lahja Documentation

Release 0.14.5

Ethereum Foundation

Sep 26, 2019

General

1 Lahja 1

2 Table of contents 3

Python Module Index 25

Index 27

CHAPTER 1

Lahja

Warning: This is a very young project. It's used and validated mainly by the Python Ethereum client (Trinity) Lahja is alpha state software. Expect bugs.

Lahja is a generic multi process event bus implementation written in Python 3.6+ that enables lightweight inter-process communication, based on non-blocking asyncio.

1.1 Goals

Lahja is tailored around one primary use case: Enabling event-based communication between different processes in moder Python applications using non-blocking asyncio.

Features:

- Non-blocking APIs based on `asyncio`
- Broadcast events within a single process or across multiple processes.
- Multiple APIs to consume events that adapt to different use cases and styles
- lightweight and simple (e.g. no IPC pipe management etc)
- Easy event routing (e.g. route specific events to specific processes or process groups)

1.2 Further reading

Here are a couple more useful links to check out.

- Source Code on GitHub
- Examples

CHAPTER 2

Table of contents

2.1 Introduction

2.1.1 Lahja

Warning: This is a very young project. It's used and validated mainly by the Python Ethereum client (Trinity) Lahja is alpha state software. Expect bugs.

Lahja is a generic multi process event bus implementation written in Python 3.6+ that enables lightweight inter-process communication, based on non-blocking asyncio.

Goals

Lahja is tailored around one primary use case: Enabling event-based communication between different processes in moder Python applications using non-blocking asyncio.

Features:

- Non-blocking APIs based on `asyncio`
- Broadcast events within a single process or across multiple processes.
- Multiple APIs to consume events that adapt to different use cases and styles
- lightweight and simple (e.g. no IPC pipe management etc)
- Easy event routing (e.g. route specific events to specific processes or process groups)

Further reading

Here are a couple more useful links to check out.

- Source Code on GitHub
- Examples

2.2 Quickstart

2.2.1 Install the library

```
pip install lahja
```

2.2.2 Import `Endpoint` and `BaseEvent`

```
import asyncio
import logging
import multiprocessing

from lahja import BaseEvent, AsyncioEndpoint, ConnectionConfig


```

2.2.3 Setup application specific events

```
class BaseExampleEvent(BaseEvent):
    def __init__(self, payload):
        super().__init__()
        self.payload = payload
```

```
class FirstThingHappened(BaseExampleEvent):
    pass
```

```
class SecondThingHappened(BaseExampleEvent):
    pass
```

2.2.4 Setup first process to receive and broadcast events

```
def run_proc1():
    setup_logging()
    loop = asyncio.get_event_loop()
    loop.run_until_complete(proc1_worker())
```

```
async def proc1_worker():
    async with AsyncioEndpoint.serve(ConnectionConfig.from_name("e1")) as server:
        server.subscribe(
            SecondThingHappened,
            lambda event: logging.info(
                "Received via SUBSCRIBE API in proc1: %s", event.payload
            ),
        )
```

(continues on next page)

(continued from previous page)

```
        await server.wait_until_any_endpoint_subscribed_to(FirstThingHappened)

        while True:
            logging.info("Hello from proc1")
            await server.broadcast(FirstThingHappened("Hit from proc1"))
            await asyncio.sleep(2)
```

2.2.5 Setup second process to receive and broadcast events

```
def run_proc2():
    setup_logging()
    loop = asyncio.get_event_loop()
    loop.run_until_complete(proc2_worker())
```

```
async def proc2_worker():
    config = ConnectionConfig.from_name("e1")
    async with AsyncioEndpoint("e2").run() as client:
        await client.connect_to_endpoints(config)
        asyncio.ensure_future(display_proc1_events(client))
        client.subscribe(
            FirstThingHappened,
            lambda event: logging.info(
                "Received via SUBSCRIBE API in proc2: %s", event.payload
            ),
        )
        await client.wait_until_any_endpoint_subscribed_to(SecondThingHappened)

        while True:
            logging.info("Hello from proc2")
            await client.broadcast(SecondThingHappened("Hit from proc2 "))
            await asyncio.sleep(2)
```

2.2.6 Start both processes

```
    p1 = multiprocessing.Process(target=run_proc1)
    p1.start()

    p2 = multiprocessing.Process(target=run_proc2)
    p2.start()
    p1.join()
    p2.join()
```

2.3 Running the examples

2.3.1 Example: Chatter between two processes

```
python examples/inter_process_ping_pong.py
```

The output will look like this:

```
INFO  05-29 11:31:45  Hello from proc2
INFO  05-29 11:31:45  Hello from proc1
INFO  05-29 11:31:45  Received via SUBSCRIBE API in proc2: Hit from proc1
INFO  05-29 11:31:45  Received via STREAM API in proc2: Hit from proc1
INFO  05-29 11:31:46  Hello from proc2
INFO  05-29 11:31:46  Received via SUBSCRIBE API in proc1: Hit from proc2
INFO  05-29 11:31:46  Hello from proc1
INFO  05-29 11:31:47  Hello from proc2
INFO  05-29 11:31:47  Hello from proc1
INFO  05-29 11:31:48  Hello from proc2
INFO  05-29 11:31:48  Received via SUBSCRIBE API in proc1: Hit from proc2
INFO  05-29 11:31:48  Hello from proc1
INFO  05-29 11:31:49  Hello from proc2
INFO  05-29 11:31:49  Hello from proc1
INFO  05-29 11:31:50  Hello from proc2
INFO  05-29 11:31:50  Received via SUBSCRIBE API in proc1: Hit from proc2
INFO  05-29 11:31:50  Hello from proc1
INFO  05-29 11:31:50  Received via SUBSCRIBE API in proc2: Hit from proc1
INFO  05-29 11:31:50  Received via STREAM API in proc2: Hit from proc1
INFO  05-29 11:31:51  Hello from proc2
INFO  05-29 11:31:51  Hello from proc1
```

2.3.2 Example: Request API

```
python examples/request_api.py
```

The output will look like this:

```
Requesting
Got answer: Yay
Requesting
Got answer: Yay
Requesting
Got answer: Yay
```

2.4 API

This section aims to provide a detailed description of all APIs. For hands-on examples, check out the *Quickstart*.

Warning: We expect each alpha release to have breaking changes to the API.

2.4.1 Endpoint

Base Endpoint API

class lahja.base.**EndpointAPI**

Bases: abc.ABC

The `Endpoint` enables communication between different processes as well as within a single process via various event-driven APIs.

are_all_endpoints_subscribed_to(*event_type: Type[lahja.common.BaseEvent]*) → bool
Return `True` if every connected remote endpoint is subscribed to the specified event type from this endpoint. Otherwise return `False`.

broadcast(*item: lahja.common.BaseEvent*, *config: Optional[lahja.common.BroadcastConfig] = None*) → None
Broadcast an instance of *BaseEvent* on the event bus. Takes an optional second parameter of *BroadcastConfig* to decide where this event should be broadcasted to. By default, events are broadcasted across all connected endpoints with their consuming call sites.

broadcast_nowait(*item: lahja.common.BaseEvent*, *config: Optional[lahja.common.BroadcastConfig] = None*) → None
A sync compatible version of *broadcast()*

> **Warning:** Heavy use of *broadcast_nowait()* in contiguous blocks of code without yielding to the *async* implementation should be expected to cause problems.

connect_to_endpoints(**endpoints*) → None
Establish connections to the given endpoints.

get_connected_endpoints_and_subscriptions() → Tuple[Tuple[str, Set[Type[lahja.common.BaseEvent]]], ...]
Return 2-tuples for all all connected endpoints containing the name of the endpoint coupled with the set of messages the endpoint subscribes to

get_subscribed_events() → Set[Type[lahja.common.BaseEvent]]
Return the set of event types this endpoint subscribes to.

is_any_endpoint_subscribed_to(*event_type: Type[lahja.common.BaseEvent]*) → bool
Return `True` if at least one of the connected remote endpoints is subscribed to the specified event type from this endpoint. Otherwise return `False`.

is_connected_to(*endpoint_name: str*) → bool
Return whether this endpoint is connected to another endpoint with the given name.

is_endpoint_subscribed_to(*remote_endpoint: str, event_type: Type[lahja.common.BaseEvent]*) → bool
Return `True` if the specified remote endpoint is subscribed to the specified event type from this endpoint. Otherwise return `False`.

request(*item: lahja.common.BaseRequestResponseEvent[TResponse], config: Optional[lahja.common.BroadcastConfig] = None*) → TResponse
Broadcast an instance of *BaseRequestResponseEvent* on the event bus and immediately wait on an expected answer of type *BaseEvent*. Optionally pass a second parameter of *BroadcastConfig* to decide where the request should be broadcasted to. By default, requests are broadcasted across all connected endpoints with their consuming call sites.

run() → AsyncContextManager[lahja.base.EndpointAPI]
Context manager API for running endpoints.

```
async with endpoint.run() as endpoint:
    ... # endpoint running within context
... # endpoint stopped after
```

classmethod serve(*config: lahja.common.ConnectionConfig*) → AsyncContextManager[lahja.base.EndpointAPI]
Context manager API for running and endpoint server.

```
async with EndpointClass.serve(config):
    ... # server running within context
... # server stopped
```

stream(*event_type: Type[TStreamEvent], num_events: Optional[int] = None*) → AsyncGenerator[TStreamEvent, None]
Stream all events that match the specified event type. This returns an `AsyncIterable[BaseEvent]` which can be consumed through an `async for` loop. An optional `num_events` parameter can be passed to stop streaming after a maximum amount of events was received.

subscribe(*event_type: Type[TSubscribeEvent], handler: Callable[TSubscribeEvent, Union[Any, Awaitable[Any]]]*) → lahja.common.Subscription
Subscribe to receive updates for any event that matches the specified event type. A handler is passed as a second argument an *Subscription* is returned to unsubscribe from the event if needed.

wait_for(*event_type: Type[TWaitForEvent]*) → TWaitForEvent
Wait for a single instance of an event that matches the specified event type.

wait_until_all_endpoints_subscribed_to(*event: Type[lahja.common.BaseEvent], *, include_self: bool = True*) → None
Block until all currently connected remote endpoints are subscribed to the specified event type from this endpoint.

wait_until_any_endpoint_subscribed_to(*event: Type[lahja.common.BaseEvent]*) → None
Block until any other remote endpoint has subscribed to the specified event type from this endpoint.

wait_until_connected_to(*endpoint_name: str*) → None
Return once a connection exists to an endpoint with the given name.

wait_until_connections_change() → None
Block until the set of connected remote endpoints changes.

wait_until_endpoint_subscribed_to(*remote_endpoint: str, event: Type[lahja.common.BaseEvent]*) → None
Block until the specified remote endpoint has subscribed to the specified event type from this endpoint.

wait_until_endpoint_subscriptions_change() → None
Block until any subscription change occurs on any remote endpoint or the set of remote endpoints changes

is_running

is_serving

name

class lahja.base.**BaseEndpoint**(*name: str*)
Bases: *lahja.base.EndpointAPI*

Base class for endpoint implementations that implements shared/common logic

are_all_endpoints_subscribed_to(*event_type: Type[lahja.common.BaseEvent], include_self: bool = True*) → bool
Return `True` if every connected remote endpoint is subscribed to the specified event type from this endpoint. Otherwise return `False`.

get_connected_endpoints_and_subscriptions() → Tuple[Tuple[str, Set[Type[lahja.common.BaseEvent]]], ...]
Return all connected endpoints and their event type subscriptions to this endpoint.

is_any_endpoint_subscribed_to(*event_type: Type[lahja.common.BaseEvent]*) → bool
Return `True` if at least one of the connected remote endpoints is subscribed to the specified event type from this endpoint. Otherwise return `False`.

is_connected_to(*endpoint_name: str*) → bool
Return whether this endpoint is connected to another endpoint with the given name.

is_endpoint_subscribed_to(*remote_endpoint: str, event_type: Type[lahja.common.BaseEvent]*) → bool
Return `True` if the specified remote endpoint is subscribed to the specified event type from this endpoint. Otherwise return `False`.

wait_for(*event_type: Type[TWaitForEvent]*) → TWaitForEvent
Wait for a single instance of an event that matches the specified event type.

wait_until_all_endpoints_subscribed_to(*event: Type[lahja.common.BaseEvent], *, include_self: bool = True*) → None
Block until all currently connected remote endpoints are subscribed to the specified event type from this endpoint.

wait_until_any_endpoint_subscribed_to(*event: Type[lahja.common.BaseEvent]*) → None
Block until any other remote endpoint has subscribed to the specified event type from this endpoint.

wait_until_connected_to(*endpoint_name: str*) → None
Return once a connection exists to an endpoint with the given name.

wait_until_connections_change() → None
Block until the set of connected remote endpoints changes.

wait_until_endpoint_subscribed_to(*remote_endpoint: str, event: Type[lahja.common.BaseEvent]*) → None
Block until the specified remote endpoint has subscribed to the specified event type from this endpoint.

wait_until_endpoint_subscriptions_change() → None
Block until any subscription change occurs on any remote endpoint or the set of remote endpoints changes

has_snappy_support = False

logger = <Logger lahja.endpoint.Endpoint (WARNING)>

AsyncioEndpoint

class lahja.asyncio.endpoint.**AsyncioEndpoint**(*name: str*)
Bases: *lahja.base.BaseEndpoint*

The `AsyncioEndpoint` enables communication between different processes as well as within a single process via various event-driven APIs.

broadcast(*item: lahja.common.BaseEvent, config: Optional[lahja.common.BroadcastConfig] = None*) → None
Broadcast an instance of *BaseEvent* on the event bus. Takes an optional second parameter of *BroadcastConfig* to decide where this event should be broadcasted to. By default, events are broadcasted across all connected endpoints with their consuming call sites.

broadcast_nowait(*item: lahja.common.BaseEvent, config: Optional[lahja.common.BroadcastConfig] = None*) → None
A non-async `broadcast()` (see `broadcast()` for more)

Instead of blocking the calling coroutine this function schedules the broadcast and immediately returns.

CAUTION: You probably don't want to use this. broadcast() doesn't return until the write socket has finished draining, meaning that the OS has accepted the message. This prevents us from sending more

data than the remote process can handle. broadcast_nowait has no such backpressure. Even after the remote process stops accepting new messages this function will continue to accept them, which in the worst case could lead to runaway memory usage.

check_event_loop() → TFunc
All Endpoint methods must be called from the same event loop.

connect_to_endpoints(**endpoints*) → None
Connect to the given endpoints and await until all connections are established.

get_subscribed_events() → Set[Type[lahja.common.BaseEvent]]
Return the set of events this Endpoint is currently listening for

request(*item: lahja.common.BaseRequestResponseEvent[TResponse], config: Optional[lahja.common.BroadcastConfig] = None*) → TResponse
Broadcast an instance of *BaseRequestResponseEvent* on the event bus and immediately wait on an expected answer of type *BaseEvent*. Optionally pass a second parameter of *BroadcastConfig* to decide where the request should be broadcasted to. By default, requests are broadcasted across all connected endpoints with their consuming call sites.

run() → AsyncIterator[lahja.base.EndpointAPI]
Context manager API for running endpoints.

```
async with endpoint.run() as endpoint:
    ... # endpoint running within context
... # endpoint stopped after
```

classmethod serve(*config: lahja.common.ConnectionConfig*) → AsyncIterator[AsyncioEndpoint]
Context manager API for running and endpoint server.

```
async with EndpointClass.serve(config):
    ... # server running within context
... # server stopped
```

stream(*event_type: Type[TStreamEvent], num_events: Optional[int] = None*) → AsyncGenerator[TStreamEvent, None]
Stream all events that match the specified event type. This returns an `AsyncIterable[BaseEvent]` which can be consumed through an `async for` loop. An optional `num_events` parameter can be passed to stop streaming after a maximum amount of events was received.

subscribe(*event_type: Type[TSubscribeEvent], handler: Callable[TSubscribeEvent, Union[Any, Awaitable[Any]]]*) → lahja.common.Subscription
Subscribe to receive updates for any event that matches the specified event type. A handler is passed as a second argument an *Subscription* is returned to unsubscribe from the event if needed.

event_loop

ipc_path

is_running

is_serving

TrioEndpoint

class lahja.trio.endpoint.**TrioEndpoint**(*name: str*)
Bases: *lahja.base.BaseEndpoint*

broadcast(*item: lahja.common.BaseEvent, config: Optional[lahja.common.BroadcastConfig] = None*) → None
Broadcast an instance of *BaseEvent* on the event bus. Takes an optional second parameter of

BroadcastConfig to decide where this event should be broadcasted to. By default, events are broadcasted across all connected endpoints with their consuming call sites.

broadcast_nowait(*item: lahja.common.BaseEvent*, *config: Optional[lahja.common.BroadcastConfig] = None*) → None
A sync compatible version of *broadcast()*

> **Warning:** Heavy use of *broadcast_nowait()* in contiguous blocks of code without yielding to the *async* implementation should be expected to cause problems.

connect_to_endpoints(**endpoints*) → None
Connect to the given endpoints and await until all connections are established.

get_subscribed_events() → Set[Type[lahja.common.BaseEvent]]
Return the set of events this Endpoint is currently listening for

request(*item: lahja.common.BaseRequestResponseEvent[TResponse], config: Optional[lahja.common.BroadcastConfig] = None*) → TResponse
Broadcast an instance of *BaseRequestResponseEvent* on the event bus and immediately wait on an expected answer of type *BaseEvent*. Optionally pass a second parameter of *BroadcastConfig* to decide where the request should be broadcasted to. By default, requests are broadcasted across all connected endpoints with their consuming call sites.

run() → AsyncGenerator[lahja.base.EndpointAPI, None]
Context manager API for running endpoints.

```
async with endpoint.run() as endpoint:
    ... # endpoint running within context
... # endpoint stopped after
```

classmethod serve(*config: lahja.common.ConnectionConfig*) → AsyncIterator[TrioEndpoint]
Context manager API for running and endpoint server.

```
async with EndpointClass.serve(config):
    ... # server running within context
... # server stopped
```

stream(*event_type: Type[TStreamEvent], num_events: Optional[int] = None*) → AsyncGenerator[TStreamEvent, None]
Stream all events that match the specified event type. This returns an `AsyncIterable[BaseEvent]` which can be consumed through an `async for` loop. An optional `num_events` parameter can be passed to stop streaming after a maximum amount of events was received.

subscribe(*event_type: Type[TSubscribeEvent], handler: Callable[TSubscribeEvent, Union[Any, Awaitable[Any]]]*) → lahja.common.Subscription
Subscribe to receive updates for any event that matches the specified event type. A handler is passed as a second argument an *Subscription* is returned to unsubscribe from the event if needed.

wait_started() → None

wait_stopped() → None

TResponse = ~TResponse

TStreamEvent = ~TStreamEvent

TSubscribeEvent = ~TSubscribeEvent

is_running

is_server_stopped

is_serving

is_stopped

logger = <Logger lahja.trio.TrioEndpoint (WARNING)>

2.4.2 Common

ConnectionConfig

class lahja.common.**ConnectionConfig**
Bases: tuple

Configuration class needed to establish Endpoint connections.

classmethod from_name(*name: str*, *base_path: Optional[pathlib.Path] = None*) → lahja.common.ConnectionConfig

name
Alias for field number 0

path
Alias for field number 1

BaseEvent

class lahja.common.**BaseEvent**
Bases: object

bind(*endpoint: EndpointAPI*, *id: Optional[NewType.<locals>.new_type]*) → None

broadcast_config(*internal: bool = False*) → lahja.common.BroadcastConfig

get_origin() → str

is_bound = False

BaseRequestResponseEvent

class lahja.common.**BaseRequestResponseEvent**
Bases: abc.ABC, *lahja.common.BaseEvent*, typing.Generic

static expected_response_type() → Type[TResponse]
Return the type that is expected to be send back for this request. This ensures that at runtime, only expected responses can be send back to callsites that issued a *BaseRequestResponseEvent*

BroadcastConfig

class lahja.common.**BroadcastConfig**(*filter_endpoint: Optional[str] = None*, *filter_event_id: Optional[NewType.<locals>.new_type] = None*, *internal: bool = False*)
Bases: object

allowed_to_receive(*endpoint: str*) → bool

Subscription

class lahja.common.**Subscription**(*unsubscribe_fn: Callable[Any]*)
Bases: object

unsubscribe() → None

2.4.3 Exceptions

exception lahja.exceptions.**BindError**
Bases: *lahja.exceptions.LahjaError*

Raise when an attempt was made to bind an event that is already bound.

exception lahja.exceptions.**ConnectionAttemptRejected**
Bases: *lahja.exceptions.LahjaError*

Raised when an attempt was made to connect to an endpoint that is already connected.

exception lahja.exceptions.**LahjaError**
Bases: Exception

Base class for all lahja errors

exception lahja.exceptions.**LifecycleError**
Bases: *lahja.exceptions.LahjaError*

Raised when attempting to violate the lifecycle of an endpoint such as starting an already started endpoint or starting an endpoint that has already stopped.

exception lahja.exceptions.**RemoteDisconnected**
Bases: *lahja.exceptions.LahjaError*

Raise when a remote disconnects while we attempting to read a message.

exception lahja.exceptions.**UnexpectedResponse**
Bases: *lahja.exceptions.LahjaError*

Raised when the type of a response did not match the `expected_response_type`.

2.4.4 Testing

> **Warning:** This API is experimental and subject to breaking changes.

Tests for the `lahja` library can be written using the **Runner/Engine/Driver** APIs. These allow for constructing reusable declarative tests against endpoints which can be run against different endpoint implementations as well as different configurations of endpoints.

Runner

Runners are in charge of the outermost execution layer. A `Runner` **must** be a callable which accepts `*args` where each argument is a `Driver`.

class lahja.tools.runner.**RunnerAPI**
Bases: abc.ABC

Engines

Engines are in charge of abstracting away how each individual endpoint implementation should be run. An `Engine` **must** implement the following API.

class lahja.tools.engine.**EngineAPI**

Bases: abc.ABC

run_drivers(**drivers*) → Awaitable[None]

Performs the actual *running* of the drivers executing them with in a manner appropriate for the individual endpoint implementation.

run_with_timeout(*coro: Callable[..., Awaitable[Any]], *args, timeout: int*) → None

Runs a coroutine with the specifid positional `args` with a timeout. **must** raise the built-in `TimeoutError` when a timeout occurs.

sleep(*seconds: float*) → None

Sleep for the provide number of seconds in a manner appropriate for the individual endpoint implementation.

Drivers

Drivers are a declarative set of instructions for instrumenting the actions and lifecycle of an endpoint. A driver **must** be a coroutine which takes an `Engine` as a single argument and performs the actions declared by the driver.

Drivers should be constructed in a *functional* maner using the utilities provided under `lahja.tools.drivers`.

A driver is composed of a single *Initializer* followed by a variadic number of *Actions*.

lahja.tools.drivers.driver.**driver**(*initializer: lahja.tools.drivers.initializers.Initializer, *actions*) → Callable[lahja.tools.engine.EngineAPI, Awaitable[None]]

Construct a *Driver*. Should contain a single *Initializer* followed by a variadic number of *Actions*.

Initializers

lahja.tools.drivers.initializers.**serve_endpoint**(*config: lahja.common.ConnectionConfig*) → lahja.tools.drivers.initializers.Initializer

lahja.tools.drivers.initializers.**run_endpoint**(*name: str*) → lahja.tools.drivers.initializers.Initializer

Actions

lahja.tools.drivers.actions.**broadcast**(*event: lahja.common.BaseEvent, config: Optional[lahja.common.BroadcastConfig] = None*) → lahja.tools.drivers.actions.AsyncAction

see `EndpointAPI.broadcast`

lahja.tools.drivers.actions.**connect_to_endpoints**(**configs*) → lahja.tools.drivers.actions.AsyncAction

see `EndpointAPI.connect_to_endpoints`

lahja.tools.drivers.actions.**throws**(*action: Union[lahja.tools.drivers.actions.SyncAction, lahja.tools.drivers.actions.AsyncAction], exc_type: Type[Exception]*) → Union[lahja.tools.drivers.actions.SyncAction, lahja.tools.drivers.actions.AsyncAction]

Checks that the provided *Action* throws the provided exception type.

lahja.tools.drivers.actions.**wait_for**(*event_type: Type[lahja.common.BaseEvent], on_event: Optional[Callable[[lahja.base.EndpointAPI, lahja.common.BaseEvent], Any]] = None*) → lahja.tools.drivers.actions.AsyncAction

Wait for an event of the provided `request_type` and call response event returned by the provide `get_response` function.

lahja.tools.drivers.actions.**wait_until_any_endpoint_subscribed_to**(*event_type: Type[lahja.common.BaseEvent]*) → lahja.tools.drivers.actions.AsyncActi

see `EndpointAPI.wait_until_any_endpoint_subscribed_to`

lahja.tools.drivers.actions.**wait_until_connected_to**(*name: str*) → lahja.tools.drivers.actions.AsyncAction

see `EndpointAPI.wait_until_connected_to`

lahja.tools.drivers.actions.**wait_any_then_broadcast**(*event: lahja.common.BaseEvent, config: Optional[lahja.common.BroadcastConfig] = None*) → lahja.tools.drivers.actions.AsyncAction

Combination of `wait_until_any_endpoint_subscribed_to` and `broadcast`

lahja.tools.drivers.actions.**serve_request**(*request_type: Type[lahja.common.BaseRequestResponseEvent[lahja.co get_response: Callable[[lahja.base.EndpointAPI, lahja.common.BaseRequestResponseEvent[lahja.common.BaseEvent]], lahja.common.BaseEvent]*) → lahja.tools.drivers.actions.AsyncAction

Wait for an event of the provided `request_type` and respond using the response event returned by the provide `get_response` function.

lahja.tools.drivers.actions.**request**(*event: lahja.common.BaseRequestResponseEvent[lahja.common.BaseEvent], config: Optional[lahja.common.BroadcastConfig] = None, on_response: Optional[Callable[[lahja.base.EndpointAPI, lahja.common.BaseEvent], Any]] = None*) → lahja.tools.drivers.actions.AsyncAction

see `EndpointAPI.connect_to_endpoints`

Optionally provide a callback `on_response` that will be run upon receipt of the response.

lahja.tools.drivers.actions.**checkpoint**(*name: str*) → Tuple[lahja.tools.drivers.actions.AsyncAction, lahja.tools.drivers.actions.AsyncAction]

Generates a pair of actions that can be used in separate drivers to synchronize their action execution. Each driver will wait until this checkpoint has been hit before proceeding.

Examples

Driver to run an endpoint as a server and wait for a client to connect.

```
from lahja.tools import drivers as d

server_driver = d.driver(
    d.serve_endpoint(ConnectionConfig(...)),
    d.wait_until_connected_to('client'),
)
```

Driver to run a client and connect to a server.

```
from lahja.tools import drivers as d

server_config = ConnectionConfig(...)
client_driver = d.driver(
    d.run_endpoint(ConnectionConfig(...)),
    d.connect_to_endpoints(server_config),
)
```

We could then run these together against the `trio` implementation of the endpoint like this.

```
from lahja.tools.runners import TrioRunner

client_driver = ...
server_driver = ...
runner = TrioRunner()
runner(client_driver, server_driver)
```

2.5 Release Notes

2.5.1 Lahja 0.14.5 (2019-09-10)

Features

- Ensure `stream()` does not suppress `CancelledError` (#156)

Bugfixes

- Fix that ensures `asyncio` streams are closed when an endpoint shuts down to prevent `ResourceWarning` warnings. (#157)

2.5.2 Lahja 0.14.4 (2019-09-05)

No significant changes.

2.5.3 Lahja 0.14.3 (2019-08-28)

Improved Documentation

- Fix broken RTD build by re-adding some info that is important for the latex job. (#155)

2.5.4 Lahja 0.14.2 (2019-08-28)

Bugfixes

- Raise `ENDPOINT_CONNECT_TIMEOUT` to `30` seconds to be more conservative about app specific expectations on the maximum time it could take for endpoints to become available upon connection attempts. (#154)

2.5.5 Lahja 0.14.1 (2019-08-13)

Features

- Add a `TrioEndpoint` as a trio based alternative to the `AsyncioEndpoint`. It can seamlessly operate with other endpoints both trio or asyncio based. (#126)
- Convert run mechanism for `RemoteEndpoint` to be async context manager based. (#131)

Bugfixes

- Use the proper `ConnectionAttemptRejected` class in a code path that used a generic `Exception` before. (#128)
- If for some reason the IPC file is missing during server shutdown, suppress the *FileNotFoundError* that is raised when we try to remove it. (#144)
- Ensure cancellation of asyncio tasks is properly handled. (#145)
- Fixed some syntax issues in the API docs that prevented them from building. Ensured the CI docs build catches these issues in the future. (#147)

Improved Documentation

- Setup towncrier to generate release notes from fragment files to ensure a higher standard for release notes. (#147)
- Fix wrong title in docs as well as wrong info in license. (#150)
- Rearrange the table of contents and move "Testing" under the API section. (#151)
- Remove visual clutter from API docs Group methods and attributes in API docs (#152)

Deprecations and Removals

- Remove `connect_to_endpoint` and `connect_to_endpoints_nowait` APIs. (#137)

2.5.6 v0.14.0

- Feature: Rename subscription wait APIs and ensure they also work well with local subscriptions

2.5.7 v0.13.0

- Feature: Implement a standard API for endpoints to support non-asyncio based implementations (e.g. Trio)
- Feature: Improve flexibility of the APIs that allow waiting on subscriptions
- Bugfix: Get rid of warnings on shutdown
- Bugfix: Repair broken examples and add a CI job to ensure they don't break again
- Performance: Don't send events to endpoints that aren't subscribed to the specific event
- Performance: Reduce number of socket sends by precombinging length prefix
- Performance: Many small performance improvements in various code paths
- Performance: Use a faster request id implementation instead of using an uuid

2.5.8 v0.12.0

- Change IPC backend from multiprocessing to asyncio
- Endpoint.broadcast() is now async
- Endpoint.broadcast_nowait() now exists, it schedules the message to be broadcast
- Endpoint.start_serving_nowait() no longer exists
- Endpoint.connect_to_endpoints_blocking() no longer exists
- Endpoint.stop() must be called or else some coroutines will be orphaned
- Endpoint can only be used from one event loop. It will remember the current event loop when an async method is first called, and throw an exception if another of its async methods is called from a different event loop.
- Messages will be compressed if python-snappy is installed
- Lahja previously silently dropped some exceptions, they are now propogated up

2.5.9 v0.11.2

- Properly set up logger

2.5.10 v0.11.1

- Turn exception that would be raised in a background task into a warning

2.5.11 v0.11.0

- Performance: Connect endpoints directly without central coordinator (BREAKING CHANGE)

2.5.12 v0.10.2

- Fix issue that can crash Endpoint

2.5.13 v0.10.1

- Fix issue that can crash Endpoint

2.5.14 v0.10.0

- Make *request* API accept a *BroadcastConfig*
- Add benchmarks

2.5.15 v0.9.0

- Implement "internal events"
- Rename *max* to *num_events*
- Ensure Futures are created on the correct event loop
- Ensure all consuming APIs handle cancellations well
- Don't try to propagate events after shutdown

2.6 Contributing

Thank you for your interest in contributing! We welcome all contributions no matter their size. Please read along to learn how to get started. If you get stuck, feel free to reach for help in our Gitter channel.

2.6.1 Setting the stage

Clone the Lahja repository

```
$ git clone --recursive https://github.com/ethereum/lahja.git
```

Optional: Often, the best way to guarantee a clean Python 3 environment is with virtualenv. If we don't have `virtualenv` installed already, we first need to install it via pip.

```
pip install virtualenv
```

Then, we can initialize a new virtual environment `venv`, like:

```
virtualenv -p python3 venv
```

This creates a new directory `venv` where packages are installed isolated from any other global packages.

To activate the virtual directory we have to *source* it

```
. venv/bin/activate
```

After we have activated our virtual environment, installing all dependencies that are needed to run, develop and test all code in this repository is as easy as:

```
pip install -e .[dev]
```

2.6.2 Running the tests

A great way to explore the code base is to run the tests.

We can run all tests with:

```
pytest
```

2.6.3 Code Style

When multiple people are working on the same body of code, it is important that they write code that conforms to a similar style. It often doesn't matter as much which style, but rather that they conform to one style.

To ensure your contribution conforms to the style being used in this project, we encourage you to read our style guide.

2.6.4 Type Hints

The code bases is transitioning to use type hints. Type hints make it easy to prevent certain types of bugs, enable richer tooling and enhance the documentation, making the code easier to follow.

All new code is required to land with type hints with the exception of test code that is not expected to use type hints.

All parameters as well as the return type of defs are expected to be typed with the exception of `self` and `cls` as seen in the following example.

```
def __init__(self, wrapped_db: BaseDB) -> None:
    self.wrapped_db = wrapped_db
    self.reset()
```

2.6.5 Documentation

Public APIs are expected to be annotated with docstrings as seen in the following example.

```
def add_transaction(self,
                    transaction: BaseTransaction,
                    computation: BaseComputation,
                    block: BaseBlock) -> Tuple[Block, Dict[bytes, bytes]]:
        """
        Add a transaction to the given block and
        return `trie_data` to store the transaction data in chaindb in VM layer.

        Update the bloom_filter, transaction trie and receipt trie roots, bloom_
↪filter,
        bloom, and used_gas of the block.

        :param transaction: the executed transaction
        :param computation: the Computation object with executed result
        :param block: the Block which the transaction is added in

        :return: the block and the trie_data
        """
```

Docstrings are written in reStructuredText and allow certain type of directives.

Notice that `:param:` and `:return:` directives are being used to describe parameters and return value. Usage of `:type:` and `:rtype:` directives on the other hand is discouraged as sphinx directly reads and displays the types from the source code type definitions making any further use of `:type:` and `:rtype:` obsolete and unnecessarily verbose.

Use imperative, present tense to describe APIs: "return" not "returns"

One way to test if you have it right is to complete the following sentence.

If you call this API it will: _____

2.6.6 Pull Requests

It's a good idea to make pull requests early on. A pull request represents the start of a discussion, and doesn't necessarily need to be the final, finished submission.

GitHub's documentation for working on pull requests is available here.

Once you've made a pull request take a look at the Circle CI build status in the GitHub interface and make sure all tests are passing. In general pull requests that do not pass the CI build yet won't get reviewed unless explicitly requested.

2.6.7 Releasing

Pandoc is required for transforming the markdown README to the proper format to render correctly on pypi.

For Debian-like systems:

```
apt install pandoc
```

Or on OSX:

```
brew install pandoc
```

To release a new version:

```
bumpversion $$VERSION_PART_TO_BUMP$$
git push && git push --tags
make release
```

How to bumpversion

The version format for this repo is `{major}.{minor}.{patch}` for stable, and `{major}.{minor}.{patch}-{stage}.{devnum}` for unstable (`stage` can be alpha or beta).

To issue the next version in line, use bumpversion and specify which part to bump, like `bumpversion minor` or `bumpversion devnum`.

If you are in a beta version, `bumpversion stage` will switch to a stable.

To issue an unstable version when the current version is stable, specify the new version explicitly, like `bumpversion --new-version 4.0.0-alpha.1 devnum`

2.7 Code of Conduct

2.7.1 Our Pledge

In the interest of fostering an open and welcoming environment, we as contributors and maintainers pledge to making participation in our project and our community a harassment-free experience for everyone, regardless of age, body size, disability, ethnicity, gender identity and expression, level of experience, education, socio-economic status, nationality, personal appearance, race, religion, or sexual identity and orientation.

2.7.2 Our Standards

Examples of behavior that contributes to creating a positive environment include:

- Using welcoming and inclusive language
- Being respectful of differing viewpoints and experiences
- Gracefully accepting constructive criticism
- Focusing on what is best for the community
- Showing empathy towards other community members

Examples of unacceptable behavior by participants include:

- The use of sexualized language or imagery and unwelcome sexual attention or advances
- Trolling, insulting/derogatory comments, and personal or political attacks
- Public or private harassment
- Publishing others' private information, such as a physical or electronic address, without explicit permission
- Other conduct which could reasonably be considered inappropriate in a professional setting

2.7.3 Our Responsibilities

Project maintainers are responsible for clarifying the standards of acceptable behavior and are expected to take appropriate and fair corrective action in response to any instances of unacceptable behavior.

Project maintainers have the right and responsibility to remove, edit, or reject comments, commits, code, wiki edits, issues, and other contributions that are not aligned to this Code of Conduct, or to ban temporarily or permanently any contributor for other behaviors that they deem inappropriate, threatening, offensive, or harmful.

2.7.4 Scope

This Code of Conduct applies both within project spaces and in public spaces when an individual is representing the project or its community. Examples of representing a project or community include using an official project e-mail address, posting via an official social media account, or acting as an appointed representative at an online or offline event. Representation of a project may be further defined and clarified by project maintainers.

2.7.5 Enforcement

Instances of abusive, harassing, or otherwise unacceptable behavior may be reported by contacting the project team at piper@pipermerriam.com. All complaints will be reviewed and investigated and will result in a response that is deemed necessary and appropriate to the circumstances. The project team is obligated to maintain confidentiality with regard to the reporter of an incident. Further details of specific enforcement policies may be posted separately.

Project maintainers who do not follow or enforce the Code of Conduct in good faith may face temporary or permanent repercussions as determined by other members of the project's leadership.

2.7.6 Attribution

This Code of Conduct is adapted from the Contributor Covenant, version 1.4, available at https://www.contributor-covenant.org/version/1/4/code-of-conduct.html

Python Module Index

l

lahja.exceptions, 13

Index

A

allowed_to_receive() (*lahja.common.BroadcastConfig method*), 12
are_all_endpoints_subscribed_to() (*lahja.base.BaseEndpoint method*), 8
are_all_endpoints_subscribed_to() (*lahja.base.EndpointAPI method*), 6
AsyncioEndpoint (*class in lahja.asyncio.endpoint*), 9

B

BaseEndpoint (*class in lahja.base*), 8
BaseEvent (*class in lahja.common*), 12
BaseRequestResponseEvent (*class in lahja.common*), 12
bind() (*lahja.common.BaseEvent method*), 12
BindError, 13
broadcast() (*in module lahja.tools.drivers.actions*), 14
broadcast() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 9
broadcast() (*lahja.base.EndpointAPI method*), 7
broadcast() (*lahja.trio.endpoint.TrioEndpoint method*), 10
broadcast_config() (*lahja.common.BaseEvent method*), 12
broadcast_nowait() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 9
broadcast_nowait() (*lahja.base.EndpointAPI method*), 7
broadcast_nowait() (*lahja.trio.endpoint.TrioEndpoint method*), 11
BroadcastConfig (*class in lahja.common*), 12

C

check_event_loop() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 10
checkpoint() (*in module lahja.tools.drivers.actions*), 15
connect_to_endpoints() (*in module lahja.tools.drivers.actions*), 14
connect_to_endpoints() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 10
connect_to_endpoints() (*lahja.base.EndpointAPI method*), 7
connect_to_endpoints() (*lahja.trio.endpoint.TrioEndpoint method*), 11
ConnectionAttemptRejected, 13
ConnectionConfig (*class in lahja.common*), 12

D

driver() (*in module lahja.tools.drivers.driver*), 14

E

EndpointAPI (*class in lahja.base*), 6
EngineAPI (*class in lahja.tools.engine*), 14
event_loop (*lahja.asyncio.endpoint.AsyncioEndpoint attribute*), 10
expected_response_type() (*lahja.common.BaseRequestResponseEvent static method*), 12

F

from_name() (*lahja.common.ConnectionConfig class method*), 12

G

get_connected_endpoints_and_subscriptions() (*lahja.base.BaseEndpoint method*), 8
get_connected_endpoints_and_subscriptions() (*lahja.base.EndpointAPI method*), 7
get_origin() (*lahja.common.BaseEvent method*), 12

get_subscribed_events() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 10
get_subscribed_events() (*lahja.base.EndpointAPI method*), 7
get_subscribed_events() (*lahja.trio.endpoint.TrioEndpoint method*), 11

H

has_snappy_support (*lahja.base.BaseEndpoint attribute*), 9

I

ipc_path (*lahja.asyncio.endpoint.AsyncioEndpoint attribute*), 10
is_any_endpoint_subscribed_to() (*lahja.base.BaseEndpoint method*), 8
is_any_endpoint_subscribed_to() (*lahja.base.EndpointAPI method*), 7
is_bound (*lahja.common.BaseEvent attribute*), 12
is_connected_to() (*lahja.base.BaseEndpoint method*), 9
is_connected_to() (*lahja.base.EndpointAPI method*), 7
is_endpoint_subscribed_to() (*lahja.base.BaseEndpoint method*), 9
is_endpoint_subscribed_to() (*lahja.base.EndpointAPI method*), 7
is_running (*lahja.asyncio.endpoint.AsyncioEndpoint attribute*), 10
is_running (*lahja.base.EndpointAPI attribute*), 8
is_running (*lahja.trio.endpoint.TrioEndpoint attribute*), 11
is_server_stopped (*lahja.trio.endpoint.TrioEndpoint attribute*), 11
is_serving (*lahja.asyncio.endpoint.AsyncioEndpoint attribute*), 10
is_serving (*lahja.base.EndpointAPI attribute*), 8
is_serving (*lahja.trio.endpoint.TrioEndpoint attribute*), 12
is_stopped (*lahja.trio.endpoint.TrioEndpoint attribute*), 12

L

lahja.exceptions (*module*), 13
LahjaError, 13
LifecycleError, 13
logger (*lahja.base.BaseEndpoint attribute*), 9
logger (*lahja.trio.endpoint.TrioEndpoint attribute*), 12

N

name (*lahja.base.EndpointAPI attribute*), 8
name (*lahja.common.ConnectionConfig attribute*), 12

P

path (*lahja.common.ConnectionConfig attribute*), 12

R

RemoteDisconnected, 13
request() (*in module lahja.tools.drivers.actions*), 15
request() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 10
request() (*lahja.base.EndpointAPI method*), 7
request() (*lahja.trio.endpoint.TrioEndpoint method*), 11
run() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 10
run() (*lahja.base.EndpointAPI method*), 7
run() (*lahja.trio.endpoint.TrioEndpoint method*), 11
run_drivers() (*lahja.tools.engine.EngineAPI method*), 14
run_endpoint() (*in module lahja.tools.drivers.initializers*), 14
run_with_timeout() (*lahja.tools.engine.EngineAPI method*), 14
RunnerAPI (*class in lahja.tools.runner*), 13

S

serve() (*lahja.asyncio.endpoint.AsyncioEndpoint class method*), 10
serve() (*lahja.base.EndpointAPI class method*), 7
serve() (*lahja.trio.endpoint.TrioEndpoint class method*), 11
serve_endpoint() (*in module lahja.tools.drivers.initializers*), 14
serve_request() (*in module lahja.tools.drivers.actions*), 15
sleep() (*lahja.tools.engine.EngineAPI method*), 14
stream() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 10
stream() (*lahja.base.EndpointAPI method*), 8
stream() (*lahja.trio.endpoint.TrioEndpoint method*), 11
subscribe() (*lahja.asyncio.endpoint.AsyncioEndpoint method*), 10
subscribe() (*lahja.base.EndpointAPI method*), 8
subscribe() (*lahja.trio.endpoint.TrioEndpoint method*), 11
Subscription (*class in lahja.common*), 13

T

throws() (*in module lahja.tools.drivers.actions*), 14
TResponse (*lahja.trio.endpoint.TrioEndpoint attribute*), 11
TrioEndpoint (*class in lahja.trio.endpoint*), 10
TStreamEvent (*lahja.trio.endpoint.TrioEndpoint attribute*), 11

TSubscribeEvent (*lahja.trio.endpoint.TrioEndpoint attribute*), 11

U

UnexpectedResponse, 13
unsubscribe() (*lahja.common.Subscription method*), 13

W

wait_any_then_broadcast() (*in module lahja.tools.drivers.actions*), 15
wait_for() (*in module lahja.tools.drivers.actions*), 15
wait_for() (*lahja.base.BaseEndpoint method*), 9
wait_for() (*lahja.base.EndpointAPI method*), 8
wait_started() (*lahja.trio.endpoint.TrioEndpoint method*), 11
wait_stopped() (*lahja.trio.endpoint.TrioEndpoint method*), 11
wait_until_all_endpoints_subscribed_to() (*lahja.base.BaseEndpoint method*), 9
wait_until_all_endpoints_subscribed_to() (*lahja.base.EndpointAPI method*), 8
wait_until_any_endpoint_subscribed_to() (*in module lahja.tools.drivers.actions*), 15
wait_until_any_endpoint_subscribed_to() (*lahja.base.BaseEndpoint method*), 9
wait_until_any_endpoint_subscribed_to() (*lahja.base.EndpointAPI method*), 8
wait_until_connected_to() (*in module lahja.tools.drivers.actions*), 15
wait_until_connected_to() (*lahja.base.BaseEndpoint method*), 9
wait_until_connected_to() (*lahja.base.EndpointAPI method*), 8
wait_until_connections_change() (*lahja.base.BaseEndpoint method*), 9
wait_until_connections_change() (*lahja.base.EndpointAPI method*), 8
wait_until_endpoint_subscribed_to() (*lahja.base.BaseEndpoint method*), 9
wait_until_endpoint_subscribed_to() (*lahja.base.EndpointAPI method*), 8
wait_until_endpoint_subscriptions_change() (*lahja.base.BaseEndpoint method*), 9
wait_until_endpoint_subscriptions_change() (*lahja.base.EndpointAPI method*), 8