

# Web Development with Node.js and MongoDB

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Video 2.3

*The Event Loop*



In this Video, we are going to take a look at...

- The Call Stack
- The Event Loop
- The EventEmitter

# The Call Stack

- Last-In First-Out data structure
- Helpful for debugging
- Programs crash on stack overflow
- Composed of stack frames
- Stack frame: arguments, return address, and local variables
- Avoid too many function calls

```
1 'use strict';
2
3 function foo(x, y) {
4     let localVariable = 4;
5     let sum = x + y;
6
7     return sum;
8 }
9
10 function bar(baz) {
11     console.log(baz);
12
13     let results = foo(2, 5);
14
15     console.log(results);
16
17     return results;
18 }
19
20 bar('foobar');
21
22 console.log('done');
23
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node-debug 01-c
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node-debug 01-call-stack.js
```

```
Node Inspector is now available from http://127.0.0.1:8080/?ws=127.0.0.1:8080&port=5858
```

```
Debugging `01-call-stack.js`
```

```
Debugger listening on port 5858
```

```
No browser matching [chrome,chromium,opera] found in the system! If this is not true, submit a bug report on https://github.com/benderjs/browser-launcher2
```

```
Please open the URL manually in Chrome/Chromium/Opera or similar browser
```

```
█
```



```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node-debug 01-call-stack.js
```

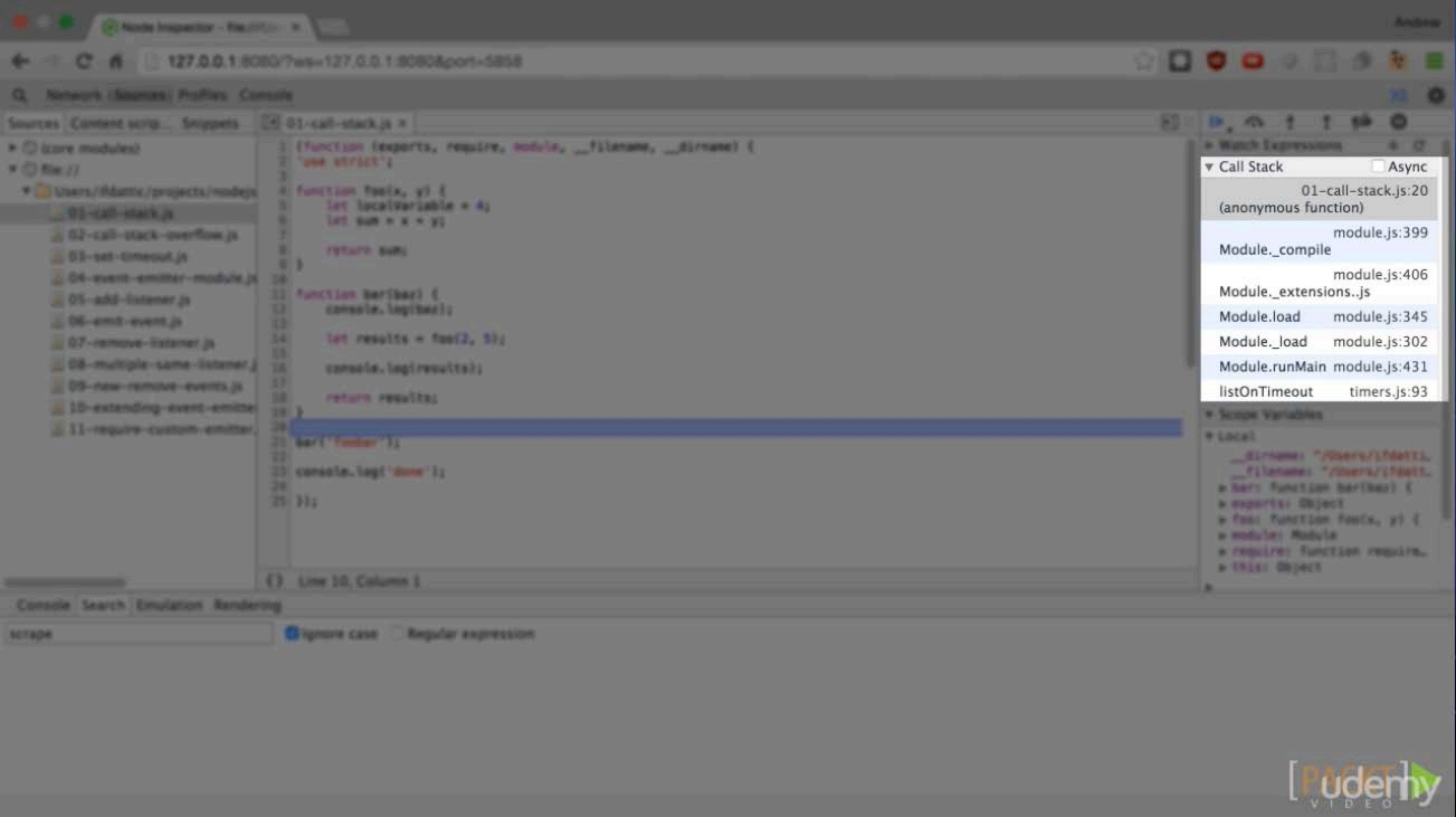
```
Node Inspector is now available from http://127.0.0.1:8080/?ws=127.0.0.1:8080&port=5858
```

```
Debugging `01-call-stack.js`
```

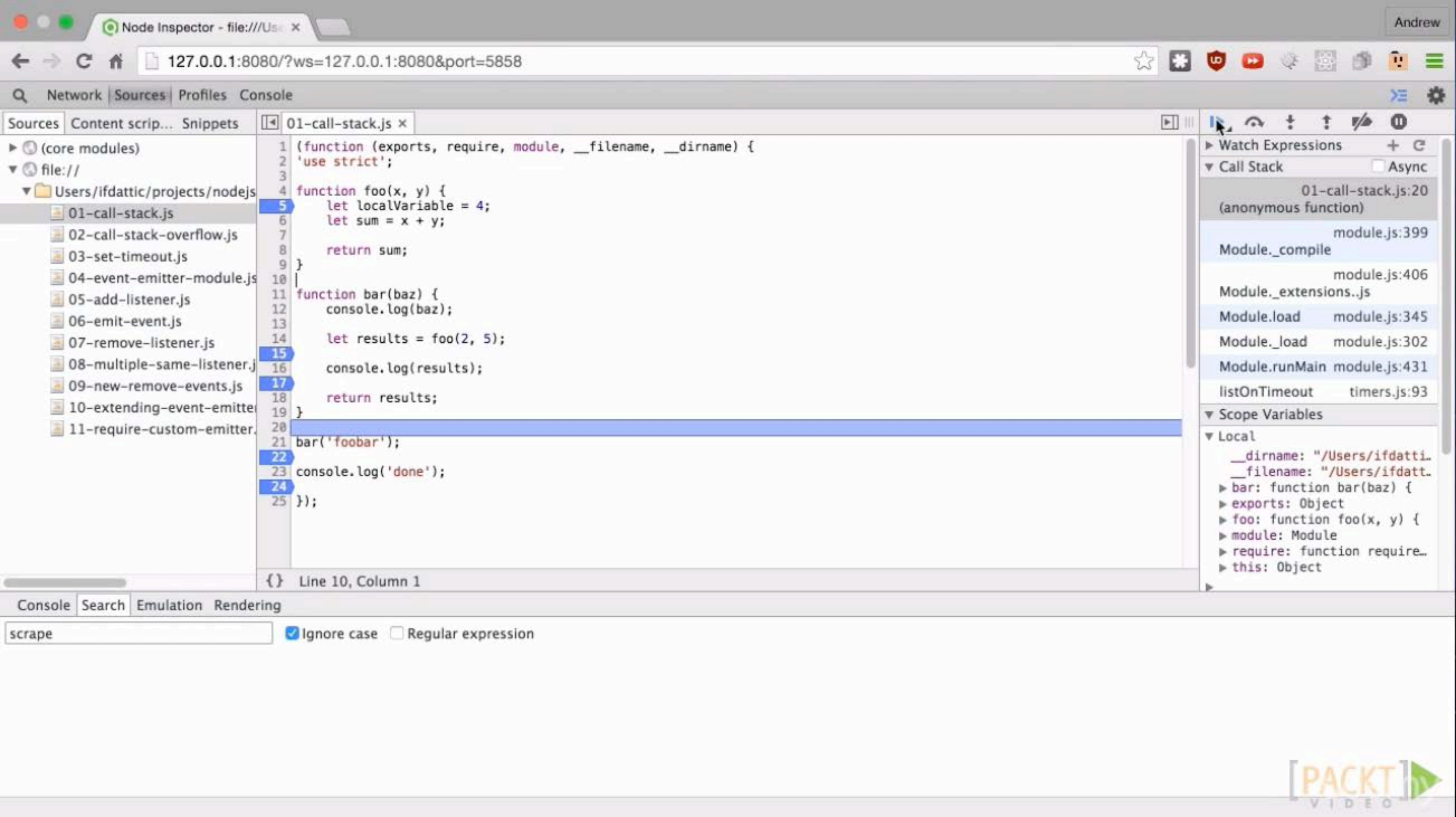
```
Debugger listening on port 5858
```

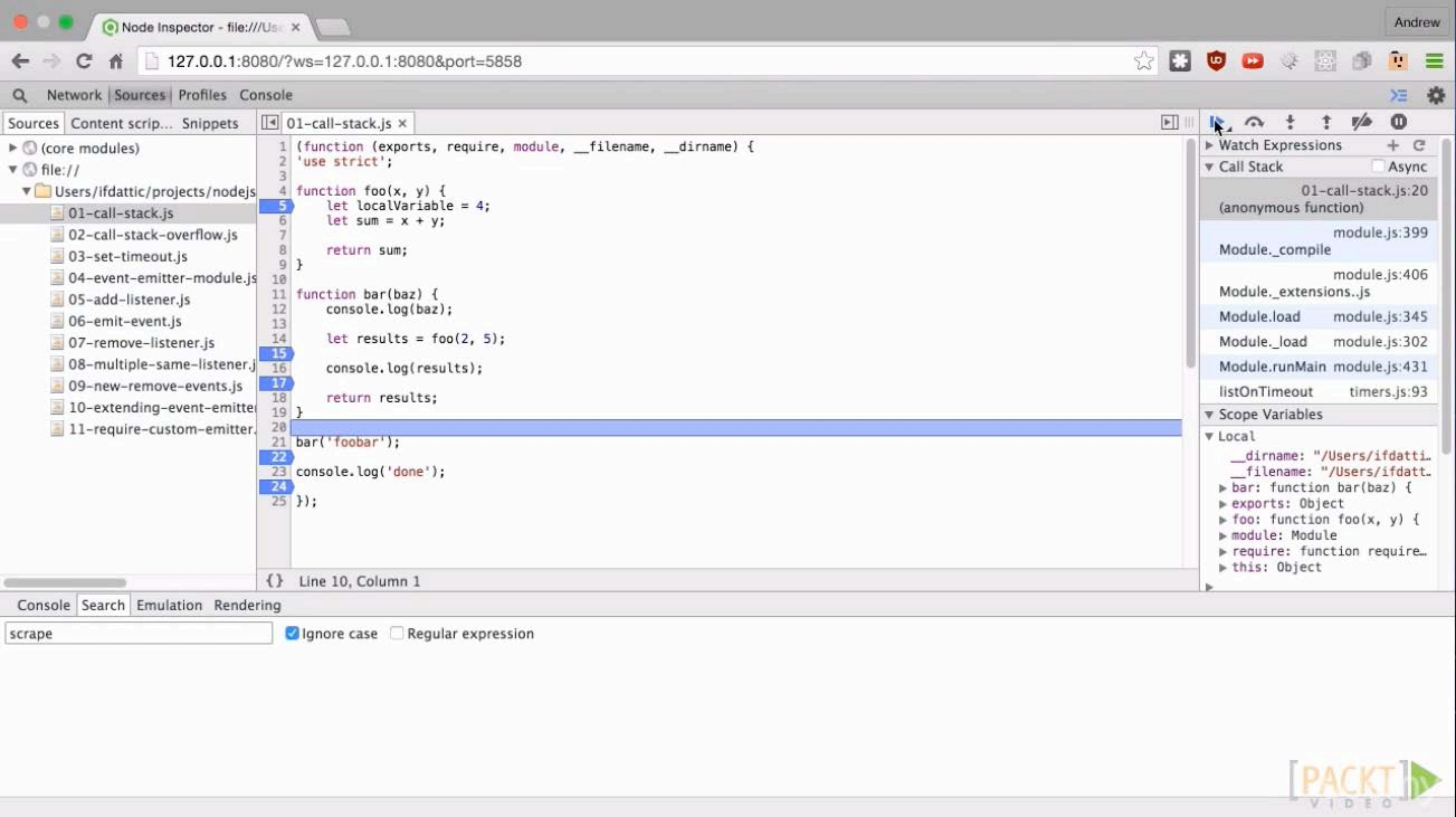
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No browser matching [chrome,chromium,opera] found in the system! If this is not true, submit a bug report on https://github.com/benderjs/browser-launcher2
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Please open the URL manually in Chrome/Chromium/Opera or similar browser
```

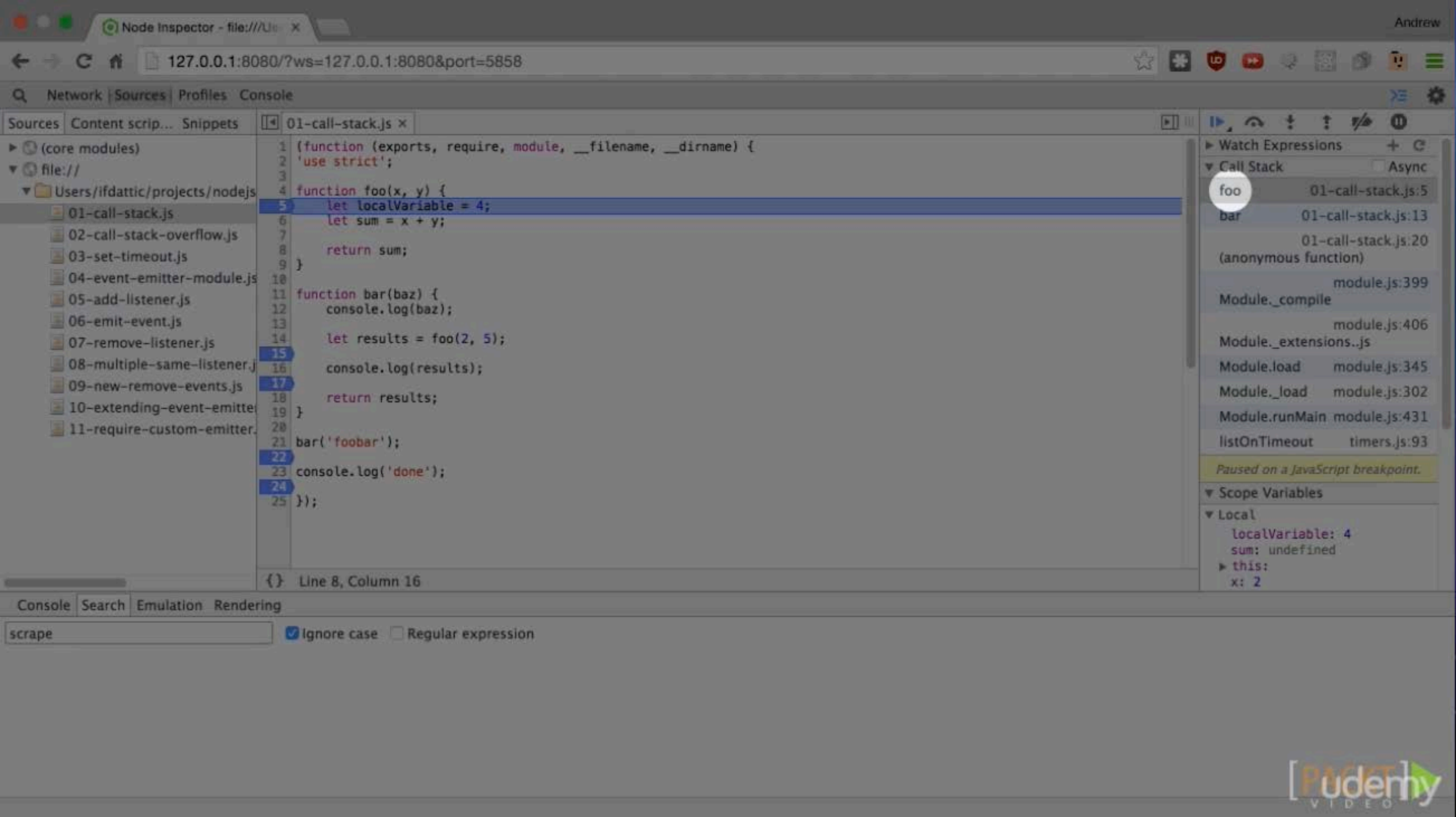


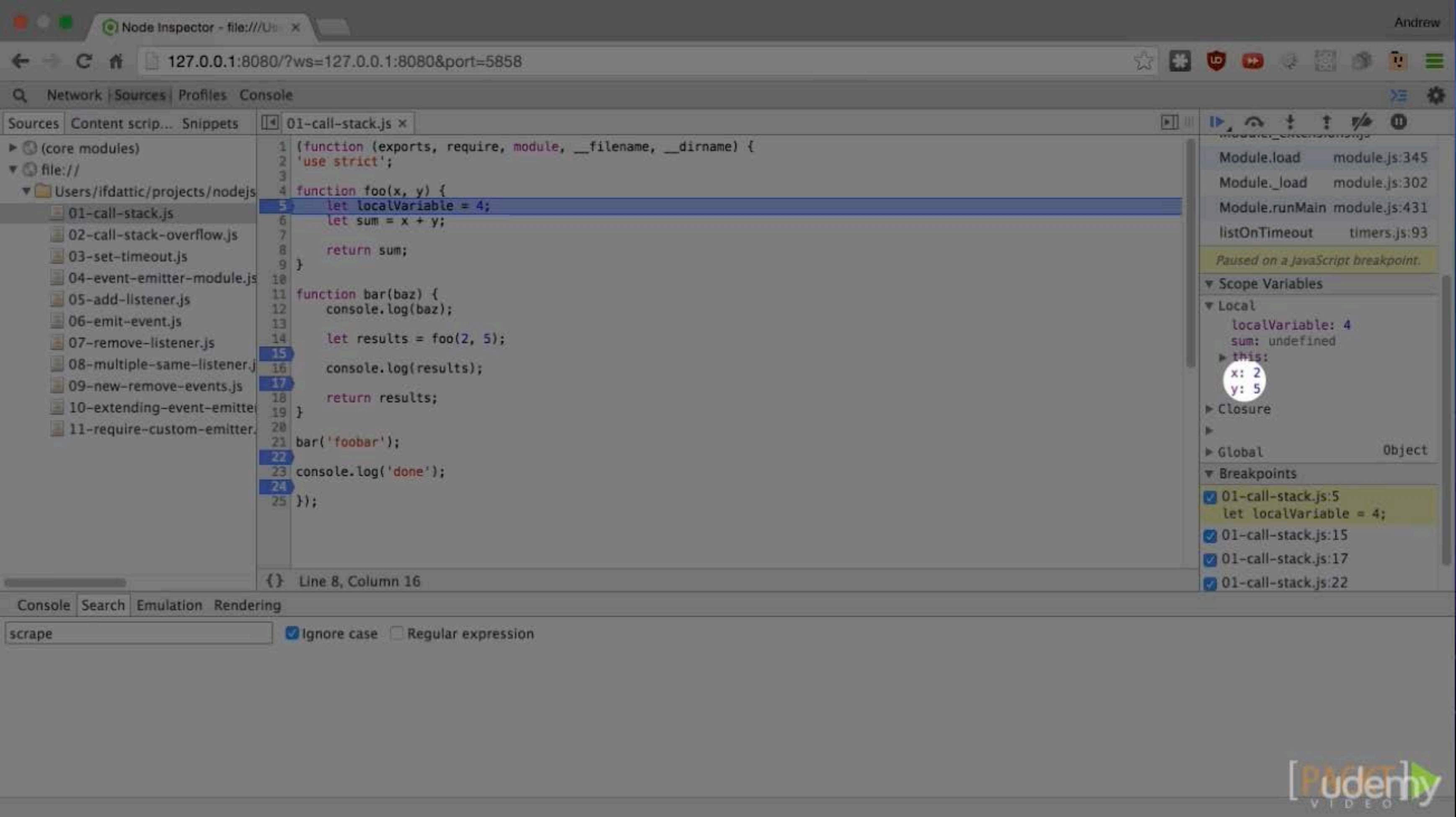




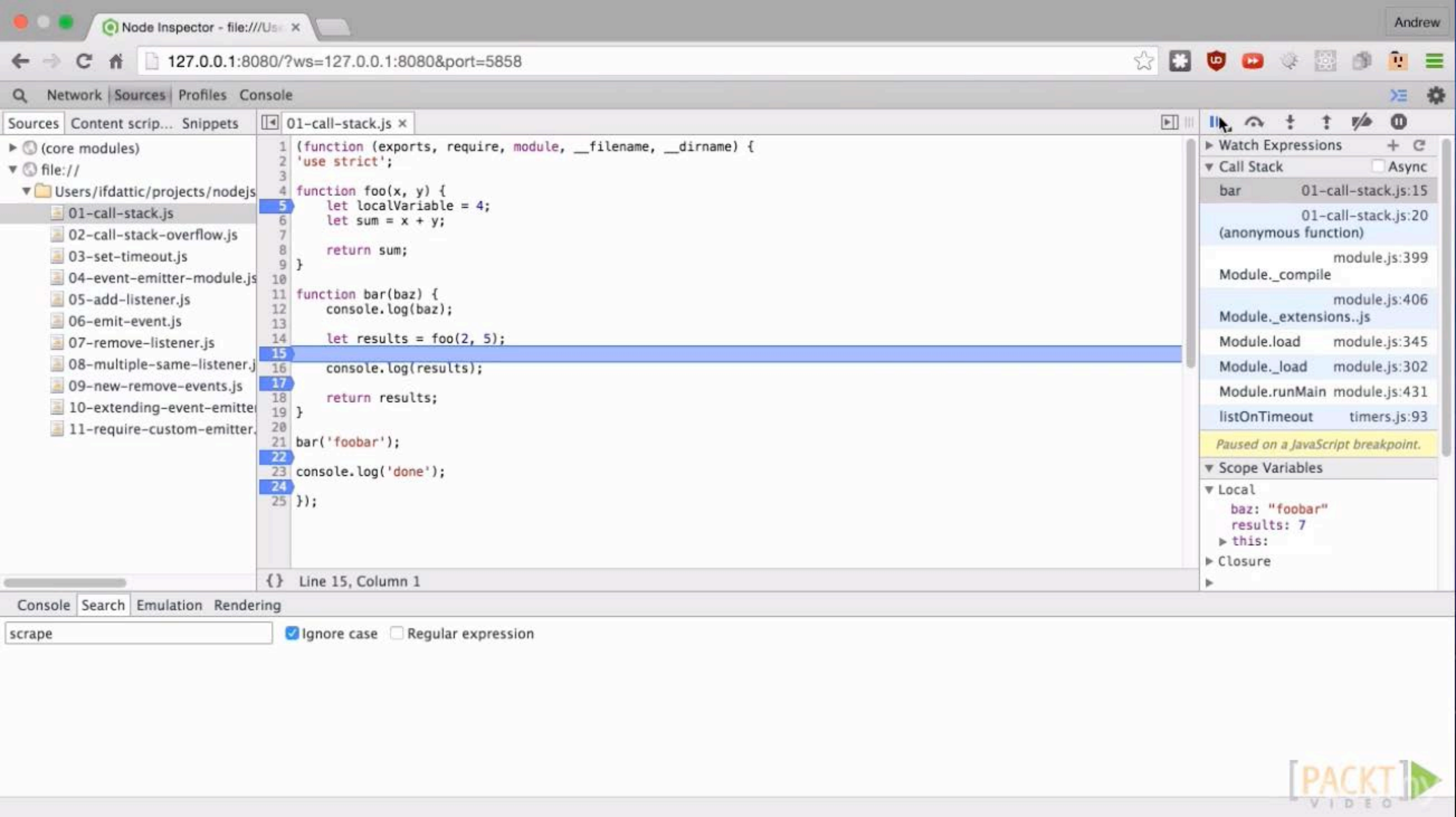




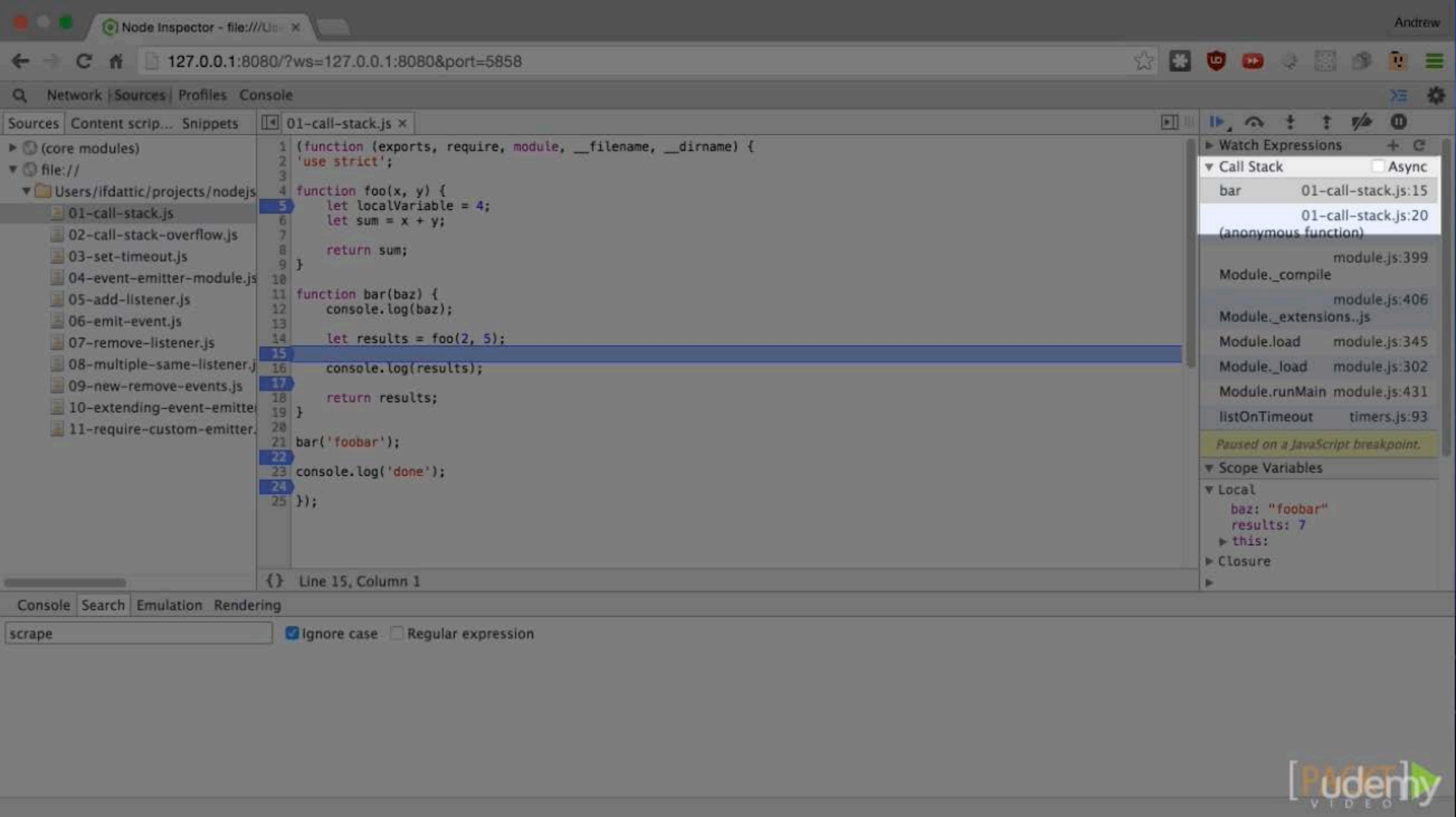












127.0.0.1:8080/?ws=127.0.0.1:8080&amp;port=5858

Network Sources Profiles Console

Sources Content scrip... Snippets 01-call-stack.js x

```
(core modules)
file:///
Users/ifdattic/projects/nodejs
01-call-stack.js
02-call-stack-overflow.js
03-set-timeout.js
04-event-emitter-module.js
05-add-listener.js
06-emit-event.js
07-remove-listener.js
08-multiple-same-listener.js
09-new-remove-events.js
10-extending-event-emitter.js
11-require-custom-emitter.js

1 (function (exports, require, module, __filename, __dirname) {
2 'use strict';
3
4 function foo(x, y) {
5   let localVariable = 4;
6   let sum = x + y;
7
8   return sum;
9 }
10
11 function bar(baz) {
12   console.log(baz);
13
14   let results = foo(2, 5);
15
16   console.log(results);
17
18   return results;
19 }
20
21 bar('foobar');
22
23 console.log('done');
24
25 });
```

{ } Line 15, Column 1

Watch Expressions +

Call Stack Async

bar 01-call-stack.js:15

01-call-stack.js:20  
(anonymous function)

module.js:399

Module.\_compile

module.js:406

Module.\_extensions..js

Module.load module.js:345

Module.\_load module.js:302

Module.runMain module.js:431

listOnTimeout timers.js:93

Paused on a JavaScript breakpoint.

Scope Variables

Local

baz: "foobar"

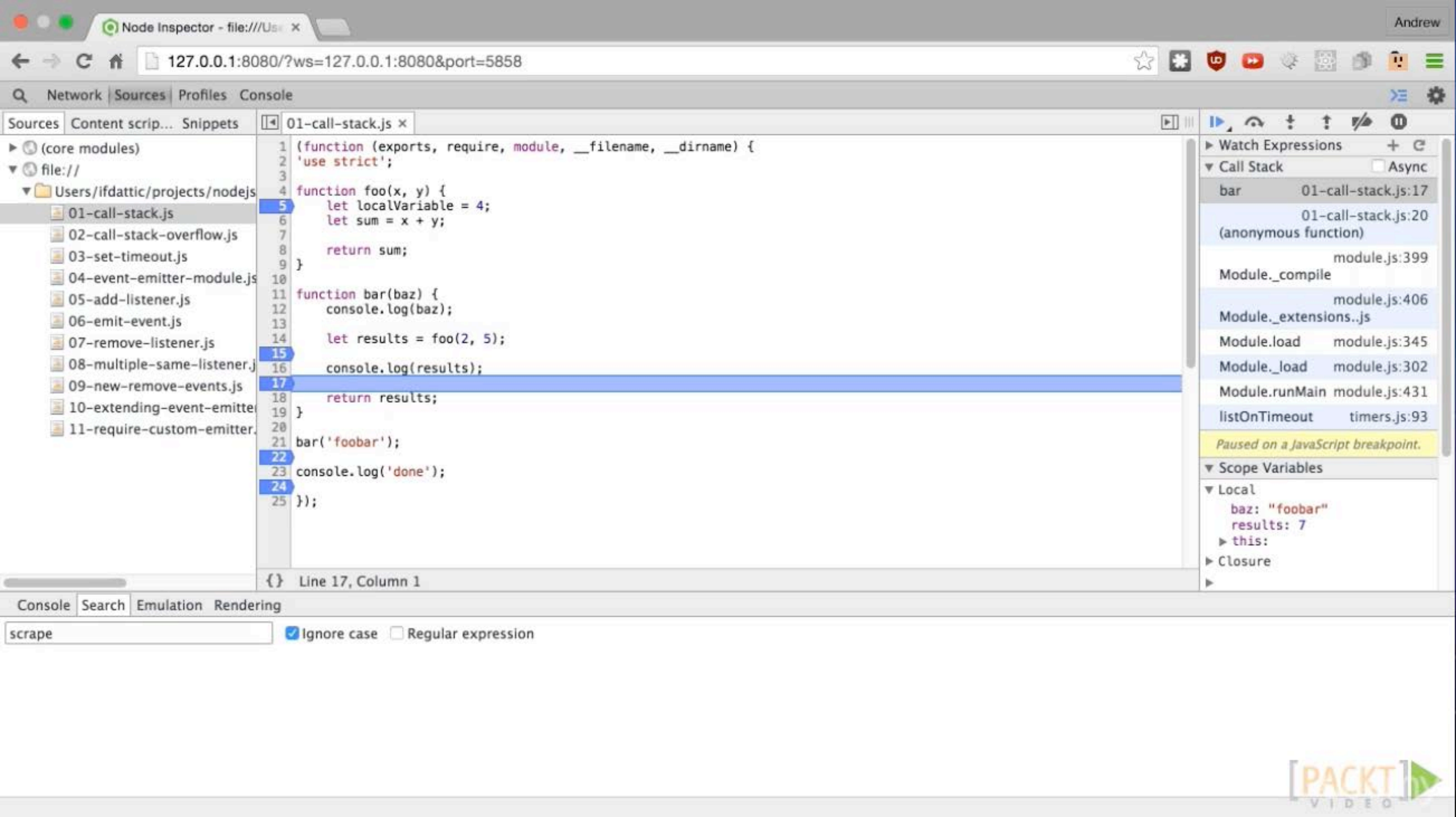
results: 7

this:

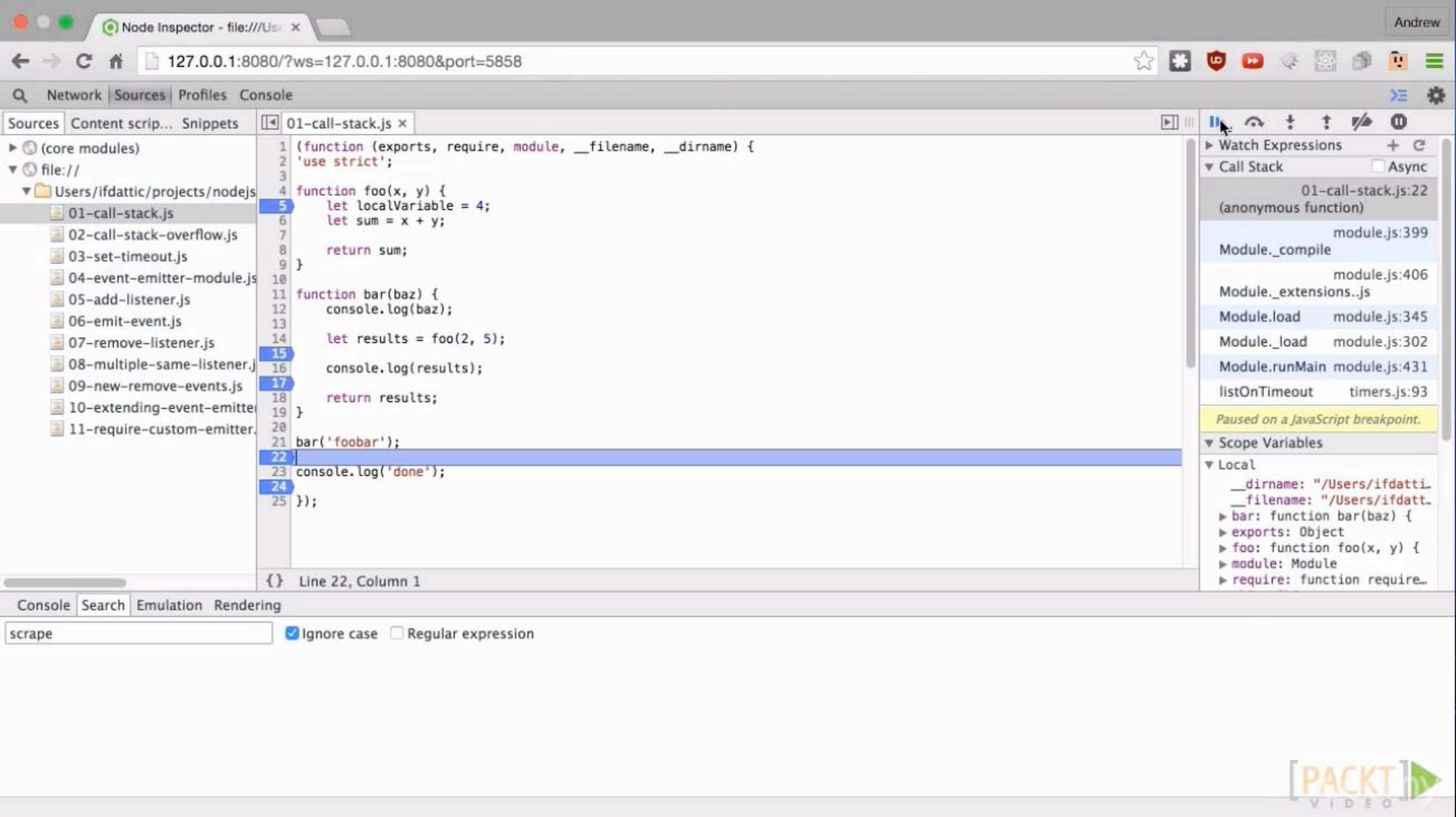
Closure

Console Search Emulation Rendering

scrape ☒ Ignore case ☐ Regular expression







127.0.0.1:8080/?ws=127.0.0.1:8080&amp;port=5858

Network Sources Profiles Console

Sources Content scrip... Snippets 01-call-stack.js x

```
(core modules)
file://
Users/ifdattic/projects/nodejs
01-call-stack.js
02-call-stack-overflow.js
03-set-timeout.js
04-event-emitter-module.js
05-add-listener.js
06-emit-event.js
07-remove-listener.js
08-multiple-same-listener.js
09-new-remove-events.js
10-extending-event-emitter.js
11-require-custom-emitter.js

1 (function (exports, require, module, __filename, __dirname) {
2 'use strict';
3
4 function foo(x, y) {
5   let localVariable = 4;
6   let sum = x + y;
7
8   return sum;
9 }
10
11 function bar(baz) {
12   console.log(baz);
13
14   let results = foo(2, 5);
15
16   console.log(results);
17
18   return results;
19 }
20
21 bar('foobar');
22 console.log('done');
23
24
25 });
```

{ } Line 22, Column 1

Watch Expressions +

Call Stack Async

01-call-stack.js:22  
(anonymous function)module.js:399  
Module.\_compilemodule.js:406  
Module.\_extensions..jsmodule.js:345  
Module.loadmodule.js:302  
Module.\_loadmodule.js:431  
Module.runMaintimers.js:93  
listOnTimeout

Paused on a JavaScript breakpoint.

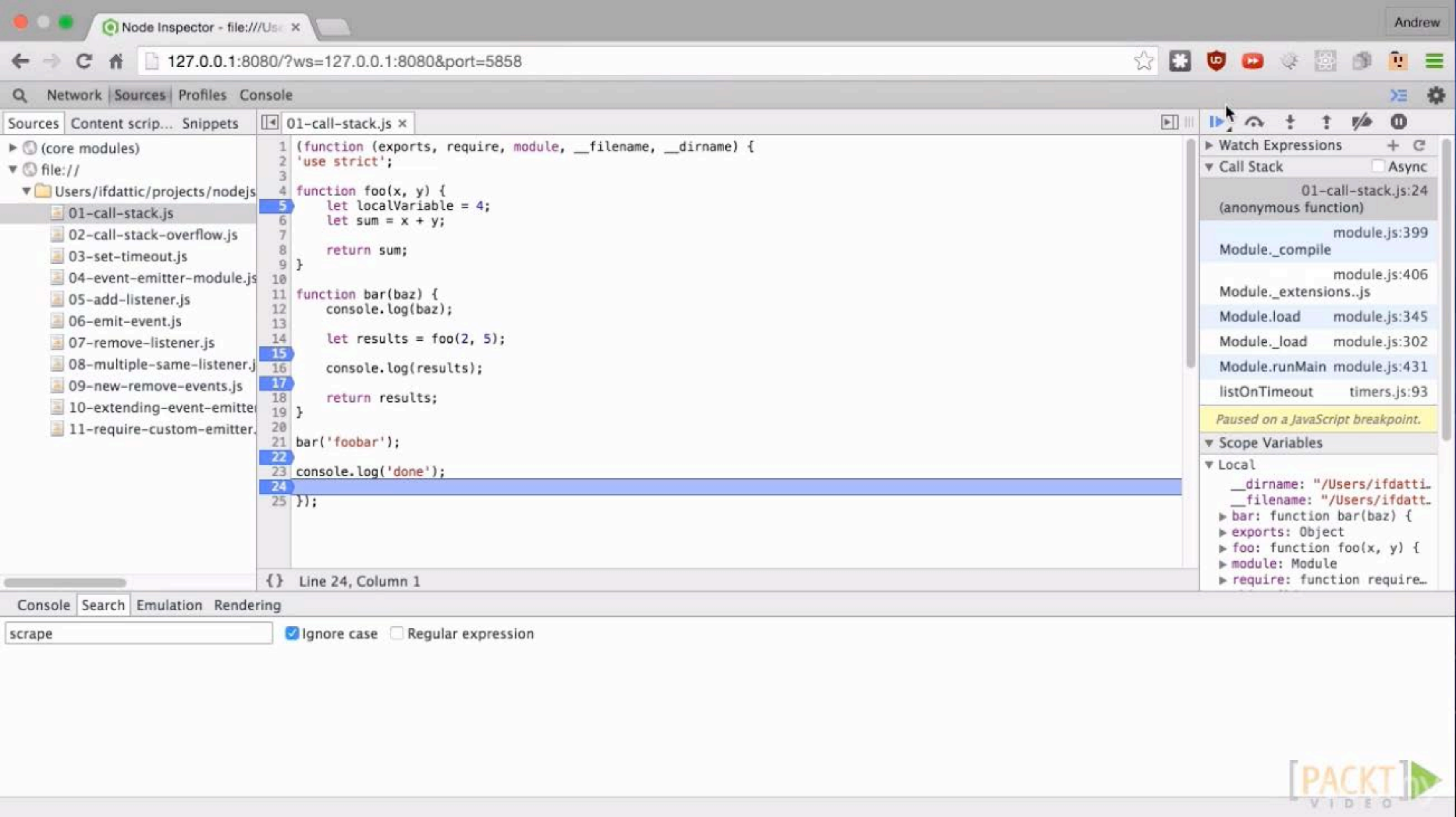
Scope Variables

Local

```
__dirname: "/Users/ifdatti...
__filename: "/Users/ifdatti...
bar: function bar(baz) {
exports: Object
foo: function foo(x, y) {
module: Module
require: function require...
```

Console Search Emulation Rendering

scrape ☒ Ignore case ☐ Regular expression





► Watch Expressions + ↻

Not Paused

Not Paused

- 01-call-stack is:5

01-call-stack.js:15

01-call-stack.js:22

01-call-stack.js.24

Console Search Emulation Rendering

☒ Ignore case ☐ Regular expression



```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node-debug 02-call-stack-overflow.js
```

```
Node Inspector is now available from http://127.0.0.1:8080/?ws=127.0.0.1:8080&port=5858
```

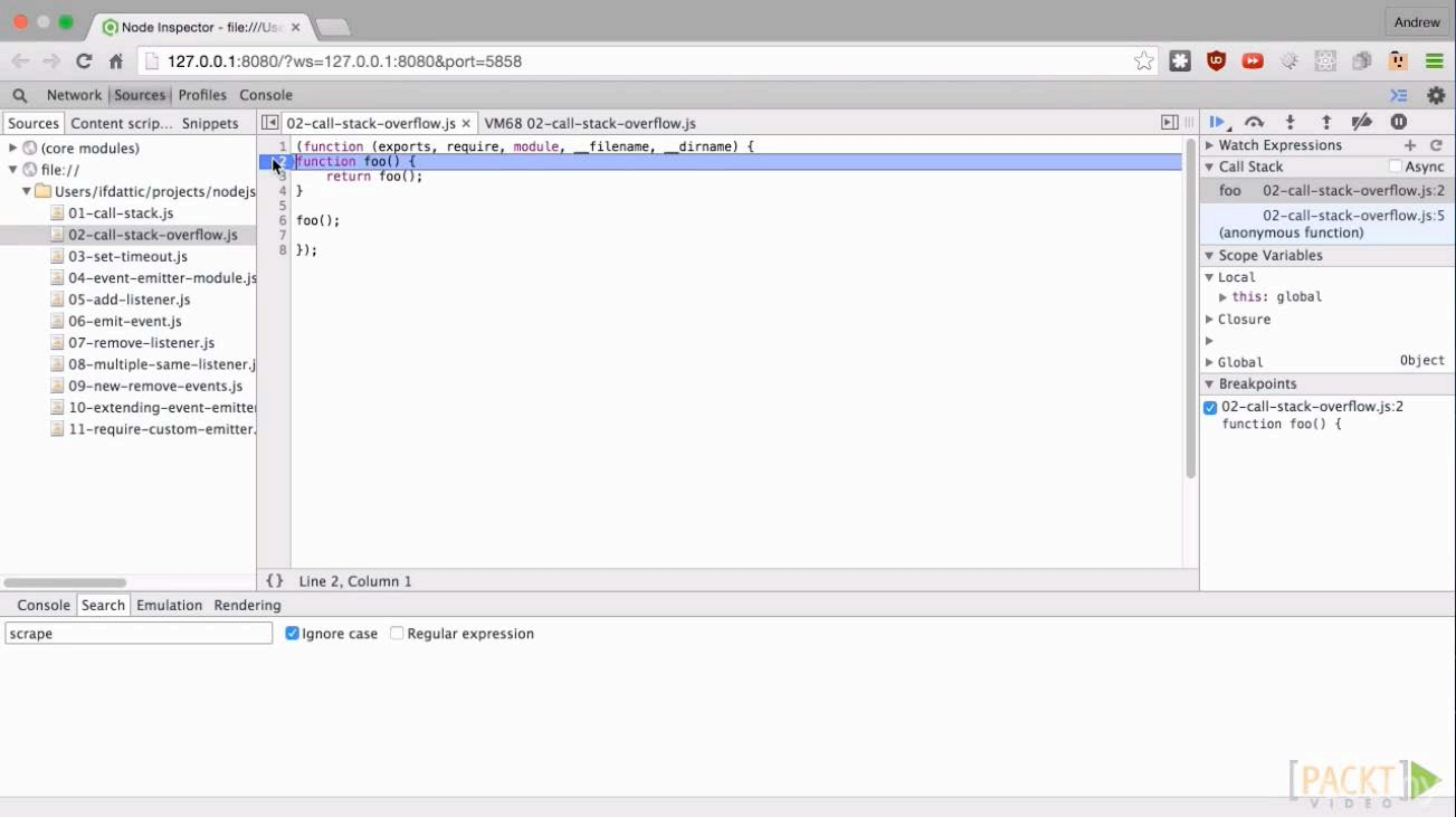
```
Debugging `02-call-stack-overflow.js`
```

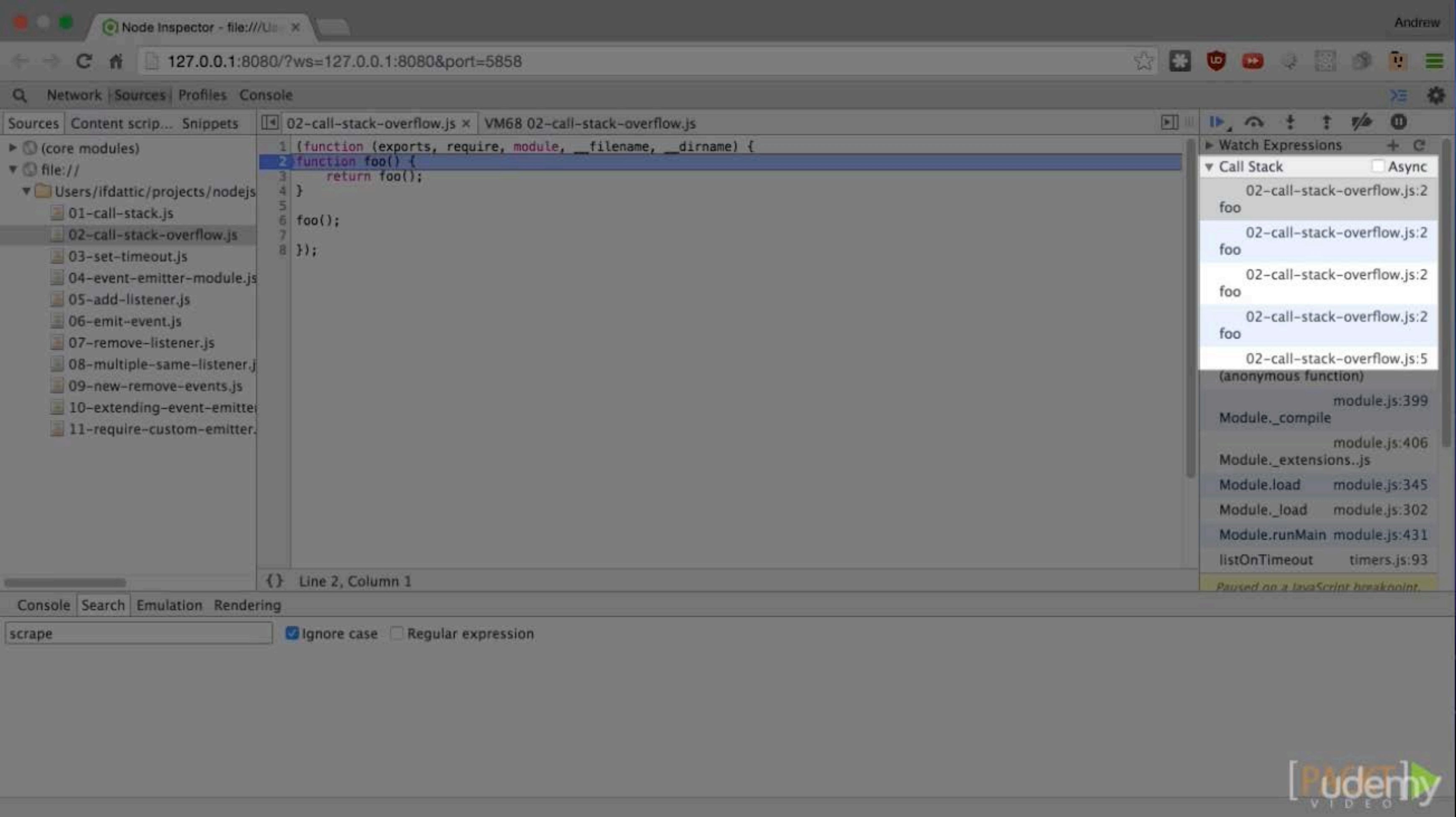
```
Debugger listening on port 5858
```

```
No browser matching [chrome,chromium,opera] found in the system! If this is not true, submit a bug report on https://github.com/benderjs/browser-launcher2
```

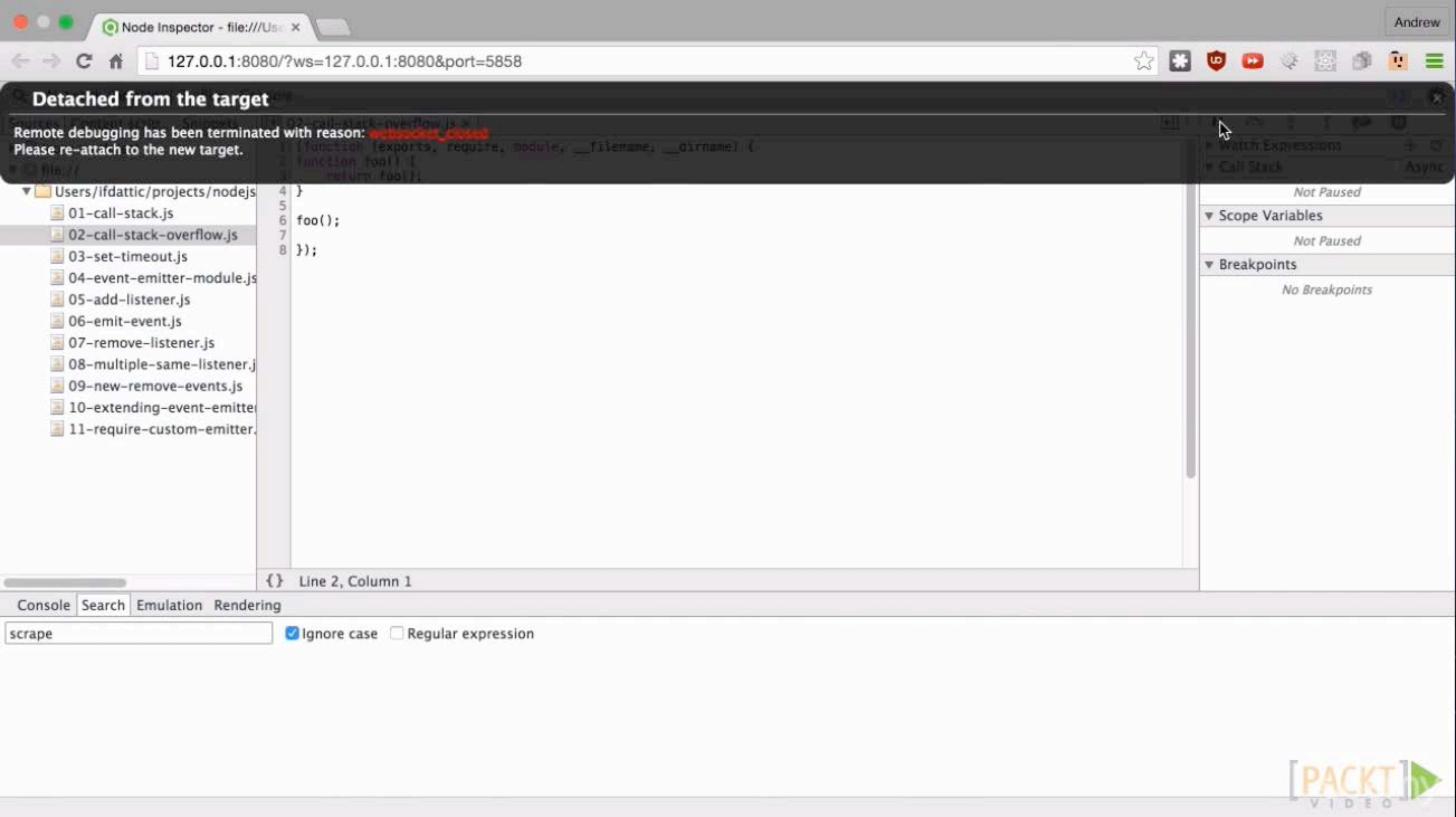
```
Please open the URL manually in Chrome/Chromium/Opera or similar browser
```

```
█
```









```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node-debug 02-call-stack-overflow.js
```

```
Node Inspector is now available from http://127.0.0.1:8080/?ws=127.0.0.1:8080&port=5858
```

```
Debugging `02-call-stack-overflow.js`
```

```
Debugger listening on port 5858
```

```
No browser matching [chrome,chromium,opera] found in the system! If this is not true, submit a bug report on https://github.com/benderjs/browser-launcher2
```

```
Please open the URL manually in Chrome/Chromium/Opera or similar browser
```

```
/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:1
```

```
function foo() {
```

```
  ^
```

```
RangeError: Maximum call stack size exceeded
```

```
    at foo (/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:1:13)
```

```
    at foo (/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:2:12)
```

```
    at foo (/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:2:12)
```

```
    at foo (/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:2:12)
```

```
    at foo (/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:2:12)
```

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```

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```

```
    at foo (/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:2:12)
```

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    at foo (/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:2:12)
```

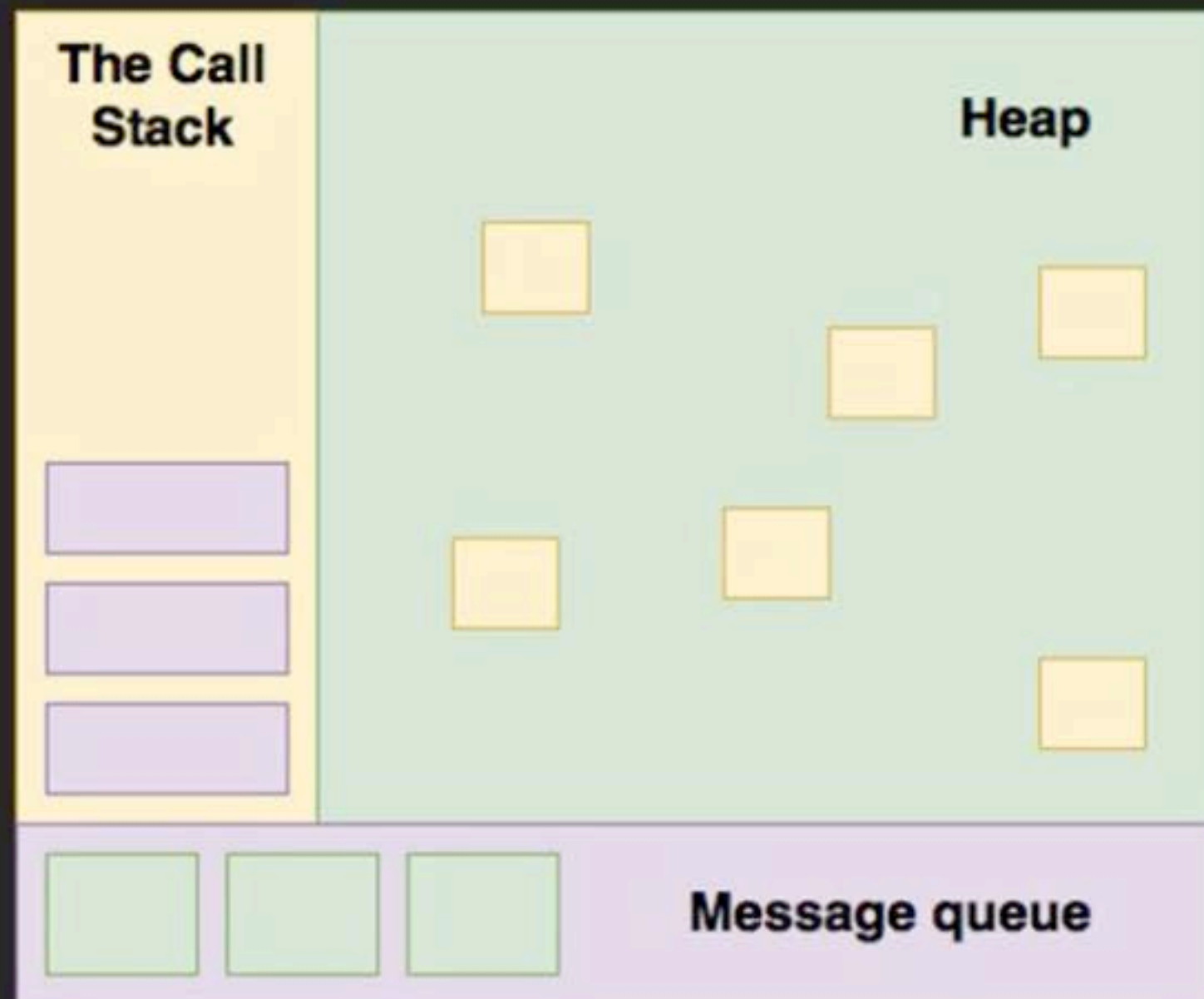
```
    at foo (/Users/ifdattic/projects/nodejs-mongodb-video-course/code/2/2.3/02-call-stack-overflow.js:2:12)
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ █
```



# The Event Loop

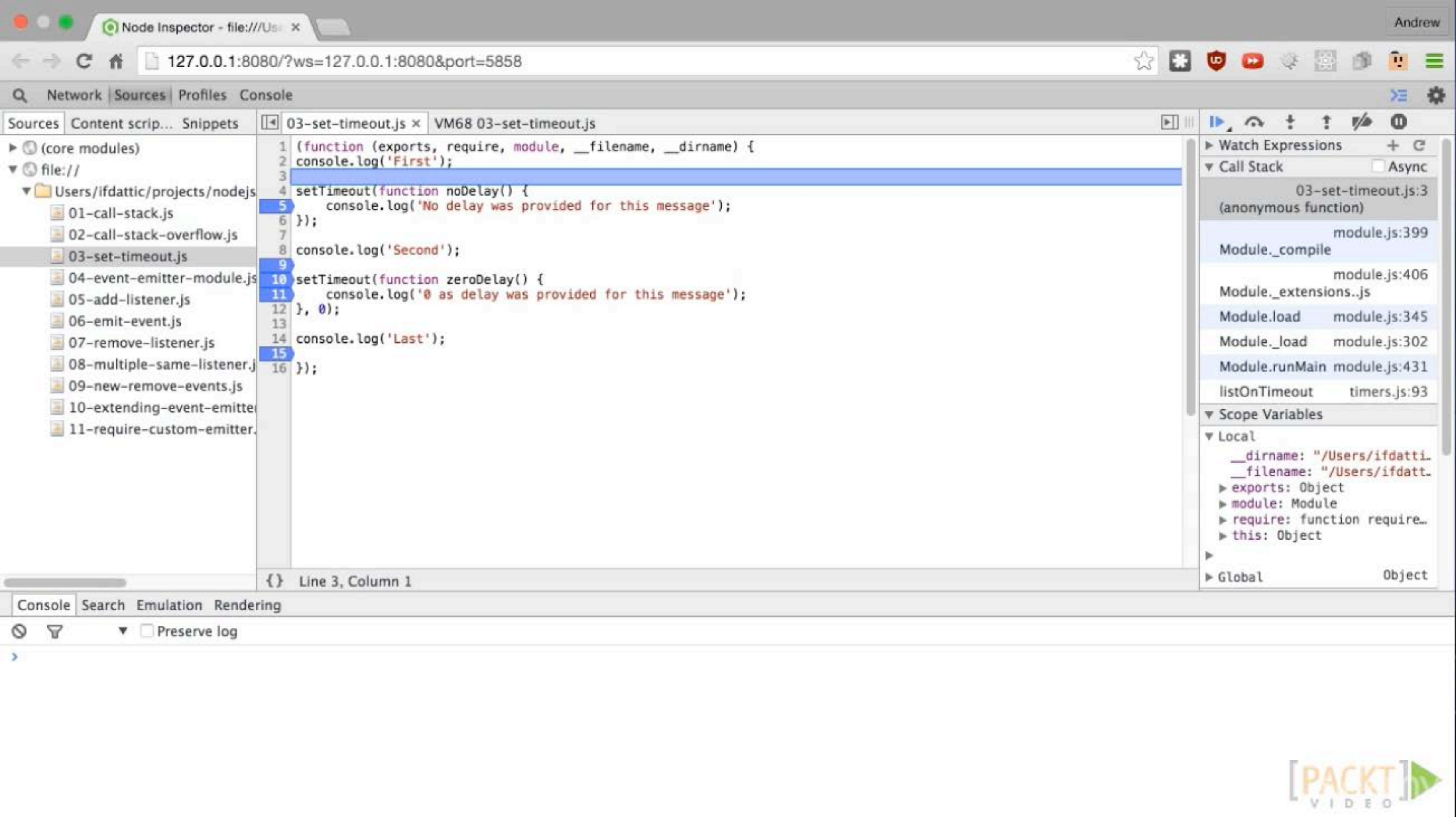


# The Event Loop

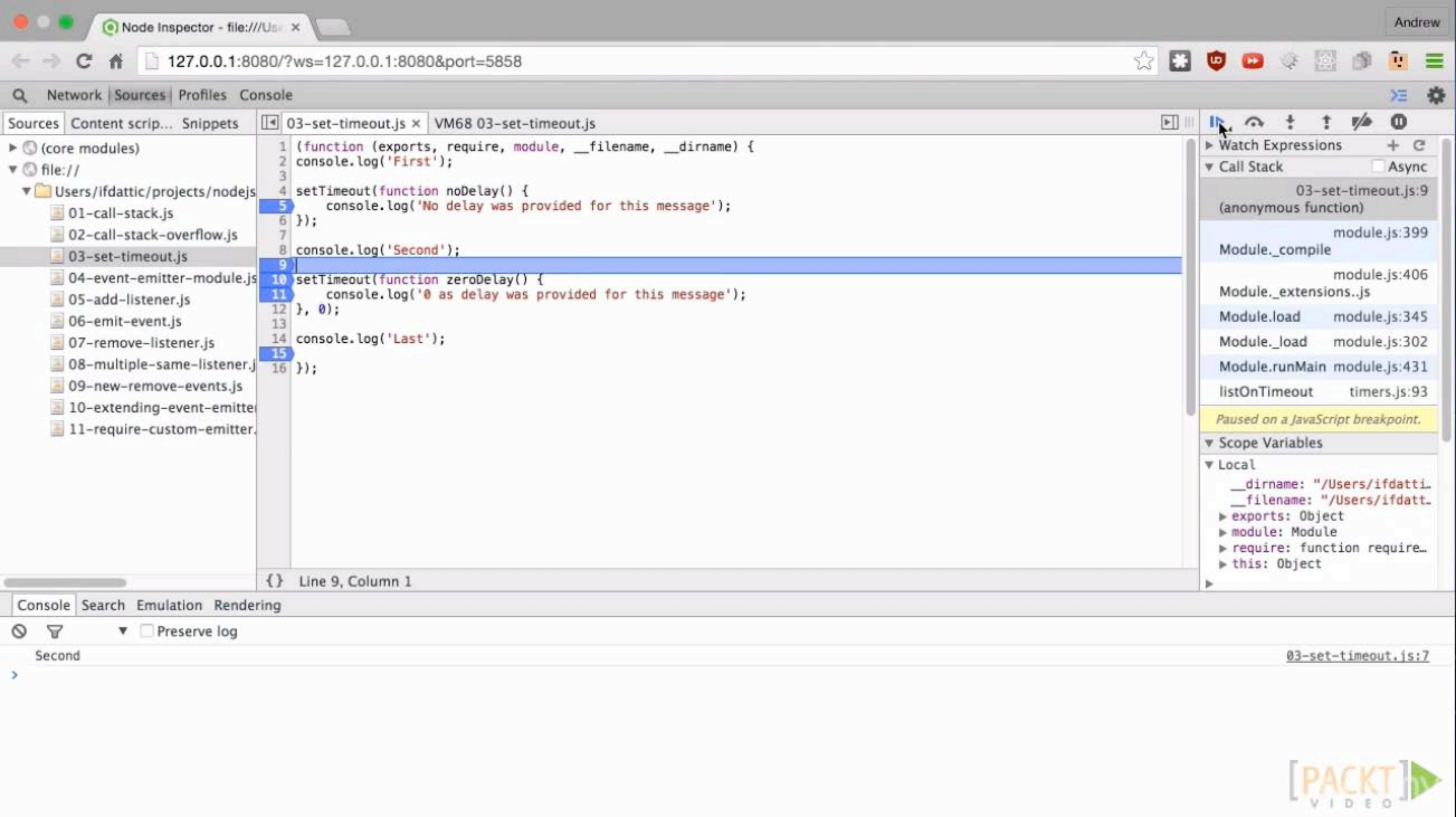
- Single thread
- Quick execution
- Separate processes

# The Event Loop

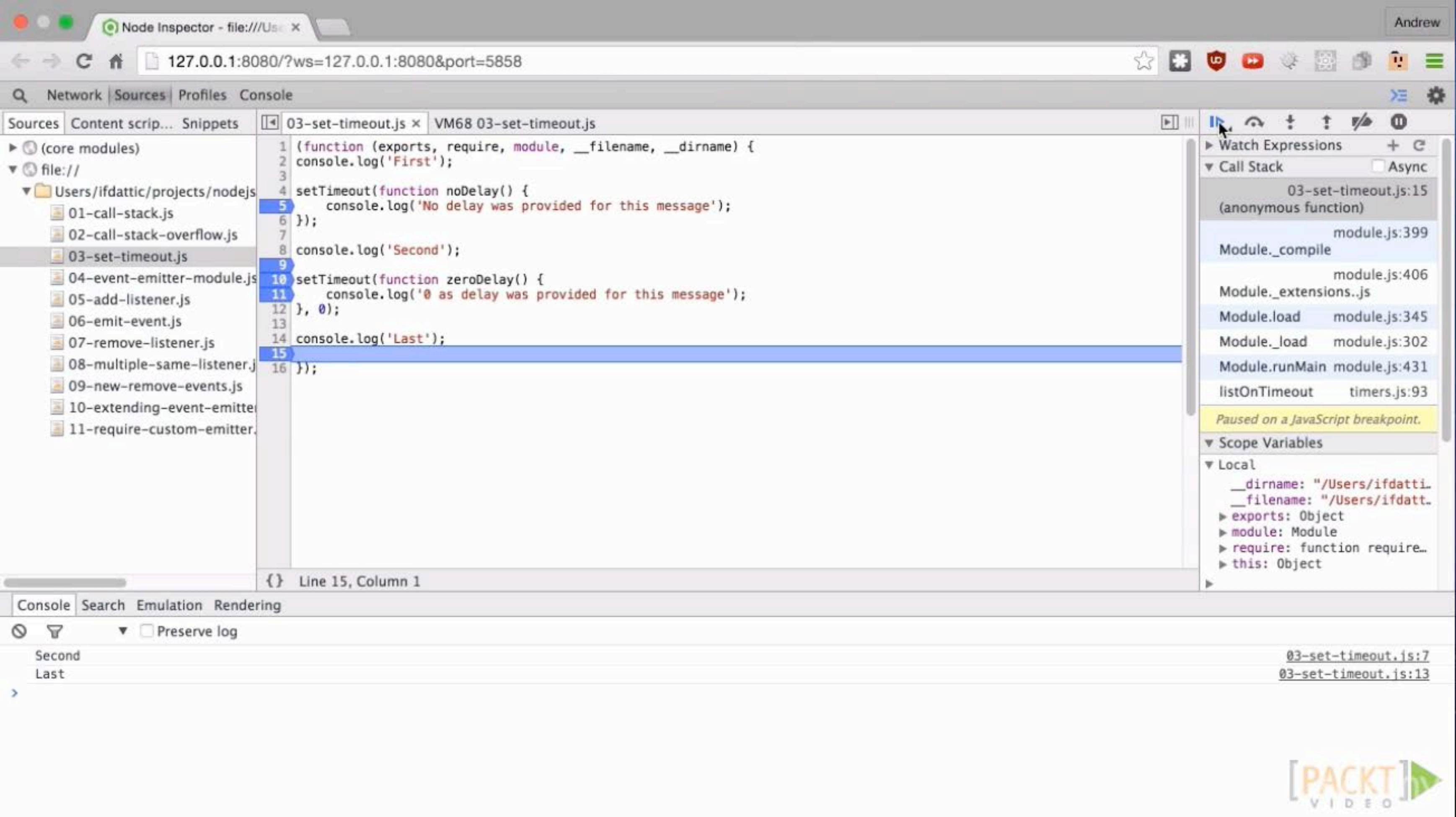
```
setTimeout(callback, delay[, arg][, ...])
```

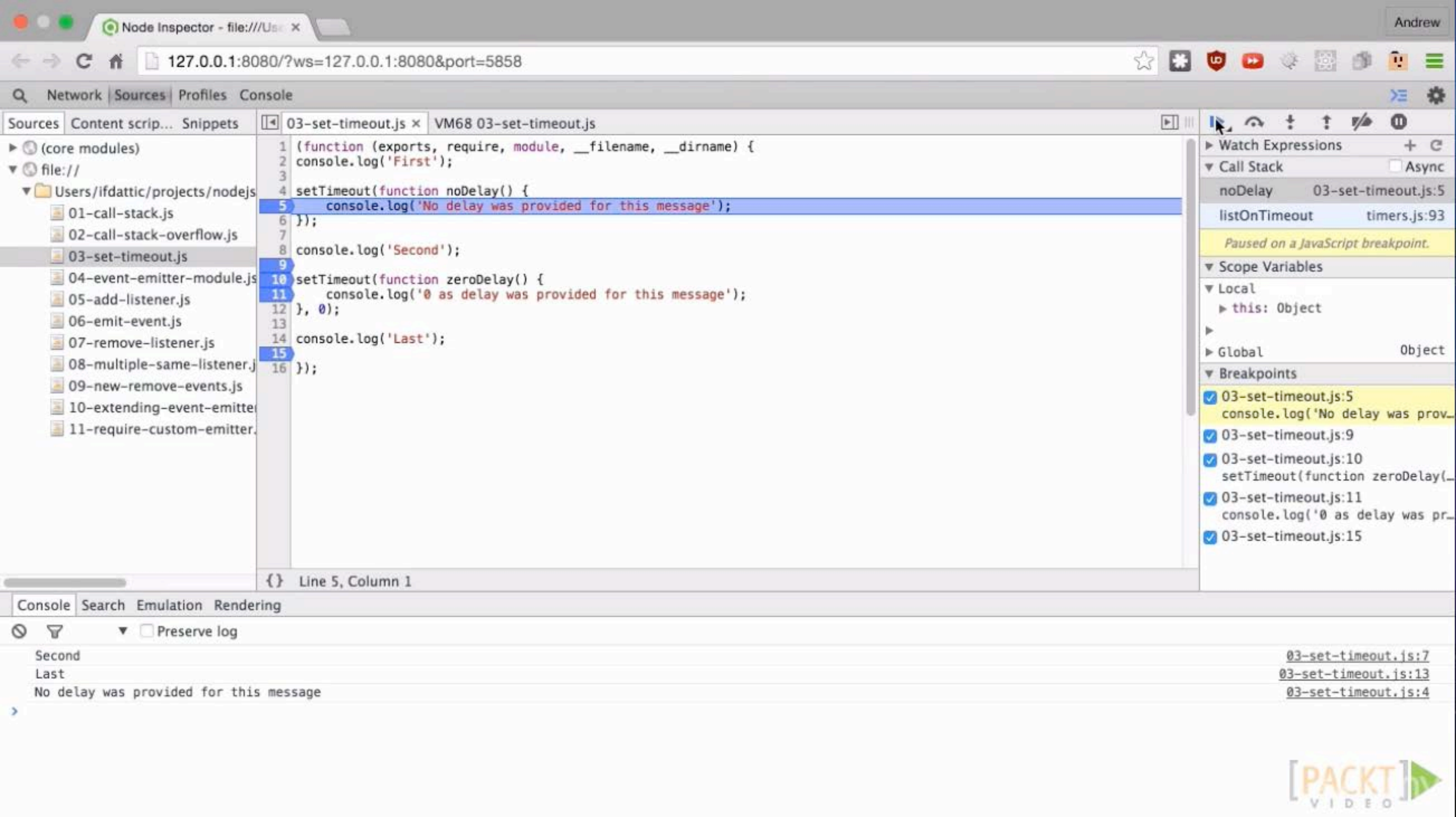














Node Inspector - file:///Use x

127.0.0.1:8080/?ws=127.0.0.1:8080&port=5858

NetworkSourcesProfilesConsole

SourcesContent scrip... Snippets

03-set-timeout.js x VM68 03-set-timeout.js

(core modules)

file://

Users/ifdattic/projects/nodejs

01-call-stack.js

02-call-stack-overflow.js

03-set-timeout.js

04-event-emitter-module.js

05-add-listener.js

06-emit-event.js

07-remove-listener.js

08-multiple-same-listener.js

09-new-remove-events.js

10-extending-event-emitter.js

11-require-custom-emitter.js

1 (function (exports, require, module, \_\_filename, \_\_dirname) {

2 console.log('First');

3

4 setTimeout(function noDelay() {

5 console.log('No delay was provided for this message');

6 });

7

8 console.log('Second');

9

10 setTimeout(function zeroDelay() {

11 console.log('0 as delay was provided for this message');

12 }, 0);

13

14 console.log('Last');

15

16 });

Watch Expressions +

Call Stack Async

zeroDelay 03-set-timeout.js:11

listOnTimeout timers.js:93

Paused on a JavaScript breakpoint.

Scope Variables

Local

this: Object

Global Object

Breakpoints

03-set-timeout.js:5 console.log('No delay was prov...

03-set-timeout.js:9

03-set-timeout.js:10 setTimeout(function zeroDelay(...

03-set-timeout.js:11 console.log('0 as delay was pr...

03-set-timeout.js:15

Line 11, Column 1

ConsoleSearch Emulation Rendering

Second

03-set-timeout.js:7

Last

03-set-timeout.js:13

No delay was provided for this message

03-set-timeout.js:4

0 as delay was provided for this message

03-set-timeout.js:10

PACKT VIDEO



# The EventEmitter

- Generic wrapper
- Execute functions on events
- Functions => listeners

```
1 'use strict';
2
3 const events = require('events');
4 const EventEmitter = new events.EventEmitter();
5
6 emitter.addListener('newMail', function (subject) {
7   console.log(subject);
8
9   console.log('Notifying of new mail!');
10 });
11
12 emitter.on('newMail', function () {
13   console.log('Adding mail to list view');
14 });
15
16 // emitter.once('newMail', function () {
17 //   console.log('I happen only once');
18 // });
19
```

```
1 'use strict';
2
3 const events = require('events');
4 const EventEmitter = new events.EventEmitter();
5
6 emitter.addListener('newMail', function (subject) {
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```



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14 });
15
16 emitter.once('newMail', function () {
17     console.log('I happen only once');
18 });
19
```

```
1 'use strict';
2
3 const events = require('events');
4 const EventEmitter = new events.EventEmitter();
5
6 emitter.addListener('newMail', function (subject) {
7     console.log('Argument provided:', subject);
8
9     console.log('Notifying of new mail!');
10 });
11
12 emitter.on('newMail', function () {
13     console.log('Adding mail to list view');
14 });
15
16 emitter.once('newMail', function () {
17     console.log('I happen only once');
18 });
19
20 emitter.emit('newMail');
21
22 emitter.emit('newMail', 'Congratulations on progress');
23
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node
```



```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node 06-emit-event.js
```

```
Argument provided: undefined
```

```
Notifying of new mail!
```

```
Adding mail to list view
```

```
I happen only once
```

```
Argument provided: Congratulations on progress
```

```
Notifying of new mail!
```

```
Adding mail to list view
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ █
```

```
1 'use strict';
2
3 const events = require('events');
4 const EventEmitter = new events.EventEmitter();
5
6 function notify() {
7     console.log('Notifying of new mail!');
8 }
9
10 EventEmitter.addListener('newMail', notify);
11
12 EventEmitter.on('newMail', function () {
13     console.log('Adding mail to list view');
14 });
15
16 // console.log(EventEmitter.listeners('newMail'));
17
18 EventEmitter.removeListener('newMail', notify);
19
20 // console.log(EventEmitter.listeners('newMail'));
21
22 // EventEmitter.removeAllListeners('newMail');
23
24 // console.log(EventEmitter.listeners('newMail'));
25
```

```
1 'use strict';
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3 const events = require('events');
4 const EventEmitter = new events.EventEmitter();
5
6 function notify() {
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24 // console.log(emitter.listeners('newMail'));
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```



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17
18 emitter.removeListener('newMail', notify);
19
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23
24 console.log(emitter.listeners('newMail'));
25
```



```
1 'use strict';
2
3 const events = require('events');
4 const EventEmitter = new events.EventEmitter();
5
6 function notify() {
7     console.log('Notifying of new mail!');
8 }
9
10 // EventEmitter.addListener('newMail', notify);
11 // EventEmitter.addListener('newMail', notify);
12 // EventEmitter.addListener('newMail', notify);
13
14 console.log(EventEmitter.listeners('newMail'));
15
16 // EventEmitter.removeListener('newMail', notify);
17
18 console.log(EventEmitter.listeners('newMail'));
19
20 // console.log(EventEmitter.getMaxListeners());
21
```

```
1 'use strict';
2
3 const events = require('events');
4 const EventEmitter = new events.EventEmitter();
5
6 function notify() {
7     console.log('Notifying of new mail!');
8 }
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```
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12 emitter.addListener('newMail', notify);
13
14 console.log(emitter.listeners('newMail'));
15
16 emitter.removeListener('newMail', notify);
17
18 console.log(emitter.listeners('newMail'));
19
20 // console.log(emitter.getMaxListeners());
21
```



```
1 'use strict';
2
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21
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]  
$ node 08-multiple-same-listener.js  
[ [Function: notify], [Function: notify], [Function: notify] ]  
[ [Function: notify], [Function: notify] ]  
10
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]  
$ █
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node 09-new-remove-events.js
```

```
Listener added
```

```
Listener added
```

```
Listener removed
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ █
```



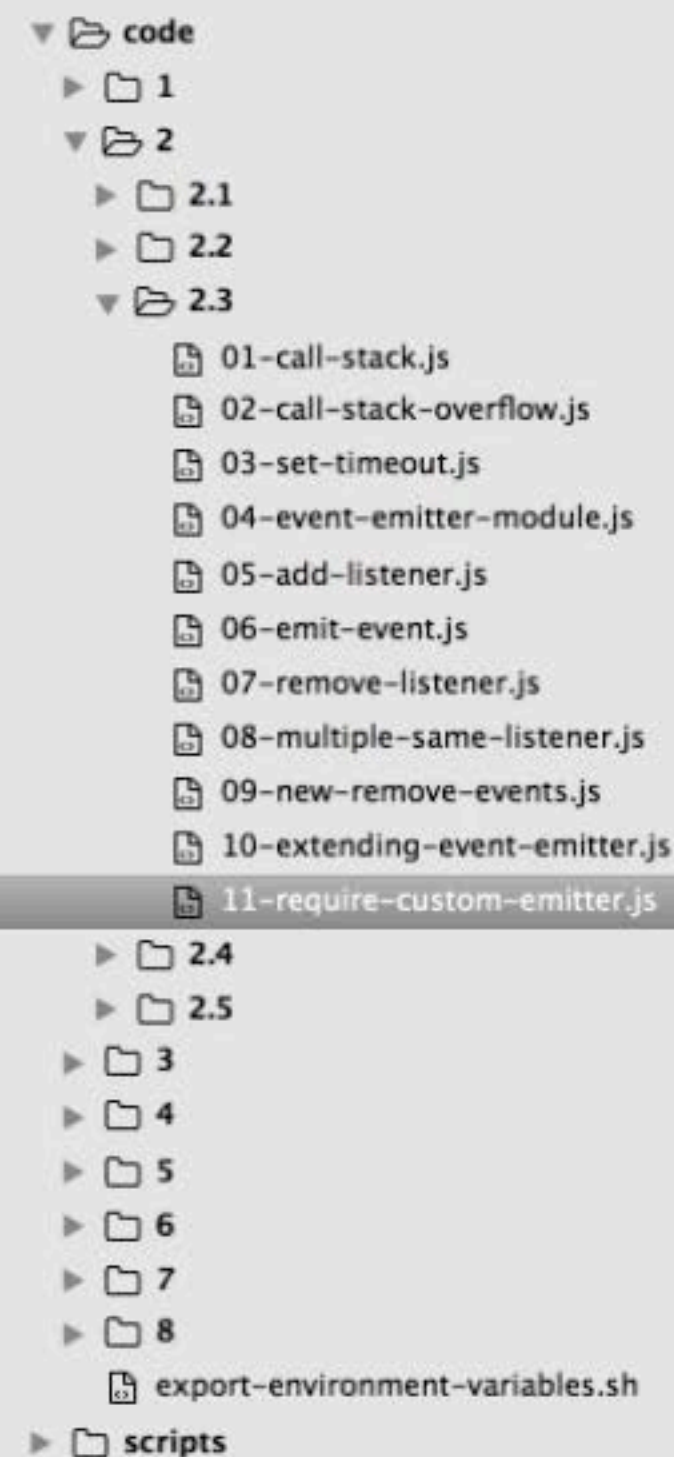
```
1 'use strict';
2
3 const util = require('util');
4 const EventEmitter = require('events').EventEmitter;
5
6 // const Box = function () {
7 //   let self = this;
8
9   //   EventEmitter.call(this);
10
11   //   setTimeout(function () {
12   //     self.emit('newMail');
13   //   });
14
15   //   self.on('delete', function (id) {
16   //     console.log('Deleting mail with id: ' + id);
17   //   });
18   // };
19
20 // util.inherits(Box, EventEmitter);
21
22 // module.exports = Box;
23
```

```
1 'use strict';
2
3 const util = require('util');
4 const EventEmitter = require('events').EventEmitter;
5
6 const Box = function () {
7     let self = this;
8
9     EventEmitter.call(this);
10
11     //     setTimeout(function () {
12     //         self.emit('newMail');
13     //     });
14
15     //     self.on('delete', function (id) {
16     //         console.log('Deleting mail with id: ' + id);
17     //     });
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```
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3 const util = require('util');
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16 //          console.log('Deleting mail with id: ' + id);
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22 module.exports = Box;
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```



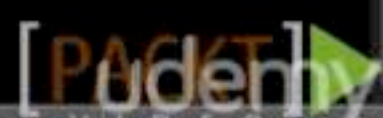
```
1 'use strict';
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12         self.emit('newMail');
13     });
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15     self.on('delete', function (id) {
16         console.log('Deleting mail with id: ' + id);
17     });
18 };
19
20 util.inherits(Box, EventEmitter);
21
22 module.exports = Box;
23
```



```
11-require-custom-emitter.js x
1 'use strict';
2
3 const Box = require('./10-extending-event-emitter');
4
5 const box = new Box();
6
7 box.on('newMail', function () {
8     console.log('Notifying of new mail');
9 });
10
11 box.emit('newMail');
12
13 box.emit('delete', 5);
14
```

16 Words, Line 1, Column 1

0 misspelled words UTF-8 Unix Spaces: 4 JavaScript (Babel)



```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ node 11-require-custom-emitter.js
```

```
Notifying of new mail
```

```
Deleting mail with id: 5
```

```
Notifying of new mail
```

```
ifdattic at ifdattic-mbp13 in ~/projects/nodejs-mongodb-video-course/code/2/2.3 on master [!]
```

```
$ █
```



Next Video

Working with Streams