TDP013 – Web Programming and Interactivity

Lecture 3: JS in the browser, AJAX, CORS, Ethics assignment

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Recap from lectures 1 and 2

- JavaScript
- Callback function
- Node.js
- Server framework written in JavaScript
- Support for almost everything in ES6 (if you work with defining your code as a module)
- MongoDB
- HTML, CSS, JavaScript Cookies

JavaScript in the browser

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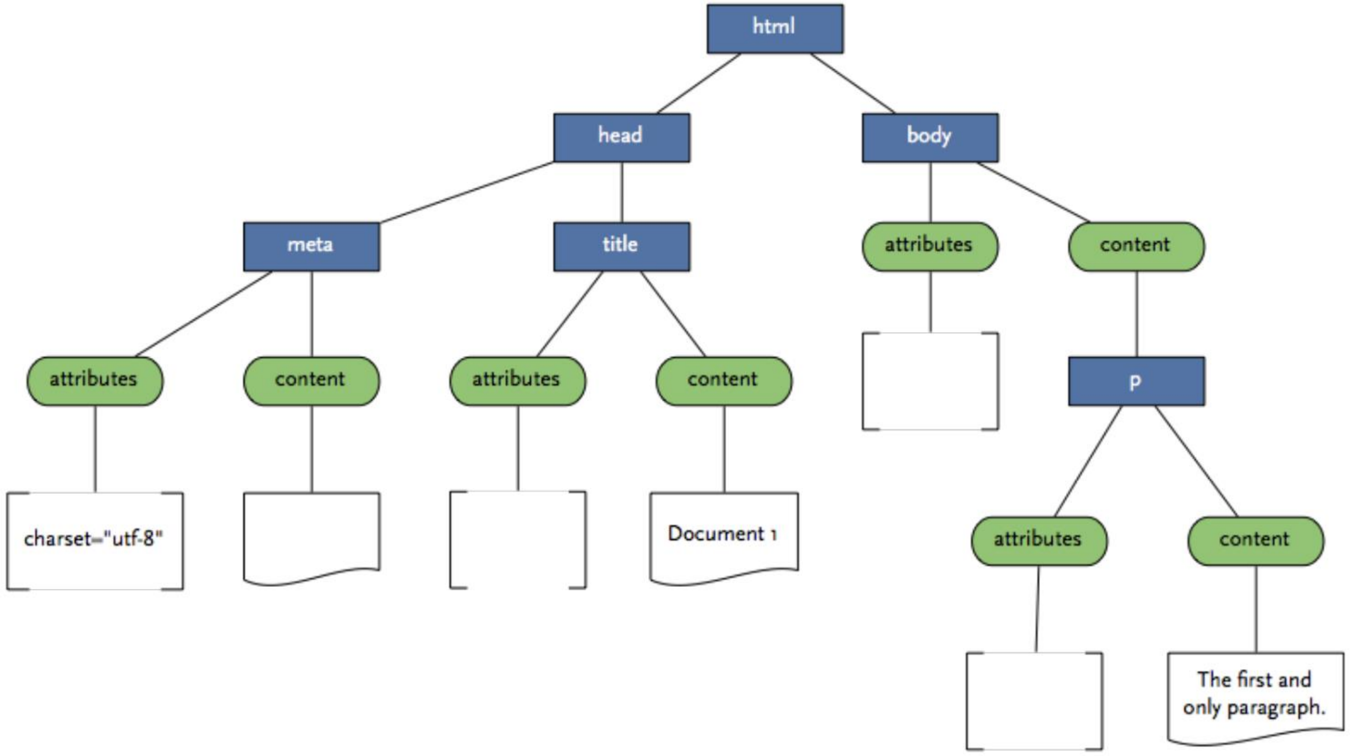
JavaScript in the browser

- Browsers have a JavaScript engine that executes JavaScript code
  - e.g. V8 in Chrome, SpiderMonkey in Firefox
- Web APIs are typically used with JavaScript
  - A list of Web APIs: https://developer.mozilla.org/en-US/docs/Web/API
  - HTML DOM API
    - access to and control of HTML elements via DOM
    - https://developer.mozilla.org/en-US/docs/Web/API/HTML_DOM_API

DOM


html
head
body
meta
title
attributes
content
attributes
content
attributes
content
attributes
content
p
attributes
content
charset="utf-8"
Document 1
The first and only paragraph.

Node in DOM

- Each element in an HTML document is a node in the DOM tree (including
- <!-- comments -->)
- There are 12 different types of nodes
- Element, TextNode and AttributeNode are the three types that are generally interesting for web design

Navigating the DOM

- To make changes to the DOM tree with JavaScript, you need to be able to get specific elements, e.g.:
- document.getElementById('param') returns the element with the specified ID
- document.getElementsByTagName('param') returns a list of elements with a specific tag
- document.querySelector(<css selector>) returns the first element based on a CSS selector
- document.querySelectorAll(<css selector>) retrieves a list of elements based on a CSS selector.

Operations on nodes

- element.childNodes returns a list of all nodes directly below element in the DOM tree.
- element.parentNode returns the node directly above element in the DOM tree.
- element.nextSibling returns the node directly to the right and at the same level as the element in the DOM tree.
- element.previousSibling returns the node directly to the left and at the same level as the element in the DOM tree.

Operations on nodes

- document.createElement(’param’) creates a new element based on a tag expressed as a string
- document.createTextNode(’param’) creates a new TextNode from a string.
- element.appendChild(child) places the specified element child last in the list of nodes directly below element
- element.removeChild(child) removes an element from the list of nodes directly below the specified element. The node must be in the list of the element’s children.

Callback and asynchronous calls

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Event-loop

- Node.js only uses on one thread and all requests are executed in this thread
- If Node.js waits for each line of the code to execute before continuing, it means that everyone who made the calls to the server need to wait

```
// a function that needs longer running time
let data = ProcessNeedsLongerRunning()
```

If we have such a function call above, the response can be very slow

- Node.js uses Promises to handle asynchronous operations

Asynchronous calls

- Run a function without pausing
- can utilize callbacks or Promises
- asynchronous functions are marked with async, and return promises

```
async function doSomething(){
        // e.g., time consuming processing
        return "Hello World"
}
```

- To wait on an async function use await
  - wait for a resolved promise, inside an async function
  - can be used to make asynchronous calls behave serially

```
async function main() {
        let a = await doSomething();
        console.log(a);
}
```

Asynchronous calls - Promise

- Object representing a “promise”
- acts as a placeholder for a result to be available at some point
- 3 states
  - pending: initial state
  - fulfilled: the operation succeeded
  - rejected: the operation failed
- created using “new Promise()” constructor
  - the constructor takes an argument, i.e., an executor function with 2 arguments
    - resolve: a function to call if the operation succeeds
    - reject: a function to call if the operation fails

Asynchronous calls - Promise

- .then(...)
  - this block handles successful resolutions
- .catch(...)
  - this block handles rejections happened in the promise or any of the .then blocks
- multiple .then(...) can be defined for the same Promise

Asynchronous calls - Promise

```
function loadData(){
        return [
                {'title': 'Gone in 60 seconds', 'year': 2000},
                {'title': 'Pulp Fiction', 'year': 1994}
        ]
}
let p = new Promise((resolve, reject) => {
        let data = loadData()
        if(data !== null){
                resolve(data)
        } else {
                reject('Failed to load data')
        }
})
p.then((x) => {
        // 'then' is called if we succeed
        console.log('Data loaded successfully:')
        console.log(JSON.stringify(x, null, 2))
}).catch((msg) => {
        // 'catch' is called if we fail
        console.log(`Something went wrong: ${msg}`)
})
```

What are callbacks?

- functions as arguments to functions
- hands over the responsibility for capturing data and events to the called function
- in JavaScript and third-party libraries
- “If I give you my passport, could you pick up the package I ordered, leave it outside my door and then call me?”

HTTP calls
Retrieving and Sending data on the web

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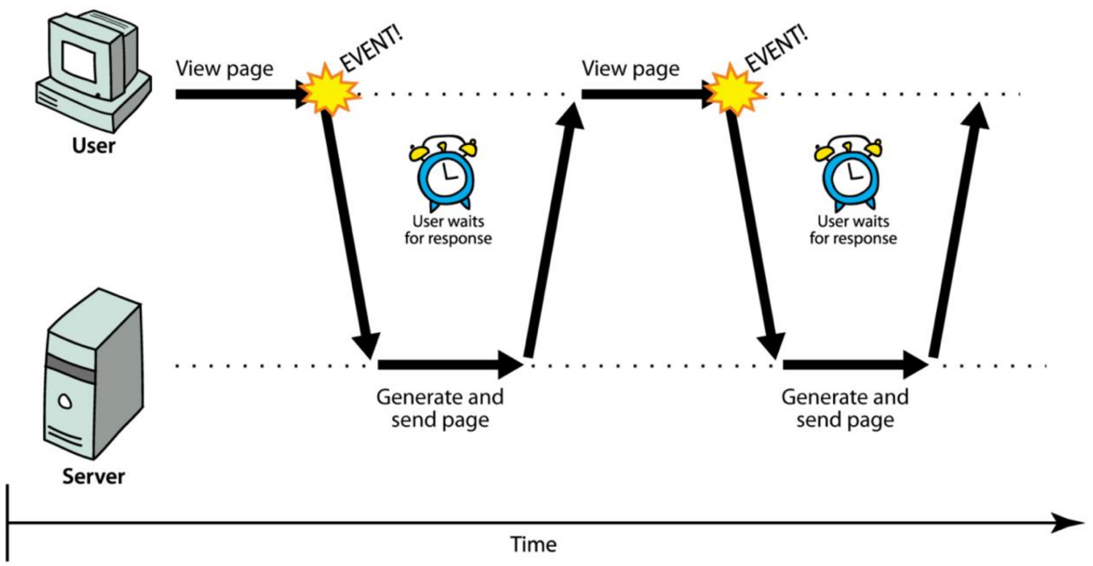
Synchronous calls on the web

- The user must wait for a response and cannot do anything in the meantime.
- The entire page is refreshed.



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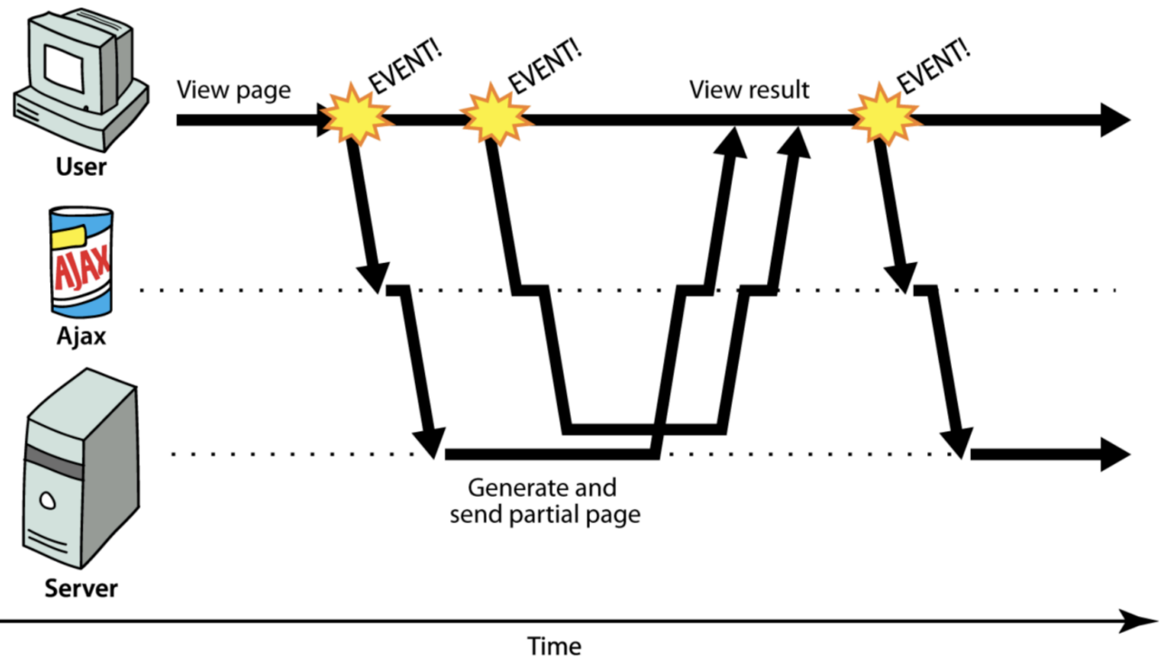
Asynchronous calls on the web

- The user can do other things while waiting for a response from the server.
- Only the affected parts of the page are changed.



https://www.rose-hulman.edu/Class/csse/csse290-WebProgramming/201330/Slides/lecture21-ajax.shtml

AJAX

- Asynchronous JavaScript and XML
- Enables asynchronous calls on the web via JavaScript
- Is done a little differently depending on which browser is used, but the differences are today very small
- What comes back from the server is (usually) JSON, XML, etc.

AJAX – Send request

```
let xhttp = new XMLHttpRequest();
xhttp.onreadystatechange = () => {
        if (xhttp.readyState == 4 && xhttp.status == 200) {
                let data = JSON.parse(xhttp.responseText);
                console.log(data);
        }
};
xhttp.open('GET', 'https://gorest.co.in/public/v1/users', true);
xhttp.send();
```

0 UNSENT

1 OPENED

2 HEADERS_RECEIVED

3 LOADING

4 DONE

"true" makes the call asynchronous

HTTP methods

HTTP – methods

- Request-Response model between client and server
- Most common methods
  - GET – Asks the server to return a specific resource
  - HEAD – Asks the server to send information about a specified resource (without sending the content itself)
  - POST – Sends information to the server that changes information on the server OR sends information that is inappropriate to include as part of the URL
  - PUT – Adds or updates a resource
  - DELETE – Deletes the specified resource
  - OPTIONS – Asks the server to return a list of HTTP commands that the server supports

HTTP – methods

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  - PUT – Adds or updates a resource
  - DELETE – Deletes the specified resource
  - OPTIONS – Asks the server to return a list of HTTP commands that the server supports

AJAX – Send data with GET

```
let xhttp = new XMLHttpRequest();
xhttp.onreadystatechange = () => {
        if (this.readyState == 4 && this.status == 200) {
                let data = JSON.parse(this.responseText);
                console.log(data);
        }
};
xhttp.open('GET', 'https://gorest.co.in/public/v1/users', true);
xhttp.send();
```

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"true" makes the call asynchronous

AJAX – Send data with POST

```
let xhttp = new XMLHttpRequest();
xhttp.onreadystatechange = function() {
        if (this.readyState == 4 && this.status == 200) {
                let data = JSON.parse(this.responseText);
                console.log(data);
        }
};
xhttp.open('POST', 'https://gorest.co.in/public/v1/users', true);
xhttp.setRequestHeader('Content-type', 'application/json');,      xhttp.setRequestHeader('Authorization', 'Bearer
<access token>');
xhttp.send('{"name": "John Doe", "gender": "male",
                        "email": "john.doe@noone.com", "status": "active"}');
```

Code Example

fetch(...)

AJAX with promises

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Why promises or callback-hell

```
fetchResource(
    url,
    function (result) {
        // Do something with the result
        fetchResource(
            newUrl,
            function (result) {
                // Do something with the new result
                fetchResource(
                anotherUrl,
                function (result) {
                        // Do something with the new result
                },
                failureCallback
            );
            },
            failureCallback
        );
    },
    failureCallback
);
```

```
fetchResource(url)
.then(handleResult, failureCallback)
.then(handleNewResult, failureCallback)
.then(handleAnotherResult, failureCallback);
```

JavaScript Fetch API

- The API allows web browser to make HTTP requests to web server
  - no need to use XMLHttpRequest
- https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API

AJAX – Send request

```
let xhttp = new XMLHttpRequest();
xhttp.onreadystatechange = () => {
        if (xhttp.readyState == 4 && xhttp.status == 200) {
                let data = JSON.parse(xhttp.responseText);
                console.log(data);
        }
};
xhttp.open('GET', 'https://gorest.co.in/public/v1/users', true);
xhttp.send();
```

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"true" makes the call asynchronous

fetch: AJAX with promises

```
const url = 'https://gorest.co.in/public/v1/users'
fetch(url, { 'method': 'GET' })
        .then(resp => resp.json()) // parse and move on to the next 'then'
        .then(data => {
                console.log(data);
});
```

```
const url = 'https://gorest.co.in/public/v1/users'
let resp = await fetch(url, { 'method': 'GET' })
if (resp.ok) { // HTTP status 200-299
        let data = await resp.json();
        console.log(data);
}
```

CORS

Cross-Origin Resource Sharing

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Same-origin policy

- A security model for web browsers
- Restrictions about how a document /scripts from one origin can access data from another origin

- Same origin
  - same protocol, host and port, “scheme/host/port”

- Link an image from an external website
- Fetch data from your API

CORS

- Restrictions due to security reasons
  - “Cross-site scripting”
  - Risk of injections
  - Can bypass authentication
- AJAX requires that all calls are made to exactly the same domain that the client is running on!
  - If your page is on the domain http://example.com, you can only call services on http://example.com/...
- CORS is used to explicitly grant permissions to the server for certain domains

CORS

- Browsers typically use the "same-origin policy"
- Before the GET/POST call, an OPTIONS call is sent to the server
- If the correct headers are returned, the browser allows you to perform GET/POST
- A relatively "neat" way of doing it that minimizes too much code changes in existing systems
    - configure CORS on the server side

CORS: Response headers

- On the server side, you add what and which domains should be allowed based on what is written as a response in headers
- Must be added to all outgoing "responses" that you want to make available
- NOTE: Here we choose to set '*' which allows all domains to call the server. In a production environment, you usually specify domains that should be allowed to send calls.

```
let headers = {};
headers['Access-Control-Allow-Origin'] = '*';
headers['Access-Control-Allow-Methods'] = 'POST, GET, OPTIONS';
res.writeHead(200, headers);
res.end();
```

CORS: Response headers

- How can you speed up and simplify the process with headers?

```
if(req.method == 'OPTIONS'){
        let headers = {};
        headers['Access-Control-Allow-Origin'] = '*';
        headers['Access-Control-Allow-Methods'] = 'POST, GET, OPTIONS';
        res.writeHead(200, headers);
        res.end();
} else {
// vid POST, GET, etc.
}
```

CORS: Response headers

- In Express.js we can do this easily with .use(…)
- .use(…) is called every time the app receives a request, regardless of which route is used
- There are libs that make working with CORS even easier
  - https://www.npmjs.com/package/cors
  - https://www.npmjs.com/package/helmet
  - …but it's a good idea to check that you don't open things up too much!

```
app.use((req, res, next) => {
        res.header('Access-Control-Allow-Origin', '*');
        res.header('Access-Control-Allow-Headers', 'Origin, X-Requested-With, Content-Type, Accept');
        next();
});
```

CORS: cors middleware

- Simple usage by enabling all cross-origin requests

```
import express from 'express';
import cors from 'cors';

let server = express();

server.use(cors())

server.get('/cors', (req, res) => {
res.status(200).send('cors');
});
```

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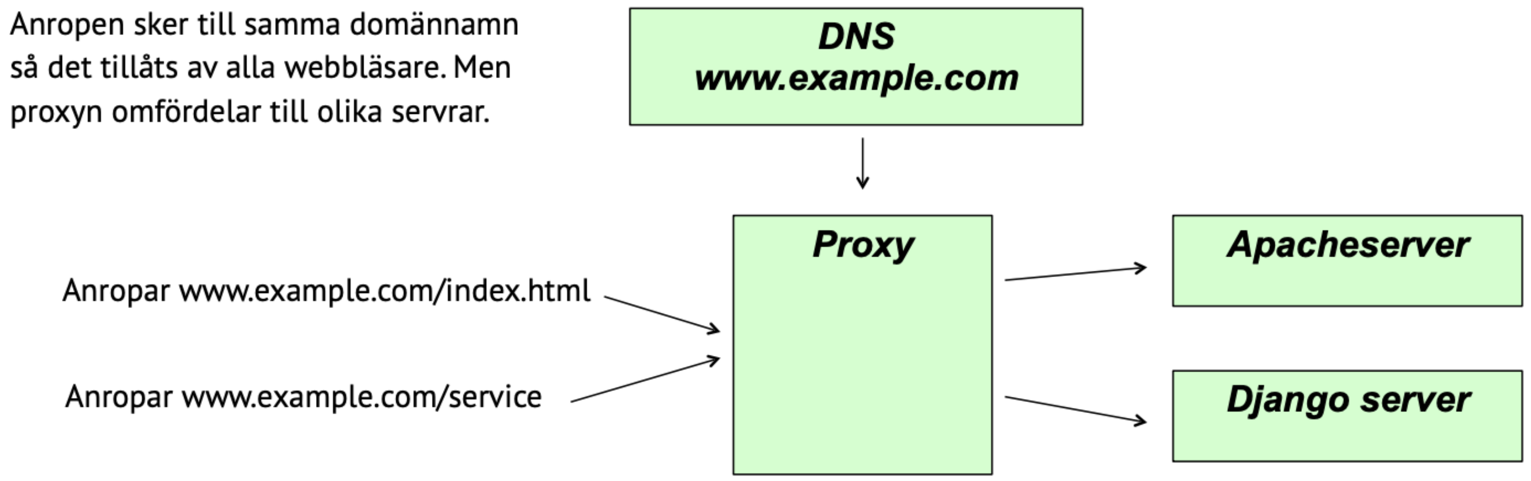
CORS: cors middleware

- With cors configuration

```
const corsOptions = {
  origin: 'http://example.com',
  optionsSuccessStatus: 200,
  methods: ['GET', 'POST', 'PUT', 'PATCH']
};

server.use(cors(corsOptions))

server.get('/cors', cors(corsOptions), (req, res) => {
  res.status(200).send('cors');
});

// cors not enabled for this route
server.get('/no-cors', (req, res) => {
  res.status(200).send('no cors');
});
```

Can you do without CORS?

- Yes, but it gets more complicated
- You can use a “proxy” that handles all calls to the domain
- A proxy can also have other benefits such as “caching” while also working with all browsers
- Out-of-scope in this course!


Anropen sker till samma domännamn så det tillåts av alla webbläsare. Men proxyn omfördelar till olika servrar.
DNS www.example.com
Proxy
Apacheserver
Django server
Anropar www.example.com/index.html
Anropar www.example.com/service

How do we check that CORS works?

- Call your server from an external domain
    - Easy if your server is online
- Option 1:
    - Create a file that makes a call to localhost
    - Then open the file directly in the browser!
    - NOTE: Does not always work for all browsers
- Option 2:
    - Make a call with OPTIONS and check the content in the headers

Code Example

Responsive web design

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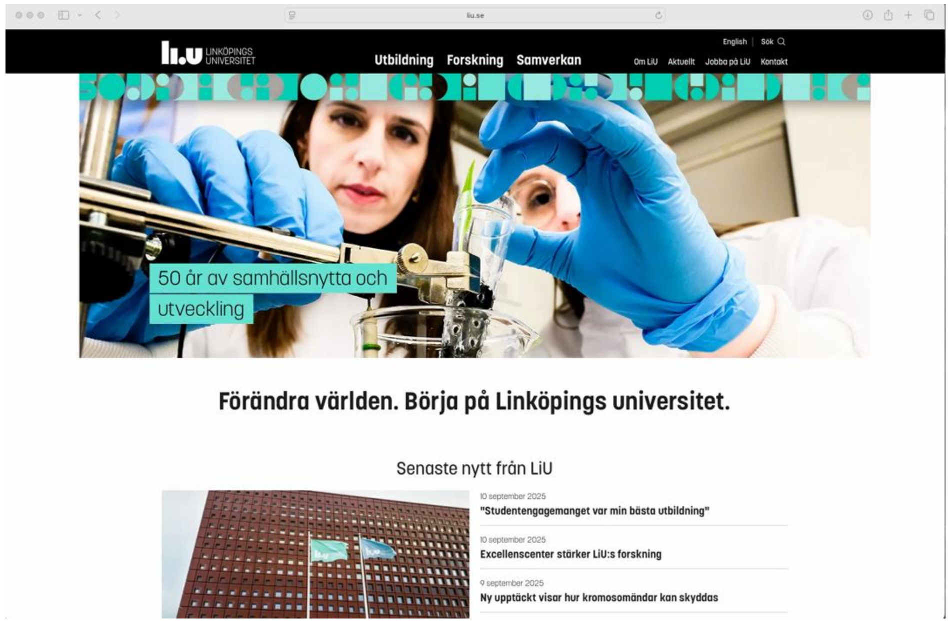
Responsive web design

- Make web pages render well and look good on all devices
  - desktops, laptops, mobiles, tablets, watches, etc.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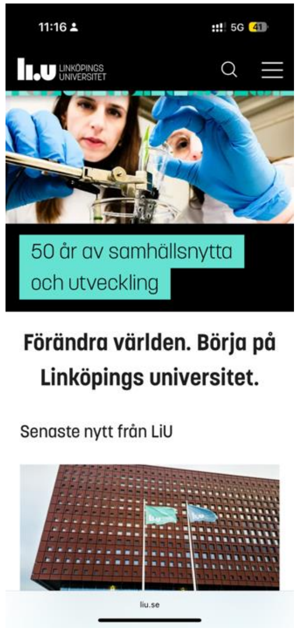
10 september 2025
"Studentengagemanget var min bästa utbildning"
10 september 2025
Excellenscenter stärker LiU:s forskning
9 september 2025
Ny upptäckt visar hur kromosomändar kan skyddas


11:16
5G
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How to design responsive web sites

- Media queries, introduced in CSS3
  - it allows us to apply CSS styles based on some conditions such as screen size, device orientation, resolution.

```
@media CONDITION {
/* … */
}
```

```
@media (max-width: 600px) {
 body {
  font-size: 14px;
  background: lightblue;
 }
}
```

More conditions: https://developer.mozilla.org/en-US/docs/Web/CSS/CSS_media_queries/Using_media_queries

Toolkit

- Bootstrap
- Foundation
- Zimit Framework
- Pure.css

Bootstrap

- CSS framework for mobile-first front-end web development
- Grid system and components
- Button example:
    - https://jsfiddle.net/lihuanyuasas/scemh0ny/

Ethics Assignment

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Task Overview

- Reflect on corporate ethics policies
- Learning objective
  - "Kunna redogöra och analysera etiska aspekter relaterade till ämnesområdet"
- What you need to do:
  - choose a company with a formal ethical code or policy (e.g., "code of conduct")
    - software or hardware development with a global connection.
  - Send your choice to Huanyu, and register on webreg by September 26, 23:59
    - Assign group for seminars on October 1st
    - *https://www.ida.liu.se/webreg3/TDP013-2025-1/UPG1*
  - Apply Gibbs's Reflective Cycle (adapted version) to analyze and reflect
  - Write a reflection about 1 page (ca. 500 words)

Ethics assignment

- Include or link to the code of ethics or policy
- Upload the documents to git
- The seminar assignment is done individually

- Deadline for report: Wednesday, October 1st
- Seminar: Wednesday, October 1st 1:15 PM–5:00 PM
  - Charlie Simonson: 1:15pm to 2pm, 2:15pm to 3:00pm
  - Anders Fröberg: 1:15pm to 2pm, 2:15pm to 3:00pm
  - Huanyu Li: 3:15pm to 4pm, 4:15pm to 5:00pm

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