The Fat-Free Alternative to XML

JSON as an XML Alternative

- JSON is a light-weight alternative to XML for data-interchange
- JSON = JavaScript Object Notation
  - It's really language independent
  - Most programming languages can easily read it and instantiate objects or some other data structure
- Defined in RFC 4627, IETF, July 2006
  - Current version is RFC 8259, December 2017
- http://json.org/ has more information

JSON TL;DR

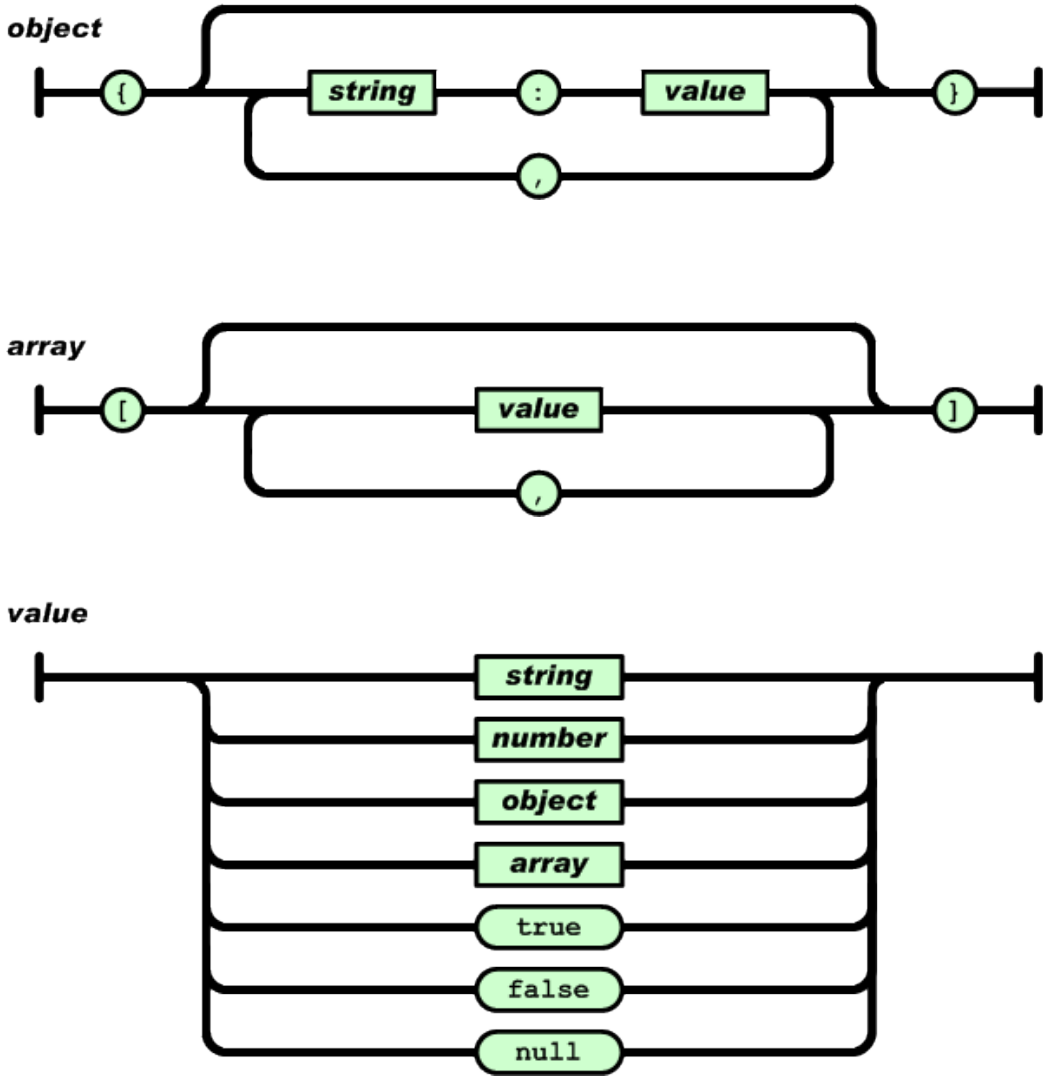
- Lightweight data-interchange format
- Easy for humans to read and write
- Easy for machines to parse and generate
- Not tied tied to Javascript or Web

Example

```
{"firstName": "John",
 "lastName" : "Smith",
 "age"         : 25,
 "address"   :
   {"streetAdr” : "21 2nd Street",
    "city"        : "New York",
    "state"       : "NY",
    ”zip"         : "10021"},
 "phoneNumber":
   [ {"type"  : "home",
    "number": "212-555-1234"},
   {"type"  : "fax",
    "number” : "646-555-4567"} ]
}
```

- This is a JSON object with five **key-value pairs**
- Objects are wrapped by curly braces
- There are no object IDs
- Keys are strings
- Values are numbers, strings, objects or arrays
- Arrays/lists are wrapped by square brackets

Simple BNF


object
{
string
:
value
}
,
array
[
value
]
,
value
string
number
object
array
true
false
null

Evaluation: JSON is …

- Simpler and more compact than XML
  - No closing tags
  - XML parsing is hard because of its complexity
  - Compressed the two are similar in size
- A better fit for OO systems than XML
- Less extensible than XML
- Widely preferred for simple data exchange

JSON is Simple

- Less syntax, no semantics
- Schemas? We don’t need no stinkin schemas!*
- Transforms? Write your own

JSON Schema

- https://json-schema.org/
- IETF draft, 3/2018
- Provide annotations
- Specifies
  - Possible properties
  - Required properties
  - Value types
  - Value constraints
  - References

```
{
  "latitude": 48.858093,
  "longitude": 2.294694
}
```

```
{  "id": "http://ex.com/geo-location.schema.json",
   "$schema": "http://json-schema.org/draft-
07/schema#",
   "title": "Longitude and Latitude Values",
   "description": "A geographical coordinate.",
   "required": [
      "latitude",
      "longitude"   ],
  "type": "object",
  "properties": {
     "latitude": {
        "type": "number",
        "minimum": -90,
        "maximum": 90  },
     "longitude": {
        "type": "number",
        "minimum": -180,
        "maximum": 180  }
  }
}
```

JSON-LD

JSON-LD is a W3C recommendation for representing RDF data as JSON objects

```
{"@context": {
   "name": "http://xmlns.com/foaf/0.1/name",
   "homepage": {
     "@id": "http://xmlns.com/foaf/0.1/workplaceHomepage",
     "@type": "@id"
   },
   "Person": "http://xmlns.com/foaf/0.1/Person"
  },
  "@id": "http://me.markus-lanthaler.com",
  "@type": "Person",
  "name": "Markus Lanthaler",
  "homepage": "http://www.tugraz.at/"
}
```

Many popular systems use JSON

- MongoDB is an open-source database for JSON objects
  - Very popular NoSQL database
  - A NoSQL DB is one that uses a model not based on relational tables
- Elastic Search is a popular, scalable information retrieval engine that uses JSON as its native representation

Example: JSON in Python

```
>>> import json
>>> x = json.load(open('example.json'))
>>> x
{u'lastName': u'Smith', u'age': 25, u'phoneNumber': [{u'type': u'home',
u'number': u'212-555-1234'}, {u'type': u'fax', u'number': u'646-555-4567'}],
u'firstName': u'John', u'address': {u'streetAdr': u'21 2nd Street', u'state':
u'NY', u'zip': u'10021', u'city': u'New York'}}
>>> x['address']['state']
u'NY'
>>> print json.dumps(x, sort_keys=True, separators=(',',':'), indent=2)
{"address":{
    "city":"New York",
    "state":"NY",
    "streetAdr":"21 2nd Street",
    "zip":"10021”},
  "age":25,
  "firstName":"John",
  "lastName":"Smith",
  "phoneNumber":[
    { "number":"212-555-1234",
      "type":"home”},
    {"number":"646-555-4567",
      "type":"fax” } ] }
>>>
```

- Python’s JSON package reads & writes JSON from/to files & strings
- Maps JSON objects to Python dictionaries
- Maps JSON arrays to Python lists
- Dump (write to file) and dumps (write to string) functions can do simple pretty printing

JSON vs. XML

- JSON: The Fat-Free Alternative to XML

  json.org page laying out the case for JSON over XML

- Stop Comparing JSON and XML

  Blog post arguing that they're very different things with their own areas of applicability

- XML ⇔JSON

  There are many web tools (e.g.: this one) and software packages (e.g. xml2dict) that can convert between simple XML and JSON representations

Jupyter Notebook Examples

- Visit http://bit.ly/kg19class and get clone string
- Clone this on your computer
- cd class_material/examples/xml/
- If needed:
  - pip3 install xmltodict
  - pip3 install jupyter
- jupyter notebook &
- In your web browser open xml2json.ipynb

Worse is Better?

- JSON vs. XML as an example of "Worse is Better"
- In 1989 Dick Gabriel headed a company with the best commercial version of Lisp
  - Lisp was considered by programming language experts to be much better than C
  - But C was 10x more popular than Lisp
  - Cf. today: Scheme vs. Python (w.r.t. mutable lists)
- Gabriel explained it as *worse is better*

  Software that's limited, but simple to learn/use, and flexible, can be more popular for most users