CLOUD-BASED SITUATIONAL ANALYSIS FOR FACTORIES PROVIDING REAL-TIME RECONFIGURATION SERVICES

NEWSLETTER. ISSUE #1

CLOUD-BASED SITUATIONAL ANALYSIS FOR FACTORIES PROVIDING REAL-TIME RECONFIGURATION SERVICES

Letter from the Coordinator

**By Scott Hansen
The Open Group**

We started the SAFIRE project with a very challenging objective in mind: to create a plug-and-play solution that would allow product manufacturers to automatically reconfigure their production processes or their products' features in real-time based on the data-streams gathered from the production processes, the use of the product and their contexts.

It's been almost two years now since we started the SAFIRE adventure, a path full of challenges that is being cleared up thanks to the determination and commitment of all the partners: four research and development partners experienced in Industry 4.0, Internet of Things and Artificial Intelligence, and three industrial partners from different activity sectors.

During these two years the consortium has collaborated in the definition of methodological and practical approaches for the application of predictive analytics applied to the reconfiguration and optimisation of manufacturing processes and manufactured products within a secure framework, ensuring trust and privacy of data. The latter has not been a minor issue, especially in the context of the GDPR adoption time-frame, which has been coincident with this two years period.

We have also had the opportunity to present our views on intelligent processes and products reconfiguration at several Industry 4.0 conferences worldwide, where we have received really valuable feedback from researchers and potential end-users of the SAFIRE solution.

By the year to come we will finalize the integration of the solution and its validation and assessment in the three industrial partners. We expect to tell you about this success story in the next issue.
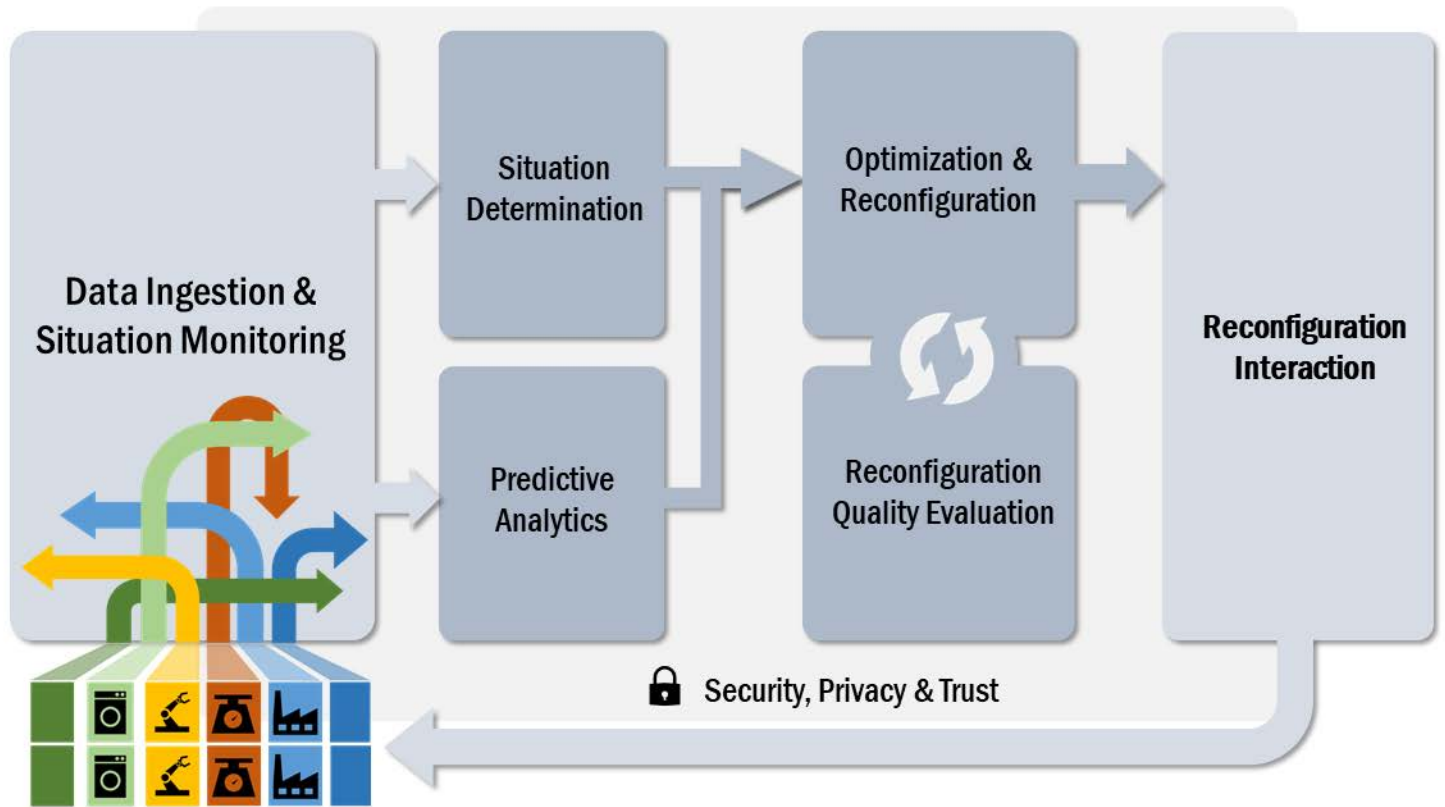
I hope you enjoy the reading.

In this issue

Reconfigure
verb

1. (tr) to rearrange the elements or settings of (a system, device, computer application, etc)

SAFIRE Concept

SAFIRE proposes a secure, privacy-aware cloud platform, that will allow manufacturers to obtain real-time reactive and predictive reconfigurations of their production systems and products based on data gathered from sensors data-streams and other sources. SAFIRE will be offered as an add-on to existing production management and control systems and implements several services to achieve this behaviour. The Situation Monitoring Services feed the Situation Determination with data from sensor streams and databases, being able to identify the context of the production process and product use, based on a generic ontology for product and process reconfiguration.

Analysis results of these services are used by the Predictive Analytics and the Optimisation & Reconfiguration Engines, which propose the necessary reconfigurations of the process or product in real-time. These services use search and related techniques to calculate new configurations to meet system metrics (e.g. real-time constraints, communications bandwidths and latencies, etc.), which are evaluated by the Reconfiguration Quality Evaluation Service. Optimised and evaluated reconfigurations will be sent to connected production assets and products using the event-driven data collection, Situation Monitoring services and Reconfiguration Interaction interfaces.

Achievements so far

During these two years we have produced methodologies and early prototypes for all the main components and services of SAFIRE: the Predictive Analytics Engine, the Dynamic Reconfiguration and Optimisation Engine, the Situational Awareness Services (comprising Situation Modelling, Situation Monitoring and Situation Determination), and Security, Privacy & Trust Framework for Product Data and Configuration.

Business Case

Every product tells a different story: there are as many ways of using a product as users exist. In the field of home appliances, this is mainly manifested in the selection of functions (washing cycle, cooking recipe) or process parameters (e.g. spin speed, temperature) and in the way users manipulate the user-interface.

SAFIRE solution allows us to register the embedded controllers of our products in a cloud platform to obtain a number of valuable services that will meaningfully improve the experience of our customers. In that way, the cloud services implemented in the platform capture data from the appliances which can be exploited not only to improve the design and manufacturing processes, but also to embed new features in the working product if they improve the experience of the user. But SAFIRE goes further by gathering data of the context and building behavioral patterns of the user that can lead to a more optimum operation of the appliances. An example is the identification of the ideal time frame to carry out a defrosting cycle, when the appliance is traditionally not used, but keeping the adecquate temperature for food preservation.

Our Business Case will be focused on demonstrating the validity of SAFIRE in the real-time "Personalization" and the "Adaptive operation".

Electrolux will assess SAFIRE in three different scenarios:

- Scenario 1. Improvement of devices' performance based on the feedback obtained from the user.
- Scenario 2: Improvement of devices' performance based on historical data containing information about usage of the appliance, incidents occurred, maintenance actions, etc.
- Scenario 3: Adaptive control of devices based on a specific situation pattern identified by SAFIRE system.

Business Case

The objective of OAS is to demonstrate the use of SAFIRE to optimize production processes and preventive maintenance activities managed by our proNto control system, by reconfiguring them based on the analysis of data gathered from the equipment and control system.

proNto is a high performance process visualisation system for SCADA and, at the same time, a control system for the process and production control level (MES). It is optimised for the control and administration of batch-oriented processes and it is particularly suitable for weighing solutions.

OAS will validate SAFIRE to demonstrate its effectiveness in monitoring data from their customers' installations and analyse this data to identify usage patterns. Patterns will be used for achieving optimal re-configuration parameters for a production process, as well as the baseline for advanced preventive maintenance.

OAS provides diagnostics and maintenance services to the manufacturing process of their customers by remote access to proNto. OAS control systems already include remote monitoring of the processes, so the data from the real processes are used e.g. for diagnostics in dynamically changing production conditions.

For demonstration purposes, OAS is installing several sensors and ICT solutions in some of its systems to remotely monitor the status of all the processes and components so SAFIRE can provide recommendations on how to optimise the maintenance activities or the the production processes.

OAS will use information/knowledge gathered from all its customers to monitor the performance of their control systems. This will be used as feedback to OAS design process to improve design of new control systems and continuously improve their services through optimised configurations.

ONA

Business Case

ONA is a leading manufacturer of EDM machines (Electrical Discharge Machining), highly specialized in large, custom and automated EDM installations. As some of the most disruptive improvements and changes in Machine Tool industry are expected to come from the digitalization paradigm, currently ONA is focusing on the research of advanced services for connected machines. A cloud platform for monitoring services is being deployed with the aim of improving ONA customer´s processes and the performance of ONA products and services.

ONA is exploring the use of SAFIRE's advanced data analytics and dynamic situational models in the field of adaptive machining. ONA has formerly performed research activities on that area taking advantage of the information captured during the in-process inspections to adapt to changes in the machining operation with respect to the pre-planned processes. The collected manufacturing data identify the behavior of the machine when manufacturing a component and defines a signature part concept that is behind the traceability service in ONA cloud platform. In this way, the impact of changes in critical parameters (like environment temperature, material and geometry, EDM process conditions and machine health) could be analyzed with a more holistic perspective for the actual manufacturing process.

There are many parameters that increase the number of ways a product can be manufactured: machine sizes, machine configuration options, or ONA Smart CNC features (like eco-mode machining for saving consumables, or the management of urgent jobs). It is expected that optimization and re-configuration modules in SAFIRE will help ONA customers to select the optimal path for EDM manufacturing in their EDM workshops of connected machines.

The SAFIRE add-on concept is also a unique opportunity to test interoperability service requirements of the ONA Cloud platform.

SAFIRE Dissemination

The SAFIRE Concept and many of its components have been presented in several Industry 4.0 events worldwide:

- PDP 2018 26th Euromicro International Conference. Cambridge, UK, March 2018.
- Big Data Spain 2017 Conference.
- 18th Working Conference on Virtual Enterprise in Vicenza, Italy.
- INDIN 2017 in Emden, Germany, July 2017
- 23rd ICE Conference in Madeira/Portugal, June 2017.
- International Conference on Industry 4.0 / European Project Leaders 2017, Iran.

Next steps

We are currently heading into the last year of the project. We have gone through multiple achievements during the first two years, but in the coming months there will be a number of important milestones like the integration of all the prototyped services into a single cloud platform and the production of a unified methodology for those early adopters who want to make their processes and products reconfigurable.

During the coming year we will also be facing one of the most critical tasks of the project: the validation and assessment of SAFIRE in the facilities of our pilot industrial users, from whom we will surely obtain really valuable feedback for its further exploitation.

Coordinator:

THE Open GROUP

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IK4 IKERLAN Research Alliance

UNIVERSITY of York

Industrial partners:

Electrolux

ONA

OAS AKTIENGESELLSCHAFT

More information in www.safire-factories.eu