

# Preserving the Past



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***GIS-T Symposium 2008***



# The Problem

- Databases include only current information
- GIS is used to analyze changes over time
- Mistakes look the same as good data



# The Need

- Retain history
- Track the database's structure
- Build in edit management




# The Solution: Continuous Versioning

- Never delete data
- Include active data dictionary
- Track the edit process
- Separate real-world history from database history
- Separate editing from published data

# History Template - Concept

<i>Entity</i>
<b><u>entityID</u></b> : Identifier <b><u>recordDate</u></b> : DateTime fromDate : Date toDate : Date recordStatus : Enum (FK) entityStatus : CodeList (FK) ... [additional attributes]

# History Template - Physical

 Table  
**Entity**

Field name	Data type	Allow nulls	Default value	Domain	Pre- cision	Scale	Length
OBJECTID	Object ID						
EntityID	Long Integer	Yes			0		
RecordDate	Date	Yes					
FromDate	Date	Yes					
ToDate	Date	Yes					
RecordStatus	Short Integer	Yes		RecordCode	0		
EntityStatus	Short Integer	Yes		EntityCode	0		

*Class template supporting continuous versioning*

Identifier of entity

Date record was created

Starting date of validity

Ending date of validity

Status of record

Status of entity in the real world

# Record Status Domain

Coded value domain

## RecordCode

Description *Record status code*  
Field type *String*  
Split policy *Default value*  
Merge policy *Default value*

Code	Description
0	Work in progress
1	Proposed
2	Withdrawn
3	Rejected
4	Accepted
5	Active
6	Replaced
7	Retired

**Edit Only**

**Published**



# Entity Status Domain

Coded value domain

## EntityCode

Description *Entity status code*  
Field type *String*  
Split policy *Default value*  
Merge policy *Default value*

Code	Description
1	Proposed
2	Under review
3	In design
4	Under construction
5	Substantial completion
6	Open to traffic
7	Accepted, in service
11	Damaged
12	Under repair
21	Jurisdiction transferred
31	Closed to traffic
32	Removed from service
33	Abandoned
34	Surplused
35	Stored
86	Demolished



# How It Works - Start

## Initial State 0

EntityID	RecordDate	FromDate	ToDate	RecordStatus	EntityStatus	...
1	08/31/2003	01/01/1978		5	6	
2	08/31/2003	01/01/1978		5	6	
3	08/31/2003	01/01/1978		5	6	
4	08/31/2003	01/01/1978		5	6	
5	08/31/2003	01/01/1978		5	6	
6	08/31/2003	01/01/1978		5	6	

# How It Works – First Change

Entity 5 damaged on 02/19/2007

## Updated State 1

EntityID	RecordDate	FromDate	ToDate	RecordStatus	EntityStatus	...
1	08/31/2003	01/01/1978		5	6	
2	08/31/2003	01/01/1978		5	6	
3	08/31/2003	01/01/1978		5	6	
4	08/31/2003	01/01/1978		5	6	
5	02/23/2007	01/01/1978	02/18/2007	<b>7</b>	6	
6	08/31/2003	01/01/1978		5	6	
7	02/23/2007	01/25/2007		5	6	
5	02/23/2007	02/19/2007		5	11	

# How It Works – Second Change

Data for Entity 7 discovered to be wrong

## Updated State 2

EntityID	RecordDate	FromDate	ToDate	RecordStatus	EntityStatus	...
1	08/31/2003	01/01/1978		5	6	
2	08/31/2003	01/01/1978		5	6	
3	08/31/2003	01/01/1978		5	6	
4	08/31/2003	01/01/1978		5	6	
5	02/23/2007	01/01/1978	02/18/2007	7	6	
6	08/31/2003	01/01/1978		5	6	
5	02/23/2007	02/19/2007		5	6	
7	02/23/2007			<b>6</b>	6	
8	02/23/2007	01/19/2007		5	6	
9	02/23/2007	02/04/2007		5	6	
7	02/23/2007	01/25/2007		5	6	



# Finding What You Want

- Current state of system:  
RecordStatus = Active
- State of system on Date:  
Date => FromDate AND Date <= ToDate



# Updating External Tables

- Select on RecordDate to extract all edits since last update
- For each EntityID, replace RecordDate, FromDate, ToDate, and RecordStatus values with those in extract where RecordStatus is Retired or Replaced
- Add all records where RecordStatus is Active

# Managing Edit Process - Concept

## *Entity*

**entityID** : Identifier  
**recordDate** : DateTime  
enteredBy : String  
fromDate : Date  
toDate : Date  
recordStatus : Enum (FK)  
editReason : CodeList (FK)  
comment : String  
entitystatus : CodeList (FK)  
...  
[additional attributes]

# Managing Edit Process - Physical

Table <i>Entity</i>							
Field name	Data type	Allow nulls	Default value	Domain	Pre- cision	Scale	Length
OBJECTID	Object ID						
EntityID	Long Integer	Yes			0		
RecordDate	Date	Yes					
EnteredBy	String	Yes					30
FromDate	Date	Yes					
ToDate	Date	Yes					
RecordStatus	Short Integer	Yes		RecordCode	0		
EditReason	Short Integer	Yes		EditCode	0		
Comment	String	Yes					255
EntityStatus	Short Integer	Yes		EntityCode	0		

*Enhanced class template supporting edit process management*

Identifier of entity

Date record was created

Name of person creating record

Starting date of validity

Ending date of validity

Status of record

Reason the update was made

Comment field for additional information

Status of entity in the real world

# Edit Reasons Domain

Coded value domain

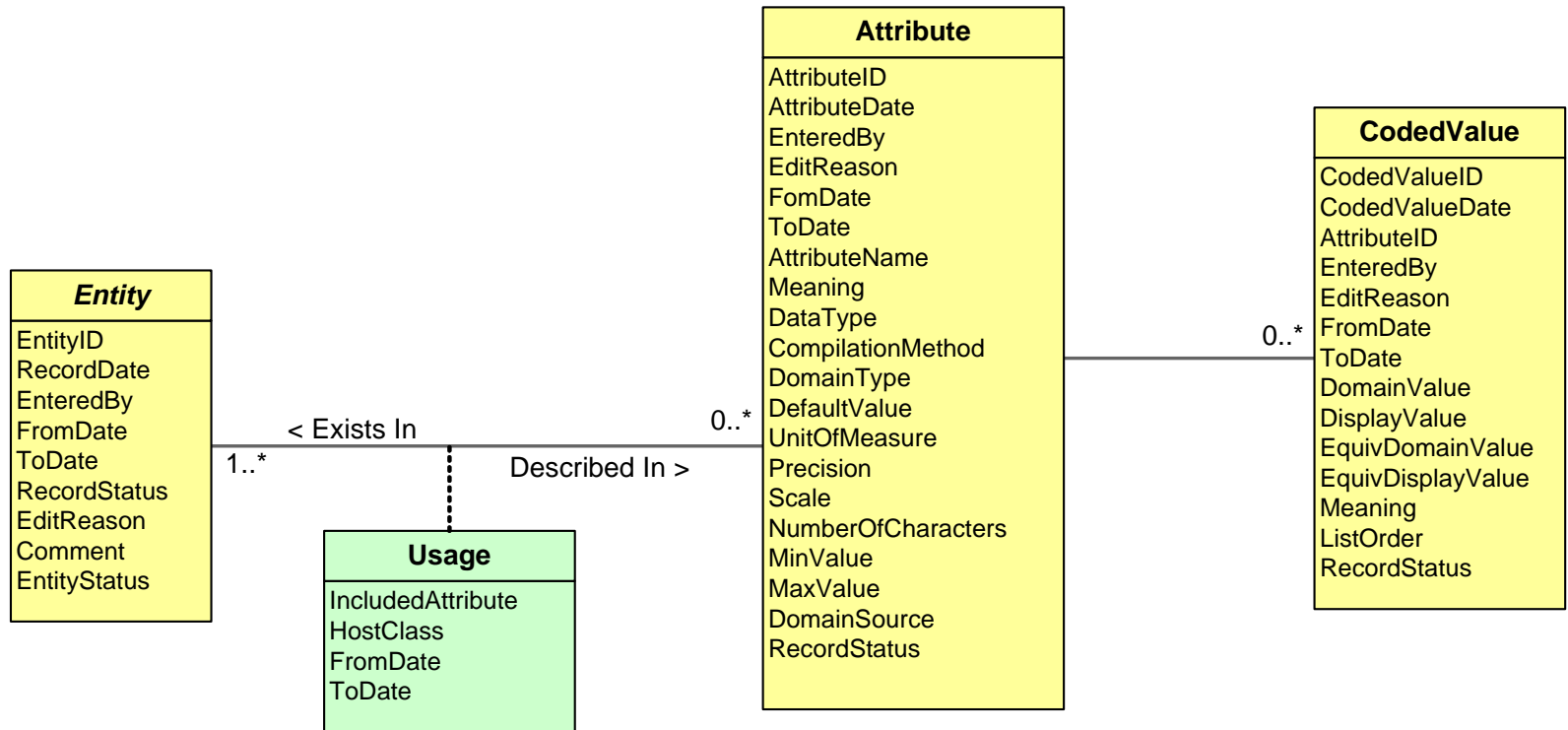
## EditCode

Description *Edit reason code*  
Field type *String*  
Split policy *Default value*  
Merge policy *Default value*

Code	Description
0	Original record
1	Error discovered
2	New info received
3	Change in entity
4	Jurisdiction change
5	Construction started
6	Construction finished
7	Field revision
8	Maintenance
9	Jurisdiction transferred
10	Put out of service
99	Other



# Database Metadata - Concept



# Attribute Use Table

Table		Attribute					
Field name	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Object ID						
AttributeID	Long Integer	Yes			0		
RecordDate	Date	Yes					
EnteredBy	String	Yes					30
EditReason	Short Integer	Yes		ReasonCode	0		
FromDate	Date	Yes					
ToDate	Date	Yes					
AttributeName	String	Yes					32
Meaning	String	Yes					64
DataType	String	Yes		DataCode			12
CompilationMethod	Short Integer	Yes		MethodCode	0		
DomainType	Short Integer	Yes		DomainCode	0		
DefaultValue	String	Yes					32
UnitOfMeasure	String	Yes		UnitCode			30
Precision	Short Integer	Yes			0		
Scale	Short Integer	Yes			0		
NumberOfChar	Short Integer	Yes			0		
MinValue	Double	Yes			0	0	
MaxValue	Double	Yes			0	0	
DomainSource	String	Yes					128
RecordStatus	Short Integer	Yes		RecordCode	0		

## Attributes contained in the geodatabase

Identifier of relationship  
 Date record was created  
 Name of person creating record  
 Reason the update was made  
 Starting date of validity  
 Ending date of validity  
 Name of attribute  
 Meaning of attribute  
 Data type for the attribute  
 Method used to compile data  
 Domain type for attribute  
 Default value  
 Unit of measure for numeric attribute  
 Total number of digits  
 Number of digits after decimal  
 Number of characters in string attribute  
 Minimum value for range domain  
 Maximum value for range domain  
 Source of domain values  
 Status of record

# Usage Relationship Table

Table <b>Usage</b>							
Field name	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Object ID						
UsageID	Long Integer	Yes			0		
HostTable	Long Integer	Yes			0		
AttributeID	Long Integer	Yes			0		
FromDate	Date	Yes					
ToDate	Date	Yes					

*Associative table for tying attributes to the tables that contain them*

Identifier of usage relationship

Name of table containing attribute

Identifier of attribute

Starting date of validity

Ending date of validity

Different meaning requires different field name

# Coded Value Table

Table <b>CodedValue</b>							
Field name	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Object ID						
CodedValueID	Long Integer	Yes			0		
RecordDate	Date	Yes					
AttributeID	Long Integer	Yes			0		
EnteredBy	String	Yes					30
EditReason	Short Integer	Yes		ReasonCode	0		
FromDate	Date	Yes					
ToDate	Date	Yes					
DomainValue	Short Integer	Yes			0		
DisplayValue	String	Yes					255
Meaning	String	Yes					64
ListOrder	String	Yes					4
RecordStatus	Short Integer	Yes		RecordCode	0		

## *Coded value domains*

Identifier of coded value  
 Date record was created  
 Identifier of relationship  
 Name of person creating record  
 Reason the update was made  
 Starting date of validity  
 Ending date of validity  
 Domain value to store  
 Domain value to display in pick list  
 Meaning of coded value  
 Position of value in pick list  
 Status of record

# Domains

## Coded value domain

### MethodCode

Description *Method of data collection*  
Field type *Short integer*  
Split policy *Default value*  
Merge policy *Default value*

Code	Description
1	Field measurement
2	Office review
3	Consultant
4	Publication
5	Aerial photography
6	Remote sensing
7	SCADA
8	Run report
88	Other method
99	Unknown

## Coded value domain

### DomainCode

Description *Type of domain*  
Field type *Short integer*  
Split policy *Default value*  
Merge policy *Default value*

Code	Description
0	Free
1	Numeric range
2	Coded values

# Domains

## Coded value domain

### UnitCode

Description *Unit of measure codes*  
 Field type *String*  
 Split policy *Default value*  
 Merge policy *Default value*

Code	Description
IN	Inch
FT	Foot (unspecified type)
US FT	US survey foot
INT FT	International foot
MI	Statute mile
KTS	Nautical mile
CM	Centimeter
M	Meter
KM	Kilometer
LAT	Latitude
LONG	Longitude
LB	Pound
TONS	US ton (2,000 lbs.)
KIP	18,000 lbs.
EACH	Each (count)

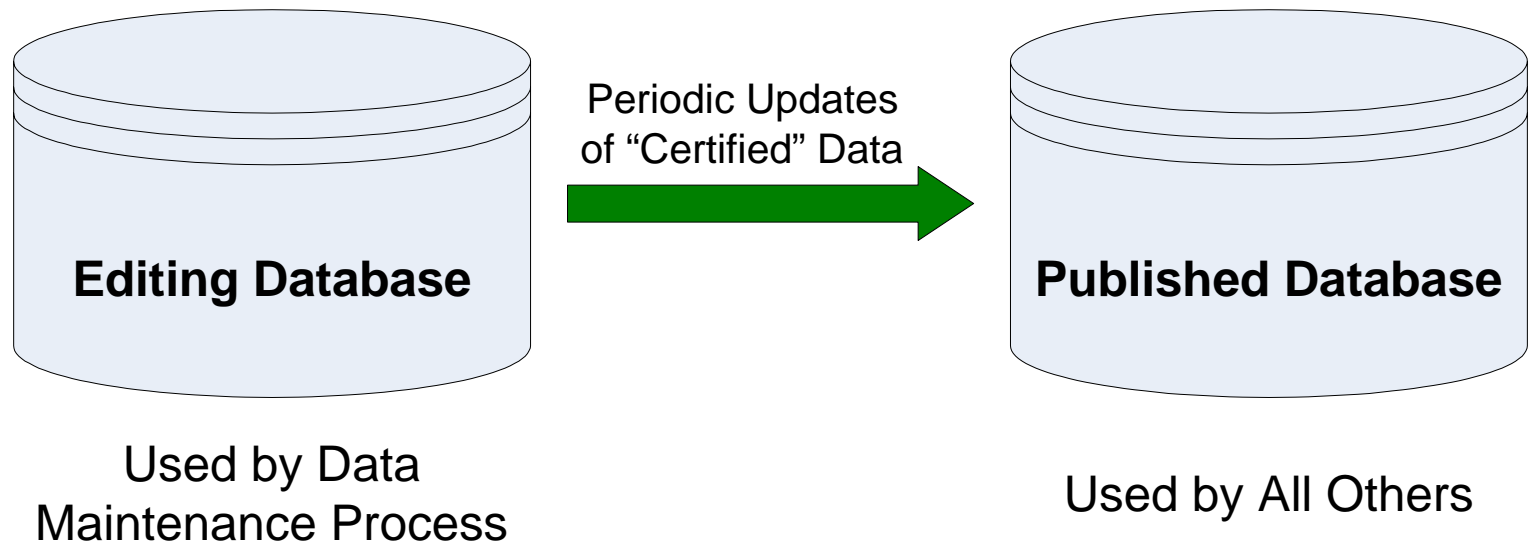
## Coded value domain

### DataCode

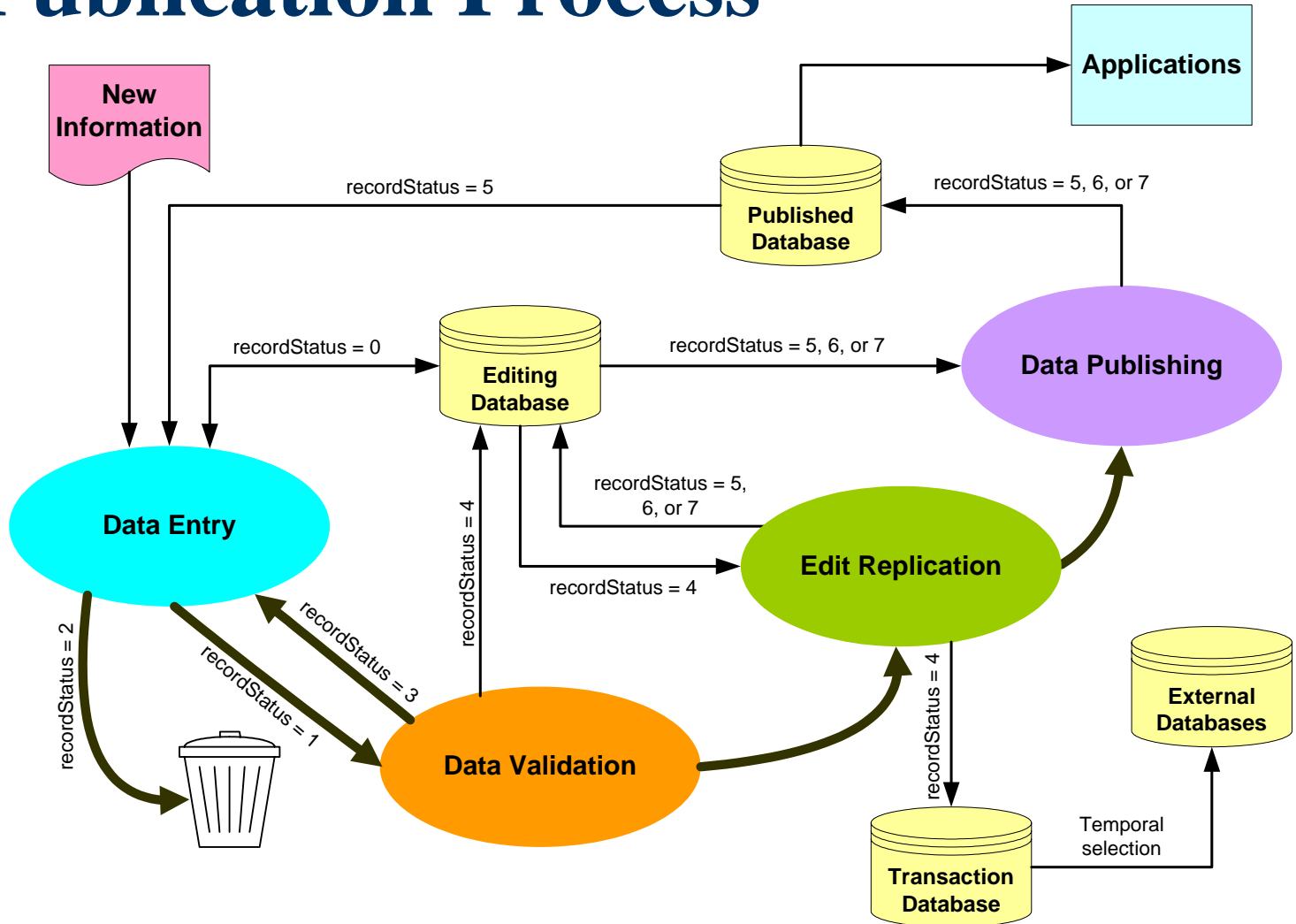
Description *Data type code*  
 Field type *String*  
 Split policy *Default value*  
 Merge policy *Default value*

Code	Description
Short Integer	Short integer (2 bytes)
Long Integer	Long integer (4 bytes)
Single	Single-precision floating point
Double	Double-precision floating point
String	String of characters
Date	Date & Time
BLOB	Binary large object
GUID	Globally unique identifier
Raster	Raster image
Geometry	Vector geometry

# Publishing Edits



# Publication Process







# For More Information

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