



The SpatioTemporal Asset Catalog

Geosoftware II

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Outline

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Introduction

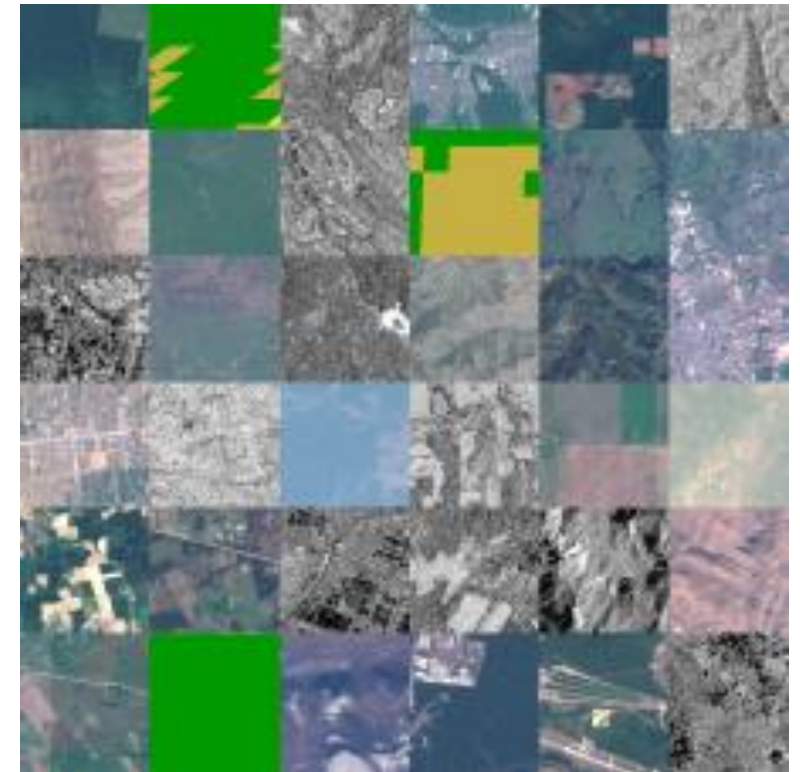
"The STAC Specification is a common language to describe geospatial information, so it can more easily be worked with, indexed, and discovered."

<https://stacspec.org/en/>

Introduction



- STAC ↔ STAC Specification
- SpatioTemporal Assets + Catalogs
- Base: JSON files
- Origin: Satellite imagery
- Today: variety of spatiotemporal uses

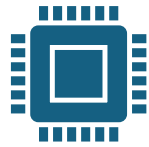


<https://eod-grss-ieee.com/dataset-search>

Overview



Common metadata



**For data providers,
developers and users**



Four core components:

Item, Catalog, Collection, (API)



Data examples:

Imagery, SAR, LiDAR, data cubes, full
motion videos

Overview



What is STAC?

Key words

- standard
- structure
- describing
- cataloging
- queryable
- accessible
- interoperable
- customizable
- flexible
- extensible
- persistent
- reliable

Overview

Why is STAC relevant?

- Makes data queryable and searchable
 - Due to standards for common metadata
- More reuse of code
 - Less new code must be written
- Easy implementable and customizable
 - accessible for many providers, developers and users

Overview



How does STAC work?

- Metadata in standardized structure
- Network of JSON files (links)
- Four core components
 - specifications

```
"links": [  
  {  
    "rel": "root",  
    "href": "../catalog.json",  
    "type": "application/json"  
  },  
]
```

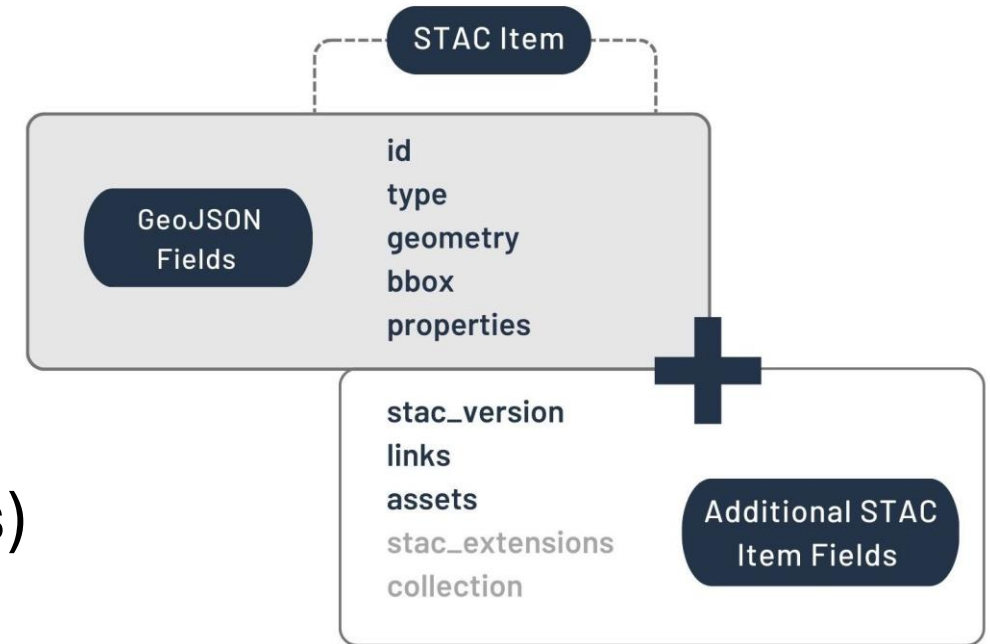
<https://github.com/radiantearth/stac-spec/blob/master/examples/catalog.json>

Overview



Core Components: Item

- Fundamental, core atomic unit
- GeoJSON
- One or more spatiotemporal asset(s)
- Fields:
 - GeoJSON fields: id, type, geometry, bbox
 - STAC item fields: stac_version, links, assets, collections



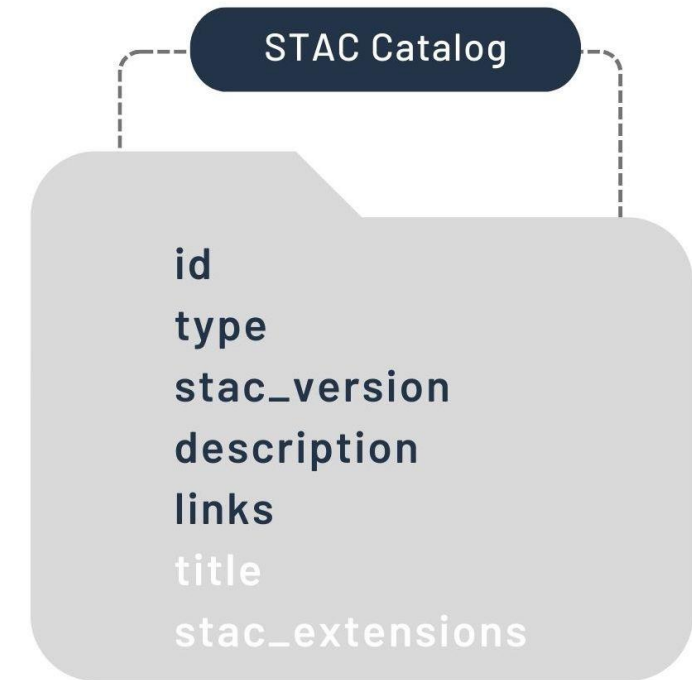
<https://stacspec.org/en/tutorials/intro-to-stac/>

Overview



Core Components: Catalog

- Links various STAC items together
- Contains lists of:
 - STAC items
 - Child STAC catalogs
- Can be linked with items, collections and other catalogs



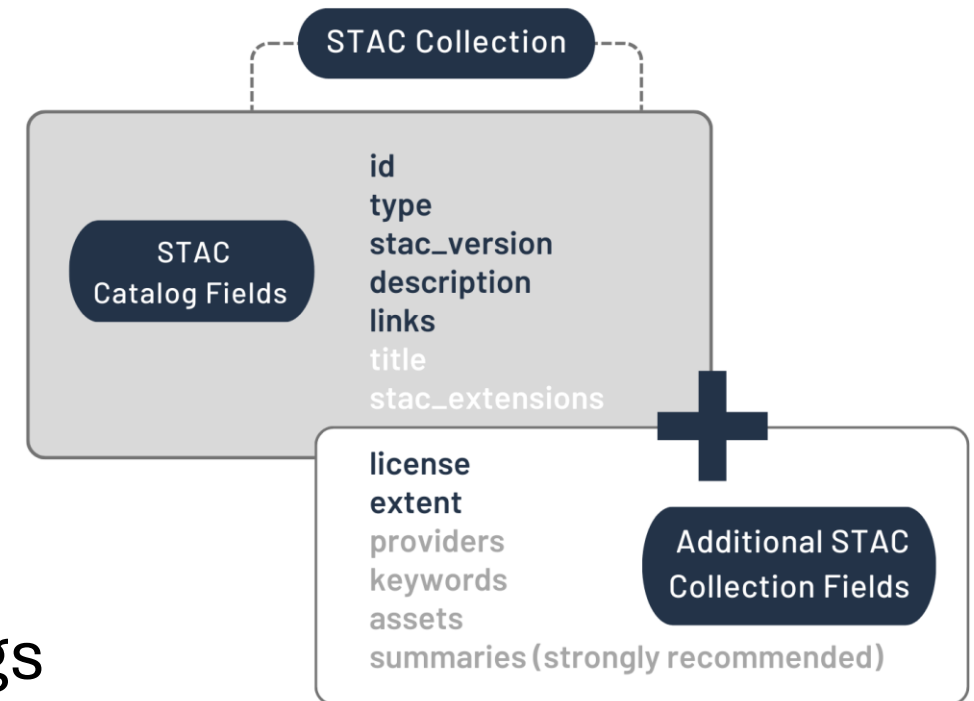
<https://stacspec.org/en/tutorials/intro-to-stac/>

Overview



Core Components: Collection

- Common additional information
- Consists of assets
 - Same properties on higher level
- Additional fields
- As standalone: describing data holdings

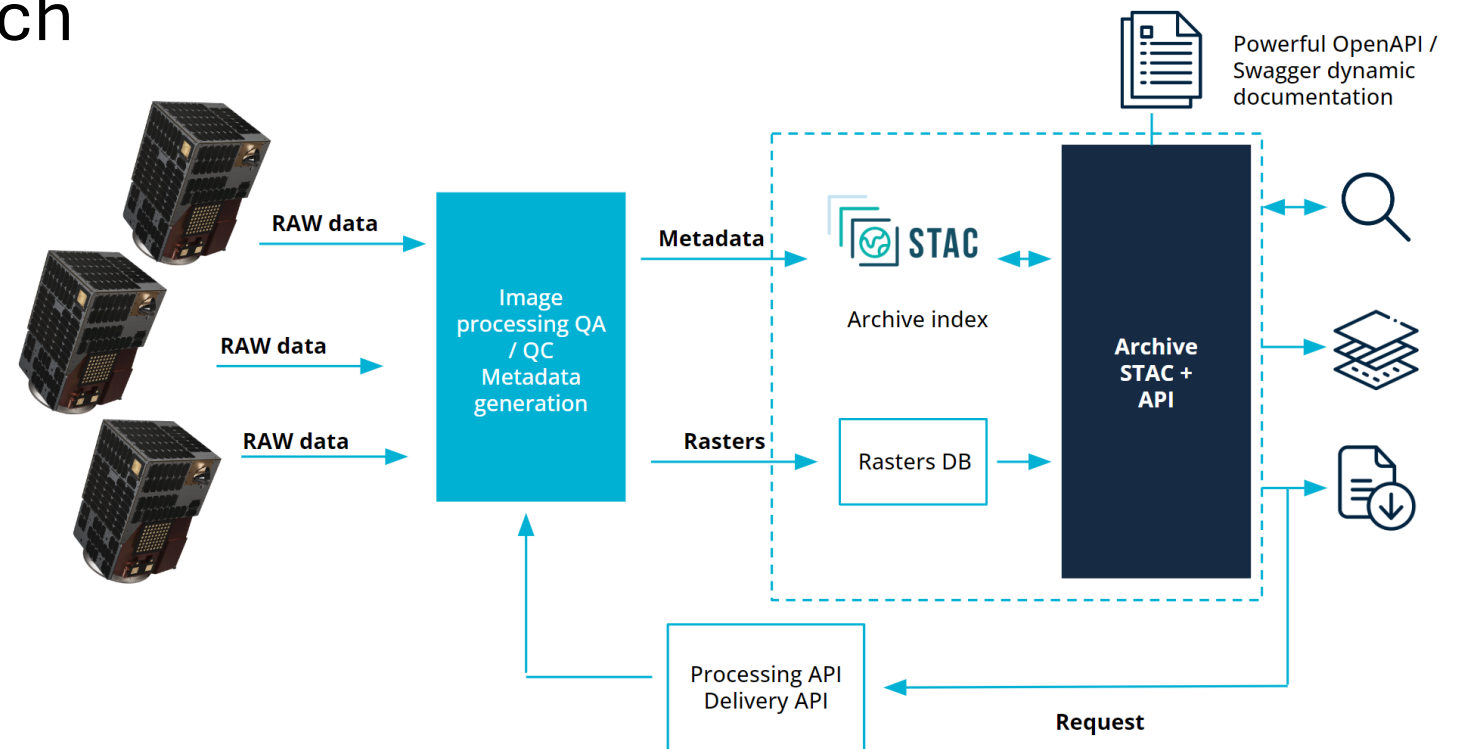


<https://stacspec.org/en/tutorials/intro-to-stac/>

Overview

Core Components: API

- Service interface for search
- Dynamic system
- Access to STAC objects stored in a database
- Processes requests
- Delivers results



<https://developers.satellogic.com/archive-service/introduction.html>

STAC Extensions



- Add specific metadata
 - Use cases
 - More detail
- Mostly hosted on GitHub
- Base: JSON schema with properties and definitions for extensions

```
{  
  "properties": {  
    "eo:cloud_cover": {  
      "type": ["array", "object"],  
      "items": {  
        "$ref": "#/definitions/eo:cloud_cover"  
      }  
    }  
  }  
}
```

<https://github.com/stac-extensions/eo/blob/main/json-schema/schema.json>

STAC Extensions



eo: Electro-optical Extension

- For EO data
- Specified on the electro-optical field
 - Platform, physical conditions, bands

```
"properties": {  
  "collection": "landsat-8-l1",  
  "datetime": "2018-10-01T01:08:32.033Z",  
  "eo:cloud_cover": 78,  
  "eo:sun_azimuth": 168.8989761,  
  "eo:sun_elevation": 26.32596431,  
  "landsat:path": 107,  
  "landsat:row": 18,  
  "eo:gsd": 30,  
  "eo:platform": "landsat-8",  
  "eo:instrument": "oli_tirs",  
  "eo:off_nadir": 0,  
  "eo:bands": [  
    {  
      "name": "B1",  
      "common_name": "coastal",  
      "gsd": 30,  
      "center_wavelength": 0.44,  
      "full_width_half_max": 0.02  
    },  
  ],  
}
```

<https://github.com/radiantearth/stac-spec/blob/v0.8.1/extensions/eo/examples/example-landsat8.json>

STAC Extensions



mlm: Machine Learning Model Extension

- To describe:
 - ML models
 - Training details
 - Inference runtime requirements
- Mostly combined with other extensions

```
properties": {  
  "description": "Basic STAC Item with only the MLM extension",  
  "datetime": null,  
  "start_datetime": "1900-01-01T00:00:00Z",  
  "end_datetime": "9999-12-31T23:59:59Z",  
  "mlm:name": "example-model",  
  "mlm:tasks": [  
    "classification"  
  ],  
  "mlm:architecture": "ResNet",  
  "mlm:input": [  

```

https://github.com/stac-extensions/mlm/blob/main/examples/item_basic.json

Conclusion and discussion

Advantages

- Improves providing, developing and using
- Enables increased accessibility and interoperability
- Many examples and use cases are already covered
- Core is simple
- Concept is flexible and customizable

Conclusion and discussion

Disadvantages

- Much work to make all data STAC compliant
- Spatiotemporal data is only one special type of data
- Limited by available libraries and tools

Conclusion and discussion

Discussion

- How to get the community bigger, how far can it grow with voluntary work and the OS base?
- How to expand to more disciplines? Is it even compatible?
- How to generalize or automatize to get faster steps forward for more availabilities?

Sources



- Stacspec
 - <https://stacspec.org/en/>
 - <https://stacspec.org/en/about/>
 - <https://stacspec.org/en/about/stac-spec/>
 - <https://stacspec.org/en/tutorials/intro-to-stac/>
- GitHub
 - <https://stac-extensions.github.io/>
 - <https://github.com/radiantearth/stac-spec/>
 - <https://github.com/radiantearth/stac-api-spec/>
 - <https://github.com/stac-extensions/eo>
 - <https://github.com/stac-extensions/mlm>
- Others
 - <https://gogeomatics.ca/spatiotemporal-asset-catalogs-enabling-online-search-and-discovery-of-geospatial-assets/>
 - <https://learn.microsoft.com/de-de/azure/orbital/organize-stac-data>
 - <https://developers.satellogic.com/archive-service/introduction.html>
 - <https://www.earthdata.nasa.gov/esdis/esco/standards-and-practices/stac>