

## Node with TypeScript

<https://github.com/peerberger/TypeScriptNode>

**Demo project:** <https://github.com/peerberger/TypeScriptNode-menu-api>

- This project was built according to this [guide](#), which you can read through to really understand the code.

### Creating a Node project with TypeScript

- Open the terminal and run the following commands.

Ex:

```
npm init -y
npm install --save-dev typescript
npx tsc --init
```

### Using TypeScript in Node

- Let's run a ts program with node!  
Create a new folder named **"src"**, and in it create a file named **"index.ts"**.  
In it, write the following.

Ex:

```
console.log("hello from ts");
```

- Now as you might remember, to run a ts program, we first need to convert it to js.  
To do that, go to package.json, and under scripts, delete the following line.

Ex:

```
"test": "echo \"Error: no test specified\" && exit 1"
```

And write the following line in its place.

Ex:

```
"build": "tsc"
```

- Open the terminal and run the following command.

Ex:

```
npm run-script build
```

- It will generate a file named **"index.js"** based on the ts code in **index.ts**, and you should see it in the same folder.

- Now you can run the js code with the following line.

Ex:

```
node src/index
```

- But doing all of this is annoying, we can make it much simpler. Run the following command to install the **ts-node** package.  
Ex:

```
npm install --save-dev ts-node
```

- With it, we can run a single command on a ts file, which will compile it into js, and launch it on node.  
So let's configure this command in package.json - add the following line under the "scripts" section so it looks like this.  
Ex:

```
"scripts": {  
  "start": "ts-node src/index.ts",  
  "build": "tsc"  
},
```

- To run this script, run the following command.  
The terminal should print the message we wrote in the **index.ts**.  
Ex:

```
npm start
```

- Now, if we want it to execute every time we change the code automatically, we can install the **ts-node-dev** package, which will execute on save. It also significantly decreases the time it takes to restart your application when you make a change.  
To install it, run the following command.  
Ex:

```
npm install --save-dev ts-node-dev
```

And edit the script we added to look like this.  
Ex:

```
"scripts": {  
  "start": "ts-node-dev --respawn src/index.ts",  
  "build": "tsc"  
},
```

This package doesn't always work on Windows computers, but you can also use the **nodemon** package, it's also more popular.  
Ex:

```
npm install --save-dev nodemon
```

```
"scripts": {  
  "start": "nodemon --exec ts-node src/index.ts",  
  "build": "tsc"  
},
```

- Now, we're gonna want to interact with other libraries. We can easily do that with ts libraries, but it can be a little tricky with js libraries.

For example, we want to use the js library **express** (to install, run the following command).

Ex:

```
npm install express
```

We can just use it in our ts code, but the whole point of ts is knowing the types and function signatures - but they don't exist in the js library.

So we need to install another package that contains them.

Ex:

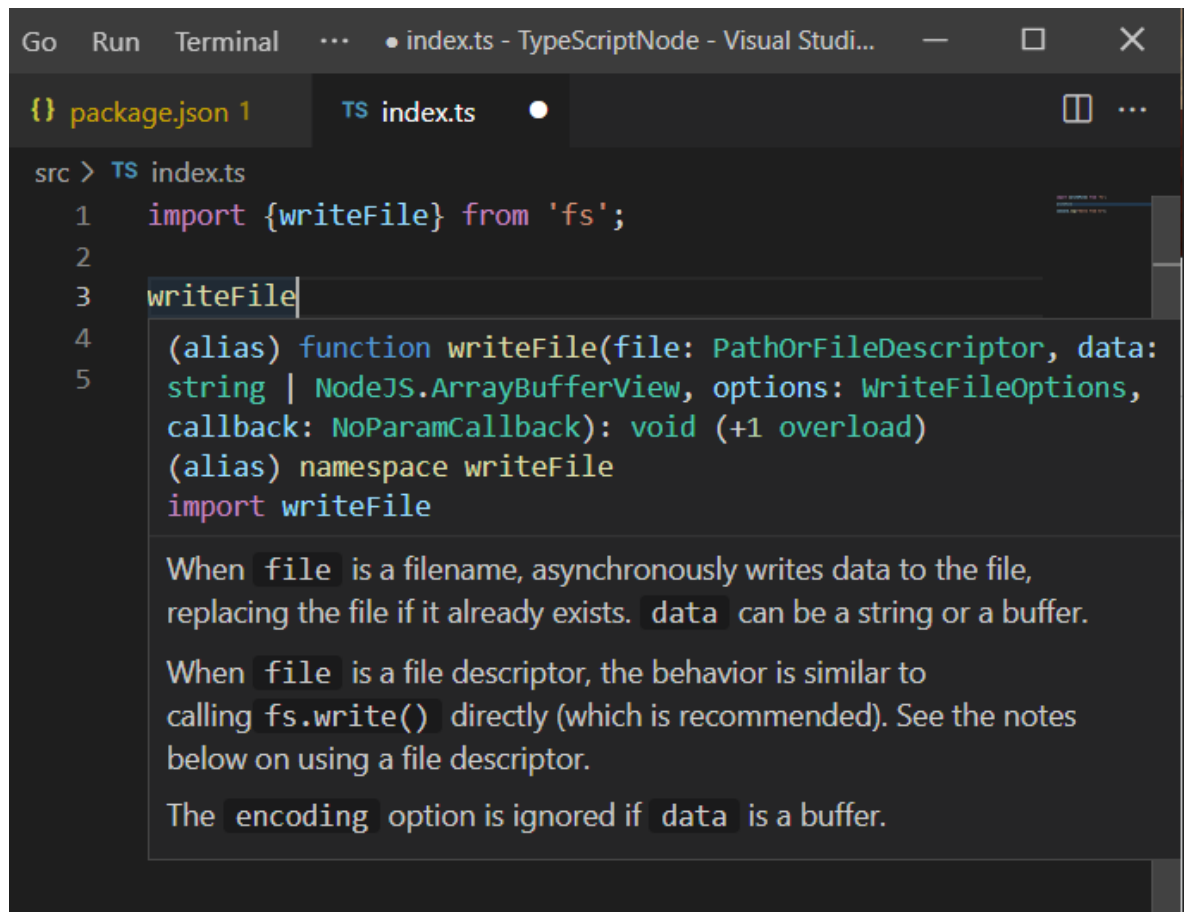
```
npm install --save-dev @types/express
```

- There's a package like this for node too.

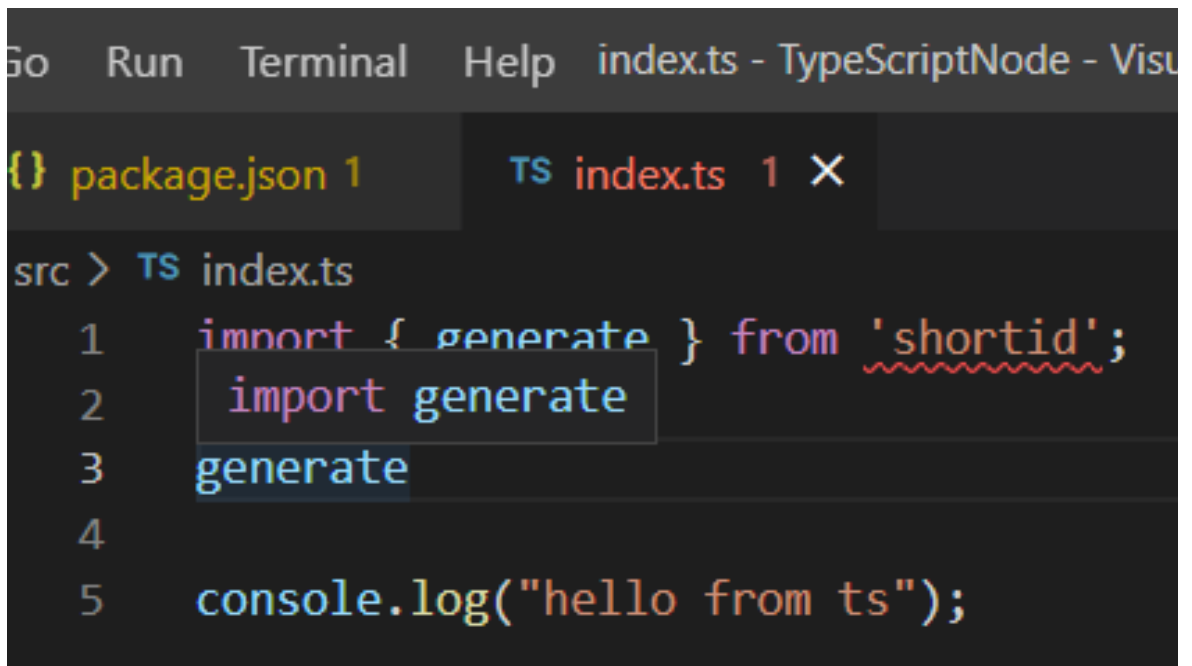
Ex:

```
npm install --save-dev @types/node
```

For example, now when you use the **writeFile** function from the **fs** module, you'll see the signature and all this additional info.



- So from now on, when you install a new js package, you're gonna want to install a **@types** package for it too (their name is usually formatted like this: "**@types/[name of the js package]**").
- But some packages don't have a **@types** package, what do we do then?  
Let's take for example the **shortid** package (it actually does have a **@types** package, but it's just an example). To install, run the following command.  
Ex:  
  
npm install shortid
- This is how it looks when you import it in ts.  
You can see it's yelling at you because there's no declaration file for **shortid**.  
Ex:

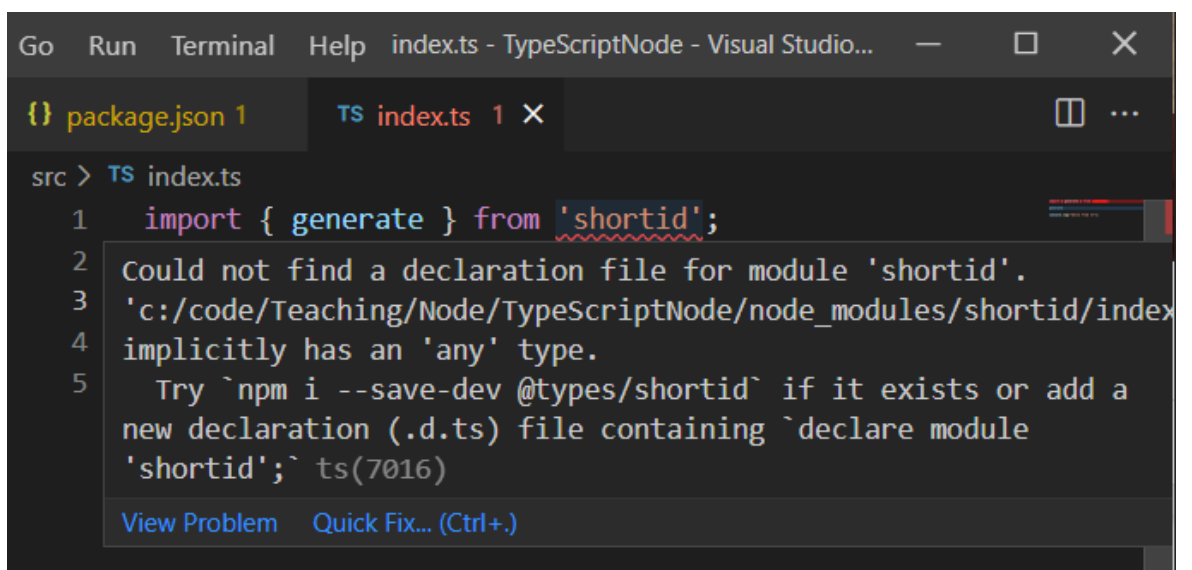


```
Go Run Terminal Help index.ts - TypeScriptNode - Visu

{} package.json 1 TS index.ts 1 X

src > TS index.ts

1 import { generate } from 'shortid';
2 import generate
3 generate
4
5 console.log("hello from ts");
```



```
Go Run Terminal Help index.ts - TypeScriptNode - Visual Studio...

{} package.json 1 TS index.ts 1 X

src > TS index.ts

1 import { generate } from 'shortid';
2 Could not find a declaration file for module 'shortid'.
3 'c:/code/Teaching/Node/TypeScriptNode/node_modules/shortid/index'
4 implicitly has an 'any' type.
5 Try `npm i --save-dev @types/shortid` if it exists or add a
  new declaration (.d.ts) file containing `declare module
  'shortid';` ts(7016)
  View Problem Quick Fix... (Ctrl+.)
```

- To deal with that, create a folder named “@types”, and in it create a file named “shortid.d.ts”.

Then write the following.

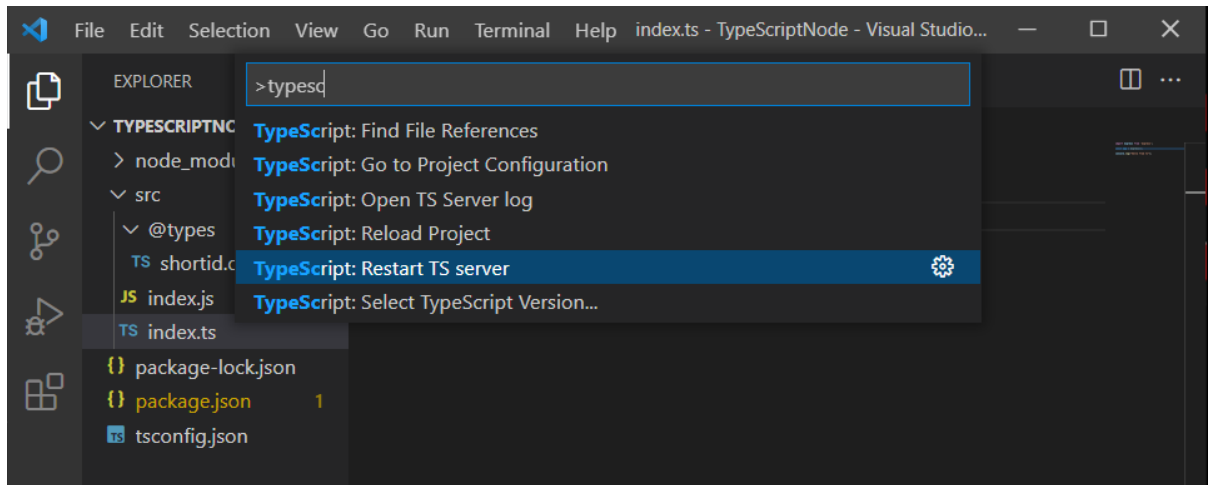
Ex:

```
declare module 'shortid';
```

Now you can see in index.ts that the error is gone.

- You can theoretically declare the full types definitions of the package, but most packages already have a **@types** package. This solution is generally for the rare occasion you come across a package that doesn’t have one, and you need to eliminate the error.

- Another troubleshooting tip is that sometimes the ts compiler is being laggy or slow, and might show you errors like “Duplicate identifier '[package name]'”. In these cases you can hit **ctrl+shift+p**, and run **TypeScript: Restart TS Server**. This will restart the ts compiler, and hopefully eliminate the errors.



- Now let's see some practical ts magic.  
Let's write some simple **express** code.  
Ex:

```
import express from 'express';

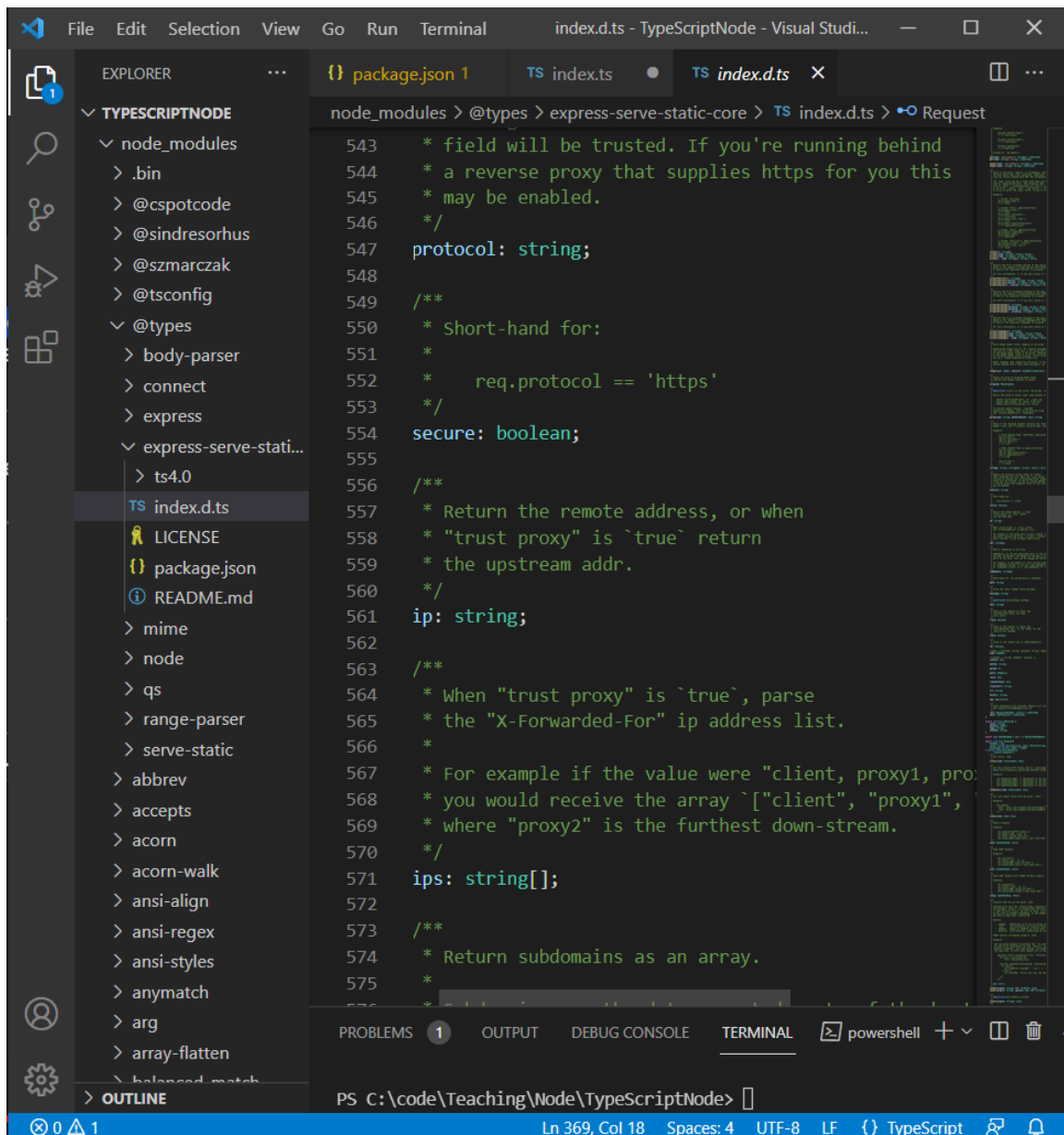
const app = express();

app.get('/', (req) => {

});

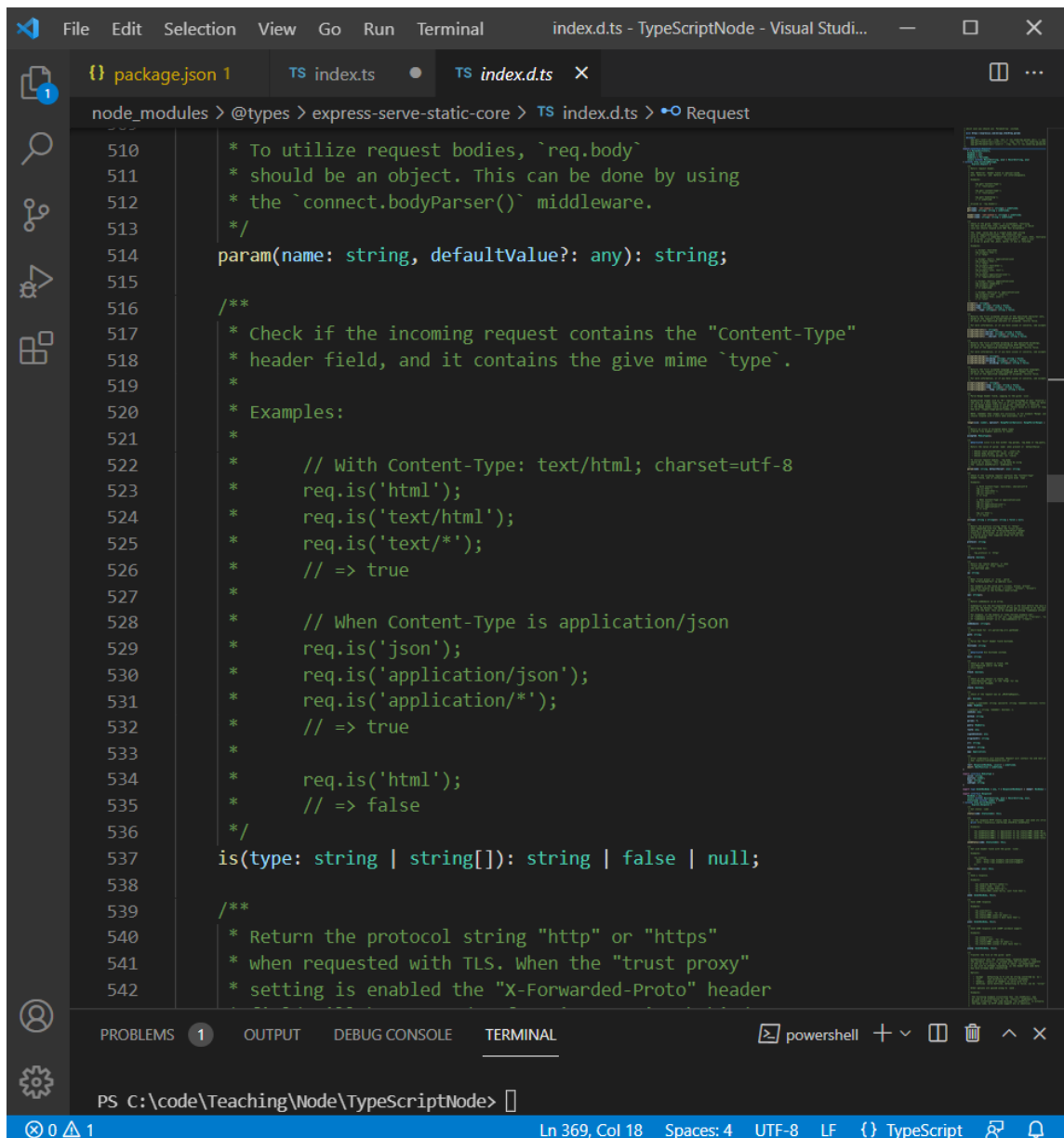
app.listen(3000, () => {
  console.log("started");
});
```

- If you right click on the **req** variable, and click on **Go to Type Definition**, it'll take you to the definition of the **Request** interface, which has all the type definitions, function signatures, and documentation of **Request**. You can see that the **secure** field is of type **boolean**, the **ip** field is of type **string**, etc.



And that the **is()** function receives a **parameter** of either type **string** or **string[]**, and **returns** a value of either type **string**, **false**, or **null**.

You even get examples of implementation in the function's doc comment.



```
node_modules > @types > express-serve-static-core > TS index.d.ts > Request
510  * To utilize request bodies, `req.body`
511  * should be an object. This can be done by using
512  * the `connect.bodyParser()` middleware.
513  */
514  param(name: string, defaultValue?: any): string;
515
516  /**
517  * Check if the incoming request contains the "Content-Type"
518  * header field, and it contains the give mime `type`.
519  *
520  * Examples:
521  *
522  *   // With Content-Type: text/html; charset=utf-8
523  *   req.is('html');
524  *   req.is('text/html');
525  *   req.is('text/*');
526  *   // => true
527  *
528  *   // When Content-Type is application/json
529  *   req.is('json');
530  *   req.is('application/json');
531  *   req.is('application/*');
532  *   // => true
533  *
534  *   req.is('html');
535  *   // => false
536  */
537  is(type: string | string[]): string | false | null;
538
539  /**
540  * Return the protocol string "http" or "https"
541  * when requested with TLS. When the "trust proxy"
542  * setting is enabled the "X-Forwarded-Proto" header
```

Whereas when you use plain js, you'd have to go to the docs to see all that.

- Next thing in working with ts, is that sometimes you're gonna want to escape the restrictions of ts.

For example, say you want to assign a new field named **"name"** on **req**.

You'll get the following error, because ts is all about strong types, and **Request** doesn't have a field named **"name"**.

Ex:



```
src > TS index.ts > app.get('/') callback
1  import e
2
3  const ap
4
5  app.get(
6    req.name = "bob";
7  });
8
9  app.listen(3000, () => {
10    console.log("started");
11  });
```

- You can work around that by casting **req** to type **any** (or any type you want) just for that one line.

Ex:

```
app.get('/', (req) => {
  (req as any).name = "bob";
});
```

Or you can also cast **req** for the entire scope, by declaring its type in the parameter declaration.

Ex:

```
app.get('/', (req: any) => {
  req.name = "bob";
});
```

- You should keep an eye on **any** and **undefined**, because ts always wants to know what type a variable is. For example, you can't define a function like this, because ts doesn't know the types of the params.

Ex:

```
src > TS index.ts > add
1  import express f
2
3  const app = expr
4
5  const add = (a, b) => {
6    return a + b;
7  }
8
```

- To fix this, you need to declare the types of the params, like we saw in the previous section.

Ex:

```
const add = (a: number, b: number) => {  
    return a + b;  
}
```

You can also declare the return type if you want to be explicit, but ts can infer that automatically.

Ex:

```
const add = (a: number, b: number): number => {  
    return a + b;  
}
```

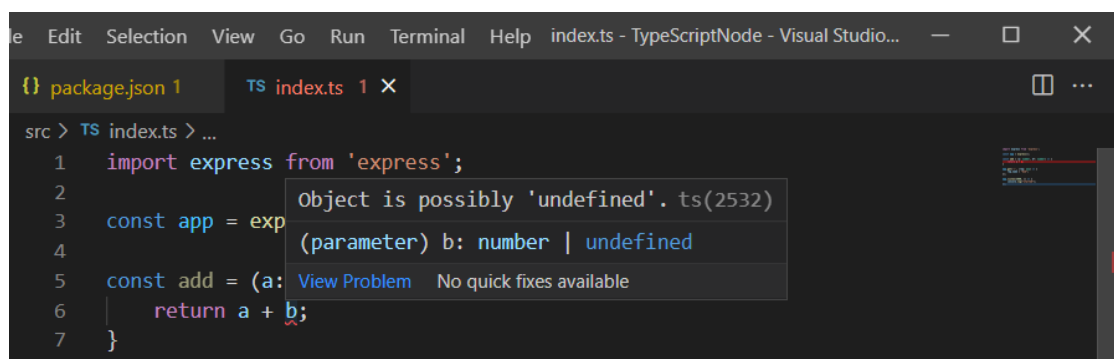
- Now, to define a variable as optional, you need to use the ? character.

Ex:

```
const add = (a: number, b?: number) => {  
    return a + b;  
}
```

- But now ts is yelling at you because it might be **undefined**, and you can't add a **number** to **undefined**.

Ex:



- In that case, you need to condition the use of the optional param by whether it's **undefined** or not.  
Now the error should disappear, because ts infers that if **b** equals **true**, it must be defined.

Ex:

```
const add = (a: number, b?: number) => {  
    if (b) {  
        return a + b;  
    }
```

```

    } else {
        return a;
    }
}

```

- But sometimes ts fails to infer that, and the error doesn't disappear. What then? In these cases, you can use the `!` character to assert that the variable is definitely not **undefined**.

Ex:

```

const add = (a: number, b?: number) => {
    return a + b!;
}

```

- Last thing you should know about is **interfaces** and **types**.
  - They are both ways to define **objects**, and **functions** (without implementing them).
  - They are mostly interchangeable - though different people might use them for different uses according to their personal conventions.
  - One possible convention is that **objects** are defined as **interfaces**, and **functions** (and everything else) are defined as **types**.
  - For example, say we want to define an **object** that represents parameters for the **function** from the previous section. We'd create an **interface** named "**Params**", and define a single parameter as type **Params**.

Ex:

```

interface Params {
    a: number,
    b: number
}

const add = (params: Params) => {
    return params.a + params.b;
}

```

One reason to do that is that if more **functions** receive this exact set of parameters, we'll be able to just declare a single parameter of type **Params**, and not repeat the declaration of all the actual parameters.

- Now, we can also define a **function** that represents all functions that receive **Params** as a parameter, and return a **number**.

To do that, we'd create a **type** named "**ParamsMethod**" (or any name that makes sense), and define the parameter as before.

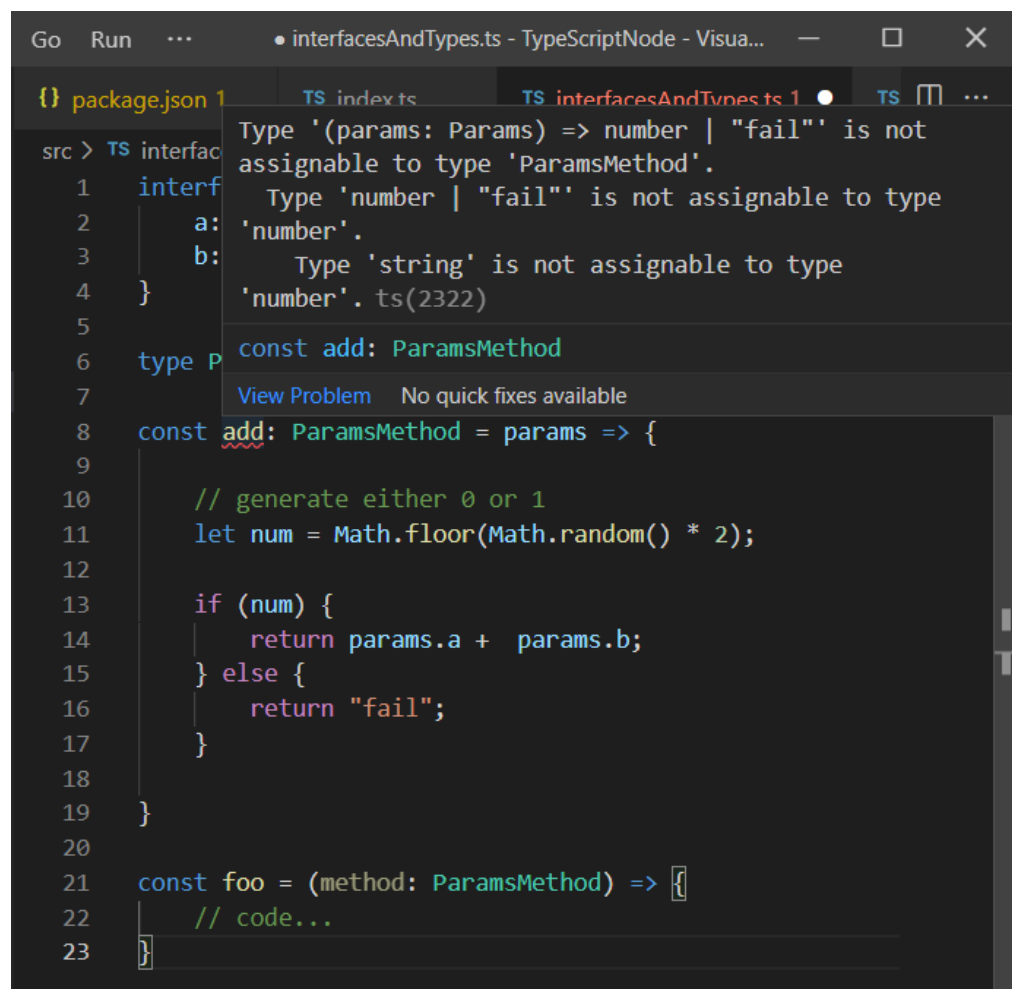
Ex:

```
interface Params {
  a: number,
  b: number
}

type ParamsMethod = (params: Params) => number;
```

One reason to do that is that now we have a **function "base type"**, and if for example we need to pass as parameter a **function** that receives **Params** as a parameter and returns a **number**, we can just declare a parameter of type **ParamsMethod**, and when we implement the **function** itself, we can define it as of type **ParamsMethod**, so if we use a wrong type somehow, we'll get an error.

Ex:



```
Go Run ... • interfacesAndTypes.ts - TypeScriptNode - Visua...
{} package.json 1 TS index.ts TS interfacesAndTypes.ts 1 • TS ...
src > TS interface
1 interf
2   a:
3   b:
4 }
5
6 type P
7
8 const add: ParamsMethod = params => {
9
10   // generate either 0 or 1
11   let num = Math.floor(Math.random() * 2);
12
13   if (num) {
14     return params.a + params.b;
15   } else {
16     return "fail";
17   }
18
19 }
20
21 const foo = (method: ParamsMethod) => {
22   // code...
23 }
```

Type '(params: Params) => number | "fail"' is not assignable to type 'ParamsMethod'.  
Type 'number | "fail"' is not assignable to type 'number'.  
Type 'string' is not assignable to type 'number'. ts(2322)

const add: ParamsMethod

View Problem No quick fixes available