Collaborative Development of a Standards-Based XML System for IGS Site Log Metadata Management and Dissemination

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Collaboration of the DCWG

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For 20 years the IGS has relied on the text Site Log file to document metadata

Meanwhile, the IGS Network has grown in the number of stations and the complexity (MGEX, RT)

For Data Centers the task of keeping metadata up to date, complete, and synchronized can be made more efficient

For Analysis Centers and other data users, the task of accessing metadata can be made simpler

We can achieve benefits of standards and discoverability described in N. Brown’s talk
Current System

Text Site Log

Advantages

- Trustworthy
- Complete
- Everything in one place
- Human readable

Disadvantages

- Parsing and vetting challenges
- Metadata also needed in other formats (SINEX, station.info, etc.)
- Managing files can be a chore
- No facilitation of machine-to-machine (M2M) exchange
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The Site Log Manager database and interface aids in timely metadata tracking and accuracy and some vetting but does not address metadata access, i.e. access is still through text Site Logs via ftp; interoperability is not facilitated.
Vision for the New System

M2M Interoperability

IGS Central Bureau

European Permanent Network

Machine-to-Machine interoperability within IGS

Simplification of updates, for example EPN to IGS Central Bureau and other metadata systems. Site Log Manager system will incorporate XML-schema-based vetting of content including parsing and validation, consistency checking, and verifying completeness.
Vision for the New System

Human-to-Machine (H2M) Interoperability

Alternate formats can be provided via web query
Vision for the New System

Improving discoverability of IGS Metadata, Data, and Products

To achieve this requires (1) adopting international standards that have been developed for the spatial data and broader Earth observation communities AND (2) linking the metadata definitions that encapsulate geodesy to these broader communities. GeodesyML, an XML OGC and ISO compliant application schema, is the mechanism to forge this link.
Why XML?

XML ESSENTIALS

What is XML?

The Extensible Markup Language (XML) is a simple text-based format for representing structured information: documents, data, configuration, books, transactions, invoices, and much more. It was derived from an older standard format called SGML (ISO 8879), in order to be more suitable for Web use.

What is XML Used For?

XML is one of the most widely-used formats for sharing structured information today: between programs, between people, between computers and people, both locally and across networks.

A short example:

```xml
<part number="1976">
  <name>Windscreen Wiper</name>
  <description>The Windscreen wiper automatically removes rain from your windscreen, if it should happen to splash there. It has a rubber <ref part="1977">blade</ref> which can be ordered separately if you need to replace it.
</description>
</part>
```

https://www.w3.org/standards/xml/core.html

If you are already familiar with HTML, you can see that XML is very similar. However, the syntax rules of XML are strict: XML tools will not process files that contain errors, but instead will give you error messages so that you fix them. This means that almost all XML documents can be processed reliably by computer software.
Site Log XML Example

Text Site Log designed for human readability

```
3.1 Receiver Type : ASHTECH Z-XII3
Satellite System : GPS
Serial Number : LP03105
Firmware Version : CB00
Elevation Cutoff Setting : 
Date Installed : 1999-10-28T00:00Z
Date Removed : 2000-04-05T00:00Z
Temperature Stabilization :
Additional Information : 120 second sampling rate until telemetry established
```

XML Site Log encoding - human readable, but more typically handled by software

```
<gnssReceiver>
  <equip:receiverType>ASHTECH Z-XII3</equip:receiverType>
  <equip:satelliteSystem>GPS</equip:satelliteSystem>
  <equip:serialNumber>LP03105</equip:serialNumber>
  <equip:firmwareVersion>CB00</equip:firmwareVersion>
  <equip:elevationCutoffSetting/>
  <equip:dateInstalled>1999-10-28T00:00Z</equip:dateInstalled>
  <equip:dateRemoved>2000-04-05T00:00Z</equip:dateRemoved>
  <equip:temperatureStabilization/>
  <equip:notes>120 second sampling rate until telemetry established</equip:notes>
</gnssReceiver>
```
Similar to HTML editor/viewer software, XML viewers are available.
Changes in Text Site Log Coming

Certain elements of the text site log will change to follow the XML schema and, where applicable, standards being used (ISO, OGC/GeodesyML)

Changes will be announced in the usual way, with text site log template and documentation available from the IGS Central Bureau

Example 1. Antenna diagrams will be dropped, and antenna information from online documentation will instead be referenced
Changes in Text Site Log Coming

Example 2. Support for 9-character RINEX3 filenames in XML and text site logs

```
<geo:siteLocation>
  <geo:city>Melbourne</geo:city>
  <geo:state>Victoria</geo:state>
  <geo:tectonicPlate>Indian/Australian</geo:tectonicPlate>
  <geo:approximatePositionITRF>
    <geo:xCoordinateInMeters>-4130636.106</geo:xCoordinateInMeters>
    <geo:yCoordinateInMeters>2894953.089</geo:yCoordinateInMeters>
    <geo:zCoordinateInMeters>-3890531.051</geo:zCoordinateInMeters>
    <geo:latitude-North>-37.82941634</geo:latitude-North>
    <geo:longitude-East>144.9753351</geo:longitude-East>
    <geo:elevation-m_ellips>-40.674</geo:elevation-m_ellips>
  </geo:approximatePositionITRF>
  <geo:notes>The GPS is located at the old Melbourne Observatory, located in the Royal Melbourne Botanical Gardens</geo:notes>
</geo:siteLocation>

<geo:Monument gml:id="MONUMENT_1">
  <gml:name>Centre of base of 5/8" spigot on GPS</gml:name>
  <gml:installedDate>2002-03-15Z</gml:installedDate>
  <geo:monumentNumber>0</geo:monumentNumber>
  <geo:receiverNumber>0</geo:receiverNumber>
</geo:Monument>
```

2. Site Location Information

<table>
<thead>
<tr>
<th>City or Town</th>
<th>Melbourne</th>
</tr>
</thead>
<tbody>
<tr>
<td>State or Province</td>
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</tr>
<tr>
<td>Country Code</td>
<td>AUS</td>
</tr>
<tr>
<td>Tectonic Plate</td>
<td>AUSTRALIA</td>
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</tbody>
</table>

1. Site Identification of the GNSS Monument

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Melbourne Observatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four Character ID</td>
<td>M005</td>
</tr>
<tr>
<td>Monument Number</td>
<td>0</td>
</tr>
<tr>
<td>Receiver Number</td>
<td>0</td>
</tr>
<tr>
<td>Monument Inscription</td>
<td></td>
</tr>
</tbody>
</table>
Example 3. Geographic coordinates decimal degrees in XML and text site logs

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<geo:siteLocation>
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Changes in Text Site Log Coming
**Metadata Entry**

**As is the case now,** IGS Site Log Manager system:
- Will accept upload of text Site Log from authenticated users
- Will accept manual entry of metadata from authenticated users
- IGS Network Coordinator vets this metadata

**New functionality to be built as part of this effort,** IGS Site Log Manager system:
- Will accept upload of XML Site Log from authenticated users
- Will accept input of XML metadata via web services from trusted authenticated sources (no vetting by IGS Network Coordinator required)

**Metadata Access**

**As is the case now:**
- Text Site Logs will be available via FTP

**New functionality to be built as part of this effort,** IGS Site Log Manager system:
- Will output XML via web service (full site log or selected elements)
- Will output a variety of text formats via web service
- Standalone software scripts for output of alternate formats from XML will be made available
Adopting an XML format has these benefits within IGS:
• Solves parsing challenges of Text Site Log
• Leads to efficiencies in tracking site log metadata
  • Automated updating of Site Log Manager by trusted systems
  • Validation done by machines rather than humans
• Facilitates any desired presentation format for metadata (SINEX, station.info, etc.)
• Extensible: as metadata needs evolve, schema can be extended
  • A proposed extension is to track quality metadata like number of available daily data files in last year; average percent of daily file completeness in last (year/month/day), etc.

Adoption of GeodesyML, a standards-based XML schema, has these additional benefits for IGS and beyond:
• Global unification of standards for encoding geodetic data and metadata
• Machine-to-machine exchange of data and metadata over the Internet with existing web services
• Greater interoperability with the geospatial and Earth observation communities
• Enhanced discovery of IGS data and metadata
• Database and GIS vendors support international standards

Application to other geodetic techniques:
• This effort can be leveraged by ILRS, IDS, IVS
**Implementation**

**Milestones to date:**
- Agreement on elements to be included in Site Log XML schema version 1.0
- Agreement on certain encoding changes for consistency
- Adoption of GeodesyML with Site Log XML schema version 1.0 as application schema

**Next steps:**
- Documentation of schema 1.0
- Agree on GeoServer Application Server or other exchange mechanism
- Provide list of all available software (client and server) for enabling this activity
- Agree on and implement software distribution mechanism
- Sandbox exploration
- Identify 2-3 groups to do a pilot demonstration of use cases/mechanisms
- Adoption of exchange mechanisms
- Documentation of exchange mechanisms
- Adopt a process for handling future needs
- Site Log Manager system (and others as desired) implement Application Server and supporting software

Much of this can happen in 2016
Final Thoughts

Needed from all stakeholders:
Use cases - document how would you like to interact with this metadata system

You can learn more about this effort by subscribing to the igs-dcwg mailing list

Thanks for your attention

Questions?