Scalable gateway solutions: IoT migration made easier

By Christian Eder, congatec

More manufacturers of computer technology for harsh environments are expanding their hardware offerings with the right glue logic to develop IoT solutions. congatec advocates vendor-independent standardization to ensure that these solutions remain scalable in line with requirements.

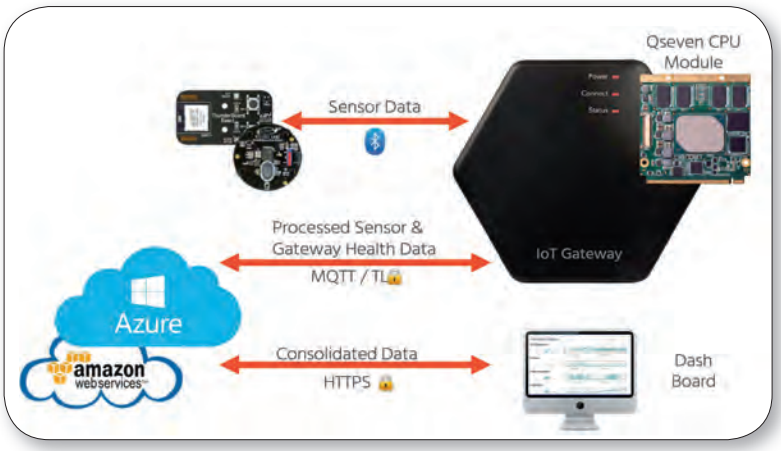

Figure 1. The congatec Cloud API for IoT Gateways enables universal integration of heterogeneous sensor networks and various database implementations in IoT clouds. The software modules are freely programmable and can be used to directly access the IoT gateway and its data as well as the connected sensor networks.

Machine and system providers need a flexible and scalable migration path to develop their IoT offering. It is an advantage if they have access to application-ready platforms that scale on demand and can both integrate existing sensor systems and support new solutions. Modular embedded computer technology based on Computer-on-Modules is ideal for such solutions as it allows highly flexible configuration to meet the application and performance demands, while also enabling cost-effective implementation of customer-specific carrier boards.

However, modules and matching carrier boards alone do not make an IoT gateway solution; standardized, application-ready, hardware abstraction middleware is also needed. That's why it makes sense for embedded manufacturers to provide their OEM customers with the right glue logic enabling them to implement their IoT solutions from sandbox to a fully connected cyber-physical factory. Such standardized middleware ensures that applications can be deployed on suitable hardware without changing the hardware access logic. But currently there are standards set for such middleware, which results in proprietary solutions that would tie machine and automation providers too closely to one embedded computing vendor. With the necessary investments easily reaching the upper five-digit range in such a middleware, OEMs cannot take decisions lightly. Much more appealing solutions are those that can be implemented either through open source projects or directly through standardization committees such as the SGET, the PICMG or future new committees. As always, someone has to take the first step towards standardization. For this reason, congatec has developed a special Application Programming Interface (API) with which to connect devices, machines and systems requiring a flexible IoT gateway to the cloud. It can integrate both smart sensor networks as well as existing smart peripherals. It serves as a framework for users to implement gateway functionality in their machines and systems on the basis of application-ready logic.

The hardware abstraction provides standardization for the application software, which also ensures its portability. The new Cloud API has an application-ready and open design. This allows the integration of a wide range of wireless sensor connections, such as Bluetooth LE, ZigBee, LoRa and other LPWANs, as well as wired protocols for building and industrial automation. Even heterogeneous protocol configurations and communication with other gateways are possible. Typical applications can be found in Industry 4.0 connected machines and systems as well as in intralogistics systems. On request, OEMs can obtain all required software modules in C++ source code, which significantly simplifies the development of own IoT applications for Linux and Windows based on this application-ready reference design. Additional software services are provided for the Cloud API and cloud connection, if required. The provision of the code is the first step of congatec towards vendor-independent standardization. The second step is building alliances with partners such as iesy or Technagon, as well as the integration of these partners or concepts agreed with others into cross-vendor initiatives such as SGET. The company has also set itself the goal of defining further standards beyond the board and module level in order to facilitate the use of embedded computer technology even more. The new Cloud API can be integrated into dedicated gateways from congatec as well as customer-specific designs and existing

Figure 2. Standardized and freely programmable IoT APIs make OEMs independent from specific manufacturers or hardware. Four IoT gateways, which are suitable for use with the new Cloud API for IoT Gateways, come from congatec, Technagon, iesy and EXPEMB (from left to right).

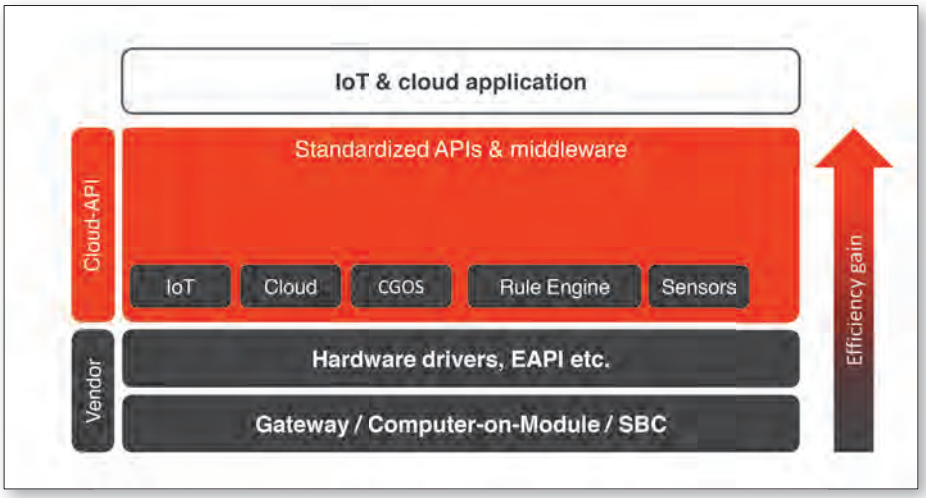

Figure 3. It is necessary to establish additional standardization of APIs and design-ins beyond the core standards in order to further simplify the development of custom-specific applications based on standardized embedded computing building blocks.

hardware platforms based on congatec hardware. For this purpose, real-time hardware virtualization is also supported. Existing solutions include the IoT gateways from Technagon, iesy, EXPEMB and congatec.

The IoT gateway from Technagon featuring the new Intel Atom Celeron or Pentium processors is based on the latest SMARC 2.0 standard and uses the new SGET eNUC standard for a standardized box PC design. Despite its small footprint of only 104 x 104mm, it supports up to three radio standards with up to six antennas. In order to meet the different requirements in the industrial environment, the box PC is available in numerous housing variants for wall, DIN rail or Vesa mounting as well as in an IP54 protected outdoor version.

The IoT gateway from iesy is also based on the eNUC standard for the carrier board and housing. Under the hood, Qseven Computer-on-Modules are used. These come either with ARM or x68 technology. The entire range of current technologies is available, from modules featuring the particularly energy-efficient i.MX6 ARM processors, or the graphics-rich AMD Embedded G-Series APUs, to the latest Intel Atom processors. This allows OEMs to scale their gateway for the widest range of varying software, performance and cost requirements. The interface offer includes the standard industrial set comprising 4x serial UART interfaces, RS232, 2x TTL as well as 3x USB and 2x GbE, and is suited for the connection of existing, mostly wired installations.

The FlexGate gateway from EXPEMB is also based on Qseven modules, but with IoT connectivity that has been specially developed for the Low Power Wide Area (LPWA) protocol LoRa. It connects up to 62,500 smart LoRa sensors and devices, providing 1 Gbit Ethernet, WLAN, 3G/4G or Bluetooth for communication with the central cloud. All these connections are available at the same time on the gateway and if a connection fails, an individual fallback can be defined with different scripts. A wide range of I/Os for interfac-

ing with the field – such as 2x USB ports, 1x serial interface, GPIOs and Modbus fieldbus support – also allows the connection of additional local devices and networks for every requirement.

Machine and systems developers looking for an even more flexible gateway for their IoT sensor networks find the appropriate dedicated hardware platform in the congatec IoT gateway. It supports up to six modules for a wide variety of wireless interfaces – from LTE to WLAN, Bluetooth and ZigBee to LPWA networks such as Sigfox or LoRa – which makes it a particularly flexible solution for heterogeneous applications and enables the consolidation of multiple gateways in a single platform. If server performance and real-time communication are required for Industry 4.0 applications, smart industrial servers based on COM Express Type 7 and offering real-time communication can be implemented via 10 Gigabit Ethernet. Up to 4 GbE interfaces support redundant and therefore fault-tolerant communication for high-availability gateways, while up to 32 PCIe lanes provide the flexibility to connect any type of peripheral. As a result, OEMs already have a wide choice of IoT gateways for use with the new Cloud API. If this selection is not sufficient, they can call upon congatec Embedded Design and Manufacturing Services to produce application-ready designs. By extending the support from standardization initiatives, the Cloud API for IoT Gateways will in future also be supported by other manufacturers.

Since the source code is made available in C++, there is no investment risk even today. Machine, systems and automation providers should therefore evaluate whether they can use the Cloud API to connect their solutions to the cloud, thereby saving valuable time and many lines of code in the development of their specific solutions. ■