Summer School

Lecture 1: What is a web system anyway?

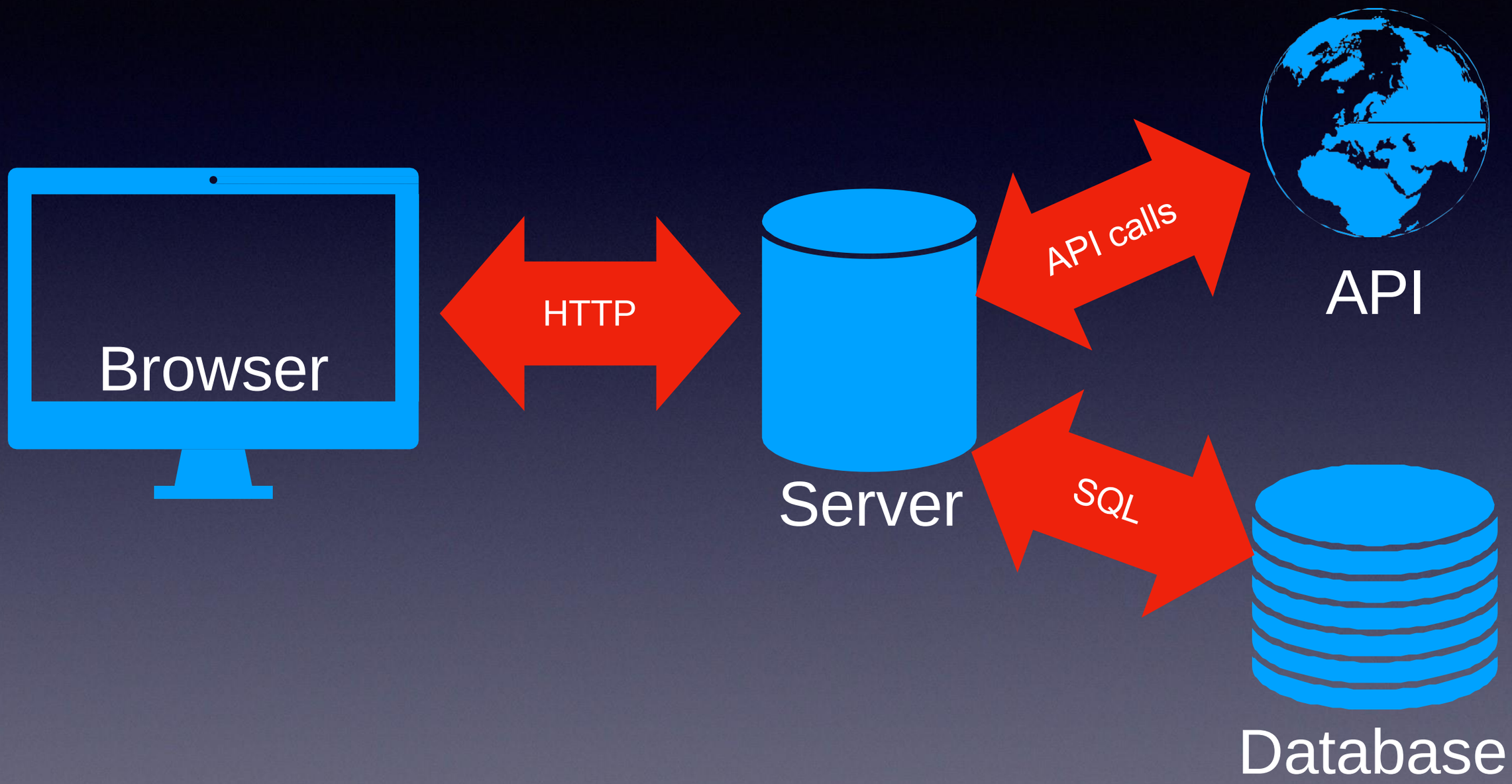
By the end of this lecture, you should know:

- The components that constitute a web system
- What a stack is
- What we will cover this week

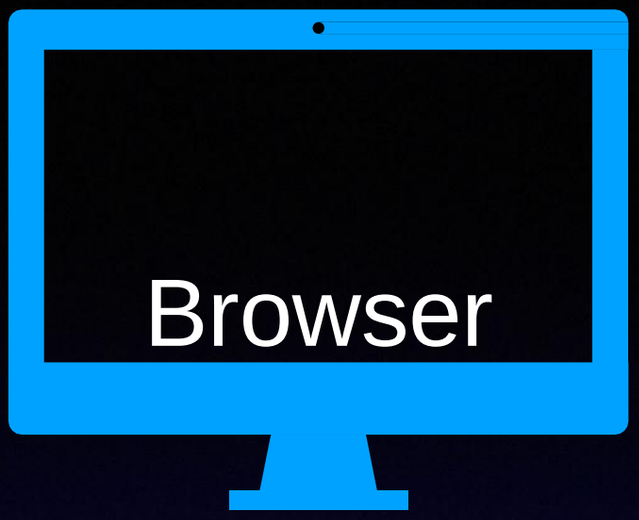
Why do we need to know about web systems?

- Get a job as a web developer (front end or back end or full stack)
- So you can publicise your own technology yourself
- Because when you say “computer science” to someone, they’ll ask if you have a website

A Web System



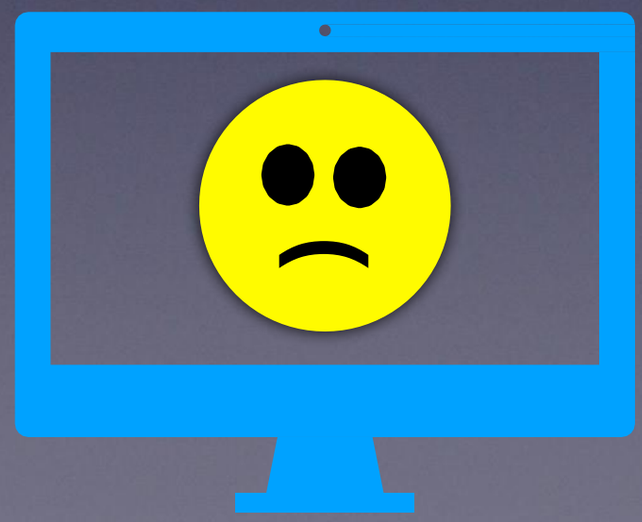
The Browser



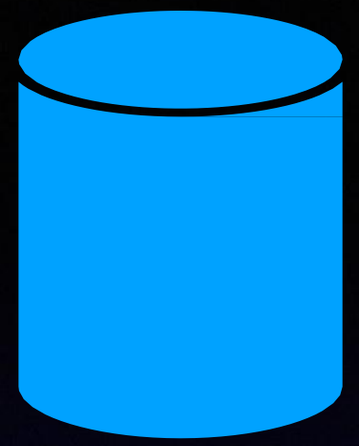
- HTML - HyperText Markup Language
- CSS - Cascading Style Sheets
- Images - (various formats, JPEG, SVG, PNG, GIF)
- JavaScript
- WebM - for multimedia

What can’t a browser do?

- You can’t assume that your browser can process **any** programming language
- It’s not a compiler (usually) and you can’t install things on it
- So if you have anything “big”, you’ll need a back end



The Server



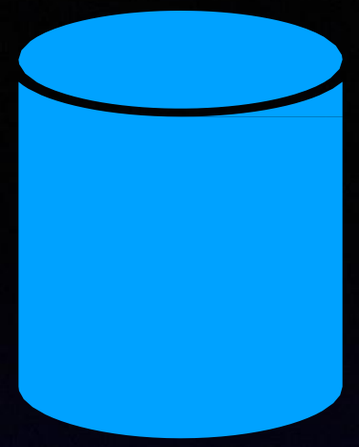
It’s just a computer!

It has an operating system and some sort of server application running on it (a stack). It can run whatever you put on it (within reason).

It responds to requests from clients and handles multiple clients at once.

It can contact other resources (servers or databases)

The Server



- Access to a shared data resource (e.g. a database or some other source of data)
- Security of execution (a server can provide an authentication service)
- Privacy of source code (clients do not see the code that is running on the server, they only see the response to their request).

Why have a server?

- Allows controlled interaction between two clients/browsers/users.
- Allows access to data resources that aren’t feasible via a browser (e.g. data visualisation on a big or “private” dataset).
- Allows access to computing resources that aren’t feasible on a user’s machine.

A word on “servers”

You can get **front-end servers** and **back-end servers.**

This is called a **headless** web site.

What is a Headless Website: Modern Dev Approach | Ramotion Agency

What's *your* stack?

- Your stack is the languages, frameworks and protocols that you are familiar with.
- A web system's stack is the languages, frameworks and protocols that it uses to do its job.
- You can uncover some of the technologies used on specific urls using https://w3techs.com/ or other tools

2024

Web Technologies used by Rgu.ac.uk

Screenshot of w3tech

Site Info - Rgu.ac.uk

Overview of web technologies used by Rgu.ac.uk.

Website Background

Description on Homepage	Aberdeen's Robert Gordon University (RGU) Home | Top Uni for Satisfaction and Employability | Aberdeen Scotland | RGU Aberdeen's RGU is the Scottish University of the Year 2021. A top university in Scotland for graduate prospects, with an international reputation for management, health, energy & technology courses.
Popularity rank	Top 1m among all websites

Content Management System

Joomla	Joomla is an open source content management system, based on PHP and MySQL, originally forked from Mambo.

Server-side Programming Language

PHP	PHP is a scripting language for creating websites.

Client-side Programming Language

JavaScript	JavaScript is a lightweight, object-oriented, cross-platform scripting language, often used within web pages.

JavaScript Library

jQuery	jQuery is a JavaScript library that simplifies HTML document traversing, event handling, animating and Ajax interaction. Originally developed by John Resig.

Email Server Provider

Microsoft	Microsoft is a multinational technology company headquartered in USA, also offering email services.

SSL Certificate Authority

Sectigo	Sectigo (formerly Comodo CA) is a US-based SSL certificate authority.

Social Widgets

Facebook used on inner pages	Facebook Social Plugins provide a way for Facebook users to share web pages with their friends.

2023

Screenshot of w3tech

Site Info - Rgu.ac.uk

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Website Background

Description on Homepage	Aberdeen's Robert Gordon University (RGU) Home | Scottish University of the Year 2021 | Aberdeen Scotland | RGU Aberdeen's RGU is the Scottish University of the Year 2021. A top university in Scotland for graduate prospects, with an international reputation for management, health, energy & technology courses.
Popularity rank	Top 100k among all websites

Content Management System

Joomla 3.9.20 51% of sites use a newer version	Joomla is an open source content management system, based on PHP and MySQL, originally forked from Mambo.

Server-side Programming Language

PHP	PHP is a scripting language for creating websites.

Client-side Programming Language

JavaScript	JavaScript is a lightweight, object-oriented, cross-platform scripting language, often used within web pages.

JavaScript Libraries

jQuery	jQuery is a JavaScript library that simplifies HTML document traversing, event handling, animating and Ajax interaction. Originally developed by John Resig.
Bootstrap	Bootstrap is an open source HTML, CSS, and JavaScript framework.
MooTools used on inner pages	MooTools (My Object-Oriented Tools) is a modular, object-oriented JavaScript framework, originally developed by Valerio Proietti.

Email Server Provider

Microsoft	Microsoft is a multinational technology company headquartered in USA, also offering email services.

SSL Certificate Authority

Sectigo	Sectigo (formerly Comodo CA) is a US-based SSL

2021

Screenshot of w3tech

Site Info - Rgu.ac.uk

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Website Background

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Popularity rank	Number 40,750 of all websites according to Alexa
Main visitors locations	

Country	Visitors	Country Rank
United Kingdom	30.3%	6,269
Nigeria	28.7%	865
India	6.2%	116,442

Content Management System

Joomla 3.9.20 27% of sites use a newer version	Joomla is an open source content management system, based on PHP and MySQL, originally forked from Mambo.

Server-side Programming Language

PHP 7.2.31 43% of sites use a newer version	PHP is a scripting language for creating websites.

Client-side Programming Language

JavaScript	JavaScript is a lightweight, object-oriented, cross-platform scripting language, often used within web pages.

JavaScript Libraries

jQuery	jQuery is a JavaScript library that simplifies HTML document traversing, event handling, animating and Ajax interaction. Originally developed by John Resig.
Bootstrap	Bootstrap is an open source HTML, CSS, and JavaScript framework.

Web Server

Nginx 1.18.0	Nginx (pronounced as "engine X") is a lightweight

2020

Screenshot of w3tech

Site Info - Rgu.ac.uk

Overview of web technologies used by Rgu.ac.uk.

Website Background

Description on Homepage	Aberdeen's Robert Gordon University (RGU) Home | A Top Ranking University for Graduate Prospects | Aberdeen Scotland | RGU Aberdeen's RGU is the top university in Scotland for graduate prospects, with an international reputation for management, health, energy & technology courses.
Popularity rank	Number 45,275 of all websites according to Alexa
Main visitors locations	

Country	Visitors	Country Rank
United Kingdom	30.3%	6,269
Nigeria	28.7%	865
India	6.2%	116,442

Content Management System

Joomla 3.8.11 (45% of sites use a newer version)	Joomla is an open source content management system, based on PHP and MySQL, originally forked from Mambo.

Server-side Programming Language

PHP 7.1.16 (35% of sites use a newer version)	PHP is a popular scripting language for creating web pages.

Client-side Programming Language

JavaScript	JavaScript is a lightweight, object-oriented, cross-platform scripting language, mainly used within web pages.

JavaScript Library

jQuery	jQuery is a JavaScript library that simplifies HTML document traversing, event handling, animating and Ajax interaction. Originally developed by John Resig.

Web Server

Nginx 1.12.2 (70% of sites use a newer version)	Nginx (pronounced as "engine X") is a lightweight open source web server developed by Igor Sysoev.

Databases

- Store data in a structured way.
- Use SQL (Structured Query Languages) to find information in databases and database commands to control them.
- Examples: include MySQL, Oracle, Microsoft SQL server, MongoDB

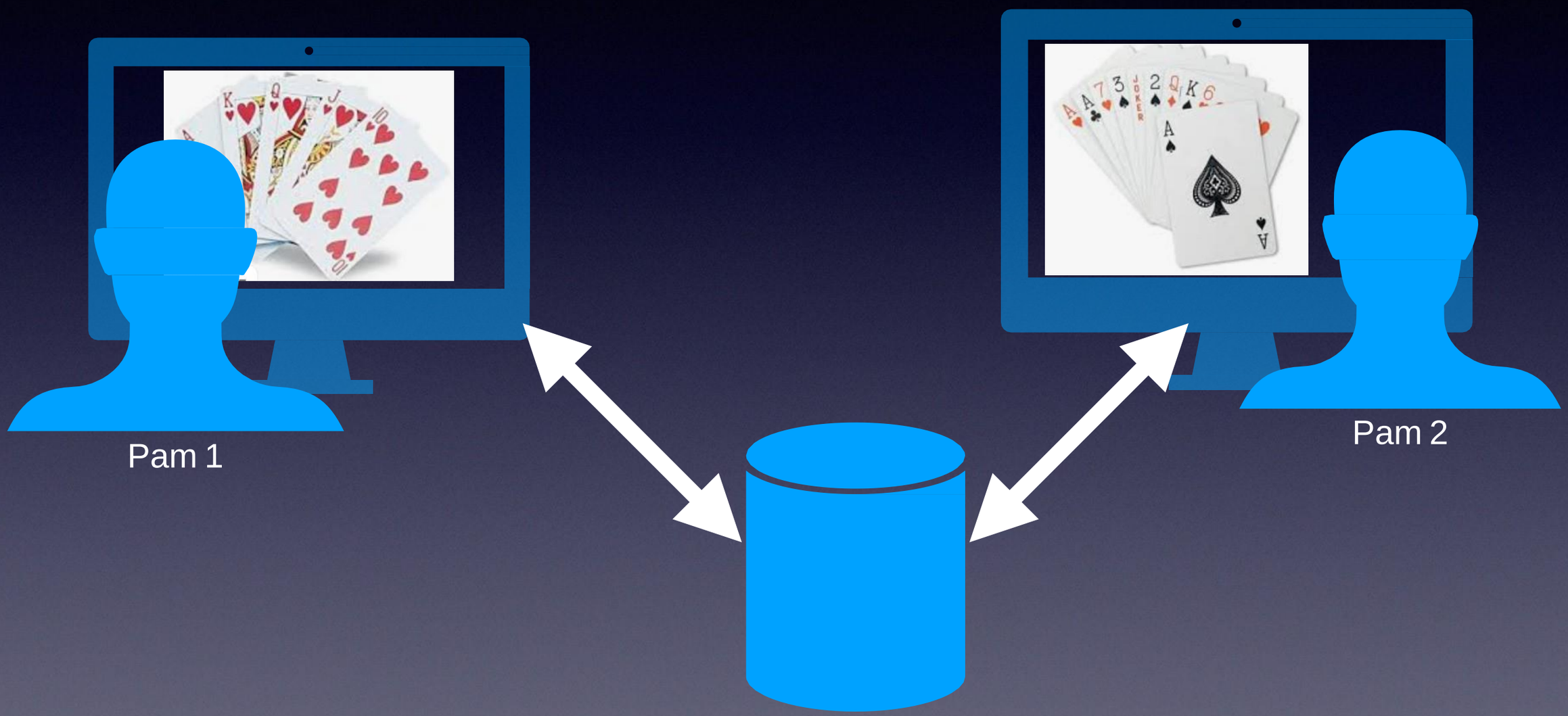
APIs

- Application Program Interface – key part of “headless” web sites
- Defines a series of **protocols** for accessing data or services
- Examples for web services include RESTful APIs or SOAP (Simple Object Access Protocol)

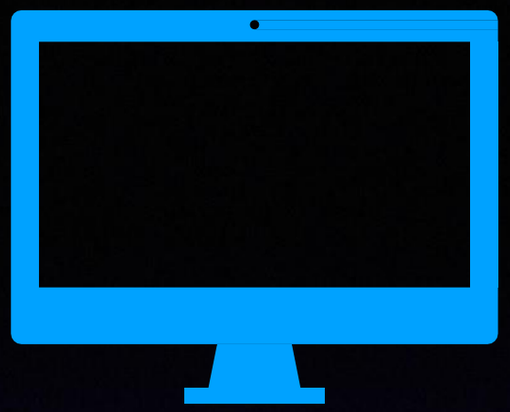
Designing a Web System

- You need to decide what the web system will do now and in the future (using some requirements analysis)
- You need to decide what functionality will go where (what goes on the client, what goes on the server, front end vs back end etc.)
- You need an idea of how to structure the multiple code files so that you can work on them easily and potentially as part of a team.

Examples - a card game

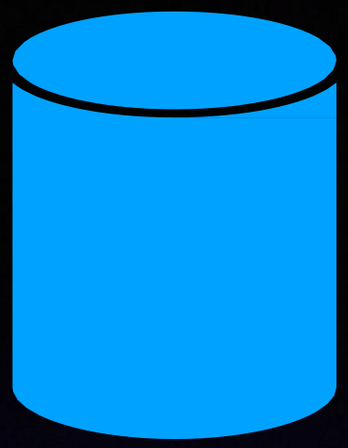


Blackjack; Texas Hold ‘Em; Fluxx; Pokemon



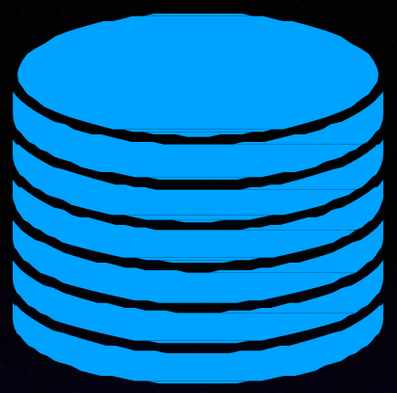
Card game

- Front end:
  - Displays cards
  - Records direct user input



Card game

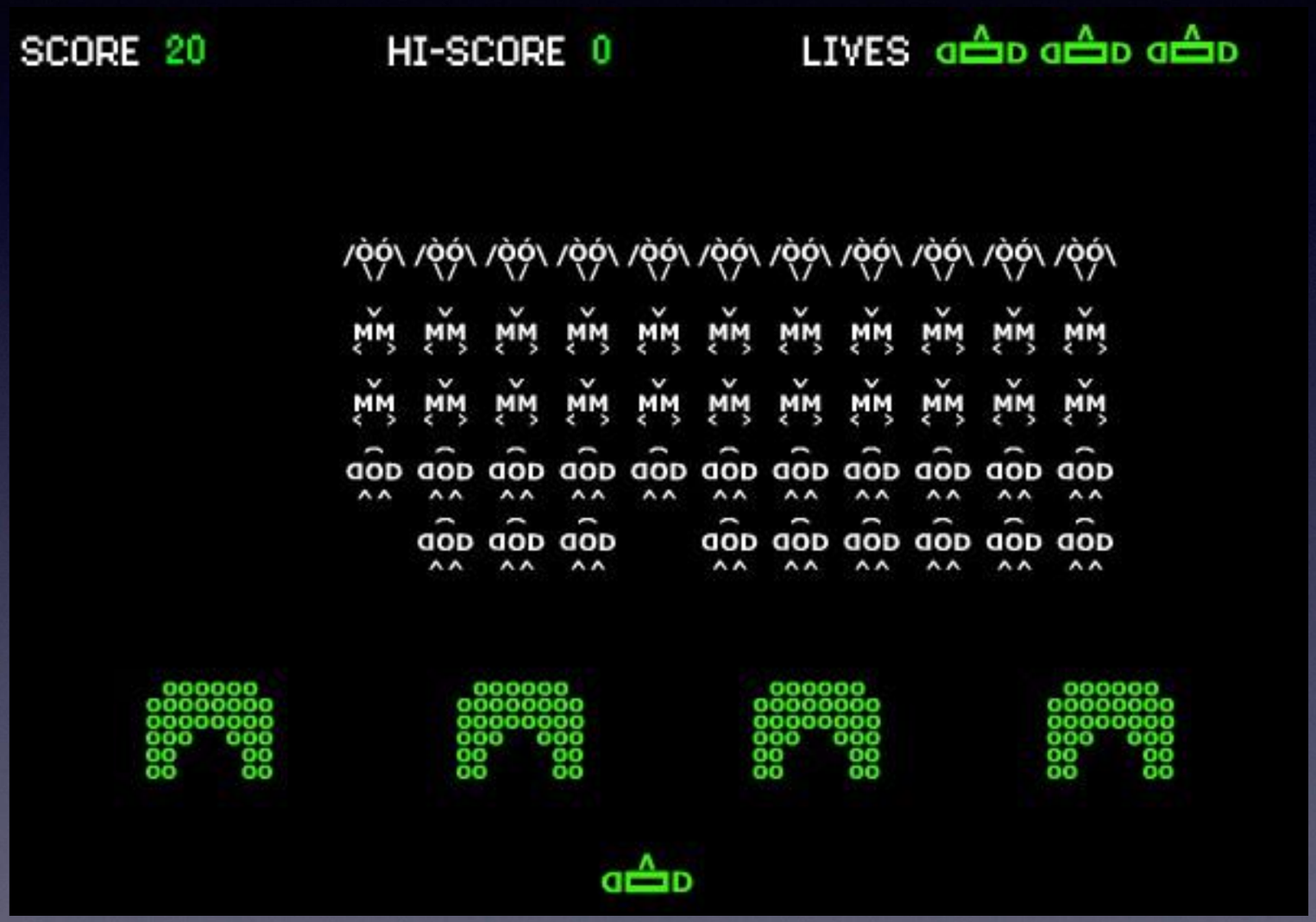
- Back end:
- “Deals” cards
- Communicates with users



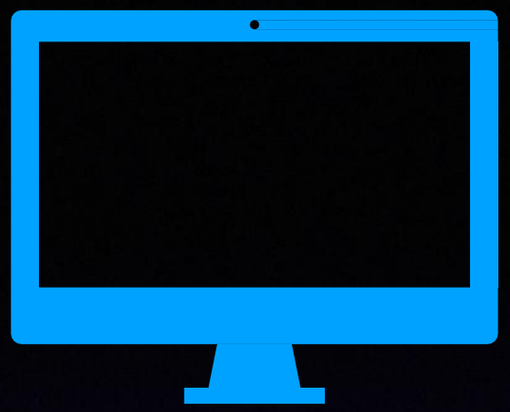
Card game

- Database:
  - User accounts
  - Handles continuity (e.g. user scores)

Examples - a time-based game

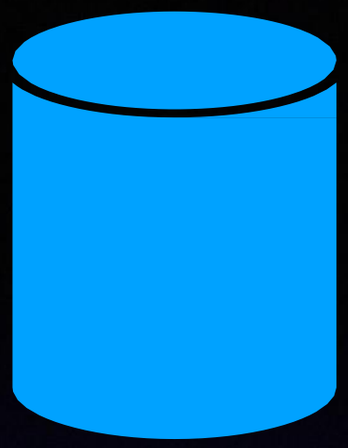


Space Invaders; Pacman;



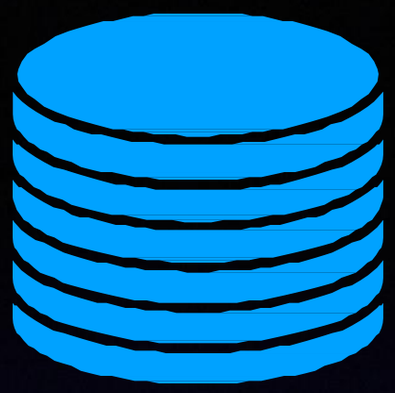
Game

- Front end:
  - Lets user play game!
  - Records direct user input



Game

- Back end:
  - “Serves” game (i.e. provides the code for each level).
  - Communicates with (between) users



Game

- Database:
  - User accounts
  - Handles continuity (e.g. user scores)

Shop

Where does the “basket” live?
Where will the stock details live?
How would you know?
Do things change at the “checkout”?

But also

- You need to develop or enhance your coding style
- You need to adopt (or strengthen) good coding practices so you can work with other people or even just work with your own, old code

Three Programmer Virtues

- Laziness: The quality that makes you go to great effort to reduce overall energy expenditure. It makes you write labor-saving programs that other people will find useful and document what you wrote so you don't have to answer so many questions about it.
- Impatience: The anger you feel when the computer is being lazy. This makes you write programs that don't just react to your needs, but actually anticipate them. Or at least pretend to.
- Hubris: The quality that makes you write (and maintain) programs that other people won't want to say bad things about.

From Larry Wall "Programming Perl", 2nd Edition, O'Reilly & Associates, 1996 via http://www.threevirtues.com

Programming Don’ts

- Don’t re-invent the wheel. Design patterns already exist. We’ll be looking at some of these in the coming weeks.
- Don’t screw over your future self.

Vibe coding

Be fearless.
Watch and understand it.
You are smarter than the computer.

ComputerPhile on AI alignment: 'Forbidden' AI Technique - Computerphile

What this module is not

- It’s not a guide to using IDEs. Use the tools available. Use the free tools where possible.
- It’s not an advert for a particular tool/platform

Lab 1

- Today’s lab is hopefully revision
- The most important thing is having **your local computer** (and you) able to run node and GitHub (or gh) through the command line
- You should also end up with a basic website with a front- and back- end, stored in a GitHub.
- Don’t spend all your time on CSS styling.

Now what?

- You should make sure you understand the main components of a web system
- You should bear in mind where you are, which computer is in front of you, and which computers are far away