菩萨相谈
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
“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
“An architectural style is a named, coordinated set of architectural constraints.”
Desired Properties

- Performance
- Scalability
- Generality
- Simplicity
- Modifiability
- Extensibility
Client Server
Stateless Client Server

Diagram:

- Client
- Load Balancer
- Server 1
- Server 2
- Client
- Client
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
Resolvable Names
Hypermedia Workshop

URI

URL

URN

Resolvable Names

Stable Names
Uniform Naming Scheme

- http://bosatsu.net/foaf/brian.rdf
- urn:isbn:0913966568
- https://w3id.org/people/bsletten
- TBD
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.”
Things to Avoid

- Author name
- Status
- Access
- File name extension
- Software mechanism
Interaction
Application #1  Application #2  Application #3

REST API

Code
GET
POST
PUT
DELETE
HEAD
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

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Ok</td>
</tr>
<tr>
<td>201</td>
<td>Created</td>
</tr>
<tr>
<td>202</td>
<td>Accepted</td>
</tr>
<tr>
<td>204</td>
<td>Success</td>
</tr>
</tbody>
</table>
## Response Codes: 3XX

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>301</td>
<td>Moved Permanently</td>
</tr>
<tr>
<td>302</td>
<td>Found</td>
</tr>
<tr>
<td>303</td>
<td>See Other</td>
</tr>
<tr>
<td>304</td>
<td>Not Modified</td>
</tr>
</tbody>
</table>
## Response Codes: 4XX

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>Bad Request</td>
</tr>
<tr>
<td>401</td>
<td>Unauthorized</td>
</tr>
<tr>
<td>403</td>
<td>Forbidden</td>
</tr>
<tr>
<td>404</td>
<td>Not Found</td>
</tr>
<tr>
<td>405</td>
<td>Method Not Allowed</td>
</tr>
<tr>
<td>409</td>
<td>Conflict</td>
</tr>
<tr>
<td>411</td>
<td>Length Required</td>
</tr>
<tr>
<td>413</td>
<td>Entity Too Long</td>
</tr>
<tr>
<td>415</td>
<td>Unsupported Media Type</td>
</tr>
</tbody>
</table>
## Response Codes: 5XX

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>Internal Error</td>
</tr>
<tr>
<td>503</td>
<td>Service Unavailable</td>
</tr>
</tbody>
</table>
Representation
<table>
<thead>
<tr>
<th>Hyper Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTP</td>
</tr>
<tr>
<td>URL</td>
</tr>
</tbody>
</table>
Hypermedia Factors (HFactors)
Embedded Links (LE)
LE Examples

// HTML
<img src="http://bosatsu.net/images/bosatsu-kanji.jpg"/>

// XInclude
<author>
  <x:include href="http://bosatsu.net/snippets/bio.xml"/>
</author>
Outbound Links (LO)
LO Examples

// HTML
<p>See you at <a href="http://uberconf.com">Überconf</a>.</p>
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)
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)
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)
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)
CU Examples

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

POST /submit/ HTTP/1.1
Host: bosatsu.net
Content-Type: text/plain
Length:34
Hey+Buddy%2C+nice+jacket
Method Context (CM)
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)
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"/>
application/svg+xml
application/atom+xml
Media Selection Considerations

- Domain-Specific
- Domain-General
- Application Semantics
- Transfer Semantics
application/vnd.amundsen.maze+xml
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

<?xml version="1.0"?>
<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

```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

- 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

Related Material

- Format Documentation
- Examples
- Tutorial

Credit: http://amundsen.com/media-types/collection/
application/vnd.collections+json
Collections+JSON

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

```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

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

```json
{
  "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>

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

http://server/sparql?query=select%20%s%20%p%20%o%20where%20%7B%20%s%20%p%20%o%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

```sql
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')


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

---

**W3C RDFa**

**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](http://www.w3.org/2012/pyRdfa/Overview.html), although it may be slightly out of sync with the code running this service.

**Distill by URI**

<table>
<thead>
<tr>
<th>Distill by URI</th>
<th>Distill by File Upload</th>
<th>Distill by Direct Text Input</th>
</tr>
</thead>
</table>

**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 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
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

http://xmins.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".
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

```xml
<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 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
Programming the Semantic Web

Toby Segaran, Colin Evans & Jannie Taylor

O'REILLY
Linked Data
Evolving the Web into a
Global Data Space

Tom Heath
Christian Bizer
threat modeling
designing for security
BULLETPROOF
SSL AND TLS
The Complete Guide to Deploying
Secure Servers and Web Applications
Questions?

✉️ brian@bosatsu.net
＠@bsletten
지도 http://tinyurl.com/bjs-gplus
髑髅 bsletten