CS3300 Introduction to Software Engineering

Lecture 08: Tools of the Trade #3

JQuery, API, AJAX, RESTful API

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Contents

jQuery

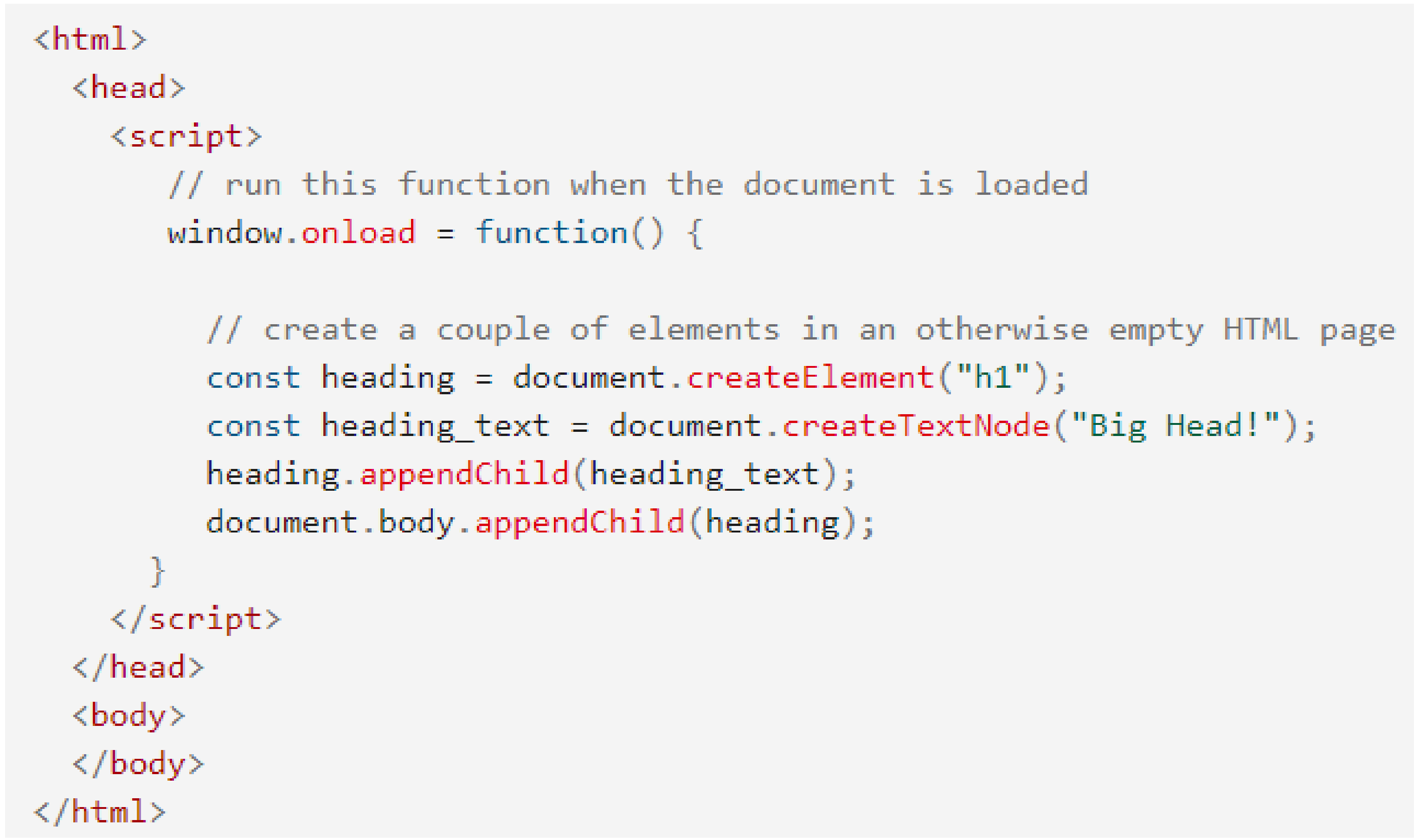
- jQuery is a fast and concise JavaScript Library that simplifies HTML document traversing, event handling, animating, and Ajax interactions for rapid web development

- Why jQuery?
  - Write less, do more

  - *$("p.neat").addClass("ohmy").show("slow");*
  - Performance
  - Plugins
  - Standard practice

DOM

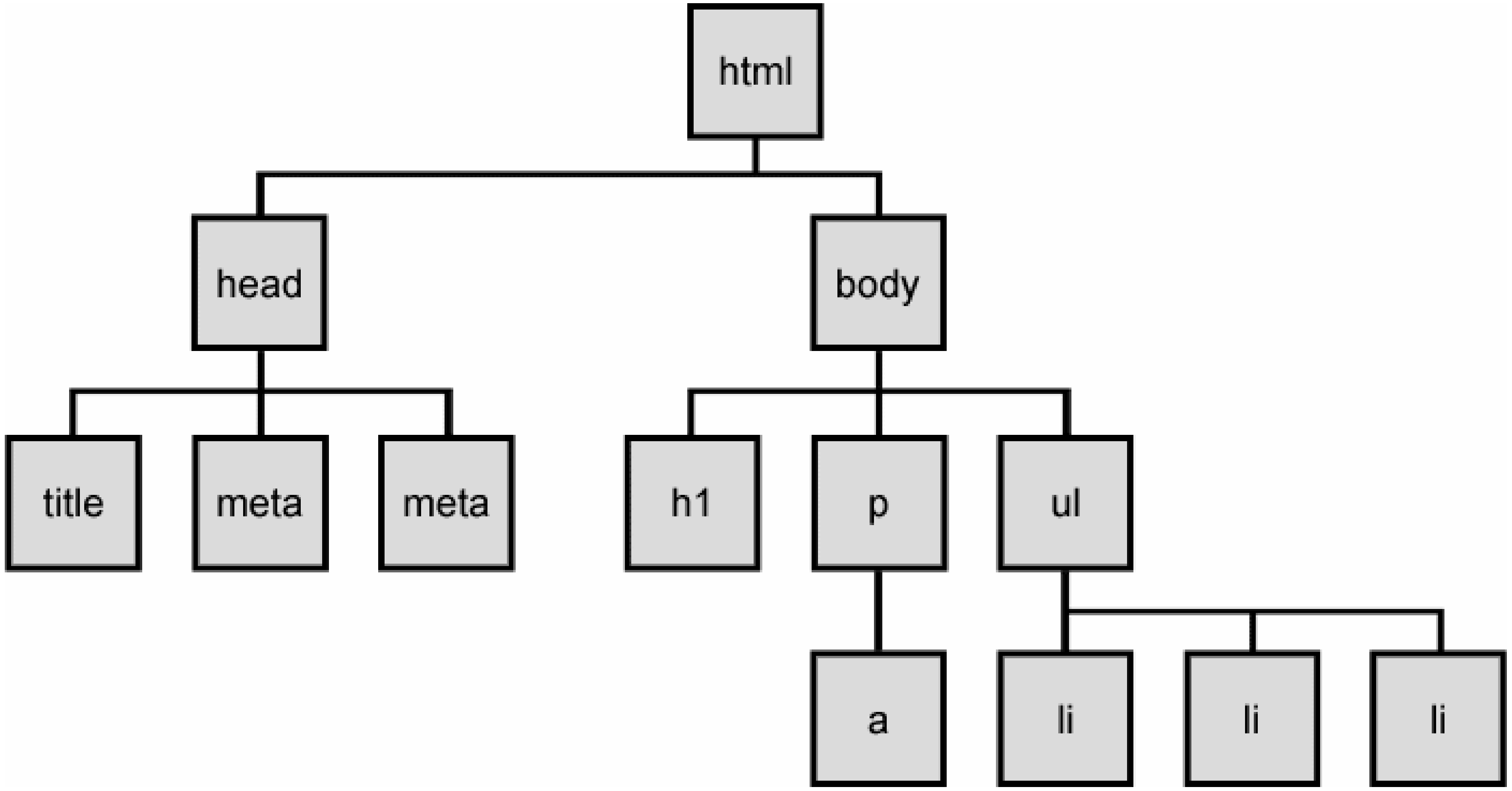
- Document Object Model (DOM) is the data representation of the objects that comprise the structure and content of a document (XML & HTML) on the web.
- Can be used to modify the document with a scripting language like JavaScript



```
<html>
  <head>
    <script>
       // run this function when the document is loaded
       window.onload = function() {

         // create a couple of elements in an otherwise empty HTML page
         const heading = document.createElement("h1");
         const heading_text = document.createTextNode("Big Head!");
         heading.appendChild(heading_text);
         document.body.appendChild(heading);
      }
    </script>
  </head>
  <body>
  </body>
</html>
```

The DOM tree



jQuery / DOM comparison

Description	DOM method	jQuery equivalent
returns array of descendants with the given ID, such as “header"	getElementById("id")	$("#id")
returns array of descendants with the given tag, such as "div"	getElementsByTagName("tag")	$("tag")
returns array of descendants with the given name attribute	getElementsByName("somename")	$("[name='somename']")
returns the first element that would be matched by the given CSS selector string	querySelector("selector")	$("selector")
returns an array of all elements that would be matched by the given CSS selector string	querySelectorAll("selector")	$("selector")

jQuery Terminology

- the jQuery function

  refers to the global jQuery object or the $ function depending on the context

- a jQuery object

  the object returned by the jQuery function that often represents a group of elements

- selected elements

  the DOM elements that you have selected for, most likely by some CSS selector passed to the jQuery function and possibly later filtered further

jQuery object

- The $ function always (even for ID selectors) returns an array-like object called a jQuery object.
- jQuery objects are wrapper objects around single or multiple DOM elements.
- You can access the actual DOM object by accessing the elements of the jQuery object

```
// false
document.getElementById("id") == $("#myid");
document.querySelectorAll("p") == $("p");
// true
document.getElementById("id") == $("#myid")[0];
document.getElementById("id") == $("#myid").get(0);
document.querySelectorAll("p")[0] == $("p")[0];
```

Using $ as a wrapper

- $ adds extra functionality to DOM elements
- passing an existing DOM object to $ will give it the jQuery upgrade

```
// convert regular DOM objects to a jQuery object
var elem = document.getElementById("myelem");
elem = $(elem);
var elems = document.querySelectorAll(".special");
elems = $(elems);
```

$(document).ready()

Before you can safely use jQuery to do anything to your page, you need to ensure that the page is in a state where it's ready to be manipulated.

Using DOM: window.onload = function() { // do stuff with the DOM }

Using jQuery: $(document).ready(function() { // do stuff with the DOM })

Using jQuery shorthand: $(function() {{ // do stuff with the DOM })

Demo Time !

Use of hide/click/hover functions using jQuery

API

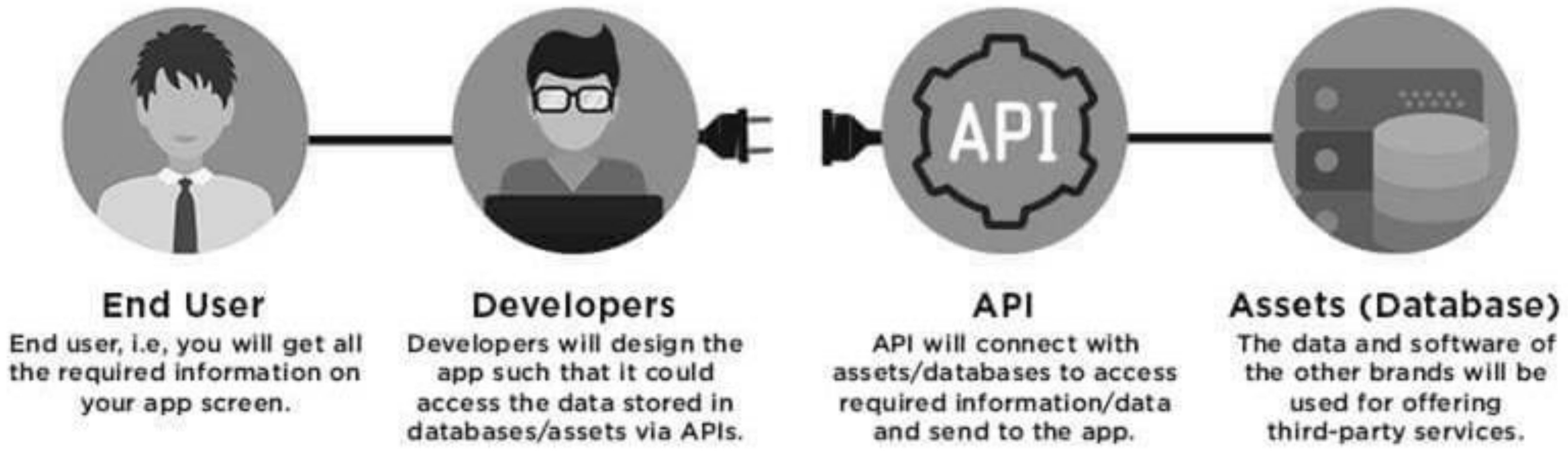
Definition
Application Programming Interface is a computing interface to a software component or a system, that defines how other components or systems can use it.

API vs. Application
Application/Library/Service: A blob of code that does things
API: The way your code can ask the application/library/service to do things. The boundary of the application/library through which requests go in and responses come out

The Browser..
…has a UI that lets you interact with the document
…has the DOM API that lets your code interact with the document

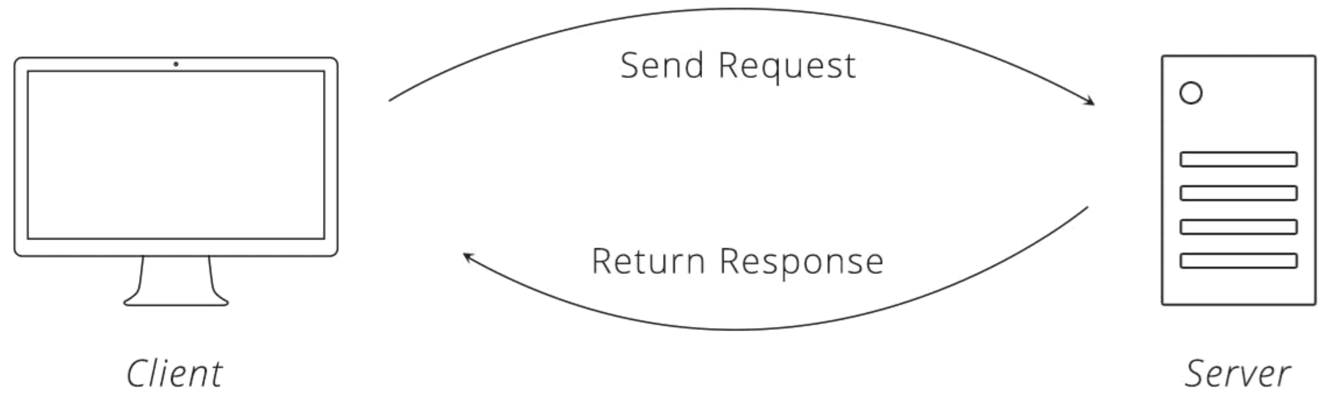
How is an API used?

You want to book a flight
Endpoints: Flight booking platform and airlines website
Most common formats of representing data are JSON and XML


API
End User
End user, i.e, you will get all the required information on your app screen.
Developers
Developers will design the app such that it could access the data stored in databases/assets via APIs.
API
API will connect with assets/databases to access required information/data and send to the app.
Assets (Database)
The data and software of the other brands will be used for offering third-party services.

Protocol of the Web

- A protocol is a system of rules that define how data is exchanged
- Main protocol on web is HTTP- Hyper-Text Transfer Protocol
- Follows Client-server Protocol.



- http://example.com, the "http" tells the browser to use the rules of HTTP when talking with the server. With the ubiquity of HTTP on the web, many companies choose to adopt it as the protocol underlying their APIs.
- Communication in HTTP centers around a concept called the Request-Response Cycle.

Request-Response Parameters

Request

- **URL**: Uniform Resource Locator – Unique address
- **Method**: Type of Action –
  - GET: Retrieve a resource
  - POST: Create a resource
  - PUT: Edit/update existing resource
  - DELETE: delete a resource
- **Header**: Meta-information about a request.
  - Referer: page making the request
  - Accept: acceptable response data types (text, pdf, etc.)
  - Cookie: contains specific user data
- **Body**: data to PUT/POST/GET

Response

- **Status Code**: 200 OK, 301 redirect, 401 Unauthorized, 500 server error…
- **Header**: Meta-information about response.
  - Content-Type: of returned object (text, pdf, etc.)
  - Set-Cookie: user data to store in browser
  - Location: Instruction to look elsewhere
- **Body**: content such as web page

Authentication - API KEY

Basic Authentication: Requires username and password; client passes in the request in an HTTP header called Authorization.; Server compares header to stored credentials, if doesn’t match returns a 401 status code.

API Key Authentication: Overcomes the weakness of using shared credentials by requiring the API to be accessed with a unique key; Server now has the option to limit administrative functions, like changing passwords or deleting accounts.

OAuth Authentication: Most widely used authentication scheme on the web. The client and server communicate back and forth to get the user a valid key. Access token don’t expire. More details here.

DEMO TIME!
Use API-key to access weather data

AJAX

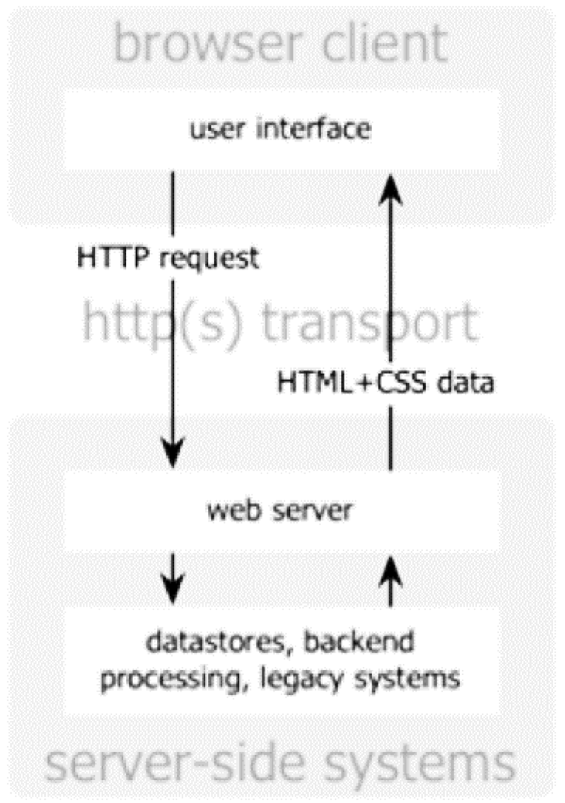
The Popular Approach

- 90s web applications ran on the server
- To take an action, user submitted a form
- To await changes, keep reloading the page
- Browser was just to display results and accept user input

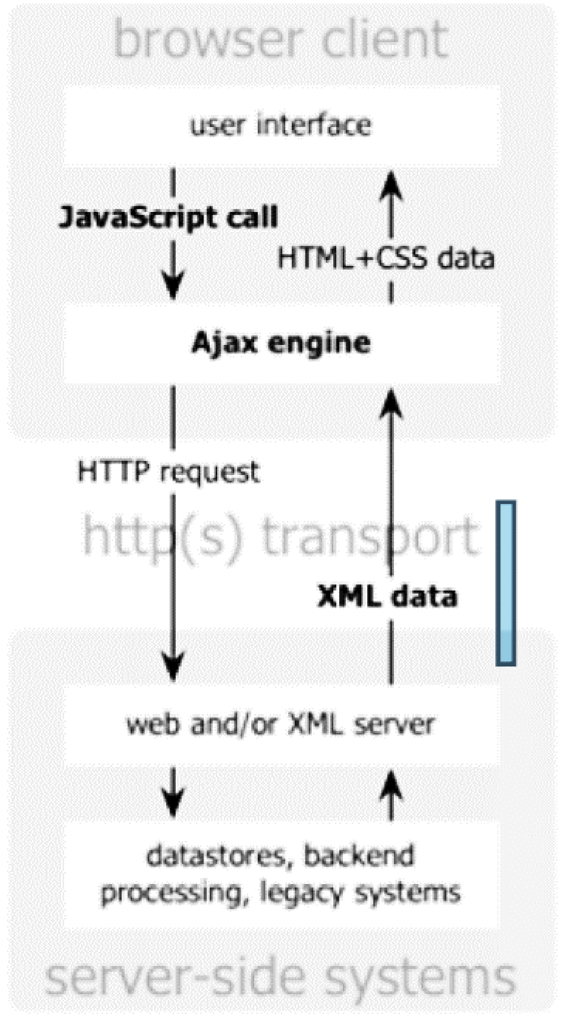
The Insight

- Many actions change little of the UI
- Client can do significant computation
- Why bother involving the server?
    - Demands more server horsepower
    - Network makes slow UI
    - Reload loses your place in the page—disruptive

AJAX



Classic
web-application Model



AJAX
web-application Model

Asynchronous
  promises etc.
JavaScript
  Computation on client
And **X**ML
  Data serialization format
  Now replaced by JSON
  But AJAJ doesn't sound as cool

Allows web pages to be updated asynchronously by exchanging data with a web server behind the scenes. This means that it is possible to update parts of a web page, without reloading the whole page. MUCH FASTER!!

All major browsers now support XMLHttpRequest (XHR) object

jQuery AJAX

- jQuery offers many Ajax-related simple & convenient methods to create GET & POST requests
- Considered a good practice to use $.ajax() method over other methods

Options:

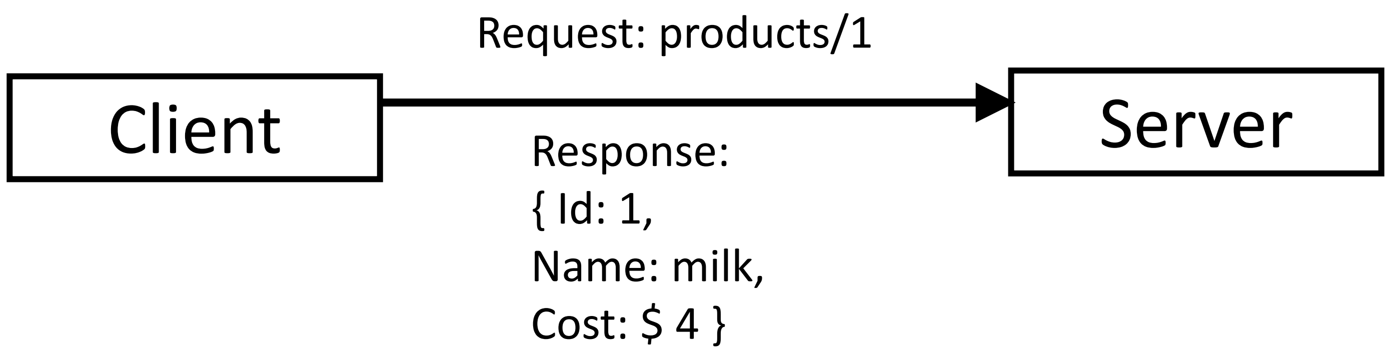
- *url*- the request url. Only mandatory option.
- *type*- type of request, “POST” or “GET”. Default is “GET”
- *datatype- “text”, “html”, “json”*
- *async*- Accepts true/false. False makes request synchronous and will block execution of other codes until response is received
- *cache*- Use to cache response if available
- *complete*- triggers a callback function to run when request is complete, regardless of success or failure
- *data*- data (string or object type) to be sent to the server
- *error*- callback function to run when request gets an error
- *success*- callback function to be run if request is success
- *timeout*- specifies time in milliseconds to wait , otherwise consider request to be a failure

DEMO TIME !!

Access data in JSON format from web via AJAX API call

RESTful APIs

- **RE**presentational **S**tate **T**ransfer
- Architectural style of web services development. Often called “Language of the Internet”
- Literally means transferring the state of representation of a resource.



- Follows HTTP protocol. GET, POST, DELETE,

RESTful APIs - Need and Principles

- Need:
  - Allows loosely coupled client-server applications. E.g.: server can be angular/reach, server: node js/php/.net
  - Independent of platform and languages
  - Scalability – Server does not store any client data
  - Can return data in any format as requested

- Principles:
  - Stateless: Every method call must include all the state the server needs to provide the method
  - Client-Server: Separate; increases portability of interface
  - Cacheable: label the response as cacheable; can be reused by client
  - Layered System: load balancing, shared caches, enhance scalability and stability

RESTful APIs- Methods

Based on Create, Read, Update and delete resources built on HTTP methods

POST GET PUT DELETE

DEMO TIME!!

Create a basic web app using REST API, VS Code IDE, Node.JS, Express

<u>Tools used:</u>

HTML/CSS/JS: Front-end Programming (**Client Side**)

VS Code: Programming IDE (**Client Side**)

Node.js: Runtime environment for applications in JavaScript (To

implement/create **web server** in JavaScript language)

Express: Backend web application framework for Node. Js (**Web Server side**)

Next Class

- TOTT #5
- Spring & SpringBoot
- Get your Laptops!!