DISRUPT

Horizon 2020
European Union funding
for Research & Innovation

H2020 - FoF11-2016: Digital Automation

NEWSLETTER #1

Decentralised architectures for optimised operations via virtualised processes and manufacturing ecosystem collaboration

DISRUPT Objectives

Industry 4.0 is the next developmental stage in the organisation of the manufacturing value chain. ICT-based systems will play a major role, mainly by creating a virtual copy of the physical world and facilitating decentralised structures through **Cyber-Physical Systems** (CPS). DISRUPT aims to spearhead the transition to the **next-generation manufacturing** by facilitating the vision of a "**Smart Factory**". The ICT capabilities can facilitate in-depth (self-) **monitoring** of machines and processes, provide **decision support** and decentralised (self-)**adjustment** of production, and foster the effective collaboration of the different **IoT-connected machines** with tools, services and actors. From a technological perspective, DISRUPT envisions each element of production to be controlled via the IoT by its virtual counterpart. The collected data will be analysed to detect **complex events** that trigger automated actions.

By combining **modelling, simulation** and **optimization**, DISRUPT will enhance decision support over a secure and flexible "plug and play" platform that will allow engineers from different disciplines to collaborate in developing services. This **cloud-based platform** will accommodate the anticipated high data volume and computational needs, while offering accessibility via any device anywhere in the world.

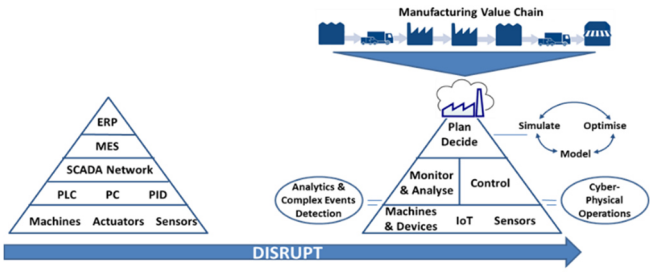

Figure 1: DISRUPT overall concept

DISRUPT Consortium

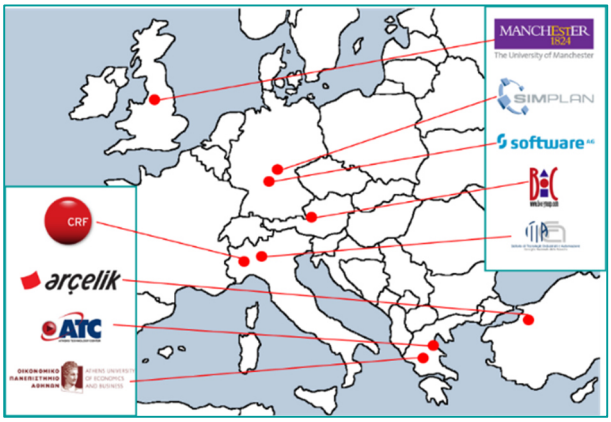

Figure 2: DISRUPT consortium

Connected Factories

The ConnectedFactories project is a coordinated action that group together all the EU projects under the call Factories of the Future FoF-11-2016. The ConnectedFactories project establishes a structured overview of available and upcoming technological approaches, best practices, future needs and challenges in the manufacturing industry. The main goal of the 'digital mapping framework' is to have a solid approach for describing and analysing what is present on the market in terms of technologies that support the deployment of digital manufacturing platforms. In the cluster there are six projects which are focusing on digital platforms for factory automation (included DISRUPT) and four projects which focus on supply chains and logistics.

Last February 2018, EFFRA organized the event "Digital Platforms for Manufacturing" in Brussels. This public event included the presentation of concrete results from ongoing and complete projects in 'Factories of the Futures', as part of an open discussion and collaboration to integrate different approaches. Specific sessions included "Integration between projects' platforms – standards & interoperability", "Value creation and business models in multi-sided markets for digital manufacturing", "Horizontal (automation) and vertical (Cloud) Cyber-security in I4.0" and "The changing role of humans in a digitalising industry". DISRUPT was presented in two such session by its Technical Coordinator, Dr Yiannis Mourtos (Athens University of Economics and Business): the first presentation referred to the DISRUPT architecture and functional requirements and a step towards a reference implementation, while the second discussed the consortium's ongoing effort and views on business models and exploitation.

All the presentations are available in the following link: http://www.effra.eu/project-news/connectedfactories-dissemination-event-presentations-now-available.

CONNECTED FACTORIES

Supported by the European Commission through the Factories of the Future PPP

DISRUPT Platform Architecture

The DISRUPT platform is an integrated environment supporting decision making, based on event-based observation and data coming from physical and digital entities in the factory plant floor and the connected supply chain networks. The platform envisions the integration of services that facilitate modelling of the manufacturing knowledge, multi-level simulation of the production capacity, optimization of the production scheduling and planning operations and analytics for improving production quality, efficiency and throughput. The platform is flexible enough to be customized to the needs of different business cases. More specifically, it offers a data driven implementation of user scenarios that enhance awareness on what is happening within and across a factory ecosystem, through integration of multisource and multiscale data from existing information systems and CPS technologies. It employs state-of-the-art software solutions for observing the evolution of key performance metrics and estimating their impact on the production and manufacturing capabilities. Further to it, it incorporates a set of decision support services that assist key players in handling disruptions in the production processes and improving their planning capacity by exploiting innovative modelling, simulation and optimisation technologies.

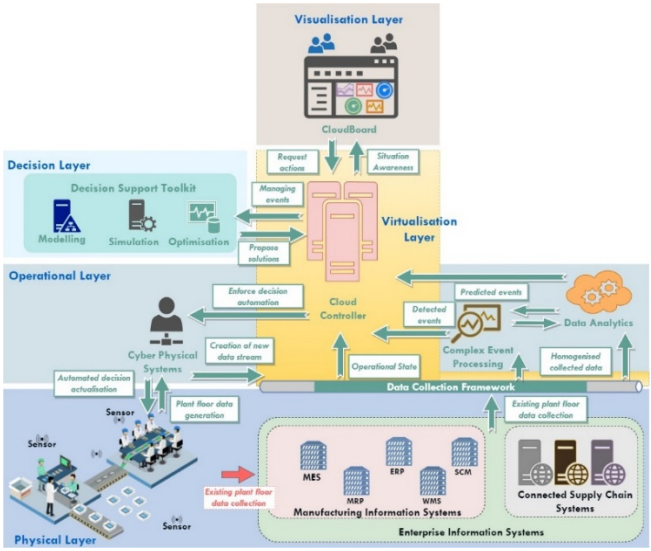

Figure 3: DISRUPT platform architecture

DISRUPT Modules

The DISRUPT system architecture is structured in four interrelated and interacting modules:

1. **The Data Analytics and Complex Event Processing module**: it harnesses the vast streams of data to provide valuable production information, thus enabling in-depth monitoring of the corresponding production processes and therefore faster response times and more informed decision-making.
2. **The Cyber-Physical Operations module**: it handles the interaction of DISRUPT with the production level via the organisation's manufacturing systems and enables self-adjustment and self-configuration via a network of modular, decentralised Smart Objects, offering synchronisation between the physical plant floor and its virtual representation.
3. **The Decision Support Toolkit**: it consists of three interrelated sub-modules, i.e., Modelling, Simulation, and Optimisation that interact to offer a wide range of decision support tools that cover multiple aspects of the whole production process

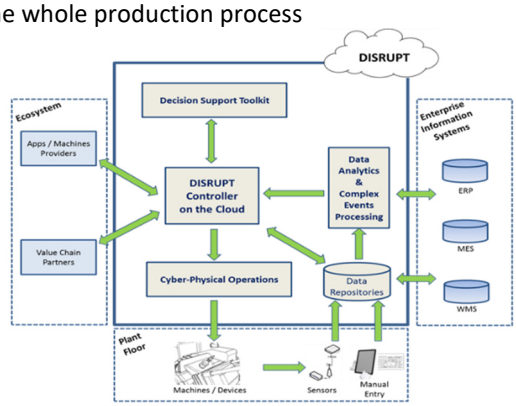

Figure 4: DISRUPT modules

4. **The DISRUPT Controller on the Cloud**: it integrates all tools and modules into one robust system, enabling their effective collaboration and the seamless communication of information, knowledge, and decisions to the plant floor and across the value chain.

Standard RAMI

RAMI4.0 (Reference Architecture Model Industry 4.0) was published in March 2017 as pre-standard IEC PAS 63088. RAMI4.0 consists of two models for the virtual (digital) representation of assets (e.g., products, production lines, machines, software — anything of value to a company).

The RAMI4.0 cubic model shows assets in the form of layers, and allows them to be described, tracked over their entire lifetime, and assigned to technical or organizational hierarchies.

A virtual representation is a hierarchy of services (vertical axis in figure above) that provide access to the properties (information and functions) of the corresponding asset.

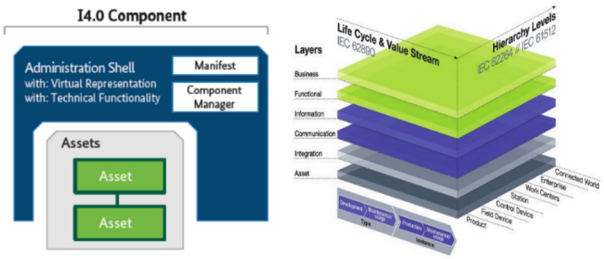

Figure 5: standard RAMI

The I4.0 Component is a model to describe and manage the properties of assets. The Admnistration Shell (dark blue in fig.) is the point of access (through services) to the information and functions of an asset.

DISRUPT is designing new business models with services such as “Multi-plant Coordination” and “Plant Monitoring with Optimisation”. These services are being investigated as RAMI4.0 services at the top (Business) layer, and as compositions of RAMI4.0 services with access to the functions of the DISRUPT architectural modules.

Reference Industrial Scenarios

Automotive sector

"Digitization is transitioning the component driven automotive industry to a software and solutions-focused industry, coupled with the growing digital consumer lifestyle"[1]. In the future, the trend is that car companies adopt a new business model, shifting from the business of manufacturing and selling cars, to fractional ownership; single journey type car sharing coupled with subscription based maintenance and connected service packages. To address these new challenges, the OEMs have already started to invest in different technologies and solutions. As examples, in 2016, Ford invested more than $180 million to enhance cloud-based services and Big Data analytics creating new partnership with technology companies and other ecosystem participants to gain competitive advantage and improvise solution maturity. General Motors has invested $130 million for data center development to realize Cloud computing facilitates interoperability; others OEMs' focus on security in areas like supply chain, cloud, automotive retail, and IoT. Jaguar Land Rover tested in its showroom in Edinburg Augmented Reality technology enabling 2500 advance booking orders of the New Discovery Sport vehicle. Therefore, the 4 essentials for the Auto I4.0 Approach are:

- Industrial Mobility,
- Digital Data,
- Security
- Digitization of the Factory

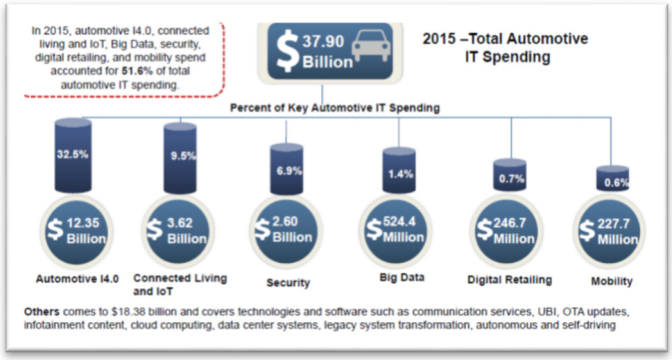

Figure 6: Automotive industry IT spending (2015)

In particular, in DISRUPT project, new technologies for the digitization of the factory will be developed and tested to help FCA (represented by CRF, in the consortium) to guarantee business continuity in the ever-changing contemporary manufacturing environment, where production goals are often derailed by late-cycle changes, the use of unqualified and nonstandard parts, unexpected plant floor events, low supplier involvement and the lack of proper decision support tools to handle the above.

DISRUPT will help to deal with uncertainties and disruptive events in supply chains and production plants to optimize operations to cope with increasing product variability, uncertainties in the supply chain, shorter lead-times and reduced working capital. Continuous optimization is required and needs adequate technology and methods, to perform early validation, and achieve company targets.

Home appliance sector

GfK's smart home study (2016)[2] covers +7.000 consumers across 7 markets: Brazil, China, Germany, Japan, South Korea, UK, USA and it shows the consumer awareness and expectations for smart home. 50% of consumers feel that smart home technology will have an impact on their life over the next few years and people have already adopted some smart home technologies, with a quarter already owning at least one smart home device in 2015.

Security, energy and entertainment are the most likely categories to drive the adoption of smart home in the near future; communicating how smart home technology will fit in with and enhance people's lives is key as well as ensuring that the user experience is engaging and intuitive in order to truly deliver mass market adoption. It will also be critical that concerns around the data collected (via smart home technology) are allayed: trust is going to be a key issue that brands will need to reassure buyers on.

The majority of consumers expect devices to connect and communicate with each other, and more than half would be willing to pay for a single application to control all the devices in the home. The interest in simplicity for the smart home is further reflected in the fact that many consumers would prefer to have a single vendor which can supply all their smart home technology (36%).

The household appliance and electronics industry in Europe currently faces the challenge of placing within the European Market innovative appliances and devices that consume less energy and other resources (as for example water), thus replacing older resource-intensive appliances; hence, the imperative need for continuous innovation in the sector. Noticeably, the company offers a huge variety of appliances, most of which (e.g., TVs, fridges, washing machines) differentiate partly or significantly every few months to meet the massively customised needs of consumers.

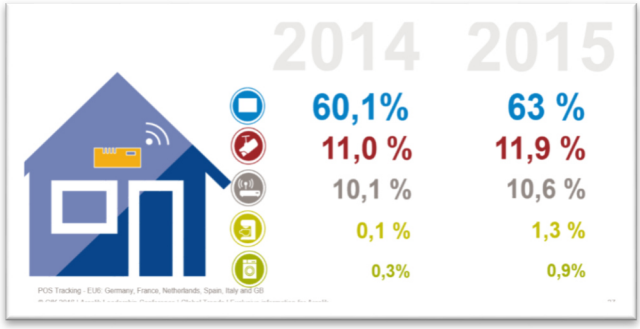

Figure 7: shares of smart home products in 2014 and 2015

Given the high expectation of the market, DISRUPT will deliver market-driven production reconfiguration services supporting ARCELIK in the manufacturing decisions for process re-design, production and capacity planning by integrating modelling, simulation and optimization components.

[1] Frost&Sullivan , Automotive Industry IT Spending—CIO Focus, Trends, and Highest Growth Areas, August 2016

[2] GFK, Future of Smart Home Study, 2016

DISRUPT @PRO-VE 2017

On September 18, 19 and 20, ITIA- CNR, one of the partner of DISRUPT organized the PRO-VE 2017 conference in Vicenza. For this edition the focus was on the "Collaborative networks in a data-rich environment" and the DISRUPT project coordinated a special session dedicated to "Manufacturing Ecosystem Collaboration". Manufacturing value chains are distributed collaborative networks dependent on complex information and material flow requiring new approaches inside and outside the factory both on process and product lifecycle level. Advances are needed in value chain and supply-chain communication and collaboration schemes that merge machine, human and organizational aspects; the new production architectures need to be more responsive to dynamic market demands which require radical change to achieve dynamic production re-configurability, scaling and resource optimization.
The special session allowed to present the main results of 4 European project including also DISRUPT; the authors discussed about their contribution to improve the integration of the ICT, automation and robotic technologies and the platforms in the paradigm of Industry 4.0. for more information: http://www.disrupt-project.eu/publications/

News and events

The 4th plenary meeting of DISRUPT project was hosted by Simplan in January 2018 in Hanau, few kilometers from Frankfurt. The meeting was very important to finalize the technical specifications for DISRUPT modules and to update each other on the development stages. During the meeting the partners discussed about the Structure of the DISRUPT platform and exploitation of the results was part of the brainstorming session during the meeting.

LogiMAT 2018

SimPlan participated to the trade fair that was held in Stuggart in March 2018, showing its software and the DISRUPT module. https://www.logimat-messe.de/en

INCOM 2018

INCOM 2018: 16th IFAC Symposium on Information Control Problems in Manufacturing. 11-13 June 2018 Bergamo-Italy.

DISRUPT team has organized a special session on **New trends and tools for Manufacturing eco-system collaboration** and a paper on DISRUPT results will also be presented.

ES 2018

ATC will participate to the Conference on Enterprise System (ES) in Limassol (Cyprus) in October 2018. ATC will present a paper on project results.
http://www.cyprusconferences.org/es2018/

CRF arçelik software AG ATC BOC www.boc-group.com
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This project has received funding from the European Union's **Horizon 2020** research and innovation programme under grant agreement N° 723541.
Start date: September, 1th 2016
Duration: 36 months
Total Budget: 3.468.312,50€

Project Leader: CRF –FCA
info@disrupt-project.eu
@DISRUPT_EU
http://www.disrupt-project.eu/