UIC-compliant IoT gateway platform opens up new possibilities

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Today, many box PCs are marketed in the guise of an IoT gateway. However, they often lack the gateways required software support and multi-functionality. A new modular, UIC-compliant IoT gateway platform with optional real-time capable virtual machines enables OEMs to reach their goals faster.

Figure 1. The fanless conga-IoT2 gateway platform with up to 8 antennas has an aluminum die-cast housing, which offers ultimate stability and cooling for use in harsh environments and is appropriately shielded for use with multiple radio protocols.

■ The most important task of IoT gateways is to access and process the data in the field in order to make decisions locally and to inform central management clouds as well as neighboring systems about important system states or processes. The same applies to digital signage installations, emobility charging stations, ticket and vending machines, as well as public video surveillance systems and many other complex IoT installations.

The challenge lies in the required flexibility of the logic to be installed. This stems from the diversified installed base with multiple heterogeneous communication channels from the devices to the IoT gateway, and numerous communication options from the gateway towards the clouds or other gateways. Even if considering only the options provided by low power wide area networks (LPWANs), basically all relevant protocols need to be supported: NB-IoT, Sigfox and LoRa, as well as GSM/LTE and, in future, the upcoming 5G. For instance, if a company sets up a local LoRa network to manage parking areas, it is quite possible that the operator wants a GSM/LTE interface to connect to the central cloud, backed up by a Sigfox interface for the event of a power failure or overload. Another alternative is a combination of LoRa and NB-IoT where GSM/LTE is used only for data-intensive system maintenance tasks and upgrades.

When adding radio technologies that span much smaller areas than LPWAN and GSM/LTE to the picture, additional standards come into pla. For instance, if Ethernet cabling for e-charging stations is too costly because of the necessary roadworks and earthworks, ZigBee interfaces must be used to provide fast peer-to-peer network communication between thousands of interconnected devices. WLAN would be far too complex and, depending on the number of WLAN nodes to be passed, also too slow. The list goes on with countless other radio solutions, including Wireless M-Bus for remote meter reading, wireless LonWorks and RF for KNX networks for facility management, or even Z-Wave and Bluetooth/BLE for home automation.

Next, there are the requirements for connecting wired logic. Starting with digital and analog I/Os via serial interfaces and fieldbuses, they go on to include Industrial Ethernet protocols such as EtherCAT, Profibus, Modbus TCP, POWERLINK, Sercos III and CC-Link IE, or even solutions such as CANopen over EtherCAT. Not to forget real-time Ethernet in compliance with the Time Sensitive Network (TSN) protocol according to IEEE 802.1, as well as numerous proprietary service interfaces to existing equipment. All this and much more can be found in the real, not yet IoT-connected world. And to develop new services and increase efficiency, all this must be connected now. Sometimes, there is also a need for fast camera interfaces, such as MIPI CSI-2 for smart camera applications, to integrate situational awareness solutions.

As of yet, there is no ready-to-use system that provides all these functions off-the-shelf. However, recognizing this need, manufacturers like congatec have developed a universally deployable IoT gateway platform that is extremely modular and can be tailored to the specific functional requirements of an OEM. With an aluminum die-cast housing that provides the best in stability and cooling for harsh environments, the platform comes with many features that OEMs can use immediately. Notably, the system offers up to 8 antenna plugs (4x SMA and 4x RP-SMA) and 6x miniPCIe, 1x M.2 and 2x USB 2.0 slots for flexible wireless and wired interface support. OEMs benefit from an IoT gateway platform that can easily connect a wide mix of devices, is pre-certified for a variety of applications, and suitable for the extended temperature range.

OEM-specific customizations of the completely fanless gateway can be carried out in various forms. The spectrum ranges from individual branding of the housing, swapping USB for PCIe slots, or omitting certain functions, to fully customized system designs.

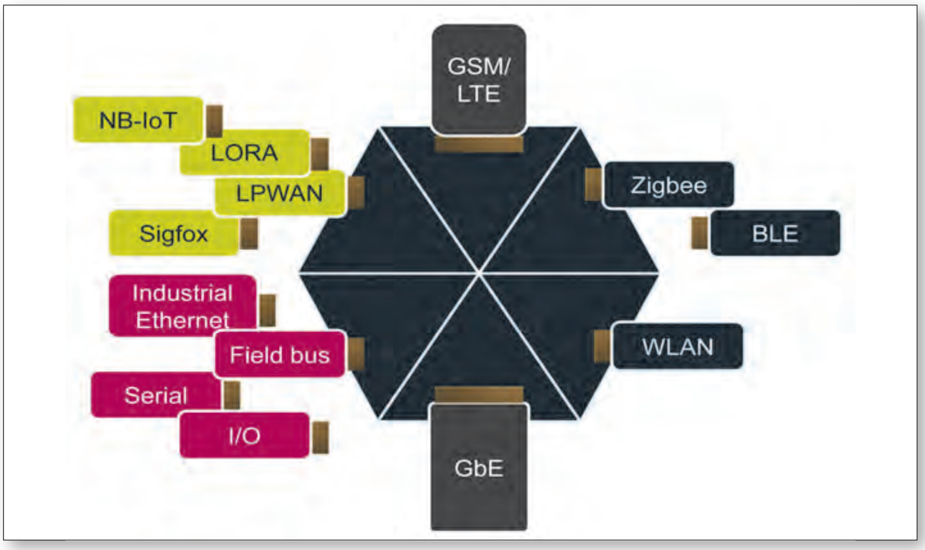

Figure 2. The conga-IoT2 platform for OEM gateways supports a wide range of miniPCIe, M.2 and USB 2.0 based interfaces off-the-shelf.

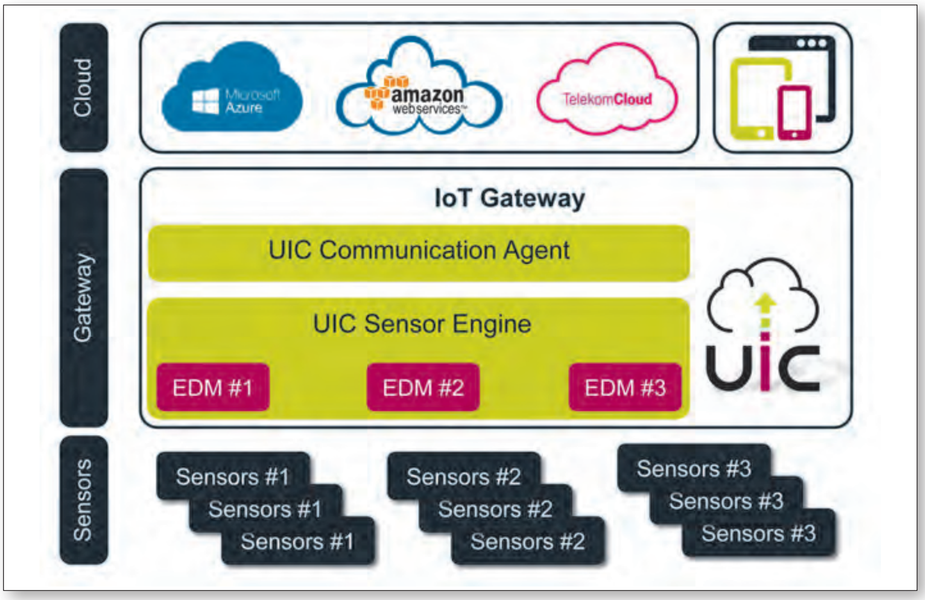

Figure 3. The IoT platform supports SGeT Universal IoT Connector (UIC). It extends the eAPI with Embedded Driver Modules (EDMs) to introduce a generic driver model.

From the moment of first evaluation, OEMs get a platform that is pre-configured and pre-certified for a variety of tasks, which saves design-in costs and speeds time-to-market. For example, different modules were pre-tested in different configurations for WiFi, 3G/LTE, LoRA, Zigbee, Sigfox, NB-IoT and BLE in the conga-IoT2 gateway. In addition, the system design was appropriately shielded for use with different radio protocols and subjected to extensive testing to effectively eliminate interference.

This means the key conditions for using heterogeneous radio technologies in a single system have already been taken into account in this platform design. In addition, the conga-IoT2 gateway also supports the Universal IoT Connector (UIC) software standard that the SGeT introduced at embedded world 2018 and for which proprietary congatec Cloud API for IoT gateways provided an essential template. The UIC is an important milestone in embedded computing as it enables any embedded hardware that has been developed in accordance with eAPI to exchange data between embedded devices and a cloud-hosted infrastructure using MQTT or XRCE. This is a truly universal approach with the advantage that the many proprietary IoT offerings can now be standardized. The UIC is based on two main pillars: the Embedded Driver Modules (EDMs) for hardware identification, security and device mapping; and a communication agent to handle and decouple communication. This will make it possible to connect the conga-IoT2 gateway and its associated peripheral networks with the more than 500 cloud services that are available worldwide. The UIC architecture defines key components to overcome the barrier presented by proprietary implementations of sensor data collection, and to publish and visualize the data securely in a cloud server infrastructure.

The UIC standard realizes this in two steps, the first of which is to cover hardware support. For this purpose, the eAPI is expanded with EDMs to provide an IoT-enabled hardware API. The EDMs introduce a generic driver model to neatly integrate aspects not covered in the eAPI. The second step is the creation of a communication agent to connect to different cloud services such as Microsoft Azure, Amazon Web Services, SAP Hana and many more, as well as the authentication of devices in a cloud application.

Future steps are aimed at complementing the existing software to increase the number of available functions. Improvements in data security and authentication are further steps that are made possible by the UIC standard. Adhering to the principles of interoperability and interchangeability, as well as scalability, makes the UIC architecture a very lean, versatile and open approach that helps to enable new technologies while minimizing the risk of investing in the wrong technology.

In cooperation with Real-Time Systems GmbH, the offering for the new conga-IoT2 platform will be expanded to further simplify the use of embedded computing technology even under the very demanding conditions of a universally deployable IoT gateway. The UIC that connects the eAPI to the hardware as well as each connected wireless network and other peripherals can be made available in virtual machines. This makes such installations relatively simple to encapsulate and port to other hardware platforms.

Currently, the conga-IoT2 platform can be equipped with the high-performance conga-QA5 Qseven modules based on the low-power Intel Atom, Celeron and Pentium processors (codename Apollo Lake/5W to 12W), which makes the platform very powerful and highly scalable. Up to four cores can host up to four virtual machines. Even more powerful designs based on COM Express modules with up to 16 cores can also be supported. The modules for the extended temperature range from -40°C to +85°C support the IEEE 1588-compliant Precision Time Protocol, which can deliver highly accurate synchronizations. All modules support Microsoft Windows 10, including the Microsoft Windows 10 IoT versions, as well as current Linux operating systems and work directly with the RTS hypervisor from Real-Time Systems. ■