

Progress Toward a Standards-Based XML System for IGS Network Site Log Metadata Management and Dissemination Using GeodesyML

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Outline

- Background on eGeodesy, GeodesyML, and international standards for metadata
- DCWG IGS Network Site Log XML concept and plan
- Site Log XML implementation progress
- Next steps

Need for eGeodesy* – demand is changing

- Geodetic services no longer service a small community
- Widespread uptake across society of accurate and reliable Positioning, Navigation and Timing (PNT) information.
- In order to service these user demands our geodetic data and the associated metadata need to be **discoverable**, **interoperable** and **authoritative**.
- The continual increase in the volume and complexity of data means we also need to generate, transfer and use data and metadata via a machine readable form.
- In order to achieve these goals it is clear that the time has come to develop an XML based standard for geodesy.

*eGeodesy is a project of Australia and New Zealand government entities concerned with surveying and mapping to enable modern IT for geodesy.



The need for a geodetic metadata standard

- No geodetic standard is available which makes geodetic data and metadata **discoverable, interoperable** and **authoritative**.
- This restricts the usability of our information.
- It also reduces our capability to maintain accurate databases, access and retrieve information, reliably integrate data from multiple sources and provide users with the authoritative data they need.
- Some standards are available which assist with basic information retrieval, and some provide for the transfer of a limited set of geodetic metadata, however, a new standard is required to meet all users current and future needs.

International Standards

- Efforts by the geodetic community to create a metadata standard should align closely with recognised international standards
 - International Organization for Standardization (ISO)
 - Open Geospatial Consortium (OGC)
 - Geography Markup Language (GML)
 - Web service standards



Extending GML

- GML provides a rich set of primitive objects like (geometry, coordinate reference system, time etc.)
- But not detailed / specific standards
 - e.g. GML can not be used to describe everything about a GNSS, VLBI, SLR, DORIS site.
- The geodetic standard needs objects like antenna, receiver, cable, adjustments etc.
- *GML Application schemas* extend GML to meet the needs of a specific community of interest (e.g. SensorML, GeoSciML, GeodesyML (proposed))
- Those object types in turn reference the primitive object types defined in the GML standard.

Proposed Solution - GeodesyML

- The geodetic community requires a standard which makes data and metadata:
 - discoverable and interoperable,
 - easily transferable via web services, and
 - based on internationally recognised data exchange methods.
- Australia and New Zealand created the Geodesy Markup Language (GeodesyML)
- GeodesyML describes how geodetic data and metadata can be defined and transferred in XML format
- GeodesyML is a proposed Application Schema of the Geography Markup Language (GML) (ISO Standard)

GeodesyML includes

- Standard way to encode:
 - GNSS related data and metadata
 - Terrestrial observations
 - Reference frames
 - Adjustments
 - Measurements
 - Site
 - Quality
 - Local Ties
- Future work will extend GeodesyML for the other techniques SLR, VLBI, DORIS.

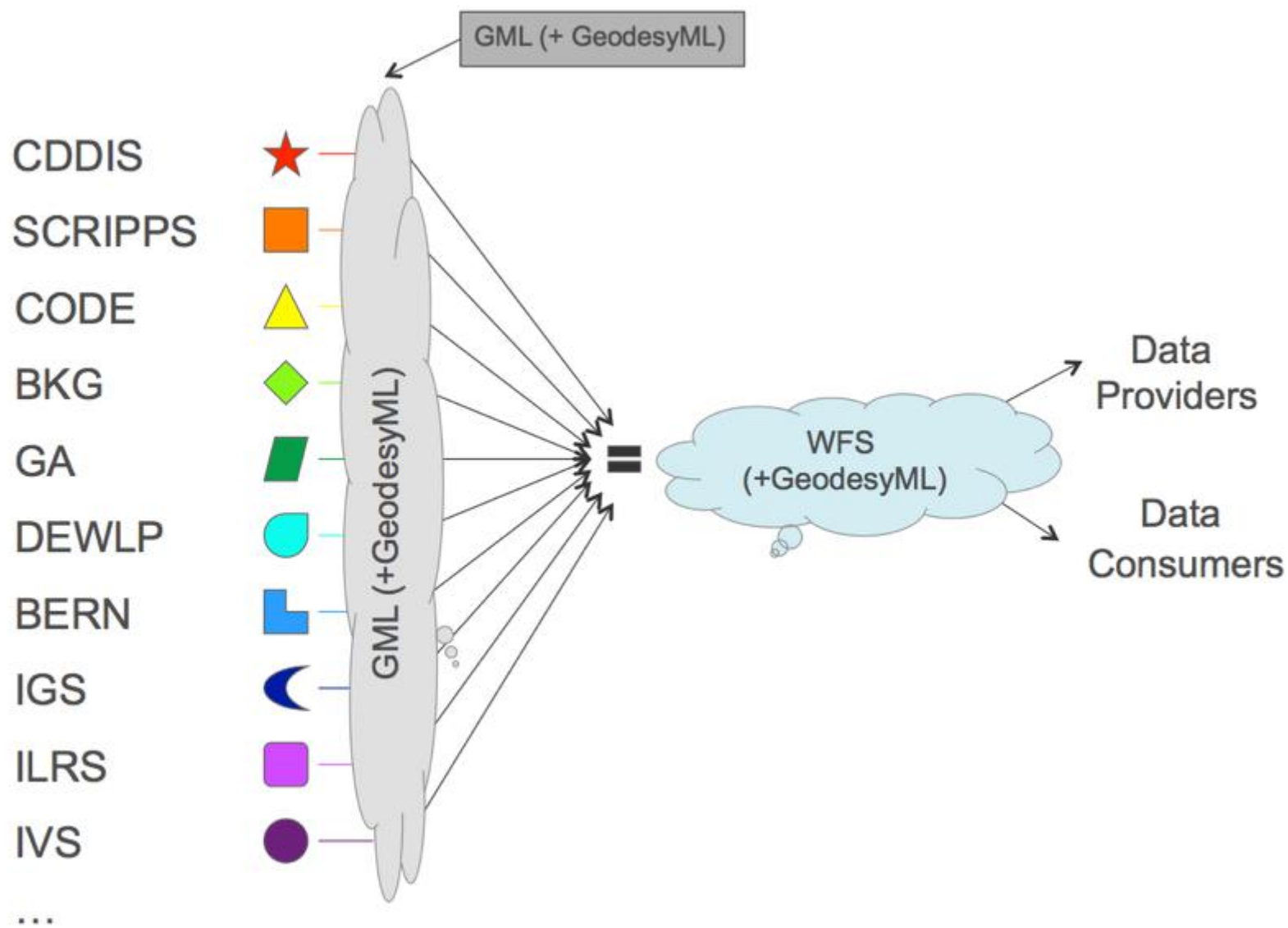


+ GeodesyML (proposed Application Schema)

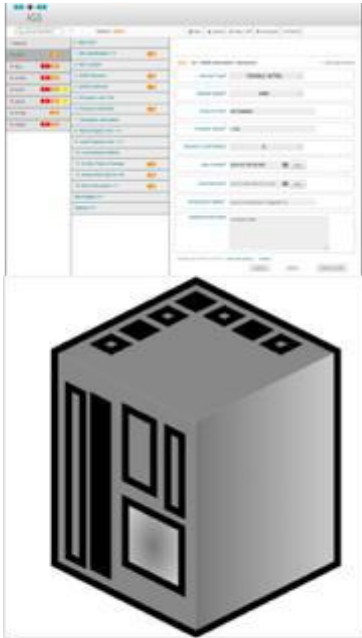


Data Centers WG IGS Station Site Log XML Effort

- Began discussions of a Site Log XML Schema in 2014 based on the SOPAC XML Schema as an alternate metadata format to the text site log
- Adopted GeodesyML in 2015
- Many institutions are involved in refining GeodesyML and testing both the schema and the mechanisms for enabling machine-to-machine interoperability (ROB, NASA, BKG, IGS, ESA, UNAVCO ...)



Data Centers WG Vision – Benefits for IGS



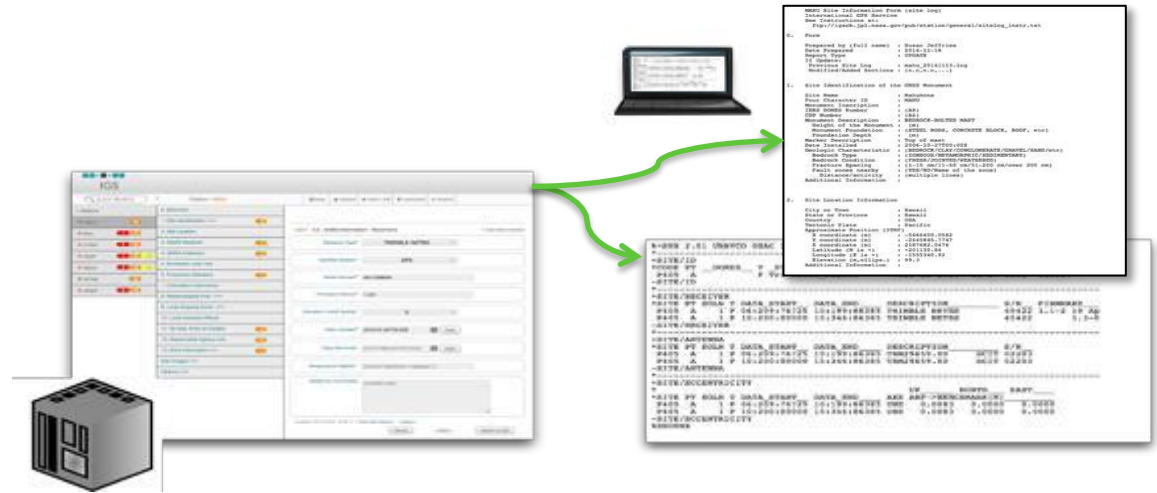
```

WGS2 Site Information Form (site log)
International GNSS Service
See Instructions At:
  http://ipsh.jpl.nasa.gov/pub/station/general/site_log_inst.txt

2. Form
Prepared by (Full name) : Susan Jeffries
Date Prepared : 2014-12-18
Report Type : TRKAGE
IS Update:
Previous Site Csg : msh_20141118-igs
Modified/Added Sections : (S-O-R-P,---)

1. Site Identification of the GNSS Monument
Site Name : Kuluksma
Four Character ID : KMRU
Monument Inscription :
IGS GNSS Number : (NA)
COP Number : (NA)
Monument Description : BRICK-BOULDER MAST
Weight of the Monument : (N)
Monument Foundation : (STEEL MORG, CONCRETE BLOCK, ROOF, etc)
Foundation Depth : (N)
Marker Description : Top of mast
Date Installed : 2004-10-17T00:00Z
Geologic Characteristic : (BEDROCK/CLAY/CONGLOMERATE/GRAVEL/SAND/etc)
Bedrock Type : (GOMPHOS/METAMORPHIC/SEDIMENTARY)
Bedrock Condition : (FRESH/POURED/WEATHERED)
Fracture spacing : (1-15 cm/11-50 cm/51-200 cm/over 200 cm)
Fault zones nearby : (YES/NO/Name of the zone)
Distance/Inclivity : (multiple lines)
Additional Information :

3. Site Location Information
City or Town : Hawaii
State or Province : Hawaii
Country : USA
Territorial State : Hawaii
Approximate Position (UTM)
X coordinate (m) : -564400.2582
Y coordinate (m) : -244883.7747
Z coordinate (m) : 218782.0476
Latitude (N is +) : +20135.84
Longitude (E is +) : -155140.92
Elevation (m/feet) : 99.9
Additional Information :
  
```



```

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SiteLogManager System

Maintain best aspects of current system

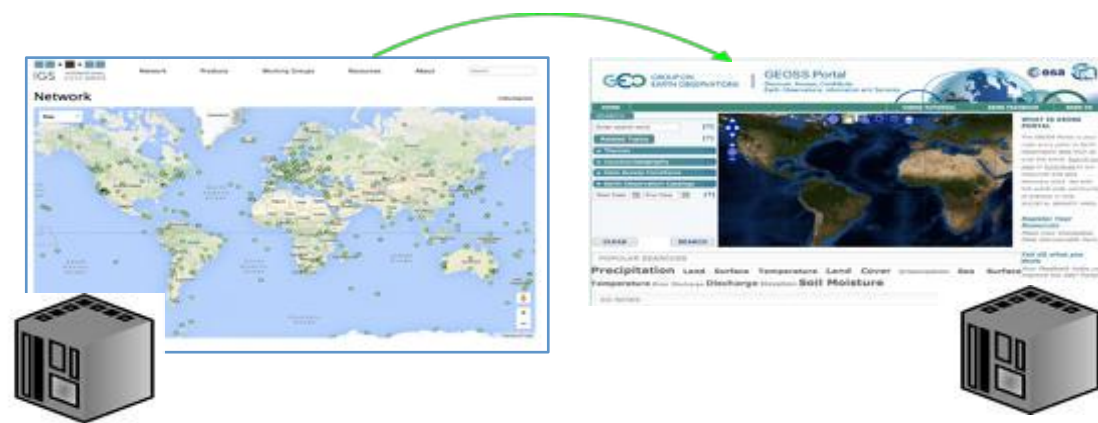
Alternate formats provided to users via web services query



Data Centers WG Vision – Benefits for IGS (cont.)



Implement Machine-to-Machine interoperability within IGS



Improve discoverability of IGS metadata, data, and products outside of IGS

Progress since Sydney IGS Workshop

- At Sydney, GeodesyML had just been adopted by DCWG, implementation was yet to begin
- Since then, work has taken place at several institutions:
 - **Geoscience Australia** is providing GeodesyML tools and support
 - **Royal Observatory of Belgium** has worked extensively with encoding site logs in GeodesyML
 - **UNAVCO** and **BKG** have investigated GeoServer OGC application server as a mechanism for providing GeodesyML encoded Site Log metadata via OGC WFS

Progress since Sydney IGS Workshop

Geoscience Australia

GeodesyML support has been built out

- GeodesyML V0.4 is available from www.geodesymml.org
- GitHub Code repository and documentation
- GeodesyML Forum
- GA has developed a user interface for GNSS metadata
<https://gnss-site-manager.geodesy.ga.gov.au>

Progress since Sydney IGS Workshop

Royal Observatory of Belgium

Royal Observatory of Belgium has rebuilt its Site Log metadata management system to use GeodesyML

- Metadata for 300+ EPN stations and 1100 EPN densification stations are encoded in GeodesyML
- Feedback provided on the 0.3 version of GeodesyML; recommended changes incorporated into GeodesyML 0.4
- Intends to use this system for its work with the European Plate Observing System (EPOS) to manage GNSS metadata
- EPOS will use GeodesyML as the format to exchange GNSS metadata

Progress since Sydney IGS Workshop

UNAVCO

UNAVCO is using GeoServer for presenting GeodesyML Site Log metadata via Web Feature Service WFS

- GeoServer is the reference implementation for Open Geospatial Consortium (OGC) Web Feature Service
- GeoServer:WFS :: Apache:HTTP
- To implement GeodesyML requires creating Application Schema Mapping for DB schema to GeodesyML
- Success after just 3 weeks of work by an intern
- Works for M2M accessing of metadata and will allow discovery/interoperability with external entities (e.g. GEO Portal)



Data Centers WG XML Metadata Effort - Next Steps

- GeodesyML encoding capability to be implemented for the IGS CB Site Log Manager using GeoServer
- Further refinements to GeodesyML based on experiences by WG members in implementation
- Additional open source codes to be developed e.g. for GeodesyML encoded metadata -> text site log and other formats
- Building of mechanisms for machine-to-machine update
- Registration of IGS assets in international systems such as GEO portal

Conclusions

- Foundation is in place for implementing modern, international standards in geodesy metadata
- GeodesyML version 0.4 is available with extensive support by Geoscience Australia
- Progress and successes using GeodesyML has happened
- Significant work left to do to turn pilot projects to production
- Significant work to make tools so that GeodesyML is easy to work with for the users outside of DCWG
- DCWG efforts will continue

Thank you!

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