

# Environmental Data Coding Specification (EDCS)

*<http://www.sedris.org/edcs.htm>*



**SEDRI<sup>TM</sup> Technology Conference**  
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# About this tutorial

## DESCRIPTION

The EDCS is the means for identifying the classification and characteristics of environmental objects. Designed as a standalone technology, it unifies the characterization of environmental "things" regardless of the method by which such "things" are represented (e.g., as surfaces, features, etc.), or whether they are cast as individual primitives or structured collections. The EDCS tutorial introduces the concept of a coding specification, how it is applied to environmental data, and the major environmental coding systems currently in use. It reviews how the structure and function of the EDCS standard covers all domains of the environment, and how EDCS relates to other coding systems. Examples from various environmental domains are provided. Use of EDCS within the SEDRIS Data Representation Model is described, and mappings between the EDCS and external environmental coding specifications is described.

## WHO SHOULD ATTEND

Those desiring to define the semantics of environmental data (the environmental "things" and what they "mean"), either as data providers, data consumers, or both. Both project managers and technical implementers will benefit from this tutorial.

## PREREQUISITE

Knowledge of other existing taxonomies or standards on environmental classification and attribution is helpful. Prior knowledge of other SEDRIS technologies is not required, however, prior attendance at either the "Introduction to SEDRIS for Managers" or "SEDRIS - The Technology Components" tutorial is recommended.

## WHAT TO EXPECT

The attendee learns about both the current implementation, and the target standardization, of the EDCS. Related standards and coding conventions are discussed as a starting point for the attendee developing mappings to/from coding systems they may be currently using. Planned developments of the EDCS are addressed in order to assist attendees in preparing to use the EDCS within their domain and ensuring that ongoing EDCS developments can be taken into account in project planning. Mechanisms for elaborating the EDCS are defined, and attendees are encouraged to get involved in extending the EDCS to meet their project requirements.



# Prerequisite

- To get the most from this tutorial, we assume you have the following understanding as a prerequisite to this session:
  - Basic understanding of taxonomies or standards to classify environmental objects.
  - Basic understanding of environmental data coding methods.
  - Basic understanding in the use and benefits of common dictionaries.
  - Attended a SEDRI overview course such as:
    - “Introduction to SEDRI for Managers”
    - “SEDRI - The Technology Components”



# Tutorial Outline



## **Using the SEDRIS for Data Interchange – A high level process**

- **How the EDCS supports the data interchange process**



## **Why EDCS ?**

- **Motivation for an EDCS, and the critical requirements**
- **Other available environmental data coding methods**



## **What is the EDCS ?**

- **The EDCS standard - background, purpose, content overview and development approach**
- **The EDCS standard – use of references, dictionary structures and content examples**



## **Using the EDCS**

- **Demonstration walk-through of the EDCS standard**
- **Searching the content**
- **Registration of new EDCS dictionary entries**



## **Applying the EDCS**

- **Examples of EDCS uses and implementations**
- **Mapping to/from the EDCS - Mapping Cases and Patterns**
- **Mapping to/from the EDCS - Other EDCS Mappings**



## **EDCS Support and Participation**

- **The SEDRIS Web Site and On-line User Support**
- **Documentation**
- **Coding References**
- **Where to Go From Here**



# EDCS Usage Overview

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- **The EDCS is designed to be used:**
  - **As a Stand Alone Component**
  - **In Other Non-SEDRIS Interchange Areas**
  - **As well as SEDRIS Data Generation or Consumption**
- **The EDCS can and is being used to better define the data requirements for various systems through the use of EDCS terms and concepts.**



# Uses of the EDCS

## As an Independent Stand Alone Component

Support to:  
Environmental  
Data Models

Support to:  
an HLA  
FOM

*Examples*  
Examples

Terrain  
Common  
Data  
Model

FOM  
Class  
Object

### Set of 9 EDCS Dictionaries

- Classification Dictionary
- Attribute Dictionary
- Attribute Value Characteristic Dictionary
- Attribute Enumerant Dictionary
- Unit Dictionary
- Unit Equivalence Class Dictionary
- Unit Scale Dictionary
- Organizational Schema Dictionary
- Group Dictionary

## Available Technology

### Goal

Unambiguous  
Representation

Loss-less  
Interchange  
of Data

Tools

### SEDRIS Components

DRM  
**EDCS**  
SRM

API  
STF

SEE-IT  
Checker  
SbS

## Within the SEDRIS Technology

### As the "Cornerstone" Component

TOOLS

API

**EDCS**

DRM

SRM

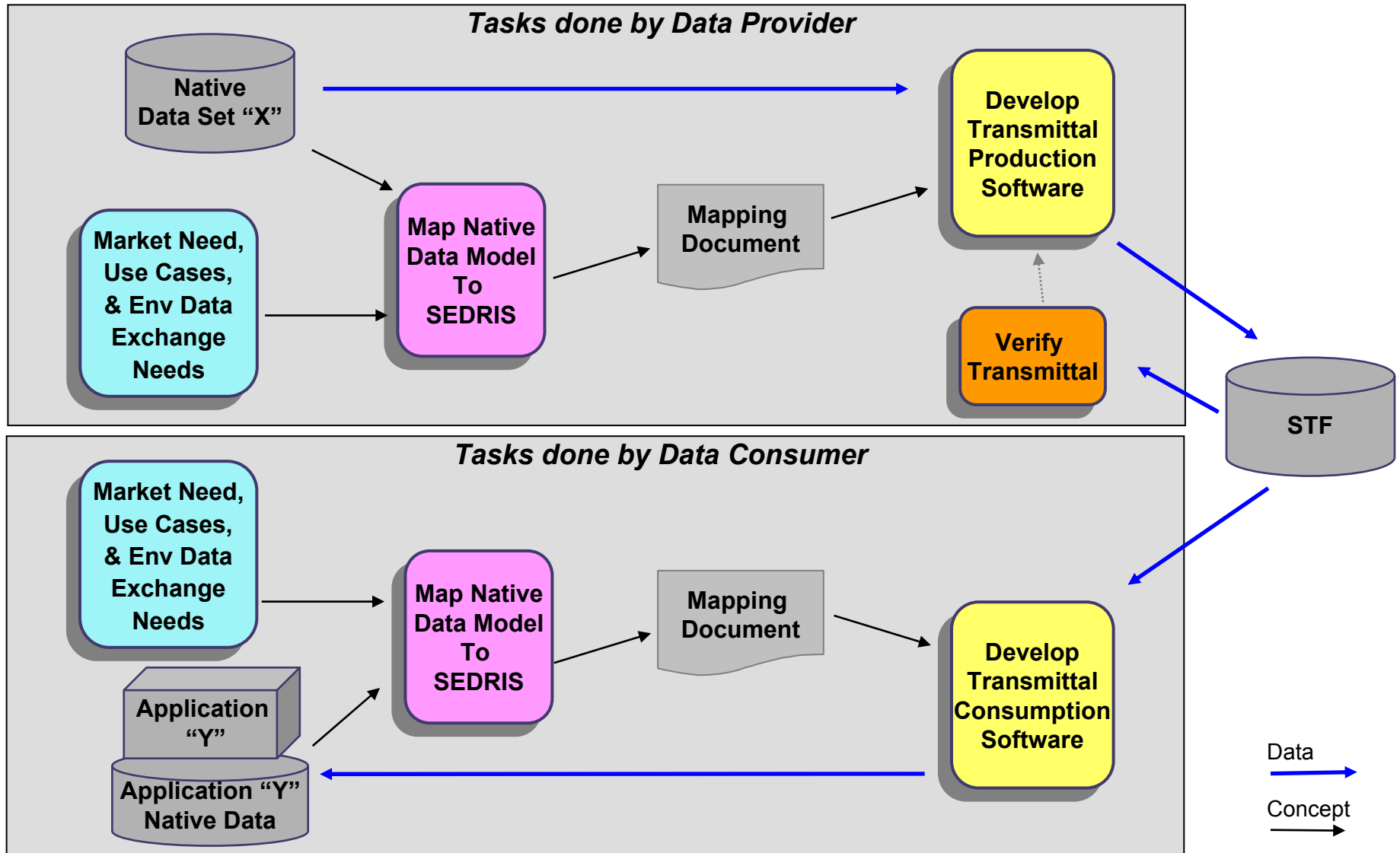


# ***Using SEDRI for Data Interchange A High Level Process***

**How the EDCS Supports  
the Data Interchange  
Process**



# Steps in SEDRIS Production and Consumption Process







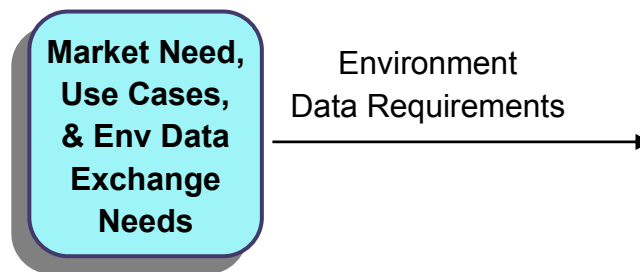
# Creating a Transmittal

- **Step 1: Native Requirements & Data Analysis**
  - Define use or application plus data exchange requirements
- **Step 2: Develop Mapping Document**
  - Use DRM, EDCS & SRM
- **Step 3: Develop Production software**
  - Add in API & STF
- **Step 4: Validate Transmittal**
  - Add in tools & applications



# Step 1: Native Analysis

- **Goal: Capture all known and potential uses for native data.**
- **Analyze:**
  - use cases
  - application requirements
  - data content and utility
  - data customer needs and applications
  - data deficiencies (e.g. metadata, data augmentation, ...)
- **Determine best way to maximize market potential for data being produced in STF**
- **Use the analysis to focus your mapping efforts in Step 2**





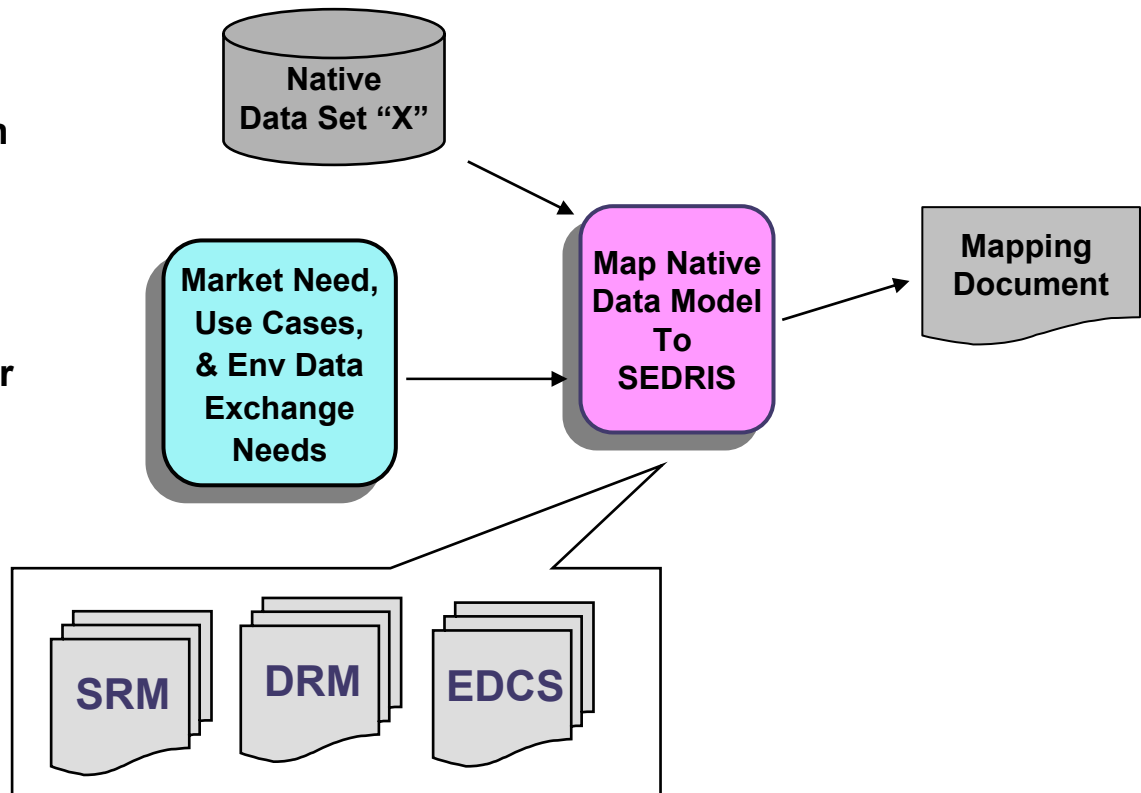
# Step 2: Mapping Document

- Purpose

- Document the **conversion from a native data to SEDRIIS**
- Find any problems the DRM, EDCS, or SRM does not handle with your production application

- Goals:

- Map native data organization to the DRM
- Use correct EDCS entries
- Document mapping
- Provide design criteria for software development
- Provide validation criteria for STF content





# Step 2: Mapping Document [2 of 3]

- **First: list primitive data elements within your native data**
- **Second: categorize as follows:**
  - Primitive data (locations, polygons, lights, etc.)
  - Organizing elements (a bag of, a tile of, etc.)
  - Descriptions (attributes, classifications, etc.)
  - Implementation artifacts (text strings, run time values)
- **Third: learn SEDRIS DRM**
  - **Primitive data classes**
    - Point, Linear, and <Areal Feature>,
    - <Point>, <Polygon>, <Light Source>, <Image>, <Sound>,
    - <Property Grid>, <Property Table>, etc.



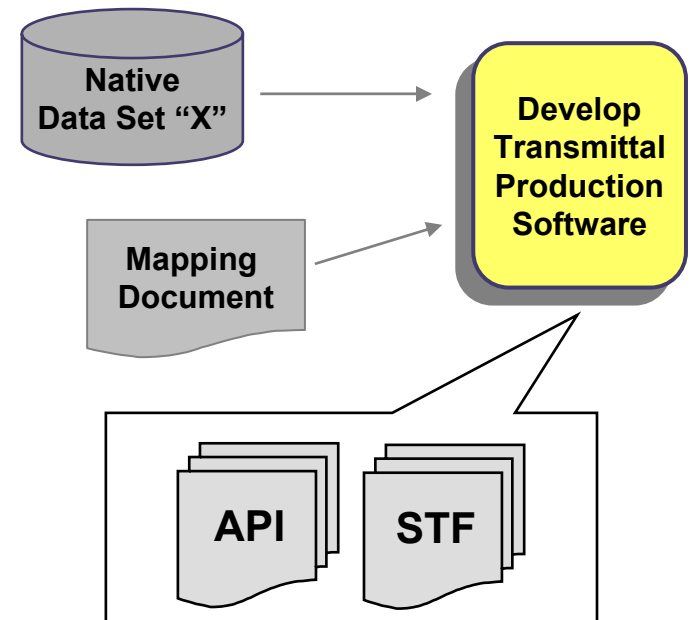
# Step 2: Mapping Document [3 of 3]

- **Learn SEDRI DRM (cont'd)**
  - **Descriptive classes**
    - <Location>, <Colour>, <Classification Data>, <Transformation>, <Property>
  - **Organizing Containers classes**
    - Hierarchies, Libraries
  - **Relevant DRM Issues**
    - Object sharing
    - Component inheritance
    - Metadata for a Transmittal
    - Feature versus geometry
    - <Hierarchy Summary Items>
- **Fourth: MAP!**
- **Fifth: Request SEDRI functionality (if needed)**
  - **SCR**
  - **DRM**
  - **EDCS**



# Step 3: Creating a Transmittal

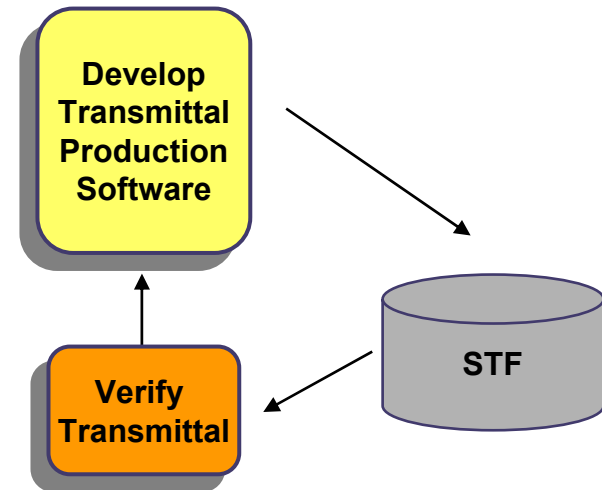
- **First: Learn basic calls of the SEDRIS API**
  - Mostly insertion functionality
- **Second: Get SEDRIS SDK**
  - Standard file directory structure
  - Populated with the SEDRIS developer's source code distribution and sample data sets
- **Third: Create translating application**
  - Developer has full control
  - Choose optimal traversal of native data
  - Access to native data
- **Finally: Create the STF**
  - Link application to core libraries
  - Run Application





# Step 4: Validate Transmittal

- **Syntax Checker**
  - Checks DRM compliance
- **Rules Checker**
  - Checks DRM Constraints
- **Depth**
  - Traverses the entire transmittal hierarchy
  - Reporting statistics on types and numbers of objects encountered
- **Transmittal Browser**
  - Browse a SEDRIS transmittal
- **Modify production software**
  - Iterative until STF is valid





# Questions ?

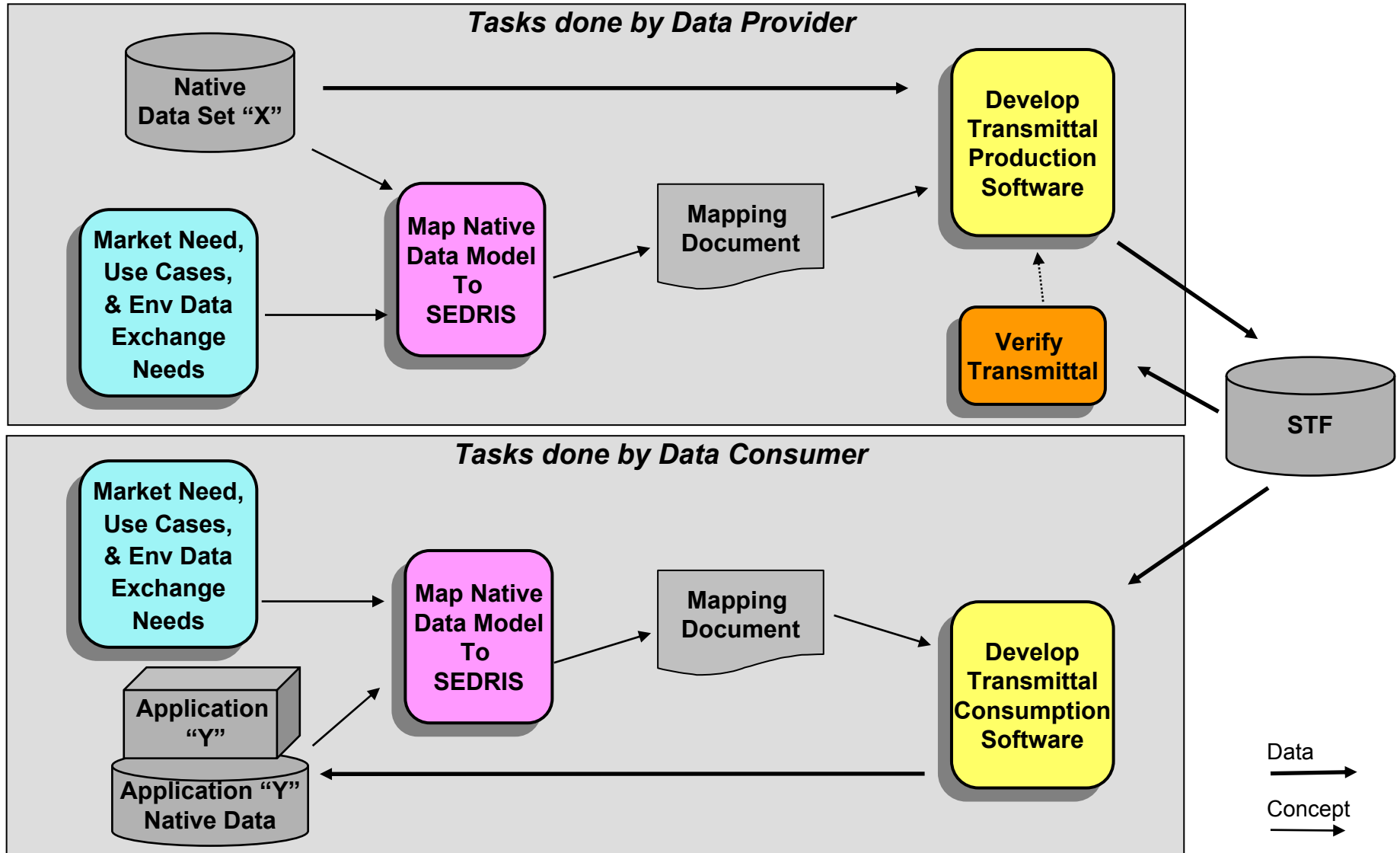
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- **Questions on Producing?**
- **Documentation**
  - Tutorial on “How to Produce & Consume SEDRI Transmittals”, see [www.sedri.org](http://www.sedri.org)
  - SEDRI Technology Documentation Set
  - Part 4: *Technical Reference Set*
  - Volume 14: *How to Produce SEDRI Transmittals (to be updated)*





# Steps in SEDRIS Production and Consumption Process





# Consuming SEDRI Transmittals

- **Step 1: Native Analysis**
  - What are your data requirements?
- **Step 2: Mapping Document**
  - Map to your data requirements
  - Learn DRM concepts
- **Step 3: Learn Implementation Details**
  - Extraction capabilities
  - Detailed DRM, EDCS, & API knowledge
- **Step 4: Create consumption software**
  - Taking advantage of the common services



# Step 1: Native Analysis

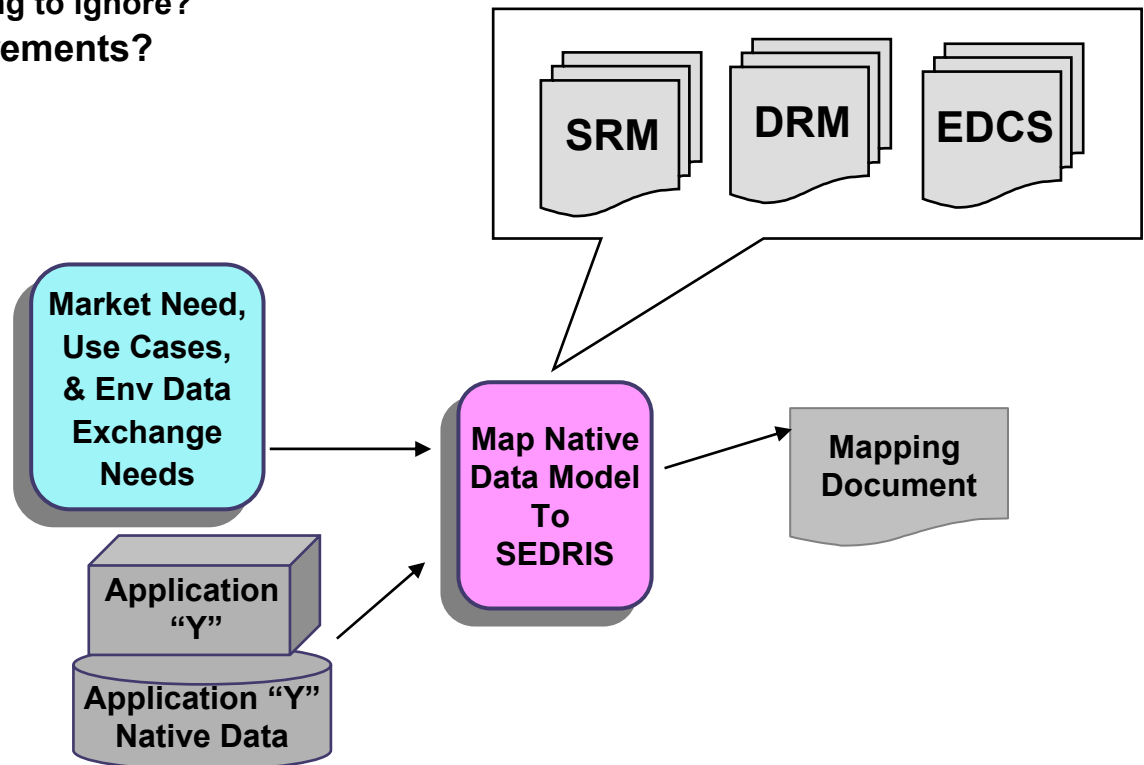
- Analyze your data requirements
- If you are a tool maker
  - What data does your tool require?
  - What features will attract the most customers?
  - What capabilities can you expand in the environmental data arena?
- If you want to import into a native format:
  - *What type of data does your native format contain?*
  - *What SEDRIS DRM classes are required to populate your native data model?*
- The SDRM is flexible (and the EDCS is complex)
  - *How much flexibility will you allow?*
  - *How much complexity can you handle?*

Market Need,  
Use Cases,  
& Env Data  
Exchange  
Needs



# Step 2: Mapping Document

- Describe the native primitive data
  - What is the native organization?
- Describe the translation from SEDRIS to native data/format
  - What data maps from SEDRIS to native data model?
  - What data do you need to “derive” from SEDRIS transmittals?
  - What algorithm will be used to derive native information?
  - What data are you going to ignore?
- Any runtime data requirements?
- Focus on primitive data





# Step 3: Learn Implementation Details

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- **Extraction Capabilities**
  - Tree traversal
  - Selection and filtering of objects
    - Spatial boundaries
    - Search filters
  - Automatic navigation via branching criteria
  - Retrieval of entire object hierarchy
  - Automatic transformation of coordinates & colors
  - Object Identification
  - Advanced DRM Functionality
  - Inter – Transmittal Referencing (ITR)
- **DRM Classes and Constraints relevant to your consumption data requirements**



# Step 4: Create Consumption Software

- **Must reflect (and implement) the input to output mapping requirements**
- **Must rely on the input and the output languages' syntax and semantics (as opposed to implied semantics)**
- **Must not make assumptions that are not supported in the input or the output language**
- **Must not hard-wire extra-transmittal context**
- **Should use the common services to fullest extent**
- **Must be able (and willing) to process enough data to extract the information it needs**

**Develop  
Transmittal  
Consumption  
Software**



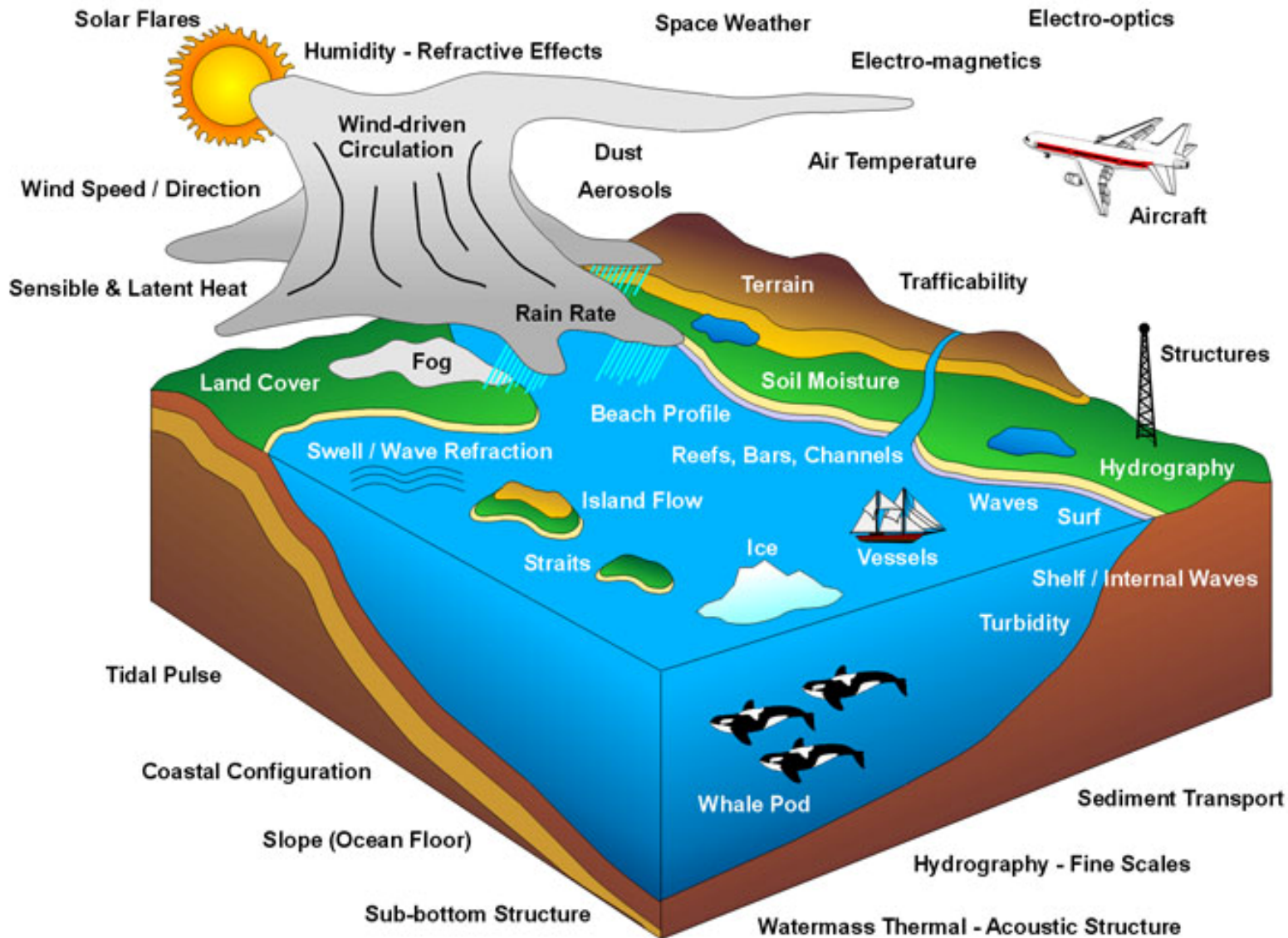
## Why EDCS ?

**Motivation for an EDCS, and the critical requirements**

**Currently available environmental data coding methods**



# All Environmental Domains

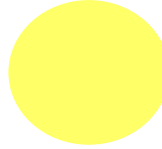






# All Environmental Domains

Solar Flares  
Space Weather  
Magnetic Fields  
Ionization  
Scintillation  
Charged Particle Counts



... ..

Air Temperature  
Aerosols  
Dust  
Fog  
Rain Rate  
Sensible and Latent Heat  
Wind Speed / Direction  
Wind - Driven Circulation  
Humidity - Refractive Effects

... ..

Terrain  
Land Cover  
Soil Moisture  
Trafficability  
Structures  
Hydrography  
Beach Profile  
Coastal Configuration  
Slope (Sea Floor)  
Sub-Bottom Structure

... ..

Waves  
Surf  
Swell / Wave Refraction  
Shelf / Internal Waves  
Acoustic Dependencies  
Island Flow  
Hydrography - Fine Scales  
Reefs, Bars, Channels  
Straits  
Tidal Pulse  
Turbidity  
Ice  
Sediment Transport  
Watermass Thermal - Acoustic Structure

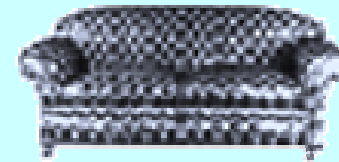
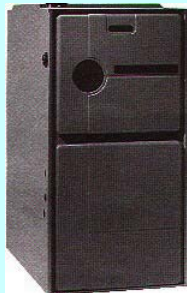
... ..

# Vehicles (and Life forms)



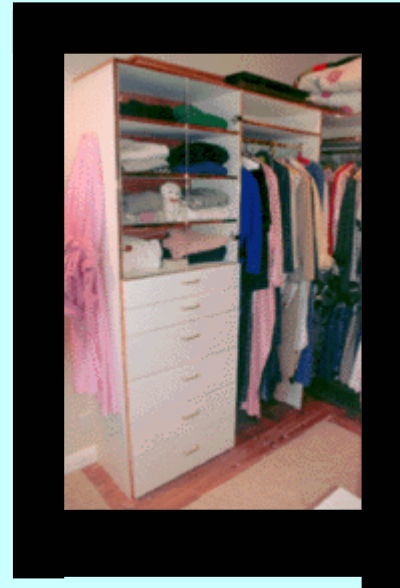


# Furniture, Openings, Equipment





# Rooms / Compositions





# An Environmental Data Coding Specification ...

- **Unifies characterizations of environmental “things”**
  - Regardless of how represented
    - Feature or Geometry or Data Table or Model or ...
  - Whether individual primitives or structured collections of primitives
    - Furniture vs. Room vs. Building vs. Facility vs. Region vs. World
- **Separates enumerations from Data Representation Models**
  - Evolve at different rates for different reasons
  - It’s a big world to capture ...
- **Answers three types of questions:**
  - 1. *What is it?***
    - Classifications and Features
  - 2. *What are its additional clarifying characteristics?***
    - Attributes and Values
  - 3. *What are its characteristic measures?***
    - Units of Measure and Scales



# Classifications (and Features)

## 1. What is it?

building, river/stream, air warning light, ocean floor



Animal?



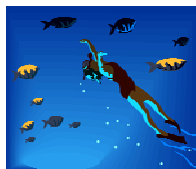
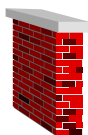
Water?



Tree?



Vegetable?



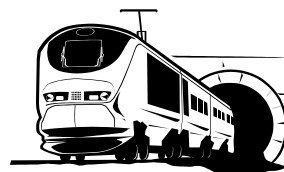
Mineral?



Weather?



Structure?



Vehicle?



Celestial?



# Attributes (and Values)

## 1. *What is it?*

building, river/stream, air warning light, ocean floor

## 2. *Additional clarifying characteristics?*

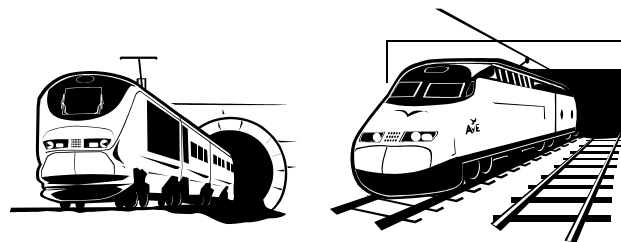
lighthouse, 1.5, red, coral



Vegetation Type?



Building Function?



Overhead Clearance?







# Units of Measure and Scales

## 1. *What is it?*

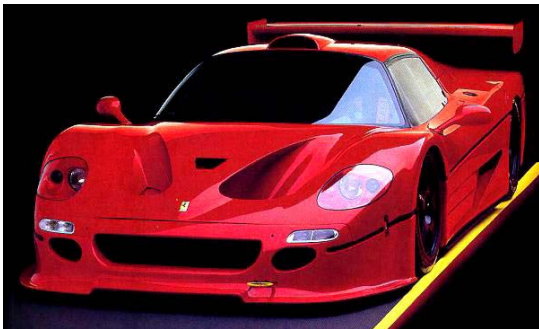
building, river/stream, air warning light, ocean floor

## 2. *Additional clarifying characteristics?*

lighthouse, 1.5, red, coral

## 3. *What are its characteristic measures and scales?*

kelvin, decametre, kilometre/hour; micro, tera, deci



**How fast?**

kilometres per hour



**How warm?**

kilokelvin



**How tall?**

decametres





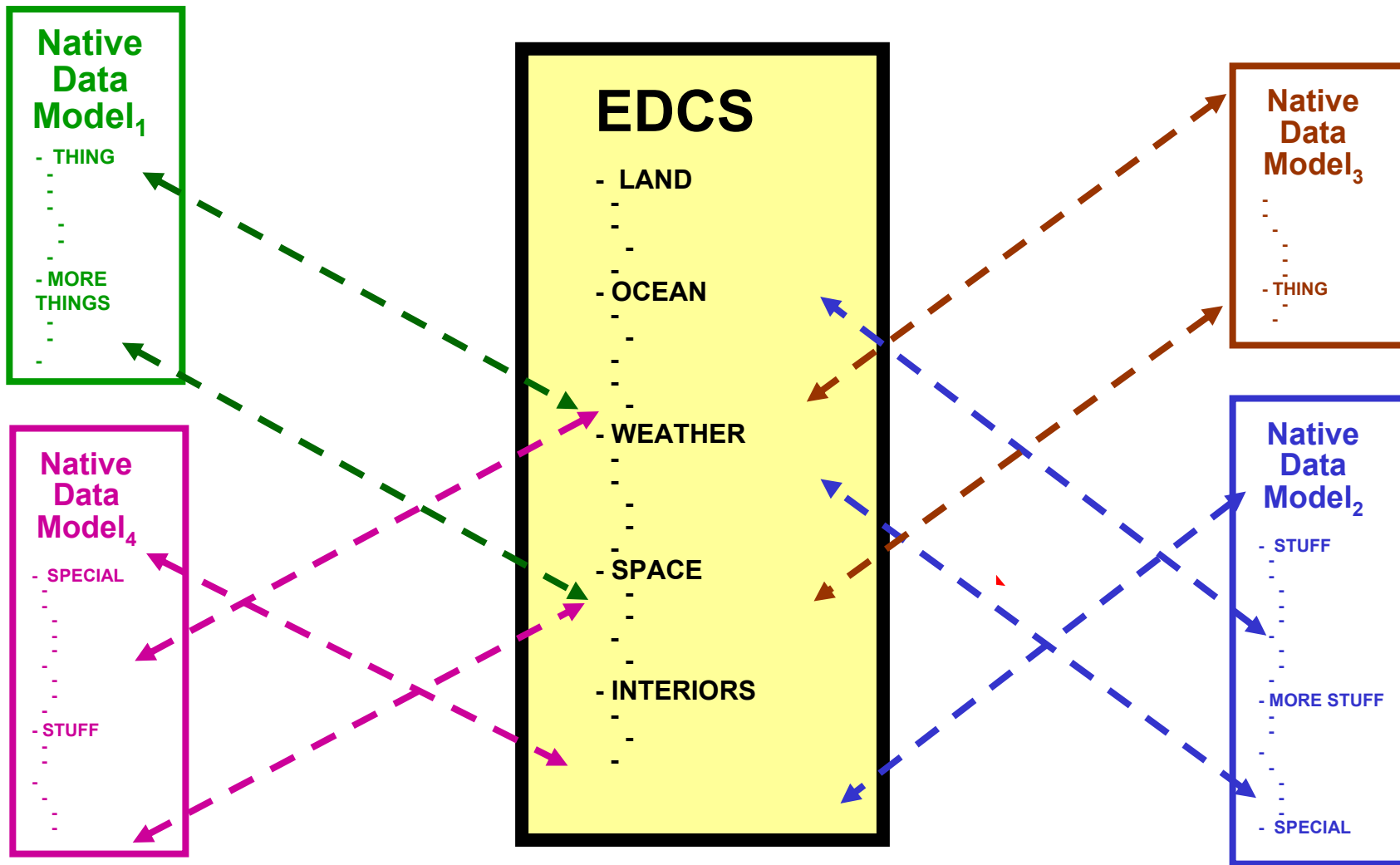
# Putting EDCS Entries Together Clarify the Object's Description

<i>What is it?</i>	<i>How is the object characterized ?</i>	<i>How is the object measured?</i>
Classifications	Attributes	Units of Measure & Scales
Building	With the <u>function</u> of a <i>Lighthouse</i> Whose <u>height</u>	is 3.05 <u>decametres</u>
River Stream	Whose <u>depth</u>	is 1.5 <u>metres</u>
Ocean Floor	Which is <u>composed</u> of <i>Coral</i> Whose <u>density</u>	is 0.97 <u>kilograms per cubic decimetre</u>





# Why is this Hard?





# Issues to Consider When Building a Dictionary of Concepts

- **Goal: Unique concepts of value to dictionary users**
- **Process for building a good dictionary is not trivial**
  - Important to choose the right approach
  - Implementing the approach is challenging
- **Identifying Concepts & Naming them can be difficult**
  - Concepts are identified and names are assigned for many reasons
  - Names are not unique, they form equivalence classes
  - How close is “good enough” in order to identify a unique concept and assign a name?
  - Names are often composed from other names, plus adjectives
- **Capturing unambiguous, concise, useful concepts is a continuing process**



# Requirements for a Coding Standard

- **Broad coverage**

- Terrain, ocean, atmosphere, space, planets, buildings, rooms, furniture, equipment, components, ...
- Both fixed and dynamic phenomena (temporal)
- Functionally neutral
  - *E.g.*, resource management vs. transportation planning vs. telecom/structure placement vs. e-commerce vs. ...

- **Unambiguous**

- Well-formed definitions and metadata
- Clean separation of semantics from syntax
- Independent of Data Model(s)

- **Scalable, flexible, extensible**

- Low overhead evolution; responsive to customers

- **Mappings to domain-specific standards**

- *E.g.*, DIGEST, WMO, IHO, commercial practices, ...



# Why EDCS

**Motivation for an EDCS, and the critical requirements**

**Other available environmental data coding methods**



# Environment Coding Specifications



ORGANIZATION	PRODUCT	DOMAIN(S)	PERSPECTIVE	WEB SITE
Digital Geographic Information Working Group (DGIWG)	Digital Geographic Information Exchange Standard (DIGEST) Feature & Attribute Coding Catalogue (FACC)	Terrain	DIGEST = Transfer Std FACC = Dictionary	<a href="http://www.digest.org">http://www.digest.org</a> Part 4 of the DIGEST, FACC 2.1
International Hydrographic Organization (IHO)	S-57 IHO Transfer Standard Data Exchange format DX-90	Maritime Navigation	S-57 = Transfer Std Feature Dictionary Appendices = Dictionary	<a href="http://www.iho.shom.fr/">http://www.iho.shom.fr/</a> <a href="http://www.universal.ca/S-57/s57_enc_catalog.html">http://www.universal.ca/S-57/s57_enc_catalog.html</a>
World Meteorological Organization (WMO)	WMO code form FM 94 BUFR WMO code form FM 92-VIII Ext. GRIB Codes	Atmosphere	FM94 = Transfer Std FM92 = Transfer Std FM92 GRIB Codes = Dictionary	WMO Manual on Codes (Pub. #306), Volume I.1 Part A, Volume I.2 Part B, and Part C Volume II: Regional Codes & National Coding Practices <a href="http://www.wmo.ch/">http://www.wmo.ch/</a>
DoD Meteorology and Oceanography Data Administration	Joint Meteorological & Oceanographic (METOC) Conceptual Data Model (JMCDM) <i>Input to the DoD Data Architecture (DDA)</i>	Atmospheric Oceanographic	JMCDM = Data Model With associated dictionaries	<a href="http://www.cnmoc.navy.mil/da/jmcdm">http://www.cnmoc.navy.mil/da/jmcdm</a> <a href="http://www-datadmn.itsi.disa.mil/ddm.htm">http://www-datadmn.itsi.disa.mil/ddm.htm</a>
National Geospatial-Intelligence Agency (NGA)	United States Imagery & Geospatial Information System (USIGS) Conceptual Data Model (UCDM)	Terrain Imagery Geospatial	UCDM = Data Model With associated dictionaries	<a href="http://164.214.2.59/sandi/datamodel/">http://164.214.2.59/sandi/datamodel/</a>



# Environment Coding Specifications

*continued*



**Open GIS Consortium**  
*Spatial connectivity*  
 for a changing world.



ORGANIZATION	PRODUCT	DOMAIN(S)	PERSPECTIVE	WEB SITE
US Geological Survey (USGS)	<b>Spatial Data Transfer Standard</b> (SDTS) Part 2, Spatial Features Catalog	Terrain	STDS = Transfer Standard Part 2 = Example Dictionary	<a href="http://mcmcweb.er.usgs.gov/sdts">http://mcmcweb.er.usgs.gov/sdts</a>
Open GIS Consortium (OGC)	Standards for a Geospatial Feature Dictionary (types & attributes)	Terrain	A Specification for GIS Interoperability Has no dictionary	<a href="http://www.opengis.org">http://www.opengis.org</a>
International Organization for Standardization – Technical Committee – Geographic Information/Geomatics (ISO/TC 211)	TC 211 Draft International Standard 19110	Terrain	A methodology Has no dictionary	<a href="http://www.iso.ch/">http://www.iso.ch/</a> <a href="http://www.statkart.no/isotc211">http://www.statkart.no/isotc211</a>



# DIGEST

From the Documentation of:

**Digital Geographic Information Exchange Standard**  
**(DIGEST)**



The Digital Geographic Information Exchange Standard (DIGEST) was developed by the **Digital Geographic Information Working Group (DGIWG)** to support efficient exchange of Digital Geographic Information among nations, data producers, and data users.

Digital Geographic Information (or geospatial information) has evolved into an essential element in the planning and conduct of civil and military operations. The required data volume, demands and data complexity dictates the need for standards to assure interoperability and compatibility. DIGEST satisfies this need by defining those aspects necessary for the exchange of Digital Geographic/Geospatial Information such as data structures, format, feature coding scheme, exchange media, and administrative procedures.

Over the last few years DIGEST has become the basis for co-production opportunities between nations. DIGEST-compliant data sets are being produced and exchanged by a number of nations to support a variety of military and civilian applications. DIGEST has become a NATO standardization agreement (**STANAG 7074**). Industry continues to develop and promote commercial software based on compliance with DIGEST.

Part 4 of DIGEST is the **Feature and Attribute Coding Catalogue (FACC)**. FACC is a comprehensive coding scheme for features, their attributes and attribute values.

See: <http://www.digest.org>





# Example FACC Features

**DIGEST Part 4**  
Edition 2.1, September 2000

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## ANNEX A - FEATURE CODES

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### A - Culture

#### AA - Culture-Extraction

##### AA010 Mine

An excavation made in the earth for the purpose of extracting natural deposits. (See also AQ090)

##### AA011 Quarry/Mine Shear Wall

The wall facing of the excavation within a quarry/mine.

##### AA012 Quarry

An excavation created by removal of stone by blasting or cutting.

##### AA013 Pit

An excavation where gravel, sand, or clay are removed for use elsewhere.

##### AA040 Rig/Superstructure

A vertical structure fitted for drilling or lifting operations.



# Example FACC Attributes / Values

## DIGEST Part 4

Edition 2.1, September 2000

Annex B-Attribute and Value Codes

### AEH Absolute Ellipsoid Height Accuracy in Metres (WGS84)

The accuracy of the ellipsoid height relative to WGS 84.

Version 2.1: New Attribute

AEH 0 Actual Value

Attribute data type = **numeric**

Units	Format	Range	Increment	Maximum Characters
Metres	Floating Point	N/A	N/A	N/A

### AFA Available Facilities

Facilities available at or in the near vicinity.

AFA 0 Unknown

AFA 1 Visitors Berth

AFA 2 Visitors Mooring

AFA 3 Sailmaker

AFA 4 Chandler

AFA 5 Provisions

AFA 6 Physician/Doctor

AFA 7 Pharmacy/Chemist

AFA 8 Drinking Water

AFA 9 Fuel Station

Attribute data type = **enumeration**



# IHO

From the Documentation of:

## International Hydrographic Organization (IHO)

The International Hydrographic Organization (IHO) is an intergovernmental consultative and technical organization working to support the safety of navigation and the protection of the marine environment.

The object of the Organization is to bring about:

- a) the coordination of the activities of national hydrographic offices;
- b) the greatest possible uniformity in nautical charts and documents;
- c) the adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys;
- d) the development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography.

S-57 is the International Hydrographic Organization Transfer Standard for Digital Hydrographic Data. It consists of a feature dictionary, a data model, and an exchange format called DX-90. S-57 is an object-based data structure; its feature dictionary describes the geometry and attributes of all features that may appear on an electronic navigation chart (ENC).

As part of the regular update activity by the DGIWG, Part 4 of DIGEST (FACC) has been incrementally updated to achieve greater harmonization with S-57. This activity resulted in DIGEST 2.1.



See: <http://www.iho.shom.fr/>

Also: [http://www.universal.ca/S-57/s57\\_enc\\_catalog.html](http://www.universal.ca/S-57/s57_enc_catalog.html)



# Example IHO Feature

## GEO OBJECT CLASSES

Object Class: **Beacon, cardinal**

Acronym: **BCNCAR**

Code: **5**

Set Attribute\_A: BCNSHP; CATCAM; COLOUR; COLPAT; CONDTN; CONVIS; CONRAD;  
DATEND; DATSTA; ELEVAT; HEIGHT; MARSYS; NATCON; NOBJNM;  
OBJNAM; PEREND; PERSTA; STATUS; VERACC; VERDAT; VERLEN;  
Set Attribute\_B: INFORM; NINFOM; NTXTDS; PICREP; SCAMAX; SCAMIN; TXTDSC;  
Set Attribute\_C: RECDAT; RECIND; SORDAT; SORIND;

### Definition:

A beacon is a prominent, specially constructed object forming a conspicuous mark as a fixed aid to navigation or for use in hydrographic survey (IHO Dictionary, S-32, 5th Edition, 420).

A cardinal beacon is used in conjunction with the compass to indicate where the mariner may find the best navigable water. It is placed in one of the four quadrants (North, East, South and West), bounded by inter-cardinal bearings from the point marked. ([UKHO NP 735, 5th Edition](#))

### References:

INT 1: IQ 130.3;  
M-4: 461;

### Remarks:

Topmark, light, fog signal, radar reflector and retro-reflector are separate objects.

Distinction: daymark; beacon lateral; beacon safe water; beacon isolated danger; beacon special purpose/general;



# Example IHO Attribute

## FEATURE OBJECT ATTRIBUTES

Attribute: **Beacon shape**

Acronym: **BCNSHP**

Code: **2**

Attribute type: E

Expected input:

ID	Meaning	INT 1	M-4
1	: stake, pole, perch, post	IQ 90;	456.1;
2	: withy	IQ 92;	456.1;
3	: beacon tower	IQ 110;	456.4;
4	: lattice beacon	IQ 111;	456.4;
5	: pile beacon		
6	: cairn	IQ 100;	456.2;
7	: buoyant beacon		459.1;

Definitions:

stake, pole, perch, post:

an elongated wood or metal pole, embedded in the bottom to serve as a navigational aid or a support for a navigational aid. (adapted from IHO Dictionary S-32, 5th Edition, 4960)

withy :

a tree without roots stuck or spoiled into the bottom of the sea to serve as a navigational aid.

beacon tower:

a solid structure of the order of 10 metres in height used as a navigational aid.

lattice beacon:

a structure consisting of strips of metal or wood crossed or interlaced to form a structure to serve as an aid to navigation or as a support for an aid to navigation.

pile beacon:

a long heavy timber(s) or section(s) of steel, wood, concrete, etc., forced into the seabed to serve as an aid to navigation or as a support for an aid to navigation. (Adapted from IHO Dictionary, S-32, 5th Edition, 3840 and Navigation Dictionary, US National Oceanic and Atmospheric Administration - NOAA, 1969)

cairn:

a mound of stones, usually conical or pyramidal, raised specifically for maritime navigation. (adapted from IHO Dictionary, S-32, 5th Edition, 601).

buoyant beacon:

a tall spar-like beacon fitted with a permanently submerged buoyancy chamber, the lower end of the body is secured to seabed sinker either by a flexible joint or by a cable under tension. (IHO Specifications, M-4, 459.1)

Remarks:

The beacon shape describes the characteristic geometric form of the beacon.



# WMO

## World Meteorological Organization



From the Documentation of:

### World Meteorological Organization (WMO)

Within the United Nations, the Geneva-based 185-Member Organization provides the authoritative scientific voice on the state and behavior of the Earth's atmosphere and climate.

The purposes of WMO are to facilitate international cooperation in the establishment of networks of stations for making meteorological, hydrological and other observations; and to promote the rapid exchange of meteorological information, the standardization of meteorological observations and the uniform publication of observations and statistics.

The WMO code form FM 94 BUFR (Binary Universal Form for the Representation of meteorological data) is a binary code designed to represent, employing a continuous binary stream, any meteorological data. The WMO code form FM 92-VIII Ext. GRIB (GRIdded Binary) is a general purpose, bit-oriented data exchange format designed as an efficient vehicle for transmitting and storing large volumes of gridded data. Both incorporate standard mechanisms to define data categories (Table A) and classifications of elements (Table B).

These are documented in the WMO Manual on Codes (Publication No. 306) - Volume I.1 Part A: Alphanumeric codes; Volume I.2 Part B: Binary codes and Part C: Common features to binary and alphanumeric codes; Volume II: Regional codes and national coding practices.

See: <http://www.wmo.ch/>



# Example GRIB Codes

TABLE 2. PARAMETERS & UNITS  
Version 2  
(PDS Octet 9)

VALUE	PARAMETER	UNITS	ABBREV.
000	Reserved		
001	Pressure	Pa	PRES
002	Pressure reduced to MSL	Pa	PRMSL
003	Pressure tendency	Pa/s	PTEND
004	Potential vorticity	Km <sup>2</sup> /kg/s	PVORT
005	ICAO Standard Atmosphere Reference Height	m	ICAHT
006	Geopotential	m <sup>2</sup> /s <sup>2</sup>	GP
007	Geopotential height	gpm	HGT
008	Geometric height	m	DIST
009	Standard deviation of height	m	HSTDV
010	Total ozone	Dobson	TOZNE
011	Temperature	K	TMP
012	Virtual temperature	K	VTMP
013	Potential temperature	K	POT
014	Pseudo-adiabatic potential temperature or equivalent potential temperature	K	EPOT
015	Maximum temperature	K	T MAX
016	Minimum temperature	K	T MIN
017	Dew point temperature	K	DPT
018	Dew point depression (or deficit)	K	DEPR
019	Lapse rate	K/m	LAPR
020	Visibility	m	VIS
021	Radar Spectra (1)	-	RDSP1
022	Radar Spectra (2)	-	RDSP2
023	Radar Spectra (3)	-	RDSP3
024	Parcel lifted index (to 500 hPa)	K	PLI
025	Temperature anomaly	K	TMP A
026	Pressure anomaly	Pa	PRESA
027	Geopotential height anomaly	gpm	GP A
028	Wave Spectra (1)	-	WVSP1
029	Wave Spectra (2)	-	WVSP2
030	Wave Spectra (3)	-	WVSP3





# JMCDM

From the Documentation of:

**Joint METOC Conceptual  
Data Model (JMCDM)**



Department of Defense  
Meteorology and Oceanography  
Data Administration

To expedite the expansion of the DoD Enterprise Data Model in the area of Meteorology and Oceanography (METOC), the METOC FAd is developing the Joint METOC Conceptual Data Model (JMCDM). JMCDM is a logical data model that integrates the geophysical data requirements of all DoD components within the Defense Data Dictionary System (DDDS).

The Joint Meteorological and Oceanographic (METOC) Conceptual Data Model (JMCDM) is a logical data model that integrates the data requirements of the Joint METOC data community. These requirements include, but are not limited to the following:

Meteorology	Oceanography
Astrometry	Geology
Mapping, Charting, and Geodesy (MC&G)	

Structurally, JMCDM is comprised of four branches: Observation Data, Derived Data, Climatological Data, and Other Data of Astrometric Origin. JMCDM and its supporting encyclopedia will serve as input for the expansion of the DoD Data Architecture (DDA).

The DDA represents the current over-arching data structure for the Department of Defense.

See: <https://www.cnmoc.navy.mil/da/jmcdm.htm> Also: <http://www-datadmn.itsi.disa.mil/ddm.html>



# Example JMCDM Features

	Definition	Name
7099	A GROUP OF CLOUDS OR OTHER OBSCURING PHENOMENA WHICH HAVE THEIR BASES AT THE SAME HEIGHT WITH COVERAGES DESCRIBED USING THE SUMMATION PRINCIPLE.	SKY-COVER-SUMMATION-STATE
7100	A SUMMARY OF ELEMENTS OF THE PHYSICAL CONDITION OF THE EARTH'S SURFACE.	DAILY-WEATHER-SUMMARY-SURFACE-STATE
7101	A SUMMARY OF PRECIPITATION EVENTS.	DAILY-WEATHER-SUMMARY-PRECIPITATION
7102	A SUMMARY OF OBSERVED ATMOSPHERIC PHENOMENA.	DAILY-WEATHER-SUMMARY-WEATHER-CONDITION
7103	A BOUNDARY OF A RANGE OF TEMPERATURES SAMPLED FOR A PERIOD OF TIME.	EXTREME-AIR-TEMPERATURE
7104	A MEASUREMENT OF PROPERTIES RELATING TO THE SOLID EARTH.	GEOLOGICAL-POINT-OBSERVATION
7106	THE HEIGHT OF A STANDARD ISOBARIC SURFACE IN UNITS PROPORTIONAL TO THE POTENTIAL ENERGY OF UNIT MASS (GEOPOTENTIAL) AT THIS HEIGHT, RELATIVE TO SEA LEVEL.	GEOPOTENTIAL-HEIGHT-ISOBARIC-LEVEL
7107	AN OBSERVATION OF THE ELEMENTS OF THE PHYSICAL STATE OF THE EARTH'S SURFACE.	GROUND-SURFACE-OBSERVATION
7108	PRECIPITATION IN THE FORM OF BALLS OR IRREGULAR LUMPS OF ICE.	HAIL
8217	A NUMERICAL FACTOR FOR A TRIGONOMETRIC TERM IN AN EARTH-GRAVITY-MODEL.	EARTH-GRAVITY-MODEL-COEFFICIENT
8220	THE ASSOCIATION OF ONE GRAVIMETRIC-CONTROL-STATION WITH ANOTHER GRAVIMETRIC -CONTROL-STATION.	GRAVIMETRIC-CONTROL-STATION-ASSOCIATION
8221	THE ACCEPTED GRAVITY RATE INFORMATION FOR A GRAVIMETRIC-CONTROL-STATION.	GRAVIMETRIC-CONTROL-STATION-GRAVITY-RATE
8226	A MEASUREMENT OF THE ACCELERATION OF A STATIONARY BODY AT OR NEAR THE EARTH 'S SURFACE AT A SPECIFIC LOCATION, DATE AND TIME.	GRAVITY-POINT-OBSERVATION
8238	A MEASUREMENT OF THE MAGNITUDE AND DIRECTION OF THE EARTH'S MAGNETIC FIELD AT A LOCATION, DATE, AND TIME.	VECTOR-MAGNETIC-OBSERVATION
10050	THE REPRESENTATION OF GEOPHYSICAL PROPERTIES BY SPHERICAL HARMONICS RELATED TO ASSOCIATED LEGENDRE FUNCTIONS.	SPHERICAL-HARMONIC-COEFFICIENT-REPRESENTATION
10051	AN ESTIMATE OF GEOPHYSICAL CHARACTERISTICS OF AN ELEMENT IN A GEOPHYSICAL-ANALYSIS-FORECAST.	GEOPHYSICAL-ANALYSIS-FORECAST-ELEMENT
10051	AN ESTIMATE OF GEOPHYSICAL CHARACTERISTICS OF A LOCATION OF THE EARTH.	GEOPHYSICAL-POINT-ANALYSIS-FORECAST
10052	AN ESTIMATE OF THE CHARACTERISTICS OF SNOW.	SNOW-ANALYSIS-FORECAST
10053	AN ESTIMATE OF NATURAL SUNLIGHT RADIATION CHARACTERISTICS.	EARTH-SOLAR-RADIATION-ANALYSIS-FORECAST



# Example JMCDM Attributes

	Definition	Datatype	High Range	Low Range	Decimal Point Quantity	Units	Domain Definition	Name
36429	THE ESTIMATED PERCENTAGE OF THE SKY DOME THAT IS COVERED BY ALL MIDDLE LEVEL CLOUDS.	INTEGER	100	0		PERCENT	A GENERAL DOMAIN COMPRISED OF THE NUMERIC CHARACTERS (0-9).	<u>CLOUD-STRATUM-ANALYSIS-FORECAST</u> <u>MIDDLE CLOUD</u> <u>COVERAGE RATE</u>
36433	THE HEIGHT ABOVE MEAN SEA LEVEL OF THE BOTTOM OF A LAYER IN THE ATMOSPHERE WHERE CONTRAIL FORMATION IS PROBABLE.	INTEGER	30000	-90		METERS	A GENERAL DOMAIN COMPRISED OF THE NUMERIC CHARACTERS (0-9) AND A MINUS SIGN (-).	CONTRAIL-ANALYSIS-FORECAST <b>BASE HEIGHT DIMENSION</b>
36437	THE ESTIMATED DENSITY OF PARTICULATE MATTER FOR AN AEROSOL-ELEMENT-ANALYSIS-FORECAST.	FIXED-POINT	10000.000	0.000	3	PARTICLES/CUBIC-CENTIMETER	A GENERAL DOMAIN COMPRISED OF THE NUMERIC CHARACTERS (0-9) AND A DECIMAL POINT (.).	AEROSOL-ELEMENT-ANALYSIS-FORECAST <b>PARTICLE CONCENTRATION RATE</b>
36438	THE CODE THAT DENOTES THE TYPE OF PARTICLE IN AN AEROSOL-ELEMENT-ANALYSIS-FORECAST.	CHARACTER-STRING				N/A	A SPECIFIC DOMAIN COMPRISED OF THE CHARACTERS IN THE ASCII CHARACTER SET.	AEROSOL-ELEMENT-ANALYSIS-FORECAST <b>ELEMENT CODE</b>
36439	THE ESTIMATED LARGEST AXIAL DIMENSION OF THE AVERAGE SIZE AEROSOL PARTICLE.	FIXED-POINT	2000.000	0000.0001	4	MICRONS	A GENERAL DOMAIN COMPRISED OF THE NUMERIC CHARACTERS (0-9) AND A DECIMAL POINT (.).	AEROSOL-ELEMENT-ANALYSIS-FORECAST <b>PARTICLE SIZE DIMENSION</b>
38723	THE QUANTITY OF TIME REQUIRED FOR ACOUSTIC ENERGY TO TRAVEL VERTICALLY FROM THE SEA FLOOR, TO THE SEDIMENT/BASEMENT INTERFACE, AND BACK TO THE SEA FLOOR, AT A LOCATION.	FIXED-POINT	20.00	0.00	2	SECONDS	A GENERAL DOMAIN COMPRISED OF THE NUMERIC CHARACTERS 0-9 AND A DECIMAL POINT (.).	ACOUSTIC-SEDIMENT-THICKNESS <b>TWO-WAY TRAVEL-TIME QUANTITY</b>
45705	THE ANGLE, MEASURED IN A CLOCKWISE DIRECTION, BETWEEN TRUE NORTH AND A LINE DRAWN FROM THE RECEIVER TO THE SOURCE.	INTEGER	359	000		ANGULAR DEGREES	A GENERAL DOMAIN COMPRISED OF THE NUMERIC CHARACTERS (0-9).	ACOUSTIC-PROPAGATION-DATA-COLLECTION-EVENT <b>RECEIVER SOURCE BEARING ANGLE</b>
47678	THE RATE OF THE RADIO FREQUENCY USED TO ASSESS THE APPARENT HEIGHT OF AN IONOSPHERIC LAYER.	INTEGER	30	0		MEGAHERTZ	A GENERAL DOMAIN COMPRISED OF THE NUMERIC VALUES 0-9.	IONOSPHERE-VIRTUAL-HEIGHT-OBSERVATION <b>FREQUENCY RATE</b>
47942	THE QUANTITY OF STANDARD DEVIATION IN THE MEAN AMPLITUDE FOR AN OMNIDIRECTIONAL-AMBIENT-NOISE-VALUE.	FIXED-POINT	30.0	0.0	1	DECIBELS	A GENERAL DOMAIN COMPRISED OF THE NUMERIC CHARACTERS (0-9) AND A DECIMAL POINT(.).	OMNIDIRECTIONAL-AMBIENT-NOISE-VALUE <b>STANDARD DEVIATION QUANTITY</b>



# UCDM

From the Documentation of:

**United States Imagery and Geospatial Information System (USIGS) Conceptual Data Model (UCDM)**



The Department of Defense directed its agencies, through DoD Directive 8320.1, to standardize data elements in use by DoD systems. This directive also established the DoD Defense Data Dictionary System (DDDS) as the central repository for these standard data elements and data entities. The DoD recognized the need to populate the DDDS with standard Mapping, Charting and Geodesy (MC&G) data elements. The National Geospatial-Intelligence Agency (NGA) volunteered to begin this process by modeling the structures presented in the Feature Attribute Coding Catalog (FACC). The FACC is part 4 of the Digital Geospatial Information Exchange Standard (DIGEST), an international exchange standard that is the result of almost 20 nations collaborating to define a coding standard for MC&G features and attributes. (The group responsible for the FACC is the Digital Geographic Information Working Group (DGIWG).)

The modeling of geospatial features and metadata began in late 1993. Collaborative sessions were and continue to be held with the participation of a wide array of DoD, civilian agencies, international and commercial partners. The IDEF1x models that were produced from these sessions collectively comprise the United States Imagery and Geospatial Information System Conceptual Data Model (UCDM.) This UCDM provides the USIGS Community with a data architecture for attaining interoperability and maximizing the usefulness and interchange of imagery and geospatial data.

See: <http://164.214.2.59/sandi/datamodel/>



# Example UCDM Features

## UCDM - C Data Dictionary Report

Entity Name	Definition
<b>ABOVE-SURFACE-MARITIME-WRECK-REPRESENTATION</b>	A model of a MARITIME-WRECK that has a permanently exposed portion.
<b>ABOVE-SURFACE-REEF-REPRESENTATION</b>	A model of a strip or ridge of rocks, sand, or coral that rises above the surface of a body of water.
<b>ABOVE-SURFACE-SNAG-REPRESENTATION</b>	A model of one or more tree stems or stumps that are above the surface of the water.
<b>ACCESS-ZONE-REPRESENTATION</b>	A model of an access zone - a zone between a CONTACT-ZONE-REPRESENTATION and the first possible clearing line.
<b>ACTIVE-ELECTRONIC-HYDROGRAPHIC-AID-TO-NAVIGATION</b>	A HYDROGRAPHIC-AID-TO-NAVIGATION actively transmitting information within the non-visual portion of the electromagnetic spectrum.
<b>ACTIVE-ELECTRONIC-HYDROGRAPHIC-AID-TO-NAVIGATION-GROUP</b>	A collection of ACTIVE-ELECTRONIC-HYDROGRAPHIC-AIDS-TO-NAVIGATION transmitting information on the same frequency
<b>ACTIVE-ELECTRONIC-HYDROGRAPHIC-AID-TO-NAVIGATION-REPRESENTATION</b>	A model of an ACTIVE-ELECTRONIC-HYDROGRAPHIC-AID-TO-NAVI
<b>ADMINISTRATIVE-FEATURE-REPRESENTATION</b>	A model of demarcation established by a responsible administrative authority.
<b>ADMINISTRATIVE-FEATURE-REPRESENTATION-AGREEMENT</b>	The association of an ADMINISTRATIVE-FEATURE-REPRESENTATION with
<b>ADMINISTRATIVE-FEATURE-REPRESENTATION-ASSOCIATION</b>	The association of two ADMINISTRATIVE-FEATURE-REPRESENTATIONS.
<b>ADMINISTRATIVE-FEATURE-REPRESENTATION-DOCUMENT</b>	The association of an ADMINISTRATIVE-FEATURE-REPRESENTATION with
<b>AERATION-BED</b>	A type of RESERVOIR that enables water to be aerated.
<b>AERIAL-CABLEWAY-LINE</b>	Cables which are strung between elevated supports as part of a conveyor system on which cars, buckets, or other carrier units are suspended.



# Example UCDM Attributes

## UCDM - C Data Dictionary Report

### ***ABOVE-SURFACE-MARITIME-WRECK-REPRESENTATION*** Height Dimension

*The exposed height of a maritime wreck at the low water datum.*

<b>Data Type:</b>	Floating-Point	<b>Length:</b>	5	<b>Decimal</b>	0
<b>Min Value:</b>	0.01	<b>Max</b>	99.99	<b>Unit of</b>	Meters

### ***ABOVE-SURFACE-REEF-REPRESENTATION*** Height Dimension

*The height of the feature, which tidal waters cover and uncover, referenced to a specified vertical datum.*

<b>Data Type:</b>	Fixed-Point	<b>Length:</b>	5	<b>Decimal</b>	1
<b>Min Value:</b>	-99.9	<b>Max</b>	999.9	<b>Unit of</b>	Meters

### ***ABOVE-SURFACE-SNAG-REPRESENTATION*** Height Dimension

*The depth of the feature below water, measured from the top or surface of the feature, referenced to a specified vertical datum. Recorded values are positive numbers.*

<b>Data Type:</b>	Fixed-Point	<b>Length:</b>	5	<b>Decimal</b>	1
<b>Min Value:</b>	-99.9	<b>Max</b>	999.9	<b>Unit of</b>	Meters

### ***ACTIVE-ELECTRONIC-HYDROGRAPHIC-AID-TO-NAVIGATION*** Morse Code Text

*The text that describes characters transmitted in Morse Code by an  
ACTIVE-ELECTRONIC-HYDROGRAPHIC-AID-TO-NAVIGATION.*

<b>Data Type:</b>	Character-String	<b>Length:</b>	50
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### ***ACTIVE-ELECTRONIC-HYDROGRAPHIC-AID-TO-NAVIGATION*** Period Seconds Quantity

*The quantity of seconds between the commencement of two identical, successive cycles of an  
ACTIVE-ELECTRONIC-HYDROGRAPHIC-AID-TO-NAVIGATION.*

<b>Data Type:</b>	Integer	<b>Length:</b>	4	<b>Decimal</b>	0
<b>Min Value:</b>	0	<b>Max</b>	9999	<b>Unit of</b>	Seconds



# SDTS

From the Documentation of:

## **Spatial Data Transfer Standard (SDTS)**



The purpose of the SDTS is to promote and facilitate the transfer of digital spatial data between dissimilar computer systems, while preserving information meaning and minimizing the need for information external to the transfer. The SDTS provides a solution to the problem of spatial data transfer from the conceptual level to the details of physical file encoding. Transfer of spatial data involves modeling spatial data concepts, data structures, and logical and physical file structures. To be useful, the data to be transferred must also be meaningful in terms of data content and data quality. SDTS addresses all of these aspects for both vector and raster data structures.

The SDTS is a robust way of transferring earth-referenced spatial data between dissimilar computer systems with the potential for no information loss. It is a transfer standard that embraces the philosophy of self-contained transfers, i.e. spatial data, attribute, geo-referencing, data quality report, data dictionary, and other supporting metadata all included in the transfer.

Part 2 specifically addresses the need for common definitions of spatial features, in particular both topographic and hydrographic. Annex A contains definitions for standard Entity Type terms. Annex B contains definitions for standard Attribute terms. Annex C contains cross-reference lists between Included Terms and Standard Terms.

See: <http://mcmcweb.er.usgs.gov/sdts/>





# Example SDTS Features

Name	Definition
AIRPORT	A facility, either on land or water, where aircraft can take off and land; usually consists of hard-surfaced landing strips, a control tower, hangars, and accommodations for passengers and cargo.
ALLUVIUM	All unconsolidated fragmental material laid down by a stream.
AMMUNITION_DUMP	A military installation used for the storage of explosives and other warlike stores.
ANTENNA	A metallic apparatus for sending and receiving electro-magnetic waves.
ANTENNA_ARRAY	A group of directional antennas.
APPROACHWAY	The airspace through which aircraft approach or leave a landing area.
ARCH	A curved structure that supports the weight of material over an open space.
BACKWATER	An area of calm water unaffected by the current of a stream.
BAR	A submerged or emerged mound, ridge, or succession of ridges of sand or other material extending across the bottom, and which may obstruct navigation.
BASIN	Any bowl-shaped depression in the surface of the land or ocean floor.
BEACH	The gently sloping shore which is washed by waves or tides, especially the parts covered by sand or pebbles.
BEACON	A fixed signal, mark, or light and associated facilities erected for the guidance of mariners or airplane pilots.
BERTH	The place where a ship lies when at anchor secured to a pier or wharf.
BOTTOM	The portion of the ground surface which lies below water.
BOUNDARY	A nonphysical line indicating the limit or extent of an area or territory.
BREAKERS	A zone or region of waves breaking into foam as they advance toward the shore.
BREAKWATER	A structure built to break the force of waves so as to protect a beach, harbor, or other waterfront facility.
BRIDGE	A structure erected over a depression or obstacle to carry traffic or some facility such as a pipeline.
BRIDGE_SUPERSTRUCTURE	Those elements of the bridge structure which are above the uppermost deck.
BUILDING	A permanent walled and roofed construction.
BUILDING_COMPLEX	A group of buildings and associated facilities functioning together as a unit.
BUOY	A float moored or anchored in water.
CABLEWAY	A conveyor system in which carrier units run on wire cables string between supports.
CAMPGROUND	The ground or area on which tents, huts, etc., are erected for temporary shelter.
CAPE	A relatively extensive land area jutting into a water body, which prominently marks a change in or interrupts notably the coastal trend of that water body.



# Example SDTS Attributes

Attribute	Definition
ABANDONED	Deserted.
ACCESS	The type of connection available to a given transportation feature.
ACIDITY	The degree to which hydrogen ions are held by soil colloids or water.
ACTIVE/INACTIVE	Engaged in activity versus no longer in use.
ADMINISTRATION	The organization that has charge of or directs or manages the operation of the feature.
AERONAUTICAL_NAVIGATION	Involving transmission of special radio signals intended to assist in the determination of aircraft position including that relative to collision hazards.
AGE	The first year in existence.
AIR/LAND/WATER	Existing in or part of the atmosphere, the Earth's dry surface, or a body of water.
AIRCRAFT_LANDING	Suitable for or designed for aircraft to descend toward and settle on.
ALTITUDE	The height of a thing above a reference level, especially above the Earth's surface. See also HEIGHT, ELEVATION.
ANNUAL_PRECIPITATION	The quantity of rain and snow falling within the period of a year.
ARCHITECTURAL_PROPERTIES	The style or method of design or construction.
AREA	The measure of a planar region of the Earth's surface.
AREA_DIVIDED	The part of the Earth's surface apportioned.
ARTIFICIALLY_IMPROVED/MANMADE/NATURAL	Artificially improved: naturally existing feature with manmade alterations; manmade: made by man rather than occurring in nature; natural: present in or produced by nature.
ATTACHED_TO_LAND	Connected to a body of land.
BARE	Exposed, not covered with such things as ice, snow or trees.
BEARING_CAPACITY	The ability of a surface or a structure to bear weight.
BLIND/OPEN	Blind, not having an outlet versus open, allowing continuous passage.
BOUNDARY_MARKER	Serving to preserve and identify the location of the boundary line.
BRAIDED	Split into many parts or choked with sandbars that divide it into an intricate network of interlacing channels.
BRANCH/PARENT	Relationship between a main stream and one of its tributaries.
BUILDINGS_NUMBER_OF	The number of permanent walled constructions present.
BUOYED	Marked with buoys used as navigation aids.
CARGO_TRANSPORTATION	Used for the moving of freight from one place to another.
CHAMBERS_NUMBER_OF	The number of enclosed spaces or compartments.
CHARTED_DEPTH	The vertical distance from the tidal datum to the bottom.
CIRCUMFERENCE	The length of the boundary line of any closed curvilinear feature.
CLEARANCE	The vertical distance from a surface to the nearest overhead obstruction.



# OGC

From the Documentation of:

Open GIS Consortium (OGC)

## Open GIS Consortium

*..... Spatial connectivity .....*

**for a changing world.**

OpenGIS is defined as transparent access to heterogeneous geodata and geoprocessing resources in a networked environment. The goal of the OpenGIS Project is to provide a comprehensive suite of open interface specifications that enable developers to write interoperating components that provide these capabilities.

OGC is organized as a tax-exempt "membership corporation," as defined in section 501(c)(6) of the US tax code, whose mission is to promote the development and use of advanced open systems standards and techniques in the area of geoprocessing and related information technologies. OGC is supported by Consortium membership fees and, to a lesser extent, development partnerships and publicly funded cooperative programs.

Much of the information accessible through OGIS is described in terms of geographic features. Geographic features include, for example, roads, surface topography, satellite images, administrative districts, land parcels, land tenures and vegetative cover. The OpenGIS Specification does not define what is meant by a feature type (e.g., that represents a road). OpenGIS provides the standards for a feature dictionary, so that each community can develop its own common dictionary of geospatial feature types and attributes.

See: <http://www.opengis.org/>



# ISO/TC 211

From the Documentation of:

**International Organization for Standardization**

**Technical Committee –Geographic Information/Geomatics**

**(ISO/TC 211)**



The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies from some 130 countries. A non-governmental organization established in 1947, its mission is to promote the development of standardization and related activities in the world with a view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity.

TC 211 addresses standardization in the field of digital geographic information. Its work aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth. TC 211 Draft International Standard 19110 defines a methodology for creating geographic object, attribute and relationship catalogues. Many applications of geographic information include a predefined catalog of object definitions, attribute definitions, and relationship definitions used within the application. These catalogues are derivatives of the application schemata. Including these catalogs, when moving geographic information from one application to another is common. Providing a consistent methodology for defining these catalogs will enhance the ability to map one catalog to another. Such a mapping may be required to use the information.

See: <http://www.iso.ch/>

See also: <http://www.statkart.no/isotc211/>



# A Shared Solution is Required!

- If you have data about the physical environment
    - Who doesn't?
  - Then you need to understand environmental coding
    - A complex topic (as we'll demonstrate)
  - Especially if you intend to interchange environmental data.
- 
- This situation/problem is not unique to a single field.
    - *E.g.*, Bureau of Land Management, city/state governments, ...
- 
- A “worldwide problem”
    - Being tackled by ISO/IEC JTC1 SC24 WG8
    - **18025: Environmental Data Coding Specification (EDCS)**
    - See the following URLs for more information:
      - <http://www.iso.ch>
      - <http://www.jtc1.org>
      - <http://isotc.iso.ch/livelink/livelink.exe?func=ll&objId=327973&objAction=browse&sort=name>
      - <http://www.sedris.org/wg8home>



## **What is the EDCS ?**

**The EDCS standard - background, purpose, content overview and development approach**

**The EDCS standard – use of references, dictionary structures and content examples**



# What is the EDCS ?

- **The EDCS provides mechanisms to unambiguously specify objects used to model environmental concepts.**
  - The EDCS supports the encoding and communication of qualitative and quantitative information associated with natural and artificial environments.
- **The EDCS specifies a collection of nine dictionaries of environmental concepts, as well as:**
  - Guidelines for expanding these dictionaries through *registration*,
  - Conventions for applying the encodings in information processing applications,
  - A functional interface to convert between numeric values given in different units of measure and scales, and
  - Organizational Schema and Groups to aid in searching specific dictionaries.
- **An EDCS Dictionary Entry for a given environmental concept minimally includes:**
  - A Definition which is a precise statement of the nature, properties, scope or essential qualities of a concept embodied in the entry.
  - A Label which is a compact and human-readable designator that is used to denote a concept; this is represented as a character string.
  - A Code which is a compact, and not necessarily human-readable, designator that is used to denote a concept; this is represented as an integer.
  - A Reference type and Reference which specifies “ties” to concepts in other standards, specifications, dictionaries or other documents.
- **The EDCS Registration process includes guidelines that delineate the requirements for adding and deprecating EDCS Dictionary entries.**





# Scope of the EDCS

## Includes, but is not limited to:

- Abstract concepts (absolute latitude accuracy, geodetic azimuth),
- Airborne particulates and aerosols (cloud, fog, snow),
- Animals (civilian, fish, human, whale),
- Atmosphere and atmospheric conditions (air temperature, precipitation rate, pressure Altitude, wind speed and direction),
- Bathymetric physiography (continental shelf, guyot, reef, seamount),
- Electromagnetic and acoustic phenomena (acoustic noise, frequency, polarization, surface reflectivity),
- Equipment (aircraft, artificial satellite, tent, train, vessel),
- Extraterrestrial phenomena (comet, planet, spacecraft),
- Hydrology (lake, rapids, river, swamp),
- Ice (ice field, ice peak, ice shelf, glacier),
- Man-made structures and their interiors (bridge, building, hallway, road, room, town),
- Ocean and littoral surface phenomena (current, surf, tide, wave),
- Ocean floor (coral, rock, sand),
- Oceanographic conditions (luminescence, salinity, specific gravity, water current speed),
- Physiography (cliff, gorge, mountain, valley region),
- Space (charged particle species, ionospheric scintillation, magnetic field, particle density),
- Surface materials (concrete, metal, paint, soil), and
- Vegetation (crop land, forest, grass land, kelp bed, tree).



# The 9 EDCS Dictionaries

- **Classification Dictionary - the type of an environmental object**
  - What is it, or how is it characterized?  
(BUILDING, RIVER, HARBOUR, ...)
- **Attribute Dictionary - the state of an environmental object**
  - What are its additional clarifying characteristics?  
(BUILDING\_FUNCTION, DEPTH, FREQUENCY, ...)
  - What constraints are enforced on values?  
(ENUMERATION, LOGICAL, STRING, INTEGER, REAL, ...)
- **Attribute Value Characteristic Dictionary - attribute value characteristics**
  - Applies to values of instances of EAs of all EDCS attribute value types or
  - Applies only to values of instances of EAs of EDCS attribute value type REAL, COUNT, INDEX, or INTEGER.
- **Attribute Enumerant Dictionary - the enumerates of an enumerated attribute**
  - For each entry in the EA Dictionary of EDCS attribute value type ENUMERATION, there is a set of entries in the EE Dictionary that specifies the allowed values of that EA Dictionary entry.
  - A set of nominal, ordinal or partitioned values  
({ SHORT | MEDIUM | TALL }, { RED | GREEN | BLUE | .. }, ...)



# The 9 EDCS Dictionaries *continued*

- **Unit Dictionary - the unit of measurement of a real valued attribute**
  - A precisely specified quantity in terms of which the magnitudes of other quantities of the same kind can be stated.  
(METRE, PASCAL, KELVIN, ...)
  - Used to specify real value types.
- **Unit Equivalence Class Dictionary - equivalence classed of EUs which measure the same quantity**
  - A partitioning of units of measure into a set, where members of a set measure the same physical quantity.  
(MASS, LENGTH, VOLUME ...)
- **Unit Scale Dictionary - the scale factor to be used with an EU**
  - A multiplicative constant applied to a unit of measure in order to avoid both excessively large or small attribute values.  
(KILO, MILLI, NANO, ...)



# The 9 EDCS Dictionaries

## *continued*

- **Organizational Schema Dictionary - organizational structure for EC and EA dictionary navigation**
  - Provided as an aid to help users of the EDCS standard identify groups of classification and attribute entries that may be related.
  - Sets of groups are defined to support efficient location of classification and attribute dictionary entries.  
(GENERAL, ...)
  
- **Group Dictionary - the groups of ECs & EAs which compose an EO**
  - For each entry in the EO Dictionary, there is a set of entries in the EG Dictionary that specifies the EG members of that EO Dictionary entry.
  - Entries identify classifications and attributes that may be related and relevant, to a domain of interest.
  - These are called “members of a group”, and they may be members of multiple groups.  
(ATMOSPHERE, LIVING\_ORGANISM, PLANT, SPACE, ...)



# Number of Entries in EDCS Dictionaries

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EDCS Dictionary	Approximate Number of Entries
▪ Classification Dictionary (EC)	1427
▪ Attribute Dictionary (EA)	1680
▪ Attribute Value Characteristic Dictionary (EV)	21
▪ Attribute Enumerant Dictionary (EE)	9000
▪ Unit Dictionary (EU)	245
▪ Unit Equivalence Class Dictionary (EQ)	164
▪ Unit Scale Dictionary (ES)	27
▪ Organizational Schema Dictionary (EO)	1
▪ Group Dictionary (EG)	55



# Managing and Distributing the EDCS Dictionaries

- **Managed as an integrated multi-table Access® database**
  - Relationally linked to tables for other coding schemes
  - Enforced constraint checking, version control
- **EDCS Dictionary Distribution:**
  - HTML Format
    - HTML formatted tables in ISO 18025 Standard
    - HTML on-line SEDRIS Web Site documentation
  - Excel® Workbook of all EDCS Dictionary content
  - C Header Files: Direct generation of code files to support SEDRIS technology ANSI C API
    - On-line documentation of 'bound' label constants and codes
    - Improves readability, reduces software coding errors
    - Easily modified to support other target languages
  - EDCS Query Tool
    - Allows the user to browse and query the EDCS with a graphical user interface.



# As Part of SEDRIIS Technology ...

- **Data Representation Model (DRM)**
  - Provides the syntax and structural semantics for representing environmental data and databases (the “grammar” of the language)
- **EDCS**
  - Provides “thing” level semantics (the dictionary of the language) (classify/attribute scheme)
- **Spatial Reference Model (SRM)**
  - Unified and robust description of the coordinate systems, and spatial reference frames, along with an accurate, efficient, and fast software implementation
- **Software Interface Specification (APIs):**
  - Allows ease of access
  - Lowers the barrier-to-entry in software development
- **SEDRIIS Transmittal Format**
  - Platform independent storage and transmission of data
- **Tools**
  - SEE-IT
  - Syntax Checker
  - SbS, etc.





# The EDCS in Relation to the DRM

**EDCS is defined independently of Data Model(s) but ...**

**The SEDRIS DRM uses the EDCS to provide values for DRM object fields.**

## *EDCS Classification Codes Support DRM ...*

**<CLASSIFICATION DATA> used with:**

<ATTRIBUTE SET>,  
<EDCS USE SUMMARY ITEM>,  
<FEATURE>,  
<GEOMETRY>,  
<MODEL>,  
<SYMBOL>  
<Classification Related Features>  
<Classification Related Geometry>

Ex.2

Ex.1

## *EDCS Attribute Codes Support DRM ...*

**<PROPERTY> used with:**

<AGGREGATE FEATURE>,  
<AGGREGATE GEOMETRY>,  
<ATTRIBUTE SET>,  
<BASE CLASSIFICATION DATA>,  
<EDCS USE SUMMARY ITEM>,  
<FEATURE>, <FEATURE TOPOLOGY>  
<GEOMETRY>, <MODEL>

Ex.3

**<STATE DATA> used with:**

<State Related Geometry>  
<State Related Features>

Ex.4

**An attributes require a value, and a value is either: an enumerant code or {unit code, unit scale code and a numeric value} or simply a value**



# Classification in SEDRIS DRM

- SEDRIS objects can be classified with the EDCS Classification Codes (ECC)
- ECCs are well documented in the Classification Dictionary of EDCS
- The 4.0 implementation of EDCS classifications consists of an EDCS integer classification code and a label (ECC\_BUILDING)
- Codes are stored in <Classification Data> objects
- SEDRIS objects can be classified:
  - Explicitly with the <Classification Data> component directly attached.
  - Implicitly by inheriting the <Classification Data> from a parent object higher in the hierarchy.



# Attribution in SEDRI DRM

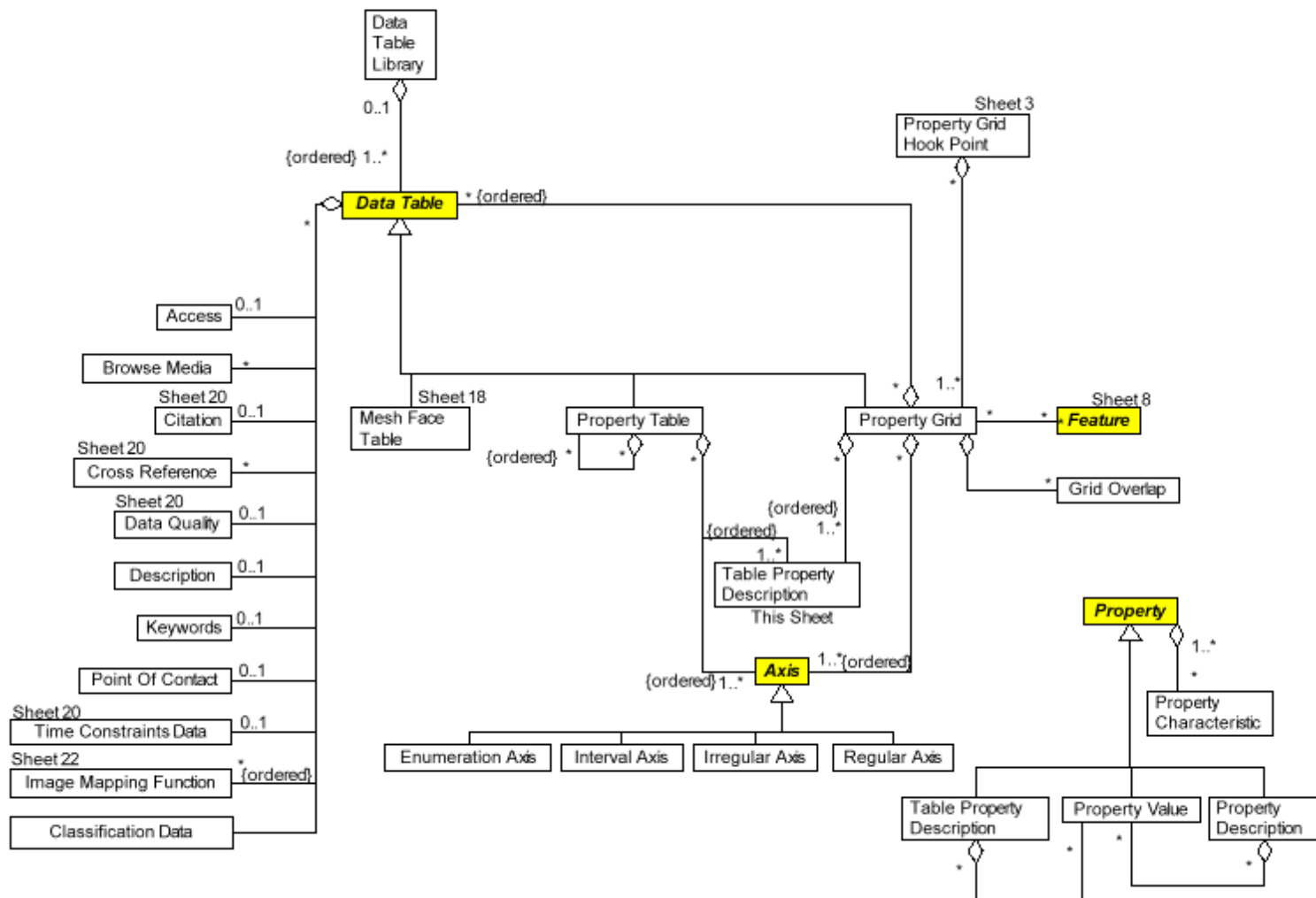
- SEDRI objects can be classified with the EDCS Attribute Codes (EAC)
- EACs are well documented in the Attribute Dictionary of EDCS
- The 4.0 implementation of EDCS attributes consists of EDCS integer attribute code and a label (EAC\_HEIGHT\_ABOVE\_SURFACE\_LEVEL)
- Codes are stored in <Property Value> objects
- SEDRI objects can be attributed with the <Property Value> that:
  - Can be included explicitly by attaching directly to the SEDRI object, or implicitly by inheriting down the hierarchy tree.
  - Contains an EAC and its value.
- SEDRI objects can have zero or more <Property Values>





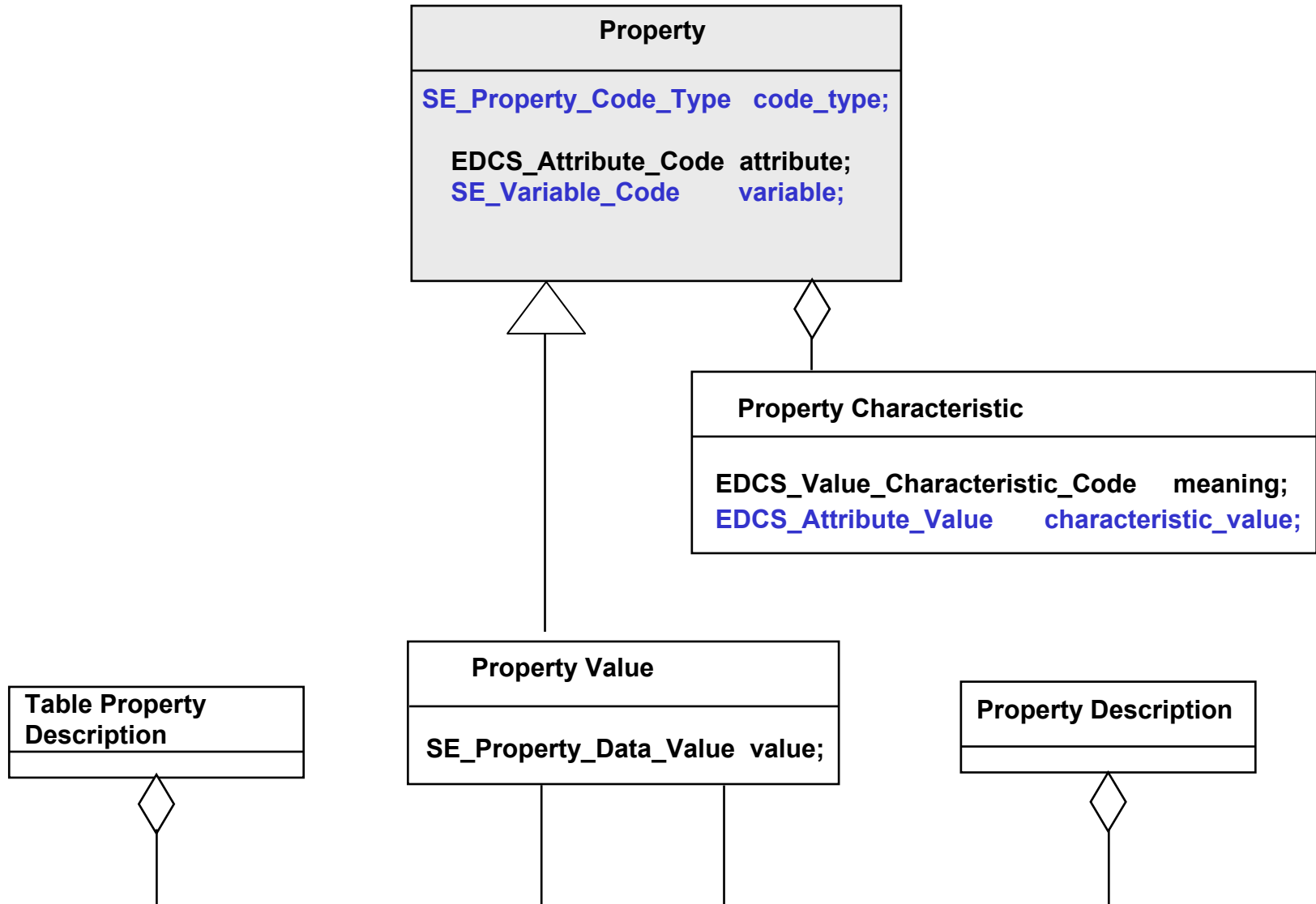
# <Property> in the DRM <Sheet 6>

Sheet: 6 Data Table, Axis, and Property  
Version: 3.1 (24 April 2003)





# <Property> in the DRM <Sheet 6>





# Functionalities of the EDCS API

The EDCS *implementation* includes the specification of mechanisms to access and use dictionary content.

- **Extract Dictionary Content\***

- *E.g.*, given a specified EDCS Dictionary and an entry Label (denoting a concept in that dictionary), what is its Definition or Code?

- **Search Dictionary Content\***

- *E.g.*, given a specified Organizational Schema and a Group Label, what are the Labels of its member Classifications?

- **Convert values among different Units of Measure / Scales**

- *E.g.*, given a value in *miles/hour*, what is its corresponding value in *metres/second*?

**\*Not a portion of the EDCS ISO Standard**





# EDCS ISO/IEC 18025 Clauses

The following Clauses make up this International Standard:

1. **Scope** defines the problem area that this International Standard addresses.
2. **Normative references** lists the normative references.
3. **Terms, definitions, symbols and abbreviated terms** contains the glossary of terminology and a list of abbreviated terms.
4. **Concepts** specifies the fundamentals of this International Standard.
5. **EDCS Classifications** defines classifications used to specify environmental data.
6. **EDCS Attributes** defines attributes used to specify environmental data.
7. **EDCS Units** specifies how the SI System of units of measure and scale is applied to specify environmental data.
8. **EDCS Organizational Schema** specifies a set of groups that are useful for locating classifications and attributes sharing a common context.
9. **EDCS Application Program Interface** is an abstract specification of data types and functions to convert between values given in different units of measure and scales.
10. **Registration** specifies the rules and guidelines that shall be followed in preparing registration proposals.
11. **Conformance** states requirements for conforming to this International Standard.



# EDCS ISO/IEC 18025 Annexes

The following Annexes are also included in this International Standard:

- A. *Deprecated EDCS Dictionary Entries* specifies those dictionary entries whose use is deprecated.
- B. *Groups and references for EDCS Classifications* provides groups and references for definitions of classifications.
- C. *Groups and references for EDCS Attributes* provides groups and references for definitions of attributes.
- D. *References for EDCS Attribute Enumerants* provides references for definitions of attribute enumerants.
- E. *References for groups in the EDCS General Organizational Schema* provides references for definitions of groups in the General Organizational Schema.
- F. *Change and deprecation plan* specifies how this International Standard and its registered items will evolve.
- G. *Abbreviations used in the construction of labels* specifies lists of abbreviations used in defining labels.
- H. *Relationship to ISO/IEC 18023* describes how this International Standard relates to the Data Representation Model of ISO/IEC 18023-1.
- I. *Template for Registration Proposals* is a set of blank forms that may be used to create proposals for registered items.

The *Bibliography* lists informative documents referenced by this International Standard.

The *EDCS Dictionary Index* provides direct links to the tables that present all EDCS dictionary entries.



# EDCS Standards Process

## *Who is developing the Standard?*

- **Developed by:**
  - Working Group (WG) 8, “*Environmental Representation*” of
  - Subcommittee (SC) 24, “*Computer Graphics and Image Processing*”
  - In collaboration with the SEDRIS Organization
- **Subcommittee 24 is part of the:**
  - ISO / IEC Joint Technical Committee (JTC 1), “*Information Technology*”
- **ISO / IEC is a joint activity of:**
  - International Organization for Standardization (ISO) and the
  - International Electrotechnical Commission (IEC)
- **This standard is uniquely identified by:**
  - The number 18025,
  - With the title of:  
  
“Information technology --  
Computer graphics and image processing --  
Environmental Data Coding Specification (EDCS)”

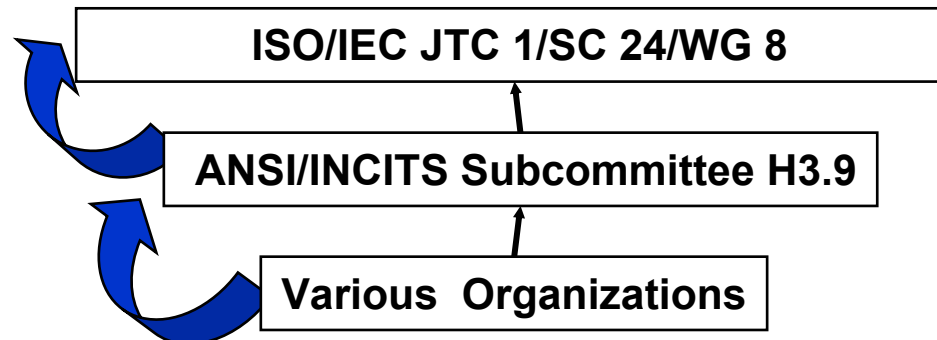


# ISO Standards Development

## *The Organization Structure*

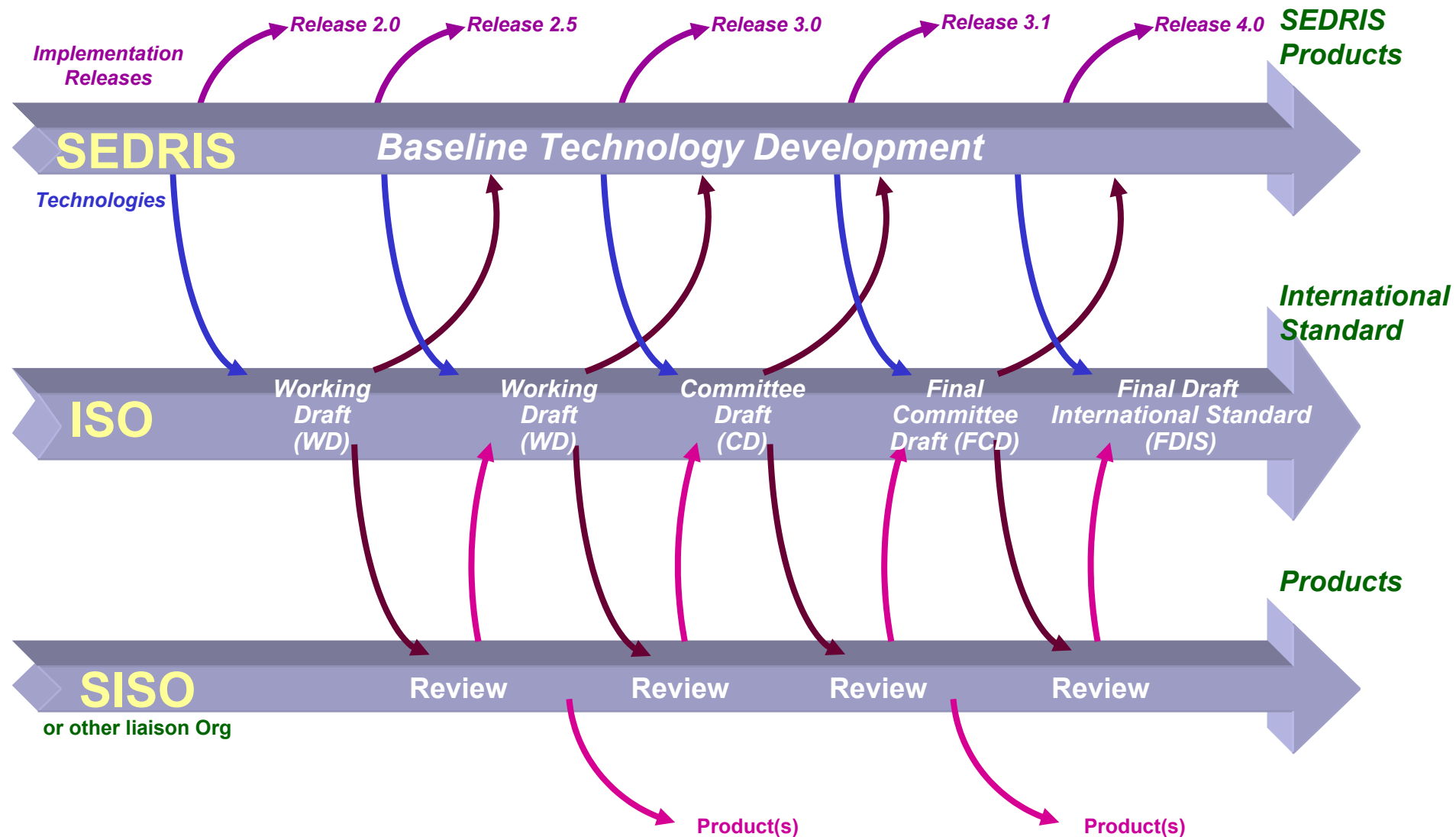
Each participating country's national standards body represents that country's interest and involvement in developing the standard.

- **For Example, The United States is represented in this process by:**
  - Subcommittee H3.9
- **Committee H3 is part of the:**
  - ANSI / INCITS Standards Organization
- **ANSI / INCITS stands for:**
  - American National Standards Institute (ANSI) InterNational Committee for Information Technology Standards (INCITS)
- **Input is provided to ANSI / INCITS H3.9 through:**
  - Industry, US government standards organizations, NASA, and individual participants
- **So ... the path via the US National Standards Body into SC24 WG8 is:**





# Process Relationship to Other Organizations





# **What is the EDCS**

**The EDCS standard - background, purpose, content overview and development approach**

**The EDCS standard – use of references, dictionary structures and content examples.**



# Use of References in the EDCS

- **Objective: Unambiguous communication across disparate domains**
  - Bring together (consistently) concepts that are seen as "authoritative" in those domains.
- The reference type, reference, and supplemental references fields of an EDCS dictionary entry serve the following purposes:
  - The specification of the nature of the relationship between the concept embodied by that entry and the concept optionally cited in the reference field,
  - The identification of the source of the concept embodied in that entry, and
  - To provide additional information useful in understanding that entry.
- The reference type and reference fields are closely related while the supplemental references field provides additional information.





# Types of References

- **Authoritative reference (AR):**

- Meets the requirements for a prescriptive reference AND has an agreement between ISO and the owner of the referenced specification to ensure that the concept referenced shall not be changed without the agreement of the ISO.

- **Prescriptive Reference (PR):**

- The concept embodied in that EDCS dictionary entry is the same concept as defined in a specification. The concept definition of the concept in the EDCS may be different from the definition in the specification because of modifications to either:
  - Include missing (implied) context not present in the definition in the specification, or
  - Match the style and structure of other concept definitions in this International Standard.

- **Informative Reference (IR):**

- The concept embodied in that EDCS dictionary entry is either the same as or is derived from a concept defined in another document. In this case, the concept defined in the EDCS shall be defined by the meaning of the words used in the concept definition and shall not require any material from the cited reference for its understanding.



# Supplemental References

## ▪ Supplemental References:

- The supplemental references field contains one or more citations that provide information useful in understanding that entry.
- Supplemental references are always for information only and do not have an EDCS reference type.
- A citation in the reference field is not repeated as a citation in the supplemental reference field even if it provides information useful in understanding that EDCS dictionary entry.



# EDCS Dictionary Structure

- **Nine dictionaries of concepts are as follows:**
  - Classification..... **EC**
  - Attribute ..... **EA**
    - Attribute Value Characteristic ..... **EV**
    - Attribute Enumerant ..... **EE**
    - Unit ..... **EU**
      - Unit Scale..... **ES**
      - Unit Equivalence Class ..... **EQ**
  - Organizational Schema ..... **EO**
    - Group ..... **EG**
- **Each dictionary entry has at least a *definition*, *label*, and *code***
  - Most also explicitly include *reference type* and *reference*
  - Some have additional information
    - Attribute: *Value Type*, *Unit Equivalence Class*
    - Unit: *Symbol*, *Quantity*, *Unit Equivalence Class*

**Note that the “E” in each dictionary acronym stands for “EDCS”.**



# EDCS Dictionary Fields

Field Names \ Dictionary									
	EC	EA	EV	EE	EU	ES	EQ	EO	EG
Label	X	X	X	X	X	X	X	X	X
Definition	X	X	X	X	X	X	X	X	X
Code	X	X	X	X	X	X	X	X	X
EA Label				X					
Symbol					X	X			
Applicability			X						
Quantity					X				
Attribute Value Type		X							
Unit(s)		EQ Label			EQ Label		EQ Label		
Organizational Schema									X
Groups	EG Label	EG Label							
Reference Type	X	X	X	X	*	**		X	X
References	X	X	X	X	X	**		X	X
Supplemental References	X	X	X	X	X	**		X	X

\* All EUs Normatively referenced with ISO 31; no separate field

\*\* All ESs Normatively referenced to tables in ISO 31 or IEC 60027-2; no separate field



# Common Dictionary Structure

## ■ Definition

- Clear and concise
- Unambiguous
- Atomic and self-contained
- Unique within same dictionary
- *May use (incorporate) previously defined EC or EA concepts*

## ■ Label

- Each uniquely denotes a concept,
- Each is a succinct expression of the concept it denotes,
- Labels are represented as character strings, and
- Labels are human readable

## ■ Code

- Each uniquely denotes a concept,
- Codes are represented as integers, and
- Codes are assigned sequentially in increasing order beginning at 1.

## ■ Use of recognized abbreviations and acronyms must satisfy a set of guidelines



# Structured Definitions

- “If an EC is used in the definition of another concept, this use is represented in the definition by placing the label for that EC in single angle brackets (< >) in the definition.”
  - Example:
    - ECL: *WATER\_CURRENT*
    - Definition: *A <CURRENT> in a <WATER\_BODY>.*
- “If an EA is used in the definition of another concept, this use is represented in the definition by placing the label for that EA in double angle brackets (<< >>) in the definition.”
  - Example:
    - EAL: *SAND\_DUNE\_ORIENTATION*
    - Definition: *The <<GEODETIC\_AZIMUTH>> of the characteristic alignment of a <SAND\_DUNE> as caused by the prevailing <WIND>s; the sand dune orientation.*



# Structured Definitions (cont'd)

- **Advantages:**
  - Tight, compact definitions
    - References are hyper-linked
  - Improved consistency
  - Replaces (difficult to define) “related concepts”
- **Disadvantage:**
  - A change in the definition a referenced EC or EA could change or invalidate an entry that makes the reference
- **Dependencies:**
  - If a definition is modified it may affect other entries
  - If a new entry is added other entries may reference it





# EC Dictionary of

---

## Classification Entries

**What is it, or how is it characterized?  
(BUILDING, RIVER, HARBOUR, ...)**



# Classification Entry Table Structure

Column	Meaning
Label	A unique string that denotes the classification - the EDCS Classification Label (ECL).
Definition	The concept definition of the EDCS Classification (EC).
Code	The EDCS Classification Code (ECC).
<i>Groups</i>	The EDCS Group Labels (EGLs) of the EGs in EO GENERAL of which this EC is a member.
Reference Type	The type of the references.
Reference	The references for this EC.
Supplemental References	The supplemental references for this EC.



# Example Classification Entry

<b>Label</b>	LIGHTHOUSE
<b>Definition</b>	A distinctive <STRUCTURE> exhibiting one or more <LIGHT>s designed to serve as an <AID_TO_NAVIGATION>; a lighthouse.
<b>Code</b>	630
<b>Groups</b>	LIGHTING_AND_VISIBILITY, TRNSP
<b>Reference Type</b>	PR
<b>Reference</b>	[FACC, Annex A: BC050]
<b>Supplemental References</b>	



# Other Example EC Entries

Label	Definition	Code	Groups	Ref Type	Reference	Supplemental Reference
AQUEDUCT	A <b>&lt;PIPE&gt;</b> or artificial channel designed to transport <b>&lt;WATER&gt;</b> from a remote source, usually by gravity; an aqueduct.	76	INFRASTRUCTURE	PR	[ <b>FACC</b> , Annex A: BH010]	
BIOLOGIC_HAZARD_REGION	A <b>&lt;REGION&gt;</b> in which a biologic substance that can kill, seriously injure, or incapacitate a person or animal through its physiological properties, is present; usually dispersed over a <b>&lt;SURFACE&gt;</b> or within the <b>&lt;ATMOSPHERE&gt;</b> .	139	ATMOSPHERE, LIVING_ORGANISM, SURFACE			
BUILT_UP_REGION	A <b>&lt;TRACT&gt;</b> containing a concentration of <b>&lt;BUILDING&gt;</b> s and other <b>&lt;STRUCTURE&gt;</b> s; a built up region.	176	SHELTER	IR	[ <b>S57A</b> , Object: BUAARE]	
COAST	A <b>&lt;TERRAIN_STRIP&gt;</b> of indefinite <b>&lt;&lt;WIDTH&gt;&gt;</b> that extends from the <b>&lt;COASTLINE&gt;</b> inland to the first major change in the <b>&lt;TERRAIN&gt;</b> ; a coast.	251	DEMARCATIION, LITTORAL, PHYSIOGRAPHY			[ <b>NSOED</b> , "coast", 1.2]



# EA Dictionary of

---

## Attribute Entries

**What are its additional clarifying characteristics?  
(BUILDING\_FUNCTION, DEPTH, ...)**

**What constraints are enforced on values?  
(ENUMERATED, LOGICAL, STRING, INTEGER, ...)**



# Attribute Entry Table Structure

Column	Meaning
Label	A unique string that denotes the attribute - the EAL.
Definition	The definition of the EDCS Attribute (EA).
Code	The EDCS Attribute Code (EAC).
Value Type	The type of the EDCS attribute, which includes: REAL, INTEGER, COUNT, INDEX, STRING, CONSTRAINED_STRING, KEY, ENUMERATION, LOGICAL and NULL.
Unit Equivalence Class Label	If the EDCS Attribute value type is REAL, this field contains an EQL. The presentation of this field is grey for all other EDCS Attribute Value Types.
Groups	The EGLs of the EGs in EO GENERAL of which this EA is a member.
Reference Type	The type of the references.
Reference	The references for this EA.
Supplemental References	The supplemental references for this EA.



# Attribute Value Types

Attribute Value Type	Definition
REAL	A real number or real value interval.
INTEGER	An integer or integer interval.
COUNT	A cardinal number, an ordinal number, a cardinal number interval, or an ordinal number interval .
INDEX	An integer used for identification.
STRING	A character string.
CONSTRAINED_STRING	A STRING whose format and/or values are constrained by an associated scheme identifying the rules comprising the constraint.
KEY	A STRING used for identification.
ENUMERATION	One of a finite set of mutually exclusive values.
BOOLEAN	An ENUMERATION with two values, FALSE (1) and TRUE (2), representing the false and true values in a two-valued logic system
NULL	An ENUMERATION with one value NULL (1), representing no information.





# Constrained Strings Example

- Constrained String – Defined:
  - A STRING whose format and/or values are constrained by an associated scheme identifying the rules comprising the constraint.
  
- Constrained String - Example:
  - Attribute: **CALENDAR\_DATE**
  
  - Definition: The calendar date; formatted as specified by **<<DATE\_FORMAT>>** or by **<<DATE\_TIME\_FORMAT>>**
  
  - Value example: “20040107” qualified by:
    - Attribute: **DATE\_FORMAT**
    - Enumerant: **YYYYMMDD**
    - Which is the calendar year 2004 of the month January of the 7<sup>th</sup> day



# Single or Interval Values

- For attribute value types of REAL, INTEGER and COUNT attribute values may be either a single value or an interval of numbers.
- There are eight types of intervals:
  - Four bounded interval types:
    - $(a, b)$ ,  $[a, b)$ ,  $(a, b]$ , and  $[a, b]$
  - Four unbounded interval types:
    - $(a, +\infty)$ ,  $[a, +\infty)$ ,  $(-\infty, b)$ , and  $(-\infty, b]$

EDCS numeric value type	Specification
SINGLE_VALUE	A single value.
OPEN_INTERVAL	The bounded open interval $(a, b)$ .
GE_LT_INTERVAL	The bounded interval $[a, b)$ .
GT_LE_INTERVAL	The bounded interval $(a, b]$ .
CLOSED_INTERVAL	The bounded interval $[a, b]$ .
GT_SEMI_INTERVAL	The unbounded interval $(a, +\infty)$ .
GE_SEMI_INTERVAL	The unbounded interval $[a, +\infty)$ .
LT_SEMI_INTERVAL	The unbounded interval $(-\infty, b)$ .
LE_SEMI_INTERVAL	The unbounded interval $(-\infty, b]$ .



# Intervals Example

- Interval - Example:
  - Attribute: **BRUSH\_DENSITY**
  - Definition: A number between 0 and 1 inclusive representing the linearly-scaled fraction of **<LAND>** covered by undergrowth (for example: scrub, brush, and/or bush); the brush density. Zero means no undergrowth and one means completely covered.
  - Value Example:
    - Real interval: (0.15, 0.50]



# Example Attribute Entry

<b>Label</b>	BUILDING_FUNCTION
<b>Definition</b>	The function of a <BUILDING>.
<b>Code</b>	209
<b>Value Type</b>	ENUMERATION
<b>Unit Equivalence Class Label</b>	
<b>Groups</b>	SHELTER
<b>Reference Type</b>	IR
<b>Reference</b>	[FACC, Annex B: BFC]
<b>Supplemental References</b>	



# Other Example EA Entries

Label	Definition	Code	Value Type	EQ Label	Groups	Ref Type	Reference	Supplemental References
AUXILIARY_VESSEL_TYPE	The type of a <WATER_SURFACE_VESSEL> designed for auxiliary operations.	140	ENUMERATION		HYDROGRAPHIC_TRNSP, TRNSP, VEHICLE			
GEODETIC_AZIMUTH	The <<VECTOR_AZIMUTH_GEODETIC>> in the horizontal plane at the observer's <LOCATION>, to either a <LINE> passing through the observer, or a vector relative to the observer, or the <DIRECTION> from the observer to an <OBJECT> or <LOCATION>.	418	REAL	PLANE_ANGLE	ABSTRACT_OBJECT, ANGULAR_MEASURE			
RELATIVE_HUMIDITY	The ratio of vapour pressure to saturation vapour pressure, where vapour pressure is the pressure exerted by the molecules of water vapour and saturation vapour pressure is the pressure exerted by molecules of water vapour in <AIR> that has attained saturation; the relative humidity.	1103	REAL	PURE_NUMBER	ATMOSPHERE, RATE_OR_RATIO	IR	[GMET]	



# EV Dictionary of

## Attribute Value Characteristic Entries

**Qualitative Characterization of the value of an attribute  
(MISSING, MULTIPLE, NOT\_APPLICABLE, ...)**

**Quantitative Characterization of sets of attribute values  
(POSITIVE\_INFINITY, NEGATIVE\_INFINITY,  
POSITIVE-OVERFLOW, ...)**



# Attribute Value Characteristic Entry Table Structure

Column	Meaning
Label	A unique string that denotes the EDCS Attribute Value Characteristic.
Definition	The definition of the EDCS Attribute Value Characteristic.
Applicability	Either "All" if the EV applies to values of instances of EAs of all EDCS attribute value types or "Numeric" if the EV applies only to values of instances of EAs of EDCS attribute value type REAL, COUNT, INDEX, or INTEGER.
Code	The EDCS Attribute Value Characteristic Code for the EV - the EVC.
Reference Type	The type of the references.
Reference	The references for this EV.
Supplemental References	The supplemental references for this EV.



# Attribute Value Characteristic Usage

- EDCS Attribute Value Characteristic Dictionary (EV) entry specifies information concerning the qualitative or quantitative characteristics of values of instances of EAs.
- The *Applicability* field in the EV Dictionary entry captures:
  - Either "All" if the EV applies to values of instances of EAs of all EDCS attribute value types or
  - "Numeric" if the EV applies only to values of instances of EAs of EDCS attribute value type REAL, COUNT, INDEX, or INTEGER.





# Quantitative Characterization

Label	Concept definition	Applicability	Code
POSITIVE_INFINITY	The attribute value is positive infinity.	Numeric	1
NEGATIVE_INFINITY	The attribute value is negative infinity.	Numeric	2
POSITIVE_OVERFLOW	The attribute value is greater than any positive value that can be represented; positive overflow.	Numeric	3
NEGATIVE_OVERFLOW	The attribute value is less than any negative value that can be represented; negative overflow.	Numeric	4
POSITIVE_UNDERFLOW	The value of the attribute value is positive and the absolute value of the attribute value is less than the absolute value of any positive value that can be represented in the implementation; positive underflow.	Numeric	5
NEGATIVE_UNDERFLOW	The value of the attribute value is negative and the absolute value of the attribute value is less than the absolute value of any negative value that can be represented in the implementation; negative underflow.	Numeric	6



# Qualitative Characterization

Label	Concept definition	Applicability	Code
MISSING	The attribute value is missing.	All	7
MULTIPLE	The attribute has more than one possible value; multiple.	All	8
NOT_APPLICABLE	No attribute value in the range of possible attribute values is applicable.	All	9
VALUE_WITHHELD	The attribute value exists, but due to policy considerations it cannot be given; value withheld.	All	10
UNDESIGNATED	The attribute value cannot be given for some reason other than it is one of: MISSING, MULTIPLE, NOT_APPLICABLE, or VALUE_WITHHELD; undesignated.	All	11
VALUE_SPECIFIED	The attribute value is specified.	All	12
NOMINAL_VALUE	This attribute value is the nominal and/or default value.	All	13
CONSTANT_VALUE	The set of attribute values are constant at this value.	All	14
TOLERANCE	Each value in the set of attribute values is rounded to a multiple of this value; tolerance.	Numeric	15
MAXIMUM_VALUE	This attribute value is the maximum valid attribute value.	Numeric	16
MINIMUM_VALUE	This attribute value is the minimum valid attribute value.	Numeric	17
UPPER_BOUND	This attribute value bounds the set of attribute values from above; upper bound.	Numeric	18
LOWER_BOUND	This attribute value bounds the set of attribute values from below; lower bound.	Numeric	19
MEASUREMENT_ERROR	The attribute value was measured or estimated with a standard error given by this value.	Numeric	20



# EE Dictionary of

---

## Attribute Enumerant Entries

**For attributes of Value Type ENUMERATION,  
what are its possible values?**

**A set of nominal, ordinal or partitioned values.**

**({ SHORT | MEDIUM | TALL }, ...)**

**Used to specify the values of enumerated attributes.**



# Attribute Enumerant Entry Table Structure

Column	Meaning
Attribute Label	The EDCS Attribute Label (EAL) for which this is an EE.
Enumerate Label	A unique string that denotes the EDCS enumerant – the EDCS Enumerant Label (EEL).
Definition	The definition of the EE, except where no EEL is presented in which case it is the definition for the EA.
Code	The EDCS Enumerant Code for the attribute enumerant – the EEC.
Reference Type	The type of references.
Reference	The references for this EE.
Supplemental References	The supplemental references for this EE.



# Example Attribute Enumerant Entry

<b>Attribute Label</b>	BUILDING_FUNCTION
<b>Enumerate Label</b>	LIGHTHOUSE
<b>Definition</b>	<LIGHTHOUSE>. *
<b>Code</b>	89
<b>Reference Type</b>	
<b>Reference</b>	
<b>Supplemental References</b>	

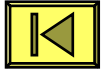


# Other Example EE Entries

Attribute Label	Enumerant Label	Definition	Code	Ref Type	Reference	Supplemental References
BUILT_UP_REGION_DENSITY						
	SPARSE	The concentration of <BUILDING>s in the <REGION> is low; a large amount of open <LAND> remains; sparse.	1	IR	[FACC, Annex B, BAC:1]	
	MODERATE	The concentration of <BUILDING>s in the <REGION> is such that space remains for the construction of more <BUILDING>s; a significant amount of open <LAND> remains; moderate.	2	IR	[FACC, Annex B, BAC:3]	
	DENSE	The concentration of <BUILDING>s in the <REGION> is such that few places remain to construct more <BUILDING>s; very little open <LAND> is available; dense.	3	IR	[FACC, Annex B, BAC:2]	



# EU Dictionary of



## Unit Entries

**What is a quantifiable measure?  
A precisely specified quantity in terms  
of which the magnitudes of other quantities  
of the same kind can be stated.**

**(METRE, PASCAL, ...)**

**Used to specify the values of numeric attributes**



# Units

EDCS adopts the ISO 31 International System of Units (SI)

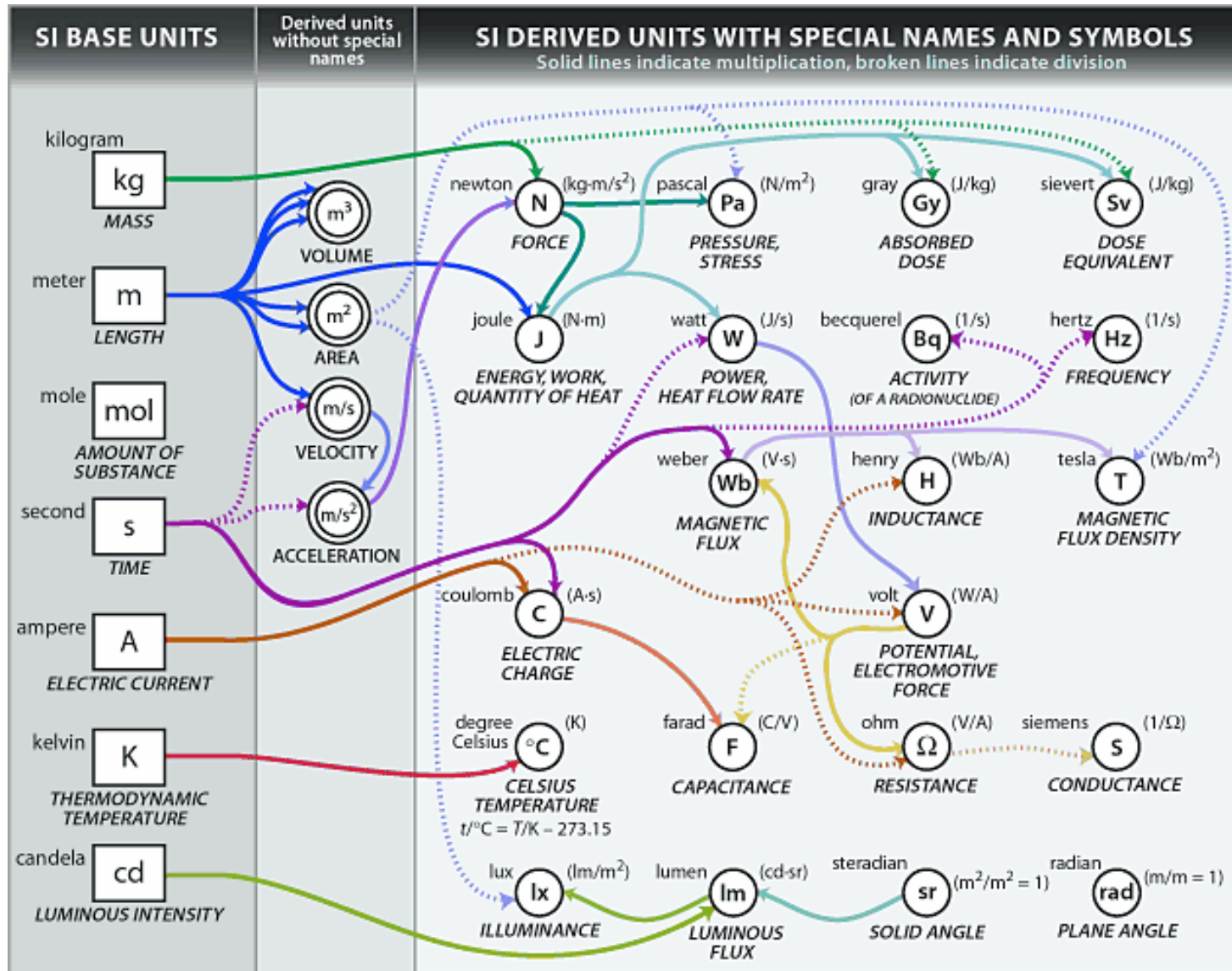
Ref: <http://physics.nist.gov/cuu/Units/index.html>

- The SI is founded on seven base units for seven base quantities assumed to be mutually independent.
- Other quantities, called derived quantities, are defined in terms of the seven base quantities via a system of quantity equations. The derived units for these derived quantities are obtained from these equations and the seven base units.
- The radian and steradian are supplemental units which are now interpreted as so-called dimensionless derived units, and they may be used in expressions for derived units.
- SI base, derived, and supplemental units may be combined with standard prefixes, or scales.
- Certain units are not part of the International System of Units; that is, they are outside the SI, but are important and widely used. Units in this category are accepted for use with the SI, and in the EDCS Standard e.g., ARC\_MINUTE, HOUR, LITRE.
- Other units outside the SI are currently accepted for use with the SI by NIST. Their continued use is [not encouraged](#). Units in this category which are accepted for use with the SI in the EDCS are referred to as deprecated units. They will be removed from a future release of the EDCS Standard; e.g., MILE, TON.





# SI Base and Example Derived Units





# Unit Dictionary Table Structure

Column	Meaning
Label	A unique string that denotes the EU – the EDCS Unit Label (EUL).
Symbol	The symbol for this EU. If the EU has no symbol, "none" is entered in this field.
Quantity	A quantity associated with this EU; additional synonymous quantities may be included parenthetically.
Definition	The concept definition of the quantity, including an expression for the quantity in terms of SI base units if the value of the symbol field is not in terms of SI base units (see 4.3.1).
EQ Label	A unique string that denotes the EDCS Unit Equivalence Class – the EQL.
Code	The EDCS Unit Code for the EU – the EUC.
Reference	The reference for this EU. For EUs within the scope of SI, either this field contains a reference to the part of ISO 31 where this quantity is defined or this field contains an explanation of its derivation from quantities defined in ISO 31.
Supplemental references	The supplemental references for this EU.



# Example Unit Dictionary Entry

<b>Label</b>	<b>METRE_PER_HOUR</b>
<b>Symbol</b>	<b>m/h</b>
<b>Quantity</b>	<b>velocity</b>
<b>Definition</b>	The distance divided by time. 1 m/h = 1 / 3,6 x 10 <sup>-3</sup> <a href="#"><u>m/s</u></a> (exactly).
<b>EQ Label</b>	<a href="#"><u>SPEED</u></a>
<b>Code</b>	145
<b>Reference</b>	ISO 31-1:1992, 1-10.a
<b>Supplemental References</b>	ISO 31-0:1992, 2.3.2.



# Other Example EU Entries

Symbol	Quantity	Definition	EQ Label	Code	References	Supplemental References
A/m	lineic electric current (linear electric current density)	The electric current in a conducting sheet divided by the width of the sheet.	LINEIC_ ELECTRIC_ CURRENT	1	ISO 31-5:1992, 5-16.a	
	magnetic field strength	A vector quantity, the rotation (curl) of which is equal to the sum of the electric current density and the time derivative of the electric flux density.			ISO 31-5:1992, 5-17.a	
	magnetization	The extent to which a magnetic material is magnetized, given by the magnetic moment per unit volume.			ISO 31-5:1992, 5-28.a	

**An EU may have multiple Quantity/Definition pairs, as does this one.**



# Examples of Deprecated Units (Annex B)

Label	Symbol	Quantity	Definition	EQ Label	Code	References
FOOT	ft	length	1 ft = 0,304 8 m (exactly).	LENGTH	51	[I31-1, 1-3.Ab]
GAL	Gal	acceleration	The change in velocity divided by time. 1 Gal = 0,01 m/s <sup>2</sup> (exactly).	ACCELERATION	52	[I31-1, 1-11.B.a]
KNOT	kn	velocity	The distance divided by time. 1 kn = 1 nautical mile per hour = 1,852 km/h = 0,514 444 m/s (exactly).	SPEED	128	[I31-1, 1-10.b (remarks)], [I1000, Annex A 1-10]
MILE	mile	length	1 mile = 1 609,344 m (exactly).	LENGTH	148	[I31-1, 1-3.Ad]
MILE_PER_HOUR	mile/h	velocity	The distance divided by time. 1 mile/h = 0,447 04 m/s (exactly).	SPEED	149	[I31-1, 1-10.Ab]
NAUTICAL_MILE	none	length	1 nautical mile = 1 852 m (exactly).	LENGTH	158	[I31-1, 1-3.a (remarks)]
YEAR	a	time (annum)	The time that elapses between two successive passages of the <SUN> through the vernal equinox. 1 year = 365,242 20 d = 31 556 926 s (approximately).	TIME	245	[I31-1, 1-7.B.a]



# ES Dictionary of

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## Unit Scale Entries

**What is the scale for its value?**

**A multiplicative constant applied to a unit of measure in order to avoid both excessively large or small attribute values.**

**(KILO, MILLI, NANO, ...)**



# Unit Scale Table Structure

Column	Meaning
Label	A unique string that denotes the EDCS Unit Scale – the ESL.
Symbol	The symbol for the ES. If an ES has no symbol, 'none' is entered in this field.
Definition	The multiple or submultiple factor of the ES.
Code	The EDCS Unit Scale Code for the unit scale – the ESC.



# Unit Scales

## For Powers of 10

Label	Symbol	Definition	Code
YOTTA	Y	$10^{24}$	1
ZETTA	Z	$10^{21}$	2
EXA	E	$10^{18}$	3
PETA	P	$10^{15}$	4
TERA	T	$10^{12}$	5
GIGA	G	$10^9$	6
MEGA	M	$10^6$	7
KILO	k	$10^3$	8
HECTO	h	$10^2$	9
DECA	da	$10^1$	10
UNI	1	$10^0$	11
DECI	d	$10^{-1}$	12
CENTI	c	$10^{-2}$	13
MILLI	m	$10^{-3}$	14
MICRO	$\mu$	$10^{-6}$	15
NANO	n	$10^{-9}$	16
PICO	p	$10^{-12}$	17
FEMTO	f	$10^{-15}$	18
ATTO	a	$10^{-18}$	19
ZEPTO	z	$10^{-21}$	20
YOCTO	y	$10^{-24}$	21

## For Powers of $2^{10}$

Label	Symbol	Definition	Code
KIBI	Ki	$2^{10}$	22
MEBI	Mi	$2^{20}$	23
GIBI	Gi	$2^{30}$	24
TEBI	Ti	$2^{40}$	25
PEBI	Pi	$2^{50}$	26
EXBI	Ei	$2^{60}$	27

- Based on SI prefixes which are integral part of the coherent system of SI Units.
- Provides scaling information for use in conjunction with EUs.
- Each ES has unique definition, and is designated by both a unique EDCS Unit Scale Label (ESL) and a unique Unit Scale Code (ESC).
- The ES Dictionary is presented in tables with its entries organized by the value of the multiplicative constant (scale factor).
- *This set of scales can not be extended by registration.*





# EQ Dictionary of

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## Unit Equivalence Class Entries

**What other units are commensurate with it?**

**A partitioning of units of measure into sets, where members of a set measure the same physical quantities and be interconverted.**

**(MASS, LENGTH, VOLUME, ...)**



# Unit Equivalence Class Table Structure

Column	Meaning
Label	A unique string that denotes the EDCS Unit Equivalence Class – the EQL.
Definition	The definition of the quantity of which the members of this EQ are called “quantities of the same kind”.
Equivalence Class Membership	The list of EULs that are members of the EQ. The labels of EUs that are part of the International System of Units are shown in <u><b>bold</b></u> . The labels of EUs that are deprecated units are shown in <u><i>italics</i></u> . The remaining EUs are those based on units used with the SI.
Code	The EDCS Unit Equivalence Class Code – the EQC.



# Example Unit Equivalence Class Entry

<b>Label</b>	ABSORBED_DOSE
<b>Definition</b>	Absorbed dose of ionizing radiation.
<b>Equivalence Class Membership</b>	<b>GRAY</b> , <i>RAD</i>
<b>Code</b>	1



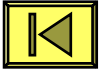
# Other Example EQ Entries

Label	Definition	Equivalence Class Membership	Code
ANGULAR_VELOCITY	Angular velocity.	RADIAN_PER_SEC	11
AREA	Area.	ARE, BARN, HECTARE, SQ_METRE	13
FIELD_OR_POWER_LEVEL_DIFF	Field or power level difference.	BEL, DB, NEPER	37
FLUX_DENSITY	Flux density.	INT_SOLAR_FLUX_UNIT, JANSKY, WATT_PER_SQ_M_HZ	39
FORCE	Force.	NEWTON	40
LENGTH	Length.	ANGSTROM, ASTRONOMICAL_UNIT, FOOT, LIGHT_YEAR, METRE, MILE, NAUTICAL_MILE, PARSEC	54
MASS	Mass.	GRAM, KILOGRAM, KILOPOUND, LONG_TON, TON, TONNE, UNIFIED_AMASS_UNIT	74
MASS_FRACTION	Mass fraction.	GRAM_PER_GRAM, GRAM_PER_KILOGRAM, KG_PER_KG, PPB_MASS_FRACTION, PPM_MASS_FRACTION, PPTH_MASS_FRACTION, PPT_MASS_FRACTION	77
PRESSURE	Pressure.	BAR, NEWTON_PER_SQ_M, PASCAL	107
RADIANCE	Radiance.	WATT_PER_SQ_METRE_SR	113
RATE	Rate.	DECAY_RATE, INV_SECOND	118
THERMO_TEMPERATURE	Thermodynamic temperature.	DEGREE_C, KELVIN	151
TIME	Time.	DAY, HOUR, MINUTE, SECOND, YEAR	152
VOLUME	Volume.	CUBIC_METRE, LITRE	156
VOLUME_FRACTION	Volume fraction.	CUBIC_M_PER_CUBIC_M	159



# EO Dictionary of

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## Organizational Schema Entries

**Provided as an aid to help users of the EDCS standard identify groups of classification and attribute entries that may be related.**



# Organizational Schema Philosophy

- EDCS Organizational Schema arrange Classification and Attribute concepts into sets based on a common context.
  - The sets need not be disjoint.
- An EDCS Organizational Schema (EO) is the end result of a *process of classification* and consists of a set of EDCS Groups (EGs).
  - No further organization is required among the EGs in an EO.
  - The EGs may or may not form a hierarchy.
- When an EO has the property that every Classification entry and every Attribute concept is a member of at least one EG, the EO is called complete.
  - All EOs in the EDCS are complete.
- Classification and Attribute concepts are not in any way affected by the groups with which they may be associated.
- Multiple Organizational Schemas may coexist.
- Since there is no definitive or single context for how entities can be arranged or organized, the EDCS supports “weak” organizational schemas which are intended solely to improve search for concepts relevant to the interests of a user.



# Organizational Schema Table Structure

Column	Meaning
Label	A unique string that denotes the organizational schema – the EDCS Organizational Schema Label (EOL).
Definition	The definition of the organizational schema.
Code	The EDCS Organizational Schema Code – the EOC.
Reference Type	The type of references.
Reference	The references for this EO.
Supplemental References	The supplemental references for this EO.



# Example Organizational Schema Entry

<b>Label</b>	GENERAL
<b>Definition</b>	A schema based on natural and/or scientific principles.
<b>Code</b>	1
<b>Reference Type</b>	
<b>Reference</b>	
<b>Supplemental References</b>	

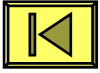
- There is currently only one Organizational Schema in the EDCS
- Others may be registered by user communities in the future





# EG Dictionary of

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## Group Entries

**Which classification and/or attributes share a common context?**

**Sets of groups defined to support efficient location of classification and attribute concepts.**



# Group Table Structure

Column	Meaning
Organizational Schema Label	The EOL for the EO of which this EG is a member.
Group Label	A unique string that denotes the EDCS Group – the EGL.
<i>Links*</i>	Hyperlinks to lists of the ECs and EAs that are members of this EG.
Definition	The definition of the EDCS Group.
Code	The EDCS Group Code – the EGC.
Reference Type	The type of references.
Reference	The references for this EG.
Supplemental References	The supplemental references for this EG.

**\*The link field is provided purely for presentation/hyperlinking purposes and is not an actual column in the Group Table implementation**



# Example Group Entry

<b>Organizational Schema Label</b>	GENERAL
<b>Group Label</b>	ABSTRACT_CONCEPT
<b>Links</b>	<a href="#">EDCS Classifications</a> <a href="#">EDCS Attributes</a>
<b>Definition</b>	ECs that either are or are related to abstract <OBJECT>s; EAs that specify the state of such concepts.
<b>Code</b>	1
<b>Reference Type</b>	
<b>Reference</b>	
<b>Supplemental References</b>	



# The Groups of the *General* Organizational Schema

ABSTRACT\_OBJECT  
ACOUSTIC\_PHENOMENON  
ADMINISTRATION  
AGRICULTURE  
AIR\_TRNSP  
AIRBORNE\_PARTICLE  
ALGORITHM\_RELATED  
ANGULAR\_MEASURE  
ANIMAL  
ATMOSPHERE  
BUILDING\_COMPONENT  
COLOUR  
COMMUNICATION  
DEMARCATIION  
DEVICE\_AND\_EQUIPMENT  
DIMENSION  
EM\_PHENOMENON  
FLUID\_CONDITION  
HARBOUR\_AND\_PORT  
HYDROGRAPHIC\_ARTEFACT  
HYDROGRAPHIC\_INDUSTRY  
HYDROGRAPHIC\_TRNSP  
HYDROLOGY  
ICE  
IDENTIFICATION  
INDUSTRY  
INFRASTRUCTURE

LAND\_INDUSTRY  
LAND\_TRNSP  
LIGHTING\_AND\_VISIBILITY  
LITTORAL  
LIVING\_ORGANISM  
LOCATION  
MATERIAL  
MILITARY\_SCIENCE  
PHYSIOGRAPHY  
PLANT  
PROPERTY\_SET  
RATE\_OR\_RATIO  
RECREATION  
RELIGION  
SHELTER  
SPACE  
SUPPORT\_STRUCTURE  
SURFACE  
SURFACE\_MATERIAL  
SURVEY  
TEMPERATURE  
TIME  
TRNSP  
USAGE\_REGION  
VEHICLE  
WATER\_BODY\_FLOOR  
WATER\_BODY\_STATE  
WATER\_BODY\_SURFACE

**The EDCS specifies  
Group entries that  
are associated with  
ECs and EAs based  
on a common  
context.**

**Each EC and each  
EA may be a  
member of more  
than one EG.**



# EDCS Dictionary Fields

Dictionary Field Names									
	EC	EA	EV	EE	EU	ES	EQ	EO	EG
Label	X	X	X	X	X	X	X	X	X
Definition	X	X	X	X	X	X	X	X	X
Code	X	X	X	X	X	X	X	X	X
EA Label				X					
Symbol					X	X			
Applicability			X						
Quantity					X				
Attribute Value Type		X							
Unit(s)		EQ Label			EQ Label		EQ Label		
Organizational Schema									X
Groups	EG Label	EG Label							
Reference Type	X	X	X	X	*	**		X	X
References	X	X	X	X	X	**		X	X
Supplemental References	X	X	X	X	X	**		X	X

\* All EUs Normatively referenced with ISO 31; no separate field

\*\* All ESs Normatively referenced to tables in ISO 31 or IEC 60027-2; no separate field



# Using the EDCS

**Demonstration walk-through of the EDCS standard**

**Searching the content**

**Registration of new EDCS dictionary entries**



# A Walk through the EDCS Document Clauses

1. **Scope** defines the problem area that this International Standard addresses.
2. **Normative references** lists the normative references.
3. **Terms, definitions, symbols and abbreviated terms** contains the glossary of terminology and a list of abbreviated terms.
4. **Concepts** specifies the fundamentals of this International Standard.
5. **EDCS Classifications** defines classifications used to specify environmental data.
6. **EDCS Attributes** defines attributes used to specify environmental data.
7. **EDCS Units** specifies how the SI System of units of measure and scale is applied to specify environmental data.
8. **EDCS Organizational Schema** specifies a set of groups that are useful for locating classifications and attributes sharing a common context.
9. **EDCS Application Program Interface** is an abstract specification of data types and functions to convert between values given in different units of measure and scales.
10. **Registration** specifies the rules and guidelines that shall be followed in preparing registration proposals.
11. **Conformance** states requirements for conforming to this International Standard.



# EDCS Key Clauses

- **4 Concepts**
  - Overview & Gateway to all following clauses
  - Value Types
  - Registration guide
- **5 EDCS Classifications**
  - EC dictionary in alphabetic tables
- **6 EDCS Attributes**
  - EA & EE dictionaries in alphabetically arranged tables
  - EV dictionary
- **7 EDCS Units**
  - EU & EQ dictionaries in alphabetically arranged tables
  - ES dictionary
- **8 EDCS Organizational Schema**
  - EO & EG dictionaries in alphabetically arranged tables

**A Walk through  
the EDCS**





# Using the EDCS

Demonstration walk-through of the EDCS standard

**Searching the content**

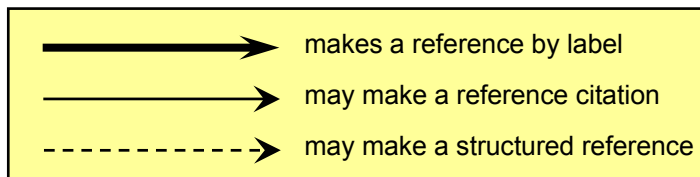
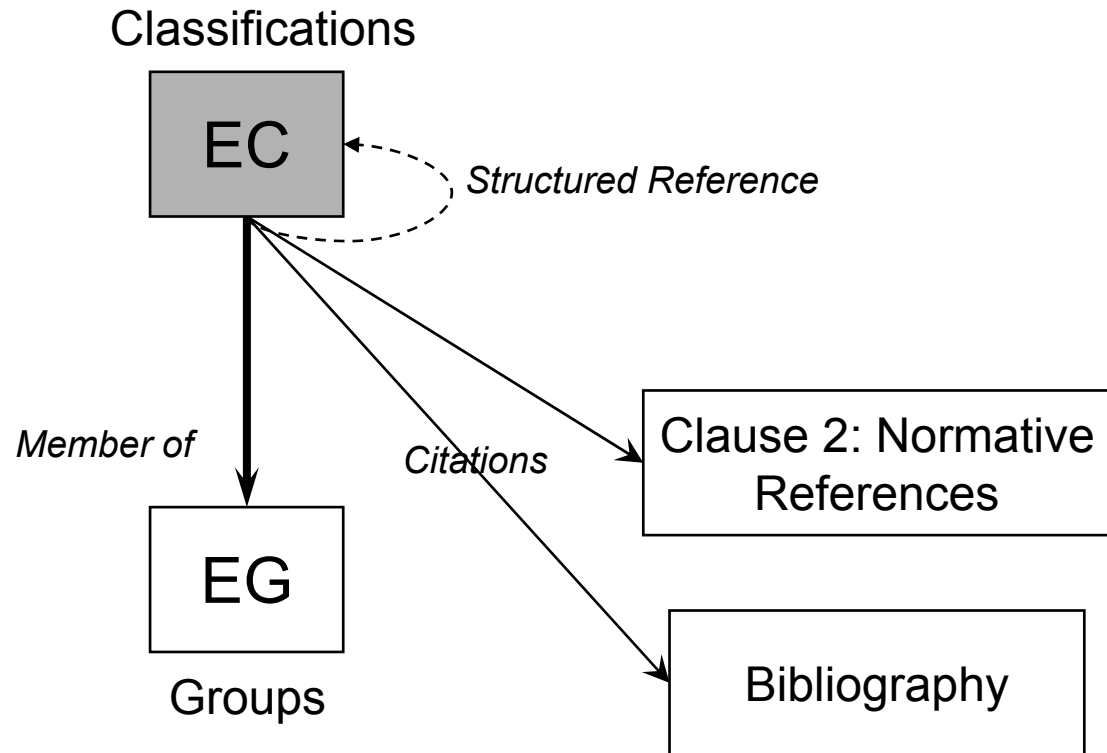
Registration of new EDCS dictionary entries



# Dictionary Relationships (1 of 5)

## Classifications

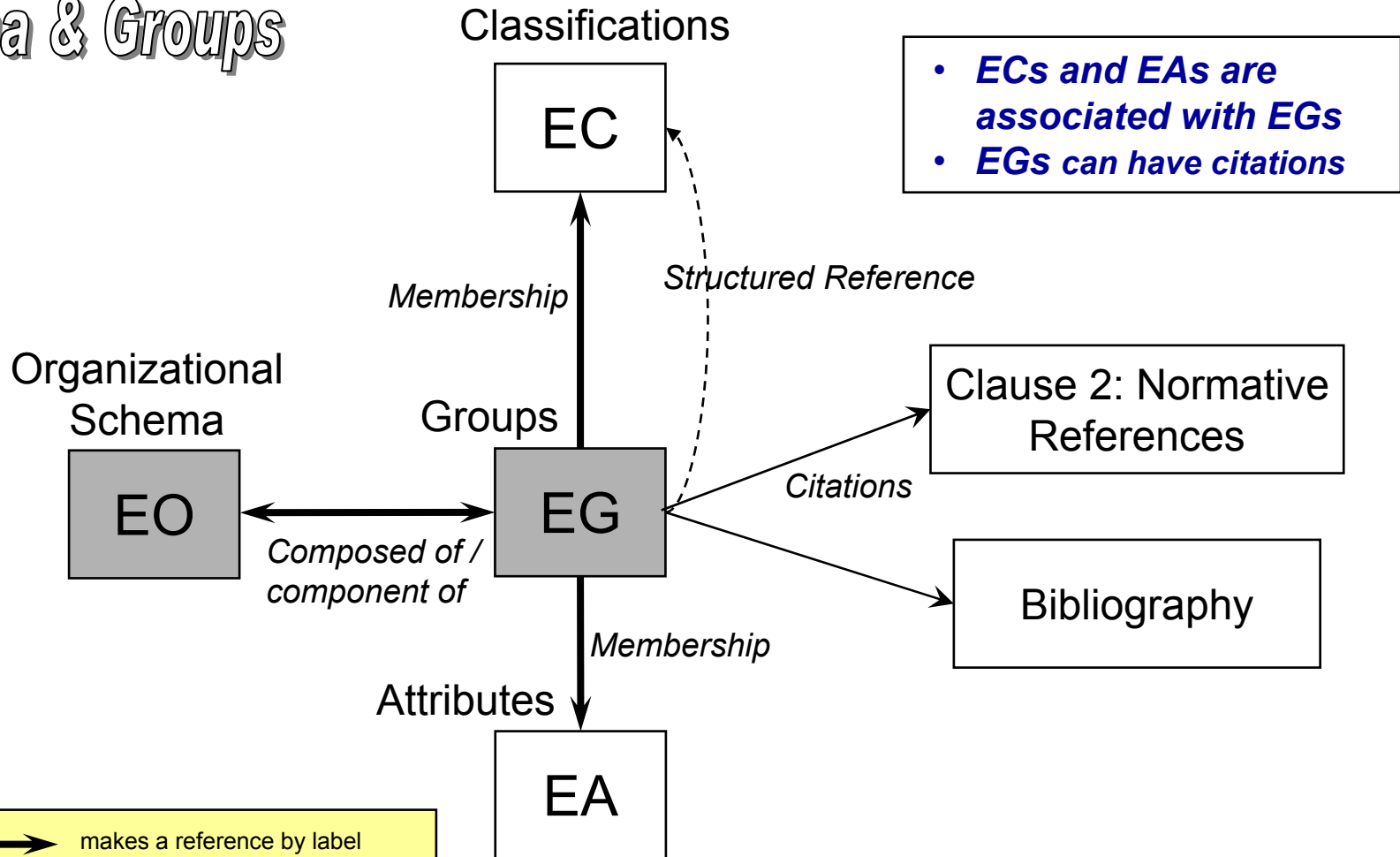
- **ECs are associated with EGs**
- **ECs have citations**
- **ECs have structured definitions, and therefore may reference other ECs**





# Dictionary Relationships (2 of 5)

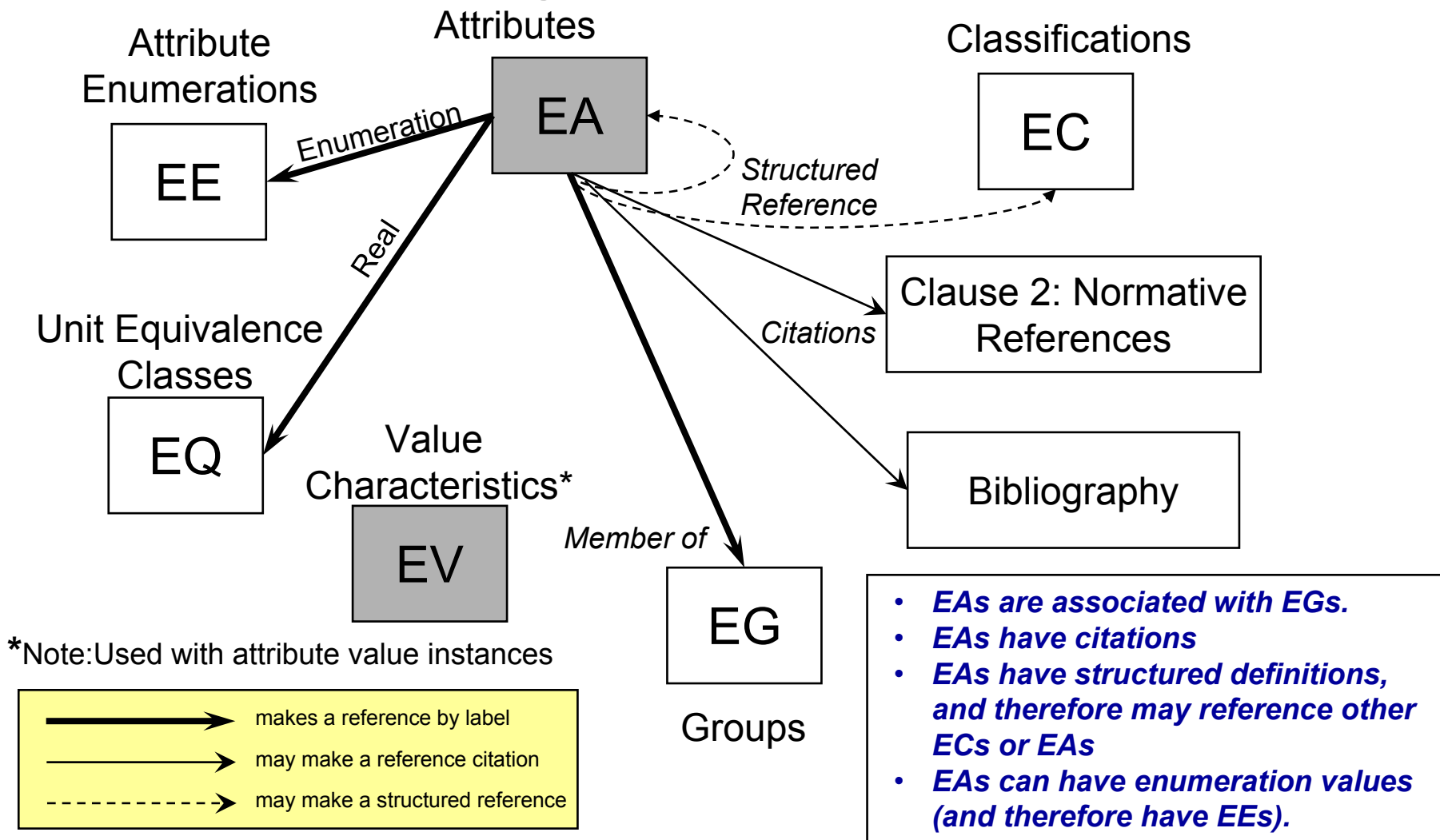
## Schema & Groups





# Dictionary Relationships (3 of 5)

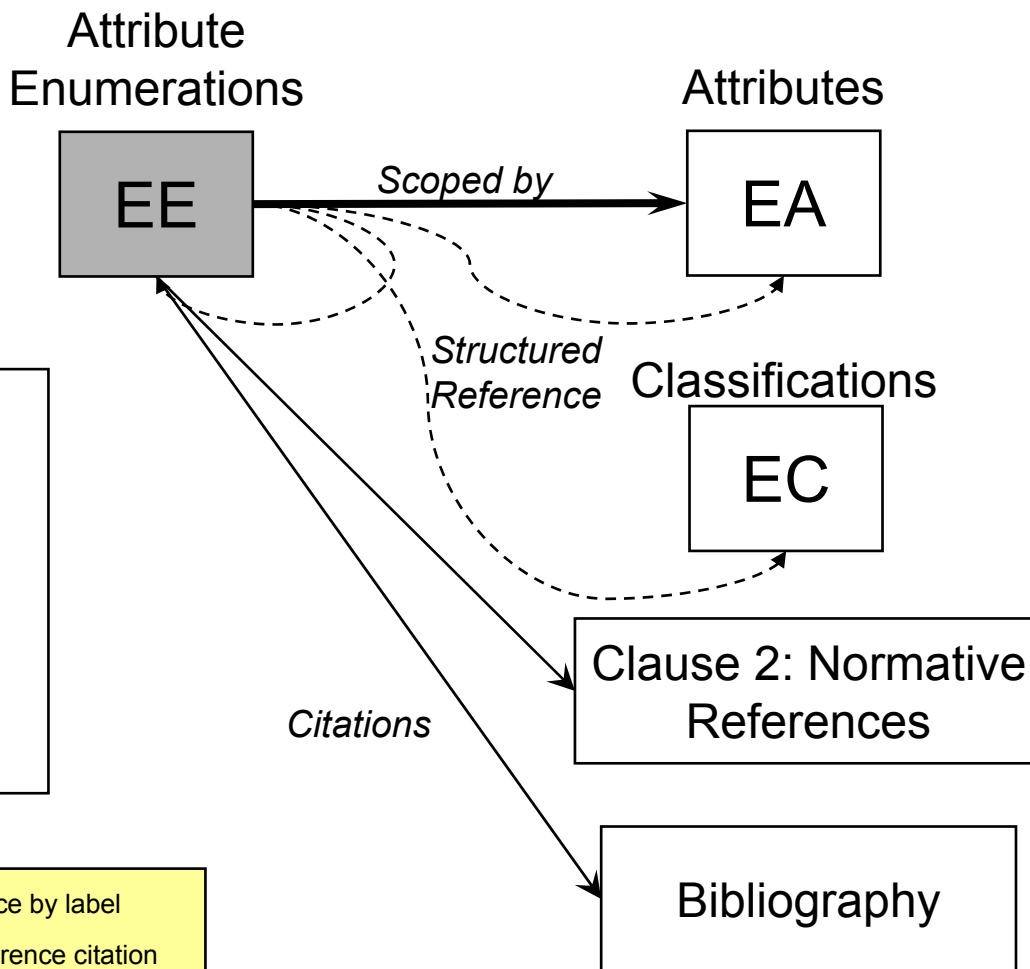
## Attributes & supporting dictionaries



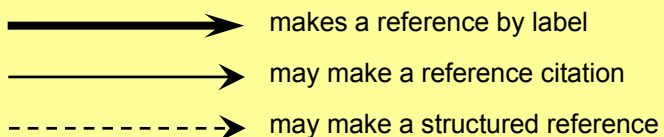


# Dictionary Relationships (4 of 5)

## Enumerants



- *EEs are scoped by their associated EA.*
- *EEs can have citations*
- *EEs have structured definitions, and therefore may reference ECs or EAs.*





# Dictionary Relationships (5 of 5)

## Units & related dictionaries

- *EUs are members of a unit equivalence class (EQ)*
- *EQs are required by EAs of type REAL.*
- *EUs have citations*
- *EUs are supported by scale factors.*



Scale\*

Unit Equivalence  
Classes



Attributes



Real

Membership  
/  
Member of



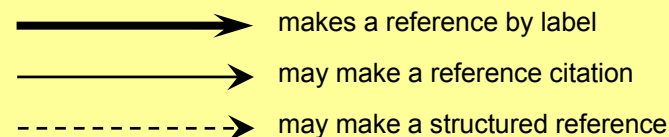
Units\*

Clause 2: Normative  
References

Citations

Bibliography

\*Note: Used with attribute real value instances





# Browsing the EDCS for Specific Concepts and Attributes

- **Searching for Concepts:**
  - Determine the concept you are searching for:
  - Open the EDCS Specification (HTML index)
  - Search the list of classification codes alphabetically:
    - Select one of the EC Tables (5.5 – 5.30 or A.3) in Clause 5 (“EDCS Classifications”)
  - Search by Group:
    - Select one of the groups in Table 8.6 in Clause 8 (“EDCS Organizational Schema”)
    - Look for a GROUP that might include the concept you are looking for
    - Read the definition of each of these classifications to choose desired concept
- **Searching for Attributes:**
  - Determine the required attributes to characterize the feature
  - Open the EDCS Specification (HTML index)
  - Search the list of attribute codes alphabetically:
    - Select one of the EA Tables (6.5 – 6.30 or A.4) in Clause 6 (“EDCS Attributes”)
    - Look for EAs that relate to required attributes
  - Search by Group:
    - Select one of the groups in Table 8.6 in Clause 8 (“EDCS Organizational Schema”)
    - Look for a GROUP that might include the attribute you are looking for
    - Read the definition of each of these attributes to choose desired attribute



# Using the EDCS Query Tool

- The EDCS Query Tool allows the user to browse and query the EDCS with a graphical user interface.
- The capabilities of the EDCS Query Tools include:
  - Browse the different EDCS dictionaries via an HTML-like interface
  - Search for keywords within all of the EDCS (Search on “Tree”)
  - Perform unit conversions based on the EDCS Unit Dictionary’s unit conversion capabilities
  - Access the mappings from other classification catalogs to the EDCS
  - Links to other related EDCS dictionary entries





# Using the EDCS

Demonstration walk-through of the EDCS standard  
Searching the content

**Registration of new EDCS dictionary entries**



# EDCS Registration and Deprecation

- In order to support continuous evolution and growth of the EDCS, a low-overhead process of *registration* has been defined, allowing for the timely addition of new concepts to the EDCS.
- Additionally, a slower, measured process of *deprecation* has been defined for removing out-dated or inappropriate concepts from the EDCS.



# EDCS Concept Registration Guidelines

- The EDCS standard allows new concepts to be defined by registration of new EDCS Dictionary Entries.
- Registration shall not be used to modify any existing standardized or registered EDCS Dictionary Entry.
- New EDCS Dictionary Entries are registered using the established procedures as outlined in Clause 10 of the EDCS.
  - The guidelines in sections 10.2 through 10.5 apply to all registered items.
  - The additional guidelines in sections 10.6 through 10.14 apply only to the indicated categories of registered items.
- These procedures require the submitter to supply all information for a new EDCS Dictionary Entry except for its code.
- Registration proposals include required information for new concepts in each EDCS dictionary, as well as accompanying administrative information.



# Applying the EDCS

## Examples of EDCS uses and implementations

Mapping to/from the EDCS - Mapping Cases and Patterns  
Mapping to/from the EDCS – Other EDCS Mappings



# Role of EDCS

- **Designed as an independent technology component that is used in a variety of applications, and supports all environmental domains**
- **EDCS application areas include:**
  - **Data modeling**
  - **Environmental database construction tools**
  - **Simulation applications**
  - **Database interchange and conversion utilities**
  - **Environmental data visualization and analysis tools**
  - **...**



# Use Case: Data Modeling

## ■ SEDRIS

- EDCS: the “dictionary” of the SEDRIS “language”
- The SEDRIS DRM depends on EDCS for identifying environmental “things” and defining their attributes
- A critical component of the SEDRIS technologies

## ■ Terrain Common Data Model (TCDM)

- An environmental data model (EDM) for terrain which exclusively uses the EDCS Dictionaries for all concepts
- Developed for use in the WARSIM and JSIMS simulation systems

## ■ Ocean and Atmosphere Data Model (OADM)

- An environmental data model (EDM) for oceanographic and atmospheric applications which exclusively uses the EDCS Dictionaries for all concepts
- Developed based on ideas from the TCDM



# Use Case: Database Construction Tools

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- **TerraTools**

- TerraSim's terrain database construction tool
- Uses EDCS in processing data semantics, and
- Utilizes EDCS in the creation of STF data sets

- **Terrain Scenario Generation and Archiving**

- A tightly-coupled collection of several off-the-shelf tools and the process for generating large area terrain databases using them
- Uses EDCS as the key component of its process data model
- EDCS integral to its data export



# Use Case: Simulation Applications

- **Close Combat Tactical Trainer (CCTT)**
  - Entity-level virtual simulation
  - Uses EDCS in database interchange
  - EDCS fully supports CCTT trafficability attributes
- **WARSIM**
  - Aggregate-level constructive simulation system
  - Relies on EDCS to define its internal data models
  - Uses EDCS for database generation & interchange
- **OneSAF**
  - Entity-level constructive simulation system
  - Relies on EDCS to define its internal data models
  - Will use EDCS for its database generation & interchange





# Use Case: Simulation Applications (cont')

## ▪ Environment Federation III

- A DMSO R&D project demonstrating use of dynamic environments in HLA-based real-time simulation
- Entity-level virtual and constructive simulation
- Runtime components (federates) communicate the state of the environment and its semantics in terms of EDCS Dictionary entries



# Use Case: Data Interchange

- **MultiGen SEDRIS Exporter**

- MultiGen-Paradigm's OpenFlight to STF converter
- Also functions as a plug-in to MultiGen Creator
- Available from [www.multigen.com](http://www.multigen.com)
- Maps internal data encodings to EDCS concepts
- EDCS also used in internal data mapping tools
  - *E.g.*, DFAD/FID to SEDRIS

- **DTED to STF converter**

- Conversion utility from NGA's elevation format to STF
- Uses mappings from DTED metadata and attribute data to EDCS
- *Available from SEDRIS Tools web site (<http://tools.sedris.org>)*



# Use Case: Data Interchange (cont'd)

- **CTDB to / from STF converter**
  - Two conversion utilities for OneSAF/ModSAF/OTB internal terrain format (CTDB)
  - Relies on EDCS for defining data processing semantics
  - *Available from SEDRIS Tools web site (<http://tools.sedris.org>)*
- **VPF to STF converter**
  - Converts data sets in NGA's Vector Product Format
  - Utilizes FACC to EDCS mappings
  - *Available from SEDRIS Tools web site (<http://tools.sedris.org>)*
- **GRIB to STF converter**
  - Converts WMO's GRIdded Binary format
  - Uses EDCS to map classification and attribute data for gridded data sets, represented in GRIB format, to STF
  - *Available from SEDRIS FTP site*



# Use Case: Data Interchange (cont'd)

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- **Environmental Scenario Generator (ESG)**
  - Currently allows for data discovery & extraction of atmospheric, space, and oceanographic data sets
  - Uses EDCS for data classification and attribution
  - *Available through ESG project*
- **E&S' GDF to / from STF converter**
  - Converts databases created by E&S' EaSIEST database tools
  - Uses EDCS to map / process data semantics
  - *Available from E&S*



# Use Case: Visualization and Analysis Tools

- **Side by Side (SbS) Viewer**

- Allows simultaneous viewing of multiple databases
- Uses EDCS to process semantics of STF data
- *Available from [www.acusoft.com/sbs](http://www.acusoft.com/sbs)*

- **SEE-IT**

- Terrain data content analysis tool
- Processes data semantics based on EDCS
- Displays EDCS codes, among other data, attached to transmittal objects and used for content analysis
- *Available from SEDRIS Tools web site (<http://tools.sedris.org>)*

- **Sensor Attribute Editor**

- A plug-in tool for SbS, based on the JRM Technologies SigSim sensor package
- Allows selection, editing, fine tuning, and viewing of material attributes in a data set
- Attributes and classifications are based on EDCS



# Use Case: Visualization and Analysis Tools (cont'd)

- **Transmittal Browser**

- Provides an interactive hierarchical tool to view the transmittal content
- Displays EDCS codes, among other data, attached to transmittal objects
- Included with SEDRIS baseline software releases

- **Model Viewer**

- Allows visual inspection of 3D icons (models) and textures in a given transmittal
- Uses EDCS for parsing classification and metadata
- Included with SEDRIS baseline software releases



# Applying the EDCS

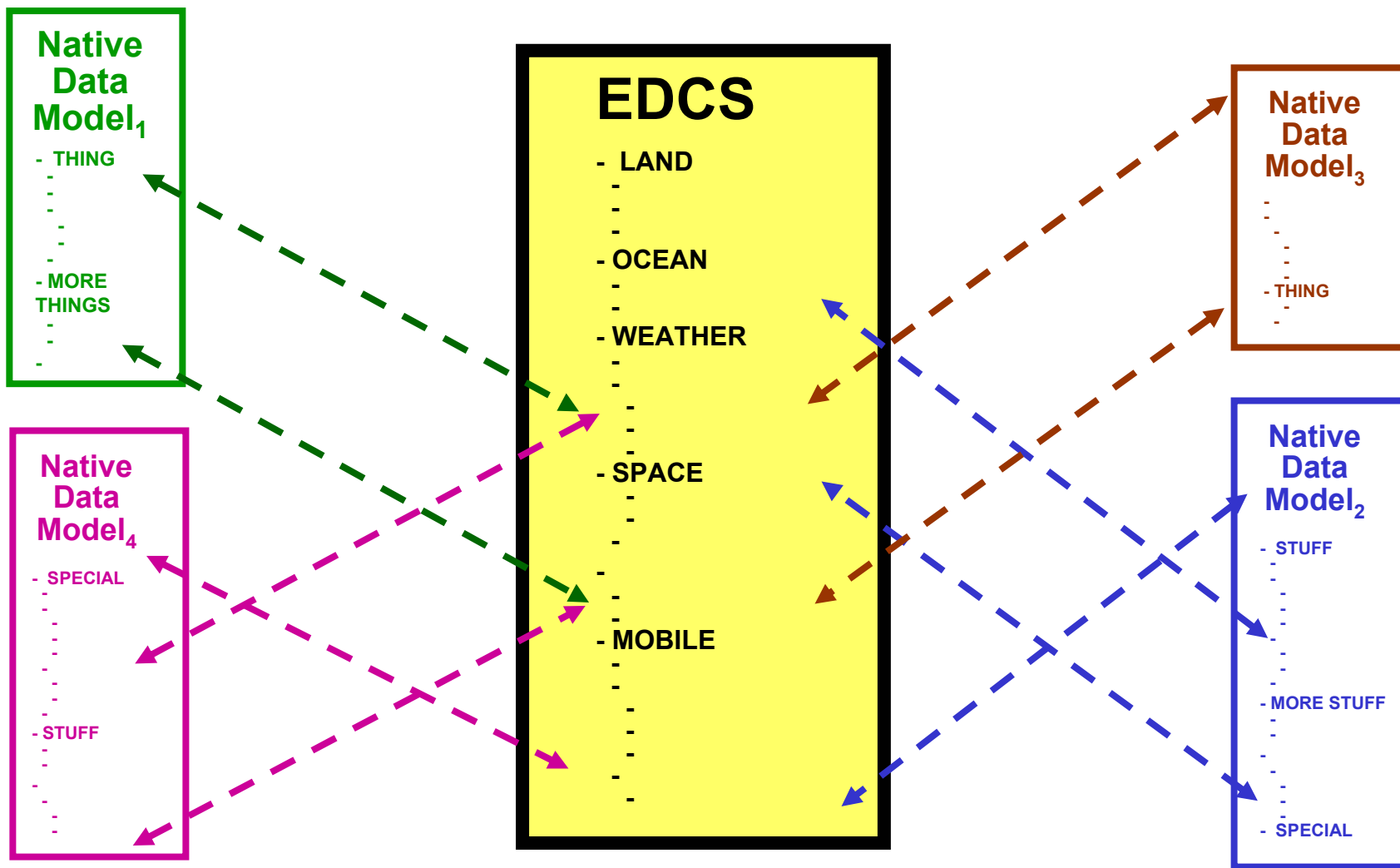
Examples of EDCS uses and implementations

**Mapping to/from the EDCS - Mapping Cases and Patterns**

**Mapping to/from the EDCS – Other EDCS Mappings**



# The Mapping Problem







# Mapping Cases & Patterns

- **One-to-zero:** There is no replacement; the concept is no longer supported.
- **One-to-one:** There is a unique exact replacement.
- **Many-to-one:** There is an exact replacement, although several current concepts may map to a single new concept.
- **One-to-one-qualified:** There is an exact replacement, however the replacement may require the composition of two or more concepts.
- **One-to-one-conditional:** There is an exact replacement, however the replacement is a different enumerant of a different concept.
- **Change in datatype:** The concept is the same, however the datatype used to realize the concept has changed.
- **Change to metadata:** Concept is mapped to a single exact Attribute Value Characteristic Dictionary concept.
- **Change in unit of measure:** The unit of measure is mapped to the attribute as well as the appropriate unit of measure.
- **Special cases:** These cases will require some human reasoning to determine the best way to complete the mapping.



# Mapping Cases Examples

## ONE-TO-ZERO

FACC Code	FACC Name	FACC Definition	EDCS Label	EDCS Definition	Notes
Feature: ZD003	Artifact Location	An indicator which identifies incomplete or illogical data at a specific location (node), used for data processing only.	N/A	N/A	There is no mapping to the EDCS because the EDCS is about environmental concepts and not data processing concepts
Attribute: FON	Type of Font	FON	N/A	N/A	There is no mapping to the EDCS because the EDCS is about environmental concepts and not presentation/display concepts.



# Mapping Cases Examples

## ONE-TO-ONE

FACC Code	FACC Name	FACC Definition	EDCS Label	EDCS Definition	Notes
Feature: AA012	Quarry	An excavation created by removal of stone by blasting or cutting.	<b>ECL</b>  QUARRY	An <a href="#">EXCAVATION</a> created by removal of stone by blasting or cutting; a quarry.	
Attribute: HGT	Height Above Surface Level	Distance measured from the lowest point of the base at ground or water level (downhill side/downstream side) to the tallest point of the feature.	<b>EAL</b>  HEIGHT_ABOVE_SURFACE_LEVEL  With <b>EUL</b> METRE and <b>ESL</b> UNI	The height measured vertically from the <a href="#">TERRAIN</a> or <a href="#">WATER BODY SURFACE</a> . For physical <a href="#">OBJECT</a> s, measured from the lowest point of the <a href="#">OBJECT</a> base (downhill side/downstream side) to the highest point of the <a href="#">OBJECT</a> .	This quantitative attribute is represented as an "integer" in FACC and as a REAL in the EDCS. We can represent an integer as a REAL in the EDCS without loss of information.
Attribute: CIC	Color Intensity Category	Identifies the intensity of color.	<b>EAL</b>  COLOUR_INTENSITY	The intensity of color of an <a href="#">OBJECT</a> .	This "coded" attribute from FACC is an "enumeration" in EDCS and is comparable to an EDCS ENUMERATION. Each value of FACC's "CIC" has a mapping to a value of COLOR_INTENSITY or to a value of Attribute Value Characteristic.



# Mapping Cases Examples

## MANY-TO-ONE

FACC Codes	FACC Names	FACC Definitions	EDCS Label	EDCS Definition	Notes
Feature: ZB060	Geodetic Point	A physical point on the Earth's surface having a surveyed position (e.g. Trig Points).	<b>ECL</b>  SURVEY_MARKER	An <a href="#">&lt;OBJECT&gt;</a> or <a href="#">&lt;MARKER&gt;</a> on the <a href="#">&lt;TERRAIN&gt;</a> with known position; a survey marker.	To further qualify the mapping to the EDCS ECL SURVEY-MARKER, a qualifying EDCS attribute might be used to capture the distinction provided by the FACC feature(s).
Feature: ZB035	Control Point / Control Station	An object or mark on the ground of known position, elevation, or both.			
Attribute: VC3	Vertical Clearance, Safe With greater than 1 meter resolution	Encodes the safe vertical clearance of an object measured from the horizontal plane toward the object.	<b>EAL</b>  VERTICAL_CLEARANCE_SAFE  With <b>EUL</b> METRE and <b>ESL</b> UNI	The safe vertical clearance of an <a href="#">&lt;OBJECT&gt;</a> measured from the ground <a href="#">&lt;SURFACE&gt;</a> underneath to the <a href="#">&lt;OBJECT&gt;</a> overhead.	The FACC attributes are numeric and use the same unit of measure "meters". The EDCS attribute is a REAL and use EQL LENGTH and EUL METRE.
Attribute: VCS	Vertical Clearance, Safe	Encodes the safe vertical clearance of an object measured from the plane toward the object overhead.			



# Mapping Cases Examples

## ONE-TO-ONE QUALIFIED

FACC Code	FACC Name	FACC Definition	EDCS Label	EDCS Definition	Notes
Feature: EB030	Land Use/Land Cover (Vegetation)	Thematic classification of the predominant vegetation and land use characteristics of the land surface covers.	<b>ECL</b> OBJECT_SET  Qualified by <b>EAL</b> OBJECT_SET_TYPE With ENUMERANT Value <b>EEL</b> LAND_COVER	<b>ECL</b> OBJECT_SET: A < <a href="#">SET</a> > of < <a href="#">OBJECT</a> >s.	The ECL OBJECT_SET is a broader concept than the FACC feature EB030. Therefore, the qualifying EAL and EEL is used to narrow the concept appropriately.
Attribute: ALA	Absolute latitude accuracy relative to WGS 84 ellipsoid	The accuracy of the latitudinal value relative to WGS 84.	<b>EAL</b> ABSOLUTE_LATITUDE_ACCURACY With <b>EUL</b> METRE and <b>ESL</b> UNI  Qualified by <b>EAL</b> VERTICAL_DATUM With ENUMERANT Value <b>EEL</b> WGS_1984_ELLIPSOID	<b>EAL</b> ABSOLUTE_LATITUDE_ACCURACY:  The accuracy of a geodetic latitude value relative to a specified horizontal < <a href="#">DATUM</a> >.	



# Mapping Cases Examples

## ONE-TO-ONE-CONDITIONAL

FACC Code	FACC Name	FACC Definition	EDCS Label	EAL Definition	Notes
Attribute: FTC	Farming Type Category  Enumerant 1  Slash & Burn-Shifting cultivation	Type of field pattern or use.	<b>EAL</b> FARMING_METHOD With ENUMERATION Value <b>EEL</b> SLASH_AND_BURN	The agricultural practice in use within an agro-ecosystem; the farming method.	The “mixed” FACC FTC attribute concept was split into three different “orthogonal” attribute concepts in the EDCS and the specific FACC “coded” values were mapped to different EDCS Enumerants (EEs) of different EDCS Attributes (EAs)
Attribute: FTC	Farming Type Category  Enumerant 3  Terraced	Type of field pattern or use.	<b>EAL</b> FIELD_PATTERN With ENUMERATION Value <b>EEL</b> TERRACED	The geometric layout used in placing seeds or young plants on a <TRACT> used for agriculture; the field pattern.	
Attribute: FTC	Farming Type Category  Enumerant 4  Ditch Irrigation	Type of field pattern or use.	<b>EAL</b> IRRIGATION_METHOD With ENUMERATION Value <b>EEL</b> DITCH	The method used to supply crops with <WATER>; the irrigation method.	
Attribute: FTC	Farming Type Category  Enumerant 9  Type of Field Pattern	Type of field pattern or use.	<b>EAL</b> FIELD_PATTERN Qualified by <b>EVL</b> UNDESIGNATED	The geometric layout used in placing seeds or young plants on a <TRACT> used for agriculture; the field pattern.	





# Mapping Cases Examples

## CHANGE IN DATA TYPE

FACC Code	FACC Name	FACC Definition	EDCS Label	EAL Definition	Notes
Attribute: HGT	Height Above Surface Level	Distance measured from the lowest point of the base at ground or water level (downhill side/downstream side) to the tallest point of the feature.	<b>EAL</b> HEIGHT_ABOVE_SURFACE_LEVEL With <b>EUL</b> METRE and <b>ESL</b> UNI	The height measured vertically from the <a href="#">&lt;TERRAIN&gt;</a> or <a href="#">&lt;WATER_BODY_SURFACE&gt;</a> . For physical <a href="#">&lt;OBJECT&gt;</a> s, measured from the lowest point of the <a href="#">&lt;OBJECT&gt;</a> base (downhill side/downstream side) to the highest point of the <a href="#">&lt;OBJECT&gt;</a> .	This quantitative attribute is represented as an "integer" in FACC and the representation in EDCS is a REAL. We can represent this "integer" attribute from FACC without loss of information.  The FACC unit of measure "meter" and the EDCS EQL LENGTH are commensurate and exactly match so no unit of measure conversion is required.
Attribute: PDS	Periodic Date Start	The start of the active period for a seasonal object (e.g. a buoy). Coded YYYYMMDD.	<b>EAL</b> PERIODIC_START_DATE Qualified by <b>EAL</b> DATE_FORMAT With ENUMERANT Value <b>EEL</b> CCYYMMDD	The start of the active period for a seasonal <a href="#">&lt;OBJECT&gt;</a> (e.g., a <a href="#">&lt;BUOY&gt;</a> ); formatted as specified by <a href="#">&lt;&lt;DATE_FORMAT&gt;&gt;</a> .	The value of the FACC attribute PDS is of type "date/structured text" whereas the value of EAL PERIODIC_START_DATE is of type CONSTRAINED_STRING. Therefore the nature of the constraint is specified; the use of EAL DATE_FORMAT as a qualifier allows us to specify that constraint. The EEL CCYYMMDD captures the format constraint from the definition of the FACC attribute PDS.



# Mapping Cases Examples

## CHANGE TO METADATA

FACC Code	FACC Name	FACC Definition	EDCS Label	EAL Definition	These 2 mappings are straight forward but illustrate for the next set below what is done when a change to attribute characteristics is applied.
Attribute: JCR	Junction Connectivity Road Enumerant 1 "Full connectivity"	Attribute: Indicates whether or not all roads can be accessed from all other roads at a junction.	<b>EAL</b> ROAD_JUNCTION_CONNECTIVITY With <b>EEL</b> FULL	The type of connectivity among <ROAD>s meeting at a junction.	
Attribute: JCR	Junction Connectivity Road Enumerant 2 "Restricted Access"	Attribute: Indicates whether or not all roads can be accessed from all other roads at a junction.	<b>EAL</b> ROAD_JUNCTION_CONNECTIVITY With <b>EEL</b> FULL	The type of connectivity among <ROAD>s meeting at a junction.	For these mappings, the concept for the FACC attribute JCR "coded" values provide a statement "about" the value of the concept, rather than a value of the concept itself.
Attribute: JCR	Junction Connectivity Road Enumerant 0 "Unknown"	Attribute: Indicates whether or not all roads can be accessed from all other roads at a junction.	<b>EAL</b> ROAD_JUNCTION_CONNECTIVITY With <b>EVL</b> MISSING	The type of connectivity among <ROAD>s meeting at a junction.	
Attribute: JCR	Junction Connectivity Road Enumerant 997 "Unpopulated"	Attribute: Indicates whether or not all roads can be accessed from all other roads at a junction.	<b>EAL</b> ROAD_JUNCTION_CONNECTIVITY With <b>EVL</b> VALUE_WITHHELD	The type of connectivity among <ROAD>s meeting at a junction.	
Attribute: JCR	Junction Connectivity Road Enumerant 998 "Not Applicable"	Attribute: Indicates whether or not all roads can be accessed from all other roads at a junction.	<b>EAL</b> ROAD_JUNCTION_CONNECTIVITY With <b>EVL</b> NOT_APPLICABLE	The type of connectivity among <ROAD>s meeting at a junction.	
Attribute: JCR	Junction Connectivity Road Enumerant 999 "Other"	Attribute: Indicates whether or not all roads can be accessed from all other roads at a junction.	<b>EAL</b> ROAD_JUNCTION_CONNECTIVITY With <b>EVL</b> UNDESIGNATED	The type of connectivity among <ROAD>s meeting at a junction.	





# Mapping Cases Examples

## CHANGE IN UNITS OF MEASURE

FACC Code	FACC Name	FACC Definition	EDCS Label	EAL Definition	Notes
Attribute: WGF	Width in Feet	A measurement of the shorter of two linear axes. For a square feature, measure either axis. For a round feature, width shall be equal to LEN. For a bridge, the width is the measurement perpendicular to the axis between the abutments.	<b>EAL</b> WIDTH, <b>EUL</b> FOOT <b>ESL</b> UNI	The length of the shorter of two linear axes; the width. For a square <a href="#">&lt;OBJECT&gt;</a> , measure either axis. For a round <a href="#">&lt;OBJECT&gt;</a> , width is equal to length. For a bridge, the width is the measurement perpendicular to the axis between the abutments.	The unit of measure for the FACC attribute WGF is FOOT. The EDCS EUL FOOT is currently supported and is a deprecated attribute. The preferred unit of measure would be EUL METRE.
Attribute: KVA	Kilovolt Capacity Attribute	Maximum voltage available on the line, as reported in kilovolts.	<b>EAL</b> MAXIMUM_VOLTAGE, <b>EUL</b> VOLT, <b>ESL</b> KILO	The maximum voltage available on an <a href="#">&lt;ELECTRICAL CABLE&gt;</a> .	Not only is the unit of measure mapped, but also the FACC representation of "Short Integer" is mapped to the EDCS value-type of REAL. We can represent a "Short Integer" as a REAL without loss of information.



# Mapping Cases Examples

## SPECIAL CASES

FACC Code	FACC Name	FACC Definition	EDCS Label	EAL Definition	Notes
Attribute: MEA	Minimum Enroute Altitude	The lowest altitude published by the host country between radio fixes which assures acceptable navigational signal coverage and meets obstacle clearing requirements.	<b>EAL</b> MINIMUM_ENROUTE_ALTITUDE	The lowest altitude between radio fixes which assures acceptable navigational signal coverage and meets obstacle clearing requirements.	The representation of the FACC attribute MEA is "Text/Structured Text" and the EDCS EAL MINIMUM_ENROUTE_ALTITUDE value type is REAL. While the concepts are equivalent, the value of MEA in the string is parsed, represented as a REAL, and assigned an EUL -- e.g. METRE -- and a ESL -- e.g. UNIT.
Attribute: AAH	Absolute Horizontal Accuracy	Absolute horizontal accuracy integer value used in the ISO 8211 encapsulation. Units shall be described by reading the UNlaah field.	<b>EAL</b> ABSOLUTE_HORIZONTAL_ACCURACY	The accuracy of a horizontal position in relation to a defined standard, expressed in units of length at 90% circular error.	According to FACC, the "Units shall be described by reading the UNlaah field." Since the FACC attribute is "numeric", it is represented in the EDCS EAL as a REAL. We also check that the unit measure in use for a given data set is appropriate (in EQL LENGTH), and then specify the EUL and ESL in use (e.g. EUL METRE and ESL UNI).



# Applying the EDCS

Examples of EDCS uses and implementations

Mapping to/from the EDCS - Mapping Cases and Patterns

**Mapping to/from the EDCS – Other EDCS Mappings**



# EDCS Mappings Support Several Product Areas

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- **US Government Data Products**

- DTED (Digital Terrain Elevation Data)
- DFAD (Digital Feature Analysis Data)
- VPF-based (Vector Product Format)

- **Commercially Developed Software Products**

- Close Combat Tactical Trainer (CCTT)
- MultiGen-Paradigm tool-internal codes

- **Public Data Coding Specifications**

- DIGEST FACC Edition 2.1
- IHO S-57
- IEEE 1278.1 (DIS Standard) associated “Enumeration and Bit Encoded Values ...” document



# Mappings for Government Data Products

- **DTED (Digital Terrain Elevation Data)**
  - Covers all NGA DTED Levels
    - Various types of elevation values plus quality metadata
- **DFAD (Digital Feature Analysis Data)**
  - Covers all DFAD features and attribution
    - Maps FIDS to classification entries plus some potential attribute values; plus DFAD-associated attributes mapped
  - Based on NGA experimental mapping to FACC, designed for a potential future DFAD-replacement product
    - EDCS allowed additional data coding flexibility
    - Goal of loss-less exchange required fixing mapping “dropouts”
  - Useful as starting point for “in-house” coding standards for many IG-oriented database developers
    - Frequent users of DFAD due to wide coverage/availability
      - *E.g.*, MultiGen-Paradigm



# Mapping DFAD FID Codes (1 of 2)

Generally, a three step process:

- **Where possible, map each feature directly to an EC**
  - FID = 206: Railroad → EC RAILROAD
  - FID = 753: Drydock → EC DRY\_DOCK
- **If no match, consider more generalized EC plus one or more EA values**
  - FID = 261: Suspension Bridge →  
EC BRIDGE with EA BRIDGE\_DESIGN = SUSPENSION
  - FID = 323: Dome Stadium →  
EC STADIUM with EA STRUCTURE\_SHAPE = DOME
- **If still no match, consider either:**
  - Adding a new, more generalized, EC (plus an EA value)
    - **FID = 532: Tower on Structure →**  
EC TOWER with EA RELATIVE\_LOCATION =  
ON\_STRUCTURE
  - Adding a new, more specialized, EC
    - **FID = 681: Steeple → EC STEEPLE**
  - Adding an additional EE for an appropriate EA
  - Adding a new EA



# Mapping DFAD FID Codes (2 of 2)

Spatial representation must be considered

- **Affects choice of EC**

- **FID = 180: Industrial Assoc. Structures (General)**

- Point or Line →

- **EC BUILDING with EA BUILDING\_FUNCTION = INDUSTRIAL**

- Area →

- **EC BUILT\_UP\_REGION with EA USAGE = INDUSTRY**

- Mapping is necessarily source-scale dependent (DFAD = 1:250k)

- **Affects appropriate use of EA(s)**

- **Point**

- HEIGHT, WIDTH, LENGTH, ORIENTATION\_ANGLE

- **If the FID is round (e.g., a Flare Pipe) then WIDTH = LENGTH**

- **Line**

- HEIGHT, WIDTH, DIRECTIVITY (to radar)

- **Area**

- HEIGHT, various density measures (roofs, trees, structures)



# Mapping DFAD Attributes

IN

OUT

DFAD Attribute	EDCS Attribute Label	Spatial Type
<b>Feature Analysis Code</b> (FAC) Number	<b>NUMERIC_OBJECT_IDENTIFIER</b>	P, L, A
<b>Predominant Height</b> (NOTE: coded as 1/2 the measured or standardized value in DFAD; meters)	<b>PREDOMINANT_HEIGHT_WITHIN_O BJ</b>	P, L, A
<b>Radar Significance Factor</b> Code Number -- <i>See related enumeration mapping</i>	<b>RADAR_SIGNIFICANCE_FACTOR</b>	P, L, A
<b>Orientation of Point Feature</b> (0-31; coded in 12.25 degree increments, Code 63 = omni-directional) -- <i>See related enumeration mapping</i>	<b>ORIENTATION_ANGLE</b>	P
<b>Length</b> (radius if circular) of Point Feature (NOTE: coded as 1/2 of the measured or standardized value in DFAD -- EXCEPTION: length for Point FIDs 230-239 coded as 1/20 measured value; meters)	<b>LENGTH</b>	P
<b>Width</b> of Point or Linear Feature (NOTE: coded as 1/2 of the measured or standardized value in DFAD -- EXCEPTION: length for Point FIDs 230-239 coded as 1/20 measured value; meters)	<b>WIDTH</b>	P, L
<b>Number of Structures</b> per square kilometer/nautical mile (0-15)	<b>STRUCTURE_DENSITY</b>	A
<b>Percent of Tree Coverage</b> (0-10) 0%-100%; coded as 1/10 the standardized percentage	<b>SUMMER_CANOPY_COVER_ FRACTION</b>	A
<b>Percent of Roof Coverage</b> (0-10) 0%-100%; coded as 1/10 the standardized percentage	<b>ROOF_COVER_FRACTION</b>	A





# Mappings for Commercially Developed Products

## Close Combat Tactical Trainer (CCTT) Tools (special purpose software)

- **Originally used unique extensions of SIF known as SIF++**
  - Incorporated *ad hoc* FACS & attribute codes supported by SIF
  - Some codes had to be re-mapped by consuming applications into usable values (by using ancillary, private files)
- **Migrated to SEDRIS (STF) and adopted full use of EDCS**
  - No private mappings or definitions
  - Maximized semantics visible in the SEDRIS transmittal
- **Development of mapping required access to engineering documentation, as well as SIF++ and ancillary files**
  - Mapped vendor “ID” → EC plus one or more EAs with values
  - Mapped vendor “MCT” → a vector of EAs with values:
    - A variety of surface characteristics attributes
    - A surface trafficability attribute
    - A pair of surface thermal attributes



# Mapping Vendor “ID”

**IN**

**OUT**

EsID	Description	EC	Additional EA
0x8301	Evaporator, Salt	SALT_EVAPORATOR	
0x8302	Evaporator, Soda	SODA_EVAPORATOR	
0x8113	Water Impoundment, Industrial	RESERVOIR	USAGE = INDUSTRY
0x8114	Wind Tunnels	BUILDING	BUILDING_FUNCTION = WIND_TUNNEL
0x8401	INDUSTRY Fabrication (general)	ASSEMBLY_PLANT	
0x1201	Farm Cluster	BUILT_UP_REGION	USAGE = AGRICULTURE
0x1202	Greenhouses	BUILDING	BUILDING_FUNCTION = GREENHOUSE
0xd304	Oil Storage Pit	STORAGE_PIT	PRIMARY_PRODUCT = OIL
0x5402	End of transmission line at power station, substation, or hydroelectric plant	POWER_TRANSMISSION_LINE- _TERMINUS	
0x4303	Colregs Demarcation Line	MARINE_LIMIT_BOUNDARY	MARINE_BOUNDARY_LIMIT = COLREGS_DEMARCATIION_LINE
0x5101	Direction Finder	BUILDING	BUILDING_FUNCTION = COMMUNICATION; NAVIGATION_SYSTEM_TYPE = RADIO_DIRECTION_FINDING



# Mapping Vendor “MCT” (1 of 2)

**IN**

**OUT**

MCT Value	MCT Description	SURFACE_MATERIAL_TYPE *	PRIMARY_MATERIAL_TYPE *	SECONDARY_MATERIAL_TYPE *	COLOURATION *
1	steel-bare	STEEL	STEEL	NOT_APPLICABLE	NOT_APPLICABLE
8	steel-paint	PAINT	STEEL	NOT_APPLICABLE	MISSING
47	clay-tile	CLAY_TILE	CLAY_TILE	NOT_APPLICABLE	NOT_APPLICABLE
48	shingle-wood	SHINGLE	SHINGLE	WOOD	NOT_APPLICABLE
53	shingle-asphalt	SHINGLE	SHINGLE	ASPHALT	NOT_APPLICABLE
114	concrete-bare	CONCRETE	CONCRETE	NOT_APPLICABLE	NOT_APPLICABLE
115	concrete-paint	PAINT	CONCRETE	NOT_APPLICABLE	MISSING
171	ice	ICE	ICE	NOT_APPLICABLE	NOT_APPLICABLE
180	asphalt-bare	ASPHALT	ASPHALT	NOT_APPLICABLE	NOT_APPLICABLE
181	asphalt-paint	PAINT	ASPHALT	NOT_APPLICABLE	MISSING
182	asphalt-paint-white	PAINT	ASPHALT	NOT_APPLICABLE	WHITE
183	alum-paint-light	PAINT	ALUMINUM	NOT_APPLICABLE	LIGHT_COLOURED

\* May use EDCS Metadata Dictionary entry to characterize the value of an EDCS Attribute



# Mapping Vendor “MCT” (2 of 2)

IN

OUT

MCT Value	MCT Description	SOIL_WETNESS *	SOIL_TYPE *	WATER_DEPTH_RANGE *	TERRAIN_TRAFFICABILITY_MEDIUM *
612	water-bedrock-depth<0.8m	NOT_APPLICABLE	UNDESIGNATED	le0r8_M	ID_29
613	water-bedrock-0.8<depth<1.6m	NOT_APPLICABLE	UNDESIGNATED	gt0r8_M_AND_le1r5_M	ID_30
614	water-bedrock-1.6<depth<2.4m	NOT_APPLICABLE	UNDESIGNATED	gt1r6_M_AND_le2r4_M	ID_28
616	water-clay-depth<0.8m	NOT_APPLICABLE	CL	le0r8_M	ID_26
617	water-clay-0.8<depth<1.6m	NOT_APPLICABLE	CL	gt0r8_M_AND_le1r5_M	ID_27
618	water-clay-1.6<depth<2.4m	NOT_APPLICABLE	CL	gt1r6_M_AND_le2r4_M	ID_28
624	water-paved-depth<0.8m	NOT_APPLICABLE	UNDESIGNATED	le0r8_M	ID_29
640	evaporites-dry	DRY	EVAPORITES	NOT_APPLICABLE	ID_17
641	evaporites-moist	MOIST	EVAPORITES	NOT_APPLICABLE	ID_9
642	evaporites-wet	WET	EVAPORITES	NOT_APPLICABLE	ID_9
643	bareground-gravel_wellgraded-dry	DRY	GW	NOT_APPLICABLE	ID_17
644	bareground-gravel_wellgraded-moist	MOIST	GW	NOT_APPLICABLE	ID_9
645	bareground-gravel_wellgraded-wet	WET	GW	NOT_APPLICABLE	ID_9
646	bareground-gravel_poorlygraded-dry	DRY	GP	NOT_APPLICABLE	ID_17
647	bareground-gravel_poorlygraded-moist	MOIST	GP	NOT_APPLICABLE	ID_9
648	bareground-gravel_poorlygraded-wet	WET	GP	NOT_APPLICABLE	ID_9
649	bareground-gravel_silty-dry	DRY	GM	NOT_APPLICABLE	ID_17
650	bareground-gravel_silty-moist	MOIST	GM	NOT_APPLICABLE	ID_9
651	bareground-gravel_silty-wet	WET	GM	NOT_APPLICABLE	ID_9
652	bareground-gravel_clayey-dry	DRY	GC	NOT_APPLICABLE	ID_17
653	bareground-gravel_clayey-moist	MOIST	GC	NOT_APPLICABLE	ID_9
654	bareground-gravel_clayey-wet	WET	GC	NOT_APPLICABLE	ID_9

\* May use EDCS Metadata Dictionary entry to characterize the value of an EDCS Attribute



# Mappings for Public Specifications

## ▪ DIGEST FACC Edition 2.1

- EDCS is a superset
- Covers all NGA VPF-based vector products
  - DNC, VITD, VMAP-series, FFD, MSDS, ...
- Covers all DIGEST-compliant VRF-based products

## ▪ IEEE 1278.1 (DIS Standard)

- Associated enumerations document (separately maintained)
  - “Enumeration and Bit Encoded Values (EBV) for Use with Protocols for Distributed Interactive Simulation Applications” IST-CR-01-01
- A standard scheme in wide use to identify 3D Models of “entities” (e.g., dynamic vehicle models) during pre-exercise data exchange
- EBV Mapping:
  - LMIS did an initial sample mapping to verify feasibility
  - AEgis revised the sample mapping
  - Remaining EBV items still need to be mapped to existing or new EDCS entries
- Objective is selective replacement of EBV
  - Support use of the EDCS within the High Level Architecture (HLA) Real-time Platform Reference (RPR) Federation Object Model (FOM)
  - Provide replacement broad-scope naming scheme for 3D Modelers



# **EDCS Support and Participation**

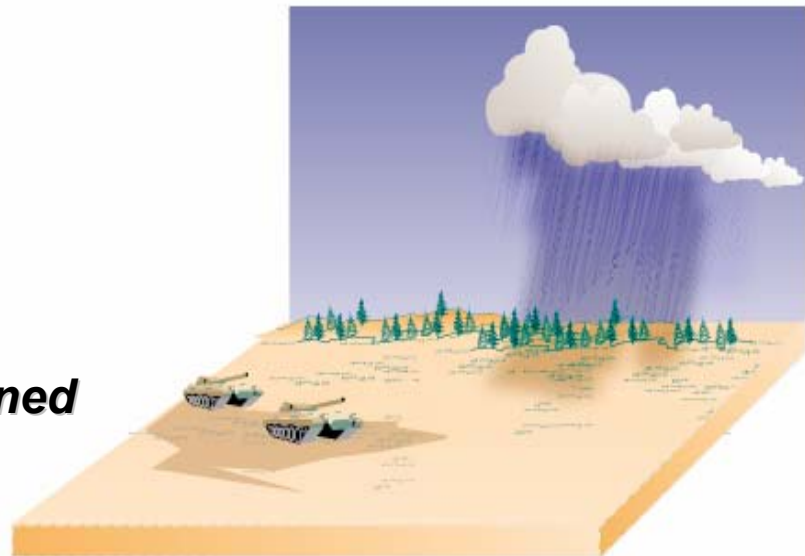
**The SEDRIIS Web Site and On-line User Support  
Documentation  
Coding References  
Where to Go from Here**



# To get More Information ...

- **Visit the SEDRIS web site:** [www.sedris.org](http://www.sedris.org)
- **Request SEDRIS Development Team Resources:**
  - **Proceedings from the SEDRIS Technology Conferences (STCs)**
    - August 20-23, 2002
    - January 6-9, 2004
  - **Various video tapes, tutorials and presentations**
  - **Contact** [help@sedris.org](mailto:help@sedris.org)
- **Attend Commercial Courses**

***A realistic environment obtained  
and reused through SEDRIS***





# Documentation is Available

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- *Specifications* (for standards development)
- *How-to Documents*
- *Overview, Training, and Information Publications*
- Each document *targeted for specific class of users* (SEDRIS customers):
  - Project managers, decision makers
  - Systems and project engineers
  - Software developers (providers, consumers, toolmakers)
  - Product users
  - Trainers and trainees





# Technical Documentation Set

- **Part 1: Introduction to SEDRIS and the Technology Documentation Set**

- **Part 2: SEDRIS and The Synthetic Environment Domain**

- **Part 3: SEDRIS Basics**

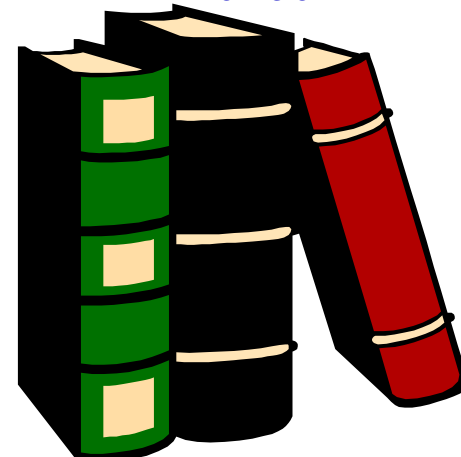
- **Part 4: Technical Reference Set**

- Volume 1: Technical Overview
- Volume 2: The SEDRIS Data Representation Model
- Volume 3: Examples of Using the SDRM
- Volume 4: Topology Technical Guide
- Volume 5: Control Link Technical Guide
- Volume 6: Data Tables Technical Guide
- Volume 7: Hierarchical Index Table Technical Guide
- Volume 8: Images and Color Models Technical Guide
- Volume 9: Attribute Inheritance and Context Technical Guide
- Volume 10: Classification, Attribute, and State Coding Specification
- Volume 11: Spatial Reference Model
- Volume 12: Application Programmer's Interface Overview
- Volume 13: How to Extract Data from SEDRIS Transmittals
- Volume 14: How to Produce SEDRIS Transmittals
- Volume 15: SEDRIS Transmittal Format Description
- Volume 16: Guide to the Build Kit
- Volume 17: SEDRIS Reference Manual
- Volume 18: Reference Implementation Listings

- **Part 5: Tools and Utilities User's Guide Set**

- Volume 1: Browser User's Guide
- Volume 2: Syntax Checker User's Guide
- Volume 3: Depth User's Guide
- Volume 4: Feature Viewer User's Guide
- Volume 5: Model Viewer User's Guide
- Volume 6: Netscape Plug-In User's Guide
- Volume 7: Ocean Profile User's Guide
- Volume 8: SEE-IT User's Guide
- Volume 9: Side-by-Side Viewer User's Guide
- Volume 10: Wind Map User's Guide
- Volume 11: API Implementations and Format Conversions User's Guide

- **Part 6: Procedures and Processes Manual**





# SEDRIIS Highlights

- *An unambiguous representation of environmental data*
  - **Semantics and relationships of data elements**
    - Expressed in a data representation model, with an
    - Associated data coding specification
  - **All environmental domains**
- *An efficient interchange of environmental data*
  - Promotes sharing and re-use
  - Ease of access and software development (API)
  - Tools and applications
- *Undergoing international standardization*  
(Your participation is Welcome!)
- *Currently in use, rigorously tested*
- *Powerful representational and interchange technology*



# Coding References

ISO:	<a href="http://www.iso.ch/">http://www.iso.ch/</a>
JTC 1:	<a href="http://www.jtc1.org">http://www.jtc1.org</a>
SC 24:	<a href="http://isotc.iso.ch/livelink/livelink.exe?func=ll&amp;objId=327973&amp;objAction=browse&amp;sort=name">http://isotc.iso.ch/livelink/livelink.exe?func=ll&amp;objId=327973&amp;objAction=browse&amp;sort=name</a>
WG8:	<a href="http://www.sedris.org/wg8home">http://www.sedris.org/wg8home</a>
EDCS:	<a href="http://www.sedris.org/edcs.htm">http://www.sedris.org/edcs.htm</a>
Registry:	<a href="http://jrtc.fhu.disa.mil/nitf/graph_reg/graph_reg.htm">http://jrtc.fhu.disa.mil/nitf/graph_reg/graph_reg.htm</a>
FACC:	<a href="http://www.digest.org">http://www.digest.org</a>
IHO:	<a href="http://www.iho.shom.fr/">http://www.iho.shom.fr/</a> <a href="http://www.universal.ca/S-57/s57_enc_catalog.html">http://www.universal.ca/S-57/s57_enc_catalog.html</a>
WMO:	<a href="http://www.wmo.ch/">http://www.wmo.ch/</a>
DDA:	<a href="http://www-datadmn.itsi.disa.mil/ddm.html">http://www-datadmn.itsi.disa.mil/ddm.html</a>
UCDM:	<a href="http://164.214.2.59/sandi/datamodel/">http://164.214.2.59/sandi/datamodel/</a>
SDTS:	<a href="http://mcmcweb.er.usgs.gov/sdts/">http://mcmcweb.er.usgs.gov/sdts/</a>
OGC:	<a href="http://www.opengis.org/">http://www.opengis.org/</a>
TC211:	<a href="http://www.statkart.no/isotc211/">http://www.statkart.no/isotc211/</a>

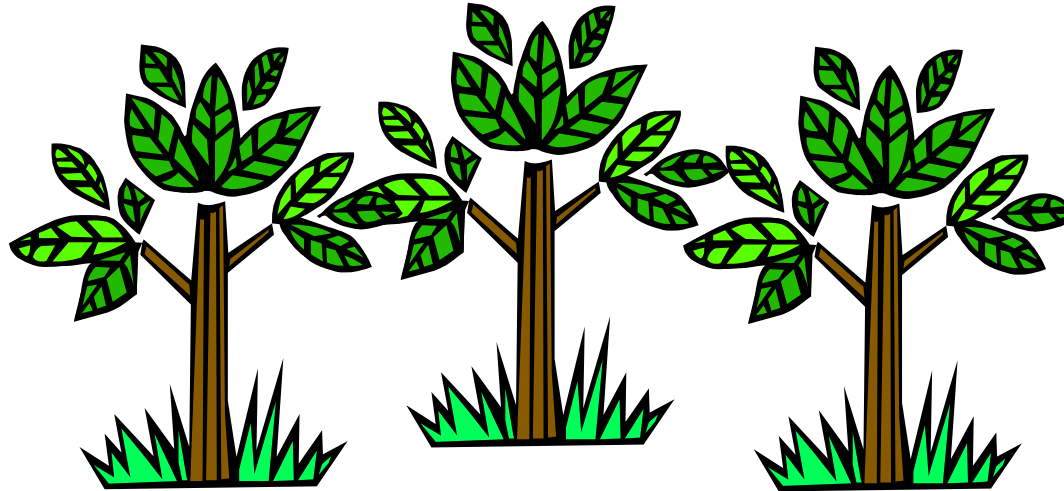


# Where to Go from Here

- Review the EDCS Specification and dictionary content.
- Review available EDCS mapping illustrations in the tutorial along with complete EDCS mappings for the FACC coding method.
- Attend the
  - ***“How to Produce and Consume Transmittals”*** on Friday, 9 Jan
- Obtain and apply the EDCS Query Tool to illustrate the breath of content in the EDCS, the application of EDCS mappings, and the EDCS unit conversion capability.



# Answering the Questions...



- How did we answer the three questions?
  1. *What is it?*
    - Classifications and Features
  2. *What are its additional clarifying characteristics?*
    - Attributes and Values
  3. *What are its characteristic measures?*
    - Units of Measure and Scales
- How did we map from an existing coding method to the EDCS?



# Review

## A Short Quiz ...

- How many dictionaries comprise the EDCS?
- What are the main two dictionaries – used to identify and characterize an object?
- What are the minimum fields required for a dictionary entry?
- What is the name of the standards organization developing the EDCS standard?
- What are SEDRIS components that further support the representation and interchange of environmental data?
- How will the content of the EDCS grow in the future?
- How do I submit new content to the EDCS?
- How can I get support?
- How can I participate?