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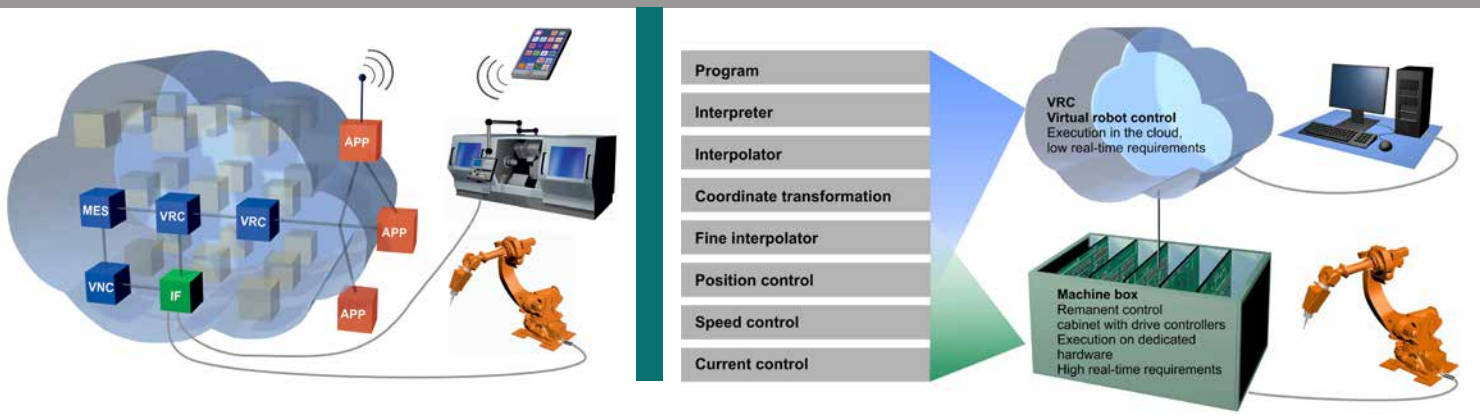

1 *Ultra flexible networked factory control through control modules as services in the cloud*

2 *Modularization of conventional control systems and possibilities to distribute them on the elements of cyber-physical systems*

INDUSTRIE 4.0 – CLOUD-BASED PROCESS CONTROL

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The vision of the cloud-based control platform

The vision of the intelligent factory of the future stands for efficient and flexible manufacturing. The research project pICASSO (Industrial Cloud-based Control Platform for Production with Cyber-physical Systems) aims at providing a scalable control platform for cyber-physical systems in industrial manufacturing. Within the framework of pICASSO, Fraunhofer IPK targets reshaping robot controls with the aid of the app concept, centrally facilitated software and scalable processing power.

In today's hierarchical architecture, a superordinate control level coordinates how single machines or parts of plants act while they are controlled by local software. In the course of the project, scientists will develop a virtual control platform to which control and optimization tasks can be outsourced. The monolithic control architecture of the plants is being broken up and transferred to the cloud to achieve this. This new production control scheme opens up new possibilities concerning the interaction of software modules, the intelligent coordination of computing power and the optimization of energy consumption.

Advantages

By transferring laborious calculations from local control to a virtual platform, less powerful hardware is needed at the individual production instances. Their control technology and associated cooling systems can therefore be laid out in smaller dimensions. Any complex task can be executed in a highly efficient manner with computing power provided in the cloud. Applying this concept means that control hardware at the machine as well as in the cloud can be configured fitting the specific requirements, which results in a higher degree of capacity utilization and cost and energy savings.

Challenges

The outlined approach necessitates interfaces to be analyzed and developed, efficient security features to be implemented, and the virtual control platform to be real-time capable. Intending to flexibly configure different software modules into a tailored solution requires all-purpose interfaces. Distributing control logic in a network calls for conceptual as well as technological implementation of secure communication channels. To generally facilitate industrial control tasks to be executed on a virtualized platform, high demands are placed on the operating system. In conjunction with the virtualization system it has to be capable of enabling multiple software modules operating in parallel to be executed under industrial real-time conditions.

Contributions of Fraunhofer IPK and the Technische Universität Berlin

The Automation Technology division of Fraunhofer IPK and the Industrial Automation Technology department of the Institute for Machine Tools and Factory Management of the Technische Universität Berlin investigate fundamentally new approaches building on the cloud-based control platform concept to realize simulations, spatial robot programming and augmented reality, as well as value-added services building on these. A substantial aspect is specifying consistent interfaces between the control modules as well as to the value-added services. Individual control functions and modules will thus be provided as a service in a needs-oriented manner, similar to the app concept. Functionality can be enriched by various value-added services, which for example may be able to simulate production sequences or to optimize their energy efficiency. Modularizing control and providing a joint pool of resources, the individual software modules can interact and for example be directly involved in simulations. Therefore, the same module may be used for simulation as well as actual operation. The virtual control platform centrally provides these modules in predefined versions with security-relevant and functional updates.

Demonstrator

Fraunhofer IPK and the Industrial Automation Technology department will demonstrate the results achieved in cooperation with the project partner Reis – whose focus in the project is on design and implementation of a modularizable robot control – in form of a demonstrator. It will comprise the virtualization platform, control modules and exemplary value-added services. This will create a reference environment serving as a basis for further research purposes as well as for technology transfer.

Project Partners

- SOTEC Software Entwicklungs GmbH + Co, Mikrocomputertechnik KG; SOA architecture, cloud computing, scaling; Ostelsheim
- Robert Bosch GmbH; Security, validation; Schwieberdingen
- robomotion GmbH; communication, security concepts; Leinfelden-Echterdingen
- Universität Stuttgart, Institute for Control Engineering of Machine Tools and Manufacturing Units (ISW); Control architectures; Stuttgart
- KUKA Inustries – Reis GmbH & Co KG Maschinenfabrik; Robot control, simulation; Obernburg
- Technische Universität Berlin, Industrial Automation Technology department; User interface, user integration; Berlin
- HOMAG Holzbearbeitungssysteme GmbH; Plant control; Schopfloch
- Fraunhofer Institute for Production Systems and Design Technology IPK; Control algorithms, value-added services; Berlin
- Linutronix GmbH; Control platform; Uhldingen

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