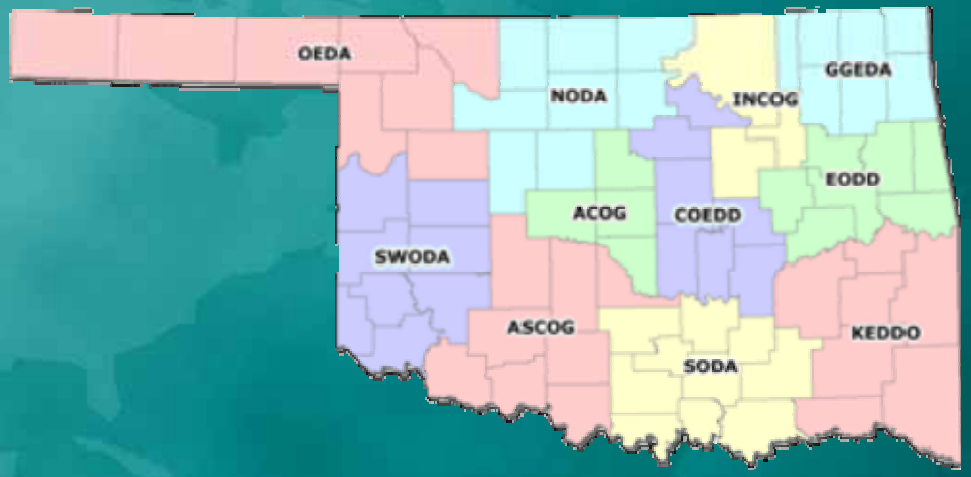
GeoCIP© Program Partners



Oklahoma GIS for GeoCIP

A Center for Spatial Analysis Report to

Oklahoma GI Council

6 November 2009

The CSA team

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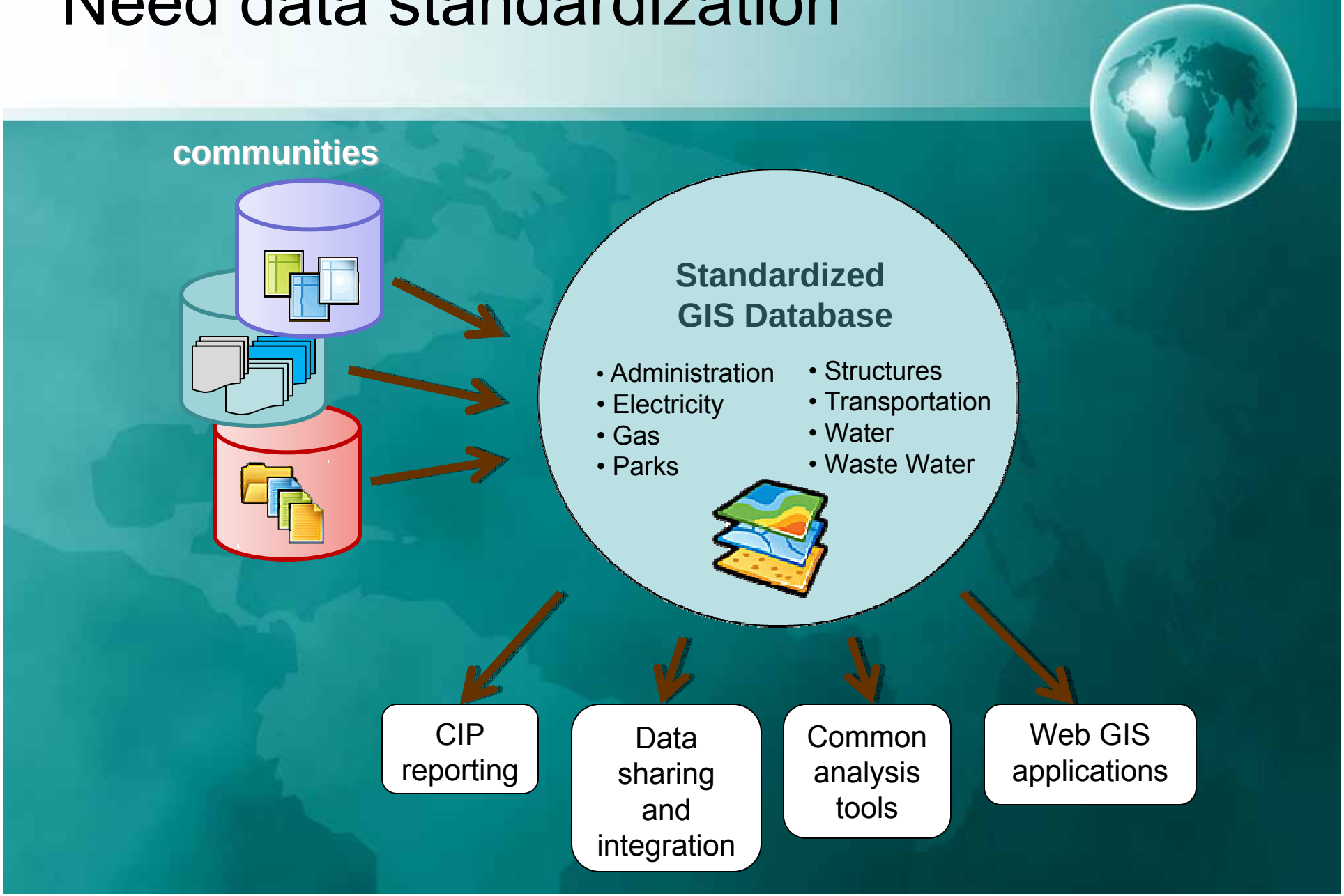
The Vision and Goals

- Vision: A GeoCIP GIS to support asset inventory and management for local governments across the state of Oklahoma over the web through collaboration with ODOC, COG, and CSA.
- Goals to support the Vision
  - A standardized database system for all communities
  - Automation of cost estimates for asset management at different geographies
  - Web-based data browsing and mapping
  - Training and planning for sustainability

Need data standardization



GeoCIP GIS Workflow

Major categories of capital assets

Community data

GeoCIP Data Models

Matching Tables

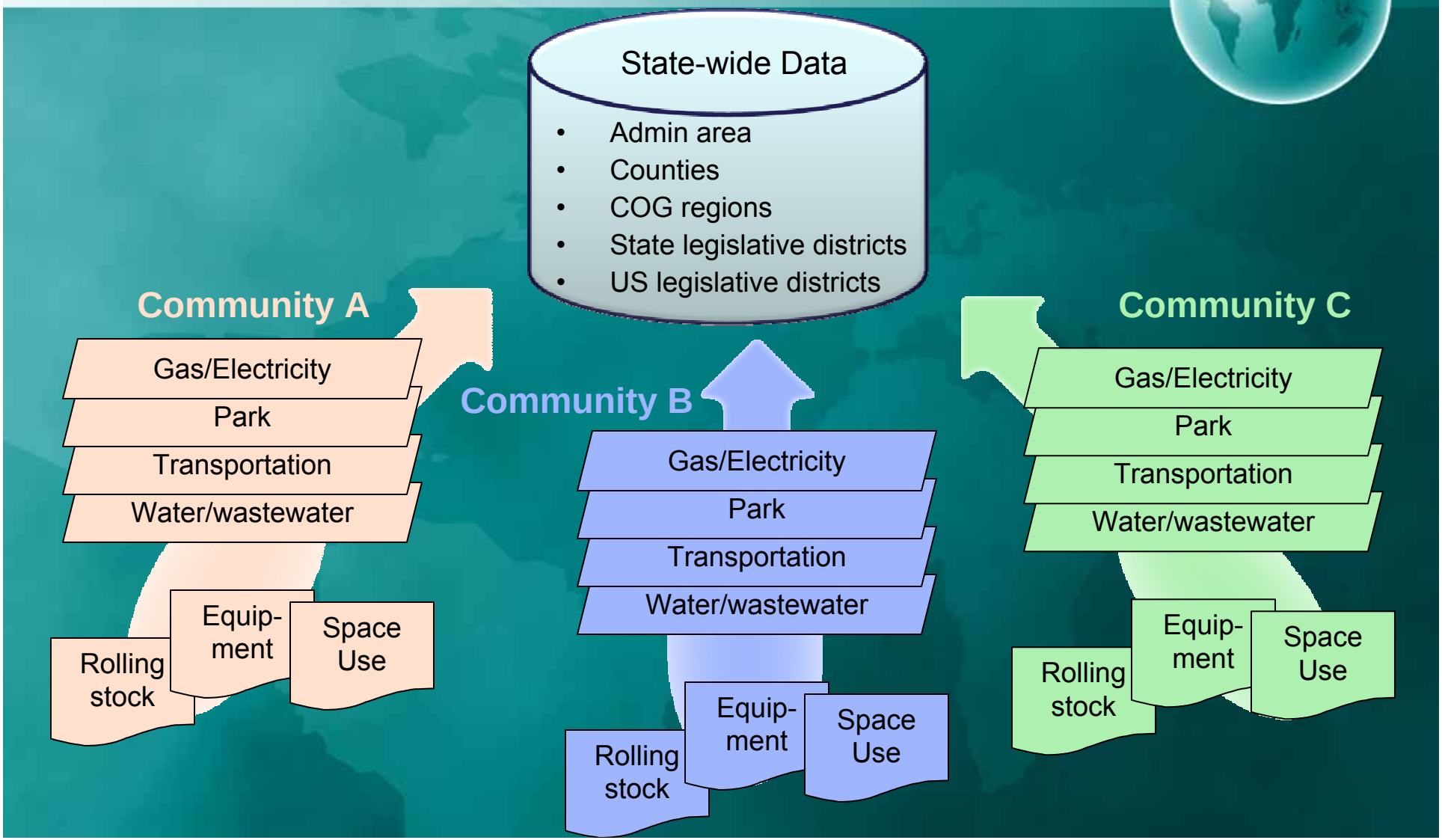
Transfer community data to GeoCIP geodatabase

Mapping Template

GeoCIP GIS Analysis Tools

Web GeoCIP GIS

GeoCIP GIS data organization

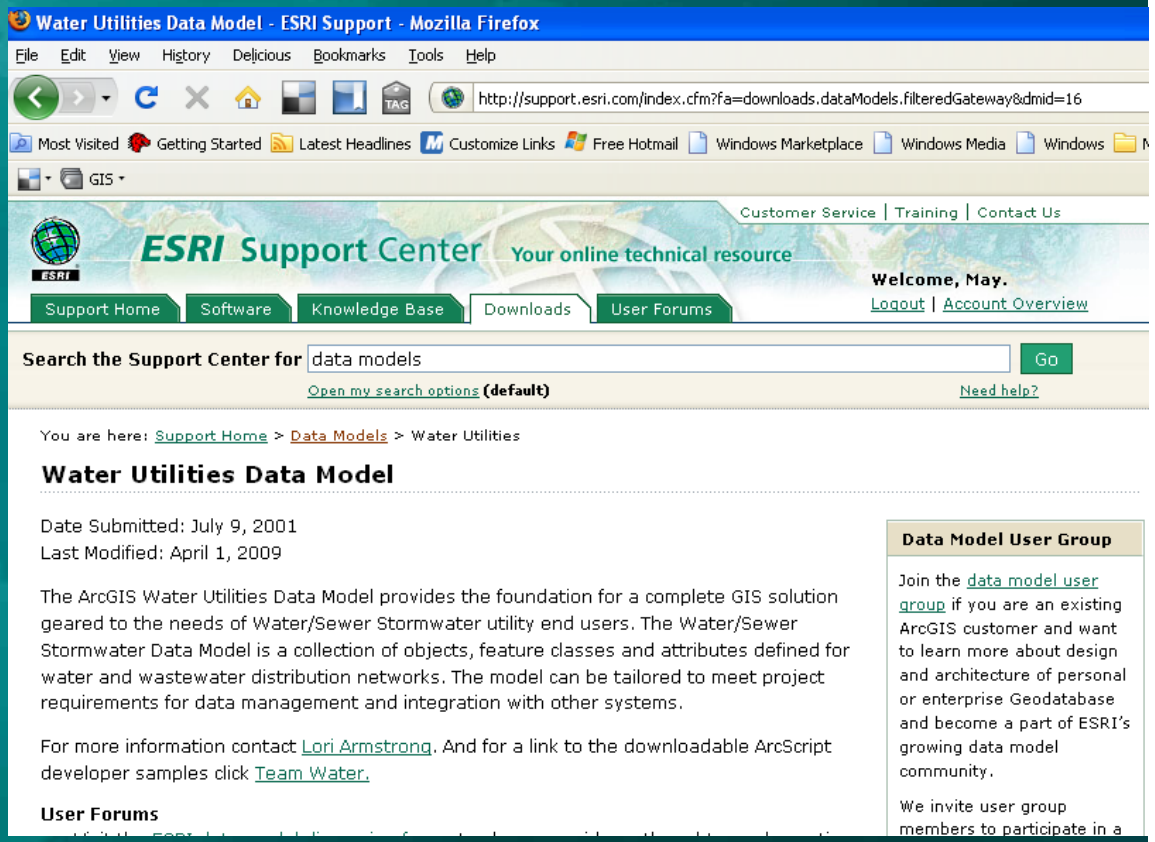


Standardization Process

- Identify applicable data models nation-wide and modify the data models to meet GeoCIP needs
- Determine what needs to be included in a data model (such as what features need to be in water utilities)
- Determine geometry for each feature
- Determine attributes for each feature
- Determine feature subtypes, data types, data domains (e.g. valid data values), and data description
- Determine matching tables from community data to the standardized data
- Edit meta data for each feature class and attribute
- Transfer community data to GeoCIP geodatabase
- Provide training to geotechs on database management

Example: Water Data Models

- ESRI Water Utilities Data Model
- GeoCIP Water
- GeoCIP Wastewater
- GeoCIP StormDrainage



Need to recognize distinctive attributes

- Example: Open drainage line (Ditch) vs. Close drainage line (Main)
  - depth of a ditch <> depth of a main line
  - ditch has width, main has diameter
- Solution
  - Represent both ditch and main as one line feature class
  - Merge attributes of the two
- Example: Appurtenance and Hydrant/Meter/Valve
  - Appear similar
  - May have distinctive attributes and functions
- Solution
  - Each is represented as a separate feature class

Hydrant, Meter, and Valve

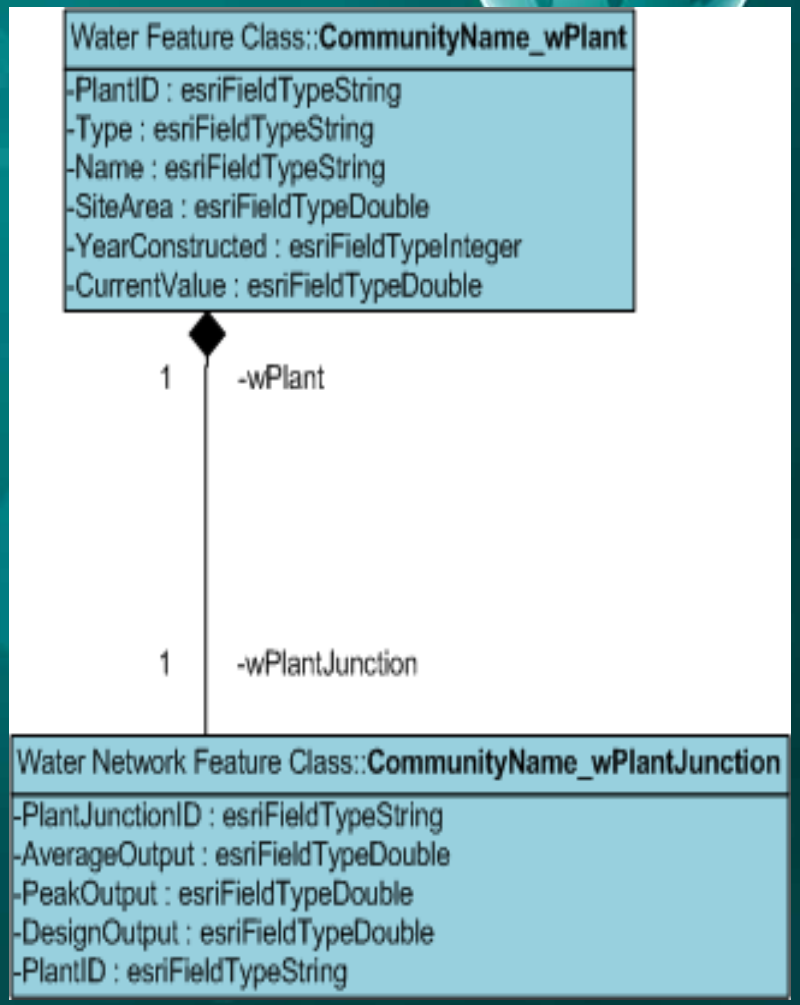
Water Network Feature Class::**CommunityName_wHydrant**
-HydrantID : esriFieldTypeString
-BarrelDiameter : wDomainDiameter = 10
-MainValveType : esriFieldTypeString
-NozzleDiameter1 : wDomainDiameter = 4
-NozzleDiameter2 : wDomainDiameter = 4
-NozzleDiameter3 : wDomainDiameter
-NozzleDiameter4 : wDomainDiameter
-OutletConfiguration : esriFieldTypeString
-SeatDiameter : esriFieldTypeInteger

Water Network Feature Class::**CommunityName_wMeter**
-MeterID : esriFieldTypeString
-Type : wDomainMeterType
-Diameter : wDomainDiameter
-FlowRange : esriFieldTypeString

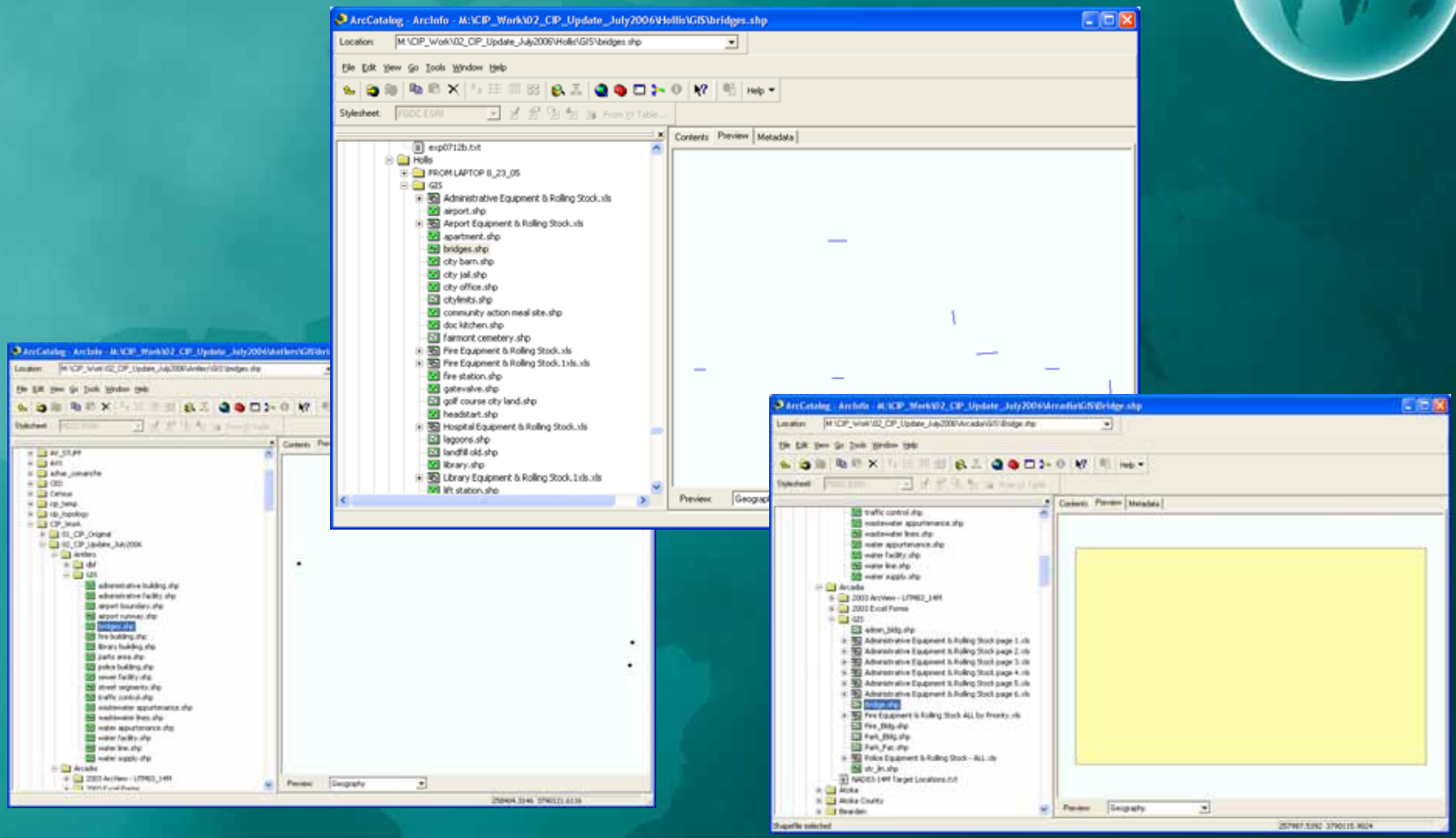
Water Network Feature Class::CommunityName_wValve
-ValveID : esriFieldTypeString
-Diameter : wDomainDiameter
-BypassValve : DomainBoolean = 0
-RegulationType : wDomainWHSystemValveRegulationType
-TurnsToClose : esriFieldTypeInteger
-SystemValveType : wDomainSystemValveType
-ControlValveType : wDomainControlValveType

Need to Recognize Proper Spatial Representation

- Plant as Point vs. Plant as Polygon
- Example
  - A plant is the end (sink) of a water/wastewater network
  - A plant has shape and area
- Solution
  - Represent a plant as both polygon (Plant feature class) and point (PlantJunction feature class)
  - One Plant, one PlantJunction
  - PlantJunction has attributes regarding network flow (e.g. average output, peak output, and design output)
  - Plant has descriptive attributes (e.g. name, site area, current value, …)



Example of geometry issues: Bridge



Example of attribute issues

Community A

CONDITION
R
S
R
R
R
R
R
S
S
R
R
R
S
R
S
R
R
R
R
R
R
R

Community B

CONDITION
SATISFACTORY
SATISFACTORY
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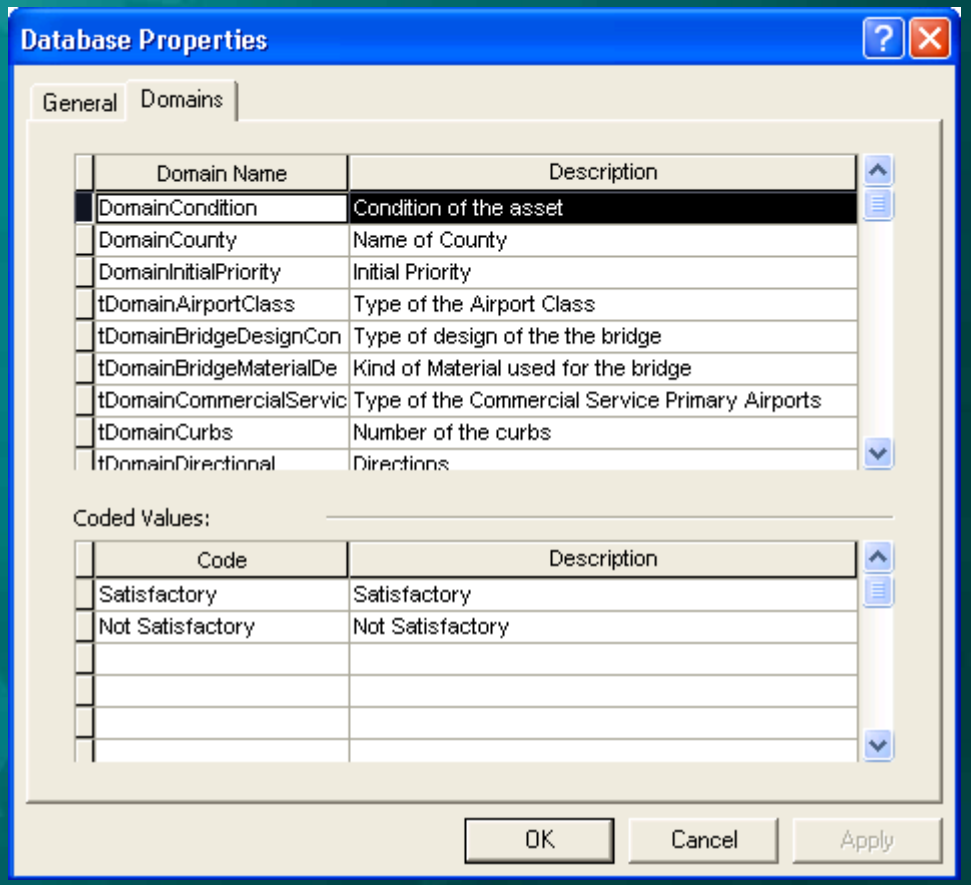
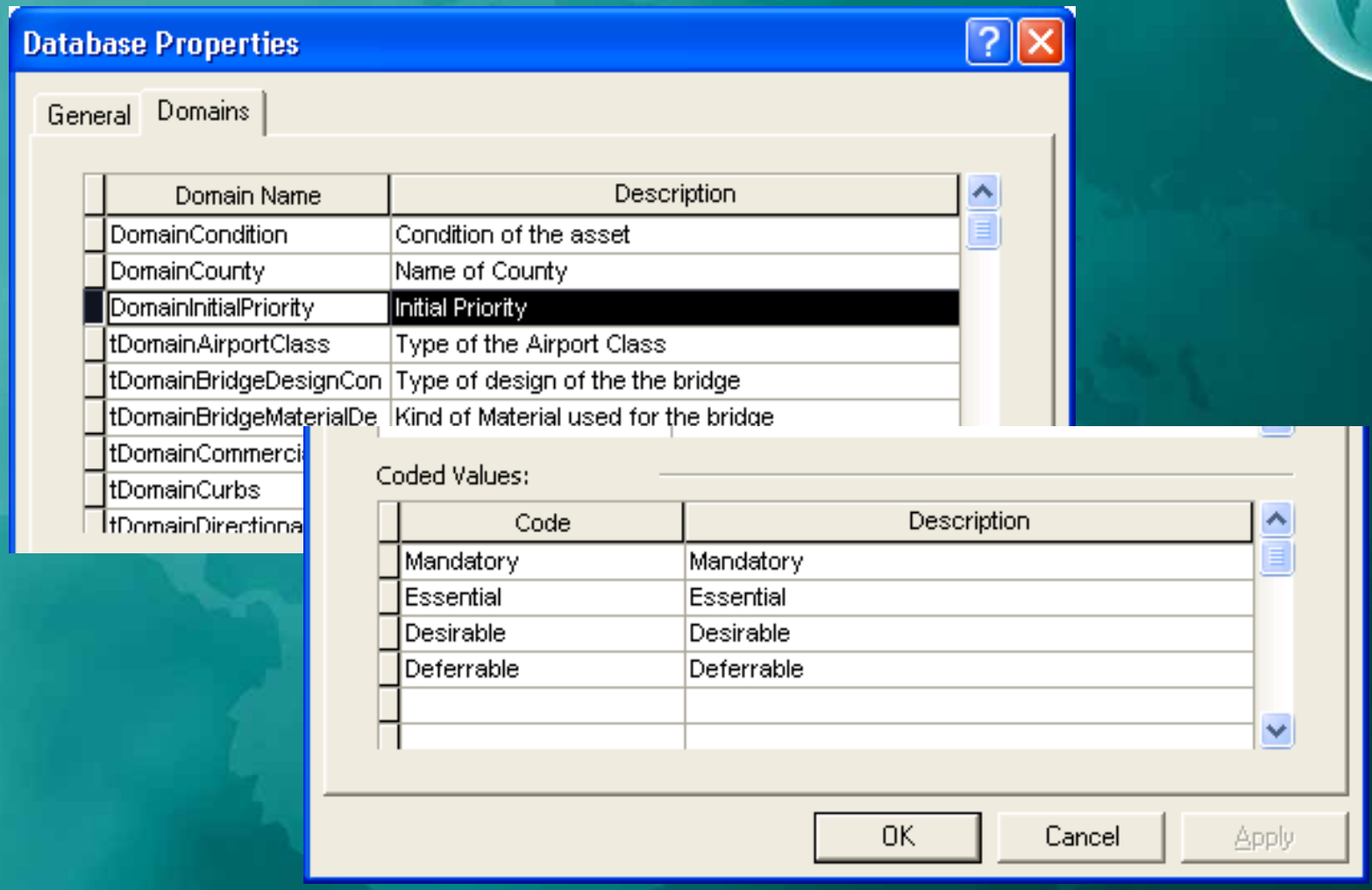


Example: standardize attribute values



Reorganize the Attributes

Type of street, type of surface & number of sidewalks for street segment	
U	Platted or dedicated but unopened for public use
D	Opened but unimproved
G	Gravel
OCR	Oil & Chip
A	Asphalt without curb & gutter
AC	Asphalt with curb & gutter
B	Brick without curb & gutter
BC	Brick with curb & gutter
C	Concrete without curb & gutter
CC	Concrete with curb & gutter
Note: Add a 0,1 or 2 to Type code for none, one or two sidewalks along street segment	

Existence of Sidewalk	
0	No Sidewalk
1	Sidewalk one side
2	Sidewalk both sides

Number of Curbs	
0	No Curbs
1	One Curb
2	Two Curbs

Street Surface Material
Gravel
Oil and Chip
Asphalt
Brick
Concrete

Reorganizing the Domain Values

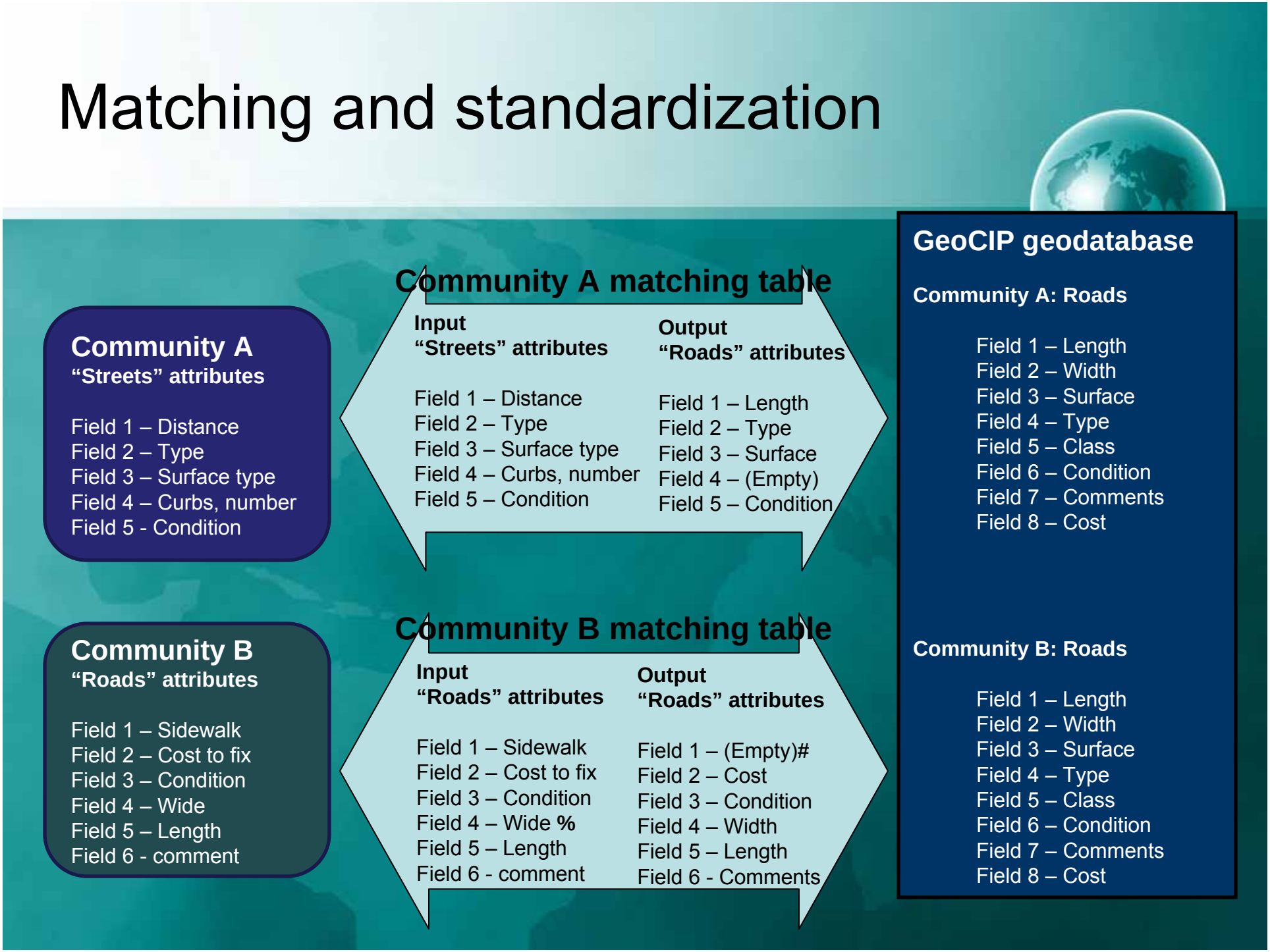
Street Classification	
A	Arterial
C	Collector
B	Commercial/industrial
R	Residential

GeoCIP Street Classification	
H	Highway
C/I	Commercial/Industrial
C	Collector
A	Arterial
RE	Residential
SR	Scenic Route
P	Private
PRO	Proposed
EA	Emergency Access
AL	Alley
R	Ramp
L	Local
U	Unknown

Matching Tables

- Match community data with GeoCIP geodatabase
- Determine matches for the following items
  - Feature classes
  - Attribute fields
- Developed a matching tool to match community data to GeoCIP geodatabase definitions
- Develop data transfer tool to transfer community data to GeoCIP geodatabase

Matching and standardization



Attribute Matching Table

Matching table (MatchingTab.txt).
This table has 5 columns: Identifier, CIP_Shapefile, ESRI_FeatureClass, SQL_Condition, and Default Value.
- **Identifier**: (required) This field is used to identify whether a line in this table is for layer matching or for field matching. The values can be:
------ {} : for community
------ [] : for shapefile
------ * : for fields
------ ? : to specify a default value of a particular field of a ESRI feature class
------ Note: Usually field matching follows right after layer matching.
- **CIP_Shapefile**: (required) This field can be a shapefile name or a field name of a CIP shapefile.
- **ESRI_FeatureClass**: (required) This field can be a feature class name or a field name of an ESRI feature class.
- **SQL_Condition**: (optional) This field is used if the CIP shapefile has to be split out into many ESRI feature classes. It has to follow the SQL structure accepted by ArcGIS. E.g. **Type = 'FH'**. In this case, ***Type*** is a field name in the shapefile (NOT the ESRI feature class). If there is no need to split, leave this field blank.
- **Default Value**: (optional) This field is used if it is necessary to assign a default value to a particular field of the ESRI feature class. In this case, the default value can be either a constant or an SQL expression to get data from variety of fields of the original shapefiles. E.g. Comments = "FAC_SQ_FT=" & [FAC_SQ_FT] → Value of the Comments field of this feature class is a combination of a text "FAC_SQ_FT=" and the value taken from the field FAC_SQ_FT of the matching shapefile.

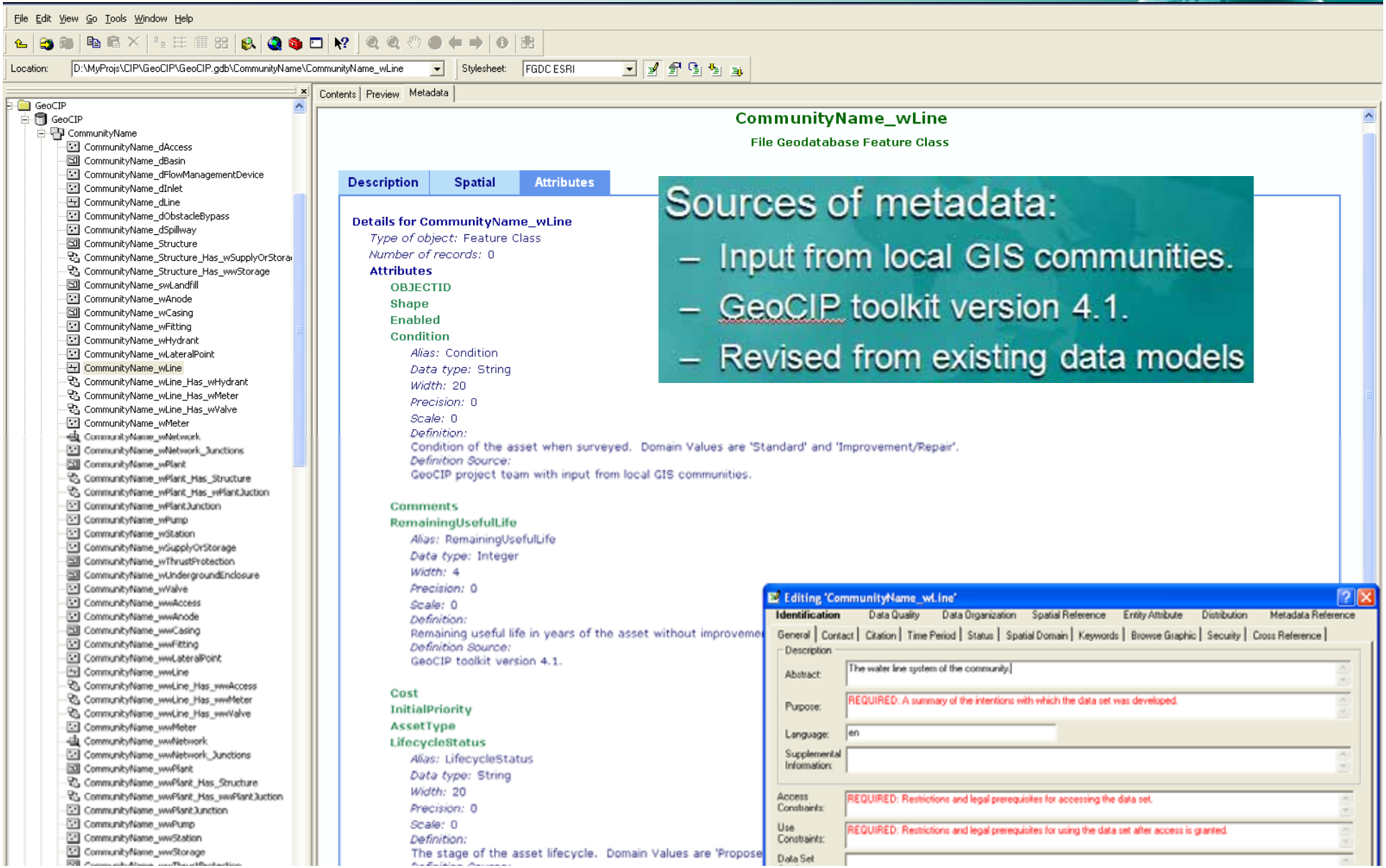
After finishing this table, please Save As this table to Tab Delimited Text (*.txt) with the filename: MatchingTab.txt. Click Yes or OK when prompted.
Required means the column cannot have null or blank value.
Optional means the column can have null or blank value.
** Please do not change the following example.

Identifier	CIP_Shapefile	ESRI_FeatureClass	SQL_condition	Default Value
{}	**Martha_**			
[]	firehydrantsmerged	Hydrant	Type = 'Fire Hydrant'	
*	APPURTENAN	FacilityID		
*	REM_LIFE	RemainingUsefulLife		
[]	gatevalvesmerged	ControlValve	Type = 'Gate Valve'	
*	APPURTENAN	facilityID		
*	REM_LIFE	RemainingUsefulLife		
{}	**Arapaho_**			
[]	Appurtenance	SystemValve	App_Type = 'HY'	
*	App_ID	Utility_ID		
*	Appurtenance	Hydrant	App_Type = 'FH'	
{}	**Ravia**			
[]	***Ravia Wastewater Apps***	***Ravia_wwAccess***	***App_Type = 'Manhole'***	
	Community			
	Date_			
	Surveyor			
*	App_ID	AccessID		
	App_Type			
*	Seg_ID	SegmentID		
*	Condition	Condition		
*	Comments	Comments		
*	REM_LIFE	RemainingUsefulLife		
*	Cost_IP_RE	Cost		
*	S_Priority	InitialPriority		
	L_Priority	LPACPriority		

Domain Matching Table

Identifier	Original Value	New Value	Field used
[]	wDomainCondition		*This is example.*
*	S	Standard	*This is example.*
*	I	Improvement	*This is example.*
[]	**DomainCondition**		**Condition, StructureCondition, ...**
*	S	S	
*	R	N	
*	I	N	
*	T	N	
*	Satisfactory	S	
*	Needs Improvement	N	
*	Should Be Replaced	N	
[]	**DomainInitialPriority**		**InitialPriority, StructureInitialPriority, ...**
*	Y	Deferrable	
*	E	Essential	
*	M	Mandatory	
*	D	Desirable	
*	Deferrable	Deferrable	
*	Essential	Essential	
[]	**wDomainWaterLineMaterial**		**Material (usually for water/wastewater line)**
*	I	CI	
*	C	CL	
*	P	PVC	
*	O	Other	
*	D	DI	
*	S	Steel	
*	U	Unknown	
*	Clay	CL	

Metadata editing



GeoCIP Data Transferring Tool

How it works

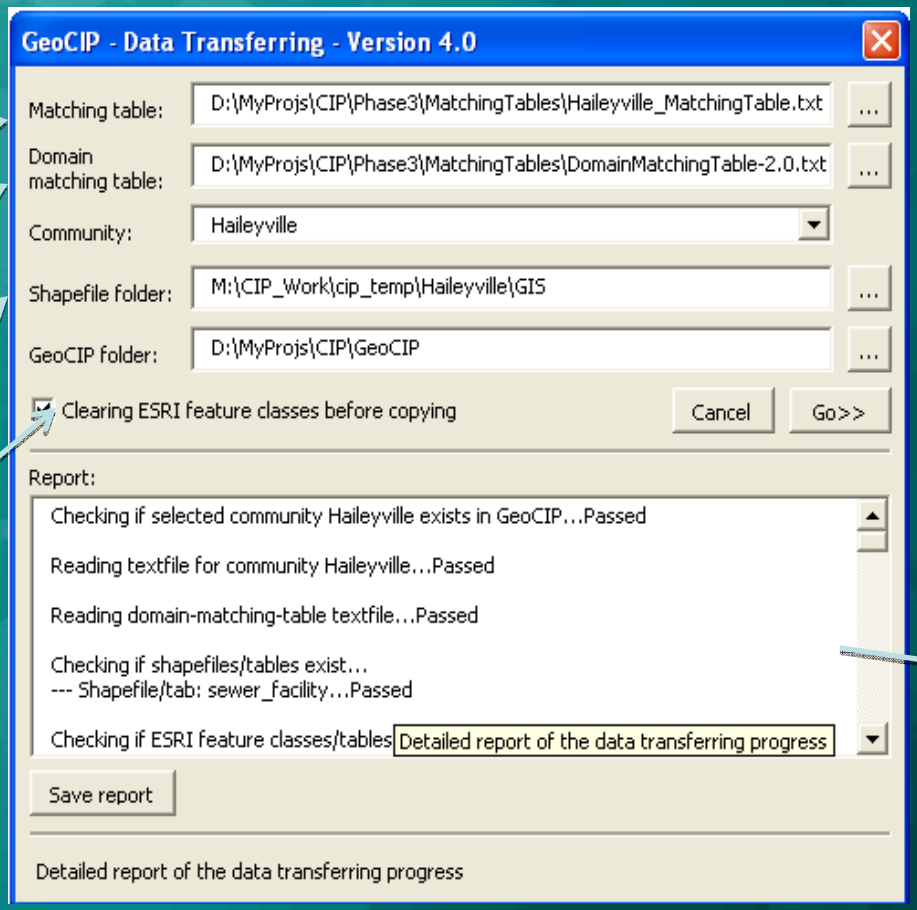
Version 4.0

Data Matching Table

Domain Matching Table

Shapefile folder

GeoCIP



What are we doing now…

- Finalize data models
  - Electricity and Gas
  - Transportation
  - Equipment
  - Rolling stock
- Compile matching tables
- Transfer data to the GeoCIP state-wide geodatabase
- Prepare documentation
- Design map template and symbology
- Plan the next training workshop
  - Coordinate Systems & Projections √
  - Editing in ArcMap √
  - Creating and Editing Topology √
  - Georeferencing CAD Data √
  - Editing and Maintaing GeoCIP® Database Models

Workshops

A series of workshops have been developed by the Center for Spatial Analysis to provide training for GeoCIP® geotechs and coordinators. These workshops have focused on building up a basic framework of GIS knowledge enabling COG geotechs to maintain the CIP infrastructure data models developed for each community.

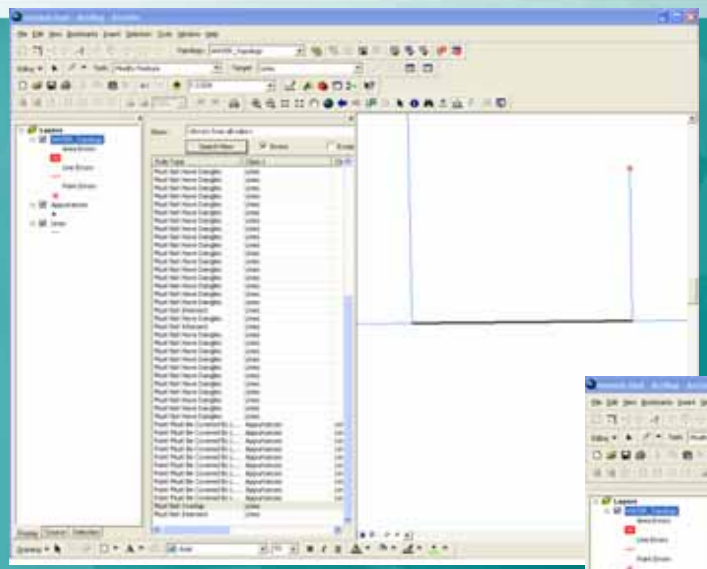
Topics Covered

- Coordinate Systems & Projections
- Editing in ArcMap
- Topology
- Georeferencing CAD data
- Editing and Maintaining GeoCIP® Database Models

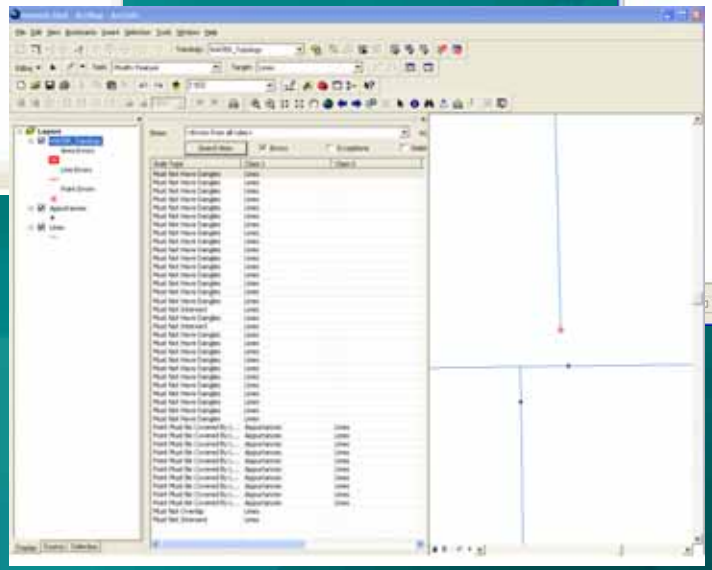
Topology

- Much of the line and point data submitted to CIP are georeferenced but lack the connectivity to other features to develop accurate spatial relationships that model the real world.
- Lines are not snapped to the endpoints of other lines.
- Intersections between lines overlap and are not connected.
- Appurtenances do not split line segments and in many cases are not lying on the line.
- Many duplicate line segments and points have been digitized.
- These potential digitizing errors create problems when trying to develop a GIS for the CIP that will accurately model real world relationships.

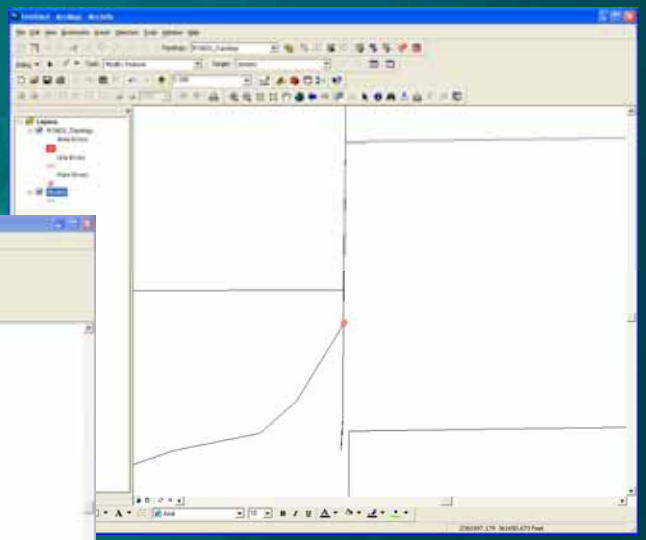
Topological errors



A duplicate water line



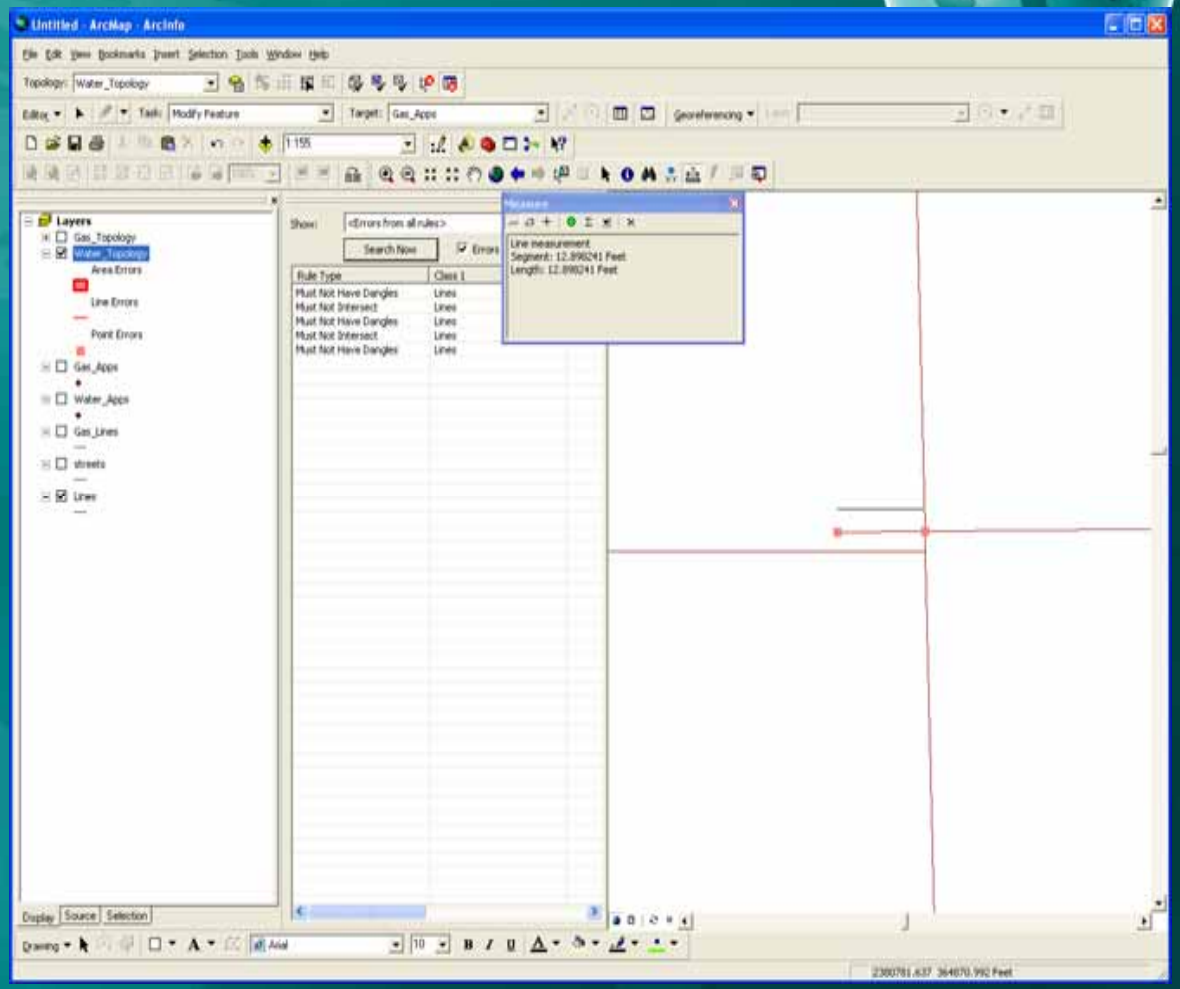
A water line should have been snapped to the water valve appurtenance.



duplicate road segments and dangle roads

Topology issues

- Should that water line connect at the intersection?
- Does the water line inventory match the geometry?
- Do those lines intersect or do they overlap?
- Is that really a 12ft water line or should it terminate a the intersection?



The next steps

- Web GIS: enable data browsing and query over the web

http://geospace.csa.ou.edu/GeoCIP

- Analyze functional needs for reporting and planning
- Develop tools to support asset analysis for communities, regions, and state
- Distribute the data and tools over the web GeoCIP® GIS
- Expand the GeoCIP® GIS to include social and economic assets, such as demographics, schools, social or cultural groups, business establishments, land parcels, sales or tax records, workforce, etc. for comprehensive asset mapping and economic development planning