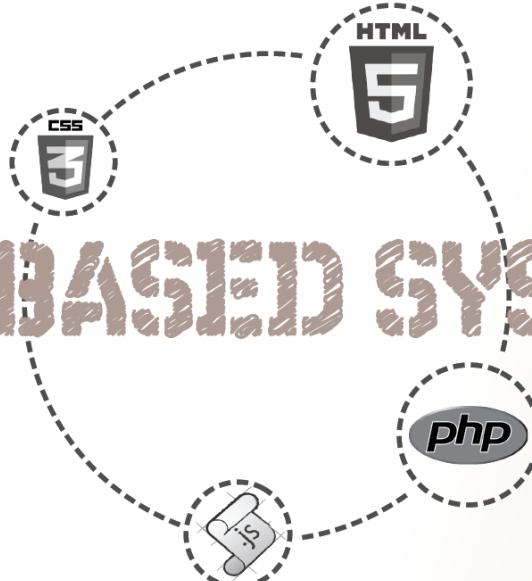


WEB-BASED SYSTEMS

IS 323



>> JavaScript: AJAX

[c] Dr. Mohammed Misbhauddin





Agenda

- Popular data formats transmitted over the web (apart from HTML)
 - **XML**
 - **JSON**
- Focus only on **JSON** format
- Single Page Architecture (SPA) using AJAX
- Example using a Public API



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JSON



JSON: JavaScript Object Notation

- Similar to XML but designed to be **human-readable**
- Uses JavaScript Notation but is **platform independent**
- Text-based Code to create **Objects**
- Used for **serializing & transmitting** structured data over network connection



JSON: JavaScript Object Notation

- Primarily used to transmit data between server and web application
- Web Services and APIs use JSON format to provide public data
- Supported by most modern programming languages
- **Advantages**
 - Easy to read and write JSON
 - Lightweight text based interchange format
 - Language independent



JSON

Top-Level
Delimiter

```
{
```

```
}
```

A **JSON Object** is enclosed between two “curly” brackets

JSON

Declaration

```
{  
    "v1": 1,  
    "v2": "two"  
}
```

Name Value

- Data is in name/value pairs
- Separated by Comma (,)
- Names are always strings (Use double-quotes)
- Values = strings, numbers, boolean, arrays, JSON objects or null

JSON

Declaration

```
{  
  "v1": [1, 2, 3, 4],  
}  
  _____  
  |       |  
  Name   Value as an array  
  _____
```

Square brackets are for arrays

JSON

Declaration

```
{  
  Name  
  "v1": {  
    "a": 2,  
    "b": 3  
  },  
}  
Value as another  
JSON Object
```

Curly brackets are for objects



NOTE

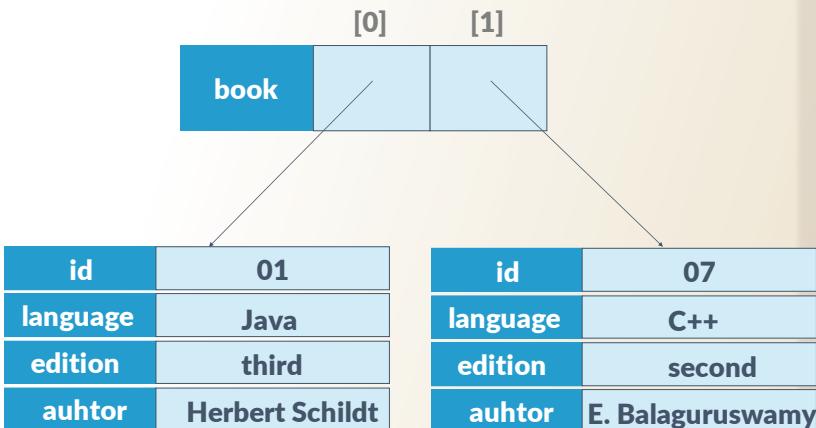
Arrays can include objects as their values

Example on the next slide



```
{  
  "book": [  
    {  
      "id": "01",  
      "language": "Java",  
      "edition": "third",  
      "author": "Herbert Schildt"  
    },  
    {  
      "id": "07",  
      "language": "C++",  
      "edition": "second",  
      "author": "E.Balagurusamy"  
    }  
  ]  
}
```

The JSON Object has an array of Objects called book





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HOW TO USE DATA WITHIN JSON FILE

ASSUME

```
var json_file =
```

```
json_file.book.length
```

```
2
```

```
json_file.book[0].language
```

```
Java
```

```
json_file.book[1].author
```

```
E.Balagurusamy
```

- We use the “.” dot operator
- Same as we did for JS Objects

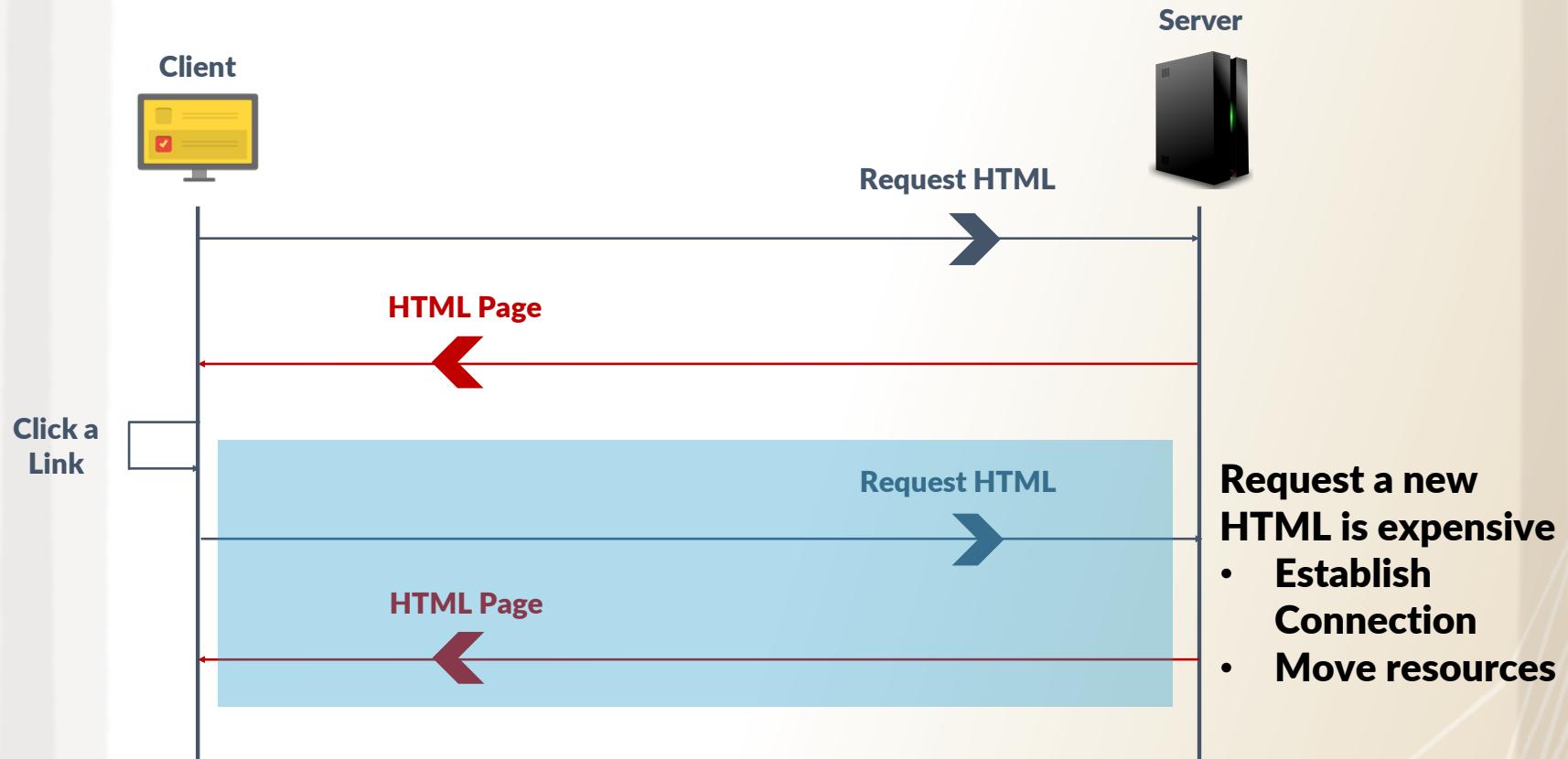
```
{  
  "book": [  
    {  
      "id": "01",  
      "language": "Java",  
      "edition": "third",  
      "author": "Herbert Schildt"  
    },  
    {  
      "id": "07",  
      "language": "C++",  
      "edition": "second",  
      "author": "E.Balagurusamy"  
    }  
  ]  
}
```



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SINGLE PAGE ARCHITECTURE

Traditional Web Architecture



Traditional Web Architecture

- Each Request from the browser requires a complete HTML page
- HTML pages are not alone. They have other dependencies such as
 - CSS for Styles
 - JS for Interaction
 - Font Files
 - Image Files
 - Other Files (If Needed)
- Each Request needs its own Individual Response
- **It becomes unnecessary when some part of the page are the same**

KFU Home Page

السبت ٢٣/٠٢/١٤٤٠ - ١٨/٠٦/٢٠١٩

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EN Q البريد الإلكتروني الادارة العليا اذهب إلى المراكز العلمية والبحثية الإدارات العمادات الكليات

رؤيةنا التميز في التعليم والبحث العلمي والريادة في الشراكة المجتمعية

الخطة الاستراتيجية 2020-2016

VISION 2030 لرئاسة مجلس الوزراء جمهورية المملكة العربية السعودية

السبت ٢٣/٠٢/١٤٤٠ - ١٨/٠٦/٢٠١٩

Same Content

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كلية علوم الحاسوب وتكنولوجيا المعلومات

الكلية كلية علوم الحاسوب وتكنولوجيا المعلومات الرئيسية

التدريب التعاوني إخلاء الطرف الإلكتروني بوابة الخدمات الإلكترونية إعادة تعيين الرمز السري صفحات أعضاء هيئة التدريس البريد الإلكتروني

السبت ٢٣/٠٢/١٤٤٠ - ١٨/٠٦/٢٠١٩

CCSIT Page



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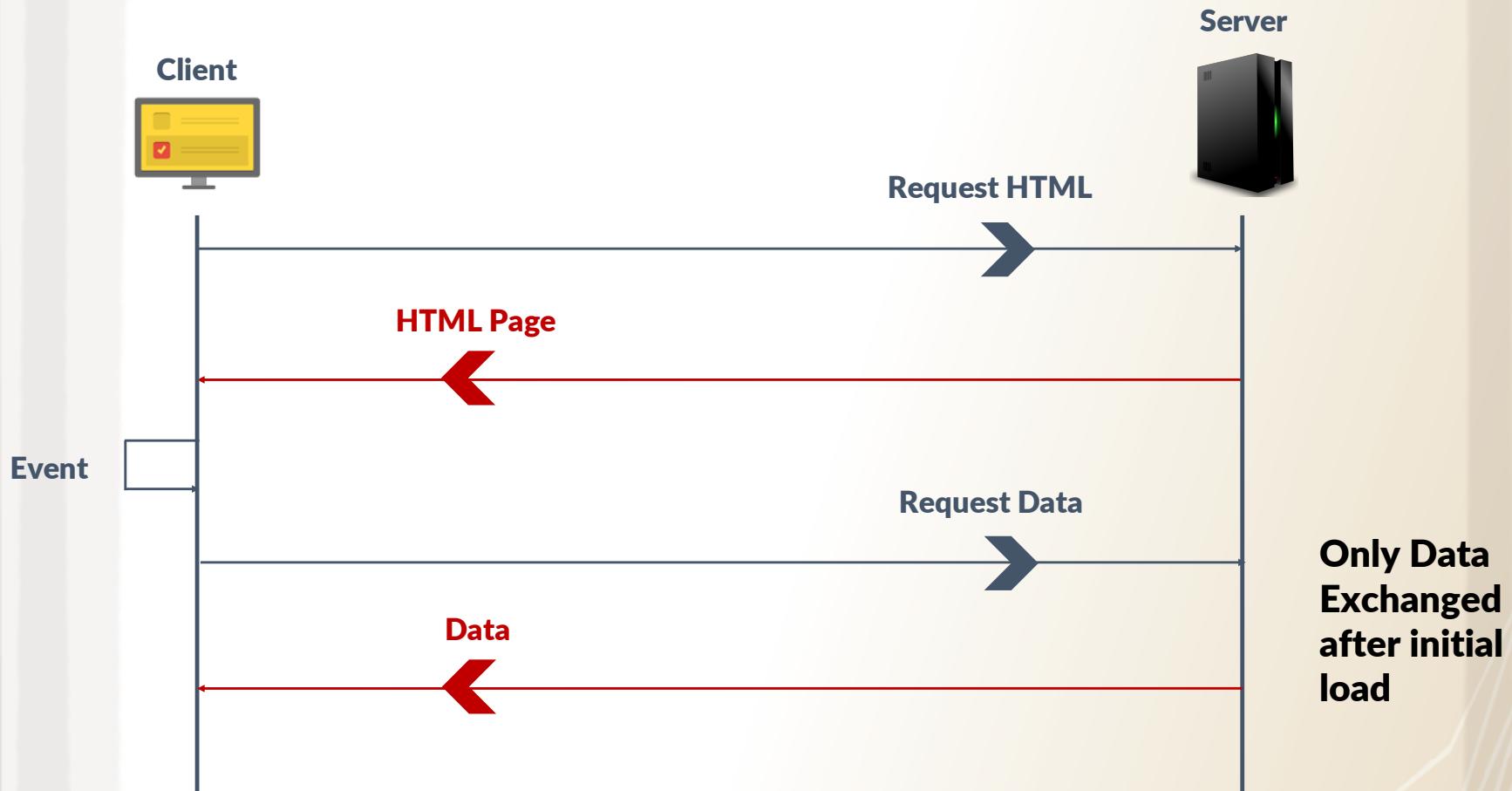
SINGLE PAGE ARCHITECTURE (SPA)



Single Page Applications (SPA)

- Apps that works inside a browser and do not need **page reloading** during usage
- Examples include Google, Gmail, Maps, Facebook, Twitter or GitHub etc.
- After the initial page load, **only data is sent back and forth** rather than the whole HTML which reduces the bandwidth

Single Page Web Architecture





Advantages of SPA

- **Speed and responsiveness:** SPA's are fast; Most resources such as HTML + CSS + Scripts with every interaction- only needing initial loading.
- **Adaptability:** Same backend code can be used for web and mobile apps
- **Offline support and caching:** SPAs sends one request to the server and then stores all the data it receives
- **Ability to separate data and UI:** Handle all future integrations and possible changes in how data enters the SPA framework



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AJAX

THE APPROACH THAT MAKES SPA POSSIBLE

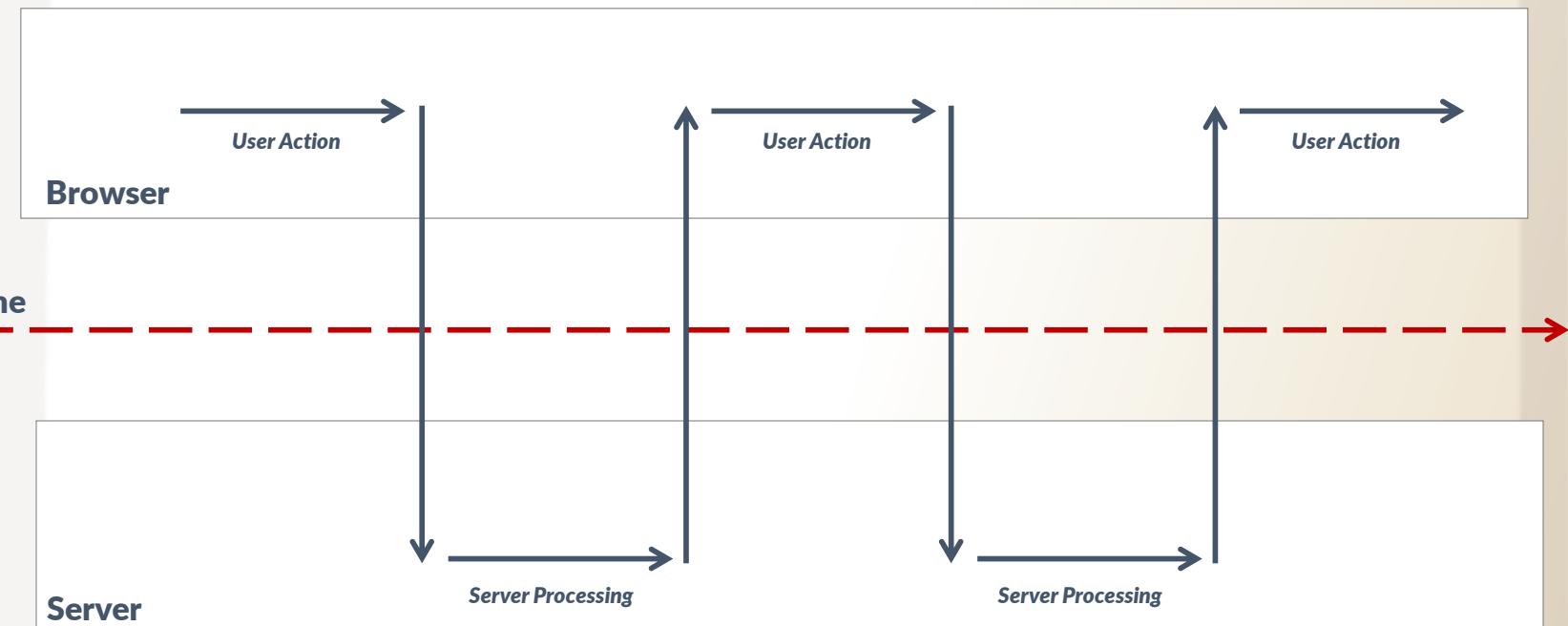


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AJAX

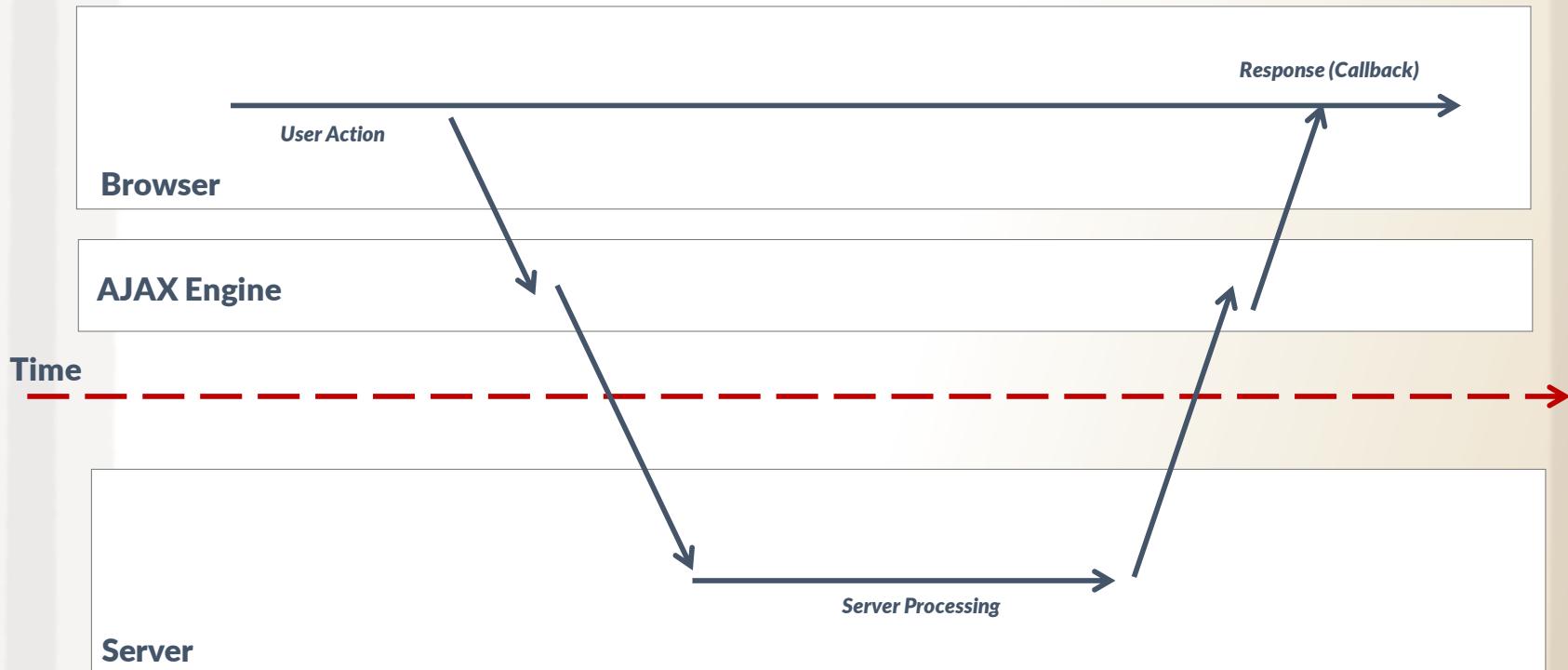
Asynchronous

Synchronous Call



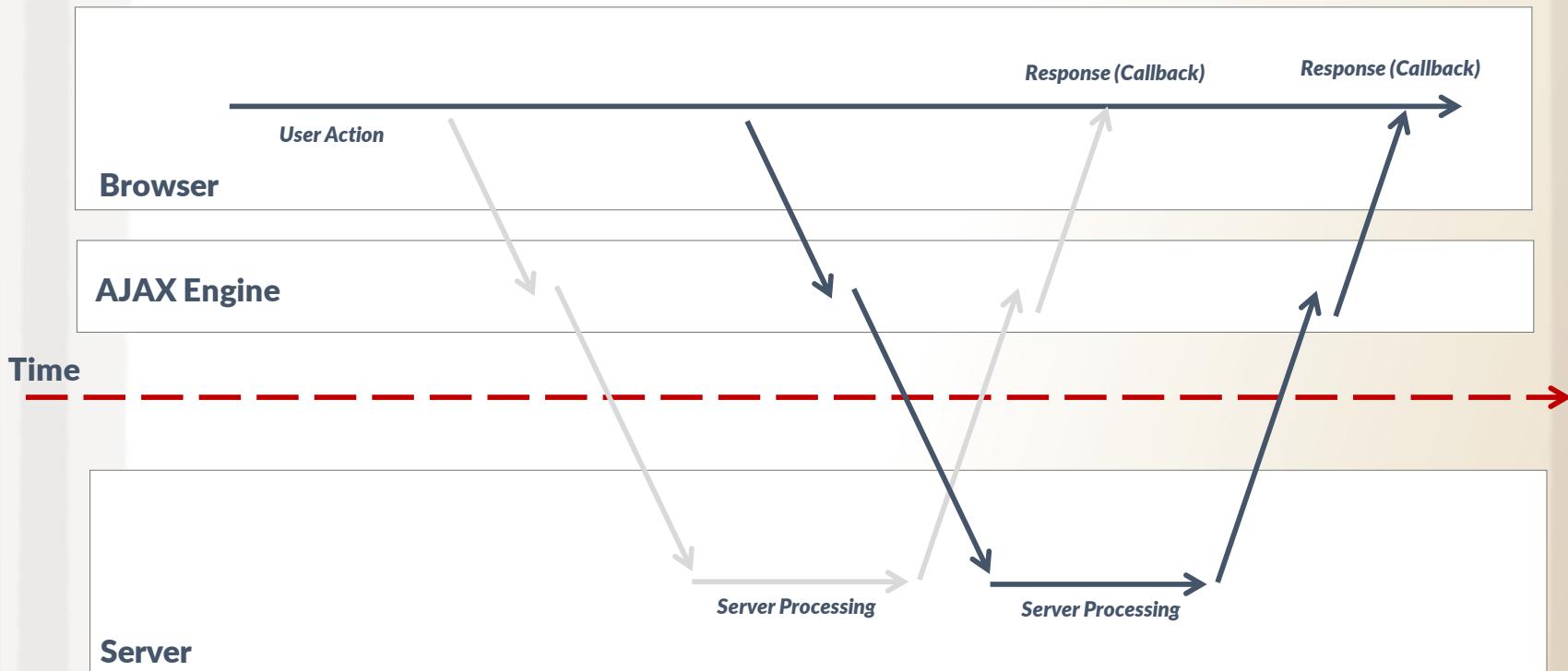
Synchronous call are blocking. The user is blocked while the request is processed at the server

Asynchronous Call



Asynchronous call are non-blocking. The user can continue working while the request is being processed. The callback function will be initiated once the request has completed.

Asynchronous Call



Since Async calls are non-blocking, multiple requests can be overlapped



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JavaScript

AJAX

Asynchronous



JavaScript Objects

- Use the **XMLHttpRequest (XHR)** Object
 - Used to exchange data **asynchronously** with the server
 - It updates parts of a web page without reloading the whole page
 - It is the keystone of AJAX

XHR Object

Attributes

- **readyState:** Returns the state an XHR client is in
- **responseText:** Returns the text received from a server
- **status:** Returns the numerical HTTP status code
- **statusText:** returns a String containing the response's status message

Methods

- **open:** Initialize a newly-created request
- **send:** Sends the request to the server
- **abort:** Cancels the request if it has already been sent

Events

- **onreadystatechange:** Called whenever the readyState attribute changes
- **onload:** called when an XHR transaction completes successfully
- **onprogress:** called periodically with info before XHR completes successfully



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JavaScript

AJAX

Asynchronous

And

XML



Response of an AJAX Call

- **XML**
 - Popular for data exchange format
- **JSON**
 - Currently the most popular data standard used
 - Our only focus in this class
- **HTML**
 - Also used popularly
 - Mainly when the data sent from the server is for display as-is



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AJAX STEP-BY-STEP



Step 1 Create XHR Object

```
Object Name (any  
name can be used)           Name of the Object's Class  
                                {  
var xhr = new XMLHttpRequest();  
                                }  
Keyword  
To create a a new Object
```

Step 2 Create a Callback Function

The diagram illustrates the assignment of an event handler to an XMLHttpRequest object. It features a large central text block: **xhr. onreadystatechange = function(){}**. Above this text, three labels are positioned with brackets: "Object" on the left, "Event of XHR Object" in the middle, and "Anonymous Function (Event Handler)" on the right. Dashed arrows point from the "Object" bracket to the "xhr." prefix of the assignment, and from the "Event Handler" bracket to the `function()` part of the assignment. Below the central text, the text "If this happens -> do this" is centered, with a dashed arrow pointing upwards towards the function body.

Step 3

Do something when the request completed

```
xhr.onreadystatechange = function(){  
    if( xhr.readyState == 4 && xhr.status == 200)  
    {  
        _____  
        Check if the request was completed  
    }  
};  
_____  
Check if the response was received successfully
```

Step 4 Open the Request to the Server

```
XHR Method           Destination Page (Service Provider)  
xhr.open("GET", "process.php", true);  
                         Method to send the data          Async
```

The open method specifies the type of request, the URL, and if the request should be handled asynchronously or not

Async: true (asynchronous) or false (synchronous)



Step 5

Send the Request to the Server

XHR Method

xhr.send();

The send method sends the request off to the server



Complete Code

```
var xhr = new XMLHttpRequest();           STEP 1

xhr.onreadystatechange = function () {      STEP 2

    if( xhr.readyState == 4 && xhr.status == 200) STEP 3
    {
        document.write(xhr.responseText);
    }
}

xhr.open("GET","process.php",true);        STEP 4
xhr.send();                            STEP 5
```

Returns the JSON
Object



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API



Application Programming Interface (API)

- Organizations provide access to their services (or data) through **APIs**
- To use the APIs, we need to sign-up for the service and use the provided **API Key** to send our requests (Some provide authentication using OAuth also).
- Requests are sent and processed using AJAX (for SPA). Can also be done from the backend (Later in the course while we study PHP)
- Some websites (directories) to locate APIs
 - <https://public-apis.xyz/>
 - <https://apilist.fun/>
 - <https://rapidapi.com>

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API Example

- <https://newsapi.org>

Sign-up to get API Key

Sample Request

Sample Output

```

{
  "status": "ok",
  "totalResults: 70,
  - articles: [
    - {
      - source: {
        id: null,
        name: "Seekingalpha.com"
      },
      author: "SA Stocks To Watch",
      title: "Stocks To Watch: Food For Thought - Seeking Alpha",
      description: "Welcome to Seeking Alpha's Stocks to Watch - a preview of key events scheduled for the next week. Follow this account and turn the e-mail alert on to receive th",
      url: https://seekingalpha.com/article/4243582-stocks-watch-food-thought,
      urlToImage: https://static3.seekingalpha.com/assets/og_image_192-
      59bf5d1c9fe6a6f025b2f9896c807e46f8e2f06c5ae787b15bf1423e6c676d4db.png,
      publishedAt: "2019-02-23T14:22:02Z",
      content: "Welcome to Seeking Alpha's Stocks to Watch - a preview of key events scheduled for the next week. Follow this account and turn the e-mail alert on to receive this article in your inbox every Saturday morning. Once again U.S.-China trade talks will be watched ... [+9960 chars]"
    },
    - {
      - source: {
        id: "business-insider",
        name: "Business Insider"
      },
      author: "Troy Wolverton",
      title: "Elon Musk's tweets show that Tesla's revamped board is still bad at its job - and it could get the company into even more trouble - Business"
    }
  ]
}

```



Sample Request

https://newsapi.org/v2/top-

headlines?country=us&category=business

&apiKey=API_KEY

Filter to ask for specific
results

Add your Key for Authentication

Code to Access the News API

```
var xhr = new XMLHttpRequest();

xhr.onreadystatechange = function () {

    if( xhr.readyState == 4 && xhr.status == 200)
    {
        var news = xhr.responseText;
    }
}

xhr.open("GET","https://newsapi.org/v2/top-
headlines?country=us&category=business&apiKey=API_KEY",true);
xhr.send();
```

Self Exercise (For Practice Only)

- Sign up for the News API (Its free for non-commercial use)
- Download the practice exercise code from the course website
 - The code written makes an AJAX request to retrieve all the articles from the NEWSAPI website related to Technology from Saudi Arabia
- The API key is empty. Please add your own API Key
- **Your Task**
 - Modify the file so that the source of the news articles is written beside it.

Top 10 Technology News Articles in Saudi Arabia

1. Xiaomi Redmi Note 7 Pro price revealed; to be launched at roughly Rs. 21,000 - Times Now [Source: [Timesnownews.com](#)]
2. Second Nokia 9 PureView photo teaser posted on Instagram - Nokiamob [Source: [Nokiamob.net](#)]
3. Microsoft might launch its next-generation of Xbox consoles at E3 2019 - Gadget Bridge [Source: [Gadgetbridge.com](#)]
4. Huawei P30 Lite will have a 6.15" 1080p+ screen, reveals TENAA - GSMArena.com news - GSMArena.com [Source: [Gsmarena.com](#)]
5. 2020 Hyundai Elite i20 To Be Bigger In Size, To Get More Features - GaadiWaadi.com [Source: [Gaadiwaadi.com](#)]
6. Nokia 2.1 Android 9 Pie Update Now Rolling Out, HMD Global Confirms - Gadgets 360 [Source: [Ndtv.com](#)]
7. Google Pixel 3 and Pixel 3 XL are on sale for \$200 off - XDA Developers [Source: [Xda-developers.com](#)]
8. How to disable any pre-installed system app bloatware on Android without root - XDA Developers [Source: [Xda-developers.com](#)]
9. [Exclusive]: OPPO F11 Pro's live images confirm dual rear cameras and pop-up selfie shooter - 91mobiles [Source: [91mobiles.com](#)]
10. Intel Iris Plus 940 Gen 11 Graphics Performance Looks Very Strong In Leaked Benchmarks - Hot Hardware [Source: [Hothardware.com](#)]



Self Exercise (For Practice Only)

- **If you want to challenge yourself try this**
 - Add four buttons on the top (Business, Sports, Technology, Entertainment)
 - Based on the selection, get top 10 articles related to that