Chapter 14. HTTP Web Services

> ❝ *A ruffled mind makes a restless pillow.* ❞
>
> — *Charlotte Brontë*

Diving In

Philosophically, I can describe HTTP web services in 12 words: exchanging data with remote servers using nothing but the operations of HTTP. If you want to get data from the server, use HTTP GET. If you want to send new data to the server, use HTTP POST. Some more advanced HTTP web service APIs also allow creating, modifying, and deleting data, using HTTP PUT and HTTP DELETE. That's it. No registries, no envelopes, no wrappers, no tunneling. The "verbs" built into the HTTP protocol (GET, POST, PUT, and DELETE) map directly to application-level operations for retrieving, creating, modifying, and deleting data.

The main advantage of this approach is simplicity, and its simplicity has proven popular. Data — usually XML or JSON — can be built and stored statically, or generated dynamically by a server-side script, and all major programming languages (including Python, of course!) include an HTTP library for downloading it. Debugging is also easier; because each resource in an HTTP web service has a unique address (in the form of a URL), you can load it in your web browser and immediately see the raw data.

Examples of HTTP web services:

- Google Data APIs allow you to interact with a wide variety of Google services, including Blogger and YouTube.
- Flickr Services allow you to upload and download photos from Flickr.
- Twitter API allows you to publish status updates on Twitter.
- …and many more

Python 3 comes with two different libraries for interacting with HTTP web services:

- `http.client` is a low-level library that implements RFC 2616, the HTTP protocol.
- `urllib.request` is an abstraction layer built on top of `http.client`. It provides a standard API for accessing

both HTTP and FTP servers, automatically follows HTTP redirects, and handles some common forms of HTTP authentication.

So which one should you use? Neither of them. Instead, you should use `httplib2`, an open source third-party library that implements HTTP more fully than `http.client` but provides a better abstraction than `urllib.request`.

To understand why `httplib2` is the right choice, you first need to understand HTTP.

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14.2. Features of HTTP

There are five important features which all HTTP clients should support.

14.2.1. Caching

The most important thing to understand about any type of web service is that network access is incredibly expensive. I don't mean "dollars and cents" expensive (although bandwidth ain't free). I mean that it takes an extraordinary long time to open a connection, send a request, and retrieve a response from a remote server. Even on the fastest broadband connection, *latency* (the time it takes to send a request and start retrieving data in a response) can still be higher than you anticipated. A router misbehaves, a packet is dropped, an intermediate proxy is under attack — there's never a dull moment on the public internet, and there may be nothing you can do about it.

HTTP is designed with caching in mind. There is an entire class of devices (called "caching proxies") whose only job is to sit between you and the rest of the world and minimize network access. Your company or ISP almost certainly maintains caching proxies, even if you're unaware of them. They work because caching is built into the HTTP protocol.

Cache-

Here's a concrete example of how caching works. You visit `diveintomark.org` in your browser. That page includes a background image, `wearehugh.com/m.jpg`. When your browser downloads that image, the server includes the following HTTP headers:

> Control: max-age *means "don't bug me until next week."*

```
HTTP/1.1 200 OK
Date: Sun, 31 May 2009 17:14:04 GMT
Server: Apache
Last-Modified: Fri, 22 Aug 2008 04:28:16 GMT
ETag: "3075-ddc8d800"
Accept-Ranges: bytes
Content-Length: 12405
Cache-Control: max-age=31536000, public
Expires: Mon, 31 May 2010 17:14:04 GMT
Connection: close
Content-Type: image/jpeg
```

The `Cache-Control` and `Expires` headers tell your browser (and any caching proxies between you and the server) that this image can be cached for up to a year. *A year!* And if, in the next year, you visit another page which also includes a link to this image, your browser will load the image from its cache *without generating any network activity whatsoever*.

But wait, it gets better. Let's say your browser purges the image from your local cache for some reason. Maybe it ran out of disk space; maybe you manually cleared the cache. Whatever. But the HTTP headers said that this data could be cached by public caching proxies. (Technically, the important thing is what the headers *don't* say; the `Cache-Control` header doesn't have the `private` keyword, so this data is cacheable by default.) Caching proxies are designed to have tons of storage space, probably far more than your local browser has allocated.

If your company or ISP maintain a caching proxy, the proxy may still have the image cached. When you visit `diveintomark.org` again, your browser will look in its local cache for the image, but it won't find it, so it will make a network request to try to download it from the remote server. But if the caching proxy still has a copy of the image, it will intercept that request and serve the image from *its* cache. That means that your request will never reach the remote server; in fact, it will never leave your company's network. That makes for a faster download (fewer network hops) and saves your company money (less data being downloaded from the outside world).

HTTP caching only works when everybody does their part. On one side, servers need to send the correct headers in their response. On the other side, clients need to understand and respect those headers before they request the same data twice. The proxies in the middle are not a panacea; they can only be as smart as the servers and clients allow them to be.

Python's HTTP libraries do not support caching, but `httplib2` does.

14.2.2. Last-Modified Checking

Some data never changes, while other data changes all the time. In between, there is a vast field of data that *might* have changed, but hasn't. CNN.com's feed is updated every few minutes, but my weblog's feed may not change for days or weeks at a time. In the latter case, I don't want to tell clients to cache my feed for weeks at a time, because then when I do actually post something, people may not read it for weeks (because they're respecting my cache headers which said "don't bother checking this feed for weeks"). On the other hand, I don't want clients downloading my entire feed once an hour if it hasn't changed!

HTTP has a solution to this, too. When you request data for the first time, the server can send back a `Last-Modified` header. This is exactly what it sounds like: the date that the data was changed. That background image referenced from `diveintomark.org` included a `Last-Modified` header.

```
HTTP/1.1 200 OK
Date: Sun, 31 May 2009 17:14:04 GMT
Server: Apache
Last-Modified: Fri, 22 Aug 2008 04:28:16 GMT
ETag: "3075-ddc8d800"
Accept-Ranges: bytes
Content-Length: 12405
Cache-Control: max-age=31536000, public
Expires: Mon, 31 May 2010 17:14:04 GMT
```

> `304: Not Modified` *means "same shit, different day."*

```
Connection: close
Content-Type: image/jpeg
```

When you request the same data a second (or third or fourth) time, you can send an `If-Modified-Since` header with your request, with the date you got back from the server last time. If the data has changed since then, then the server gives you the new data with a `200` status code. But if the data *hasn't* changed since then, the server sends back a special HTTP `304` status code, which means "this data hasn't changed since the last time you asked for it." You can test this on the command line, using curl:

```
you@localhost:~$ curl -I -H "If-Modified-Since: Fri, 22 Aug 2008 04:28:16 GMT" http://wearehugh.com/m.jpg
HTTP/1.1 304 Not Modified
Date: Sun, 31 May 2009 18:04:39 GMT
Server: Apache
Connection: close
ETag: "3075-ddc8d800"
Expires: Mon, 31 May 2010 18:04:39 GMT
Cache-Control: max-age=31536000, public
```

Why is this an improvement? Because when the server sends a `304`, *it doesn't re-send the data*. All you get is the status code. Even after your cached copy has expired, last-modified checking ensures that you won't download the same data twice if it hasn't changed. (As an extra bonus, this `304` response also includes caching headers. Proxies will keep a copy of data even after it officially "expires," in the hopes that the data hasn't *really* changed and the next request responds with a `304` status code and updated cache information.)

Python's HTTP libraries do not support last-modified date checking, but `httplib2` does.

14.2.3. ETag Checking

ETags are an alternate way to accomplish the same thing as the last-modified checking. With Etags, the server sends a hash code in an `ETag` header along with the data you requested. (Exactly how this hash is determined is entirely up to the server. The only requirement is that it changes when the data changes.) That background image referenced from `diveintomark.org` had an `ETag` header.

```
HTTP/1.1 200 OK
Date: Sun, 31 May 2009 17:14:04 GMT
```

```
Server: Apache
Last-Modified: Fri, 22 Aug 2008 04:28:16 GMT
ETag: "3075-ddc8d800"
Accept-Ranges: bytes
Content-Length: 12405
Cache-Control: max-age=31536000, public
Expires: Mon, 31 May 2010 17:14:04 GMT
Connection: close
Content-Type: image/jpeg
```

The second time you request the same data, you include the ETag hash in an `If-None-Match` header of your request. If the data hasn't changed, the server will send you back a `304` status code. As with the last-modified date checking, the server sends back *only* the `304` status code; it doesn't send you the same data a second time. By including the ETag hash in your second request, you're telling the server that there's no need to re-send the same data if it still matches this hash, since you still have the data from the last time.

ETag *means "there's nothing new under the sun."*

Again with the `curl`:

```
you@localhost:~$ curl -I -H "If-None-Match: \"3075-ddc8d800\"" http://wearehugh.com/m.jpg  ①
HTTP/1.1 304 Not Modified
Date: Sun, 31 May 2009 18:04:39 GMT
Server: Apache
Connection: close
ETag: "3075-ddc8d800"
Expires: Mon, 31 May 2010 18:04:39 GMT
Cache-Control: max-age=31536000, public
```

① ETags are commonly enclosed in quotation marks, but *the quotation marks are part of the value*. That means you need to send the quotation marks back to the server in the `If-None-Match` header.

Python's HTTP libraries do not support ETags, but `httplib2` does.

14.2.4. COMPRESSION

When you talk about HTTP web services, you're almost always talking about moving text-based data back and forth over the wire. Maybe it's XML, maybe it's JSON, maybe it's just plain text. Regardless of the format, text compresses well. The example feed in the XML chapter is 3070 bytes uncompressed, but would be 941 bytes after gzip compression. That's just 30% of the original size!

HTTP supports several compression algorithms. The two most common types are gzip and deflate. When you request a resource over HTTP, you can ask the server to send it in compressed format. You include an `Accept-encoding` header in your request that lists which compression algorithms you support. If the server supports any of the same algorithms, it will send you back compressed data (with a `Content-encoding` header that tells you which algorithm it used). Then it's up to you to decompress the data.

> ☞ Important tip for server-side developers: make sure that the compressed version of a resource has a different Etag than the uncompressed version. Otherwise, caching proxies will get confused and may serve the compressed version to clients that can't handle it. Read the discussion of Apache bug 39727 for more details on this subtle issue.

Python's HTTP libraries do not support compression, but `httplib2` does.

14.2.5. REDIRECTS

Cool URIs don't change, but many URIs are seriously uncool. Web sites get reorganized, pages move to new addresses. Even web services can reorganize. A syndicated feed at `http://example.com/index.xml` might be moved to `http://example.com/xml/atom.xml`. Or an entire domain might move, as an organization expands and reorganizes; `http://www.example.com/index.xml` becomes `http://server-farm-1.example.com/index.xml`.

Every time you request any kind of resource from an HTTP server, the server includes a status code in its response. Status code `200` means "everything's normal, here's the page you asked for". Status code `404` means "page not found". (You've probably seen 404 errors while browsing the web.) Status codes in the 300's indicate some form of redirection.

HTTP has several different ways of signifying that a resource has moved. The two most common techiques are status codes `302` and `301`. Status code `302` is a *temporary redirect*; it means "oops, that got moved over here temporarily" (and then gives the temporary address in a `Location` header). Status code `301` is a *permanent redirect*; it means "oops, that got moved permanently" (and then gives the new address in a `Location` header). If you get a `302` status code and a new address, the HTTP specification says you should use the new address to get what you asked for, but the next time you want to access the same resource, you should retry the old address. But if you get a `301` status code and a new address, you're supposed to use the new address from then on.

> `Location` *means "look over there!"*

The `urllib.request` module automatically "follow" redirects when it receives the appropriate status code from the HTTP server, but it doesn't tell you that it did so. You'll end up getting data you asked for, but you'll never know that the underlying library "helpfully" followed a redirect for you. So you'll continue pounding away at the old address, and each time you'll get redirected to the new address, and each time the `urllib.request` module will "helpfully" follow the redirect. In other words, it treats permanent redirects the same as temporary redirects. That means two round trips instead of one, which is bad for the server and bad for you.

`httplib2` handles permanent redirects for you. Not only will it tell you that a permanent redirect occurred, it will keep track of them locally and automatically rewrite redirected URLs before requesting them.

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14.3. How Not To Fetch Data Over HTTP

Let's say you want to download a resource over HTTP, such as an Atom feed. Being a feed, you're not just going to download it once; you're going to download it over and over again. (Most feed readers will check for changes once an hour.) Let's do it the quick-and-dirty way first, and then see how you can do better.

```
>>> import urllib.request
>>> a_url = 'http://diveintopython3.org/examples/feed.xml'
>>> data = urllib.request.urlopen(a_url).read()  ①
>>> type(data)                                   ②
<class 'bytes'>
>>> print(data)
<?xml version='1.0' encoding='utf-8'?>
<feed xmlns='http://www.w3.org/2005/Atom' xml:lang='en'>
  <title>dive into mark</title>
  <subtitle>currently between addictions</subtitle>
  <id>tag:diveintomark.org,2001-07-29:/</id>
  <updated>2009-03-27T21:56:07Z</updated>
  <link rel='alternate' type='text/html' href='http://diveintomark.org/'/>
  …
```

① Downloading anything over HTTP is incredibly easy in Python; in fact, it's a one-liner. The `urllib.request` module has a handy `urlopen()` function that takes the address of the page you want, and returns a file-like object that you can just `read()` from to get the full contents of the page. It just can't get any easier.

② The `urlopen().read()` method always returns a `bytes` object, not a string. Remember, bytes are bytes; characters are an abstraction. HTTP servers don't deal in abstractions. If you request a resource, you get bytes. If you want it as a string, you'll need to determine the character encoding and explicitly convert it to a string.

So what's wrong with this? For a quick one-off during testing or development, there's nothing wrong with it. I do it all the time. I wanted the contents of the feed, and I got the contents of the feed. The same technique works for any web page. But once you start thinking in terms of a web service that you want to access on a regular basis (*e.g.* requesting this feed once an hour), then you're being inefficient, and you're being rude.

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14.4. What's On The Wire?

To see why this is inefficient and rude, let's turn on the debugging features of Python's HTTP library and see what's being sent "on the wire" (*i.e.* over the network).

```
>>> from http.client import HTTPConnection
>>> HTTPConnection.debuglevel = 1                                      ①
>>> from urllib.request import urlopen
>>> response = urlopen('http://diveintopython3.org/examples/feed.xml')  ②
send: b'GET /examples/feed.xml HTTP/1.1                                ③
Host: diveintopython3.org                                              ④
Accept-Encoding: identity                                              ⑤
User-Agent: Python-urllib/3.1'                                         ⑥
Connection: close
reply: 'HTTP/1.1 200 OK'
…further debugging information omitted…
```

① As I mentioned at the beginning of the chapter, `urllib.request` relies on another standard Python library, `http.client`. Normally you don't need to touch `http.client` directly. (The `urllib.request` module imports it automatically.) But we import it here so we can toggle the debugging flag on the `HTTPConnection` class that `urllib.request` uses to connect to the HTTP server.

② Now that the debugging flag is set, information on the HTTP request and response is printed out in real time. As you can see, when you request the Atom feed, the `urllib.request` module sends five lines to the server.

③ The first line specifies the HTTP verb you're using, and the path of the resource (minus the domain name).

④ The second line specifies the domain name from which we're requesting this feed.

⑤ The third line specifies the compression algorithms that the client supports. As I mentioned earlier, `urllib.request` does not support compression by default.

⑥ The fourth line specifies the name of the library that is making the request. By default, this is `Python-urllib` plus a version number. Both `urllib.request` and `httplib2` support changing the user agent, simply by adding a `User-Agent` header to the request (which will override the default value).

Now let's look at what the server sent back in its response.

```
# continued from previous example
>>> print(response.headers.as_string())        ①
```

We're

```
Date: Sun, 31 May 2009 19:23:06 GMT                ②
Server: Apache
Last-Modified: Sun, 31 May 2009 06:39:55 GMT       ③
ETag: "bfe-93d9c4c0"                               ④
Accept-Ranges: bytes
Content-Length: 3070                               ⑤
Cache-Control: max-age=86400                       ⑥
Expires: Mon, 01 Jun 2009 19:23:06 GMT
Vary: Accept-Encoding
Connection: close
Content-Type: application/xml
>>> data = response.read()                         ⑦
>>> len(data)
3070
```

downloading 3070 bytes when we could have just downloaded 941.

① The `response` returned from the `urllib.request.urlopen()` function contains all the HTTP headers the server sent back. It also contains methods to download the actual data; we'll get to that in a minute.

② The server tells you when it handled your request.

③ This response includes a `Last-Modified` header.

④ This response includes an `ETag` header.

⑤ The data is 3070 bytes long. Notice what *isn't* here: a `Content-encoding` header. Your request stated that you only accept uncompressed data (`Accept-encoding: identity`), and sure enough, this response contains uncompressed data.

⑥ This response includes caching headers that state that this feed can be cached for up to 24 hours (86400 seconds).

⑦ And finally, download the actual data by calling `response.read()`. As you can tell from the `len()` function, this fetched a total of 3070 bytes.

As you can see, this code is already inefficient: it asked for (and received) uncompressed data. I know for a fact that this server supports gzip compression, but HTTP compression is opt-in. We didn't ask for it, so we didn't get it. That means we're fetching 3070 bytes when we could have fetched 941. Bad dog, no biscuit.

But wait, it gets worse! To see just how inefficient this code is, let's request the same feed a second time.

```
# continued from the previous example
>>> response2 = urlopen('http://diveintopython3.org/examples/feed.xml')
send: b'GET /examples/feed.xml HTTP/1.1
Host: diveintopython3.org
Accept-Encoding: identity
User-Agent: Python-urllib/3.1'
Connection: close
reply: 'HTTP/1.1 200 OK'
…further debugging information omitted…
```

Notice anything peculiar about this request? It hasn't changed! It's exactly the same as the first request. No sign of `If-Modified-Since` headers. No sign of `If-None-Match` headers. No respect for the caching headers. Still no compression.

And what happens when you do the same thing twice? You get the same response. Twice.

```
# continued from the previous example
>>> print(response2.headers.as_string())      ①
Date: Mon, 01 Jun 2009 03:58:00 GMT
Server: Apache
Last-Modified: Sun, 31 May 2009 22:51:11 GMT
ETag: "bfe-255ef5c0"
Accept-Ranges: bytes
Content-Length: 3070
Cache-Control: max-age=86400
Expires: Tue, 02 Jun 2009 03:58:00 GMT
Vary: Accept-Encoding
Connection: close
Content-Type: application/xml
>>> data2 = response2.read()
>>> len(data2)                                ②
3070
>>> data2 == data                             ③
True
```

① The server is still sending the same array of "smart" headers: `Cache-Control` and `Expires` to allow caching, `Last-Modified` and `ETag` to enable "not-modified" tracking. Even the `Vary: Accept-Encoding` header hints that the server would support compression, if only you would ask for it. But you didn't.

② Once again, this request fetches the whole 3070 bytes…

③ …the exact same 3070 bytes you got last time.

HTTP is designed to work better than this. `urllib` speaks HTTP like I speak Spanish — enough to get by in a jam, but not enough to hold a conversation. HTTP is a conversation. It's time to upgrade to a library that speaks HTTP fluently.

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14.5. Introducing httplib2

Before you can use `httplib2`, you'll need to install it. Visit code.google.com/p/httplib2/ and download the latest version. `httplib2` is available for Python 2.x and Python 3.x; make sure you get the Python 3 version, named something like `httplib2-python3-0.5.0.zip`.

Unzip the archive, open a terminal window, and go to the newly created `httplib2` directory. On Windows, open the `Start` menu, select `Run...`, type `cmd.exe` and press `ENTER`.

```
c:\Users\pilgrim\Downloads> dir
 Volume in drive C has no label.
 Volume Serial Number is DED5-B4F8

 Directory of c:\Users\pilgrim\Downloads

07/28/2009  12:36 PM    <DIR>          .
07/28/2009  12:36 PM    <DIR>          ..
07/28/2009  12:36 PM    <DIR>          httplib2-python3-0.5.0
07/28/2009  12:33 PM            18,997 httplib2-python3-0.5.0.zip
               1 File(s)         18,997 bytes
               3 Dir(s)  61,496,684,544 bytes free
```

```
c:\Users\pilgrim\Downloads> cd httplib2-python3-0.5.0
c:\Users\pilgrim\Downloads\httplib2-python3-0.5.0> c:\python31\python.exe setup.py install
running install
running build
running build_py
running install_lib
creating c:\python31\Lib\site-packages\httplib2
copying build\lib\httplib2\iri2uri.py -> c:\python31\Lib\site-packages\httplib2
copying build\lib\httplib2\__init__.py -> c:\python31\Lib\site-packages\httplib2
byte-compiling c:\python31\Lib\site-packages\httplib2\iri2uri.py to iri2uri.pyc
byte-compiling c:\python31\Lib\site-packages\httplib2\__init__.py to __init__.pyc
running install_egg_info
Writing c:\python31\Lib\site-packages\httplib2-python3_0.5.0-py3.1.egg-info
```

On Mac OS X, run the `Terminal.app` application in your `/Applications/Utilities/` folder. On Linux, run the `Terminal` application, which is usually in your `Applications` menu under `Accessories` or `System`.

```
you@localhost:~/Desktop$ unzip httplib2-python3-0.5.0.zip
Archive:  httplib2-python3-0.5.0.zip
  inflating: httplib2-python3-0.5.0/README
  inflating: httplib2-python3-0.5.0/setup.py
  inflating: httplib2-python3-0.5.0/PKG-INFO
  inflating: httplib2-python3-0.5.0/httplib2/__init__.py
  inflating: httplib2-python3-0.5.0/httplib2/iri2uri.py
you@localhost:~/Desktop$ cd httplib2-python3-0.5.0/
you@localhost:~/Desktop/httplib2-python3-0.5.0$ sudo python3 setup.py install
running install
running build
running build_py
creating build
creating build/lib.linux-x86_64-3.1
creating build/lib.linux-x86_64-3.1/httplib2
copying httplib2/iri2uri.py -> build/lib.linux-x86_64-3.1/httplib2
copying httplib2/__init__.py -> build/lib.linux-x86_64-3.1/httplib2
```

```
running install_lib
creating /usr/local/lib/python3.1/dist-packages/httplib2
copying build/lib.linux-x86_64-3.1/httplib2/iri2uri.py -> /usr/local/lib/python3.1/dist-packages/httplib2
copying build/lib.linux-x86_64-3.1/httplib2/__init__.py -> /usr/local/lib/python3.1/dist-packages/httplib2
byte-compiling /usr/local/lib/python3.1/dist-packages/httplib2/iri2uri.py to iri2uri.pyc
byte-compiling /usr/local/lib/python3.1/dist-packages/httplib2/__init__.py to __init__.pyc
running install_egg_info
Writing /usr/local/lib/python3.1/dist-packages/httplib2-python3_0.5.0.egg-info
```

To use `httplib2`, create an instance of the `httplib2.Http` class.

```
>>> import httplib2
>>> h = httplib2.Http('.cache')                                                      ①
>>> response, content = h.request('http://diveintopython3.org/examples/feed.xml')  ②
>>> response.status                                                                  ③
200
>>> content[:52]                                                                     ④
b"<?xml version='1.0' encoding='utf-8'?>\r\n<feed xmlns="
>>> len(content)
3070
```

① The primary interface to `httplib2` is the `Http` object. For reasons you'll see in the next section, you should always pass a directory name when you create an `Http` object. The directory does not need to exist; `httplib2` will create it if necessary.

② Once you have an `Http` object, retrieving data is as simple as calling the `request()` method with the address of the data you want. This will issue an HTTP `GET` request for that URL. (Later in this chapter, you'll see how to issue other HTTP requests, like `POST`.)

③ The `request()` method returns two values. The first is an `httplib2.Response` object, which contains all the HTTP headers the server returned. For example, a `status` code of `200` indicates that the request was successful.

④ The `content` variable contains the actual data that was returned by the HTTP server. The data is returned as a `bytes` object, not a string. If you want it as a string, you'll need to determine the character encoding and convert it yourself.

☞ You probably only need one `httplib2.Http` object. There are valid reasons for creating more than one, but you should only do so if you know why you need them. "I need to request data from two different URLs" is not a valid reason. Re-use the `Http` object and just call the `request()` method twice.

14.5.1. A Short Digression To Explain Why `httplib2` Returns Bytes Instead of Strings

Bytes. Strings. What a pain. Why can't `httplib2` "just" do the conversion for you? Well, it's complicated, because the rules for determining the character encoding are specific to what kind of resource you're requesting. How could `httplib2` know what kind of resource you're requesting? It's usually listed in the `Content-Type` HTTP header, but that's an optional feature of HTTP and not all HTTP servers include it. If that header is not included in the HTTP response, it's left up to the client to guess. (This is commonly called "content sniffing," and it's never perfect.)

If you know what sort of resource you're expecting (an XML document in this case), perhaps you could "just" pass the returned `bytes` object to the `xml.etree.ElementTree.parse()` function. That'll work as long as the XML document includes information on its own character encoding (as this one does), but that's an optional feature and not all XML documents do that. If an XML document doesn't include encoding information, the client is supposed to look at the enclosing transport — *i.e.* the `Content-Type` HTTP header, which can include a `charset` parameter.

[I support RFC 3023 t-shirt]

But it's worse than that. Now character encoding information can be in two places: within the XML document itself, and within the `Content-Type` HTTP header. If the information is in *both* places, which one wins? According to RFC 3023 (I swear I am not making this up), if the media type given in the `Content-Type` HTTP header is `application/xml`, `application/xml-dtd`, `application/xml-external-parsed-entity`, or any one of the subtypes of `application/xml` such as `application/atom+xml` or `application/rss+xml` or even `application/rdf+xml`, then the encoding is

1. the encoding given in the `charset` parameter of the `Content-Type` HTTP header, or
2. the encoding given in the `encoding` attribute of the XML declaration within the document, or
3. UTF-8

On the other hand, if the media type given in the `Content-Type` HTTP header is `text/xml`, `text/xml-external-parsed-entity`, or a subtype like `text/AnythingAtAll+xml`, then the encoding attribute of the XML declaration within the document is ignored completely, and the encoding is

1. the encoding given in the charset parameter of the `Content-Type` HTTP header, or
2. `us-ascii`

And that's just for XML documents. For HTML documents, web browsers have constructed such byzantine rules for content-sniffing [PDF] that we're still trying to figure them all out.

"Patches welcome."

14.5.2. How httplib2 Handles Caching

Remember in the previous section when I said you should always create an `httplib2.Http` object with a directory name? Caching is the reason.

```
# continued from the previous example
>>> response2, content2 = h.request('http://diveintopython3.org/examples/feed.xml')  ①
>>> response2.status                                                                  ②
200
>>> content2[:52]                                                                     ③
b"<?xml version='1.0' encoding='utf-8'?>\r\n<feed xmlns="
>>> len(content2)
3070
```

① This shouldn't be terribly surprising. It's the same thing you did last time, except you're putting the result into two new variables.
② The HTTP `status` is once again `200`, just like last time.
③ The downloaded content is the same as last time, too.

So… who cares? Quit your Python interactive shell and relaunch it with a new session, and I'll show you.

```
# NOT continued from previous example!
# Please exit out of the interactive shell
```

```
# and launch a new one.
>>> import httplib2
>>> httplib2.debuglevel = 1                                                     ①
>>> h = httplib2.Http('.cache')                                                 ②
>>> response, content = h.request('http://diveintopython3.org/examples/feed.xml')  ③
>>> len(content)                                                                ④
3070
>>> response.status                                                             ⑤
200
>>> response.fromcache                                                          ⑥
True
```

① Let's turn on debugging and see what's on the wire. This is the `httplib2` equivalent of turning on debugging in `http.client`. `httplib2` will print all the data being sent to the server and some key information being sent back.

② Create an `httplib2.Http` object with the same directory name as before.

③ Request the same URL as before. *Nothing appears to happen.* More precisely, nothing gets sent to the server, and nothing gets returned from the server. There is absolutely no network activity whatsoever.

④ Yet we did "receive" some data — in fact, we received all of it.

⑤ We also "received" an HTTP status code indicating that the "request" was successful.

⑥ Here's the rub: this "response" was generated from `httplib2`'s local cache. That directory name you passed in when you created the `httplib2.Http` object — that directory holds `httplib2`'s cache of all the operations it's ever performed.

☞ If you want to turn on `httplib2` debugging, you need to set a module-level constant (`httplib2.debuglevel`), then create a new `httplib2.Http` object. If you want to turn off debugging, you need to change the same module-level constant, then create a new `httplib2.Http` object.

What's on the wire? Absolutely

You previously requested the data at this URL. That *nothing.*

request was successful (`status: 200`). That response included not only the feed data, but also a set of caching headers that told anyone who was listening that they could cache this resource for up to 24 hours (`Cache-Control: max-age=86400`, which is 24 hours measured in seconds). `httplib2` understand and respects those caching headers, and it stored the previous response in the `.cache` directory (which you passed in when you create the `Http` object). That cache hasn't expired yet, so the second time you request the data at this URL, `httplib2` simply returns the cached result without ever hitting the network.

I say "simply," but obviously there is a lot of complexity hidden behind that simplicity. `httplib2` handles HTTP caching *automatically* and *by default*. If for some reason you need to know whether a response came from the cache, you can check `response.fromcache`. Otherwise, it Just Works.

Now, suppose you have data cached, but you want to bypass the cache and re-request it from the remote server. Browsers sometimes do this if the user specifically requests it. For example, pressing `F5` refreshes the current page, but pressing `Ctrl+F5` bypasses the cache and re-requests the current page from the remote server. You might think "oh, I'll just delete the data from my local cache, then request it again." You could do that, but remember that there may be more parties involved than just you and the remote server. What about those intermediate proxy servers? They're completely beyond your control, and they may still have that data cached, and will happily return it to you because (as far as they are concerned) their cache is still valid.

Instead of manipulating your local cache and hoping for the best, you should use the features of HTTP to ensure that your request actually reaches the remote server.

```
# continued from the previous example
>>> response2, content2 = h.request('http://diveintopython3.org/examples/feed.xml',
...     headers={'cache-control':'no-cache'})  ①
connect: (diveintopython3.org, 80)             ②
send: b'GET /examples/feed.xml HTTP/1.1
Host: diveintopython3.org
user-agent: Python-httplib2/$Rev: 259 $
accept-encoding: deflate, gzip
cache-control: no-cache'
reply: 'HTTP/1.1 200 OK'
```

```
…further debugging information omitted…
>>> response2.status
200
>>> response2.fromcache                    ③
False
>>> print(dict(response2.items()))         ④
{'status': '200',
 'content-length': '3070',
 'content-location': 'http://diveintopython3.org/examples/feed.xml',
 'accept-ranges': 'bytes',
 'expires': 'Wed, 03 Jun 2009 00:40:26 GMT',
 'vary': 'Accept-Encoding',
 'server': 'Apache',
 'last-modified': 'Sun, 31 May 2009 22:51:11 GMT',
 'connection': 'close',
 '-content-encoding': 'gzip',
 'etag': '"bfe-255ef5c0"',
 'cache-control': 'max-age=86400',
 'date': 'Tue, 02 Jun 2009 00:40:26 GMT',
 'content-type': 'application/xml'}
```

① `httplib2` allows you to add arbitrary HTTP headers to any outgoing request. In order to bypass *all* caches (not just your local disk cache, but also any caching proxies between you and the remote server), add a `no-cache` header in the `headers` dictionary.

② Now you see `httplib2` initiating a network request. `httplib2` understands and respects caching headers *in both directions* — as part of the incoming response *and as part of the outgoing request*. It noticed that you added the `no-cache` header, so it bypassed its local cache altogether and then had no choice but to hit the network to request the data.

③ This response was *not* generated from your local cache. You knew that, of course, because you saw the debugging information on the outgoing request. But it's nice to have that programmatically verified.

④ The request succeeded; you downloaded the entire feed again from the remote server. Of course, the server also sent back a full complement of HTTP headers along with the feed data. That includes caching headers, which `httplib2` uses to update its local cache, in the hopes of avoiding network access the *next* time you request this feed. Everything about HTTP caching is designed to maximize cache hits and minimize network access. Even though you bypassed the cache this time, the remote server would really appreciate it if you would cache the result for next time.

14.5.3. How `httplib2` Handles `Last-Modified` and `ETag` Headers

The `Cache-Control` and `Expires` caching headers are called *freshness indicators*. They tell caches in no uncertain terms that you can completely avoid all network access until the cache expires. And that's exactly the behavior you saw in the previous section: given a freshness indicator, `httplib2` *does not generate a single byte of network activity* to serve up cached data (unless you explicitly bypass the cache, of course).

But what about the case where the data *might* have changed, but hasn't? HTTP defines `Last-Modified` and `Etag` headers for this purpose. These headers are called *validators*. If the local cache is no longer fresh, a client can send the validators with the next request to see if the data has actually changed. If the data hasn't changed, the server sends back a `304` status code *and no data*. So there's still a round-trip over the network, but you end up downloading fewer bytes.

```
>>> import httplib2
>>> httplib2.debuglevel = 1
>>> h = httplib2.Http('.cache')
>>> response, content = h.request('http://diveintopython3.org/')   ①
connect: (diveintopython3.org, 80)
send: b'GET / HTTP/1.1
Host: diveintopython3.org
accept-encoding: deflate, gzip
user-agent: Python-httplib2/$Rev: 259 $'
reply: 'HTTP/1.1 200 OK'
>>> print(dict(response.items()))                                   ②
{'-content-encoding': 'gzip',
 'accept-ranges': 'bytes',
 'connection': 'close',
 'content-length': '6657',
 'content-location': 'http://diveintopython3.org/',
 'content-type': 'text/html',
 'date': 'Tue, 02 Jun 2009 03:26:54 GMT',
 'etag': '"7f806d-1a01-9fb97900"',
 'last-modified': 'Tue, 02 Jun 2009 02:51:48 GMT',
```

```
 'server': 'Apache',
 'status': '200',
 'vary': 'Accept-Encoding,User-Agent'}
>>> len(content)                                      ③
6657
```

① Instead of the feed, this time we're going to download the site's home page, which is HTML. Since this is the first time you've ever requested this page, `httplib2` has little to work with, and it sends out a minimum of headers with the request.

② The response contains a multitude of HTTP headers… but no caching information. However, it does include both an `ETag` and `Last-Modified` header.

③ At the time I constructed this example, this page was 6657 bytes. It's probably changed since then, but don't worry about it.

```
# continued from the previous example
>>> response, content = h.request('http://diveintopython3.org/')  ①
connect: (diveintopython3.org, 80)
send: b'GET / HTTP/1.1
Host: diveintopython3.org
if-none-match: "7f806d-1a01-9fb97900"                 ②
if-modified-since: Tue, 02 Jun 2009 02:51:48 GMT      ③
accept-encoding: deflate, gzip
user-agent: Python-httplib2/$Rev: 259 $'
reply: 'HTTP/1.1 304 Not Modified'                    ④
>>> response.fromcache                                ⑤
True
>>> response.status                                   ⑥
200
>>> response.dict['status']                           ⑦
'304'
>>> len(content)                                      ⑧
6657
```

① You request the same page again, with the same `Http` object (and the same local cache).

② `httplib2` sends the `ETag` validator back to the server in the `If-None-Match` header.

③ `httplib2` also sends the `Last-Modified` validator back to the server in the `If-Modified-Since` header.

④ The server looked at these validators, looked at the page you requested, and determined that the page has not changed since you last requested it, so it sends back a `304` status code *and no data*.

⑤ Back on the client, `httplib2` notices the `304` status code and loads the content of the page from its cache.

⑥ This might be a bit confusing. There are really *two* status codes — `304` (returned from the server this time, which caused `httplib2` to look in its cache), and `200` (returned from the server *last time*, and stored in `httplib2`'s cache along with the page data). `response.status` returns the status from the cache.

⑦ If you want the raw status code returned from the server, you can get that by looking in `response.dict`, which is a dictionary of the actual headers returned from the server.

⑧ However, you still get the data in the `content` variable. Generally, you don't need to know why a response was served from the cache. (You may not even care that it was served from the cache at all, and that's fine too. `httplib2` is smart enough to let you act dumb.) By the time the `request()` method returns to the caller, `httplib2` has already updated its cache and returned the data to you.

14.5.4. How `http2lib` Handles Compression

HTTP supports several types of compression; the two most common types are gzip and deflate. `httplib2` supports both of these.

> *"We have both kinds of music, country AND western."*

```
>>> response, content = h.request('http://diveintopython3.org/')
connect: (diveintopython3.org, 80)
send: b'GET / HTTP/1.1
Host: diveintopython3.org
accept-encoding: deflate, gzip                                    ①
user-agent: Python-httplib2/$Rev: 259 $'
reply: 'HTTP/1.1 200 OK'
>>> print(dict(response.items()))
{'-content-encoding': 'gzip',                                     ②
 'accept-ranges': 'bytes',
 'connection': 'close',
 'content-length': '6657',
 'content-location': 'http://diveintopython3.org/',
 'content-type': 'text/html',
 'date': 'Tue, 02 Jun 2009 03:26:54 GMT',
```

```
 'etag': '"7f806d-1a01-9fb97900"',
 'last-modified': 'Tue, 02 Jun 2009 02:51:48 GMT',
 'server': 'Apache',
 'status': '304',
 'vary': 'Accept-Encoding,User-Agent'}
```

① Every time httplib2 sends a request, it includes an Accept-Encoding header to tell the server that it can handle either deflate or gzip compression.

② In this case, the server has responded with a gzip-compressed payload. By the time the request() method returns, httplib2 has already decompressed the body of the response and placed it in the content variable. If you're curious about whether or not the response was compressed, you can check response['-content-encoding']; otherwise, don't worry about it.

14.5.5. How httplib2 Handles Redirects

HTTP defines two kinds of redirects: temporary and permanent. There's nothing special to do with temporary redirects except follow them, which httplib2 does automatically.

```
>>> import httplib2
>>> httplib2.debuglevel = 1
>>> h = httplib2.Http('.cache')
>>> response, content = h.request('http://diveintopython3.org/examples/feed-302.xml')  ①
connect: (diveintopython3.org, 80)
send: b'GET /examples/feed-302.xml HTTP/1.1                                             ②
Host: diveintopython3.org
accept-encoding: deflate, gzip
user-agent: Python-httplib2/$Rev: 259 $'
reply: 'HTTP/1.1 302 Found'                                                             ③
send: b'GET /examples/feed.xml HTTP/1.1                                                 ④
Host: diveintopython3.org
accept-encoding: deflate, gzip
user-agent: Python-httplib2/$Rev: 259 $'
reply: 'HTTP/1.1 200 OK'
```

① There is no feed at this URL. I've set up my server to issue a temporary redirect to the correct address.

② There's the request.

③ And there's the response: `302 Found`. Not shown here, this response also includes a `Location` header that points to the real URL.

④ `httplib2` immediately turns around and "follows" the redirect by issuing another request for the URL given in the `Location` header: `http://diveintopython3.org/examples/feed.xml`

"Following" a redirect is nothing more than this example shows. `httplib2` sends a request for the URL you asked for. The server comes back with a response that says "No no, look over there instead." `httplib2` sends another request for the new URL.

```
# continued from the previous example
>>> response                                                          ①
{'status': '200',
 'content-length': '3070',
 'content-location': 'http://diveintopython3.org/examples/feed.xml',  ②
 'accept-ranges': 'bytes',
 'expires': 'Thu, 04 Jun 2009 02:21:41 GMT',
 'vary': 'Accept-Encoding',
 'server': 'Apache',
 'last-modified': 'Wed, 03 Jun 2009 02:20:15 GMT',
 'connection': 'close',
 '-content-encoding': 'gzip',                                         ③
 'etag': '"bfe-4cbbf5c0"',
 'cache-control': 'max-age=86400',                                    ④
 'date': 'Wed, 03 Jun 2009 02:21:41 GMT',
 'content-type': 'application/xml'}
```

① The `response` you get back from this single call to the `request()` method is the response from the final URL.

② `httplib2` adds the final URL to the `response` dictionary, as `content-location`. This is not a header that came from the server; it's specific to `httplib2`.

③ Apropos of nothing, this feed is compressed.

④ And cacheable. (This is important, as you'll see in a minute.)

The `response` you get back gives you information about the *final* URL. What if you want more information about the intermediate URLs, the ones that eventually redirected to the final URL? `httplib2` lets you do that, too.

```
# continued from the previous example
>>> response.previous                                           ①
{'status': '302',
 'content-length': '228',
 'content-location': 'http://diveintopython3.org/examples/feed-302.xml',
 'expires': 'Thu, 04 Jun 2009 02:21:41 GMT',
 'server': 'Apache',
 'connection': 'close',
 'location': 'http://diveintopython3.org/examples/feed.xml',
 'cache-control': 'max-age=86400',
 'date': 'Wed, 03 Jun 2009 02:21:41 GMT',
 'content-type': 'text/html; charset=iso-8859-1'}
>>> type(response)                                              ②
<class 'httplib2.Response'>
>>> type(response.previous)
<class 'httplib2.Response'>
>>> response.previous.previous                                  ③
>>>
```

① The `response.previous` attribute holds a reference to the previous response object that `httplib2` followed to get to the current response object.

② Both `response` and `response.previous` are `httplib2.Response` objects.

③ That means you can check `response.previous.previous` to follow the redirect chain backwards even further. (Scenario: one URL redirects to a second URL which redirects to a third URL. It could happen!) In this case, we've already reached the beginning of the redirect chain, so the attribute is `None`.

What happens if you request the same URL again?

```
# continued from the previous example
>>> response2, content2 = h.request('http://diveintopython3.org/examples/feed-302.xml')  ①
connect: (diveintopython3.org, 80)
send: b'GET /examples/feed-302.xml HTTP/1.1                                              ②
Host: diveintopython3.org
```

```
accept-encoding: deflate, gzip
user-agent: Python-httplib2/$Rev: 259 $'
reply: 'HTTP/1.1 302 Found'                                          ③
>>> content2 == content                                              ④
True
```

① Same URL, same httplib2.Http object (and therefore the same cache).

② The 302 response was not cached, so httplib2 sends another request for the same URL.

③ Once again, the server responds with a 302. But notice what *didn't* happen: there wasn't ever a second request for the final URL, http://diveintopython3.org/examples/feed.xml. That response was cached (remember the Cache-Control header that you saw in the previous example). Once httplib2 received the 302 Found code, *it checked its cache before issuing another request*. The cache contained a fresh copy of http://diveintopython3.org/examples/feed.xml, so there was no need to re-request it.

④ By the time the request() method returns, it has read the feed data from the cache and returned it. Of course, it's the same as the data you received last time.

In other words, you don't have to do anything special for temporary redirects. httplib2 will follow them automatically, and the fact that one URL redirects to another has no bearing on httplib2's support for compression, caching, ETags, or any of the other features of HTTP.

Permanent redirects are just as simple.

```
# continued from the previous example
>>> response, content = h.request('http://diveintopython3.org/examples/feed-301.xml')   ①
connect: (diveintopython3.org, 80)
send: b'GET /examples/feed-301.xml HTTP/1.1
Host: diveintopython3.org
accept-encoding: deflate, gzip
user-agent: Python-httplib2/$Rev: 259 $'
reply: 'HTTP/1.1 301 Moved Permanently'                                                  ②
>>> response.fromcache                                                                   ③
True
```

① Once again, this URL doesn't really exist. I've set up my server to issue a permanent redirect to http://diveintopython3.org/examples/feed.xml.

② And here it is: status code 301. But again, notice what *didn't* happen: there was no request to the redirect URL. Why not? Because it's already cached locally.
③ httplib2 "followed" the redirect right into its cache.

But wait! There's more!

```
# continued from the previous example
>>> response2, content2 = h.request('http://diveintopython3.org/examples/feed-301.xml')  ①
>>> response2.fromcache                                                                  ②
True
>>> content2 == content                                                                  ③
True
```

① Here's the difference between temporary and permanent redirects: once httplib2 follows a permanent redirect, all further requests for that URL will transparently be rewritten to the target URL *without hitting the network for the original URL*. Remember, debugging is still turned on, yet there is no output of network activity whatsoever.
② Yep, this response was retrieved from the local cache.
③ Yep, you got the entire feed (from the cache).

HTTP. It works.

⁂

14.6. Beyond HTTP GET

HTTP web services are not limited to GET requests. What if you want to create something new? Whenever you post a comment on a discussion forum, update your weblog, publish your status on a microblogging service like Twitter or Identi.ca, you're probably already using HTTP POST.

Both Twitter and Identi.ca both offer a simple HTTP-based API for publishing and updating your status in 140 characters or less. Let's look at Identi.ca's API documentation for updating your status:

Identi.ca REST API Method: statuses/update

Updates the authenticating user's status. Requires the status parameter specified below. Request must be a POST.

URL

https://identi.ca/api/statuses/update.*format*

Formats

xml, json, rss, atom

HTTP Method(s)

POST

Requires Authentication

true

Parameters

status. Required. The text of your status update. URL-encode as necessary.

How does this work? To publish a new message on Identi.ca, you need to issue an HTTP POST request to http://identi.ca/api/statuses/update.*format*. (The format bit is not part of the URL; you replace it with the data format you want the server to return in response to your request. So if you want a response in XML, you would post the request to https://identi.ca/api/statuses/update.xml.) The request needs to include a parameter called status, which contains the text of your status update. And the request needs to be authenticated.

Authenticated? Sure. To update your status on Identi.ca, you need to prove who you are. Identi.ca is not a wiki; only you can update your own status. Identi.ca uses HTTP Basic Authentication (*a.k.a.* RFC 2617) over SSL to provide secure but easy-to-use authentication. httplib2 supports both SSL and HTTP Basic Authentication, so this part is easy.

A POST request is different from a GET request, because it includes a *payload*. The payload is the data you want to send to the server. The one piece of data that this API method *requires* is status, and it should be *URL-encoded*. This is a very simple serialization format that takes a set of key-value pairs (*i.e.* a dictionary) and transforms it into a string.

```
>>> from urllib.parse import urlencode              ①
>>> data = {'status': 'Test update from Python 3'}  ②
```

```
>>> urlencode(data)                                          ③
'status=Test+update+from+Python+3'
```

① Python comes with a utility function to URL-encode a dictionary: urllib.parse.urlencode().

② This is the sort of dictionary that the Identi.ca API is looking for. It contains one key, status, whose value is the text of a single status update.

③ This is what the URL-encoded string looks like. This is the *payload* that will be sent "on the wire" to the Identi.ca API server in your HTTP POST request.

```
>>> from urllib.parse import urlencode
>>> import httplib2
>>> httplib2.debuglevel = 1
>>> h = httplib2.Http('.cache')
>>> data = {'status': 'Test update from Python 3'}
>>> h.add_credentials('diveintomark', 'MY_SECRET_PASSWORD', 'identi.ca')    ①
>>> resp, content = h.request('https://identi.ca/api/statuses/update.xml',
...     'POST',                                                             ②
...     urlencode(data),                                                    ③
...     headers={'Content-Type': 'application/x-www-form-urlencoded'})      ④
```

① This is how httplib2 handles authentication. Store your username and password with the add_credentials() method. When httplib2 tries to issue the request, the server will respond with a 401 Unauthorized status code, and it will list which authentication methods it supports (in the WWW-Authenticate header). httplib2 will automatically construct an Authorization header and re-request the URL.

② The second parameter is the type of HTTP request, in this case POST.

③ The third parameter is the *payload* to send to the server. We're sending the URL-encoded dictionary with a status message.

④ Finally, we need to tell the server that the payload is URL-encoded data.

☞ The third parameter to the add_credentials() method is the domain in which the credentials are valid. You should always specify this! If you leave out the domain and later reuse the httplib2.Http object on a different authenticated site, httplib2 might end up leaking one site's username and password to the other site.

This is what goes over the wire:

```
# continued from the previous example
send: b'POST /api/statuses/update.xml HTTP/1.1
Host: identi.ca
Accept-Encoding: identity
Content-Length: 32
content-type: application/x-www-form-urlencoded
user-agent: Python-httplib2/$Rev: 259 $

status=Test+update+from+Python+3'
reply: 'HTTP/1.1 401 Unauthorized'                     ①
send: b'POST /api/statuses/update.xml HTTP/1.1          ②
Host: identi.ca
Accept-Encoding: identity
Content-Length: 32
content-type: application/x-www-form-urlencoded
authorization: Basic SECRET_HASH_CONSTRUCTED_BY_HTTPLIB2  ③
user-agent: Python-httplib2/$Rev: 259 $

status=Test+update+from+Python+3'
reply: 'HTTP/1.1 200 OK'                               ④
```

① After the first request, the server responds with a `401 Unauthorized` status code. `httplib2` will never send authentication headers unless the server explicitly asks for them. This is how the server asks for them.
② `httplib2` immediately turns around and requests the same URL a second time.
③ This time, it includes the username and password that you added with the `add_credentials()` method.
④ It worked!

What does the server send back after a successful request? That depends entirely on the web service API. In some protocols (like the Atom Publishing Protocol), the server sends back a `201 Created` status code and the location of the newly created resource in the `Location` header. Identi.ca sends back a `200 OK` and an XML document containing information about the newly created resource.

```
# continued from the previous example
```

```
>>> print(content.decode('utf-8'))                          ①
<?xml version="1.0" encoding="UTF-8"?>
<status>
 <text>Test update from Python 3</text>                      ②
 <truncated>false</truncated>
 <created_at>Wed Jun 10 03:53:46 +0000 2009</created_at>
 <in_reply_to_status_id></in_reply_to_status_id>
 <source>api</source>
 <id>5131472</id>                                            ③
 <in_reply_to_user_id></in_reply_to_user_id>
 <in_reply_to_screen_name></in_reply_to_screen_name>
 <favorited>false</favorited>
 <user>
  <id>3212</id>
  <name>Mark Pilgrim</name>
  <screen_name>diveintomark</screen_name>
  <location>27502, US</location>
  <description>tech writer, husband, father</description>
  <profile_image_url>http://avatar.identi.ca/3212-48-20081216000626.png</profile_image_url>
  <url>http://diveintomark.org/</url>
  <protected>false</protected>
  <followers_count>329</followers_count>
  <profile_background_color></profile_background_color>
  <profile_text_color></profile_text_color>
  <profile_link_color></profile_link_color>
  <profile_sidebar_fill_color></profile_sidebar_fill_color>
  <profile_sidebar_border_color></profile_sidebar_border_color>
  <friends_count>2</friends_count>
  <created_at>Wed Jul 02 22:03:58 +0000 2008</created_at>
  <favourites_count>30768</favourites_count>
  <utc_offset>0</utc_offset>
  <time_zone>UTC</time_zone>
  <profile_background_image_url></profile_background_image_url>
  <profile_background_tile>false</profile_background_tile>
```

```
    <statuses_count>122</statuses_count>
    <following>false</following>
    <notifications>false</notifications>
  </user>
  </status>
```

① Remember, the data returned by `httplib2` is always bytes, not a string. To convert it to a string, you need to decode it using the proper character encoding. Identi.ca's API always returns results in UTF-8, so that part is easy.

② There's the text of the status message we just published.

③ There's the unique identifier for the new status message. Identi.ca uses this to construct a URL for viewing the message on the web.

And here it is:

14.7. Beyond HTTP POST

HTTP isn't limited to GET and POST. Those are certainly the most common types of requests, especially in web browsers. But web service APIs can go beyond GET and POST, and httplib2 is ready.

```
# continued from the previous example
>>> from xml.etree import ElementTree as etree
>>> tree = etree.fromstring(content)                                          ①
>>> status_id = tree.findtext('id')                                          ②
>>> status_id
'5131472'
>>> url = 'https://identi.ca/api/statuses/destroy/{0}.xml'.format(status_id)  ③
>>> resp, deleted_content = h.request(url, 'DELETE')                         ④
```

① The server returned XML, right? You know how to parse XML.

② The findtext() method finds the first instance of the given expression and extracts its text content. In this case, we're just looking for an <id> element.

③ Based on the text content of the <id> element, we can construct a URL to delete the status message we just published.

④ To delete a message, you simply issue an HTTP DELETE request to that URL.

This is what goes over the wire:

```
send: b'DELETE /api/statuses/destroy/5131472.xml HTTP/1.1      ①
Host: identi.ca
Accept-Encoding: identity
user-agent: Python-httplib2/$Rev: 259 $

'
reply: 'HTTP/1.1 401 Unauthorized'                               ②
send: b'DELETE /api/statuses/destroy/5131472.xml HTTP/1.1      ③
Host: identi.ca
Accept-Encoding: identity
authorization: Basic SECRET_HASH_CONSTRUCTED_BY_HTTPLIB2        ④
user-agent: Python-httplib2/$Rev: 259 $
```

```
'
reply: 'HTTP/1.1 200 OK'                              ⑤
>>> resp.status
200
```

① “Delete this status message.”

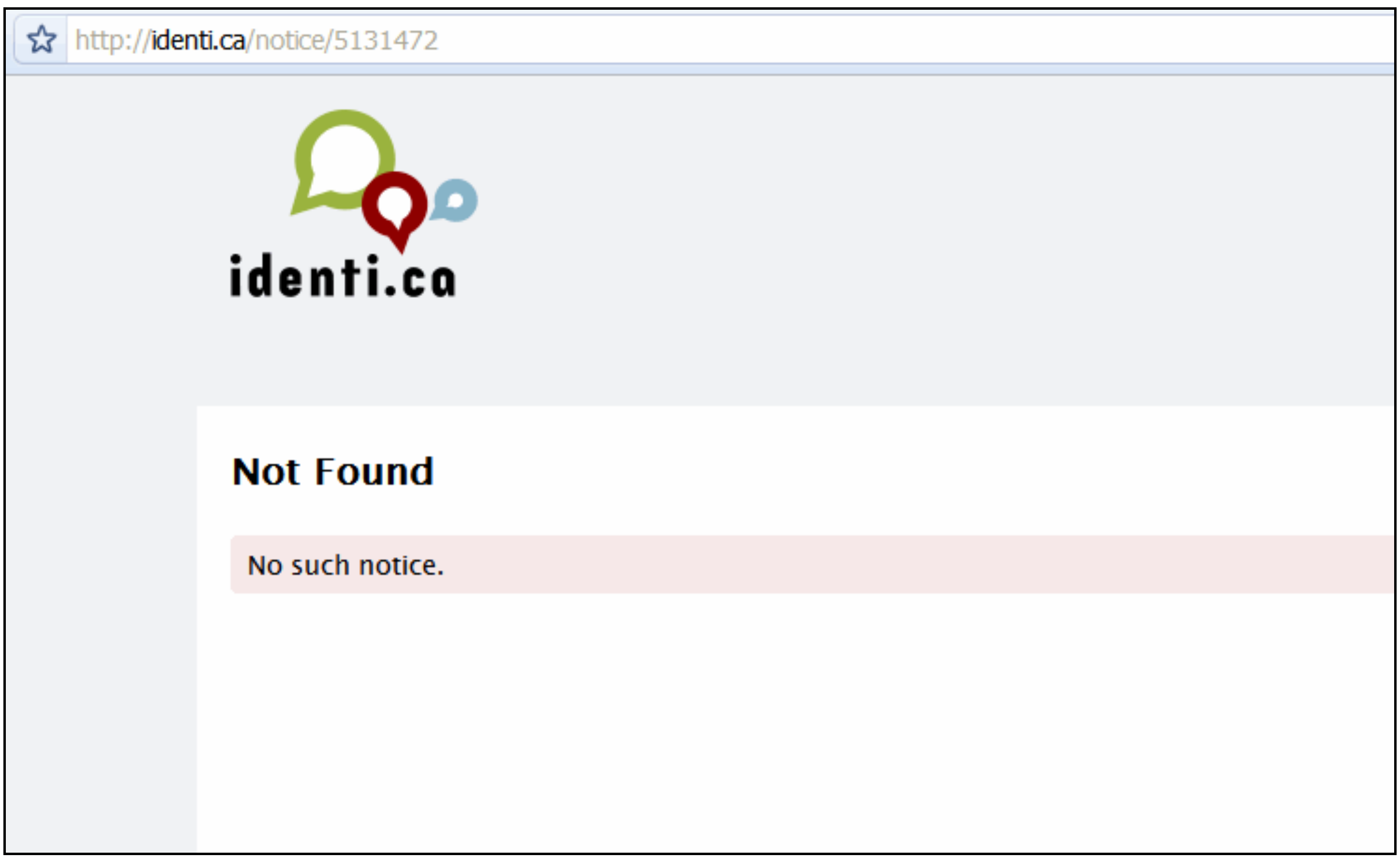
② “I’m sorry, Dave, I’m afraid I can’t do that.”

③ “Unauthorized? Hmmph. Delete this status message, *please*…

④ …and here’s my username and password.”

⑤ “Consider it done!”

And just like that, poof, it’s gone.



14.8. Further Reading

`httplib2`:

- `httplib2` project page
- More `httplib2` code examples
- Doing HTTP Caching Right: Introducing `httplib2`
- `httplib2`: HTTP Persistence and Authentication

HTTP caching:

- HTTP Caching Tutorial by Mark Nottingham
- How to control caching with HTTP headers on Google Doctype

RFCs:

- RFC 2616: HTTP
- RFC 2617: HTTP Basic Authentication
- RFC 1951: deflate compression
- RFC 1952: gzip compression