



Enabling through life product-instance management: Solutions and challenges

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ABSTRACT

Developments in the area of radio frequency identification (RFID) and sensor network technologies have created new possibilities for product lifecycle management (PLM). These technologies are enabling building blocks upon which various business applications for product management can be built. A significant aspect in the through-life management of products is the gathering and management of data related to the product during the various phases of its lifecycle. Both RFID and wireless sensor technologies have created novel levels of product status visibility and automatic identification with granularity to the level of individual components.

We consider three approaches that leverage automatic identification technologies and miniaturised wireless sensors to support PLM strategies at the product instance level based on a product centric computing paradigm. The paper draws upon a number of case studies focusing on the various phases of a product's lifecycle: Beginning of Life, Middle of Life and End of Life. We used the case studies to extract technical, capability and information requirements needed to support PLM strategies. We compared the ability and suitability of existing architectural approaches to meet the key requirements we identified. Furthermore we assessed them to evaluate their level of support for managing product instances at different lifecycle phases. Finally, we present an extension to significantly improve the ability of the most promising architecture for supporting PLM strategies.

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1. Introduction

The life of a product does not begin at a manufacturing plant and terminate at a retailer. Just as the human cycle of life, a product's life evolves from its inception as an idea and transforms its way into design, testing, manufacture, usage and ultimately its retirement and eventual disposal. Ameri and Dutta (2005) and Stark (2004) highlighted the development of the concept of product lifecycle management (PLM, CIMdata, 2007) as knowledge management by capture, storage, processing and usage of product related knowledge throughout the life of a product. The rationale for PLM strategies are many (Stark, 2004), such as improved detection of deficiencies or failures in the design or manufacturing process (which may require comparison and correlation of data from multiple parts or products of the same type), as well as the ability to make better end-of-life decisions (Parlikad and McFarlane, 2004) to extract maximum residual value from the products and to ensure safe disposal of the components that cannot be re-used or re-manufactured. Even two

objects of the same type, which are manufactured at the same time and location, may be subjected to completely different usage patterns during their lifetime. Other reasons for collecting such data include better management of warranties and tracking of liability as well as maximising utility and even detecting counterfeit products (Ranasinghe et al., 2007).

This product-instance oriented definition of PLM is significantly different from definitions used in other contexts. PLM as used by CAD/CAM and even ERP system vendors usually signifies the management of product design documents and the different variations and versions of those documents, while the “usage” phase of product instances tends to be omitted. In the commercial context, a product's lifecycle is the time span from the market launch of a product type, model or family until it is no longer being produced and sold. These different uses of the concepts product lifecycle and PLM tend to be a source of confusion; in this paper the product lifecycle is the lifecycle of a product instance from when it is conceived and produced until it is destroyed or recycled, while PLM signifies the processes and systems related to managing that lifecycle.

PLM strategies are particularly important for products or parts that have a high monetary value, long service life, as well as objects or parts that are frequently inspected and repaired or

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