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# Mastering React Server Components and Server Actions in React 19

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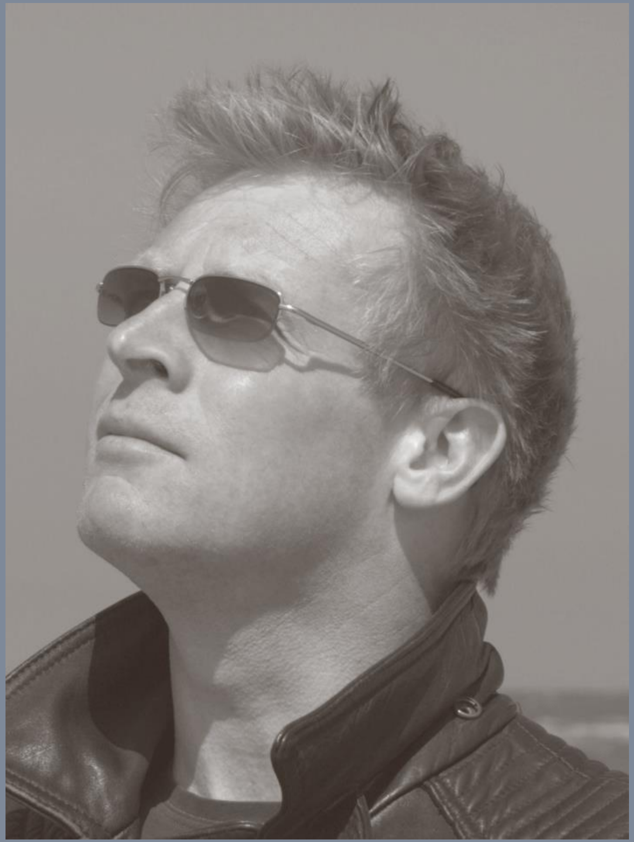
@mauricedb



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## Topics

- What are **React Server Components** and why would you care?
- Using **Next.js** and the **App Router**
- Turning a React **Client Component into** a React **Server Component**
- **Updates and caching** with React Server Components
- **Querying the database** from a React Server Component
- **Suspense** & React Server Components
- React Server Components and **streaming**
- **Which components** are really React Server Components?
- Using **React Server Actions**

## Type it out by hand?

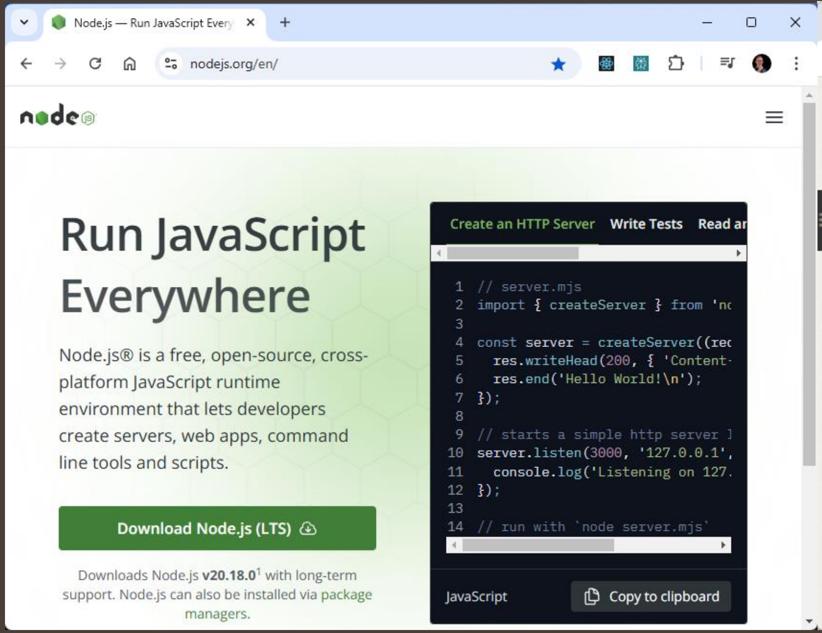
*“Typing it drills it into your brain much better than simply copying and pasting it. You're forming new neuron pathways. Those pathways are going to help you in the future. Help them out now!”*

## Prerequisites

Install Node & NPM

Install the GitHub repository

## Install Node.js & NPM



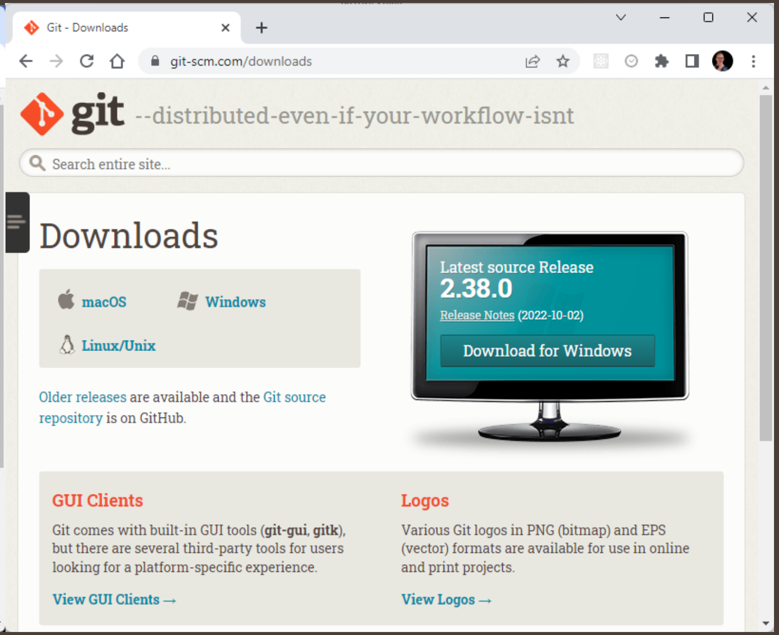
Run JavaScript Everywhere

Node.js® is a free, open-source, cross-platform JavaScript runtime environment that lets developers create servers, web apps, command line tools and scripts.

Download Node.js (LTS)

Downloads Node.js **v20.18.0**[1] with long-term support. Node.js can also be installed via package managers.

```
// server.mjs
import { createServer } from 'nc

const server = createServer((rec
  res.writeHead(200, { 'Content-
  res.end('Hello World!\n');
});

// starts a simple http server l
server.listen(3000, '127.0.0.1',
  console.log('Listening on 127.
});

// run with `node server.mjs`
```



Downloads

Older releases are available and the Git source repository is on GitHub.

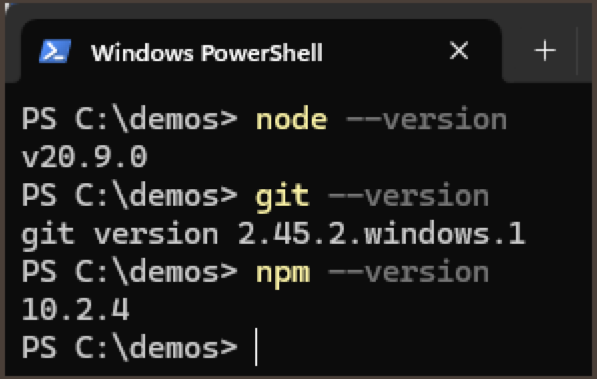
Latest source Release
2.38.0
Release Notes (2022-10-02)

**GUI Clients**

Git comes with built-in GUI tools (**git-gui**, **gitk**), but there are several third-party tools for users looking for a platform-specific experience.

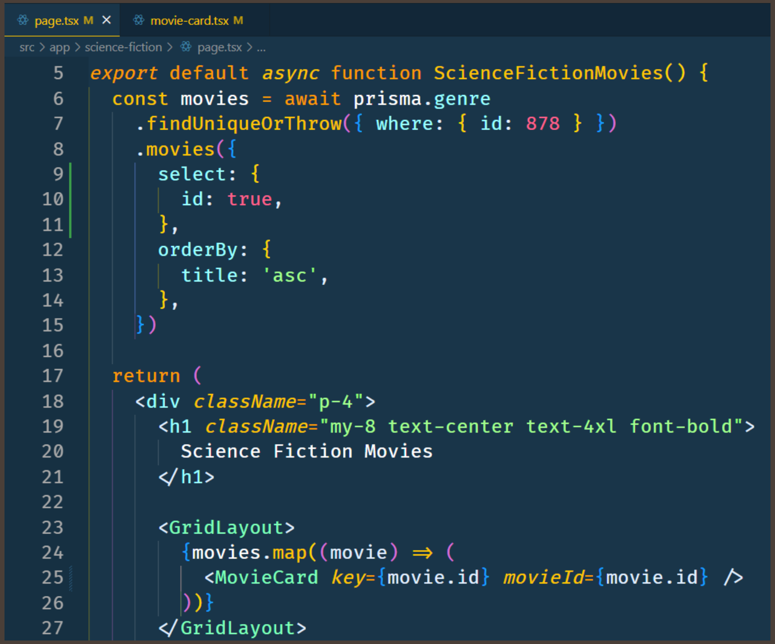
**Logos**

Various Git logos in PNG (bitmap) and EPS (vector) formats are available for use in online and print projects.



```
PS C:\demos> node --version
v20.9.0
PS C:\demos> git --version
git version 2.45.2.windows.1
PS C:\demos> npm --version
10.2.4
PS C:\demos>
```

# Following Along

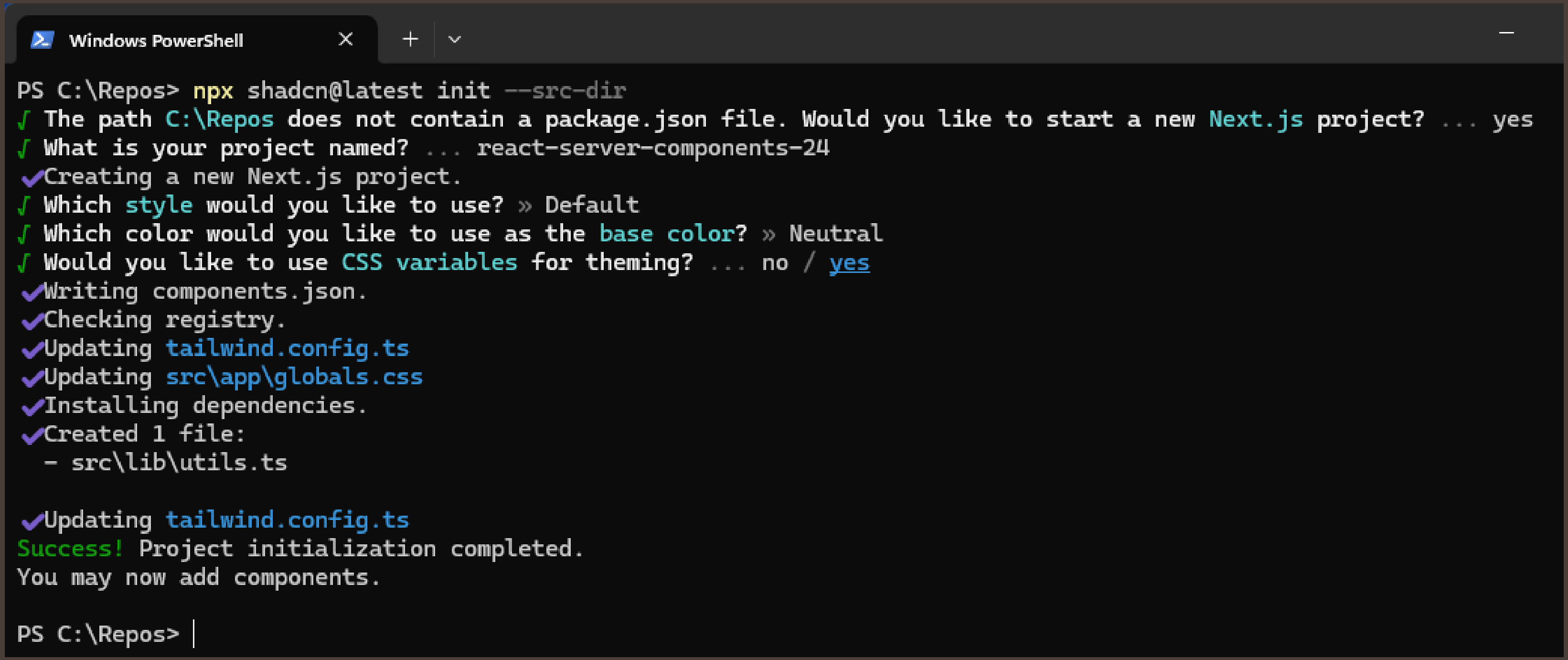


```tsx
export default async function ScienceFictionMovies() {
  const movies = await prisma.genre
    .findUniqueOrThrow({ where: { id: 878 } })
    .movies({
      select: {
        id: true,
      },
      orderBy: {
        title: 'asc',
      },
    })

  return (
    <div className="p-4">
      <h1 className="my-8 text-center text-4xl font-bold">
        Science Fiction Movies
      </h1>

      <GridLayout>
        {movies.map((movie) => (
          <MovieCard key={movie.id} movieId={movie.id} />
        ))}
      </GridLayout>
```

- Repo: [https://github.com/mauricedb/react-server-components-24](https://github.com/mauricedb/react-server-components-24)
- Slides: [https://www.theproblemsolver.dev/docs/react-advanced-2024.pdf](https://www.theproblemsolver.dev/docs/react-advanced-2024.pdf)

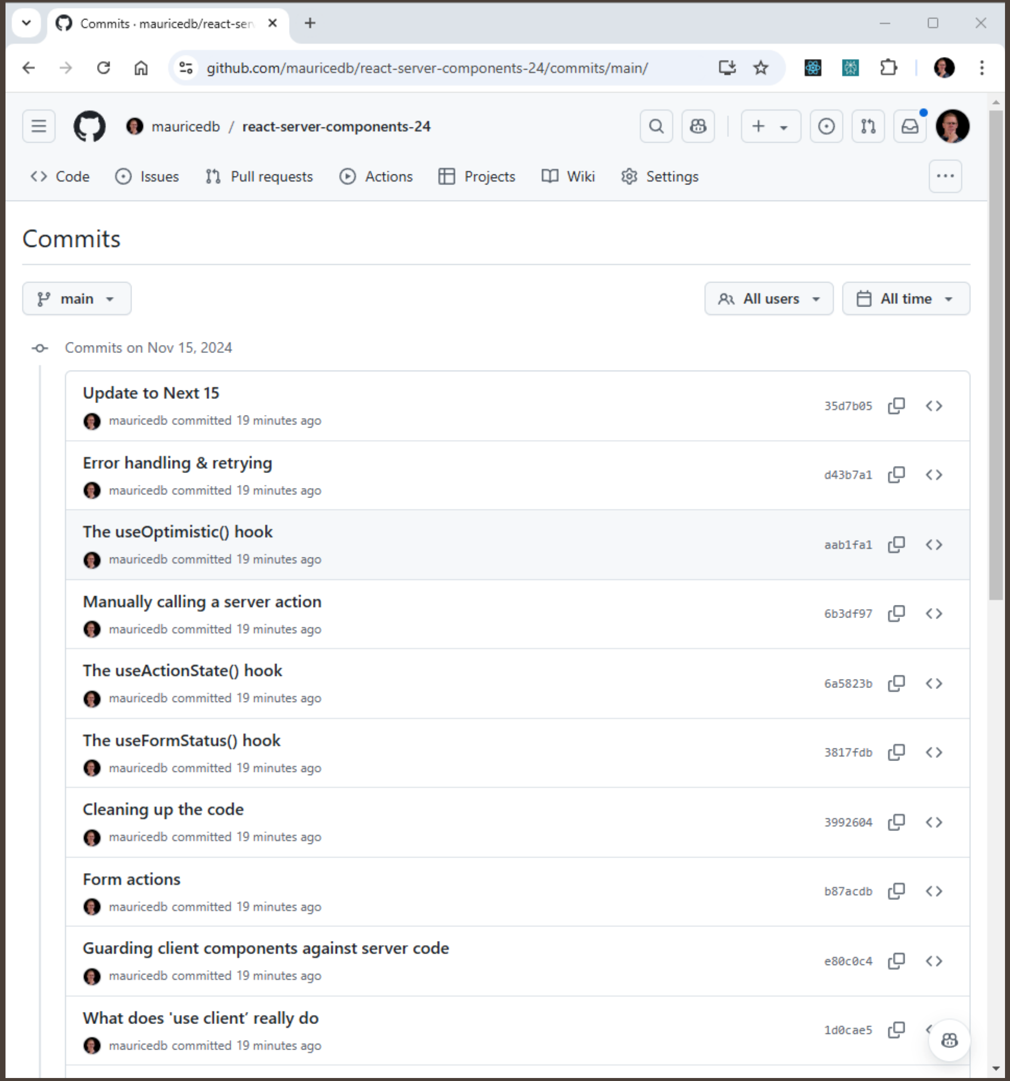
# Create a new Next.js app with shadcn/ui

- npx shadcn@latest init --src-dir



```
PS C:\Repos> npx shadcn@latest init --src-dir
√ The path C:\Repos does not contain a package.json file. Would you like to start a new Next.js project? ... yes
√ What is your project named? ... react-server-components-24
✔Creating a new Next.js project.
√ Which style would you like to use? » Default
√ Which color would you like to use as the base color? » Neutral
√ Would you like to use CSS variables for theming? ... no / yes
✔Writing components.json.
✔Checking registry.
✔Updating tailwind.config.ts
✔Updating src\app\globals.css
✔Installing dependencies.
✔Created 1 file:
  - src\lib\utils.ts

✔Updating tailwind.config.ts
Success! Project initialization completed.
You may now add components.

PS C:\Repos>
```

# The changes


Commits · mauricedb/react-ser
github.com/mauricedb/react-server-components-24/commits/main/
mauricedb / react-server-components-24
Code
Issues
Pull requests
Actions
Projects
Wiki
Settings
main
All users
All time

Commits

Commits on Nov 15, 2024

Update to Next 15
mauricedb committed 19 minutes ago
35d7b05

Error handling & retrying
mauricedb committed 19 minutes ago
d43b7a1

The useOptimistic() hook
mauricedb committed 19 minutes ago
aab1fa1

Manually calling a server action
mauricedb committed 19 minutes ago
6b3df97

The useActionState() hook
mauricedb committed 19 minutes ago
6a5823b

The useFormStatus() hook
mauricedb committed 19 minutes ago
3817fdb

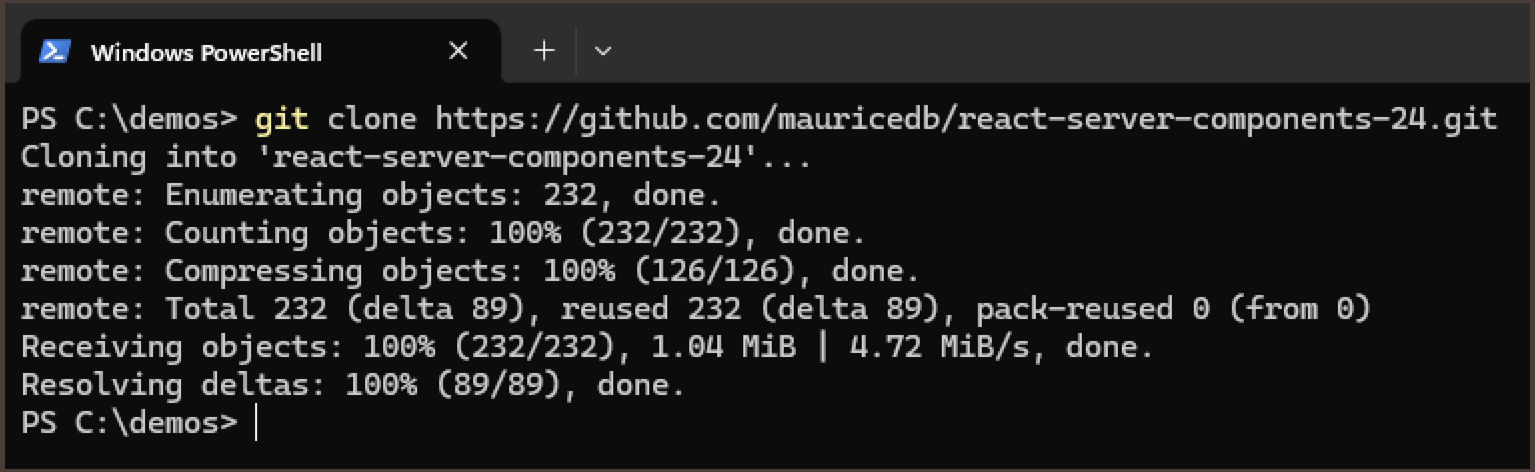
Cleaning up the code
mauricedb committed 19 minutes ago
3992604

Form actions
mauricedb committed 19 minutes ago
b87acdb

Guarding client components against server code
mauricedb committed 19 minutes ago
e80c0c4

What does 'use client' really do
mauricedb committed 19 minutes ago
1d0cae5

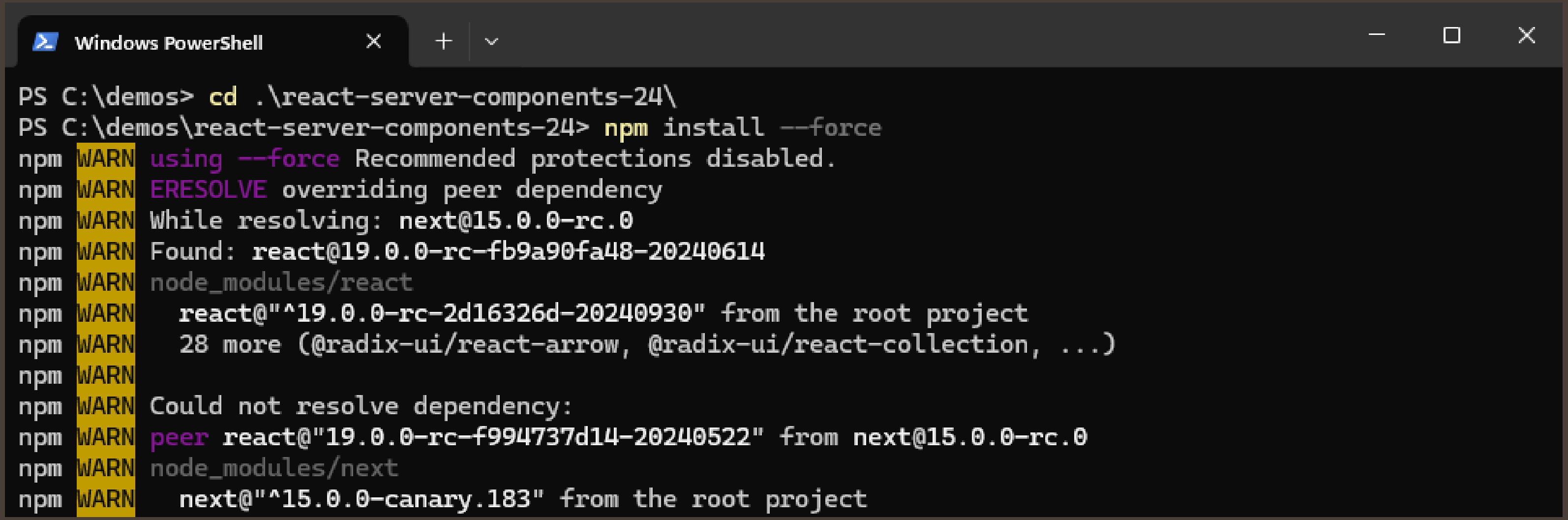
## Clone the GitHub Repository



```
PS C:\demos> git clone https://github.com/mauricedb/react-server-components-24.git
Cloning into 'react-server-components-24'...
remote: Enumerating objects: 232, done.
remote: Counting objects: 100% (232/232), done.
remote: Compressing objects: 100% (126/126), done.
remote: Total 232 (delta 89), reused 232 (delta 89), pack-reused 0 (from 0)
Receiving objects: 100% (232/232), 1.04 MiB | 4.72 MiB/s, done.
Resolving deltas: 100% (89/89), done.
PS C:\demos>
```

## Install NPM Packages

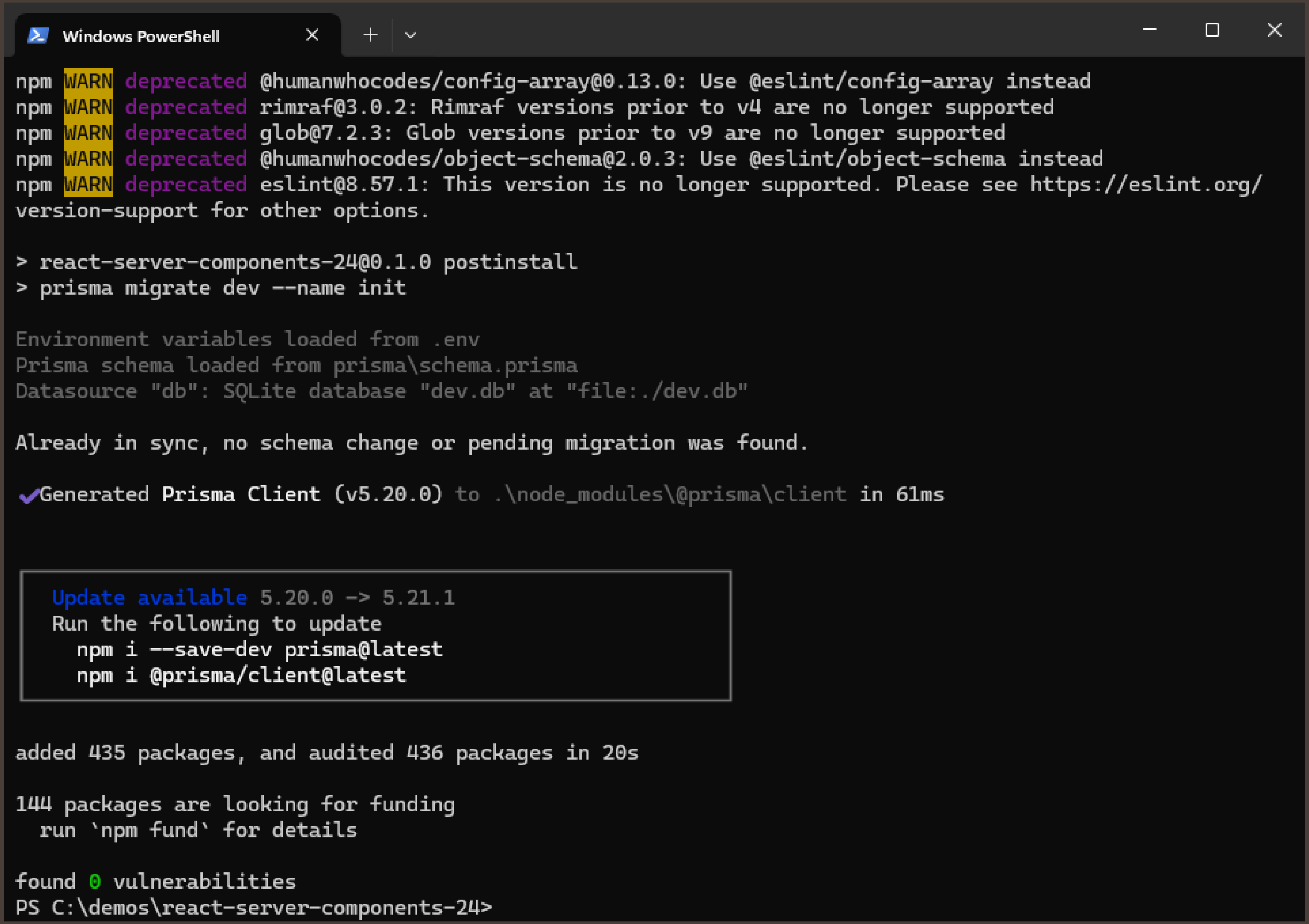
- ☞ Use: npm install –force ☜



Windows PowerShell

```
PS C:\demos> cd .\react-server-components-24\
PS C:\demos\react-server-components-24> npm install --force
npm WARN using --force Recommended protections disabled.
npm WARN ERESOLVE overriding peer dependency
npm WARN While resolving: next@15.0.0-rc.0
npm WARN Found: react@19.0.0-rc-fb9a90fa48-20240614
npm WARN node_modules/react
npm WARN   react@"^19.0.0-rc-2d16326d-20240930" from the root project
npm WARN   28 more (@radix-ui/react-arrow, @radix-ui/react-collection, ...)
npm WARN
npm WARN Could not resolve dependency:
npm WARN peer react@"19.0.0-rc-f994737d14-20240522" from next@15.0.0-rc.0
npm WARN node_modules/next
npm WARN   next@"^15.0.0-canary.183" from the root project
```

## Install NPM Packages



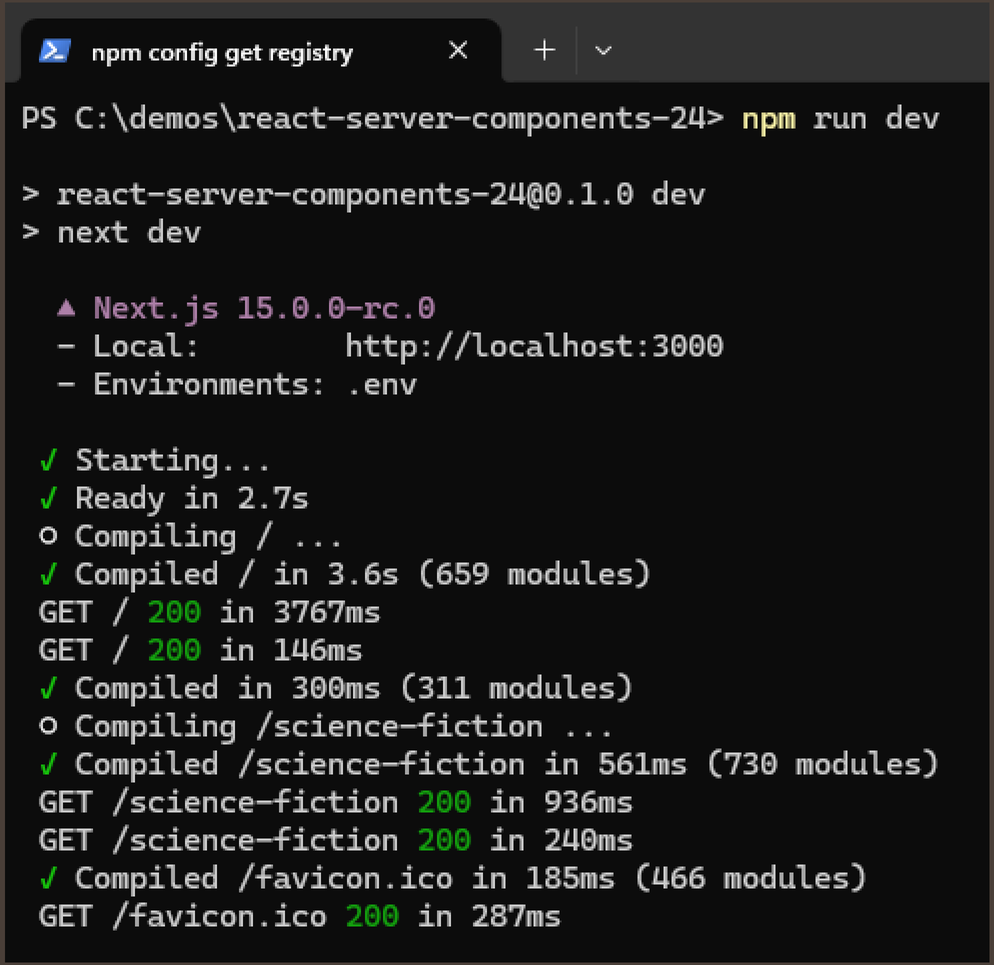
Windows PowerShell

```
npm WARN deprecated @humanwhocodes/config-array@0.13.0: Use @eslint/config-array instead
npm WARN deprecated rimraf@3.0.2: Rimraf versions prior to v4 are no longer supported
npm WARN deprecated glob@7.2.3: Glob versions prior to v9 are no longer supported
npm WARN deprecated @humanwhocodes/object-schema@2.0.3: Use @eslint/object-schema instead
npm WARN deprecated eslint@8.57.1: This version is no longer supported. Please see https://eslint.org/
version-support for other options.

> react-server-components-24@0.1.0 postinstall
> prisma migrate dev --name init

Environment variables loaded from .env
Prisma schema loaded from prisma\schema.prisma
Datasource "db": SQLite database "dev.db" at "file:./dev.db"

Already in sync, no schema change or pending migration was found.

✔Generated Prisma Client (v5.20.0) to .\node_modules\@prisma\client in 61ms


┌─────────────────────────────────────────────────────────┐
│  Update available 5.20.0 -> 5.21.1                      │
│  Run the following to update                            │
│    npm i --save-dev prisma@latest                       │
│    npm i @prisma/client@latest                          │
└─────────────────────────────────────────────────────────┘

added 435 packages, and audited 436 packages in 20s

144 packages are looking for funding
  run `npm fund` for details

found 0 vulnerabilities
PS C:\demos\react-server-components-24>
```

## Start branch

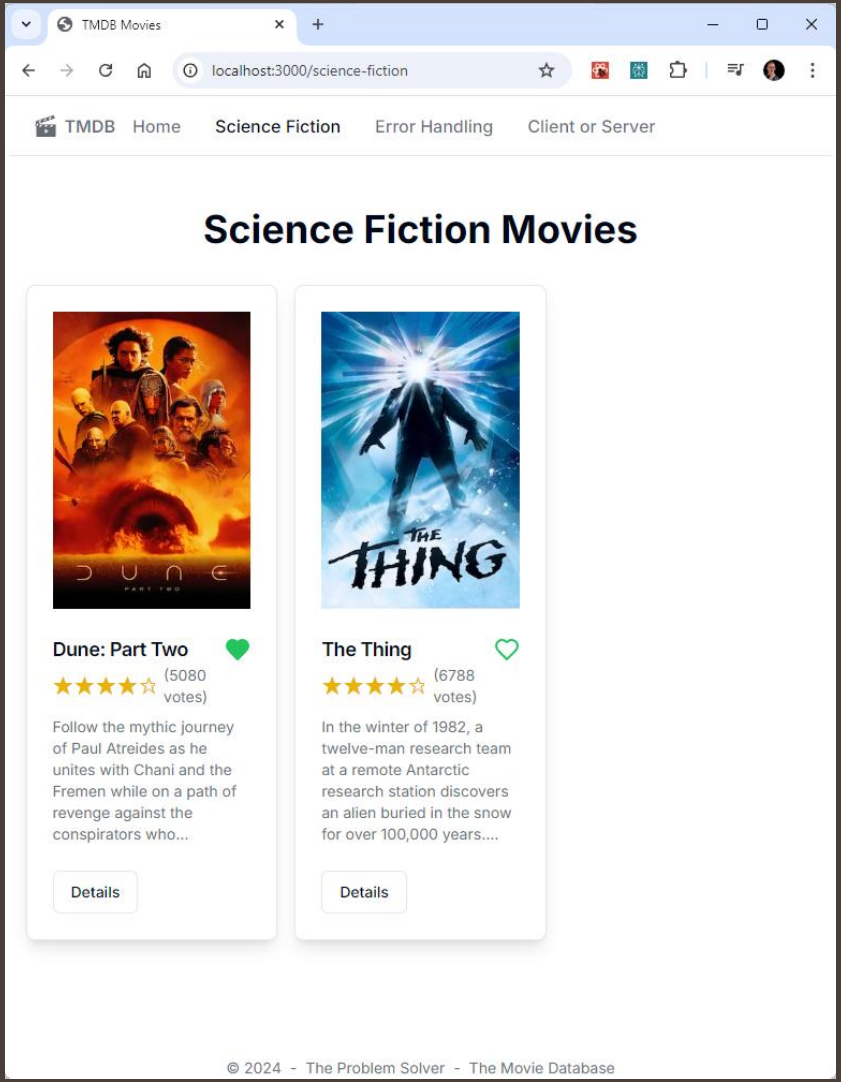
- Start with the **00-start** branch
    - `git checkout --track origin/00-start`

## Start the application



```
PS C:\demos\react-server-components-24> npm run dev

> react-server-components-24@0.1.0 dev
> next dev

  ▲ Next.js 15.0.0-rc.0
  - Local:        http://localhost:3000
  - Environments: .env

 ✓ Starting...
 ✓ Ready in 2.7s
 ○ Compiling / ...
 ✓ Compiled / in 3.6s (659 modules)
 GET / 200 in 3767ms
 GET / 200 in 146ms
 ✓ Compiled in 300ms (311 modules)
 ○ Compiling /science-fiction ...
 ✓ Compiled /science-fiction in 561ms (730 modules)
 GET /science-fiction 200 in 936ms
 GET /science-fiction 200 in 240ms
 ✓ Compiled /favicon.ico in 185ms (466 modules)
 GET /favicon.ico 200 in 287ms
```

## The application



Science Fiction Movies

Dune: Part Two
★★★★☆ (5080 votes)
Follow the mythic journey of Paul Atreides as he unites with Chani and the Fremen while on a path of revenge against the conspirators who...
Details

The Thing
★★★★☆ (6788 votes)
In the winter of 1982, a twelve-man research team at a remote Antarctic research station discovers an alien buried in the snow for over 100,000 years....
Details

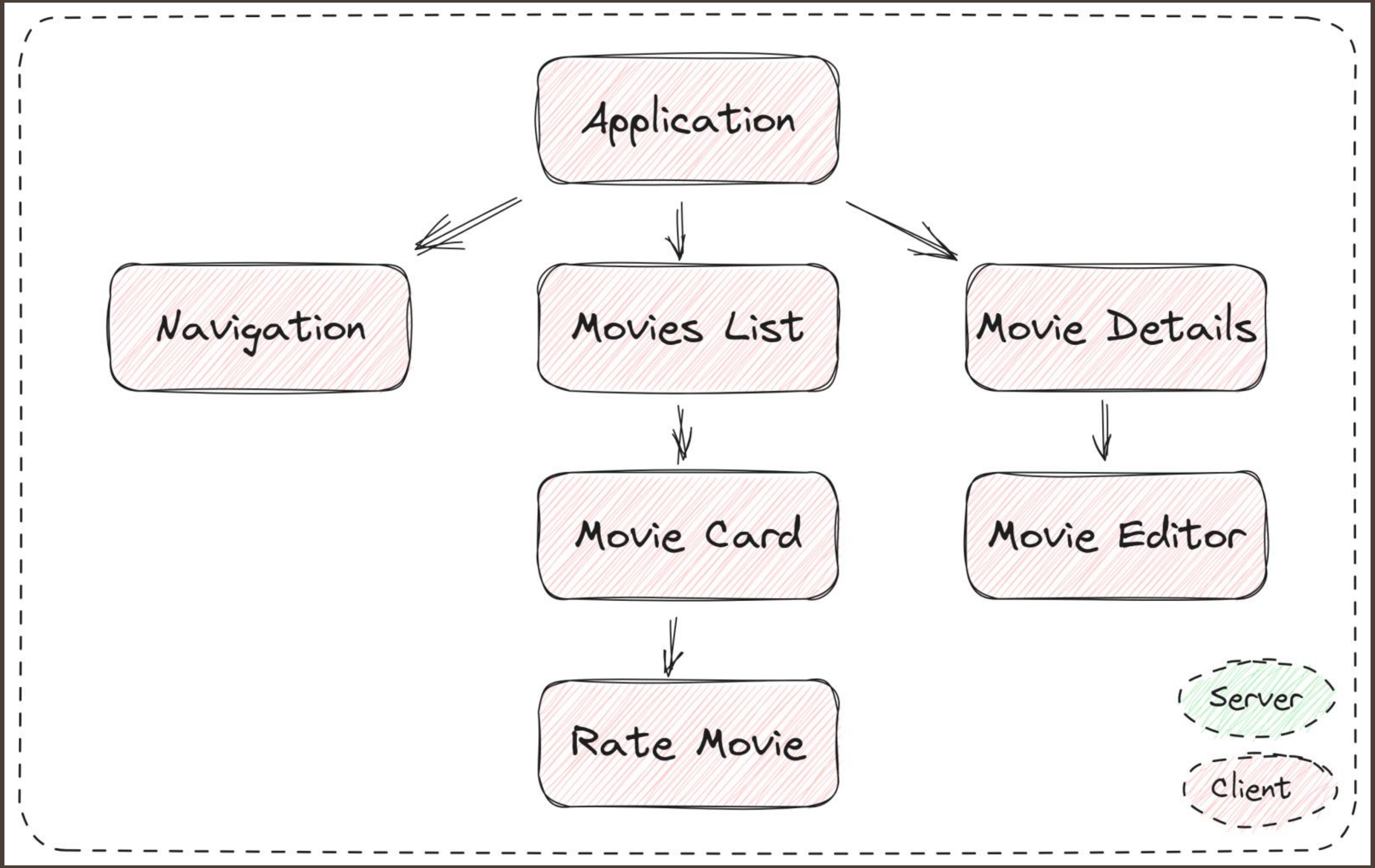
© 2024 - The Problem Solver - The Movie Database

## What are React Server Components?

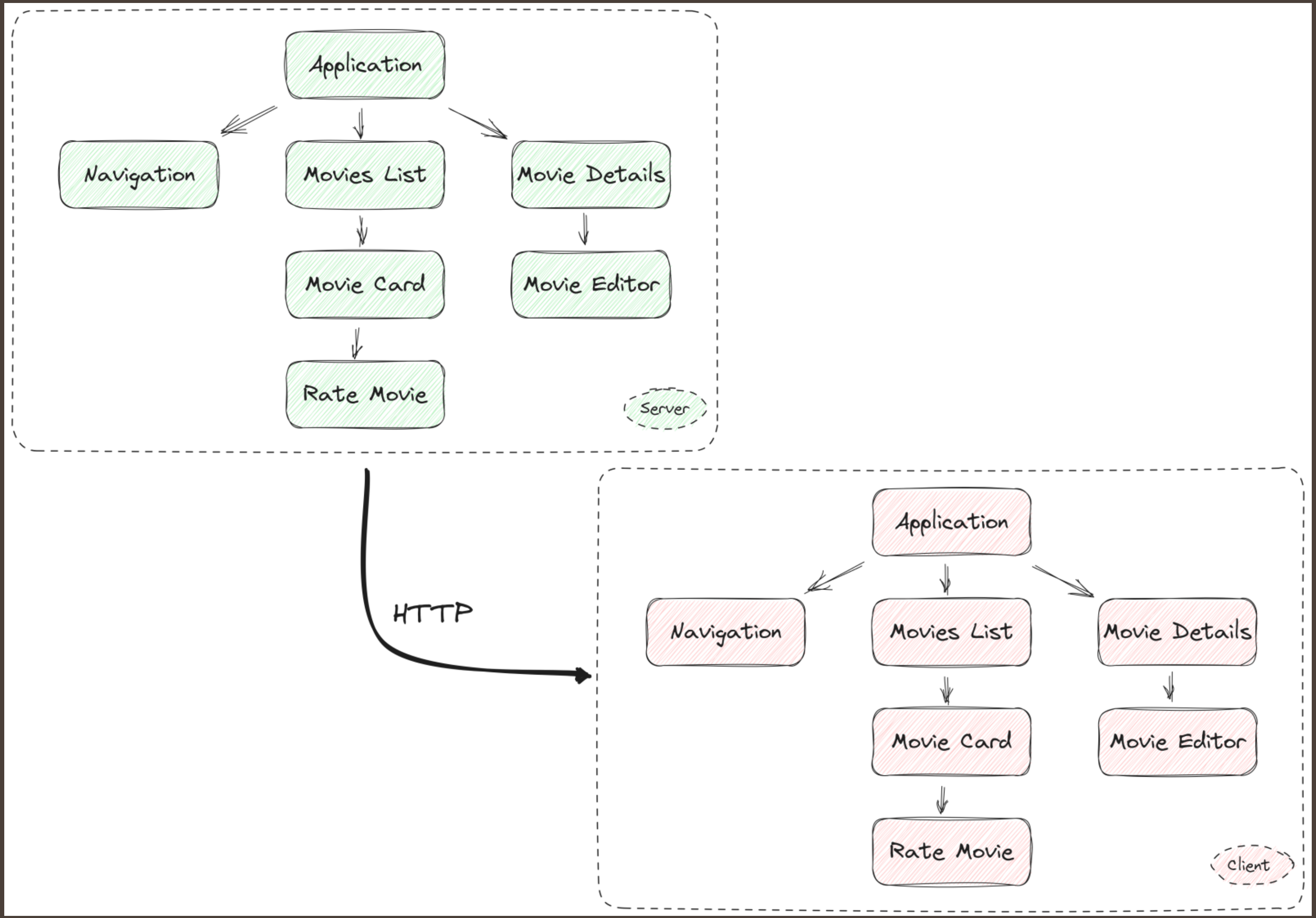
## React Server Components

- React Server Components (RSC) **only execute on the server**
  - Traditionally React components always execute in the browser
- RSC are **not the same as Server Side Rendering**
  - With SSR components are executed both on the client and server
- Applications are a **combination of server and client components**
- The result: The back and front-end **code are more integrated**
  - Leading to **better type safety** ☺

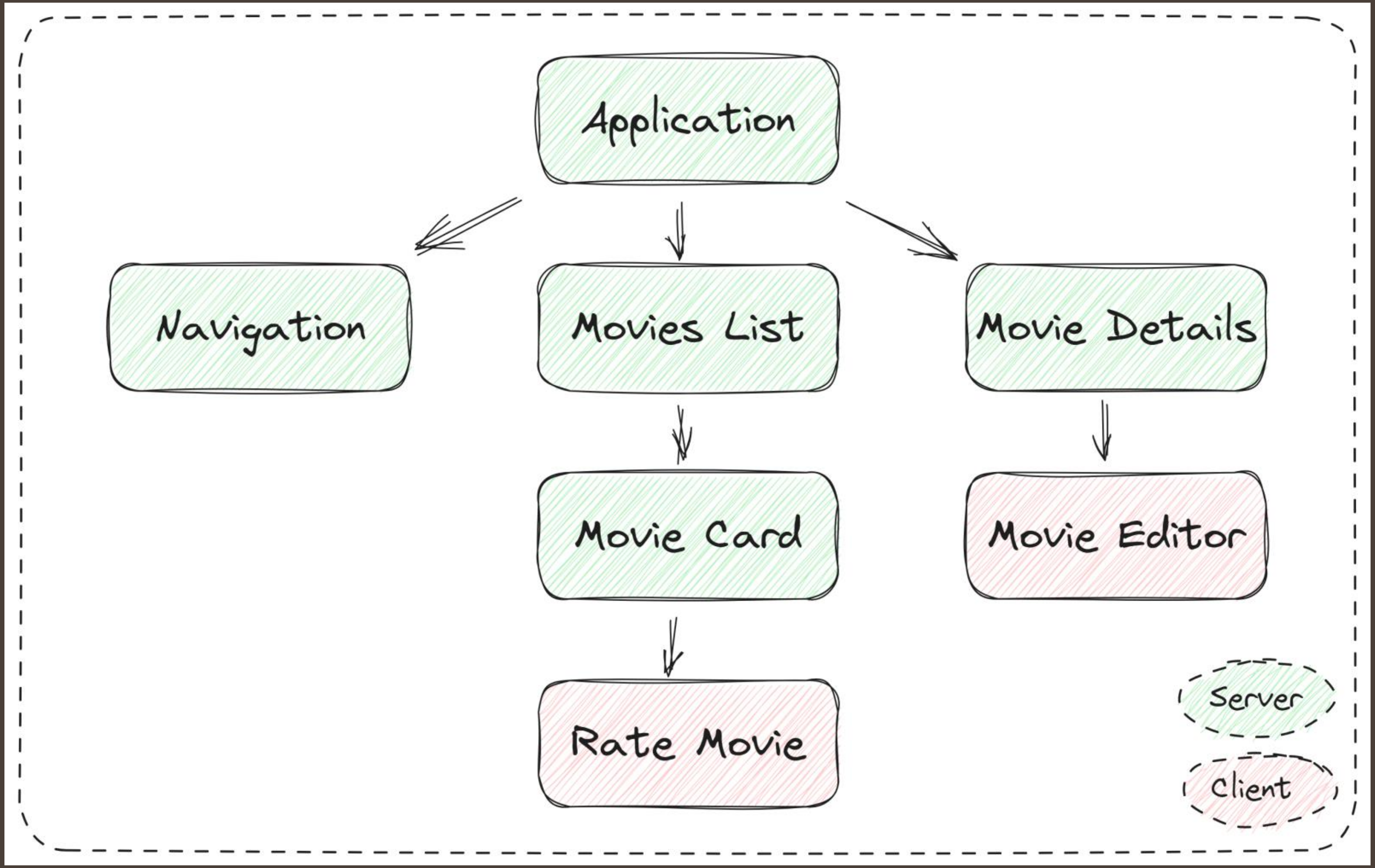
# Before RSC (no SSR)



# Server Side Rendering



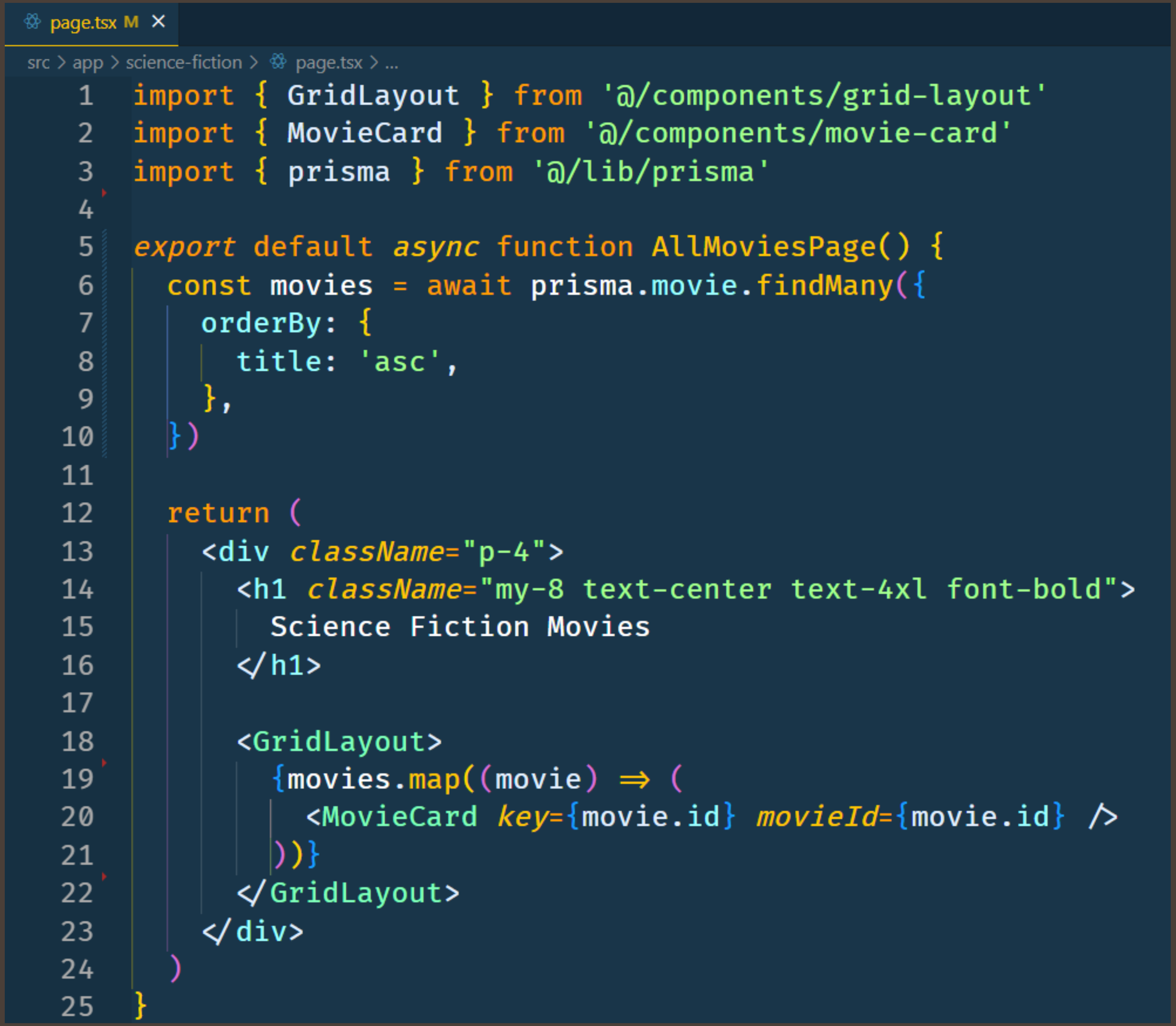
## With RSC


Application
Navigation
Movies List
Movie Details
Movie Card
Movie Editor
Rate Movie
Server
Client

## React Server Components

- Server components can be **asynchronous**
  - Great to load data from some API
- Server components **render just once**
  - No re-rendering with state changes or event handling
- The server component **code is not send to the browser**
  - Can safely use secure API key's etc.
  - Smaller bundle sizes

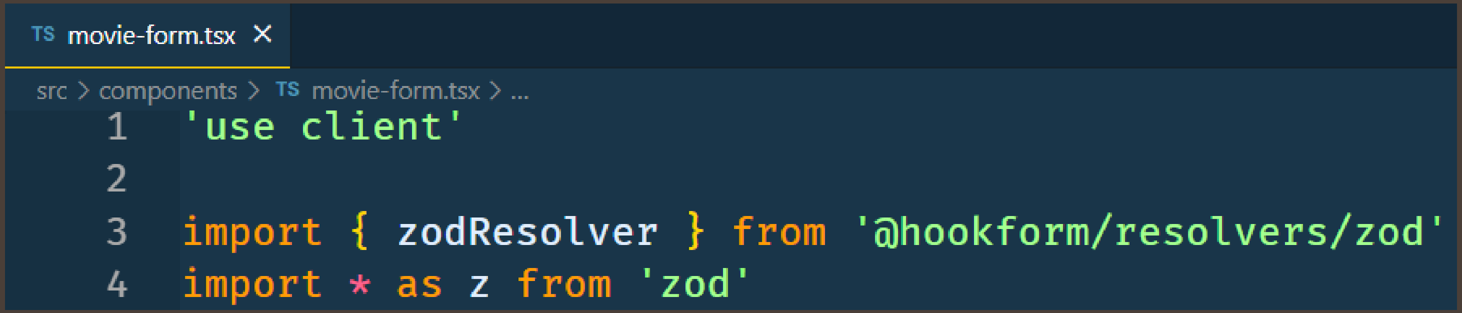
## React Server Component



```tsx
import { GridLayout } from '@/components/grid-layout'
import { MovieCard } from '@/components/movie-card'
import { prisma } from '@/lib/prisma'

export default async function AllMoviesPage() {
  const movies = await prisma.movie.findMany({
    orderBy: {
      title: 'asc',
    },
  })

  return (
    <div className="p-4">
      <h1 className="my-8 text-center text-4xl font-bold">
        Science Fiction Movies
      </h1>

      <GridLayout>
        {movies.map((movie) => (
          <MovieCard key={movie.id} movieId={movie.id} />
        ))}
      </GridLayout>
    </div>
  )
}
```

# React Client Components

- **Server components can render both server and client components**
  - Client components can only render other client components
- Adding **'use client'** to the top of a component makes it a client component
  - Used as a directive for the bundler to include this in the client JS bundle
- A client component is **still executed on the server** as part of SSR
  - When using Next.js


TS movie-form.tsx ×
src > components > TS movie-form.tsx > ...

```tsx
'use client'

import { zodResolver } from '@hookform/resolvers/zod'
import * as z from 'zod'
```

# Next.js and the App Router

## Next.js and the App Router

- **React is no longer just a client side library**
  - We need additional server side capabilities
  - As well as additional code bundling options
- **Next.js is the best production option available**
  - ☞ Remix doesn't support RSC yet ☜
- There are also more **experimental options**
  - Waku from Daishi Kato
  - React Server Components Demo from the React team

## Rendering RSC’s

- **React Server Components are only rendered on the server**
  - And shipped to the client as a JSON like structure
  - The React Server Component Payload
- The client then **injects** these JSON objects **into the React tree**
  - Where it would previously have rendered these components themself
- ☞ **React already used a 2 step process** ☜
  - Components render to a virtual DOM
    - Just a series of JavaScript objects
  - Reconciliation maps the virtual DOM to the browser DOM
    - Or an HTML stream in the case or Server Side Rendering

## Async transport

- RSC’s are **streamed asynchronously** to the client
  - Enables using Suspense boundaries while loading

## Code bundling

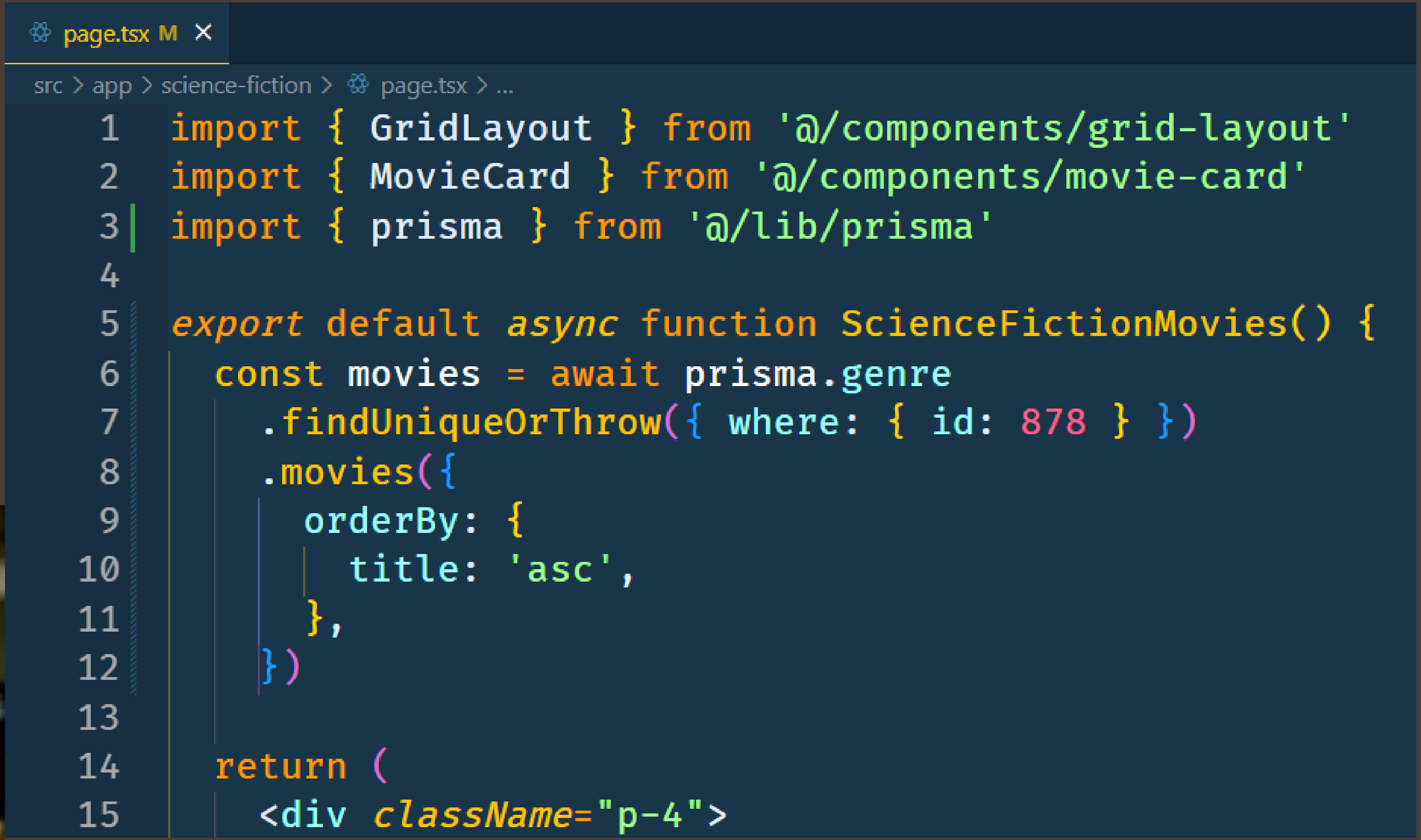
- **Multiple JavaScript bundles** have to be made
  - The client and server have different code bundles
- **Server Component code is never executed on the client**
  - Can use **react-server-dom-webpack** or a similar package

## Fetching data in a RSC

## Fetching data in a RSC

- React Server Components an **execute normal Node.js code**
  - Read/write files on disk
  - Do fetch requests to other servers
  - Execute CRUD in a database
- RSC's **can be asynchronous** where needed
  - Just **await** whatever action needs to be done

src\app\science-fiction\page.tsx



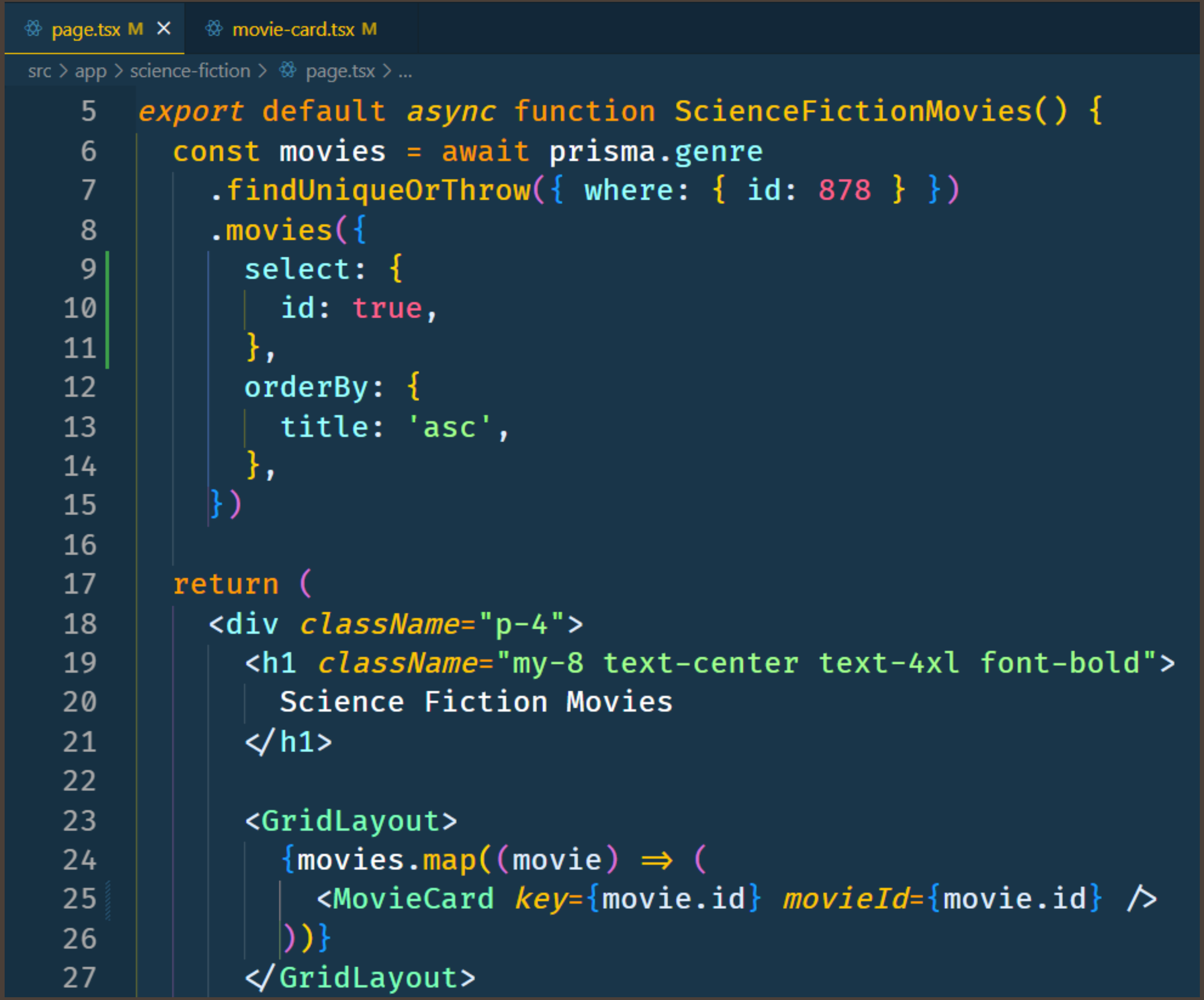
```tsx
import { GridLayout } from '@/components/grid-layout'
import { MovieCard } from '@/components/movie-card'
import { prisma } from '@/lib/prisma'

export default async function ScienceFictionMovies() {
  const movies = await prisma.genre
    .findUniqueOrThrow({ where: { id: 878 } })
    .movies({
      orderBy: {
        title: 'asc',
      },
    })

  return (
    <div className="p-4">
```

## Async server child components

## Child RSC components

- A RSC component can render other RSC child components
  - They can execute the same server based code
  - Including async/await where needed

src\app\science-fiction\page.tsx

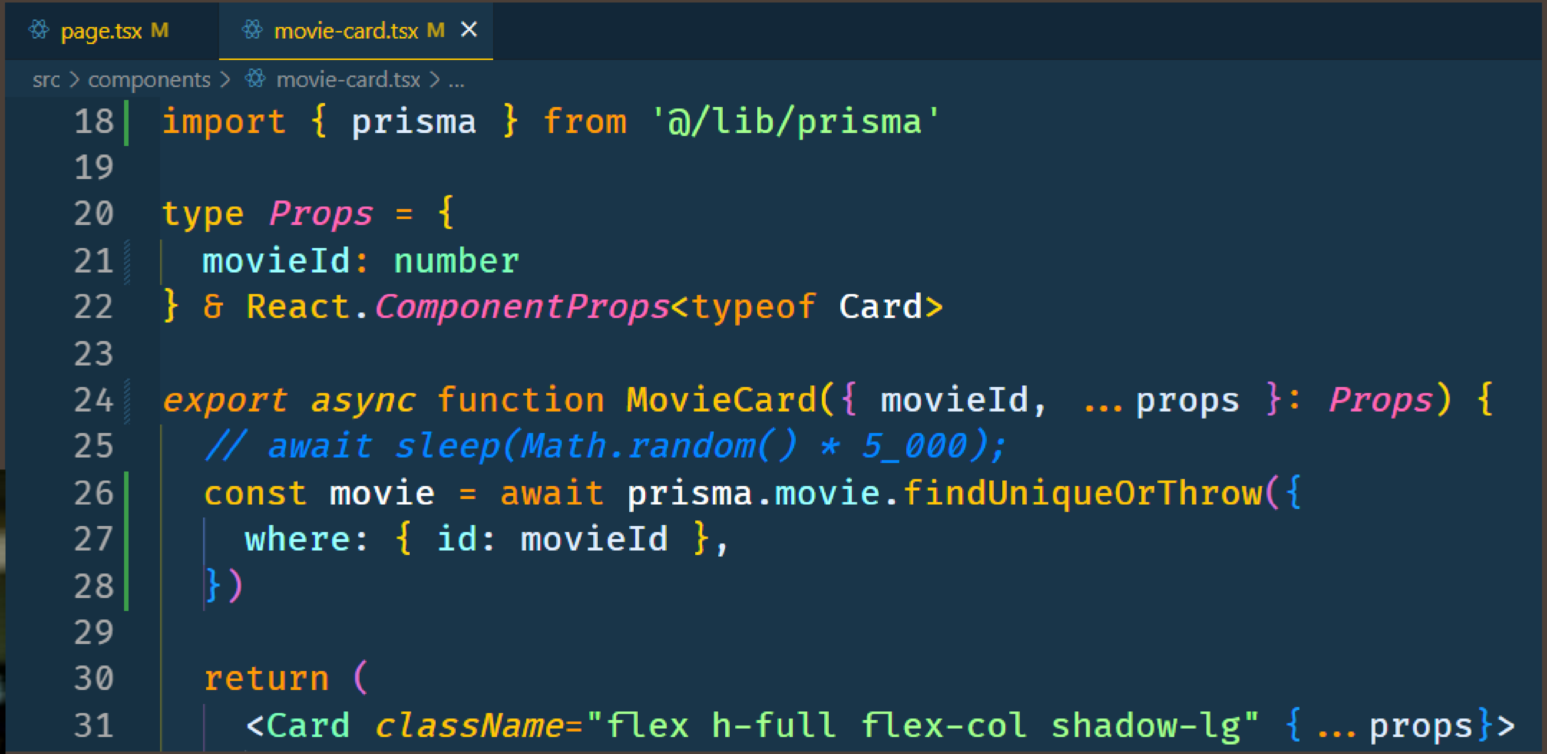


page.tsx M × | movie-card.tsx M

src > app > science-fiction > page.tsx > ...

```tsx
export default async function ScienceFictionMovies() {
  const movies = await prisma.genre
    .findUniqueOrThrow({ where: { id: 878 } })
    .movies({
      select: {
        id: true,
      },
      orderBy: {
        title: 'asc',
      },
    })

  return (
    <div className="p-4">
      <h1 className="my-8 text-center text-4xl font-bold">
        Science Fiction Movies
      </h1>

      <GridLayout>
        {movies.map((movie) => (
          <MovieCard key={movie.id} movieId={movie.id} />
        ))}
      </GridLayout>
```

## src\components\movie-card.tsx



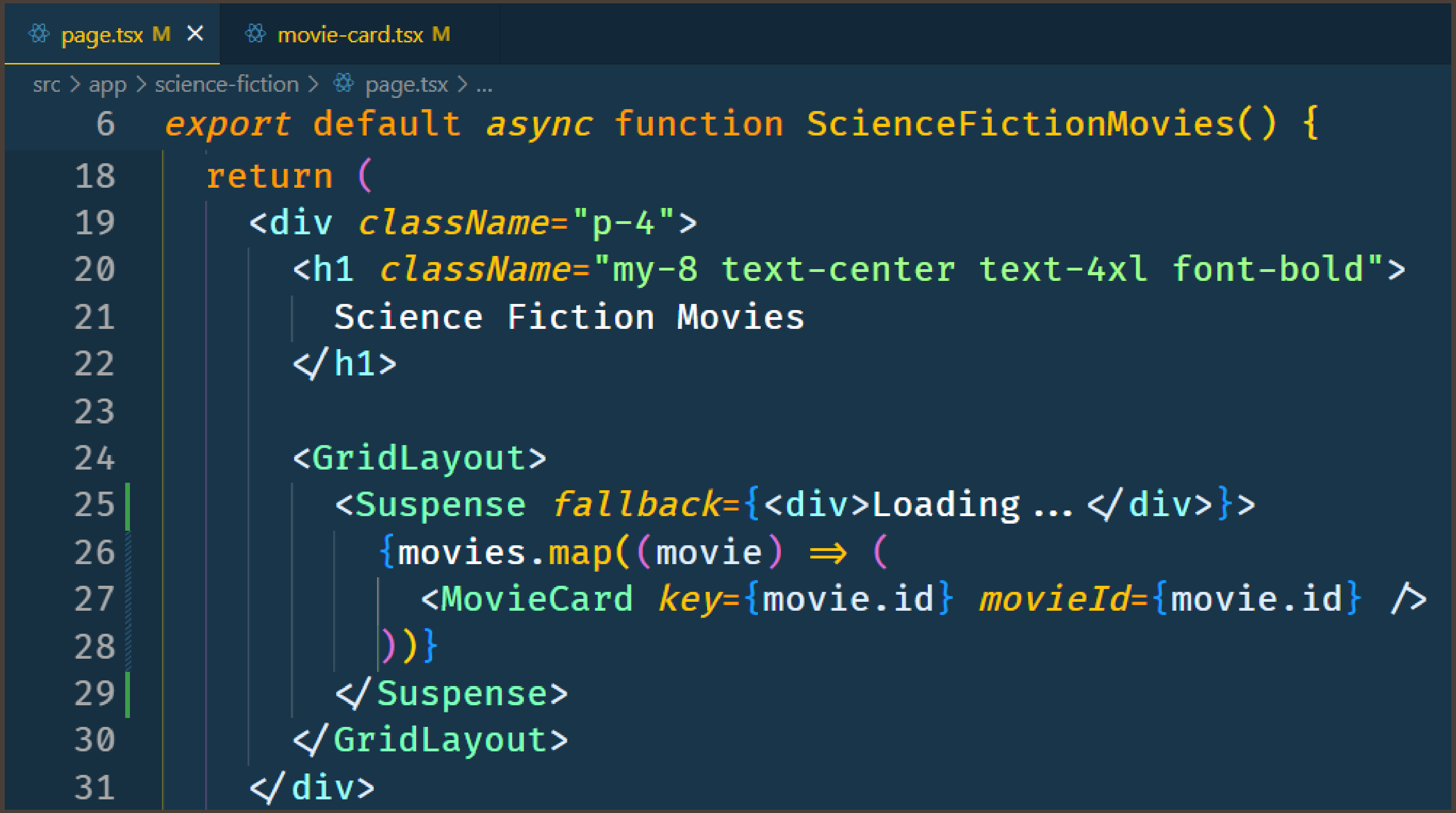
```tsx
import { prisma } from '@/lib/prisma'

type Props = {
  movieId: number
} & React.ComponentProps<typeof Card>

export async function MovieCard({ movieId, ...props }: Props) {
  // await sleep(Math.random() * 5_000);
  const movie = await prisma.movie.findUniqueOrThrow({
    where: { id: movieId },
  })

  return (
    <Card className="flex h-full flex-col shadow-lg" {...props}>
```

## Suspense & RSC pages

## Suspense & RSC pages

- React Server Components are **suspended until they resolve**
  - Can be controlled with **<Suspense /> boundaries**
- Next.js makes it easy to **suspend when rendering an async page**
  - **Add a loading.tsx** next to the page.tsx
  - They can be nested and the closest loading component will be used

src\app\science-fiction\page.tsx

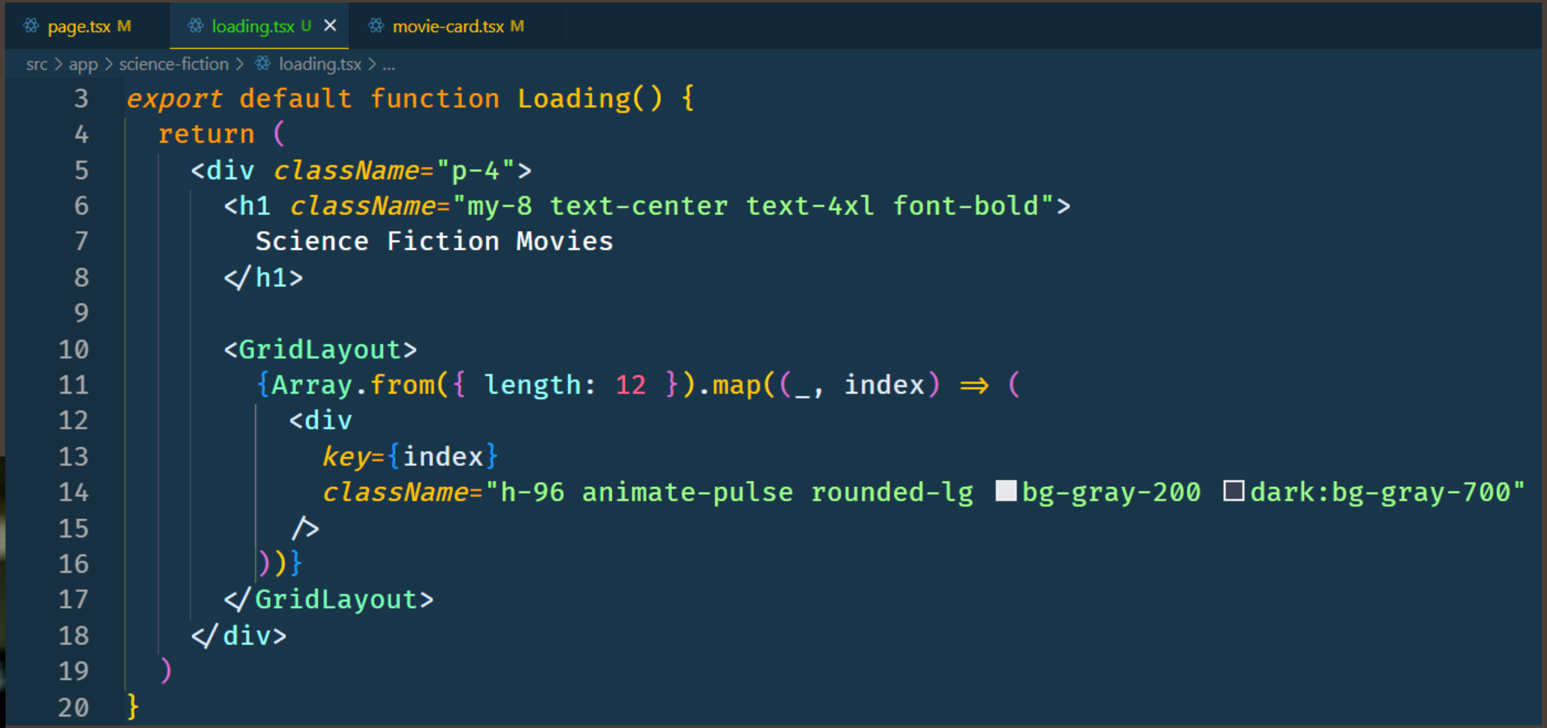


page.tsx M × movie-card.tsx M

src > app > science-fiction > page.tsx > ...

```tsx
export default async function ScienceFictionMovies() {
  return (
    <div className="p-4">
      <h1 className="my-8 text-center text-4xl font-bold">
        Science Fiction Movies
      </h1>

      <GridLayout>
        <Suspense fallback={<div>Loading ...</div>}>
          {movies.map((movie) => (
            <MovieCard key={movie.id} movieId={movie.id} />
          ))}
        </Suspense>
      </GridLayout>
    </div>
```

src\app\
science-fiction\
loading.tsx



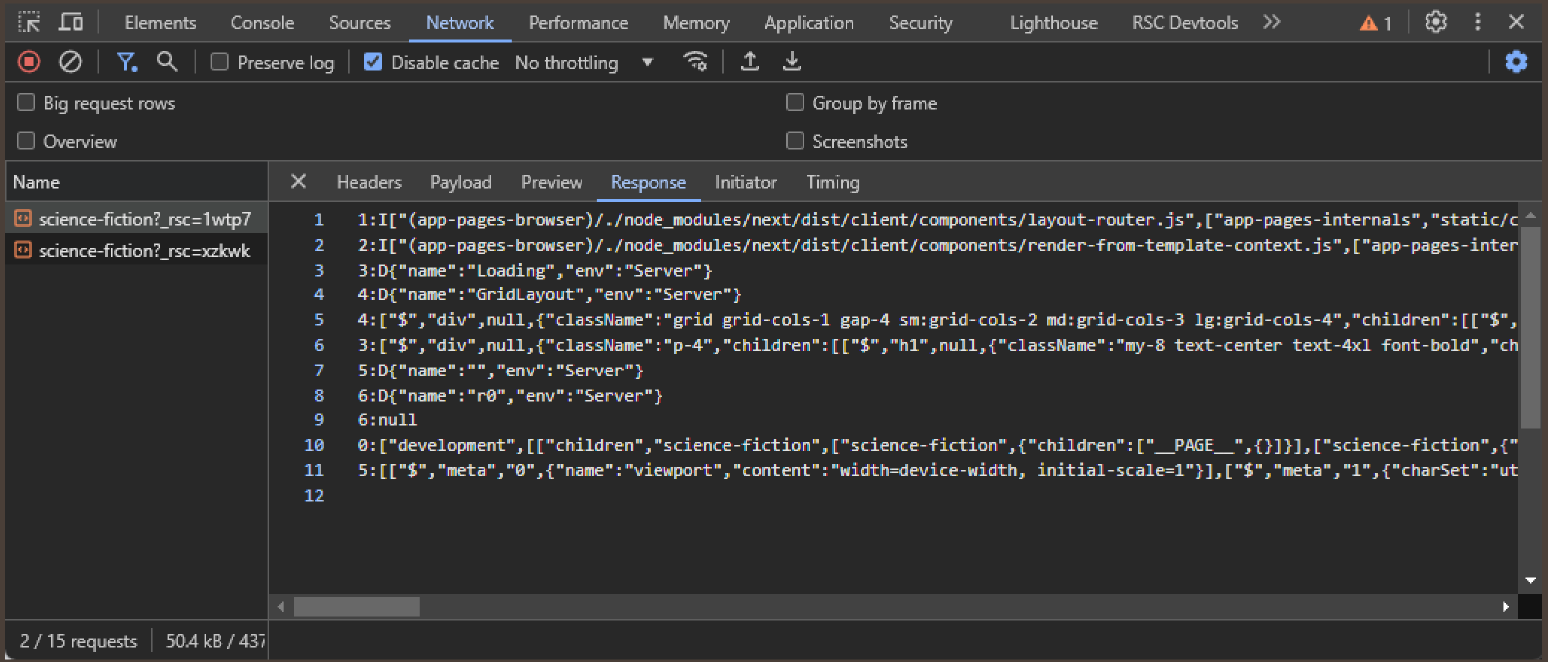
```tsx
export default function Loading() {
  return (
    <div className="p-4">
      <h1 className="my-8 text-center text-4xl font-bold">
        Science Fiction Movies
      </h1>

      <GridLayout>
        {Array.from({ length: 12 }).map((_, index) => (
          <div
            key={index}
            className="h-96 animate-pulse rounded-lg bg-gray-200 dark:bg-gray-700"
          />
        ))}
      </GridLayout>
    </div>
  )
}
```

## RSC and streaming

## RSC and streaming

- **Async React Server Components are streamed to the browser**
  - Using the React Server Component Payload
  - On the client they are suspended until the component resolves
- **Server action responses** can also stream components back
  - After a ***revalidatePath()*** or a ***revalidateTag()***

# RSC Payload



```
1:I["(app-pages-browser)/./node_modules/next/dist/client/components/layout-router.js",["app-pages-internals","static/c
2:I["(app-pages-browser)/./node_modules/next/dist/client/components/render-from-template-context.js",["app-pages-inter
3:D{"name":"Loading","env":"Server"}
4:D{"name":"GridLayout","env":"Server"}
4:["$","div",null,{"className":"grid grid-cols-1 gap-4 sm:grid-cols-2 md:grid-cols-3 lg:grid-cols-4","children":[["$",
3:["$","div",null,{"className":"p-4","children":[["$","h1",null,{"className":"my-8 text-center text-4xl font-bold","ch
5:D{"name":"","env":"Server"}
6:D{"name":"r0","env":"Server"}
6:null
0:["development",[["children","science-fiction",["science-fiction",{"children":["__PAGE__",{}]}],["science-fiction",{"
5:[["$","meta","0",{"name":"viewport","content":"width=device-width, initial-scale=1"}],["$","meta","1",{"charSet":"ut
```

## Client components

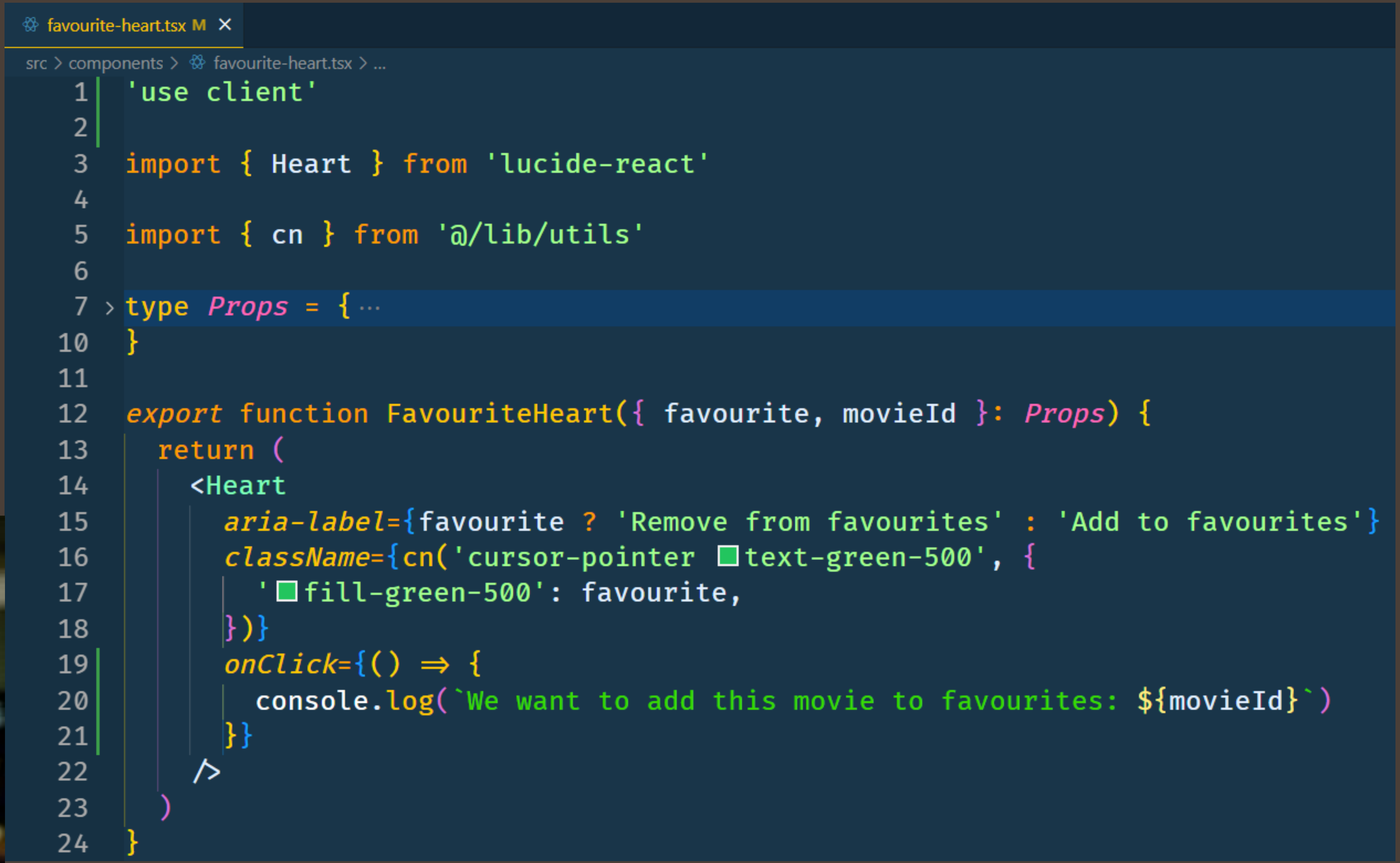
## Client components

- **Client components are required in a number of scenarios**
  - With interactive UI elements like elements with a click handler
  - When using browser API's like localStorage
  - When using React hooks like useState(), useEffect() etc.
- Add the **`use client`** directive
  - Makes a component a client component
- Client components **render in the browser**
  - Can't be asynchronous (for now)
- **Can't access files or databases** on the local machine
  - Other than using browser API's
- With **Server Side Rendering** they can also execute on the server
  - Next.js uses SSR by default

## Client Component or Server Component

- **React Server Components normally perform better**
  - Only render once on the server
  - The code doesn't need to be shipped to the browser
- **Can be async and await data** to be fetched
  - No need for a render/effect/re-render cycle in the browser
- **Components that don't need client capabilities should be SRC's**
  - State, effects, browser API's etc. are client requirements

src\components\favourite-heart.tsx


favourite-heart.tsx M ×

src > components > favourite-heart.tsx > ...

```tsx
'use client'

import { Heart } from 'lucide-react'

import { cn } from '@/lib/utils'

type Props = {⋯
}

export function FavouriteHeart({ favourite, movieId }: Props) {
  return (
    <Heart
      aria-label={favourite ? 'Remove from favourites' : 'Add to favourites'}
      className={cn('cursor-pointer 🟩text-green-500', {
        '🟩fill-green-500': favourite,
      })}
      onClick={() => {
        console.log(`We want to add this movie to favourites: ${movieId}`)
      }}
    />
  )
}
```

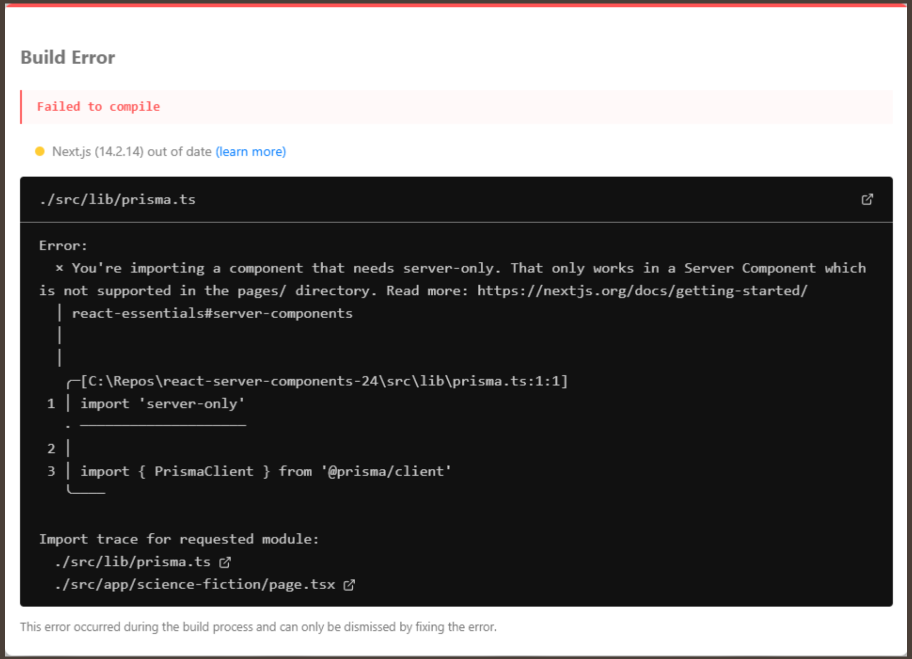
## What does 'use client’ really do

## What is a server component?

- What is a server component and what is not?
  - **Client components are marked with 'use client'**
- But **not all other components are server components**
  - With a component without 'use client' it depends on their parents
- If a component is a client component
  - Then **all components it renders are also client components**
- ☞ There is ***no 'use server'*** for server components ☜
  - The ***'use server'*** directive exists but is used for Server Actions
  - But there is a ***server-only*** NPM package

## server-only

- Import the **server-only** NPM package
  - With components that must run on the server



**Build Error**

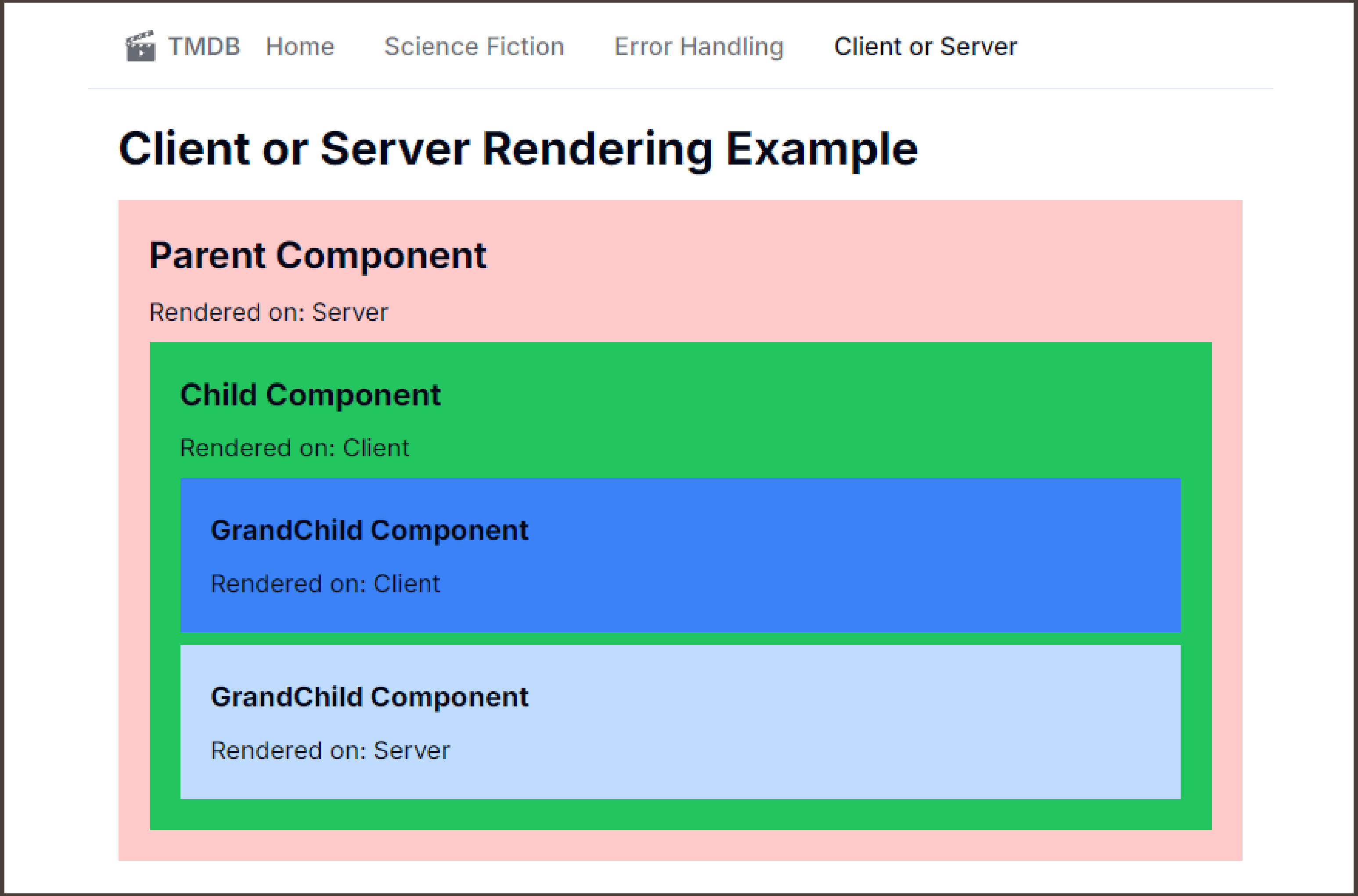
```
Failed to compile
```

● Next.js (14.2.14) out of date (learn more)

```
./src/lib/prisma.ts

Error:
  × You're importing a component that needs server-only. That only works in a Server Component which
is not supported in the pages/ directory. Read more: https://nextjs.org/docs/getting-started/
   │ react-essentials#server-components
   │
   │
    ╭─[C:\Repos\react-server-components-24\src\lib\prisma.ts:1:1]
  1 │ import 'server-only'
    · ────────────────────
  2 │
  3 │ import { PrismaClient } from '@prisma/client'
    ╰────

Import trace for requested module:
  ./src/lib/prisma.ts
  ./src/app/science-fiction/page.tsx
```

This error occurred during the build process and can only be dismissed by fixing the error.

## GrandChild is both a client and server component



TMDB Home Science Fiction Error Handling Client or Server

Client or Server Rendering Example

Parent Component

Rendered on: Server

Child Component

Rendered on: Client

GrandChild Component

Rendered on: Client

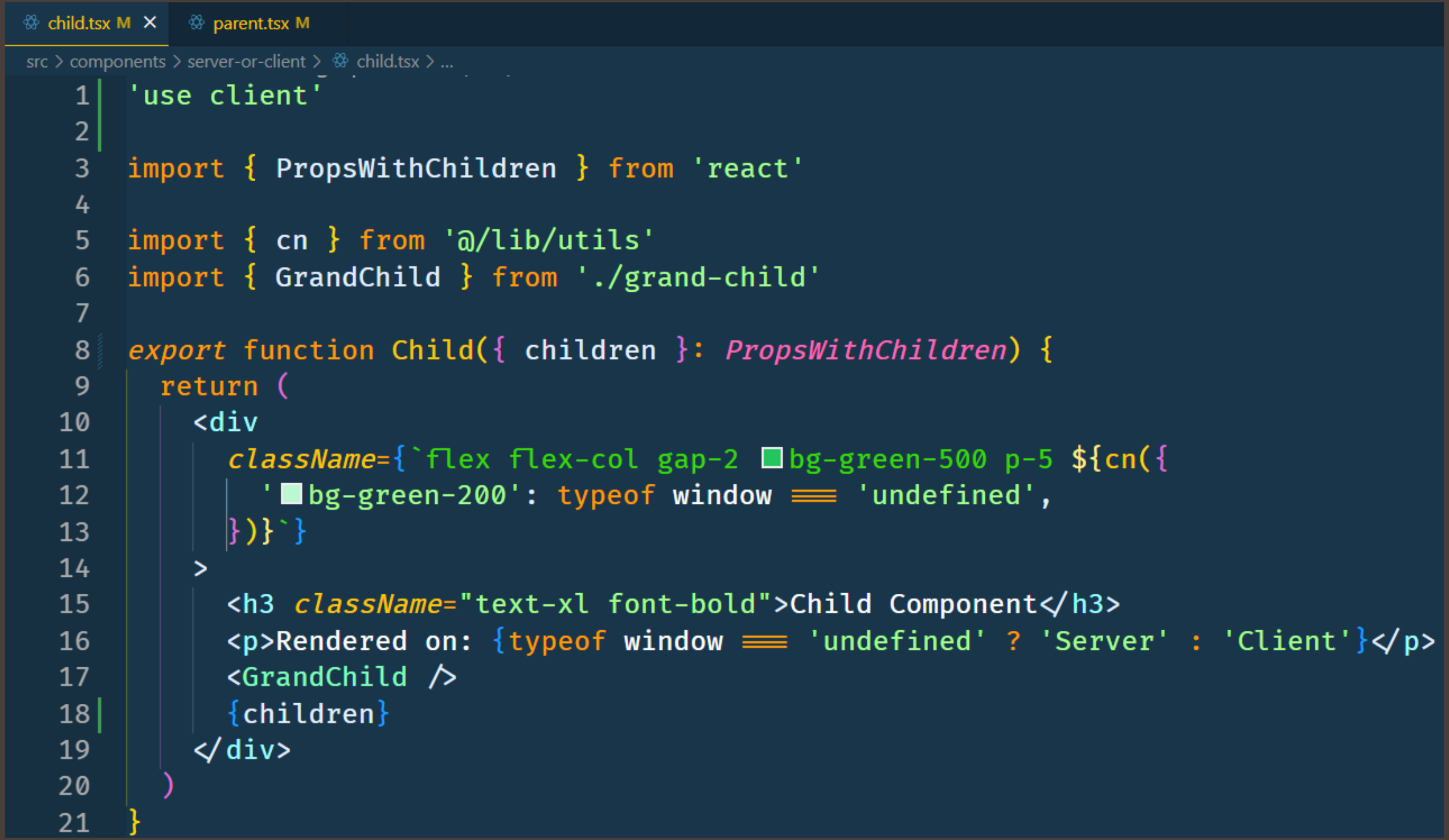
GrandChild Component

Rendered on: Server

## Using an RSC as a child of a client component

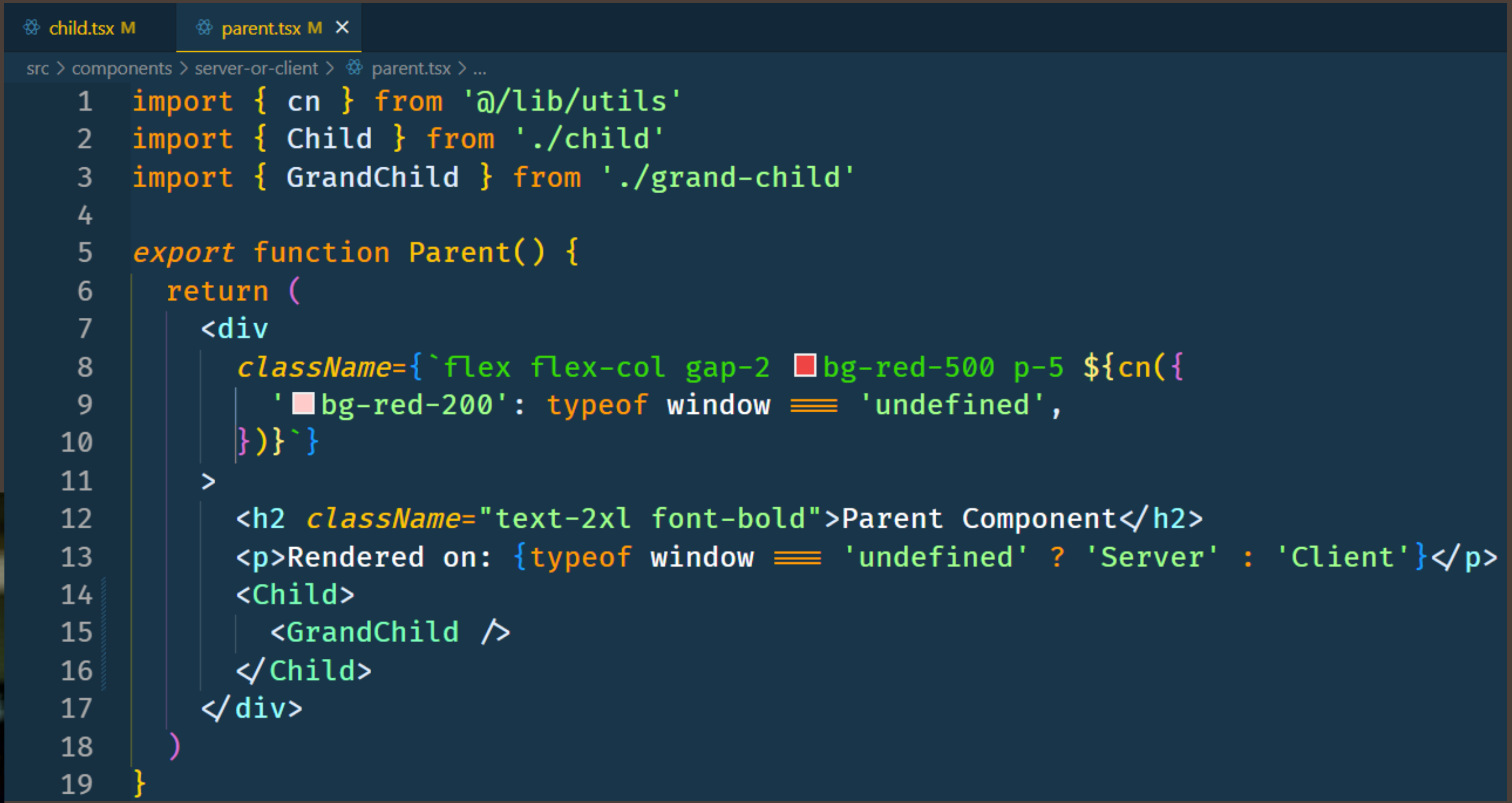
- **A client component can have a server component as a child**
  - As long as it doesn't render it
- **Render the child server component** from another server component
  - 💡 And pass it as a children prop into the client component 💡

## src\components\server-or-client\child.tsx



```tsx
'use client'

import { PropsWithChildren } from 'react'

import { cn } from '@/lib/utils'
import { GrandChild } from './grand-child'

export function Child({ children }: PropsWithChildren) {
  return (
    <div
      className={`flex flex-col gap-2 bg-green-500 p-5 ${cn({
        'bg-green-200': typeof window === 'undefined',
      })}`}
    >
      <h3 className="text-xl font-bold">Child Component</h3>
      <p>Rendered on: {typeof window === 'undefined' ? 'Server' : 'Client'}</p>
      <GrandChild />
      {children}
    </div>
  )
}
```

## src\components\server-or-client\parent.tsx



```tsx
import { cn } from '@/lib/utils'
import { Child } from './child'
import { GrandChild } from './grand-child'

export function Parent() {
  return (
    <div
      className={`flex flex-col gap-2 bg-red-500 p-5 ${cn({
        'bg-red-200': typeof window === 'undefined',
      })}`}
    >
      <h2 className="text-2xl font-bold">Parent Component</h2>
      <p>Rendered on: {typeof window === 'undefined' ? 'Server' : 'Client'}</p>
      <Child>
        <GrandChild />
      </Child>
    </div>
  )
}
```

## Break time

## Calling Server Actions

## Calling Server Actions

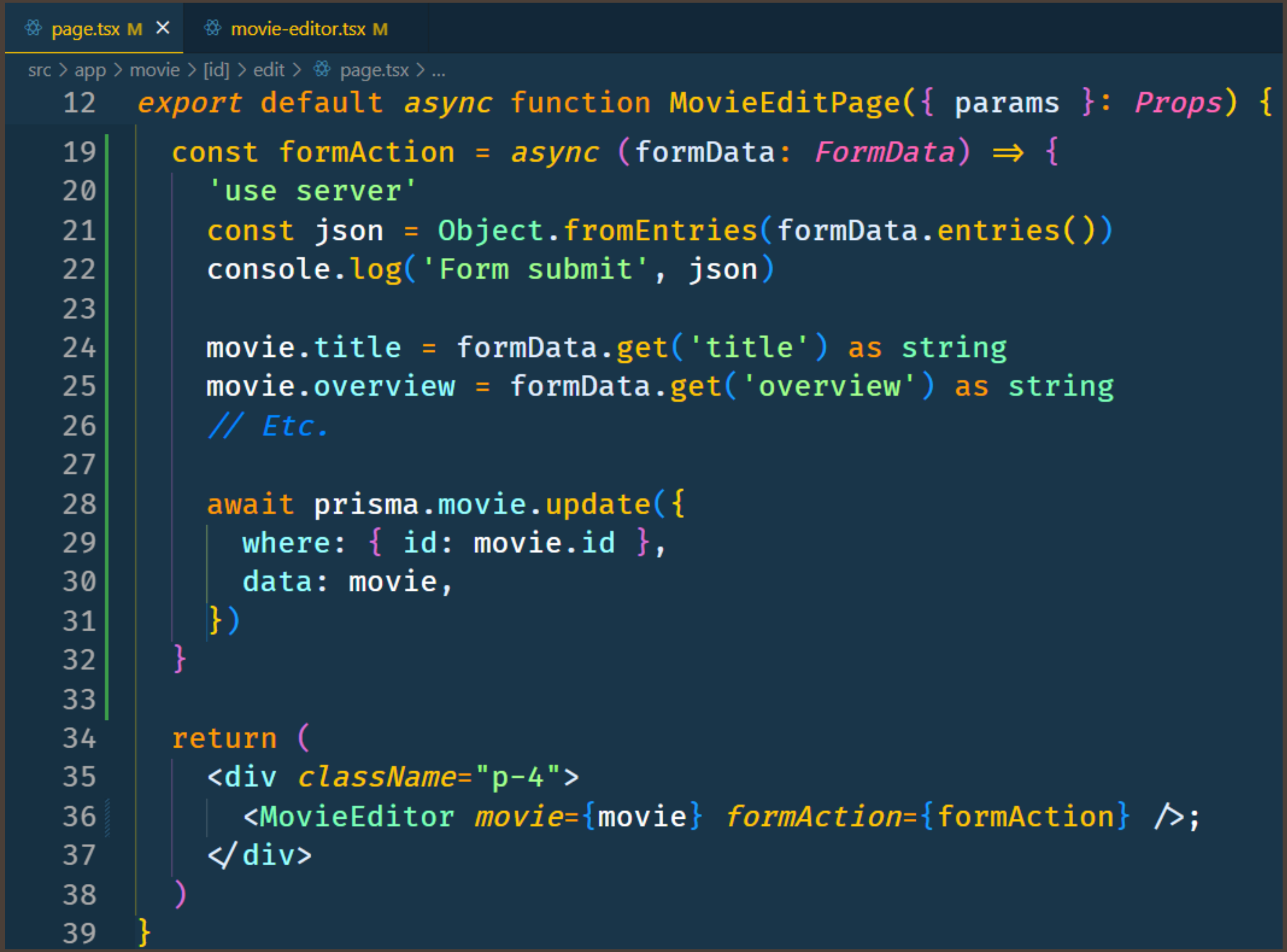
- **React Server Actions** are functions that we can **call on the client**
  - But then **execute on the server**
- Add the ***'use server'*** annotation
  - Can be at the top of a file or a single function
  - Not related to server components
- Can be passed as **the action of a client side <form />**
  - The forms data is passed as a **FormData** parameter
  - Even works if JavaScript is disabled ☺
- Can also be **called as a normal asynchronous function**
  - The network request is handled for you

## Form actions

## Form actions

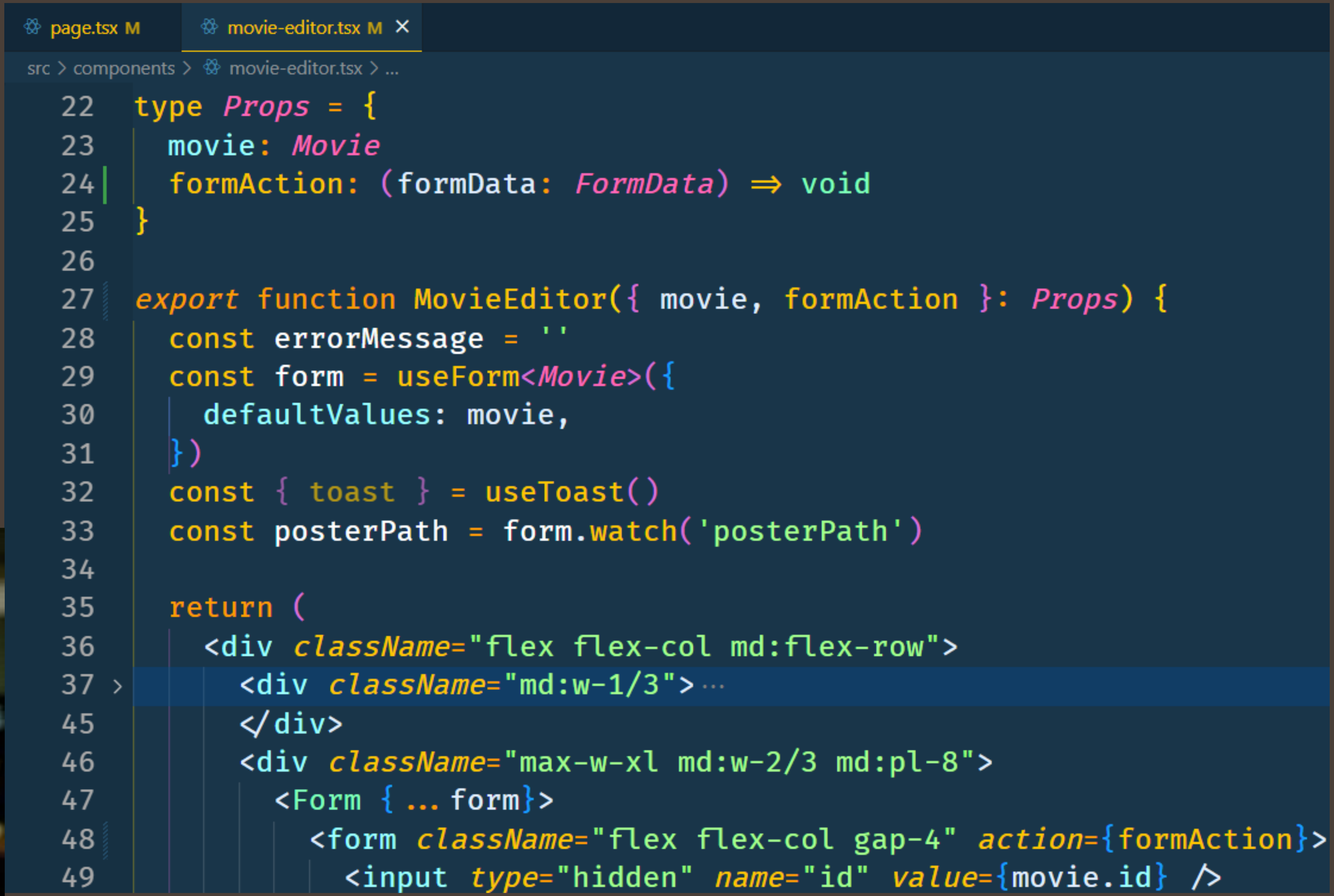
- A <form> element can take a ‘action’ prop
  - Can point to an action function that executes on the client or server
  - More flexible that using the onSubmit
- All the <input> from the form is passed as a FormData parameter
  - Use hidden inputs to pass additional data
- 🔥 The server action function works even if JavaScript is disabled

## src\app\movie\[id]\edit\page.tsx



```tsx
export default async function MovieEditPage({ params }: Props) {
  const formAction = async (formData: FormData) => {
    'use server'
    const json = Object.fromEntries(formData.entries())
    console.log('Form submit', json)

    movie.title = formData.get('title') as string
    movie.overview = formData.get('overview') as string
    // Etc.

    await prisma.movie.update({
      where: { id: movie.id },
      data: movie,
    })
  }

  return (
    <div className="p-4">
      <MovieEditor movie={movie} formAction={formAction} />;
    </div>
  )
}
```

src\components\movie-editor.tsx



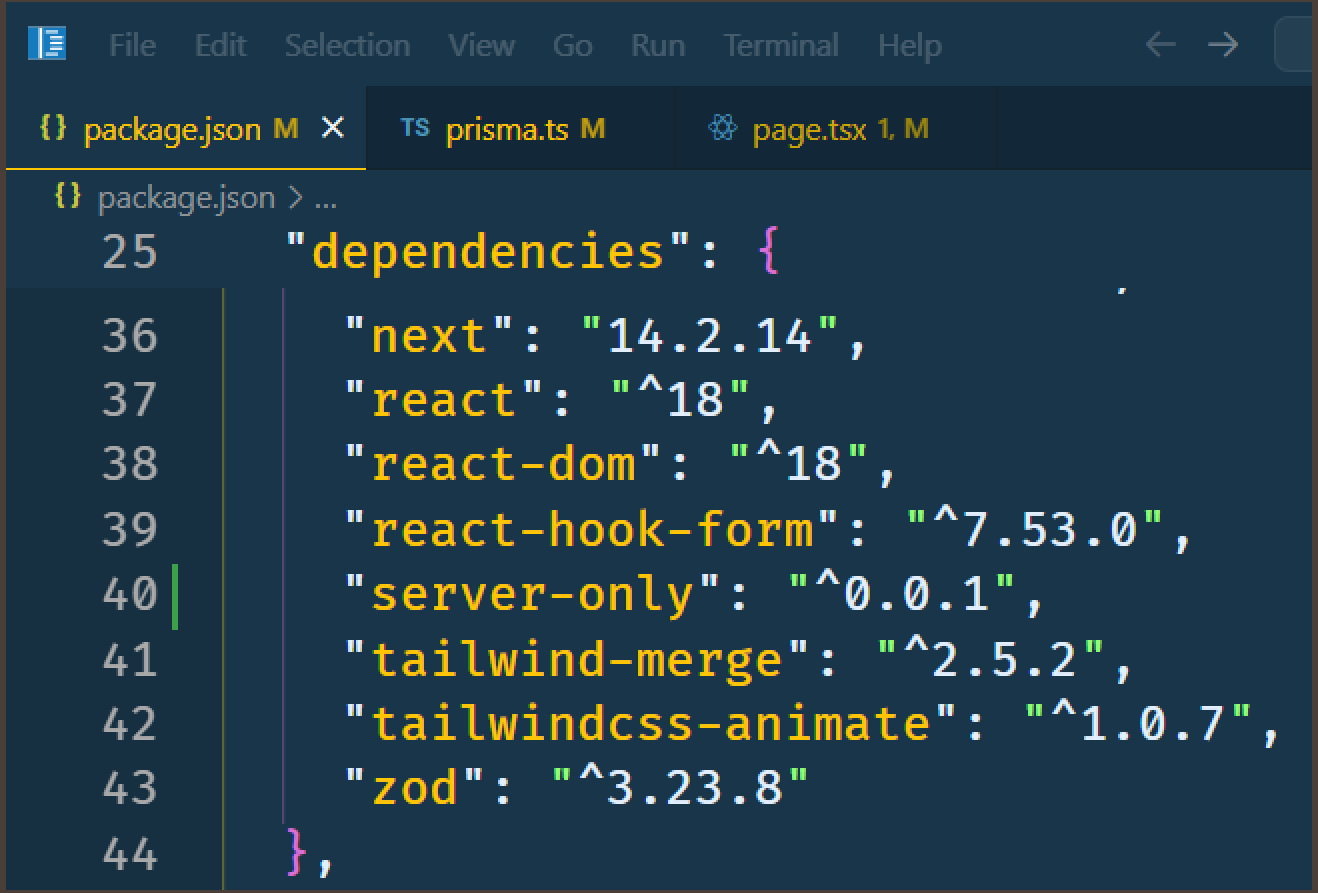
```tsx
type Props = {
  movie: Movie
  formAction: (formData: FormData) => void
}

export function MovieEditor({ movie, formAction }: Props) {
  const errorMessage = ''
  const form = useForm<Movie>({
    defaultValues: movie,
  })
  const { toast } = useToast()
  const posterPath = form.watch('posterPath')

  return (
    <div className="flex flex-col md:flex-row">
      <div className="md:w-1/3">…
      </div>
      <div className="max-w-xl md:w-2/3 md:pl-8">
        <Form {...form}>
          <form className="flex flex-col gap-4" action={formAction}>
            <input type="hidden" name="id" value={movie.id} />
```

## Guarding client components against server code

## server-only

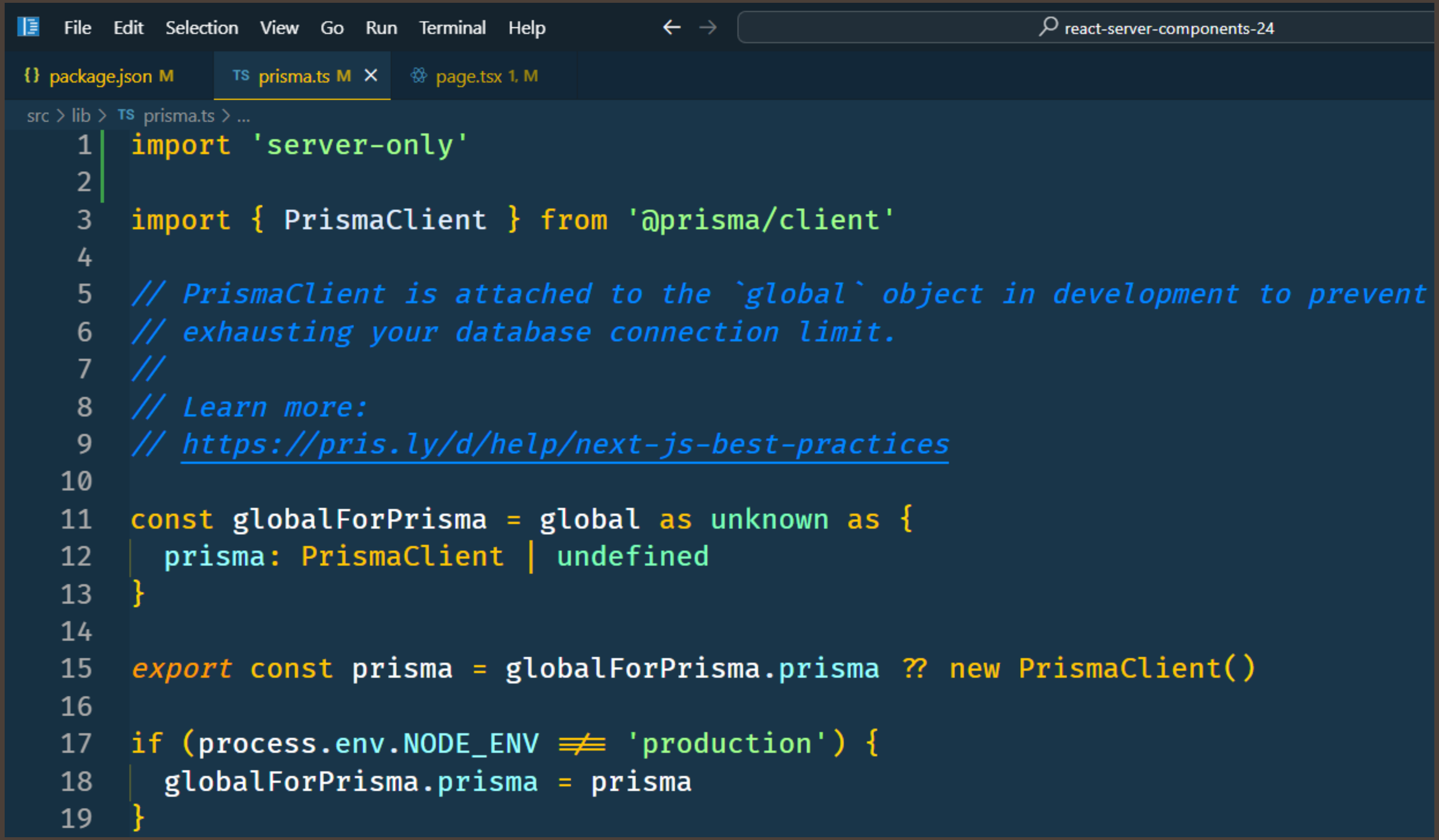
- **Components that render in the browser shouldn’t execute server code**
  - This would usually result in a runtime error
- An immediate **compile time error** is better
  - The server-only package does this
  - npm install server-only
- Add **import 'server-only’** to any code that should not be imported
  - Only needed in the modules that actually execute the Node code

## package.json



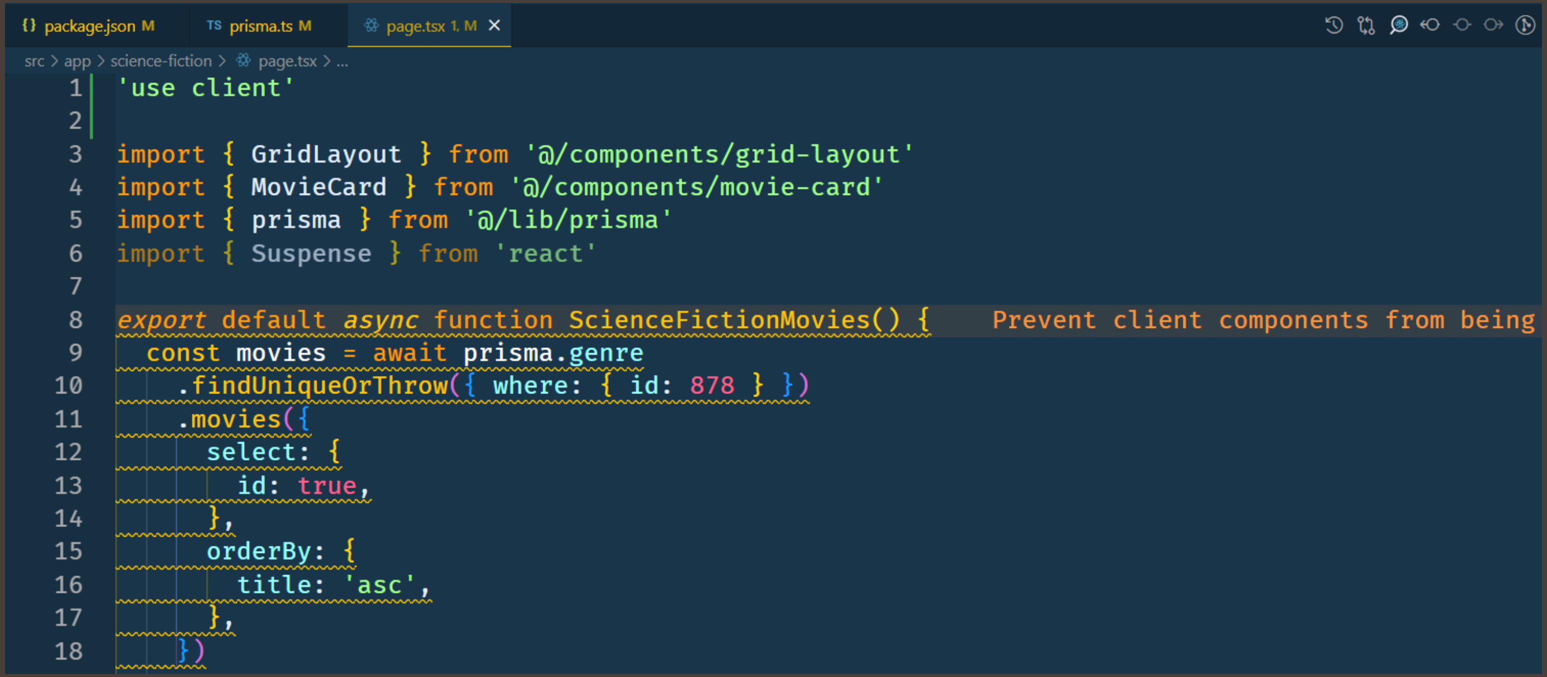
```
  "dependencies": {
    "next": "14.2.14",
    "react": "^18",
    "react-dom": "^18",
    "react-hook-form": "^7.53.0",
    "server-only": "^0.0.1",
    "tailwind-merge": "^2.5.2",
    "tailwindcss-animate": "^1.0.7",
    "zod": "^3.23.8"
  },
```

## src\lib\prisma.ts


File Edit Selection View Go Run Terminal Help
react-server-components-24
package.json M
prisma.ts M
page.tsx 1, M
src > lib > prisma.ts > ...

```ts
import 'server-only'

import { PrismaClient } from '@prisma/client'

// PrismaClient is attached to the `global` object in development to prevent
// exhausting your database connection limit.
//
// Learn more:
// https://pris.ly/d/help/next-js-best-practices

const globalForPrisma = global as unknown as {
  prisma: PrismaClient | undefined
}

export const prisma = globalForPrisma.prisma ?? new PrismaClient()

if (process.env.NODE_ENV !== 'production') {
  globalForPrisma.prisma = prisma
}
```

src\app\
science-fiction\
page.tsx

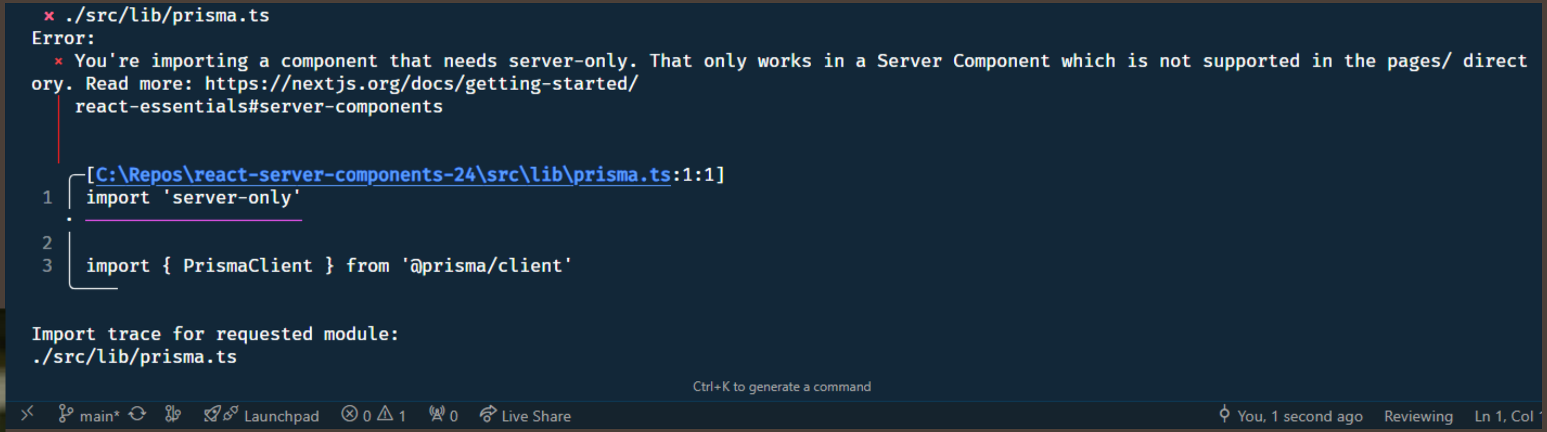


package.json M    prisma.ts M    page.tsx 1, M

src > app > science-fiction > page.tsx > ...

```tsx
'use client'

import { GridLayout } from '@/components/grid-layout'
import { MovieCard } from '@/components/movie-card'
import { prisma } from '@/lib/prisma'
import { Suspense } from 'react'

export default async function ScienceFictionMovies() {    Prevent client components from being
  const movies = await prisma.genre
    .findUniqueOrThrow({ where: { id: 878 } })
    .movies({
      select: {
        id: true,
      },
      orderBy: {
        title: 'asc',
      },
    })
```

## The error



```
 × ./src/lib/prisma.ts
Error:
  × You're importing a component that needs server-only. That only works in a Server Component which is not supported in the pages/ direct
ory. Read more: https://nextjs.org/docs/getting-started/
    react-essentials#server-components


    ╭─[C:\Repos\react-server-components-24\src\lib\prisma.ts:1:1]
    │ import 'server-only'
    · ────────────────────
    │
    │ import { PrismaClient } from '@prisma/client'
    ╰────

Import trace for requested module:
./src/lib/prisma.ts
```

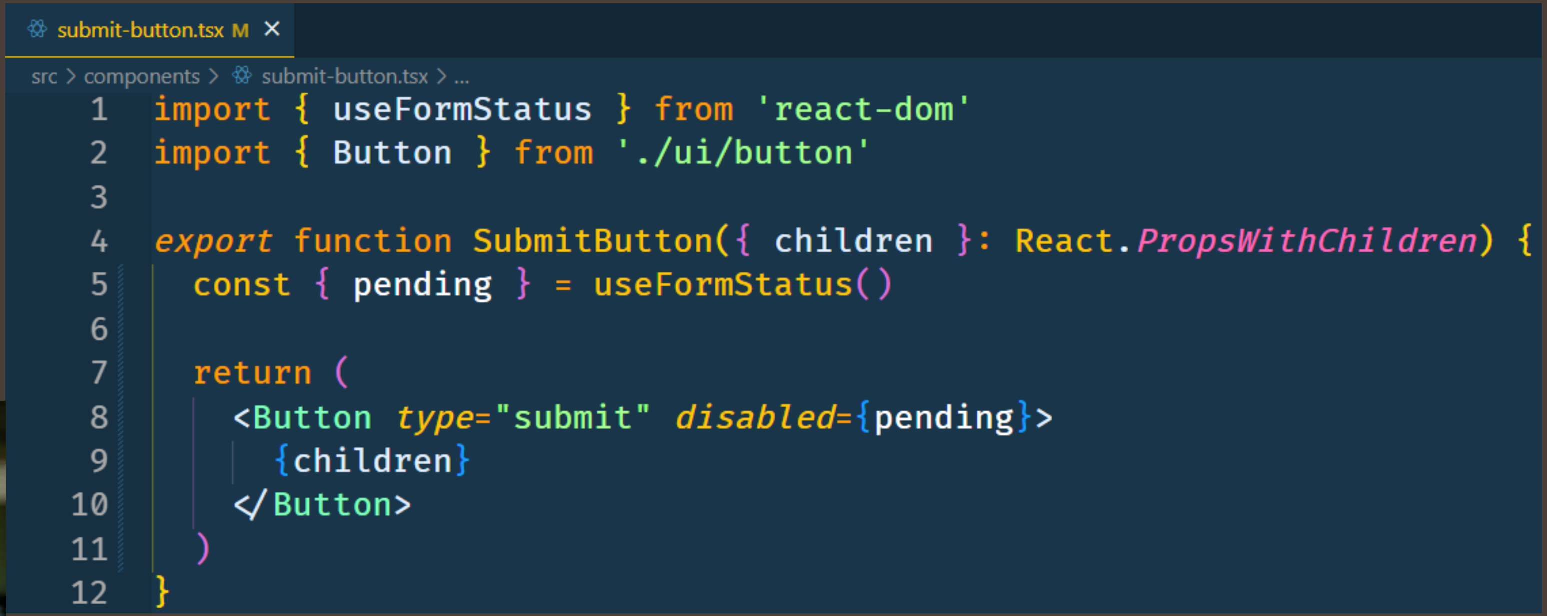
Ctrl+K to generate a command
main* Launchpad 0 1 0 Live Share You, 1 second ago Reviewing Ln 1, Col

# The useFormStatus() hook

## useFormStatus hook

- The **useFormStatus()** hook gives **information about form submition**
  - The pending status let’s you know if a submit is active
- ☞ Must be in a component that is **rendered as child from the <form>** ☜

## src\components\submit-button.tsx


submit-button.tsx M ×

src > components > submit-button.tsx > ...

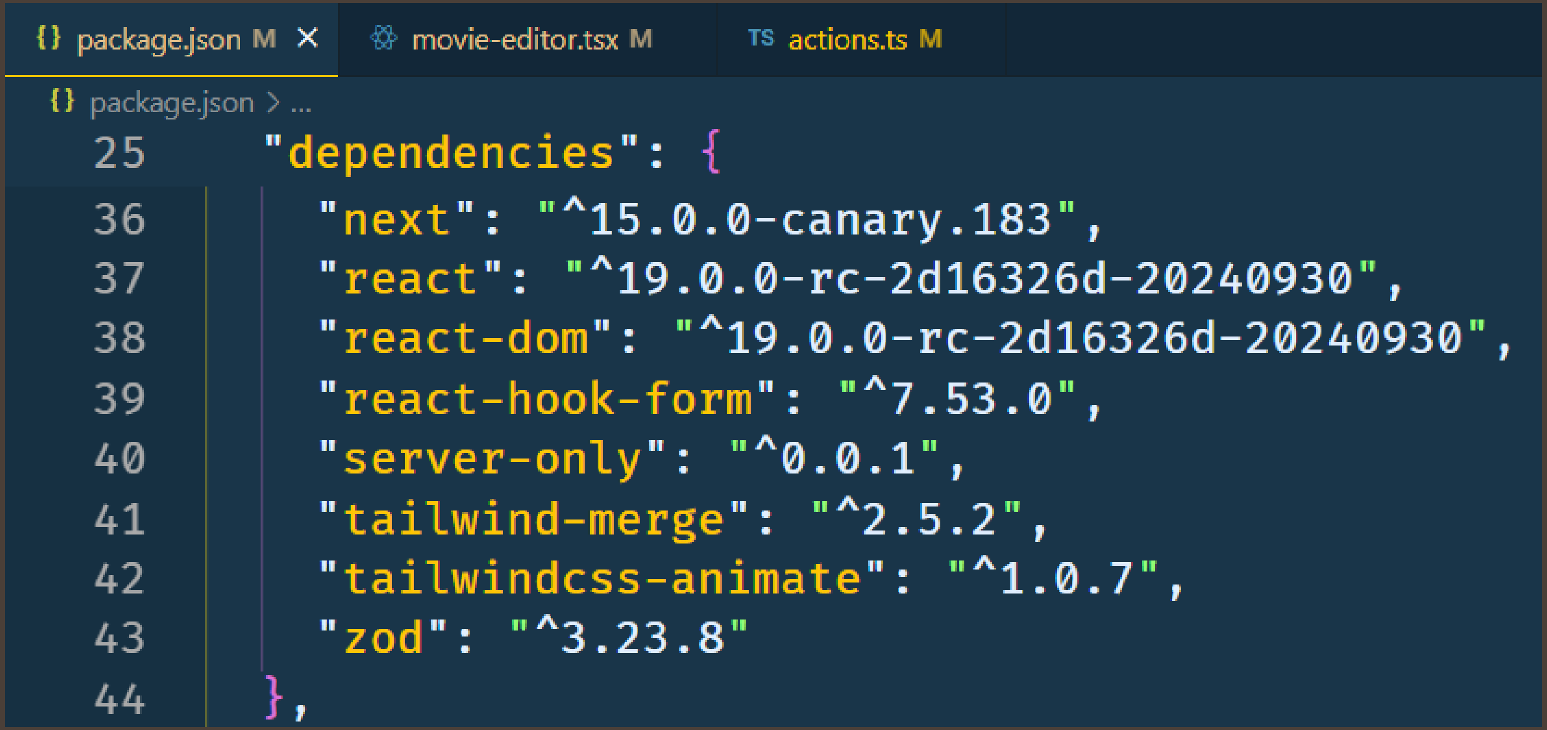
```tsx
import { useFormStatus } from 'react-dom'
import { Button } from './ui/button'

export function SubmitButton({ children }: React.PropsWithChildren) {
  const { pending } = useFormStatus()

  return (
    <Button type="submit" disabled={pending}>
      {children}
    </Button>
  )
}
```

## The useActionState() hook

## useActionState hook

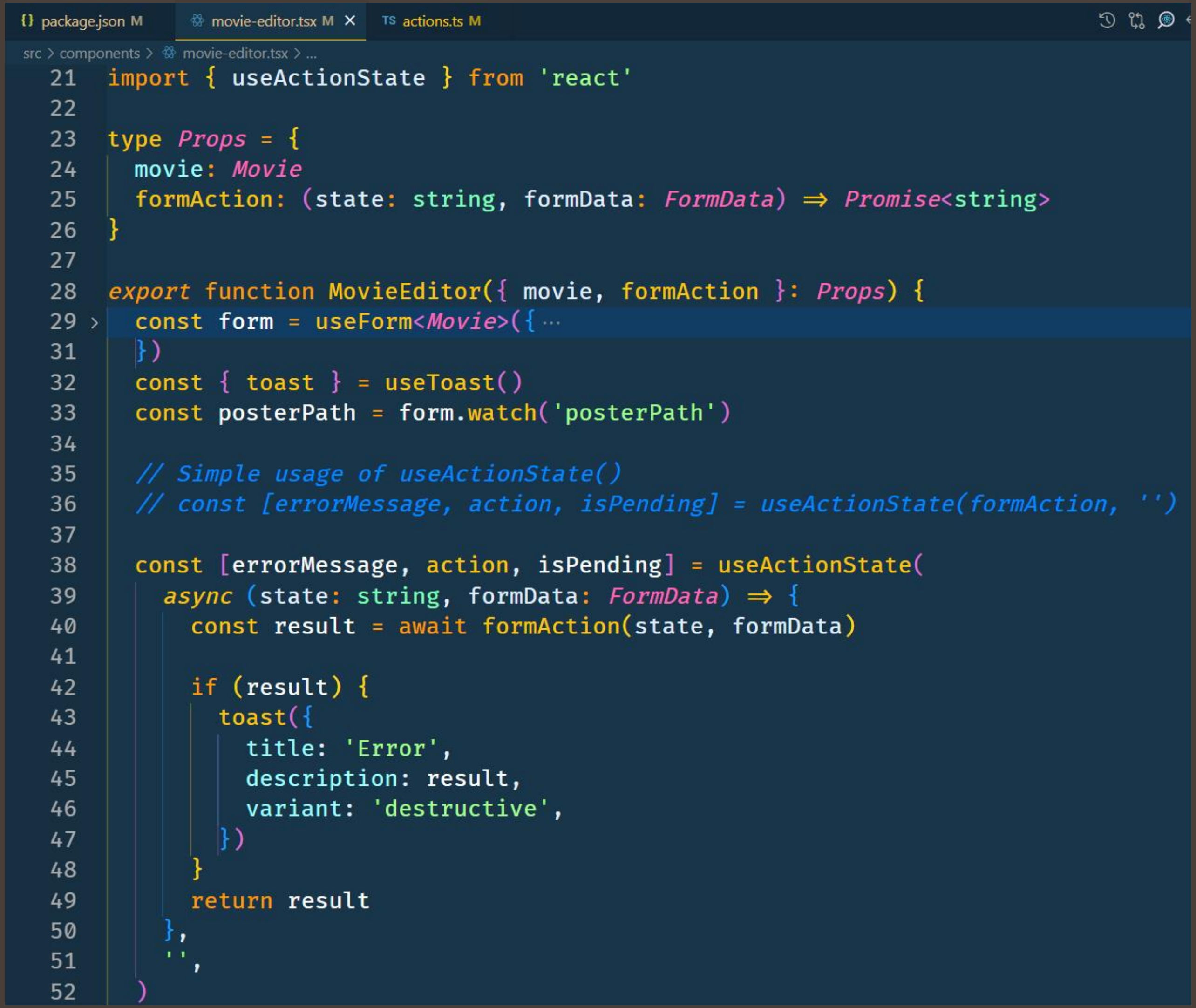
- Updates component **state based on the result of a form action**
  - The state round trips to the action function
  - Useful for form validation etc
- ☞ Note: **useFormState** for now with **production React/Next.js**! ☜
  - Doesn’t expose an isPending status

## package.json



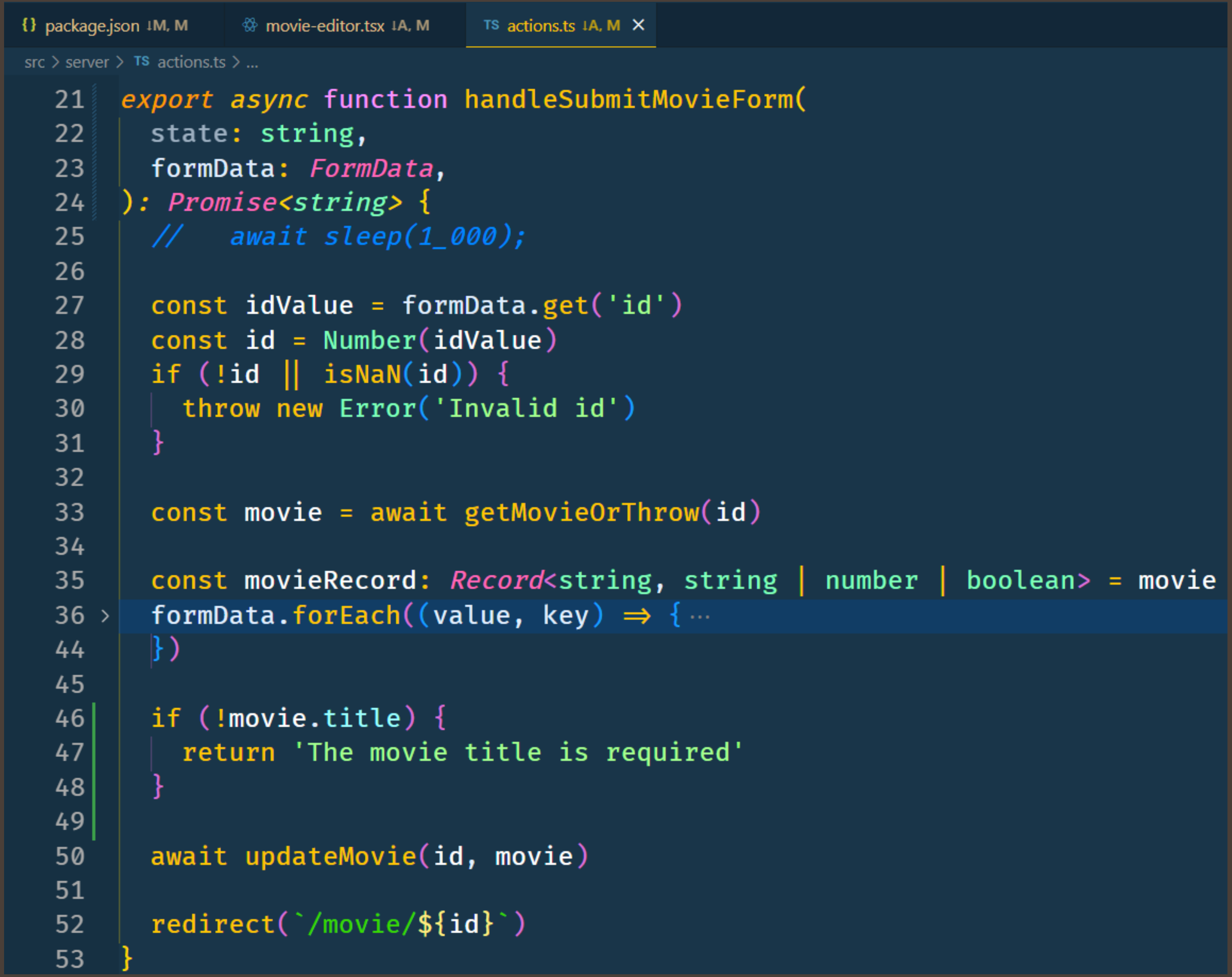
```json
  "dependencies": {
    "next": "^15.0.0-canary.183",
    "react": "^19.0.0-rc-2d16326d-20240930",
    "react-dom": "^19.0.0-rc-2d16326d-20240930",
    "react-hook-form": "^7.53.0",
    "server-only": "^0.0.1",
    "tailwind-merge": "^2.5.2",
    "tailwindcss-animate": "^1.0.7",
    "zod": "^3.23.8"
  },
```

## src\components\movie-editor.tsx



```tsx
import { useActionState } from 'react'

type Props = {
  movie: Movie
  formAction: (state: string, formData: FormData) => Promise<string>
}

export function MovieEditor({ movie, formAction }: Props) {
  const form = useForm<Movie>({ ···
  })
  const { toast } = useToast()
  const posterPath = form.watch('posterPath')

  // Simple usage of useActionState()
  // const [errorMessage, action, isPending] = useActionState(formAction, '')

  const [errorMessage, action, isPending] = useActionState(
    async (state: string, formData: FormData) => {
      const result = await formAction(state, formData)

      if (result) {
        toast({
          title: 'Error',
          description: result,
          variant: 'destructive',
        })
      }
      return result
    },
    '',
  )
```

src\server\actions.ts



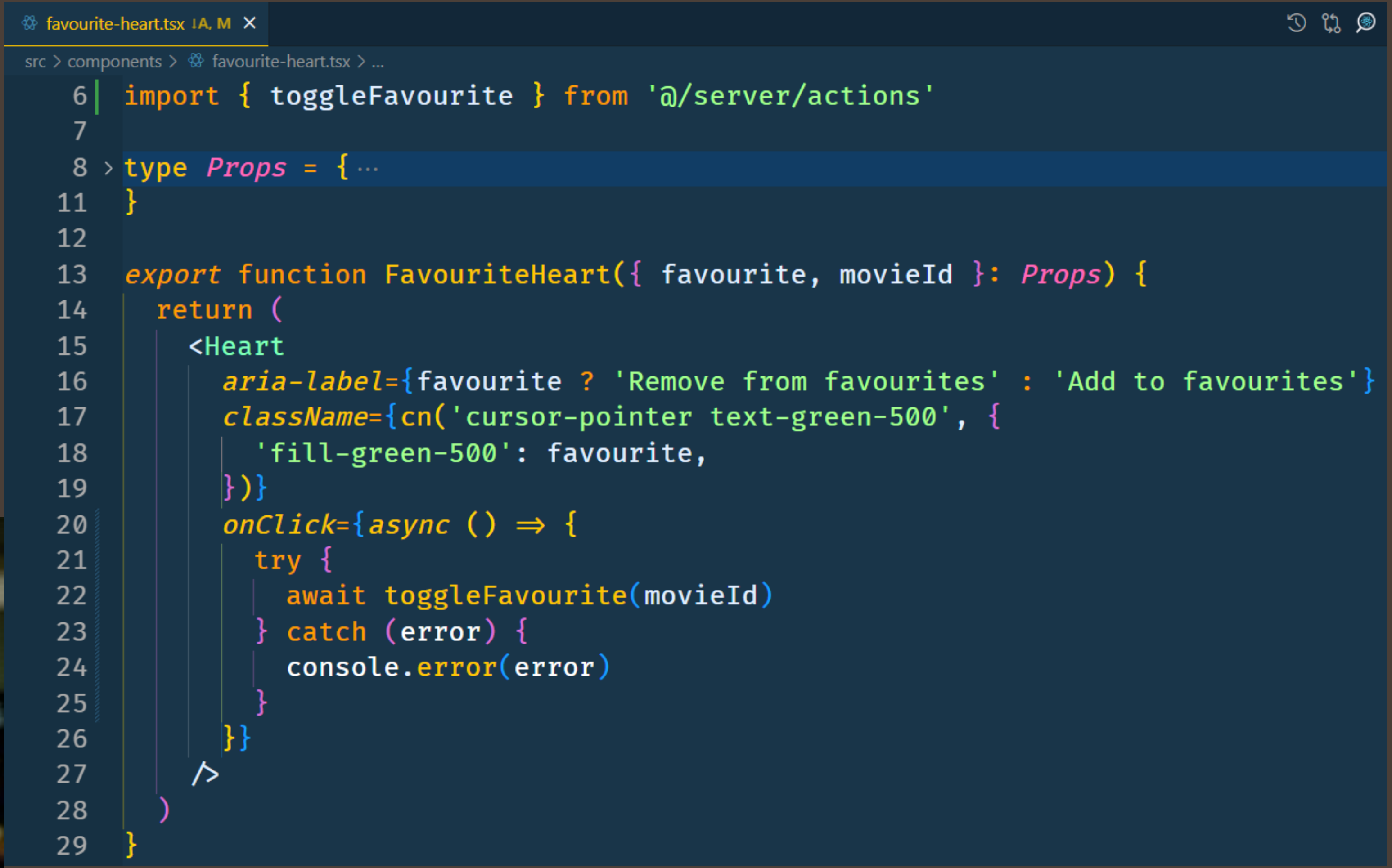
```
export async function handleSubmitMovieForm(
  state: string,
  formData: FormData,
): Promise<string> {
  //   await sleep(1_000);

  const idValue = formData.get('id')
  const id = Number(idValue)
  if (!id || isNaN(id)) {
    throw new Error('Invalid id')
  }

  const movie = await getMovieOrThrow(id)

  const movieRecord: Record<string, string | number | boolean> = movie
  formData.forEach((value, key) => { ···
  })

  if (!movie.title) {
    return 'The movie title is required'
  }

  await updateMovie(id, movie)

  redirect(`/movie/${id}`)
}
```

## Manually calling a server action

## Manually calling a server action

- Server actions act as **normal asynchronous functions**
  - Makes the boundary between server and client almost transparent
- **Call like a normal async function** when needed
  - The network call is handled for you
- Return **any result you want**
  - As long as it can be serialized to JSON
- **Don’t use throw new Error(‘Some message’)**
  - ☞ Error messages are hidden in a production build ☜

src\components\favourite-heart.tsx


favourite-heart.tsx !A, M
src > components > favourite-heart.tsx > ...

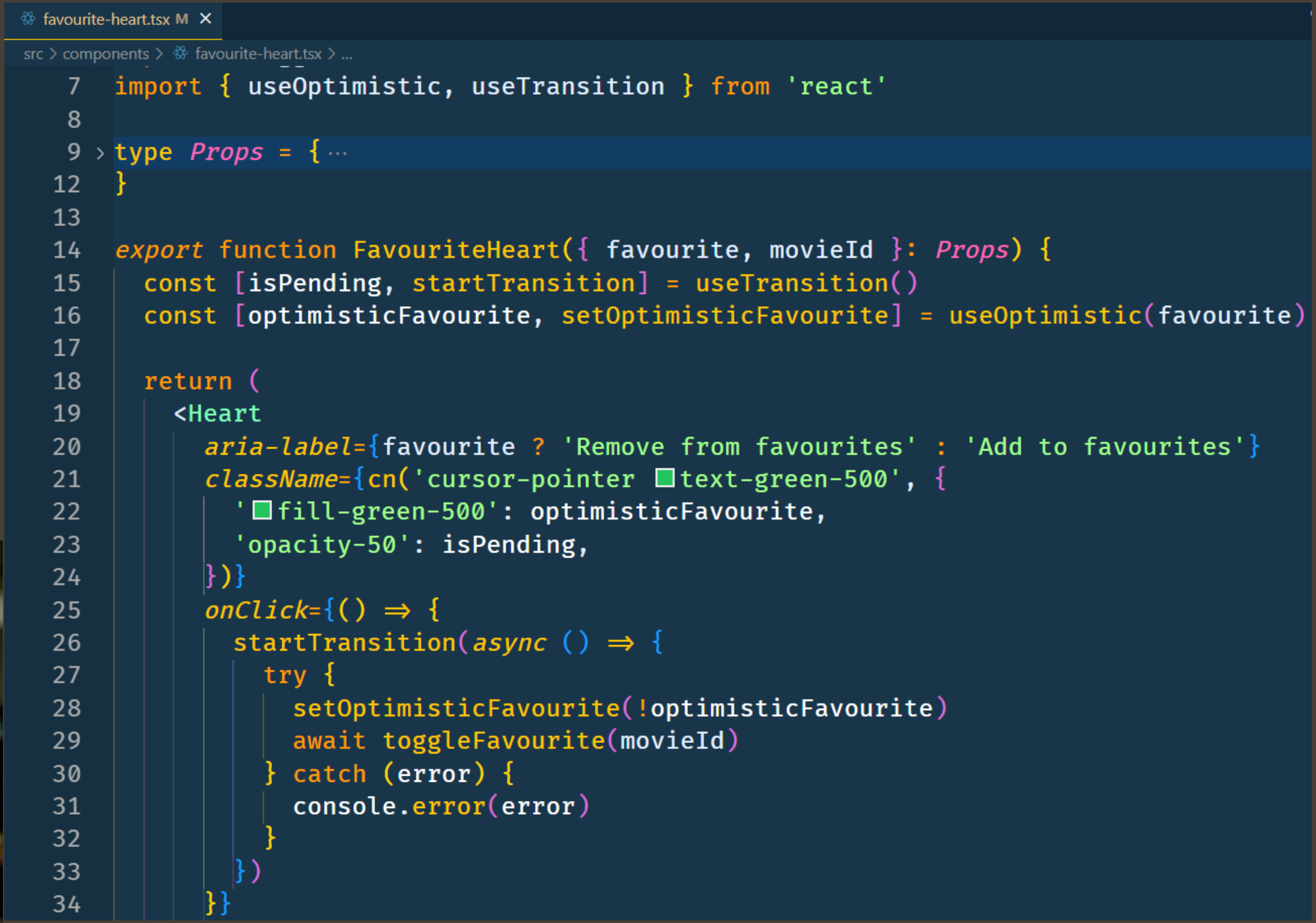
```tsx
import { toggleFavourite } from '@/server/actions'

type Props = {…
}

export function FavouriteHeart({ favourite, movieId }: Props) {
  return (
    <Heart
      aria-label={favourite ? 'Remove from favourites' : 'Add to favourites'}
      className={cn('cursor-pointer text-green-500', {
        'fill-green-500': favourite,
      })}
      onClick={async () => {
        try {
          await toggleFavourite(movieId)
        } catch (error) {
          console.error(error)
        }
      }}
    />
  )
}
```

## The useOptimistic() hook

## useOptimistic hook

- Create more **responsive user interfaces**
    - Immediately update the UI with an optimistic state before an asynchronous action
- Use whatever **optimistic state** you want
    - Automatically updated when the action completes

src\components\
favourite-heart.tsx


favourite-heart.tsx M ✕

src > components > favourite-heart.tsx > ...

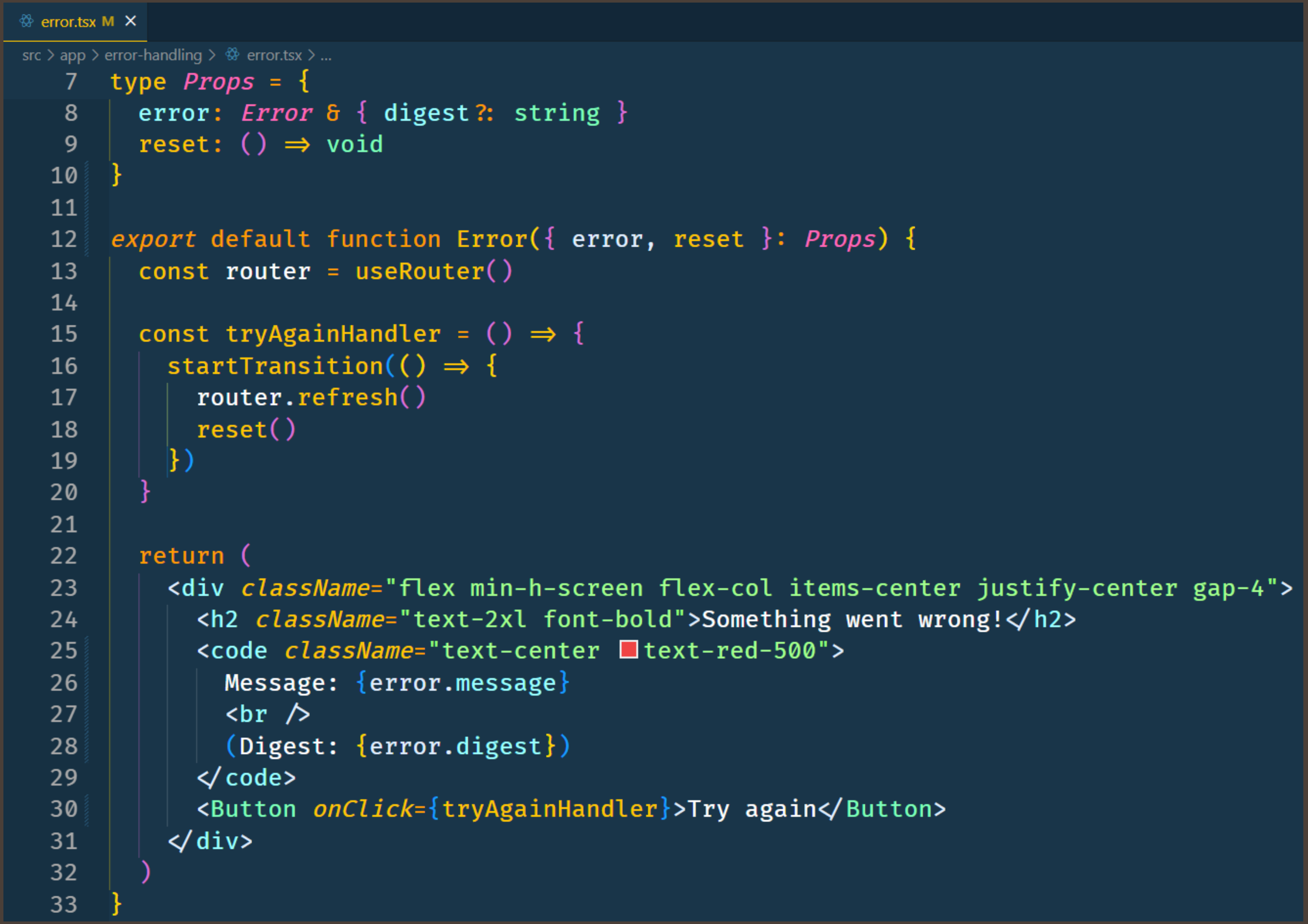
```tsx
import { useOptimistic, useTransition } from 'react'

type Props = {…
}

export function FavouriteHeart({ favourite, movieId }: Props) {
  const [isPending, startTransition] = useTransition()
  const [optimisticFavourite, setOptimisticFavourite] = useOptimistic(favourite)

  return (
    <Heart
      aria-label={favourite ? 'Remove from favourites' : 'Add to favourites'}
      className={cn('cursor-pointer 🟩text-green-500', {
        '🟩fill-green-500': optimisticFavourite,
        'opacity-50': isPending,
      })}
      onClick={() ⇒ {
        startTransition(async () ⇒ {
          try {
            setOptimisticFavourite(!optimisticFavourite)
            await toggleFavourite(movieId)
          } catch (error) {
            console.error(error)
          }
        })
      }}
```

## Error handling & retrying

## Error handling & retrying

- An **ErrorBoundary will catch errors** in React Server Components
  - The normal expected React behavior
- Next.js makes it easy to **catch errors**
  - **Add a error.tsx** next to the page.tsx
  - They can be nested and the closest will be used

## src\app\error-handling\error.tsx



error.tsx M

src > app > error-handling > error.tsx > ...

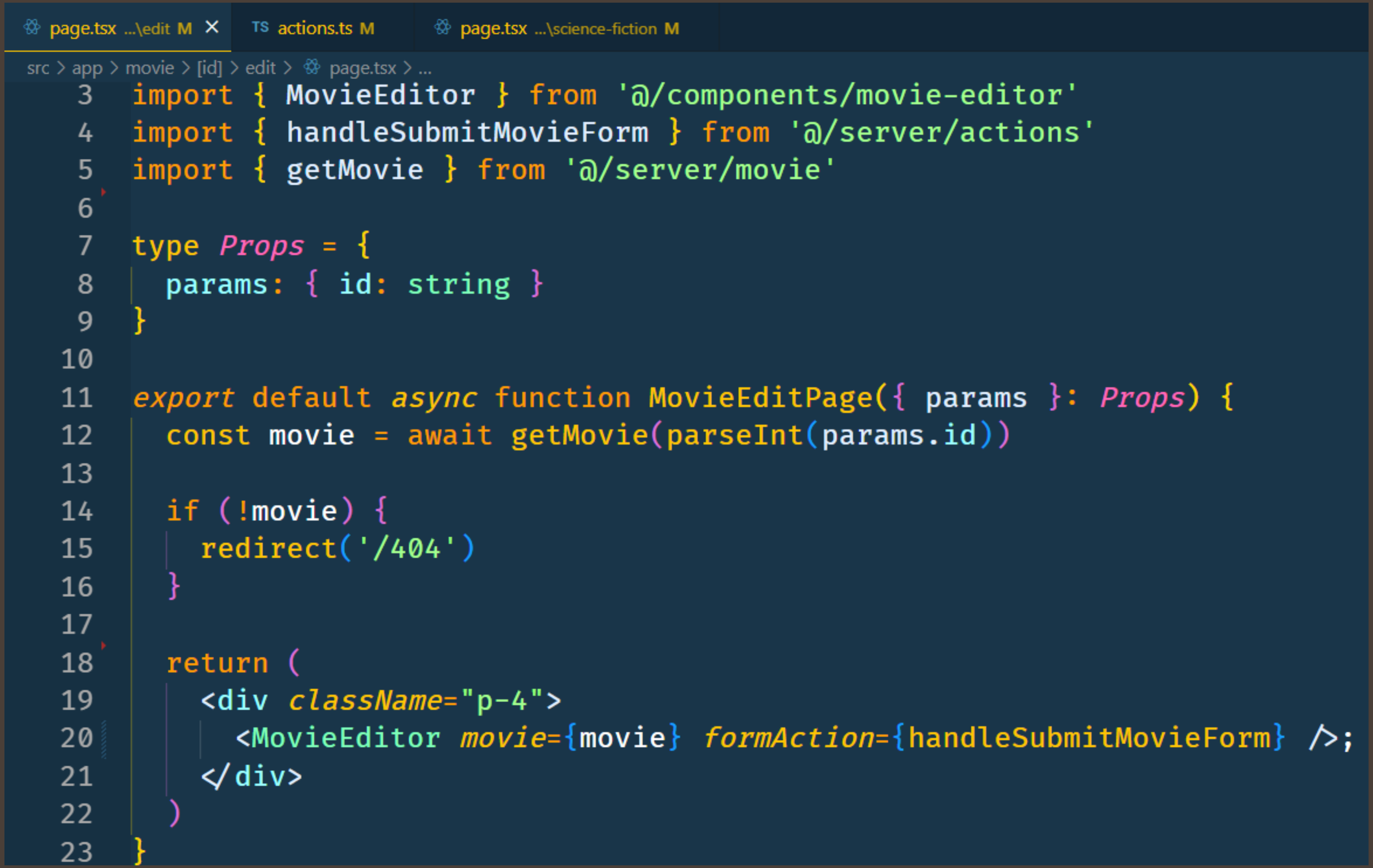
```tsx
type Props = {
  error: Error & { digest?: string }
  reset: () => void
}

export default function Error({ error, reset }: Props) {
  const router = useRouter()

  const tryAgainHandler = () => {
    startTransition(() => {
      router.refresh()
      reset()
    })
  }

  return (
    <div className="flex min-h-screen flex-col items-center justify-center gap-4">
      <h2 className="text-2xl font-bold">Something went wrong!</h2>
      <code className="text-center text-red-500">
        Message: {error.message}
        <br />
        (Digest: {error.digest})
      </code>
      <Button onClick={tryAgainHandler}>Try again</Button>
    </div>
  )
}
```

## Cleaning up the code

## Cleaning up the code

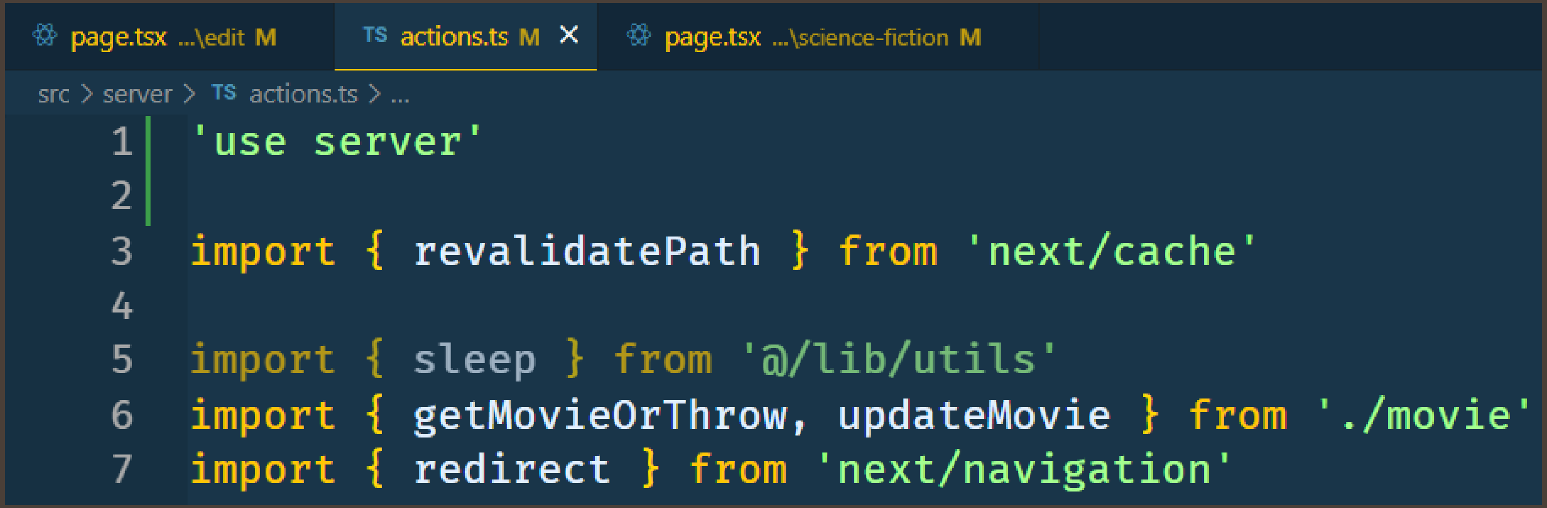
- It's considered a **best practice** not to put server logic in the UI
    - Server actions typically go into a separate actions.ts

src\app\movie
[id]\edit\
page.tsx


page.tsx ...\edit M
actions.ts M
page.tsx ...\science-fiction M
src > app > movie > [id] > edit > page.tsx > ...

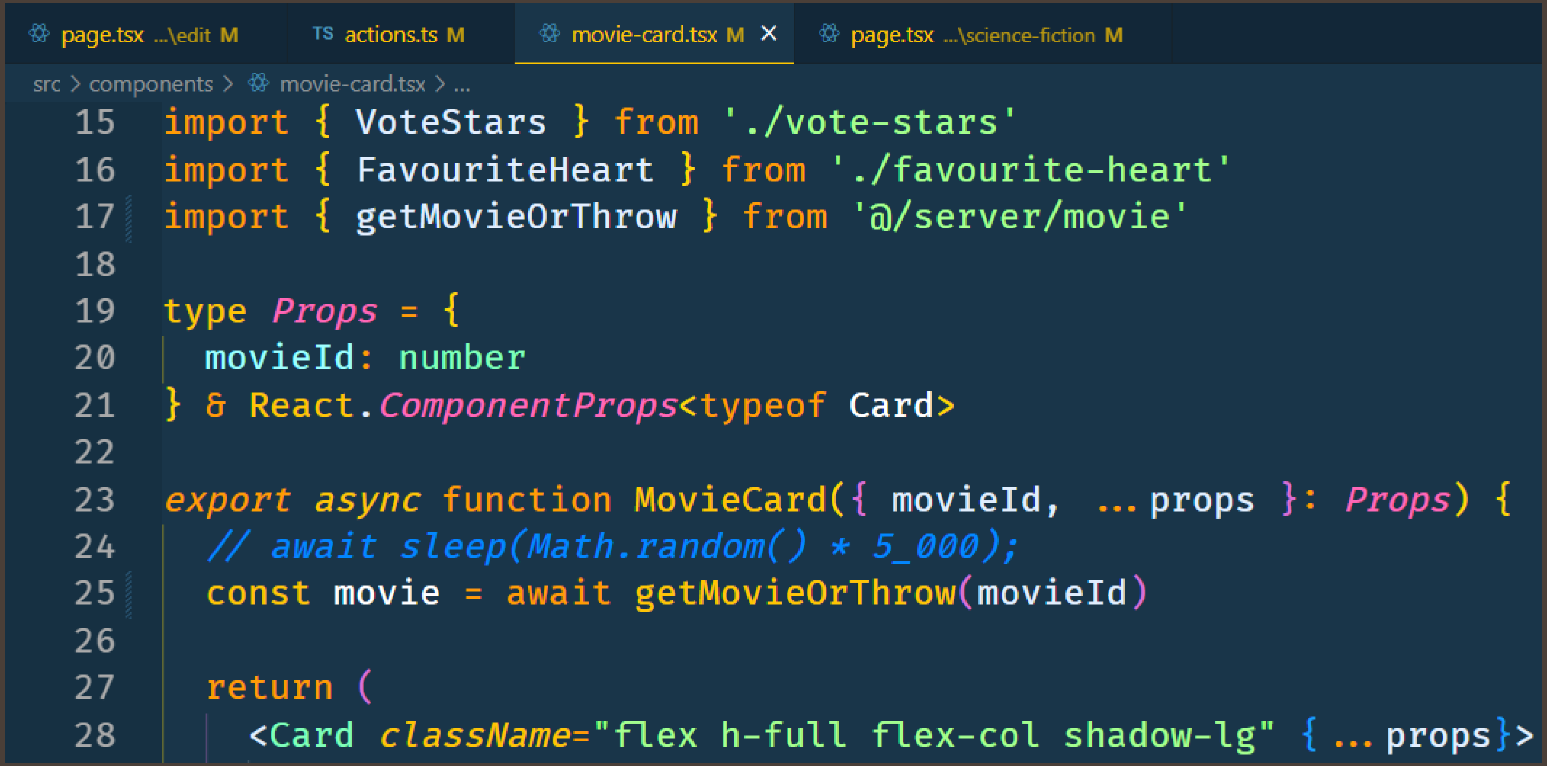
```tsx
import { MovieEditor } from '@/components/movie-editor'
import { handleSubmitMovieForm } from '@/server/actions'
import { getMovie } from '@/server/movie'

type Props = {
  params: { id: string }
}

export default async function MovieEditPage({ params }: Props) {
  const movie = await getMovie(parseInt(params.id))

  if (!movie) {
    redirect('/404')
  }

  return (
    <div className="p-4">
      <MovieEditor movie={movie} formAction={handleSubmitMovieForm} />;
    </div>
  )
}
```

## src\server\ actions.ts


page.tsx ...\edit M
TS actions.ts M ×
page.tsx ...\science-fiction M
src > server > TS actions.ts > ...

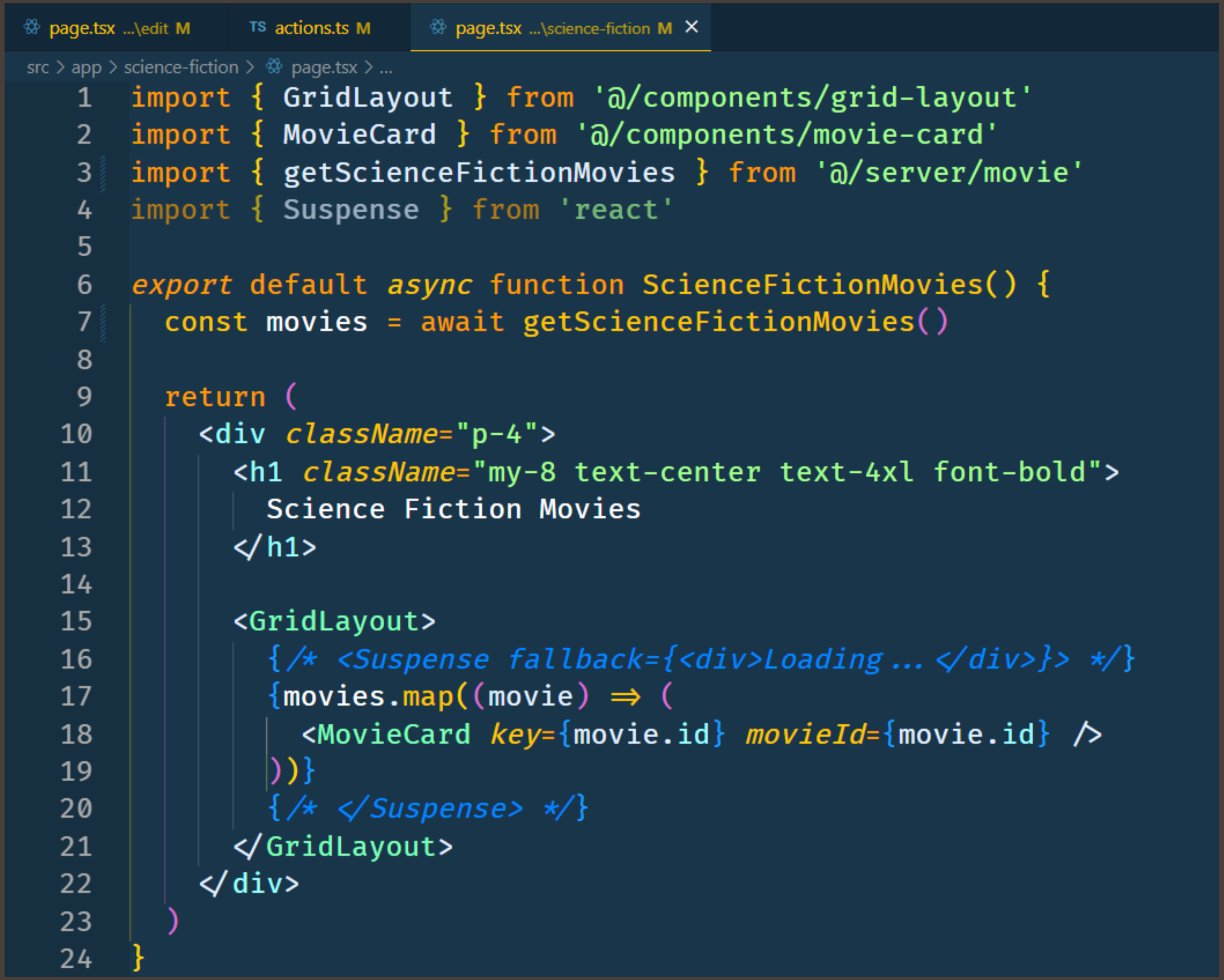
```ts
'use server'

import { revalidatePath } from 'next/cache'

import { sleep } from '@/lib/utils'
import { getMovieOrThrow, updateMovie } from './movie'
import { redirect } from 'next/navigation'
```

src\components\movie-card.tsx


page.tsx ...\edit M
actions.ts M
movie-card.tsx M
page.tsx ...\science-fiction M
src > components > movie-card.tsx > ...

```tsx
import { VoteStars } from './vote-stars'
import { FavouriteHeart } from './favourite-heart'
import { getMovieOrThrow } from '@/server/movie'

type Props = {
  movieId: number
} & React.ComponentProps<typeof Card>

export async function MovieCard({ movieId, ...props }: Props) {
  // await sleep(Math.random() * 5_000);
  const movie = await getMovieOrThrow(movieId)

  return (
    <Card className="flex h-full flex-col shadow-lg" {...props}>
```

src\app\
science-fiction\
pa


page.tsx ...\edit M
actions.ts M
page.tsx ...\science-fiction M
src > app > science-fiction > page.tsx > ...

```tsx
import { GridLayout } from '@/components/grid-layout'
import { MovieCard } from '@/components/movie-card'
import { getScienceFictionMovies } from '@/server/movie'
import { Suspense } from 'react'

export default async function ScienceFictionMovies() {
  const movies = await getScienceFictionMovies()

  return (
    <div className="p-4">
      <h1 className="my-8 text-center text-4xl font-bold">
        Science Fiction Movies
      </h1>

      <GridLayout>
        {/* <Suspense fallback={<div>Loading ... </div>}> */}
        {movies.map((movie) => (
          <MovieCard key={movie.id} movieId={movie.id} />
        ))}
        {/* </Suspense> */}
      </GridLayout>
    </div>
  )
}
```

## Recommendations with React Server Components

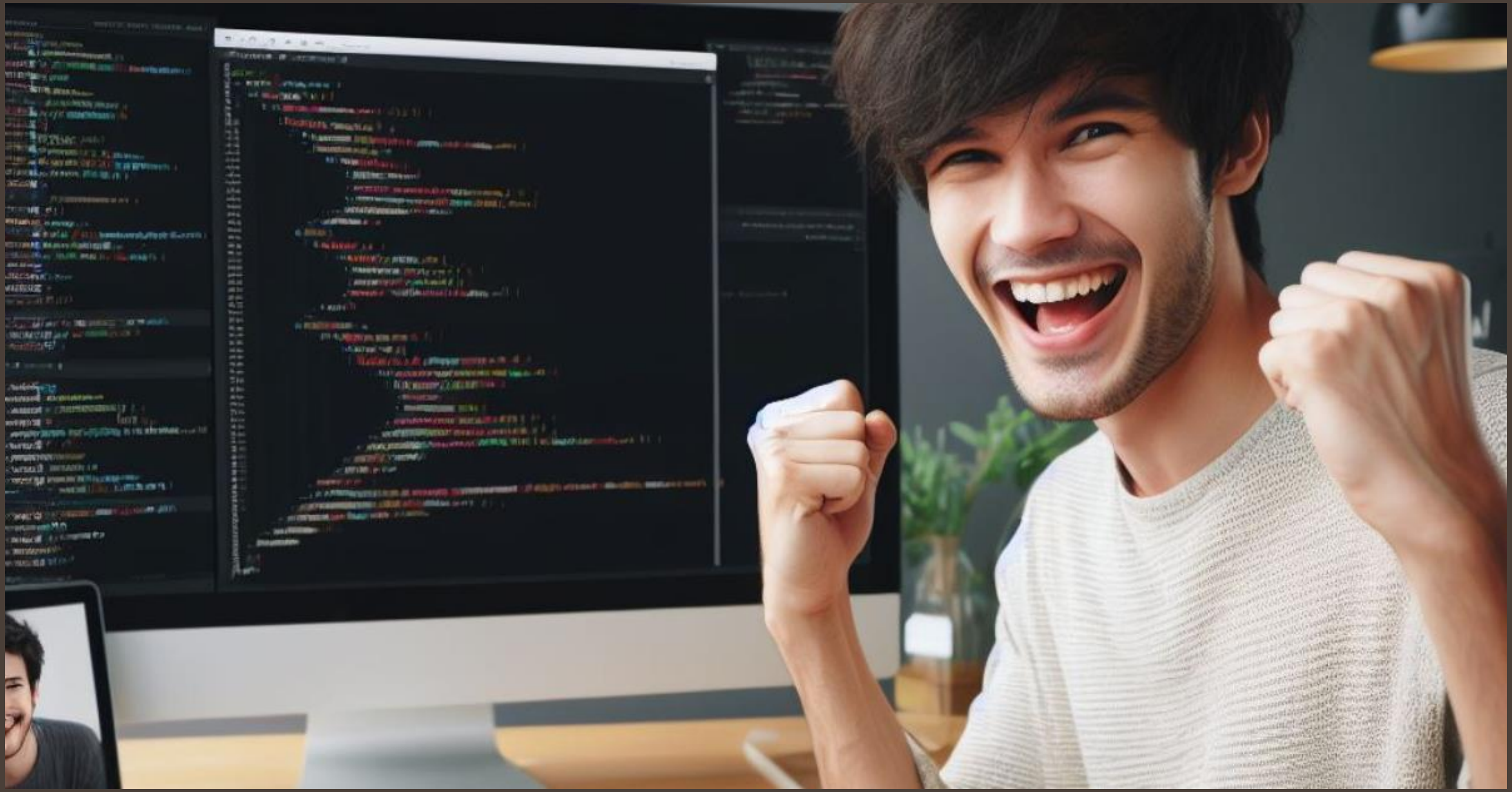
## Recommendations

- **Start with Shared** components
  - Can run on the server or client as needed
  - Will default to act as Server Components
- Switch to **Server only components if needed**
  - When you need to use server side capabilities
- Only use **Client only components when absolutely needed**
  - Local state or side effects
  - Interactivity
  - Required browser API's
- Learn all about the **new capabilities of Next.js**
  - App Router

## Conclusion

- React Server Components are a **great new addition to React**
  - Helps with keeping the client more responsive
  - Makes the application architecture easier
- **Use Next.js and the App Router**
  - Because you need a server
- React **Client Components**
  - Are components with state and interactivity and require 'use client'
- **React Server Components are streamed**
  - And use Suspense boundaries until they are done
- **Server Actions** are a great way to call back into the server
  - They also update the invalidated server components on the client

Thank you for joining



Share your thoughts