



W3C Web of Things Interest Group

April 11, 2016

Bezirk is to the IoT what bio/organic is to agricultural products
IoT that tastes better



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mainstream business models
revolve on the value of data
for service providers



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user-centrism and privacy

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IoT responsiveness



[Partner Maintenance] Chamberlain MyQ garage doors

Scheduled Maintenance Report for Wink

Scheduled

We've been informed that the Chamberlain MyQ garage door web services will be undergoing maintenance on Monday, Nov. 10 01:00 EST (Nov. 9, 22:00 PST). The maintenance is expected to last about 4 hours and users will not be able to use the Chamberlain garage doors from the app during this time.

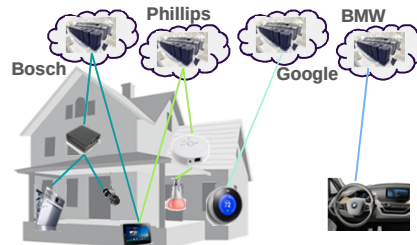
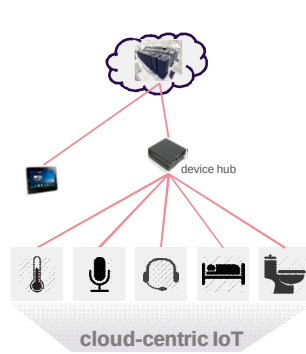
Posted 3 months ago · Nov 08, 2014 · 22:52 UTC

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IoT reality check fragmentation



corporations

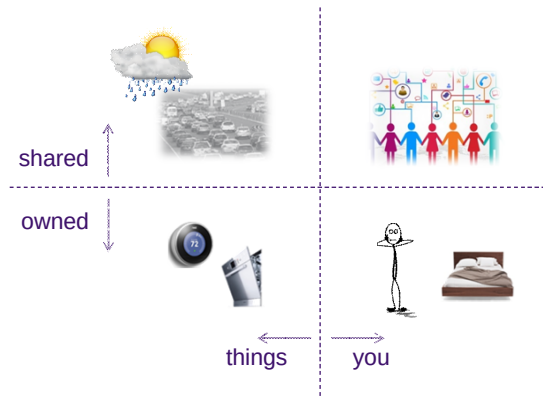
- consumer **Data** has business value
- little incentive to share that value

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not all **Data** is created equal

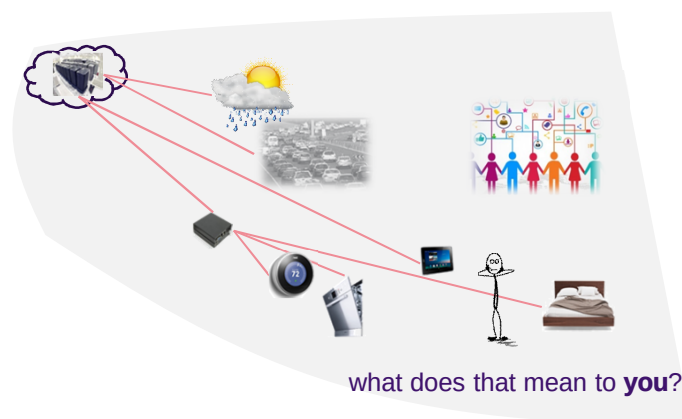


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mainstream IoT
raw **Data** pumped to the cloud



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mainstream IoT Loss of privacy

cloud-centric IoT

intimacy

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Social reasons for boundaries

shared

owned

reclaim the expected boundaries of privacy

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Empower users to reclaim boundaries Privacy

Bezirk

cloud-centric IoT

Who knows about this?

Just you and I.

policies

- ✓ **Quality:** local integration
- ✓ **Respectful:** data ownership

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Security model user-centric **Spheres and Pipes**

Bezirk

Pipe to cloud

Sphere: Bob's car

Sphere: Bob's personal

Bob's Home Entertainment

Bob's Home Systems

Bob's Doctor

Pipe

- **Pipes between spheres / to cloud**
secure channels for data & events
 - requested by services, authorized by users
 - policy enforced by middleware
only authorized exchanges go through
- **Spheres of trust**
boundaries of confidentiality
 - managed by users
create sphere, join service...
 - **easy** user experience
balances usability & security

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Bezirk and WoT

the story so far

Introduces boundaries to the IoT

for reasons:

- Social: **privacy**
- Technical: **scope and scale**

Promotes

- Decentralized models with linked data
- Computation in local/mobile devices

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Scope and Scale

IoT is not the Internet



- **History:** successful apps for the **internet** run on general purpose computers and access remote services
e.g. email, web browsing
- **Now:** must a sensor/appliance shoulder the burden of being a peer on the internet?
e.g. access control, privacy...
- must a sensor/appliance communicate *primarily* with remote services?

IoT ≠ give every device an IP(v6) address

our
claim

IoT topology should recognize and support two kinds of communication patterns: **local** and **remote**

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Scope and Scale addressing a Thing

landscape of addressing schemas

address	applications	who receives	
node e.g. 172.16.254.1 (IPv4)	Internet routing: IPv4 (1981), IPv6 (1998) LANs: Bluetooth, WiFi...	identified node sender must know recipient's address	network def.
geo e.g. (40.426, -79.965, 500) (lat, long, radius)	sensor networks, safety & disaster response, transportation	whoever is in the area	semantic: application defined
topic label e.g. "user location"	pub/sub: Java Messaging Service (message centric), Data Distribution Service (data centric)	whoever subscribes to the topic	semantic: application defined

different addressing schemas solve different problems

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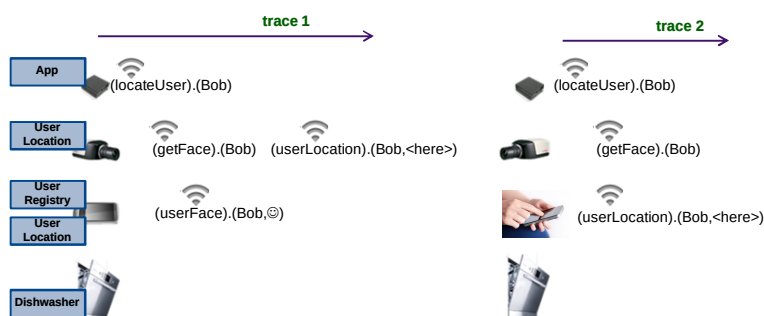
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Scope and Scale addressing a Thing



resolving requests via semantic addressing (example: by topic)



→ how a request is resolved depends on the **status** of the environment

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Scope and Scale addressing a Thing



1. **Directed**, aka unicast: a sender explicitly identifies the **service endpoint** of the recipient - an opaque handle generated by Bezirk.
2. **Publish-subscribe**, aka multicast: a sender publishes messages stamped with a **semantic address**. Bezirk instances deliver to all recipients that match the address.
 - By design, senders have no prior knowledge of the recipients, and obtain no knowledge unless (some of) the recipients reply back.

Semantic Address includes:

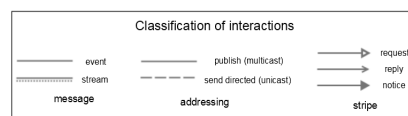
- The physical **location** of recipients as a triple of names
 - *region* (e.g. "floor1" or "Pennsylvania"), *area* (e.g. "bedroom" or "greater Pittsburgh"), and *landmark* (e.g. "window" or "Point State Park").
- The **pipes** to be traversed, which may
 - exclude pipe traversal (local only),
 - identify one specific pipe to traverse, or
 - include *all* pipes in the dissemination environment.

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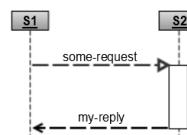
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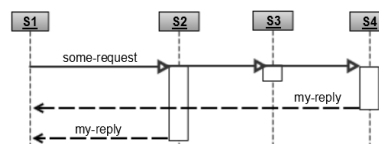
(note) supported interaction patterns



Classic request-reply



Group request-reply



Combinations of event/stream request-reply



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Bezirk and WoT

Introduces boundaries to the IoT

for reasons:

- Social: **privacy**
- Technical: **scope and scale**

Sphere

Promotes

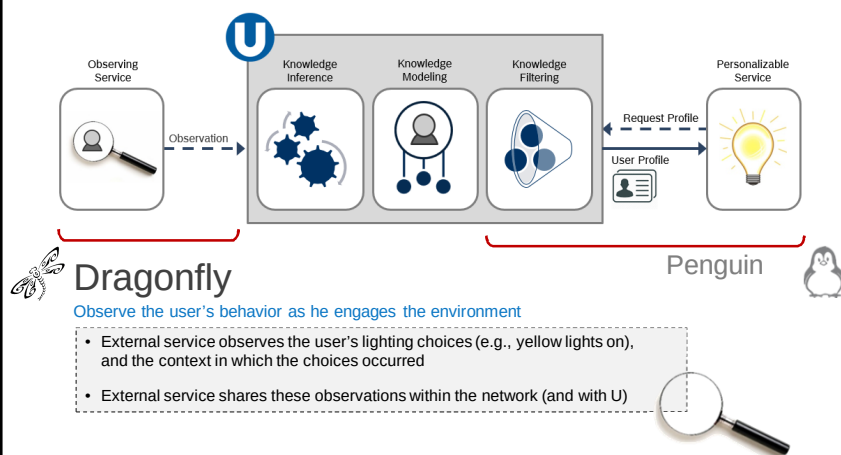
- Decentralized models with linked data
- Computation in local/mobile devices

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Modeling IoT Data in a mobile world model interchange protocols are key



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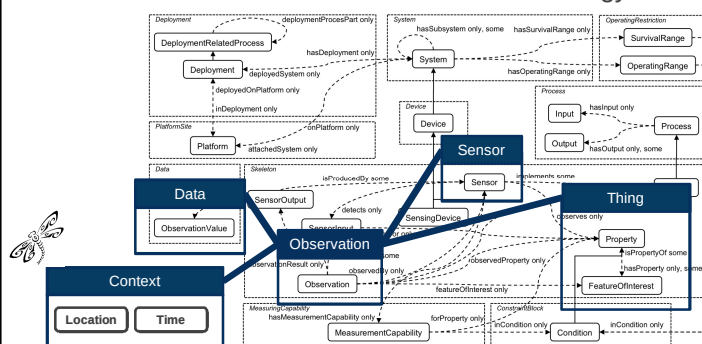
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Modeling user observations tailored subset of SSN for IoT



W3C Semantic Sensor Network Ontology



W3C SDW-WG Reqs (<http://www.w3.org/TR/sdw-ucr/>)

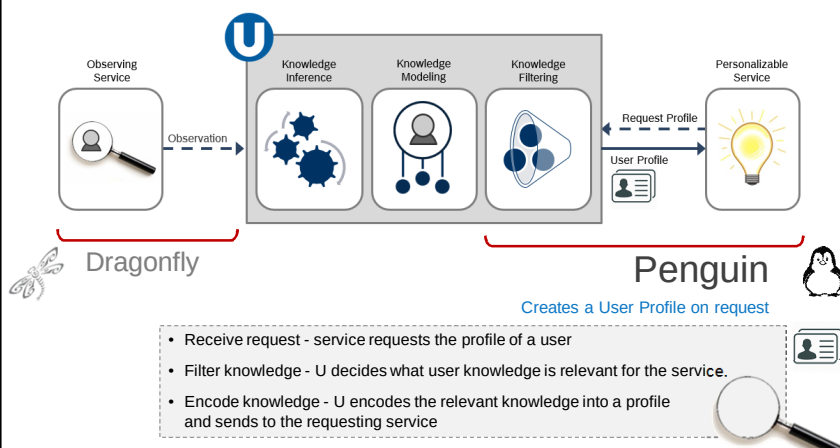
REQ 5.18 Lightweight Model for IoT and **REQ 5.20 Machine-to-Machine**

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Modeling IoT Data in a mobile world

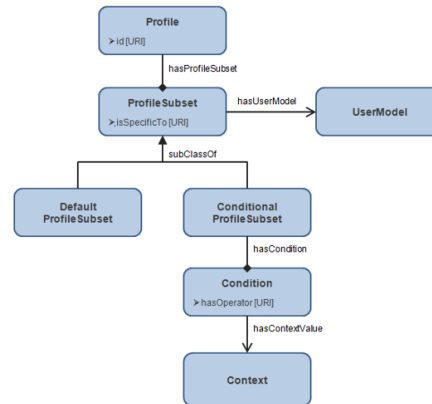


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Modeling user profiles based on UPOS: User Profile Ontology



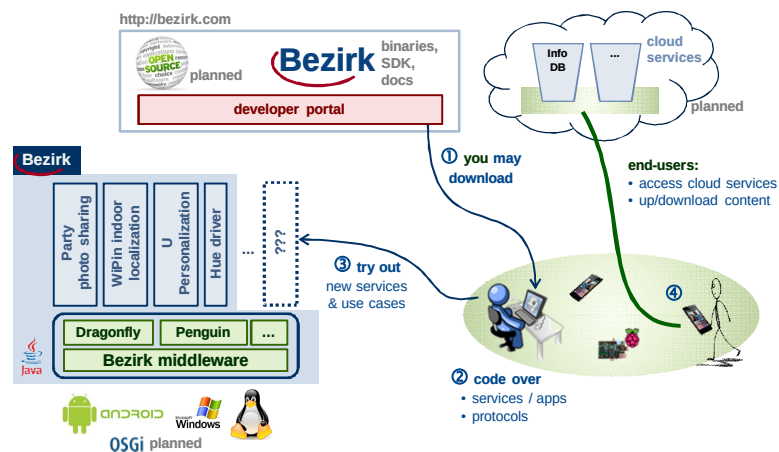
M. Sutterer, et al. "UPOS: User Profile Ontology with Situation-Dependent Preferences Support" 1st Intl Conf Advances in Computer-Human Interaction, 2008

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2nd quarter 2016 SDK, binaries



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