

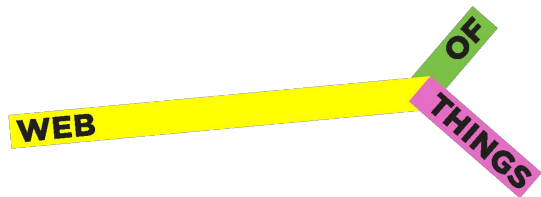


# The Web of all the other things...

WoT principles applied to CPG, Apparel, etc.

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Dominique Guinard | 4th of June 2019



*“Activate the things that move your business”*



# building the web of things

With examples in Node.js and Raspberry Pi



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## 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 be 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 a 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 ubiquitous 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 and discuss its position on top of this ecosystem of RESTful devices.

Our main aim is to provide the basis for building the Web of Things. By providing practical guidelines to blend real-world devices into the existing Web, devices and their properties become browsable with any Web browser, without the need for any additional software or driver to be installed. Moreover, simple mashups can be built out of components from physical devices and other resources that can be built with

WEB  
OF  
THINGS

# 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 [...]

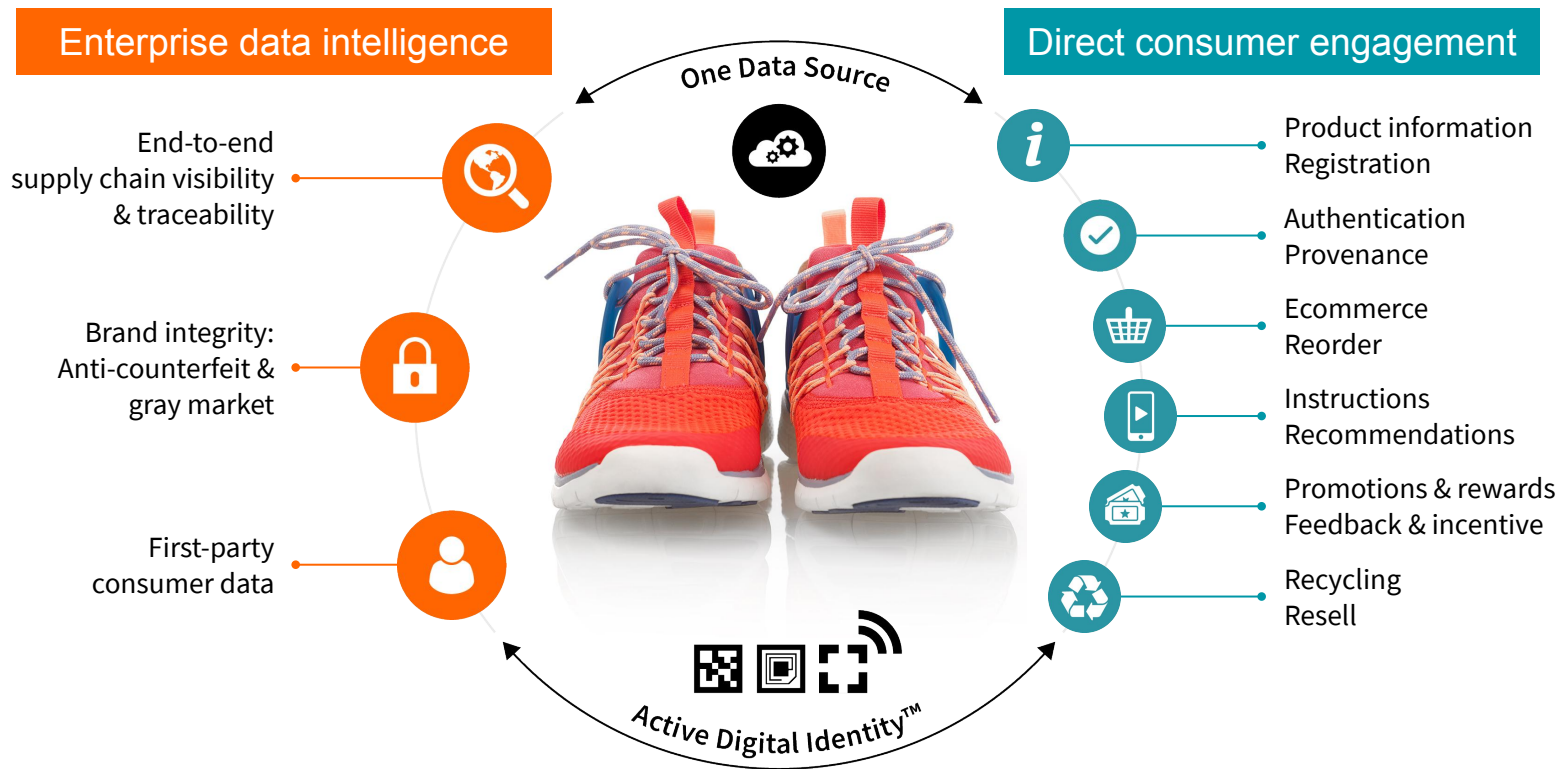
Kevin Aston



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

©The New Yorker Collection 1993 Peter Steiner  
From cartoonbank.com. All rights reserved.

# WHEN *EVERY* PRODUCT IS A SMART PRODUCT



# Why does it matter here?

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+



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# Standards in the CPG, Apparel, Pharma space

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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

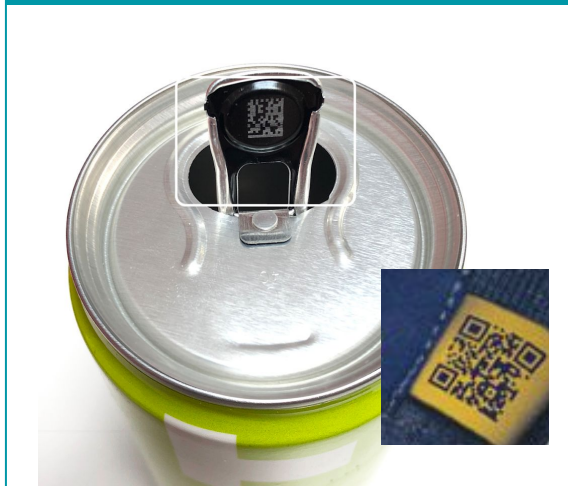
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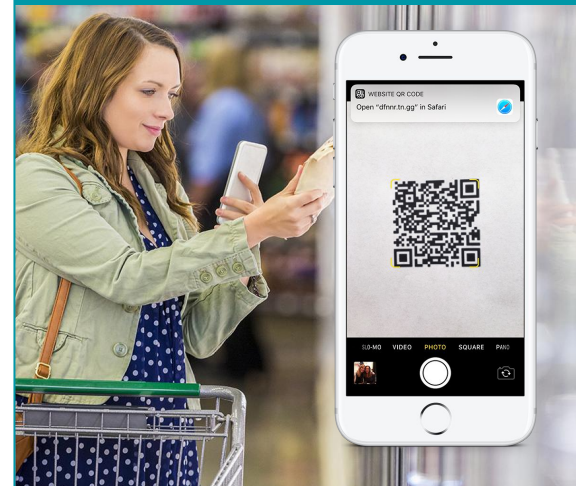
ONE CODE FOR ENTIRE LIFECYCLE



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

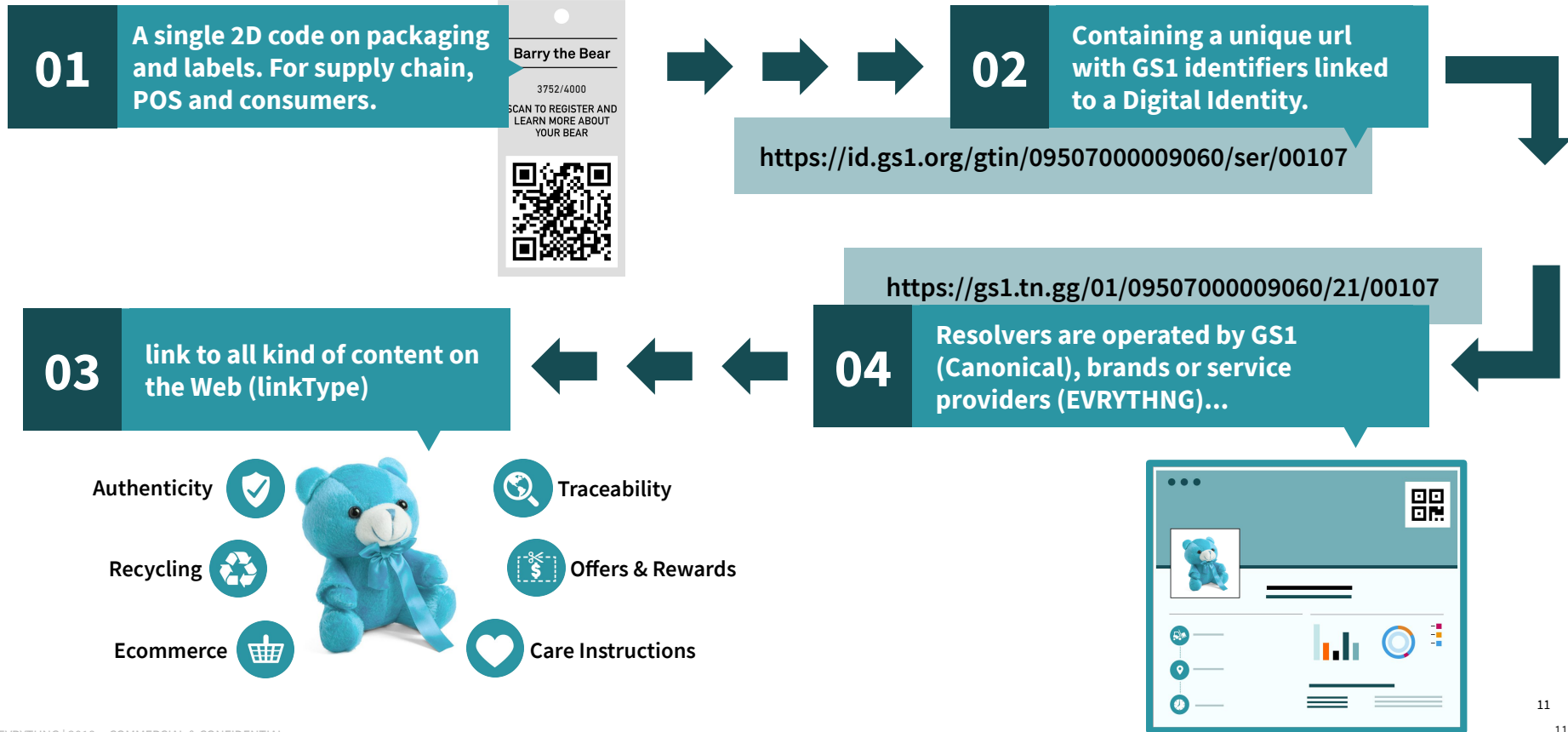


2 billion+ smartphones  
can now scan standard  
product codes with camera



Technology originated by EVERYTHING

# Resolvers: Delivering Web content for Digital Links



# GS1 DIGITAL LINK EXPLORED: MOWI



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

 **GS1 Digital Link Tools** [Home](#) [Generator](#) [Verifier](#)



## Get Started with the GS1 Digital Link


This [new standard](#), ratified in August 2018, allows physical products to connect to the Web, using an intelligent product identity in the cloud, supporting not just point of sale scanning but consumer interaction and a host of new digital applications.



### Create Your GS1 Digital Link

See how GS1 Digital Links are formatted and what attributes can be included.

[OPEN GENERATOR](#)



### Verify Your GS1 Digital Link

Already created a Digital Link? Check that it is valid with our verifier too.

[OPEN VERIFIER](#)

- 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**

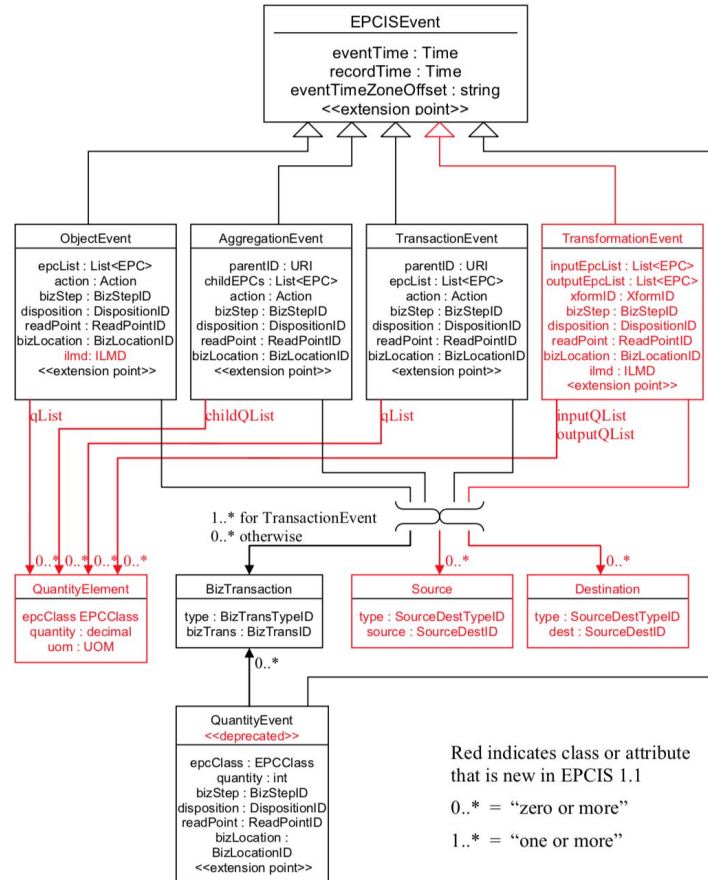
## **Making Track and Trace first class citizen of the Web**

# 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*

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## 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



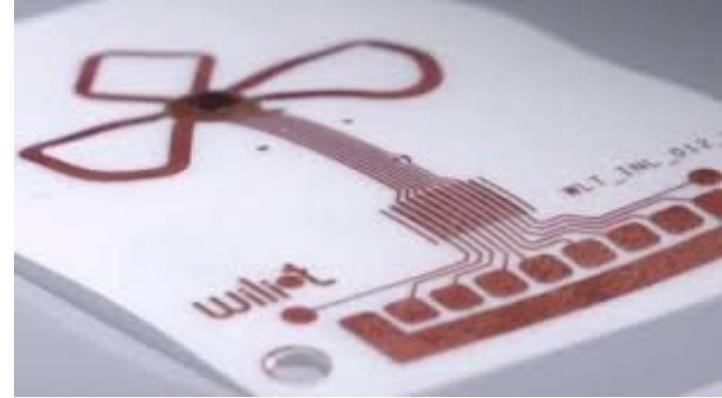
# Back to W3C WoT

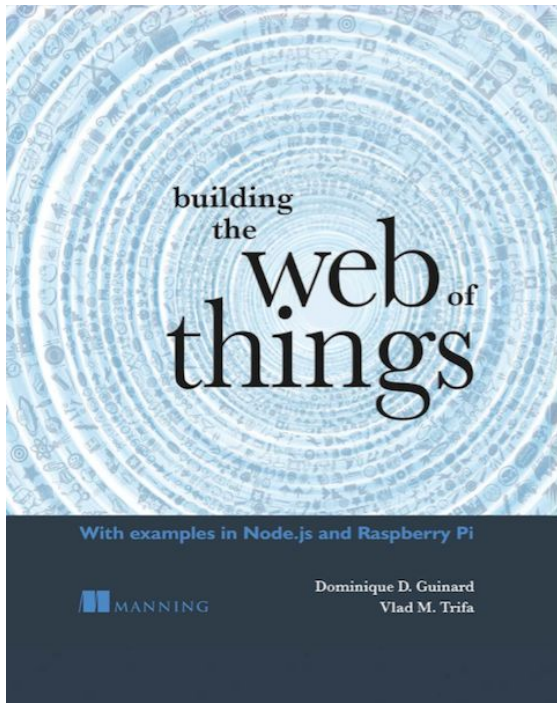
## *Building Bridges*

# Building bridges for all the things!



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





39% off “Building the Web of Things”  
with code “39guinard” on:

<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!*

Steve Grey-Wilson, Thingworx, A PTC Business



Pi Supply

# OUR PRIMARY COLORS

Choose and use these colors for general elements

Primary & Accent

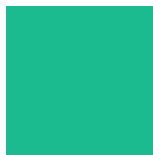


Text colors

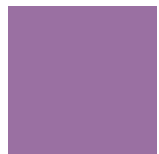


# PRIMARY COLORS

Choose and pick any of these colours to use in charts and diagrams as keys



Secondary



Tertiary