INSPIRE Good Practices: GeoPackage encoding and additional candidates

JRC INSPIRE Team

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GeoPackage Good practice - initiation

This Good Practice (GP) describes a mechanism to create INSPIRE data sets encoded using the OGC GeoPackage encoding standard. These data sets will be compliant with the INSPIRE Implementing Rules (IR), and technical compliance can be shown through transformation to the default encoding (GML). In this perspective, the GeoPackage can be used both as an additional and an alternative encoding for INSPIRE data sets.

Intended outcome is that various communities of INSPIRE implementers create logical data models for GeoPackage for a wide range of INSPIRE themes and use cases. To make sure interoperability and compliance are guaranteed, all these implementers rely on the common process and set of rules described in this good practice.

Main benefits of the Good Practice

to Data Providers:

- the relatively simple data models focus on key values, which simplify data harmonisation as compared to creating full INSPIRE GML
- more robust encoding based on the use of templates reduces number of schema and encoding errors
- usability and re-usability of provided data is considerably improved
- GeoPackage files can handle large number of features in a smaller file size, hence the sharing of entire data sets, sized medium to large is facilitated.

to Data Users:

- the simplified data model aligns directly with use cases
- GeoPackage encoded data can be directly used in GIS tools without any ETL process, with good performance. The data consumption experience is considerably improved with possibility to directly edit/update data, create views and store styles
- loading data on GIS or making queries on the file database is faster, since the vector layers in geopackage are inherently rtree indexed (spatial indexing).

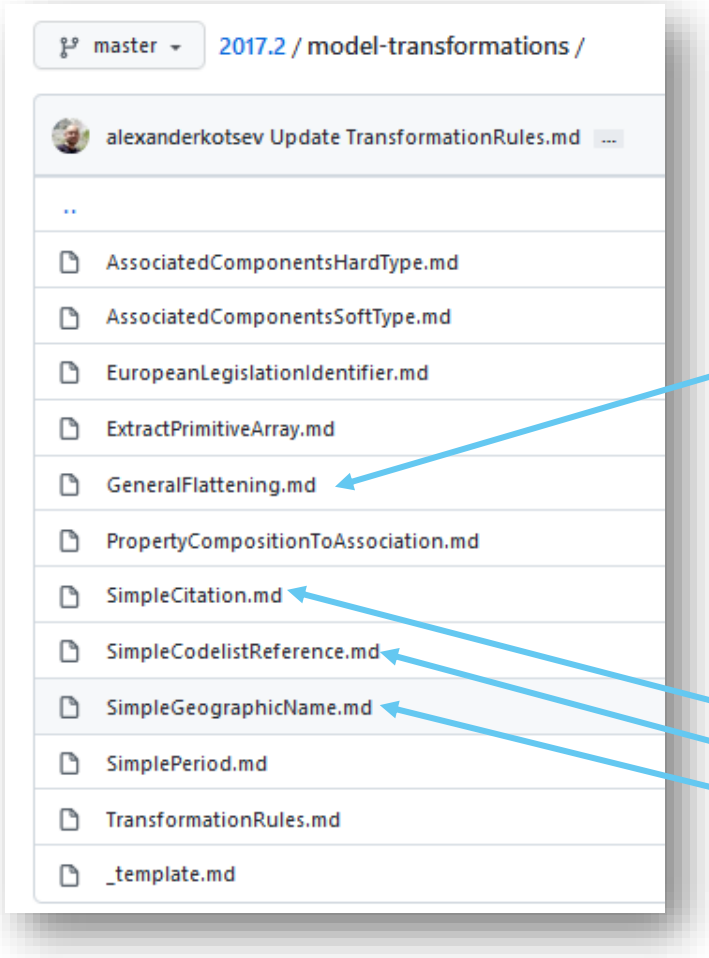
GeoPackage Good practice - initiation

For any GeoPackage logical schema to be accepted as specific implementation of this GP, the following resources must be created:

- A description of the logical model, its relevance and expected benefits, its implementations and its limitations compared to the default encoding
- An empty GeoPackage template file
- A formal, executable specification of the *UML-to-Geopackage* model transformation or *the GML-to-GeoPackage* model transformation referencing and conforming to the generic INSPIRE model transformation rules in the INSPIRE-MIF model-transformation-rules repository. These *generic INSPIRE model transformation rules* are encoding-agnostic and will/may be underpinning the development of different encodings for INSPIRE data. These will in turn be described in their own, encoding-specific INSPIRE-MIF repositories. The gp-geopackage-encodings repository is the encoding-specific repository for this GP.
- The *executable specification* can be delivered in any form that takes a computer-readable model as input and creates a computer-readable model as output. They need to be documented in such a way that the mapping is human-readable. Examples include an annotated *ShapeChange* configuration, an *XSLT*, or *a hale studio* model transformation.
- A formal, *executable model for data transformation* that allows to transform a data set encoded as GeoPackage to the default encoding. This can be delivered as an ETL workbench (e.g. hale studio transformation project, FME workbench), as a standalone program or as a service. In all cases, the executable model must be documented in a human-readable form.

Generic rules (encoding agnostic) → encoding-specific rules (e.g., GPKG)→ use-case specific rules (e.g., END rules)

Generic INSPIRE transformation rules



Specific GPKG Transformation Rules

To transform the streamlined or full conceptual models to logical GeoPackage schemas, several transformation rules are applied. Some have a **general scope and are specified in the** INSPIRE Action 2017.2 (Alternative Encodings) Model Transformation Rules, some have been refined in the INSPIRE UML-to-GeoPackage encoding rule, and others have been developed specifically in the scope of the END GeoPackage work, though they might also be applied elsewhere. …..

Specific END GPKG Transformation Rules

Flatten hierarchical structures with property name limit (MT_ENDGPK01)

This rule is based on the General Flattening rule and the GeoPackage flattening rule. It modifies these rules to optimize data usability in different geographic information system software. In these applications, usability is reduced when property names are long, so this rule applies a maximum length of 31 characters for property names.
To stay within this maximum property name length, this model transformation rule is often combined with:

1. Substitution of complex types through simpler types:
   a. Simple Citation
   b. Simple Codelist Reference
   c. Simple Geographic Name
   d. Simplified Localized Character String
2. Usage of related tables for elements where the allowed cardinality is greater than 1

GeoPackage Good practice - initiation

Concrete implementations

- **EEA END reporting** (extension of *Transport Networks*, *Human Health and Safety*, and *Area Management/Restriction/Regulation Zones and Reporting Units* data themes). Guidelines, Video tutorials, Reporting examples and Validation Rules available in dedicated section of the Eionet Portal ; available also pre-defined GeoPackage templates and the END Data model documentation aligning END reporting requirements with the INSPIRE data models and the source for creating GeoPackage encoding rules and templates

- **HaDEA GO-PEG project:** GO-DEPTH use case (extension of Geology data theme), building on the EEA END reporting approach and developed in cooperation with ISPRA (Italian Institute for Environmental Protection and Research). Video and presentation used during the GO-PEG workshop “Keeping the pace with INSPIRE developments: alternative encodings for INSPIRE and new features in hale studio” available here. A geological 3D model of the Po Basin data set, which implements this GP, is downloadable via OGC API service here

Optimal use case:

delivery of entire datasets sized medium to large

SpatioTemporal Asset Catalog (STAC)

The STAC Specification aim to describe information about the earth at a certain place and time (SpatioTemporal Asset file) making it easier to be indexed and discovered. Examples of SpatioTemporal Asset files are remotely-sensed imagery, SAR, Point Clouds, Data Cubes, Full Motion Video, hyperspectral, LiDAR and derived data like NDVI, Digital Elevation Models, mosaics, etc.

- 4 semi-independent specifications:
  - **STAC Item** → single spatiotemporal asset as GeoJSON feature + datetime + links.
  - **STAC Catalog** → JSON file of links that provides a structure to organize and browse STAC Items
  - **STAC Collection** → extends STAC Catalog with additional information such as the extents, license, keywords, providers, etc.
  - **STAC API** → RESTful endpoint that enables search of STAC Items. STAC API implements and extends the OGC API- Features - e.g., constraining 'features' to require time as well as space, and to always link to an 'asset'. Ongoing work for STAC API to become a full OGC standard

Expected benefit: facilitate the way geospatial assets are exposed online, searched for and queried.

STAC SpatioTemporal Asset Catalog

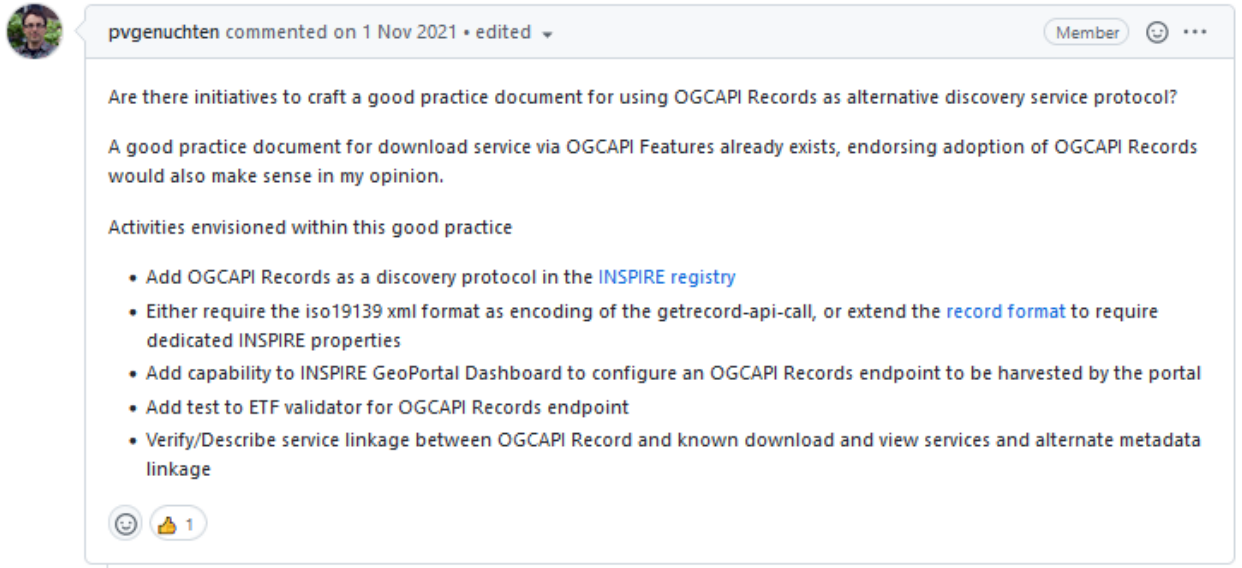
https://stacspec.org/

OGC API - Records

OGC API - Records is a multi-part **draft specification** aimed at enabling the creation, modification and query of metadata on the web.

Current specification (Part 1) covers read-only access to records and simple query capabilities. Capabilities for richer queries or to create, update or delete records will be specified in additional parts.

GP proposed in the *INSPIRE-MIF/helpdesk* repository: https://github.com/INSPIRE-MIF/helpdesk/issues/66



Expected benefit: enable capability to create, modify, and query metadata on the Web.

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https://ogcapi.ogc.org/records/

OGC Vector Tiles

Vector Tiles is a technology that optimizes delivering vector data over the web to create maps. The OGC has coordinated several initiatives to advance the use of Vector Tiles. Current strategy is to advance Vector Tiles extensions in current OGC standards.

Several demos available for WMS, WMTS, WFS, Web API e.g.

- GeoSolutions_VTP Extension_WMTS GeoServer Service with MapStore Client
- GeoSolutions VTP Extension WMS GeoServer Service with MapStore Client
- interactive instruments_VTP Extension_WFS Server Demo
- interactive instruments - Vector Tiles Web API

More advanced work is the **Vector Tiles Pilot Phase 2** aimed *to deliver an architecture for vector tiles based on feature and tile servers, and GeoPackage*. Engineering Reports generated from the Pilot, not yet approved for public release

Expected benefit: Enable faster map loads (reducing size) and flexible styling with modern, easy-to-use tools.

https://www.ogc.org/projects/initiatives/vt-pilot-2018

https://www.ogc.org/projects/initiatives/vtp2

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Thank you!

European Commission