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An OGC Hydrology & Hydrogeology Interoperability Experiment

71st OGC Technical Committee

Mountain View, CA. USA

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Overview

OGC Hydrology Domain Working Group Ground/Water Interoperability Experiment 1 (IE)

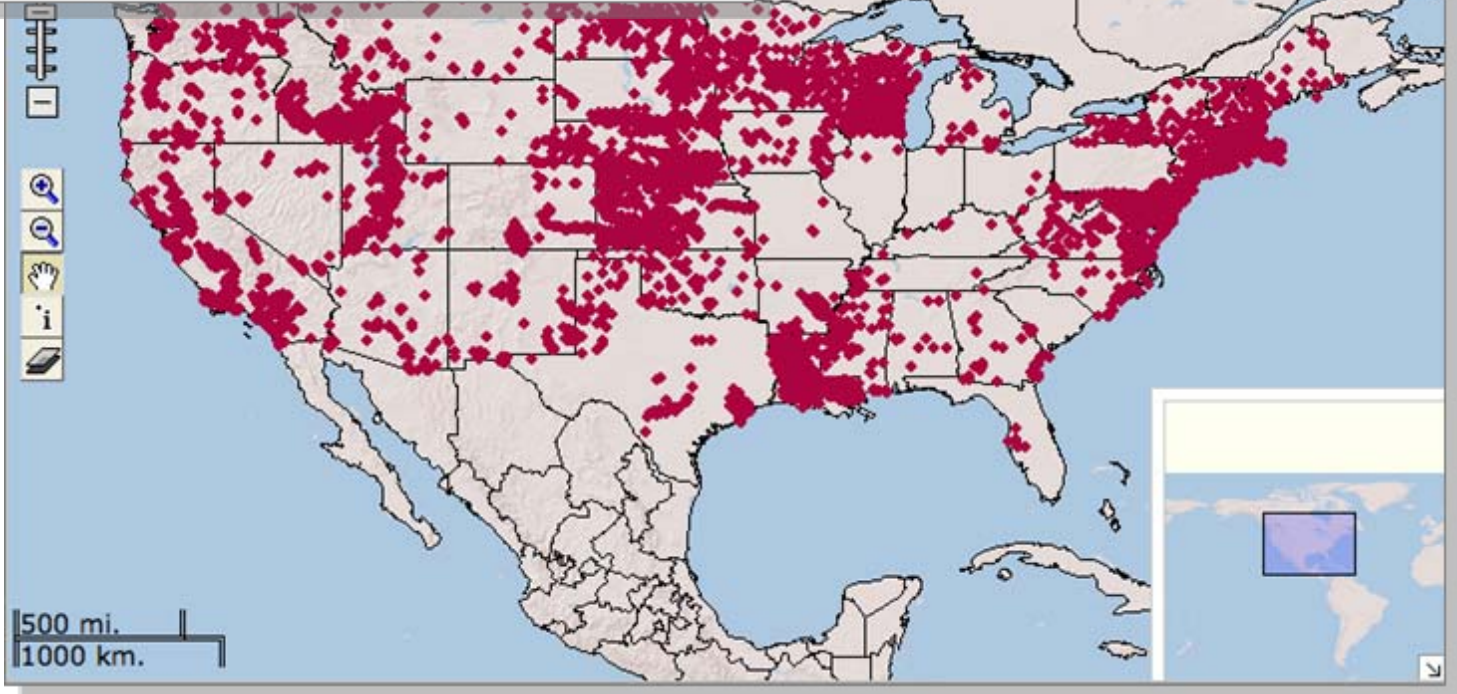
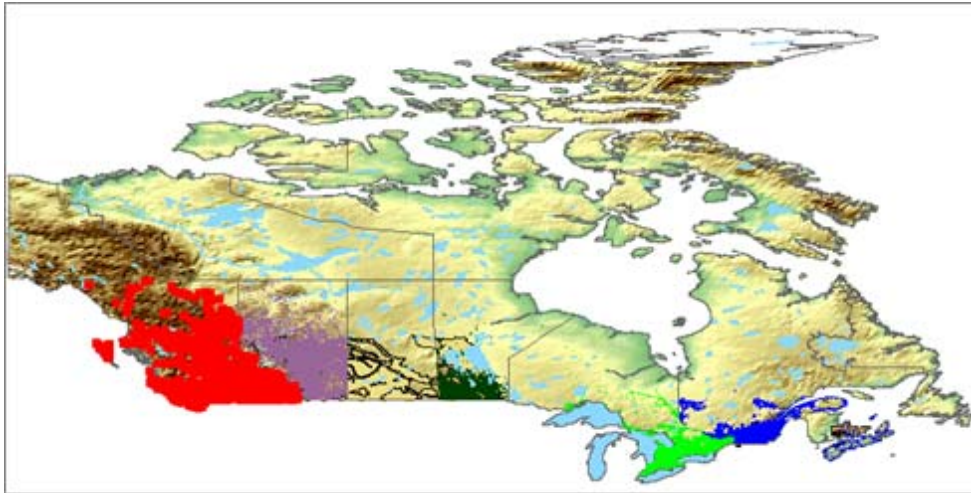
- **IE Description**
- **Early Results**
- **Early Lessons Learned**
- **Demo**



- **GW is a significant source of water for humans**
- **Ground/water feature and observation data**
 - **distributed:** many data providers (~1000 in Canada alone)
 - **heterogeneous:** structure and content (e.g. level, flow, quality)
 - **massive instances:** millions of wells (features/sensors) & time series (observ.)
 - **massive schema:** thousands of properties (e.g. for quality)
 - **few standard services:** very few OGC gr/water services
- **Existing schema standards for water**
 - WaterML (USA), GroundwaterML (CAN), WTDF (AU), WQX (USA), OGC O&M, SensorML,...
 - consolidation in WaterML 2 via OGC HDWG
- **Relevant OGC Web service standards**
 - SOS, WFS, WMS, CSW



Sensor sites & well locations





IE Objectives

Ground/Water feature and observation interop:

1. Advance design of WaterML 2 schema

- harmonize existing schemas

2. Advance fit of OGC services with gr/water data

- SOS, WFS, WMS, CSW

3. Advance GW data exchange between US & CAN

- in cross-border Great Lakes area (Lake Superior) for water wells and levels



1. Advance design of WaterML 2 schema

- **merge** or **link** existing schemas (WaterML, O&M, GWML)?
- when to **restrict**: what is special about gr/water observations?
- when **not** to **restrict**: does it need to be extensible?

2. Advance fit of OGC services with gr/water data

- **SOS 1**: not designed for **massive** networks (i.e. GetCap lists each sensor)
- **CSW**: include individual sensors?

3. Advance GW data exchange between US & CAN

- **what is a gr/water observation?**
1/n sensors, 1/n time points, 1/n time series, 1/n properties?



View, query and download water wells & levels:

- **View US & CAN well/sensor locations**
 - WMS (GetMap)

- **Query on one well/sensor and display data**
 - WMS (GetFeatureInfo)
 - **well:** WFS (getFeature via BBOX) **or**
 - **level:** SOS (GetObservation via BBOX)
 - return GWML or WaterML and display as HTML

- **Download cross-border wells and levels**
 - Zoom to area of interest (find BBOX)
 - **well:** WFS (GetFeature via BBOX and thematic filter) **or**
 - **level:** SOS (GetObservation via BBOX and time filter)
 - Export as GWML, WaterML, Excell, or KML



IE Participants (to date--alphabetical)

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▪ **CSIRO**

David Lemon

Peter Fitch

Peter Taylor

▪ **GSC**

Boyan Brodaric

Eric Boisvert

Heryk Julien

Francois Letourneau

Dave Sharpe

Alex Smirnoff

▪ **SDSC / CUAHSI**

David Maidment

Ilya Zaslavsky

David Valentine

▪ **USGS**

Nate Booth

Dave Briar

Tom Kunicki

I-Lin Kuo



IE Dates, Workplan, Outputs

- **Dec 8, 2009: Request for Participation**
 - RFP closed today

- **Dec 8, 2009: Milestone 1**
 - preliminary WaterML 2 schema, example instances, documents (CSIRO)
 - preliminary services: SOS & WFS (GSC), SOS (USGS), CSW (SDSC)
 - preliminary demo of use-case

- **June 2010: Milestone 2**
 - intermediate results at OGC TC

- **Dec 2010: Final Milestone**
 - final results
 - technology demo
 - change requests re: OGC specs
 - wrap and report at OGC TC and AGU 2010



IE Call for Participation

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- **Role 1: Observer**
 - participate in discussions, meetings, etc.

- **Role 2: Participant**
 - participate in some activities:
 1. WaterML development for gw data (CSIRO led)
 2. SOS/WFS/WMS deployment for gw data (Great Lakes?) (GSC-USGS led)
 3. CSW deployment for services (SDSC led)

- **Contact an existing participant**



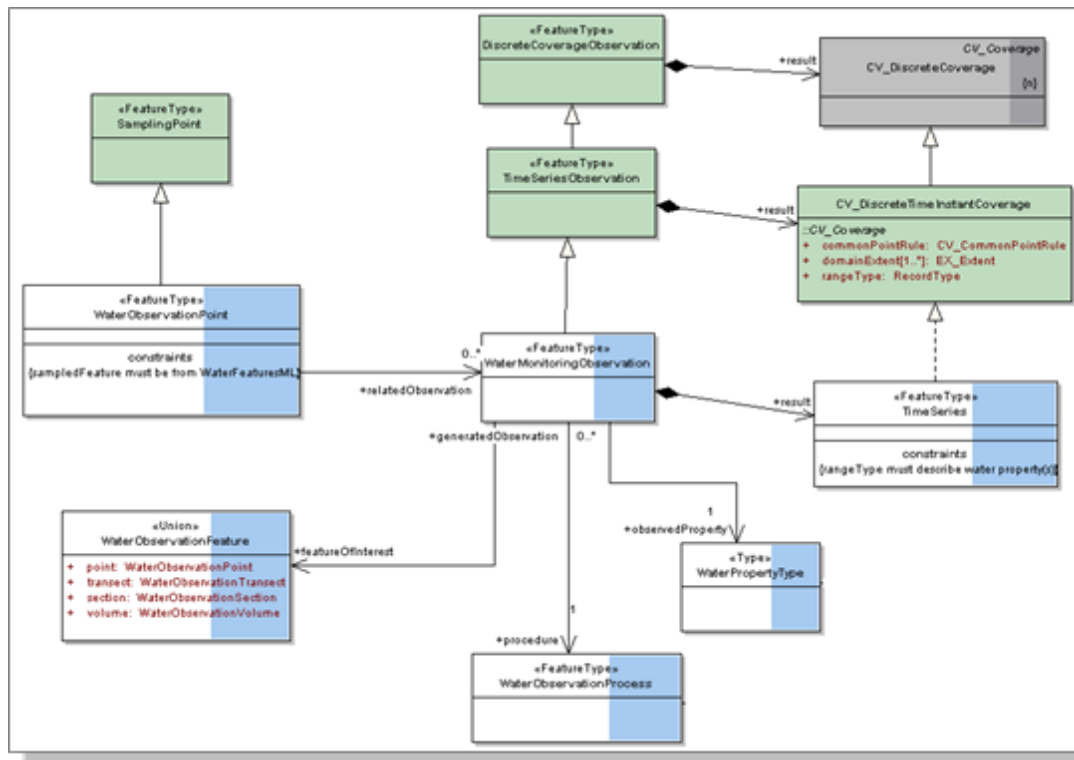
IE Milestone 1 Assumptions

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- **WaterML 2 beta**
- **Groundwater levels**
 - GSC from water well data
 - USGS from sensors
- **SOS 1.0.0**
 - BBOX and temporal filters
- **Observation result is 'Time Series'**
 - for single and multiple observations
 - inline-feature-of-interest for observation location

1. WaterML 2 schema revised

- specialize O&M from WaterML and WTDf
- link to GWML
- revised schema, instances, UML documentation



IE Milestone 1 Results

2. Advance fit of OGC services with gr/water data

- preliminary services established: SOS (WaterML) and WFS (GWML—GSC)

3. Advance GW data exchange between US & CAN

- cross-border groundwater levels displayed, queried, downloaded

query

view

download

The image displays several screenshots from the Groundwater Information Network (GIN) website, illustrating the results of the IE Milestone 1. The central screenshot shows a map of the Hydrology Interoperability Experiment area, with various data layers visible. The map includes a legend for 'Visible layers' such as 'Reference overlay for Canada', 'USGS Groundwater level', 'Ontario Water Levels', and 'Ontario Water Wells'. The map also shows a search bar, a zoom control, and a 'Zoom to a specific area' section. The left screenshot shows the 'Sensor Observation Service (SOS)' page, displaying details for a specific observation, including the sensor name, sampling time, and observed property. The right screenshot shows the 'Hydrology Interoperability Experiment' page, which includes a map and a data table. The bottom right screenshot shows a Google Earth interface with a 3D view of the study area.



IE Lessons and Actions

■ WaterML 2

- **problem:** some limitations in extensibility
- **solution:** use more general feature-of-interest
- **problem:** need governing group for WaterML 2, to coordinate design
- **to do:** refine water result types and document

■ OGC Services

- **problem:** what to expose in GetCapabilities (many sensors, much data)?
- **solution:** report one sensor collection in GetCapabilities,
report data for a sensor in GetObservation
- **to do:** deploy in CWS for discovery, SOS 2?

■ Implementation

- **problem:** vendor support for SOS 1
- **solution:** home-grown SOS
- **to do:** query: temporal, phenomena, value filter
data: water well data and some quality data



Final notes

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- **Public IE Wiki**

http://external.opengis.org/twiki_public/bin/view/HydrologyDWG/GroundwaterInteroperabilityExperiment

- **OGC HDWG exploring other IEs (e.g. surface water)**

- **Acknowledgements**

- **OGC:** C.Reed, D.Arctur, G.Buehler, L.McKee

Thank you!