



Making INSPIRE Usable: ArcGIS and Alternative Encodings

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Photo credit: Scott Jordan, NWS Storm Survey, Wikimedia Commons

Today's Purpose

- To improve **ease-of-use** and **usability** and make data **pervasive** for **problem solving**

Spatial Data Infrastructures



- Save Lives and Safeguard Property
- Improve Quality of Life & the Environment
- Save Taxpayer Dollars



Agenda

How do we get there?

- 1. Data schemas that work (model transformations and alternative encodings)
- 2. Getting source data into the simplified models (ETL)
- 3. Implementation Patterns in geospatial infrastructure
- 4. See it in action (demo)
- 5. Federating data make it pervasive - open data, open platform, open standards, SEO
- 6. Conclusions- where do we go from here?

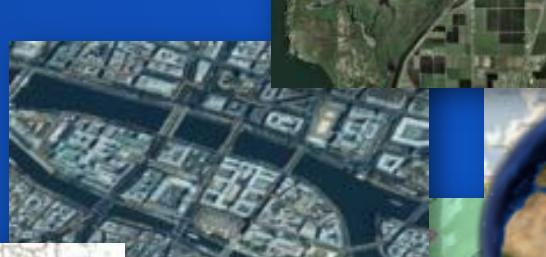
Urban planning



Health



Climate change



Conservation



Safety



Transportation



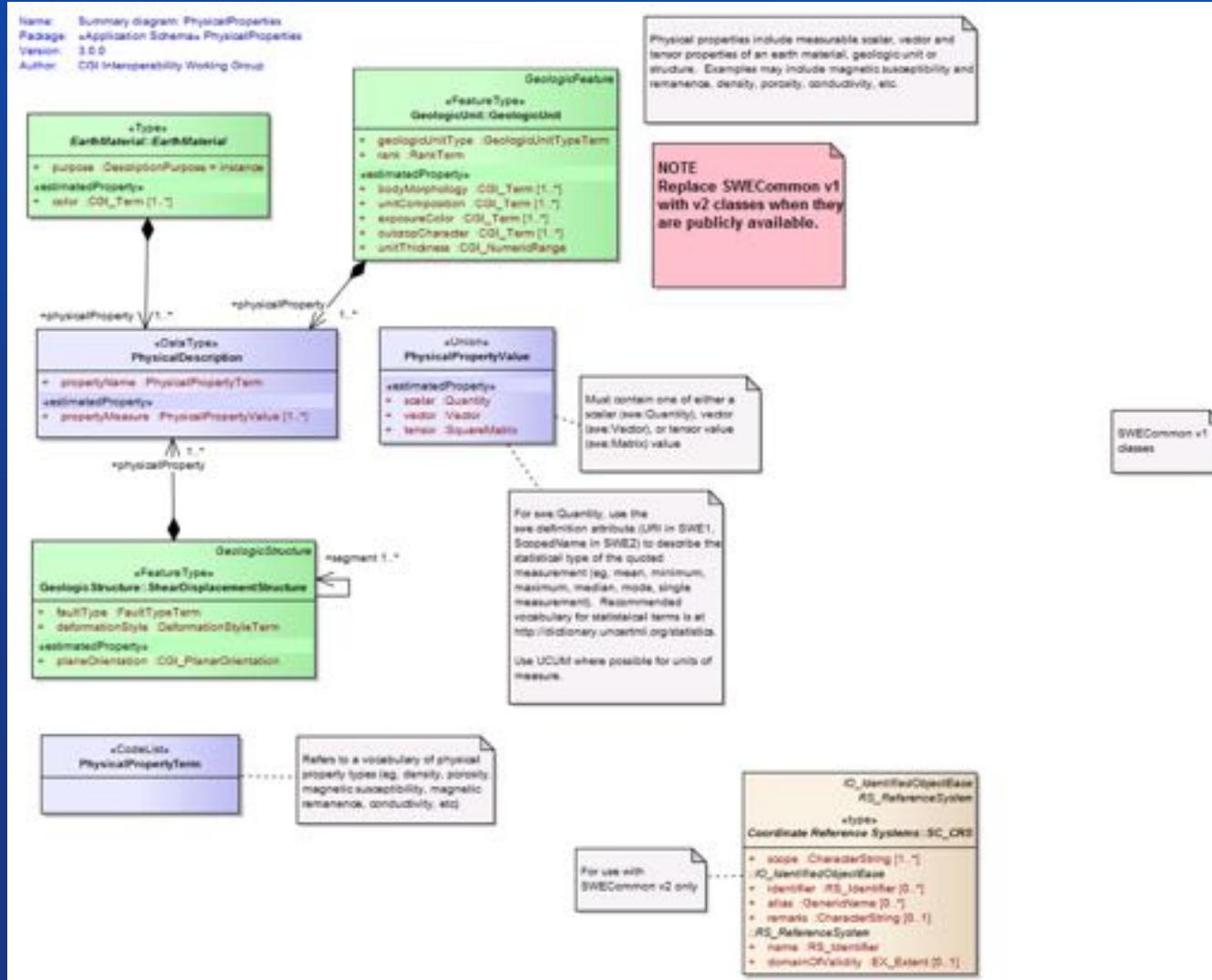
...and much more

Simplification of INSPIRE through Alternative Encodings

Action 2017.2 on alternative encodings for INSPIRE data

Background and Context

"The INSPIRE xml schemas are complex... simple use is difficult in standard GIS clients." - from Action 2017.2



According to Art. 7 of the IRs on data interoperability, alternative encodings can be used as long as an encoding rule is publicly available that specifies schema conversion rules for all spatial object types and all attributes and association roles and the output data structure used.



2017.2 Alternative Encodings

(proposed)

- The action will define alternative encoding rules (mainly **for the purpose of viewing/analysis in mainstream GIS systems**) for a number of selected application schemas and a template and procedure for proposing and endorsing additional encoding rules in the future.



Flattened Data Structure

(Example: proposed GeoJSON)

Flat File - A file structure for data records that have no structured relationship. A flat file takes up less computer space than other types (e.g., network, relational) but requires that the database application know how the information is organized in the file.

Example of flat data structure:

- XML with no XLinks
- Shapefile
- CSV
- GeoJSON

Model Transformation Rules

Our goal is to be “encoding agnostic”

OGC W3C Best Practice 4:
**Use spatial data encodings that
match your target audience.**
*This might involve providing data in
several different formats.*

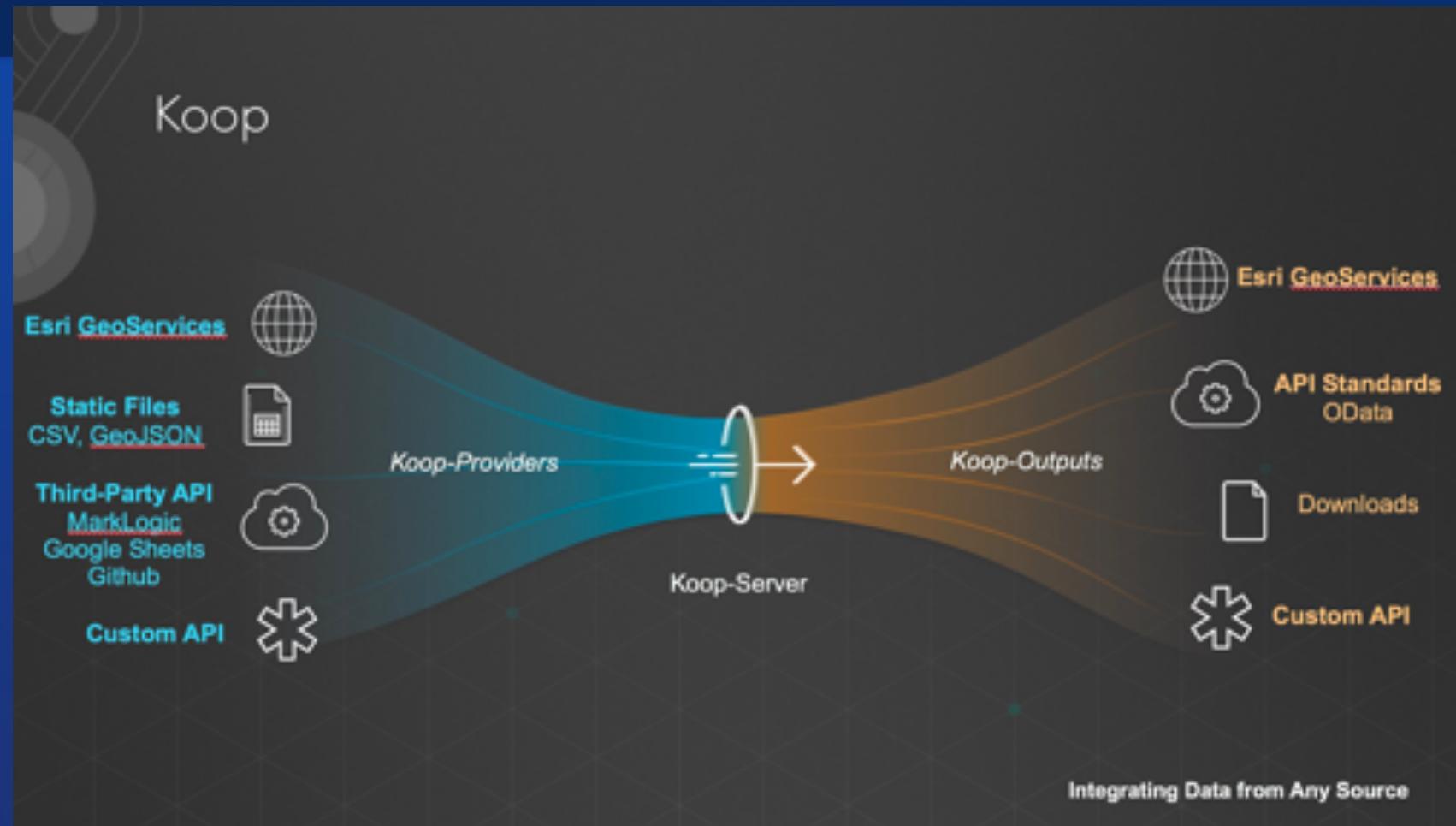
Source: Spatial Data on the Web Best
Practices, W3C Working Group Note 28
September 2017
<https://www.w3.org/TR/sdw-bp/>



THE SECRET SAUCE!

Koop Open Source GeoSpatial ETL Engine by Esri

A web server for on-the-fly transform of geospatial data



Leave your data where it lives with Koop and ArcGIS - <https://koopjs.github.io/>

Model Transformation Rules

(Proposed)

- General Flattening
- Simple Citation
- Simple Codelist Reference
- Simple Period
- Etc...

Additional Proposed:

- Retain Additional Nested Child Elements
- Fan Out Features by Geometry Type
- Fan Out Feature Types to Multiple Feature Classes
- Abbreviate Compound Property Names to Limit Field Lengths

Action 2019.2: Improving accessibility of data sets through network services



Simplified Metadata Requirements (Proposed)

Removing requirement for service-level metadata

“Requirements to document download and view services in stand-alone (ISO 19119) service metadata records are removed. Instead, network services shall be exclusively documented through the metadata returned by the service itself as a response to a Get Download/View Service Metadata request.”

Municipal Boundaries of Italy 2019

Last updated 22 days ago | 7,926 Records



The map displays the detailed administrative boundaries of Italy's municipalities as of January 1, 2019. The boundaries are represented by a complex network of blue lines. The map also shows parts of surrounding countries and major urban centers.

Legend:

- COO_UTS: 258
- PRO_COM: 58091
- PRO_COM_T: 058091
- COMUNE: Roma
- COMUNE_A:

Search: Search data and map

Information: Municipal Boundaries of Italy 2019

Tools: Overview, Data (selected), API Explorer, Zoom to, Print, Share, Embed, HERE, Powered by Esri

[View Data](#) [Feature Layer](#) [Custom License](#)

Metropolitan city and municipal (comune) boundaries/administrative units of Italy from BOUNDARIES OF ADMINISTRATIVE UNITS FOR STATISTICAL PURPOSES as of 1 January 2019. This is the more detailed version (not the generalized version). Source: Istat <https://www.istat.it/it/archivio/222527> Original shapefile name: Com01012019_WGS84

[More](#)

Attributes

[Chart](#) [Map Visualization](#)



About

Italy Group

Shared By: [\[User\]](#)

Data Sources: [\[Link\]](#)

[View Metadata](#)

[Create Web Map](#)

[Create a Story](#)

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[WPS](#)

[Download](#) [APIs](#)

[Full Dataset](#)

[Spreadsheet](#)

[KML](#)

[Shapefile](#)

[File Geodatabase](#)

[Additional Resources](#)

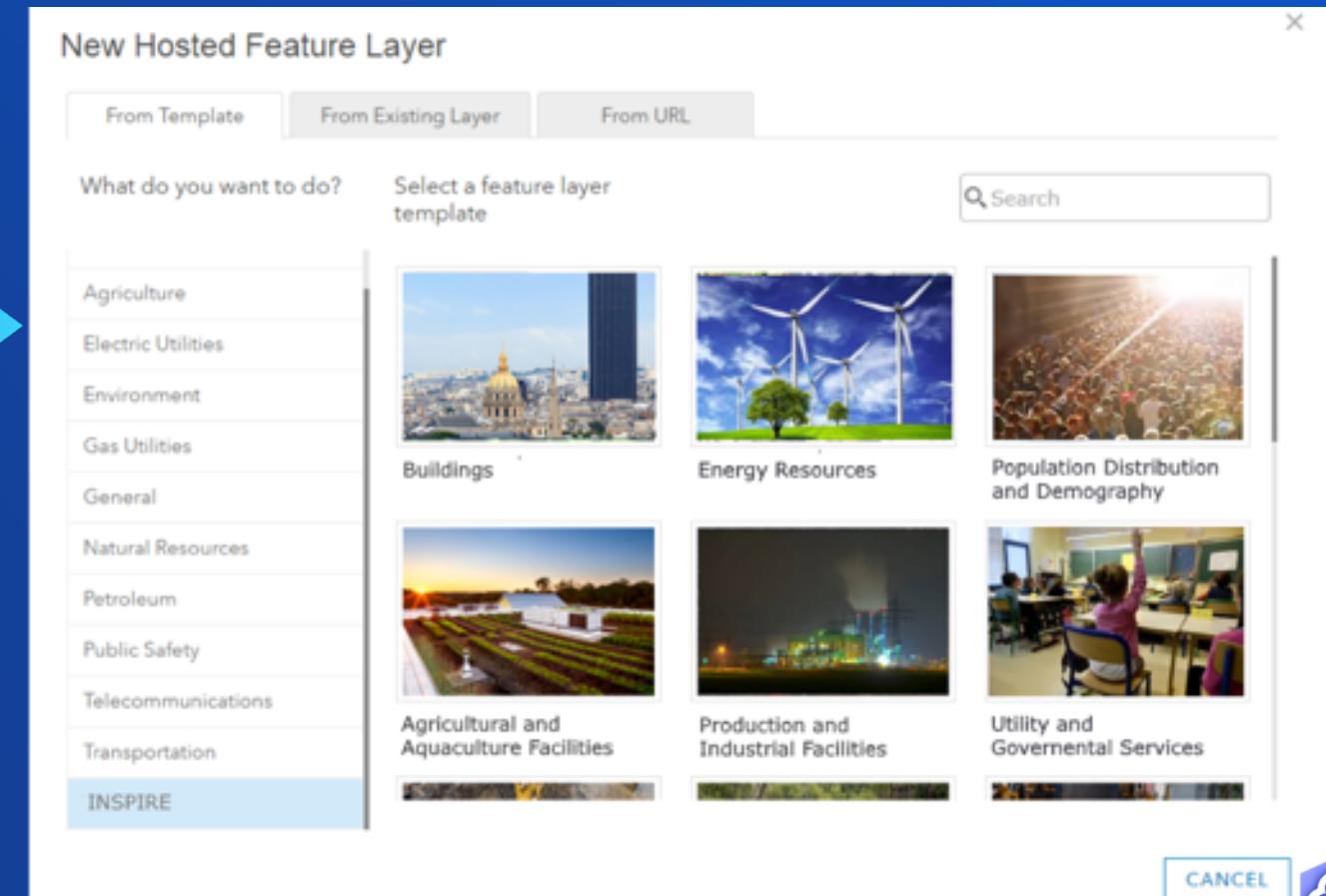
[WPS](#)



Future Directions: Treat INSPIRE data within ArcGIS Online like any other data

“Flattened” Data Schema as Hosted Feature Layer Templates

“Flatten” the INSPIRE data structure following the General Model Simplification Rule (proposed 2017.2 Alternative Encodings)



Hosted feature layer templates for
INSPIRE Simplified application schemas



ArcGIS
Online

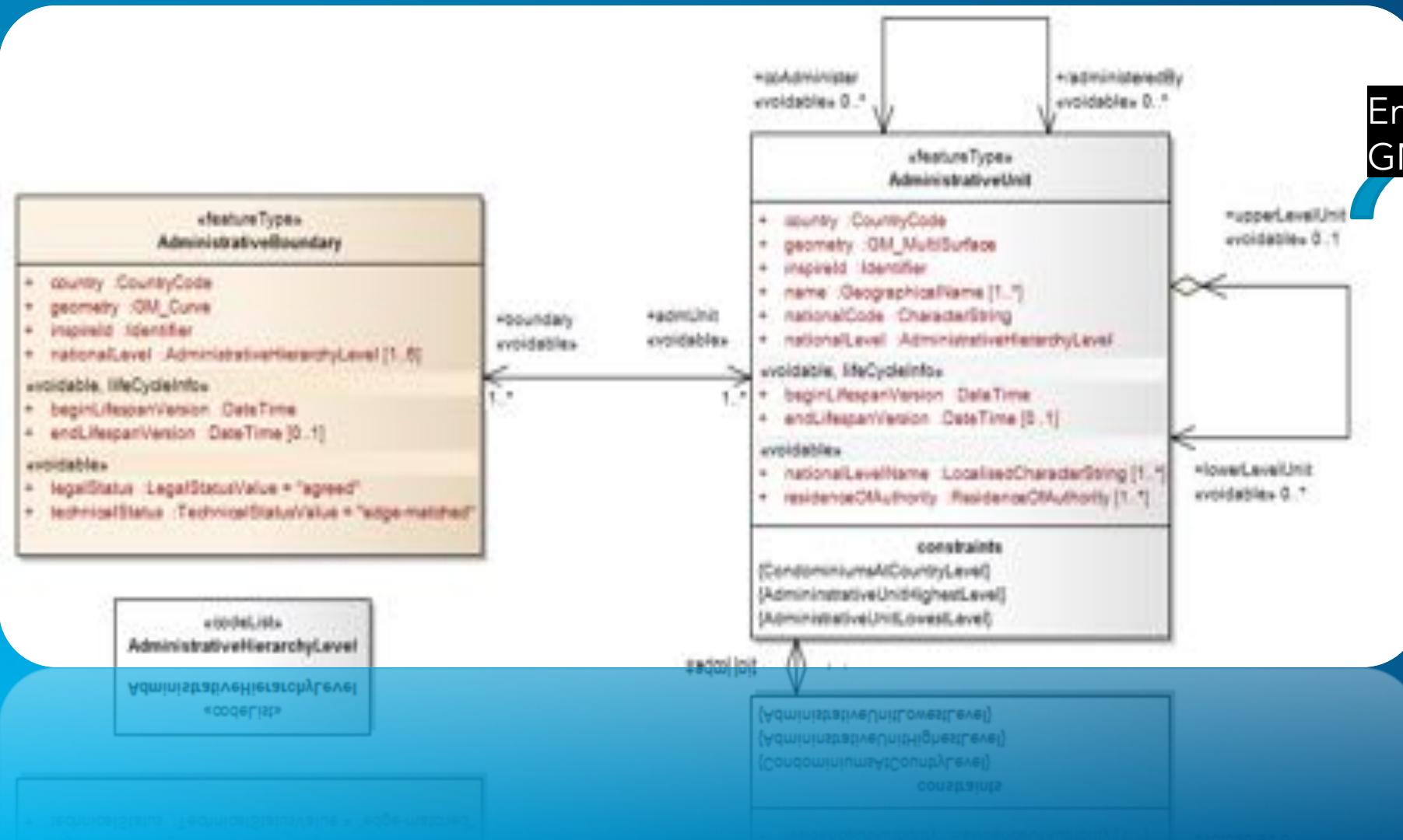
Getting source data into the simplified models (ETL)

Sören Dupke, con terra

Simplified Models

- Model Transformation
 - UML -> Esri INSPIRE Geodatabase
 - Rules / Assumptions
 - FME Workspace

UML - Administrative Units



GML - Administrative Units

name空间为“<http://www.w3.org/2001/XMLSchema.xsd>”；ns0空间为“<http://inspire.ec.europa.eu/schemas/au/4.0>”；ns1空间为“<http://inspire.ec.europa.eu/schemas/base/3.3>”；ns2空间为“<http://inspire.ec.europa.eu/schemas/base/3.3/baseTypes.xsd>”；ns3空间为“<http://schemas.opengis.net/gml/3.2/GeographicalFeatureType>”；ns4空间为“<http://schemas.opengis.net/gml/3.2/GeographicalFeaturePropertyType>”。

该XSD文件由Shapefile生成，包含以下主要元素：

- AdministrativeBoundary**: 表示行政边界。
- geometry**: 表示地理形状。
- AdministrativeUnit**: 表示行政区划。
- AdministrativeLevel**: 表示行政区划级别。
- Country**: 表示国家。
- GeographicalName**: 表示地名。

该XSD文件还定义了多个属性和限制，例如：

- 对于**AdministrativeBoundary**，**geometry** 属性的类型是 **MultiSurfacePropertyType**。
- 对于**AdministrativeBoundary**，**name** 属性的类型是 **AdministrativeName**。
- 对于**AdministrativeBoundary**，**country** 属性的类型是 **Country**。
- 对于**AdministrativeBoundary**，**legalStatus** 属性的类型是 **LegalStatus**。
- 对于**AdministrativeBoundary**，**residenceOfAuthority** 属性的类型是 **AdministrativeUnit**。
- 对于**AdministrativeBoundary**，**beginningSpanVersion** 和 **endingSpanVersion** 属性的类型是 **DateTime**。
- 对于**AdministrativeBoundary**，**upperLevelUnit** 属性的类型是 **AdministrativeUnit**。
- 对于**AdministrativeBoundary**，**boundary** 属性的类型是 **MultiSurfacePropertyType**。
- 对于**AdministrativeUnit**，**name** 属性的类型是 **AdministrativeName**。
- 对于**AdministrativeUnit**，**country** 属性的类型是 **Country**。
- 对于**AdministrativeUnit**，**legalStatus** 属性的类型是 **LegalStatus**。
- 对于**AdministrativeUnit**，**residenceOfAuthority** 属性的类型是 **AdministrativeUnit**。
- 对于**AdministrativeUnit**，**beginningSpanVersion** 和 **endingSpanVersion** 属性的类型是 **DateTime**。
- 对于**AdministrativeUnit**，**upperLevelUnit** 属性的类型是 **AdministrativeUnit**。
- 对于**AdministrativeUnit**，**boundary** 属性的类型是 **MultiSurfacePropertyType**。
- 对于**AdministrativeLevel**，**name** 属性的类型是 **AdministrativeName**。
- 对于**AdministrativeLevel**，**country** 属性的类型是 **Country**。
- 对于**AdministrativeLevel**，**legalStatus** 属性的类型是 **LegalStatus**。
- 对于**AdministrativeLevel**，**residenceOfAuthority** 属性的类型是 **AdministrativeUnit**。
- 对于**AdministrativeLevel**，**beginningSpanVersion** 和 **endingSpanVersion** 属性的类型是 **DateTime**。
- 对于**AdministrativeLevel**，**upperLevelUnit** 属性的类型是 **AdministrativeUnit**。
- 对于**AdministrativeLevel**，**boundary** 属性的类型是 **MultiSurfacePropertyType**。
- 对于**Country**，**name** 属性的类型是 **NationalName**。
- 对于**Country**，**language** 属性的值必须在 **LanguageCode** 编码列表中。
- 对于**Country**，**nativityValue** 属性的值必须在 **NativityValue** 编码列表中。
- 对于**Country**，**nameStatusValue** 属性的值必须在 **NameStatusValue** 编码列表中。
- 对于**Country**，**nameTitle** 属性的值必须在 **NameTitle** 编码列表中。
- 对于**Country**，**nameForm** 属性的值必须在 **NameForm** 编码列表中。
- 对于**Country**，**nameCode** 属性的值必须在 **NameCode** 编码列表中。
- 对于**GeographicalName**，**name** 属性的类型是 **AdministrativeName**。
- 对于**GeographicalName**，**language** 属性的值必须在 **LanguageCode** 编码列表中。
- 对于**GeographicalName**，**nativeName** 属性的值必须在 **NativeName** 编码列表中。
- 对于**GeographicalName**，**status** 属性的值必须在 **Status** 编码列表中。
- 对于**GeographicalName**，**title** 属性的值必须在 **Title** 编码列表中。
- 对于**GeographicalName**，**form** 属性的值必须在 **Form** 编码列表中。
- 对于**GeographicalName**，**code** 属性的值必须在 **Code** 编码列表中。

Alternative Encodings

- <https://github.com/INSPIRE-MIF/2017.2>
 - Examples for GeoJSON
- General Rules
- Example Encodings:
 - Assumptions

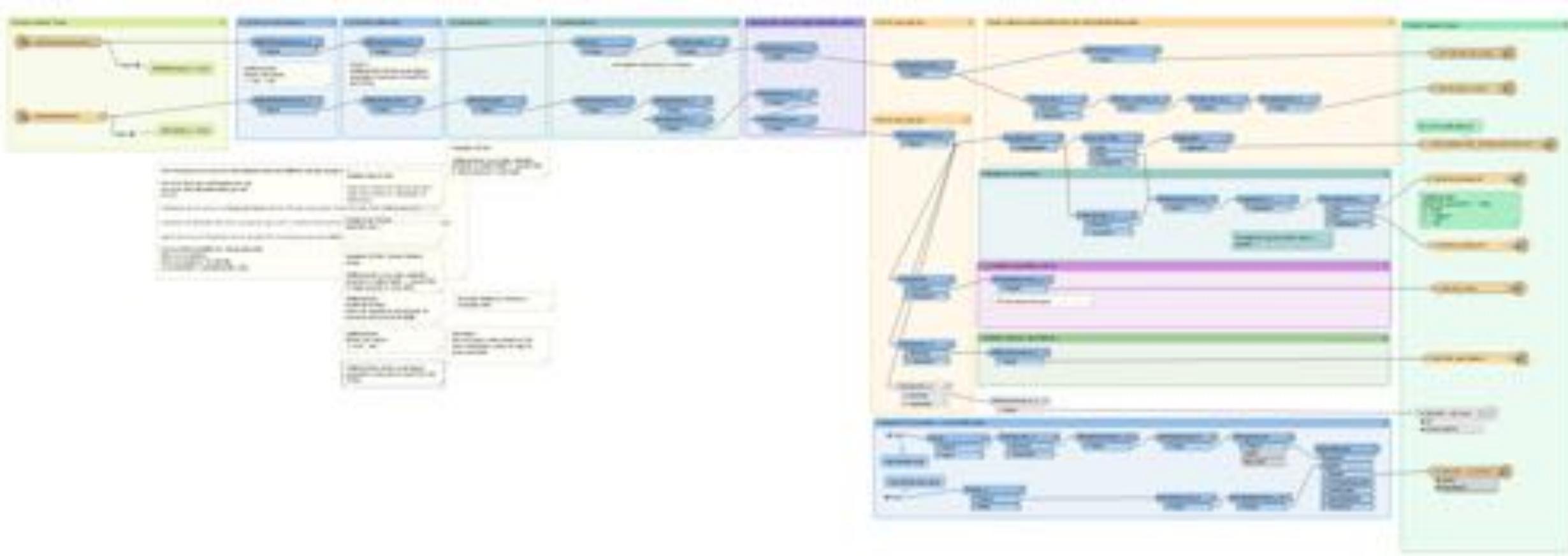
Alternative Encoding Rules for AdministrativeUnits

- Substitute all attributes that have a property type with a Codelist Sterotype through a inline codelist reference using MT008().
- Apply the General Flattening rule to simplify the remaining properties: MT001(separator: '_')
- Modified Rule MT005: copy the value of language to name_lang
- **Additional Rule: move high cardinality properties to related table -> expose first or single property in main table**
- Implicit information: Store only upperlevelUnit property as lowerlevelUnit is the inverse and can be derived from the upperLevelUnit property
- **Simple Void values -> void = null. Void Reasons have to be stored in Metadata like described for GeoJSON mapping**
- **N:M Relationships are stored in an additional Table**
- AdministrativeUnit: Fanout By nationalLevel

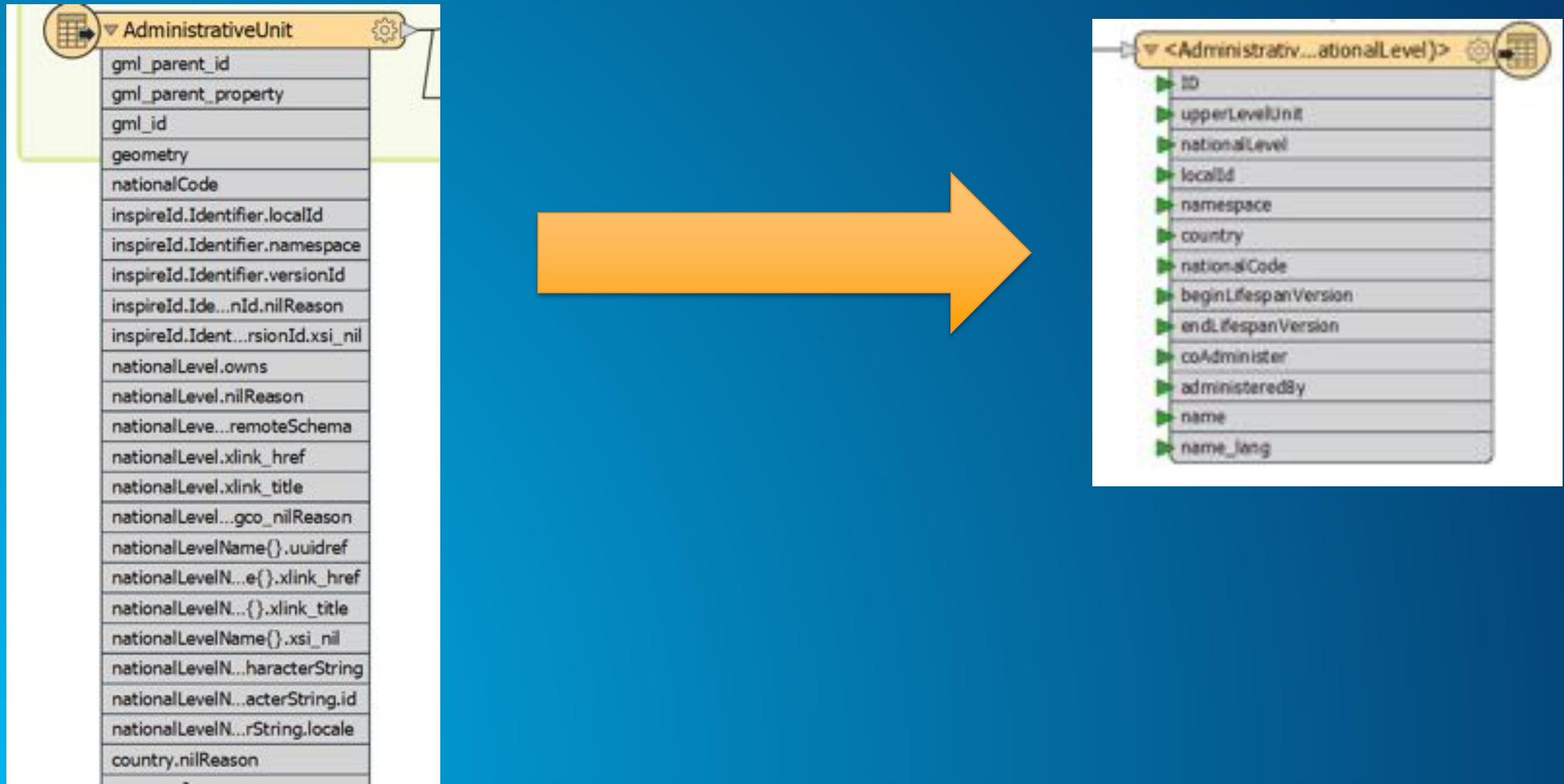
Assumptions for further simplification

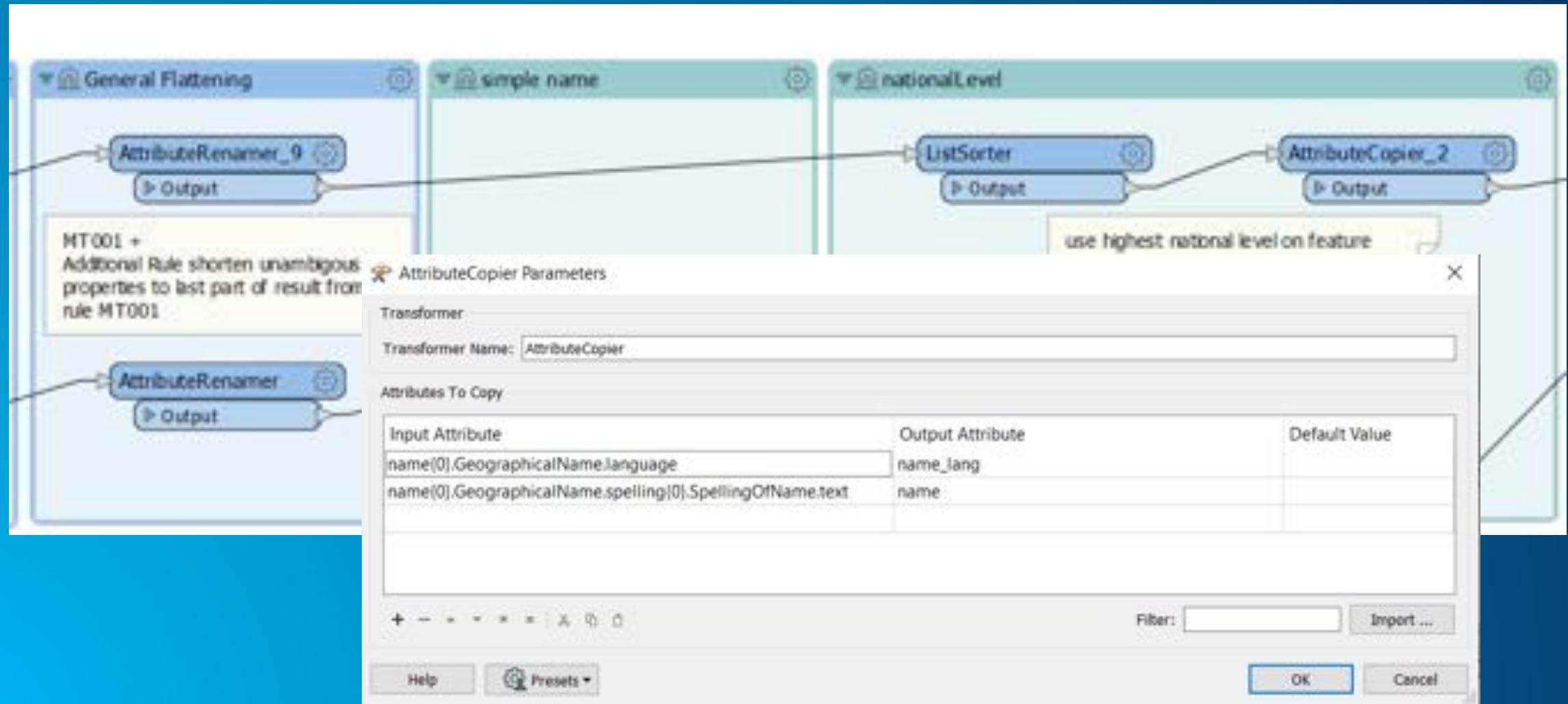
- The Simple Administrative Units encoding can be used as an *alternative encoding* for administrative units data that fulfills the following requirements:
 - There is not more than one coAdminister relation per Unit
 - There is not more than one administeredBy relation per Unit
 - There are no Condominiums (for now, can easily be added)
- Could even be simplified further if:
 - There is only one LevelName per Unit
 - There is only one residence of Authority per Unit
 - There is no coAdminister / administeredBy

Implementation with FME

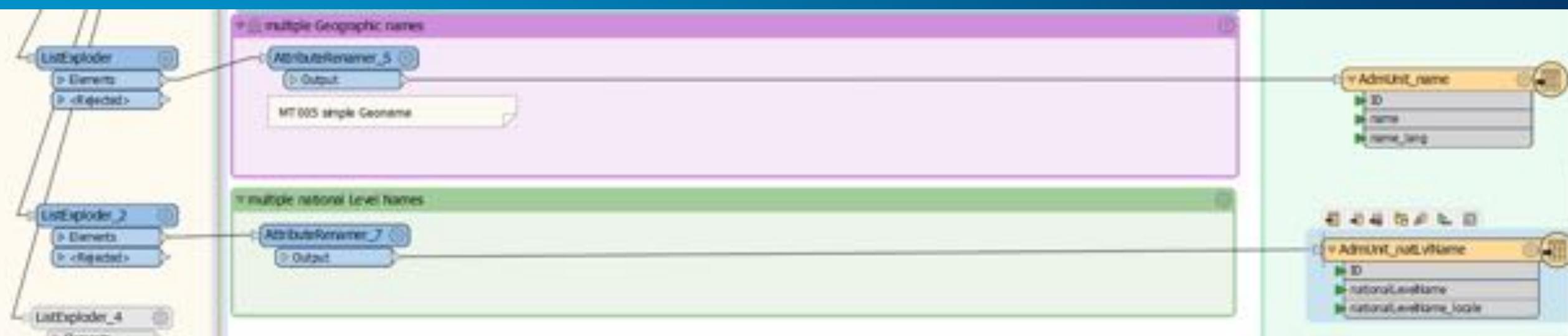


Simplification





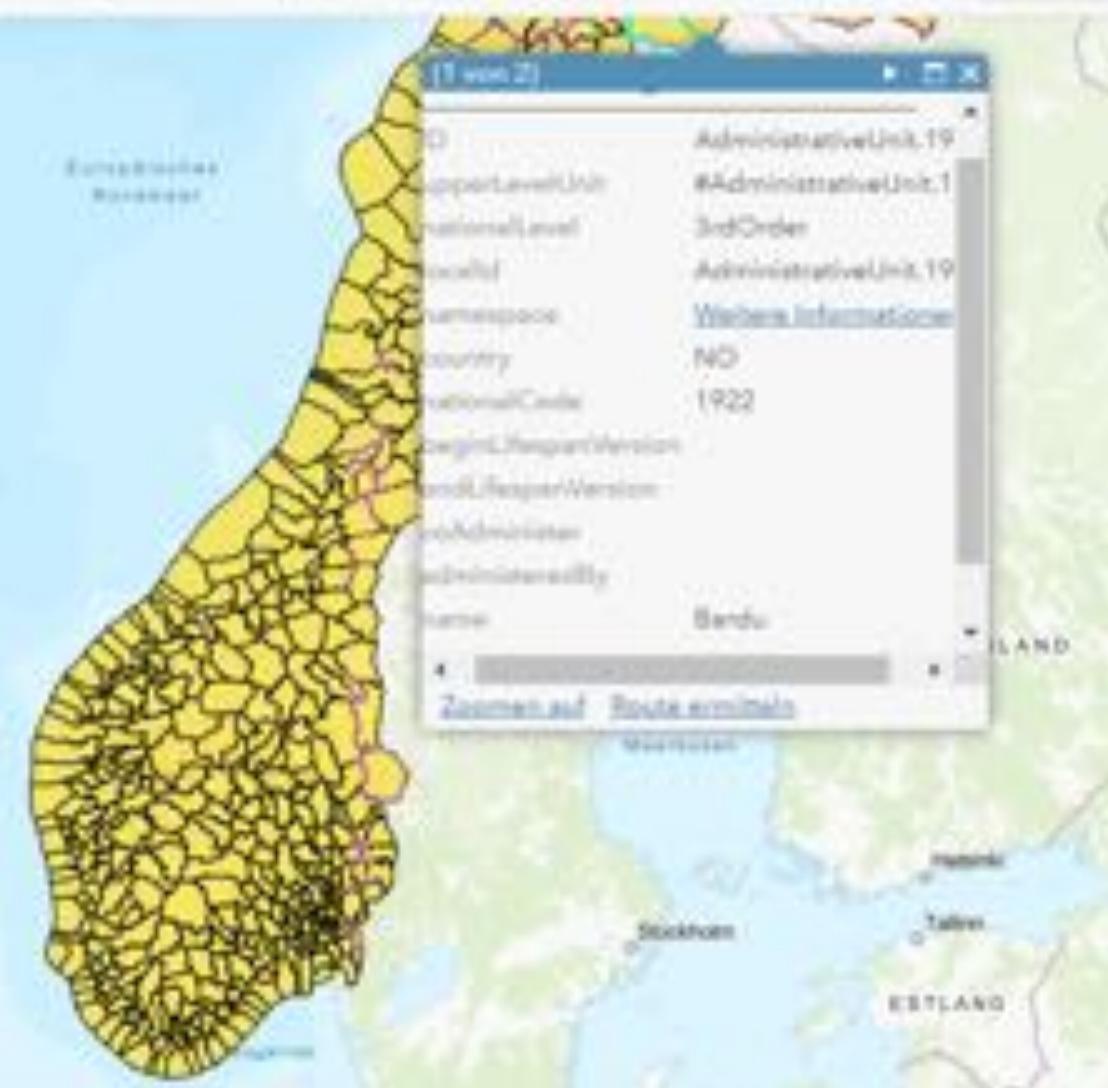
1:n Relationships



Info Inhalt Legende

Inhalt:

- Administrative Units INSPIRE (Norway) - AdminBoundary.natLvl
- Administrative Units INSPIRE (Norway) - AdministrativeBoundary
- Administrative Units INSPIRE (Norway) - AdministrativeUnit 1stOrder
- Administrative Units INSPIRE (Norway) - AdministrativeUnit 3rdOrder
- Administrative Units INSPIRE (Norway) - AdministrativeUnit 2ndOrder
- Topografiefläche
- Administrative Units INSPIRE (Norway) - AdmUnit.natLvlName
- Administrative Units INSPIRE (Norway) - AdmUnit.name



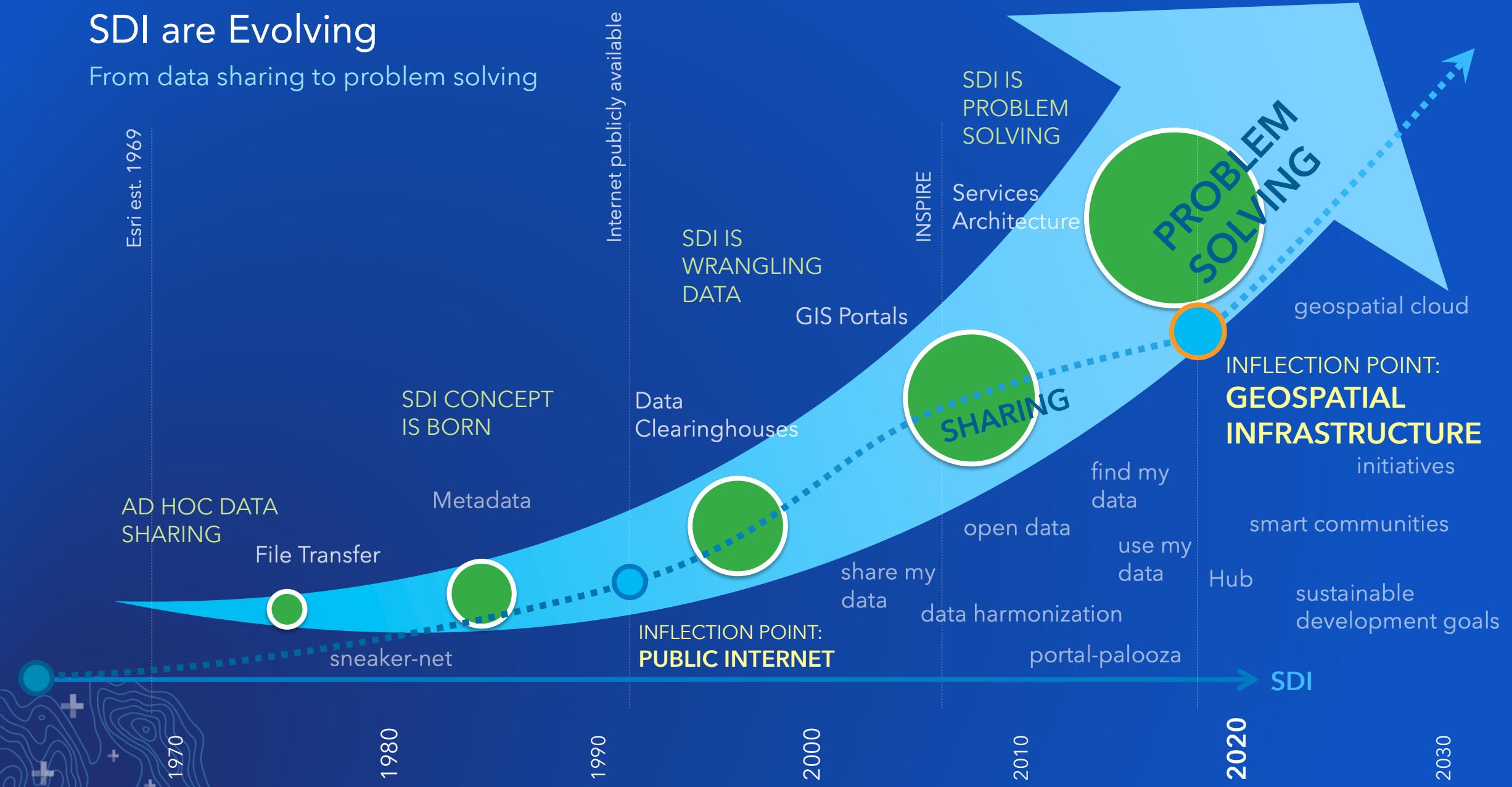
Implementation Patterns

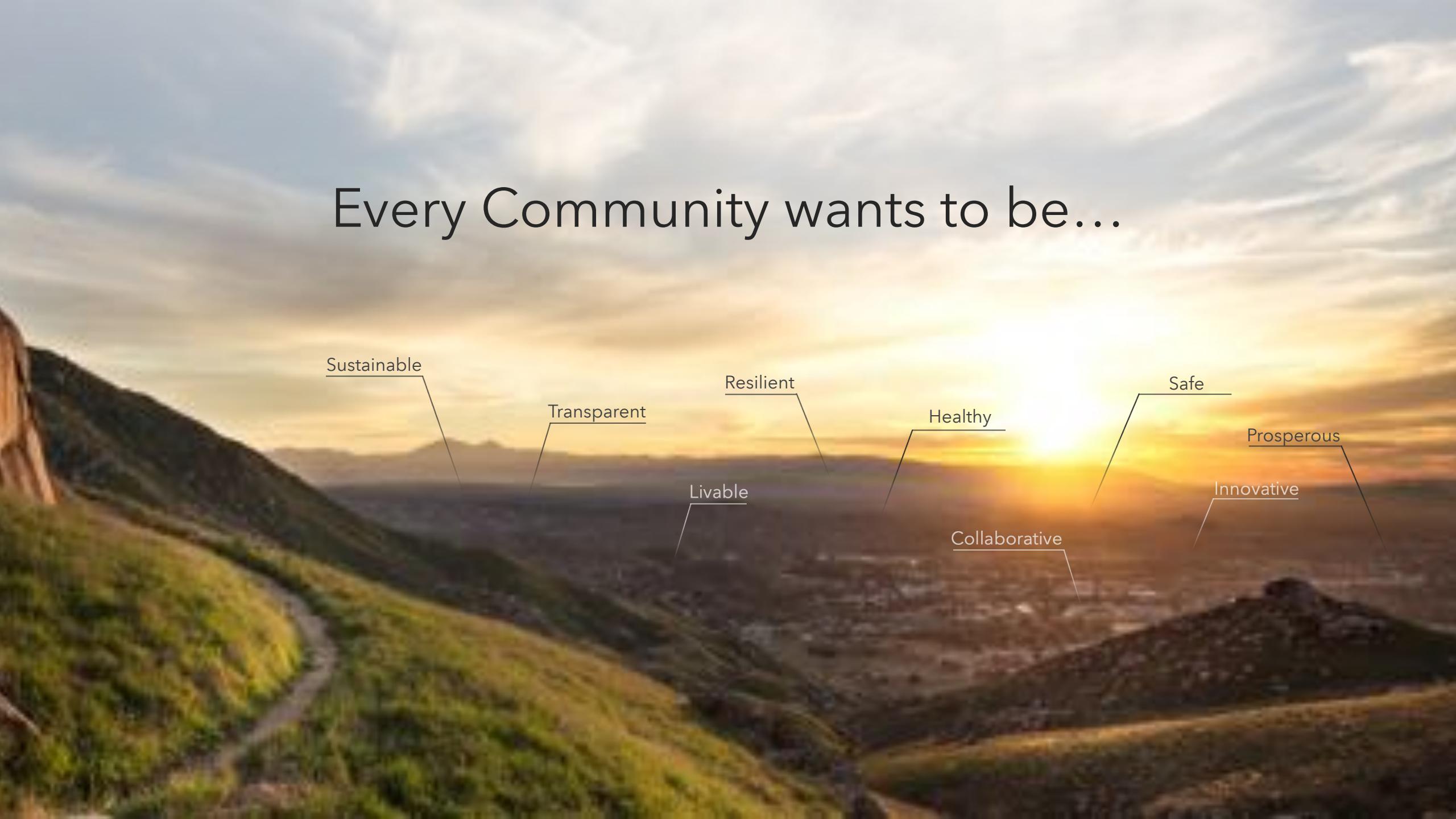
Evolving SDI with Geospatial Infrastructure



SDI are Evolving

From data sharing to problem solving





Every Community wants to be...

Sustainable

Transparent

Resilient

Livable

Healthy

Collaborative

Safe

Prosperous

Innovative



Give INSPIRE a Purpose

Sustainable

Transparent

Resilient

Livable

Healthy

Collaborative

Safe

Prosperous

Innovative

Aspirations get translated into
actionable, real-world Initiatives supported with INSPIRE data



Implementation patterns

- **Hybrid Approach**
 - On-Premises environment in data production
 - Cloud environment in data publishing
- **Cloud Approach**
 - Cloud environment in data production
 - Cloud environment in data publishing

Hybrid Approach

hub.arcgis.com

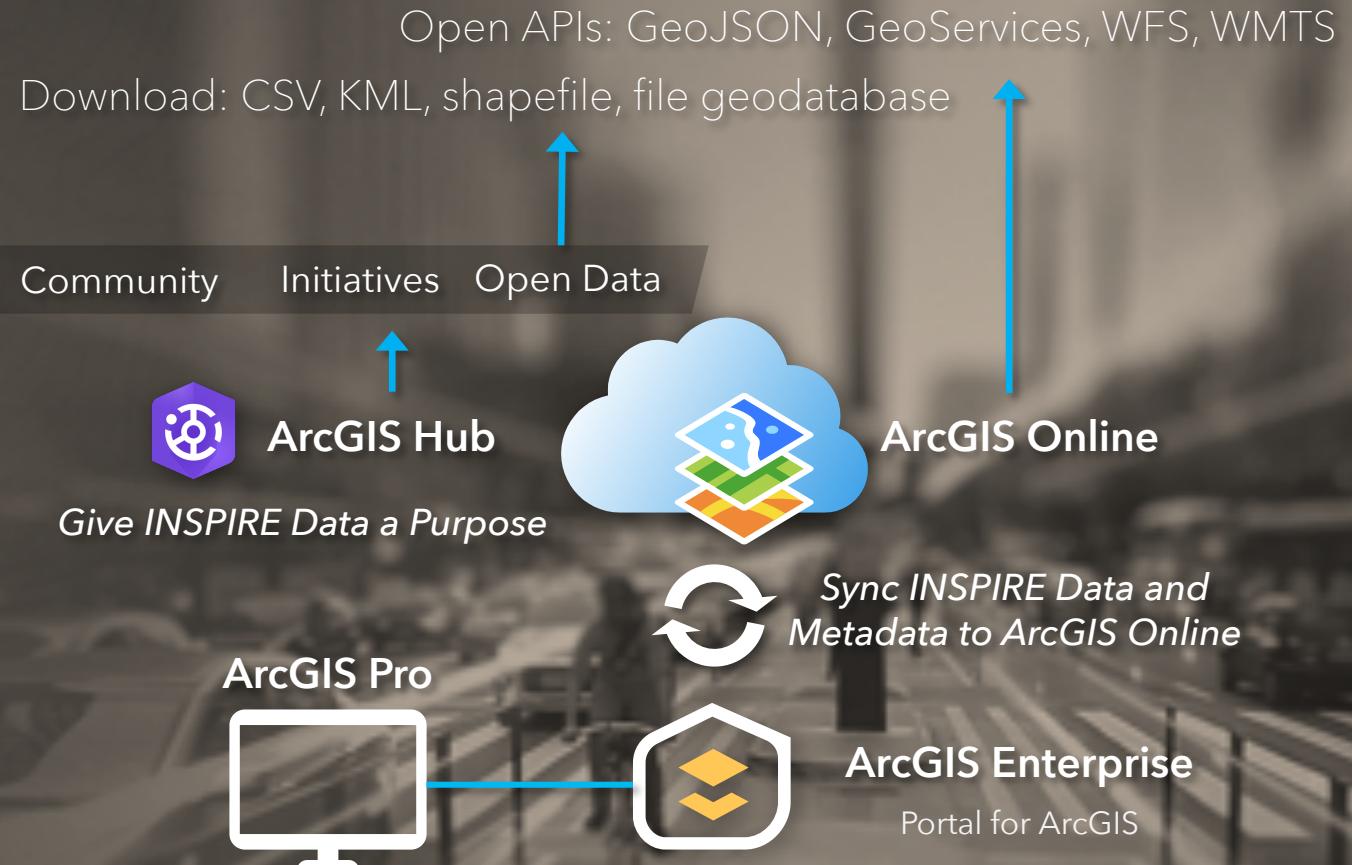
- Open Data
- Initiatives
- Community

ArcGIS Online

- Cloud
- Services and Open API's
- Collaboration

ArcGIS Enterprise

- On-Premises
- Distributed Production



Cloud Approach

hub.arcgis.com

- Open Data
- Initiatives
- Community

ArcGIS Online

- Cloud
- Services and Open API's
- Collaboration
- Production

ArcGIS Desktop

- On-Premises
- Optional Local Production



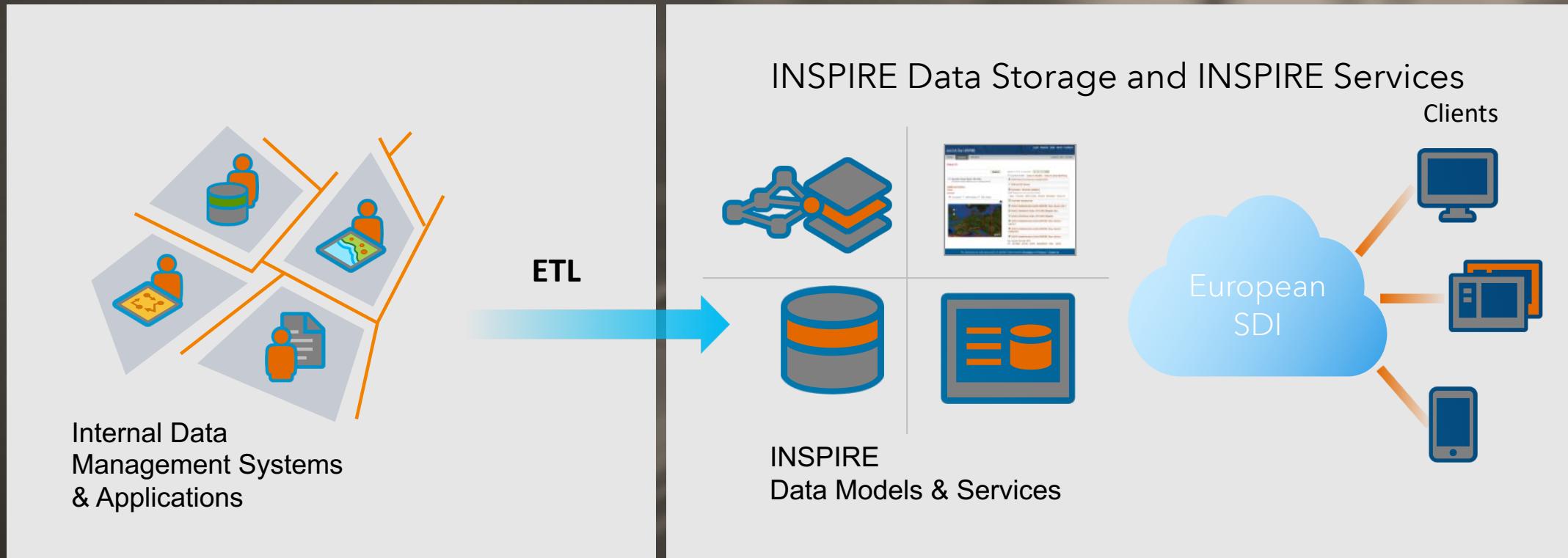
Extract Transform Load Workflows

- It's All About Data...
 - Integration
 - Transformation
 - Automation

Christian Dahmen
Team Lead
Spatial ETL Product Services

Extract Transform Load Workflows

Data Transformation Challenges



INSPIRE Solution Pack for FME®

Desktop

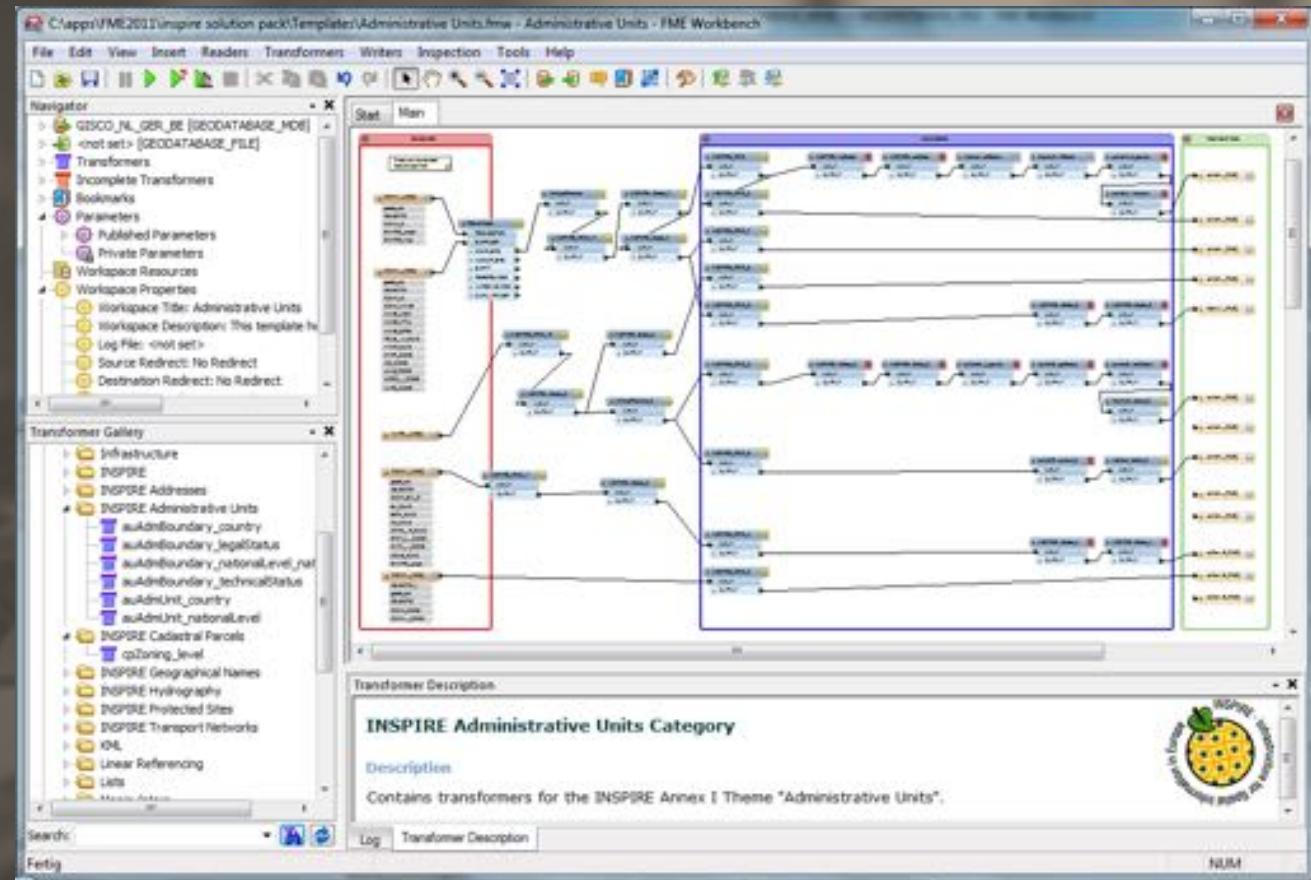
- Create Workflows
- Transform (local) Data

Server / Cloud

- Give Access to Organizations
- Automate Workflows

Key Features

- Optimized for ArcGIS for INSPIRE
- Support for INSPIRE GML + Atom
- Workspace Templates
- Tutorials and Documentation



Vision

User's Perspective

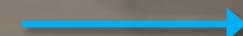
- „INSPIRE As a Service“
- Service-based Approach
- Fully (at least highly)-Automated



Sign-Up
&
Upload your data



Services
Data
APIs



Vision *Behind the Scenes*

- con terra data services
 - Data Transformation as a Service
- Automated Workflow
 - Upload Data
 - Data Validation
 - Data Transformation into (flattened) INSPIRE Data Models
 - Upload INSPIRE data to ArcGIS Online
 - Set up INSPIRE Services

Open APIs: GeoJSON, GeoServices, WFS, WMTS



ArcGIS Online / Hub Demo

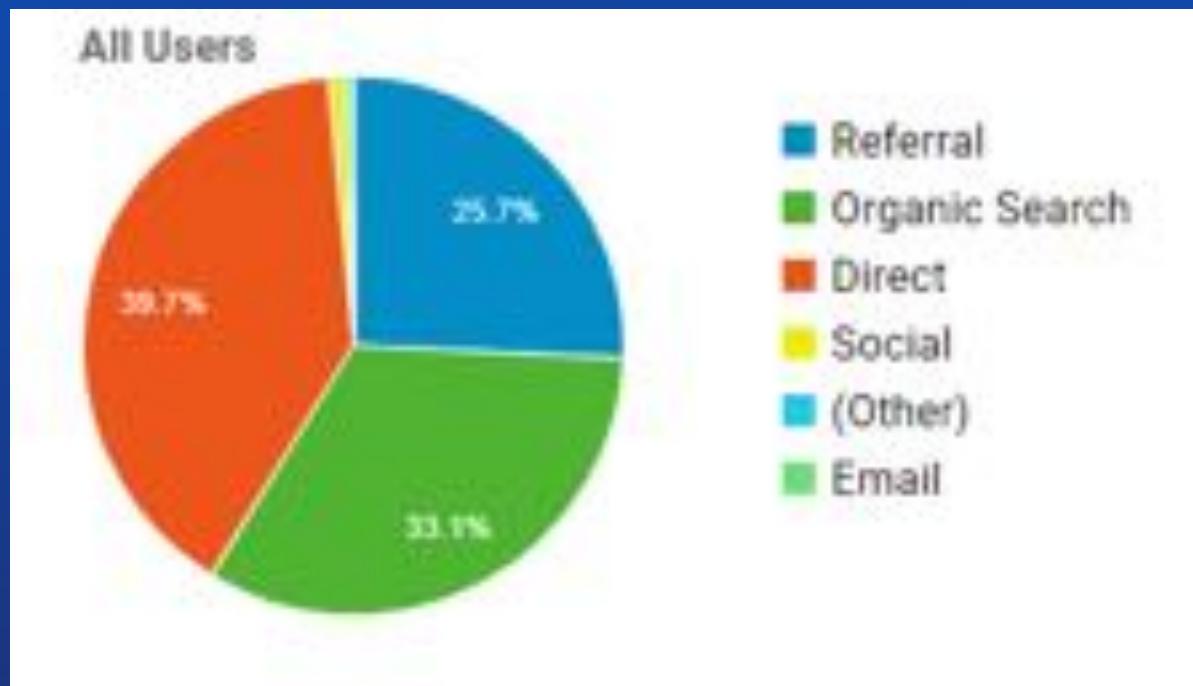
Jussi Lehtonen, Esri-Fi

Make It Pervasive

Federate with open data, open platforms, open standards, and indexable by search engines

How users find your data in your Hub Sites?

User Acquisition Sources



Source: Hub Google Analytics, Jan-Jun 2019

- **33% Search Google**
 - Click on a trustworthy looking source
 - 33% of search-based users land on the home page; the rest on an actual dataset!
- **25%: Referrals from a trusted source**
 - From an already trusted .gov website

"Authoritative" data vs. source discovery

OGC W3C Best Practice 2: Make your spatial data indexable by search engines

Search Engine Optimization (SEO)

The process of getting traffic from the “free,” “organic,” “editorial” or “natural” search results on search engines.

By optimizing:

- Content
- Architecture
- HTML
- Trust
- Links
- User

Source: <https://searchengineland.com/guide/what-is-seo>

The Periodic Table of SEO Success Factors

Content → Architecture → HTML → Trust → Links → User

Qu	RELEVANCE	Provide relevant and topic-specific content.
Rs	RESEARCH	Research keywords and topics your target audience is searching for.
Cr	CRAWL	Ensure engines crawl and index your website correctly.
Kw	KEYWORD	Optimize for keywords and phrases that matter.
Mo	MOBILE	Optimize for mobile devices and responsive design.
Tt	TECHNOLOGY	Use modern technologies like AMP and JSON-LD.
Fr	FRESHNESS	Create timely, relevant, and informative content.
Dd	DEPTH	Provide in-depth, detailed descriptions for what pages you want to rank.
Ds	DESCRIPTIONS	Use meta descriptions that accurately reflect the content of the page.
Co	CONTENT	Generate high-quality, unique content.
Lo	LINKS	Conduct link-building activities.
Au	AUTHORITY	Establish authority through citations, backlinks, and social signals.
Va	VERIFIABILITY	Use visual aids, transcripts, and subtitles for better indexing.
Ux	USER EXPERIENCE	Optimize user experience for better engagement and conversion.
Mm	MOBILITY	Mobile optimization and responsive design.
Sp	SPEED	Optimize site speed for faster loading times.
St	STRUCTURE	Use schema markup, internal linking, and other structural elements.
An	ANALYTICS	Create content that can be tracked and analyzed.
Ps	PERSONALIZATION	Provide personalized content based on user behavior.
Hd	HEADINGS	Use clear, descriptive headings and sub-headings.
En	ENGLISH	Write in English for better readability and searchability.
Ac	ACCESSIBILITY	Ensure your website is accessible to everyone.
Hs	HOSTING	Choose a reliable hosting provider.
Dt	DATA	Use structured data to help engines understand your content.
Ur	URLS	Use descriptive URLs with clear page structure.
Am	ALT ATTRIBUTES	Add alt attributes to images for better indexing.
Re	REFERRALS	Identify referring sites and analyze their metrics.
Ba	BACKLINKS	The more high-quality backlinks you have, the better.
In	INTERNAL LINKS	Consider link architecture for better indexing in specific categories.



How Hub Sites Help SEO your Data



Links

More links

to your dataset pages

Architecture

Mobile Design

all new features go through mobile-specific designs, e.g. increasing text size within a search box.

HTML

Enforce HTTPS

to automatically redirect any requests over HTTP to HTTPS

Content

A Sitemap

that shows web crawlers the way through your site

Dataset page html inserts

that web crawlers love to read <tags>

Optimized Media Content

improved image and multimedia embed capabilities and improved accessibility

Links

More Links to your Dataset Pages

GIS Nation

Analysts Initiatives NGDA Performance

Bureau of Land Management

Last updated 2 years ago | 267 Records



Overview Data API Explorer

9/4/2017 Feature Layer 0 Comments

Related Data

Data

[US Fish and Wildlife \(USFW\)](#)
US NSDI | slove_usnsdi

The Surface Management Agency (SMA) Geographic Information System (GIS) dataset, found in the A-16 National...

Type: Feature Layer Last Updated: September 4, 2017 Rows: 169 Tags: SMA, Surface Management A...

Data

[Alaska Native Allotment](#)
US NSDI | slove_usnsdi

The Surface Management Agency (SMA) Geographic Information System (GIS) dataset, found in the A-16 National...

Type: Feature Layer Last Updated: September 4, 2017 Rows: 6 Tags: SMA, Surface Management A...

Data

[Local](#)
US NSDI | slove_usnsdi

The Surface Management Agency (SMA) Geographic Information System (GIS) dataset, found in the A-16 National...

Type: Feature Layer Rows: 157

Data

[US Fish and Wildlife \(USFW\)](#)
US NSDI | slove_usnsdi

The Surface Management Agency (SMA) Geographic Information System (GIS) dataset, found in the A-16 National...

Type: Feature Layer Rows: 169

About

The Surface Management Agency (SMA) Geographic Information System (GIS) dataset, found in the A-16 National Geospatial Data Asset Portfolio, depicts federal land in the U.S. This tile layer portrays a subset of the SMA GIS

Enforce HTTPS

Hub > INSPIRE Online > Site Home

< Customize Settings Capabilities >

Site Title: INSPIRE Online

Subdomain: hub.arcgis.com

Site URL: arcgis

URL Preview: <https://arcgis-inspire-esri.hub.arcgis.com>

Enforce HTTPS

About Site
This field will appear in the ArcGIS overview and is used to describe this site in search results.

esri INSPIRE Online Gallery Open Data ArcGIS for INSPIRE About

Inspiring What's Next

ArcGIS supports INSPIRE, the infrastructure for spatial information in Europe.

Reimagine INSPIRE

Esri's Vision for enriching the INSPIRE experience

Esri provides an easy to implement solution, hosted in the cloud or on-premise, that is scalable, open, and secure.

The user-driven approach of ArcGIS Open Data initiatives and the broad adoption of Esri's Web GIS pattern can provide a powerful framework for supporting comprehensive INSPIRE capabilities for data delivery and use that go beyond satisfying pure compliance criteria.

Read this visionary article from Jack Dangermond and Esri's INSPIRE experts about the future of INSPIRE - Reimagine INSPIRE by Leveraging Open Data and Web GIS.

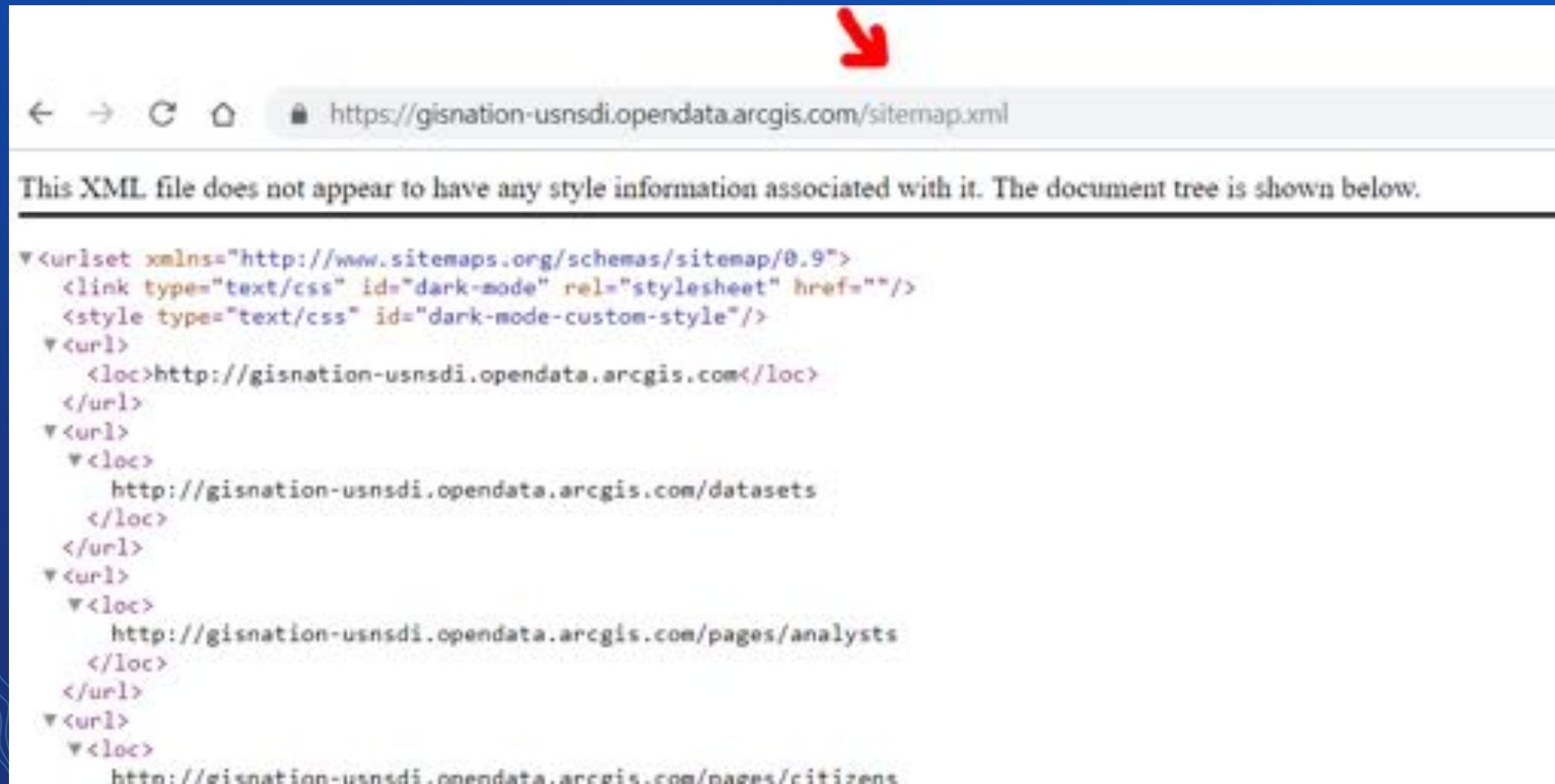


Data working sessi

HTML

A Sitemap that shows web crawlers the way through your site

[https://\[YOURSITE\]/sitemap.xml](https://[YOURSITE]/sitemap.xml)



The screenshot shows a browser window with the URL <https://gisnation-usnsdi.opendata.arcgis.com/sitemap.xml> in the address bar. A red arrow points to the browser's status bar at the top right, which displays the same URL. The main content area of the browser shows the XML code of the sitemap. The code includes a root element <urlset> with several <url> elements, each containing a <loc> element pointing to different pages on the website.

```
<urlset xmlns="http://www.sitemaps.org/schemas/sitemap/0.9">
  <link type="text/css" id="dark-mode" rel="stylesheet" href="" />
  <style type="text/css" id="dark-mode-custom-style"/>
  <url>
    <loc>http://gisnation-usnsdi.opendata.arcgis.com</loc>
  </url>
  <url>
    <loc>
      http://gisnation-usnsdi.opendata.arcgis.com/datasets
    </loc>
  </url>
  <url>
    <loc>
      http://gisnation-usnsdi.opendata.arcgis.com/pages/analysts
    </loc>
  </url>
  <url>
    <loc>
      http://gisnation-usnsdi.opendata.arcgis.com/pages/citizens
    </loc>
  </url>
</urlset>
```

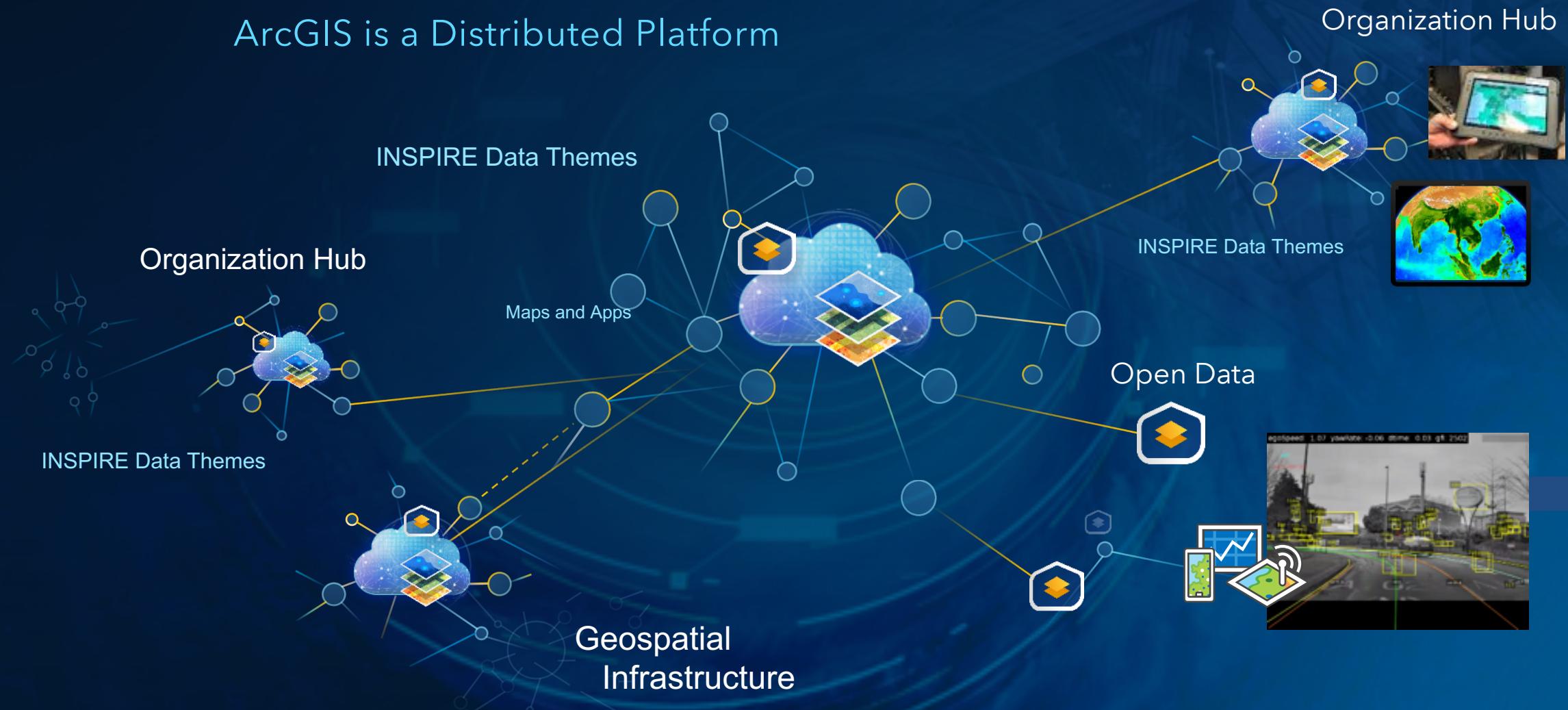
ArcGIS Hub

> 2,500 governments and organizations

> 234,000 curated datasets

Hub of Hubs

ArcGIS is a Distributed Platform



Supporting GIS Workflows in All Environments

What Have We Learned?

- **Simplify** for usability and usefulness by all your target audiences.
- Make it **pervasive**. Make it your mission to make your SDI data **open** and available, integrated within applications and initiatives.

It's time to focus on use.

The background of the image is a wide-angle photograph of a natural landscape during sunset or sunrise. The sky is filled with soft, warm-colored clouds ranging from pale yellow to deep orange and red. In the foreground, there are rolling hills covered in green vegetation, with some brownish-yellow areas suggesting dry grass or shrubs. In the distance, a range of mountains is visible, their peaks partially obscured by the low-hanging clouds.

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