Framework Data Content Base Standard

Course Information

The National Spatial Data Infrastructure (NSDI) Framework is a collaborative initiative to develop geographic datasets that are compatible based upon spatial location and content. The Framework approach allows data collected for variety of reasons and agencies to work together seamlessly; which can ultimately reduce project costs and increase interagency cooperation. The Framework Data Content Base Standards Suite dictates the requirements for Framework data.

This course covers the fundamentals of the Framework Data Content Base Standard which addresses the components which are contiguous throughout each of the Framework Standards. It is designed for users who are both interested in an overview of the Framework Data Content Base Standard as well as designers and developers implementing Framework data, and associated tools.

Prerequisites

- General Understanding of GIS, Geospatial Data and Metadata
- Familiarity with the FGDC and NSDI
- Basic knowledge of Geographic Data Standards (specifically ISO 19100 series)

Related Topics

NSDI Training Tracks:
An initiative to define areas, topics, and materials for training within the NSDI.

ISO 19100 Series:
Suite of standards developed for geographic data and datasets. The most notable is ISO 19135 which pertains to metadata.

ANSI Standards:
Similar work to ISO, but standards directly apply to data created within the United States.

FederalGeographicDataCommittee fgdc

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Framework Data Content Base Standard

Course modules

- **Understanding Framework**

- **Framework Data Content Standards Suite**

- **Framework Data Content Base Standard**

- **Implementing the Framework Base Standard**

- **Course Review and Comprehensive Self-Test**

Estimated Time

Estimated time for the entire course is 180 minutes.

Learning Objectives

Module 1:
- Framework Concept
- 7 Thematic Elements of Framework
- Key Contributors
- Practical Uses for Framework

Module 2:
- Framework Data Content Standards
- Need for Framework Standards
- Difference between Framework and data transfer standards
- Framework Standards Structure

Module 3:
- Purpose of the Framework Base Standard and its importance
- How the Base Standard differs from the thematic Framework standards
- Who to contact for assistance with the Framework Base Standard

Module 4:
- Requirements for Framework conformity
- Encoding and Implementation
- Specific Modeling and Markup Languages to use

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Pre-Test

Instructions:

This pre-test is designed to assess your understanding and knowledge of Framework and the Framework Base Standard before starting this course. Don't worry about right or wrong answers; make a note of topics you may need to concentrate on as you take this course. Good Luck!

Proceed To

Framework Pre-Test

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Match the answer from column 2 to the word or phrase in column 1 that it most correctly defines.

Column 1

Framework

Framework Standards

Framework Base Standard

Framework Themes

Column 2

A. a suite of standards designed to address requirements specific to Framework data

B. general structure for all GIS data currently in use

C. 7 themes of commonly used geospatial data

D. common ideas in Framework

E. basic requirements of all Framework standards

F. an initiative to develop a readily available set of basic geospatial data

G. a step-by-step guide to creating Framework data

Answers: Framework – F, Framework Standards – A, Framework Base Standard – E, Framework Themes - C

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Module 1: Understanding Framework

Topics

- **What is Framework**

- **Seven Thematic Components**

- **Why is Framework Important**

- **Framework Organizations**

- **Practical Uses of Framework**

- **Module Exercise and Summary**

First Topic

What is Framework

Time Requirement

Estimated time for this module is 25 minutes

Key Terms

Framework
Thematic Elements
NSDI
FGDC
Geospatial
GIS

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

What is Framework

Framework is a set of common themes of geospatial data that provide the basic data "skeleton" needed by users of Geographic Information Systems (GIS). The data layers that make up the Framework are the bones on which state agencies, local and county governments, tribal governments, academic GIS users, and the private sector can build their own GIS data. Framework data layers are intended to be made available to the user community as freely and as easily as possible.

Key aspects of Framework:

- **Seven themes of most commonly used digital geospatial data**
- **Procedures, technology, and guidelines that provide for integration, sharing, and use of these data.**
- **Institutional relationships and business practices that encourage the maintenance and use of data.**

Key benefits of Framework:

- **Facilitate production and use of geographic data**
- **Reduce overall operating costs for geographic data clients**
- **Improve service and decision-making**

next Topic

Seven Thematic Elements of Framework

Quick Facts

Although the Framework concept had been discussed since the 1970s, 1996 marked the first year that the FGDC began funding Framework related projects

The Bigger Picture

The ultimate goal of Framework and the Framework Data Content Standards is to provide uniformity to data and data sources. In doing so data becomes accessible to more users, and reduces cost in data redundancy.
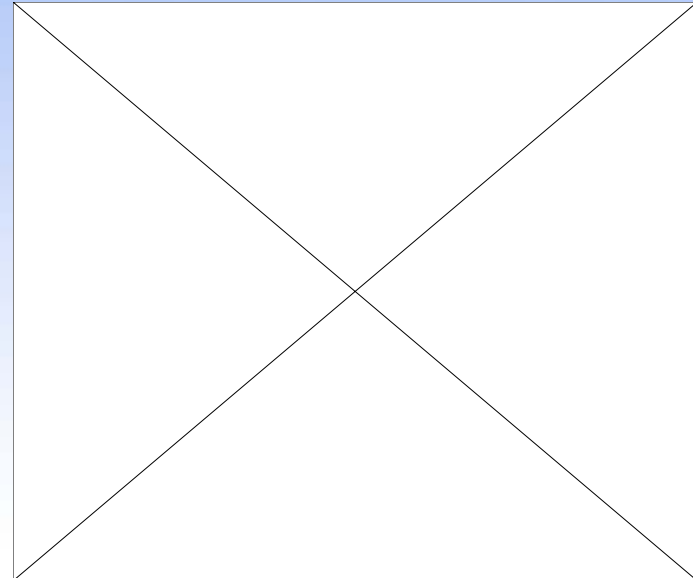
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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Seven Thematic Elements of Framework

Geographic data users from many disciplines have a recurring need for a few themes of basic data:

- **Cadastral information**
- **Orthoimagery**
- **Elevation**
- **Geodetic control**
- **Hydrography**
- **Governmental units**
- **Transportation**

Many organizations produce and use such data every day. These themes comprise the core geospatial data used by most Geographic Information Systems (GIS) applications. Essentially, the NSDI seeks to assemble this basic geospatial data nationwide and the Framework is the foundation for this effort.

next Topic

Framework Theme: Cadastral
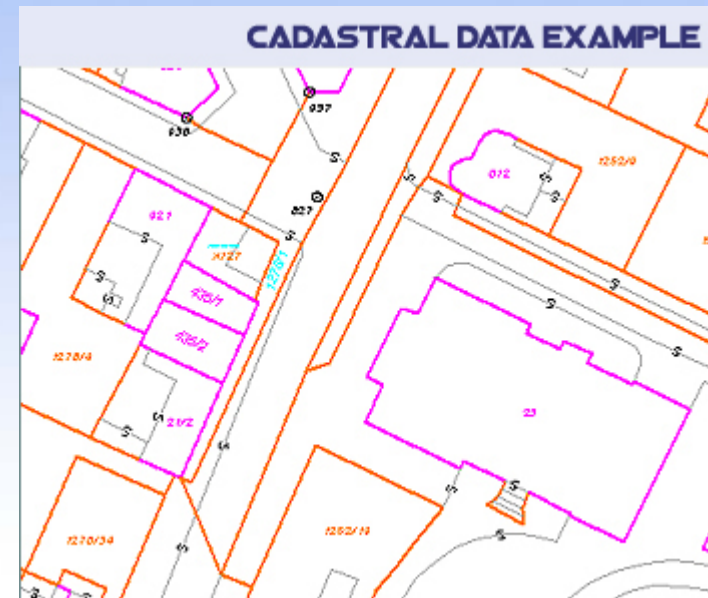
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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework Theme - Cadastral

Cadastral data describes the geographic extent of past, current, and future right, title, and interest in real property, including above, surface, and below ground and water, and the foundation to support the description of that geographic extent. Cadastral information can include reference systems such as the Public Land Survey System (PLSS) and similar systems for areas not covered by the PLSS (for example, the Connecticut Western Reserve in Ohio). It also includes publicly administered parcels, such as military reservations, national forests, and state parks, as well as marine jurisdictions. The Framework also provides a means to link existing parcel data into the larger cadastral network.

CADASTRAL DATA EXAMPLE

next Topic

Framework Theme: Digital Orthoimagery

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Framework Theme - Digital Orthoimagery

Digital orthoimagery is georeferenced images of the Earth's surface, collected by a sensor in which image object displacement has been removed for sensor distortions and orientation and for terrain relief.

Many geographic features, including those that are part of the Framework, can be interpreted and compiled from an orthoimage. Orthoimages can also serve as a backdrop to reference the results of an application to the landscape. The Framework may include imagery that varies in resolution from sub meter to tens of meters. Accurately positioned, high-resolution data (pixels of 1 meter or finer) are presumed to be the most useful for supporting the compilation of Framework features, particularly those that support local data needs.

DIGITAL ORTHOIMAGERY DATA EXAMPLE

next Topic

Framework Theme: Elevation

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA
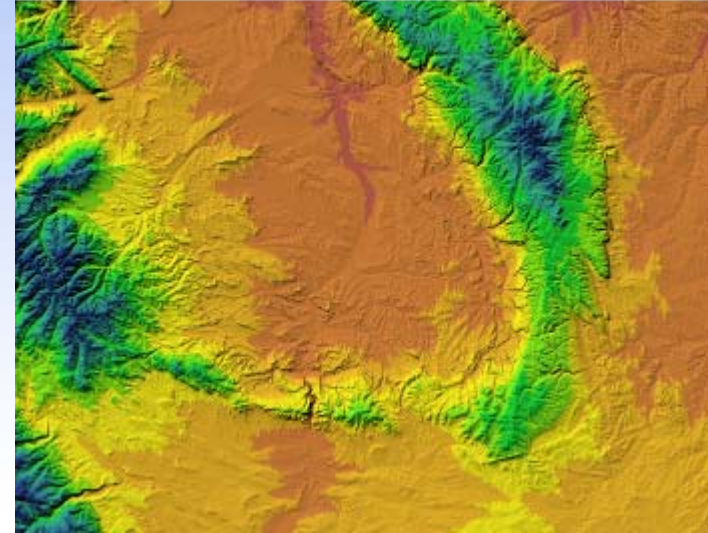
Framework Theme - Elevation

Elevation data provides information about terrain. Elevation refers to a spatially referenced vertical position above or below a datum surface. The Framework includes the elevations of land surfaces and the depths below water surfaces (bathymetry). Elevation and bathymetry may be modeled in various forms, such as in an evenly spaced grid or as irregularly spaced points (triangulated irregular network, hypsography, mass points).

Elevation data are used in many different applications. Users may want a representation of the terrain, such as a contour map, spot elevations, or a three-dimensional perspective view. Elevation data are also used to build models and perform applications, ranging from line-of-sight calculations, to road planning, to water runoff. Elevation data are also combined with other data themes in applications and mapping.

ELEVATION DATA EXAMPLE

next Topic

Framework Theme: Geodetic Control

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework Theme - Geodetic Control

Geodetic control provides a common, consistent, and accurate reference system for establishing coordinates for all geographic data. The fundamental geodetic control for the United States is provided through the National Spatial Reference System (NSRS) managed by the National Oceanic and Atmospheric Administration (NOAA).

Geodetic control information plays a crucial role in developing all Framework data and users' applications data, because it provides the spatial reference source to register all other spatial data. In addition, geodetic control information may be used to plan surveys, assess data quality, plan data collection and conversion, and fit new areas of data into existing coverages.

GEODETIC CONTROL MARKER

next Topic

Framework Theme: Governmental Units

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework Theme **-** Governmental Units

Governmental units include the nation, tribes, states, counties and statistically equivalent areas, incorporated places and consolidated cities, functioning and legal minor civil divisions, federal- or state-recognized American Indian reservations and trust lands, and Alaska Native regional corporations.

Governmental unit boundaries are used for a wide variety of applications. Some need the boundaries only for information and orientation; others require the polygons to determine inclusion related to a number of other features. Business GIS is a very active field that uses these boundaries for statistical analysis and decision making.

GOVERNMENTAL UNIT DATA EXAMPLE

West Virginia Counties

next Topic

Framework Theme: Hydrography

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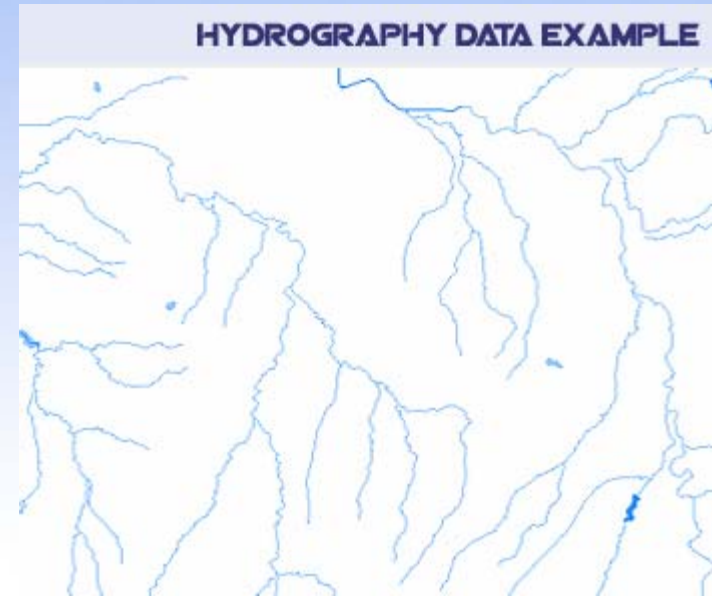FAQ

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework Theme - Hydrography

Hydrography includes surface water features such as lakes, ponds, streams and rivers, canals, oceans, and coastlines. Each hydrography feature is assigned a permanent feature identification code and may also be identified by a feature name. Spatial positions of features are encoded as flowlines and polygons. Network connectivity, direction of flow, and a linear referencing system are also encoded.

Hydrography is important to many applications. As with other data themes, many users need hydrographic features as reference or base map data. Other applications, particularly environmentally oriented analyses, need the information for analysis and modeling of water supply, pollution, flood hazard, wildlife, development, and land suitability.

next Topic

Framework Theme: Transportation

HYDROGRAPHY DATA EXAMPLE

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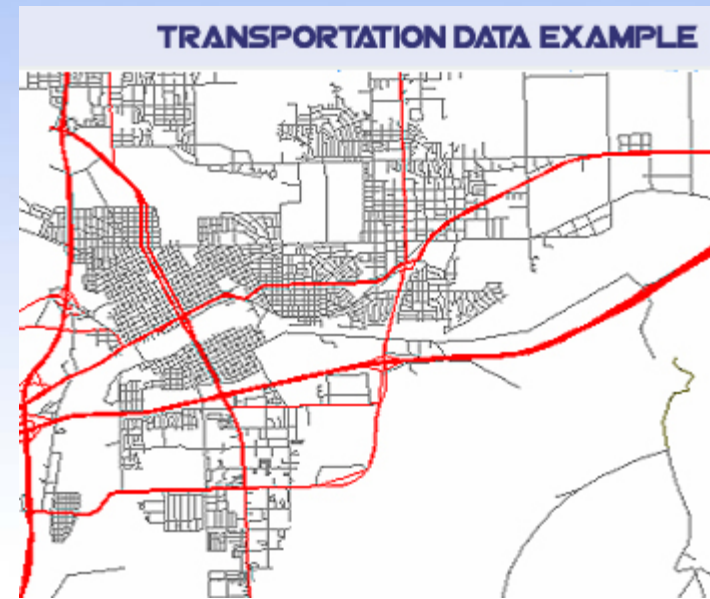# NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework Theme - Transportation

Transportation data are used to model the geographic locations, interconnectedness, and characteristics of the transportation system within the United States. The transportation system includes both physical and non-physical components representing all modes of travel that allow the movement of goods and people between locations. Sub-themes representing the physical components of the transportation infrastructure include the road, railroad, transit, and waterway networks, plus airport facilities.

Transportation features and related data are important elements of many planning applications. Geocoding applications use road and related address data for uses ranging from marketing analysis to site identification. Routing applications use street network data for operations such as vehicle dispatch and fleet management.

TRANSPORTATION DATA EXAMPLE

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Why Framework is Important

Framework leverages individual geospatial data efforts so data can be shared. It provides basic geospatial data in a common format and an accessible environment.

Common standards and guidelines provide GIS data developers with a template to use and expand, as needed, rather than developing their own from scratch. As more organizations participate, the data pool widens, and more resource savings and operational benefits are realized. In addition, Framework data can be used to address phenomena that do not adhere to jurisdictional boundaries or predefined regions. Users can perform cross-jurisdictional and cross-organizational analyses and operations.

Not only does Framework ensure trustworthy data – the best available data for an area, certified, and described according to a common standard, it also includes procedures, guidelines, and technology to enable participants to integrate, maintain, and distribute Framework data. Organizations can funnel their resources into applications, rather than duplicating data production efforts.

Framework addresses these common problems

1. **Most organizations need more data than they can afford. Often, large amounts of money are spent on basic geospatial data, leaving a shortage of funds for applications and project development. Some organizations cannot afford to collect base information at all.**

2. **Organizations often need data outside their jurisdictions or operational areas. They do not collect these data themselves, but other organizations do.**

3. **Data collected by different organizations are often incompatible. The data may cover the same area but use different geographic bases and standards. In addition, information needed to solve cross-jurisdictional problems is often unavailable.**

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Framework Organizations

Framework Organizations

The Federal Geographic Data Committee (FGDC), Geospatial One-Stop (GOS), and The National Map are three national geospatial initiatives that share the goal of building the NSDI. FGDC focuses on policy, standards, and advocacy; GOS focuses on discovery and access; and The National Map focuses on integrated, certified base mapping content. The National Geospatial Programs Office (NGPO) of the U.S. Geological Survey is the organizational host for these complementary activities.

While the above entities are key players in providing guidance and tools to implement Framework, the data itself comes from multiple sources: local, state and federal government, tribes, and the private sector. *The Framework is built from the ground up* as organizations share data and coordinate data development. To assist this ground-up implementation, USGS Geospatial Liaisons work with state coordination councils to develop specific NSDI implementation plans that are built on the strategic and business plans for each council.

Partnerships are key

Similar government entities, such as neighboring counties, or a county and city within its boundaries, may partner to combine data for a larger area. Two states may collaborate for an issue that crosses their borders. Two federal agencies may have a common interest in an area.
Public and private sector organizations, such as utilities and local governments, often have common land interests.

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Practical Uses for Framework

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Practical Uses for Framework

In times of crisis, first responders of all disciplines rely on continuous streams of detailed and updated information to effectively respond to disasters and speed recovery. In particular, geospatial information facilitates informed decisions and improves communication throughout the emergency response community. While geospatial information and technologies are integrated into the emergency response mechanisms in a number of cities, counties, and states, much work remains to be done to improve the overall status of national preparedness (Napier, 2003).

The need for detailed, up-to-date information for emergency response is one critical example of a practical need for Framework. Framework seeks to provide consistent data coverage to aid users working in geographic areas of different sizes and shapes. The Framework also supports users who need both detailed and generalized data. These realities mean that users will inevitably require data from more than one Framework effort, spanning all or part of several regional or even statewide Framework efforts.

Next Topic

Framework at the National Level

The Bigger Picture

Challenges to the geospatial community are often not as much related to technology as they are in managing the quantity and quality of available information, synthesizing that information to ensure completeness and consistency, making this information readily available and interoperable, and – particularly – developing business models that stimulate data sharing and commitments to long-term information stewardship (Ogrosky, 2003).

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework at the National Level

National Map: http://nationalmap.gov

- Provides access to networked databases of current information about the Nation's landscape.
- Consistent structure for geographic knowledge needed by the Nation
- Builds data sharing and data update partnerships at multiple levels

GeoSpatial One-Stop: http://www.geo-one-stop.gov

- Provides a comprehensive public portal (www.geodata.gov) for geospatial information from federal agencies and a growing number of state, local, tribal, and private agencies
- Advanced information on future investments in geospatial information provides opportunities for collaboration and intergovernmental partnerships
- Builds communities around data categories through the efforts of "data stewardship leaders"

The Challenge

If the National Map is going to work, it will be built up from the local level to create an integrated national collection of spatial data. That will require strong local teams, working together in regional groups across political boundaries, to create parts of what will be brought together into a whole by a national team of partners from all levels of government and the private sector. This is a complex institutional challenge. The National Map cannot be completed by any one agency or level of government. It can only be accomplished through partnerships and teamwork, built on shared efforts and success.

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework at the State Level

Delaware's Framework, like *The National Map*, depends on data from a variety of sources, at different scales and resolutions. Different spatial data communities in Delaware recognized the advantages of the Framework concept, and started talking with staff from the USGS about ways to combine USGS Digital Line Graph data with more recent, often more accurate, local data. More importantly, a place was needed to update those data in real time, to combine and compare data, and to host discussions: a "collaboration laboratory".

The result is the Data Mapping Integration Laboratory (DataMIL), an Internet portal that offers public access to Delaware's Framework and information about its GIS community. DataMIL offers access to several information pathways that lead users into a map production lab, a map integration lab, a set of data maintenance forums, and a metadata explorer. (Mahaffie, 2003)

Nuts and Bolts

Delaware's Framework began with a committee comprised from different geospatial data agencies, with a broad mission to facilitate data sharing. In 2000, the GIS community met to ratify a Delaware Spatial Data Framework to make use of existing data. This let the community formally recognize the stewardship of those members ready to provide Framework data and to bring along (sometimes slowly) those who were almost ready. In 2001, the Delaware Spatial Data Implementation Team (I-Team) was created to oversee maintenance and improvement of Delaware's Framework.

Next Topic

Framework at the Local Level

NSDI

NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework at the Local Level

Data produced by county and municipal governments is an important aspect of Framework since it is often the most accurate and timely information available for an area. The FEMA Flood Hazard Map Modernization Program (MAP MOD) relies on both national and local data sets as vital components in the production of updated digital flood maps.

In Wyoming, MAP MOD is integrating local, state, and regional partnerships into the mapping process by building on their knowledge and data development efforts. Framework data, such as the National Hydrography Dataset (NHD), is used in creating cost estimates and study area reach lengths for local data development efforts. FEMA is dependent on local and state support for data exchange and updates. The more local data a base map can contain the more accurate and useful a new or enhanced FEMA flood hazard map can be.

Review Exercise and Summary

The Challenge

In the past, involving local organizations in the NSDI has usually been in the form of a "give us your data" approach. An important challenge to the Framework at the local level is engaging state and local governments to become contributors to, and users of Framework data models, standards, and guidelines. This community-based approach recognizes regional councils as a key mechanism for linking local data with the state and federal levels.

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<u>Understanding Framework Exercise</u>

Framework in action

Framework is not just an abstract concept, but is being applied and used in real world projects. The previously mentioned Delaware DataMIL is one such example. Now that you have the basics of the project let's go see Framework in Action!

Step 1) **Open an Internet Browser and proceed to:**
     http://datamil.delaware.gov

Step 2) **Find the MapLab link and click it to open the interactive map window**

Step 3) **Explore the website's features, then design and print a map of your choice**

Step 4) **Explore the other features that comprise the DataMIL website**

Step 5) **Close all DataMIL Internet windows and proceed with the course**

Next Topic

Module Summary

NSDI

NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Module **1** Summary

Understanding Framework

- Framework is a set of geospatial data that provides the basic data "skeleton" needed by users of Geographic Information Systems (GIS).

- Seven themes comprise the overall Framework infrastructure: Cadastral, Orthoimagery, Elevation, Geodetic Control, Hydrography, Governmental Units, and Transportation

- Participation and collaboration by federal, tribal, state, local, and private agencies will benefit the entire GIS community and advance the National Spatial Data Infrastructure

- Framework data reduces costs, increases data interoperability, and facilitates interagency cooperation.

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Module 2: Framework Data Content Standards Suite

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Module 2: Framework Data Content Standards Suite

Topics

- **What are the Framework Data Content Standard Parts**

- **Purpose for Standard Suite**

- **Hierarchy of Standard Parts**

- **Standard Related Contact Information**

- **Module Exercise and Summary**

Key Terms

Spatial Data

Transfer Standard

Framework

Standards

Hierarchy

First Topic

What are the Framework Data Content Standard Parts

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What Are The Framework Data Content Standard Parts

Framework in action

The Framework Data Content Standards are:

- **A suite of standard parts that collectively define minimum requirements for data to be considered Framework data**

- **Each of the seven themes has its own standard part, and potentially sub-parts.**

- **None of the individual Framework Standard parts can stand on its own.**

  - *Only when a dataset meets both the requirements set forth in a thematic standard part(s) and the Framework Base Standard can it be considered Framework data.*

Next Topic

Purpose for the Standards

Quick Facts

Each standard part was developed and edited by thematic experts

Certain themes have additional pieces to address sub components. For example Transportation has separate parts to address different elements (i.e. roads, airports, etc.)

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Purpose for the Standard Suite

The purpose of the Framework Data Content Standard is to provide guidelines for creating and documenting data that allows computer software to use a set of characteristics to parse data sets and test for compatibility. It does not to define how a user must create data.

The Framework Standard is not a transfer standard; rather it is intended to structure data and information about data such that computers can communicate between each other to determine whether or not data sets are compatible for a certain project.

The Framework Data Content Standard dictates minimum requirements for certain thematic data and how that data is described; not how the data is packaged for transfer.

Additional Information

- Transfer standards are designed to enable the transfer of data between different computers while preserving data integrity.

- The Spatial Data Transfer Standard (SDTS) is the American National Standard (ANSI approved) for the transfer of geospatial data.

Next Topic

Hierarchy of Standard Parts

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Hierarchy of Standard Parts

Framework in action

Each Framework Data Content thematic part must be used in conjunction with both the Framework Base Standard and any sub parts that apply. The Base Standard lays a foundation on which the thematic Framework Standard pieces are built.

Example: A Framework compliant Roads Layer would meet all the requirements set forth in the following Framework Data Content Standards:
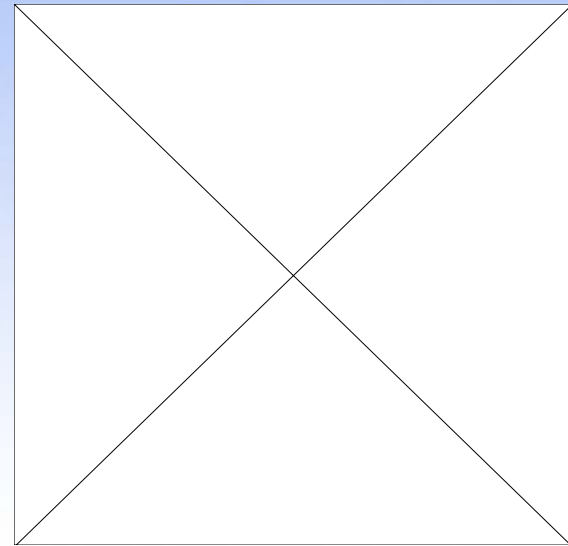
Framework
 ↑Framework Base
   ↑ Transportation Base (Part 7)
    ↑ Roads (Part 7c)

Note: Data must meet the qualifications for all relevant pieces of the Framework Standards hierarchy to be considered Framework data.

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Contact Information

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Contact Information

Federal Geographic Data Committee Secretariat
c/o U.S. Geological Survey
590 National Center
Reston, Virginia 20192 USA
Telephone: 703-648-5514
Facsimile: 703-648-5755
Internet (electronic mail): gdc@fgdc.gov
WWW Home Page: http://www.fgdc.gov

How are Standards Standardized?

The American National Standards Institute (ANSI) has accredited the International Committee for Information Technology Standards (INCITS) as a standards development organization working under ANSI rules. Framework standards will go through the ANSI/INCITS standards process in order to secure broad non-Federal participation in their development and to take advantage of the technical expertise in ISO and ANSI standards that members of INCITS Technical Committee L1, Geographic Information Systems, can provide.

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Review Exercise

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<u>Framework data Content Standards Suite Exercise</u>

The purpose of this exercise is to explore the quantity and quality of Framework related information available on the Internet. Open an Internet browser window and perform a quick internet search (e.g. Google or Yahoo) for "FGDC Framework Standards" to answer the following questions:

1. How many results does the search engine return?
2. How useful are these sites in addressing what Framework is?
3. How many are filled with technical jargon?
4. Do any have examples of Framework in use?
5. Is your understanding of Framework significantly improved after performing this search?

Next Topic

Module 2 Summary

Points About framework

- Framework is useful and valuable

- Currently Framework is not a big concern with many agencies, however it is becoming more important and usage is on the rise

- General information on the concept of Framework isn't widely available

- Framework is the key to data continuity, cost reduction, seamless availability, and inter-agency co-operability.

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Module   Summary

Framework Data Content Standards Suite

- Is a suite of standard parts that collectively define the minimum requirements for data to be considered Framework data

- Each of the seven themes has its own part and in some cases sub-parts.

- The standards provide guidelines for creating and documenting data in a manner that can be parsed by a computer to find compatible datasets

- The Framework Standards are not data transfer standards (i.e. SDTS).

Next Topic

Module 3: Framework Data Content Base Standard

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Module 3: Framework Data Content Base Standard

Topics

- **What is the Framework Data Content Base Standard**

- **Why is the Base Standard Important**

- **Module Exercise and Summary**

Key Terms

Framework Data Content
Base Standard

Framework Data Content
Thematic Standards

Data exchange

Metadata

NSDI

First Topic

What is the Framework Data Content Base Standard

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What is the Framework Content Data Base Standard

The Base Standard is a set of common requirements for data exchange standards for the seven Framework themes (geodetic control, elevation, orthoimagery, hydrography, transportation, cadastral, and government unit boundaries). Each of these themes have very different content and structure, but the Base Standard outlines a common method for describing these disparate data themes and provides context for implementing each of the more specific thematic Framework Standard parts.
In a nutshell, the Base Standard provides a foundation on which the thematic Framework Standard parts can be built.

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What the Base Standard is not

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What the Base Standard Is not

The Base Standard is not meant to be used alone. It identifies required methods for describing data content, structure, and relationships. These methods are used in the thematic Framework standards to fully characterize and classify each of the elements in a theme and their relationships with each other.

The Base Standard is not to be confused with a metadata standard. Though the purpose of both standards is to describe data content, the Base Standard actually depends on a suite of standards (a feature model standard, an application schema standard, as well as a metadata standard) in order to fulfill its purpose.

The Base Standard does not provide any guidelines for how to create or structure data. It provides methods for *describing* how data is structured.

Quick Comparison

A metadata standard provides a common set of terms to communicate information about where the data came from, why it was created, how it was created, and what kind and quality of information it includes.

The Framework Data Content Base Standard provides all of the above, PLUS the means to communicate information that developers need to create software to parse data based on its characteristics.

Next Topic

Why is the Base Standard Important

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Why is the Base Standard Important

The Base Standard is the cornerstone for Framework. It sets the foundation and structure for all other Framework Standards. The intended users of the Framework Standards are system architects, database designers, and software developers. The Base Standard enables them to develop common methods of data exchange. Different sources of data may be structured in very different ways (even within the same theme!), but a standard way of describing the data content makes it much easier to develop tools to facilitate data acquisition and use.

The Base Standard provides a common starting point or foundation from which to implement the Framework Standards for each of the seven themes, resulting in more efficient implementation.

The Bigger Picture

A major goal of NSDI (National Spatial Data Infrastructure) is to provide a distributed network of foundation data to serve as a building block for the seamless mix of government and commercial data holdings available for information access and decision making.

The Framework Base Standard provides the documentation and description of data content that is key to creating this distributed network of reliable foundation data.

Next Topic

How is the Base Standard different from the seven thematic Framework Standards

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<u>How are the Base Standards different from the Thematic Framework Standard Parts</u>

The Base Standard has eight requirements for describing the data content of all thematic Framework data. Definitions and notations are provided for understanding how to implement these requirements.

The thematic standard parts define and describe conceptual data structures and relationships pertinent to each particular theme, using the methods outlined in the Base Standard.

A dataset that meets Framework Standards will have a document that adheres to its specific thematic part. It will not have a separate document that adheres to the Base Standard, as well. The Base Standard, rather, is a reference document to each of the thematic Framework Standard parts.

Examples

Terms defined in the Base Standard:

accuracy
application schema
metadata
permanent identifier

Terms defined in the thematic Framework Standard part for elevation:

convex hull
Delaunay transformation
rectified grid
triangulated irregular network

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Who to contact for questions about the Base Standard

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<u>Who to Contact for Questions about the Base Standard</u>

Federal Geographic Data Committee Secretariat
c/o U.S. Geological Survey
590 National Center
Reston, Virginia 20192 USA
Telephone: (703) 648-5514
Facsimile: (703) 648-5755
Internet (electronic mail): gdc@fgdc.gov
WWW Home Page: http://www.fgdc.gov

Next Topic

Review Exercise and Self-Test

Module **3** Exercises and Self-test

Two examples of a data dictionary from two different Framework standards are included below. Based on the descriptions of the Framework Base Standard and its relationship to the different thematic standard parts, as described in this unit, answer following questions.

Example A   Example B

Module 3 Exercise

Example A

Data dictionary table format

Line	Name/Role Name	Definition	Obligation/Condition	Maximum Occurrence	Data Type	Domain

Name/Role Name
The name/role name is a label assigned to a data dictionary or to a data dictionary element. The class name begins with an upper case letter. Spaces do not appear in an entity name: instead multiple words are concatenated, with each word starting with a capital letter (example: XnnnYmmm). Entity names are unique within the entire data dictionary of this standard.

Element names start with a lower case letter. Spaces do not appear in an element name: instead multiple words are concatenated, with subsequent words starting with a capital letter (example: xnnnYmmm). Element names are unique within an entity by the combination of the entity and element names (example: Dataset.name).

Role names are used to identify the roles of the classes at the ends of a model association and are preceded by the term "Role name" followed by a colon to distinguish them from other types of data dictionary elements.

Definition
The definition is the data or metadata entity description.

Back to Module 3 Exercise

NSDI

Example B

Data Dictionary

	Name/Role name	Definition	Obligation/ Condition	Maximum occur.	Data Type	Domain
1.	CV_Coverage		M	1		
2.	domainExtent	contains the extent of the spatiotemporal domain of the coverage. Data type EX_Extent is defined in ISO 19115.	M	*	Class	EX_Extent(19115)
3.	rangeType	describes the range of the coverage. Data type RecordType defined in ISO/TS 19103.	M	1	Class	RecordType(19103)
4.	commonPointRule	identifies the procedure for evaluating the CV_Coverage at a position that falls either on a boundary between geometric objects or in the boundaries of two or more overlapping geometric objects, where the objects are either CV_Domain or CV_Value Objects. Data type defined at 5.9.	M	1	Class	CV_CommonPointRule (?)
5.	role name: CRS	links the CV_Coverage to the coordinate reference system. SC_CRS is specified in ISO 19111.	M	1	Association	SC_CRS(19111)
6.	role name: domainElement	links the CV_Coverage to the set of CV_DomainObjects in the spatiotemporal domain.	M	1	Association	CV_DomainObject (?)

Back to Module 3 Exercise

NSDI

True or False: Example A is from the Framework Base Standard.

Answer: False

How does example A relate to example B?

A) example A shows the required format and explanations needed to implement a data dictionary for a specific theme such as example B

B) example A is the metadata for Example B

C) Example A is a subset of the data dictionary in Example B

D) Example A references information in Example B

Answer: A

<u>Module summary</u>

Framework Data Base Content Standard

- **Is a set of common requirements shared by the each of the Framework Data Content Standard parts**

- **Provides a foundation on which the seven thematic parts are built**

- **Is not a metadata standard, rather provides methods for describing how data should be structured**

- **Is a reference document to each of the thematic standard parts and sub-parts**

Next Topic

Course Progress Review

Before continuing let's take a break and test our newly acquired Framework knowledge. Click and drag the answer from column 2 to the word or phrase in column 1 that it most correctly defines.

Column 1

Framework

Framework Base Standard

Elevation

Column 2

A. the combination of requirements used by all Framework Thematic Standard parts

B. one of the 7 Framework themes

C. a sub-part of a Framework theme

D. a combined set of nationwide spatial data that can be used for GIS projects

E. the database where all governmental spatial data is stored

Answer: Framework - D, Framwork Base Standard - A, Elevation - B

NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Module 4: Framework Data Content Base Standard Requirements

Topics

- **Framework Data Content Base Standard Requirements**

- **Encoding and Implementing the Framework Standards**

- **Module Exercise and Summary**

First Topic

Framework Data Content Base Standard Requirements

NSDI

NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

<u>Framework Data Content Base Standard Requirements</u>

In this module you will learn about the eight different requirements for Framework data, as specified in the Framework Base Standard. Each requirement is addressed as a separate topic, however special attention will be given to the following, as they are the most crucial requirements for creating Framework data:

- **Application Schema**

- **Data Dictionary**

- **Metadata**

<u>Requirement 1: Related Reference Model Schema</u>

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Requirement 1: Related Reference Model Schema

The Framework Data Content Standards are all dependent upon concepts addressed in one or more of the ISO 19100 series of geographic information standards. For example, the metadata component implemented by the Framework Base Standard is based on ISO 19115 which specifies requirements for all geographic metadata.

The figure to the right details the interactions between the Framework Data Content Base Standard and the ISO 19100 series of standards. All yellow folders are derived from ISO geographic standards.

Next Topic

**Requirement 2:
Application Schema**

ISO 19123 Coverages

ISO 19107 Spatial Schema

ISO 19133 Tracking and Navigation

ISO 19115 Metadata

<<Application Schema>> Framework (From Logical View)

ISO 19108 Temporal Schema

ISO 19109 Rules for Application Schema

ISO 19111 Referencing by Coordinates

Dependencies on ISO **19100** Series

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Requirement 2: Application Schema

**Each of the Framework Data Content Standards include an integrated application schema.
This schema is designed to define the following information content of each data set address.**

- **Feature types**
- **Attribute types**
- **Attribute domain**
- **Feature relationships**
- **Spatial representation**
- **Data organization**
- **Metadata**

The Unified Modeling Language (UML) should be used to express this schema. Important UML notes:

- **UML is not a database or implementation model**
- **UML is an abstract model that shows relationships between elements.**

Further UML details are provided in the Encoding section of this module.

Next Topic

Requirement 3: Data Dictionary

NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Requirement **3:** Data Dictionary

Each thematic Framework Data Content Standard must contain documentation of all features, attributes, and relationships (including definitions). A data dictionary table should be used to describe and explain the elements outlined in the UML diagram. The data dictionary must conform to the format provided within the Framework Data Content Base Standard, and must include the following six attributes (as defined by the Framework Data Content Base Standard):

- **Name/Role Name**
- **Definition**
- **Obligation/Condition**
- **Maximum Occurrence**
- **Data type**
- **Domain**

Next Topic

Requirement 4: Metadata

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Requirement **4:** Metadata

All datasets shall have metadata that conforms to at least the minimal set of mandatory elements of either ISO 19115, Geographic Information – Metadata, or FGDC-STD-001-1998, Content Standard for Digital Geospatial Metadata, Version 2.0. However, more extensive metadata should be provided. Each thematic standard must specify the metadata necessary for documenting data for that theme. Annex C provides the data dictionary elements from ISO 19115 that are pertinent to the Framework Data Content Base Standard. All metadata elements need to be documented according to the UML application schema for metadata expressed in ISO 19115.

Next Topic

Requirement 5: Model Integration

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References
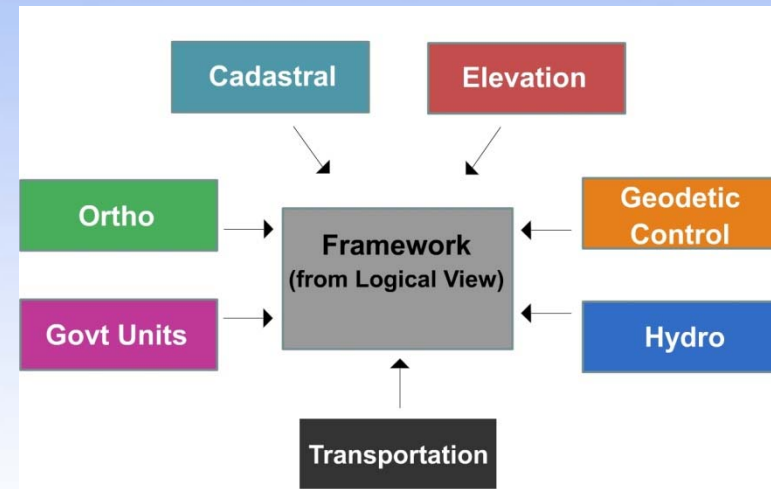
NSDI

Requirement **5:** Model integration

The model integration requirement demonstrates each of the abstract concepts of Framework and how each is dependent upon the application schemas for each data theme, as well as the Framework Data Content Base Standard. The integration is based on the ISO profile, which is a general package that outlines the list of standards used by the thematic theme standard parts. See the diagram to the right.

Data from each theme adds to the greater Framework whole.

Next Topic

Requirement 6: Establishment of a Permanent Identifier

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Requirement 6: Establishment of a Permanent Identifier

This requirement establishes the need for permanent identifiers for thematic themes for the purposes of data consistency. If a theme contains features such as roads, waterways, parcels, etc; two fields 'namespace' and 'permanent identifier' must be included in the UML model for those features; however, it is up to each thematic standard to determine when and how 'namespace' and 'permanent identifier' will be populated.

Example

The table below is an example attribute table from the National Hydrography Dataset (NHD) Reaches, where GNIS_ID is the 'permanent identifier' and GNIS_NAME is the 'namespace'.

COMID	FDATE	RESOL-UTION	GNIS_ID	GNIS_NAME	LENGHTKM	REACHCODE	FLOWDIR	FTYPE	FCODE
15970247	11/10/99	3	01599176	Deep Creek	1.120	10180004000162	1	460	46006
15970271	11/10/99	3	01599481	East Fork Medicine Bow River	5.135	10180004000098	1	460	46006
15968501	11/10/99	3	01599504	East Fork Wagonhound Creek	6.809	10180004000207	1	460	46006
15968763	11/10/99	3	01599577	Elk Creek	2.946	10180004000492	1	460	46006
15968759	11/10/99	3	01599788	Foote Creek	5.505	10180004000126	1	460	46006
17493791	11/10/99	3	01599818	Four Mile Creek	10.200	10180010000070	1	460	46006
17492497	11/10/99	3	01600626	Jimmie Creek	3.219	10180010000767	1	460	46006
15970383	11/10/99	3	01601408	Middle Fork Rock Creek	4.952	10180010000491	1	460	46006

Next Topic

Requirement 7: ISO (19109) Feature Model and Notation

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Requirement 7: ISO (19109) Feature Model and Notation

The Framework Data Content Standards all use a common feature model (as documented in ISO 19109) to organize spatial information.

Requirement 8: Extensibility

Each thematic Framework Standard defines specific requirements for a theme based on that theme's Data Content Model, however if a data creator wishes to provide additional attributes, feature classes can be associated with the 'ExtendedAttribute' class to accomplish this task.

Flexibility/Adaptability

- **Technology is always changing and updating**

- **Users have different needs and goals**

The Framework Data Content Standards were designed to account for both through the extensibility requirement which allows additional attributes to be added to a dataset without compromising its Framework status.

Next Topic

Encoding and Implementation

NSDI

Encoding and implementation

The process of encoding is simply formatting or structuring data in a regulated manner. The Framework standards are encoded by applying the application schemas through the use of several different modeling and markup languages:

- **Unified Modeling Language (UML)**

- **Extensible Markup Language (XML)**

- **Geographic Markup Language (GML)**

Specific knowledge of each language is important for data and tool designers; as such each is addressed in the following sections.

The Bigger Picture

The Framework Base Standard does not have a specific application schema that can be implemented. Implementation of the Framework Data Content Standards in relation to data and tool creation occurs at the thematic level. Each thematic part complies with the Framework Base Standard. As such a road layer (for example) created in accordance with the Framework Transportation Roads part meets all Framework requirements.

Next Topic

Unified Modeling Language
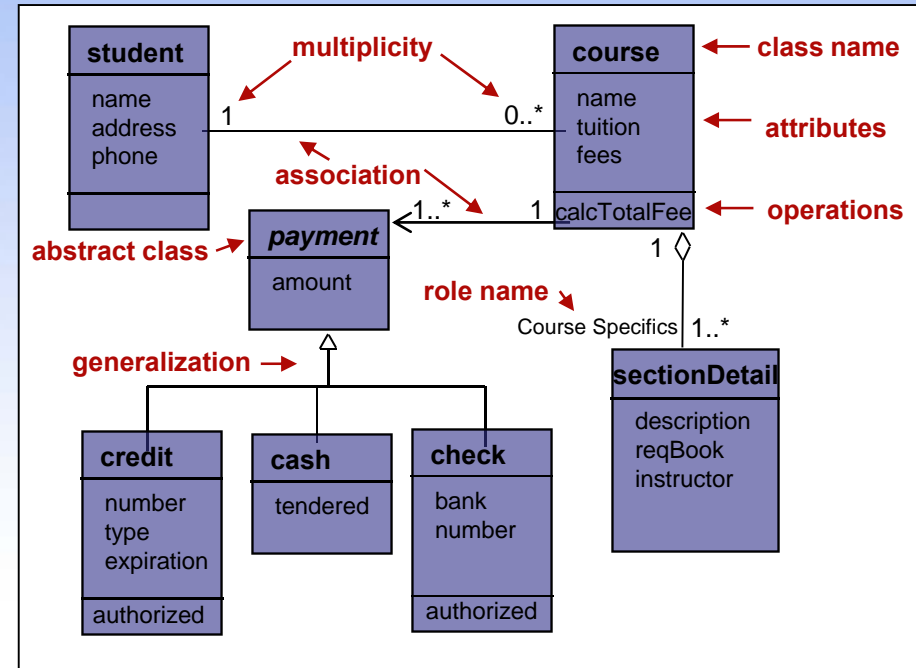
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UnIfied Modeling Language

- **The Unified Modeling Language (UML) is an object modeling and specification language used in software engineering. UML helps create an abstract model of a system using standardized symbols.**

- **UML is a General Purpose Modeling language which was designed to specify, visualize, construct, and document software-intensive systems.**

For more information:
http://www.uml.org

The simplified UML class diagram on the right models a student taking and paying for a course. Each blue box is a representation of a 'class' or a specific data type. The central class in the diagram is <u>course</u> *which is associated with the* <u>student</u> *and* <u>payment</u> *classes. Payment can either be by credit, cash, or check. Each course (e.g. English 1010) can have multiple sections which are represented by the sectionDetail class.*

Next Topic

Extensible Modeling Language

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Extensible Markup Language

It is important to realize that the Extensible Markup Language (XML) is not specifically addressed in the Framework Base Standard, however many of the subsequent standards implement XML, thus some basic information is provided.

XML is a simple and flexible text based language derived from the Standardized General Markup Language (SGML) (ISO 8879). Originally XML was designed to meet the challenges of large-scale electronic publishing, but currently it is playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere.

For more information:
http://www.xml.org

XML is designed to:

- Separate syntax from semantics providing a common framework for structuring information (browser rendering semantics is completely defined by stylesheets)
- Allow custom markup for any imaginable application domain
- Support internationalization (Unicode) and platform independence
- Be the future of structured information including databases

Next Topic

Geography Markup Language

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Geography Markup Language

It is important to realize that the Geography Markup Language (GML) is not specifically addressed in the Framework Base Standard, however many of the subsequent standards implement GML, thus some basic information is provided.

GML is an XML based encoding standard for geographic information developed by the Open Geospatial Consortium (OGC). The objective is to allow Internet browsers the ability to view web based mapping without additional components or viewers.

For more information:
http://www.opengis.net/gml
http://www.opengeospatial.org

GML is designed to:

- **Provide a standard means to encode geospatial information (position, location, extent etc.) in XML**

- **Separate content from presentation. GML is focused on capturing geographic content**

- **GML is "styled" into a presentation format such as SVG (Scalable Vector Graphics) for map drawing or other visualizations**

- **Be consistent with existing OGC Standards for expressing geographic features**

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Review Exercise and Self-Test

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Framework base Standard Requirements Exercise

Framework In Action (Part 2)

Now that you have a better understanding of Framework, the Framework Data Content Standards, and the specifics of the Framework Base Standard, let's examine some data.

Step 1) Open an Internet Browser and proceed to a search engine (i.e. Google) and search for "GIS data clearinghouse"

Step 2) Select a Clearinghouse of your choice

Step 3) Search for a Rivers layer that is NHD and one that is not NHD

Step 4) Download both and open them with your favorite GIS software (optional)

Step 5) Examine the data and associated metadata to answer the questions in the box to the right

Next Topic

Module Summary

Exercise questions

Can you tell if the data meets Framework specifications? How?

What differences do you see between the different layers?

Do the attribute tables resemble the one provided as an example previously in this course?

Does the site make it clear what data sources they have that are Framework compliant?

Is the site user-friendly? If not, how would you change it?

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Module Summary

Framework Base standard requirements

- **Eight different requirements are specified by the Framework Base Standard**

- **Lays out the specifications on which a foundation for the seven thematic standards are built**

- **Provides rigid requirements to ensure proper structure and documentation for Framework data, but allows for expansion of certain aspects to meet specific user needs**

- **Modeling and Mark-up Languages are used to diagram and specify the details to a programmer who wishes to create tools that are Framework compliant**

Next Topic

Module 5: Course Review and Self-Test

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Module 5: Course Review and Comprehensive Self-Test

Topics

- **Review Exercise (Geo-pardy)**

- **Comprehensive Self-Test**

- **Course Evaluation**

- **Certificate of Completion**

First Topic

Geo-pardy

NSDI

NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

<u>Geo-pardy Instructions</u>

This review exercise is structured very similar to the TV show Jeopardy. To play simply click on the category and dollar amount for each question. If you wish to keep score, tally your results on a scratch piece of paper. Good Luck and have fun!

Next Topic

Geo-pardy Game

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Let's Play Framework Data

Content Base Standard

Geo-pardy!!

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework	Framework Standard Parts	Framework Base Standard	FBS Requirements	Uses / Users
$100	$100	$100	$100	$100
$200	$200	$200	$200	$200
$300	$300	$300	$300	$300
$400	$400	$400	$400	$400
$500	$500	$500	$500	$500

Final Geo-pardy

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NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

<u>Self-Test</u>

Instructions

This test is designed to test your understanding of Framework and the Framework Base Standard after completing this course. The test is comprised of both multiple choice and true/false questions. Good Luck!

Next Topic

Self-Test

NSDI

How many themes does Framework incorporate?

A) 3

B) 5

C) 7

D) 9

Answer - C

Which is NOT a benefit of the Framework approach?

A) data interoperability

B) cost reduction

C) interagency cooperation

D) guaranteed data accuracy

Answer - D

Which is NOT a Framework data theme?

A) cadastral

B) transportation

C) geodetic control

D) population

Answer - D

How many requirements are specified by the Framework Base Standard?

A) 7

B) 8

C) 9

D) 10

Answer - B

What purpose do the GML/XML code languages serve in the Framework standards?

A) they are different formats for Framework data

B) they tell a programmer how to implement the standard

C) they diagram the flow of the standard

D) they tell your computer that data is Framework quality

Answer - B

NSDI

The Framework Data Base Standard:

A) describes how to create specific Framework data

B) is the components that all Framework standard parts have in common

C) documents how a programmer should build a tool to create Framework data

D) is the entire suite of standards needed to create Framework data

Answer - B

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What is the purpose of the 'extensibility' requirement?

A) allow attributes not specified by the Framework standards to be added

B) linking different data layers together

C) it documents the steps for populating an attribute table

D) provides the data source with a unique name

Answer - A

The Framework Base Standard is a data transfer standard.

A) True

B) False

Answer – False

Each thematic Framework standard part was developed by experts in that given field.

A) True

B) False

Answer - True

Metadata is not required to conform with the Framework Base Standard.

A) True

B) False

Answer - False

Course Certificate

Instructions

Congratulations! You have completed the Framework Data Content Base Standard Training Material..

Next Topic

Course Certificate

NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

<u>Course Certificate</u>

Congratulations, you have successfully completed the Framework Base Standard Training! In order to print the certificate below you will need a copy of Adobe Acrobat Reader, http://www.adobe.com/products/acrobat/readstep2.html.

After you open the certificate file, type your name and today's date on the name/date line and print.

<u>Click here to receive course certificate</u>

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<u>References</u>

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