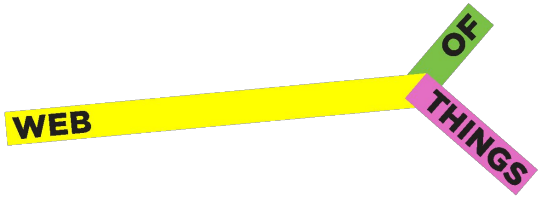
The Web of all the other things...

WoT principles applied to CPG, Apparel, etc.

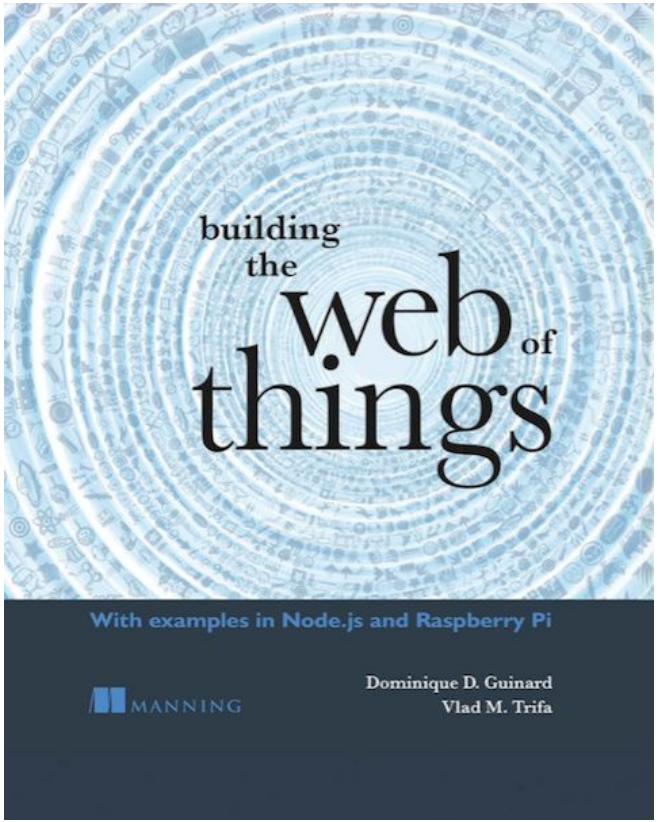
Dominique Guinard | 4th of June 2019

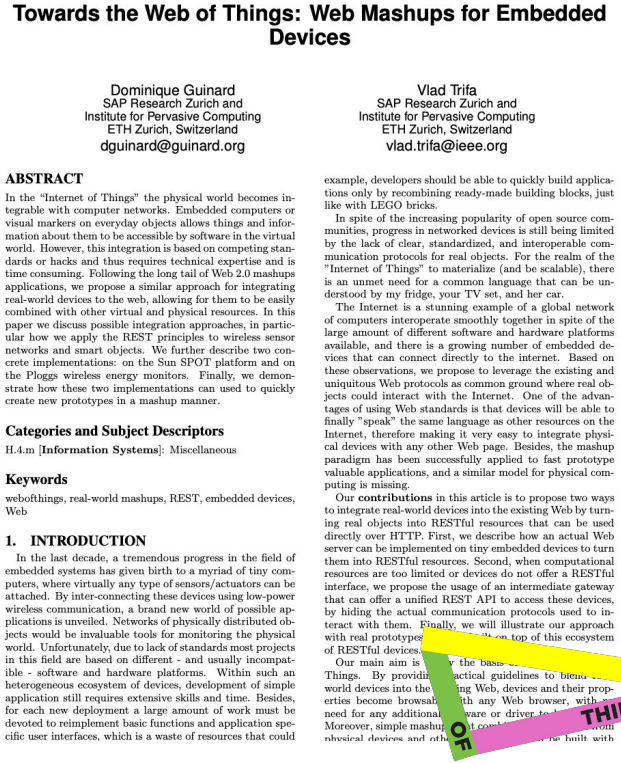


"Activate the things that move your business"

Back to the roots of the WoT…

https://book.webofthings.io





Towards the Web of Things: Web Mashups for Embedded Devices

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ABSTRACT

In the "Internet of Things" the physical world becomes integrable with computer networks. Embedded computers or visual markers on everyday objects allows things and information about them to be accessible by software in the virtual world. However, this integration is based on competing standards or hacks and thus requires technical expertise and is time consuming. Following the long tail of Web 2.0 mashups applications, we propose a similar approach for integrating real-world devices to the web, allowing for them to be easily combined with other virtual and physical resources. In this paper we discuss possible integration approaches, in particular how we apply the REST principles to wireless sensor networks and smart objects. We further describe two concrete implementations: on the Sun SPOT platform and on the Ploggs wireless energy monitors. Finally, we demonstrate how these two implementations can used to quickly create new prototypes in a mashup manner.

Categories and Subject Descriptors

H.4.m [**Information Systems**]: Miscellaneous

Keywords

webofthings, real-world mashups, REST, embedded devices, Web

1. INTRODUCTION

In the last decade, a tremendous progress in the field of embedded systems has given birth to a myriad of tiny computers, where virtually any type of sensors/actuators can be attached. By inter-connecting these devices using low-power wireless communication, a brand new world of possible applications is unveiled. Networks of physically distributed objects would be invaluable tools for monitoring the physical world. Unfortunately, due to lack of standards most projects in this field are based on different - and usually incompatible - software and hardware platforms. Within such an heterogeneous ecosystem of devices, development of simple application still requires extensive skills and time. Besides, for each new deployment a large amount of work must be devoted to reimplement basic functions and application specific user interfaces, which is a waste of resources that could example, developers should be able to quickly build applications only by recombining ready-made building blocks, just like with LEGO bricks.

In spite of the increasing popularity of open source communities, progress in networked devices is still being limited by the lack of clear, standardized, and interoperable communication protocols for real objects. For the realm of the "Internet of Things" to materialize (and be scalable), there is an unmet need for a common language that can be understood by my fridge, your TV set, and her car.

The Internet is a stunning example of a global network of computers interoperate smoothly together in spite of the large amount of different software and hardware platforms available, and there is a growing number of embedded devices that can connect directly to the internet. Based on these observations, we propose to leverage the existing and uniquitous Web protocols as common ground where real objects could interact with the Internet. One of the advantages of using Web standards is that devices will be able to finally "speak" the same language as other resources on the Internet, therefore making it very easy to integrate physical devices with any other Web page. Besides, the mashup paradigm has been successfully applied to fast prototype valuable applications, and a similar model for physical computing is missing.

Our **contributions** in this article is to propose two ways to integrate real-world devices into the existing Web by turning real objects into RESTful resources that can be used directly over HTTP. First, we describe how an actual Web server can be implemented on tiny embedded devices to turn them into RESTful resources. Second, when computational resources are too limited or devices do not offer a RESTful interface, we propose the usage of an intermediate gateway that can offer a unified REST API to access these devices, by hiding the actual communication protocols used to interact with them. Finally, we will illustrate our approach with real prototypes [illegible] on top of this ecosystem of RESTful devices.

Our main aim is [illegible] the basis [illegible] Things. By providing [illegible] practical guidelines to bring [illegible] world devices into the [illegible] ing Web, devices and their properties become browsable with any Web browser, with [illegible] need for any additional [illegible] ware or driver to [illegible] Moreover, simple mashups [illegible] can [illegible] from physical devices and [illegible] be built with

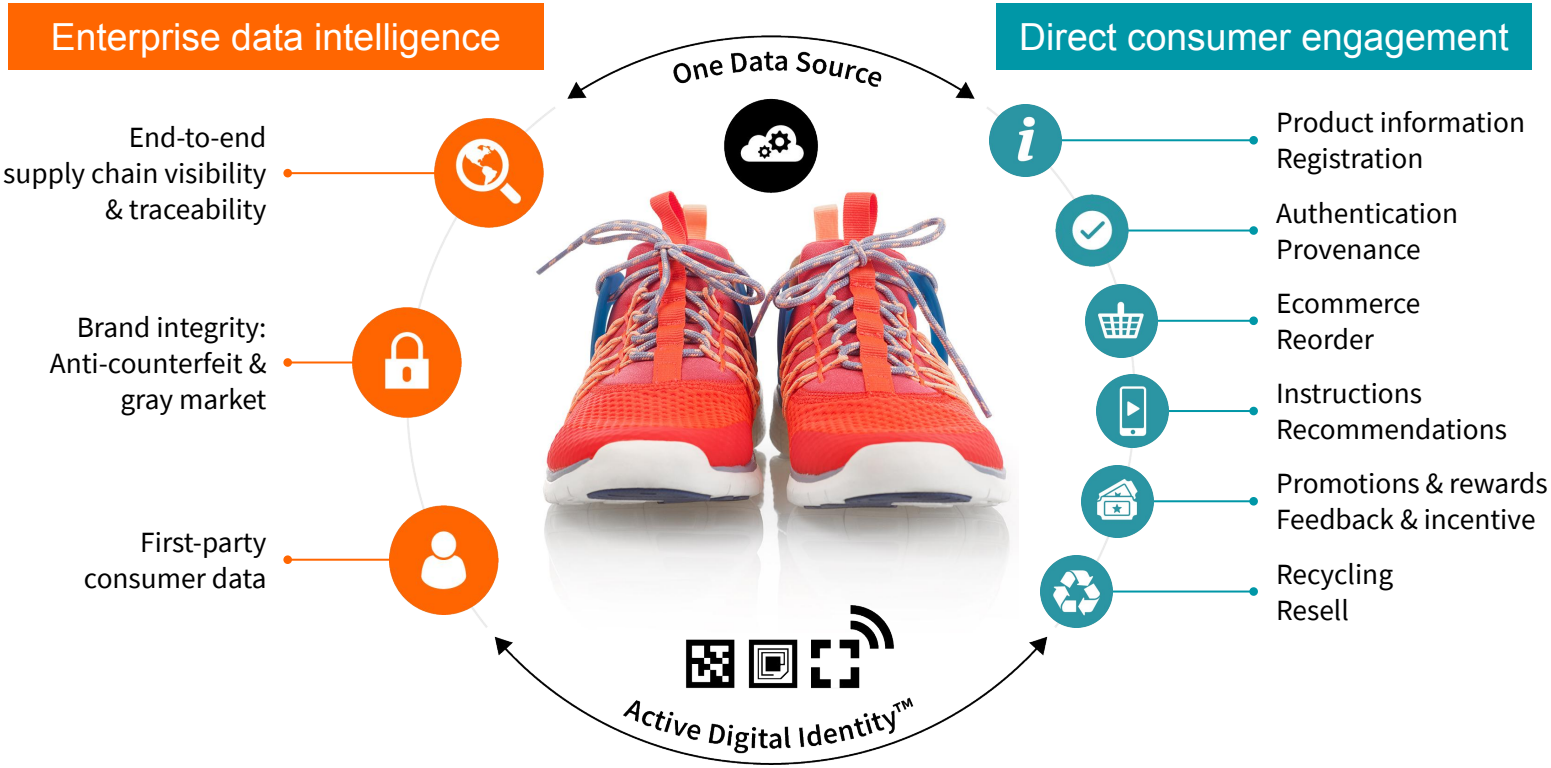
Where the IoT was born...

"Internet of Things" started life as the title of a presentation I made at Procter & Gamble (P&G) in 1999. Linking the new idea of RFID in P&G's supply chain to the then-red-hot topic of the Internet [...]

Kevin Aston

"On the Internet, nobody knows you're a dumb product."

WHEN *EVERY* PRODUCT IS A SMART PRODUCT



Why does it matter here?

+

+

Standards in the CPG, Apparel, Pharma space

Digital Link - Web *Identity*

EPCIS - *Tracking*

GS1 Digital Link standard
Giving Products a unique *Web* Identity

DIGITIZING PRODUCTS AT MASS SCALE

Global barcode upgrade with new web-connected standard—GS1 Digital Link

https://id.gs1.org/gtin/09507000009060/ser/00107

ONE CODE FOR ENTIRE LIFECYCLE

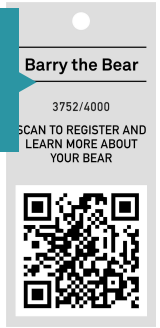
Mass scale digital serialization on packaging—high speed and very low marginal cost

2 billion+ smartphones can now scan standard product codes with camera

Technology originated by EVRYTHNG

Resolvers: Delivering Web content for Digital Links

01 A single 2D code on packaging and labels. For supply chain, POS and consumers.



02 Containing a unique url with GS1 identifiers linked to a Digital Identity.

https://id.gs1.org/01/09507000009060/21/00107

https://gs1.tn.gg/01/09507000009060/21/00107

03 Resolvers are operated by GS1 (Canonical), brands or service providers (EVRYTHNG)...

04 link to all kind of content on the Web (linkType)

- Authenticity
- Traceability
- Recycling
- Offers & Rewards
- Ecommerce
- Care Instructions

11

GS1 DIGITAL LINK EXPLORED: MOWI

CASE STUDY

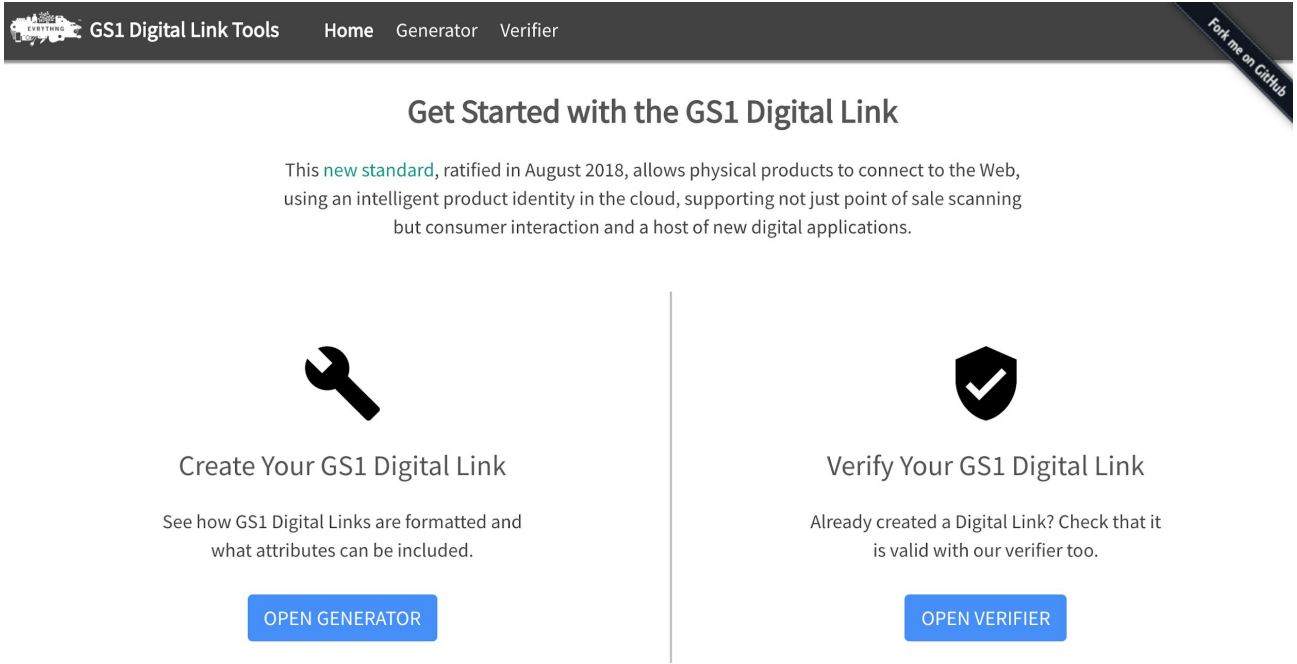
Base URL | Product GTIN | Batch Number

https://hrjwx.etn.gg/01/2829001000004/10/01G119077

Product Category | Batch Category

- Products serialized at batch level
- Compatibility with existing processes, supply chain systems and identifiers
- Simplifies printing process as standard format URLs with GS1 IDs are generated by Mowi
- Encoded in a consumer-scannable QR code

Open Source GS1 Digital Link Tools



- Playground for the GS1 Digital Link
- Link Generator
- QR Generator with default experience
- Verifier
- Open sourced on GitHub

https://digital-link.evrythng.com

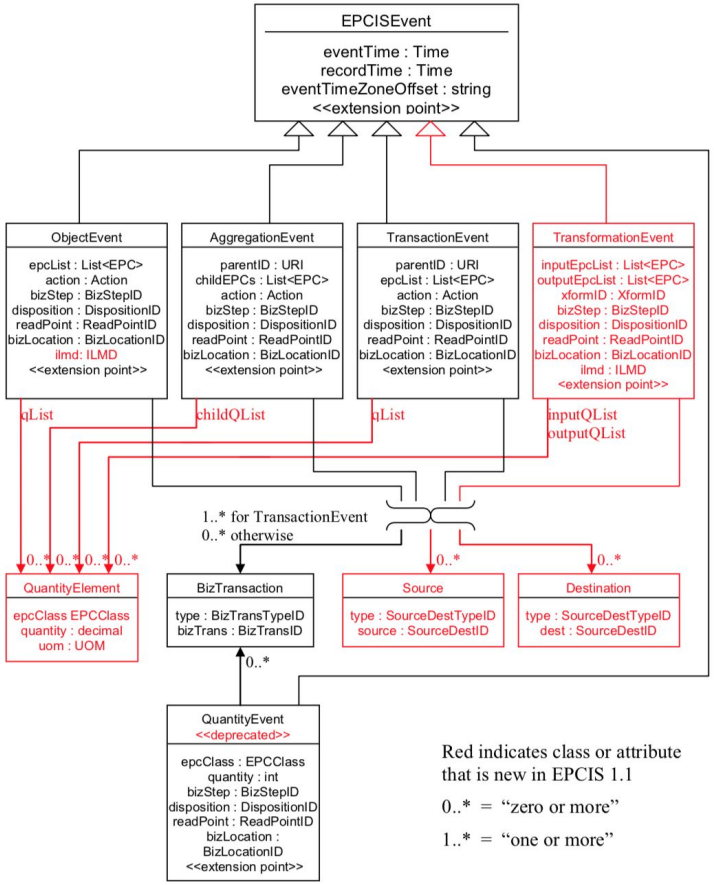
EPCIS 2.0 standard
Making Track and Trace first class citizen of the Web

EPCIS in a nutshell

What: Events of type Object (e.g., scan of a pallet), Aggregations (e.g., putting Objects on a Pallet) and Transformations.

Why: Each of these events then has an action: Add, Observe or Delete.

Where: It also specifies Business Locations (places)



Electronic Product Code *Information Service*

1.1

- SOAP + WSDL interface
- XML

```
https://epcis.evrythng.io/events/ObjectEvent?EQ_
bizStep=urn:epcglobal:cbv:bizstep:shipping,urn:e
pcglobal:cbv:bizstep:decommissioning&EQ_eventTim
e=2015-03-15T00:00:00.000-04:00
```

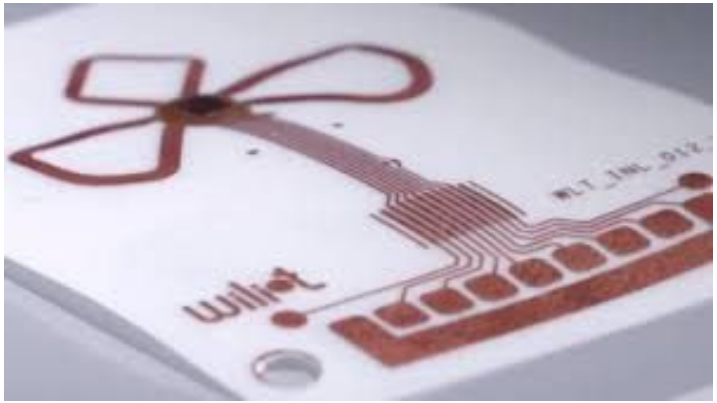
2.0

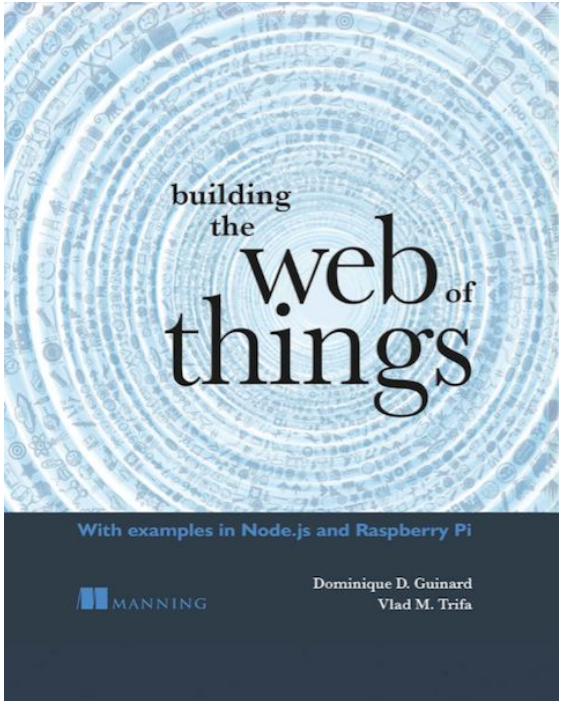
- HTTP REST interface
- JSON-LD

Back to W3C WoT
Building Bridges

Building bridges for all the things!

- Lines between tagged & embedded are blurring
- A number of use cases benefit from these 2 worlds talking





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https://book.webofthings.io

> *IoT needs an application layer, and leveraging the web is the right thing to do! This terrific book will show you how to get there in a few weeks.*
>
> Sanjay Sarma, AutoID Labs, MIT

> *Dom and Vlad are thought leaders in IoT, focused on how to achieve results in practice.*
>
> Andy Chew, Cisco UK

> *A complex subject covered in detail from beginning to end ... very readable too!*
>
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Pi Supply