APIS AND LINKED DATA

A MATCH MADE IN HEAVEN

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ATHENS, GREECE, 7TH NOVEMBER 2015

AGENDA

- Linked Data Overview
- Business Models on Linked Data
- What is an API?
- Business Importance Around APIs
- APIs and Linked Data
- JSON-LD
- Hydra
- DeepGraphs
- Linda

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LINKED DATA

"The term Linked Data refers to a set of best practices for publishing and connecting structured data on the Web."

"the Semantic Web is the goal or end result… Linked Data provides the means to reach that goal"

From '*Linked Data: The Story So Far*' - Heath, Bizer and Berners-Lee 2009

"The goal of Linked Data is to enable people to share *structured data* on the Web as easily as they can share documents today."

- Bizer/Cyganiak/Heath Linked Data Tutorial, linkeddata.org

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LINKED DATA DESIGN ISSUES

Tim Berners-Lee
Date: 2006-07-27, last change: $Date: 2009/06/18 18:24:33 $
Status: personal view only. Editing status: imperfect but published.
Up to Design Issues

Linked Data

The Semantic Web isn't just about putting data on the web. It is about making links, so that a person or machine can explore the web of data. With linked data, when you have some of it, you can find other, related, data.

Like the web of hypertext, the web of data is constructed with documents on the web. However, unlike the web of hypertext, where links are relationships anchors in hypertext documents written in HTML, for data they links between arbitrary things described by RDF,. The URIs identify any kind of object or concept. But for HTML or RDF, the same expectations apply to make the web grow:
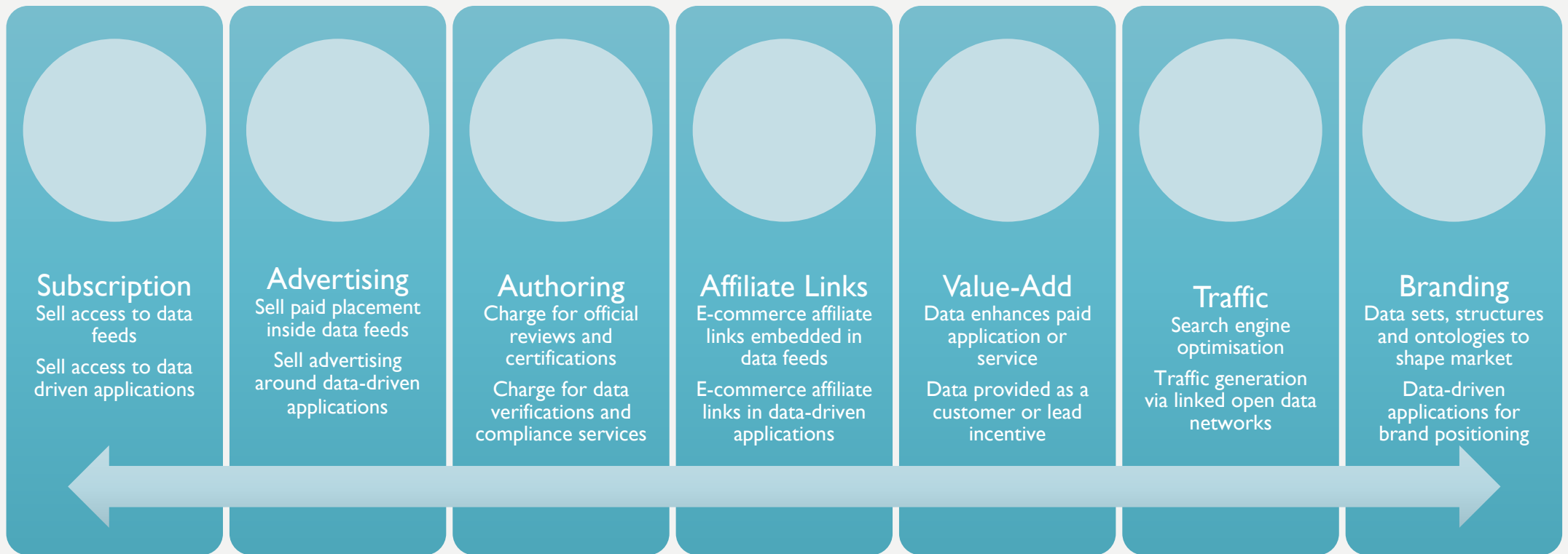
1. Use URIs as names for things

2. Use HTTP URIs so that people can look up those names.

3. When someone looks up a URI, provide useful information, using the standards (RDF*, SPARQL)

4. Include links to other URIs. so that they can discover more things.

LINKED DATA
★ On the web, open license
★★ Machine-readable data
★★★ Non-proprietary format
★★★★ RDF standards
★★★★★ Linked RDF
IS YOUR DATA 5 ★ ?

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URIS AND HTTP

- *"A Uniform Resource Identifier' (URI) provides a simple and extensible means for identifying a resource"* – W3C RFC 3986

- HTTP URIs may be 'de-referenced' on the Web

- HTTP URIs are used for "real world" things

    - http://adrianstevenson.com/id/me

    - http://dbpedia.org/resource/Love

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LINKED DATA BUSINESS MODELS

Subscription
Sell access to data feeds

Sell access to data driven applications

Advertising
Sell paid placement inside data feeds

Sell advertising around data-driven applications

Authoring
Charge for official reviews and certifications

Charge for data verifications and compliance services

Affiliate Links
E-commerce affiliate links embedded in data feeds

E-commerce affiliate links in data-driven applications

Value-Add
Data enhances paid application or service

Data provided as a customer or lead incentive

Traffic
Search engine optimisation

Traffic generation via linked open data networks

Branding
Data sets, structures and ontologies to shape market

Data-driven applications for brand positioning

@mpetyx Direct   Indirect

WHAT IS AN API?

- 'Application Programming Interface'

  – *"API is an online interface that allows distributed systems to communicate with one another and exchange information"*

  – *"APIs are carefully thought out pieces of code created by programmers .. that allow other applications to interact with their application"*
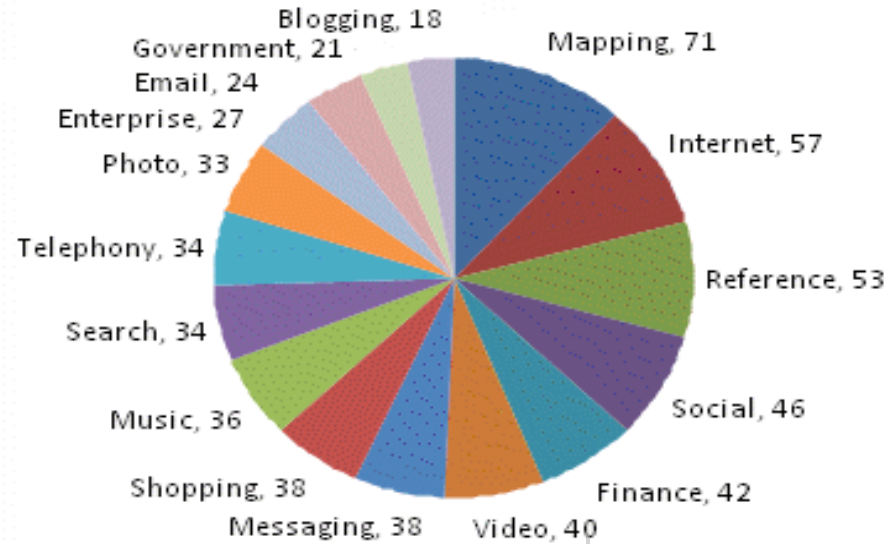
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APIS

- Allow machine readability of data
  - Typically over the Web
- Provide *other systems* with access to content or functions
- Many types – e.g.
  - Google, Facebook, Flickr, twitter APIs ….
  - OAI-PMH
  - Linked Data API, SPARQL
  - Others include SOLR, SRU, Z39.50, SOAP, ….

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APIS ARE MACHINE TO MACHINE

- API is software-to-software interface, not a user interface
- E.g. Cinema ticket websites use API:
  - Sends credit card info to remote application
  - Remote application sends response back to ticket website saying OK to issue the tickets
- User see **one** interface

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Number of API Providers, Top 15 Categories

Blogging, 18
Government, 21
Email, 24
Enterprise, 27
Photo, 33
Telephony, 34
Search, 34
Music, 36
Shopping, 38
Messaging, 38
Video, 40
Finance, 42
Social, 46
Reference, 53
Internet, 57
Mapping, 71

ProgrammableWeb.com Nov, 2008

programmableweb API Growth Over Time

7000
6000
5000
4000
3000
2000
1000
0

2006 2007 2008 2009 2010 2011 2012
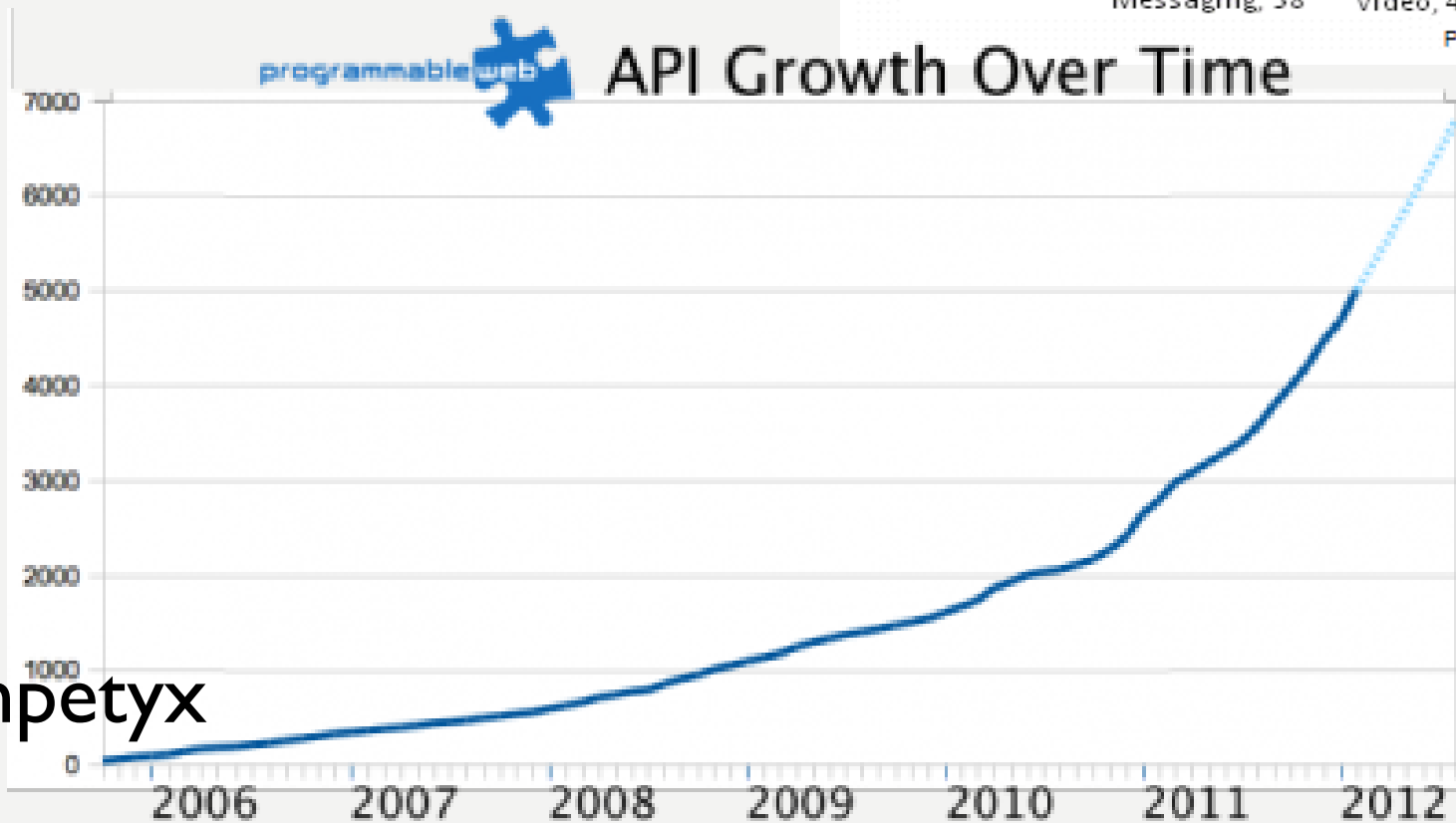
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958 million websites

60 trillion

web pages

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WHY NEED AN API AT ALL?

A small team/Company

Shipping is Priority

No Time

API Saves Money

Someone else is doing it better
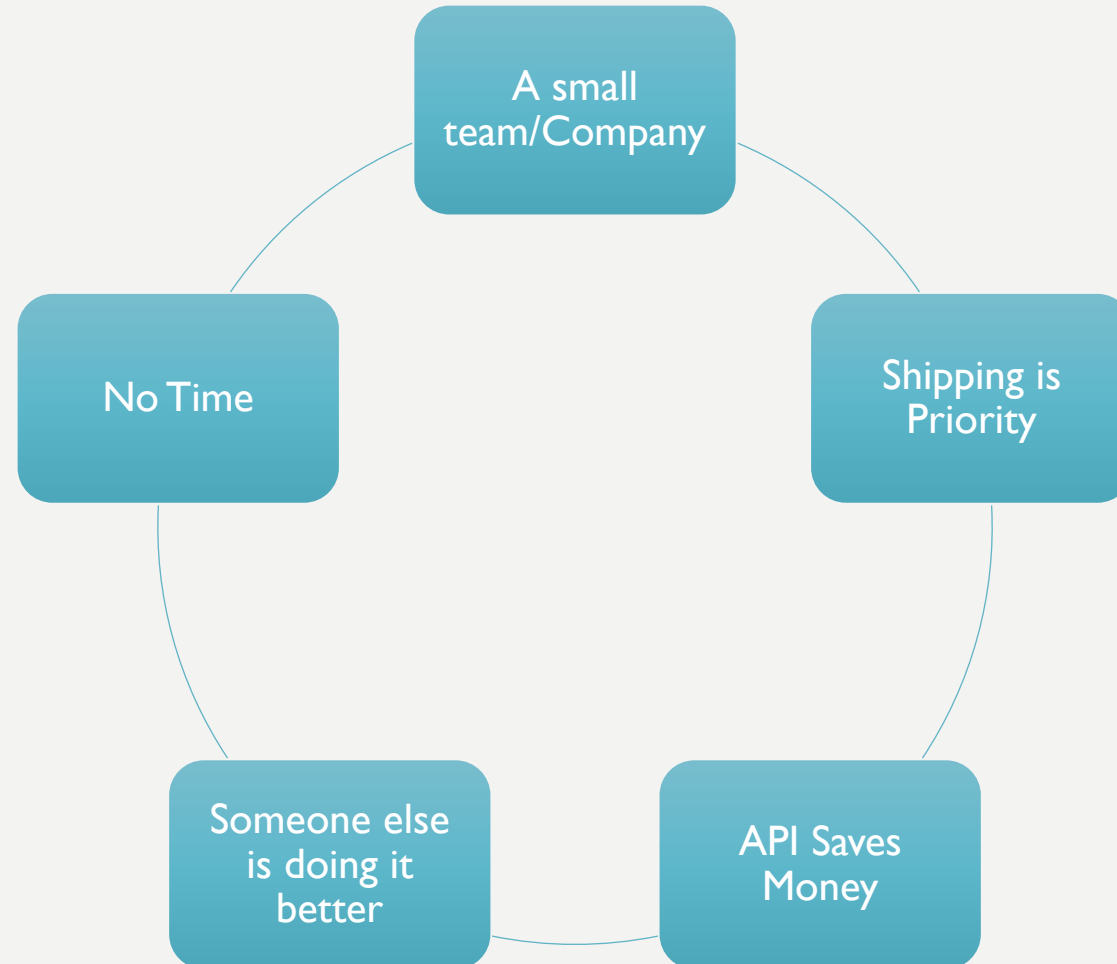
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IMPORTANT OF API STABILITY IN SMES

Markeplaces, Hubs, Directories, Search

Ad-hoc requests

Sandboxing environments

Testing
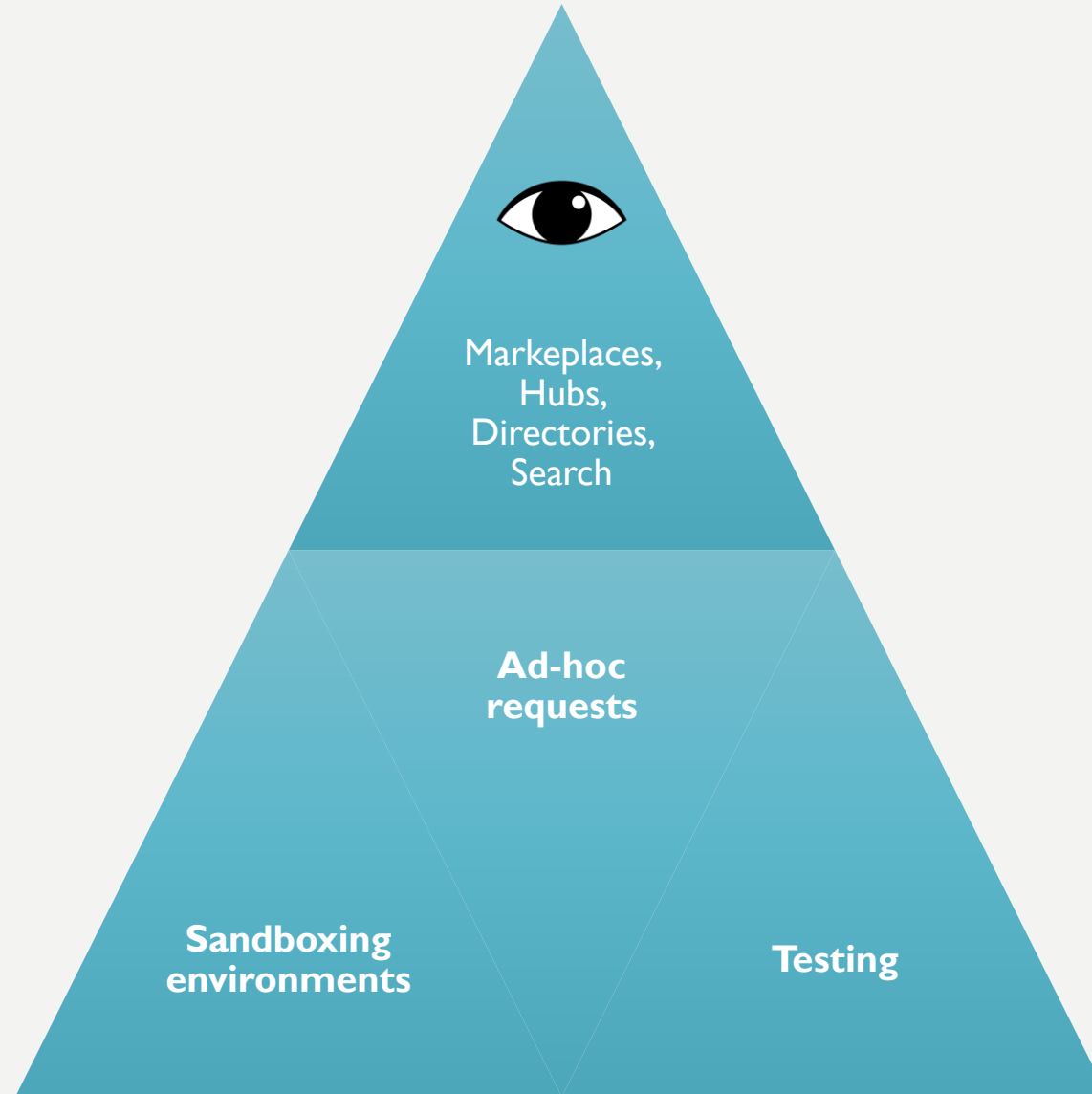
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EACH API IS UNIQUE

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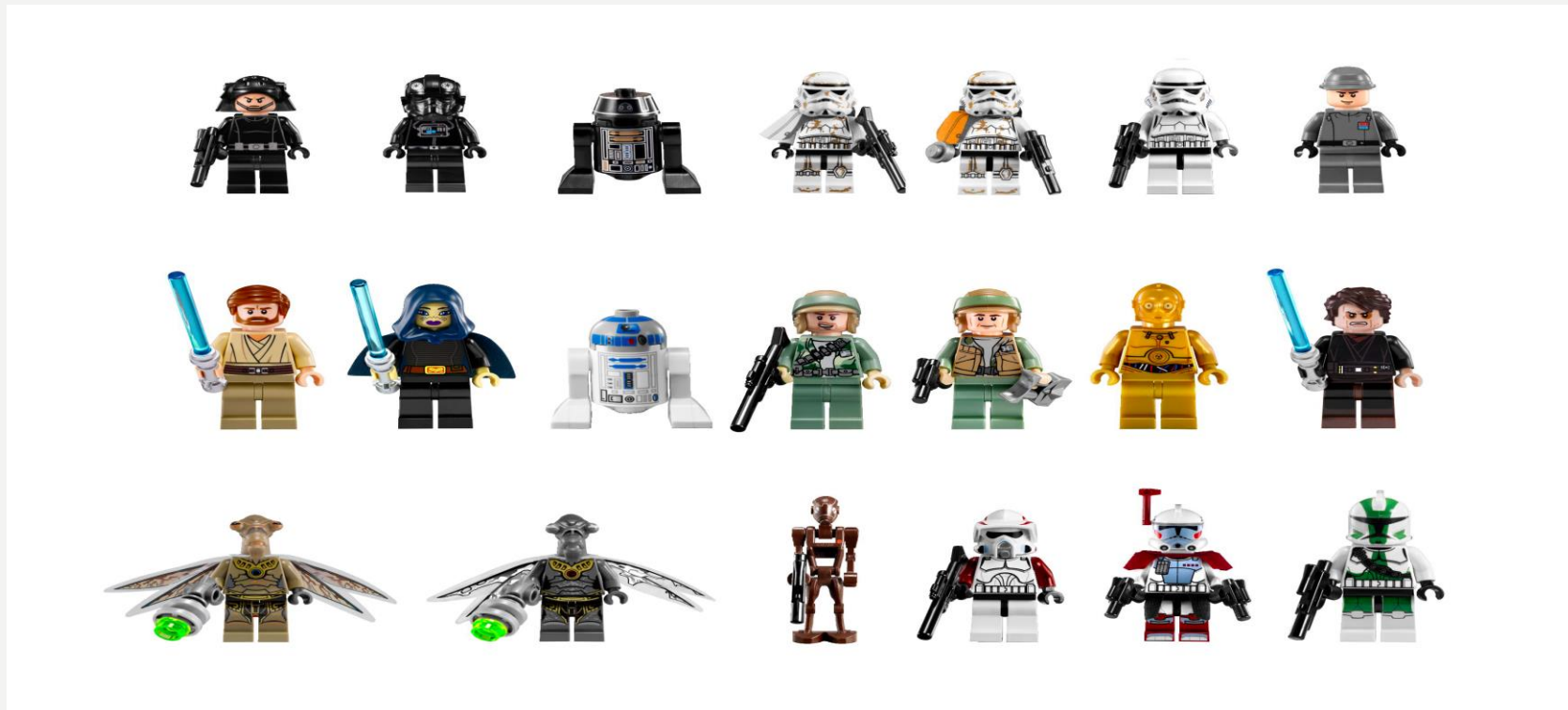
OPEN APIS

WILL ORACLE V. GOOGLE MEAN THE DEATH OF THE API ECONOMY?

Jennifer Riggins, Contributing Writer

Jun. 22 2015, 12:30PM EDT

Between the advents of mobile computing and the Internet of Things (IoT), the API is rapidly becoming the most important leverage point in the history of computing. Few, if any, profoundly scalable innovations are able to fully deliver on their potential without the employment of APIs. A possible threat has emerged in the form of the court case *Oracle America, Inc. v. Google, Inc.* centered on Oracle's claim that their Java APIs are copyrightable.

AUTOMATED API PROVISIONING

- Problem: How do I use an API without specifically coding for it?

- Answer: Use vocabulary to define operations on classes and properties

- Proposition: Annotations are the result of operations on entities or the relationships between entities.

  – Those results are also entities, which may be operated upon.

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LINKS AND OPERATIONS

- Define operations on entities, types of entities, or their properties.

- When does a property link to an entity?

- How do you use pagination to reference and collect linked entities?

- What operations can I perform on an entity, or property of that entity?

- Where does authentication/authorization intersect with generic API interactions?

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INTRODUCING JSON-LD

@graph

@context

@id

JSON-based syntax to express linked data

@language

@value

@list

@type

@set

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SELF-DESCRIBING MESSAGES

- Give objects types (@type)

```json
{
  "@context": {
    "schema":      "http://schema.org/",
    "Person":      "schema:Person",
    "colleagues":  {"@id": "schema:colleagues", "@type":
"@id"},
    "name":        "schema:name",
    "image":       {"@id": "schema:image", "@type": "@id"},
    "url":         {"@id": "schema:url", "@type": "@id"}
  }
}
{
  "@context": "http://example.com/context.jsonld",
  "@type": "Person",
  "image":
"http://localhost:9393/examples/schema.org/janedoe.jpg",
  "colleagues": [
    "http://www.xyz.edu/students/alicejones.html",
    "http://www.xyz.edu/students/bobsmith.html"
  ],
  "name": "Jane Doe",
  "url": "http://www.janedoe.com"
}
```

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SELF-DESCRIBING MESSAGES

- Give objects types (@type)

- Associate properties with IRIs

```
{
  "@context": {
    "schema":      "http://schema.org/",
    "Person":      "schema:Person",
    "colleagues":  {"@id": "schema:colleagues", "@type":
"@id"},
    "name":        "schema:name",
    "image":       {"@id": "schema:image", "@type": "@id"},
    "url":         {"@id": "schema:url", "@type": "@id"}
  }
}
{
  "@context": "http://example.com/context.jsonld",
  "@type": "Person",
  "image":
"http://localhost:9393/examples/schema.org/janedoe.jpg",
  "colleagues": [
    "http://www.xyz.edu/students/alicejones.html",
    "http://www.xyz.edu/students/bobsmith.html"
  ],
  "name": "Jane Doe",
  "url": "http://www.janedoe.com"
}
```

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SELF-DESCRIBING MESSAGES

- Give objects types (@type)

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- Use *terms* defined in a referenced context

```json
{
  "@context": {
    "schema":      "http://schema.org/",
    "Person":      "schema:Person",
    "colleagues":  {"@id": "schema:colleagues", "@type":
"@id"},
    "name":        "schema:name",
    "image":       {"@id": "schema:image", "@type": "@id"},
    "url":         {"@id": "schema:url", "@type": "@id"}
  }
}
{
  "@context": "http://example.com/context.jsonld",
  "@type": "Person",
  "image":
"http://localhost:9393/examples/schema.org/janedoe.jpg",
  "colleagues": [
    "http://www.xyz.edu/students/alicejones.html",
    "http://www.xyz.edu/students/bobsmith.html"
  ],
  "name": "Jane Doe",
  "url": "http://www.janedoe.com"
}
```

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SELF-DESCRIBING MESSAGES

- Give objects types (@type)

- Associate properties with IRIs

- Use *terms* defined in a referenced context

- Specify property types in context

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```
{
  "@context": {
    "schema":      "http://schema.org/",
    "Person":      "schema:Person",
    "colleagues":  {"@id": "schema:colleagues", "@type":
"@id"},
    "name":        "schema:name",
    "image":       {"@id": "schema:image", "@type": "@id"},
    "url":         {"@id": "schema:url", "@type": "@id"}
  }
}
{
  "@context": "http://example.com/context.jsonld",
  "@type": "Person",
  "image":
"http://localhost:9393/examples/schema.org/janedoe.jpg",
  "knows": [
    "http://www.xyz.edu/students/alicejones.html",
    "http://www.xyz.edu/students/bobsmith.html"
  ],
  "name": "Jane Doe",
  "url": "http://www.janedoe.com"
}
```

DESCRIBING APIS WITH JSON-LD

In search for the API Nirvana

DeepGraphs

WHAT IS HYDRA?

- W3C Community Group for Linked APIs
  - REST + Linked Data
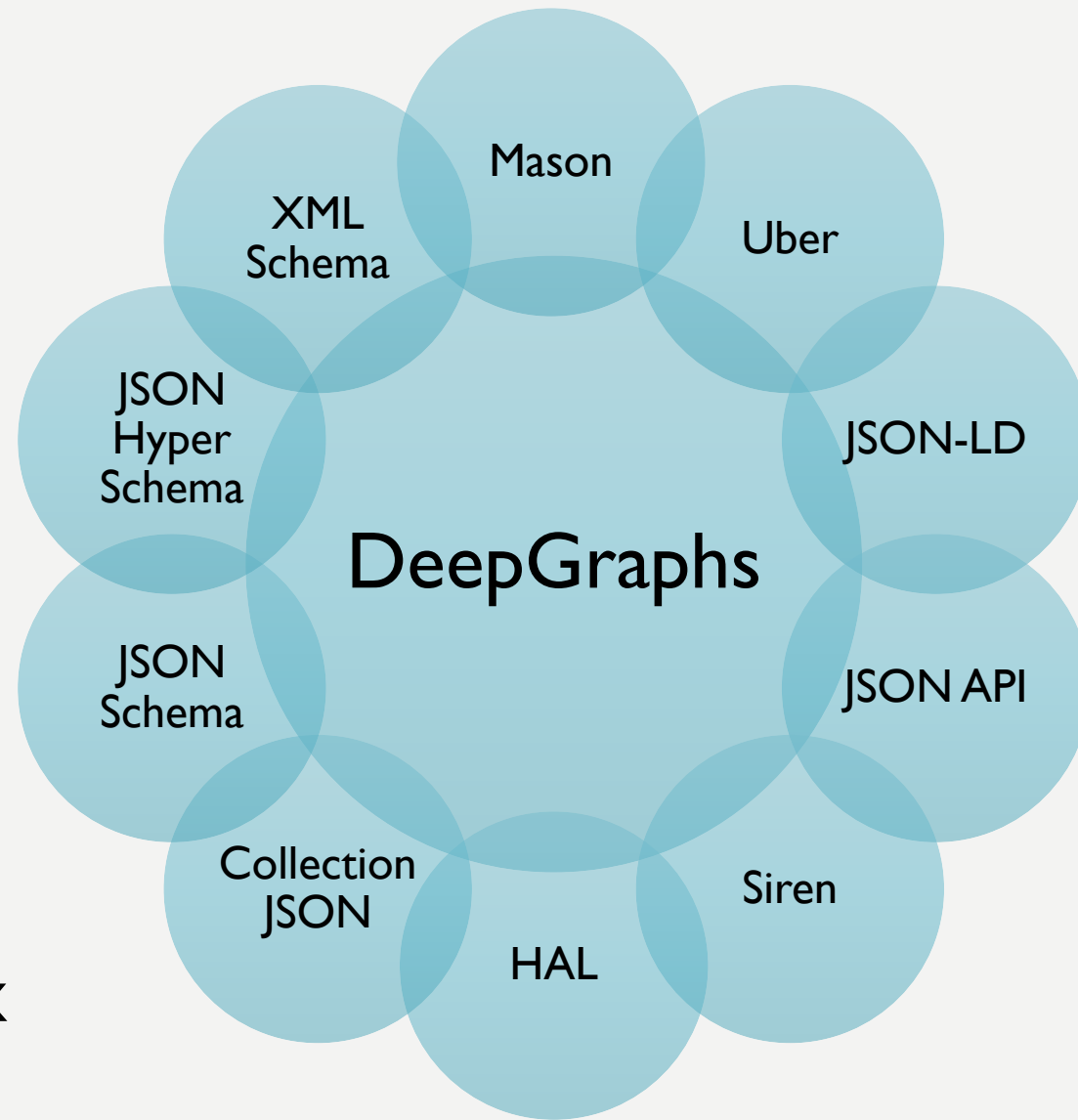 - "At the intersection of web schemas and RESTful web applications"

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DEEPGRAPHS APPROACH

Goal: Modelling Hypermedia Responses

I Vocabulary

❖ Hydra Documents

❖ SWRL Rules

❖ JSON-LD Responses

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SIMILAR APPROACHES/ MEDIA TYPES

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THE LINDA SOLUTION

- **Usage** and **Publication** of Linked Data
- **Renovation** and **Conversion** of existing data formats into **Structures** that support the semantic enrichment and interlinking of data

http://linda-project.eu/

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JOIN THE HACK

http://linda-project.eu/hackathon/

http://linda-project.eu/

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THANK YOU

Michael Petychakis

```
<a
href="mailto:mpetyx@epu.ntua.gr?Subject=Hell
o" target="_top">Drop me an e-mail</a>
```

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