INCT
INTERSCITY
Future Internet for Smart Cities

Internet of Things: From Theory to Practice or Mapping the value beyond the hype

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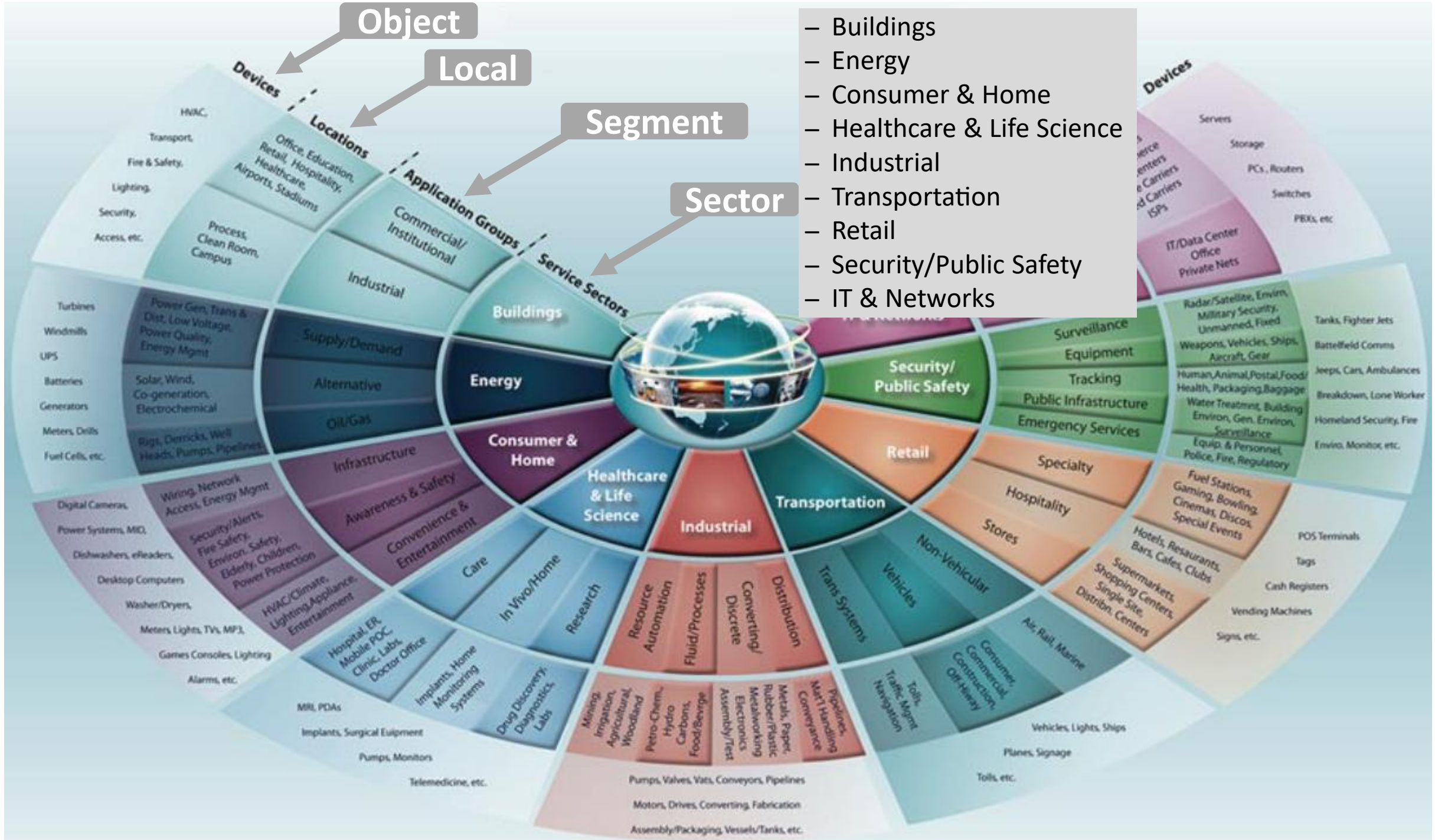
INTERNET OF THINGS

Internet of Things

- Inter-networking of physical devices embedded with electronics, software, sensors, actuators, and network connectivity which enable them to collect and exchange data
- Literally present in all segments of our live

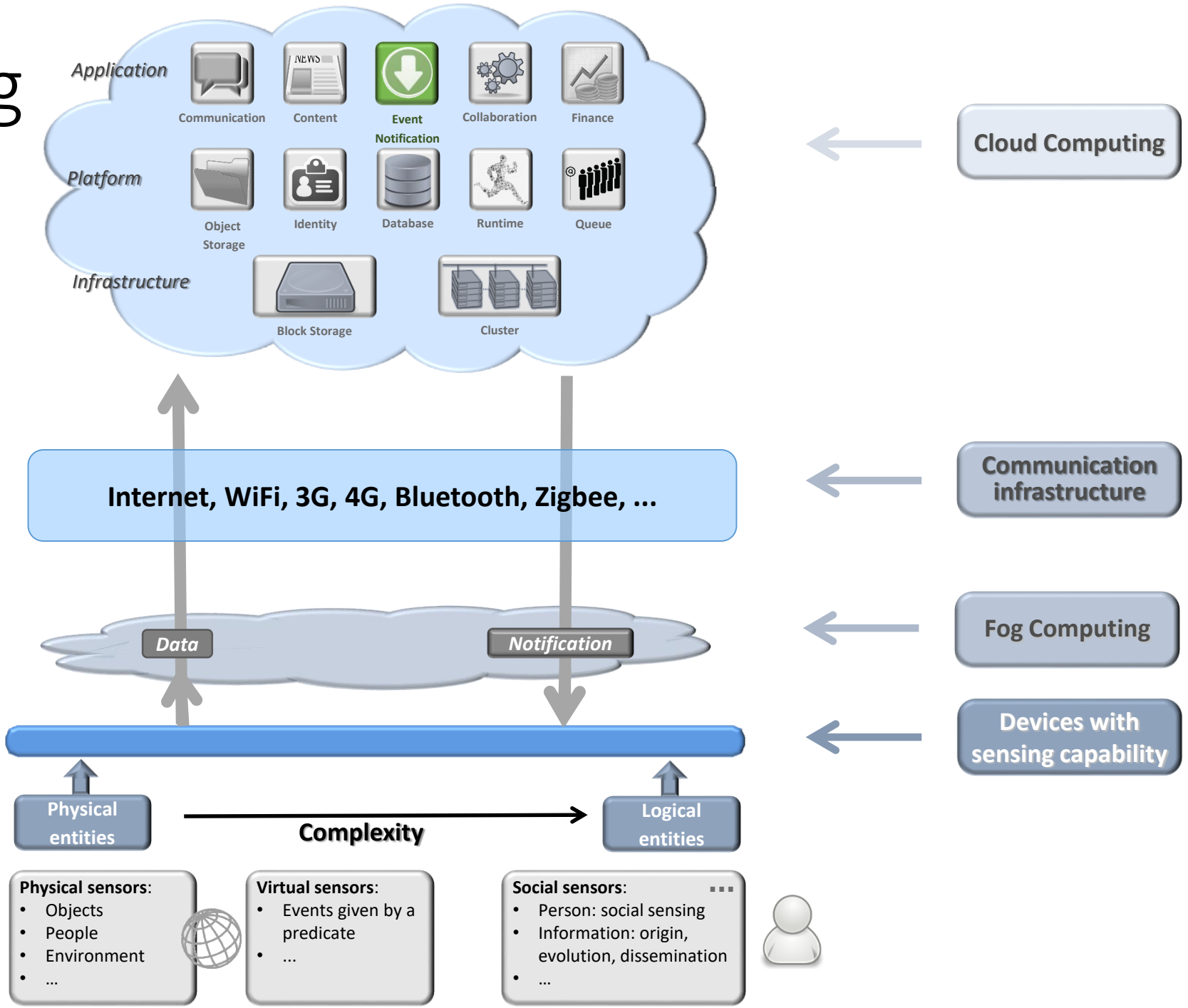
- Raw material provided by the Intenet of Things: **data**



- Buildings
- Energy
- Consumer & Home
- Healthcare & Life Science
- Industrial
- Transportation
- Retail
- Security/Public Safety
- IT & Networks

Sensing

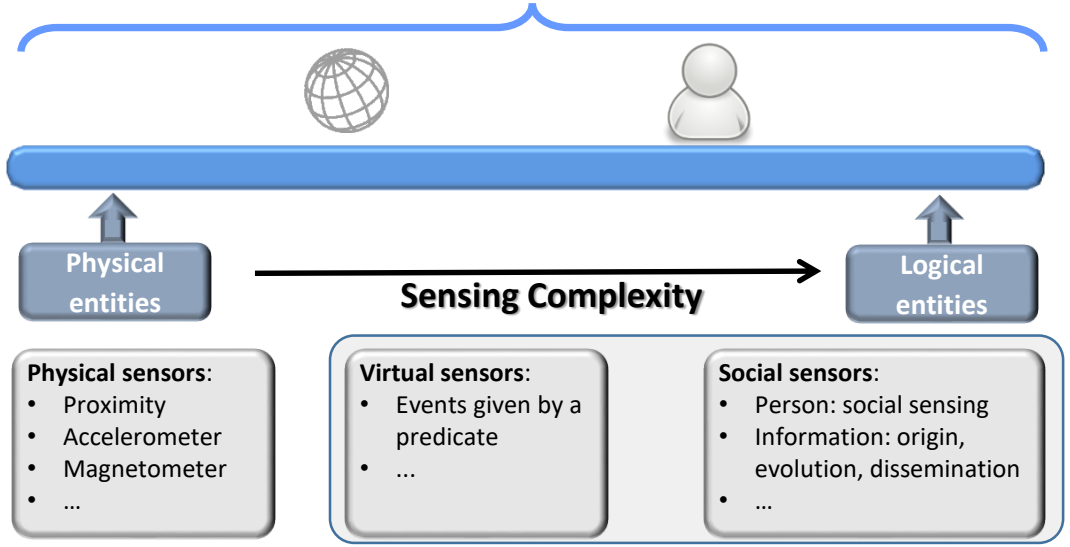
in a broader context



Sensing
in a broader context

Useful data to the user needs to be ….
- **Localization & Tracking**
- **Information fusion**
- **Security**
- **“Building block”**
- **…**

Smartphones have 20+ physical sensors

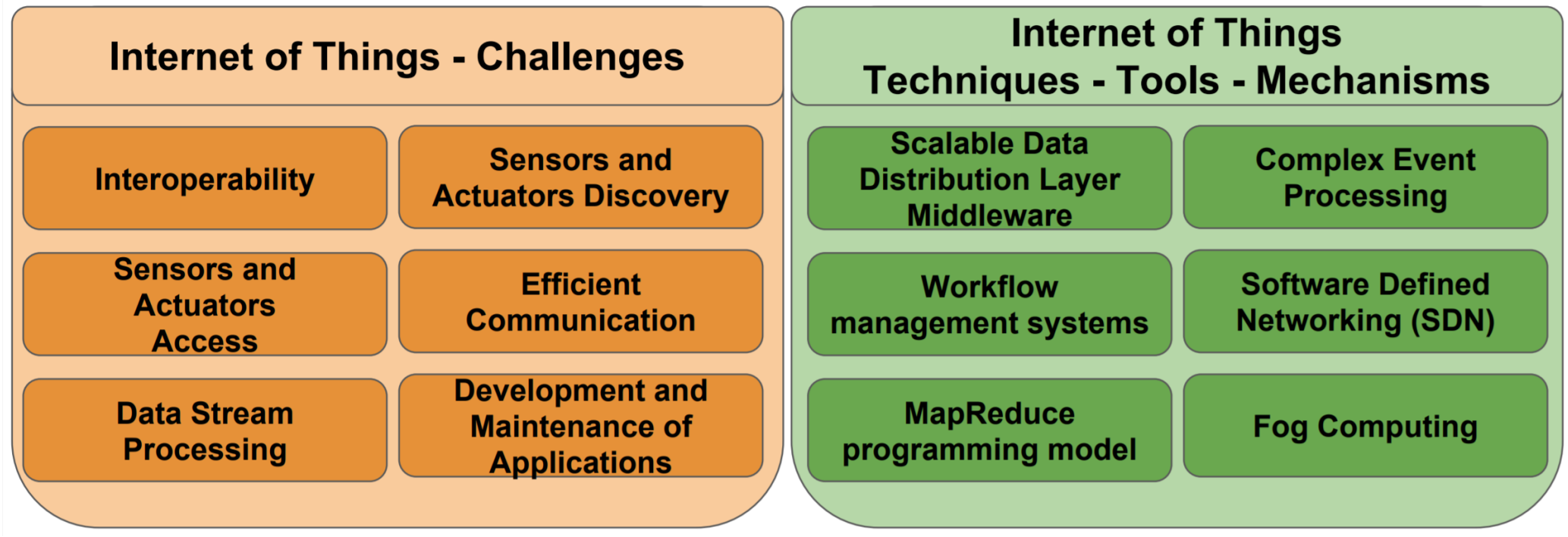


Broad sensing spectrum

We can create virtual sensors

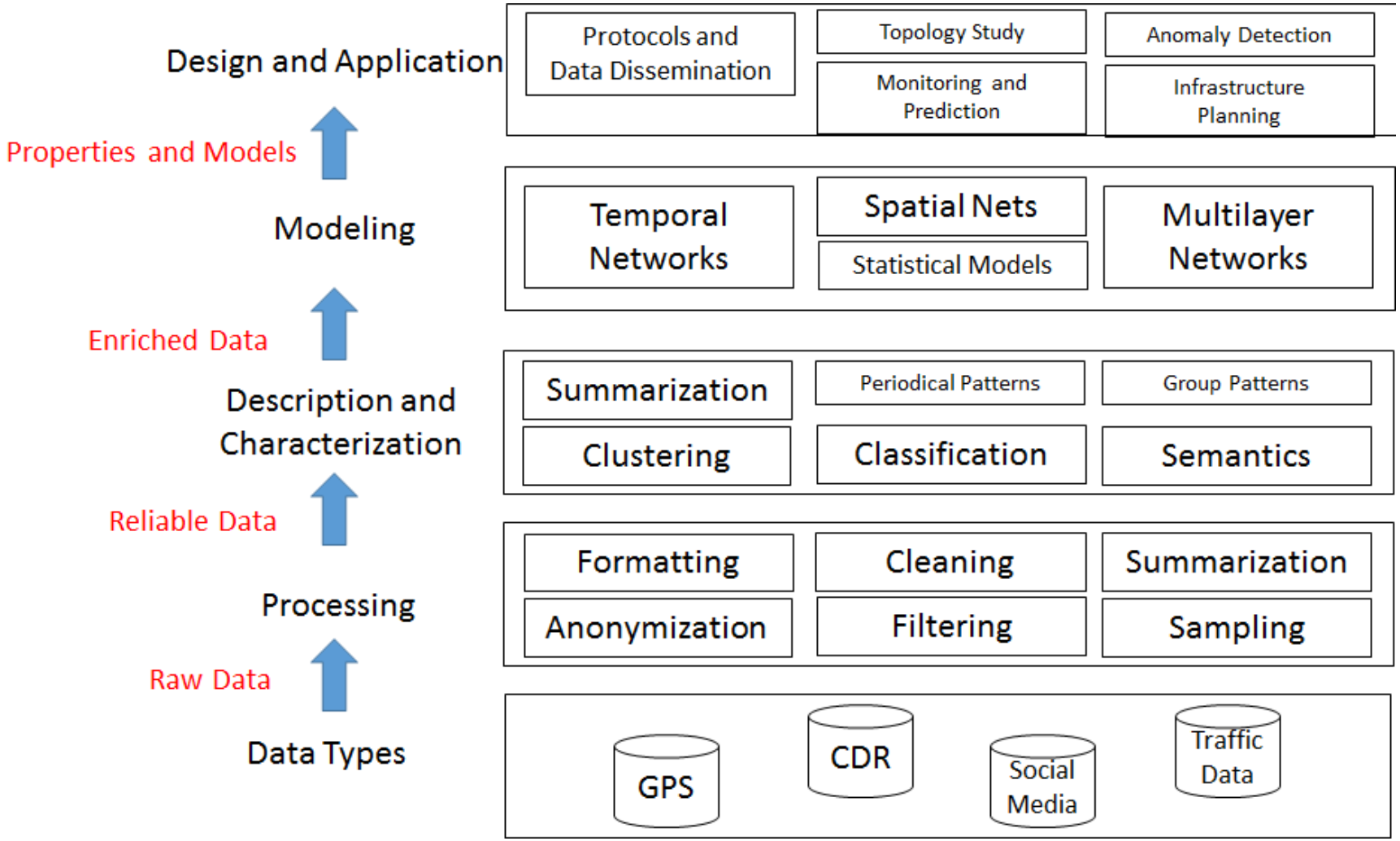
We can create social sensors

IoT building blocks or The theory behind IoT



From: InterSCity: Addressing Future Internet Research Challenges for Smart Cities
By Alfredo Goldman
http://interscity.org/publications/2016/InterSCity_NoF_2016-slides.pdf

IoT building blocks or The theory behind IoT

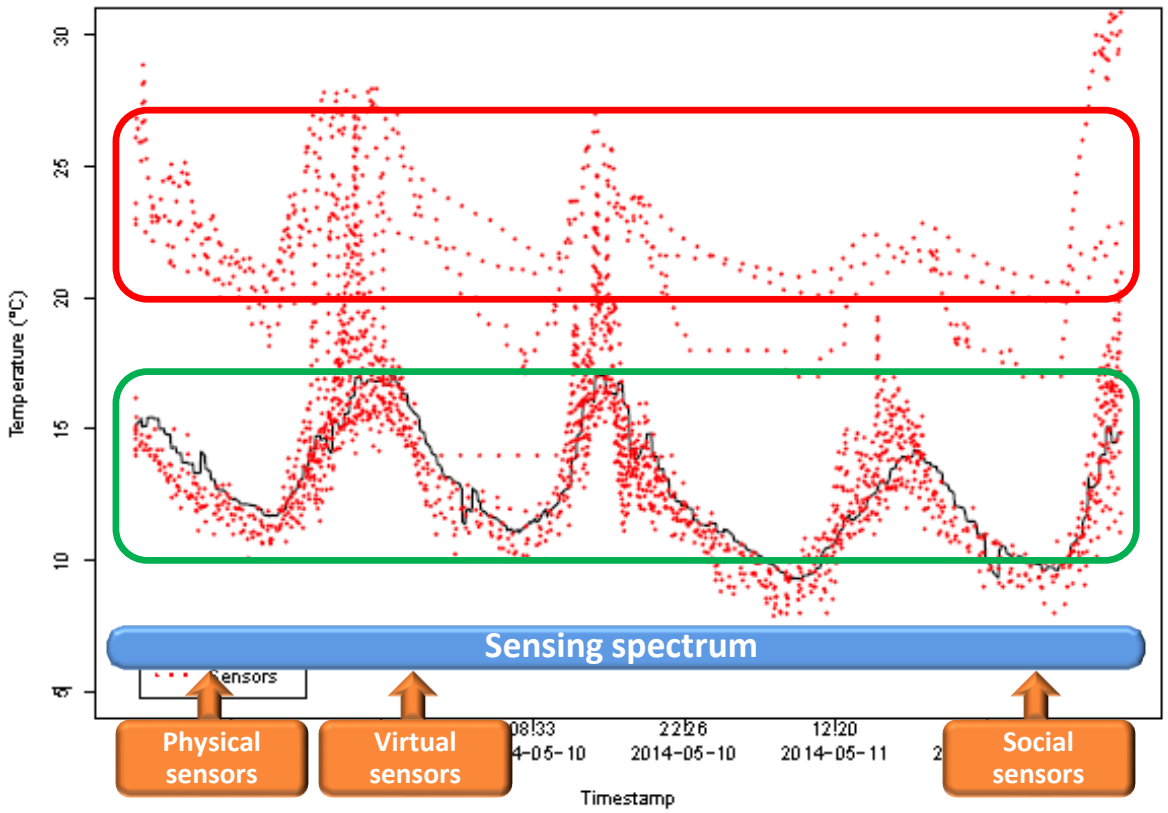


A theory taste: Processing

- Cleaning
  - Treat missing values
  - Identify and remove outliers
  - Solve inconsistencies
- Integration
  - Aggregate multiple data types
  - Detect and solve conflicts
- Transformation
  - Standardization
  - Establish a common unit
  - Summarization
- Anonymization

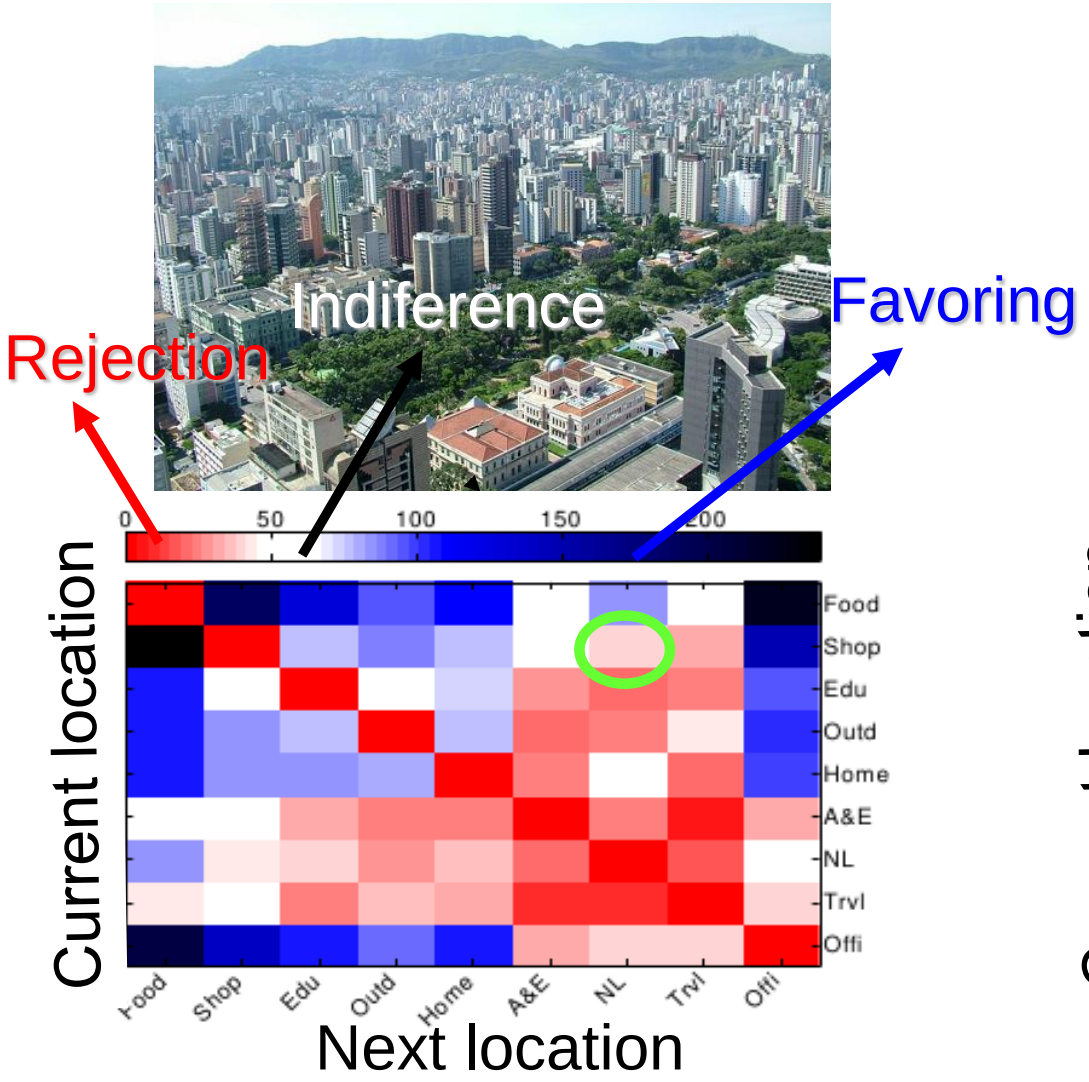
A theory taste: Processing and data filtering

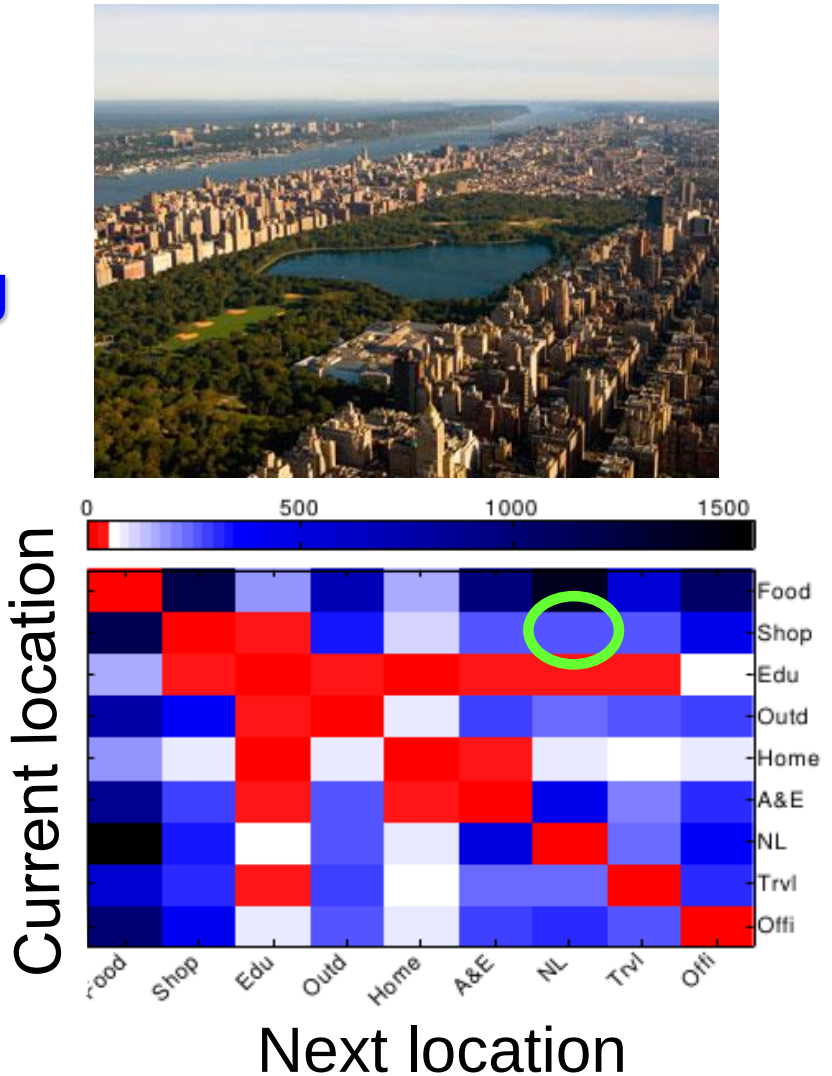
- Question: Can we just get and use sensor data available on the Web, …?
- Example: temperature data collected from sensors (London and region)



- Any “visible” problem here?
- Some typical problems:
  - Data in different scales
  - No data description
  - Data classified in a wrong way
  - Hardware problem
  - …
- We cannot just get and use any data!
- We need data filtering!

A theory taste: Social sensing





People

Infrastructure

Environment

IoT and its different segments

- Data will be generated from different sources in different segments
  - Isolated data has "little" value!
- IoT hardware is a differential, but …
- … but the real **value** here will be the treatment of data coming from IoT hardware
- “Technology” that leads to knowledge

Individual data has “little” value

07/12/2015 12h48 - Atualizado em 07/12/2015 13h25

Chip em bueiros vai monitorar pontos com risco de alagamentos em SP

Sensor vai apontar locais com lixo e obstruídos durante temporais na capital. Ação faz parte de um plano montado pela Prefeitura para período de chuva.

Sensors in storm drains will monitor points with flood risk in SP

Sensors will help to schedule the cleaning service

Is this data useful? Of course!

Different data sources or How to have a better processing

FORTUNE | Tech

INTERNET OF THINGS

IBM bought The Weather Company because weather affects nearly everything

Jonathan Vanian
Oct 28, 2015

IBM on Wednesday said that it had acquired most of The Weather Company including Weather.com and Weather Underground news sites as well as its vast trove of weather data. The deal does not include the company's cable television outlet, The Weather Channel, which will continue to broadcast.

IBM would not confirm the financial terms of the deal, but the *Wall Street Journal* reported that the price was over $2 billion.

If you're scratching your head at the deal, you're not alone. Why would Big Blue (IBM, -0.44%), purveyor of mainframe computers and business software, acquire a company that brought us Hurricane Sandy coverage?

Individual data has “little” value

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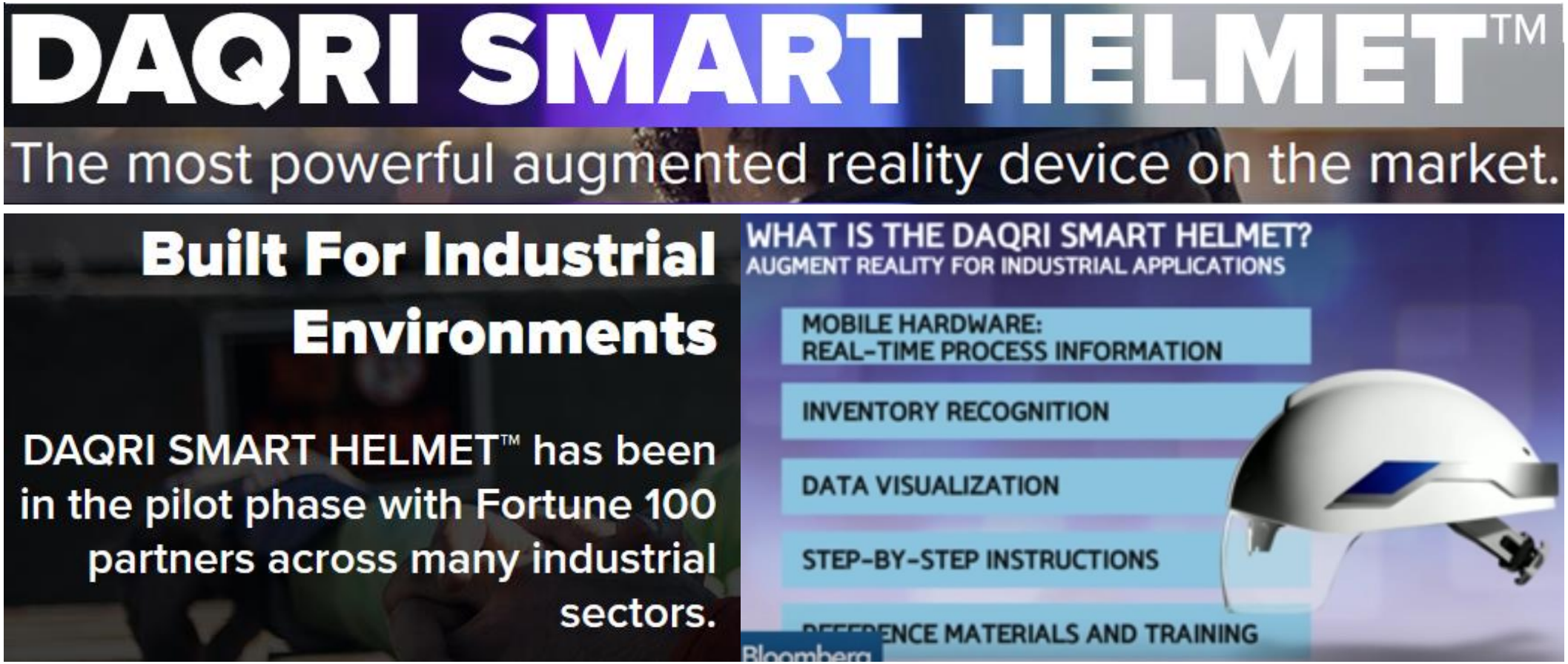
Is this data useful? Of course!

Weather forecast can change the schedule!

IoT and its different segments or The “original” Google glass in practice



IoT and its different segments

THE WALL STREET JOURNAL.

TECH

U.S. and Chinese Tech Firms Team Up on Sensor Networks for 'Smart Cities'

Sensity, CAS Smart City to work on technology that could monitor traffic and air quality, and provide video surveillance

Sensity Systems adds sensors and other technology to light poles for 'smart city' networks, as shown in this fixture installed in Kansas City, Mo. *PHOTO: SENSITY SYSTEMS INC.*

By DON CLARK

6 COMMENTS

Updated May 12, 2016 8:22 p.m. ET

China plans to spend heavily on technology to help cities cope with headaches such as air pollution and traffic jams—and perhaps unruly mobs and outlaws. Silicon Valley companies are teaming up to seize the opportunity despite civil liberties issues, a trend that could raise the profile of players like Sensity Systems Inc.

The closely held company, whose investors include Cisco Systems Inc. and General Electric Co., on Friday is expected to announce a joint venture with a spinoff from China's Academy of Sciences to help build new-wave data networks with such features as video surveillance and sensors to monitor traffic and air quality.

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Wall Street Journal, May 12, 2016

http://www.wsj.com/articles/u-s-and-chinese-tech-firms-team-up-on-sensor-networks-for-smart-cities-1463081921

Was Google crazy?

US$ 249

US$ 99

TIME

GOOGLE

The Real Reason Google Paid $3.2 Billion For Nest

The potential market for its products could be big, like really big

By Verne Kopytoff | Jan. 14, 2014

where they are. Imagine turning on the oven from work so that dinner is waiting when you get home or letting the maid in the front door while on relaxing at the beach.

Connected homes are expected to make for a huge market. Sales of the technology are expected to pass $40 billion in the next five to seven years, according a Gene Munster, an analyst for Piper Jaffray.

Technology companies including Google, Intel and Cisco Systems are serious about capturing a piece of the market. So are telecommunications giants like AT&T, appliance manufacturers Honeywell and GE along with firms that install home security systems like ADT.

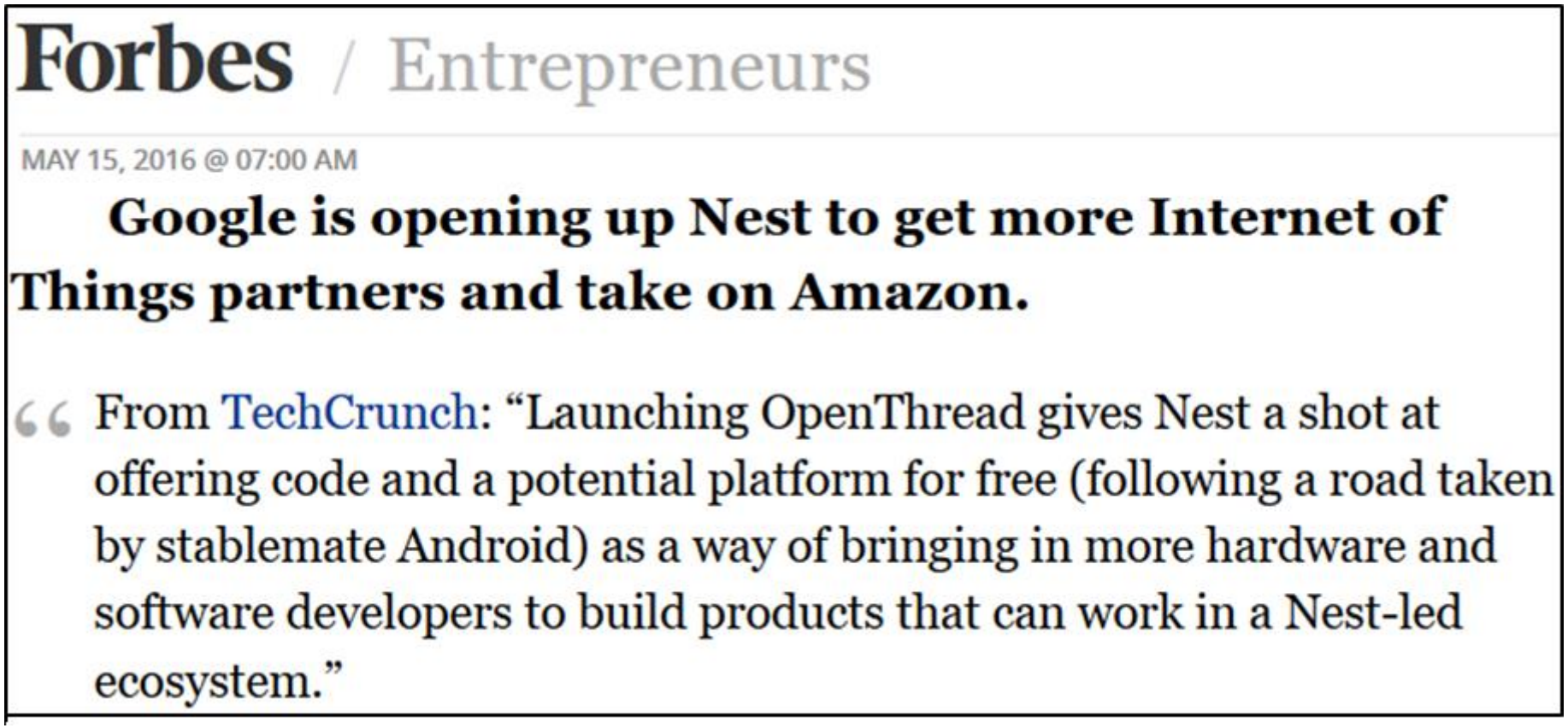
But the race is not just about selling fancy appliances. It's also a fight for which company coordinates smart homes and collects data about the habits of those who live inside. Internet companies like Google are trying to learn as much as they can about consumers to better target them with advertising. Knowing what people do at home—whether they cook a lot or when they leave for their job—could add a new dimension to personalized ads beyond what can be learned from their use of desktop computers and smartphones.

Market value

Players

Data
↓
Information
↓
Knowledge

Look back and have an idea of what to expect



Forbes / Entrepreneurs

MAY 15, 2016 @ 07:00 AM

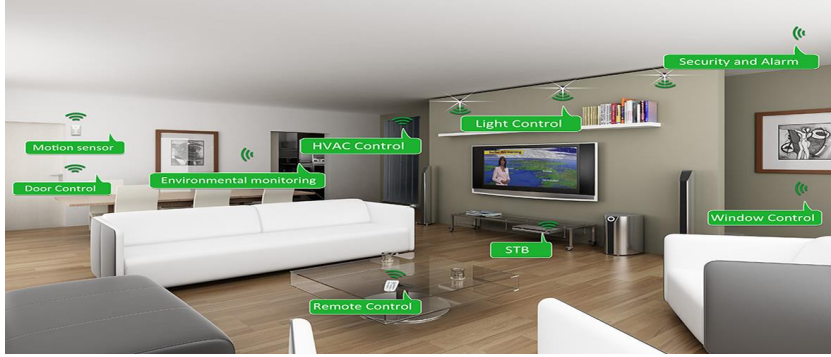
Google is opening up Nest to get more Internet of Things partners and take on Amazon.

“From TechCrunch: “Launching OpenThread gives Nest a shot at offering code and a potential platform for free (following a road taken by stablemate Android) as a way of bringing in more hardware and software developers to build products that can work in a Nest-led ecosystem.”

Forbes, May 15, 2016

http://www.forbes.com/sites/quickerbettertech/2016/05/15/5-tech-news-items-from-this-week-that-could-make-you-money/#69d832320367

IoT in practice or
The “war” for your home



- Fact: several companies are already competing to be the IoT solution for the smart home/building of the future
- Strategy: create distinct ecosystems (such as iOS and Android smartphone market)
- Some companies and their initiatives:
  - Google: Google Home (Nest is now a company of Alphabet)
  - Amazon: Echo and Alexa
  - Apple: Apple TV hub and HomeKit
  - Samsung: SmartThings hub
  - LG: SmartThinQ hub
- All of these systems work within their individual product lines, but none provide a cohesive solution that allows interconnectivity

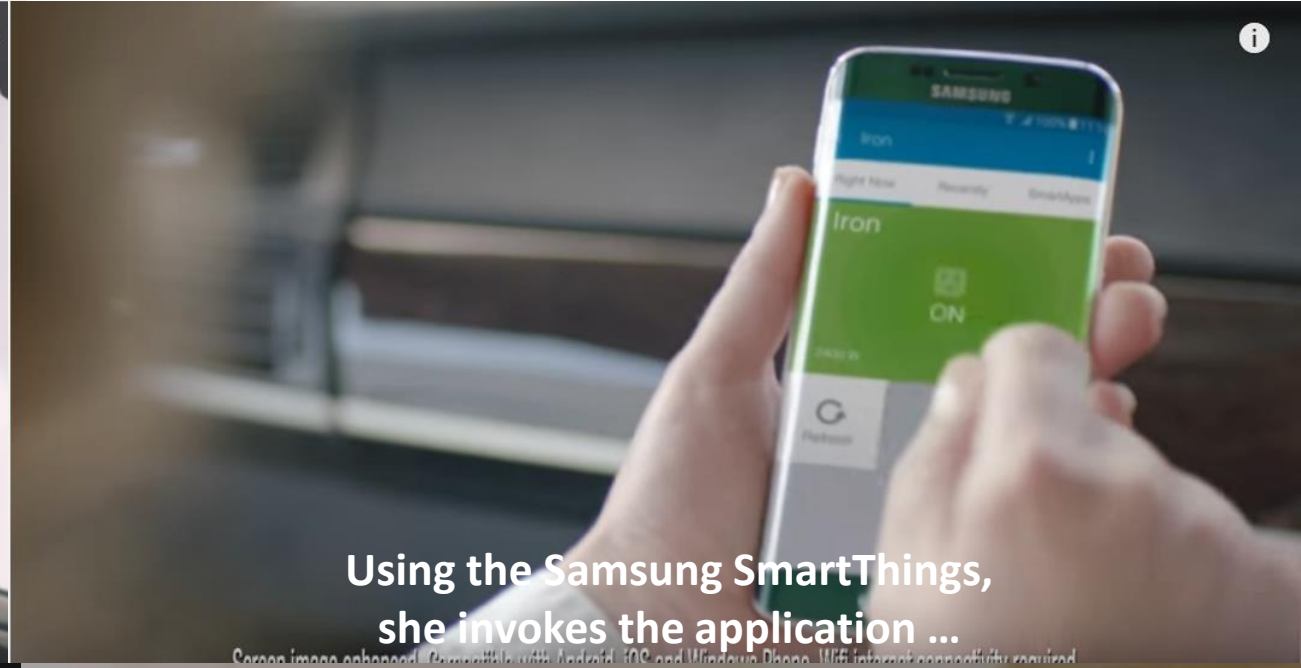
Google Home

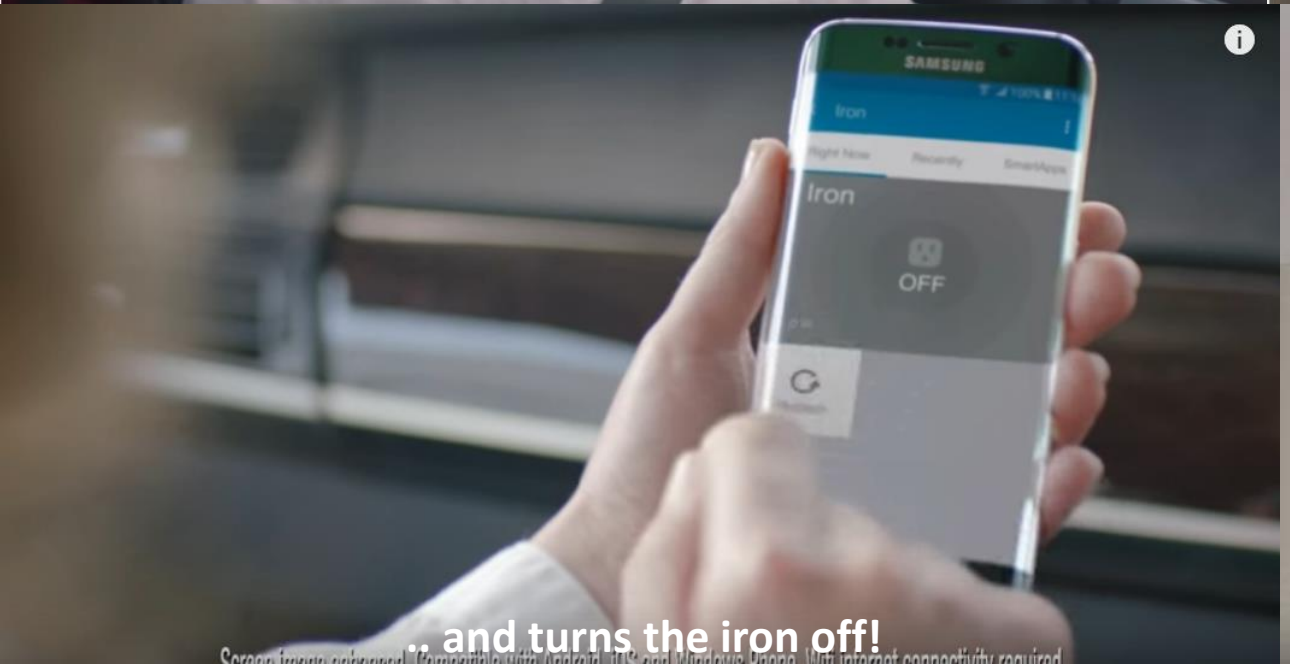
Highs:

- It can be personalized to you, giving you info on your commute, weather, and calendar
- Works with Chromecast
- Answers questions and follow-ups fairly well
- Lots of choices for music

Lows:

- Can only link to one Google account for now
- Limited smart home control

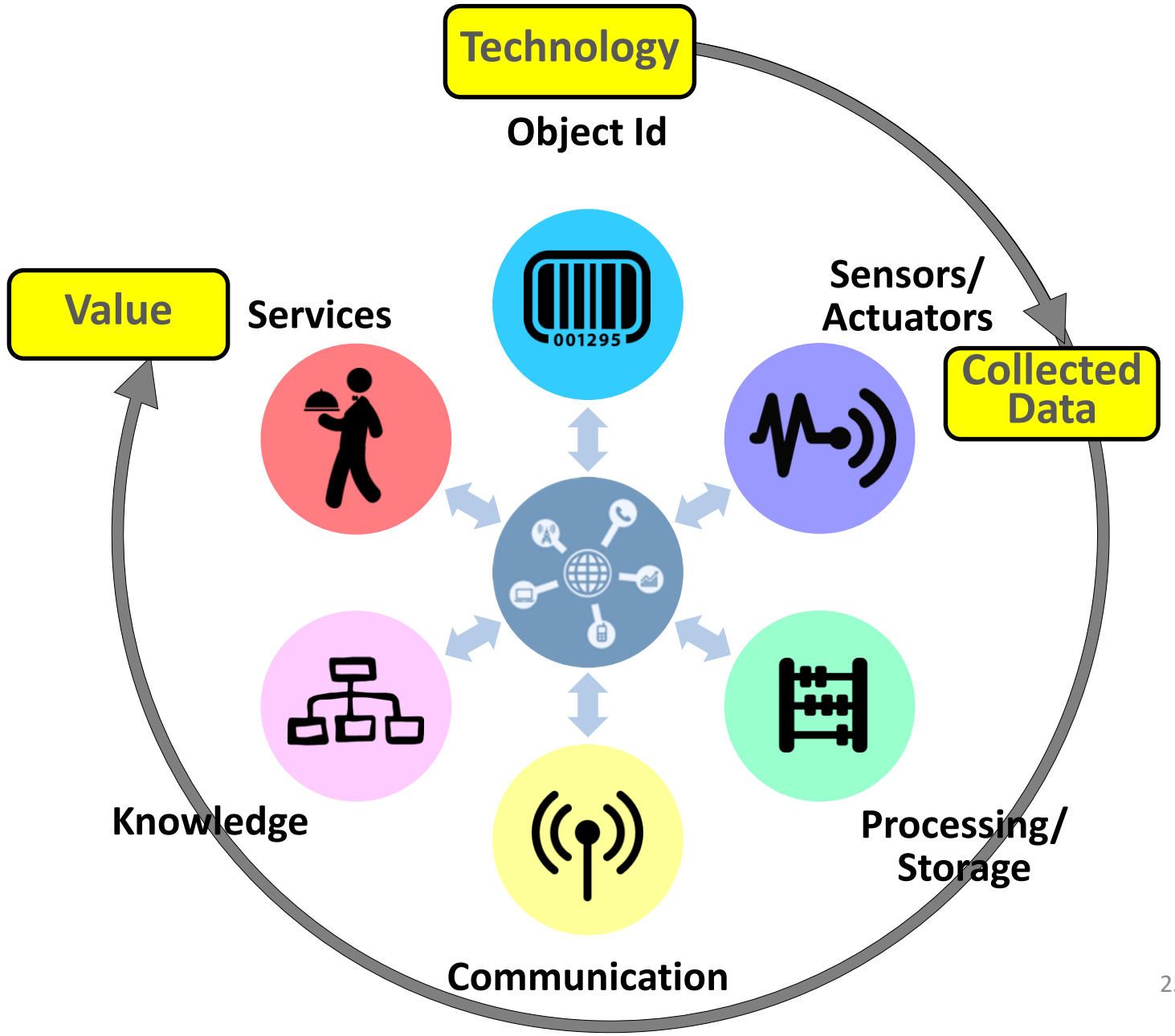




Scenes from Samsung SmartThings | Caught Out
https://www.youtube.com/watch?v=FTiTjqOMCnw

Ultimate goal for IoT

- Create value for people, business, society at large
- Design for personalization!
  - Fundamental issue!



Google Ad or Is this the value?

PARKS PERSPECTIVES

Access and Entertainment | Advertising and Apps | Connected Home Systems and Controls | Connected CE and Platforms | Digital Health | Digital Home Support Services | Digital Media and Content Distribution

Disrupting the PPC Model - Google's First Attempt at Advertising on Google Home

by **Dina Abdelrazik** | Mar. 21, 2017

Last Thursday, Google provided an unsolicited ad to Google Home on its smart speaker. Google Home users reported asking their de news updates, and traffic, the speaker played a 17-second promo immediately took notice of the sly ad insertion taking to social me disruptive.

But among the backlash, Google's attempt at advertising should come as no surprise. It is after all an advertising search engine. Having cornered the market by monetizing the point-and-click experience, Google will naturally do the same with its voice-first device. However, as this trial illustrated, advertising on a user interface without a screen poses a challenge. Search on a computer, tablet, or phone, provides the consumer the ability to swipe past and ignore sponsored ads without fully disrupting the user experience. Now, imagine if you were locked out of your computer for 30 seconds while an ad played on your entire screen—you would feel captive. This is comparable to the ad experience on a voice-first device.

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Latest in Gear

The Morning After: Friday, July 28th 2017

17m ago

Amazon's 'The Hub' is a delivery locker for residential buildings

3h ago

SpaceX schedules Falcon Heavy's maiden launch for November

5h ago

Sling's video production

OK, Google: Don't put ads in the Google Assistant

Users didn't pay $130 to get audio commercials.

Nathan Ingraham, @nateingraham
03.17.17 in Internet

151 Comments | 2680 Shares

THE BACKLASH WAS QUICK

It is no surprise that the comments on Reddit and Twitter were overwhelmingly negative. It may have led to Google pulling the promotion from distribution as discussed in this Twitter thread.

Matt McGee @mattmcgee — 16 Mar
Replying to @dannysullivan @brysonmeunier
I can't replicate that on my Home. :-(

brysonmeunier @brysonmeunier — Follow

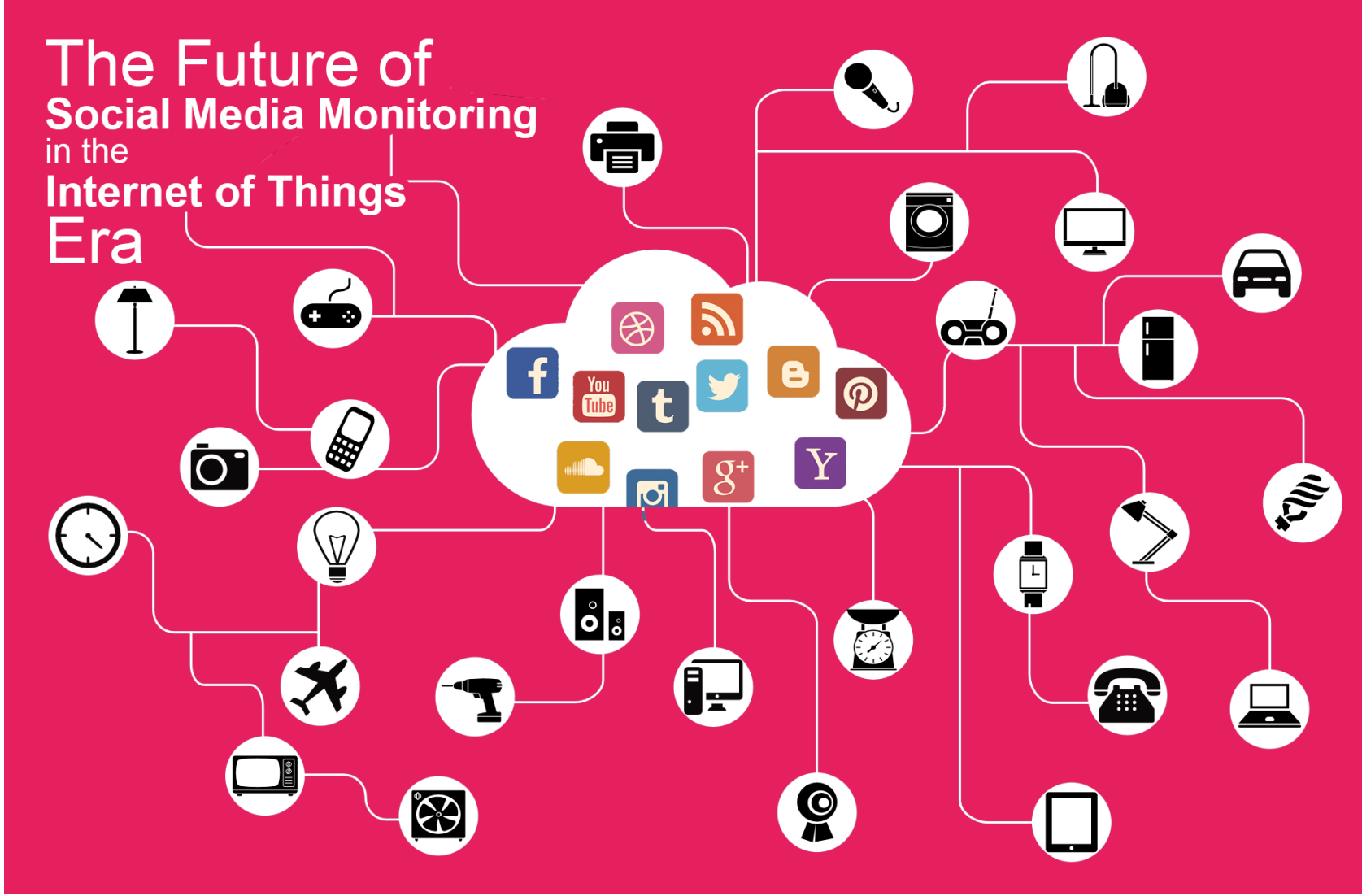
they may have turned it off as there appears to be a backlash.

5:36 PM - Mar 16, 2017

1

Social media and IoT

Social IoT (SIoT)



Social IoT

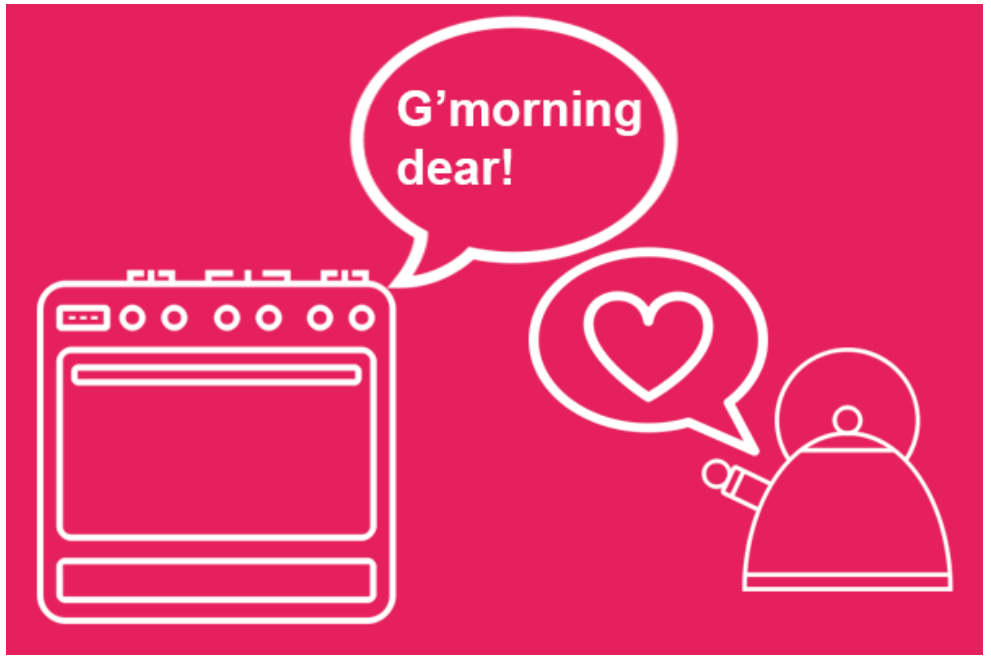
- Convergence of social media and the smart objects era services
  - New social interactions
- In SIoT, all smart objects are socialized and social relationships can be established among them
- What do we need?
  - Novel data fusion algorithms, use of machine learning techniques to automate decision making and support efficient social communication and collaboration among smart objects

Social IoT

- Goals:
  - Build a smarter world with social IoT (SIoT) applications
  - Keep separate humans and smart objects
  - Enable things to have their own social networks and interactions
- Perspectives:
  - Business applications and services will be associated with different groups of objects, where things will establish friendship's relationship to the achievement of mutual benefits
  - For instance, services designed towards reducing energy consumption of different cooperating objects
  - Smart objects will establish social relationships on the basis of their profile, their activities (e.g., mobility), as well as their interests

A new era in social media marketing & monitoring

- Social media companies will probably adopt new strategies for the future where smart devices will be socially interconnected
- Challenge: design smart objects optimized for use with social media, i.e., automated posts and shares to be regularly generated by the devices themselves
  - How about standards for that interaction?
- Possible outcomes:
  - Predict the development of new social communities among the smart objects
  - Identify and take advantage of new emerging trends for IoT devices coupled with social media



A new era in social media marketing & monitoring

- What will we need?
  - New social media monitoring techniques
  - New social media monitoring tools to work in collaboration with billions of socially-enabled IoT devices in an emerging social media era

  ➡Efficient social media analytics in the SIoT era
- Possible outcomes:
  - Changes in the business landscape as it is known today
  - Businesses can take decisions for their marketing strategy, by analyzing such data that will be gathered with the use of IoT-enabled social media monitoring applications

Conclusion
Or some takeaways

- Mapping the value beyond the hype:
  - Hype may actually understate the full potential of IoT
  - Understand where real value can be created and successfully address a set of system issues (theory), including **interoperability** at different levels, so IoT works in practice

- What are we going to need?
  - Research, education, training, policies …

Thank you!