

# The Web of Things

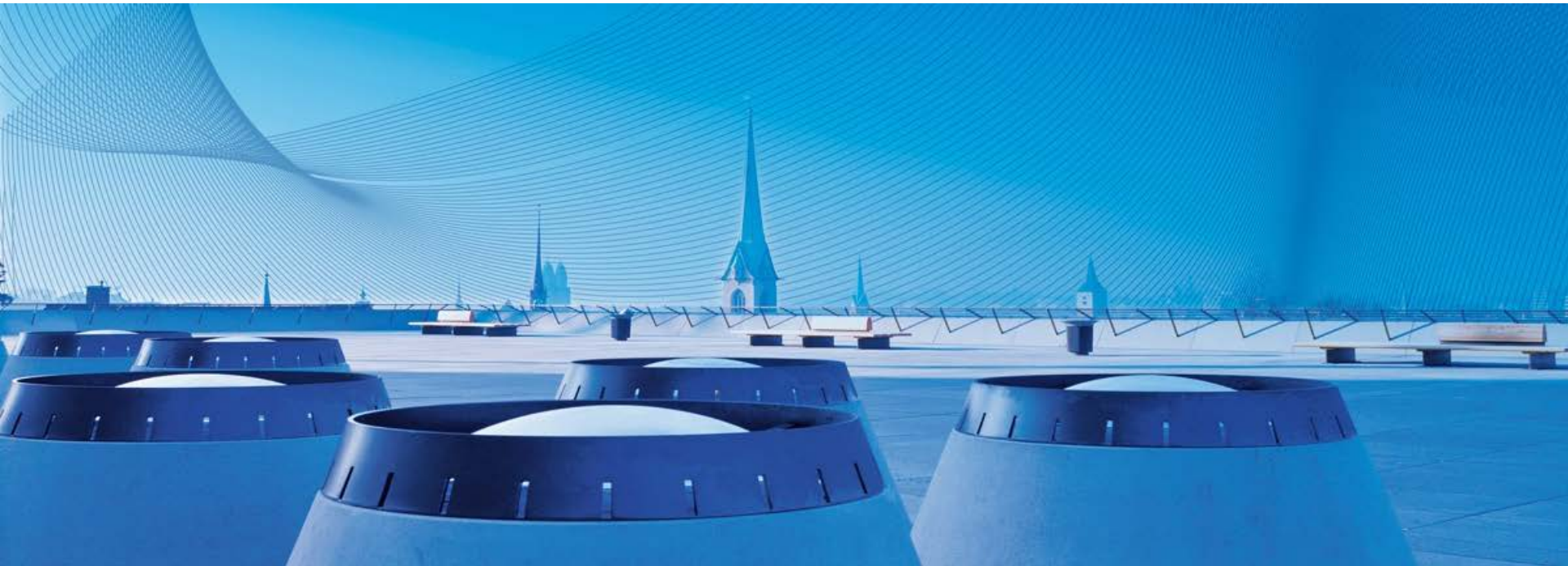
Internet of Things Zurich Meetup

**Simon Mayer** [[simon.mayer@inf.ethz.ch](mailto:simon.mayer@inf.ethz.ch)]

Distributed Systems Group, ETH Zurich



*architecting the web of things for tinkerers and hackers*





**“Facebook for Things”**

**An Active Digital Identity for *evry thng***



Cuno's talk: *“From selling a box to operating a service”*

Organizing the world's objects:  
Things get **unique digital profiles**



# Koubachi

**Give your plant a voice!**

**Beta**



Never again forget to water or fertilize your plants. It's fast, it's easy and it's fun!

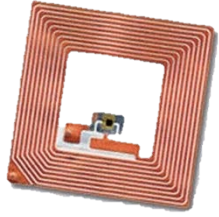
my.koubachi beta  
**Sign Up!**

 Koubachi iPhone App Review  
Watch

[www.koubachi.ch](http://www.koubachi.ch)



# Towards a Web of Things



# The Web of Things: Quick rundown



+ Internet Connection [IPv6]

+ Embedded Web server

+ Resource-Oriented Modelling (REST)

[IPv6] Hui, J.W., and Culler, D.E.: IP is dead, long live IP for wireless sensor networks. (2008)

## The Web of Things: REST benefits

- Great for open, interoperable APIs
  - Greatly facilitates creation of **mashups**
- Web features for free
  - **Bookmark** your devices and their functionality
  - **Caching** for scalability, **security** mechanisms
  - **People are used to exploring the Web using a browser**
- *Seems to facilitate application development*

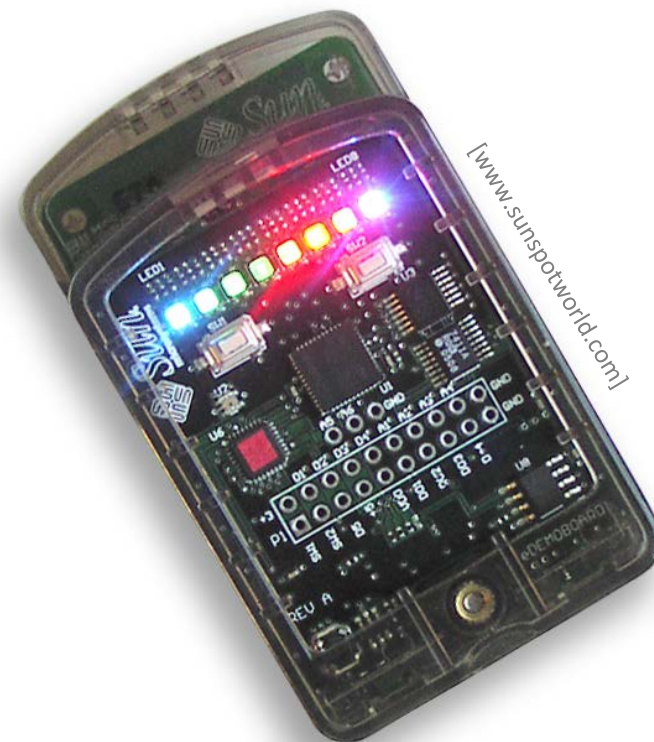


[derekskeba.com]



[cern.ch]

## Example: RESTful Sun SPOTs



### Example Resources....

**Light Sensor:** [http://host/\[SpotName\]/sensors/light](http://host/[SpotName]/sensors/light)

**LED Switch:** [http://host/\[SpotName\]/actuators/leds/3/switch](http://host/[SpotName]/actuators/leds/3/switch)

# The *People's* Web of Things

I don't have a PhD in  
computer science...<sup>1</sup>



**Enable tech-savvy users to develop applications**

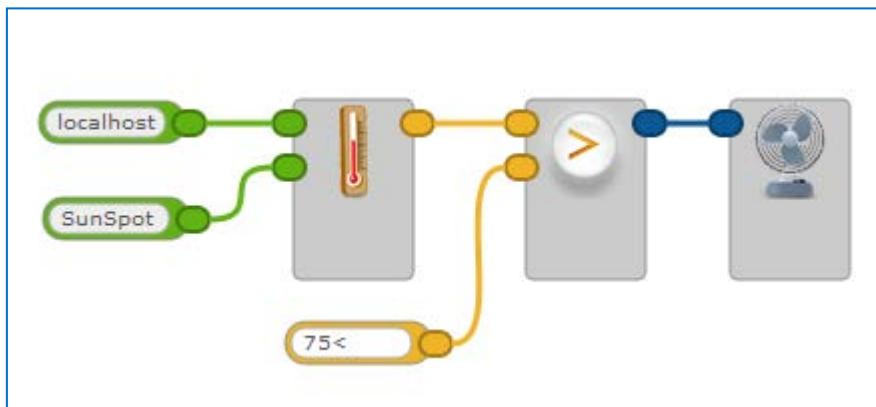
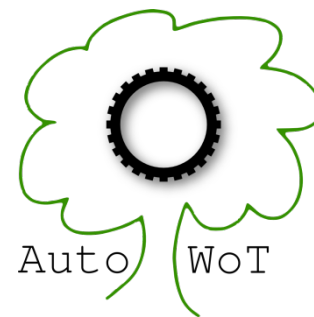
[«programming the real world»]

<sup>1</sup> Non-PhD-Nabaztag: Dom Guinard



# The *People's* Web of Things

- Facilitate the **integration** of things into the web
  - AutoWoT toolkit [[code.google.com/p/autowot/](http://code.google.com/p/autowot/)]
- Facilitate the **composition** of RESTful services
  - Clickscript (visual programming) + Web of Things modules

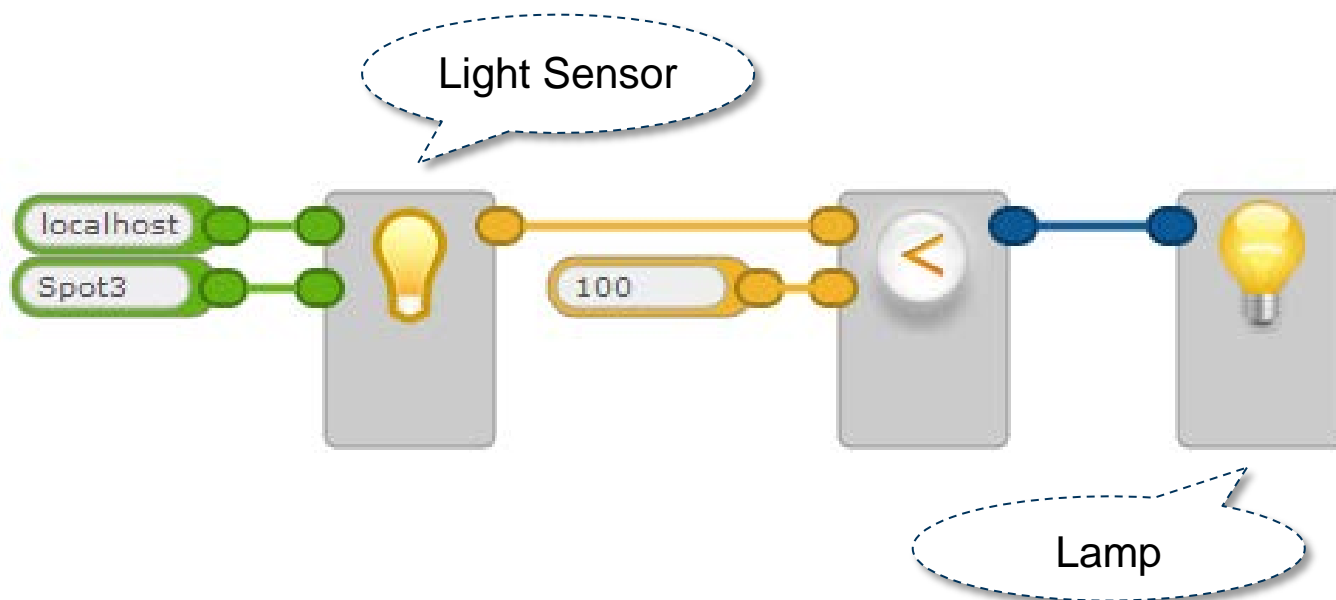


```
$.ajax({
  beforeSend: function(xhrObj) {
    xhrObj.setRequestHeader("Accept","application/json");
  },
  url: aurl,
  type: "GET",
  dataType: "json",
  success: function(result) {
    var temp = result.resource.getter.value
    state.outputs.item(0).setValue(temp)
    component.finishAsync();
  },
  error: function(msg) {alert("Error on: " + aurl); }
});
```

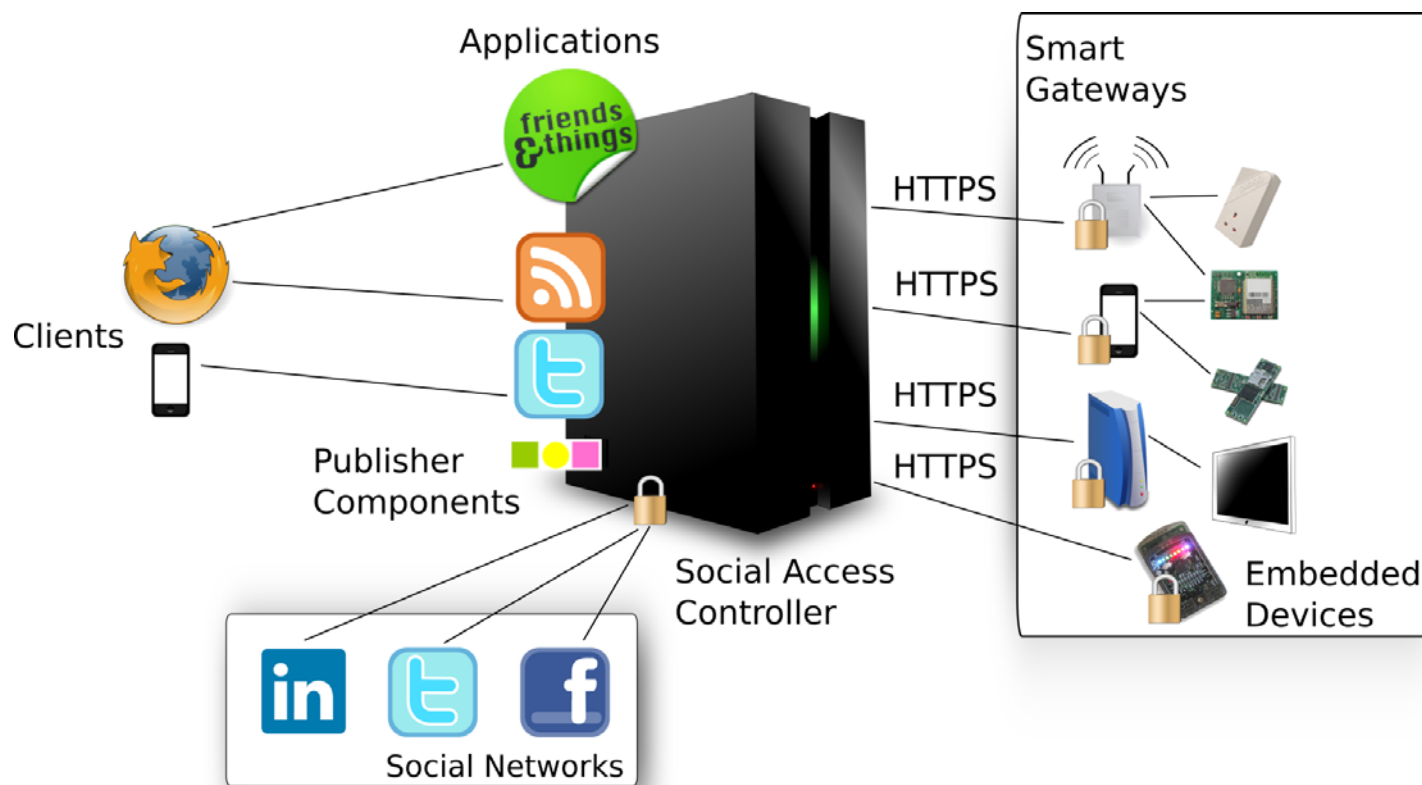
Mayer, S., Guinard, D., Trifa, V., Facilitating the Integration and Interaction for the Web of Things  
Naef, L.: [www.clickscript.ch](http://www.clickscript.ch)



Is there a demo on this, too?



# The Social Web of Things



- Sharing of physical and digital artifacts

# The *Social* Web of Things

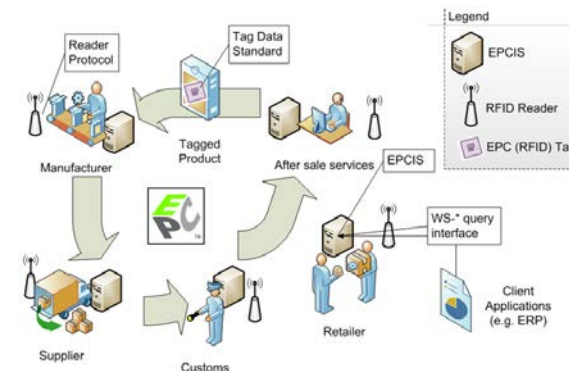
@home      Sharing your energy consumption  
                 Encouraging energy savings...



@work      Laboratory automation  
                 “You may monitor my mass spectrometer”



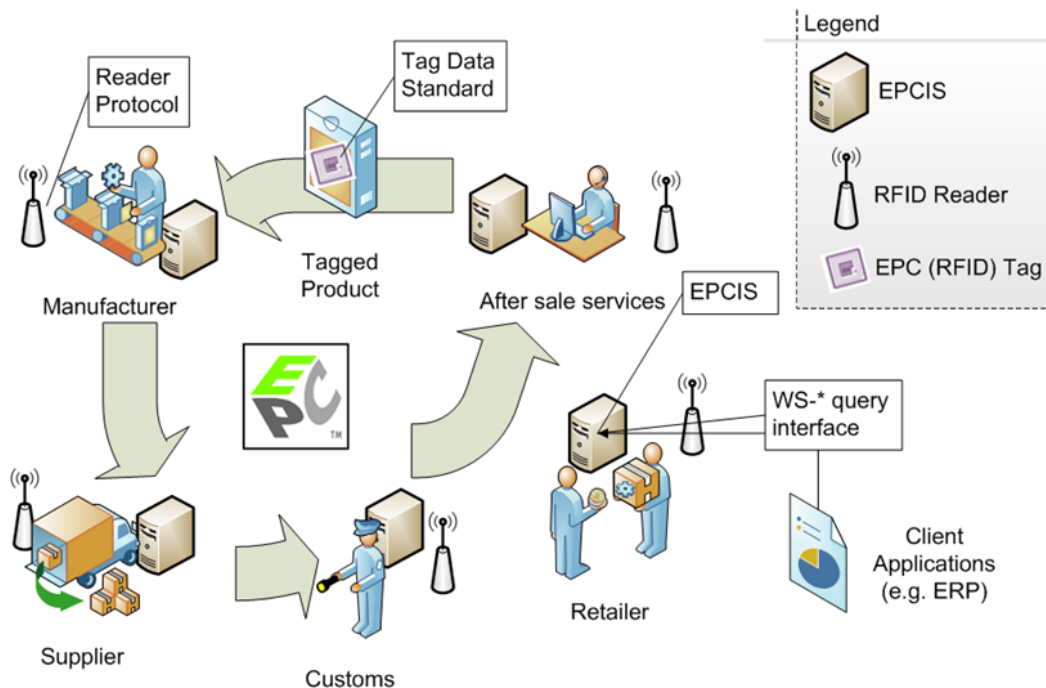
@business      Sharing the trace of tagged products  
                 RESTful EPCIS



# The *Businesses'* Web of Things

- Electronic Product Code Information System (EPCIS)
- Dashboard & Mashups based on RESTified API

**epc *CLOUD* appliance** 





# The next big thing(s) in smart things environments



**Service Discovery**



**Scaling Up**

# Service Discovery: Smarter Things?

- Adding semantics for service discovery
  - RDF, Microformats, Microdata
    - Microdata: [www.schema.org](http://www.schema.org), [data-vocabulary.org](http://data-vocabulary.org)



...and tell others!

- Make things just smart enough to know what they can (basically) do...
  - Syntactic level (e.g., data types)
  - Semantic level?

**Goal:** Support users in mashing up services in smart things ecosystems!

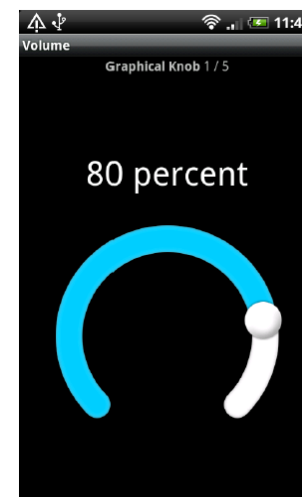
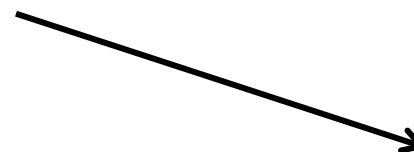
# Service Discovery: Smarter Things?

```
1 <span itemscope itemprop="interaction">You can  
2   <span itemprop="name">scale</span> this resource within  
   a range of  
3   <span itemprop="type-range">[0,100]</span>  
4   <span itemprop="type-unit">percent</span> (values are  
   of type  
5   <span itemprop="type-name">int</span>).  
6 </span>
```

*Human- and machine-readable volume controller interaction markup.*



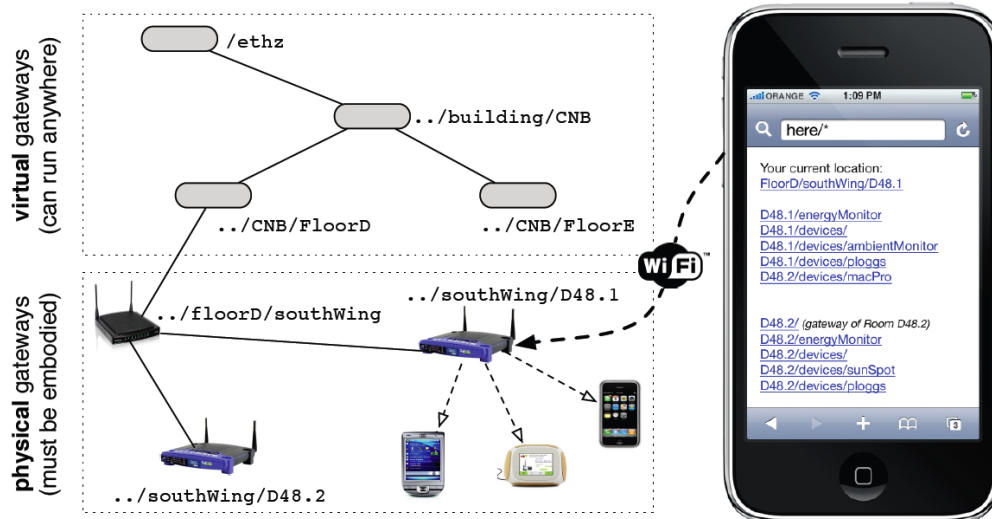
**InterWoTions**



# Scaling Up: Global-scale Service Lookup?

- Find services offered by Web-enabled resources
  - Globally, but with emphasis on nearby things!

- Location
  - Geometric: GPS
  - Symbolic: places hierarchy



**Goal:** A location-aware management infrastructure for smart things!

Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology ZurichFONDS NATIONAL SUISSE  
SCHWEIZERISCHER NATIONALFONDS  
FONDO NAZIONALE SVIZZERO  
SWISS NATIONAL SCIENCE FOUNDATION**SAP RESEARCH**

## Web of Things Team @ ETH Zurich

Matthias Kovatsch, Benedikt Ostermaier

## Evrythng Crew

Dominique Guinard, Vlad Trifa, Niall Murphy, Andy Hobsbawm

Christian Floerkemeier, Andreas Tschofen, Mathias Mueller, Mathias Fischer





# WoT 2012

## Third International Workshop on the Web of Things

[www.webofthings.org/wot](http://www.webofthings.org/wot)

Collocated with Pervasive 2012

June 19 2012, Newcastle, UK

Paper submission deadline: March 2, 2012

# WEB OF THINGS

*architecting the web of things for tinkerers and hackers*



# Thank you for your attention!



# Image Sources

Umbrella: [www.ambientdevices.com/cat/images/umbrella\\_full.jpg](http://www.ambientdevices.com/cat/images/umbrella_full.jpg)

Sun SPOT: [www.pats.ua.ac.be/content/images/sunspot.jpg](http://www.pats.ua.ac.be/content/images/sunspot.jpg)

Plogg: [www.vesternet.com/images/products/large/Plogg.jpg](http://www.vesternet.com/images/products/large/Plogg.jpg)

RN 134: [nl.mouser.com/Search/ProductDetail.aspx?qs=AgCZVjZcwuP1xHgaTPUeWA%3D%3D](http://nl.mouser.com/Search/ProductDetail.aspx?qs=AgCZVjZcwuP1xHgaTPUeWA%3D%3D)

Nabaztag: [www.productdose.com/article.php?article\\_id=5599](http://www.productdose.com/article.php?article_id=5599)

Squeezebox: [ii.alatest.com/product/full/0/8/Logitech-Squeezebox-Radio-0.jpg](http://ii.alatest.com/product/full/0/8/Logitech-Squeezebox-Radio-0.jpg)

Pot Plant: <http://www.ikea.com/us/en/catalog/products/90164898/>

Fridge: [www.antennamag.com/online/wp-content/uploads/2011/04/refrigerator\\_lg.jpg](http://www.antennamag.com/online/wp-content/uploads/2011/04/refrigerator_lg.jpg)

RFID Tag: [smallbiztrends.com/wp-content/uploads/2011/02/rfid-large.jpg](http://smallbiztrends.com/wp-content/uploads/2011/02/rfid-large.jpg)

Chumby: [chumby.files.wordpress.com/2010/01/07\\_b.jpg](http://chumby.files.wordpress.com/2010/01/07_b.jpg)

Mass Spectrometer: [www.jeol.com/Portals/0/prodshots/Al/JMS-T100LC.jpg](http://www.jeol.com/Portals/0/prodshots/Al/JMS-T100LC.jpg)

Phone: [www.phoneblog.com/wp-content/uploads/2011/11/samsung-galaxy-nexus.jpg](http://www.phoneblog.com/wp-content/uploads/2011/11/samsung-galaxy-nexus.jpg)

Robot Dog: [www.resonancepub.com/images/Robot\\_Dog.gif](http://www.resonancepub.com/images/Robot_Dog.gif)

Frame: [reviews.cnet.com/sc/33421202-2-200-0.gif](http://reviews.cnet.com/sc/33421202-2-200-0.gif)

Toaster: [www.freeimagesarchive.com/data/media/198/1\\_toaster.jpg](http://www.freeimagesarchive.com/data/media/198/1_toaster.jpg)

Car: [img.wallpaperstock.net:81/2009-audi-e-tron-2-wallpapers\\_15156\\_1024x768.jpg](http://img.wallpaperstock.net:81/2009-audi-e-tron-2-wallpapers_15156_1024x768.jpg)

## More References...

1. Mayer, S., Guinard, D.: *An Extensible Discovery Service for Smart Things*
2. Mayer, S.: *Service Integration – A Web of Things Perspective*
3. Guinard, D.: *Mashing up Your Web-Enabled Home*, Touch the Web 2010
4. Guinard, D., Fischer, M., Trifa, V.: *Sharing Using Social Networks in a Composable Web of Things*, Proc. of the First IEEE International Workshop on the Web of Things (WOT2010). Mannheim, Germany, March 2010
5. Pautasso, C., Zimmermann, O., Leymann, F.: *Restful web services vs. "big" web services: making the right architectural decision*, WWW '08

... and have a look at our other papers at <http://www.vs.inf.ethz.ch/pub/>