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## SMART VORTEX

### Scalable Semantic Product Data Stream Management for Collaboration and Decision Making in Engineering



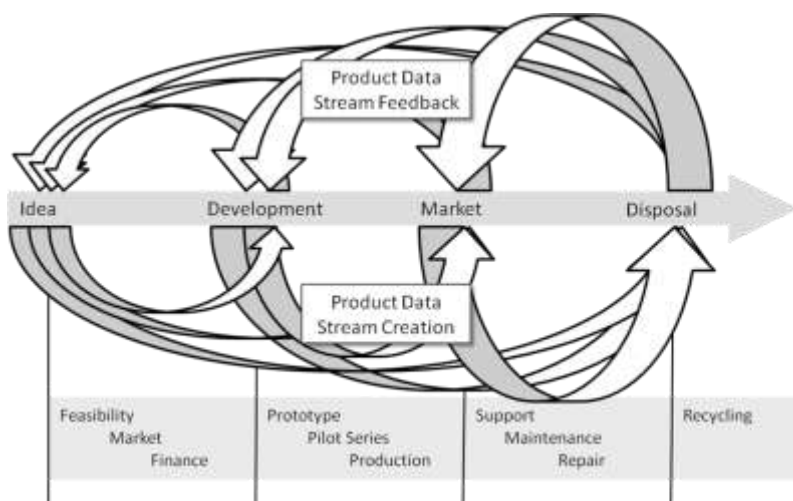
*“Helping industry to cope with data deluge in Design & Manufacturing”*

## ANNUAL REPORT 2012

The SMART VORTEX project is a 48 months FP7 Integration Project started on October 1st 2010, under the domain of Strategic Objective 4.3 Intelligent Information Management.

The SMART VORTEX Project aims at providing a technological infrastructure and interoperable methods, tools, and services that will support large-scale industrial innovation and collaborative engineering projects; making possible that information management will underpin an intelligent analysis of massive data streams and growth of business value and capabilities.

In this project, the union of all product data streams, both along the direction of the product lifecycle and the product and innovation process feedback, is called **SMART VORTEX**. It comprises amongst other, sensors` data, design, simulation, experimental, and testing data, multi-media collaboration data and data from higher level inferred events generated by analyses.



## IMPORTANT WORK AREAS

The course of action within SMART VORTEX project is organized in four overlapping cycles that comprises the development of all project processes towards accomplishing project objectives and thus generate expected results.

- **The Inception and Elaboration cycle** is the first cycle, aimed at creating “common ground” among all consortium participants. This cycle has started with the definition of requirements analysis, which comprised setting up the definition of the standard RTD workflow of requirements needed for the RTD cycle of the project.
- **The requirements analysis and identification of user scenarios** cycle; aimed at collecting the needs and expectations of end users and service providers for SMART VORTEX development. Key activities performed comprised organisation for setting up the analysis of user requirements, needs and usage scenarios.
- **The suite modelling, data & system architecture cycle;** aimed at creating information models of concepts, relationships, constraints and rules for the technological framework of the project. Key activities performed comprised organisation and setting up the evaluation for high-level semantic representations for streaming information and data sources as well as for information and semantic modelling.
- **The semantic data stream models and access language cycle;** aimed at developing semantic models for sensors` data streams and collaborative models. Key activities performed comprised evaluation of operational details for this area of work.

The development of the SMART VORTEX suite is being tested in three specific application scenarios and work areas representing real-world problems:

- Smart data stream enabled decision making and cooperation support in complex design and engineering environments.
- Efficient information life cycle and data stream management of individual data for functional products business models.
- Product data steam sharing and collaboration in complex cross-organizational scenarios.

## TARGET OUTCOMES AND EXPECTED IMPACT

The SMART VORTEX of product data streams is the core concept, around which targeted outcomes are developed: capturing tractable information, delivering pertinent information, collaboration and decision support.

In SMART VORTEX we are creating a suite of innovative high-impact components, containing architecture, methods, tools and services for supporting large-scale collaborative engineering projects by intelligent management and analysis of massive data streams to achieve better collaboration and decision making. SMART VORTEX outputs are delivered as the expected results are generated.

The SMART VORTEX project was designed to produce high-impact regarding industrial application scenarios and research, as project outcomes are a natural match to the key problems presented by the SMART VORTEX industrial application scenarios. Thusly, we expect to lead industry into knowledge-driven and service oriented business models, by:

- Supporting the delivery of industrial functional products business models by capturing and analysing tractable information;
- Bringing the real-life experience and simulation closer together to increase product quality, cost savings and therefore the value for customers and vendors altogether;
- Innovating in goal driven collaborative cross-organisational setting, among all players in the entire product life-cycle.

As functional products business models are implemented in the industry, and the industries` service levels increase, the continuous feedback obtained from analysed tractable data could: a) be fed into the development of product updates or even totally new products; b) drive to high customer satisfaction; c) provide domain-knowledge based support; and d) increase knowledge based leadership. In addition, a goal-driven IP collaboration at cross-organizational level will enable a knowledge based extension of the value chains.

## **PROGRESS TO DATE**

During 2012 efforts were focused on consolidating and implementing the SMART VORTEX infrastructure and services. Specially, getting ready and making available core elements to execute first user trials and connect data stream producers from industry to the SMART VORTEX infrastructure.

Main activities comprised designing and implementing the architecture for the Data Stream Management System (DSMS) development, interface specifications, the collaboration components and systems, ontologies and protocols, query languages, integration with tools, user interface prototype, as well as the demonstration and evaluation plan.

The main achievements of SMART VORTEX along 2012 are:

- We have successfully finished the requirements analysis and identification of user scenarios cycle, including the general architecture of the SMART VORTEX suite, end user interviews, requirements analysis, and the definition of measurable success criteria for the project.
- The use-cases for preparing Y3 demonstrators have been specified fine-grained.
- The basic infrastructure services was implemented, including the description of all data types and models occurring within the project, and the semantic models for the data streams together with the matching access languages.

## **DISSEMINATION AND AWARENESS RAISING**

During 2012, a second version of the Dissemination Plan targeting both scientific and industry communities was delivered. It defines the steps to be taken in order to communicate the project results and increase SMART VORTEX visibility; as well as the dissemination strategy, the target audiences, and the communication channels to be used depending on the audience.

As part of the 2012 dissemination activities, several scientific articles have been published. The project characteristics, scope and preliminary research results and publications have been presented to targeted audiences in several events and conferences; including conferences such as the VINNOVA-Conference Groundbreaking Information Technology, and Strategic Foundation Conference on Information Technology, CRIWG Conference on Collaboration and Technology, 3rd Third International Engineering Systems Symposium (CESUN2012), 12th international annual meeting of the Group Decision and Negotiation conference (GDN2012), 16th ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW 2013), ASONAM conference in August in Istanbul.

Among publications we can mention the article published in the International Journal of Computers & Industrial Engineering, “Comparing quantitative and qualitative approaches in querying data streams for system fault detection” and the paper published: **Functional Products - Goodbye to the industrial age**, Ericsson Business Review. 18, 2, pp21-24 which was sent to all Ericsson customer countries, i.e. in more than 130 countries.

Additionally, SMART VORTEX industrial partners have kept promoting the project’s scope, goals and challenges among both: key people of R&D+i, production, business development and other internal departments, as well as through its partnership network, including commercial enterprises.

## **FUTURE WORK**

During 2013 efforts will be focused in developing the SMART VORTEX Meta Data Schema (SVMDS) and the preparation of the demonstrators.

Main activities will comprise: further level of integration of the SMART VORTEX infrastructure; development and integration of visualization tools; refining and adapting the collaboration tools for collaborative problem solving and decision making process at different phases of the Product Lifecycle, cross-organizational level and/or when sharing large volumes of industrial streaming data; developing IPR oriented collaborative environments and turning the infrastructure into applications; and developing the trial prototypes in the selected scenarios and deploying services for executing the user trials.

Project outputs will be defined from market perspective coupled with a business model to refine the exploitation vision of project outputs and partners. These actions will be driving proper dissemination of SMART VORTEX findings.

## **FURTHER INFORMATION**

- EC ICT Information and Communication Technologies Projects: [SMART VORTEX](#)
- **SMART VORTEX Project website:** [www.smartvortex.eu](http://www.smartvortex.eu)
- **Project Co-ordinator:** Ruben Riestra, INMARK