CANopen and the Internet-of-Things

The CANopen Internet-of-Things (IoT) specification is intended for embedded CANopen networks without IoT connectivity. It specifies to access local and remote CANopen networks using a CANopen IoT gateway supporting web protocols and communication services.

(Source: Adobe Stock)

In many application fields, specifically-designed cell phone or tablet apps enable users to perform remote control and maintenance of air conditioning and heating at home or at the office. Those apps also allow to monitor condition of automated systems' components to know, when the components have to be replaced to prevent performance deterioration. This means there is a demand to provide an access from the web-based monitoring or control unit to the embedded sensor with serial industrial network interface and vice versa. This is fulfilled for the networks supporting internet protocols. This access may invoke cloud connection or rather use of the cloud for remote data processing or distribution. But what about embedded networks without embedded internet protocol controllers?

The CAN in Automation (CiA) Special Interest Group (SIG) CANopen IoT designed specification CiA 309-5. It allows CANopen embedded network users to access their local and remote CANopen networks using web protocols and communication services such as Restful HTTP, Websocket, and MQTT (coming soon).

Let us take a look on what is special about CANopen IoT (Internet-of-things). One of the challenging issues is that the end user has typically no detailed information on the serial industrial network interface. Usually, the serial industrial network system is totally transparent for the end user. Nevertheless, serial industrial network systems often require geographical addresses such as device identifier, or device parameter addresses to allow an access to a specific network participant or a dedicated function. From anywhere in- and outside the embedded network, such a pool of harmonized-functions shall be accessible. Independent of the hardware platform and communication technique, the end user can rely on and control the harmonized functionality, without any knowledge on serial industrial network details. CiA suggested therefore using logical addressing as system-wide and technology-independent identifiers for CANopen elements. This addressing method allows functions such as data monitoring and process control, to be requested by users without knowledge of CANopen. Surely the system itself has to be pre-configured by the technician having CANopen know-how.

Furthermore, CiA members intend to offer more confortable diagnostics by providing an enhanced, harmonized, visualization. The embedded devices provide their diagnostic data in a certain manner. This requirement may be solved by providing the entire visualization directly on the embedded device. Therefore any industrial terminal, tablet, cell phone, remote desktop, etc. might serve as human machine interface for diagnostic services. ▷

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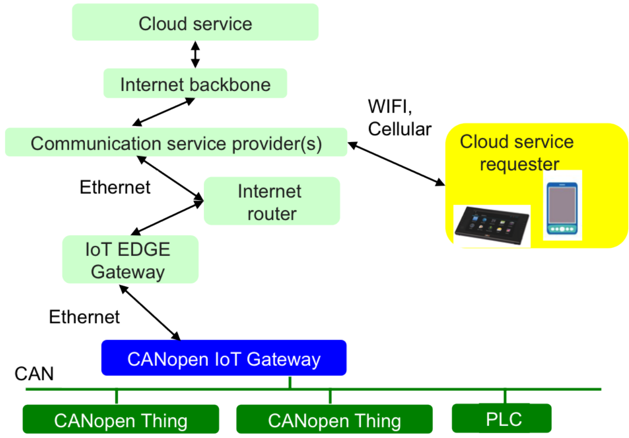

Figure 1: CANopen IoT cloud connection path example (Source: CAN in Automation)

By passing the limiting central host controller, this would open entirely new possibilities for (remote) diagnostic and maintenance. But providing its visualization is typically very memory demanding. Small sensors, which do not have the required memory resources, could provide their visualization using a gateway with HTTP and Websocket protocols with broadband Internet connection.

CiA members are currently working on this challenge for CANopen users. The SIG CANopen IoT provides a harmonized solution for the above mentioned challenges. On application level CiA intends to offer function-oriented services. Using these new services the application-specific, harmonized, functions can be initiated, monitored, and controlled. The functions are CANopen communication services and parameters mapped with logical addressing into Restful HTTP or Websocket. The functions are requested/collected either straight or through the cloud using an existing Internet infrastructure. The requester/collector is the web-based application while data provided is the application server located in the CANopen IoT gateway. For example the CANopen IoT gateway may either tunnel HTTP requests/responses straight to the web app or through the cloud. In case of the cloud, the communication path has to comprise the edge gateway having all tunneled data prepared for cloud-conform processing. The example of the local communication would include a CANopen IoT gateway, which contains the IoT and CANopen functional parts and manages the interaction between them. The CANopen functional part communicates with the CANopen embedded network while the gateway provides the data obtained there to the other gateway functional parts. The IoT functional part prepares embedded CANopen data in JSON format and maps it into the Restful HTTP request/response accordingly for the transmission to the CANopen network/web-based application.

Since CANopen process data or diagnostic information may occur upon an event and thus data is dynamically updated for the submission to the web, the bidirectional communication may be optimized by use of a Websocket protocol. A Websocket session is established by the web app and once CANopen data occurs in the CANopen functional part, it is processed in the IoT part and is submitted to the web app. In this case, the web app does not need to poll HTTP requests for this data to the gateway. ◀

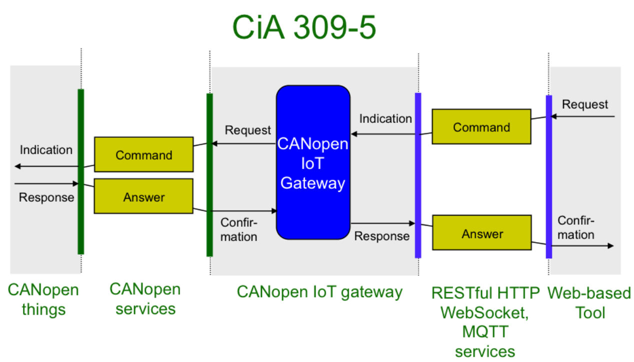

Figure 2: CANopen IoT gateway communication (Source: CAN in Automation)

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