



*Simulation for
manufacturing & engineering*



High-performance computing at your fingertips!

Explore real world use cases showing how companies use
the power of cloud computing.

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The cloudSME Appcenter – use advanced simulation applications in your web browser

1. Would you like to increase your target market by offering your software solution in the cloudSME Appcenter?
2. Or are you looking for the right software application, to enhance your business processes, but struggle with license costs or lack the technical knowledge?
3. Or would you like to be more innovative and develop a new business idea using cloud technologies?

Then find out, what the cloudSME Appcenter holds for you!

Technically the Appcenter is the frontend of the cloudSME platform, which was developed in the European research and innovation project cloudSME (funded under grant agreement no. 608886) to particularly support the uptake of advanced simulation technology among small and medium-sized companies.

The cloudSME project – innovation support for small and medium-sized enterprises (SMEs)

Due to several reasons, like expensive software licenses, the lack of technical knowledge and high costs for the purchase and the maintenance of hardware resources, smaller companies are still reluctant regarding the use of simulation, although they could considerably benefit from cost savings and a boost to their innovative and competitive capability.

The idea of the cloudSME Appcenter will overcome these obstacles, providing a row of simulation software solutions and simulation use cases implemented by cloudSME project partners that:

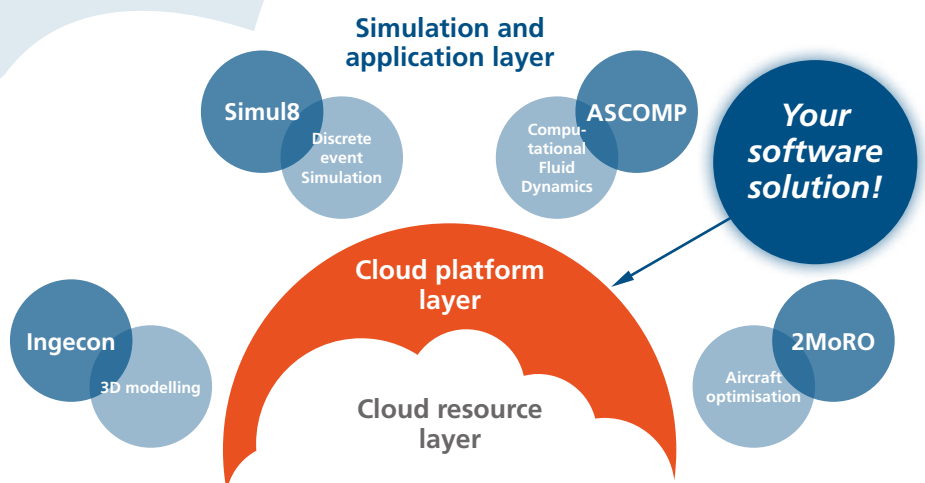
- are implemented as a service (**SaaS**) to be consumed at a **usage-based prize**.
- can be run on **different Clouds** using different cloud infrastructures (IaaS, HPC).
- can use **High-Performance-Computing** (HPC).
- are easily **reconfigurable and interoperable**.
- can be deployed easily accessing **fast track deployment API** (PaaS).
- are **easy to use** (many template solutions won't require special technical knowledge).

See, how other companies use the cloudSME Appcenter

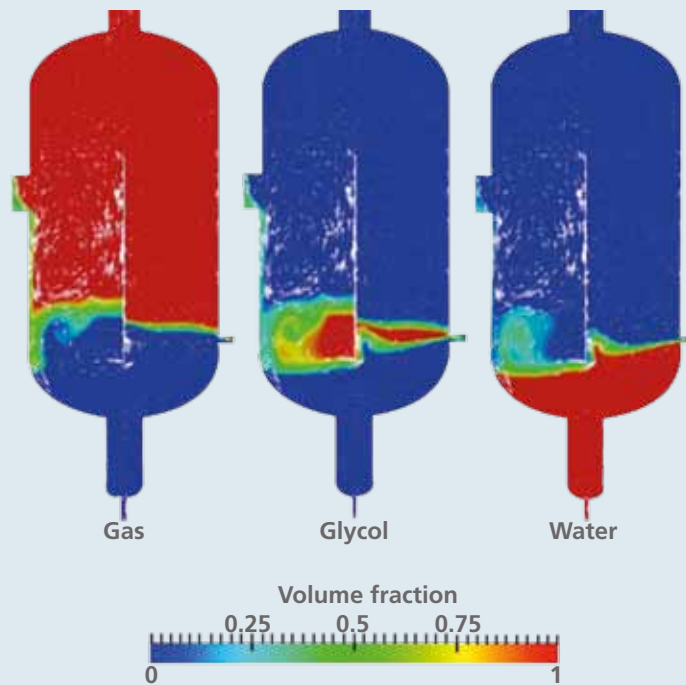
There is a plurality of possibilities to use the Appcenter for your own purposes. Find some inspiring examples of companies who are already implemented their solution on the following pages!

Explore...

- ★★★
 - Real expert solutions, like advanced CFD applications.
- ★★
 - Specialist use cases supporting business model development on their basis.
- ★
 - Easy-to-use templates, which can be used without further technical knowledge.



Explore the world of HPC supported fluid dynamics simulation with TransAT (CFD)



From product design to product testing - Computational Fluid Dynamics (CFD), is widely used in manufacturing and engineering today. But due to high costs, caused by required hardware, IT-maintenance and expensive software licenses this technology is not available for everyone so far. This can be changed by offering an opportunity to use CFD at a usage-based price in the cloud.

Flexible analysis of single and multi-phase flows of different materials

The use of CFD simulation became widespread today. It is used in various industries to analyze the interaction of fluids, gases and solids (air, water, oil, blood), in technical facilities or even in the human body for example. But CFD usually is very computing intensive. Offering the technology on a cloud platform at a usage fee will open this technology to far more people than it was the case before and lower the entry barrier for relying on a powerful CFD simulation software.

TransAT is an expert Computational Fluid Dynamics (CFD) application, developed by the Swiss company ASCOMP, which is a specialized in the simulation of industrial fluid dynamics and heat & mass transfer, with specific focus on multiphase flow and complex-physics fluids.

With the help of IT-provider Eurobios, who is a French consultant, trainer and value added reseller for use cases on physical modeling and numerical simulations in large scale projects, they deployed their solution into the cloudSME Appcenter. The expected benefit for them is an increased number of customers, addressed by simplifying the access and offering the solution on a common platform for simulation. Both companies will also provide help and consultancy services on demand. The potential market for fluid dynamics simulation is very large, in particular multiphase flows are a crucial issue in process engineering. The cloudSME project is a unique opportunity to connect the end-users with CFD specialists.

Are you interested to use CFD to improve your product development using a scalable and easy to use cloud-based platform?

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Model helicopter configuration and optimization using HPC-based CFD solver technology

The market for unmanned aerial vehicle systems and drones will increase over the next years. The small simulation software provider ProcEng Moser wants to open up this market with their configuration and optimization service for model helicopters, but faces limitations due to their local hardware resources. Using DHCAE's CFD solver technology in the cloudSME Appstore, will enable them to overcome these barriers.

Their optimization service especially comprises the technical design of the helicopter rotor and its blades. Computer simulation precisely analyzes the collisions between the air flow and the moving blades that make helicopters fly by calculating differential equations from the collisions. Taking into account a plenty of surrounding factors and variables, the optimization process requires a large number of CFD simulations and structure analyses to cover this large range of parameters.

This will result in a fundamental database which helps to understand and optimize the helicopters, but requires massive computational power.

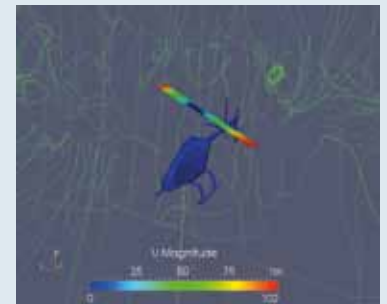
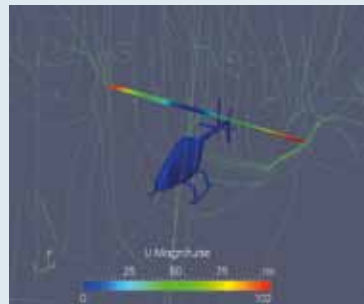
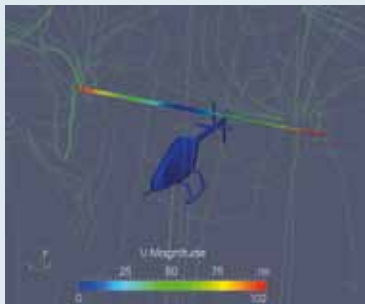
The implementation of CFD solver technology in the cloudSME high performance environment will facilitate the use of HPC resources and the conduction of advanced and CPU intensive analysis (e.g. transient simulations) - particularly for small and medium-sized companies (SMEs), that shrank from the connected costs so far.

Therefore, DHCAE Tools provides a graphical user interface (GUI) based multi-purpose CFD/FEA environment for the open source solvers OpenFOAM® and CalculiX, including solver extensions. The availability of the source code allows specific adaptations of solvers and utilities to the end user's needs. Customized tools for a convenient job control and solution monitoring will be made available (runGui).

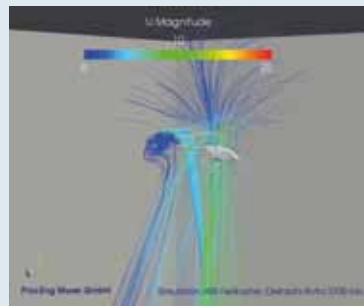
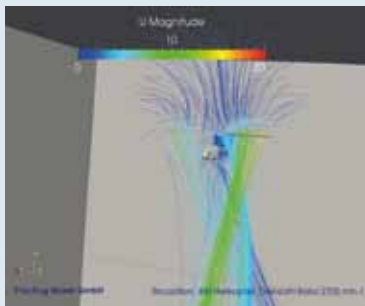
As a result, ProcEng Moser's business line "Technical configuration and optimization of model helicopters" can be extended and in the long run and the market for unmanned aerial vehicle systems and drones can be opened up. DHCAE Tools, however, will be able to expand their portfolio with on-demand services by addressing new customer groups. The provision of their software is significantly simplified. The frequently arising problems with installation and maintenance of the tools and libraries, especially within a Linux environment, are eliminated. The time for getting the modelling environment ready for use is very small or zero.

With the OpenFOAM® library, a wide range of CFD application areas is covered, e.g. for mechanical and plant engineering, automotive engineering, aircraft industries etc.

Simulation of rotors:



Influence of hood:



Contact:

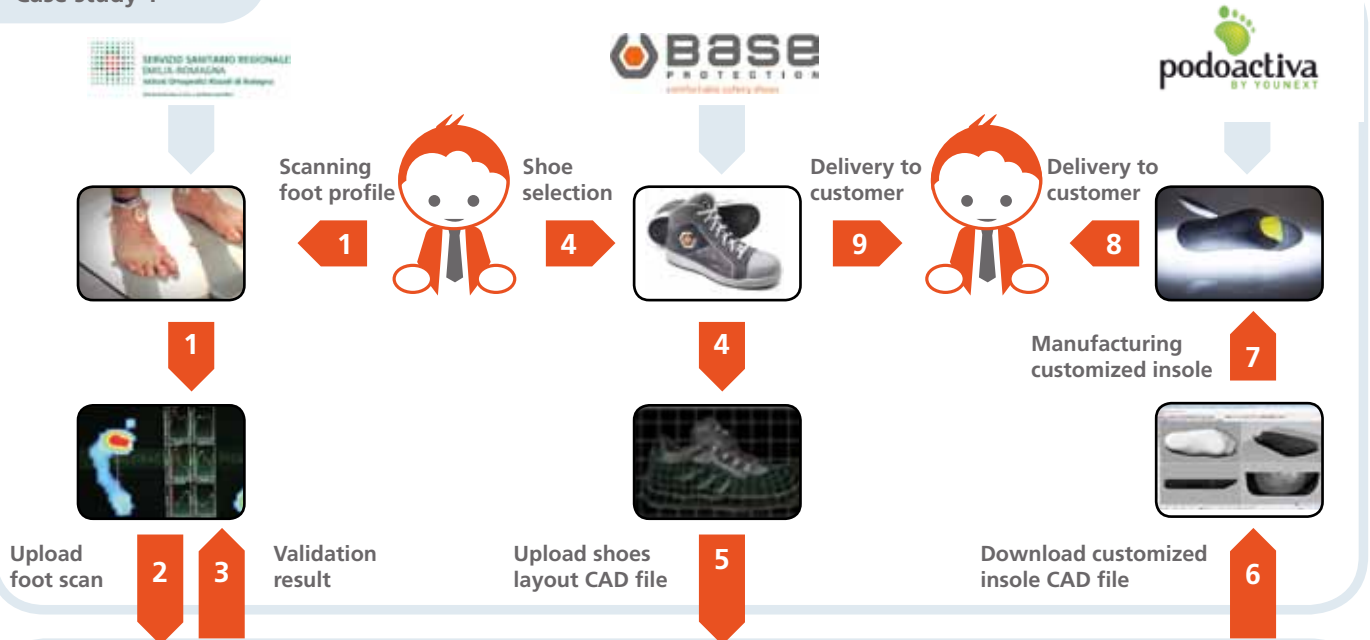
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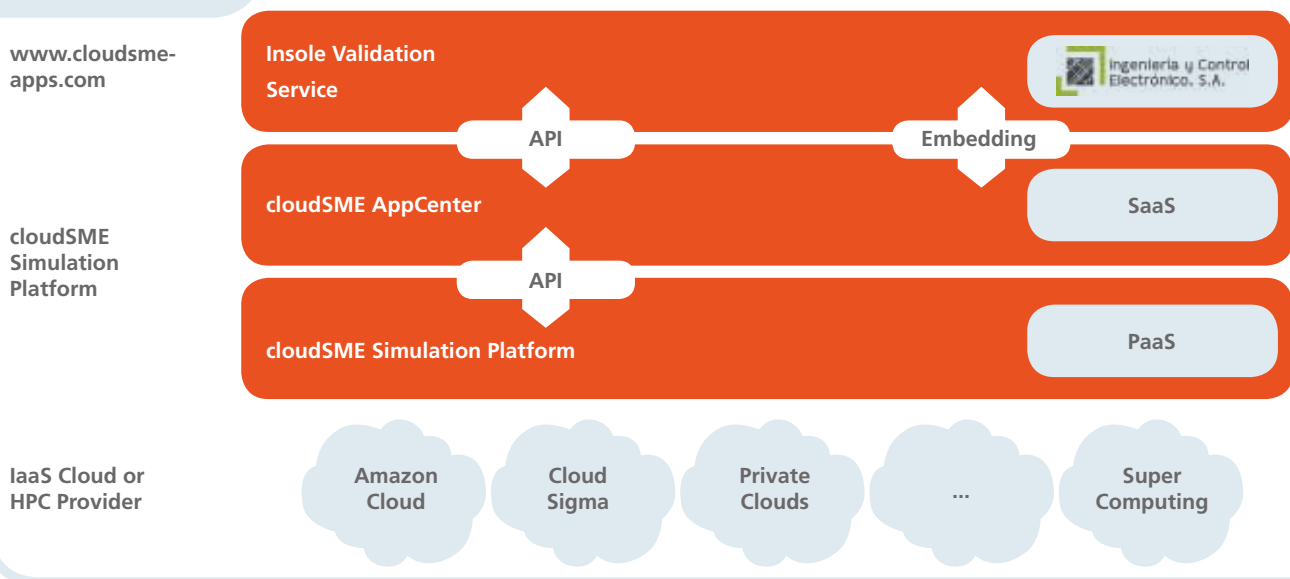
Walking on clouds – from Spain to Italy!

Using the cloud, this way is not so far! One Italian and two Spanish companies bring insole & shoe customization service to the cloudSM Appcenter.

Case study 1



cloudSME





The case study

The market for customized insoles would be much bigger, if the design process – one of the bottlenecks, causing high costs – could be reduced and the insoles could be offered at a much more competitive price.

By migrating their 3D insole scan & design method to the cloudSME Appcenter, Podoactiva, a Spanish biotechnology company specialised in podiatry and biomechanics and the IT provider INGECON, found a way to achieve both: address a considerably increased group of worldwide customers and cut costs.

As cloud computing allows for the access of High-Performance Computing capabilities and enables many simultaneous remote user accesses, the computing time needed for the design will be dramatically decreased, while the manufacturing capability will increase.

The benefits of cloud-based insole design

Ingecon's web based "3D Scan Insole Designer" is a set of tools which will allow it to fully automate and facilitate the design process while enabling a row of benefits for customers (Figure 1):

1. After a scan of the foot is made, the scan has just to be uploaded to the Validator on the cloudSME platform.
2. The user will get back the results immediately and can – in case of an invalid scan – repeat the procedure.
3. Immediate validation will avoid rejections and delay in the design.
4. If the customer wants to have the right shoe as well, he will have the option choose the right shoe model out of the collection of Base Pro (another cloudSME partner who is currently implementing his solution in the App Center).
5. Both files can be uploaded then and will be downloaded again in the manufacturer's office, where the shoe will be produced and automatically sent to the customer (Step 6, 7, 8, & 9).

Interested to use this application in your own business as well?

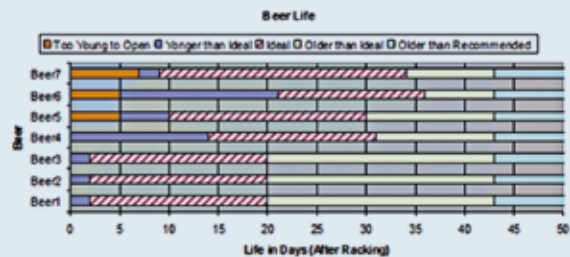
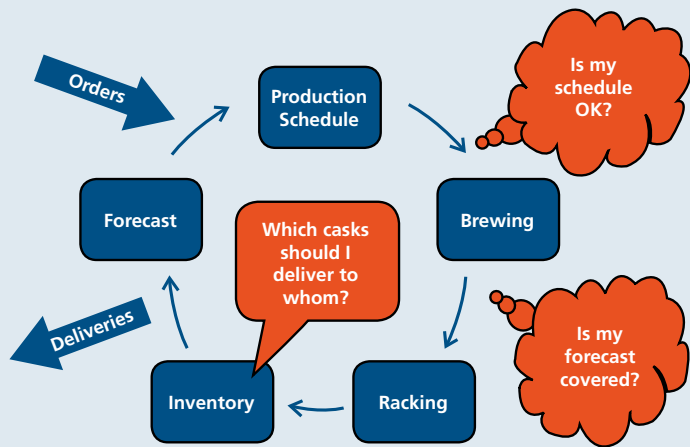
Like, Base Protection (see figure), an Italian Manufacturer of Safety Shoes, uses the software to offer a new service to their customers. They will not only have the opportunity to design tailor-made insoles, but to order a perfectly fitting set of a shoe and an insole.

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Always guarantee best beer quality using the cloudSME process optimizer



You already produce the world's best craft beer, but would also like to ensure, that quality is always at its optimum level? Then just try our brewery process optimizer.

One of the key quality objectives shared by Craft Brewers is to ensure that their products are consumed in an optimum time window. Beer should neither be consumed when it is too young nor too old and the age at which cask conditioned Craft Beer is at its best varies from product to product.

Process simulation will help you to guarantee the best quality to your customers

When faced with multiple product lines and multiple outlets, the scheduling of the brewing processes and timely procurement of raw ingredients can be a very complex and time consuming task. In this case the use of discrete-event simulation software to create a process model of the system is very useful.

In the present case the IT provider, Saker Solutions, developed a SIMUL8-based template solution which can be used by a small or medium-sized brewery with the typical manufacturing chain. Using their process optimiser will enable breweries to improve various processes. The Hobsons brewery who already has a low return rate of craft beer that hasn't been consumed at the right time, aims to even reduce this rate, in order to improve their competitive capability.

Process simulation will enable intelligent decision making in relation to the optimal utilization of the dispatch warehouse which will as a consequence maximize the potential for a cask to be opened when the beer that it contains is at its ideal age. This intelligence involves understanding how stock should be allocated and dispatched from the finished goods warehouse. The main output from the simulation model will therefore be which casks/kegs should be when shipped to whom.

As well as improving quality objectives, the model will also provide additional benefits, like the

1. reduction operational and handling costs,
2. development of a better understanding of how the repatriation of casks/kegs should be orchestrated to increase the utilisation of casks/kegs
3. reduction of the capital costs of investments in additional assets as the business grows
4. ability to experiment with different production schedules to help the brewery to understand how their quality objectives can be underpinned by evaluating what should be brewed and when.
5. increase of the user's competitive capability, as simulation software isn't widespread among breweries yet.

Using this easy-to-use template solution in the cloudSME App-center, the cost of model building and creating a decision support tool will no longer be prohibitive to typical craft brewers.

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Equating stock flow with cash flow. How inventory management can overcome cash flow problems

Small businesses live or die by their cash flow. But many struggle to manage their inventory, tying up much needed cash in stock. Despite this, many use no system for forecasting their inventory needs other than experience and guesswork. Tidy Books took this as an opportunity to develop and market its inventory forecasting software.

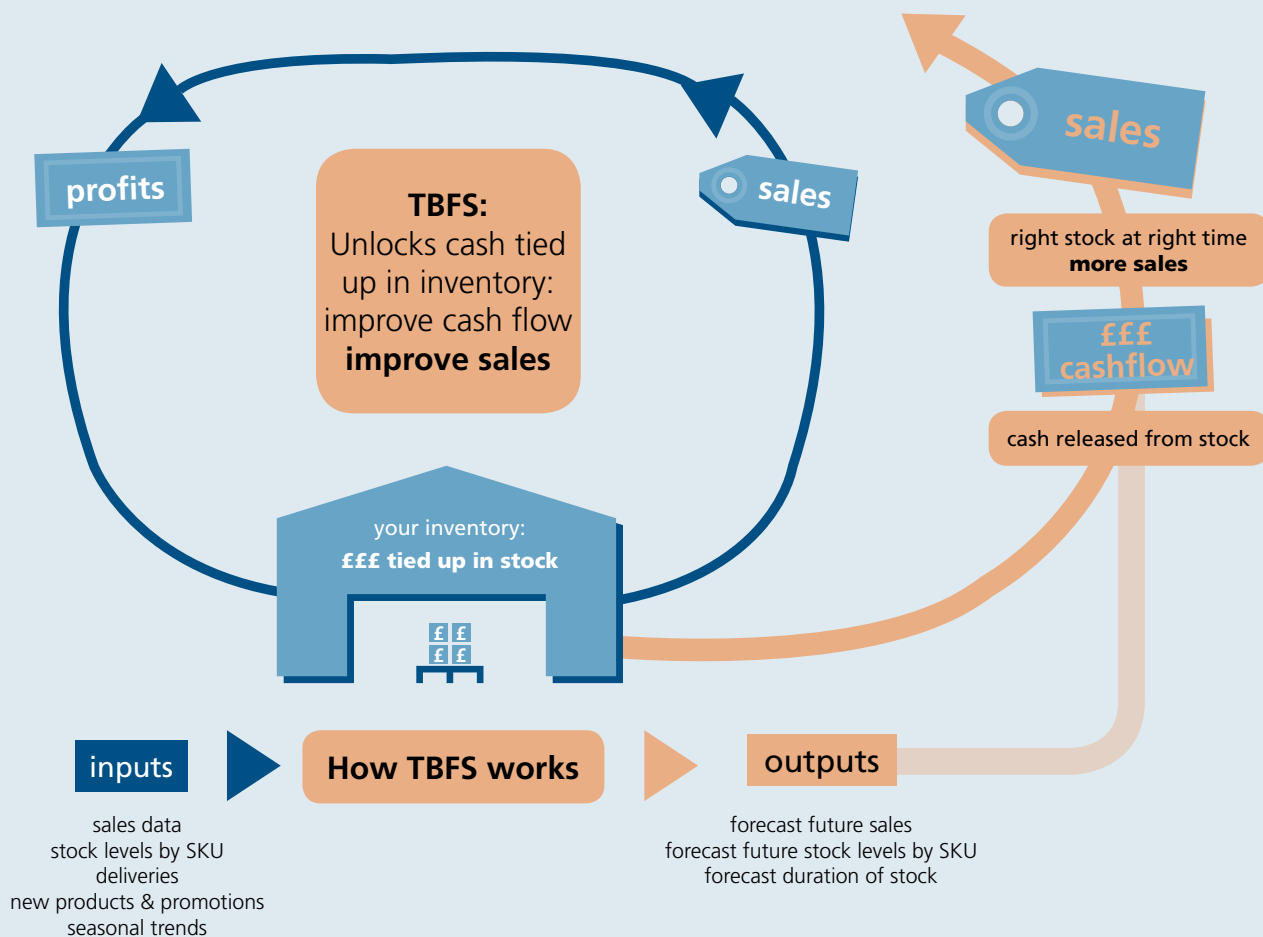
Tidy Books, a manufacturing SME, experienced a severe cash flow problem and so developed their own solution; a stock forecasting and management system called TBFS (Tidy Books Inventory Forecasting Software). TBFS greatly improved insight into their processes and enabled Tidy Books to have the right products in stock at the right time. Tidy Books were able to maximise potential sales and unlock cash tied up in stock, which ultimately saved the business.

Tidy Books saw the opportunity to commercialise TBFS for other small manufacturers, via offering a cloud based version of it in the cloudSME Appcenter. Developed with Tidy Books' experience as a typical small manufacturer, the inventory forecasting software will be an affordable, simple and comprehensive, monthly subscription service enabling SMEs to get in control of their stock and plan for the future.

Together with the IT-provider Outlandish they're currently developing a cloud version of TBFS, which will be a tailored easy-to-use tool for manufacturers who have the similar processes

Do you have too much cash tied up in stock, which you could put to much better use for your business? Get in contact!

Your business' cash & stock flow



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Standardized process optimization for manufacturers



Another process simulation tool, based on the well-known BPMN 2.0 standard, will be provided by the software provider SimSoft whose expertise is the production of simulators and a wide range of simulation software and games. **This easy-to-use application will help manufacturers to optimize their workflows, through the improvement of their utilization and the reduction of cycle times.**

Simsoft will provide the simulation-based decision support tool, SimBusPro, which supports BPMN (Business Process Model and Notation) 2.0. BPMN, a

global standard for process modeling and one of the most important components of successful Business-IT alignment and a modeling notation in which businesses and other such institutions are endowed with a common and universal platform through which their internal business procedures can be represented in a graphical notation.

The BPMN standard enables high flexibility

This involves various benefits for users: The modeling editor in the SimBusPro portal allows importing pre-defined BPMN models to simulate. Users can design their business process models with any BPMN editor and use SimBusPro portal to run simulations of the input business process models.

SimBusPro's additional features include its ability to generate easy-to-understand yet meaningful simulation reports about modelled business processes, and its ability to generate multiple alternative reports based on different scenarios, which enables the program to achieve its goal of accomplishing simulation-based optimization.

By using SimBusPro manufacturers from different branches will be able to enhance their business processes and yield improvements in their existing systems. The two manufacturing firms whose business processes are to be improved in this experiment, are Özdekan Rubber and Gökdoğan Shelving and Equipment Systems. Özdekan Rubber is a manufacturing firm which specialises in the production of a wide array of rubber products ranging from lead rubber bearings for seismic isolation to earth-moving machinery spare parts. Gökdoğan Shelving and Equipment Systems, on the other hand, is a firm that manufactures a plethora of industrial shelving systems. Both companies aim to minimize their operational costs (particularly through time savings in their manufacturing cycles), whilst maximising the efficiency of their processes. This example incorporating two such different manufacturers shows, how flexible SimBusPro can be applied.

Are you a manufacturing company aiming to improve your business processes in order to get more competitive? Then find out, which benefits SimBusPro holds for your business!

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Make targeted improvements to your business processes

This special use case implemented a process optimisation tool, suited to the needs of a cutting tools manufacturing company. Cutting Tools (www.cut-tools.co.uk) is a small manufacturer of precision cutting tools and a flat-bed tool maker for industry providing cutting services. Customers come from a whole range of industries from automotive, aerospace, medical, pharmaceutical, printing, to shoe making and packaging industries.

Cutting Tools' costs are very high with regard to raw materials such as steel cutting blades and plywood bases for the tool products. In order to enhance their business process management, SIMUL8 and Saker Solutions developed a template solution which is able to run many scenarios of different order types and manufacturing process configurations to provide the optimal vision for the best process efficiency.

Experience the benefits of cloud-based process optimization!

Specifically, the experiment concentrated on four key business objectives:

- a) Capital Investment Planning – providing the company with a vision for the optimal investments for improving efficiency, throughput and capacity to take on larger orders.
- b) Production Planning and optimisation – a vision through cloud-based simulation for the best use of all production resources (staff, machines, and designing).
- c) Performance Evidence – Vision to show large customers that the company has the Process Capability to undertake new orders.
- d) Save money – Each above mentioned objectives should be reached at an affordable price through the HPC and Simulation software via the Cloud

Find out, how “SIMUL8 in the cloud” could also help your business!



Figure 1: Addition of extra machines at the blade bending process. Experiment to reduce bottlenecks regarding investment planning.

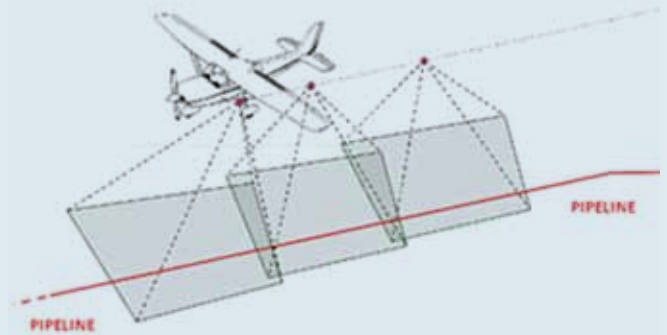
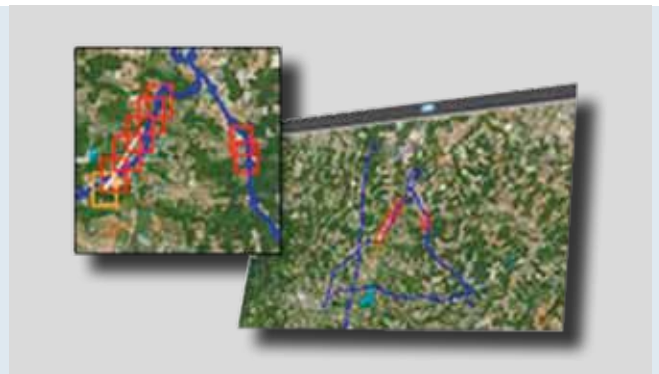
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High definition image analysis using the cloud



High definition image analysis enables the detection of inefficiencies or hazards in industrial facilities, special areas, manufacturing lines or nearly any kind of scenario you can imagine. Drones or other vehicles can be equipped with a high resolution camera, enabling the easy monitoring and maintenance of oil pipelines or power plants for example.

Calculate even biggest data amounts using HPC-based cloud computing

2MoRO solutions and AeroDrones have developed a high definition image recognition solution that can be embedded onto any kind of existing system, from industrial machines to a UAV or aircrafts. Any high definition image can be analyzed in almost real time through continuous analysis or could be gathered for a delayed and grouped analysis.

Their cloud-based solution provides all end-users but notably small and medium-sized companies with the ability to integrate an image recognition and analysis into their processes without

the need of possessing the high demanding infrastructure typically required by this activity. Typical use cases are, quality analysis on a manufacturing products, encroachment detection, nearby detection of hazardous activities, etc.

Today there aren't too many users of image recognition software among this group. The main goal is to leverage this solutions and reduce the inherent constraints. 2MoROs primarily work focuses on optimizing the duration of an analysis through the use of the Cloud in order to parallelize treatments. Then simplification of the usage in order to allow an easy and fast integration into existing industrial processes.

Are you interested in trying this kind of technology in your business?

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CloudFreIT – Cloud-based Simulation Models for Freight Transport Intermodal Terminals

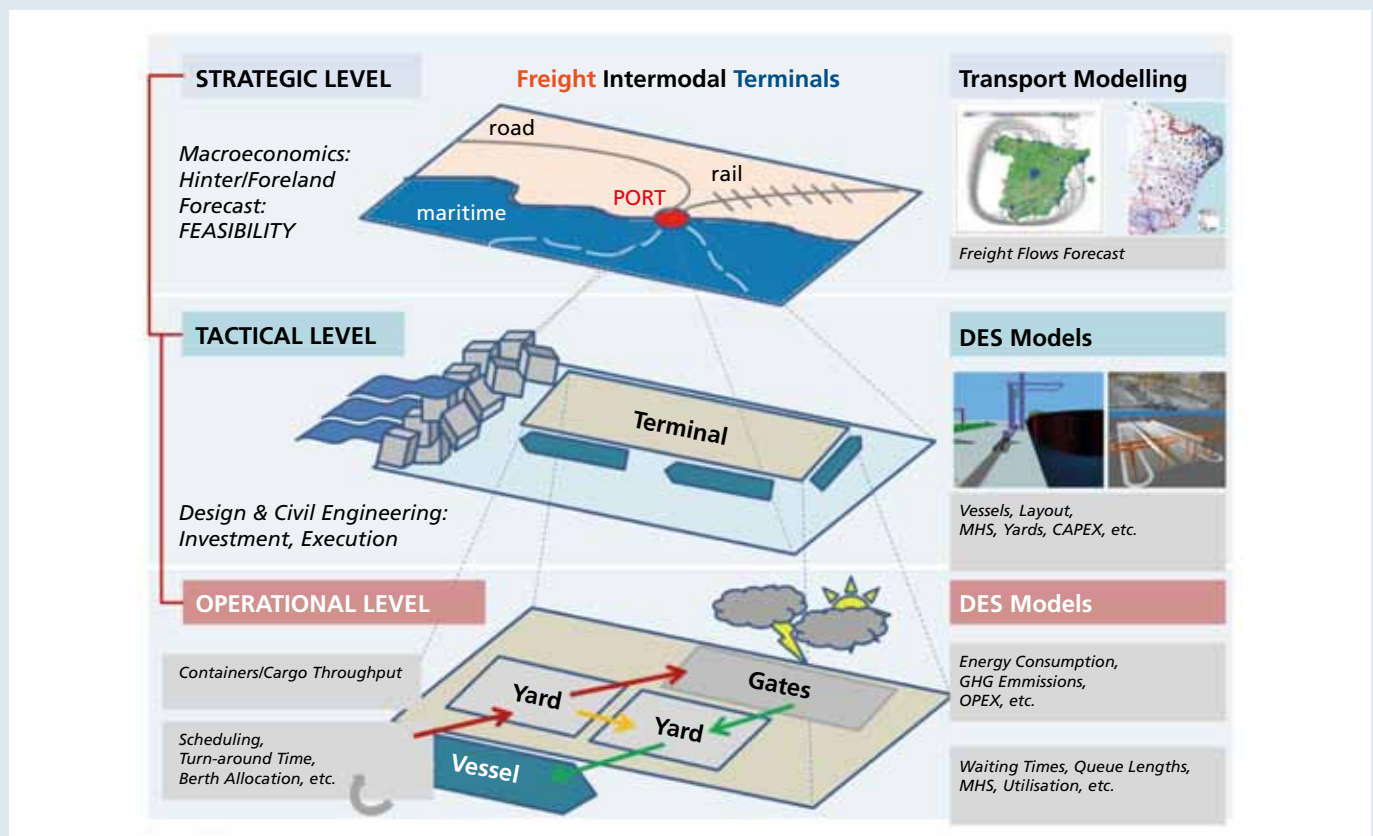
Globalisation has dramatically changed the nature, scale and demands of freight intermodal terminals, which are crucial infrastructures for Europe’s competitiveness and trade with the rest of the world and within its internal market. Increasing their performance through improving the productivity of the assets will depend on fewer, faster, more sustainable, and better planned interventions.

Improve the interaction of intermodal terminals

Intermodal nodes typically entail a natural bottleneck in the transfer of goods involving different modes of transport, which could generate inefficiencies in co-modality. The use of simulation software may improve the performance of key elements within any intermodal transportation system. The full engineering consultancy services provider PROYFE, aims to enhance its market positioning by offering a reliable, complete and solid solution, providing logistic companies with an easy to access environment for developing feasible concurrent simulation

analysis supporting and enhancing the planning, design, engineering, execution and operation of intermodal terminals. Their solution, called CloudFreIT, encompasses the construction of a series of modular, generic and flexible cloud-based discrete event simulation models of typical freight transport intermodal terminals. Its main objectives are the following:

1. CloudFreIT will provide a generic easy-to-adapt pre-built series of simulation models representing the main elements (material handling systems, yards, etc.) and their corresponding typical configuration and operational schemas as well as the main related sub-systems (energy supply, maintenance, etc.) allowing to acquire and provide holistic and interlinked analyses of intermodal terminals.
2. CloudFreIT will enable a CMS (Collaborative Modelling and Simulation) platform for multidisciplinary contributions of different agents involved in the entire life-cycle of intermodal terminals. Thus, simulation models will get its raison d’être coming through their most complained reproach, i.e., its ephemeral condition and utility beyond ad-hoc and punctual simulation-based projects.

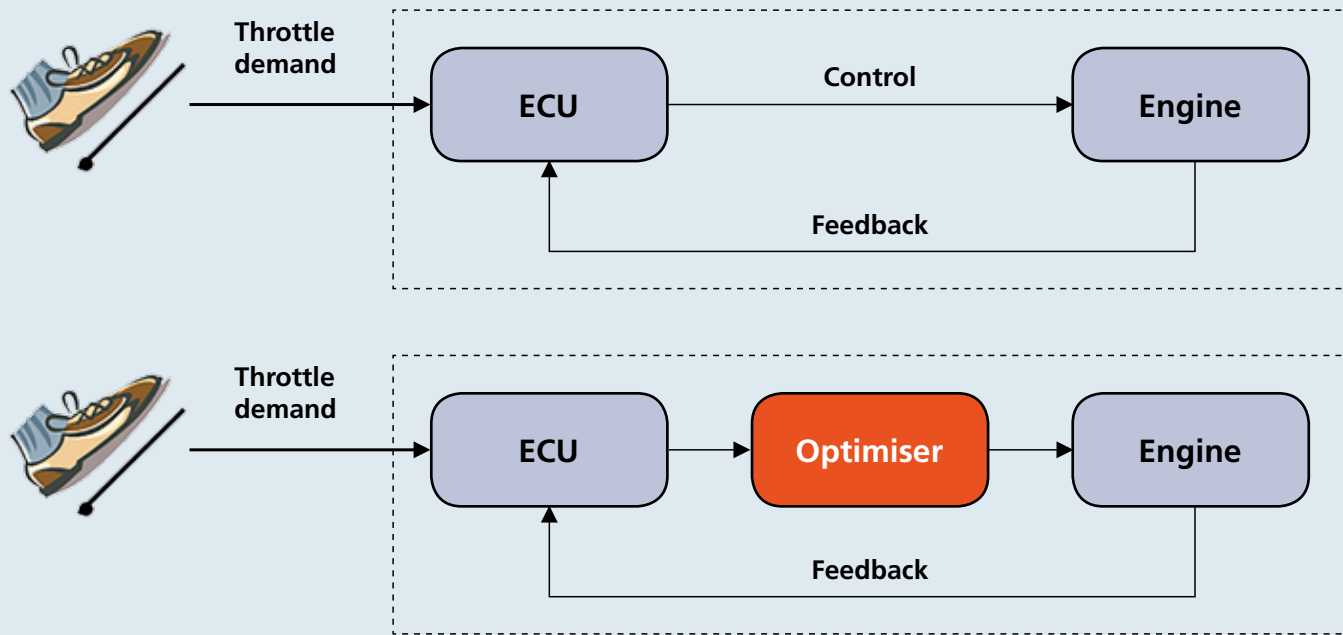


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Emission reduction in the cloud



The reduction of emissions across various industries became increasingly important over the last decades. Sustained research and development for new products in the automotive, heavy duty trucks/transportation, ships, power generation sectors, etc. was dictated by international policies and environmental legislation which have driven down exhaust gas emissions significantly.

This experiment involves the development of G-VOLUTION's sustainable, low-carbon energy conversion technology for heavy-duty powertrains through application of CMCL innovations' advanced engineering software simulation tool, SRM Engine Suite, which will be integrated with the HPC Cloud platform. The latter is a virtual engineering design tool for simulating the performance of fuels, combustion and emissions analysis in Internal Combustion (IC) engines and chemical reactors.

The software offers a novel probability density function (PDF)-based approach while accounting for detailed chemical kinetics, turbulent mixing, heat losses and all the components (EGR pressure loops, boosting, etc.) prevalent in modern IC engines. One of the major goals of this experiment is to enable a multi-fuel technology for heavy duty commercial vehicles with 15% lower carbon footprint.

It's usually the numerical treatment of the detailed chemical kinetics schemes for describing the fuel(s) oxidation and the ensuing emissions formation pathways that makes such multi-fuel IC engine calculations highly CPU-intensive. Hence, the availability of an HPC Cloud-based design solution will be ideal for vehicle/equipment manufacturers and facilitate the commercial uptake of these Cloud-based virtual engineering models which has been limited by the availability of computational resources.

As a result of the experiment, customers will be able to:

- Develop low-carbon, low-emission, and high efficiency industrial processes and automotive engines.
- Enjoy cost- and time-effective design and engineering process.
- Make use of accessibility, usability and scalability of the software solutions.

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The cloudSME cloud infrastructure and baseline technology

The Appcenter is the frontend of the Cloudsme platform technology which is accessible through any web browser and basically working similar to a normal online shop offering simulation software for engineering and manufacturing as a Service (SaaS).

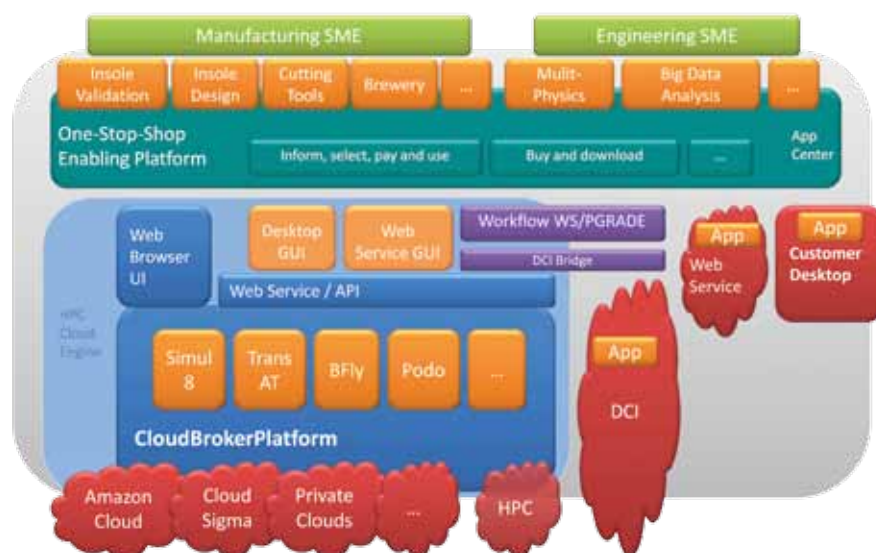
The main components of CloudSME Simulation platform are the Cloudbroker Platform and the WS-PGRADE framework. While the WS-PGRADE/gUSE framework supports the development and deployment of HPC applications across different types of Distributed Computing Infrastructures (DCIs), the CBP environment enables the deployment and execution of compute-intensive applications on different clouds and widely automates user, software, resource, job, and invoice management.

Key features of the cloudSME platform

The cloudSME platform will

- offer the possibility to run, store and modify workflows.
- provide **access to various cloud resources** (IaaS) which are either provided by cloudSME partners or rented from commercial cloud offerings (Amazon Web Services, OpenStack, OpenNebula, Eucalyptus) and other HPC resources (e.g. cluster, supercomputers, desktop grid, service grid)
- enable the **easy integration of multiple heterogeneous cloud resources** and a high level of abstraction through the hardware independent design.
- enable browser, programmatic and command line access, cross-domain.
- provide access through different application programming interfaces (APIs), enabling to quickly assemble customized simulation solutions in the cloud via simulation software specific plug-ins
- be **suitable for any kind of batch-oriented command line software, both Linux and Windows-based**, and both serial or parallel processing (via MPI for example) and will virtually support any cloud infrastructure
- provide the opportunity to choose the cloud infrastructure, a job should be ran on
- enable jobs to be run on multiple cloud instances (possibly with multiple CPUs or specialized processors such as GPUs) that can share the processing load of the software and deliver significantly faster performance
- offer **leading security standards** to beneficiaries, incorporating SSL transport layer encryption and authentication and authorization security using different passwords and user roles.

Architectural overview of the cloudSME baseline technology



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