



## BaSys 4.2 – what are the challenges?

Dynamic markets, documentation obligations, lot size 1: Production is changing, and companies that keep up with this change, even embracing Industrie 4.0, will have clear competitive advantages in the future. But the challenges of modern production can no longer be mastered without digitalizing the manufacturing processes.

In our global world, minor influences can create or eliminate trends. If demand for a smartphone is not as strong as expected, this is not only a problem for the smartphone's manufacturer, but also for all suppliers. If the requested number of units decreases, order gaps must be filled with new products. Customers must also be willing to pay for small lots: With the current production systems, break-even cannot be achieved for small lots and individually produced products. These systems are designed for mass production; any change in the production processes is effort-intensive and costly.

In order to sustain production in a high-wage country like Germany, we must embark on new paths. At its core, Industrie 4.0 is a software revolution. The end-to-end digitalization and networking of production processes not only increases their efficiency, but also makes it possible to change the production efficiently and thus produce small lot sizes. In the future, this will determine profit margins and thus the competitiveness of companies.

## How will BaSys 4.2 solve these challenges?

BaSys 4.2 with its open-source reference implementation Eclipse BaSys digitalizes manufacturing processes and integrates the devices on the shopfloor with a company's IT. BaSys 4.2 bridges different protocols and thus enables communication between devices and IT. In order for this communication to work, however, a common language is necessary that gives meaning to the information. For this purpose, BaSys 4.2 uses asset administration shells and structures information into sub-models, which gives meaning to data. In production, for example, this allows data to be clearly associated with the manufactured products. The integration of live data turns them into digital twins that do not only know the status of products, processes, and devices, but also influence and control production.

BaSys 4.2 implements a service-based production in which each product is described by its own recipe containing the production services required for the manufacturing of each product. BaSys thus separates the implementation of production steps from the manufacturing process. Up to now, process steps have been implemented, for example, in PLCs; all PLCs together determine the manufacturing process. Changes to the process require reprogramming of the PLCs, which leads to side effects and expensive delays. BaSys continues to implement process steps in PLCs. The combination into a process is done based on services by means of recipes.

## About BaSys 4.2

In the BaSys 4.2 project, Fraunhofer IESE, in collaboration with 19 partners from research and industry, will explore the continuous engineering of manufacturing processes and Industrie 4.0 for the production industry. The results will be incorporated as components into the BaSys middleware. Continuous engineering enables changing the production relative to the manufactured product, the manufacturing resources, and the manufacturing process. The downtimes of a plant are optimized, ideally enabling continuous manufacturing with lot size 1. In order to achieve this, BaSys 4.2 focuses on the following areas:

- Edge computing, for making decisions close to devices
- Model-based capability description
- Virtualization of production

## The vision of BaSys 4.2 – what solutions for industry will emerge from it?

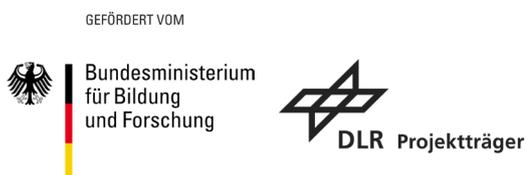
With its open-source components, BaSys supports the digitalization of production processes in companies. The following application scenarios pursued in BaSys satellite projects illustrate the capabilities of the BaSys middleware:

- **Service-based production:** Devices provide their capabilities as services. These are accessed individually for each product by means of a recipe. If a device fails, other production lines with devices offering the same capabilities can take over seamlessly. Dashboards neatly illustrate the production process.
- **Self-documenting production:** A product's digital twin receives all the quality data about the product. This makes the production process traceable. It is known which parts were used for the production of a product, and which quality exactly was achieved in the production. BaSys offers integration with databases such as SAP HANA and thereby provides valuable data for Big Data analytics.
- **Coordinated maintenance intervals:** Sensor data, such as the energy consumption in milling processes, can be used not only to predict the quality of a product, but also to determine when maintenance is due. By optimizing maintenance intervals, downtimes can be avoided and costs can be saved.

### Project Partners:



### Funding Agency and Project Sponsor



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