Thomas Watson

@wa7son

github.com/watson

Thomas Watson

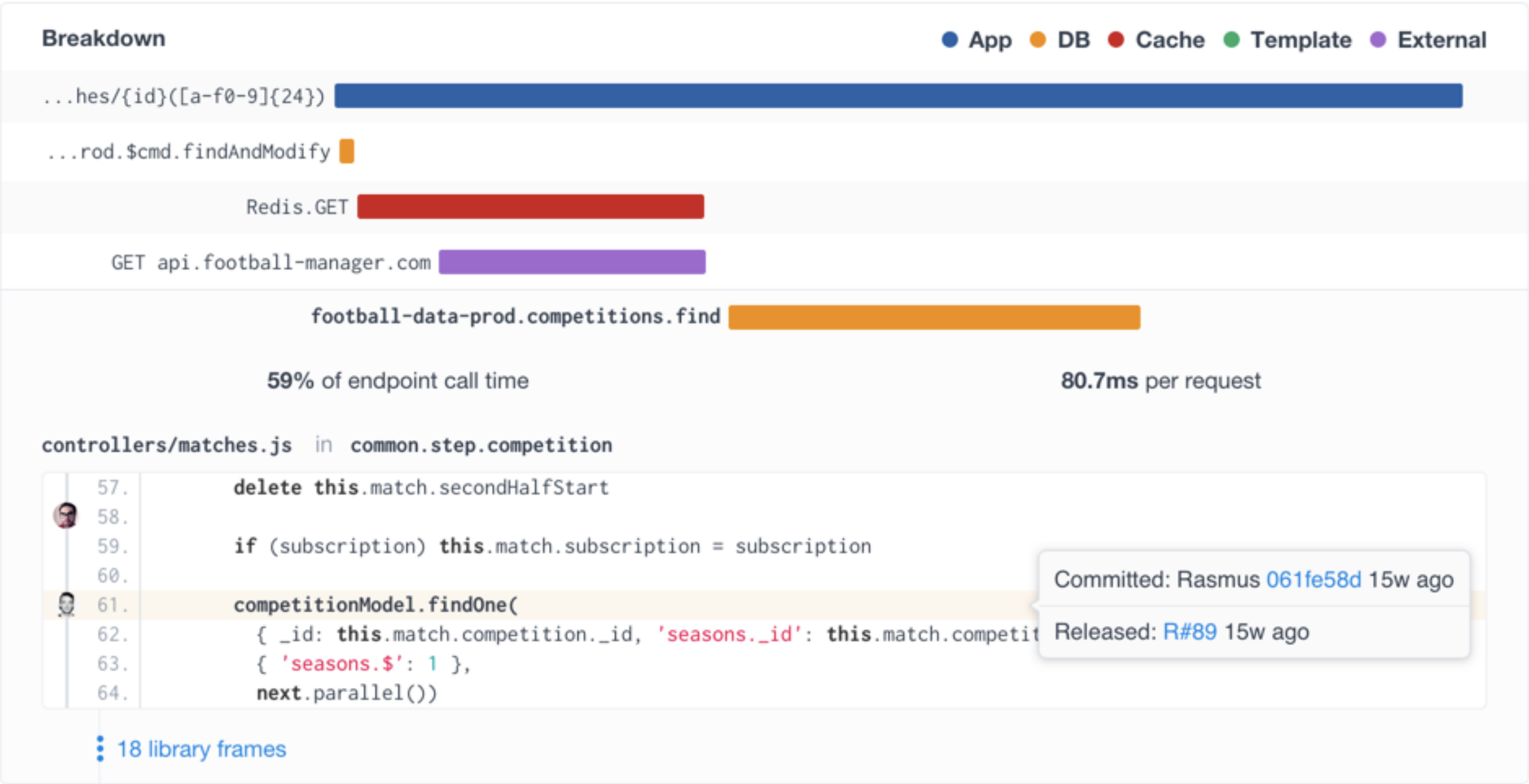
@wa7son

github.com/watson

opbeat

Detailed activity breakdown

Simple performance breakdown that shows you where your app needs optimizing, like SQL queries, MongoDB queries, http requests to other services, etc.



JSpbeat

Instrumenting Node.js in production

HTTP Request lifetime

HTTP Request lifetime

Normal solutions

- Use a global or singleton object to store context

Normal solutions

- ~~Use a global or singleton object to store context~~
- Pass a context object around between function calls

Normal solutions

- ~~Use a global or singleton object to store context~~
- ~~Pass a context object around between function calls~~
- ???

Goals

- Track HTTP request as transactions
- Instrument I/O
- Instrument potential CPU expensive operations
- Associate exceptions with transactions
- Don’t manually pass context around in the app
- Plug’n’play
- Almost no overhead

Problems

- Multiple HTTP requests active at the same time
- Not possible to associate exceptions with origin HTTP request
- No API to pass context across the async boundary

Problems

- Multiple HTTP requests active at the same time
- Not possible to associate exceptions with origin HTTP request
- No API to pass context across the async boundary

Solution

1. Record context when a callback is queued on the event loop
2. Restore context when the callback is de-queued from the event loop

Solution

```
global.currentTransaction = new Transaction(req)
```

1. Record context when a callback is queued on the event loop
2. Restore context when the callback is de-queued from the event loop

Solution

global.currentTransaction = new Transaction(req)

1. Record context when a callback is queued on the event loop
2. Restore context when the callback is de-queued from the event loop

global.currentTransaction

Patch the core

- Patch the HTTP server to access new requests
- Patch **every** async operation
  - timers
  - process.nextTick
  - Promise (native)
  - libuv
- Patch Module._load

Patch the core

- Patch the HTTP server to access new requests
- Patch **every** async operation
  - timers
  - process.nextTick
  - Promise (native)
  - libuv
- Patch Module._load

AsyncWrap

https://github.com/nodejs/tracing-wg

```
var asyncWrap = process.binding('async_wrap')
```

```
var asyncWrap = process.binding('async_wrap')

asyncWrap.setupHooks({init, pre, post, destroy})
asyncWrap.enable()
```

```
var asyncWrap = process.binding('async_wrap')

asyncWrap.setupHooks({init, pre, post, destroy})
asyncWrap.enable()

function init (uid, provider, parentUid, parentHandle) {
  log('async_wrap: init')
}
function pre (uid) {
  log('async_wrap: pre')
}
function post (uid) {
  log('async_wrap: post')
}
function destroy (uid) {
  log('async_wrap: destroy')
}
```

```
function post (uid) {
  log('async_wrap: post')
}
function destroy (uid) {
  log('async_wrap: destroy')
}

var fs = require('fs')

log('user: before')
fs.open(__filename, 'r', function (err, fd) {
  log('user: done')
})
log('user: after')
```

```
var asyncWrap = process.binding('async_wrap')

asyncWrap.setupHooks({init, pre, post, destroy})
asyncWrap.enable()

function init (uid, provider, parentUid, parentHandle) {
  log('async_wrap: init')
}
function pre (uid) {
  log('async_wrap: pre')
}
function post (uid) {
  log('async_wrap: post')
}
function destroy (uid) {
  log('async_wrap: destroy')
}

var fs = require('fs')

log('user: before')
fs.open(__filename, 'r', function (err, fd) {
  log('user: done')
})
log('user: after')
```

```
user: before
async_wrap: init
user: after
async_wrap: pre
user: done
async_wrap: post
async_wrap: destroy
```

```
var asyncWrap = process.binding('async_wrap')

asyncWrap.setupHooks({init, pre, post, destroy})
asyncWrap.enable()

function init (uid, provider, parentUid, parentHandle) {
  console.log('async_wrap: init')
}
function pre (uid) {
  console.log('async_wrap: pre')
}
function post (uid) {
  console.log('async_wrap: post')
}
function destroy (uid) {
  console.log('async_wrap: destroy')
}

var fs = require('fs')

console.log('user: before')
fs.open(__filename, 'r', function (err, fd) {
  console.log('user: done')
})
console.log('user: after')
```

```
var asyncWrap = process.binding('async_wrap')

asyncWrap.setupHooks({init, pre, post, destroy})
asyncWrap.enable()

function init (uid, provider, parentUid, parentHandle) {
  console.log('async_wrap: init')
}
function pre (uid) {
  console.log('async_wrap: pre')
}
fun
  c
}
function destroy (uid) {
  console.log('async_wrap: destroy')
}

var fs = require('fs')

console.log('user: before')
fs.open(__filename, 'r', function (err, fd) {
  console.log('user: done')
})
console.log('user: after')
```

```
FATAL ERROR: node::AsyncWrap::AsyncWrap init hook threw
```

```
fs.writeSync(1, util.format('%s\n', msg))
```

```
fs.writeSync(1, util.format('%s\n', msg))

process._rawDebug(msg)
```

```
var asyncWrap = process.binding('async_wrap')

asyncWrap.setupHooks({init, pre, post, destroy})
asyncWrap.enable()

function init (uid, provider, parentUid, parentHandle) {
  process._rawDebug('async_wrap: init')
}
function pre (uid) {
  process._rawDebug('async_wrap: pre')
}
function post (uid) {
  process._rawDebug('async_wrap: post')
}
function destroy (uid) {
  process._rawDebug('async_wrap: destroy')
}

var fs = require('fs')

process._rawDebug('user: before')
fs.open(__filename, 'r', function (err, fd) {
  process._rawDebug('user: done')
})
process._rawDebug('user: after')
```

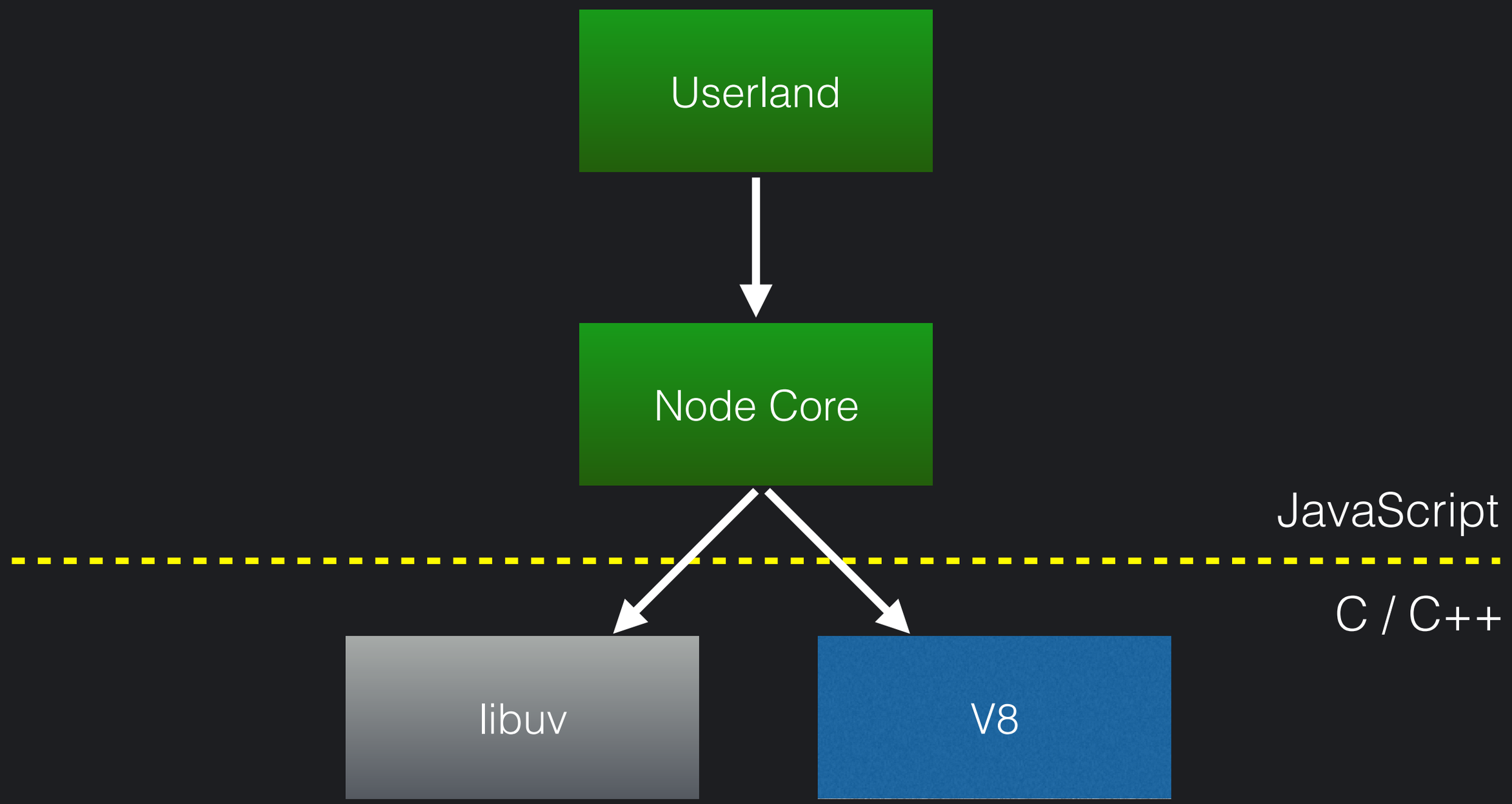
```
user: before
async_wrap: init
user: after
async_wrap: pre
user: done
async_wrap: post
async_wrap: destroy
```

```
function init (uid, provider, parentUid, parentHandle) {
  // this         => current handle
  // uid          => 1, 2, 3...
  // provider     => 0 - 23 (asyncWrap.Providers)
  // parentUid    => 1, 2, 3...
  // parentHandle => parent `this`
}
```

```
> var asyncWrap = process.binding('async_wrap')
undefined
> asyncWrap.Providers
{ NONE: 0,
  CRYPTO: 1,
  FSEVENTWRAP: 2,
  FSREQWRAP: 3,
  GETADDRINFOREQWRAP: 4,
  GETNAMEINFOREQWRAP: 5,
  HTTPPARSER: 6,
  JSSTREAM: 7,
  PIPEWRAP: 8,
  PIPECONNECTWRAP: 9,
  PROCESSWRAP: 10,
  QUERYWRAP: 11,
  SHUTDOWNWRAP: 12,
  SIGNALWRAP: 13,
  STATWATCHER: 14,
  TCPWRAP: 15,
  TCPCONNECTWRAP: 16,
  TIMERWRAP: 17,
  TLSWRAP: 18,
  TTYWRAP: 19,
  UDPWRAP: 20,
  UDPSENDWRAP: 21,
  WRITEWRAP: 22,
  ZLIB: 23 }
```

```
function init (uid, provider, parentUid, parentHandle) {
  // this         => current handle
  // uid          => 1, 2, 3...
  // provider     => 0 - 23 (asyncWrap.Providers)
  // parentUid    => 1, 2, 3...
  // parentHandle => parent `this`
}
```

Handle Objects



Handle Objects

```
const TCPConnectWrap = process.binding('tcp_wrap').TCPConnectWrap;
const TCP = process.binding('tcp_wrap').TCP;

const req = new TCPConnectWrap();
req.oncomplete = oncomplete;
req.address = address;
req.port = port;

const socket = new TCP();
socket.onread = onread;
socket.connect(req, address, port);

// later
socket.destroy();
```

net.connect

Handle Objects

```
const TCPConnectWrap = process.binding('tcp_wrap').TCPConnectWrap;
const TCP = process.binding('tcp_wrap').TCP;

const req = new TCPConnectWrap();
req.oncomplete = oncomplete;
req.address = address;
req.port = port;

const socket = new TCP();
socket.onread = onread;
socket.connect(req, address, port);

// later
socket.destroy();
```

req === this

socket === this

net.connect

Timers

```
log('user: before #1')
setTimeout(function () {
  log('user: done #1')
}, 2000)
log('user: after #1')

log('user: before #2')
setTimeout(function () {
  log('user: done #2')
}, 2000)
log('user: after #2')
```

Timers

```
log('user: before #1')
setTimeout(function () {
  log('user: done #1')
}, 2000)
log('user: after #1')

log('user: before #2')
setTimeout(function () {
  log('user: done #2')
}, 2000)
log('user: after #2')
```

```
user: before #1
async_wrap: init
user: after #1
user: before #2
user: after #2
```

Timers

```
log('user: before #1')
setTimeout(function () {
  log('user: done #1')
}, 2000)
log('user: after #1')

log('user: before #2')
setTimeout(function () {
  log('user: done #2')
}, 2000)
log('user: after #2')
```

```
user: before #1
async_wrap: init
user: after #1
user: before #2
user: after #2

async_wrap: pre
user: done #1
user: done #2
async_wrap: post
async_wrap: destroy
```

Show some real code

AsyncWrap Gotchas

- Handle creation time
- console.log
- process.nextTick
- Timers
- Promises
- Multiple AsyncWrap’s

ES6 Modules

Slides & Code

github.com/watson/talks

Takk!

@wa7son

github.com/watson

opbeat