

# **Advanced Application of the DRM**

## **Atmospheric Representations**



**SEDRI<sup>TM</sup> Technology Conference**  
**Lake Buena Vista, Florida**  
**7 January 2004**

**Louis Hembree**  
**Naval Research Laboratory**  
**831-656-4787**  
**[hembree@nrlmry.navy.mil](mailto:hembree@nrlmry.navy.mil)**

# Tutorial Introduction

- **Description:** The tutorial will focus on using the SEDRIS DRM to represent atmospheric data with primary emphasis on gridded data sets and observation data sets. Example mappings will also be presented and discussed.
- **Who Should Attend:** Data producers and data users who want to use the DRM for representation of atmospheric data. The tutorial:  
*“Fundamentals of the DRM”*  
DRM is a prerequisite.
- **What to Expect:** Based on the case examples provided, the attendee should gain a working understanding of the various techniques for use of the DRM in modeling or converting atmospheric data sets into SEDRIS.

# OVERVIEW

**Objective:** To illustrate the process of mapping a native atmospheric data set into SEDRIS Data Representation Model, and to present some example mappings

- Preparation
- Basic Mapping Process
- A Mapping Checklist
- Example Atmospheric Mappings
- Conversion Software

# Preparation

**Become familiar with the SEDRIS Data Representation Model and supporting documentation.**

- Tutorials
- Documentation
- SEDRIS Web Site - [www.sedris.org](http://www.sedris.org)
  - Data Representation Model (DRM)
  - Environmental Data Coding Specification (EDCS)
  - SEDRIS Spatial Reference Model (SRM)

# Basic Mapping Process

# Determine Initial Class Structure

- **What is the basic “data structure” of your data/native data set?**
  - Grid, point, profile, tables, etc.
- **How can this basic structure be further organized?**
  - A grid of profiles, grid of tables, by time, by location, etc.
- **Identify corresponding SEDRIS DRM classes and relationships.**
- **Repeat until all data relationships are represented.**
- **May have to try several approaches to find “best” overall representation.**

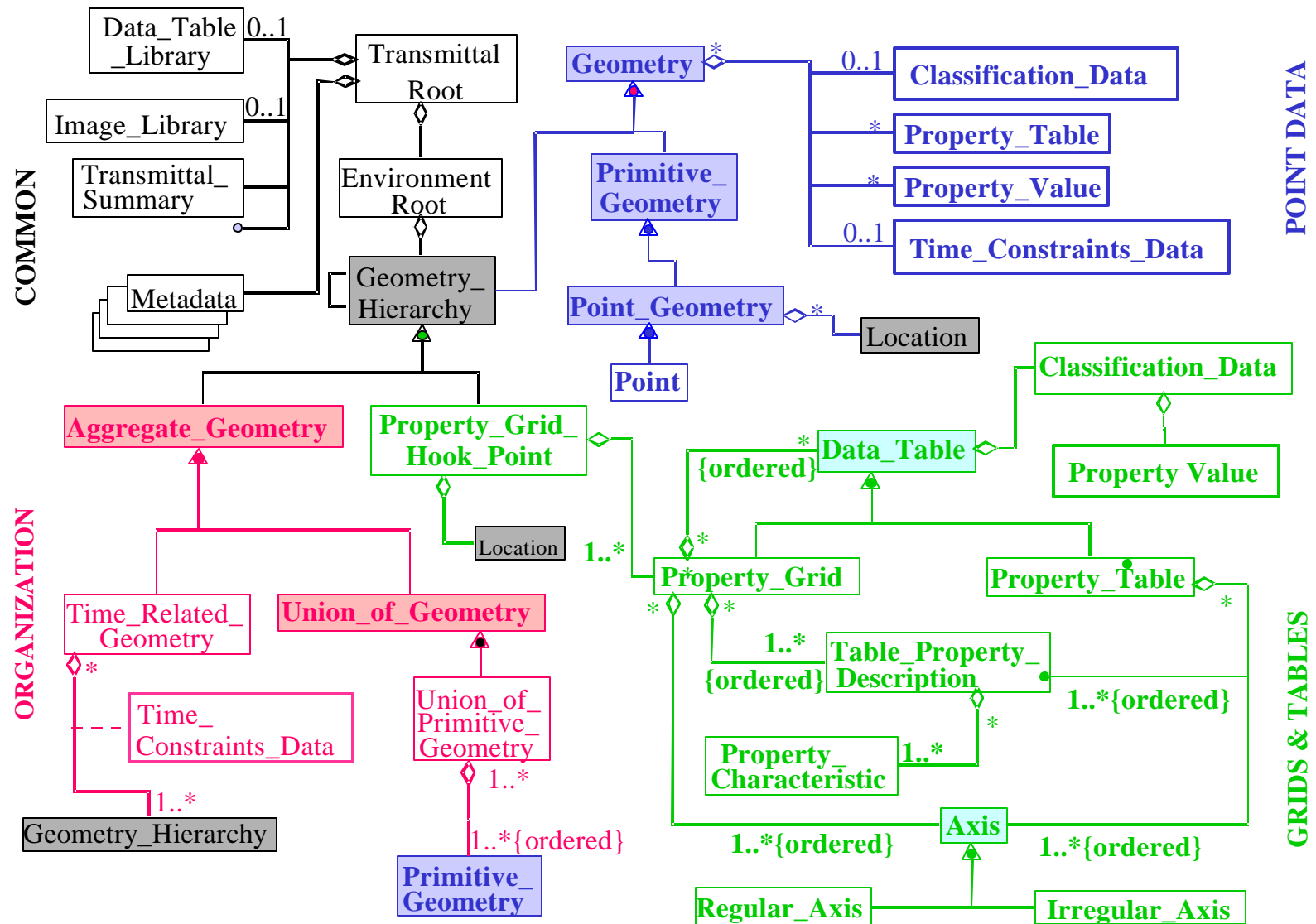
# Fill Out Class Fields

- Check for appropriate EDCS Classification codes (EC) for Property\_Grids, Data\_Tables, *etc.*
  - *Use the EDCS Query Tool*
- Check for EDCS Attribute codes (EA) corresponding to parameters.
- Collect coordinate and projection information.
- Determine how to represent time: absolute, relative, time interval.

# General Notes

- Abstract classes are not instantiated.
- All mappings must start with Transmittal\_Root.
- Aggregations are used to group data by some attribute (date, time, location, etc), i.e. base forecast time, season, etc.
- Property\_Grids must have at least 1 spatial axis.
- Pressure levels and sigma surfaces are not spatial dimensions.
- Property\_Grids & Property\_Tables can contain other Property\_Tables (nested tables).
- Points can have Property\_Table and Property\_Value components.
- Table\_Property\_Description describes what is contained in each table cell.

# Relevant Parts of SEDRIS 3.1 DRM

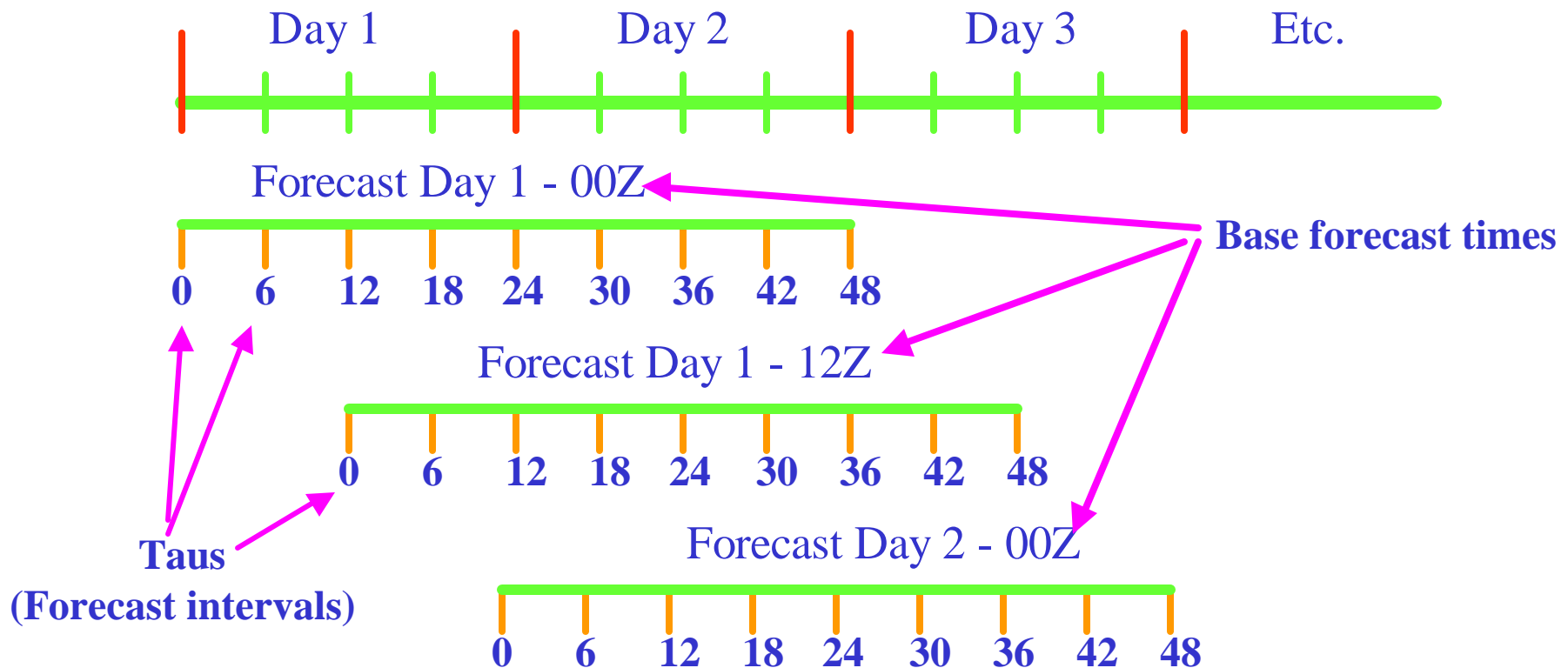


# EXAMPLE MAPPINGS

- **Atmospheric Forecast Grids**
- **Point & Profile Data**

# Atmospheric Forecast Grids

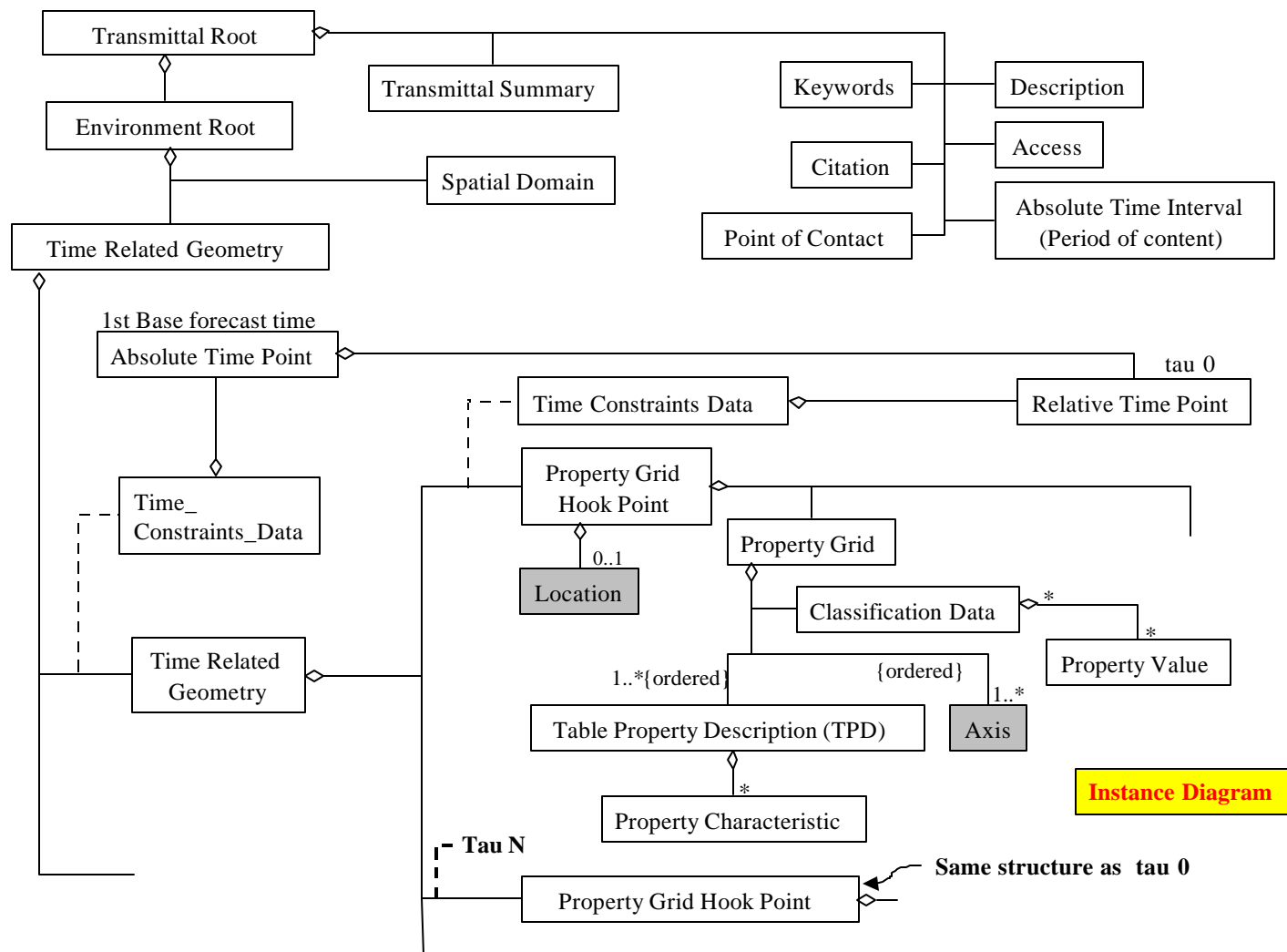
# Example Forecast Grid Relationships



**METOC forecasts typically start at some base time and forecast fields are created at some interval (6 hrs) and extend for some period (48 hours). The forecasts are run every 12 hours typically. Therefore, there can be several overlapping forecasts available at a given time.**

# High Level Atmospheric Grid Mapping

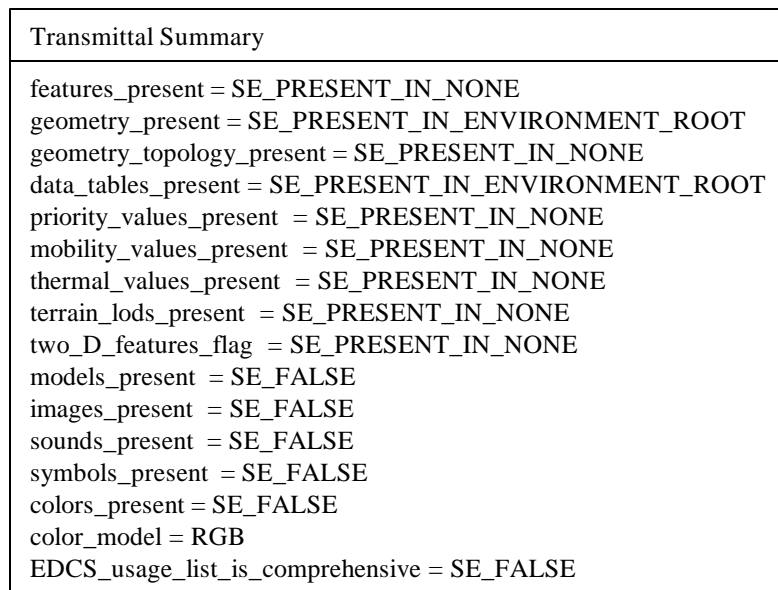
A high level mapping for atmospheric grids showing the DRM classes used and the organization used. Note the nested Time Related Geometries.



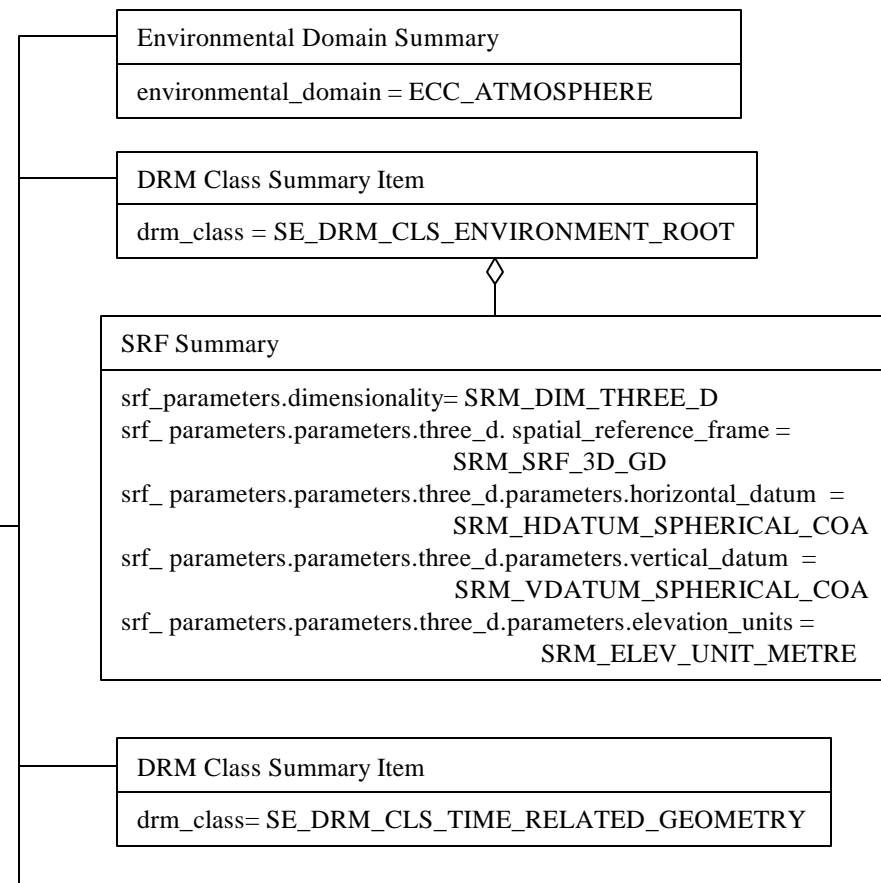
# Filling the Transmittal Summary

## Summarizes the content of the transmittal in terms of

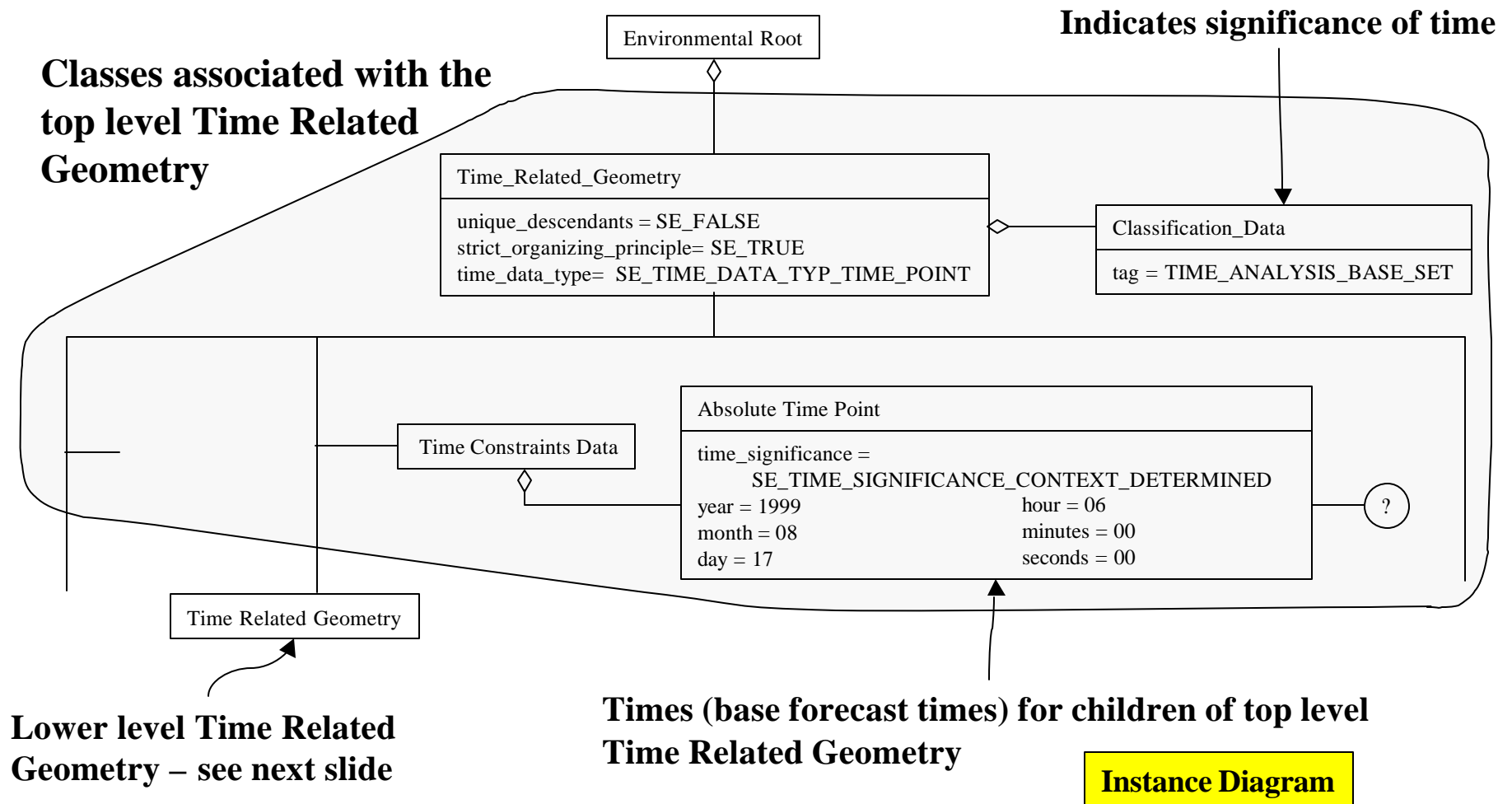
- **Environmental domains represented (terrain, ocean, etc.)**
- **Types of data used (geometry, features, data tables etc.)**
- **SEDRIS DRM classes used**
- **Classifications used**
- **Spatial reference frames used**



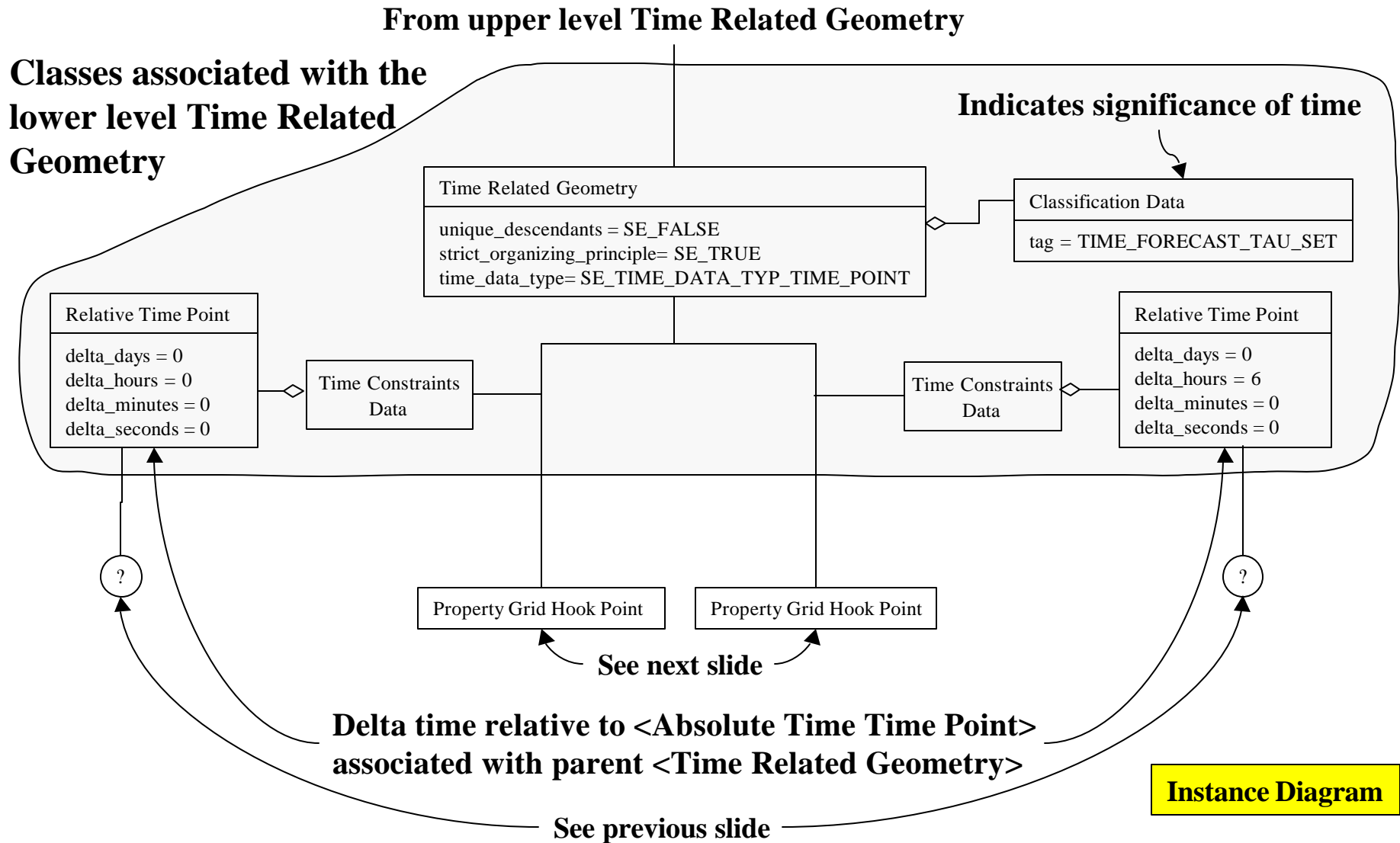
**Instance Diagram**



# Top Level Nested Time Related Geometry

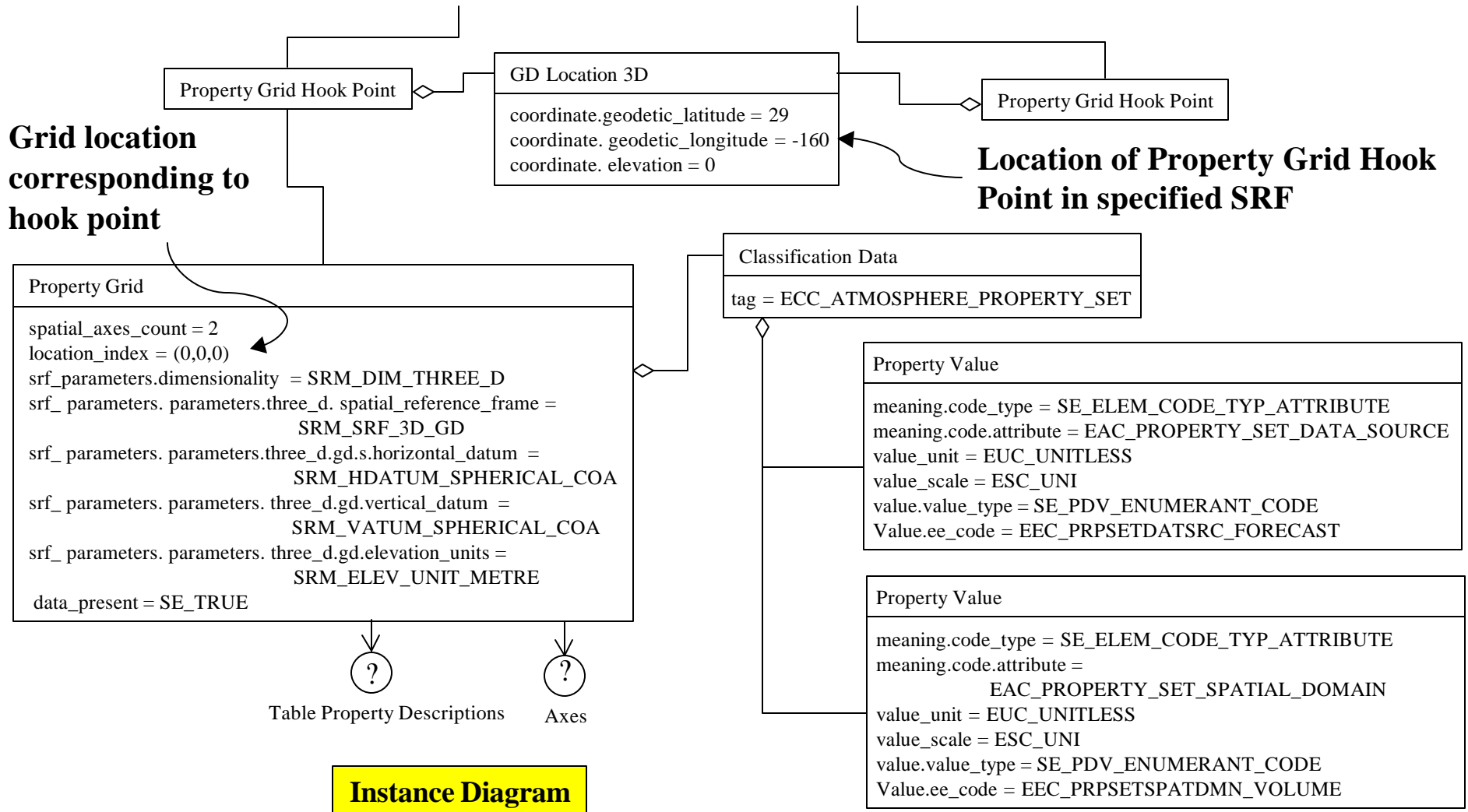


# Lower Level Time Related Geometry



# Placing Property Grid

## From parent Time Related Geometry



# Specifying Contents of Property Grid

From parent Property Grid

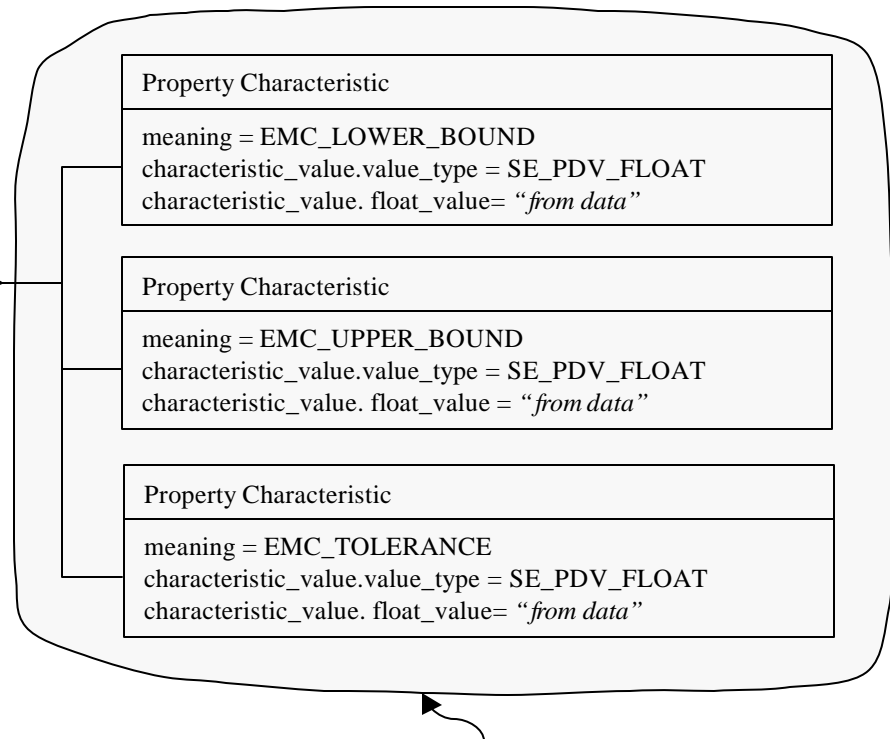
?

Table Property Description
meaning.code_type = SE_ELEM_CODE_TYP_ATTRIBUTE Meaning.code.attribute = EAC_AIR_TEMPERATURE value_unit = EUC_PASCAL value_scale = ESC_HECTO value_type = SE_PDV_FLOAT component_data_table_ecc = SE_NULL

Specifies contents of Property Grid

Table Property Description
meaning.code_type = SE_ELEM_CODE_TYP_ATTRIBUTE Meaning.code.attribute = EAC_WIND_SPEED_U value_unit = METRE_PER_SEC value_scale = ESC_UNI value_type = SE_PDV_FLOAT component_data_table_ecc = SE_NULL

Instance Diagram

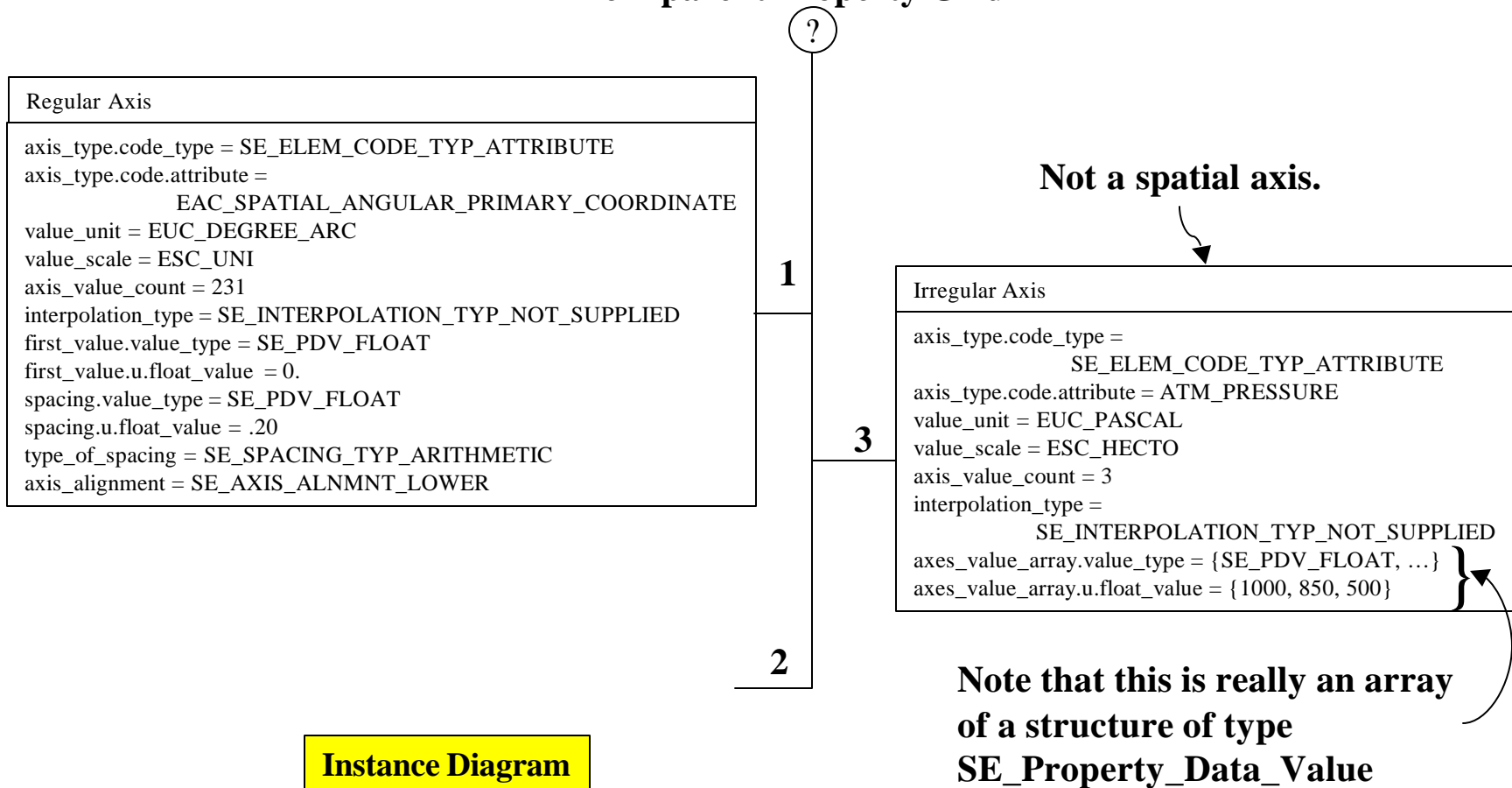


**Contains characteristics of the parameter specified in the Table Property Description. Can also include missing value flag among others. Used to compress gridded data.**

# Setting the Axis for Atmospheric Volume Grid

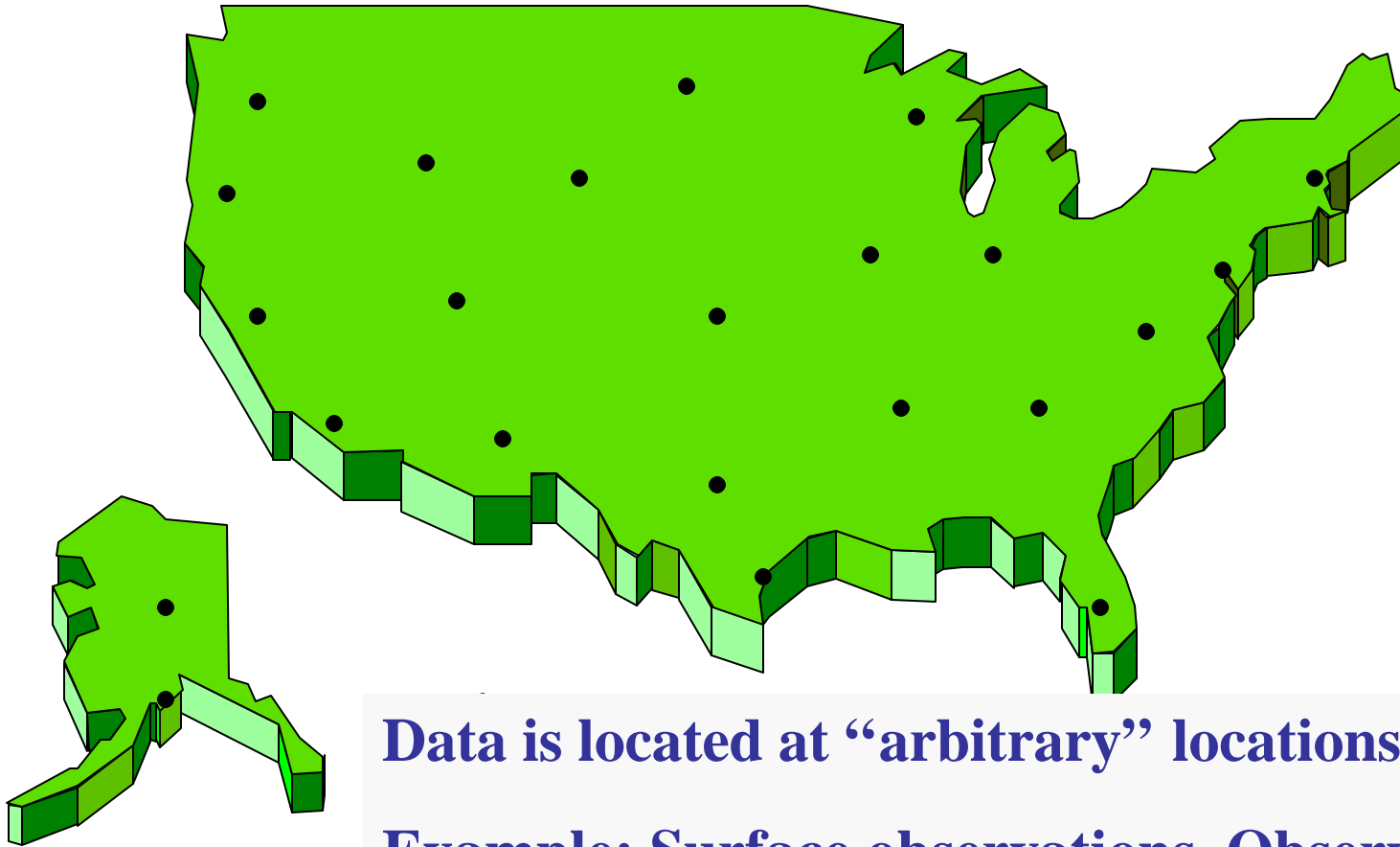
Axes classes are ordered with the spatial axes coming first. The parent Property Grid had `spatial_axes_count = 2`, therefore the regular axes are the spatial axes as they are the first two axes.

From parent Property Grid



# **Point & Profile Data**

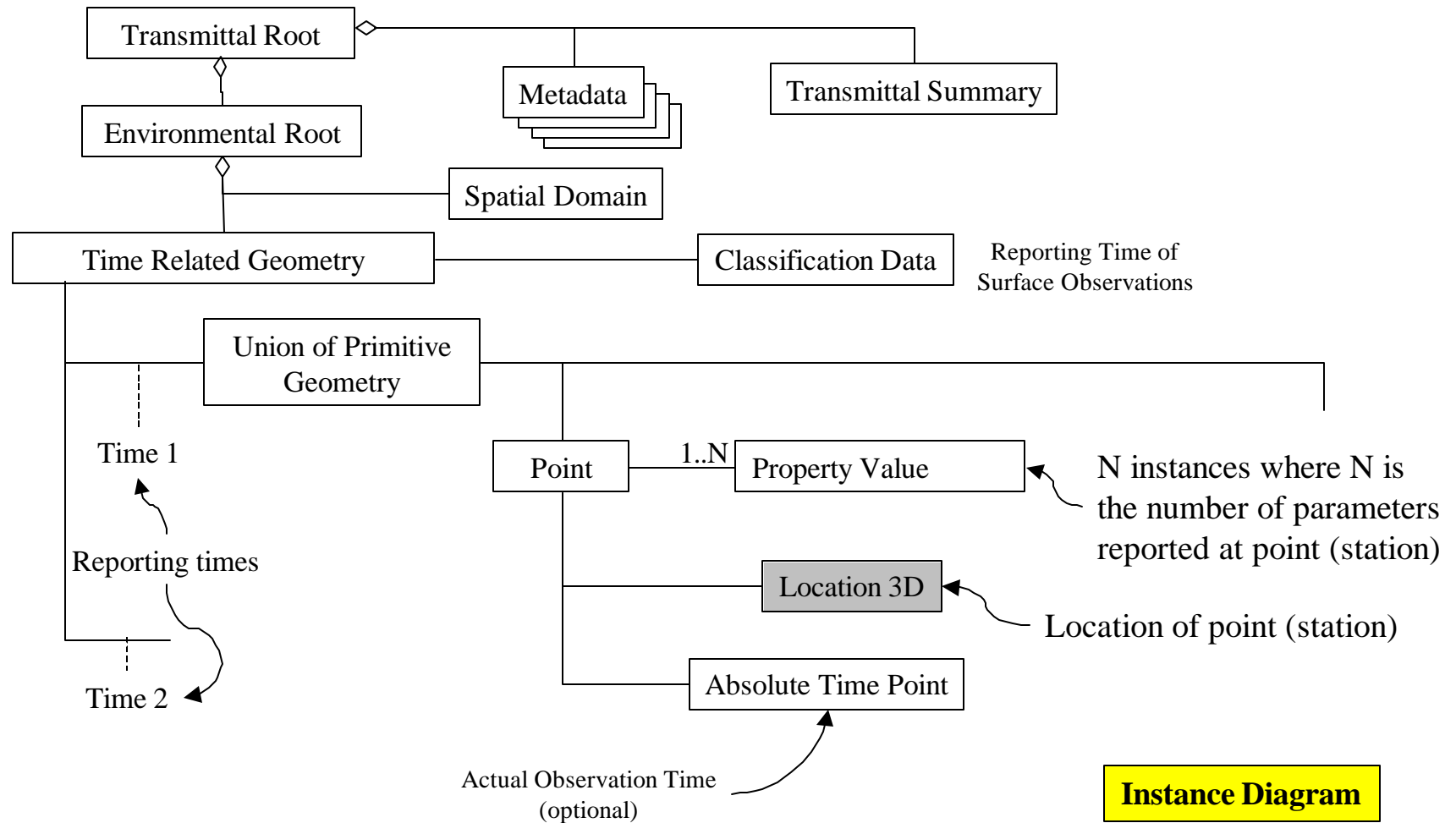
# Point Data -- Surface Observations



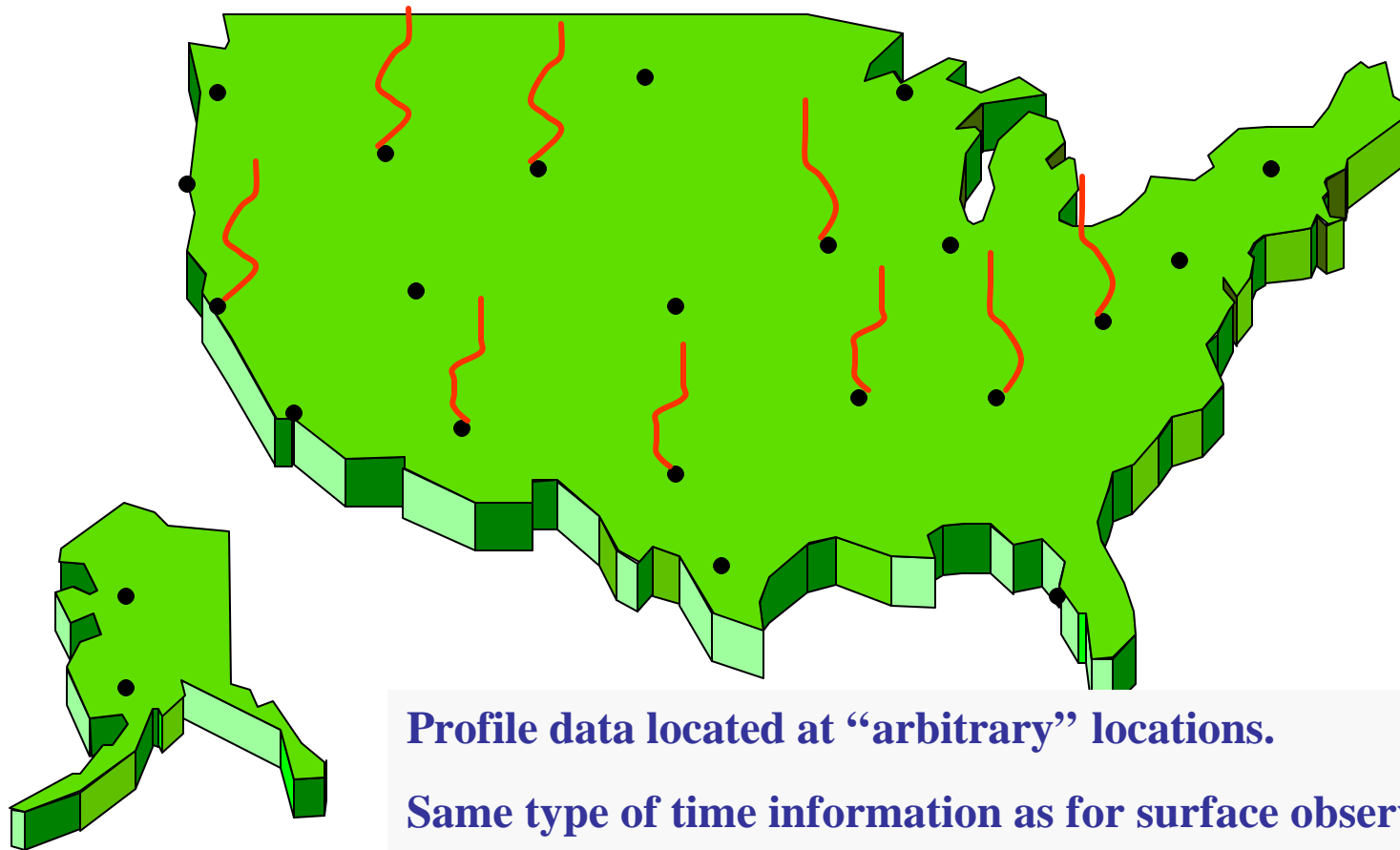
**Data is located at “arbitrary” locations**

**Example: Surface observations. Observations are assigned to a specific hour, but can actually occur  $\pm$  some delta about the hour.**

# Surface Observations



# Profiles -- Radiosonde Data

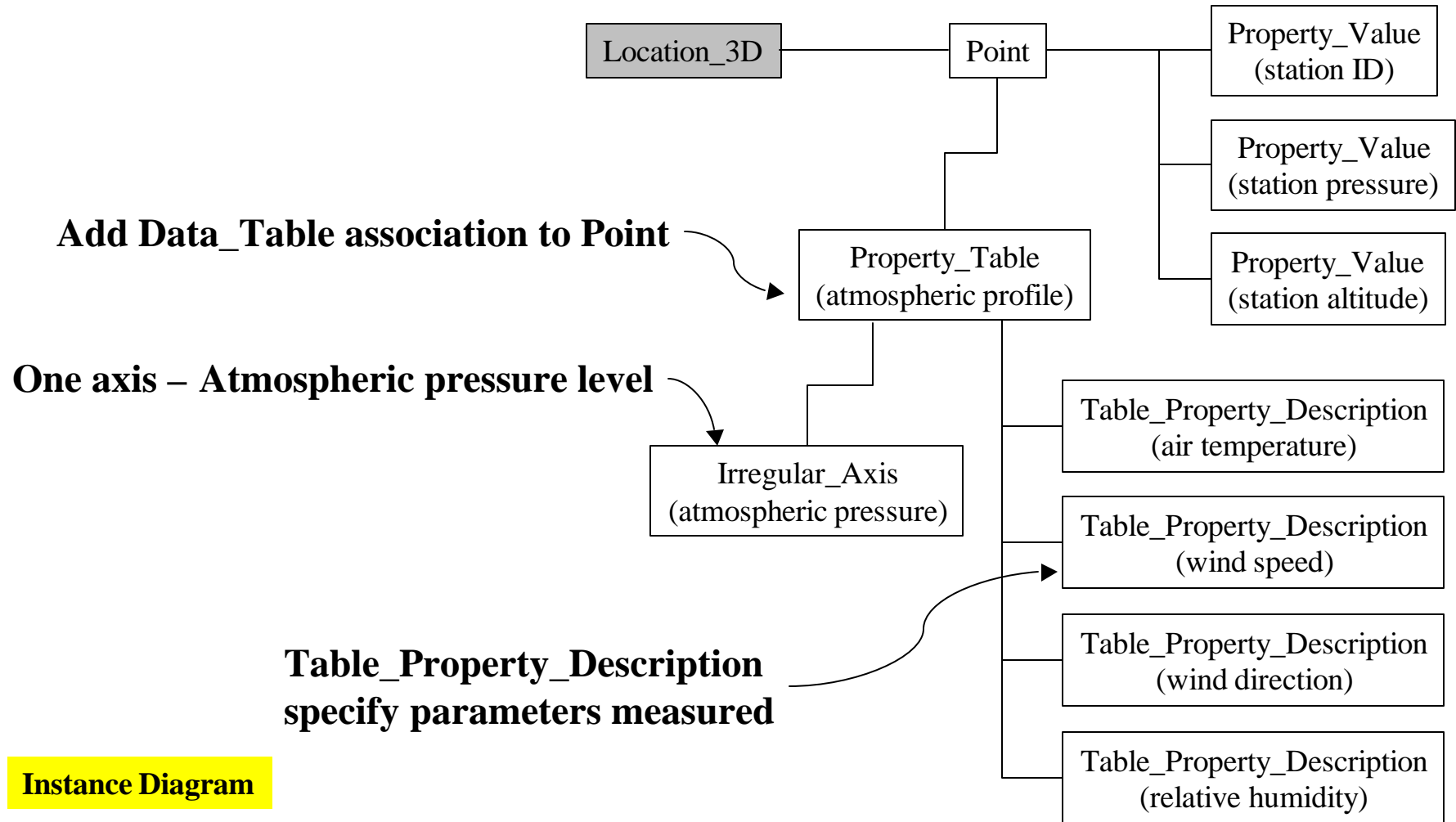


**Profile data located at “arbitrary” locations.**

**Same type of time information as for surface observations.  
Radiosonde profiles also contain surface observation data.**

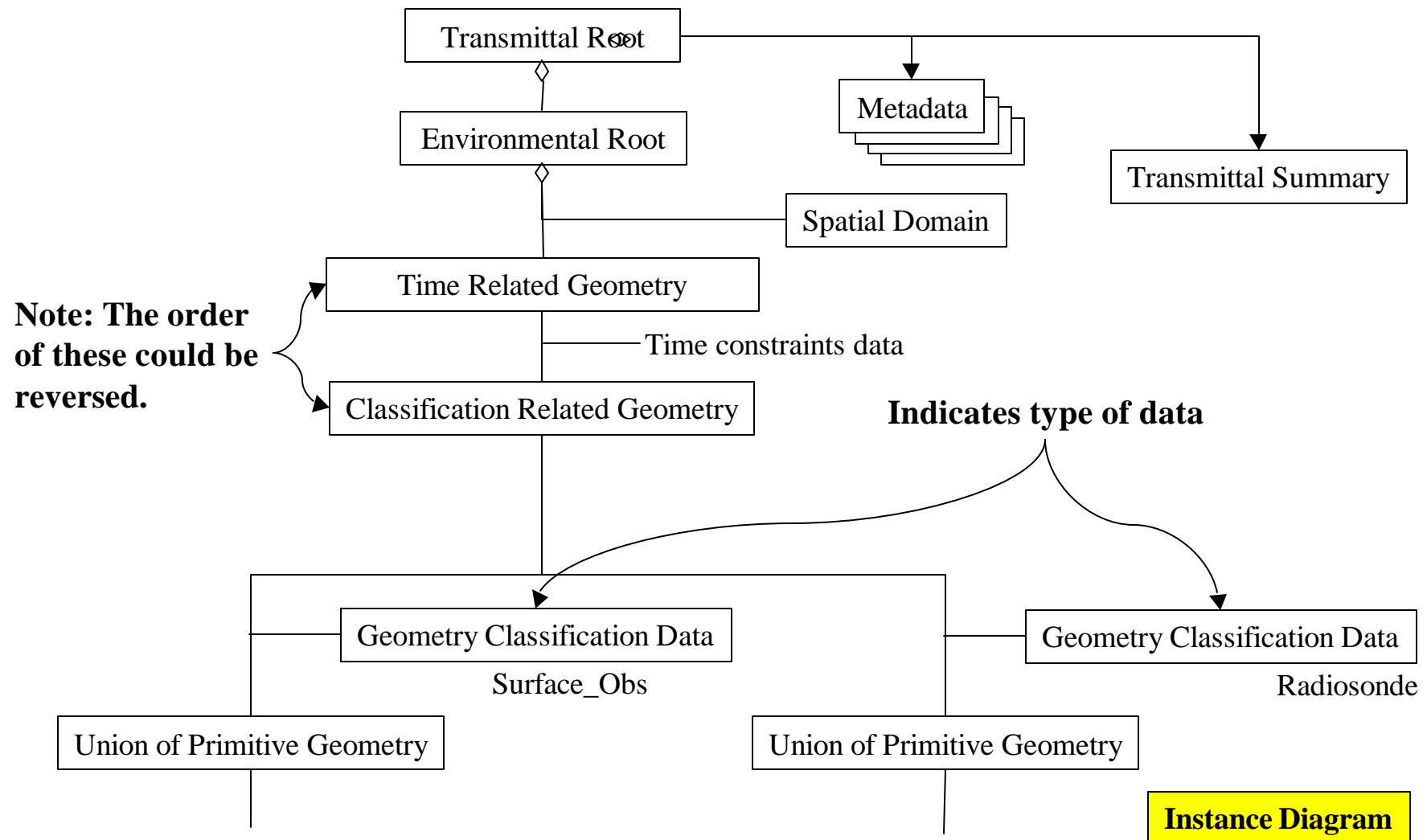
# Radiosonde

- Basic mapping same as for surface observations
- Classification data = Radiosonde



**Instance Diagram**

# Surface Obs & Radiosondes



# **GRIB Conversion Software**

# Gridded Binary (GRIB) Format

- GRIB is a World Meteorological Organization standard format for gridded data
  - Binary format
  - One level, time, parameter combination per message
- A set of GRIB messages contains no information about the relationship between the messages

# GRIB to STF Conversion Software

- Reads and analyzes the GRIB messages in a data set.
- Maps the information to the gridded representation previously presented.
- STF size is smaller than the aggregate of the original GRIB files.
- Conversion time is of the order of minutes.

# The *sedcfg* component

- Uses several external files in mapping process
  - file used to map GRIB parameter IDs to EDCS Attributes
  - file used to map GRIB level IDs to EDCS
  - file used to specify the appropriate horizontal and vertical datums
  - GRIB tables (used by GRIB decoder)
  - Metadata file: information not included in GRIB file

# SUMMARY

- Presented outline for doing a mapping along with a checklist.
- Presented example atmospheric mappings:
  - Grids
  - Surface Observation
  - Radiosondes
- GRIB to STF conversion program developed.