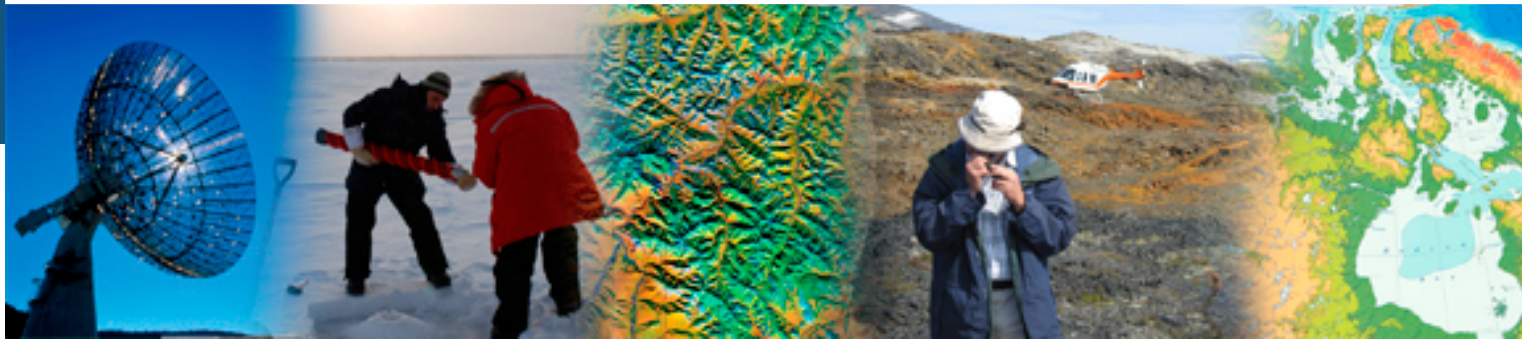
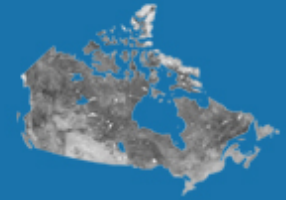


The following was presented at DMT'12  
(May 20-23, 2012).

The contents are provisional and will be  
superseded by a paper in the  
DMT'12 Proceedings.

See also earlier Proceedings (1997-2011)

<http://ngmdb.usgs.gov/info/dmt/>



# Managing Complex Schema Upgrades with FME and ArcGIS

Richard Nairn  
Geological Survey of Canada(Calgary)



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada

# Outline

---

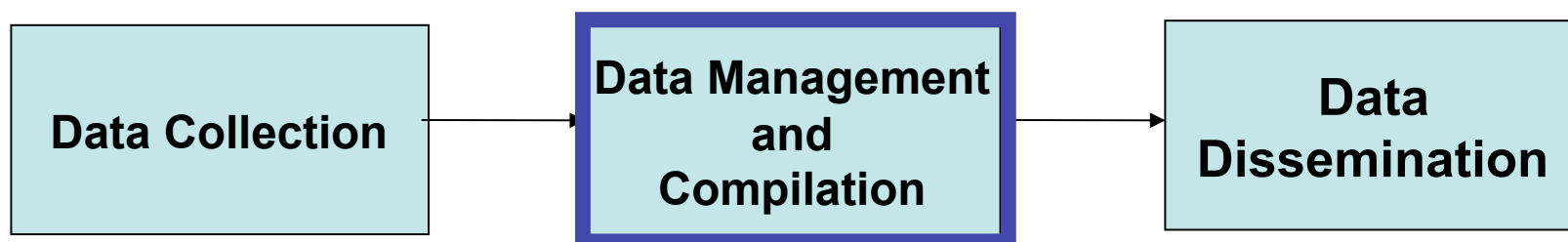
- Overview of Surficial Data Model
- Describe Workflow of Schema Upgrade
- Using ArcCatalog to Setup Geodatabase
- Using FME to Translate Data
  - Workbench basics
  - Readers and writers
  - Transformer Introduction
- Using Custom Transformers
- Future Steps



# Context

---

- Geo-mapping for Energy and Minerals Program (GEM)
- Geological Map Flow project (GMF)



- Designed to reflect the steps involved in creating a standardized surficial geology map.
- Streamline the process of compiling, editing, publishing.
- Workflow has multiple components
  1. Geodatabase
  2. Style File
  3. Font File.



---

## **Brief history**

The science language was first developed following an extensive review of existing data models and maps.

It was then refined by a small working group through iterative consultations with GSC surficial geology mappers.

Today, the working group is known as the Surficial Legend Review Committee and involves surficial geology mappers, science editors, and GIS experts.



# How is it described?

- Science language
- Legend
- Symbolology

**Group:** Ice-contact features  
**Feature type:** Esker ridge  
**Location confidence:** Defined  
**Sense:** Known  
**True ground length:** Accurate  
**Geological event name:** e.g. X Glaciation

## Legend

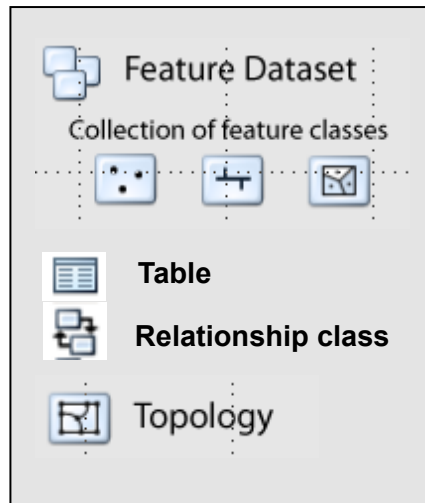
Esker ridge (sense known)..... >>>>>>>>>>



# Geodatabase

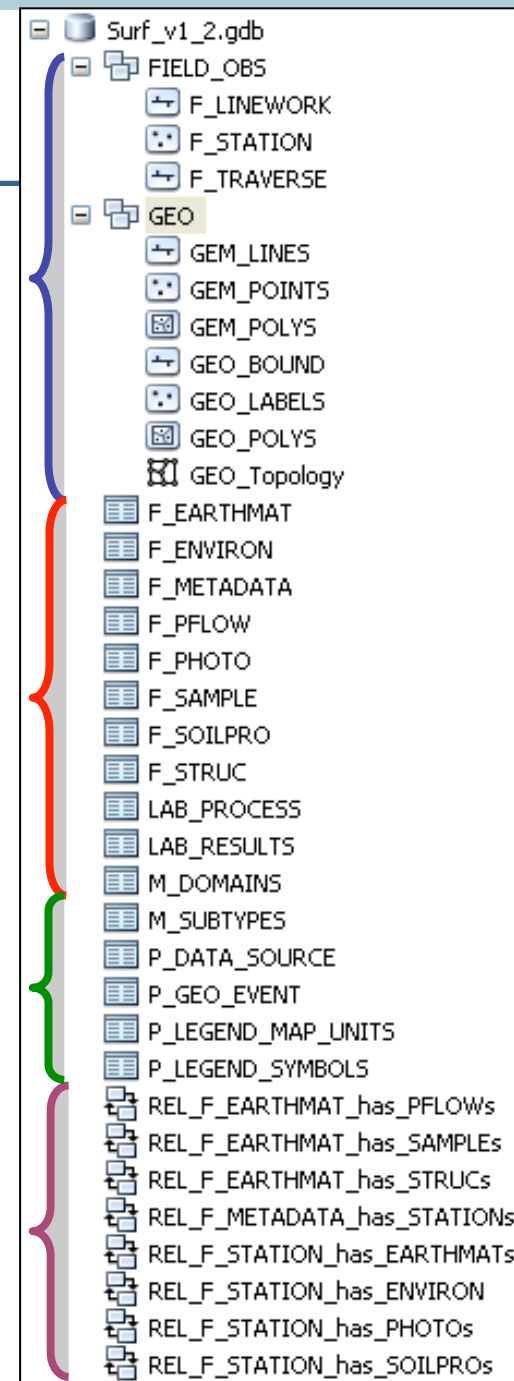
## Geodatabase elements

- Feature classes
- Data tables
- Metadata tables
- Relationship classes



## Naming convention

F\_: Field data  
 GEM\_: GEoMorphological features  
 GEO\_: GEoLogical map units  
 LAB\_: sample analysis LAB results  
 P\_: Project specific information



# Geodatabase

- Science Language is managed using coded domains
- Each Feature Class is controlled by Subtypes:
  - 218 Subtypes in total
- Coded Domains control allowed attributes
  - 635 Domains

181   GEM_POINTS		20201001   To be defined (All)	
360	FTYPE_DID	102	Buried drumlin ridge
361	FTYPE_DID	106	Alluvial bar or levee ridge
362	FTYPE_DID	110	Ice-pushed ridge
363	FTYPE_DID	119	Crag-and-tail
364	FTYPE_DID	120	Drumlin
365	FTYPE_DID	121	Drumlinoid or fluting
366	FTYPE_DID	122	Fluted bedrock
367	FTYPE_DID	123	Buried drumlin
368	FTYPE_DID	124	Buried drumlinoid or fluting
369	FTYPE_DID	126	Gelifluction-lobe or solifluction-lobe
370	FTYPE_DID	150	Eolian lag deposit
371	FTYPE_DID	163	Recently deglaciated area
372	FTYPE_DID	168	Nivation hollows
373	FTYPE_DID	172	Ice-flow direction
374	FTYPE_DID	179	Avalanche track
	FTYPE_DID	GFv	GFv: Glaciofluvial sediments - Veneer
118   GEM_LINES		30701005   Esker ridge (Sense known or inferred)	





# Why upgrade – Why FME

- Surficial Data Model is not a mature product yet.
- Science Language is refined in response to feedback.
- Changes in Symbology.
- Targeting yearly schema release
- Each release can bring many modifications

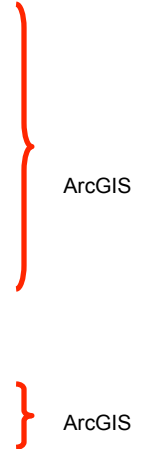
GEO_LABELS and GEO_POLYS		V1.00			v1.1	
<b>New symbol colour chart</b>	CONTROL_SID	field_name	domain_code	domain_value_en	domain_code	domain_value_en
<i>new colour codes; same labels</i>	722	SYMBOL_DID	3.01.04.006	Ab: Alluvial sediments - Blanket	3.01.04.005	Ab: Alluvial sediments - Blanket
	745	SYMBOL_DID	3.01.07.029	GFh: Glaciofluvial sediments - Hummocky sediments	3.01.07.038	GFh: Glaciofluvial sediments - Hummocky sediments
	750	SYMBOL_DID	3.01.08.120	GLr: Glaciolacustrine sediments - Beach sediments	3.01.08.151	GLr: Glaciolacustrine sediments - Beach sediments
<b>For Control_SID = 700 (Cs)</b>		field_name	domain_code	domain_value_en	domain_code	domain_value_en
<i>CONTROL no longer exists - is replaced by "to be defined"</i>	CONTROL_SID	700	Cs: Colluvial and mass-wasting deposits - Stratified	793	x: To be defined - To be defined	
<i>UTYPE no longer exists - is replaced by "to be defined"</i>	UTYPE_DID	Cs	Cs: Colluvial and mass-wasting deposits - Stratified scree	x	x: To be defined - To be defined	
<i>SYMBOL no longer exist - is replaced by "to be defined"</i>	SYMBOL_DID	3.01.01.166	Cs: Colluvial and mass-wasting deposits - Stratified scree	3.01.99.990	x: To be defined - To be defined	
<i>Append comment</i>	EDIT_REMARKS				Was coded as Cs	
<b>For Control_SID = 765 (Tx)</b>		field_name	domain_code	domain_value_en	domain_code	domain_value_en
<i>Control no longer exists - is replaced by "to be defined"</i>	CONTROL_SID	765	Tx: Glacial sediments - Reworked till	793	x: To be defined - To be defined	
<i>UTYPE no longer exists - is replaced by "to be defined"</i>	UTYPE_DID	Tx	Tx: Glacial sediments - Reworked till	x	x: To be defined - To be defined	
<i>SYMBOL no longer exist - is replaced by "to be defined"</i>	SYMBOL_DID	3.01.10.204	Tx: Glacial sediments - Reworked till	3.01.99.990	x: To be defined - To be defined	
<i>Append comment</i>	EDIT_REMARKS				Was coded as Tx	
<b>For UTYPE2 = Cs</b>		field_name	domain_code	domain_value_en	domain_code	domain_value_en
<i>Cs is replaced by X</i>	UTYPE2_DID	Cs	Cs: Colluvial and mass-wasting deposits - Stratified scree	x	x: To be defined - To be defined	
<b>For UTYPE2 = Tx</b>		field_name	domain_code	domain_value_en	domain_code	domain_value_en
<i>Tx is replaced by X</i>	UTYPE2_DID	Tx	Tx: Glacial sediments - Reworked till	x	x: To be defined - To be defined	
<b>For UTYPE = Tst</b>		field_name	domain_code	domain_value_en	domain_code	domain_value_en
<i>Tst is replaced by Ts</i>	UTYPE_DID	Tst	Tst: Glacial sediments - Streamlined till	Ts	Ts: Glacial sediments - Streamlined till	
<b>For UTYPE2 = Tst</b>		field_name	domain_code	domain_value_en	domain_code	domain_value_en
<i>Tst is replaced by Ts</i>	UTYPE2_DID	Tst	Tst: Glacial sediments - Streamlined till	Ts	Ts: Glacial sediments - Streamlined till	



# Schema Upgrade Workflow

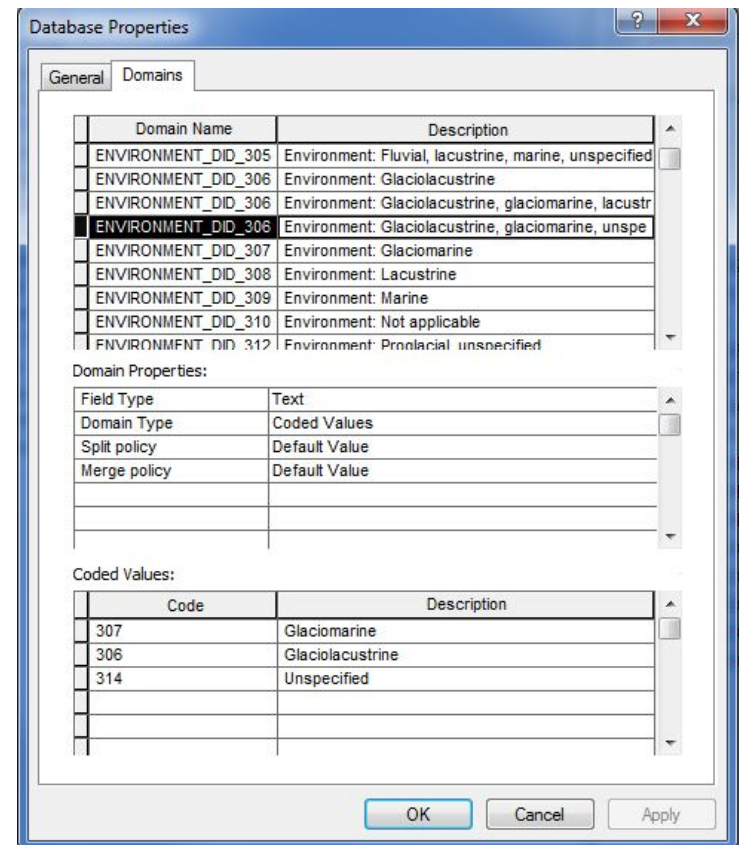
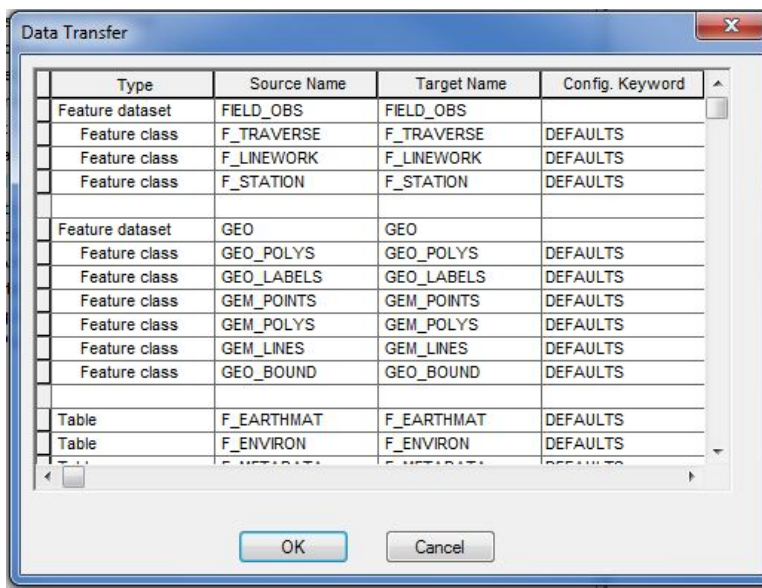
---

1. Create Target Geodatabase
2. Import Current Surficial Data Model Schema
3. Import Existing Projection Definition
4. Transfer Required Project-Specific Domain Information
5. Apply Schema Transformation with FME
6. Transfer and Merge XML Metadata for GeoDatabase



# Geodatabase Setup using ArcCatalog

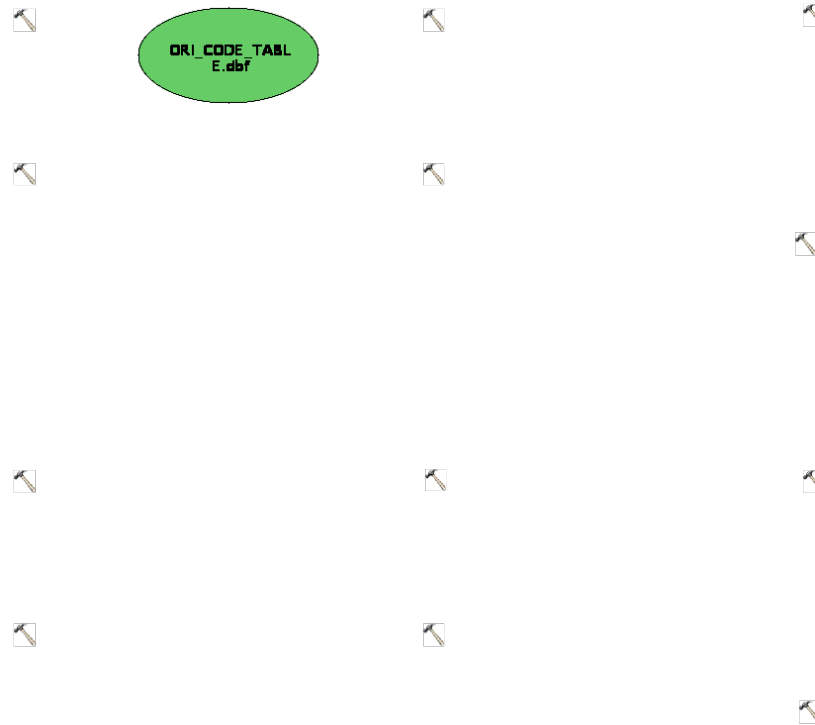
- Geodatabase is not upgraded in place.
- New geodatabase created – New Schema imported
- Contains all updated feature classes and domains.
- Import Projection information.



# Transferring Project Domains

---

- Goal is to reduce manual steps
- Used existing workflow to create ModelBuilder Tool



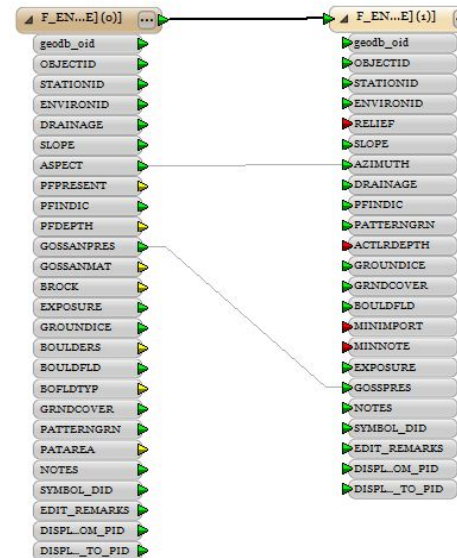


# Using FME to Transform Schema

- Simple schema changes (eg. field length) require no action
- Renaming field requires a simple feature class remapping

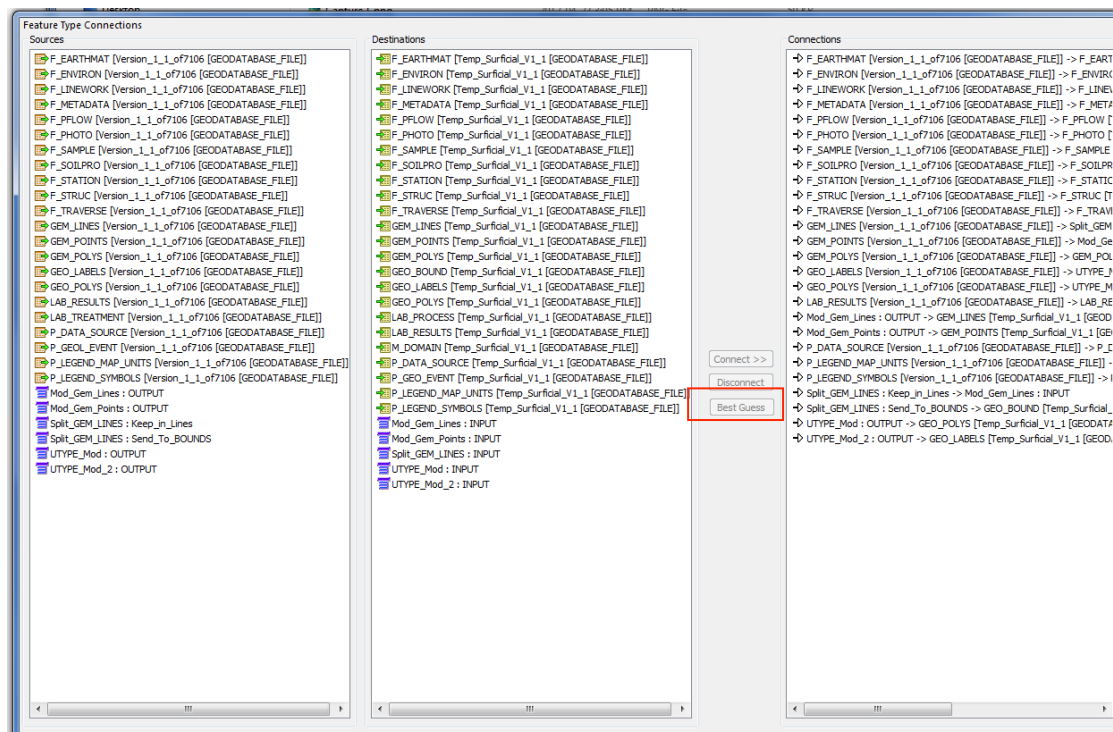
## Simple Schema Change

- Add Reader and Writer
- Connect Reader and Writer
- Remap any renamed attributes



# Using FME to Transform Schema

- If you have many feature classes: Feature Connection Wizard
  - Manual or Best Guess
    - Any feature class that has the same name
    - Any attribute that has the same name



# FME Transformers

- What is a transformer?

A transformer is an FME Workbench object that carries out the restructuring of features from the source data to the destination data. FME contains over 400 different transformers that perform different types of restructuring.

- FME Transformer Reference Guide

## FME® Transformer Reference Guide

This guide contains a high-level summary of each transformer's functionality. For detailed information, you can select *FME Transformers* from the Workbench Help menu, or visit [www.safe.com/documentation](http://www.safe.com/documentation) to download documentation.

### CONTENTS

<b>3D</b> .....	1	<b>MANIPULATORS</b> .....	16
These transformers create and modify three-dimensional surface and solid geometries.		These transformers modify (manipulate) the geometry or attributes of individual features in isolation from other features.	
<b>CALCULATORS</b> .....	1	<b>MRF</b> .....	24
These transformers calculate a value and supply it to a new attribute on a feature.		These transformers repair geometry, particularly during data migration from CAD to GIS.	
<b>COLLECTORS</b> .....	3	<b>NETWORK</b> .....	24
These transformers operate on collections of features at the same time. The collection of features may be replaced by new features based upon them, have their attributes or geometries altered, or have their orders altered.		These transformers operate on linear features that are connected in a network, performing operations such as priority calculation and orientation correction.	
<b>COORDINATE SYSTEMS</b> .....	5	<b>POINT CLOUD</b> .....	25
These transformers relate to coordinate systems and reprojection.		These transformers create, use, and output point cloud features. They operate only on data consisting of point clouds.	
<b>DATABASE</b> .....	6	<b>RASTERS</b> .....	25
These transformers allow interaction with external databases. Data can be extracted from databases and merged into the feature stream or merged onto features.		These transformers create, use, and output rasters. They operate on data consisting of a regularly spaced grid of values.	
<b>FILTERS</b> .....	7	<b>STRINGS</b> .....	29
These transformers perform tests on feature geometry and/or attributes, and allow the feature to be routed to different destinations.		These transformers operate on character strings held in FME attributes.	
<b>GEOMETRIC OPERATORS</b> .....	8	<b>STYLERS</b> .....	30
These transformers operate on the geometry of individual features or groups of features.		These transformers are used to prepare features for output to particular formats by providing a convenient interface for setting color and other display characteristics.	
<b>INFRASTRUCTURE</b> .....	13	<b>SURFACES</b> .....	31
These transformers provide interaction with the underlying FME translation engine facilities.		These transformers create, use, and output surfaces. They operate on data that defines a surface through the z coordinate, and then either outputs this surface in a variety of ways or applies the surface to other data.	
<b>KML</b> .....	15	<b>WEB SERVICES</b> .....	32
These transformers manipulate feature geometry and/or attributes for output using the OGCKML Writer.		These transformers access web services using the HTTP protocol.	
<b>LINEAR REFERENCING</b> .....	15	<b>WORKFLOW</b> .....	33
These transformers work with linear referencing data structures on FME features. Some transformers allow you to create and apply measure-related information held in attributes onto the geometry of FME features.		These transformers run workspaces either locally or on an FME Server.	
<b>LISTS</b> .....	16	<b>XML</b> .....	34
These transformers operate on FME attribute lists.		These transformers work with XML data by mapping XML elements into FME features, using stylesheets to convert XML documents, and querying collections of XML data.	





# FME Transformers - Sampler

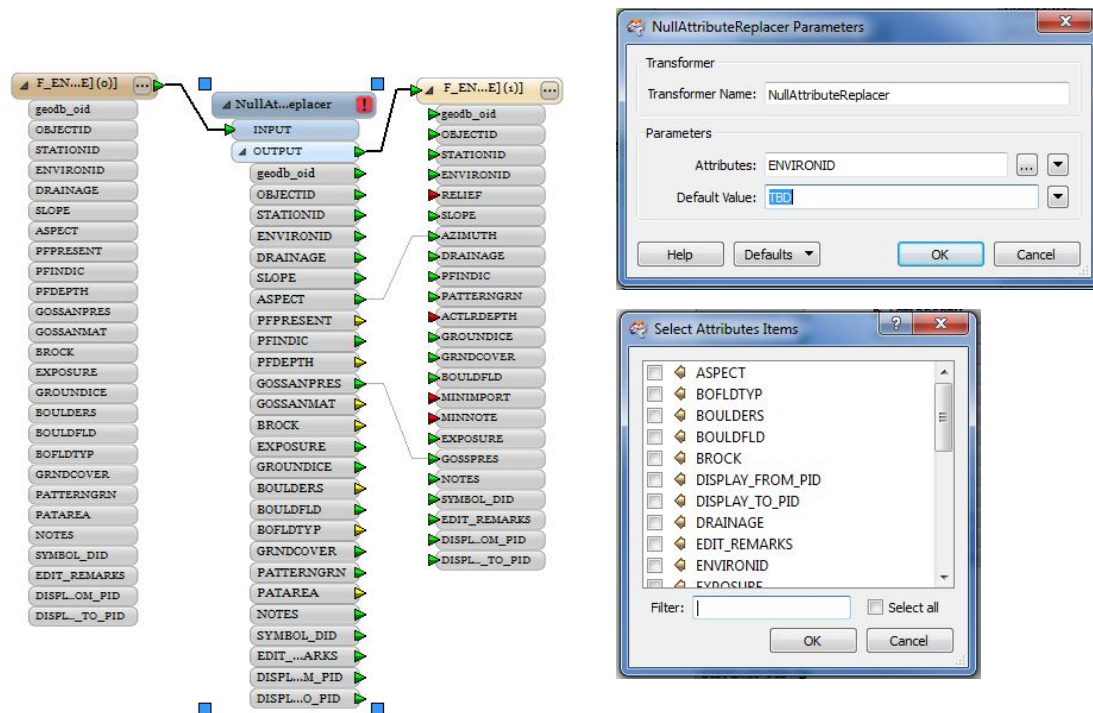
---

- **Calculators** – Calculates a value into a new attribute
  - AreaCalculator – Calculates the area of an object and stores in attribute.
  - BoundsExtractor – Extracts minimum and max coordinates into new attribute
  - DateFormatter – Reformats and replaces date or time strings into a new format
  - DecimalDegreesCalculator – Calculates decimal degree from separate DMS values.
- **Collectors** – Operates on collections of features at the same time
  - BoundingBoxAccumulator – Takes a set of features and creates 2d bounding box
  - HullAccumulator – Creates convex or concave hulls for a group of features.
- **Filters** – Performs tests on features and routes accordingly
  - ChangeDetector – Detects changes between two sets of input features
  - Sampler – Preserves a number of features or sampling of features
  - SpatialFilter – Filters based on spatial relationship (overlap, contained)
- **Geometric** – Operates on the geometry of individual features
  - Clipper
  - Dissolver
  - PolygonBuilder



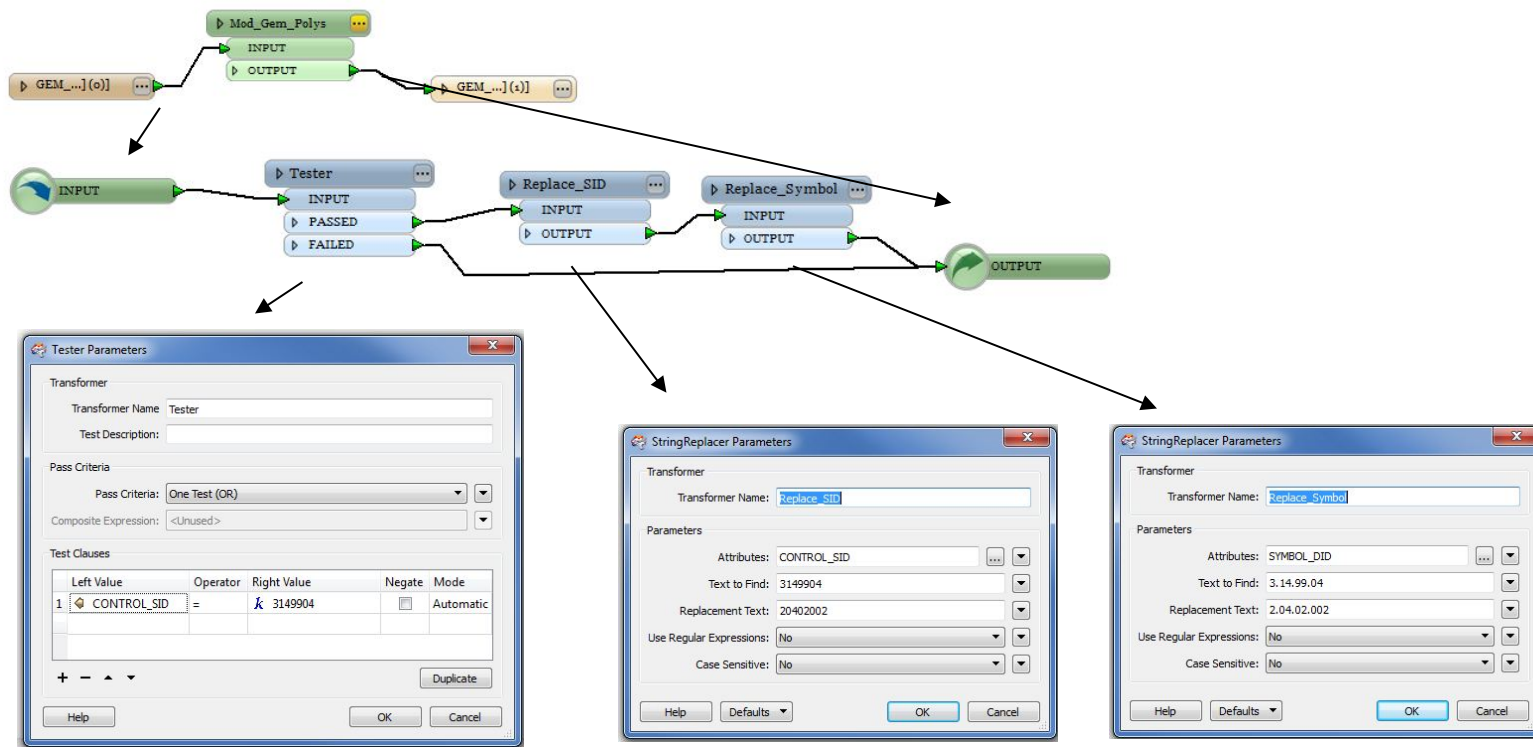
# FME Transformers

- Simple transformations can be done in-line with Reader and Writer



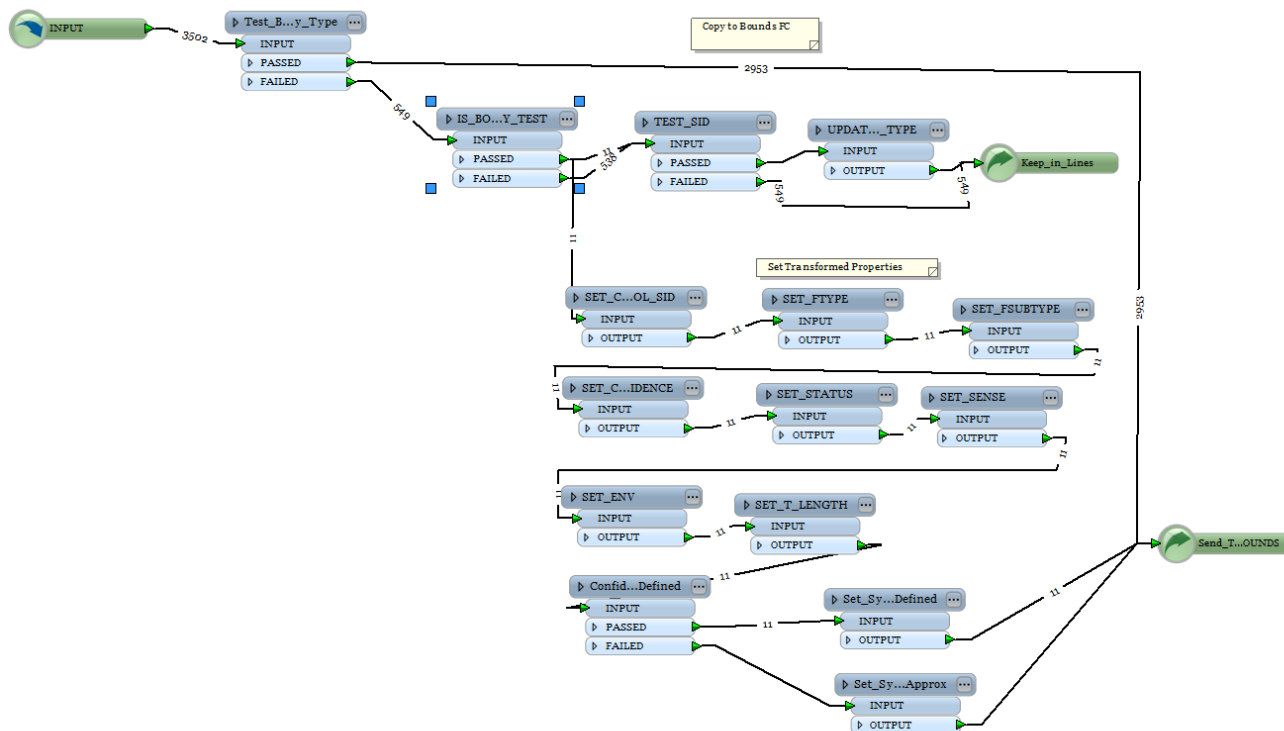
# Custom FME Transformers

- Creating a custom transformer generates a separate workspace for the transformer.
- Allows reusability of common tasks.



# Custom FME Transformers

- FME annotates the workspace with the number of features processed.
- Can attach data loggers, or inspectors to prototype or debug.



# Why Use FME?

- This transformation gets applied to two feature classes...



# Future Steps

---

- Automate Projection transfer with custom ArcCatalog Tool
- Build reference geodatabase and map for validating transformation.



# Contact Info & Thanks

---

- Richard Nairn ([Richard.Nairn@NRCan-RNCan.gc.ca](mailto:Richard.Nairn@NRCan-RNCan.gc.ca))
- Christine Deblonde ([Christine.Deblonde@NRCan-RNCan.gc.ca](mailto:Christine.Deblonde@NRCan-RNCan.gc.ca))
  - Surficial Data Model (Open File OF\_7003)
- Doug Lemay ([Doug.Lemay@NRCan-RNCan.gc.ca](mailto:Doug.Lemay@NRCan-RNCan.gc.ca))
- Elizabeth Macey ([Elizabeth.Macey@NRCan-RNCan.gc.ca](mailto:Elizabeth.Macey@NRCan-RNCan.gc.ca) )
- David Huntley ([David.Huntley@NRCan-RNCan.gc.ca](mailto:David.Huntley@NRCan-RNCan.gc.ca))
- William Chow ([William.Chow@NRCan-RNCan.gc.ca](mailto:William.Chow@NRCan-RNCan.gc.ca))

