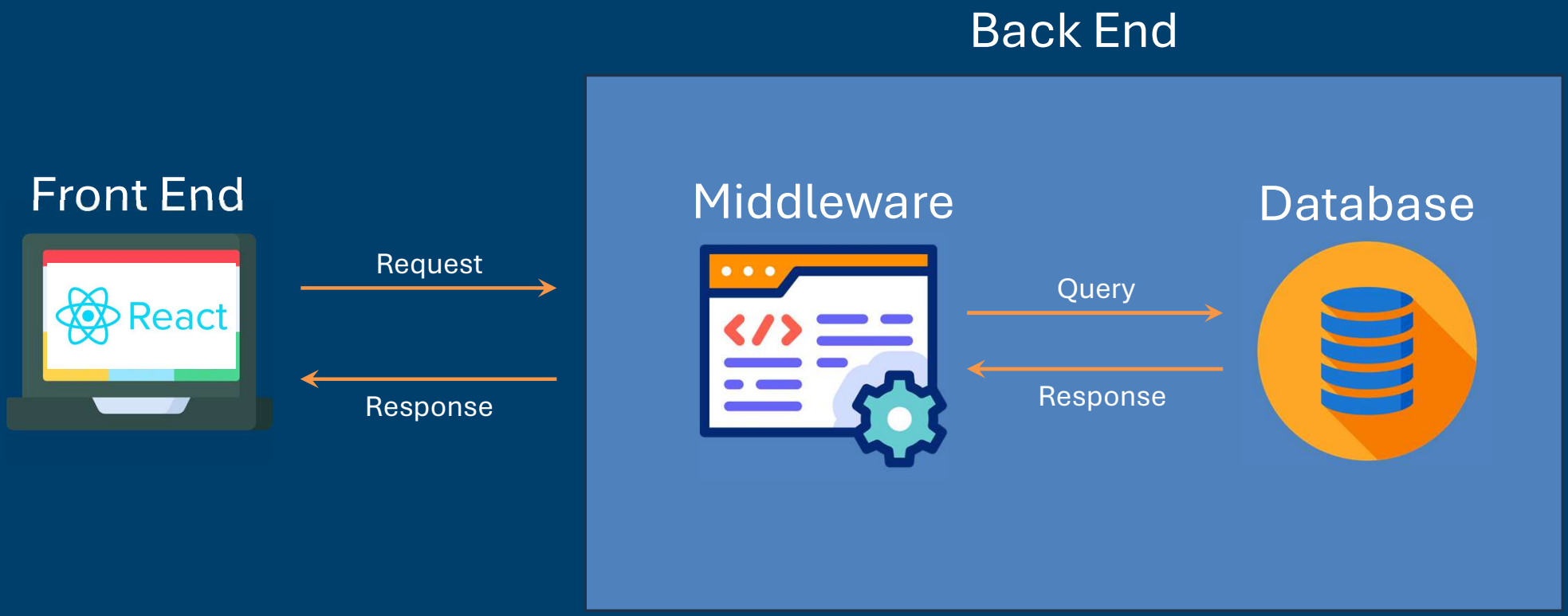
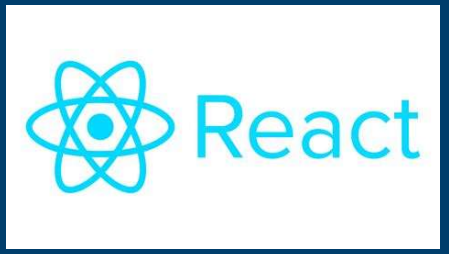
Creating a Database Backend with Prisma and Postgres


Back End
Front End
Middleware
Database
React
Request
Response
Query
Response

Front End

- React
- Alternative interfaces



Middleware

- Node.js
- Express
- Prisma

Prisma

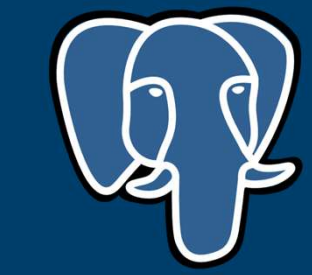
- Object-relational mapping (ORM)
- TypeScript -> SQL Querying
- Great for integration with REACT
- Node.js with Express

Database

- Docker
- PostgreSQL

Postgres

- Object-Relational Database Management System
- Uses and extends the SQL Language
- ACID-compliant
- Free and Open Source



PostgreSQL

Front End

React

Middleware

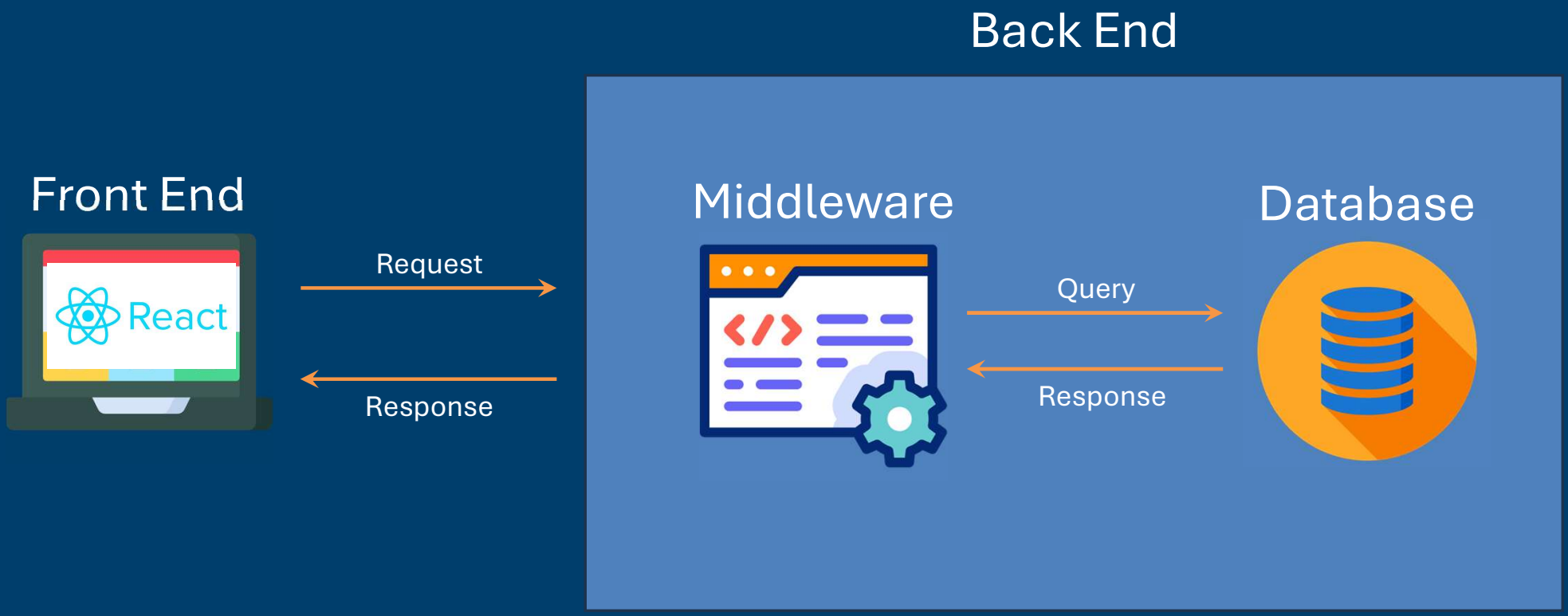
node express

Prisma

Database

docker

PostgreSQL


Back End
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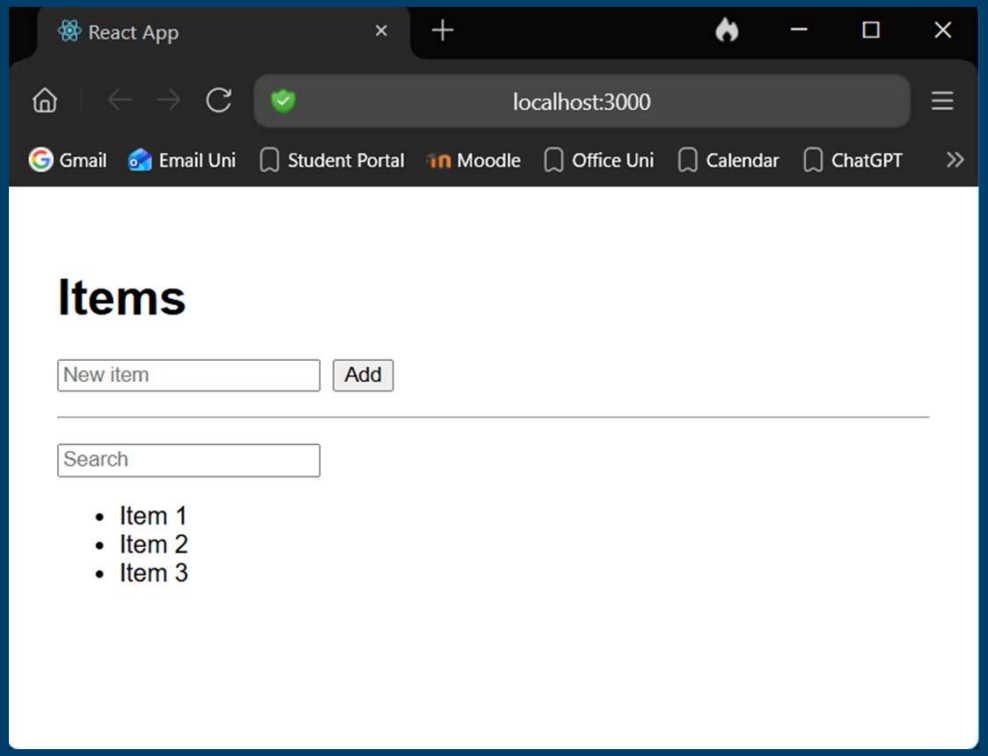
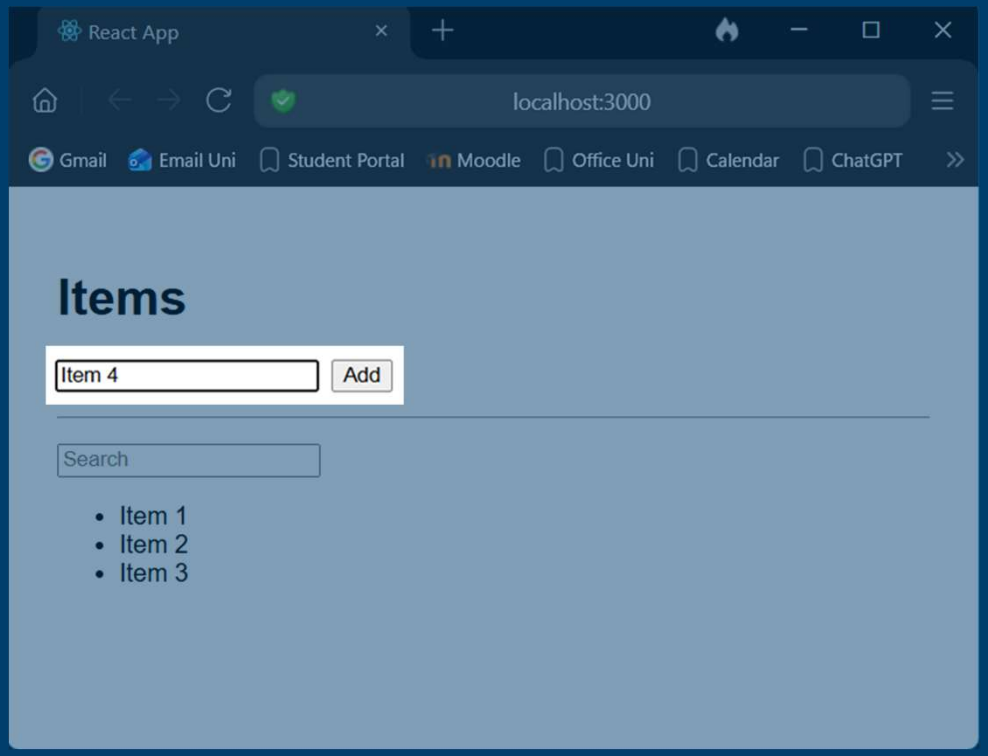
Tutorial

The Project


React App
localhost:3000
Gmail
Email Uni
Student Portal
Moodle
Office Uni
Calendar
ChatGPT
Items
New item
Add
Search
Item 1
Item 2
Item 3

The Project


React App
localhost:3000
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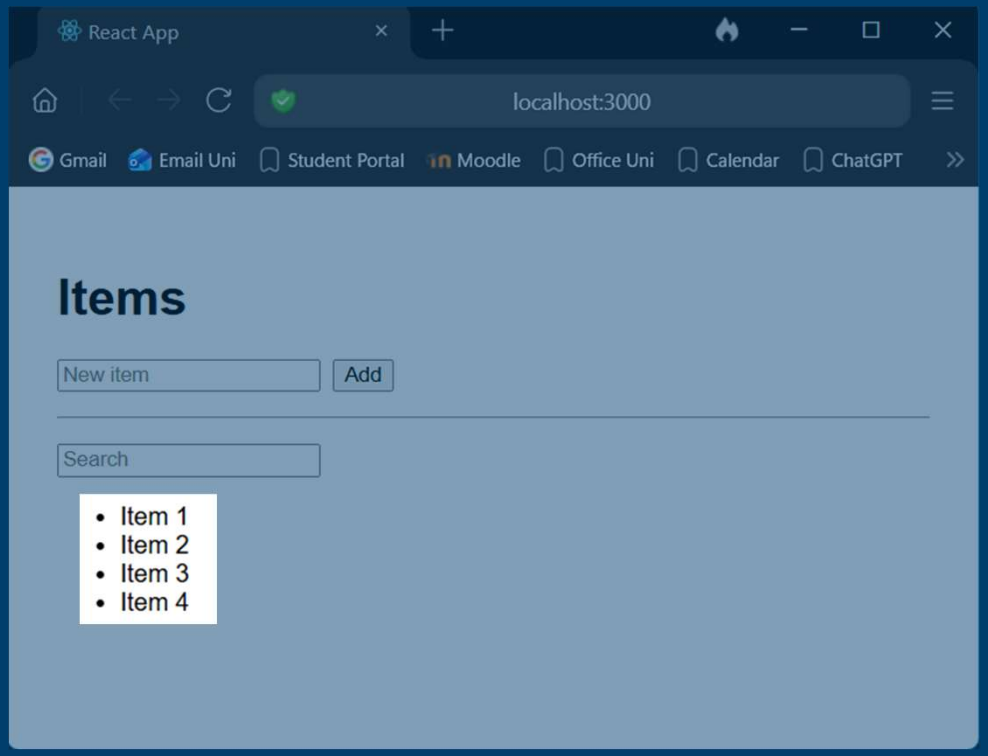
Items
Item 4
Add
Search
Item 1
Item 2
Item 3

The Project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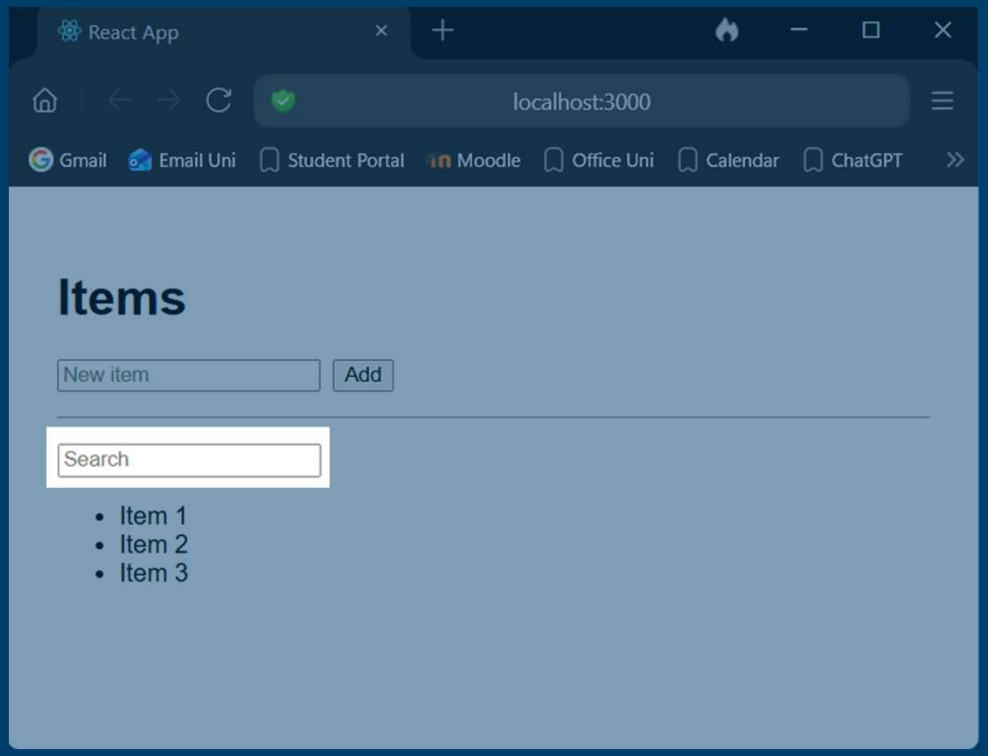
New item
Add
Search
Item 1
Item 2
Item 3
Item 4

The Project


React App
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Office Uni
Calendar
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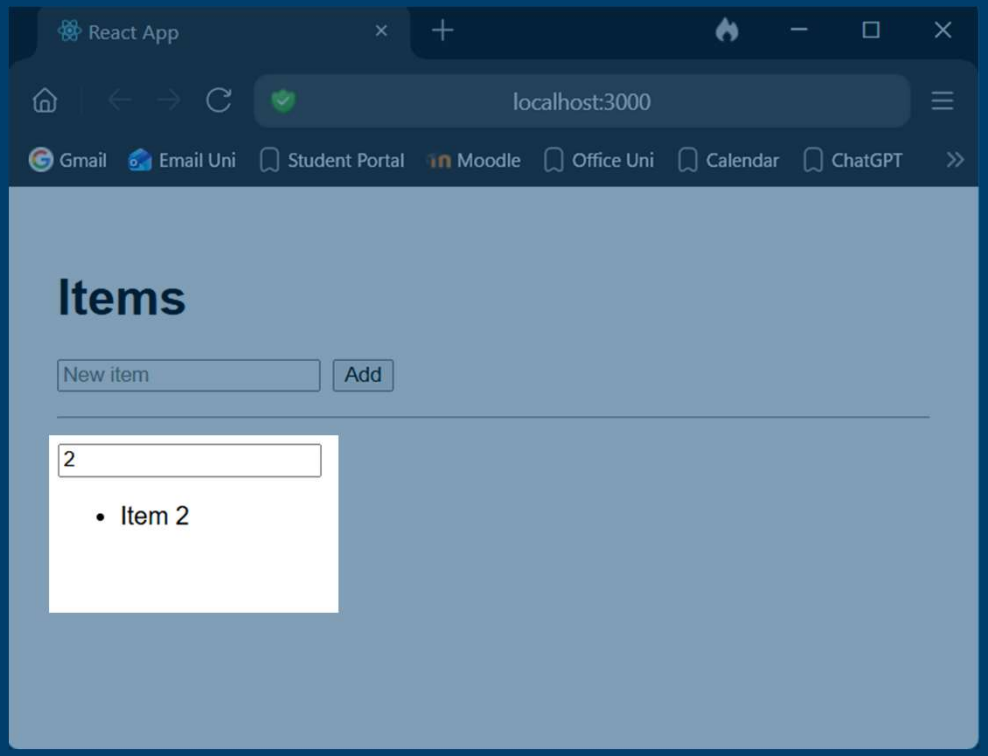
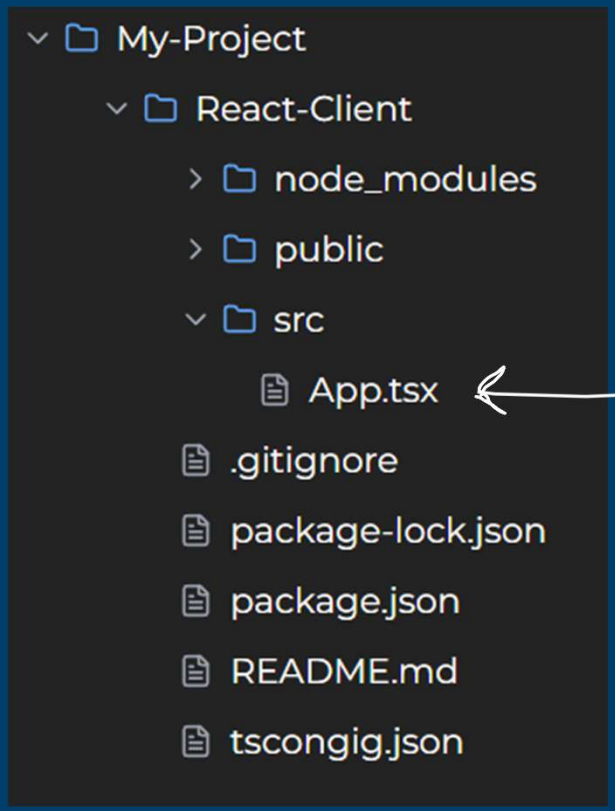
Items
New item
Add
Search
Item 1
Item 2
Item 3

The Project


React App
localhost:3000
Gmail
Email Uni
Student Portal
Moodle
Office Uni
Calendar
ChatGPT
Items
New item
Add
2
Item 2

The Project

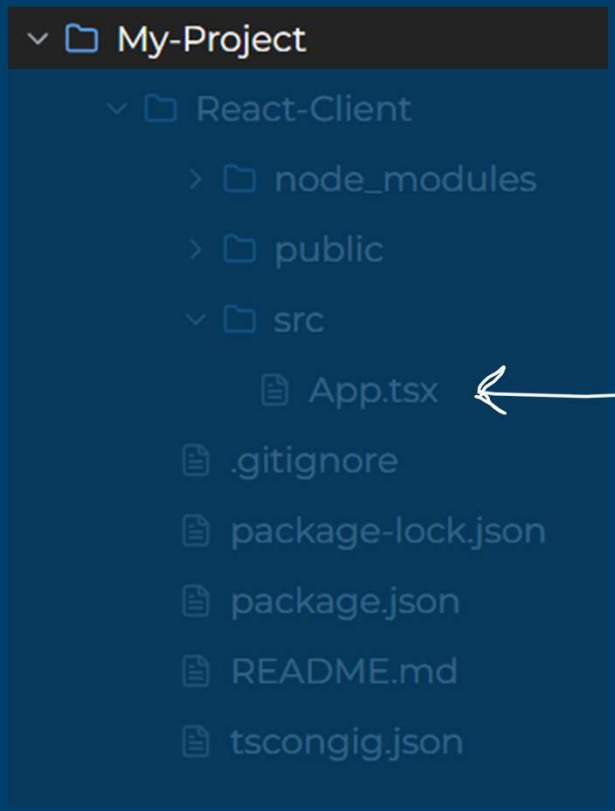
```
npx create-react-app React-Client --template typescript
```



Only this file has been edited

The Project

```
npx create-react-app React-Client --template typescript
```



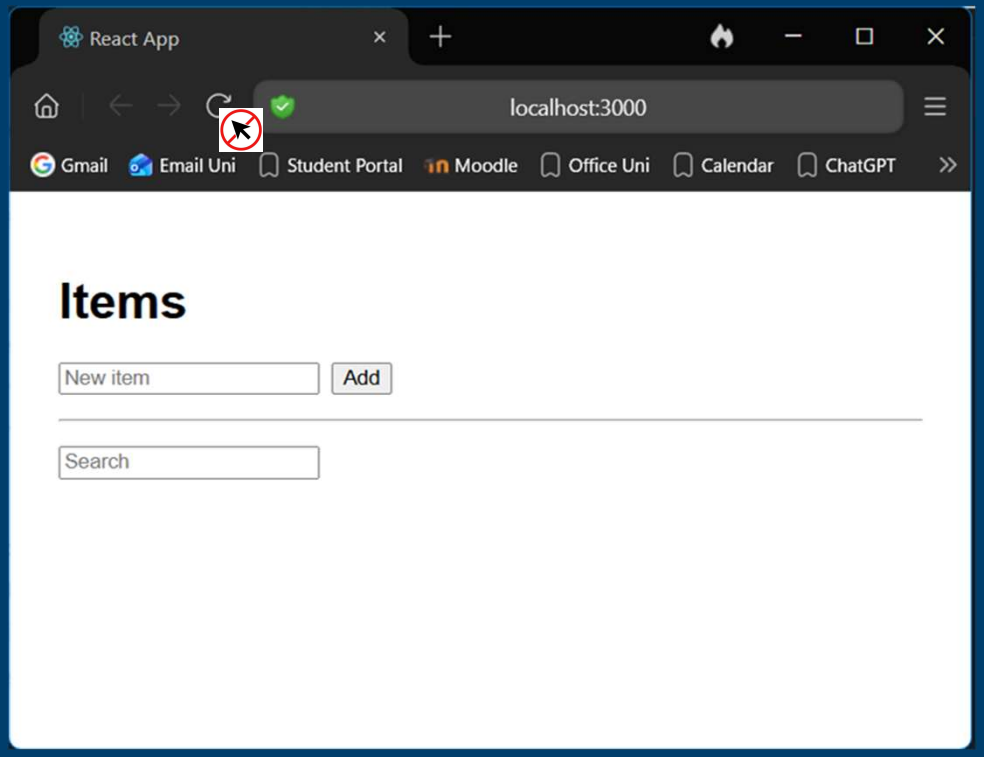
Only this file has been edited

The Project - ./React-Client/src/App.tsx

```tsx
import { useState } from "react";

interface Item {
  id: number;
  name: string;
}

function App() {
  const [items, setItems] = useState<Item[]>([]);
  const [name, setName] = useState("");
  const [search, setSearch] = useState("");

  const createItem = () => {
    if (!name.trim()) return;

    const newItem: Item = {
      id: items.length ? items.at(-1)!.id + 1 : 1,
      name,
    };
    setItems([...items, newItem]);
    setName("");
  };

  const searchItems = (q: string) => {
    setSearch(q);
  };

  const filteredItems = items.filter((item) =>
    item.name.toLowerCase().includes(search.toLowerCase())
  );

  return (
    <div style={{ padding: "2rem", fontFamily: "sans-serif" }}>
      <h1>Items</h1>

      <input
        placeholder="New item"
        value={name}
        onChange={(e) => setName(e.target.value)}
      />
      <button onClick={createItem} style={{ marginLeft: "0.5rem" }}>
        Add
      </button>

      <hr style={{ margin: "1rem 0" }} />

      <input
        placeholder="Search"
        value={search}
        onChange={(e) => searchItems(e.target.value)}
      />

      <ul>
        {filteredItems.map((item) => (
          <li key={item.id}>{item.name}</li>
        ))}
      </ul>
    </div>
  );
}

export default App;
```

The problem...


NO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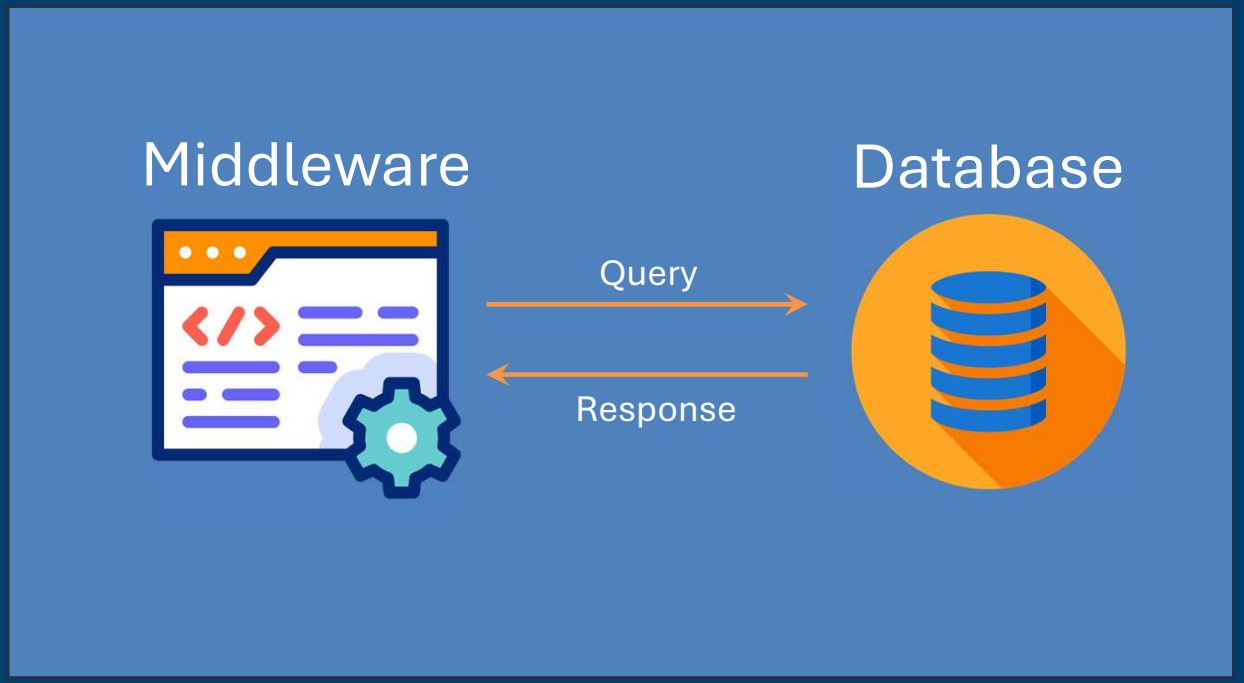
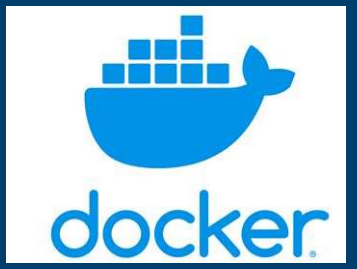
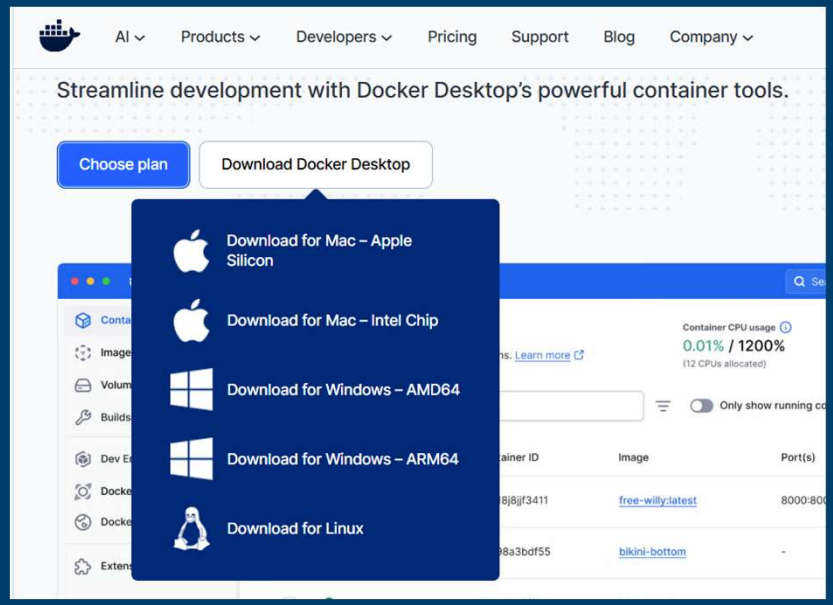
Back End

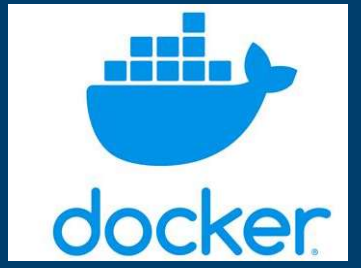


Creating Postgres Database

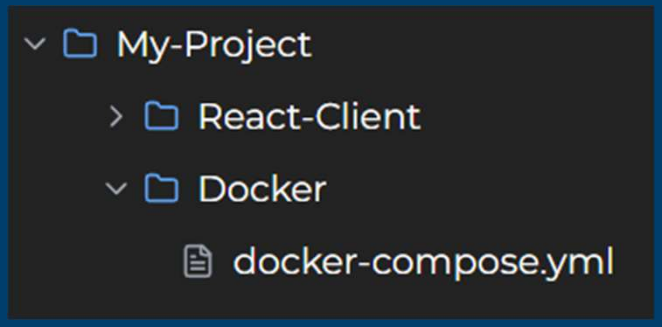


- Docker Desktop from www.docker.com

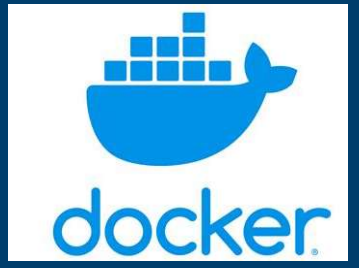




- Create a Docker folder and docker-compose.yml

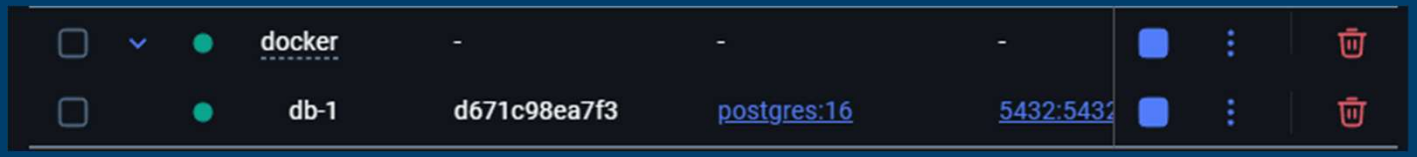


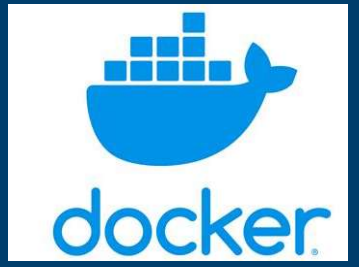

```yaml
version: '3.9'

services:
  db:
    image: postgres:16
    restart: always
    environment:
      POSTGRES_USER: app_user
      POSTGRES_PASSWORD: app_password
      POSTGRES_DB: app_db
    ports:
      - "5432:5432"
    volumes:
      - postgres_data:/var/lib/postgresql/data

volumes:
  postgres_data:
```



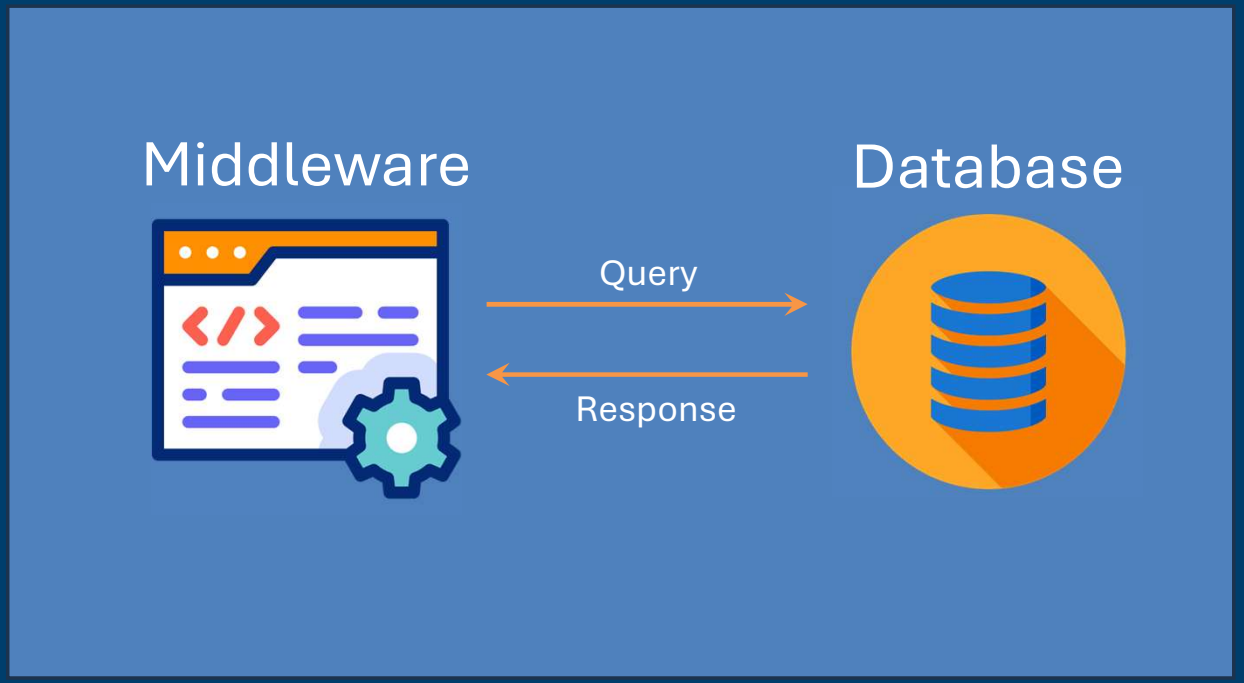
- Run the command to start Postgres

```
cd .\Docker\
docker compose up -d
```



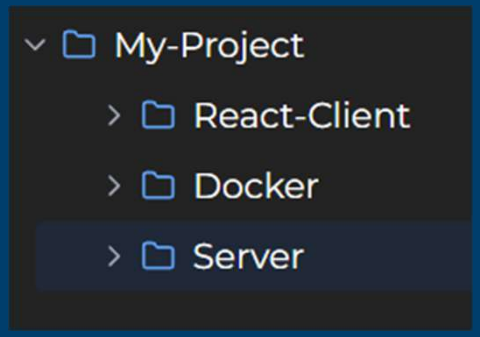


Back End



Initialising Node.js Middleware

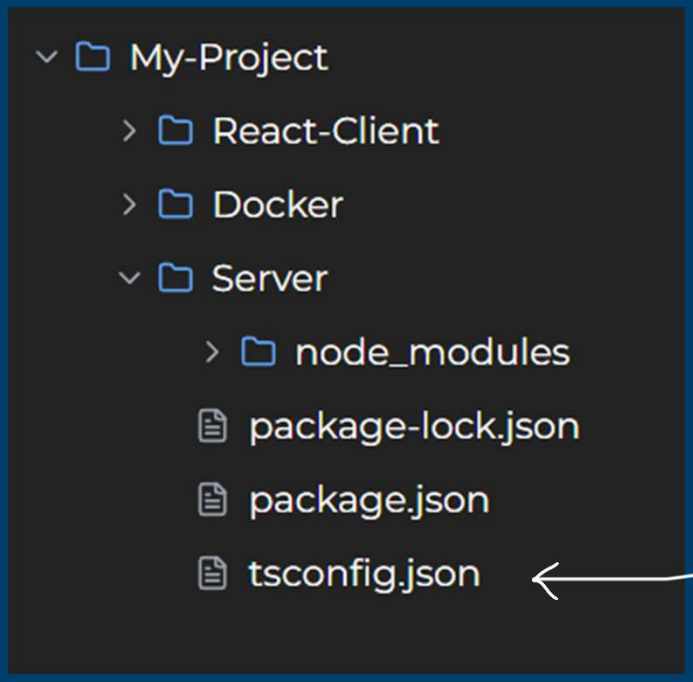
- Create a Server directory



- Initialise Node.js

```
cd .\Server\
npm init -y
npm install express cors
npm install -D typescript ts-node nodemon @types/node @types/express
@types/cors
npx tsc --init
```

- TypeScript Configuration




```
{
  "compilerOptions": {
    "module": "CommonJS",
    "target": "ES2020",
    "moduleResolution": "Node",
    "strict": true,
    "esModuleInterop": true,
    "forceConsistentCasingInFileNames": true,
    "noEmit": true,
    "allowImportingTsExtensions": true,
    "rootDir": "./src",
    "outDir": "./dist",
  },
  "include": ["src/index.ts", "prisma/**/*.ts"]
}
```

Configuring Prisma

```
npm install -D prisma@6.19.0 @prisma/client@6.19.0
npx prisma init
```

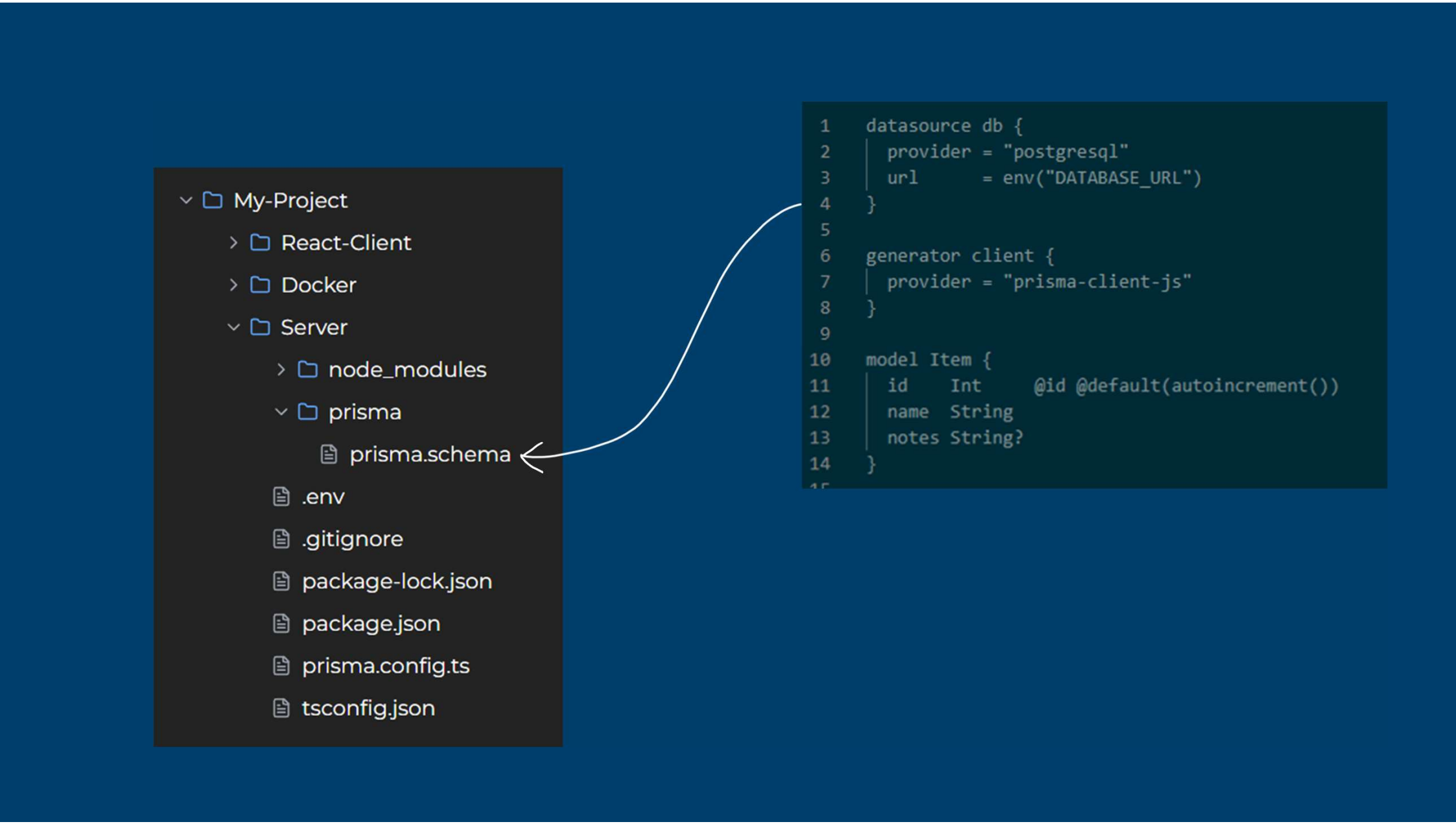
Don’t try this with Prisma 7.0.1

What is schema.prisma?

- Object-Relational Model configuration file
- Defines database tables with object types

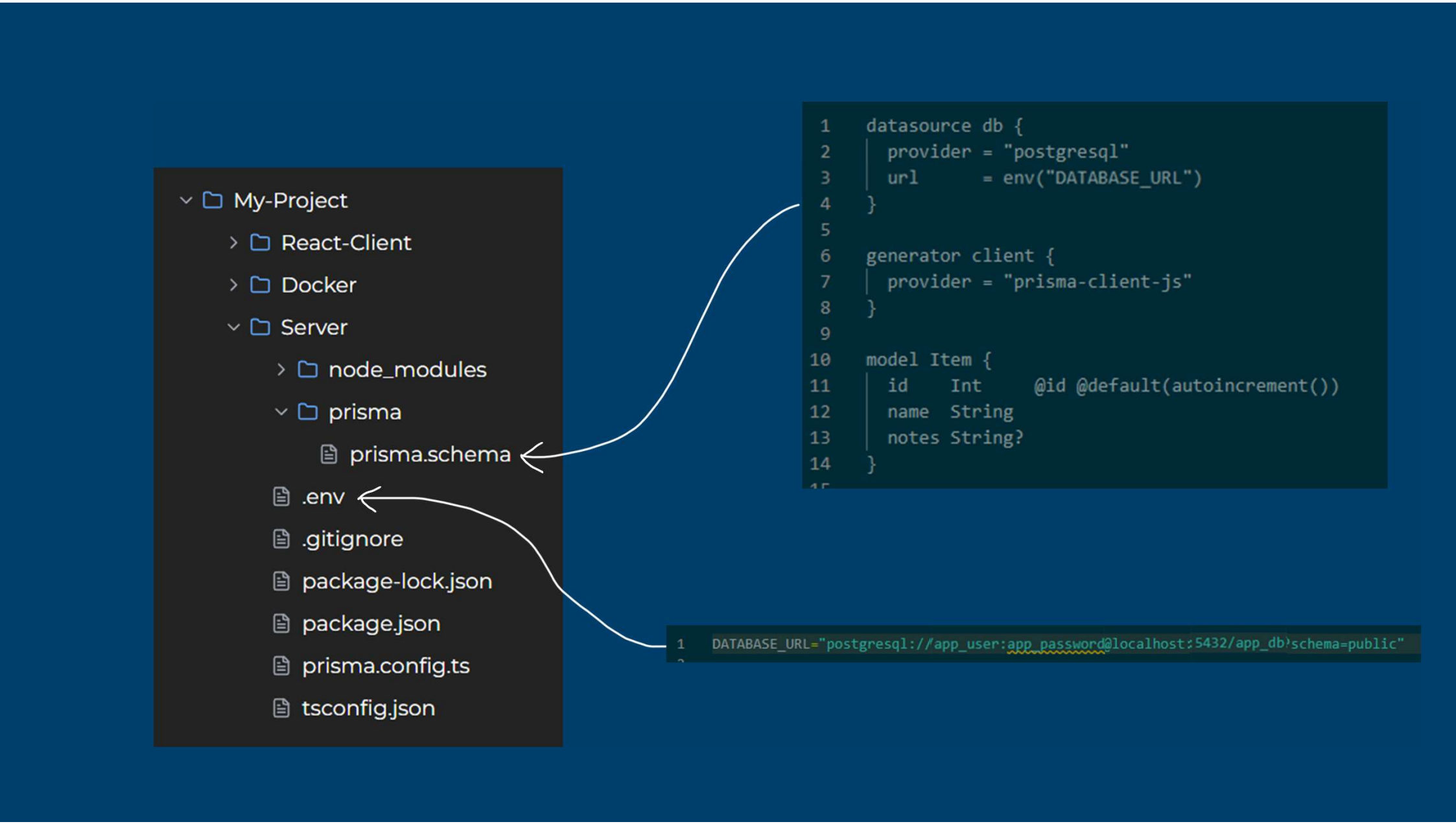
What is schema.prisma?

```
datasource db {
  provider = "postgresql"
  url      = env("DATABASE_URL")
}

generator client {
  provider = "prisma-client-js"
}

model Item {
  id    Int     @id @default(autoincrement())
  name  String
  notes String?
}
```


My-Project
React-Client
Docker
Server
node_modules
prisma
prisma.schema
.env
.gitignore
package-lock.json
package.json
prisma.config.ts
tsconfig.json
datasource db {
provider = "postgresql"
url = env("DATABASE_URL")
}
generator client {
provider = "prisma-client-js"
}
model Item {
id Int @id @default(autoincrement())
name String
notes String?
}

Step 3: Configure Prisma – ./React-Client/App.tsx

```tsx
import { useState } from "react";

interface Item {
  id: number;
  name: string;
}

function App() {
  const [items, setItems] = useState<Item[]>([]);
  const [name, setName] = useState("");
  const [search, setSearch] = useState("");

  const createItem = () => {
    if (!name.trim()) return;

    const newItem: Item = {
      id: items.length ? items.at(-1)!.id + 1 : 1,
      name,
    };
    setItems([...items, newItem]);
    setName("");
  };

  const searchItems = (q: string) => {
    setSearch(q);
  };

  const filteredItems = items.filter((item) =>
    item.name.toLowerCase().includes(search.toLowerCase())
  );

  return (
    <div style={{ padding: "2rem", fontFamily: "sans-serif" }}>
      <h1>Items</h1>

      <input
        placeholder="New item"
        value={name}
        onChange={(e) => setName(e.target.value)}
      />
      <button onClick={createItem} style={{ marginLeft: "0.5rem" }}>
        Add
      </button>

      <hr style={{ margin: "1rem 0" }} />

      <input
        placeholder="Search"
        value={search}
        onChange={(e) => searchItems(e.target.value)}
      />

      <ul>
        {filteredItems.map((item) => (
          <li key={item.id}>{item.name}</li>
        ))}
      </ul>
    </div>
  );
}

export default App;
```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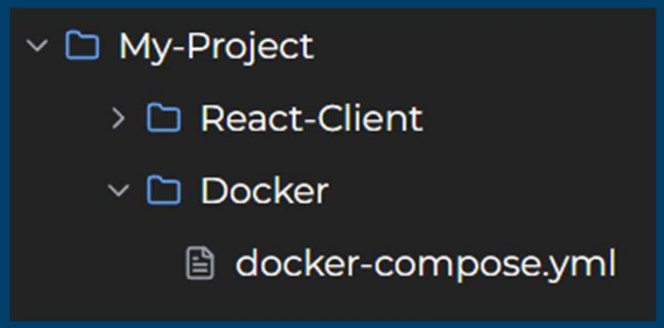
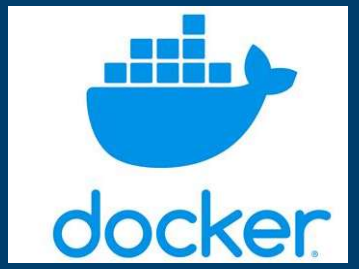
tsconfig.json
datasource db {
provider = "postgresql"
url = env("DATABASE_URL")
}
generator client {
provider = "prisma-client-js"
}
model Item {
id Int @id @default(autoincrement())
name String
notes String?
}
DATABASE_URL="postgresql://app_user:app_password@localhost:5432/app_db?schema=public"

./Docker/docker-compose.yml

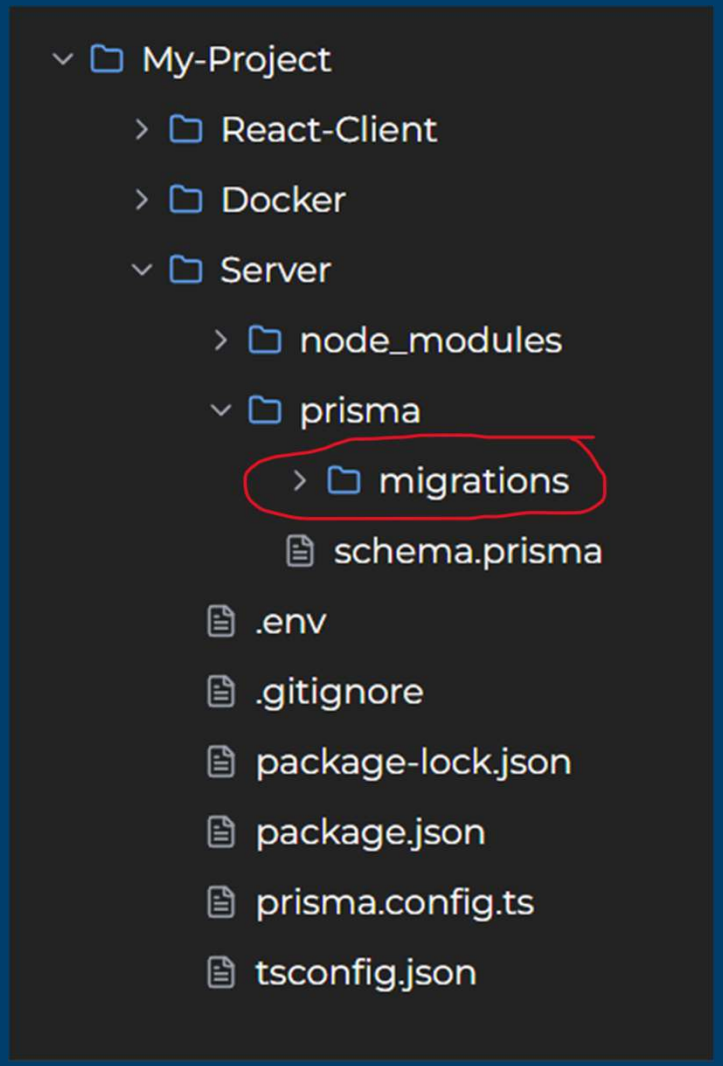



```yaml
version: '3.9'

Run All Services
services:
  Run Service
  db:
    image: postgres:16
    restart: always
    environment:
      POSTGRES_USER: app_user
      POSTGRES_PASSWORD: app_password
      POSTGRES_DB: app_db
    ports:
      - "5432:5432"
    volumes:
      - postgres_data:/var/lib/postgresql/data

volumes:
  postgres_data:
```



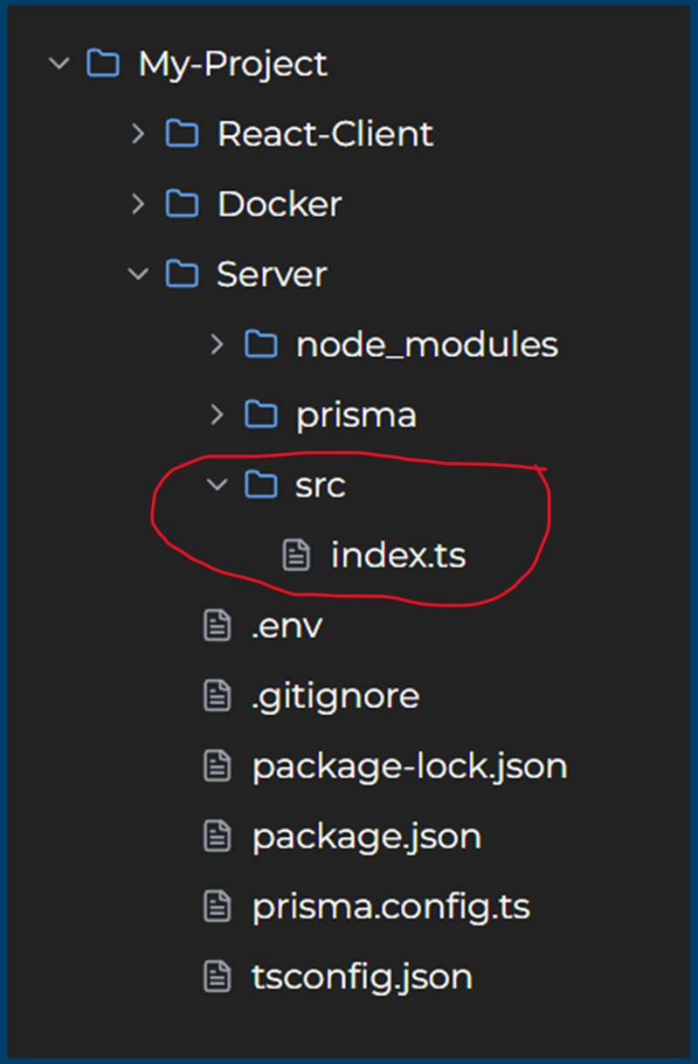
- Migrate schema.prisma

```
npx prisma migrate reset
npx prisma migrate dev --name init
npx prisma generate
```



Creating Express Web API

- Create ‘src/index.ts’



./Server/src/index.ts

```
1   import express from "express";
2   import cors from "cors";
3   import { PrismaClient } from "@prisma/client";
4
5   const prisma = new PrismaClient({
6     log: ["query", "info", "warn", "error"]
7   });
8
9   const app = express();
10
11  app.use(cors());
12  app.use(express.json());
```

./Server/src/index.ts

```
39  async function main() {
40    try {
41      await prisma.$connect();
42      console.log("Connected to database!");
43
44      app.listen(4000, () => {
45        console.log("Server running on http://localhost:4000");
46      });
47    } catch (err) {
48      console.error("❌ Server failed to start:");
49      console.error(err);
50      process.exit(1);
51    }
52  }
53
54  void main();
```

./Server/src/index.ts

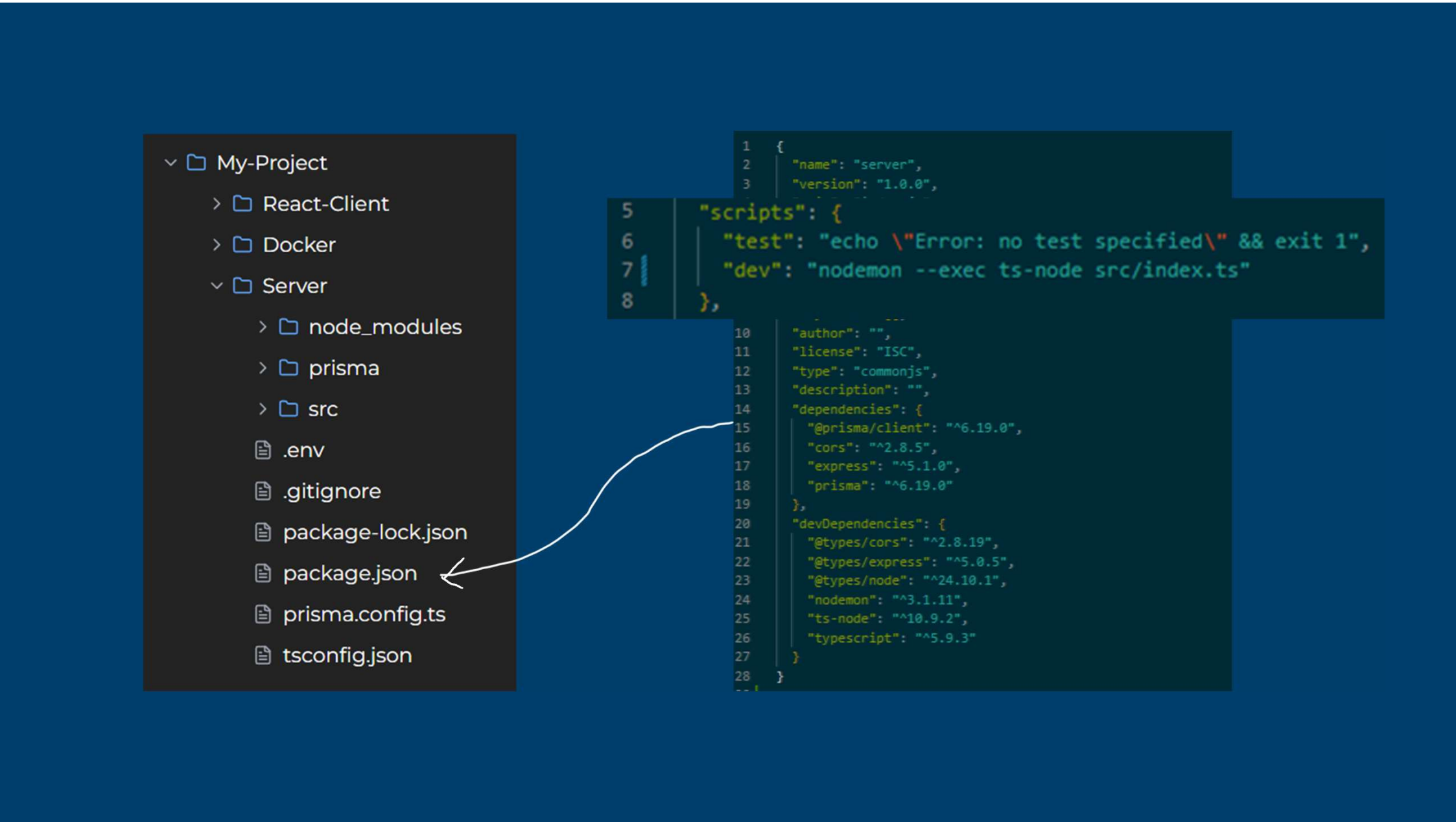
```ts
app.get("/items", async (req, res) => {
  const items = await prisma.item.findMany();
  res.json(items);
});

app.post("/items", async (req, res) => {
  const item = await prisma.item.create({ data: req.body });
  res.json(item);
});

app.get("/search", async (req, res) => {
  const q = typeof req.query.q === "string" ? req.query.q : "";

  const results = await prisma.item.findMany({
    where: {
      name: {
        contains: q,
        mode: "insensitive"
      }
    }
  });

  res.json(results);
});
```

GET
http://localhost:4000/items

POST
http://localhost:4000/items
Body: { “name” : “<ITEM NAME>” }

GET
http://localhost:4000/search
?q=<SEARCH>

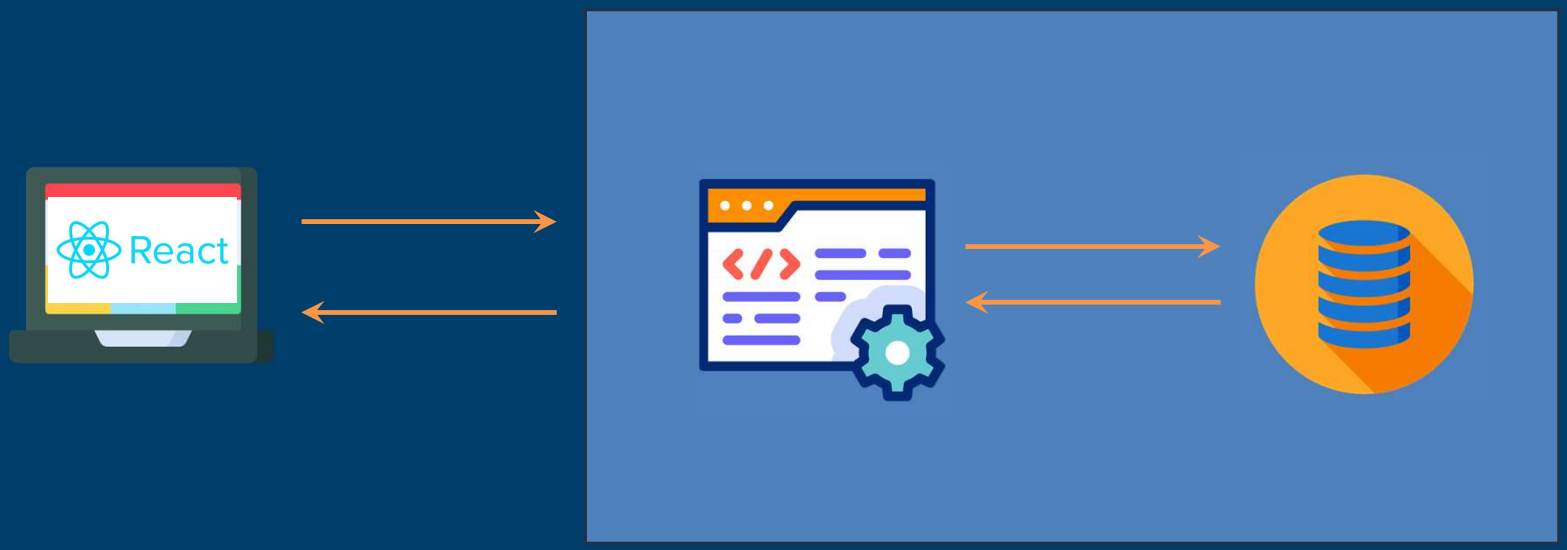
Running the Backend


My-Project
React-Client
Docker
Server
node_modules
prisma
src
.env
.gitignore
package-lock.json
package.json
prisma.config.ts
tsconfig.json
{
"name": "server",
"version": "1.0.0",
"scripts": {
"test": "echo \"Error: no test specified\" && exit 1",
"dev": "nodemon --exec ts-node src/index.ts"
},
"author": "",
"license": "ISC",
"type": "commonjs",
"description": "",
"dependencies": {
"@prisma/client": "^6.19.0",
"cors": "^2.8.5",
"express": "^5.1.0",
"prisma": "^6.19.0"
},
"devDependencies": {
"@types/cors": "^2.8.19",
"@types/express": "^5.0.5",
"@types/node": "^24.10.1",
"nodemon": "^3.1.11",
"ts-node": "^10.9.2",
"typescript": "^5.9.3"
}
}

./Server/

```
PS C:\Users\Callu\Documents\Tutorial\Postgres-Prisma-Tutorial\server> npm run dev

> server@1.0.0 dev
> nodemon --exec ts-node src/index.ts

[nodemon] 3.1.11
[nodemon] to restart at any time, enter `rs`
[nodemon] watching path(s): *.*
[nodemon] watching extensions: ts,json
[nodemon] starting `ts-node src/index.ts`
prisma:info Starting a postgresql pool with 17 connections.
Connected to database!
Server running on http://localhost:4000
```

Connecting to the Backend



./React-Client/src/App.tsx

```tsx
import { useEffect, useState } from "react";

type Item = {
  id: number;
  name: string;
};

function App() {
  const [items, setItems] = useState<Item[]>([]);
  const [name, setName] = useState("");
  const [search, setSearch] = useState("");
```

./React-Client/src/App.tsx

```
12
13  const fetchItems = async (): Promise<void> => {
14    const res = await fetch("http://localhost:4000/items");
15    const data: Item[] = await res.json();
16    setItems(data);
17  };
18
```

GET
http://localhost:4000/items

./Server/src/index.ts

```
app.get("/items", async (req, res) => {
  const items = await prisma.item.findMany();
  res.json(items);
});
```

./React-Client/src/App.tsx

```
19  const createItem = async (): Promise<void> => {
20    await fetch("http://localhost:4000/items", {
21      method: "POST",
22      headers: { "Content-Type": "application/json" },
23      body: JSON.stringify({ name })
24    });
25    setName("");
26    fetchItems();
27  };
```

POST
http://localhost:4000/items
Body: { “name” : “<ITEM NAME>” }

Calls ./Server/src/index.ts

```
app.post("/items", async (req, res) => {
  const item = await prisma.item.create({ data: req.body });
  res.json(item);
});
```

./React-Client/src/App.tsx

```tsx
  const searchItems = async (q: string): Promise<void> => {
    setSearch(q);
    const res = await fetch("http://localhost:4000/search?q=" + q);
    const data: Item[] = await res.json();
    setItems(data);
  };
```

GET
http://localhost:4000/search
?q=<SEARCH>

Calls ./Server/src/index.ts

```ts
app.get("/search", async (req, res) => {
  const q = typeof req.query.q === "string" ? req.query.q : "";

  const results = await prisma.item.findMany({
    where: {
      name: {
        contains: q,
        mode: "insensitive"
      }
    }
  });

  res.json(results);
});
```

./React-Client/src/App.tsx

```tsx
  return (
    <div style={{ padding: "2rem", fontFamily: "sans-serif" }}>
      <h1>Items</h1>

      <input
        placeholder="New item"
        value={name}
        onChange={e => setName(e.target.value)}
      />
      <button onClick={createItem} style={{ marginLeft: "0.5rem" }}>
        Add
      </button>

      <hr style={{ margin: "1rem 0" }} />

      <input
        placeholder="Search"
        value={search}
        onChange={e => searchItems(e.target.value)}
      />

      <ul>
        {items.map((item: any) => (
          <li key={item.id}>{item.name}</li>
        ))}
      </ul>
    </div>
  );
}

export default App;
```

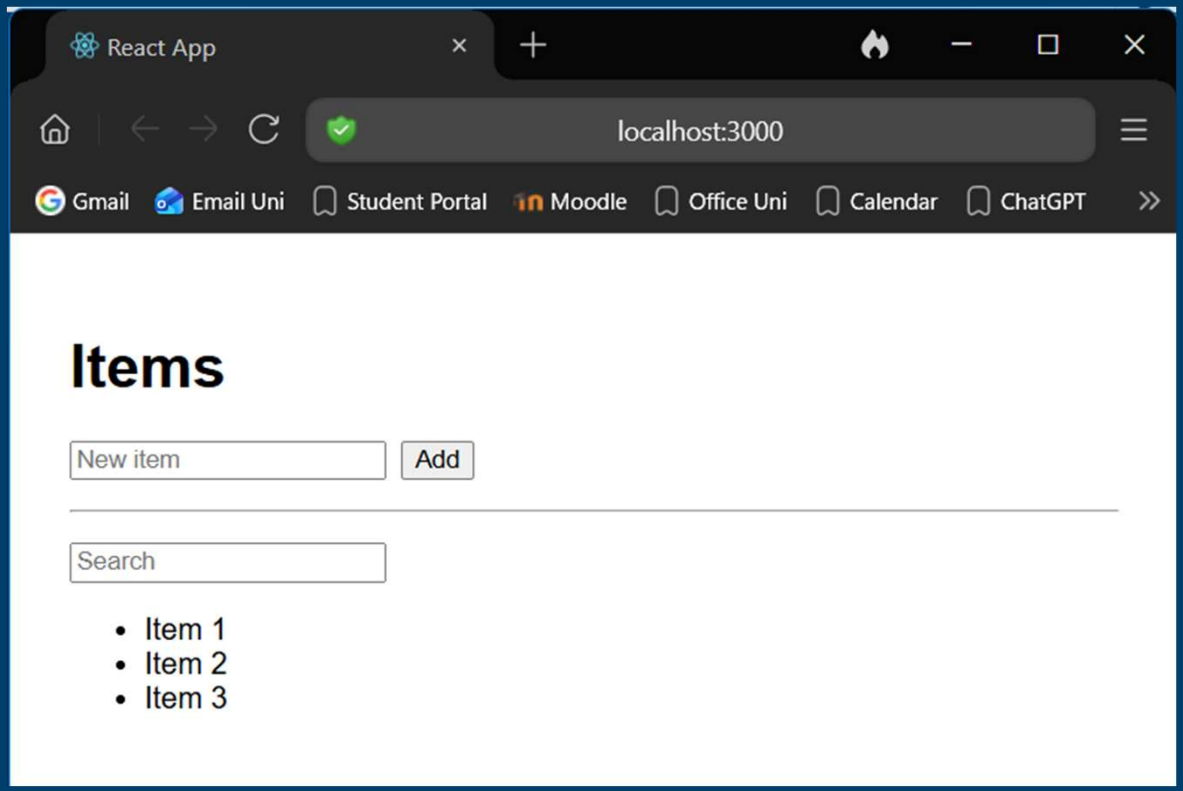
Finished!!

- ./Server/

```
npm run dev
```

- ./React-Client/

```
npm start
```



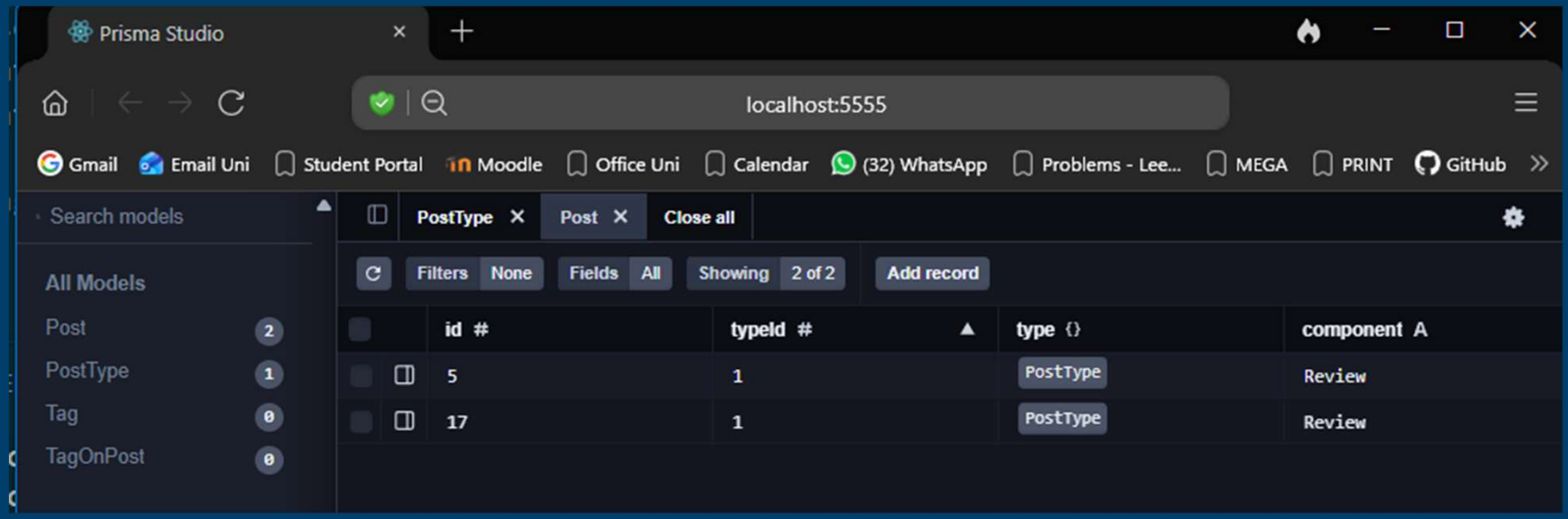
Advanced Tips

Security Considerations

- The demo is not suitable for prod
- Use cors to restrict request origin
- Authenticate users
- Validate Inputs
- Use HTTPS in production

Prisma Studio

```
\Postgres-Prisma-Tutorial\server> npx prisma studio
```



Scaling Databases

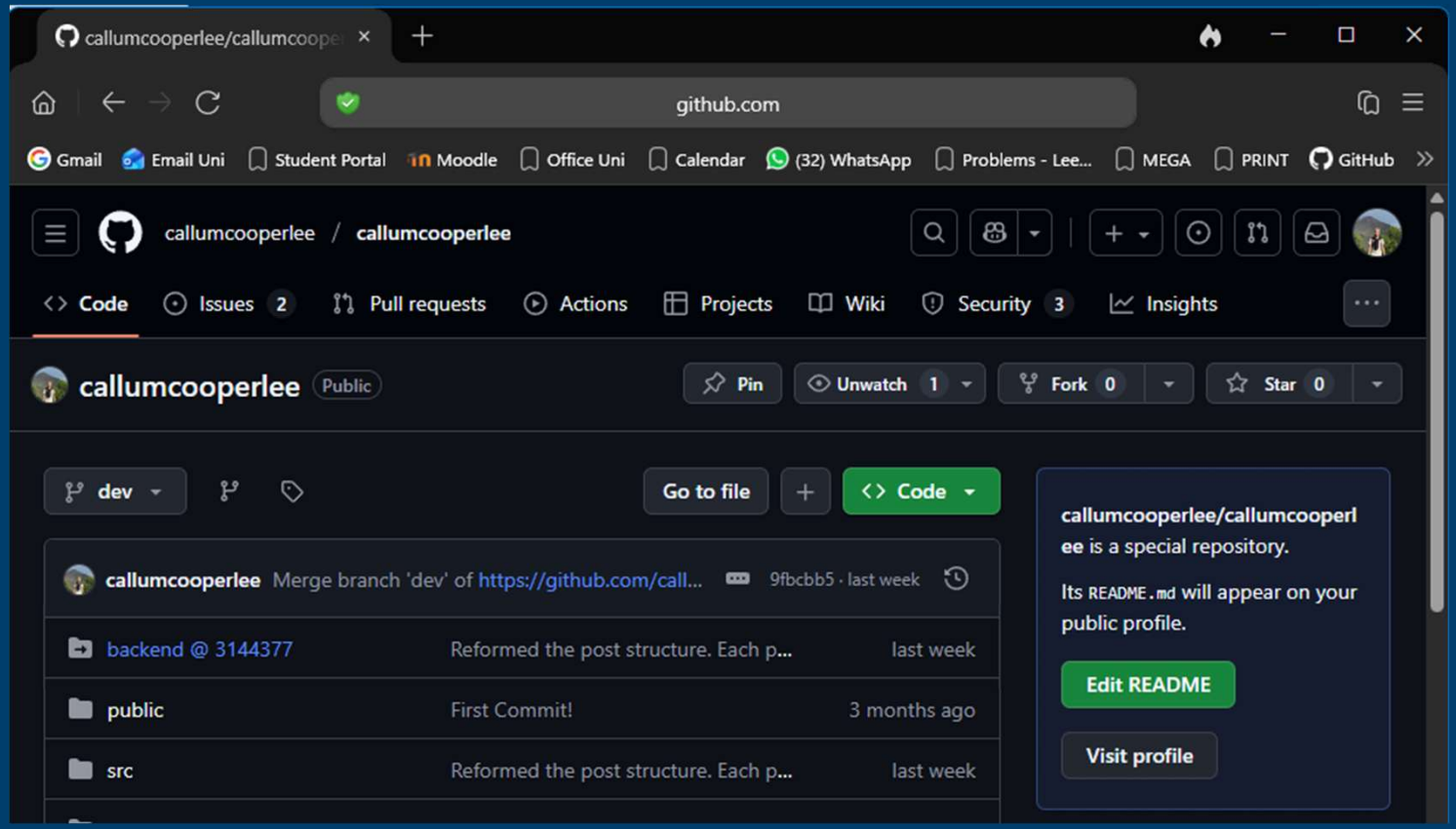
```
datasource db {
  provider = "postgresql"
  url      = env("DATABASE_URL")
}

generator client {
  provider = "prisma-client-js"
}

model PostType {
  id        Int      @id @default(autoincrement())
  name      String   @unique
  metadata  Json
  template  String
  createdAt DateTime @default(now())
  updatedAt DateTime @updatedAt

  posts     Post[]
}

model Post {
  id        Int      @id @default(autoincrement())
  typeId    Int
  type      PostType @relation(fields: [typeId], references: [id])
  component String
  metadata  Json
  createdAt DateTime @default(now())
  updatedAt DateTime @updatedAt

  tags      TagOnPost[]
}

model Tag {
  id        Int        @id @default(autoincrement())
  name      String     @unique
  posts     TagOnPost[]
}

model TagOnPost {
  postId Int
  tagId  Int

  post   Post @relation(fields: [postId], references: [id])
  tag    Tag  @relation(fields: [tagId], references: [id])

  @@id([postId, tagId])
}
```

Remember to migrate using ‘npx prisma migrate’ every time shema.prisma is updated

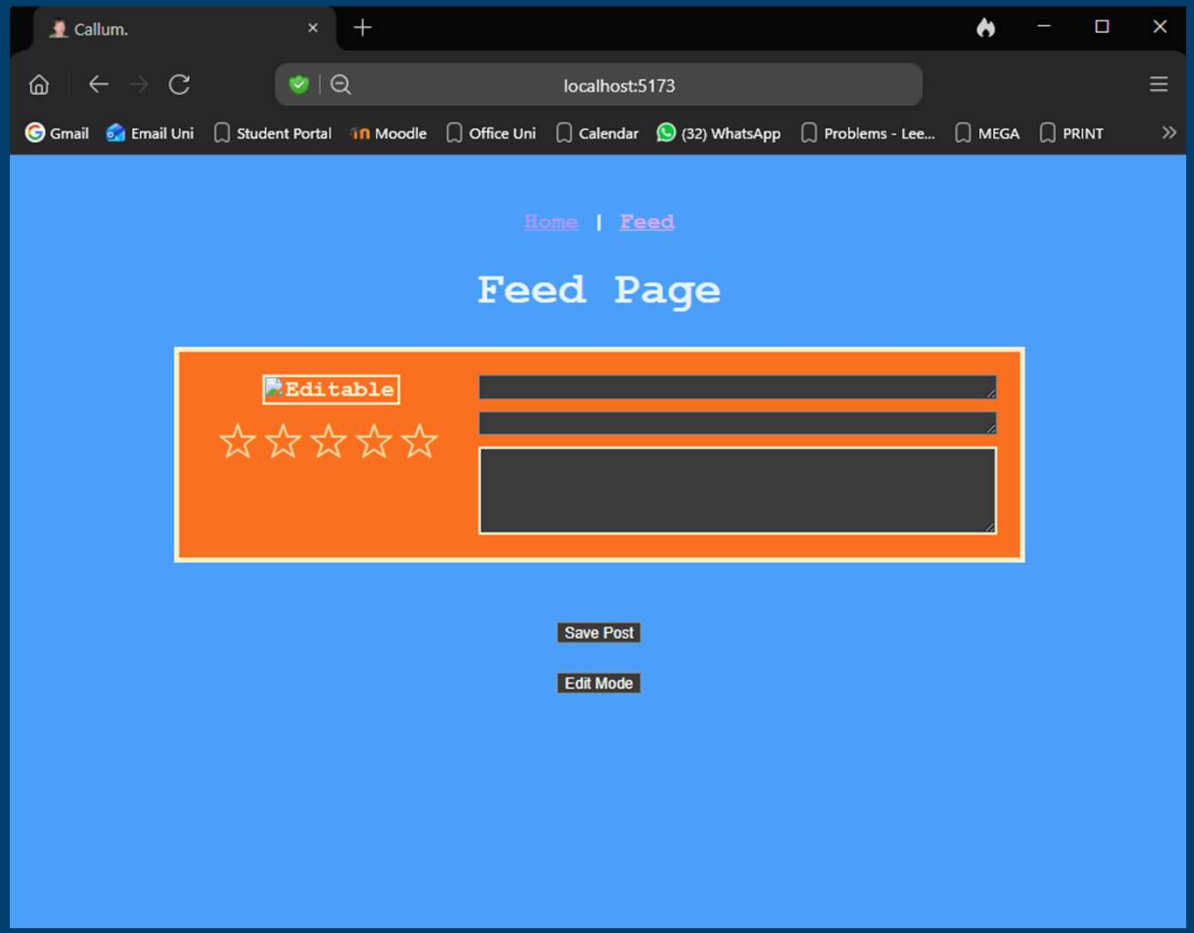
File Upload

```
45  router.post("/", upload.single("thumbnail"), async (req: Request, res: Response) => {
46    try {
47      const { typeId, metadata, component, tagIds } = req.body;
48      const parsedMetadata = metadata ? JSON.parse(metadata) : {};
49
50      if (req.file) {
51        parsedMetadata.thumbnail = `/uploads/${req.file.filename}`;
52      } else {
53        parsedMetadata.thumbnail = parsedMetadata.thumbnail || "/uploads/default.png";
54      }
55
56      const post = await prisma.post.create({
57        data: {
58          component,
59          metadata: parsedMetadata,
60          type: { connect: { id: Number(typeId) } },
61          tags: tagIds
62            ? { create: JSON.parse(tagIds).map((id: number) => ({ tagId: id })) }
63            : undefined,
64        },
65      });
66
67      res.status(201).json(post);
68    } catch (err) {
69      console.error(err);
70      res.status(500).json({ error: "Failed to create post" });
71    }
```

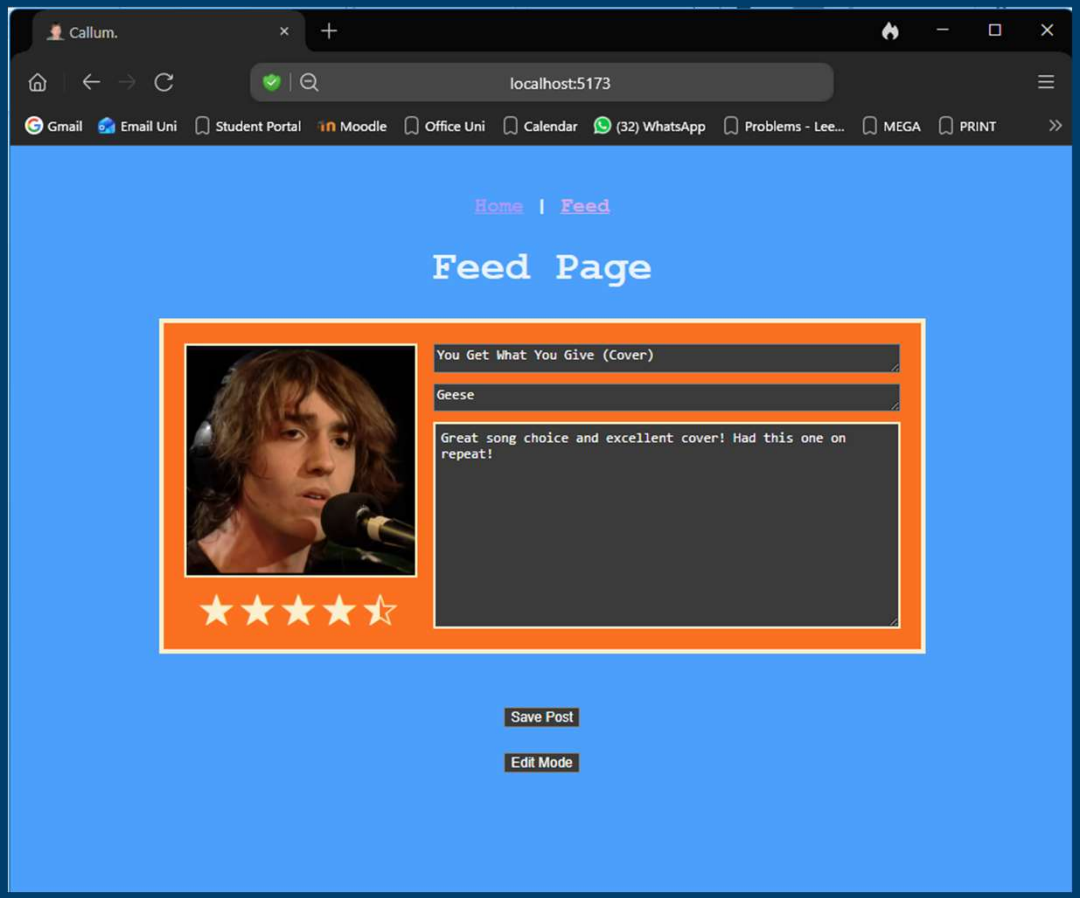
File Upload


callumcooperlee/callumcooper
github.com
Gmail
Email Uni
Student Portal
Moodle
Office Uni
Calendar
(32) WhatsApp
Problems - Lee...
MEGA
PRINT
GitHub
callumcooperlee / callumcooperlee
Code
Issues 2
Pull requests
Actions
Projects
Wiki
Security 3
Insights
callumcooperlee Public
Pin
Unwatch 1
Fork 0
Star 0
dev
Go to file
Code
callumcooperlee Merge branch 'dev' of https://github.com/call... 9fbcbb5 · last week
backend @ 3144377 Reformed the post structure. Each p... last week
public First Commit! 3 months ago
src Reformed the post structure. Each p... last week
callumcooperlee/callumcooperlee is a special repository.
Its README.md will appear on your public profile.
Edit README
Visit profile

My website!


Callum.
localhost:5173
Gmail
Email Uni
Student Portal
Moodle
Office Uni
Calendar
(32) WhatsApp
Problems - Lee...
MEGA
PRINT
Home | Feed
Feed Page
Editable
Save Post
Edit Mode

My website!


Callum.
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MEGA
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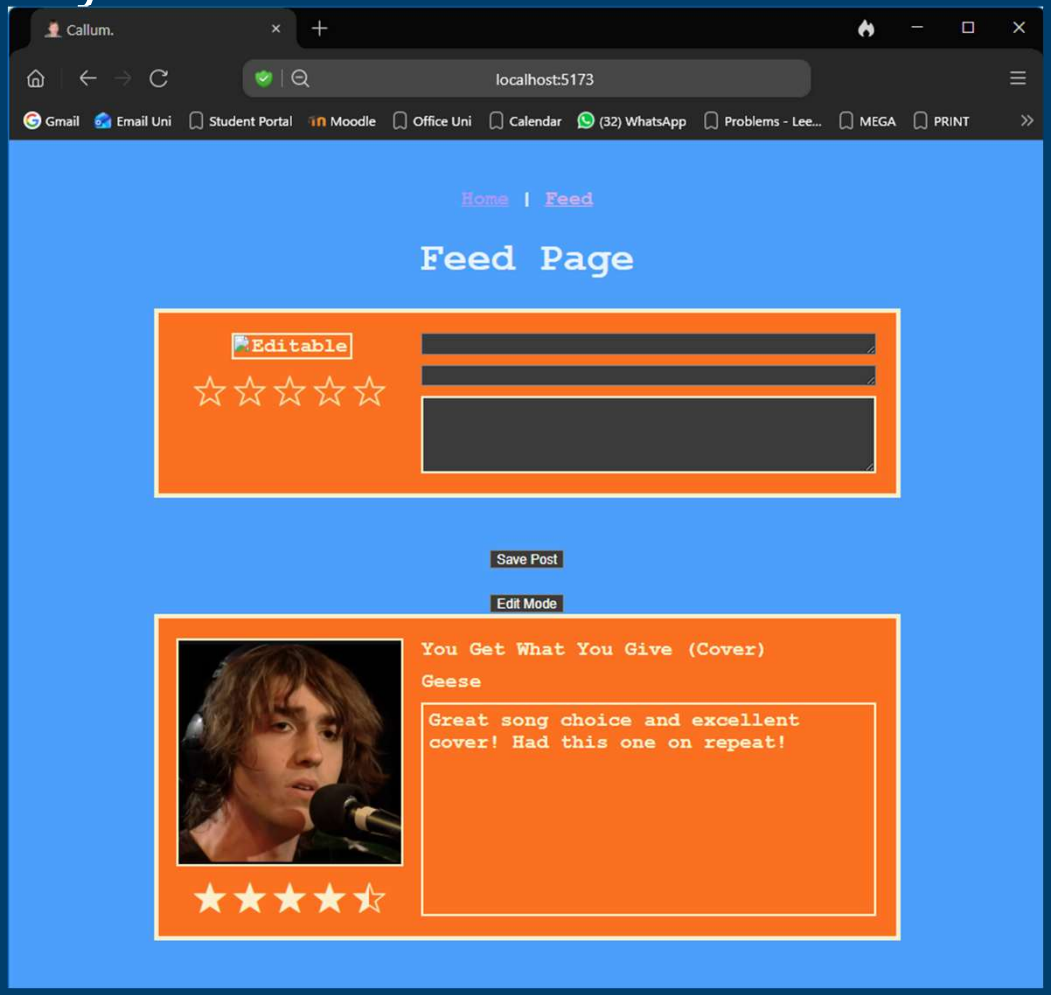
Home | Feed
Feed Page
You Get What You Give (Cover)
Geese
Great song choice and excellent cover! Had this one on repeat!
Save Post
Edit Mode

My website!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MEGA
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Edit Mode
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Looking to the future..

- Easy to implement security considerations
- More complex table relationships
- Powerful and scalable queries
- Easy to move to a host device

Thanks For Listening! Any Questions?

Sources:

- https://create-react-app.dev/docs/adding-typescript/
- https://www.docker.com/products/docker-desktop/
- https://www.postgresql.org/about/
- https://en.wikipedia.org/wiki/ACID
- https://www.prisma.io/
- https://nodejs.org/en
- https://expressjs.com/
- https://expressjs.com/en/resources/middleware/cors.html
- https://medium.com/@byte.talking/multi-form-data-uploads-with-react-js-express-and-multer-b19adb3c1de2

Tutorial:

- https://github.com/callumcooperlee/Postgres-Prisma-Tutorial