


# 菩萨相谈

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## Hypermedia

Doing REST Right

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# Speaker Qualifications

- Specialize in next-generation technologies
- Author of "Resource-Oriented Architecture Patterns for Webs of Data"
- Speaks internationally about REST, Semantic Web, Security, Visualization, Architecture
- Worked in Defense, Finance, Retail, Hospitality, Video Game, Health Care and Publishing Industries
- One of [Top 100 Semantic Web People](#)

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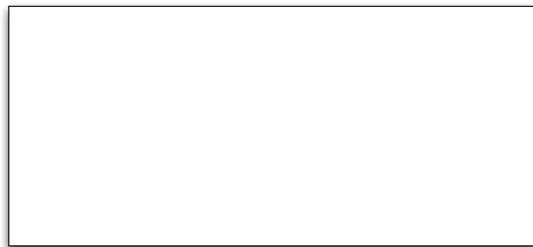
# Agenda

- Introduction
- Hue API (Level 2)
- Hypermedia
- Hue API (Level 3)

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# Introduction



<b>URL</b>

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<b>HTTP</b>
<b>URL</b>

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# Hue API (Level 2)

## Hue API

- <http://developers.meethue.com>
- iOS/OS X SDK
- Java
- Android SDK

Demo

<http://www.flickr.com/photos/61107193@N03/8964142468>

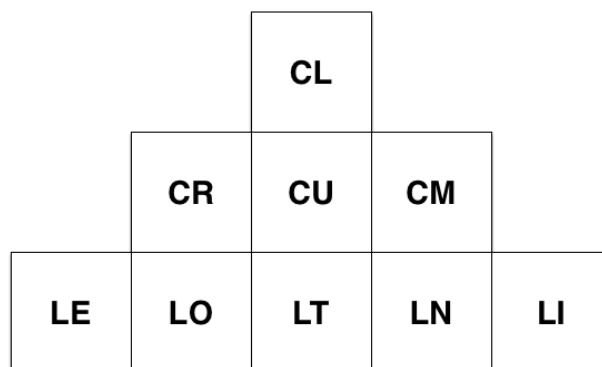


Hypermedia

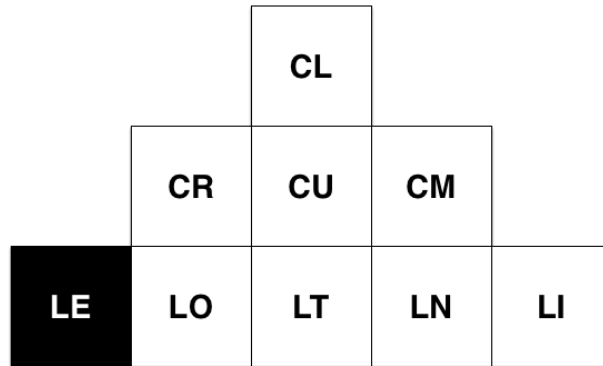
<b>Hyper Media</b>
<b>HTTP</b>
<b>URL</b>

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## Hypermedia (HFactors)



# Embedded Links (LE)



<http://amundsen.com/blog/>

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## LE Examples

```

```

HTML

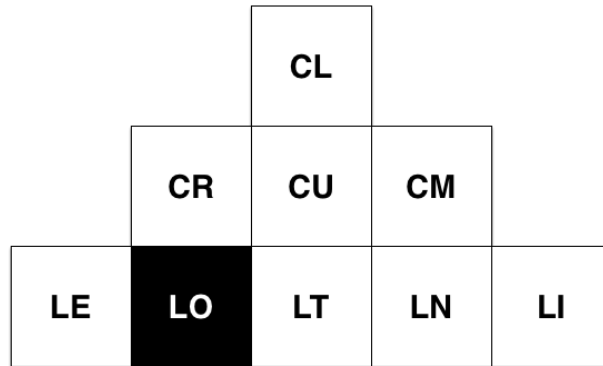
```
<x:include href="http://bosatsu.net/snippets/bio.xml" />
```

XINCLUDE

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# Outbound Links (LO)



<http://amundsen.com/blog/>

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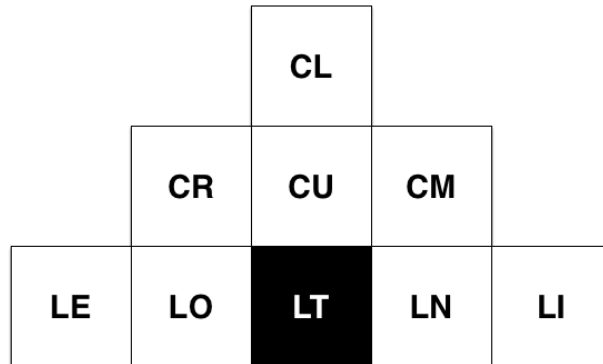
# LO Examples

`<p>See you at Überconf.`

HTML

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# Link Templates (LT)



<http://amundsen.com/blog/>

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## LT Examples

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

HTML

<http://bosatsu.net/submit?course=REST>

URL

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# LT Examples

URI Templates (RFC 6570)

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

URL

```
http://example.com/~fred/  
http://example.com/~mark/
```

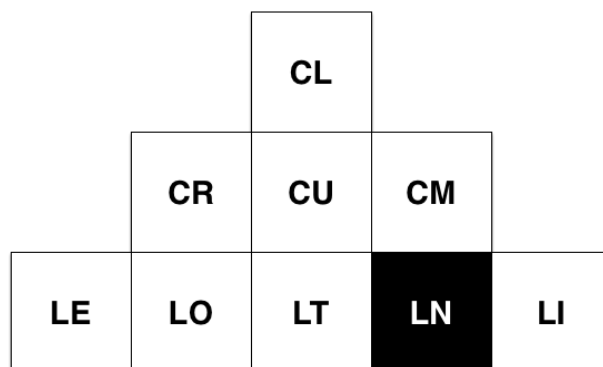
URL

```
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
```

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## Non-Idempotent Links (LN)



# LN Examples

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

HTML

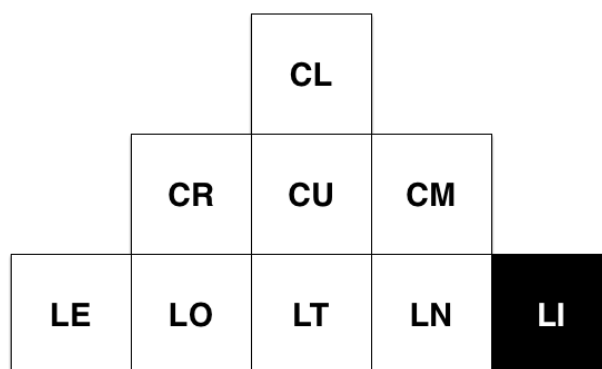
```
POST /submit/ HTTP/1.1  
Host: bosatsu.net  
Content-Type: application/x-www-form-urlencoded  
Length: 34
```

HTTP

```
feedback=Hey+Buddy%2C+nice+jacket
```

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# 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>
```

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## W3C HTML Form HTTP Extensions

### W3C HTML Form HTTP Extensions

HTML

```
<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>
```

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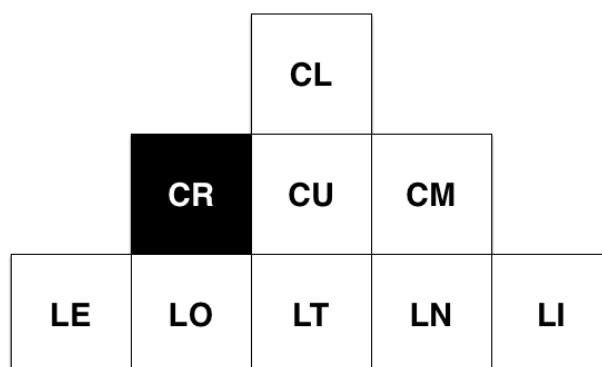
# W3C HTML Form HTTP Extensions

```
<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>
```

HTML

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## Read Context (CR)



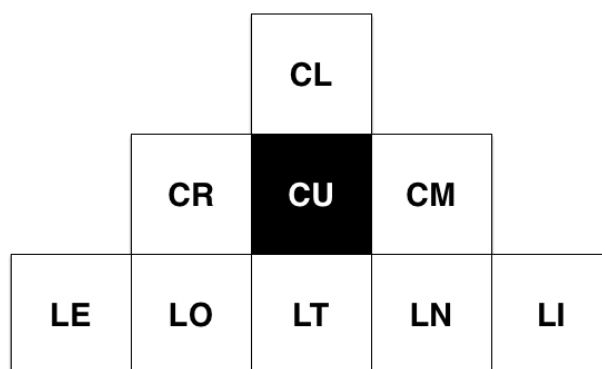
# CR Examples

XINCLUDE

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

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## Update Context (CU)



# CU Examples

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

HTML

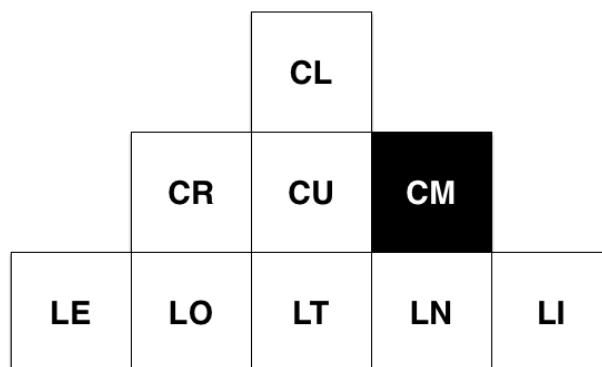
```
POST /submit/ HTTP/1.1
Host: bosatsu.net
Content-Type: text/plain
Length:34

Hey+Buddy%2C+nice+jacket
```

HTTP

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## Method Context (CM)





# CM Examples

HTML

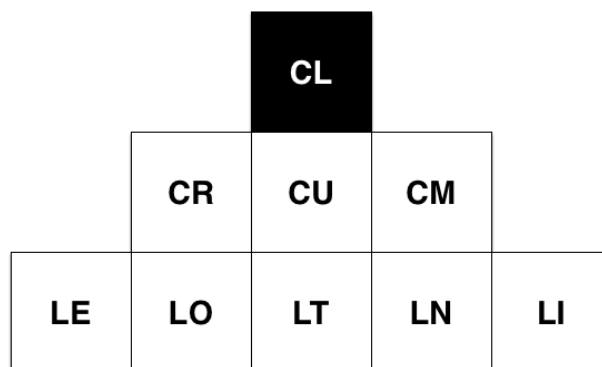
```
<form method="post" action="/feedback">  
  <input name="keywords" type="text" value="foo,bar,baz"/>  
  <input type="submit"/>  
</form>
```

HTML

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

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# Link Context (CL)



# CL Examples

```
<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>
```

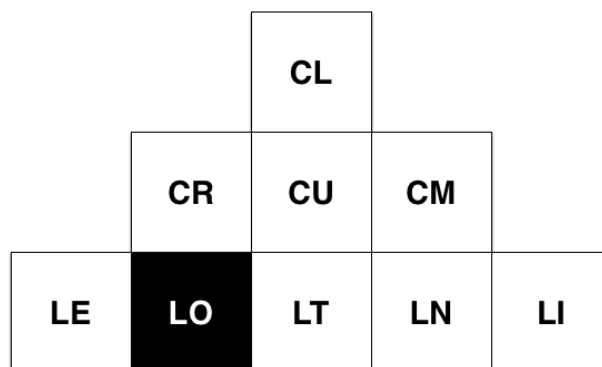
ATOM

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

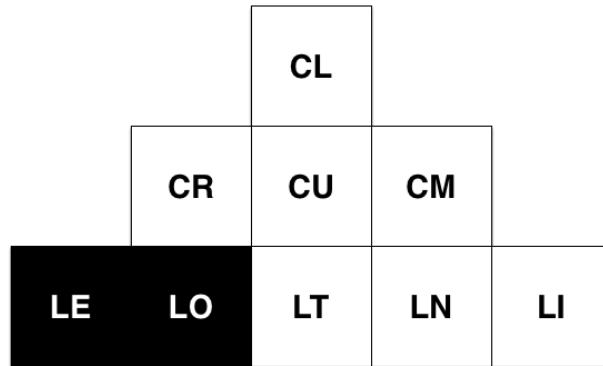
HTML

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## text/uri-list



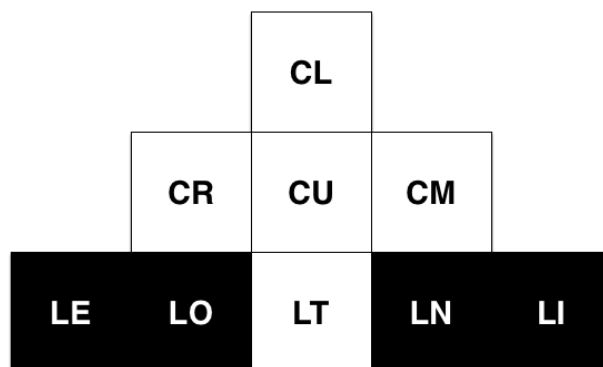
# application/svg+xml



<http://amundsen.com/blog/>

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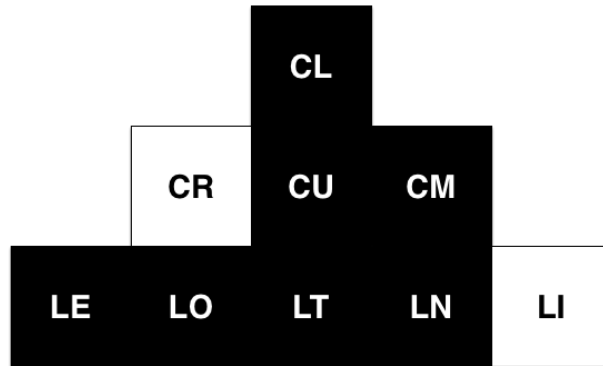
# application/atom+xml



<http://amundsen.com/blog/>

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text/html



<http://amundsen.com/blog/>

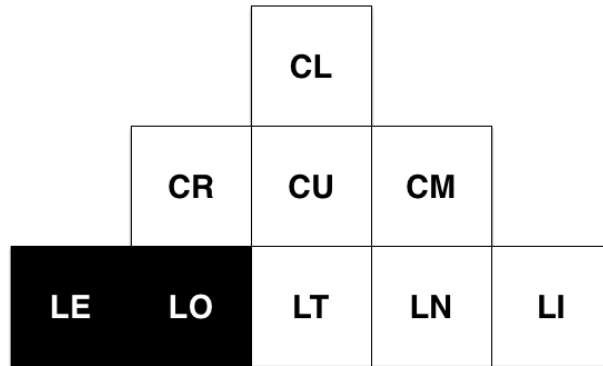
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## Considerations

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

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# application/vnd.amundsen.maze+xml



<http://amundsen.com/blog/>

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# application/vnd.amundsen.maze+xml

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

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GET /examples/mazes/2d/ HTTP/1.1  
Host: amundsen.com  
Accept: application/vnd.amundsen.maze+xml

HTTP

```
<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>
```

XML

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GET /examples/mazes/2d/five-by-five/ HTTP/1.1  
Host: amundsen.com  
Accept: application/vnd.amundsen.maze+xml

HTTP

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

XML

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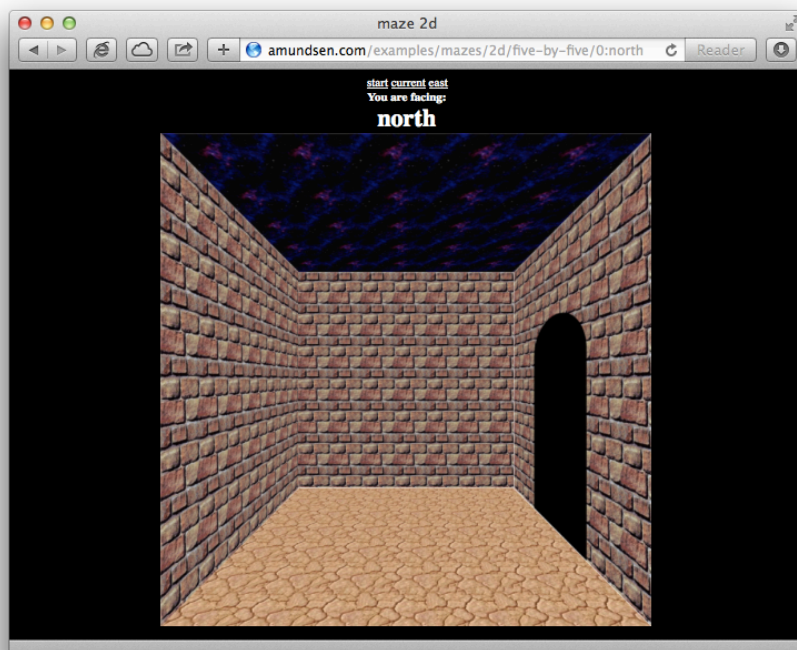
```
GET /examples/mazes/2d/five-by-five/0:north HTTP/1.1
Host: amundsen.com
Accept: application/vnd.amundsen.maze+xml
```

HTTP

```
<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>
```

XML

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# 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/>

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## 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

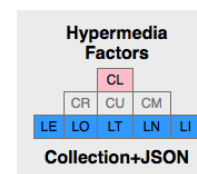
- [Collection+JSON on github](#)
- [Collection+JSON Support in Roar!](#)
- [An experimental gem to help with producing Hypermedia APIs with a MIME type of 'application/vnd.collection+json \(Ruby\)](#)
- [Implementation of Collection+JSON media type \(Java\)](#)

#### MIME Types

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

#### Related Material

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

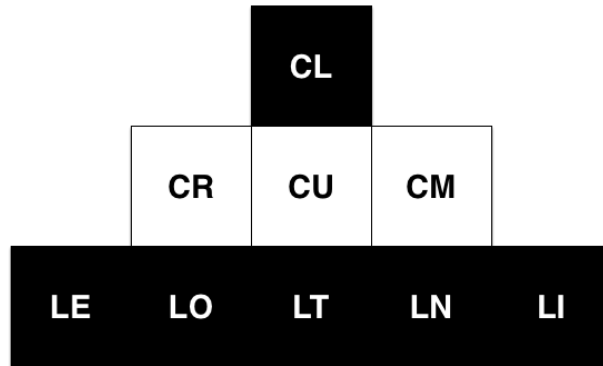


<http://amundsen.com/media-types/collection/>

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# application/vnd.collections+json



<http://amundsen.com/blog/>

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## Collections+JSON

JSON

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

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# Collections+JSON

JSON

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

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## http://example.org/api

JSON

```
{  
  "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"  
    }]  
  }  
}
```

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# http://example.org/account

JSON

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

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# http://example.org/account;page=2

JSON

```
{
  "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": []
}
```

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# http://example.org/account

JSON

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

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# http://example.org/account

JSON

```
{
  ...
  "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" }
    ]
  } ]
  ...
}
```

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# http://example.org/account

JSON

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

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# 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" : "" }
    ]
  }
  ...
}
```

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

JSON

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

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## Hue API (Level 3)

# http://localhost:8080/hue/api

```
HTTP/1.1 200 OK
Date: Wed, 26 Feb 2014 01:12:39 GMT
Server: NetKernel [1060-NetKernel-EE 5.2.1] - Powered by Jetty
ETag: "1a7a971e"
Last-Modified: Wed, 26 Feb 2014 01:12:39 GMT
Content-Type: application/vnd.collections+json
Content-Length: 616
```

HTTP

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# http://localhost:8080/hue/api

```
{ "collection": {
  "version": "1.0",
  "href": "http://localhost:8080/hue/api",
  "links": [{
    "rel": "bridge",
    "href": "http://localhost:8080/hue/bridge"
  }, {
    "rel": "light",
    "href": "http://localhost:8080/hue/light"
  }, {
    "rel": "group",
    "href": "http://localhost:8080/hue/group"
  }, {
    "rel": "schedule",
    "href": "http://localhost:8080/hue/schedule"
  }]
}
```

JSON

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# http://localhost:8080/hue/bridge

```
{ "collection": {
  "version": "1.0",
  "href": "http://localhost:8080/hue/bridge",
  "items": [{
    "href": "http://localhost:8080/hue/bridge/1",
    "data": [{ "name": "id", "value": "001788ffffe10c240" },
             { "name": "internalipaddress", "value": "192.168.1.23" }]
  }],
  "queries": [{
    "encoding": "uri-template",
    "rel": "search",
    "href": "http://localhost:8080/bridge{/id,internalipaddress}",
    "prompt": "Search",
    "data": [...]
  }]
}
}
```

JSON

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# http://localhost:8080/hue/light

```
{
  "collection": {
    "version": "1.0",
    "href": "http://localhost:8080/hue/light",
    "items": [{
      "href": "http://localhost:8080/hue/light/id/1",
      "data": [{ "name": "name", "value": "Strip 3" }]
    }, {
      "href": "http://localhost:8080/hue/light/id/2",
      "data": [{ "name": "name", "value": "Strip 2" }]
    }, {
      "href": "http://localhost:8080/hue/light/id/3",
      "data": [{ "name": "name", "value": "Strip 1" }]
    }
  ],
  "queries": [{
    "encoding": "uri-template",
    "rel": "search",
    "href": "http://localhost:8080/light{/id,on,bridge,name}",
    "prompt": "Search",
    "data": [...]
  }]
}
}
```

JSON

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# http://localhost:8080/hue/light/id/1

```
HTTP/1.1 200 OK
Date: Wed, 26 Feb 2014 01:26:52 GMT
Server: NetKernel [1060-NetKernel-EE 5.2.1] - Powered by Jetty
Last-Modified: Wed, 26 Feb 2014 01:26:52 GMT
Content-Type: application/vnd.collections+json
Content-Length: 2798
```

HTTP

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# http://localhost:8080/hue/light/id/1

```
{
  "collection": {
    "version": "1.0",
    "href": "http://localhost:8080/hue/light/id/1",
    "links": [ { "rel": "edit", "href": "http://localhost:8080/hue/light/id/1" } ],
    "items": [ {
      "href": "http://localhost:8080/hue/light/id/1",
      "data": [
        { "name": "name", "value": "Strip 3" },
        { "name": "type", "value": "Color light" },
        { "name": "model", "value": "LST001" },
        { "name": "version", "value": "66010400" },
        { "name": "on", "value": false },
        { "name": "brightness", "value": 1 },
        { "name": "hue", "value": 46920 },
        { "name": "saturation", "value": 254 },
        { "name": "alert", "value": "none" },
        { "name": "effect", "value": "none" }
      ]
    } ],
    ...
  }
}
```

JSON

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# http://localhost:8080/hue/light/id/1

JSON

```
{
  "collection": {
    "version": "1.0",
    "href": "http://localhost:8080/hue/light/id/1",
    ...
    "template": {
      "data": [
        { "name": "name", "value": "", "prompt": "Light Name" },
        { "name": "on", "value": "", "prompt": "On" },
        { "name": "brightness", "value": "", "prompt": "Brightness" },
        { "name": "hue", "value": "", "prompt": "Hue" },
        { "name": "saturation", "value": "", "prompt": "Saturation" },
        { "name": "alert", "value": "", "prompt": "Alert" },
        { "name": "effect", "value": "", "prompt": "Effect" }
      ]
    }
  }
}
```

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## Demo

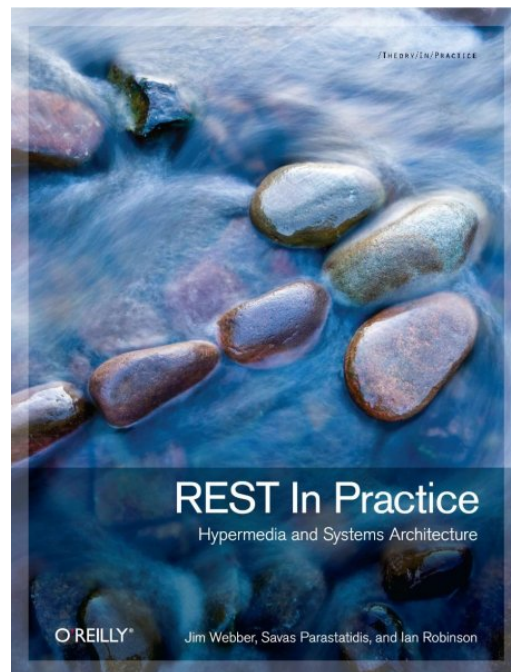
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## Books





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*Creating Evolvable Hypermedia Applications*



*Building*

# Hypermedia APIs with HTML5 & Node

O'REILLY®

*Mike Amundsen*

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*Services for a Changing World*

# RESTful Web APIs



O'REILLY®

*Leonard Richardson,  
Mike Amundsen & Sam Ruby*

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## Questions?

✉ [brian@bosatsu.net](mailto:brian@bosatsu.net)

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

🍷 <http://tinyurl.com/bjs-gplus>

🌐 [bsletten](https://bsletten.com)