Sensor Observation Service for the GeoEvent Extension

Making sensor data come alive

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ESRI UC 2017
Motivation
Intentions

• Sensor Web technologies are increasingly used
  - Several sensor data providers and SOS instances
    • NOAA, IOOS, NANOOS
    • USGS
    • German Federal Waterways Administration
    • Air quality measurements in Europe

• Accessibility of near real-time sensor data for the ArcGIS platform is required
Observations & Measurements

- Used for encoding data observed by sensors
- Observation comprises
  - Timestamp
  - Value (if applicable including unit of measurement)
  - Observed property
  - Feature of interest
- O&M 2.0 data model approved as an ISO standard
- O&M 2.0 XML encoding approved as an OGC standard
Sensor Observation Service

- Pull-based access to observations
- Mediator between:
  - client <-> data archive / simulation / real-time sensor system
- Hides the heterogeneous structure of proprietary sensor data formats and protocols
- Data formats: O&M and SensorML
- Versions: 1.0 and 2.0
Approach

• Use of the ArcGIS GeoEvent Extension for Server
  - Requesting sensor data from an OGC Sensor Observation Service (SOS)
  - Processing and filtering sensor data
  - Transfer sensor data to different endpoints (e.g. Feature-Service, Stream-Service)

• Requirements:
  - Development of an Input Connector for requesting a SOS
Architecture
Sensor Observation Service for the GeoEvent Extension

SOS Input Connector

**SOS Inbound Transport**

Observation Parameters:
- SOS URL
- Offering
- Observed Property
- Procedure

Request Parameters:
- Request Interval
- Initial Request

**SOS Inbound Adapter**

- Byte [ ] deserializing
- XML parsing
- GeoEvent Definition

GeoEvent creation

GeoEvent
SOS Input Connector
SOS Inbound Transport

• Use of a polling mechanism to request and receive sensor data from an SOS server
  - Request interval as a parameter
• Requests only new data that was available since the last request
• Time filter as a request parameter

http://www.pegelonline.wsv.de/webservices/gis/sos?
request=GetObservation&observedProperty=Wasserstand&
(...)&eventTime=2017-02-13T12:30:00.000/2017-02-
13T12:45:00.000&(...)
SOS Inbound Transport

- Process flow of the SOS Inbound Transport

![Diagram showing the process flow of the SOS Inbound Transport](image)

- **initial request:**
  - Start: \( n \) days ago
  - End: current time
- **2nd request:**
  - Start: \( T_1 \)
  - End: current time
- **3rd request:**
  - Start: \( T_2 \)
  - End: current time

current time - \( n \) days ago

latest sampling Time \( T_1 \)

latest sampling Time \( T_2 \)

latest sampling Time \( T_2 \)
SOS Inbound Transport

- Time filter very important for retrieving data
  - Observations consist of two timestamps:
    - `resultTime` and `phenomenonTime`
  1. Data could arrive later in the database → `resultTime > phenomenonTime`
  2. If data is requested periodically, observations can be missed

→ Connector considers the `phenomenonTime` of previously retrieved data to create the time filter for the next period
Visualization

• Water level observation with the Operations Dashboard
Demonstration

• Demo video
Next Steps

• Integration with additional SOS instances available for public use
  - NOAA Oceanology data
  - IOOS Oceanology data
  - European Air Quality data

• Making the SOS Adapters Open Source
  - requires additional testing
Thanks for your attention!

Any Questions?

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