Case Study: Developing a Single Board Computer with Renesas RZ/N1D

As the Ethernet technology started taking over the traditional Fieldbus communication it became clear that the industrial communication will no longer be a differentiator, but a "must-have" commodity. One of the clear requirements from the customers is easy implementation of various industrial Ethernet protocols with unified API towards the application, so they can focus on what they know best – building the application.

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Deep Know-How in Embedded Development and System Integration

Emtrion GmbH from Karlsruhe, Germany has been providing embedded development services for the last 20 years. Moreover, they manufacture own developed System on Module (SOM/COM) and Single Board Computer (SBC) with own board support packages (BSPs). Emtrion guarantees a long term availability of up to 15 years, which is a key requirement for industrial, medical and railway applications.

The Challenge

The growth of the industrial Ethernet technologies in past years pushed Emtrion to investigate the business opportunities in this area. Using the know how in development of single board computers, Emtrion needed a hardware platform which offers enough performance and memory for Linux based development on one hand and an industrial Ethernet functionality on the other hand with support for the most frequently used industrial Ethernet protocols like EtherCAT, CANopen and PROFINET. However, since Emtrion does not have industrial Ethernet know-how in-house, they needed a partner to outsource this task. Further requirements were small package, low power consumption, flexibility for connectivity and of course, an affordable price.

The available multiprotocol SoCs on the market offer very complex software environment that is not unified across various industrial Ethernet protocols. Furthermore, there is limited or non-existing development support, which impacts significantly the development time.

The Solution

Renesas is a market leader in industrial Ethernet and offers a wide portfolio of silicon solutions. With the performant Dual Arm® Cortex®-A7 core with Linux support, the Renesas RZ/N1D family serves as the basis for the development of the Single Board Computer. The chip has an integrated LCD controller for a simple display connectivity as well as an integrated 5 port Gbit switch which supports multiple industrial Ethernet protocols. The DDR2/3 controller allows up to 16 Gb address capability which is more than enough for this application. Renesas is also known for long term availability, which reinforced our confidence in RZ/N1D.

The personal and direct support from Renesas helped us keep our development within the plan. We outsourced the development of the communication interface to the company Port because of their long time experience in industrial Ethernet and their knowledge of the Renesas platform. The personal and direct communication with Renesas and Port was quite straightforward and allowed us to develop our product in less than 4 months.

Ramona Maurer, CEO Emtrion:

Renesas is the right partner for industrial applications. With the long product availability they support the long product life cycles in this market. Renesas helped us start faster, providing development boards as well as the first samples of the RZ/N1D. The preliminary and limited documentation was compensated from fast reaction of the Renesas support team. RZ/N1 ecosystem is fully developed and numerous Renesas business partners provided the missing communication capabilities for our products.

RZ/N1D Capabilities

High performance: The Arm® based multicore architecture allows even more demanding applications running on the Cortex®-A7 core, while the Cortex®-M3 core completely takes over the real-time communication.

Flexible software environment: Currently two operating systems are available for the Cortex® A7 core.

1. Linux with the respective Yocto recipes to build the Linux, U-Boot and root file system.
2. ThreadX - Express Logic's advanced Real-Time Operating System (RTOS) designed specifically for deeply embedded, real-time, and IoT applications.

CODESYS® is the leading hardware independent IEC 61131-3 development system for programming and creating controller applications. Among others it supports industrial Ethernet master stacks for EtherCAT, EtherNet/IP, Sercos, CANOpen and PROFINET.

Flexibility in the Ethernet communication: the 5 port managed switch supports all major industrial Ethernet protocols as well as advanced functionalities like QoS, IEEE 1588-2008, VLAN frames, Cut-through, etc. Various protocols have already been ported directly over a single abstraction layer (OSAL). This allows easy implementation and simplified switch between these protocols, with minimal impact on the application.

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