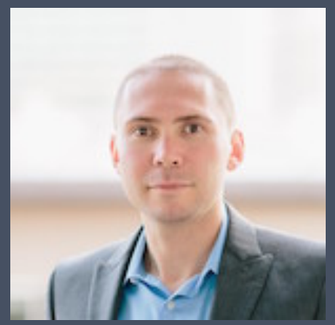
YOU DON'T KNOW NODE

QUICK INTRO TO 6 CORE FEATURES

BETTER APPS-
BETTER LIFE

ABOUT PRESENTER

AZAT MARDAN



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ABOUT PRESENTER

- WORK: TECHNOLOGY FELLOW AT CAPITAL ONE
- EXPERIENCE: FDIC. NIH. DOCUSIGN. HACKREACTOR AND STORIFY
- BOOKS: REACT QUICKLY. PRACTICAL NODE.JS. PRO EXPRESS.JS. EXPRESS.JS API AND 8 OTHERS
- TEACH: NODEPROGRAM.COM


5 HACKS TO GETTING THE JOB OF YOUR DREAMS TO LIVE A HAPPIER & HEALTHIER LIFE
BY AZAT MARDAN
2015
PROGWRITER [2.0: BEYOND BOOKS]
SECRETS of a successful online course creator and other INCOME strategies – that REALLY work
PROGWRITER [PROGRAMMER + WRITER]
LESSONS learned on my path from ordinary developer to WRITER of multiple programming books – THAT SELL
Practical Node.js
Building Real-World Scalable Web Apps
Azat Mardan
Full Stack JavaScript
Learn Backbone.js, Node.js and MongoDB
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INTRODUCTION TO OAUTH WITH NODE.JS
Start learning Backbone.js, Node.js and MongoDB
[AZAT MARDAN]
RAPID PROTOTYPING WITH JS
AGILE JAVASCRIPT DEVELOPMENT
THE COMPREHENSIVE BOOK ON EXPRESS.JS
EXPRESS.JS GUIDE
AZAT MARDAN
React Quickly
AZAT MARDAN
MANNING
OH MY JS
THE BEST JAVASCRIPT ARTICLES
[АЗАТ МАРДАН]
БЫСТРОЕ ПРОТОТИПИРОВАНИЕ с JS
ГИБКАЯ РАЗРАБОТКА НА JAVASCRIPT
JavaScript and Node FUNdamentals
A Collection of Essential Basics
AZAT MARDAN
Pro Express.js
Azat Mardan
Apress
Express.js Deep API Reference
Azat Mardan
Apress

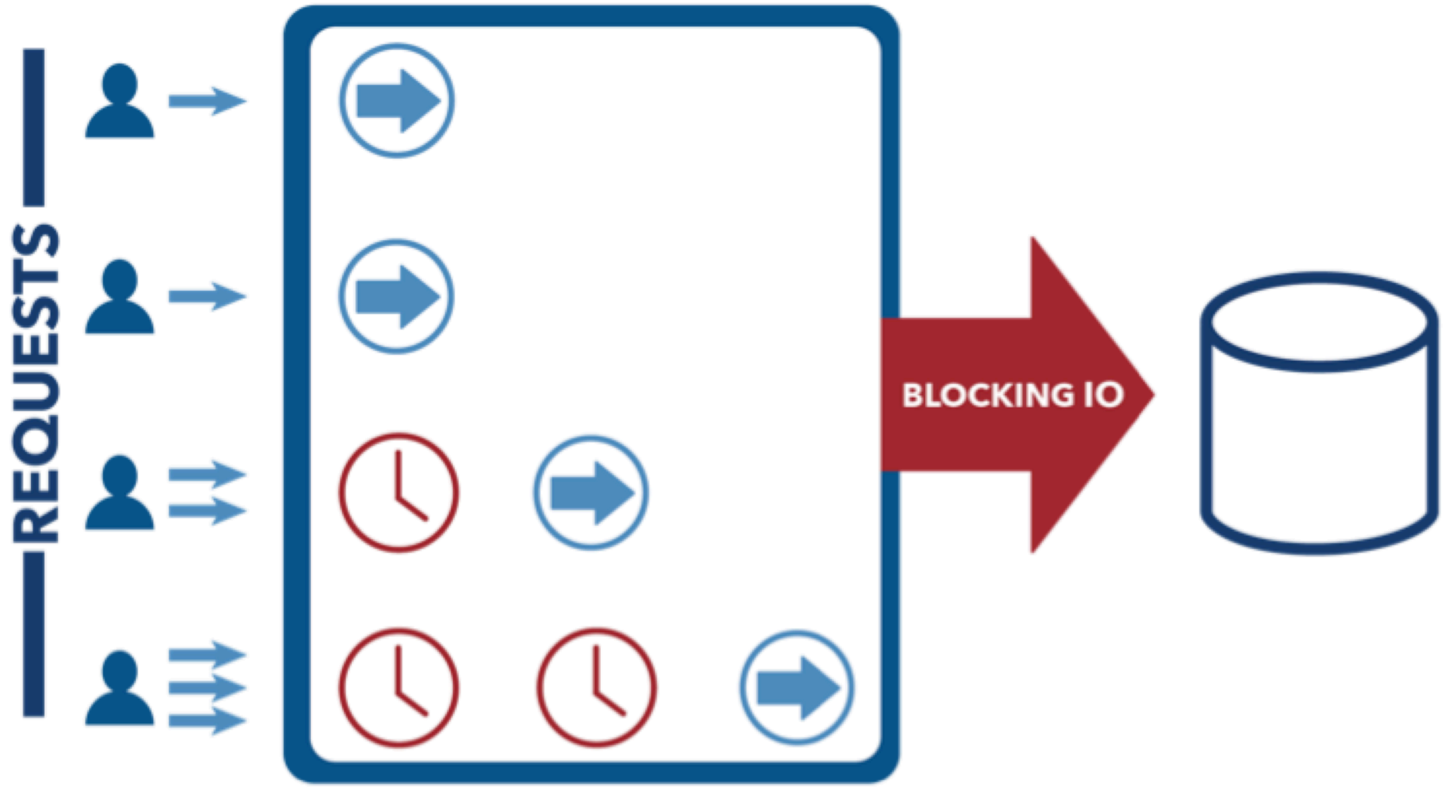
STARTING WITH BASICS: WHY USE NODE?

WAIT FOR INPUT/OUTPUT WHICH ARE THE MOST

JAVA SLEEP

```
System.out.println("Step: 1");
System.out.println("Step: 2");
Thread.sleep(1000);
System.out.println("Step: 3");
```

TECH | BLOCKING I/O



NODE "SLEEP"

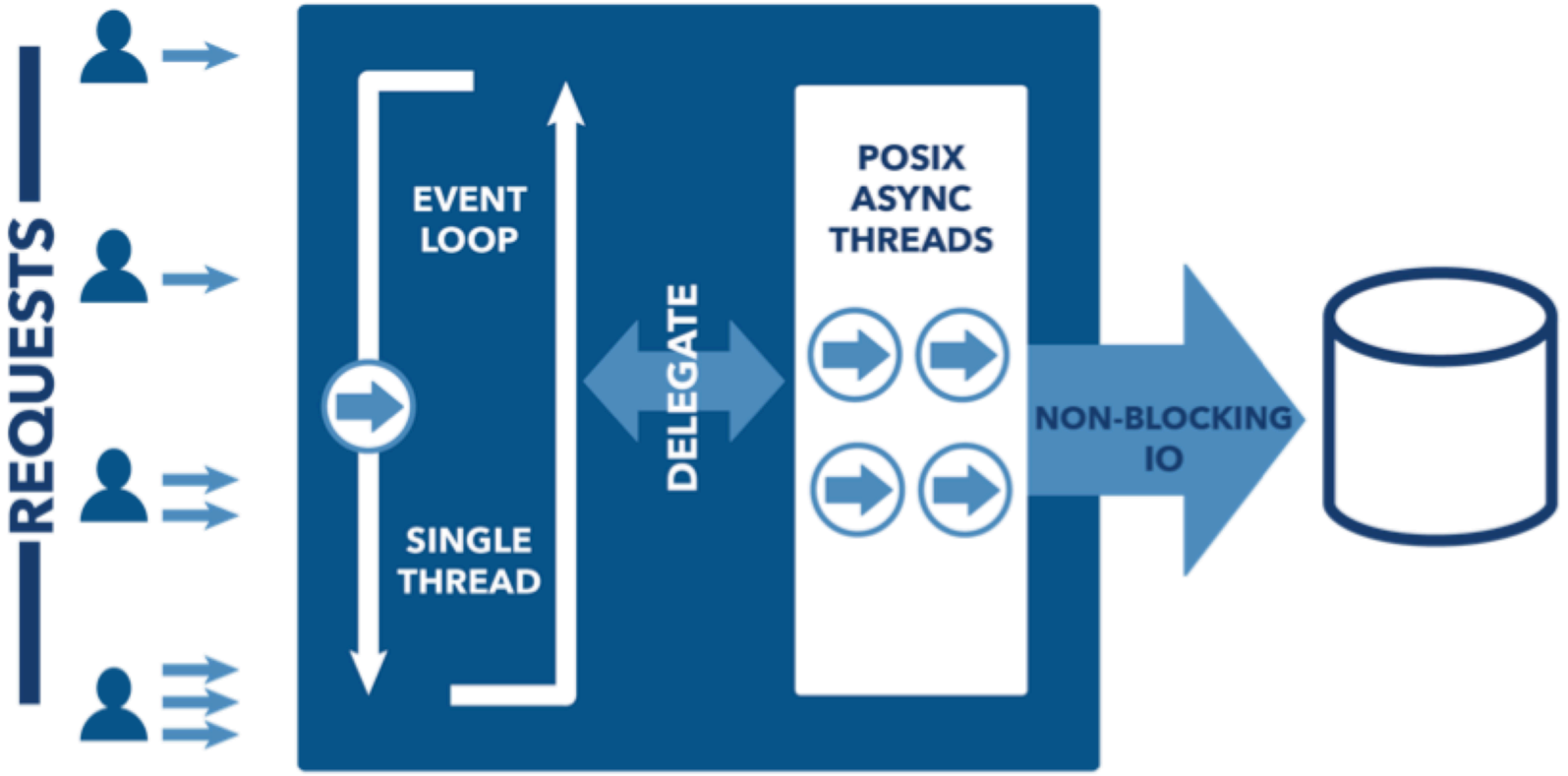
```
console.log('Step: 1')
setTimeout(function () {
  console.log('Step: 3')
}, 1000)
console.log('Step: 2')
```

PROCESS MULTIPLE TASKS

```
console.log('Step: 1')
setTimeout(function () {
  console.log('Step: 3')
  // console.log('Step 5')
}, 1000);
console.log('Step: 2')
// console.log('Step 4')
```

EVENT LOOP

TECH | # NON-BLOCKING I/O

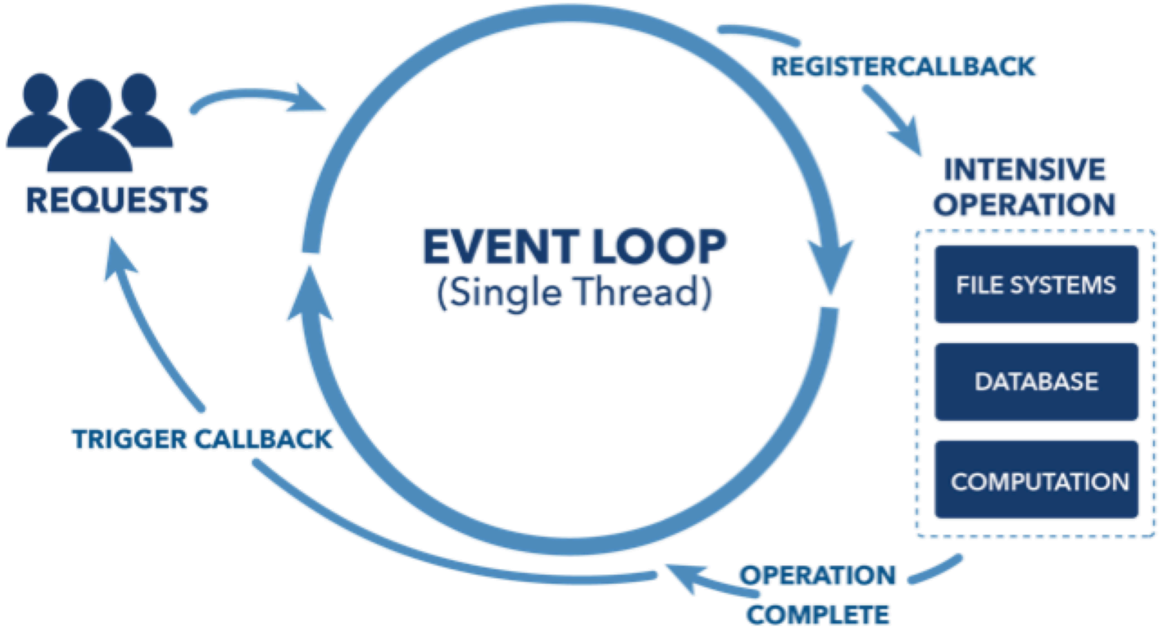


[MUTLI-THREADING] IS THE SOFTWARE EQUIVALENT OF A NUCLEAR DEVICE BECAUSE IF IT IS USED INCORRECTLY, IT CAN BLOW UP IN YOUR FACE.

HTTP://BLOG.CODINGHORROR.COM/THREADING-CONCURRENCY-AND-THE-MOST-POWERFUL-PSYCHOKINETIC-EXPLOSIVE-IN-THE-UNIV

SINGLE THREAD – NO WORRIES

TECH | # NON-BLOCKING I/O



IT'S STILL POSSIBLE TO WRITE BLOCKING CODE IN NODE.JS. 

BLOCKING NODE.JS CODE

```
// blocking.js
console.log('Step: 1')
for (var i = 1; i<1000000000; i++) {
  // This will take 100-1000ms
}
console.log('Step: 2')
```

BLOCKING NODE.JS CODE

```
var fs = require('fs')

var contents = fs.readFileSync('accounts.txt','utf8')
console.log(contents)
console.log('Hello Ruby\n')

var contents = fs.readFileSync('ips.txt','utf8')
console.log(contents)
console.log('Hello Node!')
//data1->Hello Ruby->data2->Hello NODE!
```

NON-BLOCKING NODE.JS CODE

```
var fs = require('fs')

var contents = fs.readFile('accounts.txt','utf8', function(err,contents){
   console.log(contents)
})
console.log('Hello Python\n')

var contents = fs.readFile('ips.txt','utf8', function(err,contents){
   console.log(contents)
})
console.log("Hello Node!")
//Hello Python->Hello Node->data1->data2
```

MOST OF NODE IS JAVASCRIPT

- ARRAY
- STRING
- PRIMITIVES
- FUNCTIONS
- OBJECTS

NODE != BROWSER JAVASCRIPT

HOW TO CREATE GLOBAL VARIABLES (NO `window` IN NODE)?

GLOBAL

```
global.__fi
lename__
```

```
global.__dirname
```

global.module

```
global.requ
ire()
```

global.process

- HOW TO ACCESS CLI INPUT. OS. PLATFORM. MEMORY USAGE. VERSIONS. ETC.?
- WHERE TO STORE PASSWORDS?

PROCESS

```
process.pid
```

process.versions

process.arch

process.argv

process.env

```
process.upt
ime()
```

process.memoryUsage()

process.cwd()

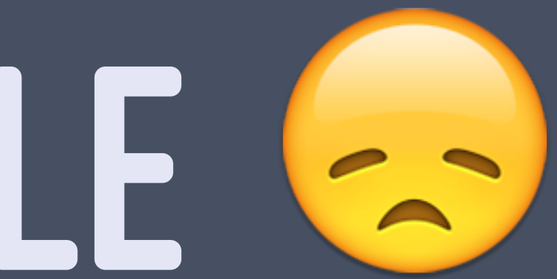
process.exit()

```
process.on(
)
```

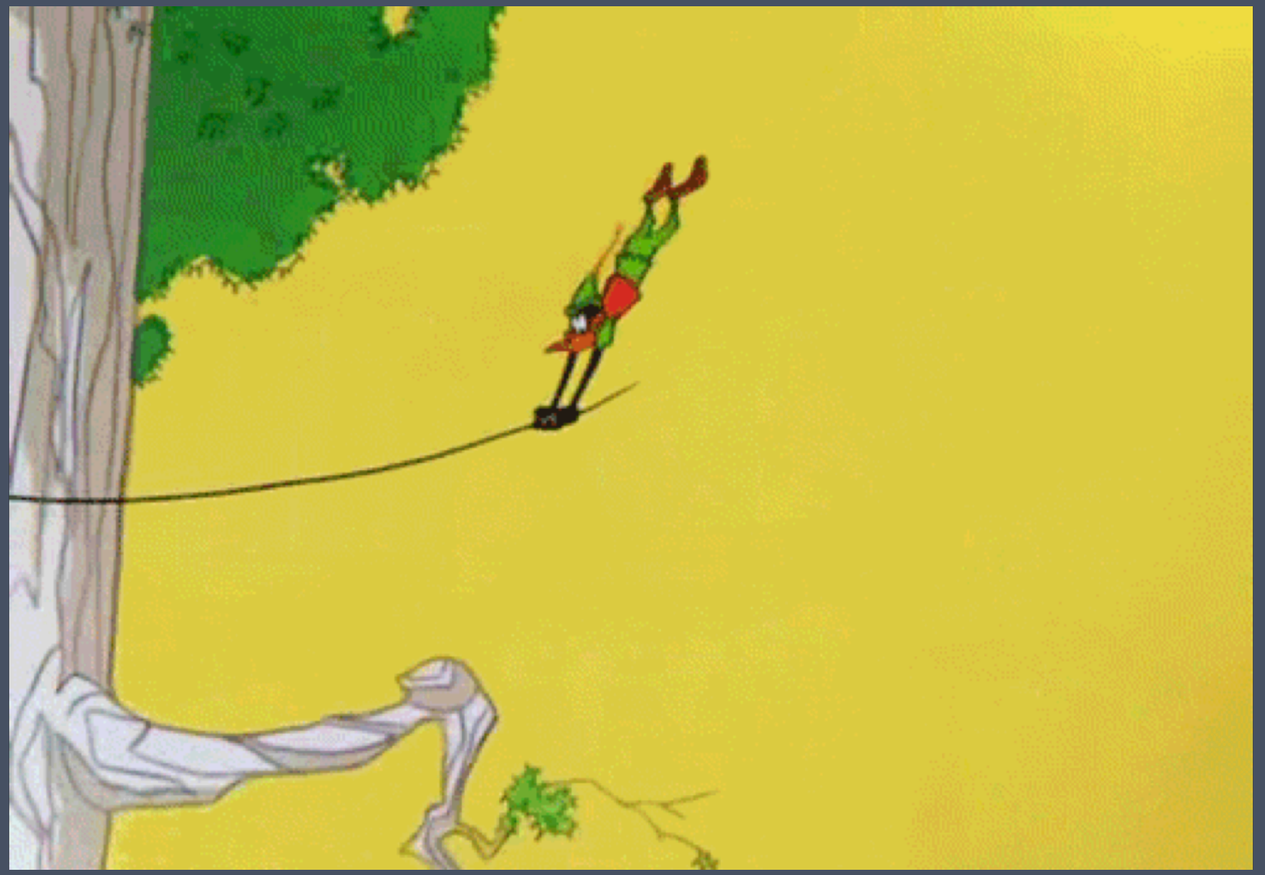
WHO LIKES AND UNDERSTANDS CALLBACKS?

HTTP://CALLBACKHELL.COM

```
fs.readdir(source, function (err, files) {
  if (err) {
    console.log('Error finding files: ' + err)
  } else {
    files.forEach(function (filename, fileIndex) {
      console.log(filename)
      gm(source + filename).size(function (err, values) {
        if (err) {
          console.log('Error identifying file size: ' + err)
        } else {
          console.log(filename + ' : ' + values)
          aspect = (values.width / values.height)
          widths.forEach(function (width, widthIndex) {
            height = Math.round(width / aspect)
            console.log('resizing ' + filename + 'to ' + height + 'x' + height)
            this.resize(width, height).write(dest + 'w' + width + '_' + filename, function(err) {
              if (err) console.log('Error writing file: ' + err)
            })
          }.bind(this))
        }
      })
    })
  }
})
```

CALLBACKS ARE NOT VERY DEVELOPMENTAL SCALABLE 

ME WHEN WORKING WITH DEEPLY NESTED CALLBACKS



EVENTS

EVENTS

IN NODE.JS AN EVENT CAN BE DESCRIBED SIMPLY AS A STRING WITH A CORRESPONDING CALLBACK.

```
emitter.on('done', function(results) {
  console.log('Done: ', results)
})
```

EVENT HANDLING IN NODE USES THE OBSERVER PATTERN

AN EVENT. OR SUBJECT. KEEPS TRACK OF ALL FUNCTIONS THAT ARE ASSOCIATED WITH IT

THESE ASSOCIATED FUNCTIONS, KNOWN AS OBSERVERS, ARE EXECUTED WHEN THE GIVEN EVENT IS TRIGGERED

USING EVENT EMITTERS

```
var events  = require('events')
var emitter = new events.EventEmitter()

emitter.on('knock', function() {
  console.log('Who\'s there?')
})

emitter.on('knock', function() {
  console.log('Go away!')
})

emitter.emit('knock')
```

INHERITING FROM EVENTEMITTER

```
// job.js
var util = require('util')
var Job = function Job() {
  // ...
  this.process = function() {
    // ...
    job.emit('done', { completedOn: new Date() })
  }
}

util.inherits(Job, require('events').EventEmitter)
module.exports = Job
```

INHERITING FROM EVENTEMITTER

```
// weekly.js
var Job = require('./job.js')
var job = new Job()

job.on('done', function(details){
  console.log('Job was completed at', details.completedOn)
  job.removeAllListeners()
})

job.process()
```

LISTENERS

```
emitter.listeners(eventName)
emitter.on(eventName, listener)
emitter.once(eventName, listener)
emitter.removeListener(eventName, listener)
```

PROBLEMS WITH LARGE DATA

- SPEED: TOO SLOW
- BUFFER LIMIT: ~1GB

STREAMS

ABSTRACTIONS FOR CONTINUOS CHUNKING OF DATA

NO NEED TO WAIT FOR THE ENTIRE RESOURCE TO

TYPES OF STREAMS

- READABLE
- WRITABLE
- DUPLEX
- TRANSFORM

STREAMS INHERIT FROM EVENT EMITTER

STREAMS ARE EVERYWHERE!

- HTTP REQUESTS AND RESPONSES
- STANDARD INPUT/OUTPUT (STDIN&STDOUT)
- FILE READS AND WRITES

READABLE STREAM EXAMPLE

`process.stdin`

STANDARD INPUT STREAMS CONTAIN DATA GOING INTO APPLICATIONS.

THIS IS ACHIEVED VIA A READ OPERATION.

TYPICALLY COMES FROM THE KEYBOARD USED TO START

TO LISTEN IN ON DATA FROM STDIN, USE THE `data` AND `end` EVENTS:

```
// stdin.js
process.stdin.resume()
process.stdin.setEncoding('utf8')

process.stdin.on('data', function (chunk) {
  console.log('chunk: ', chunk)
})

process.stdin.on('end', function () {
  console.log('--- END ---')
})
```

DEMO

```
$ node stdin.js
```

NEW INTERFACE read()

```
var readable = getReadableStreamSomehow()
readable.on('readable', () => {
  var chunk
  while (null !== (chunk = readable.read())) {
    console.log('got %d bytes of data', chunk.length)
  }
})
```

WRITABLE STREAM EXAMPLE

`process.stdout`

STANDARD OUTPUT STREAMS CONTAIN DATA GOING OUT OF THE APPLICATIONS.

THIS IS DONE VIA A WRITE OPERATION.

DATA WRITTEN TO STANDARD OUTPUT IS VISIBLE ON THE

WRITABLE STREAM

TO WRITE TO `stdout`, USE THE `write` FUNCTION:

```
process.stdout.write('A simple message\n')
```

WHAT ABOUT HTTP?

```
const http = require('http')
var server = http.createServer( (req, res) => {
  var body = ''
  req.setEncoding('utf8')
  req.on('data', (chunk) => {
    body += chunk
  })
  req.on('end', () => {
    var data = JSON.parse(body)
    res.write(typeof data)
    res.end()
  })
})

server.listen(1337)
```

PIPE

```
var r = fs.createReadStream('file.txt')
var z = zlib.createGzip()
var w = fs.createWriteStream('file.txt.gz')
r.pipe(z).pipe(w)
```

WHAT DATA TYPE TO USE FOR BINARY DATA?

BUFFERS

BINARY DATA TYPE. TO CREATE:

- `Buffer.alloc(size)`
- `Buffer.from(array)`
- `Buffer.from(buffer)`
- `Buffer.from(str[, encoding])`

DOCS: HTTP://BIT.LY/11EACZ1

WORKING WITH BUFFER

```
// buf.js
var buf = Buffer.alloc(26)
for (var i = 0 ; i < 26 ; i++) {
  buf[i] = i + 97 // 97 is ASCII a
}
console.log(buf) // <Buffer 61 62 63 64 65 66 67 68 69 6a 6b 6c 6d 6e 6f 70 71 72 73 74 75 76 77 78 79 7a>
console.log(buf.toString('utf8')) // abcdefghijklmnopqrstuvwxyz
```

BUFFER CONVERTION

```
buf.toString('ascii') // outputs: abcdefghijklmnopqrstuvwxyz
buf.toString('ascii', 0, 5) // outputs: abcde
buf.toString('utf8', 0, 5) // outputs: abcde
buf.toString(undefined, 0, 5) // encoding defaults to 'utf8', outputs abcde
```

REMEMBER FS?

```
fs.readFile('/etc/passwd', function (err, data) {
  if (err) return console.error(err)
  console.log(data)
});
```

`data` **IS BUFFER!**

DEMO

```
$ node server-stream
```

STREAMS AND BUFFER DEMO

```
// server-stream.js
app.get('/stream', function(req, res) {
  var stream = fs.createReadStream(largeImagePath)
  stream.pipe(res)
})

$ node server-stream
```

HTTP://LOCALHOST:3000/STREAM
HTTP://LOCALHOST:3000/NON-STREAM

RESULTS IN DEVTOOLS

`/stream` RESPONDS FASTER!

`X-Response-Time`
`~300ms vs. 3-5s`

STREAM RESOURCES

HTTPS://GITHUB.COM/SUBSTACK/STREAM-ADVENTURE

```
$ sudo npm install -g stream-adventure
$ stream-adventure
```

HTTPS://GITHUB.COM/SUBSTACK/STREAM-HANDBOOK

HOW TO SCALE A SINGLE THREADED SYSTEM?

CLUSTER USAGE

- MASTER: STARTS WORKERS
- WORKER: DO THE JOB. E.G.. HTTP SERVER

NUMBER OF PROCESSES = NUMBER OF CPUS

CLUSTERS

```
var cluster = require('cluster')
if (cluster.isMaster) {
  for (var i = 0; i < numCPUs; i++) {
    cluster.fork()
  }
} else if (cluster.isWorker) {
  // your server code
})
```

CLUSTER DEMO

1. RUN `code/cluster.js` WITH NODE (`$ node cluster.js`).
2. INSTALL `loadtest` WITH NPM: `$ npm install -g loadtest`
3. RUN LOAD TESTING WITH: `$ loadtest  http://localhost:3000 -t 20 –c 10`

PRESS CONTROL+C ON THE SERVER TERMINAL

CLUSTER LIBRARIES

- CORE CLUSTER: LEAN AND MEAN
- STRONG-CLUSTER-CONTROL (HTTPS://GITHUB.COM/STRONGLOOP/STRONG-CLUSTER-CONTROL). OR `$ SLC RUN`: GOOD CHOICE
- PM2 (HTTPS://GITHUB.COM/UNITECH/PM2): GOOD CHOICE

PM2

https://github.com/unitech/pm2

http://pm2.keymetrics.io

ADVANTAGES:

- LOAD-BALANCER AND OTHER FEATURES
- OS RELOAD DOWN-TIME. I.E., FOREVER ALIVE

PM2 DEMO: TYPICAL EXPRESS SERVER

```
var express = require('express')
var port = 3000
global.stats = {}
console.log('worker (%s) is now listening to http://localhost:%s',
 process.pid, port)
var app = express()
app.get('*', function(req, res) {
  if (!global.stats[process.pid]) global.stats[process.pid] = 1
  else global.stats[process.pid] += 1;
  var l ='cluser '
    + process.pid
    + ' responded \n';
  console.log(l, global.stats)
  res.status(200).send(l)
})
app.listen(port)
```

PM2 DEMO

USING `server.js`:

```
$ pm2 start server.js -i 0
```

IN A NEW WINDOW:

```
$ loadtest  http://localhost:3000 -t 20 -c 10
$ pm2 list
```

SPAWN VS FORK VS EXEC

- `require('child_process').spawn()` - LARGE DATA. STREAM. NO NEW V8 INSTANCE
- `require('child_process').fork()` - NEW V8 INSTANCE. MULTIPLE WORKERS
- `require('child_process').exec()` - BUFFER. ASYNC. ALL THE DATA AT ONCE

SPAWN EXAMPLE

```
fs = require('fs')
process = require('child_process')
var p = process.spawn('node', 'program.js')
p.stdout.on('data', function(data)) {
  console.log('stdout: ' + data)
})
```

FORK EXAMPLE

```
fs = require('fs')
process = require('child_process')
var p = process.fork('program.js')
p.stdout.on('data', function(data)) {
  console.log('stdout: ' + data)
})
```

EXEC EXAMPLE

```
fs = require('fs')
process = require('child_process')
var p = process.exec('node program.js', function (error, stdout, stderr) {
  if (error) console.log(error.code)
})
```

HOW TO HANDLE ASYNC ERRORS?

HANDLING ASYNC ERRORS

EVENT LOOP: ASYNC ERRORS ARE HARDER TO HANDLE/DEBUG. BECAUSE SYSTEM LOSES CONTEXT OF THE ERROR. THEN. APPLICATION CRASHES.

TRY/CATCH IS NOT GOOD ENOUGH.

SYNCHRONOUS ERROR IN NODE

```
try {
  throw new Error('Fail!')
} catch (e) {
  console.log('Custom Error: ' + e.message)
}
```

FOR SYNC ERRORS TRY/CATCH WORKS FINE.

ASYNC ERROR EXAMPLE

```
try {
  setTimeout(function () {
    throw new Error('Fail!')
  }, Math.round(Math.random()*100))
} catch (e) {
  console.log('Custom Error: ' + e.message)
}
```

THE APP CRASHES!

ME WHEN ASYNC ERROR'S THROWN

ASYNC ERRORS

HOW TO DEAL WITH IT?

BEST PRACTICES FOR ASYNC ERRORS?

- LISTEN TO ALL "ON ERROR" EVENTS
- LISTEN TO `uncaughtException`
- USE `domain` (SOFT DEPRECATED) OR ASYNCWRAP
- LOG. LOG. LOG & TRACE
- NOTIFY (OPTIONAL)
- EXIT & RESTART THE PROCESS

ON('ERROR')

ANYTHING THAT INHERITS FROM OR CREATES AN INSTANCE OF THE ABOVE: EXPRESS. LOOPBACK. SAILS. HAPI. ETC.

```
server.on('error', function (err) {
  console.error(err)
})
```

ON('ERROR') CHAINED METHOD EXAMPLE

```
var http = require(‘http’)
var server = http.createServer(app)
  .on('error', function(e) {
    console.log(‘Failed to create server’)
    console.error(e)
    process.exit(1)
  })
```

ON('ERROR') NAMED VARIABLE EXAMPLE

```
var req = http.request(options, function(res) {
  // … processing the response
})

req.on('error', function(e) {
  console.log('problem with request: ' + e.message)
})
```

UNCAUGHTEXCEPTION

`uncaughtException` IS A VERY CRUDE MECHANISM FOR EXCEPTION HANDLING. AN UNHANDLED EXCEPTION MEANS YOUR APPLICATION - AND BY EXTENSION NODE.JS ITSELF - IS IN AN UNDEFINED STATE. BLINDLY RESUMING MEANS ANYTHING COULD HAPPEN.

UNCAUGHTEXCEPTION

ALWAYS LISTEN TO `uncaughtException`!

```
process.on(‘uncaughtException’, handle)
```

OR

```
process.addListener('uncaughtException', handle)
```

UNCAUGHTEXCEPTION EXPANDED EXAMPLES

```
process.on('uncaughtException', function (err) {
  console.error('uncaughtException: ', err.message)
  console.error(err.stack)
  process.exit(1)
})
```

OR

```
process.addListener('uncaughtException', function (err) {
  console.error('uncaughtException: ', err.message)
  console.error(err.stack)
  process.exit(1)
```

DOMAIN

THIS MODULE IS SOFTLY DEPRECATED IN 4.0 (MOST LIKEY WILL BE SEPARATE FROM CORE MODULE). BUT THERE'S NO ALTERNATIVES IN CORE AS OF NOW.

DOMAIN EXAMPLE

```
var domain = require('domain').create()
domain.on('error', function(error){
  console.log(error)
})
domain.run(function(){
  throw new Error('Failed!')
})
```

DOMAIN WITH ASYNC ERROR DEMO

DOMAIN-ASYNC.JS:

```
var d = require('domain').create()
d.on('error', function(e) {
    console.log('Custom Error: ' + e)
})
d.run(function() {
  setTimeout(function () {
    throw new Error('Failed!')
  }, Math.round(Math.random()*100))
});
```

C++ ADDONS

HOW TO WRITE C/C++ BINDING FOR YOUR IOT. HARDWARE. DRONE. SMARTDEVICE. ETC.?

NODE AND C++

CREATE THE `hello.cc` FILE:

```
#include <node.h>

namespace demo {

using v8::FunctionCallbackInfo;
using v8::HandleScope;
using v8::Isolate;
using v8::Local;
using v8::Object;
using v8::String;
using v8::Value;
```

NODE AND C++

CREATE THE `hello.cc` FILE:

```
void Method(const FunctionCallbackInfo<Value>& args) {
  Isolate* isolate = args.GetIsolate();
  args.GetReturnValue().Set(String::NewFromUtf8(isolate, "capital one"));
}

void init(Local<Object> exports) {
  NODE_SET_METHOD(exports, "hello", Method);
}

NODE_MODULE(addon, init)

}  // namespace demo
```

CREATING binding.gyp

CREATE binding.gyp:

```
{
  "targets": [
    {
      "target_name": "addon",
      "sources": [ "hello.cc" ]
    }
  ]
}
```

NODE-GYP

```
$ npm install -g node-gyp
```

HTTPS://GITHUB.COM/NODEJS/NODE-GYP

CONFIGURING AND BUILDING

```
$ node-gyp configure
$ node-gyp build
```

CHECK FOR COMPILED `.node` FILES IN BUILD/RELEASE/

C++ ADDONS EXAMPLES

HTTPS://GITHUB.COM/NODEJS/NODE-ADDON-EXAMPLES

INCLUDING ADDON

CREATE `hello.js` AND INCLUDE YOUR C++ ADDON:

```
var addon = require('./build/Release/addon')
console.log(addon.hello()) // 'capital one'
```

RUN

```
$ node hello.js
```

CAPITAL ONE

WE USE NODE A LOT!

HTTPS://WWW.YOUTUBE.COM/WATCH?V=BJPELJHV11C

30-SECOND SUMMARY

1. EVENT EMITTERS
2. STREAMS
3. BUFFERS
4. CLUSTERS
5. C++ ADDONS
6. DOMAIN

THE END

Atwood's Law

Any application that *can* be written in JavaScript, *will* eventually be written in JavaScript.

SLIDES & CODE 

Dear Kate,

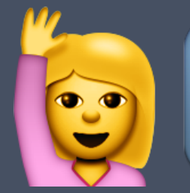
Here's to the crazy ones. The misfits. The rebels. The troublemakers. The round pegs in the square holes. The ones who see things differently. They're not fond of rules. And they have no respect for the status quo. You can quote them, disagree with them, glorify or vilify them. About the only thing you can't do is ignore them. Because they change things. They push the human race forward. And while some may see them as the crazy ones, we see genius. Because the people who are crazy enough to think they can change the world, are the ones who do.

Take care,
John Appleseed

HTTPS://GITHUB.COM/AZAT-CO/YOU-DONT-KNOW-NODE

OR

PDF: HTTP://BIT.LY/1VJWPQK

Q&A ❓  ➡️ 

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