Fetch, Axios & Web Services

Which one?

Axios (npm library)

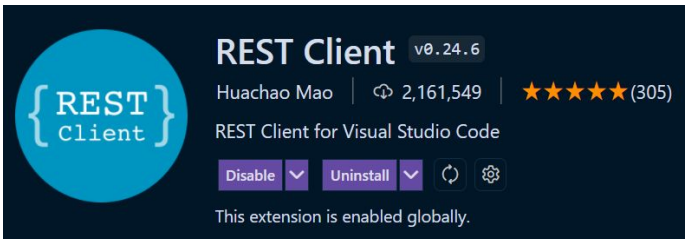
Fetch (browser built-in)

node-fetch (npm lib)

Topics

- Browser fetch() function
- NodeJS axios library
- Sending HTTP GET Requests
- Handling HTTP Responses
- Sending HTTP POST Request

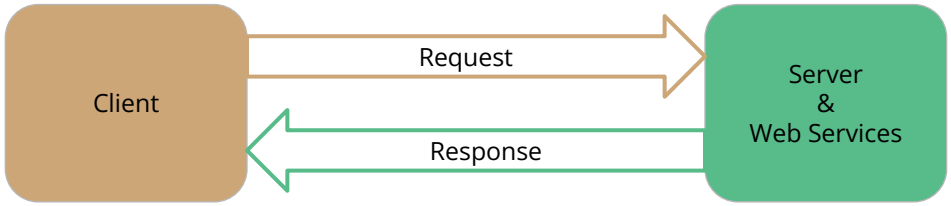
Recommended Tools/Extensions



VSCode Extension

Browser Extension

HTTP Request & Response



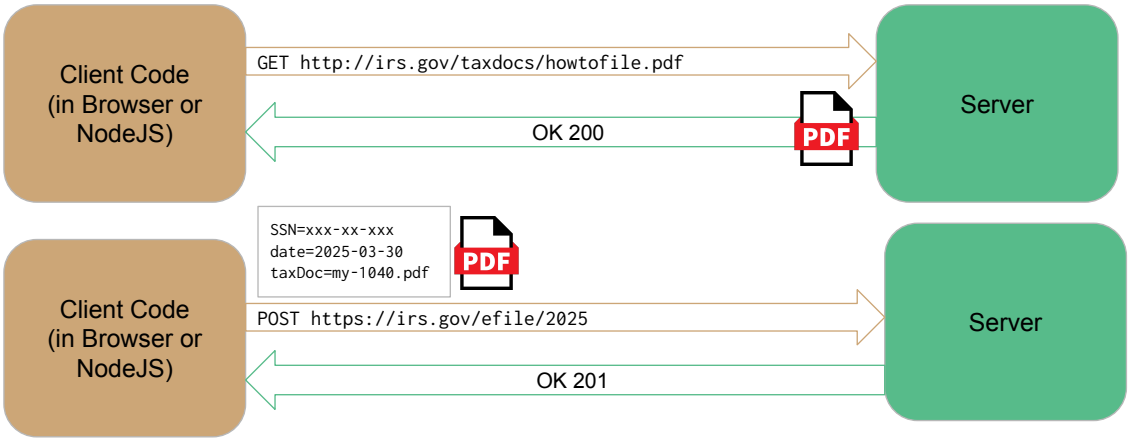
HyperText: *payload in response can be contents in **any** format (CSS, HTML, JPG, JS, JSON, PDF, PNG, ZIP, ...)*

Basic Use

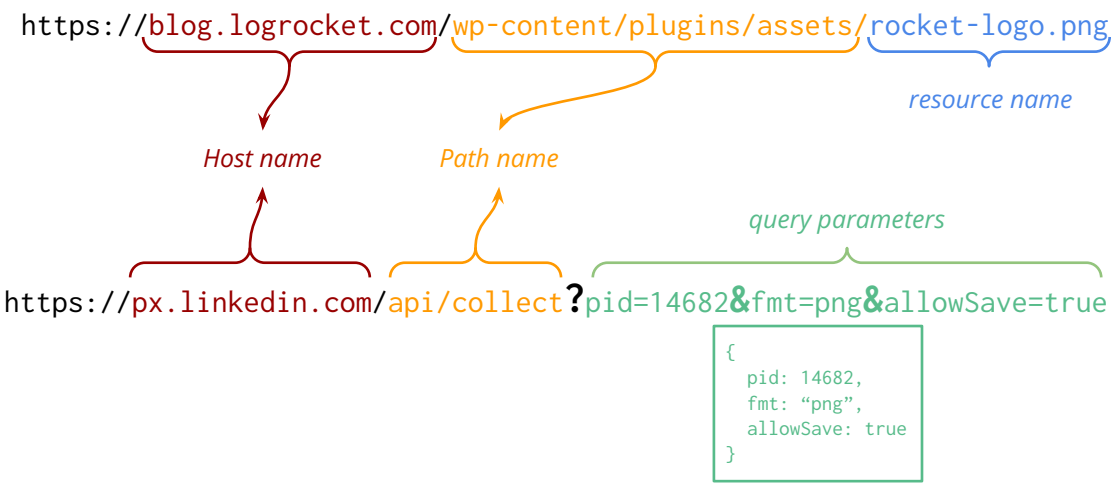
```
fetch("http://some.website.org")
  .then((r:Response) => {
     //
     // Process the response
     // from the server here
     //
   })
  .catch((e:any) => {
     //
     // Handle potential
     // errors here
     //
   });
```

```
import axios, {AxiosResponse} from "axios";

axios.get("http://some.website.org")
  .then((r:AxiosResponse) => {
     //
     // Process the response
     // from the server here
     //
   })
  .catch((e:any) => {
     // Handle potential
     // errors here
   });
```

HTTP Methods: GET versus POST



URL components



Part A: Sending HTTP GET Requests

Using axios

```
# In a new folder/directory
npm init -y

npm install axios

# Add Axios type declaration file
npm install -D @types/axios

# Add other libs
npm install -D ts-node typescript

# Initialize tsconfig.json
npx tsc --init

npx ts-node my-first-axios.ts
```

```
// In my-first-axios.ts (Option #1)
import axios, {AxiosResponse} from "axios"
axios.get("http://info.cern.ch")
  .then((resp: AxiosResponse) => {
    console.log(resp.headers);
    return resp.data;
  })
  .then((whatsInIt: any) => {
    console.log(whatsInIt);
  });
```

```
// In my-first-axios.ts (Option #2)
import axios, {AxiosResponse} from "axios"
axios.get("http://info.cern.ch")
  .then((resp: AxiosResponse) => resp.data)
  .then((whatsInIt: any) => {
    console.log(whatsInIt);
  });
```

Live Demo
NodeJS & Web DevTools => Network

Example of Web Services

- Random Users
  - Documentation: https://randomuser.me/documentation
  - Service Endpoint https://randomuser.me/api
- Random Quotes
  - Documentation: https://github.com/lukePeavey/quotable
  - Service Endpoint: https://api.quotables.io
- A gazillion more Web Services: https://github.com/public-apis/public-apis
  - Pick ones that allow CORS

Example #1: Random User

Browser https://randomuser.me/api

```
type RandUserData = {
  results: Array<RandomUser>;
  info: any
}

type RandomUser = {
  name: {
    title: string;
    first: string;
    last: string;
  },
  email: string
}
```

```
axios.request({
      method: “GET”,
      url: “https://randomuser.me/api”
   })
  .then((resp:AxiosResponse) => rest.data)
  .then((incoming: RandUserData) => {
    console.log(incoming.info);
    for (let k = 0; k < incoming.results.length; k++) {
      console.log(incoming.results[k]);
    }
  });
```


VSCode Demo

Example #2: Random Quote

Browser http://api.quotable.io/random

```
type Quote = {
  tags: Array<string>;
  content: string;
  author: string;
  length: number

}
```

```
axios.request({
      method: “GET”,
      url: “http://api.quotable.io/random”
   })
  .then((resp:AxiosResponse) => rest.data)
  .then((q: Quote) => {
    console.log(`${q.content} [${q.author}]`)
  });
```


Example #1: Random User with Query Params

Browser https://randomuser.me/api?results=5&nat=gb,fr&inc=name,email,picture

```
type RandUserData = {
  results: Array<RandomUser>;
  info: any
}

type RandomUser = {
  name: {
    title: string;
    first: string;
    last: string;
  },
  email: string
}
```

```
axios.request({ method: “GET”,
    url: “https://randomuser.me/api”,
    params: {
      results: 5,
      nat: “gb,fr”,
      inc: “name,email,picture”
    }
   })
  .then((resp:AxiosResponse) => rest.data)
  .then((incoming: RandUserData) => {
    console.log(incoming.info);
    for (let k = 0; k < incoming.results.length; k++) {
      console.log(incoming.results[k]);
    }
  });
```

Example #3: Random Quotes with Query params

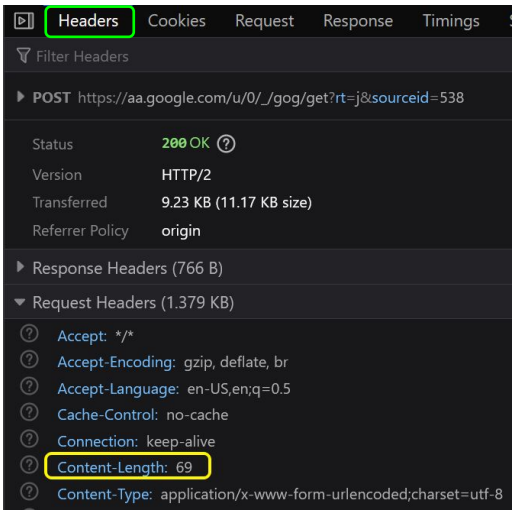
Browser http://api.quotable.io/quotes?limit=3

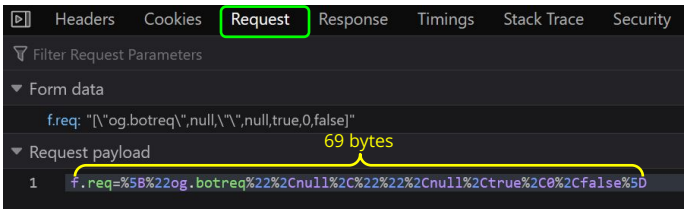
```
type QuoteResponse = {
  count: number,
  results: Array<Quote>
}

type Quote = {
  tags: Array<string>;
  content: string;
  author: string;
  length: number

}
```

```
axios.request({
      method: “GET”,
      url: “http://api.quotable.io/quotes”,
      params: {
        limit: 3
      }
   })
  .then((resp:AxiosResponse) => rest.data)
  .then((qr: QuoteResponse) => {
    console.log(qr.count)
    for (let q of qr.results) {
      console.log(q);
    }
  });
```


Part B: Sending HTTP POST requests (“Email” with attachments)

Example: HTTP POST Request + Data Payload





Important options for POST

```
const options = {
  method: "POST",
  url: "https://aa.google.com/u/0/_____",
  data: discussed-in-the-next-few-slides
  headers: {
    "Content-Type": discussed-in-the-next-few-slides
  }
}
axios.request(options)
  .then((r:Response) => { /* your code here */  });
```


HTTP Post Data Payload

- Request must include "Content-Type" header to inform server how to parse/unpack the data payload

Content-Type	Format of Data Payload	When to Use
`application/x-www-form-urlencoded`	Key-value pair, special characters are encoded using ASCII Hex	Multiple **textual** data items of *relatively small size*
`multipart/form-data`	Multiple "documents", delimited by special lines. Binary data are encoded to hex	Multiple **text** or **binary** data items of *larger size* (images, PDF, ….), each item becomes one attachment of your "email"
`application/json`	JSON (converted to text)	Structured textual data
`text/plain`	Any plain text	Unstructured textual data

HTTP POST: Plain Text attachment

```
const myMessage: string = “Hello World\n” +
  “Do you copy?”;

axios.request({
  method: “POST”,
  url: “https://pizza4.me/order”
  headers: {
    “Content-Type”: “text/plain”
  },
  data: myMessage
})
.then((r:Response) => { /* code here */ });
```

Rarely used in practice

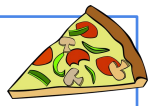
Actual HTTP Request

```
POST /order HTTP 1.1
Host: https://pizza4.me
Content-Type: text/plain
Content-Length: 24

Hello World
Do you copy?
```


VSCode Demo

HTTP POST: JSON data attachment

```
const pizzaOrder = {
  size: 8,
  crust: “thin”,
  toppings: [“cheese”, “green pepper”, “ham”],
  extraCheese: true
}

axios.request({
  method: “POST”,
  url: “https://pizza4.me/order”,
  headers: {
    “Content-Type”: “application/json”
  },
  data: JSON.stringify(pizzaOrder)
})
.then((r:Response) => { /* code here */ });
```



- *Use JSON.stringify() to convert a JS/TS object to its string representation*
- *The data is delivered as plain/text*

Actual HTTP Request

```
POST /order HTTP/1.1
Host: https://pizza4.me
Content-Type: application/json
Content-Length: 89

{“size”:8,”crust”:”thin”,”toppings”
:[“cheese”,”green pepper”,”ham”],
“extraCheese”:true}
```


HTTP POST: application/x-www-form-urlencoded

```
const payload = new URLSearchParams();
payload.append(“size”, “8”);      // must be a string
payload.append(“crust”, “thin”);
payload.append(“extraCheese”, “true”);
const toppings = [“cheese”, “green pepper”, “ham”];
for(let k = 0; k < toppings.length; k++) {
  formData.append("toppings[]", t);
  // formData.append(`toppings[${k}]`, t);
}

axios.request({
  method: “POST”,
  url: “https://pizza4.me/order”,
  headers: {
    “Content-Type”: “application/x-www-form-urlencoded”
  },
  data: payload
})
.then((r:Response) => { /* code here */ });
```

Actual HTTP Request

```
POST /order HTTP/1.1
Host: https://pizza4.me
Content-Type: application/x-www-form-urlencoded
Content-Length: 93

size=8&crust=thin&extraCheese=true&toppings[]=ch
eese&toppings[]=green%20pepper&toppings[]=ham
```

Key name for arrays ends with `[]` (empty brackets)

HTTP POST: multipart/form-data

```
import * as FormData from “form-data”;
const payload = new FormData();
payload.append(“size”, 8);
payload.append(“crust”, “thin”);
toppings = [“cheese”, “green pepper”, “ham”]
toppings.forEach((t) => {
  payload.append("toppings[]", t);
});

axios.request({
  method: “POST”,
  url: “https://pizza4.me/order”,
  headers: payload.getHeaders(),
  data: payload
})
.then((r:Response) => { /* code here */ });
```

- *Use this for sending multiple data which can be expressed as key-value pairs of significantly large size*
- *Each data item can be text or binary (a **Blob** object in the Web API doc)*
- *The HTTP protocol enforces a limit on the maximum message size. A huge payload must be split into smaller chunks*

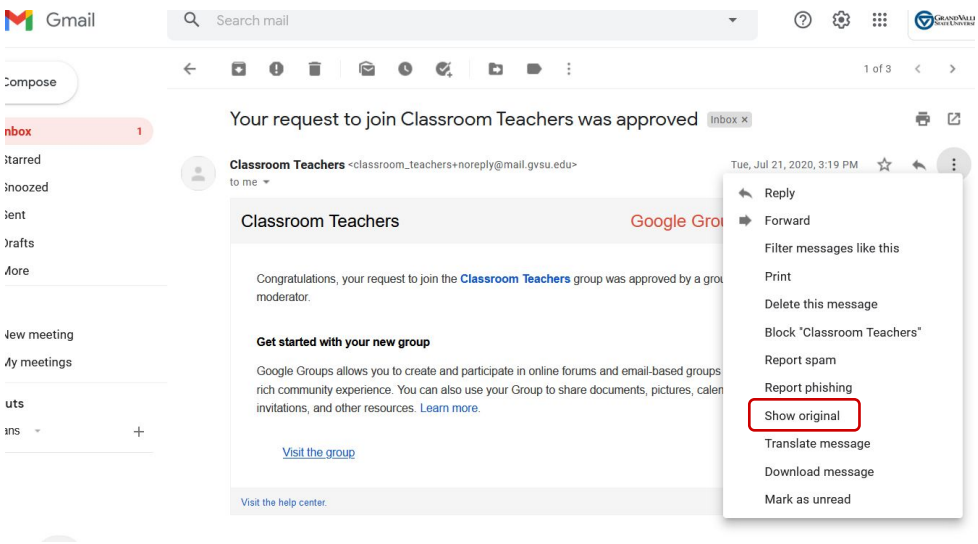
Actual HTTP Request

```
POST /order HTTP/1.1
Host: https://pizza4.me
Content-Type: multipart/form-data; boundary=letseatpizza
Content-Length: xxxx

--letseatpizza
Content-Disposition: form-data; name=”size”
Content-type: text/plain

8
--letseatpizza
Content-Disposition: form-data; name=”toppings[]”

cheese
--letseatpizza
Content-Disposition: form-data; name=”toppings[]”

green pepper
--letseatpizza
Content-Disposition: form-data; name=”extraCheese”

true
--letseatpizza--
```

- *The boundary text (“letseatpizza” in example) will be auto generated by the utility you use*
- *Each part may include more headers.*
- *Parts with binary data will include Content-Type header with proper value (such as “image/jpeg”) to inform the server how to unpack each part*

Try this

For a real example of a multipart message, open a message that has attachments in GMail and select “Show Original”

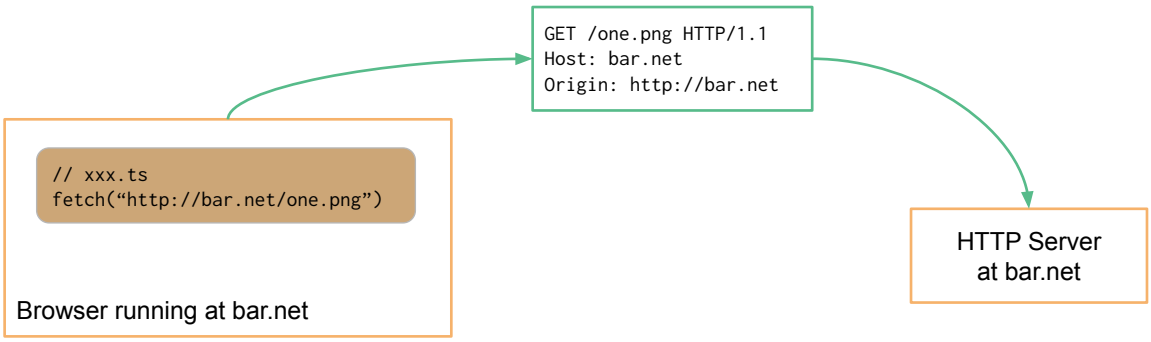


Security Issues

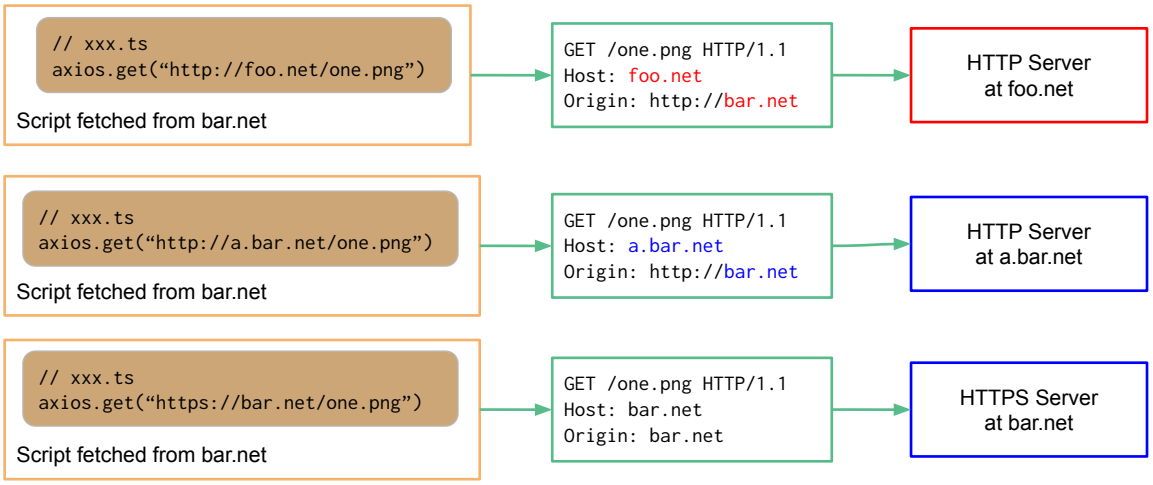
Browser Same-Origin Policy

- Scripts loaded from http://some.domain.net are allowed to fetch resources from http://some.domain.net
- Scripts loaded from http://some.domain.net are NOT automatically allowed to fetch from (cross-origin)
  - https://some.domain.net (different protocol)
  - http://some.domain.org (different domain)
  - http://some.other-name.net (different domain)
  - http://some.domain.net:9000 (different port)
- Cross-origin requests require *special handling by the server*!

Same Origin



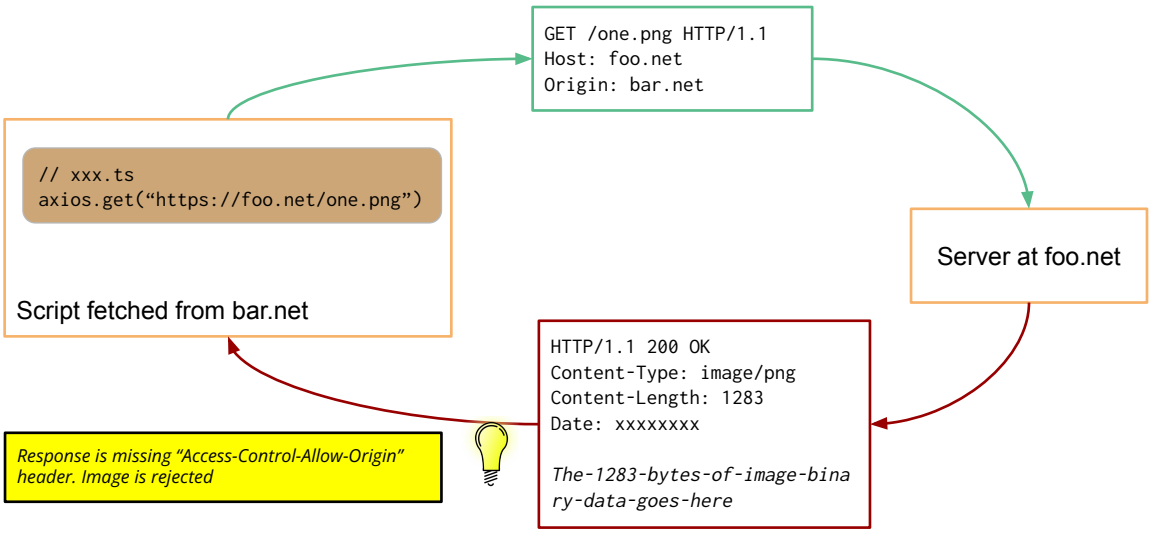
Different Origin (Cross Origin)



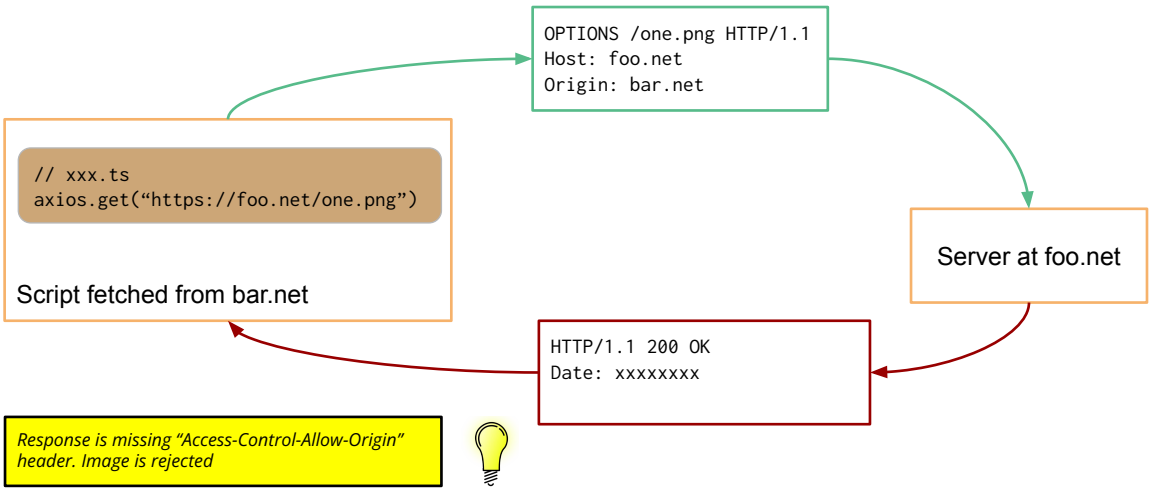
CORS (Cross-Origin Resource Sharing)

- New(er) spec to allow **browsers** "break" the **same-origin** policy
- Typical Client/Server negotiation sequence:
  - Client: send an HTTP OPTION query that include the following header lines
    - "`Origin`" and "`Access-Control-Request-Method`"
  - Server: responds with the following header lines
    - `Access-Control-Allow-Origin`
    - `Access-Control-Allow-Methods`

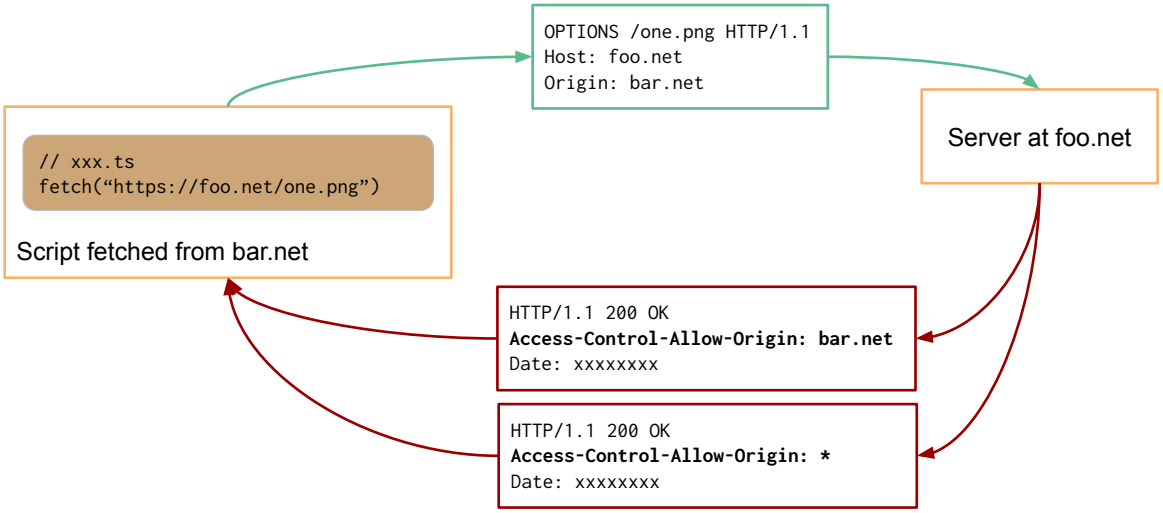
CORS: Rejected Response (Simplified)



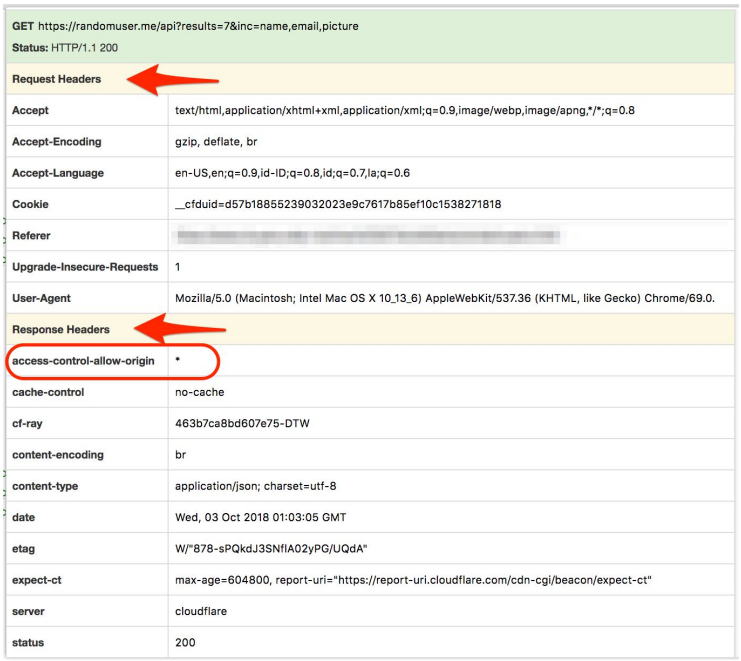
CORS: Rejected Response (Actual Message Types)



CORS: Accepted Response



WebDevTools Network: CORS



GET https://randomuser.me/api?results=7&inc=name,email,picture Status: HTTP/1.1 200	
Request Headers	
Accept	text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8
Accept-Encoding	gzip, deflate, br
Accept-Language	en-US,en;q=0.9,id-ID;q=0.8,id;q=0.7,la;q=0.6
Cookie	__cfduid=d57b18855239032023e9c7617b85ef10c1538271818
Referer	
Upgrade-Insecure-Requests	1
User-Agent	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_6) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/69.0.
Response Headers	
access-control-allow-origin	*
cache-control	no-cache
cf-ray	463b7ca8bd607e75-DTW
content-encoding	br
content-type	application/json; charset=utf-8
date	Wed, 03 Oct 2018 01:03:05 GMT
etag	W/"878-sPQkdJ3SNfIA02yPG/UQdA"
expect-ct	max-age=604800, report-uri="https://report-uri.cloudflare.com/cdn-cgi/beacon/expect-ct"
server	cloudflare
status	200

Solving CORS issue

1. Change the server settings to enable CORS (*only possible if you are the admin of that server*)
2. Access the service via a middleware
   a. Your script (in the browser) sends the request to a middleware (running on the same host where keep the script)
   b. The middleware then sends the actual request to the actual server

   This strategy tricks the Browser as if the responses are coming from the middleware running on the same host
3. Using a third-party Proxy server (in place of your own middleware)