An efficient distributed discovery service for EPCglobal network in nested package scenarios

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ABSTRACT

Today, obtaining and managing all the information about supply chains are key tasks for the improvement and progress of business and commercial strategies. Ubiquitous information technologies, like RFID, can be used for tracking and tracing of materials and items as they move through the supply chain. In this scenario, EPCglobal consortium provides an architecture framework for collecting, sharing and accessing information about EPC-tagged objects. One of the key components of EPCglobal architecture required to implement track and trace capabilities is the discovery service (DS). Although DS is still under development, it is expected that DS will be implemented by a centralized architecture. Another key component is the object name service (ONS), which is used to resolve the Internet addresses of the EPC information services (EPCISs). According to EPCglobal specification, ONS is based on the traditional Internet DNS. In this work, an alternative solution to implement ONS and DS services is presented. Both services are based on a distributed architecture, which eliminates the disadvantages and weaknesses of the centralized implementations of ONS and DS. In addition, the proposed distributed EPCglobal network architecture allows item level track and trace capabilities even if item visibility along the complete supply chain is not possible. In previous works, other authors always assume complete item visibility. However, in many industrial fields where items are packaged to facilitate the transport and distribution, this supposition is not true. Both EPCglobal network solutions are analytically compared, concluding with the benefits of using the distribution solution.

1. Introduction

During the life cycle of any goods, suppliers of material, as well as manufacturers of intermediate and final products, distributors, retailers, and final customers are interconnected due to the exchange of products and information. The term supply chain refers to all these business elements and the relationship among them from the origin to the final distribution of the product to the customers. Since this term was defined at the beginning of the 1980s, a lot of research work has been done with a clear objective: To obtain and manage all the available information to improve and progress in the business and commercial strategies. An interesting revision of supply chains is presented in Bi and Lin (2009).

"Internet of Things" (IoT) is a concept that has been increasing its relevance in the last years. IoT stands for the connection of computer networks with physical objects, that is, the worldwide interconnection of all databases containing object-related data.

This basic idea can be applied to the improvement of industrial operations and to the increase in transparency in supply chains (Ilic et al., 2009). The obtaining of a supply chain by the participants makes possible to carry out controls, to identify special situations and to trigger alarms that allow to reach a best level in the business activity. Faulty product control, theft, counterfeiting and inventory shrinkage are examples of scenarios where the visualization of the supply chain is beneficial to the business.

In the context of business supply chains, the RFID technology can be used for the efficient tracking of materials and items as they move through the chain (Niederman et al., 2007; Gaukler and Seifert, 2007). EPCglobal is an international industry consortium that has provided a specification for the electronic product code (EPC) which can be used to uniquely identify single products (EPCglobal, 2009). In addition, EPCglobal architecture has been designed to enable the sharing of product information among organizations. One of the fundamental design principles for the EPCglobal network is that each company should be able to keep control of the data they collect or generate about a specific product within their own organization, i.e., information is decentralized across multiple organizations.

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