

Programmeren 6: Fullstack Webdevelopment (React & Node.js)

Knowledgebase: <https://luukftf.github.io/knowledgebase>

(code: <https://github.com/LuukFTF/knowledgebase>)

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A. backend - Nodejs & Express & MongoDB

<https://www.youtube.com/watch?v=ENrzd9HAZK4>

let vs var

let is in de scope, var doet onverwachte dingen

Functions

(function via parameter)

functie in een functie meegeven

```
function helle() {  
    console.log("Hello World")  
}  
  
function hello2(a) {  
    a()  
}  
  
hello2(hello)  
  
// Hello World
```

anonieme functie

```
let b = function() {  
    console.log("Anonieme Functie")  
}  
  
b()  
  
// Anonieme Functie
```

object functie

```
let j = {  
    "abc" : 1,  
    "xyx" : "asd",  
    "f1" : hello,  
    "f2" : b,  
    "f3" : function() {  
        console.log("Functie 3")  
    }  
}
```

```
j.f1()
j.f2()
j.f3()

// Hello World
// Anonieme Functie
// Functie 3
```

callback function

```
if (true) {
  j.f1()
} else {

}
```

nested functions

Arrow Function

```
let f = () => {
  console.log("Random Arrow Function")
}
```

IIFE old workaround for `var`

```
(function() {
:
:
})();
```

recursie regel 1. zorg dat het kan stoppen regel 2. zorg dat de recursie dichterbij de eindconditie kan komen

```
function recursion(n) {
  if (n == 1) {
    return 1
  }
  return n + recursion(n - 1)
}
```

beter alternatief op recursion

```
function count(n) {  
  let total = 0;  
  for (let i = 1; i <= n; i++ ) {  
    total += 1  
  }  
  
  return total  
}
```

NPM Packages

Express Mongoose Nodemon Dotenv

/node_module gitignore

Installing & Setup

installing software (windows)

```
winget install npm # install npm  
winget install nodejs # install nodejs  
winget install mongodb # install mongoddb  
  
npm -v # check if npm is correctly installed  
nodejs -v # check if nodejs is correctly installed  
mongodb -v # check if mongodb is correctly installed
```

setup new project

```
git clone # clone corresponding git repo  
  
npm install express mongoose dotenv # add express, mongoose & dotenv dependency to  
project  
npm install --save-dev nodemon # add nodemon dependency to project development  
  
npm i # install repo packages
```

update

```
npm update # update all packages, respecting package versioning rules
```

run


```
cd 'C:\Program Files\MongoDB\Server\5.1\bin\'  
mongod.exe  
  
net start mongod  
  
npm run dev || npm start
```

.ENV

init

```
require('dotenv').config()
```

call

```
process.env.DATABASE_URL
```

.env file (.gitignore)

```
DATABASE_URL=mongodb://localhost/songs  
PORT=8000
```

.env.example file

```
DATABASE_URL=mongodb://host/dbname  
PORT=3000
```

Endpoint

Resources

Middleware

Models

Database

Mongoose Schema

Checker

<http://checker.basboot.nl/>

VPS: api hosted.hr: webservice.json

CORS

Acces-Allow-Origin

B. HTTP, RESTfull API & OAuth

<https://www.youtube.com/watch?v=-MTSQjw5DrM>

API < an Application Programming Interface is an interface that defines interactions between multiple software applications or mixed hardware-software intermediaries. >

idempotency < Idempotence is the property of certain operations in mathematics and computer science whereby they can be applied multiple times without changing the result beyond the initial application. >

Safe Method < Deze method veranderd niks op de server >

HTTP

Hypertext Transfer Protocol

Uniform Interface

stateless

Cacheable

Software

Postman Insomnia

VScode extension: REST Client

Methods

name	function	safe	idempotent	Status Code Response
POST	create		x	201
GET	read	x	x	200
PUT	create / update (geheel)		x	200
PATCH	update (deel)			200
DELETE	destroy		x	204
OPTIONS	get possible methods	x	x	200
HEAD	get without body	x	x	200
TRACE				200
CONNECT				200

POST overloading < sending HTTP requests that doesnt exist can be done with a POST request. You send a method with the head that specifies what custom request you are using (document this correctly)>

Custom Methods < another way to use create new request methods, is to use custom http methods, just exchange *post* for something else like *undelete* (document this correctly) >

URIs

< Uniform Resource Identifier > <https://www.slideshare.net/landlessness/teach-a-dog-to-rest>

protocol://userinfo@subdomain.domain.tld:port/path?query#fragment

```
https://api.com/v2/comet
```

network_location/resource

structuur / hierarchie (pad) nevenschikking (😊) leesbaarheid (- _) geen extensies (of extensies over de inhoud, liever application/json /xml (.json .xml))

routing verbergt techniek

Representatieformaten

Mensen: html

Mensen & Machines: html met microformats

Machines: json, xml, yaml, rss

JSON

```
{
  "widget": {
    "debug": "on",
    "window": {
      "title": "Sample Konfabulator Widget",
      "name": "main_window",
      "width": 500,
      "height": 500
    },
    "image": {
      "src": "Images/Sun.png",
      "name": "sun1",
      "hOffset": 250,
      "vOffset": 250,
      "alignment": "center"
    },
    "text": {
```

```

        "data": "Click Here",
        "size": 36,
        "style": "bold",
        "name": "text1",
        "hOffset": 250,
        "vOffset": 100,
        "alignment": "center",
        "onMouseUp": "sun1.opacity = (sun1.opacity / 100) * 90;"
    }
}
}

```

XML

```

<widget>
  <debug>on</debug>
  <window title="Sample Konfabulator Widget">
    <name>main_window</name>
    <width>500</width>
    <height>500</height>
  </window>
  <image src="Images/Sun.png" name="sun1">
    <hOffset>250</hOffset>
    <vOffset>250</vOffset>
    <alignment>center</alignment>
  </image>
  <text data="Click Here" size="36" style="bold">
    <name>text1</name>
    <hOffset>250</hOffset>
    <vOffset>100</vOffset>
    <alignment>center</alignment>
    <onMouseUp>
      sun1.opacity = (sun1.opacity / 100) * 90;
    </onMouseUp>
  </text>
</widget>

```

YAML

```

widget:
  debug: 'on'
  window:
    title: Sample Konfabulator Widget
    name: main_window
    width: 500
    height: 500
  image:
    src: Images/Sun.png

```

```
name: sun1
hOffset: 250
vOffset: 250
alignment: center
text:
  data: Click Here
  size: 36
  style: bold
  name: text1
  hOffset: 250
  vOffset: 100
  alignment: center
onMouseUp: sun1.opacity = (sun1.opacity / 100) * 90;
```

Request

```
POST https://api.com/v2/comet HTTP/1.1
Accept: application/json
Authorization: <token>
Connection: keep-alive
```

```
{
  "body": "body"
}
```

VERB / resource uri / protocol

Response

```
HTTP/1.1 200 OK
Age: 2323
Connection: keep-alive
```

```
{
  "id": "2"
  "status": "3"
}
```

protocol / statuscode

Basic Networking

IP/TCP & OSI model

Packets (information)

7 layers

L7 - Application {L6 - Presentation} {L5 - Session}

L4 - Transport - protocol / ports (TCP & UDP + https:443, http:80, ssh:22, ftp) L3 - Network - ip adressen L2 - Data Link - mac adressen L1 - Physical - ethernet ports

Statuscodes

Uniform Interface kan errors afhandelen HTTP Errors

2XX good

200 - OK 201 - Created 204 - No Content

3XX recoverable error

300 - Multiple Choices 302 - Found (redirect) 304 - Not Modified

4XX client error

400 - Bad Request 401 - Unauthorized 403 - Forbidden 404 - Not found

5XX server error

500 - Internal Server Error 501 - Not Implemented 503 - Service Unavailable

CORS headers

General

```
vb. res.header("Acces-Control-Allow-Origin", "*"); res.header("Acces-Control-Allow-Headers", "Origin, X-  
Requested-With, Content-Type, Accept")
```

Options

RESTfull API

RESTful < *Representational State Transfer, invented by Roy Fielding in 2000* >

JSON

API Documentation

OpenAPI Specification <https://swagger.io/specification/>

Postman

HATEOAS (Linking)

< *Hypermedia as the Engine of Application State* > <https://en.wikipedia.org/wiki/HATEOAS>

HAL

https://en.wikipedia.org/wiki/Hypertext_Application_Language

```
{
  "_links": {
    "self": { "href" : "http://api....." },
    "collection": { "href" : "http://api....." }
  }
}
```

link relation types

self collection alternate edit related previous & next first & last

Pagination

start (begin bij 1) limit (aantal)

```
GET /items?start=6&limit=5
Accept: application/json
```

pagina 6 tot en met 10

```
{
  "pagination": {
    "currentPage": 2,
    "currentItems": 5,
    "totalPages": 2,
    "totalItems": 10,
    "links": {
      "first": {
        "page": 1,
        "href": "/items?start=1&limit=5"
      },
      "last": {
        "page": 2,
        "href": "/items?start=6&limit=5"
      },
      "previous": {
        "page": 1,
        "href": "/items?start=1&limit=5"
      },
      "next": {
        "page": 2,
        "href": "/items?start=6&limit=5"
      },
    },
  }
}
```



```
}  
}
```

Response Categories

items links pagination

```
GET /items/  
Accept: application/json
```

```
HTTP/1.1 200 OK  
Content-Type: application/json  
  
{  
  "items": [  
    {  
      "id": "200",  
      "title": "test",  
      "links": {  
        "self": "/items/200"  
      }  
    },  
    {  
      "id": "201",  
      "title": "test",  
      "links": {  
        "self": "/items/201"  
      }  
    },  
  ],  
  "links": {  
    "self": "/items/"  
  },  
  "pagination": {  
    "currentPage": 1,  
    "currentItems": 4,  
    "totalPages": 1,  
    "totalItems": 4,  
    "links": {  
      "first": {  
        "page": 1,  
        "href": "/items/"  
      },  
      "last": {  
        "page": 1,  
        "href": "/items/"  
      },  
      "previous": {  
        "page": 1,  
        "href": "/items/"  
      }  
    }  
  }  
}
```

```

    },
    "next": {
      "page": 1,
      "href": "/items/"
    },
  },
}
}
}

```

Type RESTFULL Resources

REST Resource < *Het type resource wat in de body teruggestuurd word* >

Detail < *all data of specific item* >

```

GET https://pokeapi.co/api/v2/pokemon/4
Accept: application/json

```

```

HTTP/1.1 200 OK
Content-Type: application/json

{
  "id": 4,
  "name": "charmander",
  "base_experience": 62,
  "height": 6,
  "weight": 85,
  "location_area_encounters": "https://pokeapi.co/api/v2/pokemon/4/encounters",
  "stats": [
    {
      "base_stat": 39,
      "stat": {
        "name": "hp",
        "url": "https://pokeapi.co/api/v2/stat/1/"
      }
    },
    {
      "base_stat": 52,
      "stat": {
        "name": "attack",
        "url": "https://pokeapi.co/api/v2/stat/2/"
      }
    },
  ],
}

```

GET, PUT/PATCH, DELETE, OPTIONS

Collection < *list of items with indexable information* >

```
GET https://pokeapi.co/api/v2/pokemon
Accept: application/json
```

HTTP/1.1 200 OK

Content-Type: application/json

```
{
  "results": [
    {
      "name": "bulbasaur",
      "url": "https://pokeapi.co/api/v2/pokemon/1/"
    },
    {
      "name": "ivysaur",
      "url": "https://pokeapi.co/api/v2/pokemon/2/"
    },
    {
      "name": "venusaur",
      "url": "https://pokeapi.co/api/v2/pokemon/3/"
    },
    {
      "name": "charmander",
      "url": "https://pokeapi.co/api/v2/pokemon/4/"
    },
    {
      "name": "charmeleon",
      "url": "https://pokeapi.co/api/v2/pokemon/5/"
    },
    {
      "name": "charizard",
      "url": "https://pokeapi.co/api/v2/pokemon/6/"
    },
    {
      "name": "squirtle",
      "url": "https://pokeapi.co/api/v2/pokemon/7/"
    }
  ]
  "pagination": {
    "currentPage": 1,
    "currentItems": 7,
    "totalPages": 160,
    "count": 1118,
  }
}
```

GET, POST, OPTIONS

Composition < *a combination of different types of resources* >

```
GET https://pokeapi.co/api/v2/location/2/  
Accept: application/json
```

```
HTTP/1.1 200 OK  
Content-Type: application/json  
  
{  
  "id": 2,  
  "name": "eterna-city",  
  "region": {  
    "name": "sinnoh",  
    "url": "https://pokeapi.co/api/v2/region/4/"  
  },  
  "areas": [  
    {  
      "name": "eterna-city-area",  
      "url": "https://pokeapi.co/api/v2/location-area/2/"  
    },  
    {  
      "name": "eterna-city-west-gate",  
      "url": "https://pokeapi.co/api/v2/location-area/788/"  
    }  
  ],  
  "game_indices": [  
    {  
      "game_index": 9,  
      "generation": {  
        "name": "generation-iv",  
        "url": "https://pokeapi.co/api/v2/generation/4/"  
      }  
    }  
  ],  
}
```

GET, OPTIONS, (PUT/PATCH)

Function < *functional resource, custom input generates custom output* */distance/rdam;adam* >

```
GET https://pokeapi.co/api/v2/battle/4;6  
Accept: application/json
```

```
// calculation who wins the battle with stats and winner
```

GET, OPTIONS

Controller < *special function* >

```
GET https://pokeapi.co/api/v2/hit
Accept: application/json
```

```
// calculation if a pokemon is still alive after a hit, amount left & stats
```

POST, OPTIONS

OPTIONS < *see what html methods are possible on this link* >

```
OPTIONS https://pokeapi.co/api/v2/pokemon/4/
Accept: application/json
```

```
// insert options response
GET, PUT/PATCH, DELETE, OPTIONS
```

Queries

Filter

/pokemon?type=fire

OAuth

C. operations - VPS & Linux

Virtual Private Server (VPS)

Basic Networking / VPS commands

```
ssh username@ip
```

Linux

<https://cheatography.com/davechild/cheat-sheets/linux-command-line/>

Basic BASH commands

```
pwd # Show current directory
mkdir [dir] # Make directory
cd [dir] # Change directory to dir
cd .. # Go up a directory
cd / # go to root dir
cd ~ # go to home dir
cd - # go to previous dir
ls # List files
df -h # show disks
du -h # show disk usage for a dir
-a # Show all (including hidden)
-t # Sort by last modified
-S # Sort by file size
cp [dir || file] [new dir || file] # copy
mv [dir || file] [new dir || file] # move
rm [dir || file] # remove
touch [name] # new file

top # show live processes
ps # process snapshot
kill [pid] # kill process
uptime # Show uptime
uname -a # Show system and kernel
whoami # Show your username
[tool] -v # show if tool is installen and which version
[tool] help || -h || --help || man # manuals and information
whereis || where [tool] # find location of installed tool
clear # clear screen

CTRL-C # Stop dcurent running command
```

?how to clean cache & logs

Installing Backend MERN

installing software (linux)

```
sudo apt update # update apt packages
sudo apt install npm # install npm
sudo apt install nodejs # install nodejs
sudo apt install mongodb # install mongodb

npm -v # check if npm is correctly installed
nodejs -v # check if nodejs is correctly installed
mongodb -v # check if mongodb is correctly installed
```

installing project on server / locally

```
git clone / pull [repo] # clone or pull repository

cd [dir] # change directory to repo dir

npm i # install repo packages
node . # start node index.js

sudo systemctl start mongodb # start mongodb server

sudo systemctl status mongodb # check status of mongodb server
```

configuration

```
mongo --eval 'db.runCommand({ connectionStatus: 1 })' # diagnostic mongo command

sudo systemctl stop mongodb # stop mongodb server
sudo systemctl restart mongodb # restart mongodb server

sudo ufw status # check firewall status

sudo nano /etc/mongodb.conf # edit mongodb config
```

Screen

```
sudo apt install screen

screen
screen -r
```

ctrl+a d

Installing Frontend MERN

File Rights

<https://www.linux.com/training-tutorials/understanding-linux-file-permissions/>

Read Write eXecute RWX

list with rights `ls -l`

```
drwxrwxr-x 3 ubuntu-user ubuntu-group 4096 Nov 23 10:59 helloworld
drwx----- 2 root          dialout    4096 Dec 3  13:54 test
```

Rights Owner Group Other

Right codes Owner, Group, Other

--==-----==

d: directory r: read w: write x: execute

change right modus `chmod` change owner `chown`

Directories

var/www/

D. frontend - React

javascript framework

reactjs.org

History

Facebook

De facebook website werd te complex om met traditionele webdesign technieken te bouwen.

React

Facebook bedacht React in 2013 om beter om te gaan met grote hoeveelheid data die door de app "stroomt".

FLOW / Typescript

Facebook bedacht "FLOW" om een betere ontwikkelomgeving voor Javascript te bouwen.

Frontend Frameworks

```
React
Angular
Vue

Svelte
Gatsby (CMS)
Stencil
Preact
React Native
```

The 3 Modern Frontend Framework Concepts

Single Page Application < Een React app bestaat uit 1 enkele HTML pagina. De pagina bevat een Javascript Applicatie, geschreven in React. >

Components < Geïsoleerde componenten >

Databinding < Data oriented, React kan automatisch de DOM updaten zodra je een variabele aanpast. (Reactive) >

General

Native In Web

Webcomponents

Modules

Components

Een React App is opgebouwd uit geïsoleerde components.

Een component bevat Javascript en HTML (JSX)

Composition App HAS a shop Shop HAS products

Inheritance (fixed structure) Shop EXTENDS app

Example (pseudo code):

app.js

```
<body>
  <Navigation />
  <Shop />
</body>
```

Navigation.js

```
<div>
  <button>home</button>
  <button>about us</button>
  <button>shop</button>
</div>
```

shop.js

```
<div>
  <Product />
  <Product />
  <Product />
</div>
```

Wanneer gebruik je react en wanneer niet?

Statische Website (Onepager / Papier) Statische tekst en afbeeldingen in een html pagina. (Geen react nodig)

Web Applicatie

- Complexe logica
- Complexe interactie
- Veel gebruikersdata

React Native

React native voor native (mobile) apps

Build Process

Directory Structure

- /public || /docs
- /src
 - App.js
 - index.js
 - style.css
- package.json

Flashback naar OOP in PRG04

```
class Car extends Vehicle {  
  constructor() {  
    super()  
  }  
  public drive() {  
    console.log("Vrooom")  
  }  
}
```

geen public of private > alles is private

CommonJS vs ES6 modules

In NodeJS heb je met CommonJS modules gewerkt

CommonJS

```
const express = require('express');  
const myapp = require('./app.js');  
  
:
```

In React (en Node 17) werk je met ES6 modules

ES6

```
export default function App() {  
}
```

```
import App from "./App.js"

:
```

or

```
export function App() {
}
```

```
import { App } from "./App.js"

:
```

No Dom Manipulation (Old way)

In je React code staat geen rechtstreekse DOM manipulation meer!

Oude Methode:

shop.html

```
<div>
  <p>winkelwagen</p>
  <div id="items">1</div>
  <button id="button">Buy Item</button>
</div>

<script src="shop.js"></script>
```

shop.js

```
let cart = document.querySelector("#items")
let btn = document.querySelector("#button")
btn.addEventListener("click", ()=>buyItem())

let items = 1

function buyItem(){
  items++
  cart.innerHTML = `Winkelwagen: ${items}`
}
```

index.js

```
import React from "react";
import ReactDOM from "react-dom";

import { App } from "./App";

ReactDOM.render(<App />, document.getElementById("root"))
```

App.js

```
import React from "react";
import "./style.css";

export class App extends React.Component {
  render() {
    return(
      <div className="app">

        </div>

    );
  }
}
```

Databinding

Een component haalt JSON data van een API.

De HTML wordt niet herladen. Alleen de DOM elementen die de data tonen worden aangepast.

Variabelen in een component zijn verbonden aan de view van het component. Als de variabele verandert, verandert de view automatisch mee.

```
let items = 1

function buyItem(){
  items++
}

function render() {
  <div>
    <p>winkelwagen</p>
    <p>{ items }</p>
    <button onClick={ buyItem() }>Buy Item</button>
  </div>
}
```

psuedocode!

State

Reactive data maak je aan middels een state variabele

State variabelen mogen alleen door de eigenaar aangepast worden.

```
:

export class Product extends React.Component {
  constructor {
    super()

    this.state = {
      name: "Canon 200D",
      description: "Een mooie canon camera",
      price: 499
    }
  }

  updatePrice() {
    this.setState((oldState) => {
      name: "6D",
      price: oldState.price + 500
    })
  }

  render() {
    return(
      <div className="product">
        <h1>{ this.state.title }</h1>
        <p>{ this.state.description }</p>
        <h2>Price: { this.state.price }</h2>
        <button onClick={ () => this.updatePrice() }>Aanbieding</button>
      </div>
    );
  }
}

:
```

Prop

Met Props kan je reactive data aan een childcomponent doorgeven.

Het child component kan props data tonen maar niet bewerken.

```
:
```

```

export class Product extends React.Component {

  :
  render() {
    return(
      <div className="product">
        <h1>{ this.props.title }</h1>
        <p>{ this.props.description }</p>
      </div>
    );
  }
}

:

```

```

:

export class Shop extends React.Component {

  :
  render() {
    return(
      <div className="shop">
        :

        <Product name="Google Chromecast"/>
        <Product name="Skullcandy Crusher"/>
        <Product name="Duracell AA Batterijen"/>

        :
      </div>
    );
  }
}

}

```

Een component kan de waarde van zijn props niet aanpassen!

Prop & State

```

:

export class Shop extends React.Component {
  constructor {
    super()

    this.state = {
      products: ["Canon 200D", "Google Chromecast", "Skullcandy Crusher",
"Duracell AA Batterijen"]

```

```

    }
  }

  :

  render() {
    return(
      <div className="shop">

        :
        <Product name={ this.state.products[0] }/>
        <Product name={ this.state.products[1] }/>
        <Product name={ this.state.products[2] }/>
        <Product name={ this.state.products[3] }/>
        :

      </div>
    );
  }
}

```

Map (Array)

loop over array ("foreach")

```

:
export class Shop extends React.Component {
  constructor {
    super()

    this.state = {
      products: ["Canon 200D", "Google Chromecast", "Skullcandy Crusher"]
    }
  }

  :

  render() {
    const allProducts = this.state.products.map((prod, index) => (
      <Product key={ index } name={ prod }/>
    ))

    return(
      <div className="shop">

        :
        <div>
          { allProducts }
        </div>
        :
      </div>
    );
  }
}

```



```

    </div>
  );
}
}

```

Get Array length

```
<h2>Total Products: { this.state.products.length } </h2>
```

Add to Array

```

addProduct {
  this.setState((oldState) => {
    products: [...oldState.products, "Duracell AA Batterijen"]
  })
}

```

Event Handlers

Een child component kan event handlers in een parent aanroepen.

Dit is de manier om de state van een parent te veranderen vanuit een child.

```

export class Product extends React.Component {
  :
  render() {
    :
    <button onClick={ Shop.doSomething() }>Button</button>
    :
  }
  :
}

```

Lifting state up

Data die in je hele app relevant is plaats je vaak in de main app.

Data Store

Gebruik bij complexe / nested flow (big scale, coolblue)

React Full Example vanilla

index.js

```
import React from "react";
import ReactDOM from "react-dom";

import { App } from "./App";

ReactDOM.render(<App />, document.getElementById("root"))
```

App.js

```
import React from "react";
import "./style.css";
import { Shop } from "./Shop.js"

export class App extends React.Component {

  constructor() {
    super()
    console.log("Created the app")
    this.doSomething()
  }

  doSomething() {
    console.log("Doing something!")
  }

  render() {
    return(
      <div className="app">
        <h1>Title</h1>
        <p>Hello World!</p>

        <Shop />
        <Shop />
      </div>
    );
  }
}
```

Shop.js

```
import React from "react";
import "./style.css";

export class Shop extends React.Component {
```

```
render() {  
  return(  
    <div className="shop">  
      <h1>SHOP</h1>  
      <p>This is a shop</p>  
    </div>  
  );  
}
```

style.css

```
.body {  
  background-color: lightgrey;  
}  
  
.shop {  
  background-color: white;  
  margin: 20px;  
  padding: 20px  
}
```

E. frontend - Sass

styleguides <http://styleguides.io/>

<https://web.archive.org/web/20170523012226/http://codepen.io/guide/#one>

Links

<https://www.youtube.com/watch?v=fgTGADljAeg>

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publish date: 0000-00-00

modified date: 0000-00-00