GIS Standards and Interoperability

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Interoperability and Standards
Why are We Talking About These?

• Interoperability is *Essential* for Enterprise GIS
• Standards are Emerging that Support Interoperability
• GIS Users Work in a Heterogeneous Environments
GIS Implementations Follow Common Patterns

Desktop

- Ad Hoc Projects
- Analysis/Modeling/Mapping

Multi-User

- Shared Database
- Fixed Applications
- Transactions

Work-Groups

Federated

- Integration
- Sharing
- Collaboration

Organizations

Professional
The Web - A New Pattern for Implementing GIS
Becoming a New Platform

Supporting
• Collaborative Computing
• Service Integration (Mashups)
• User Contributed Content
• Distributed Data Management

GeoWeb

Web 2.0

Web 1.0

Map Services

Many Participants
• Interconnected
• Interoperable
• Integrative
• Dynamic

. . . An Agile Framework for Collaboration & Integration of Systems
Soon We’ll Be Fusing Everything
Providing New Possibilities for Sharing, Integrating & Using

- Creating Mashups among GIS Servers
- Integrating Consumer Basemaps w/GIS Data
- Publishing GIS Services into Consumer Viewers
- Integrating Georeferenced Web Content (Geo-RSS, Photos, Documents . . . )
Interoperability In All Forms
Essential to GIS

- Platform Choices
- Technology Standards Support in the GIS
- Spatial ETL via Interoperability Extensions
- Content Standards and Data Models
Content Standards

- Data Models
- Metadata (19139)
- North American Profile

Transformation Procedures (ETL)

- Formats
- Schema
- Semantic

ETL = Extract, Transform & Load Data

GIS Desktop

GIS Server

Simple Features

GML
GIS Systems
Manage & Disseminate Geographic Knowledge

Use
- Desktop GIS
- 3D Explorer
- Web Map Viewer
- Mobile
- Open APIs
- Enterprise Service Bus

Serve
- Server GIS

Author
- Desktop GIS
ESRI’s Support for Interoperability and Standards
Strong Support in Core Technology

**Standards**

- **Data Management**
  - Simple Features
  - Metadata Standards
    - ISO 19115, 19119, 19139, …

- **Data Formats**
  - GML, Mid/Mif, Tab, DWG, DGN

- **Web Services Standards**
  - Data & Presentation Services
    - WMS, WFS, WCS, OpenLS
  - Registry & Catalog Services
    - CAT 1.0, OAI-PMH, CS-W

**Products**

- **Provider Level Support**
  - ArcIMS
  - ArcIMS + Data Delivery Extension
  - ArcGIS Engine
  - ArcGIS Server
  - Portal Toolkit

- **Consumer Level Support**
  - ArcMap
  - ArcMap + Data Interoperability Extension
  - Portal Toolkit Components
  - ArcGIS Explorer
  - WebADF
Standards Based Interoperability
Some of the OGC Web Services Standards

• **Web Mapping Service (WMS)**
  – HTTP protocol for publishing and query of web based map layers as image data (PNG, GIF, JPEG)

• **Web Feature Service (WFS)**
  – HTTP protocol for publishing web based map layers as vector data (GML 2.1.2, SF GML, GDB GML, …)

• **Web Coverage Service (WCS)**
  – HTTP protocol for publishing and query of web based image services – a sort of web based image processing service (GeoTiff, HDF-EOS, DTED, NITF, GML)

• **Catalog Services – Web (CS-W)**
  – Defines several web interfaces for data discovery
Standards Based Interoperability
Throughout Data and Services Life Cycle

1. Create Content
2. Document (Metadata)
3. Catalog
4. Publish
5. Discover
6. Use/Access

Web Mapping
W*S

Desktop GIS
Support
SF, WMS, WFS, GML

Metadata Explorer
Z39.50, CSW

Metadata Server

Catalog Service
Z39.50, CSW

Internet

GIS Server

Catalog

WMS
WFS
WCS

SF - Binary,
SF – SQL Types & Functions

ISO 19115
ISO 19115-2
ISO 19139

Standards Based Interoperability
Throughout Data and Services Life Cycle
GIS Servers Provide a Framework

Nodes in a network

GIS Servers

ETL (Extract, Transform, Load)

GIS Datasets (Local, state, federal, private)
Data Interoperability
New Data Sources & Converters

Supports Data Transformation
- Formats
- Data Models
- Schema
- Projections / Datum

Supports Complex Data Transformation
- Works in Desktop Now
- Engine & Server @ 9.2

Creating Custom Format Converters

Integrated with ModelBuilder

Support for OGC Standards
The Enterprise Implementation
GeoPortal as Component of the Core GIS System

Client Applications

Mobile

Browser

2-D & 3-D Desktop Viewers

Desktop GIS

Web Services Platform

Enterprise GeoPortal

Data Warehouse

GeoPortal

• Search
• Channels
• Link Browser Map
• Download:
  • ArcGIS Explorer
  • Toolbar for ArcMap
  • ...
• Collaboration

Catalog Services

Catalog

GIS Data

Open Web Services

Tracking Services

Geo-processing Services

2-D Base Map (Cache)

3-D Base Map (Cache)

Browser Catalog Services

Mobile Catalog Services

2-D & 3-D Desktop Catalog Services

Desktop Catalog Services

Web Services Platform

GIS Data

Open Web Services

Tracking Services

Geo-processing Services

2-D Base Map (Cache)

3-D Base Map (Cache)

Browser Catalog Services

Mobile Catalog Services

2-D & 3-D Desktop Catalog Services

Desktop Catalog Services
GIS Portals Play An Important Role
Search For and Access GIS Data and Web Services

Shared Catalog that References

- Datasets
- Map Services
- Communities
- GIS Activities
- Data Models
- GIS Services

The U.S. GeoSpatial One-Stop
www.geodata.gov
GIS Server Must Be Open & Interoperable

Using Standards to Integrate with Any System

Web
- REST, SOAP XML, JavaScript, KML, V.E. ...

OGC
- GML, WFS, WMS, WCS ...

Enterprise Integration
- SOAP, XML, EJB, SQL

Application Content
- CAD, Image, PDF
Servers Need to Support Mashups

Integrating GIS Services & Making Use of Consumer Map Services

Helping Users Tell Stories in Internet Map Sites . . .

. . . And Integrating Web Content into GIS
Enterprise GIS Business Architectures

Geocentric Workflows

Geographic information as the foundation of mission operations

Geospatially-Enabled Workflows

Infusing geospatial intelligence in enterprise IT systems

Geospatial Intelligence
Facilities and Asset Management
Land Records Management

Command & Control
Business Intelligence
Supply Chain
Maintain Infrastructure Data

Web and Mobile-based Clients

Data Integration Between Systems

Central Web Access to Information Resources (including GIS)

Mapping for Visual Analysis and Reporting

Manage Large Spatial Databases

Remotely Access and Edit Data

Support Business Processes with Applicable Spatial Information
GIS Server: Enterprise Integration Through Standards

Integration Platform

Clients

Application Servers

GIS
EAM
ERP
CIS

Desktop
Browser
Mobile

Data Servers

J2EE, .NET (SOAP/XML)

EIS
Interoperability In All Forms
Essential to GIS

- Platform Choices
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Some Additional Resources

  - Whitepapers
  - OGC Compliancy

• **OGC Website** - [www.opengeospatial.org](http://www.opengeospatial.org)
  - See Compliancy Pages

• **ArcGIS Product Help**
  - Metadata Support
  - Data Interoperability
  - GML Support

• **Data Models**
GIS Day: November 14, 2007

An Opportunity to Share Your Knowledge