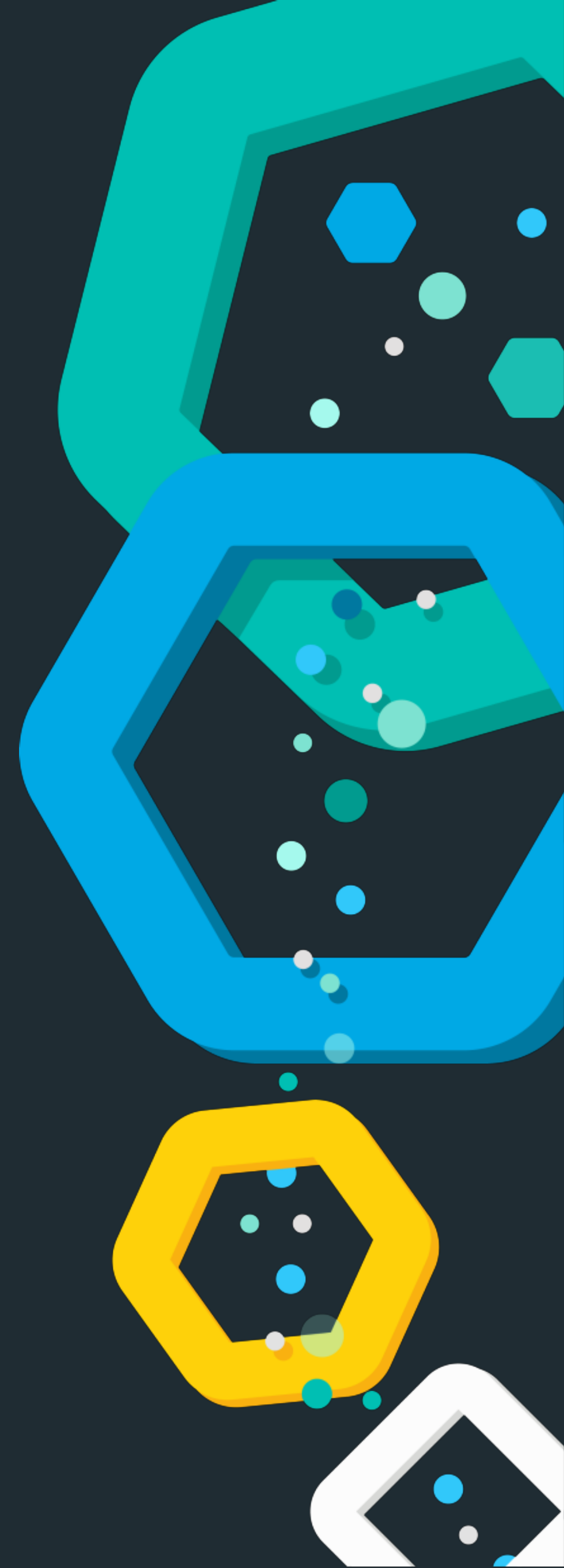




Standards in Distributed Tracing

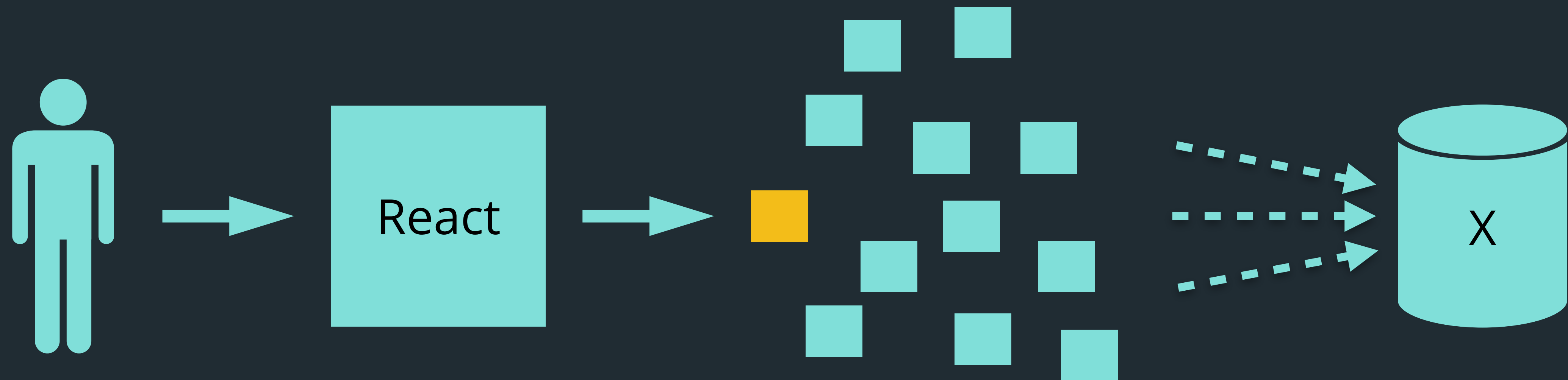
Thomas Watson
March 2019



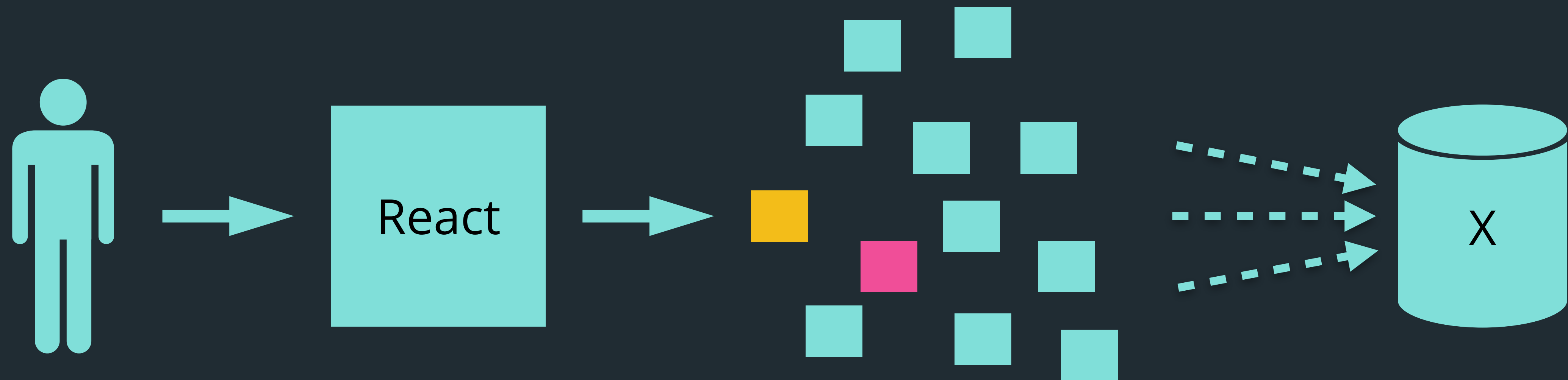
Agenda

- Distributed Tracing overview
- TraceContext
- OpenTracing
- OpenCensus

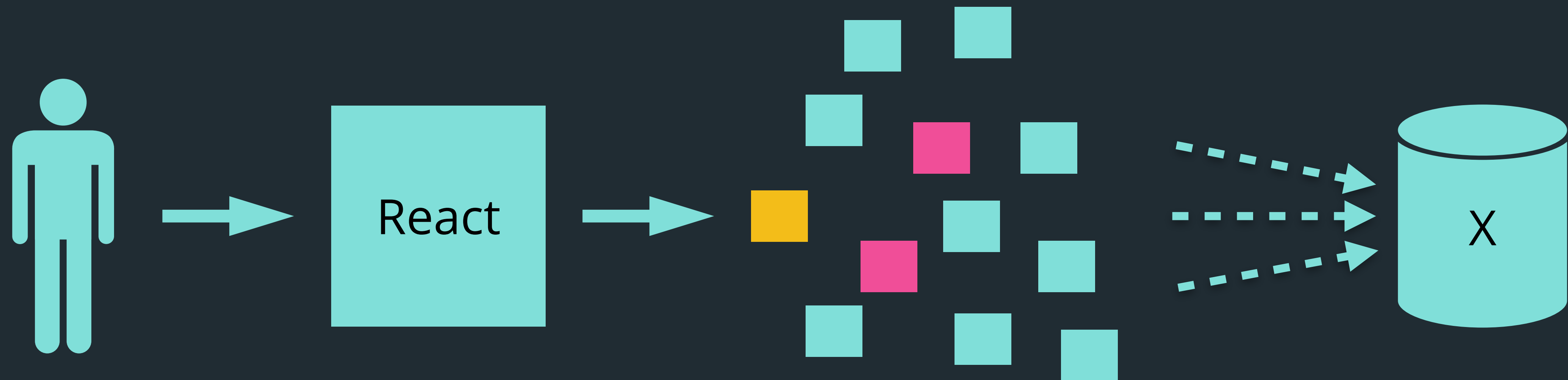
Tracing Microservices



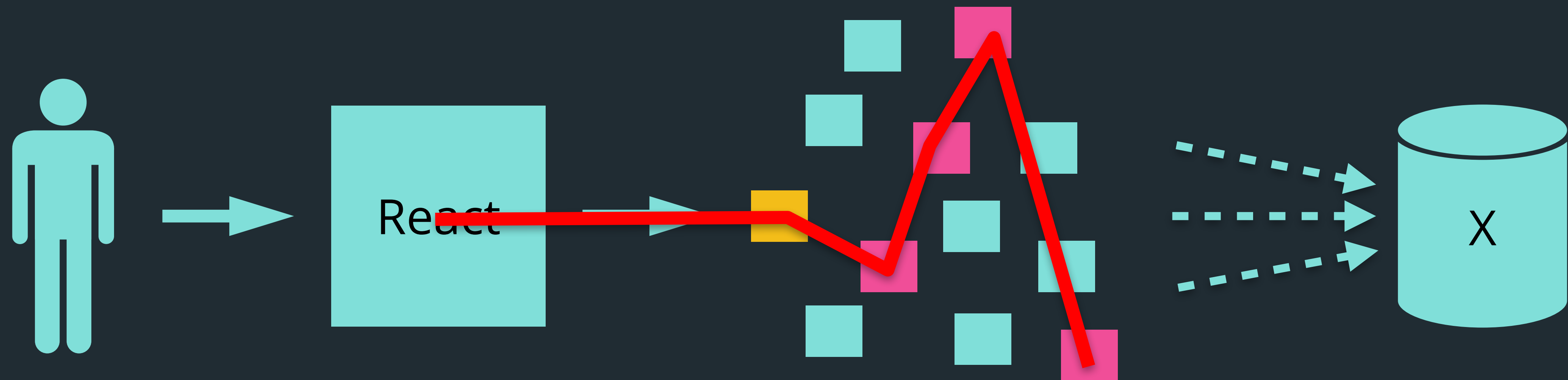
Tracing Microservices



Tracing Microservices



Tracing Microservices

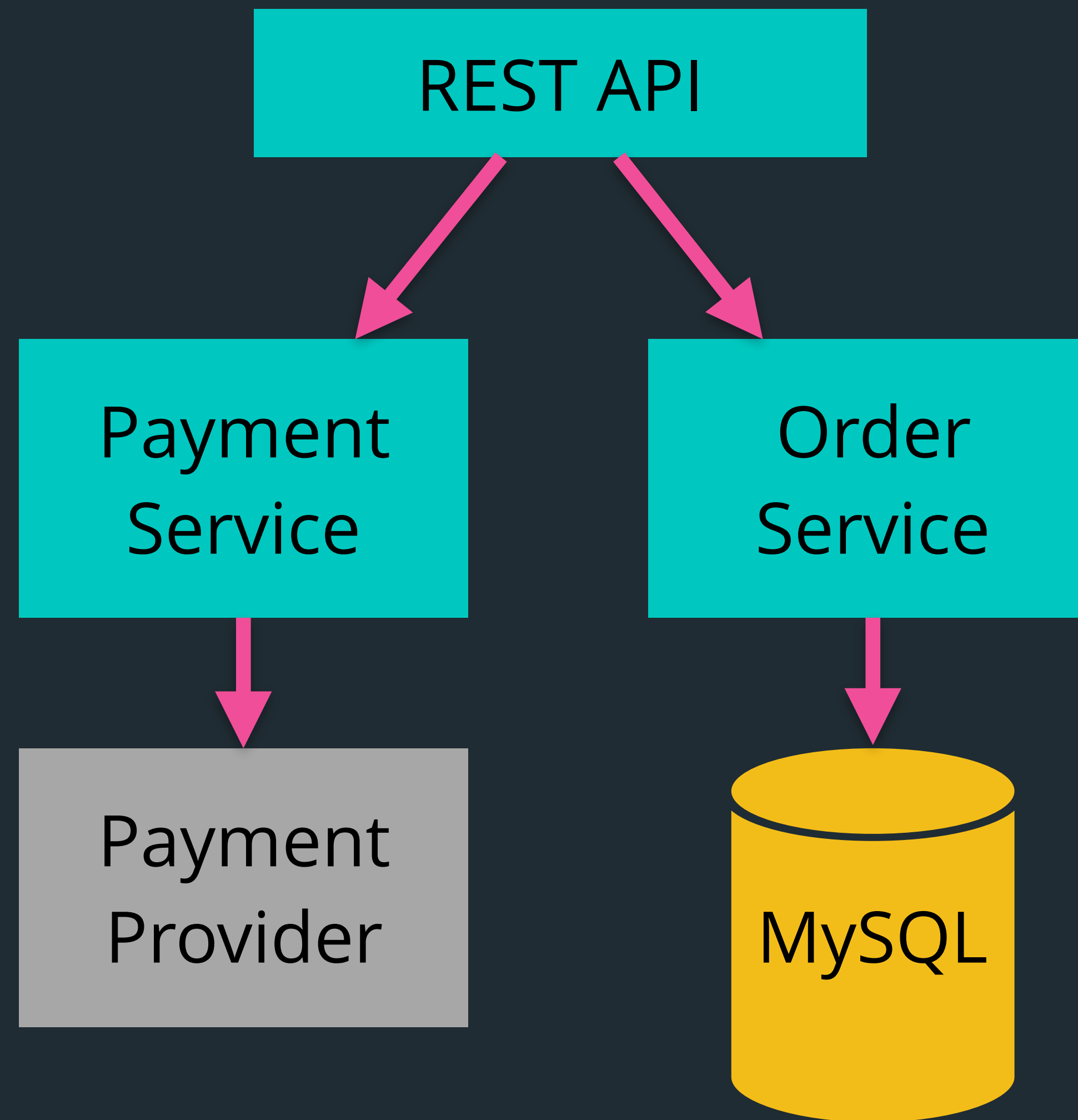




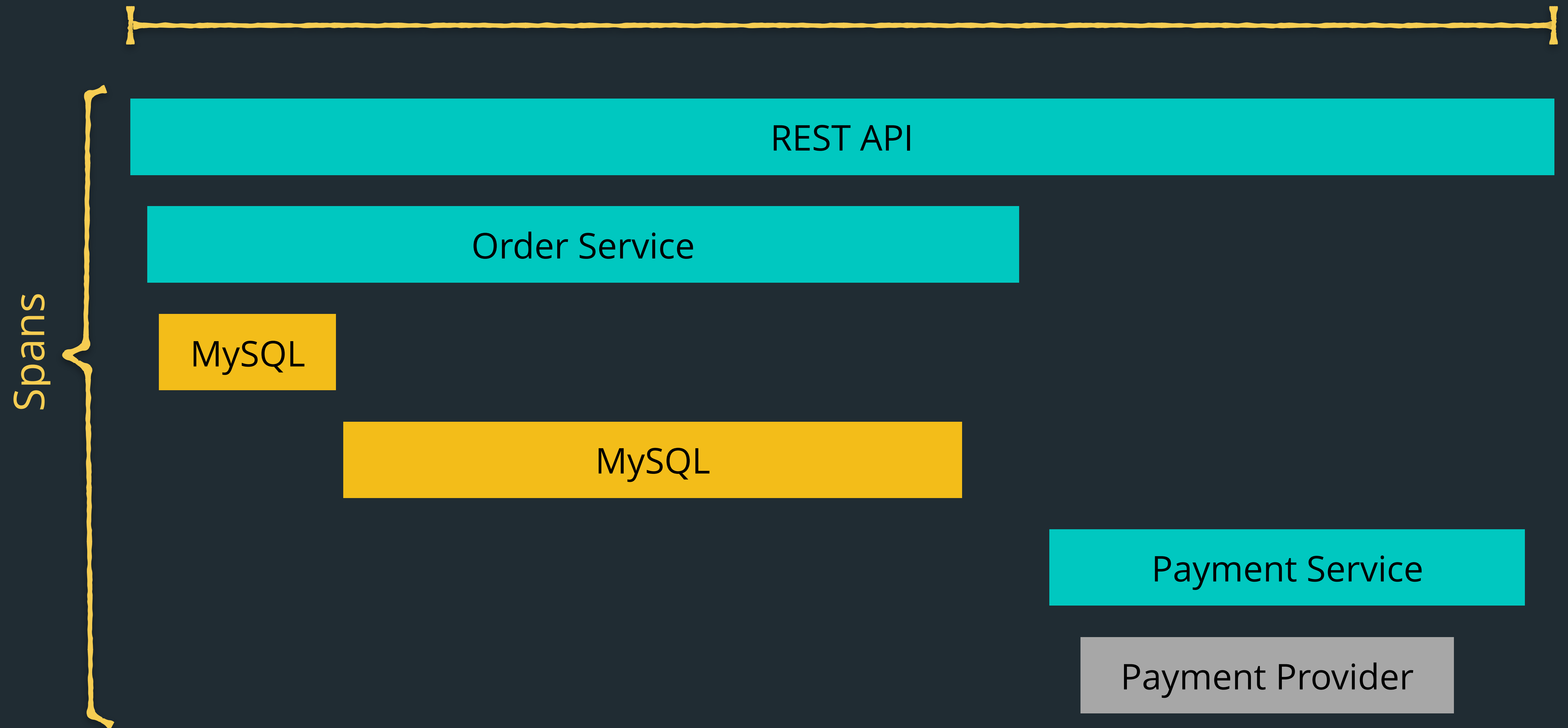
Distributed Tracing

Agents, Clients, and Tracers

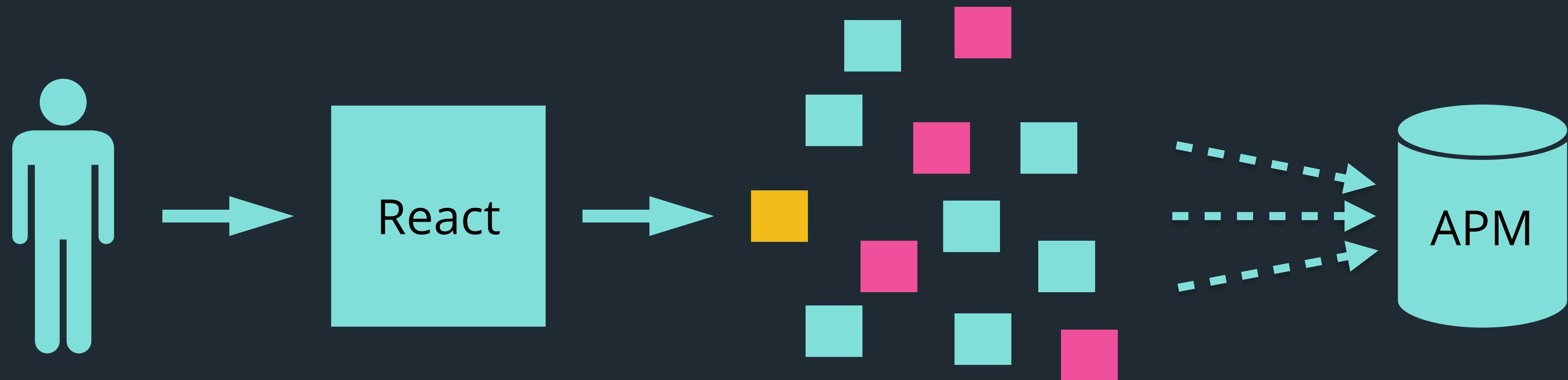
The APM library with many names



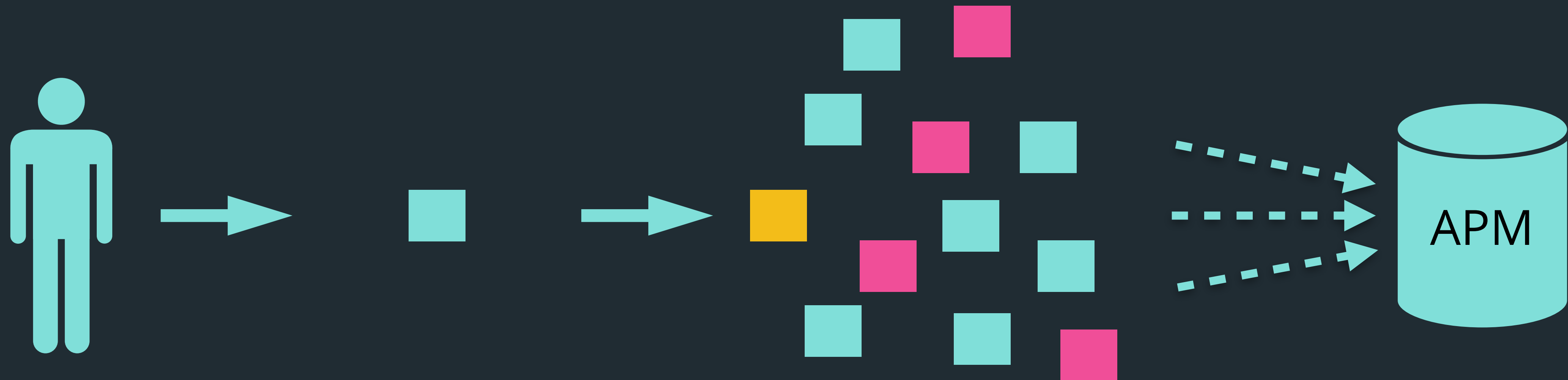
Timeline



Tracing Microservices



Tracing Microservices



Tracing Microservices





Challenges

Interservice Communication



GET /products HTTP/1.1
Host: www.example.com
Date: Mon, 29 Oct 2018 16:11:05 GMT
Connection: keep-alive
Content-Length: 0

<magic header>




```
GET /products HTTP/1.1
Host: www.example.com
<magic header>
Date: Mon, 29 Oct 2018 16:11:05 GMT
Connection: keep-alive
Content-Length: 0
```

GET /products HTTP/1.1

Host: www.example.com

traceparent: 00-82c5500f40667e5500e9ae8e9711553c-992631f881f78c3b-01

Date: Mon, 29 Oct 2018 16:11:05 GMT

Connection: keep-alive

Content-Length: 0

DRAFT



Trace Context Working Group

GET /products HTTP/1.1

Host: www.example.com

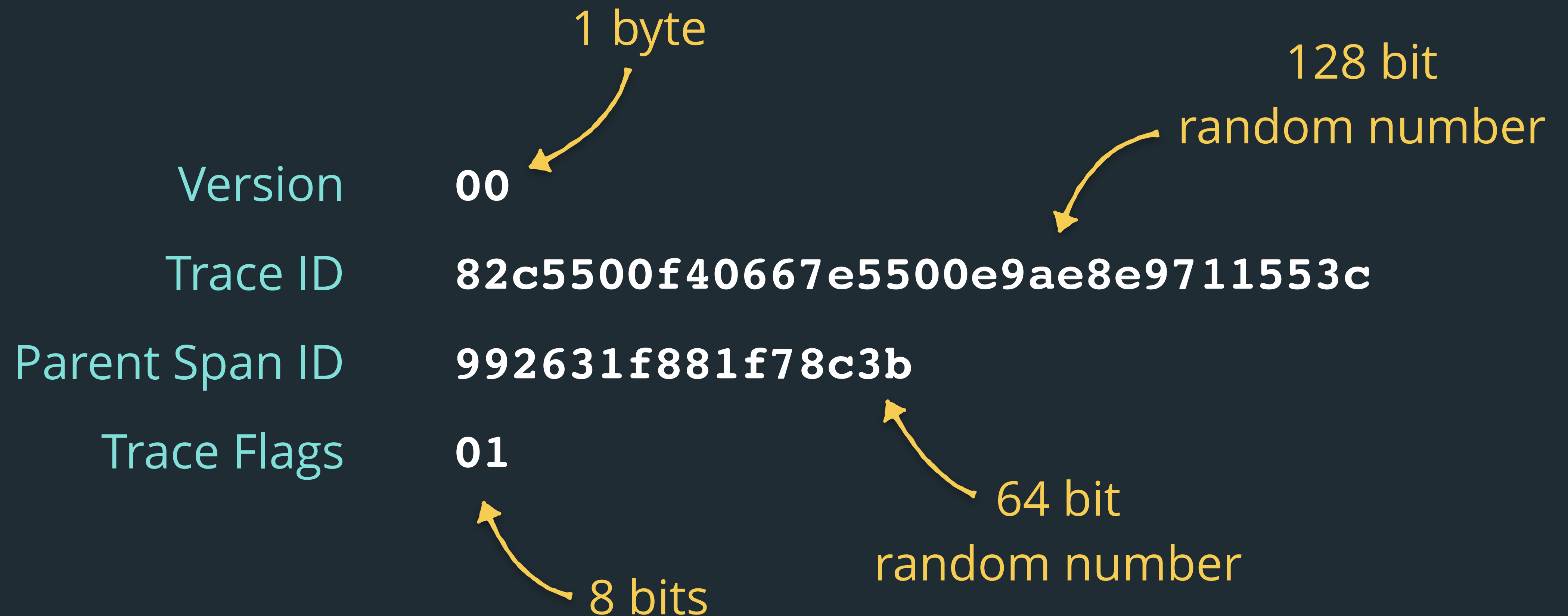
traceparent: 00-82c5500f40667e5500e9ae8e9711553c-992631f881f78c3b-01

Date: Mon, 29 Oct 2018 16:11:05 GMT

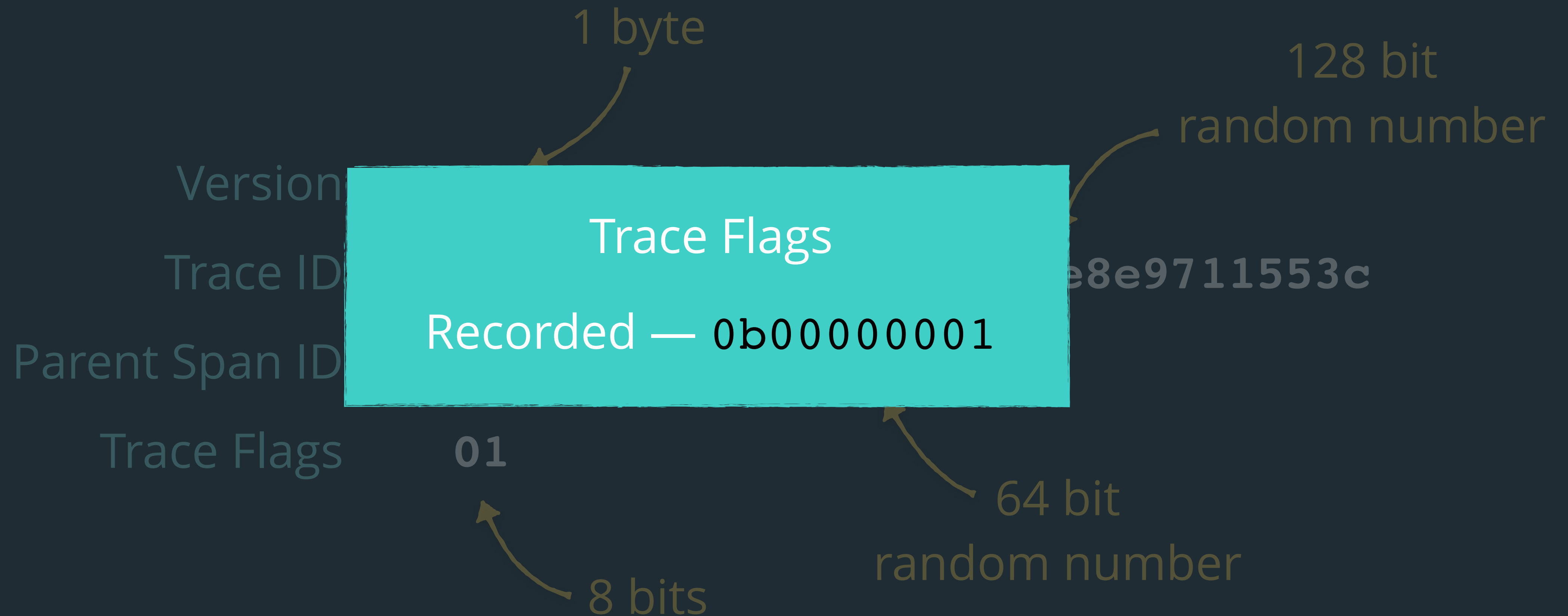
Connection: keep-alive

Content-Length: 0

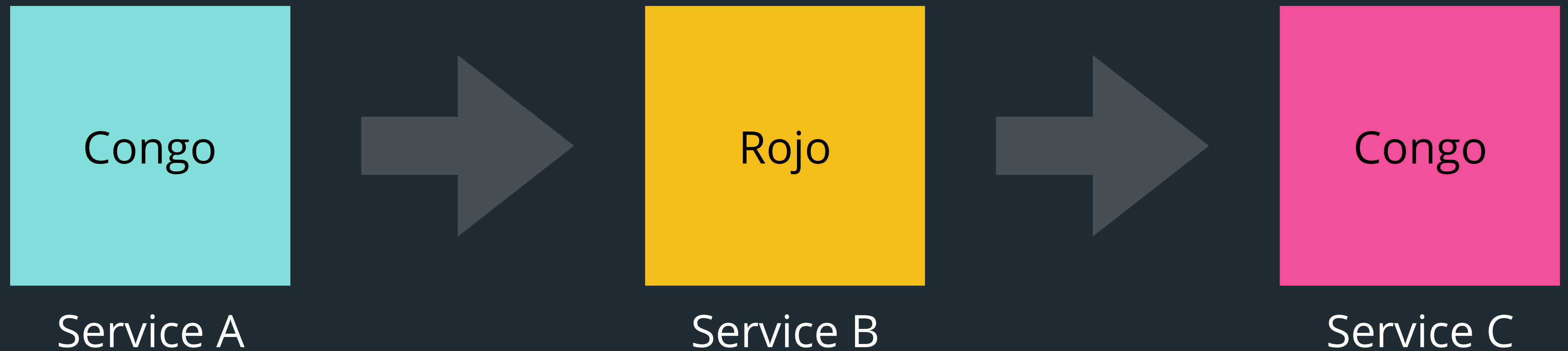
traceparent



traceparent



Multi-Vendor Environments



```
GET /products HTTP/1.1
Host: www.example.com
traceparent: 00-82c5500f40667e5500e9ae8e9711553c-992631f881f78c3b-01
Date: Mon, 29 Oct 2018 16:11:05 GMT
Connection: keep-alive
Content-Length: 0
```


DRAFT

GET /products HTTP/1.1

Host: www.example.com

traceparent: 00-82c5500f40667e5500e9ae8e9711553c-992631f881f78c3b-01

tracestate: <vendorname1=opaqueValue1>,<vendorname2=opaqueValue2>,...

Date: Mon, 29 Oct 2018 16:11:05 GMT

Connection: keep-alive

Content-Length: 0

tracestate

Up to 32 unique vendors

`<vendorname1=opaqueValue1>,<vendorname2=opaqueValue2>,...`



Parent
(potentially vendor specific)

Programmatic API	
Integrations (frameworks, db's, etc)	
Context Propagation (in process)	
Context Propagation (cross service)	
Data format	
Backend transport protocol	
Backend / UI	

	TraceContext
Programmatic API	
Integrations (frameworks, db's, etc)	
Context Propagation (in process)	
Context Propagation (cross service)	✓
Data format	
Backend transport protocol	
Backend / UI	

OPENTRACING

npm install opentracing

opentracing - npm

https://www.npmjs.com/package/opentracing

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npm

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opentracing

0.14.3 • Public • Published a year ago

Readme

0 Dependencies

220 Dependents

36 Versions

build passing

coverage 89%

npm package 0.14.3

node >=0.10

OpenTracing API for JavaScript

This library is a JavaScript implementation of Open Tracing API. It is intended for use both on the server and in the browser.

Required Reading

To fully understand this platform API, it's helpful to be familiar with the [OpenTracing project](#) and [terminology](#) more specifically.

install

> npm i opentracing

weekly downloads

282,041

version	license
0.14.3	MIT
open issues	pull requests
18	5

install

```
> npm i opentracing
```

↓ weekly downloads

282,041

version

0.14.3

license

MIT

open issues

18

pull requests

5

Readme

0 Dependencies

build

passing

coverage

89%

npm package

0.14.3

node

>=0.10

OpenTracing API for JavaScript

This library is a JavaScript implementation of Open Tracing API. It is server and in the browser.

Required Reading


```
const opentracing = require('opentracing')  
  
const tracer = new opentracing.Tracer()  
  
const span = tracer.startSpan('some work')  
  
// Do some work  
  
span.finish()
```

```
span.setTag('user.id', user.getId())  
  
span.log({  
    'event': 'error',  
    'error.object': err  
})
```

```
// Start a new (parentless) root Span:
const parent = Tracer.startSpan( 'DoWork' )

// Start a new (child) Span:
const child = Tracer.startSpan( 'load-from-db', {
  childOf: parent.context()
})

// Start a new async (FollowsFrom) Span:
const child = Tracer.startSpan( 'async-cache-write', {
  references: [
    opentracing.followsFrom(parent.context())
  ]
})
```

```
const headersCarrier = {}

// "Serialize" Span Context into headersCarrier
tracer.inject(
  clientSpan.context(),
  Tracer.FORMAT_HTTP_HEADERS,
  headersCarrier
)

// Add tracing headers to headers of outgoing request
Object.assign(outboundHTTPReq.headers, headersCarrier)
```

```
// "De-serialize" Span Context from inbound HTTP request headers
const headersCarrier = inboundHTTPReq.headers

const wireCtx = tracer.extract(
  Tracer.FORMAT_HTTP_HEADERS,
  headersCarrier
)

const serverSpan = tracer.startSpan('...', { childOf: wireCtx })
```

```
Tracer.FORMAT_TEXT_MAP  
Tracer.FORMAT_HTTP_HEADERS  
Tracer.FORMAT_BINARY
```

```
const { Tracer } = require('my-custom-tracer')  
  
const tracer = new Tracer()  
  
const opentracing = require('opentracing')  
  
opentracing.initGlobalTracer(tracer)  
  
// then later...  
const tracer = opentracing.globalTracer()
```

```
const { Tracer } = require('my-custom-tracer')
const tracer = new Tracer()

const express = require('express')
const expressOpenTracing = require('express-opentracing')

const app = express()

app.use(expressOpenTracing({ tracer }))

// ...
```


WIP: ScopeManager

https://docs.google.com/document/d/1C_thV0lGRe0fVqUq7-qn7eZfbH2oyuJQqFgRnGRTSBY/edit

ScopeManager: Possible Solutions

- async-listener
- async_hooks
- async-hook-jl (*AsyncWrap binding wrapper*)
- zone.js
- domain

Proposed solution

Given all of the above, the scope manager should be implemented with the following underlying implementations.

- `async_hooks` for Node ≥ 8
- Fork of `async-listener` with the following fixes for Node < 8
 - Bind promises on `then()` instead of `resolve()`.
 - Fix the memory leak when an error is thrown from a promise callback.
 - Remove any globals to avoid conflicts with the original `async-listener`.
- `zone.js` for browser support.
- Optionally, use `async-hook-jl` for Node `^4.7 || ≥ 6.9 < 8`. This would probably make sense only if there is a performance benefit over `async-listener`. In my experience, it's actually slower, and comes with its own set of problems which are avoidable by simply relying on `async-listener` for these versions instead.

Contributions per language at github.com/opentracing-contrib

- Java: 50
- Python: 11
- Go: 9
- C#: 3
- Scala: 3
- JavaScript: 2
- Ruby: 2
- C++: 1
- Erlang: 1
- nginx: 1

	TraceContext
Programmatic API	
Integrations (frameworks, db's, etc)	
Context Propagation (in process)	
Context Propagation (cross service)	✓
Data format	
Backend transport protocol	
Backend / UI	

	TraceContext	OpenTracing
Programmatic API		✓
Integrations (frameworks, db's, etc)		(✓)
Context Propagation (in process)		((✓))
Context Propagation (cross service)	✓	
Data format		
Backend transport protocol		
Backend / UI		



npm install @opencensus/nodejs

@opencensus/nodejs - npm

https://www.npmjs.com/package/@opencensus/nodejs

npm: possibly marvellous

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@opencensus/nodejs

0.0.9 • Public • Published 22 days ago

Readme

4 Dependencies

3 Dependents

9 Versions

OpenCensus for Node.js

chat on [gitter](#)

OpenCensus Node.js is an implementation of OpenCensus, a toolkit for collecting application performance and behavior monitoring data. Right now OpenCensus for Node.js supports custom tracing and automatic tracing for HTTP and HTTPS.

The library is in alpha stage and the API is subject to change.

Please join [gitter](#) for help or feedback on this project.

Installation

install

> npm i @opencensus/nodejs

weekly downloads

1,589

version	license
0.0.9	Apache-2.0
open issues	pull requests
39	18

@wa7son

install

```
> npm i @opencensus/nodejs
```

↓ weekly downloads

1,589

version

0.0.9

license

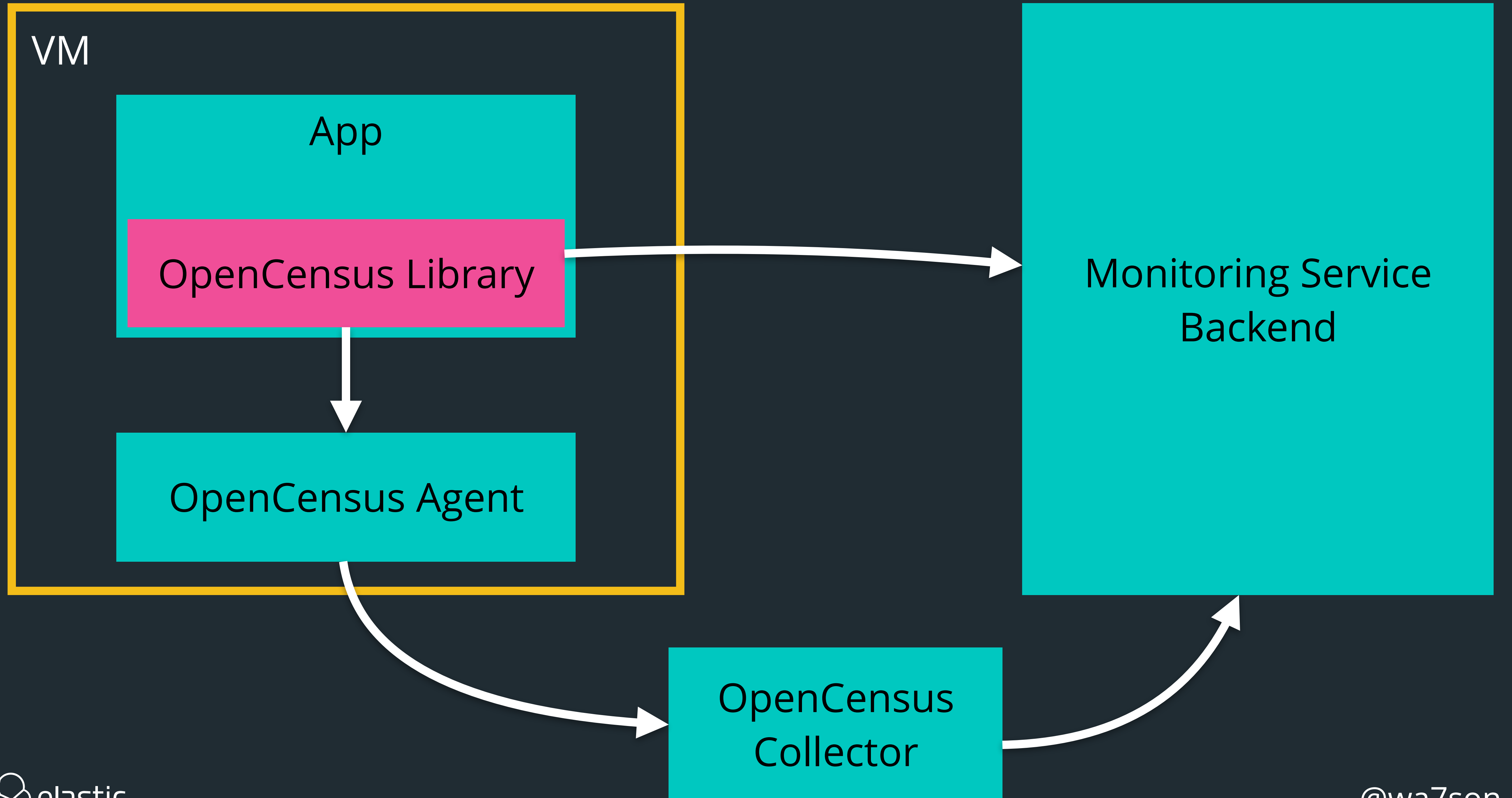
Apache-2.0

open issues

pull requests

lication
rts custom





Implementation Details

- continuation-local-storage + async_hooks
- require-in-the-middle
- shimmer
- @opencensus/instrumentation-all
 - @opencensus/instrumentation-grpc
 - @opencensus/instrumentation-http
 - @opencensus/instrumentation-https
 - @opencensus/instrumentation-http2
 - @opencensus/instrumentation-mongodb
 - (@opencensus/instrumentation-redis)

	TraceContext	OpenTracing
Programmatic API		✓
Integrations (frameworks, db's, etc)		(✓)
Context Propagation (in process)		((✓))
Context Propagation (cross service)	✓	
Data format		
Backend transport protocol		
Backend / UI		

	TraceContext	OpenTracing	OpenCensus
Programmatic API		✓	✓
Integrations (frameworks, db's, etc)		(✓)	(✓)
Context Propagation (in process)		((✓))	✓
Context Propagation (cross service)	✓		✓
Data format			(✓)
Backend transport protocol			(✓)
Backend / UI			



*But I heard a rumor that OpenTracing
and OpenCensus are planning to
merge?!*

Thank you



@wa7son

github.com/watson

