Data Acquisition via Application Programmable Interfaces

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Introduction

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Logistics

- GitHub Repository: https://github.com/apetresc/rotman-api
- Notebook: RAC Link

Schedule

Part 1 (Today)

- Introduction and motivation
- HTTP, REST, and the languages of the web
- Authentication schemes
- Lots and lots of practical examples

Part 2

- Scraping unstructured data from the web
- Parsing
- Automated spiders

Part 3

- The server-side of APIs
- Deploying to the Cloud
- Project Description

What is an API?

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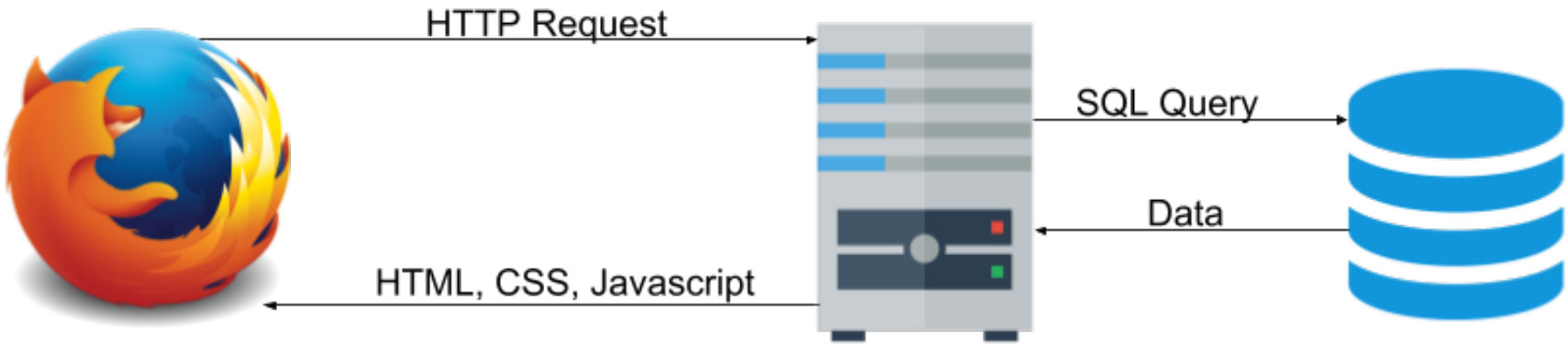
Web Architecture

In Its Simplest Possible Form



Web Architecture

In Its Modern Form

HTTP

Hyertext Transfer Protocol

- The language of the web
- Transactional
- Stateless

Anatomy of a Request

Marco

```
GET /api/v2/evolution-chain/1?format=json HTTP/1.1
```

Anatomy of a Request

Marco

```
GET /api/v2/evolution-chain/1?format=json HTTP/1.1

Host: pokeapi.co
Connection: keep-alive
Accept: application/json
```

Anatomy of a Response

Polo

```
HTTP/1.1 200 OK
Server: nginx
Content-Type: application/json
Content-Length: 3238
[...]


{
  "id": 1,
  "chain": {
    "species": "bulbasaur",
    [...]
  }
}
```

Methods

- `HEAD`
- `GET`
- `POST/PUT`
- `DELETE`

Return Codes

- 200 Success
- 300 Redirect
- 400 Client Error
- 500 Server Error

Return Codes — 200 Success

- `200 OK`
- `201 Created`
- `202 Accepted`
- `204 No Content`
- `206 Partial Content`

Return Codes — 300 Redirect

- `301 Moved Permanently`
- `302 Moved Temporarily`
- `304 Not Modified`

Return Codes — 400 Client Error

- `400 Bad Request`
- `401 Unauthorized`
- `403 Forbidden`
- `404 Not Found`
- `405 Method Not Allowed`

Return Codes — 500 Server Error

- `500 Internal Server Error`
- `501 Not Implemented`
- `503 Service Unavailable`

Some Important Headers

- `Set-Cookie` / `Cookie`
- `User-Agent`
- `Expires` / `Cache-Control`

A much more comprehensive listing can be found on the Mozilla Developer Network.

JSON

JavaScript Object Notation

```
{
  "a": true,
  "b": {
    "c": 1,
    "d": [
      {"x": 1},
      {"y": 2}
    ]
  }
}
```

XML

eXtensible Markup Language

```
<card xmlns="http://businesscard.org/schema.xml">
  <name>John Doe</name>
  <title>CEO, Widget Inc.</title>
  <email>john.doe@widget.com</email>
  <phone>(202) 456-1414</phone>
  <logo url="widget.gif"/>
</card>
```

XSD

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
        xmlns:b="http://businesscard.org"
        targetNamespace="http://businesscard.org">

  <element name="card" type="b:card_type"/>
  <element name="name" type="string"/>
  <element name="title" type="string"/>
  <element name="email" type="string"/>
  <element name="phone" type="string"/>
  <element name="logo" type="b:logo_type"/>

  <complexType name="card_type">
    <sequence>
      <element ref="b:name"/>
      <element ref="b:title"/>
      <element ref="b:email"/>
      <element ref="b:phone" minOccurs="0"/>
      <element ref="b:logo" minOccurs="0"/>
    </sequence>
  </complexType>

  <complexType name="logo_type">
    <attribute name="url" type="anyURI"/>
  </complexType>

</schema>
```

Authentication and Authorization

- Unauthenticated
- HTTP Basic Auth
- API Access Tokens
- OAuth 1/2

HTTP Basic Auth

Example

```
GET /user HTTP/1.1

Host: api.github.com
Authorization: Basic YXBldHJlc2M6MFk4aWJYdU7wvabj
```

- Extremely easy to implement
- This does authentication, not authorization, in spite of the header
- Not secure - the string there is just a base64 encoding, not any sort of encryption

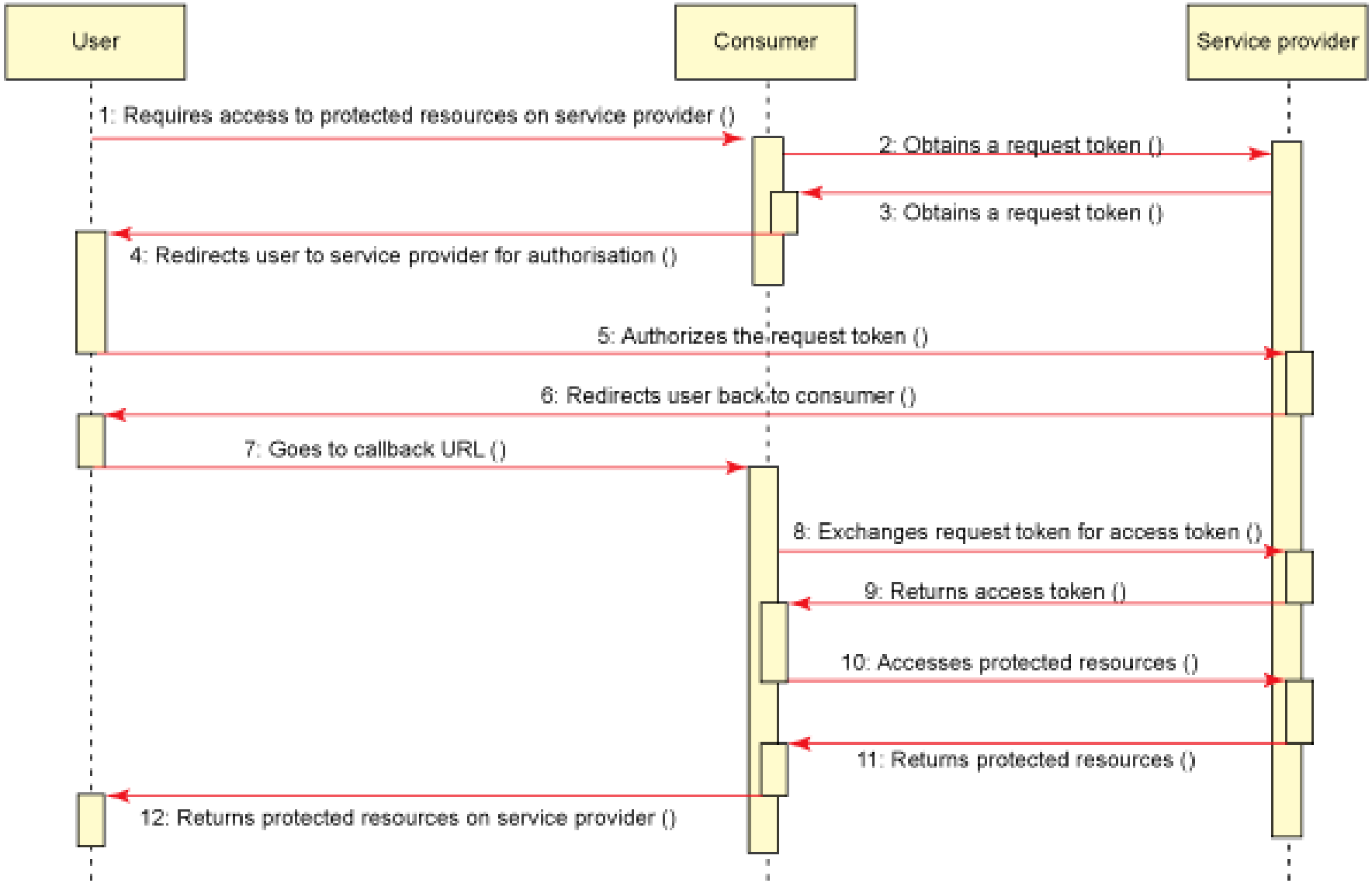
API Access Token

Example

```
GET /v3/businesses/q9_gLvTNf11etVxbH7JYOQ HTTP/2
Host: api.yelp.com
Authorization: Bearer p1hiON8SYR-Z[...]
```

- Easy to use for clients
- Only works for server-side, single-user applications

OAuth


User
Consumer
Service provider
1: Requires access to protected resources on service provider ()
2: Obtains a request token ()
3: Obtains a request token ()
4: Redirects user to service provider for authorisation ()
5: Authorizes the request token ()
6: Redirects user back to consumer ()
7: Goes to callback URL ()
8: Exchanges request token for access token ()
9: Returns access token ()
10: Accesses protected resources ()
11: Returns protected resources ()
12: Returns protected resources on service provider ()

Luckily, this whole dance can be automated away with the right library!

Request a token

```
from requests_oauth2.services import GoogleClient
google_auth = GoogleClient(
      client_id="your-google-client-id",
      client_secret="super-secret",
      redirect_uri="http://localhost:5000/google/oauth2callback",
      )

    authorization_url = google_auth.authorize_url(
        scope=["email"],
        response_type="code",
        )
```

Authorize with the token

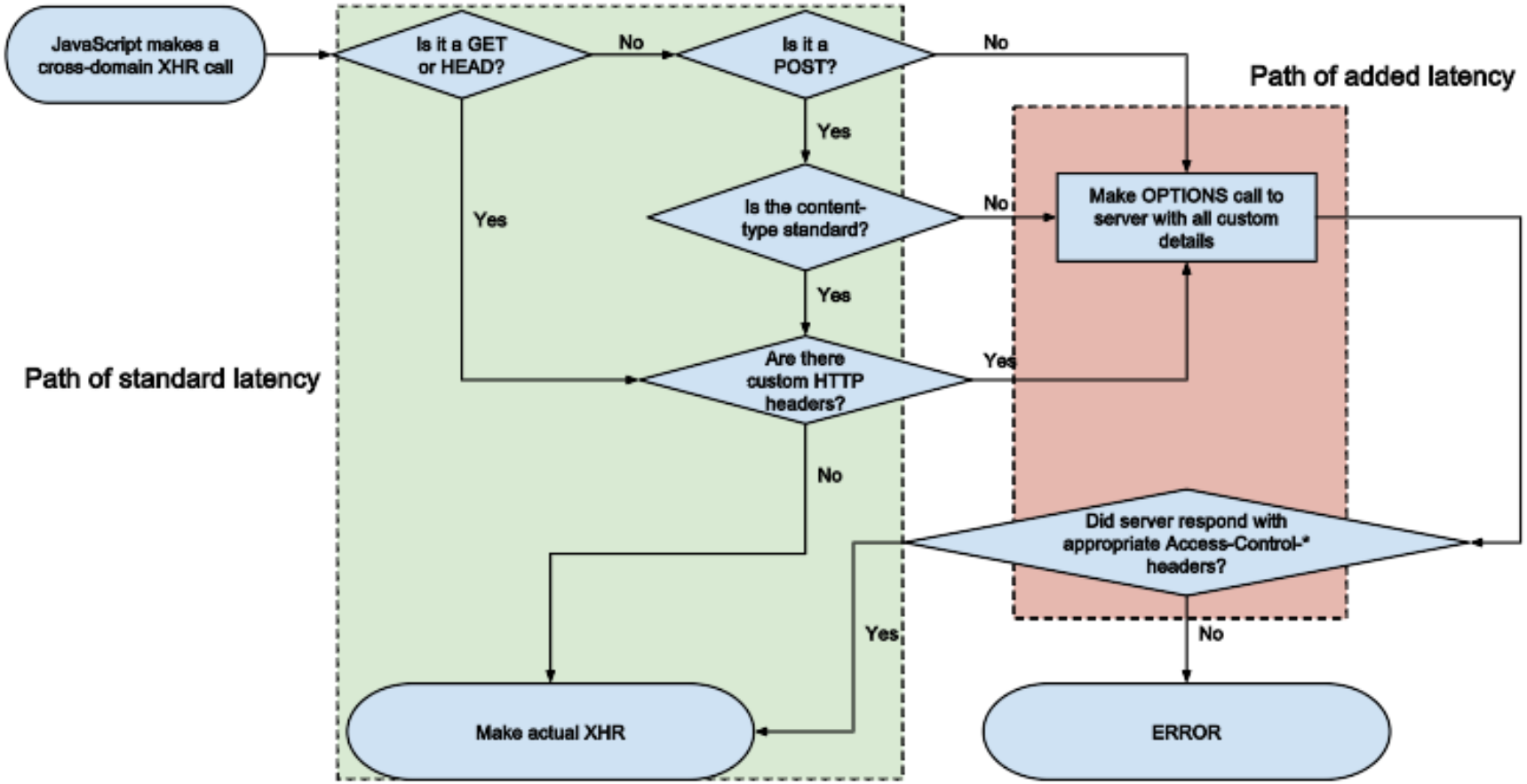
```
code = get_request_parameter("code")
data = google_auth.get_token(
      code=code,
      grant_type="authorization_code",
      )

session["access_token"] = data["access_token"]

with requests.Session() as s:
    s.auth = OAuth2BearerToken(access_token)
    r = s.get("https://www.googleapis.com/plus/v1/people/me")
    r.raise_for_status()
    data = r.json()
```

CORS

Cross-Origin Resource Sharing



Demo - GitHub

Demo - Yelp