

Google™



Building Custom Client Libraries for Google APIs

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Building Custom Client Libraries for Google APIs

Hashtags: [#io2011](#) [#GoogleAPIs](#)

Feedback: <http://goo.gl/ifSQM>

Outline

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- Introducing the APIs Discovery Service

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- Walk-through of the format

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- How to build a client library

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- **Introducing the APIs Discovery Service**
- Walk-through of the format
- How to build a client library

How Google Builds APIs

How Google Builds APIs

- How Google Builds APIs - I/O 2010
 - <http://goo.gl/MZ5Up>

How Google Builds APIs

- How Google Builds APIs - I/O 2010
 - <http://goo.gl/MZ5Up>
- Google APIs are RESTful

How Google Builds APIs

- How Google Builds APIs - I/O 2010
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- Google APIs are RESTful
- An API is a collection of:
 - Resources
 - Methods on the resources
 - Parameters for each method

How Google Builds APIs

- How Google Builds APIs - I/O 2010
 - <http://goo.gl/MZ5Up>
- Google APIs are RESTful
- An API is a collection of:
 - Resources
 - Methods on the resources
 - Parameters for each method
- All new APIs are built on a common infrastructure

How Google Builds Client Libraries



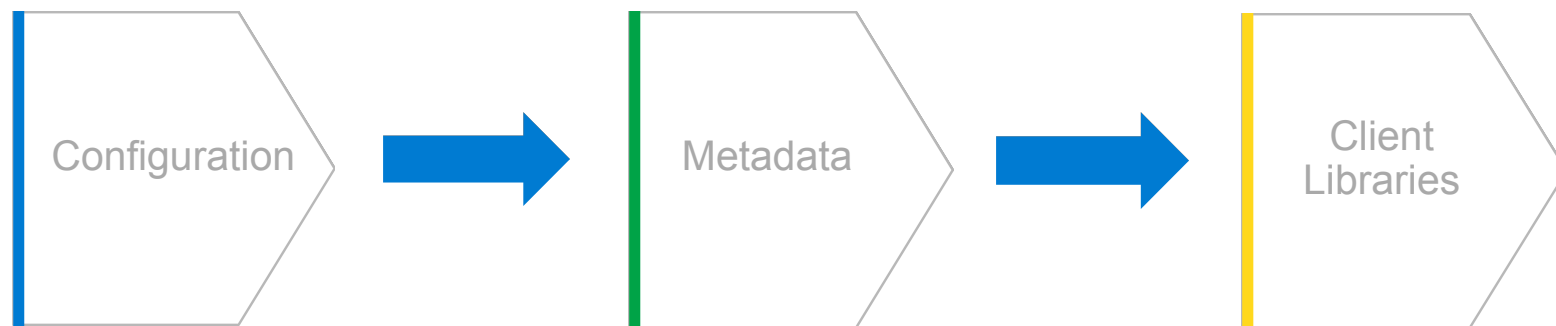
How Google Builds Client Libraries

- The API configuration allows the creation of a machine readable metadata for each API
 - *Discovery document*



How Google Builds Client Libraries

- The API configuration allows the creation of a machine readable metadata for each API
 - *Discovery document*
- The metadata is used in the client libraries to construct the API calling surfaces



Introducing the APIs Discovery Service

A service that exposes metadata about Google APIs in a machine readable format for client libraries and other tools to consume

[**https://code.google.com/apis/discovery**](https://code.google.com/apis/discovery)

APIs Discovery Service - Benefits & Motivation

APIs Discovery Service - Benefits & Motivation

- Scalability

APIs Discovery Service - Benefits & Motivation

- Scalability
- Automation

APIs Discovery Service - Benefits & Motivation

- Scalability
- Automation
- Transparency

APIs Discovery Service - Demo

- Google APIs Explorer
 - <https://code.google.com/apis/explorer>
- Build exclusively on top the APIs Discovery Service
- Now open-sourced!
 - <http://code.google.com/p/google-apis-explorer/>

APIs Discovery Service - Demo - APIs Explorer



APIs Explorer Using Public Access. [Switch to Private Access](#) with scope:

Select a service	Select a version	Select a method	Fill in parameters
diacritize Diacritize API	v1 Documentation	url.get Expands a short URL or gets creation time and analytics.	*shortUrl = <input type="text"/> The short URL, including the protocol. (string)
moderator Moderator API		url.insert Creates a new short URL.	projection = <input type="text"/> Additional information to return. (string)
shopping Search API for Shopping		url.list Retrieves a list of URLs shortened by a user.	
translate Translate API			
urlshortener URL Shortener API			

* required field

History

APIs Discovery Service - Other Uses by Google

- The family of Google APIs Client Libraries
 - Java, Python, PHP, Ruby, .NET
 - <http://code.google.com/apis/discovery/libraries.html>
- Google APIs Support in Google Plugin for Eclipse
 - <http://code.google.com/eclipse/docs/googleapis.html>

Outline

- Introducing the APIs Discovery Service
- **Walk-through of the format**
- How to build a client library

Discovery Service - API Features

- Features
 - Directory of supported APIs
 - Discovery Document
 - Methods
 - Parameters
 - Resources & Schemas
 - Authentication
- JSON-based API served from
 - <https://www.googleapis.com/discovery/v1/...>

API Features - Directory of Supported APIs



APIs Explorer Using Public Access. [Switch to Private Access](#) with scope:

Select a service	Select a version	Select a method	Fill in parameters
diacritize Diacritize API	v1 Documentation	url.get Expands a short URL or gets creation time and analytics.	*shortUrl = <input type="text"/> The short URL, including the protocol. (string)
moderator Moderator API		url.insert Creates a new short URL.	projection = <input type="text"/> Additional information to return. (string)
shopping Search API for Shopping		url.list Retrieves a list of URLs shortened by a user.	
translate Translate API			
urlshortener URL Shortener API			<input type="button" value="Execute"/> * required field

History

API Features - Directory of Supported APIs

The screenshot displays the Google APIs Explorer interface. At the top left is the "Google apis" logo. Below it is the "APIs Explorer" header. A status bar indicates "Using Public Access. [Switch to Private Access](#) with scope: ".

Select a service	Select a version	Select a method	Fill in parameters
<ul style="list-style-type: none">diacritize Diacritize APImoderator Moderator APIshopping Search API for Shoppingtranslate Translate APIurlshortener URL Shortener API	v1 Documentation	<ul style="list-style-type: none">url.get Expands a short URL or gets creation time and analytics.url.insert Creates a new short URL.url.list Retrieves a list of URLs shortened by a user.	<ul style="list-style-type: none">*shortUrl = <input type="text"/> The short URL, including the protocol. (string)projection = <input type="text"/> Additional information to return. (string) <p><input type="button" value="Execute"/> * required field</p>

History

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API Features - Directory of Supported APIs

GET <https://www.googleapis.com/discovery/v1/apis>

API Features - Directory of Supported APIs

GET <https://www.googleapis.com/discovery/v1/apis>

```
{
  "items": [
    {
      "kind": "discovery#directoryItem",
      "id": "urlshortener:v1",
      "name": "urlshortener",
      "version": "v1",
      "description": "URL Shortener API",
      "discoveryLink": "./apis/urlshortener/v1/rest",
      "icons": {
        "x16": "http://www.google.com/images/icons/product/search-16.gif",
        "x32": "http://www.google.com/images/icons/product/search-32.gif"
      },
      "documentationLink": "http://code.google.com/apis/urlshortener/v1/getting_started.html",
      "labels": [
        "labs"
      ],
      "preferred": true
    }
  ]
}
```

API Features - Directory of Supported APIs

GET <https://www.googleapis.com/discovery/v1/apis>

"items": [

```
buzz v1
customsearch v1
diacritize v1
discovery v1
latitude v1
moderator v1
prediction v1.2
shopping v1
siteVerification v1
taskqueue v1beta1
translate v2
urlshortener v1
```

]

API Features - Directory of Supported APIs

GET <https://www.googleapis.com/discovery/v1/apis>

```
{
  "items": [
    {
      "kind": "discovery#directoryItem",
      "id": "urlshortener:v1",
      "name": "urlshortener",
      "version": "v1",
      "description": "URL Shortener API",
      "discoveryLink": "./apis/urlshortener/v1/rest",
      "icons": {
        "x16": "http://www.google.com/images/icons/product/search-16.gif",
        "x32": "http://www.google.com/images/icons/product/search-32.gif"
      },
      "documentationLink": "http://code.google.com/apis/urlshortener/v1/getting_started.html",
      "labels": [
        "labs"
      ],
      "preferred": true
    }
  ]
}
```

Identifying information about the API

API Features - Directory of Supported APIs

GET <https://www.googleapis.com/discovery/v1/apis>

```
{
  "items": [
    {
      "kind": "discovery#directoryItem",
      "id": "urlshortener:v1",
      "name": "urlshortener",
      "version": "v1",
      "description": "URL Shortener API",
      "discoveryLink": "./apis/urlshortener/v1/rest",
      "icons": {
        "icons": {
          "x16": "http://www.google.com/images/icons/product/search-16.gif",
          "x32": "http://www.google.com/images/icons/product/search-32.gif"
        },
        "documentationLink": "http://code.google.com/apis/urlshortener/v1/getting_started.html",
        "labs":
      ],
      "preferred": true
    }
  ]
}
```

Documentation details

API Features - Directory of Supported APIs

GET <https://www.googleapis.com/discovery/v1/apis>

```
{
  "items": [
    {
      "kind": "discovery#directoryItem",
      "id": "urlshortener:v1",
      "name": "urlshortener",
      "version": "v1",
      "description": "URL Shortener API",
      "icons": {
        "x16": "http://www.google.com/images/icons/product/search-16.gif",
        "x32": "http://www.google.com/images/icons/product/search-32.gif"
      },
      "documentationLink": "http://code.google.com/apis/urlshortener/v1/getting_started.html",
      "labels": [
        "labs"
      ],
      "preferred": true
    }
  ]
}
```

A link to the Discovery document.

Anatomy of an API - Url Shortener API

- Squeezes loooooong urls into fewer characters:

<http://maps.google.com/maps/place?cid=13048026345962796583&q=Moscone+Center,+Howard+Street,+San+Francisco,+CA&gl=us&hl=en&dtab=0&sll=37.783742,-122.402127&sspn=0.017637,0.032015&ie=UTF8&ll=37.797306,-122.421427&spn=0,0&z=15>

→ <http://goo.gl/maps/ICGE>

- <http://code.google.com/apis/urlshortener/>

Anatomy of an API - Url Shortener API

- Resources = **Url object**
- Methods:
 - **get** - Retrieve a url object with expansion information.
 - **insert** - Shortens the given url object.
 - **list** - Retrieves a list of url objects shortened by the user (Authentication required).

API Features - Discovery Document

GET <https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

API Features - Discovery Document

GET <https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

```
{
  "kind": "discovery#restDescription",
  "name": "urlshortener",
  "version": "v1",
  "description": "URL Shortener API",
  "protocol": "rest",
  "basePath": "/urlshortener/v1/",
  "auth": { ... },
  "schemas": { ... },
  "resources": {
    "url": {
      "methods": {
        "get": {
          "id": "urlshortener.url.get",
          "path": "url",
          "httpMethod": "GET",
          "description": "...",
          "parameters": { ... },
          "parameterOrder": [
            "shortUrl"
          ],
          "response": {
            "$ref": "Url"
          }
        }
      }
    }
  }
}
```

API Features - Discovery Document

GET <https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

```
{
  "kind": "discovery#restDescription",
  "name": "urlshortener",
  "version": "v1",
  "description": "URL Shortener API",
  "protocol": "rest",
  "basePath": "/urlshortener/v1/",
  "auth": { ... },
  "schemas": { ... },
  "resources": {
    "url": {
      "methods": {
        "get": {
          "id": "urlshortener.url.get",
          "path": "url",
          "httpMethod": "GET",
          "description": "...",
          "parameters": { ... },
          "parameterOrder": [
            "shortUrl"
          ],
          "response": {
            "$ref": "Url"
          }
        }
      }
    }
  }
}
```

General API Details

API Features - Discovery Document

GET <https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

```
{
  "kind": "discovery#restDescription",
  "name": "urlshortener",
  "version": "v1",
  "description": "URL Shortener API",
  "protocol": "rest",
  "basePath": "/urlshortener/v1/",
  "auth": { ... },
  "schemas": { ... },
  "resources": {
    "url": {
      "methods": {
        "get": {
          "id": "urlshortener.url.get",
          "path": "url",
          "httpMethod": "GET",
          "description": "...",
          "parameters": { ... },
          "parameterOrder": [
            "shortUrl"
          ],
          "response": {
            "$ref": "Url"
          }
        }
      }
    }
  }
}
```

Authentication

API Features - Discovery Document

GET <https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

```
{
  "kind": "discovery#restDescription",
  "name": "urlshortener",
  "version": "v1",
  "description": "URL Shortener API",
  "protocol": "rest",
  "basePath": "/urlshortener/v1/",
  "auth": { ... },
  "schemas": { ... },
  "resources": {
    "url": {
      "methods": {
        "get": {
          "id": "urlshortener.url.get",
          "path": "url",
          "httpMethod": "GET",
          "description": "...",
          "parameters": { ... },
          "parameterOrder": [
            "shortUrl"
          ],
          "response": {
            "$ref": "Url"
          }
        }
      }
    }
  }
}
```

Schemas

API Features - Discovery Document

GET <https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

```
{
  "kind": "discovery#restDescription",
  "name": "urlshortener",
  "version": "v1",
  "description": "URL Shortener API",
  "protocol": "rest",
  "basePath": "/urlshortener/v1/",
  "auth": { ... },
  "schemas": { ... },
  "resources": {
    "url": {
      "methods": {
        "get": {
          "id": "urlshortener.url.get",
          "path": "url",
          "httpMethod": "GET",
          "description": "...",
          "parameters": { ... },
          "parameterOrder": [
            "shortUrl"
          ],
          "response": {
            "$ref": "Url"
          }
        }
      }
    }
  }
}
```

Resources

API Features - Discovery Document

GET <https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

```
{
  "kind": "discovery#restDescription",
  "name": "urlshortener",
  "version": "v1",
  "description": "URL Shortener API",
  "protocol": "rest",
  "basePath": "/urlshortener/v1/",
  "auth": { ... },
  "schemas": { ... },
  "resources": {
    "url": {
      "methods": {
        "get": {
          "id": "urlshortener.url.get",
          "path": "url",
          "httpMethod": "GET",
          "description": "...",
          "parameters": { ... },
          "parameterOrder": [
            "shortUrl"
          ],
          "response": {
            "$ref": "Url"
          }
        }
      }
    }
  }
}
```

Methods

Anatomy of an HTTP Request

Request

```
GET https://www.googleapis.com/urlshortener/v1/url?shortUrl=http://goo.gl/maps/lCGE
```

Response

```
{  
  "kind": "urlshortener#url",  
  "id": "http://goo.gl/maps/lCGE",  
  "longUrl": "http://maps.google.com/...",  
  "status": "OK"  
}
```

Anatomy of an HTTP Request

Request

```
GET https://www.googleapis.com/urlshortener/v1/url?shortUrl=http://goo.gl/maps/lCGE
```

Response

```
{  
  "kind": "urlshortener#url",  
  "id": "http://goo.gl/maps/lCGE",  
  "longUrl": "http://maps.google.com/...",  
  "status": "OK"  
}
```

HTTP Method

Anatomy of an HTTP Request

Request

GET <https://www.googleapis.com/urlshortener/v1/url?shortUrl=http://goo.gl/maps/lCGE>

Response

```
{  
  "kind": "urlshortener#url",  
  "id": "http://goo.gl/maps/lCGE",  
  "longUrl": "http://maps.google.com/...",  
  "status": "OK"  
}
```

Path

Anatomy of an HTTP Request

Request

GET <https://www.googleapis.com/urlshortener/v1/url?shortUrl=http://goo.gl/maps/lCGE>

Response

```
{  
  "kind": "urlshortener#url",  
  "id": "http://goo.gl/maps/lCGE",  
  "longUrl": "http://maps.google.com/...",  
  "status": "OK"  
}
```

Parameters

Anatomy of an HTTP Request

Request

```
GET https://www.googleapis.com/urlshortener/v1/url?shortUrl=http://goo.gl/maps/lCGE
```

Response

```
{  
  "kind": "urlshortener#url",  
  "id": "http://goo.gl/maps/lCGE",  
  "longUrl": "http://maps.google.com/...",  
  "status": "OK"  
}
```

Response body

Discovery Document - Methods

How does Discovery model an HTTP request?

```
"resources": {  
  "url": {  
    "methods": {  
      "get": {  
        "id": "urlshortener.url.get",  
        "path": "url",  
        "httpMethod": "GET",  
        "description": "...",  
        "parameters": { ... },  
        "parameterOrder": [  
          "shortUrl"  
        ],  
        "response": {  
          "$ref": "Url"  
        }  
      }  
    }  
  }  
}
```

Discovery Document - Methods

How does Discovery model an HTTP request?

```
"resources": {  
  "url": {  
    "methods": {  
      "get": {  
        "id": "urlshortener.url.get",  
        "path": "url",  
        "httpMethod": "GET",  
        "description": "...",  
        "parameters": { ... },  
        "parameterOrder": [  
          "shortUrl"  
        ],  
        "response": {  
          "$ref": "Url"  
        }  
      }  
    }  
  }  
}
```

- "methods" container for all methods related to this resource.

Discovery Document - Methods

How does Discovery model an HTTP request?

```
"resources": {  
  "url": {  
    "methods": {  
      "get": {  
        "id": "urlshortener.url.get",  
        "path": "url",  
        "httpMethod": "GET",  
        "description": "...",  
        "parameters": { ... },  
        "parameterOrder": [  
          "shortUrl"  
        ],  
        "response": {  
          "$ref": "Url"  
        }  
      }  
    }  
  }  
}
```

- "methods" container for all methods related to this resource.
- HTTP Method: GET, PUT, POST, DELETE

Discovery Document - Methods

How does Discovery model an HTTP request?

```
"resources": {  
  "url": {  
    "methods": {  
      "get": {  
        "id": "urlshortener.url.get",  
        "path": "url",  
        "httpMethod": "GET",  
        "description": "...",  
        "parameters": { ... },  
        "parameterOrder": [  
          "shortUrl"  
        ],  
        "response": {  
          "$ref": "Url"  
        }  
      }  
    }  
  }  
}
```

- "methods" container for all methods related to this resource.
- HTTP Method: GET, PUT, POST, DELETE
- Path
 - URI Template v04
 - Not the full url

Discovery Document - Calculating URI

<https://www.googleapis.com/urlshortener/v1/url>

Discovery Document - Calculating URI

<https://www.googleapis.com/urlshortener/v1/url>

Discovery document absolute URI:

<https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

Discovery Document - Calculating URI

<https://www.googleapis.com/urlshortener/v1/url>

Discovery document absolute URI:

<https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

+

"basePath": "/urlshortener/v1/"

Discovery Document - Calculating URI

<https://www.googleapis.com/urlshortener/v1/url>

Discovery document absolute URI:

<https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

+

"basePath": "/urlshortener/v1/"

+

```
"methods": {  
  "get": {  
    "path": "url"  
  }  
}
```


Discovery Document - Calculating URI

<https://www.googleapis.com/urlshortener/v1/url>

Discovery document absolute URI:

<https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest>

+

"basePath": "/urlshortener/v1/"

+

```
"methods": {  
  "get": {  
    "path": "url"  
  }  
}
```

(May contain variables in the form {var}, populated from "parameters" section)

Discovery Document - Methods

How does Discovery model an HTTP request?

```
"resources": {
  "url": {
    "methods": {
      "get": {
        "id": "urlshortener.url.get",
        "path": "url",
        "httpMethod": "GET",
        "description": "...",
        "parameters": { ... },
        "parameterOrder": [
          "shortUrl"
        ],
        "response": {
          "$ref": "Url"
        }
      }
    }
  }
}
```

- "methods" container for all methods related to this resource.
- HTTP Method: GET, PUT, POST, DELETE
- Path
 - URI Template v04
 - Not the full url
- Parameters

Discovery Document - Methods

How does Discovery model an HTTP request?

```
"resources": {  
  "url": {  
    "methods": {  
      "get": {  
        "id": "urlshortener.url.get",  
        "path": "url",  
        "httpMethod": "GET",  
        "description": "...",  
        "parameters": { ... },  
        "parameterOrder": [  
          "shortUrl"  
        ],  
        "response": {  
          "$ref": "Url"  
        }  
      }  
    }  
  }  
}
```

- "methods" container for all methods related to this resource.
- HTTP Method: GET, PUT, POST, DELETE
- Path
 - URI Template v04
 - Not the full url
- Parameters
- Request & Response

Discovery Document - Parameters

```
"parameters": {  
  "projection": {  
    "location": "query",  
    "type": "string",  
    "description": "...",  
    "enum": [  
      "ANALYTICS_CLICKS",  
      "ANALYTICS_TOP_STRINGS",  
      "FULL"  
    ],  
    "enumDescriptions": [ ... ]  
  },  
  "shortUrl": {  
    "location": "query",  
    "type": "string",  
    "description": "...",  
    "required": true  
  }  
}
```

Discovery Document - Parameters

```
"parameters": {  
  "projection": {  
    "location": "query",  
    "type": "string",  
    "description": "...",  
    "enum": [  
      "ANALYTICS_CLICKS",  
      "ANALYTICS_TOP_STRINGS",  
      "FULL"  
    ],  
    "enumDescriptions": [ ... ]  
  },  
  "shortUrl": {  
    "location": "query",  
    "type": "string",  
    "description": "...",  
    "required": true  
  }  
}
```

- Details the path and query parameters for each method.

Discovery Document - Parameters

```
"parameters": {  
  "projection": {  
    "location": "query",  
    "type": "string",  
    "description": "...",  
    "enum": [  
      "ANALYTICS_CLICKS",  
      "ANALYTICS_TOP_STRINGS",  
      "FULL"  
    ],  
    "enumDescriptions": [ ... ]  
  },  
  "shortUrl": {  
    "location": "query",  
    "type": "string",  
    "description": "...",  
    "required": true  
  }  
}
```

- Details the path and query parameters for each method.

.../v1/url?shortUrl=http://goo.gl/maps/ICGE

Discovery Document - Parameters

```
"parameters": {
  "projection": {
    "location": "query",
    "type": "string",
    "description": "...",
    "enum": [
      "ANALYTICS_CLICKS",
      "ANALYTICS_TOP_STRINGS",
      "FULL"
    ],
    "enumDescriptions": [ ... ]
  },
  "shortUrl": {
    "location": "query",
    "type": "string",
    "description": "...",
    "required": true
  }
}
```

- Details the path and query parameters for each method.
- Includes type information about each parameter (string, integer, number, boolean, any).

Discovery Document - Parameters

```
"parameters": {  
  "projection": {  
    "location": "query",  
    "type": "string",  
    "description": "...",  
    "enum": [  
      "ANALYTICS_CLICKS",  
      "ANALYTICS_TOP_STRINGS",  
      "FULL"  
    ],  
    "enumDescriptions": [ ... ]  
  },  
  "shortUrl": {  
    "location": "query",  
    "type": "string",  
    "description": "...",  
    "required": true  
  }  
}
```

- Details the path and query parameters for each method.
- Includes type information about each parameter (string, integer, number, boolean, any).
- Additional details on parameters, such as enum values, required, repeated.
- Properties come from JSON Schema draft-03 (with some additions).
<http://json-schema.org>

Discovery Document - Resources & Schemas

```
"schemas": {  
  "Url": {  
    "id": "Url",  
    "type": "object",  
    "properties": {  
      "id": {  
        "type": "string",  
        "description": "..."  
      },  
      "kind": {  
        "type": "string",  
        "description": "...",  
        "default": "urlshortener#url"  
      },  
      "longUrl": {  
        "type": "string",  
        "description": "..."  
      }  
    }  
  }  
}
```

Discovery Document - Resources & Schemas

```
"schemas": {  
  "Url": {  
    "id": "Url",  
    "type": "object",  
    "properties": {  
      "id": {  
        "type": "string",  
        "description": "..."  
      },  
      "kind": {  
        "type": "string",  
        "description": "...",  
        "default": "urlshortener#url"  
      },  
      "longUrl": {  
        "type": "string",  
        "description": "..."  
      }  
    }  
  }  
}
```

- What do the requests and responses look like?

Discovery Document - Resources & Schemas

```
"schemas": {  
  "Url": {  
    "id": "Url",  
    "type": "object",  
    "properties": {  
      "id": {  
        "type": "string",  
        "description": "..."  
      },  
      "kind": {  
        "type": "string",  
        "description": "...",  
        "default": "urlshortener#url"  
      },  
      "longUrl": {  
        "type": "string",  
        "description": "..."  
      }  
    }  
  }  
}
```

- What do the requests and responses look like?
- Top-level "schemas" object.

Discovery Document - Resources & Schemas

```
"schemas": {  
  "Url": {  
    "id": "Url",  
    "type": "object",  
    "properties": {  
      "id": {  
        "type": "string",  
        "description": "..."  
      },  
      "kind": {  
        "type": "string",  
        "description": "...",  
        "default": "urlshortener#url"  
      },  
      "longUrl": {  
        "type": "string",  
        "description": "..."  
      }  
    }  
  }  
}
```

- What do the requests and responses look like?
- Top-level "schemas" object.
- Schemas identified by ID.

Discovery Document - Resources & Schemas

```
"schemas": {  
  "Url": {  
    "id": "Url",  
    "type": "object",  
    "properties": {  
      "id": {  
        "type": "string",  
        "description": "..."  
      },  
      "kind": {  
        "type": "string",  
        "description": "...",  
        "default": "urlshortener#url"  
      },  
      "longUrl": {  
        "type": "string",  
        "description": "..."  
      }  
    }  
  }  
}
```

```
{  
  "methods": {  
    "get": {  
      "response": {  
        "$ref": "Url"  
      }  
    }  
  }  
}
```

("\$ref" is JSON Referencing syntax).

Discovery Document - Resources & Schemas

```
"schemas": {  
  "Url": {  
    "id": "Url",  
    "type": "object",  
    "properties": {  
      "id": {  
        "type": "string",  
        "description": "..."  
      },  
      "kind": {  
        "type": "string",  
        "description": "...",  
        "default": "urlshortener#url"  
      },  
      "longUrl": {  
        "type": "string",  
        "description": "..."  
      }  
    }  
  }  
}
```

- What do the requests and responses look like?
- Top-level "schemas" object.
- Schemas identified by ID.
- JSON Schema draft-03
<http://json-schema.org>

Discovery Document - Resources & Schemas

```
"schemas": {  
  "Url": {  
    "id": "Url",  
    "type": "object",  
    "properties": {  
      "id": {  
        "type": "string",  
        "description": "..."  
      },  
      "kind": {  
        "type": "string",  
        "description": "...",  
        "default": "urlshortener#url"  
      },  
      "longUrl": {  
        "type": "string",  
        "description": "..."  
      }  
    }  
  }  
}
```

Response from "get" method:

```
{  
  "id": "http://goo.gl/maps/lCGE",  
  "kind": "urlshortener#url",  
  "longUrl": "http://maps.google..."  
}
```

Discovery Document - Authentication

- Some methods require authentication
- OAuth 2.0 (<http://oauth.net/2/>)
- Supported by most new Google APIs
- Permissions are specified using "scopes".
- Discovery documents the "scopes" supported by each method.

Discovery Document - Authentication

```
"auth": {  
  "oauth2": {  
    "scopes": {  
      "https://www.googleapis.com/auth/urlshortener": {  
        "description": "Manage your goo.gl short URLs"  
      }  
    }  
  }  
}
```

Discovery Document - Authentication

```
"auth": {  
  "oauth2": {  
    "scopes": {  
      "https://www.googleapis.com/auth/urlshortener": {  
        "description": "Manage your goo.gl short URLs"  
      }  
    }  
  }  
}
```

- Top-level "auth" section contains all auth-related information.

Discovery Document - Authentication

```
"auth": {  
  "oauth2": {  
    "scopes": {  
      "https://www.googleapis.com/auth/urlshortener": {  
        "description": "Manage your goo.gl short URLs"  
      }  
    }  
  }  
}
```

- Top-level "auth" section contains all auth-related information.
- OAuth 2.0 scopes are the only piece of auth info.

Discovery Document - Authentication

```
"auth": {  
  "oauth2": {  
    "scopes": {  
      "https://www.googleapis.com/auth/urlshortener": {  
        "description": "Manage your goo.gl short URLs"  
      }  
    }  
  }  
}
```

- Top-level "auth" section contains all auth-related information.
- OAuth 2.0 scopes are the only piece of auth info.
- Scope value.

Discovery Document - Authentication

```
"auth": {  
  "oauth2": {  
    "scopes": {  
      "https://www.googleapis.com/auth/urlshortener": {  
        "description": "Manage your goo.gl short URLs"  
      }  
    }  
  }  
}
```

- Top-level "auth" section contains all auth-related information.
- OAuth 2.0 scopes are the only piece of auth info.
- Scope value.
- Description of the scope.

Discovery Document - Authentication

```
"auth": {  
  "oauth2": {  
    "scopes": {  
      "https://www.googleapis.com/auth/urlshortener": {  
        "description": "Manage your goo.gl short URLs"  
      }  
    }  
  }  
}
```

```
"methods":  
  "list": {  
    "scopes": [  
      "https://www.googleapis.com/auth/urlshortener"  
    ]  
  }  
}
```

Discovery Document - Descriptions

- Most objects in the Discovery document have a "description" property.
- Including methods, parameters, schema properties
- Explains the purpose of each of those properties.
- Useful for generating documentation for client libraries.

Other Tips

- SSL only (https, no http)
- No API key
- Api-level methods
- Nested Resources
- Schema references (\$ref)
- URI Templates
- OAuth 2.0

Outline

- Introducing the Discovery API
- Walk-through of the format
- **How to build a client library**

Building a Client Library

Three simple steps

Building a Client Library

Three simple steps

1

Fetch the Discovery Document

Building a Client Library

Three simple steps

1

Fetch the Discovery Document

2

Build a Resource and a Request

Building a Client Library

Three simple steps

1

Fetch the Discovery Document

2

Build a Resource and a Request

3

Make a REST call and fetch the response

Simple Python Client Example

- Fully functional client library (no Auth)
- 35 lines of Python code!

```

import httplib2
import json
import uritemplate
import urlparse
import urllib

DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'
h = httplib2.Http()
resp, content = h.request(DISCOVERY)
discovery = json.loads(content)

BASE_URI = urlparse.urljoin(DISCOVERY, discovery['basePath'])

class Collection(object): pass

def build(discovery, collection):
    for name, resource in discovery.get('resources', {}).iteritems():
        setattr(collection, name, build(resource, Collection()))
    for name, method in discovery.get('methods', {}).iteritems():
        setattr(collection, name, createNewMethod(name, method))
    return collection

def createNewMethod(name, method):
    def newMethod(**kwargs):
        body = kwargs.pop('body', None)
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))
        for pname, pconfig in method.get('parameters', {}).iteritems():
            if pconfig['location'] == 'path' and pname in kwargs:
                del kwargs[pname]
        if kwargs:
            url = url + '?' + urllib.urlencode(kwargs)
        return h.request(url, method=method['httpMethod'], body=body,
                        headers={'content-type': 'application/json'})

    return newMethod

service = build(discovery, Collection())
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]

```

```

import httplib2
import json
import uritemplate
import urlparse
import urllib

DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'
h = httplib2.Http()
resp, content = h.request(DISCOVERY)
discovery = json.loads(content)

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        setattr(collection, name, build(resource, Collection()))
    for name, method in discovery.get('methods', {}).iteritems():
        setattr(collection, name, createNewMethod(name, method))
    return collection

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    def newMethod(**kwargs):
        body = kwargs.pop('body', None)
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))
        for pname, pconfig in method.get('parameters', {}).iteritems():
            if pconfig['location'] == 'path' and pname in kwargs:
                del kwargs[pname]
        if kwargs:
            url = url + '?' + urllib.urlencode(kwargs)
        return h.request(url, method=method['httpMethod'], body=body,
                        headers={'content-type': 'application/json'})

    return newMethod

service = build(discovery, Collection())
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]

```



```
import httplib2
import json
import uritemplate
import urlparse
import urllib
```

```
DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'
h = httplib2.Http()
resp, content = h.request(DISCOVERY)
discovery = json.loads(content)
```

```
BASE_URI = urlparse.urljoin(DISCOVERY, discovery['basePath'])
```

```
class Collection(object): pass
```

```
def build(discovery, collection):
```

```
    for name, resource in discovery.get('resources', {}).iteritems():
        setattr(collection, name, build(resource, Collection()))
    for name, method in discovery.get('methods', {}).iteritems():
        setattr(collection, name, createNewMethod(name, method))
    return collection
```

```
def createNewMethod(name, method):
```

```
    def newMethod(**kwargs):
        body = kwargs.pop('body', None)
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))
        for pname, pconfig in method.get('parameters', {}).iteritems():
            if pconfig['location'] == 'path' and pname in kwargs:
                del kwargs[pname]
        if kwargs:
            url = url + '?' + urllib.urlencode(kwargs)
        return h.request(url, method=method['httpMethod'], body=body,
                        headers={'content-type': 'application/json'})
```

```
    return newMethod
```

```
service = build(discovery, Collection())
```

```
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]
```

Fetch Discovery Document

```
DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'  
h = httplib2.Http()  
resp, content = h.request(DISCOVERY)  
discovery = json.loads(content)
```

```
BASE_URI = urlparse.urljoin(DISCOVERY, discovery['basePath'])
```

```
class Collection(object): pass
```

```
def build(discovery, collection):
```

```
    for name, resource in discovery.get('resources', {}).iteritems():  
        setattr(collection, name, build(resource, Collection()))
```

```
    for name, method in discovery.get('methods', {}).iteritems():  
        setattr(collection, name, createNewMethod(name, method))
```

```
    return collection
```

```
def createNewMethod(name, method):
```

```
    def newMethod(**kwargs):
```

```
        body = kwargs.pop('body', None)
```

```
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))
```

```
        for pname, pconfig in method.get('parameters', {}).iteritems():
```

```
            if pconfig['location'] == 'path' and pname in kwargs:
```

```
                del kwargs[pname]
```

```
        if kwargs:
```

```
            url = url + '?' + urllib.urlencode(kwargs)
```

```
        return h.request(url, method=method['httpMethod'], body=body,  
                        headers={'content-type': 'application/json'})
```

```
    return newMethod
```

```
service = build(discovery, Collection())
```

```
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]
```

Calculate Base URI

```
DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'  
h = httplib2.Http()  
resp, content = h.request(DISCOVERY)  
discovery = json.loads(content)
```

```
BASE_URI = urlparse.urljoin(DISCOVERY, discovery['basePath'])
```

```
class Collection(object): pass
```

```
def build(discovery, collection):
```

```
    for name, resource in discovery.get('resources', {}).iteritems():  
        setattr(collection, name, build(resource, Collection()))
```

```
    for name, method in discovery.get('methods', {}).iteritems():  
        setattr(collection, name, createNewMethod(name, method))
```

```
    return collection
```

```
def createNewMethod(name, method):
```

```
    def newMethod(**kwargs):
```

```
        body = kwargs.pop('body', None)
```

```
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))
```

```
        for pname, pconfig in method.get('parameters', {}).iteritems():
```

```
            if pconfig['location'] == 'path' and pname in kwargs:
```

```
                del kwargs[pname]
```

```
        if kwargs:
```

```
            url = url + '?' + urllib.urlencode(kwargs)
```

```
        return h.request(url, method=method['httpMethod'], body=body,  
                        headers={'content-type': 'application/json'})
```

```
    return newMethod
```

```
service = build(discovery, Collection())
```

```
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]
```

Collection

```
DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'  
h = httplib2.Http()  
resp, content = h.request(DISCOVERY)  
discovery = json.loads(content)
```

```
BASE_URI = urlparse.urljoin(DISCOVERY, discovery['basePath'])
```

```
class Collection(object): pass
```

```
def build(discovery, collection):
```

```
    for name, resource in discovery.get('resources', {}).iteritems():
```

```
        setattr(collection, name, build(resource, Collection()))
```

```
    for name, method in discovery.get('methods', {}).iteritems():
```

```
        setattr(collection, name, createNewMethod(name, method))
```

```
    return collection
```

```
def createNewMethod(name, method):
```

```
    def newMethod(**kwargs):
```

```
        body = kwargs.pop('body', None)
```

```
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))
```

```
        for pname, pconfig in method.get('parameters', {}).iteritems():
```

```
            if pconfig['location'] == 'path' and pname in kwargs:
```

```
                del kwargs[pname]
```

```
        if kwargs:
```

```
            url = url + '?' + urllib.urlencode(kwargs)
```

```
        return h.request(url, method=method['httpMethod'], body=body,  
                        headers={'content-type': 'application/json'})
```

```
    return newMethod
```

```
service = build(discovery, Collection())
```

```
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]
```

Populate methods and sub-collections

```
DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'  
h = httplib2.Http()  
resp, content = h.request(DISCOVERY)  
discovery = json.loads(content)
```

```
BASE_URI = urlparse.urljoin(DISCOVERY, discovery['basePath'])
```

```
class Collection(object): pass
```

```
def build(discovery, collection):  
    for name, resource in discovery.get('resources', {}).iteritems():  
        setattr(collection, name, build(resource, Collection()))  
    for name, method in discovery.get('methods', {}).iteritems():  
        setattr(collection, name, createNewMethod(name, method))  
    return collection
```

```
def createNewMethod(name, method):  
    def newMethod(**kwargs):  
        body = kwargs.pop('body', None)  
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))  
        for pname, pconfig in method.get('parameters', {}).iteritems():  
            if pconfig['location'] == 'path' and pname in kwargs:  
                del kwargs[pname]  
        if kwargs:  
            url = url + '?' + urllib.urlencode(kwargs)  
        return h.request(url, method=method['httpMethod'], body=body,  
                        headers={'content-type': 'application/json'})  
    return newMethod
```

```
service = build(discovery, Collection())  
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]
```

Make REST Call

```
DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'  
h = httplib2.Http()  
resp, content = h.request(DISCOVERY)  
discovery = json.loads(content)
```

```
BASE_URI = urlparse.urljoin(DISCOVERY, discovery['basePath'])
```

```
class Collection(object): pass
```

```
def build(discovery, collection):  
    for name, resource in discovery.get('resources', {}).iteritems():  
        setattr(collection, name, build(resource, Collection()))  
    for name, method in discovery.get('methods', {}).iteritems():  
        setattr(collection, name, createNewMethod(name, method))  
    return collection
```

```
def createNewMethod(name, method):  
    def newMethod(**kwargs):  
        body = kwargs.pop('body', None)  
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))  
        for pname, pconfig in method.get('parameters', {}).iteritems():  
            if pconfig['location'] == 'path' and pname in kwargs:  
                del kwargs[pname]  
        if kwargs:  
            url = url + '?' + urllib.urlencode(kwargs)  
        return h.request(url, method=method['httpMethod'], body=body,  
                        headers={'content-type': 'application/json'})  
    return newMethod
```

```
service = build(discovery, Collection())  
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]
```


API Surface

```
DISCOVERY = 'https://www.googleapis.com/discovery/v1/apis/urlshortener/v1/rest'
h = httplib2.Http()
resp, content = h.request(DISCOVERY)
discovery = json.loads(content)

BASE_URI = urlparse.urljoin(DISCOVERY, discovery['basePath'])

class Collection(object): pass

def build(discovery, collection):
    for name, resource in discovery.get('resources', {}).iteritems():
        setattr(collection, name, build(resource, Collection()))
    for name, method in discovery.get('methods', {}).iteritems():
        setattr(collection, name, createNewMethod(name, method))
    return collection

def createNewMethod(name, method):
    def newMethod(**kwargs):
        body = kwargs.pop('body', None)
        url = urlparse.urljoin(BASE_URI, uritemplate.expand(method['path'], kwargs))
        for pname, pconfig in method.get('parameters', {}).iteritems():
            if pconfig['location'] == 'path' and pname in kwargs:
                del kwargs[pname]
        if kwargs:
            url = url + '?' + urllib.urlencode(kwargs)
        return h.request(url, method=method['httpMethod'], body=body,
                        headers={'content-type': 'application/json'})

    return newMethod
```

```
service = build(discovery, Collection())
print service.url.insert(body='{"longUrl": "http://www.google.com/io"}')[1]
```

Run

```
$ python miniclient.py
{
  "kind": "urlshortener#url",
  "id": "http://goo.gl/fbsS",
  "longUrl": "http://www.google.com/"
}
```


Static vs Dynamic Usage

Static vs Dynamic Usage

- Strongly Typed Languages
 - Generate the data model classes and API surface at compile time

Static vs Dynamic Usage

- Strongly Typed Languages
 - Generate the data model classes and API surface at compile time
- Dynamically Typed Languages
 - JSON-based data model
 - Build data model objects on the fly at runtime

Simple Python Client Example

- Working Demo
- Stripped down version of the Google APIs Python Client

Google API Client for Python

- Parameter checking
- Parameter names
- Authentication
- Request bodies

Google APIs Client for Python

```
from apiclient.discovery import build

service = build('urlshortener', 'v1')

print service.url().insert(
    body={'longUrl': 'http://www.google.com/'}).execute()
```

<http://code.google.com/p/google-api-python-client>

Libraries

<http://code.google.com/p/...>

Project	Language/Runtime	Status
google-api-python-client	Python	Beta
google-api-java-client	Java	Beta
google-api-php-client	PHP	Alpha
google-api-ruby-client	Ruby	Alpha
google-api-dotnet-client	.NET	Alpha

Review

Review

- Google APIs Discovery Service
 - Provides machine readable description of other Google APIs
 - <https://code.google.com/apis/discovery>

Review

- Google APIs Discovery Service
 - Provides machine readable description of other Google APIs
 - [**https://code.google.com/apis/discovery**](https://code.google.com/apis/discovery)
- Used by today by
 - Google APIs Explorer
 - Google APIs client libraries
 - Google Plugin for Eclipse

Conclusion

- What's next?
 - Explore the format ...
 - Look at the APIs Explorer code
 - Look at the client libraries code

Conclusion

- What's next?
 - Explore the format ...
 - Look at the APIs Explorer code
 - Look at the client libraries code
- Show us what you can build
 - Client libraries in various languages
 - IDE Plugins
 - IntelliJ? Visual Studio?
 - Your own explorers

Questions?

Hashtags: `#io2011 #GoogleAPIs`

Feedback: `http://goo.gl/ifSQM`

Google™

