

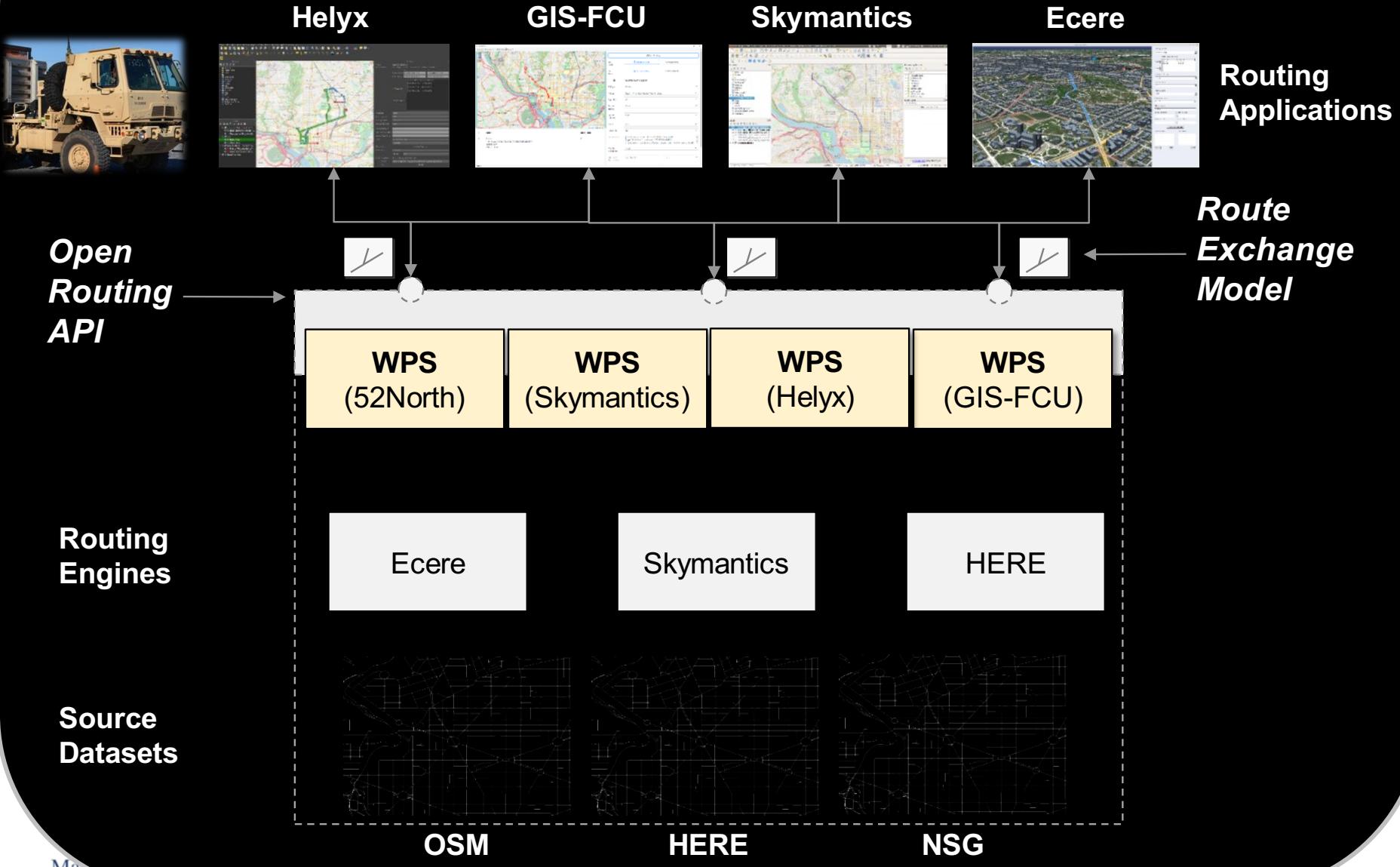
Sponsor

**AIRBUS**

# **Route Ontology and Encoding**

113th OGC Technical Committee  
Toulouse, France  
Clemens Portele  
20 November 2019

# Open Routing API and Route Exchange Model...



# “Route Exchange Model” – Requirements

---



- Consistent with current OGC API implementations
- GeoJSON to benefit from existing tooling
- Support for fetching parts of a route in environments with low bandwidth or intermittent connectivity
- Modular and extensible

# A Route example

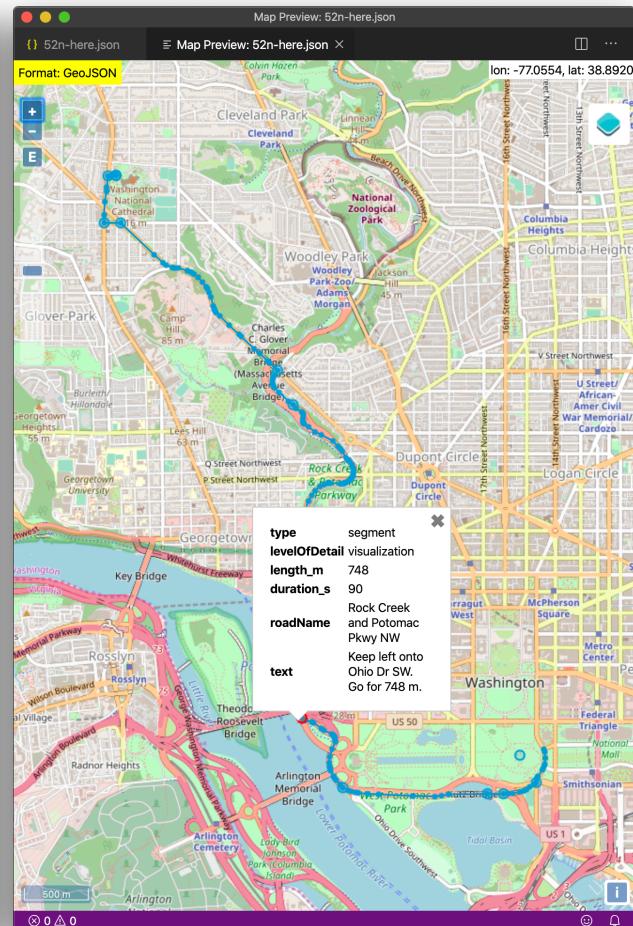
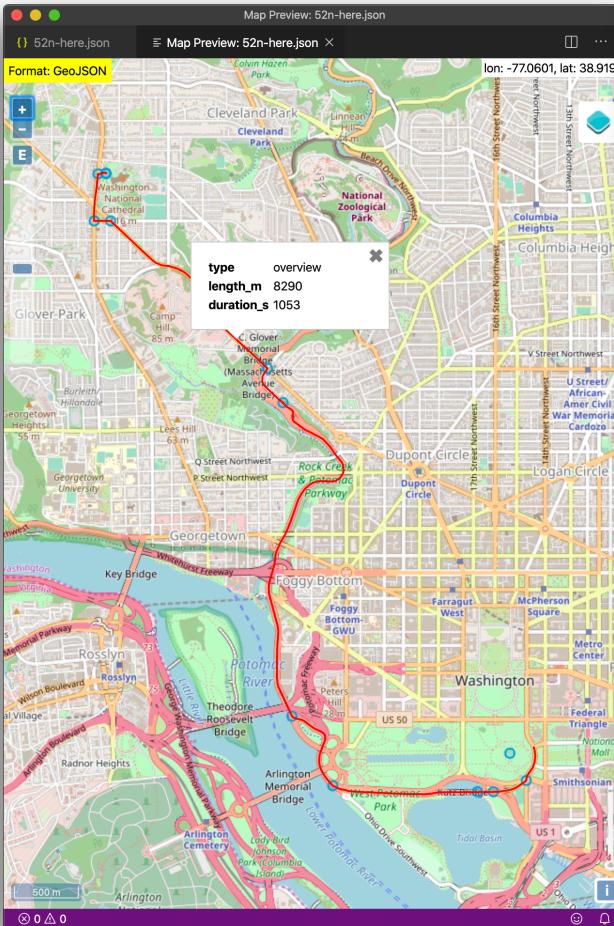


*in Visual Studio Code editor*

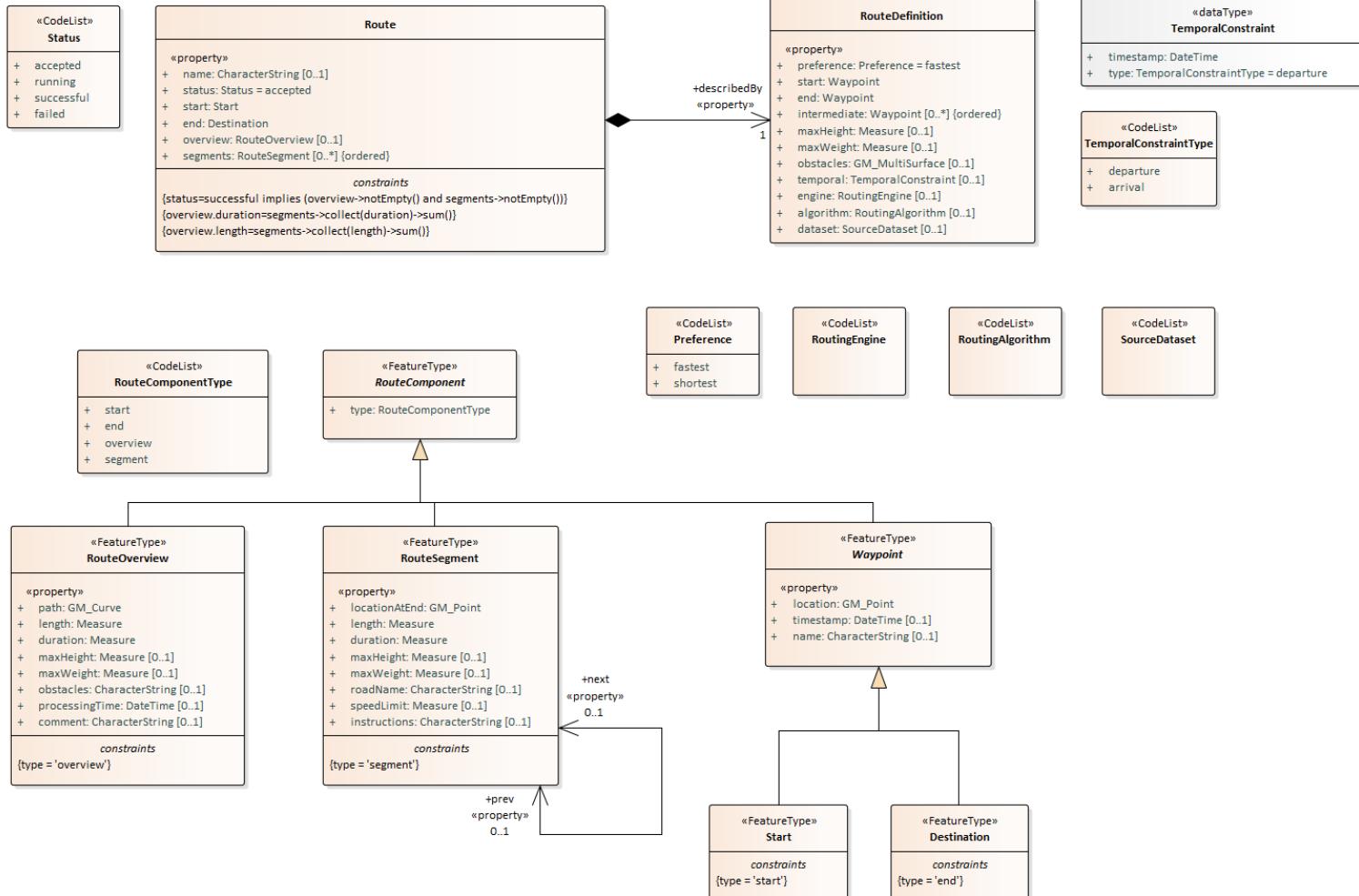
52n-here.json

```
tele > Events > 191115-OGC-TC-Toulouse > Routes > (1) 52n-here.json > [ ] features > {} 0 > {} properties
1 {
2   "type": "FeatureCollection",
3   "status": "successful",
4   "features": [
5     {
6       "type": "Feature",
7       "properties": {
8         "type": "overview",
9         "length_m": 8290,
10        "duration_s": 1053
11      },
12      "geometry": {
13        "type": "LineString",
14        "coordinates": [
15        ]
16      },
17      "bbox": [...]
18    },
19    {
20      "type": "Feature",
21      "properties": {
22        "type": "start"
23      },
24      "geometry": {
25        "type": "Point",
26        "coordinates": [
27          -77.0721,
28          38.9309
29        ]
30      }
31    },
32    {
33      "type": "Feature",
34      "properties": {
35        "type": "segment",
36        "levelOfDetail": "visualization",
37        "length_m": 70,
38        "duration_s": 46,
39        "instructions": "continue",
40        "text": "Head north on North Rd. Go for 70 m."
41      },
42      "geometry": {
43        "type": "Point",
44        "coordinates": [
45          -77.0721011,
46          38.9308998
47        ]
48      }
49    }
50  ],
51  "type": "FeatureCollection",
52  "status": "successful",
53  "features": [
54    {
55      "type": "Feature",
56      "properties": {
57        "type": "overview",
58        "length_m": 8290,
59        "duration_s": 1053
60      }
61    }
62  ]
63 }
```

Ln 9, Col 26   Spaces: 2   UTF-8   LF   JSON



# Route Model





# Route Ontology ?

---

- An ontology could be abstracted from the Route Model and the Routing API specified in the pilot
  - Does not cover everything as the pilot has covered only a selected set of use cases and requirements
- Consistency with the Route Exchange Model and the continued use of GeoJSON is important
  - It should be possible to amend the GeoJSON with a JSON-LD context based on the ontology
  - Requires JSON-LD 1.1 due to the use of nested lists for geometries

# Step 1: Derive the vocabulary from the Route Model



```
1 @prefix rte: <https://raw.githubusercontent.com/cportele/route/master/route#> .
2 @prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
3 @prefix owl: <http://www.w3.org/2002/07/owl#> .
4 @prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
5 @prefix skos: <http://www.w3.org/2004/02/skos/core#> .
6 @prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .

7
8 rte:Route
9     a           owl:Class ;
10    skos:definition "A way to get from a starting point to a destination."@en .
11
12 rte:RouteComponent
13    a           owl:Class ;
14    skos:definition "A component of the route."@en ;
15    rdfs:comment "For example, an overview of the complete route or a segment or waypoint along the route."@en .

16
17 rte:RouteOverview
18    a           owl:Class ;
19    rdfs:subClassOf rte:RouteComponent ;
20    skos:definition "An overview of the complete route from start to destination with the main properties of the route."@en .

21
22 rte:RouteSegment
23    a           owl:Class ;
24    rdfs:subClassOf rte:RouteComponent ;
25    skos:definition "An overview of the complete route from start to destination with the main properties of the route."@en .

26
27 rte:Waypoint
28    a           owl:Class ;
29    rdfs:subClassOf rte:RouteComponent ;
30    skos:definition "An overview of the complete route from start to destination with the main properties of the route."@en .

31
32 rte:Start
33    a           owl:Class ;
```

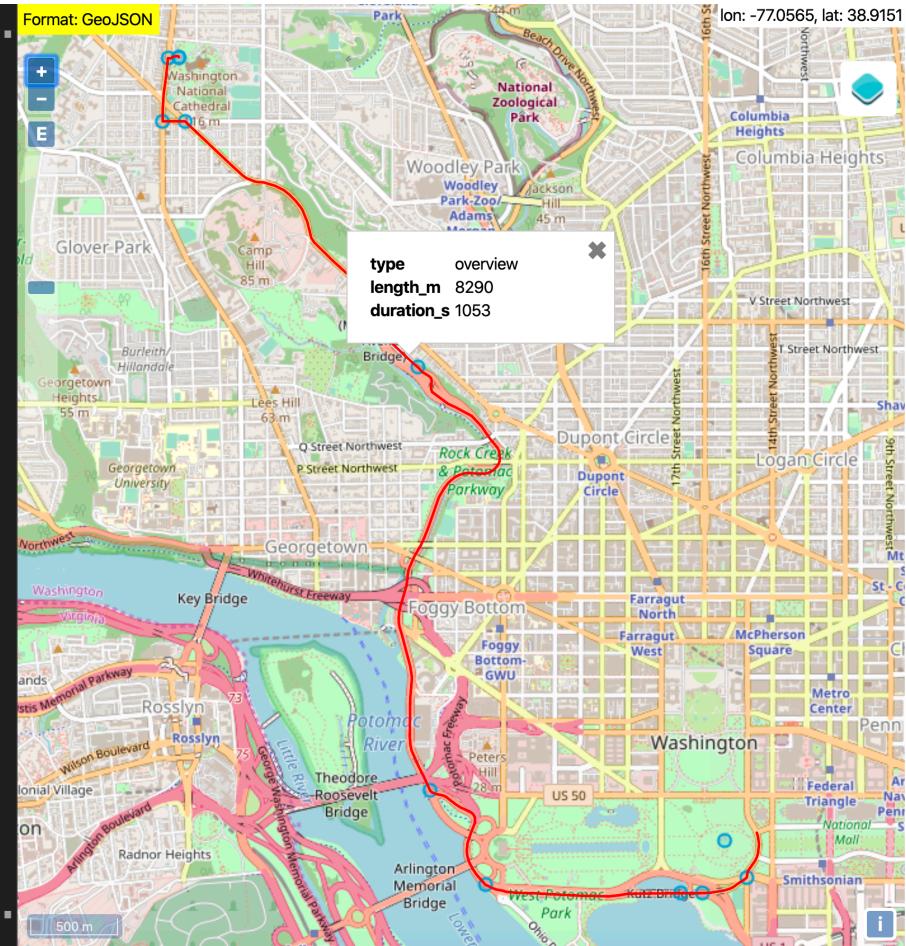
# Step 2:

## Define a context, amend the GeoJSON



Users > portele > Documents > GitHub > ogc > route > 52n-here.jsonld > ...

```
1      "@context": {  
2          "@version": 1.1,  
3          "geojson": "https://purl.org/geojson/vocab#",  
4          "rte": "https://raw.githubusercontent.com/cportele/route/master/route#",  
5          "Feature": "geojson:Feature",  
6          "FeatureCollection": "geojson:FeatureCollection",  
7          "GeometryCollection": "geojson:GeometryCollection",  
8          "LineString": "geojson:LineString",  
9          "MultiLineString": "geojson:MultiLineString",  
10         "MultiPoint": "geojson:MultiPoint",  
11         "MultiPolygon": "geojson:MultiPolygon",  
12         "Point": "geojson:Point",  
13         "Polygon": "geojson:Polygon",  
14         "bbox": {  
15             "@container": "@list",  
16             "@id": "geojson:bbox"  
17         },  
18         "coordinates": {  
19             "@container": "@list",  
20             "@id": "geojson:coordinates"  
21         },  
22         "features": {  
23             "@container": "@set",  
24             "@id": "geojson:features"  
25         },  
26         "geometry": "geojson:geometry",  
27         "id": "@id",  
28         "properties": "@nest",  
29         "name": "rdfs:label",  
30         "status": "rte:status",  
31         "length_m": "rte:length",  
32         "duration_s": "rte:duration",  
33         "instructions": "rte:instructions",  
34         "text": "rte:text",  
35         "roadName": "rte:roadName"  
36     },  
37     "type": "FeatureCollection",  
38     "id": "https://api.example.com/v1/routes/4711",  
39     "@type": [
```



# Same document in GitHub



cporete / route

Code Issues 0 Pull requests 0 Actions Projects 0 Wiki Security Insights Settings

Branch: master route / 52n-here.json Find file Copy path

cporete Add sample route 4865a0c 3 minutes ago

1 contributor

1058 lines (1058 sloc) | 30.2 KB

Raw Blame History

Mapbox © Mapbox © OpenStreetMap Improve the underlying map

Brookmont Cleveland Park University Heights

Lower Potomac River

Independence Ave SW

Turn slightly left onto 15th St SW.  
Go for 282 m.

type segment  
levelOfDetail visualization  
length\_m 282  
duration\_s 73  
roadName Independence Ave SW  
text Turn slightly left onto 15th St SW.  
Go for 282 m.

# Same document in the JSON-LD Playground showing the semantic annotations



JSON-LD Input    Options    Document URL

```
{
  "@context": {
    "@version": 1.1,
    "geojson": "https://purl.org/geojson/vocab#",
    "rte": "https://raw.githubusercontent.com/cportele/route/master/route#",
    "Feature": "geojson:Feature",
    "FeatureCollection": "geojson:FeatureCollection",
    "GeometryCollection": "geojson:GeometryCollection",
    "LineString": "geojson:LineString",
    "MultiLineString": "geojson:MultiLineString",
    "MultiPoint": "geojson:MultiPoint",
    "MultiPolygon": "geojson:MultiPolygon",
    "Point": "geojson:Point",
    "Polygon": "geojson:Polygon",
    "bbox": {
      "@container": "@list",
      "@id": "geojson:bbox"
    },
    "coordinates": {
      "@container": "@list",
      "@id": "geojson:coordinates"
    },
    "features": {
      "@container": "@set",
      "@id": "geojson:features"
    }
  }
}
```

Expanded   Compacted   Flattened   Framed   N-Quads   Normalized   Table   Visualized   Signed with RSA   Signed with Bitcoin

```
[
  {
    "@type": [
      "https://purl.org/geojson/vocab#FeatureCollection",
      "https://raw.githubusercontent.com/cportele/route/master/route#Route"
    ],
    "https://purl.org/geojson/vocab#features": [
      {
        "@type": [
          "https://purl.org/geojson/vocab#Feature",
          "https://raw.githubusercontent.com/cportele/route/master/route#RouteOverview"
        ],
        "https://purl.org/geojson/vocab#bbox": [
          {
            "@list": [
              {
                "@value": -77.0731902
              },
              {
                "@value": 38.8867736
              },
              {
                "@value": -77.0328605
              }
            ]
          }
        ]
      }
    ]
  }
]
```

# Some open issues

---



- What media type to use for such documents?
  - application/geo+json – it works wherever GeoJSON works
  - application/ld+json – it has semantic annotations
- GeoJSON has a predefined context that I could have referenced directly, but I wanted to deviate from it
  - Use JSON-LD 1.1 (lists of lists, support for @nest)
  - Support multiple values for @type
- How to handle a JSON representation of Web Links based on RFC 8288 in a JSON-LD context?