



M  
WORLD TOUR  
2019



# Level 3: Automating Quality Control



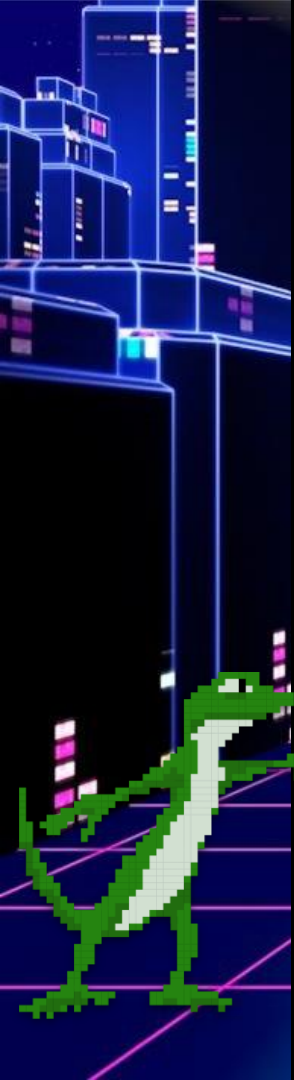
# AGENDA

- 1 Why do we validate data?
- 2 Indoor mapping standards compliance
- 3 Validating CAD data
- 4 Validating topology
- 5 Automating validation workflows

START

# Data validation means checking ...

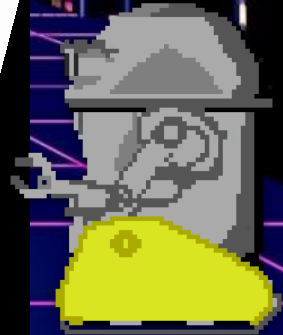
- Single objects (geometry and attributes)
- Relationships between objects
- Completeness
- Correctness
- Standards compliance





# Data validation means checking ...

- Schema or data model
- Attribute values and domains
- Geometry
- Topology and spatial relationships
- Networks
- And more

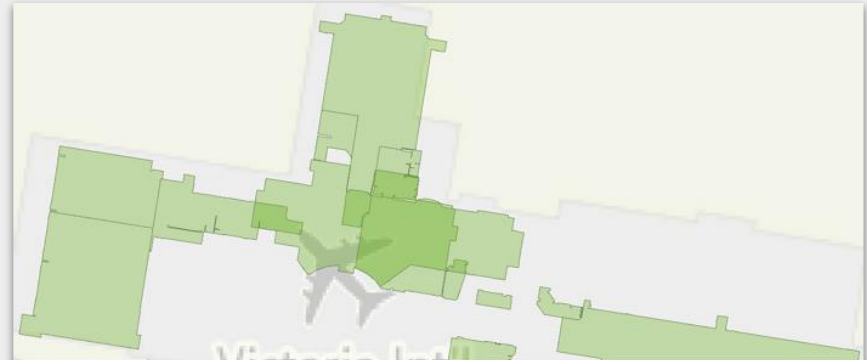


# Indoor Mapping



Venues worldwide are generating indoor maps of their spaces for:

- Space management / planning
- Geolocating assets
- Helping patrons navigate



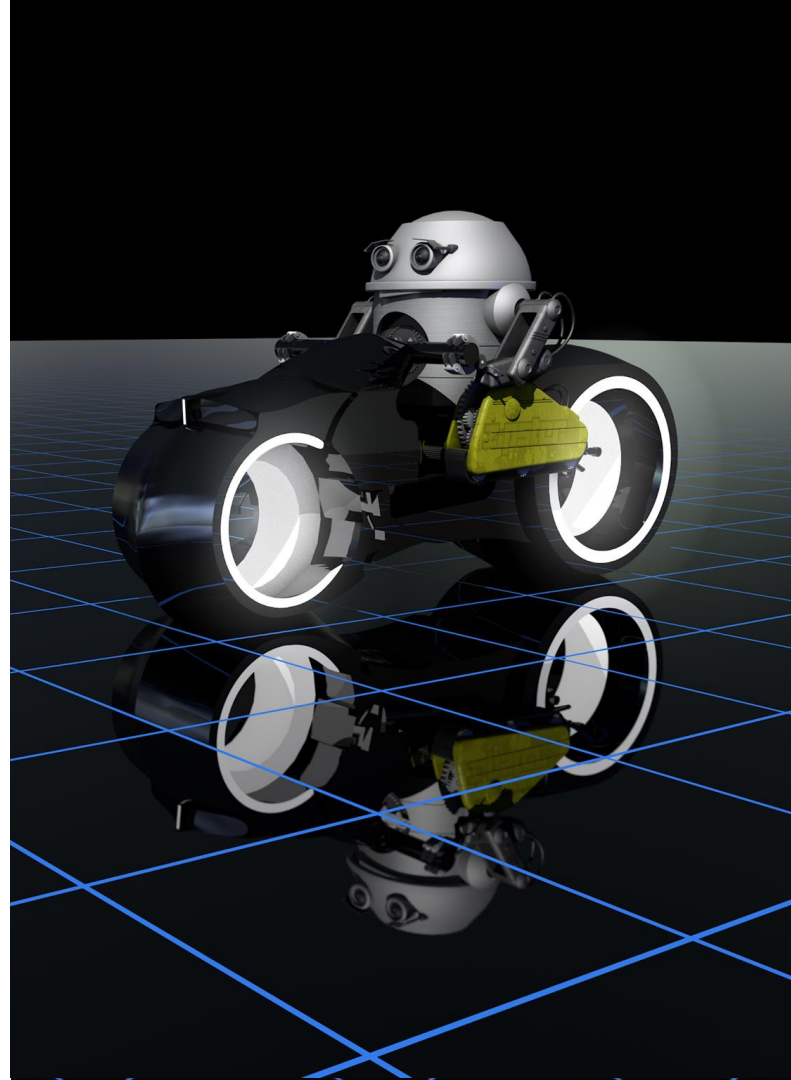
id	category	restriction	name	alt_name	display_point.x	display_point.y	level_id	address_id	correlation_id
1	b0cd7...	gatearea	<null>	<null>	-123.43071832...	48.6406429084...	0424cf4c...	<null>	<null>
2	018de...	checkin	<null>	<null>	-123.42938882...	48.6403338207...	84e7afc6...	<null>	<null>
3	f38a03...	baggageclaim	<null>	<null>	-123.43146310...	48.6405237499...	84e7afc6...	<null>	<null>
4	dd77f5...	gatearea	<null>	<null>	-123.43050432...	48.6409460709...	84e7afc6...	<null>	<null>

# Indoor Mapping Challenges

- Must **integrate** multiple sources to produce an indoor map.
  - GeoJSON, Revit, IFC, CAD (Autodesk, Bentley), Civil 3D, Esri Geodatabase, databases, CityGML ...
- Must **transform** inconsistent data.
- Must **comply** with specifications of the indoor format, e.g. IMDF, HERE, ArcGIS Indoors, IndoorGML.
  - Strict data models and explicit spatial relationships.
- Venues constantly change, so maps need to be updated **automatically**.

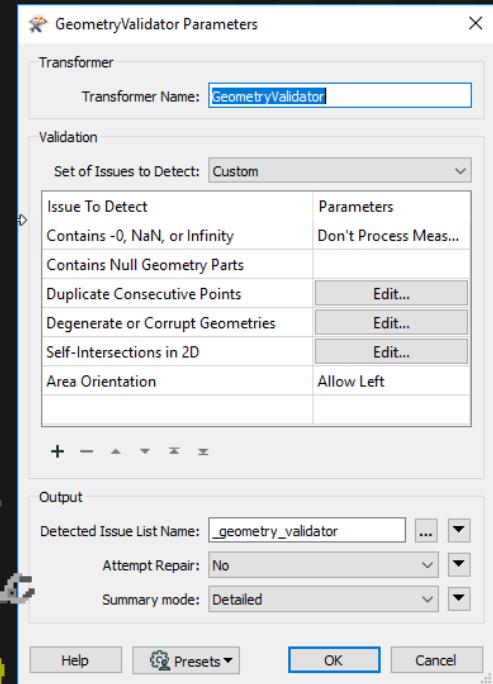
# Tips for Validating Attributes

- Phone Numbers / UUID / Business Names:
  - AttributeValidator and regular expressions  
(`^\+[0-9-]{10,15}$|^$`)
- Hours of Opening – OSM Standard:
  - “24/7”, “Mo-Fr 08:30-20:00”
- Websites:
  - Regular expressions  
`^http://|^https://`
  - HTTPCaller & HTTP Status Code



# Useful Transformers for Validating Geometries

- **GeometryValidator** – pass only valid geometries.
- **GeometryFilter** – filter by geometry type and pass only valid ones.
- **SpatialFilter** or **SpatialRelator** – ensure valid spatial relationships.
  - Choosing the right spatial join transformer:  
see the article [fme.ly/byu](https://fme.ly/byu)



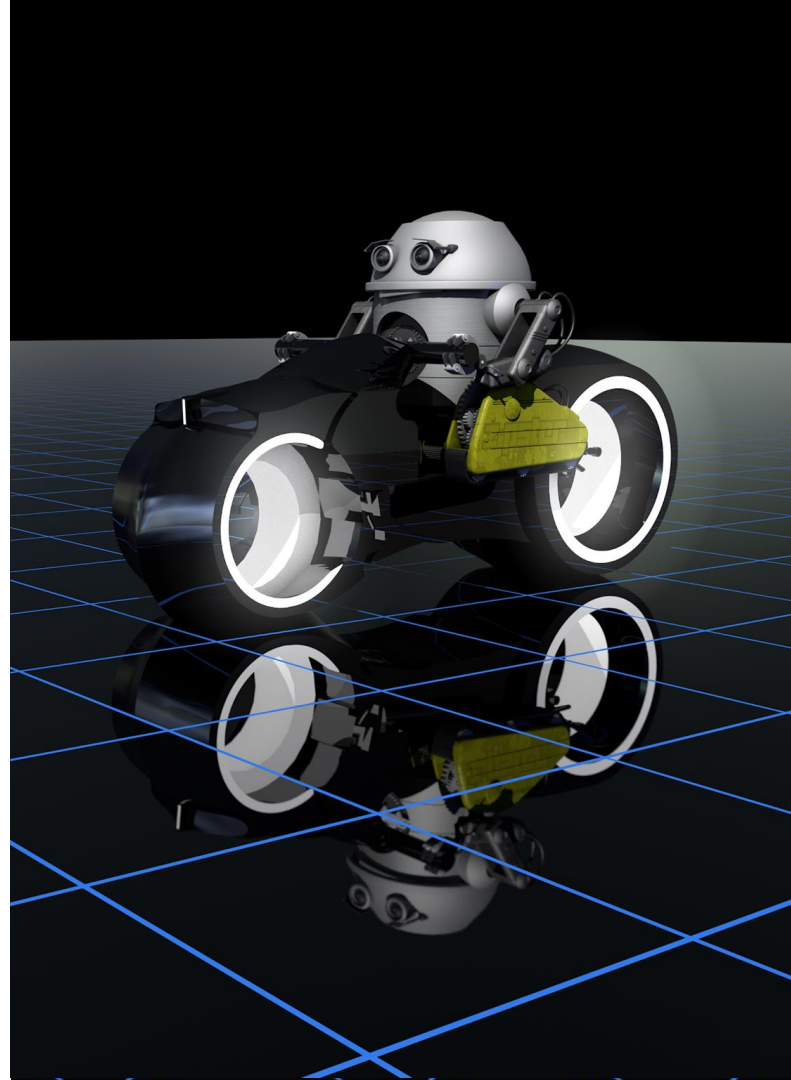


# Automated IMDF Validation

A. **Upload** your IMDF data and get your validation report. [safe.com/imdf](https://safe.com/imdf)

*or*

A. Add an **IMDFValidator** transformer to your workspace - available from FME Hub - [hub.safe.com](https://hub.safe.com)





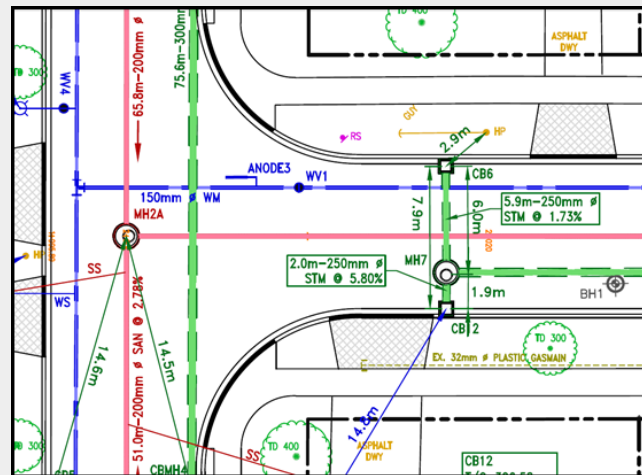
# CAD Standards Compliance



# CAD Data

Key source of data updates for many GIS departments.

- Very loose schemas or data models.
- Hard to impose a drawing standard on contractors.
- Often more detail than is needed in GIS.



# City of Kitchener



- Digital Submission Compliance
- Contractor CAD data added to GIS
- CAD standard
  - Standards Checker
  - Attribute Checker
  - Topology Checker

	A	B	C	D
1	autocad_layer	autocad_linetype	autocad_color	autocad_lineweight
2	PR_SAN_MAIN	ByLayer	14	DEFAULT
3	PR_SAN_SERV	Continuous	ByLayer	DEFAULT
4	PR_STM_CULVERT	DASHED2	ByLayer	DEFAULT
5	PR_STM_FAC	Continuous	ByLayer	DEFAULT
6	PR_STM_CB_LEAD	DASHED2	ByLayer	DEFAULT
7	PR_STM_MAIN	DASHED2	ByLayer	DEFAULT
8	PR_STM_SERV	DASHED2	ByLayer	DEFAULT
9	PR_SAN_STUB	Continuous	ByLayer	DEFAULT
10	PR_STM_STUB	DASHED2	ByLayer	DEFAULT
11	PR_WAT_CASING	Continuous	ByLayer	DEFAULT
12	PR_WAT_SERV	Continuous	ByLayer	DEFAULT
13	PR_STM_OUTLET	DASHED2	ByLayer	DEFAULT
14	PR_STM_INLET	DASHED2	ByLayer	DEFAULT
15	PR_WAT_MAIN	CENTERX2	172	0

	A	B	C	D	E	F	G	
1	FeatureTypeName	AttributeName	MinLength	MaxLength	Type	MinValue	MaxValue	Restricted
32	PR_WAT_MAIN	OWNERSHIP	1	10	C			CAMBRIDGE,DUAL,KITCHENER,MTO,PRIVATE,REGION,WATERLOO,WILMOT
33	PR_WAT_MAIN	DIAMETER	1	4	I			0,25,38,50,75,100,150,200,250,300,350,400,450,600,750,900,1200
34	PR_WAT_MAIN	OVERSIZED_DIAMETER	1	4	I	25	1000	
35	PR_WAT_MAIN	MATERIAL	1	20	C			AC,CI,COP,CPP,DI,HDPE,HDPE IN CI,PVC,PVCB,PVCF,ST
36	PR_WAT_MAIN	INSTALLATION_DATE	8	8	D			
37	PR_WAT_MAIN	ENGINEERING_NOTES	0	250	C			
38	PR_WAT_MAIN	CONSULTANT	1	250	C			





# Validating *Topology*

Hydrographic Networks, Electric, Water, Gas Networks

# Tips for Validating Topology

- Relationships include:
  - Connectivity
  - Adjacency
  - Enclosure
- Rules:
  - ISO 19110 Feature Catalog
  - Database connectivity rules



# Natural Resources Canada

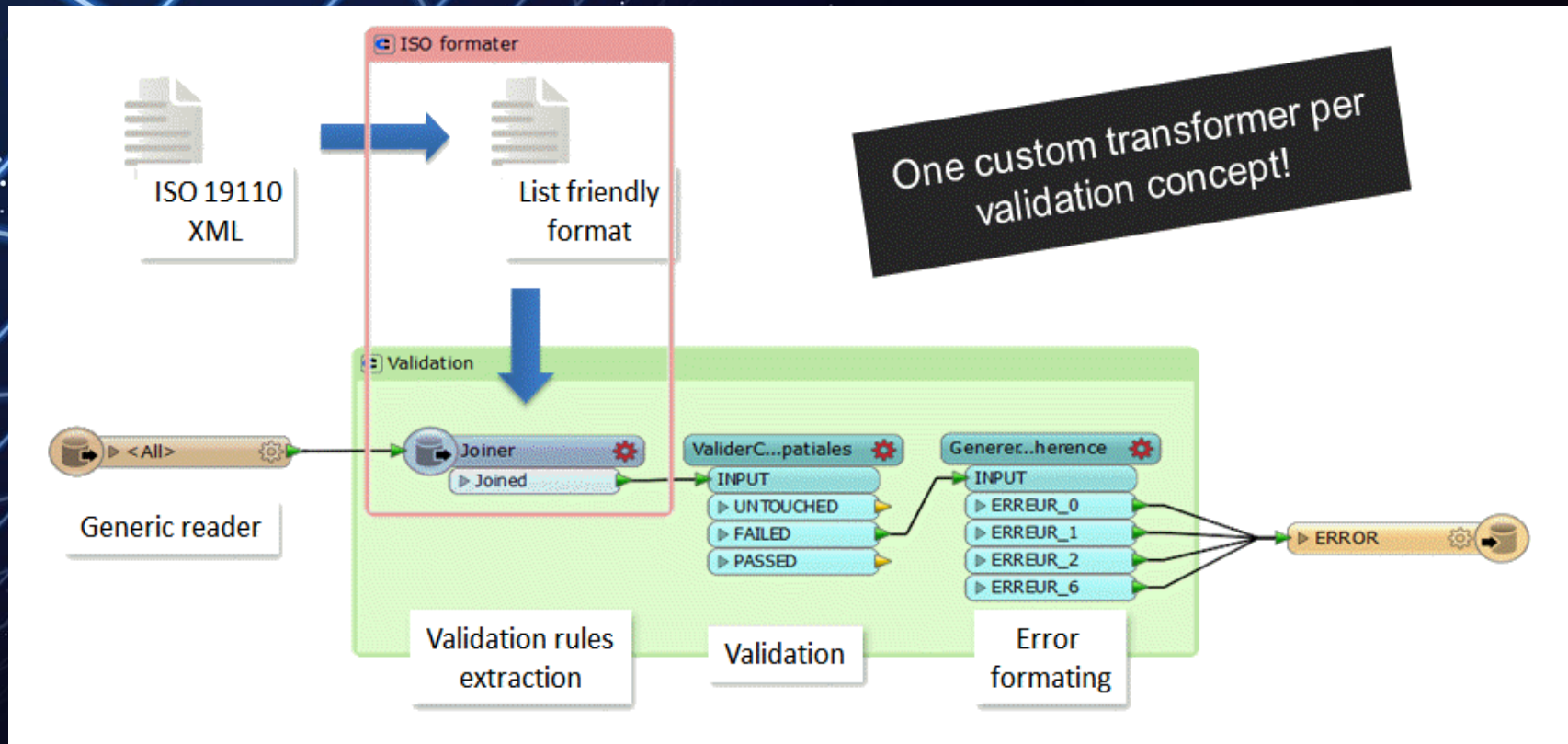
*Maintaining the feature catalog for Canada's national map*

## Spatial Relationships

<u>Spatial Constraint</u>	<u>ID:</u> <u>30912287</u>
<b>WITHIN</b> <b>(T*F,**F,***)</b>	1,1    BDG1610005: <b>Waterbody, ocean</b>

## Attribute Values

<u>Domain attribute validation</u>	<u>ID:</u> <u>30912555</u>
<u>Parameters</u>	<u>Value</u>
Attribute name	ELEVATION
Regular Expression	^\d(\d)?(\d)?(\d)?\d?\$



FME Workspace for NRC's Catalog Validation

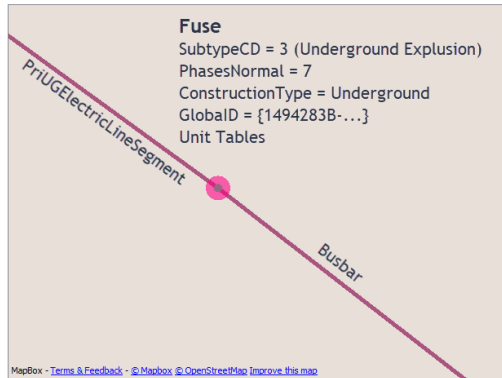




# Utility Network Topology: Connectivity

# Utility Network Migration Workspaces

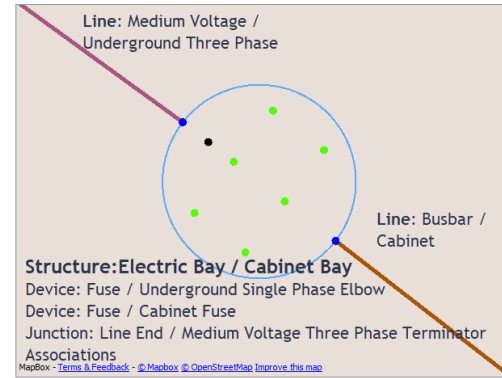
- Schema mapping
- Topology
  - Geometric Network (lines & junctions)
  - Explicit network (associations between junctions & devices)
- Creating Assemblies



**ArcGIS Device**

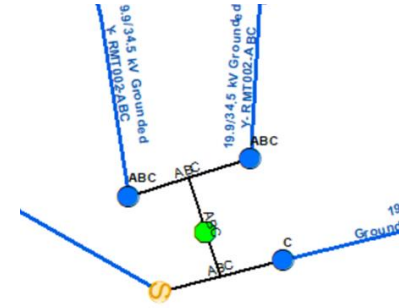
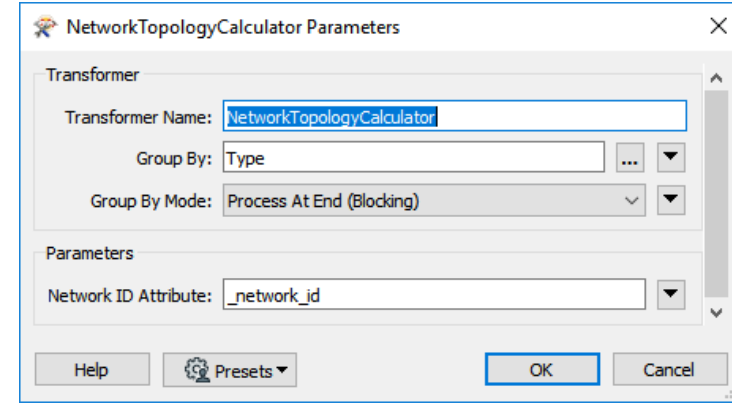


**UN Assembly**



# Transformers for Validating Connectivity

- **NetworkTopologyCalculator** for building geometric networks (lines & junctions).
- **SpatialFilter** for identifying objects that are supposed to connect, e.g. devices on lines.
- **TopologyBuilder** and **PointOnLineOverlayer** for building connected features and identifying missing junctions/devices.





# Validating Automatically

Tip: set up your data validation workflows to run automatically.

- On a **schedule**, e.g. daily quality control.
- In response to an **event**.
  - “Watch” a directory, FTP, Amazon S3 bucket ...
  - Email.
  - Database triggers.
- As a **web service**.
- Self-serve **drag-and-drop** webpage (or mobile app) that anyone on the team can use.



# Real-time Display Upload CAD data and watch it appear in real-time

## Step 1

### Download example data

[distribution\\_N25\\_good.dwg](#)

[distribution\\_N25\\_bad.dwg](#)

[Next step](#)



# FME Transformer Gallery

Manipulate your data exactly as needed by using any combination of FME's 497 transformers.

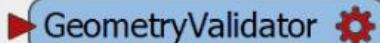



Filter By

All Categories

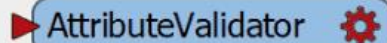

Sort By

Most Used

 **GeometryValidator** 

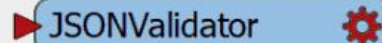



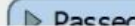
**GeometryValidator** - Detects selected issues in input features, and optionally repairs detected issues. Each input feature is processed individually.

 **AttributeValidator** 

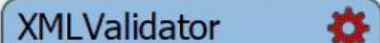



**AttributeValidator** - Validates any number of attributes against user-defined test conditions, routing the feature according to the outcome of the test(s) and identifying any tests it has failed.

 **JSONValidator** 



**JSONValidator** - Validates the syntax of JSON (JavaScript Object Notation) text.

 **XMLValidator** 



**XMLValidator** - Validates the syntax or schema of an XML file or text. There are different ways to specify the XML source to be validated:

# Data Validation Resources



**Improving Data Compliancy Using FME**

City of Kitchener



**CAD Data Validation using FME**

Colonial Pipeline



**Data Validation Victories: Tips for Better Data Quality**

Safe Webinar



**FME Extensive Usage Inside the Mapping Production System**

Natural Resources Canada



**Creating & Validating IMDF**

Knowledge Center



**Ultimate Geospatial Data Validation Checklist**

Safe Blog



**IMDF Validator**





Questions?