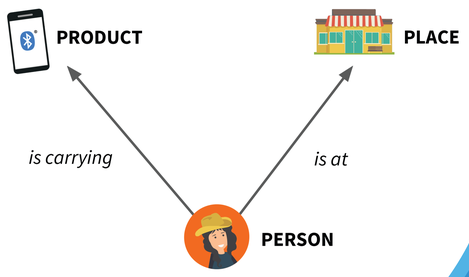
Towards a ubiquitous, real-time machine-contextual-awareness based on active RFID and semantic web technologies

Human Contextual Awareness

Humans can identify **physical actors** and the *semantic relationships* between them.



Can machines observe the people, products and places of the physical world in real-time, digitally represent them, and understand the context of their physical and digital relationships?

In other words:

Is ubiquitous machine-contextual-awareness a possibility?

Several recent trends support this hypothesis:

- Billions of devices can be radio-identified at several meters distance [1].
- Heterogeneous Internet-connected radio-identification infrastructure [2].
- Widespread adoption of open wireless packet protocols [3].
- People, products and places are digitally represented on the Internet.
- Industry-pressure is standardising such digital representation.

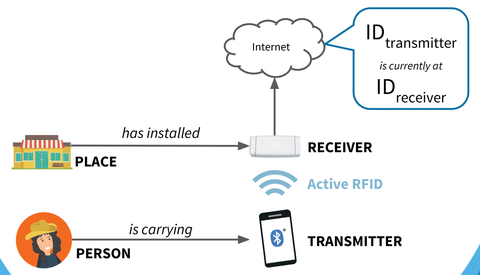
Machine Contextual Awareness

Identifying, associating and representing real-world devices in real-time, including their semantic relationships, enables ubiquitous machine-contextual-awareness.

In the above example, machines could infer that the person is at work, and more. This principle has been successfully demonstrated in a human-readable way [8].

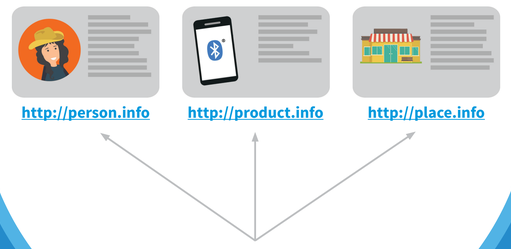
Machine Identification

Machines can detect and identify devices via **Active RFID** and relay this information to the Internet in real-time.



Digital Representation

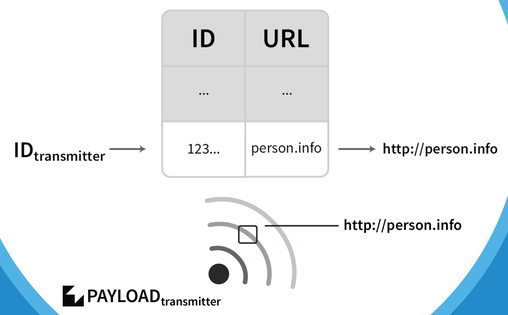
People, products and places are digitally represented on the Internet.



This digital representation is accessed via a **URL**.

Machine Association

Machines can associate a radio-identified device with its corresponding URL. This is accomplished through a lookup table [4] or via an explicit URL in the radio payload.



ex: UriBeacon / Eddystone [5]

Machine Representation

Machines can represent people, products and places, as well as their *semantic relationships*, using JSON-LD [6] and Schema.org [7], which, thanks to adoption by popular search engines, are becoming a de facto standard.

```
{
  "@context": "http://schema.org",
  "@type": "Person",
  "name": "Barn Owl",
  "image": "http://person.info/me.jpg",
  "url": "http://person.info"
}
```

This representation can easily be embedded in a webpage on the Internet.

Ongoing work is focused on the following:

- An open, distributed and secure lookup table (ID → URL)
- Development of open source machine-contextual-awareness software
- Potential application to passive RFID (ex: EPC Gen 2)

The authors invite collaboration from the scientific and industrial communities.

References and Links

[1] Annual Report, Bluetooth SIG, 2014-Present.
[2] J. Dungen *et al* "Towards a simple, versatile, distributed low-power wireless M2M infrastructure", in *2013 IEEE 38th Conf. on Local Computer Networks (LCN)*, Sydney, Australia, pp.890-895.
[3] Jameel, M.I.; Dungen, J. "Low-power wireless advertising software library for distributed M2M and contextual IoT", *Internet of Things (WF-IoT)*, 2015 IEEE 2nd World Forum on, Milan, Italy, pp.597-602.
[4] reelyActive, "chickadee". [Online]. Available: https://github.com/reelyactive/chickadee.
[5] Google inc., "Eddystone". [Online] https://github.com/google/eddystone.
[6] W3C JSON-LD Community Group, "JSON-LD". [Online]. Available: http://json-ld.org/.
[7] W3C Schema.org Community Group, "Schema.org". [Online]. Available: http://schema.org/.
[8] reelyActive, "Smart Spaces". [Online]. Available: http://smartspac.es

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