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FUTURE INTERNET AND ITIL FOR INTELLIGENT MANAGEMENT IN INDUSTRIAL ROBOTICS SYSTEMS

BY

ADRIAN CHIOREANU[*] and STELIAN BRAD

Technical University of Cluj-Napoca

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Abstract. Based on Future Internet and ITIL, cutting edge concepts and approaches related to software service systems in distributed architectures for managing information and processes in industrial robot platforms are introduced. A new approach in defining the business relation for entities that have various interests related to industrial robots, as well as tools that support the new business approach, are also identified in this paper.

Key words: future Internet; ITIL; industrial robotic systems.

1. Introduction

Novel technologies and new infrastructure capabilities are shaping the behavior of the production sector, and for the first time participants in different business processes, from end-users to suppliers and producers, are more and more involved iteratively, as well as simultaneously (Konrad *et al*., 1998), in any number and from any geographical location.

Given the nature of the field under study, which includes robotics systems, a mix of technologies, stakeholders and types of business/economic relations, this paper represents the result of the effort undergone in two main directions: company surveys and literature surveys on software service systems.

[*] Corresponding author: *e-mail*: adrian.chioreanu@com.utcluj.ro

The survey made on different categories of people, including producers, academics, operators, analysts and developers, presented the challenge of addressing the appropriate questions to the appropriate interviewer so that in the end a conclusion may be drawn on how we can improve the business relation between them by means of an innovating IT platform.

The European Commission has created a positive context for this topic by supporting the creation of the so called EUROP SRA (EUROP, 2009), that has as main objectives some of the following: the creation of a generic, flexible framework to allow easy design of robotic solutions using technologies from various producers; the creation of means capable to assure the remote management of the robotized production capacities from different locations; and the stimulation of cooperation between those which produce, exploit and maintain robotic systems.

2. Future Internet/Internet of Services in Robotic Systems

Important driving forces that will shape the future generation of software services and service-based applications, such as: user empowerment, innovation, evolvability, reconfigurability (Chang *et al*., 2008), adaptability, and demand rather than supply driven processes, are presented in the documents describing the Future Internet and Internet of Services (CORDIS, 2009; Papazoglou *et al*., 2008). By taking advantage of the previous experiences, researching in scientific literature, and conducting company surveys we found out that these six vectors are among the ones that are also responsible for the development that is to be seen in the industrial robotics field as economic competition is putting pressure on the manufacturing companies.

The Internet of today has a limited view of the world, where the major resources are communication links and the main objects are end-points to be linked together (Future Internet Assembly…, 2010). The ability of an application or service to request and provide data content which is to be mixed in order to offer a new service will play a pivotal role in the creation of the Future Internet/ Internet of Services. This is exactly what the future networks that will assure the communication and intelligent management of the robotic systems need: a flexible open architecture platform that is able to gather/ route information from different service providers/users in an effort to offer new customizable information services that make instant use of the knowledge and expertise found in different stakeholders portfolios.

In the context of Future Internet, namely: trust, interoperability, user orientation, high complexity, scalability and easy exchange of information (Future Internet, 2020), the aim is to address the current challenges of distributed architecture platforms for industrial robotic systems.

3. ITIL for Industrial Systems

One of the starting points in our research were the concepts present in ITIL, as they have become a global standard, rapidly gaining adherents around the world.

What is ITIL? ITIL, IT Infrastructure Library, is a collection of best practices in ITSM (IT Service Management) used as an international standard in this area. ITIL is a set of concepts and management policy used in the development and governance of the information technology (IT) infrastructures.

ITIL Service Management only touches the technology aspect (ITIL, 2011). ITIL is not about software code in particular, but about creating and maintaining successful IT systems that bring added value to the companies.

The previously developed (Mohamed *et al*., 2008) industrial robotic platforms addressed the issue of services from a narrow perspective, usually being focused on technology and processes rather than needs and usability. We discovered that in the present context, industrial platform architectures must be created starting with the analysis of the perspectives on services, wrapped up by ITIL in four words: individuals, partners, processes, technology.

4. A Step Further

Mapping the concepts of service systems and Future Internet to our needs, a novel business relation approach that will bring benefits to all entities involved in the industrial robotics field may be defined. The new business relation approach will rely on a software platform, a platform for communication, cooperation and networking between stakeholders dedicated to the management of operation, production and maintenance of industrial robotic systems, a platform designed to support communication between different robotic systems (technically heterogeneous) that work in cooperation, platform that provides support for the intelligent and remote management of robotic production capacity.

When conceiving the new paradigm we took into account the key aspect (ITIL, 2011; Menken, 2099) that assures a successful alignment of the IT with the business objectives and performed the appropriate actions (s. Table 1).

Given the tendencies, imposed mainly by the European Commission and NGOs, that are driving the business IT into the next decade (Fig. 1), we identified a series of concepts and constrains that can use to our advantage in designing the robotic platform of the future, a complex system (Brad, 2008), a new paradigm for the relation between stakeholders interested in robotics.

Table 1
Key ITIL Aspects and our Actions

Aspects	Actions
Thorough understanding of the business's environment and stakeholders	Company surveys Literature surveys on software service systems
Allocate time to familiarize with the material	Company surveys Literature surveys on software service systems
Acceptance of innovation and new processes	Explain to potential stakeholders the benefits of such a platform
IT staff understanding the needs of the business	Clarify the advantages of such a platform from a developer point of view
The business understanding the potential	Explain to potential stakeholders the benefits of such a platform
Information available and accessible to everyone who needs it	Design online access to various information types Customizable reports, and Customizable services Dedicated to different types of users
Continuous tracking of technologies for the business	Survey the state of the art in industrial robotics software platforms, Research on software reconfigurability (Chang *et al*., 2008)

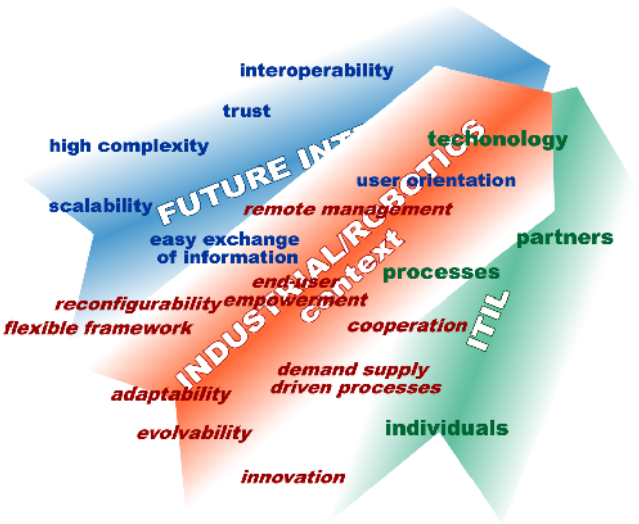

Fig. 1 – Key terms defining the driving forces shaping the future IT systems used in industry.

SMEs using industrial robotic systems (Pires, 2006) need fast (in real-time, if possible) and cost-affordable support for various issues occurring during the usage phase of the implemented robots (*e.g.* service, maintenance, task

change, etc.), possibility to remote monitoring and analysis of the robotized production facilities for optimizing work, for preventive actions, etc., as well as possibility to ensure cooperation of the implemented robotic technologies originated from various producers (when this occurs).

Robot producers need information over the lifecycle of the units implemented in production to use this information for improving future designs and services (Alting & Jorgensen, 1993).

The gap between this aspects is the lack of dedicated product-service solutions that facilitate the integrated intelligent management of robotic systems originated from various producers (Nakamura & Machino, 2008), of different generations in different configurations.

We put most of our attention on the first three layers that define the Business and IT Alignment in any major organization (Fig. 2). Starting from top to bottom, identifying the stakeholders (*e.g.* factory, producer, integrator, academic) and their core business processes (*e.g.* factory – manufactures goods, academics – teaches people and creates knowledge). Using the interviews made on different stakeholders we could conclude that there are only a few IT services that are used in a company and that support the core business process (like *e*-mail, CAD applications, and automatic procurement systems).

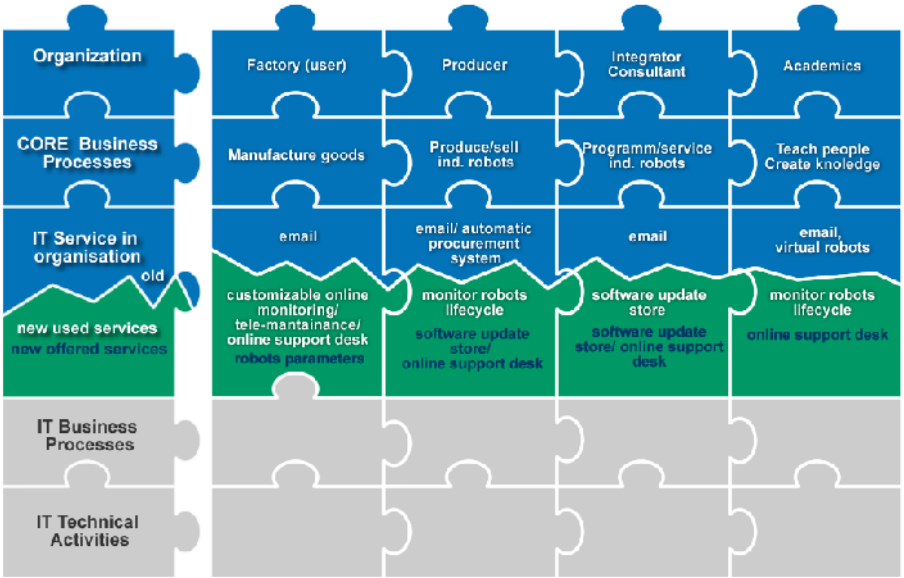

Fig. 2 – Business and IT Alignment.

Committed to focus on the core processes, we started working around the ITIL Framework best practices by putting the "how" questions (*e.g.* how should we design the platform for availability, capacity and continuity of services?) and the "why" questions (e.g. why does a factory need customizable online monitoring? Why should the producer use the lifecycle services?) in

order to find innovative IT services that might increase the competitively of each of the partners.

We identified some new IT services that may provide added value and increase the competitiveness of each of the entities (*e.g.* customizable online monitoring, online support, lifecycle monitoring). As result we come up with the key specifications of a successful platform, defined taking into account the three main directions, namely: Future Internet, SRA, ITIL, along with the results from the company surveys. Thus, the future platform (Fig. 3)

a) is web-based, allowing the access to relevant production data from various places;

b) supports major roles, such as: user, consultant, producer, integrator, researcher, etc.;

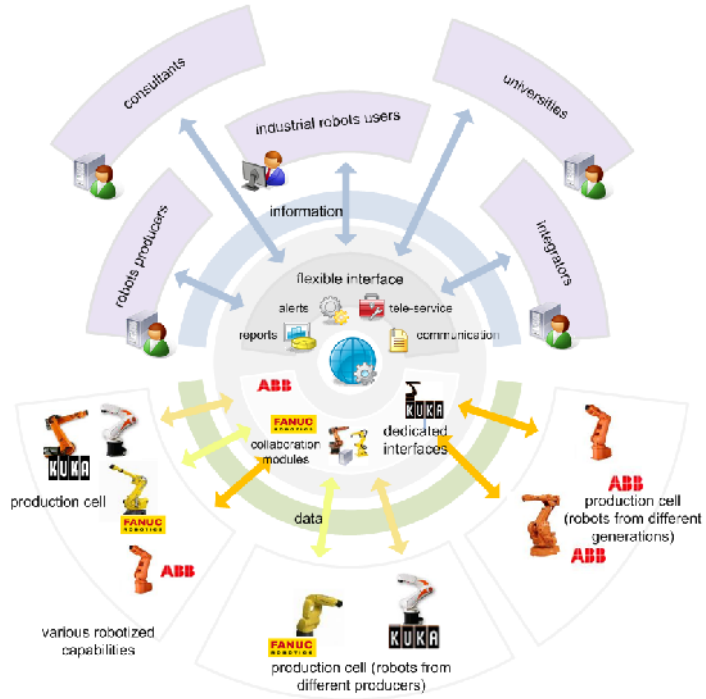

Fig. 3 – Flexible collaboration and monitoring platform.

c) integrates in an extended business model all the stakeholders (users, producers, integrators, advisers, as well as researchers/academics);

d) will be a generic framework where the actors in the network define business processes supported by virtual customizable environments;

e) offers communication, cooperation and service provision between various entity-actors in the system *via* Internet;

f) supports definition of services, access rights and member profiles in the cooperative network;

g) should be designed having in mind a "win–win" philosophy;

h) allows reconfiguration of the business processes for providing data and information (*e.g*. towards users, for tele-assistance and monitoring, for remote optimization of production, etc.);

i) supports data and information management by means of expert modules (customized by the user);

j) supports the integration of various robotic technologies (from various producers/generations) and provides a unitary user-interface by means of specialized protocols, differentiated on various technologies;

k) process and offers the information according to specific user needs;

l) offers intuitive user-interface that will encourage the development of various tele-applications (*e.g*. off-line application development, tele-service, tele-monitoring in real time);

m) facilitates the creation of "virtual rooms" for intelligent management of various input, state and output parameters for single robotic systems as well as for a network of heterogeneous robotic systems;

n) by means of business intelligence modules allows the selection of parameters that are to be monitored and analysed, as well as the way of structuring and displaying information;

o) by means of production intelligence modules, allows the monitoring of production enhanced taking advantage of analysis algorithms.

All this leads us to the need of defining and developing a web-based communication, cooperation and management platform intended: to relate various stakeholders involved in the production, operation and maintenance of industrial robotic systems, to facilitate the communication between various heterogeneous robotic systems for cooperative work, and to support the remote intelligent management of robotized production capacities.

5. Conclusions

We converged to the idea that our future effort should be dedicated in putting to test the potential of the ideas defining the Future Internet (trust, interoperability, user centric, high complexity, scalability and easy exchange of information), in developing a platform that offers customizable services for cooperation/management/tele-maintenance dedicated to the robotized production systems that follows the ITIL philosophy (best practices developed from four perspectives: individuals, partners, processes, technology). The emerging platform based on new policies and technologies is supposed to have a major impact in understanding and managing industrial capabilities.

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FUTURE INTERNET ŞI ITIL PENTRU MANAGEMENTUL INTELIGENT AL SISTEMELOR ROBOTICE INDUSTRIALE

(Rezumat)

Pornind the la Future Internet şi ITIL, sunt prezentate noi concepte şi abordări privind sistemele de servicii software având arhitecturi distribuite menite să gestioneze informaţii şi procese în platforme ce reunesc roboţi industriali. Un nou model de relaţii de afaceri ce au loc între diferite entităţi care au interese comune legate de roboţii industriali, precum şi instrumente care suportă acest model sunt descrise în lucrare.