巻/頭/言

Agile Service Engineering in IIoT Ecosystems

IIoT エコシステムでのアジャイルサービスエンジニアリング

Thomas Usländer

The trend towards the Industrial Internet of Things (IIoT) is very strong and irreversible. Is it driven by customer demand or rather by the idea that the new technological possibilities such as smart sensors and the handling of big data offers new business opportunities? Considering the industrial production domain, up to now, optimization in industrial production has mainly targeted matter, energy and cost. However, the potential of data, information and knowledge in industrial production is still widely unexploited. IIoT technologies, ranging from smart sensors and actuators, edge and cloud-based data storage and analytics up to informed decision support, promises to exploit this potential.

Various initiatives all over the world are aiming to follow this approach. Germany has started this competitive race with its Industrie 4.0 initiative that claims to have disruptive effects on the business level. It may finally lead to the 4th industrial revolution. In Japan, similar ideas are pursued by the Robot Revolution Initiative and the Industrial Value Chain Initiative. There is one common need on the technological level: an open architecture for networked cyber-physical systems with agreed standards for communication (such as OPC UA) and information modeling (such as AutomationML or OPC UA companion specifications). Furthermore, these technological achievements enable the development of so-called product-service systems. This means that in future automation products such as machine tools, robots, sensors or conveyors cannot be sold anymore without being accompanied by software-based services. These services encompass or support capabilities for condition monitoring, preventive maintenance, machine learning or artificial intelligence, either close to the asset (edge processing) or in data centers (cloud processing). However, as the end user wants to use these capabilities for a whole production plant across individual, possibly heterogeneous plant components, the associated services have to perfectly fit together. Furthermore, they even cooperate in order to achieve integrated services for whole production plants, may be even integrating supply chains.

This has severe consequences for the whole engineering process for product-service systems:

(1) The analysis and design for product-service systems must encompass the service engineering, too.

(2) Service engineering has to consider the IIoT platform for which the services will be offered. In particular, this relates to the architecture and generic capabilities of the IIoT platform chosen.

(3) In order not to be "locked-in" to one IIoT platform vendor, it is preferable to support open standards for the communication and information modelling aspects of the services.

(4) The service engineering must encompass the whole lifetime of the product including the usage and maintenance phase of the product. As the IIoT platforms undergo revisions, too, an agile service engineering approach is indispensable that is well synchronized with the version management of the associated product.

(5) Continuous and automated testing of the products including their services must be organized and carried out in order to master the complexity.

Likewise, the IIoT platforms have to be prepared for such a highly flexible and open service ecosystems. There are no fixed use cases that can be clearly analyzed by interrogating the future demands of the customers. The customer base is not fully known and the known customers are not able to express their requirements as they learn from the capabilities of the rapidly emerging IIoT platforms. Hence, a product and development manager needs a service engineering methodology and tool to break down hypothetical use cases to IIoT platform requirements and map them to existing and emerging technologies and IIoT platform products.

The exploitation of the economic potential and promises of the IIoT will only be possible if the strategic importance of systematic engineering is understood, including the specifics of the emerging IIoT ecosystem landscape.

《概要》

世界各国でIIoT(Industrial IoT)による資源の最適利用への期待が高まっており，戦略的取組みが進んでいる。ドイツのIndustrie4.0戦略はビジネスレベルで飛躍的な効果を目指しており，日本ではRRI(Robot Revolution Initiative)やIVI(Industrial Value-chain Initiative)が同様の取組みを進めている。技術的には通信標準(OPC UA等)や情報モデル標準(AutomationML等)を伴ったサイバーフィジカルシステムのオープンアーキテクチャが必要であり，将来的に多くの自動化機器はソフトウェアで実現されたサービスと連携していることが当たり前となる。このような時代の製造業は，顧客が想定するユースケースを実現するのではなく，顧客のユースケースの仮説検討・検証を行って高い顧客価値が提供できるサービスを設計できなければならない。このようなサービスは複数の会社の製品が連携することで実現されると想定されるため，柔軟に他社製品と連携した製品・サービスを体系的に設計する方法論をもつことが，競争戦略として重要になってくる。

Doctor of Engineering, Head of Department Information Management and Production Control(ILT), Fraunhofer IOSB, Germany