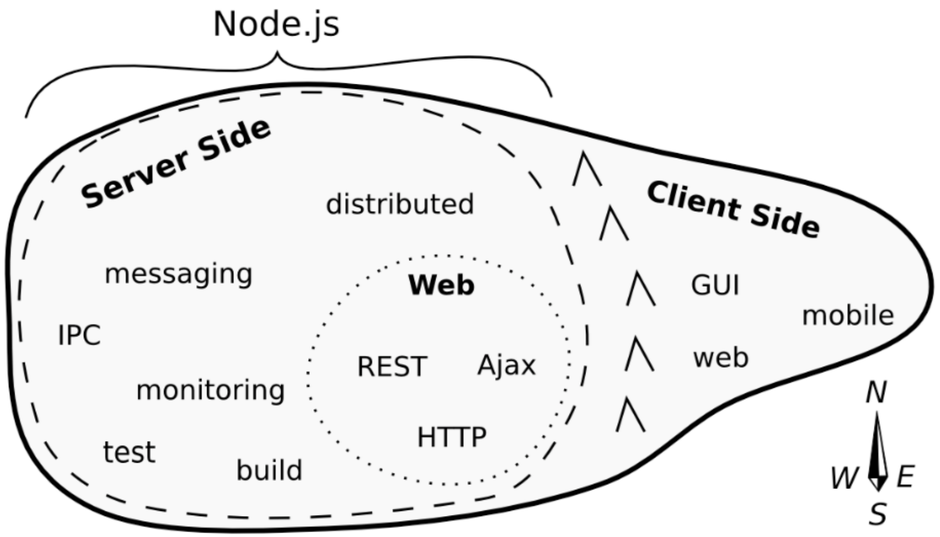
Node.js

Part 1.
Node.js Intro!

#01. Node.js Introduction

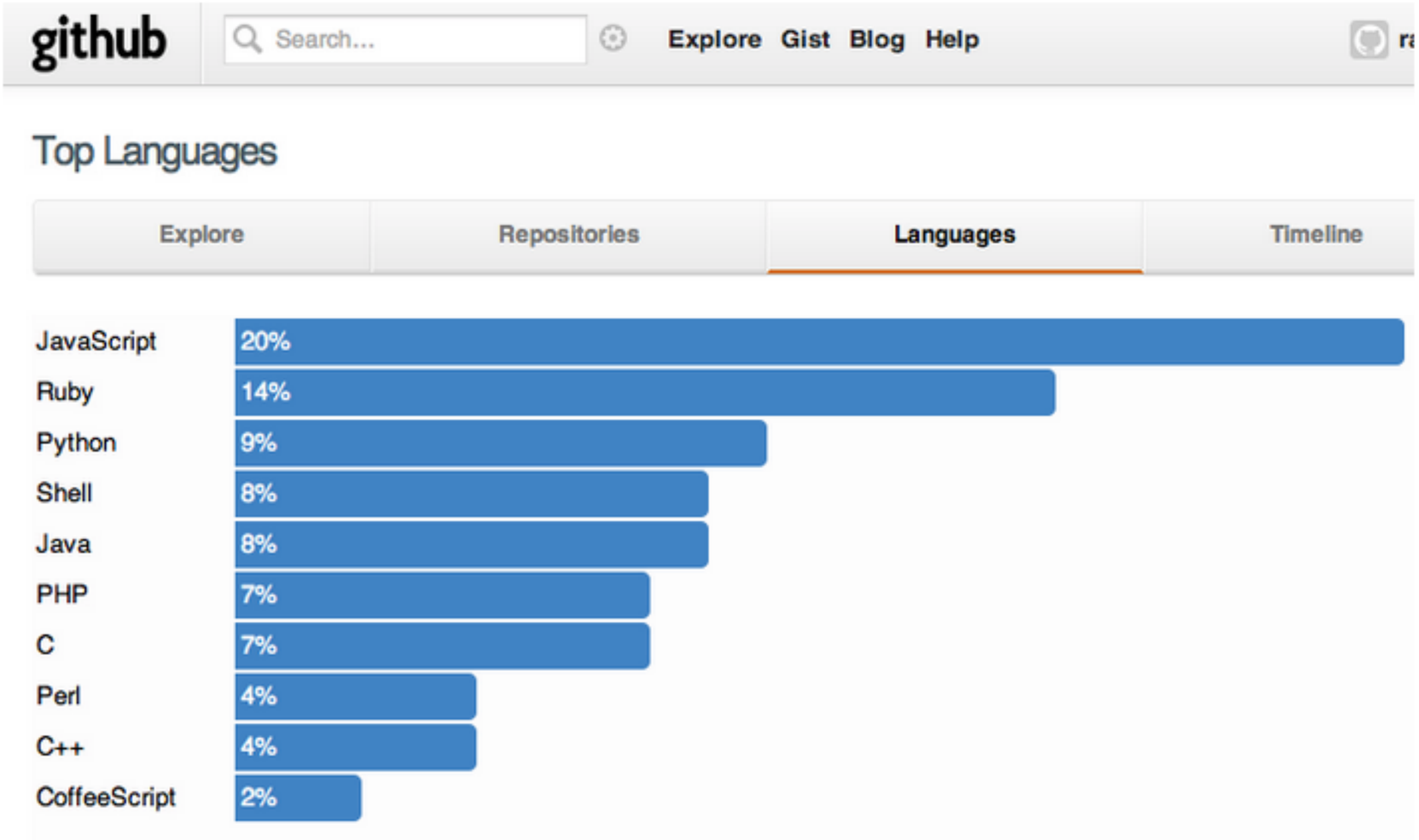


- Server side Javascript
- Event driven
- Asynchronous
- Non-Blocking I/O
- Single Threaded
- Lightweight
- Fast

Node.js Benefits #1

JavaScript

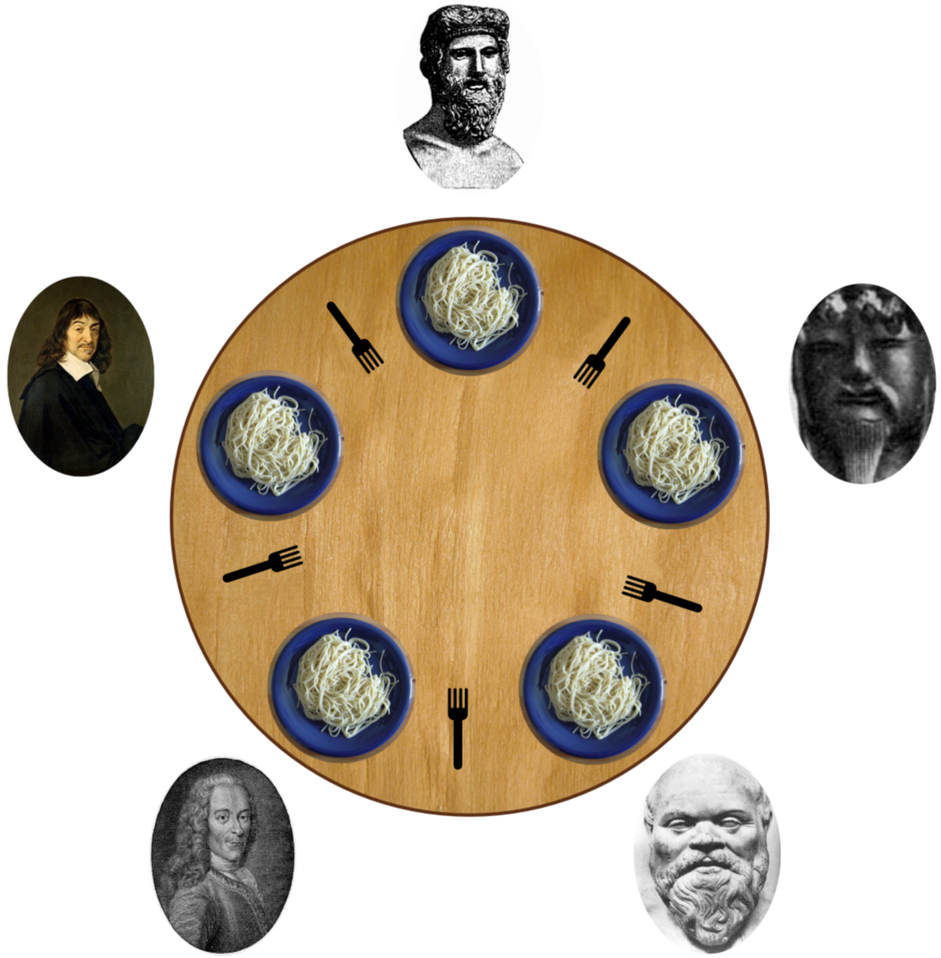
JavaScript is Mainstream.. in github..



Node.js Benefits #2 -> MEAN Stack

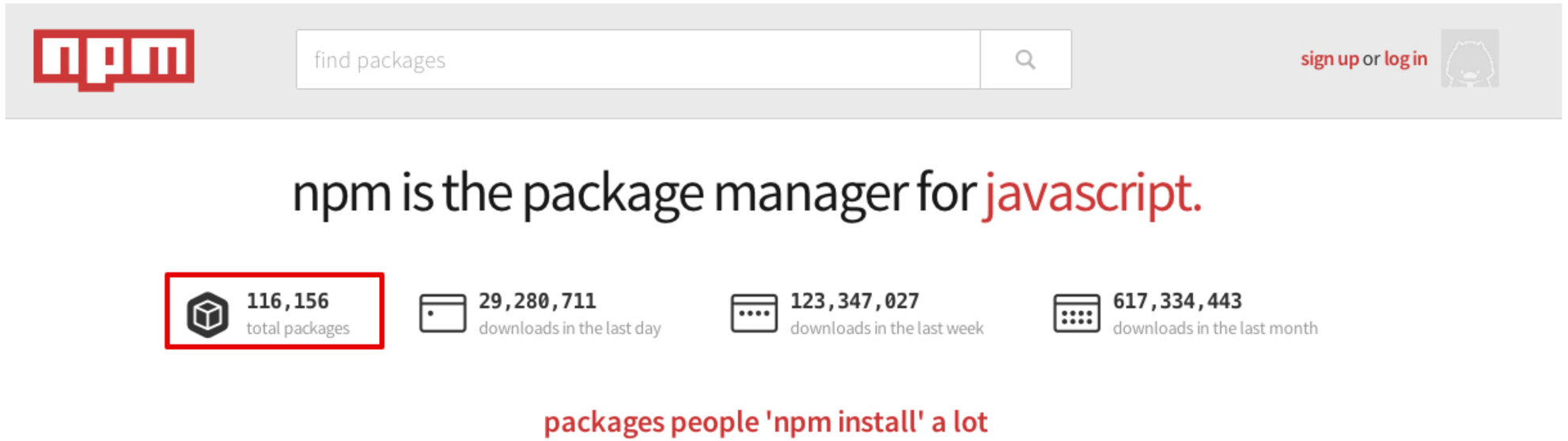
{Json}

Node.js Benefits #3



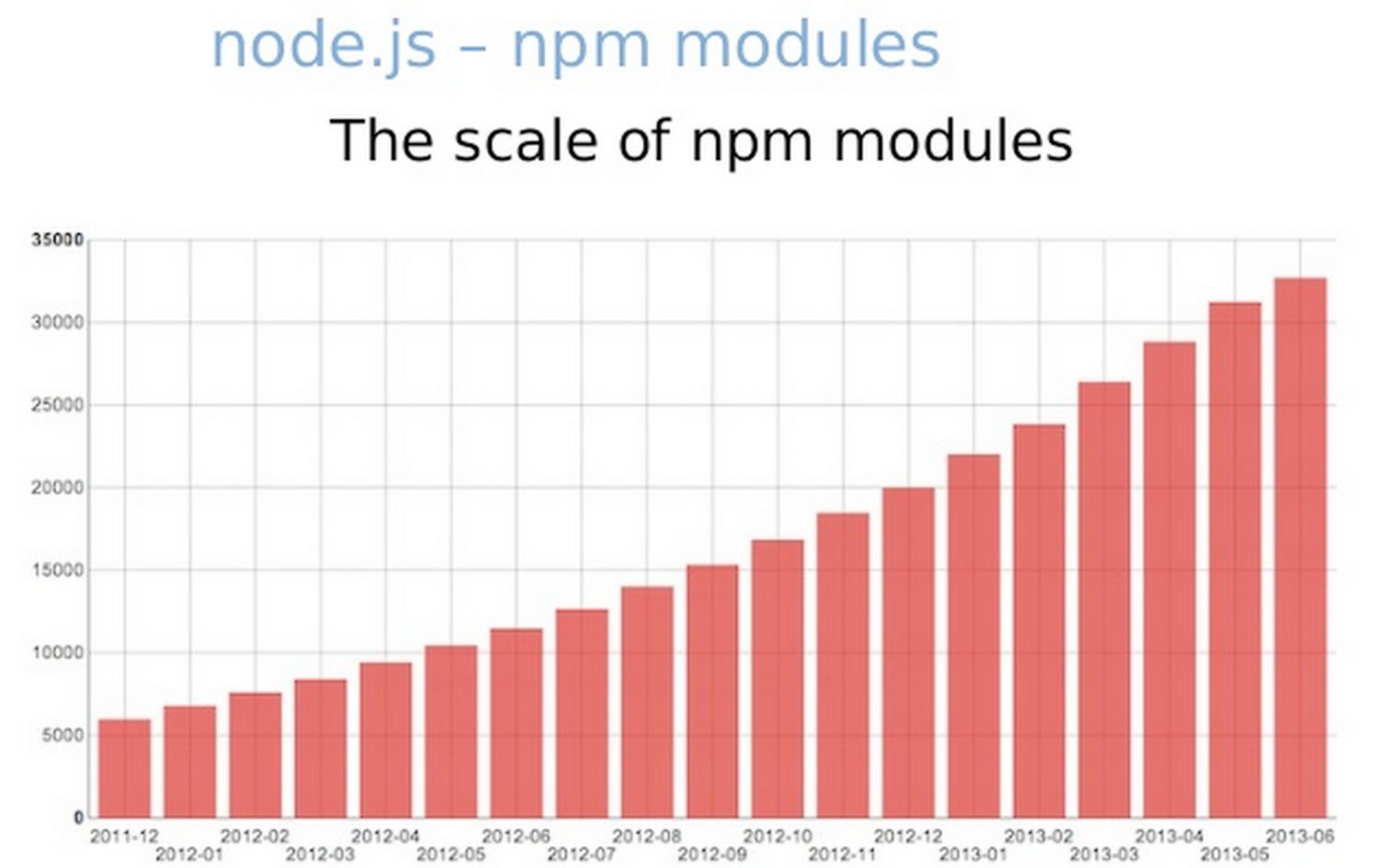
Single thread

Node.js Benefits #4



Node Package Manager

Node.js Benefits #4



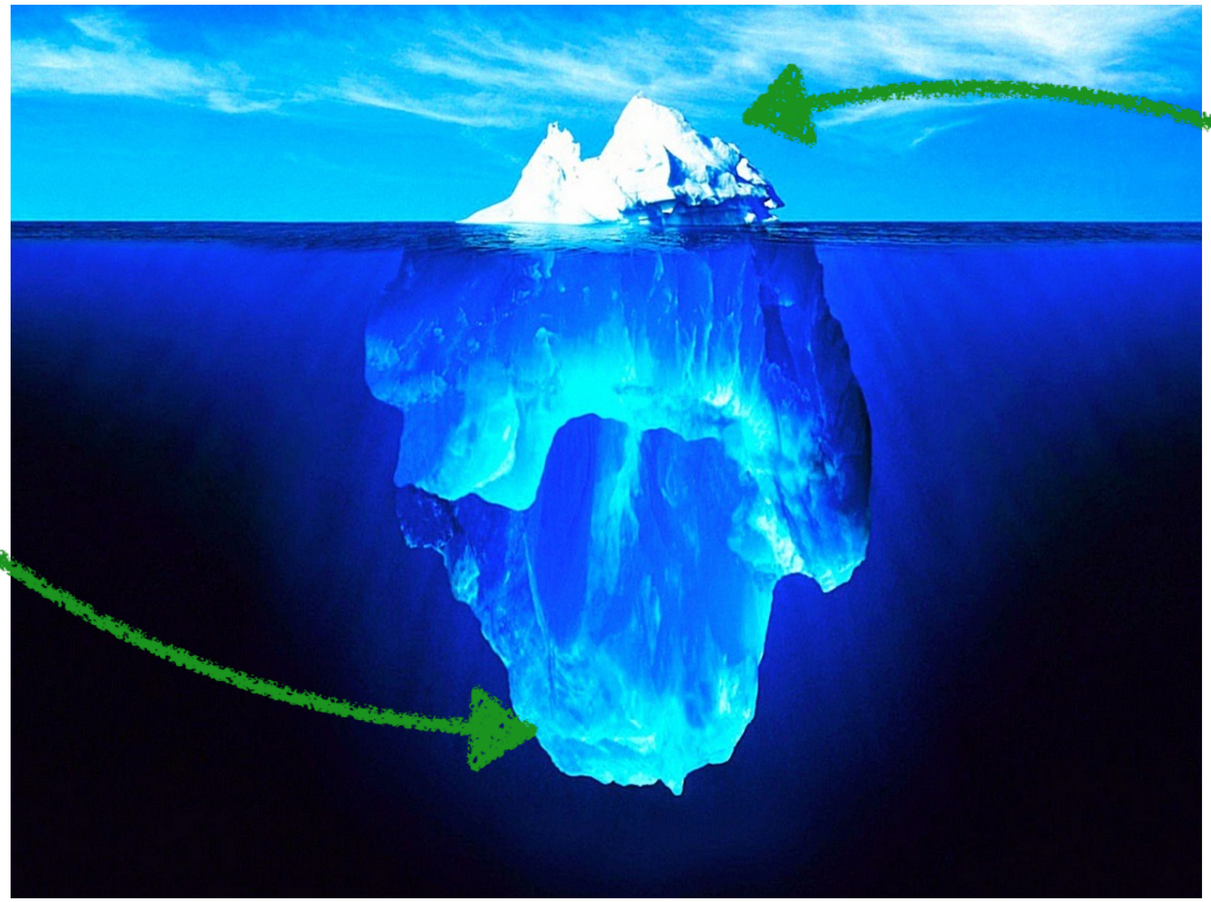
Node.js Drawbacks #1

```
asncFunction1(function(err, result) {
    asncFunction2(function(err, result) {
        asncFunction3(function(err, result) {
            asncFunction4(function(err, result) {
                asncFunction5(function(err, result) {
                    // do something useful
                })
            })
        })
    })
})
```

모든 비동기가 가지는

Callback hell!!

Node.js Drawbacks #2

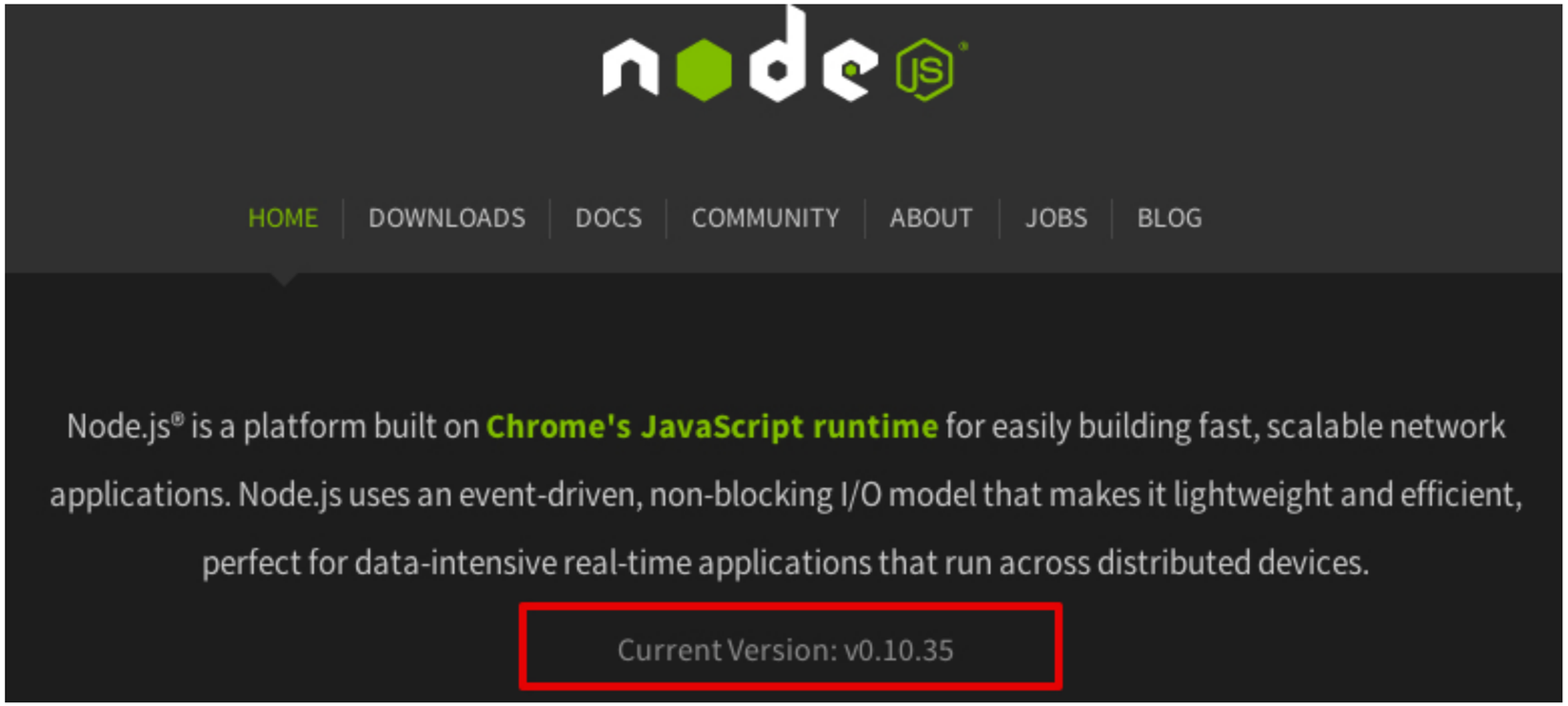


Java??

JS is not Java!!

Javascript..

Node.js Drawbacks #3



v0.10, v0.12, v4.xx

Node.js Applications

Network Program

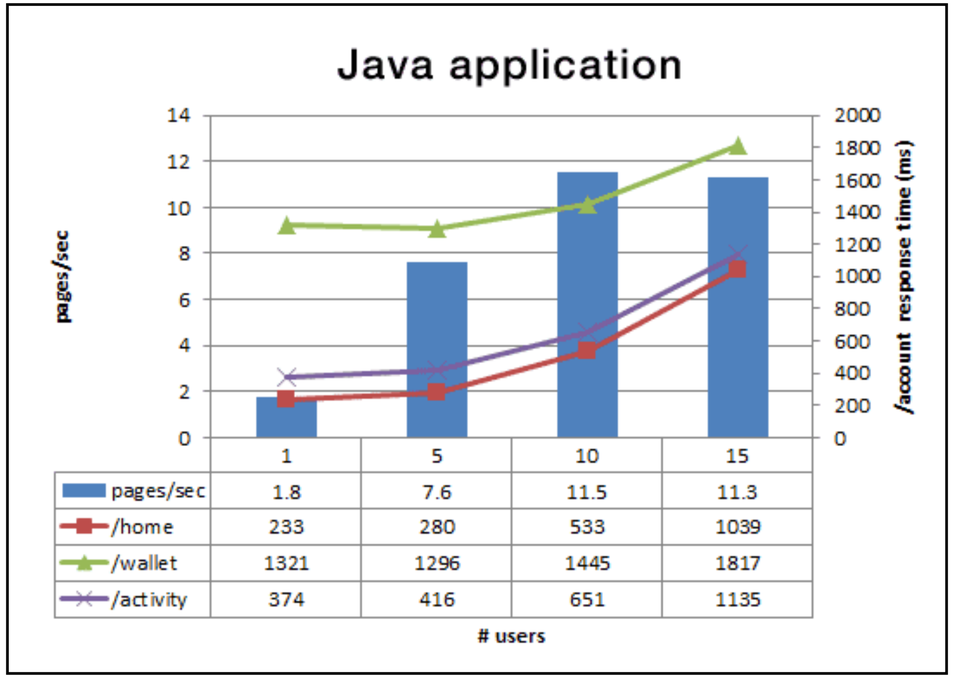
Tools

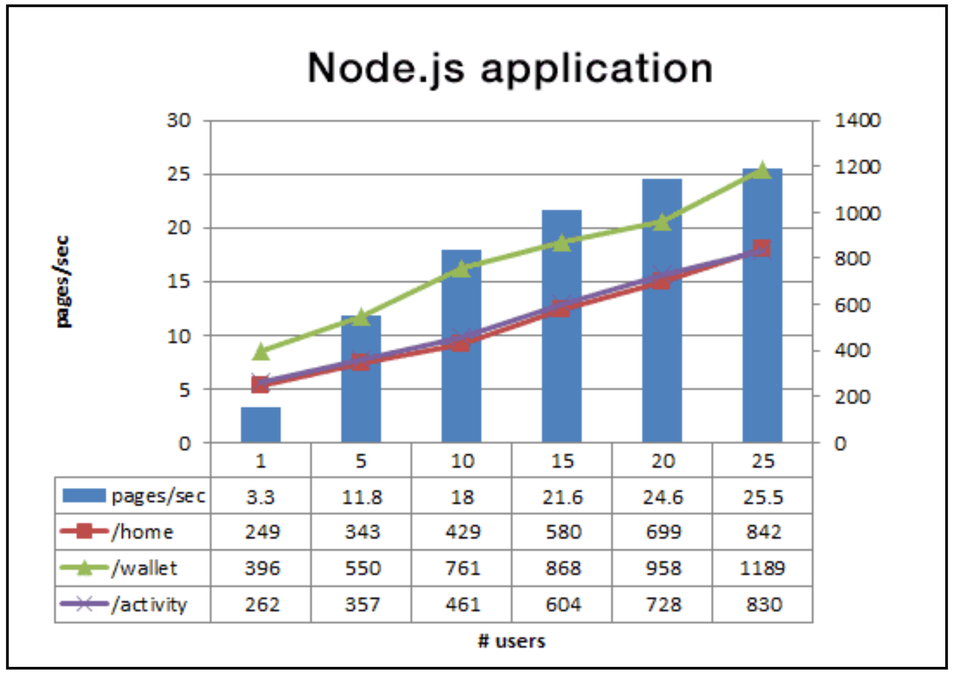
Robot

Desktop Application

Node.js References

Node.js Paypal



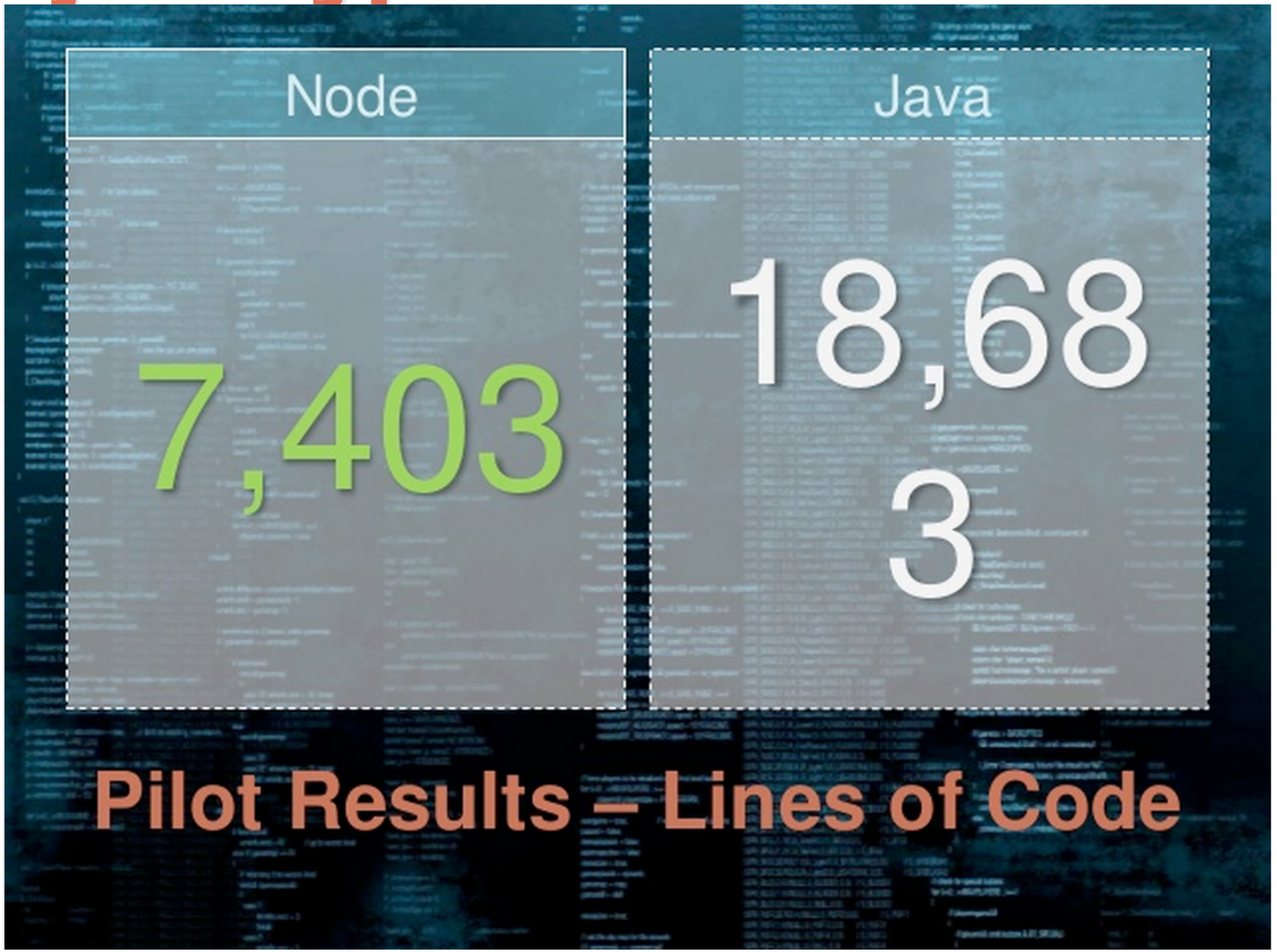


Double the requests per second vs. the Java application. This is even more interesting because our initial performance results were using **a single core for the node.js** application compared to **five cores in Java**. We expect to increase this divide further.

35% decrease in the average response time for the same page. This resulted in the pages being served **200ms faster**— something users will definitely notice.

[출처] https://www.paypal-engineering.com/2013/11/22/node-js-at-paypal/

Node.js Paypal



[출처]http://www.slideshare.net/lennymarkus/node-js-at-paypal

Node.js Paypal

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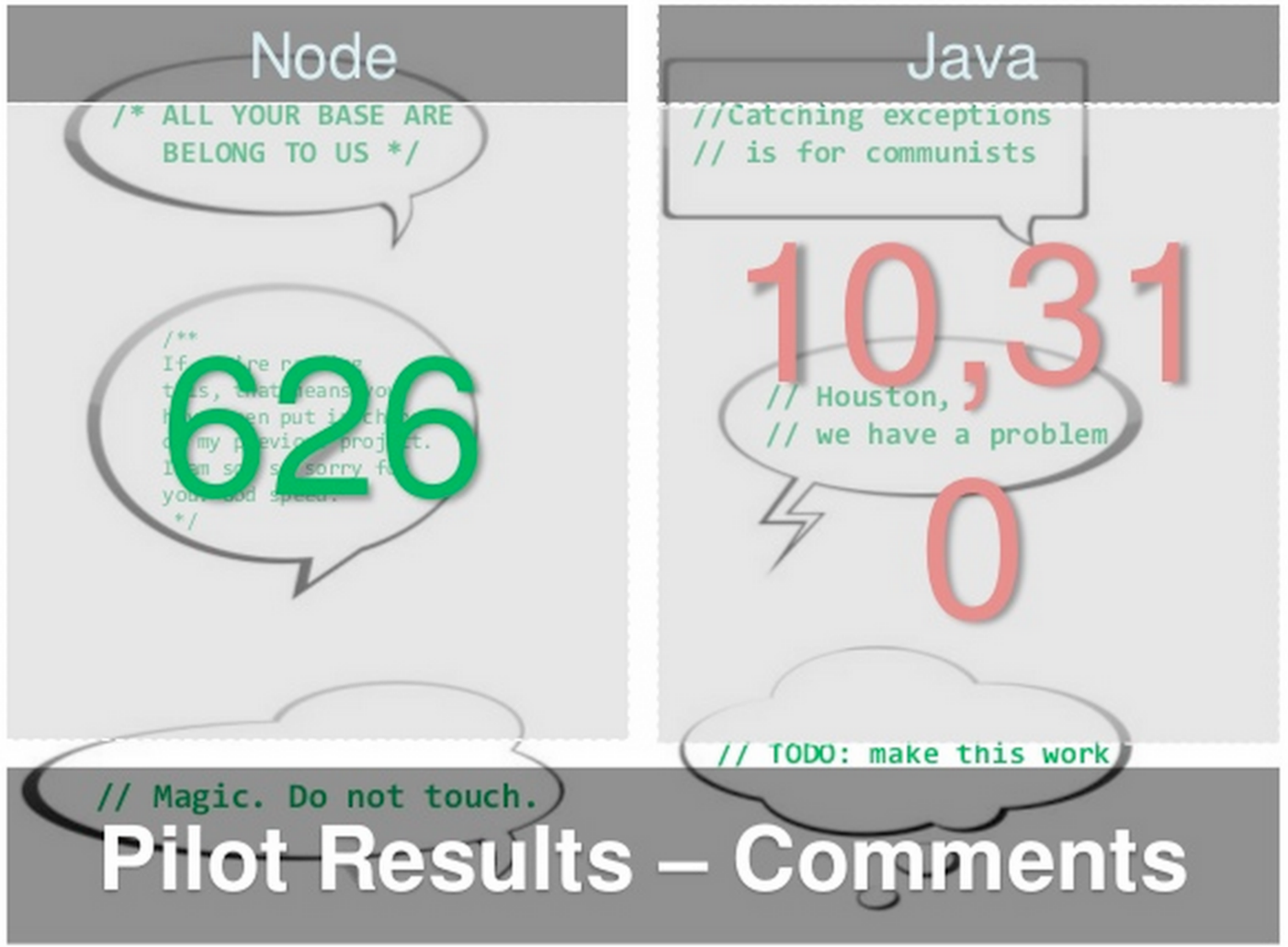
Node.js Paypal



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Node.js Paypal

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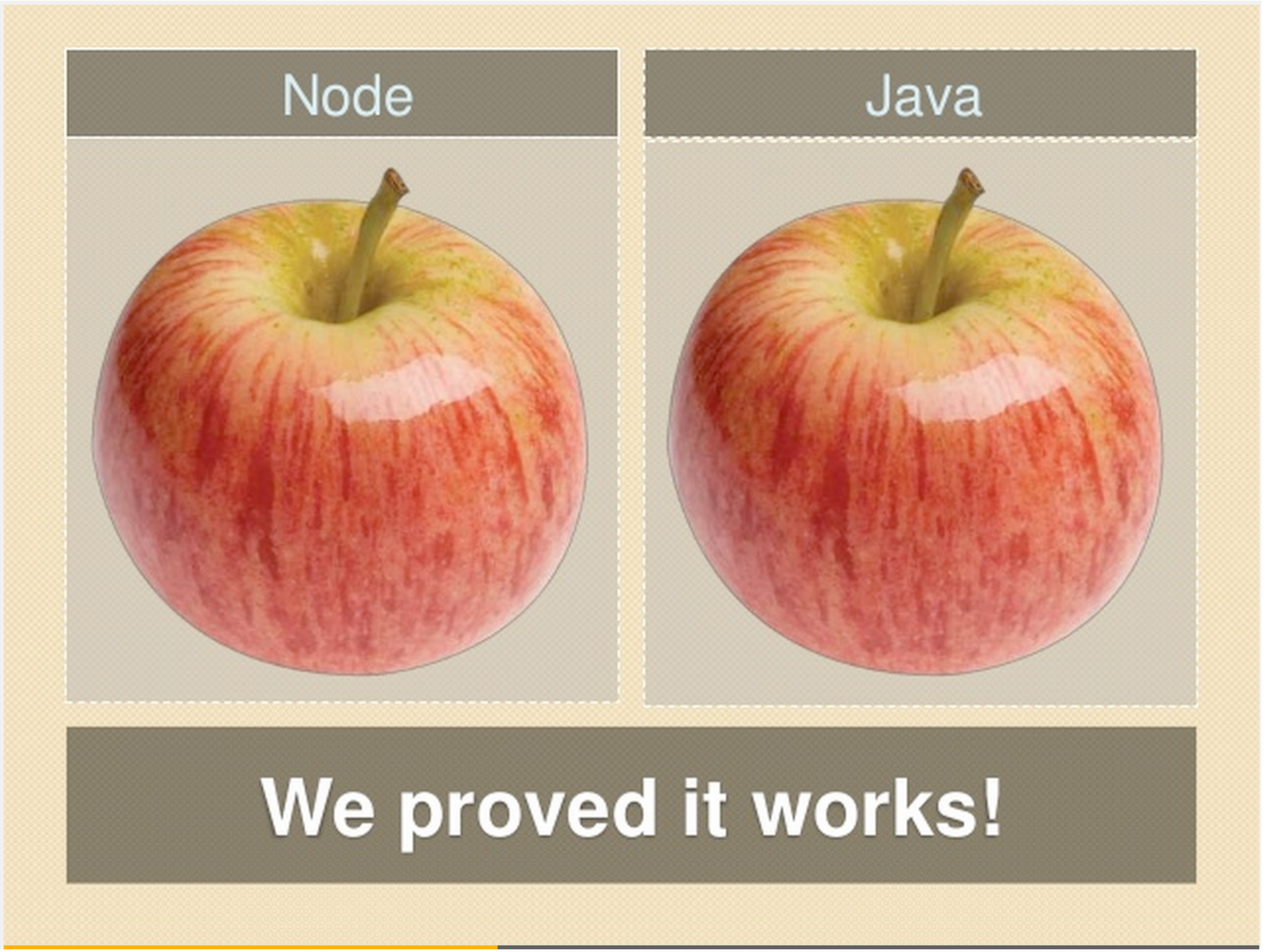
Node.js Paypal



[출처]http://www.slideshare.net/lennymarkus/node-js-at-paypal

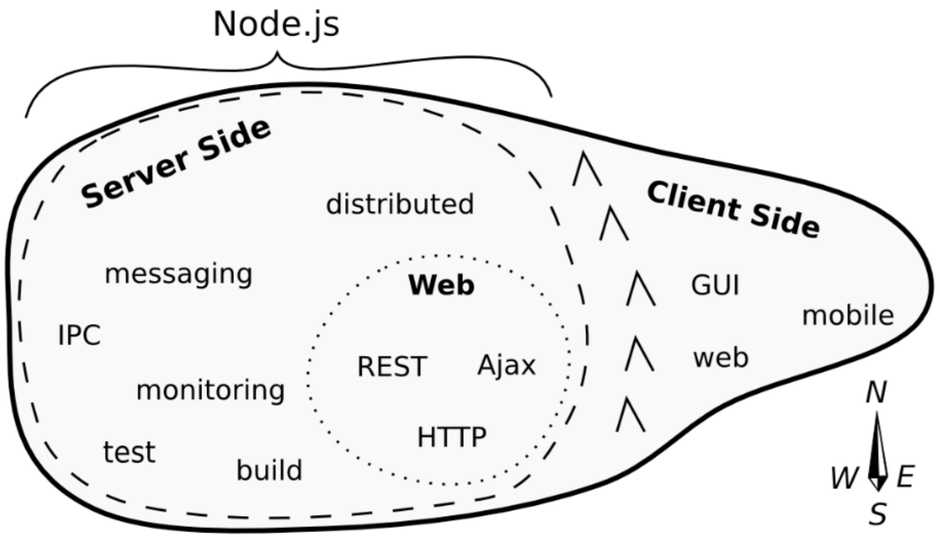
Node.js Good Points

- REST + JSON APIs
- Single-page web app
- Real-time web app
- Rapid Prototyping
- I/O Processing

Node.js Bad Points

- CPU Intensive Job
- Multi-thread app
- Big Data
- Complex Business Logic

#02. Node.js's Phillosophy



- Server side Javascript
- Event driven
- Asynchronous
- Non-Blocking I/O
- Single Threaded
- Lightweight
- Fast

Event driven

Asynchronous

(sync_db.js)

```
var db = new Database({host: ‘localhost'});
var conn = db.connect();
var results = conn.find({name: 'pcw'});
console.log(results);
```

(async_db.js)

```
var db = new Database({host: ‘localhost'});
db.connect(function(err, conn) {
    conn.find({name : 'pcw'}, function(err, results) {
        console.log(results);
    });
});
```

Asynchronous

(sync_db.js)

```
var db = new Database({host: ‘localhost'});
var conn = db.connect();
var results = conn.find({name: 'pcw'});
console.log(results);
```

(async_db.js)

```
var db = new Database({host: ‘localhost'});
db.connect(function(err, conn) {
    conn.find({name : 'pcw'}, function(err, results) {
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    });
});
```
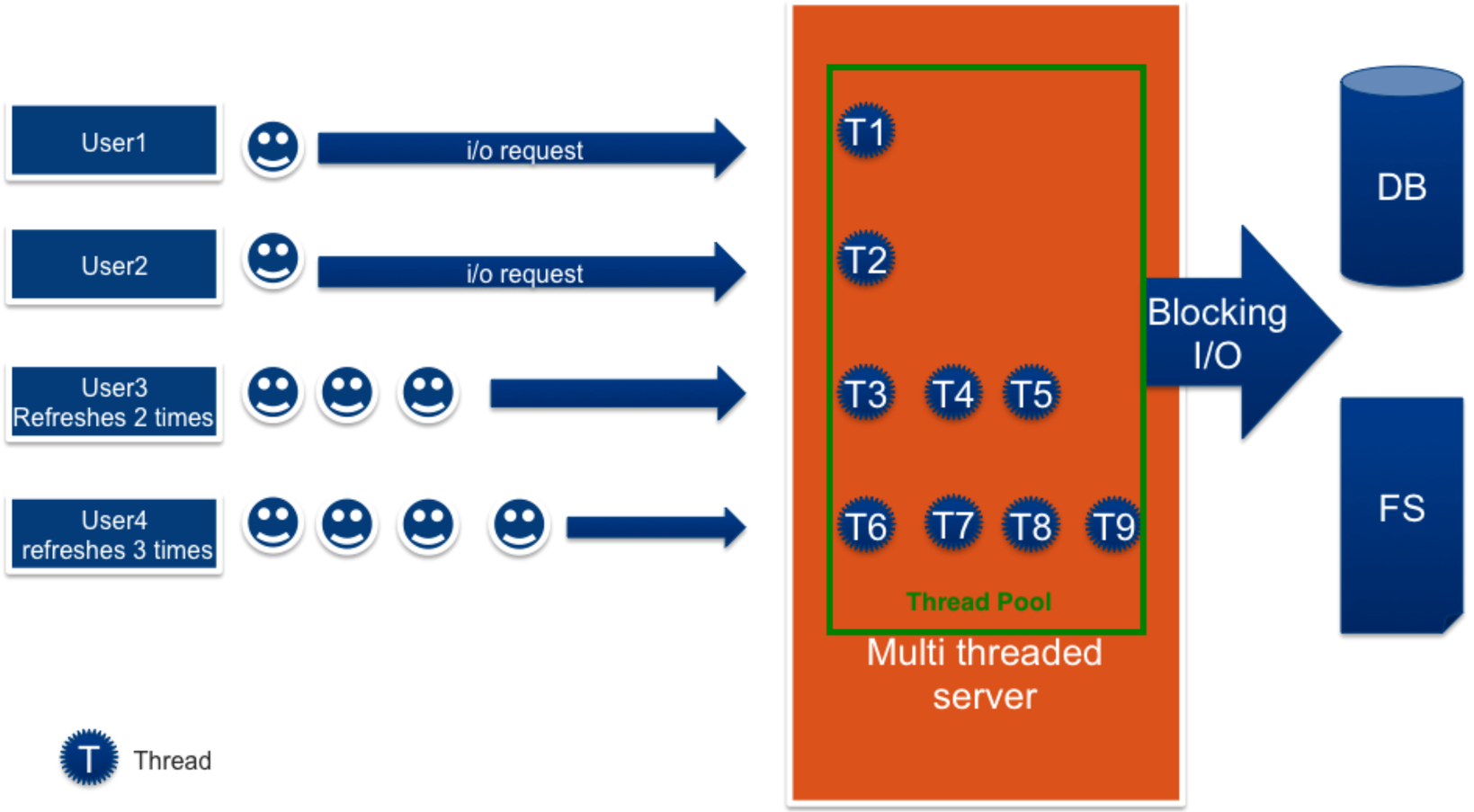
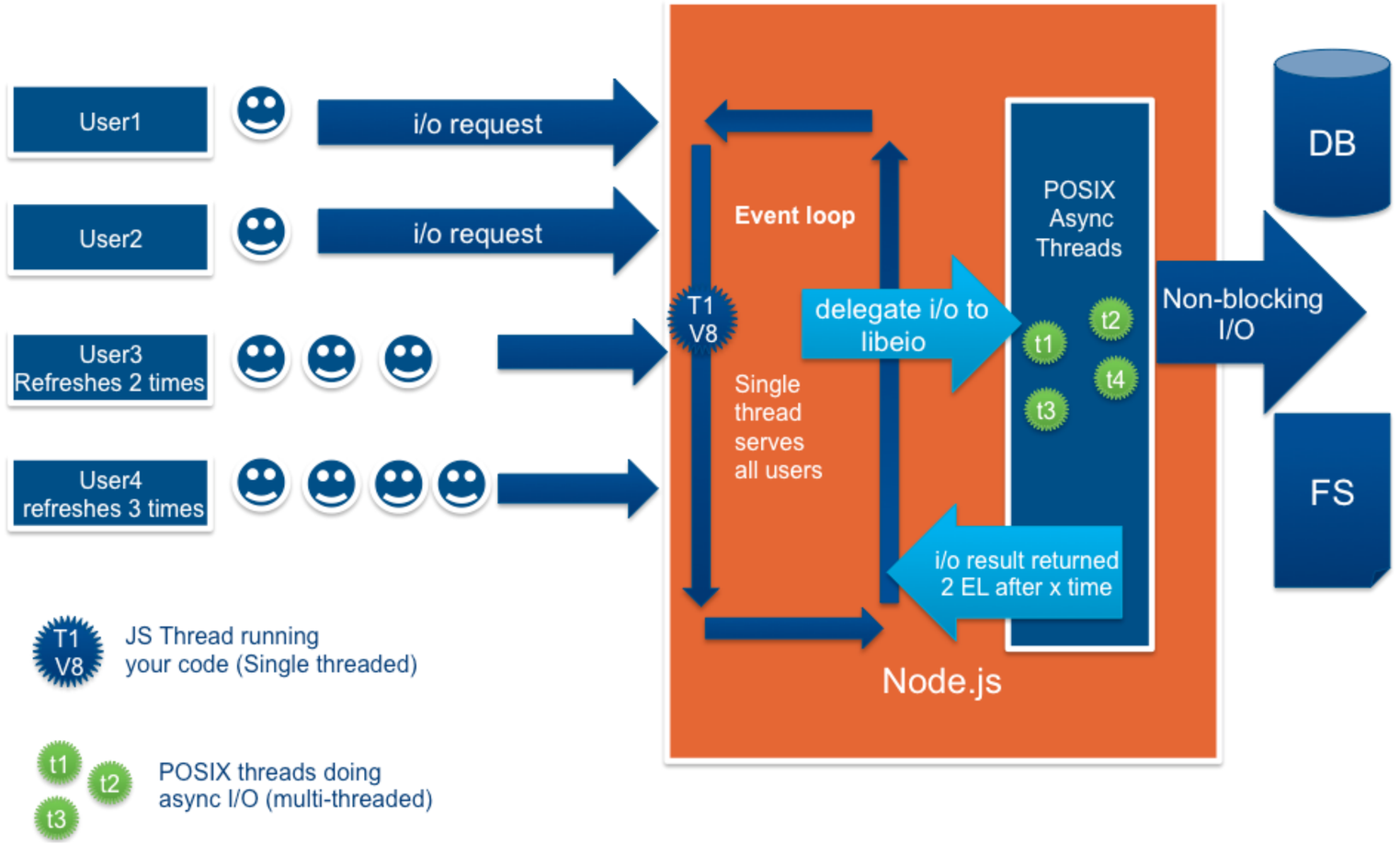

Blocking IO + Multi-Threaded Server



Blocking I/O + direct interface to clients leads to thread-pools w/ larger number threads and more memory requirements

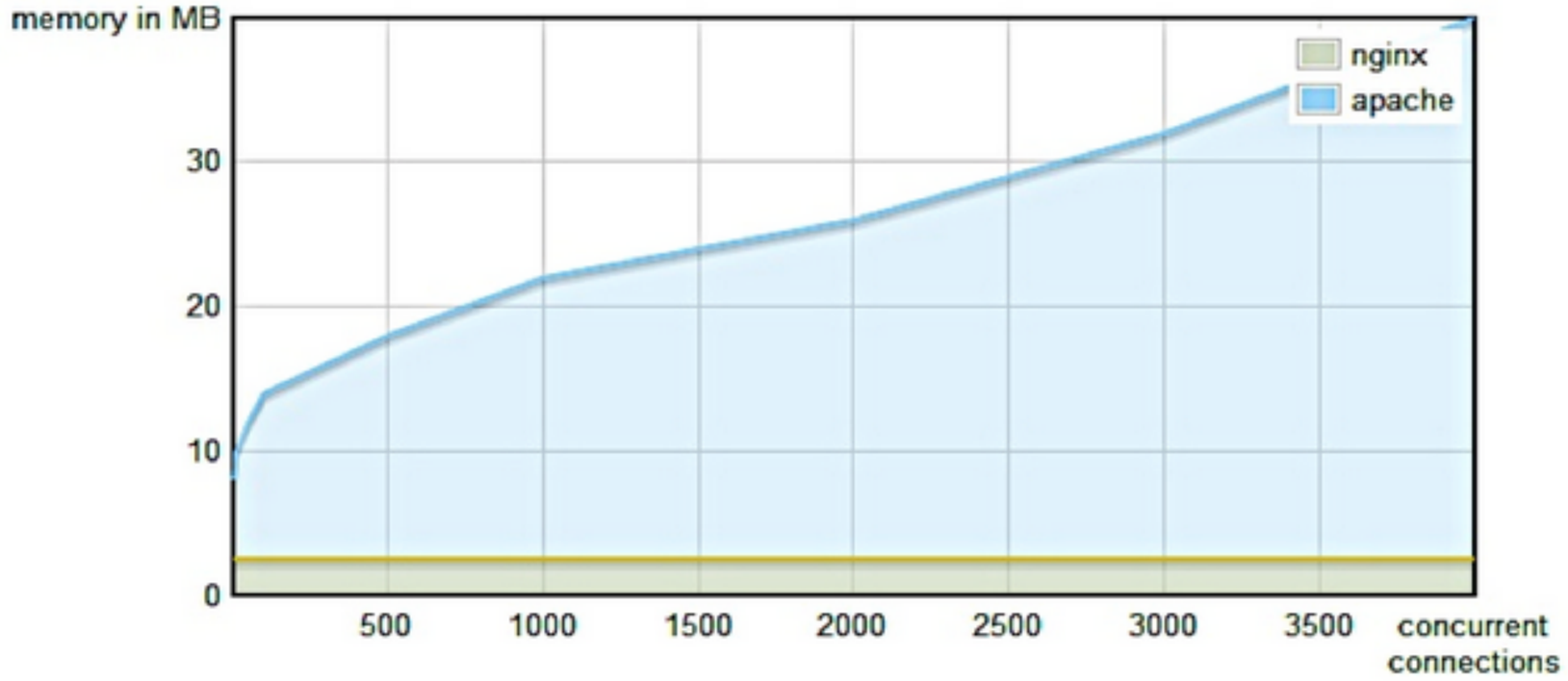
[출처] : http://blog.pivotal.io/cloud-foundry-pivotal/products/future-proofing-your-apps-cloud-foundry-and-node-js

Async-IO + Event based Server



[출처] : http://blog.pivotal.io/cloud-foundry-pivotal/products/future-proofing-your-apps-cloud-foundry-and-node-js

Memory Usage : Nginx vs Apache

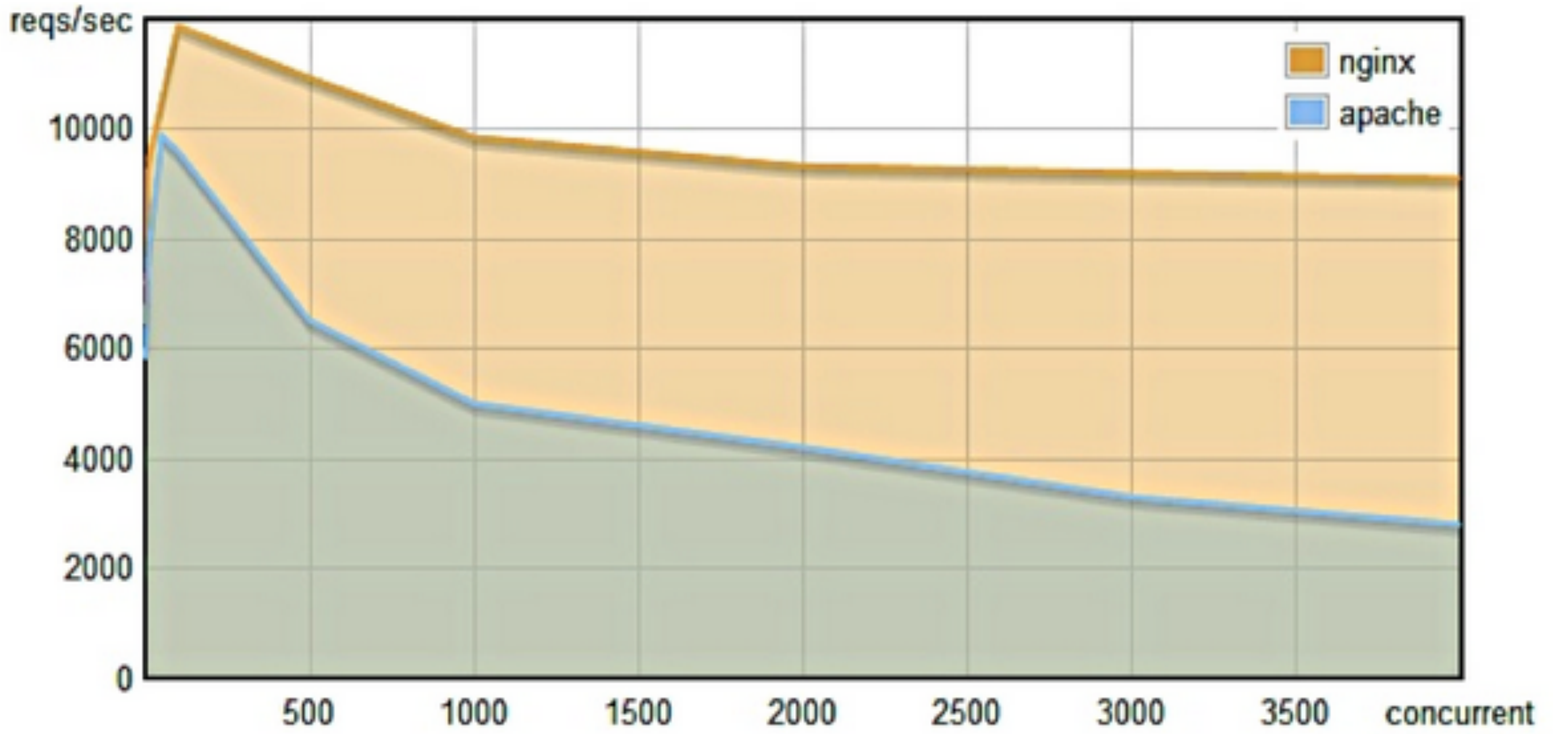


Memory v/s concurrent connections

At ~4000 concurrent connections,
- Nginx uses 3MB memory
- Apache uses 40MB memory

Ref: http://blog.webfaction.com/a-little-holiday-present

Performance : Nginx vs Apache



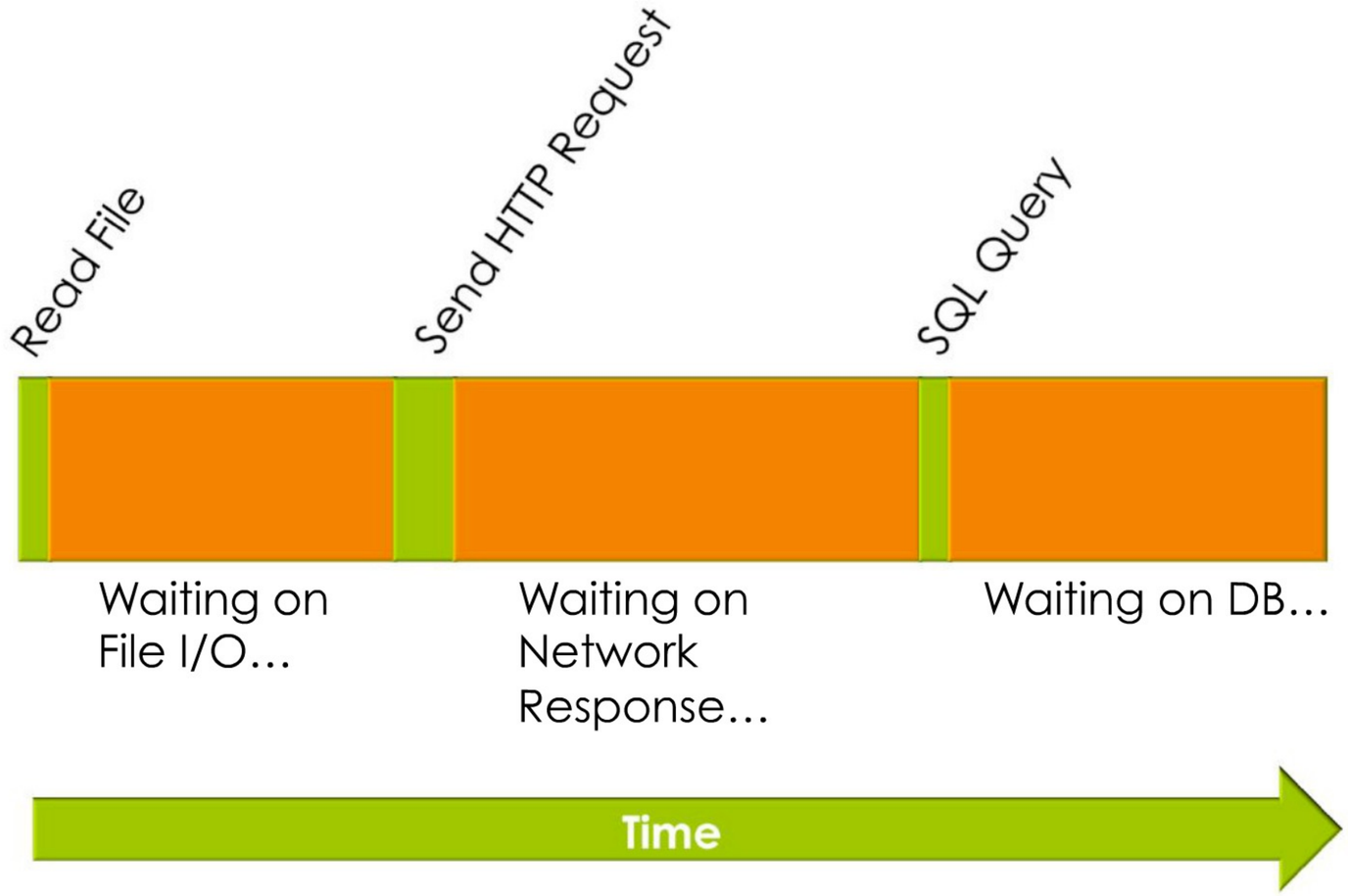
Reqs/sec v/s concurrent connections

At ~4000 concurrent connections,
- Nginx can serve ~9000 reqs/sec
- Apache can serve ~3000 reqs/sec

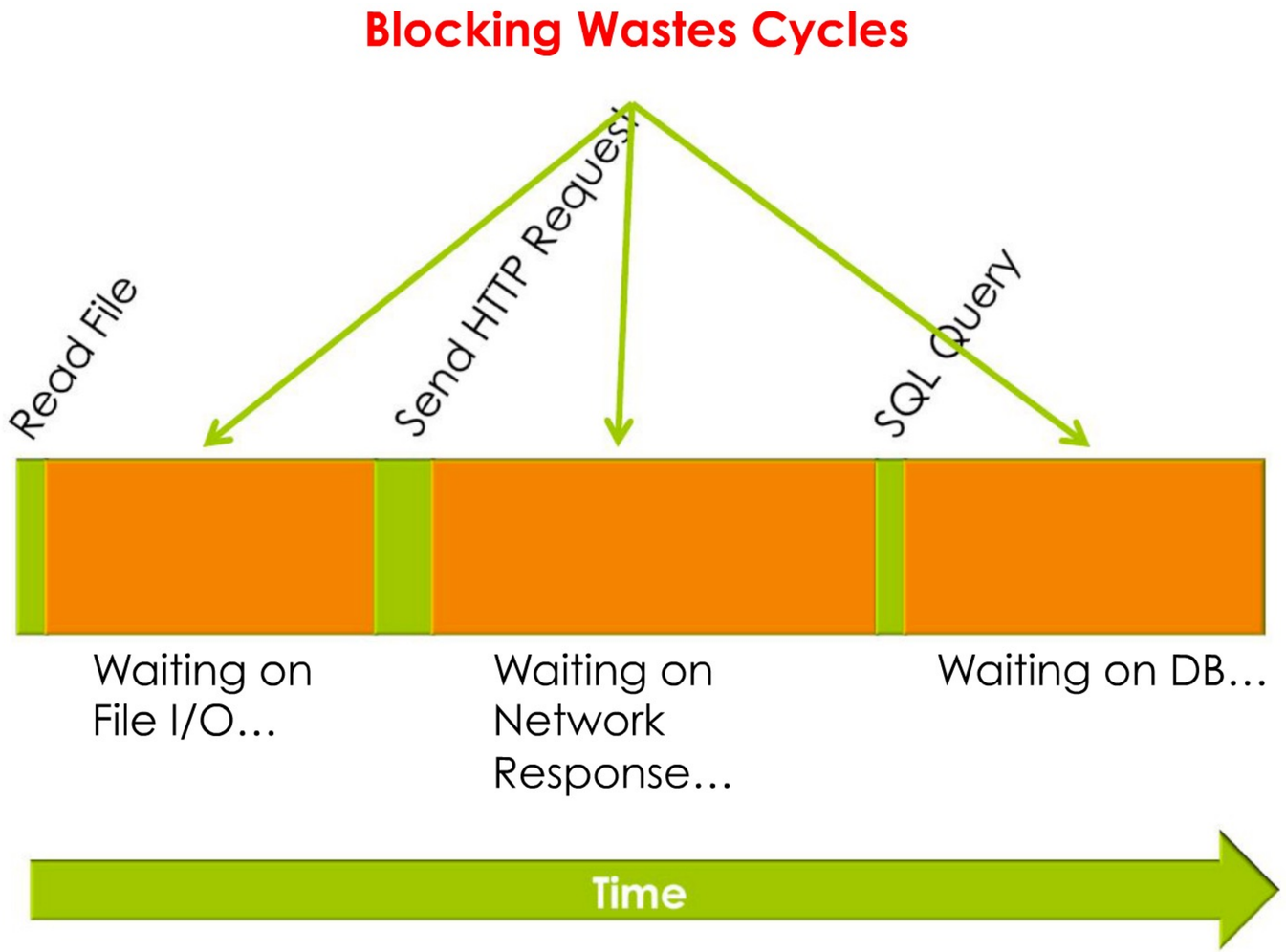
Ref: http://blog.webfaction.com/a-little-holiday-present

#04. Traditional Thread vs Eventloop

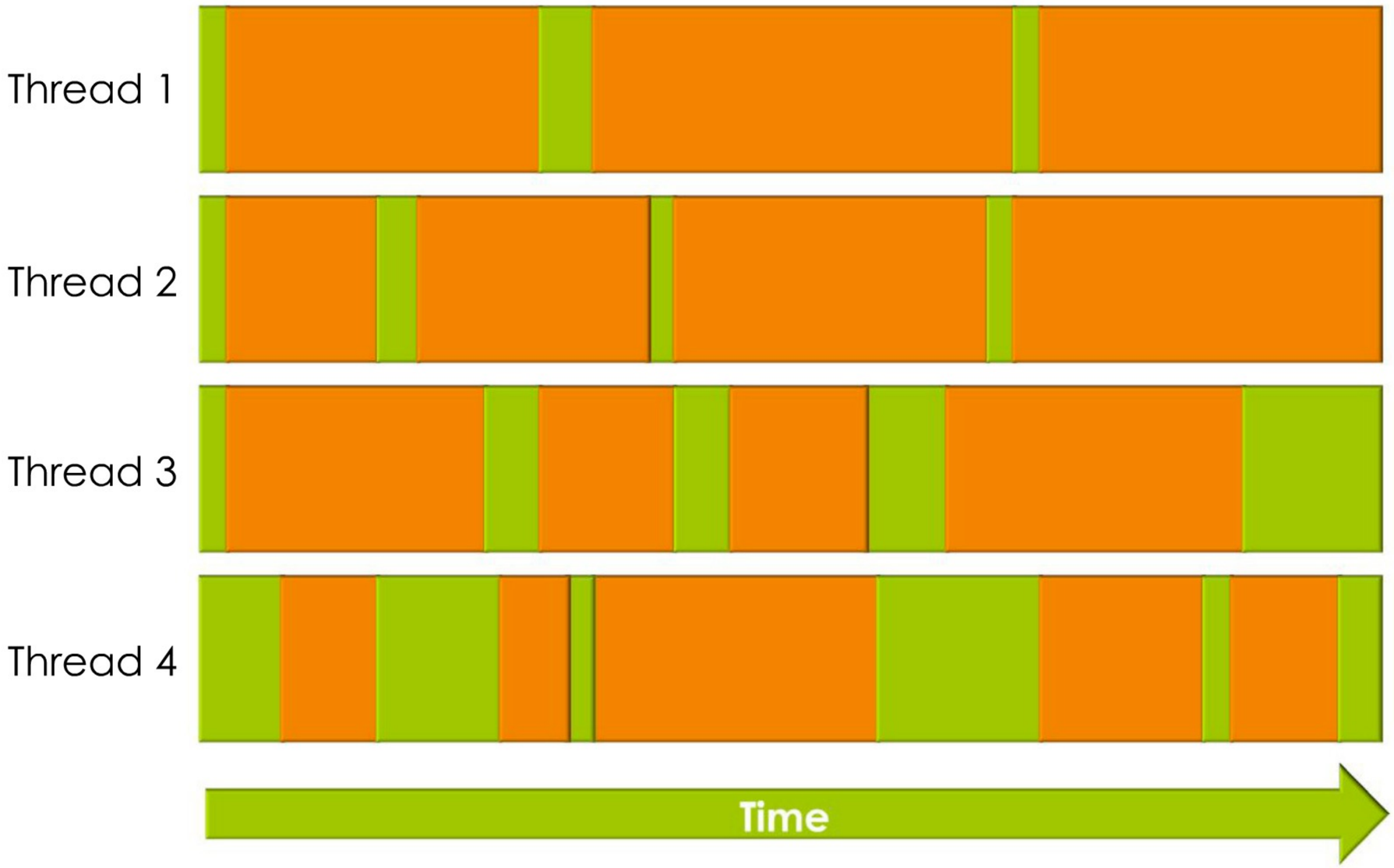
One Worker's Lifecycle



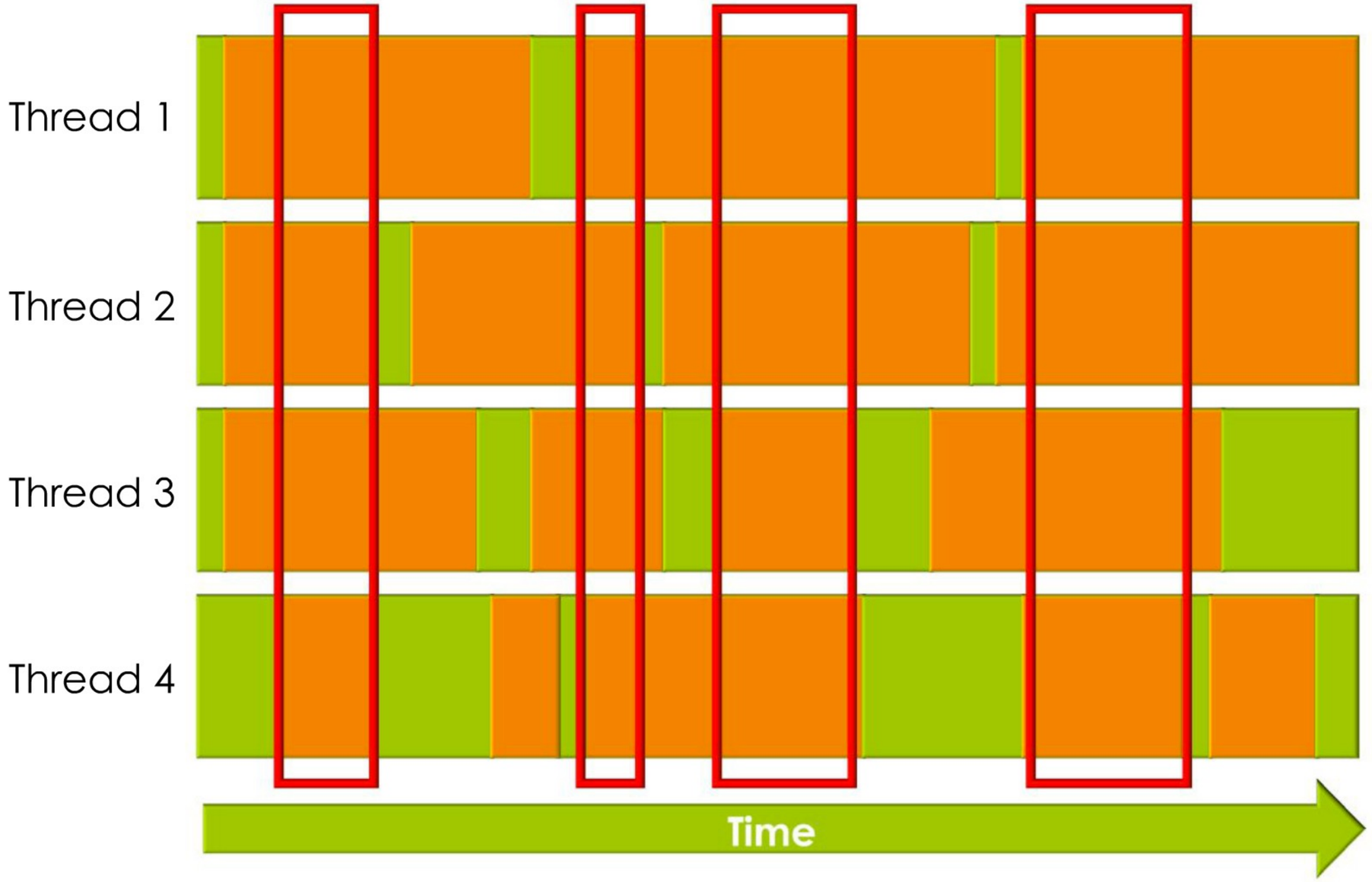
One Worker's Lifecycle



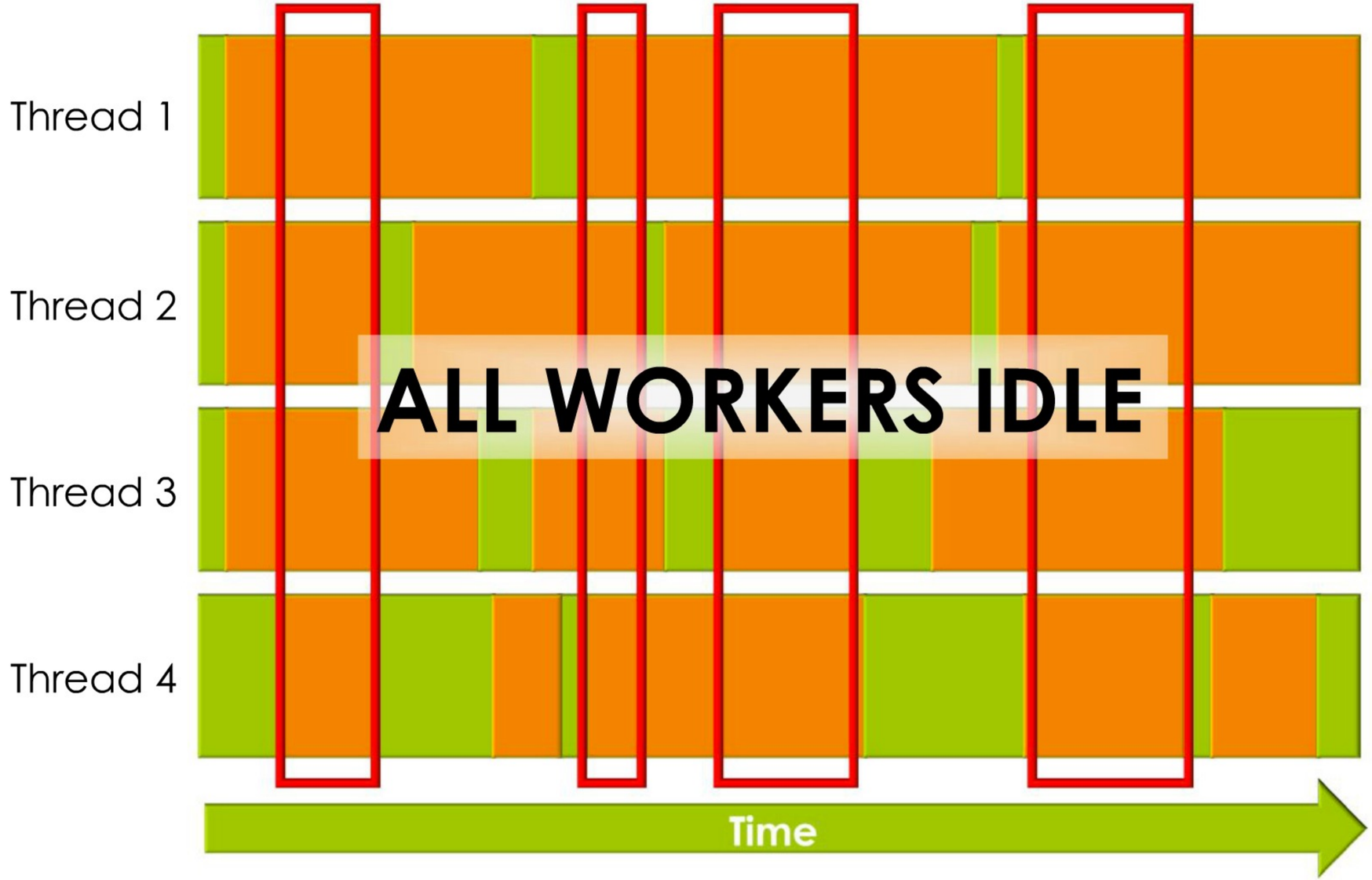
Multiple Workers..



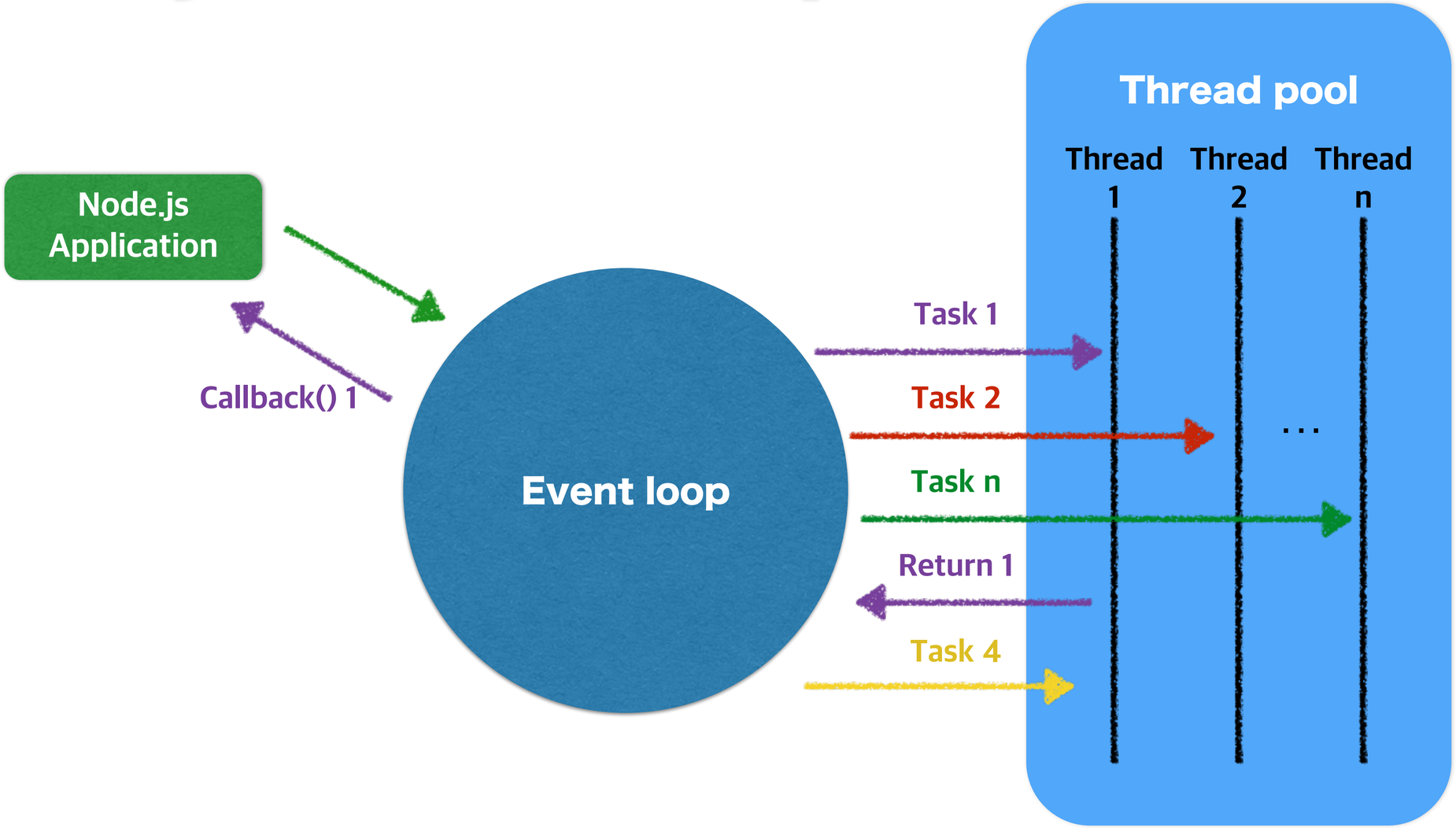
Multiple Workers..



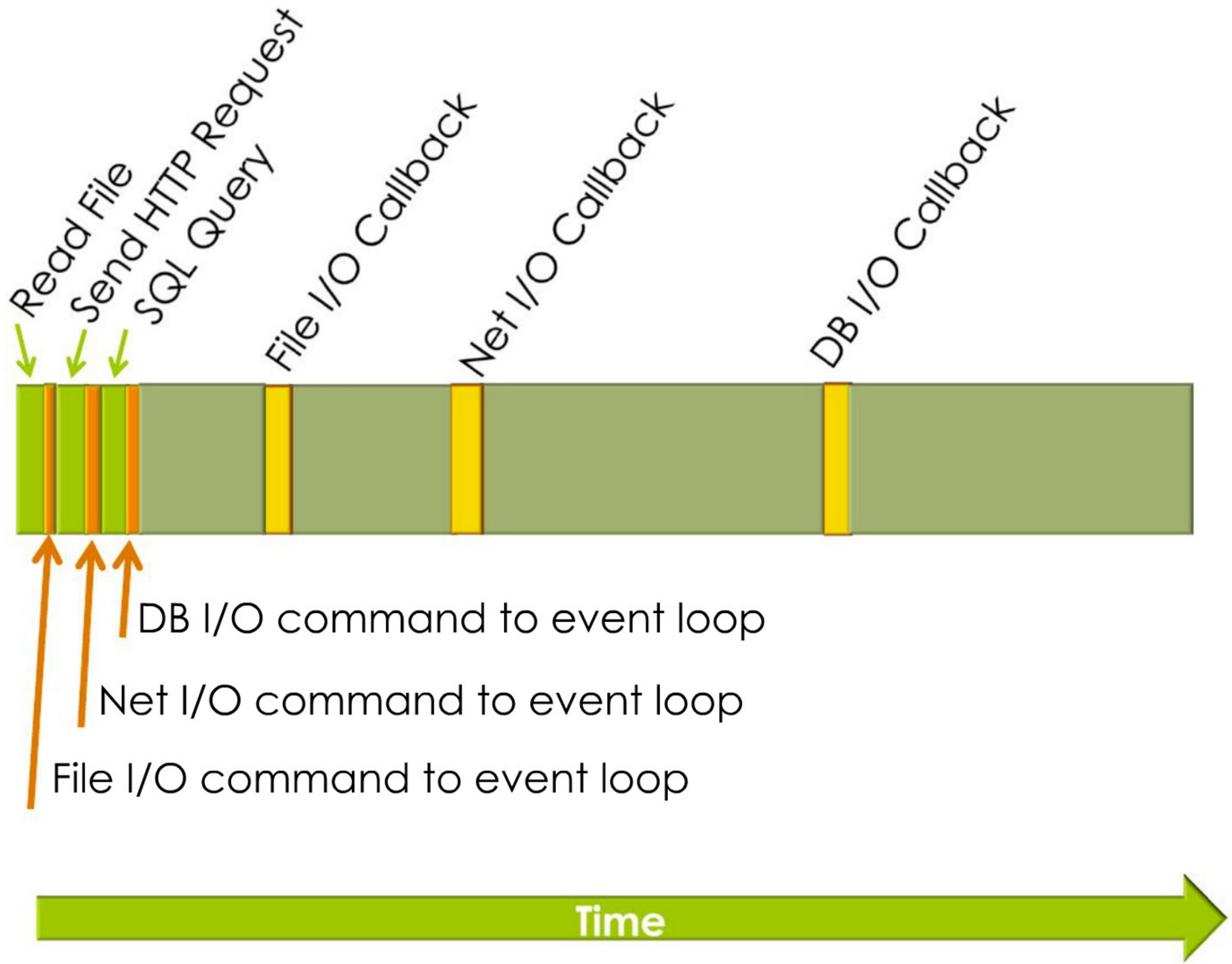
Multiple Workers..



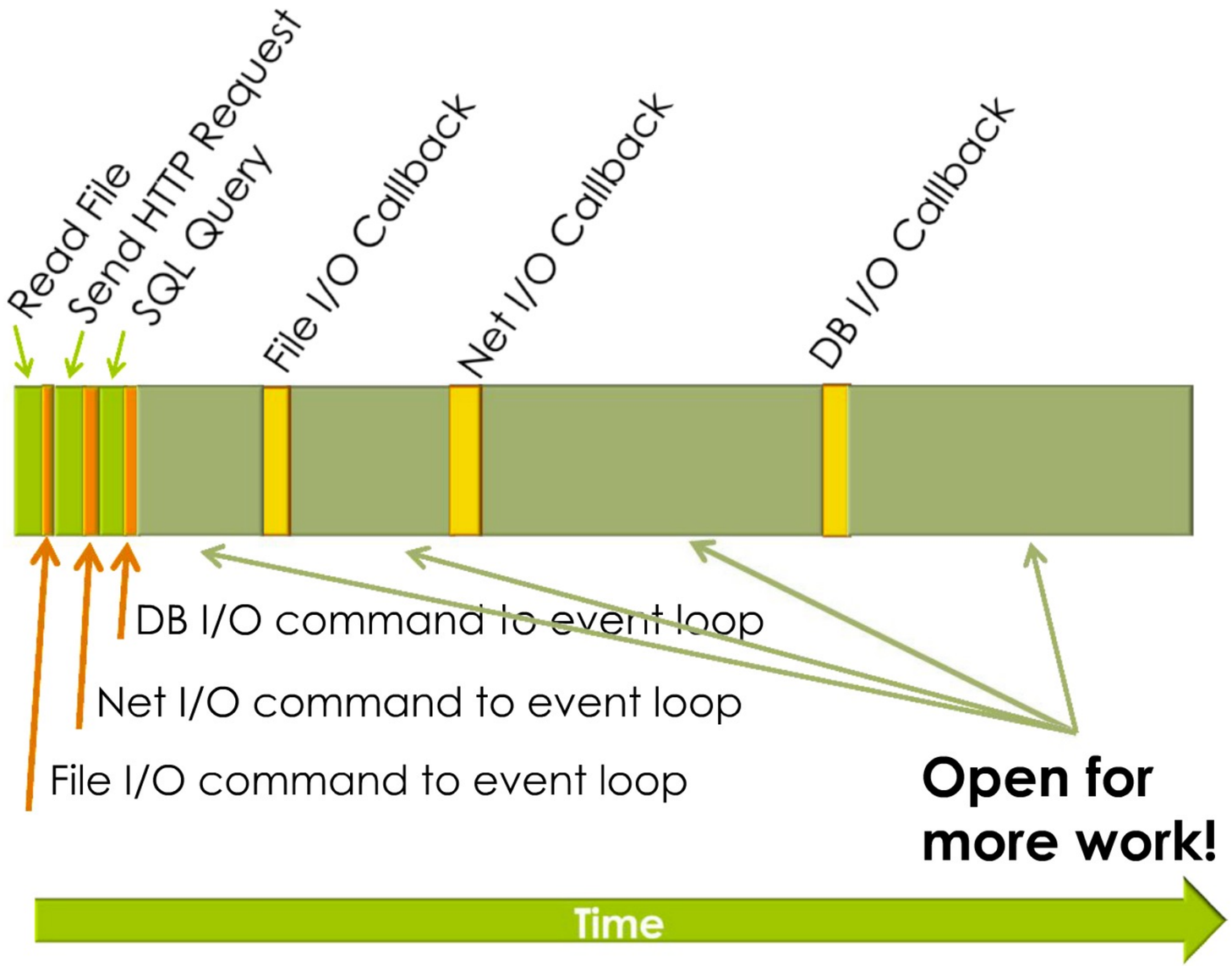
Node.js Event Loop



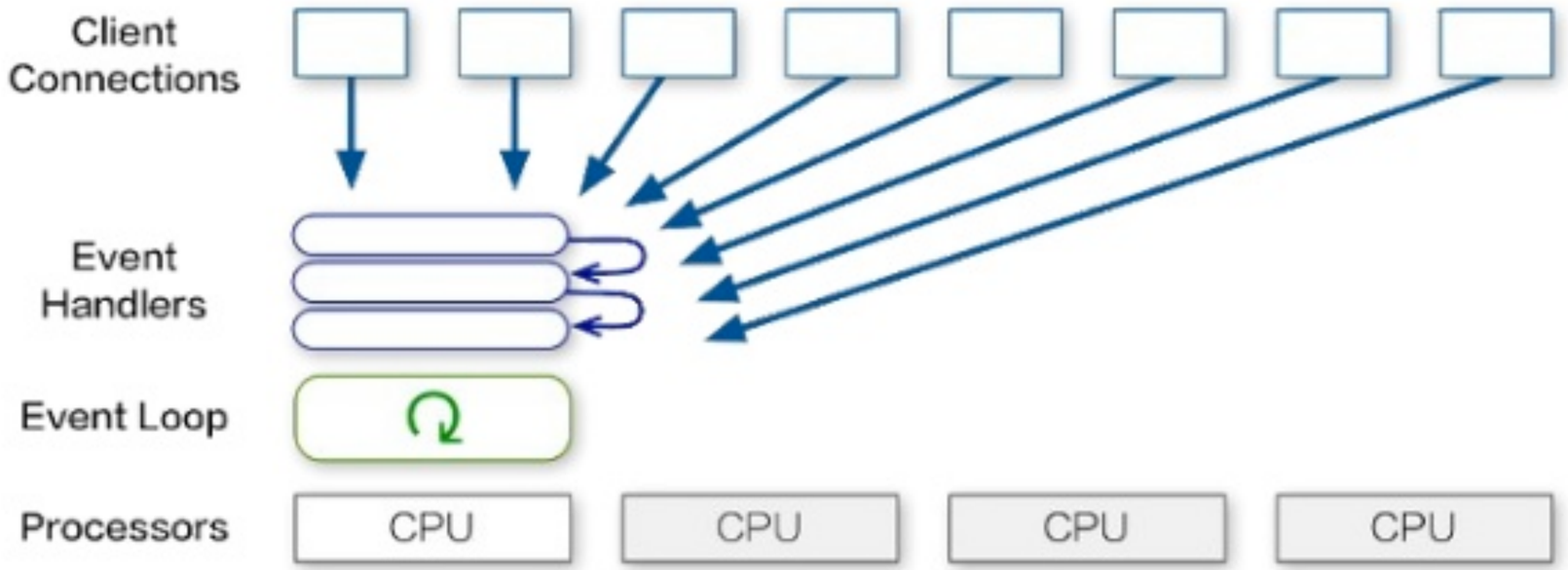
Node.js Event Loop



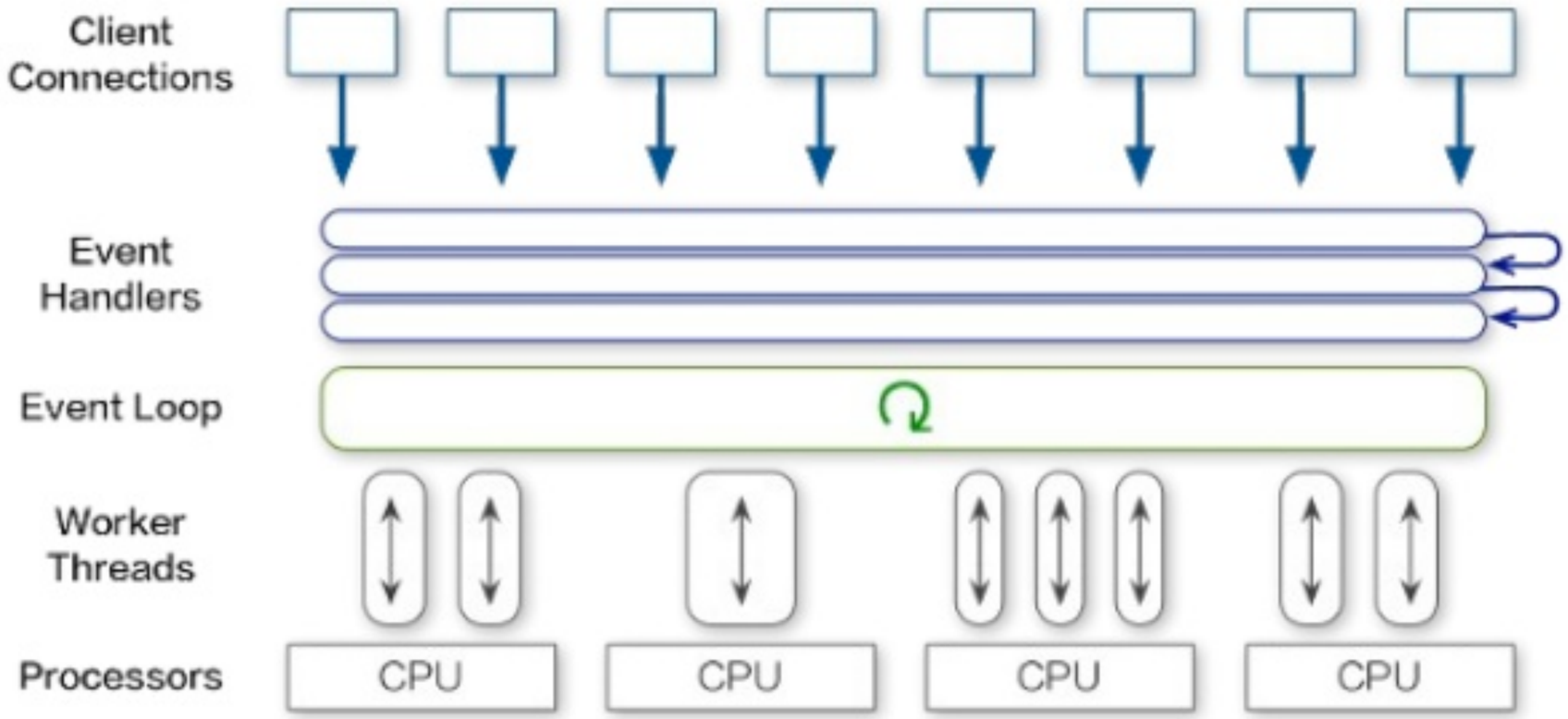
Node.js Event Loop do More Work!!



Single Thread??

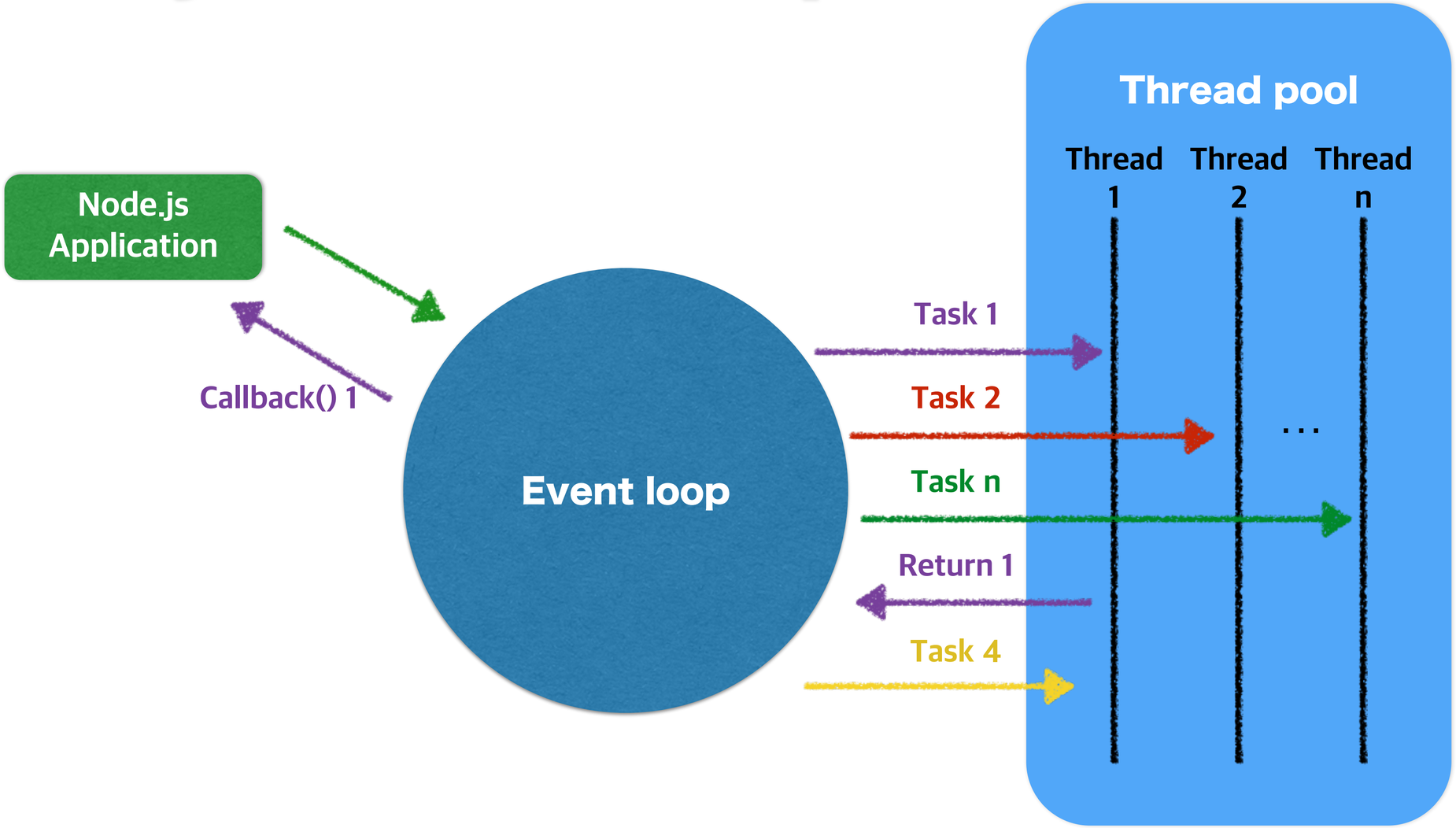


Multi-Thread without locking.

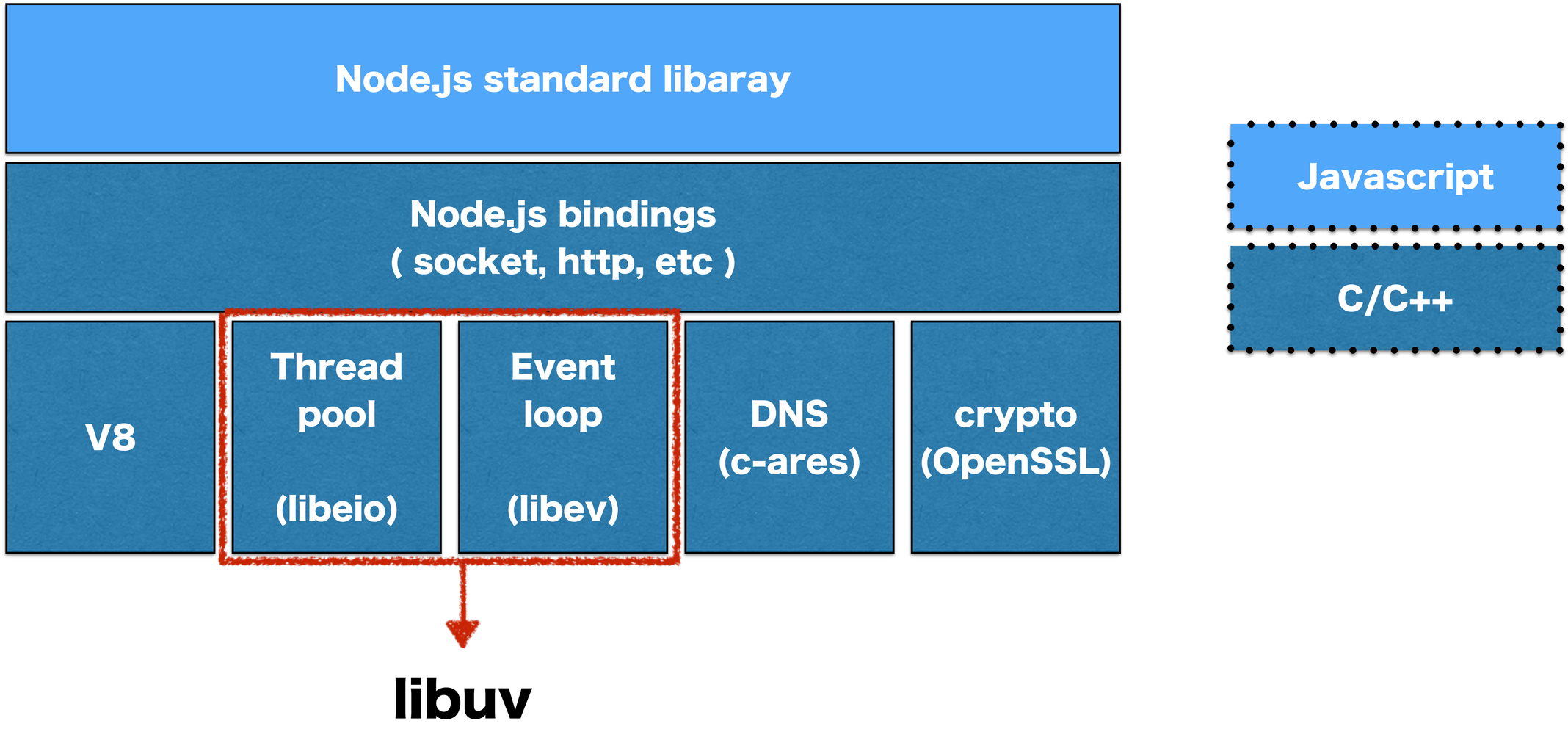


#05. Node.JS Architecture

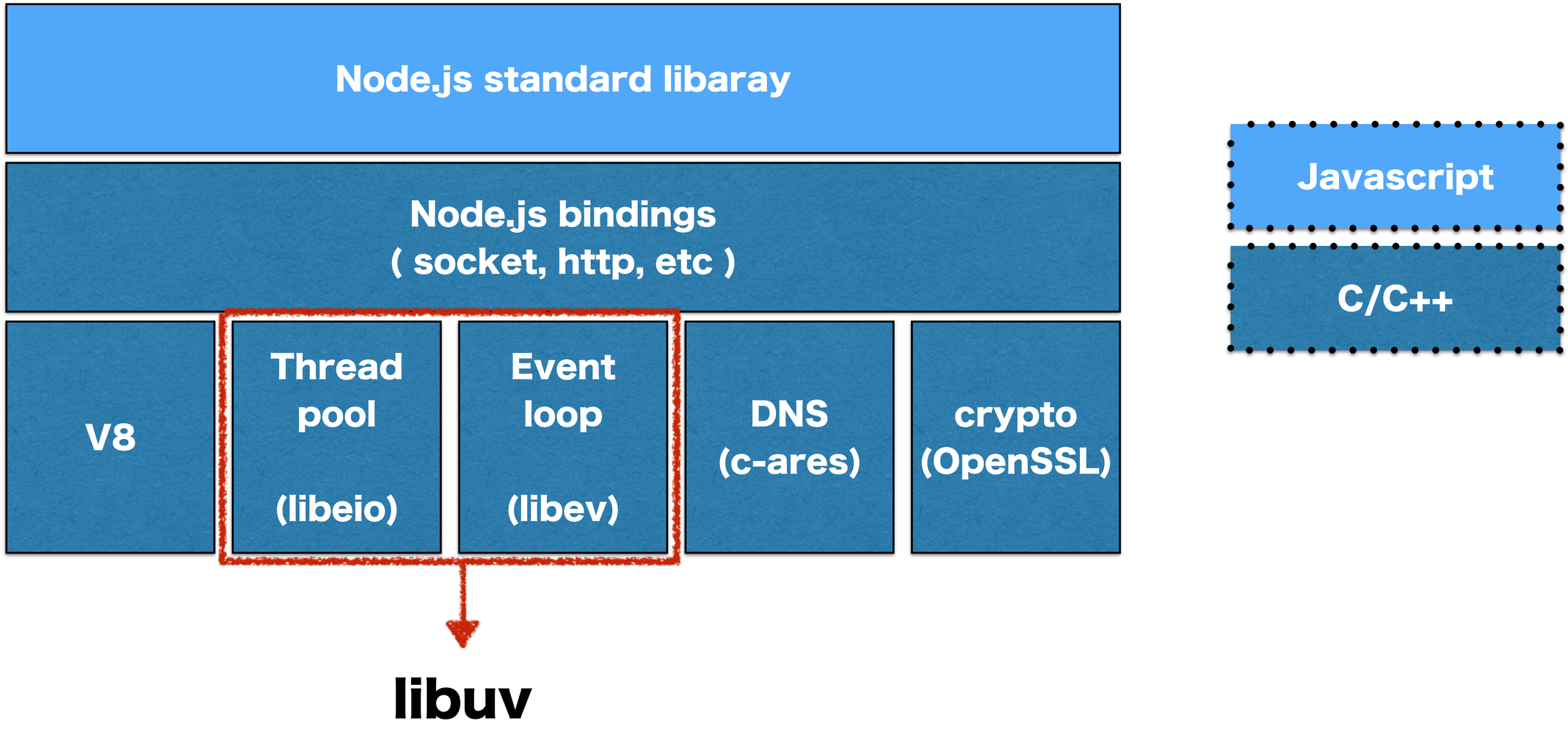
Node.js Event Loop



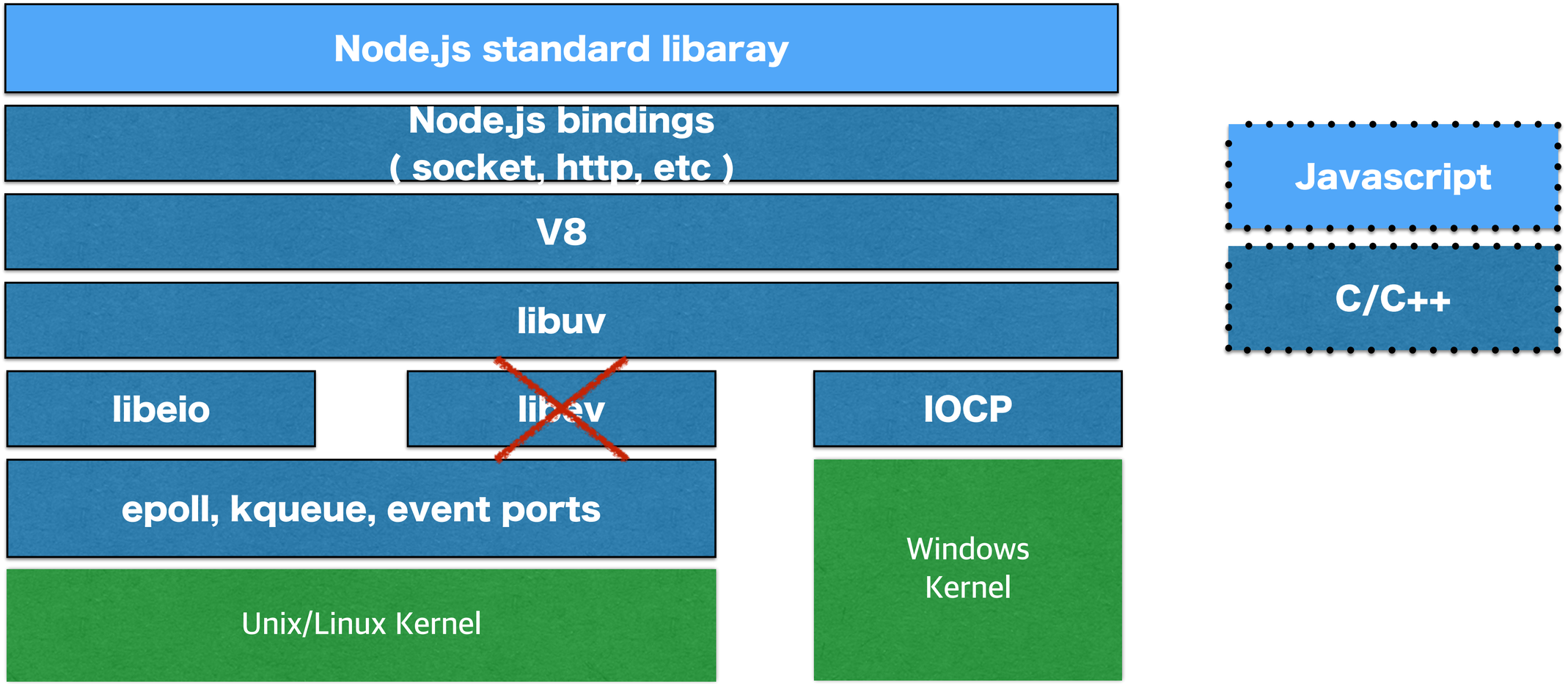
Node.js - Architecture



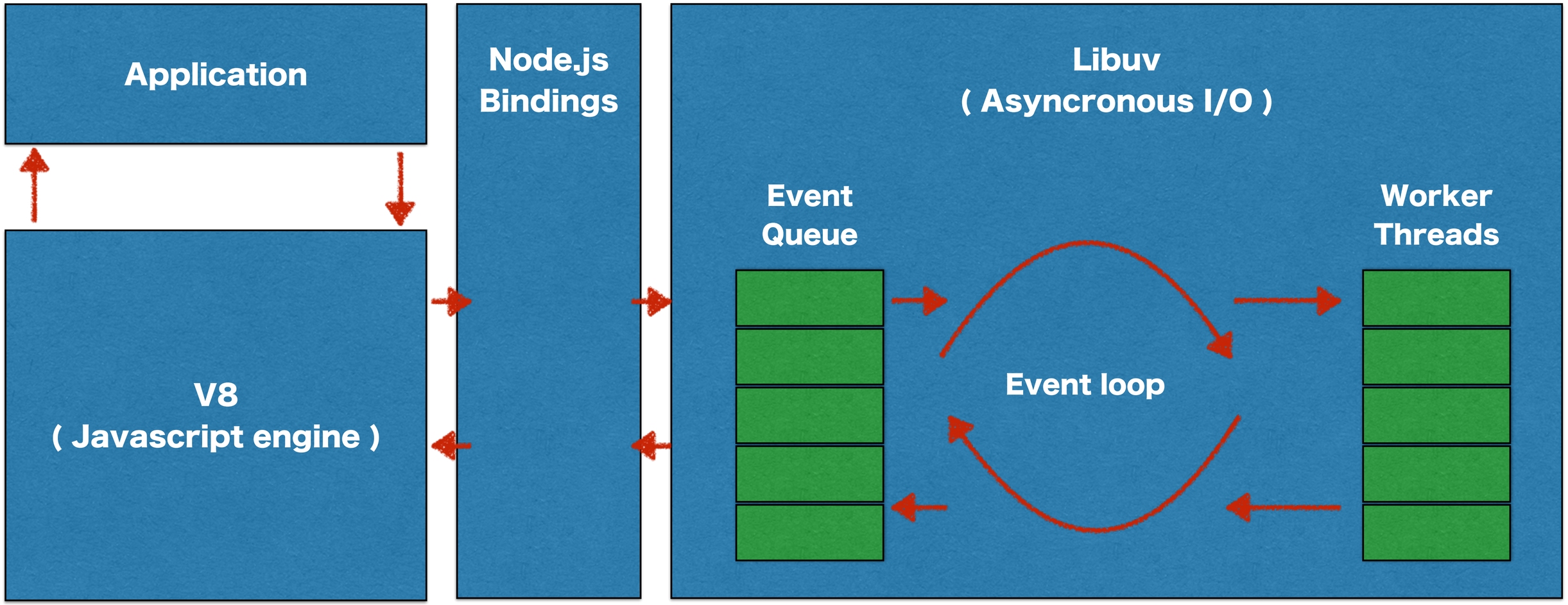
Node.js - Architecture



Node.js - Architecture



Node.js System



Node.js Event Loop

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

fs.readFile('./data.txt', function(err, data) {
    if( err ) { throw err; }

    console.log(data);
});
```

Node.js Event Loop

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fs.readFile('./data.txt', function(err, data) {
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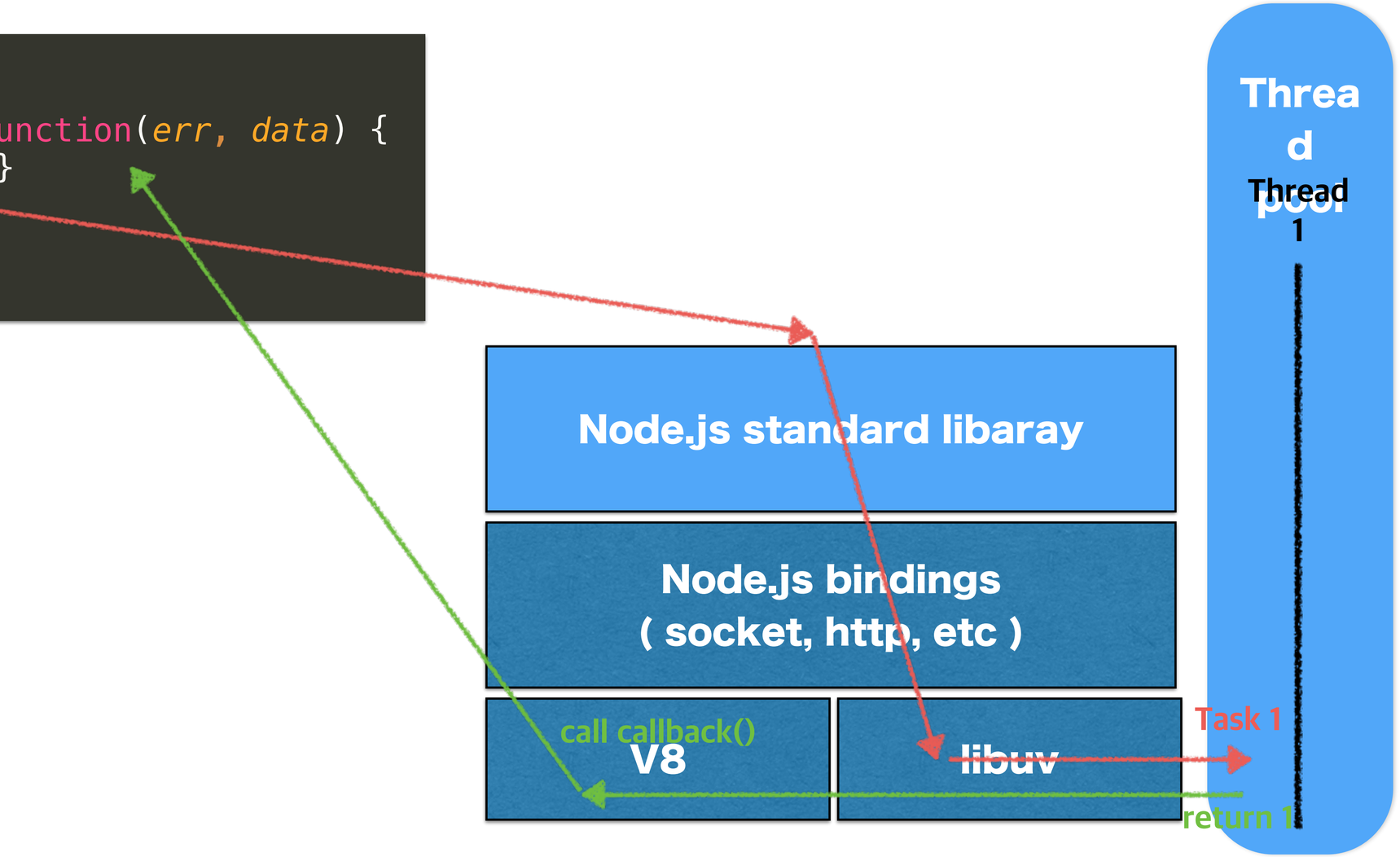

Part 2.
Node.JS Workshop

Install Node.js

(Node.js, NVM, NPM)

Node.js Workshop#0

(hello nodejs)

Node.js WS #0

```
$ mkdir nodestudy
$ cd nodestudy
```

Node.js WS#0
(전역객체 - helloConsole.js)

```
console.log('hello nodejs!!');

var json = { msg: ‘Hello nodejs!!'};
console.log('My name is %j', json);

var a = 10;
var b = 20;
console.log('a + b = %d', a+b);

console.time('timeout');
setTimeout(function() {
  console.timeEnd('timeout');
},1000);

console.log('filename : ', __filename);
console.log('dirname : ', __dirname);
```

Node.js WS#0
(전역객체 - helloConsole.js)

```
$ node helloConsole
```

Node.js WS#0
(전역객체 - helloConsole.js)

```
console.log('hello nodejs!!');

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},1000);

console.log('filename : ', __filename);
console.log('dirname : ', __dirname);
```

Node.js WS#0
(전역객체 - helloProcess.js)

```
console.log('env = ', process.env);

console.log('version = ', process.version);

console.log('versions = ', process.versions);

console.log('platform = ', process.platform);

console.log('memory usage = ', process.memoryUsage());

console.log('up time = ', process.uptime());
```

Node.js WS#0
(전역객체 - helloProcess.js)

```
$ node helloProcess
```

Node.js WS#0
(전역객체 - helloProcess.js)

```
console.log('env = ', process.env);

console.log('version = ', process.version);

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console.log('memory usage = ', process.memoryUsage());

console.log('up time = ', process.uptime());
```
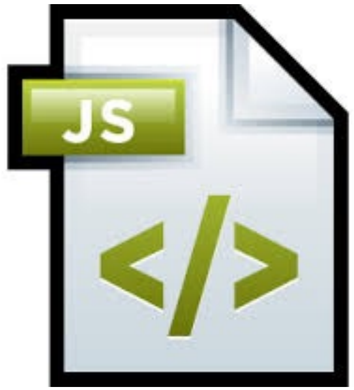
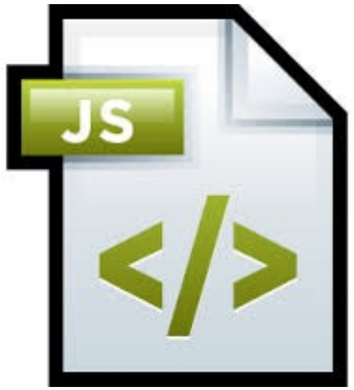

Node.js Workshop #1

(모듈과 친해지기)

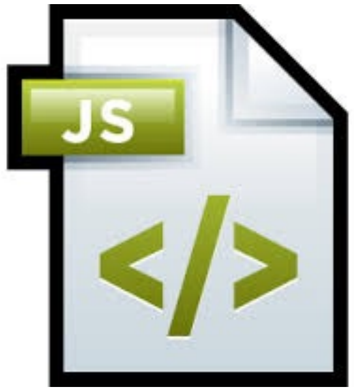
Node.js WS #1
(module system)



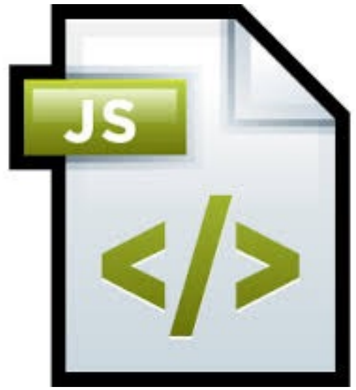
http



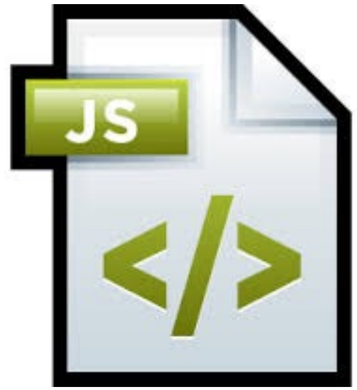
Stream



net



fs



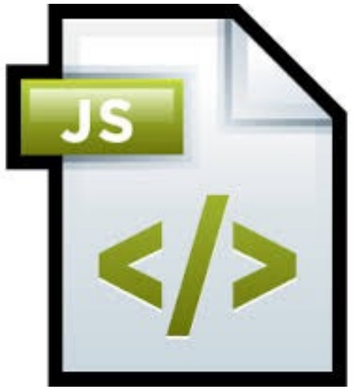
EventEmitter

...

Node.js WS #1
(module system)

app.js

require('math')



math

exports.abs
exports.pow

Node.js WS #1

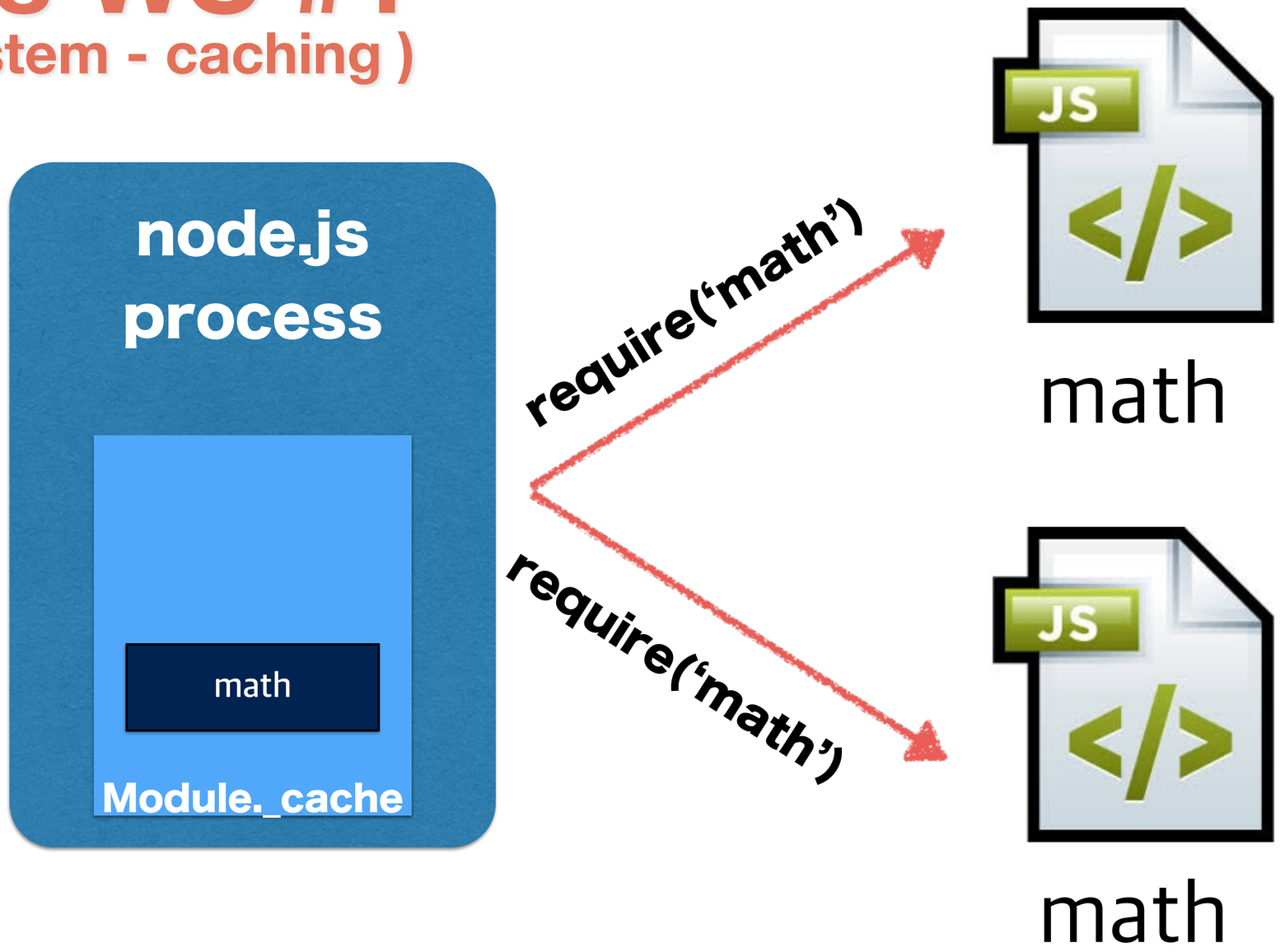
(math.js)

```
exports.abs = function(number) {
    return number < 0 ? -number : number;
};

exports.pow = function(x, y) {
    var value = 1;

    for( var i = 0; i < y; i++ ) {
        value *= x;
    }

    return value;
};
```

(app.js)

```
var math = require('./math');

console.log('math.abs(%d) = %d', -100, math.abs(-100));
console.log('math.pow(%d, %d) = %d', 2, 3, math.pow(2, 3));
```

Node.js WS #1
(module system - caching)



Node.js WS #1
(npm)

npm 사용해보기

Node.js WS #1
(npm)

```
$ npm init
```

Node.js WS #1
(npm - package.json)

```
{
  "name": "nodestudy",
  "version": "1.0.0",
  "description": "",
  "main": "helloConsole.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "author": "",
  "license": "ISC"
}
```

Node.js WS #1
(npm - package.json)

```
{
  "name": "nodestudy",
  "version": "1.0.0",
  "description": "",
  "main": "helloConsole.js",
  "scripts": {
    "start": "node xxxx.js",
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "author": "",
  "license": "ISC"
}
```

Node.js WS #1
(npm)

colors 모듈 설치

Node.js WS #1
(npm)

```
$ npm install colors —save
```

Node.js WS #1
(npm - package.json)

```
{
  "name": "nodestudy",
  "version": "1.0.0",
  "description": "",
  "main": "helloConsole.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "author": "",
  "license": "ISC",
  "dependencies": {
    "colors": "^1.0.3"
  }
}
```

Node.js WS #1
(helloColors.js)

```
var colors = require('colors');

console.log('hello'.green);
console.log('i like cake and pies'.underline.red);
console.log('inverse the color'.inverse);
console.log('OMG Rainbows!'.rainbow);
console.log('Run the trap'.trap);
```

Node.js WS #1
(EventEmitter)

EventEmitter?

Many objects in Node emit events: a net.Server emits an event each time a peer connects to it, a fs.readStream emits an event when the file is opened. **All objects which emit events are instances of events.EventEmitter.** You can access this module by doing: require("events");

Typically, event names are represented by a camel-cased string, however, there aren't any strict restrictions on that, as any string will be accepted.

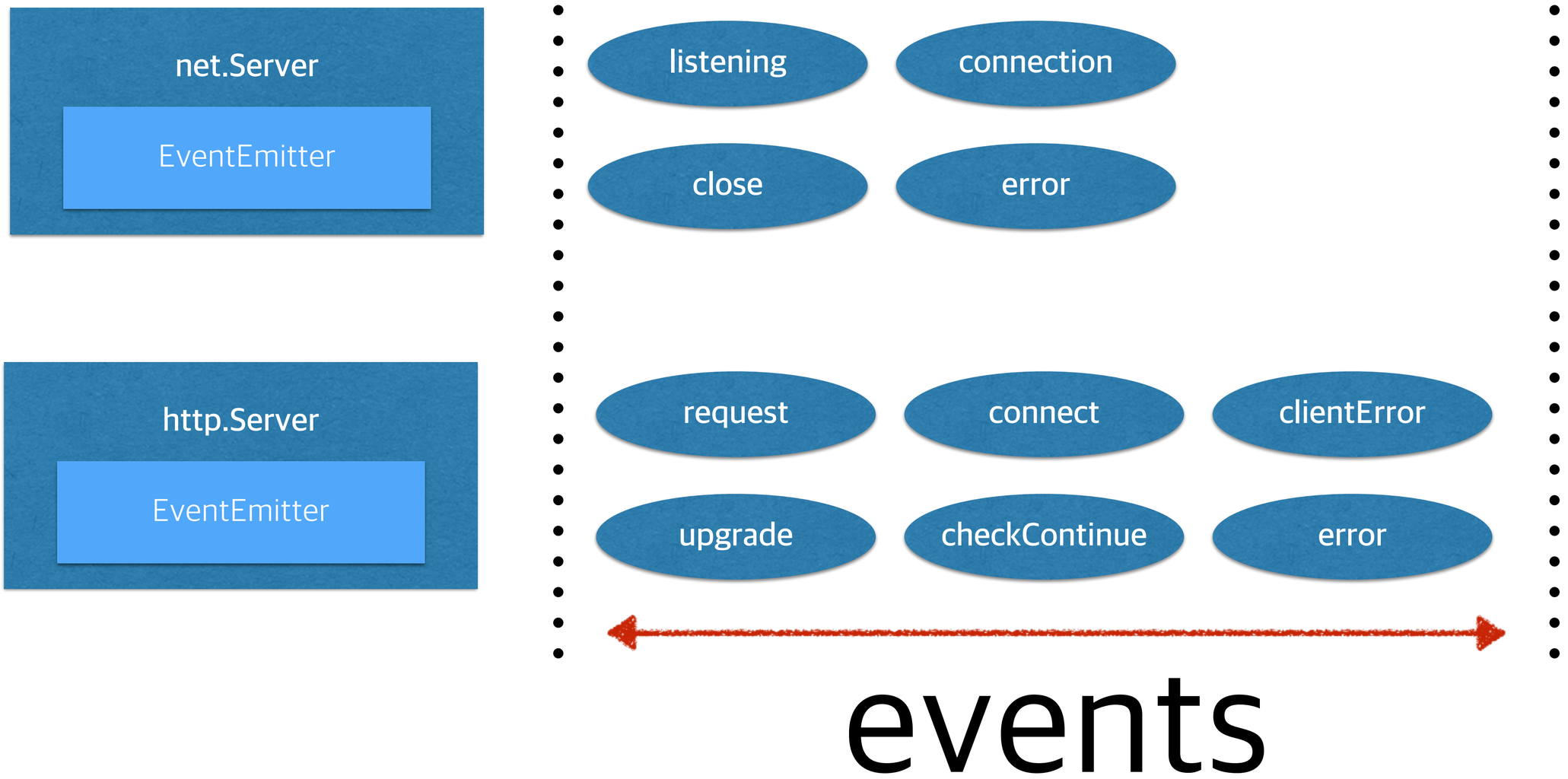
Functions can then be attached to objects, to be executed when an event is emitted. These functions are called listeners. Inside a listener function, this refers to the EventEmitter that the listener was attached to.

[출처] http://nodejs.org/api/events.html

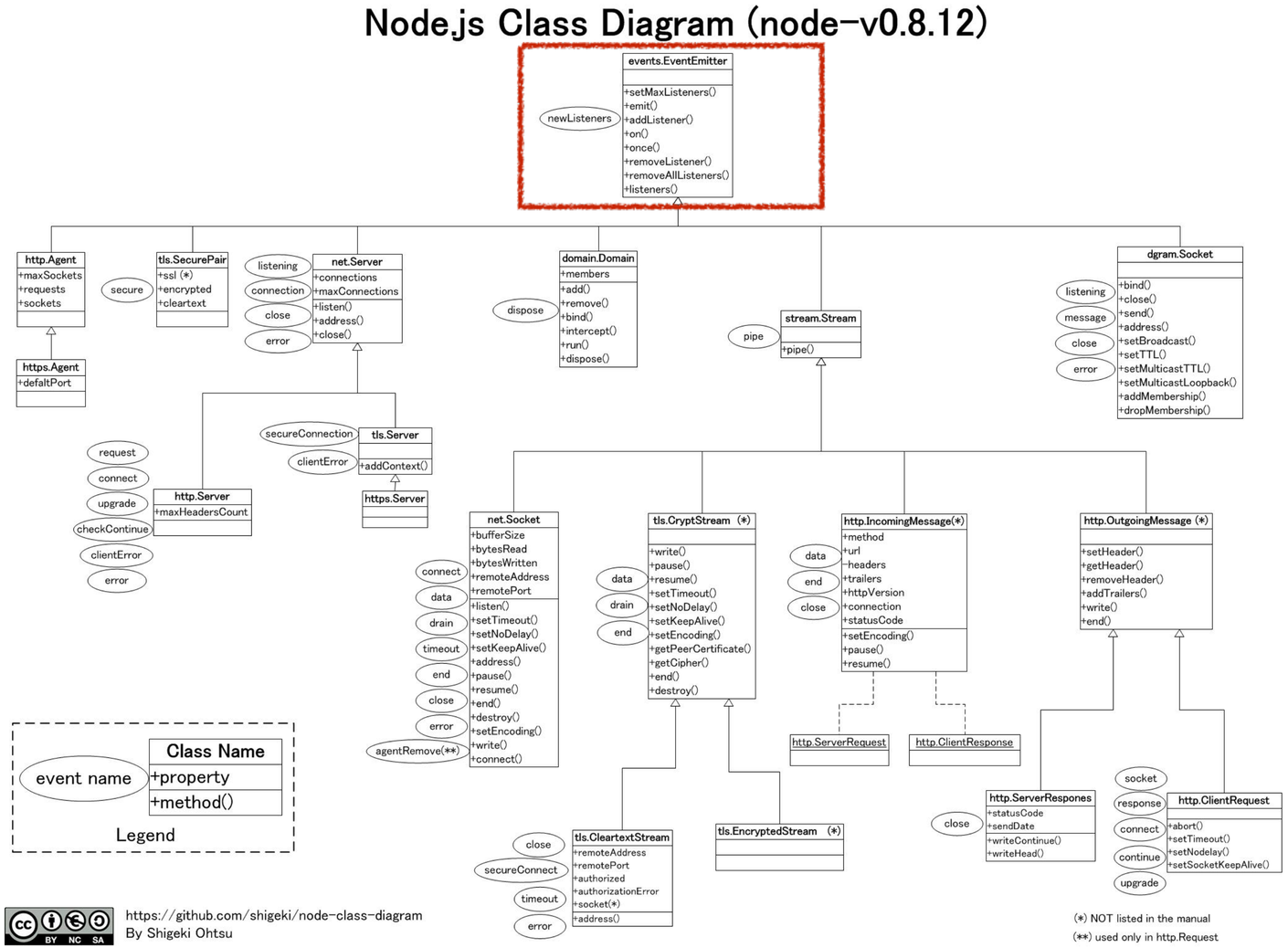
Node.js WS #1
(EventEmitter)

request

Node.js WS #1
(EventEmitter)



Node.js WS #1
(EventEmitter)



Node.js WS #1
(EventEmitter)

```
var EventEmitter = require('events').EventEmitter;
var eventEmitter = new EventEmitter();


eventEmitter.on('customevent', function() {
    console.log('Event Occur!!');
});

eventEmitter.emit('customevent');
```

Node.js WS #1
(EventEmitter - addListener)

EventEmitter

```
_events = { };
```

```
function addListener(type, listener) { ... };
function emit(type) { ... };
```

Node.js WS #1
(EventEmitter - addListener)

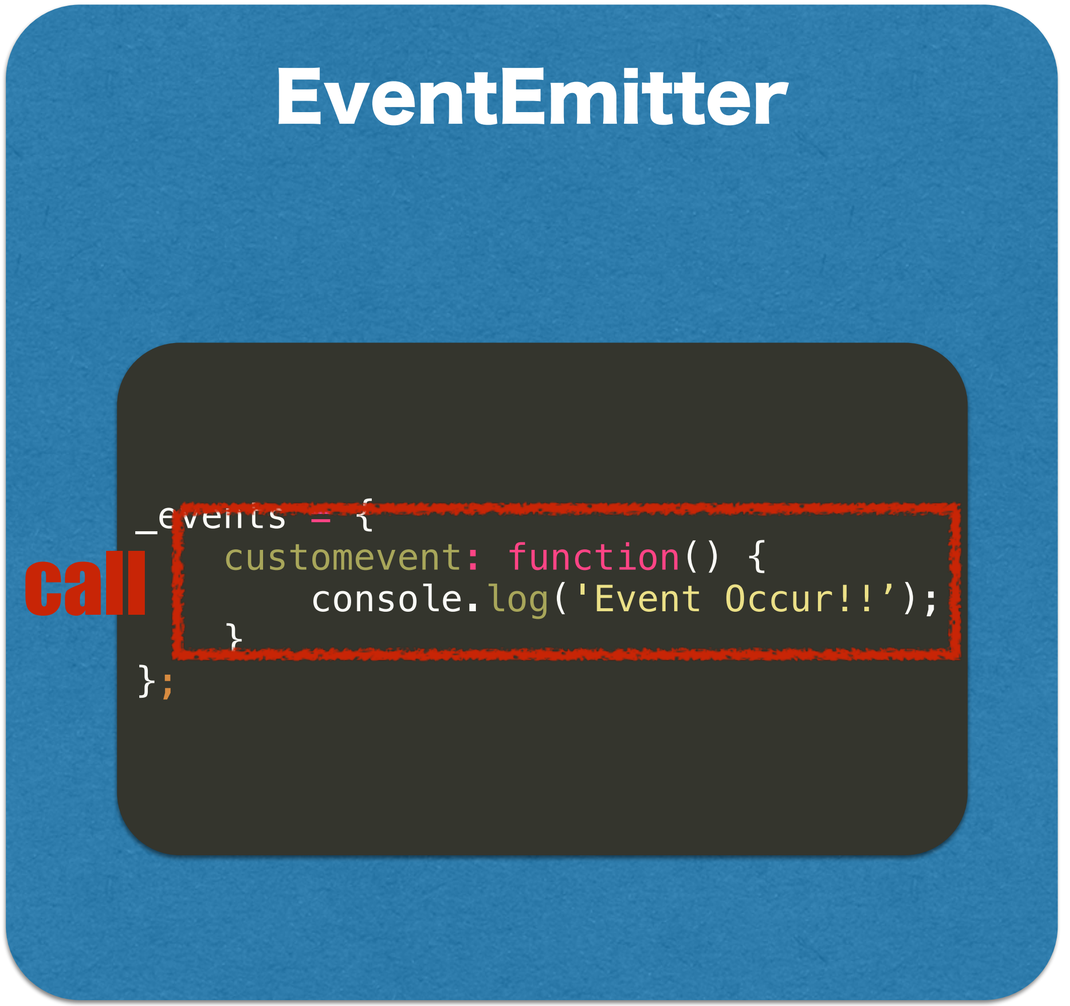
EventEmitter

```
_events = {
    customevent: function() {
        console.log('Event Occur!!');
    }
};
```

```
addListener('customevent', function() {
    console.log('Event Occur!!');
});
```

Node.js WS #1
(EventEmitter - emit)

```
emit('customevent');
```



Node.js WS #1
(EventEmitter - timer.js)

```
var EventEmitter = require('events').EventEmitter;
var timer = new EventEmitter();

var count = 0;
var interval = 1000;

timer.on('timed', function(count, uptime) {
    console.log('Event!! count : %d, uptime : %d ms', count, uptime);
});

setInterval(function() {
    timer.emit('timed', ++count, count * interval);
}, interval);
```

Node.js WS #1
(Stream)

Stream?

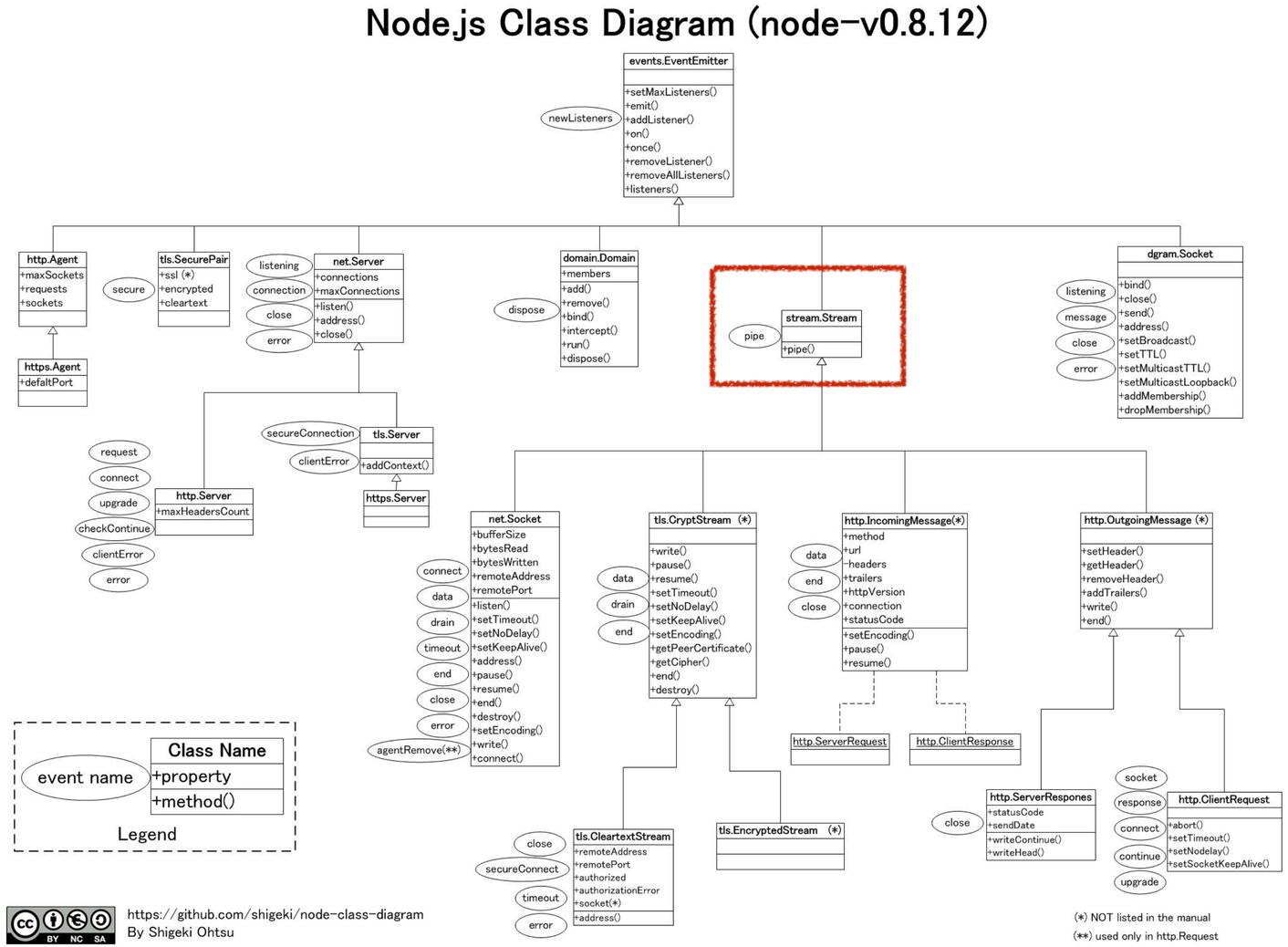
데이터가 열을 지어 흐르는 것처럼 입력되는 것. 데이터 통신에서 데이터를 비트의 열로 변환하여 직렬로 전송하는 것.

[네이버 지식백과] 데이터 스트림 [data stream] (컴퓨터인터넷IT용어대사전, 2011.1.20, 일진사)

A stream is an **abstract interface** implemented by various objects in Node. For example a request to an HTTP server is a stream, as is stdout. Streams are readable, writable, or both. **All streams are instances of EventEmitter**

[출처] http://nodejs.org/api/stream.html

Node.js WS #1
(Stream)



Node.js WS #1
(Stream)

Stream
(Readable)

Stream
(Writable)

Node.js WS #1
(Stream)

- File 입/출력
- Socket 입/출력
- stdin/stdout

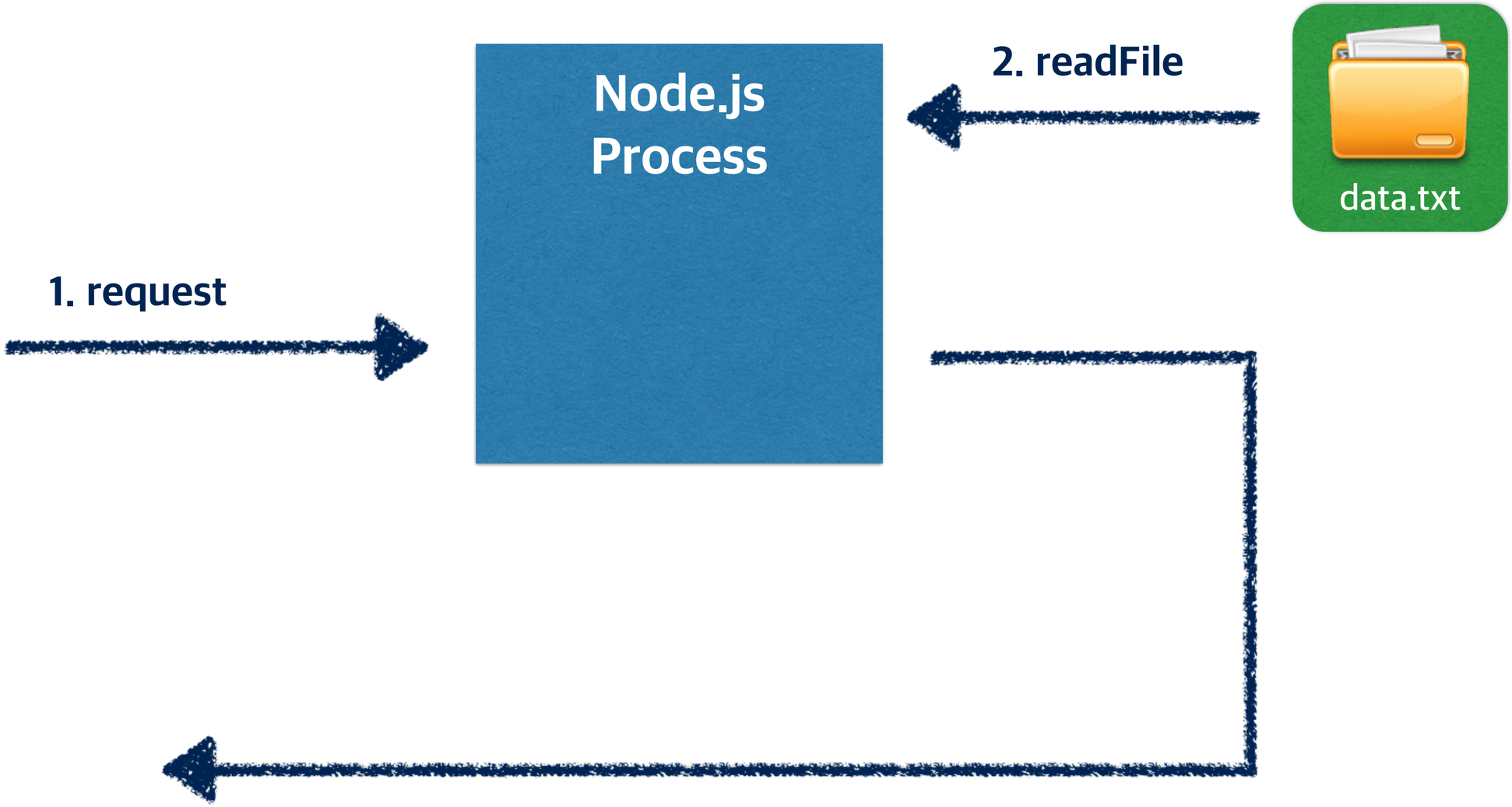
Node.js WS #1
(Stream - module_stream.js)

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

var server = http.createServer(function (req, res) {
    // req is an http.IncomingMessage, which is a Readable Stream
    // res is an http.ServerResponse, which is a Writable Stream

    fs.readFile(__dirname + '/data.txt', function (err, data) {
        res.end(data);
    });
});

server.listen(8000);
```

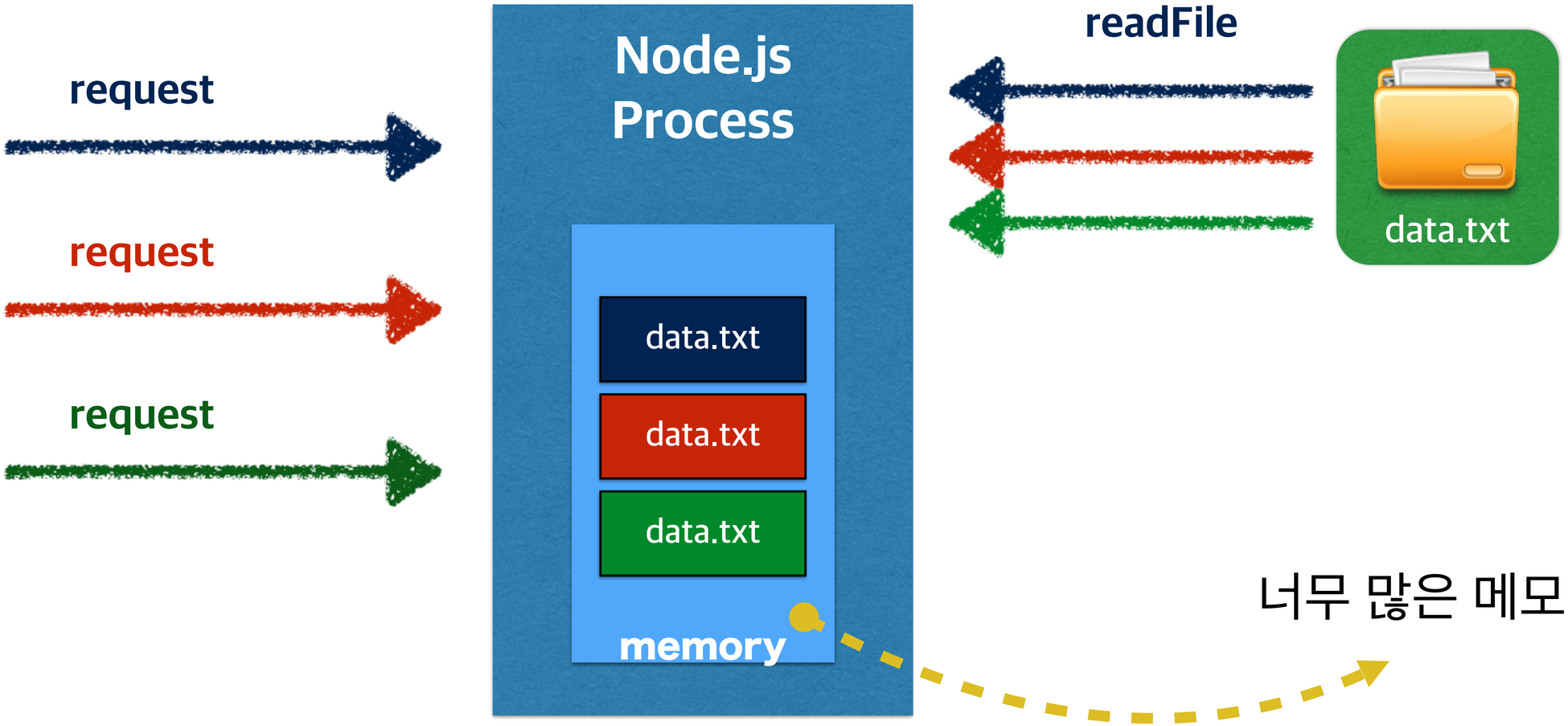
Node.js WS #1
(Stream - module_stream.js)

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

var server = http.createServer(function (req, res) {
    // req is an http.IncomingMessage, which is a Readable Stream
    // res is an http.ServerResponse, which is a Writable Stream

    fs.readFile(__dirname + '/data.txt', function (err, data) {
        res.end(data);
    });
});

server.listen(8000);
```

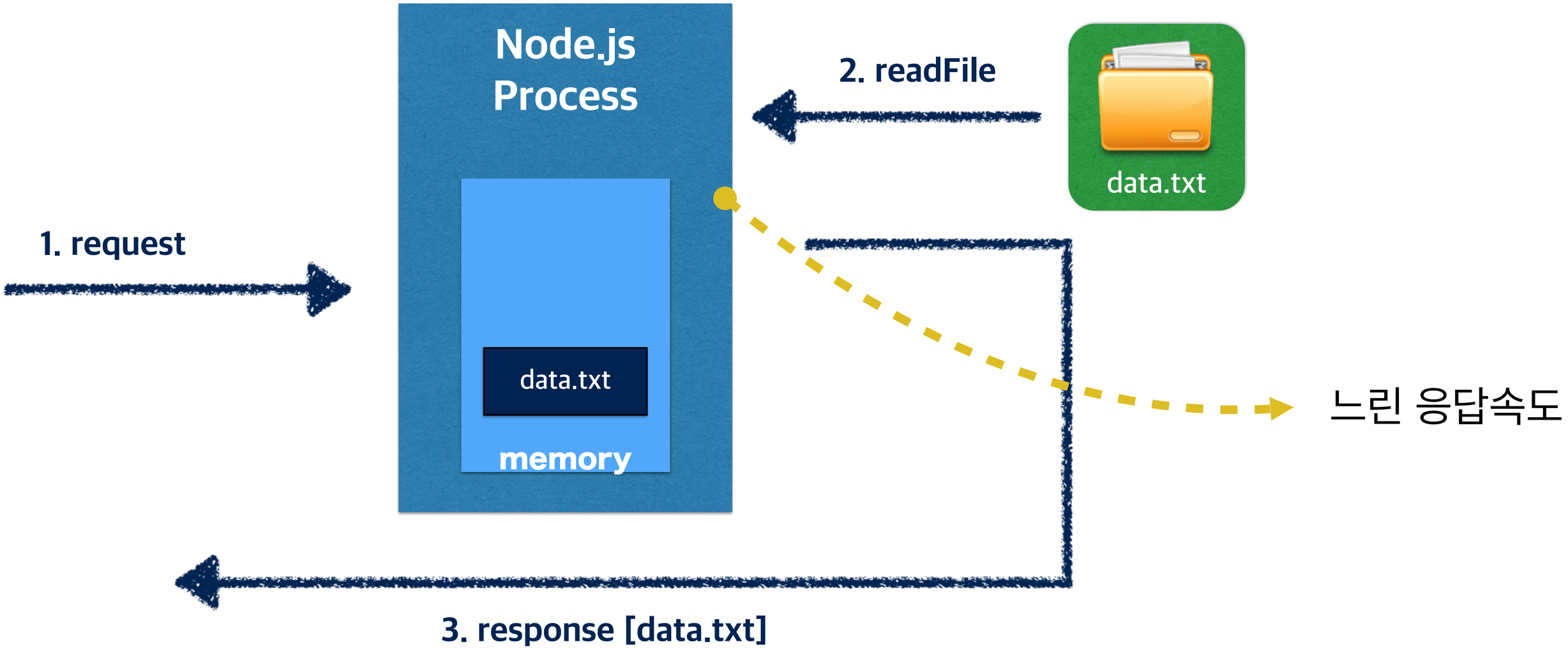
Node.js WS #1
(Stream - module_stream.js 동작)



Node.js WS #1
(Stream - module_stream.js 단점-1)



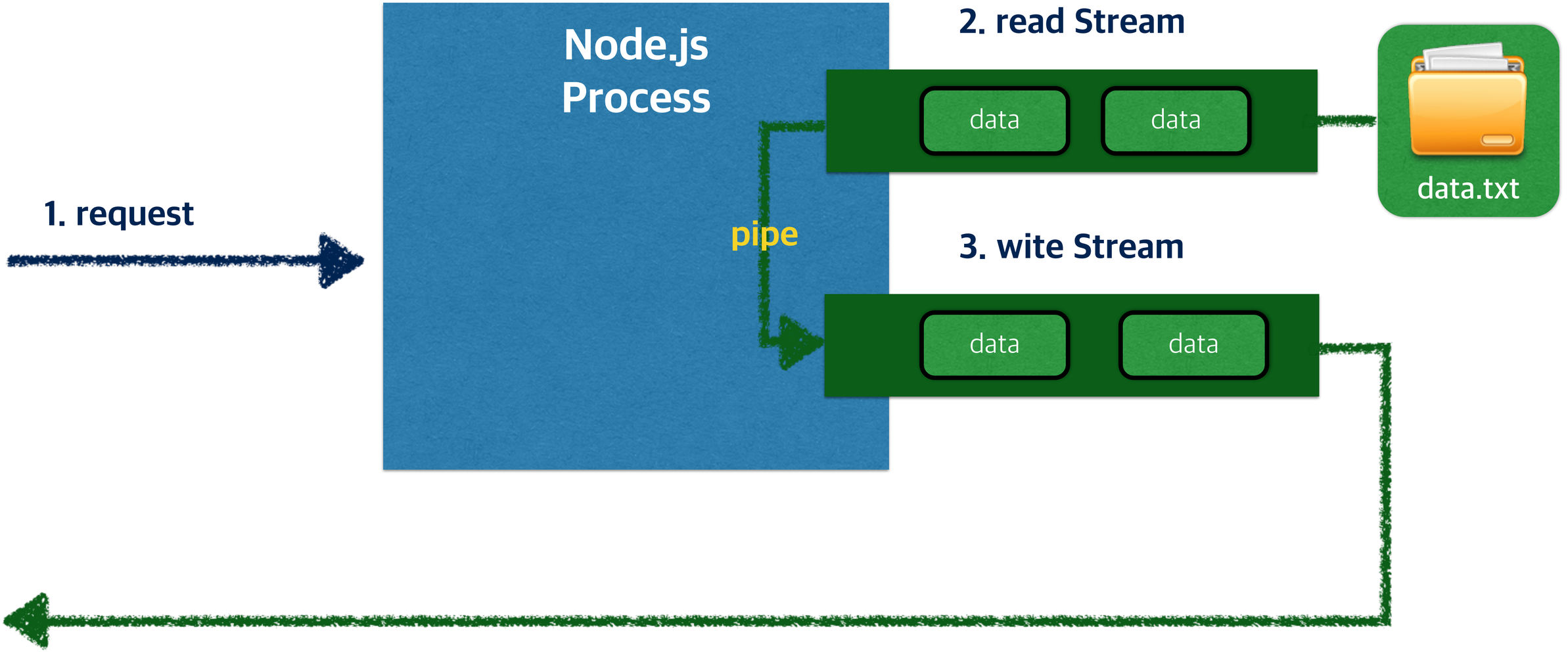
Node.js WS #1
(Stream - module_stream.js 단점-2)



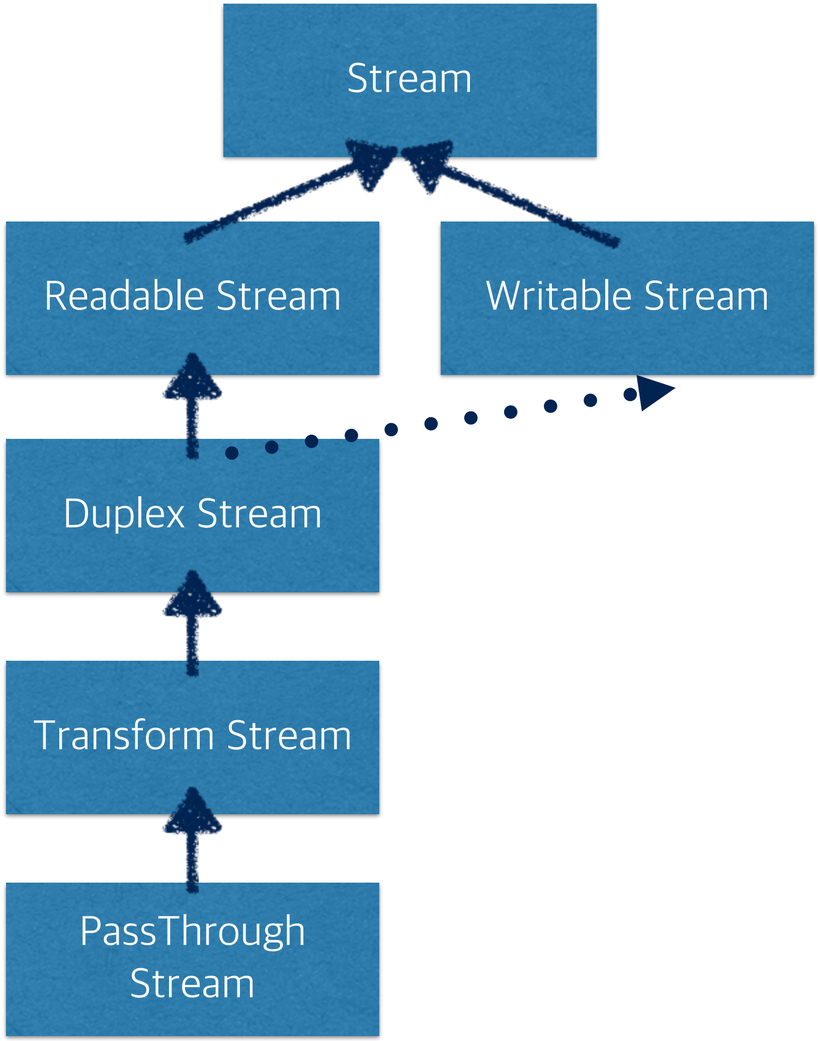
Node.js WS #1
(Stream - module_stream.js)

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

var server = http.createServer(function (req, res) {
    // req is an http.IncomingMessage, which is a Readable Stream
    // res is an http.ServerResponse, which is a Writable Stream

    //fs.readFile(__dirname + '/data.txt', function (err, data) {
    //    res.end(data);
    //});
    var stream = fs.createReadStream(__dirname + '/data.txt');
    stream.pipe(res);
});

server.listen(8000);
```

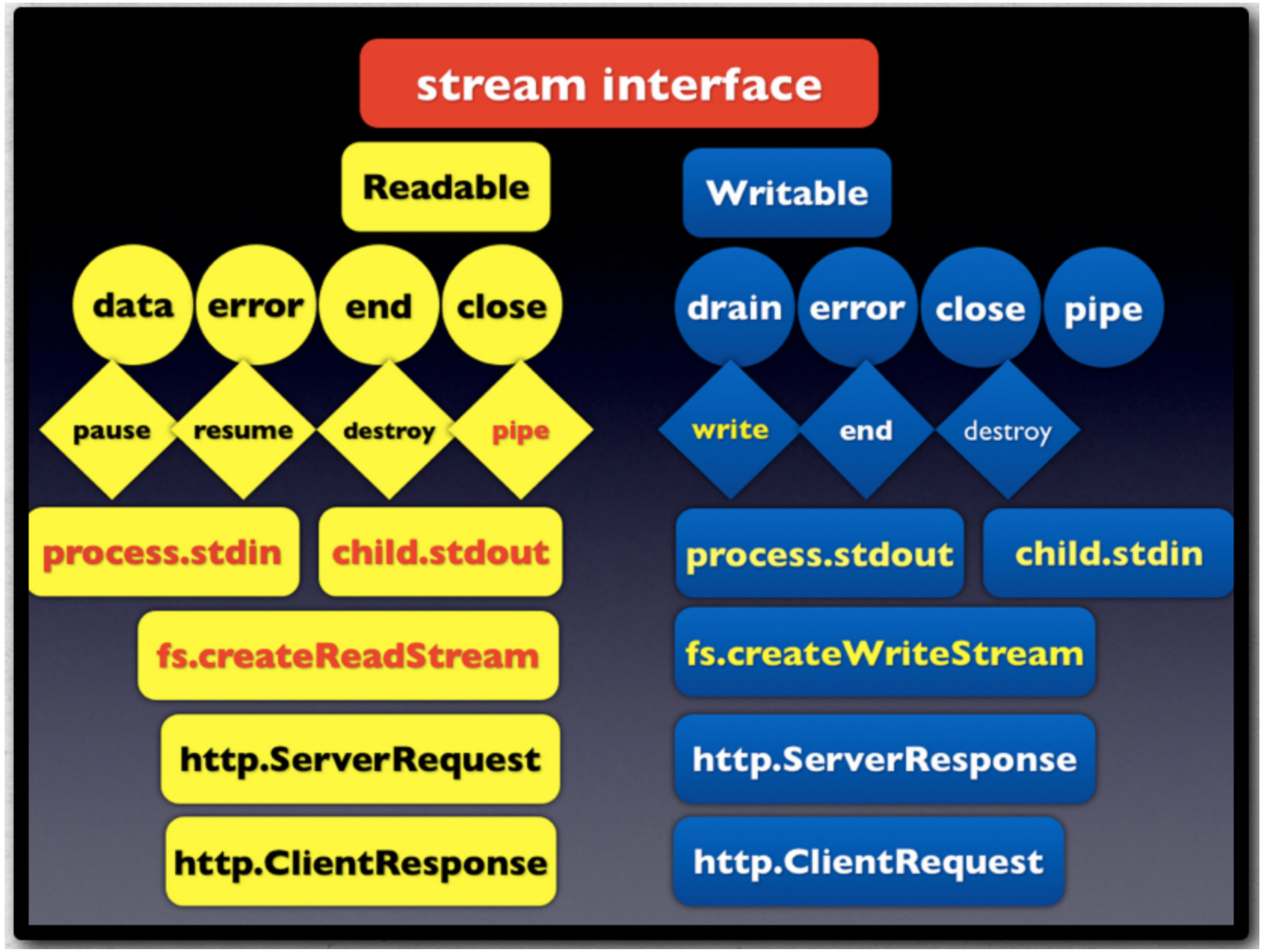
Node.js WS #1
(Stream - module_stream.js 동작)



Node.js WS #1
(Stream)



Node.js WS #1
(Stream)



[출처] http://nodeqa.com/nodejs_ref/61

Node.js WS #1
(npm)

```
$ sudo npm install socket.io —save
$ sudo npm install socket.io-client —save
```

Node.js WS #1
(echoserver.js)

```
var Server = require('socket.io');
var io = new Server();

io.on('connect', function(socket){
    console.log('socket connected');

    socket.on('message', function(data) {
        console.log('receive : ', data);
        socket.send('echo : '+ data);
    });

    socket.on('disconnect', function() {
        console.log('socket disconnected');
    })
});

io.listen(3000);
```

Node.js WS #1
(echoclient.js)

```
var io = require('socket.io-client');
var socket = io('http://127.0.0.1:3000');

socket.on('connect', function() {
    console.log('connected!!');
});
socket.on( 'message', function( data) {
    console.log( "received : ", data);
});
process.stdin.resume();
process.stdin.setEncoding('utf8');
process.stdin.on('data', function (chunk) {
    if( !socket.disconnected ) {
        socket.send(chunk);
        console.log('send : ' + chunk);
    }
});
```

Node.js Workshop #2

(RESTful API Server - MemoServer)

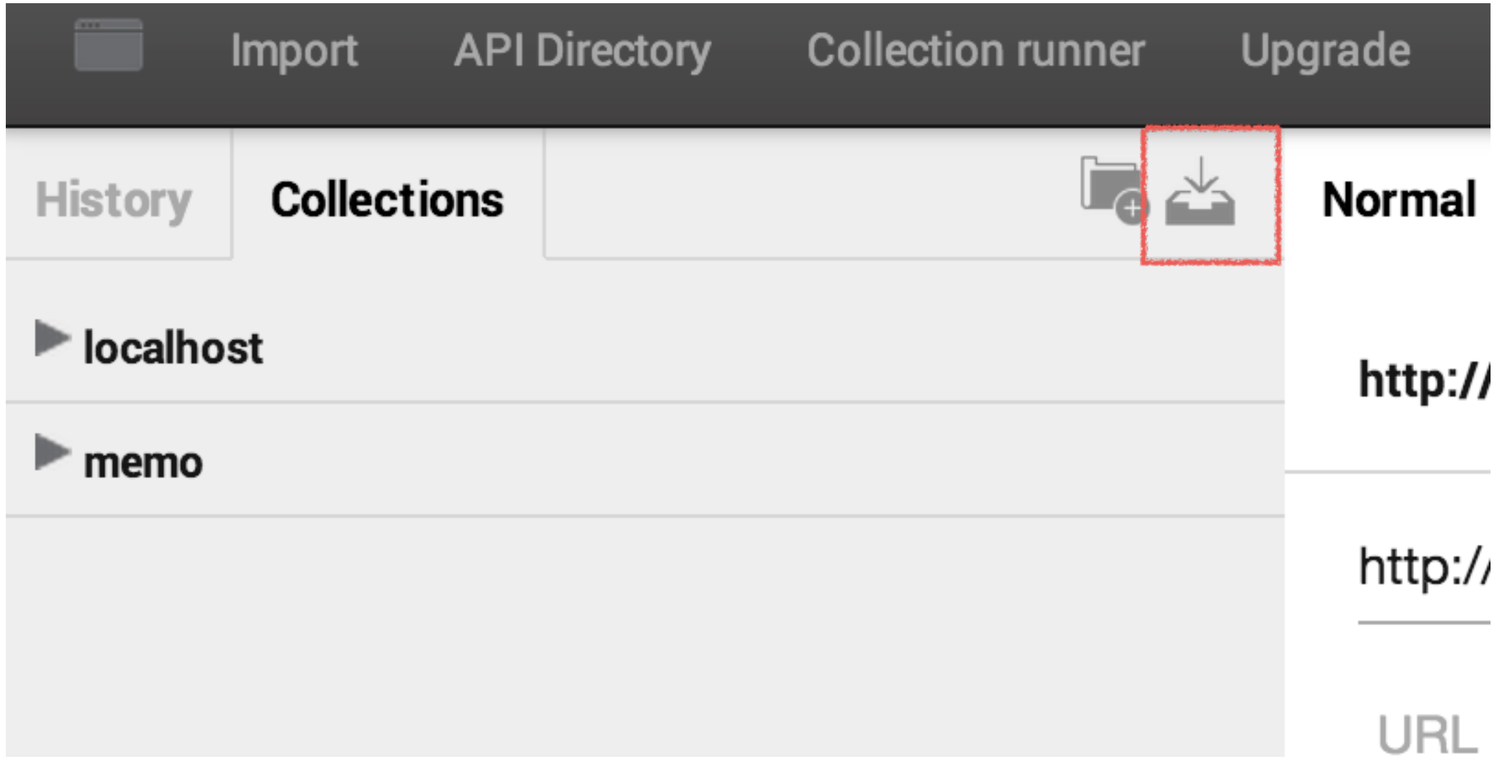
Node.js WS #2

Postman?

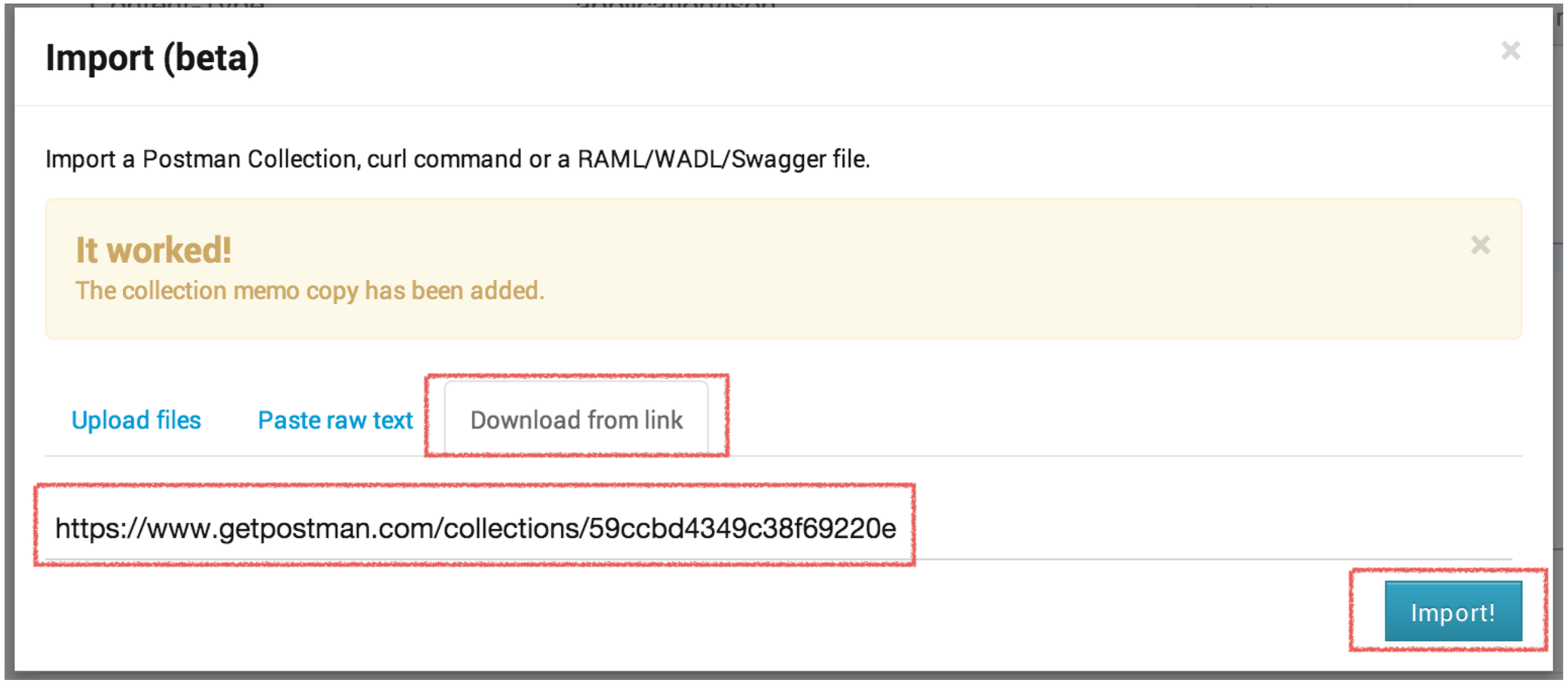
Postman helps you be more efficient while working with APIs. Postman is a scratch-your-own-itch project. The need for it arose while one of the developers was creating an API for his project. After looking around for a number of tools, nothing felt just right. The primary features added initially were a history of sent requests and collections.

https://chrome.google.com/webstore/detail/postman-rest-client-packa/fhbjgbiflinjbdggehcddcbncdddomop?utm_source=gmail

Node.js WS #2

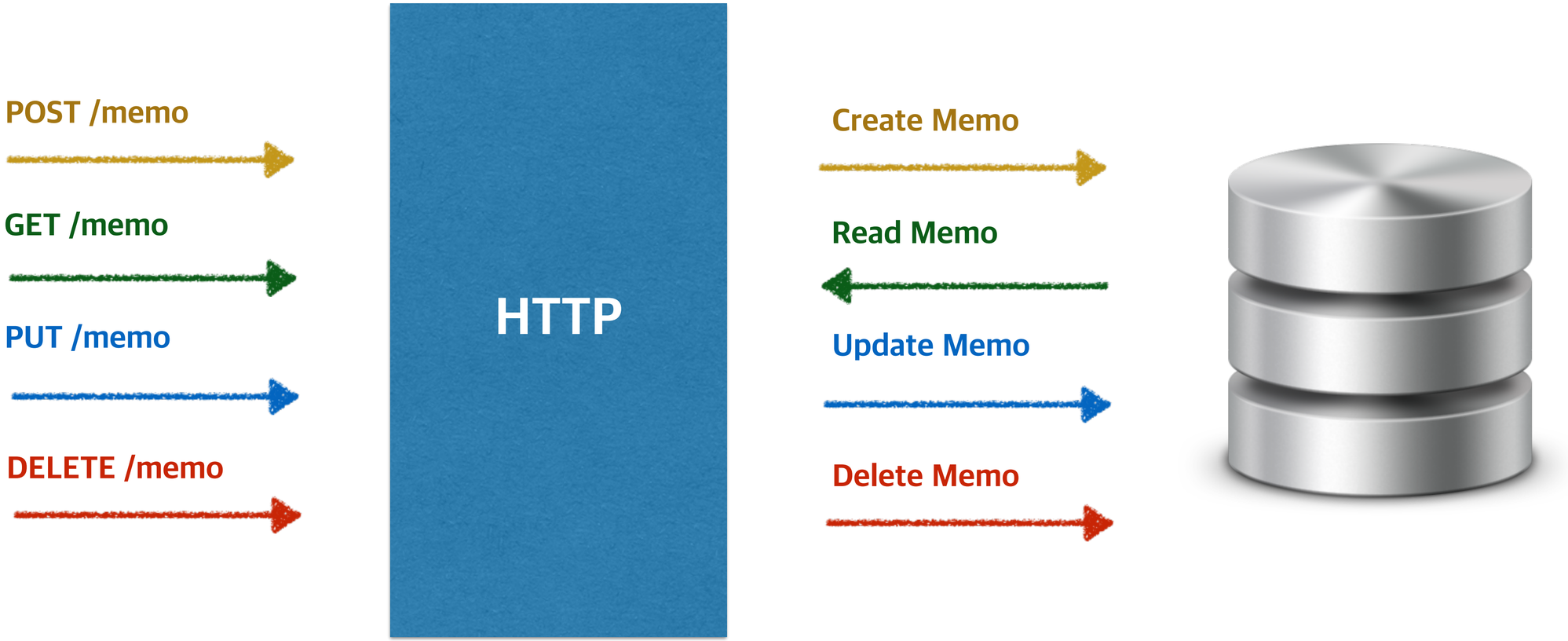

Import
API Directory
Collection runner
Upgrade
History
Collections
Normal
localhost
memo
http://
http://
URL

Node.js WS #2



https://www.getpostman.com/collections/59ccbd4349c38f69220e

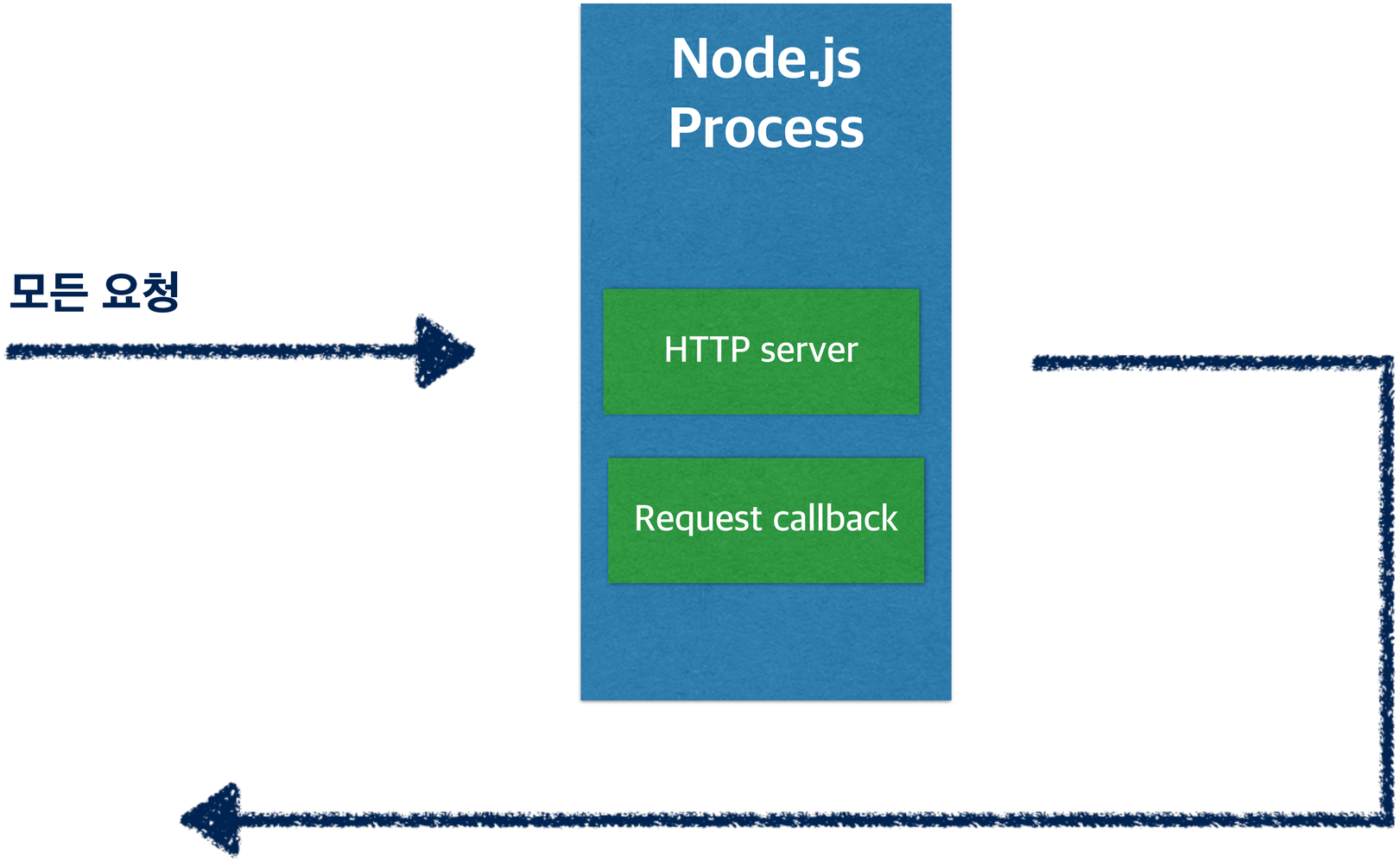
Node.js WS #2
(MemoServer Introduction)



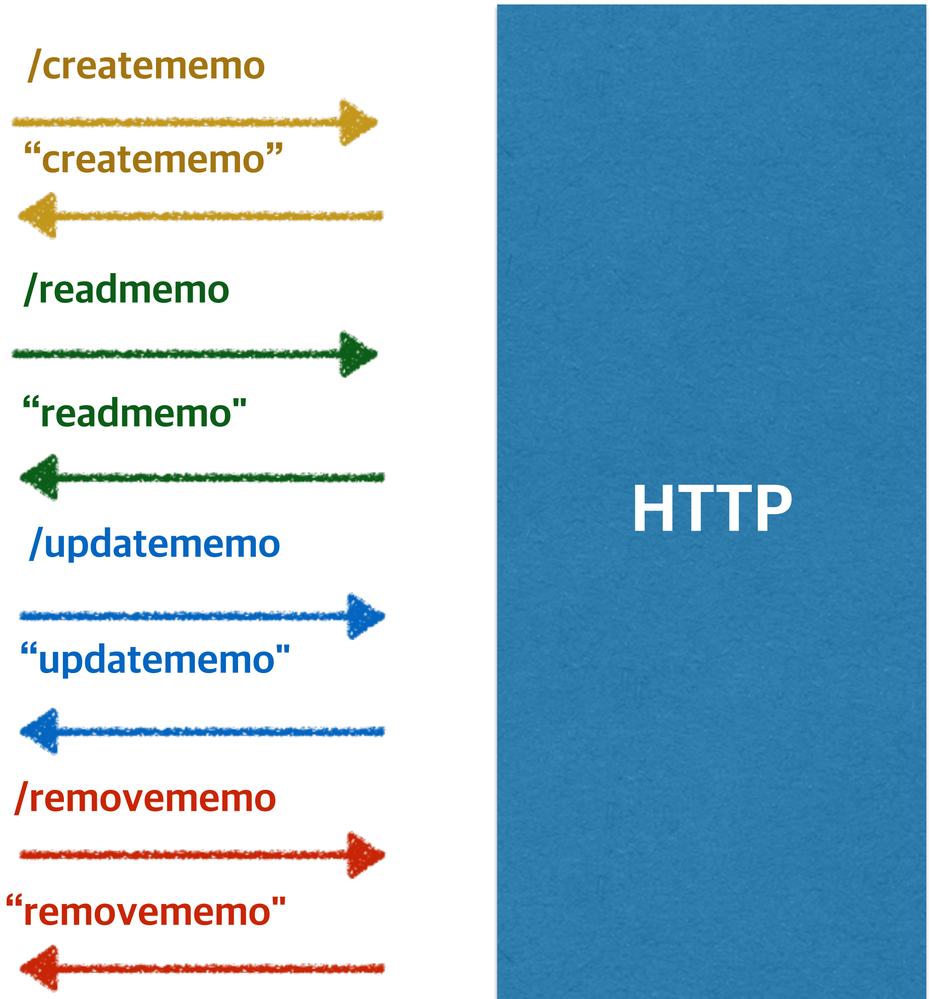
Node.js WS #2
(server.js)

```
var http = require('http');

function onRequest(req, res) {
    res.writeHead(200, {"Content-Type": "text/plain"});
    res.write('hello http server!!');
    res.end();
}

var server = http.createServer(onRequest);
server.listen(8080);
```

Node.js WS #2
(server.js interaction)



Node.js WS #2
(server.js - Add Router)



Node.js WS #2
(server.js - Add Router)

```
var http = require('http');
var url = require('url');

function onRequest(req, res) {
    var pathname = url.parse(req.url).pathname;

    switch( pathname ) {
        case '/creatememo' :
            res.writeHead(200, {"Content-Type": "text/plain"});
            res.write('creatememo');
            res.end();
            break;
        case '/readmemo' :
            res.writeHead(200, {"Content-Type": "text/plain"});
            res.write('readmemo');
            res.end();
            break;
        case '/updatememo' :
            res.writeHead(200, {"Content-Type": "text/plain"});
            res.write('updatememo');
            res.end();
            break;
        case '/removememo' :
```

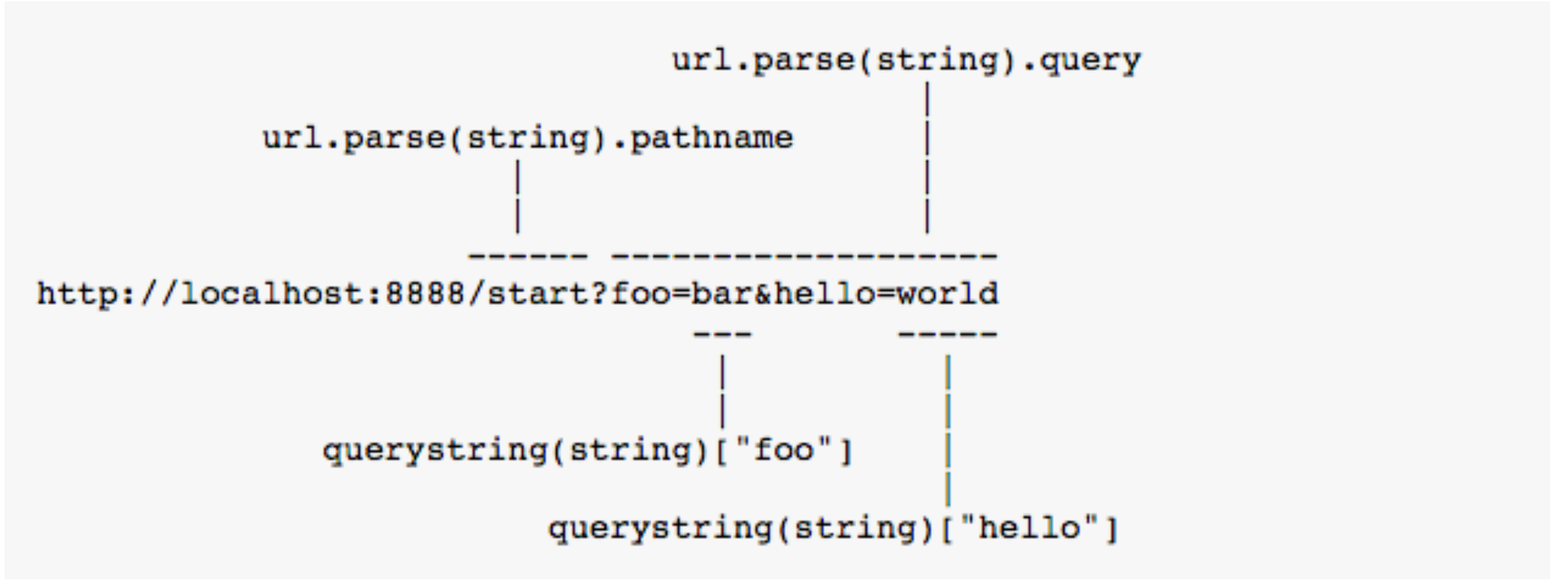
Node.js WS #2
(server.js - Add Router)

```
    case '/removememo' :
            res.writeHead(200, {"Content-Type": "text/plain"});
            res.write('removememo');
            res.end();
            break;
    default :
            res.writeHead(404, {"Content-Type": "text/plain"});
            res.write('pathname error');
            res.end();
            break;
    }
}


var server = http.createServer(onRequest);
server.listen(8080);
```

Node.js WS #2
(server.js - Add Router)

```
var http = require('http');
var url = require('url');

function onRequest(req, res) {
    var pathname = url.parse(req.url).pathname;

    …

}


var server = http.createServer(onRequest);
server.listen(3000);
```

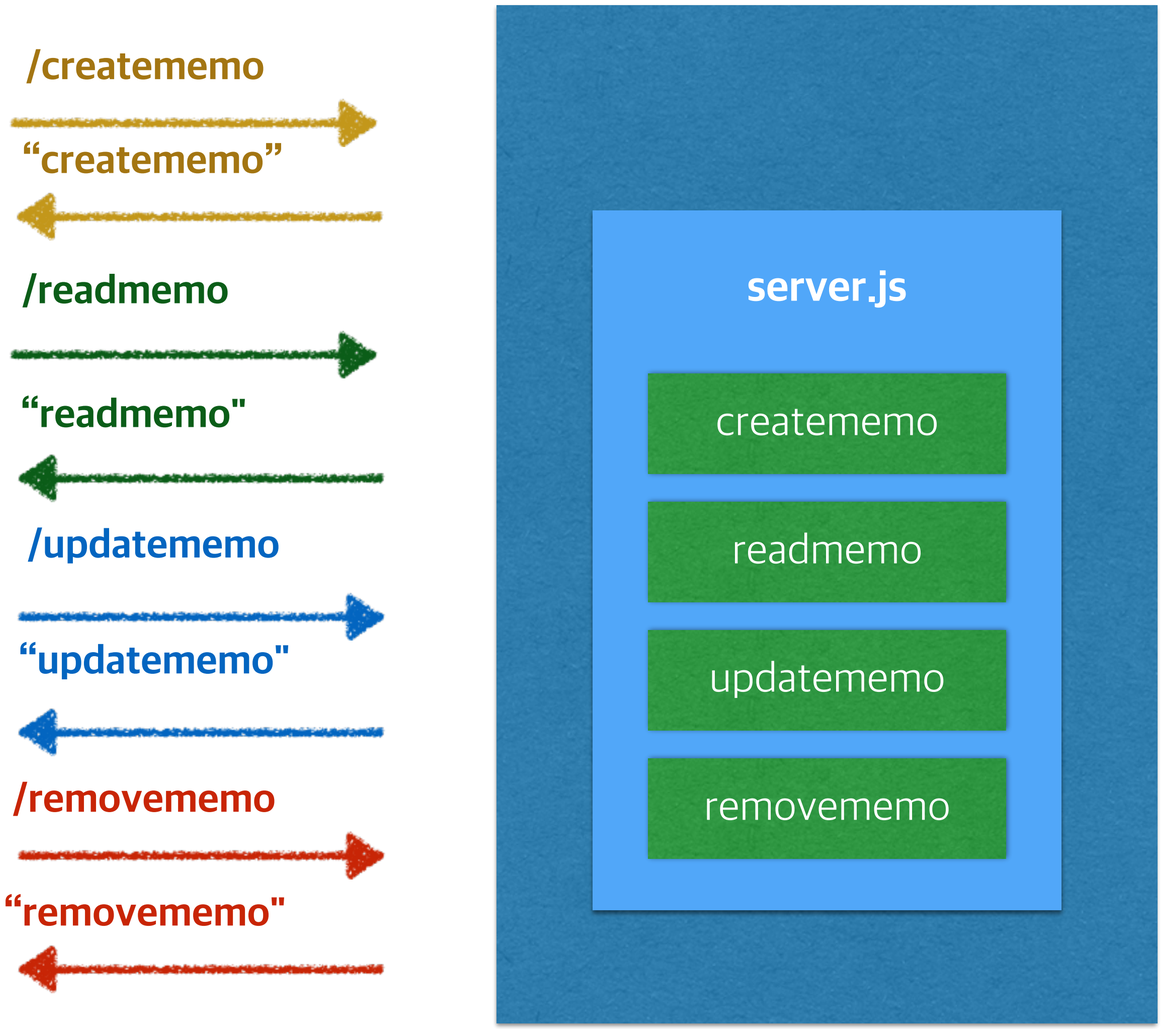
Node.js WS #2
(server.js - Add Router)



URL
+ href + protocol + slahes + host + auth + hostname + port + pathname + search + path + query + hash
+ parse() + format() + resolve()

http://nodejs.org/api/url.html

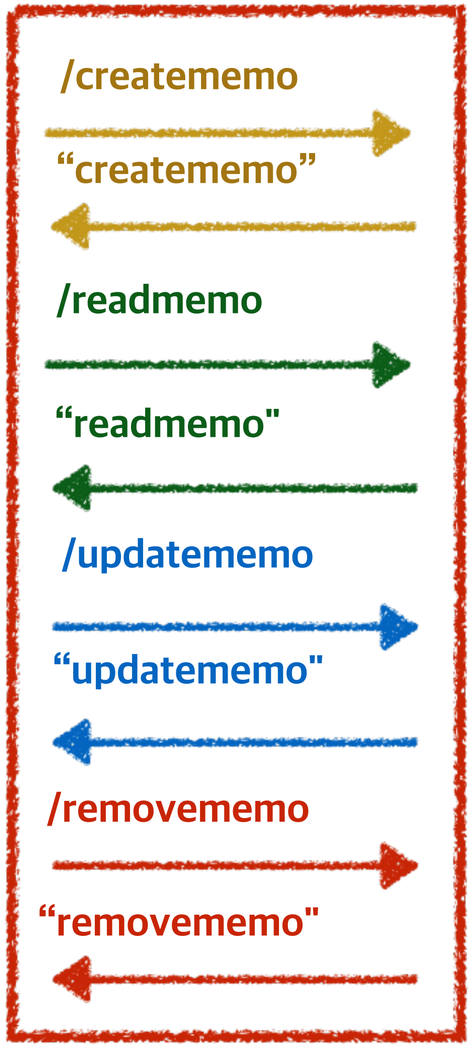
Node.js WS #2
(server.js - Add Router)

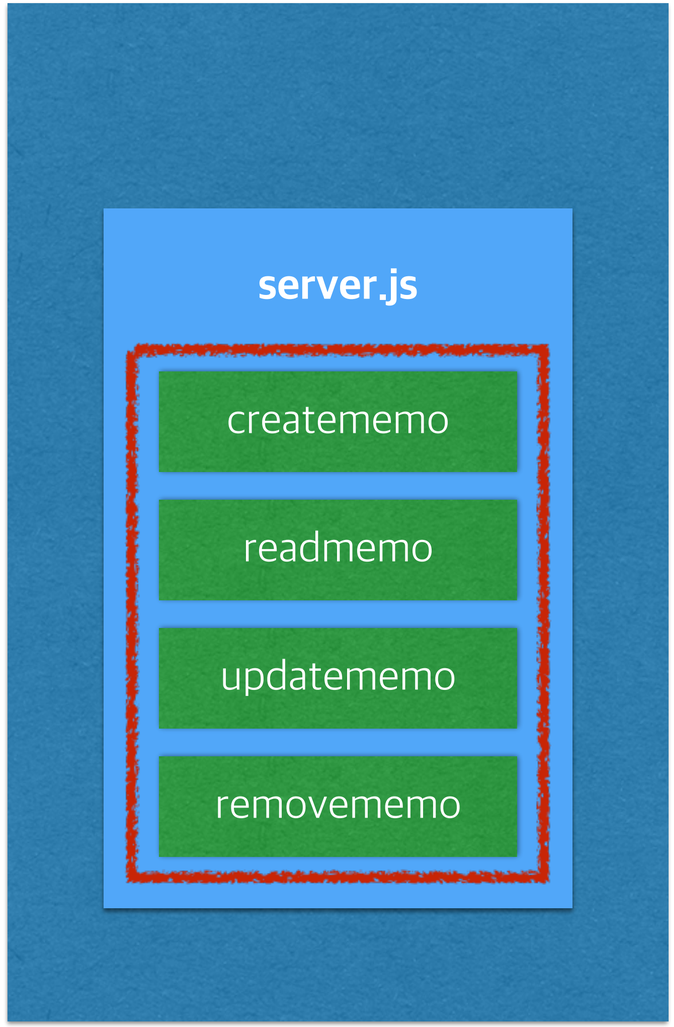


Node.js WS #2
(server.js - Add Router)

RESTful

- POST
- GET
- DELETE
- PUT





Node.js WS #2
(server.js - Add Router)

POST /memo

“creatememo”

GET /memo

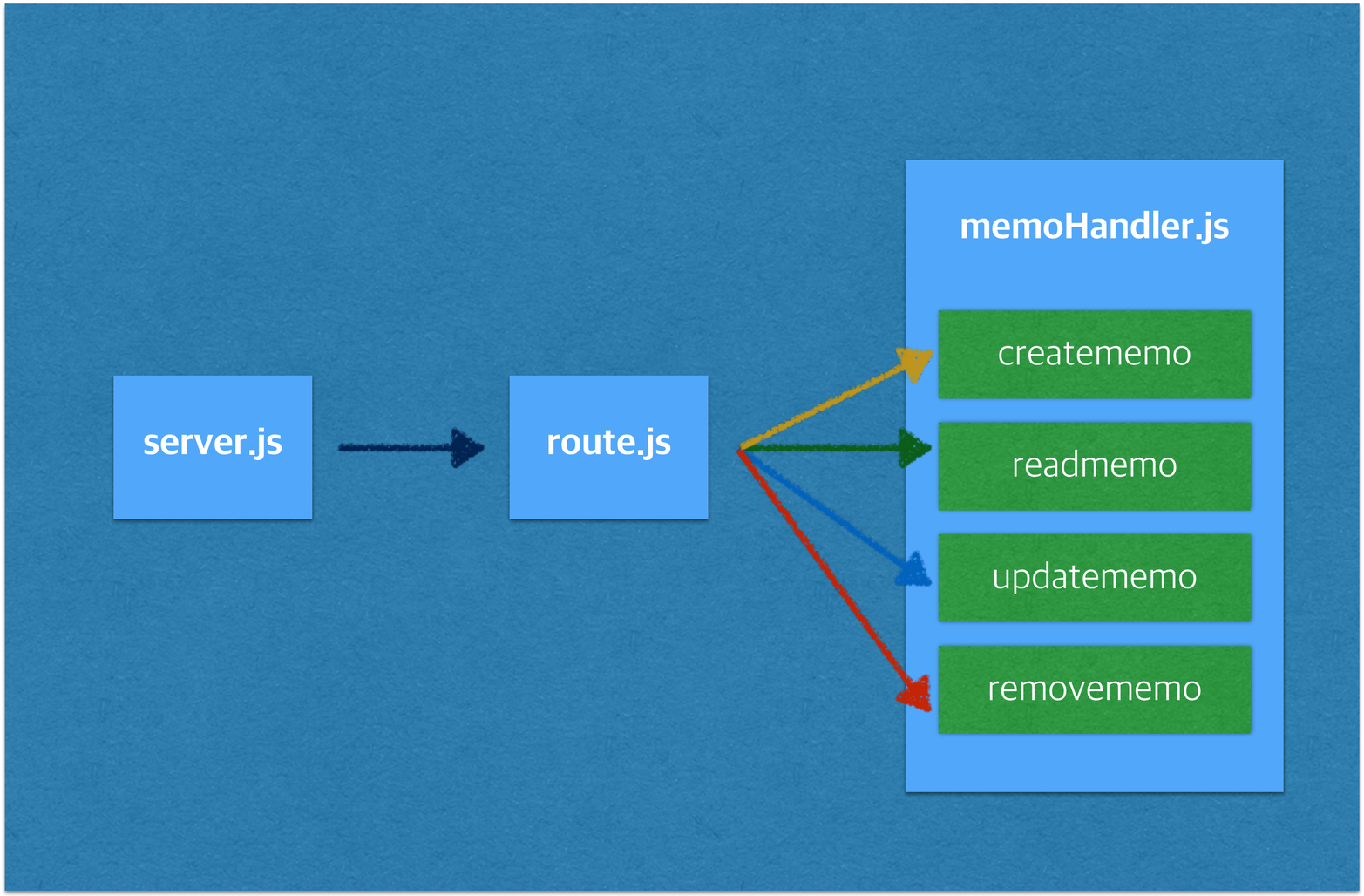
“readmemo"

PUT /memo

“updatememo"

DELETE /memo

“removememo"



Node.js WS #2
(memoHandler.js)

```
/** memoHandler.js **/

exports.create = function(req, res, body) {
    res.writeHead(200, {"Content-Type": "text/plain"});
    res.write('creatememo');
    res.end();
};

exports.read = function(req, res) {
    res.writeHead(200, {"Content-Type": "text/plain"});
    res.write('readmemo');
    res.end();
};

exports.update = function(req, res, body) {
    res.writeHead(200, {"Content-Type": "text/plain"});
    res.write('updatememo');
    res.end();
};

exports.remove = function(req, res, body) {
    res.writeHead(200, {"Content-Type": "text/plain"});
    res.write('removememo');
    res.end();
};
```

Node.js WS #2
(route.js)

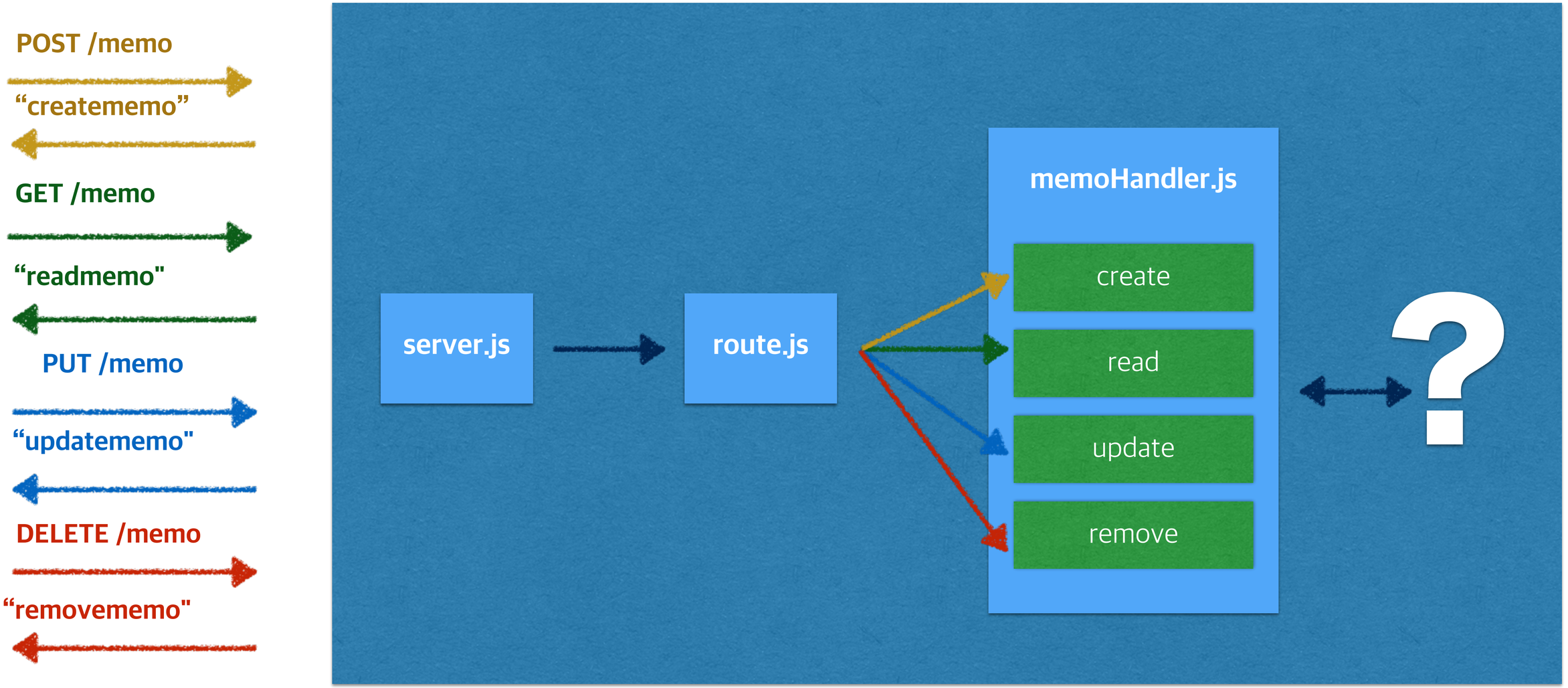
```
/** route.js **/
var memoHandler = require('./memoHandler.js');
var url = require('url');

exports.route = (function() {

    var handlers = {};

    handlers['/memo'] = {
        POST: memoHandler.create,
        GET: memoHandler.read,
        PUT: memoHandler.update,
        DELETE: memoHandler.remove
    };

    function route(req, res, body) {
        var pathname = url.parse(req.url).pathname;
        var method = req.method.toUpperCase();

        if(typeof handlers[pathname][method] === 'function') {
            handlers[pathname][method](req, res, body);
        } else {
            res.writeHead(404, {"Content-Type": "text/plain"});
            res.write('pathname error');
            res.end();
        }
    }

    return route;
})();
```

```
{ '/memo':
   {
     POST: [Function],
     GET: [Function],
     PUT: [Function],
     DELETE: [Function]
   }
 }
```

Node.js WS #2
(server.js)

```
var http = require('http');
var route = require('./route.js');


function onRequest(req, res) {
    var body = '';

    req.on('data', function(chunk) {
        body += chunk;
    });

    req.on('end', function() {
        route.route(req, res, body);
    });
}


var server = http.createServer(onRequest);
server.listen(8080);
```

Node.js WS #2
(server.js - Add Router)



Node.js WS #2
(Database)

https://github.com/louischatriot/nedb

README.md

NeDB (Node embedded database)

Embedded persistent database for Node.js, written in Javascript, with no dependency (except npm modules of course). You can **think of it as a SQLite for Node.js projects**, which can be used with a simple `require` statement. The API is a subset of MongoDB's. You can use it as a persistent or an in-memory only datastore.

NeDB is not intended to be a replacement of large-scale databases such as MongoDB! Its goal is to provide you with a clean and easy way to query data and persist it to disk, for web applications that do not need lots of concurrent connections, for example a continuous integration and deployment server and desktop applications built with Node Webkit.

NeDB was benchmarked against the popular client-side database TaffyDB and NeDB is much, much faster. That's why there is now a browser version, which can also provide persistence.

Check the change log in the wiki if you think nedb doesn't behave as the documentation describes! Most of the issues I get are due to non-latest version NeDBs.

- Document DB
- Written in Javascript
- East Install
- Mongodb API와 비슷

Node.js WS #2
(Database - nedb format)

```
{"author":"pcw","memo":"test","date":{"$$date":1421153113134},"_id":"nxi5jUVW2AZe1Hd9"}
{"author":"pcw","memo":"test","date":{"$$date":1421153130192},"_id":"CmOjzsOHwwHgMPo0"}
{"author":"pcw","memo":"test","date":{"$$date":1421153130455},"_id":"JQMJDc7LcKyb3sn5"}
{"author":"pcw","memo":"test","date":{"$$date":1421153130625},"_id":"ijy4xW0sUJfa9GMt"}
{"author":"pcw","memo":"test","date":{"$$date":1421153130832},"_id":"MIGjwM6sUgIoV1YI"}
{"author":"pcw","memo":"test","date":{"$$date":1421153131282},"_id":"nttf0FVySpcM8b5N"}
{"author":"pcw","memo":"test","date":{"$$date":1421153131563},"_id":"oMetRNzbGmgkV8cE"}
```

Node.js WS #2
(Database)

Installation, tests

Module name on npm is `nedb`.

```
npm install nedb --save   // Put latest version in your package.json

npm test   // You'll need the dev dependencies to test it
```

Node.js WS #2
(memoHandler.js)

```
/** memoHandler.js **/

var Datastore = require('nedb');
var db = new Datastore({ filename: './data/memo', autoload: true });
var querystring = require('querystring');
var url = require('url');


exports.create = function(req, res, body) {
    _insertMemo( body , function(error, result) {
        res.writeHead(200, {"Content-Type": "application/json"});
        res.write( '{ "result": "creatememo"}');
        res.end();
    });
};

exports.read = function(req, res) {
    _findMemo({}, function(error, results) {
        res.writeHead(200, {"Content-Type": "application/json"});
        res.write(JSON.stringify(results));
        res.end();
    });
};

exports.update = function(req, res, body) {
    var query = url.parse(req.url).query;
    var where = querystring.parse(query);

    _updateMemo(where, body, function(error, results) {
        res.writeHead(200, {"Content-Type": "application/json"});
        res.write('updatememo');
        res.end();
    });
};
```

Node.js WS #2 (memoHandler.js)

```
exports.remove = function(req, res, body) {
    var query = url.parse(req.url).query;
    var where = querystring.parse(query);

    _removeMemo(where, function(error, results) {
        res.writeHead(200, {"Content-Type": "application/json"});
        res.write( '{"result": "removememo"}');
        res.end();
    });
};

function _insertMemo(body , callback) {
    body = typeof body === 'string' ? JSON.parse(body) : body;

    var memo = {
        author: body.author,
        memo : body.memo,
        date: new Date()
    };
    db.insert(memo, callback);
}

function _findMemo(where, callback) {
    where = where || {};
    db.find(where, callback);
}

function _updateMemo(where, body, callback) {
    body = typeof body === 'string' ? JSON.parse(body) : body;
    db.update(where, {$set: body}, {multi: true}, callback);
}

function _removeMemo(where, callback) {
    db.remove(where, {multi: true}, callback);
}
```

Node.js WS #2
(기본 server.js - 라우터 추가)

POST /memo

“creatememo”

GET /memo

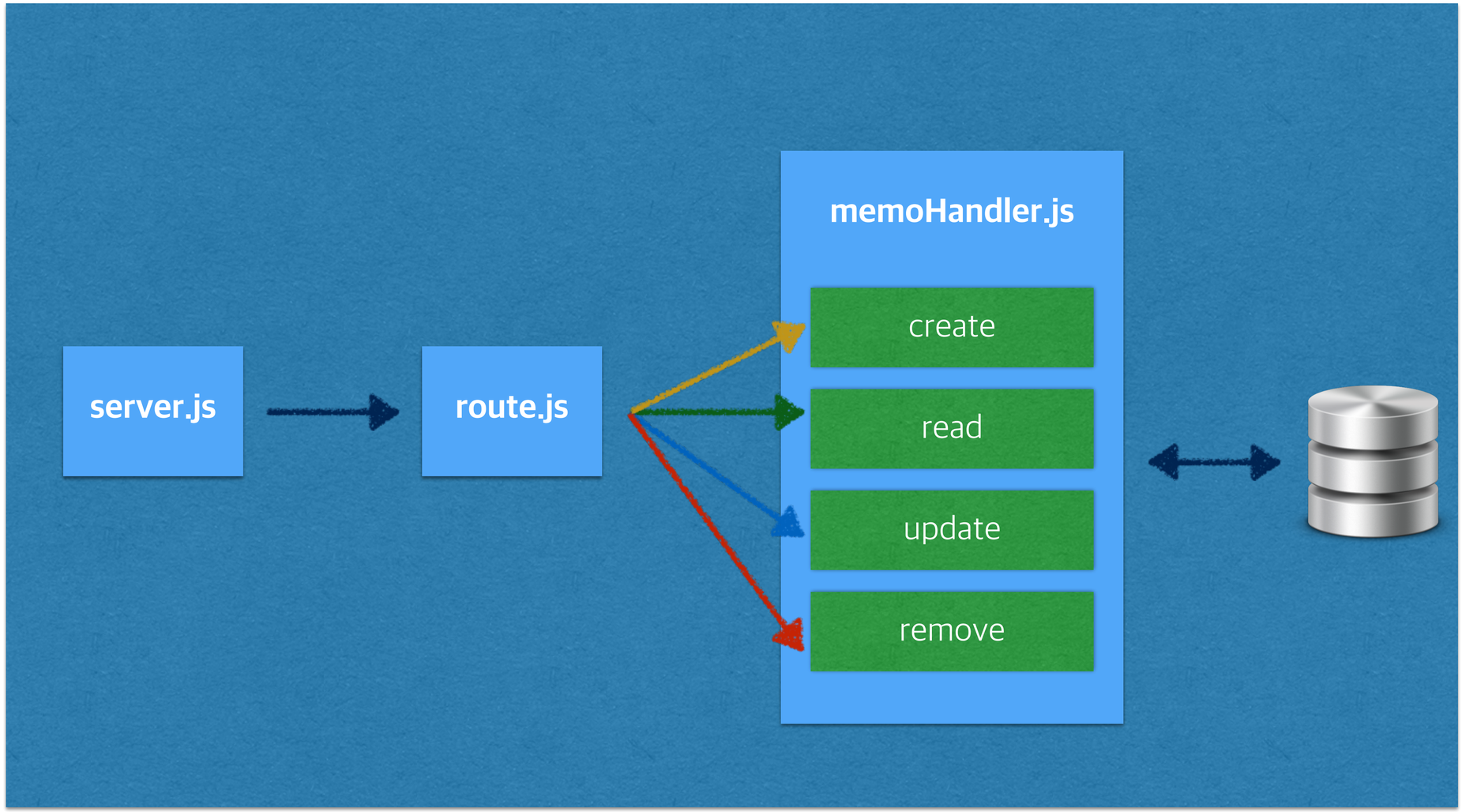
“readmemo"

UPDATE /memo

“updatememo"

DELETE /memo

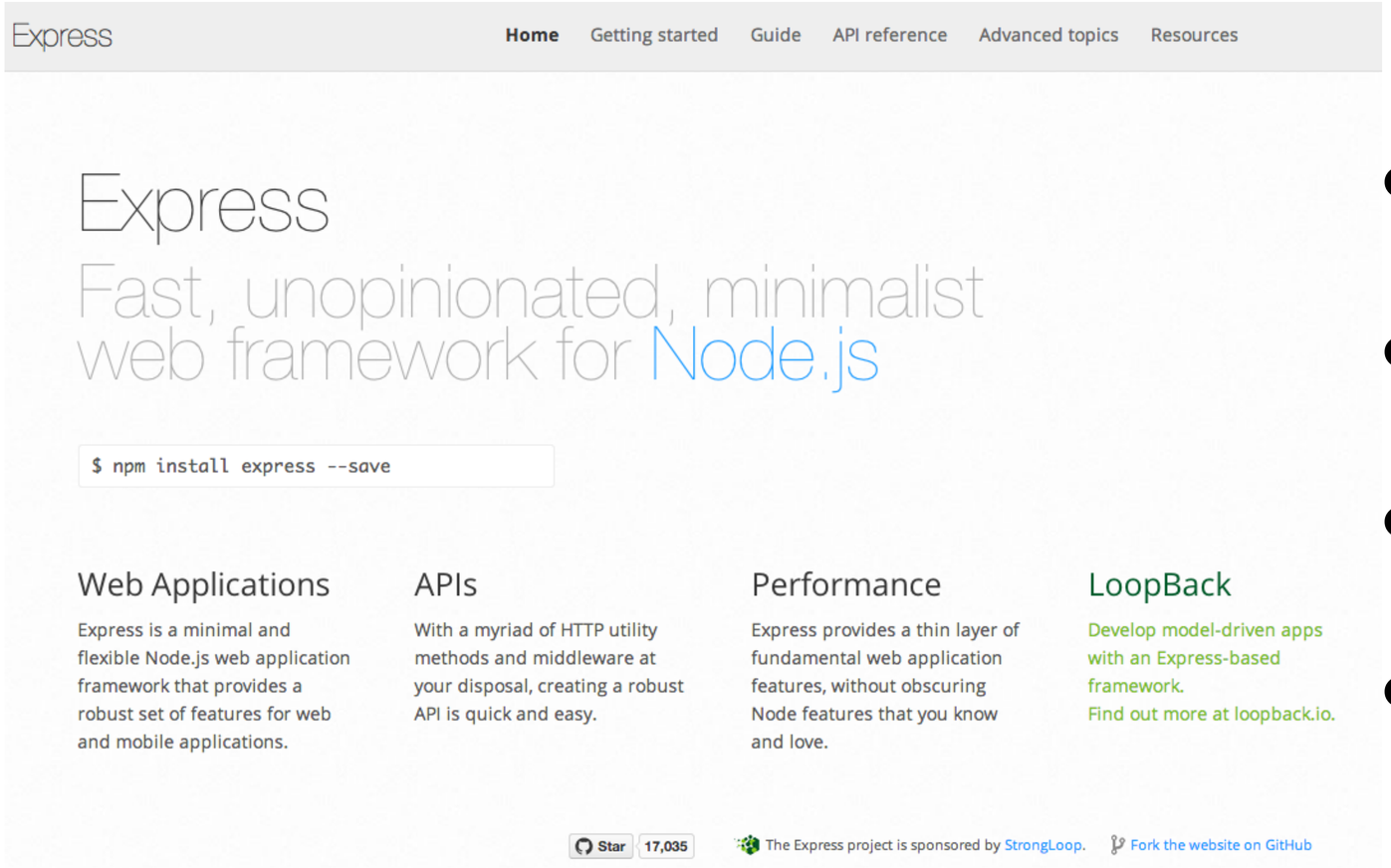
“removememo"



Node.js WS #3

(express)

Node.js WS #3
(express)



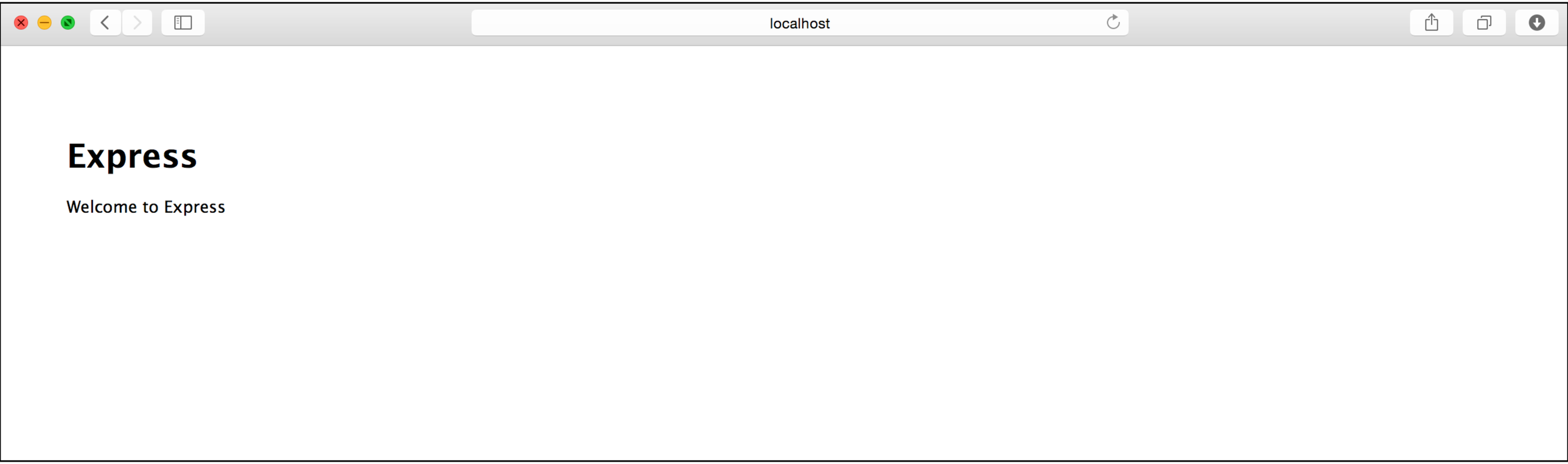
- Web Framework
- Prasing HTTP request
- Managing Session
- Organizing Routes

Node.js WS #3
(express)

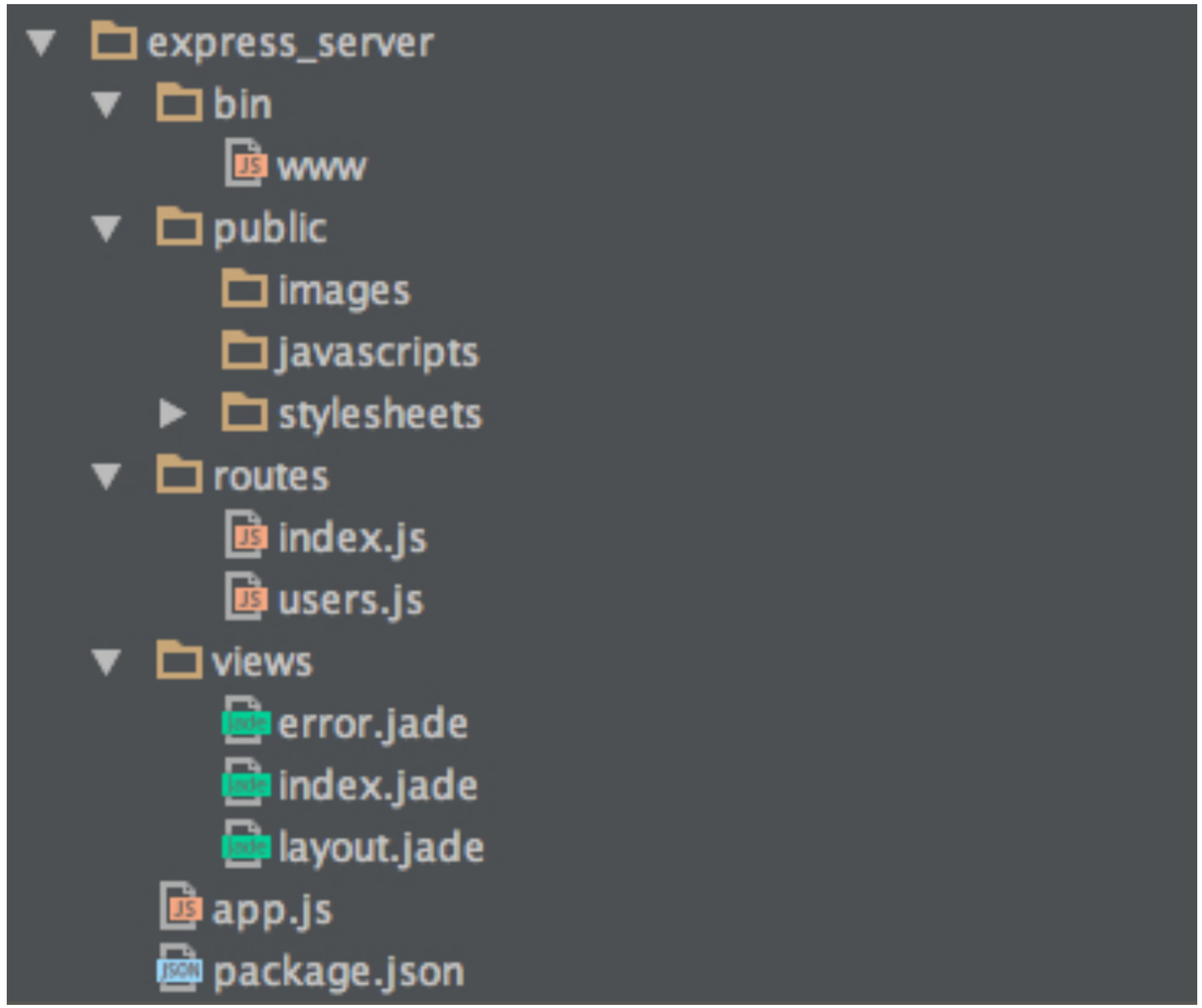
```
$ npm install -g express-generator@4
$ express express_memoserver
$ cd express_memoserver
$ npm install
$ npm start
```

Node.js WS #3
(express)

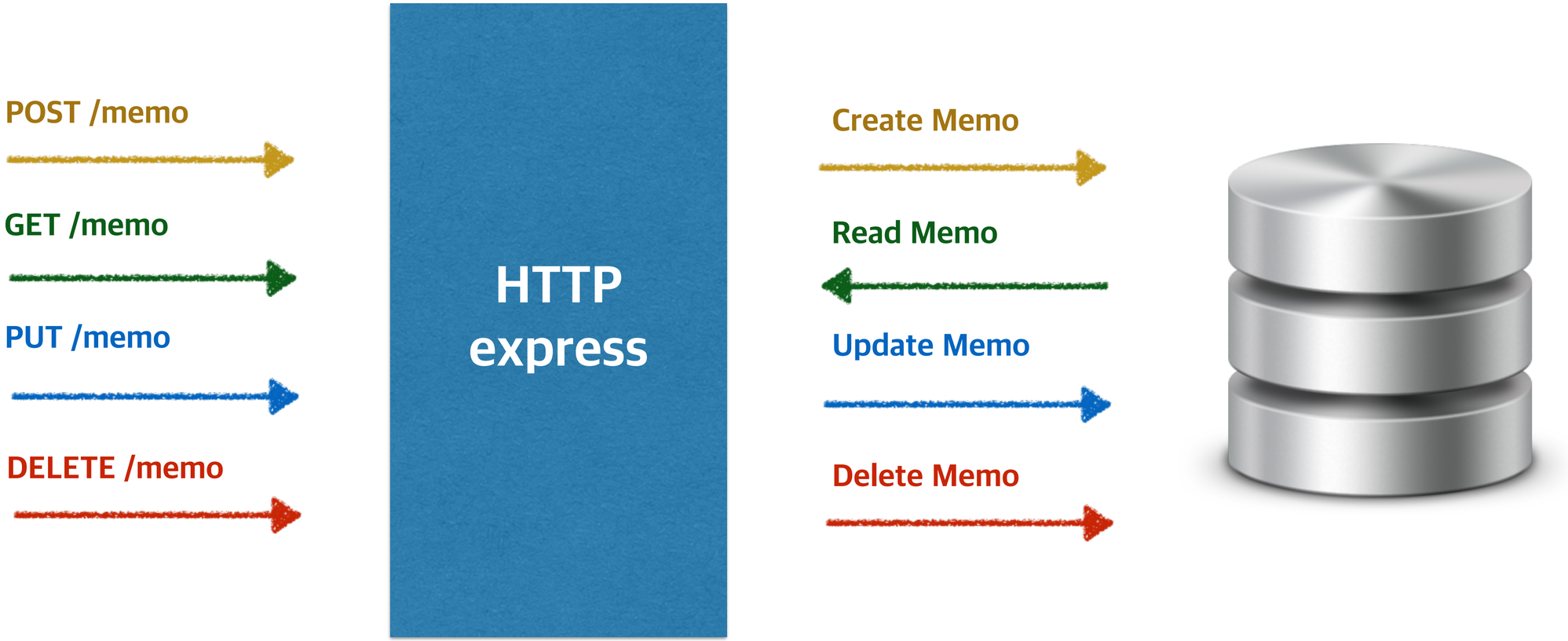
localhost:3000



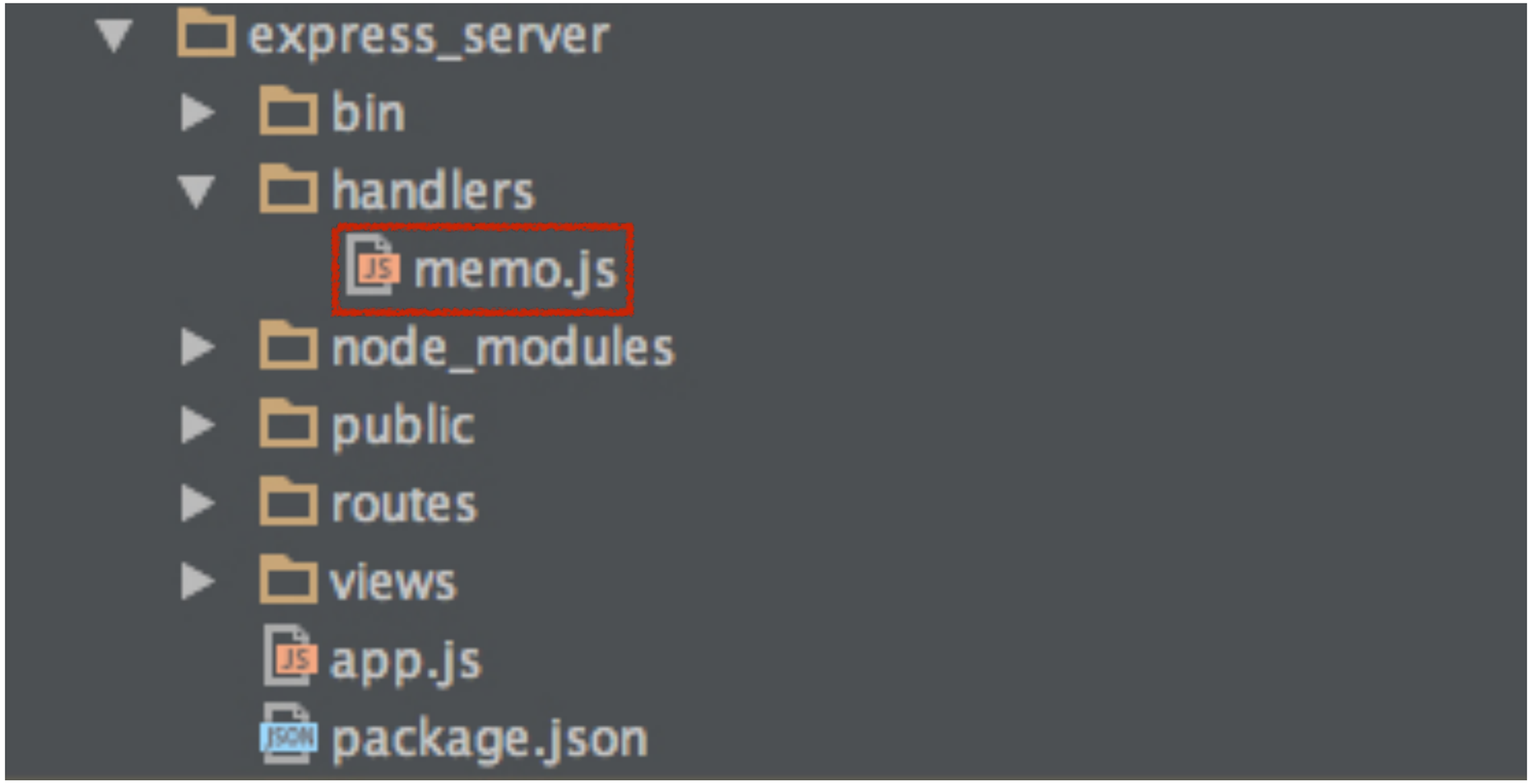
Node.js WS #3
(express - Directory Structure)



Node.js WS #3
(express - memoserver)



Node.js WS #3
(express - handlers/memo.js)



Node.js WS #3
(express- handlers/memo.js(1/2))

```
/** memo.js **/
var Datastore = require('nedb');
var db = new Datastore({ filename: './data/memo', autoload: true });

exports.create = function(req, res) {
    var body = req.body;

    _insertMemo( body , function(error, result) {
        res.json( {error: error, result: result});
    });
};

exports.read = function(req, res) {
    _findMemo({}, function(error, results) {
        res.json( {error: error, results: results});
    });
};

exports.update = function(req, res) {
    var where = req.query;
    var body = req.body;

    _updateMemo(where, body, function(error, results) {
        res.json( {error: error, results: results});
    });
};

exports.remove = function(req, res) {
    var where = req.query;

    _removeMemo(where, function(error, results) {
        res.json( {error: error, results: results});
    });
};

function _insertMemo(body , callback) {
```

Node.js WS #3
(express- handlers/memo.js(2/2))

```
function _insertMemo(body , callback) {
    body = typeof body === 'string' ? JSON.parse(body) : body;

    var memo = {
        author: body.author,
        memo : body.memo,
        date: new Date()
    };

    db.insert(memo, callback);
}

function _findMemo(where, callback) {
    where = where || {};
    db.find(where, callback);
}

function _updateMemo(where, body, callback) {
    db.update(where, {$set: body}, {multi: true}, callback);
}

function _removeMemo(where, callback) {
    db.remove(where, {multi: true}, callback);
}
```

Node.js WS #3
(express - routes/memo.js)

Node.js WS #3
(express - route/memo.js)

```
var express = require('express');
var router = express.Router();
var memo = require('../handlers/memo');

router.post('/', memo.create);

router.get('/', memo.read);

router.put('/', memo.update);

router.delete('/', memo.remove);

module.exports = router;
```

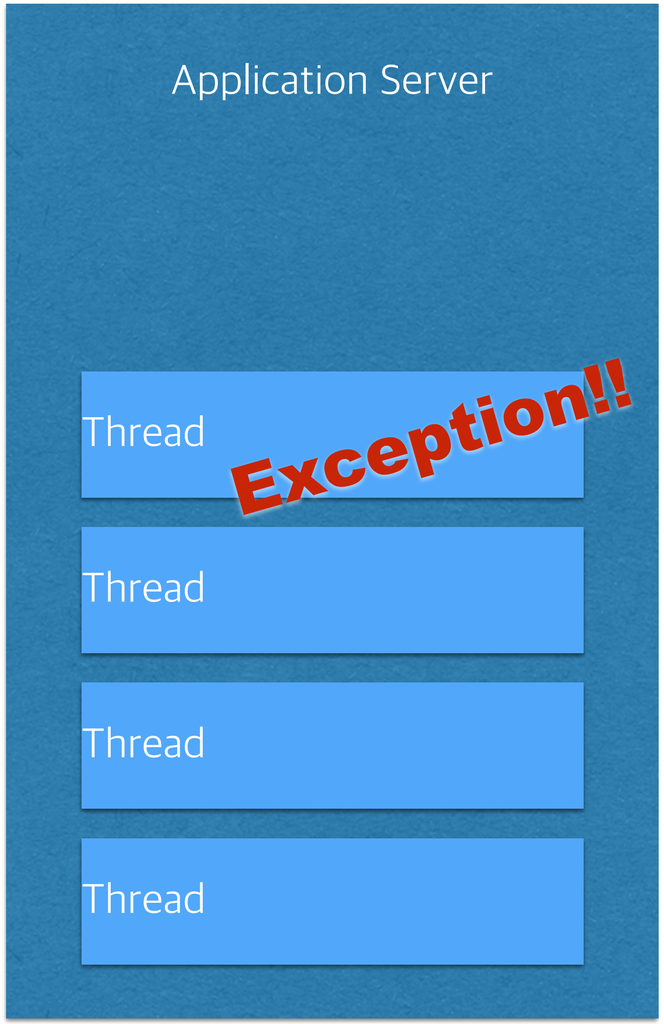
Node.js WS #3
(express - app.js)

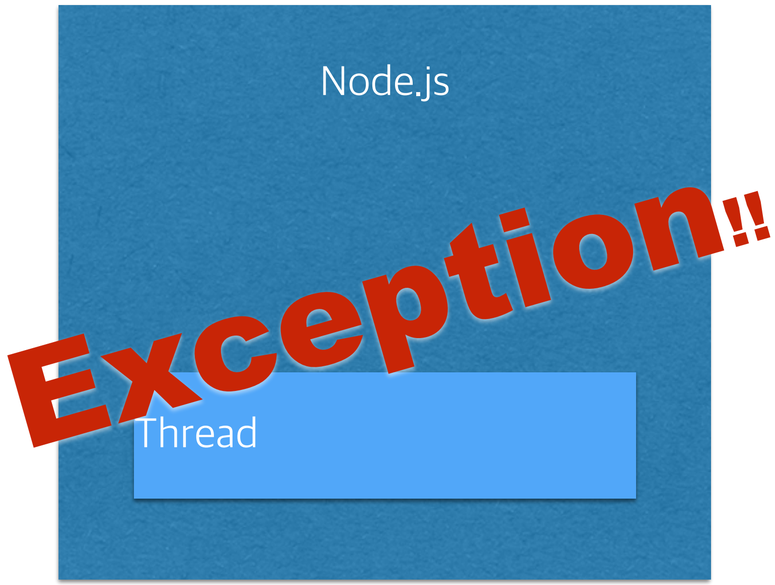
```
var express = require('express');
var path = require('path');
var favicon = require('static-favicon');
var logger = require('morgan');
var cookieParser = require('cookie-parser');
var bodyParser = require('body-parser');

var routes = require('./routes/index');
var users = require('./routes/users');
var memo = require('./routes/memo');


var app = express();

// view engine setup
app.set('views', path.join(__dirname, 'views'));
app.set('view engine', 'jade');

app.use(favicon());
app.use(logger('dev'));
app.use(bodyParser.json());
app.use(bodyParser.urlencoded());
app.use(cookieParser());
app.use(express.static(path.join(__dirname, 'public')));

app.use('/', routes);
app.use('/users', users);
app.use('/memo', memo);


/// catch 404 and forward to error handler
```

Part 3.
Node.JS Production
Leady Go!

- Error handling
- Multi process
- Callback hell
- Logging
- Unit test

Node.js Production Ready
(Error handling)





Node.js Production Ready
(Error handling)

Error handling

- try, catch
- uncaghtException
- domain
- forever / pm2

Node.js Production Ready
(Error handling - uncaughtException)

```
function makeException() {
    throw new Error('Custom Exception!!');
}

setTimeout(function() {
    console.log('Hello');
    setTimeout(function(){
        console.log('Wold');
    }, 1000);
}, 1000);

makeException();

console.log('!!!!');
```

Node.js Production Ready
(Error handling - uncaughtException)

```
process.on('uncaughtException', function(error) {
    console.log('Error ' + error.stack);
});

function makeException() {
    throw new Error('Custom Exception!!');
}

…
```

Node.js Production Ready
(Error handling - uncaughtException)

```
process.on('uncaughtException', function(error) {
    console.log('Error ' + error.stack);
    process.exit(1);
});


function makeException() {
    throw new Error('Custom Exception!!');
}

…
```

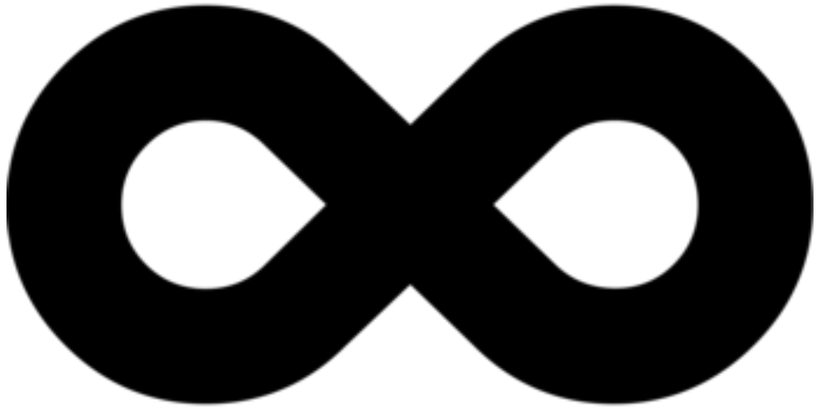
Node.js Production Ready
(Error handling - try,catch)

```
function makeException() {
    throw new Error('Custom Exception!!');
}

setTimeout(function() {
    console.log('Hello');
    setTimeout(function(){
        console.log('Wold');
    }, 1000);
}, 1000);

try{
    makeException();
}catch(err) {
    console.log('try-catch ' + err.stack);
}

console.log('!!!!');
```

Node.js Production Ready
(Error handling - Domain)

```
var domain = require('domain');
var d = domain.create();
var fs = require('fs');

d.on('error', function(err) {
  console.error(err);
});

d.run(function() {
  fs.readFile('somefile.txt', function (err, data) {
    if (err) throw err;
    console.log(data);
  });
});
```

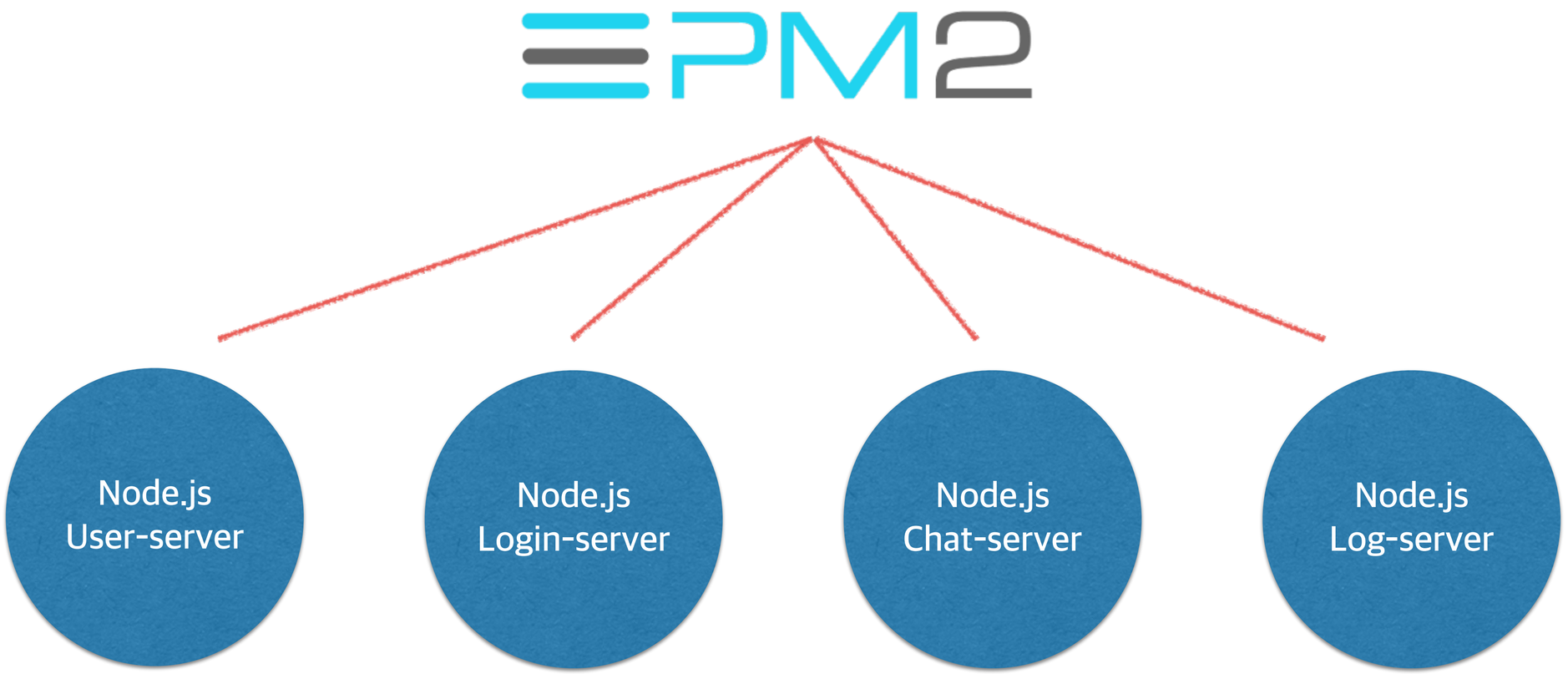
Node.js Production Ready
(Error handling)



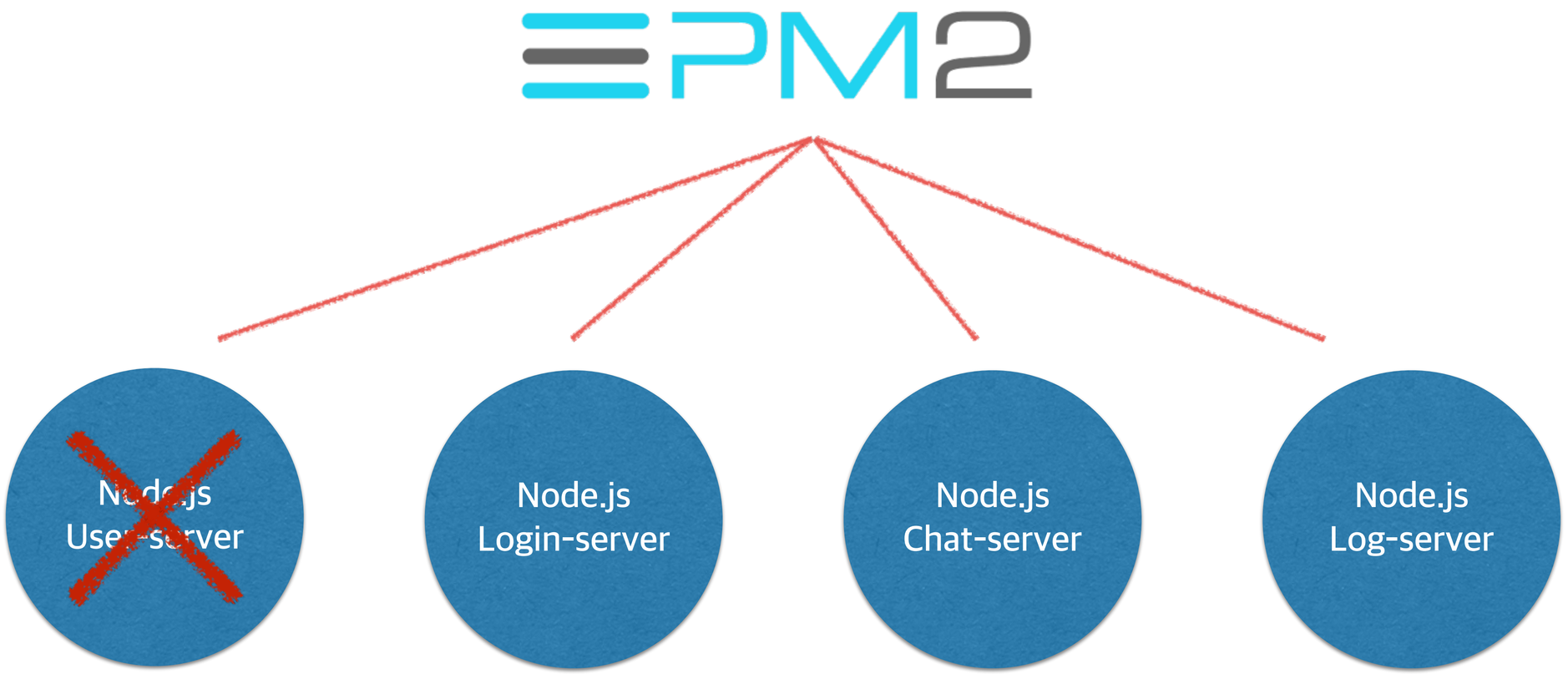
Node.js Production Ready
(Error handling)

PM2 is a production process manager for Node.js applications with a built-in load balancer. It allows you to keep applications alive forever, to reload them without downtime and to facilitate common system admin tasks.

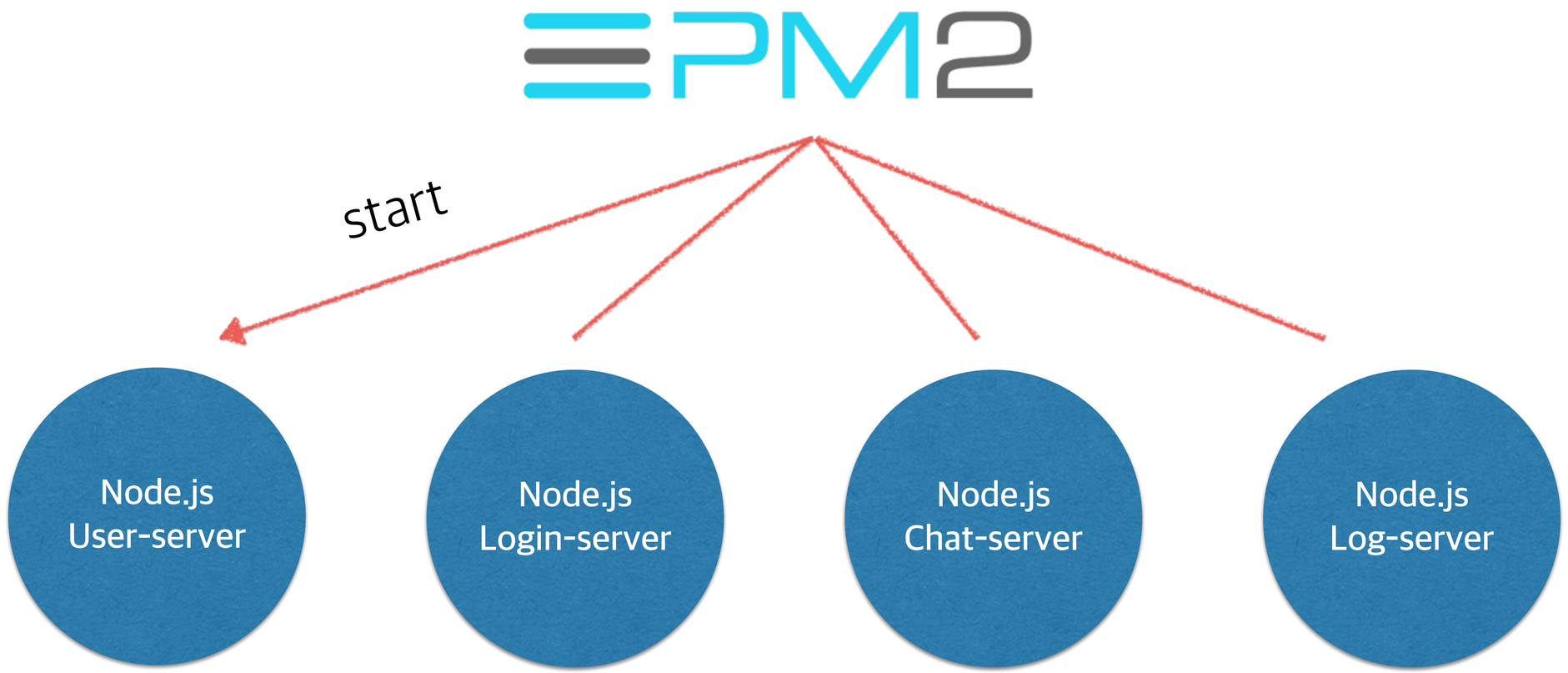
Node.js Production Ready
(Error handling)



Node.js Production Ready
(Error handling)



Node.js Production Ready
(Error handling)



Node.js Production Ready
(Error handling)

```
[tknew:~/Unitech/pm2] master(+84/-121)+* ± pm2 list
PM2  Process listing
```

App Name	id	mode	PID	status	Restarted	Uptime	memory	err logs
bashscript.sh	6	fork	8278	online	0	10s	1.379 MB	/home/tknew/.pm2/logs/bashscript.sh-err.log
checker	5	cluster	0	stopped	0	2m	0 B	/home/tknew/.pm2/logs/checker-err.log
interface-api	3	cluster	7526	online	0	3m	15.445 MB	/home/tknew/.pm2/logs/interface-api-err.log
interface-api	2	cluster	7517	online	0	3m	15.453 MB	/home/tknew/.pm2/logs/interface-api-err.log
interface-api	1	cluster	7512	online	0	3m	15.449 MB	/home/tknew/.pm2/logs/interface-api-err.log
interface-api	0	cluster	7507	online	0	3m	15.449 MB	/home/tknew/.pm2/logs/interface-api-err.log

```
Editing file on Transport
[echokill out (153)] log message from echo auto kill
[echo out (147)] log message from echo.js
[echokill out (154)] log message from echo auto kill
[echo err (1245)] err msg from echo.js
[echo out (148)] log message from echo.js
[echokill out (155)] log message from echo auto kill
[echo out (149)] log message from echo.js
[echokill err (115)] error message, killing my self
[PM2 DAEMON (13)] ["2013-05-29T13:39:43.407Z","Script /home/tknew/Unitech/pm2/examples/echokill.js 166 exited code 255\n"]
[PM2 DAEMON (14)] ["2013-05-29T13:39:43.447Z","/home/tknew/Unitech/pm2/examples/echokill.js - id167 worker online\n"]
[echo err (1246)] err msg from echo.js
[echo out (150)] log message from echo.js
[echokill out (156)] log message from echo auto kill
[echo out (151)] log message from echo.js
[echokill out (157)] log message from echo auto kill
[echo err (1247)] err msg from echo.js
[echo out (152)] log message from echo.js
[echokill out (158)] log message from echo auto kill
```

```
PM2 monitoring :

 ● web-ui                [                    ] 0 %
[5] [cluster_mode]       [                    ] 0 B

 ● check-online          [                    ] 0 %
[4] [fork_mode]          [|||||               ] 1.258 MB

 ● interface-api         [|||||||||||||||||||| ] 73 %
[3] [cluster_mode]       [|||||||||||         ] 35.223 MB

 ● interface-api         [|||||||||||||||||||| ] 78 %
[2] [cluster_mode]       [|||||||||||         ] 35.418 MB

 ● interface-api         [|||||||||||||||||||| ] 90 %
[1] [cluster_mode]       [|||||||||||         ] 35.137 MB

 ● interface-api         [|||||||||||||||||   ] 63 %
[0] [cluster_mode]       [|||||||||||         ] 35.137 MB
```

Node.js Production Ready
(Error handling)

Install PM2

```
$ npm install pm2 -g
```

npm is a builtin CLI when you install Node.js - Installing Node.js with NVM

Node.js 0.11.14 is recommended for cluster mode and reload feature.

Start an application

```
$ pm2 start app.js
$ pm2 start app.js -i max  # Enable load-balancer and cluster features
```

Node.js Production Ready
(Error handling)

```
syntaxfishui-MacBook-Pro:nodejsstudyexample syntaxfish$ pm2 start server.js
[PM2] Process server.js launched
```

App name	id	mode	PID	status	restarted	uptime	memory	watching
server	2	fork	5350	online	0	0s	40.250 MB	disabled

```
 Use `pm2 info <id|name>` to get more details about an app
syntaxfishui-MacBook-Pro:nodejsstudyexample syntaxfish$ kill -9 5350
syntaxfishui-MacBook-Pro:nodejsstudyexample syntaxfish$ pm2 list
```

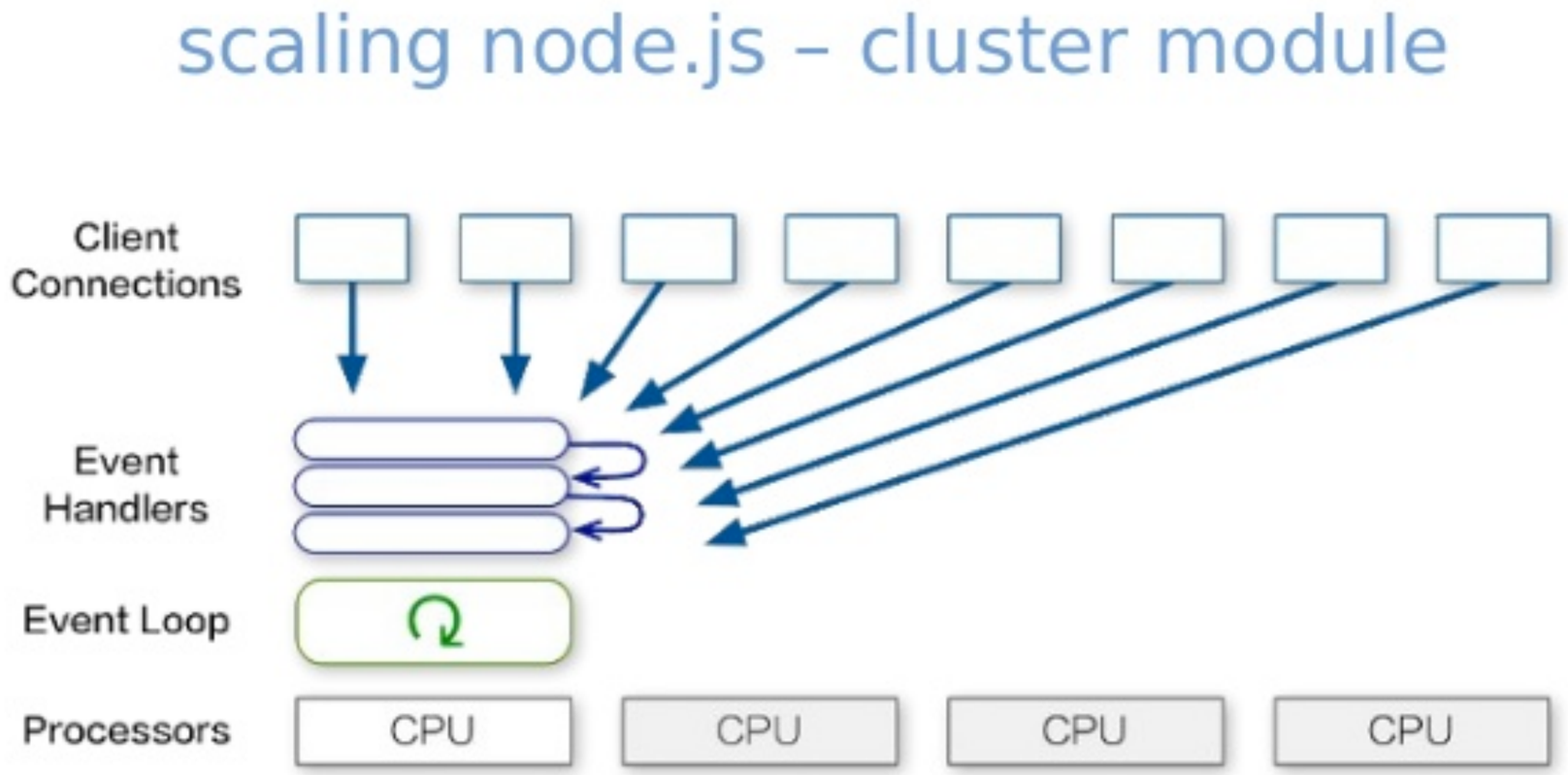
App name	id	mode	PID	status	restarted	uptime	memory	watching
server	2	fork	5353	online	1	4s	156.613 MB	disabled

Node.js Production Ready
(Multi process)

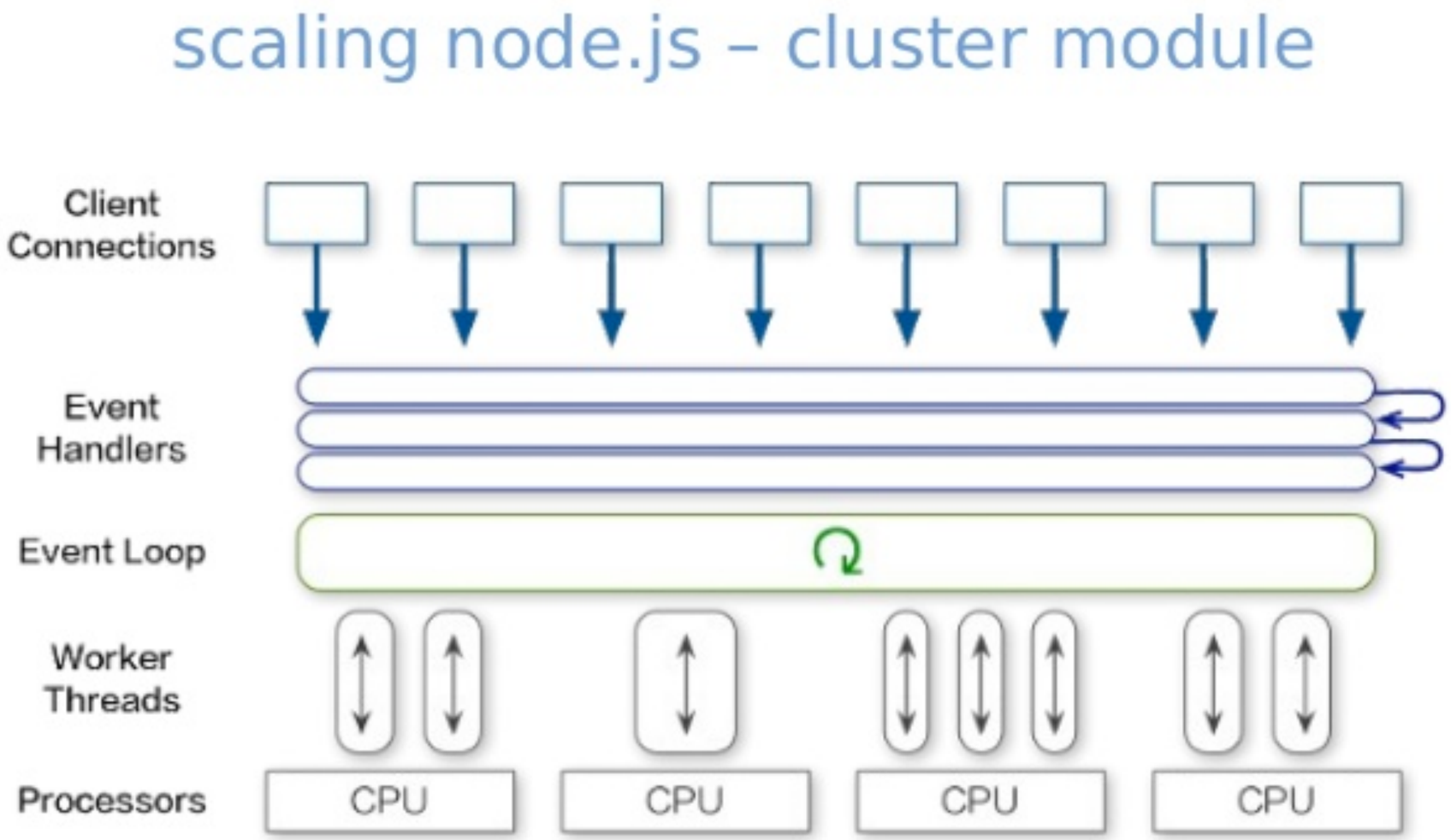
Multi process

- cluster

Node.js Production Ready
(Multi process)



Node.js Production Ready
(Multi process)



Node.js Production Ready
(Multi process)

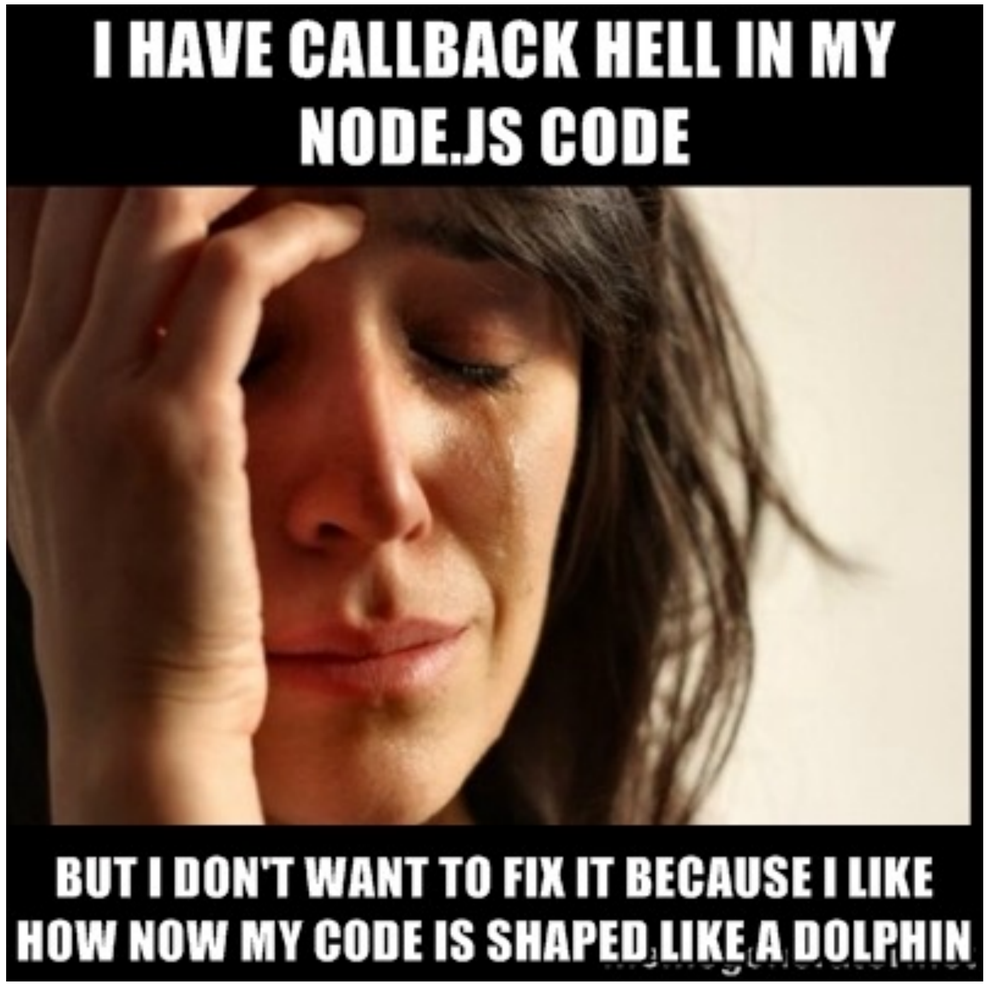
```
var http = require('http');
var cluster = require('cluster');

if( cluster.isMaster ) {
    var cpus = require('os').cpus().length;

    for( var i = 0; i < cpus; i++ ) {
        cluster.fork();
    }
} else {
    function onRequest(req, res) {
        res.writeHead({'Content-type': 'text/plain'});
        res.end('Process on ' + process.pid);

        for( var i = 0; i < 100000; i++ ) {
            console.log('Dummy job');
        }
```

Node.js Production Ready
(Multi process)

```
  };
    var server = http.createServer(onRequest);
    server.listen(8000);
}
```

Node.js Production Ready
(Callback hell)

```
app.get('/some_resources', function (req, res) {
  db.query('SELECT A ...', function (err, a) {
    if (err) return res.end(err);

    db.query('SELECT B ... WHERE a=' + a, function (err, b) {
      if (err) return res.end(err);

      db.query('SELECT C ... WHERE b=' + b, function (err, c) {
        if (err) return res.end(err);

        db.query('SELECT D ... WHERE c=' + c, function (err, d) {
          if (err) return res.end(err);

          res.end(d);
        });
      });
    });
  });
});
```



Node.js Production Ready
(Callback hell)

Callback hell

- async
- promise

Node.js Production Ready
(Callback hell - async)

Async.js

Async is a utility module which **provides straight-forward,** powerful functions for working with asynchronous JavaScript. Although originally designed for use with Node.js and installable via npm install async, it can also be used directly in the browser.

https://github.com/caolan/async

Node.js Production Ready
(Callback hell - async)

Control Flow

- series
- parallel
- parallelLimit
- whilst
- doWhilst
- until
- doUntil
- forever
- waterfall
- compose
- seq
- applyEach
- applyEachSeries
- queue

- queue
- priorityQueue
- cargo
- auto
- retry
- iterator
- apply
- nextTick
- times
- timesSeries

Node.js Production Ready
(Callback hell)

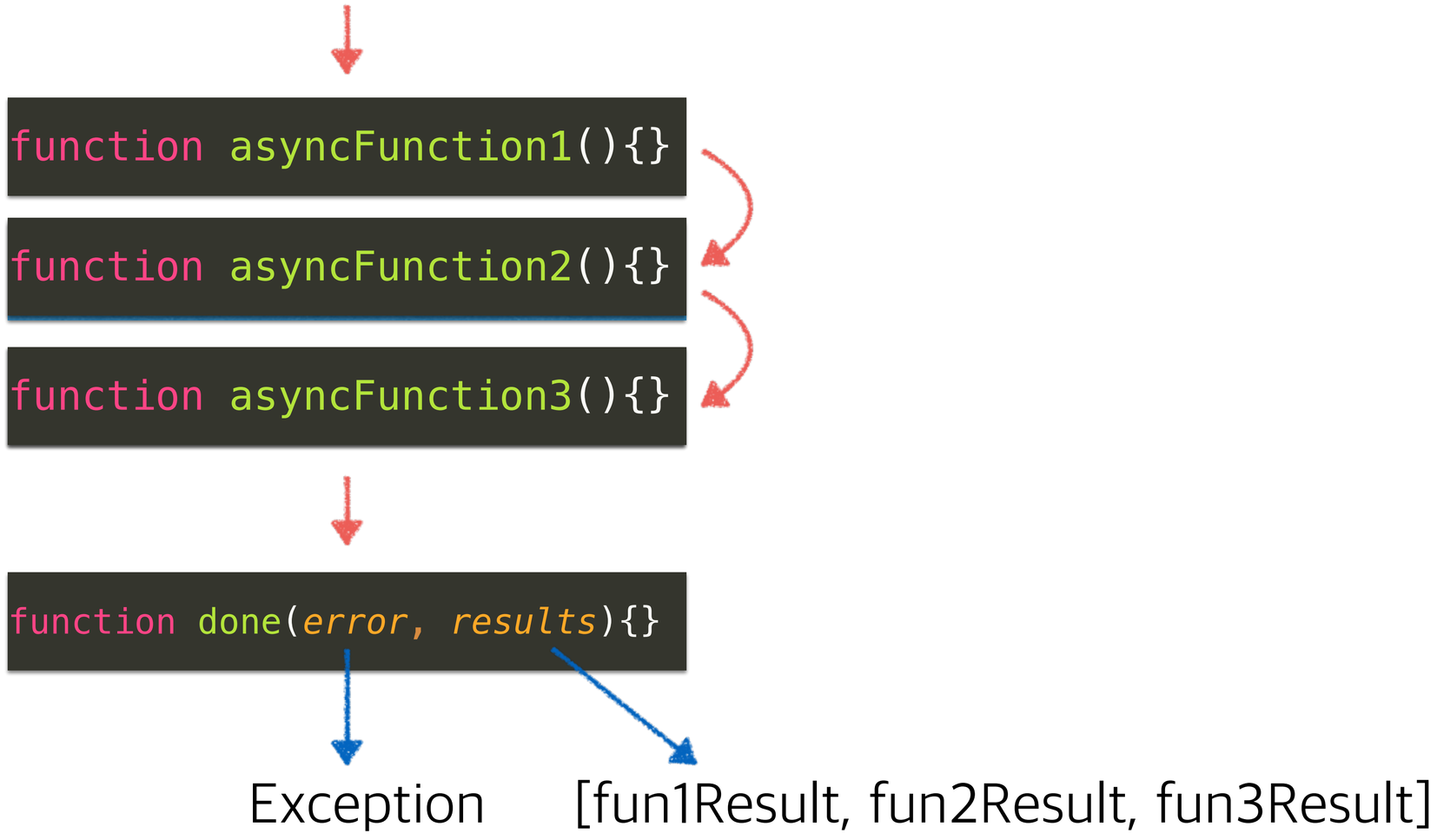
```
asyncFunction1(function(error, results) {
    asyncFunction2(function(error, results) {
        asyncFunction3(function(error, results) {
            done(error, results);
        });
    });
});
```

Node.js Production Ready
(Callback hell - async.series)

```
var async = require('async');

async.series([
    function asyncFunction1(cb) {
        setTimeout(function(){
            console.log('asyncFunction1');
            cb(null, 'asyncFunction1');
        }, 1000);
    },
    function asyncFunction2(cb) {
        console.log('asyncFunction2');
        cb(null, 'asyncFunction2');
    },
    function asyncFunction3(cb) {
        console.log('asyncFunction3');
        cb(null, 'asyncFunction3');
    }
], function done(error, results) {
    console.log('error: ', error);
    console.log('results: ', results);
});
```

Node.js Production Ready

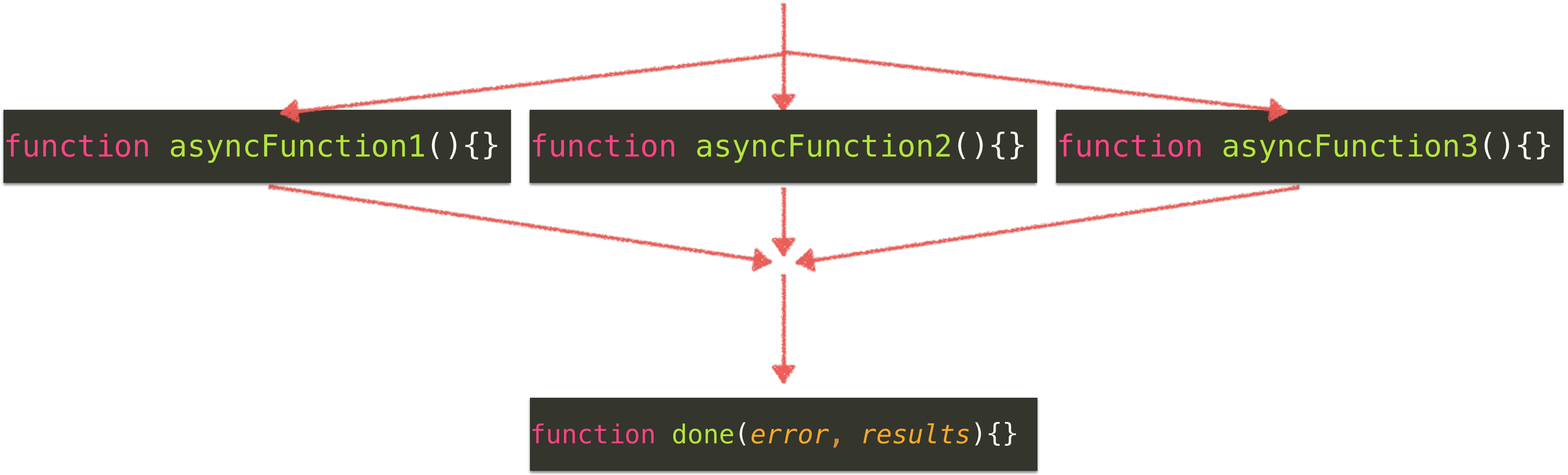
(Callback hell - async.series)



Node.js Production Ready
(Callback hell - async.parallel)

```
var async = require('async');

async.parallel([
    function asyncFunction1(cb) {
        setTimeout(function(){
            console.log('asyncFunction1');
            cb(null, 'asyncFunction1');
        }, 1000);
    },
    function asyncFunction2(cb) {
        console.log('asyncFunction2');
        cb(null, 'asyncFunction2');
    },
    function asyncFunction3(cb) {
        console.log('asyncFunction3');
        cb(null, 'asyncFunction3');
    }
], function done(error, results) {
    console.log('error: ', error);
    console.log('results: ', results);
});
```

Node.js Production Ready
(Callback hell - async.parallel)

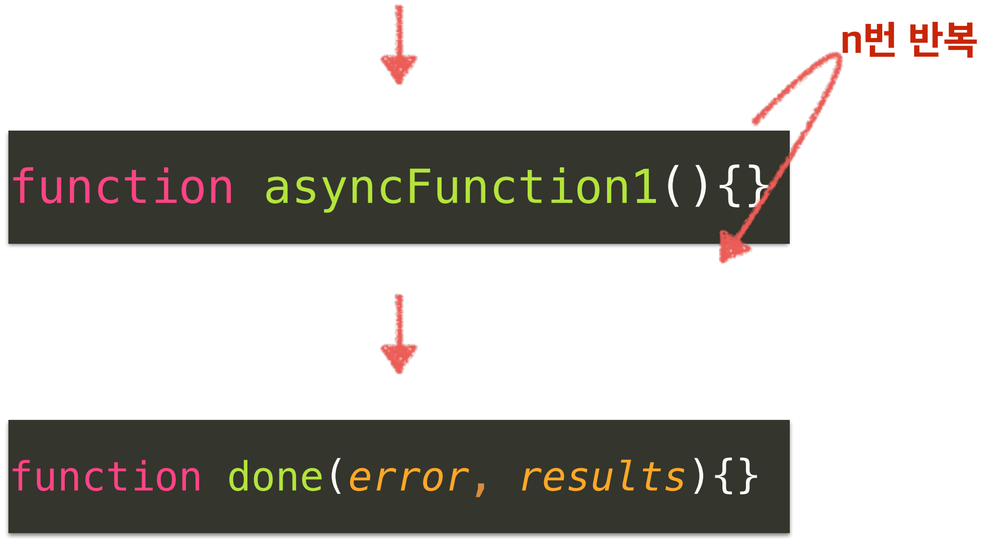


Node.js Production Ready
(Callback hell - async.times)

```
var async = require('async');

async.times(5, function asyncFunction(n, next) {
    console.log('[%d] asyncFunction', n);
    next(null, 'asyncFunction' + n);
},function done(error, results) {
    console.log('error: ', error);
    console.log('results: ', results);
});
```

Node.js Production Ready

(Callback hell - async.times)

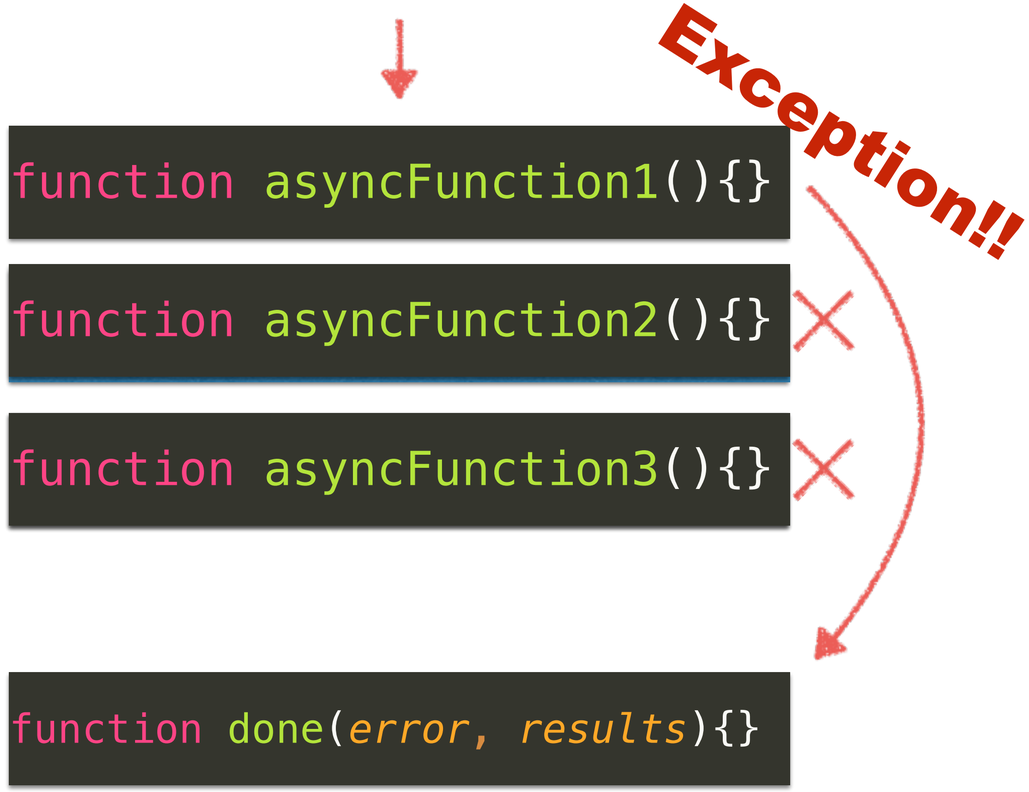


Node.js Production Ready
(Callback hell - async.series)

```
var async = require('async');

async.series([
    function asyncFunction1(cb) {
        setTimeout(function(){
            console.log('asyncFunction1');
            cb(new Error('timeout'), 'asyncFunction1');
        }, 1000);
    },
    function asyncFunction2(cb) {
        console.log('asyncFunction2');
        cb(null, 'asyncFunction2');
    },
    function asyncFunction3(cb) {
        console.log('asyncFunction3');
        cb(null, 'asyncFunction3');
    }
], function done(error, results) {
    console.log('error: ', error);
    console.log('results: ', results);
});
```

Node.js Production Ready

(Callback hell - async.series)



Node.js Production Ready
(Event logging)

Event logging

- winston

Node.js Production Ready
(Event logging - winston)

winston

Winston is designed to be a **simple and universal logging library** with support for multiple transports. A transport is essentially a storage device for your logs. Each instance of a winston logger **can have multiple transports configured at different levels**. For example, one may want error logs to be stored in a persistent remote location (like a database), but all logs output to the console or a local file.

https://github.com/flatiron/winston

Node.js Production Ready
(Event logging - winston)

Installation

```
npm install winston
```

Node.js Production Ready
(Event logging - winston#1)

```
var winston = require('winston');

winston.log('info', 'Hello distributed log files!');
winston.info('Hello again distributed logs');
```

Node.js Production Ready
(Event logging - winston#2)

```
var winston = require('winston');
var Logger = winston.Logger;
var File  = winston.transports.File;
var Console = winston.transports.Console;


var options = {
    levels: {
        info: 0,
        normal: 1,
        minor: 2,
        critical: 3
    },
    colors: {
        info: 'green',
        normal: 'blue',
        minor: 'yellow',
        critical: 'red'
    },
```

Node.js Production Ready
(Event logging - winston#2)

```
  },
    transports: [
        new File({
            name : 'log-file',
            filename: 'log-file.log',
            level: 'info'
        }),
        new Console({
            level: 'critical',
            colorize: true
        })
    ]
};
var logger = new Logger(options);
logger.info('info!!');
logger.normal('normal!!');
logger.minor('minor!!');
logger.critical('critical!!');
```

Q&A