

程序代写代做 CS编程辅导

FIT1050 Web Fundamentals



Web Servers and Server-Side Scripting

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Week 11

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Learning objectives

Web servers and server-side scripting

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- Understand how the software components of a web server interact
- Differentiate server-side scripting from client-side scripting

Asynchronous data exchange

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- Understand the basics of how AJAX works
- View a real-world example of JSON data

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Web page state management

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- Consider the challenges of persistent state in web sites
- Compare approaches for storing a website's current state

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Web Servers and Server-Side Scripting

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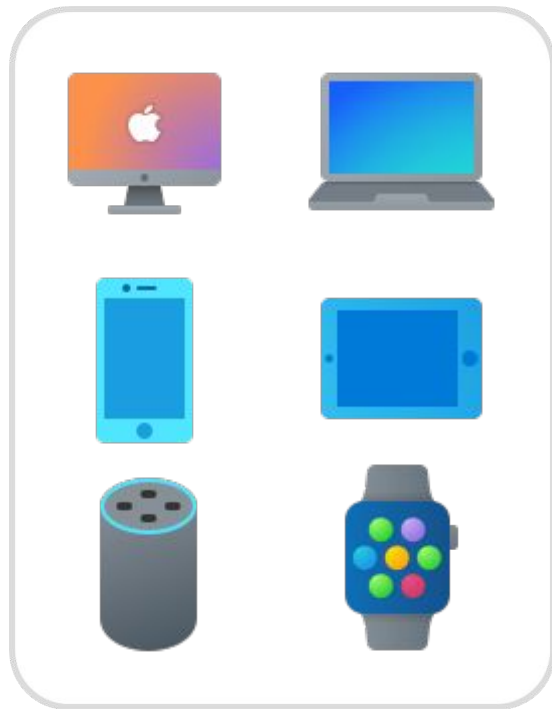
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Review: Client-server model of computing

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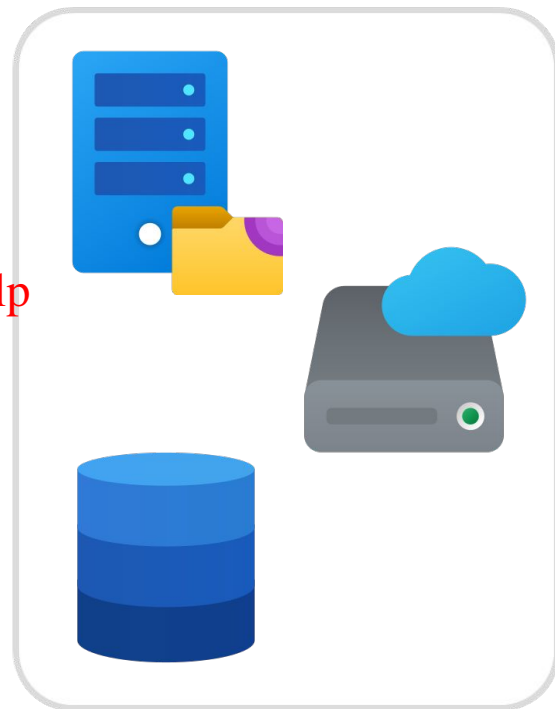
Clients request data and servers send responses. **Both are able to execute scripts.**



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Do you understand me?
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I can accept...
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Hello, I am here for you.
I also understand you.
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Sending you data...



Server-side scripting

Code stored on a web server is executed on the server to generate a result. Only the result is sent to the user's web browser.

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- No real-time access to user interactions
- Running a code requires a request and response cycle (i.e. page reload)
- Original code cannot be inspected by users

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Great for back-end tasks!

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- Store data persistently.
- Run secure code.
- Execute remote applications.

Different types of server environments

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Servers can be used in various stages of web development for different reasons.

Within a single project there may be several servers involved.



Development

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- Typically local, where new code tested as changes are made.

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Staging

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- Typically remote, testing using a duplicate of the production environment.

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Production

- Code is deployed online to be served as a publicly accessible website.

HTTP servers

An HTTP server or **HTTP daemon** (often confusingly referred to as a **web server**) is an application with a specific job:

- Bind to a network port and listening.
- Wait for incoming HTTP requests for data.
- Return a response - a file containing data.

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The response usually contains the requested file, but could also contain pre-defined or generated page:

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- A list of files stored in a folder.
- A page for an HTTP error message.

Common HTTP server software

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- **Apache** and **Nginx** are popular free open source software



- **IIS (Internet Information Services)** is available as an optional feature in Microsoft Windows.

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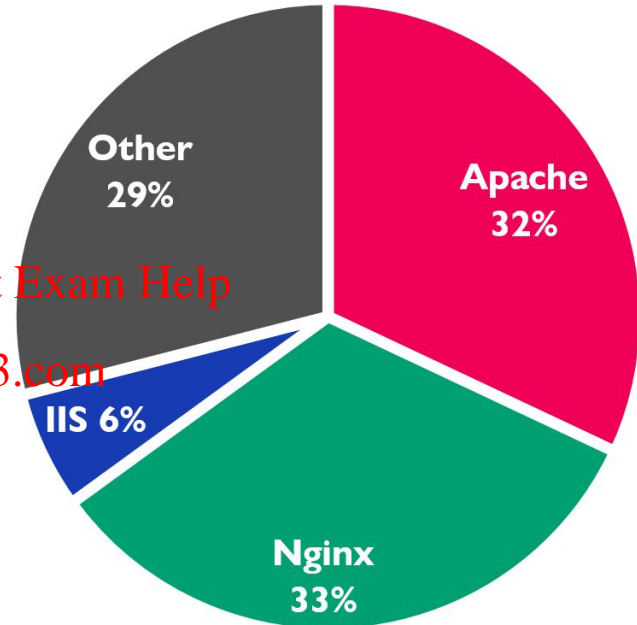
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- **Other HTTP servers include**
 - Commercial enterprise products such as **Litespeed**
 - **Google Web Server** platform
 - Other specialised servers

Estimated Market Share



Server-side scripting

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Web servers can run script processors to support different languages.



PHP

ASP

P.NET

Java

Ruby

ColdFusion

Perl

Python

JavaScript (Node.js)

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Your choice of language will depend on:

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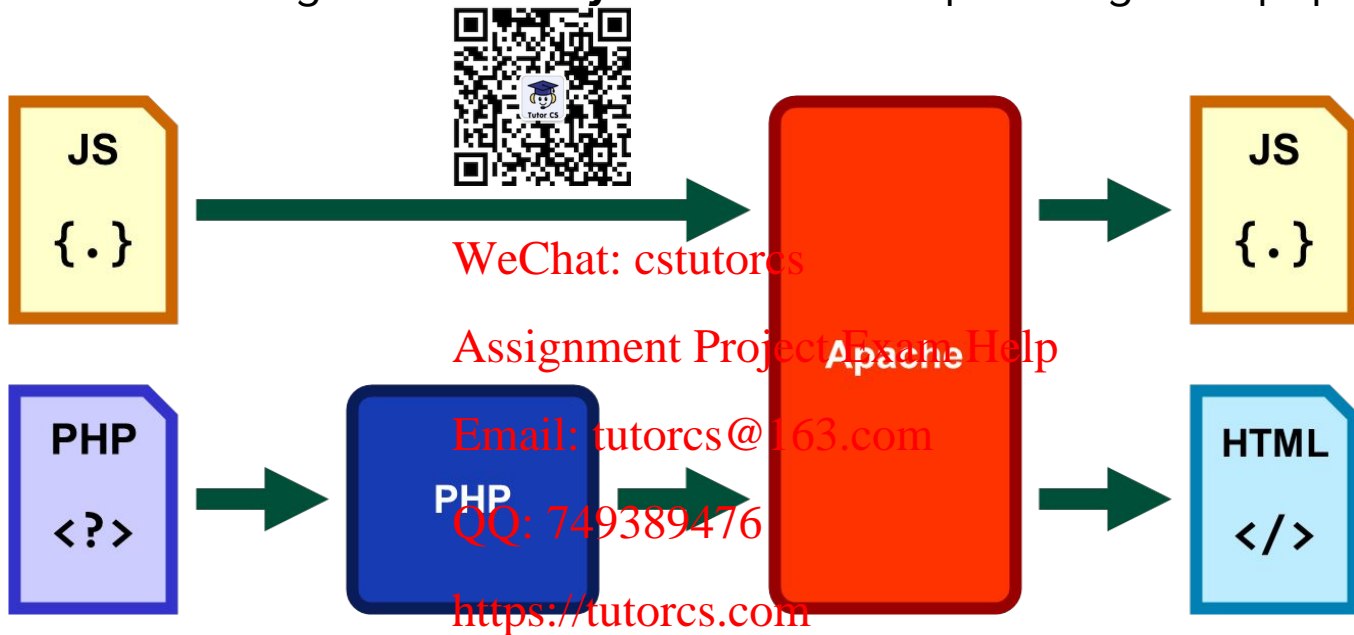
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- Developer knowledge and skills.
- Script processor software installed on the web server.
- Third-party scripts that you want to use.

Scripting languages and processors

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The HTTP server is configured to **always** run server scripts using a script processor.



In the example, the client never sees **PHP** code - only the generated **HTML** output.

PHP has the largest market share

PHP Hypertext Pre-processor

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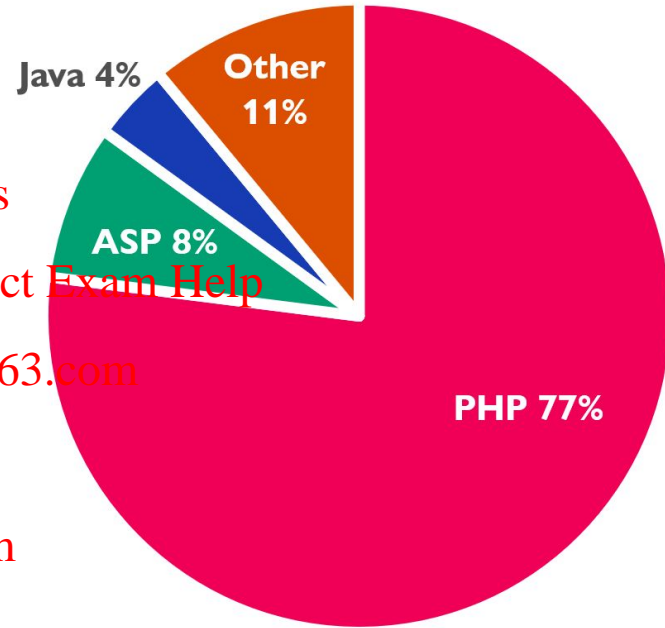
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Estimated Market Share



- A scripting language
 - Also the name of the server-side script that executes the PHP scripts
- Initially released in 1995
- Dynamically typed
- Case-sensitive variables
- Case-insensitive functions
- Primarily used to dynamically generate web pages

Databases

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Almost all reasonably large sites use a database to store site data. For example:



- Store user login details
- Store information about site
- Store and manage site content separately from HTML

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A server-side script processor can connect to the database create, read, update or delete data. For example:

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- Securely processing user login requests.
- Lookup and data based on information in the request URL.
- Insert site content into page templates to make HTML documents.

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SQL database management systems

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The vast majority of modern relational database management systems rely on an implementation of the SQL language to execute commands on a database server:



MySQL

PostgreSQL

MS SQL

Oracle

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MariaDB

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Transact-SQL

DB2

etc.

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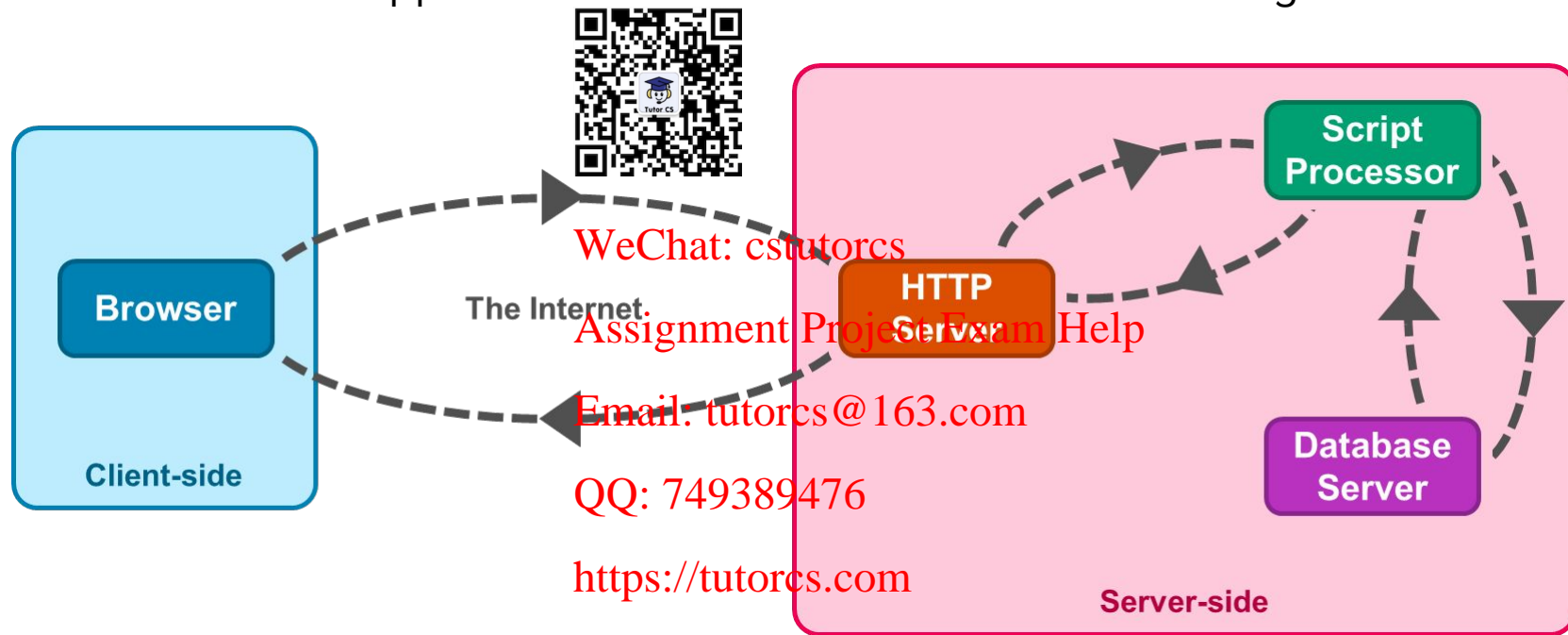
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While SQL is a standardised language, specific implementations do not always follow standards.

Communication between applications

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The various software applications of a web server stack can exchange information.



The user's web browser is unaware of the server-side interactions.

Choosing between client-side and server-side

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Client-side and server-side development approaches are fundamentally different.

Choose the right technique for t



- **Some client-side scripting tasks are impossible with server-side scripting**
- **Some server-side scripting tasks are impossible with client-side scripting**

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Some tasks can be done with either, with consideration of differences:

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- Timing (client is immediate, server requires request-response)
- Data storage (browser vs server storage and database)
- Security (client code may be accessible to the user)

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Asynchronous Data Exchange

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Combining client and server-side scripting

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The best of both worlds:

JavaScript can initiate communication with a server to fetch new data. This allows client-server data exchange without the need for full page reloads



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Consider an address search feature:

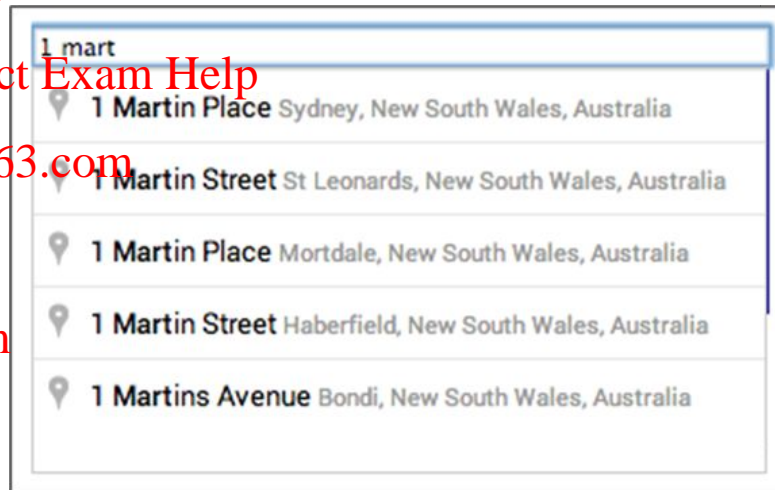
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- User starts typing an address.
- Capture the input, send it to a server.
- Server performs a database search.
- Search results are sent back to the client.
- Insert the search results into the page.



AJAX

AJAX is **A**synchronous **J**avaScript **A**nd **X**ML

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All modern web browsers have the ability to:

- Send a request to a server using JavaScript
- Receive a response without reloading the page
- Modify the DOM to perform client-side rendering of content

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The name is a little misleading!

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Practically any data format can be used in this exchange (HTML fragment, XML, JavaScript, plain-text, etc). XML data is not specifically required.

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Synchronous vs asynchronous HTTP

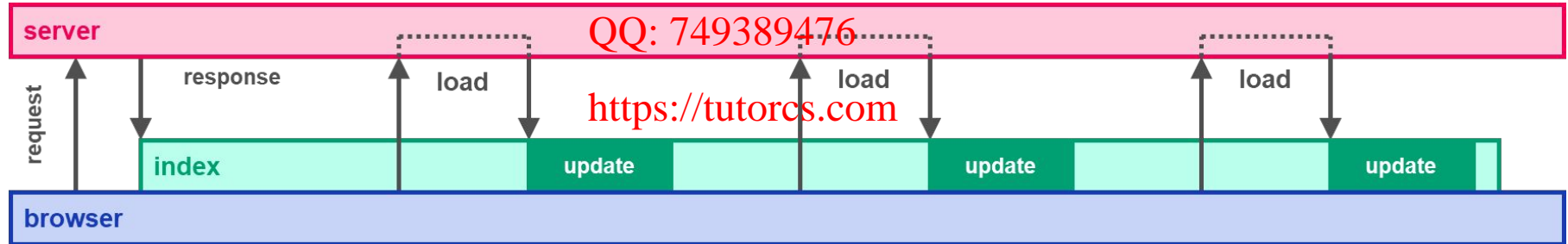
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With **synchronous HTTP**, each response is loaded as an entire new page.



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With **AJAX**, responses load the data required to update parts of the initial page.



Web Service APIs

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Most commonly we think of web services as **Application Programming Interfaces**.



- Can be accessed via HTTP client or server-side code.
- Data usually provided in JSON or XML formats

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Allows sites to use data from a wide variety of third-party web services.

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- <https://developers.google.com/youtube/v3/docs/>
- <https://developer.musixmatch.com/documentation>
- <https://openweathermap.org/api>
- <https://www.reddit.com/dev/api/>

Example: Reddit provides JSON data

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```
{"kind": "Listing", "data": {"modhash": "", "dist": 26, "children": [{"kind": "t3", "data": {"approved_at_utc": null, "subreddit": "cats", "selftext": "", "author_fullname": "t2_4olb3", "is_reported": false, "mod_reason_title": null, "gilded": 0, "clicked": false, "text": "Please do us mods a favor and if you report something for \"Claiming ownership of another person's cat\", make a post in the post you're reporting linking to the OC poster. Thank you!", "link_flair_richtext": [], "subreddit_name_prefixed": "r/cats", "hidden": false, "pwls": 6, "link_flair_css_class": "discussion", "downs": 0, "thumbnail_height": null, "parent_whitelist_status": "all_ads", "hide_score": false, "name": "t3_9ko0du", "quarantine": false, "link_flair_text_color": "dark", "author_flair_background_color": "#f0f0f0", "subreddit_type": "public", "ups": 12, "domain": "self.cats", "media_embed": {}, "thumbnail_width": null, "author_flair_template_id": null, "is_original_content": false, "user_reports": [], "secure_media": null, "is_reddit_media_domain": false, "is_meta": false, "category": null, "secure_media_embed": {}, "link_flair_text":
```

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JSON data = JavaScript Objects

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```
{  
  "name": "John",  
  "age": 30,  
  "car": null  
}
```



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JSON is JavaScript with extra rules:

- Property names must be double-quoted strings
- Double-quotes all string values
- Properties cannot contain JavaScript functions
- No semicolon at the end

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If this JSON was loaded into a variable
named **data**:

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```
console.log( data.name );  
console.log( data.car );
```

**JSON code must be completely valid
for it to be parseable after loading.**

Browsing JSON data structures

Logging JSON response data in your browser's console allows it to be browsed as a tree structure.

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JSON text can also be pasted directly into the console and run to evaluate it.

Third-party tools can also be used:

- <https://jsoneditoronline.org/>
- <https://jsonformatter.org/json-viewer>

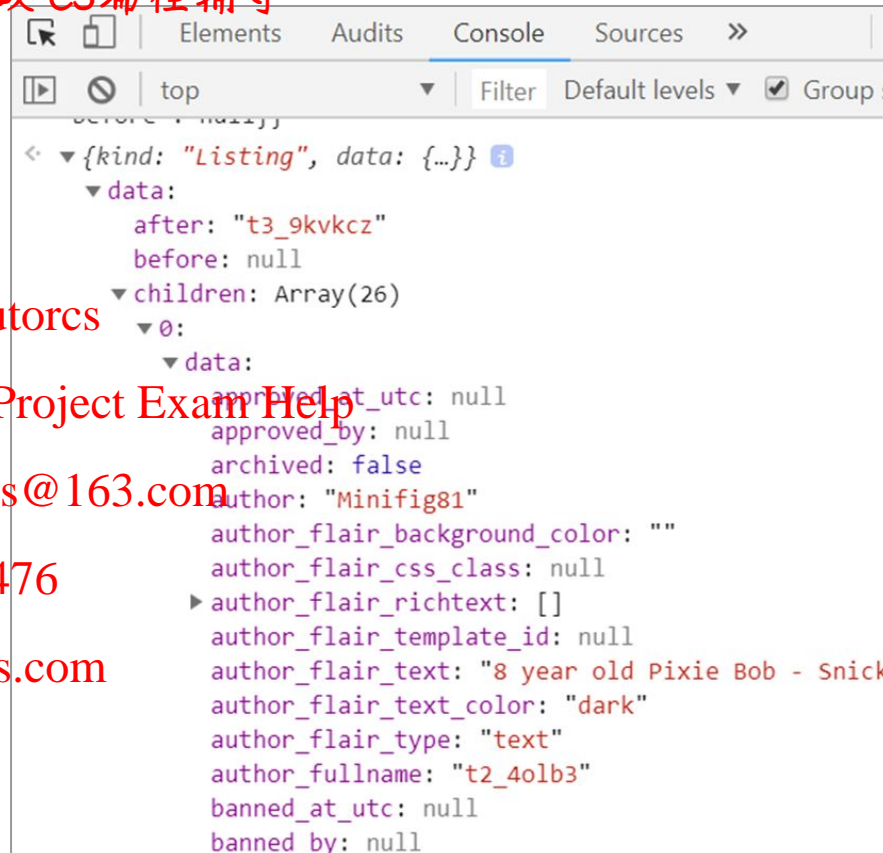
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Web Page

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State Management

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HTTP is a stateless protocol

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HTTP was originally designed to be a "**stateless protocol**", which means:

- Each request is independent of previous requests.
- The protocol is not required to have knowledge of past requests.
- There is no assumption consecutive requests originate from the same client.

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This means that any given URL should return the same result when requested from any client, provided the requested resource has not changed.

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But it seems like websites do remember users and data between pages and browsing sessions...

Users expect persistent state

Imagine you are doing some online shopping. You add some items to your cart, but accidentally close the tab.

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When you re-open the site, you see...

- You are still logged in
- Your items are still in the cart

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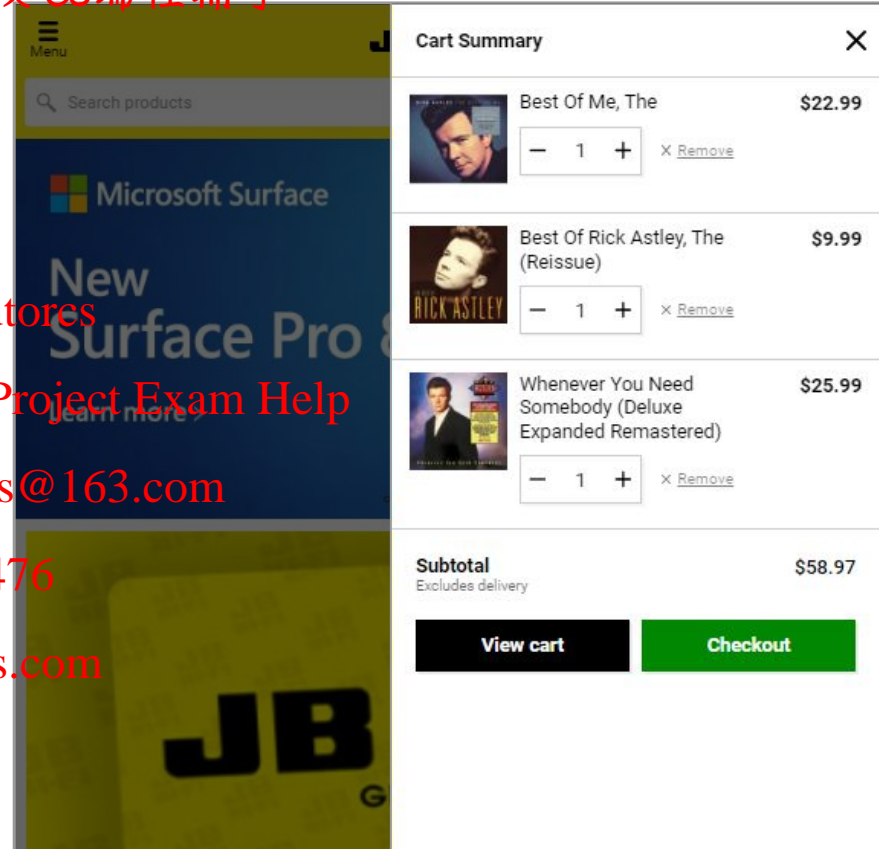
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How does the website remember this information if HTTP is stateless?



HTTP Cookies

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Cookies are text files that a browser saves on the client to store site-specific data.



- Temporary or persistent, survive between browser sessions
- Can only be read by the domain that originally created it.
- Limited to 4KB, automatically sent to the server on every request to the domain.
- Can be deleted by the user.

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While 4KB is very small, it still stores thousands of characters of data:

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- Personalisation when viewing the page (user preferences)
- Identify users to a server (user tracking IDs, login status, analytics)
- Save/restore application state (save games, shopping carts)

HTML5 web storage

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Web storage is an alternative way of storing temporary (session storage) and persistent (local storage) text data. Web storage works in all modern browsers.



For most browsers:

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Stored data is not sent to the server on each request. This enables higher capacity with minimal impact on site loading performance.

Server-side data storage

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Data stored on the client is accessible to JavaScript, including third-party scripts.

Secure state storage can make it possible to use a server-side database instead.



Some correlation between the client and server is required:

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- Store all state data relating to a client on the server
- Generate a random ID, store it on the server and on the client using a cookie
- When the client needs to identify itself, it sends the ID to the server
- The server uses the ID to load the stored state data

This technique uses a form of tracking cookie, but it's an essential part of how modern web applications manage state.

Next week

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- Search engines and search engine optimisation.
- Preparing for the unit's final
- Upload website files to a web



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Reminders

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- **Participation Milestone 5 takes place in the week 12 lab session.**
 - Attend your allocated lab class to attempt some practice exam questions.
 - Marks awarded for reasonable attempts completed during class.
- **Assignment 3 is due at the end of week 12, 11:55PM.**
 - Review the assignment marking guidelines document.

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