

PennApps Node.js Workshop

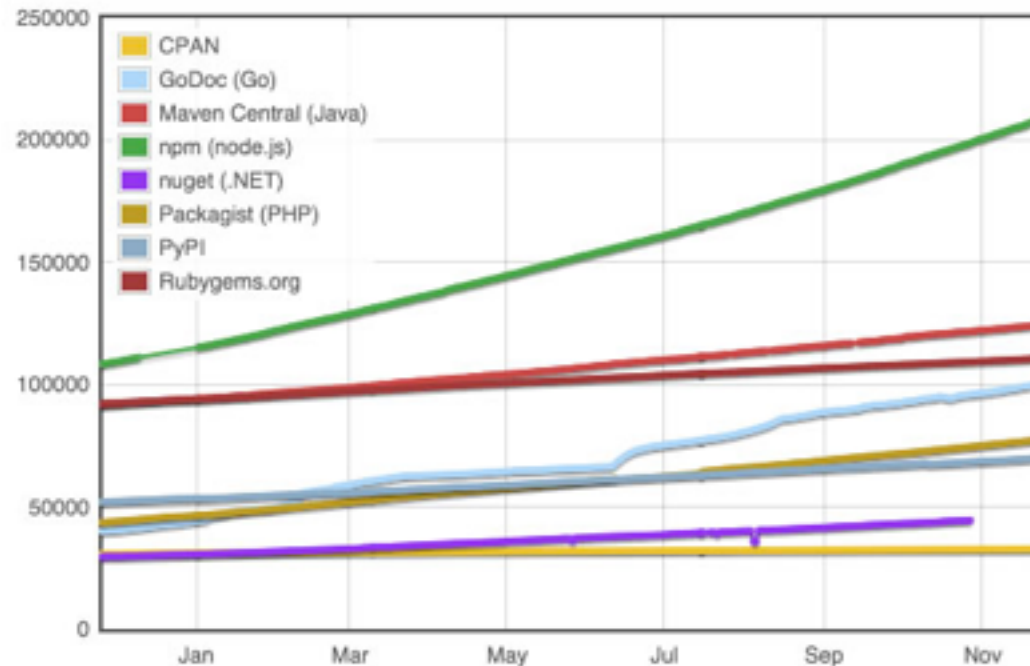
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Why Node.js?

- Already using it for the browser
- Growing FAST

Module Counts



Outline

1. Intro to Javascript
2. Intro to the Web
3. Node.js

Installing Node.js

- Use [Node Version Manager \(NVM\)](#) to manage and install Node.js versions
 - Use this even if you plan on just using one version
- We will be using version 6.5.0
- When you have trouble remembering what methods do, use [MDN](#)

Printing in Javascript

- You can print a value by passing a string to `console.log`
 - I will denote output with `// -->`

```
console.log('hello  
world'); // --> "hello world"
```

Running Javascript

- Use a REPL (Read-Execute-Print-Loop):
 - with the `node` command in terminal
 - with the console in a browser
- Execute `.js` files with the `node` command:
`node file.js`

Literals

- Numbers: 1, 2, 3, 1.28e4, NaN, Infinity
- Strings: 'xyz', 'foo \n', '\u2603'
- Boolean: true, false
- Objects: { title: 'Javascript', language: true }
- Array: [1, 2, 'ham', 'spam']
- Functions:

```
var square = function (x) {  
  return x * x;  
};
```

Objects

- Lightweight, mutable key-value stores
- Literal notation uses curly braces
- Access with `obj.propertyName` or `obj['propertyName']`

```
var obj = {  
  prop: 'hello'  
}  
  
obj.prop // --> "hello"  
obj['prop'] // --> "hello"
```


Functions

- First-class JS object
 - Allows JavaScript to use functional programming techniques
- Returns values with the `return` keyword
 - Otherwise, `undefined` is returned

```
var square = function (x) {  
  return x * x;  
};
```

Functions vs Calls

- Don't get confused with the difference between function calls and the function itself!
 - The call will always end with parentheses

```
var square = function (x) {  
  return x * x;  
};  
  
console.log(square); // function  
console.log(square(2)); // function call
```

What is a callback?

- A callback is a function that's bound to a single asynchronous call
- It is passed as an argument to another function, with the expectation that it will be executed once some async task is finished

```
var cb = function () {  
  console.log('callback ran!');  
};  
// wait 500ms, then run the callback  
setTimeout(cb, 500);  
// --> 'callback ran!'
```

Node-Style Callbacks

- Since so many operations rely on callbacks, a standard callback has emerged in Node.js

```
var cb = function (err, results...) {...}
```

- `err` contains an error, if one occurred
 - Otherwise, it should be `null`
- After `err`, there can be any number of results arguments containing data

Installing npm packages

- Node.js libraries are called packages
- The command to install them is `npm install package_name`
 - When installed, the package is installed in the current directory's `node_modules` directory
- To use a package, pass the name of the package as a string to the `require` function at the top of the file (e.g. `require('pry')`)

package.json

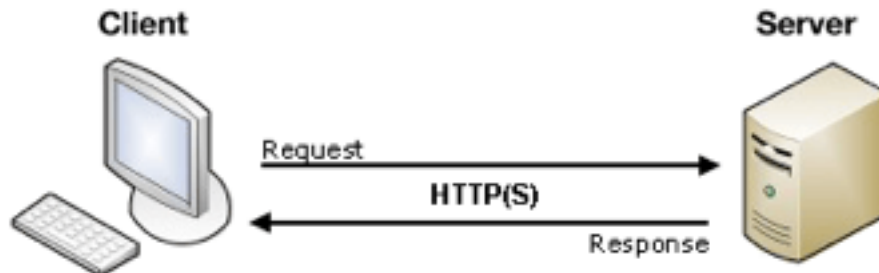
- Contains metadata for the app (e.g. name, author, etc.)
- Contains scripts
 - Can be called with `npm script` (e.g. `npm start`)
- Contains list of dependencies
 - Can be installed with `npm install`

```
{  
  "name": "pennapps-nodejs-workshop",  
  "private": true,  
  "scripts": {  
    "start": "node ./bin/run-server.js"  
  },  
  "author": "Justin Kim",  
  "dependencies": {  
    "body-parser": "1.8.1",  
    "debug": "2.0.0",  
    "ejs": "1.0.0",  
    "express": "4.9.0"  
  }  
}
```

The Web

HTTP

- Stands for Hypertext Transfer Protocol
- A **client** (e.g. web browser, phone, computer, etc.) sends a **request** to a **server**
- The **server** receives this **request** and sends back a **response**
- This **response** is usually a web page (i.e. HTML with accompanying files) or data, usually in XML or JSON



HTTP Verbs

- The five most common types of HTTP requests are:
 - GET
 - POST
 - PUT/PATCH
 - DELETE

GET Request

- This is usually the default type of request sent
 - When you enter a URL or click a link, a GET request is sent for the web page
 - When a web page updates, it probably sent a GET request behind the scenes to get the new data
- It should only be used to *get* something

POST Request

- This should be used to *send* data from the client to the server
- While you can technically use GET requests to send data as well, you should absolutely use POST requests if you're sending data
 - It's much more robust and secure
- This is the default type of request sent when submitting a form (e.g. log in)

PUT/PATCH Request

- This should be used to *update* something on the server
- Technically, you can use a POST request to update as well, but it is convention to use a PUT or PATCH request
- The main difference between a PUT request and a PATCH request:
 - A PUT request is used to update an entire record
 - A PATCH request is only used to update part of it

DELETE Request

- This should be used to *delete* something on the server
- Technically, you can use a POST request to delete as well, but it is convention to use a DELETE request

Node.js

What is Node.js?

- [Node.js](#) is a JavaScript runtime built on [Chrome's V8 JavaScript engine](#)
- Practically, this means you can now run JavaScript outside of the browser
- It is NOT a web framework

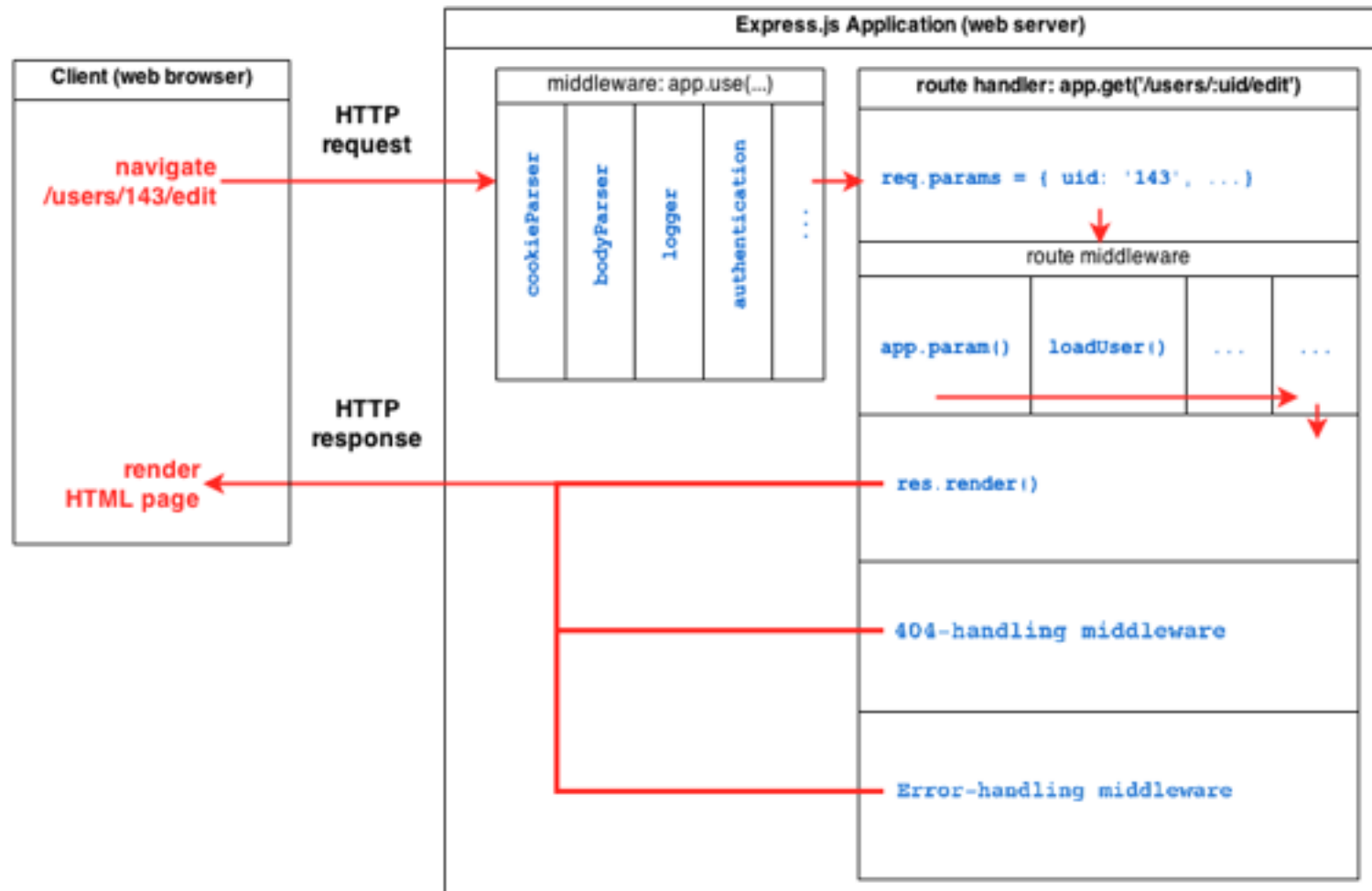
Express

- Is a package – must install via npm
- Handles URL routing, requests, and responses
- Is oriented around middlewares and handler functions

Hello World Express App

```
var express = require('express');
var app = express();
var port = process.env.PORT || 3000;
app.get('/', function (req, res) {
  return res.send('hello world!');
});
// Start listening for requests
app.listen(port, function () {
  console.log('Listening on port ' +
port);
});
```

Anatomy of an Express App



Middleware

- A **middleware function** is a function that handles a request
 - They are *chained together* so that multiple middlewares run on the same request
- Middleware parameters:
 - `req` - an object representing the request
 - `res` - an object representing the response. Has several methods (`.render`, `.send`, `.json`) to send data and complete the request
 - `next` - a callback (!) that passes control to the next middleware
- You can modify the `req` and `res` object directly - they are the actual objects that will be passed to other middlewares

```
var noOpMiddleware = function (req, res, next) {  
  next();  
};
```

Adding Middleware in Express

- It's just a matter of using `app.use()`
 - Note, middlewares will run in the order you add them

```
app.use(function (req, res, next) {  
  console.log('I am a middleware!');  
  next();  
});
```

The Express Router

- Behaves like middleware
- Performs routing functions (i.e. handles requests to different urls)
- Used to modularize your code by defining subsections

Router Example

```
var router = express.Router();
router.use(function (req, res, next) {
  console.log('I am a router!');
  next();
});
router.get('/', function (req, res, next) {
  res.send('Hello from the router!');
});
app.use('/router', router);
```

Router Methods

- We've already seen that routers can:
 - use middleware
 - handle "get" requests
- You can actually handle ANY HTTP verb just by calling `router.verb()`
- Supported methods include:
 - `router.use()`
 - `router.get()`
 - `router.post()`
 - `router.put()`
 - `router.patch()`

Route Parameters

- By putting a colon before a section of a route, you can create a *parametrized route*
 - with the parameter values available on `req.params`
- For example, if you have the route `/user/:id`, then it will match:
 - `/user/1234` → `req.params.id = '1234'`
 - `/user/justin` → `req.params.id = 'justin'`
 - `/user/id` → `req.params.id = 'id'`
- Useful for creating a RESTful API

Requests

- The request object is passed in to every middleware function in order
- Most of its properties are set by the middleware themselves
 - The `req.body` property is set by the [body-parser](#) middleware
 - The `req.cookies` property is set by the [cookie-parser](#) middleware

Responses

- `res.set()` - sets a header value. Useful for allowing your app to be used from any site
 - `res.set('Access-Control-Allow-Origin', '*')`
- `res.status()` - set the HTTP status code to indicate an error
 - `res.status(404)` for Not Found errors
- `res.send()` - send a string, object, or Array as data
 - `res.send({error: 'Mocha exploded!'})`
- `res.redirect()` - redirect to another page
 - `res.redirect('/login')` - redirect to login page

Local Variables

- To specify the values for variables in your template (i.e. the client), just modify `res.locals`
- This can be done with some middleware:

```
app.use(function (req, res, next) {  
  res.locals.title = 'My Awesome Express App';  
  next();  
});
```

Rendering

- Once you've set up your local variables, call `res.render(template)`
 - it'll render the template using the local values
- You can also pass in more local variables at call time

```
app.get('/', function (req, res) {  
  res.render('index', {greeting: 'hi'});  
});
```

View Engine

- Express expects your templates to be in a `views` folder
 - you can use any (or many) libraries to process those templates
- Let's use [EJS](#) (Embedded JavaScript) to render our `.ejs` templates and also as the default

```
app.engine('ejs', require('ejs').renderFile);  
app.set('view engine', 'ejs');
```

EJS

- You can render JavaScript variables with `<%= variable %>`
- You can also run JavaScript directly on the browser with `<% CODE %>`
- These files typically have the extension `.html.ejs`

Next Steps

- Look at [MongoDB](#)
 - Use [mongoose](#) as your ODM
- Look at [jQuery](#)
 - Useful for manipulating the DOM
- After all that, look at frontend frameworks
 - [ReactJS](#)
 - [EmberJS](#)
 - [BackboneJS](#)