

Integration of PROFINET Protocol Stack into the RTAndroid Platform

(Master thesis)



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Topic

PROFINET is a real-time capable communication standard widely used in industrial control scenarios and field devices. It is standardized as part of IEC 61158 and is continuously developed by the PI International Group.

The major benefit of PROFINET over other field bus systems such as Modbus is full compatibility with the ubiquitous computer networking standard Ethernet (IEEE 802.3). This allows for the use of cost-efficient networking equipment instead of requiring specialized hardware and enables communication utilizing internet protocols such as TCP/IP to coexist with control data on the same network.

RTAndroid is an extended version of the Android platform that adds real-time capabilities and is developed at Informatik 11 – Embedded Software. It can be used for reliable process control in industrial environments.

State of the Art

Multiple PROFINET communication stacks from vendors such as Moxes are available for integration into custom operating systems. As commercial solutions however, concerns about pricing and limited hardware compatibility make them unsuitable for use in research projects.

Objective

In the RTAndroid platform, hardware interfaces such as digital outputs are currently only accessible over a custom communication protocol and a USB Field Device Adapter. Recent research has enabled the use of RTAndroid on the low cost ODROID XU4 development board featuring an Ethernet port. The objective of this work is to utilize the Ethernet peripheral on the ODROID to interface and control commercially available PROFINET-enabled Field Devices. As the focus of RTAndroid is on the use as an I/O-Controller, this will entail only a partial implementation of the whole PROFINET Protocol Stack.

Parts of the PROFINET communication are subject to stringent timing requirements that might require changes to the Linux kernel to meet. Therefore the implementation will be primarily in C++, with JNI and Java high level components to enable interaction with Android applications.

Approach

The first step is to research the components and protocols that make up the PROFINET communication standard. This will allow planning the further implementation effort.

In the second step, the necessary protocols and interface to the Ethernet port are implemented. This includes changes to ensure timing requirements for real-time communication over Ethernet are met.

The third step is to integrate the developed communication stack with the remainder of the RTAndroid platform and expose PROFINET Field Devices for use in Android applications.

The final step is to evaluate the work with existing PROFINET hardware. For this purpose, a fully certified PROFINET Field Device running a commercial stack is used.