Improved Data Usability: From an analysis of the GML Data Specifications to Alternate Encodings

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Agenda

- Study for GDI-DE in 2017
  - How can we improve the default encoding to make INSPIRE Data more usable?
- Work for MIG 2017.2 on Alternate Encodings in 2018/2019
  - How can we use alternate encodings to make INSPIRE Data more usable?
  - What is the current state of data usability for GML and GeoJSON in the most important GIS tools?

Analysis of the INSPIRE GML Encoding

July to August 2018

The GDI-DE Analysis

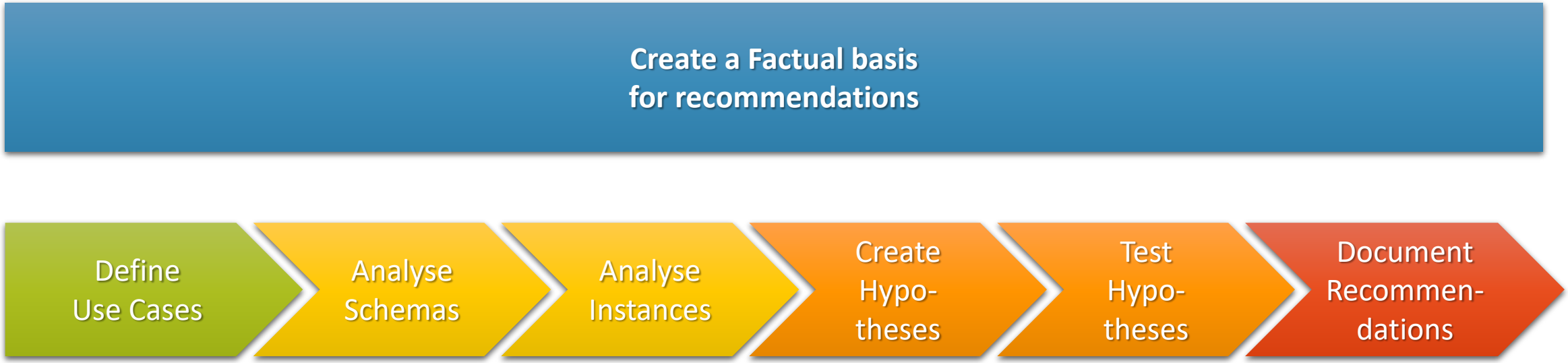
Context:

- INSPIRE Fitness for Purpose discussions
- Timeframe: 4 weeks (April 2017)

Objectives:

- Determine concrete issues by use case with the current data specifications
  - Interoperability issues
  - Implementation issues
- Quantify issues and their impact where possible
- Suggest improvements, with a focus on the Technical Guidance

Methodology of the Analysis



- BU-core*d
- sd
- ef
- us-*
- nz

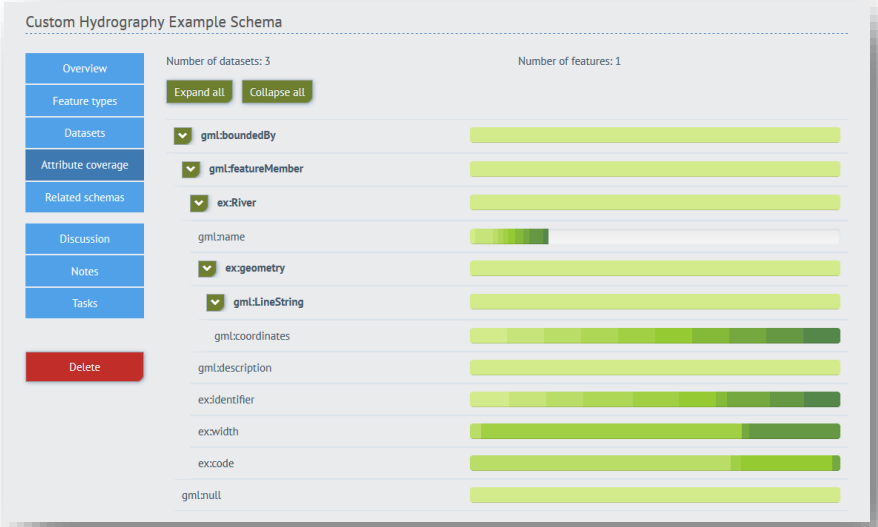
Use Cases

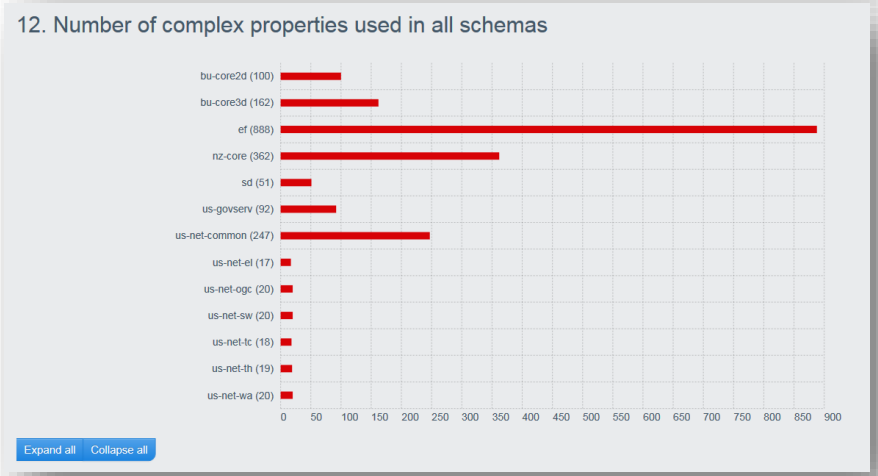
- Data Management (what problems does this pattern solve for data management in a relational database?)
- Data Exchange
- Data Portrayal
- Data Harmonization
- Data Analysis in a Desktop GIS
- Data Publishing through View Services
- Data Publishing through Download Services

Schema and Data Analysis

- element depth
- use of base types
- reference types
- use of choices and substitutions constructs
- statistics of property type and occurrences
- statistics of frequently used concepts like Voidable, UnitOfMeasure
- statistics on geometry properties usage
- Schema coverage through known data sets

… and more would be possible.

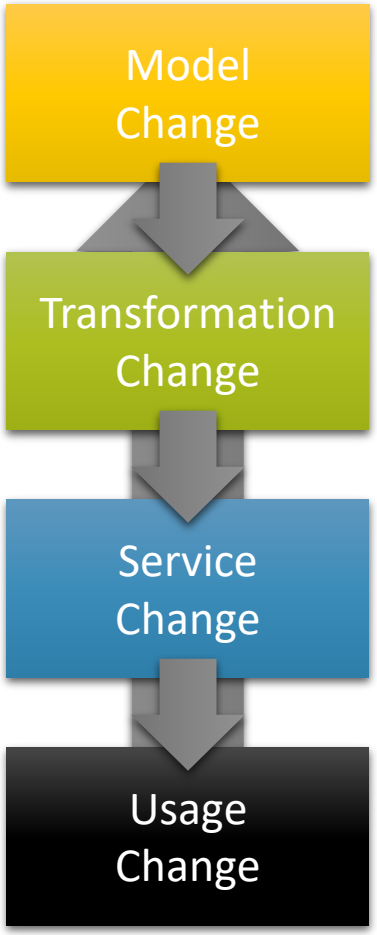




Tools used: Agile Standardisation in hale connect

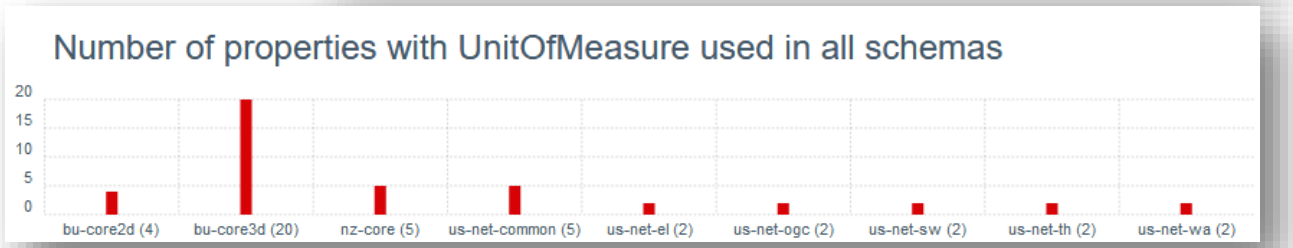
- Model-driven
  - No Schema Language Mismatches between steps
- Data-driven
  - Inform every step with real-world data
- Usage-driven
  - Instantly validate data fitness-for-purpose

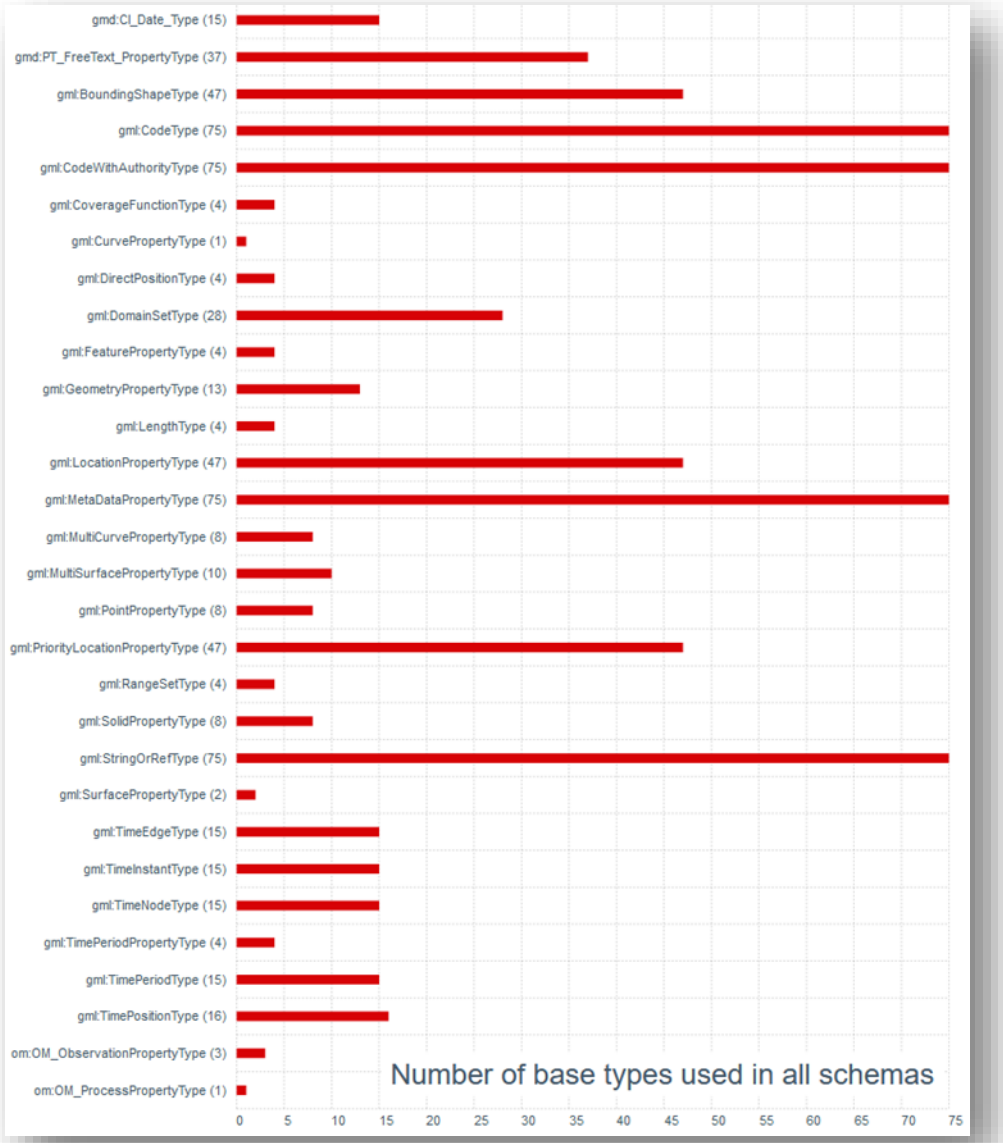
- Collaboration
  - Versioning, Forking
  - Comments, Tasks, Notes



Schema Analysis: Example

- bu-core2d
  - F bu-core2d:BuildingPart
  - F bu-core2d:Building
    - S beginLifespanVersion [1:1] : dateTimeExtension
    - C boundedBy [0:1] : gml:BoundingShapeType
    - → buildingNature [0:*] : gml:ReferenceType
    - ? choice [0:1]
      - → conditionOfConstruction [1:1] : gml:ReferenceType
    - C currentUse [0:*] : AnonymousType
    - C dateOfConstruction [0:1] : AnonymousType
    - C dateOfDemolition [0:1] : AnonymousType
    - C dateOfRenovation [0:1] : AnonymousType





Identified Problems by Use Case

Data Management
- OO vs. Layers
- OO vs. RDBMS/ODBMS

Data Exchange
- Resolution of file-external references
- Support for dataset fragments

Data Portrayal
- Nested properties
- Code list references
- Complex geometry model (Building)
- leastDetailedViewingResolution

Data Harmonisation
- Missing Codelists
- Semantic mismatches (classification)
- Semantic ambiguity
- Networks/Topologies

Data Analysis
- Complex attribute structures
- Multiple geometries per „layer“

Data Publishing
- GetFeatureInfo and complex schemas
- Some geometries and constructs not supported

(Some) Recommendations

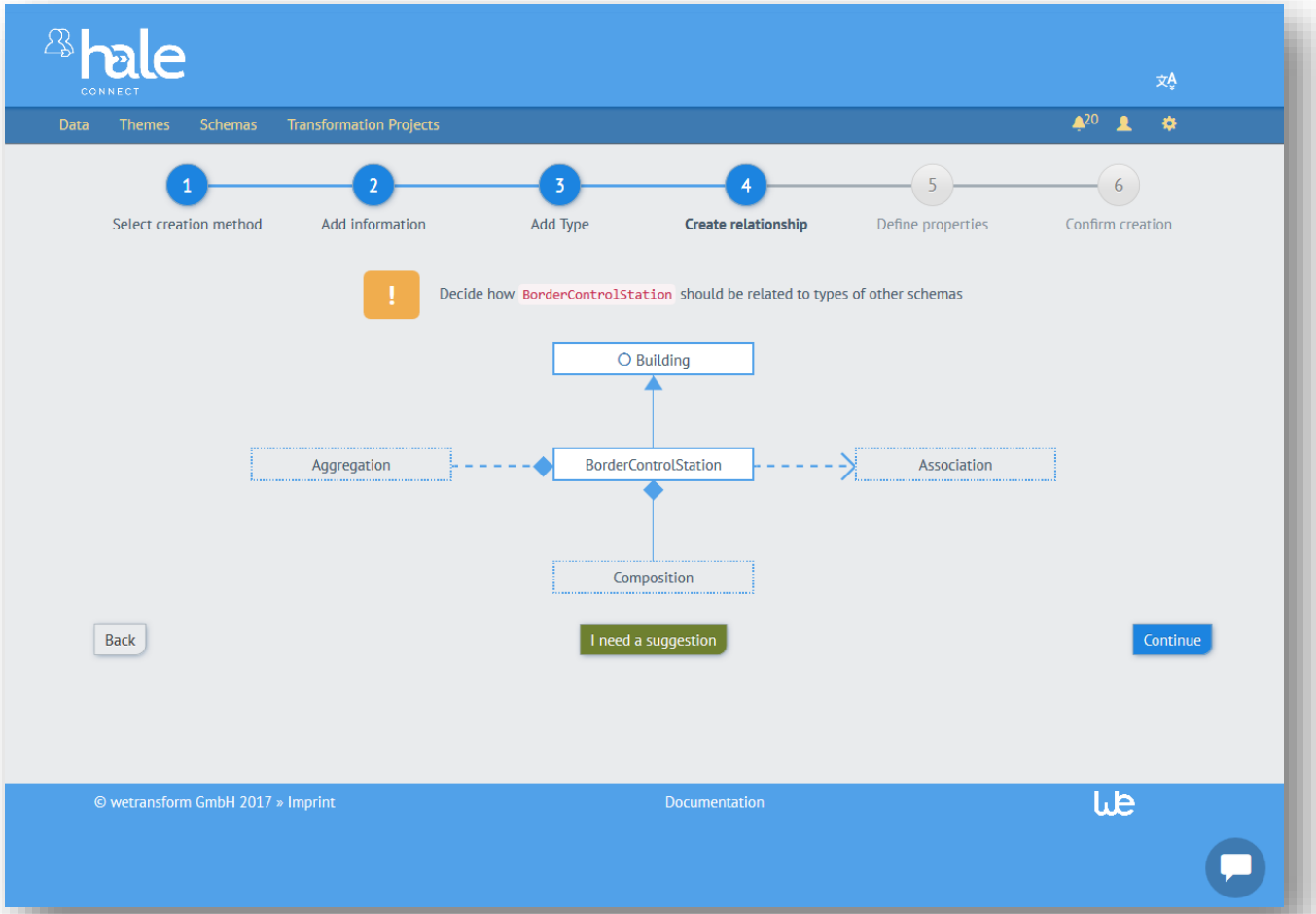
- Flatten some structures where cardinality is usually 1
- Simplify attributes representing measures and remove obligation to provide `UnitOfMeasure` for attributes that are `Voidable`
- Simplify `xs:choice` elements in data models
- Reduce use of substitution groups
- Avoid features with multiple geometry attributes
- Provide middleware to support alternative encodings
- Provide code list references in XML Application Schemas
- Provide alternative data models for View Services
- **Use alternative logical models for specific elements**
- **Use alternative/additional encodings**

Conclusions

- Medium to high degree of complexity in INSPIRE schemas comes from multiple sources:
  - The structure reflects the thematic structure of the real-world features behind.
  - The specifications reuse existing standards.
  - The data models are object-oriented and were created using an MDA approach.
- Comparison to other national or international standards shows that overall complexity is in line with expectations
- XML schema ia still the only established mainstream technology for a formal definition of data exchange formats
  - Significant tooling available

Easy INSPIRE Extensions

- Touch-friendly View
  - Based on UML Model
- Recommendation Engine
- Easy re-use of components of other schemas/models
- Supports subset of UML/XSD concepts
  - Classes, Choices, Enumerations
  - Interhitance, Aggregation, Reference



Work on Alternate Encodings (GeoJSON)

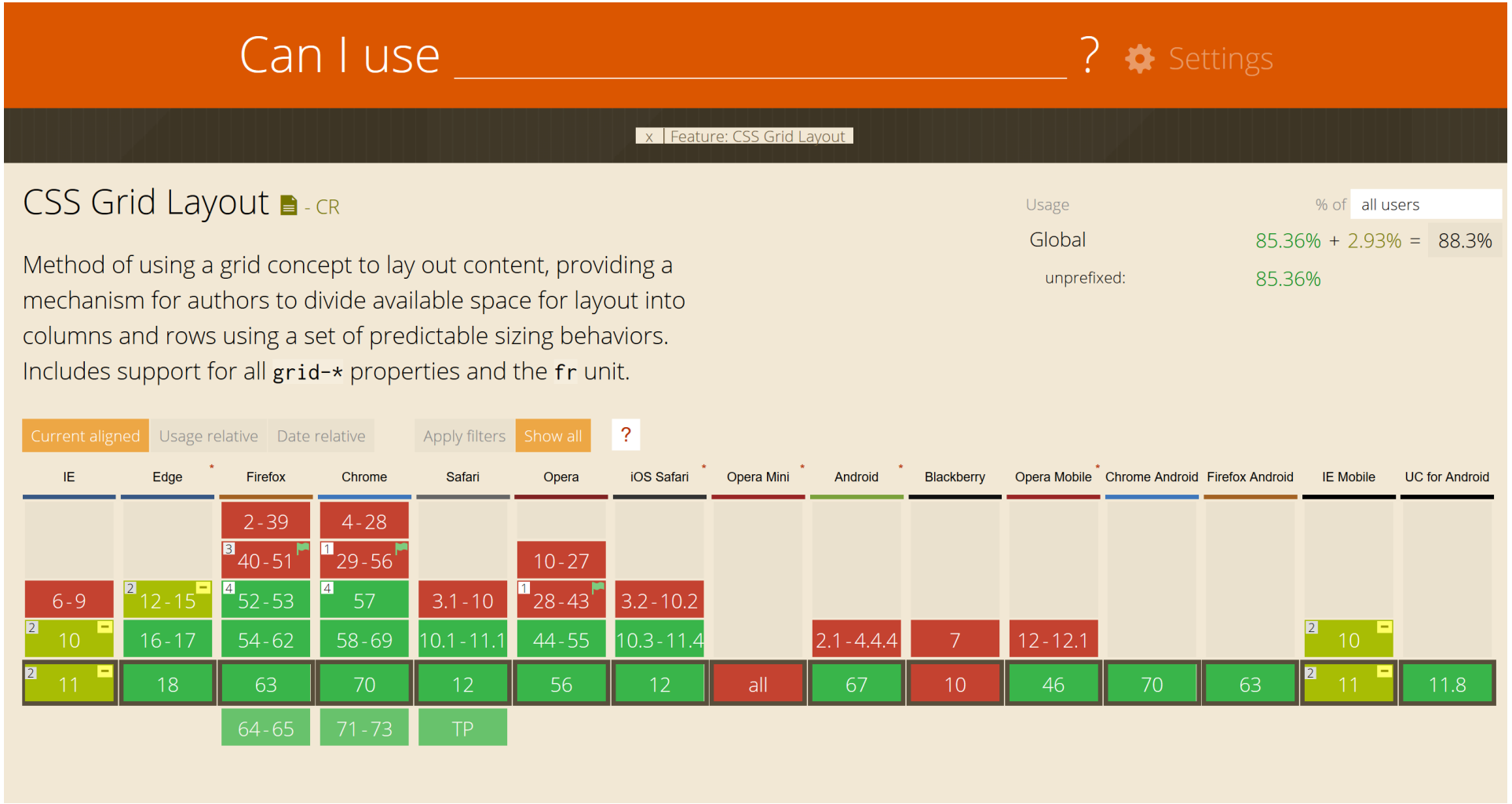
November 2018 to June 2019

Outline for an Alternate Encoding

- Scope
  - Use Cases
  - INSPIRE Themes
  - Cross-cutting INSPIRE requirements
- General Encoding Rules
- Conformance Classes
- Mapping to the Default encoding
- ATS/ETS, Examples

- Optional: Model Transformations (for Simplification, Flattening)

How can the encoding be used?



What to optimize the encoding for?

- What general and/or domain specific use case(s) was the encoding in the example developed for?
- Usability in current applications
- What INSPIRE themes would it be suitable for?
- Which specific technical problems does this encoding solve?
- Which INSPIRE general encoding and data specification requirements does it address?
  - Should the encoding be applicable to all themes, including those that use 3D geoemtries, coverages/TINs, Topologies, …?
- What clients or other software was this encoding tested with? What were the results?

Questions? Feedback?

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