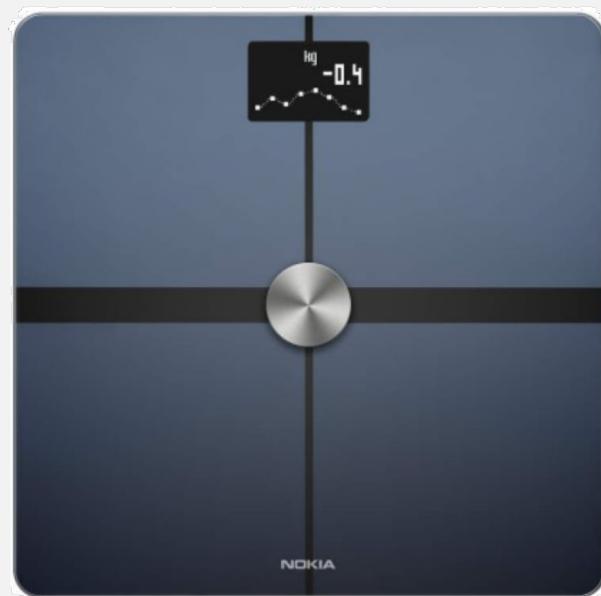


The Siloization of the IoT: A Guide out of the App trap

Armin Haller
Australian National University

**“We expect to see 20 billion
internet-connected things by
2020.”** [Gartner 2017]

... but what do they look like





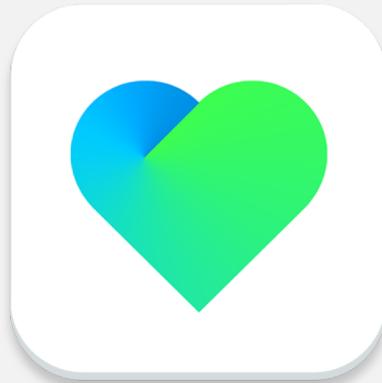




Enabled through common standards ...

- **Physical Communication**
Bluetooth, 802.11 Wi-Fi, LPWAN, etc.
- **Network/Transport**
TCP/IPv4/IPv6, 6LowPAN etc.
- **Data Protocols**
HTTP/CoAP, Zigbee, Websocket, AMQP, MQTT etc.

... but many silos on the App level



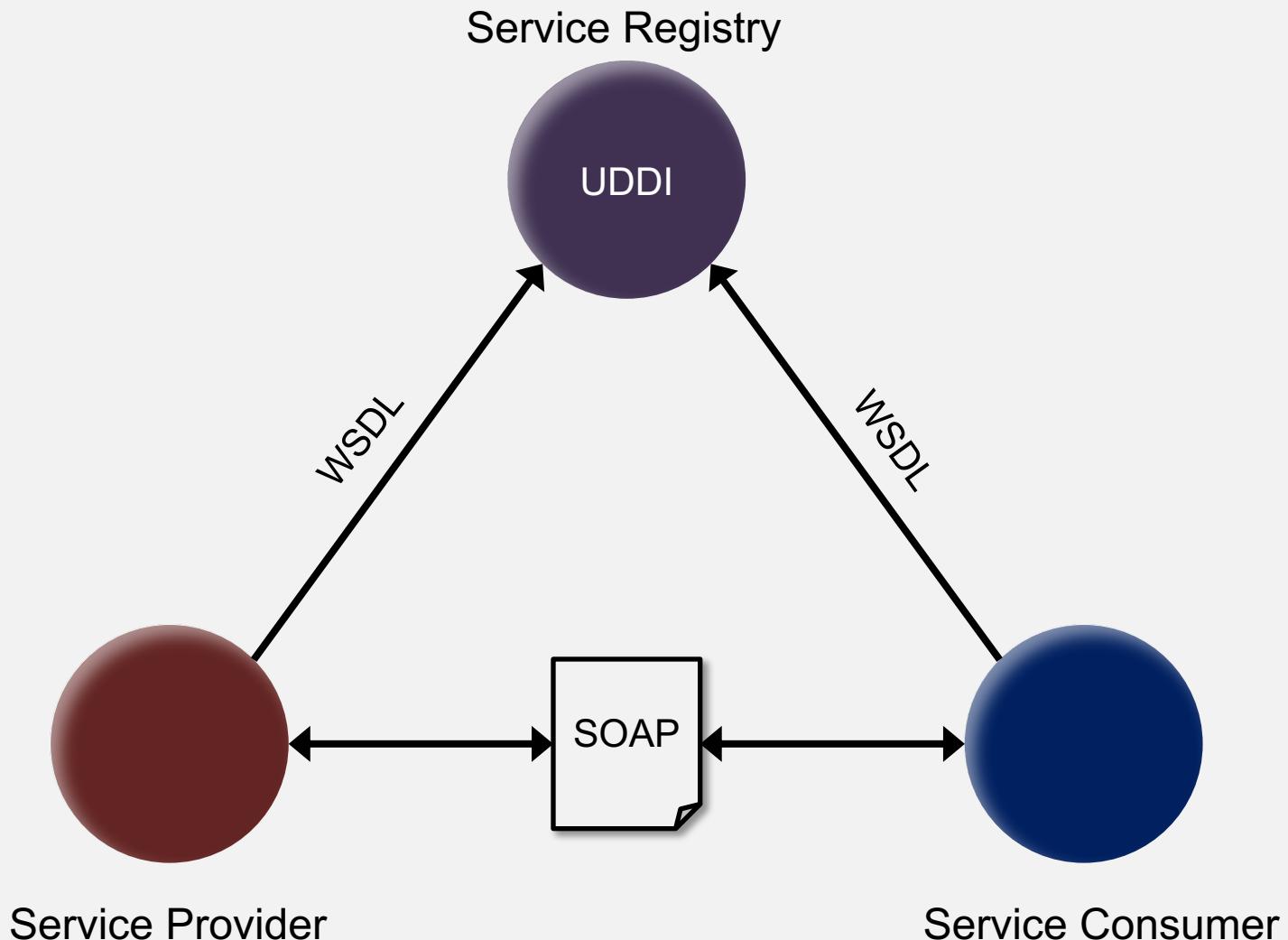
...

Some proprietary proposals ...

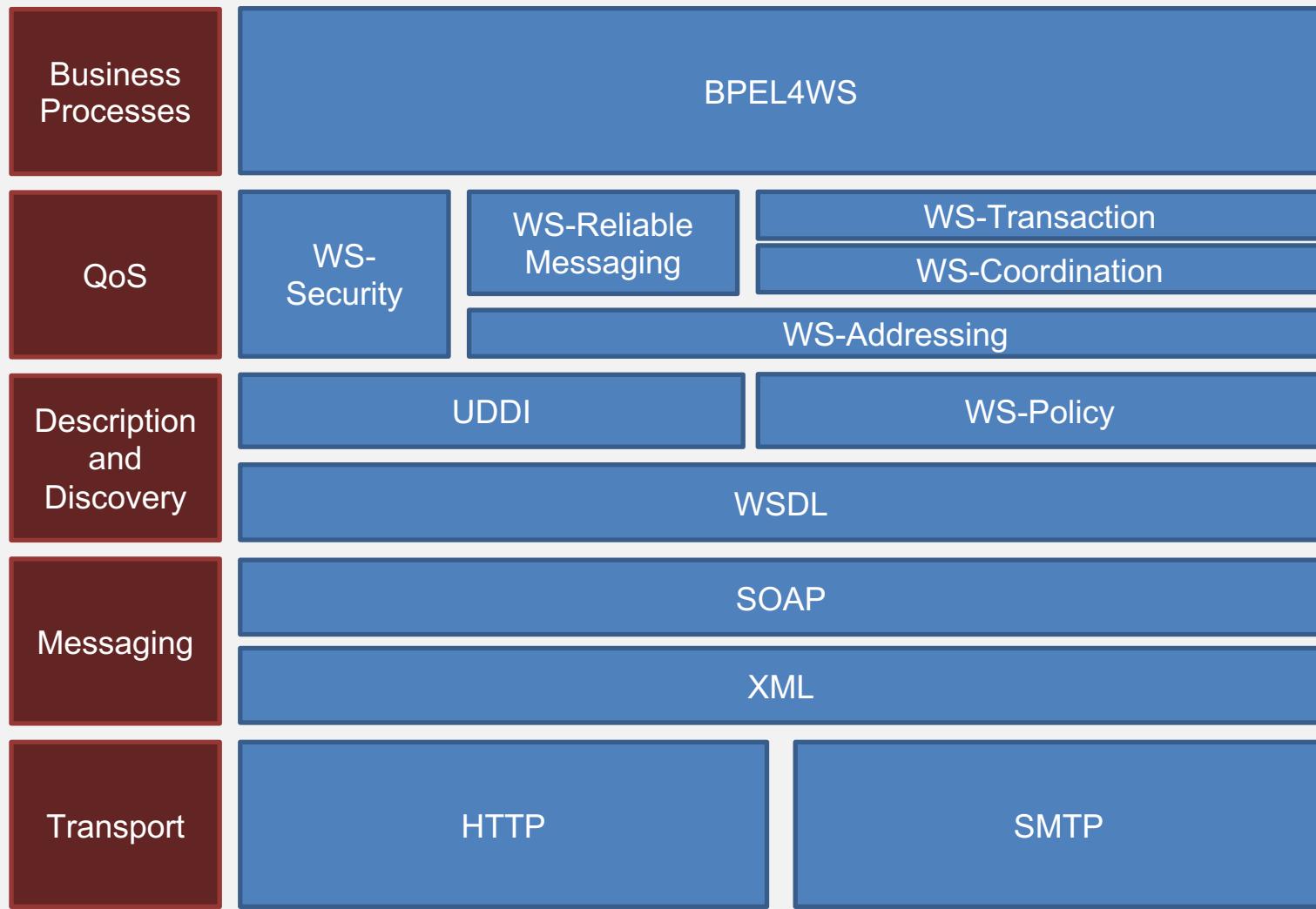
... for **Discovery** (e.g. Physical Web,
HyperCat, UPnP) ...

...but standards are needed.

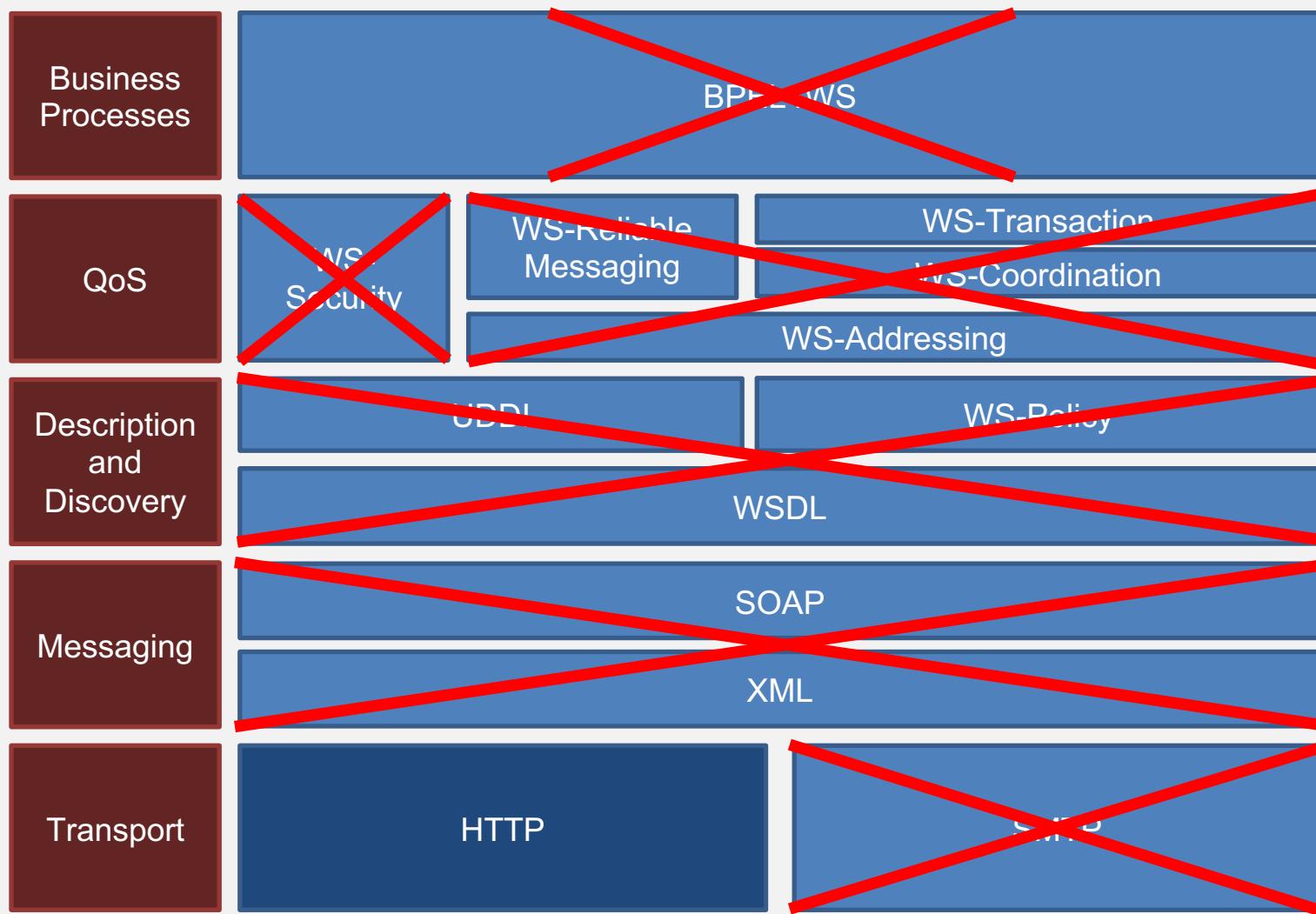
Remember?



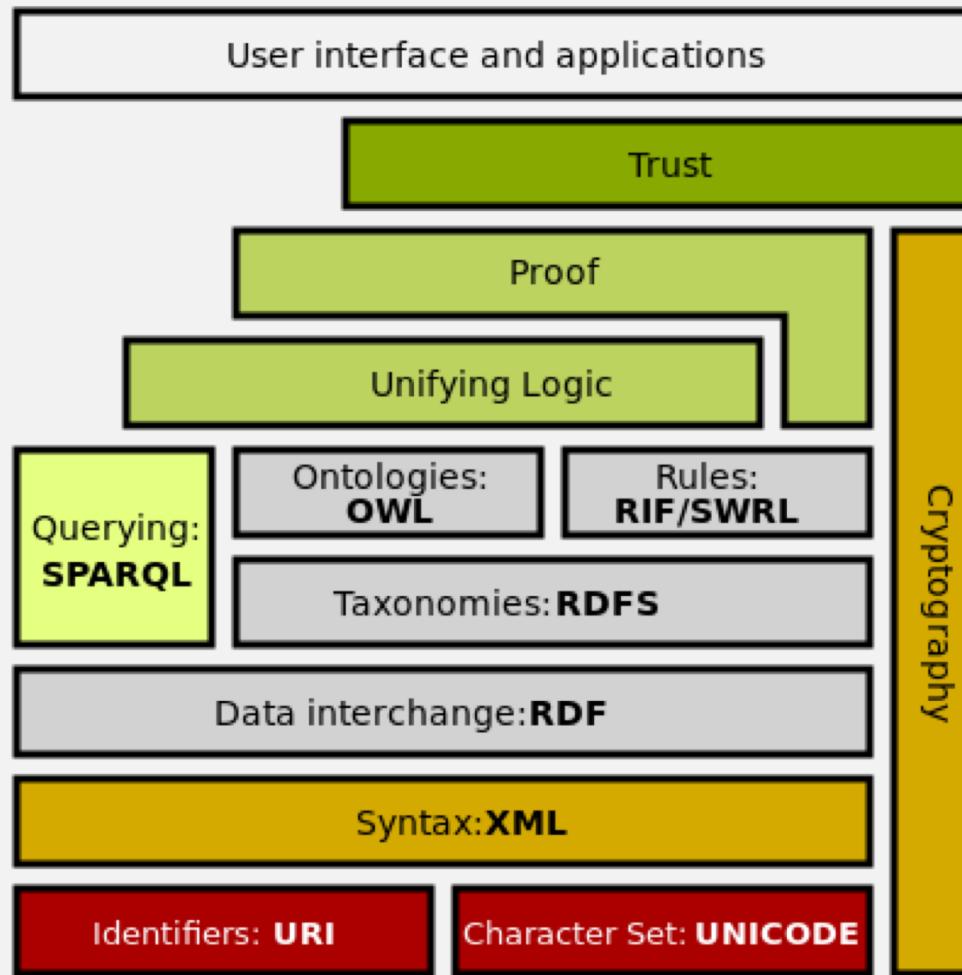
Envisioned Web Service protocol stack



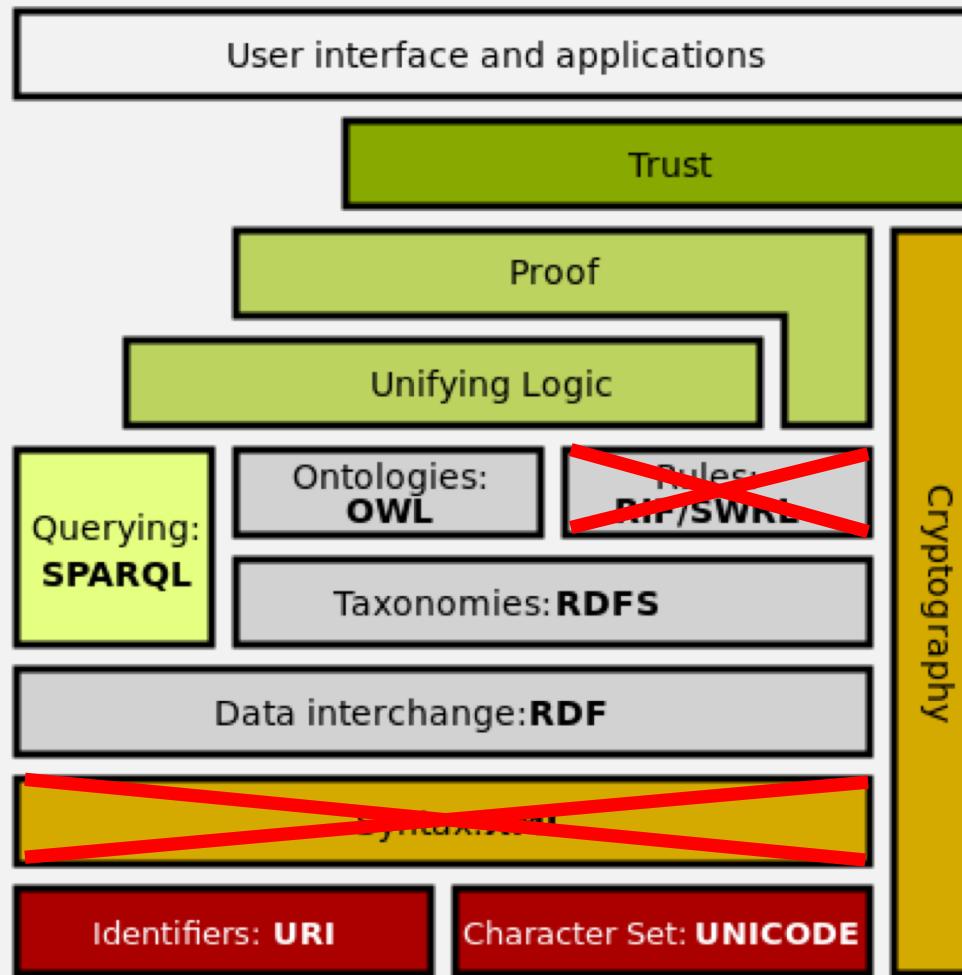
Real Web Service protocol stack



Adding semantics to Web Service stack



Adding semantics to Web Service stack

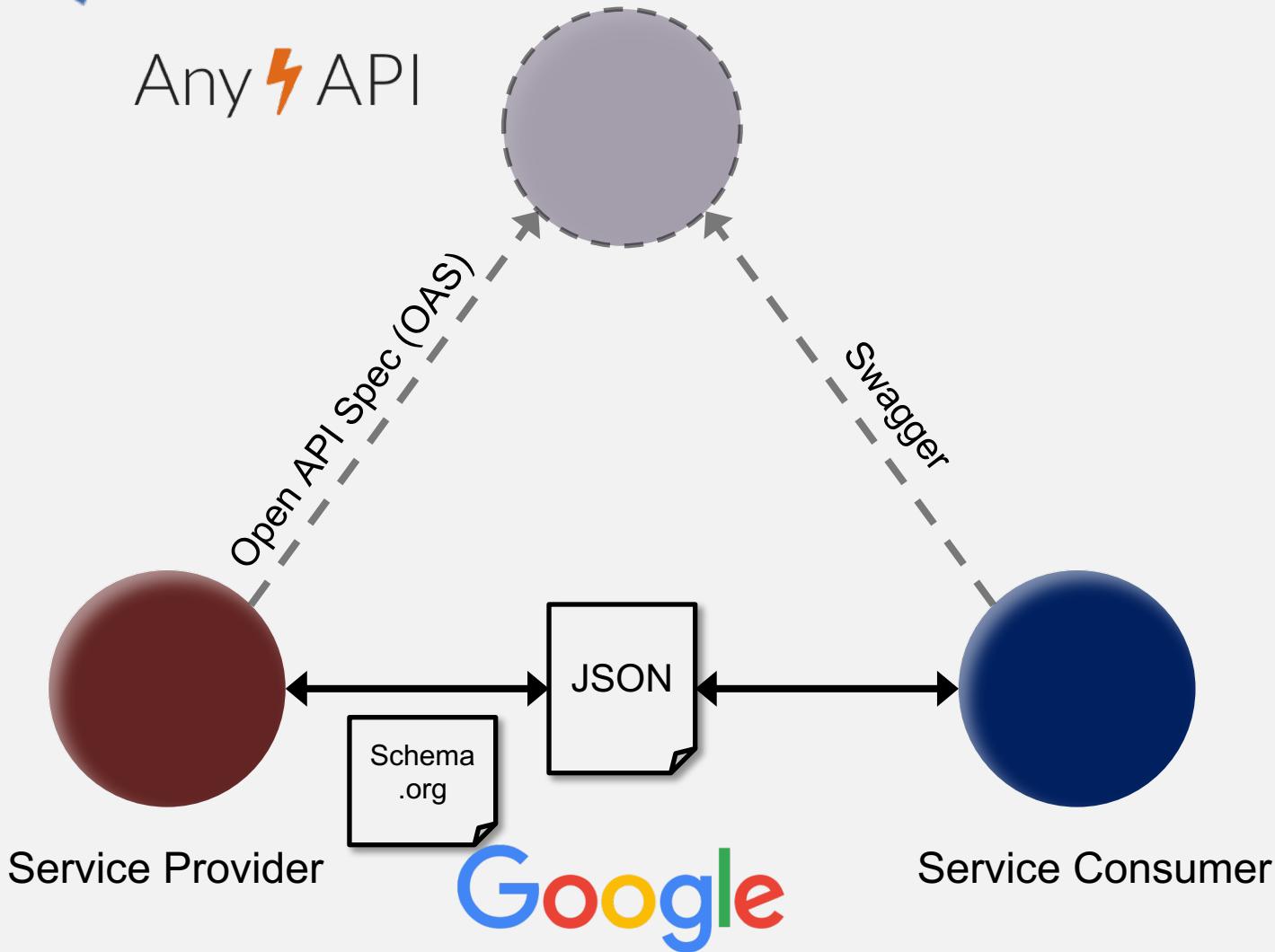


Reality



ProgrammableWeb

Any API



W3C SSN-XG 2012

Semantic Sensor Network Ontology

Author

W3C Semantic Sensor Network Incubator Group

Description

This ontology describes sensors and observations, and related concepts. It does not describe domain concepts, time, locations, etc. these are intended to be included from other ontologies via OWL imports.

This ontology is developed by the W3C Semantic Sensor Networks Incubator Group (SSN-XG). The concepts and structure of the ontology were discussed in the group's meetings and on the mailing list. For more information on the group's activities see: <http://www.w3.org/2005/Incubator/ssn/>

Please report any errors to the Semantic Sensor Network Incubator Activity via the public W3C list public-xg-ssn@w3.org

See also

<http://www.w3.org/2005/Incubator/ssn/>

Latest Version

<http://purl.oclc.org/NET/ssnx/ssn>

Rights

Copyright 2009 - 2011 W3C.

URI

The namespace for this ontology is <http://purl.oclc.org/NET/ssnx/ssn>

Prefix

When used in XML documents the suggested prefix is `ssn`

Table of Contents

Section	Module	Classes	Properties
DUL	DUL	DesignedArtifact , Event , InformationObject , Method , Object , PhysicalObject , Process , Quality , Region , Situation	describes , hasLocation , hasPart , hasParticipant , hasQuality , hasRegion , includesEvent , includesObject , isDescribedBy , isLocationOf , isObjectIncludedIn , isParticipantIn , isQualityOf , isRegionFor , isSettingFor , satisfies
Skeleton	Skeleton	FeatureOfInterest , Observation , Property , Sensing , Sensor , SensorInput	detects , featureOfInterest , forProperty , hasProperty , implementedBy , implements , isPropertyOf

W3C SOSA/SSN 2017

Semantic Sensor Network Ontology



W3C Recommendation 19 October 2017 (Link errors corrected 08 December 2017)

This version:

<https://www.w3.org/TR/2017/REC-vocab-ssn-20171019/>

Latest published version:

<https://www.w3.org/TR/vocab-ssn/>

Latest editor's draft:

<https://w3c.github.io/sdw/ssn/>

Implementation report:

<https://w3c.github.io/sdw/ssn-usage/>

Previous version:

<https://www.w3.org/TR/2017/PR-vocab-ssn-20170907/>

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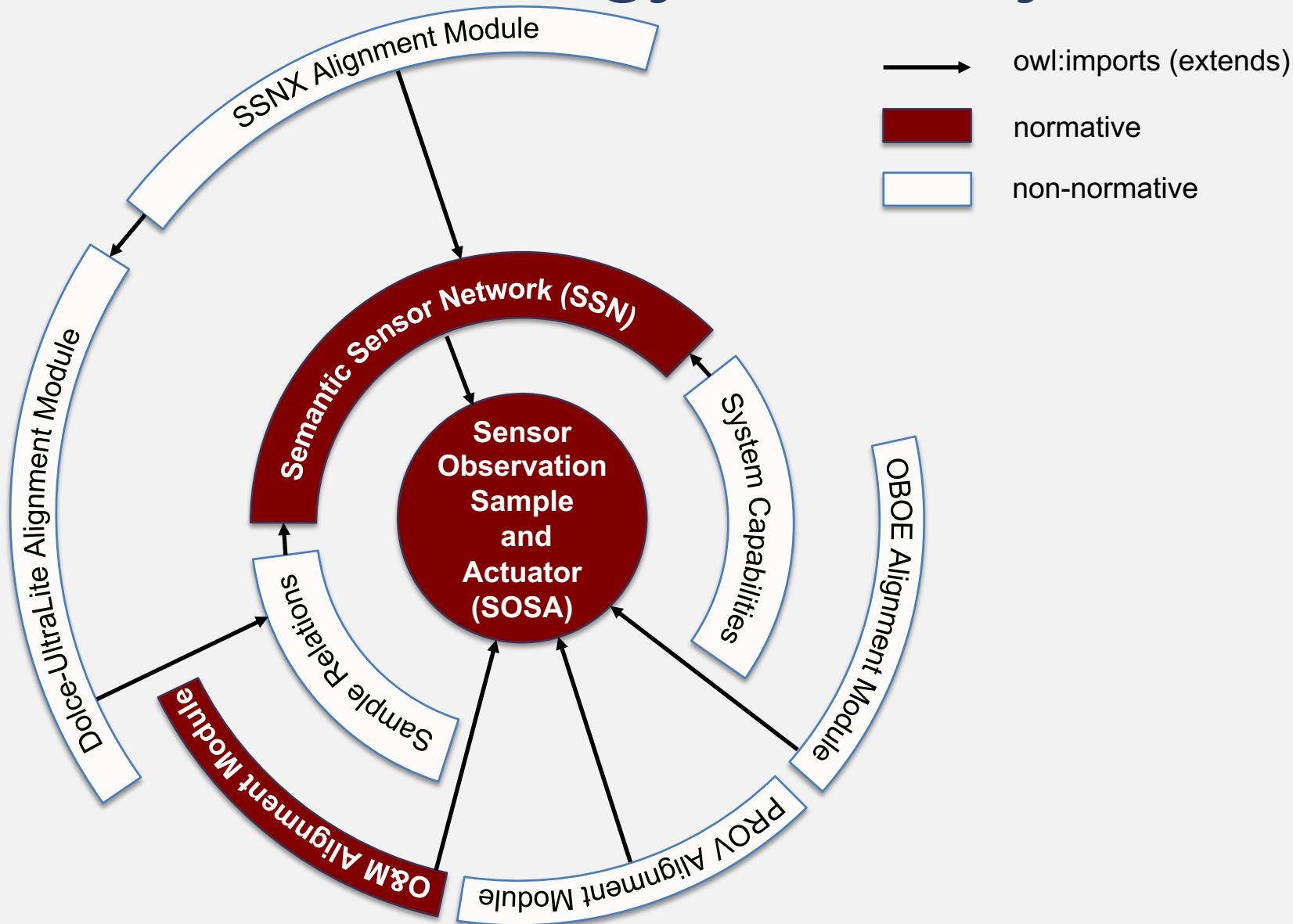
OGC 16-079

Please check the [errata](#) for any errors or issues reported since publication.

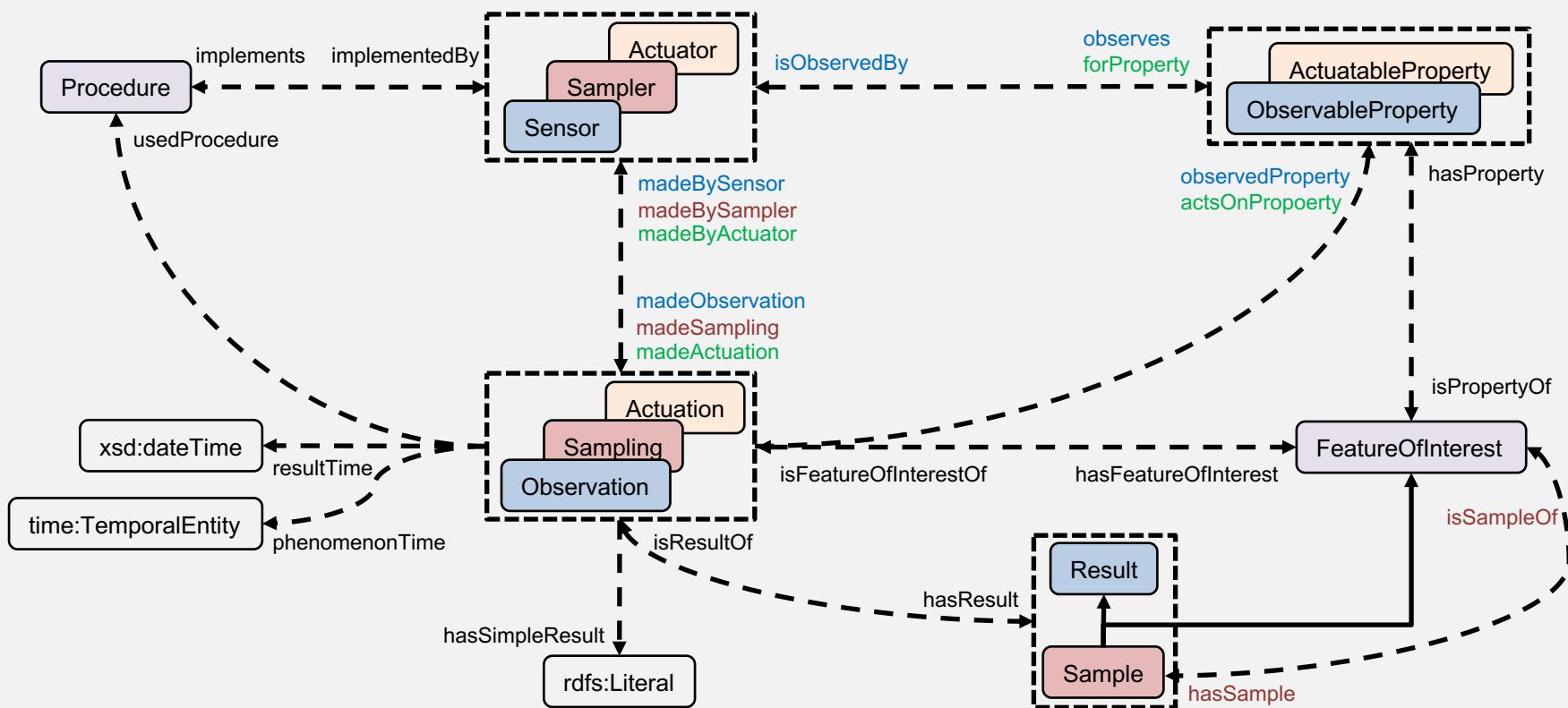
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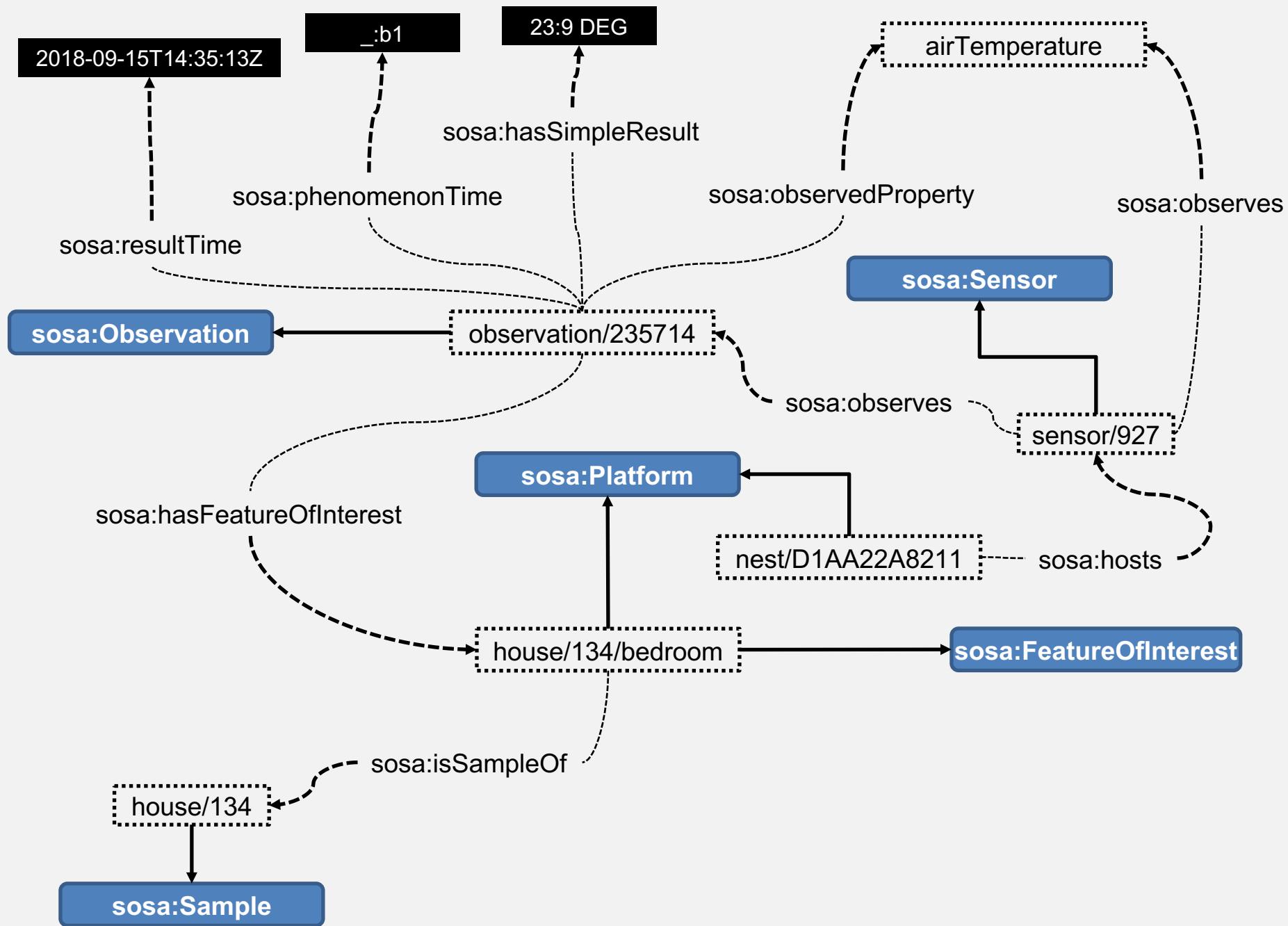
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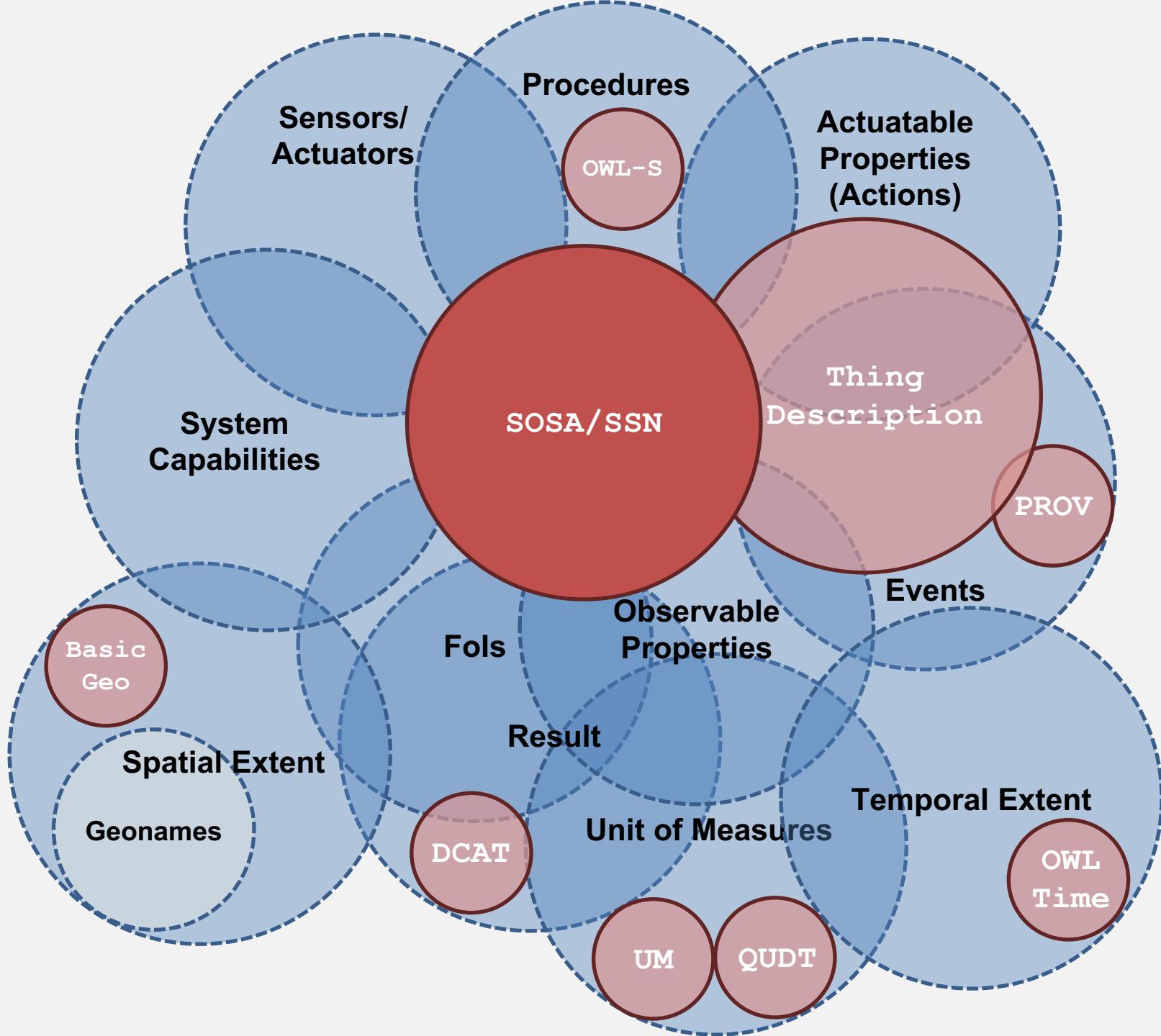
SOSA/SSN ontology onion-layers



SOSA core concepts



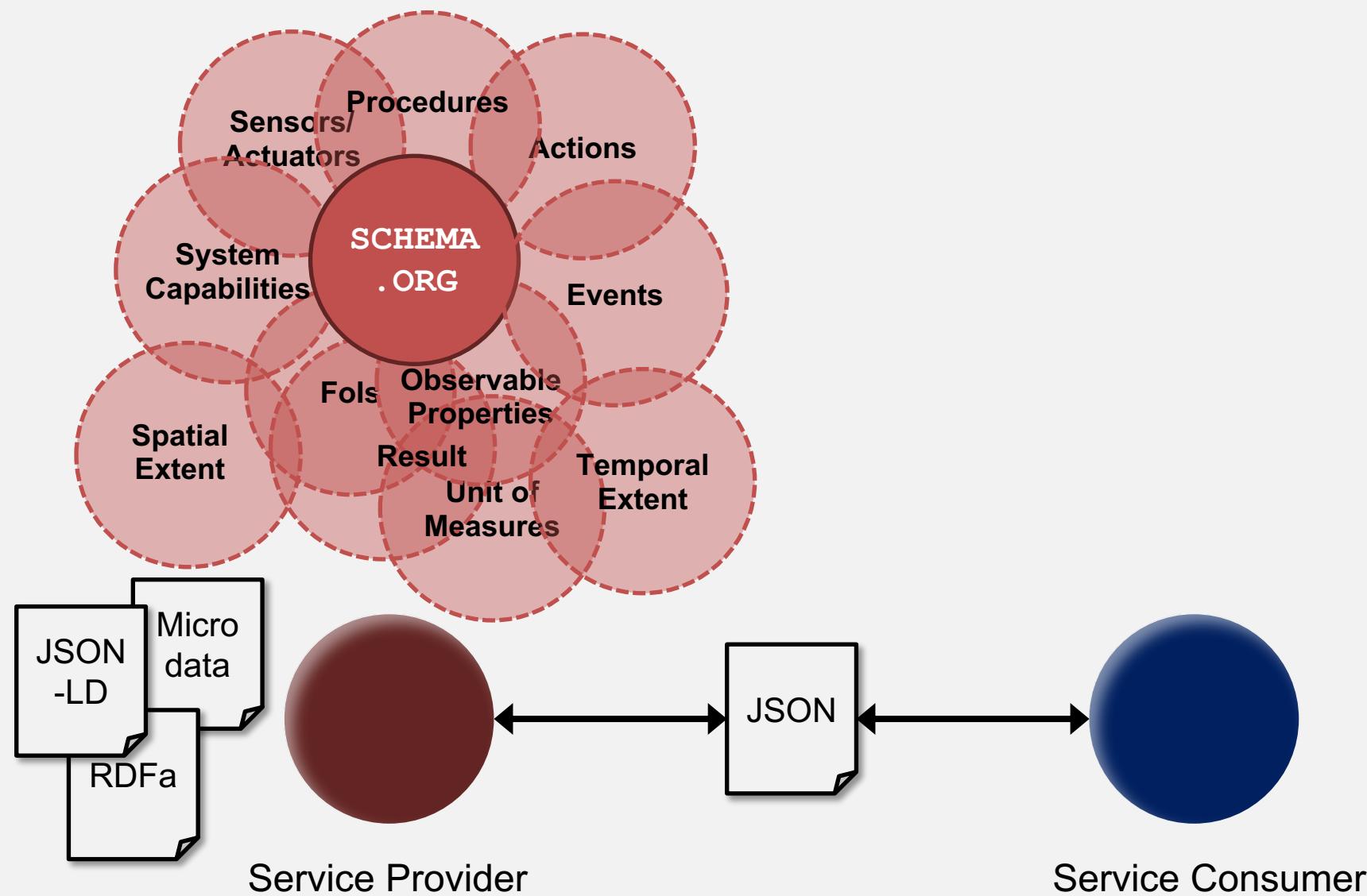




Missing pieces

- Standardized Taxonomy of Observable Properties (Quantities)
 - e.g. weight, height, temperature, color
- Controlled Vocabulary of Features of Interest (Phenomena) per domain
 - e.g. waterbody, air, arm, heart, soil, fire
- Industry Controlled Vocabulary of Sensor/Actuator types
 - e.g. scale, thermometer, pedometer, flame detector
- Standardized Industry Procedures (i.e. computational, voice, gesture **processes**)
 - e.g. on/off, louder/quieter, twisting

... at the very least



Conclusion

- Interoperability only guaranteed through the use of the **Web platform** (HTML5, HTTP)
- **Standardized metadata** required to know how to interact with IoT devices
- Established metadata standards (ontologies) **still missing**

... **schema.org** may plug the gap in the short-term

<http://www.w3.org/ns/ssn/>

QUESTIONS?