Geospatial and location standards for:

- Aviation
- Built Environment & 3D
- Defense & Intelligence
- Emergency Response & Disaster Management
- Geosciences & Environment
- Government & SDI
- Energy & Utilities
- Law Enforcement / Public Safety
- Mobile Internet & LBS
- Sensor Webs
- University & Research
<table>
<thead>
<tr>
<th>Year</th>
<th>Not for profit</th>
<th>Standards</th>
<th>Members</th>
<th>Consensus driven</th>
</tr>
</thead>
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<td>1994</td>
<td></td>
<td>35+</td>
<td>500+</td>
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OGC Sensor Web Enablement

- Sensors connected to and discoverable on the Web
- Sensors have position & generate observations
- Sensor descriptions available
- Services to task and access sensors
- Local, regional, national scalability
- Enabling the Enterprise
Basic Requirements for Sensor Web

- Quickly discover sensors and sensor data (secure or public) that can meet my needs – location, observables, quality, ability to task

- Obtain sensor information in a standard encoding that is understandable by me and my software

- Readily access sensor observations in a common manner, and in a form specific to my needs

- Task sensors, when possible, to meet my specific needs

- Subscribe to and receive alerts when a sensor measures a particular phenomenon
2 Services & 2 Encodings

O&M

SensorML

SOS

SPS
- Developed in UML
- UML $\rightarrow$ XML mapping (fully automated)
  - UML Package
  - UML Classes
  - UML Attributes and Association Roles
  - UML Stereotypes
Semantic Representation

- ~2005 (Probst et al)
- Direct mapping from UML/O&M to OWL/O&M
  - Issues with classes to concept modeling
  - Super/sub-class not always clear
  - Inconsistencies detected (feature representation/real thing)
Semantic Representation

- ~2013 (Cox)

**UML is frame-based**
- Attributes owned by classes
- Association-roles owned by classes
- property redefinition/refinement uncommon and complicated

**RDF is open-world**
- Properties scoped to Ontology (namespace)
- Property re-use expected
- rdfs:subPropertyOf easy, commonly used
Semantic Representation

- ~2013 (Cox)
- O&M Integrated into ISO Framework
  - Basic Types (19103)
  - Geometry (19107)
  - Temporal (19108)
  - Feature (19109)
  - Metadata (19115)
  - Coverage (19123)
  - Metamodel (19150-2)
Semantic Sensor Network Ontology

- ~2005/11
- Four classes and several relationships for system, sensors and deployment information (phases and sites)
SSN \( \rightarrow \) Linked Sensor Data Cube

- Australian Climate Observations Reference Network - Surface Air Temperature (ACORN-SAT) dataset
- Google’s Linked-data API
- SSN Ontology + RDF Data Cube vocabulary
Next Attempt: JSON-LD?

```json
{
  "@context": {
    "featureOfInterest": {
      "@id": "http://ogc.org/FeatureOfInterest",
      "@type": "@id"
    },
    "procedure": {
      "@id": "http://ogc.org/Procedure",
      "@type": "@id"
    },
    "observedProperty": {
      "@id": "http://ogc.org/ObservedProperty",
      "@type": "@id"
    },
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "samplingTime": {
      "@id": "http://ogc.org/SamplingTime",
      "@type": "xsd:dateTime"
    },
    "result": {
      "@id": "http://ogc.org/Result",
      "@type": "xsd:double"
    }
  },
  "@id": "http://my.org/Observations/ff75eb34cf0022",
  "@type": "http://ogc.org/ObservationTypes/OM_Measurement",
  "featureOfInterest": "http://example.com/FeatureOfInterests/Waddensea",
  "procedure": "http://my.org/Sensors/g3",
  "observedProperty": "http://ogc.org/observedProperties/temperature",
  "samplingTime": "2015-01-27T17:43:12",
  "result": "11.3"
}
```
Ingo Simonis
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