

Every drop counts!

Trouble-free chip production thanks to smart sensor technology

An IoT solution from T-Systems MMS helped resolve a problem that was chipping away at semiconductor manufacturer GlobalFoundries' processes.

Author: Durga Godbole

Water is life. All human, animal, and plant life is inconceivable without water. This is also the case in the semiconductor industry – an industry which is currently seeing a promising boom worldwide.

The PwC study "Opportunities for the global semiconductor market" forecasts that worldwide chip sales will rise to \$575 billion this year. Based on the \$481 billion in sales in the previous record year of 2018, this would correspond to a compound annual growth rate (CAGR) of 4.6 percent. However, chip production depends on the availability of ultrapure water and immaculately clean environment. That's because semiconductor chips – which power our day-to-day gadgets such as cellphones, micro-waves, washing machines, laptops and, to some extent, even our cars – are produced in a dust-free environment using a very stringent process. In this sense, "ultrapure

water" is an indispensable supply medium in semiconductor production worldwide and needs to be permanently available.

Take GlobalFoundries, for example. With a workforce of around 15,000 employees worldwide, the company produces microchips for more than 200 customers in the automotive and manufacturing industries, for computers, mobile communications and consumer electronics, among others. In addition to production facilities in the USA and Singapore, the company operates Europe's largest semiconductor plant in Dresden, Saxony. And, with a "promising" stock market value of \$26 billion, GlobalFoundries was one of the most valuable newcomers to the U.S. stock market when it was listed on the Nasdaq technology exchange last fall.

With its commitment to research and development, the company is one of the

driving forces behind establishing the Free State of Saxony as a leading micro- and nanoelectronics center in Europe. But the control valves for ultrapure water – which is needed to remove any chemical residues from the silicon wafers that are used to manufacture the high-end 300 mm chips in Dresden – were posing a peculiar challenge at this plant.

"Previously, the inlet and outlet valves to the basins in which these wafers are cleaned had to be painstakingly checked for damage on site by experienced specialist personnel. Any damage to these valves was unpredictable and could potentially lead to disruptions. We needed to digitalize the process of monitoring these valves in order to save time, effort, and costs," says Dr. Axel Preusse, Process Engineer, GlobalFoundries.

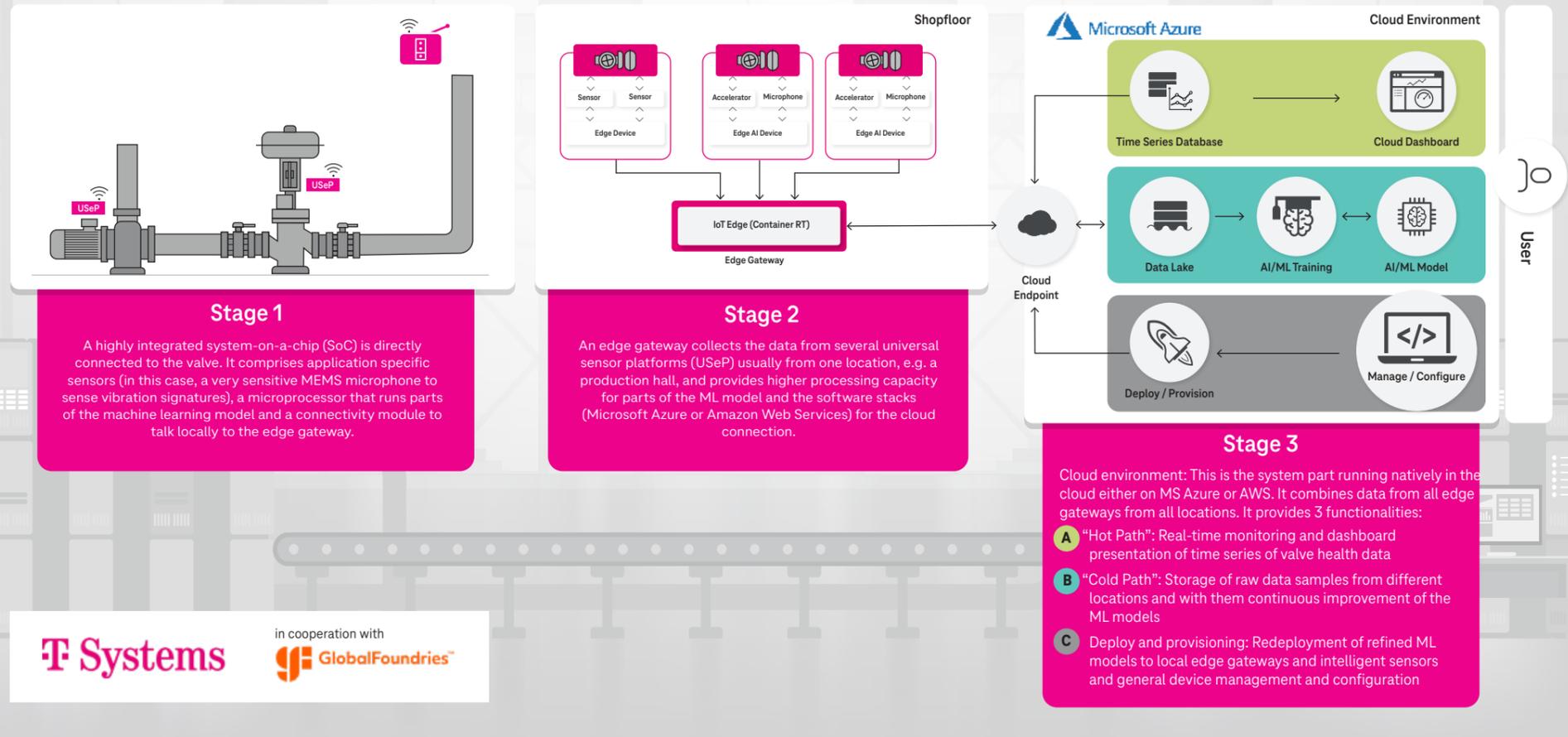


Dr. Axel Preusse, Process Engineer at GlobalFoundries

With T-Systems MMS and the Smart Systems Hub, we had a team at our disposal that brought in a very broad skillset that is not available internally in this particular form. The team worked on the project with a high level of self-motivation.



Solution overview



A visual representation of the solution.

How Smart Systems Hub solved the problem

GlobalFoundries, together with T-Systems MMS and other partners, launched a pilot project as part of the "Digital Product Factory" program of the Smart Systems Hub, one of 12 Digital Innovation Hubs in Germany.

The intended IoT solution would comprise everything from sensor technology and data pre-processing in edge computing hardware to presentation in cloud dashboards. The team had to overcome challenges like selection of suitable sensors, implementation of machine learning algorithms for the early detection of damage, and realization of a flexible cloud platform for clear display and evaluation of the valve status. The solution aimed to enable the necessary maintenance to be carried out in good time and, more importantly, without production downtime.

How it all came together

To enable acoustic monitoring of the condition of the valves directly on site, the highly integrated edge hardware from the Dresden-based sensor technology specialist "Sensry" was used. The data thus obtained was pre-processed by machine learning algorithms developed jointly with "Coderitter" (Code-Knights), a Dresden-based IoT startup. The data was transferred to the cloud and clearly presented in dashboards using the "Cloud Shopfloor Intelligence" platform developed by T-Systems MMS.

A smooth resolution for predictive maintenance

For GlobalFoundries, the data-based, self-learning IoT solution ensures that the ultrapure water valves are monitored digitally and in real time on clear dashboards. This not only lightens the workload of

specialist personnel, but also enables early and increasingly accurate determination of maintenance requirements, thanks to machine learning. It also ensures better compliance with production-critical metrics due to up-to-date knowledge of the current operating status and increased reliability.

"With T-Systems MMS and the Smart Systems Hub, we had a team at our disposal that brought in a very broad skillset that is not available internally in this particular form. The team worked on the project with a high level of self-motivation," says Dr. Preusse from GlobalFoundries.

Green benefits

Engineers at GlobalFoundries are now able to plan maintenance cycles for valves, ensure safety in production through early detection of defects, and improve assembly capacity planning. The

company benefited from reduced material and service-level costs for failure detection and maintenance services, high resource efficiency, reduced energy and raw material consumption, simplified R&D, reduced number of trips for maintenance work, and extended lifetime for their machines and devices.

Future Security through digitalization

"The deployed Cloud Shopfloor Intelligence solution in its combination with state-of-the-art sensor and edge computing technologies is highly flexible and scalable, and enables easy integration into other applications and business processes. We are delighted to have been able to assist GlobalFoundries in resolving a very challenging problem," says Christoph Kögler, Head of IoT & Cloud Solutions, T-Systems MMS. ■