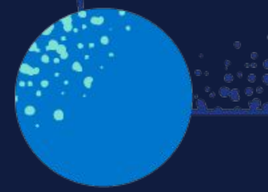
Introduction to OpenTelemetry with Python



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https://github.com/JessicaGarson/Introduction-to-OpenTelemetry-with-Python

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Agenda

- Observability basics
- What is OpenTelemetry and why use it
- Django and Flask instrumentation
- The state of OpenTelemetry
- Conclusion and next steps

I had attempted to find a short primer on starting with OpenTelemetry with Python but couldn’t find much more than a **demo application**.

https://opentelemetry-python.readthedocs.io/en/latest/examples/django/README.html
https://opentelemetry.io/docs/languages/python/getting-started/

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ChatGPT

Sure! Imagine you have a big box of crayons (these are like different parts of a computer program) and you want to make a beautiful picture (which is like running the program to do something cool). But sometimes, while you're drawing, a crayon might break or not color the way it should. This can make your picture not turn out as nice as you wanted.

OpenTelemetry is like having a magical friend who watches you while you draw. This friend takes notes on which crayons you use, how they perform, and if they break. Then, if something goes wrong, your magical friend can tell you exactly which crayon broke and why, so you can fix it and make sure your picture turns out great next time!

So, OpenTelemetry helps people who make computer programs make sure their programs run smoothly and fix any problems that happen.


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Observability fundamentals

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Observability helps you determine what's happening inside your system by analyzing the data it outputs

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What isn’t operating as expected

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Beyond detecting problems

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What is an agent?

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An observability agent is a software component or tool that collects, processes, and sends telemetry data from a system or application to an observability platform for analysis.

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Logs

Logs are records of events in a system, documenting operations, errors, and activities to aid in troubleshooting, monitoring, and compliance.

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Metrics

Metrics are quantitative measurements that track the performance and health of a system

Traces

Traces track the path and interactions of a request through a system.

What is OpenTelemetry (OTel)?

OpenTelemetry (OTel) is an observability framework that is open source and vendor neutral, designed to work with any backend system.

It provides standardized APIs, libraries, and tools to collect telemetry data such as metrics, logs, and traces.

OpenTelemetary enables comprehensive monitoring across services and platforms.

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Why?


Logs alone are simply not
enough sometimes

Um, what?

```
> * 2024-05-10 08:00:06.117  55  54440319  ...  http://api.nasa.gov/neo/rest/v1/neo/sentry/544...
> * 2024-05-10 08:00:06.117  56  54440642  ...                                                NaN
v * 2024-05-10 08:00:06.117  57  54440644  ...  http://api.nasa.gov/neo/rest/v1/neo/sentry/544...
```

Copy ▾ | Similar entries ▾ | Expand nested fields | Hide log summary


```
{
  insertId: "663e0c460001c9a60e5e65c3"
  labels: {2}
  logName: "projects/ncav-293119/logs/run.googleapis.com%2Fstdout"
  receiveTimestamp: "2024-05-10T12:00:06.338017672Z"
  resource: {2}
  textPayload: "57  54440644  ...  http://api.nasa.gov/neo/rest/v1/neo/sentry/544..."
  timestamp: "2024-05-10T12:00:06.117158Z"
}
```


```
> * 2024-05-10 08:00:06.117  [43 rows x 18 columns]
```

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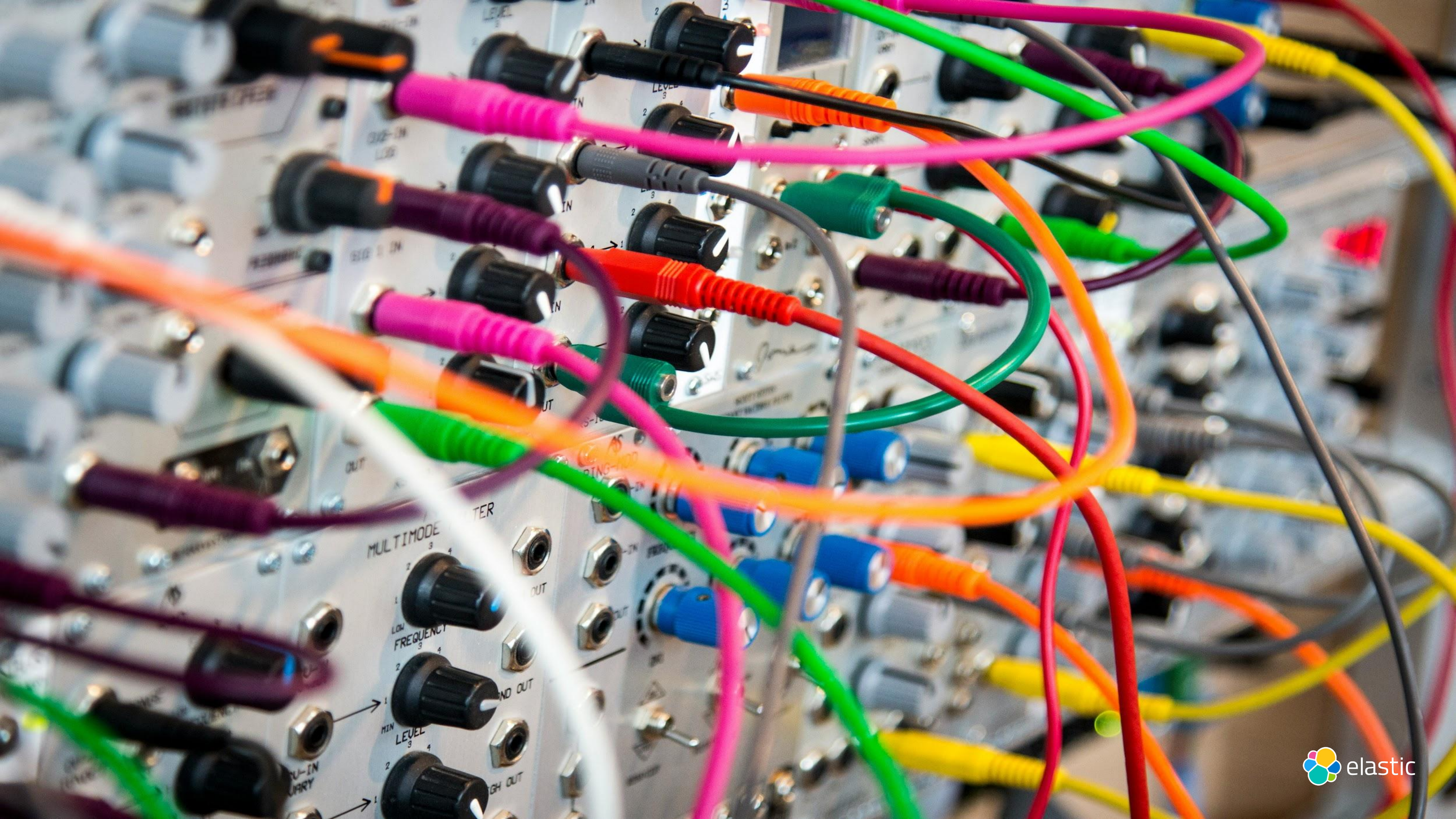
MULTIMODE
FREQUENCY
LEVEL
OUT
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Future proof

Spans within traces? What?!?!

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Spans are the building blocks of traces.
They include the following information:

- Name
- Parent span ID (empty for root spans)

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```
{
    "name": "add_item_view_span",
    "context": {
        "trace_id": "0x81364006fe668cb26a54e20918be9620",
        "span_id": "0x9a048a860bb7c9ac",
        "trace_state": "[]"
    },
    "kind": "SpanKind.INTERNAL",
    "parent_id": null,
    "start_time": "2024-08-15T20:55:42.634538Z",
    "end_time": "2024-08-15T20:55:42.637830Z",
    "status": {
        "status_code": "UNSET"
    },
    "attributes": {},
    "events": [],
    "links": [],
    "resource": {
        "attributes": {
            "service.name": "to-do-list-app-manual",
            "service.version": "1.0.0"
        },
        "schema_url": ""
    }
}
```


OHHH!

A span within a trace!

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Instrumenting refers to the process of adding observability features to your application to collect telemetry data, such as traces, metrics, and logs.

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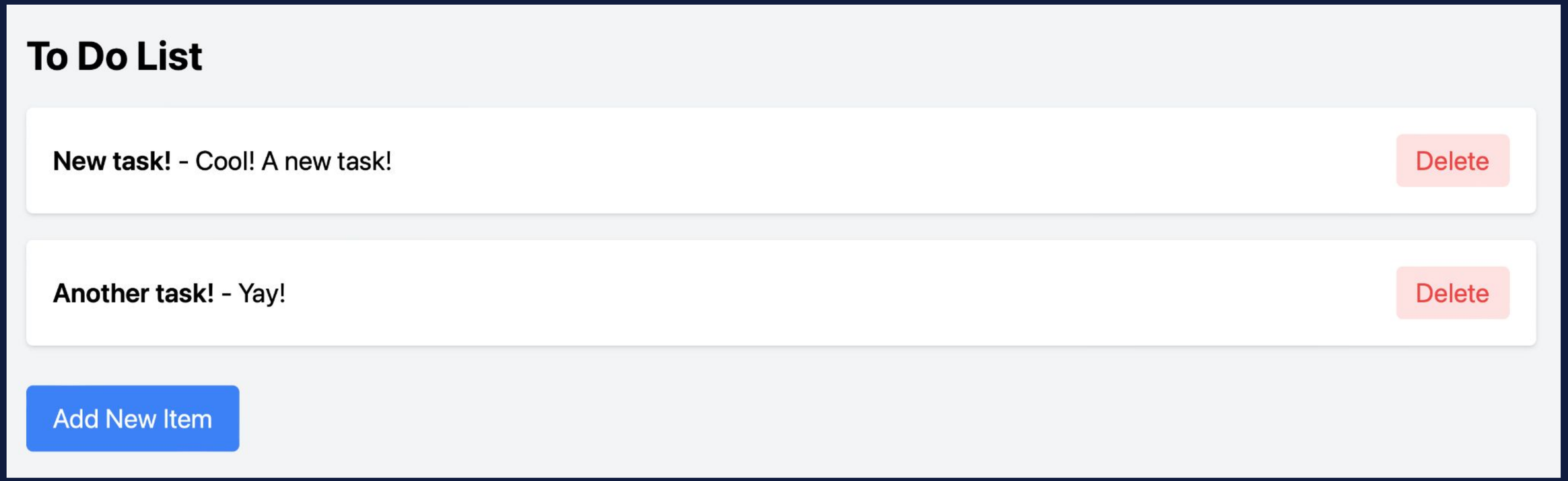
Django Example

The classic Django example



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How do you get that data to show in your console?

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```
pip install django django-environ elastic-opentelemetry opentelemetry-instrumentation-django
opentelemetry-bootstrap --action=install
```

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settings.py

```
env = environ.Env()

environ.Env.read_env(os.path.join(BASE_DIR, '.env'))

OTEL_EXPORTER_OTLP_HEADERS = env('OTEL_EXPORTER_OTLP_HEADERS')
OTEL_EXPORTER_OTLP_ENDPOINT = env('OTEL_EXPORTER_OTLP_ENDPOINT')
```

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.env example

```
OTEL_EXPORTER_OTLP_HEADERS="Authorization=ApiKey%20yourapikey"
OTEL_EXPORTER_OTLP_ENDPOINT="https://your/host/endpoint"
```

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```python
import os
import sys
from opentelemetry import trace
from opentelemetry.sdk.trace import TracerProvider
from opentelemetry.sdk.trace.export import BatchSpanProcessor, ConsoleSpanExporter
from opentelemetry.sdk import resources

def main():
    """Run administrative tasks."""
    os.environ.setdefault("DJANGO_SETTINGS_MODULE", "todolist_project.settings")

    resource = resources.Resource(attributes={
        resources.SERVICE_NAME: "your-service-name",
        resources.SERVICE_VERSION: "1.0.0"
    })

    trace_provider = TracerProvider(resource=resource)
    trace.set_tracer_provider(trace_provider)

    console_exporter = ConsoleSpanExporter()

    span_processor = BatchSpanProcessor(console_exporter)
    trace.get_tracer_provider().add_span_processor(span_processor)
```

manage.py

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Automatic Instrumentation

The process by which an agent modifies the bytecode of your application's classes, often to insert monitoring code

manage.py

```
def main():
    """Run administrative tasks."""
    os.environ.setdefault("DJANGO_SETTINGS_MODULE", "todolist_project.settings")
    DjangoInstrumentor().instrument()

    # Set up resource attributes for the service
    resource = resources.Resource(attributes={
        resources.SERVICE_NAME: "to-do-list-app",
        resources.SERVICE_VERSION: "1.0.0"
    })

    trace_provider = TracerProvider(resource=resource)
    trace.set_tracer_provider(trace_provider)

    otlp_exporter = OTLPSpanExporter()

    # Set up the BatchSpanProcessor to export traces
    span_processor = BatchSpanProcessor(otlp_exporter)
    trace.get_tracer_provider().add_span_processor(span_processor)
    turn go(f, seed, [])
}
```

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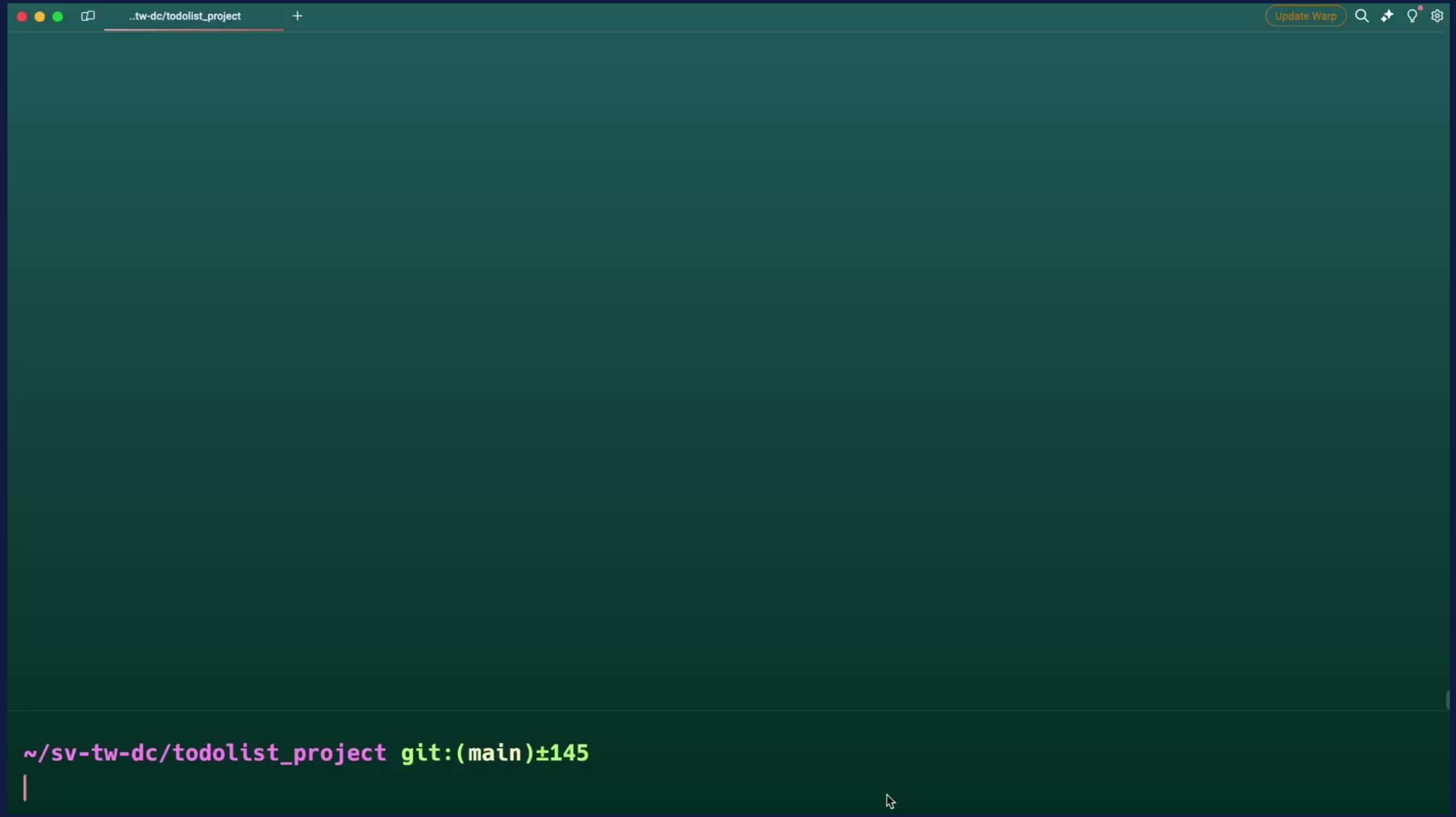
..tw-dc/todolist_project
Update Warp
~/sv-tw-dc/todolist_project git:(main)±145

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Manual instrumentation

Manual instrumentation requires incorporating particular code segments into your application to collect and transmit telemetry data.

So when would you want to use manual instrumentation?

Step 1: Delete this line from your manage.py file

```
# DjangoInstrumentor().instrument()
```

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Step 2: Update your views.py

```
tracer = trace.get_tracer(__name__)

meter = get_meter(__name__)

view_counter = meter.create_counter(
    "view_requests",
    description="Counts the number of requests to views",
)

view_duration_histogram = meter.create_histogram(
    "view_duration",
    description="Measures the duration of view execution",
)
```

```python
def index(request):
    start_time = time()

    with tracer.start_as_current_span("index_view_span") as span:
        items = ToDoItem.objects.all()
        span.set_attribute("todo.item_count", items.count())
        response = render(request, 'todo/index.html', {'items': items})

    view_counter.add(1, {"view_name": "index"})
    view_duration_histogram.record(time() - start_time, {"view_name": "index"})

    return response
```

```python
def add_item(request):
    start_time = time()

    with tracer.start_as_current_span("add_item_view_span") as span:
        if request.method == 'POST':
            form = ToDoForm(request.POST)
            if form.is_valid():
                form.save()
                span.add_event("New item added")
                response = redirect('index')
            else:
                response = render(request, 'todo/add_item.html', {'form': form})
        else:
            form = ToDoForm()
            response = render(request, 'todo/add_item.html', {'form': form})

    view_counter.add(1, {"view_name": "add_item"})
    view_duration_histogram.record(time() - start_time, {"view_name": "add_item"})

    return response
```

```python
def delete_item(request, item_id):
    start_time = time()

    with tracer.start_as_current_span("delete_item_view_span") as span:
        item = get_object_or_404(ToDoItem, id=item_id)
        span.set_attribute("todo.item_id", item_id)
        if request.method == 'POST':
            item.delete()
            span.add_event("Item deleted")
            response = redirect('index')
        else:
            response = render(request, 'todo/delete_item.html', {'item': item})

    view_counter.add(1, {"view_name": "delete_item"})
    view_duration_histogram.record(time() - start_time, {"view_name": "delete_item"})

    return response
```

Step 3: Update your models.py

```python
from django.db import models
from opentelemetry import trace

tracer = trace.get_tracer(__name__)

class ToDoItem(models.Model):
    title = models.CharField(max_length=100)
    description = models.TextField(blank=True)
    created_at = models.DateTimeField(auto_now_add=True)

    def __str__(self):
        return self.title

    def save(self, *args, **kwargs):
        with tracer.start_as_current_span("save_todo_item_span") as span:
            span.set_attribute("todo.title", self.title)
            if self.pk:
                span.add_event("Updating ToDoItem")
            else:
                span.add_event("Creating new ToDoItem")

            super(ToDoItem, self).save(*args, **kwargs)
```

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```
python manage.py runserver

Watching for file changes with StatReloader
Performing system checks...

System check identified no issues (0 silenced).
October 23, 2024 - 23:36:52
Django version 5.1, using settings 'todolist_project.settings'
Starting development server at http://127.0.0.1:8000/
Quit the server with CONTROL-C.

[23/Oct/2024 23:36:59] "GET / HTTP/1.1" 200 1695
```

Flask

No code instrumentation for automatic instrumentation

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```
export OTEL_RESOURCE_ATTRIBUTES="service.name=flask-todo-app"
export OTEL_EXPORTER_OTLP_HEADERS="Authorization=<your_authorization_header_value>"
export OTEL_EXPORTER_OTLP_ENDPOINT="<your_elastic_cloud_url>"
```

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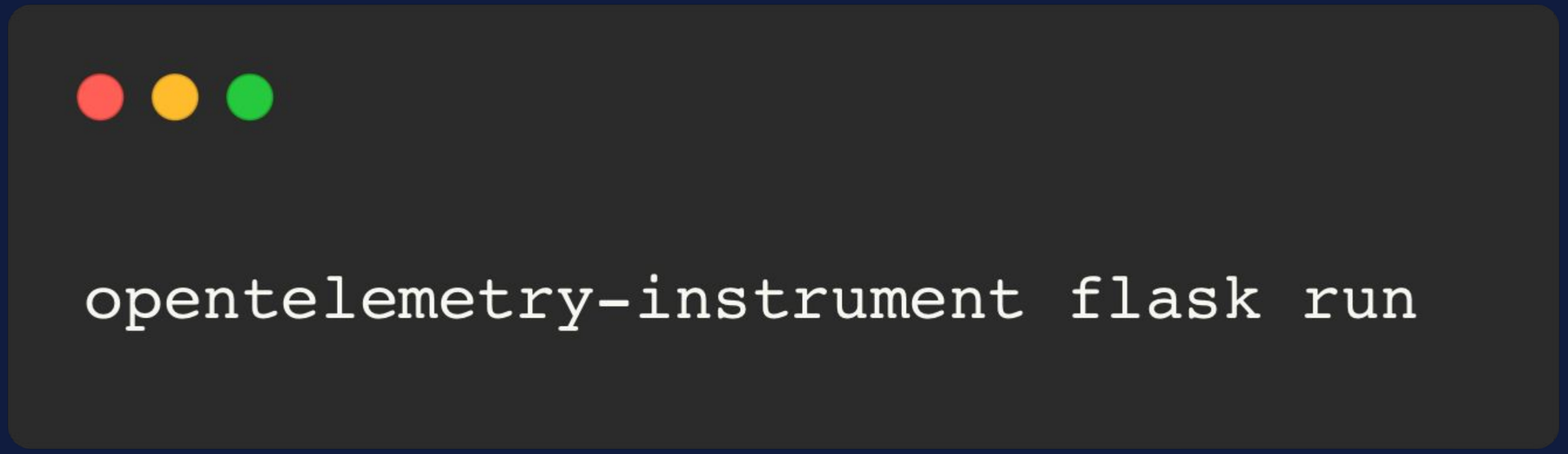

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To-Do List

Add new task

ADD TASK

New task! Delete

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Manual instrumentation in Flask

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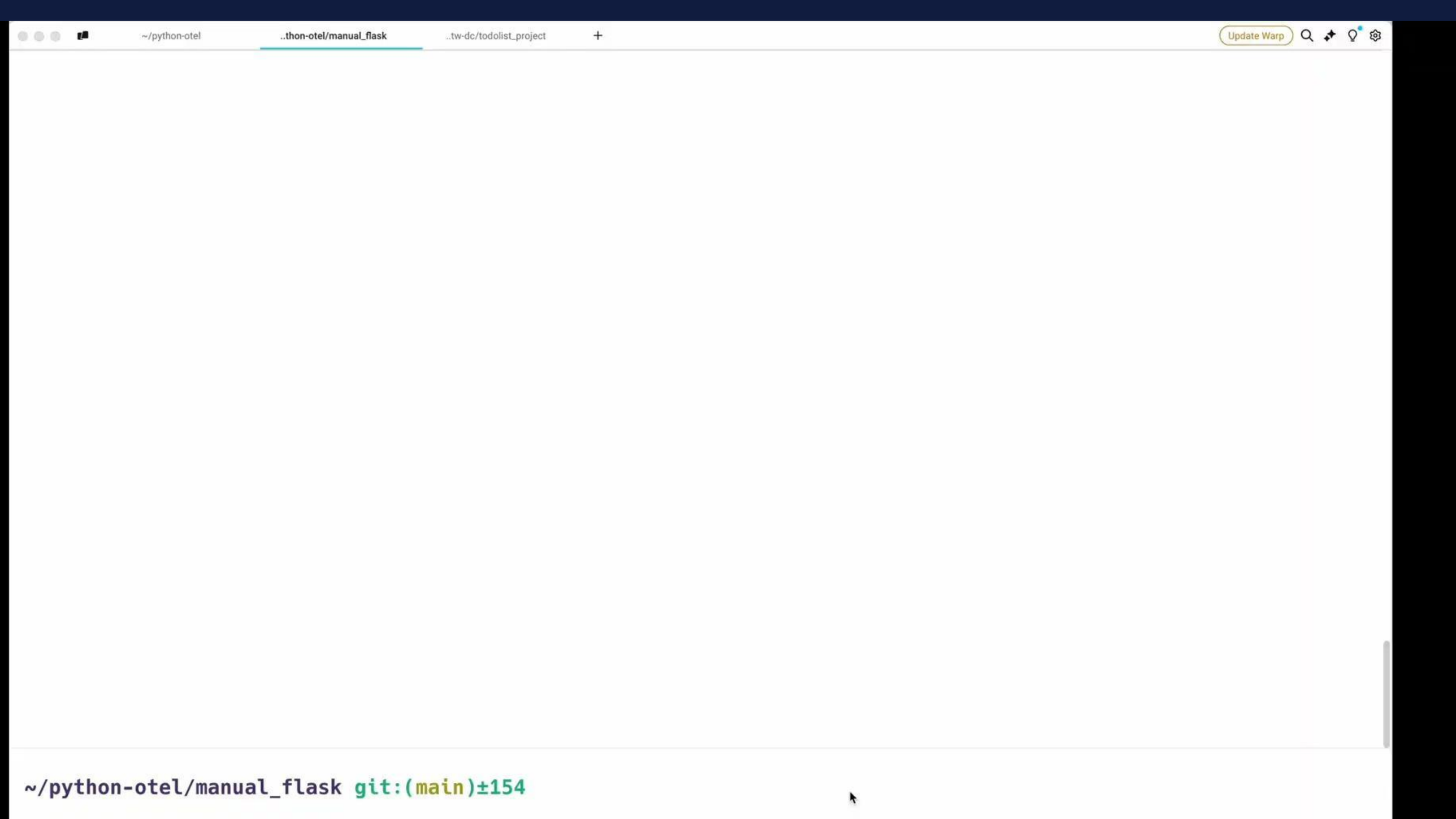
~/python-otel
..thon-otel/manual_flask
..tw-dc/todolist_project
Update Warp
~/python-otel/manual_flask git:(main)±154

OpenTelemetry Collector

A solution for receiving, processing, and exporting telemetry data. It eliminates the need to manage and maintain multiple agents or collectors.

https://opentelemetry.io/docs/demo

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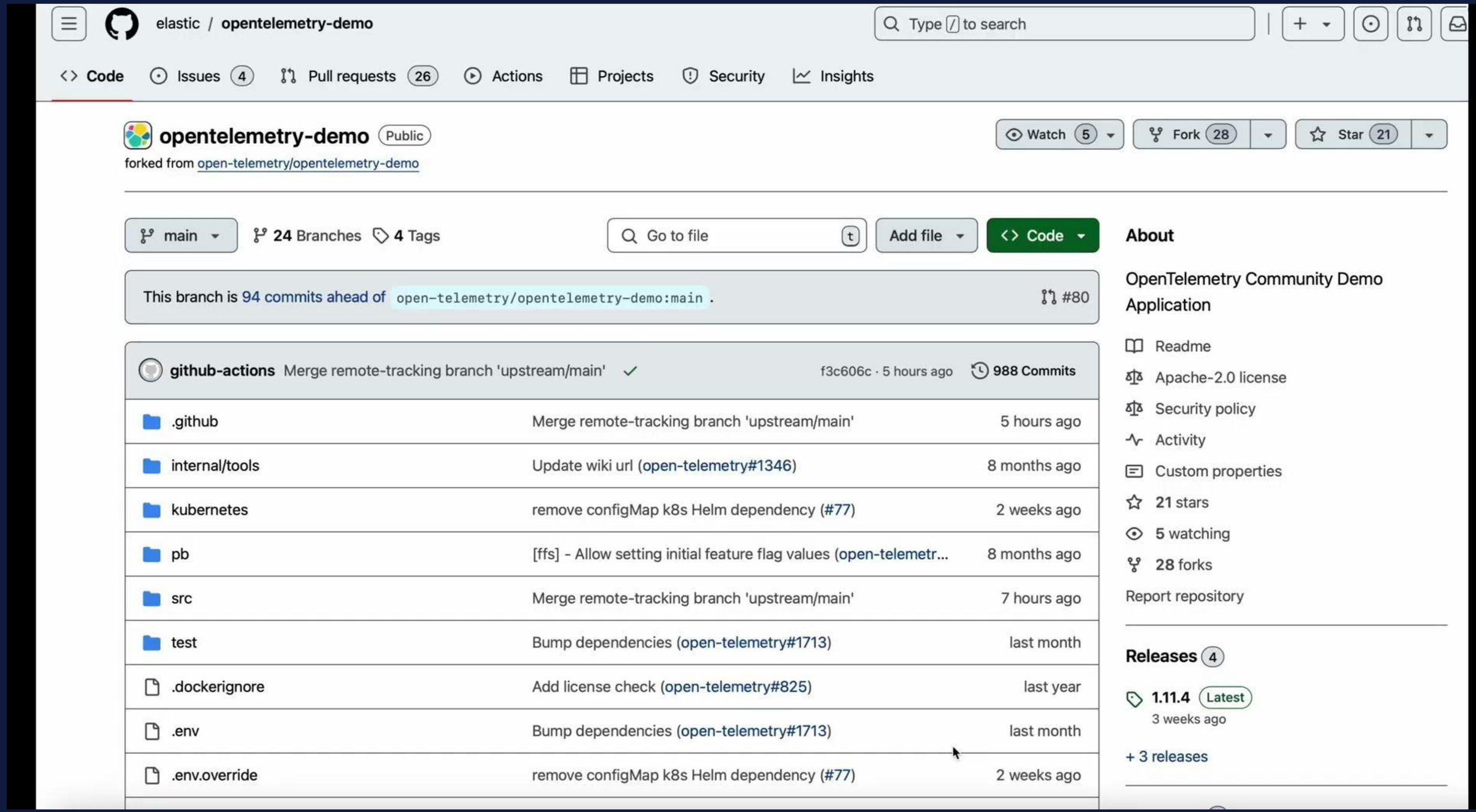
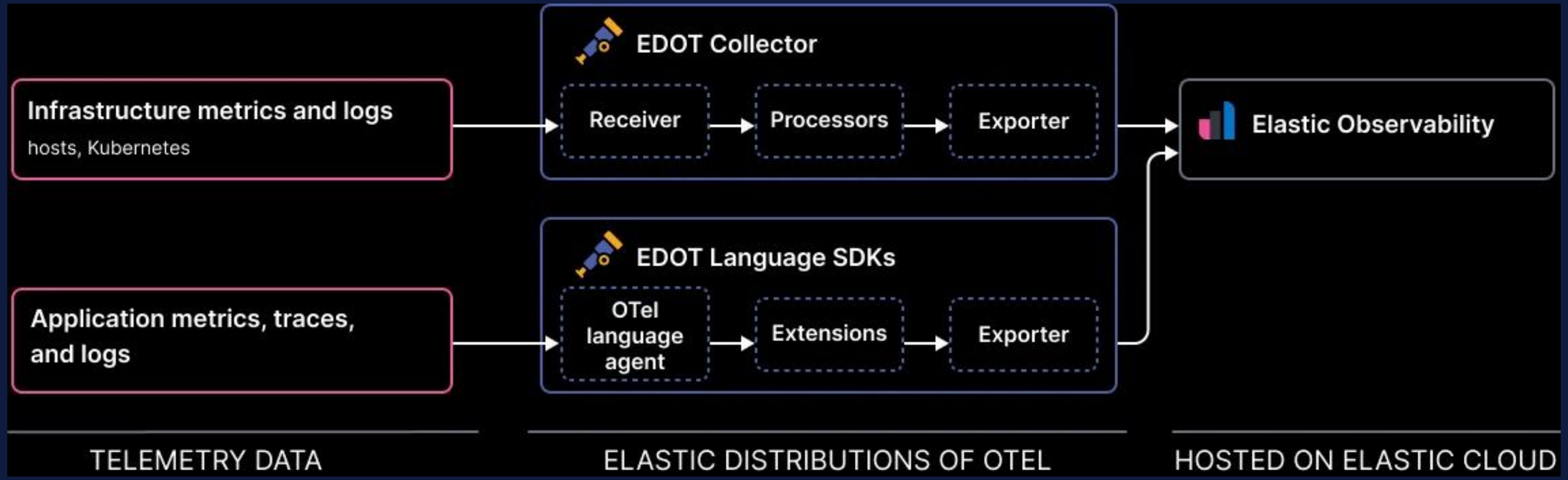

elastic / opentelemetry-demo
Type / to search
Code
Issues 4
Pull requests 26
Actions
Projects
Security
Insights
opentelemetry-demo
Public
forked from open-telemetry/opentelemetry-demo
Watch 5
Fork 28
Star 21
main
24 Branches
4 Tags
Go to file
t
Add file
Code
This branch is 94 commits ahead of open-telemetry/opentelemetry-demo:main .
#80
github-actions Merge remote-tracking branch 'upstream/main'
f3c606c · 5 hours ago
988 Commits
.github Merge remote-tracking branch 'upstream/main' 5 hours ago
internal/tools Update wiki url (open-telemetry#1346) 8 months ago
kubernetes remove configMap k8s Helm dependency (#77) 2 weeks ago
pb [ffs] - Allow setting initial feature flag values (open-telemetr... 8 months ago
src Merge remote-tracking branch 'upstream/main' 7 hours ago
test Bump dependencies (open-telemetry#1713) last month
.dockerignore Add license check (open-telemetry#825) last year
.env Bump dependencies (open-telemetry#1713) last month
.env.override remove configMap k8s Helm dependency (#77) 2 weeks ago
About
OpenTelemetry Community Demo Application
Readme
Apache-2.0 license
Security policy
Activity
Custom properties
21 stars
5 watching
28 forks
Report repository
Releases 4
1.11.4 Latest
3 weeks ago
+ 3 releases


EDOT Collector
Infrastructure metrics and logs
hosts, Kubernetes
Receiver
Processors
Exporter
Elastic Observability
EDOT Language SDKs
Application metrics, traces, and logs
OTel language agent
Extensions
Exporter
TELEMETRY DATA
ELASTIC DISTRIBUTIONS OF OTEL
HOSTED ON ELASTIC CLOUD

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State of adoption

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https://opentelemetry.io/status/

Closing thoughts

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OpenTelemetry (OTel) is an open-source, vendor-neutral observability framework designed to integrate with any backend system.

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It's very easy to start instrumenting your code.

It is highly configurable and extensible

It scales well from large applications to small applications

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Let me know if this talk inspires you to build anything. I'm @JessicaGarson on most platforms.


Thank you!
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