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TITLE: Summary of IoT Workshop at OGC TC, November 2011
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Background

A workshop on the Internet of Things (IoT) was held on 30 November 2011, in conjunction with the OGC Technical Committee meeting in Brussels Belgium. The goal of the workshop was to explore the role of OGC in the broader development of the Internet of Things. The workshop reviewed current IoT activities of several organizations. The workshop discussed the application of OGC standards to IoT. Relevant OGC topics include location, sensor webs, spatial models and location-enabled mobile services.
Presentations from the workshop are posted: http://www.opengeospatial.org/event/111130iot

This memo contains three sections:

- Agenda of the IoT Workshop
- Summary of Recommendations for OGC
- Compilation of Presenter Recommendations

Agenda of the IoT Workshop

Presentation Title	Speaker
Workshop Overview	George Percivall, OGC
ITU Overview of Internet of Things (IoT)	Yong-Woon KIM, ITU
FI-Ware Architecture for IoT	Denes Bisztray, Nokia Siemens Networks
Electric Vehicle Charging Stations Information: An Application of the OGC Web Feature Service	Daniel Santillan, EOX IT Services GmbH and Ballade project.
Indoor localisation and tracking.	Thomas Kolbe, TU-Berlin
Coffee Break	Big Bang Theory – IoT Scene
Requirements for IoT from the Environmental and Geospatial domain	Denis Havlik, AIT, ENVIROFI project
W3C Semantic Sensor Network Incubator Activity and IoT	Laurent Lefort, CSIRO
SenseBox and IoT recommendations for OGC Sensor Web Enablement (SWE)	Arne H. Bröring, 52North
Bringing IoT to the mass market - what should a standard do?	Ben Pirt, Pachube
Group discussion of Next Steps	All

"Open GeoSMS to IoT " by Kuo-Yu (Slayer) Chuang was discussed but not presented in the workshop due to lack of time, it should be considered as part of the workshop.

Summary of Recommendations for OGC

This summary of recommendations focuses on actions to be taken by OGC. The broader set of recommendations by all presenters is provided in the next section.

- Promote the use of existing OGC standards in IoT activities of other organizations.
    - OGC standards for Location and SWE are already being used in IoT. This is occurring with little direct involvement by OGC members.
    - Increase participation in industry events relevant to IoT to increase awareness of OGC, e.g., Mobile World Congress, M2M/ETSI, IoT Meet-ups.
    - OGC standards beyond SWE and location are relevant to IOT e.g., WFS, GML, CityGML, GeoSMS, GeoXACML, PUCK. For a comprehensive list see "OGC input to ITU IoT Standards Roadmap", OGC Doc 11-170.

- Initiate new OGC standards development directly tuned to IoT and Web of Things.
    - Initiate an OGC Web of Things standardization activity suitable for consumer IoT devices, e.g., REST interface. Involve existing IoT companies to get broad adoption.
    - Apply OGC information models to IoT "thing-level" abstraction, e.g., SWE
    - Develop an eMobility GML schema based on the Ballade data model.

- Increase OGC implementation activities that advance standards in IoT
    - Coordinate with other standard developing organizations, e.g., ITU, W3C, OMA.
    - Participate with projects implementing IoT, e.g., FI-Ware, SenseBox
    - Investigate requirements to implement IoT in OGC Testbeds.

Compilation of Presenter Recommendations

Each presenter provided a set of recommendations as shown in the next section. A compilation of the recommendations is provided here.

- **Workshop Overview: George Percivall, OGC**
    - Develop consistent approaches to Location in IoT
    - Develop consistent approaches to Sensors in IoT
    - Coordination between standard developing organizations
    - Advance standards development through rapid prototyping for several scenarios
        - E.g., OGC OWS-9 Testbed in planning now.

- **ITU Overview of Internet of Things (IoT): Yong-Woon KIM, ITU**
    - OGC's SWE may be complementary with ITU's Web of Things (Y.WoT, http://www.itu.int/md/T09-SG13-111010-TD-WP2-0274/en).
    - OGC's SWG may be one of enabling technologies for the IoT.

- **FI-Ware Architecture for IoT: Denes Bisztray, Nokia Siemens Networks**
    - disconnectivity management and handling of mobile devices
    - context awareness
    - more autonomous sensors
        - actuators, application layer, data processing and communication capabilities on a sensor/device node

    - device-device interaction
    - autonomous networks of devices
    - thing-level abstraction

- **Electric Vehicle Charging Stations Information: Daniel Santillan, EOX**
    - We see justification for further standardization within OGC eMobility GML (using our data model as starting point?)
    - Interoperability Initiative e.g. Test bed,
    - Interoperability Experiment, etc.

- **Indoor localisation and tracking: Thomas Kolbe, TU-Berlin**
    - 3D models are essential to Indoor Navigation
        - for route planning/addressing, esp. considering diff. locomotion types
        - for position determination / tracking of persons or objects
    - Semantic 3D Building Models provide spatial and semantic context information (CityGML, IFC)
    - Multilayered Space Model assesses the combination of different space representations
        - sensor space (one per sensor type / localisation method)
        - different subspacing of topography wrt. mode of locomotion
    - IndoorGML is a data model and exchange format (based on GML) for the representation of the indoor navigation aspects
        - complementary to CityGML, IFC, GDF
        - A new OGC IndoorGML SWG is about to be started!!

- **Requirements for IoT from Environmental domain: Denis Havlik, AIT, ENVIROFI**
    - IoT versus OGC standards
        - OK, we definitely have plenty of overlaps…
        - Can we use "the best" from both sides?
        - But: what is "the best" and how to describe it?
        - Uff… And the gaps?
    - TO DO
        - Analyse gaps & overlaps
        - Decide on a way to describe(*)
        - Merge (where possible) - best practices?
        - Fill the gaps!
        - Interoperability!
    - OGC Standards relevant for IoT
        - OGC SWE Suite: Sensors are things; IoT needs all of the SWE functionality (observation storage, discovery & access; tasking, event processing)
        - Geo-security: Geo-XACML for both restrictions & application logic
        - Other: PUCK? Catalogue? WFS? WCS? …

- **W3C Semantic Sensor Network Incubator Activity and IoT: Laurent Lefort, CSIRO**
    - Semantic Web standards can help to build modular standards
        - IoT standards requires multiple perspectives and domain-specific extensions
        - More work needed for Energy Management, WSN comms

    - Diverging trends for APIs
        - Schemaless approaches (triples or key-value pairs?)
        - Aligned with ontology
        - Can fit in HTML5 platform (Mobile Web, Augmented Reality)
        - Solution: Multi-formats APIs strategy
    - Convergence of Sensor Web/IoT and Social Web standards
        - Management of live data, identity/privacy
    - Machine-to-Machine (M2M) applications have special modeling requirements (actuation, control loops)
        - This is also critical for Augmented Reality

- **SenseBox and IoT recommendations for OGC SWE: Arne H. Bröring, 52North**
    - Concentrate on HTTP-based protocols !?
        - In opposition to TCP/IP based approaches
    - Standardize REST API for the WoT !?
    - Lightweight encodings (JSON) for O&M / SensorML !
        - New "ThingML" ??
    - Call it Web of Things at OGC ?!

- **Bringing IoT to the mass market - what should a standard do? Ben Pirt, Pachube**
    - Involve existing IoT companies – need to get buy-in
    - Document use cases
    - Examine existing standards and make sure one doesn't already exist!
    - Define the core data model
    - Define areas for extensibility
    - Define data formats and how they map on to the model
    - Build test suite / reference implementation / libraries

- **Open GeoSMS to IoT : Kuo-Yu Slayer Chuang**
    - Open GeoSMS work with (Wireless) Sensor Networks
    - Open GeoSMS to Pachube
    - Open GeoSMS works with EDM
    - Open GeoSMS enhances LBS and O2O (Online to Offline) services