

Enabling IoT connectivity

An astonishing estimation: in 2020, more than 200 billion devices will be connected to each other. To realize the power of the IoT, the main focus must be on the use of the data that these connected devices provide.

The ability to share data is based on intelligent gateways, which unlock these borders and enable companies to interconnect industrial infrastructure devices and secure data flow between e.g. a CAN network and the cloud. Data can be aggregated, shared, and filtered for analysis purposes – an action field for b-plus and the Gatebox 100.

Connecting a device to the Internet or with a cloud solution is possible with a lot of industrial PCs on the market. But it is not easy to determine which one of this wide variety matches your individual system. To work out the differences between all these industrial PCs is already a question of engineering. Specific interfaces and functions establish the right connection for the needed application. In most existing infrastructures, the basis is a data source and most likely an interface, e.g. analog or digital I/O or a bus interface like CAN.

Most IoT (Internet of Things) gateways offer typical PC interfaces for a simple IoT connectivity. When it comes to more industrial interfaces, the variety of products is smaller and often it is hard to find GPIOs or CAN on these gateways. Thus, most developers have to decide if it makes sense to build a second industrial PC with the required interfaces. The other option is to build and qualify a whole new industrial PC with IoT gateway functionality and at the end to reinvent the wheel to face two applications in one single box.

Knowing this challenge from customers, B-Plus developed an IoT gateway that is a compromise between building a whole new industrial PC and having an extra box for interface connectivity: The Gatebox 100 is a Box PC with flexible I/O shields, called Smart I/O Driver Interface (Siodi). Because of this concept, it is possible to implement additional interfaces without developing something new. It is irrelevant if the customer needs additional analog/digital I/Os, field buses like CAN, audio, or customer specific I/O cards. Predefined options, including scalable CPU Power, are already implemented.

Always up-to-date base unit with CAN options

The base configuration of the Industrial PC with only 150 mm width, 58 mm height, and 95 mm length brings data acquisition and communication together. The standard version with two Gigabit Ethernet interfaces provides two physically separated networks for the setup of firewall applications. Furthermore, the standard box provides two USB 2.0, one HDMI connector, and also two 9-pin Dsub connectors with variable EIA-232/EIA-485/CAN options.



Figure 1: Gatebox 100 standard variation

But how can you make sure that the industrial PC includes the perfect balance between computing power and power consumption in your application? With respect to the specific operating conditions or for software reasons, it is important to choose the fitting computing platform. For this reason, the Gatebox 100 is based on Smarc CPU modules which offer various performance classes and architectures. Hence, it can be equipped with Freescale i.MX6 series (ARM) as well as x86 solutions like Intel Quark X1000, Atom E38xx series or DM&P Vortex EX. For the future product life cycle, the next generation of processor modules can be used with the same box.

Variable I/O concept fits any application

To specify your requirements, this industrial PC is equipped with a special interface area where custom interfaces can be added. With the flexible Siodi shields of the Gatebox 100, system designers are able to configure an individual system. With a special system service called Siodi service, the I/O data is made available to the OS. Siodi service is capable of multiple processes, which lets you connect to the Siodi I/O shield with various software processes. For example, you can realize a logging application that runs 24/7 and in parallel a separate maintenance software can grab data from the same source or configure the I/Os. Having the I/O data in the OS, the Siodi API can be included directly in the application and connected to the cloud – without any extra way regarding the shield functions.

One key aspect is the connectivity, because getting available data into the cloud is the main goal of an IoT gateway. The Gatebox 100 has options for wireless connections, like WWAN, WLAN, or LTE to connect to the cloud, and options like CAN or digital I/Os to connect to sensors and the machine.

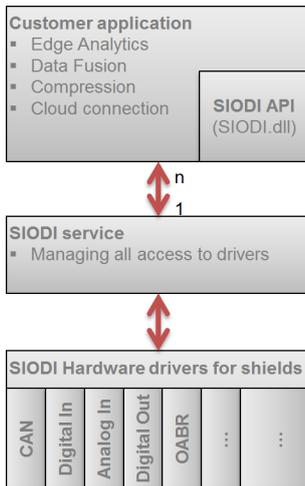


Figure 2: Siodi software architecture

In real time and measurement environments, it is important to get machine or sensor data within temporal correlation between different machines. The gateway offers a CTSS option where the Ethernet port utilizes IEEE1588/802.1AS to synchronize the time within a network. With this time sensitive networking option (TSN), it is possible to acquire sensor data from different data sources, e.g. more gateways, and to send this data to the cloud for analysis.

Robust 24/7 design

A lot of companies are already using industrial PCs for intelligent communication between their machines. Most industrial PCs are developed for installation in air-conditioned cabinets and run 24/7. But what happens with applications in harsh environments? What about all the systems that must endure fluctuating temperatures or voltages, for example outdoor applications?

Especially for these requirements, B-Plus developed the Gatebox 100: it is a robust, small, but powerful industrial PC, which meets the challenges of outdoor operation maintenance-free. It even ensures reliable operation in an operating temperature down to -40 °C, which makes it suitable for the use in outdoor cabinets. In order to meet the requirements of industrial applications, B-Plus has created a 24/7 endurance runner, which is completely maintenance-free. The industrial PC needs no fan, no battery, and also no moving parts. The passive cooling concept, super caps, and industrial 2,5-inch or M.2 SSDs, guarantee reliable operation and reduce service costs.

In some environments, voltage fluctuations can also occur. With standard PC hardware, you will get undefined states or reboots of your PCs. To avoid this, the IoT gateway has a 6,5 V_{DC} to 32 V_{DC} wide range input. To bring existing applications to an IoT infrastructure, it is necessary to find a good spot to mount the gateway. The gateway offers various mounting options, which round up the package enabling operation in the standard desktop version, mounted on the wall or DIN rail.

Maintenance and refitting of Industry 4.0

The complexity of industry systems increases the probability of a system breakdown. With machines that are not connected, the service technician has to do on-site service, even if a reboot of the machine would solve the problem. With an IoT gateway, it is possible to see the status of the machine and remotely do a reboot. Since the gateway itself isn't part of the machine, it stays online and can monitor the reboot. As a consequence, the gateway opens up the use of hidden data for remote diagnostics.

When an industrial machine has broken down, debugging the error can take a long time. This problem doesn't exist with the use of the Gatebox, because it is a stand-alone system which can monitor the health of the whole system. The occurring errors or log files can be analyzed in a laboratory to eliminate further failures. The existing data base of industry PCs together with a corresponding evaluation and analyzing tools make the system complete and support trouble-free function and maintenance of Industry 4.0.

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Box PC **CAN integrated via I/O shields**

The Gatebox 100 by B-Plus (Germany) is an embedded, fan-less box PC based on a flexible interface concept. Two optional CAN interfaces are available.

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Control system **Suitable for mobile machines**

The increasing complexity of mobile machinery results in growing demands of I/O controllers. In accordance with those market requirements B-Plus (Germany) developed the b-CAN-Cube-Mini.

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IoT gateway **Spam filter for IoT**

Dell's Edge Gateway 5000 series delivers an IoT gateway with analytic capabilities, I/O options, and the ability to operate in extreme environments. The solution was designed for the rigors of building and factory automation.

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Embedded World 2016 **IoT gateway and ARM Cortex modules**

At the Embedded World, TQ is showing – in cooperation with Gemalto – a gateway solution to enable "Secure IoT". The company is also planning two mini-modules with ARM Cortex-A7 processor architecture.

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