

Esri Federal GIS Conference

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esri.com/fedcon



GIS Community Standards

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GIS

- **Creating and Managing Geo Information Products**
 - **Proprietary**
 - **Open Specifications**
 - **Standards**

- **Dissemination of Geo Products**
 - **Proprietary**
 - **Open Specifications**
 - **Standards**

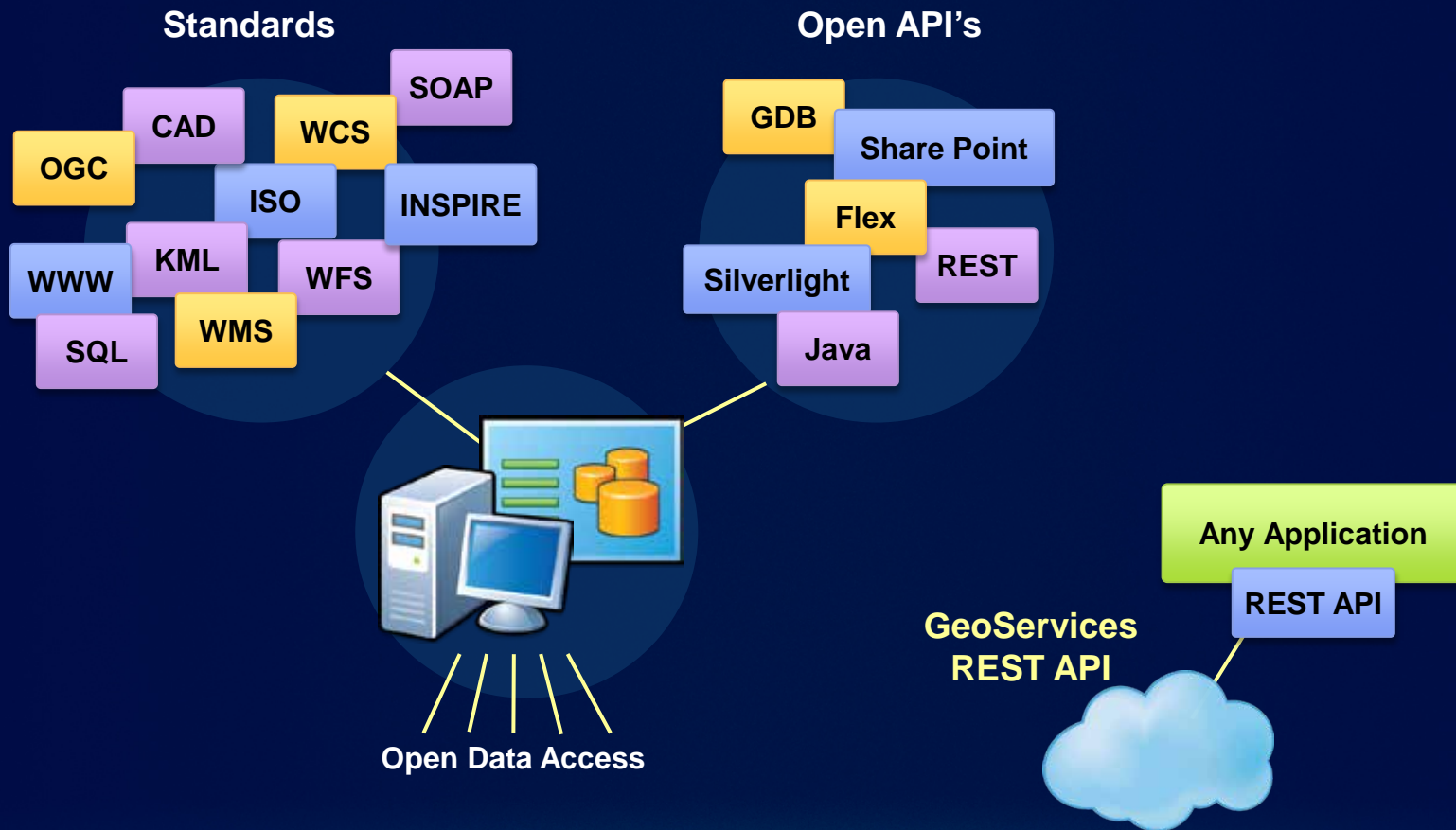
ArcGIS — A Complete System

Easier
More Powerful
and Everywhere



ArcGIS is Open & Interoperable

Using Standards to Integrate with Any System



Interoperability Enablers

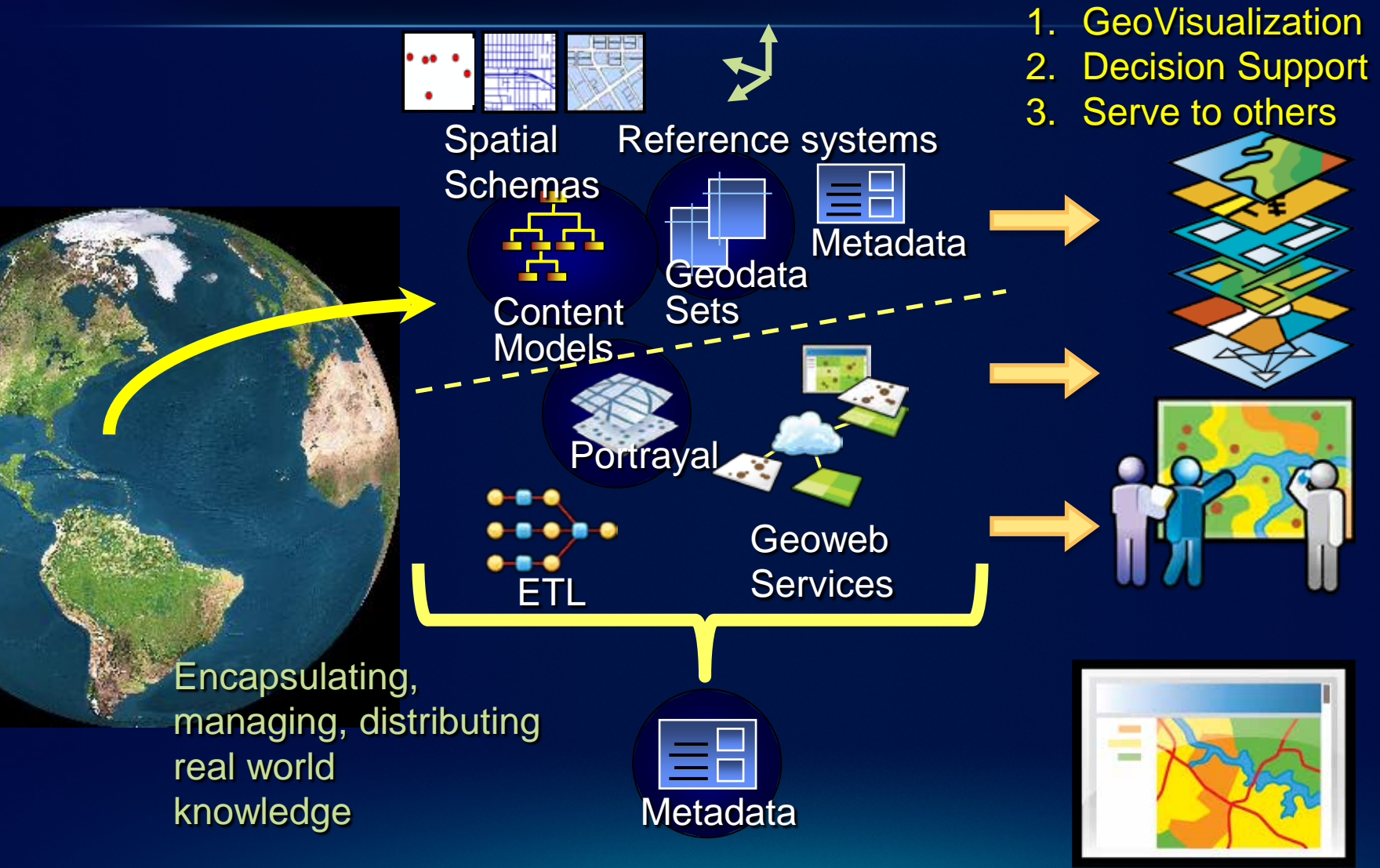
Standards used in creation of Geo Information products

- Metadata:
 - ISO 19139, FGDC, ...
- Data:
 - Simple Features Model, ...
 - WKT, WKB, Spatial Types, GML, netCDF, ...

Standards used for Dissemination

- File Based
 - Simple Features Access, ...
- On Demand Services
 - OGC Web Services - WMS, WFS, WCS, CS-W, WMTS, WPS, ...

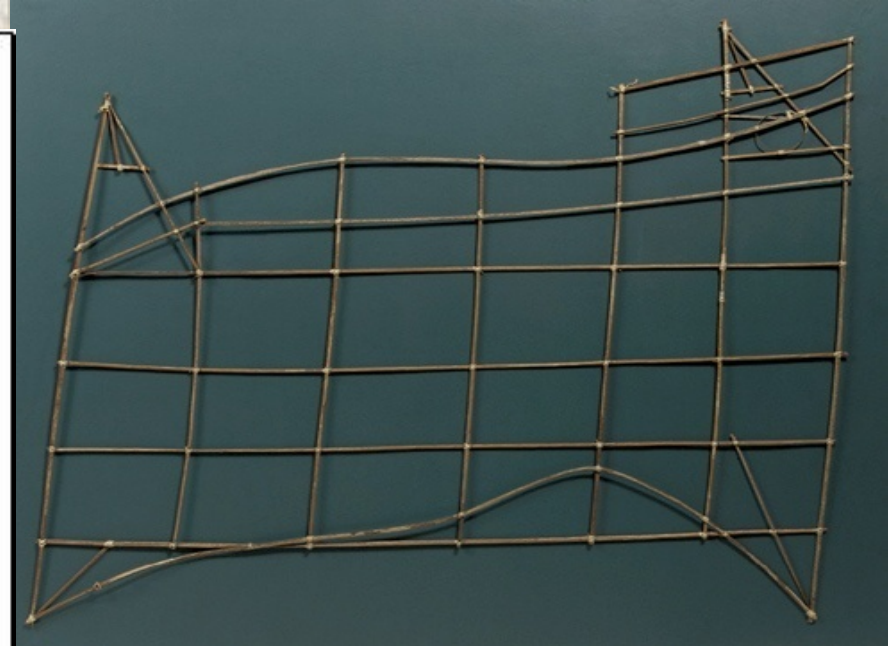
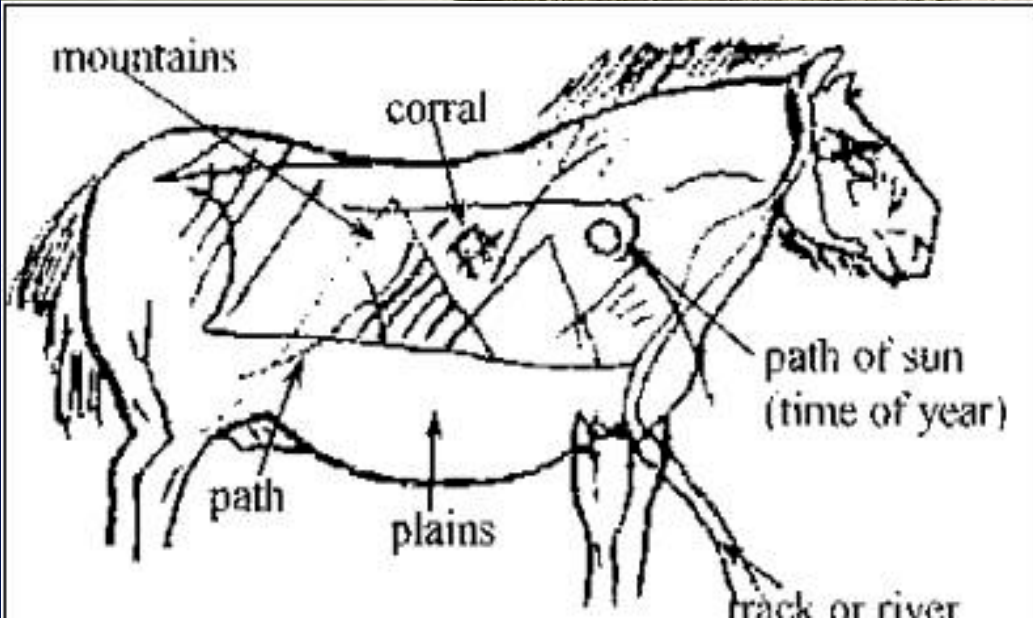
Abstracting Geographic Knowledge



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

Even the earliest map must have had metadata



We use maps every day not knowing anything about them

Frederick, MD, USA - Google Maps - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://maps.google.com/maps?sourceid=navclient&ie=UTF-8&rlz=1T4GGIH_enUS269US269&q=Frederick,+MD,+USA&um=1&sa=X&oi=geocode_result&resnum=1&t=Image Go Links

Google [Frederick, MD, USA](#) Go [Bookmarks](#) [4 blocked](#) [Check](#) [AutoLink](#) [AutoFill](#) [Send to](#) [Frederick](#) [MD](#) [USA](#) [Settings](#) [Links](#)

[Web](#) [Images](#) [Maps](#) [News](#) [Shopping](#) [Gmail](#) [more](#) [Sign in](#) | [Help](#)

Google Maps e.g., "10 market st, san francisco" or "hotels near lax"


Frederick, MD, USA Search Maps Show search options

Search the map Find businesses Get directions

Search Results My Maps [Print](#) [Send](#) [Link to this page](#)

Frederick, MD [Make this my default location](#)

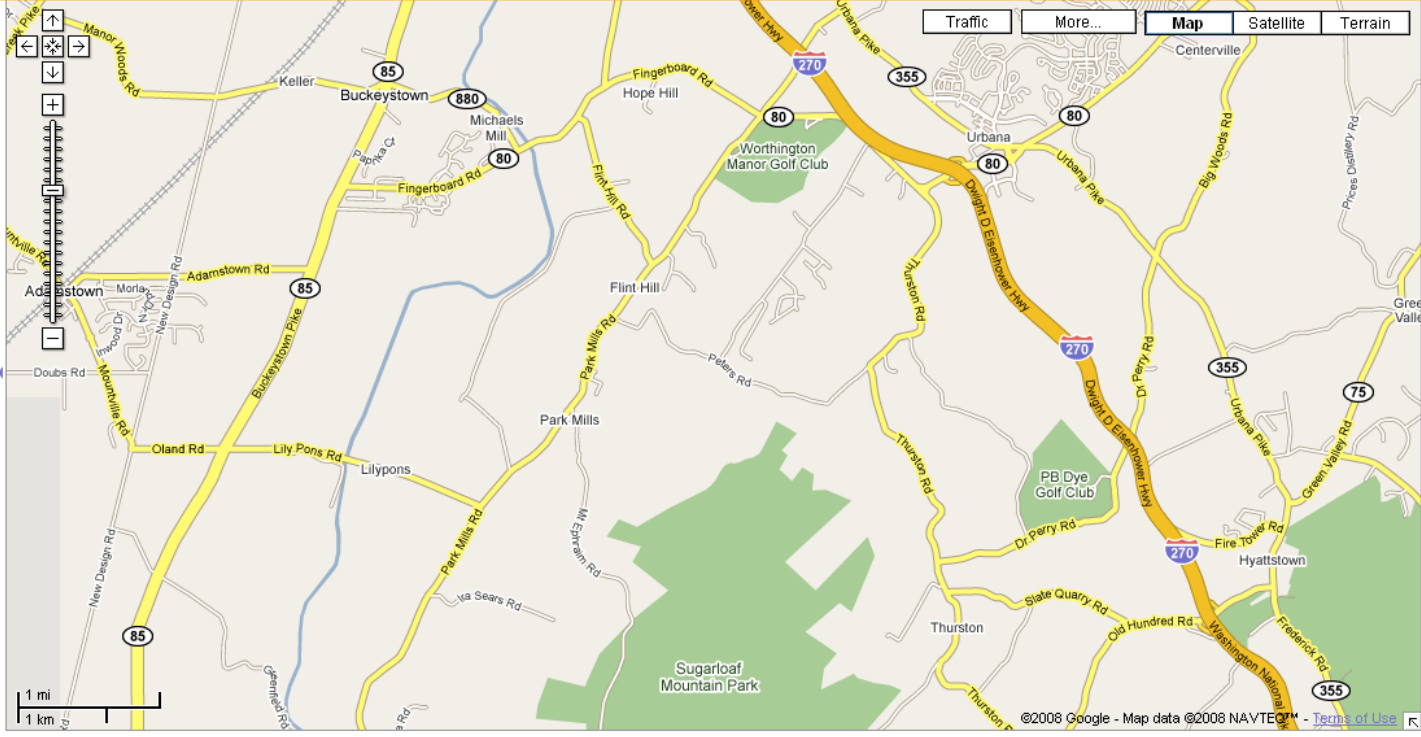
New! [Explore this area](#)

Photos 

Popular Searches [pb dye golf club](#) [bechtel](#) [giant](#) [ft detrick](#) [ceresville mansion](#) [la paz](#)

User-Created Maps [Downtown Brunswick](#)

[More photos, videos, and user-created maps](#)



Map Satellite Terrain

©2008 Google - Map data ©2008 NAVTEQ™ - [Terms of Use](#)

Done Internet

start 6 Internet Expl... Amendment 19118_AnX-A200... 2 Microsoft Offi... Adobe Acrobat Pr... Microsoft PowerP... Search Desktop 1:41 AM

Why should metadata be standardized?

- Provide resource producers an idea of the metadata they should collect**
- Provide consistent terminology for global search**
- Provide an understanding of data – around the Globe and across information communities**

Geospatial Metadata standards:

- **Content Standard for Digital Geospatial Metadata (FGDC 1992)**
- **Directory Information Describing Digital Geo-referenced Data Sets, CAN/CGSB 171.3-95**
- **Australia & New Zealand: Core metadata elements for land and geographic directories in Australia and New Zealand**
- **CEN TC287: Geographic Information - Data description – Metadata (1996)**
- **ISO 19115:2003 Geospatial metadata**
- **ISO 15836:2003 The Dublin Core metadata element set**
- **ISO 19110:2005 + Amendment 1 Feature Catalogue**
- **ISO 19119:2005 Services**
- **ISO 19139:2007 Metadata XML Schema implementation**
- **ISO 19115-2:2009 Extensions for imagery and gridded data**
- **ISO 19130:2010 Imagery sensor models for geopositioning**
- **ISO/DIS 19157 Quality (incorporating ISO 19113/19114/19138)**



ISO 19115/19139 Profiles

- Australia-New Zealand Profile
- North American Profile of ISO 19115:2003 (NAP)
 - CAN/CGSB-171.100-2009
 - INCITS 453-2009
- INSPIRE Metadata Directive
- ISO19115/ISO19119 Application Profile for CSW 2.0
- C3Grid ISO 19115 Metadata Profile
- Marine Community Metadata Profile of ISO 19115
- Energy Industry Profile of ISO 19115-1
- USGIN ISO 19139 Profile
- DISDI Geospatial Metadata Profile (DGMP)
- National System for Geospatial Intelligence Metadata Foundation (NMF)
- A metadata profile for precision agriculture based on ISO 19115 standard.
- WMO Core Profile of the ISO 19115 Metadata Standard
- Transformation of HDF-EOS metadata from the ECS model to ISO 19115-based XML
- Draft African metadata profile of ISO19115
- Samoan profile
- NOKIS – an ISO 19115 Based Metadata System
- The UDK and ISO 19115 Standard
- Latin American Profile
- Núcleo Español de Metadatos (NEM)
- UK GEMINI
- Biological profile
- Coastal zone profile
- S100 Metadata profile (IHO)

Metadata at Esri

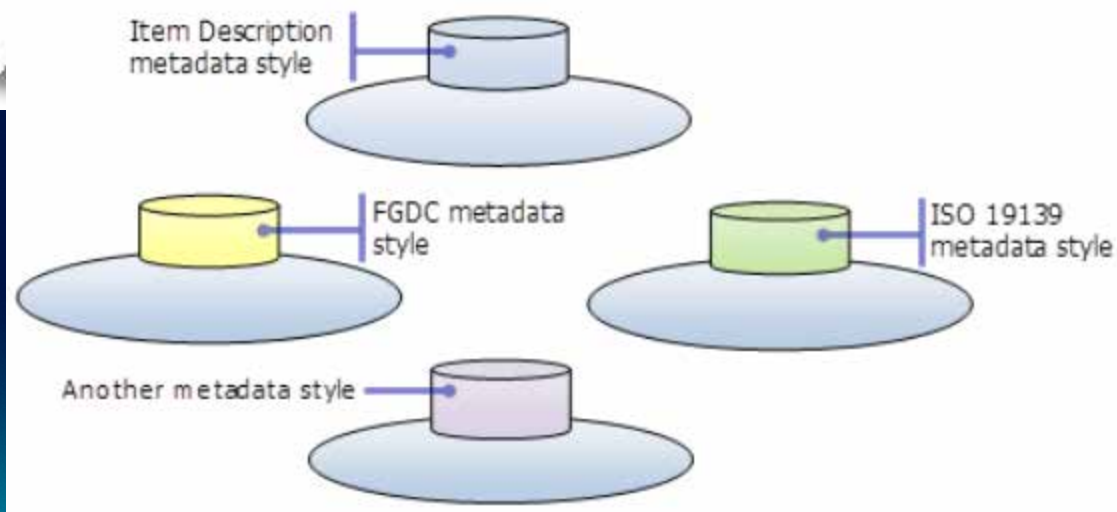
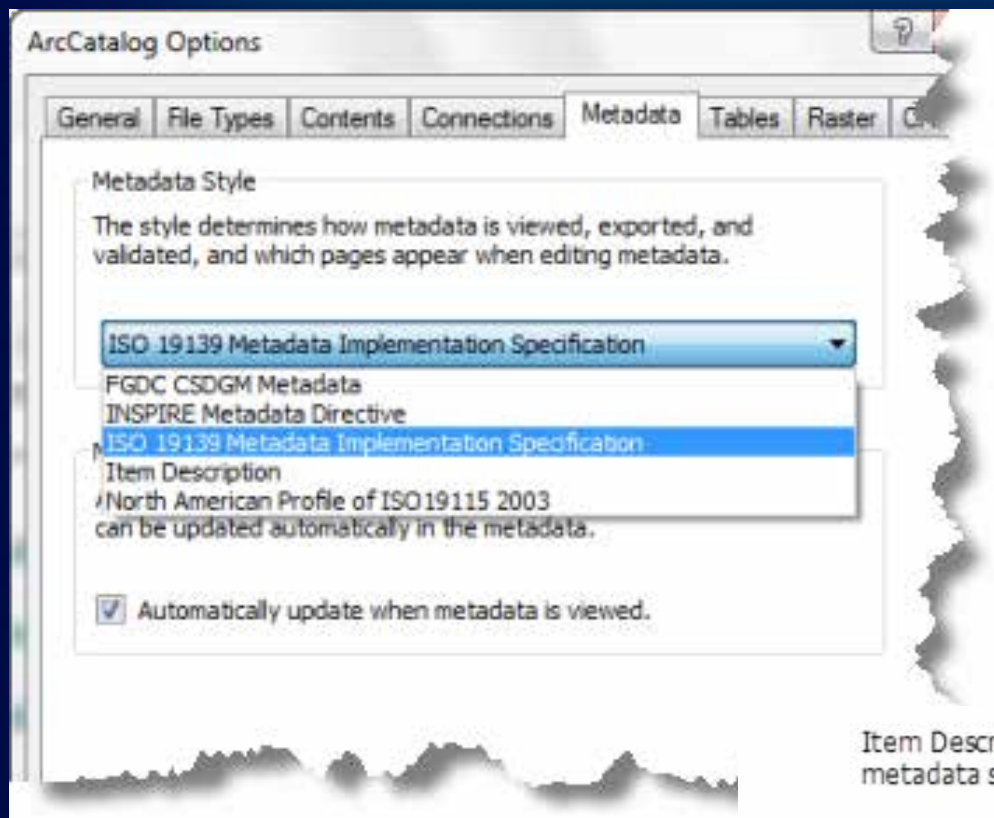
- **Early advocate for metadata**
 - **Data documentation/properties**
 - **ArcCatalog**
 - Full support for FGDC
 - Early support for ISO19115:2003
 - **Support for Clearinghouses and metadata/discovery related services**
 - **ArcGIS Server**
 - **Esri Geoportal Server**
 - **Continuing support for the development of metadata standards and practices**
 - OGC
 - ISO



ArcGIS 10 Metadata support

- **Make metadata easier**
- **Complete support for FGDC and many ISO metadata standards**
 - **Content Standard for Digital Geospatial Metadata**
 - **19115 – Metadata**
 - **19119 – Services**
 - **19139 – Implementation Specification for 19115 and 19119**
 - **19110 – Feature Cataloguing Methodology**
- **Support profiles of ISO metadata standards**
 - **North American Profile**
 - **INSPIRE**
- **Auto update of metadata per the data's intrinsic properties**
- **Validation - standards based metadata**
- **Extensible to support emerging profiles**
- **Templates supporting auto fill common metadata elements**
- **Provide methods for updating multiple metadata records (change address/phone number for example)**

Set the metadata standard/style you regularly use



Selected metadata style

- All options are set appropriately for a given metadata standard or profile
- Controls the display, creation, editing, validation, and default export format
- Different styles include different pages
 - North American Profile style supports adding country codes

The diagram illustrates the configuration of a metadata form. It consists of two panels. The top panel shows a form with two dropdown menus: 'Language' set to 'English' and 'Character Set' set to 'utf8'. A large blue arrow points from this panel to the bottom panel. The bottom panel shows the same form but with an additional 'Country' dropdown menu set to 'CANADA', which is highlighted with a blue border. The 'Language' and 'Character Set' fields remain the same as in the top panel.

Language	English
Character Set	utf8

↓

Language	English
Country	CANADA
Character Set	utf8

ArcGIS 10.1 Internal Metadata Validation

- Identify and fix problems as you type

Page
flagged
for
having
errors



Save X Exit

Contacts Maintenance Constraints

Resource

Details

Extents Points of Contact Maintenance Constraints Spatial Reference Spatial Data Representat

Content

Quality Lineage Distribution Fields References Geoprocessing History

attribute description is required
band minimum value must be less than the maximum value
minimum value must be a real value

Content Information

Image Description

Attribute Description

Content Type Image

Band

Sequence Identifier / Type

Descriptor Band_1

Min Value not a number

Max Value 251

Units Empty

Peak Response

Bits per Value 8

The shortest wavelength the sensor is capable of collecting in this band. Data type: Real. From: ISO 19115:2003.

Problems
listed



Missing
required
value



Invalid
data type



Expected
value
described



ArcGIS 10.1 Internal Metadata Validation

- As problems are fixed, errors are automatically removed from the list at the top of the page

Page
has no
errors



Save X Exit

Details
Contacts
Maintenance
Constraints

Resource

Details
Extents
Points of Contact
Maintenance
Constraints
Spatial Data Representat
Content
Quality
Lineage
Distribution
Fields
References
Geoprocessing History

Content Information

Image Description [X]

Attribute Description: temperature

Content Type: Physical Measurement

Band [X]

Sequence Identifier / Type: [] []

Descriptor: Band_1

Min Value: -48

Max Value: 43

Units: temperature, degree Celsius Cel

Peak Response: []

Bits per Value: 8

Tone Gradation: []

Scale Factor: []

Offset: []

The shortest wavelength the sensor is capable of collecting in this band. Data type: Real. From: ISO 19115:2003.

ArcGIS 10.1 Internal Metadata Validation

- Different validation rules for each style/standard

ISO 19139 style

FGDC CSDGM style

Save X Exit

Overview

! [abstract is required](#)

Item Description

Title

Thumbnail

Tags

Save X Exit

Overview

! [abstract is required](#)
! [purpose is required](#)
! [use limitation is required](#)
! [a tag, topic or keyword is required](#)

Item Description

Title

Thumbnail

Tags

Delete Update...

Moving to ArcGIS 10

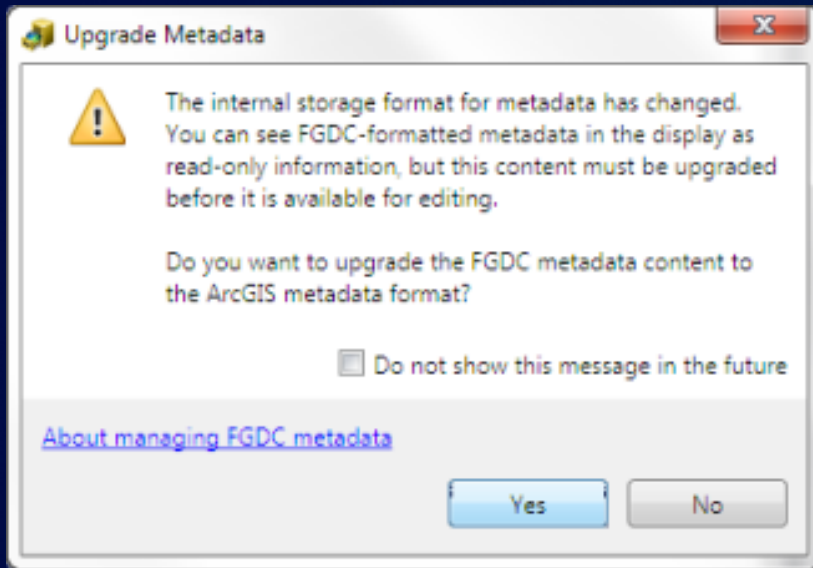
[Illustrated guide to complete FGDC metadata](#)

Step by step, fully illustrated guide ties the ArcGIS metadata editor to the FGDC Production rules and CSGDM Workbook

The image displays three overlapping screenshots of the ArcGIS metadata editor interface, illustrating the process of setting up metadata constraints.

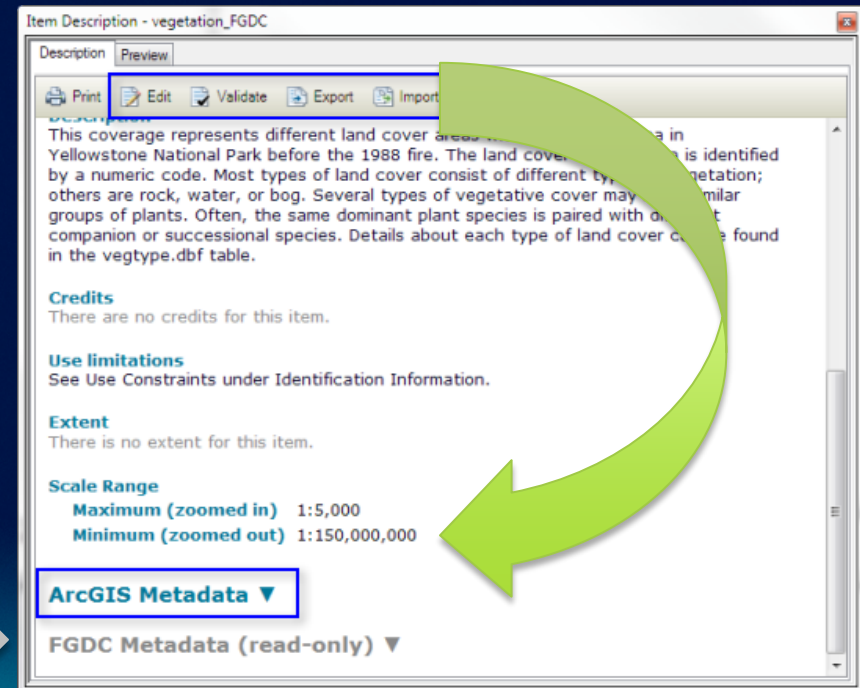
- Top Screenshot:** Shows the "Processing environment" field set to "Microsoft Windows Vista Version 6.0 (Build 6002) Service Pack 2". A callout points to this field with the label "1.13 Native Data Set Environment".
- Middle Screenshot:** Shows the "Legal Constraints" section. The "Access Constraints" and "Use Constraints" dropdown menus are both set to "Empty". A callout points to the text "Data is provided with the ArcGIS Desktop Tutorial Data installation." in the "Other Constraints" field with the label "1.7 Access Constraints".
- Bottom Screenshot:** Shows the "Resource Constraints" section. The "Use Limitation" field contains the text: "See the ESRI License Agreement for Disclaimer of Warranties and Limitation on Liabilities with respect to the sample Data contained herein. The sample Data is the intellectual property of the respective data provider(s) and is used herein with permission. Source: National Park Service, Yellowstone National Park. The sample Data is redistributable with proper metadata and source attribution notices to the respective data provider(s).". A callout points to this text with the label "1.8 Use Constraints".

Upgrading from ArcGIS 9.3.1



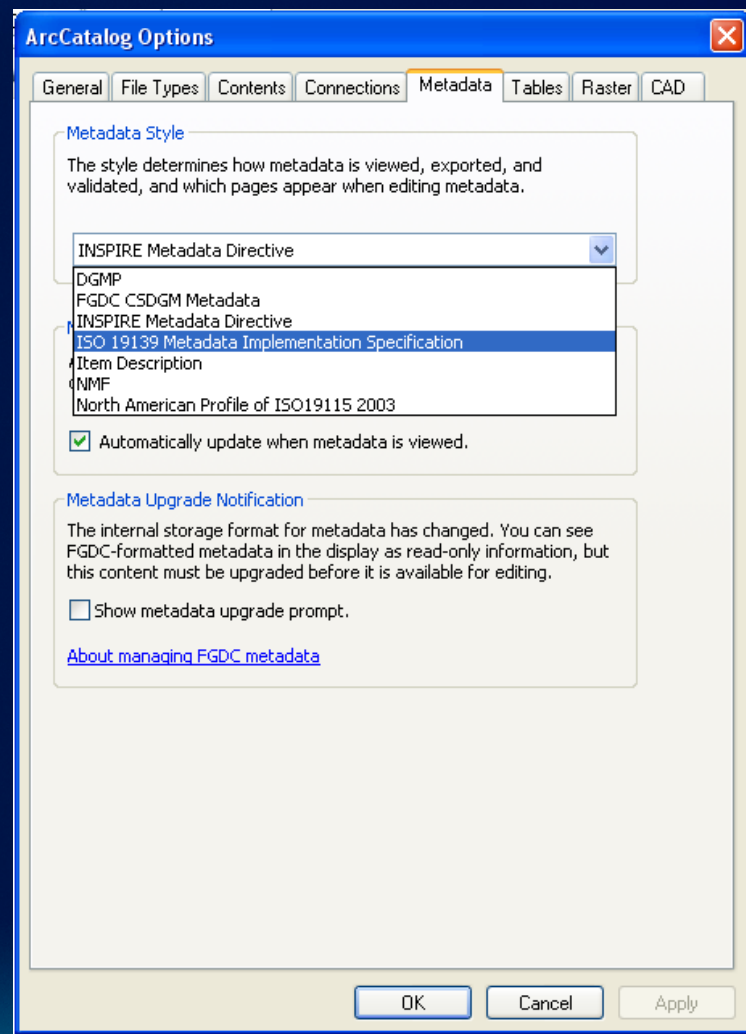
Buttons let you manage ArcGIS metadata

9.3.1 FGDC content is read-only in the Description tab



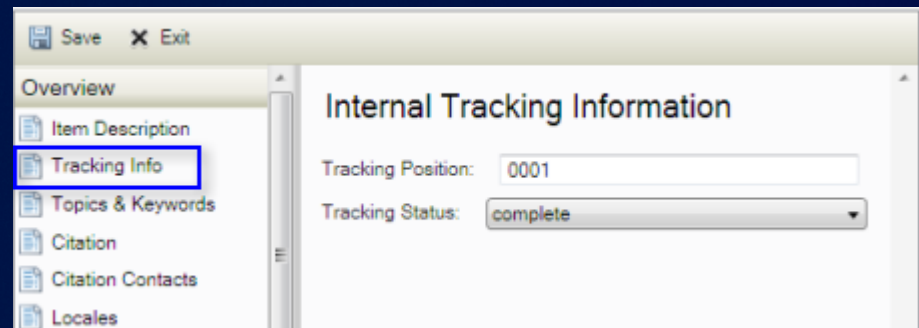
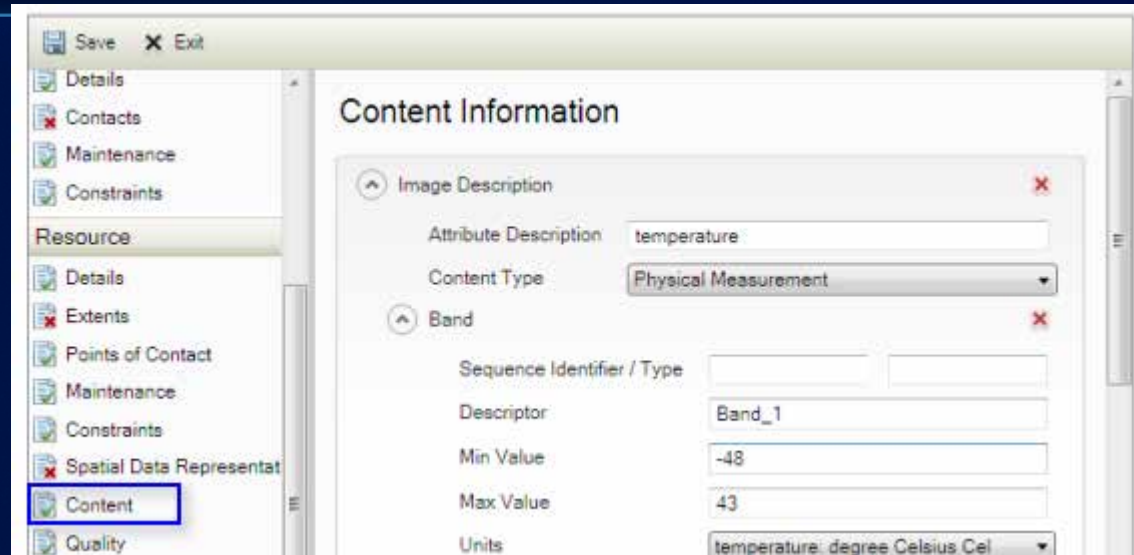
Tailor ArcCatalog for your profile

- **Metadata tool kit –**
 - **Custom metadata editor containing source code for all pages**
 - **Windows Presentation Foundation (WPF) application using C# and XAML**
 - **ArcGIS Metadata documentation**
 - **XSLT style sheets**
 - **Custom style configuration files**
 - **Sample Visual Studio solution**
 - **Complete instructions**



Metadata tool kit

- Profile/subset ISO standard
 - Modify existing pages
- Add community specific metadata
 - Add custom pages
- Save to custom xml



```
<mdDateSt Sync="TRUE" >20120221 </mdDateSt>  
- <myData>  
  <trackingPosition>0001 </trackingPosition>  
  <trackingStatus>complete </trackingStatus>  
</myData>  
</metadata>
```

ArcGIS Metadata Support

- **Comprehensive support for FGDC and ISO metadata standards**
- **Robust validation**
 - Internal validation as metadata is produced
 - Tailored to specific to profiles
 - External validation for export xml
 - Official XML Schema validation
- **Metadata Toolkit**
 - Tailor full power of ArcCatalog to support any profile

Metadata SIG meeting – Friday, 10:00 – 11:00 AM, Room 301

Interoperability Enablers

Standards used in creation of Geo Information products

- Metadata:
 - ISO 19139, FGDC, ...
- Data:
 - Simple Features Model, ...
 - WKT, WKB, Spatial Types, GML, netCDF, ...

Standards used for Dissemination

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 - OGC Web Services - WMS, WFS, WCS, CS-W, WMTS, WPS, ...

Simple Features

- Simple Feature specification
 - Common Architecture
 - Geometry Model
 - Well Known Text Representation for Geometry
 - Well Known Binary Representation for Geometry
 - Well Known Text Representation for Spatial reference Systems
 - ...
 - Part 2 – SQL Option
 - Database schema to support feature tables, Geometry, and Spatial Reference
 - SQL Geometry Type
 - SQL routines for constructing / obtaining a geometry object given its WKT, WKB representations
 - SQL Operations on Type Geometry
 - ...







Simple Features

- Simple Feature specification defines:
 - Data access model
 - Database schema
 - 2D Geometry model for points, lines, polygons
 - “Well-Known” data formats for geometry and spatial reference
- ISO and OGC specifications for simple feature access

Feature Tables contain rows (features) sharing common properties (Feature Attributes).

Geometry is a Feature Attribute.

Feature Table

				
	10	area1	yellow	
	11	area2	green	
	12	area3	Blue	← Feature
	13	area4	red	

Geometry

Feature Attribute

GML

GML or Geography Markup Language is an XML based encoding Standard for geographic information developed by the Open Geospatial Consortium (OGC).

- GML Profiles – Point profile, Simple Features Profile
 - Simple Feature profile
 - Initially motivated to help WFS use of GML 3
 - Constrains the many optional elements of GML schema
 - Provides 3 levels of compliancy: Level 0 , 1 and 2
- GML Application Schemas – OSMasterMap, CityGML, WaterML, O&M, Top10NL,....

Interoperability Enablers

Standards used in creation of Geo Information products

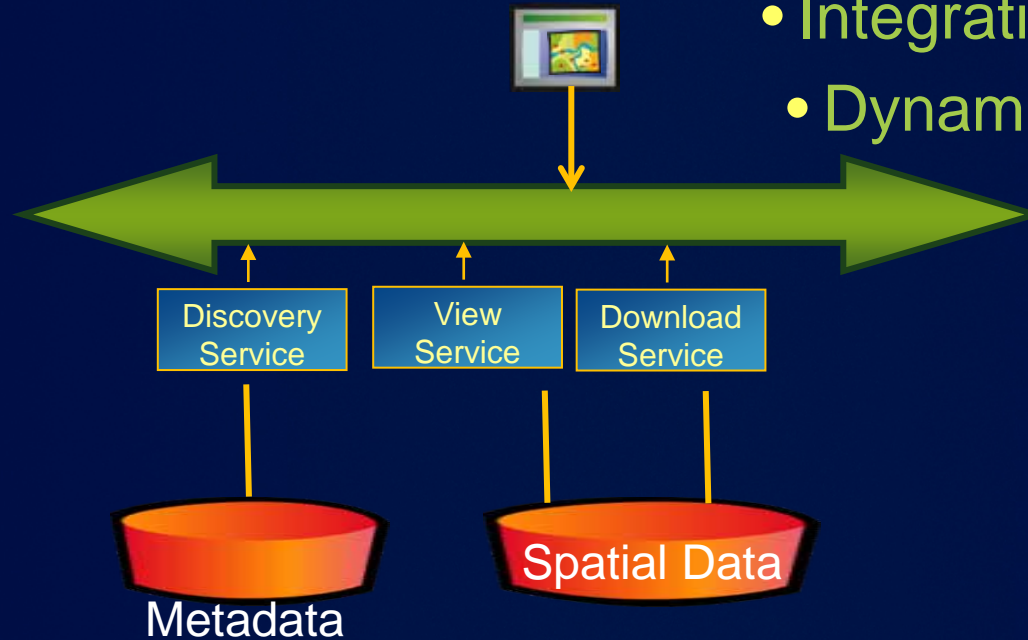
- Data:
 - Simple Features Model, ...
 - WKT, WKB, Spatial Types, GML, netCDF, ...
- Metadata:
 - ISO 19139, FGDC, ...

Standards used for Dissemination

- File Based
 - Simple Features Access, ...
- On Demand Services
 - OGC Web Services - WMS, WFS, WCS, CS-W, WMTS, WPS, ...

Services Oriented Architecture (SOA)

- Interconnected
- Interoperable
- Integrative
- Dynamic



Loosely Coupled and Orchestrated Services

Types of ArcGIS Services



Map

View or query a 2D map on the server



Geocode

Perform address matching on the server



Geometry

Provides basic geometric operations for use by web service clients (ex. simplify, buffer, difference, trim, ...)



Geoprocessing

Run a geo processing tool or model on the server and get the results back



Image

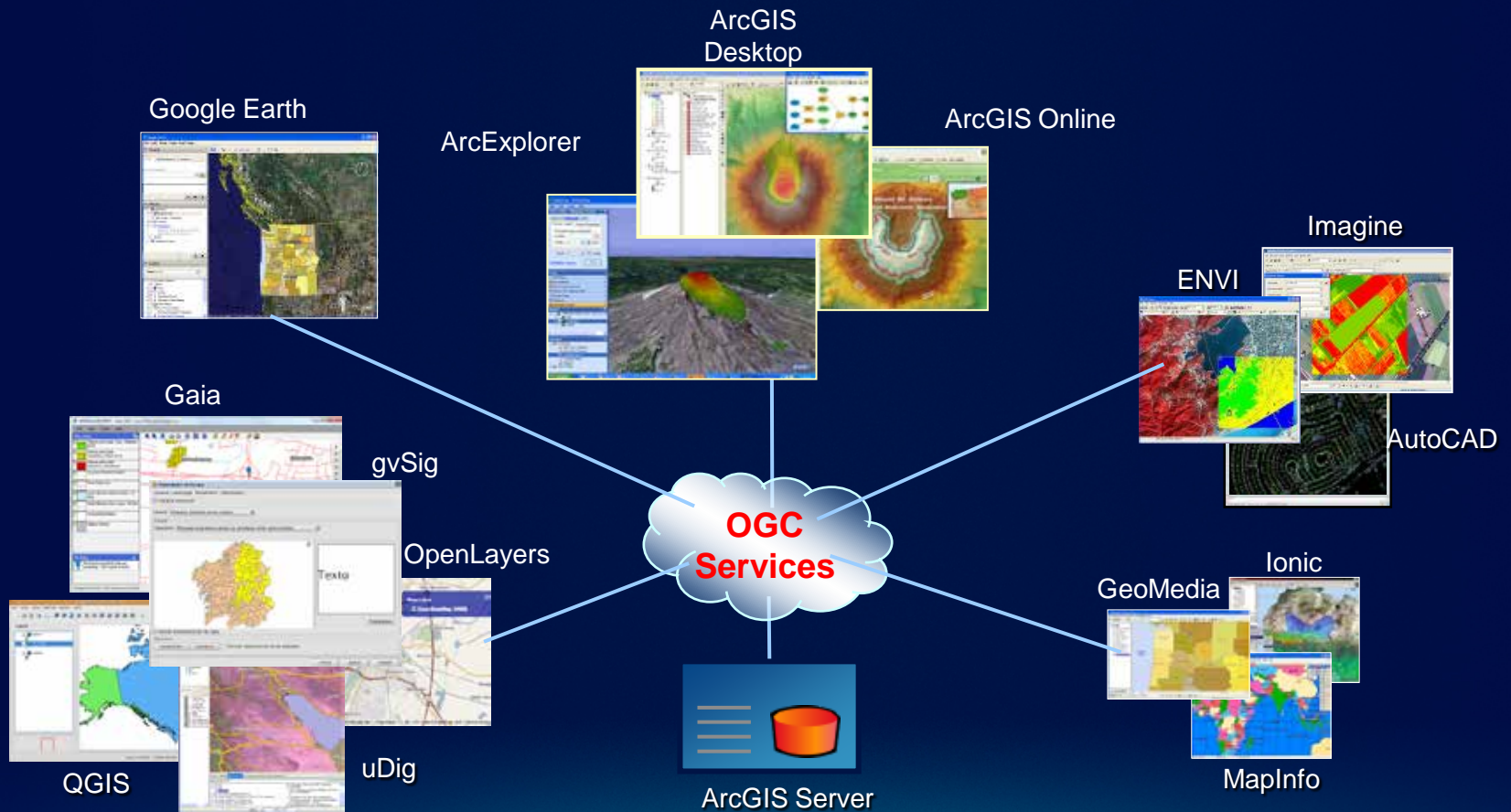
Provide access to raster data through a Web service



Feature

Provide access to feature querying and editing

ArcGIS Server - Building open and interoperable Systems



ArcGIS – Supporting OGC Web Services

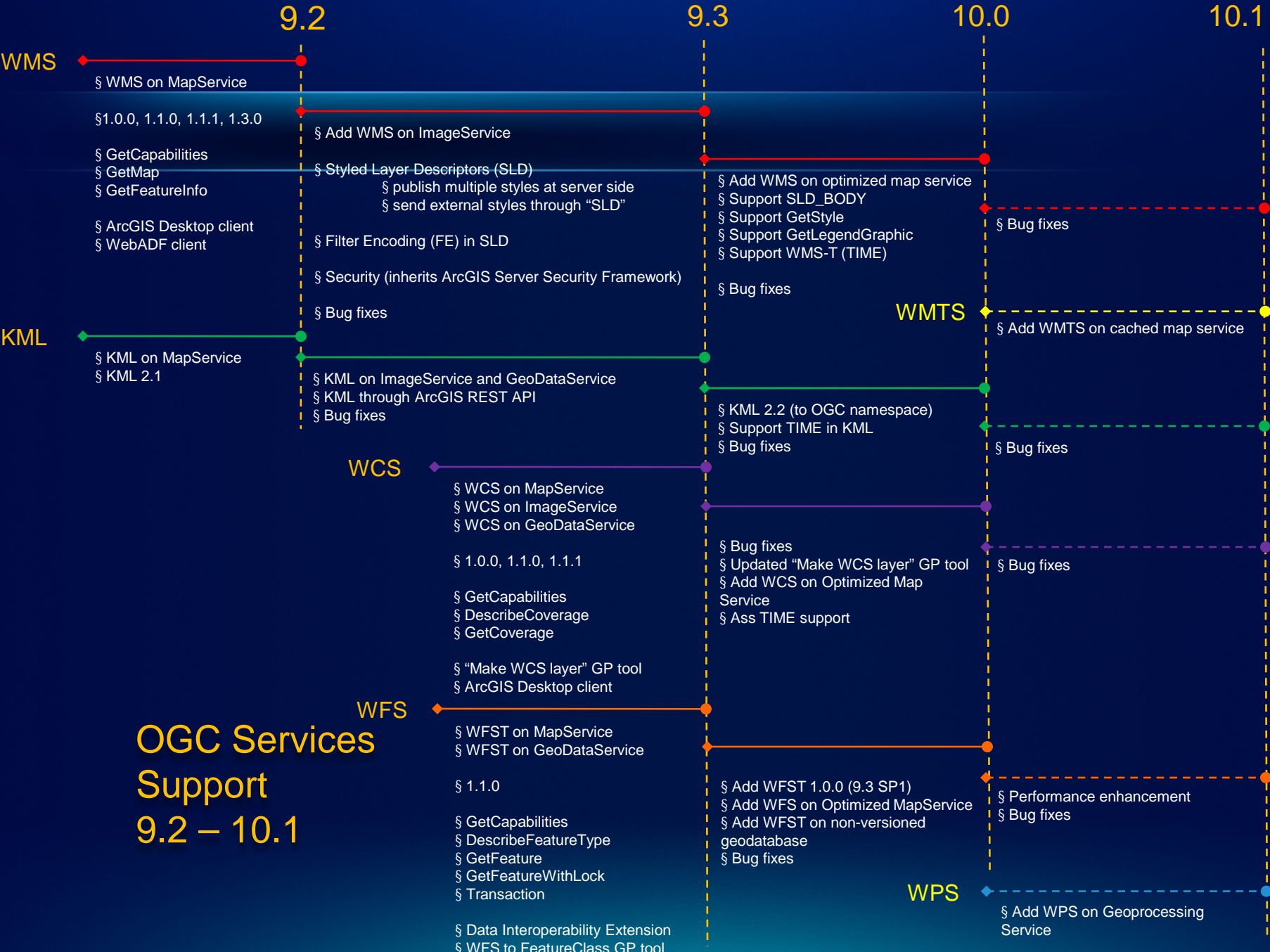
- **WebMap Service** : Geospatial “picture” publishing/viewing service
- **Web Map Tiling Specification** : Provides Tiled images
- **Web Feature Service** : Geospatial feature publishing/streaming service
- **Web Coverage Service** : Imagery and gridded data publishing/processing service
- **Keyhole Markup Language Service** : Geospatial feature publishing/streaming service
- **Web Processing Service** : Geospatial Processing Service
- **Catalog Services Web** : Provides an interface for registering and discovering metadata
- **Sensor Observation Service** : Delivering Sensor observations

OGC Services in ArcGIS Server - Architecture

- **Implemented as capabilities of ArcGIS Server services**
 - **Map Service**
 - **WMS, WCS, WFS, KML, WMTS (10.1)**
 - **Image Service**
 - **WMS, WCS, KML**
 - **GeoData Service**
 - **WCS, WFS, KML**
 - **Geoprocessing Service**
 - **WPS (10.1)**
- **Inherit from ArcGIS Server services**
 - **Rich features from ArcObjects (cartography, geodatabase, caching, geoprocessing etc.)**
 - **Good authoring and publishing work flow**
 - **Scalability and Durability in distributed environment**
 - **Performance**
 - **Security mechanism**

ArcGIS Server – OGC versus REST Services

<i>Difference</i>	<i>ArcGIS Server OGC Services</i>	<i>ArcGIS Server REST Services</i>
<i>Interfaces</i>	OGC (ISO) Standards	Geoservices REST specification
<i>Encoding style</i>	KVP, RESTful, SOAP	REST
<i>Metadata encoding</i>	OWS XML	Esri JSON
<i>Feature encoding</i>	GML, KML	Esri JSON
<i>Feature editing</i>	Pessimistic locking	No lock, last win
<i>Symbology encoding</i>	SLD	Esri JSON
<i>Filter encoding</i>	OGC Filter spec	Esri JSON
<i>Client applications</i>	OGC compliant clients (ArcGIS Desktop, uDig, gvSig, OpenLayers, OpenScales etc.)	Esri products (ArcGIS Desktop, ArcGIS JS/Flex/Silverlight API), ...



OGC / ISO standards support (ArcGIS 10.1)

- WMS
 - + SLD
 - + Filter Encoding Support
 - + Time Support
- WFS
 - + Transactions
 - + Filter Encoding Support
- WCS
 - +GeoTiff, NITF, HDF, JPEG, JPEG2000, PNG
- WMTS
 - + REST & KVP Encoding
- WPS
 - + Synchronous
 - + Asynchronous
 - + Data and Services as inputs
- CSW
 - + OGC Core
 - + ISO 19139
 - + ebRIM

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

ArcGIS Support for OGC Web services

- **Server**
 - ArcGIS Server
 - Esri Geoportal Server
 -
- **Client**
 - Desktop Applications
 - API's
 - Viewers
 -
- **More Information**
- ESRI Web Site : White papers, Product Support Matrix, OGC compliancy
 - <http://www.esri.com/standards>

GIS

- **Creating and Managing Geo Information Products**

- **Proprietary**
- **Open Specifications**
- **Standards**



Shapefiles

Open FGDB Api

- **Dissemination of Geo Products**

- **Proprietary**
- **Open Specifications**
- **Standards**



Geoservices REST Specification

Geoservices REST Specification

Demonstrations

OGC Supported Standards

Clients

WMS

WMS w-TIME

KML

NetCDF

WFS

WCS

WMTS (New 10.1)

WPS (New 10.1)

ArcGIS Desktop

ArcGIS.com

ArcGIS API for Flex

Open Layers

Exelis ENVI

Quantum GIS

Upcoming Events (www.esri.com/events)

March 8 - MeetUp at Esri (Vienna, VA)

April 12 - MeetUp in DC area (location TBD)

Mar 24-27 – Esri Partner Conference (Palm Springs, CA)

Mar 26-29 – Esri Developer Summit (Palm Springs, CA)

July 21-24 – Esri Homeland Security Summit (San Diego, CA)

July 23-27 – Esri International User Conference (San Diego, CA)



Thursday Evening Reception

- 6:30 – 9:30 pm
- **Smithsonian Air and Space Museum**
- **Logistics:**
 - 6:15 – 10:00 pm Buses transport between convention center and reception
 - Conference Badge needed for reception
 - Coat check – available at entrance
 - Serving hot hors d'oeuvres and beverages



Friday Closing Session and Hosted Lunch

- **Join conference attendees for lunch and closing session**
- **11:30 am – 1:30 pm**
- **Ballrooms A-C, Third Level**
- **Closing Speaker – Chris Smith, United States Department of Agriculture**
- **Wrap-up and request for feedback with Jack Dangermond**



Questions ?