Ethernet communication powers the steelworks

A PROFINE T controller stack implementing Industrial Ethernet communications is the basis of an effective process control system for the steel manufacturer SSAB. The technology has provided an ability to deploy very large networks consisting of up to 150 field devices, including a number of drives, and operate at cycle times of 8 to 32 milliseconds even without exploiting the system’s full performance potential.

SSAB’s requirements on the implementation included the connection of Preview to the field devices via a standard Ethernet interface and a tight integration of the PROFINE T controller stack. For this reason, they viewed a pure software solution as the only viable option. Another item on SSAB’s wish list was the possibility to configure PROFINE T using Preview’s own tools in order to achieve a high level of integration. The use of a PROFINE T controller stack met all these requirements, and SSAB quickly decided to go for this solution.

Use of PROFINE T controller stack

The PROFINE T controller stack was integrated into Preview during a working session. Adaptation to the special development and runtime environment took only one day, as the stack selected has been specifically designed and developed to allow quick porting. The architecture provides a porting layer that includes all the program parts that are specific to the processor, memory and operating system. In this way, no adjustments need to be made to the code of the PROFINE T controller stack itself. Once ported to Preview, any subsequent changes to the runtime environment, such as the use of a newer Linux kernel, can be made simply by recompiling and binding the protocol stack to the current development environment.

Preview features an integrated tool for the configuration of the PROFINE T network. The tool makes use of the descriptions of the individual field device characteristics, which are provided in the respective GSDML files. On completion of the configuration, the definitions made for the individual devices are saved to XML files. These files are then read and converted to the format required by the PROFINE T controller stack when the Preview runtime system is started. The detailed interface documentation ensures smooth interaction with external configurators.

During tests of the implementation, a high network load was observed after the PROFINE T communication started. This was due to the great number of field devices that the SSAB application used in the PROFINE T network, and that it initially transmitted a very large number of broadcast and multicast messages because of the respective specification in the PROFINE T standard. The solution was to use a special configuration interface enabling the implementation to influence the communication load in such a way that network load is minimized and the field devices quickly begin data exchange after the PROFINE T communication is started. Some devices also showed interoperability problems resulting from the implementation of different versions of the PROFINE T standard. The logging functionality integrated in the protocol stack proved very useful here. It can be connected directly to the respective interface of the operating system, allowing quick and easy identification and solution of problems that have occurred.

Steelworks expansion program

To expand the steelworks in Mobile, Alabama/USA, SSAB planned to build a new plant for the processing of sheet steel based on the smelting of scrap metal in an electric arc furnace. The new plant was to be the first SSAB plant to use PROFINE T as the main communication protocol. This decision had already been made before an executable PROFINE T implementation was even available for Preview, and was considered a major challenge. Today, ten controllers successfully operate using PROFINE T in the Mobile steelworks to control a total of more than 650 field devices, including Siemens drives and ET200 modules. Some of the networks used are very large consisting of up to 150 field devices, including a number of drives. These networks operate with cycle times of 6 to 30 milliseconds, even without exploiting the full I/O potential. The Preview platform uses a computer with x86 architecture, a 2.16 GHz processor, 4 GB RAM and an Ethernet controller on the mainboard. The current operating system is Linux in kernel version 2.6.33.7 with real-time capabilities.

“Softing’s PROFINE T stack meets all our requirements,” said Robert Karlsson, head of development at SSAB. “The cooperation with Softing