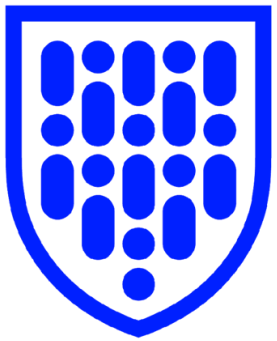

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Agenda: Module 2

- How does the **Internet** work
- Introduction to **IPs** and **ports**
- Introduction to **HTTP**
- How do **web browsers** work
- Introduction to **HTML**
- Introduction to **CSS**
- **Fluid layout** and **Responsive CSS**

Front-end development basics

Module 2
Part 1

How does the internet work

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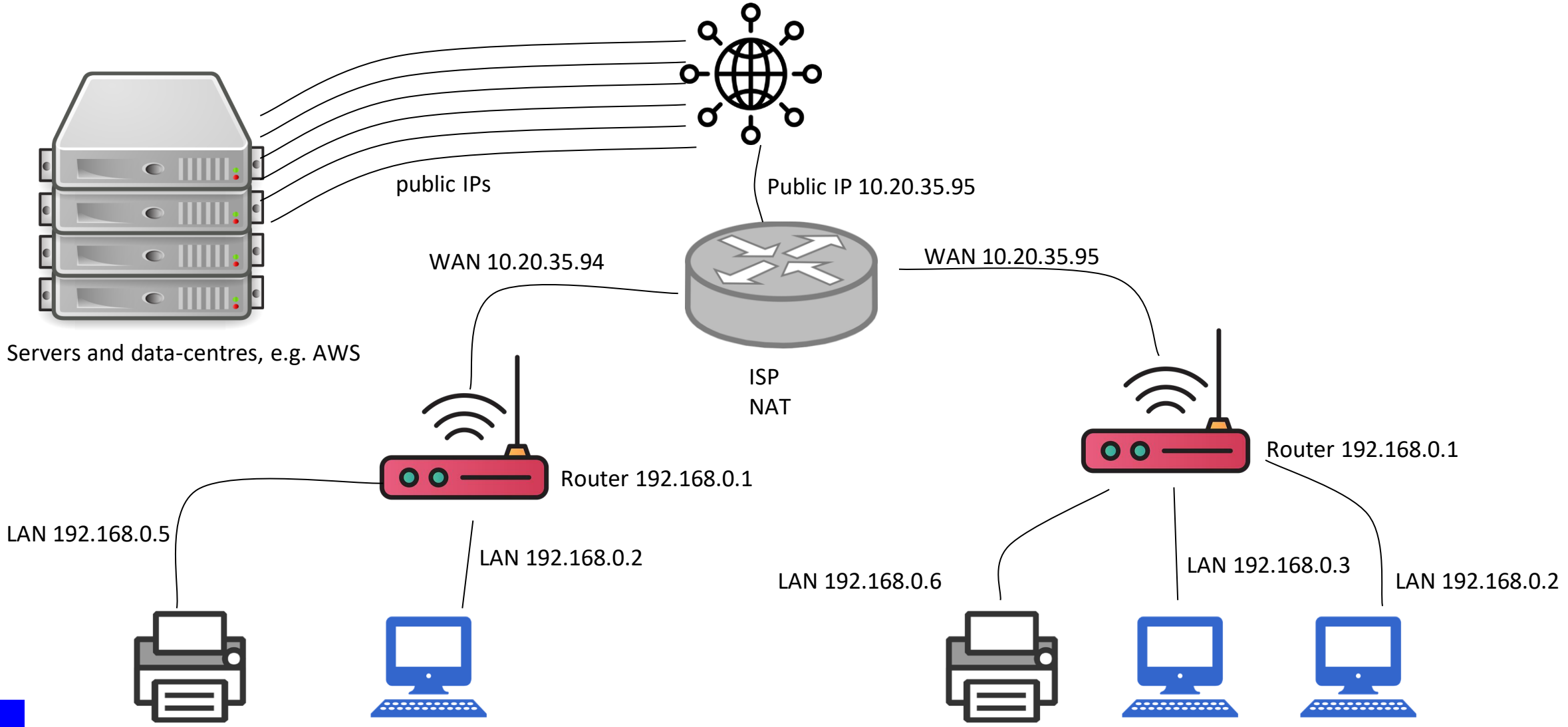
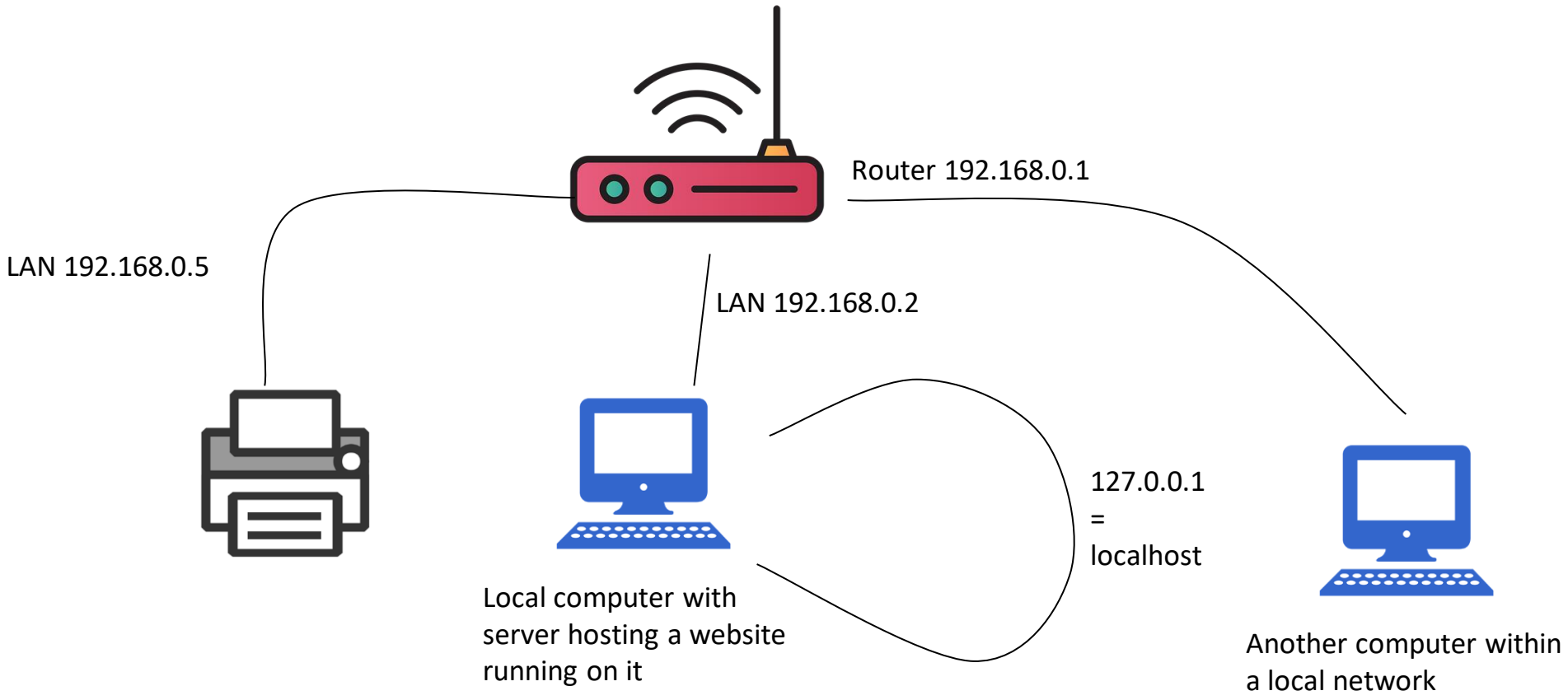
How does the Internet work?

- The **Internet** is a collection of interconnected devices which are spread across the globe, like computers, internet routers, basically anything that connects to the internet
- Each device on the **Internet** gets assigned an **IP (Internet Protocol) address**
- Devices can be accessed using assigned **IP addresses**
- Some **IP addresses** are publicly accessible while some others are private and hidden within a **local network**
- Whenever you use internet, you in fact use **IP**

How does the Internet work?

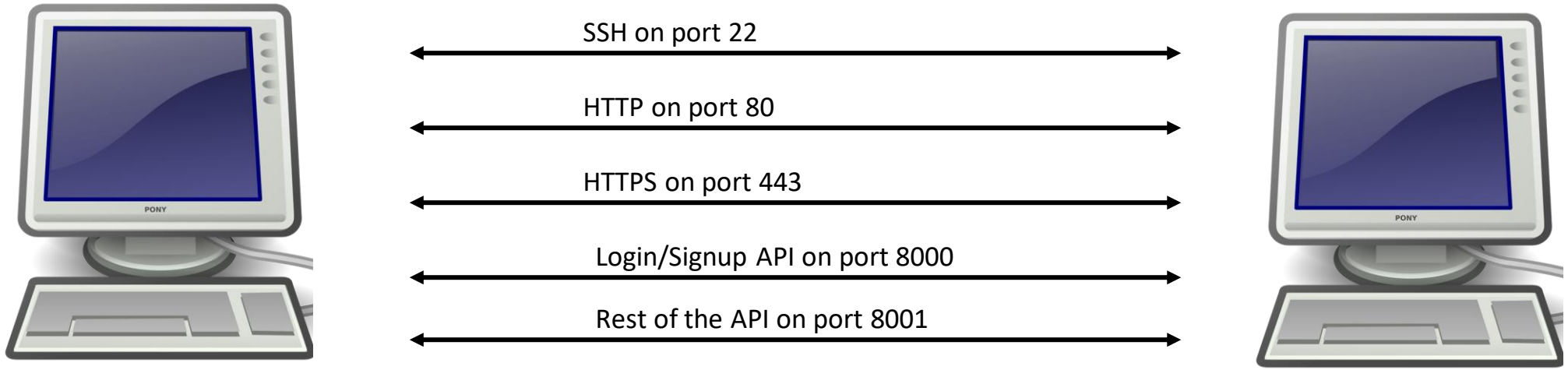


How does the Internet work?



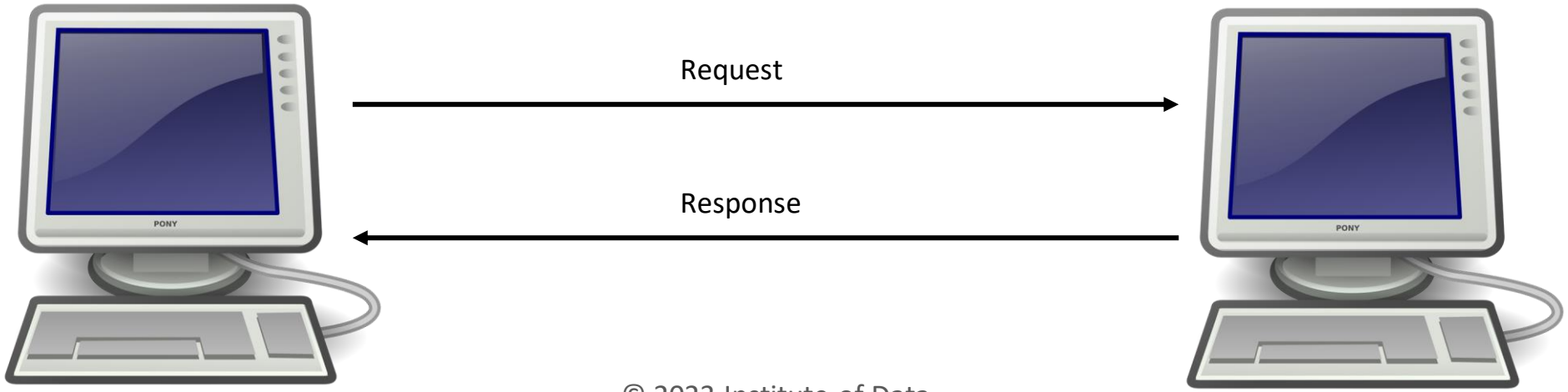
How does the Internet work? - ports

- Each computer connected to the Internet can allow incoming traffic on many different ports
- Some ports are reserved to be used by the specific application, e.g. when you browse the Internet you use port 80 for normal connections and port 443 for secure connections (which are mostly standard now)



Client, server, request and response

- Clients and server exchange information by the client requesting something from the server - requesting a web page, confirming purchase of an item, sending a form
- Both, request and response contain data that client and server are exchanging and additionally some metadata
- Client may request establishing a connection that will allow the server to stream data to the user, like YouTube



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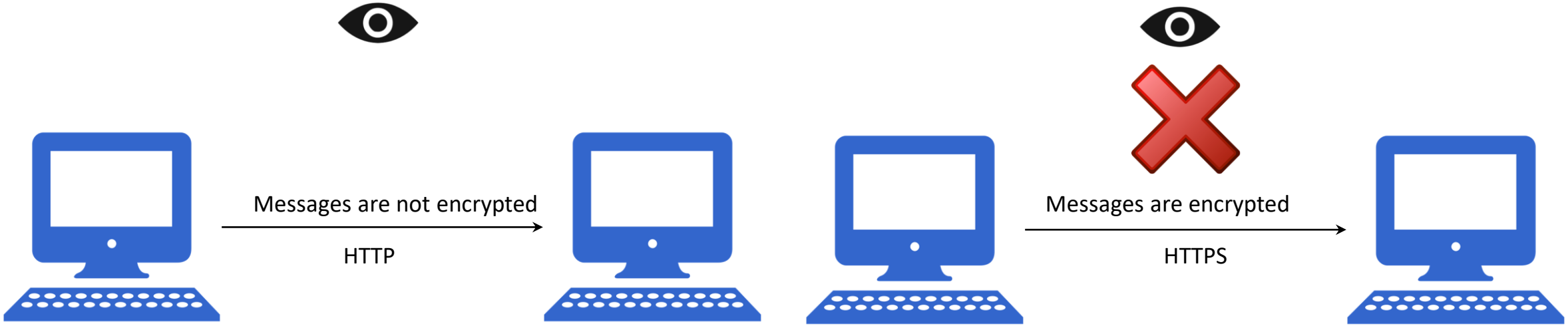
HTTP - HyperText Transfer Protocol

- **HTTP** is a way of communicating that is based on Request/Response model
- Web browsers, mobile apps and more send information to the servers for processing and storage
- Web browsers can also request content from the server
  - asking to send a web page (HTML file) from server to client
  - asking to send an information that is stored on the server, e.g. information about the calendar or emails in the mailbox (JSON)

HTTPS - secure version of HTTP

- Messages sent over HTTPs are encrypted
- Use of secure HTTPs is indicated by the padlock icon next to the URL in the browser navigator panel



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Website, Web page and URL

- Website can consist of many webpages
- Traditionally each webpage is represented by single HTML document
- A URL, or Uniform Resource Locator is a string of text that defines where something is located on the Web, e.g.

  https://www.institutedata.com/picture.jpg

  https://www.institutedata.com/courses/software-engineering-program/

Website vs Webpage

https://www.institutedata.com

File name: index.html
URL: https://www.institutedata.com/index.html
URL: https://www.institutedata.com

File name: images/image.jpg
URL: https://www.institutedata.com/images/ima

File name: contact.html
URL: https://www.institutedata.com/contact.html
URL: https://www.institutedata.com/contact

File name: courses/web-development.html
URL: https://www.institutedata.com/web-development.html
URL: https://www.institutedata.com/web-development

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How do web browsers work?

- **Web browsers** allow our computer to access **web pages** on the **Internet**.
- Typed in **URL** is translated to **IP** in a process of accessing a **web page**; your **browser** always uses **IP** to display a **web page**
- When visiting a **web page** your **browser** downloads an **HTML** file from its **URL** and then executes the file inside the browser, thus creating a **web page**

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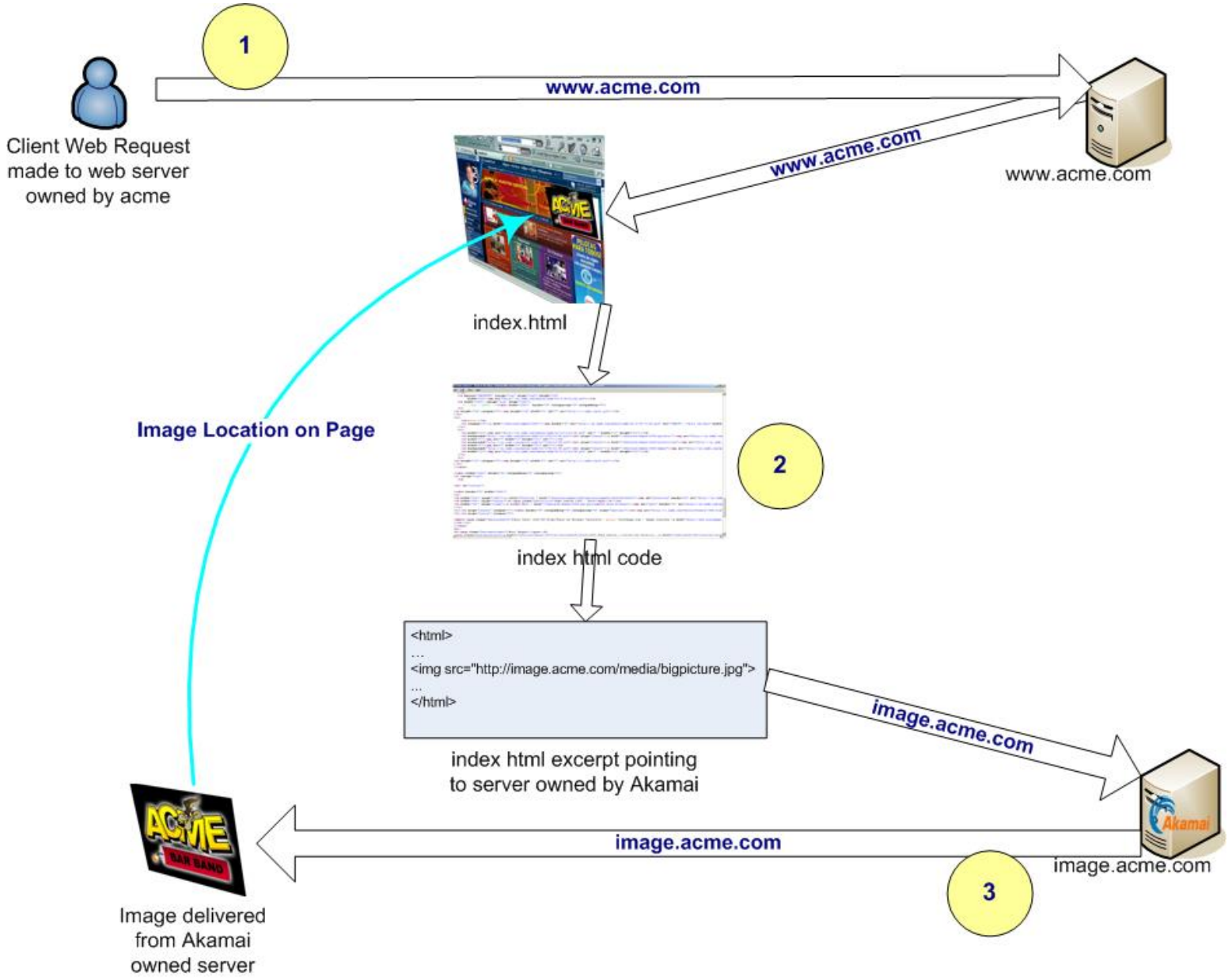
How do web browsers work?



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Browser support

- Web development is a constantly evolving field with new features and feature proposals constantly added to the HTML and CSS specifications
- Older browsers are not capable of supporting new functionalities and there are still a lot of old browsers being used
- Web developers should write code that covers a wide range of devices. To check browser support for given HTML tag or CSS property you can use https://caniuse.com or https://developer.mozilla.org/
- There are special programs called preprocessors that preprocess code to increase browser support, e.g. autoprefixer for CSS

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Browser support - shimming and polyfilling

- The process of making new features work on old browsers is called either shimming or polyfilling
- Shims and polyfills commonly use JavaScript to mimic functionalities missing in older browsers
- Shims and polyfills are usually less performant than native features in new browsers

Front-end development basics

Module 2
Part 2

HTML

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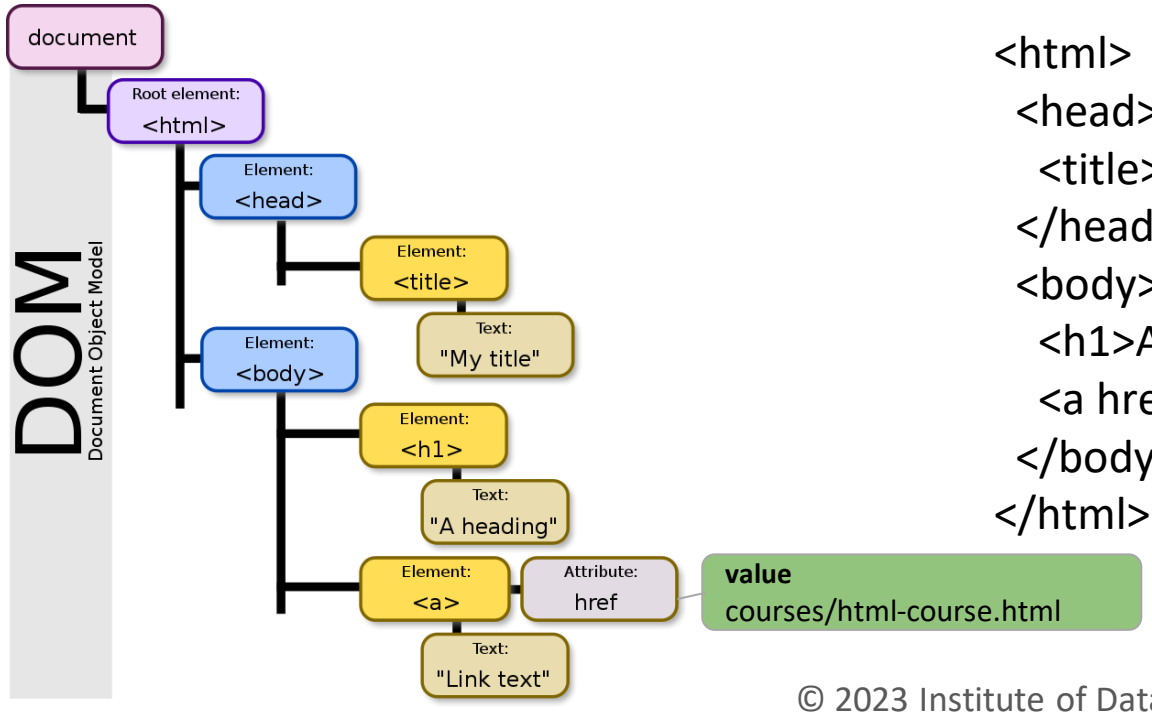
HTML

- HTML stands for HyperText Markup Language
- HTML gives our website a structure, content and provides it with metadata
- HTML tag - - is called an HTML element when the webpage load
- HTML tags can have attributes assigned to them, e.g
  - <html lang=”en”>
  - <a src=”images/image.png” title=”My cat”>

Document Object Model - DOM

- Browser loads the HTML from the Internet and then parses it to construct the DOM - in-memory representation of the structure and content of the page
- parent, child, sibling, descendant, direct descendant




```
<html>
 <head>
  <title>My title</title>
 </head>
 <body>
  <h1>A heading</h1>
  <a href=”courses/html-course.html”>Link text</a>
 </body>
</html>
```

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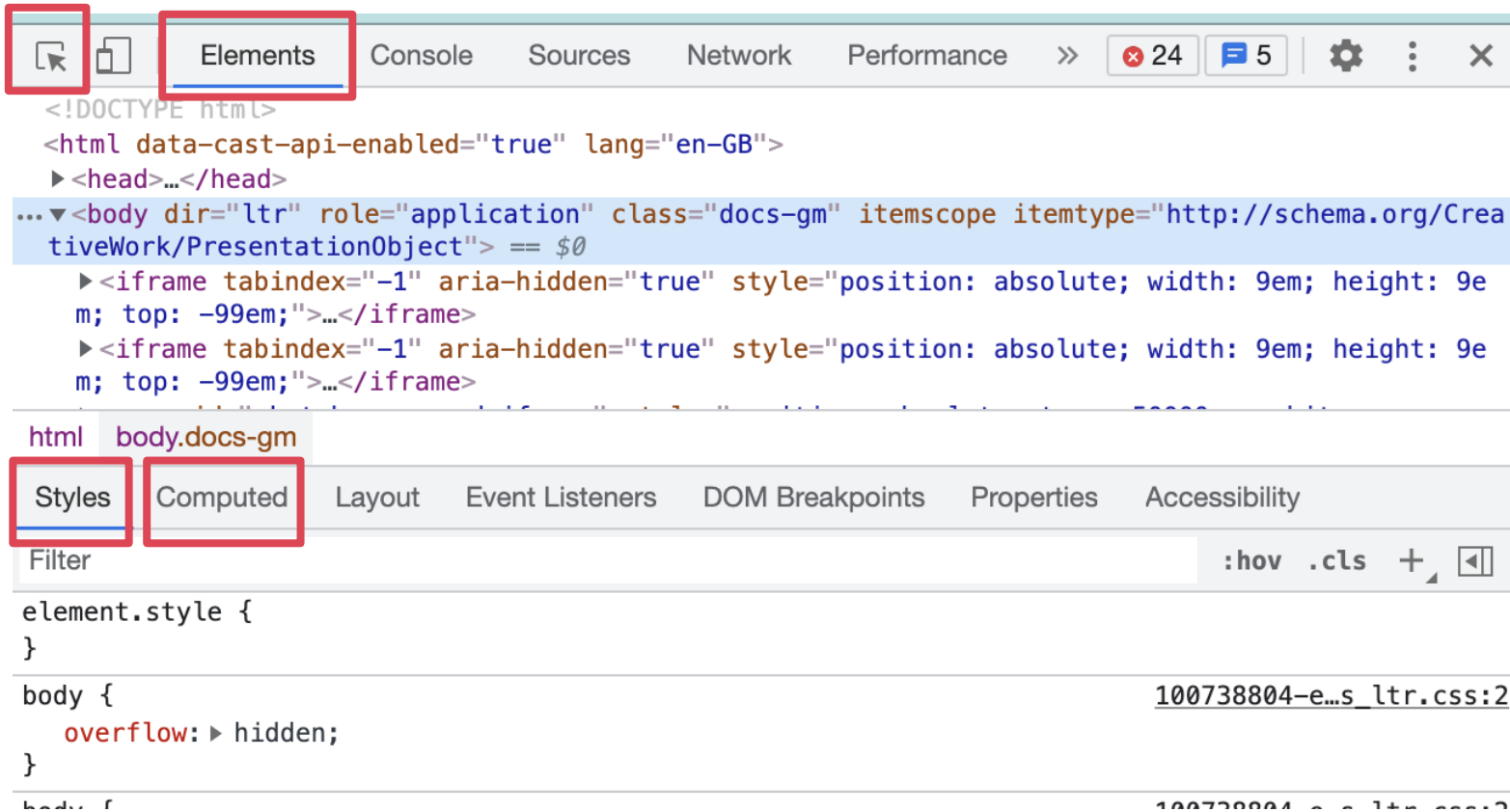
Id and class

- id and class attributes can be added to each of the html elements
- id is a identifier of the element on the page, the same id shouldn’t repeat on the same page twice (within HTML document)
- class allows to assign one or multiple CSS classes to each HTML element
- With use of JavaScript you can find elements by their id or classes

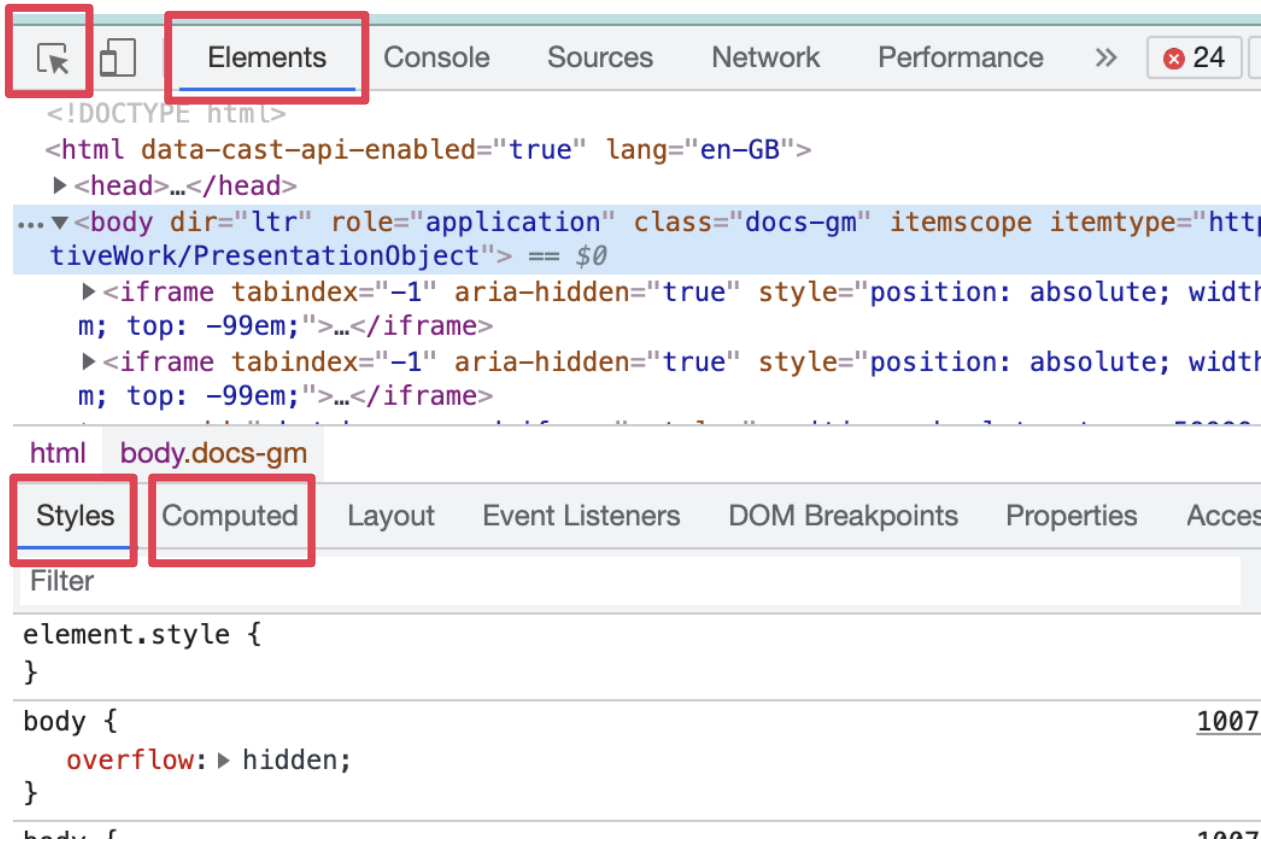
Chrome developers tools

- F12 - shortcut to open developers tools
- Inspection tool
- Elements tab
  - Styles subtab
  - Computed subtab
  - $ and $$ magic Chrome commands



Exercise - Chrome developers tools

- Go to your favourite website and try inspecting elements
- Have a look at styles tab and try changing some values



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Head and metadata

- Link to the icon and page title
- Page metadata - meta tag
- Metadata is used by search engines and other 3rd party platforms
- There can be different metadata for different sub-pages
- Links to CSS and inline CSS styles
- Links to JavaScript and inline JavaScript code
- head section isn’t visible like other content of the page
- Other types of metadata, e.g. OpenGraph or Twitter data

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Block elements

- Block element occupies the entire horizontal space of its parent element and vertical space equal to the height of its content
- Block element can contain other block elements or inline elements
- Block element will start with a new line and end with a new line
- div is generic block container
- Block elements height can be set using CSS

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Inline elements

- Inline elements occupy the space equal to its content
- Inline elements can contain text or other inline elements
- They neither start with a new line nor end with a new line, hence inline
- Height cannot be set on inline elements
- span is generic inline container
- Inline elements height cannot be set using CSS

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Line break

- Creates line break in a block of text
- Should only be used within a paragraph to shape the text - line breaks are not commonly used
- Do not use line breaks to create space in the design
- Useful when writing poems or introducing a line break in an address
- With introduction of HTML5 both syntaxes are valid -
 and

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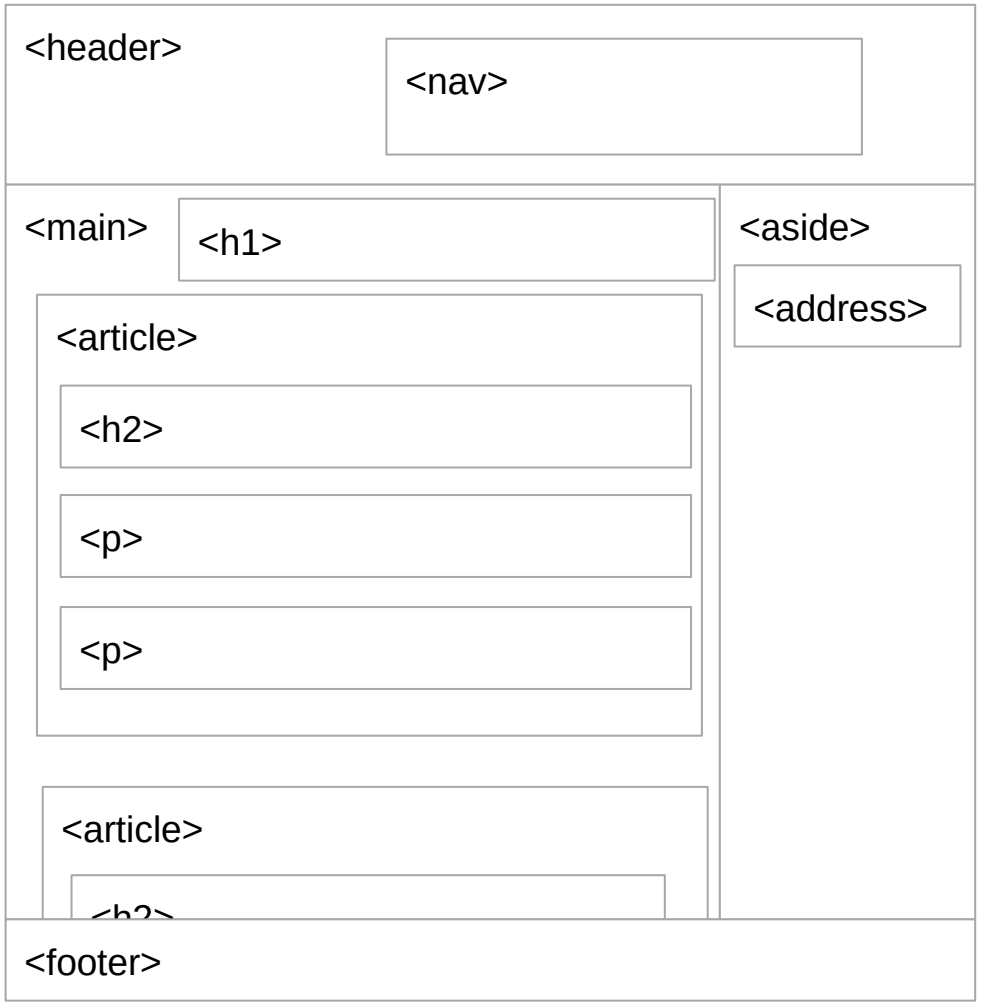
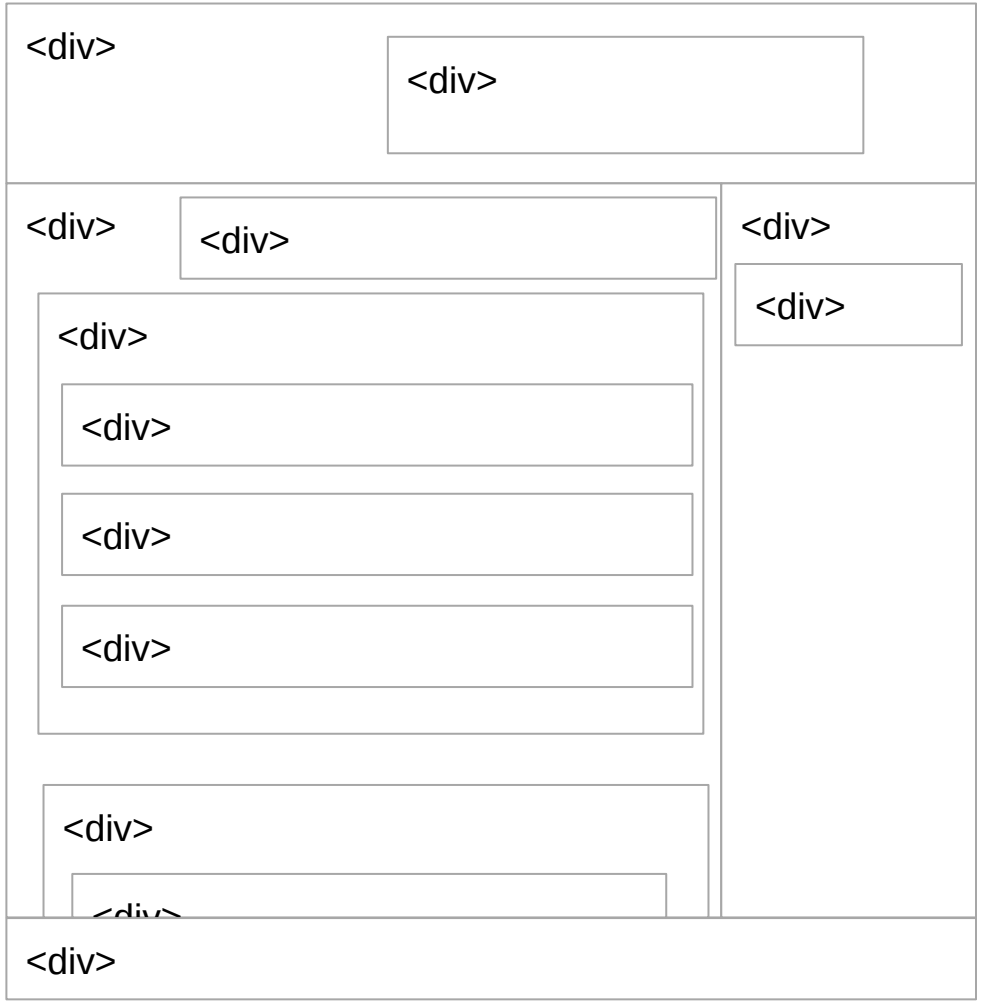
Semantic elements

- A semantic element describes its meaning to the browser, search engine and the web developer
- div and span are not semantic elements
- It is possible to style semantic and non-semantic elements so they look the same
- Using semantic elements improves accessibility of the page - visually impaired people use **screen readers** to browse the web
- Using semantic elements improves SEO (Search Engine Optimization) of the page - it ranks higher in search engines like Google

Semantic elements





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Headings

- Headings are wrapped with <h1></h1> … <h6></h6> elements
- Headings are used by search engines to index your page, text inside them is important for SEO
- Each heading elements represents different level of content in the document, h1 represents the main heading, h2 represents a subheading etc.
- Preferably there’s one h1 element per page
- Documents with too many headings elements are hard to navigate (aim to have at most 3 heading elements per page)

Paragraphs

- Wrap each paragraph of text with a <p> element
- Using paragraphs will help people using screen readers navigate through the content

```
<p>
  Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.
</p>
```

HTML entities

- HTML entity is a special string that starts with & and ends with ;
- Entities are used to display reserved characters (&, <, >, “), invisible characters (non-breaking space) or other special characters
- & = & (reserved as beginning of HTML entity)
- < = < (reserved as beginning of HTML tag)
- > = > (reserved as end of HTML tag)
- " = “ (reserved as beginning of HTML attribute)
-   = non-breaking space
- © = ©

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Ordered and unordered lists

- Unordered lists are used to mark up lists where order doesn't matter, they're usually represented as bullet points
- Ordered lists are used to mark up lists where order does matter, they're usually represented as numbered lists
- Both types of lists can be nested

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Emphasis and strong

- Emphasis and strong elements are used to stress certain words in a paragraph
- Emphasis () will make enclosed text italic
- Strong () will make enclosed content bold
- Screen readers will read that content in a special tone of voice
- There’re also Italic (<i>), bold (<b>), underline (<u>) elements

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Other text elements

- Description lists (<dl>, <dt>, <dd>)
- Quotations (<quote>, <q>)
- Citations (<cite>)
- Abbreviations (<abbr>)
- Contact details (<address>)
- Superscript and subscript (<sub> , <sup>)
- Computer code (<code>)
- Times and dates (<time>)

Hyperlinks - anchor element (<a>)

- Anchor element <a> links the HTML element to another place on the Internet (hence the web)
- Link points to an URL with use of src attribute
- Almost anything can be turned into a link - text, an image or the entire section of a page
- Link can be in 5 different states: normal, hover, focus, active and visited
- title and target attributes (target=”_blank”)
- download attribute informs the browser about the filename of the downloaded file

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Comments

- Comments are used to include comments for ourselves and developers in the HTML code
- Comments aren’t displayed in the HTML page
- Comments are used to document, point out something unusual, tricky or unresolved
- <!-- Here goes arbitrary text - a comment -->

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Multimedia elements

- Multimedia HTML tags allow us to embed various elements like images, videos or audio into our website
- Images and videos will occupy space equal to their size
- Historically audio and video were embedded on the web with use of plugins like flash, now we have native HTML5 <audio> and <video> elements
- Audio and video can be controlled with JavaScript

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Image

- <img src="images/my_photo.jpg” alt="Me on holidays">
- alt attribute adds alternative text to the image that search engines and screen readers can make use of. It is also displayed for users who use turned off images to save bandwidth
- If an image is purely decorative then you should include it to the webpage using CSS background property to enhance screen-readers’ users experience
- You can use <figure> and <figcaption> if you plan to add any caption to your image, <figure> and <figcaption> elements can be used to annotate any other type of content, e.g. tables

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Video

- src, controls, autoplay, loop, muted, poster and preload attributes
- Including <p> tag inside <video> tag results in displaying fallback text when video cannot be displayed
- Not all browsers support all video formats so it’s possible to improve support by embedding the same video in different formats using a <source> tag
- Videos when resized will keep their aspect-ratio
- It is possible to add subtitles to the video

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Audio

- <audio> is very similar to <video>
- src, controls, autoplay, loop, muted and preload attributes
- Including <p> tag inside <audio> tag results in displaying fallback text when video cannot be displayed
- Not all browsers support all audio formats so it’s possible to improve support by embedding the same audio in different formats using a <source> tag
- By default audio doesn’t have any display - only when using controls attribute the controls are displayed

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Tables

Cells	

- Display structured data
- Used for tabular data and not for layouts
- Single cell can span multiple rows and columns - colspan and rowspan
- col and colgroup
- Accessibility of tables can be improved

Forms

- Forms are everywhere where we want to collect data from a user - names, passwords, files, financial transactions
- Forms are sent to the server for processing and storage
- Form root element

```
<form action="/order" method="POST">
```

- Input types are text, password, number, checkbox, radio, file and more
- Labelling inputs with <label> is very important for accessibility and SEO

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HTML - iframe

- iframe allows us to embed content of the other web page within our web page
- This is sometimes used to ensure security of the payment, where users provide their payment details only within the iframe of their bank or other known payment provider

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HTML - canvas

- **Canvas** allows us to paint arbitrary shapes
- https://jspaint.app/

Lab 2.1: Working with HTML

- **Purpose:**
  - Practice using HTML elements
- **Resources:**
  - W3Schools
    - https://w3schools.com/
  - Mozilla Developers Network - HTML
    - https://developer.mozilla.org/en-US/docs/Learn/HTML

HOMEWORK

- Go to the Mozilla website and read about HTML elements - https://developer.mozilla.org/en-US/docs/Web/HTML/Element
- Read about HTML forms - https://developer.mozilla.org/en-US/docs/Learn/Forms

Front-end development basics

Module 2
Part 3

CSS

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What is CSS?

- Styling language that is used to change the appearance of the web pages
  - appearance
  - layout
- CSS stands for Cascading Style Sheets
- Many different ways of achieving the same result
- CSS syntax

```
selector {
  property: value;
  property: value;
}
```

Selectors

- CSS Selectors are used to define elements that you want to style
- There are four types of selectors: class, type, id and attribute selectors
- Most common and most useful is class selector
- Universal selector selects all HTML elements
- Selectors can be joined together to create more specific selectors

```
.class-selector {}
#id-selector {}
div /* type selector */
a[title] {} /* attribute selector - links with defined title attribute*/
a[title=”institute of data”] {} /* attribute selector*/
* {} /* universal selector */
div.class-selector#id-selector {} /* specific selector */
```

Selectors - Combinators

- Combinators allows us to style elements in relation to the current element, e.g. sibling, parent or descendants
- Pseudo-classes allow us to style elements that are in a certain state, e.g. a link that is hovered
- Pseudo-elements allow us to style certain parts of HTML elements, e.g. first line of paragraph or generate content using CSS

```
.class-selector div {} /* descendant combinator */
.class-selector > .another-class-selector {} /* direct descendant combinator */

a:hover {} /* :hover pseudo-class targets only links that are hovered */

.article-title::before /* pseudo-element inserted before each .article-title */
```

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Specificity

- When styling elements with different selectors the browser must decide which CSS style (rules) to apply in a scenario of conflicting styles - this is specificity
- More specific selectors take precedence over less specific ones
- type selectors < class selectors < id selectors < inline style
- Avoid overly specific selectors
- When classes conflict the last one defined in the CSS file takes precedence
- Avoid !important to CSS rule will move this rule to the
- Avoid using !important

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Naming conventions

- Traditionally we name CSS classes using hyphen-case, but we can also use camelCase or PascalCase
- Object Oriented CSS - .leftPanel .logo-image
- Functional CSS - .m-2, .h-20, .row, .border-1, .underlined
- When working on a big project, we split parts of the website into smaller pieces and then use class names that are relevant to the given section, e.g. .container
- For small projects it is common to use type selectors
- Keep class names consistent by adhering to the project style guide

Inheritance - initial and inherit

- initial and inherit values can be applied to any CSS Property
- initial will set the value of the property to default (initial) value
- inherit will make an element inherit a targeted rule from the parent
- Inherited properties are CSS rules that are inherited by default
- Non-inherited properties get initial value if the value is not specified

```
p {
 border: 1px solid green;
 color: red
}
```

```
<p>The quick brown fox <em>jumps</em> over the lazy dog</p>
```

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Dimension units

- Dimension units are used to define style of the element with properties like width, margin, padding, font-size
- Most common dimension units are px, em, rem, %, vh, vw
- vh and vw are used to define elements in relation to the size of the viewport

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Display

- inner and outer display
- One value syntax:

  display: block|inline|inline-block|flex|inline-flex|grid|inline-grid
- Two value syntax:

  display: [block|inline][flow|flex|grid], e.g. display: block flex;
- display: none

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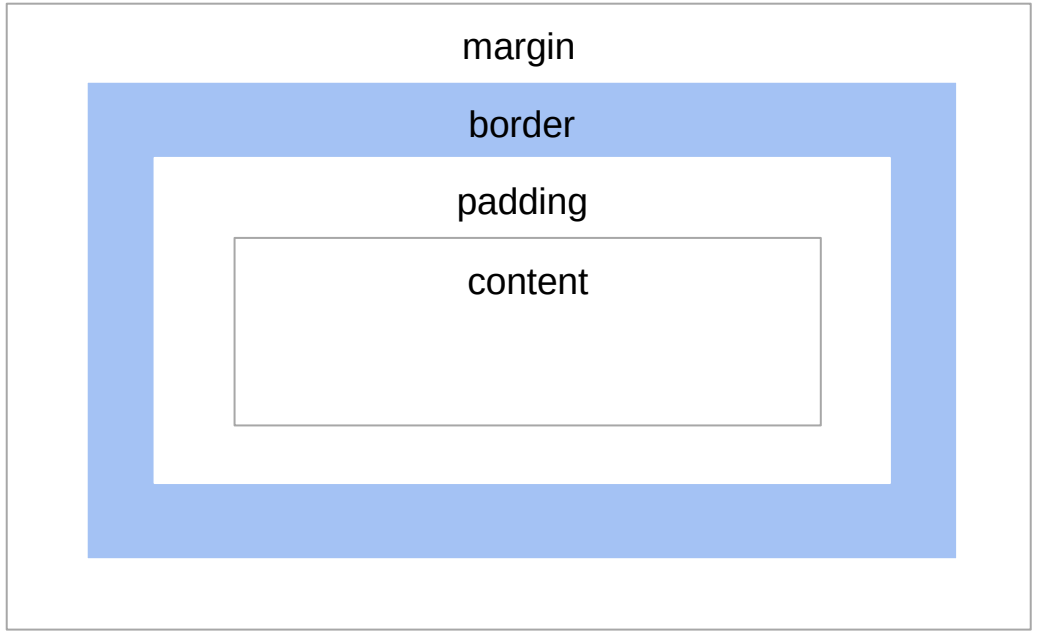
Layout - normal document flow

- Normal layout document flow consists of block and inline elements
- block - vertically-based
- inline - horizontally-based
- inline-block - horizontally-based with some of the block properties
- Floats - legacy way of creating layouts

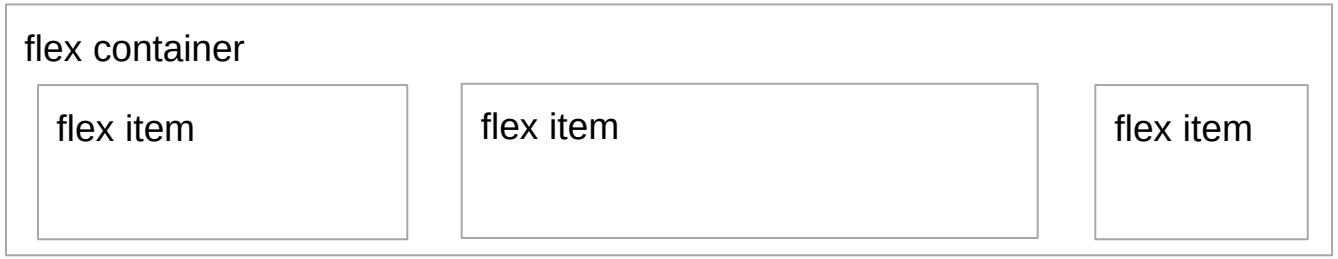
Box model + border-radius and outline

- margin: 5px | 5px 10px | 0 10px 5px -10px;
- padding: 5px | 5px 10px | 0 10px 5px 0;
- border: 1px solid blue;
- width: 50px;
- height: 100px;
- min-width: 20px; max-width: 100vw;
- min-height: 100vh; max-height: 200px;
- box-sizing: border-box | content-box
- border-radius: 10px | 50%;
- outline: 1px solid blue;



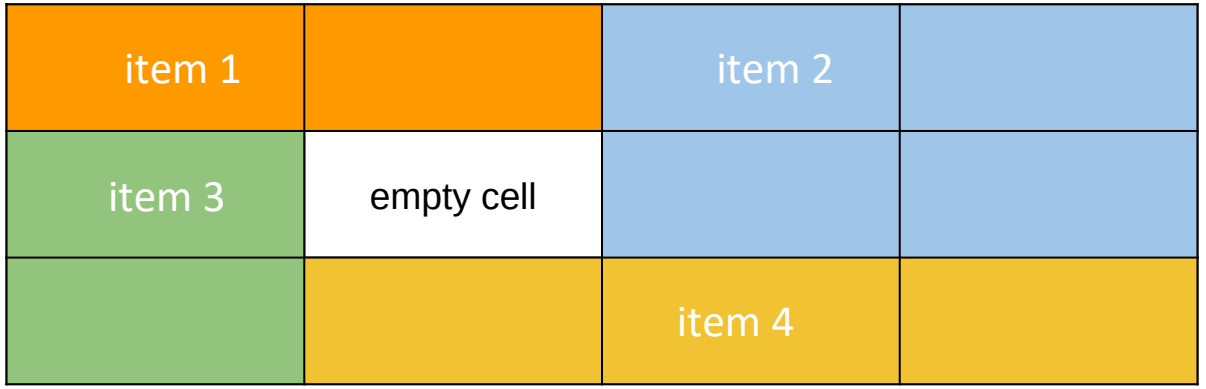
Flexbox Layout

- Efficient way to lay out
- Easy way of aligning items vertically and horizontally
- Easy way defining how to redistribute remaining space by either increasing the spacing or enlarging or shrinking the items
- Works well with elements of unknown or dynamic size
- Direction-agnostic - works well with vertical or horizontal layouts
- Not all flex features are supported on all the browsers



CSS Grid Layout

- Two-dimensional grid-based layout - as opposed to flexbox which is one-dimensional
- Grid can do things Flexbox cannot do and vice versa
- Limited browser support



Background

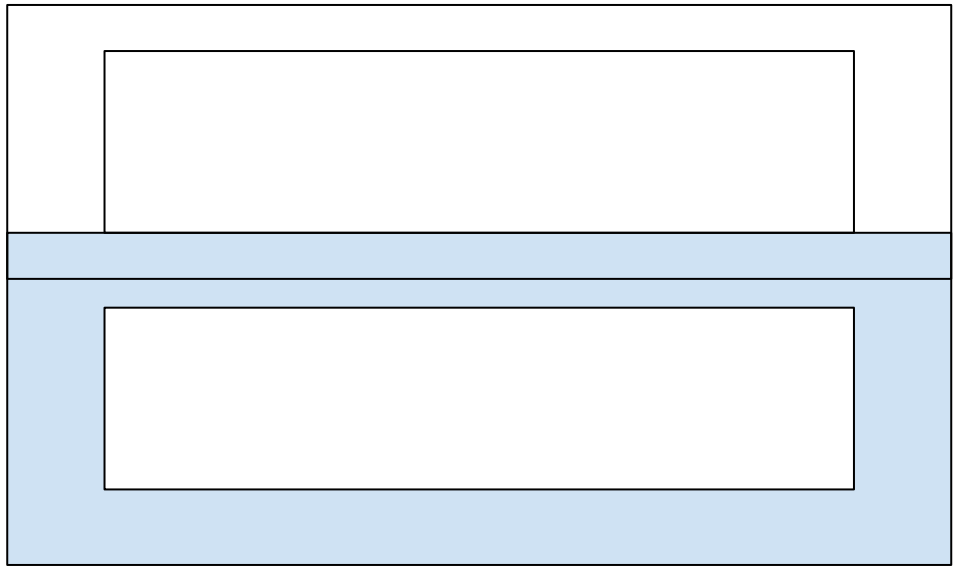
- Decorative images should be included using the CSS background property, rather than <img> tag
- A lot of background properties are used to position and scale the background image of an HTML element in a way that it will always show the part of an image that’s relevant, e.g. on mobile we need to scale down and position the image
- It is possible to add multiple background to one HTML element

Lab 2.2: Working with CSS layouts - flexbox

- **Purpose:**
  - Learning and using the most important concept in layouts - flexbox
- **Resources:**
  - CSS tricks guide to flexbox
    - https://css-tricks.com/snippets/css/a-guide-to-flexbox/

Margin collapsing

- The top and bottom margins are sometimes collapsed into a single margin whose size is the larger of the two margins
- There are exceptions to this rule



Collapsed margins

Position

- position: static | relative | absolute | fixed | sticky
- left: 50px; top: 20px; right: 40px; bottom: 30px;
- Absolutely positioned elements are removed from the document flow
- Relative position is set on the parent, then all the children that are positioned absolutely are positioned in relation to the parent whose position is relative
- Sticky elements activate when scrolling the page

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Colors

- Colors are used to color backgrounds, borders, outlines and text (font, shadow, underline)
- Named colors - red, green, slateblue
- RGB functional notation - rgb(255, 99, 71, 0.7), rgb(255, 99, 71, 70%)
- Hexadecimal string notation - #rrggbb, #rgb, #rrggbbaa, #rgba
- HSL functional notation
- Colors and accessibility
- Palette generators

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Styling text

- Font styles - font-family, font-size, font-weight, color, font-weight, text-transform, text-decoration, text-shadow
- Text layout styles - text-align, line-height, letter-spacing, word-spacing
- Default fonts and Web Safe Fonts - sans-serif, serif, monospace, cursive, fantasy
- Font stacks
- @font-face
- Font licensing and using fonts from the Internet

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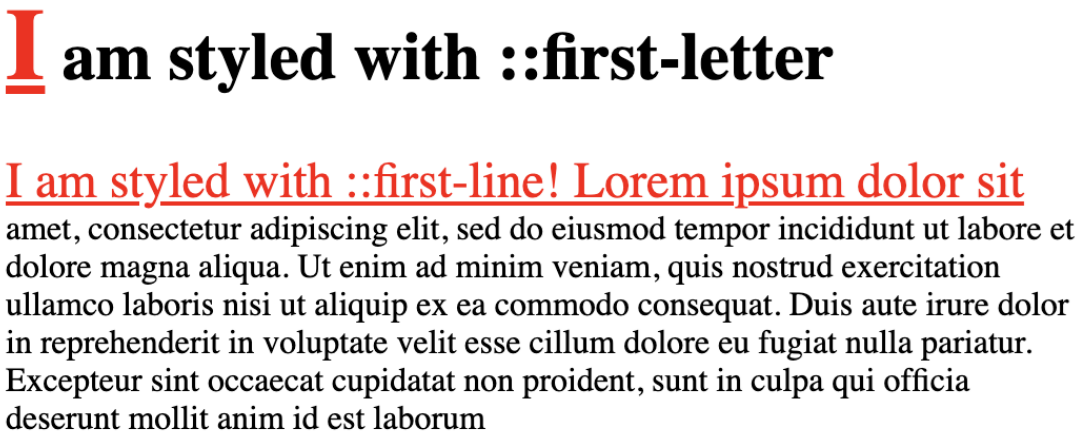
Styling links with pseudo-classes

- Link selectors - a, a:link, a:hover, a:active, a:visited, a:focus
- By default links are:underlined, unvisited links are blue and visited are purple and hovering a link changes pointer to a hand
- You can navigate links on any page just by pressing the Tab key and focusing on different links
- When styling links:
    - underline or highlight in some other way
    - make them react when hovered or focused
    - Change cursor when hovering over the link

Pseudo-elements and css-generated content

- Pseudo-elements - ::before, ::after, ::first-letter, ::first-line
- Used with other selectors, e.g div::after or .class::first-line
- Generate content combining CSS content rule and ::before and ::after pseudo-elements
- Style first letter or first line of text



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Calculate CSS property value - calc()

- Supports 4 operators: +, -, *, / and parentheses e.g.

```
calc(100% - (40px + 5% / 2))
```

- Uses standard operator precedence rules
- length, angle, percentage, number or time can be the result of a calculation
- **+** and **-** characters must be surrounded by whitespaces, it's recommended to surround also ***** and **/**
- calc() makes it easy to set width of an element with a margin

Lab 2.3: Working with CSS

- **Purpose:**
  - Learning and using various CSS rules
- **Resources:**
  - W3Schools
    - https://w3schools.com/
  - Mozilla Developers Network - CSS
    - https://developer.mozilla.org/en-US/docs/Learn/CSS

Lab 2.4: Build your own website

- **Purpose:**
  - The goal of this lab is to build your own resume-website from scratch
- **Resources:**
  - W3Schools
    - https://w3schools.com/
  - Mozilla Developers Network - HTML
    - https://developer.mozilla.org/en-US/docs/Learn/HTML
  - Mozilla Developers Network - CSS
    - https://developer.mozilla.org/en-US/docs/Learn/CSS

Front-end development basics

Module 2
Part 4

Responsive CSS and advanced CSS concepts

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CSS variables (Custom properties)

- Define CSS variables that can be reused throughout the webpage
- Color system - easy way of reusing main website colors
- Design system - easy way of reusing CSS stylings to provide a consistent look & feel to the website
- Limited browser support - it's more common to use variables provided by CSS preprocessors

```
:root {
  --primary-color: #FFEE77;
  --secondary-color: #77EEFF;;
  --border-1: solid 5px var(--secondary-color);
  --spacing: 5px;
}
```

```
.box {
  color: var(--secondary-color);
  background: var(--primary-color);
  border: var(--border-1);
  padding: calc(var(--spacing) * 4);
}
```

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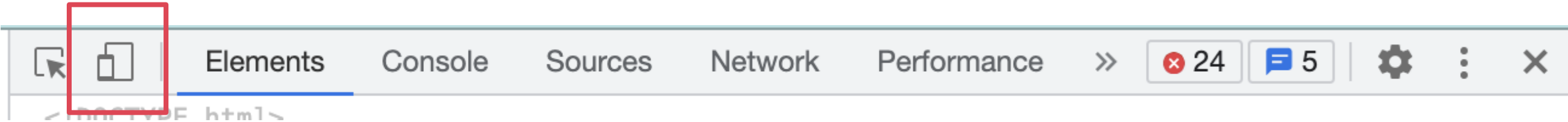
Responsive design - fluid layout

- Goal of responsive design is to ensure that website looks good on all devices
- Web developers create different layouts for different devices
- You can use developer tools to emulate different screen sizes in the browser or just resize the browser window
- It’s common to use different set of font-sizes for mobile and desktop

Chrome developers tools

- Developers tools can be used to emulate screens with smaller or bigger resolution than our actual screen
- Useful for developing and testing the website for different devices



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Responsive CSS - mobile-first and desktop-first

- What is mobile-first and desktop-first?
- Why **mobile-first** or **desktop-first**?
  - Website owners know what devices are used by their customers and try to direct their approach in a way that will generate the best conversion rates
  - If some UX problem can be solved on mobile then it also can be solved on the bigger devices

Responsive CSS - media queries

- Media queries let you apply CSS only when the user's device and browser setup matches the condition
- The most common media-queries are min-size and max-size that test the viewport size, but there are also other ones that work with other environment properties, like whether device is a touchscreen or user wanting to print the page
- Use of min-width is associated with the mobile-first design approach, max-width with desktop-first - usually you'll try to use one type of media-query in a project

```
@media screen and (min-width: 800px [and max-width: 1200px]) {
    body {
      font-size: 15px;
    }
}
```

```
@media media-type and (media-feature-rule) {
  /* CSS rules to apply */
}
```

Responsive CSS - breakpoints

- Breakpoints are defined screen widths at which a media different queries get activated
- It’s common to extract breakpoints to the variables and name them
- In practice it is common to use default breakpoints from CSS framework
- To cope with half-pixel accuracy on displays like retina, you can subtract a fraction out of max-width media-query
- Breakpoints are associated with different devices like mobile, tablet, laptop, desktop, TV etc.

name	value	min-width	max-width (notice the subtracted fraction)
xs	0px	min-width: 0px	-
sm	600px	min-width: 600px	max-width: 599.98px
md	960px	min-width: 960px	max-width: 959.98px
lg	1280px	min-width: 1280px	max-width: 1279.98px
xl	1920px	min-width: 1920px	max-width: 1919.98px

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Responsive images

- We want to display higher resolution images on larger screens and smaller resolution images in smaller screens
- There are two approaches to responsive images CSS and HTML based
- CSS-based approach uses background-image and media-queries
- HTML-based approach uses <img> tag and approach known from media-queries
- Art direction - changing an image to a different one, or a different crop of the same image, to suit needs of different displays
- For decorative images use CSS background property, for images that convey certain meaning use HTML img tag

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Reset CSS

- Not all the default CSS settings of the browser are the same
- Developers include reset CSS on their websites to ensure that initial CSS for all the websites is the same
- Reset CSS can be used to remove any extra styling from all the elements or leave some of the default styles
- Rebooting - applying a certain look and feel
- Provides a simple baseline to build upon

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Design tools

- Very often in your web developer career the designs for the websites to build will be provided by the UI designer. Those are usually shared via design tools like Figma or Adobe XD
- Quite often, a lot of CSS can be copied from the design tools - text styling, margin, padding, but unfortunately not layouts
- Popular design tools include - InVision, Figma, Sketch, Adobe XD

Lab 2.5: Build your own website - responsive CSS

- **Purpose:**
  - The goal of this lab is to add responsive media-queries to the website you built in the previous exercise to it looks great on both desktop and mobile
- **Resources:**
  - CSS tricks - guide to media queries
    - https://css-tricks.com/a-complete-guide-to-css-media-queries/

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Links

- https://www.w3schools.com/TAGS/default.ASP
- https://developer.mozilla.org/en-US/docs/Web/
- https://css-tricks.com/
- https://stackoverflow.com/