

From HAR to OpenTelemetry Trace: Redefining Browser Observability



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Monitor, debug, and optimize web applications

Agenda



- 01 **Introduction**
- 02 **OpenTelemetry**
- 03 **HAR files**
- 04 **ThousandEyes**
- 05 **HAR to OTel traces**
- 06 **Architecture**
- 07 **Demo**
- 08 **Lesson learned**

Introduction

What comes to mind when you hear OpenTelemetry?



Join at

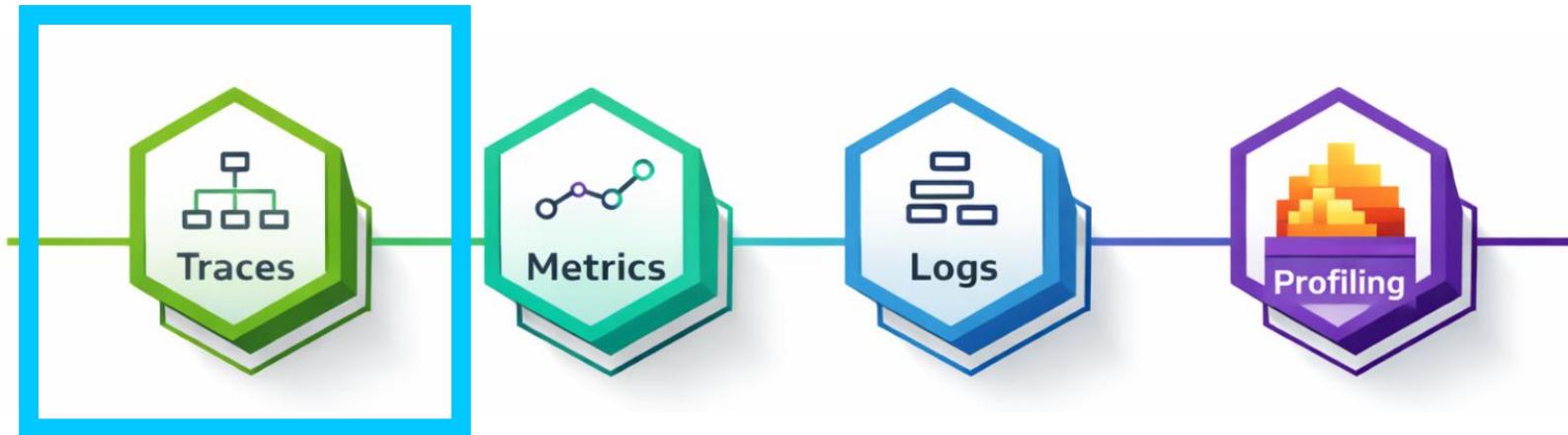
slido.com

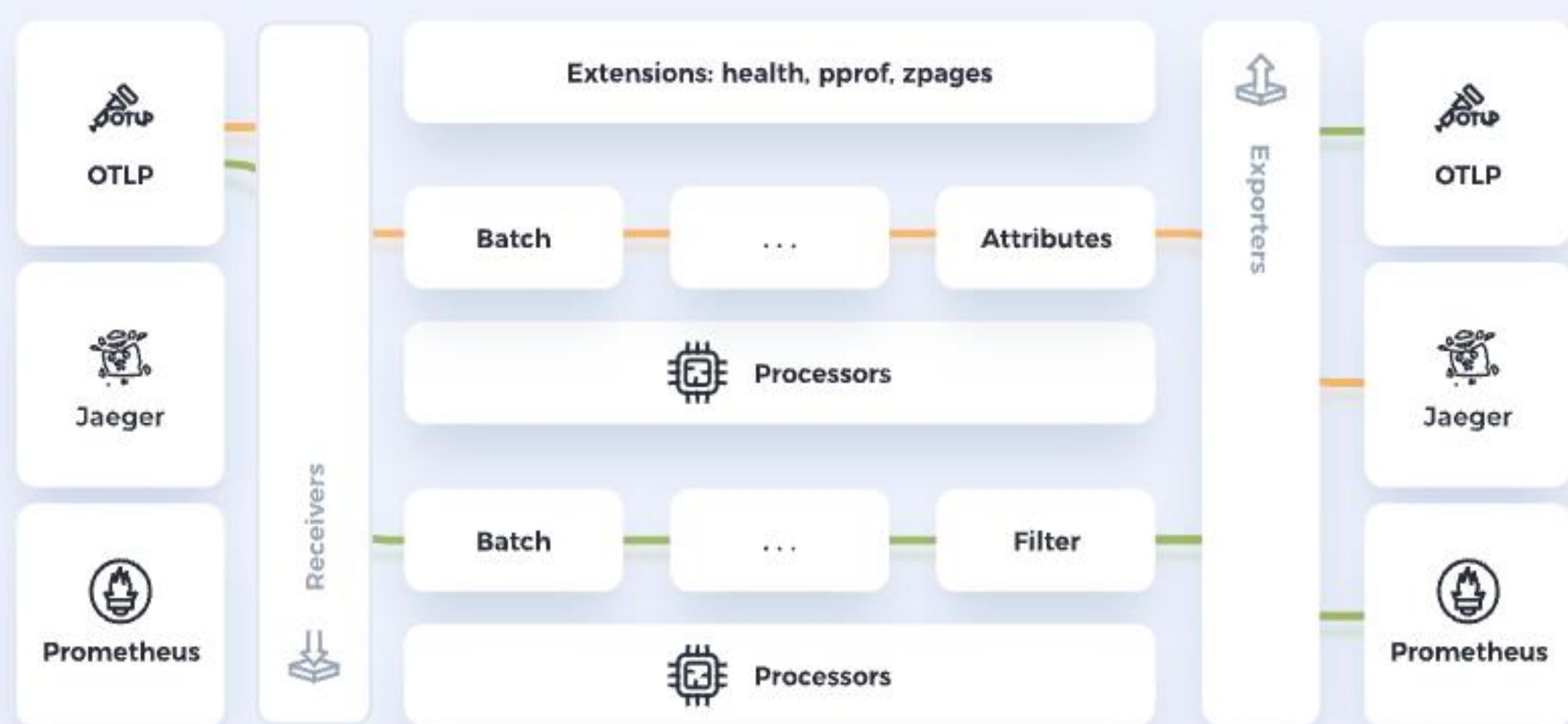
#2345678

OpenTelemetry (OTel)



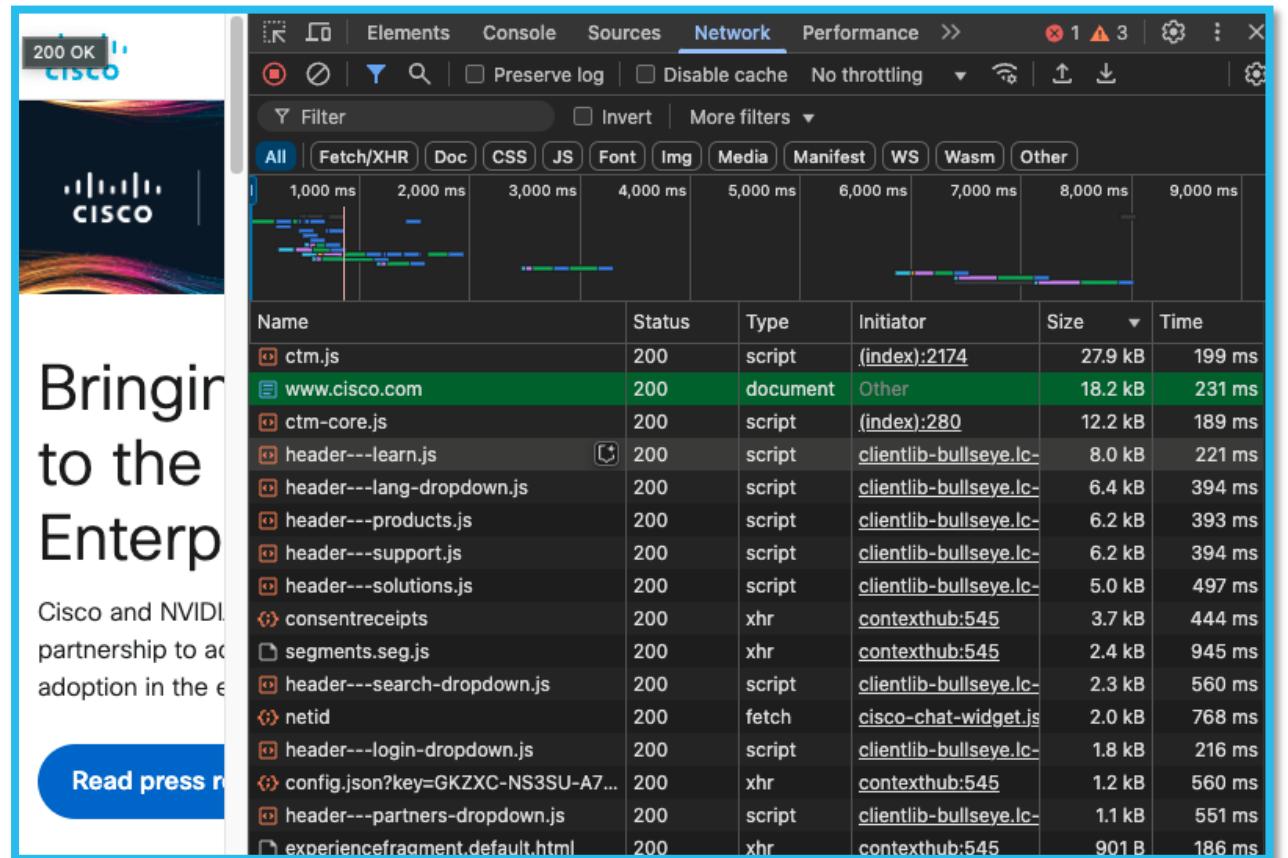
- Open-source observability framework
- Tools, APIs, and SDKs
- Management of telemetry data





HAR (HTTP Archive)

- Web browser's interaction
- JSON
- Contains sensitive data
- Debug



HAR (HTTP Archive) - Format

```
{  
  "log": {  
    "version": "1.2",  
    "creator": {  
      "name": "WebInspector",  
      "version": "537.36"  
    },  
    "pages": [  
      {  
        "startedDateTime": "2025-02-28T17:52:59.157Z",  
        "id": "page_1",  
        "title": "https://www.cisco.com/",  
        "pageTimings": {  
          "onContentLoad": 852.1480000345036,  
          "onLoad": 857.499000034295  
        }  
      }  
    ],  
    "entries": [  
      {  
        ...  
      },  
      {  
        "_connectionId": "335189",  
        "_fromCache": "memory",  
        "_initiator": {  
          "type": "parser",  
          "url": "https://www.cisco.com/",  
          "lineNumber": 129  
        },  
        "_priority": "Low",  
        "_resourceType": "script",  
        "cache": {},  
        "connection": "443",  
        "pageref": "page_1",  
        "request": {  
          "method": "GET",  
          "url": "https://rum.hlx.page/.rum/@adobe/helix-rum-js@%5E2/dist/rum-standalone.js",  
          "httpVersion": "http/2.0"  
        }  
      }  
    ]  
  }  
}
```

ThousandEyes



- Network monitoring
- Monitoring agents
- Real-time



ThousandEyes Page load Test



Cloud & Enterprise Agents | Cloud & Enterprise Agents

Test: Test Page Load | Agents: All | https://www.cisco.com

Metrics: Page Load Time | Fri, Feb 28 18:30 – 18:40 UTC (in 33 seconds) | Run Instant Test | Snapshot | Submit Feedback | Antonio Jimenez | antonjim PROD US

Page Load | Web | HTTP Server | Web | Page Load Time | Overlay | Agents | Average Page Load Time | 18:30 | 2055 ms | < 1 ms | WEB | 18:30

Map | Table | Waterfall | San Francisco, CA | Page: Cisco: Software, Network, and Cybersecurity Solutions - Cisco

Screenshots | Waterfall Overview | 0ms | 500ms | 1000ms | 1500ms | 2000ms | 2500ms | 3000ms | 3500ms | 4000ms | 4500ms | 5000ms

232 items | Search by URL or Domain... | Component Type

| Component | Response Code | Domain | Provider | Size (kB) | Duration | Waterfall |
|----------------------|---------------|------------------------|---------------------|-----------|----------|-----------|
| virtualprofile | 200 [Headers] | cdcvps.cloudapps.ci... | Cisco Systems, Inc. | 0.4 | 1411 | |
| virtualprofile | 200 [Headers] | cdcvps.cloudapps.ci... | Cisco Systems, Inc. | 0.4 | 1349 | |
| virtualprofile | 200 [Headers] | cdcvps.cloudapps.ci... | Cisco Systems, Inc. | 0.4 | 1292 | |
| rum-standalone.js | 200 [Headers] | rum.hix.page | Fastly | 5.9 | 968 | |
| cisco-chat-widget.js | 200 [Headers] | bufweb.cisco.com | Cisco Systems, Inc. | 1798.8 | 949 | |
| s.gif | 200 [Headers] | www.cisco.com | Akamai Technologies | < 0.1 | 661 | |
| netid | 200 [Headers] | dsc.cisco.com | Google LLC | 0.5 | 627 | |

ThousandEyes © 2025 | Privacy

HAR to OTel traces

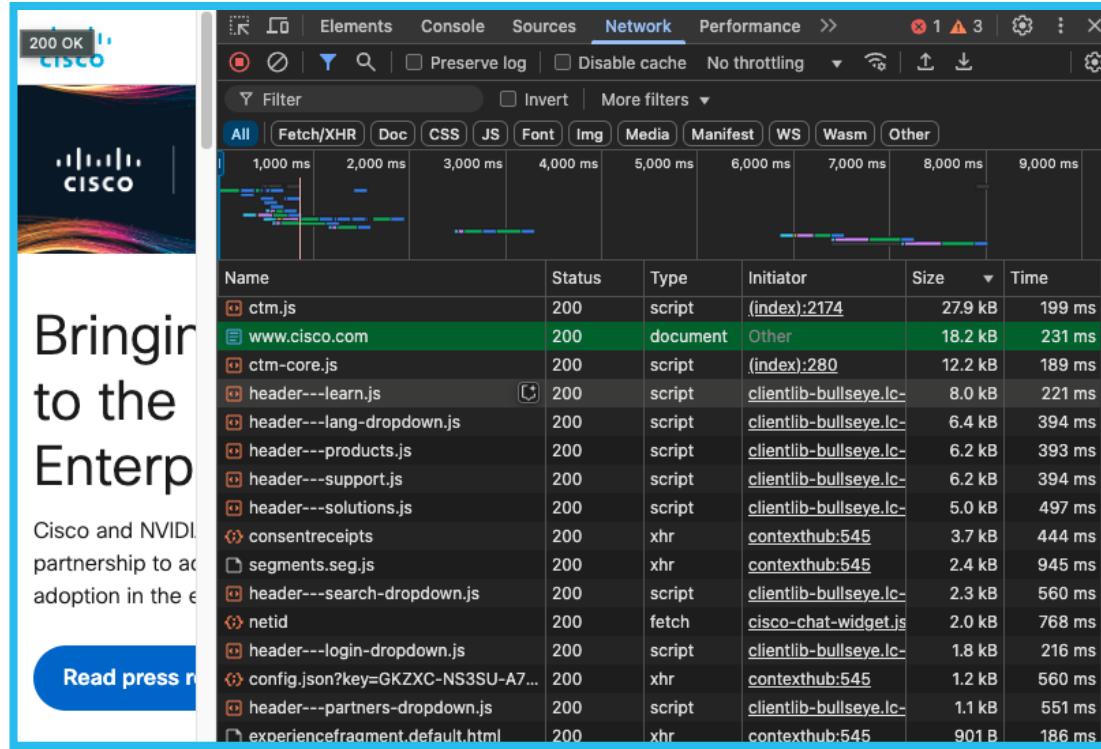
200 OK

CISCO

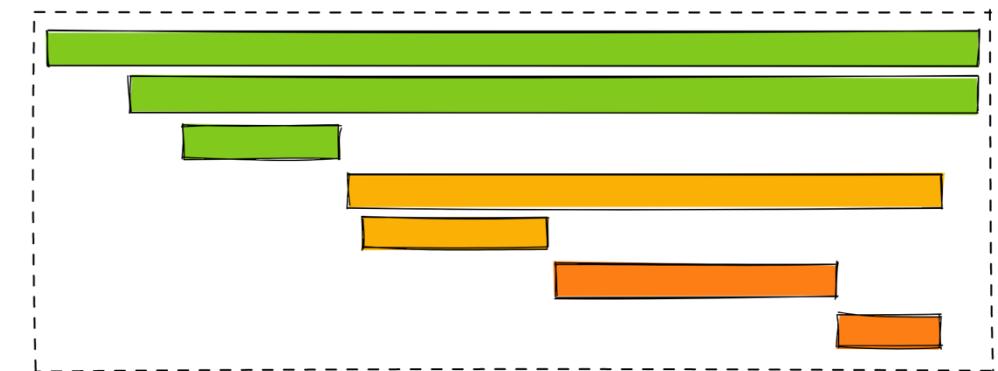
Bringing to the Enterprise

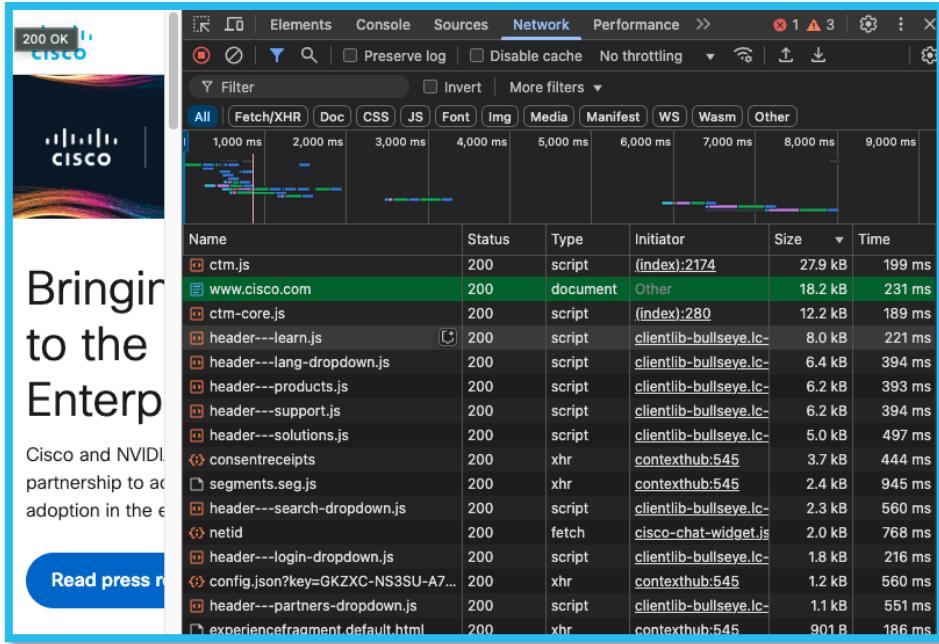
Cisco and NVIDIA partnership to accelerate adoption in the enterprise

Read press release



| Name | Status | Type | Initiator | Size | Time |
|-----------------------------------|--------|----------|--------------------------|---------|--------|
| ctm.js | 200 | script | (index):2174 | 27.9 kB | 199 ms |
| www.cisco.com | 200 | document | Other | 18.2 kB | 231 ms |
| ctm-core.js | 200 | script | (index):280 | 12.2 kB | 189 ms |
| header---learn.js | 200 | script | clientlib-bullseye.lc... | 8.0 kB | 221 ms |
| header---lang-dropdown.js | 200 | script | clientlib-bullseye.lc... | 6.4 kB | 394 ms |
| header---products.js | 200 | script | clientlib-bullseye.lc... | 6.2 kB | 393 ms |
| header---support.js | 200 | script | clientlib-bullseye.lc... | 6.2 kB | 394 ms |
| header---solutions.js | 200 | script | clientlib-bullseye.lc... | 5.0 kB | 497 ms |
| consentreceipts | 200 | xhr | contexthub:545 | 3.7 kB | 444 ms |
| segments.seg.js | 200 | xhr | contexthub:545 | 2.4 kB | 945 ms |
| header---search-dropdown.js | 200 | script | clientlib-bullseye.lc... | 2.3 kB | 560 ms |
| netid | 200 | fetch | cisco-chat-widget.js | 2.0 kB | 768 ms |
| header---login-dropdown.js | 200 | script | clientlib-bullseye.lc... | 1.8 kB | 216 ms |
| config.json?key=GKZXC-NS3SU-A7... | 200 | xhr | contexthub:545 | 1.2 kB | 560 ms |
| header---partners-dropdown.js | 200 | script | clientlib-bullseye.lc... | 1.1 kB | 551 ms |
| experiencefragment.default.html | 200 | xhr | contexthub:545 | 901 B | 186 ms |





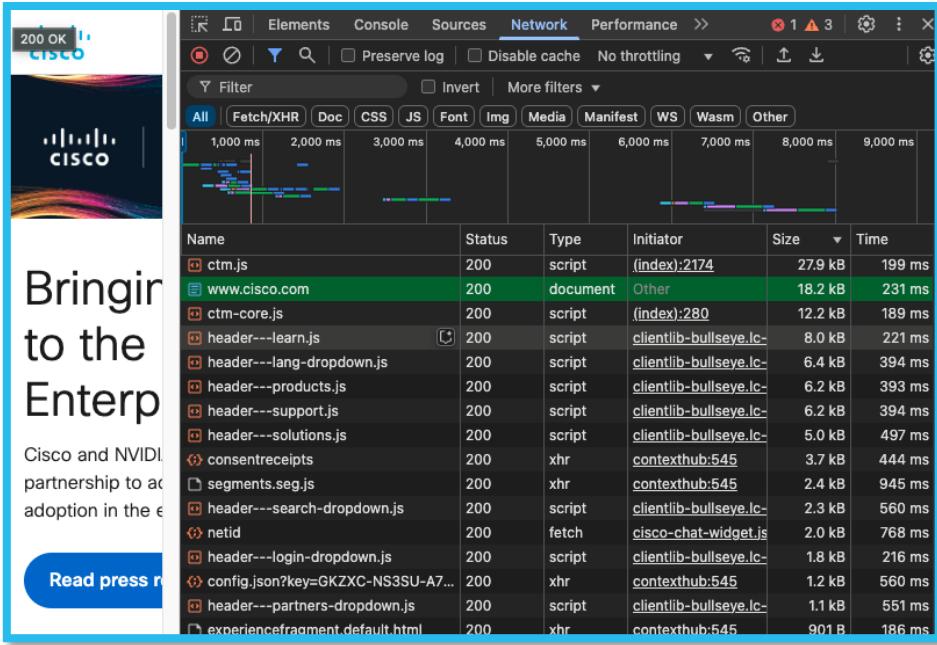
Bring it to the Enterprise

Cisco and NVIDIA partnership to accelerate adoption in the enterprise

Read press release

Root Span

- Name: HTTP <url>
- Capture total time of the page load



For each request in the HAR -> a child span

- Name: Get <resource>
- HTTP attributes
- URL of the resource

OTel trace – Span

Name: <Method> <target>

kind: *SPAN_KIND_CLIENT*

start_time_unix_nano

end_time_unix_nano

status: *STATUS_CODE_OK* or
STATUS_CODE_ERROR

trace_id /span_id

More info:

<https://docs.thousandeyes.com/product-documentation/integration-guides/opentelemetry/data-model/data-model-v2/traces>

<https://opentelemetry.io/docs/specs/semconv/http/http-spans>

OTel trace - Span - Attributes Semantic convention

| Attribute | Type | Description | Examples | Requirement Level | Stability |
|---|--------|--|--|--|-----------|
| http.request.method | string | HTTP request method. [1] | GET ; POST ; HEAD | Required | stable |
| server.address | string | Host identifier of the " URI origin " ² HTTP request is sent to. [2] | example.com ; 10.1.2.80 ; /tmp/my.sock | Required | stable |
| server.port | int | Port identifier of the " URI origin " ² HTTP request is sent to. [3] | 80 ; 8080 ; 443 | Required | stable |
| url.full | string | Absolute URL describing a network resource according to RFC3986 ⁴ [4] | https://www.foo.bar/search?q=openTelemetry#SemConv ; //localhost | Required | stable |
| http.response.status_code | int | HTTP response status code ⁵ . | 200 | Conditionally Required If and only if one was received/sent. | stable |

More info: <https://opentelemetry.io/docs/specs/semconv/http/http-spans/>

OTel trace - Span - Attributes Semantic convention

- We are **not** streaming the headers

[11] `http.request.header` : Instrumentations SHOULD require an explicit configuration of which headers are to be captured. Including all request **headers can be a security risk** - explicit configuration helps avoid leaking sensitive information. The `User-Agent` header is already captured in the `user_agent.original` attribute. Users MAY explicitly configure instrumentations to capture them even though it is not recommended. The attribute value MUST consist of either multiple header values as an array of strings or a single-item array containing a possibly comma-concatenated string, depending on the way the HTTP library provides access to headers.

[12] `http.response.header` : Instrumentations SHOULD require an explicit configuration of which headers are to be captured. Including all response **headers can be a security risk** - explicit configuration helps avoid leaking sensitive information. Users MAY explicitly configure instrumentations to capture them even though it is not recommended. The attribute value MUST consist of either multiple header values as an array of strings or a single-item array containing a possibly comma-concatenated string, depending on the way the HTTP library provides access to headers.

More info: <https://opentelemetry.io/docs/specs/semconv/http/http-spans/>

OTel trace – Resource Attributes

thousandeyes.account.id

thousandeyes.test.type

thousandeyes.test.id

thousandeyes.test.name

thousandeyes.source.agent.id

thousandeyes.source.agent.name

thousandeyes.source.agent.location

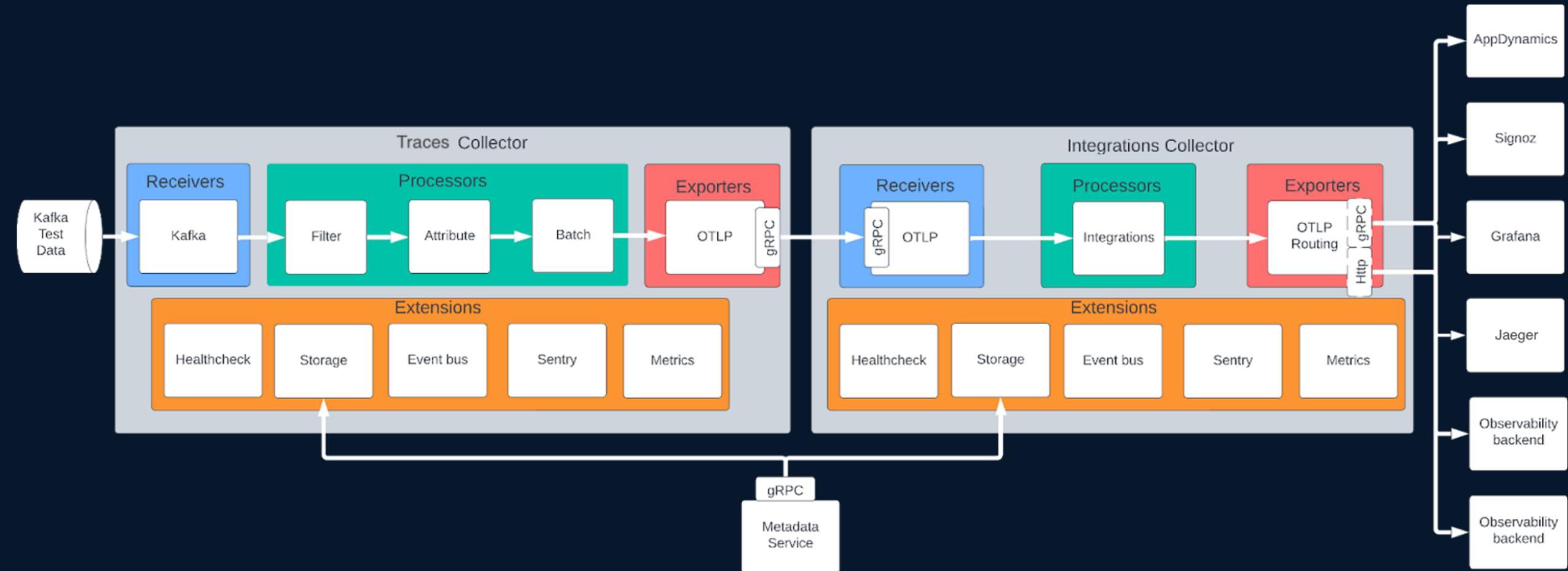
thousandeyes.permalink

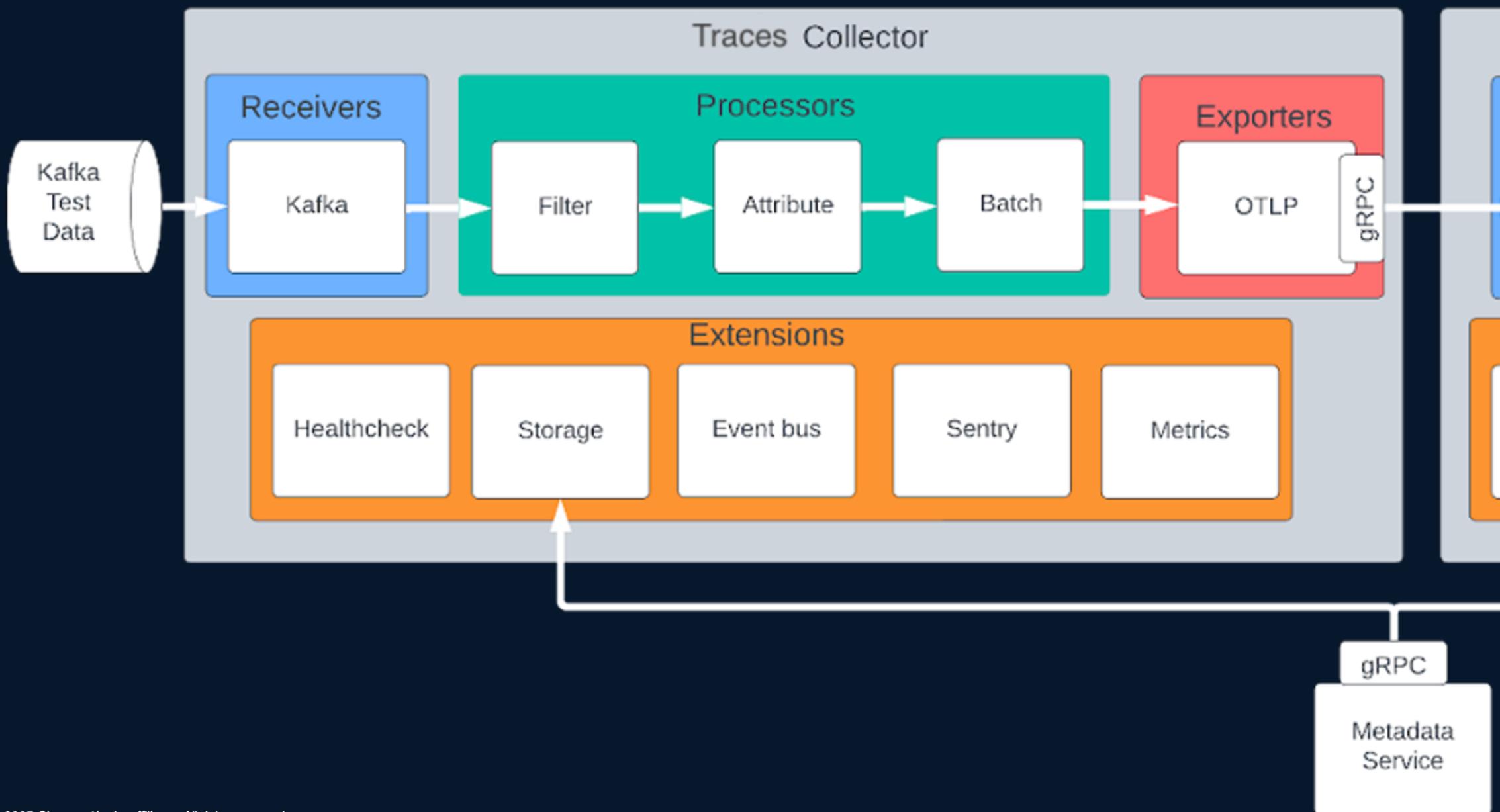
More info: <https://docs.thousandeyes.com/product-documentation/integration-guides/opentelemetry/data-model/data-model-v2/traces>

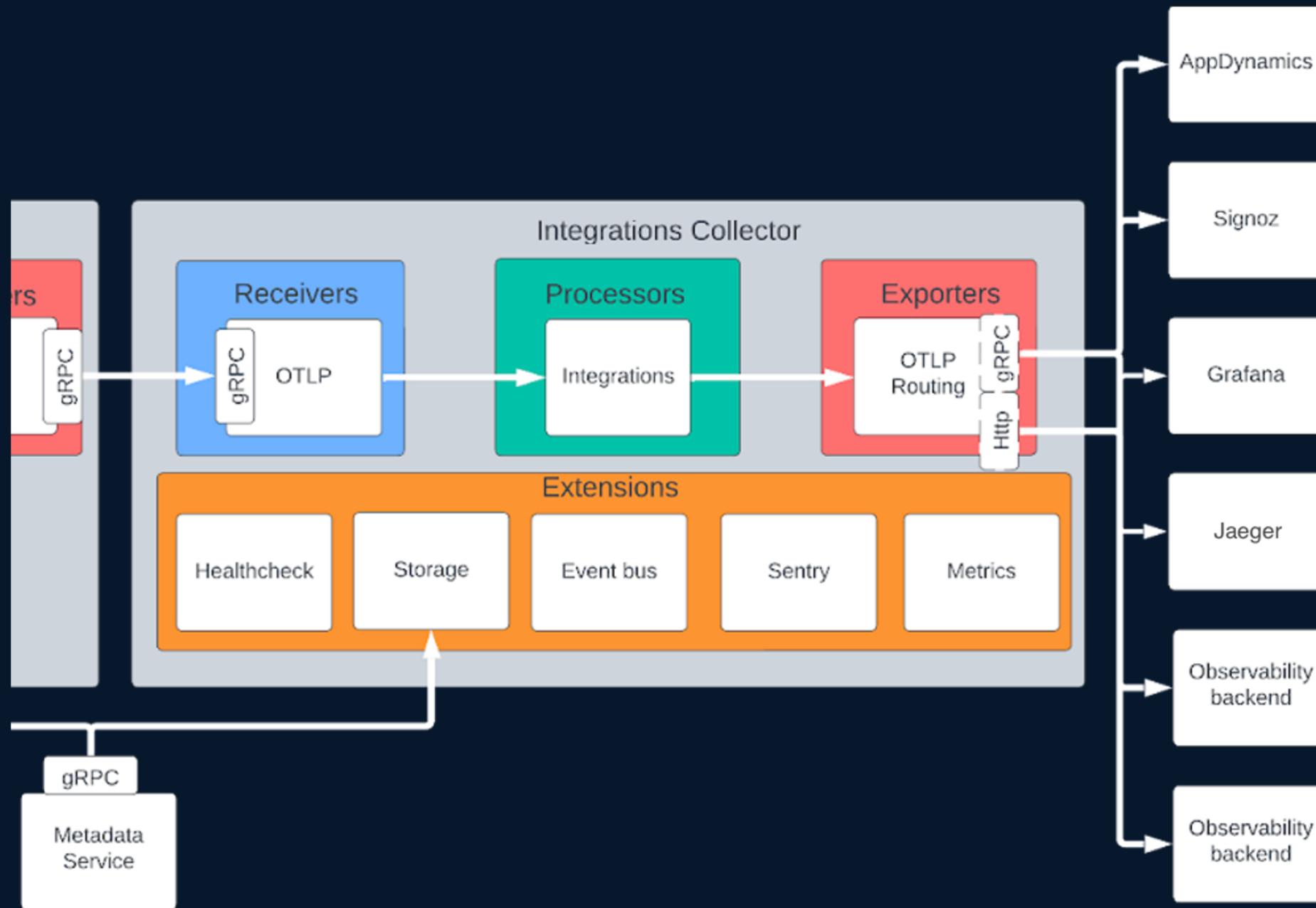
OTel trace

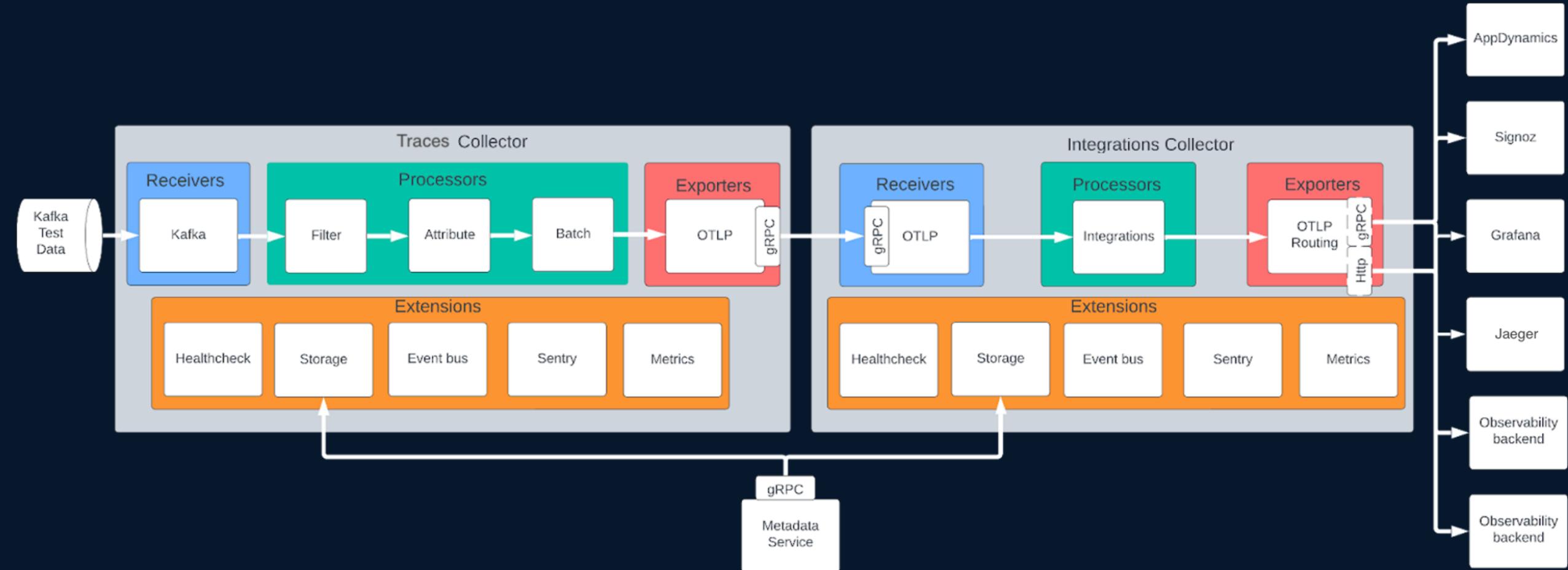
```
{  
  resource_spans {  
    resource {  
      attributes {  
        key: "meta.signal_type"  
        value {  
          string_value: "trace"  
        }  
      }  
      attributes {  
        key: "service.name"  
        value {  
          string_value: "www.thousandeyes.com"  
        }  
      }  
      attributes {  
        key: "thousandeyes.stream.id"  
        value {  
          string_value: "16fedf53-93d6-4f32-a3b6-4e3dd90ebc5d"  
        }  
      }  
    }  
  }  
}
```

Architecture









Demo

Cloud & Enterprise Agents

< Test Settings

Start with a single test

Event Detection

Views

Test Settings

Agent Settings

BGP Monitors

Endpoint Agents

Cloud Insights Trial

Devices

Internet Insights

Dashboards

Alerts

Integrations

Sharing

New Test

Layer

Routing

Network

DNS

Web

Voice

Test Type

HTTP Server

Page Load

Transaction

API

FTP Server

Test Name

Demo

Test Description

Optional

Basic Configuration

Advanced Settings

URL

www.cisco.com

Schedule

Default

Round-Robin

Interval

1 minute

Agents

Select agent(s)

Alerts

 Enable

4 of 4 alert rules selected

Edit Alert Rules

Cancel

Run Once

Create New Test

Cloud & Enterprise Agents

Test: Demo



https://www.cisco.com

Agents: San Francisco, CA


Run Instant Test
Snapshot
Submit Feedback

Event Detection

Page Load

Web

HTTP Server

Web

Metrics: Page Load Time (Primary) + 2

Sat, Mar 1 12:20 – 12:30 UTC (in 17 seconds)



Views

Test Settings

Agent Settings

BGP Monitors

Endpoint Agents



Cloud Insights Trial



Devices



Internet Insights



Dashboards

Alerts



Integrations



Sharing



Account Settings



Metrics: Page Load Time (Primary) + 2

Sat, Mar 1 12:20 – 12:30 UTC (in 17 seconds)



Page Load Time Primary

Off

Agents

Average Page Load Time

Page Load Time

Primary

Overlay

Timeouts

Completion

21:00

March

03:00

06:00

09:00

12:00

3520 ms

< 1 ms

WEB

1

WEB

0

WEB

100%

0%

WEB

0%

 Cloud & Enterprise Agents > Endpoint Agents > Cloud Insights Trial > Devices > Internet Insights > Dashboards Alerts > Integrations Sharing > Account Settings >Integrations 1.0 Integrations 2.0 

1 item

 Search... New IntegrationName Type Status Target Supported Services 

Grafana

OpenTelemetry

Connected

https://otlp-gateway-prod-eu-west-2.g...

Streaming

:

Search Upload

Service (51)

www.cisco.com

Operation (67)

all

Tags ?

http.status_code=200 error=true

Lookback

Last Hour

Max Duration Min Duration

e.g. 1.2s, 100ms, 500us e.g. 1.2s, 100ms, 500us

Limit Results

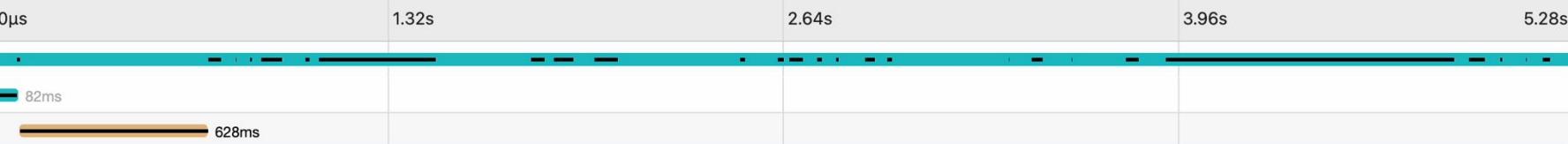
20

Find Traces



Trace Start **March 1 2025, 16:30:35.303** | Duration **5.28s** | Services **47** | Depth **2** | Total Spans **216****Service & Operation**

▼ > ▼ >>

**GET /rum/@adobe/helix-rum-js@%5E2/dist/rum-standalone.js**Service: **rum.hlx.page** | Duration: **628ms** | Start Time: **92ms**▼ **Tags**

| | |
|---------------------|---|
| http.request.method | GET |
| http.response.code | 200 |
| server.address | rum.hlx.page |
| server.port | 443 |
| span.kind | client |
| url.full | https://rum.hlx.page/.rum/@adobe/helix-rum-js@%5E2/dist/rum-standalone.js |

▼ **Process**

| | | |
|------------------------------------|---|---|
| thousandeyes.account.id | 2089262 | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.data.version | v2 | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.permalink | https://app.thousandeyes.com/view/tests?__a=2089262&agentId=14410&teRegion=0&testId=6640252 | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.source.agent.id | 14410 | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.source.agent.location | San Francisco, California, US | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.source.agent.name | San Francisco, CA | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.stream.id | aed27ea6-f83f-4aa5-9e7d-03c1c789c2d6 | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.test.domain | cea | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.test.id | 6640252 | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.test.name | Demo | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |
| thousandeyes.test.type | page-load | <input type="checkbox"/> Copy <input type="checkbox"/> JSON |



Search Upload

Service (58)

cisco-tags.cisco.com

Operation (2)

all

Tags ?

http.status_code=200 error=true

Lookback

Last Hour

Max Duration Min Duration

e.g. 1.2s, 100ms, 500us e.g. 1.2s, 100ms, 500us

Limit Results

20

Find Traces



Search Upload

Service (61)

www.cisco.com

Operation (67)

all

Tags ?

http.status_code=200 error=true

Lookback

Last Hour

Max Duration Min Duration

e.g. 1.2s, 100ms, 500us

Limit Results

20

Find Traces



Logo by Lev Polyakov
www.polyakovproductions.com

Lesson learned



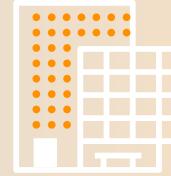
Tracing

- New use cases for trace



OTel

- OTel community is very helpful
- Semantic convention well defined
- otel-collector mature



Performance

- insights into web applications
- Improving monitoring
- Identify performance issues

