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2024

Client-Server Interaction in React

Connecting React to HTTP APIs

Fulvio Corno
Luigi De Russis
Enrico Masala

Outline

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

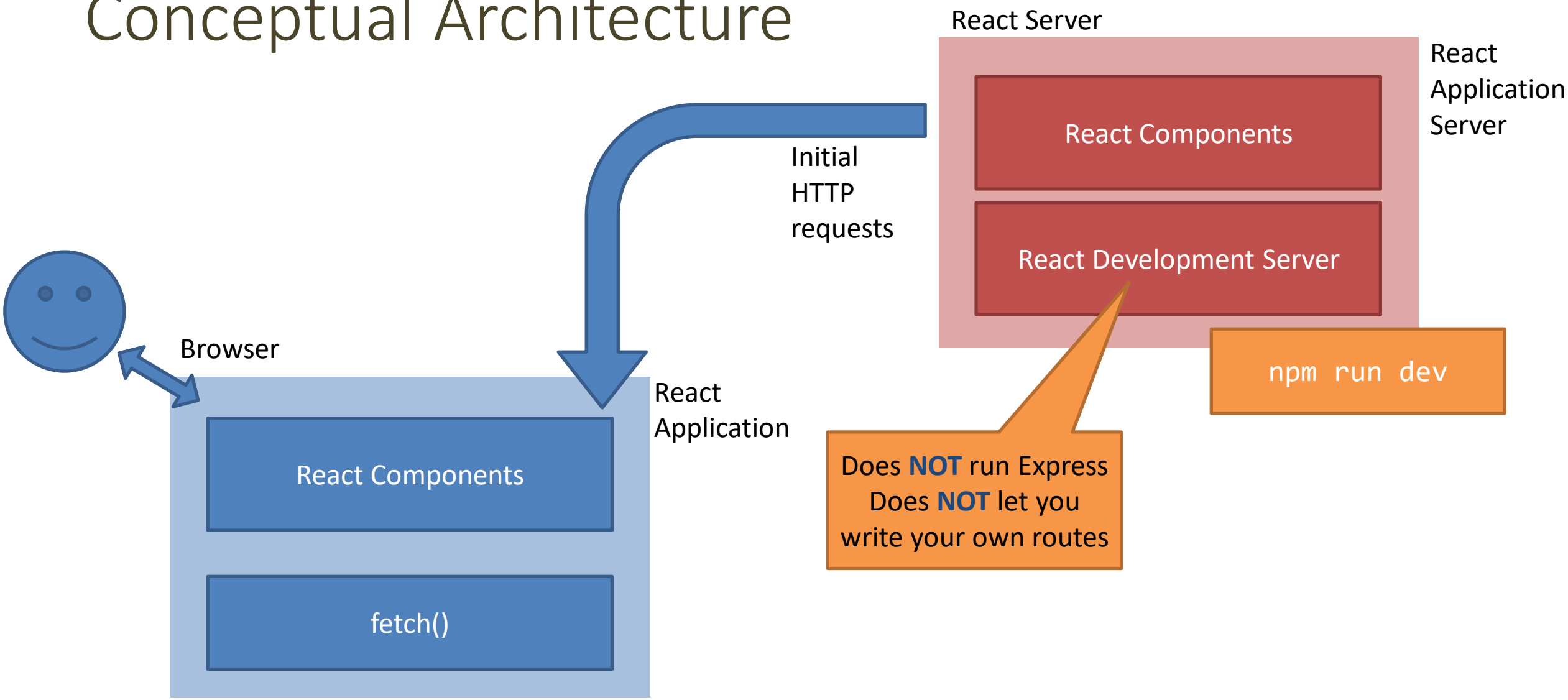
https://www.robinwieruch.de/react-fetching-data

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

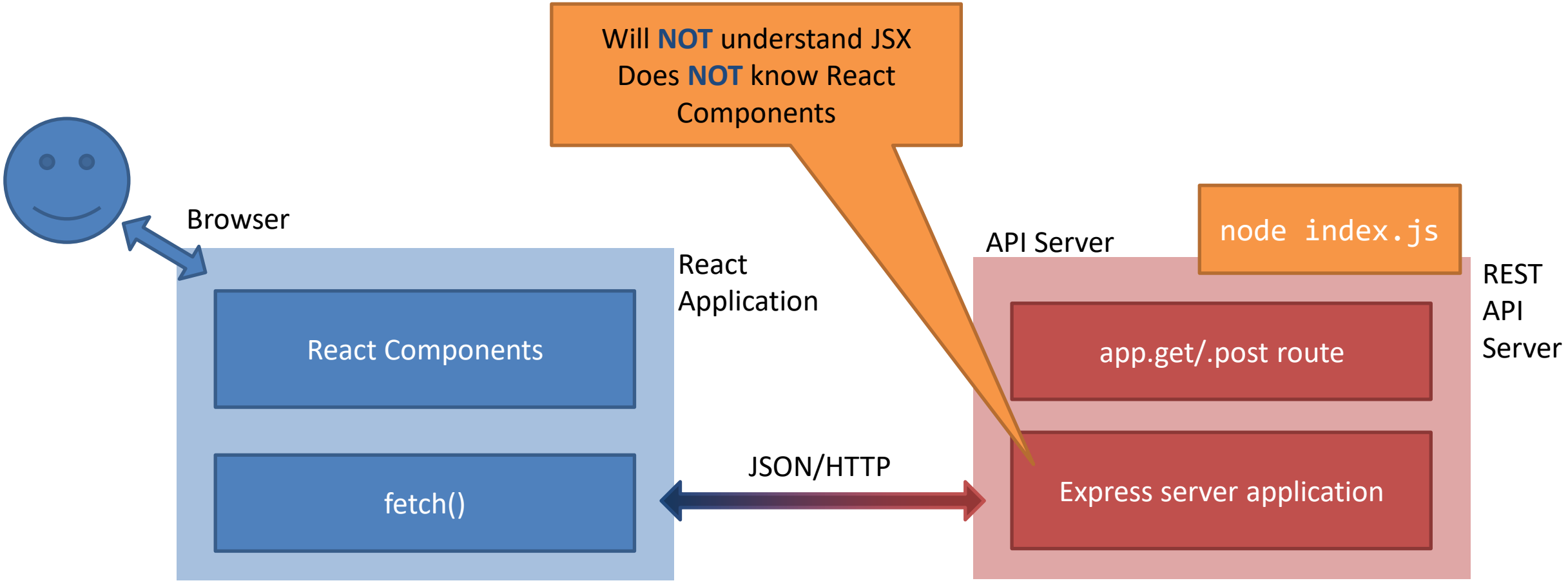
A Client and a Server walk into a bar…

THE “TWO SERVERS” PROBLEM

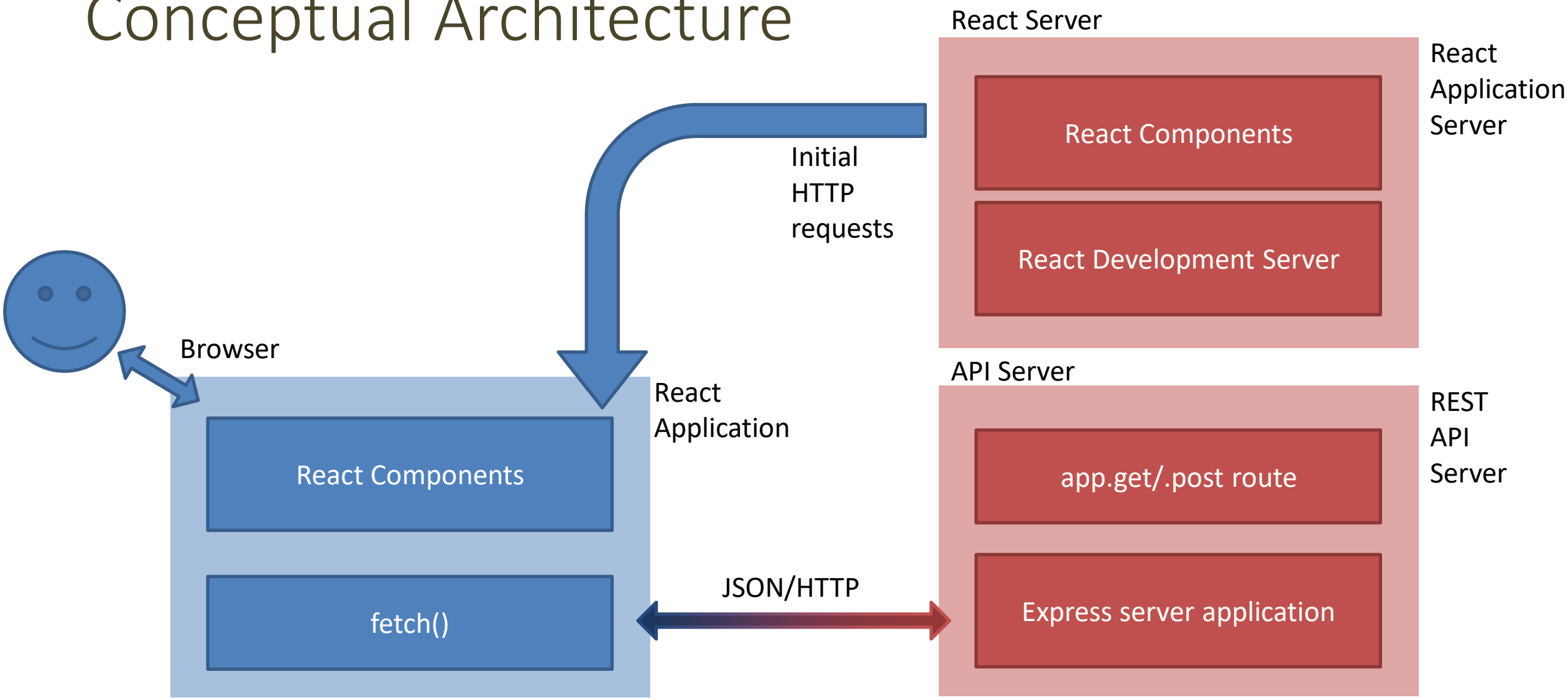
Conceptual Architecture



Conceptual Architecture



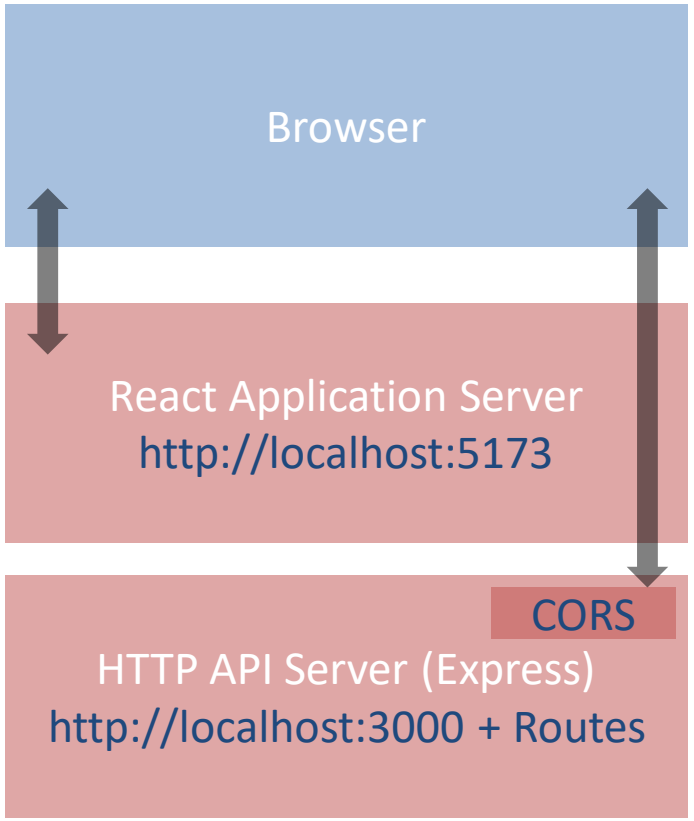
Conceptual Architecture



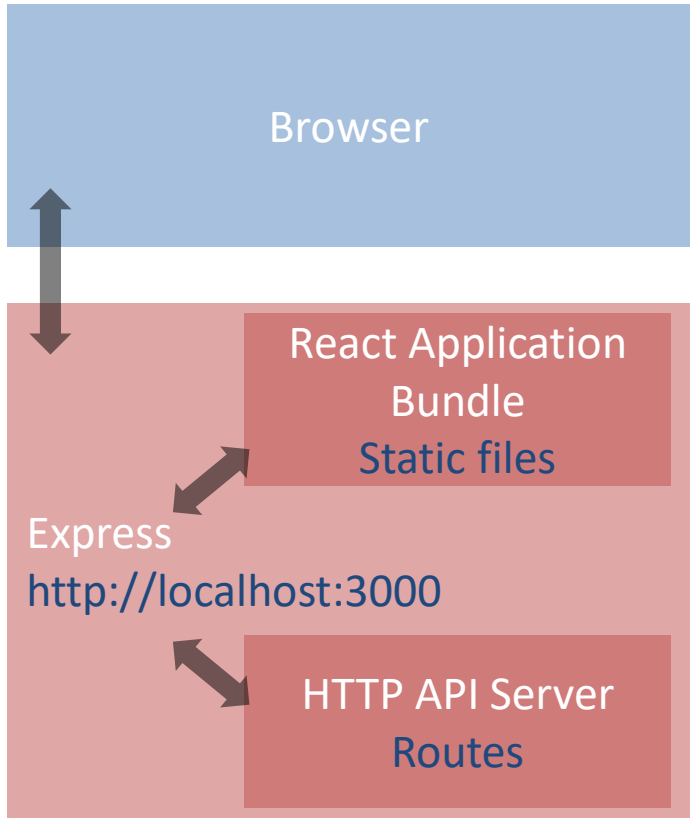
Issues

- 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/

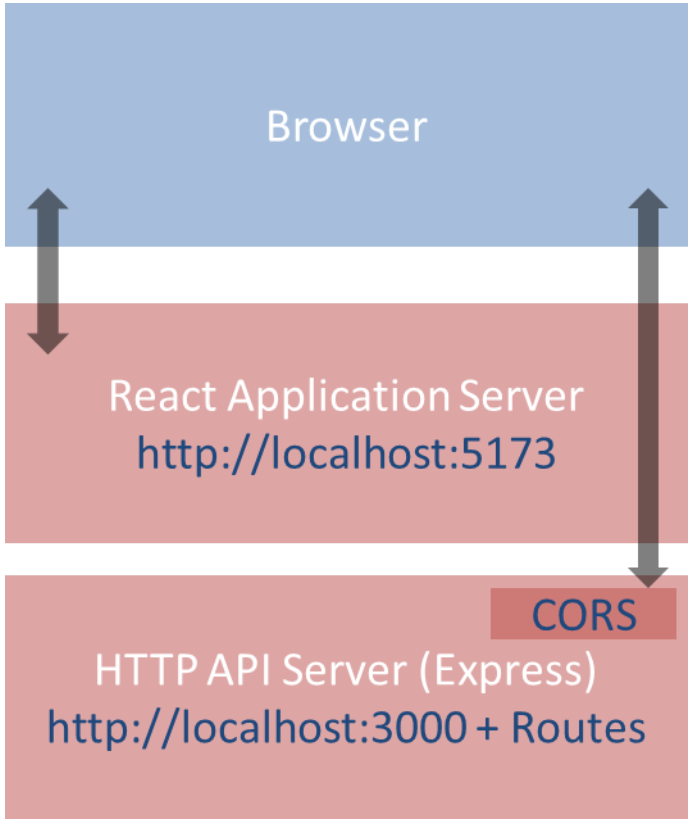
Full Stack React, Chapter “Using Webpack with Create React App / Using Create React App with an API server”

Side-by-side deployment

RUNNING TWO SEPARATE SERVERS

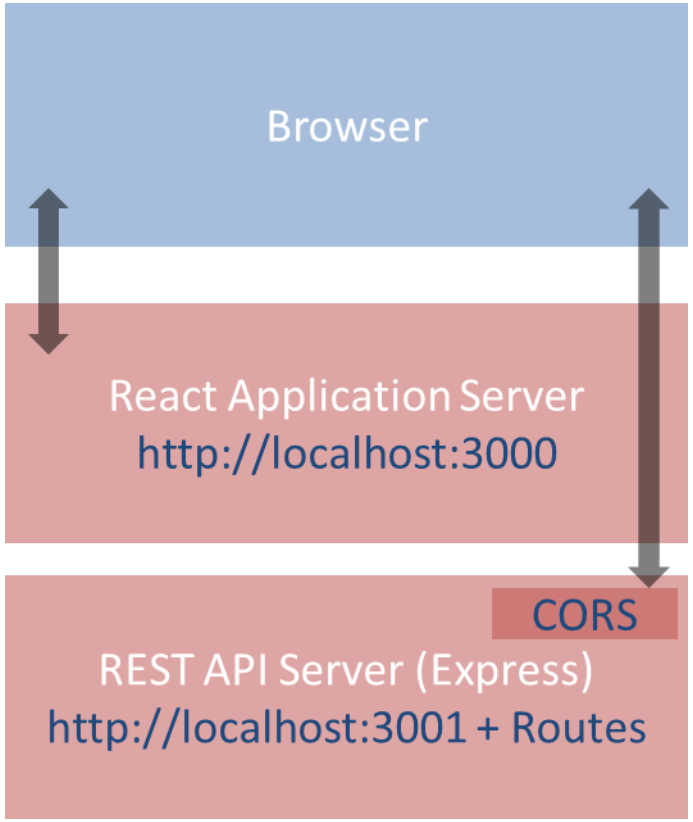
Double-Server Setup

- 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



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.js (node express server)
var cors = require('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

Example

API.js 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.js for the API Server

```
const express = require('express');
const port = 3000;
const cors = require('cors');
const app = express();
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.js

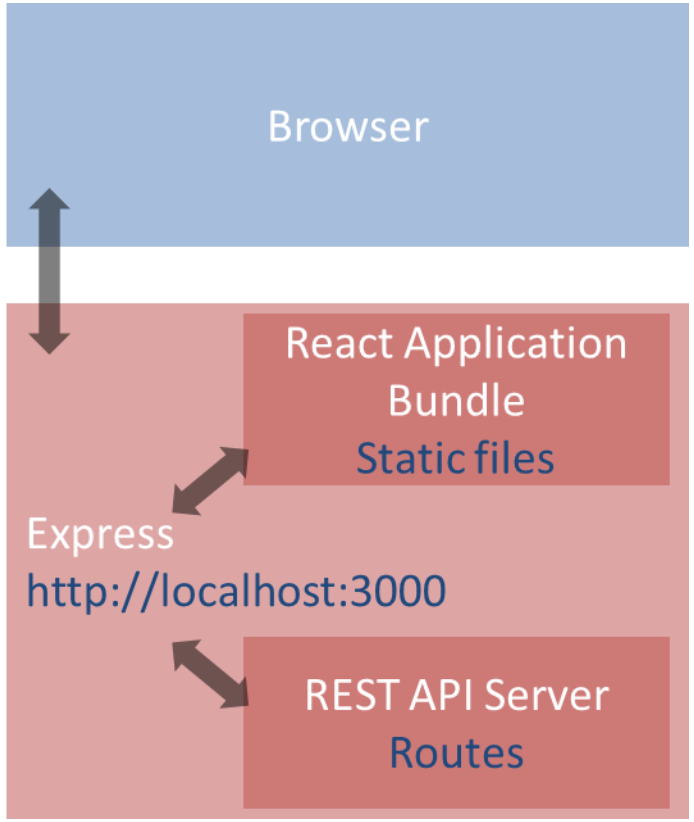
https://vitejs.dev/guide/static-deploy.html

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 start` 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

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