OGCii™

Interoperability Institute

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Development of Training Materials for NSDI Support Using OGC Standards

Final Report

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Project Title: Development of Training Materials for NSDI Support Using OGC Standards

Final Report

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Executive Summary

Five modules in PowerPoint format were developed to provide guidance for individuals and organizations wishing to serve their transportation data holdings on the worldwide web, in a form compatible with the Framework Data Standard (FDS). The modules include:

• Geospatial Interoperability - Introduction and Overview
• The General Feature Model and Geography Markup Language
• The Framework Data Standard , Part 7: Transportation
• Harmonizing Your Data with the Framework Data Standard
• Serving Your Data Via WFS

Among the project goals was reusability of the framework material. This report contains a guide to the completed materials and the portions that should be changed if they are adapted to address another Theme of the Framework Data Standard.

These slides can be used for self-education, but are also suitable as core material for instructional or workshop venues. This report includes suggestions for augmenting the slide sets with additional material for creation of a complete course of instruction.

Documents contributed by the OGC and OGCii provided much outline material and many of the graphics in the slide sets. The task also required a significant amount of

primary authoring in order to provide sufficient detail to be of practical use to implementers.

Project Narrative

OGCii proposed to "develop and deliver content for a core curriculum in the underlying concepts and operational deployment of systems for publishing data compliant with the FGDC-endorsed NSDI Geographic Information Framework Data Content Standard [FDS], using standard, interoperable data services and best practices developed or adopted by the Open Geospatial Consortium (OGC)."

OGCii further specified that "[t]he resulting program will include information suitable for providing managers and decision makers an overview of the benefits, operational processes, and technical architecture that attend to such installations. However, the primary focus will be on training and easing the learning curve for implementers, providing guidance on how most efficiently to approach the often daunting task of serving their data as part of the NSDI, and where to find products and deployment information that is too product-specific to include in the broadly applicable set of lessons that are envisioned."

These targets have been met. The introductory module is suitable for decision makers to become acquainted with the concepts and technologies that support geospatial interoperability and the process for implementing it with local data offerings.

The rest of the modules are technical, and intended primarily for implementers.

The second module introduces the concepts of Features, as defined by OGC and ISO Standards, and as used in the FDS. This module also includes a brief introduction to GML. This is not strictly necessary: WFSs produce GML, so implementers generally do not need to. However, questions about GML arise regularly, and some knowledge of the topic can be useful in validating or debugging a WFS implementation.

The third module describes the FDS Transportation Model, which builds upon the Feature concept. The module introduces the main concepts in the model, including the notion of Transportation Features and concepts that are built upon it, including road segments and routes. This module also describes the Transportation Event Model. The focus of this module is the Roads component of the model, which serves as an example for the remaining portions of the FDS Transportation Theme.

The fourth module provides guidance as to how to develop a mapping, or cross-walk, from the implementer's local data model to the FDS Transportation Model.

The fifth and final module describes the workings of the Web Feature Service, and outlines several approaches to transforming local data according to the mapping discussed in the fourth module.

These modules do not attempt to provide step-by-step instructions or be fully comprehensive in themselves. Rather, they serve as outlines for the subject matter, and provide guidance to using more complete, primary sources of information, especially the FDS Standards Documents themselves.

Project Activities

The flow of activities in this project proceeded essentially as planned. Materials were assembled from a wide array of sources made available by the OGC and OGCii, collated and organized according to subject matter, then ordered to form the backbone of the instructional course.

Substantial additional material was required for modules 2 – 5, and this was created anew, based upon the FDS Standards Documents themselves, the author's background in interoperable geospatial data systems, and comments received from reviewers.

Materials were distributed to a variety of persons in several public agencies and private organizations. Comments were received from the following individuals, and resulted in significant improvement to the final product:

> Julie Maitra, FGDC
> Lynda Wayne, NSDI Online Training Program
> Paul Scarponcini, Bentley Systems, Incorporated (subject matter expert)
> Raj Singh, Open Geospatial Consortium (subject matter expert)

Modularity and Reusability

The modules were planned to be structured so that their content could be reused easily in compiling or reorganizing the coursework. This effort was directed especially towards the notion of developing material that could support all the themes of the Framework Data Standard.

The Appendix of this report provides guidance as to what changes would need to be made in each slide set to provide training for another Theme of the FDS.

Technical Challenges

Among the issues confronted during the preparation of these materials, two were particularly challenging:

(1) It was difficult to organize the substantial array of materials garnered from prior projects of the OGC and OGCii. The issue is generic, and essentially one of metadata. Each slide conveys information relevant to a given topic, but there is no adequate source

of metadata as to what information the slide contains. Slide titles were sometimes useful in this regard, but usually not sufficient. Likewise, PowerPoint "outline mode" was helpful but not entirely adequate to the task. The process ultimately entailed sorting slides into separate files, each dedicated to a specific topic. This was cumbersome but effective. More powerful and more flexible tools would have been helpful for this part of the effort.

(2) The process described by these materials - publishing local data via standard services, and organizing it according to a standard information model – is multifaceted and layered, with quite a few dependencies among the topics that need to be covered. Incorporating all the information in a rather terse document was challenging. On a few occasions, as the material was filled in, we found that substantial reorganizations were helpful in promoting a smooth flow of ideas between and within the modules. Reorganizations of this type should be anticipated in future efforts of this kind.

Deviations from the Original Proposal

The primary difference from the project as originally conceived involves the amount of original material that was required to satisfy project goals. We originally anticipated that a suitable reorganization of the slides and text in these documents would form the bulk of the training program. And in fact, materials provided by the OGC and OGCii were sufficient to create a broadly comprehensive and current introduction to geospatial interoperability. However, as work on the project proceeded, it became clear that the needs of implementers were more specific than offered by most of this material. Contributed materials were extensively incorporated, but with more editing and reorganization than originally anticipated.

This is the first instructional material from the OGC or OGCii that describes a process for semantic harmonization, although the topic has been touched upon in more general presentations, and an OGC Interoperability Experiment was conducted in 2003 that illustrates the feasibility of the approach outlined in these slides.

The timeframe was also extended, to accommodate issues encountered in organizing the contributed materials as noted above.

Access to Deliverables

The training slides will be made available, free of charge, on the worldwide web at http://www.ogcii.org/nsdi_training/

Plans for the Future

We expect these slides to be used as the basis for presentations, workshops, and classes on implementation of FGDC–endorsed standards, as well as for individual instruction.

The materials would be significantly enhanced by development of a case study of a small data set being followed through the entire process of semantic harmonization and implementation in a data service. Such a component was conceived but determined to be a substantial effort in its own right, and beyond the scope of the current project.

However, an example like this should be considered by individuals seeking to enhance these materials, or to develop a course around them. For greatest utility, it will be necessary to develop a native dataset sufficiently familiar in outline to a wide and varied group of transportation data providers. Proper identification of such a dataset will require review by an array of parties knowledgeable about transportation data.

It is also hoped that future efforts will adapt these same materials to instruction relevant to the other Themes of the Framework Data Standard.

Feedback on Cooperative Agreements Program

What are the CAP Program strengths and weaknesses?

The accessibility and flexibility of the program are major strengths. The very reasonable level of reporting requirements, including one interim and one final report, allowed the great bulk of time and effort to be devoted to execution of the project itself.

Where does it make a difference?

We expect these materials to be helpful in a variety of venues. Without the funding for this project, it is not clear when any such training programs would have been created. The OGC and OGCii are repositories of a significant amount of information, and it is hoped that the training materials created will help transfer this information to the professionals who manage transportation data throughout the nation.

Was the assistance you received sufficient or effective?

The assistance was more than adequate, in terms of guidance provided initially, and in conduct of the administrative components of the program throughout its course. Advisories from program management about deadlines and options for modifying them

were very helpful. We also very much appreciated the interim reviews of our work by the project Technical Lead.

What would you recommend that the FGDC do differently?

It would be beneficial to create more of a community of the CAP program participants, but

Are there factors that are missing or additional needs that should be considered?

We did not identify any such items during the course of this work.

Are there program management concerns that need to be addressed, such as the time frame?

We found it necessary to request additional time to complete the project; apparently this is fairly common. A timeframe of 18 months, rather than one year, turned out to be more suitable for this project, and we would suggest that program administration consider this as an option for future projects under the Cooperative Agreements Program.

If you were to do this again, what would you do differently?

We would have started earlier on the segments that required primary authoring and used the contributed documents more as supplementary information and illustration, which is how they were ultimately incorporated. This would have been a relative rather than an absolute change. The first module, for example, was based substantially on contributed materials.

We would also explore placing more emphasis on tools for assisting the development of mappings between local and standard data models, and perhaps less emphasis on the Geography Markup Language. Semantic harmonization is a substantial domain of research, possibly worthy of an entire course in its own right. However, some reviewer comments suggested that it would have been worth exploring more deeply.

We also would have been more aggressive about securing reviewers early in the process.

We considered whether it would have been desirable to develop a more complete set of training materials for a smaller portion of the process of publishing transportation data through the NSDI, rather than covering the entire process in the first iteration of the project. However, given the uncertainty of obtaining funding for continuation of the project in future years, and desire for continuity throughout the course, we concluded that it made more sense to provide a backbone for a complete course of instruction. This allows trainers, workshop developers, and other sources to augment these materials

according to their own plans and requirements, and leaves open the option for more piecemeal enrichment of these materials for future work, and possibly other programs. The material as it stands is suitable for self-instruction by enterprising individuals and also appropriate as core material for lecture or workshop venues.

Appendix: using these slides for training in other FDS Themes

The slide sets delivered in completion of this project were designed to be separable into reusable components. Many topics and concepts are identical for the entire range of FDS Themes, and the organization of the materials allows replacement of transportation topics or concepts with their equivalents from other Themes.

In summary:

- Module 1 is substantially reusable as is, with few changes.
- Module 2 is substantially reusable as is, but requires somewhat more replacement of code snippets and concepts from the FDS Theme for which the training is intended.
- Module 3 needs to be replaced wholesale with detailed engineering model of the FDS Theme for which the training is intended.
- Module 4 contains much reusable material, and its organization is suitable for reuse. However, quite a few minor changes are required, in many cases just a single word on a slide. Please see Table 1.
- Module 5 is substantially reusable as is, but requires replacement of some notions in code and text with concepts from the FDS Theme for which the training is intended.

Table 1 provides detail on which portions of the training modules contain references to transportation, and would therefore need to be changed to accommodate another Theme of the FDS.

Table 1: Components that refer to transportation topics

Module 1: Geospatial Interoperability – Introduction and Overview		
Slide(s)	Change Required	Comments (see below)
19	Text in graphic	2
21	Text in graphic	2
25	Text in graphic	2
Module 2: Features and Geography Markup Language		
Slide(s)	Change Required	Comments (see below)
4	Text in graphic	2
5	Text in graphic	2

8	Entire slide	4
18	Entire slide	1, 2, 4
28	Entire slide	3, 4
29 - 30	"Roads" reference in XML code	3
31 - 32	Transportation concepts in code and text	1, 3

Module 3: The FDS Transportation Model		
Module is specific to Transportation – replace in its entirety for other FDS Themes		

Module 4: Harmonizing Your Data with the FDS Transportation Model		
Slide(s)	Change Required	Comments (see below)
2	Reference correct FDS Theme	1
5, 7	Text in graphic	2
8	Sub-bullet at end of slide	1
10	Reference correct FDS Theme	1
11	First item – reference correct Theme	1
12	Examples in sub-bullets	1
14, 16-18	References to Tables in FDS documents	1
22, 23, 25 - 27	Change references to transportation and transportation objects	1
28, 29	Entire slide	4
31	Item 3 – refer to objects in correct Theme	1
32, 33	Refer to objects in correct Theme, if relevant	1
34 - 36	All – IF ExtendedAttribute is not relevant to Theme	Discusses ExtendedAttribute
37, 38	Refer to correct Theme and corresponding FDS document	1
40, 42	Refer to correct Theme	1
44	Item 1 - refer to correct Theme	1
46	Item 3 sub-bullet – refer to correct Theme	1
47	Example code – use an element from an object in the correct Theme	3
48 - 53	Replace slides with examples from correct Theme	3
57	Refer to correct Theme	1
58 - 63	Refer to documents and objects from correct Theme	3
64	Item 4 sub-bullet 2 – refer to objects in correct Theme	1

Module 5: Serving Your Data via WFS		
Slide(s)	Change Required	Comments (see below)
17 – 19, 23	Change code examples for relevance to correct Theme	3, 4
24	Change item 1 and URL	1, 3
27, 37 – 39, 41	Change the word "transportation"	1
46	Refer to object from correct Theme (instead of RoadSeg)	1
48, 49	Refer to object from correct Theme in text and URL	1, 3
50	Replace slide with references to correct Theme and corresponding document and table	Exercise
51	Use object from correct Theme in URL	3
52	Use object and document references for correct Theme	1

Table 1 Comments:
1. Transportation items or concepts in text
2. Transportation items or concepts in a graphic
3. Transportation items or concepts in code (including URLs and XML snippets)
4. Transportation example