

# Web Developer

Programmazione - Javascript e Typescript

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# JSON and AJAX

Dynamic Content

Shadi Lahham - Web development

# JSON

JSON è un formato leggero per lo scambio di dati, sviluppato da Douglas Crockford nel 2001 per sostituire XML.

JSON è solo un contenitore di dati, non verrà MAI eseguito, non è questo il suo scopo

# Javascript Object Notation

un file JSON possiede un elenco di elementi come se fosse un array

- Lightweight data-interchange format
  - Douglas Crockford in 2001 to replace XML
  - Easy to read and write for humans,
  - Easy to parse and generate for machines
- Has two structures
  - **Collection of name:value pairs**. In different languages, realized as an object, record, struct, dictionary, hash table, etc.
  - **Ordered list of values**. In most languages, realized **as an array**, vector, list, or sequence
- **JSON vs Javascript objects**
  - Keys must be stored with quotes
  - Values can be number, string, boolean, array, object, null
- **Validate your JSON**
  - Use [JSONLint](#) or [jsonlint CLI](#).

JSON può rappresentare un oggetto una struttura, o può essere anche un elenco di singoli dati (come se fosse un array in JS)

# Storing data in JSON

```
{  
  "firstName": "Jane",  
  "lastName": "Smith",  
  "address": {  
    "streetAddress": "425 2nd Street",  
    "city": "San Francisco",  
    "state": "CA",  
    "postalCode": 94107  
  },  
  "phoneNumbers": [  
    "212 732-1234",  
    "646 123-4567" ]  
}
```

DIFFERENZA tra oggetto JSON e oggetto JS

bisogna mettere le doppie virgolette ANCHE NELLA CHIAVE " ", e anche ovviamente il valore delle chiavi, se mettiamo però anche su JS le "" nella chiave, JS non si lamenta e funziona normalmente

# JSON vs a Javascript object

```
{  
  "firstName": "Jane",  
  "lastName": "Smith",  
  "address": {  
    "streetAddress": "425 2nd Street",  
    "city": "San Francisco",  
    "state": "CA",  
    "postalCode": 94107  
  },  
  "phoneNumbers": [  
    "212 732-1234",  
    "646 123-4567" ]  
}
```

```
let person = {  
  firstName: 'Jane',  
  lastName: 'Smith',  
  address: {  
    streetAddress: '425 2nd Street',  
    city: 'San Francisco',  
    state: 'CA',  
    postalCode: 94107  
  },  
  phoneNumbers: [ '212 732-1234', '646  
123-4567' ]  
};
```

# Common JSON mistakes

```
{  
  name: "John",           // mistake: property name without quotes  
  "surname": 'Smith',     // mistake: single quotes in value (must be double)  
  'isAdmin': false,       // mistake: single quotes in key (must be double)  
  "birthday": new Date(2000, 2, 3), // mistake: no "new" is allowed, only bare values  
  "friends": [0,1,2,3],   // here all fine  
  "age": 25               // mistake: missing comma  
  "profession": "tester", // mistake: trailing comma  
}
```

su JSON è vietato:

1. non mettere le virgolette "" nella chiave
2. usare le singole quotes '
3. non usare dei valori puri come new
4. non mettere la , dopo un'altra chiave
5. inserire la virgola all'ultima chiave

## Note

Comments are not allowed in a JSON file

The above example is just to illustrate possible errors in a JSON file

# JSON array

```
[  
  {  
    "name": "John Smith",  
    "email": "john.smith@example.com"  
  },  
  {  
    "name": "David Jones",  
    "email": "david.jones@example.com"  
  }  
]
```



# Writing a JSON to the DOM

```
// assuming we get a profile from an external source
//
// myProfile
//
// {
//   "firstName": "Liz",
//   "lastName": "Howard",
//   "cats": [ "Tribbles", "Jean Claws" ]
// }
```

```
let p = document.createElement('p');
p.innerHTML = 'My name is ' + myProfile.firstName + ' ' + myProfile.lastName + '.';
p.innerHTML += 'My cats are ' + myProfile.cats.join(', ') + '.';
```

# JSON methods

JavaScript provides these two methods:

- `JSON.stringify` to convert objects into JSON
- `JSON.parse` to convert JSON back into an object

è utile farlo magari per inviare degli oggetti nel mio linguaggio e lo trasformo in una stringa per passarlo magari ad un altro linguaggio che lo riconverte in un oggetto nel linguaggio ex: di backend come JAVA

# JSON.stringify();

```
let student = {  
  name: 'John',  
  age: 30,  
  isAdmin: false,  
  courses: ['html', 'css', 'js'],  
  wife: null  
};
```

```
let json = JSON.stringify(student);  
console.log(typeof json); // a string!  
console.log(json);
```

si usa mettendo come `parametro` il nostro oggetto di JS,  
trasformandolo in un formato leggibile da JSON

risultato di come diventa l'oggetto di JS convertito in stringa su JSON

**Resultant JSON-encoded object**

```
{  
  "name": "John",  
  "age": 30,  
  "isAdmin": false,  
  "courses": ["html", "css", "js"],  
  "wife": null  
}
```

# JSON.parse();

`.parse()` -> riceve il `parametro` di tipo `STRING` che rappresenta un JSON (quindi deve essere un JSON valido!), che produce un valore che rappresenta quel JSON in JS

```
let user = '{ "name": "John", "age": 35, "isAdmin": false, "friends": [0,1,2,3] }';
```

```
user = JSON.parse(user);
```

```
console.log(user.friends[1]); // 1
```

## Note

The `parse()` method can potentially throw errors that need to be handled

# AJAX

## Asynchronous JavaScript and 'XML'

permette di aggiornare parti di una pagina web senza ricaricarla completamente rimandando da parte del server dei pezzi della pagina già inviati (inutili), inviando e ricevendo dati che richiediamo da aggiungere alla pagina, in modo asincrono.

# Request & response

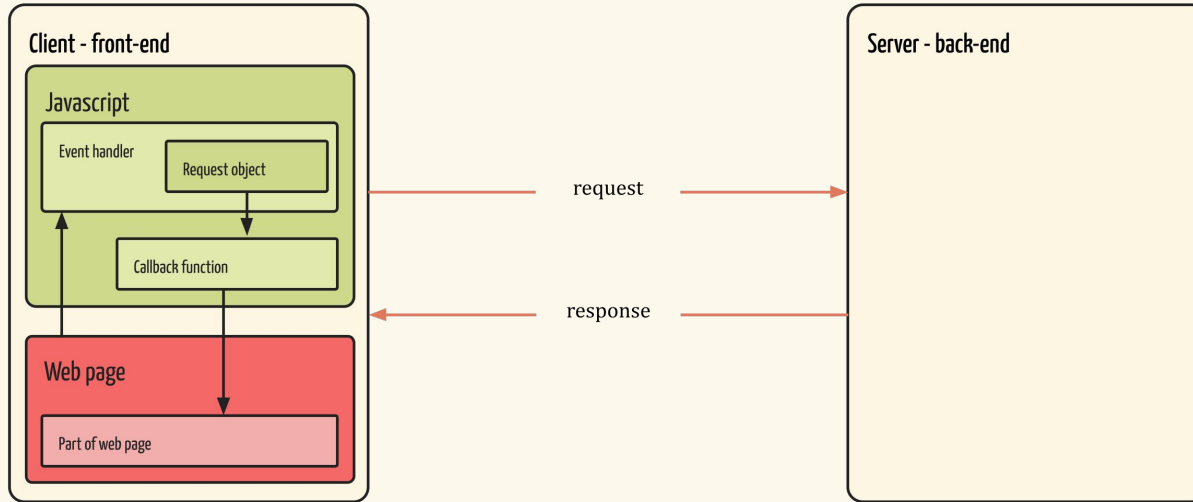
Con AJAX, è possibile inviare e ricevere dati dal server in modo asincrono, ovvero senza interrompere l'interazione con la pagina web.

1. An event occurs in a web page, e.g. the page is loaded or a button is clicked
2. An XMLHttpRequest object is created by JavaScript
3. The XMLHttpRequest object sends a request to a web server
4. The server processes the request
5. The server sends a response back to the web page
6. The response is read by JavaScript
7. Proper action, such as a page update, is performed by JavaScript

# Request & response

API --> application program interface

## Client server interaction



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# An XMLHttpRequest

PAY LOAD è il meccanismo che permette di inviare il dato che voglio inviare

```
// instantiate a new request
const request = new XMLHttpRequest();
const endpoint = 'https://fakeapi.example.com/data';
```

L'endpoint è l'URL del server a cui vogliamo inviare la richiesta.

```
// add event listeners
request.addEventListener('load', function () {
  // transform a string into a usable object
  console.log(JSON.parse(request.responseText));
});
```

```
// prepare the request
request.open('GET', endpoint, true); // third parameter makes an asynchronous request (default)
request.setRequestHeader('Content-type', 'application/json'); // not needed for GET requests
```

```
// send the request
request.send();
```

open --> inizializza la richiesta.

'GET' --> è il metodo HTTP utilizzato per richiedere dati dal server.

endpoint --> è l'URL a cui inviare la richiesta.

true --> rende la richiesta asincrona (non blocca il resto del codice mentre attende la risposta).

Imposta l'intestazione HTTP per la richiesta.

Content-type --> application/json specifica che il contenuto che ci aspettiamo è in formato JSON.

Nota --> Questa intestazione non è necessaria per le richieste GET, ma è comunemente usata per le richieste POST o PUT quando si invia JSON al server.



# HTTP verbs & CRUD operations vengono detti verbi

HTTP Verb	Action	CRUD
richiediamo delle risorse <b>GET</b>	Requests data from a specified resource	<b>Read</b>
dichiariamo di creare una risorsa <b>POST</b>	Submits data to be processed to create a new resource	<b>Create</b>
aggiorniamo una risorsa già esistente <b>PUT</b>	Uploads data to update an entire resource	<b>Update</b>
eliminiamo la risorsa specificata <b>DELETE</b>	Deletes the specified resource	<b>Delete</b>

## Other HTTP verbs

HEAD, TRACE, OPTIONS, CONNECT, PATCH

# HTTP verbs & CRUD operations

**HTTP verbs** utilizzati per specificare il tipo di azione da eseguire su una risorsa durante una richiesta HTTP

- used to specify the type of action to be performed on a resource when making requests over HTTP - Hypertext Transfer Protocol
- integral to the principles of REST - Representational State Transfer

## CRUD operations

- correspond to basic actions that can be performed on data
  - Create, Read, Update, Delete

corrispondono alle azioni di base che possono essere eseguite sui dati. L'acronimo CRUD sta per:

- Create (Crea): Operazione di creazione di una nuova risorsa.
- Read (Leggi): Operazione di lettura di una risorsa esistente.
- Update (Aggiorna): Operazione di aggiornamento di una risorsa esistente.
- Delete (Elimina): Operazione di eliminazione di una risorsa esistente.

# Request events

le diverse tipologie di eventi a cui possiamo agganciare un eventlistener ALLA RICHIESTA, che contiene un event handler (che scatta quando viene invocato il listener)

## **loadstart**

fires when the process of loading data has begun. This event always fires first

## **progress**

fires multiple times as data is being loaded, giving access to intermediate data

## **error**

fires when loading has failed

## **abort**

fires when data loading has been canceled by calling abort()

## **load**

fires only when all data has been successfully read

# Request events

## **loadend**

fires when the object has finished transferring data  
always fires and will always fire after error, abort, or load

copre + casi visti precedentemente (finally)

## **timeout**

fires when progression is terminated due to preset time expiring è deciso dal browser

## **readystatechange**

fires when the readyState attribute of a document has changed

quando viene cambiato l'oggetto della richiesta, passa da una fase ad un'altra

# A request using onLoad

SHORTCUT per event listener con richiesta di LOAD

```
// instantiate a new request
const request = new XMLHttpRequest();
const endpoint = 'https://fake.service.com/username?id=some-unique-id';

// prepare the request
request.open('GET', endpoint);

// shortcut for addEventListener with 'load' event
request.onload = function () {
  if (request.status === 200) {    200 risposta andata a buon fine!
    console.log("User's name is " + request.responseText);
  } else {
    console.log('Request failed. Returned status of ' + request.status);
  }
};

// send the request
request.send();
```

# A request using readyState

```
const request = new XMLHttpRequest();
const method = 'GET';
const endpoint = 'https://developer.mozilla.org/';

request.open(method, endpoint);

request.onreadystatechange = function () {
  if (request.readyState === XMLHttpRequest.DONE && request.status === 200) {
    console.log(request.responseText);
  }
};

request.send();
```

# XMLHttpRequest.readyState values

sono gli stati di risposta della "lettera"

0	UNSENT	Client has been created. open() not called yet.
1	OPENED	open() has been called. <i>stata preparata</i>
2	HEADERS_RECEIVED	send() has been called, and headers and status are available. <i>ricevo i metadati</i>
3	LOADING	Downloading; responseText holds partial data. <i>sta caricando ancora le parti mancanti (in progresso)</i>
4	DONE	The operation is complete. <i>la risposta è arrivata tutta</i>

You can use them as constants e.g. `XMLHttpRequest.DONE`

# HTTP Status Messages

To check the status use `XMLHttpRequest.status` and `XMLHttpRequest.statusText`

## Categories

1xx: Information

2xx: Successful

3xx: Redirection

4xx: Client Error *il problema è l'utente mio*

5xx: Server Error *il problema non è dell'utente, ma della sede diciamo*

## Most common

200 OK *tutto buono ed è autorizzato*

403 Forbidden

404 Not Found

500 Internal Server Error

## Complete list

[HTTP Messages](#) , [HTTP Status Codes](#)



# A PUT request example

```
const request = new XMLHttpRequest();
const endpoint = 'https://fake.service.com/user/1234';
const payload = { name: 'John Smith', age: 34 };

// prepare the request - specifying the content type and encoding
request.open('PUT', endpoint);
request.setRequestHeader('Content-Type', 'application/json;charset=UTF-8');

request.onload = function () {
  // questa è una shortcut ed è DISPONIBILE PER TUTTI GLI EVENTI!
  if (request.status === 200) {
    let userInfo = JSON.parse(request.responseText);
    // NON CAMBIA NULLA DALL'ORIGINALE!
  }
};

request.send(JSON.stringify(payload));
```

## Question

What would we need to change if this were a POST request?

# Content type

MIME -> un valore standard utilizzato per descrivere il tipo di dati contenuti nel corpo di un messaggio HTTP o email. È essenziale per comunicare al server quale tipo di contenuto si sta inviando nella richiesta o quello che si sta RICEVENDO.

Media type (formerly MIME type) - Multipurpose Internet Mail Extensions)

- a standard way of describing a data type in the body of an HTTP message or email
- The MIME type is passed in the Content-Type header

```
request.setRequestHeader('Content-Type', 'application/json;charset=UTF-8');  
request.setRequestHeader('Content-type', 'application/json');
```

`text/plain` for plain text

`text/html` for HTML content

`application/javascript` for JavaScript files

`application/xml` for XML data

`image/jpeg` for JPEG images

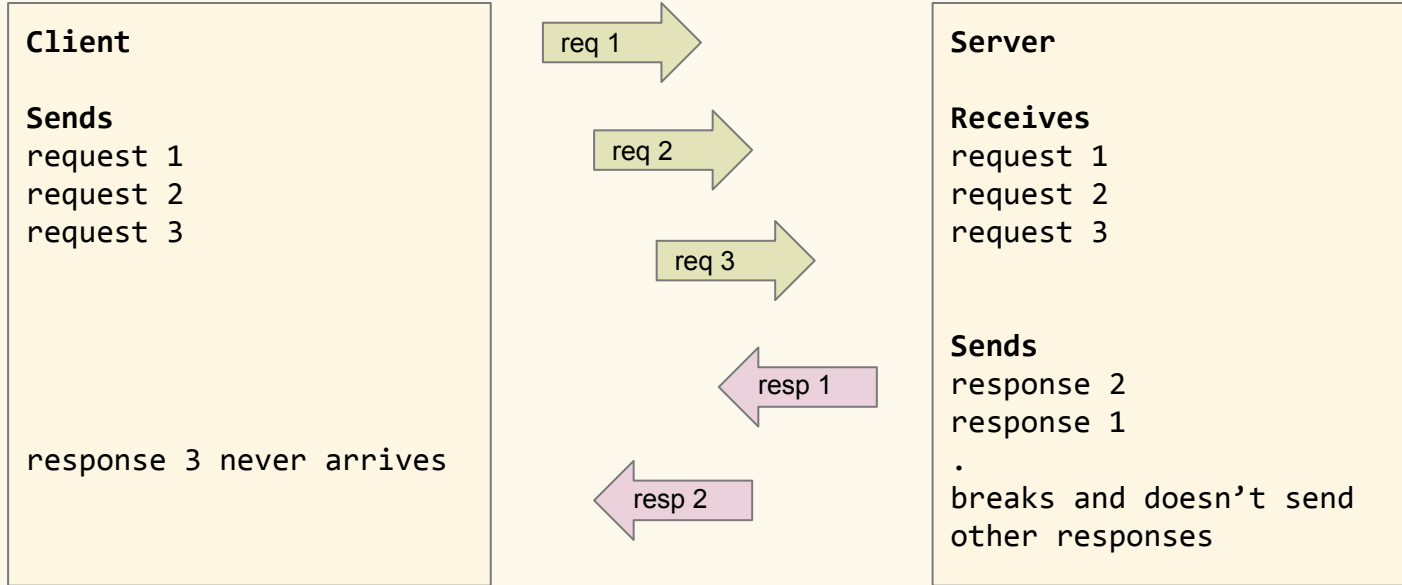
`image/png` for PNG images

`audio/webm` for WebM audio files

`video/mp4` for MP4 video files

[Important MIME types for Web developers](#)

# Request & response order



# Debugging requests

The screenshot shows the Chrome DevTools Network tab. The top bar includes tabs for Elements, Console, Sources, Network (selected), Performance, Memory, Application, Security, Lighthouse, Recorder, and Performance insights. Below the tabs are icons for recording, pausing, and filtering, along with checkboxes for 'Preserve log', 'Disable cache', and 'No throttling'. A filter input field is set to 'Filter'. Below the filter are checkboxes for 'Invert', 'Hide data URLs', and 'Hide extension URLs'. A row of filter buttons includes 'All', 'Fetch/XHR' (selected), 'Doc', 'CSS', 'JS', 'Font', 'Img', 'Media', 'Manifest', 'WS', 'Wasm', and 'Other'. The main panel shows a list of requests on the left and details on the right. The selected request is 'edff10bc-bcef-4728-bfbe-b463e106841f'. The details panel shows the 'Headers' tab with 'General' and 'Response Headers' sections. The 'General' section displays: Request URL: https://run.mocky.io/v3/edff10bc-bcef-4728-bfbe-b463e106841f, Request Method: GET, Status Code: 200 OK, Remote Address: 91.208.207.216:443, and Referrer Policy: strict-origin-when-cross-origin. The 'Response Headers' section shows: Access-Control-Allow-Credentials: true, Access-Control-Allow-Methods: GET, Access-Control-Allow-Origin: null, Access-Control-Expose-Headers: \*, and Access-Control-Max-Age: 86400. At the bottom, a status bar shows '2 / 8 requests', '485 B / 1.8 kB transferred', and '105 B / 1'.

Name	Headers	Preview	Response	Initiator	Timing
forbidden-resource					
edff10bc-bcef-4728-bfbe-b463e106841f	<div>▼ General</div> <div>Request URL: https://run.mocky.io/v3/edff10bc-bcef-4728-bfbe-b463e106841f</div> <div>Request Method: GET</div> <div>Status Code: 200 OK</div> <div>Remote Address: 91.208.207.216:443</div> <div>Referrer Policy: strict-origin-when-cross-origin</div> <div>▼ Response Headers <input type="checkbox"/> Raw</div> <div>Access-Control-Allow-Credentials: true</div> <div>Access-Control-Allow-Methods: GET</div> <div>Access-Control-Allow-Origin: null</div> <div>Access-Control-Expose-Headers: *</div> <div>Access-Control-Max-Age: 86400</div>				

## DevTools

Use to debug all network activity. Filter by Fetch/XHR requests

# Status and error handling

```
const request = new XMLHttpRequest();
request.open('GET', endpoint);
request.onload = function () {
  if (request.status === 200) {
    // do something useful with request
  } else {
    console.error("Request didn't load successfully. Error code:", request.statusText);
  }
};
request.onerror = function () {
  console.error('Network error');
};
request.send(); mandiamo la richiesta http
```

## Notes

Remember to use onprogress to show a loader give users a feedback message

Always handle errors since there is no guarantee that HTTP requests will succeed

# Fetch API

Le Browser API consentono di inviare richieste HTTP dal front-end di un'app web, aggiornando dinamicamente i contenuti senza ricaricare la pagina.

La Fetch API, alternativa moderna all'XMLHttpRequest (XHR), semplifica le richieste HTTP asincrone e supporta risposte in formati come JSON, testo o XML.

# Fetch API

The Browser APIs offer a way to send HTTP requests from the front-end of a web app, enabling live updates of dynamic content without the need to refresh the page

This functionality enables communication with a web server and allows for responses in JSON, plain text, or XML format

The Fetch API, a contemporary substitute for XHR, was introduced in modern browsers to simplify asynchronous HTTP requests

# Fetch API

```
const endpoint = 'https://run.mocky.io/v3/fake';

fetch(endpoint)
  .then(response => {
    if (response.ok) {
      return response.json();
    } else {
      throw new Error('Network response was not ok.');
```

```
    }
  })
  .then(data => {
    // do something with data
    console.log(data);
  })
  .catch(error => {
    console.error('Error fetching data:', error);
  });
```



# Put using Fetch

```
const endpoint = 'https://fake.pipedream.net';

fetch(endpoint, {
  method: 'PUT',
  body: JSON.stringify({ name: 'John', age: 30 }),
  headers: {
    'Content-Type': 'application/json'
  }
})
.then(response => {
  if (!response.ok) {
    throw new Error('Network response was not ok');
  }
  return response.json();
})
.then(data => console.log(data))
.catch(error => console.error('Error making PUT request:', error));
```

Simulating the backend

# JSON blob

tramite JSON blob ci permette di creare degli oggetti JSON e accedere in maniera remota tramite HTTPS request a quel determinato oggetto

JSON blob allows you to create JSON objects online and access them as endpoint via HTTPS requests

<https://jsonblob.com/api#endpoints>

## Important

Read the documentation and experiment with creating a JSON to make sure you understand how it works

# Alternatives

[Mocky](#)

[My JSON Server](#)

[JSONBin.io](#)

[Beeceptor](#)

[Reqres](#)

[JSON Server - requires nodejs](#)

CORS è un meccanismo di sicurezza che controlla come un sito web può richiedere risorse da un dominio diverso dal proprio.

CORS

Cross-origin resource sharing

è essenziale per abilitare la condivisione sicura dei dati tra domini diversi nelle applicazioni web

# CORS

## Same-Origin Policy

Browsers restrict web pages from making requests to different origins as a security measure to prevent malicious attacks

## Cross-Origin Resource Sharing

Allows controlled access to resources from different origins

[CORS on MDN](#)

[CORS on Wikipedia](#)

# Same-origin policy

Requests originating from

`https://store.company.com/dir/page.html`

URL	Outcome	Reason
<code>https://store.company.com/<b>dir2</b>/other.html</code>	success	
<code>https://store.company.com/<b>dir/inner</b>/other.html</code>	success	
<code><b>http</b>://store.company.com/not-secure.html</code>	failure	Different protocol
<code>https://store.company.com:<b>81</b>/dir/other.html</code>	failure	Different port
<code>https://<b>news</b>.company.com/dir/other.html</code>	failure	Different host

# Preflight

## Preflight Requests

Before making an request, the browser makes an OPTIONS request to check if the server allows the actual request

Both XMLHttpRequest and the Fetch API may trigger a preflight request for certain cross-origin requests



# Preflight

Requests that trigger a preflight:

- Requests that use methods other than GET, HEAD, or POST
- Requests that include headers other than the simple headers
  - e.g. Content-Type
- Requests that use certain types of content types
  - e.g. application/json with a custom header

# HTML crossorigin attribute

Specifies CORS usage for resources that are fetched from a different domain than the HTML page

- e.g. images, scripts, fonts

Prevents CORS errors that arise when fetching resources without proper permissions

- browser defaults to same-origin which might lead to CORS issues
- often used when embedding resources from CDNs

Applies to HTML elements like `<audio>`, `<img>`, `<link>`, `<script>`, and `<video>`

```

<link rel="stylesheet" href="styles.css" crossorigin="anonymous">
<script src="script.js" crossorigin="anonymous"></script>
```

[crossorigin](#) | MDN

Your turn

# 1.Factory

- Write car.json, a JSON that represents a car object
  - Make your object complete, having at least one property of the following types
  - Number, String, Boolean, Array, Object, Null
- Write a factory.json that represents a car factory
  - Follow the same rules above
- Transform car.json into cars.json with 5 cars
- Cars should belong to a factory
  - Write two variants of factory.json
  - One that has cars directly embedded in the factory JSON structure
  - Another that uses cars referring to their IDs

## 2.DOM Factory

- Write your cars and factory objects as JSON strings in a variable
- Parse them with `JSON.parse()`;
- Write each of them to the DOM in a list
  - You should use a styled CSS `<ul><li>` list with no bullets
  - Don't use `<table>`

Bonus

### 3.Remote factory

- Use jsonblob to store JSON data about cars and a car factory
- You can use as many blobs as you need. Decide the structure in a way to reduce the amount of data you modify with HTTP requests
- Write an application that displays a factory with a list of cars
- Clicking on each car should display a collapsible panel with more information about the car
- It should be possible to edit the car details
- Save the modified data to jsonblob with an HTTP request
- Whenever data is modified you should reload the new data from jsonblob once the writing has finished

Continues on next page >>>

### 3.Remote factory

- You should handle all error cases in your application. If an HTTP request fails, you should display a message to the user
- Your project should include a folder called 'json' with all the initial json files that you upload to jsonblob (the initial state of your DB)
- Your readme (markdown) should include links to all the jsonblobs that you are using as well as a list of their IDs



## 4.Parallel factory

- Create another version of the factory that uses the same jsonblobs that you created for the previous exercise
- Make sure that each car information is stored in a different jsonblob
- The page should display the list of cars with detailed information about each car directly visible without a collapsible panel
- Make sure that you request all jsonblobs in parallel (at the same time) not in sequence (one after another)
- Show a loader or a loading message while loading and show the list only when data has returned from all jsonblobs and all requests finished
- Make sure that your code handles all **errors**

# References

JSON

[JSON.org](https://www.json.org/)

[JSON Syntax](#)

[JSON.stringify\(\)](#)

[JSON.parse\(\)](#)

# References

[XMLHttpRequest](#)

[XMLHttpRequest.open\(\)](#)

[XMLHttpRequest.send\(\)](#)

[Using XMLHttpRequest](#)

# References

[HTTP Methods GET vs POST](#)

[An introduction to HTTP verbs](#)

[HTTP request methods](#)