Application of cloud technologies in process technology

Exploring the options

Industrial automation technology is constantly changing, providing users with significant advantages. This also applies to cloud applications such as the Proficloud from Phoenix Contact. It can, for example, be used to integrate meteorological data from the Internet as a process variable into the application, in order to be able to react quickly to events such as heavy rain (lead).

Until 1960, approximately, data was predominantly measured locally in the process industry. If the system operator needed a measured value, he had to go on site physically and take the information from the relevant measuring instrument, which was fairly time-consuming. Today, this way of proceeding is outdated, as centralised maintenance has arrived in the process industry in the mean time. While each sensor or actuator type required a separate proprietary transmission system in the early years, these solutions have been replaced by standardised signals over the years. Although the control boards still consisted of hundreds
of switches and display instruments, at least the forwarding of signals was based on relevant standards (image 1).

Figure 1 - In the past, control boards consisted of hundreds of switches and display instruments

In the early 1970s, control boards got equipped with automation technology (image 2). The first applications took over the control of individual plant parts and relieved the strain on staff in the control room. As a result, even complex processes could be controlled. This led to more efficient processes on the one hand, but, on the other hand, caused problems whenever a control system failed. Of course, the development did not stop in the 1970s, which means that there have been numerous innovations in the modern process technology since then, and new technologies are used. The last major step surely was the use of central control engineering, which was introduced in the 1980s. In general, one can recognise that most of the innovations were judged with a certain scepticism at first. The system operators asked themselves: Do we really need this? Do we really save time and money using this? Can the quality of the manufactured products really be improved? And will the production process still be safe? Those are aspects that are usually discussed when it comes to introducing such innovations (image 3).

Figure 2 - Single system parts could be controlled via analog flow meters

Figure 3 - Digital flow meters belong to the numerous innovations and new technologies that are used in process technology
Using all data that is provided by modern devices

At the moment, processing companies are dealing with the subject of cloud technologies: How can they be implemented and which kinds of advantages result from their use? The following considerations shall demonstrate in which way this technology can help to improve the industry. A modern process system is built on the basis of the classic automation pyramid. For around two years however, people are discussing about extending this pyramid. The extension – described as Namur Open Architecture (NOA) – uses information that is provided by modern devices and was not used frequently before. Without influencing the actual process, data from the intelligent sensors and actuators is read out and evaluated in a type of “data diode” (image 4).

Figure 4 - The limitless web services contribute to the optimisation of the system
Innovative systems, such as the open control platform PLCnext Technology and the Proficloud provided by Phoenix Contact, can be used for this purpose. PLCnext controllers are able to read data from any sensors with a large number of different protocols, in parallel to the process controller. This data is then transmitted as raw data or after pre-processing within the PLCnext controller to the Proficloud. Here they can be reused in many different ways or be completed by additional information. Thanks to the openness of the cloud solution, this sensor data can be analysed on the basis of intelligent algorithms, for example by apps of the manufacturer or even third-party providers. This way, the perfect time for maintenance can be proposed. In addition, companies that have specialised in Big Data can generate recommendations for the plant operator based on this data (image 5).

**Accessing information from the Internet without having to deal with web technologies**

However, is there any further data, next to the sensor data, that can be used for the optimisation of processes? An application that has already been implemented gives the answer to that. Around 25% of the Dutch national territory lie below the sea level, about 50% lie between sea level and one meter above sea level. So water has a major significance in the Netherlands. That is why the local government provides its citizens with official data regarding this topic. Any interested private person, company, or institution can obtain information on the rainfall forecast, river level predictions, or how much water from the North Sea will be pressed towards of the coast by the wind. And how can this data be send to the process controller of a company now? This is where the Proficloud of Phoenix Contact comes into play. Based on the open communication between the cloud and the web-based weather service, a third-party provider offers the necessary data precisely for any position in the Netherlands. Through integrated cloud services, the weather information is then transferred to the controller directly as a process variable. This way, the programmer – in this case of the Sielprozess – is able to access web data without having to deal with web technologies anyway. This is done by software developers of the cloud application that have specialised in that (image 6).
This example can also be applied to applications in processing companies. The industry has just started to explore the technical potentials. Therefore, it is very likely that more and more ideas will be developed regarding how to use the connection between cloud and processes in a profitable way. Predicting the need for maintenance of sensors and especially actuators is only the most obvious idea. Predictions regarding the necessary energy requirements are also conceivable, and the current produced by (own) wind turbine generators and solar systems is taken into account. A process that requires a high amount of energy can be scheduled to a time slot where the mains has a high energy surplus and the current can be purchased to a correspondingly low price.

**Benefit from the advantages without the need for new controllers**

Such thoughts and similar ideas often only emerge when the technical conditions to realise those ideas are available. This is the case regarding the new opportunities in information technology that are spreading in the markets right now. However, users ask themselves if they have to install new control technology in order to benefit from the advantages of cloud-based solutions. Or is there another option for the transfer of existing components into the cloud?
Using new technologies, increase the efficiency of production for the long term

The Proficloud of Phoenix Contact is an open IoT system. On this platform, manufacturing companies as well as service providers can establish their own web applications, as well as develop and provide services and mobile applications. Manufacturers use the Proficloud for example to operate their own software for data acquisition, analysis, and visualisation and to securely provide this information to further participants if necessary. Furthermore, the data can be aggregated worldwide and be comprehensively evaluated through the connection to big data applications.

The IoT Gateway of Phoenix Contact connects the components to the Proficloud, without the need to interfere with the automation technology. The coordinated interaction between the gateway hardware and cloud platform enables the collection of sensor and process data and the encrypted transmission of this data to cloud applications for further processing. Existing systems can also send their status data to the Proficloud via the IoT Gateway in order to implement applications such as big data, pattern recognition, and condition monitoring. This way, the efficiency of production is increased for the long term.

The IoT gateway is simply parameterised directly on the device using web-based management. No additional engineering software is required.