Node.js and Express

2020/21 COMP3322 Modern Technologies on WWW

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Node.js

- Node.js is an open-source, cross-platform, runtime environment that allows developers to create **server-side** applications in JavaScript.
- It is available on Microsoft Windows, macOS, Linux, Solaris, FreeBSD, etc.
- Node.js has an event-driven architecture capable of asynchronous I/O.
  - This is the major difference between Node.js and PHP.
    - Most functions in **PHP block until completion**, while Node.js functions are **non-blocking** (i.e. asynchronous) and use callbacks to signal completion or failure.
  - These design choices aim to optimize throughput and scalability in web applications with many input/output operations.

Node.js

- Node.js on its own does not provide a lot of features to support web-development.
- If you want to add specific handling for different HTTP requests (e.g. GET, POST, DELETE, etc.), handle requests at different URL paths, dynamically create the response, then you have to write the code yourself, or you can avoid reinventing the wheel and **use a web framework**.
  - Express is the most popular Node web framework.
- The node package manager (**NPM**) is the pre-installed package manager for the Node.js server platform.
  - It serves two functions: installing packages and managing dependencies.
  - It provides access to hundreds of thousands of reusable packages.

Setup Node

- https://developer.mozilla.org/en-US/docs/Learn/Server-side/Express_Nodejs/development_environment#Installing_Node
- For Windows and macOS
  - Download the installer directly from node.js site:
  - https://nodejs.org/en/download/
- For Ubuntu 18.04 (or on Windows 10 Linux subsystem)
  - Don't install directly from the normal Ubuntu repositories
  - Open a terminal and run the following commands:

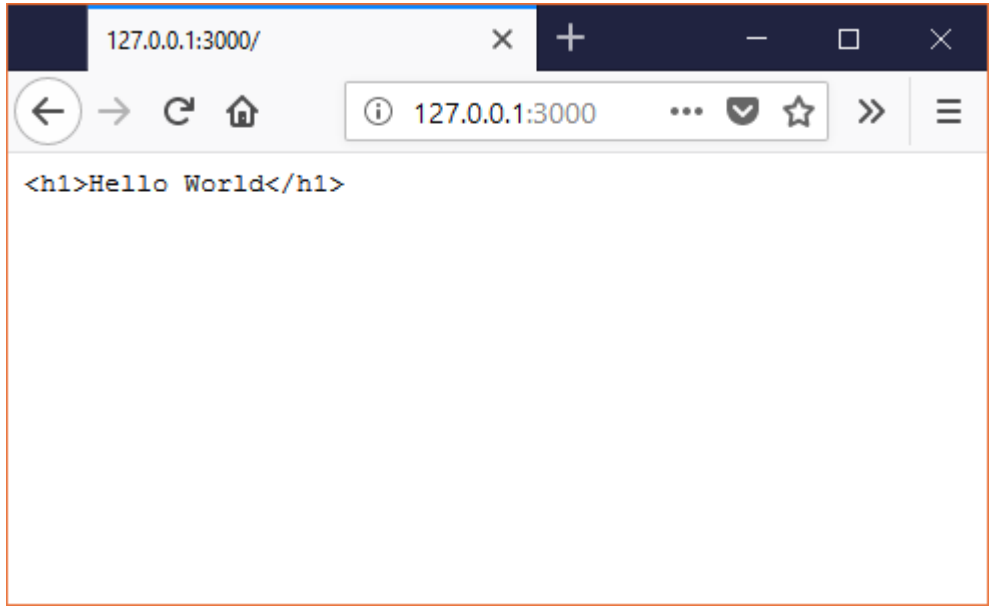
```
curl -sL https://deb.nodesource.com/setup_12.x | sudo -E bash –
sudo apt-get install -y nodejs
```

A Simple Node Program

```
//Load HTTP module
const http = require("http");
const hostname = '127.0.0.1';
const port = 3000;

//Create HTTP server and listen on port 3000 for requests
const server = http.createServer((req, res) => {

  //Set the response HTTP header with HTTP status and Content type
  res.statusCode = 200;
  res.setHeader('Content-Type', 'text/plain');
  res.end('<h1>Hello World</h1>\n');
});

//listen for request on port 3000, and as a callback function have
the port listened on logged
server.listen(port, hostname, () => {
  console.log(`Server running at http://${hostname}:${port}/`);
});
```

imports the "http" module

```
> node hellonode.js
Server running at http://127.0.0.1:3000/
```




```
<html>
▶ <head>…</head>
▼ <body>
    <pre><h1>Hello World</h1></pre>
  </body>
</html>
```

How do Node.js+Express work?

- A web server can be seen as a function that takes in a HTTP request and outputs an HTTP response.
- To do so, the web server needs to
  - know **the type** of request (GET, POST, HEAD, etc.).
  - know the request **resource** (identify by **the path**, **query string**, and **fragment**).
  - perform some **computation** (according to the request and resource).
  - generate and return the response.

How do Node.js+Express work?

- Express provides mechanisms to:
  - Specify which functions are called for requests with different HTTP **request verbs** (e.g., GET & POST) at different URL **paths** (**routes**).
  - **Specify which template** ("view") **engine** is used, where are the template files located, and which templates to use to render the response.
  - Set common web application settings like the port to use for connecting.
  - Specify where to **find the static files**, e.g. CSS files and image files.
  - Use any database mechanism supported by Node.

How do Node.js+Express work?

- Express provides mechanisms to:
  - Add request processing "middleware" at any point within the **request handling pipeline**.
    - **Middlewares are functions** executed in the middle of the request handling pipeline
      - Middleware function may produce an output which could be the final output or could be used by the next middleware until the cycle is completed.
    - Thus, to serve a request, we may have more than one middleware and they execute one after the other in the order to generate the output.
    - There are middlewares for cookies, sessions, and users, getting POST/GET parameters, etc.

A Simple Express Example

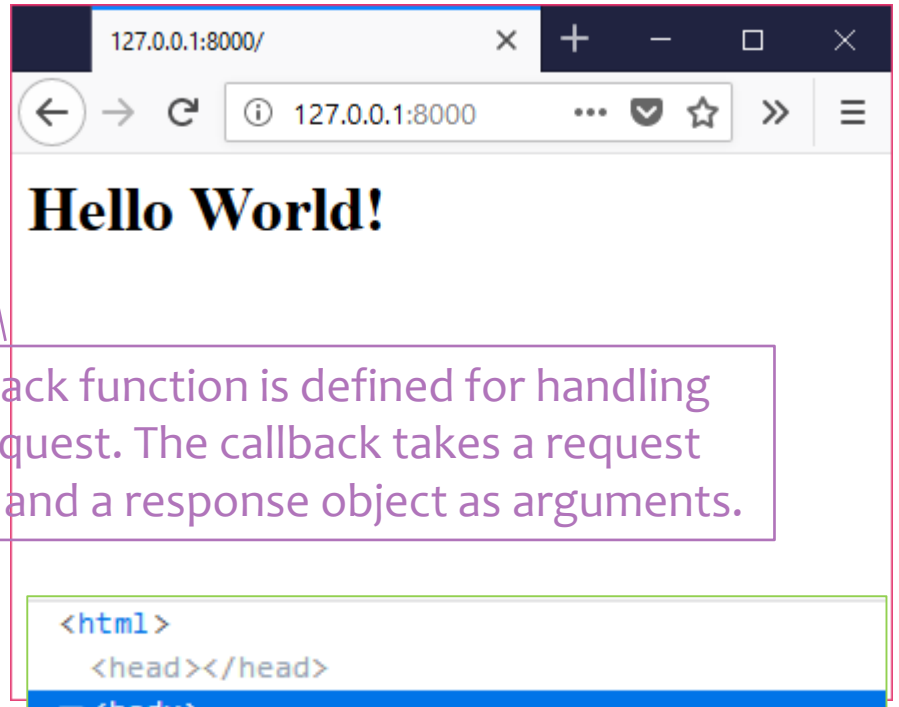
creates an express app

imports the "express" module

```
const express = require('express')
const app = express();

app.get('/', (req, res) => {
  res.send('<h1>Hello World!</h1>')
});

app.listen(8000, () => {
  console.log('Example app listening on port
8000!')
});
```

The app.get() function only responds to HTTP GET requests with the specified URL path ('/'). – Specify the "route"

```
> node index.js
Example app listening on port 8000!
```



A callback function is defined for handling GET request. The callback takes a request object and a response object as arguments.

```
<html>
  <head></head>
  <body>
    <h1>Hello World!</h1>
  </body>
</html>
```

A Simple Express Example

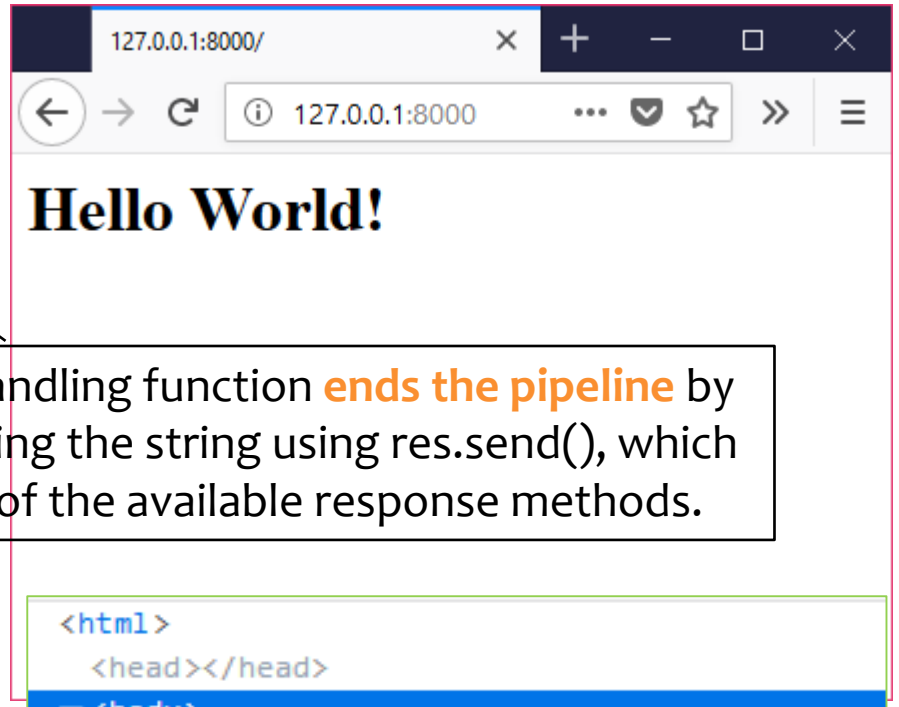
creates an express app

imports the "express" module

```
const express = require('express')
const app = express();

app.get('/', (req, res) => {
  res.send('<h1>Hello World!</h1>')
});

app.listen(8000, () => {
  console.log('Example app listening on port
8000!')
});
```

This starts a server listening for connection at port 8000.

```
> node index.js
Example app listening on port 8000!
```



This handling function **ends the pipeline** by returning the string using res.send(), which is one of the available response methods.

```
<html>
  <head></head>
  <body>
    <h1>Hello World!</h1>
  </body>
</html>
```

Using Express

- To run the simple express program, you have to execute the following steps in a terminal:
  - Create a project folder for your application
  - Use npm to initialize the project
  - Install express to your project
  - Create a file name index.js and copy the code to it
  - Start the server

```
mkdir myapp
cd myapp
```

```
npm init

npm install express
```

```
node index.js
```

- Or we can install the express generator and use it to generator the application skeleton.
  - npm install express-generator -g
  - the -g flag installs the tool globally in the system so that you can call it from anywhere
  - You will learn about that in Workshop 4.

Routing

- Routing refers to how the system responds to a client request **to a particular endpoint** – a path and a specific HTTP request (GET, POST, etc).

```
const app = express();
```

- Assume an instance of express is created with the name app.
- Route definition takes the following structure:
  - app.METHOD(PATH, HANDLER)

```
app.get('/', function (req, res) {
  res.send('<h1>Hello World!</h1>')
})
```

```
app.put('/user', function (req, res) {
  res.send('Got a PUT request at /user')
})
```

```
app.post('/', function (req, res) {
  res.send('Got a POST request')
})
```

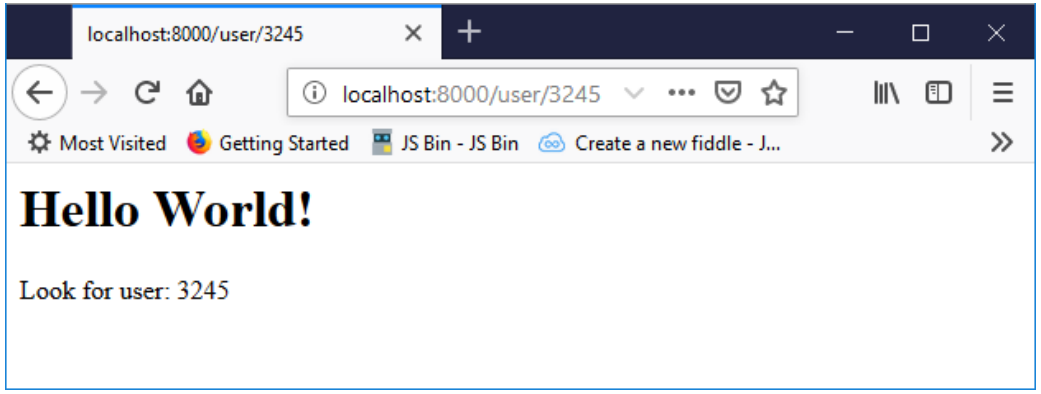
```
app.delete('/user', function (req, res) {
  res.send('Got a DELETE request at /user')
})
```

app.METHOD(PATH, HANDLER [,HANDLER . . .])

Route Handlers and Route parameters

- For the handler, it could be:
  - A **single** callback function
  - **More than** one callback function; separated by commas
  - An **array of** callback functions
  - If a callback function is not the end of the chain, it must call **next()** to pass control to the next function.
- We can capture the value(s) **at a specific** position(s) in the URL path as **Route Parameter**(s).
  - The captured values are populated in the **req.params** object, with the name of the route parameter specified in the path as their respective keys.
  - Now we can use the same set of route handlers to process different paths under the same path tree.
    - e.g. '/user/1234', '/user/2468'

```
app.get('/user/:userid',
  (req, res, next) => {
    let who = req.params.userid;
    res.locals.rdata = 'Look for user: '+who;
    next();
  },
  (req, res) => {
    let msg = '<h1>Hello World!</h1>';
    msg += res.locals.rdata;
    res.send(msg);
  }
);
```



https://expressjs.com/en/api.html#req

Request and Response Objects

- The req object represents the received **HTTP request**. Here are some properties that can be accessed:

Properties	Description
req.app	Returns a reference to the current app instance.
req.baseurl	It specifies the URL path on which a router instance was mounted.
req.cookies	When we use **cookie-parser** middleware, this property is an object that contains cookies sent by the request.
req.hostname	It contains the hostname from the "host" http header.
req.ip	It specifies the remote IP address of the request.
req.method	Returns the HTTP method of the request
req.originalUrl	This property holds the **original request** URL.
req.params	An object containing properties mapped to the named **route parameters**.
req.path	It contains the **path** part of the request URL.
req.protocol	The request protocol string, "http" or "https" when requested with TLS.
req.query	An object containing a property for each **query string** parameter in the route.

https://expressjs.com/en/api.html#res

Request and Response Objects

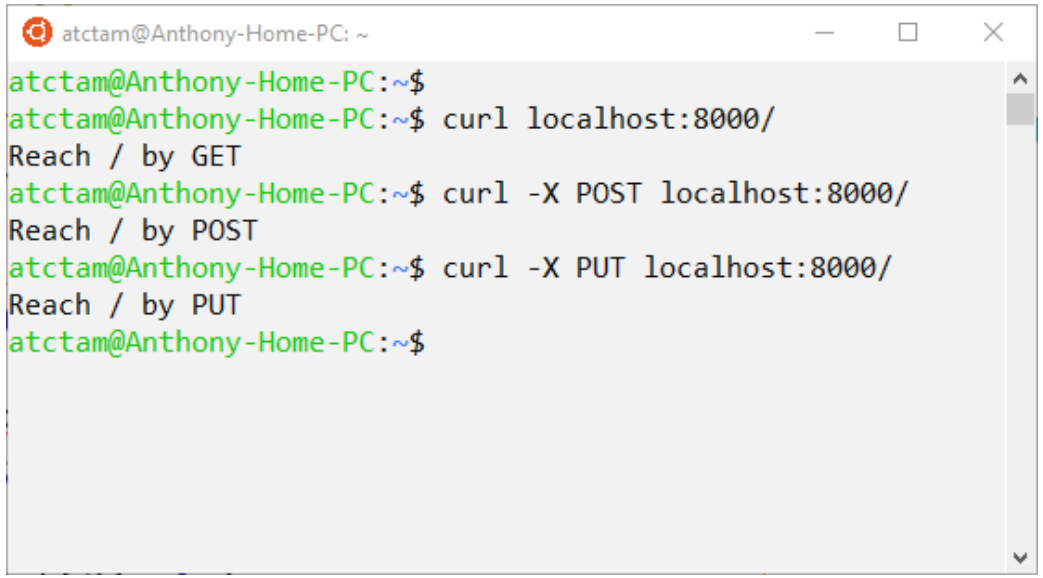
- The res object represents the **HTTP response** that an Express app is going to send.

Properties /Methods	Description
res.app	Returns a reference to the current app instance.
res.headersSent	A Boolean property that **indicates if the app has sent the HTTP headers** for the response.
res.locals	It specifies an object that contains response local variables scoped to the request.
res.append( )	Appends the specified value to the HTTP response header field.
res.cookie( )	Sets the HTTP Set-Cookie header with the options provided.
res.clearCookie( )	Clears the cookie specified by name and given options.
res.end( )	Use to quickly **end the response** without any data.
res.get( )	This method provides HTTP response header specified by field.
res.json( )	This method returns the **response in JSON format**.
res.redirect( )	**Redirects to the URL** derived from the specified path, with specified status.
res.render( )	**Renders a view** and sends the rendered HTML string to the client.
res.send( )	**Sends the HTTP response body**.
res.sendStatus( )	Sets the response HTTP status code to statusCode and send its string representation as the response body.
res.set( )	Sets the response's HTTP header field to input value.
res.status( )	Sets the HTTP status for the response.

Routing

- We can create **chainable route handlers** for a **single route path** for different HTTP requests by using app.route()

```
app.route('/')
  .get( (req, res) => {
      res.send("Reach "+req.originalUrl+" by
"+req.method);
  })
  .post( (req, res) => {
      res.send("Reach "+req.originalUrl+" by
"+req.method);
  })
  .put( (req, res) => {
      res.send("Reach "+req.originalUrl+" by
"+req.method);
  });
```



Routing

- We can use the express.Router class to create modular, **mountable** route handlers.
- Adv:
  - Organize the routings in separate files.
  - This router module can be used to handle requests to different paths of **similar structure**.

```
const express = require('express')
const app = express();

var tryRouter = require('./tryRouter');

app.use('/c3322', tryRouter);
app.use('/c3230', tryRouter);

app.listen(8000, () => {
  console.log('Example app listening on port 8000!')
});
```

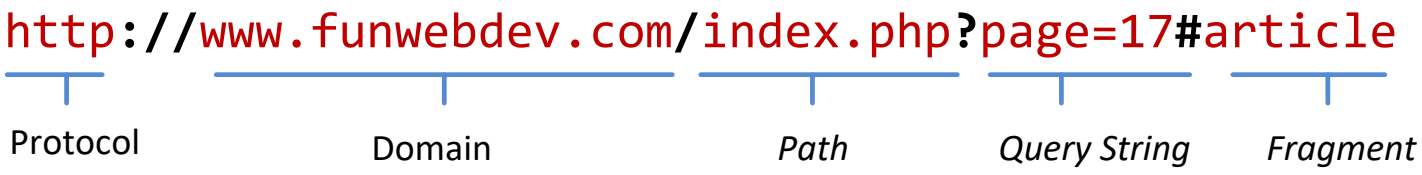
tryRouter.js

```
const express = require('express')
const router = express.Router();

function output(req, res) {
  res.send("I am in " + req.originalUrl);
}

router.get('/', output);

router.get('/about', output);

router.get('/contact', output);

module.exports = router;
```

atctam@Anthony-Home-PC: ~

```
atctam@Anthony-Home-PC:~$ curl localhost:8000/c3322/
I am in /c3322/
atctam@Anthony-Home-PC:~$ curl localhost:8000/c3322/about
I am in /c3322/about
atctam@Anthony-Home-PC:~$ curl localhost:8000/c3322/contact
I am in /c3322/contact
atctam@Anthony-Home-PC:~$ curl localhost:8000/c3230/
I am in /c3230/
atctam@Anthony-Home-PC:~$ curl localhost:8000/c3230/about
I am in /c3230/about
atctam@Anthony-Home-PC:~$ curl localhost:8000/c3230/contact
I am in /c3230/contact
atctam@Anthony-Home-PC:~$ curl localhost:8000/c1111/
```

Route Paths



- Query strings are not part of the route path.
- In addition to Route Parameters (slide# 14), we can represent **Route paths** as strings, string patterns, or regular expressions.
- Here are some examples of route paths based on string patterns:
  - '/ab?cd' – could be '/acd' and '/abcd'
  - '/ab+cd' – possible matches are: '/abcd', '/abbcd', '/abbbcd', . . .
  - '/ab*cd' – possible matches are: '/abcd', '/abxyzcd', '/ab12vn34cd', . . .

https://medium.com/@mayankv/regex-for-dummies-6542be2b4ebd

app.all(PATH, HANDLER [,HANDLER . . .])

Routing

- There is a **special routing** method, app.all(), used to load middleware functions at a path **for all HTTP request** methods.
- For example, the following callback is executed for requests to /secret whether using GET, POST, PUT, DELETE, or any other HTTP request method

```
app.all('/secret', (req, res, next) => {
  console.log('Accessing the secret section ...');
  next(); // pass control to the next handler
})
```

Middleware

- As implied by the name, Middleware is a function appears **in the middle** between an initial request and final handler.
- Middleware is commonly used to perform tasks like body parsing for URL-encoded or JSON requests, cookie parsing for basic cookie handling, or even building JavaScript modules on the fly.
- All middleware functions have access to the **request object** (req), the **response object** (res), and the **next middleware** function in the request handling pipeline.
- Middleware functions are always invoked **in the order** in which they are added.

Middleware

- A middleware function can perform the following tasks:
  - It can **execute** any code.
  - It can make **changes to** the **req**uest and the **res**ponse **objects**.
  - It can **end** the request-response cycle.
  - It can **call** the next middleware function in the pipeline.
- If the function is not the end of the pipeline, it must call **next()** to pass control to the next function.

Application-Level Middleware

- We can use app.use() and app.METHOD() functions to **bind** application-level middleware to the app object.
- app.use() could be use with or without a mount path.

```
app.use(function () {}) //Is executed every time the app receives a request

app.use('/someroute', function() {}) //Added to a specific path
```

- Like app.METHOD(), app.use() can have one or more middleware functions.
- To **skip** the rest of the middleware functions from a router **sub-stack**, call **next('route')** to pass control to the next route.

```
app.get('/user/:id', function () {
  if (req.params.id == '111') next('route');
  else next();
}, function () {
  res.send("Normal");
});

app.get('/user/:id', function () {
  res.send("Special");
});
```

Error-handling Middleware

- Error-handling middleware always takes **four** arguments.
  - This is to identify it as an error-handling middleware function.
  - Even if you don't need to use the next(), you must specify it to maintain the signature.
- Define error-handling middleware functions in the same way as other middleware functions like the following:

```
app.use(function (err, req, res, next) {
  console.error(err.stack);
  res.status(500).send('Something broke!');
})
```

Router-Level Middleware

- Similar to application-level middleware, it is bound to an instance of **express.Router()**.
  - router.use()
  - router.METHOD()

```
//This code is executed for every request to the router
router.use(function (req, res, next) {
  console.log('Time:', Date.now());
  next();
})
```

- We can skip the following middleware functions in a route by using next('route').
- We can even skip the rest of the router's middleware functions, call next('router') to pass control back out of the router instance.

Built-in Middleware

- Express has the following built-in middleware functions:
  - **express.static** serves static assets such as HTML files, images, and so on.
  - **express.json** parses incoming requests with JSON payloads.
  - **express.urlencoded** parses incoming requests with URL-encoded payloads.

- A few middleware functions were included in Express before 4.x, you can find the list @ https://expressjs.com/en/api.html#express

Static Files

- Express supports serving static files such as images, CSS style files, and JavaScript files.
- We use the express.static() middleware function to **specify the root directory** from which the static files are located.
  - For example, use the following code to serve images, CSS files, and JavaScript files in a directory named public:

```
app.use(express.static('public'))
```

  - Express looks up the files relative to the static directory, so **the name of the static directory is not part of the URL**.

```
your-project
|- node_modules ...
|- public
|   |- css
|   |   `- style.css
|   |- images
|   |   |- logo.png
|   |   `- cat.jpg
|   |- js
|   |   `- ajax.js
|   `- hello.html
`- index.js
```

```
http://localhost:8000/images/cat.jpg
http://localhost:8000/css/style.css
http://localhost:8000/js/ajax.js
http://localhost:8000/images/logo.png
http://localhost:8000/hello.html
```

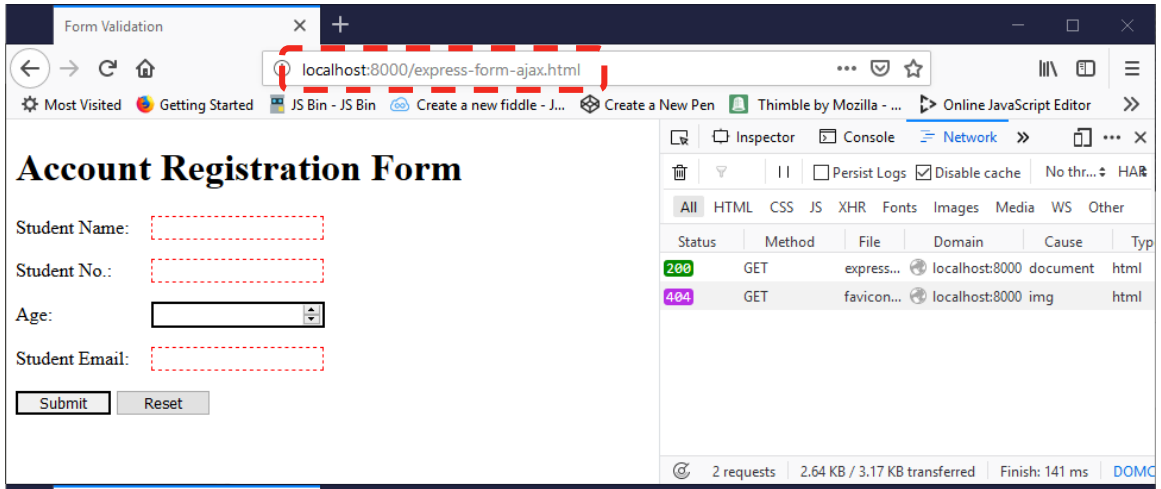
Static Files

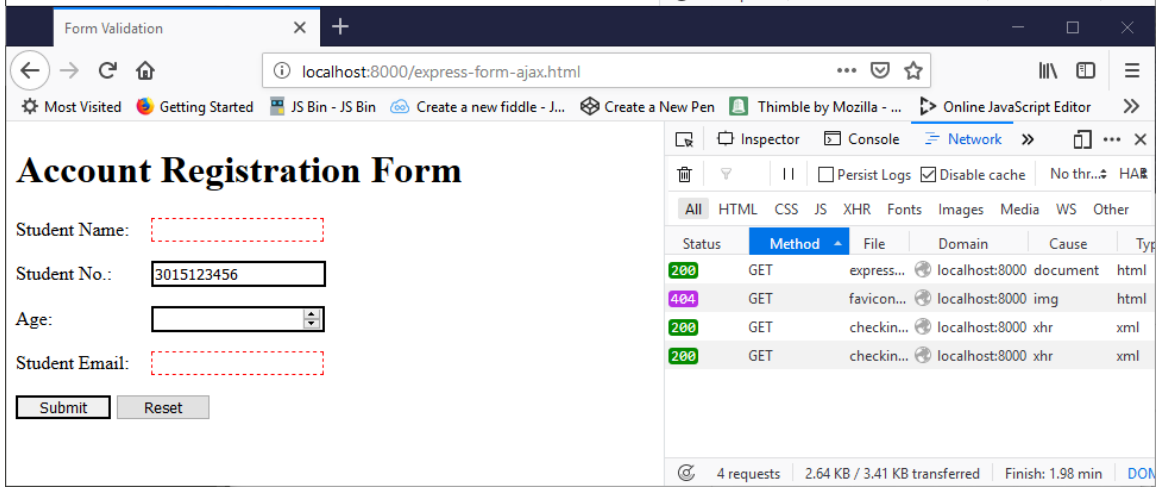
- We can create a "virtual path" in the URL for serving the static files.
  - A virtual path is the path **not actually exists** in the file system

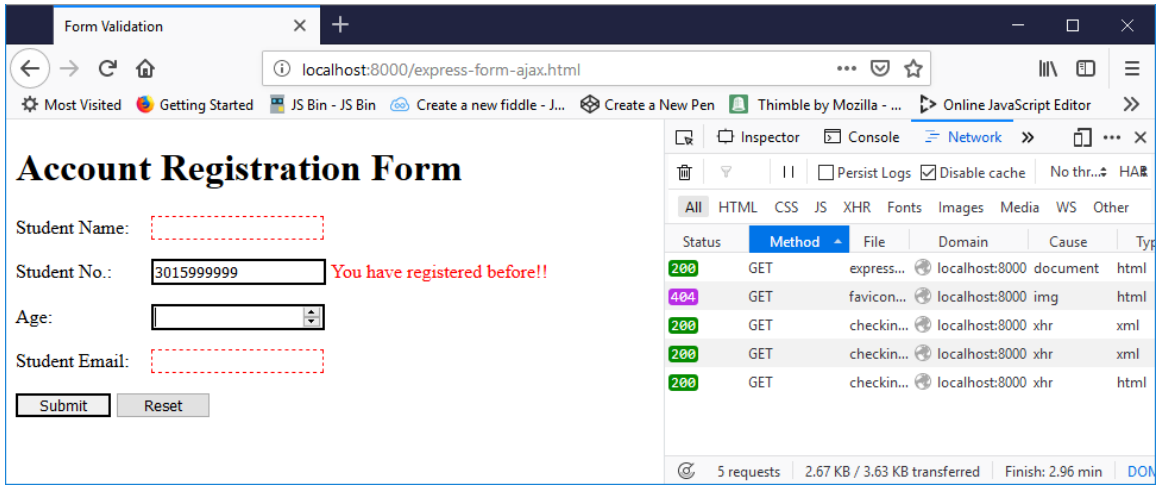
```
app.use('/static',express.static('public'))
```

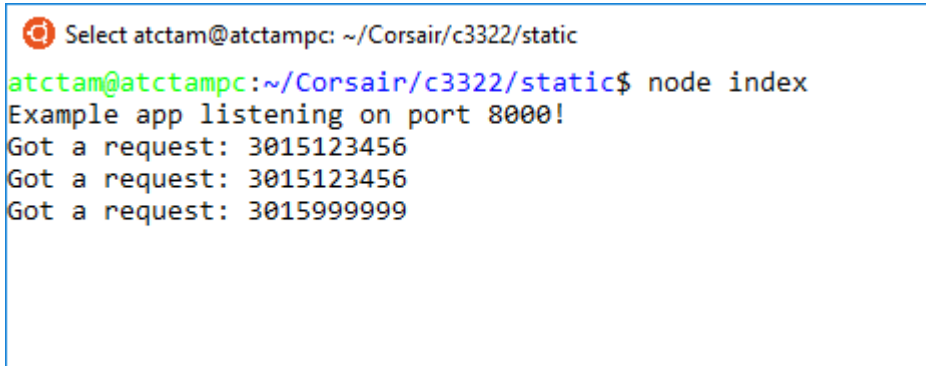
```
http://localhost:8000/static/images/cat.jpg
http://localhost:8000/static/css/style.css
http://localhost:8000/static/js/ajax.js
http://localhost:8000/static/images/logo.png
http://localhost:8000/static/hello.html
```

Demo – Our Account Registration Form









Demo – Our Account Registration Form

```
Windows PowerShell
PS D:\c3322\static> ls

    Directory: D:\c3322\static

Mode                LastWriteTime         Length Name
----                -------------         ------ ----
d-----        11/7/2018  11:50 AM                node_modules
d-----        11/7/2018  11:57 AM                public
-a----        11/7/2018   1:32 PM            451 index.js
-a----        11/7/2018  11:50 AM          13091 package-lock.json
-a----        11/7/2018  11:50 AM            252 package.json

PS D:\c3322\static> ls .\public\

    Directory: D:\c3322\static\public

Mode                LastWriteTime         Length Name
----                -------------         ------ ----
-a----        11/7/2018  11:59 AM           2551 express-form-ajax.html

PS D:\c3322\static>
```

express-form-ajax.html – only change from using checking.php to checking

```
function ajaxRequest() {
      ajaxObj.onreadystatechange = ajaxResponse;
      ajaxObj.open('GET', "checking?number="+snum.value, true);
      ajaxObj.send();
    }
    snum.addEventListener('blur', ajaxRequest);
```

Demo – Our Account Registration Form

This is for locating the static file – express-form-ajax.html

index.js

```
const express = require('express')
const app = express();

app.use(express.static('public'));

const USERNAME = '3015999999';

app.get('/checking', (req, res) => {
  console.log("Got a request: "+req.query.number);
  if ((req.query.number) && (req.query.number == USERNAME))
    res.send('You have registered before!!');
  else
    res.end();
})

app.listen(8000, () => {
  console.log('Example app listening on port 8000!')
});
```

checking.php

```
<?php

define("USERNAME", '3015999999');

if (isset($_GET['number']) && ($_GET['number'] == USERNAME))
{
  echo "You have registered before!!";
} else {
  echo "";
}
?>
```

This is for the route: GET /checking

Using Template Engines

- What is a template engine?
  - A template engine allows you to **define templates** for your web application.
  - The engine **replaces the (JavaScript) variables** in the template with actual values **at runtime** while transforming the template to an actual **HTML file** which is then sent to the client.
- There are several template engines you can use with Express, e.g., **Pug**, Mustache, and EJS.
- Jade (**which is renamed to Pug**) is the default template engine of Express application generator. Of this reason, we shall learn using Pug as the template engine.
- To **install pug** to your project: `npm install pug`

Using Pug

- To use Pug, include these two lines in your code.

```
app.set("view engine", "pug");

app.set("views", "./views");
```

To use Pug template

Set the directory where the template files are located

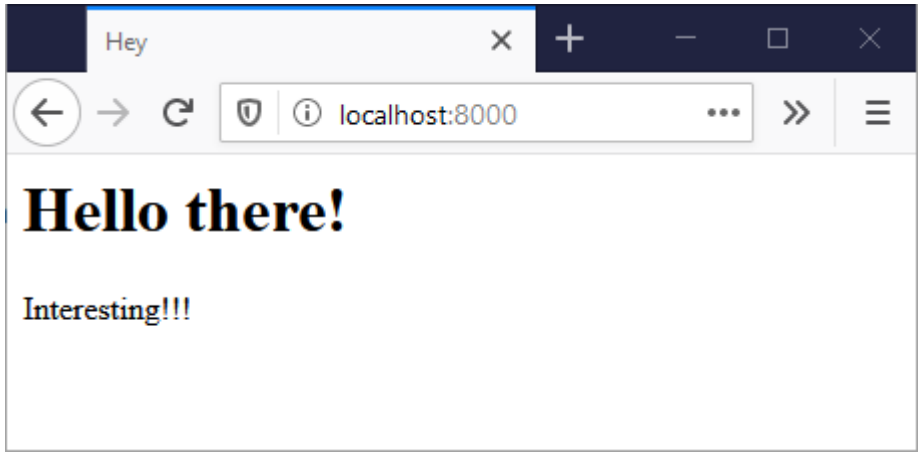
- Create a Pug template file, e.g., hello.pug.

```
html
  head
    title= title
  body
    h1= message
    <p>Interesting!!!</p>
```

Render the view hello.pug

- Then create a route to **render** the hello.pug file.

```
app.get('/', function (req, res) {
  res.render('hello',
    { title: 'Hey', message: 'Hello there!' })
})
```



Learning Pug

- Pug relies on **indentation** to describe the structure of the template. There are **no closing tags**.

```
p Hello World
```

```
<p>Hello World</p>
```

```
p
  | Hello <i>World</i>
```

```
<p>Hello <i>World</i></p>
```

```
<ul>
  li Item A
  li Item B
  li Item C
</ul>
```

```
<ul>
  <li>Item A</li>
  <li>Item B</li>
  <li>Item C</li>
</ul>
```

```
//- This is a pug comment
// This is for html
p This is a <em>paragraph</em>
```

```
<!-- This is for html-->
<p>This is a <em>paragraph</em></p>
```

Learning Pug - Attributes

```
a(href='google.com') Google
```

```
<a href="google.com">Google</a>
```

```
input(
  type='checkbox'
  name='milk'
  checked
)
```

```
<input type="checkbox" name="milk" checked="checked" />
```

```
a(style={color: 'red', background: 'green'})
```

```
<a style="color:red;background:green;"></a>
```

```
p.button
```

```
<p class="button"></p>
```

```
a#link
```

```
<a id="link"></a>
```

```
.content
```

```
<div class="content"></div>
```

```
#content
```

```
<div id="content"></div>
```

Learning Pug – Adding Code

Code starts with '-' is not added to the output

```
- for (var x = 0; x < 3; x++)
  li= 'item'+x
```

```
<li>item0</li>
<li>item1</li>
<li>item2</li>
```

With '=', JavaScript expression is evaluated and output

```
ul
  each val in [1, 2, 3, 4, 5]
    li= val
```

```
<ul>
  <li>1</li>
  <li>2</li>
  <li>3</li>
  <li>4</li>
  <li>5</li>
</ul>
```

```
- var n = 0;
ul
  while n < 4
    li= n++
```

```
<ul>
  <li>0</li>
  <li>1</li>
  <li>2</li>
  <li>3</li>
</ul>
```

Learning Pug – Adding Code

```
html
  body
    h1 Hello World!

    if user != null
      p Hi there, #{user}!
      p= "Hi there, "+user+"!"
    else
      p Hi there, unknown person!
```

```
app.get('/', function (req, res) {
  res.render('test1',
  {user: 'Thomas'})
})
```

Hello World!

Hi there, Thomas!

Hi there, Thomas!

```
app.get('/', function (req, res) {
  res.render('test1')
})
```

Hello World!

Hi there, unknown person!

By default, the contents **after a tag** are assumed to be **a string**, but the code in between #{ and } is evaluated.

With =, this indicates that the contents **after that tag** is a **JavaScript expression** instead.

In principle, we can pass a function expression to the template!!

Learning Pug – Including External Files

We can insert the contents of another Pug file into current one.

```
//- index.pug
doctype html
html
  include head.pug
  body
    h1 My Web Page
    p Welcome to my boring web site.
    #place
    include foot.pug
    script
      include ../public/js/other.js
```

views/index.pug

```
//- head.pug
head
  title My Homepage
  script(src='/js/jquery-3.3.1.js')
  <link rel="stylesheet" type="text/css" href="/style/style.css">
```

views/head.pug

```
//- foot.pug
footer#footer
  p Copyright (c) fool
```

views/foot.pug

```
$(document).ready( () => {
  $('#place').html("<p>Dynamically added paragraph</p>");
})
```

public/js/other.js

```
h1 {
  color: green;
}
p {
  font-weight : bold;
}
div {
  background-color: yellow;
  width: 50%;
}
```

public/style/style.css

```
usepug/
├── index.js
├── node_modules
├── package-lock.json
├── package.json
├── public
│   ├── js
│   │   ├── jquery-3.3.1.js
│   │   └── other.js
│   └── style
│       └── style.css
└── views
    ├── foot.pug
    ├── head.pug
    └── index.pug
```

Learning Pug – Including External Files

index.js

```
const express = require('express')
const app = express();

app.use(express.static('public'));
app.set("view engine", "pug");
app.set("views", "views");

app.get('/', (req, res) => {
  res.render('index');
})

app.listen(8000, () => {
  console.log('Example app list
});
```

My Web Page

Welcome to my boring web site.

Dynamically added paragraph

Copyright (c) fool

Inspector | Console | Debugger | { } Style Editor | Performance | M

Search HTML

```
<!DOCTYPE html>
<html>
  <head>
    <title>My Homepage</title>
    <script src="/js/jquery-3.3.1.js"></script>
    <link rel="stylesheet" type="text/css" href="/style/style.css">
  </head>
  <body>
    <h1>My Web Page</h1>
    <p>Welcome to my boring web site.</p>
    <div id="place">
      <p>Dynamically added paragraph</p>
    </div>
    <footer id="footer">
      <p>Copyright (c) fool</p>
    </footer>
    <script>
      $(document).ready( () => { $('#place').html("<p>Dynamically added
      paragraph</p>"); })
    </script>
  </body>
</html>
```

Learning Pug – Template Inheritance

- Template inheritance allows you to build a **base pug template** that ***contains all the common elements*** of your site and **defines blocks** that **child templates can override**.
- In Pug, template inheritance works via the **block** and **extends** keywords.
- In a template, a **block** is simply a "block" of Pug that a child template may replace.

Learning Pug – Template Inheritance

```
//- layout.pug
html
  head
    title My Site - #{title}
    block scripts
      script(src='/jquery.js')
  body
    block content
    block foot
      #footer
        p some footer content
```

Pug blocks can provide default content, if appropriate.

```
//- pageA.pug
extends layout.pug

block scripts
  script(src='/jquery.js')
  script(src='/pets.js')

block content
  h1= title
  - var pets = ['cat', 'dog']
  each petName in pets
    p= petName
```

To extend this layout, create a new file and **use the extends directive** with a path to the parent template. Then, define one or more blocks to override the parent block content.

Cookies

- To parse cookies with Express, we need the **cookie-parser** middleware.
- Install cookie-parser

```
npm install cookie-parser
```

- Import cookie-parser module to your program, and cookie-parser as a middleware.

```
var cookieParser = require('cookie-parser’)
app.use(cookieParser())
```

- We can get all the cookies sent in the request via the req object
  - req.cookies returns an object with cookie names as keys.
  - if no cookie is sent, req.cookies returns {}

Cookies

- To set a cookie in the response message, we use the cookie() method of the res object.

```
res.cookie('name', 'value')  // set cookie name to value

// set cookie name to value with other restrictions
res.cookie('name', 'value', {domain: 'i.cs.hku.hk', path: '/user',
                             expires: new Date(Date.now() + 86400)})
```

- To clear a cookie, use clearCookie() method
  - Must specify the name and the option which were specified in the res.cookie() (excluding expires and maxAge)

```
res.clearCookie('name', {domain: 'i.cs.hku.hk', path: '/user'})
```

Sessions

- To use server-side session, we need the express-session middleware.
- Install express-session `npm install express-session`
- The session middleware handles all things for us
  - Creating the session (and session cookie)
  - Creating the session object in **req** object
- We can add our **session variables** to the **req.session** object.
- The default storage is the MemoryStore
  - The memorystore is deleted everytime the server stops; for production system, use a more stable storage (e.g., database).

Sessions

- To use session, the minimum requirement is to pass in a secret for signing the session ID cookie.

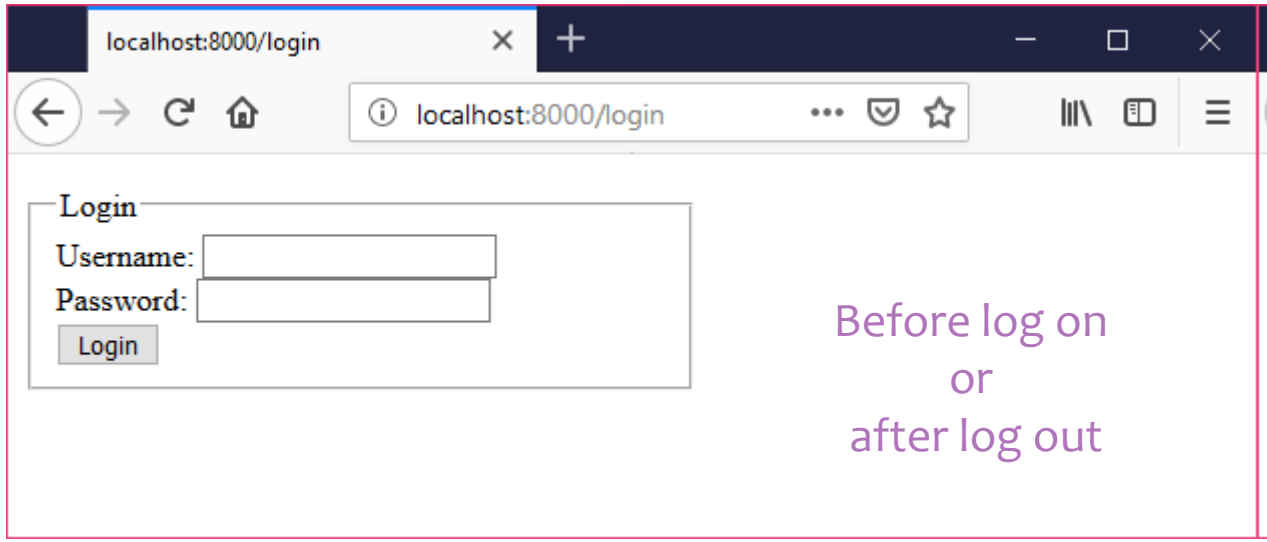
```
app.use(session({secret: "something"}))
```

- Possible settings:

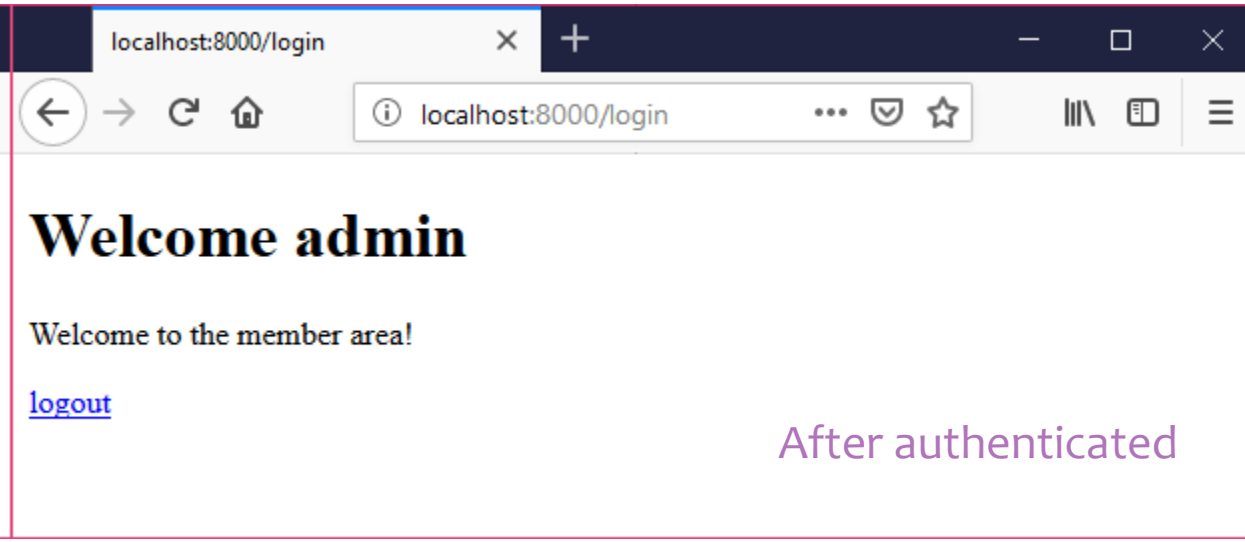
```
app.use(session({secret: "something", cookie: {maxAge: 600000, path: '/users'} }))
```

- To destroy the session, use **req.session.destroy**(callback)
  - The callback will be executed once the operation completed.
- To get the session ID, access the req property **req.sessionID** or req.session.id
- To get the properties of session cookie, use **req.session.cookie**

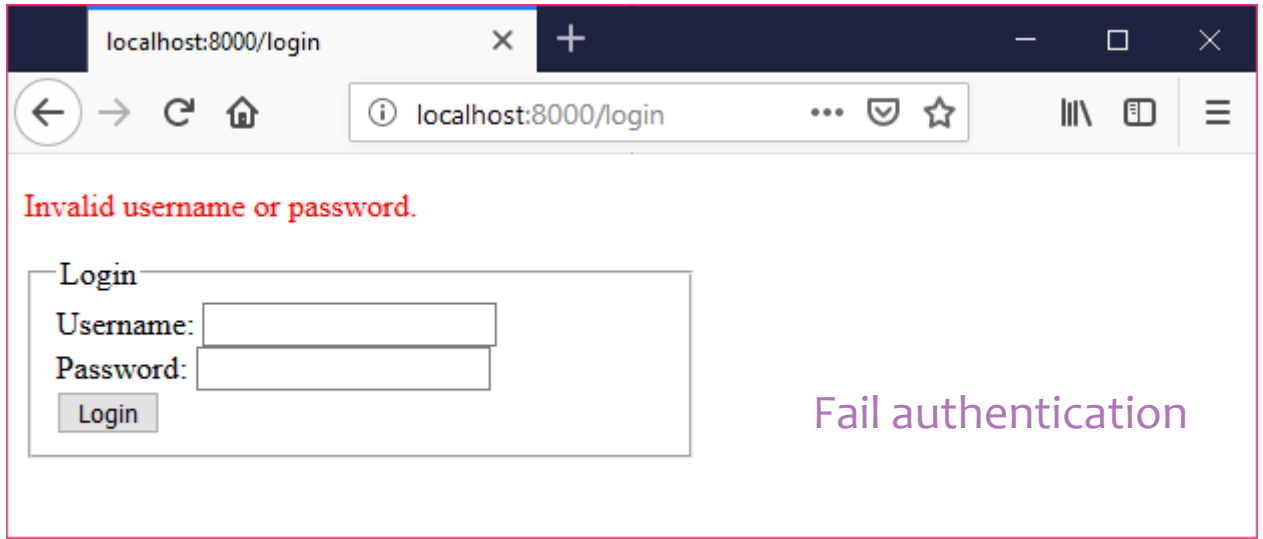
Demo – The login page again



Before log on
or
after log out



After authenticated



Fail authentication

```
session
├── index.js
├── node_modules
├── package-lock.json
├── package.json
└── views
    ├── access.pug
    └── login.pug
```

views/login.pug

```
<!DOCTYPE HTML>
<HTML>
<HEAD>
  style.
    #error {
      color: #ff0000;
    }
    fieldset {
      width: 50%;
    }
</HEAD>
<BODY>
  <form action="login" method="post">
    <p id="error">
      if msg != null
        span= msg
      else
        span= ""
    </p>
    <fieldset name="logininfo">
      <legend>Login</legend>
      <label for="username">Username:</label>
      <input type="text" name="username" id="username" /><br />
      <label for="password">Password:</label>
      <input type="password" name="password" id="password" /><br />
      <input type="submit" name="login" value="Login">
    </fieldset>
  </form>
</BODY>
</HTML>
```

views/access.pug

```
<!DOCTYPE HTML>
<HTML>
<BODY>
  h1 Welcome #{username}
  <p>Welcome to the member area!</p>
  <p>
    <a href="login?action=Logout">logout</a>
  </p>
</BODY>
</HTML>
```

index.js

```
//Set a predefined account
const SYSUSER = "admin";
const SYSPASSWORD = "secret"

const express = require('express')
const app = express();
//const bodyParser = require('body-parser');

app.set("view engine", "pug");
app.set("views", "views");

var session = require('express-session');

//Add session middleware to the pipeline
app.use(session({secret: "Hello World!"}));

//app.use(bodyParser.urlencoded({extended: false}));
app.use(express.urlencoded({extended: false}));

//for the routes - GET /login and GET/login?action=Logout
app.get('/login', (req, res) => {
  console.log(req.session.id);
```

To get the urlencoded data carried by HTTP POST, use the built-in express.urlencode() method (on Express v4.16.0 or above). Otherwise, use the body-parser middleware.

The extended option allows to choose between parsing the URL-encoded data with the standard querystring library (when false) or the qs library (when true)

index.js

```
//for the routes - GET /login and GET/login?action=Logout
app.get('/login', (req, res) => {
  console.log(req.session.id);
  if ((req.query.action) && (req.query.action == "Logout")) {
    req.session.destroy((err) => {
      if (err)
        console.log("Cannot access session");
    });
    res.redirect('/login');
  } else {
    if (req.session.login)
      res.render('access', {username: SYSUSER});
    else
      res.render('login');
  }
});

//for the route - POST /login
app.post('/login', (req, res) => {
  console.log(req.session.id);
  if (req.session.login)
    res.render('access', {username: SYSUSER});
```

Destroy the session and redirect to '/login'

If already logged in

Render the login page for the GET

index.js

```
//for the route - POST /login
app.post('/login', (req, res) => {
  console.log(req.session.id);
  if (req.session.login)
    res.render('access', {username: SYSUSER});
  if ((req.body.username == SYSUSER) && (req.body.password == SYSPASSWORD)) {
    req.session.login = SYSUSER;
    res.render('access', {username: SYSUSER});
  } else
  res.render('login', {msg: 'Invalid username or password.'});
});

app.listen(8000, () => {
  console.log('Example app listening on port 8000!')
});
```

If already logged in

If authenticated, set session variable and render the access page

Render the login page with error msg

Readings

- MDN web docs
  - Express/Node introduction
    - https://developer.mozilla.org/en-US/docs/Learn/Server-side/Express_Nodejs/Introduction
  - Setting up a Node development environment
    - https://developer.mozilla.org/en-US/docs/Learn/Server-side/Express_Nodejs/development_environment

References

- Express
  - https://expressjs.com/
- Pug – Language reference
  - https://pugjs.org/api/express.html
- Rendering pages server-side with Express (and Pug)
  - https://gist.github.com/joepie91/c0069ab0e0da40cc7b54b8c2203befe1
- Express-session
  - https://expressjs.com/en/resources/middleware/session.html