Industry and in the Environment. They work together with companies of all sizes in the search for solutions for their processes and products, and NablaDot can tailor offerings so that they mesh seamlessly with your R&D cycles. NablaDot use state of the art software and hardware for the computation and analysis of fluid flow.

#### Summary Challenge Objectives Solution Benefits

The objective of this experiment has been the introduction of computational fluid dynamics (CFD) tools, integrated in a cloud environment, in the design cycle for the condensing biomass boilers of Biocurve. In particular, the CFD tools (automatic mesh generator, CFD solver and CFD post-processing) have been applied to the simulation of the heat exchanger.

#### Summary Challenge Objectives Solution Benefits

BioCurve manufactures condensing biomass boilers (that is, the most efficient technology) for central heating and hot water systems. Its design was previously based on the experience of the BioCurve technical staff. A prototype was designed and improved through trial-and-error cycles. The only software used in the design process was CAD software and spreadsheets. The time needed to design a prototype of a condensing biomass boiler was close to 6 months. An additional 6 months were necessary to bring the prototype boiler to the market. Thus, the capability of BioCurve to develop new models or improve existing ones was very limited.

#### Summary Challenge Objectives Solution Benefits

The objective of this experiment has been the introduction of computational fluid dynamics (CFD) tools, integrated in a cloud environment, in the design cycle for the condensing biomass boilers of Biocurve.

#### Summary Challenge Objectives Solution Benefits

The CFD tools (automatic mesh generator, CFD solver and CFD post-processing) have been applied to the simulation of the heat exchanger, one of the main components of the boilers manufactured by Biocurve. One of the challenges of the experiment has been the creation of a user-friendly interface and workflow. This has been a main requirement of the experiment, since Biocurve staff has never employed CFD tools previously.

#### Summary Challenge Objectives Solution Benefits

The use of the CloudFlow application can save Biocurve around € 23,000 in the design of a new boiler model, taking into account the reduction of the number of prototypes should be built and, as a consequence, the lower time-to-market required. The Cloud application would allow Biocurve to increase the number of new models developed per year (currently, Biocurve is able to design 1 new model per year). The reduction of the size of the boilers due to a better design can save around 15 percent of the total costs of a boiler.

This product (condensing biomass boilers) is positioned in the residential/commercial pellet boilers market. With the CloudFlow application, Biocurve will be enabled to speed up the maturity of some products (15 kW, 25 kW or 100 kW) even 1 year in advance and enter in some currently unaffordable markets thanks to reducing costs (that is, low outputs markets and Eastern Europe market). It is estimated that sales of current boilers will be increased by 80-100 units/year, new sales of lower output range boilers will reach 100-150 units/year and of higher output boilers, 50-80 units/year. Addressing a customer segment defined by the domestic and commercial (tertiary) heating sector, in a three-year horizon Biocurve estimates to face a market around 600,000 potential buyers, with a potential share reaching 0.05 percent and leading to incomes of € 2.55 million. Between 3 to 6 new jobs would be created if this volume of sales will be reached.

From the point of view of NablaDot, this experiment has provided NablaDot with a new business model, through the development of CFD tools on the cloud. This business model can be offered both to SMEs and large companies. Currently, NablaDot's business (approximately 90 percent of the turnover) is based on CFD consultancy using commercial CFD software and in-house computational resources. In the long term (5 years from now), it is expected that 40-50 percent of the turnover (around € 150,000) will be related to ad-hoc development and supporting of CFD tools used in the cloud.



UNIZAR-BIFI provides computing power to mainly local manufacturing companies. In the medium term (3 years), the market size of HPC centers (companies demanding power computing) is expected to be twentyfold. This project helps to expand its services to a wider geographical range and to maintain its remarkable position as an HPC center. According to the expectations, this will represent an increase of incomes between € 30,000 and € 150,000 in the next 3 years and the creation of new jobs (between 2 and 5).

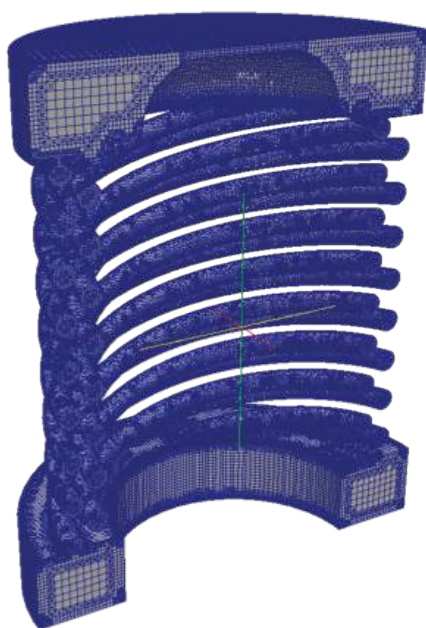
## Partnership

### End User 1: BioCurve, Spain

BioCurve is a highly technified company, which designs and manufactures biomass boilers. Within its portfolio one may find the only biomass boilers with condensing technology, without auxiliary equipment. This design, patented, allows them to work with minimum emissions and maximum performance, unparalleled in the market.

### Domain Expert & HPC Provider: BIFI (University of Zaragoza), Spain

BIFI consists of researchers from the University of Zaragoza and other Spanish and foreign universities. Their aim is to develop a competitive research in computation applied to physics of complex systems and biological systems. In addition to the research in basic science, the promotion of technology transfer between university and industry is an essential goal for us. For this purpose, BIFI offers HPC and cloud computing services.



Simulation model of the heat exchanges



Resulting heat exchanger design



## 6. I4MS Project Technologies

ReConcell

<http://www.reconcell.eu/>



ReconCell

Developer	ReconCell Innovation Action and its partners.
I4MS Tech Sector:	Robotics/IoT
Service offered:	Easy to (re-)configure and (re-)program workcell for small batch production.

SMEs have the potential to benefit from robotic automation, but often cannot use it due to set-up and maintenance complexity. This requires expert knowledge and time for configuration and programming, which is too costly for them. Robotic automation is, thus, in many cases, economically infeasible for SMEs, especially when producing small batch sizes.

ReconCell has developed an easy to (re-)configure and (re-)program workcell, making robot solutions commercially viable even for small batch sizes (~1000 units) by reducing set-up and maintenance effort substantially. The ReconCell System is based on a layered concept. First, the economic feasibility is assessed together with the customer at the hand of the planned product assembly and performing a business model analysis to determine relevant KPIs. Secondly, the next layer of the ReconCell System implements the assembly with automated testing in a simulation environment. Here, reconfigurable hardware elements are used to design the required workcell layout and assembly processes. Lastly, after verification, product assembly takes place in the real workcell under machine vision-based monitoring and novel force-based control of execution to assure product quality and the previously defined KPIs.

The key innovative components of the ReConcell are:

- 3D vision system that enables monitoring, recognition, and posture estimation for fast re-positioning of workpieces.
- Smart reconfigurable workcell design that includes passively reconfigurable fixtures to enable fast adaptation of the robotic assembly workcell with minimum human intervention, but still have the possibility of human interaction on demand.
- Cooperative robots that speed up the work, jump-in in the case of problems, replace something, or simply sequentially execute assembly operations.
- Force-based control and adaptation capabilities to relax the requirements with respect to inaccuracies in positioning or tolerance-deviations during assembly.
- Effective robot programming technologies and innovative strategies and concepts to enable fast acquisition of new assembly skills and skill libraries.
- Robot assembly cell simulation which associates with the design of the product and simulation of robot assembly.
- Business modelling techniques to support setting-up of a new production process.

### Target users

The ReconCell system targets manufacturing companies producing small batch sizes (~1000 units). The system is a feasible solution for both large production lines as well as for few-of-a-kind production, which often takes place in SMEs.

## Demonstration Case: InterSight

### End User: HOP Ubiquitous, Spain

HOP Ubiquitous, S.L. (HOPU) is a SME established in Spain. HOPU is focused on research and development of networks protocols, IoT management, IoT security and final Internet of Things solutions. HOPU is specialized in applying their IoT management, security and networking protocols over an IoT platform called Homard (<https://homard.hopu.eu/>). Homard is being used and integrated for final customers by companies such as Fujitsu (RunMyProcess), FIWARE and Microsoft (Azure IoT Suite).

#### Summary Challenge Objectives Solution Benefits

Enhancing lot-size one production with the support of robots, digitalization of processes and human-machine cooperation.

#### Summary Challenge Objectives Solution Benefits

Smart Spot is an integral product for Smart Cities developed from HOP UBIQUITOUS, which offers a wide range of configurations and extensions to satisfy multiple needs in the urban monitoring market. For example, Smart Spot can include optional extensions for air quality monitoring and extra communication modules for emerging technologies such as LoRa. For that reason, sales departments and production lines have communication issues due to the diversity of configurations and optional add-ons. At the same time, it is remarkable that production lines and sales department are not located at the same place, therefore making the communication even more difficult.

This product is an excellent example of a lot-size one product, since every unit is highly customizability among a wide number of options, i.e., number of gases, type of gases, communication extensions (LoRa, NB-IoT, GPRS etc.), and other monitoring capacities as noise, VOCs, Particulates Matter etc. As the variety due to personalization is high and the production batches are low, manual assemble is not cost effective, motivating the adaptation of the Recon-Cell workcell for this manufacturing process.

#### Summary Challenge Objectives Solution Benefits

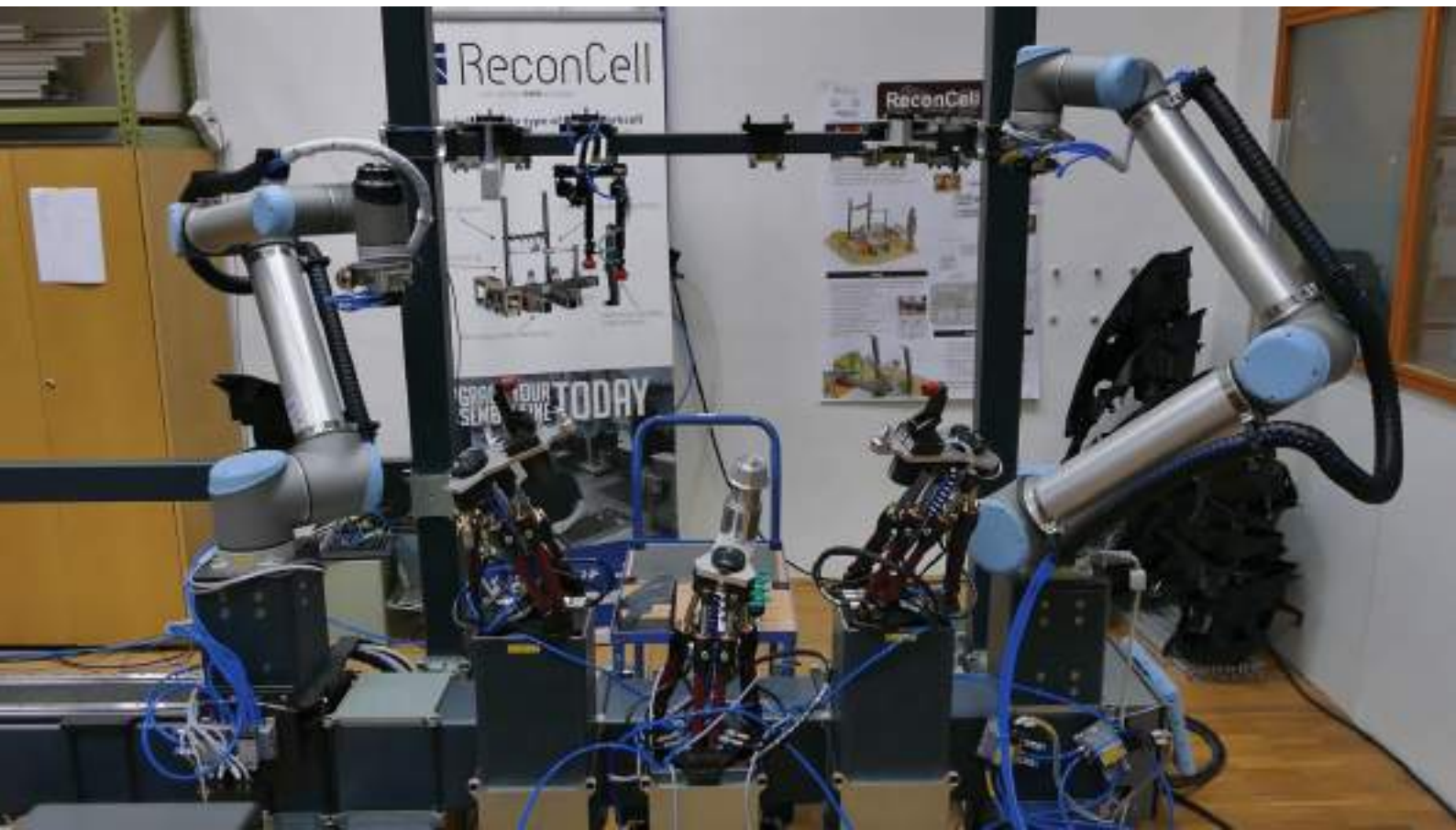
ReconCell is an opportunity to solve this problematic, digitalizing the process of preparing the orders through a Robot Assisted Assembly, thereby robot will configure the extensions (PCBs) that every order has, making it as a cyberphysical interface between sales and production departments, what we have defined as InterSight, i.e., a shared vision and interconnection among departments.

This project allows HOP Ubiquitous to explore the opportunities of a Smart Assembly Line with reconfiguration capabilities that could support the company, enabling it with an intelligent solution that solves the identified challenges in a product line with multiple product configurations. This proposal brings forward a practical solution for an assembly line depending on the order, in which the robot mounts a different set of PCBs based on the product configuration. Thereby, blue collar workers will focus on setting up and finalizing the products based on the processed orders by the robot. Thereby, making the process more efficient, economic and reliable.

#### Summary Challenge Objectives Solution Benefits

The elements to manipulate during the process that are the backplate and different model of boards are placed by an operator and once placed, the different robotic arms through the use of different clamps are able to make different configurations of the boards on the backplate depending on the input parameters of the process. Once the configuration has been carried out using algorithms of artificial vision, it is verified that the plates have been placed correctly.

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Reconfigurable Working Cell Model

## Partnership

### Competence Centers: Jožef Stefan Institute, Slovenia

Is the leading Slovenian scientific research institute, covering a broad spectrum of basic and applied research. The staff of more than 960 specializes in natural sciences, life sciences and engineering. The subjects concern production and control technologies, communication and computer technologies, knowledge technologies, biotechnologies, new materials, environmental technologies, nanotechnologies, and nuclear engineering

## 6. I4MS Project Technologies

### Open Platform for Innovation in Logistics (OPIL)

**L4MS**

Smart logistics for manufacturing

<https://www.l4ms.eu/l4ms/>

Developer:	Logistics for Manufacturing (L4MS) Innovation Action and its partners.
I4MS Tech Sector:	Robotics, Logistics Automation.
Service offered:	OPIL, an IoT platform for automating intra-factory logistics

OPIL is an open industrial IoT platform that enables the rapid and cost-effective deployment of customized and flexible logistics solutions for manufacturing companies. More specifically, OPIL provides plug and play connectivity with equipment for optimal material handling on the factory floor. These include (but not limited to) mobile robots, Automated Guided Vehicles (AGVs), workers and sensors as well as IT infrastructure of the factory such as, Warehouse Management Systems (WMS), Enterprise Resource Planning (ERP) and Manufacturing Execution Systems (MES).

OPIL also provides a ready integration with a state-of-the-art 3D factory simulator (with mobile robots, AGVs, workers and sensors) allowing the complete development and testing of logistics solutions virtually, and presentation of the solutions to factories before the real-world implementation. The 3D simulator supports the estimation of investment costs and guides the orchestration of the deployment tasks.

OPIL enables new actors in the business value chain, since the complete digitalization of logistics facilitates new business models (PaaS, SaaS) allowing logistics automation and optimization at a fraction of the prices of the currently available solutions.

#### Target users

OPIL end users are manufacturing SMEs or MidCaps in need of automating their material handling systems. OPIL is especially interesting for companies dealing with demand fluctuations and changes in product configurations. In such cases, OPIL drastically reduces set-up times for implementing new logistics tasks as well as for coping with changes in layout of the manufacturing floor.

System Integrators can benefit from OPIL by developing highly customized logistics solutions for manufacturing users, which communicate with new and legacy hardware and software. This allows integrating hardware and software products from different vendors and providers to obtain full interoperability among the different systems.

Technology and Automated Guided Vehicle (AVG) suppliers can use OPIL to develop products (e.g. AGVs, mobile robots) and components (e.g. track and trace systems) that are state-of-the-art, cost-effective and interoperable with other suppliers' products.

## Demonstration Case: Piloting OPIL with an Estonian Manufacturer

### End User: Chemi-Pharm, Estonia

Chemi-Pharm AS, based in Tallinn, develops, produces and sells allergen-free disinfection agents, cleaning and maintenance products, and a luxury skin care line. The company's main customers are in the medical sector. Chemi-Pharm is represented in 17 countries and export makes up over 70 per cent of the whole production.

#### Summary Challenge Objectives Solution Benefits

In this pilot project, an automated logistic solution integrating Automated Guided Vehicles (AGVs) and track and trace functionality has been designed applying OPIL and the 3D factory simulation software Visual Components. The designed solution is tested at IMECC in a test environment to reassemble the main properties of the Chemi-Pharm factory.

#### Summary Challenge Objectives Solution Benefits

For CHEMI-PHARM, the primary focus for implementing an automated intra-factory logistics system, based on OPIL, is to increase efficiency in manufacturing and their internal logistics processes. Due to large quantities of fast moving incoming and outgoing units, raw materials and finished products need to be transported from one location to another continuously. Failure to do this on time results in interrupted workflows, leading to lower efficiency.

Every internal logistics movement data entries also have to be made to keep track of the materials. Both physical on-time movement and data entries take up unreasonable time and affect the workflow. Furthermore, as demand is expected to change in the coming years, the automated logistics system should be highly flexible and easy to set up, such that eventual changes in layouts and logistics tasks can be adopted in short times and at the minimum effort to avoid long production stops.

#### Summary Challenge Objectives Solution Benefits

The main objective of this project is to optimize the intra factory logistics tasks so that overall production time is decreased while maintaining the required production quality. The second objective is to reduce the design and planning time of the automated logistic system by creating a Digital Twin of the factory integrating the Visual Components simulation software with OPIL.

The digital Twin allows simulating the resulting system in a real production scenario, including disturbances and simulating the actual interaction between the factory Enterprise Applications and the hardware (AGVS and sensors) that are actually to be implemented in the system.

#### Summary Challenge Objectives Solution Benefits

A pilot project is developed to implement AGVs using OPIL modules to manage the transportation tasks of raw materials from the warehouse to the Filling area in the production floor and vice versa. Once production has ended, finished goods are transported by the AGV robot from the Filling area to the Ready products warehouse.

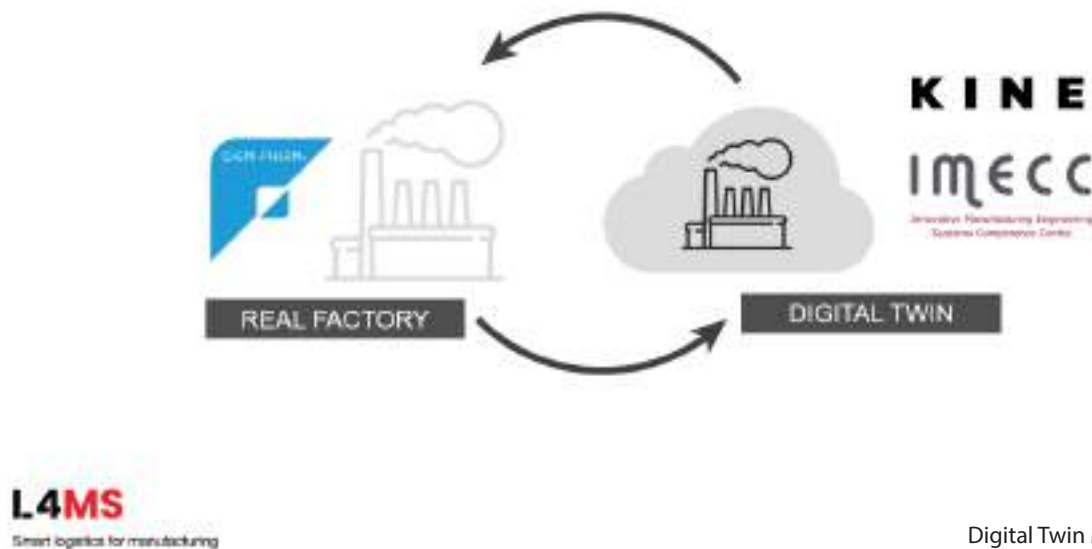


1. Creation of the digital twin of the CHEMI factory for designing and planning the logistic system.
2. Setting-up a small CHEMI-PHARM factory model at IMECC to test the intended logistics functionality.

During the first phase of the project a virtual factory (digital twin) is developed using the Visual Components simulation. During this phase the following questions are addressed:

- Is one AGV enough to transport raw materials and goods on a euro pallet?
- Should a forklift or pulling (truck) be used for transporting the euro pallets?
- Is there enough space to rotate AGV with the euro pallet?

In the second phase of the project a small factory model of the CHEMI factory is built at IMECC. The model reassembles a small part of the Raw material and Ready products warehouse, as well as 2 production lines. This model is intended to test the interaction of OPIL with the AVGs and operators that are fulfilling the planned logistic tasks.



Digital Twin Model in L4MS

The main benefits for CHEMI-PHARM are:

- Transportation and moving of raw materials and ready products are transported in an efficient way.
- Human factor and effort in terms of making entries into IT systems are reduced to minimum. The logistics system automates recording of raw materials and finished products.
- Interaction between human forklift operators and AGVs is enabled.
- Unresponsive or faulty AGVs do not influence the completion of a task.
- Have a flexible logistic system that can be adapted to production demand changes at the longest effort possible.



## Partnership

### System Integrator: KINE, Finland

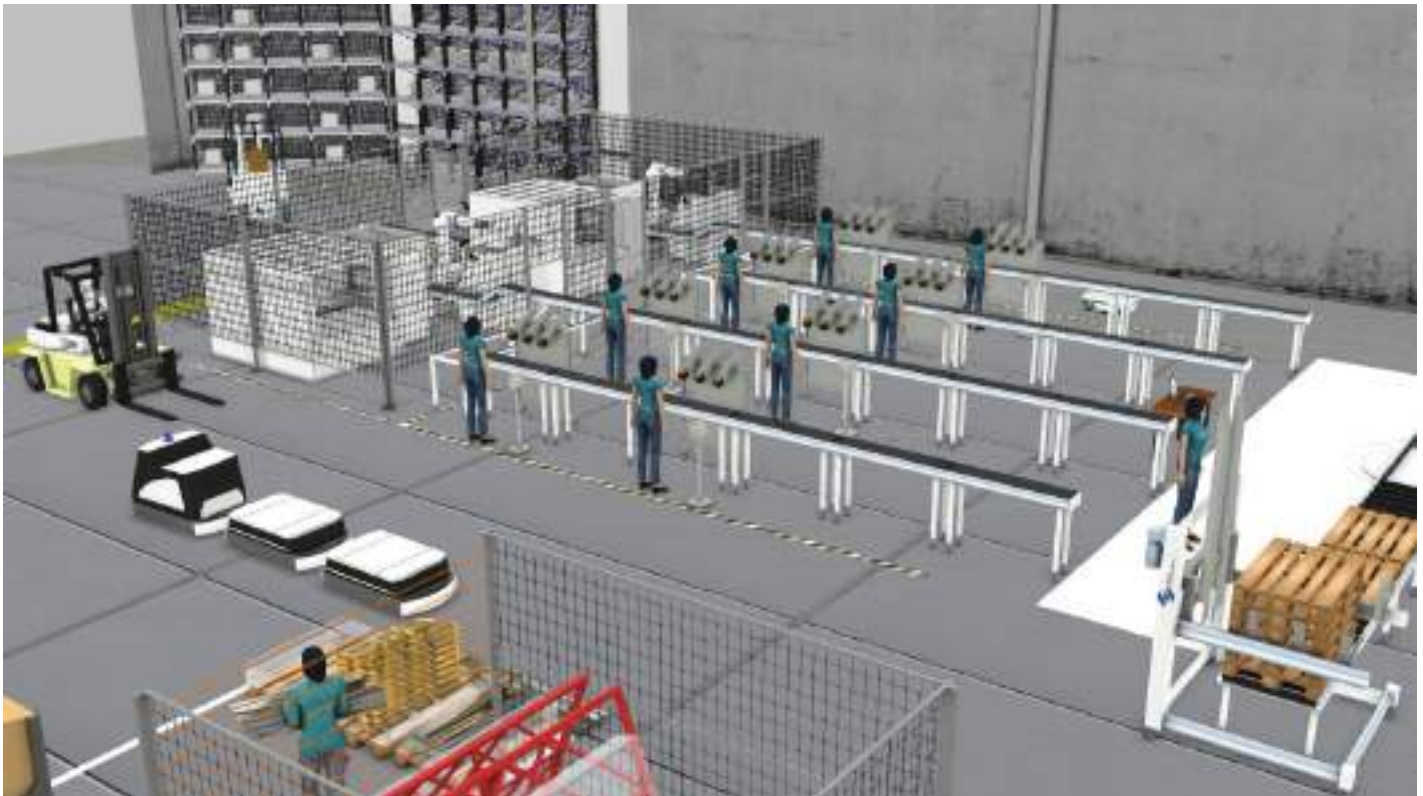
KINE., located in Turku, Finland, is specialized in robotics and automated solutions. The company designs and provides robot systems for industrial needs globally. The company has experience on logistical optimization and IoT solutions.

### Competence Center: IMECC, Estonia

IMECC Ltd (Innovative Manufacturing Engineering Systems Competence Centre) is a high-tech consortium which is owned by several Estonian industrial companies and Tallinn University of Technology as science partner. IMECC's main activities are research and development in the fields of digital manufacturing, process automation, mechatronics, and materials technology.

### 3D Simulation software provider: Visual Components, Finland

Visual Components is a developer of 3D simulation software for manufacturing. Visual Components software is used for applications including layout planning, production simulation, off-line programming and PLC verification.



Simulation model used for Chemi Pharm during the design of its automated logistic system.



## 6. I4MS Project Technologies

### Cloud HPC Simulation Center



Competence Center for  
Cloud-based HPC simulation



<https://cloudsme.eu/>

Developer:	Cloud SME & CloudiFacturing Innovation Actions and their partners.
I4MS Tech Sector:	High Performance Computing (HPC) & Cloud-based simulations.
Service offered:	

The Cloud HPC Simulation Center consists out two solutions.

#### Cloud HPC Simulation Platform

Is a middleware for compute intensive applications in the cloud. It works on different public and private clouds (e.g., Amazon Web Services, CloudSigma, OpenStack, OpenNebula and Eucalyptus) and high-performance computing (HPC) infrastructures, and widely automates user, software, resource, job and invoice management.

The Cloud HPC Simulation Platform is suitable for any kind of batch-oriented command line software, both Linux or Windows-based and both serial or parallel (via MPI or other tools). It can be accessed through any web browser and through different application programming interfaces (APIs)

#### Cloud HPC Simulation Platform

The AppCenter is a vendor independent one-stop-shop for cloud software and services (SaaS Apps) for manufacturing and engineering. It is accessible through any web browser or as a web service, and basically works similar to a normal online shop. The management of resources is an automated process, including provisioning and accounting.

Software and service providers offer their different products through the shop and set their pricing. Users select the product they would like to use, pay for the number of credits they would like to buy (e.g., individual download, number of accesses, usage time, subscription, etc.), and can then directly obtain or execute the selected software and services through the shop.

Adapters to different kinds of software and service offerings, such as simple download, web services and the cloudSME Platform, are available, and more can be integrated. The AppCenter also includes a REST-based web service application programming interface (API) for programmatical access and automation. It is available in hosted and licensed variants. We also provide corresponding consulting, training and support.

#### Target users

Both HPC simulation service providers as well as companies interested in adopting these technologies can profit from this platform.

For service providers, the platform offers the possibility to offer simulation tools using the AppCenter. Customized services can be configured to cope with specific market needs.

For engineering and manufacturing users, the platform offers the possibility to gain access to simulation and HPC in a pay-per-use way, opening the possibility to improve their design and engineering processes without having to acquire expensive software applications and hardware capabilities.

## Demonstration case: Cloud-based Simulation and Optimization Environment

Service provider: LCM Linz Center of Mechatronics GmbH, Austria

LCM are partners for research and development projects. The basis of their services is mechatronics, intelligent networking of computer science, mechanics and electronics. In this discipline, LCM is world leader. Their clients are large international corporations as well as local SME or small businesses.

Summary Challenge Objectives Solution Benefits

In this demonstration case the system modeler SyMSpace was configured using the Clod SME platform to improve the efficiency, lower the cost, improve power density and speed up the manufacturing process of electric motors. This is done by using the cloud services to perform electromagnetic, thermal and mechanic simulation.

Summary Challenge Objectives Solution Benefits

The design process of high-quality electro-mechanical electric drives with flexible prototyping and manufacturing requires finding optimal geometric, electric, magnetic and thermal parameters of the rotor, stator, winding and power electronics components. The complex interdependencies of these parameters affect the thermal behavior, efficiency and production costs of these products. Furthermore, long simulation and optimization cycles have an important effect on time -to-market of electric drives, which is a key performance parameter for companies developing them.

Summary Challenge Objectives Solution Benefits

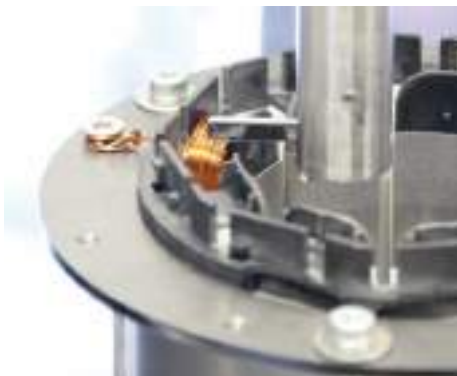
LCM has developed a software platform that makes it possible to carry out digital development or optimization of mechatronic components and systems from the design stage up to prototype testing. A key characteristic of SyM-Space is that holistic optimizations, considering several different engineering domains, can be performed from a cloud platform. This allows for drastic reduction of simulation and optimization time which results in important reduction of the design to prototyping cycles. As the platform charges users in a using a pay-per-use model, large hardware and software investments are no longer required for companies requiring High Performance Simulations to improve their products and processes.

In this context, the objective of this project is customizing SyMSpace for the design of electric drivers using the Cloud SME platform. The resulting cloud-based simulation is demonstrated by optimizing the design of drives of Hanning, a company specialized in the development and production of customized drive systems and components.

Summary Challenge Objectives Solution Benefits

SyMSpace optimizes electric drives by linking several simulation tools passing data from one to another (e.g. the geometric and winding data to an electromagnetic solver, the obtained losses to the thermal model, and so on) and automatically running this simulation chain.

The simulation model is constructed such that it can be generally applicable to the design of electric drives. Therefore, other companies addressing the electrical drive design market in other application areas (automation, aerospace, automotive, consumer, etc.) can also make use of this model.



Electric drive before optimization



New electric drive after optimization

Using SyMSpace in the cloud environment provides the user with sufficient calculation power even for extensive models and deep optimization runs (up to 15.000 individual simulation cycles) - on demand and on pay per use basis. Due to the streamlined process without human data handover, Hanning can process a prototype request from design to optimization to production data in very fast time. The target is to get the finished prototype within 5 working days.

Thanks to high performance cloud computing and simulation, in this project LCM further developed SyMSpace solution towards improved electrical drives design. From a business point of view this allows LCM to ensure to its end-users increased product quality, product flexibility, and reduced design to production time from more than one month to less than one week. With such level of innovation potential, the new solution can be scaled up quickly in Europe since several companies are already competing in this market. A market analysis demonstrated that more than ten companies in EU (e.g. Faulhaber, Maxon, Emerson, etc.) are addressing the electrical drive design market in more than thirty application areas (automation, aerospace, automotive, consumer, etc.). In the short term the new cloud application of SyMSpace is expected to allow LCM to increase turnover by more than 350'000 €, to hire 5 more FTE and to improve customer satisfaction up to 50%.

## Partnership

### End User: Hanning Elektro-werk, Germany

Is a company specialized in the development and production of customized drive systems and components. Its product line ranges from AC and three-phase motors, linear actuators, frequency inverters, fan drives through to drain, and circulation pumps.

# 7. What's Next?

## Join MS: The Online Community of the EU Manufacturing Industry

The place to connect, chat and interact in the manufacturing ecosystem

The I4MS-Go project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement no 768631. The content of this community and website does not represent the opinion of the European Union, and the European Union is not responsible for any use that might be made of such content.

The I4MS (ICT Innovation for Manufacturing SMEs) online community offers you a place to connect, chat and interact with people within the smart manufacturing industry to share common interests and enhance your business. You can access exclusive content, you can learn from experts and get feedback, but also peer-to-peer, and you can feel part of something by becoming an active member and sharing content and experiences... It is fun and productive to be part of a community!

The I4MS online community is the place to share interesting content about manufacturing, to speak about technologies, experiments and experiences of SMEs (small and medium size enterprise) and competence centres making digital transformation happen... It is a space where you can have a voice to gain more visibility within the industry, so this community works as a central information point that will provide you with information on the latest trends, news and events about the digitisation of the manufacturing industry in Europe.

Get inspiration, share information and discover the funding opportunities available for you, network and find synergies and business partnerships. I4MS online community has been created within the I4MS initiative, which is promoted by the European Commission to support the European leadership in manufacturing through the adoption of ICT technologies.

The European manufacturing industry is a big ecosystem with several key players involved working to boost it, and this community aims to gather them all:

- Digital Innovation Hubs (DHIs), actors that support both technologically and financially startups, SMEs and mid-caps through services related to innovation to facilitate its digitisation.
- Innovation Actions (IAs), actions funded by the European Commission to boost and facilitate the digitisation and innovation of a technology, as well as to provide technology oriented support and offer funding through small experiments.
  - Research and Technology Organizations (RTOs), such as competence centers and technology institutes.
  - IT providers, offering solutions to digital challenges.
  - Aggregators of SMEs, as clusters at regional level, associations, tech parks, chambers of commerce, etc.
  - Manufacturing mid-caps and SMEs, some of them already beneficiaries of the I4MS initiative.
  - Funding experts and investors.
  - Researchers and experts in manufacturing and innovation.





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