

菩薩相談



Hypermedia Workshop

Resource Architectural Constraints and the Properties They Induce

Brian Sletten ([🐦@bsletten](#))

03/17/2015

Speaker Qualifications

- Specialize in next-generation technologies
- Author of 'Resource-Oriented Architecture Patterns for Webs of Data'
- Speaks internationally about REST, Semantic Web, Data Science, Security, Visualization, Architecture
- Worked in Defense, Finance, Retail, Hospitality, Video Game, Health Care, Telecommunications and Publishing Industries
- International Pop Recording Artist

Agenda

- Introduction
- Identity
- Interaction
- Representation
- Description
- Patterns
- Linked Data



Introduction



“ Approximately half of the talks at API conferences start with a variation of this slide: 'we're doing great, because there are more than 12,000 APIs...' ”

Ruben Verborgh

<http://ruben.verborgh.org/blog/2015/02/25/fostering-intelligence-by-enabling-it/>

“ Personally, I never understood how overgrowth can be a good thing: 12,000 APIs means 12,000 different ways of engaging in machine-to-machine interaction.”

Ruben Verborgh

<http://ruben.verborgh.org/blog/2015/02/25/fostering-intelligence-by-enabling-it/>

“Software architecture research investigates methods for determining how best to partition a system, how components identify and communicate with each other, how information is communicated, how elements of a system can evolve independently, and how all of the above can be described using formal and informal notations.”

Dr. Roy T. Fielding

http://www.ics.uci.edu/~fielding/pubs/dissertation/fielding_dissertation.pdf

“My work is motivated by the desire to understand and evaluate the architectural design of network- based application software through principled use of architectural constraints, thereby obtaining the functional, performance, and social properties desired of an architecture.”

Dr. Roy T. Fielding

http://www.ics.uci.edu/~fielding/pubs/dissertation/fielding_dissertation.pdf

“An architectural style is a named, coordinated set of architectural constraints.”

Dr. Roy T. Fielding
http://www.ics.uci.edu/~fielding/pubs/dissertation/fielding_dissertation.pdf

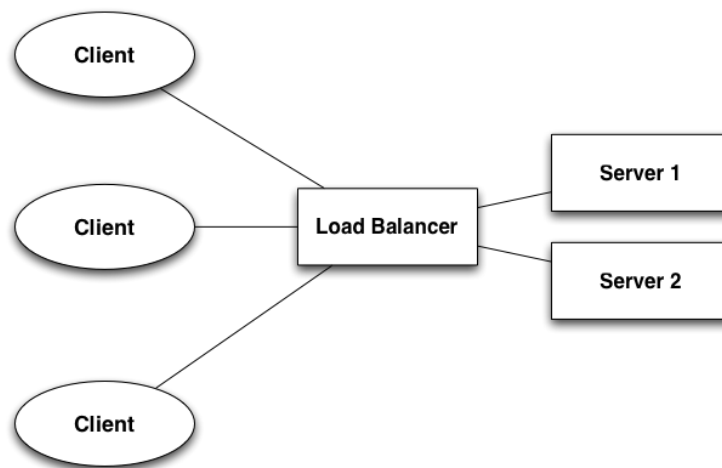
Desired Properties

- Performance
- Scalability
- Generality
- Simplicity
- Modifiability
- Extensibility

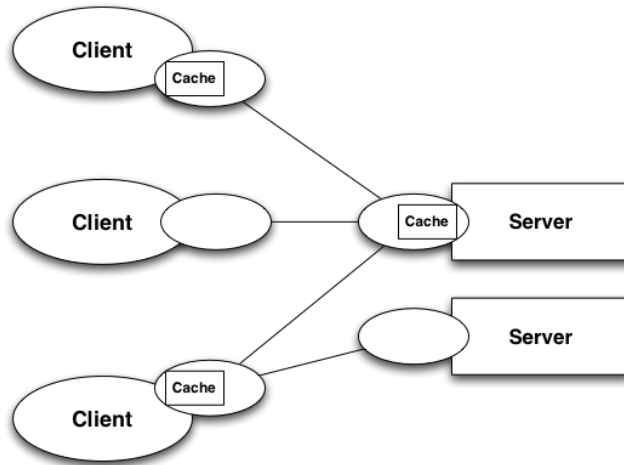
Client Server



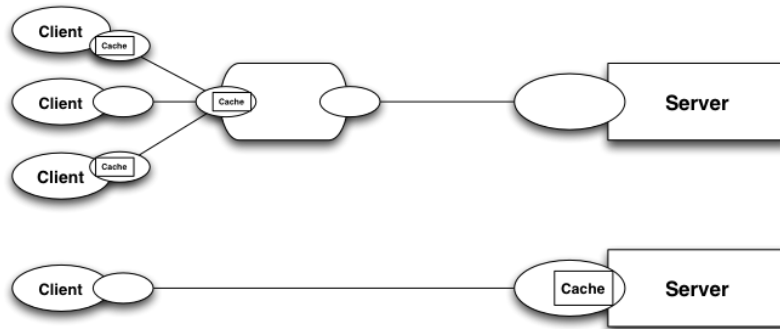
Stateless Client Server



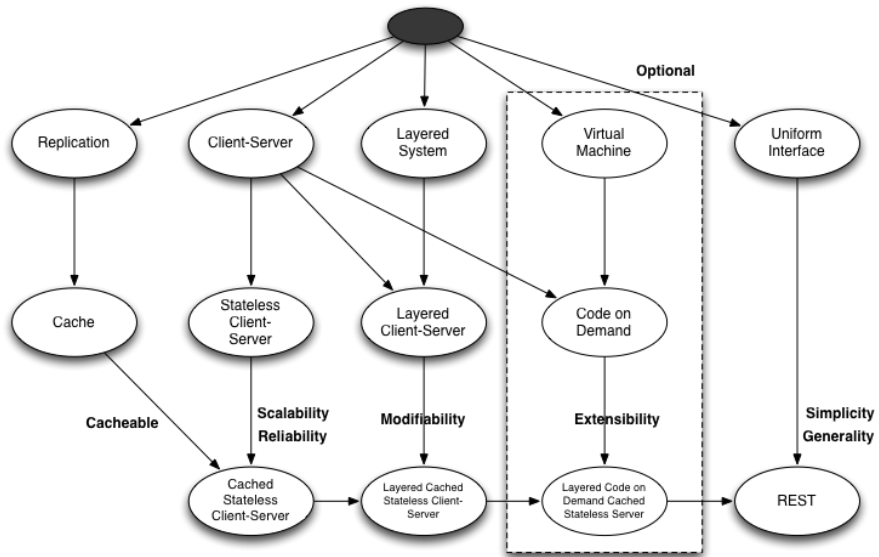
Stateless Client Server w/ Cache and Uniform Interface



Layered Stateless Client Server w/ Cache and Uniform Interface



REST on a Slide



Credit: [Architectural Styles and the Design of Network-based Software Architectures](#)



Identity

“The function of a name is to facilitate sharing.”

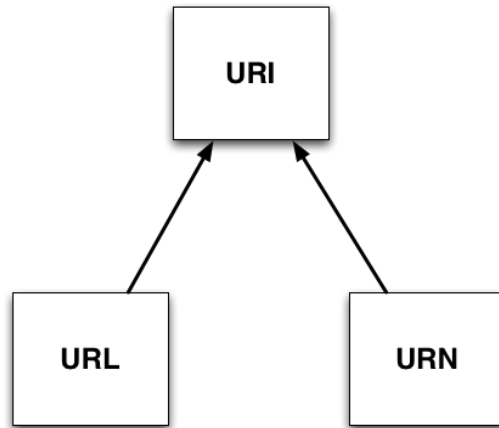
Ross J. Anderson

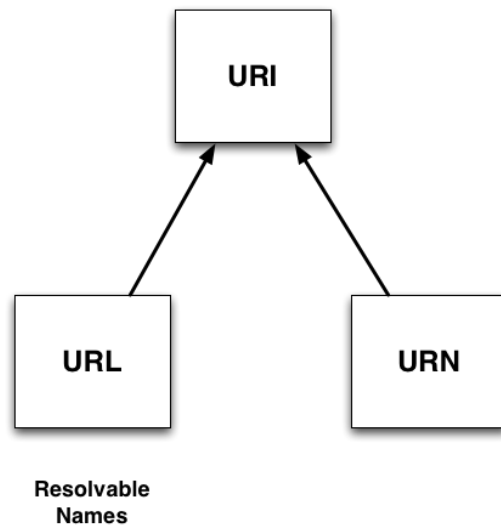
“When systems become large, the scale-up problems are not linear; there is often a qualitative change in complexity, and some things that are trivial to deal with in a network of only a few machines and principals (such as naming) suddenly become a big deal.”

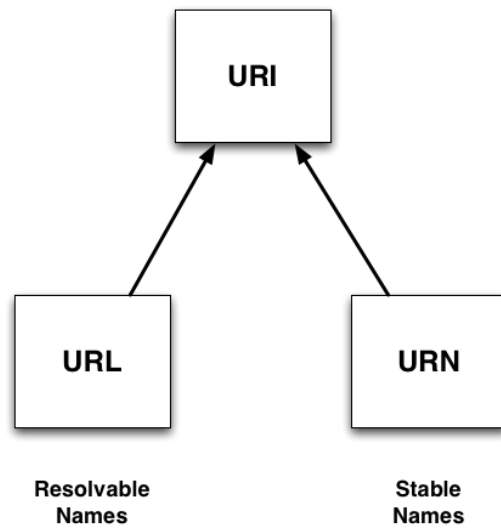
Ross J. Anderson

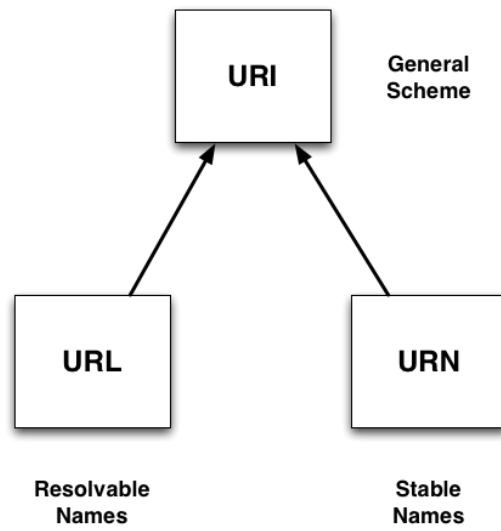
Naming Scheme Properties

- Identity
- Disambiguation
- Scope
- Resolvability









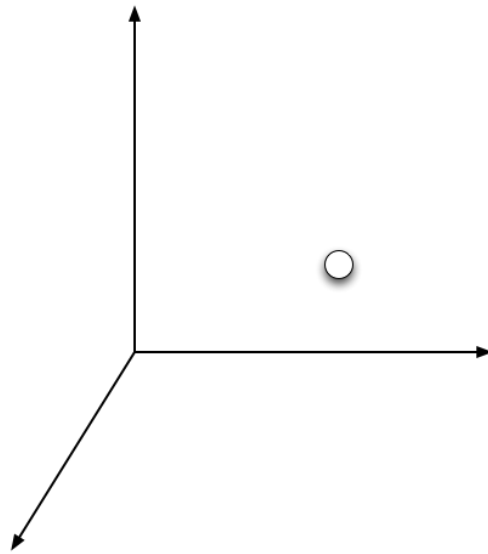
Uniform Naming Scheme

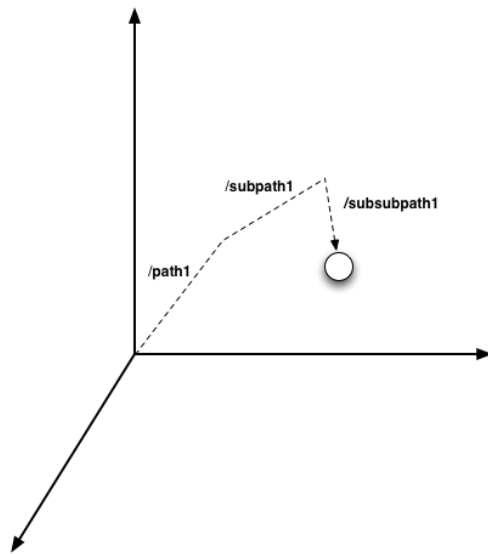
- <http://bosatsu.net/foaf/brian.rdf>
- <ftp://ftp.funet.fi/pub/standards/RFC/rfc959.txt>
- <urn:isbn:0913966568>
- <https://w3id.org/people/bsletten>
- TBD

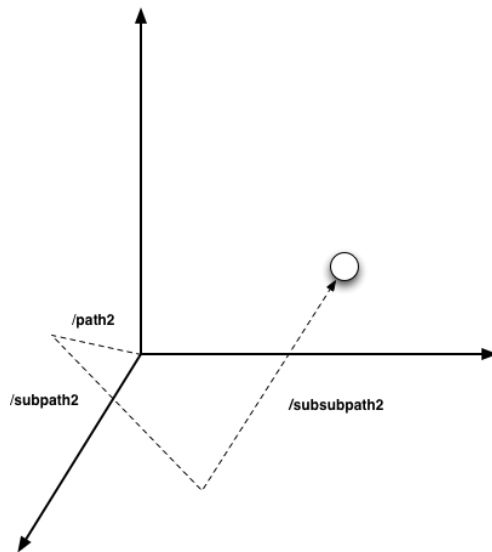
URL

What REST Says About URLs

.







Resource For the Current Time

<http://example.com/time/timezone/EDT>

<http://example.com/time/timezone/PDT>

<http://example.com/time/state/us/hawaii>

<http://example.com/time/timezone/HAST>

Canonical vs Historical

<http://bosatsu.net/talks/topic/rest>

<http://bosatsu.net/talks/conf/nfjs/2013/rest/minneapolis>

Versioning URLs

- Just don't do it
- Seriously, don't do it
- Conflates identity with representation
- Impact on API evolution

“Global naming leads to global network effects.”

“Any resource anywhere can be given a URI.”

“Any resource of significance should be given a URI.”

“A URI will repeatedly refer to 'the same' thing.”

“The significance of identity for a given URI is determined by the person who owns the URI, who first determined what it points to.”

“URI space does not have to be the only universal space.”

“What makes a cool URI? A cool URI is one which does not change.”

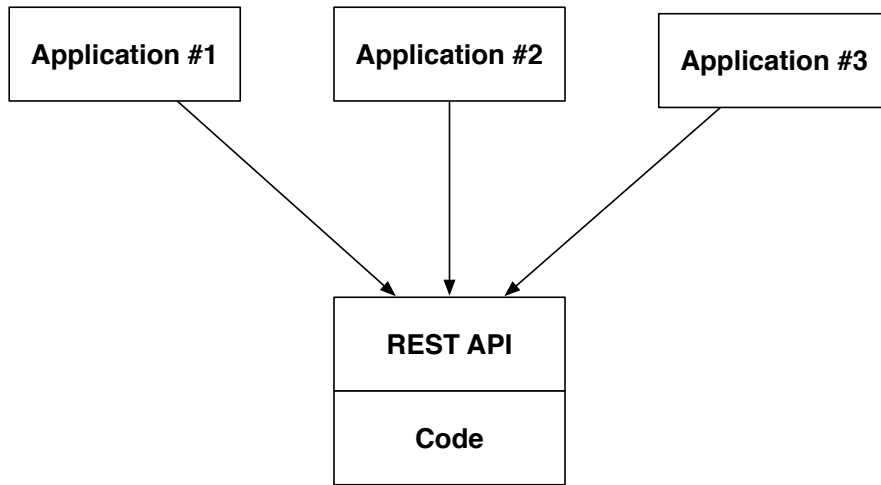
Tim Berners-Lee
Cool URIs Don't Change

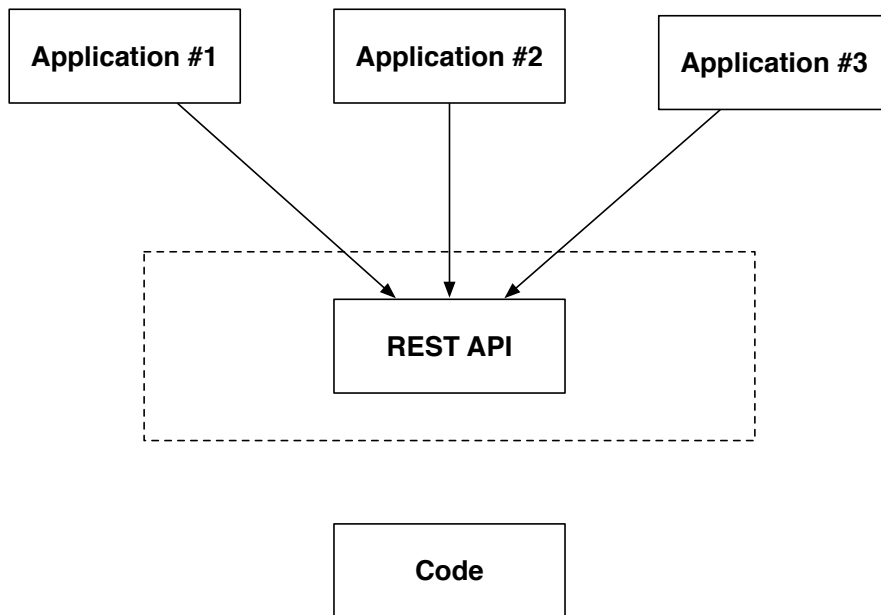
Things to Avoid

- Author name
- Status
- Access
- File name extension
- Software mechanism



Interaction



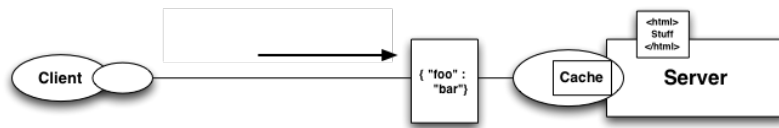


HTTP
URL

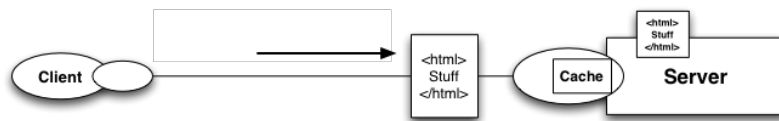
GET



POST



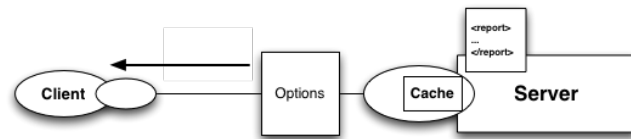
PUT



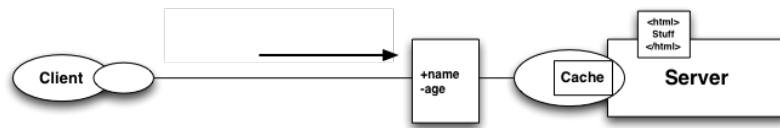
DELETE



OPTIONS



PATCH



```
OPTIONS /example/buddies.xml HTTP/1.1  
Host: www.example.com
```

```
HTTP/1.1 200 OK  
Allow: GET, PUT, POST, OPTIONS, HEAD, DELETE, PATCH  
Accept-Patch: application/example, text/example
```

```
GET /example/buddies.xml HTTP/1.1  
Host: www.example.com
```

```
HTTP/1.1 200 OK  
.  
.  
Etag: "e0023aa4e"
```

```
PATCH /example/buddies.xml HTTP/1.1
Host: www.example.com
Content-Type: application/example
If-Match: "e0023aa4e"
Content-Length: 100
[patch changes]
```

```
HTTP/1.1 204 No Content
Content-Location: /example/buddies.xml
ETag: "e0023aa4f"
```

Idempotency

GET	✓
POST	✗
PUT	✓
PATCH	~✓
DELETE	✓

Response Codes: 2XX

Code	Meaning
200	Ok
201	Created
202	Accepted
204	Success

Response Codes: 3XX

Code	Meaning
301	Moved Permanently
302	Found
303	See Other
304	Not Modified

Response Codes: 4XX

Code	Meaning
400	Bad Request
401	Unauthorized
403	Forbidden
404	Not Found
405	Method Not Allowed
409	Conflict
411	Length Required
413	Entity Too Long
415	Unsupported Media Type

Response Codes: 5XX

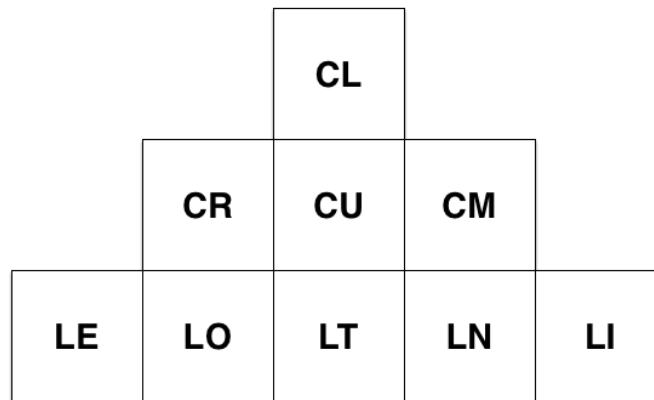
Code	Meaning
500	Internal Error
503	Service Unavailable



Representation

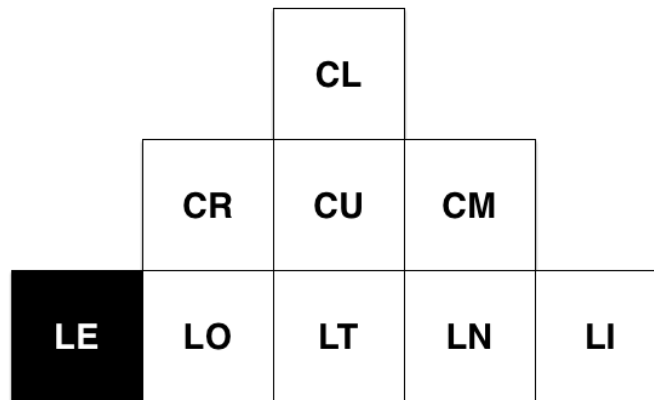
Hyper Media
HTTP
URL

Hypermedia Factors (HFactors)



Credit: [Mike Amundsen](#)

Embedded Links (LE)



Credit: [Mike Amundsen](#)

LE Examples

```
// HTML
```

```

```

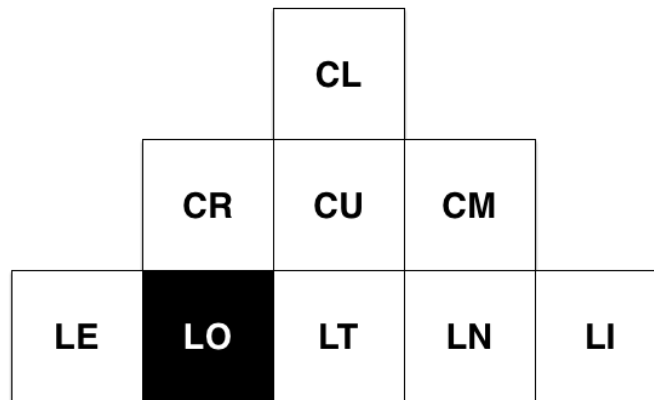
```
// XInclude
```

```
<author>
```

```
  <x:include href="http://bosatsu.net/snippets/bio.xml"/>
```

```
</author>
```

Outbound Links (LO)



Credit: [Mike Amundsen](#)

LO Examples

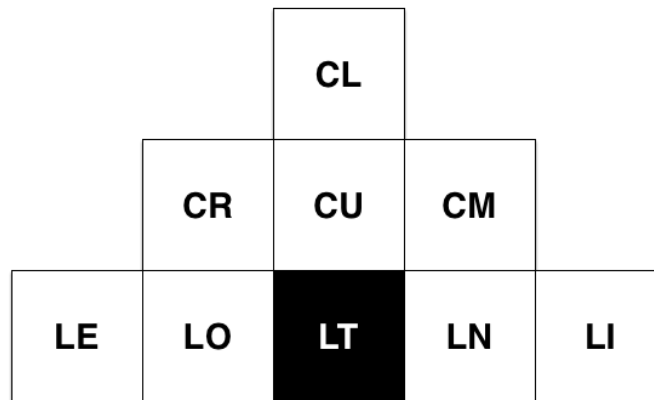
```
// HTML
```

```
<p>
```

```
  See you at <a href="http://uberconf.com">Überconf</a>.
```

```
</p>
```

Outbound Links (LT)



Credit: [Mike Amundsen](#)

LT Examples

```
// HTML
<form method="get" action="http://bosatsu.net/submit">
  <input type="text" name="course" value="REST"/>
  <input type="submit"/>
</form>
```

```
// HTTP
http://bosatsu.net/submit?course=REST
```

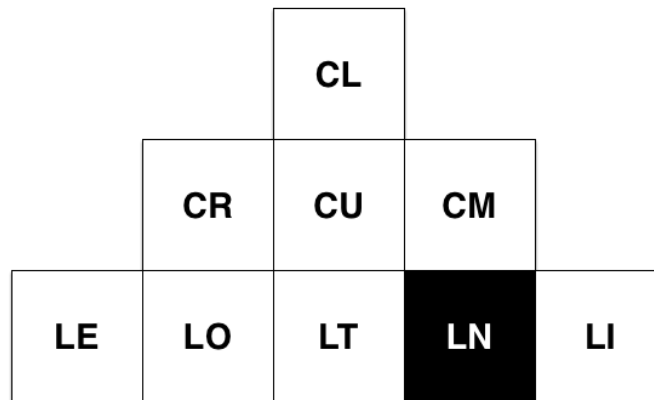
LT Examples

URI Templates (RFC 6570)

```
http://example.com/~{username}/  
http://example.com/dictionary/{term:1}/{term}  
http://example.com/search{?q,lang}
```

```
http://example.com/~fred/  
http://example.com/~mark/  
http://example.com/dictionary/c/cat  
http://example.com/dictionary/d/dog  
http://example.com/search?q=cat&lang=en  
http://example.com/search?q=chien&lang=fr
```

Non-Idempotent Links (LN)



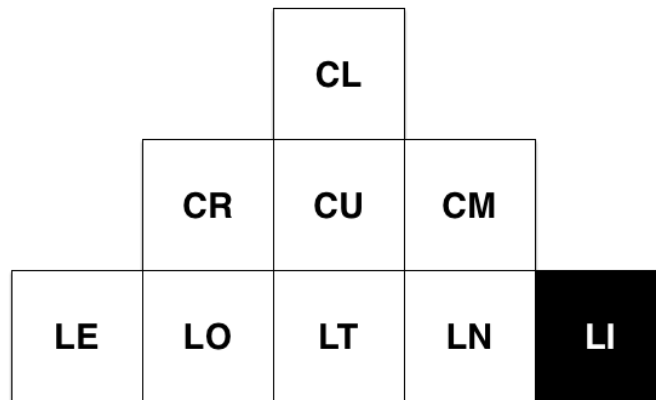
Credit: [Mike Amundsen](#)

LN Examples

```
// HTML
<form method="post" action="http://bosatsu.net/submit/">
  <textarea name="feedback">Hey Buddy, nice jacket</textarea>
  <input type="submit"/>
</form>
```

```
POST /submit/ HTTP/1.1
Host: bosatsu.net
Content-Type: application/x-www-form-urlencoded
Length:34
feedback=Hey+Buddy%2C+nice+jacket
```


Idempotent Links (LI)



Credit: [Mike Amundsen](#)

LI Examples

```
// Atom
<link rel="edit" href="http://bosatsu.net/feed/edit/1"/>
```

```
// HTML
<script type="text/javascript">
function delete(url) {
  var xhr = new XMLHttpRequest();
  xhr.open("DELETE", url);
}
</script>
```

W3C HTML Form HTTP Extensions

<http://www.w3.org/TR/form-http-extensions/>

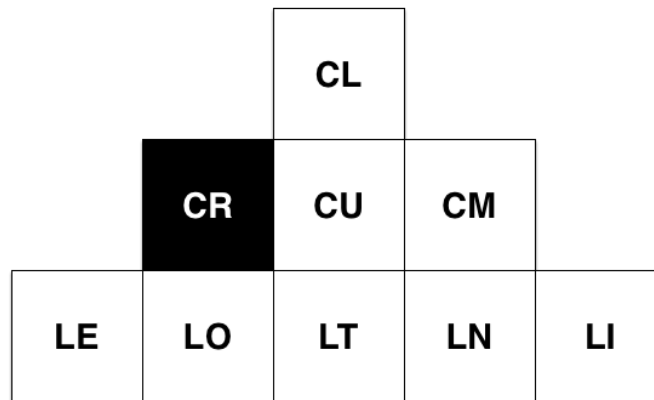
```
<form action="http://www.example.com/cms/hogmanay" method="PUT">
  <input name="If-Unmodified-Since"
    type="hidden" value="Tue, 1 Jan 2013 12:00:00 GMT"
    payload="_header"/>
  <textarea name="content">
    For auld lang syne, my dear,
      For auld lang syne.
    We'll tak a cup o' kindness yet,
      For auld lang syne.
    And there's a hand, my trusty fere!
      And gie's a hand o' thine!
    And we'll tak a right gude-willie waught,
      For auld lang syne.
  </textarea>
  <button type="submit">Update</button>
</form>
```

W3C HTML Form HTTP Extensions

<http://www.w3.org/TR/form-http-extensions/>

```
<form action="http://www.example.com/logs" method="DELETE">  
  <label for="since">Since</label>  
  <input id="since" name="since" type="datetime"/>  
  <button type="submit">Delete</button>  
</form>
```

Read Context (CR)

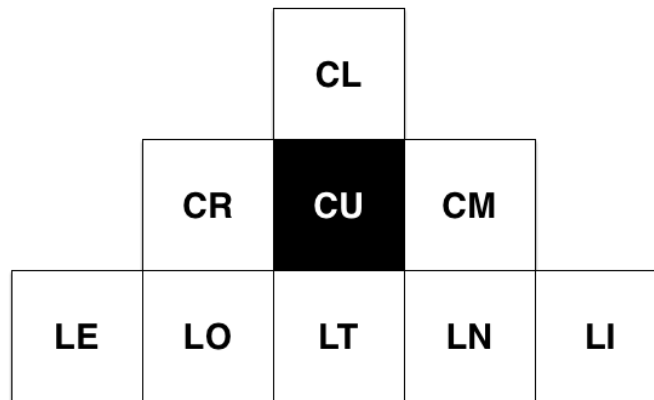


Credit: [Mike Amundsen](#)

CR Examples

```
<x:include href="http://bosatsu.net/snippets/bio.xml"  
  accept-language="en, en-gb; q=0.9, jp;q=0.3"/>
```

Update Context (CU)



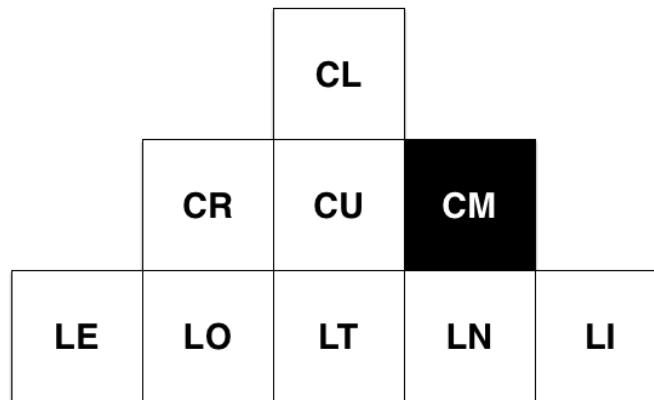
Credit: [Mike Amundsen](#)

CU Examples

```
// HTML
<form method="post" action="http://bosatsu.net/submit/"
  enctype="text/plain">
  <textarea name="feedback">Hey Buddy, nice jacket</textarea>
  <input type="submit"/>
</form>
```

```
POST /submit/ HTTP/1.1
Host: bosatsu.net
Content-Type: text/plain
Length:34
Hey+Buddy%2C+nice+jacket
```


Method Context (CM)



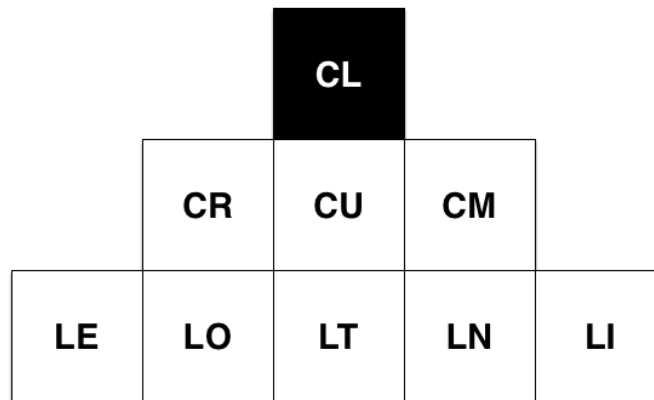
Credit: [Mike Amundsen](#)

CM Examples

```
// HTML
<form method="post" action="/feedback">
  <input name="keywords" type="text" value="foo,bar,baz"/>
  <input type="submit"/>
</form>
```

```
// HTML
<form method="get" action="/feedback">
  <input name="keywords" type="text" value="foo,bar,baz"/>
  <input type="submit"/>
</form>
```

Link Context (CL)



Credit: [Mike Amundsen](#)

CL Examples

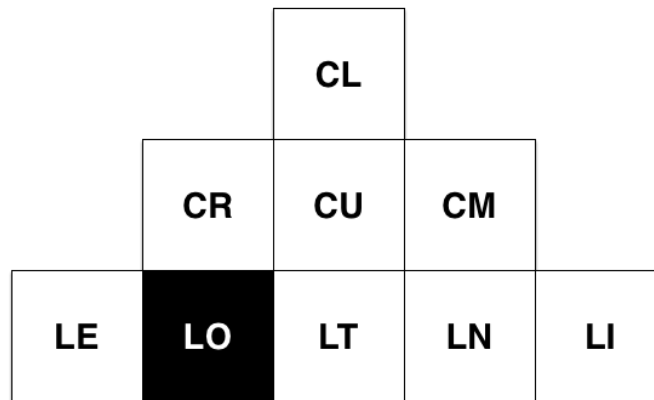
```
// Atom
```

```
<entry>  
  <title>The Bully</title>  
  <link rel="edit" href="http://bosatsu.net/feed/1"/>  
  <id>tag:bosatsu.net,2013:3.2397</id>  
  <updated>2013-03-01T12:29:29Z</updated>  
  <published>2013-02-13T08:29:29-04:00</published>  
  <author>  
    <name>Brian Sletten</name>  
  </author>  
  <content>Hey Buddy, nice car.</content>  
</entry>
```

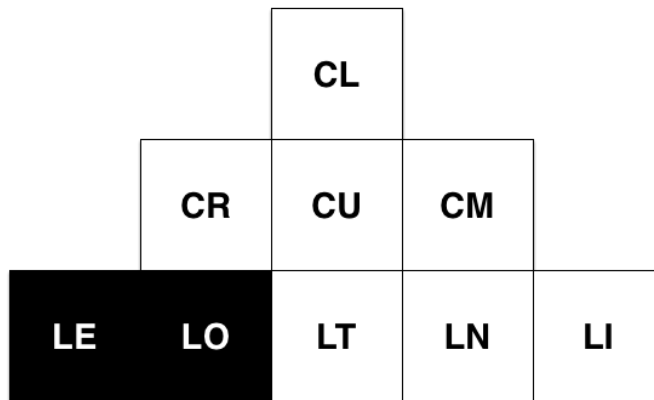
```
// HTML
```

```
<link rel="stylesheet" href="http://bosatsu.net/css/default.css"/>
```

text/uri-list

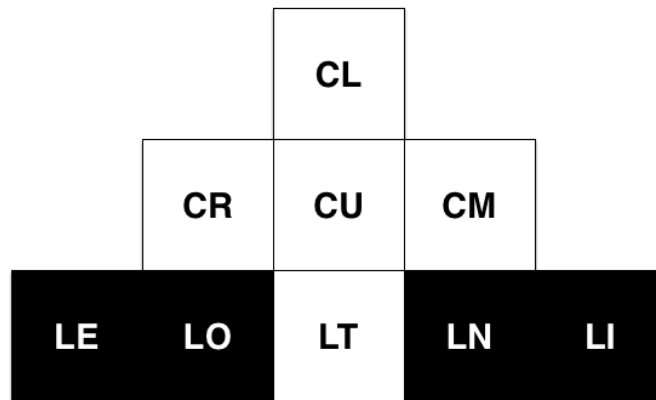


application/svg+xml



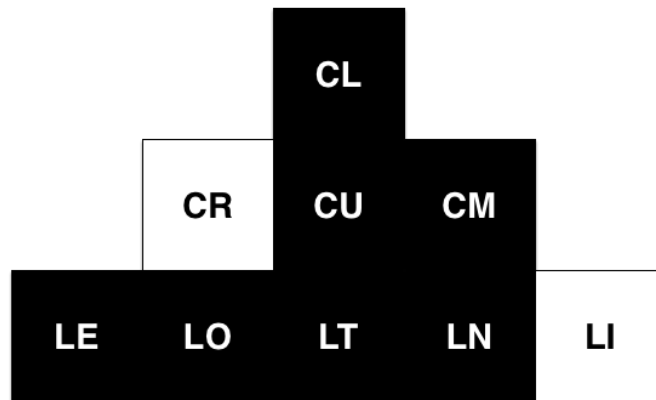
Credit: [Mike Amundsen](#)

application/atom+xml



Credit: [Mike Amundsen](#)

application/html

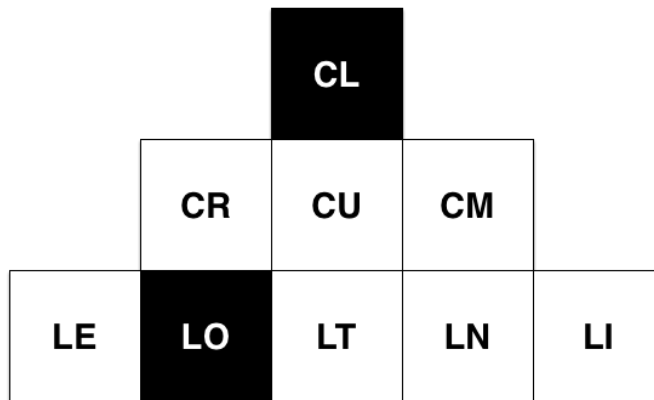


Credit: [Mike Amundsen](#)

Media Selection Considerations

- Domain-Specific
- Domain-General
- Application Semantics
- Transfer Semantics

application/vnd.amundsen.maze+xml



Credit: [Mike Amundsen](#)

application/vnd.amundsen.maze+xml

- Domain-Specific
- Application Semantics
- Meaningful links:
 - start
 - north
 - east
 - west
 - south
 - exit

Maze Starting Point

GET /examples/mazes/2d/ HTTP/1.1

Host: amundsen.com

Accept: application/vnd.amundsen.maze+xml

```
<maze version="1.0">
  <collection>
    <link href="http://amundsen.com/examples/mazes/2d/fifty-by-fifty/"
          rel="maze"/>
    <link href="http://amundsen.com/examples/mazes/2d/five-by-five/"
          rel="maze"/>
    <link href="http://amundsen.com/examples/mazes/2d/my-new-maze/"
          rel="maze"/>
    <link href="http://amundsen.com/examples/mazes/2d/ten-by-ten/"
          rel="maze"/>
  </collection>
</maze>
```

Requesting a Specific Maze

GET /examples/mazes/2d/five-by-five/ HTTP/1.1

Host: amundsen.com

Accept: application/vnd.amundsen.maze+xml

```
<maze version="1.0">
  <item>
    <link href="http://amundsen.com/examples/mazes/2d/five-by-five/0:north"
          rel="start" />
    <debug>
      ...
    </debug>
  </item>
</maze>
```

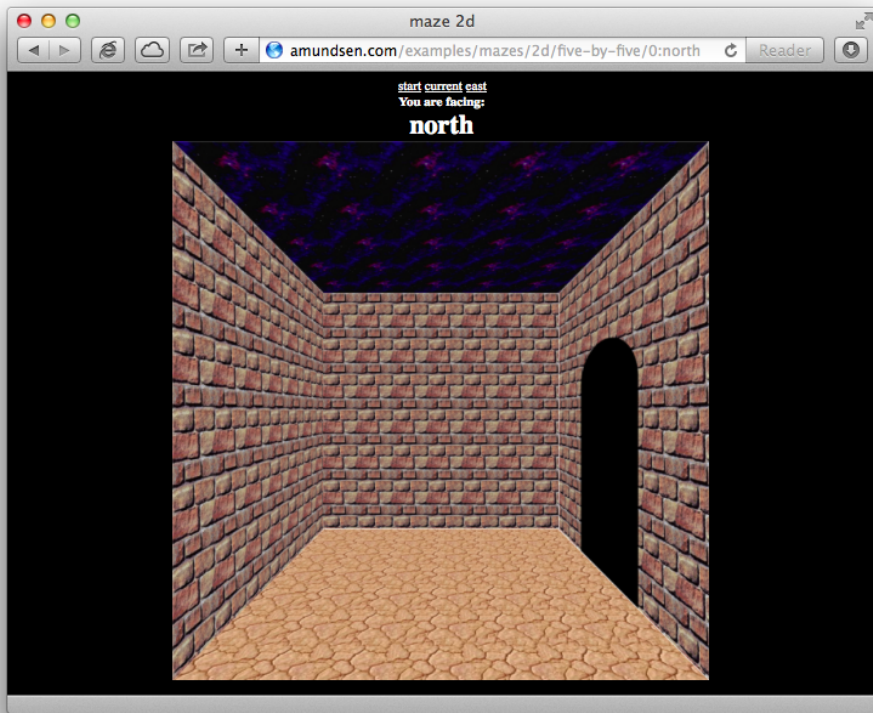
Starting a Specific Maze

GET /examples/mazes/2d/five-by-five/0:north HTTP/1.1

Host: amundsen.com

Accept: application/vnd.amundsen.maze+xml

```
<maze version="1.0">
  <cell>
    <link
      href="http://amundsen.com/examples/mazes/2d/five-by-five/0:north"
      rel="current" debug="0:1,1,1,0" total="25" side="5" />
    <link
      href="http://amundsen.com/examples/mazes/2d/five-by-five/5:east"
      rel="east" />
  </cell>
</maze>
```



Maze Clients

- <http://amundsen.com/examples/misc/maze-client.html>
- <https://github.com/caelum/restfulie/tree/master/full-examples/mikemaze>
- <http://yloiseau.net/hacks/maze/>

Media Types

[Home](#) » [Collection+JSON](#)

Collection+JSON - Hypermedia Type

Description

[Collection+JSON](#) is a JSON-based read/write hypermedia-type designed to support management and querying of simple collections. It is similar to the [The Atom Syndication Format \(RFC4287\)](#) and the [The Atom Publishing Protocol \(RFC5023\)](#). However, [Collection+JSON](#) defines both the format and the semantics in a single media type. It also includes support for [Query Templates](#) and expanded write support through the use of a [Write Template](#).

Collection+JSON on the Web

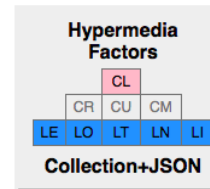
- [Collection+JSON on github](#)
- [Collection+JSON Support In Roar!](#)
- [An experimental gem to help with producing Hypermedia APIs with a MIME type of 'application/vnd.collection+json \(Ruby\)](#)
- [Implementation of Collection+JSON media type \(Java\)](#)

MIME Types

- [application/vnd.collection+json](#) **approved**

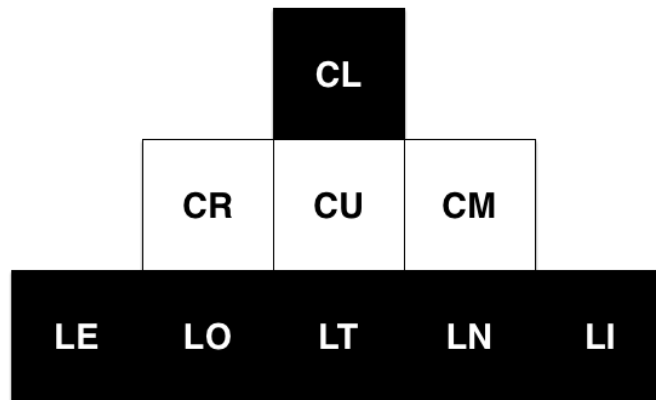
Related Material

- [Format Documentation](#)
- [Examples](#)
- [Tutorial](#)



Credit: <http://amundsen.com/media-types/collection/>

application/vnd.collections+json



Credit: [Mike Amundsen](#)

Collections+JSON

```
{ "collection" :  
  {  
    "version" : "1.0",  
    "href" : "http://example.org/friends/"  
  }  
}
```

Collections+JSON

```
{ "collection" :  
  {  
    "version" : "1.0",  
    "href" : "http://example.org/friends/",  
    "links" : [],  
    "items" : [],  
    "queries" : [],  
    "template" : [],  
    "error" : []  
  }  
}
```

API Starting Point

<http://example.org/api>

```
{ "collection":  
  {  
    "version": "1.0",  
    "href": "http://example.org/api",  
    "links": [{  
      "rel": "account",  
      "href": "http://example.org/account"  
    }, {  
      "rel": "order",  
      "href": "http://example.org/order"  
    }, {  
      "rel": "product",  
      "href": "http://example.org/product"  
    }]  
  }  
}
```

Request Accounts

<http://example.org/account>

```
{ "collection":  
  {  
    "version": "1.0",  
    "href": "http://example.org/account",  
    "links": [{  
      "rel": "next",  
      "href": "http://example.org/account;page=2"  
    }],  
    "items": [],  
    "queries": [],  
    "template": []  
  }  
}
```

Request Accounts

<http://example.org/account;page=2>

```
{ "collection":  
  {  
    "version": "1.0",  
    "href": "http://example.org/account;page=2",  
    "links": [{  
      "rel": "prev",  
      "href": "http://example.org/account"  
    }],  
    "rel": "next",  
    "href": "http://example.org/account;page=3"  
  }],  
  "items": [],  
  "queries": [],  
  "template": []  
}
```

Account Items

<http://example.org/account>

```
{ "collection":  
  {  
    "version": "1.0",  
    "href": "http://example.org/account",  
    ...  
    "items": [  
      ],  
    ...  
  }  
}
```


Account Items

<http://example.org/account>

```
{
  ...
  "items": [ {
    "href": "/account/id/9468",
    "data": [
      { "name": "username",
        "value": "bob" },
      { "name": "id",
        "value": "9468" }
    ],
    "links": [
      { "name": "open",
        "value": "/order/account/id/9468;status=open" },
      { "name": "recent",
        "value": "/order/account/id/9468;status=recent" }
    ]
  } ]
  ...
}
```

Account Queries

<http://example.org/account>

```
{  "collection":  
  {  
    "version": "1.0",  
    "href": "http://example.org/account",  
    ...  
    "queries": [  
    ],  
    ...  
  }  
}
```

Account Queries

<http://example.org/account>

```
{
  ...
  "queries": [ {
    "encoding": "uri-template",
    "rel" : "search",
    "href" : "/account{;status,page,ipp}"
    "data": [
      { "name": "status",
        "value": "" },
      { "name": "page",
        "value": "" },
      { "name": "ipp",
        "value" : "" }
    ]
  }
  ...
}
```

Account Queries

<http://example.org/account;status=open;page=2>

```
{  ...
  "queries": [ {
    "encoding": "uri-template",
    "rel" : "search",
    "href" : "/account{;status,page,ipp}"
    "data": [
      { "name": "status",
        "value": "open" },
      { "name": "page",
        "value": "2" },
      { "name": "ipp",
        "value" : "" }
    ]
  }
]
...
}
```



Description

State of the Art?

- No real support for hypermedia
- Often object wrappers on either side
- Static contract
- Domain-specific

Description Languages

- [RAML](#)
- [Swagger](#)
- [Apiary.io](#)

Hydra + JSON-LD

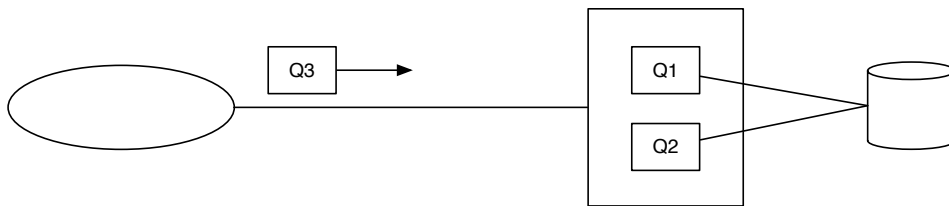
<http://www.hydra-cg.com>

- Standard format
- Hypermedia-aware
- Arbitrary domains
- Extensible
- Interoperable w/ RDF and Linked Data



Patterns

Named Query Resource



Intent

- Client-driven resource definition
- Reusable queries
- Potentially cacheable

SPARQL Protocol

<http://server/sparql?query=<URL-encoded-query>>

```
SELECT ?s ?p ?o
WHERE {
  ?s ?p ?o
}
LIMIT 100
```

<http://server/sparql?query=select%20%3Fs%20%3Fp%20%3Fo%20where%20%7B%20%3Fs%20%3Fp%20%3Fo%20%7D%20limit%20100>

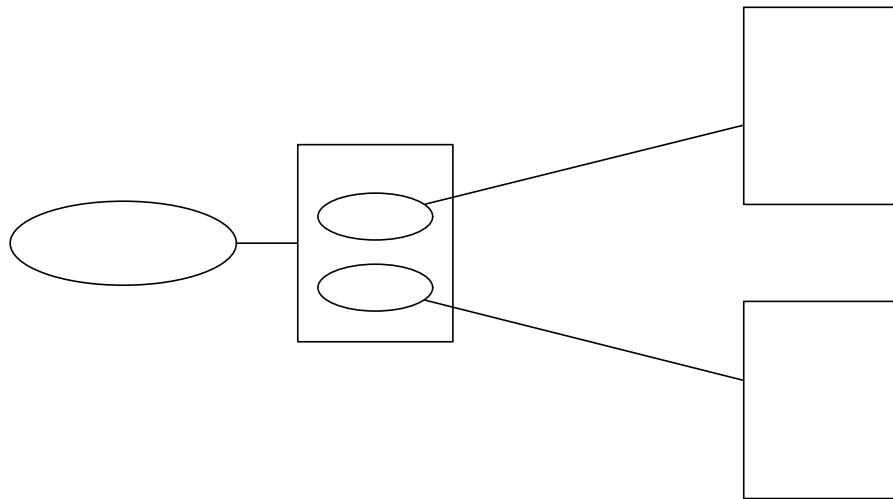
Most Important Query Ever Run

<http://tinyurl.com/n9hhs68>

Consequences

- Potentially cacheable
- Client-imposed burdens on your system
- Complicated privilege models
- Linked Data Fragments

Gateway Resource



Intent

- Client-focused resource abstractions over external resources
- Adapter for orchestration, data aggregation and content extraction

ql.io

```
prodid = select ProductID[0].Value from eBay.FindProducts where
  QueryKeywords = 'macbook pro';
details = select * from eBay.ProductDetails where
  ProductID in ('{prodid}') and ProductType = 'Reference';
reviews = select * from eBay.ProductReviews where
  ProductID in ('{prodid}') and ProductType = 'Reference';
return select d.ProductID[0].Value as id, d.Title as title,
  d.ReviewCount as reviewCount, r.ReviewDetails.AverageRating as rating
  from details as d, reviews as r
  where d.ProductID[0].Value = r.ProductID.Value
  via route '/myapi' using method get;

curl http://tinyurl.com/p7zgg9y
```

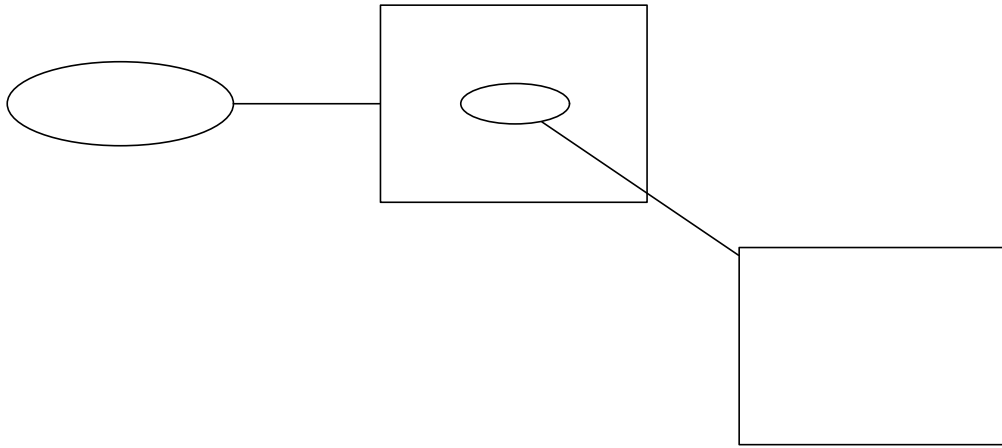
```
[
  { "id": "115174685",
    "title": "Apple MacBook Pro A1278 13.3" Laptop - MD101LL/A (June, 2012)",
    "reviewCount": 81, "rating": 4.5 },
  { "id": "84755204",
    "title": "Apple MacBook Pro 13.3" Laptop - MC374LL/A (April, 2010)",
    "reviewCount": 182, "rating": 4.5 },
  { "id": "108850048",
    "title": "Apple MacBook Pro 13.3" Laptop (April, 2010) - Customized",
    "reviewCount": 42, "rating": 4.5 },
  { "id": "108808476",
    "title": "Apple MacBook Pro 15.4" Laptop (April, 2010) - Customized",
    "reviewCount": 29, "rating": 4.5 },
  { "id": "78092464",
    "title": "Apple MacBook Pro 13.3" Laptop - MB990LL/A (June, 2009)",
    "reviewCount": 136, "rating": 4.5 }
]
```

```
insert into bitly.shorten (longUrl) values ('http://ql.io/docs')
select long_url from bitly.shorten where shortUrl = 'http://bit.ly/uZIVmY'
insert into flickr.photos.upload with
  parts "{req.parts[0]}", "{req.parts[1]}"
select * from bing.soap.search where q = "ql.io";
keyword = "ql.io";
web = select * from bing.search where q = "{keyword}";
tweets = select id as id, from_user_name as user_name, text as text
  from twitter.search where q = "ql.io";
return {
  "keyword": "{keyword}",
  "web": "{web}",
  "tweets": "{tweets}"
}
```

Consequences

- Pipes and Filters vs The Web
- Table Structure vs Graph
- Potential to Lose Fidelity

Transformation Resource




Intent

- New resources to extract or transform content from other resources
- No impact on original resource

RDFa Distiller

<http://www.w3.org/2012/pyRdfa/Overview.html>




RDFa 1.1 Distiller and Parser


Warning: This version implements [RDFa 1.1 Core](#), including the handling of the [Role Attribute](#). The distiller can also run in XHTML+RDFa 1.0 mode (if the incoming XHTML content uses the RDFa 1.0 DTD and/or sets the `version` attribute). The [package available for download](#), although it may be slightly out of sync with the code running this service.

[Distill by URI](#) [Distill by File Upload](#) [Distill by Direct Text Input](#)

Distill by URI

URI:

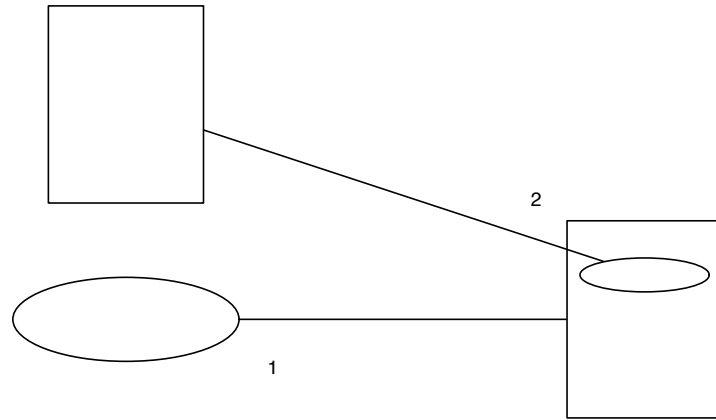
Output Format: 

Returned content: 

Consequences

- Strict adherence to published commitments
- Improved by source adherence to cache controls
- Tangled authentication and authorization models

Callback Resource



Intent

- Support asynchronous models on the Web
- Leverage existing infrastructure

GitHub WebHooks

<http://developer.github.com/webhooks/>

[GitHub:Developer](#)

[API](#)

[Developers](#)

[Blog](#)

[Support](#)

Search

[API](#)

[Reference](#)

[Webhooks](#)

[Guides](#)

[Libraries](#)

Webhooks

[Events](#)

[Payloads](#)

[Ping Event](#)

[Service Hooks](#)

Webhooks allow you to build or set up integrations which subscribe to certain events on GitHub.com. When one of those events is triggered, we'll send a HTTP POST payload to the webhook's configured URL. Webhooks can be used to update an external issue tracker, trigger CI builds, update a backup mirror, or even deploy to your production server. You're only limited by your imagination.

Each webhook can be installed [on an organization](#) or [a specific repository](#). Once installed, they will be triggered each time one or more subscribed events occurs on that organization or repository.

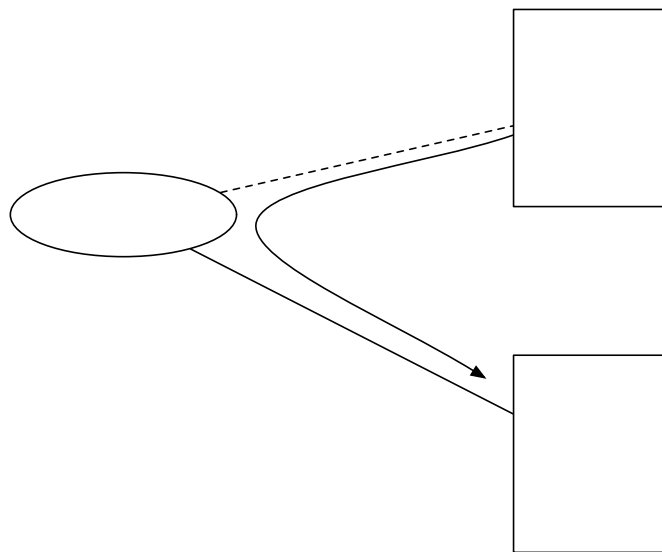
Events

When configuring a webhook, you can choose which events you would like to receive payloads for. You can [even opt-in to all current and future events](#).

Consequences

- Security implications of client as 'server'
- Credential management

Curated URI Resource



Intent

- Abandon the baggage of resource location while maintaining its strengths
- 'Types of URLs'

W3ID

<https://w3id.org/>

Permanent Identifiers for the Web

Secure, permanent URLs for your Web application that will stand the test of time.

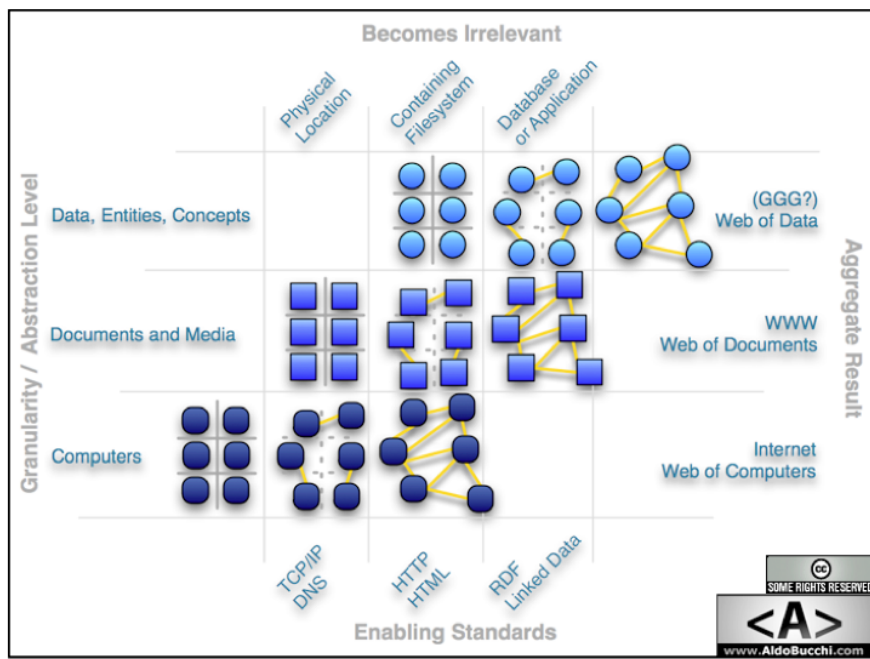
The purpose of this website is to provide a secure, permanent URL (<http://en.wikipedia.org/wiki/URL>) re-direction service for Web applications. This service is run by the W3C Permanent Identifier Community Group (<http://www.w3.org/community/perma-id/>).

Consequences

- Constant roundtrips



Linked Data



Credit: Aldo Bucchi

Brian's birthday is May 26th.

Brian's birthday is May 26th.

<https://w3id.org/people/bsletten's>
<http://xmlns.com/foaf/0.1/birthday> is "05-26".

A Single Fact

```
# N-Triple Serialization of the Fact
<https://w3id.org/people/bsletten>
  <http://xmlns.com/foaf/0.1/birthday> "05-26" .
```

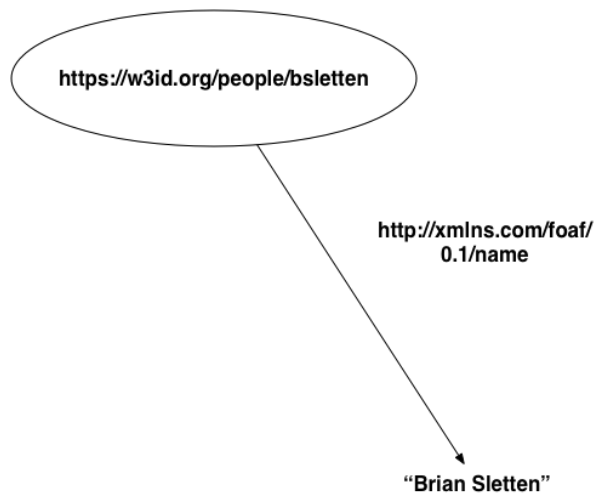


<https://w3id.org/people/bsletten>'s name is Brian Sletten.

<https://w3id.org/people/bsletten's>
<http://xmlns.com/foaf/0.1/name> is "Brian
Sletten".

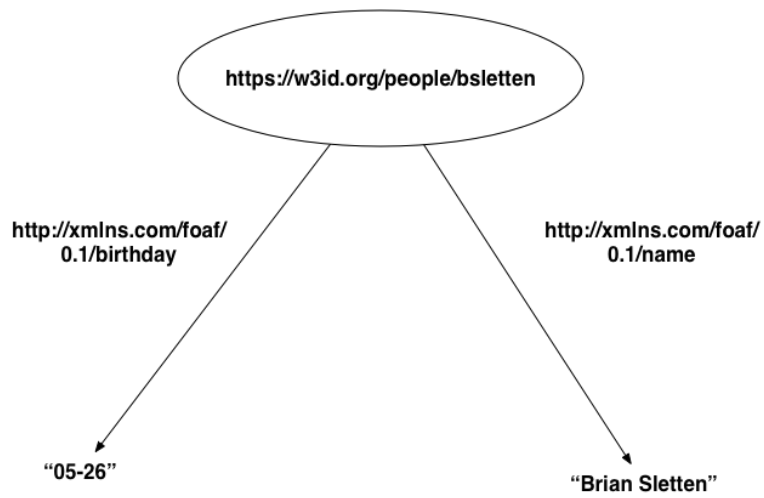
A Single Fact

```
# N-Triple Serialization of the Fact
<https://w3id.org/people/bsletten>
  <http://xmlns.com/foaf/0.1/name> "Brian Sletten" .
```



Two Facts

```
# N-Triple Serialization of the Facts
<https://w3id.org/people/bsletten>
  <http://xmlns.com/foaf/0.1/birthday> "05-26" .
<https://w3id.org/people/bsletten>
  <http://xmlns.com/foaf/0.1/name> "Brian Sletten" .
```

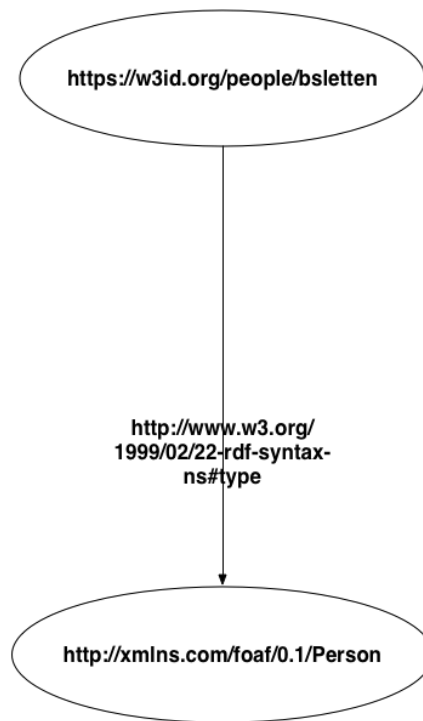


<https://w3id.org/people/bsletten> is a person.

<https://w3id.org/people/bsletten>
<http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://xmlns.com/foaf/0.1/Person>.

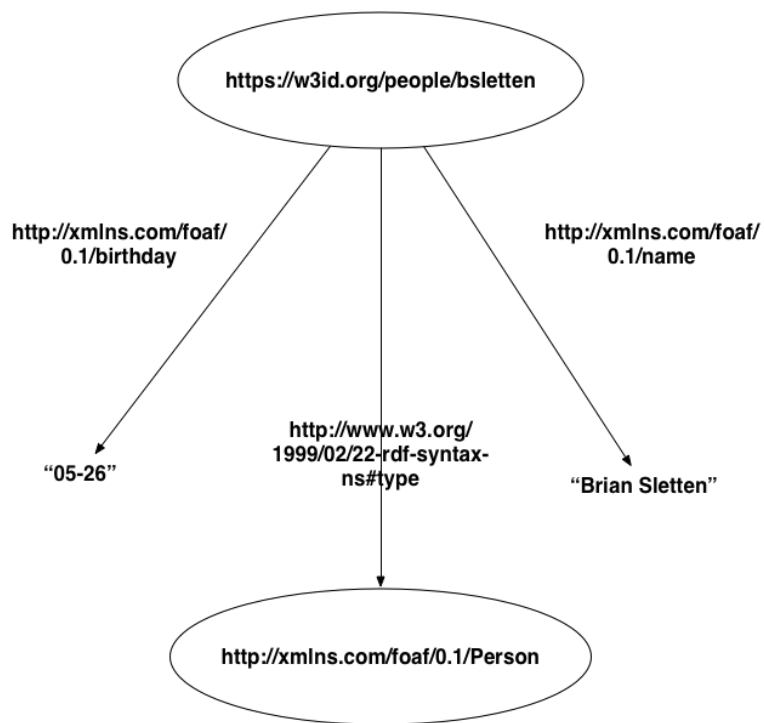
A Single Fact

```
# N-Triple Serialization of the Fact
<https://w3id.org/people/bsletten>
  <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
    <http://xmlns.com/foaf/0.1/Person> .
```

Three Facts

```
# N-Triple Serialization of the Facts
<https://w3id.org/people/bsletten>
  <http://xmlns.com/foaf/0.1/birthday> "05-26" .
<https://w3id.org/people/bsletten>
  <http://xmlns.com/foaf/0.1/name> "Brian Sletten" .
<https://w3id.org/people/bsletten>
  <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
    <http://xmlns.com/foaf/0.1/Person> .
```



RDF/XML

```
> rdfcat --out xml facts.nt
```

```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:foaf="http://xmlns.com/foaf/0.1/" >
  <rdf:Description rdf:about="https://w3id.org/people/bsletten">
    <foaf:birthday>05-26</foaf:birthday>
    <foaf:name>Brian Sletten</foaf:name>
    <rdf:type rdf:resource="http://xmlns.com/foaf/0.1/Person"/>
  </rdf:Description>
</rdf:RDF>
```

Turtle

```
> rdfcat --out ttl facts.nt
```

```
<https://w3id.org/people/bsletten>  
  a      <http://xmlns.com/foaf/0.1/Person> ;  
  <http://xmlns.com/foaf/0.1/birthday>  
    "05-26" ;  
  <http://xmlns.com/foaf/0.1/name>  
    "Brian Sletten" .
```

Turtle

```
> rdfcat --out ttl http://bosatsu.net/turtle/brian.ttl  
<https://w3id.org/people/bsletten>  
  <http://xmlns.com/foaf/0.1/depiction>  
    <http://bosatsu.net/images/briansletten.jpg> .
```

Turtle

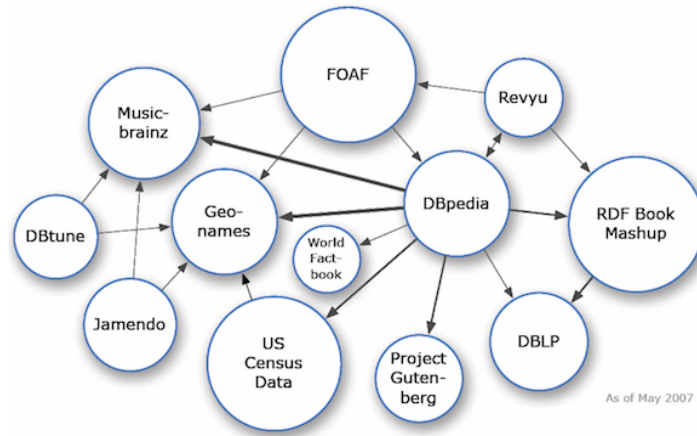
```
> rdfcat --out ttl facts.nt http://bosatsu.net/turtle/brian.ttl
```

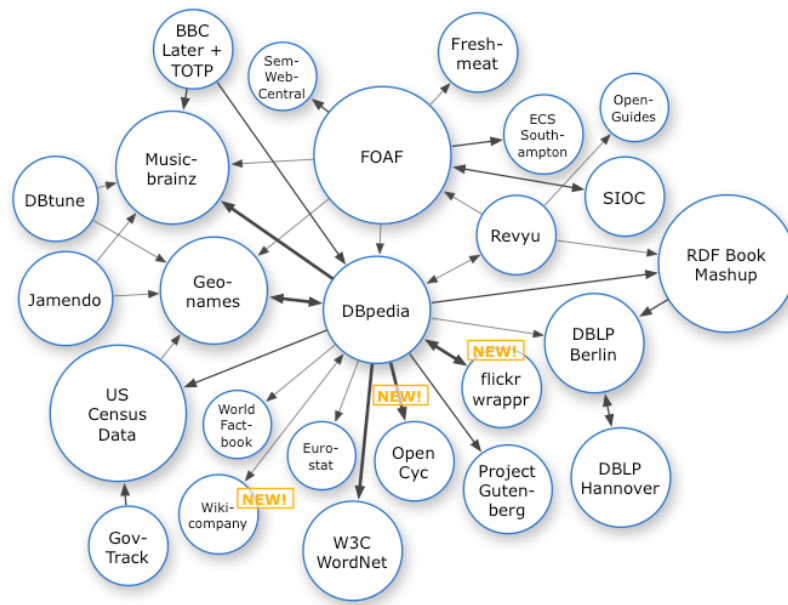
```
<https://w3id.org/people/bsletten>  
  a      <http://xmlns.com/foaf/0.1/Person> ;  
  <http://xmlns.com/foaf/0.1/birthday>  
    "05-26" ;  
  <http://xmlns.com/foaf/0.1/depiction>  
    <http://bosatsu.net/images/briansletten.jpg> ;  
  <http://xmlns.com/foaf/0.1/name>  
    "Brian Sletten" .
```

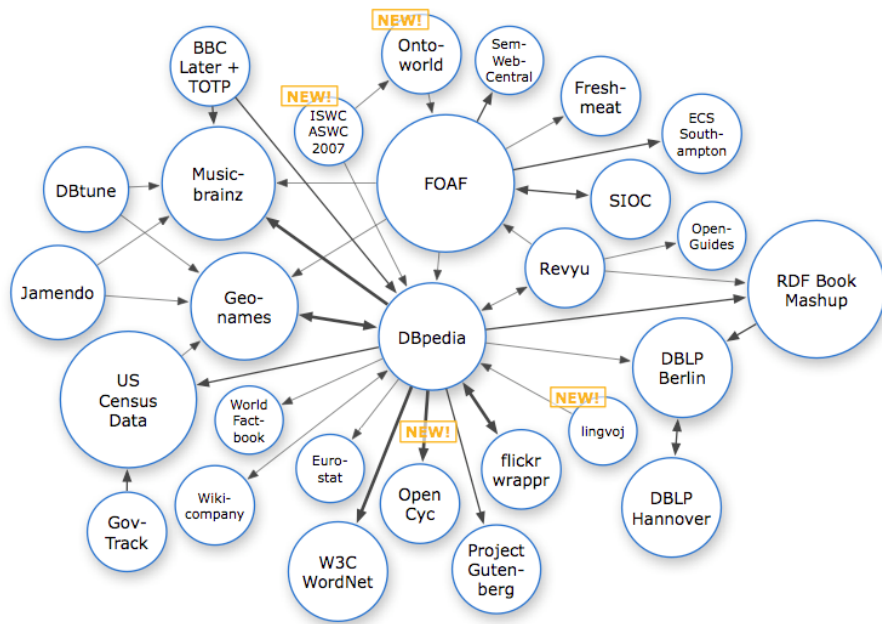
Principles

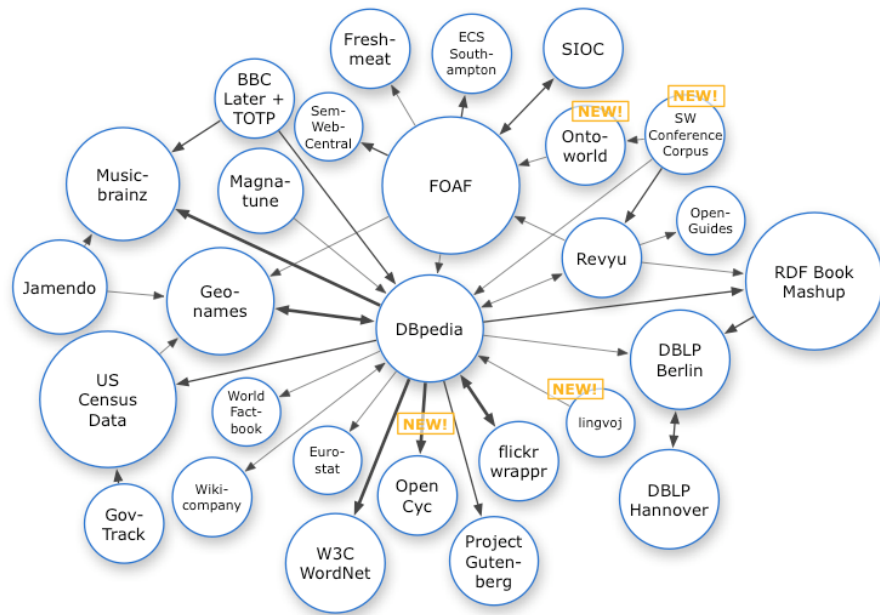
<http://www.w3.org/DesignIssues/LinkedData.html>

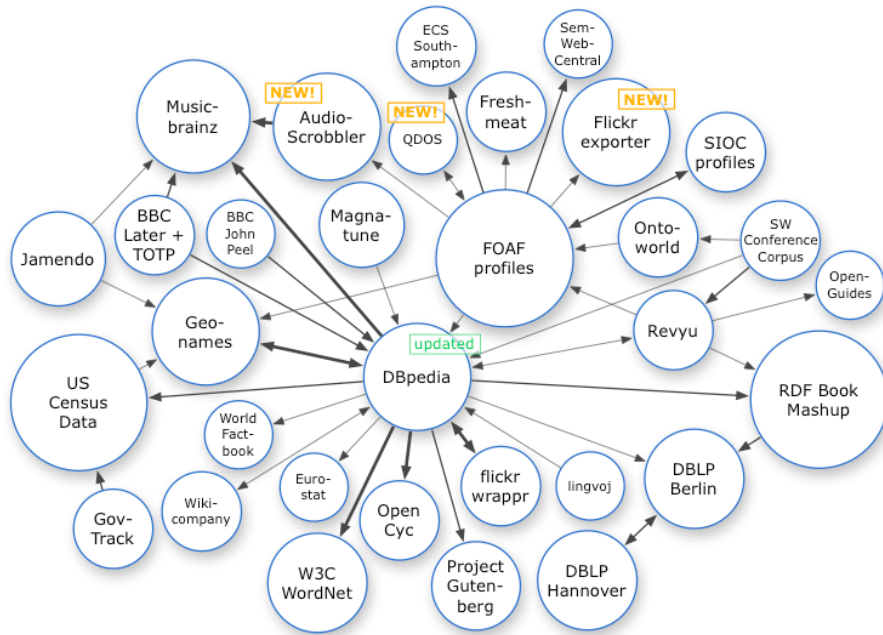
- Use URIs to name things
- Use HTTP URIs to make them resolvable
- When someone resolves a URI, provide useful information via standards (SPARQL, RDF, etc.)
- Include links for discoverability

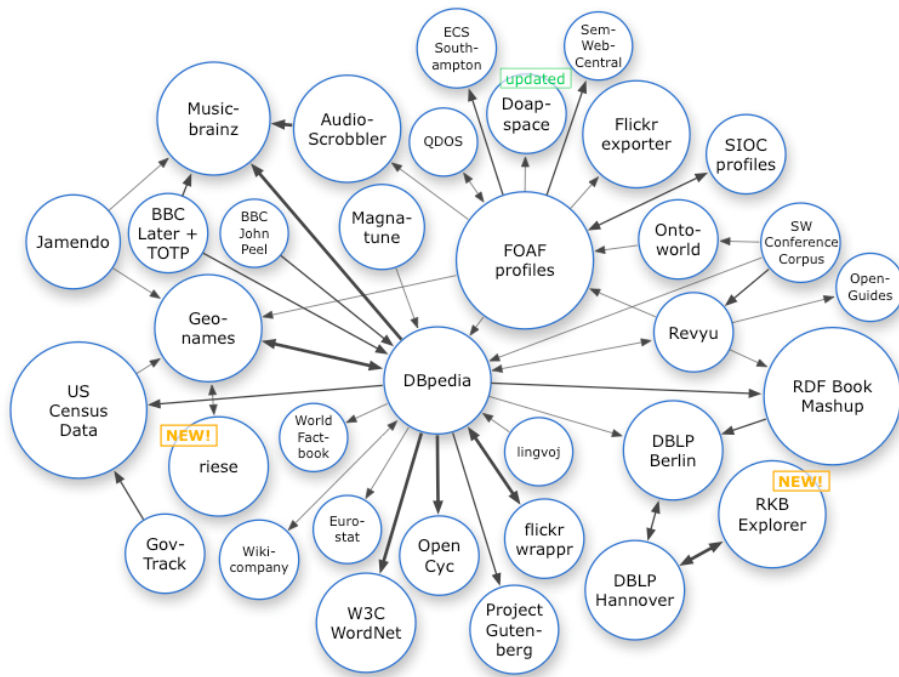


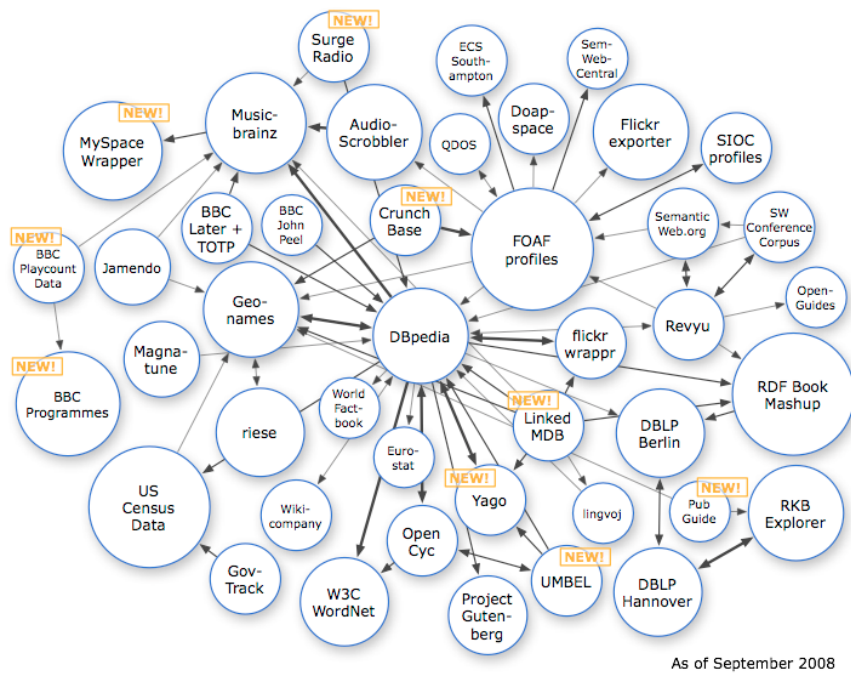


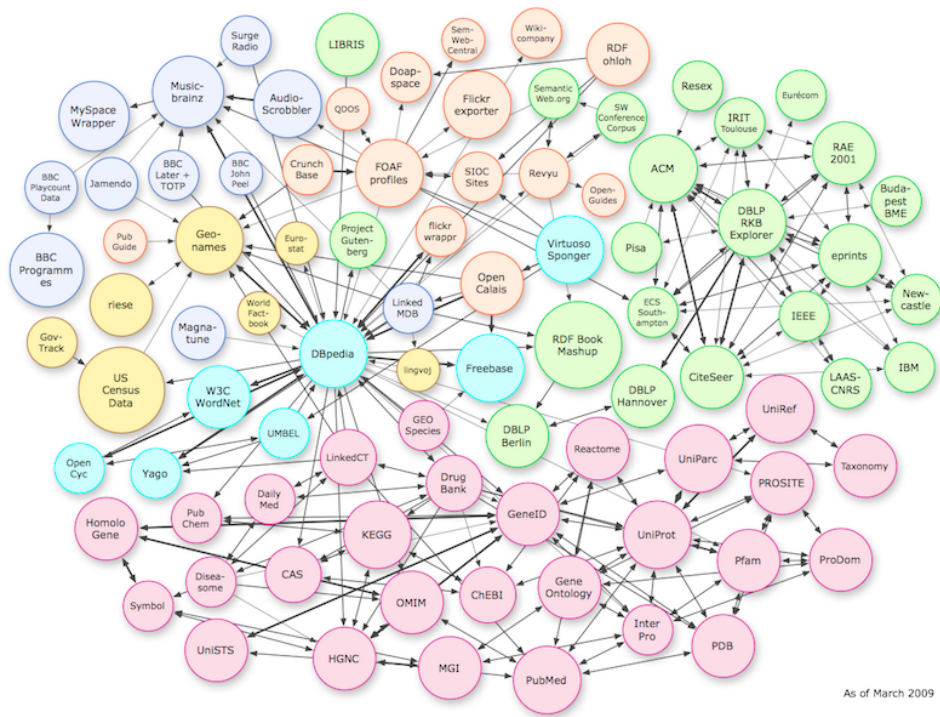


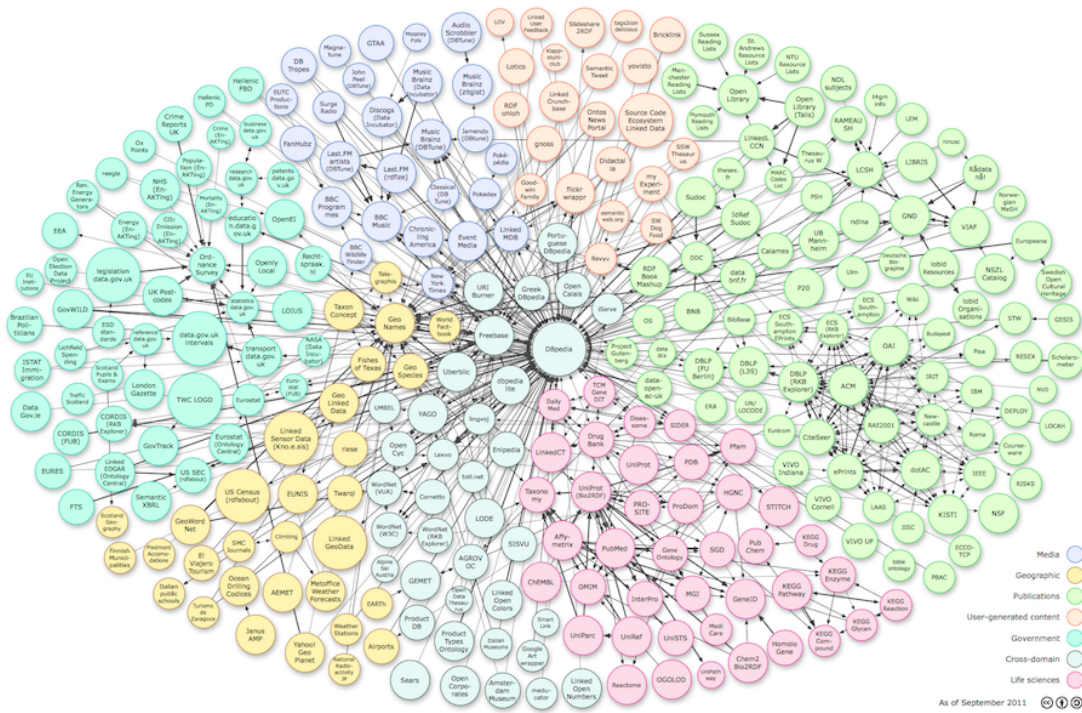


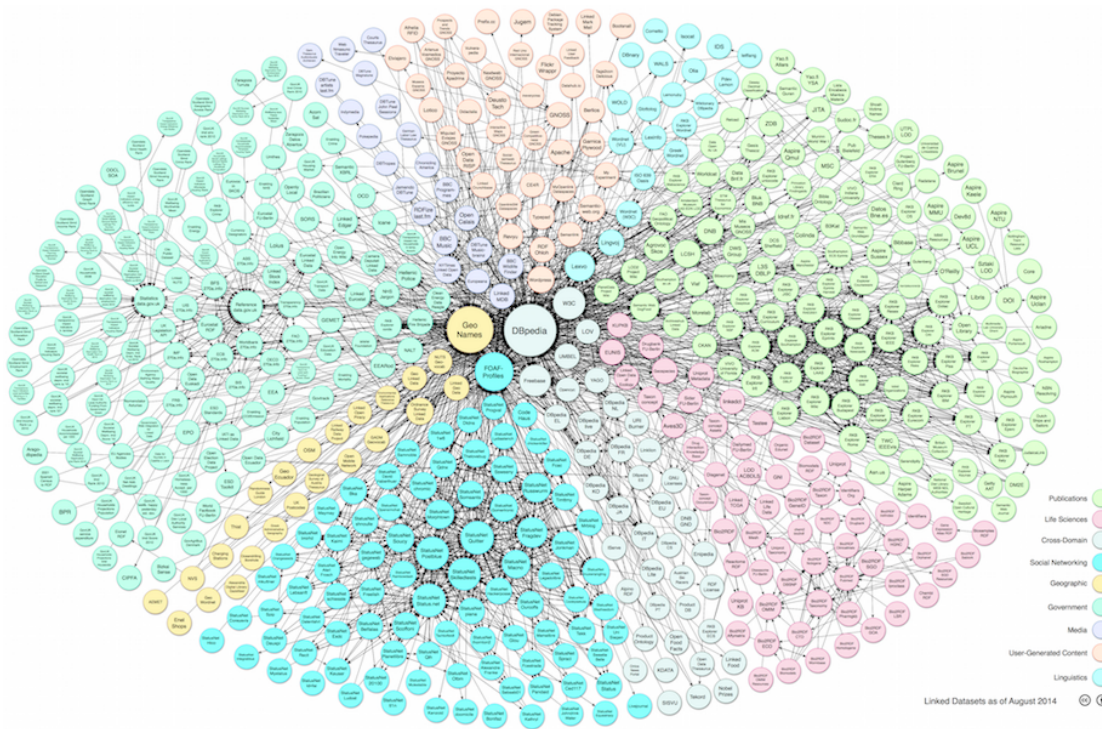












DBPedia

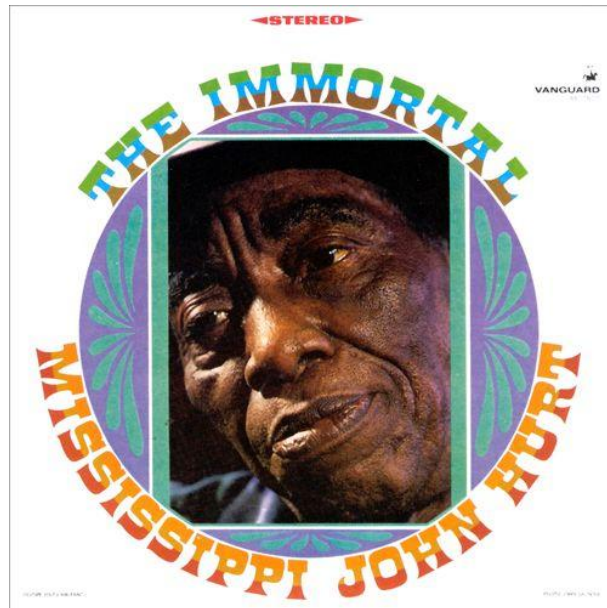
<http://dbpedia.org>

Artists for St. Patrick's Day

- Find music recommendations related to St. Patrick's Day
- Use DBPedia to find musical artists who are from Ireland

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX dbo: <http://dbpedia.org/ontology/>
PREFIX : <http://dbpedia.org/resource/>
SELECT DISTINCT ?name ?person ?artist WHERE {
  ?person foaf:name ?name .
  ?person rdf:type dbo:MusicalArtist .
  ?person dbo:associatedMusicalArtist ?artist .
  { ?person dbo:hometown :Republic_of_Ireland . }
  UNION
  { ?person dbo:birthPlace :Republic_of_Ireland . }
}
ORDER BY ?name
```

<http://tinyurl.com/jwtt2aj>



Linked Data Platform

<http://www.w3.org/TR/ldp/>



Linked Data Platform 1.0

W3C Recommendation 26 February 2015

This version:

<http://www.w3.org/TR/2015/REC-ldp-20150226/>

Latest published version:

<http://www.w3.org/TR/ldp/>

Latest editor's draft:

<http://www.w3.org/2012/ldp/hg/ldp.html>

Test suite:

<https://dvcs.w3.org/hg/ldpwg/raw-file/default/tests/ldp-testsuite.html>

Implementation report:

<https://dvcs.w3.org/hg/ldpwg/raw-file/default/tests/reports/ldp.html>

Previous version:

<http://www.w3.org/TR/2014/PR-ldp-20141216/>

Editors:

[Steve Speicher, IBM Corporation](#)
[John Arwe, IBM Corporation](#)
[Ashok Malhotra, Oracle Corporation](#)

RelFinder

<http://www.visualdataweb.org/relfinder.php>



Books

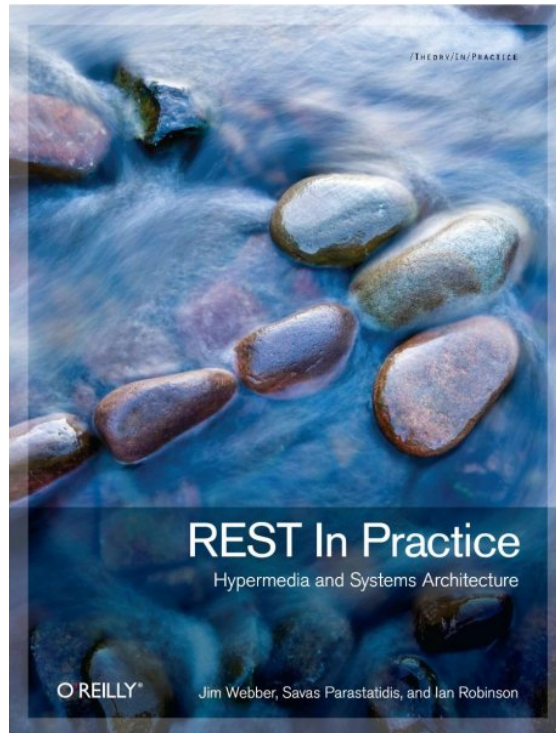
Web Services for the Real World

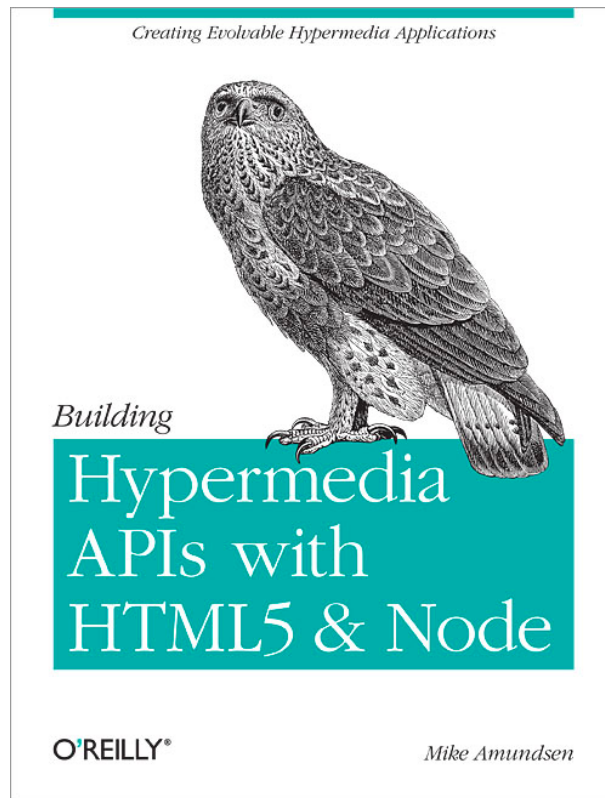


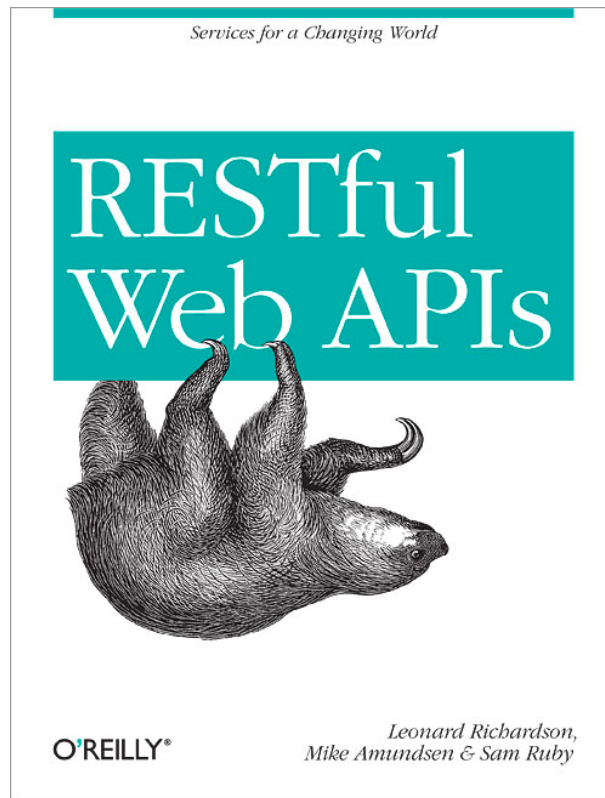
O'REILLY*

Leonard Richardson & Sam Ruby

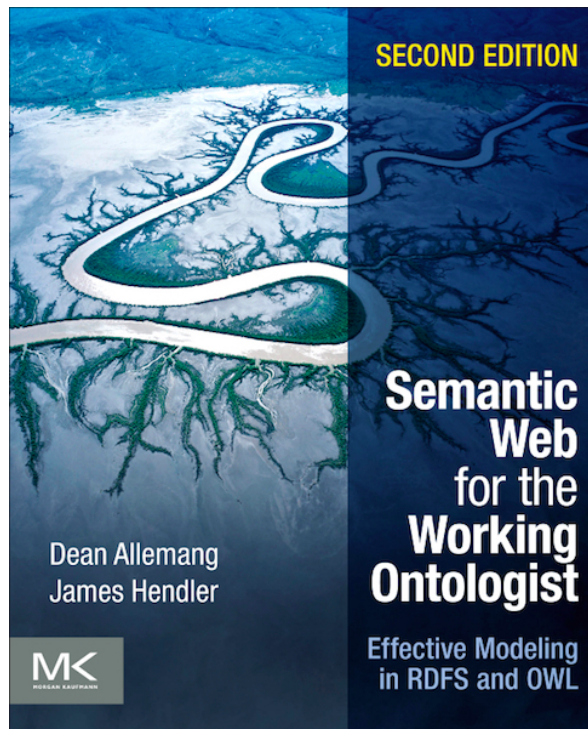


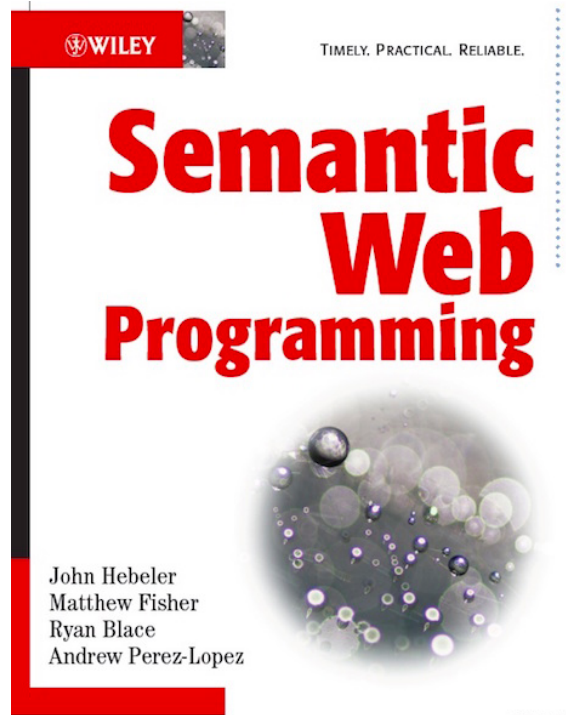


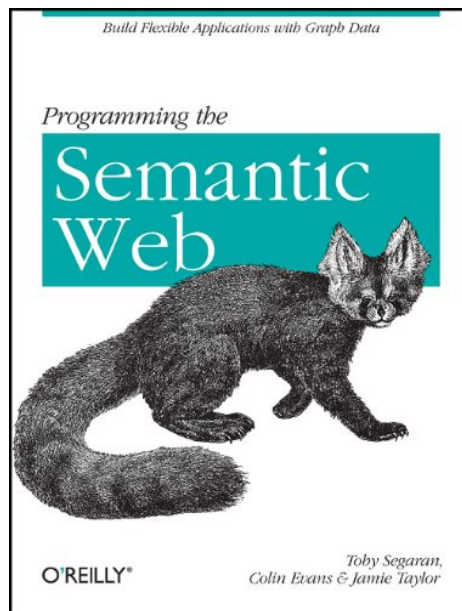


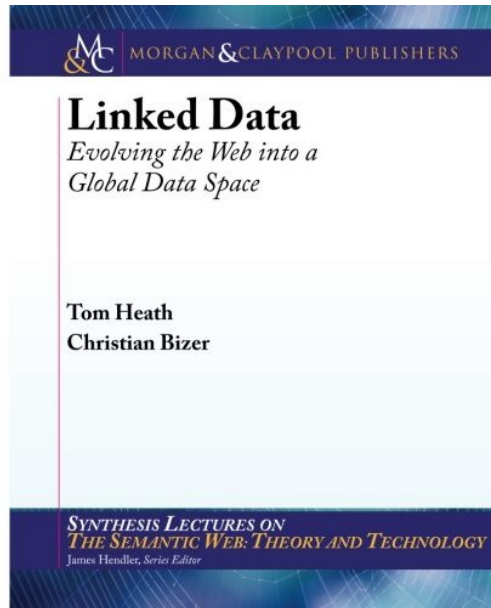


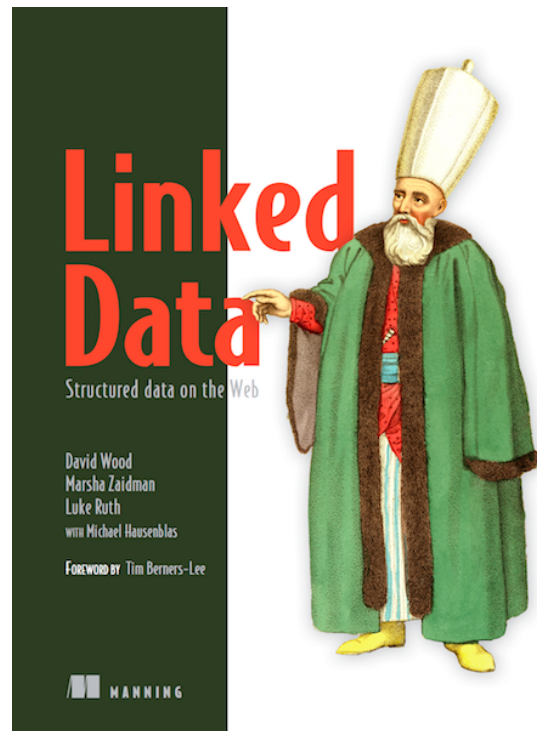


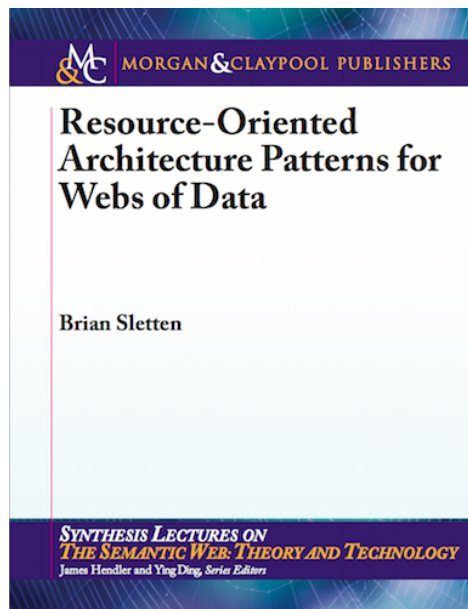




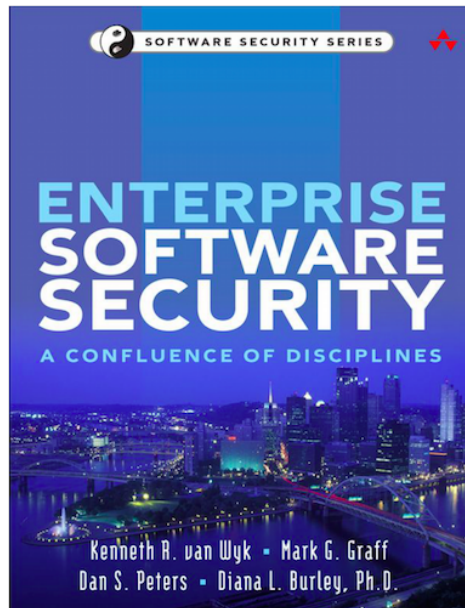


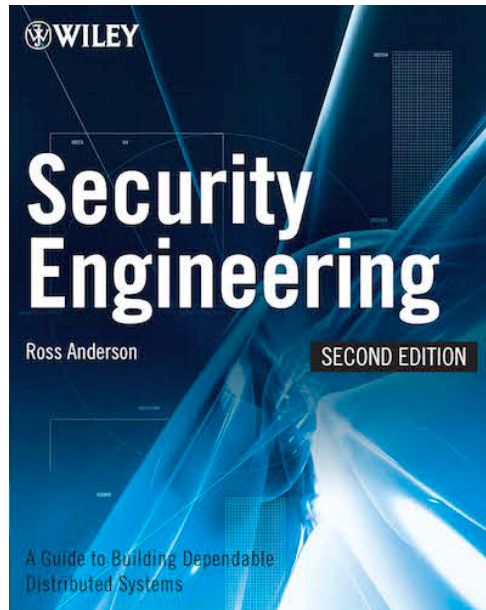


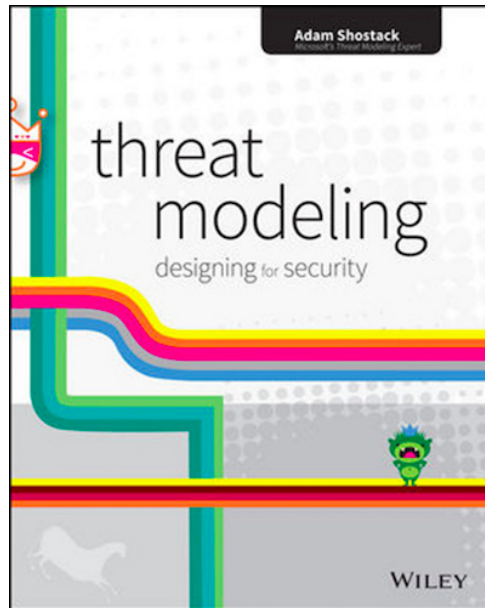


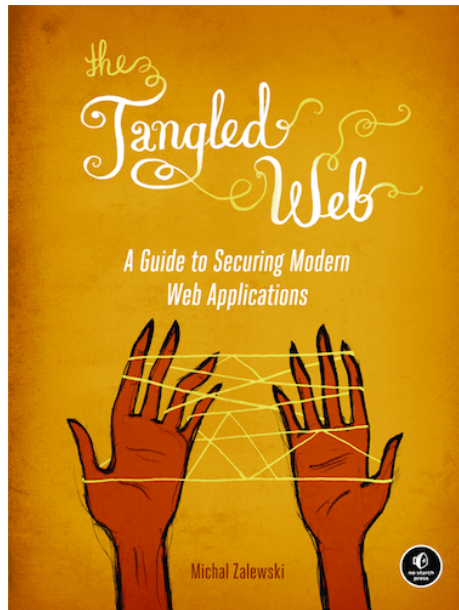


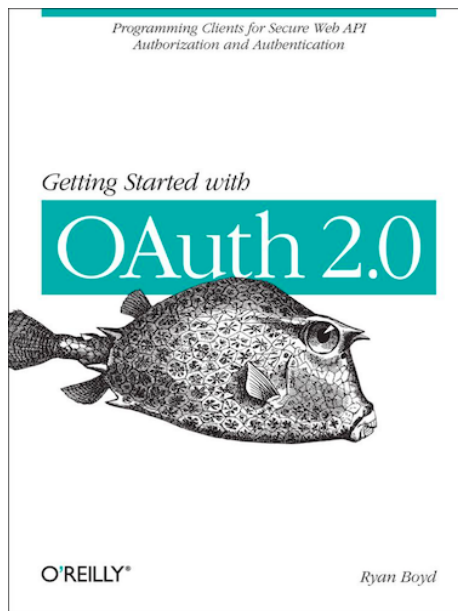


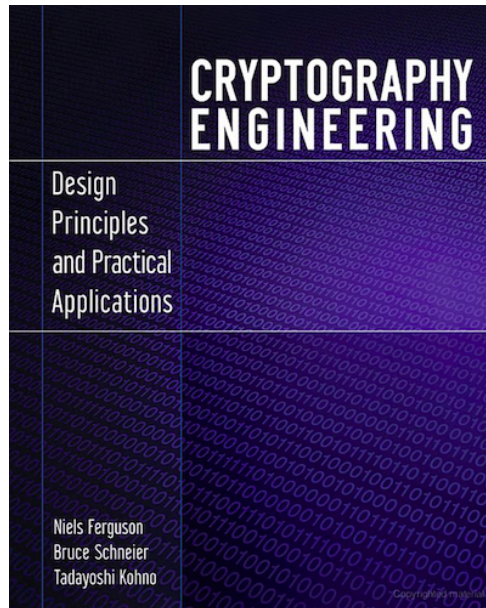












BULLETPROOF SSL AND TLS

The Complete Guide to Deploying
Secure Servers and Web Applications



Questions?

✉ brian@bosatsu.net

🐦 [@bsletten](https://twitter.com/bsletten)

📄 <http://tinyurl.com/bjs-gplus>

🌐 [bsletten](https://bsletten.com)