<WA1/>
<AW1/>
2025

Client-Server Interaction in React

Connecting React to HTTP APIs

Fulvio Corno
Luigi De Russis

Outline

- The “two servers” problem
  - Two servers + CORS → we will use this, in the course
  - Build + Express (single server)
  - Also: Understanding Build (webpack, imports, …)

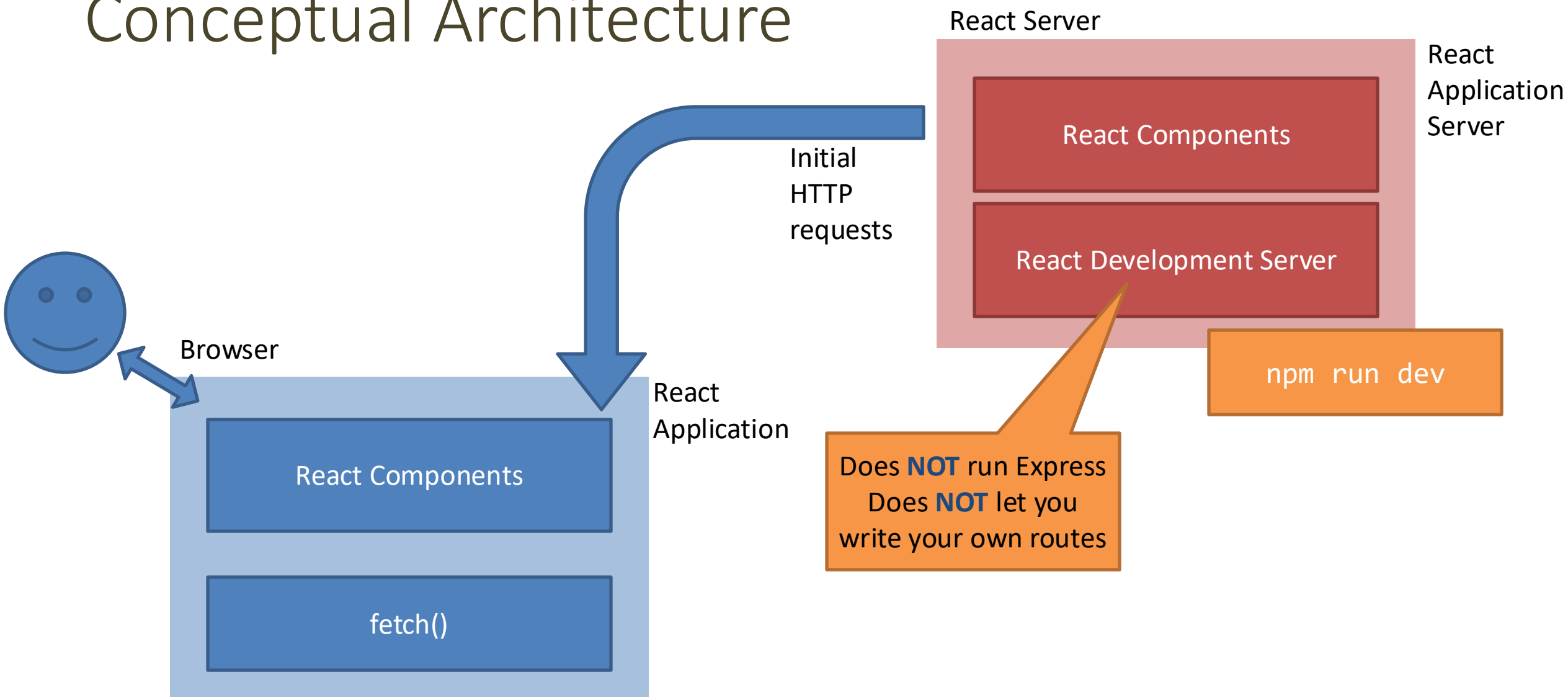
https://www.robinwieruch.de/react-fetching-data

Full Stack React, Chapter “Using Webpack with Create React App”

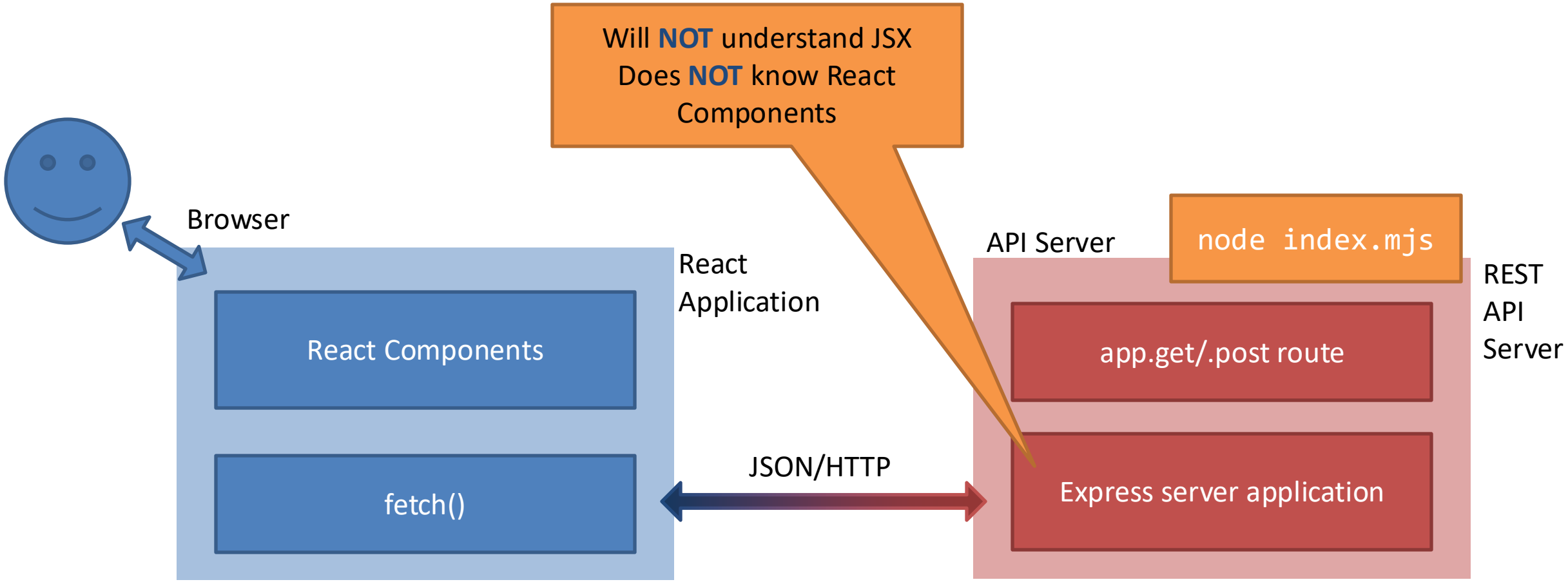
A Client and a Server walk into a bar…

THE “TWO SERVERS” PROBLEM

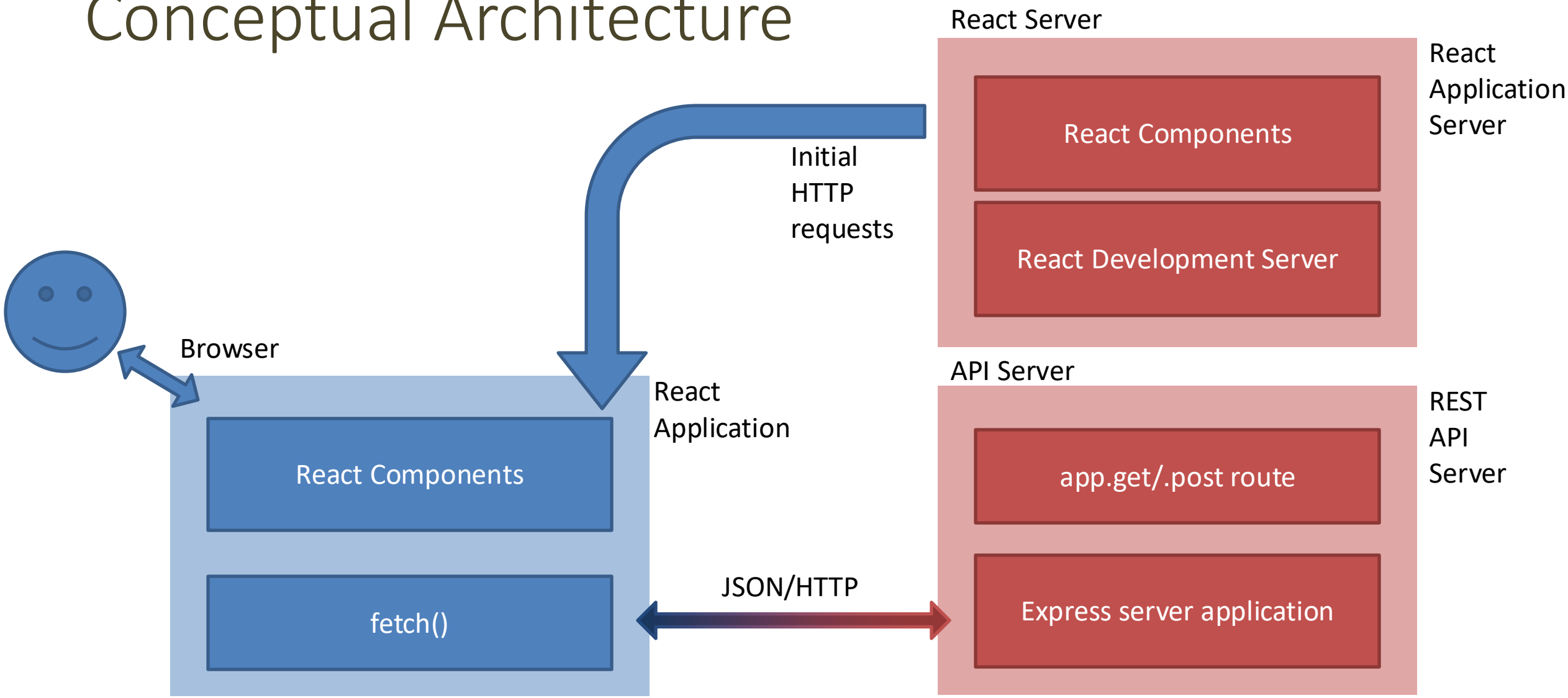
Conceptual Architecture



Conceptual Architecture



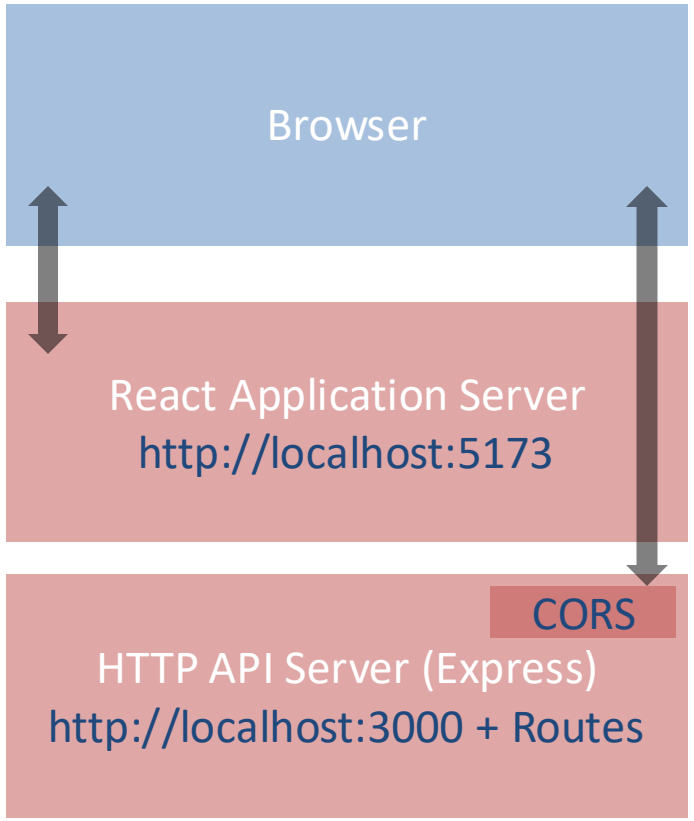
Conceptual Architecture



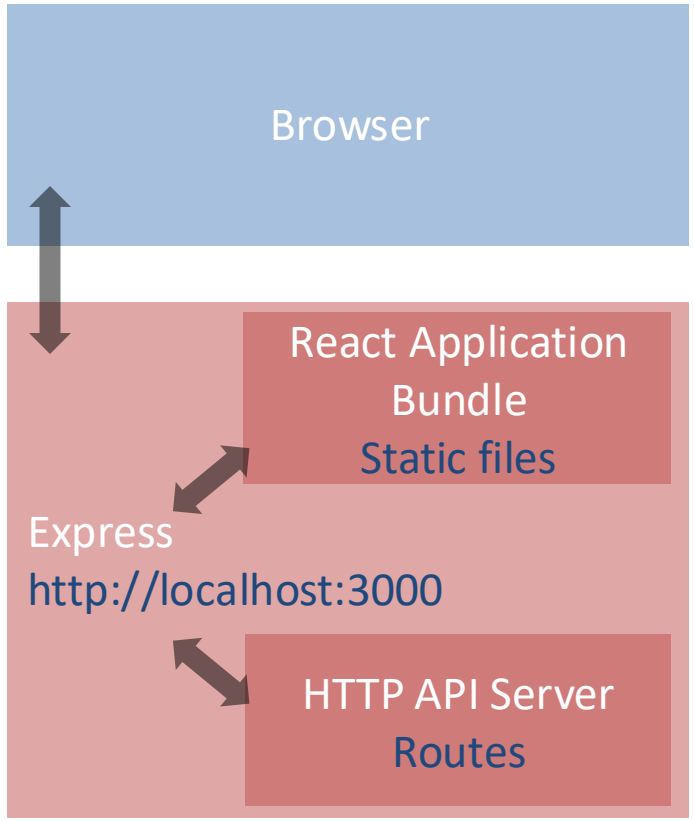
Issues

- Deployment
  - One-server-does-all or two-separate-servers?
  - Development vs. Production trade-off
    - convenience/debug/turnaround time vs performance/security
  - Cross-Origin security limitations
- Opportunities
  - Separate the load
  - Use any API Server (even 3rd party ones)

Two Possible Solutions



Two independent servers + CORS configuration



Build a production bundle and host it in a web server

We will use this, in the course

https://www.newline.co/fullstack-react/articles/using-create-react-app-with-a-server/

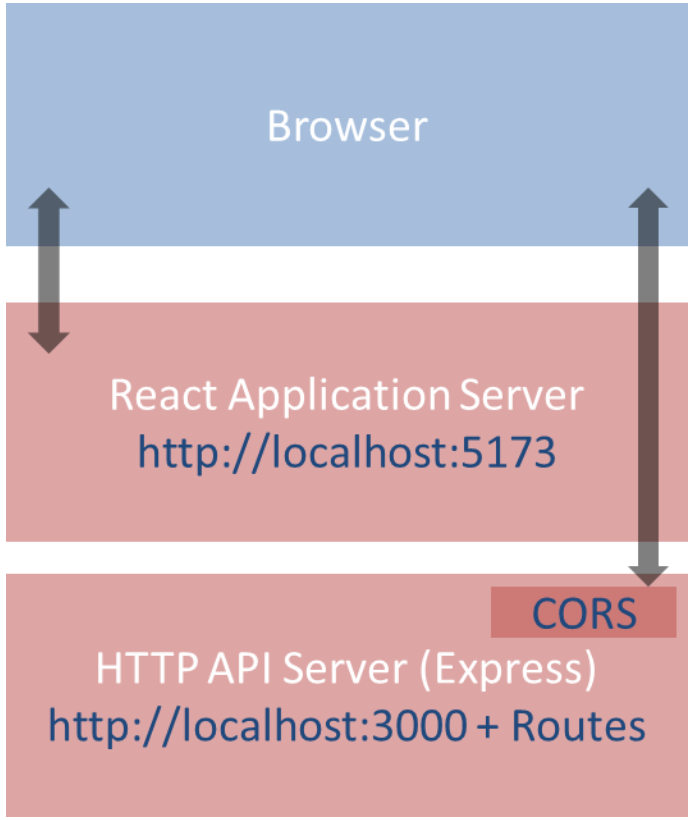
Full Stack React, Chapter “Using Webpack with Create React App / Using Create React App with an API server”

Side-by-side deployment

RUNNING TWO SEPARATE SERVERS

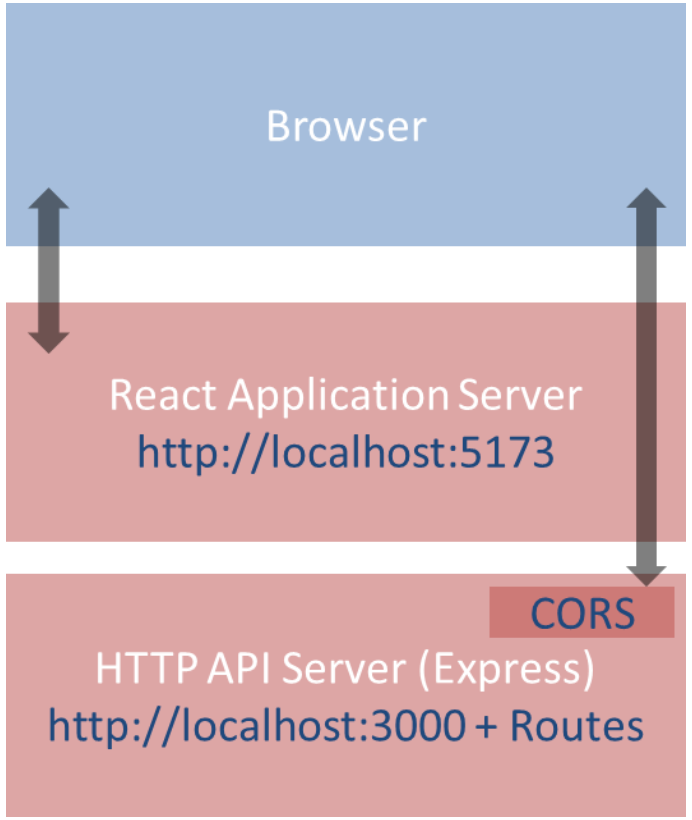
Double-Server Setup

- React Web Server and HTTP API server are hosted separately
  - Different hosts, and/or
  - Different ports
- The browser:
  - Receives the React application
  - Directs the API requests to the API server



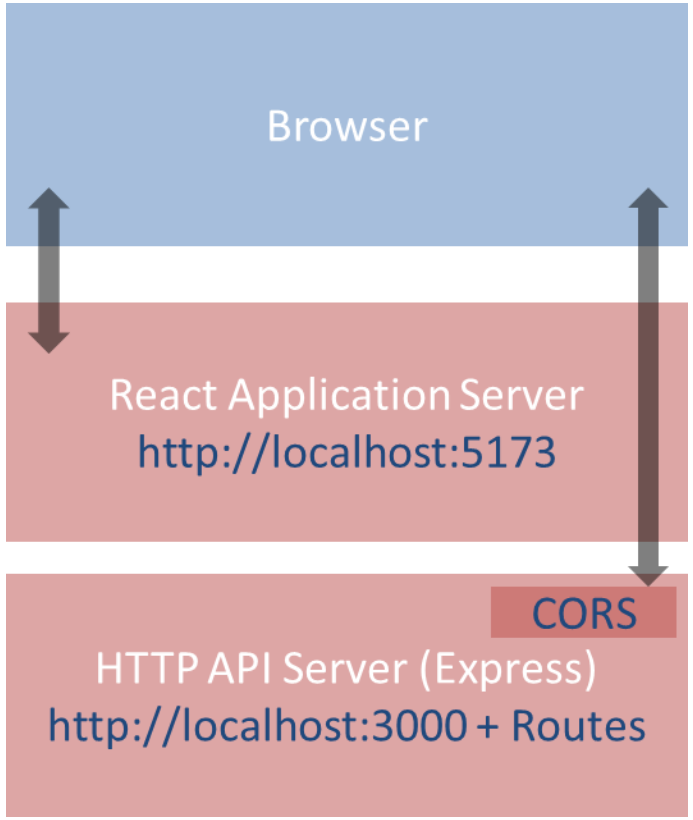
Double-Server Setup

- Must run two web servers
  - React project: `npm run dev`
  - Express project: `node index.js`
  - Two projects, in two different directories (or different servers)
- Problem: handle **CORS**
  - *Cross-Origin Resource Sharing*
  - Default security policy prevents loading data from other servers
  - Details not discussed here



Double-Server Setup

- React Web Server and HTTP API server are hosted separately
  - Different hosts, and/or
  - Different ports
- The browser:
  - Receives the React application
  - Directs the API requests to the API server



Advantages and Disadvantages

- Servers are easy to deploy
- Scalable solution: requests are sent to the appropriate server

- Only possible configuration if the HTTP API is provided by a third party
  - Public APIs

- Need to configure cross-origin resource sharing (CORS) on API server
- Requires using absolute URLs to access APIs

- Wrongly configured CORS might be a security risk (undesired access to APIs from e.g., mock websites)

How To Configure

- Configure CORS on API server for development

```
// index.mjs (node express server)
import cors from 'cors';  // npm install cors

//Enable All CORS Requests (for this server)
app.use(cors());
//Use ONLY for development, otherwise restrict domain
```

- In production mode, use different domains for React and API servers, NEVER allow CORS requests from any origin, always specify origin
  - See also https://github.blog/security/application-security/localhost-dangers-cors-and-dns-rebinding/

Example

API.mjs in the React Application

```
const APIURL=new URL('http://localhost:3000');

async function getCourses() {
  return fetch(new URL('/courses', APIURL))
    .then((response)=>{
      if(response.ok) {
        return response.json() ;
      } else {
        throw response.statusText;
      }
    })
    .catch((error)=>{
      throw error;
    });
}
```

Called in useEffect()

index.mjs for the API Server

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

const app = express();
const port = 3000;
app.use(cors());

app.get('/courses', (req, res) => {
  dao.listCourses()
    .then((courses) => res.json(courses))
    .catch((dbErrorObj)=>
      res.status(503)
         .json(dbErrorObj));
});

app.listen(port, () => console.log(`Example app
listening at http://localhost:${port}`));
```

Calls dao.mjs

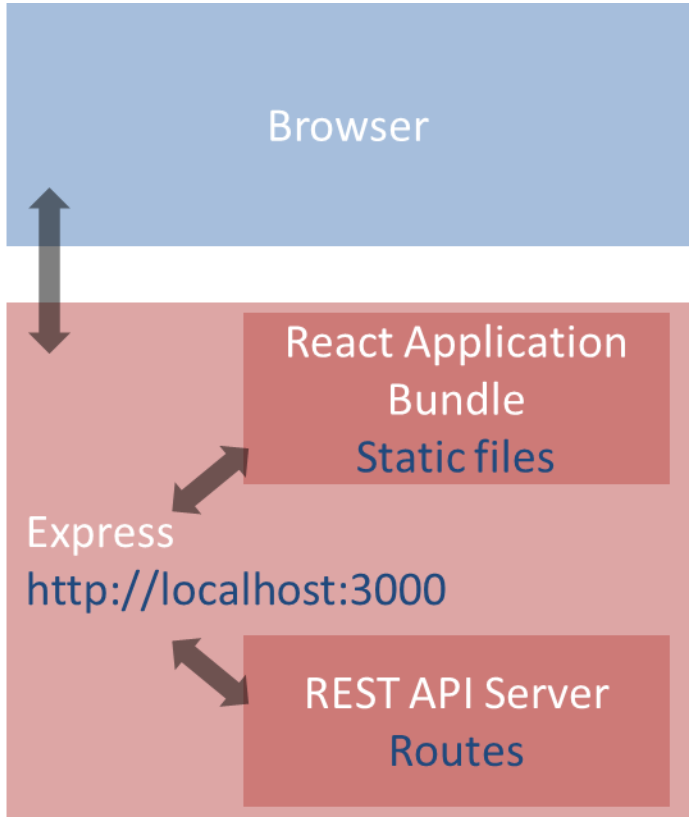
https://vitejs.dev/guide/static-deploy.html

Packing and moving the React application into any web server

DEPLOYING A BUILD INSIDE A SERVER

Deploying the React Bundle

- React does not need to run in the development server
- `npm run build` will create a "production bundle" with all the contents needed to run the application
- This bundle is composed of static files (html, js, assets) and may be served by *any webserver* (including Apache, nginx, express, php, …)



Build Command

`npm run build`

```
[luigi@meletta react-qa]$ npm run build

> react-qa@0.0.0 build
> vite build

vite v4.2.1 building for production...
✓ 340 modules transformed.
dist/index.html                                  0.39 kB
dist/assets/bootstrap-icons-cfe45b98.woff2     121.34 kB
dist/assets/bootstrap-icons-999550fa.woff      164.36 kB
dist/assets/index-4e55b3b0.css                 274.30 kB | gzip: 40.19 kB
dist/assets/index-b55e27f4.js                  210.40 kB | gzip: 69.73 kB
✓ built in 1.02s
```

Creates everything under `./dist`

https://vitejs.dev/guide/static-deploy.html

What Does “build” Do?

- Most of the work in “building” the static application is done by Babel and Webpack
  - Babel translates all JSX (and new JS syntax) into basic JS (according to the ‘`production`’ property in `package.json`)
  - Webpack packs and minimizes all JS code into a single file
  - Prepares an `index.html` that loads all the JS code
- The content of the “dist” folder is self-contained and may be moved to the deployment server
- All debugging capabilities are removed

Check the Build Results

- You may test the built app by running `npm run preview`
- The vite's preview command will launch a local static web server
  - serving the files from "dist" at http://localhost:4173

Hosting The Build in Express

- `cd express-api-server`
- `cp –r ..../react-app/dist .`
- Define a static route in `server.js`

```
app.use(express.static('./build'));

app.get('/', (req,res)=> {res.redirect('/index.html')} );
```

- In the application, you may call APIs locally
  - `fetch('/api/questions')...`

Hosting the Build in Online Services

- Different online services allow free hosting of static websites, e.g.,
  - GitHub Pages, GitLab Pages, Firebase, Vercel, etc.
- Some of them are free or have a free tier.
- To host the build on such services, refer to the guide at https://vitejs.dev/guide/static-deploy.html.

Pros and Cons

- Simple to deploy the final application (anywhere)
- May include the application inside the API server (in production, too)
- The JS code runs on every browser (thanks to polyfills and transpiling)

- The build cannot be directly modified
- Need a save/build/copy/reload cycle for every modification

Other “Magic” By Webpack

- Packing of all imported modules
- Bundling of Assets
  - Images
  - CSS files
- CSS Modules

In Development Mode…

- `npm run dev` runs the “Webpack development server” (WDS)
- All our code is transpiled and packed into a `bundle.js` that is automatically inserted into `index.html`
  - Contains all our code, plus React, plus imported modules
  - Also handles imports of non-JS files
- `bundle.js` does not exist – it’s kept in-memory by the WDS
- Sets up hot-reloading and synchronized error messages (via websockets)

Imports in Webpack

- `import logo from './logo.svg';`
- `import logo from './logo.png';`
  - Will include the image reference inside the bundle (placed under static/media)
  - Small files are rendered inline
- `import './Button.css';`
  - This component will use these CSS declarations
  - All CSS will be concatenated into a single file, but here we are stating the dependency
- `import styles from './Button.module.css';`
  - Files ending with .module.css are CSS modules
  - Styles may be applied with `className={styles.primary}`
  - Class names are *renamed to be unique*: no conflict with other Components' styles

Why Use Imports

- Scripts and stylesheets get minified and bundled together to avoid extra network requests.
- Missing files cause compilation errors instead of 404 errors for your users.
- Result filenames include content hashes, so you do not need to worry about browsers caching their old versions.

- They are an optional mechanism. “Traditional” loading (with link) still works, if you save your files in the public directory

License

- These slides are distributed under a Creative Commons license “**Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0)**”
- **You are free to:**
  - **Share** — copy and redistribute the material in any medium or format
  - **Adapt** — remix, transform, and build upon the material
  - The licensor cannot revoke these freedoms as long as you follow the license terms.
- **Under the following terms:**
  - **Attribution** — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
  - **NonCommercial** — You may not use the material for commercial purposes.
  - **ShareAlike** — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.
  - **No additional restrictions** — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.
- https://creativecommons.org/licenses/by-nc-sa/4.0/