PROCESS WORLDWIDE

Milestone Digitization/IIoT

Impetus for Digital Transformation

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Digitalization and Industry 4.0 have arrived in the process industry — a lot more quickly and with far greater penetration than some would have believed of this generally conservative, safety-minded sector. It was precisely the process automation experts for the large chemical companies who recognized the potential opportunities at an early stage, and drove forward the required developments, particularly the necessary standardization. Siemens is amongst the pace-setters on the supplier side. In the course of this progression, the supplier of automation and electrification engineering has become a software giant able to offer its customers a digital solution for practically every challenge.

The generation now gradually moving into retirement is the one that still dimly recalls them — those early central operator control rooms in the 1960s: with a display system installed on their wall for every meter that you wanted to keep an eye on. Key electrical parameters of chemical production processes could be monitored here centrally — a massive gain in efficiency and safety.

Quite probably, you can still take a photo of an early control room today, somewhere at BASF, Wacker, Bayer, etc. The operating and monitoring stations, mounted on a giant wall, remained in place long after they had become obsolete. And even if today, some 50 to 60 years later, they appear genuinely antique, they were the first step towards automation and, ultimately, towards the digitalization of production processes in the process industry.

Simatic Lays the Foundations for Automation

Digitalization in the process industry: the first greenfield plants are already exploiting the full potential of Industry 4.0
(Source: Siemens)

Not long earlier, in the mid-1950s, developers at the Siemens-Schuckertwerke plant in Erlangen had set down a first milestone on that journey. Starting from transistors, which were an innovation at the time, they developed a contactless controller, for which they submitted a patent application in 1958. Under the name Simatic, it became the basis of an automation system which repeatedly opened up fresh applications with the advent of microprocessor technology from 1973 onwards. Even back then, software was partly responsible for this triumphant advance.

In the 1970s, key things happened with regard to automation in chemical plants. Central control units, combined with display systems, made operating the increasingly complex plants significantly easier. However, redundancy concepts needed to ensure that a second computer could quickly take over the work in the event of the central system failing.

Decentralized and Robust, from the 1990s On

In the early 1980s, Siemens launched the Teleperm M control system, comprising an automation, display and bus system. It was used in many process engineering processes and systems. The transition to decentralized systems during this decade can be considered a paradigm shift.

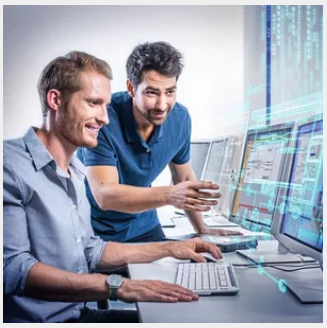
With Simatic PCS 7, the successor system to Teleperm M, Siemens took account of that shift from the 1990s on. Based on Simatic hardware and software components, it rapidly established itself as a distributed control system in countless process industry plants worldwide. Its architecture, with robust, distributed controllers, networked with each other across a bus system, delivered an increase in availability. Even bigger, more complex plants could be built and operated safely. Simatic PCS 7 is still demonstrating its added value and

flexibility today. In the current version 9.0, it is the basis for implementing the various digitalization strategies of users and also opening up the field level, Profinet and Profibus-based, for digitalization.

For this to have succeeded, the parameters needed to be right. One of these was consistency of the automation solutions. In that respect, characteristic for the understanding and set-up of automation structures was the "automation pyramid", comprising levels building on one another, from the field level through the management and operational control level to management levels using MES and ERP systems.

FROM AUTOMATION SPECIALIST TO SOFTWARE GIANT



Simatic PCS 7 Viable Through to Industry 4.0

It's intriguing to speculate whether the creators of the first versions of Simatic PCS 7 could have imagined that their concepts would survive such radical changes through to digitalization and Industry 4.0. Of course, the control system was continuously developed and functionally expanded in the intervening 20 years. The fact that this was possible speaks for its flexibility.

Today, the digital twin is the core of the comprehensive Siemens offer for the process industry, making integrated engineering, a digital workflow and transparent production possible. The direction of travel towards this was set around 15 years ago. That was the first time the various systems were no longer viewed in isolation. It became increasingly apparent that the added value lay in transferring information consistently from one tool to another.

Manuel Keldenich, Head of Marketing for Process Control Systems and Software, reviews developments over the last ten years at Siemens, "One milestone in digitalization was opening up the engineering software in order to achieve seamless linking with the automation systems and, beyond that, with simulation. By doing so, we laid the foundations for the Digital Twin."

He anticipates a real shift coming from the introduction of the completely web-based (HTML5) process control system Simatic PCS neo, launched in 2019 at the Hanover Fair, as an additional system software. "Even at last year's Hanover Fair, we were already able to demonstrate the expanded opportunities from augmented reality linking, live on a column model engineered and operated using Simatic PCS neo," Keldenich notes, adding, "For example, it is easily possible to fade up exploded drawings or real-time data or current readings which a maintenance engineer in the plant is currently working on, directly onto his tablet."

Noa Paves the Way to Digitalization

The development of systems into tools which prepared the way for digitalization went hand in hand with growing acceptance in the target groups, amongst plant designers and automation experts in the process industry. Numerous experts in the chemical and pharmaceutical industry collaborated on establishing the requirements for the necessary consistency and smooth data exchange.

As a suitable data format, Namur Open Architecture (NOA) — along with Dexpi (Data Exchange in the Process Industry) — can be cited as a milestone. Acceptance manifested itself not just at the theoretical level. Keldenich reports, "Nowadays, there are numerous examples and digitalization applications up and running at many globally operating players in the chemical and pharmaceutical industry. The managers there quickly recognized the advantages that e.g. consistent data from engineering to operations provide."

However, he added, on the other hand there continue to be many smaller and mid-sized companies who still have massive potential when it comes to digitalization. "People continue to import and export Excel lists to exchange data, or link information using simple tagging. But gradually SMEs are also starting to engage with the massive opportunities that digitalization offers them," he said.

How Do You Make Plants More Profitable?

The primary motive for the early movers sounds simple and familiar: the challenge is to improve plant's cost-effectiveness. The recognition that the plant's digital twin plays a vital role in this is taking hold. Keldenich emphasizes, "It's not just about creating it, but above all about also keeping it up-to-date and, logically, in automated form." That results in benefits over the entire life-cycle of a plant, given that — particularly in the process industry — plants are continuously being optimized, in some cases over several decades.

Things move in the direction of Artificial Intelligence, according to Keldenich, if for instance the maintenance system recognizes the respective optimum time for maintenance without prompting and derives a strategy, based on that, for how operational maintenance can be planned and implemented as efficiently as possible.

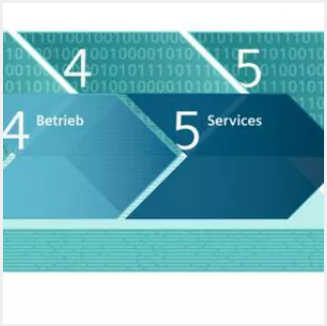
"If we are speaking about digital twins, then as a rule we also need to give some thought to 'dark data'. To date, plant operators have only seen the tip of the data mountain; a lot of plant and equipment information was not used," says Keldenich, explaining, "If you can identify this information, connect it together and so convert it into smart data, the plant will operate more cost-effectively and also with greater environmental efficiency, with fewer downtimes and shorter set-up times, for instance for modernizations."

The Digital Twin Comes to Life in the Cloud

The digital twin can come into being — and be brought to life — via a cloud portal where all data — from engineering to control engineering or automation, simulation and other external sources etc. — can be effectively linked together. Ideally, this includes a 3D virtual reality environment in which plant operator and maintenance staff are able both to work operationally and to practice standard workflows and emergency scenarios realistically, or schedule maintenance tours.

In this environment, the operator is kept up-to-date regarding the performance of their plant and of the installed equipment in real time thanks to an operations intelligence dashboard. From this it is possible to incrementally achieve a continuous improvement in plant efficiency during ongoing operation and over the complete lifecycle.

GALLERY





Stand-alone Solutions Are also Possible

Siemens supports this with an integrated software portfolio, starting with the engineering software Comos, which enables users to create the process engineering basis for comprehensive digitalization of their processes. “But that is not necessarily a requirement in order to benefit from the possibilities of digitalization,” explains Keldenich, “Comos comprises numerous software solutions that can also be used as stand-alone solutions. Some customers came on board, for example, through Comos Walkinside, which provides a virtual 3D environment for operator training.”

That was the approach adopted by the petroleum company Total E&P, for instance: it realized a virtual reality visualization 3D model of an FPSO (Floating, Production, Storage and Offloading) unit. Operating staff practiced standard workflows, emergency scenarios and much more, using it for three months in the training room, while the ship was en route from the dock in South Korea to the destination site, off the coast of Angola. As a result, it was possible to take the FPSO into productive operation several weeks earlier than planned and start to exploit oil.

Virtual Commissioning as an “Entry Drug”

Companies in other sectors, such as the pharmaceutical industry, might find their entry into digitalization via simulation using Simit. Plant operators can use it to test automation functions on the virtual or real controller in advance, and thus discover and rectify faults well before the factory acceptance test (FAT).

Keldenich says, “Many of our customers who have had this kind of experience frequently opt for fully integrated approaches on the next project, also taking Comos into consideration, because then alongside the automation function it is also possible to simulate and test the process engineering planning directly at the same time.” Thus, for instance, P&IDs created in Comos can be transferred into Simit and further used directly there.

The next step involves integrating the engineering (Comos) and the simulation (Simit) with the process control engineering or automation (e.g. Simatic PCS 7). These three components, crucially, make it possible to create a sustainable digital twin. Here, too, Keldenich is already able to report on successful examples.

Biopolymer Production as a Trailblazer in Digitalization

Take Cathay Biotech, in Wusu (China), for instance: in its biopolymer production, practically the full potential of digitalization is being exploited. From the digital plant model, created using Comos, the process control system — in this case Simatic PCS 7 — receives the information it needs to smoothly control continuous production. Also involved in the process is the MES, Simatic IT, which sends e.g. electronic work orders.

The maintenance system is integrated too: in the event of a fault, the control system sends an alarm to Comos MRO. This not only generates a repair order, but also derives optimized maintenance schedules from this and many other “experiences” and data. Integration along these lines makes it possible to produce products based on sustainable raw materials so efficiently and in such high quality that they can compete against oil-based products, Keldenich notes.

A Vision for the Process Industry

Even that does not exhaust all the possibilities from digitalization that Siemens offers, particularly to users from the process industry. Eckard Eberle, who as CEO Process Automation since 2014 has joint responsibility for the strategy of Siemens Digital Industries, supports the digital transformation in this customer group for the long term.

He says, “Since Vision 2020, which we unveiled in 2014, we have driven the subject of digitalization forward, both through in-house developments and through various

acquisitions. From 2017 on, we have focused even more strongly on the process industry, where we had already been gaining market share for many years up to that point." As part of Vision 2020+ in 2018, under which Digital Industries came into being as one of three operational Siemens companies, Siemens eventually bundled together all the key themes of Industry 4.0. Eberle confirms, "Since then we have been driving digitalization strategies even more consistently and supporting both core processes and ancillary plants from a single unit."

MTPs Integrated from a Browser at the Press of a Button

In the future development of business, it is certain that the new, completely web-based process control system Simatic PCS neo will play a key role. For Eberle, it is a further milestone in digitalization. Modular plants, in particular, are set to benefit in future from the new, HTML5-based system software, which builds on the proven Simatic hardware platform that is jointly used with Simatic PCS 7.

One of the most important features is that Simatic PCS neo supports the MTP (Module Type Package) standard in the respectively-current version, meaning that plant designers and operators can import, display and orchestrate automated package units at the press of a button, so to speak. "That's how plug-and-produce can actually work," Keldenich is convinced. In existing control systems, that could never have been implemented so compellingly, he thinks. "Our technologically fully rethought system offers massive advantages and flexibility in that respect."

Siemens has bought up further key building-blocks to support process industry digitalization, and integrated them into its portfolio. XHQ, for example, which is an operations intelligence software. "The customer can use it to pull together data from a wide range of sources, aggregate it, contextualize it and thus use it in his day-to-day decisions — for instance raw materials prices, stock levels, the performance of certain plant components, weather data and much more," Keldenich explains.

He is equally convinced about the benefits of the "gProms" platform from PSE, which is used to create simulations of process flows. Siemens bought up the advanced process modelling (APM) expert PSE following a period of strategic partnership, in Q4 2019. "Using this tool, the customer can quickly gain three or four percent in performance during

ongoing operations. That has a direct impact on their Ebit." Thanks to the close interlocking of its technology with Comos, Simit and the Siemens process control systems, it is possible to create soft sensors, for instance, more easily and to calculate the performance of plants in advance.

Lastly, Keldenich describes the software Plantsight, being developed jointly by Siemens and Bentley Systems for the process industry, as the "silver bullet". Using it, it is possible to access all data and information via a single cloud-based portal, he says. That means the system automatically supports in decision-taking. "In 2020, we would have liked to have shown even more in Hanover," Keldenich regrets, adding, "We have integrated further functionalities, such as those XHQ offers. As such, our solutions are growing ever stronger together — in order to reach the next level of the digital twin."

The Future: AI, 5G and Edge Technologies

It sounds futuristic to imagine that, in the short or mid term, even voice control and chatbots will support the operator. In these areas too, says Keldenich, very promising projects are already underway in chemical companies; even in loud environments, maintenance staff can communicate straightforwardly with the digital assistant via Messenger (similar to Whats App) and use this to call up information through pre-filtered displays.

The onward path to comprehensive digitalization of the process industry leads almost inevitably through 5G. Keldenich confirms as much, "We need it in production, in logistics, in maintenance — not just for driverless transport systems." In the process, and above all in hybrid sectors, 5G supports in using data even better across the entire value chain. Here, another current acquisition by Siemens is set to play a role: Pixeom, which with its Edge technology will contribute towards being able to make better use of Edge apps which analyze data on a machine locally, and transmit their analyses to higher-level systems. On that point, it is a particular benefit that Siemens is able to exploit synergies better than ever before, through bundling industry-wide aspirations for digitalization into Digital Industries. Thus, the major step from supplier of electrification and automation engineering to software giant driving the digital translation forward across sectors is being accomplished.

ADDITIONAL INFORMATION

The digital future in view

From the first process control system to the fully-integrated digital software-based process chain — Siemens has consistently been driving Industry 4.0 forward for years. As an innovation driver, the company sets milestones and benchmarks from which the process industry also benefits. And Siemens is already optimally equipped for a future with the 5G standard, thanks to recent acquisitions.

ABOUT THE AUTHOR

Ulla Reutner

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