noFilis CrossTalk 2.0 as Device Management Solution

Experiences while integrating RFID hardware into SAP Auto-ID Infrastructure

ABSTRACT
Intelligent objects, results of the modern RFID technology, tend to be used extensively in business contexts to improve processes like goods receipt, goods issue, logistical tracking of returnable transport items, and kanban. Those RFID-enabled processes need large support from existing Enterprise Resource Planning (ERP) systems. Therefore this paper evaluates software systems which help integrating RFID technology into existing ERP systems. To this end, we use an exemplary kanban scenario to show how the device management software noFilis CrossTalk fits into common middleware like the SAP Auto-ID infrastructure. Finally we evaluate noFilis CrossTalk and give a short outlook.

1. INTRODUCTION
Radio Frequency Identification (RFID) is a technology that supports automatic identification of objects, without the need of visual contact. Using RFID in business processes, entities such as products or shelves can be understood as intelligent objects, leading to a significant increase in efficiency, transparency and/or innovation of business processes [5, 2]. Based on an exemplary scenario, the following chapters will outline the implementation of a process, specifically the configuration of RFID systems and their connection to back-end systems. In conclusion, the results of this implementation and the utilized systems will be evaluated.

2. BACKGROUND
The technological basis for understanding the implementation chapter is provided in here by introducing a concrete architecture (figure 1). noFilis CrossTalk 2.0 is used as RFID Device Controller. Its purpose is to preliminary filter RFID read events and the forwarding them to the SAP Auto-ID Infrastructure (AII) 5.1. The task of the AII is to control RFID-supported processes and forward meaningful events to connected ERP-systems.

Initially, a tagged product is moved into the range of an RFID reader, which represents the beginning of the message processing in the RFID system. In this case, a read event is created by the reader device, which is sent to CrossTalk. CrossTalk itself is divided into agents that are directly connected to the reader devices, and a central CrossTalk server. To prevent stressing the server with a huge amount of data traffic and redundant read events, the individual agents at the reading devices already filter duplicate read events. The last step is the forwarding of filtered data from the CrossTalk server to the AII, which processes this data by means of predefined rules and then executes certain activities that represent the business logic.

3. SCENARIO IMPLEMENTATION
3.1 Exemplary scenario
For the exemplary scenario we choose an established process of the domain of Supply Chain Management which is a kanban process. We consider two companies: company A, an auto manufacturer, is placing orders at company E, an engine manufacturer, one a threshold is reached. Orders are created during a Kanban-based subprocess, which triggers the reordering of engines that have been installed. After the production of an ordered engine from company E, the engine is being commissioned with an RFID tag and an EPC that is assigned by the AII. After packing the engine, it is loaded and sent to company A. At arrival, A unloads and unpacks the engine to use it directly for production purposes. Figure 2 shows that during the entire process every change in state of the manufactured engine will be registered in the AII by means of various RFID readers. Thereby changes in state of the order are realized in back-end systems, which also allow specific actions such as sending an Advanced Shipping Notice (ASN).
3.2 Crosstalk

To implement the given scenario, the architecture shown in figure 3 has been designed. It is assumed that both companies involved use CrossTalk agents to manage their RFID devices and that the generated data is processed by a mutual CrossTalk server as well as a single Auto-ID Infrastructure. The next step is to develop a process of CrossTalk services [3], which can be arranged in nearly arbitrary orders by connectors. For this purpose, a subprocess (noFilis CrossTalk speaks about micro processes) must be developed for the server and each of its agents. The deployment of these processes can be directly done by conducting several configuration steps in the central CrossTalk web interface, because the server engine knows the IP address of the CrossTalk clients.

The service PML Server which is running in a micro process on the CrossTalk server, centrally manages the connection from CrossTalk to the AII. Messages are also buffered at that place prior to their forwarding to the AII. PML Server encapsulates a HTTP listener and server to receive PML messages from CrossTalk agents and forward them to AII. Therefore, a listener ID can be defined for the service to get an URL for agents.

Figure 4 shows the arrangement of necessary services and devices with the example of the CrossTalk agent of company A. The used services are now explained briefly:

- **Read Point** Triggers event-based or permanently a reading-process. Sets the device ID (which can be defined for each antenna of a given RFID reader) required for PML messages to the AII.
- **Tag Filter** Tag duplicates are filtered to save bandwidth and control the data volume.
- **PML Encoder** Converts RFID read events into a PML report. If commands for the AII (like IN, OUT, WRITE) are required and are not supported by devices directly, these can be defined here. Besides, a name for given device controller should be defined here for PML message (e.g. CROSSTALK) and message processing in AII.
- **HTTP Sender** Sends PML reports to the Crosstalk Server whereas the URL of PML Server must be defined here.
- **Message Cache** Caches PML reports if HTTP Sender is unable to deliver a report to Crosstalk Server because of a connection loss.

3.3 Auto-ID Infrastructure

Implementation of the exemplary scenario requires many different configuration steps to be made in the AII. First of all, a basic configuration of the AII has to be made, enabling the AII, for example, to communicate with CrossTalk. This basic configuration also contains the creation of a logical system, the definition of ID types, number ranges and company prefixes, the setup of HTTP services for the connection to ABAP systems and Crosstalk as well as the creation of a product hierarchy.

Following the configuration for each subprocess takes place: Whereas the basic configuration can be understood as the...
Figure 4: CrossTalk process in the agent of the auto manufacturer

initialization of company data, the process implementation represents the actual process logic. The AII has to be set up how to react on receiving read events from a specific reader. The particular process configuration steps that still remain are the creation of number ranges, the declaration of devices and locations as well as the definition of conditions, rules and activities [4].

4. EVALUATION OF NOFILIS CROSS TALK

Referring to the evaluation criteria defined by TU Darmstadt [1], we share experiences made with CrossTalk using this evaluation criteria.

Customizability. Out of a certain number of services it is possible to create individual micro processes in CrossTalk. This facilitates the system’s adaptation to the particular environment of the company, which leads to a flexible and configurable RFID middleware.

Scalability. CrossTalk is designed as a client/server architecture, in which an arbitrary amount of CrossTalk agents can be installed to communicate with the central CrossTalk server. Thereby every agent can in turn manage multiple RFID devices. In that way the system can be expanded by new RFID devices without problems.

Integration into AII. Specific services (e.g. PML Server) for communication with the AII are already predefined in CrossTalk. Therefore, the integration into the AII is easy to be set up.

Hardware support. Because of a missing standard for the connection to RFID reader devices, CrossTalk offers proprietary RFID device drivers. For the current CrossTalk version 2.0 the supported devices have to be integrated into the network and must not be connected via the mostly available serial port, for what a control computer or specific hardware adapters would be necessary [5]. Besides, tag writing is only fully supported for RFID printers, combined RFID readers/writers can have problems with this task.

Administration interface. CrossTalk has a clear, intuitive web interface that is accessible through the network.

Commitment to standards. Both the PML and the ALE standard are supported by corresponding services, which enable CrossTalk to be connected not only to the AII but also to other RFID middleware.

5. SUMMARY AND OUTLOOK

Not much time has passed yet, since RFID technology has taken its first steps into the business world. Software packages like the SAP Auto-ID Infrastructure and noFilis CrossTalk now enable the integration of RFID into business processes. Nevertheless we can say that the integration and configuration of the RFID middleware and the integration in ERP-systems on the one hand is not just plug-and-play and on the other hand is crucial for the success of a RFID implementation. So, this task must not be underestimated in RFID implementations.

6. REFERENCES