Syntactic Interoperability and Spatial Support through practical development

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The fast pace development of Geographic Information System (GIS) has benefited us in almost all aspects of our daily life by acting as a media (Sui and Goodchild, 2001). The development of distributed computing infrastructure calls to share geographic information resources to build inexpensive distributed GIS applications. The problems of incompatibility in format, syntax, semantics, quality, and spatial support emerged within the efforts of sharing the geographic information resources. Different standards organizations, such as OGC and FGDC, are trying to set up standards and implementing GISs based on relevant standards to solve the interoperability problems. In the context of Geographic Information Science (GIScience), Goodchild (2004) suggested to research on spatial webs and data integration to address them in a relevant NGA sponsored project.

We actively practice in solving interoperability issues through the project of *Virginia Access – Middle Atlantic Geospatial Information Consortium* (NASA NAG13-01009) and the project of *Building an Interoperable Web Mapping Portal for the Middle Atlantic Region* (USGS/FGDC CAN. 03HQAG0146).

1. We participated in developing the FGDC framework data content standard (http://www.fgdc.gov/RReview/RRlogin.php) for Digital Elevation Model and are in the process of reviewing the standards. The FGDC framework data content standard involves the differentiation of metadata for each of seven themes and five sub-themes of transportation. This experience gives us the opportunity to observe the theoretical aspect of metadata for syntactic interoperability.
2. Collaborated with NASA Geospatial Interoperability Office, we are mapping our interoperable efforts to *Geospatial Interoperability Reference Model*, which recommends different standards for different aspects and levels of services, for example, EPSG, OGC WMS, FGDC Metadata and OGC GML/WFS are adopted to comply with Geospatial Reference Systems, Maps and Visualization, Metadata and Catalog Access, and Data Access standards/specifications respectively.
3. FGDC clearinghouse node and Geospatial One-Stop harvested portal are also constructed to exchange geospatial products with government agencies, such as USGS, and general public using Z39.50 and FGDC metadata standards

(http://gis.scs.gmu.edu/metaweb/smms.asp). This research and development effort gives us opportunities to observe the implementation aspect of metadata for syntactic interoperability.

4. Our research has been focused on different issues of distributed GIS since 1997 (Yang et al, 2004c). The research resulted in 3 software prototypes, products. Data generalization and abstraction methods are adopted and implemented in our high performance WebGIS prototype (Yang et al, 2004a). This practical development, we believe can contribute to the effort of providing spatial support.

5. Advanced distributed geospatial information computing methods, such as GridGIS (Yang et al, 2004b), is also under research and development. We are trying to develop a suite of middleware services (Yang and Tao, 2004) to share geospatial information resources, including data and process, in the cyber-infrastructure as envisioned by NSF (http://www.nsf-middleware.org/) and Gehegan (2004). We hope to provide practical development contribution to the interoperability issues of GIScience and contribute to all the four topics identified by the meeting of *specialist meeting on spatial webs* through the research.

Although our research and development have potential contributions to the four topics of the meeting, we envision our contributions to the spatial webs as 1) to the syntactic interoperability from both theoretical and practical metadata aspects, and 2) to the spatial support through our development and research on high-performance distributed GIS.

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