

Independent
Internet-Draft
Intended status: Informational
Expires: July 12, 2014

H. Butler
Hobu Inc.
M. Daly
Cadcorp
A. Doyle
MIT
S. Gillies
Mapbox Inc.
T. Schaub
OpenGeo
S. Drees

January 8, 2014

The GeoJSON Format
draft-butler-geojson-00

Abstract

GeoJSON is a geospatial data interchange format based on JavaScript Object Notation (JSON). It defines several types of JSON objects and the manner in which they are combined to represent data about geographic features, their properties, and their spatial extents. This document recommends a single coordinate reference system based on WGS 84. Other coordinate reference systems are not recommended.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on July 12, 2014.

Copyright Notice

Copyright (c) 2014 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction	3
1.1.	Requirements Language	3
1.2.	Conventions Used in This Document	4
1.3.	Definitions	4
1.4.	Example	4
2.	GeoJSON Object	6
2.1.	Geometry Object	6
2.1.1.	Position	6
2.1.2.	Point	7
2.1.3.	MultiPoint	7
2.1.4.	LineString	7
2.1.5.	MultiLineString	7
2.1.6.	Polygon	7
2.1.7.	MultiPolygon	8
2.1.8.	Geometry Collection	8
2.2.	Feature Object	8
2.3.	Feature Collection Object	8
3.	Coordinate Reference System Object	8
3.1.	Named CRS	9
3.2.	Linked CRS	9
4.	Bounding Box	10
5.	Security Considerations	11
6.	IANA Considerations	11
7.	References	11
7.1.	Normative References	11
7.2.	Informative References	12
Appendix A.	Geometry Examples	12
A.1.	Point	12
A.2.	LineString	12
A.3.	Polygon	12
A.4.	MultiPoint	13
A.5.	MultiLineString	14
A.6.	MultiPolygon	14
A.7.	GeometryCollection	15
Appendix B.	Contributors	16
	Authors' Addresses	16

1. Introduction

GeoJSON is a format for encoding data about geographic features using JavaScript Object Notation (JSON) [[RFC4627](#)]. The format is concerned with features in the broadest sense; any thing with qualities that are bounded in geographical space may be a feature whether it is a physical structure or not. The concepts in GeoJSON are not new; they are derived from pre-existing open geographic information system standards (for COM, SQL, and XML) and have been streamlined to better suit web application development using JSON.

GeoJSON comprises the seven concrete geometry types defined in the OpenGIS Simple Features Implementation Specification for SQL [[SFSQL](#)]: 0-dimensional Point and MultiPoint; 1-dimensional curve LineString and MultiLineString; 2-dimensional surface Polygon and MultiPolygon; and the heterogeneous GeometryCollection. GeoJSON representations of instances of these geometry types are analogous to the well-known binary (WKB) and text (WKT) representations described in that same specification.

GeoJSON also comprises the types Feature and FeatureCollection. Feature objects in GeoJSON contain a geometry object with one of the above geometry types and additional properties. A FeatureCollection object contains an array of feature objects. This structure is analogous to that of the Web Feature Service (WFS) response to GetFeatures requests specified in [[WFSv1](#)] or to a KML Folder of Placemarks [[KMLv2.2](#)]. Some implementations of the WFS specification also provide GeoJSON formatted responses to GetFeature requests, but there is no particular service model or feature type ontology implied in the GeoJSON format specification.

Since its initial publication in 2008 [[GeoJSON](#)], the GeoJSON format specification has steadily grown in popularity. It is widely used in JavaScript web mapping libraries, JSON-based document databases, and web APIs.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

1.2. Conventions Used in This Document

The ordering of the members of any JSON object defined in this document MUST be considered irrelevant, as specified by [[RFC4627](#)].

Some examples use the combination of a JavaScript single line comment (//) followed by an ellipsis (...) as placeholder notation for content deemed irrelevant by the authors. These placeholders must of course be deleted or otherwise replaced, before attempting to validate the corresponding JSON code example.

Whitespace is used in the examples inside this document to help illustrate the data structures, but is not required. Unquoted whitespace is not significant in JSON.

1.3. Definitions

- o JavaScript Object Notation (JSON), and the terms object, name, value, array, number, true, false, and null are to be interpreted as defined in [[RFC4627](#)].
- o Inside this document the term "geometry type" refers to the seven case-sensitive strings: "Point", "MultiPoint", "LineString", "MultiLineString", "Polygon", "MultiPolygon", and "GeometryCollection".
- o As another shorthand notation the term GeoJSON types refers to the nine case-sensitive strings "Feature", "FeatureCollection" and the geometry types listed above.

1.4. Example

A GeoJSON feature collection:


```
{
  "type": "FeatureCollection",
  "features": [{
    "type": "Feature",
    "geometry": {
      "type": "Point",
      "coordinates": [102.0, 0.5]
    },
    "properties": {
      "prop0": "value0"
    }
  }, {
    "type": "Feature",
    "geometry": {
      "type": "LineString",
      "coordinates": [
        [102.0, 0.0],
        [103.0, 1.0],
        [104.0, 0.0],
        [105.0, 1.0]
      ]
    },
    "properties": {
      "prop0": "value0",
      "prop1": 0.0
    }
  }, {
    "type": "Feature",
    "geometry": {
      "type": "Polygon",
      "coordinates": [
        [
          [100.0, 0.0],
          [101.0, 0.0],
          [101.0, 1.0],
          [100.0, 1.0],
          [100.0, 0.0]
        ]
      ]
    },
    "properties": {
      "prop0": "value0",
      "prop1": {
        "this": "that"
      }
    }
  }
}]
}
```


2. GeoJSON Object

GeoJSON always consists of a single object. This object (referred to as the GeoJSON object below) represents a geometry, feature, or collection of features.

- o The GeoJSON object **MUST** have a member with the name "type". The value of the member **MUST** be one of the GeoJSON types.
- o The GeoJSON object **MAY** have any number of other members.
- o A GeoJSON object **MAY** have a "bbox" member, the value of which **MUST** be a bounding box array (see 4. Bounding Boxes).

2.1. Geometry Object

A geometry object is a GeoJSON object where the "type" value is one of the geometry types. A GeoJSON geometry object of any type other than "GeometryCollection" **MUST** have a member with the name "coordinates". The value of the coordinates member is always an array. The structure of the elements in this array is determined by the type of geometry.

2.1.1. Position

A position is the fundamental geometry construct. The "coordinates" member of a geometry object is composed of either:

- o one position (in the case of a Point geometry),
- o an array of positions (LineString or MultiPoint geometries),
- o an array of arrays of positions (Polygons, MultiLineStrings),
- o or a multidimensional array of positions (MultiPolygon).

A position is represented by an array of numbers. There **MUST** be two or more elements. The first two elements will be longitude and latitude, or easting and northing, precisely in that order and using decimal numbers. Altitude or elevation **MAY** be included as an optional third element.

Additional position elements **MAY** be included but **MUST** follow the three specified above and **MAY** be ignored by software. Interpretation and meaning of additional elements is beyond the scope of this specification.

Examples of positions and geometries are provided in "Appendix A. Geometry Examples".

2.1.2. Point

For type "Point", the "coordinates" member MUST be a single position.

2.1.3. MultiPoint

For type "MultiPoint", the "coordinates" member MUST be an array of positions.

2.1.4. LineString

For type "LineString", the "coordinates" member MUST be an array of two or more positions.

2.1.5. MultiLineString

For type "MultiLineString", the "coordinates" member MUST be an array of LineString coordinate arrays.

2.1.6. Polygon

To specify a constraint specific to polygons, it is useful to introduce the concept of a linear ring:

- o A linear ring is a closed LineString with 4 or more positions.
- o The first and last positions are equivalent (they represent equivalent points).
- o A linear ring is the boundary of a surface or the boundary of a hole in a surface.

Though a linear ring is not explicitly represented as a GeoJSON geometry type, it leads to a canonical formulation of the Polygon geometry type definition as follows:

- o For type "Polygon", the "coordinates" member MUST be an array of linear ring coordinate arrays.
- o For Polygons with more than one of these rings, the first MUST be the exterior ring and any others MUST be interior rings. The exterior ring bounds the surface and the interiors rings (if present) bound holes within the surface.

2.1.7. MultiPolygon

For type "MultiPolygon", the "coordinates" member MUST be an array of Polygon coordinate arrays.

2.1.8. Geometry Collection

A GeoJSON object with type "GeometryCollection" is a geometry object which represents a collection of geometry objects. A geometry collection MUST have a member with the name "geometries". The value corresponding to "geometries" is an array. Each element in this array is a GeoJSON geometry object.

2.2. Feature Object

A GeoJSON object with the type "Feature" is a feature object.

- o A feature object MUST have a member with the name "geometry". The value of the geometry member is a geometry object as defined above or a JSON null value.
- o A feature object MUST have a member with the name "properties". The value of the properties member is an object (any JSON object or a JSON null value).
- o If a feature has a commonly used identifier, that identifier SHOULD be included as a member of the feature object with the name "id".

2.3. Feature Collection Object

A GeoJSON object with the type "FeatureCollection" is a feature collection object. An object of type "FeatureCollection" MUST have a member with the name "features". The value corresponding to "features" is an array. Each element in the array is a feature object as defined above.

3. Coordinate Reference System Object

The coordinate reference system (CRS) of a GeoJSON object is determined by its OPTIONAL "crs" member (referred to as the CRS object below). If an object has no crs member, then its parent or grandparent object's crs member SHALL be acquired. If no crs member can be so acquired, the default CRS SHALL apply to the GeoJSON object.

The default coordinate reference system for all GeoJSON objects SHALL be a geographic coordinate reference system, using the WGS84 datum,

and with longitude and latitude units of decimal degrees. This coordinate reference system is equivalent to the OGC's urn:ogc:def:crs:OGC::CRS84 [[OGCURN](#)]. An OPTIONAL third position element SHALL be the height in meters above the WGS 84 reference ellipsoid. For widest interoperability, GeoJSON data SHOULD use this default coordinate reference system and omit CRS objects.

If an application demands a different coordinate reference system, the following specifications shall be followed:

- o CRS SHOULD be defined as highly in GeoJSON object hierarchy as possible, ideally in the FeatureCollection, and SHOULD NOT be repeated or overridden in child objects.
- o The value of a member named "crs" is a JSON object (referred to as the CRS object below) or JSON null. If the value of CRS is null, no CRS can be assumed.
- o A non-null CRS object has two mandatory members: "type" and "properties".
- o The value of the type member indicates the type of CRS object.
- o The value of the properties member must be an object.
- o The presence of a CRS object SHALL NOT change the ordering of coordinates specified in [section 2.1.1](#).

[3.1.](#) Named CRS

A CRS object may indicate a coordinate reference system by name. In this case, the value of its "type" member must be the string "name". The value of its "properties" member must be an object containing a "name" member. The value of that "name" member must be a string identifying a coordinate reference system. OGC CRS URNs such as "urn:ogc:def:crs:OGC::CRS84" are RECOMMENDED over legacy identifiers such as "EPSG:4326".

```
"crs": {  
  "type": "name",  
  "properties": {  
    "name": "urn:ogc:def:crs:OGC::CRS84"  
  }  
}
```

[3.2.](#) Linked CRS

A CRS object may link to CRS parameters on the Web. In this case, the value of its "type" member must be the string "link", and the value of its "properties" member must be a Link object.

A link object has one required member: "href", and one optional member: "type". The value of the required "href" member must be a dereferenceable URI. The value of the optional "type" member must be a string that hints at the format used to represent CRS parameters at the provided URI. Suggested values are: "proj4", "ogcwkt", "esriwkt", but others can be used::

```
"crs": {
  "type": "link",
  "properties": {
    "href": "http://example.com/crs/42",
    "type": "proj4"
  }
}
```

Relative links may be used to direct processors to CRS parameters in an auxiliary file:

```
"crs": {
  "type": "link",
  "properties": {
    "href": "data.crs",
    "type": "ogcwkt"
  }
}
```

4. Bounding Box

A GeoJSON object MAY have a member named "bbox" to include information on the coordinate range for its geometries, features, or feature collections. The value of the bbox member MUST be an array of length 2*n where n is the number of dimensions represented in the contained geometries, with the lowest values for all axes followed by the highest values. The axes order of a bbox follows the axes order of geometries.

Example of a bbox member on a feature:


```
{
  "type": "Feature",
  "bbox": [-180.0, -90.0, 180.0, 90.0],
  "geometry": {
    "type": "Polygon",
    "coordinates": [
      [
        [-180.0, 10.0],
        [20.0, 90.0],
        [180.0, -5.0],
        [-30.0, -90.0]
      ]
    ]
  }
  //...
}
```

Example of a bbox member on a feature collection:

```
{
  "type": "FeatureCollection",
  "bbox": [100.0, 0.0, 105.0, 1.0],
  "features": [
    //...
  ]
}
```

5. Security Considerations

This memo raises no security issues.

6. IANA Considerations

There are no IANA considerations beyond those in [\[RFC4267\]](#).

7. References

7.1. Normative References

- [GeoJSON] Butler, H., Daly, M., Doyle, A., Gillies, S., Schaub, T., and C. Schmidt, "The GeoJSON Format Specification", June 2008.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC4627] Crockford, D., "The application/json Media Type for JavaScript Object Notation (JSON)", [RFC 4627](#), July 2006.

[7.2.](#) Informative References

- [KMLv2.2] Wilson, T., "OGC KML", OGC 07-147r2, April 2008.
- [OGCURN] Whiteside, A., "Definition identifier URNs in OGC namespace", OGC 07-092r3, January 2009.
- [SFSQL] OpenGIS Consortium, Inc., "OpenGIS Simple Features Specification For SQL Revision 1.1", OGC 99-049, May 1999.
- [WFSv1] Vretanos, P., "Web Feature Service Implementation Specification", OGC 02-058, May 2002.
- [WGS84] National Imagery and Mapping Agency, "Department of Defense World Geodetic System 1984, Third Edition", 1984.

[Appendix A.](#) Geometry Examples

Each of the examples below represents a valid and complete GeoJSON object.

[A.1.](#) Point

Point coordinates are in x, y order (easting, northing for projected coordinates, longitude, latitude for geographic coordinates):

```
{
  "type": "Point",
  "coordinates": [100.0, 0.0]
}
```

[A.2.](#) LineString

Coordinates of LineString are an array of positions (see "2.1.1. Position"):

```
{
  "type": "LineString",
  "coordinates": [
    [100.0, 0.0],
    [101.0, 1.0]
  ]
}
```

[A.3.](#) Polygon

Coordinates of a Polygon are an array of LinearRing (cf. "2.1.6 Polygon") coordinate arrays. The first element in the array

represents the exterior ring. Any subsequent elements represent interior rings (or holes).

No holes:

```
{
  "type": "Polygon",
  "coordinates": [
    [
      [100.0, 0.0],
      [101.0, 0.0],
      [101.0, 1.0],
      [100.0, 1.0],
      [100.0, 0.0]
    ]
  ]
}
```

With holes:

```
{
  "type": "Polygon",
  "coordinates": [
    [
      [100.0, 0.0],
      [101.0, 0.0],
      [101.0, 1.0],
      [100.0, 1.0],
      [100.0, 0.0]
    ],
    [
      [100.2, 0.2],
      [100.8, 0.2],
      [100.8, 0.8],
      [100.2, 0.8],
      [100.2, 0.2]
    ]
  ]
}
```

[A.4.](#) MultiPoint

Coordinates of a MultiPoint are an array of positions::


```
{
  "type": "MultiPoint",
  "coordinates": [
    [100.0, 0.0],
    [101.0, 1.0]
  ]
}
```

[A.5.](#) MultiLineString

Coordinates of a MultiLineString are an array of LineString coordinate arrays:

```
{
  "type": "MultiLineString",
  "coordinates": [
    [
      [100.0, 0.0],
      [101.0, 1.0]
    ],
    [
      [102.0, 2.0],
      [103.0, 3.0]
    ]
  ]
}
```

[A.6.](#) MultiPolygon

Coordinates of a MultiPolygon are an array of Polygon coordinate arrays:


```
{
  "type": "MultiPolygon",
  "coordinates": [
    [
      [
        [102.0, 2.0],
        [103.0, 2.0],
        [103.0, 3.0],
        [102.0, 3.0],
        [102.0, 2.0]
      ]
    ],
    [
      [
        [100.0, 0.0],
        [101.0, 0.0],
        [101.0, 1.0],
        [100.0, 1.0],
        [100.0, 0.0]
      ],
      [
        [100.2, 0.2],
        [100.8, 0.2],
        [100.8, 0.8],
        [100.2, 0.8],
        [100.2, 0.2]
      ]
    ]
  ]
}
```

[A.7.](#) GeometryCollection

Each element in the geometries array of a GeometryCollection is one of the geometry objects described above:


```
{
  "type": "GeometryCollection",
  "geometries": [{
    "type": "Point",
    "coordinates": [100.0, 0.0]
  }, {
    "type": "LineString",
    "coordinates": [
      [101.0, 0.0],
      [102.0, 1.0]
    ]
  }]
}
```

Appendix B. Contributors

The GeoJSON format is the product of discussion on the GeoJSON mailing list: <http://lists.geojson.org/listinfo.cgi/geojson-geojson.org>.

Comments are solicited and should be addressed to the GeoJSON mailing list at geojson@lists.geojson.org or to the GeoJSON issue tracker at <https://github.com/geojson/draft-geojson/issues>.

Authors' Addresses

H. Butler
Hobu Inc.

M. Daly
Cadcorp

A. Doyle
MIT

S. Gillies
Mapbox Inc.

Email: sean.gillies@gmail.com
URI: <http://sgillies.net>

T. Schaub
OpenGeo

S. Drees
Rheinaustr. 62
Bonn 53225
DE

Email: stefan@drees.name

URI: <http://sdre.es/>