



Embracing passive and active RFID as **ambient data**

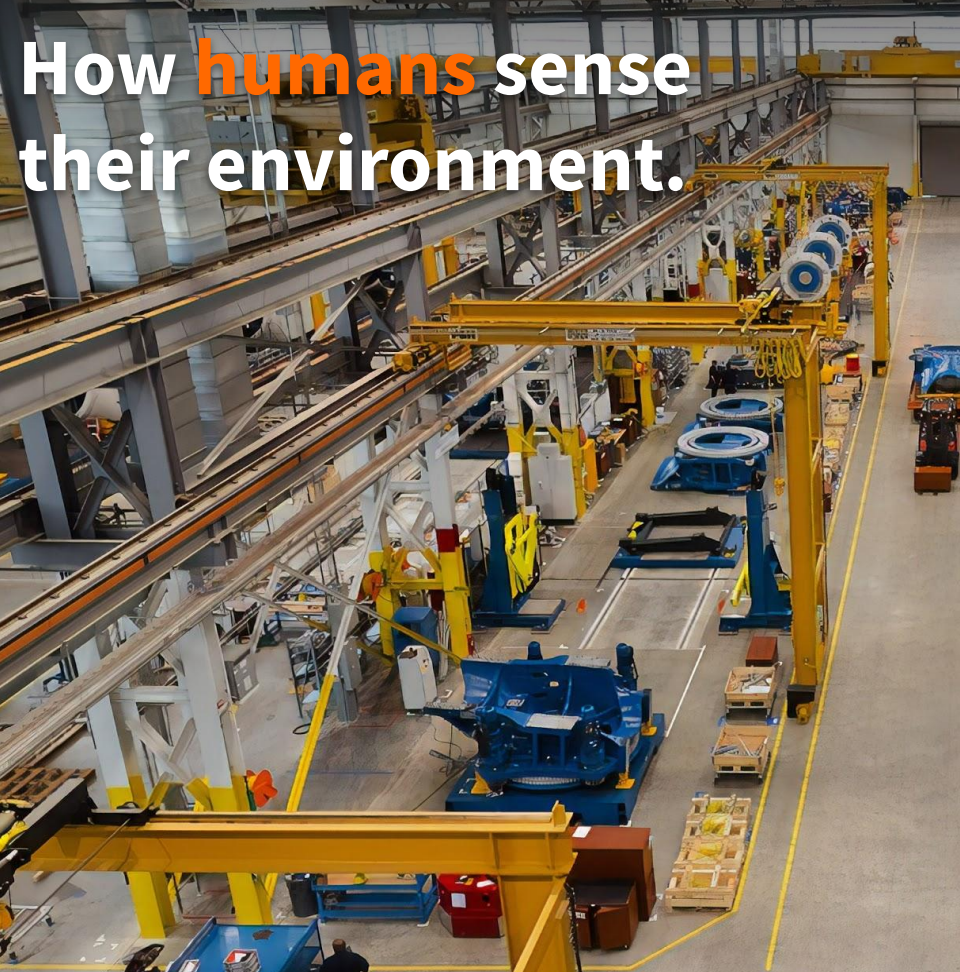
Jeffrey Dungen, co-founder and CEO of **reelyActive**

Part 1:

Human ambience. Machine ambience.



How **humans** sense
their environment.



How **machines** sense
their environment.



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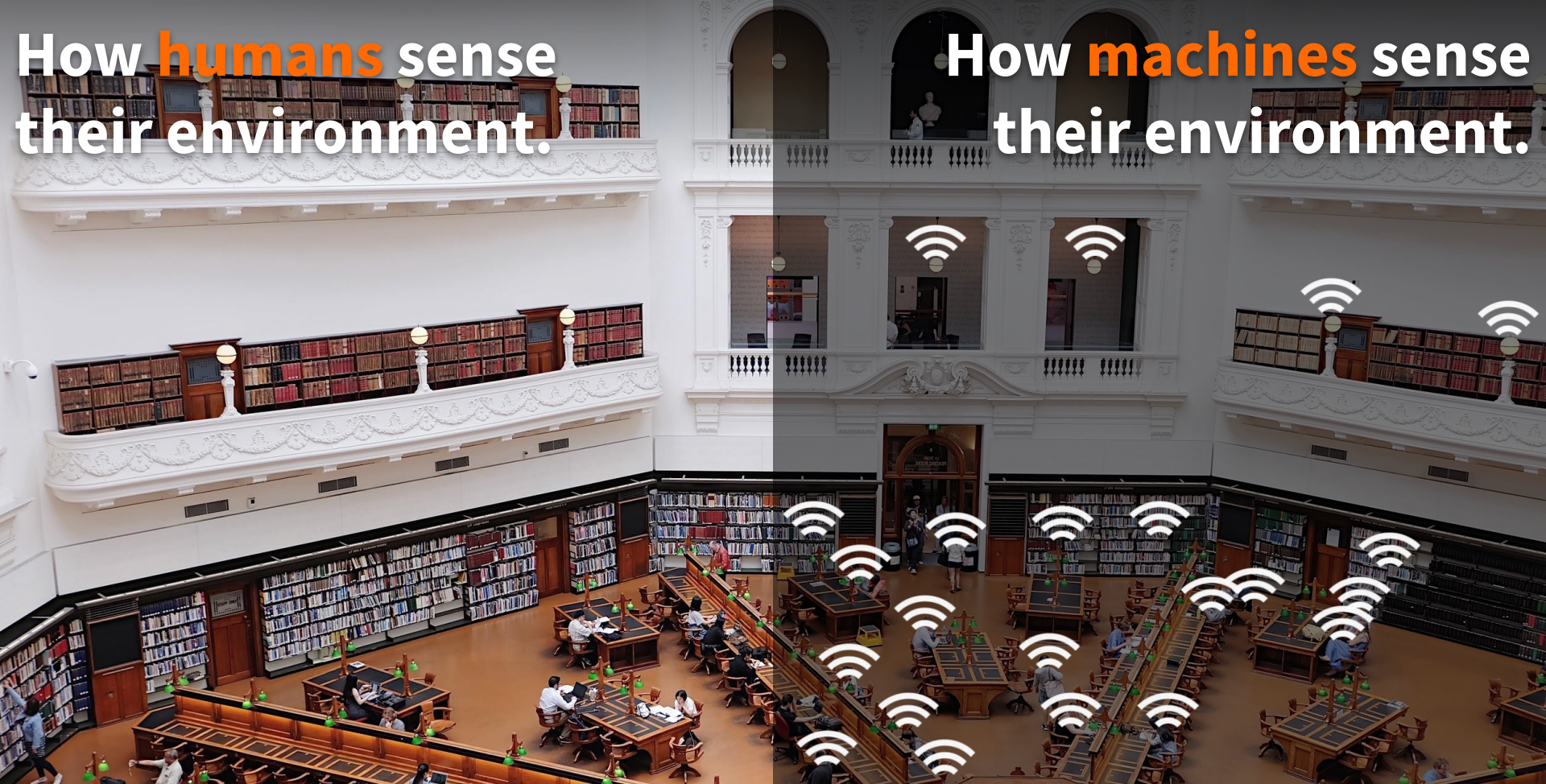
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Embracing passive and active RFID as ambient data



How **humans** sense
their environment.

How **machines** sense
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**engage
again**

How **humans** sense
their environment.



How **machines** sense
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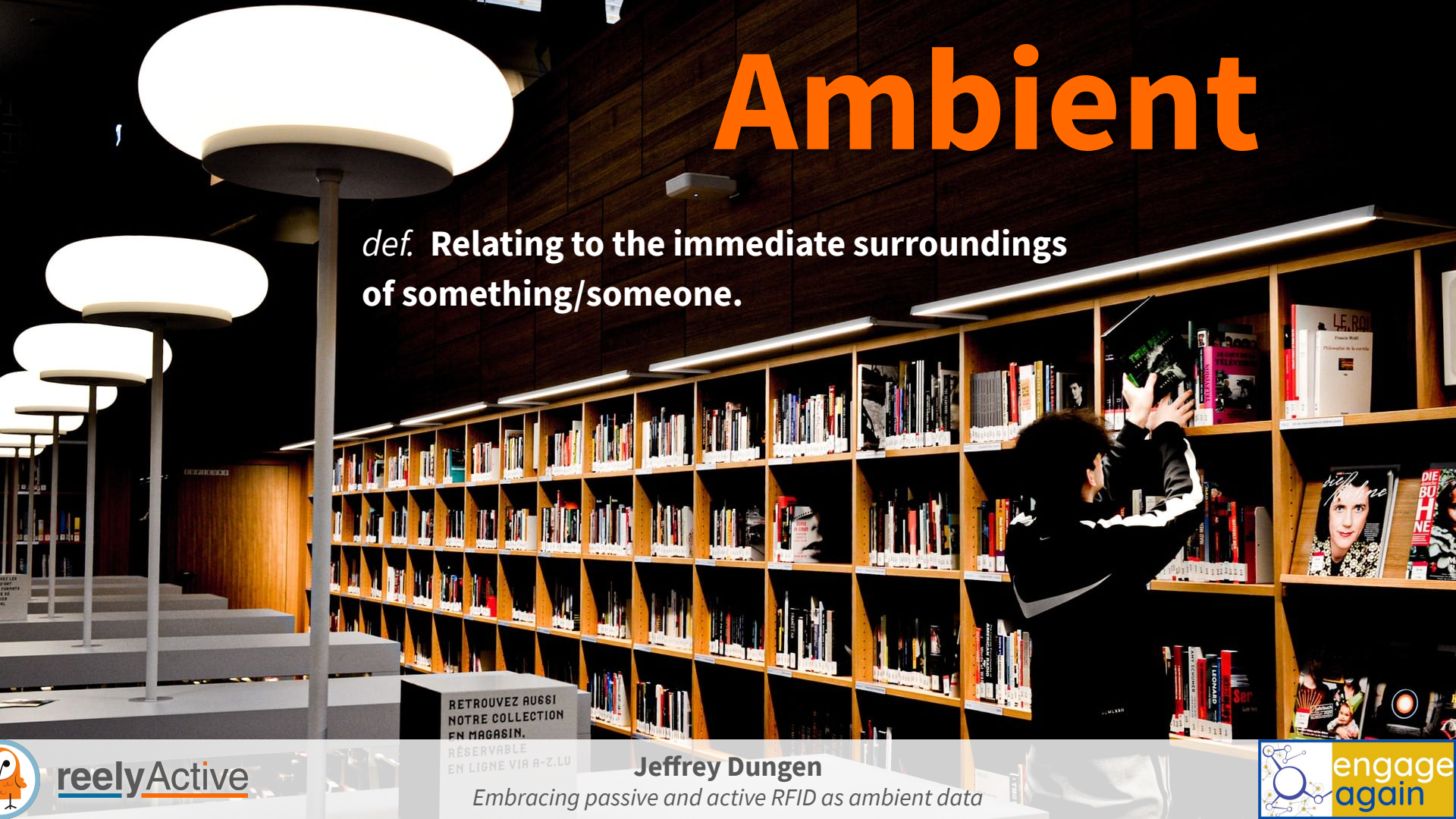
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**engage
again**

Ambient

def. Relating to the immediate surroundings of something/someone.



Machine-readable ambient data?

- AutoID: **what?**
- RTLS: **where?**
- M2M/WSN: **how?**



With tens of billions of standard passive and active RFID tags shipping annually, can we imagine these as a **ubiquitous** source of **ambient data** with the potential to enrich the spaces in which we live, work and play?





Why does Jeff care about **ubiquitous RFID** as **ambient data**?

I'm a computer engineer by training and spent my career:

2004-2010: Building 5.8GHz Active RFID RTLS (from the ground up)

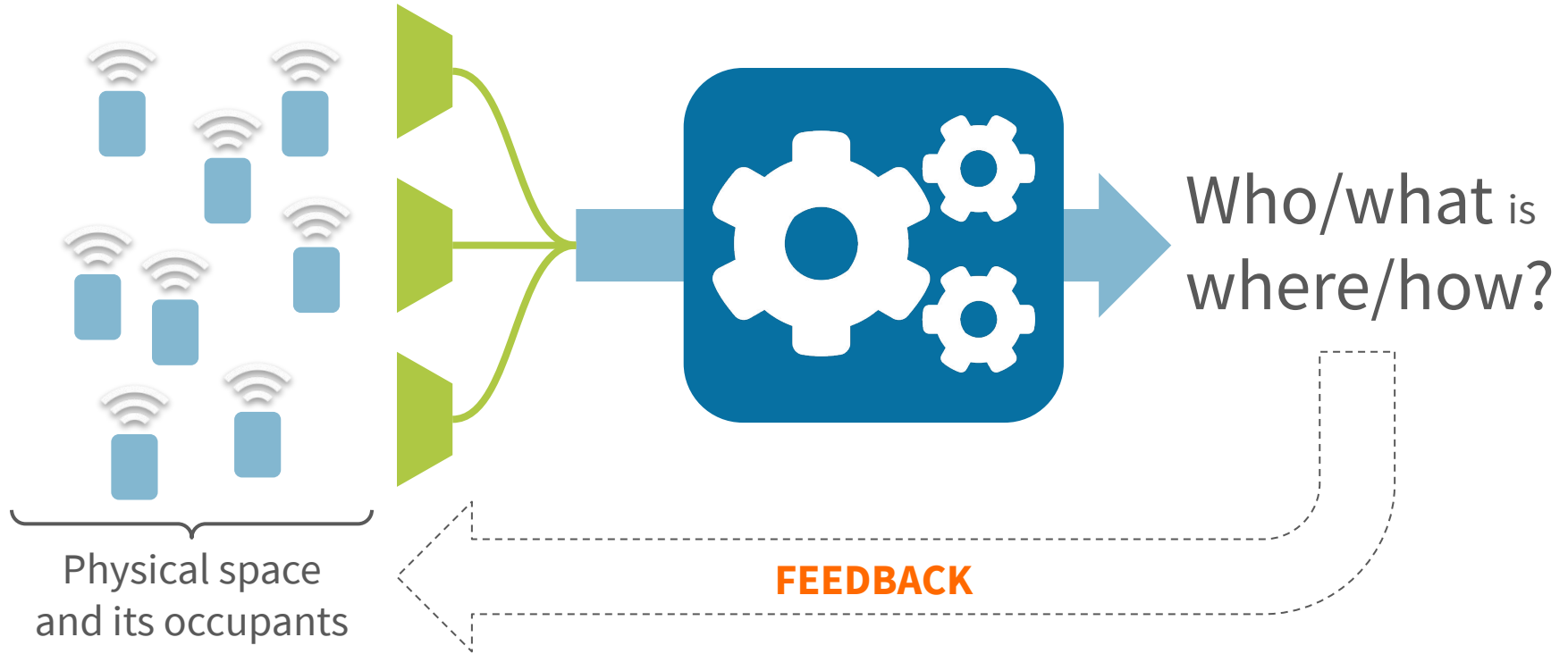
2010-2011: Building a webcam for public spaces (from the ground up)

2012-today: Building reelyActive (from the ground up)

The insight:

The industry is evolving from isolated, single-purpose deployments to the widespread, *opportunistic* application of a ubiquitous set of technologies in *any* environment.

An emergent ambient data cycle?



Part 2:

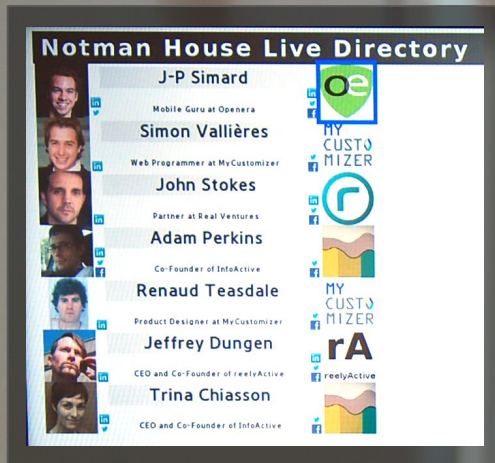
Ambient data feedback?



2012

Live Directory

*Ambient data display of
RFID-tagged occupants.*



915MHz Active RFID



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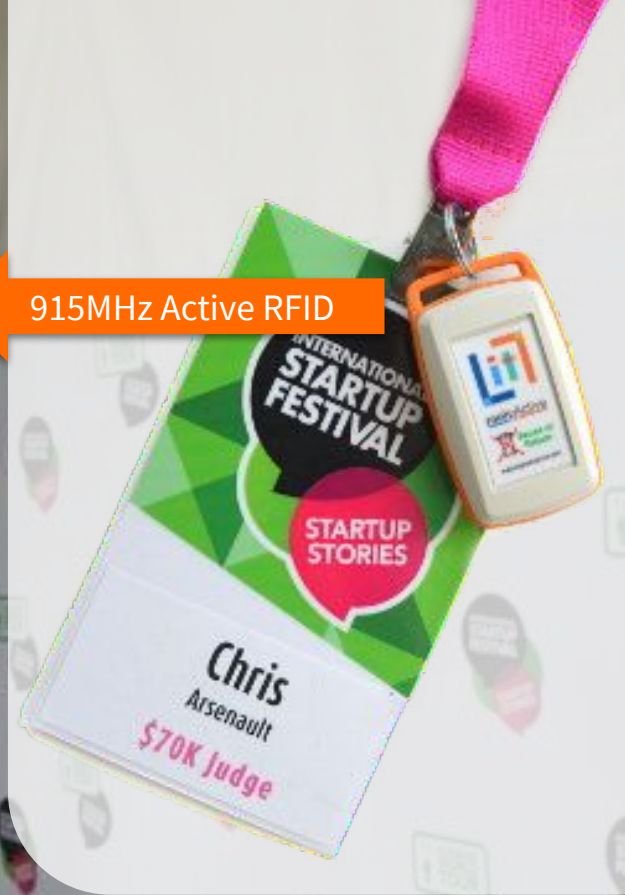
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915MHz Active RFID



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**engage
again**

Part 3:

What makes this *technically* possible?



Machine readability

At a human scale

—RFID

Metadata association

As structured data

—Digital Twins



Global RFID Standards



Structured Data Standards

I structure data
using standard
vocabularies.

schema.org

```
"@context": { "schema": "https://schema.org/" },
"@graph": [
  {
    "@id": "JDu",
    "@type": "schema:Person",
    "schema:givenName": "Jeffrey",
    "schema:familyName": "Dungen",
    "schema:gender": "Male",
    "schema:nationality": "CA",
    "schema:worksFor": {
      "@type": "schema:Organization",
      "schema:name": "reelyActive",
      "schema:url": "https://www.reelyactive.com"
    },
    "schema:jobTitle": "Co-founder and CEO"
  }
]
```

I organise and
connect data
on the Web.



Physical

Identification and location

Semantic

Identification and location



Bluetooth Low Energy: 1B device shipments*

RAIN RFID founded

JSON-LD ratified and made a W3C standard

** and “the Apple ambient data event”*



“This session will address how these abundant sources of **ambient data** can be harnessed, interpreted and contextualised for real-world applications, including the challenges and opportunities ahead.”

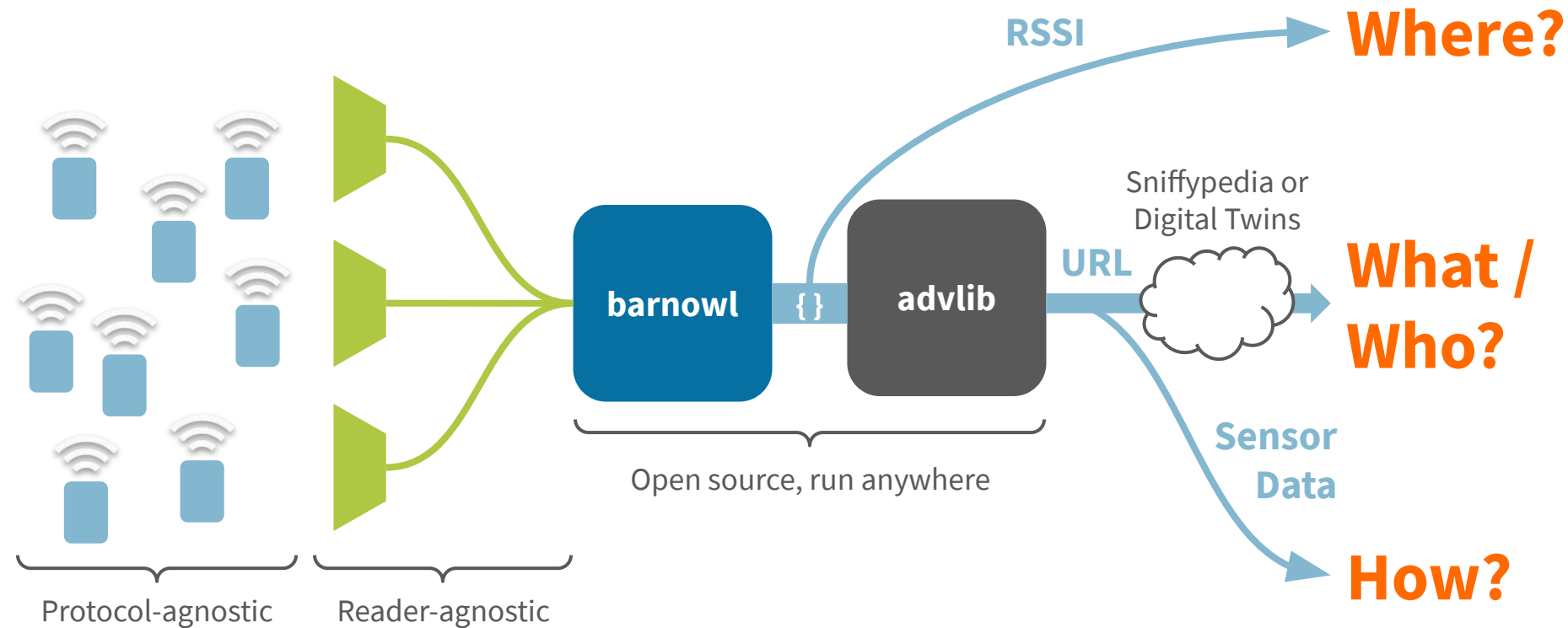


Part 4:

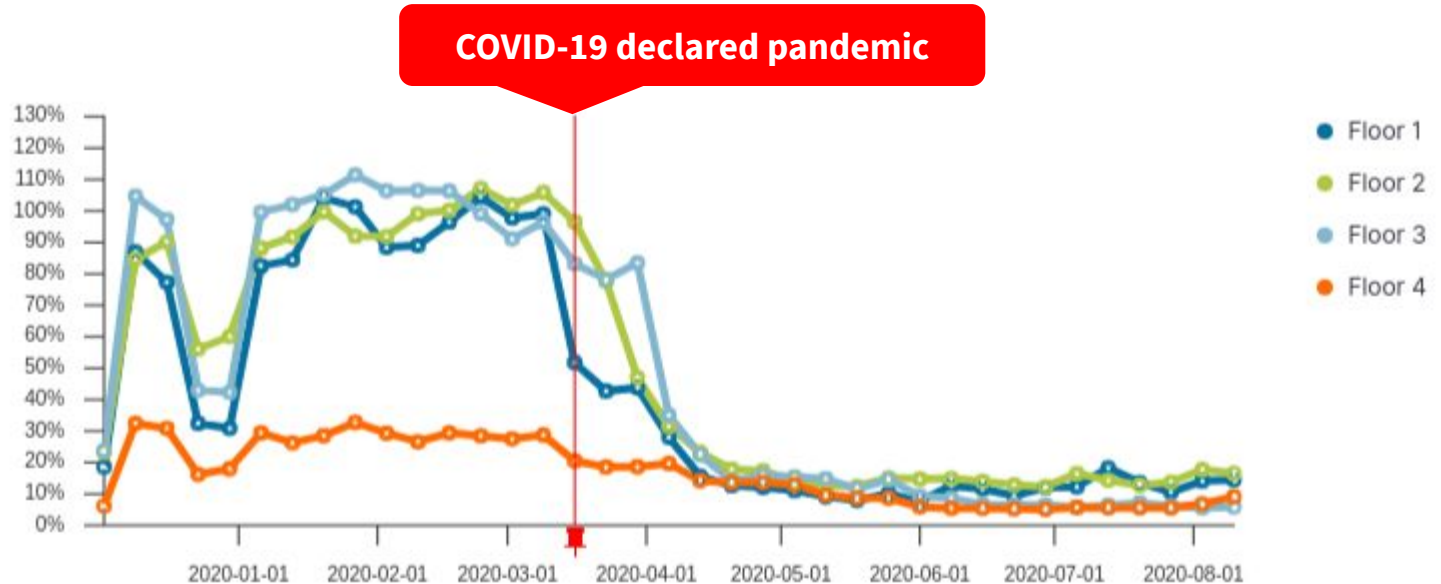
What's possible today?



A lightweight, open source stack



Anonymous Occupancy Analytics



Mobile Contact Tracing

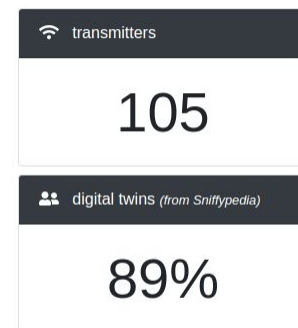
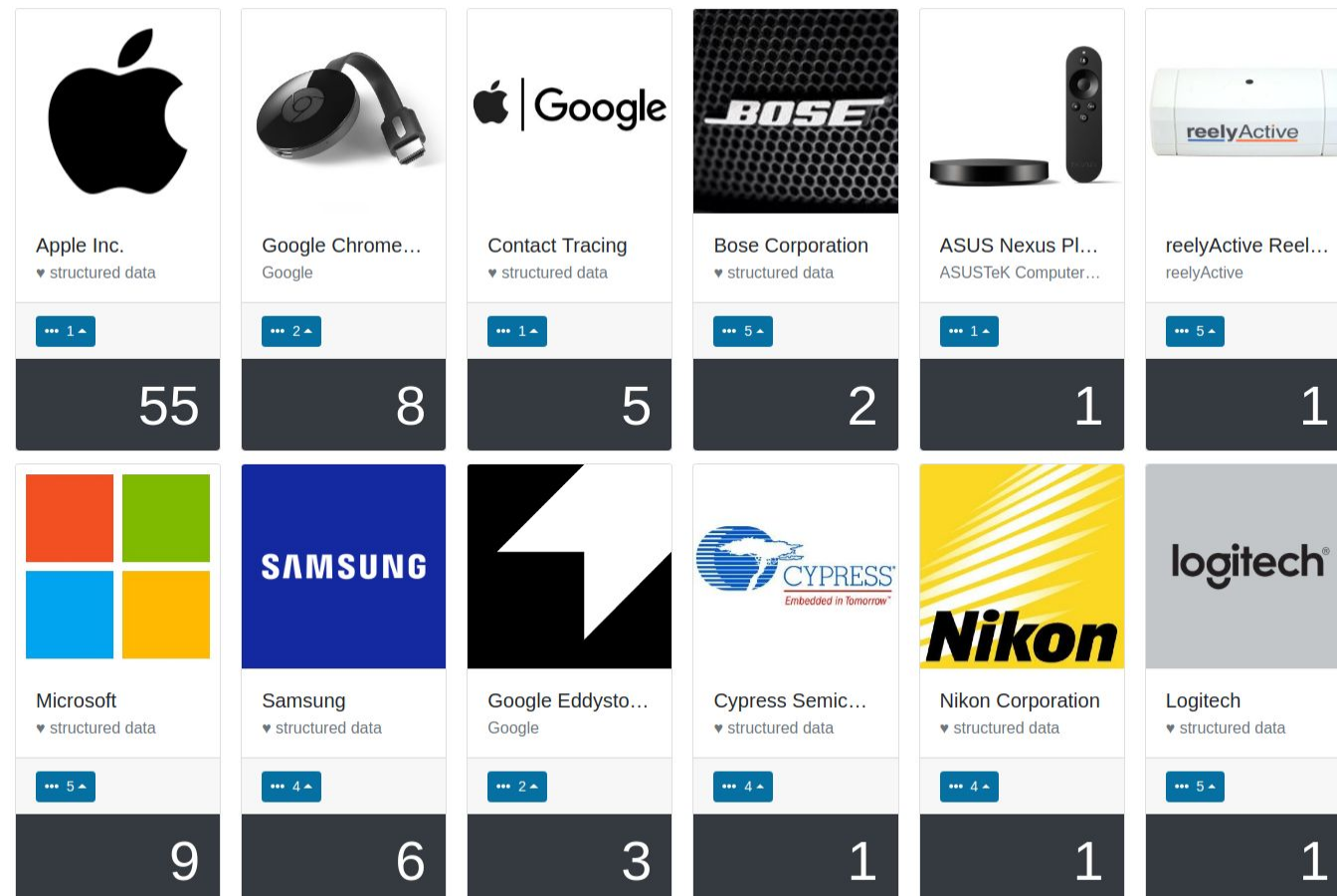






Privacy-Preserving Contact Tracing





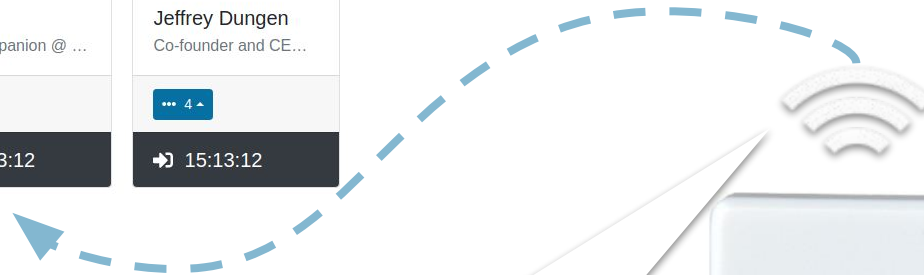
My current rolling proximity identifier is:
XXXXXXXXXX-XXXX-XXXX-XXXX-XXXXXXXXXXXXXX





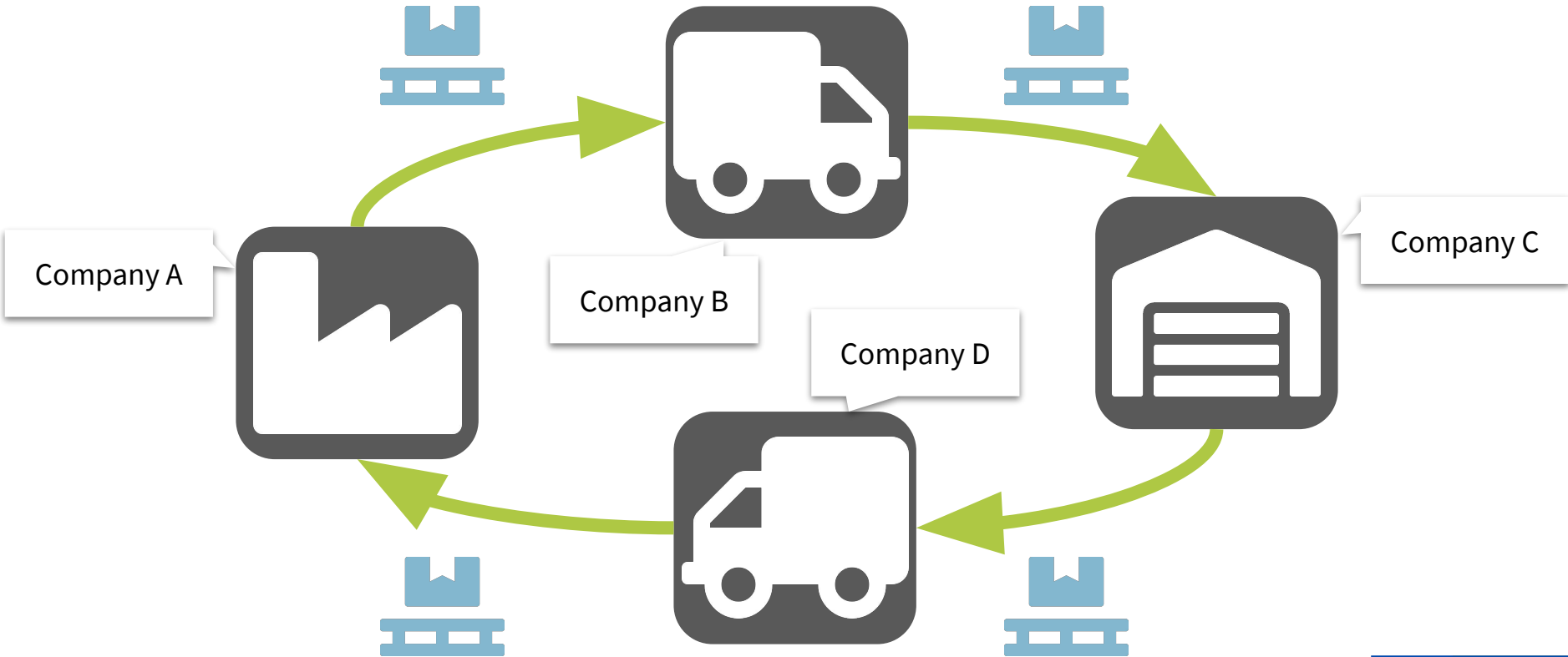
 <p>Camille Leclerc Client Success Lead...</p> <p>... 1 ▲</p> <p>➔ 15:13:10</p>	 <p>Jeff's Dror Bag Tumi</p> <p>... 1 ▲</p> <p>➔ 15:13:10</p>	 <p>Obélix Furry companion @ ...</p> <p>... 0 ▲</p> <p>➔ 15:13:12</p>	 <p>Jeffrey Dungen Co-founder and CE...</p> <p>... 4 ▲</p> <p>➔ 15:13:12</p>
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 transmitters	65
 digital twins (incl. Sniffypedia)	75%



My digital twin can be looked up at the URL:
<https://reelyactive.com/team/obelix>

Multi-Site Asset Tracking



Part 5:

What's holding back ambient data?



AIM

RAIN RFID

Web / SEO

How do we get everyone in the **same space?**

(Pun very much intended!)

Bluetooth SIG

Applied
Research

Semantic Web





Read my 3256 page
Core Specification

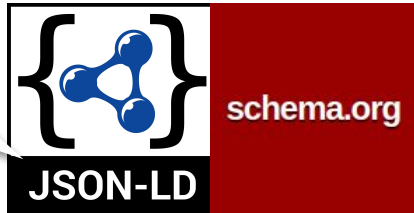


How do we make the technology **easy to adopt?**

(Let's be honest, even for engineers, it isn't!)

Hardware
Walled Gardens

At least I have a playground!
json-ld.org/playground/



Are most of the examples about Bluetooth because my readers are less accessible in terms of cost?



How do we make the infrastructure **accessible**?

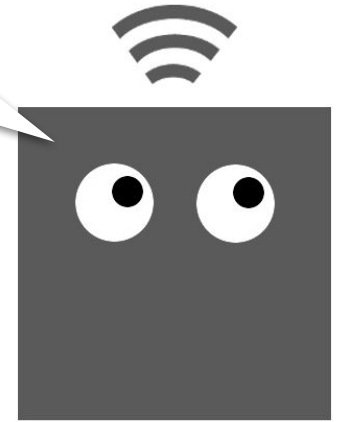
(A question of cost and control.)



Even so, my readers may be subject to vendor-limited access to the data stream!



Do we really need to manually
enter all this in sniffypedia.org?



How do we make digital twins **universal**?

(Worth the SEO alone???)



How do we encourage opt-in with **informed consent**?

(Earn and retain participants trust.)



Business **opportunity** or business threat?

(Why invest in a threatening future?)

Part 6:

Sell the future!



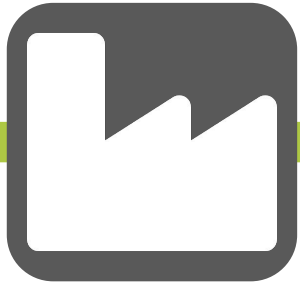
Discover. Exchange. Benefit. (Repeat)

- Any person, product or place can be automatically *discovered* at a human scale.
- Each actor chooses what information to *exchange* where, and with whom/what.
- Every participant *benefits* from exchanging their ambient data as part of a new economy.





I'm part of the
Internet of Things!

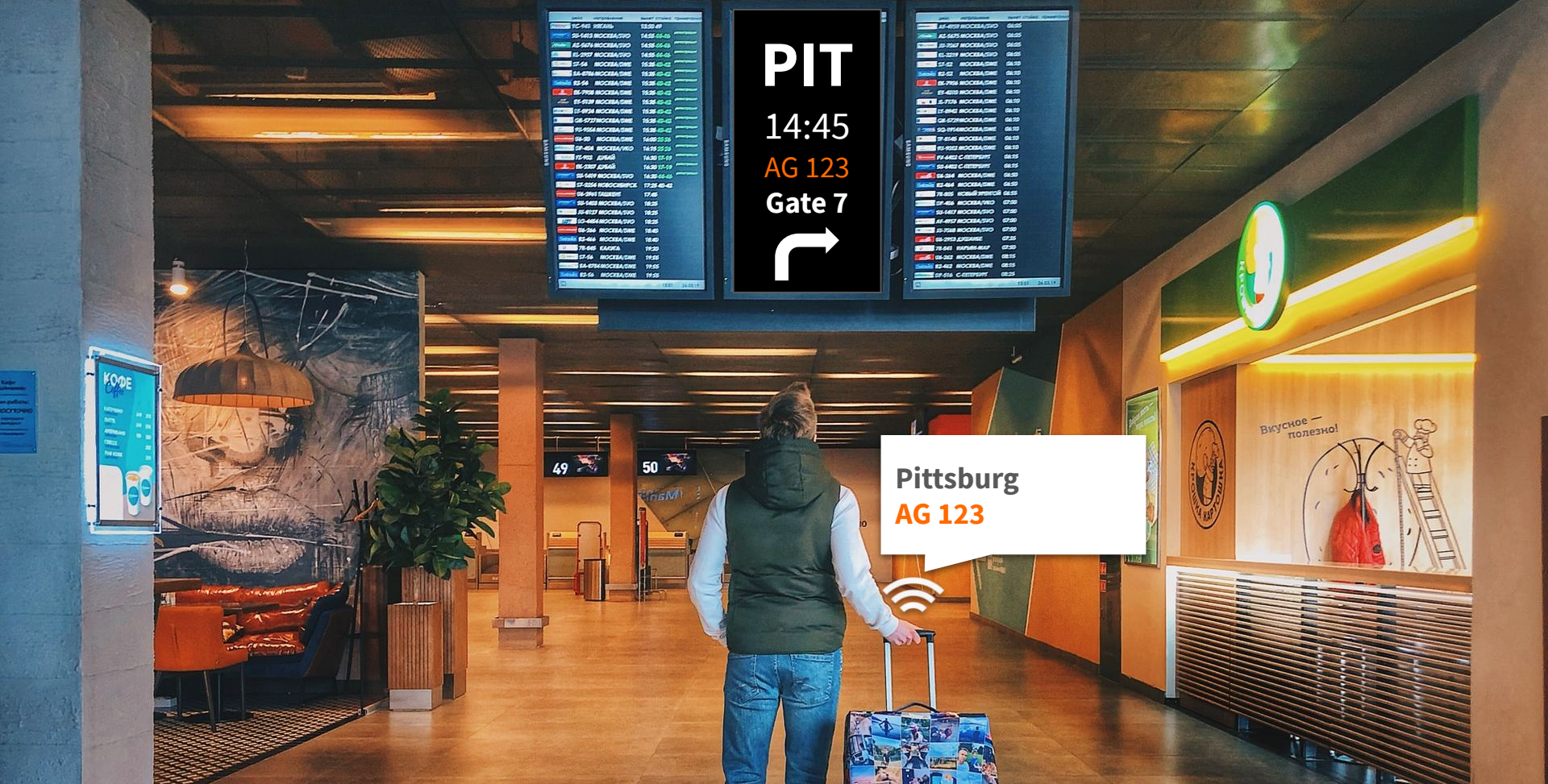


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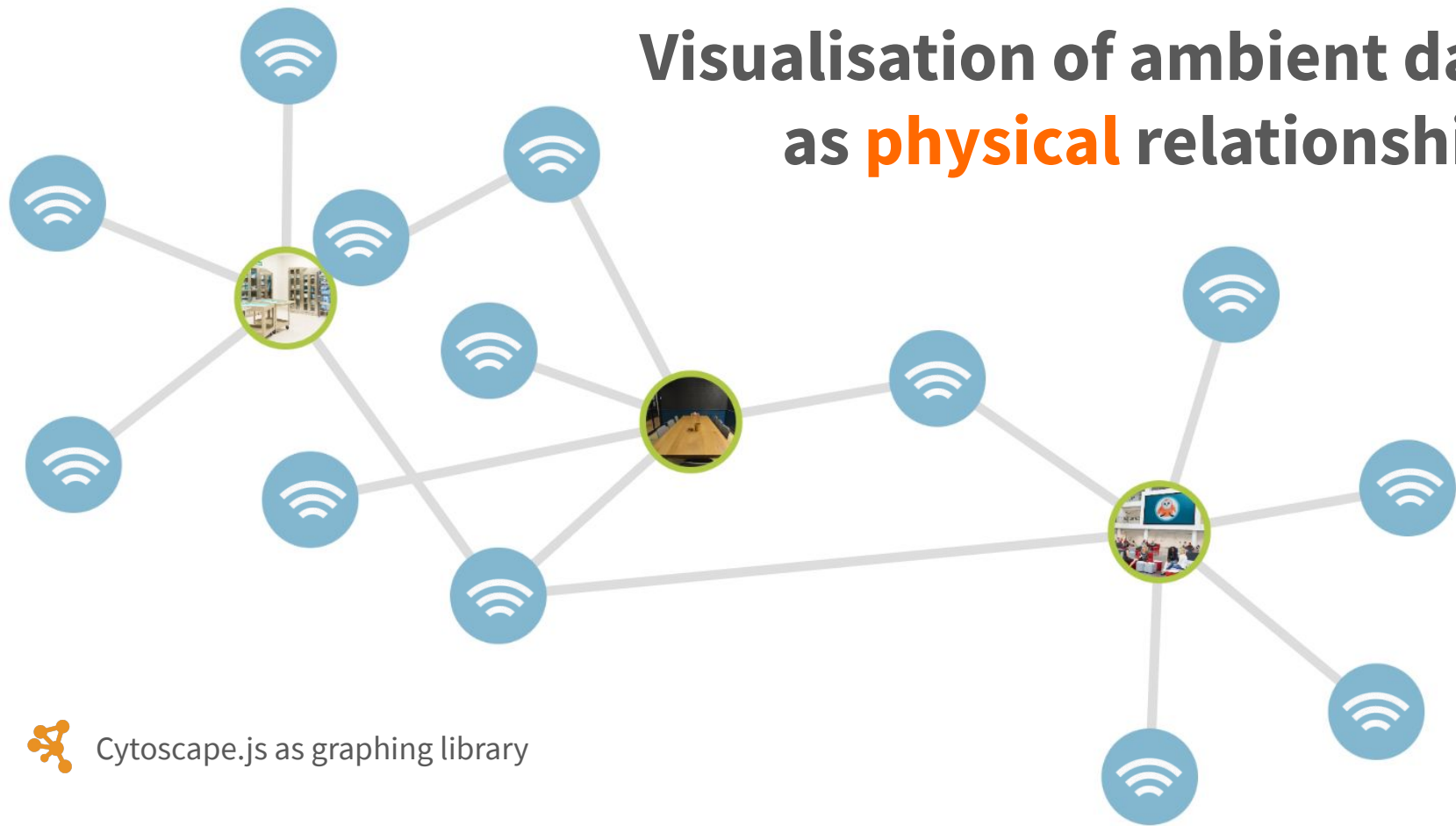
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Visualisation of ambient data as **physical** relationships



Cytoscape.js as graphing library



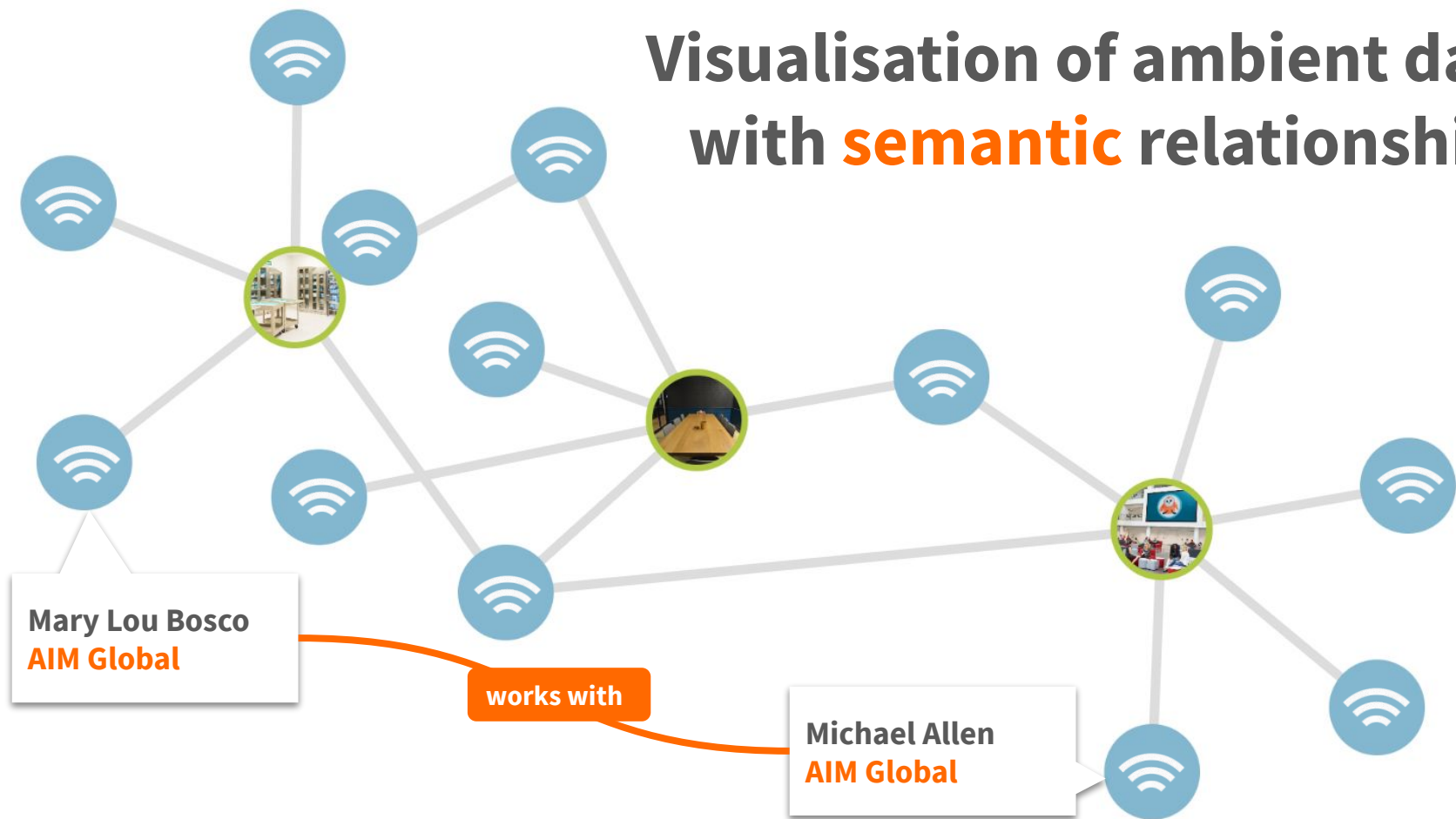
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Visualisation of ambient data with **semantic** relationships



Part 7:

Make this a reality!





Buckminster Fuller

“You never change things by fighting against the existing reality.

To change something, **build a new model** that makes the old model obsolete.”



There are countless products, people and places that have the potential to seamlessly exchange information—for *their mutual benefit*—simply by the fact that they are radio-identifiable at a human scale. The tens of billions of standard passive and active RFID devices our industries have dispersed across the planet in just the past few years are enough to **catalyse a new economy of ambient data**. The challenge is no longer one of technology, but rather of building a new model.

Let's build that new model!



Towards a Simple, Versatile, Distributed Low-Power Wireless M2M Infrastructure

Jeffrey Dungen, Traian Antonescu, Pier-Olivier Genest
reelyActive

Montréal, Québec, Canada

Email: jeff@reelyactive.com, traian@reelyactive.com, pier-olivier@reelyactive.com

Abstract—Existing wireless M2M infrastructure based on cellular and WiFi networks is often unsuitable for the number of simple, inexpensive, low-power wireless devices that identify the considerations for a suitable low-power wireless M2M area network infrastructure. A novel design with the capability to support multiple technologies and to easily extend coverage is presented and the implementation details of the infrastructure are discussed.

TABLE I
COMPARISON OF SELECT LOW-POWER RADIO TECHNOLOGIES

Technology	Packet Size	Transfer Rate	Band
BLE	27 bytes	1Mbps	2.4GHz
IEEE 802.15.4	128 bytes	250kbs (max)	Several
DASH7	256 bytes	200kbs	433MHz

IEEE M2M CIP 2013

Low-Power Wireless Advertising Software Library for Distributed M2M and Contextual IoT

Mohamed Inran Jameel

McGill University

Montréal, Québec, Canada

Email: inran.jameel@mail.mcgill.ca

Jeffrey Dungen

reelyActive

Montréal, Québec, Canada

Email: jeff@reelyactive.com

Abstract—Bluetooth Smart is a new standard for low-power, global low-power wireless standard. It is a far more recent occurrence, bringing with it billions of devices. These devices are capable of spontaneously broadcasting short messages to any potential receiving devices in range. If a widespread infrastructure of such receiving devices were to exist, these broadcast messages

IEEE WF-IoT 2015

Towards collective hyperlocal contextual awareness among heterogeneous RFID systems

Jeffrey Dungen, Juan Pinazo Nieto

reelyActive

Montréal, Québec, Canada

Email: jeff@reelyactive.com, juan@reelyactive.com

Abstract—Until recently, cases of independently operated radio frequency identification (RFID) deployments occupying a common space could be considered rare. However, the recent emergence of the RAIN Alliance and the EPCglobal standard (EPC) is resulting in the proliferation of RFID systems in infrastructure for the radio-identification of things and people through standardized passive and active RFID technologies, respectively. Consequently, today there are EPCglobal situations where independently operated RFID systems are likely to co-exist, both commercially and informally. In this paper, we present a mechanism for mutual discovery and the subsequent exchange of structured data among such co-located, and often heterogeneous, systems. The resulting infrastructure is a representation of the physical world, where the physical world is represented by the RFID systems. This infrastructure is a representation of the physical world, where the physical world is represented by the RFID systems. This infrastructure is a representation of the physical world, where the physical world is represented by the RFID systems.

IEEE IoP 2017

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Open Source Permissively-Licensed Software

Pareto

-ANYWHERE by **reelyActive**

github.com/reelyactive

reelyactive.github.io

- barnowl
- advlib
- raddec
- sniffypedia.org
- etc...

Education & Advocacy

Art & Activism



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Jeffrey Dungen

Co-founder and CEO of reelyActive

jeff@reelyactive.com | @reelyActive