

smartFactory^{KL}

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Press Release

The administrative shell - at the core of *Production Level 4*

- From name plate to digital twin
- Interoperability, the prerequisite for future viability

The administrative shell is becoming a key technology in the implementation of the latest production architectures. The digital name plate provides an administrative unit for every production asset, which creates entirely new possibilities for flexible and resilient manufacturing networks.



Once upon a time, there was a data plug

Any element of production can be an asset: products, machines, screws, systems, motors, terminals, or controls. "Even conceptual assets can be included, for example, a CAD file or a flow chart," said Prof. Christian Diedrich from Otto von Guericke University in Magdeburg, who is also lead manager of the "Networked Administrative Shell" project.

The Asset Administration Shell (AAS) [[German: Verwaltungsschale \(VWS\)](#)] is the central point where, ideally, the current version of all data is stored, for example, manuals, checklists, or wiring diagrams. That is why it is often described as a data plug. Once all the data is uniformly stored and universally accessible, the AAS can be used for the next step in development: the communication with actual machines. The machine can then self-describe its capabilities or skills to the outside world and offer them to others in the network. "This represents the transition from static data models to living systems in actual production, to a simulation model, a digital twin," said Prof. Ruskowski, Chair of SmartFactory Kaiserslautern. "As a digital twin, the administrative shell can be considered a key element for *Production Level 4*."

The administrative shell is a prerequisite for new production architectures

The concept of [Skill-Based Production](#) is based on the ability of an asset to self-describe. This enables networked machines to know about their own and other current skills. Humans can also see which skills can be accessed, for example, for use in product design. Some skills that are not present in the company are, perhaps, easily purchased in the network.

The idea continues with the products to be manufactured: the asset's administration shell brings along and communicates the skills required for its own manufacture by the means of production. The product tells the available machines in the network what machining step it currently needs, for example, a hole 24 mm in diameter and 50 mm deep. "Available machines then offer to do that work," explained Ruskowski. "Our latest *Production Level 4* demonstrator implements an eco-system that facilitates construction of a truck from knobbed blocks (Lego). We even go a step further. The machines also tell us how long the job takes, what it costs, and how much energy is consumed. The future criteria for deciding whether or not a machine is given the job order may be energy efficiency or cost. In addition, our machines autonomously decide whether it is better to drill or mill the hole." Perhaps a basis for the choice could be the material. "This is where AI methods step in. Ultimately, we achieve a flexible, highly efficient, and resilient manufacturing network following the concept of Production Level 4," said Ruskowski.

The administrative shell stores entire life cycles

Andreas Orzelski, from Phoenix Contact and Platform Industrie 4.0 is also active on the board of IDTA (International Twin Assoziation) and describes another feature of the administrative shell: the life cycle folder. "Included is the entire life cycle, from product idea to disposal." Project [ReCircE](#) allows SmartFactory-KL to study this concept in terms of improving product recycling. "The information must be included that I absolutely must have, for example, to recognize what, if any, parts have recently been replaced and are still serviceable or, to tell me which products can be recycled pollution-free," said project manager Dr. Christiane Plociennik. This can only function if I know what materials have been used. "[Sustainability](#) is one of the core principles of Production Level 4. Here, we are referring to economics, environment, and the role of humans," added Ruskowski.



Interoperability and Open Source are key to future viability

One of the biggest obstacles in the practical development of new technologies is the lack of interoperability and standards. Organizations like SmartFactory-KL or the IDTA are committed to ensuring that the necessary software components are available as Open Source to allow companies to set up solutions on a uniform basis, as is already the case in IT today. "In effect, Open Source is also a kind of standardization, just in a different way," said Orzelski. "We are very serious about this topic in everything we do, especially, in achieving worldwide success with the administrative shell for Germany as an industrial center, which is very much characterized by exports."

SmartFactory-KL is currently building a *Production Level 4 Shared Production* ecosystem based on Skill-Based Production. By 2025, the flexible production network should be working via the digital platform [Gaia-X](#). Before assets (machines, services, etc.) can become part of the European data platform Gaia-X in the future, they must meet certain technical standards, for example, in relation to security or skill descriptions. This information is also in the administrative shell. "In [smartMA-X](#), a Gaia-X project, we test the technical functionalities. We then use these results to develop standardization recommendations," said Ruskowski.

Ever since its founding, SmartFactory-KL has advocated for manufacturer and technology independent solutions. For example, our member companies Weidmüller, TE Connectivity, and Harting jointly developed a Smart plug connector (SmeC - [Smart Electronic Connector](#)) as a use case for the *Production Level 4 Demonstrator* at Hannover Messe 2020. "We bring stakeholders together from the worlds of science and business," said Ruskowski. "We want to escape our silo mentality to achieve sustainability in all aspects of production."

About the Technology Initiative SmartFactory KL e.V.

SmartFactory-KL refers to a research and industry network supported by three pillars – a non-profit association which is joined by two research institutes. Membership in the [Technology-Initiative SmartFactory Kaiserslautern](#) association is open to research institutes and industrial companies. The association explores the issues related to industrial manufacturing being studied at the research unit [Innovative Factory Systems at DFKI](#) and at the [Department of Machine Tools and Controls \(WSKL\) at TU Kaiserslautern](#). Since 2019, the responsible person for organization and content has been [Prof. Martin Ruskowski](#). He is the chairman of the association's board of directors, head of the DFKI research department, and faculty chair. SmartFactory-KL brings stakeholders from industry and research together in a unique Industrie 4.0 network, to facilitate collaboration on joint projects to develop and implement concepts for the factory of the future. The manufacturer-independent demonstration and research platform enables joint testing of innovative production technologies by industry representatives and researchers in a realistic factory environment. In 2016, the [German Federal Ministry for Economic Affairs and Energy \(BMWi\)](#) appointed SmartFactory-KL as the lead manager of the [Mittelstand 4.0 Competence Center \(SME4.0\) Kaiserslautern](#) consortium, which performed the mission of supporting the digitalization efforts of SMEs until 2021. The [Mittelstand-Digital Zentrum Kaiserslautern](#) project was launched in 2021 with SmartFactory-KL again as lead manager. In 2019, the network revisited the concepts of Industrie 4.0, which resulted in the upgrade now known as [Production Level 4 \(PL4\)](#), and in 2020, SmartFactory-KL introduced the world's first [PL4 Demonstrator](#), where the goal of autonomous production will be continuously advanced in the coming years. Since 2020, the association has also participated in the European [GAIA-X](#) network research project [smartMA-X](#), where the PL4 demonstrator plays a major role in the European project. The Technology Initiative SmartFactory Kaiserslautern is also a founding member of [SmartFactory-EU](#).

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