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# **Doozer Documentation**

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Doozer is a library for building services that are driven by consumers. Doozer applications read from objects that implement the *Consumer Interface* and provide the message received to a callback for processing. The message can be processed before handing it off to the callback, and the callback's results can be processed after they are returned to the application.



## INSTALLATION

You can install Doozer using Pip:

```
$ python -m pip install doozer
```

You can also install it from source:

```
$ python setup.py install
```





## QUICKSTART

```
from __future__ import annotations

from doozer import Abort, Application

class FileConsumer:
    """Read lines from a file."""

    def __init__(self, filename):
        self.filename = filename
        self._file = None

    def __iter__(self):
        """FileConsumer objects are iterators."""
        return self

    def __next__(self):
        """Return the next line of the file, if available."""
        if not self._file:
            self._file = open(self.filename)
        try:
            return next(self._file)
        except StopIteration:
            self._file.close()
            raise Abort("Reached end of file", None)

    async def read(self):
        """Return the next line in the file."""
        return next(self)

async def callback(app, message):
    """Print the message retrieved from the file consumer."""
    print(app.name, "received:", message)
    return message

app = Application(
    __name__,
    callback=callback,
    consumer=FileConsumer(__file__),
)
```

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```
@app.startup
async def print_header(app):
    """Print a header for the file being processed."""
    print("# Begin processing", app.consumer.filename)

@app.teardown
async def print_footer(app):
    """Print a footer for the file being processed."""
    print("# Done processing", app.consumer.filename)

@app.message_preprocessor
async def remove_comments(app, line):
    """Abort processing of comments (lines that start with #)."""
    if line.strip().startswith("#"):
        raise Abort("Line is a comment", line)
    return line
```

## RUNNING APPLICATIONS

Doozer provides a `doozer` command to run your applications from the command line. To run the application defined in the quickstart above, `cd` to the directory containing the module and run:

```
$ doozer run file_printer
```

Doozer's CLI can also be invoked by running the installed package as a script. To avoid confusion and prevent different installations of Doozer from interfering with one another, this is the recommended way to run Doozer applications:

```
$ python -m doozer run file_printer
```

If a module contains only one instance of a Doozer *Application*, `python -m doozer run` will automatically detect and run it. If more than one instance exists, the desired application's name must be specified:

```
$ python -m doozer run file_printer:app
```

This form always takes precedence over the former, and the `doozer` command won't attempt to auto-detect an instance even if there is a problem with the name specified. If the attribute specified by the name after `:` is callable, `python -m doozer run` will call it and use the returned value as the application. Any callable specified this way should require no arguments and return an instance of *Application*. Autodiscovery of callables that return applications is not currently supported.

More detailed information about Doozer's command line interface can be found in *Command Line Interface*.



## **LOGGING**

Doozer applications provide a default logger. The logger returned by calling `logging.getLogger()` will be used. The name of the logger is the name given to the application. Any configuration needed (e.g., `logging.basicConfig()`, `logging.config.dictConfig()`, etc.) should be done before the application is started.



## DEBUG MODE

Debugging with `asyncio` can be tricky. Doozer provides a debug mode enables `asyncio`'s debug mode as well as debugging information through Doozer's logger.

Debug mode can be enabled through a configuration setting:

```
app.settings['DEBUG'] = True
```

or by providing a truthy value for debug when calling `run_forever()`:

```
app.run_forever(debug=True)
```

Contents:

### 5.1 Consumer Interface

To work with Doozer, a consumer must conform to the Consumer Interface. To conform to the interface, the object must expose a `coroutine()` function named `read`.

Below is a sample implementation.

```
from __future__ import annotations

from doozer import Abort, Application

class FileConsumer:
    """Read lines from a file."""

    def __init__(self, filename):
        self.filename = filename
        self._file = None

    def __iter__(self):
        """FileConsumer objects are iterators."""
        return self

    def __next__(self):
        """Return the next line of the file, if available."""
        if not self._file:
            self._file = open(self.filename)
        try:
            return next(self._file)
```

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```

        except StopIteration:
            self._file.close()
            raise Abort("Reached end of file", None)

    async def read(self):
        """Return the next line in the file."""
        return next(self)

async def callback(app, message):
    """Print the message retrieved from the file consumer."""
    print(app.name, "received:", message)
    return message

app = Application(
    __name__,
    callback=callback,
    consumer=FileConsumer(__file__),
)

@app.startup
async def print_header(app):
    """Print a header for the file being processed."""
    print("# Begin processing", app.consumer.filename)

@app.teardown
async def print_footer(app):
    """Print a footer for the file being processed."""
    print("# Done processing", app.consumer.filename)

@app.message_preprocessor
async def remove_comments(app, line):
    """Abort processing of comments (lines that start with #)."""
    if line.strip().startswith("#"):
        raise Abort("Line is a comment", line)
    return line

```

## 5.2 Callbacks

Doozer operates on messages through a series of `asyncio.coroutine()` callback functions. Each callback type serves a unique purpose.



### 5.2.1 callback

This is the only one of the callback settings that is required. Its purpose is to process the incoming message. If desired, it should return the result(s) of processing the message as an iterable.

```
async def callback(application, message):
    return ['spam']

Application('name', callback=callback)
```

**Note:** There can only be one function registered as `callback`.

### 5.2.2 error

These callbacks are called when an exception is raised while processing a message.

```
app = Application('name')

@app.error
async def log_error(application, message, exception):
    logger.error('spam')
```

**Note:** Exceptions raised while postprocessing a result will not be processed through these callbacks.

### 5.2.3 message\_acknowledgement

These callbacks are intended to acknowledge that a message has been received and should not be made available to other consumers. They run after a message and its result(s) have been fully processed.

```
app = Application('name')

@app.message_acknowledgement
async def acknowledge_message(application, original_message):
    await original_message.acknowledge()
```

### 5.2.4 message\_preprocessor

These callbacks are called as each message is first received. Any modifications they make to the message will be reflected in what is passed to `callback` for processing.

```
app = Application('name')

@app.message_preprocessor
async def add_process_id(application, message):
    message['pid'] = os.getpid()
    return message
```

## 5.2.5 result\_postprocessor

These callbacks will operate on the result(s) of `callback`. Each callback is applied to each result.

```
app = Application('name')

@app.result_postprocessor
async def store_result(application, result):
    with open('/tmp/result', 'w') as f:
        f.write(result)
```

## 5.2.6 startup

These callbacks will run as an application is starting.

```
app = Application('name')

@app.startup
async def connect_to_database(application):
    await db.connect(application.settings['DB_HOST'])
```

## 5.2.7 teardown

These callbacks will run as an application is shutting down.

```
app = Application('name')

@app.teardown
async def disconnect_from_database(application):
    await db.close()
```

# 5.3 Command Line Interface

Doozer provides the following command line interface.

## 5.3.1 doozer

```
usage: doozer [-h] [--version] [-a APP] {run} ...
```

**-h, --help**  
show this help message and exit

**--version**  
show program's version number and exit

**-a, --app**  
the path to the application to run

## doozer run

Import and run an application.

```
usage: doozer run [-h] [--verbose | --quiet] [-r] [-w WORKERS] [-d]
               application-path
```

### application-path

‘the path to the application to run’

### -h, --help

show this help message and exit

### --verbose, -v

verbose mode

### --quiet, -q

quiet mode

### -r, --reloader

‘reload the application on changes’

### -w <workers>, --workers <workers>

‘the number of asynchronous tasks to run’

### -d, --debug

‘enable debug mode’

## 5.3.2 Further Details

When developing locally, applications often need to be restarted as changes are made. To make this easier, Doozer provides a `--reloader` option to the `run` command. With this option enabled, Doozer will watch an application’s root directory and restart the application automatically when changes are detected:

```
$ python -m doozer run file_printer --reloader
```

**Note:** The `--reloader` option is not recommended for production use.

It’s also possible to enable Doozer’s *Debug Mode* through the `--debug` option:

```
$ python -m doozer run file_printer --debug
```

**Note:** The `--debug` option is not recommended for production use.

This will also enable the reloader.

### 5.3.3 Extending the Command Line

For information about how to extension Doozer’s command line interface, see *Extending the Command Line*.

## 5.4 Extensions

Extensions provide additional functionality to applications. Configuration management is shared between applications and extensions in a central location.

### 5.4.1 Using Extensions

```
from doozer import Application
from doozer_sqlite import SQLite

app = Application(__name__)
db = SQLite(app)

db.connection.execute('SELECT 1;')
```

### 5.4.2 Developing Extensions

Doozer provides an *Extension* base class to make extension development easier.

```
from doozer import Extension

class SQLite(Extension):
    DEFAULT_SETTINGS = {'SQLITE_CONNECTION_STRING': ':memory:'}

    def __init__(self, app=None):
        self._connection = None
        super().__init__(app)

    @property
    def connection(self):
        if not self._connection:
            conn_string = self.app.settings['SQLITE_CONNECTION_STRING']
            self._connection = sqlite3.connect(conn_string)
        return self._connection
```

The *Extension* class provides two special attributes that are meant to be overridden:

- *DEFAULT\_SETTINGS* provides default values for an extension’s settings during the *init\_app()* step. When a value is used by an extension and has a sensible default, it should be stored here (e.g., a database hostname).
- *REQUIRED\_SETTINGS* provides a list of keys that are checked for existence during the *init\_app()* step. If one or more required settings are not set on the application instance assigned to the extension, a *KeyError* is raised. Extensions should set this when a value is required but has no default (e.g., a database password).

### 5.4.3 Extending the Command Line

Doozer offers an extensible command line interface. To register your own commands, use `register_commands()`. Any function passed to it will have its usage created directly from its signature. During the course of initializing the application for use with the extension (i.e., `init_app()`), Doozer will check for a method on the extension's instance named `register_cli` and call it. If you place any calls to `register_commands()` inside it, the command line interface will be extended automatically.

In order to access the new commands, the doozer command line utility must be given a reference to an *Application*. This is done through the `--app` argument:

```
$ doozer --app APP_PATH
```

**Note:** For details about the syntax to use when passing a reference to an *Application*, see *Running Applications*.

A positional argument in the Python function will result in a required positional argument in the command:

```
def trash(heap):
    pass
```

```
$ doozer --app APP_PATH NAMESPACE trash HEAP
```

A keyword argument in the Python function will result in a positional argument in the command with a default value to be used when the argument is omitted:

```
def trash(heap='marjory'):
    pass
```

```
$ doozer --app APP_PATH NAMESPACE trash [HEAP]
```

A keyword-only argument in the Python function will result in an optional argument in the command:

```
def trash(*, heap='marjory'):
    pass
```

```
$ doozer --app APP_PATH NAMESPACE trash [--heap HEAP]
```

By default, all optional arguments will have a flag that matches the function argument's name. When no other optional arguments start with the same character, a single-character abbreviated flag can also be used.

```
$ doozer --app APP_PATH NAMESPACE trash [-g HEAP]
```

The `trash` function can then be registered with the CLI:

```
register_commands('fraggle', [trash])
```

```
$ doozer --app APP_PATH fraggle trash --help
```

Additionally, if a command includes a `quiet` or `verbose` argument, it will automatically receive the count of the number of times it was specified (e.g., `-v` will have the value 1, `-vv` will have the value 2). When both arguments are included, they will be added as a mutually exclusive group.

---

**Note:** Due to how `argparse` handles argument counts, `quiet` and `verbose` will be set to `None` rather than `0` when the flag isn't specified when the command is invoked.

---

```
$ doozer --app APP_PATH fraggle trash -vvvv
$ doozer --app APP_PATH fraggle trash --quiet
```

### 5.4.4 Available Extensions

Several extensions are available for use:

- [Henson-AMQP](#)
- [Henson-Database](#)
- [Henson-Logging](#)

## 5.5 contrib Packages

While it is possible to build your own plugins, the Doozer contrib package contains those that we think will most enhance your application.

### 5.5.1 Retry

Retry is a plugin to add the ability for Doozer applications to automatically retry messages that fail to process.

**Warning:** Retry registers itself as an error callback on the [Application](#) instance. When doing so, it inserts itself at the beginning of the list of error callbacks. It does this so that it can prevent other callbacks from running.

If you have an error callback that you want to run even when retrying a message, you will need to manually inject it into the list of error callbacks *after* initializing Retry.

### Configuration

Retry provides a couple of settings to control how many times a message will be retried. `RETRY_THRESHOLD` and `RETRY_TIMEOUT` work in tandem. If values are specified for both, whichever limit is reached first will cause Doozer to stop retrying the message. By default, Doozer will try forever (yes, this is literally insane).

RETRY_BACKOFF	A number that, if provided, will be used in conjunction with the number of retry attempts already made to calculate the total delay for the current retry. Defaults to 1.
RETRY_CALLBACK	A coroutine that encapsulates the functionality needed to retry the message. <code>TypeError</code> will be raised if the callback isn't a <code>coroutine()</code> .
RETRY_DELAY	The number of seconds to wait before scheduling a retry. If <code>RETRY_BACKOFF</code> has a value greater than 1, the delay will increase between each retry. Defaults to 0.
RETRY_EXCEPTIONS	An exception or tuple of exceptions that will cause Doozer to retry the message. Defaults to <code>RetryableException</code> .
RETRY_THRESHOLD	The maximum number of times that a Doozer application will try to process a message before marking it as a failure. if set to 0, the message will not be retried. If set to <code>None</code> , the limit will be controlled by <code>RETRY_TIMEOUT</code> . Defaults to <code>None</code> .
RETRY_TIMEOUT	The maximum number of seconds during which a message can be retried. If set to <code>None</code> , the limit will be controlled by <code>RETRY_THRESHOLD</code> . Defaults to <code>None</code> .

## Usage

Application definition:

```
from doozer import Application
from doozer.contrib.retry import Retry

async def print_message(app, message):
    print(message)

app = Application('retryable-application', callback=my_callback)
app.settings['RETRY_CALLBACK'] = print_message
Retry(app)
```

Somewhere inside the application:

```
from doozer.contrib.retry import RetryableException

async def my_callback(app, message):
    raise RetryableException
```

## API

**class** `doozer.contrib.retry.Retry` (*app=None*)

A class that adds retries to an application.

**init\_app** (*app*)

Initialize an `Application` instance.

**Parameters** *app* (*Application*) – Application instance to be initialized.

**Raises**

- **TypeError** – If the callback isn't a coroutine.
- **ValueError** – If the delay or backoff is negative.

**Return type** `None`

**class** `doozer.contrib.retry.RetryableException`

Exception to be raised when a message should be retried.

## 5.5.2 Sphinx

The Sphinx contrib plugin adds a directive that can be used to document extensions to the Doozer command line interface.

```
class doozer.contrib.sphinx.DoozerCLIDirective(name, arguments, options, content,
                                              lineno, content_offset, block_text, state,
                                              state_machine)
```

A Sphinx directive that can be used to document a CLI extension.

This class wraps around [autoprogram](#) to generate Sphinx documentation for extensions that extend the Doozer CLI.

```
.. doozercli:: doozer_database:Database
   :start_command: db
```

Changed in version 1.2.0: The `prog` option will default to the proper way to invoke command line extensions.

For full details of the options support by the `doozercli` directive, please refer to the [sphinxcontrib-autoprogram documentation](#).

## 5.6 API

Here's the public API for Doozer.

### 5.6.1 Application

```
class doozer.base.Application(name, settings=None, *, consumer=None, callback=None)
```

A service application.

Each message received from the consumer will be passed to the callback.

#### Parameters

- **name** (`str`) – The name of the application.
- **settings** (`Optional[Any]`) – An object with attributed-based settings.
- **consumer** (`Optional[Consumer]`) – Any object that is an iterator or an iterable and yields instances of any type that is supported by `callback`. While this isn't required, it must be provided before the application can be run.
- **callback** (`Optional[Callable[... Awaitable]]`) – A callable object that takes two arguments, an instance of `doozer.base.Application` and the (possibly) pre-processed incoming message. While this isn't required, it must be provided before the application can be run.

**error** (`callback`)

Register an error callback.

**Parameters** **callback** (`Callable[... Awaitable]`) – A callable object that takes three arguments: an instance of `doozer.base.Application`, the incoming message, and the exception that was raised. It will be called any time there is an exception while reading a message from the queue.

**Return type** `Callable[... Awaitable]`

**Returns** The callback.



**Raises** `TypeError` – If the callback isn't a coroutine.

**message\_acknowledgement** (*callback*)

Register a message acknowledgement callback.

**Parameters** **callback** (`Callable[... Awaitable]`) – A callable object that takes two arguments: an instance of `doozer.base.Application` and the original incoming message as its only argument. It will be called once a message has been fully processed.

**Return type** `Callable[... Awaitable]`

**Returns** The callback.

**Raises** `TypeError` – If the callback isn't a coroutine.

**message\_preprocessor** (*callback*)

Register a message preprocessing callback.

**Parameters** **callback** (`Callable[... Awaitable]`) – A callable object that takes two arguments: an instance of `doozer.base.Application` and the incoming message. It will be called for each incoming message with its result being passed to `callback`.

**Return type** `Callable[... Awaitable]`

**Returns** The callback.

**Raises** `TypeError` – If the callback isn't a coroutine.

**result\_postprocessor** (*callback*)

Register a result postprocessing callback.

**Parameters** **callback** (`Callable[... Awaitable]`) – A callable object that takes two arguments: an instance of `doozer.base.Application` and a result of processing the incoming message. It will be called for each result returned from `callback`.

**Return type** `Callable[... Awaitable]`

**Returns** The callback.

**Raises** `TypeError` – If the callback isn't a coroutine.

**run\_forever** (*num\_workers=1, loop=None, debug=False*)

Consume from the consumer until interrupted.

**Parameters**

- **num\_workers** (`int`) – The number of asynchronous tasks to use to process messages received through the consumer. Defaults to 1.
- **loop** (`Optional[AbstractEventLoop]`) – An event loop that, if provided, will be used for running the application. If none is provided, the default event loop will be used.
- **debug** (`bool`) – Whether or not to run with debug mode enabled. Defaults to True.

**Raises** `TypeError` – If the consumer is None or the callback isn't a coroutine.

Changed in version 1.2: Unhandled exceptions resulting from processing a message while the consumer is still active will stop cause the application to shut down gracefully.

**Return type** `NoReturn`

**startup** (*callback*)

Register a startup callback.

**Parameters** `callback` (`Callable[... Awaitable]`) – A callable object that takes an instance of `Application` as its only argument. It will be called once when the application first starts up.

**Return type** `Callable[... Awaitable]`

**Returns** The callback.

**Raises** `TypeError` – If the callback isn't a coroutine.

**teardown** (`callback`)

Register a teardown callback.

**Parameters** `callback` (`Callable[... Awaitable]`) – A callable object that takes an instance of `Application` as its only argument. It will be called once when the application is shutting down.

**Return type** `Callable[... Awaitable]`

**Returns** The callback.

**Raises** `TypeError` – If the callback isn't a coroutine.

## 5.6.2 Command Line Interface

Collection of Doozer CLI tasks.

`doozer.cli.register_commands` (`namespace`, `functions`, `namespace_kwargs=None`,  
`func_kwargs=None`)

Register commands with the doozer CLI.

The signature of each function provided through `functions` will be mapped to its command's interface. Any positional arguments in the function's signature will become required positional arguments to the command. Keyword arguments in the signature will also become positional arguments, although they will use the default value from the signature when not specified on the command line. Keyword-only arguments in the signature will become optional arguments on the command line.

### Parameters

- **namespace** (`str`) – A name representing the group of commands. The namespace is required to access the commands being added.
- **functions** (`Sequence[Callable]`) – A list of callables that are used to create sub-commands. More details can be found in the documentation for `add_commands()`.

---

**Note:** This function is a wrapper around `add_commands()`. Please refer to its documentation for any arguments not explained here.

---

**Return type** `None`

### 5.6.3 Configuration

**class** `doozer.config.Config`

Custom mapping used to extend and override an app's settings.

**from\_mapping** (*mapping*)

Convert a mapping into settings.

Uppercase keys of the specified mapping will be used to extend and update the existing settings.

**Parameters** `mapping` (`Mapping[str, Any]`) – A mapping encapsulating settings.

**Return type** `None`

**from\_object** (*obj*)

Convert an object into settings.

Uppercase attributes of the specified object will be used to extend and update the existing settings.

**Parameters** `obj` (`object`) – An object encapsulating settings. This will typically be a module or class.

**Return type** `None`

### 5.6.4 Exceptions

Custom exceptions used by Doozer.

**exception** `doozer.exceptions.Abort` (*reason, message*)

An exception that signals to Doozer to stop processing a message.

When this exception is caught by Doozer it will immediately stop processing the message. None of the remaining callbacks will be called.

If the exception is caught while processing a result, that result will no longer be processed. Any other results generated by the same message will still be processed.

**Parameters**

- **reason** (`str`) – The reason the message is being aborted. It should be in the form of “noun.verb” (e.g., “provider.ignored”).
- **message** (`Any`) – The message that is being aborted. Usually this will be the incoming message, but it can also be the result.

### 5.6.5 Extensions

**class** `doozer.extensions.Extension` (*app=None*)

A base class for Hension extensions.

**Parameters** `app` (`Optional[doozer.base.Application]`) – An application instance that has an attribute named `settings` that contains a mapping of settings to interact with a database.

**property** `DEFAULT_SETTINGS`

A dict of default settings for the extension.

When a setting is not specified by the application instance and has a default specified, the default value will be used. Extensions should define this where appropriate. Defaults to `{}`.

**Return type** `Mapping`

**property** `REQUIRED_SETTINGS`

An iterable of required settings for the extension.

When an extension has required settings that do not have default values, their keys may be specified here. Upon extension initialization, an exception will be raised if a value is not set for each key specified in this list. Extensions should define this where appropriate. Defaults to `()`.

**Return type** `Iterable`

**property** `app`

Return the registered app.

**Return type** `ForwardRef`

**init\_app** (*app*)

Initialize the application.

In addition to associating the extension's default settings with the application, this method will also check for the extension's required settings.

**Parameters** `app` (*Application*) – An application instance that will be initialized.

**Return type** `None`

## 5.7 Changelog

### 5.7.1 Version 2.0.0

Release TBD

- Drop support for Python 3.4, 3.5, and 3.6 (*backwards incompatible*)
- Add type annotations

### 5.7.2 Version 1.2.0

Released 2017-12-03

- Unhandled exceptions raised while processing a message will stop the application
- Set the event loop when running with the reloader
- Renamed to Doozer
- Relicensed under [MIT License](#)

### 5.7.3 Version 1.1.0

Released 2016-11-11

- Add `henson.cli.register_commands` to extend the command line interface
- Messages are logged using `logging.DEBUG` instead of `logging.INFO`
- Calls to `print` in `henson.cli.run` are updated to `app.logger.info`
- References to objects used by `henson.Application` are removed once they are no longer needed to allow the memory to be freed up before the next message is received.
- `uvloop` will be used for the event loop if it's installed.

- Automatically register extensions to a registry on the application
- Add `hensoncli` Sphinx directive to document extensions to the command line interface
- `hensoncli.run` and any command line extensions that request it support `quiet` and `verbose` flags to set verbosity

### 5.7.4 Version 1.0.0

Released 2016-03-01

- Initial release



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