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JSR 353 : Java API for JSON Processing

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Oracle

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Program Agenda

- Overview
- JAX-RS usecase
- JSR 353
- API
- Demo

JSON Overview

- JSON is a light-weight data exchange format
  - Minimal, textual and a subset of JavaScript
  - Easy for humans/machines to read and write
  - For e.g.:

```
{"name":"Bob", "age":20, "phone":["276 1234", "123 4567"]}
```

  - Used heavily in RESTful web services, configuration, databases, browser/server communication

JSON Overview

- JSON is used by popular web sites in their RESTful web services
  - Facebook, Twitter, Amazon, …
  - Twitter Streaming API discontinues XML

JSON Overview

http://search-domainname-domainid.us-east-1.cloudsearch.amazonaws.com/2011-02-01/search?q=star+wars

```
{
    "rank":"-text_relevance",
    "match-expr":"(label 'star wars')",
    "hits":{
        "found":7,
        "start":0,
        "hit":[
            {"id":"tt0086190"},
            {"id":"tt0120915"},
            {"id":"tt0121766"}, …]
    },
    …
}
```

Source: http://docs.amazonwebservices.com/cloudsearch/latest/developerguide/searching.html

JSON Overview

```
http://search.twitter.com/search.json?q=JSON

{
    "created_at":"Thu, 06 Sep 2012 21:45:04 +0000",
    "from_user":"loggly”,
    "metadata":{"result_type":"recent"},
    "text":"Good news if you log JSON.  (And another reason to
   switch to JSON if you haven't already.) http:\/\/t.co\/
   9Dz2JP41",
    …
}
```

Source: https://dev.twitter.com/docs/using-search

JAX-RS XML usage

- JAX-RS applications handle XML using JAXP API

```
@Produces("application/xml")
public Source getBook(String id) {
    return new StreamSource(…);
}
```

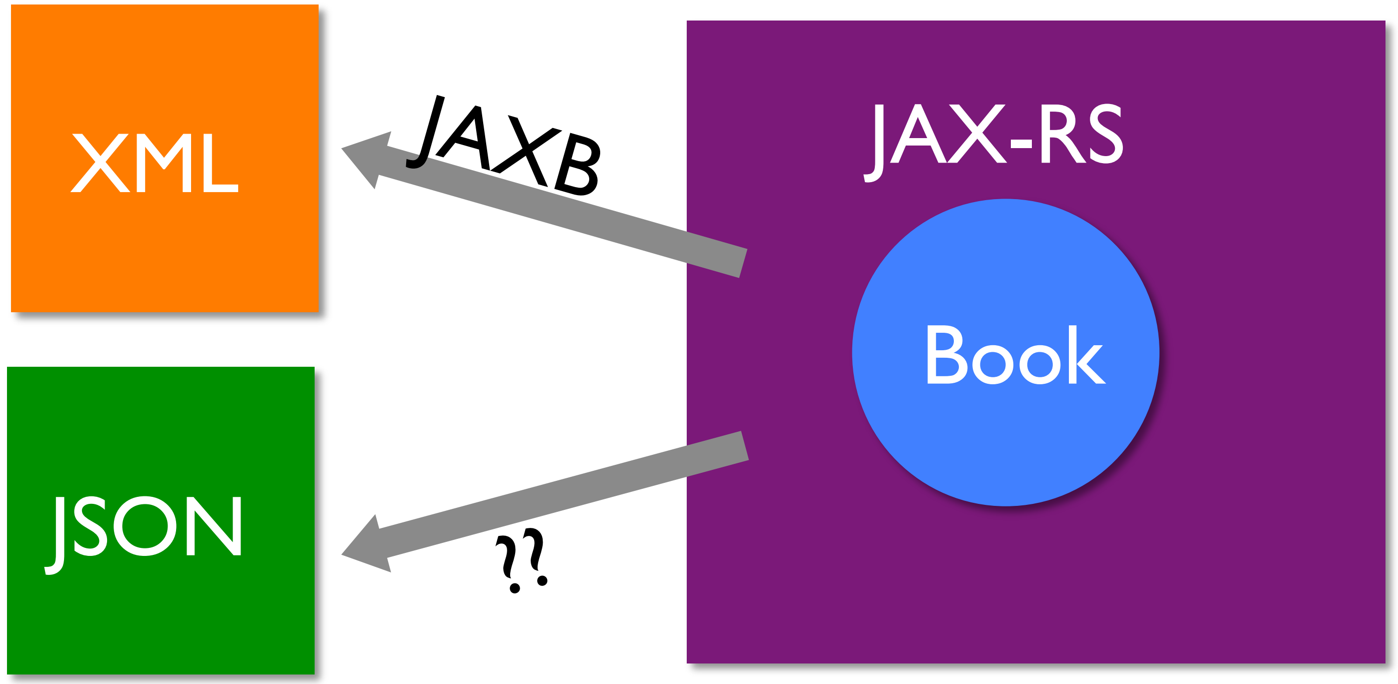
JAX-RS – XML Usage

- JAX-RS applications handle XML using JAXB API

```
@Produces("application/xml")
public Book getBook(String id) {
    return new Book(...);
}
```

JAX-RS – Content Negotiation

```
@Produces({"application/xml", "application/json"})
public Book getBook(String id) {
    return new Book(…);
}
```



Java Implementations for JSON

org.json

json-taglib

Jackson

json-simple

mjson

fastjson

jsonij

jjson

Argo

org.json.me

json-io

Json-lib

Stringtree

XStream

Jettison

SOJO

Flexjson

JsonMarshaller

google-gson

Json-smart

JAX-RS – JSON Solutions

- A custom MessageBodyWriter that converts to JSON
  - JSONObject (For e.g. json.org's API) → JSON
  - POJO/JAXB → XML → JSON (For e.g. using jettison)
  - POJO/JAXB → JSON (For e.g. using jackson, eclipseLink etc.)
- No standard API
- Some solutions have technical limitations
- Applications/Frameworks need to bundle the libraries

Standard API

- Application can use standard types
- Leaner, portable applications

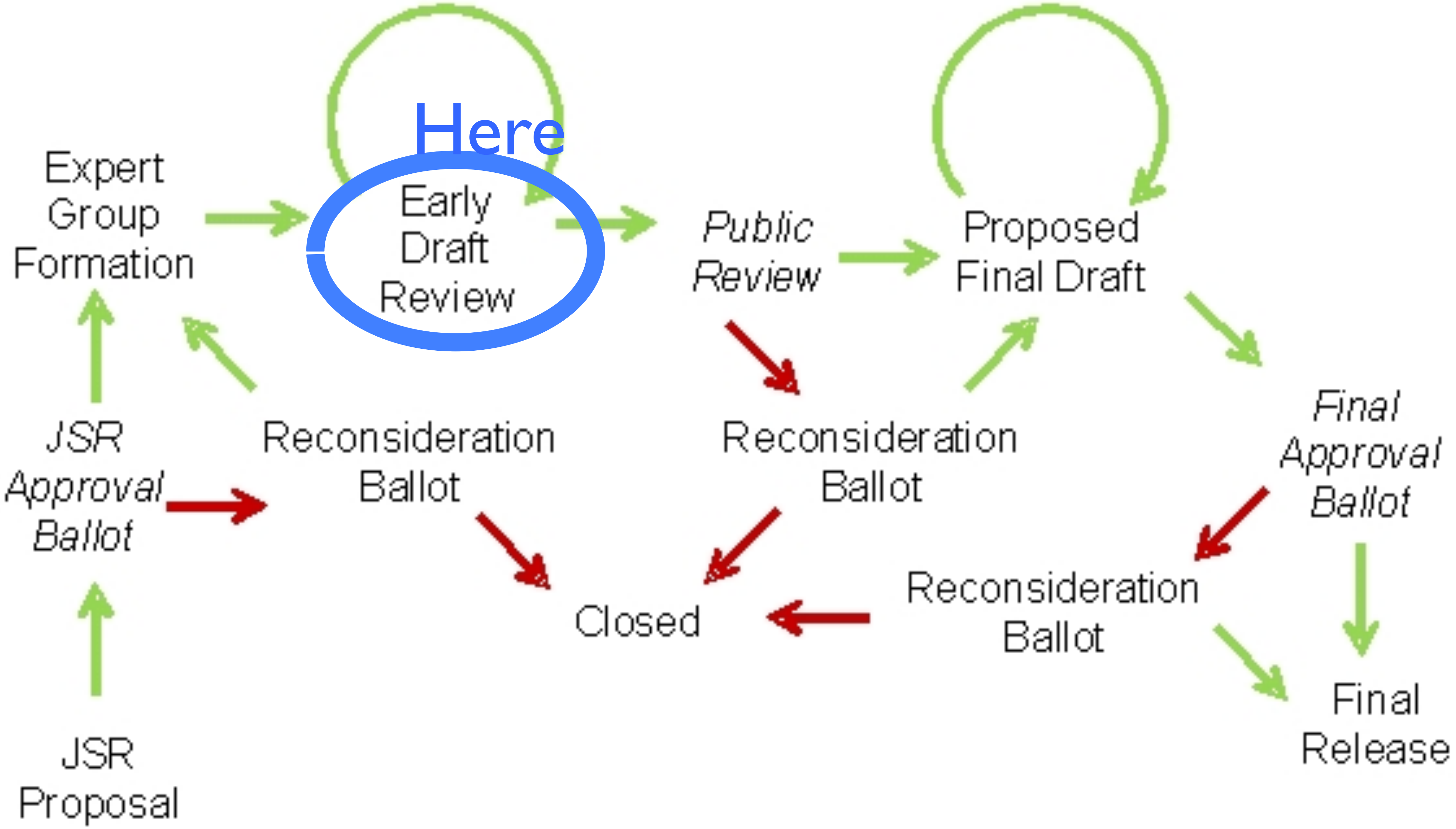
Standard API

- Parsing/Processing JSON
  - Similar to JAXP
- Data binding : JSON text <-> Java Objects
  - Similar to JAXB
- Two JSRs:
  - Processing/Parsing, Binding

JSR 353 :Java API for Processing JSON

- Streaming API to produce/consume JSON
    - Similar to StAX API in XML world
- Object model API to represent JSON
    - Similar to DOM API in XML world
- EG
    - Oracle, RedHat, Twitter
    - 3 individual members
    - And, user community !

JSR 353 - Status



Source: http://blogs.oracle.com/darcy/entry/pictorial_jcp

JSR 353 - Transparency

- Using json-processing-spec java.net open source project
- Mailing lists:
  - users@json-processing-spec.java.net
  - jsr353-experts@json-processing-spec.java.net
  - Lists are archived (publicly readable)
- Issue Tracker:
  - http://java.net/jira/browse/JSON_PROCESSING_SPEC

Source: http://www.flickr.com/photos/benjamin_galle/3142187694/

JSR 353 - Schedule

- Align with Java EE 7 schedule
  - Early Draft – Sep 2012
  - Public Review – Dec 2012
  - Proposed Final Draft – Mar 2013
  - Final Release – Apr 2013

Source:http://www.flickr.com/photos/29254399@N08/3187186308

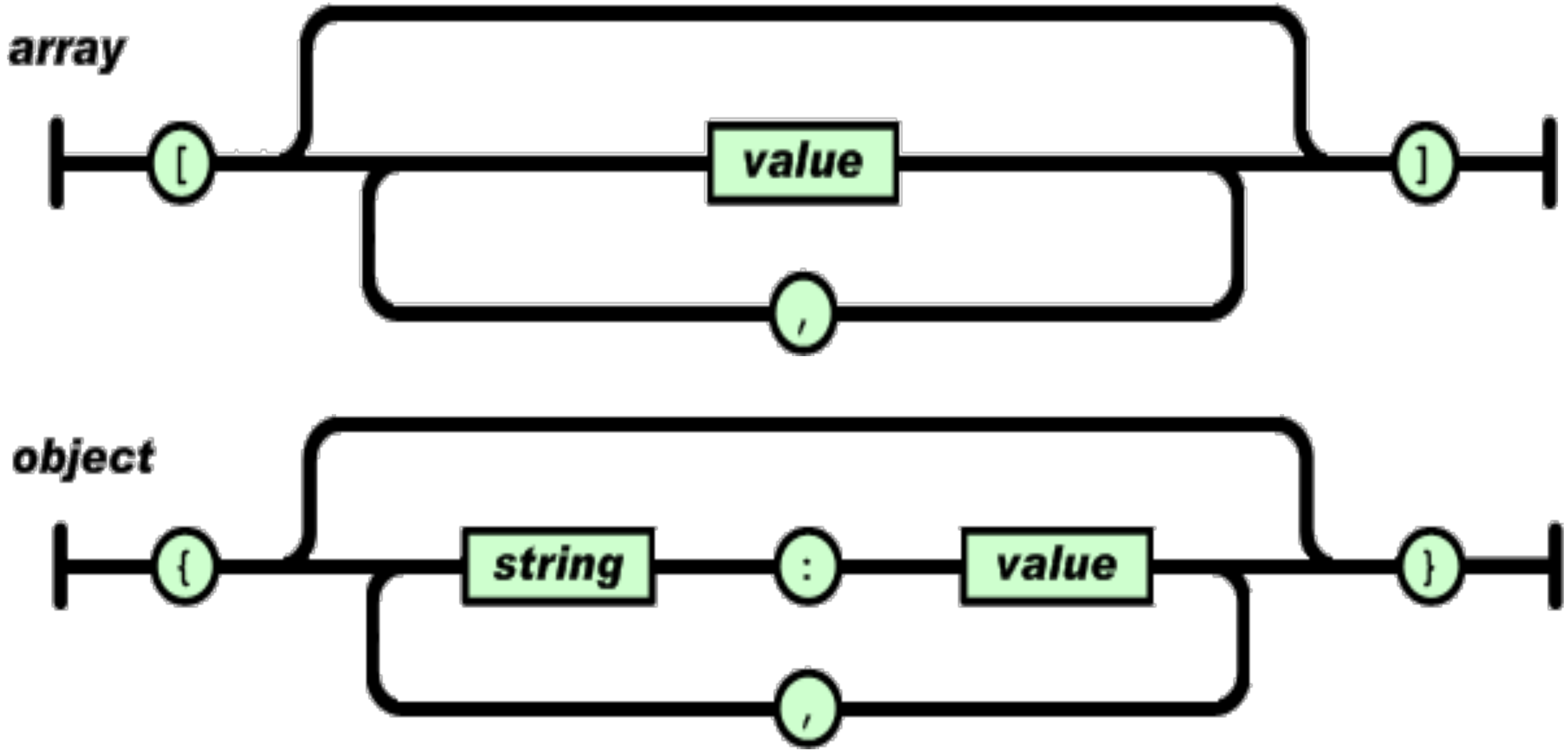
JSR 353 - RI

- Using jsonp java.net open source project
  - by GlassFish community
- Up-to-date w.r.t spec (pretty much !)
- EDR bits are in maven central

JSR 353 - Work in Progress

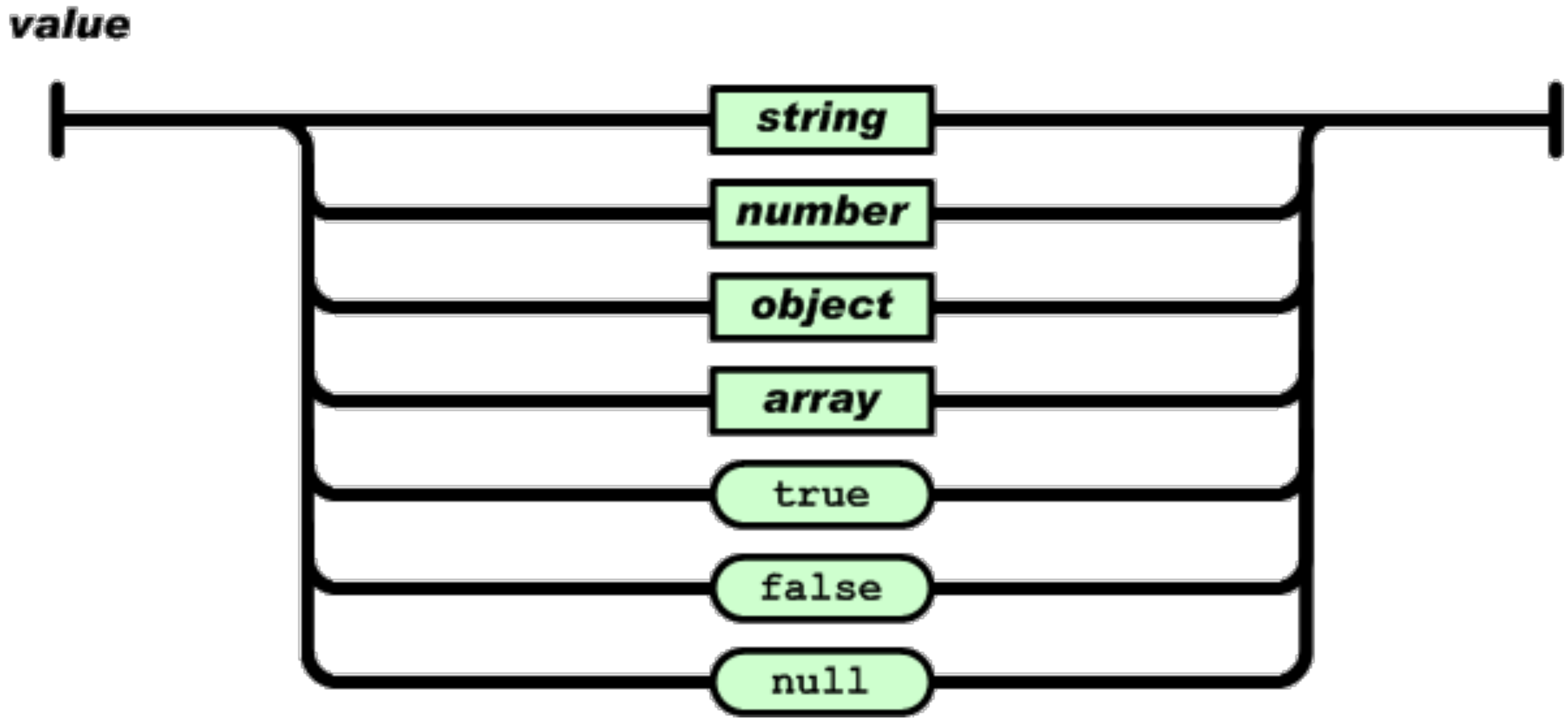
Note: The APIs might change before final release !

API - JSON Grammar



Source: http://json.org

API - JSON Grammar

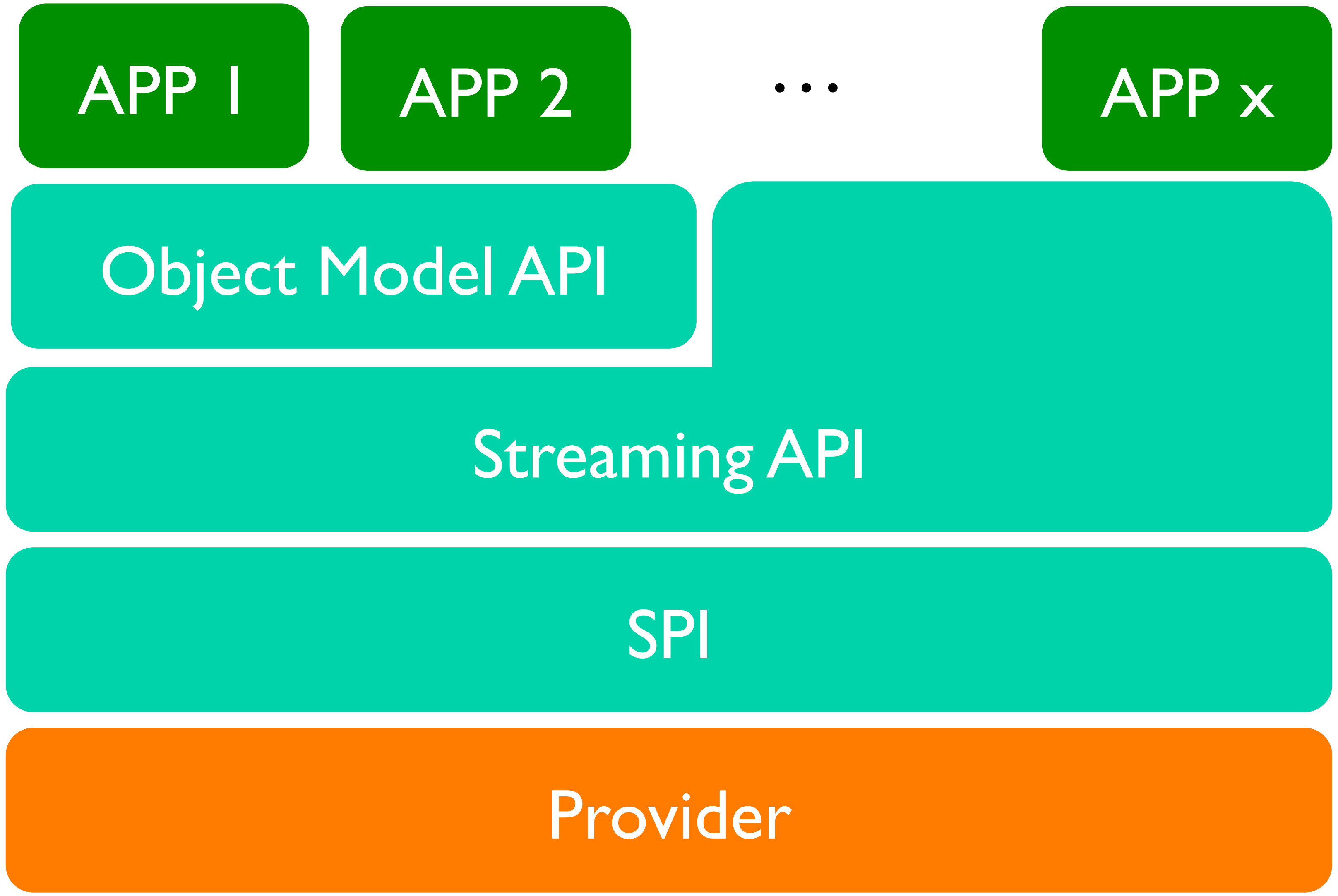


Source: http://json.org

API - Streaming & Object Model

- Streaming API
  - Low-level, efficient way to parse/generate JSON
  - Provides pluggability for parsers/generators
- Object Model API
  - Simple, easy to use high-level API
  - Implemented on top of streaming API

API Architecture



Streaming API - JsonParser

- JsonParser – Parses JSON in a streaming way from input sources
  - Similar to StAX's XMLStreamReader, a pull parser
- Created using :
  - Json.createParser(…), Json.createParserFactory().createParser(…)
- Optionally, configured with features
- Parser state events :
  - START_ARRAY, START_OBJECT, KEY_NAME, VALUE_STRING, VALUE_NUMBER, VALUE_TRUE, VALUE_FALSE, VALUE_NULL, END_OBJECT, END_ARRAY

Streaming API - JsonParser

```
{
    "firstName": "John", "lastName": "Smith", "age": 25,
    "phoneNumber": [
        { "type": "home", "number": "212 555-1234" },
        { "type": "fax", "number": "646 555-4567" }
    ]
}
```

Streaming API - JsonParser

```
  START_OBJECT
{
    "firstName": "John", "lastName": "Smith", "age": 25,
    "phoneNumber": [
        { "type": "home", "number": "212 555-1234" },
        { "type": "fax", "number": "646 555-4567" }
    ]
}
```

Streaming API - JsonParser

```
{                     ↑ KEY_NAME
    "firstName": "John", "lastName": "Smith", "age": 25,
    "phoneNumber": [
        { "type": "home", "number": "212 555-1234" },
        { "type": "fax", "number": "646 555-4567" }
    ]
}
```

Streaming API - JsonParser

```
{                                 ↑ VALUE_STRING
    "firstName": "John", "lastName": "Smith", "age": 25,
    "phoneNumber": [
        { "type": "home", "number": "212 555-1234" },
        { "type": "fax", "number": "646 555-4567" }
    ]
}
```

Streaming API - JsonParser

VALUE_NUMBER

```
{
    "firstName": "John", "lastName": "Smith", "age": 25,
    "phoneNumber": [
        { "type": "home", "number": "212 555-1234" },
        { "type": "fax", "number": "646 555-4567" }
    ]
}
```

Streaming API - JsonParser

```
{
    "firstName": "John", "lastName": "Smith", "age": 25,
    "phoneNumber": [
        { "type": "home", "number": "212 555-1234" },
        { "type": "fax", "number": "646 555-4567" }
    ]
}
```

↑ START_ARRAY

Streaming API - JsonParser

```
{
    "firstName": "John", "lastName": "Smith", "age": 25,
    "phoneNumber": [
        { "type": "home", "number": "212 555-1234" },
        { "type": "fax", "number": "646 555-4567" }
    ]
}
```

END_ARRAY ↑

Streaming API - JsonParser

```
{
    "firstName": "John", "lastName": "Smith", "age": 25,
    "phoneNumber": [
        { "type": "home", "number": "212 555-1234" },
        { "type": "fax", "number": "646 555-4567" }
    ]
}
Iterator<Event> it = parser.iterator();
Event event = it.next();                    // START_OBJECT
event = it.next();                          // KEY_NAME
event = it.next();                          // VALUE_STRING
String name = parser.getString();           // "John”
```

Streaming API - JsonGenerator

- JsonGenerator – Generates JSON in a streaming way to output sources
  - Similar to StAX's XMLStreamWriter
- Created using :
  - Json.createGenerator(…), Json.createGeneratorFactory().createGenerator(…)
- Optionally, configured with features
  - For e.g. pretty printing
- Allows method chaining

Streaming API - JsonGenerator

```
JsonGenerator ge=Json.createGenerator(…);
ge.startWriteArray()
    .startWriteObject()
      .write("type", "home”)
      .write("number", "212 555-1234")
    .end()
    .startWriteObject()
      .write("type", "fax”)
      .write("number", "646 555-4567")
    .end()
  .end()
.close();
```

```
[
  {
    "type": "home”,
    "number": "212 555-1234"
  },
  {
    "type": "fax”,
    "number": "646 555-4567"
  }
]
```

Object Model API

- JsonObject/JsonArray – JSON object and array structures
    - JsonString and JsonNumber for string and number values
- JsonBuilder – Builds JsonObject and JsonArray
- JsonReader – Reads JsonObject and JsonArray from input source
- JsonWriter – Writes JsonObject and JsonArray to output source

Object Model API - JsonObject

- Holds name/value pairs and immutable
- Name/value pairs can be accessed as Map<String, JsonValue>

```
JsonObject obj = …;
Map<String, JsonValue> map = obj.getValues();    // as a map

String str = obj.getStringValue(“foo”);

Set<String> names = obj.getNames();   // all names
```

Object Model API - JsonObject

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JsonObject obj = …;
Map<String, JsonValue> map = obj.getValues();    // as a map

String str = obj.getStringValue(“foo”);

Set<String> names = obj.getNames();   // all names
```

Object Model API - JsonArray

- Holds a list of values and immutable
- Values can be accessed as List<JsonValue>

```
JsonArray arr = …;

List<JsonValue> list = arr.getValues();   // as a list

String str = arr.getStringValue(0);
```

Object Model API - JsonArray

- Holds a list of values and immutable
- Values can be accessed as List<JsonValue>

```
JsonArray arr = …;

List<JsonValue> list = arr.getValues();   // as a list

String str = arr.getStringValue(0);
```

Object Model API - JsonArray

- Holds a list of values and immutable
- Values can be accessed as List<JsonValue>

```
JsonArray arr = …;

List<JsonValue> list = arr.getValues();   // as a list

String str = arr.getStringValue(0);
```

Object Model API - JsonBuilder

- Builder to build JsonObject and JsonArray from scratch
- Allows method chaining
- Type-safe (cannot mix array and object building methods)
- Can also use existing JsonObject and JsonArray in a builder

```
// builds empty JSON object
JsonObject obj = new JsonBuilder().beginObject().endObject().build();
```

Object Model API - JsonBuilder

```
JsonArray arr = new JsonBuilder()
  .beginArray()
    .beginObject()
      .add("type", "home”)
      .add("number", "212 555-1234")
    .endObject()
    .beginObject()
      .add("type", "fax”)
      .add("number", "646 555-4567")
    .endObject()
  .endArray()
.build();
```

```
[
  {
    "type": "home”,
    "number": "212 555-1234"
  },
  {
    "type": "fax”,
    "number": "646 555-4567"
  }
]
```

Object Model API - JsonBuilder

```
//Build using existing objects/subtrees
JsonObject home = …;
JsonObject fax = …;
JsonArray arr = new JsonBuilder()
  .beginArray()
    .add(home)
    .add(fax)
  .endArray()
.build();
```

Object Model API - JsonReader

- Reads JsonObject and JsonArray from input source
  - i/o Reader, InputStream (+ encoding)
- Optionally, configured with features
- Uses pluggable JsonParser

```
// Reads a JSON object
try(JsonReader reader = new JsonReader(io)) {
    JsonObject obj = reader.readObject();
}
```

Object Model API - JsonWriter

- Writes JsonObject and JsonArray to output source
    - i/o Writer, OutputStream (+ encoding)
- Optionally, configured with features. For e.g. pretty printing
- Uses pluggable JsonGenerator

```
// Writes a JSON object
try(JsonWriter writer = new JsonWriter(io)) {
    writer.writeObject(obj);
}
```

API - Configuration

- Configuration is a set of parser/generator features
  - Pretty Printing, Single-Quoted strings
- Supports extensibility (custom features)
- Can be used in streaming & object-model API

```
// Writes a JSON object prettily
JsonConfiguration config = new
    JsonConfiguration().withPrettyPrinting();
try(JsonWriter writer = new JsonWriter(io, config)) {
    writer.writeObject(obj);
}
```

API - Configuration (future)

- Perhaps, can have a corresponding annotation for a feature
- Can be used for injection

```
public class MyServlet extends HttpServlet {
    @Custom(a=“xxx”, b=12)
    @PrettyPrinting
    @Inject
    JsonGeneratorFactory factory;

    public void doGet(HttpServletRequest req, HttpServletResponse res) {
        factory.createGenerator(servlet.getOutputStream());
        …
    }
}
```

API - TODO

- Added Exceptions, equals()/hashCode() semantics after EDR
- Reworked JsonGenerator abstraction after EDR
- Miscellaneous

API Summary

- API provides :
  - Parsing input streams into immutable objects or event streams
  - Writing event streams or immutable objects to output streams
  - Programmatically navigating immutable objects
  - Programmatically building immutable objects with builders
- API becomes
  - A base for building data binding, transformation, querying, or other manipulation APIs

DEMO

Resources

- http://json-processing-spec.java.net
- http://jsonp.java.net
- users@json-processing-spec.java.net

Q&A