

Product customization as Linked Data: demonstration

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Abstract. Exposing data about customizable products is a challenging issue, because of the number of features and options a customer can choose from, and the many constraints that exist between them. These constraints are not tractable without automatic reasoning. But the configuration process, which helps a customer to make her choice, one step at a time, is a traversal of a graph of partially defined products - that is, Linked Data. This natural yet fruitful abstraction for product customization results in a generic configuration API, in use at Renault, who has begun publishing data about its range in this way. Current achievements and prototypes of forthcoming developments are presented.

Keywords: configuration, customizable product, Linked Data, Good-Relations, automotive

1 Introduction

Publishing product data to improve e-business performance and visibility on the web is gaining momentum, thanks to vocabularies such as GoodRelations [1], or to the Schema.org initiative.

But exposing data about customizable products is a challenging issue. In industries practicing “Build to Order” of fully customizable products, ranges are huge, because of the number of features and options a customer can choose from: more than 10^{20} different cars are for sale at Renault. Ranges are also complex, because of the many constraints between features which invalidate some of their combinations: if every combination of distinctive features and options were possible, there would be 10^{25} different Renault cars, not our mere 10^{20} - meaning you have only one chance upon 100,000 to define an existing Renault car, if you choose its specifications without taking the constraints into account. Automatic reasoning is required to handle the constraints - a computationally hard task. It is possible to publish such range definitions on the web, including the constraints, by means of Semantic Web languages [2]. But it would not bring many practical results soon, as one cannot expect strong reasoning capabilities from client agents. This could hinder the publishing of descriptions of customizable product on the web of e-business data.

This question is the subject of the paper “Product Customization as Linked Data”, that will be presented in the “In Use and Industrial” track of this ESWC conference, and which the demonstration herein intends to illustrate. The paper describes how product configuration can be seen as a linked data application, and shows the benefits of this approach as to web e-business.

The crux of the paper centers around modeling the configuration process as the traversal of a graph of “Partially Defined Products”(PDP), or “Configurations”, each configuration linking to those that refine it: for reference, a configurator is an application that helps a user interactively define a product step by step, each step describing a valid partially defined product, with a list of remaining choices given all previous selections. Each of these choices links to another PDP until completion. Thus, the configuration process traverses a graph whose nodes are PDPs. Now identify each PDP with a URI returning, among other relevant information, the list of the PDPs it is linked to: what you get is a description of the range as Linked Data.

Renault has begun to publish data about its range in this way, and this is the main subject of this demonstration, which intends:

- to show how to use the data returned by the Linked Data based configuration API to easily implement full-featured web configurators, such as the one which will be presented;
- to highlight some of the benefits of Linked Data modeling, in e-business related use cases.

As work at Renault is still in progress, the demonstration will mix presentations of systems that are in production and prototypes built upon the data returned by these systems. In both cases, we will focus on the (linked) data, which are the cornerstone of all this work and of services and applications that have been made available.

2 Linked Data based Configuration at Renault

The Linked Data based Configuration API is implemented as a REST web service using Jersey¹.

This service is a facade in front of the configuration engine that provides the reasoning capabilities. Implementation of the latter, developed at Renault, is based on a compiled representation of the Constraint Satisfaction Problem that models the description of the range. Problems involving CSP are well-known to be computationally hard, but the hard part of the problem is fully solved in an offline compilation phase, guaranteeing bounded and fast response times for configuration related queries: time is linear on the size of the compiled representation, which happens to remain small enough [3].

We won't dwell any longer on this topic, as it is not the subject here: this demonstration, as well as the paper it refers to, are not about reasoning and the way it is implemented. In fact, one of the main points of this work is precisely about hiding the complexity of reasoning from clients. We'd like instead

¹ <http://jersey.java.net/>

to remark that most, if not all, configurator applications on the web could be (re-)implemented as Linked Data: it is just a matter of wrapping in a REST service the configuration engine they use.

2.1 Related work

The exact context of this work is the borderline where product configuration meets e-Commerce applications of Linked Data. The main work in the same context that we know of is Volkswagen’s “Car Option Ontology”². Their approach is different: they publish the constraints, in a proprietary vocabulary. We prefer to host the reasoning on the server, and free clients from the burden, ensuring maximal usability of the data that we provide.

2.2 Architecture of the solution

It is presented in Fig. 1.

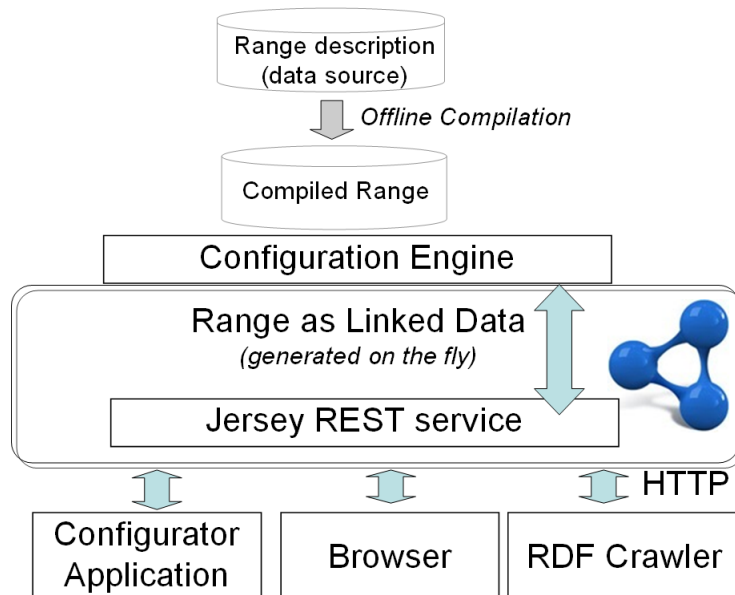


Fig. 1. Architecture.

The published data is the current commercial offer. It is managed by upstream systems, then “compiled” into the binary data used by the configuration engine (size: <100MB). Linked Data is materialized on the fly when PDPs are queried (30 KB per PDP)

² <http://purl.org/coo/ns>

3 Content of the demonstration

3.1 Systems in production

As of this writing (April 2012), the Linked Data service in production only returns JSON data, and only for German and Italian markets³. Depending on the pace of evolutions and deployments, more markets and/or data formats (RDF/XML, turtle) may be available by the time of the conference.

3.2 Accessing PDP data and implementation of client applications

Nevertheless all functionalities of Renault's configuration engine are already made accessible through the JSON data, including querying in free order, pricing information, filtering on a maximum price, negative choices, conflict resolution, completion, etc.,

This API - which, for the largest part, can be identified with the JSON data returned by the server when dereferencing the URIs of PDPs - therefore allows for the development of client applications that include configuration functionalities, and this was the first use of it envisioned at Renault. The development of such applications (in particular, a salesman assistant) are on their way.

One of the first goal of this demonstration, therefore, is to explain how to construct such applications from this data. This happens to be rather simple: for the web application developer, it is just a matter of displaying and/or following the links included in the data. As this data is published on the web, it can be used by developers outside of Renault: when such data is available from other automotive manufacturers, this is an opportunity to develop innovative mashups, such as range comparators.

3.3 RDF Data

A simple and generic ontology⁴ describes the classes and properties involved in the modeling of the configuration process as Linked Data. We will show the inclusion of corresponding RDFa markup in the HTML pages of our prototype configurator application. This is interesting, because a configuration is a commercial offer (it can indeed always be completed to a valid product), and it can therefore be seamlessly described using GoodRelations [1], the "Web Vocabulary for E-Commerce".

3.4 Benefits in e-business use cases

Then, we intend to illustrate some of the benefits in e-business use cases. There, we will use a Proof Of Concepts implementation that has been widely used at Renault when promoting the solution. The main idea is the fact that identifying

³ <http://co.rplug.renault.{de,it}/docs>

⁴ <http://purl.org/configurationontology>

the PDPs with URIs allows their easy sharing between media and applications. In the demonstration, we'll show how a potential customer can begin a configuration by clicking on an ad or decoding a QR code in a billboard, modify it on her smartphone or PC; exchange it with members of her family; share it on FaceBook; have it transferred to the salesman's assistant when she finally goes to a shop, and have it converted to an order. See Fig. 2.

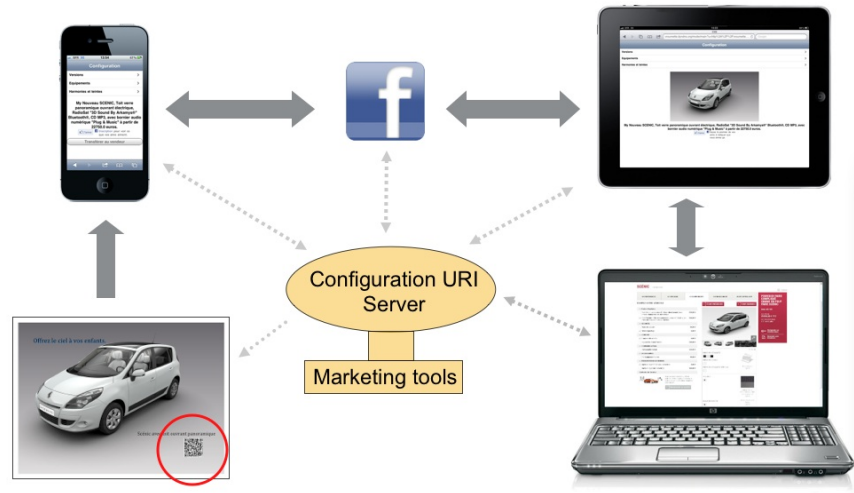


Fig. 2. Sharing PDPs between applications, devices and media.

4 Conclusion

The demonstration should succeed in showing that the challenging issue of publishing data about customizable products can be solved elegantly using Linked Data principles. We hope to convince people of the benefits of the method for e-business. They should be able to get started implementing such a solution, or developing applications using such data.

References

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