New COM Standard SMARC 2.0 starts with Apollo Lake

By Christian Eder, congatec

At the beginning of June, the Standardization Group for Embedded Technologies (SGET) released the new SMARC 2.0 specification. congatec is offering its first modules for this form factor equipped with the new Intel Atom, Celeron and Pentium processors developed under the code name Apollo Lake.

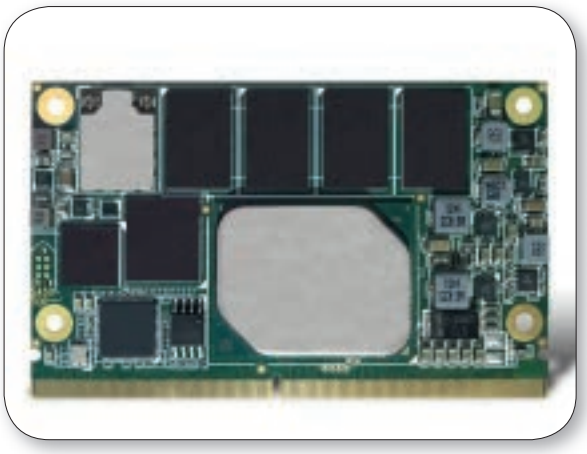

Figure 1. The conga-SA5 Computer-on-Module features Apollo Lake processors and provides optional onboard WiFi and Bluetooth (BLE).

■ With the revision of 1.1 to 2.0, SMARC has evolved from a specification that was partially outdated and rather arbitrary due to the Alternate Function Blocks to a basically new standard with a clear profile and unique positioning. With its numerous graphics, camera, sound, network and optional wireless interfaces, the new specification is suited for IoT-enabled multimedia platforms as well as many other graphics-intensive low-power applications. SMARC 2.0 positions itself exactly between the two well established module standards, Qseven and COM Express. Compared to the Qseven standard, which allows low-cost entry into the world of computer modules and integrates various x86 and ARM low-power processors for the process and field levels, SMARC offers more interfaces – in particular, more multimedia interfaces. Compared to the high-performance COM Express modules that make up the COM performance class, SMARC 2.0 is positioned in the low-power processor segment and also supports fewer interfaces than COM Express.

SMARC 2.0 provides predominantly modern serial I/Os as well as video and network interfaces, making it a choice for many multimedia and graphics-oriented IoT applications (Internet of Things). To make life particularly easy for developers of such applications, congatec also offers optional WiFi and Bluetooth in compliance with the M.2 1216 interface specification, thereby rounding off the interface portfolio of SMARC 2.0 modules for IoT designs. Applications can be found in digital signage systems, commercial streaming clients, industrial thin clients and HMIs, all kinds of GUI devices, POS systems, professional gaming machines, infotainment platforms, as well as IoT gateways.

With 314 pins, the SMARC 2.0 connector – which is also used in the MXM 3.0 graphic card standard – can support up to four video outputs thereby affording SMARC 2.0 a strong multimedia orientation. 2x24-bit LVDS/eDP/MIPI DSI plus HDMI/DP++ and DP++ are further provided, plus 2x MIPI camera interfaces and two audio interfaces over HDA and I2S. New features include additional USB ports for up to six USB, including two USB 3.0, a second Ethernet port for segmented IoT connection or line and ring structures, a fourth PCI Express Lane and one ESPI. Discontinued is the support for the obsolete parallel camera and display interfaces, external eMMC, SPDIF, one of the three I2S channels, and the Alternate Function Blocks. The latter was perceived as too open by many vendors and customers, since it allowed manufacturers to implement whatever they wanted and no standardisation efforts were made prior to the SMARC 2.0 specification. This is also why SMARC 1.1 modules offer very little design security if the module interfaces are executed on these pins.

SMARC 2.0 offers a large selection of internal and external graphic interfaces. For the connection of external screens two Dual Mode DisplayPorts (also called DisplayPort++ or DP++) are provided. The advantage: Systems supporting DP++ functionality for external displays can be controlled via DisplayPort, HDMI and even VGA signals. SMARC 2.0 is also very flexible and forward-looking with regard to the control of internal displays. The interface most commonly used today is LVDS. However, thanks to the two 24-bit data channels it is also possible to control panels with very high resolutions. In addition to the display signals, a complete set of support signals is available. As an alternative to LVDS, SMARC 2.0 modules also provide two independent embedded DisplayPort (eDP) signal sets to control two internal panels. A third, forward-looking alternative is the option to control panels via MIPI DSI (display serial interface) as specified by the Mobile Industry Processor Interface Alliance. Displays that support MIPI DSI are mostly used in smartphones. While generally smaller, these displays still feature high resolutions and are produced in very large

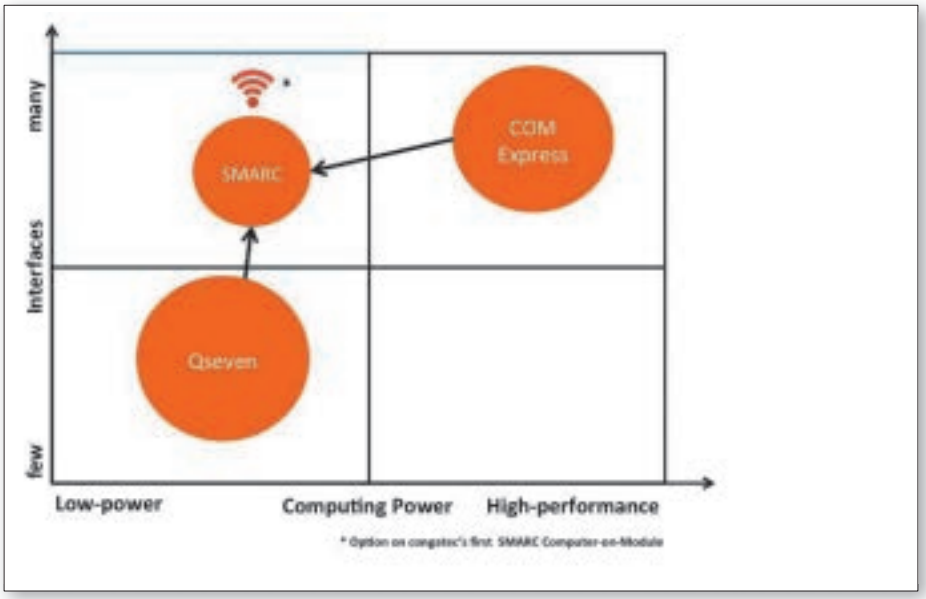

Figure 2. SMARC 2.0 fits between COM Express and Qseven in the competitive landscape.

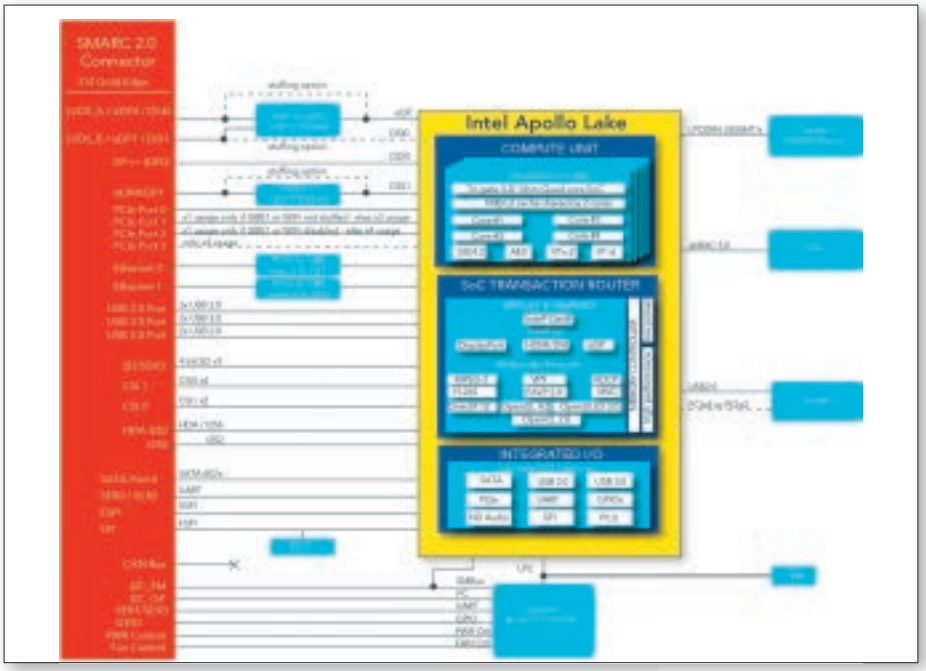

Figure 3. Block diagram of the conga-SA5 including Intel Apollo Lake processor

quantities. Like eDP, MIPI DSI consists of fast serial differential wire pairs, but uses different data rates and protocols. Two Gigabit Ethernet ports provide a particular advantage for IoT or Industry 4.0 applications, because no additional hardware is required to realize two separate network segments for the logic and the security functions. The two GbE ports are handy to implement cable-saving line and even redundant ring topologies. The SMARC 2.0 connector also provides SDPs (software defined pins) for both Ethernet ports. These configurable I/Os can be used for hardware-based implementation of the Precision Time Protocol (PTP) in accordance with IEEE 1588, thereby achieving accuracies in the nanosecond range.

Today, wireless connectivity is a must even for demanding automation applications. In recognition of this trend, the SMARC 2.0 specification defines a dedicated area on the module for the placement of the necessary miniature RF connectors for high frequency signals (short U.FL connector).

All SMARC 2.0 modules that require antenna connections for wireless interfaces implement these connectors in the same position to ensure consistent interchangeability. Congatec modules additionally provide the appropriate logic interfaces, such as WLAN and Bluetooth, via the M.2 1216 interface specification. This widens the choice of radio protocols and gives maximum flexibility for

customizing end-user applications. The feature set is a good fit for the new Intel Atom, Celeron and Pentium processors. The first congatec SMARC 2.0 module integrates with the brand new processor generation launched in late October. The new module not only sets new standards in terms of low-power processor performance but also impresses with pre-integrated wireless interfaces supporting up to 433 Mbit/s of WiFi, Bluetooth Low Energy and, as an additional add-on upon request, NFC. When coupled with the dual GbE interfaces, any demands from current IoT-enabled embedded computing devices can be met. Developers of SMARC 1.1 devices can request a free upgrade check from congatec that specifies the required design effort. The new SMARC 2.0 Computer-on-Modules (conga-SA5) are equipped with the Intel Atom processors x5-E3930, E3940 and x7-E3950 for the extended temperature range of -40°C to + 85°C; or with the Intel Celeron N3350 and quad-core Intel Pentium N4200 processors. All versions integrate the latest Intel Gen 9 graphics for displays that support up to 4k and can be controlled via dual channel LVDS, eDP, DP++ or MIPI DSI. The modules feature up to 8 GB LPDDR4 RAM with up to 2,400 MT/s. Thanks to the M.2 1216 interface, wireless IoT connectivity becomes an optional standard feature of the new SMARC 2.0 modules.

Depending on the requirements of the application, connectivity modules can be soldered onto the module with 2.4 or 5 GHz WLAN b/g/n/ac and Bluetooth Low Energy (BLE). The new SMARC 2.0 modules further provide 2x Gigabit Ethernet with hardware-assisted real-time support for the Precision Time Protocol (PTP). For highly integrated designs, the modules provide up to 128 GB of flash memory via the powerful eMMC 5.0 interface. Compared to eMMC 4.0, this doubles the data rate to 3.2 Gbit/s, thereby shortening boot and load times. Six Gbps SATA and SDIO interfaces provide yet additional memory space. Generic extensions can be implemented via four PCIe lanes, two USB 3.0 and four USB 2.0; and a further two SPI, four Serial and two MIPI CSI camera interfaces are provided. Audio signals are transmitted via HDA.

The new modules support Microsoft Windows 10, including all MS Windows 10 IoT distributions and Android for mobile applications. To make entering the world of SMARC 2.0 even easier, congatec will soon be complementing its SMARC 2.0 ecosystem with a starter kit and a comprehensive set of accessories. congatec's comprehensive Embedded Design and Manufacturing services for application-specific carrier board and system designs further simplify application development. ■