



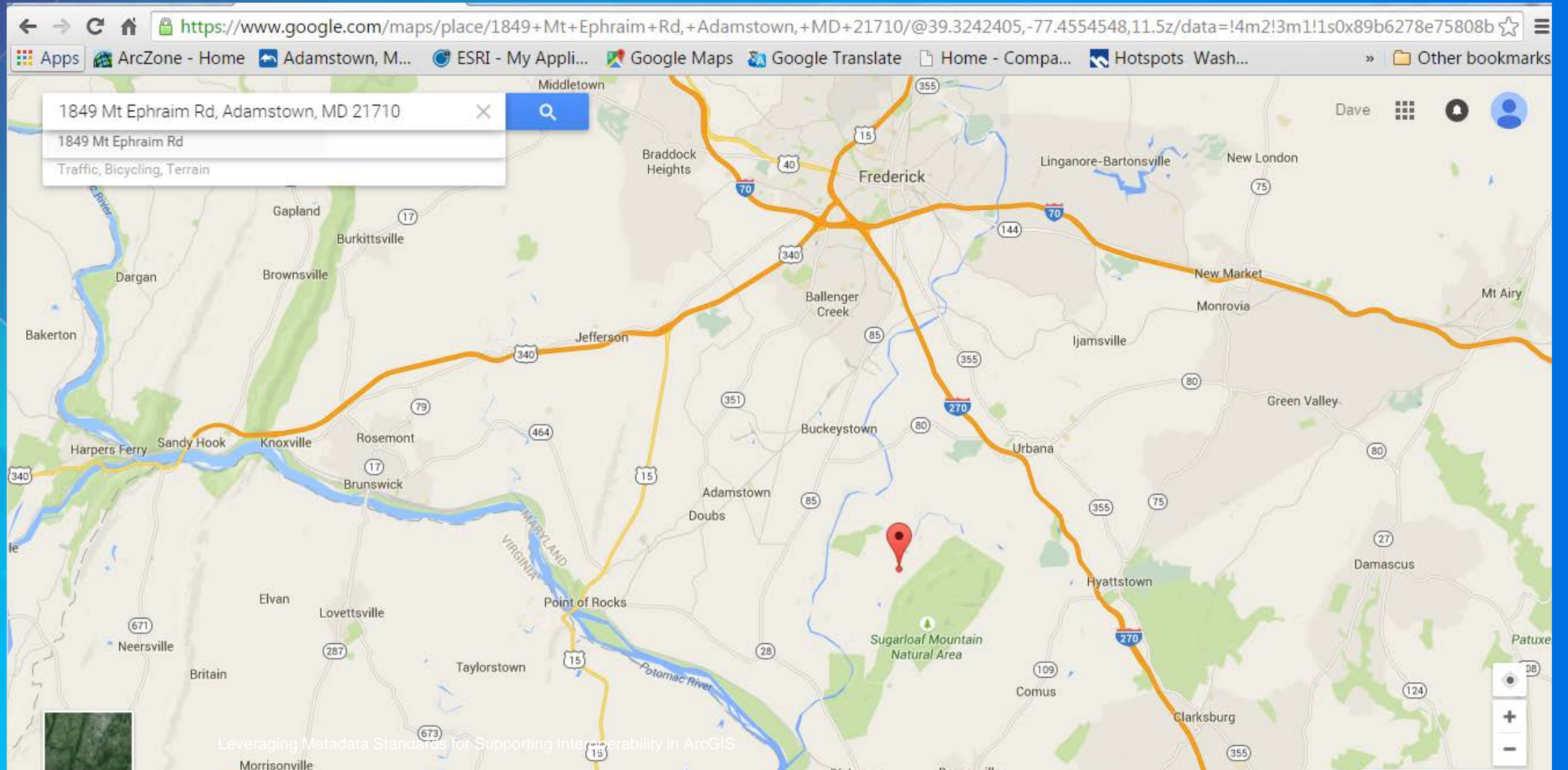
# Leveraging metadata standards in ArcGIS to support Interoperability

David Danko and Aleta Vienneau

# Leveraging Metadata Standards in ArcGIS for Interoperability

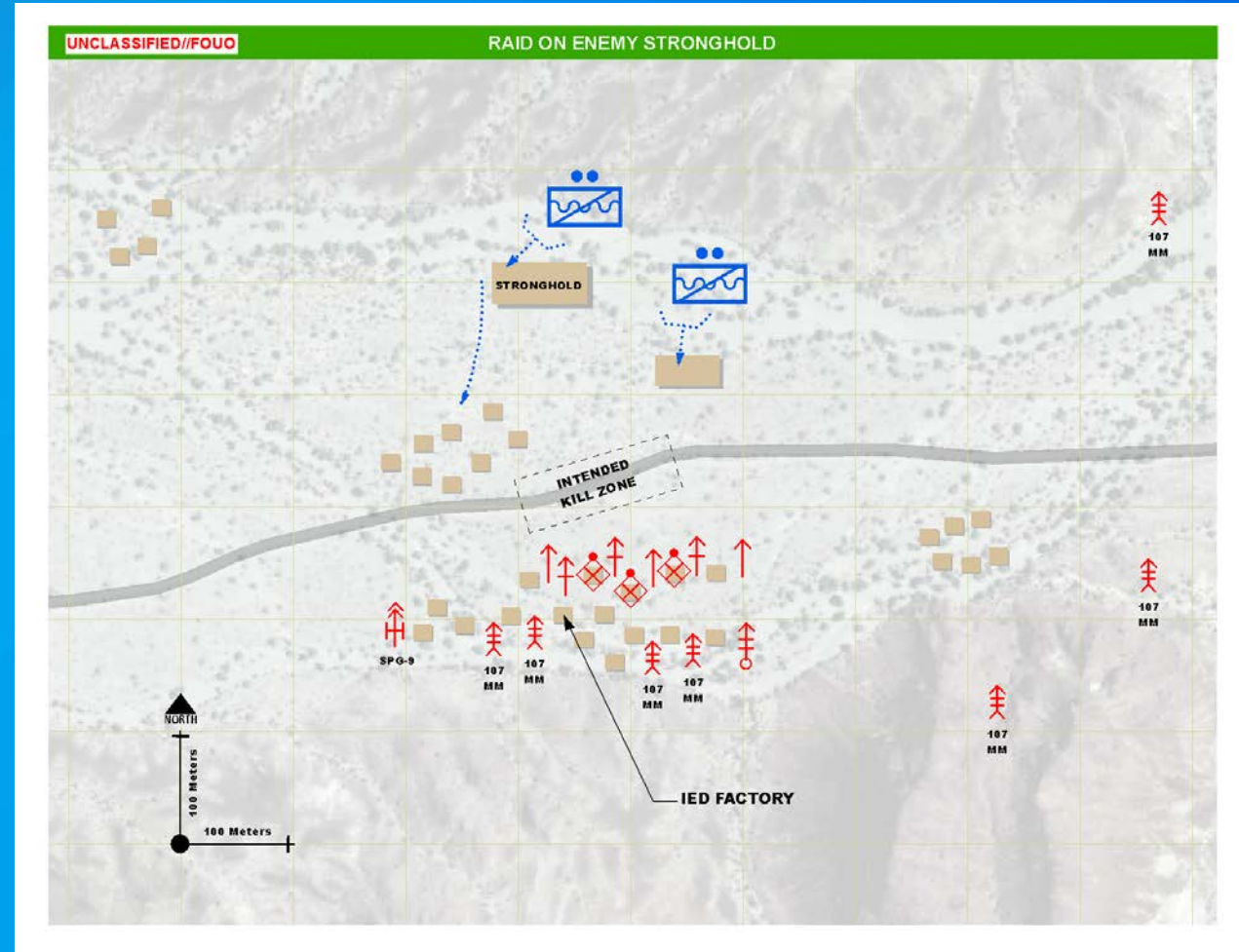
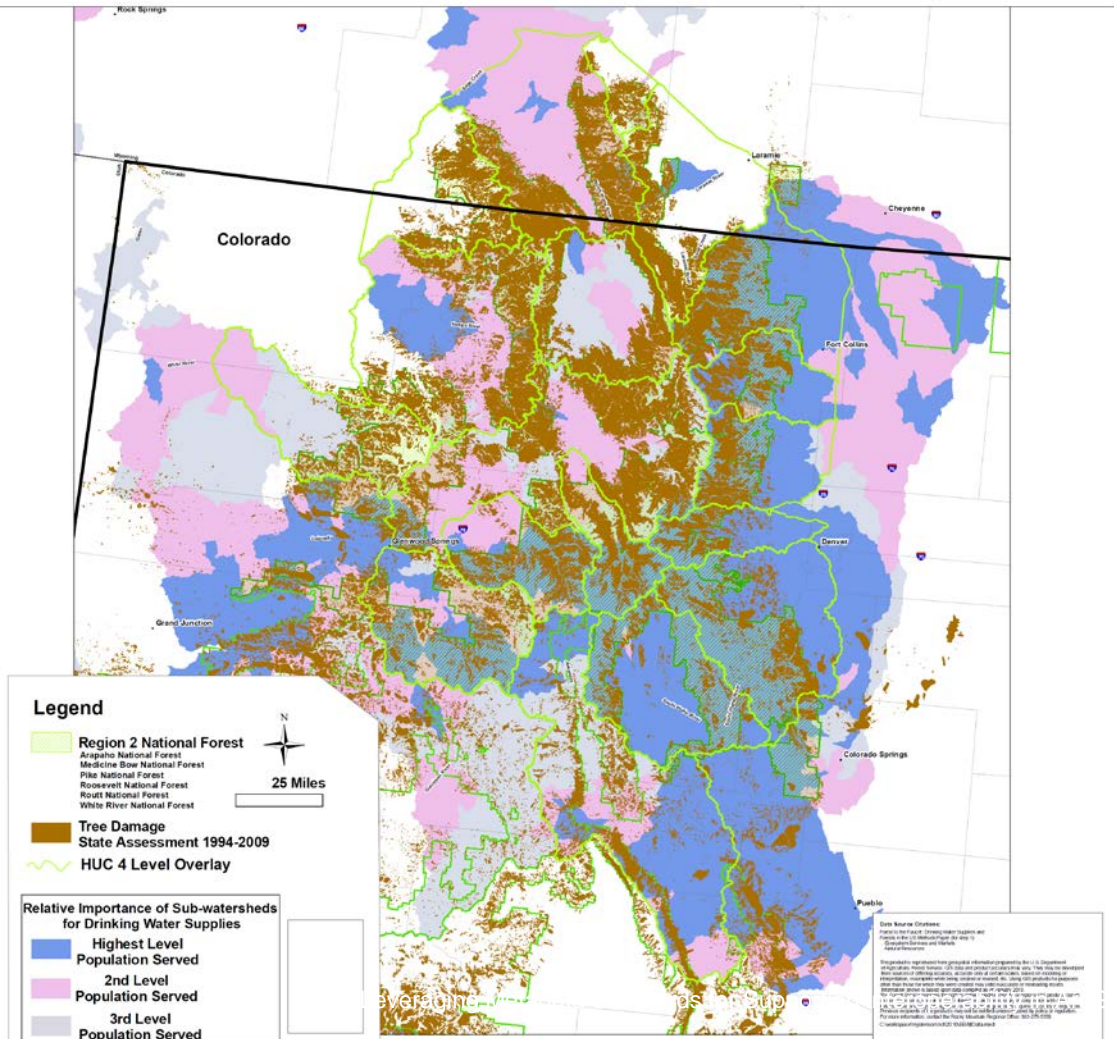
- **Why metadata and metadata standards?**
- **Overview of metadata standards**
- **ArcGIS for Desktop standards support**
- **Notes for specific metadata styles**
- **Customizing the metadata editor**
- **What's next for ArcGIS**

# We use maps every day not knowing much about them

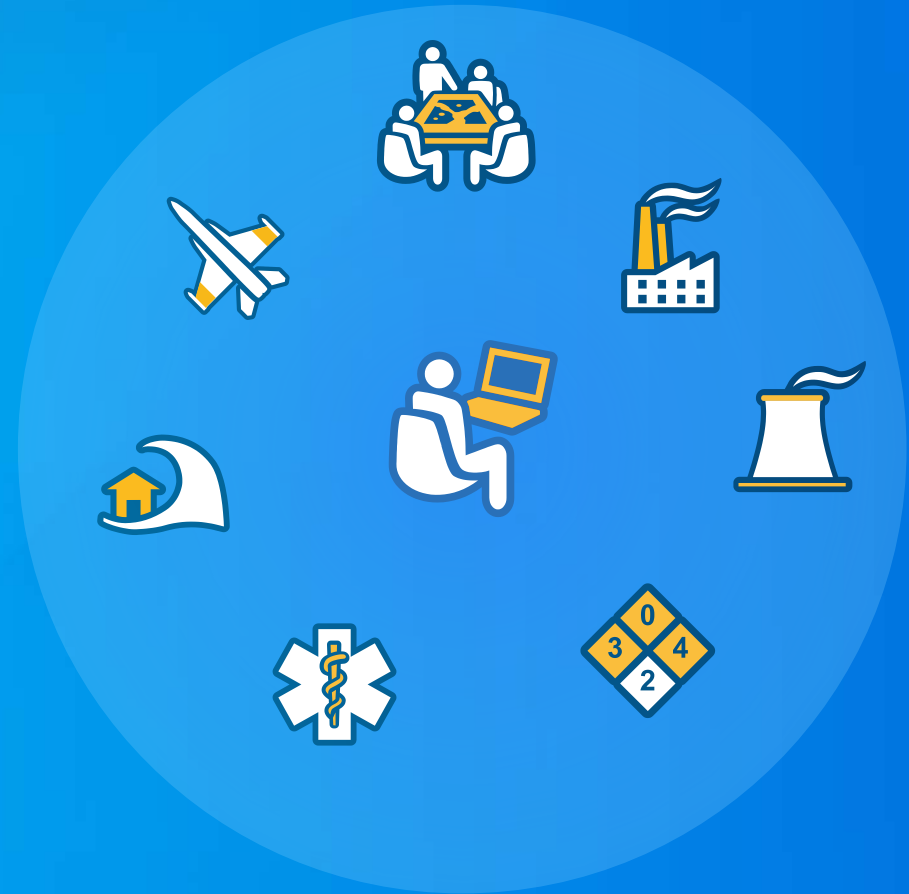
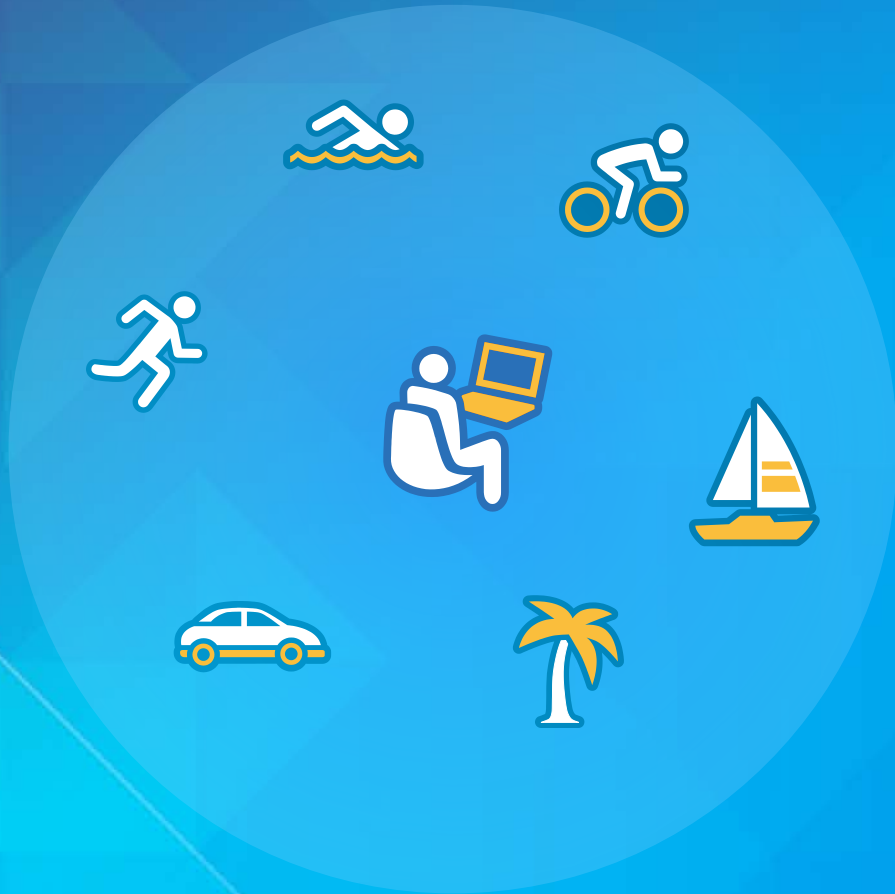


# With property, money, or lives at stake – we need to know more

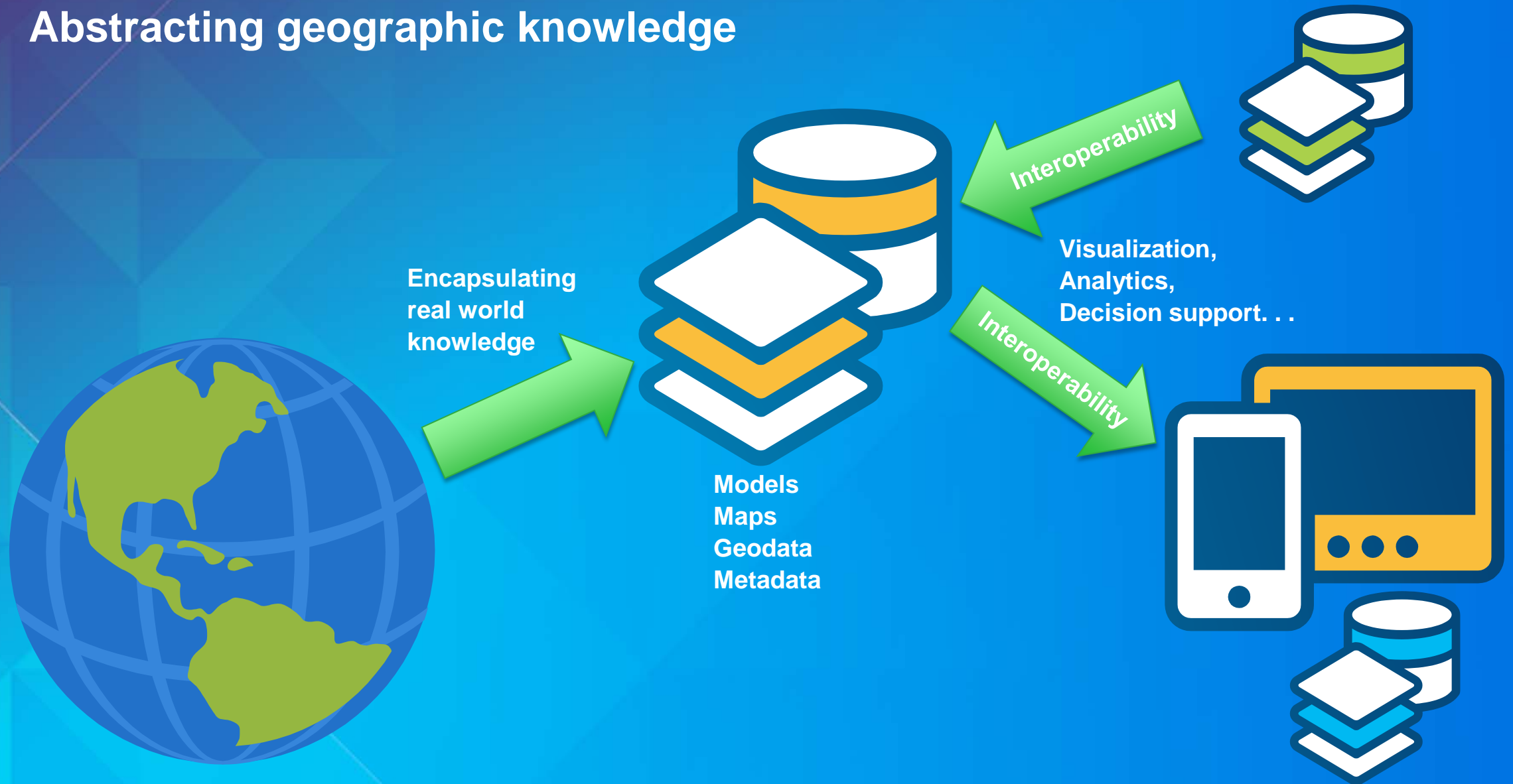
## Concept Map: Priority Watershed Restoration in the Central Rocky Mountains



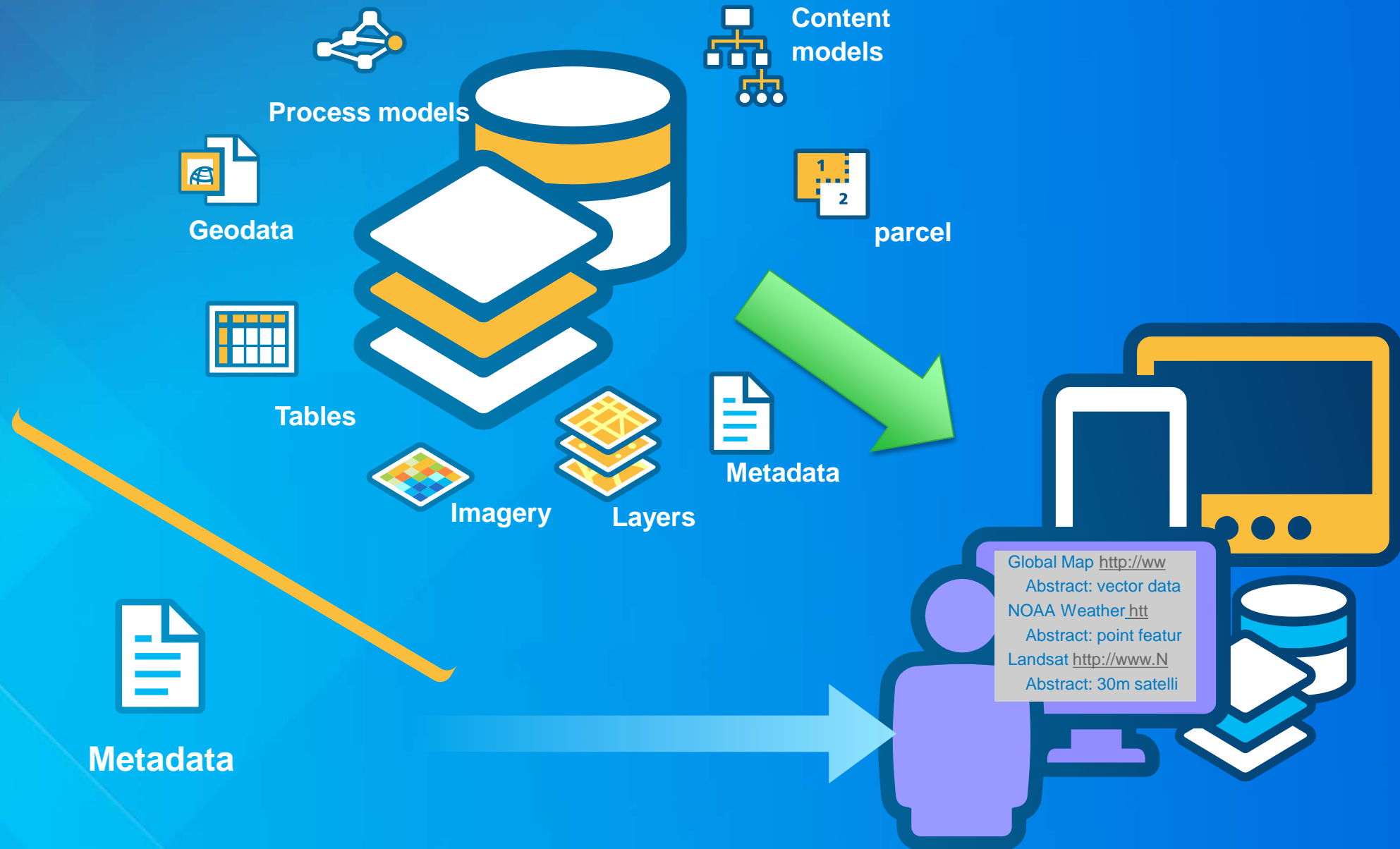
# Always need/use metadata



# Abstracting geographic knowledge



# Abstracting geographic knowledge



# Why metadata and metadata standards?

Metadata is useful!

- **Communicate the assumptions, limitations, approximations, simplifications**
  - Enables understanding
- **Support decisions, discovery, and reuse**
- **Identify a resource's worth**
- **Archive information**





# Why metadata and metadata standards?

## Why follow metadata standards?

- **Content checklist for authors**
- **Common understanding of geospatial data**
  - **Between countries**
  - **Between communities**
- **Publish to metadata catalogs**
- **Consistent terminology for global search**





# Overview of Metadata Standards

# Metadata standards

Content Standard for Digital Geospatial Metadata (FGDC 1992)

Defines metadata elements and content for describing geospatial datasets

FGDC standard

# ISO Metadata related standards

Name of Standard	Description	Status
<b>ISO 19109:2005 Rules for application schema</b>	<b>Defines the a general feature model and rules for creating and documenting application schemas for modeling features and their properties allowing physical applications to understand and share data</b>	<b>Under revision: Sent to ISO for publication</b>
<b>ISO 19110:2005 + Amendment 1 Methodology for feature cataloguing</b>	<b>Catalogue defining features and properties for a domain of interest and/or a dataset and a schema for encoding in XML</b>	<b>Under revision: FDIS 2014-7, IS 2016-02</b>
ISO 19111:2007 Spatial referencing by coordinates	Metadata about/defining a coordinate reference system	International standard
ISO 19111-2:2009 Spatial referencing by coordinates-Extension for parametric value	Metadata about/defining a coordinate reference system using parametric values	International standard
ISO 19112:2003 Spatial referencing by geographic identifiers	Metadata about/defining a reference system which uses spatial unit identifiers other than coordinates i.e. gazetteer, postal code, etc.	International standard
ISO 19113:2002 Quality principles	Defines the principles, the elements/sub-elements of data quality	Superseded by 19157
ISO 19114:2003 Quality evaluation procedures	Defines procedures for determining data quality	Superseded by 19157

# ISO Metadata related standards

Name of Standard	Description	Status
ISO 19115:2003 Geospatial metadata	Defines metadata elements and schema describing geospatial datasets	Superseded by 19115-1
ISO 19115-1:2014 Geospatial metadata fundamentals	Revision of ISO19115 which defines metadata elements and schema describing geospatial resources i.e. datasets and services	International standard
<b>ISO 19115-2:2009 Extensions for imagery and gridded data</b>	<b>Defines additional metadata elements and schema describing imagery and gridded geospatial datasets</b>	<b>Under revision: 1<sup>st</sup> meeting 2015-06, CD 2016-03, DIS 2016-11, TS 2017-11</b>
<b>ISO 19115-3: XML schema implementation metadata fundamentals</b>	<b>Provides a schema for implementing ISO 19115-1 in XML</b>	<b>Under development: TS 2015-09</b>
ISO 19119:2005 Services	Provides a framework and defines the metadata for services enabling users to access and process geographic information across a generic computing interface. The metadata portion of this standard has been moved to ISO19115-1	Partially superseded by 19115-1
ISO 19130:2010 Imagery sensor models for geopositioning	Specifies a sensor model describing the physical and geometrical properties of specific sensors	International standard

# OGC ISO Metadata related standards

Name of Standard	Description	Status
<b>ISO 19130-1 Imagery sensor models for geopositioning</b>	<b>Revision of ISO 19130-1</b>	<b>Under revision: CD 2015-12 DIS 2016-06, IS 2017-06</b>
ISO 19130-2:2014 Imagery sensor models for geopositioning SAR, InSAR, Lidar and Sonar	Specifies a sensor model describing the physical and geometrical properties for the stated sensors	International standard
ISO 19138:2006 Data quality measures	Defines commonly used measures for reporting data quality for the sub-elements defined in ISO 19113 and a structure so they may be maintained in a register.	Superseded by 19157
ISO 19139:2007 Metadata XML Schema implementation	Provides encoding rules and a schema for implementing ISO 19115 in XML.	International standard To be partially superseded by ISO 19115-3
<b>ISO 19139-1 Metadata XML Schema implementation</b>	<b>This revision will only include the encoding rules for metadata</b>	<b>Under revision: CD 2015-06 DIS 2016-06, TS 2017-06</b>
ISO 19139-2:2012 Metadata - XML schema for imagery and gridded data	Provides a schema for implementing ISO 19115-2 in XML	International standard

# ISO Metadata related standards

Name of Standard	Description	Status
ISO 19157:2013 Data Quality	Defines the principles and components for describing, evaluating, and the measures used for reporting data quality. Revising and replacing ISO 19113, 19114, 19138.	International standard
<b>ISO 19157-2 Data Quality XML Schema implementation</b>	<b>Provides a schema for implementing ISO 19157 in XML</b>	<b>Under development: TS 2016-05</b>
ISO 15836:2009 The Dublin Core metadata element set	Cross domain resource descriptions – not limited to specific resources	International standard

Name of Standard	Description	Status
W3C Data Catalog Vocabulary (DCAT)	An RDF vocabulary designed to facilitate interoperability between data catalogs published on the Web.	International standard



# Metadata standards

OpenGIS® Catalogue Services Specification	Specifies the interfaces, bindings, and a framework for defining application profiles required to publish and access digital catalogues of metadata for geospatial data, services, and related resource information.	OGC Standard
OGC® Catalogue Services Standard 2.0 Extension Package for eBRIM Application Profile: Earth Observation Products	Defines the way Earth Observation product metadata resources are organized and implemented in the Catalogue for discovery, retrieval and management.	OGC Standard
Ordering Services Framework for Earth Observation Products Interface Standard	Specifies the interfaces, bindings, requirements, conformance classes, and a framework for implementing extensions that enable complete workflows for ordering of Earth Observation (EO) data products	OGC Standard
OGC® OpenSearch Geo and Time Extensions	Specifies the Geo and Time extensions to the OpenSearch query protocol.	OGC Standard
FGDC CSDGM Application Profile for CSW 2.0 CAT2 AP FGDC	Catalogue Services based on the FGDC Content Standard for Digital Geospatial Metadata (CSDGM)	OGC Best practices

# Different categories of standards

## Semantic Interoperability

- **Definitional/content standards**
  - What to write
  - Optionality

### ISO 19115-1 Metadata

Title = name by which the resource is known

<<DataType>> CI_Citation
+ title : CharacterString
+ alternateTitle [0..*] : CharacterString
+ date [1..*] : CI_Date
+ edition [0..1] : CharacterString
+ editionDate [0..1] : Date
+ identifier [0..*] : MD_Identifier
+ citedResponsibleParty [0..*] : CI_ResponsibleParty
+ presentationForm [0..*] : CI_PresentationFormCode
+ series [0..1] : CI_Series
+ otherCitationDetails [0..1] : CharacterString
+ collectiveTitle [0..1] : CharacterString
+ ISBN [0..1] : CharacterString
+ ISSN [0..1] : CharacterString

Overview

- Item Description
- Topics & Keywords
- Citation

! title is required

Title



# Different categories of standards

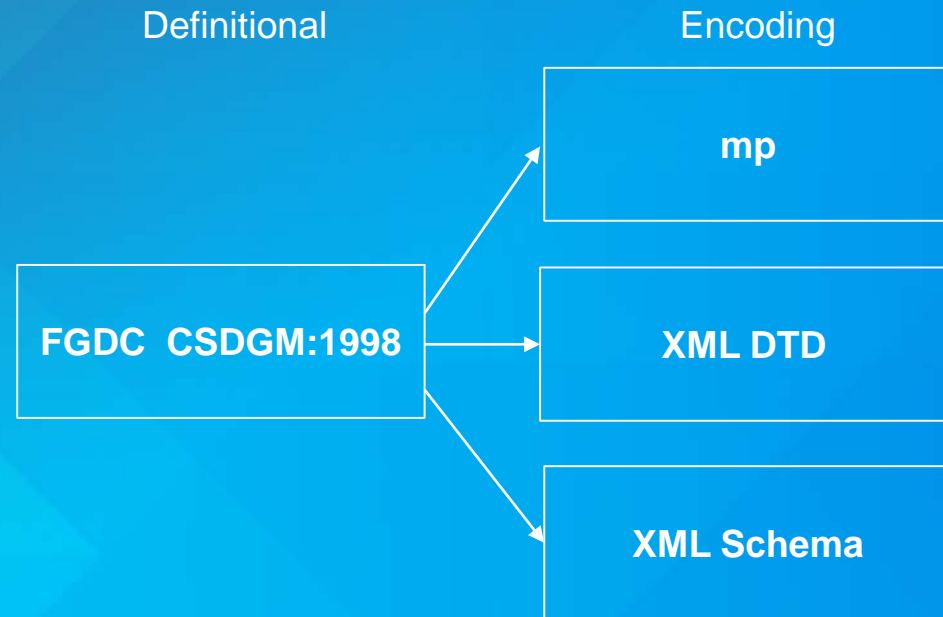
## Technical Interoperability

- Encoding/implementation specifications
  - Format
  - Validity

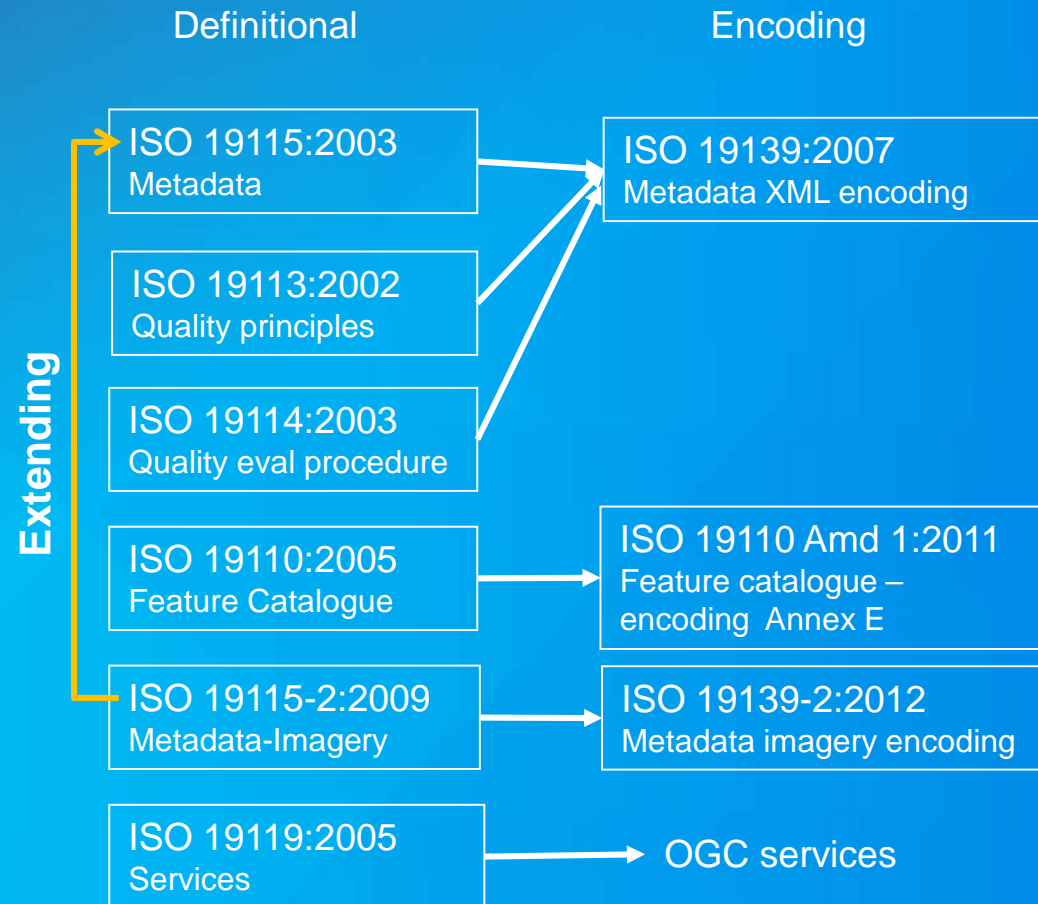


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  <MD_DataIdentification>  
    <citation>  
      <CI_Citation>  
        <title>  
          <gco:CharacterString>Types of vegetation within the park</gco:CharacterString>  
        </title>  
      </CI_Citation>  
    </citation>  
  </MD_DataIdentification>  
</identificationInfo>
```

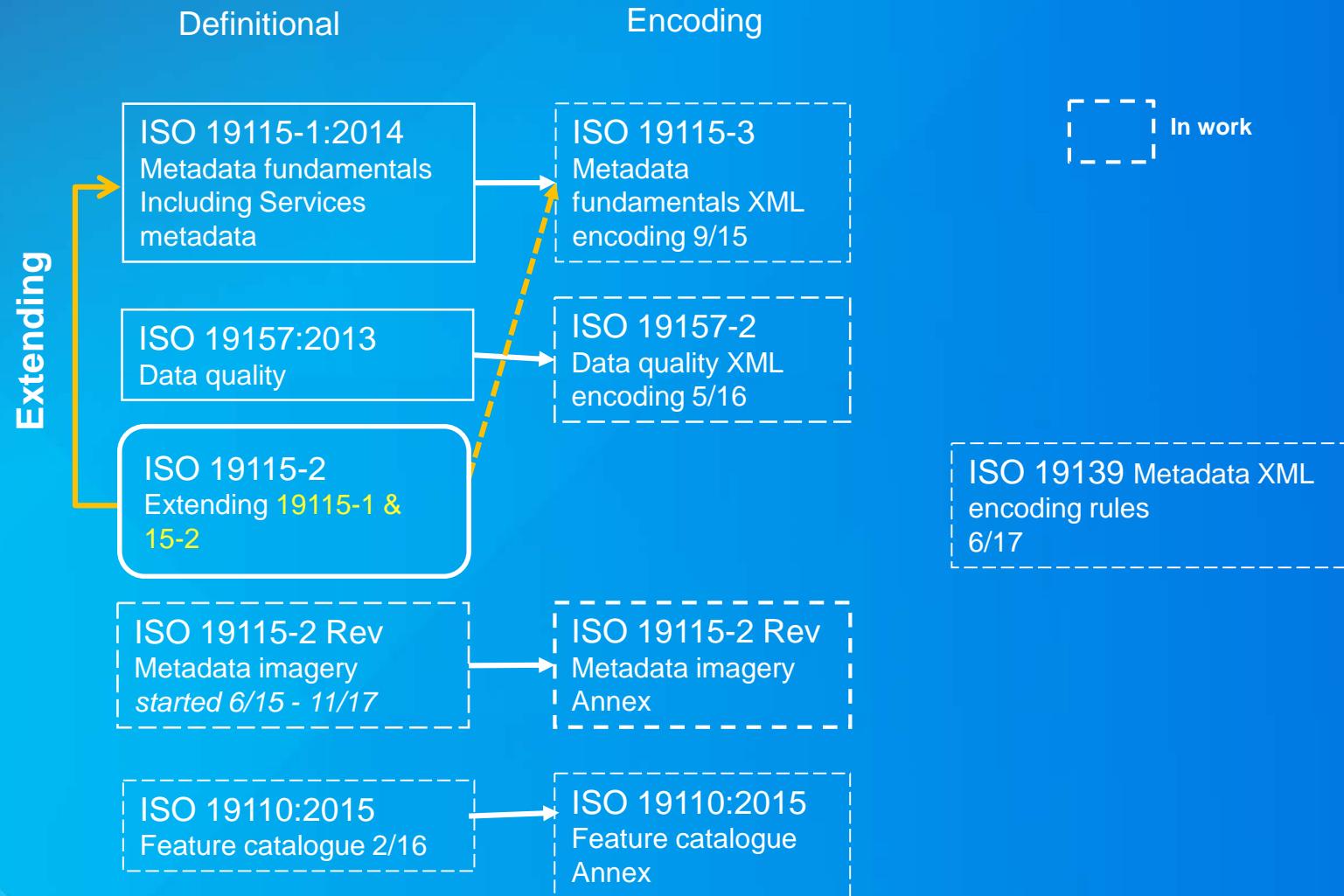
# Content Standard for Digital Geospatial Metadata (CSDGM)



# ISO metadata standards today



# ISO metadata standards future



# ISO 19115 (-1) 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)

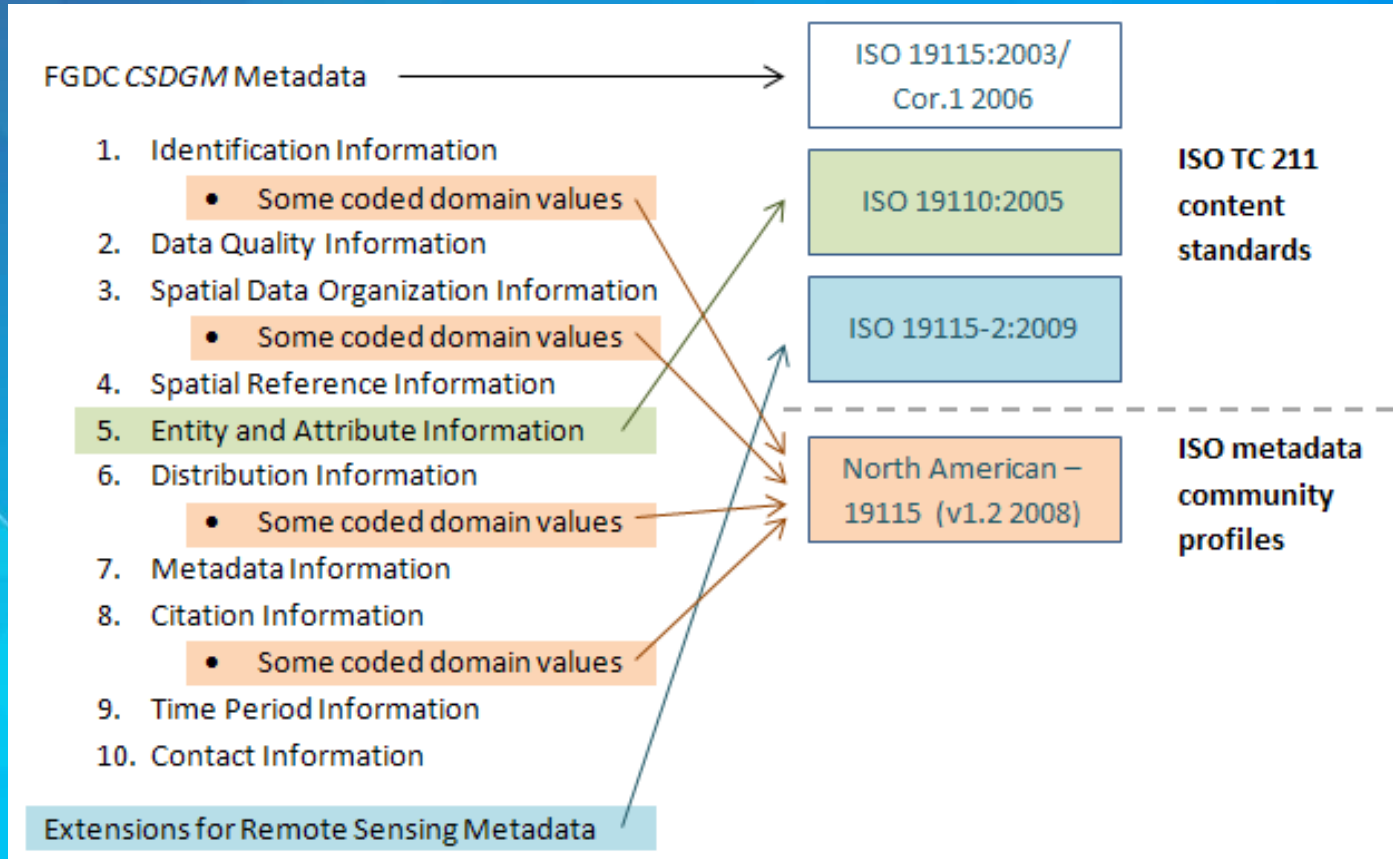
UK GEMINI

Biological profile

Coastal zone profile

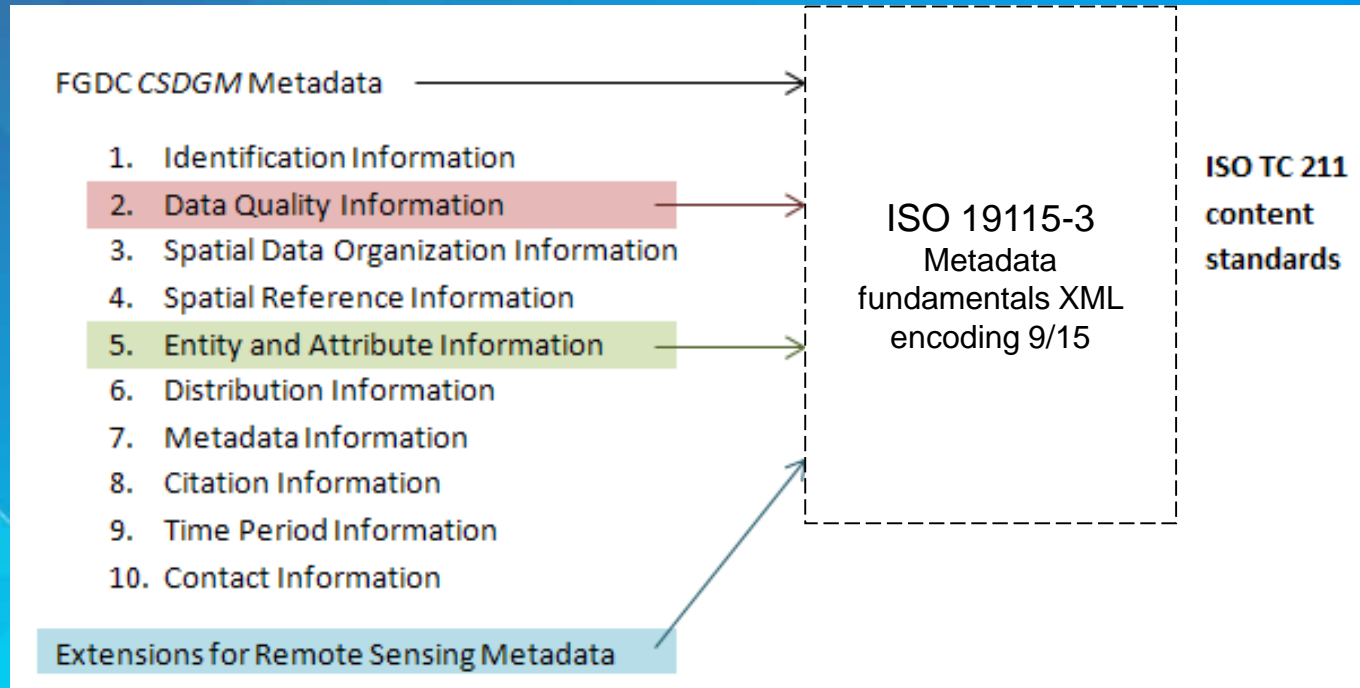
S100 Metadata profile (IHO)

# Comparison of CSDGM and ISO metadata standards





# Comparison of CSDGM and ISO metadata standards



# Metadata standard validation

- **Implementation specification XML Schemas published on the web by standards organizations**
  - Schemas published in several different locations
  - TC 211 recently upoloaded XML schemas to new central ISO repository
    - <http://standards.iso.org/iso/>

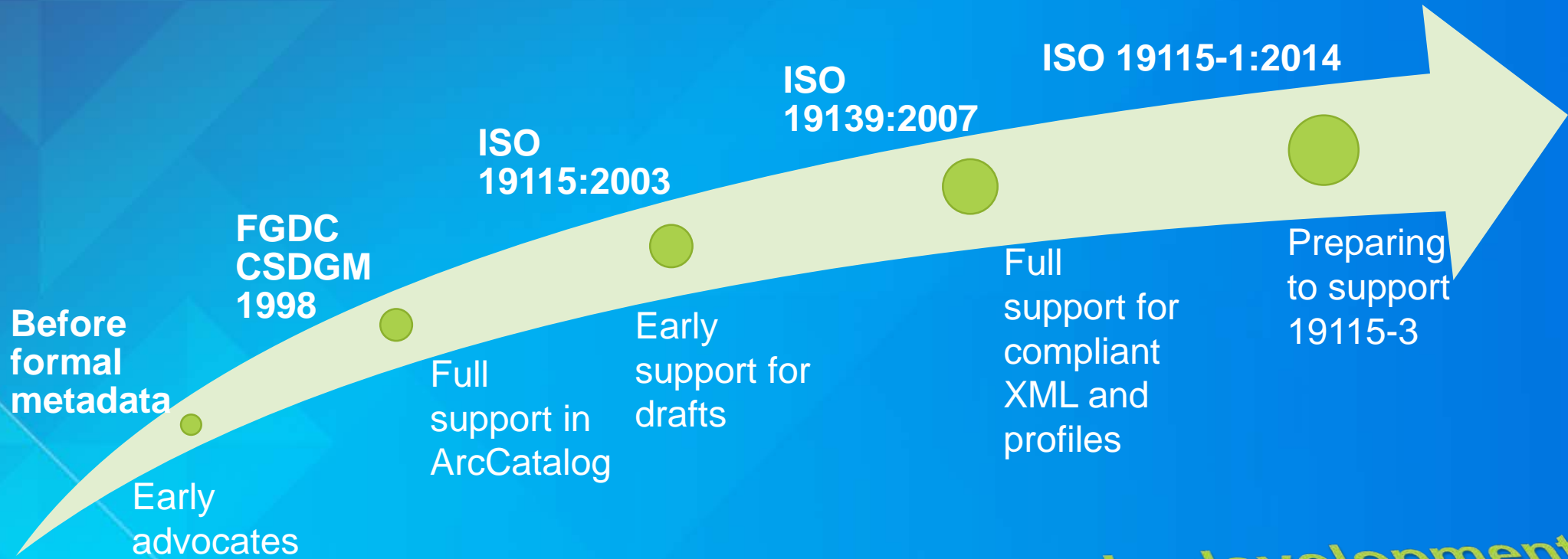
# Metadata standard validation

- **What are schematrons?**
  - **Supplement to XML Schemas**
  - **With to evaluate content standard rules not evaluated by XML Schemas**
  - **Profiles may provide to evaluate profile-specific rules**
  - **Run Schematrons as XSLTs to produce a report**

The background features a vibrant blue gradient. On the left side, there are several overlapping geometric shapes in shades of purple and yellow. A small, semi-transparent yellow map fragment is visible within one of these shapes. The text is centered in the upper right quadrant.

# Support in ArcGIS for Desktop

# Esri is committed to supporting metadata standards



**Participate in standards development**

# ArcGIS standards support

- *Content Standard for Digital Geospatial Metadata (CSDGM)*
- ISO 19115:2003 / ISO 19139:2007
- ISO 19119:2005 / OGC CSW 2008
- ISO 19110:2005 / ISO 19110:2005 Amd.1 2011 Annex E

# ArcGIS standards support

- **Profiles**
  - **North American Profile of ISO 19115:2003 (NAP)**
  - **INSPIRE Metadata Directive**
- **Both are based on ISO 19115/19139**
- **Both reference ISO 19119 content**

# ArcGIS uses a flexible system to support standards

- Content stored in the ArcGIS metadata format
- Includes all concepts for supported standards and profiles



# ArcGIS uses a flexible system to support standards

- **Concepts and rules tuned appropriately for your metadata style**
  - Pages added to or removed from the ArcGIS metadata editor
  - Elements added to or removed from a page as needed
  - Validation rules indicate, as you type, which elements are required

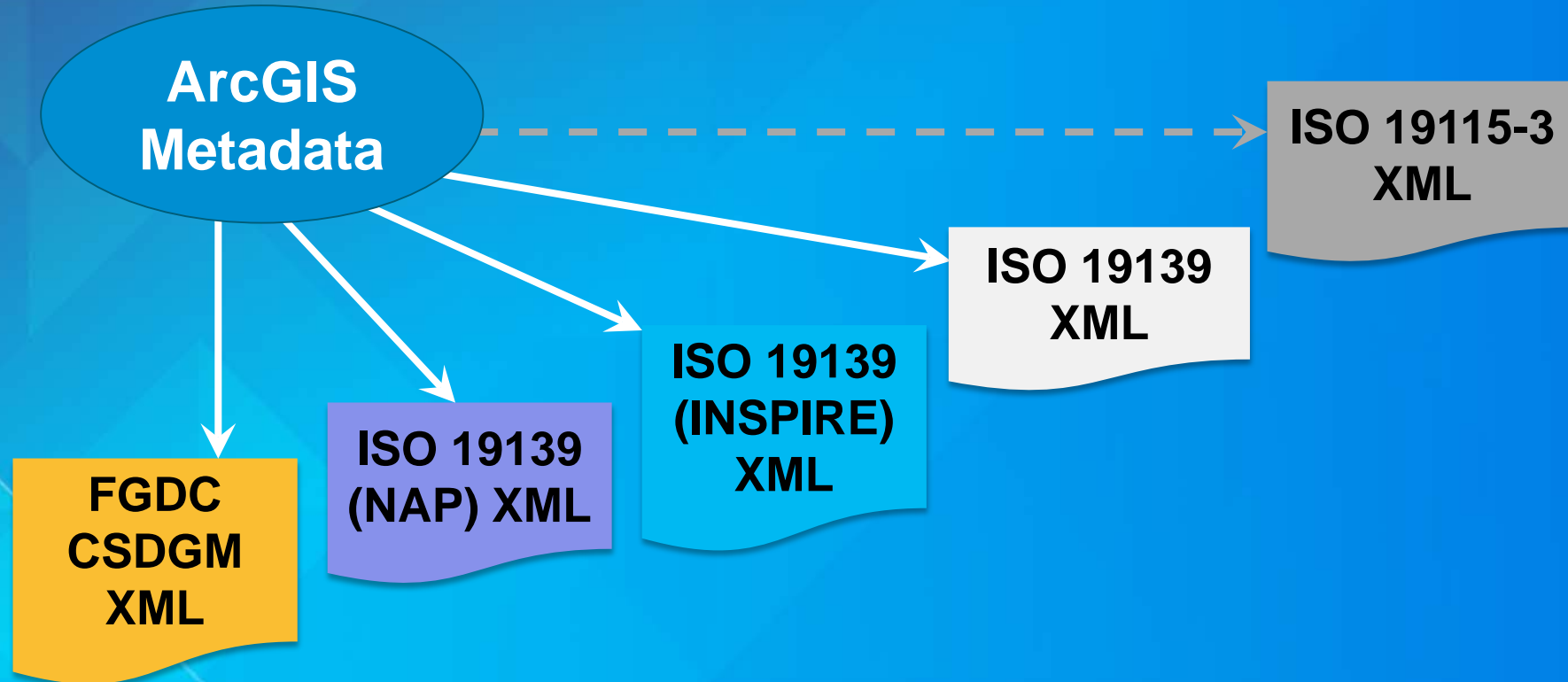
# ArcGIS uses a flexible system to support standards

- **Change your metadata standard—change the metadata style**
  - **Edit metadata, check if other content required**
  - **Export metadata to another standard format**
  - **Validate metadata for another standard**
  - **Publish to another metadata catalog**

# Export standard-compliant metadata to use outside ArcGIS

- **Export ArcGIS metadata content to a standard format XML file**
- **Validate exported file using XML schema provided by standards organization**
- **Use industry standard XML tools to validate**
  - **Microsoft .NET Framework XML capabilities**
  - **Provides warning and error messages**

# Export standard-compliant metadata to use outside ArcGIS



# Export standard-compliant metadata to use outside ArcGIS

- **Publish standard-format XML file to a metadata catalog**
  - **Some catalogs incorporate validation into the publishing process**
  - **Consider catalog rules as well as standard rules when editing metadata**

# ArcGIS standards support

- **A flexible system that adapts to changing standards**
- **Enhances interoperability**

# FGDC CSDGM Metadata Style

- **Prompt to upgrade FGDC CSDGM-format metadata**
  - Content appears at the bottom of metadata display
  - Read-only in the Description tab
- **Allow ArcGIS to automatically update content**
  - Spatial reference properties
  - Vector and raster data properties

# FGDC CSDGM Metadata Style

- **Search ArcGIS 10.3.x Help with keyword FGDC**
- **Creating and managing FGDC metadata – walks you through**
- **Differences between ArcGIS and CSDGM metadata**
- **Complete illustrated guide**



# FGDC CSDGM Metadata Style

- **Validation with online FGDC-provided XML DTD for validation**
- **Can validate metadata with mp**
  - **Export metadata to CSDGM-format XML file**
  - **Run USGS MP Metadata Translator tool with Conversion Type = None**
  - **Warning and error messages produced by mp**
  - **Use a custom model or script to combine export and mp validation**

# ISO 19139 Metadata Styles

- **Two ISO 19139 metadata styles provided since 10.2.1**
  - **ISO 19139 Metadata Implementation Specification**
  - **ISO 19139 Metadata Implementation Specification GML 3.2**
- **Same content and rules, different GML namespace in exported XML file**
- **Some metadata catalogs or tools may require XML files with one GML namespace or the other**

# ISO 19139 Metadata Styles

- **Validate button: validates using online ISO XML Schemas**
- **Reference ISO 19139 XML Schemas provided in different locations on the web**
  - **Original style references online XML Schemas using GML 3.2.0**
  - **GML 3.2 style references online XML Schemas using GML 3.2.1**
- **No difference in result for metadata created in ArcGIS for Desktop**

# North American Profile (NAP) Style

- **Additional codelist values and mandatory elements**
  - Supports tighter transition from CSDGM
- **NAP-specific rules available in the editor**
- **No NAP-specific XML Schemas**
- **Exported metadata validates with ISO 19139 for data or CSW for services**

# INSPIRE Metadata Directive Style

- Supports creating ISO metadata that conforms to the INSPIRE Metadata Directive
- Limited codelist values in the editor as appropriate
- INSPIRE-specific rules available in the editor
- Exported metadata validates with ISO 19139 for data or CSW for services

## Other ISO Standards and Profiles

- **Complete ISO 19139 content is supported with the ISO 19139 metadata style**
- **Follow the rules for your standard or profile, ignoring 19139-specific rules as appropriate**

## Other ISO Standards and Profiles

- **Use the ArcGIS Metadata Toolkit to customize the ArcGIS metadata editor**
  - Download from [support.esri.com](http://support.esri.com)
  - Latest version supports 10.3.x
  - Create a custom metadata style
  - Documentation for the ArcGIS metadata format

# Other ISO Standards and Profiles

- **Toolkit provides code for all pages in the metadata editor**
  - **C# WPF application with XAML forms**
  - **Modify elements on existing pages**
  - **Add custom pages**
  - **Change codelist values**
  - **Change validation rules**
- **Programming guide**
- **Sample project**



# What's next for ArcGIS

- **Provide support for creating standard-compliant metadata in ArcGIS Pro**
- **Improved metadata support across the ArcGIS platform**
- **Support new ISO metadata standards after XML Schemas are finalized**
- **Update styles to reference schemas from new repository**

# Leveraging Metadata Standards in ArcGIS for Interoperability

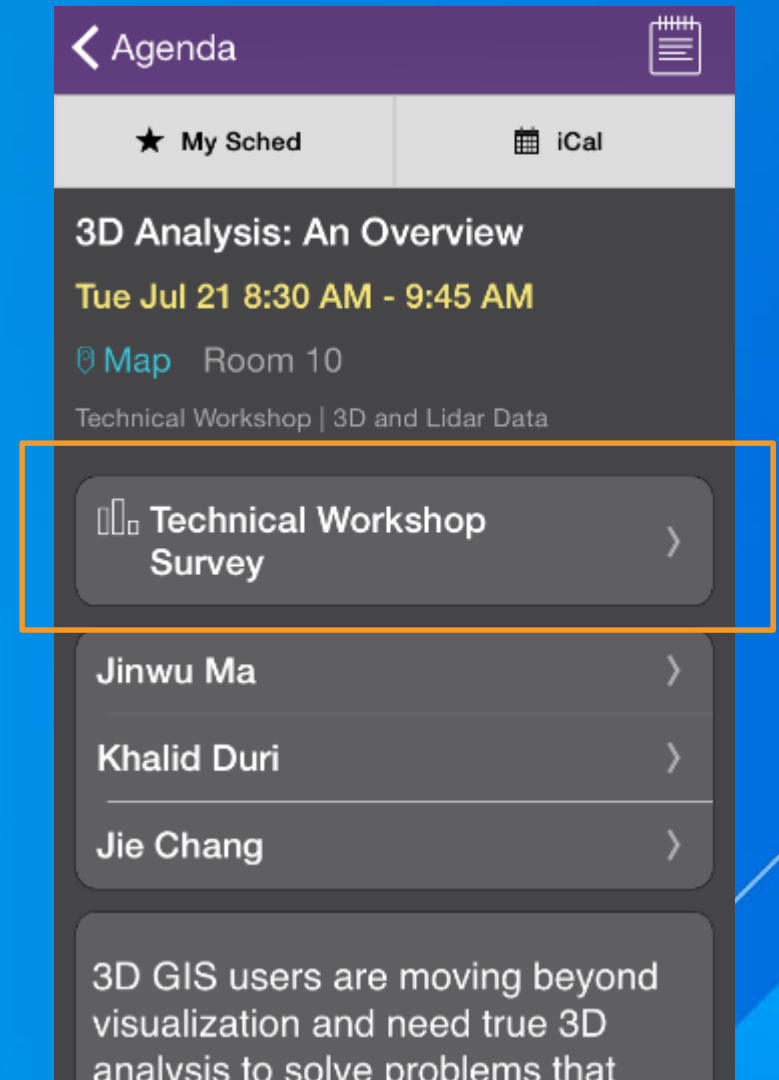
- **Data interoperability requires metadata interoperability**
- **Metadata important in ArcGIS**
- **The best metadata tool for anyone concerned with interoperability**

# Remaining metadata sessions at this UC

- **Working with Metadata in ArcGIS**
  - Wednesday 1:30 - 2:45 Ballroom 6 D
  - Thursday 3:15 - 4:30 Room 32 B
- **Metadata Special Interest Group meeting**
  - Wednesday 5:30 – 7:00 Room 12

# Thank you...

- Please fill out the session survey in your mobile app
- Select "Leveraging metadata standards in ArcGIS to support Interoperability" in the Mobile App
  - Use the Search Feature to quickly find this title
- Click "Technical Workshop Survey"
- Answer a few short questions and enter any comments
- Paper surveys
  - Offering ID: 1734





Understanding our world.