Can a Product Have a Facebook? A New Perspective on Product Avatars in Product Lifecycle Management

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Abstract. In today's business environment, customer expectation towards product lifecycle information accessibility and quality is rising. Concepts such as the Internet of Things (IoT) respond to these demands enabling products becoming "intelligent" and capable of interaction. Simultaneously, society is changing with people spending more and more time online. Social networks allow them to interact richly with both their personal and professional contacts. Users of social network share information about their lives with a wide network of people who can respond directly. Being the most widely used social network Facebook's functionality and usability have continuously evolved, culminating in the introduction of the timeline. The timeline is a representation of the users' entire life, de facto managing the user's "lifecycle" information. Considering the above developments, the question arises, whether it is feasible for a product to have a Facebook which acts as its product avatar, and whether that would contribute towards fulfilling the increasing customer demands towards product lifecycle information accessibility and quality?

Keywords: Social networks, Facebook, PLM, Product Avatar, production, Internet of Things, product state, data management.

1 Introduction

In today's global business environment, almost every company faces the challenges regarding increasing complexity and market turbulence [1]. Today's customers expect physical products and related information of the highest quality. New developments, such as Web 2.0 or the Internet of Things (IoT), on the one hand offer good opportunities, but on the other add to the complexity, e.g. through new options, risks [2] and turbulence, alongside rapid unexpected change [1].

Products are becoming increasingly intelligent and are to some extent already able to interact with each other and users and even to take their own decisions [3]. At the same time, social networks such as Facebook, designed to support users in every aspect of their lives [4] are becoming increasingly prominent on the Internet. These Web 2.0 services are furthermore characterised by their evolutionary, user-centric innovation and development of functionality and usability.

These physical and virtual worlds are converging, with products are already using communication services like Twitter [5]. Complimenting these developments, concepts such as product avatars [19] have already put forward the idea of digital counterparts for products enabling stakeholders to benefit from value-added services built on product lifecycle information generated by Intelligent Products.

In the light of these developments, questions arise regarding the feasibility and potential benefit of applying the evolving information infrastructures of social networks such as Facebook to meet challenges regarding product lifecycle information accessibility and quality. Can social networks functionalities such as Facebook timeline be applied to facilitate suitable product avatars towards owners and other stakeholders throughout the entire product lifecycle?

2 Intelligent products and their lifecycles

The following sections elaborate on the basic information management concepts which underpin the investigation Facebook functionality put forward in this paper: item-level PLM, IoT, and Product Avatars.

2.1 Internet of Things

The concept of the Internet of Things extrapolates the idea of the Internet - a global, interconnected network of computers – to describe a network of interconnected things such as everyday objects [6], products, and objects in the surrounding environments [5]. It is a networked system of self-organizing objects which interact autonomously with each other and with related processes, leading to an expected convergence of physical things with the virtual world of the Internet. The IoT was first mentioned in 1999 [7], but has been given new impetus with the availability of increasingly affordable sensors, actuators, embedded systems and computers. The economic sustainability is a key factor in the industrial take-up of IoT concepts by practitioners.

At the heart of the concept lies the idea that objects - things - are capable of information processing, communication with each other and with their environment, and autonomous decision taking and thus – become "intelligent" [3;6;8]. This ties in with the related concept of Intelligent Products, of which a well accepted definition is:

"...a physical and information based representation of an item [...] which possesses a unique identification, is capable of communicating effectively with its environment, can retain or store data about itself, deploys a language to display its features, production requirements, etc., and is capable of participating in or making decisions relevant to its own destiny." [9]

An Intelligent Product is therefore not just the product itself but also its enabling information infrastructure. Up to now, Intelligent Products are not "socially intelligent" [10] in terms that they can create their own infrastructure to communicate, store information and interact with human users. But when an advanced information infrastructure designed by socially intelligent users is available, an Intelligent Product

can make of it and therefore enhance information quality and accessibility for human users.

2.2 Product Lifecycle Management

Every product has a lifecycle. Manufacturers are increasingly becoming aware of the benefits inherent in managing those lifecycles [11]. Today's products are becoming increasingly complicated. For example, the amount of component parts is increasing. Simultaneously, development, manufacturing and usage cycles are accelerating [11] and production is being distributed geographically [12]. These trends highlight the need for innovative concepts for structuring and handling product related information efficiently throughout the entire lifecycle. On top that, customer demand for more customisation and variation stresses the need for a PLM at *item* and not merely type-level.

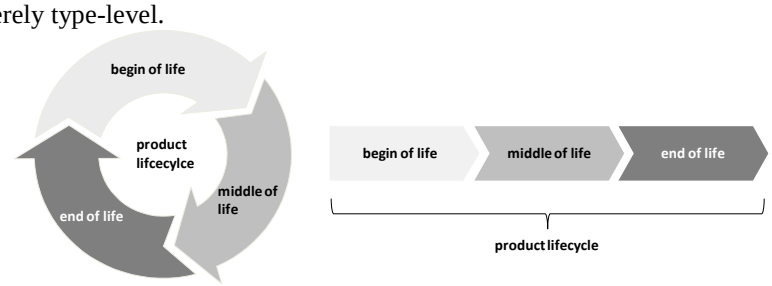


Fig. 1. Variations of the representation of product life cycles (based on [13;14]

PLM expands on the concept of Product Data Management (PDM) to include information generated and used beyond design and manufacturing [15;16]. Besides merely handling product and process related data, PLM also has to take into account the interdependencies of information and communication between all of the stakeholders involved in the product lifecycle.

Common graphical representations of the product lifecycle encompass three phases – begin of life, middle of life and end of life –arranged either in a circle or a straight line (see Fig. 1). The linear form represents the product lifecycle "from the cradle to the grave" whilst the circular form stresses PLM "from cradle to cradle" with a focus on recycling, refurbishing and reuse: the final phase feeds back into the first.

The social web offers a number of opportunities for item-level PLM. For example, Web 2.0-based product information acquisition could contribute to the improvement of the quality of future products [17;18]. One approach to representing the complex information flows connected to an individual product is the ***Product Avatar***. This concept describes a *digital counterpart* of the physical Intelligent Product which exposes functionality and information to stakeholders of the product's lifecycle via a user interface [19].

3 Facebook as a social network

Over the last years, with the development of Web 2.0, social networks became a central and unavoidable medium for social interaction worldwide [20]. In a recent study of German users and their time spent online social networks were far ahead with 23% in Dec. 2011 coming from 14% in Dec. 2010 [21]. In other countries, like the United States of America the ratio is even more extreme [22;23]. Facebook, founded in 2004 as a social networking platform strictly limited to students from Harvard University, opened their user base step by step to all users globally. After passing myspace in 2008 in terms of active users, Facebook today has 845 million monthly active users and is recognized as the largest and most powerful social networking site worldwide [24;25].

Facebook's presentation and usability changed over time, introducing both evolutionary and revolutionary new services. The innovation impulses for many of these changes came directly from the user community. [26] From being a mostly static way of presenting information of oneself it became a holistic platform where users can find almost everything from office tools over video conferencing [4;27] to news reading, with users claiming to find the presented sources more credible than automated reading suggestions and more relevant for the personal taste [24;28].

The newest development within Facebook is the timeline, introduced in Sept. 2011, becoming obligatory for all Facebook users in Feb. 2012. The timeline is a complete rewiring of the way Facebook works [27]. Facebook's vision of becoming the gateway to the Internet or passport for users' online identity [4] made a big step forward. Facebook intends to gather all information of a person over the person's whole life even before Facebook existed. New functions like location based services help to generate accurate information/data [29] and help Facebook positioning itself as a personal archive. This archive is not just searchable, maintained and data-driven [27] but also always available on smartphones, computers and dynamically connected to other archives of users through "friendship" or "subscription" [30].

With the introduction of Facebook's like button, and apps/cookies to be implemented in the design of websites outside of the social network environment, Facebook, in an extreme case, has the opportunity to gather data of the whole online experience of a user and connecting it with the information/data of the personal profile. This then automatic and passively collection of data completes the already actively provided content and allows Facebook to make it accessible on the user's online profile. Theoretically, the user's online profile could become richer and more complete than its offline one with information about everything, from favourite music to recently bought groceries on Amazon [27].

As Facebook develops very fast supported by a huge user community, maybe it is possible to take advantage of (social) functionalities to manage information and relationships and thus learn from processes formed by the social requirements of human users shaping Facebook services and functionalities for Intelligent Products.

4 Facebook to represent product avatars

In this section, first today's usage of Facebook for business purposes will be elaborated on followed by a presentation of how Facebook and its functionalities could be a promising approach to represent a product and its connected information/data as well as interdependencies as an intelligent product avatar over the whole product lifecycle.

4.1 Facebook and business

With Facebook's extremely fast growth, business is trying to benefit from the newly available opportunities. Besides on-line advertising, Facebook's main source of income, external businesses try to make use of the huge user and/or potential customer base. The huge, multi-cultural data base of Facebook users is deployed for market and increasingly academic research in different fields, ranging from business studies to psychology [20;23]. New approaches in innovation, like customer co-creation [22,31], or research in decision making [32] also make use of the vast opportunities to interact with specific target groups incl. available embedded data.

The first applications of companies interacting with customers on Facebook were in the domain of involved user-centric marketing and customer relationship management. Facebook provided the possibility to set up a "fan page" of the company itself or their products. These "fan pages" could contain product information, pictures/videos, marketing events and easily and constantly accessible product support through the Facebook "wall". Users can indicate their interest in one of these "fan pages" through the "like" button functionality and thus subscribe to updates, special deals etc. and gain access to a fast an transparent communication channel with companies representatives. Taking a product "fan page", e.g. the iPhone, today it has mostly a representative and marketing functionality. The "fan page" does not represent a single iPhone, it is a product representation people interested can get general information, support or just show their network that they are fascinated by it.

The whole potential of Facebook in communication and interaction as well as information/data gathering, organization and accessibility are not yet used. But as in the age of IoT and PLM products become intelligent and customers demand individualized information of the product that might be not enough. In the following, the idea of an individual product having a Facebook profile not a fan page with all socially embedded functionality will be proposed and elaborated in more detail.

4.2 Facebook functions interpreted from a product avatar perspective

One question comes to mind is, why do "fan pages" (products) and "profiles" (users) have different functionalities and design? A profile of a person using Facebook contains a lot of more possibilities to provide information about the individual, options to indicate connections to other profiles and additionally communication services. Should a product also have these possibilities and could it

make use of them? As was claimed before, products become more intelligent, the requirements towards an information infrastructure for a products digital representation are increasing. Treating a product like a person and to give it a "real" Facebook profile (see Fig. 2) instead of a simple "fan page" could provide just that: an advanced information infrastructure tested by millions of socially intelligent users.

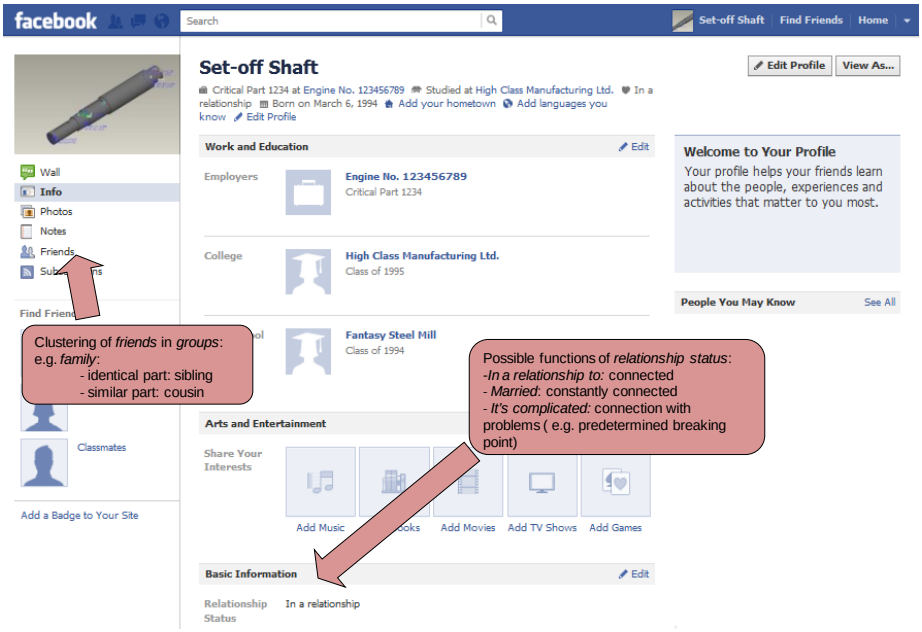


Fig. 2. Example of Facebook page for an Intelligent Product

In Tab.1 an exemplary collection of selected functionalities, the possible usage within a product lifecycle perspective and the benefit for stakeholders are presented.

Table 1: interpretation of Facebook functionalities an possible benefit

Facebook function	Interpretation as PLM function	Possible application and benefit/impact
check-in	Location based services	Applications ranging from Supply Chain (SCM) and Stock Management to Tracking and Tracing (T&T)
status	Documentation of product state [33]	Wide range of applications. For SCM and logistics, status updates can be mapped to T&T with LBS to present the status of a product in production, distribution and reverse logistics scenarios. Different views upon product state can be controlled via rights management.
friends	Map connections between the products and product lifecycle stakeholders.	For example, a service technician can be "friends" with a product so he will receive updates to its status.

Facebook function	Interpretation as PLM function	Possible application and benefit/impact
groups	Organisation and structuring of product and component part information.	Organisation of products, component parts and the related information into subsets. Friends can be organized into groups such as “assembly group”, “accounts”, “service technician”. For example, all parts of an engine could be “friends” in an “engine” group.
timeline	Representation of the product lifecycle over time with accentuation of important events [27]	Can store all events related to the product throughout its entire lifecycle: from production, relocation, allocation to new assembly groups, repairs, ownership changes etc. Can be updated in real time and annotated with meta-data using the comment function. Can provide a history of product status throughout the lifecycle.
“like” button	Documentation of acknowledgement/approval of lifecycle events by stakeholders	Lifecycle stakeholder can quickly and easily document approval of a certain actions, useful e.g. for quality gate reviews, delivery receipt substitutions in combination with check-in.
relationship status	Indication of degree of physical connection between products and component parts	Defines the type of physical connection, e.g.: (see Fig.2)
employer	Documentation of the legal status of product	Reference to the owner of the product with history of ownership for each part.
education	Documentation of the manufacturing history of individual products	Provides a structured collection of individual manufacturing data (e.g. processes parameters) which can be used to track the entire manufacturing process. Useful in safety-critical industries (e.g. aerospace, pharmaceuticals) or in combating plagiarism.
comment	Annotation of any kind of interaction and information with meta-data.	Every event can be annotated with meta-information by commenting. E.g. in case a product is “in a relationship” with another product the provider of grease gets a notification (targeted audience) and suggests the corresponding lubricant for this suitable for this event.
profile picture	Graphical representation of the product, e.g. a photo or design.	Product picture can be updated after every modification. Can be used e.g. for monitoring the state of a product.
photo album	Additional graphical or textual information	Can be used to provide e.g. a dynamic online user manual or certificates for the product.
privacy settings	Rights management.	Through privacy settings in combination with the group functions, addressees of information can be specifically targeted (e.g. service technician, owner etc.)

To give a more graphical example of possible interpretations of Facebook lingo, Fig. 3 highlights the idea of using Facebook family ties to express the connection a product has based on its manufacturer and/or product properties.

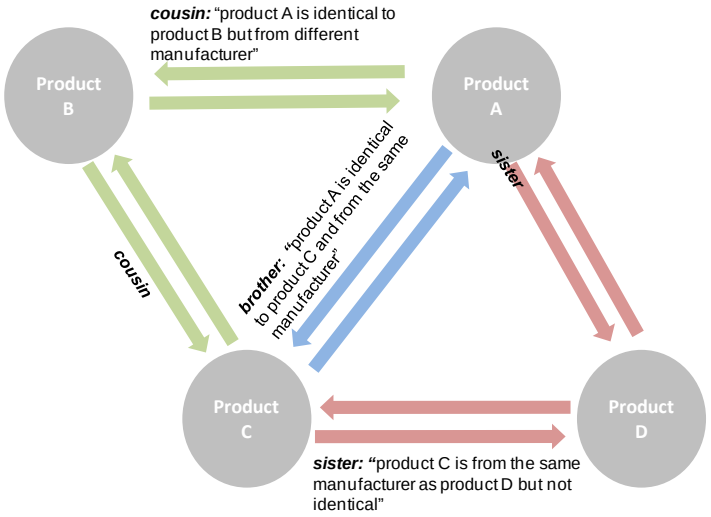


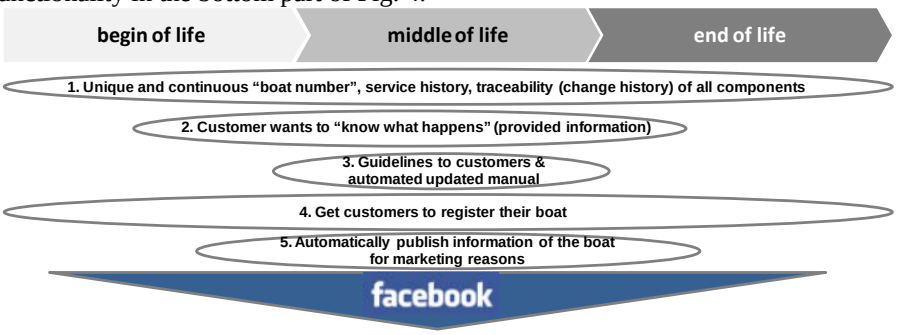
Fig. 3. Possible interpretation of family ties (available Facebook options) for products

In this section the different functions have been presented with a short interpretation and possible benefits from a product lifecycle point of view, but without concrete examples. However, examples of real-life industrial application are crucial to understanding. Thus, in the following section a, still selective, example of an intelligent product (a boat) is presented and selected situations are chosen to be represented by means of Facebook functionalities as a product avatar over the whole product lifecycle.

5 Exemplary Facebook product avatar of a leisure boat life cycle

Leisure boat builders are increasingly realising the need to emphasize both the after-sales market and their customers' demands for products that are easy in upkeep, environmentally friendly and which offer them added-value services to enhance their boating experience. In order to fulfil these requirements, they need to take concepts such as item-level PLM, Intelligent Products and Product Avatars into consideration. In an initial, non-representative survey, five main areas of potential improvement were defined by industry representatives. As a boat is a very complex product with various parts put together from different manufacturers and ventures plus a high proportion of customization (e.g. interior design etc.), boats are very individual. So the possibility to manage the huge amount of variations and keep all information and records up-to-date would be a huge advantage for manufacturers and customers.

In Fig. 4 these areas of improvement are roughly positioned within the phases of the Product Lifecycle. They are then each mapped to a possible Facebook functionality in the bottom part of Fig. 4.



1. *(boat number)* either name of Facebook **groups** (e.g. boat no. xxx) or an individual profile for the complete boat with no. xxx as part of the name. *(service history)* all needed data and information is collected in the **timeline** of the boat, and in more detail in the **timeline** of the specific part in focus. *(traceability)* also in through the **timeline**, e.g. change of component is shown as a change of friends with **location**, **time** and **tagged** service technician
2. an up-to-date **status** during manufacturing , usage and customer relevant end-of-life provides customers with all necessary information (adjustable in granularity through Facebook's internal prioritizing algorithms)
3. **photo albums** with photo of the boat and "tags" of individual parts (represented as friends), e.g. engine or tv, with specific information. Thus each part (even after exchange) has an up-to-date manual as a photo album
4. product avatar in Facebook, the boat is directly registered through **name** and customer has direct benefit of it
5. selected **privacy settings** and an algorithm information like e.g. location in summer 2012 can be tracked through Google maps

Fig. 4. Transformation of selected events during the product lifecycle into Facebook

6 Conclusion and outlook

The possibility of a Product Avatar representation of product lifecycle information of an Intelligent Product have been described in more detail after elaborating on the development of the social network Facebook and the its various functionalities for private and business use. The theoretical concept illustrates selected practical examples of the life cycle of a boat interpreted with Facebook functionalities in the following section.

To conclude, the approach presented to apply the developments of Facebook and its user-driven, constantly evolving information infrastructure to the Product Avatar of an Intelligent Product currently seems feasible and promising.

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