Building software to run in the Cloud

Anatomy of an Internet Service

HTTP

Clients and Servers

Requests and Responses

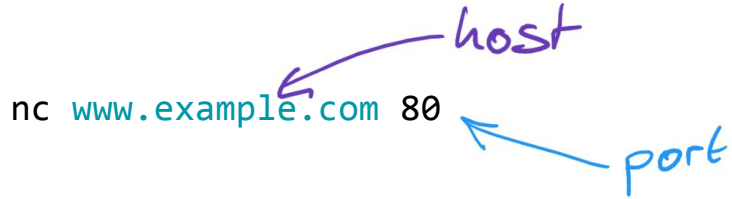
HTTP Request/Response

Demo:

```
nc www.example.com 80
```

HTTP Request/Response

Demo:



HTTP Request/Response

Demo:


```
nc www.example.com 80
GET / HTTP/1.1
Host: www.example.com
```

HTTP Request/Response

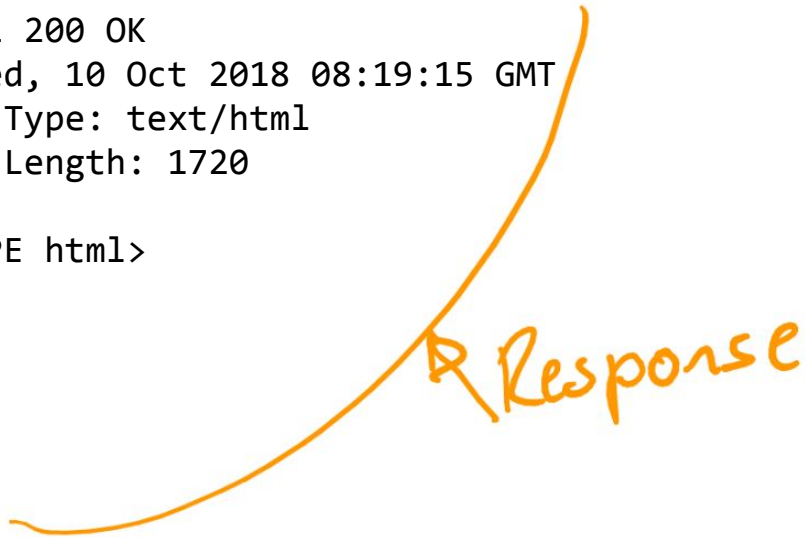
Demo:

Request

```
nc www.example.com 80
GET / HTTP/1.1
Host: www.example.com

HTTP/1.1 200 OK
Date: Wed, 10 Oct 2018 08:19:15 GMT
Content-Type: text/html
Content-Length: 1720

<!DOCTYPE html>
<html>
.
.
.
```



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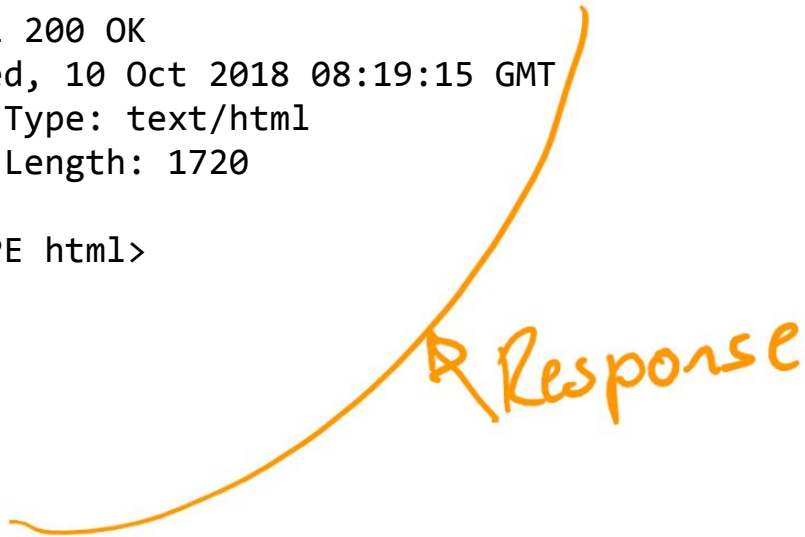
Headers



HTTP Request/Response

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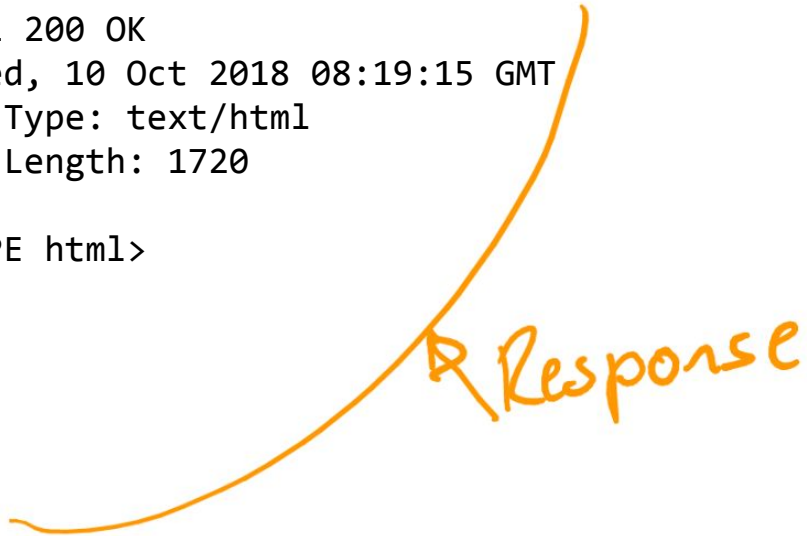
Headers

Response Body

```
<!DOCTYPE html>
<html>
.
.
.
```



The Webserver

Where did the www.example.com HTTP response come from?

The Webserver

Where did the www.example.com HTTP response come from?

The local Webserver

Demo:

```
http -v http://localhost:8080
GET / HTTP/1.1
Host: localhost:8080
User-Agent: curl/7.58.0
Accept: */*

HTTP/1.1 200
Content-Type: text/html;charset=UTF-8
.
.
.
etc
```

JSON

```
{
  "name"  : "Matthew",
  "kids"  : 2,
  "likes" : ["dogs", "cheese", "sunshine"]
}
```

JSON

```
{
  "id"        : 3,
  "title"     : "buy carrots",
  "completed" : false
}
```

Fetching JSON from the local Webserver

Fetching JSON from the local Webserver

```
http localhost:8080/api/todos

HTTP/1.1 200
Content-Type: application/json;charset=UTF-8
Date: Wed, 10 Oct 2018 18:02:30 GMT
Transfer-Encoding: chunked

[]
```

Fetching JSON from the local Webserver

```
http localhost:8080/api/todos

HTTP/1.1 200
Content-Type: application/json;charset=UTF-8
Date: Wed, 10 Oct 2018 18:02:30 GMT
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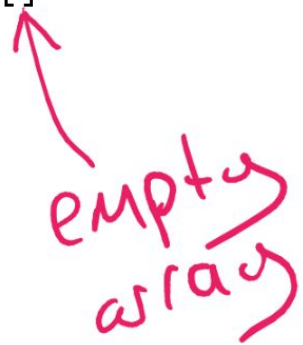

Sending JSON to the local Webserver

Sending JSON to the local Webserver

```
http POST http://localhost:8080/api/todos <<< '{"title": "buy carrots"}'

HTTP/1.1 200
Content-Type: application/json;charset=UTF-8
Date: Wed, 10 Oct 2018 18:17:13 GMT
Transfer-Encoding: chunked

{
    "completed": false,
    "id": 3,
    "title": "buy carrots"
}
```

Sending JSON to the local Webserver

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HTTP/1.1 200
Content-Type: application/json;charset=UTF-8
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{
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```

"Method" or "Verb"

Sending JSON to the local Webserver

```
http PUT http://localhost:8080/api/todos/1 <<< '{"title": "buy carrots",
"completed":true}'

HTTP/1.1 200
Content-Type: application/json;charset=UTF-8
Date: Wed, 10 Oct 2018 18:18:39 GMT
Transfer-Encoding: chunked

{
     "completed": true,
     "id": 1,
     "title": "buy carrots"
}
```

Sending JSON to the local Webserver

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http PUT http://localhost:8080/api/todos/1 <<< '{"title": "buy carrots",
"completed":true}'

HTTP/1.1 200
Content-Type: application/json;charset=UTF-8
Date: Wed, 10 Oct 2018 18:18:39 GMT
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A Web Application

Q: What do we `GET` from `http://localhost:8080/` ?

A Web Application

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A: Some HTML

A Web Application

```
<!doctype html>
<html>
<head>
    <title>UOB Todo App</title>
    <link rel="stylesheet" href="/static/css/main.css">
</head>
<body>
<div id="app"></div>
<script src="/static/js/app.js"></script>
</body>
</html>
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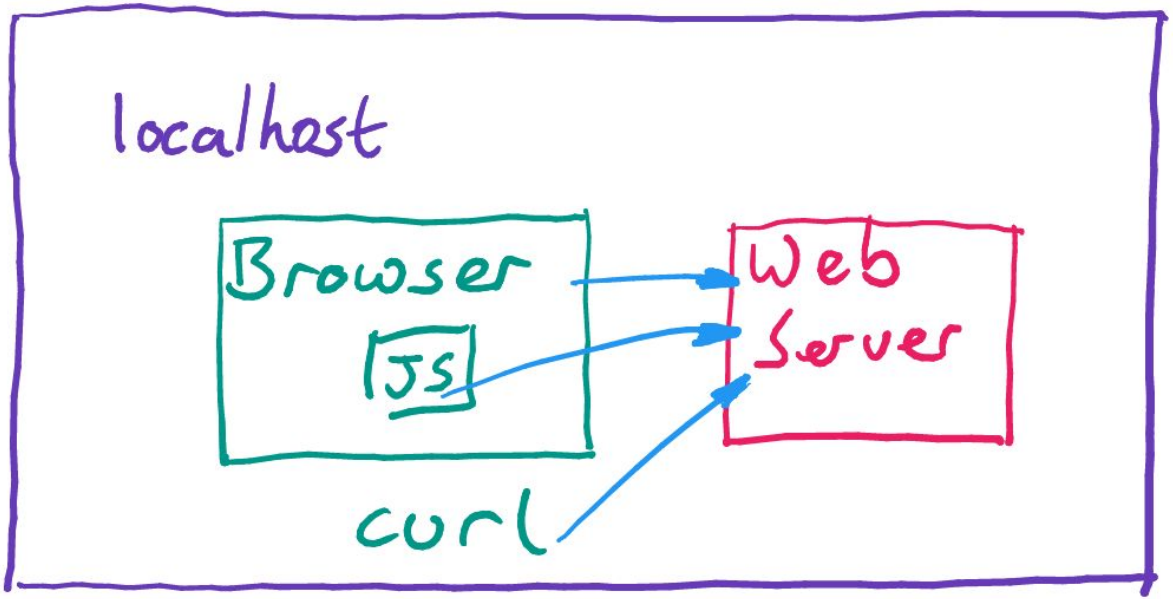
JavaScript?

- A programming language (not related to Java)
- Run by the browser
- In the browser, JavaScript code can:
  - Add/remove/change things on the page
  - Make more HTTP requests (to the same server)

“Architecture”



The Webserver Code

The Webserver Code

Example:

```
@Controller
public class IndexController {

    @GetMapping("/")
    public String index() {
        return "index";
    }
}
```

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Because of the `@Controller` annotation, `IndexController` is a “Spring Bean” - ie it’s created and managed by Spring code

The Webserver Code

Types of Spring Bean which can be used for responding to HTTP requests:

```
@Controller
@RequestMapping
@RestController
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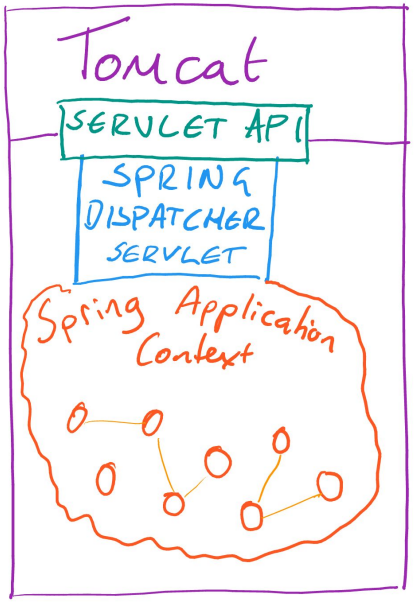
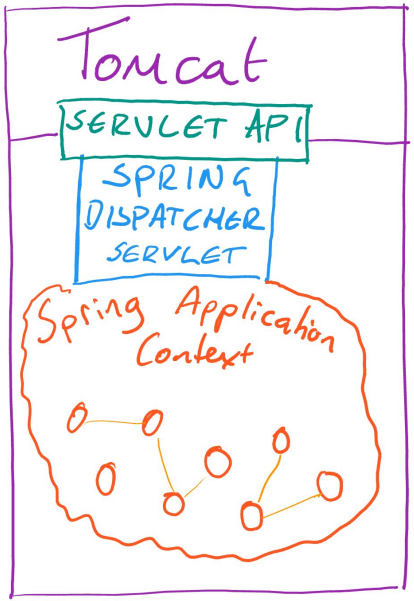


The Webserver Code

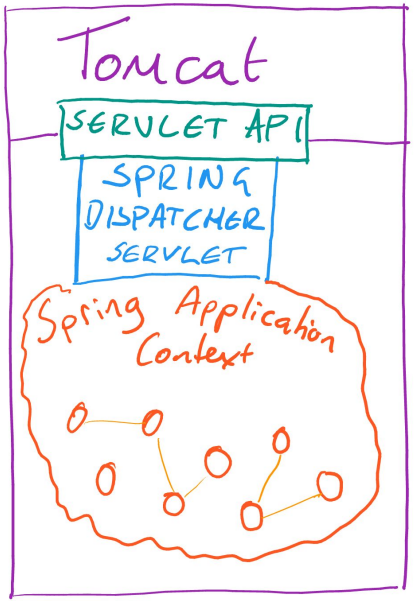
Inside the Java app:



READS AND WRITES ACTUAL HTTP

The Webserver Code

Inside the Java app:



READS AND WRITES ACTUAL HTTP

JAVA STANDARD FOR WEB SERVICES

The Webserver Code

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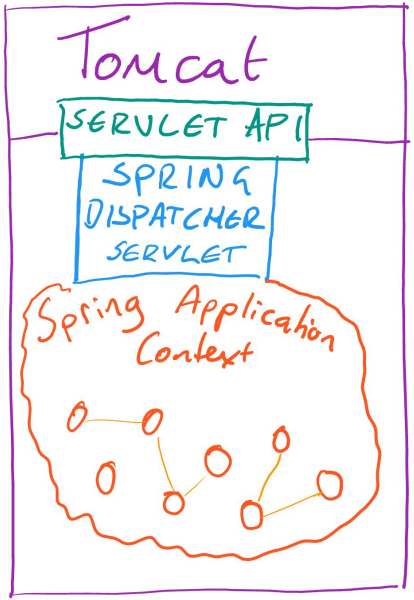

READS AND WRITES ACTUAL HTTP

JAVA STANDARD FOR WEB SERVICES

FINDS THE RIGHT "BEAN" AND CALLS A METHOD ON IT

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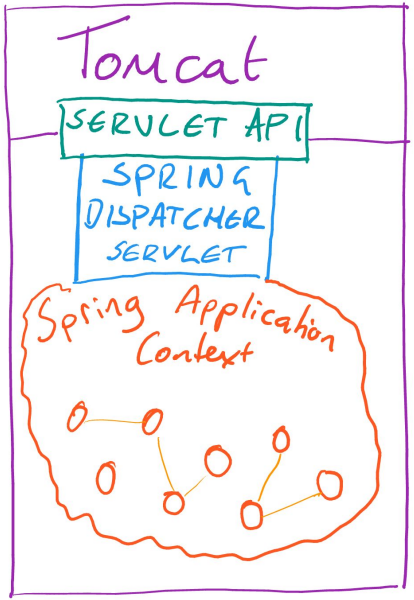

READS AND WRITES ACTUAL HTTP

JAVA STANDARD FOR WEB SERVICES

FINDS THE RIGHT "BEAN" AND CALLS A METHOD ON IT

"BEANS" ARE JUST INSTANCES OF YOUR CLASSES WHICH SPRING IS MANAGING

The Client Code

The Client Code

Vue files contain:
Templates
Bindings
Functions

(show some code)

Calling Server code from the Client

```
axios.post('/api/todos', {"title": this.newTitle,})
```

```
@PostMapping()
public TodoItem createTodo(@RequestBody TodoItem item) {
    if (item.getTitle().equals("")) {
        throw new BadRequestException("empty 'title'");
    }
    return todoSource.save(item);
}
```

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Calling Server code from the Client

This →

```
axios.post('/api/todos', {"title": this.newTitle,})
```

Calls This ↓

```
@PostMapping()
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        throw new BadRequestException("empty 'title'");
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```

What's this??

Where is the data stored?

```
@Autowired
public TodoController(TodoRepository todoSource){
    this.todoSource = todoSource;
}
```

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“Dependency Injection”

Where is the data stored?

In the TodoRepository

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In ~~the TodoRepository~~ memory

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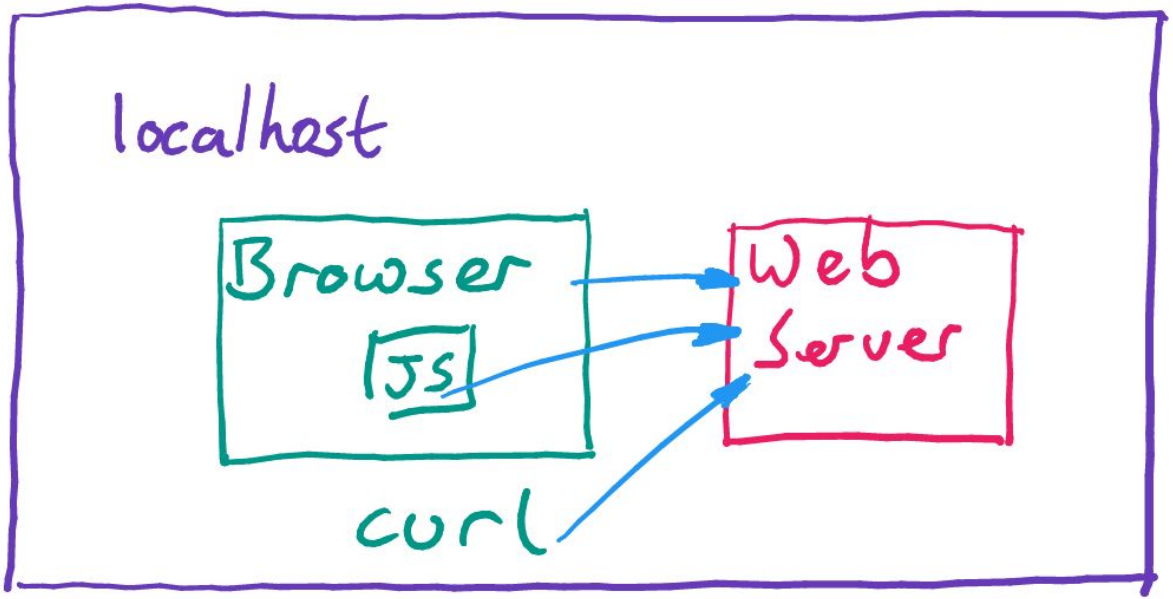
“Architecture”



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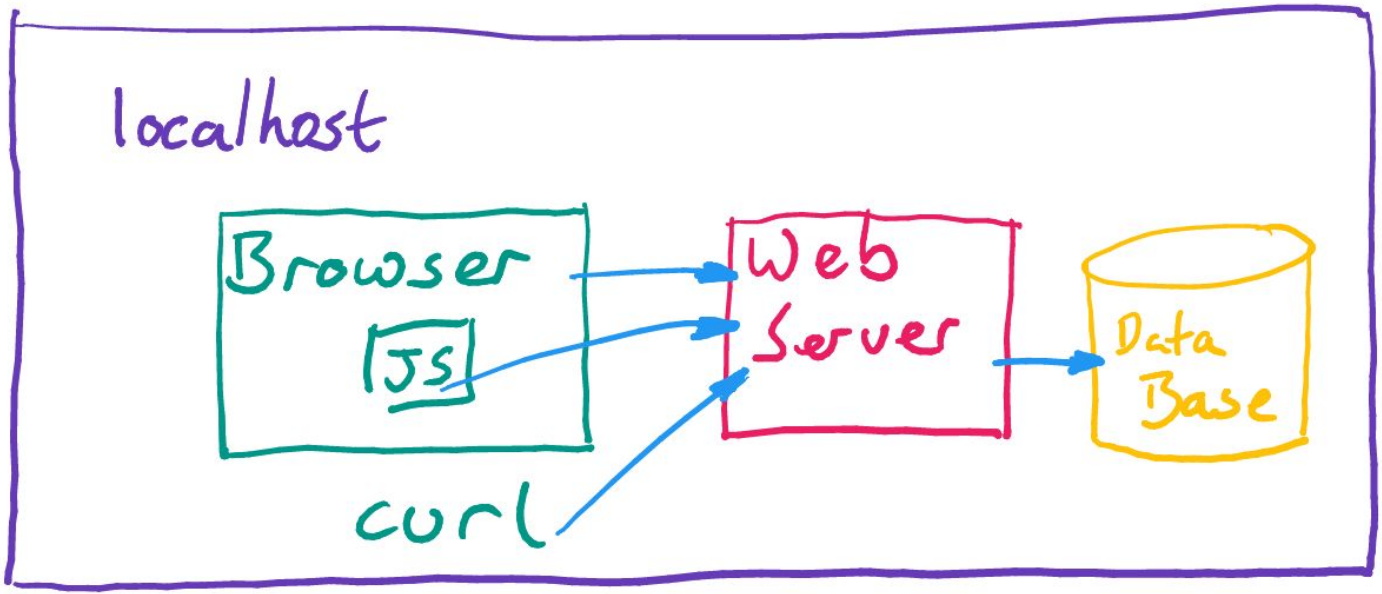

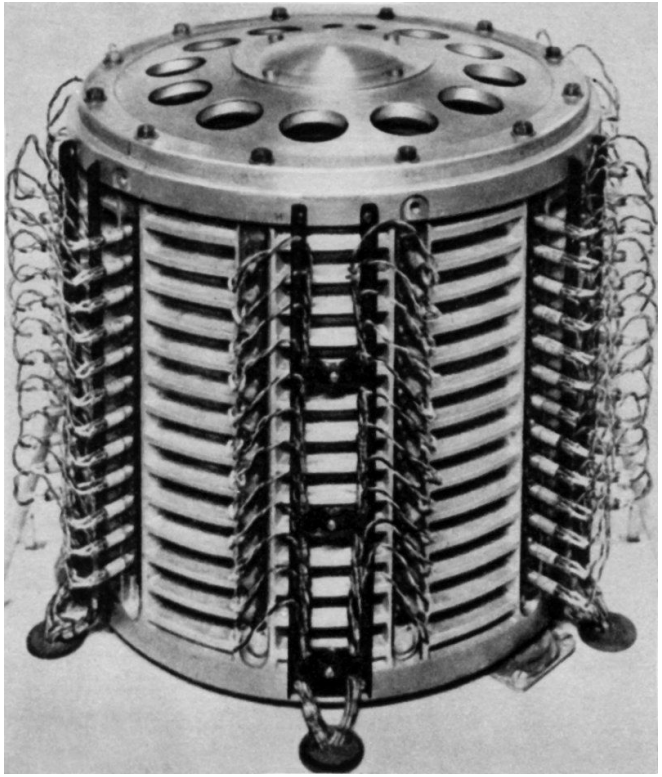


ORACLE

Who can use this app?

Who can use this app?

Answer:

You, by using `localhost`

localhost → 127.0.0.1

Who can use this app?

Answer:

People on the same network as you, if they know your IP address.

192.168.9.43

From the internet?

Probably not.

Your computer is not connected directly to the internet, but through a router.

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Probably not.

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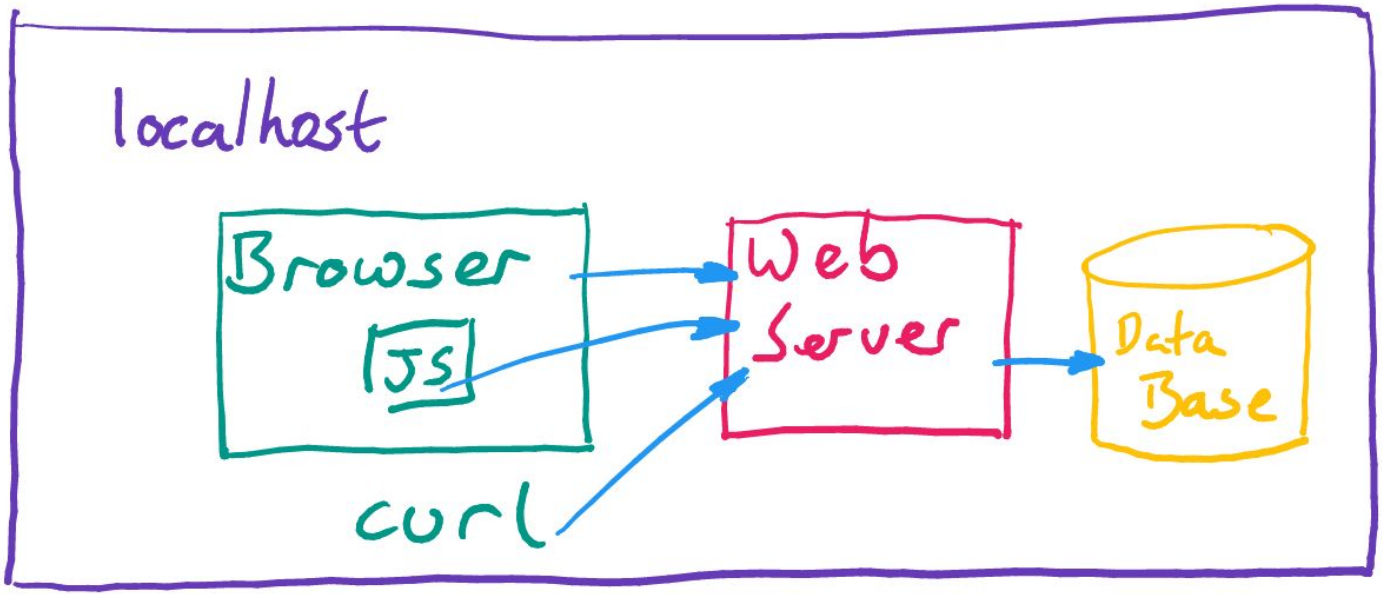
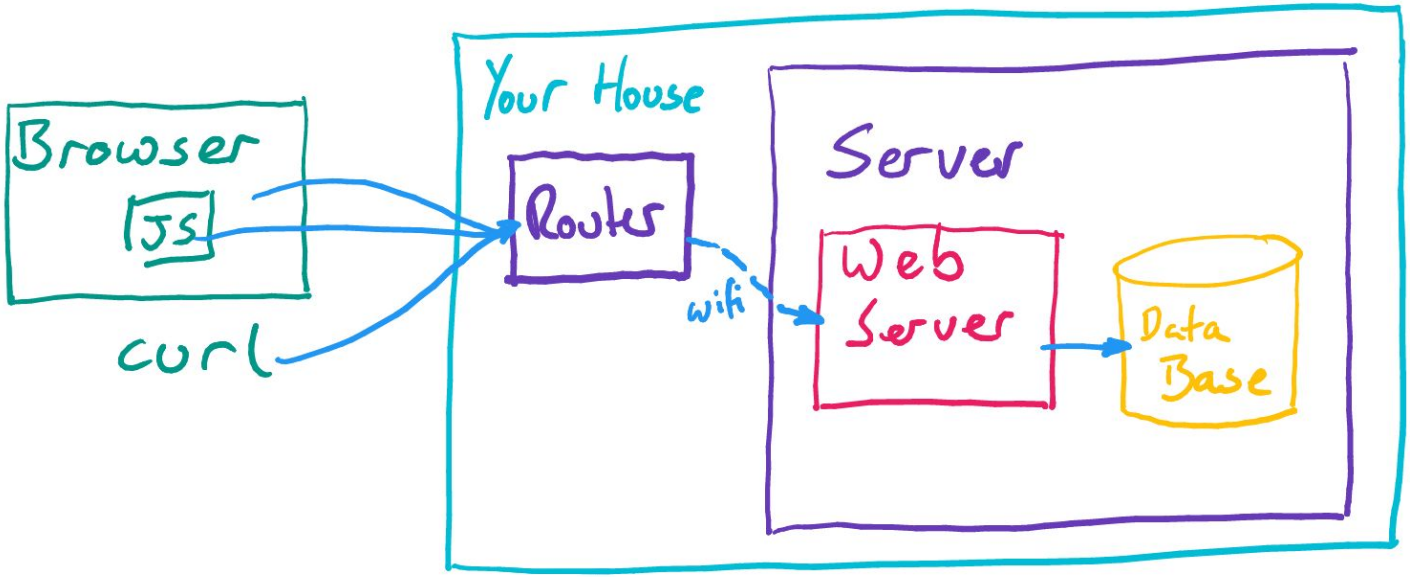
Configure the router to forward connections to your computer


localhost
Browser
JS
curl
Web
Server
Data
Base


Browser
JS
curl
Your House
Router
wifi
Server
Web Server
Data Base

How to measure reliability?

How to measure reliability?

Simplest:

What % of the time is the web application useable?

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Simplest:

What % of the time is the web application useable?

99%

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What % of the time is the web application useable?

99% => unavailable for 7 hours/month

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Simplest:

What % of the time is the web application useable?

99% => unavailable for 7 hours/month
99.9% => unavailable for 43 minutes/month

How to measure reliability?

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What % of the time is the web application useable?

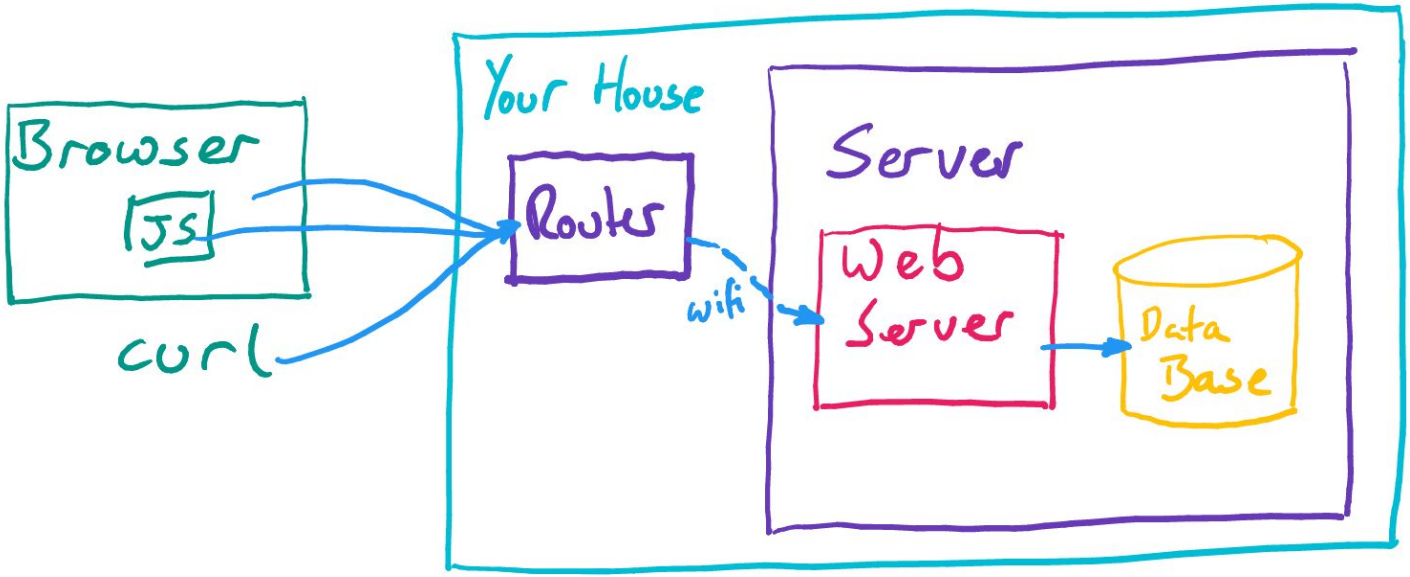
99% => unavailable for 7 hours/month
99.9% => unavailable for 43 minutes/month
99.99% => unavailable for 4 minutes/month

How to measure reliability?

Simplest:

What % of the time is the web application useable?

99% => unavailable for 7 hours/month
99.9% => unavailable for 43 minutes/month
99.99% => unavailable for 4 minutes/month
99.999% => unavailable for 26 seconds/month


Browser
JS
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Your House
Router
wifi
Server
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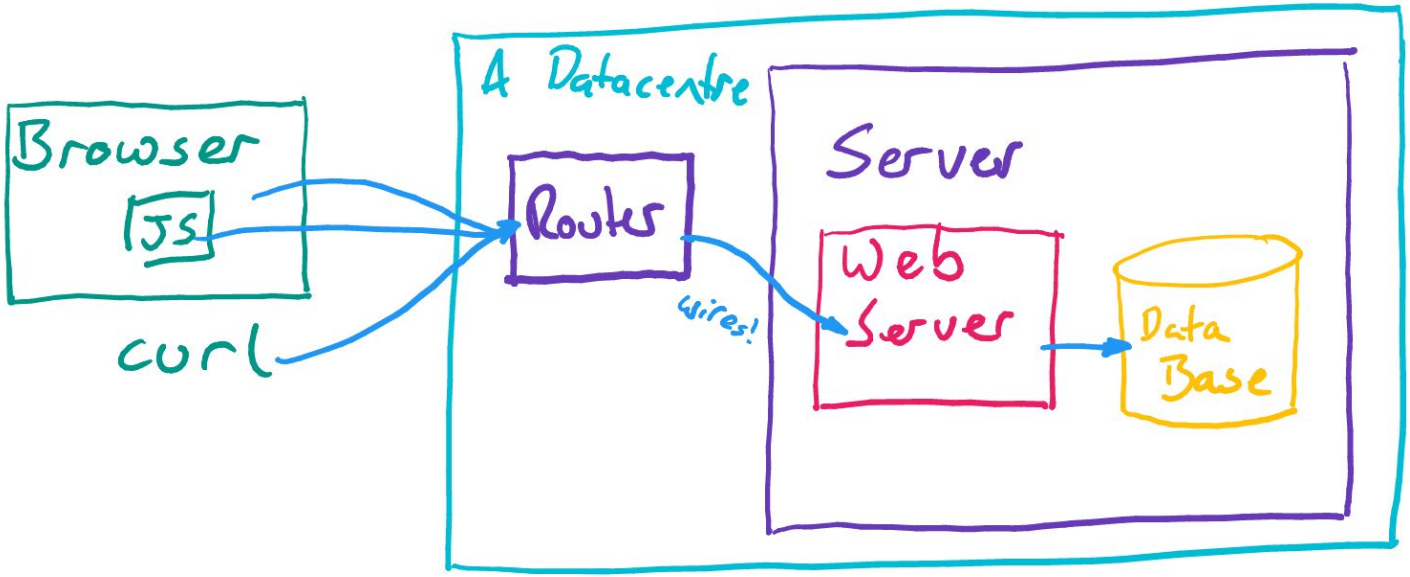
Data Base


Browser
JS
curl
A Datacentre
Router
wires!
Server
Web Server
Data Base

We have solved some problems

- Temperature, power, network all very reliable
- IP addresses are fixed

We still have some problems

- We had to buy a computer and put it in the DC
- Hardware failure.
- Scaling.
- Updating your OS.
- Updating your application.

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...solution?


the Cloud

IS JUST OTHER PEOPLE'S COMPUTERS

https://tinyurl.com/uob-oracle-cloud