

COMP1531



Full-Stack - HTTP Servers

Lecture 4.2

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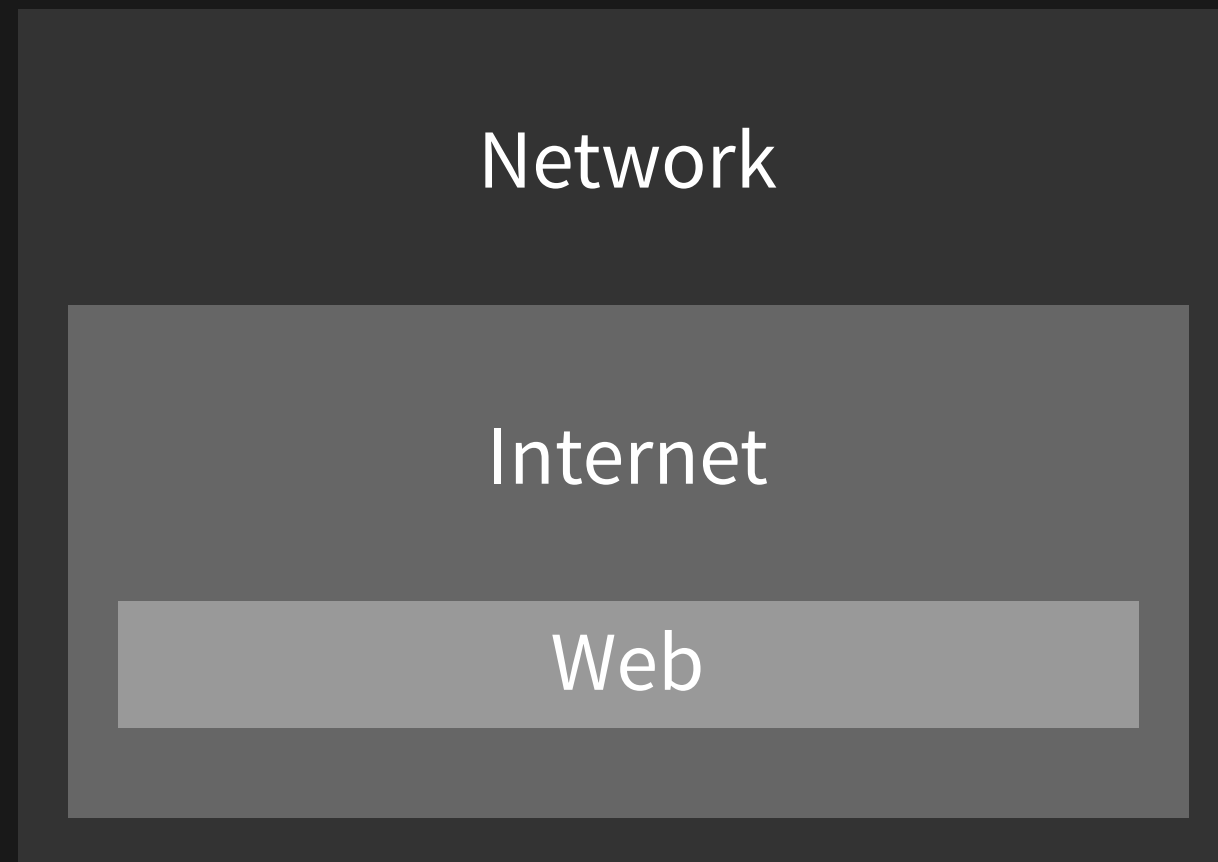
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In This Lecture

- **Why?** 🤔
 - Web servers are fundamental part of web-based full-stack software
- **What?** 📰
 - Networks
 - Express Server
 - APIs
 - Crud

Networks

- **Network:** A group of interconnected computers that can communicate
- **Internet:** A global infrastructure for networking computers around the entire world together
- **World Wide Web:** A system of documents and resources linked together, accessible via URLs



Networks

If you want to learn more about networking, go and study COMP3331.

Network Protocols

- Communication over networks must have a certain "structure" so everyone can understand.
- Humans do this all the time - waving, handshakes, clapping. Standard operation procedure that structures how we share info.
- Different "structures" (protocols) are used for different types of communication.

Network Protocols

[source](#)

HTTP is an example of one of the protocols. It is the protocol of the web. The primary protocol you use to access URLs in your web browser.



Network Protocols

Examples



HTTP: Hypertext Transfer Protocol

I.E. Protocol for sending and receiving HTML documents (nowadays much more)

Web Browsers (Client)

Web Servers



Web browsers are applications to request and receive HTTP.



NodeJS Express Server

A very popular `npm` library exists to allow you to run your own HTTP server with NodeJS.
It's called [Express Server](#).



NodeJS Express Server

```
1 import express from 'express';
2
3 const app = express();
4 const port = 3000;
5
6 app.use(express.text());
7
8 app.get('/', (req, res) => {
9   res.send('Hello World!');
10 });
11
12 app.listen(port, () => {
13   console.log(`Listening on port ${port}`);
14 });
```

4.2_express_basic.ts



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4.2_express_basic.ts

This is us importing the express library



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4.2_express_basic.ts

This creates an instance of a server, and we define the network port to run on.

A port is essentially one of the roads in and out of a computer's network. There are often 65,000-ish.



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12 app.listen(port, () => {
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```

[4.2_express_basic.ts](#)

This line is a quirk of `express` that is required in order for the data of many requests to be interpreted.



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6 app.use(express.text());
7
8 app.get('/', (req, res) => {
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```

[4.2_express_basic.ts](#)

This says that "when URL / is accessed, call this function". The function sends some text to the person accessing that URL.

If we want our server to do more, we need to write lots more of these.



NodeJS Express Server

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[4.2_express_basic.ts](#)

This line actually starts the server (on a particular port). It essentially runs an infinite loop so the program runs forever constantly waiting for new people to "access" it via a certain URL.



NodeJS Express Server

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[4.2_express_basic.ts](#)

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Let's take a step back to learn about what servers are used for.

API

An API (Application Programming Interface) refers to an interface exposed by a particular piece of software.

The most common usage of "API" is for Web APIs, which refer to a "contract" that a particular service provides. The interface of the service acts as a black box and indicates that for particular endpoints, and given particular input, the client can expect to receive particular output.



Web API

RESTful API

A RESTful API is an application program interface (API) that uses HTTP requests to GET, PUT, POST and DELETE data. These 4 methods describe the "nature" of different API requests.

GET, PUT, POST, DELETE are HTTP Methods. They refer to CRUD operations.

Method	Operation
POST	Create
GET	Read
PUT	Update
DELETE	Delete



RESTful API

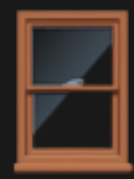
Different CRUD properties require different approaches for input. All output are the same.

```
1 import express from 'express';
2
3 const app = express();
4 const port = 3001;
5
6 app.use(express.text());
7
8 app.get('/apple', (req, res) => {
9   const name = req.query.name;
10  res.send(JSON.stringify({
11    msg: `Hi ${name}, thanks for sending apple!`,
12  }));
13 });
14
15 // same for .put and .delete
16 app.post('/orange', (req, res) => {
17   const body = JSON.parse(req.body);
18   const name = body.name;
19   res.send(JSON.stringify({
20     msg: `Hi ${name}, thanks for sending orange!`,
21   }));
22 });
23
24 app.listen(port, () => {
25   console.log(`Listening on port ${port}`);
26 });
```

RESTful API

Different CRUD properties require different approaches for input.

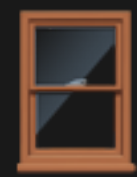
- For inputs:
 - GET|DELETE: via `req.query` (capture URL)
 - PUT|POST: via `req.body` (capture body)
- For outputs:
 - All outputs should be packaged up as JSON



RESTful API

If we embrace the use of JSON everywhere, we can make use of other library feature to clean up the code.

```
1 import express from 'express';
2
3 const app = express();
4 const port = 3001;
5
6 app.use(express.json());
7
8 app.get('/apple', (req, res) => {
9   const name = req.query.name;
10  res.json({
11    msg: `Hi ${name}, thanks for sending apple!`,
12  });
13 });
14
15 // same for .put and .delete
16 app.post('/orange', (req, res) => {
17   const name = req.body.name;
18   res.json({
19     msg: `Hi ${name}, thanks for sending orange!`,
20   });
21 });
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23 app.listen(port, () => {
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RESTful API

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4 const port = 3001;
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6 app.use(express.json());
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9   const name = req.query.name;
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23 app.listen(port, () => {
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```


RESTful API

Task

Create a web server that uses CRUD to allow you to create, update, read, and delete a point via HTTP requests

Use a global variable to manage the state.



Talking To A Web Server

How can we talk to a web server as a client?

1. API client
2. Web Browser
3. An NPM library: `sync-requests`

API Client (ARC, Postman)

How to download/install ARC:

- Open google chrome
- Google "ARC client"
- Install the addon and open it
- Follow the demo in the lectures

You may need to use a tool like this in the final exam.

API Client (ARC, Postman)



Web Browser

Requests Library

We can use an npm package `sync-requests` to allow us to programmatically send RESTful API requests. `npm install sync-requests`.

We can send them to our previous server.

```
1 import request from 'sync-request';  
2  
3 const res = request(  
4   'GET',  
5   'http://localhost:3001/apple?name=Hayden'  
6 );  
7 console.log(JSON.parse(String(res.getBody())));
```

4.2_requests.ts

Requests Library

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We can send them to our previous server.

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3 const res = request(  
4   'GET',  
5   'http://localhost:3001/apple?name=Hayden'  
6 );  
7 console.log(JSON.parse(String(res.getBody())));
```

`4.2_requests.ts`

Let's look at the `sync-request` library to see if we can remove `name=Hayden` from URL.



Working With jest

```
1 import request from 'sync-request';
2
3 describe('Test Apple', () => {
4   test('If it returns a name string successfully', () => {
5     const res = request(
6       'GET',
7       'http://localhost:3001/apple',
8       {
9         qs: {
10           name: 'Hayden',
11         },
12       }
13     );
14     const bodyObj = JSON.parse(String(res.getBody()));
15     expect(bodyObj.msg).toBe('Hi Hayden, thanks for sending apple!');
16   });
17 });
18 describe('Test Orange', () => {
19   test('If it returns a name string successfully', () => {
20     const res = request(
21       'POST',
22       'http://localhost:3001/orange',
23       {
24         body: JSON.stringify({ name: 'Hayden' }),
25         headers: {
26           'Content-type': 'application/json',
27         },
28       }
29     );
30     const bodyObj = JSON.parse(String(res.getBody()));
31     expect(bodyObj.msg).toBe('Hi Hayden, thanks for sending orange!');
32   });
33 });
```



```
33  });
```

4.2_requests.test.ts

How To Wrap Into Project

In general, iteration 2 requires that you implement an HTTP server. However! Many of the routes that exist in iteration 2 are just wrappers of your iteration 1 functions.

Therefore it should be easy to "wrap" your iteration 1 functions with an HTTP server. I.E. Most of the "server" stuff you'll do is just routing, gathering bodies, and returning responses, while treating your iteration 1 functions like blackboxes.



Optional! Making Life Easier.

Did you know we can make node auto restart if new files are compiled?

If we:

- Run `npm install --save-dev nodemon`
- Replace `node` with `nodemon` in `package.json`

Then run `npm run start` in a separate terminal.



Optional! Making Life Easier.

Did you know we can make `tsc` auto run if source files are changed?

If we:

- Add `--watch` flag to `tsc` command

Then run `npm run tsc` in a separate terminal.

👂 Feedback



Or go to the [form here](#).

