Course by Consortium GARR and Reti Business & IT Consulting

OAuth2 Overview

OIDC primer - a course on OpenID Connect

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Introduction to OAuth 2.0

OAuth 2.0 is an IETF standard for authorization. It supersedes OAuth 1.0 with which it is not backward compatible.

OAuth 2.0 Core

- OAuth 2.0 Framework - RFC 6749
- Bearer Token Usage - RFC 6750
- Threat Model and Security Considerations - RFC 6819

OAuth 2.0 Extensions

- OAuth 2.0 Device Flow (draft)
- OAuth 2.0 Token Introspection - RFC 7662, to determine the active state and meta-information of a token
- PKCE - Proof Key for Code Exchange, better security for native apps
- Native Apps - Recommendations for using OAuth 2.0 with native apps
- JSON Web Token - RFC 7519
- OAuth Assertions Framework - RFC 7521
- SAML2 Bearer Assertion - RFC 7522, for integrating with existing identity systems
- JWT Bearer Assertion - RFC 7523, for integrating with existing identity systems

Introduction to OAuth 2.0

The OAuth 2.0 authorization framework enables a third-party application to obtain limited access to an HTTP service, either on behalf of a resource owner by orchestrating an approval interaction between the resource owner and the HTTP service, or by allowing the third-party application to obtain access on its own behalf. [RFC 6749]

OAuth2 defines a mean to represent the authorization granted to the third-party, the access token, and a set of flows and mechanisms to:

- obtain the authorization, that is the access token
- convey the authorization to a third-party application
- use the authorization on a protected resource

All on top of the HTTP protocol

OAuth 2.0 Actors

- **Resource owner** (RO): the granting access entity, usually the user and his User Agent
- **Resource Server** (RS): the server hosting the resource to be accessed (eg an API)
- **Client**: the application to which the grant is entitled (a web app, a desktop app, a mobile app, a javascript-on-top-of-user-agent app...)
- **Authorization Server** (AS): registers clients, authenticates users, and issues access tokens.

OAuth 2.0 bits and pieces

Access token: a string representing an authorization issued to the Client (for which is usually opaque) - OAuth 2.0 does not mandate the format nor the content of the access token

Refresh token: credentials used to obtain access tokens when the current access token becomes invalid or expires.

Scopes: set of rights delegated to the client on the Resource Server - expressed as a list of space-delimited, case-sensitive strings.

Protocol Endpoints:

- Authorization endpoint (Authorization Server)
- Token endpoint (Authorization Server)
- Redirection Endpoint (Client) [SHOULD require the use of TLS by RFC 6749]

OAuth 2.0 Flows

Authorization Code Grant

It is the main flow to obtain an access token, and mainly targeted to web applications.

- client authentication
- employ an intermediate authorization phase represented by an authorization code
- The access token is exchanged without the involvement of the Resource Owner User Agent

Implicit Grant

A simplified authorization code flow optimized for clients implemented in a browser.

- No client authentication
- No intermediary code to obtain the access token

Resource Owner Password Credentials Grant

It is a flow for highly trusted Clients:

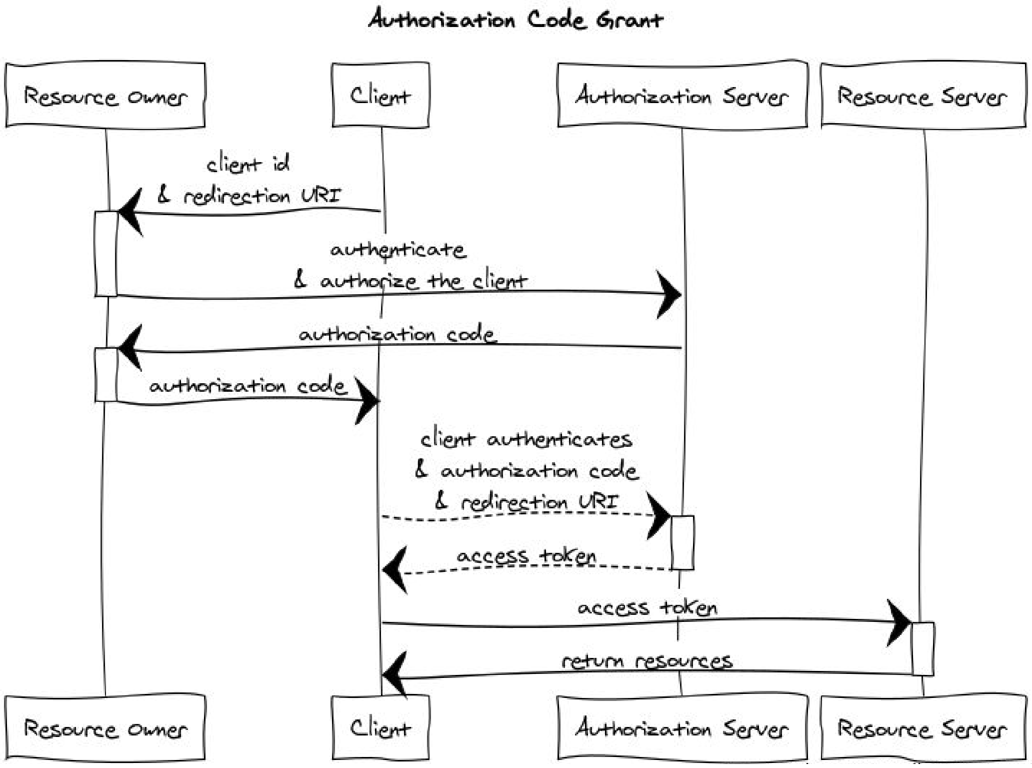
- the Resource Owner credentials are used directly by the Client to obtain an authorization

Client Credentials Grant

It is a flow for third party Clients with very limited access to resources:

- It is based on Client credentials only

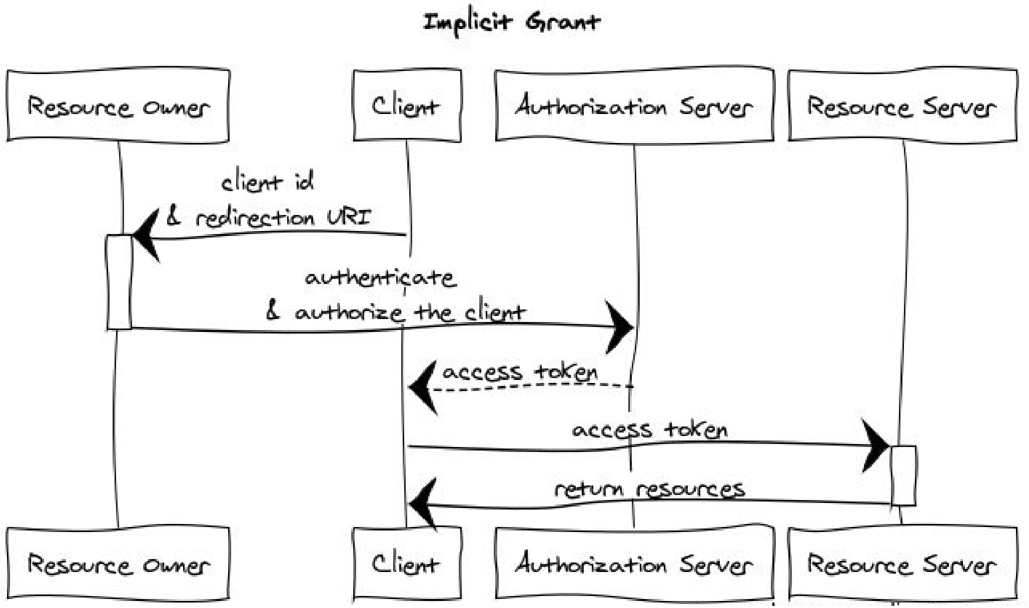
Authorization Code Grant



- The Client redirects the RO to the AS sending client_id, scopes, and redirection URI
- The AS authenticates the RO and obtains user authorization for the Client
- The AS redirect the RO to the Client with an authorization code
- The Client authenticates on the AS and sends the authorization code along with the redirection URI (for verification)
- The AS sends an access token to the Client
- The Client sends the access token to the RS to access the resources

Implicit Grant

Note that in the implicit grant the Client usually runs on top of the Resource Owner User Agent



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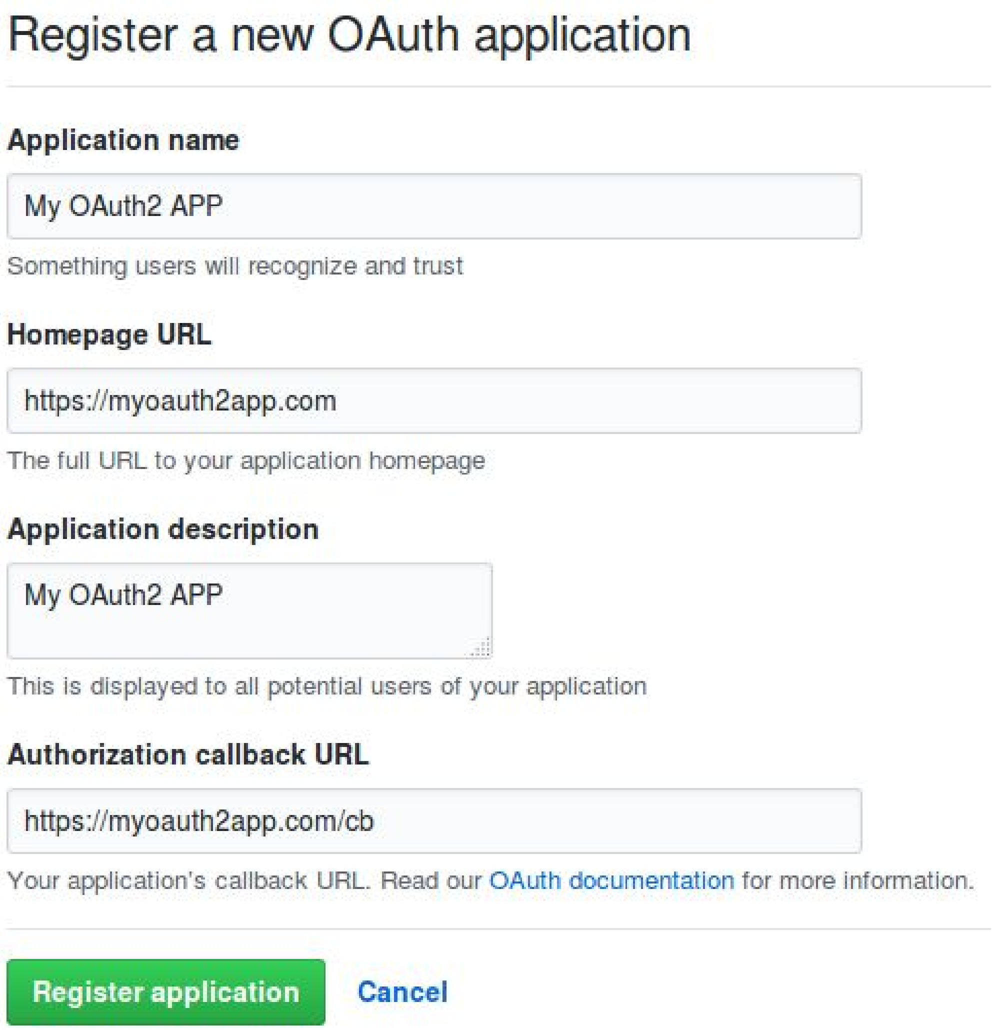
Authorization Code Grant - Demo



Register a new OAuth application

Application name

My OAuth2 APP

Something users will recognize and trust

Homepage URL

https://myoauth2app.com

The full URL to your application homepage

Application description

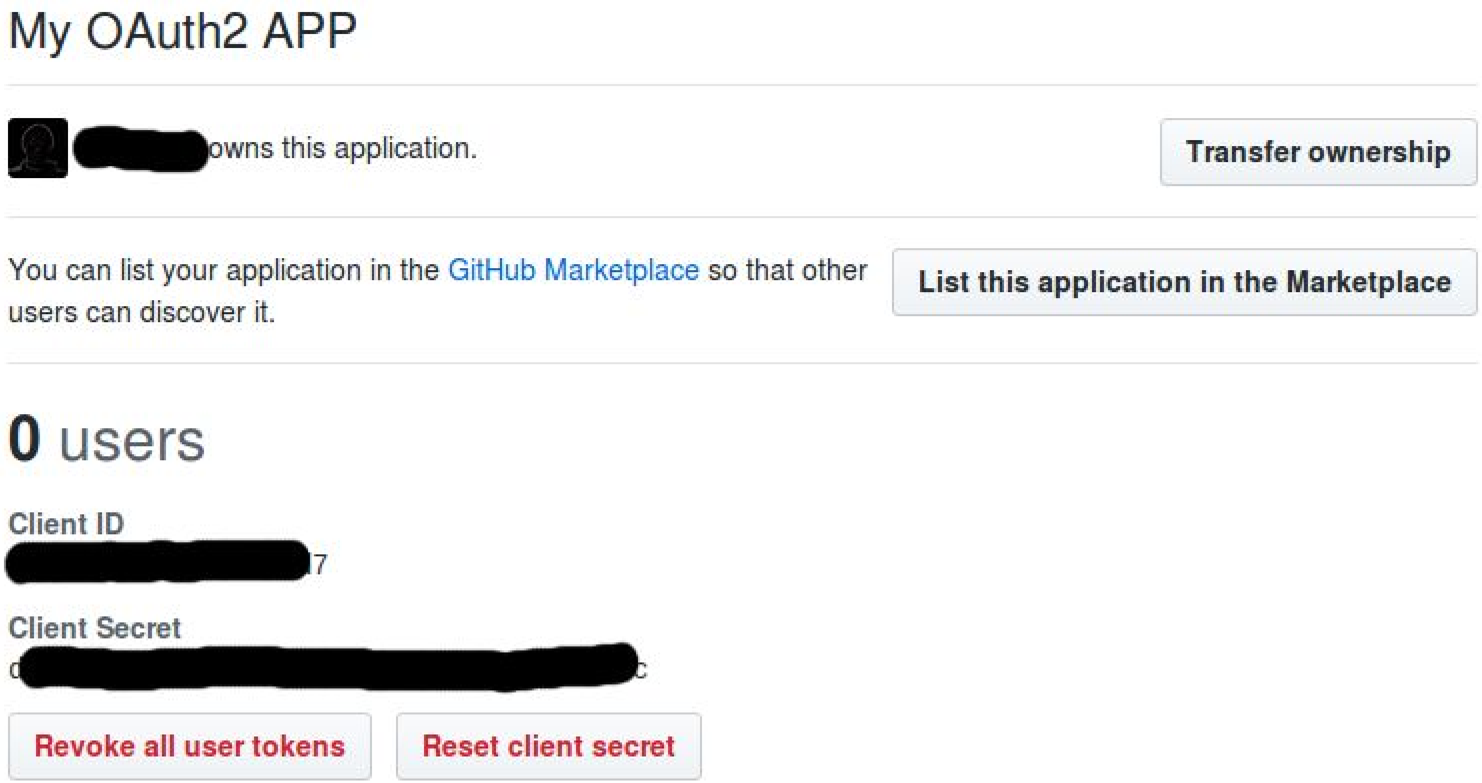
My OAuth2 APP

This is displayed to all potential users of your application

Authorization callback URL

https://myoauth2app.com/cb

Your application's callback URL. Read our OAuth documentation for more information.



My OAuth2 APP

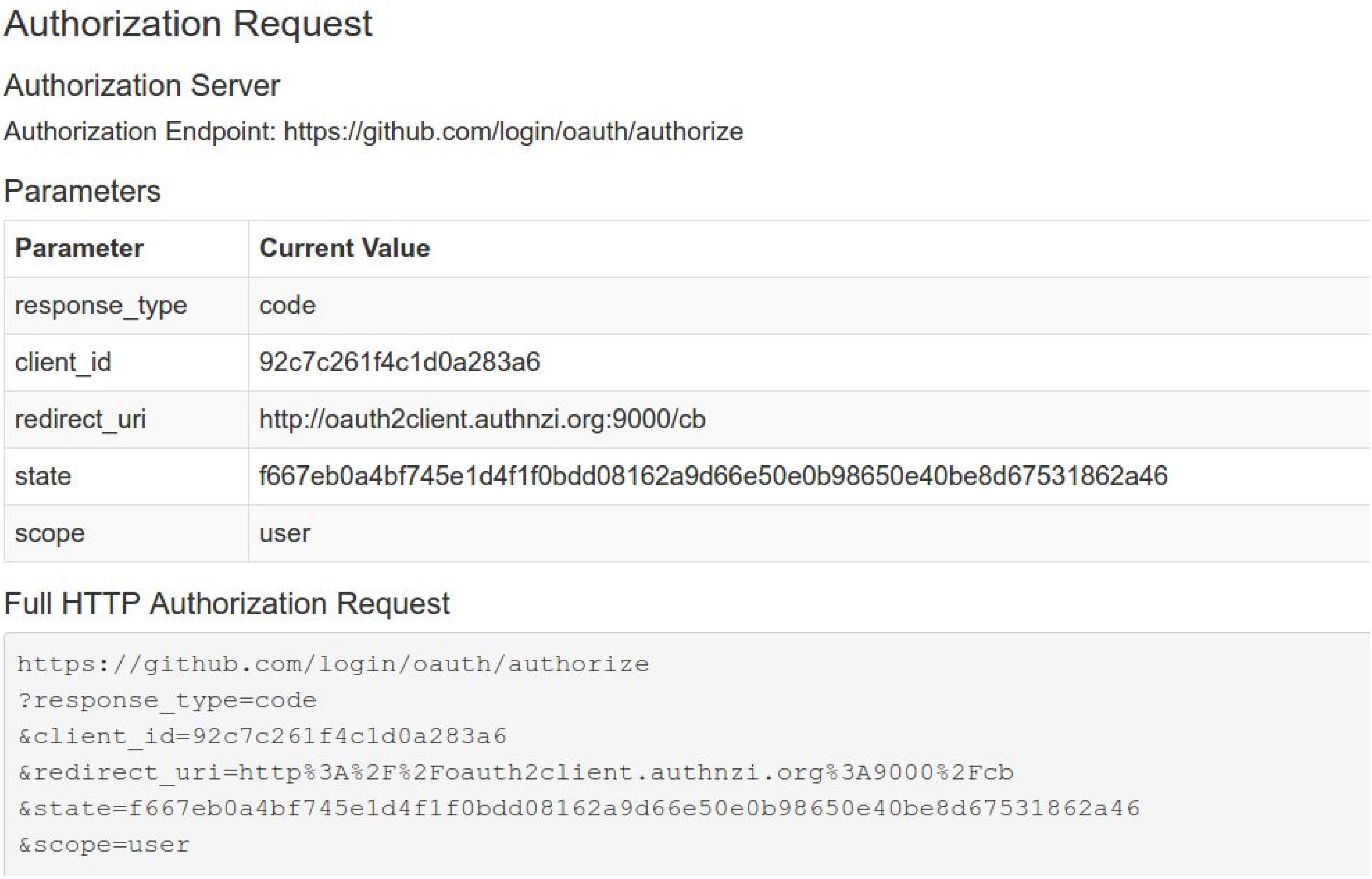
[redacted] owns this application.

You can list your application in the GitHub Marketplace so that other users can discover it.

0 users

Client ID
[redacted]7

Client Secret
[redacted]c



Authorization Request

Authorization Server

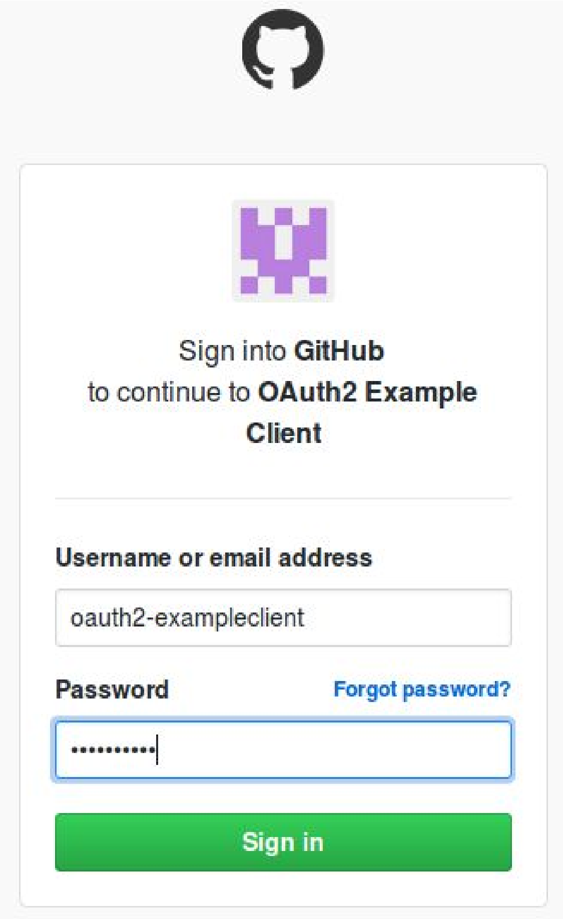
Authorization Endpoint: https://github.com/login/oauth/authorize

Parameters

Parameter	Current Value
response_type	code
client_id	92c7c261f4c1d0a283a6
redirect_uri	http://oauth2client.authnzi.org:9000/cb
state	f667eb0a4bf745e1d4f1f0bdd08162a9d66e50e0b98650e40be8d67531862a46
scope	user

Full HTTP Authorization Request

```
https://github.com/login/oauth/authorize
?response_type=code
&client_id=92c7c261f4c1d0a283a6
&redirect_uri=http%3A%2F%2Foauth2client.authnzi.org%3A9000%2Fcb
&state=f667eb0a4bf745e1d4f1f0bdd08162a9d66e50e0b98650e40be8d67531862a46
&scope=user
```



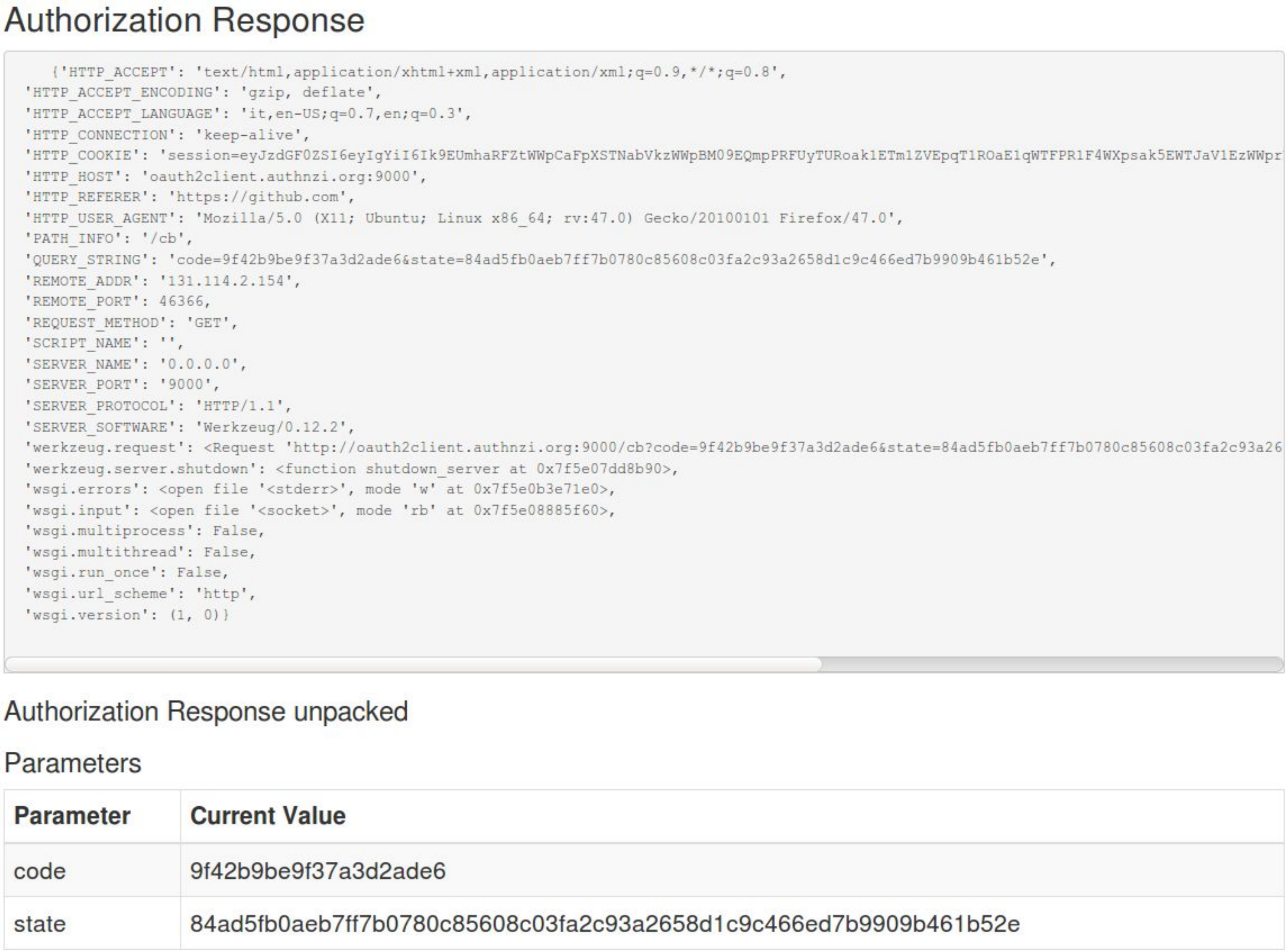
Sign into **GitHub**
to continue to **OAuth2 Example Client**

Username or email address

oauth2-exampleclient

Password

••••••••••



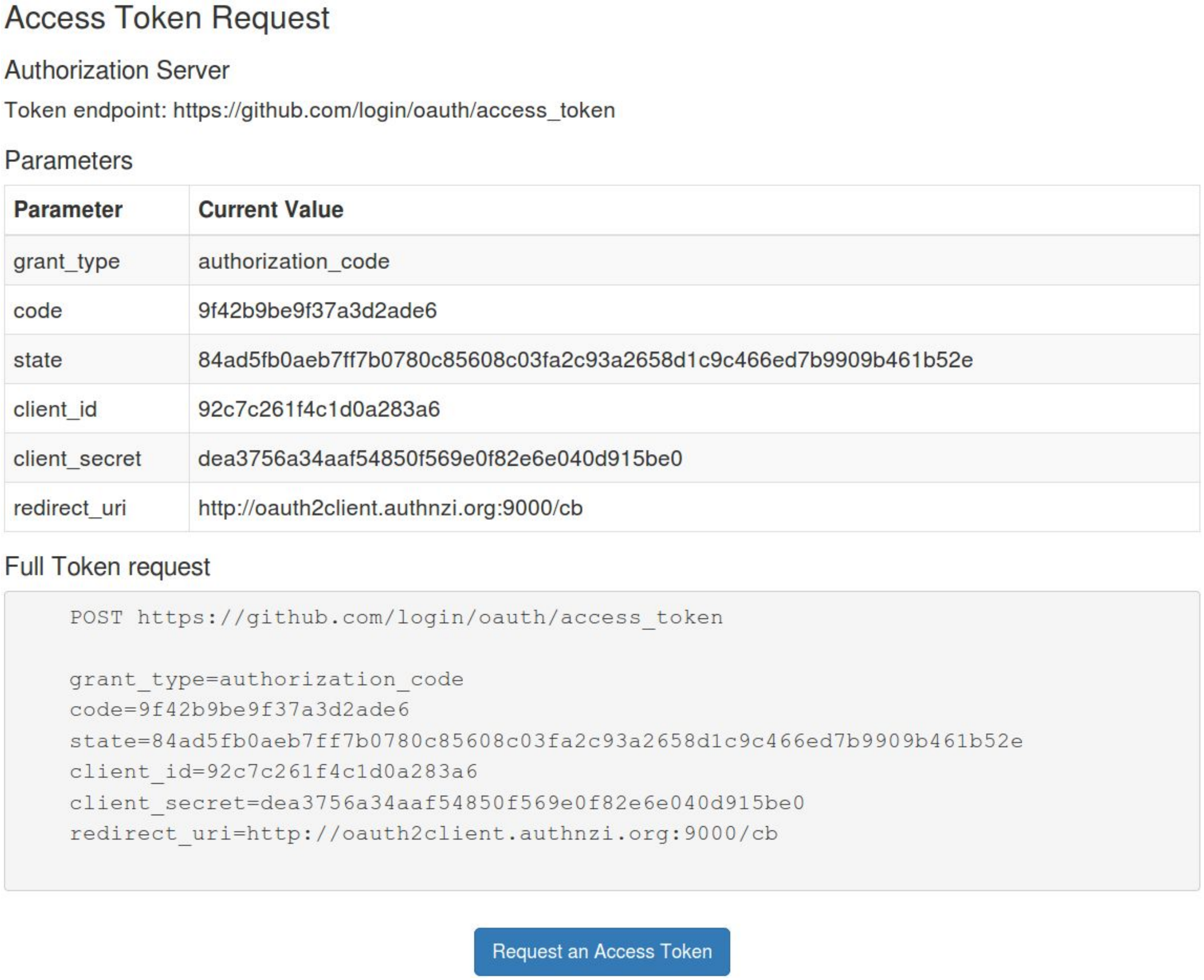
Authorization Response

```
   {'HTTP_ACCEPT': 'text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8',
 'HTTP_ACCEPT_ENCODING': 'gzip, deflate',
 'HTTP_ACCEPT_LANGUAGE': 'it,en-US;q=0.7,en;q=0.3',
 'HTTP_CONNECTION': 'keep-alive',
 'HTTP_COOKIE': 'session=eyJzdGF0ZSI6eyIgYiI6Ik9EUmhaRFZtWWpCaFpXSTNabVkzWWpBM09EQmpPRFUyTURoak1ETm1ZVEpqT1ROaE1qWTFPR1F4WXpsak5EWTJaV1EzWWpr
 'HTTP_HOST': 'oauth2client.authnzi.org:9000',
 'HTTP_REFERER': 'https://github.com',
 'HTTP_USER_AGENT': 'Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:47.0) Gecko/20100101 Firefox/47.0',
 'PATH_INFO': '/cb',
 'QUERY_STRING': 'code=9f42b9be9f37a3d2ade6&state=84ad5fb0aeb7ff7b0780c85608c03fa2c93a2658d1c9c466ed7b9909b461b52e',
 'REMOTE_ADDR': '131.114.2.154',
 'REMOTE_PORT': 46366,
 'REQUEST_METHOD': 'GET',
 'SCRIPT_NAME': '',
 'SERVER_NAME': '0.0.0.0',
 'SERVER_PORT': '9000',
 'SERVER_PROTOCOL': 'HTTP/1.1',
 'SERVER_SOFTWARE': 'Werkzeug/0.12.2',
 'werkzeug.request': <Request 'http://oauth2client.authnzi.org:9000/cb?code=9f42b9be9f37a3d2ade6&state=84ad5fb0aeb7ff7b0780c85608c03fa2c93a26
 'werkzeug.server.shutdown': <function shutdown_server at 0x7f5e07dd8b90>,
 'wsgi.errors': <open file '<stderr>', mode 'w' at 0x7f5e0b3e71e0>,
 'wsgi.input': <open file '<socket>', mode 'rb' at 0x7f5e08885f60>,
 'wsgi.multiprocess': False,
 'wsgi.multithread': False,
 'wsgi.run_once': False,
 'wsgi.url_scheme': 'http',
 'wsgi.version': (1, 0)}
```

Authorization Response unpacked

Parameters

Parameter	Current Value
code	9f42b9be9f37a3d2ade6
state	84ad5fb0aeb7ff7b0780c85608c03fa2c93a2658d1c9c466ed7b9909b461b52e



Access Token Request

Authorization Server

Token endpoint: https://github.com/login/oauth/access_token

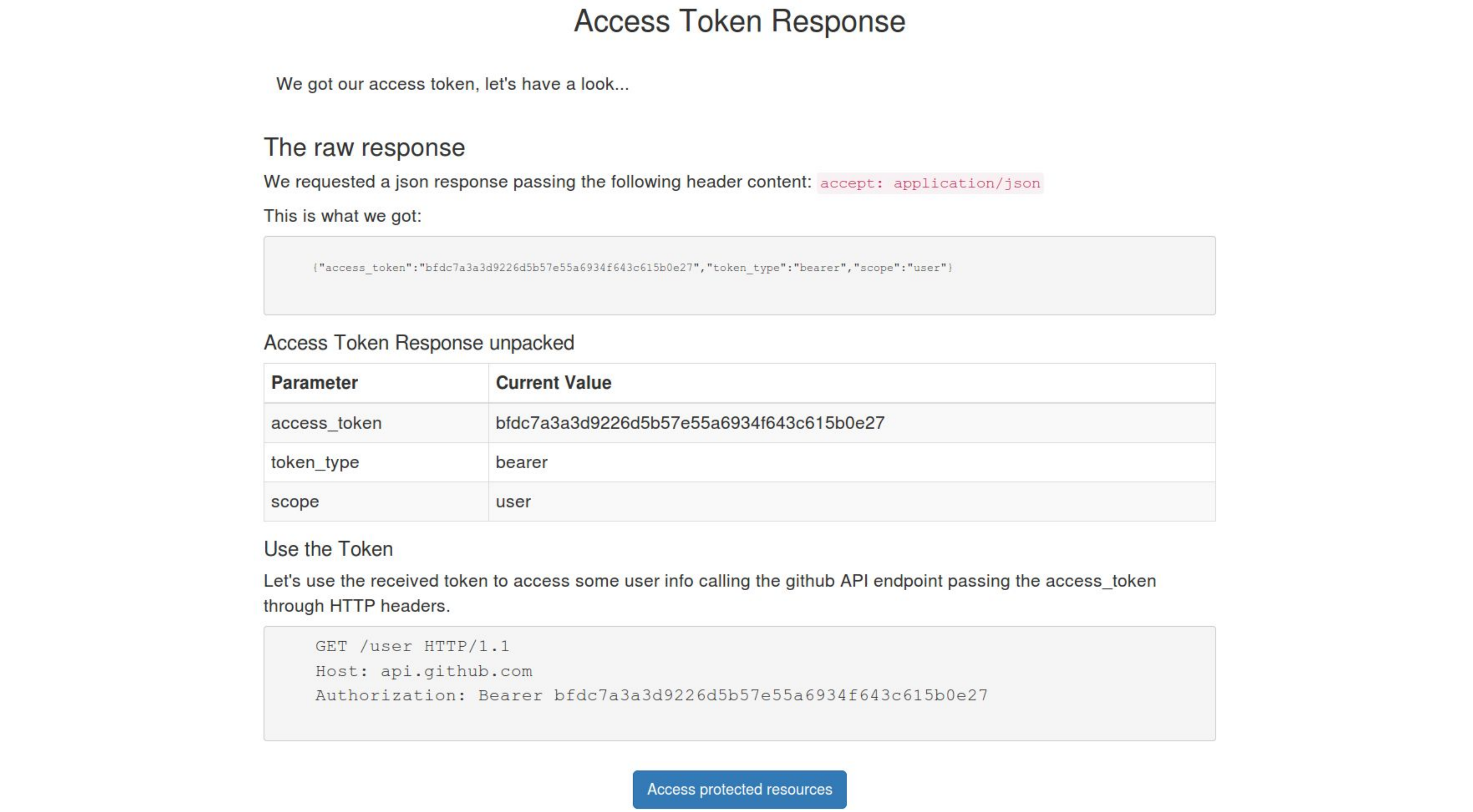
Parameters

Parameter	Current Value
grant_type	authorization_code
code	9f42b9be9f37a3d2ade6
state	84ad5fb0aeb7ff7b0780c85608c03fa2c93a2658d1c9c466ed7b9909b461b52e
client_id	92c7c261f4c1d0a283a6
client_secret	dea3756a34aaf54850f569e0f82e6e040d915be0
redirect_uri	http://oauth2client.authnzi.org:9000/cb

Full Token request

```
    POST https://github.com/login/oauth/access_token

    grant_type=authorization_code
    code=9f42b9be9f37a3d2ade6
    state=84ad5fb0aeb7ff7b0780c85608c03fa2c93a2658d1c9c466ed7b9909b461b52e
    client_id=92c7c261f4c1d0a283a6
    client_secret=dea3756a34aaf54850f569e0f82e6e040d915be0
    redirect_uri=http://oauth2client.authnzi.org:9000/cb
```



Access Token Response

We got our access token, let's have a look...

The raw response

We requested a json response passing the following header content: `accept: application/json`

This is what we got:

```
{"access_token":"bfdc7a3a3d9226d5b57e55a6934f643c615b0e27","token_type":"bearer","scope":"user"}
```

Access Token Response unpacked

Parameter	Current Value
access_token	bfdc7a3a3d9226d5b57e55a6934f643c615b0e27
token_type	bearer
scope	user

Use the Token

Let's use the received token to access some user info calling the github API endpoint passing the access_token through HTTP headers.

```
GET /user HTTP/1.1
Host: api.github.com
Authorization: Bearer bfdc7a3a3d9226d5b57e55a6934f643c615b0e27
```

```
{
  "login": "oauth2-exampleclient",
  "id": 29506477,
  "avatar_url": "https:\/\/avatars1.githubusercontent.com\/u\/29506477?v=3",
  "gravatar_id": "",
  "url": "https:\/\/api.github.com\/users\/oauth2-exampleclient",
  "html_url": "https:\/\/github.com\/oauth2-exampleclient",
  "followers_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/followers",
  "following_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/following{\/other_user}",
  "gists_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/gists{\/gist_id}",
  "starred_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/starred{\/owner}{\/repo}",
  "subscriptions_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/subscriptions",
  "organizations_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/orgs",
  "repos_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/repos",
  "events_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/events{\/privacy}",
  "received_events_url": "https:\/\/api.github.com\/users\/oauth2-exampleclient\/received_events",
  "type": "User",
  "site_admin": false,
  "name": null,
  "company": null,
  "blog": "",
  "location": null,
  "email": null,
  "hireable": null,
  "bio": null,
  "public_repos": 0,
  "public_gists": 0,
  "followers": 0,
  "following": 0,
  "created_at": "2017-06-17T15:35:35Z",
  "updated_at": "2017-06-19T09:30:40Z",
  "private_gists": 0,
  "total_private_repos": 0,
  "owned_private_repos": 0,
  "disk_usage": 0,
  "collaborators": 0,
  "two_factor_authentication": false,
  "plan": {
    "name": "free",
    "space": 976562499,
    "collaborators": 0,
    "private_repos": 0
  }
}
```

Summary

In order to use the OAuth2 Authorization code flow:

- register a Client (indicating the Redirection endpoint), obtain a client_id & client_secret
- issue an authorization request to the Authorization Endpoint by redirecting the user browser
- parse the Authorization Server request to the Client Redirection Endpoint and extract the authorization code
- issue an access token request to the Token Endpoint sending the authorization code
- parse the response to extract the access token
- use the access token on the Resource Server

Q&A

Thanks for your attention!