# 08. Data Model Schema Design

GE3238 GIS Design and Practices
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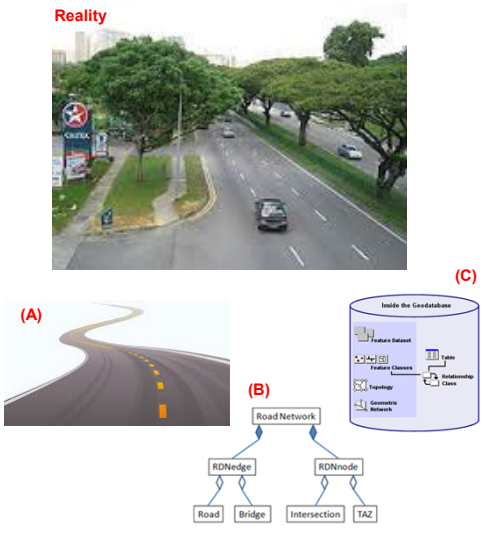
# Learning Objectives

- Interlinking structure between data models
- Unified Modeling Language (UML) and some OO concepts
  - Class, property, and relation
  - Type
- Tool to represent a data model

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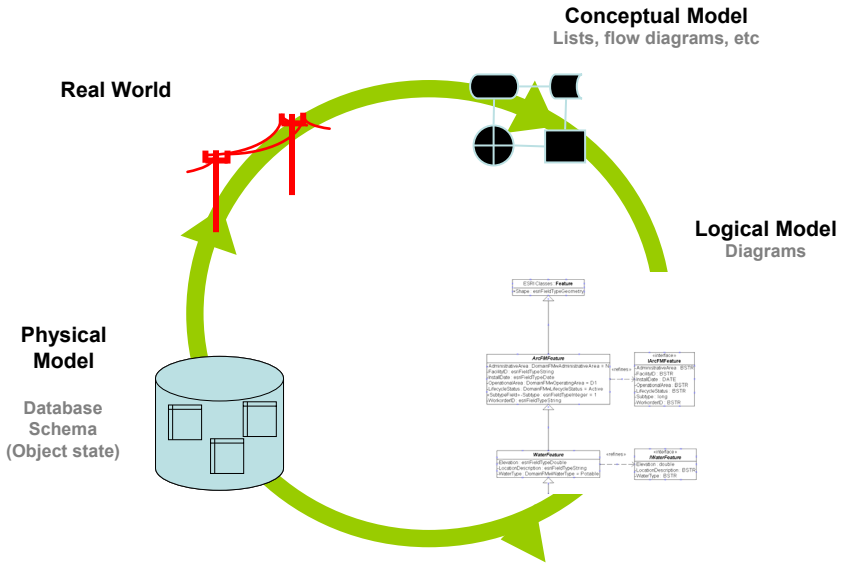
# Overview: Modeling Process

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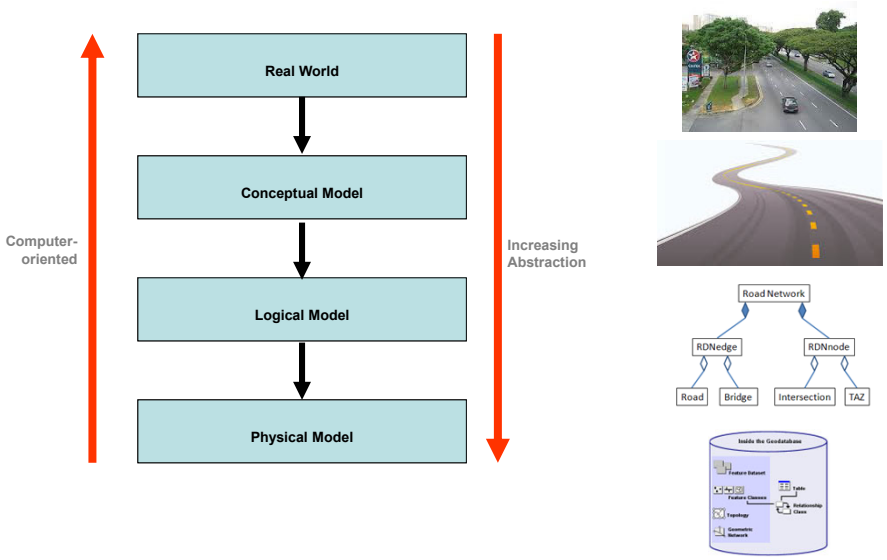
# Data Model Levels

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# Utility Management, An Example

- Pipe segments may be managed in different ways
- Basic supporting features not participating in the distribution of water
- Metered or non-metered

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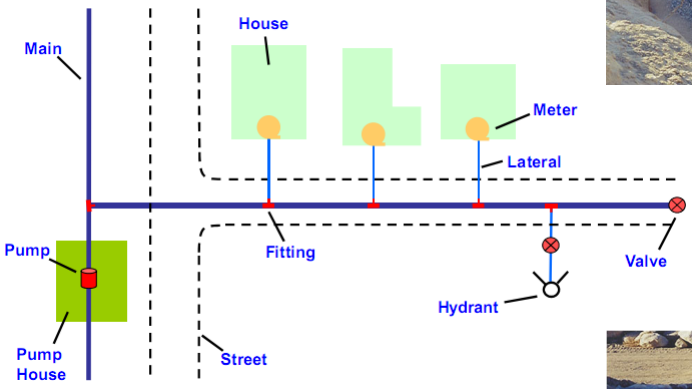
# Utility Management

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## Choosing the Appropriate (Mix of) Data Model(s)
(from week 7)

- Fundamental: vector and raster
  - What exactly do vector/raster tell you?
    - Discrete versus continuous
    - Traditional data models treat geometry and attribute as separate things
- Objects-based model
- Those built on top of the fundamental
  - Transportation network was introduced; relations are important
  - But what about bus route?
  - Vector and raster together?

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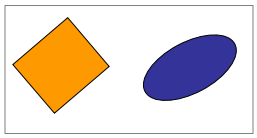
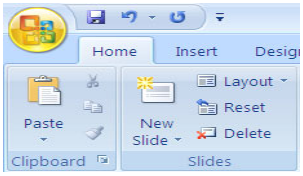
## What Is an Object?






- Everything
- An object can represent
  - a **spatial feature** such as a road or a hydrologic unit
  - a road layer or the coordinate system of the road layer

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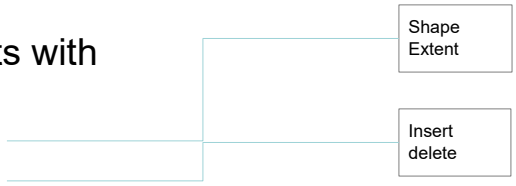
# Class

- A set of objects with similar
  - Properties
  - Behaviors




- Relations
  - Instantiation*
    - Class-instance
  - IS-A (hierarchy)
    - Specialization
    - Generalization

| Classroom |
| --- |
| -m_chShape : char<br>-m_nSize : double<br>-m_bTechroom : bool<br>-m_nLimit : int |
| +personNo() : int<br>+enter(in person, in time) : bool<br>+leave(in person, in time) : bool |

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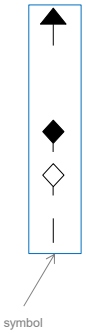
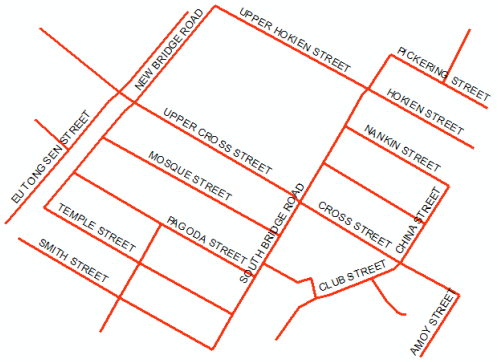
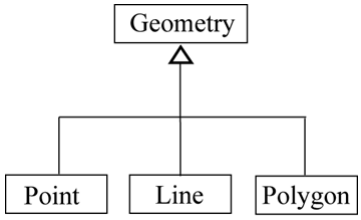
# Class

- Relations
  - Instantiation
  - IS-A
  - Parthood
    - Composition
    - Aggregation
  - Association

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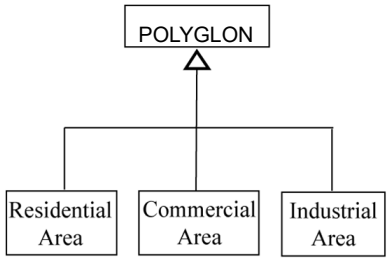
# IS-A relationship

- Type inheritance
  - A subclass is a member of a superclass
  - A subclass inherits the properties and methods of the superclass
  - A subclass can have additional properties and methods



An example of type inheritance.

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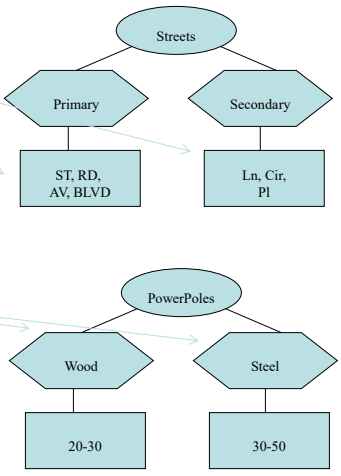
# Domain and Subtype (following Esri's terminology)

- Domain
  - Attribute domains are rules that describe the legal values of a field type
- Subtype
  - a method of dividing your feature classes or tables into logical groupings based on an attribute value

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# Cardinality and Association

- One-to-one (1:1)
- Many-to-one (M:1)
- Many-to-many (M:N)

- The above three are said to be the cardinality of a given table in relation to another

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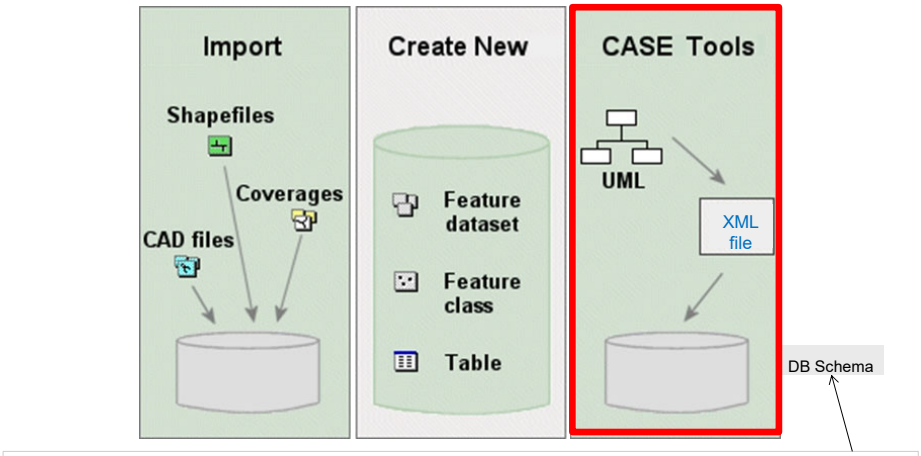
# Three Ways to Define/Author Geodatabase Structure




**Database schema** refers to the organization of data, to create a blueprint, of how a database will be constructed(divided into database tables).

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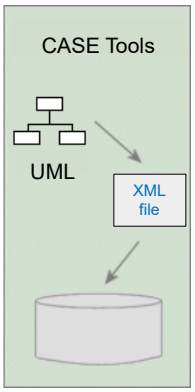
# Logical Data Model

- Model the user's view of data
  - identify information needs
  - determine data needed to support information needs
  - organize data into logical groupings

- Define the set of data objects required by your application
- Define the relationships between objects

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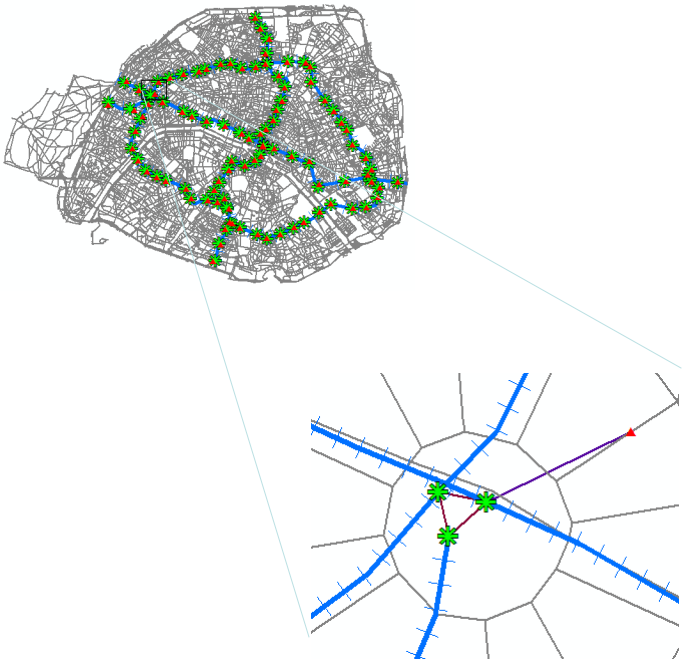

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# Logical Data Model, An Example

- Multimodal transportation system
  - Information needs
  - Classes representing transportation modes
  - Relationships between classes

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# Logical Data Model, An Example

- Multimodal transportation system
  - Information needs
    - Multimodal connectivity
    - Cost (Travel time)
  - Classes representing transportation modes
    - Roads
    - Subway lines
    - Bus routes
    - Bus codes
  - Relationships between classes
    - Roads, subway lines, and bus routes “are part of” the transportation network
    - Bus codes “are associated with” bus routes

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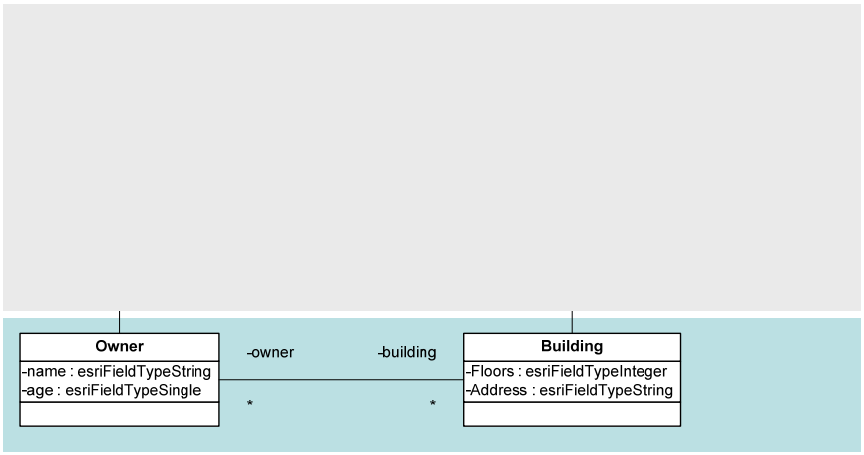
# Example of Logical Geodatabase Model in UML

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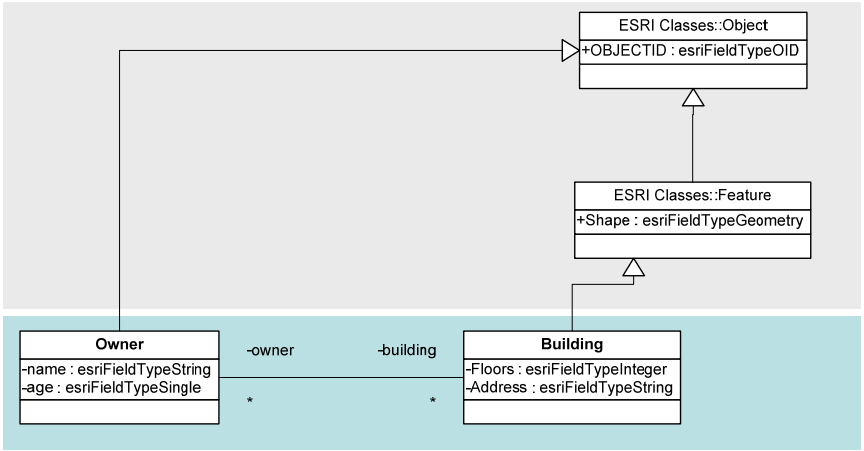
# Meaning in this diagram?

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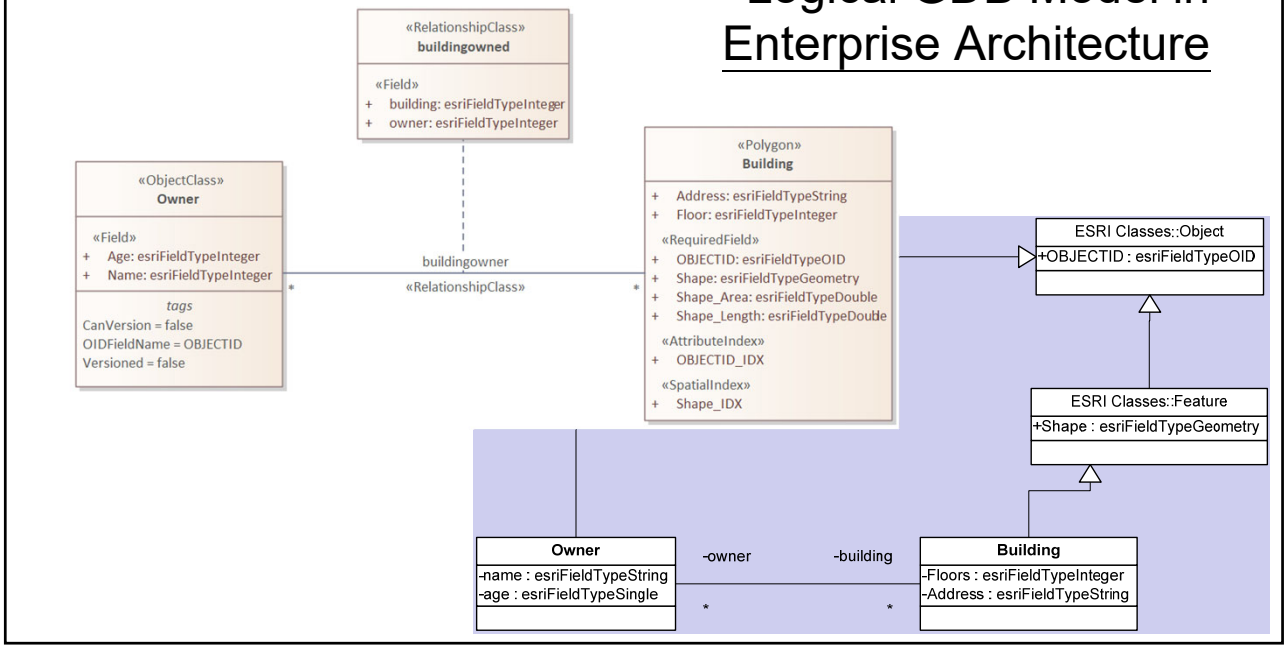
# Logical GDB Model in Enterprise Architecture

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# Main Window of EA with ArcGIS support

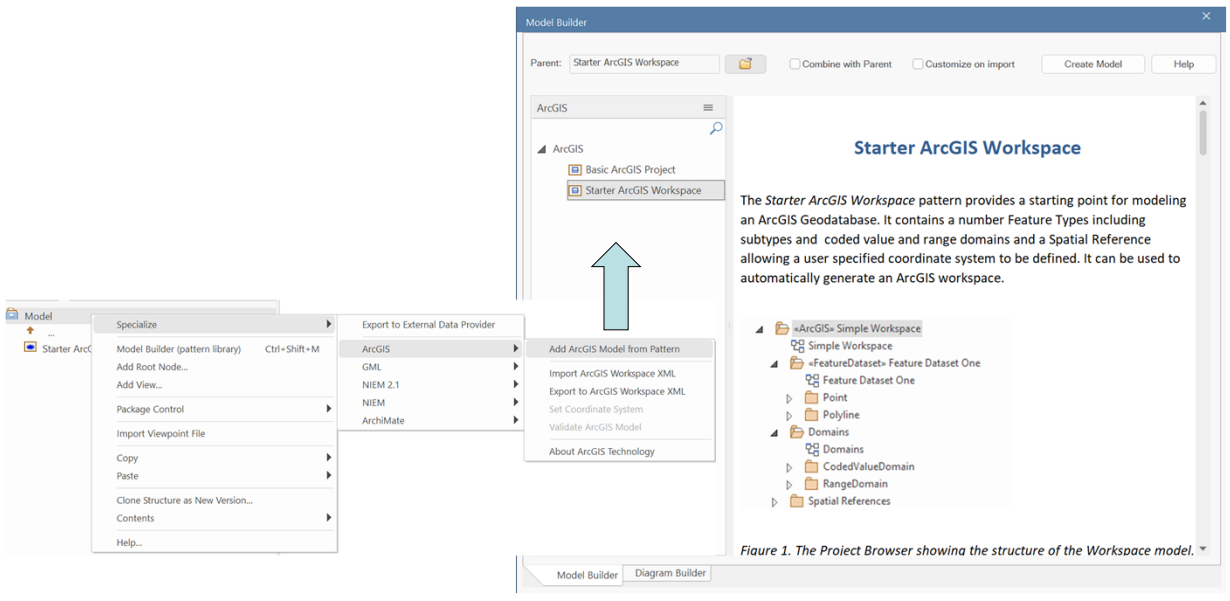


*Figure 1. The Project Browser showing the structure of the Workspace model.*

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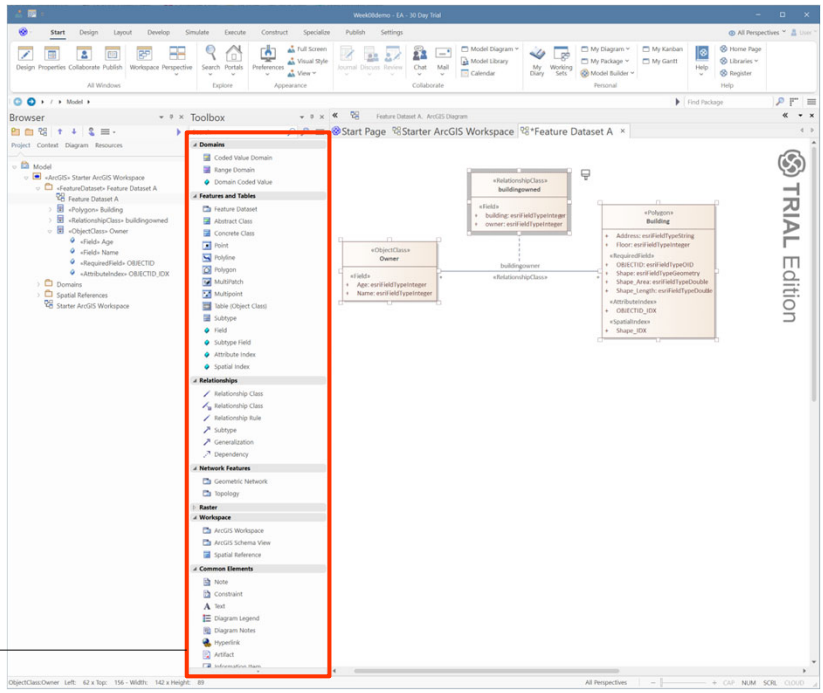
# Main Window of EA with ArcGIS support




See next slide

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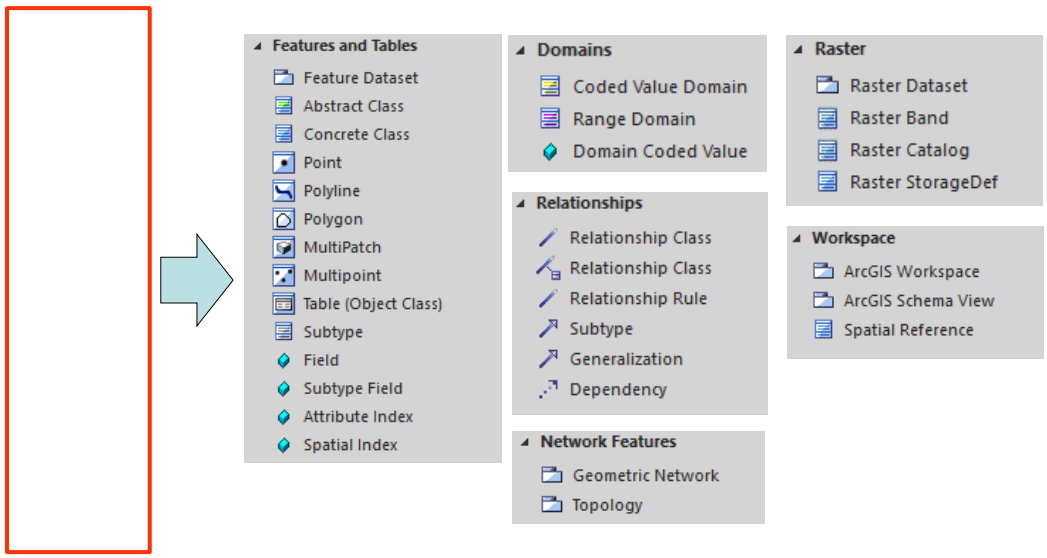
# Main Window of EA with ArcGIS support

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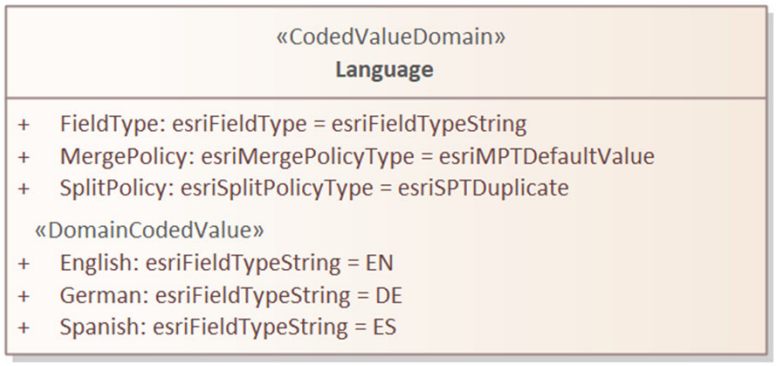
# Basic Spatial Entities

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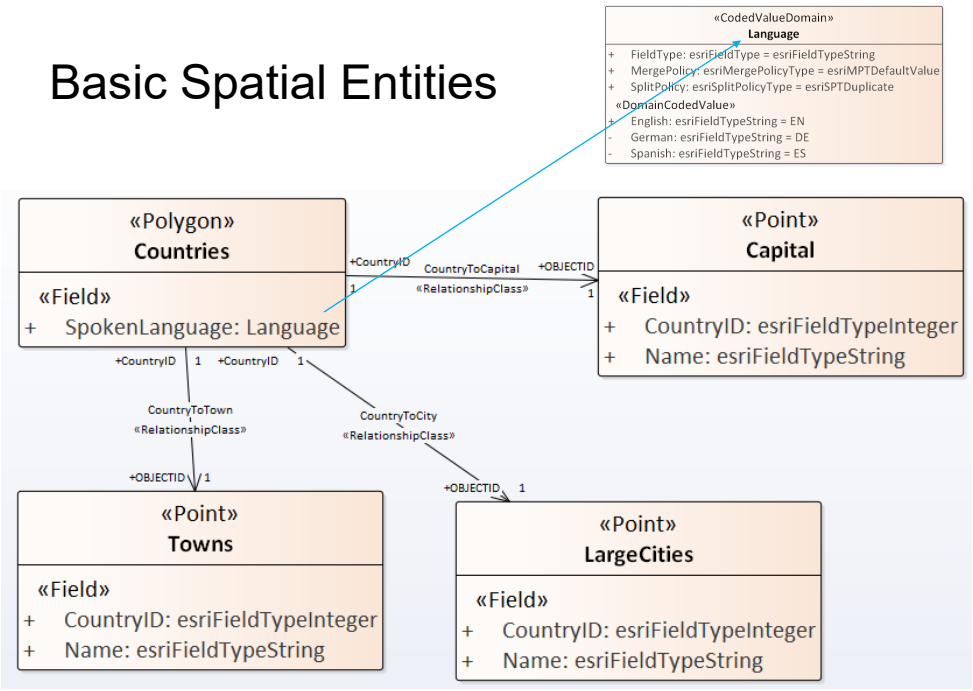
# Basic Spatial Entities

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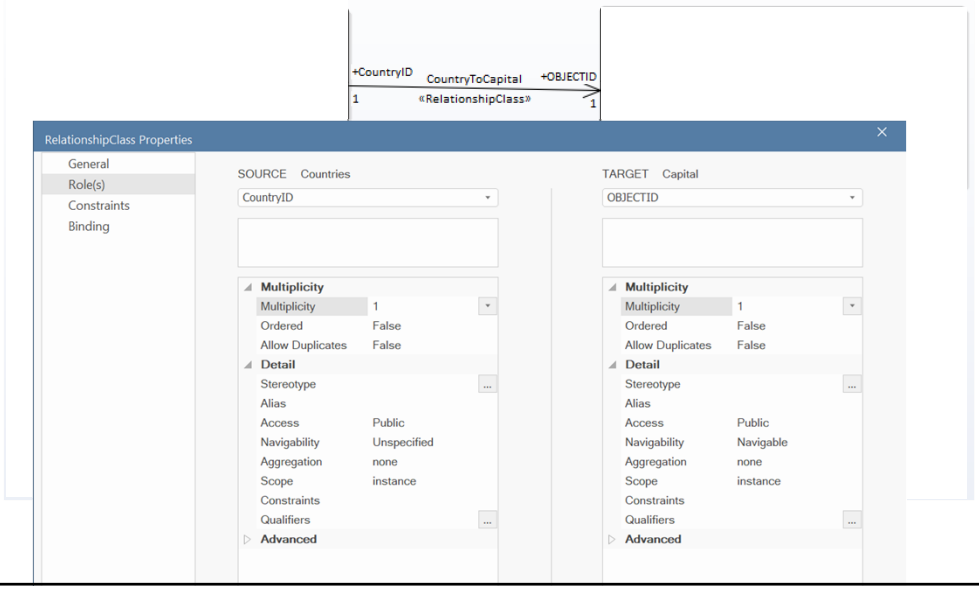
# Basic Spatial Entities

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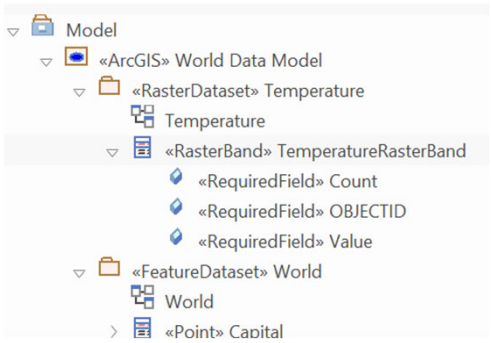
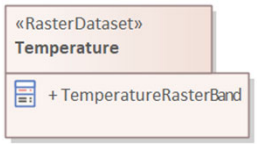
# Basic Spatial Entities





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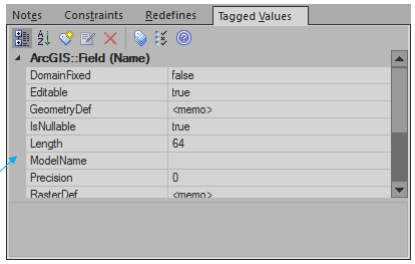
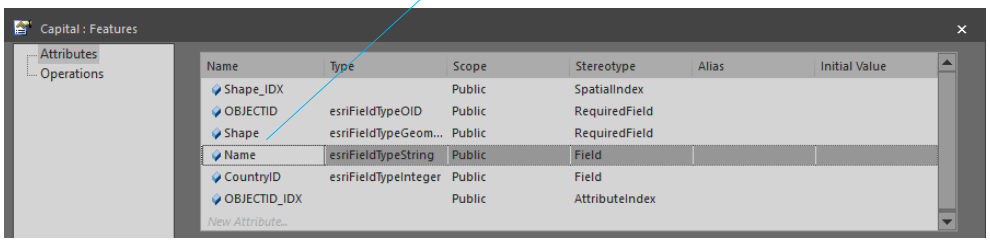
# “Fields” and “Field Properties”

- Fields → attributes
- Attributes can have properties

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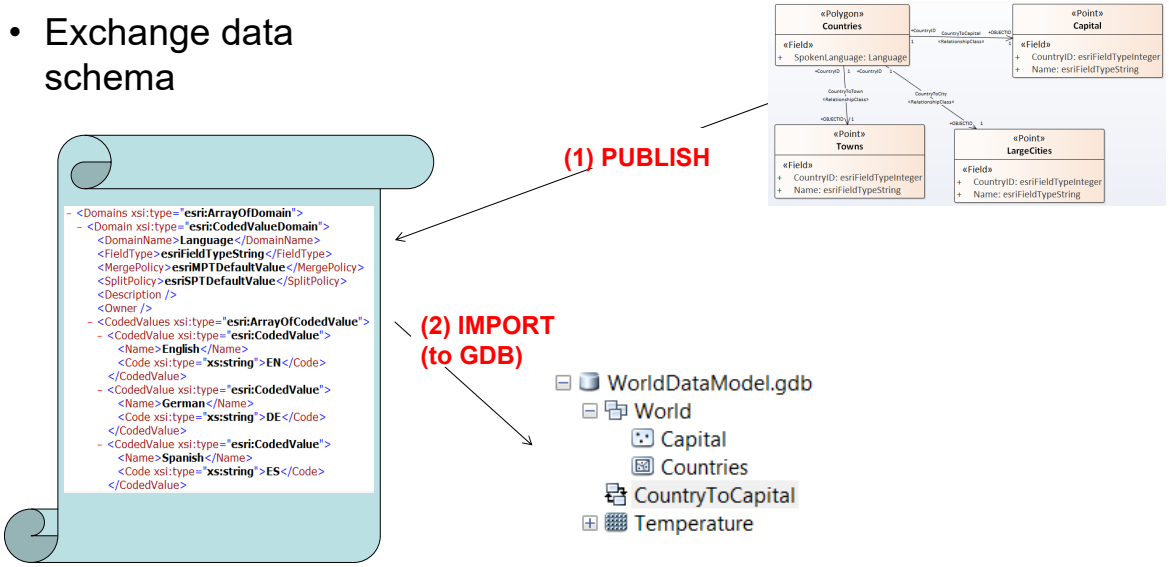
# XML Workspace Document

- Exchange data schema

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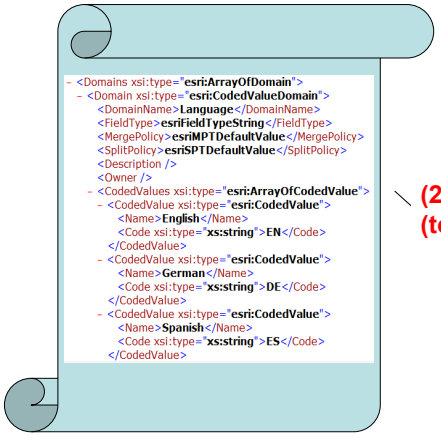
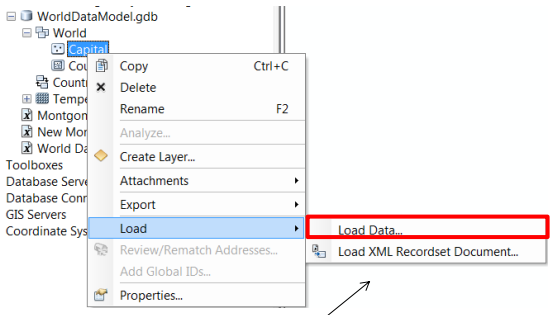
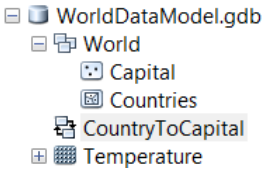
# XML Workspace Document

- Exchange data schema




**(2) IMPORT (to GDB)**




**(3) LOAD DATA**

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# Summary

- Types of data models
  - Interlinking structure between these models
- Static diagram of UML
  - Class, property, and relation
  - Type
- Tool to represent a data model: Enterprise Architecture
  - Integration with Geodatabase via a XML file

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