

## **Sensor Roadmap 4.0 - Prospects towards a uniform topology for process control and smart sensor networks**

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Smart functions of sensors simplify their use and enable plug-and-play, even though they are more complex. This is particularly important for, self-diagnostics, self-calibration and self-configuration/parameterization. Intelligent field devices, digital field networks, Internet Protocol (IP)-enabled connectivity and web services, historians, and advanced data analysis software are providing the basis for the future project "Industrie 4.0" and Industrial Internet of Things (IIoT).

Important smart features include connectivity and communication ability according to a unified protocol (OPC-UA currently most widely discussed), maintenance and operating functions, traceability and compliance, virtual description to support a continuous engineering, and well as interaction capabilities between sensors. This is a prerequisite for the realization of Cyber Physical Systems (CPS) within these future automation concepts for the process industry. Therefore, smart process sensors enable new business models for users, device manufacturers, and service providers.

The departure from current automation to smart sensor has already begun. Further development is based on the actual situation over several steps. Possible perspectives will be via additional communication channels to mobile devices, bidirectional communication, integration of the cloud and virtualization. The integration of virtual runtime environments can provide a more flexible topology for process control environments.

The talk summarizes the currently discussed requirements to process sensors 4.0 [1] and introduces an online NMR sensor as an example, which was developed in the EU project CONSENS [2,3].

[1] Technologie-Roadmap 4.0 – Voraussetzungen für die zukünftigen Automatisierungskonzepte, Herausgegeben von VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik (GMA) und NAMUR – Interessengemeinschaft Automatisierungstechnik der Prozessindustrie, Düsseldorf, November 2015.

[2] K. Meyer et al.: Process control with compact NMR, Trends in Analytical Chemistry 83 (2016), 39-52

[3] CONSENS – Integrated Control and Sensing for Sustainable Operation of Flexible Intensified Processes, funded by the European Union's Horizon 2020 research and innovation programme under grant agreement N° 636942; [www.consens-spire.eu](http://www.consens-spire.eu)