CO-LOCATED SYMPOSIUM

Smart Data Systems and Applications

Monday November 14, 14:00 – 17:30

Smart data systems and applications support the processing and integration of data into a unified view from disparate Big Data sources, data warehouses, sensors and devices in the Internet of Things, social platforms, and databases, whether on-premises or cloud, structured or unstructured and software-as-a- service applications to support Big Data analytics. Big Data is an umbrella term referring to the large amounts of digital data continually generated by tools and machines, and the global population. Discussion will follow on the results and participants will learn how they can interact with the e-Sides on- line platform to see how results change over time and how they can collaborate to provide their thoughts in the community position papers on the seven most pressing issues.

The area of smart data processing includes the ability to clearly define, interoperate, openly share, access, transform, link, syndicate, and manage data. Under this perspective, it becomes crucial to have knowledge-based meta-data representation techniques to structure the data sets and content, annotate them, link them with associated processes and software services, and deliver or syndicate information to recipients. These are the mechanisms that convert stale data to smart data. This area also includes adaptive frameworks and tool-suites in support of smart data processing by allowing the best use of both data in motion (e.g. data streams from sensors), and data at rest, and may rely on advanced techniques for efficient resource management, and partitioning of intensive data workloads across a number of private and public clouds.

This symposium welcomes position statements from researchers and industry practitioners on smart data systems and applications. Topics are organized, but are not limited to, the following major application pillars:

1. Smart manufacturing and Industry 4.0
2. Smart Healthcare
3. Smart Cities
4. Smart Tourism
5. Smart Agriculture and Livestock Production
6. Smart Transportation and Logistics

The symposium will foster discussions and brainstorming on future trends in smart data systems and applications and will bring together academics/researchers and industrial stakeholders/experts forming a network of collaborators that will promote applied research and enable the formation of consortia for submitting new proposals for collaboration and EU funding.

Attendance to the symposium is open to ICSOC 2017 participants. For more information, please contact the Symposium Chairs:

Chair

Mike Papazoglou, mikep@uvt.nl (mailto:mikep@uvt.nl), European Research Institute in Services Science (ERISS), Tilburg University (The Netherlands)

Co-Chair

Bernd Krämer, kraemer@servtech.info (mailto:kraemer@servtech.info), ServTech e.V. (Germany)

Making smart knowledge from not-so-smart data

Nicolas Seydoux, Khalil Drira

November 2017

1 Motivational use case

Smart cities are by essence cyber-physical systems of systems: their emergence is fueled by the joint deployment of devices networks and data-driven services. Very diverse area of urban living are of concern in smart cities: both public and personal transportation systems, resources management, including water and electricity, environment monitoring for weather and pollution, safety of the citizens crisis management in emergency situations, entertainment with tourism travelling and cultural information... All these areas have heterogeneous stakeholders and end users, they are based on unrelated infrastructures, and their data sources are a permanently evolving mix of pre-existing datasets, devices, and human input remotely through social networks and locally through physical interaction.

Let us consider the daily life of Julia, a smart city citizen. When Julia gets on the bus, she uses her smartphone to pay for the bus fare, and the smartphone communicates locally with the surrounding on-board information sources or remotely with cloud applications, in order to discover points of interest that are on the bus route, and especially near the bus stops where she is most likely to get off. As it happens, there is a new exposition of a painter she likes, at a local museum. There is also a convenience store that sells her usual brand dog food, and she is almost out of it. When she approaches her home, she notices that a street lamp is dysfunctional, and notifies on a city smartphone application. When she gets home, the heating system raised the temperature after it has been kept at a lower level while she was out.

2 Deconstructing the use case

Underlying this use case are multiple challenges and design choices. First, one can notice the user-centric approach, with a high adaptation of the service to the customer profile. Data is integrated from very diverse sources: a public repository for the museum, a company one for the convenience store, and a private one for the information that Julia was out of dog food. This part also raises privacy issues, because not all of her application should have access to sensitive data such as her position or her habits. Julia also becomes a human sensor when she provides feedback about the streetlamp.

To sum it, this use case is grounded into highly interoperable, yet very flexible, machine-understandable data. It supposes privacy policies explicit description, and actionable data that can be used as an input to many application in diverse domains. The semantic web is one way to accomplish this vision.

3 Building smart data

The semantic web proposes highly expressive, dereferencable data descriptions based on vocabularies called ontologies. This expressivity allows to give comprehensive descriptions of devices, either embedded in the device itself or in a description repository (called a knowledge base). Semantic web technologies also allow the production of rich knowledge, capturing its own collection context to make it more reusable.

The high level of formalism of semantic models enables knowledge to be leveraged in reasoning processes, where new knowledge is inferred based on existing knowledge and rules. These rules can be either generic, pre-existing rules, or application specific. The formalism of semantic knowledge also allows for inconsistency detection, which is a real challenge in the domain of smart city where a piece of data will be used in many various domains.

4 Open challenges

The high expressivity and formalism of the semantic web technologies and principles come at a cost, and their adoption as solutions in the constrained domain of the IoT still faces challenges. Richer data formats are more resource-intensive for processing and memory, while the IoT is characterized by the high distribution and high constraints on the nodes. Adaptation of the data is therefore required depending on the node that is processing it. With 50 billion connected nodes predicted by 2020, and the obvious increase in term of produced data volume it entails, scalability is a core concern for semantic solutions to IoT issues.

Making Data Management Smarter with Data Movement in Fog Computing

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Abstract

Fog Computing paradigm has been initially introduced in the telco sector *"to provide compute, storage, and networking services between Cloud data centers and devices at the edge of the network"* [2]. One of the main objective is to change the way in which the data have been usually managed. In fact, the usual paradigm that implies data generated and stored on the core of the network while used at the edge, is not longer valid. Now, devices at the edge are prosumers (producers and consumers at the same time) and this is clear especially in applications where IoT-based approaches become dominant (e.g., Smart Cities).

This significant change in the reference scenario has impact also on the information systems engineering: data are always more frequently generated on the edge and moving them to the cloud to be processed could be not efficient or even impossible due to high latency or privacy/security issues. Thus, design, development, and execution of applications must take into account these constraints by also exploiting the Fog Computing seen as a continuum between the Cloud and the Edge of the network [3].

To deal with this issue, we need to investigate how the **Fog Computing paradigm can be coupled with the Service Oriented Computing** paradigm to provide models and techniques to support the **data movement** (i.e., information logistics) in heterogeneous environments which include both Cloud and Edge. This implies a specific understanding on how to support the compliance with the new regulations (e.g., GPDR [1]) which could hamper, if data are not properly protected, the data movement. The objective could be to enable a **Data as a Service**-based approach to the users (which could be a developer or even a final user) which hides the complexity of the data management when Fog environment is considered.

References

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3. OpenFog Consortium Architecture Working Group: OpenFog Architecture Overview (February 2016), http://www.openfogconsortium.org/ra

Artifact-driven Process Monitoring: Challenges and Opportunities

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In multi-party business processes, each organizations controls only a portion of the process. Therefore, being able to fully monitor these processes becomes paramount to improve coordination among parties, and to promptly react to issues. To this aim, we proposed a novel technique to autonomously and continuously monitor inter-organizational business processes, named *artifact-driven process monitoring*[3].

This technique exploits the Internet of Things (IoT) paradigm to perform monitoring tasks directly on physical objects exchanged by organizations. In particular, physical objects are equipped with sensors, a computing device, and a communication interface, thus becoming *smart*. Based on sensor data collected and exchanged among them, smart objects can detect when activities are executed without requiring human interaction. Also, by relying on the Extended-GSM artifact-centric process modeling language[2], which does not enforce dependencies among activities, smart objects can continue monitoring the process even after an issue is detected. To prove the effectiveness of this technique, an artifact-driven monitoring platform was developed and tested against several processes from the logistics domain[1].

To be reliable, artifact-driven monitoring requires organizations to share with each other information on their processes and data collected by smart objects. However, organizations may want to share this information only partially, yet at the same time exploit artifact-driven monitoring to also monitor their private processes. Additionally, organizations may not fully trust monitoring information provided by the other organizations. This introduces the challenge of integrating artifact-driven monitoring with *data quality and privacy* frameworks, which would be beneficial to address such issues.

Secondly, artifact-driven monitoring currently focuses on detecting and reporting violations as soon as they occur. This gives the opportunity to introduce *reactive mechanisms* to automatically take corrective actions once a violation occurs. In particular, smart objects could be equipped with actuators to automate such actions. Similarly, artifact-driven monitoring could be applied to the robotics domain to autonomously execute activities that are currently manual.

References

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van der Aalst, W.M.P., Kumar, A., Pentland, B.T., Weske, M. (eds.) Proceedings of the BPM Demo Track and BPM Dissertation Award co-located with 15th International Conference on Business Process Modeling (BPM 2017), Barcelona, Spain, September 13, 2017. CEUR Workshop Proceedings, vol. 1920. CEUR-WS.org (2017)
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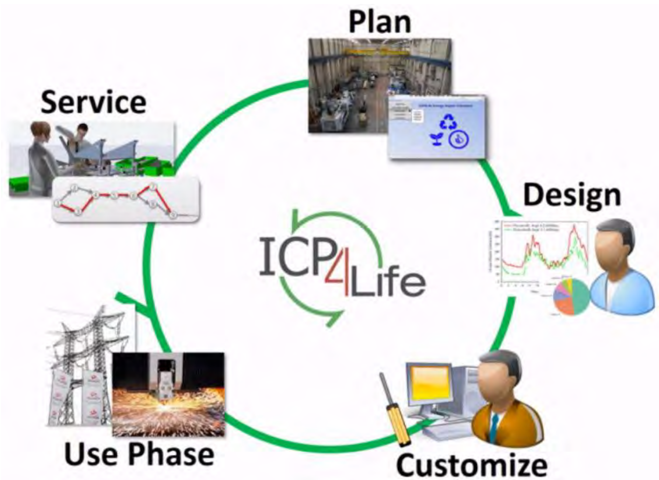
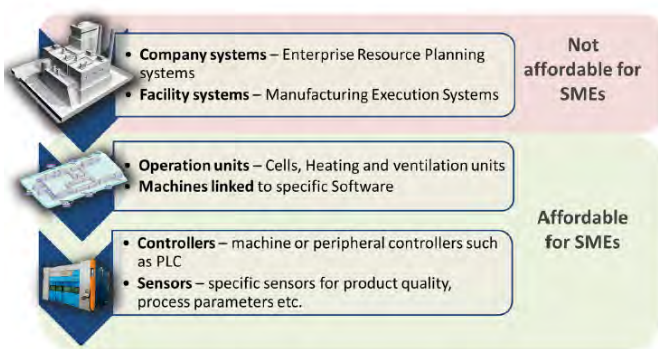
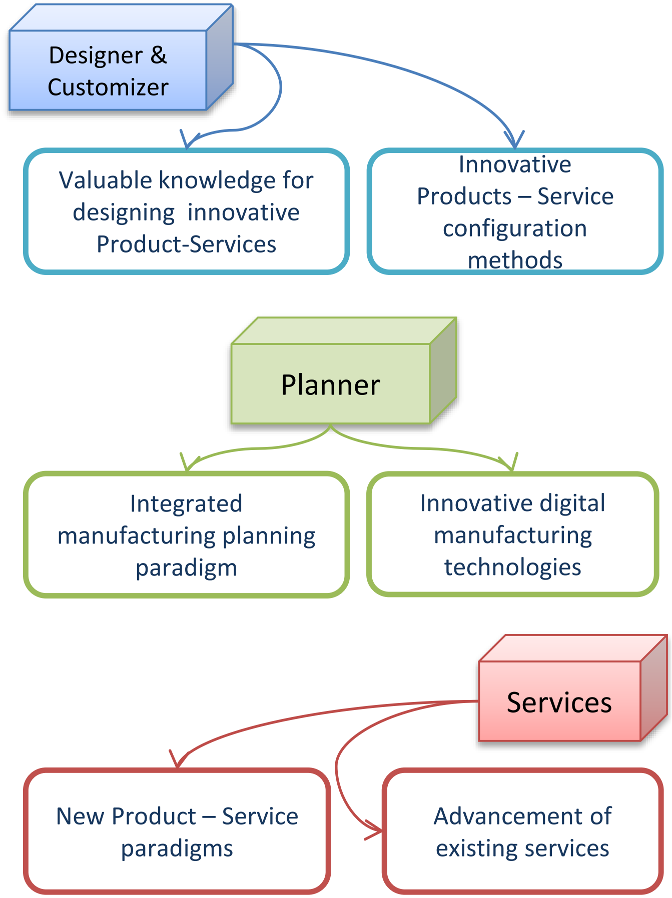
3. Baresi, L., Meroni, G., Plebani, P.: On handling business process anomalies through artifact-based modeling. In: CAiSE'16 Forum. pp. 9–16. CEUR-WS.org (2016)

An Integrated Collaborative Platform for Managing Product-Service Engineering LifeCycle

ICP4Life

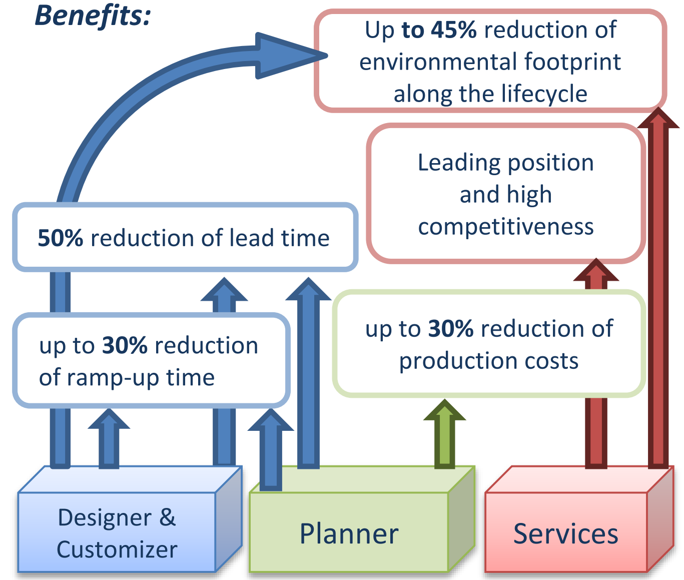






ICP4Life brings into reality an integrated, collaborative working paradigm and platform for design, development and service of the Product-Service Systems, consisting of three main components: Designer, Customizer and Planner and the corresponding Services.

Benefits:

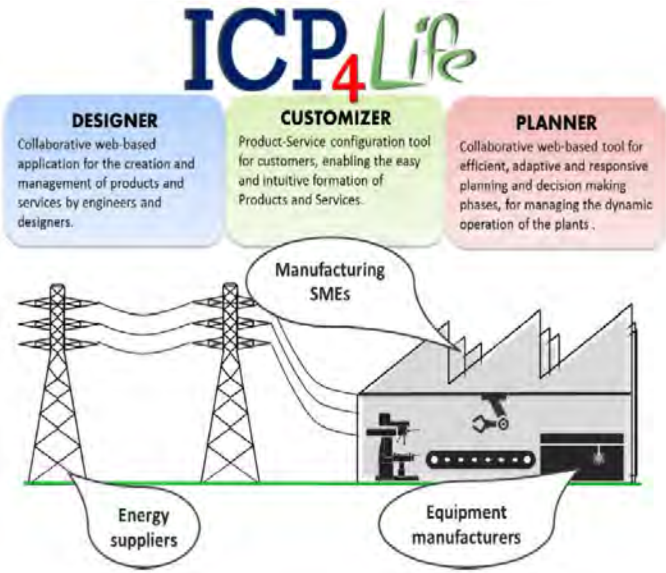


ICP4Life project is founded by the European Union´s H2020 framework program under the grant agreement N˚636862.

Consortium:

PRIMA INDUSTRIE · ABGAM · LASERLAM · Fraunhofer IAO · ECN Centrale Nantes · sertech · INTRASOFT · IMS · NB · INERTIA · tecnalia · TAURON

PLATFORM Components



DESIGNER component implements a collaborative web-based application for interdisciplinary designs, development and management of Product-Service Systems.

CUSTOMIZER component is a configuration tool supporting customers, enabling the easy and intuitive configuration of Products – Services Systems. It is used for managing relevant data across all stakeholders: manufactures, suppliers, customers and other organizations.

PLANNER component supports the efficient, adaptive and responsive planning and decision making phases for managing the dynamic operation of factories along their suppling chain and lifecycle.

Designed by Fraunhofer IAO

CONSORTIUM Partners

The ambitious project ICP4Life is developed by 12 strongly motivated consortium partners, representing renowned academic research organizations in the field of Product – Service Systems and digital manufacturing; technology providers of smart wireless sensors; system integrators and enthusiastic end-users from equipment manufacturing, machinery, energy supply, which are highly committed to deploy the ICP4Life Platform in their manufacturing environments.

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ICP4Life

An Integrated Collaborative Platform for Managing the Product - Service Engineering Lifecycle

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