«Industrial Grade Linux»

Research and development project proposal

Open Source Software and Linux are widely used in our days in a broad range of applications, including desktop and server computers, network infrastructure, handheld devices, automotive telematics and many others. Due to openness, scalability, high quality of code, wide range of supported platforms and peripherals Linux is a perspective candidate for almost any kind of application.

However, in some fields Linux is not yet widely accepted, mostly due to high level of specialization and traditional approach of system developers. Example of such areas would be:

- automation and control
- safety critical systems
- medical applications

In order to advance Linux for these areas and especially in the area of automation and control, some additional research and development is necessary which is the subject of the following proposal.

Ultimate goal of the project is to develop a solid understanding for current state-of-the-art of «Industrial Grade Linux» and to identify areas, where improvement is necessary. As a result, a solid embedded Linux distribution (based on Slind) shall be provided with these improvements implemented. The following main stages can be identified for the project:

1. Prepare an analysis of the topic to identify relevant technologies and related Open Source Software tools

2. Develop a first version of Linux distribution by integrating existing tools and frameworks for industrial / building automation into Slind

3. Identify emerging automation and control technologies, which are not yet represented by Open Source solution and perform development in these areas

All these stages are dependant on each other and shall be executed in order, however stage 2 and 3 could be parallelized. More detailed description of each stage is provided below.

Part 1. State-of-the-art report for Industrial Grade Linux

Scope:

The study shall answer the following questions:

- Which technologies constitute a basis for a modern automation and control system (including building and plant automation)? Both host and device side technologies shall be covered.

- How well these technologies are represented by Open Source Software? List of projects, covering these technologies shall be provided, including at least description, target area, maturity and applicability.

- For the areas, which are not yet covered by Open Source Software: what is the area of application, importance, perspectives and how difficult it would be to implement it?

From the technologies perspective, at least the following topics shall be covered:

- SCADA systems

- Communication protocols

- Human Machine Interface (HMI)

- Modeling and development

- Process control

- System features like real-time support, reliability, etc.

This study shall provide hands-on experience, i.e. not only information obtained from external sources, but also results of direct tools application. Comparative analysis shall be provided when necessary and possible, for example in situations, when several tools with similar functionality exist. From the point of view of protocols, the following are the subject of special interest:

- BACnet

- Profibus/Profinet

- HART

- ZigBee

- X10

- ZWave

- CAN

Quality of results, obtained on this stage of project, will be a basis for further steps. For example, if it will be determined, that industrial automation area provides more solid base for showcase, this area shall be selected on step two.

Results: *State of the art report*

Time frame: *TBD*

Budget: *TBD*

Part 2. Industrial Grade Linux distribution based on Slind

Scope:

After successful completion of first part of this project, it would be necessary to build up a Slind based Industrial Grade Linux distribution for end devices (controllers), using the most perspective components and technologies, identified on the first step, as well as application example, demonstrating possibilities of Linux-based automation.

Proposed application examples (showcases):

A) Industrial Automation

1. Controller Device, which shall be an embedded device, implementing process control algorithms and communicating with a Management Station

2. Management Station, implementing basic SCADA functionality on Linux and working with Controller Device

B) Building Automation

1. Network of simple controller devices (no graphical user interface), running Linux and solving typical home automation tasks (for example light control)

2. Management station, providing control interface for devices on the network and communicating to these devices using specified protocol (like X10 or ZigBee)

The distribution for controllers shall be based on Slind (www.slind.org) and provide basic functionality of HMI, communication, process control (ex. Motion control) and data acquisition. All significant relevant components (industrial or building automation) shall be integrated into Slind independently on showcase selected.

For management station there is no preference to any particular Linux distribution, however all selected components shall be distributed in source code without any licensing fee.

Results: *Showcase with all source code and documentation*

Time frame: *TBD*

Budget: *TBD*

Part 3. Advanced Linux for automation and control

TBD