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Context

- **Express**, together with **Node.js**, allow **JavaScript** to be used on the *back-end*
    - Allow using **JavaScript** to create *back-end* software
    - Allow the development of an application completely based on **JavaScript**

- The applications are developed, on the backend with **JavaScript**
    - Then, the applications are published with **Express**

- **Node.js** was not created to develop applications
    - **Express** creates a layer on the internal structure
    - **Express** publishes the functions needed to build the application

Express

- **Server side and mobile app framework**
  - Allows creating mobile and web applications with one or several pages
  - Allows the development of *back-end* functionalities for web applications and API
- Uses **JavaScript**
- **Templating**
  - Includes two module motors (Jade e EJS) that make the data flow easier and allow using other models
- Supports *Model-View-Controller* (**MVC**) architecture
- Uses **Node.js**
- **Multiplatform** (not limited to the operating system)
- Express **code generators** allow the fast creation of complex applications

Main characteristics

- Minimalistic code
- Robust *Routing*
  - *Routing*: decide what to do when a request arrives
- Easily integrable on the top template motors
- Works with the *middleware* concept
  - *Middleware*: intermediate “layer” capable of mediation between different technologies
- Focus on high performance
- Uses *Representational State Transfer* (**REST**) patterns and best practices
- Allows *content negotiation* (**RESTFul**)
  - *Content negotiation*: HTTP mechanism that allows accessing several versions of the same document from the same *Uniform Resource Identifier* (**URI**)

Middleware

- A set of functions called by Express' routing layer
- Put between the initial period and the route needed
- Functions
  - Defined as *middleware stack*
  - Called by the order they are added in (*First In First Out* – **FIFO**)
- Work as a filter of the requests
  - By passing through the *middleware*, the request can be changed before being delivered to the following process
- Applications become easier to maintain, and with fewer code

Middleware: how to use

- Usage:
  - `app.use()` [called for each HTTP method]
  - `app.METHOD()` [METHOD = GET, POST, PUT]

By defining the `app` variable without `var` or defining it as `global.app`, it is now considered a global variable and may be accessed in any external file (inside the project)

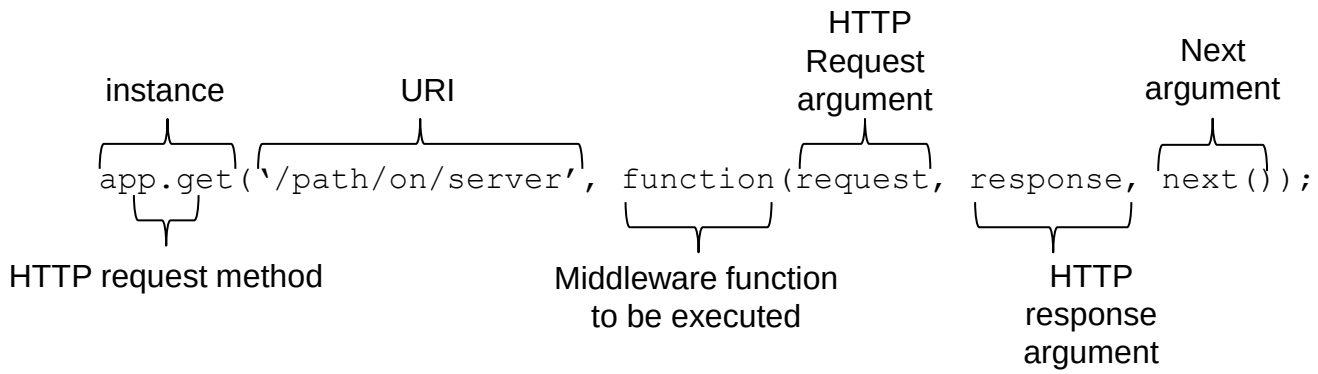
```
// Example:
var app = express();

app.use(function (request, response, next) {
  console.log('Time:', Date.now());
  next();
});
```

- *Middleware* is processed after receiving the order sent by the routing. Possible problems:
  - GET is executed before the middleware, POST is executed after
  - If the application is not updated, the code isn't invoquing `next()`
  - `request` and `response` are the same instance for all the *middlewares* and routes
    - Two *middlewares* modify the object's properties in different ways
      - Might cause errors on the application
        - Be aware of the changes made by the *middleware*

Routes

- Objective: decide what to do when a request arrives
- Structure: `app.METHOD(PATH, FUNCTION)`
  - app: Express instance
  - METHOD: HTTP method (GET, POST, PUT or DELETE)
  - PATH: path on the server
  - FUNCTION: function to execute when the route is followed
    - next needs to be explicitly invoqued, so that the middleware knows what is the next operation

- *Routing*: definition of URIs and how they respond to requests. Structure:



More information on routing: http://expressjs.com/en/guide/routing.html

Routing: example ‘Ola mundo’

```
const express = require('express');
const app = express();
app.get('/', function(request, response){
   response.send('Ola mundo');
});
```

- Example of root (/) route that responds with the message “Ola mundo”

Routing: example two routes

```
const express = require('express');
const app = express();
app.get('/', function(request, response, next){
   response.send('Vou para a raiz');
});
app.get('/help', function(request, response, next){
   response.send('Vou para a ajuda');
});
```

- *Middleware* calls the next given as parameter

- Two routes:
  - /: shows 'Vou para a raiz'
  - /help: shows 'Vou para a ajuda'

Routing: example previous database session

```
const express = require('express');
const app = express();
app.use(function(request,response,next){
   db.load(function(err,session){
      if(err){
         return next(err);
      } else if(!session){
         return next(new Error('Sem sessão');
      }
      request.session = session;
      next();
   });
});
app.get('/',function(request,response,next){…});
```

- We want to load a database session before processin any request
- With app.use we make it mandatory to call db.load() before any request
- Call to next is made to the database:
  - If error, goes to next
  - If no session, creates an error
  - Next is called only after all validations
    - And then, the route '/' is called

Routing: router module

```
//pagina.js
const express = require('express');
const router = express.Router();
router.use(function timeLog(req,res,next){
   console.log('Time: ',Date.now());
   next();
});
router.get('/', function(req,res){
   res.send('Raiz');
});
router.get('/about', function(req,res){
   res.send('Sobre');
});
module.exports=router;
```

```
//servidor.js
const pag = require('./pagina');
app.use('/pagina',pagina);
```

- Simplify the route management
- Creates route handler
- Can be exported and used
- Code:
  - pagina.js
    - Creates a router as a module
    - Loads a middleware function (timeLog)
    - Defines two routes ('/' e '/sobre')
    - Exports the router created
  - servidor.js
    - Loads the file pagina.js
    - Forces its usage on servidor.js

Routing: character sequences (regular expressions)

```
app.get('/ab?cd', function(req,res){
   res.send('ab?cd');
});
```

/acd, /abcd

```
app.get('/ab+cd', function(req,res){
   res.send('ab+cd');
});
```

/abcd, /abbcd, /abbbcd, …

```
app.get('/ab*cd', function(req,res){
   res.send('ab*cd');
});
```

/abcd, /abacd, /abxcd, /abQUALQUERcd, /ab453cd, …

```
app.get('/ab(cd)?e', function(req,res){
   res.send('/ab(cd)?e');
});
```

/abe, /abcde

Reply methods

- The response (res) object‘s methods send the response to the client and end the request-response cycle
  - If none is called, the request is left suspended

Método	Descrição
`res.download()`	Requests to download a file
`res.end()`	Ends the response process
`res.json()`	Sends a JSON response
`res.jsonp()`	Sends a JSON response with support for JSONP
`res.redirect()`	Redirects a request
`res.render()`	*Renders* a view model
`res.send()`	Sends a response (several types)
`res.sendFile()`	Sends a file
`res.sendStatus()`	Configures the response’s status code and sends its representation in a character sequence

Static files

- Express' HTML pre-processor (Jade) does not allow HTML basic tags (wit < and >)
- To avoid learning a new language, we can use static files
- Just refer to the name of the folder that contains static files

```
app.use(express.static(__dirname+'/nomePasta');
```

Links the *middleware* to the application by using the global variable `__dirname` containing the path to the folder

```
app.use('/public',express.static('assets');
```

Allows delivering files to a folder called assets from the /public route

```
app.use('/template',
     global.express.static('views/template'));
```

The route /template can access the files in views/template

```
app.get('/template/index', function(req,res){
   app.use(express.static('views');
   res.sendFile(__dirname+'/views/template' +
     'index.html');
```

Creates the /template/index route and all the files accessed by that route use the folder views.

Sequelize module

- **Sequelize:** *Object-relational mapping* (**ORM**) framework ready for Node.js
- Supports PostgreSQL, MySQL, MariaDB, SQLite, MSSQL
- Allows all SQL operations.
- Steps:
    1. Install the following modules `sequelize` and `mysql`
    2. Configure a connection
    3. Create an instance for the database
- More information: https://sequelize.org/v5/

Sequelize with MySQL

- Configuring the connection:

```
const sequelize  = new Sequelize('nomeDB','utilizador','pass', {
   host: 'localhost',
   dialect: 'mysql',
   pool : {
      max: 5,
      min: 0,
      idle: 1000
},});
```

ou

```
const sequelize = new sequelize('mysql://utilizador:pass@host/nomeBD');
```

Pessoa

- cod
- nome
- ativo

- Usage:

```
Pessoa.findOne().then(function(p){
   console.log(p.get('nome'));
});
```

Allows finding one result on the database and returns its 'nome'.

```
Pessoa: findAll({where: {cod: 2}});
```

```
SELECT * FROM Pessoa WHERE cod=2
```

```
Pessoa: findAll({where: {cod: 2, ativo: 1}});
```

```
SELECT * FROM Pessoa WHERE cod=2 and ativo=1
```

```
Pessoa: destroy({where: {cod: 1}});
```

```
DELETE FROM Pessoa WHERE cod=1
```

```
Pessoa: update({nome: 'Manuel'}, {where: {cod: 2}});
```

```
UPDATE Pessoa SET nome= 'Manuel' WHERE cod=2
```

MySQL com Node.js

- Using JSON objects

- Steps:
  1. Install module `mysql`
  2. Configure a connection (creation of a dedicated file)
  3. Call the database connection on the script

```
// (Step 2) connect.js
const mysql = require('mysql');
module.exports = {
   con: mysql.createConnection({
      host: 'localhost',
      user: 'utilizador',
      password: 'pass',
      database: 'nomeBD'
   });
}
```

```
// (Step 3) script.js
const ligacao = require('./connect');
ligacao.con.query("SELECT * FROM Pessoa", function(err,rows,fields){
   if(!err){
      for(x=0; x < rows.length; x++){
         console.log("Pessoa -> Cod: " + rows[x].cod + ", Nome: " + rows[x].nome);
      }
   }
});
```

Pessoa

- cod
- nome
- ativo

More about MySQL with Node.js: https://www.w3schools.com/nodejs/nodejs_mysql.asp

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Do conhecimento à prática.