

Grokking HTTP

Ben Ramsey

Why HTTP?

**Because you are a
web developer.**

HTTP is the Web.

- A client-server architecture
- Atomic operations
- Cacheable responses
- A uniform and constrained interface
- Layered system
- Allows for code on demand

HTTP is RESTful.

Grokking HTTP

- My favorite HTTP tools
- Overview of the protocol
- Content negotiation
- Conditional requests
- Caching
- The future of HTTP

grok • /'grɒk/

To grok is to intimately and completely share the same reality or line of thinking with another physical or conceptual entity. Author Robert A. Heinlein coined the term in his best-selling 1961 book *Stranger in a Strange Land*. In Heinlein's view, *grokking* is the intermingling of intelligence that necessarily affects both the observer and the observed.

–from Wikipedia, <http://en.wikipedia.org/wiki/Grok>

My Favorite Tools

HTTPie

- Ditch cURL. Use HTTPie.
- httpie.org
- Perfect for testing and debugging APIs
- Free; requires Python

```
1. zsh
ramsey on earendil in ~
$ http -v PUT httpbin.org/put hello=world
PUT /put HTTP/1.1
Host: httpbin.org
Content-Type: application/json; charset=utf-8
Accept-Encoding: identity, deflate, compress, gzip
Accept: application/json
User-Agent: HTTPie/0.2.0

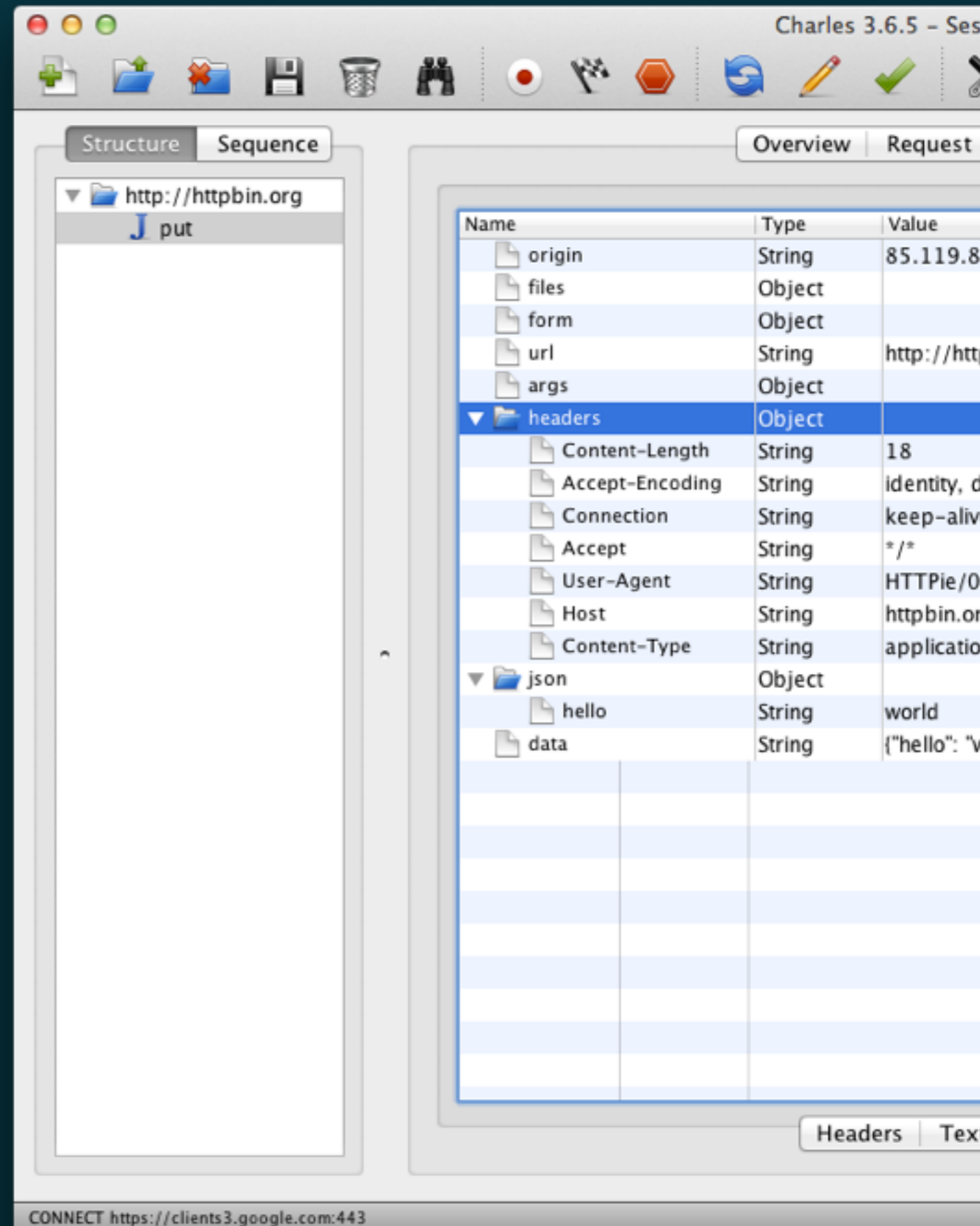
{
  "hello": "world"
}

HTTP/1.1 200 OK
Content-Type: application/json
Date: Mon, 30 Jul 2012 00:38:07 GMT
Server: gunicorn/0.13.4
Content-Length: 472
Connection: keep-alive

{
  "args": {},
  "data": "{\"hello\": \"world\"}",
  "files": {},
  "form": {},
  "headers": {
    "Accept": "application/json",
    "Accept-Encoding": "identity, deflate, compress, gzip",
    "Connection": "keep-alive",
    "Content-Length": "18",
    "Content-Type": "application/json; charset=utf-8",
    "Host": "httpbin.org",
    "User-Agent": "HTTPie/0.2.0"
  },
  "json": {
    "hello": "world"
  },
  "origin": "85.119.83.153",
  "url": "http://httpbin.org/put"
}
```

Charles

- I cannot recommend this enough!
- charlesproxy.com
- Perfect for debugging Ajax and Flash remoting (AMF) requests
- Well worth the \$50 license fee



Setting Headers

```
<?php
header('HTTP/1.1 201 Created');
header('Location: http://example.com/books/decd0562');
header('ETag: "decd0562-1"');
header('Last-Modified: Sun, 29 Jul 2012 23:26:49 GMT');
header('Content-Type: application/hal+json');

echo json_encode(array(
    '_links' => array(
        'self' => array(
            'href' => 'http://example.com/books/decd0562',
        ),
    ),
    'author' => 'Stoyan Stefanov',
    'id' => 'decd0562',
    'isbn10' => '1449320198',
    'isbn13' => '9781449320195',
    'publisher' => 'O\Reilly Media',
    'title' => 'JavaScript for PHP Developers',
    'year' => 2012,
));
```

Other Tools

- PHP cURL functions
- fopen wrappers for http/https
 - `file_get_contents()`
 - `file_put_contents()`
 - `stream_context_create()`
- PHP `pecl_http` extension

Protocol Overview

RFC 2616

Methods

- GET
- POST
- PUT
- DELETE
- HEAD
- OPTIONS
- TRACE
- CONNECT

Safe Methods

- GET & HEAD should not take action other than retrieval
- These are considered safe
- This allows user agents to represent POST, PUT, & DELETE in a special way

Idempotence

- Side effects of $N > 0$ identical requests is the same as for a single request
- GET, HEAD, PUT, and DELETE share this property
- OPTIONS and TRACE are inherently idempotent

GET

GET /books/9790482c HTTP/1.1

Host: example.com

Accept-Encoding: identity, deflate, compress, gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

GET /books/9790482c HTTP/1.1

Host: example.com

Accept-Encoding: identity, deflate, compress, gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

GET /books/9790482c HTTP/1.1

Host: example.com

Accept-Encoding: identity, deflate, compress, gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

HTTP/1.1 200 OK

Date: Sun, 29 Jul 2012 22:46:43 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

ETag: "9790482c-1"

Last-Modified: Sun, 15 Jul 2012 16:34:23 GMT

Content-Length: 254

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/9790482c"
    }
  },
  "author": "Luke Welling, Laura Thomson",
  "id": "9790482c",
  "isbn10": "0672329166",
  "isbn13": "9780672329166",
  "publisher": "Pearson Education",
  "title": "PHP and MySQL Web Development",
  "year": 2008
}
```

HTTP/1.1 200 OK

Date: Sun, 29 Jul 2012 22:46:43 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

ETag: "9790482c-1"

Last-Modified: Sun, 15 Jul 2012 16:34:23 GMT

Content-Length: 254

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/9790482c"
    }
  },
  "author": "Luke Welling, Laura Thomson",
  "id": "9790482c",
  "isbn10": "0672329166",
  "isbn13": "9780672329166",
  "publisher": "Pearson Education",
  "title": "PHP and MySQL Web Development",
  "year": 2008
}
```


HTTP/1.1 200 OK

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Last-Modified: Sun, 15 Jul 2012 16:34:23 GMT

Content-Length: 254

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/9790482c"
    }
  },
  "author": "Luke Welling, Laura Thomson",
  "id": "9790482c",
  "isbn10": "0672329166",
  "isbn13": "9780672329166",
  "publisher": "Pearson Education",
  "title": "PHP and MySQL Web Development",
  "year": 2008
}
```

HTTP/1.1 200 OK

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Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

ETag: "9790482c-1"

Last-Modified: Sun, 15 Jul 2012 16:34:23 GMT

Content-Length: 254

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/9790482c"
    }
  },
  "author": "Luke Welling, Laura Thomson",
  "id": "9790482c",
  "isbn10": "0672329166",
  "isbn13": "9780672329166",
  "publisher": "Pearson Education",
  "title": "PHP and MySQL Web Development",
  "year": 2008
}
```

POST

```
POST /books HTTP/1.1
Host: example.com
Content-Type: application/hal+json
Accept-Encoding: identity, deflate, compress, gzip
Accept: application/hal+json
User-Agent: HTTPie/0.2.0
```

```
{
  "author": "Stoyan Stefanov",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

HTTP/1.1 201 Created

Date: Sun, 29 Jul 2012 23:26:49 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Location: <http://example.com/books/decd0562>

ETag: "decd0562-1"

Last-Modified: Sun, 29 Jul 2012 23:26:49 GMT

Content-Length: 239

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

HTTP/1.1 201 Created

Date: Sun, 29 Jul 2012 23:26:49 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Location: <http://example.com/books/decd0562>

ETag: "decd0562-1"

Last-Modified: Sun, 29 Jul 2012 23:26:49 GMT

Content-Length: 239

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

HTTP/1.1 201 Created

Date: Sun, 29 Jul 2012 23:26:49 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Location: <http://example.com/books/decd0562>

ETag: "decd0562-1"

Last-Modified: Sun, 29 Jul 2012 23:26:49 GMT

Content-Length: 239

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

HTTP/1.1 201 Created

Date: Sun, 29 Jul 2012 23:26:49 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Location: <http://example.com/books/decd0562>

ETag: "decd0562-1"

Last-Modified: Sun, 29 Jul 2012 23:26:49 GMT

Content-Length: 239

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```


PUT

PUT /books/decd0562 HTTP/1.1

Accept-Encoding: identity, deflate, compress, gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

Host: example.com

If-Match: "decd0562-1"

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "pubDate": "September 22, 2012",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

PUT /books/decd0562 HTTP/1.1

Accept-Encoding: identity, deflate, compress, gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

Host: example.com

If-Match: "decd0562-1"

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "pubDate": "September 22, 2012",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

PUT /books/decd0562 HTTP/1.1

Accept-Encoding: identity, deflate, compress, gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

Host: example.com

If-Match: "decd0562-1"

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "pubDate": "September 22, 2012",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

HTTP/1.1 200 OK

Date: Sun, 29 Jul 2012 23:47:59 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

ETag: "decd0562-2"

Last-Modified: Sun, 29 Jul 2012 23:47:59 GMT

Content-Length: 270

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "pubDate": "September 22, 2012",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

HTTP/1.1 200 OK

Date: Sun, 29 Jul 2012 23:47:59 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

ETag: "decd0562-2"

Last-Modified: Sun, 29 Jul 2012 23:47:59 GMT

Content-Length: 270

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "pubDate": "September 22, 2012",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

HTTP/1.1 200 OK

Date: Sun, 29 Jul 2012 23:47:59 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

ETag: "decd0562-2"

Last-Modified: Sun, 29 Jul 2012 23:47:59 GMT

Content-Length: 270

Content-Type: application/hal+json

```
{
  "_links": {
    "self": {
      "href": "http://example.com/books/decd0562"
    }
  },
  "author": "Stoyan Stefanov",
  "id": "decd0562",
  "isbn10": "1449320198",
  "isbn13": "9781449320195",
  "pubDate": "September 22, 2012",
  "publisher": "O'Reilly Media",
  "title": "JavaScript for PHP Developers",
  "year": 2012
}
```

DELETE


```
DELETE /books/decd0562 HTTP/1.1
Accept-Encoding: identity, deflate, compress, gzip
Accept: application/hal+json
User-Agent: HTTPie/0.2.0
Host: example.com
If-Match: "decd0562-2"
```

HTTP/1.1 204 **No Content**

Date: Mon, 30 Jul 2012 00:01:44 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Content-Length: 0

Content-Type: application/hal+json

HTTP/1.1 204 No Content

Date: Mon, 30 Jul 2012 00:01:44 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Content-Length: 0

Content-Type: application/hal+json

Status Codes

- Informational (1xx)
- Successful (2xx)
- Redirection (3xx)
- Client error (4xx)
- Server error (5xx)

Content Negotiation

- Also called “conneg”
- “the process of selecting the best representation for a given response when there are multiple representations available”
- Two kinds:
 - server-driven
 - agent-driven

Server-driven Negotiation


```
GET /books/9790482c HTTP/1.1
Accept-Charset: utf-8
Host: example.com
Accept-Language: en-us, en-gb;q=0.8, en;q=0.7
Accept-Encoding: gzip
Accept: application/hal+json
User-Agent: HTTPie/0.2.0
```

GET /books/9790482c HTTP/1.1

Accept-Charset: utf-8

Host: example.com

Accept-Language: en-us, en-gb;q=0.8, en;q=0.7

Accept-Encoding: gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

GET /books/9790482c HTTP/1.1

Accept-Charset: utf-8

Host: example.com

Accept-Language: en-us, en-gb;q=0.8, en;q=0.7

Accept-Encoding: gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

```
GET /books/9790482c HTTP/1.1
Accept-Charset: utf-8
Host: example.com
Accept-Language: en-us, en-gb;q=0.8, en;q=0.7
Accept-Encoding: gzip
Accept: application/hal+json
User-Agent: HTTPie/0.2.0
```

```
GET /books/9790482c HTTP/1.1
Accept-Charset: utf-8
Host: example.com
Accept-Language: en-us, en-gb;q=0.8, en;q=0.7
Accept-Encoding: gzip
Accept: application/hal+json
User-Agent: HTTPie/0.2.0
```

HTTP/1.1 200 OK

Date: Mon, 30 Jul 2012 02:42:26 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Content-Language: en-us

ETag: "9790482c-1"

Vary: Accept,Accept-Charset,Accept-Language,Accept-Encoding

Content-Encoding: gzip

Content-Length: 213

Content-Type: application/hal+json; charset=utf-8

{

...

}

HTTP/1.1 200 OK

Date: Mon, 30 Jul 2012 02:42:26 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Content-Language: en-us

ETag: "9790482c-1"

Vary: Accept,Accept-Charset,Accept-Language,Accept-Encoding

Content-Encoding: gzip

Content-Length: 213

Content-Type: application/hal+json; charset=utf-8

{

...

}

HTTP/1.1 200 OK

Date: Mon, 30 Jul 2012 02:42:26 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Content-Language: en-us

ETag: "9790482c-1"

Vary: Accept,Accept-Charset,Accept-Language,Accept-Encoding

Content-Encoding: gzip

Content-Length: 213

Content-Type: application/hal+json; charset=utf-8

{

...

}

HTTP/1.1 200 OK

Date: Mon, 30 Jul 2012 02:42:26 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Content-Language: en-us

ETag: "9790482c-1"

Vary: Accept,Accept-Charset,Accept-Language,Accept-Encoding

Content-Encoding: gzip

Content-Length: 213

Content-Type: application/hal+json; charset=utf-8

{

...

}

HTTP/1.1 200 OK

Date: Mon, 30 Jul 2012 02:42:26 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Content-Language: en-us

ETag: "9790482c-1"

Vary: Accept,Accept-Charset,Accept-Language,Accept-Encoding

Content-Encoding: gzip

Content-Length: 213

Content-Type: application/hal+json; charset=utf-8

{

...

}

Agent-driven Negotiation

GET /books/9790482c HTTP/1.1

Host: example.com

User-Agent: HTTPie/0.2.0

HTTP/1.1 300 Multiple Choices

Date: Mon, 30 Jul 2012 02:57:42 GMT

Server: Apache/2.2.22 (Ubuntu)

X-Powered-By: PHP/5.3.10-1ubuntu3.2

Content-Length: 444

Content-Type: application/hal+json

```
{
  "_links": {
    "alternate": [
      {
        "href": "http://example.com/books/9790482c.en-us.html",
        "hreflang": "en-us",
        "type": "text/html; charset=utf-8"
      },
      {
        "href": "http://example.com/books/9790482c.en-us.json",
        "hreflang": "en-us",
        "type": "application/hal+json; charset=utf-8"
      },
      {
        "href": "http://example.com/books/9790482c.en-us.xml",
        "hreflang": "en-us",
        "type": "application/hal+xml; charset=utf-8"
      }
    ],
    "self": {
      "href": "http://example.com/books/9790482c"
    }
  }
}
```

Conditional Requests

Request Headers

- If-Modified-Since
- If-Unmodified-Since
- If-Match
- If-None-Match
- If-Range

GET /books/9790482c HTTP/1.1

Host: example.com

Accept-Encoding: identity, deflate, compress, gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

If-Modified-Since: Sun, 15 Jul 2012 16:34:23 GMT

HTTP/1.1 304 **Not Modified**

Date: Mon, 30 Jul 2012 03:39:51 GMT

Server: Apache/2.2.22 (Ubuntu)

Vary: Accept-Encoding

GET /books/9790482c HTTP/1.1

Host: example.com

Accept-Encoding: identity, deflate, compress, gzip

Accept: application/hal+json

User-Agent: HTTPie/0.2.0

If-Modified-Since: Sun, 15 Jul 2012 16:34:23 GMT

HTTP/1.1 304 Not Modified

Date: Mon, 30 Jul 2012 03:39:51 GMT

Server: Apache/2.2.22 (Ubuntu)

Vary: Accept-Encoding

Caching

Response Headers

- Expires
- Cache-Control
 - max-age
 - s-maxage
 - public
 - private
- no-cache
- no-store
- must-revalidate
- proxy-revalidate

Cache-Control: max-age=3600, must-revalidate

The Future of HTTP

- HTTP Bis IETF Working Group
<http://tools.ietf.org/wg/httpbis/>
- RFCs and specifications that extend HTTP:
 - [WebDAV](#) and related extensions
 - [RFC 5789](#) (PATCH Method)
 - [RFC 6266](#) (Use of Content-Disposition)
 - [RFC 6585](#) (Additional Status Codes)
 - [Method Registrations](#)
 - [Authentication Scheme Registrations](#)
 - [Permanent Message Header Fields](#)

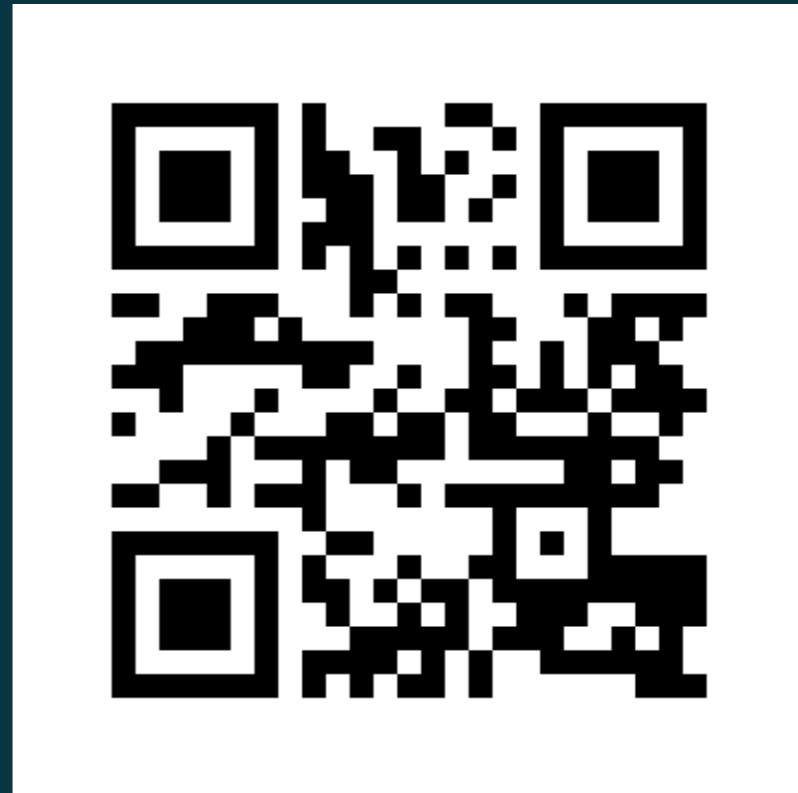
There's too much in
HTTP to fully grok it
in one presentation.

More Resources

- [RFC 2616](#) (HTTP)
- Mark Nottingham: mnot.net
- Mark's [Caching Tutorial](#)
- [RFC 2295](#) (Transparent Content Negotiation in HTTP)
- [RFC 2296](#) (HTTP Remote Variant Selection Algorithm)

Thank you.

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Grokking HTTP

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