Implementing the OGC Sensor Web Enablement Standards for Marine Applications

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Motivation

• Existing earth observation networks deliver a multitude of in-situ data capturing the state of the earth
• Data sets are of high value for scientists and other stakeholders
• Different data delivery methods and formats
Motivation

- GIS
- Web Client
- Desktop System

Observation Network 1
Observation Network 2
Observation Network 3
Motivation

- GIS
- Web Client
- Desktop System

OGC/ISO Observations & Measurements
  - OGC SensorML
  - OGC Sensor Observation Service

- SOS
  - Observation Network 1
- SOS
  - Observation Network 2
- SOS
  - Observation Network 3
OGC Sensor Web Enablement
Sensor Web Developments in NeXOS

- Sensor Plug & Play
  - Cover the full path from sensor to application
  - Self description of sensors
- Automatic connection and data publication
  - Based on OGC PUCK, SensorML, SOS, EXI
- Sensor Web Infrastructure
  - Open source SWE implementations
  - Data viewer
- Demonstrate interoperability
- Efficient data transmission (EXI)
Idea

- Facilitate the integration of instruments on platforms
- Provide an universal instrument driver → no instrument-specific driver code
- Use OGC PUCK protocol to read SensorML from device
- SensorML describes manufacturer’s command protocol
- Use manufacturer protocol to configure, initialize instrument and acquire its data
- Automatic configuration of the full sensor data flow → from the sensor to Web applications
SWE Bridge Instrument Driver

Retrieve SensorML from instrument, w/ PUCK protocol

Read instrument cmd protocol, config params from SensorML

Issue configuration commands

Issue data acquisition command, log as O&M records

SensorML

Driver

O&M data

O&M data log

Instrument

Config params

read PUCK Acq data Cmd + data

nexos
SWE Bridge Instrument Driver

• Written in ‘C’
• Developed by UPC
• No reliance on operating system → portable to “bare metal” systems
• Developers must write instrument-specific protocol description in SensorML
  – SensorML can be utilized anywhere it can be parsed
Low Bandwidth

• Many platforms use Iridium for commands and telemetry
  – 2400 bps data rate
  – Short burst messages < 2kB
  – Airtime is not cheap, modem consumes power
• SensorML and O&M are XML-based, notoriously verbose
Low Bandwidth

- SensorML, O&M converted to compressed binary (EXI format); enables high throughput/processing on small controllers
- E.g. Slocum Glider CTD data file (105 samples)

<table>
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<tr>
<th>Format</th>
<th>Size</th>
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<tr>
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<tr>
<td>O&amp;M XML</td>
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<tr>
<td>Compressed EXI</td>
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O&M EXI more efficient than Slocum binary!
Instrument Data Access

O&M Data
GetObservation

Push O&M data, SensorML via Iridium

SensorML

Driver

O&M data log

Shore-side Iridium log

InsertSensor
InsertResult

SOS

SensorML

O&M data log
Instrument Data Access

- “52°North Helgoland”: Web-based Sensor Web viewer displays any O&M formatted data
Instrument Configuration

Modified SensorML

SOS

Modified SensorML

DescribeSensor

UpdateSensor Description

Push SensorML via Iridium

Configuration Service

Instrument configured per SensorML on restart

Write PUCK

Modified SensorML
Conclusion and Next Steps

• Marine observatories benefit from the use of standards
  – Interoperability
  – Data re-use
• Sensor Web allows a full plug-and-play chain from the instrument to Web applications
• Support of constrained communication links
• Many results available as open source software
• Contribution to marine SWE profile development activities
• Cooperation with further projects: BRIDGES, FixO³, ODIP 2, SeaDataCloud
• NeXOS ends in October 2017 → current activities:
  – Final integration steps
  – Demonstration activities
www.nexosproject.eu

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