

Turborepo and Monorepos 1 of 18

What are monorepos

As the name suggests, a single repository (on github lets say) that holds all your frontend, backend, devops code.

Few repos that use monorepos are -

1. <https://github.com/code100x/daily-code>

The screenshot shows the GitHub repository 'code100x / daily-code'. The 'Code' tab is active. The commit history lists several commits from 'hkirat'. The commits are organized into three main categories: '.husky', 'apps', and 'packages', which are highlighted with a red box. The commits are as follows:

- more lint commit message (last month)
- Appbar and Trackcard (last month)
- Fixed the nav bar so it doesn't disappear when scrolling (last month)

1. <https://github.com/calcom/cal.com>

The screenshot shows the GitHub repository 'calcom / cal.com'. The 'Code' tab is active. The commit history lists many commits from 'emrysal v3.9.0'. The commits are organized into various directories such as '.changeset', '.github', '.husky', '.snaplet', '.vscode', '.well-known', '.yarn', and '_checks_'. Within these, specific sub-directories like 'apps', 'deploy', 'infra', and 'packages' are highlighted with a red box. The commits are as follows:

- Add changesets/cli to release embed (#8126) (10 months ago)
- Fix Misspelled in .github/PULL_REQUEST_TEMPLATE (#1...) (yesterday)
- chore: cleanup .husky directory (#11583) (6 months ago)
- upgrades copycat (last month)
- chore: Settings update (3 months ago)
- chore: create security.txt (#13454) (last month)
- perf: yarn patch dayjs (#13542) (last month)
- test: Bookings: Add more automated tests for organizatio... (last month)
- v3.9.0 (1 hour ago)
- docs: Adds deployment guides for AWS, GCP and Azure (...) (last month)
- Update api image Dockerfile (#13890) (2 weeks ago)
- refactor: Moving credential syncing to API (#13963) (4 hours ago)
- fix: update inlang settings.json (#13295) (2 months ago)
- fix: deploy script (3 months ago)

Do you need to know them very well as a full stack engineer

Not exactly. Most of the times they are setup in the project already by the

- ☰ Turborepo and Monorepos 1 of 18 follow the right practises

Good to know how to set one up from scratch though

Why Monorepos?

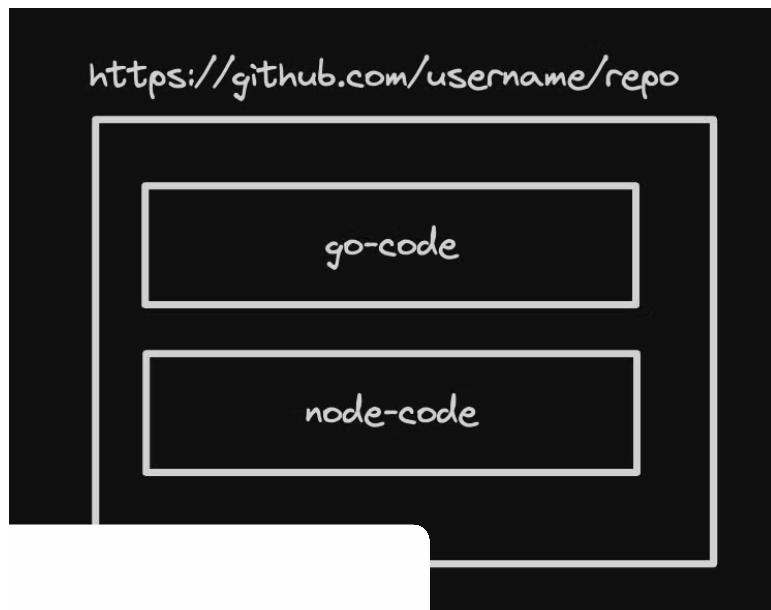
Why not Simple folders?

Why cant I just store services (backend, frontend etc) in various top level folders?

You can, and you should if your

1. Services are highly decoupled (dont share any code)
2. Services don't depend on each other.

For eg - A codebase which has a Golang service and a JS service



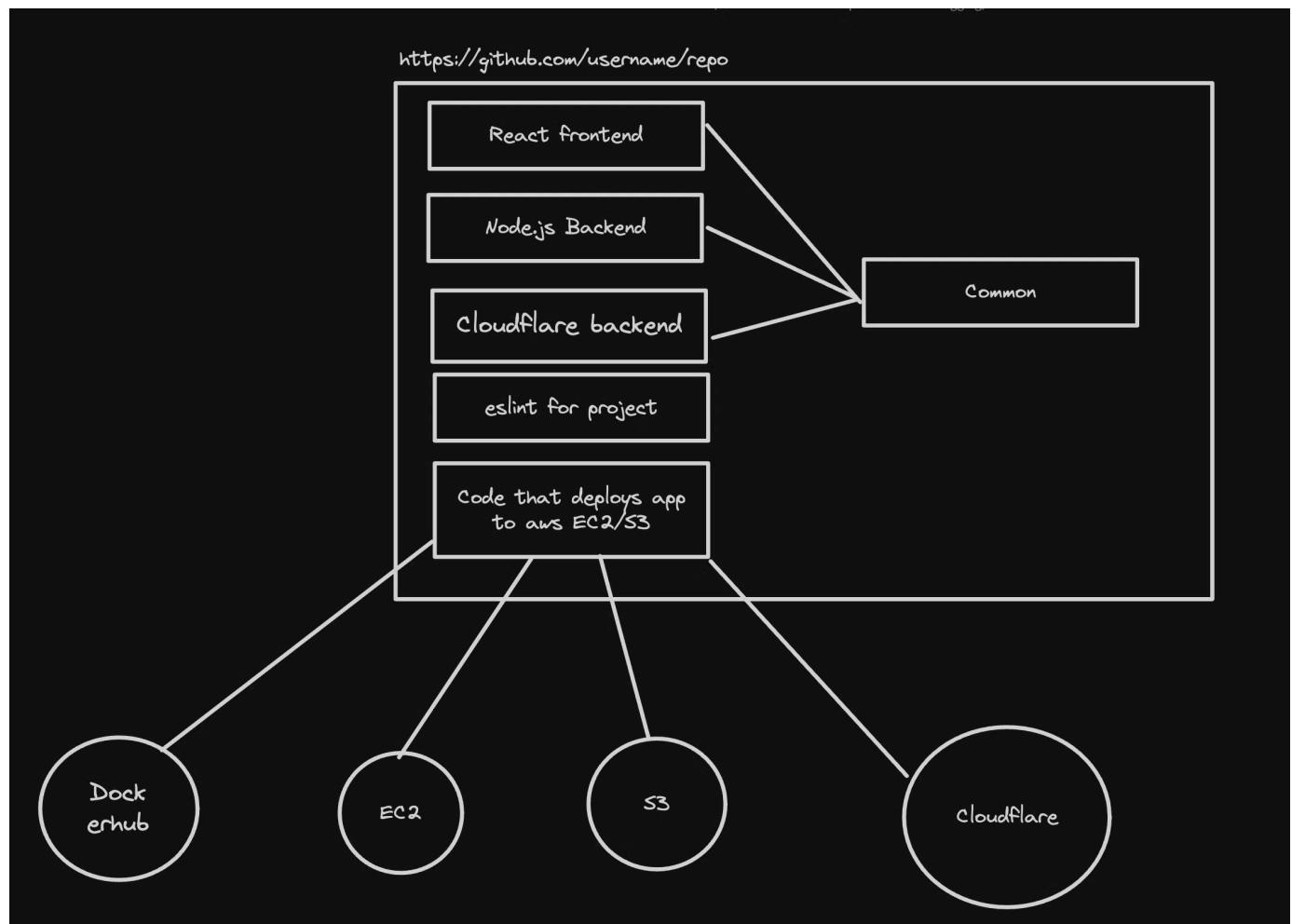
Why monorepos?

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2. Enhanced Collaboration

3. Optimized Builds and CI/CD: Tools like TurboRepo offer smart caching and task execution strategies that can significantly reduce build and testing times.

4. Centralized Tooling and Configuration: Managing build tools, linters, formatters, and other configurations is simpler in a monorepo because you can have a single set of tools for the entire project.



Common monorepo Turborepo and Monorepos 1 of 18

framework in Node.js

1. Lerna - <https://lerna.js.org/>
2. nx - <https://github.com/nrwl/nx>
3. Turborepo - <https://turbo.build/> – Not exactly a monorepo framework
4. Yarn/npm workspaces –
<https://classic.yarnpkg.com/lang/en/docs/workspaces/>

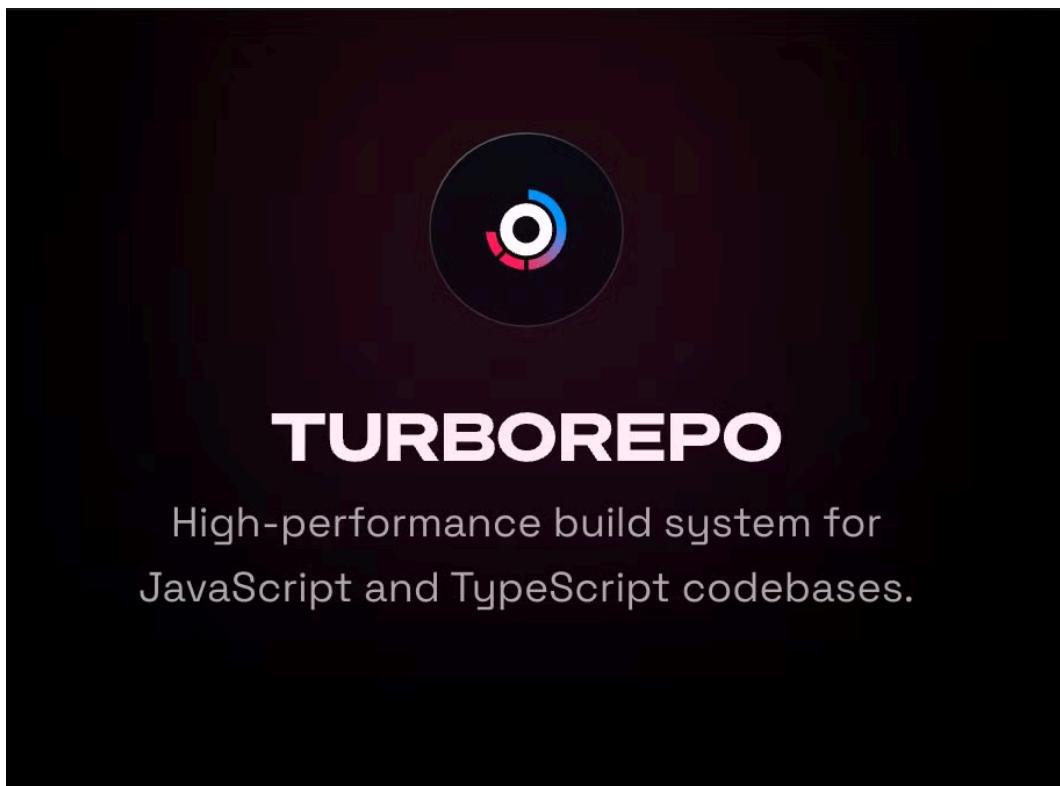
We'll be going through turborepo since it's the most relevant one today and provides more things (like build optimisations) that others don't



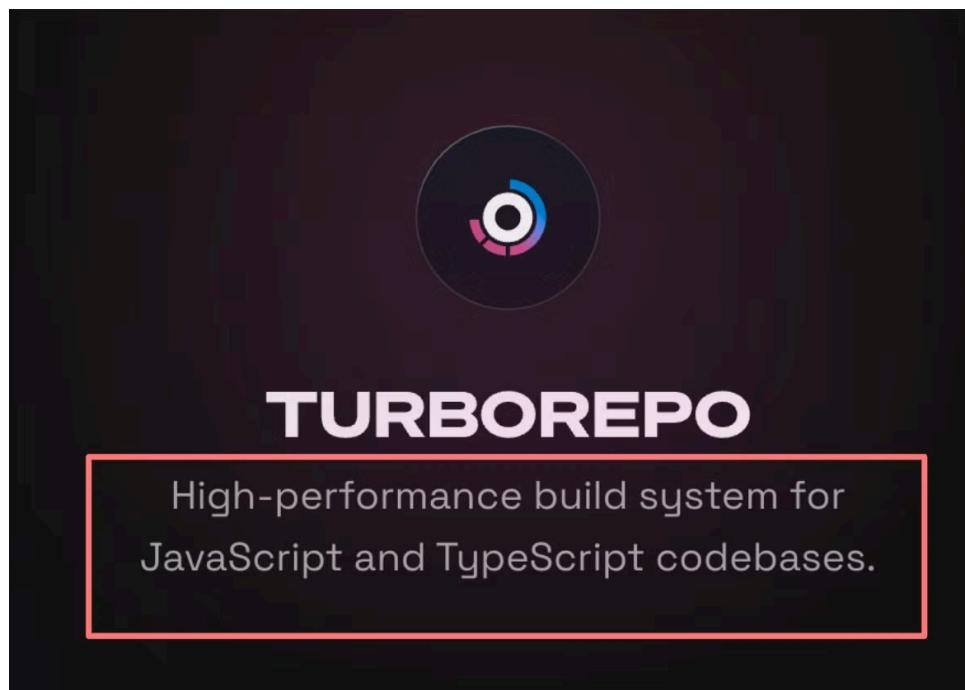


History of Turborepo

1. Created by [Jared Palmer](#)
2. In December 2021 Acquired/aqui-hired by [Vercel](#)
3. Mild speculation/came from a random source - Pretty hefty deal!
4. They've built a bunch of products, Turborepo is the most used one



Build system vs Build system orchestrator vs Monorepo framework



Build System

A build system automates the process of transforming source code written by developers into binary code that can be executed by a computer. For JavaScript and TypeScript projects, this process can include transpilation (converting TS to JS), bundling (combining multiple files into fewer files), and minification (removing unnecessary characters). A build system might also handle deployment, such as pushing generated files to a server or building a static website.

Build System Orchestrator

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A build system orchestrator rather than a direct build system itself. It doesn't directly perform tasks like transpilation, bundling, minification, or running tests. Instead, TurboRepo allows you to define tasks in your monorepo that call other tools (which are the actual build systems) to perform these actions.

These tools can include anything from tsc, vite etc

Monorepo Framework

A monorepo framework provides tools and conventions for managing projects that contain multiple packages or applications within a single repository (monorepo). This includes dependency management between packages, workspace configuration.

Turborepo as a build system orchestrator

Turborepo is a **build system orchestrator**.

The key feature of TurboRepo is its ability to manage and optimize the execution of these tasks across your monorepo. It does this through:

- 1. Caching:** TurboRepo caches the outputs of tasks, so if you run a task and then run it again without changing any of the inputs (source files, dependencies, configuration), TurboRepo can skip the actual execution (ie. This can significantly speed up build times, especially in continuous integration environments).

2 **Parallelization:** It can run independent tasks in parallel, making efficient
☰ → Turborepo and Monorepos 1 of 18 This reduces the overall time needed to complete all tasks in your project.

3. **Dependency Graph Awareness:** TurboRepo understands the dependency graph of your monorepo. This means it knows which packages depend on each other and can ensure tasks are run in the correct order.

Let's initialize a simple Turborepo

Ref <https://turbo.build/repo/docs>

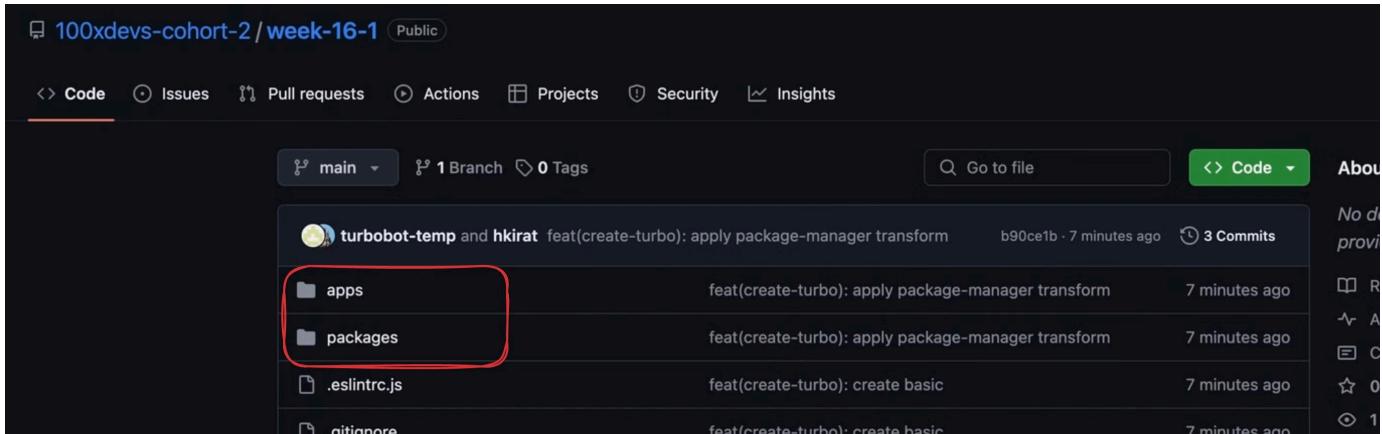
1. Initialize a Turborepo

`npx create-turbo@latest`

1. Select **npm workspaces** as the monorepo framework

💡 If you’re following along locally, remember that you can close this starter from the terminal by running `npm install` inside the root folder.

By the end, you will notice a folder structure that looks like this –



Explore the folder structure

There are 5 modules in our project

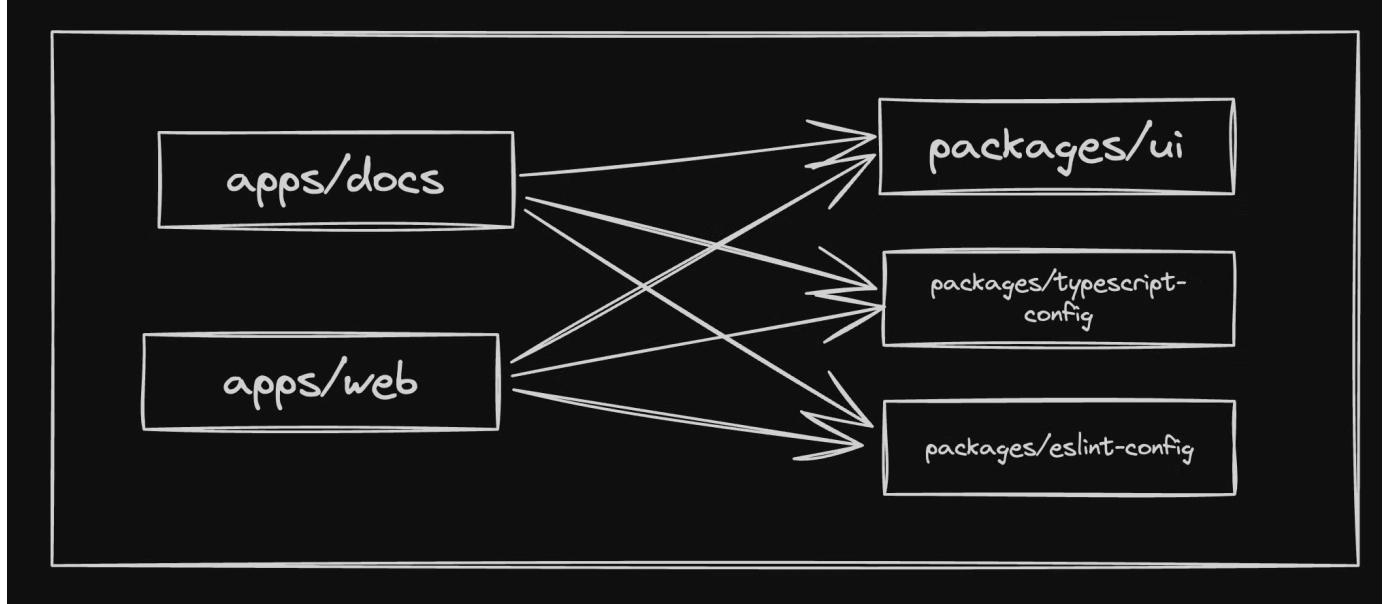
End user apps (websites/core backend)

1. **apps/web** – A Next.js website
2. **apps/docs** – A Docs website that has all the documentation related to your project

1 packages/ui - UI packages

Turborepo and Monorepos 1 of 18 Shareable TS configuration

3. packages/eslint-config - Shareable ESLint configuration



Let's try to run the project

In the root folder, run

```
npm run dev
```



You might have to upgrade your node.js version

```
web:dev:  
web:dev: You are using Node.js 18.1.0. For Next.js, Node.js version >= v18.17.0 is required.  
docs:dev: You are using Node.js 18.1.0. For Next.js, Node.js version >= v18.17.0 is required.  
command (/Users/kirat/Projects/project/apps/web)
```

Y ⏪ || Turborepo and Monorepos 1 of 18 | on

1. localhost:3000

2. localhost:3001

This means we have a single `repo` which has multiple `projects` which share code from `packages/ui`

Exploring root package.json

```
{> package.json > ...}
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  name: "project",
  "private": true,
  ▷ Debug
  "scripts": {
    "build": "turbo build",
    "dev": "turbo dev",
    "lint": "turbo lint",
    "format": "prettier --write \"**/*.{ts,tsx,md}\""
  },
  "devDependencies": {
    "@repo/eslint-config": "*",
    "@repo/typescript-config": "*",
    "prettier": "^3.2.5",
    "turbo": "latest"
  },
  "engines": {
    "node": ">=18"
  },
  "packageManager": "npm@7.24.2",
  "workspaces": [
    "apps/*",
    "packages/*"
  ]
}
```

scripts

This represents what command runs when you run

1. npm run build
2. npm run dev
3. npm run lint

turbo build goes into all packages and apps and runs **npm run build** inside them (provided they have it)

Exploring packages/ui

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1. package.json

```
{  
  "name": "@repo/ui", → Name of package (eg @100x/ui)  
  "version": "0.0.0",  
  "private": true,  
  "exports": {  
    "./button": "./src/button.tsx",  
    "./card": "./src/card.tsx",  
    "./code": "./src/code.tsx"  
  }, → What all this package exports  
}
```

2. src/button.tsx

```
"use client"; → client component  
  
import { ReactNode } from "react";  
  
interface ButtonProps {  
  children: ReactNode;  
  className?: string;  
  appName: string;  
}  
  
export const Button = ({ children, className, appName }: ButtonProps) => {  
  return (  
    <button  
      className={className}  
      onClick={() => alert(`Hello from your ${appName} app!`)}  
    >  
      {children}  
    </button>  
  );  
};
```

This is an interesting folder that was introduced recently. More details here -

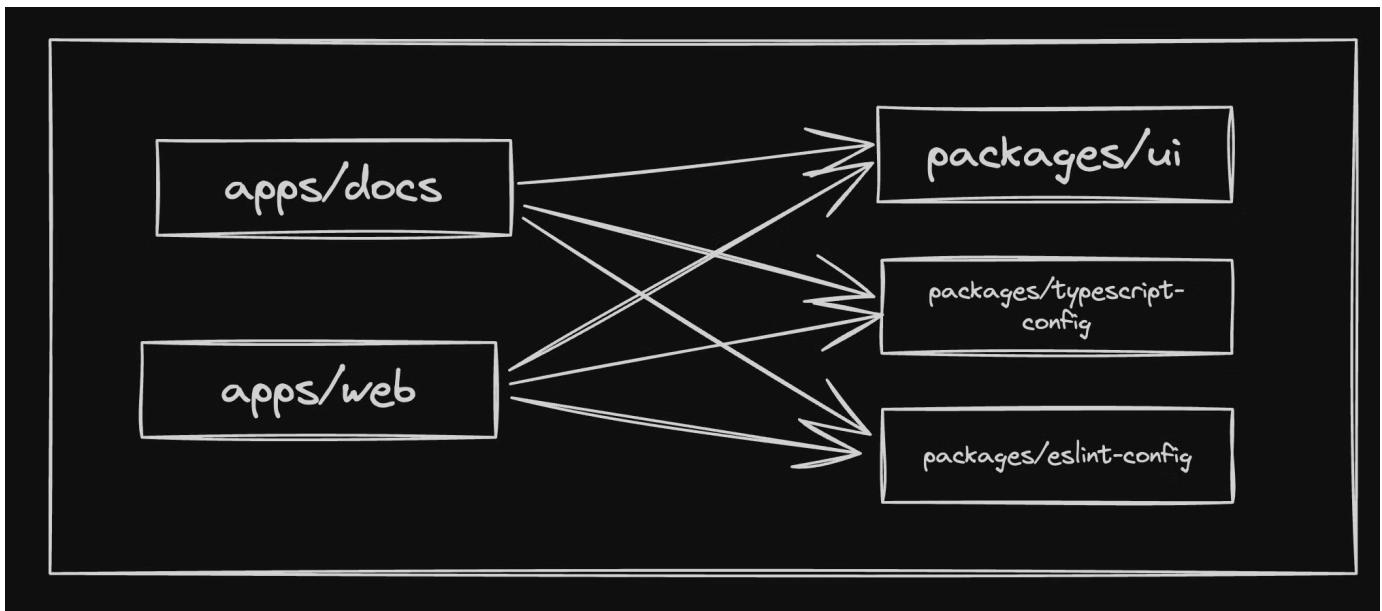
Turborepo and Monorepos 1 of 18 -concepts/monorepos/code-generation

We'll come back to this after a few slides

Exploring apps/web

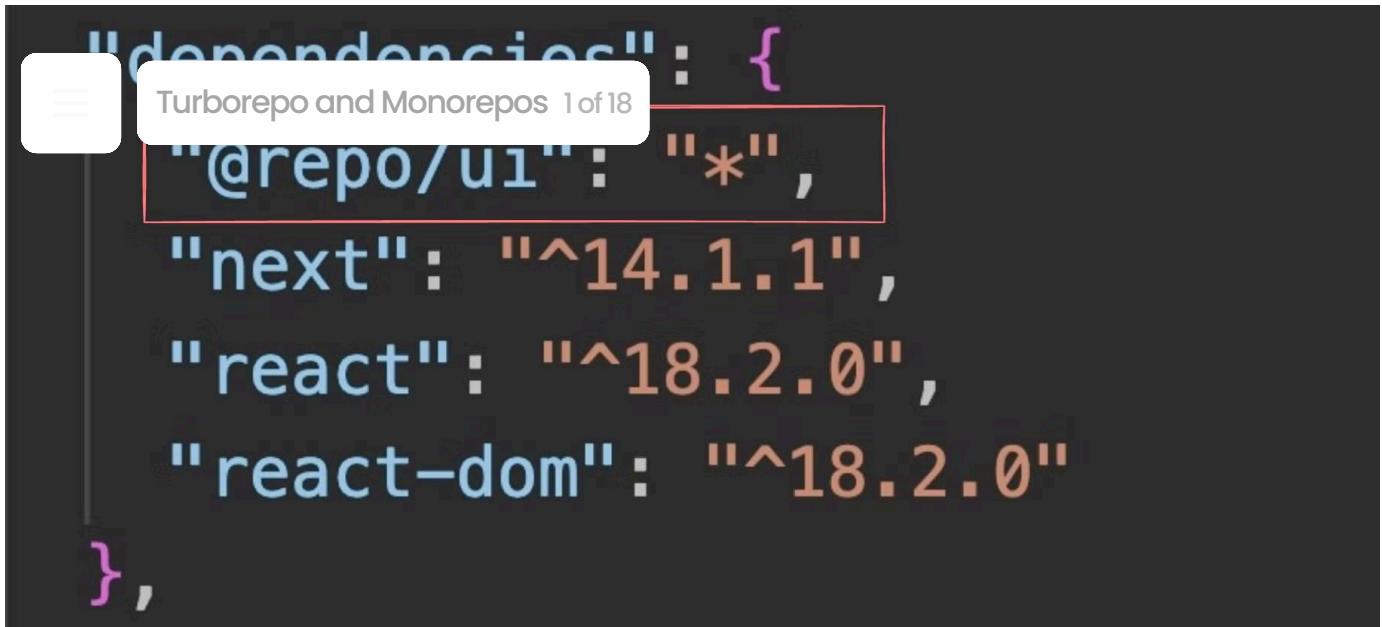
1. Dependencies

It is a simple next.js app. But it uses some **UI components** from the **packages/ui** module



2. Exploring package.json

If you explore package.json of `apps/web`, you will notice `@repo/ui` as a dependency



```
"dependencies": {  
  "@repo/ui": "*",  
  "next": "^14.1.1",  
  "react": "^18.2.0",  
  "react-dom": "^18.2.0"  
},
```

3. Exploring page.tsx

This is a very big page, let's try to see the import and usage of the `Button` component

```
> import Image from "next/image";  
import { Card } from "@repo/ui/card";  
import { Code } from "@repo/ui/code";  
import styles from "./page.module.css";  
import { Button } from "@repo/ui/button";
```

Import from packages module



```
<Button appName="web" className={styles.button}>  
  Click me!  
</Button>
```

The same `Button` component can be used by the `apps/docs` website as well

Let's add a new page

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Try adding a new page to `/admin` to the `apps/web` next.js website.

It should use a simple `Admin` component from `packages/ui`

Steps to follow -

- Create a new file `admin.tsx` inside `packages/ui/src`
- Export a simple React component

▼ Solution

```
"use client";
```

```
export const Admin = () => {
  return (
    <h1>
      hi from admin component
    </h1>
  );
};
```

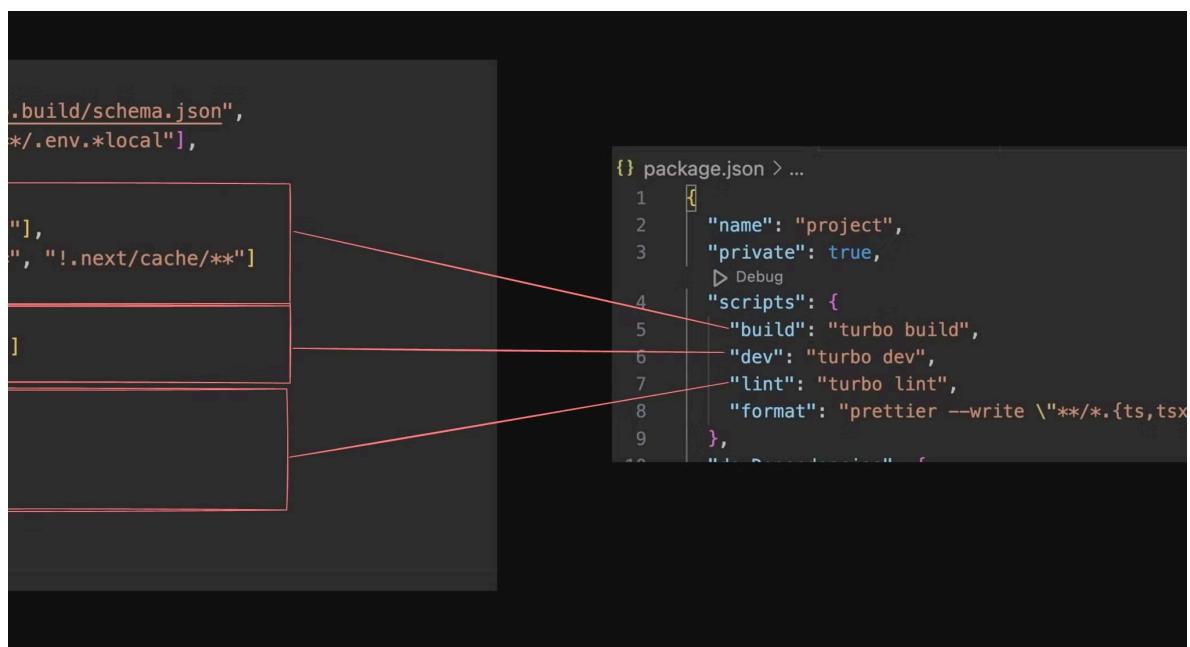
- Add the component to exports in `packages/ui/package.json`
- Create `apps/web/app/admin/page.tsx`
- Export a default component that uses the `@repo/ui/admin` component
- Run `npm run dev` (either in root or in `apps/web`) and try to see the website
- Go to `http://localhost:3000/admin`



You can also use the `packages/ui/turbo/generators` to quickly bootstrap a new component
Try running `npx gen react-component` and notice it'll do step 1, 2, 3 for you in one cli call

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Exploring turbo.json



```
.build/schema.json",
/*!.env.*local"],

"],
"!next/cache/**"]

]

}

package.json > ...
1  {
2    "name": "project",
3    "private": true,
4    "scripts": {
5      "build": "turbo build",
6      "dev": "turbo dev",
7      "lint": "turbo lint",
8      "format": "prettier --write \"**/*.ts,tsx"
9    },
10   "dependencies": {}
```

Ref - <https://turbo.build/repo/docs/getting-started/create-new#3-understanding-turbojson>

References -

<https://turbo.build/repo/docs/reference/configuration#globalDependencies>

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Adding React projects

1. Go to the apps folder

```
cd apps
```

2. Create a fresh vite app

```
npm create vite@latest
```

1. Update package.json to include `@repo/ui` as a dependency

```
"@repo/ui": "*",
```

1. Run npm install in the root folder

```
cd ..  
npm install
```

1. Run npm run dev

```
npm run dev
```

1. Try importing something from the `ui` package and rendering it

2. Add a `turbo.json` to the react folder to override the `outputs` object of this module.

Ref <https://turbo.build/repo/docs/core-concepts/monorepos/configuring-outputs>

V [View slide](#)

```
☰ 3) Turborepo and Monorepos 1 of 18
pipeline": {
  "build": {
    "outputs": ["dist/**"]
  }
}
}
```

Caching in Turborepo

Ref - <https://turbo.build/repo/docs/getting-started/create-new#using-the-cache>

One of the big things that make turborepo fast and efficient is caching. It watches your files across builds and returns the cached response of builds if no files have changed.

Try running `npm run build` more than once and you'll see the second times it happens extremely fast.

You can also explore the `node_modules/.cache/turbo` folder to see the zipped cache files and unzip them using

```
tar --use-compress-program=unzstd -xvf name.tar.zst
```

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Adding a Node.js app

Everything else remains the same (Create a new project, add typescript, add express...)

The only thing that's different is that `tsc` doesn't perform great with turborepo

You can use either `tsup` or `esbuild` for building your backend application

1. Create `apps/backend`

2. Initialize empty ts repo

```
npm init -y  
npx tsc --init
```



1. Use base tsconfig (Ref -

[https://github.com/turbohq/turbo/tree/main/examples/kitchen-](https://github.com/turbohq/turbo/tree/main/examples/kitchen-sink)

```
☰ 3: Turborepo and Monorepos 1 of 18 g/base.json",
compilerOptions": {
  "lib": ["ES2015"],
  "module": "CommonJS",
  "outDir": "./dist",
},
"exclude": ["node_modules"],
"include": ["."]}
```

1. Add dependencies

```
npm i express @types/express
```

1. Add `src/index.ts`

```
import express from "express";

const app = express()

app.get("/", (req, res) => {
  res.json({
    message: "hello world"
  });
})
```

1. Update `turbo.json`

```
{
  "extends": ["//"],
  "pipeline": {
    "build": {
      "outputs": ["dist/**"]
    }
  }
}
```

1. Install esbuild

1 Add build script to package.json

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```
cd packages/common\nnpx tsc --init\n  platform=node --bundle --outdir=dist"
```

Adding a **common** module

A lot of times you need a module that can be shared by both frontend and backend apps

1. Initialize a `packages/common` module

```
cd packages\nmkdir common
```

1. Initialize an empty node.js project

```
npm init -y\nnpx tsc --init
```

1. Change the name to `@repo/common`

2. Export a few things from `src/index.ts`

```
export const NUMBER = 1;
```

1. Add it to the `package.json` of various apps (next app/react app/node app)

1 Import it in there and try to use it

☰ 1 Turborepo and Monorepos 1 of 18 ↴ see if it works as expected