

A large industrial robotic arm, white and grey, is positioned in a factory setting. It is surrounded by safety fencing and other industrial equipment. The background shows a long conveyor belt system and various machinery. A blue square with the text 'Technical article' is overlaid on the left side of the image.

Technical
article

Clear to cloudy

New concepts for cloud connectivity

When it comes to the networking of machinery and equipment, everything is usually sunshine and roses: fully developed and reliable bus systems, such as PROFINET, ensure a trouble-free communication. However, in order to keep dark clouds away from the communication with the cloud, there are now new concepts for connecting the field level.

Higher productivity, improved quality or even new business models – cloud computing is an important prerequisite for utilizing the benefits of digitalization also in an industrial setting. Whether it is to analyze and improve the product quality through a big data analysis of all relevant parameters. Whether it is to evaluate important performance indicators when running machines or robots to achieve a higher availability, worldwide and for a wide range of manufacturers. And whether it is to enable machine builders to present new marketing models, in which customers pay according to the intensity of use or the quality achieved.

These applications, though, can only function, if they are fed with data from the field level. The actual power consumption, the temperature, the vibration, the movement speed and the respective curve progressions over time are indicative of the plant conditions or the process quality. Combined with other data sources, such as the material used, the supplier or the condition of the tools used, completely new possibilities for optimizing processes are opened up.



PROFIBUS goes to the cloud: with SIMATIC CloudConnect 7, existing installations can be connected to the cloud.

However, it makes little sense to connect each individual sensor to the cloud – rather, the programmable logic controller (PLC) is the ideal instance for aggregating the field data. Furthermore, the PLC also provides process-relevant information. Thus, a vibration or temperature value is only relevant, if a machine is actually producing – when it is in standby, the sensors still deliver values, but these do not provide any information about the production process.

With the CloudConnect products, Siemens now offers the possibility to optimally transmit this information to a wide variety of cloud platforms, such as MindSphere, Microsoft Azure, IBM Cloud or Amazon Web Services (AWS). In doing so, three application scenarios are supported: an integrated solution for automation projects with the SIMATIC S7-1500, a module for the connection of existing installations (e.g., with the SIMATIC S7-300) as well as an Industrial IoT gateway – such as the RUGGEDCOM RX1400.

For the flagship, the SIMATIC S7-1500, a powerful module is now available in the form of the communications processor CP 1545-1. The configuration takes place in the TIA Portal: here, the data points, of which the values are to be “sent up”, are simply selected. In addition to a cyclic transmission in freely definable time intervals, it is also possible to provide logical conditions.

An application example: a cloud-based monitoring of pressing machines is to be realized, which evaluates the power consumption as well as the movement speeds of the cylinders. For the implementation, the corresponding values are made available in the SIMATIC S7-1500 CPU and earmarked in the engineering for the transmission to the cloud. To feed the “Data Lake” of the cloud with only the relevant information, a logical flag is programmed in the PLC, which controls the transmission depending on the machine status.

In order for existing installations to also benefit from the advantages of digitalization, the module SIMATIC CloudConnect 7 was specifically developed for retrofit tasks. The module cyclically queries the data from the PLC, e.g., a SIMATIC S7-300, and transports it to the cloud. CloudConnect 7 is connected to the front port of the CPU or to a CP, so that usually no changes in the STEP 7 program are required. Even if there is no space left on the top-hat rail, CloudConnect 7 can be mounted in the control cabinet thanks to this flexible cabling. Also noteworthy is the connection of PROFIBUS installations – the support of the MPI interface makes it possible. In the engineering, the existing STEP 7 project is used to utilize the existing semantics of data types and symbolics – a re-entry of the absolute memory addresses, which can be prone to errors, is no longer necessary.

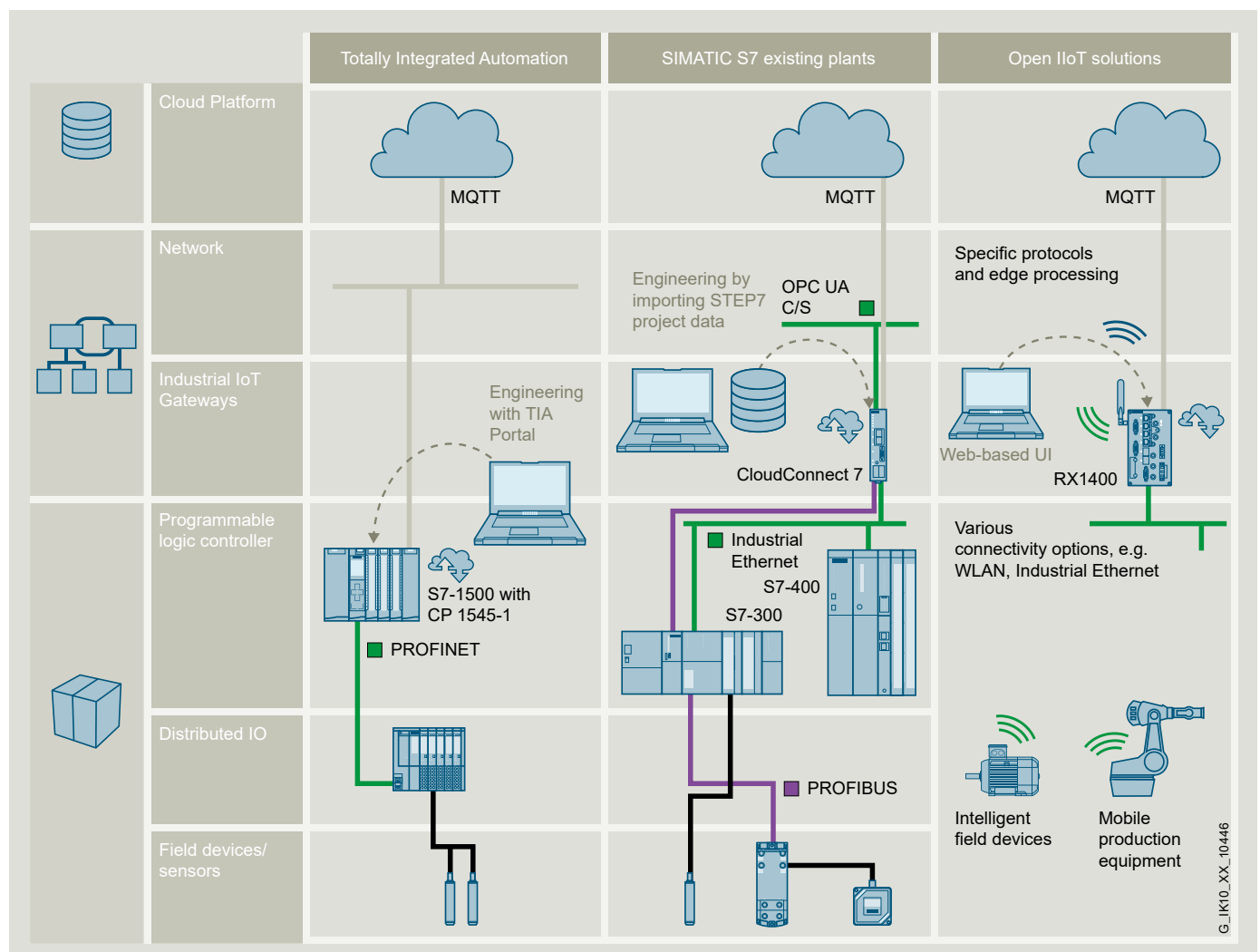
As with the integrated solution, CloudConnect 7 offers the configuration of different trigger conditions for controlling the cloud communication. A possible implementation for CloudConnect 7 is “Predictive Quality”, i.e., the cloud-based evaluation of production data for the prediction of the product quality to be expected – e.g., to discharge critical products for a separate re-examination. Such applications only make sense, if they are rolled out in the entire machine park, i.e., in particular, the existing machines are also included. To this end, the existing SIMATIC S7 PLCs are supplemented with CloudConnect 7. By reading in the STEP 7 projects, the application engineer

can easily select the relevant data points.

CloudConnect 7 then cyclically queries the corresponding tags during runtime and transmits the information to the cloud for further evaluation.

Finally, should it be necessary to connect additional IIoT devices – e.g., WLAN-enabled sensors – the RUGGEDCOM RX1400 represents the right choice. The RX1400 offers multiple Ethernet interfaces as well as WLAN for communication with the field level and also supports LTE mobile communications. Instead of the CloudConnect software, the

device can also be programmed itself, e.g., to realize your own preprocessing of the data as an edge device. Even greater connectivity is offered by the RUGGEDCOM RX1500, which grows with the applications thanks to its modular design. For example, this means that data from complex combination sensors evaluating motor parameters (vibration, temperature, power consumption, etc.) can be collected and transmitted to the cloud. An app for intelligent maintenance management can use this information and the expected production program to schedule a possible overhaul.



Three scenarios for the cloud connections can be realized: integrated into the automation, as a retrofit for existing installations or as connectivity for any Ethernet-capable sensor.

Security information

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Common to all products is the use of established standards. As cloud protocol, the open Message Queuing Telemetry Transport (MQTT) protocol is employed, which is supported by a large number of cloud providers. By means of predefined profiles, all necessary parameters for MindSphere, the IoT operating system from Siemens, as well as other common cloud platforms are set with a mouse click. Alternatively, all communication parameters can also be manually assigned to support additional platforms. At the field level, the CP 1545-1 can directly access the data management of the SIMATIC S7 CPU. CloudConnect 7 utilizes S7 communication and Modbus to cyclically query data from field devices. And with the RUGGEDCOM RX1400/RX1500, any own protocol can be implemented, including an application-specific processing logic. In the future, the devices will also support OPC UA – so that especially SIMATIC CloudConnect 7 can also serve as a gateway for existing installations.

Whether as an integral part of a modern TIA setup, as an easy option for existing installations or as a rugged all-rounder for a wide range of IIoT implementations – with its cloud connectivity products, Siemens always has the right answer when it comes to connecting the field level to the cloud.

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