

# A Novel Solution to Link Physical Products with Digital Services

Runhua Xu<sup>1</sup>, Remo Frey<sup>1</sup> and Alexander Ilic<sup>2</sup>

## I. ABSTRACT

In this post, we present a new Internet of Things (IoT) solution to link physical products with digital services in a low-cost manner. Along with the solution, we propose a new standard for stakeholders in the value chain to describe and share information about product-related services. The content of the poster consists of five sections, shown as follows.

### A. Background

As product differentiation is getting more difficult and services can typically provide higher and more stable revenue [1], manufacturers are moving from a good-dominant business towards a service-dominant business [2]. While in a B2B setting several companies build their strategy on contractual product-service bundles, this concept is difficult to be applied to most B2C products. In a B2C setting, products and services are loosely coupled. In many cases, manufacturers lose connection to consumers after point-of-sale (PoS), which prevents them from providing services proactively to consumers.

IoT extends physical world to enable powerful and context-aware applications. With IoT, it becomes possible to link physical products with digital product-related services, thereby enabling manufacturers not only as goods providers but also as service providers. Through providing services, manufacturers can be connected directly with consumers, which might impact current business models as well as value chains.

### B. Available IoT Solutions

One approach to link physical products with digital services is to manufacture intelligent products. Novel IoT products like Nest and FitBit are able to learn from consumer behavior and automatically provide services and feedbacks by integrating

microprocessors, communication and control components into traditional thermostats and pedometers. Nevertheless, integrating such intelligent features typically requires a new product design and a different manufacturing process, which results to higher cost to manufacturers. This further leads to a higher product price that prevents consumers from purchasing those products. Consequently, the installed base of intelligent products is still limited at the moment.

### C. An Indirect IoT Solution

As a result, we propose another solution that leverages IoT technologies, smartphones and a standardized service-mapping platform to indirectly link a wide range of products with their corresponding services. Fig.1 demonstrates the logic flow.

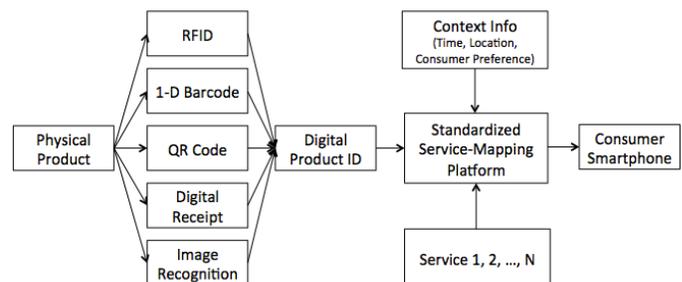


Fig. 1. Demonstration of an indirect IoT solution of linking products with services

First, IoT technologies contribute to represent each physical product with a digital identifier. By reading a wireless tag / a barcode, importing a digital receipt or taking a picture of a product, consumers can use their smartphones to interact with the physical product to obtain its digital identifier like EAN. After knowing the identifier, smartphones communicate with a standardized product to service mapping platform where different product services are collected. The platform picks out services that are only relevant to the product identifier and returns them back to consumers' smartphones. By using smartphones, additional context information such as time and location can be easily retrieved to make returned services more relevant. For instance, the platform will not return services that are only available in Europe to a consumer who is recognized to be physically in the United States.

With the new solution, manufacturers do not need to produce new intelligent products. Instead, we leverage

1. Runhua Xu and Remo Frey are PhD students from the Chair of Information Management, ETH Zurich, email: [rxu@ethz.ch](mailto:rxu@ethz.ch) and [rfrey@ethz.ch](mailto:rfrey@ethz.ch), Phone: +41 44 632 8256, Address: Weinbergstrasse 56/58, 8092 Zurich, Switzerland (Runhua Xu is the corresponding author and the poster presenter)

2. Alexander Ilic, an Assistant Professor from the Institute of Technology Management, University of St.Gallen, email: [alexander.ilic@unisg.ch](mailto:alexander.ilic@unisg.ch), Address: Dufourstrasse 50, 9000 St.Gallen, Switzerland

smartphones to make a wide range of products smarter and connected because smart components like microprocessors, sensors, actuators and communication modules are already embedded in smartphones. The solution makes it cheaper for manufacturers to link products with services, and it can be adopted by a wide range of products like consumer goods. Consumers are able to easily access services by simply reading a tag or scanning a barcode with their smartphones. Additional workload such as getting a product identifier, communicating with the service-mapping platform, and selecting returned services could be done quickly and automatically by a mobile app.

However, as one of the key components, there is no standard to describe product-related services and the mapping platform mentioned above does not exist at the moment. Thus, our research tries to address those gaps.

#### D. Proposed Standards and Platform

Nowadays, there are already standards that are widely used to describe product information. For instance, standardized product identifiers like EAN and UPC are used globally for companies to share product master data in supply chain management; Schema.org proposed a standardized markup vocabulary to describe product attributes on the Web. However, those standards have not addressed product services that are getting more importance in different markets [2]. Therefore, based on an analysis of 29 product-related services in a pre-study, we propose a new standard as presented in Table 1. Due to the space limitation, we only demonstrate a high-level overview of the standard together with its most important properties.

Table 1. Proposed standard to describe product services

Property	Description
Name	Name of the service
Description	Description of the service
ServiceID	A unique identifier to represent the service
Offer	An offer to provide the service (i.e. price, currency, details about service provider, payment method)
URI	URI to the service Webpage, doc, video
ProductSupported	Products that can use the service
Location	Locations that provide the service
ValidTime	Valid date/time to access the service
Category	Service category/type to facilitate searching
SameAs	A pointer to the same service
RelatedTo	A pointer to another related services
SimilarTo	A pointer to a functionally similar service
Rating	Customer rating of the service
Comment	Customer comments of the service
Restrictions	Target customers, minimum number of order, minimum subscription period
Delivery	Time interval to deliver the service
DigitalSignature	A digital signature that signs all non-user generated content

Similarly to providing product master data, manufacturers

can provide information for services they offer in the proposed standard to a service-mapping platform. The platform takes the responsibility of returning relevant product services when a product identifier is inputted. APIs will also be provided to enable developers to call for the mapping service through HTTP request in mobile / Web apps. In addition to working closely with manufacturers, the platform can also leverage the power of crowdsourcing to facilitate consumers to provide service information.

#### E. Discussion

Our proposed IoT solution brings values to different stakeholders. The solution makes it possible for consumers to ‘obtain’ services directly from physical products through a simple action (scan, touch, or take a photo) on smartphones, which saves consumers’ time and efforts in finding out a product service online. Meanwhile, direct interaction with products also improves user experience and may further bring consumers closer to products [3].

Manufacturers can also benefit from adopting the proposed solution. First, providing services creates an additional revenue stream for manufacturers, and service in general has a higher and more stable margin [1]. With the proposed solution, manufacturers can enable a wide range of physical products as service end-points with a relatively low cost because no additional smart components need to be integrated to existing products. Second, combining smartphones with services provides manufacturers with an opportunity to know each consumer in detail. Even though a consumer has not registered personal information with a manufacturer, with the help of a mobile app, the manufacturer is able to know what products a consumer owns, what services s/he has looked at and how frequently s/he has interacted with her/his products. Based on analyzing such data, the manufacturer can proactively conduct personalized marketing to the consumer through the mobile app, which is proved to be more powerful and efficient than mass marketing [4].

By providing mapping service, the platform can charge manufacturers or business users to generate revenue. It also provides the possibility of fostering a community of developers to use the mapping service and create solutions for all possible consumer needs.

#### REFERENCES

- [1] R. Oliva and R. Kallenberg, “Managing the Transition from Products to Services,” *Int. J. Serv. Ind. Manag.*, vol. 14, no. 2, pp. 160–172, 2003.
- [2] A. Tukker, “Product Services for a Resource-Efficient and Circular Economy – A Review,” *J. Clean. Prod.*, Dec. 2013.
- [3] J. Forlizzi and S. Ford, “The Building Blocks of Experience : An Early Framework for Interaction Designers,” in *3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, 2000, pp. 419–423.
- [4] M. Dorotic, T. H. A. Bijmolt, and P. C. Verhoef, “Loyalty Programmes: Current Knowledge and Research Directions,” *Int. J. Manag. Rev.*, vol. 14, no. 3, pp. 217–237, Sep. 2012.