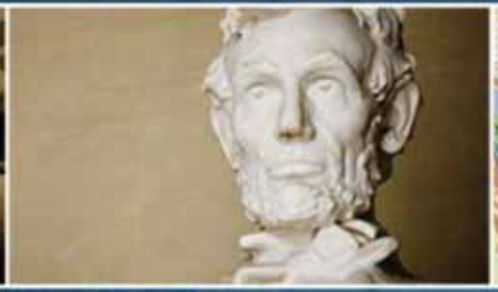
Esri Federal User Conference

GIS: The Geographic Approach for the Nation



ArcGIS support for Federal GIS standards

David Danko, Esri

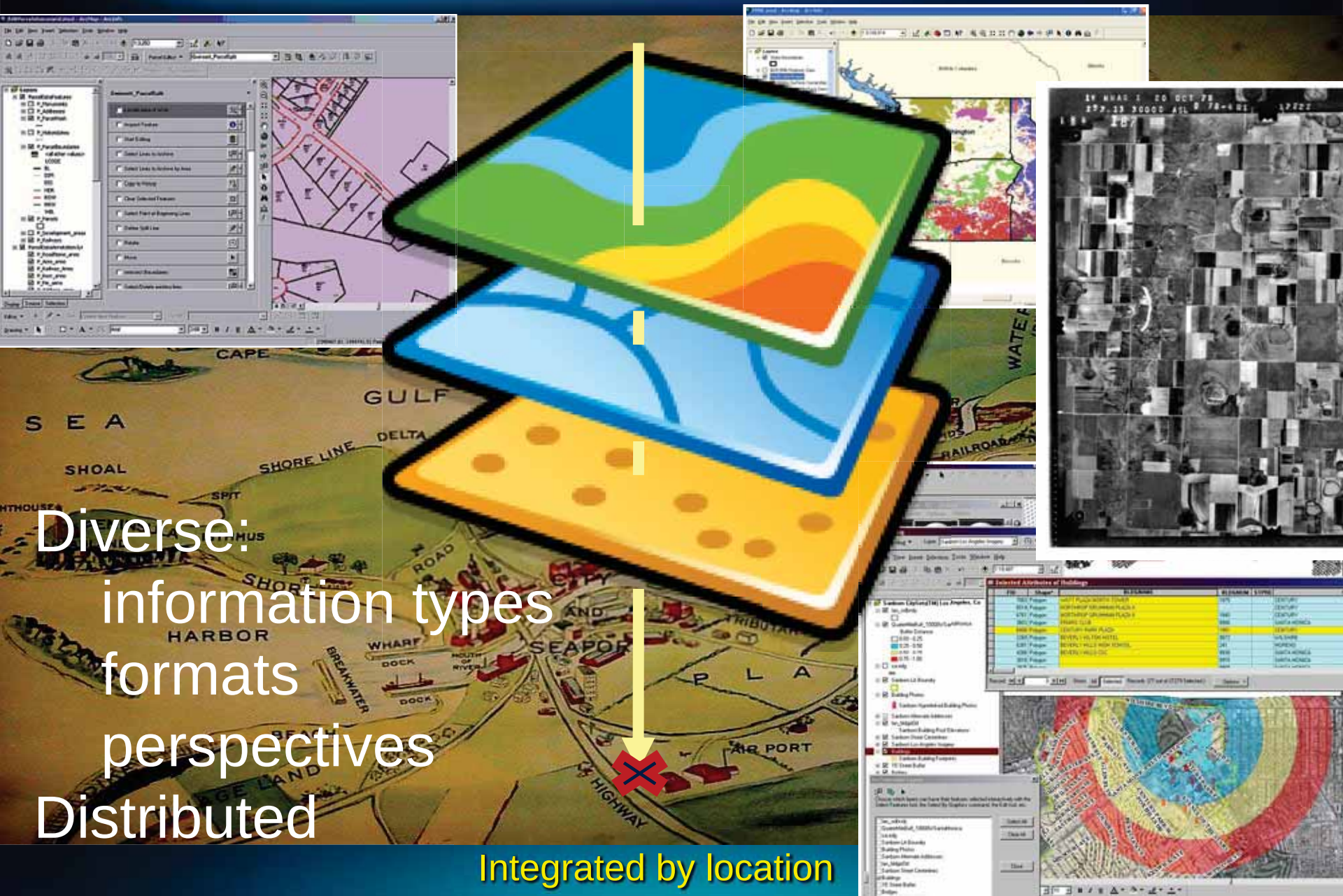
Kevin Sigwart, Esri

Nadine Alameh, OGC

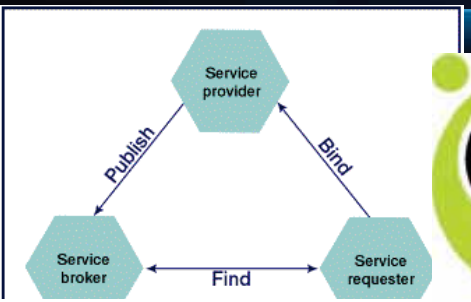
What we are going to talk about

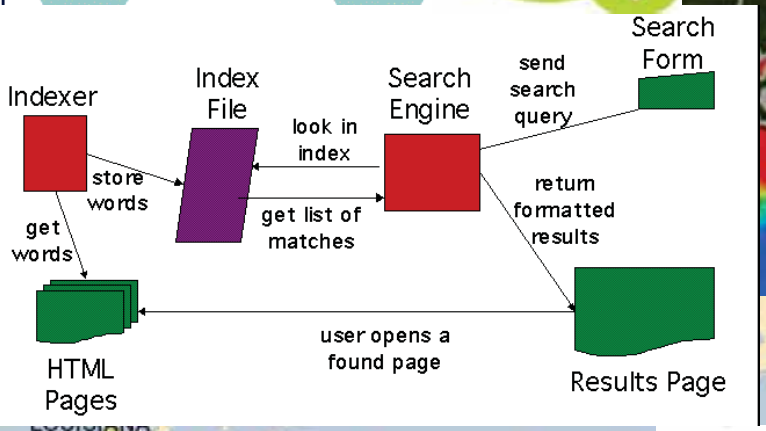
- Interoperability
- Federal GIS Standards
- ArcGIS – Support for ISO and OGC standards
- OGC activities and the Federal government

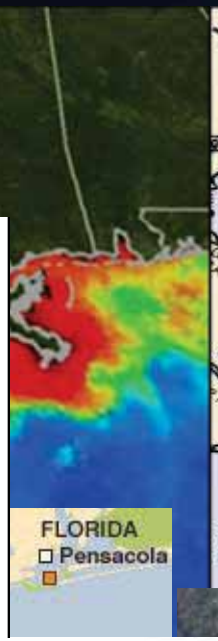
GIS needs to be interoperable because. . .

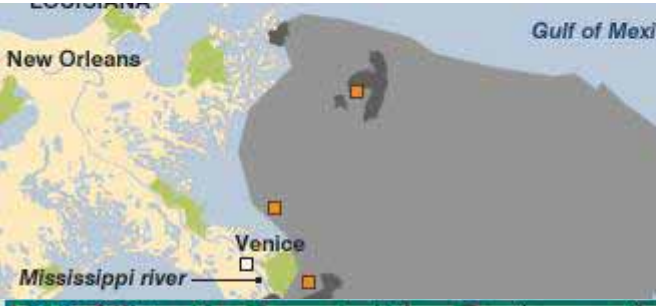


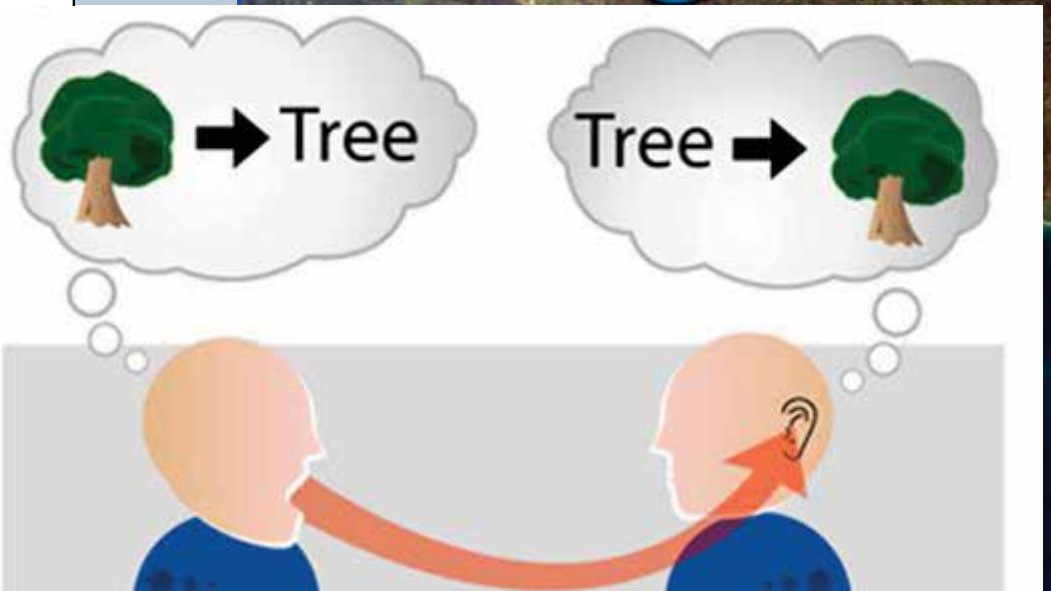
Interoperability is key to what you do

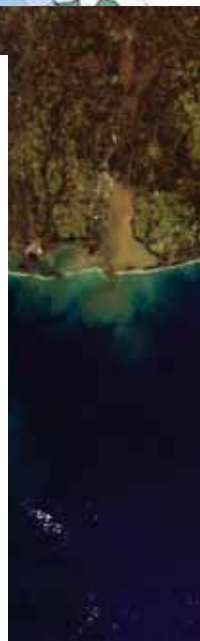












Open – Standards, Specifications, Best Practices, Design Patterns – Enable interoperability

Formats

Service Patterns

Network Protocols

Application Program Interfaces

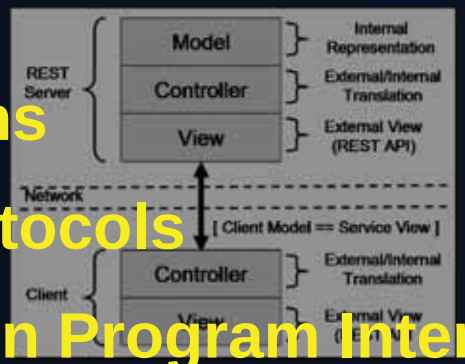
Data structures/content models/schemas

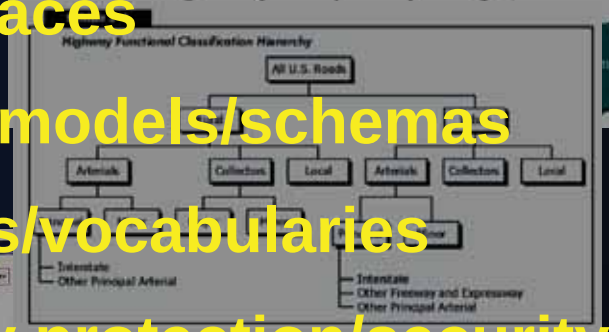
Classification systems/vocabularies

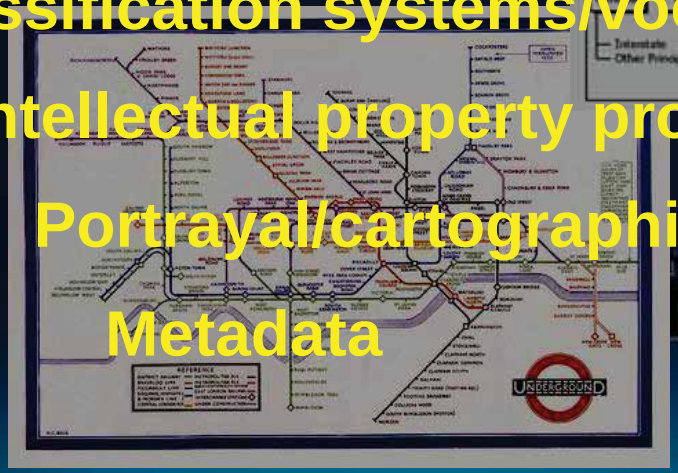
Intellectual property protection/security

Portrayal/cartographic conventions

Metadata



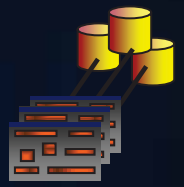




Esri - Understanding the importance of Interoperability

UNIX®

Interoperability

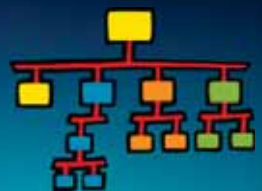


Technical

- Focus on broad-based IT standards,
- Multiple platforms
- Published APIs & formats
- Support multiple formats & projections
- Metadata catalogs
- Testbeds

Semantic

- Community data models
- Metadata standardization and management
- Training
- Publications



ESRI learns about and supports interoperability through active participation:

Organizations

- ISO TC 211
- OGC
- ANSI/INCITS –L1
- CEN
- Global Map
- GSDI
- DGIWG
- IHO
- GWG

Implementations

-Platform

-IT/industry standards

-APIs

-GIS standards

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Standards Development

-International Standards

-Regional Standards

-National Standards

-Information Community Standards

Projects/Testbeds

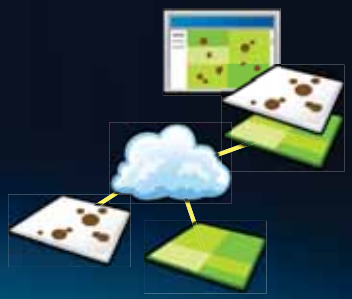
–OGC Web Services testbeds

–GEOSS

–INSPIRE

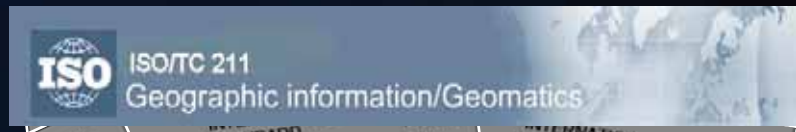
–Geospatial One-Stop

–NATO Core GIS



Standards development – active participation

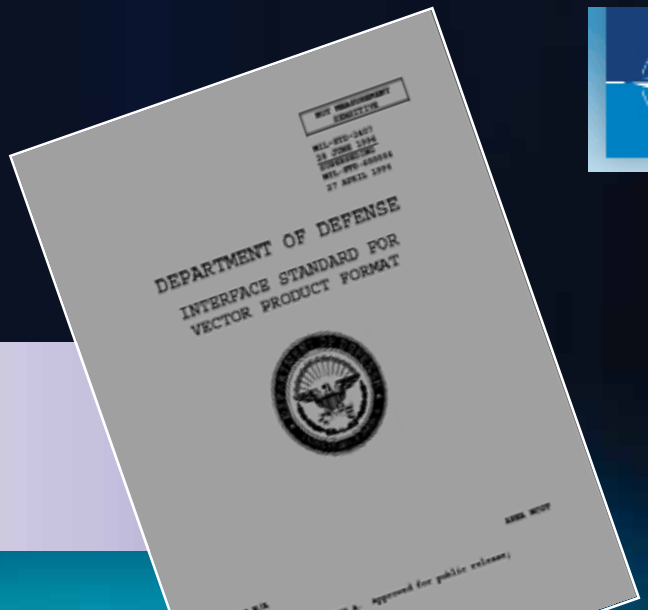
- Principal member
- Actively participates:
  - Technical Committee
  - Planning Committee
  - Board of Directors
  - All three OGC programs
- Current chair or co-chair
  - Metadata Working Group (WG)
  - Web Map Service WG
- Architecture board
- Implement a majority of the 31 standards



- Provide leadership role in ISO TC 211 Standards Development
- Provide technical experts on many standards project teams
- Meeting sponsorship
- Informed by ISO standards in product development and professional services

Past standardization in the US Government

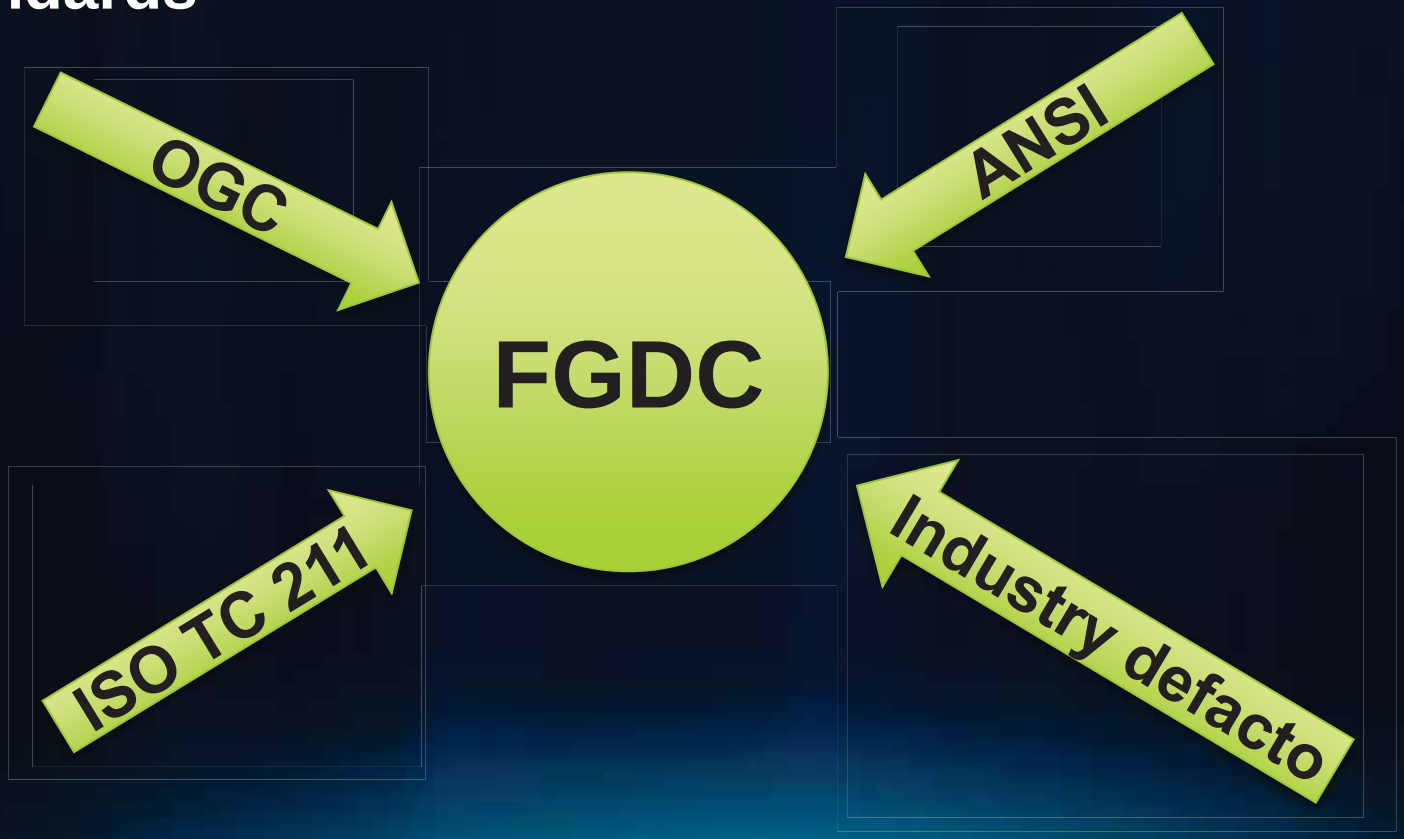
- US Civilian
  - NIST and FGDC
    - FIPS
    - Content Standard for Digital Geospatial Metadata
    - Spatial Data Transfer Standard (SDTS)
    - Geospatial Positioning Accuracy Standards
    - Geographic Information Framework Data Standards
    - . . .
- US Defense
  - DMA/NGA
    - US Mil-Standards
    - US Mil-Performance Specs
    - NATO – STANAGs



FGDC Endorsed External Standards

- October 2010

"FGDC endorses non-Federal authorized standards"



FGDC endorsed External Standards (1)

http://www.fgdc.gov/standards/fgdc-endorsed-external-standards/index_html

- GeoTIFF Revision 1.0
- Hierarchical Data Format V 5.0
- Codes for Identification of Hydrologic Units in the U.S. and the Caribbean (Outlying) Areas . . .
- Codes for the Identification of Counties and Equivalent Areas of the United States . . .
- Codes for the Identification of the States and Equivalent Areas within the United States, Puerto Rico, and the Insular Areas
- Identifying Attributes for Named Physical and Cultural Geographic Features (Except Roads and Highways) of the United States . . .
- North American Profile of ISO 19115:2003 - Geographic information - Metadata (NAP - Metadata)
- Codes for the Identification of Metropolitan and Micropolitan Statistical Areas and Related Statistical Areas of the United States and Puerto Rico
- Codes for the Identification of Congressional Districts and Equivalent Areas of the United States . . .
- ISO 19107 - Spatial schema
- ISO 19108 - Temporal schema w/Corrigendum 1
- ISO 19110 - Methodology for Feature Cataloguing
- ISO 19111 - Spatial referencing by coordinates + extension for parametric values
- ISO 19112 - Spatial referencing by geographic identifiers
- ISO 19115 - Metadata + Corrigendum 1
- ISO 19115 - Metadata - Part 2: Extensions for imagery and gridded data
- ISO 19118 - Encoding
- ISO 19119 – Services + Amd 1
- ISO 19123 - Schema for coverage geometry and functions
- ISO 19132 - Location Based Services - Reference model
- ISO 19133 - Location Based Services - Tracking and navigation
- ISO 19134 - Location Based Services - Multimodal routing and navigation
- ISO 19135 - Procedures for registration of geographical information items
- ISO 19141 - Schema for moving features
- ISO 19109 - Rules for application schema
- ISO 19127 - Geodetic codes and parameters
- ISO 19131 - Data product specifications + Amendment 1
- ISO 19136 - Geographic Markup Language
- ISO 19144 -- Classification Systems -- Part 1: Classification system structure
- ISO 3166 - Codes for the Representation of Names Of Countries and their Subdivisions

FGDC endorsed External Standards (2)

http://www.fgdc.gov/standards/fgdc-endorsed-external-standards/index_html

- ISO 6709Standards representation of geographic point locations by coordinates w/Corrigendum 1
- ISO/IEC 13818 -2: MPEG 2 - video
- ISO/IEC 13818-3: MPEG 2 - audio
- ISO/IEC 15444-1: JPEG 2000
- ISO/IEC IS 10918-1 : JPEG
- ISO 19103 - Conceptual schema language
- ISO 19104 - Terminology
- ISO 19138 -- Data quality measures
- ISO 19139 -- Metadata -- XML schema implementation
- NetCDF (Network Common Data Form)
- Web Feature Service Implementation Specification, version 1.1.0 with Corrigendum 1
- Filter Encoding Implementation Specification, version 1.1
- Web Map Context (WMC) Documents Implementation Specification, Version 1.1.0 w/Corrigendum 1
- Web Processing Service, Version: 1.0.0 w/ Corrigendum
- Symbology Encoding Implementation Specification, version 1.1.0
- Styled Layer Descriptor profile of the Web Map Service Implementation Specification, version 1.1.0
- Sensor Observation Service Interface Standard, version 1.0.0
- Location Services: Tracking Service Interface Standard
- Web Map Service Implementation Specification, Version 1.3.0
- SensorML Encoding Standard v 1.0 w/Schema Corrigendum 1 (1.01)
- Catalogue Service (CAT) Implementation Specification (2.0.2) + Corrigendum for OpenGIS Implementation Specification 07-006: Catalogue Services, Version 2.0.2
- Catalogue Services Specification 2.0.2 - ISO Metadata Application Profile
- Web Map Tile Service Implementation Standard, version 1.0.0
- Web Coverage Service (WCS) Implementation Standard, version 1.1.2 w/Corrigendum 2
- Location Services (OpenLS): Core Services, version 1.2
- OGC KML 2.2 – Abstract Test Suite (1.0.0)
- KML, version 2.2.0
- Location Services (OpenLS): Part 6-Navigation Service
- Location Services: Tracking Service Interface Standard
- Sensor Planning Service Implementation Specification, version 1.0.0
- Tagged Image File Format (TIFF)

GWG Mandated Standards

Geospatial-Intelligence Standards Working Group

- "…coordinate population of the DoD IT Standards Registry (DISR) with GEOINT standards…"

DISR approved GEOINT Standards – mandated (1)

- CSM - Community Sensor Model
- DFDD - DGIWG Feature Data Dictionary
- DGIWG FACC - Feature and Attribute Coding Catalogue
- FIPS Pub 10-4 - Country codes
- FM 92-X Ext. GRIB WMO
- FM 94-X Ext. BUFR WMO
- GeoTIFF Revision 1.0
- GML 3.1.1
- IEC 80000-6- Quantities and units - Part 6: Electromagnetism
- ISO 19107: Spatial schema
- ISO 19108: Temporal schema
- ISO 19109 - Rules for application schema
- ISO 19110: Methodology for feature cataloguing
- ISO 19111: Spatial referencing by coordinates
- ISO 19112: Spatial referencing by geographic identifiers
- ISO 19115: Metadata
- ISO 19119: Services, Extensions of the service metadata model
- ISO 19123: Schema for coverage geometry and functions
- ISO 19126: Feature concept dictionaries and registers
- ISO 19135: Procedures for item registration
- ISO 19136: Geography Markup Language
- ISO 3166-1: Codes for the representation of names of countries and their subdivisions
- ISO 6709: Standard representation of geographic point location by coordinates
- ISO 80000-1: Quantities and units - Part 1: General
- ISO 80000-3: Quantities and units - Part 3: Space and time
- ISO 80000-4: Quantities and units - Part 4: Mechanics
- ISO 80000-7: Quantities and units - Part 7: Light
- ISO/IEC 12087-5: Image Processing and Interchange (IPI) Functional specification
- ISO/IEC 13818-1: Genericinformation
- ISO/IEC 13818-2: MPEG-2 Video
- ISO/IEC 13818-3: coding of moving pictures and associated audio MPEG-2 Audio
- ISO/IEC 15444-1 - JPEG 2000 image coding
- ISO/IEC 15444-9: JPEG 2000 image coding system: Interactivity tools,
- ISO/IEC 8632-1: Computer graphics - Metafile for the storage and transfer of picture description information
- ISO/IEC 8632-3:1999 CGM- Binary encoding
- ISO/TS 19138: Data quality measures
- ISO/TS 19139: Metadata - XML schema implementation
- ITU-R TF460-6 Standard-frequency and time-signal emissions
- ITU-T Rec. H.264 Advanced video coding for generic audiovisual service
- ITU-T Recommendation T.81 (Digital compression and coding of continuous-tone still images
- Joint METOC Broker Language (JMBL)
- MIL-STD-188-198A(4) JPEG Image Compression for the NITF
- MIL-STD-188-199(1) Vector Quantization Decompression for the NITF
- MIL-STD-2401 World Geodetic System 84 (WGS84)

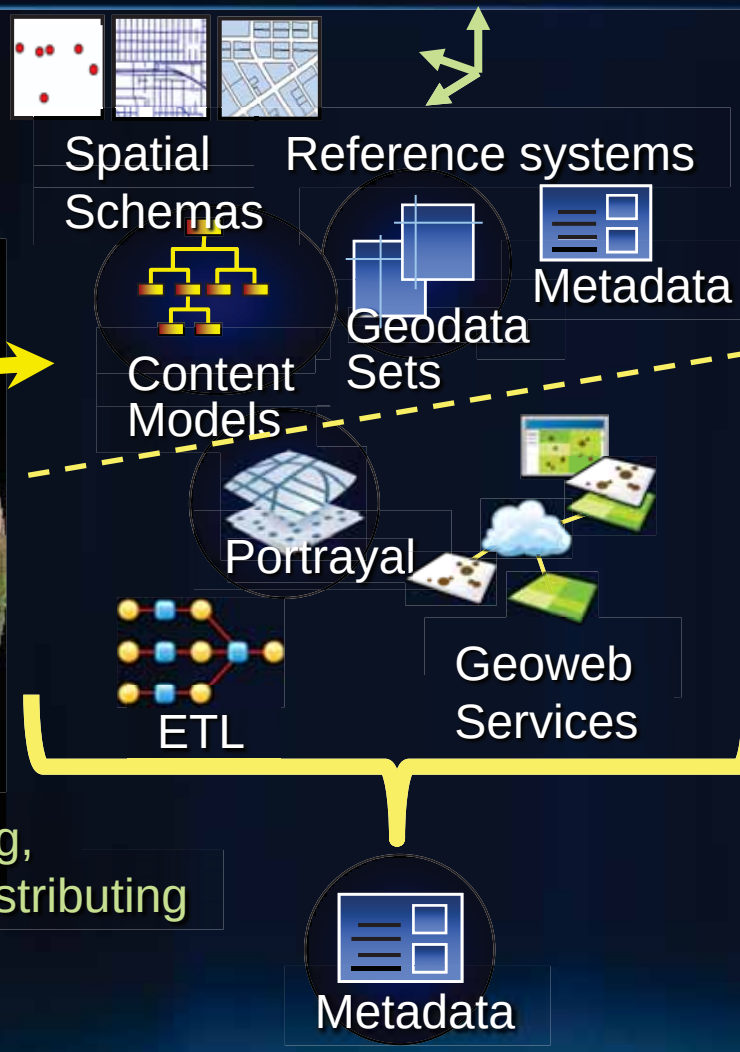
https://nsgreg.nga.mil/DISR-approved.jsp

DISR approved GEOINT Standards – mandated (2)

- MIL-STD-2407- Vector Product Format (VPF)
- MIL-STD-2411- Raster Product Format
- MIL-STD-2411-1 Registered Data Values For Raster Product Format
- MIL-STD-2411-2(1) Raster Product Format Files into the NITF
- MIL-STD-2500C National Imagery Transmission Format (NITF)
- MISB Standard 0102.8 - Security Metadata Universal and Local Sets for Digital Motion Imagery
- MISB Standard 0301.5 - Profile for Aerial Surveillance and Photogrammetry Applications
- MISB Standard 0601.4 UAS Datalink Local Metadata Set
- MISB Standard 0604.1 , Time Stamping Compressed Motion Imagery
- MISB Standard 0807.5 KLV Metadata Dictionary
- MISB Standard 0902.1 Motion Imagery Sensor Minimum Metadata Set
- MISP v5.5 Motion Imagery Standards
- NEC 2.0 National System for Geospatial-Intelligence (NSG) Entity Catalog
- NFDD 2.0 National System for Geospatial-Intelligence (NSG) Feature Data Dictionary
- NSG TDS Content Spec v3.0 Topographic Data Store
- OCL - Object Constraint Language
- OGC KML 2.2.0
- OGC SensorML v1.0.0 Sensor Model Language
- OGC SLD 1.1.0 Styled Layer Descriptor
- OGC WCS 1.1.2 Web Coverage Service
- OpenGIS Filter 1.1 Filter Encoding
- OpenGIS SOS 1.0 Sensor Observation Service
- Rec. BT.601-6 - Studio encoding parameters of digital television for standard
- SE 1.1.0 Symbology Encoding
- SMPTE 336M- Data Encoding Protocol Using Key-Length-Value
- SMPTE 377M-1- Material Exchange Format (MXF) - File Format Specification
- SPS 1.0 Sensor Planning Service
- STANAG 3809 - Digital Terrain Elevation Data (DTED) Exchange Format
- STANAG 4559 - NATO Standard ISR Library Interface (NSILI)
- STANAG 4607 - NATO Ground Moving Target Indicator Format (GMTIF)
- STANAG 7098 - Compressed ARC Digitized Raster Graphics (CADRG)
- STANAG 7099 Edition 2 Controlled Image Base (CIB)
- STANAG 7194 - NATO Imagery Interpretability Rating Scale
- STDI-0001 - Support Data Extensions (SDE) NITF
- STDI-0002 The Compendium of Controlled Extensions (CE) for NITF
- STDI-0006 National Imagery Transmission Format (NITF)
- TIFF Revision 6.0
- UML - Unified Modeling Language
- USIP 1 IP Unmanned Systems Interoperability Profile
- WFS 1.1 Web Feature Service
- WMC 1.1 Web Map Context
- WMS 1.3 Web Map Service
- WMTS v1.0.0 Web Map Tile Service
- WPS 1.0 Web Processing Service

https://nsgreg.nga.mil/DISR-approved.jsp

Abstracting Geographic Knowledge

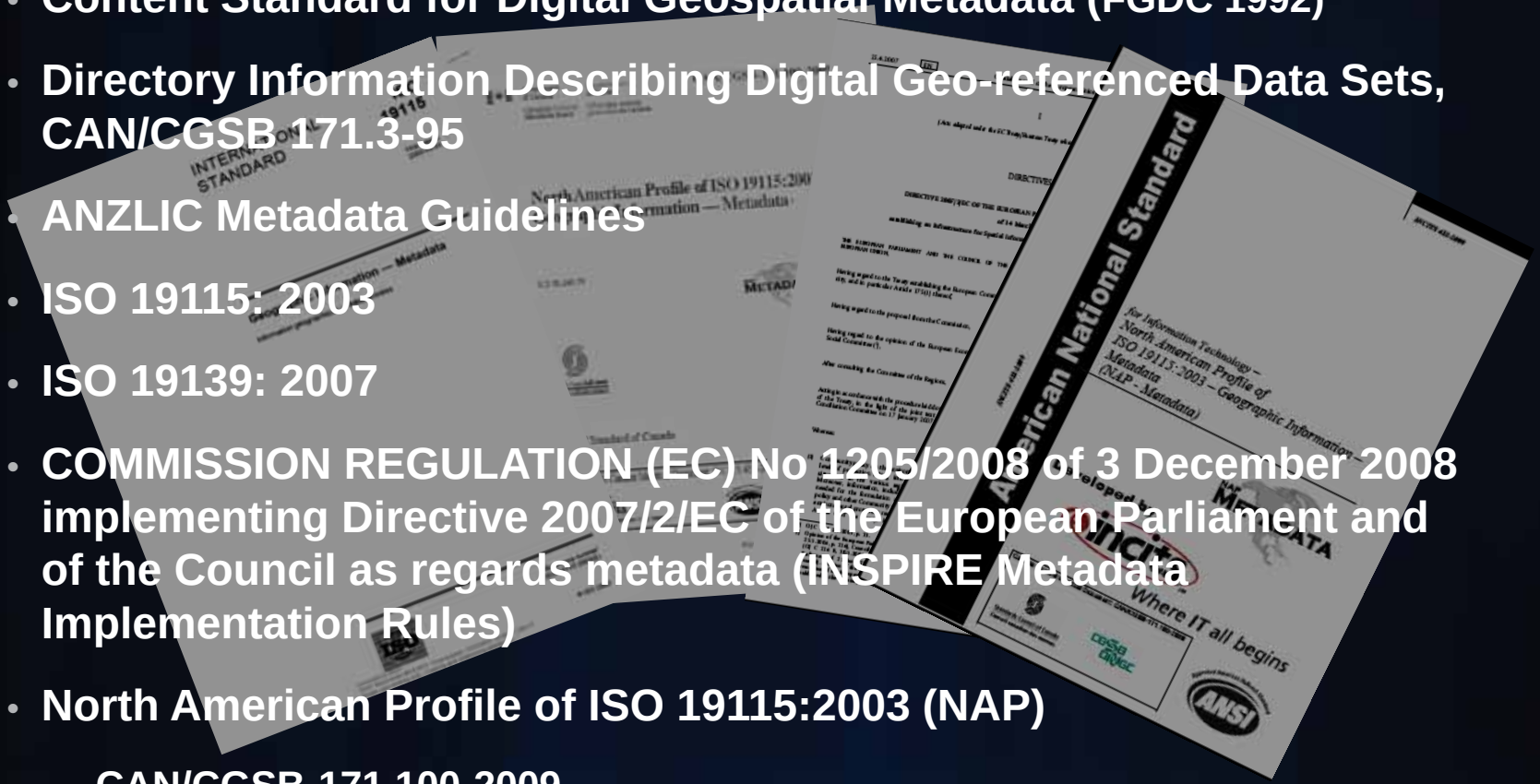


1. GeoVisualization
2. Decision Support
3. Serve to others

Encapsulating, managing, distributing real world knowledge

Geospatial Metadata standards:

- **Content Standard for Digital Geospatial Metadata (FGDC 1992)**
- **Directory Information Describing Digital Geo-referenced Data Sets, CAN/CGSB 171.3-95**
- **ANZLIC Metadata Guidelines**
- **ISO 19115: 2003**
- **ISO 19139: 2007**
- **COMMISSION REGULATION (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata (INSPIRE Metadata Implementation Rules)**
- **North American Profile of ISO 19115:2003 (NAP)**
  - **CAN/CGSB-171.100-2009**
  - **INCITS 453-2009**

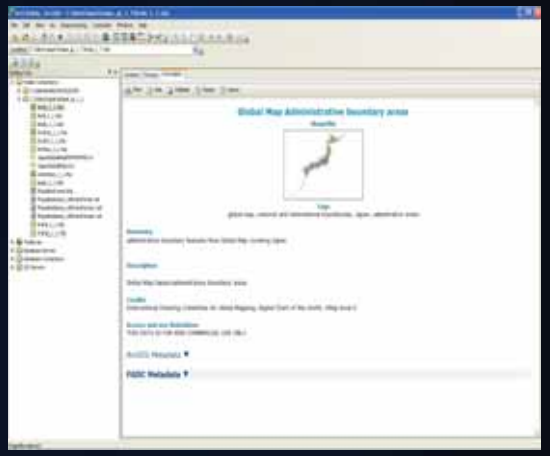


Why is metadata so important

- An element of abstraction
- It describes the abstraction
- Abstractions/Geospatial data are imperfect
  - A model, a “point of view”
  - Assumptions, limitations, approximations, simplifications
- Expanded use of Geographic Information
  - Proliferation of data
  - The producer is not the user
- Geospatial resources are valuable
  - Reuse
  - Management

Metadata at ESRI

- Early advocate for metadata
  - Data documentation/properties
  - ArcCatalog
    - Full support for FGDC – early-on
    - Early support for ISO19115:2003
  - Continuing support for the development of ISO metadata standards
  - ArcIMS Metadata Server
  - ArcGIS Server Geoportal Extension



Metadata support ArcGIS 10

- New Metadata Editor – Fully supports
  - ISO 19115/19139 and its Level 1 profiles: NAP, INSPIRE . .
- Auto update of metadata per the data's intrinsic properties
- Easy migration from FGDC & ESRI-ISO to ArcGIS metadata
- Basic metadata indexed for faster searching
- XML schema validation tools
- Extensible to support emerging profiles

ArcCatalog 10

Metadata related meetings:

Metadata Discussion Group :

Thursday, January 20th

1:30 p.m. to 2:30 p.m.

Room 306

Introducing Esri's Open Source Geoportal Server

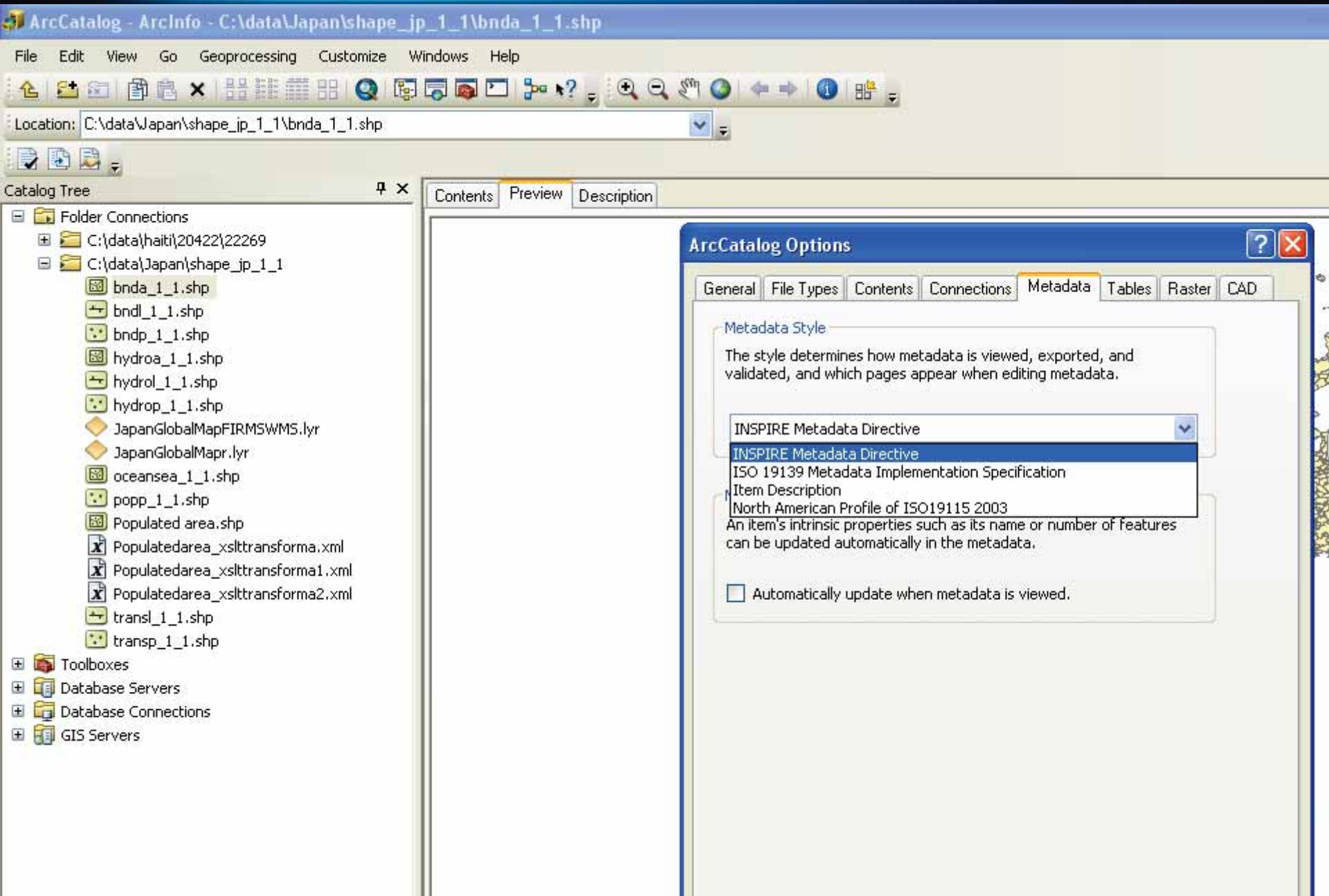
Friday 21 Jan

Room 202 B 8:30 AM

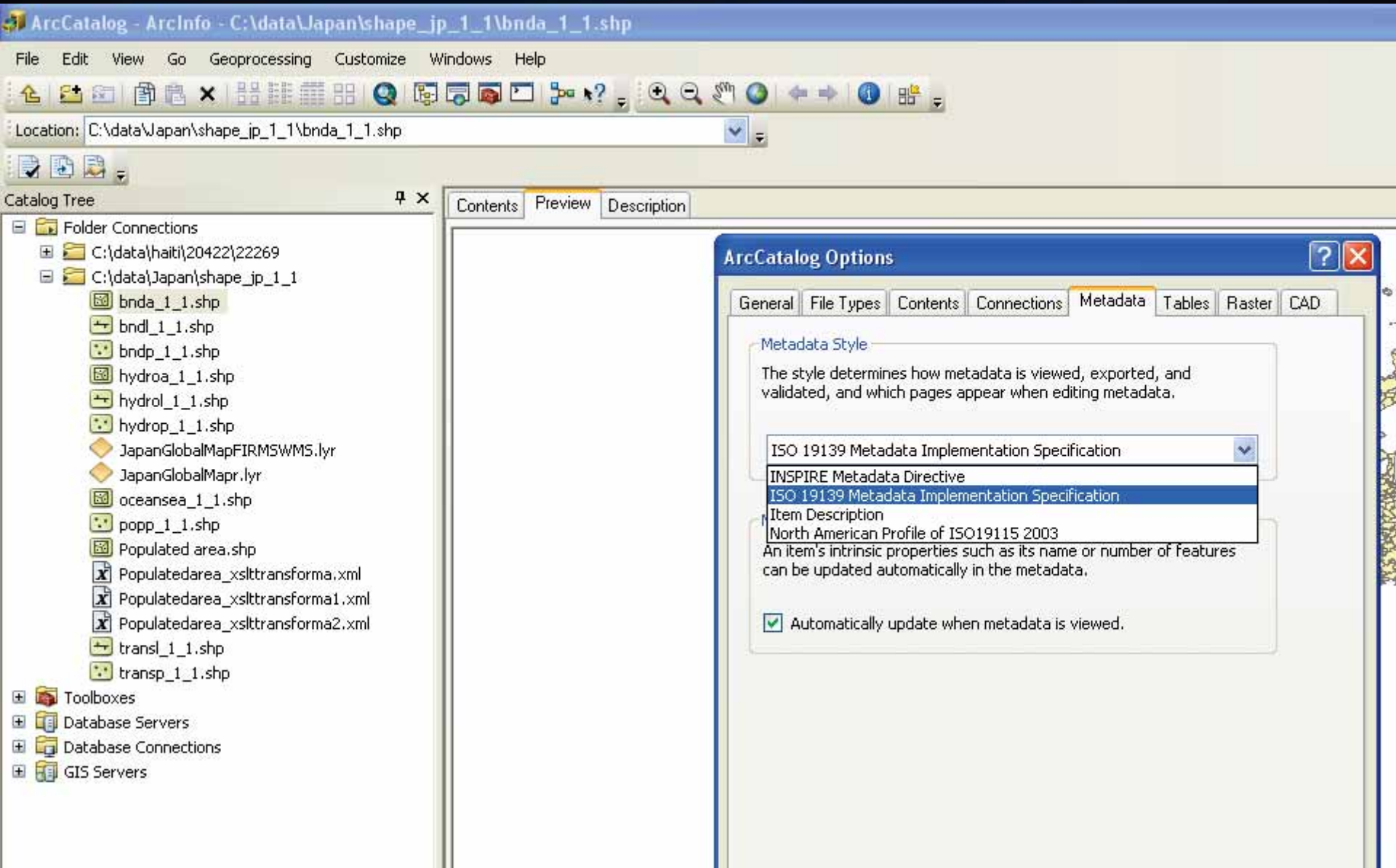
Spatial Data Infrastructure (SDI)/Geoportal Extension User Group

Friday, January 21, 2011; 2:30-3:30 PM
Room 303

Customize ArcCatalog to use your preferred Metadata Standard/Profile

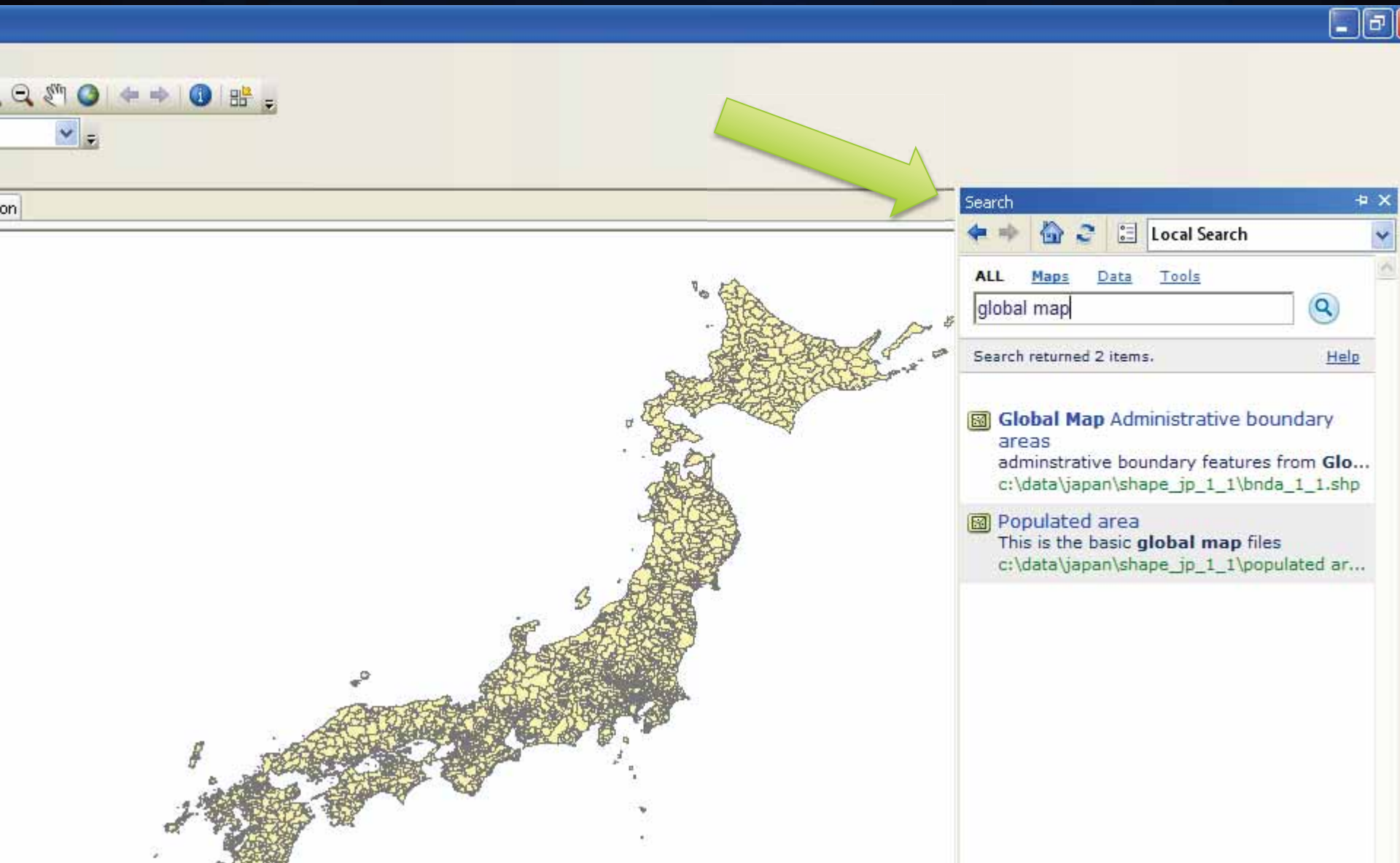


Set ArcCatalog to automatically update metadata

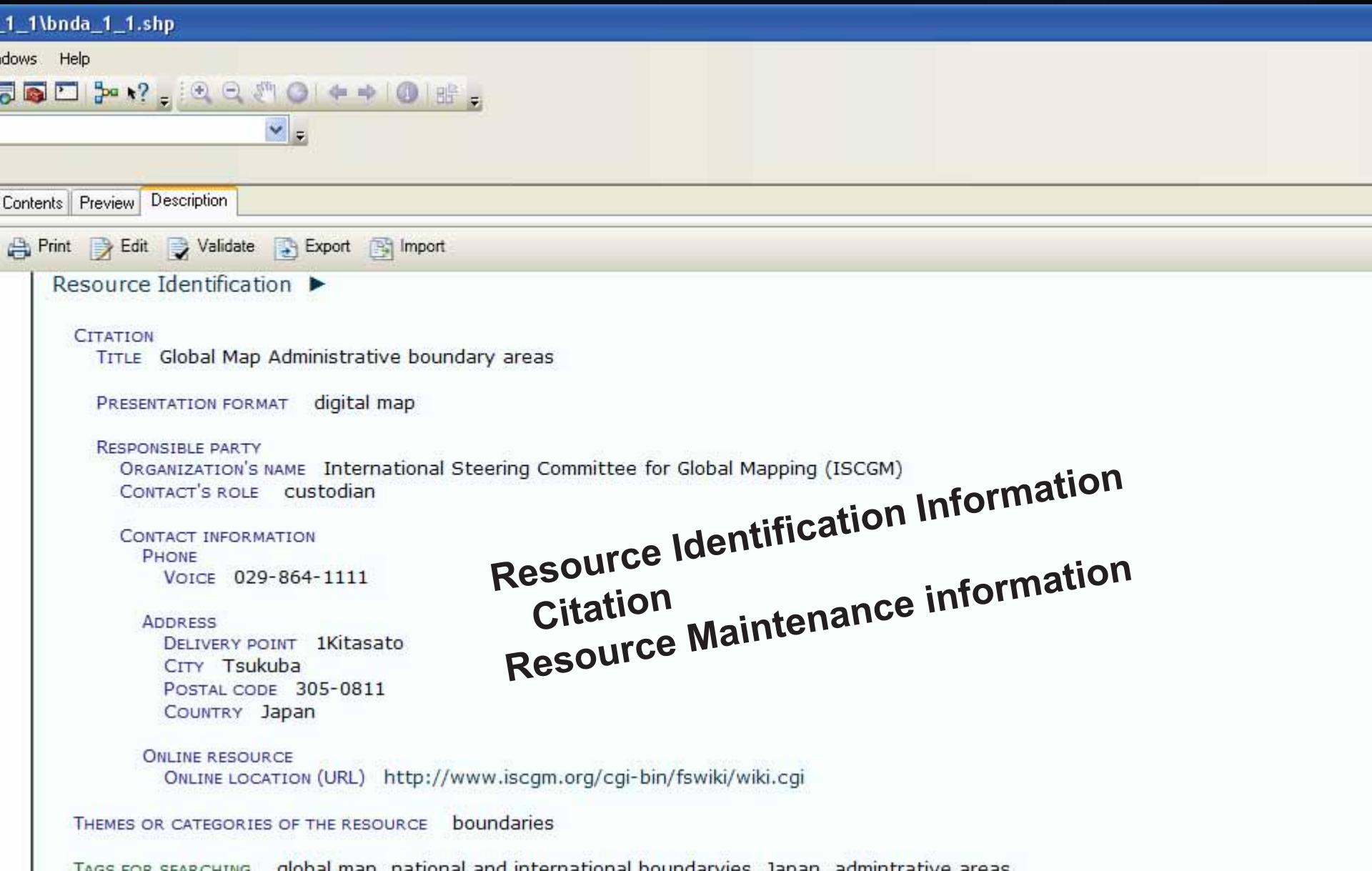


Default setting is Item Description profile of metadata

Search for Datasets, tools, maps, layers, services, etc



“ISO 19139 Implementation Specification” supports full ISO 19115/19139/+ . . .



“ISO 19139 Implementation Specification” supports full ISO 19115/19139/+ .

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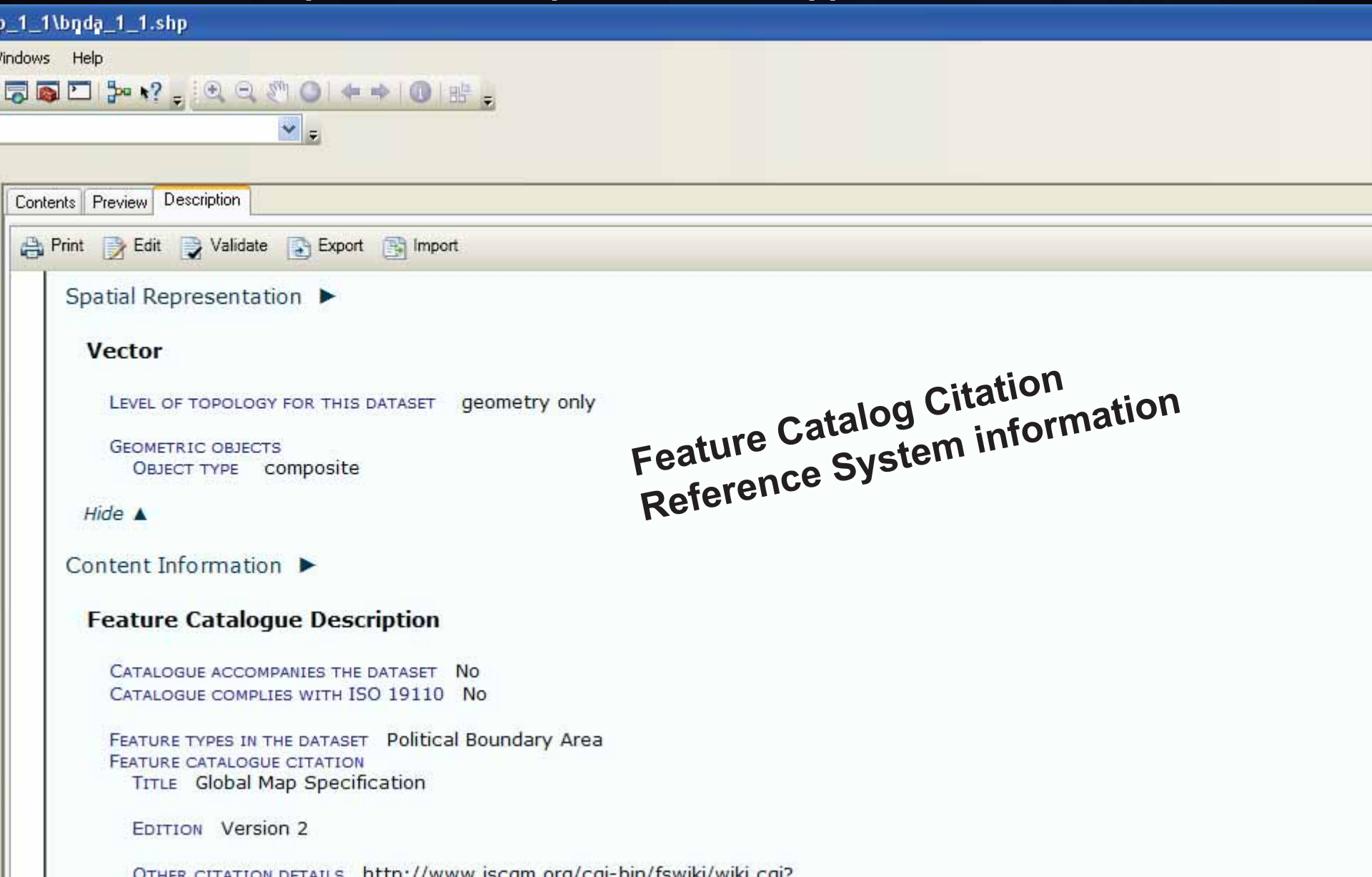
SPATIAL REPRESENTATION TYPE vector

* PROCESSING ENVIRONMENT Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 3; ESRI ArcGIS 10.0.0.2414

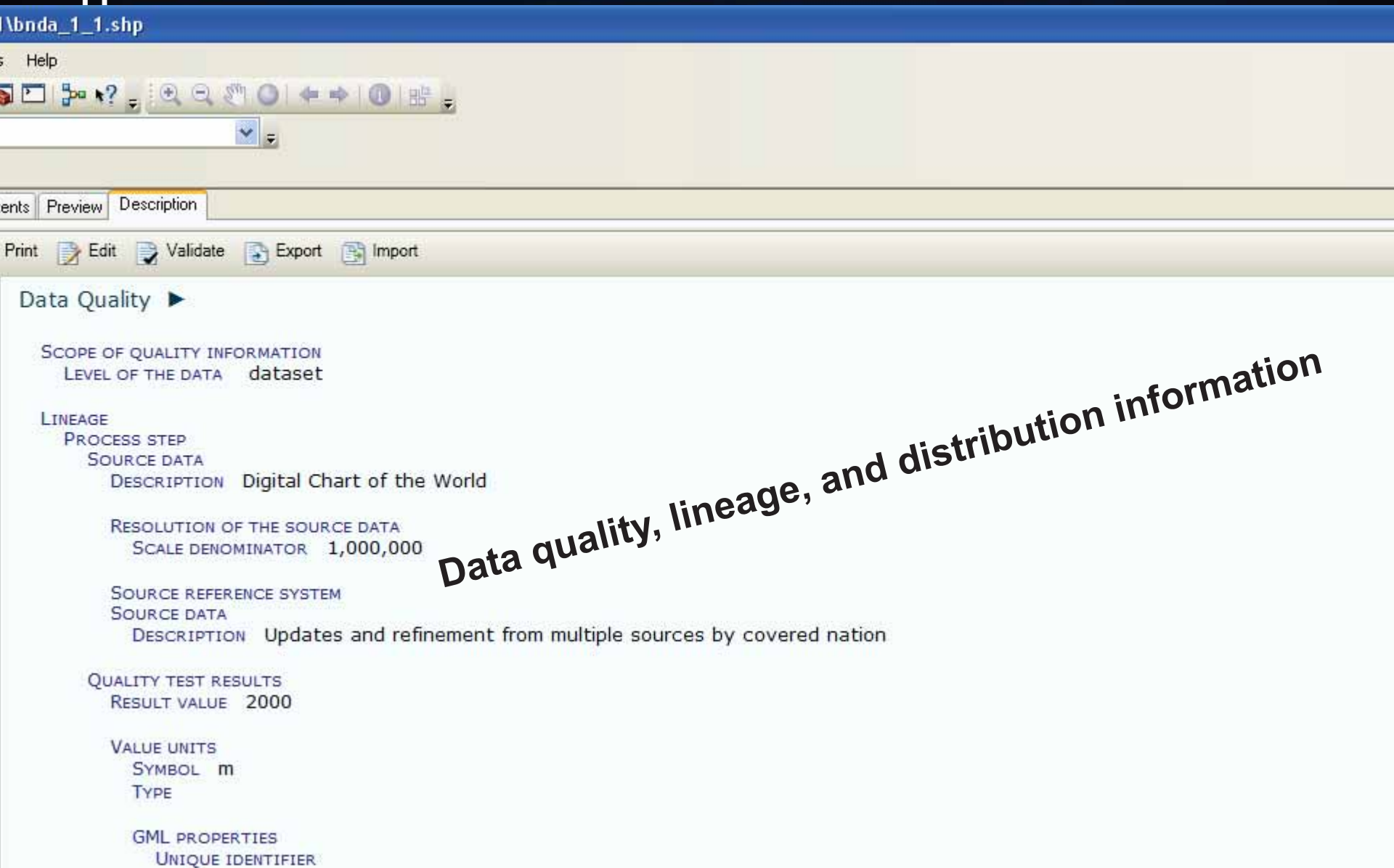
OTHER EXTENT INFORMATION
GEOGRAPHIC EXTENT
BOUNDING RECTANGLE
* EXTENT TYPE Extent used for searching
* WEST LONGITUDE 122.930801

Resource Constraints
Spatial Representation
Information
Geographic, descriptive, and vertical extent

“ISO 19139 Implementation Specification” supports full ISO 19115/19139/+ .



“ISO 19139 Implementation Specification” supports full ISO 19115/19139/+ . . .



Data quality, lineage, and distribution information

“ISO 19139 Implementation Specification” supports full ISO 19115/19139/+ .

jp_1_1\bnda_1_1.shp

Windows Help

Contents | Preview | Description

Print | Edit | Validate | Export | Import

Distribution Information ▶

DISTRIBUTOR
CONTACT INFORMATION
ORGANIZATION'S NAME The International Steering Committee for Global Mapping (ISCGM)
CONTACT'S ROLE publisher

ORDERING PROCESS
INSTRUCTIONS
Apply for user id and password before downloading

DISTRIBUTION FORMAT
* FORMAT NAME Shapefile

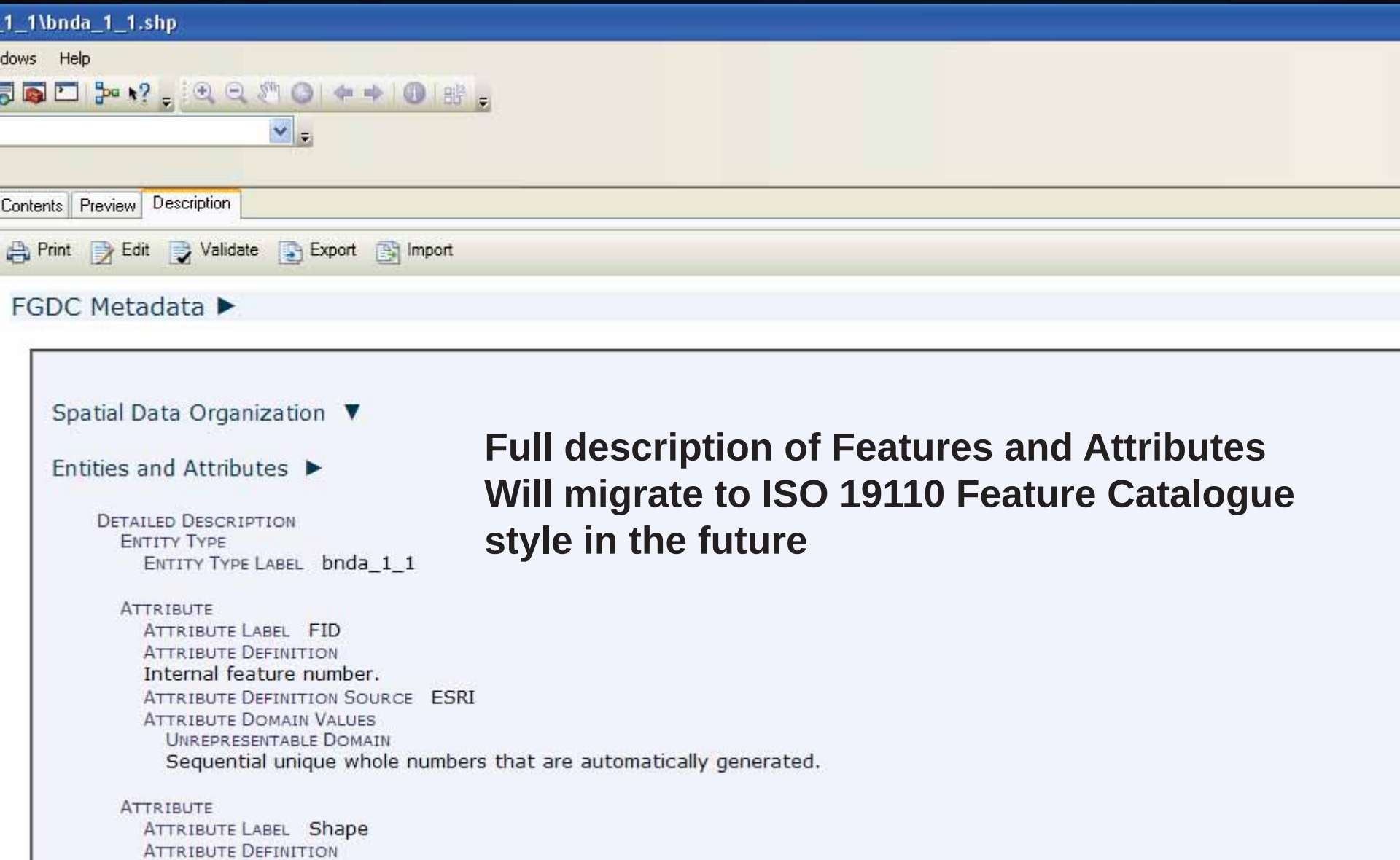
DISTRIBUTION FORMAT
FORMAT VERSION vpf

TRANSFER OPTIONS
* TRANSFER SIZE 8.450

ONLINE SOURCE
ONLINE LOCATION (URL) http://www.iscgm.org/login.html
FUNCTION PERFORMED download

Hide ▲

FGDC Entity and Attribute section remains



Full description of Features and Attributes Will migrate to ISO 19110 Feature Catalogue style in the future

pan\shape_jp_1_1\bnda_1_1.shp

Customize Windows Help

a_1_1.shp

Contents | Preview | Description

Save | Cancel

Overview
- Item Description
- Topics & Keywords
- Citation
- Citation Contacts
- Locales

Metadata
- Details
- Contacts
- Maintenance
- Constraints

Resource
- Details
- Service Details
- Extents
- Points of Contact
- Maintenance
- Constraints
- Spatial Reference
- Spatial Data Representation
- Content
- Quality

Resource Citation

Titles

Title: Global Map Administrative boundary areas

Alternate Title:

Collective Title:

Presentation Form: Digital Map

Identifiers

Dates

Created Date: 7/9/2010

Publication Date: 7/9/2010

Revised Date: 7/9/2010

Edition

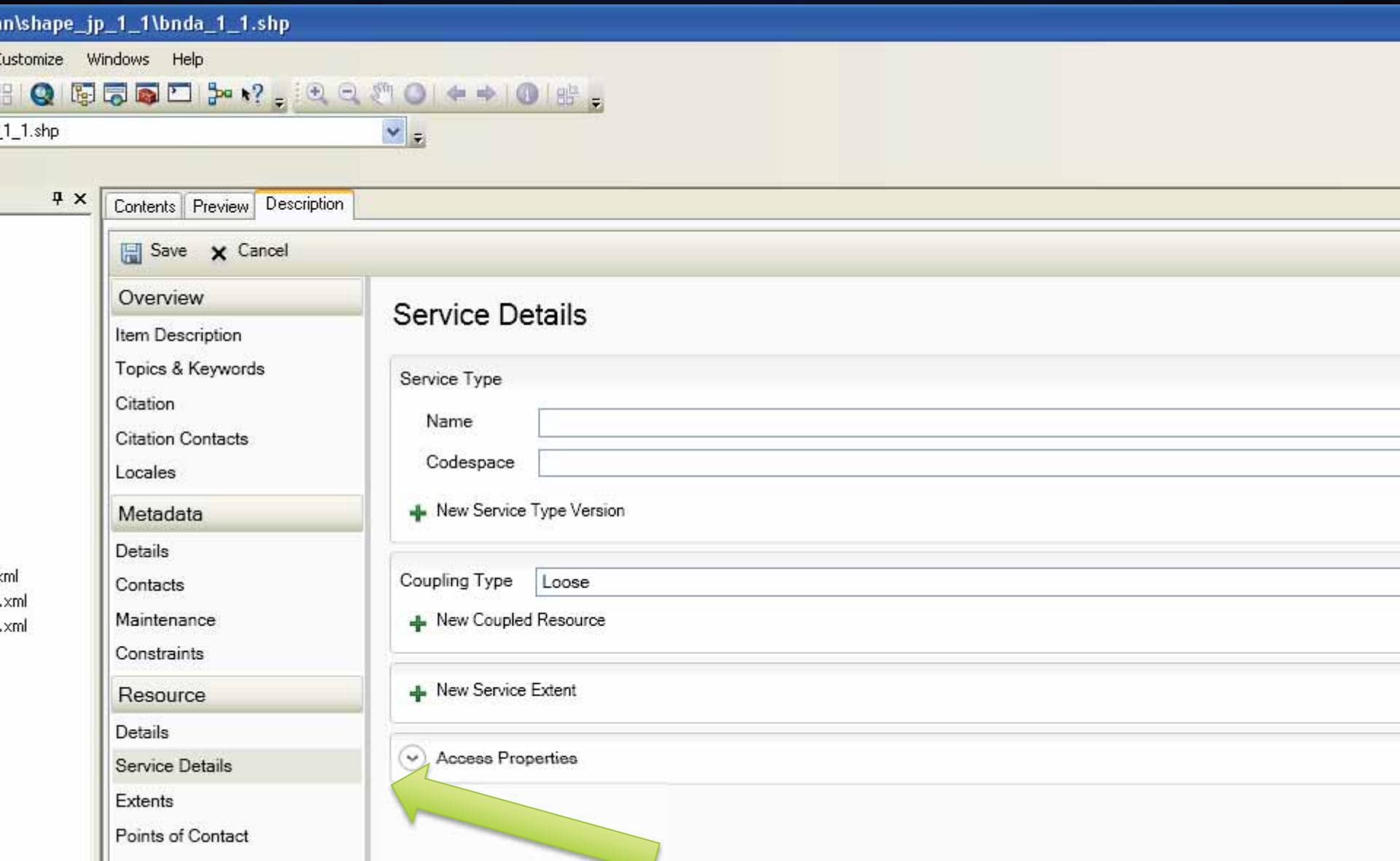
Series

Responsible Party: International Steering Committee for Global Mapping (ISCGM)

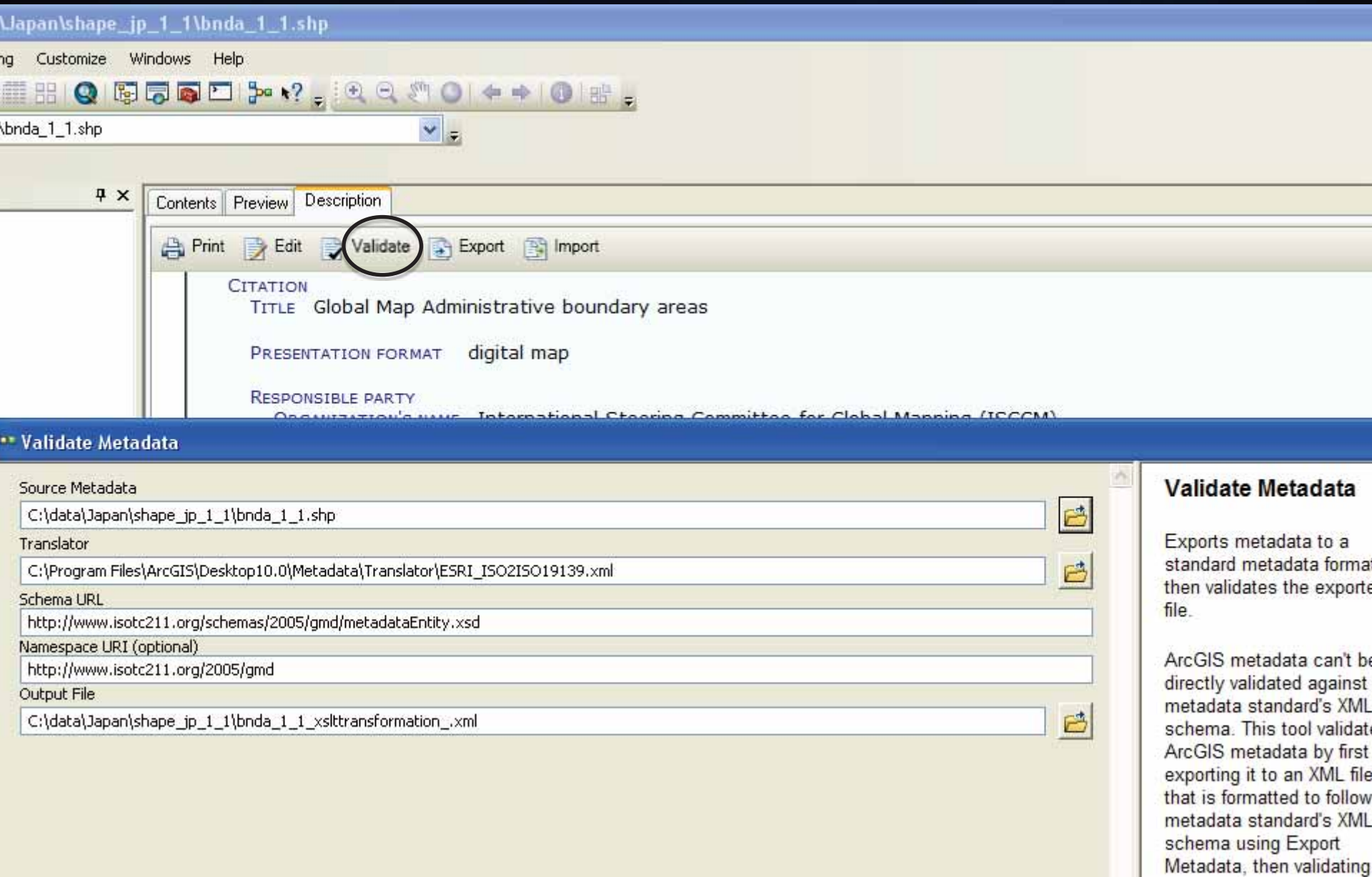
Name:

Full menu for editing

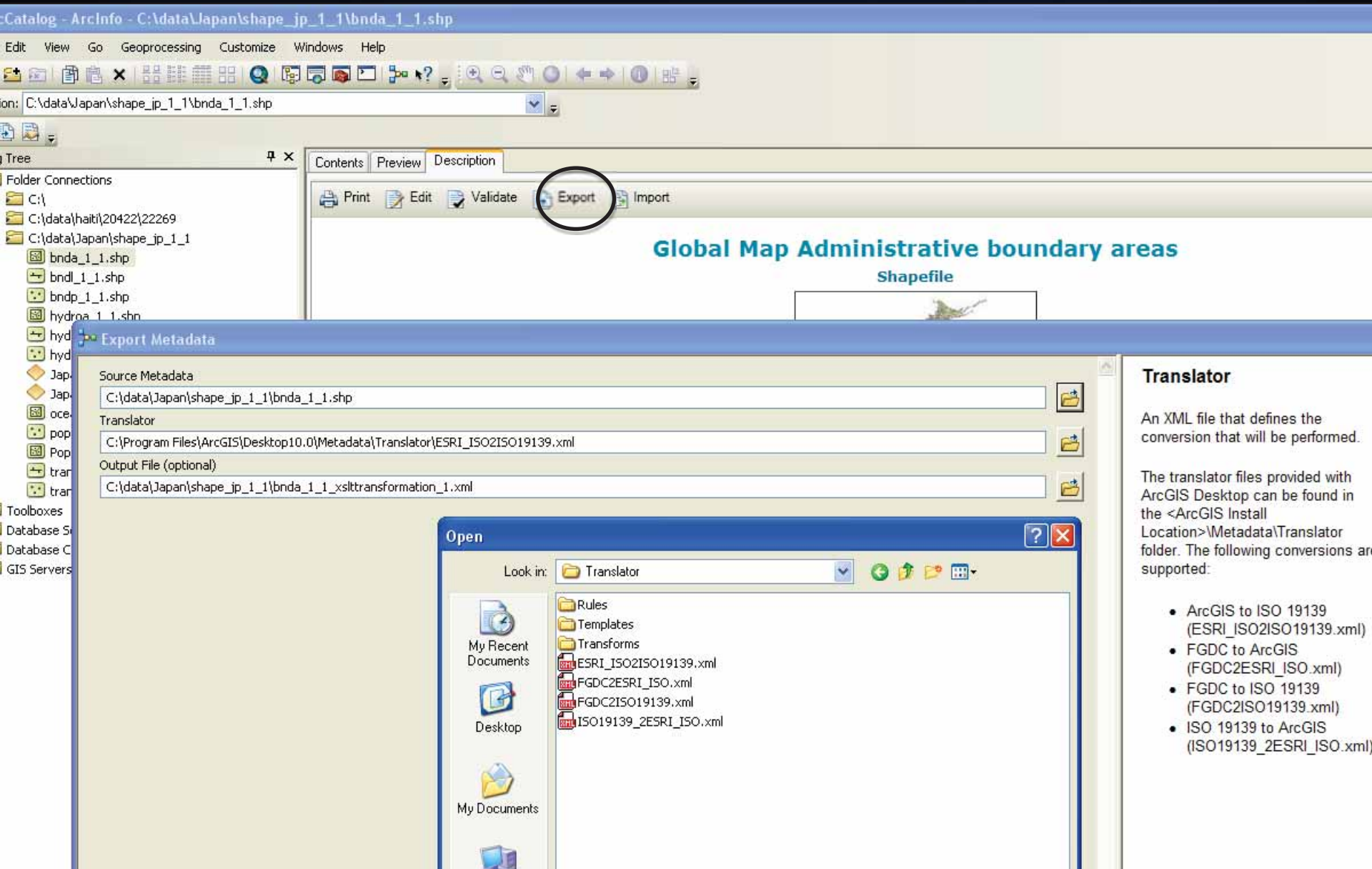
Includes ISO 19119 Service metadata required by NAP



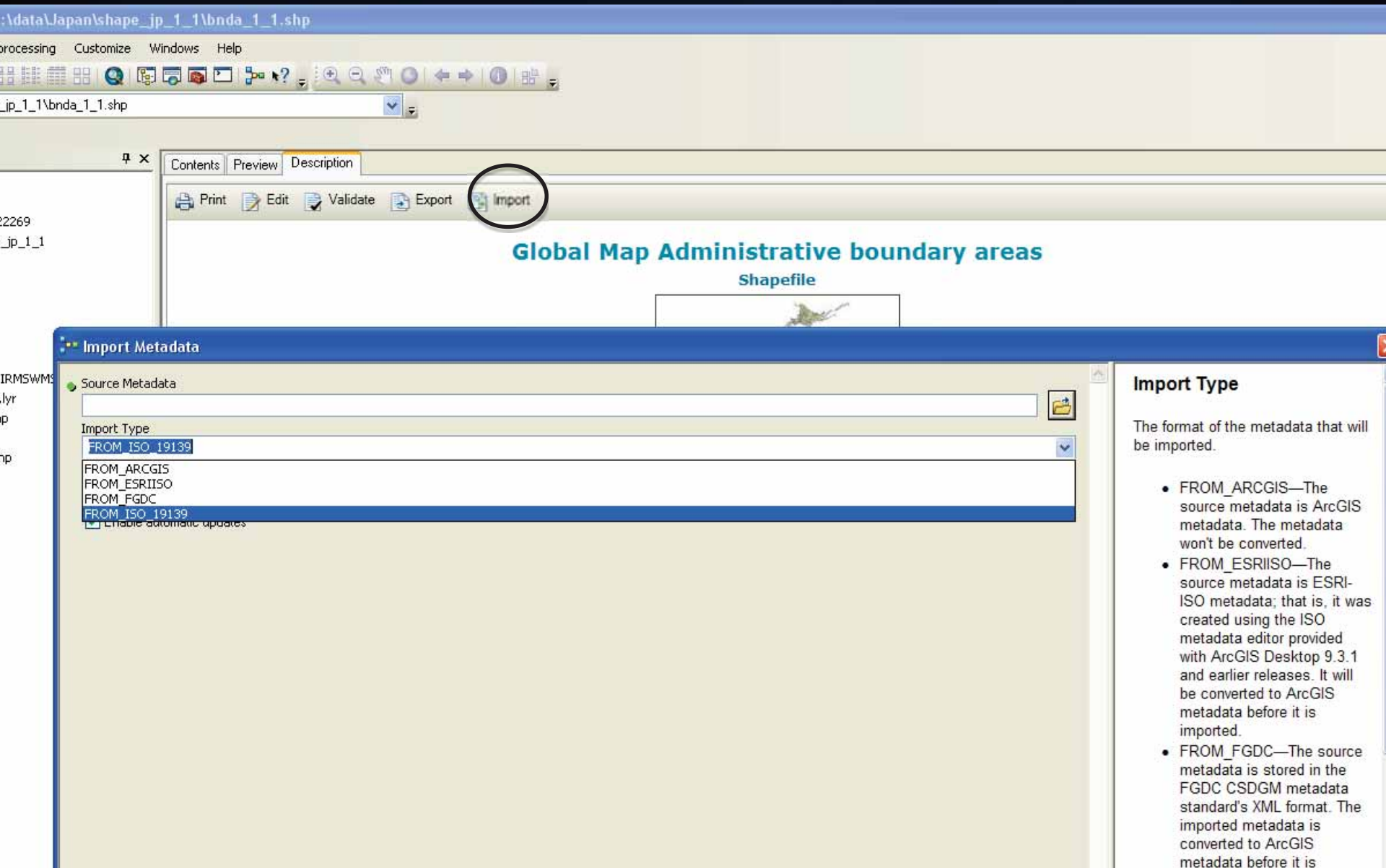
Supports validation against standard or profile XML Schema



Select translator for Export



Select style of input metadata



Intrinsic metadata automatically collected

ArcCatalog - ArcInfo - C:\data\Japan\shape_jp_1_1\bndl_1_1.shp

File Edit View Go Geoprocessing Customize Windows Help

Location: C:\data\Japan\shape_jp_1_1\bndl_1_1.shp

Catalog Tree

- Folder Connections
  - C:\
  - C:\data\haiti\20422\22269
  - C:\data\Japan\shape_jp_1_1
    - bnda_1_1.shp
    - bndl_1_1.shp
    - bndp_1_1.shp
    - hydroa_1_1.shp
    - hydrol_1_1.shp
    - hydrop_1_1.shp
    - JapanGlobalMapFIRMSWMS.lyr
    - JapanGlobalMapr.lyr
    - oceansea_1_1.shp
    - popp_1_1.shp
    - Populated area.shp
    - transl_1_1.shp
    - transp_1_1.shp
- Toolboxes
- Database Servers
- Database Connections
- GIS Servers

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Print Edit Validate Export Import

CITATION
TITLE bndl_1_1

PRESENTATION FORMAT digital map

DATASET LANGUAGES English (UNITED STATES)

SPATIAL REPRESENTATION TYPE vector

* PROCESSING ENVIRONMENT Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 3; ESRI ArcGIS 10.0.0.2414

OTHER EXTENT INFORMATION
GEOGRAPHIC EXTENT
BOUNDING RECTANGLE
* EXTENT TYPE Extent used for searching
* WEST LONGITUDE 122.930801
* EAST LONGITUDE 153.983093
* NORTH LATITUDE 45.557331
* SOUTH LATITUDE 20.423935
* EXTENT CONTAINS THE RESOURCE Yes

VERTICAL EXTENT
* MINIMUM VALUE 0.000000
* MAXIMUM VALUE 0.000000

Hide ▲

Spatial Representation ▶

Vector

LEVEL OF TOPOLOGY FOR THIS DATASET geometry only

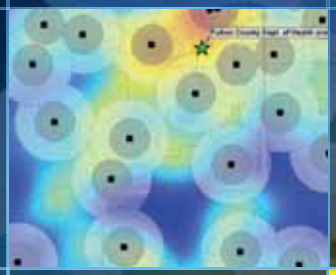
GEOMETRIC OBJECTS
OBJECT TYPE composite

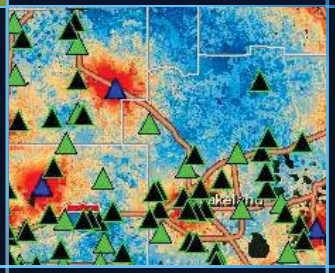
Hide ▲

Reference System ▶

Leveraging OGC standards with ArcGIS

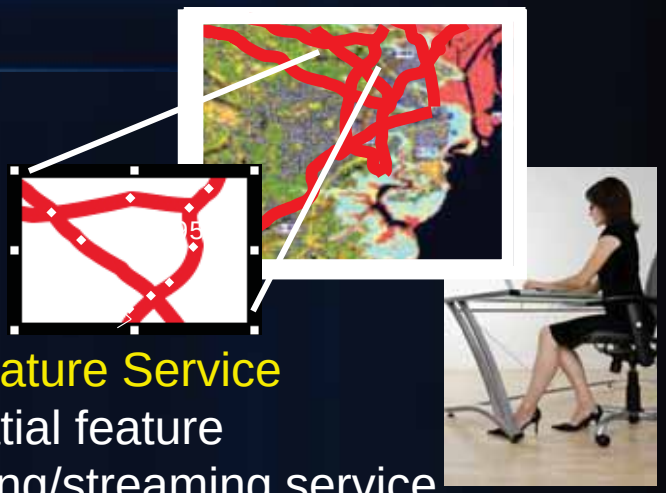
Kevin Sigwart





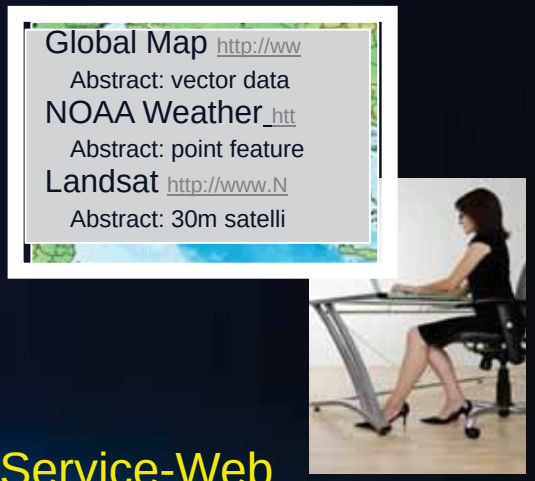
OGC Web Services

Web Map Service
Geospatial “picture” publishing/viewing service
(PNG, GIF, JPEG)



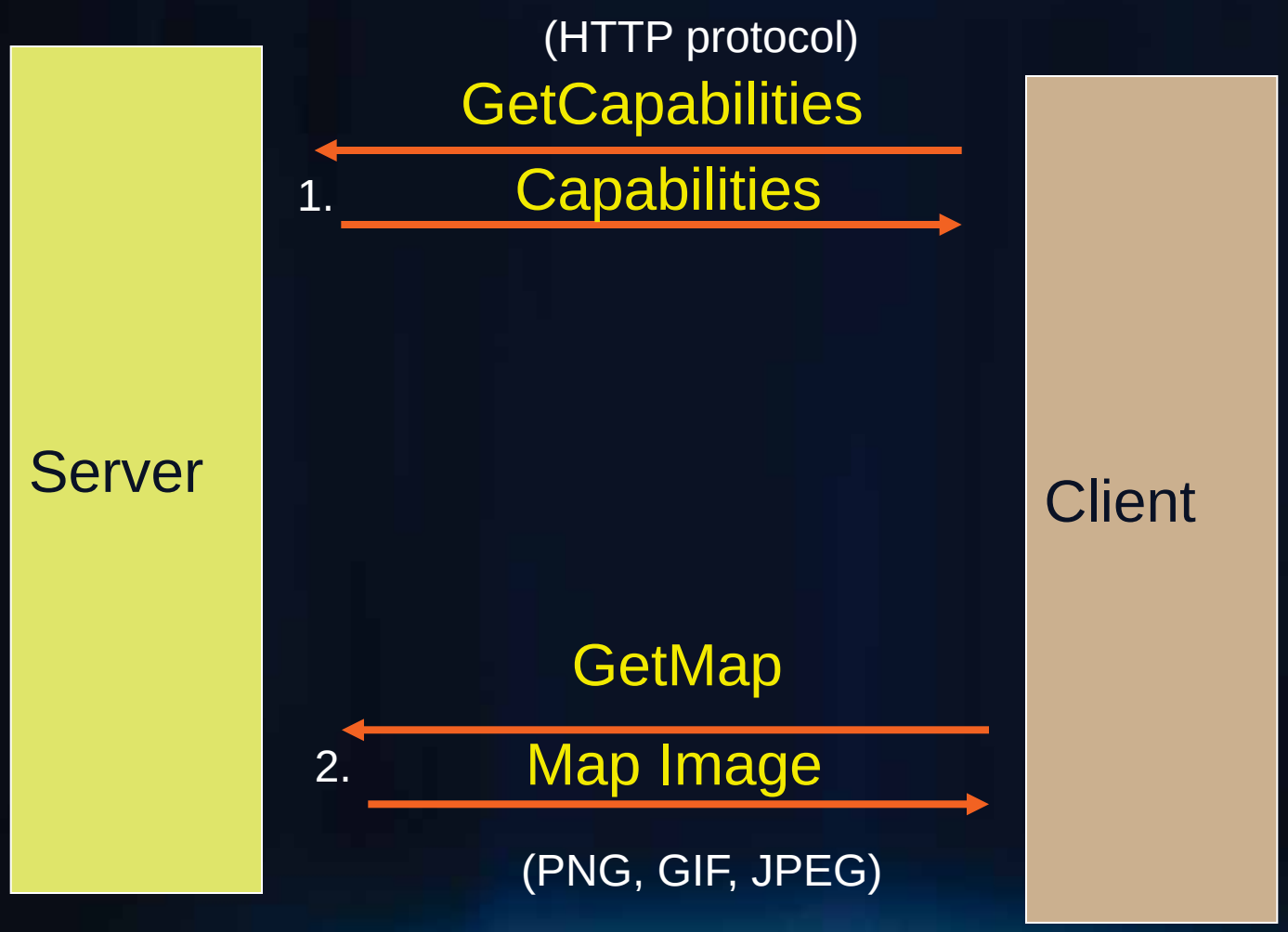
Web Feature Service
Geospatial feature publishing/streaming service
(GML)

Web Coverage Service
Imagery and gridded data publishing/processing service (GeoTIFF. .)
)

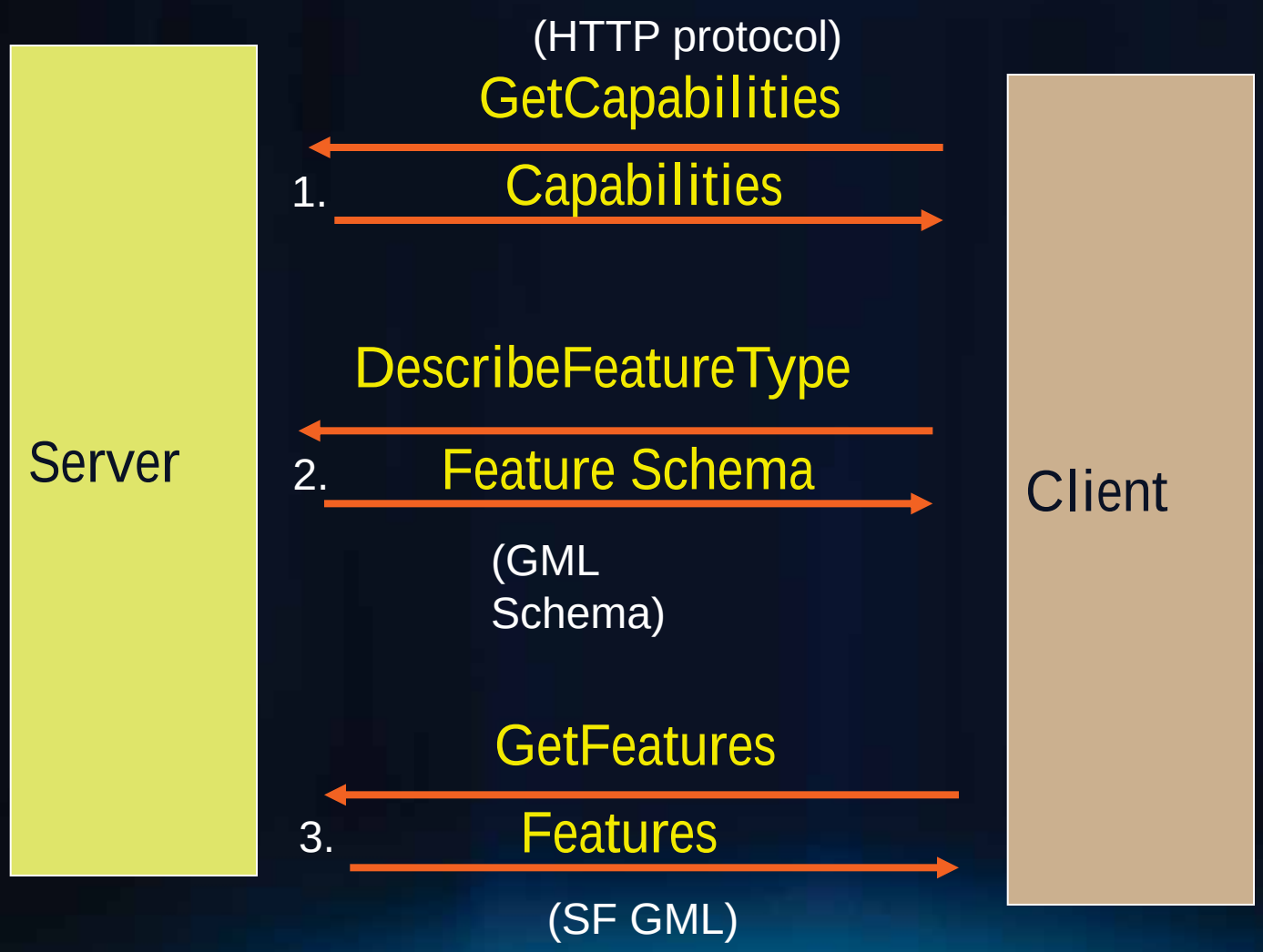


Catalog Service-Web
Metadata publishing/search service
(ISO 19115 Metadata . . .)

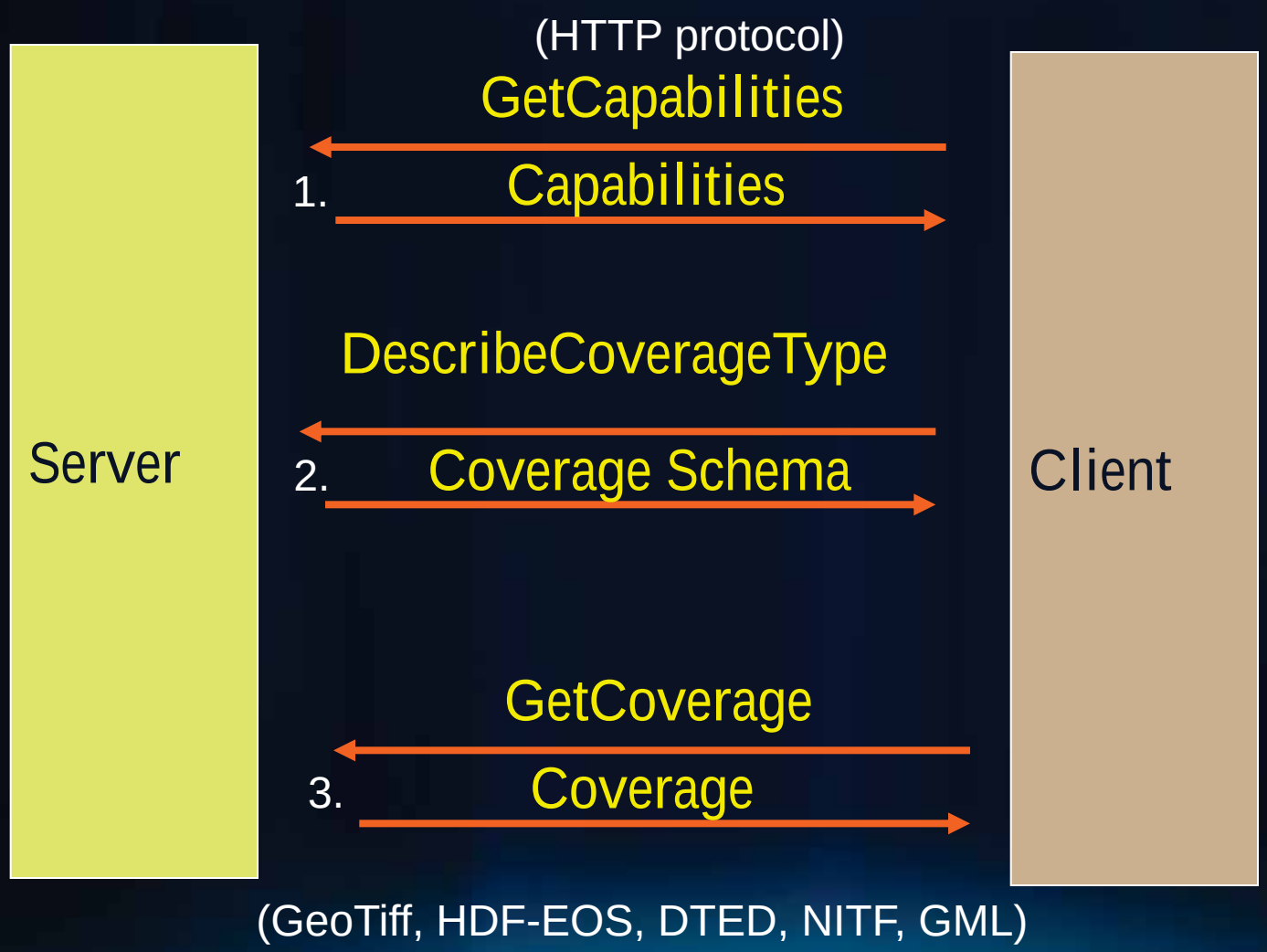
How WMS works



How WFS works



How WCS works



OGC / ISO standards support (ArcGIS 10.0)

- WMS
  + SLD
  + Filter Encoding Support
  + Time Support
- WFS
  + Transactions
  + Filter Encoding Support
- WCS
  +GeoTiff, NITF, HDF, JPEG, JPEG2000, PNG
- GML
  + Simple Features GML
  + OS Master Map, Top10NL, NATO, CityGML
- KML
  + OGC KML
- Metadata
  + ISO 19139
  + North American Profile
  + Inspire Profile
- CSW
  + OGC Core
  + ISO 19139
  + ebRIM

http://www.esri.com/library/whitepapers/pdfs/supported-ogc-iso-standards.pdf

ArcGIS – Future Planned OGC Implementations

10.1

- Web Processing Service (WPS)
- Web Map Tiling Service (WMTS)
- …….

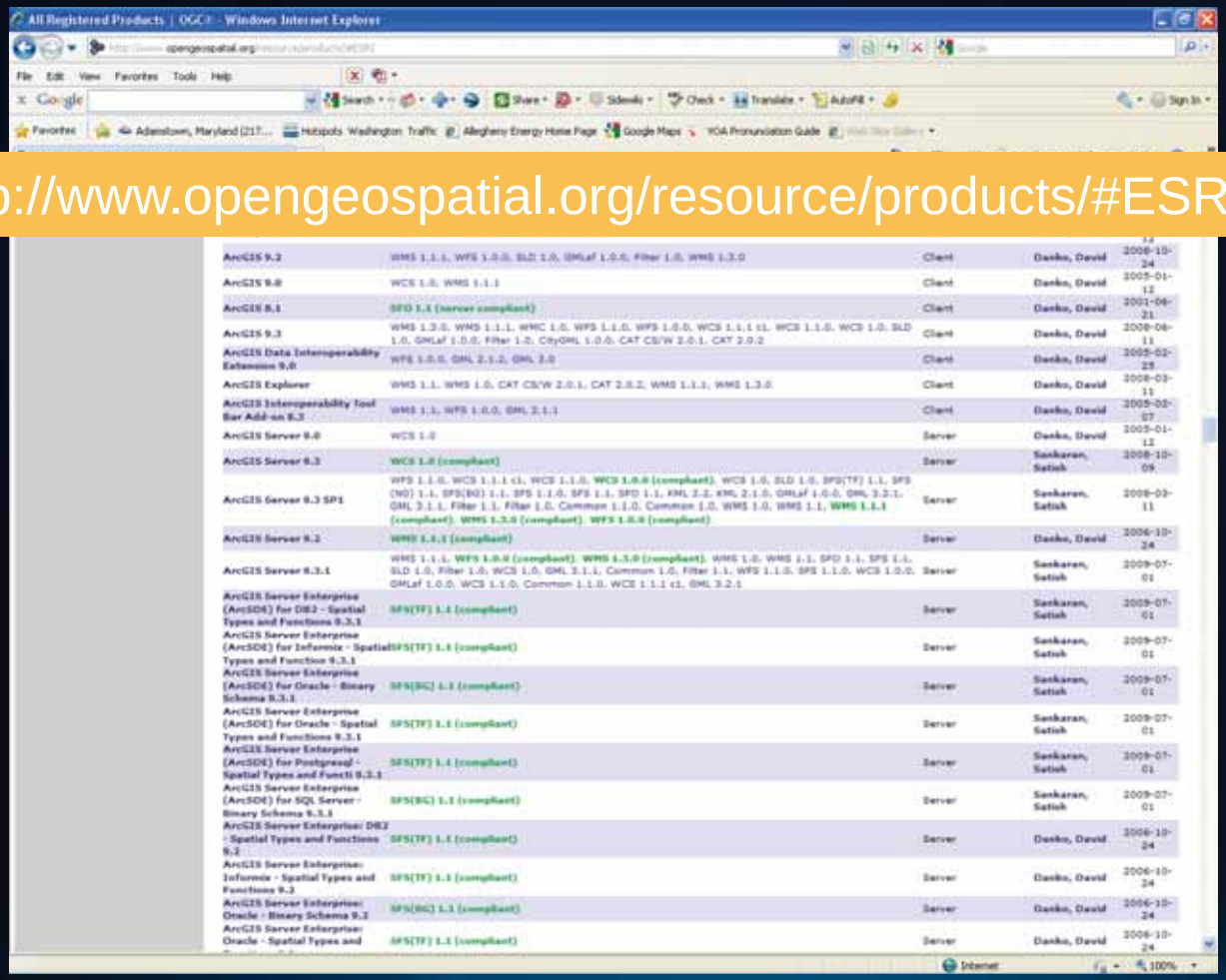
Resources

- ESRI Web Site
  - White papers
  - Product Support Matrix
  - OGC Compliancy

  Link:
  http://www.esri.com/standards

- OGC Website
- Link:
  http://www.Opengeospatial.org

ArcGIS – OGC Standards Compliant Implementations



http://www.opengeospatial.org/resource/products/#ESRI

OGC in the Federal Government

Nadine Alameh