Future Internet

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Serialization Formats for Web Pages

RDF Graph Serializations for Web Pages

- Microdata
- RDFa
- JSON-LD

RDFa, Microdata, Json-LD and Microformats

RDFa, Microdata, Json-LD and Microformats are progressively evolving the Web towards a machine-processable semantic web.

All four formalisms allow you to add annotations to web pages using HTML tags.

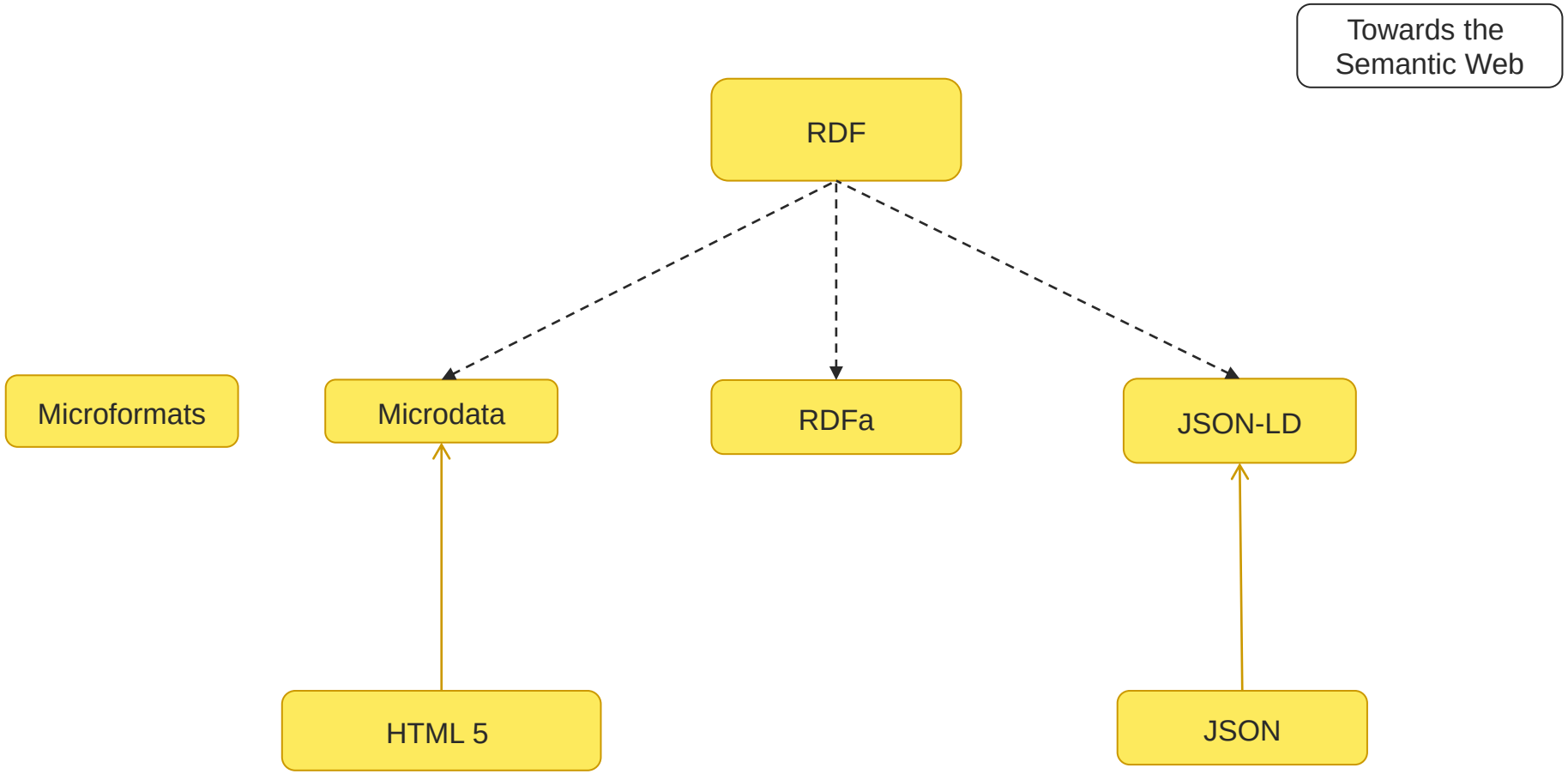
- RDFa, Microdata, Json-LD are serializations of RDF datasets
- RDFa, Microdata introduce new HTML attributes
- Json-LD uses the Json format inserted in the SCRIPT tag of the HTML code
- Microformats was the first attempt to use vocabularies to annotate web page data, which is now obsolete

Google defines this metadata formats as STRUCTURED DATA and uses them, for example, to obtain rich snippets.

A snippet is the informational content that Google adds to your search results: in addition to Page Title and Page Link, it can include:

Description | Images | Reviews, etc.

Structured data



JSON-LD

JSON-LD (*JSON-Linked Data*) is a JSON-based format to serialize Linked Data.

It is currently Google's recommended format for annotating web pages for SEO purposes

JSON-LD

JSON-LD (*JSON-Linked Data*) is a JSON-based format to serialize Linked Data.

JSON (JavaScript Object Notation): is an open standard file format, and data interchange format, that uses human-readable text to store and transmit data objects consisting of attribute–value pairs

Goals:

- easily integrate semantic annotation into deployed systems that already use JSON,
- store Linked Data in JSON-based storage engines

JSON-LD

The latest version released is

JSON-LD 1.1 - Third Edition,
W3C Recommendation 16 July 2020
https://www.w3.org/TR/json-ld11/

Unlike microdata and RDFa,

JSON-LD structured are placed in the SCRIPT tag

JSON-LD – HTML page

```
<html>

  <head>

    <title>Generative Artificial Intelligence </title>

    <script type="application/ld+json">
    {
         "@context": {
            "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
            "rdfs": "http://www.w3.org/2000/01/rdf-schema#",


        ……….

    }
    </script>

  </head>
```

JSON-LD

Basic concepts:

- a universal identifier mechanism for JSON objects via the use of IRIs
- a node is identified using the @id keyword
- vocabularies can be declared using @context keyword

  More generally, @context can be used to map terms (i.e., strings) to IRIs and use them as shortcuts throughout a JSON-LD document
- default vocabulary can be set using @vocab keyword
- the type (i.e., class) of a graph node is specified using @type keyword
- multiple nodes can be specified using @graph keyword

JSON-LD

```
{
  "@context": {
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
   "@vocab": "http://schema.org/"
  },
  .........
}
```

In the case of a single context, you can simply indicate "@context": "IRI"

```
"@context": "https://schema.org",
.........
```

JSON-LD

```
{
  "@context": {
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
        "@vocab": "http://schema.org/"
  },
  "@id": "Event#0005",
  "@type": "http://www.exampleOntol.org/Event",
  "ex:name": "Generative Artificial Intelligence",
  "ex:place": "Genoa"
}
```

```
or "@type": "ex:Event"
```

Data properties

JSON-LD

```
{
  "@context": {
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
       "@vocab": "http://schema.org/"
  },
  "@id": "Event#0005",
  "@type": "http://www.exampleOntol.org/Event",
  "ex:name": "Generative Artificial Intelligence",
  "ex:place": "Genoa",

  "ex:hasSpeaker": {
      "@id": "Speaker#1",
      "@type": "Person"
      ..............
        }
}
```

Object property

JSON-LD

```
{
  "@context": {
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
       "@vocab": "http://schema.org/"
  },
  "@id": "Event#0005",
  "@type": "ex:Event",
  "ex:name": "Generative Artificial Intelligence",
  "ex:place": "Genoa",

  "ex:hasSpeaker": {
      "@id": "Speaker#1",
      "@type": "Person",
      "url": ["http://homepage.com", "http://office.com"]
        }
}
```

multiple values: array - list of values […. , ……]

Testing

To test the JSON-LD code, use:

JSON-LD Playground: https://json-ld.org/playground

JSON-LD

https://json-ld.org/playground

JSON-LD Playground

Compacted view

Examples: Person | Event | Place | Product | Recipe | Library

JSON-LD Input | Options | Document URL

```
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
    "@vocab": "http://schema.org/"
  },
  "@id": "Event#0005",
  "@type": "ex:Event",
  "ex:name": "Generative Artificial Intelligence",
  "ex:place": "Genoa",

  "ex:hasSpeaker": {
  "@id": "Speaker#1",
  "@type": "Person",
  "url": ["http://homepage.com", "http://office.com"]
    }
}
```

Expanded | Compacted | Flattened | Framed | N-Quads | Canon

```
{
  "@id": "Event#0005",
  "@type": "http://www.exampleOntol.org#Event",
  "http://www.exampleOntol.org#hasSpeaker": {
    "@id": "Speaker#1",
    "@type": "http://schema.org/Person",
    "http://schema.org/url": [
      "http://homepage.com",
      "http://office.com"
    ]
  },
  "http://www.exampleOntol.org#name": "Generative Artificial Intelligence",
  "http://www.exampleOntol.org#place": "Genoa"
}
```

JSON-LD

https://json-ld.org/playground

JSON-LD Playground

Expanded view

```
{
  "@context": {
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
    "@vocab": "http://schema.org/"
  },
  "@id": "Event#0005",
  "@type": "ex:Event",
  "ex:name": "Generative Artificial Intelligence",
  "ex:place": "Genoa",

  "ex:hasSpeaker": {
  "@id": "Speaker#1",
  "@type": "Person",
  "url": ["http://homepage.com", "http://office.com"]
    }
}
```

Expanded | Compacted | Flattened | Framed | N-Quads | Canonize

```
{
  "@id": "Event#0005",
  "@type": [
    "http://www.exampleOntol.org#Event"
  ],
  "http://www.exampleOntol.org#hasSpeaker": [
    {
      "@id": "Speaker#1",
      "@type": [
        "http://schema.org/Person"
      ],
      "http://schema.org/url": [
        {
          "@value": "http://homepage.com"
        },
        {
          "@value": "http://office.com"
        }
      ]
    }
  ],
  "http://www.exampleOntol.org#name": [
    {
      "@value": "Generative Artificial Intelligence"
    }
  ],
  "http://www.exampleOntol.org#place": [
    {
      "@value": "Genoa"
    }
  ]
}
```

JSON-LD

```
{
  "@context": {
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
        "@vocab": "http://schema.org/"
  },
  "@graph": [{
  "@id": "Event#0005",
  "@type": "http://www.exampleOntol.org/Event",
  "ex:name": "Generative Artificial Intelligence",
  "ex:place": "Genoa",
  "ex:hasSpeaker": "Speaker#1"
  }, {
  "@id": "Speaker#1",
  "@type": "Person",
  "url": "[http://homepage.com, http://office.com]"
        }]
  }
```

@graph
to represent a graph
with more nodes

JSON-LD

https://json-ld.org/playground

JSON-LD Playground

JSON-LD Input | Options | Document URL

```
{
  "@context": {
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
    "@vocab": "http://schema.org/"
  },
  "@graph": [{
  "@id": "Event#0005",
  "@type": "http://www.exampleOntol.org/Event",
  "ex:name": "Generative Artificial Intelligence",
  "ex:place": "Genoa",
  "ex:hasSpeaker": "Speaker#1"
  }, {
  "@id": "Speaker#1",
  "@type": "Person",
  "url": "[http://homepage.com, http://office.com]"
    }]
  }
```

Expanded | Compacted | Flattened | Framed | N-Quads | Canonized

```
{
  "@graph": [
    {
      "@id": "Event#0005",
      "@type": "http://www.exampleOntol.org/Event",
      "http://www.exampleOntol.org#hasSpeaker": "Speaker#1",
      "http://www.exampleOntol.org#name": "Generative Artificial Intelligence",
      "http://www.exampleOntol.org#place": "Genoa"
    },
    {
      "@id": "Speaker#1",
      "@type": "http://schema.org/Person",
      "http://schema.org/url": "[http://homepage.com, http://office.com]"
    }
  ]
}
```

JSON-LD

https://json-ld.org/playground

JSON-LD Playground

```
{
  "@context": {
    "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "xsd": "http://www.w3.org/2001/XMLSchema#",
    "ex": "http://www.exampleOntol.org#",
    "@vocab": "http://schema.org/"
  },
  "@id": "Event#0005",
  "@type": "ex:Event",
  "ex:name": "Generative Artificial Intelligence",
  "ex:place": "Genoa",

  "ex:hasSpeaker": {
  "@id": "Speaker#1",
  "@type": "Person",
  "url": ["http://homepage.com", "http://office.com"]
    }
}
```

Expanded | Compacted | Flattened | Framed | N-Quads | Canonized

```
{
  "@graph": [
    {
      "@id": "Event#0005",
      "@type": "http://www.exampleOntol.org#Event",
      "http://www.exampleOntol.org#hasSpeaker": {
        "@id": "Speaker#1",
        "@type": "http://schema.org/Person",
        "http://schema.org/url": [
          "http://homepage.com",
          "http://office.com"
        ]
      },
      "http://www.exampleOntol.org#name": "Generative Artificial Intelligence",
      "http://www.exampleOntol.org#place": "Genoa"
    },
    {
      "@id": "Speaker#1",
      "@type": "http://schema.org/Person",
      "http://schema.org/url": [
        "http://homepage.com",
        "http://office.com"
      ]
    }
  ]
}
```

Framed view for the previous example:

Note that it uses the @graph keyword even though it was not in our code (it is taken from the object property hasSpeaker)