
kazoo Documentation

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Kazoo is a Python library designed to make working with *Zookeeper* a more hassle-free experience that is less prone to errors.

Kazoo features:

- A wide range of recipe implementations, like Lock, Election or Queue
- Data and Children Watchers
- Simplified Zookeeper connection state tracking
- Unified asynchronous API for use with greenlets or threads
- Support for [gevent](#) 0.13 and [gevent](#) 1.0
- Support for [eventlet](#)
- Support for Zookeeper 3.3 and 3.4 servers
- Integrated testing helpers for Zookeeper clusters
- Pure-Python based implementation of the wire protocol, avoiding all the memory leaks, lacking features, and debugging madness of the C library

Kazoo is heavily inspired by [Netflix Curator](#) simplifications and helpers.

Note: You should be familiar with Zookeeper and have read the [Zookeeper Programmers Guide](#) before using *kazoo*.

Reference Docs

1.1 Installing

kazoo can be installed via `pip` or `easy_install`:

```
$ pip install kazoo
```

Kazoo implements the Zookeeper protocol in pure Python, so you don't need any Python Zookeeper C bindings installed.

1.2 Basic Usage

1.2.1 Connection Handling

To begin using Kazoo, a `KazooClient` object must be created and a connection established:

```
from kazoo.client import KazooClient

zk = KazooClient(hosts='127.0.0.1:2181')
zk.start()
```

By default, the client will connect to a local Zookeeper server on the default port (2181). You should make sure Zookeeper is actually running there first, or the `start` command will be waiting until its default timeout.

Once connected, the client will attempt to stay connected regardless of intermittent connection loss or Zookeeper session expiration. The client can be instructed to drop a connection by calling `stop`:

```
zk.stop()
```

Logging Setup

If logging is not setup for your application, you can get following message:

```
No handlers could be found for logger "kazoo.client"
```

To avoid this issue you can at the very minimum do the following:

```
import logging
logging.basicConfig()
```

Read [Python's logging tutorial](#) for more details.

Listening for Connection Events

It can be useful to know when the connection has been dropped, restored, or when the Zookeeper session has expired. To simplify this process Kazoo uses a state system and lets you register listener functions to be called when the state changes.

```
from kazoo.client import KazooState

def my_listener(state):
    if state == KazooState.LOST:
        # Register somewhere that the session was lost
    elif state == KazooState.SUSPENDED:
        # Handle being disconnected from Zookeeper
    else:
        # Handle being connected/reconnected to Zookeeper

zk.add_listener(my_listener)
```

When using the `kazoo.recipe.lock.Lock` or creating ephemeral nodes, its highly recommended to add a state listener so that your program can properly deal with connection interruptions or a Zookeeper session loss.

Understanding Kazoo States

The `KazooState` object represents several states the client transitions through. The current state of the client can always be determined by viewing the `state` property. The possible states are:

- LOST
- CONNECTED
- SUSPENDED

When a `KazooClient` instance is first created, it is in the *LOST* state. After a connection is established it transitions to the *CONNECTED* state. If any connection issues come up or if it needs to connect to a different Zookeeper cluster node, it will transition to *SUSPENDED* to let you know that commands cannot currently be run. The connection will also be lost if the Zookeeper node is no longer part of the quorum, resulting in a *SUSPENDED* state.

Upon re-establishing a connection the client could transition to *LOST* if the session has expired, or *CONNECTED* if the session is still valid.

Note: These states should be monitored using a listener as described previously so that the client behaves properly depending on the state of the connection.

When a connection transitions to *SUSPENDED*, if the client is performing an action that requires agreement with other systems (using the Lock recipe for example), it should pause what it's doing. When the connection has been re-established the client can continue depending on if the state is *LOST* or transitions directly to *CONNECTED* again.

When a connection transitions to *LOST*, any ephemeral nodes that have been created will be removed by Zookeeper. This affects all recipes that create ephemeral nodes, such as the Lock recipe. Lock's will need to be re-acquired after the state transitions to *CONNECTED* again. This transition occurs when a session expires or when you stop the clients connection.

Valid State Transitions

- *LOST* -> *CONNECTED*

New connection, or previously lost one becoming connected.

- *CONNECTED* -> *SUSPENDED*

Connection loss to server occurred on a connection.

- *CONNECTED* -> *LOST*

Only occurs if invalid authentication credentials are provided after the connection was established.

- *SUSPENDED* -> *LOST*

Connection resumed to server, but then lost as the session was expired.

- *SUSPENDED* -> *CONNECTED*

Connection that was lost has been restored.

Read-Only Connections

New in version 0.6.

Zookeeper 3.4 and above [supports a read-only mode](#). This mode must be turned on for the servers in the Zookeeper cluster for the client to utilize it. To use this mode with Kazoo, the `KazooClient` should be called with the `read_only` option set to `True`. This will let the client connect to a Zookeeper node that has gone read-only, and the client will continue to scan for other nodes that are read-write.

```
from kazoo.client import KazooClient

zk = KazooClient(hosts='127.0.0.1:2181', read_only=True)
zk.start()
```

A new attribute on `KeeperState` has been added, `CONNECTED_RO`. The connection states above are still valid, however upon *CONNECTED*, you will need to check the clients non-simplified state to see if the connection is *CONNECTED_RO*. For example:

```
from kazoo.client import KazooState
from kazoo.client import KeeperState

@zk.add_listener
def watch_for_ro(state):
    if state == KazooState.CONNECTED:
        if zk.client_state == KeeperState.CONNECTED_RO:
            print("Read only mode!")
        else:
            print("Read/Write mode!")
```

It's important to note that a `KazooState` is passed in to the listener but the read-only information is only available by comparing the non-simplified client state to the `KeeperState` object.

Warning: A client using read-only mode should not use any of the recipes.

1.2.2 Zookeeper CRUD

Zookeeper includes several functions for creating, reading, updating, and deleting Zookeeper nodes (called znodes or nodes here). Kazoo adds several convenience methods and a more Pythonic API.

Creating Nodes

Methods:

- `ensure_path()`
- `create()`

`ensure_path()` will recursively create the node and any nodes in the path necessary along the way, but can not set the data for the node, only the ACL.

`create()` creates a node and can set the data on the node along with a watch function. It requires the path to it to exist first, unless the *makepath* option is set to *True*.

```
# Ensure a path, create if necessary
zk.ensure_path("/my/favorite")

# Create a node with data
zk.create("/my/favorite/node", b"a value")
```

Reading Data

Methods:

- `exists()`
- `get()`
- `get_children()`

`exists()` checks to see if a node exists.

`get()` fetches the data of the node along with detailed node information in a `ZnodeStat` structure.

`get_children()` gets a list of the children of a given node.

```
# Determine if a node exists
if zk.exists("/my/favorite"):
    # Do something

# Print the version of a node and its data
data, stat = zk.get("/my/favorite")
print("Version: %s, data: %s" % (stat.version, data.decode("utf-8")))

# List the children
children = zk.get_children("/my/favorite")
print("There are %s children with names %s" % (len(children), children))
```

Updating Data

Methods:

- `set()`

`set()` updates the data for a given node. A version for the node can be supplied, which will be required to match before updating the data, or a `BadVersionError` will be raised instead of updating.

```
zk.set("/my/favorite", b"some data")
```

Deleting Nodes

Methods:

- `delete()`

`delete()` deletes a node, and can optionally recursively delete all children of the node as well. A version can be supplied when deleting a node which will be required to match the version of the node before deleting it or a `BadVersionError` will be raised instead of deleting.

```
zk.delete("/my/favorite/node", recursive=True)
```

1.2.3 Retrying Commands

Connections to Zookeeper may get interrupted if the Zookeeper server goes down or becomes unreachable. By default, kazoo does not retry commands, so these failures will result in an exception being raised. To assist with failures kazoo comes with a `retry()` helper that will retry a function should one of the Zookeeper connection exceptions get raised.

Example:

```
result = zk.retry(zk.get, "/path/to/node")
```

Some commands may have unique behavior that doesn't warrant automatic retries on a per command basis. For example, if one creates a node a connection might be lost before the command returns successfully but the node actually got created. This results in a `kazoo.exceptions.NodeExistsError` being raised when it runs again. A similar unique situation arises when a node is created with ephemeral and sequence options set, [documented here on the Zookeeper site](#).

Since the `retry()` method takes a function to call and its arguments, a function that runs multiple Zookeeper commands could be passed to it so that the entire function will be retried if the connection is lost.

This snippet from the lock implementation shows how it uses `retry` to re-run the function acquiring a lock, and checks to see if it was already created to handle this condition:

```
# kazoo.recipe.lock snippet

def acquire(self):
    """Acquire the mutex, blocking until it is obtained"""
    try:
        self.client.retry(self._inner_acquire)
        self.is_acquired = True
    except KazooException:
        # if we did ultimately fail, attempt to clean up
        self._best_effort_cleanup()
        self.cancelled = False
        raise

def _inner_acquire(self):
    self.wake_event.clear()

    # make sure our election parent node exists
    if not self.assured_path:
        self.client.ensure_path(self.path)

    node = None
    if self.create_tried:
        node = self._find_node()
    else:
```

```
self.create_tried = True

if not node:
    node = self.client.create(self.create_path, self.data,
                             ephemeral=True, sequence=True)
    # strip off path to node
    node = node[len(self.path) + 1:]
```

`create_tried` records whether it has tried to create the node already in the event the connection is lost before the node name is returned.

Custom Retries

Sometimes you may wish to have specific retry policies for a command or set of commands that differs from the `retry()` method. You can manually create a `KazooRetry` instance with the specific retry policy you prefer:

```
from kazoo.retry import KazooRetry

kr = KazooRetry(max_tries=3, ignore_expire=False)
result = kr(client.get, "/some/path")
```

This will retry the `client.get` command up to 3 times, and raise a session expiration if it occurs. You can also make an instance with the default behavior that ignores session expiration during a retry.

1.2.4 Watchers

Kazoo can set watch functions on a node that can be triggered either when the node has changed or when the children of the node change. This change to the node or children can also be the node or its children being deleted.

Watchers can be set in two different ways, the first is the style that Zookeeper supports by default for one-time watch events. These watch functions will be called once by kazoo, and do *not* receive session events, unlike the native Zookeeper watches. Using this style requires the watch function to be passed to one of these methods:

- `get()`
- `get_children()`
- `exists()`

A watch function passed to `get()` or `exists()` will be called when the data on the node changes or the node itself is deleted. It will be passed a `WatchedEvent` instance.

```
def my_func(event):
    # check to see what the children are now

# Call my_func when the children change
children = zk.get_children("/my/favorite/node", watch=my_func)
```

Kazoo includes a higher level API that watches for data and children modifications that's easier to use as it doesn't require re-setting the watch every time the event is triggered. It also passes in the data and `ZnodeStat` when watching a node or the list of children when watching a nodes children. Watch functions registered with this API will be called immediately and every time there's a change, or until the function returns `False`. If `allow_session_lost` is set to `True`, then the function will no longer be called if the session is lost.

The following methods provide this functionality:

- `ChildrenWatch`
- `DataWatch`

These classes are available directly on the `KazooClient` instance and don't require the client object to be passed in when used in this manner. The instance returned by instantiating either of the classes can be called directly allowing them to be used as decorators:

```
@zk.ChildrenWatch("/my/favorite/node")
def watch_children(children):
    print("Children are now: %s" % children)
# Above function called immediately, and from then on

@zk.DataWatch("/my/favorite")
def watch_node(data, stat):
    print("Version: %s, data: %s" % (stat.version, data.decode("utf-8")))
```

1.2.5 Transactions

New in version 0.6.

Zookeeper 3.4 and above supports the sending of multiple commands at once that will be committed as a single atomic unit. Either they will all succeed or they will all fail. The result of a transaction will be a list of the success/failure results for each command in the transaction.

```
transaction = zk.transaction()
transaction.check('/node/a', version=3)
transaction.create('/node/b', b"a value")
results = transaction.commit()
```

The `transaction()` method returns a `TransactionRequest` instance. It's methods may be called to queue commands to be completed in the transaction. When the transaction is ready to be sent, the `commit()` method on it is called.

In the example above, there's a command not available unless a transaction is being used, *check*. This can check nodes for a specific version, which could be used to make the transaction fail if a node doesn't match a version that it should be at. In this case the node */node/a* must be at version 3 or */node/b* will not be created.

1.3 Asynchronous Usage

The asynchronous Kazoo API relies on the `IAsyncResult` object which is returned by all the asynchronous methods. Callbacks can be added with the `rawlink()` method which works in a consistent manner whether threads or an asynchronous framework like *gevent* is used.

Kazoo utilizes a pluggable `IHandler` interface which abstracts the callback system to ensure it works consistently.

1.3.1 Connection Handling

Creating a connection:

```
from kazoo.client import KazooClient
from kazoo.handlers.gevent import SequentialGeventHandler

zk = KazooClient(handler=SequentialGeventHandler())

# returns immediately
event = zk.start_async()
```

```
# Wait for 30 seconds and see if we're connected
event.wait(timeout=30)

if not zk.connected:
    # Not connected, stop trying to connect
    zk.stop()
    raise Exception("Unable to connect.")
```

In this example, the `wait` method is used on the event object returned by the `start_async()` method. A timeout is **always** used because its possible that we might never connect and that should be handled gracefully.

The `SequentialGeventHandler` is used when you want to use `gevent` (and `SequentialEventletHandler` when `eventlet` is used). Kazoo doesn't rely on `gevents/eventlet` monkey patching and requires that you pass in the appropriate handler, the default handler is `SequentialThreadingHandler`.

1.3.2 Asynchronous Callbacks

All `kazoo_async` methods except for `start_async()` return an `IAsyncResult` instance. These instances allow you to see when a result is ready, or chain one or more callback functions to the result that will be called when it's ready.

The callback function will be passed the `IAsyncResult` instance and should call the `get()` method on it to retrieve the value. This call could result in an exception being raised if the asynchronous function encountered an error. It should be caught and handled appropriately.

Example:

```
import sys

from kazoo.exceptions import ConnectionLossException
from kazoo.exceptions import NoAuthException

def my_callback(async_obj):
    try:
        children = async_obj.get()
        do_something(children)
    except (ConnectionLossException, NoAuthException):
        sys.exit(1)

# Both these statements return immediately, the second sets a callback
# that will be run when get_children_async has its return value
async_obj = zk.get_children_async("/some/node")
async_obj.rawlink(my_callback)
```

1.3.3 Zookeeper CRUD

The following CRUD methods all work the same as their synchronous counterparts except that they return an `IAsyncResult` object.

Creating Method:

- `create_async()`

Reading Methods:

- `exists_async()`
- `get_async()`

- `get_children_async()`

Updating Methods:

- `set_async()`

Deleting Methods:

- `delete_async()`

The `ensure_path()` has no asynchronous counterpart at the moment nor can the `delete_async()` method do recursive deletes.

1.4 Implementation Details

Up to version 0.3 kazoo used the Python bindings to the Zookeeper C library. Unfortunately those bindings are fairly buggy and required a fair share of weird workarounds to interface with the native OS thread used in those bindings.

Starting with version 0.4 kazoo implements the entire Zookeeper wire protocol itself in pure Python. Doing so removed the need for the workarounds and made it much easier to implement the features missing in the C bindings.

1.4.1 Handlers

Both the Kazoo handlers run 3 separate queues to help alleviate deadlock issues and ensure consistent execution order regardless of environment. The `SequentialEventHandler` runs a separate greenlet for each queue that processes the callbacks queued in order. The `SequentialThreadingHandler` runs a separate thread for each queue that processes the callbacks queued in order (thus the naming scheme which notes they are sequential in anticipation that there could be handlers shipped in the future which don't make this guarantee).

Callbacks are queued by type, the 3 types being:

1. Session events (State changes, registered listener functions)
2. Watch events (Watch callbacks, DataWatch, and ChildrenWatch functions)
3. Completion callbacks (Functions chained to `IAsyncResult` objects)

This ensures that calls can be made to Zookeeper from any callback **except for a state listener** without worrying that critical session events will be blocked.

Warning: Its important to remember that if you write code that blocks in one of these functions then no queued functions of that type will be executed until the code stops blocking. If your code might block, it should run itself in a separate greenlet/thread so that the other callbacks can run.

1.5 Testing

Kazoo has several test harnesses used internally for its own tests that are exposed as public API's for use in your own tests for common Zookeeper cluster management and session testing. They can be mixed in with your own *unittest* or *nose* tests along with a *mock* object that allows you to force specific *KazooClient* commands to fail in various ways.

The test harness needs to be able to find the Zookeeper Java libraries. You need to specify an environment variable called `ZOOKEEPER_PATH` and point it to their location, for example `/usr/share/java`. The directory should contain a `zookeeper-*.jar` and a `lib` directory containing at least a `log4j-*.jar`.

If your Java setup is complex, you may also override our classpath mechanism completely by specifying an environment variable called `ZOOKEEPER_CLASSPATH`. If provided, it will be used unmodified as the Java classpath for Zookeeper.

You can specify an optional `ZOOKEEPER_PORT_OFFSET` environment variable to influence the ports the cluster is using. By default the offset is 20000 and a cluster with three members will use ports 20000, 20010 and 20020.

1.5.1 Kazoo Test Harness

The `KazooTestHarness` can be used directly or mixed in with your test code.

Example:

```
from kazoo.testing import KazooTestHarness

class MyTest(KazooTestHarness):
    def setUp(self):
        self.setup_zookeeper()

    def tearDown(self):
        self.teardown_zookeeper()

    def testmycode(self):
        self.client.ensure_path('/test/path')
        result = self.client.get('/test/path')
        ...
```

1.5.2 Kazoo Test Case

The `KazooTestCase` is complete test case that is equivalent to the mixin setup of `KazooTestHarness`. An equivalent test to the one above:

```
from kazoo.testing import KazooTestCase

class MyTest(KazooTestCase):
    def testmycode(self):
        self.client.ensure_path('/test/path')
        result = self.client.get('/test/path')
        ...
```

1.5.3 Zake

For those that do not need (or desire) to setup a Zookeeper cluster to test integration with kazoo there is also a library called `zake`. Contributions to [Zake's github repository](#) are welcome.

Zake can be used to provide a *mock client* to layers of your application that interact with kazoo (using the same client interface) during testing to allow for introspection of what was stored, which watchers are active (and more) after your test of your application code has finished.

1.6 API Documentation

Comprehensive reference material for every public API exposed by *kazoo* is available within this chapter. The API documentation is organized alphabetically by module name.

1.6.1 kazoo.client

Kazoo Zookeeper Client

Public API

class `kazoo.client.KazooClient`

An Apache Zookeeper Python client supporting alternate callback handlers and high-level functionality.

Watch functions registered with this class will not get session events, unlike the default Zookeeper watches. They will also be called with a single argument, a `WatchedEvent` instance.

__init__ (*hosts='127.0.0.1:2181', timeout=10.0, client_id=None, handler=None, default_acl=None, auth_data=None, read_only=None, randomize_hosts=True, connection_retry=None, command_retry=None, logger=None, **kwargs*)

Create a `KazooClient` instance. All time arguments are in seconds.

Parameters

- **hosts** – Comma-separated list of hosts to connect to (e.g. 127.0.0.1:2181,127.0.0.1:2182,[:1]:2183).
- **timeout** – The longest to wait for a Zookeeper connection.
- **client_id** – A Zookeeper client id, used when re-establishing a prior session connection.
- **handler** – An instance of a class implementing the `IHandler` interface for callback handling.
- **default_acl** – A default ACL used on node creation.
- **auth_data** – A list of authentication credentials to use for the connection. Should be a list of (scheme, credential) tuples as `add_auth()` takes.
- **read_only** – Allow connections to read only servers.
- **randomize_hosts** – By default randomize host selection.
- **connection_retry** – A `kazoo.retry.KazooRetry` object to use for retrying the connection to Zookeeper. Also can be a dict of options which will be used for creating one.
- **command_retry** – A `kazoo.retry.KazooRetry` object to use for the `KazooClient.retry()` method. Also can be a dict of options which will be used for creating one.
- **logger** – A custom logger to use instead of the module global `log` instance.

Basic Example:

```
zk = KazooClient()
zk.start()
children = zk.get_children('/')
zk.stop()
```

As a convenience all recipe classes are available as attributes and get automatically bound to the client. For example:

```
zk = KazooClient()
zk.start()
lock = zk.Lock('/lock_path')
```

New in version 0.6: The `read_only` option. Requires Zookeeper 3.4+

New in version 0.6: The `retry_max_delay` option.

New in version 0.6: The `randomize_hosts` option.

Changed in version 0.8: Removed the unused watcher argument (was second argument).

New in version 1.2: The `connection_retry`, `command_retry` and `logger` options.

handler

The `IHandler` strategy used by this client. Gives access to appropriate synchronization objects.

retry (*func*, **args*, ***kwargs*)

Runs the given function with the provided arguments, retrying if it fails because the ZooKeeper connection is lost, see [Retrying Commands](#).

state

A `KazooState` attribute indicating the current higher-level connection state.

client_state

Returns the last Zookeeper client state

This is the non-simplified state information and is generally not as useful as the simplified `KazooState` information.

client_id

Returns the client id for this Zookeeper session if connected.

Returns client id which consists of the session id and password.

Return type tuple

connected

Returns whether the Zookeeper connection has been established.

set_hosts (*hosts*, *randomize_hosts*=None)

sets the list of hosts used by this client.

This function accepts the same format `hosts` parameter as the `init` function and sets the client to use the new hosts the next time it needs to look up a set of hosts. This function does not affect the current connected status.

It is not currently possible to change the chroot with this function, setting a host list with a new chroot will raise a `ConfigurationError`.

Parameters

- **hosts** – see description in `KazooClient.__init__()`
- **randomize_hosts** – override client default for host randomization

Raises `ConfigurationError` if the `hosts` argument changes the chroot

New in version 1.4.

Warning: Using this function to point a client to a completely disparate zookeeper server cluster has undefined behavior.

add_listener (*listener*)

Add a function to be called for connection state changes.

This function will be called with a `KazooState` instance indicating the new connection state on state transitions.

Warning: This function must not block. If its at all likely that it might need data or a value that could result in blocking than the `spawn()` method should be used so that the listener can return immediately.

remove_listener (*listener*)

Remove a listener function

start (*timeout=15*)

Initiate connection to ZK.

Parameters *timeout* – Time in seconds to wait for connection to succeed.

Raises `timeout_exception` if the connection wasn't established within *timeout* seconds.

start_async ()

Asynchronously initiate connection to ZK.

Returns An event object that can be checked to see if the connection is alive.

Return type Event compatible object.

stop ()

Gracefully stop this Zookeeper session.

This method can be called while a reconnection attempt is in progress, which will then be halted.

Once the connection is closed, its session becomes invalid. All the ephemeral nodes in the ZooKeeper server associated with the session will be removed. The watches left on those nodes (and on their parents) will be triggered.

restart ()

Stop and restart the Zookeeper session.

close ()

Free any resources held by the client.

This method should be called on a stopped client before it is discarded. Not doing so may result in filehandles being leaked.

New in version 1.0.

command (*cmd='ruok'*)

Sent a management command to the current ZK server.

Examples are *ruok*, *envi* or *stat*.

Returns An unstructured textual response.

Return type str

Raises `ConnectionLoss` if there is no connection open, or possibly a `socket.error` if there's a problem with the connection used just for this command.

New in version 0.5.

server_version (*retries=3*)

Get the version of the currently connected ZK server.

Returns The server version, for example (3, 4, 3).

Return type tuple

New in version 0.5.

add_auth (*scheme, credential*)

Send credentials to server.

Parameters

- **scheme** – authentication scheme (default supported: “digest”).
- **credential** – the credential – value depends on scheme.

Returns True if it was successful.

Return type bool

Raises `AuthFailedError` if it failed though the session state will be set to `AUTH_FAILED` as well.

add_auth_async (*scheme, credential*)

Asynchronously send credentials to server. Takes the same arguments as `add_auth()`.

Return type `IAsyncResult`

unchroot (*path*)

Strip the chroot if applicable from the path.

sync_async (*path*)

Asynchronous sync.

Return type `IAsyncResult`

sync (*path*)

Sync, blocks until response is acknowledged.

Flushes channel between process and leader.

Parameters *path* – path of node.

Returns The node path that was synced.

Raises `ZookeeperError` if the server returns a non-zero error code.

New in version 0.5.

create (*path, value='', acl=None, ephemeral=False, sequence=False, makepath=False*)

Create a node with the given value as its data. Optionally set an ACL on the node.

The ephemeral and sequence arguments determine the type of the node.

An ephemeral node will be automatically removed by ZooKeeper when the session associated with the creation of the node expires.

A sequential node will be given the specified path plus a suffix *i* where *i* is the current sequential number of the node. The sequence number is always fixed length of 10 digits, 0 padded. Once such a node is created, the sequential number will be incremented by one.

If a node with the same actual path already exists in ZooKeeper, a `NodeExistsError` will be raised. Note that since a different actual path is used for each invocation of creating sequential nodes with the same path argument, the call will never raise `NodeExistsError`.

If the parent node does not exist in ZooKeeper, a `NoNodeError` will be raised. Setting the optional *makepath* argument to *True* will create all missing parent nodes instead.

An ephemeral node cannot have children. If the parent node of the given path is ephemeral, a `NoChildrenForEphemeralsError` will be raised.

This operation, if successful, will trigger all the watches left on the node of the given path by `exists()` and `get()` API calls, and the watches left on the parent node by `get_children()` API calls.

The maximum allowable size of the node value is 1 MB. Values larger than this will cause a `ZookeeperError` to be raised.

Parameters

- **path** – Path of node.
- **value** – Initial bytes value of node.
- **acl** – ACL list.
- **ephemeral** – Boolean indicating whether node is ephemeral (tied to this session).
- **sequence** – Boolean indicating whether path is suffixed with a unique index.
- **makepath** – Whether the path should be created if it doesn't exist.

Returns Real path of the new node.

Return type `str`

Raises `NodeExistsError` if the node already exists.

`NoNodeError` if parent nodes are missing.

`NoChildrenForEphemeralsError` if the parent node is an ephemeral node.

`ZookeeperError` if the provided value is too large.

`ZookeeperError` if the server returns a non-zero error code.

create_async (*path*, *value*='', *acl*=None, *ephemeral*=False, *sequence*=False, *makepath*=False)

Asynchronously create a ZNode. Takes the same arguments as `create()`.

Return type `IAsyncResult`

New in version 1.1: The `makepath` option.

ensure_path (*path*, *acl*=None)

Recursively create a path if it doesn't exist.

Parameters

- **path** – Path of node.
- **acl** – Permissions for node.

ensure_path_async (*path*, *acl*=None)

Recursively create a path asynchronously if it doesn't exist. Takes the same arguments as `ensure_path()`.

Return type `IAsyncResult`

New in version 1.1.

exists (*path*, *watch*=None)

Check if a node exists.

If a watch is provided, it will be left on the node with the given path. The watch will be triggered by a successful operation that creates/deletes the node or sets the data on the node.

Parameters

- **path** – Path of node.
- **watch** – Optional watch callback to set for future changes to this path.

Returns `ZnodeStat` of the node if it exists, else `None` if the node does not exist.

Return type `ZnodeStat` or `None`.

Raises `ZookeeperError` if the server returns a non-zero error code.

exists_async (*path*, *watch*=None)

Asynchronously check if a node exists. Takes the same arguments as `exists()`.

Return type `IAsyncResult`

get (*path*, *watch*=None)

Get the value of a node.

If a watch is provided, it will be left on the node with the given path. The watch will be triggered by a successful operation that sets data on the node, or deletes the node.

Parameters

- **path** – Path of node.
- **watch** – Optional watch callback to set for future changes to this path.

Returns Tuple (value, `ZnodeStat`) of node.

Return type tuple

Raises `NoNodeError` if the node doesn't exist

`ZookeeperError` if the server returns a non-zero error code

get_async (*path*, *watch*=None)

Asynchronously get the value of a node. Takes the same arguments as `get()`.

Return type `IAsyncResult`

get_children (*path*, *watch*=None, *include_data*=False)

Get a list of child nodes of a path.

If a watch is provided it will be left on the node with the given path. The watch will be triggered by a successful operation that deletes the node of the given path or creates/deletes a child under the node.

The list of children returned is not sorted and no guarantee is provided as to its natural or lexical order.

Parameters

- **path** – Path of node to list.
- **watch** – Optional watch callback to set for future changes to this path.
- **include_data** – Include the `ZnodeStat` of the node in addition to the children.
This option changes the return value to be a tuple of (children, stat).

Returns List of child node names, or tuple if `include_data` is `True`.

Return type list

Raises `NoNodeError` if the node doesn't exist.

`ZookeeperError` if the server returns a non-zero error code.

New in version 0.5: The `include_data` option.

get_children_async (*path*, *watch=None*, *include_data=False*)

Asynchronously get a list of child nodes of a path. Takes the same arguments as `get_children()`.

Return type `IAsyncResult`

get_acls (*path*)

Return the ACL and stat of the node of the given path.

Parameters **path** – Path of the node.

Returns The ACL array of the given node and its `ZnodeStat`.

Return type tuple of (ACL list, `ZnodeStat`)

Raises `NoNodeError` if the node doesn't exist.

`ZookeeperError` if the server returns a non-zero error code

New in version 0.5.

get_acls_async (*path*)

Return the ACL and stat of the node of the given path. Takes the same arguments as `get_acls()`.

Return type `IAsyncResult`

set_acls (*path*, *acls*, *version=-1*)

Set the ACL for the node of the given path.

Set the ACL for the node of the given path if such a node exists and the given version matches the version of the node.

Parameters

- **path** – Path for the node.
- **acls** – List of `ACL` objects to set.
- **version** – The expected node version that must match.

Returns The stat of the node.

Raises `BadVersionError` if version doesn't match.

`NoNodeError` if the node doesn't exist.

`InvalidACLError` if the ACL is invalid.

`ZookeeperError` if the server returns a non-zero error code.

New in version 0.5.

set_acls_async (*path*, *acls*, *version=-1*)

Set the ACL for the node of the given path. Takes the same arguments as `set_acls()`.

Return type `IAsyncResult`

set (*path*, *value*, *version=-1*)

Set the value of a node.

If the version of the node being updated is newer than the supplied version (and the supplied version is not -1), a `BadVersionError` will be raised.

This operation, if successful, will trigger all the watches on the node of the given path left by `get()` API calls.

The maximum allowable size of the value is 1 MB. Values larger than this will cause a `ZookeeperError` to be raised.

Parameters

- **path** – Path of node.
- **value** – New data value.
- **version** – Version of node being updated, or -1.

Returns Updated `ZnodeStat` of the node.

Raises `BadVersionError` if version doesn't match.

`NoNodeError` if the node doesn't exist.

`ZookeeperError` if the provided value is too large.

`ZookeeperError` if the server returns a non-zero error code.

set_async (*path*, *value*, *version=-1*)

Set the value of a node. Takes the same arguments as `set()`.

Return type `IAsyncResult`

transaction()

Create and return a `TransactionRequest` object

Creates a `TransactionRequest` object. A Transaction can consist of multiple operations which can be committed as a single atomic unit. Either all of the operations will succeed or none of them.

Returns A `TransactionRequest`.

Return type `TransactionRequest`

New in version 0.6: Requires Zookeeper 3.4+

delete (*path*, *version=-1*, *recursive=False*)

Delete a node.

The call will succeed if such a node exists, and the given version matches the node's version (if the given version is -1, the default, it matches any node's versions).

This operation, if successful, will trigger all the watches on the node of the given path left by `exists` API calls, and the watches on the parent node left by `get_children` API calls.

Parameters

- **path** – Path of node to delete.
- **version** – Version of node to delete, or -1 for any.
- **recursive** (*bool*) – Recursively delete node and all its children, defaults to False.

Raises `BadVersionError` if version doesn't match.

`NoNodeError` if the node doesn't exist.

`NotEmptyError` if the node has children.

`ZookeeperError` if the server returns a non-zero error code.

delete_async (*path*, *version=-1*)

Asynchronously delete a node. Takes the same arguments as `delete()`, with the exception of *recursive*.

Return type `IAsyncResult`

class `kazoo.client.TransactionRequest` (*client*)

A Zookeeper Transaction Request

A Transaction provides a builder object that can be used to construct and commit an atomic set of operations. The transaction must be committed before its sent.

Transactions are not thread-safe and should not be accessed from multiple threads at once.

Note: The `committed` attribute only indicates whether this transaction has been sent to Zookeeper and is used to prevent duplicate commits of the same transaction. The result should be checked to determine if the transaction executed as desired.

New in version 0.6: Requires Zookeeper 3.4+

create (*path, value='', acl=None, ephemeral=False, sequence=False*)

Add a create ZNode to the transaction. Takes the same arguments as `KazooClient.create()`, with the exception of *makepath*.

Returns None

delete (*path, version=-1*)

Add a delete ZNode to the transaction. Takes the same arguments as `KazooClient.delete()`, with the exception of *recursive*.

set_data (*path, value, version=-1*)

Add a set ZNode value to the transaction. Takes the same arguments as `KazooClient.set()`.

check (*path, version*)

Add a Check Version to the transaction.

This command will fail and abort a transaction if the path does not match the specified version.

commit_async ()

Commit the transaction asynchronously.

Return type `IAsyncResult`

commit ()

Commit the transaction.

Returns A list of the results for each operation in the transaction.

1.6.2 kazoo.exceptions

Kazoo Exceptions

Public API

exception `kazoo.exceptions.KazooException`

Base Kazoo exception that all other kazoo library exceptions inherit from

exception `kazoo.exceptions.ZookeeperError`

Base Zookeeper exception for errors originating from the Zookeeper server

exception `kazoo.exceptions.AuthFailedError`

exception `kazoo.exceptions.BadVersionError`

exception `kazoo.exceptions.ConfigurationError`

Raised if the configuration arguments to an object are invalid

exception `kazoo.exceptions.InvalidACLError`

exception `kazoo.exceptions.LockTimeout`
Raised if failed to acquire a lock.

New in version 1.1.

exception `kazoo.exceptions.NoChildrenForEphemeralsError`

exception `kazoo.exceptions.NodeExistsError`

exception `kazoo.exceptions.NoNodeError`

exception `kazoo.exceptions.NotEmptyError`

Private API

exception `kazoo.exceptions.APIError`

exception `kazoo.exceptions.BadArgumentsError`

exception `kazoo.exceptions.CancelledError`
Raised when a process is cancelled by another thread

exception `kazoo.exceptions.ConnectionDropped`
Internal error for jumping out of loops

exception `kazoo.exceptions.ConnectionClosedError`
Connection is closed

exception `kazoo.exceptions.ConnectionLoss`

exception `kazoo.exceptions.DataInconsistency`

exception `kazoo.exceptions.MarshallingError`

exception `kazoo.exceptions.NoAuthError`

exception `kazoo.exceptions.NotReadOnlyCallError`
An API call that is not read-only was used while connected to a read-only server

exception `kazoo.exceptions.InvalidCallbackError`

exception `kazoo.exceptions.OperationTimeoutError`

exception `kazoo.exceptions.RolledBackError`

exception `kazoo.exceptions.RuntimeInconsistency`

exception `kazoo.exceptions.SessionExpiredError`

exception `kazoo.exceptions.SessionMovedError`

exception `kazoo.exceptions.SystemZookeeperError`

exception `kazoo.exceptions.UnimplementedError`

exception `kazoo.exceptions.WriterNotClosedException`
Raised if the writer is unable to stop closing when requested.
New in version 1.2.

exception `kazoo.exceptions.ZookeeperStoppedError`
Raised when the kazoo client stopped (and thus not connected)

1.6.3 `kazoo.handlers.gevent`

A gevent based handler.

Public API

class `kazoo.handlers.gevent.SequentialGeventHandler`

Gevent handler for sequentially executing callbacks.

This handler executes callbacks in a sequential manner. A queue is created for each of the callback events, so that each type of event has its callback type run sequentially.

Each queue type has a greenlet worker that pulls the callback event off the queue and runs it in the order the client sees it.

This split helps ensure that watch callbacks won't block session re-establishment should the connection be lost during a Zookeeper client call.

Watch callbacks should avoid blocking behavior as the next callback of that type won't be run until it completes. If you need to block, spawn a new greenlet and return immediately so callbacks can proceed.

async_result ()

Create a `AsyncResult` instance

The `AsyncResult` instance will have its completion callbacks executed in the thread the `SequentialGeventHandler` is created in (which should be the gevent/main thread).

dispatch_callback (*callback*)

Dispatch to the callback object

The callback is put on separate queues to run depending on the type as documented for the `SequentialGeventHandler`.

event_object ()

Create an appropriate Event object

lock_object ()

Create an appropriate Lock object

rlock_object ()

Create an appropriate RLock object

static sleep_func (*seconds=0, ref=True*)

Put the current greenlet to sleep for at least *seconds*.

seconds may be specified as an integer, or a float if fractional seconds are desired.

If *ref* is false, the greenlet running `sleep()` will not prevent `gevent.wait()` from exiting.

spawn (*func, *args, **kwargs*)

Spawn a function to run asynchronously

start ()

Start the greenlet workers.

stop ()

Stop the greenlet workers and empty all queues.

Private API

class `kazoo.handlers.gevent.AsyncResult`

A one-time event that stores a value or an exception.

Like `Event` it wakes up all the waiters when `set()` or `set_exception()` method is called. Waiters may receive the passed value or exception by calling `get()` method instead of `wait()`. An `AsyncResult` instance cannot be reset.

To pass a value call `set()`. Calls to `get()` (those that currently blocking as well as those made in the future) will return the value:

```
>>> result = AsyncResult()
>>> result.set(100)
>>> result.get()
100
```

To pass an exception call `set_exception()`. This will cause `get()` to raise that exception:

```
>>> result = AsyncResult()
>>> result.set_exception(RuntimeError('failure'))
>>> result.get()
Traceback (most recent call last):
...
RuntimeError: failure
```

`AsyncResult` implements `__call__()` and thus can be used as `link()` target:

```
>>> import gevent
>>> result = AsyncResult()
>>> gevent.spawn(lambda : 1/0).link(result)
>>> result.get()
Traceback (most recent call last):
...
ZeroDivisionError: integer division or modulo by zero
```

exception

Holds the exception instance passed to `set_exception()` if `set_exception()` was called. Otherwise `None`.

get (*block=True, timeout=None*)

Return the stored value or raise the exception.

If this instance already holds a value / an exception, return / raise it immediately. Otherwise, block until another greenlet calls `set()` or `set_exception()` or until the optional timeout occurs.

When the *timeout* argument is present and not `None`, it should be a floating point number specifying a timeout for the operation in seconds (or fractions thereof).

get_nowait ()

Return the value or raise the exception without blocking.

If nothing is available, raise `gevent.Timeout` immediately.

rawlink (*callback*)

Register a callback to call when a value or an exception is set.

callback will be called in the `Hub`, so it must not use blocking `gevent` API. *callback* will be passed one argument: this instance.

ready()

Return true if and only if it holds a value or an exception

set (*value=None*)

Store the value. Wake up the waiters.

All greenlets blocking on `get()` or `wait()` are woken up. Sequential calls to `wait()` and `get()` will not block at all.

set_exception (*exception*)

Store the exception. Wake up the waiters.

All greenlets blocking on `get()` or `wait()` are woken up. Sequential calls to `wait()` and `get()` will not block at all.

successful()

Return true if and only if it is ready and holds a value

unlink (*callback*)

Remove the callback set by `rawlink()`

wait (*timeout=None*)

Block until the instance is ready.

If this instance already holds a value / an exception, return immediately. Otherwise, block until another thread calls `set()` or `set_exception()` or until the optional timeout occurs.

When the *timeout* argument is present and not `None`, it should be a floating point number specifying a timeout for the operation in seconds (or fractions thereof).

Return value.

1.6.4 kazoo.handlers.threading

A threading based handler.

The `SequentialThreadingHandler` is intended for regular Python environments that use threads.

Warning: Do not use `SequentialThreadingHandler` with applications using asynchronous event loops (like `gevent`). Use the `SequentialGeventHandler` instead.

Public API

class `kazoo.handlers.threading.SequentialThreadingHandler`

Threading handler for sequentially executing callbacks.

This handler executes callbacks in a sequential manner. A queue is created for each of the callback events, so that each type of event has its callback type run sequentially. These are split into two queues, one for watch events and one for async result completion callbacks.

Each queue type has a thread worker that pulls the callback event off the queue and runs it in the order the client sees it.

This split helps ensure that watch callbacks won't block session re-establishment should the connection be lost during a Zookeeper client call.

Watch and completion callbacks should avoid blocking behavior as the next callback of that type won't be run until it completes. If you need to block, spawn a new thread and return immediately so callbacks can proceed.

Note: Completion callbacks can block to wait on Zookeeper calls, but no other completion callbacks will execute until the callback returns.

async_result()

Create a `AsyncResult` instance

dispatch_callback(callback)

Dispatch to the callback object

The callback is put on separate queues to run depending on the type as documented for the `SequentialThreadingHandler`.

event_object()

Create an appropriate Event object

lock_object()

Create a lock object

queue_empty

alias of `Empty`

queue_impl

alias of `Queue`

rlock_object()

Create an appropriate RLock object

sleep_func()

sleep(seconds)

Delay execution for a given number of seconds. The argument may be a floating point number for subsecond precision.

start()

Start the worker threads.

stop()

Stop the worker threads and empty all queues.

Private API

class `kazoo.handlers.threading.AsyncResult(handler)`

A one-time event that stores a value or an exception

1.6.5 kazoo.handlers.utils

Kazoo handler helpers

Public API

`kazoo.handlers.utils.capture_exceptions(async_result)`

Return a new decorated function that propagates the exceptions of the wrapped function to an `async_result`.

Parameters `async_result` – An async result implementing `IAAsyncResult`

```
kazoo.handlers.utils.wrap(async_result)
```

Return a new decorated function that propagates the return value or exception of wrapped function to an `async_result`. NOTE: Only propagates a non-None return value.

Parameters `async_result` – An async result implementing `IAsyncResult`

Private API

```
kazoo.handlers.utils.create_socket_pair(module, port=0)
```

Create socket pair.

If `socket.socketpair` isn't available, we emulate it.

```
kazoo.handlers.utils.create_tcp_socket(module)
```

Create a TCP socket with the CLOEXEC flag set.

1.6.6 kazoo.interfaces

Kazoo Interfaces

Changed in version 1.4: The classes in this module used to be interface declarations based on *zope.interface.Interface*. They were converted to normal classes and now serve as documentation only.

Public API

`IHandler` implementations should be created by the developer to be passed into `KazooClient` during instantiation for the preferred callback handling.

If the developer needs to use objects implementing the `IAsyncResult` interface, the `IHandler.async_result()` method must be used instead of instantiating one directly.

```
class kazoo.interfaces.IHandler
```

A Callback Handler for Zookeeper completion and watch callbacks.

This object must implement several methods responsible for determining how completion / watch callbacks are handled as well as the method for calling `IAsyncResult` callback functions.

These functions are used to abstract differences between a Python threading environment and asynchronous single-threaded environments like `gevent`. The minimum functionality needed for `Kazoo` to handle these differences is encompassed in this interface.

The Handler should document how callbacks are called for:

- Zookeeper completion events
- Zookeeper watch events

name

Human readable name of the Handler interface.

timeout_exception

Exception class that should be thrown and captured if a result is not available within the given time.

sleep_func

Appropriate sleep function that can be called with a single argument and sleep.

async_result()

Return an instance that conforms to the `IAsyncResult` interface appropriate for this handler

create_connection()
A socket method that implements Python's `socket.create_connection` API

dispatch_callback(callback)
Dispatch to the callback object
Parameters **callback** – A `Callback` object to be called.

event_object()
Return an appropriate object that implements Python's `threading.Event` API

lock_object()
Return an appropriate object that implements Python's `threading.Lock` API

rlock_object()
Return an appropriate object that implements Python's `threading.RLock` API

select()
A select method that implements Python's `select.select` API

socket()
A socket method that implements Python's `socket.socket` API

spawn(func, *args, **kwargs)
Spawn a function to run asynchronously
Parameters

- **args** – args to call the function with.
- **kwargs** – keyword args to call the function with.

This method should return immediately and execute the function with the provided args and kwargs in an asynchronous manner.

start()
Start the handler, used for setting up the handler.

stop()
Stop the handler. Should block until the handler is safely stopped.

Private API

The `IAsyncResult` documents the proper implementation for providing a value that results from a Zookeeper completion callback. Since the `KazooClient` returns an `IAsyncResult` object instead of taking a completion callback for async functions, developers wishing to have their own callback called should use the `IAsyncResult.rawlink()` method.

class kazoo.interfaces.IAsyncResult

An Async Result object that can be queried for a value that has been set asynchronously.

This object is modeled on the `gevent.AsyncResult` object.

The implementation must account for the fact that the `set()` and `set_exception()` methods will be called from within the Zookeeper thread which may require extra care under asynchronous environments.

value

Holds the value passed to `set()` if `set()` was called. Otherwise `None`.

exception

Holds the exception instance passed to `set_exception()` if `set_exception()` was called. Otherwise `None`.

get(block=True, timeout=None)

Return the stored value or raise the exception

Parameters

- **block** (*bool*) – Whether this method should block or return immediately.
- **timeout** (*float*) – How long to wait for a value when *block* is *True*.

If this instance already holds a value / an exception, return / raise it immediately. Otherwise, block until `set()` or `set_exception()` has been called or until the optional timeout occurs.

get_nowait()

Return the value or raise the exception without blocking.

If nothing is available, raise the Timeout exception class on the associated `IHandler` interface.

rawlink (*callback*)

Register a callback to call when a value or an exception is set

Parameters **callback** (*func*) – A callback function to call after `set()` or `set_exception()` has been called. This function will be passed a single argument, this instance.

ready()

Return *True* if and only if it holds a value or an exception

set (*value=None*)

Store the value. Wake up the waiters.

Parameters **value** – Value to store as the result.

Any waiters blocking on `get()` or `wait()` are woken up. Sequential calls to `wait()` and `get()` will not block at all.

set_exception (*exception*)

Store the exception. Wake up the waiters.

Parameters **exception** – Exception to raise when fetching the value.

Any waiters blocking on `get()` or `wait()` are woken up. Sequential calls to `wait()` and `get()` will not block at all.

successful()

Return *True* if and only if it is ready and holds a value

unlink (*callback*)

Remove the callback set by `rawlink()`

Parameters **callback** (*func*) – A callback function to remove.

wait (*timeout=None*)

Block until the instance is ready.

Parameters **timeout** (*float*) – How long to wait for a value when *block* is *True*.

If this instance already holds a value / an exception, return / raise it immediately. Otherwise, block until `set()` or `set_exception()` has been called or until the optional timeout occurs.

1.6.7 kazoo.protocol.states

Kazoo State and Event objects

Public API

```
class kazoo.protocol.states.EventType
    Zookeeper Event
```


Represents a Zookeeper event. Events trigger watch functions which will receive a `EventType` attribute as their event argument.

CREATED

A node has been created.

DELETED

A node has been deleted.

CHANGED

The data for a node has changed.

CHILD

The children under a node have changed (a child was added or removed). This event does not indicate the data for a child node has changed, which must have its own watch established.

class `kazoo.protocol.states.KazooState`

High level connection state values

States inspired by Netflix Curator.

SUSPENDED

The connection has been lost but may be recovered. We should operate in a “safe mode” until then. When the connection is resumed, it may be discovered that the session expired. A client should not assume that locks are valid during this time.

CONNECTED

The connection is alive and well.

LOST

The connection has been confirmed dead. Any ephemeral nodes will need to be recreated upon re-establishing a connection. If locks were acquired or recipes using ephemeral nodes are in use, they can be considered lost as well.

class `kazoo.protocol.states.KeeperState`

Zookeeper State

Represents the Zookeeper state. Watch functions will receive a `KeeperState` attribute as their state argument.

AUTH_FAILED

Authentication has failed, this is an unrecoverable error.

CONNECTED

Zookeeper is connected.

CONNECTED_RO

Zookeeper is connected in read-only state.

CONNECTING

Zookeeper is currently attempting to establish a connection.

EXPIRED_SESSION

The prior session was invalid, all prior ephemeral nodes are gone.

class `kazoo.protocol.states.WatchedEvent`

A change on ZooKeeper that a Watcher is able to respond to.

The `WatchedEvent` includes exactly what happened, the current state of ZooKeeper, and the path of the node that was involved in the event. An instance of `WatchedEvent` will be passed to registered watch functions.

type

A `EventType` attribute indicating the event type.

state

A `KeeperState` attribute indicating the Zookeeper state.

path

The path of the node for the watch event.

class `kazoo.protocol.states.ZnodeStat`

A `ZnodeStat` structure with convenience properties

When getting the value of a node from Zookeeper, the properties for the node known as a “Stat structure” will be retrieved. The `ZnodeStat` object provides access to the standard Stat properties and additional properties that are more readable and use Python time semantics (seconds since epoch instead of ms).

Note: The original Zookeeper Stat name is in parens next to the name when it differs from the convenience attribute. These are **not functions**, just attributes.

creation_transaction_id (*czxid*)

The transaction id of the change that caused this znode to be created.

last_modified_transaction_id (*mzxid*)

The transaction id of the change that last modified this znode.

created (*ctime*)

The time in seconds from epoch when this node was created. (ctime is in milliseconds)

last_modified (*mtime*)

The time in seconds from epoch when this znode was last modified. (mtime is in milliseconds)

version

The number of changes to the data of this znode.

acl_version (*aversion*)

The number of changes to the ACL of this znode.

owner_session_id (*ephemeralOwner*)

The session id of the owner of this znode if the znode is an ephemeral node. If it is not an ephemeral node, it will be *None*. (ephemeralOwner will be 0 if it is not ephemeral)

data_length (*dataLength*)

The length of the data field of this znode.

children_count (*numChildren*)

The number of children of this znode.

Private API

class `kazoo.protocol.states.Callback`

A callback that is handed to a handler for dispatch

Parameters

- **type** – Type of the callback, currently is only ‘watch’
- **func** – Callback function
- **args** – Argument list for the callback function

1.6.8 kazoo.recipe.barrier

Zookeeper Barriers

Maintainer None

Status Unknown

Public API

class kazoo.recipe.barrier.**Barrier**(*client, path*)

Kazoo Barrier

Implements a barrier to block processing of a set of nodes until a condition is met at which point the nodes will be allowed to proceed. The barrier is in place if its node exists.

Warning: The `wait()` function does not handle connection loss and may raise `ConnectionLossException` if the connection is lost while waiting.

__init__(*client, path*)

Create a Kazoo Barrier

Parameters

- **client** – A `KazooClient` instance.
- **path** – The barrier path to use.

create()

Establish the barrier if it doesn't exist already

remove()

Remove the barrier

Returns Whether the barrier actually needed to be removed.

Return type bool

wait(*timeout=None*)

Wait on the barrier to be cleared

Returns True if the barrier has been cleared, otherwise False.

Return type bool

class kazoo.recipe.barrier.**DoubleBarrier**(*client, path, num_clients, identifier=None*)

Kazoo Double Barrier

Double barriers are used to synchronize the beginning and end of a distributed task. The barrier blocks when entering it until all the members have joined, and blocks when leaving until all the members have left.

Note: You should register a listener for session loss as the process will no longer be part of the barrier once the session is gone. Connection losses will be retried with the default retry policy.

__init__(*client, path, num_clients, identifier=None*)

Create a Double Barrier

Parameters

- **client** – A `KazooClient` instance.
- **path** – The barrier path to use.
- **num_clients** (*int*) – How many clients must enter the barrier to proceed.
- **identifier** – An identifier to use for this member of the barrier when participating. Defaults to the hostname + process id.

enter()
Enter the barrier, blocks until all nodes have entered

leave()
Leave the barrier, blocks until all nodes have left

1.6.9 kazoo.recipe.counter

Zookeeper Counter

Maintainer None

Status Unknown

New in version 0.7: The Counter class.

Public API

class `kazoo.recipe.counter.Counter` (*client, path, default=0*)

Kazoo Counter

A shared counter of either int or float values. Changes to the counter are done atomically. The general retry policy is used to retry operations if concurrent changes are detected.

The data is marshaled using `repr(value)` and converted back using `type(counter.default)(value)` both using an ascii encoding. As such other data types might be used for the counter value.

Counter changes can raise `BadVersionError` if the retry policy wasn't able to apply a change.

Example usage:

```
zk = KazooClient()
counter = zk.Counter("/int")
counter += 2
counter -= 1
counter.value == 1

counter = zk.Counter("/float", default=1.0)
counter += 2.0
counter.value == 3.0
```

__init__ (*client, path, default=0*)

Create a Kazoo Counter

Parameters

- **client** – A `KazooClient` instance.
- **path** – The counter path to use.
- **default** – The default value.

__add__ (*value*)

Add value to counter.

__sub__ (*value*)

Subtract value from counter.

1.6.10 kazoo.recipe.election

ZooKeeper Leader Elections

Maintainer None

Status Unknown

Public API

class `kazoo.recipe.election.Election` (*client, path, identifier=None*)
Kazoo Basic Leader Election

Example usage with a `KazooClient` instance:

```
zk = KazooClient()
election = zk.Election("/electionpath", "my-identifier")

# blocks until the election is won, then calls
# my_leader_function()
election.run(my_leader_function)
```

__init__ (*client, path, identifier=None*)
Create a Kazoo Leader Election

Parameters

- **client** – A `KazooClient` instance.
- **path** – The election path to use.
- **identifier** – Name to use for this lock contender. This can be useful for querying to see who the current lock contenders are.

cancel ()
Cancel participation in the election

Note: If this contender has already been elected leader, this method will not interrupt the leadership function.

contenders ()
Return an ordered list of the current contenders in the election

Note: If the contenders did not set an identifier, it will appear as a blank string.

run (*func, *args, **kwargs*)
Contend for the leadership

This call will block until either this contender is cancelled or this contender wins the election and the provided leadership function subsequently returns or fails.

Parameters

- **func** – A function to be called if/when the election is won.
- **args** – Arguments to leadership function.
- **kwargs** – Keyword arguments to leadership function.

1.6.11 kazoo.recipe.lease

Zookeeper lease implementations

Maintainer Lars Albertsson <lars.albertsson@gmail.com>

Maintainer Jyrki Pulliainen <jyrki@spotify.com>

Status Beta

Public API

```
class kazoo.recipe.lease.NonBlockingLease(client, path, duration, identifier=None,  
                                           utcnow=<built-in method utcnow of  
                                           type object at 0x7f0b619a9a00>)
```

Exclusive lease that does not block.

An exclusive lease ensures that only one client at a time owns the lease. The client may renew the lease without losing it by obtaining a new lease with the same path and same identity. The lease object evaluates to True if the lease was obtained.

A common use case is a situation where a task should only run on a single host. In this case, the clients that did not obtain the lease should exit without performing the protected task.

The lease stores time stamps using client clocks, and will therefore only work if client clocks are roughly synchronised. It uses UTC, and works across time zones and daylight savings.

Example usage: with a `KazooClient` instance:

```
zk = KazooClient()  
# Hold lease over an hour in order to keep job on same machine, with failover if it dies.  
lease = zk.NonBlockingLease("/db_leases/hourly_cleanup", datetime.timedelta(minutes = 70),  
    identifier = "DB hourly cleanup on " + socket.gethostname())  
if lease:  
    do_hourly_database_cleanup()
```

```
__init__(client, path, duration, identifier=None, utcnow=<built-in method utcnow of type  
         object at 0x7f0b619a9a00>)
```

Create a non-blocking lease.

Parameters

- **client** – A `KazooClient` instance.
- **path** – The lease path to use.
- **duration** – Duration during which the lease is reserved. A `timedelta` instance.
- **identifier** – Unique name to use for this lease holder. Reuse in order to renew the lease. Defaults do `socket.gethostname()`.
- **utcnow** – Clock function, by default returning `datetime.datetime.utcnow()`. Used for testing.

```
class kazoo.recipe.lease.MultiNonBlockingLease(client, count, path, du-  
                                                ration, identifier=None,  
                                                utcnow=<built-in method  
                                                utcnow of type object at  
                                                0x7f0b619a9a00>)
```

Exclusive lease for multiple clients.

This type of lease is useful when a limited set of hosts should run a particular task. It will attempt to obtain leases trying a sequence of ZooKeeper lease paths.

Parameters

- **client** – A `KazooClient` instance.
- **count** – Number of host leases allowed.
- **path** – ZooKeeper path under which lease files are stored.
- **duration** – Duration during which the lease is reserved. A `timedelta` instance.
- **identifier** – Unique name to use for this lease holder. Reuse in order to renew the lease. Defaults do `socket.gethostname()`.

- **utcnow** – Clock function, by default returning `datetime.datetime.utcnow()`. Used for testing.

__init__ (*client, count, path, duration, identifier=None, utcnow=<built-in method utcnow of type object at 0x7f0b619a9a00>*)

1.6.12 kazoo.recipe.lock

Zookeeper Locking Implementations

Maintainer Ben Bangert <ben@groovie.org>

Status Production

Error Handling

It's highly recommended to add a state listener with `add_listener()` and watch for `LOST` and `SUSPENDED` state changes and re-act appropriately. In the event that a `LOST` state occurs, its certain that the lock and/or the lease has been lost.

Public API

class `kazoo.recipe.lock.Lock` (*client, path, identifier=None*)
Kazoo Lock

Example usage with a `KazooClient` instance:

```
zk = KazooClient()
lock = zk.Lock("/lockpath", "my-identifier")
with lock: # blocks waiting for lock acquisition
    # do something with the lock
```

Note: This lock is not *re-entrant*. Repeated calls after already acquired will block.

__init__ (*client, path, identifier=None*)
Create a Kazoo lock.

Parameters

- **client** – A `KazooClient` instance.
- **path** – The lock path to use.
- **identifier** – Name to use for this lock contender. This can be useful for querying to see who the current lock contenders are.

acquire (*blocking=True, timeout=None*)
Acquire the lock. By defaults blocks and waits forever.

Parameters

- **blocking** (*bool*) – Block until lock is obtained or return immediately.
- **timeout** (*float or None*) – Don't wait forever to acquire the lock.

Returns Was the lock acquired?

Return type `bool`

Raises `LockTimeout` if the lock wasn't acquired within *timeout* seconds.

New in version 1.1: The timeout option.

cancel ()
Cancel a pending lock acquire.

contenders()

Return an ordered list of the current contenders for the lock.

Note: If the contenders did not set an identifier, it will appear as a blank string.

release()

Release the lock immediately.

class `kazoo.recipe.lock.Semaphore` (*client, path, identifier=None, max_leases=1*)

A Zookeeper-based Semaphore

This synchronization primitive operates in the same manner as the Python threading version only uses the concept of leases to indicate how many available leases are available for the lock rather than counting.

Note: This lock is not meant to be *re-entrant*.

Example:

```
zk = KazooClient()
semaphore = zk.Semaphore("/leasepath", "my-identifier")
with semaphore: # blocks waiting for lock acquisition
    # do something with the semaphore
```

Warning: This class stores the allowed `max_leases` as the data on the top-level semaphore node. The stored value is checked once against the `max_leases` of each instance. This check is performed when `acquire` is called the first time. The semaphore node needs to be deleted to change the allowed leases.

New in version 0.6: The Semaphore class.

New in version 1.1: The `max_leases` check.

__init__ (*client, path, identifier=None, max_leases=1*)

Create a Kazoo Lock

Parameters

- **client** – A `KazooClient` instance.
- **path** – The semaphore path to use.
- **identifier** – Name to use for this lock contender. This can be useful for querying to see who the current lock contenders are.
- **max_leases** – The maximum amount of leases available for the semaphore.

acquire (*blocking=True, timeout=None*)

Acquire the semaphore. By default blocks and waits forever.

Parameters

- **blocking** (*bool*) – Block until semaphore is obtained or return immediately.
- **timeout** (*float or None*) – Don't wait forever to acquire the semaphore.

Returns Was the semaphore acquired?

Return type `bool`

Raises `ValueError` if the `max_leases` value doesn't match the stored value.

`LockTimeout` if the semaphore wasn't acquired within *timeout* seconds.

New in version 1.1: The `blocking`, `timeout` arguments and the `max_leases` check.

cancel()

Cancel a pending semaphore acquire.

lease_holders()

Return an unordered list of the current lease holders.

Note: If the lease holder did not set an identifier, it will appear as a blank string.

release()
Release the lease immediately.

1.6.13 kazoo.recipe.partitioner

Zookeeper Partitioner Implementation

Maintainer None

Status Unknown

`SetPartitioner` implements a partitioning scheme using Zookeeper for dividing up resources amongst members of a party.

This is useful when there is a set of resources that should only be accessed by a single process at a time that multiple processes across a cluster might want to divide up.

Example Use-Case

- Multiple workers across a cluster need to divide up a list of queues so that no two workers own the same queue.

Public API

```
class kazoo.recipe.partitioner.SetPartitioner(client, path, set, parti-
                                             tion_func=None, identi-
                                             fier=None, time_boundary=30,
                                             max_reaction_time=1,
                                             state_change_event=None)
```

Partitions a set amongst members of a party

This class will partition a set amongst members of a party such that each member will be given zero or more items of the set and each set item will be given to a single member. When new members enter or leave the party, the set will be re-partitioned amongst the members.

When the `SetPartitioner` enters the `FAILURE` state, it is unrecoverable and a new `SetPartitioner` should be created.

Example:

```
from kazoo.client import KazooClient
client = KazooClient()

qp = client.SetPartitioner(
    path='/work_queues', set=('queue-1', 'queue-2', 'queue-3'))

while 1:
    if qp.failed:
        raise Exception("Lost or unable to acquire partition")
    elif qp.release:
        qp.release_set()
    elif qp.acquired:
        for partition in qp:
            # Do something with each partition
```

```
elif qp.allocating:
    qp.wait_for_acquire()
```

State Transitions

When created, the `SetPartitioner` enters the `PartitionState.ALLOCATING` state.

ALLOCATING -> ACQUIRED

Set was partitioned successfully, the partition list assigned is accessible via `list/iter` methods or calling `list()` on the `SetPartitioner` instance.

ALLOCATING -> FAILURE

Allocating the set failed either due to a Zookeeper session expiration, or failure to acquire the items of the set within the timeout period.

ACQUIRED -> RELEASE

The members of the party have changed, and the set needs to be repartitioned. `SetPartitioner.release()` should be called as soon as possible.

ACQUIRED -> FAILURE

The current partition was lost due to a Zookeeper session expiration.

RELEASE -> ALLOCATING

The current partition was released and is being re-allocated.

```
__init__(client, path, set, partition_func=None, identifier=None, time_boundary=30,
         max_reaction_time=1, state_change_event=None)
```

Create a `SetPartitioner` instance

Parameters

- **client** – A `KazooClient` instance.
- **path** – The partition path to use.
- **set** – The set of items to partition.
- **partition_func** – A function to use to decide how to partition the set.
- **identifier** – An identifier to use for this member of the party when participating. Defaults to the hostname + process id.
- **time_boundary** – How long the party members must be stable before allocation can complete.
- **max_reaction_time** – Maximum reaction time for party members change.
- **state_change_event** – An optional Event object that will be set on every state change.

acquired

Corresponds to the `PartitionState.ACQUIRED` state

allocating

Corresponds to the `PartitionState.ALLOCATING` state

failed

Corresponds to the `PartitionState.FAILURE` state

finish()

Call to release the set and leave the party

release

Corresponds to the `PartitionState.RELEASE` state

release_set()

Call to release the set

This method begins the step of allocating once the set has been released.

wait_for_acquire (*timeout=30*)

Wait for the set to be partitioned and acquired

Parameters *timeout* (*int*) – How long to wait before returning.

class `kazoo.recipe.partitioner.PartitionState`

High level partition state values

ALLOCATING

The set needs to be partitioned, and may require an existing partition set to be released before acquiring a new partition of the set.

ACQUIRED

The set has been partitioned and acquired.

RELEASE

The set needs to be repartitioned, and the current partitions must be released before a new allocation can be made.

FAILURE

The set partition has failed. This occurs when the maximum time to partition the set is exceeded or the Zookeeper session is lost. The partitioner is unusable after this state and must be recreated.

1.6.14 `kazoo.recipe.party`

Party

Maintainer Ben Bangert <ben@groovie.org>

Status Production

A Zookeeper pool of party members. The `Party` object can be used for determining members of a party.

Public API

class `kazoo.recipe.party.Party` (*client, path, identifier=None*)

Simple pool of participating processes

__init__ (*client, path, identifier=None*)

__iter__ ()

Get a list of participating clients' data values

__len__ ()

Return a count of participating clients

join ()

Join the party

leave ()

Leave the party

class `kazoo.recipe.party.ShallowParty` (*client, path, identifier=None*)

Simple shallow pool of participating processes

This differs from the `Party` as the identifier is used in the name of the party node itself, rather than the data. This places some restrictions on the length as it must be a valid Zookeeper node (an

alphanumeric string), but reduces the overhead of getting a list of participants to a single Zookeeper call.

```
__init__(client, path, identifier=None)
__iter__()
    Get a list of participating clients' identifiers
__len__()
    Return a count of participating clients
join()
    Join the party
leave()
    Leave the party
```

1.6.15 kazoo.recipe.queue

Zookeeper based queue implementations.

Maintainer None

Status Possibly Buggy

Note: This queue was reported to cause memory leaks over long running periods. See: <https://github.com/python-zk/kazoo/issues/175>

New in version 0.6: The Queue class.

New in version 1.0: The LockingQueue class.

Public API

```
class kazoo.recipe.queue.Queue(client, path)
```

A distributed queue with optional priority support.

This queue does not offer reliable consumption. An entry is removed from the queue prior to being processed. So if an error occurs, the consumer has to re-queue the item or it will be lost.

```
__init__(client, path)
    Parameters
    • client – A KazooClient instance.
    • path – The queue path to use in ZooKeeper.

__len__()
    Return queue size.

get()
    Get item data and remove an item from the queue.
    Returns Item data or None.
    Return type bytes

put(value, priority=100)
    Put an item into the queue.
    Parameters
    • value – Byte string to put into the queue.
    • priority – An optional priority as an integer with at most 3 digits. Lower values
        signify higher priority.
```

class `kazoo.recipe.queue.LockingQueue` (*client, path*)

A distributed queue with priority and locking support.

Upon retrieving an entry from the queue, the entry gets locked with an ephemeral node (instead of deleted). If an error occurs, this lock gets released so that others could retake the entry. This adds a little penalty as compared to `Queue` implementation.

The user should call the `LockingQueue.get()` method first to lock and retrieve the next entry. When finished processing the entry, a user should call the `LockingQueue.consume()` method that will remove the entry from the queue.

This queue will not track connection status with ZooKeeper. If a node locks an element, then loses connection with ZooKeeper and later reconnects, the lock will probably be removed by Zookeeper in the meantime, but a node would still think that it holds a lock. The user should check the connection status with Zookeeper or call `LockingQueue.holds_lock()` method that will check if a node still holds the lock.

Note: `LockingQueue` requires ZooKeeper 3.4 or above, since it is using transactions.

__init__ (*client, path*)

Parameters

- **client** – A `KazooClient` instance.
- **path** – The queue path to use in ZooKeeper.

__len__ ()

Returns the current length of the queue.

Returns queue size (includes locked entries count).

consume ()

Removes a currently processing entry from the queue.

Returns True if element was removed successfully, False otherwise.

Return type bool

get (*timeout=None*)

Locks and gets an entry from the queue. If a previously got entry was not consumed, this method will return that entry.

Parameters **timeout** – Maximum waiting time in seconds. If None then it will wait untill an entry appears in the queue.

Returns A locked entry value or None if the timeout was reached.

Return type bytes

holds_lock ()

Checks if a node still holds the lock.

Returns True if a node still holds the lock, False otherwise.

Return type bool

put (*value, priority=100*)

Put an entry into the queue.

Parameters

- **value** – Byte string to put into the queue.
- **priority** – An optional priority as an integer with at most 3 digits. Lower values signify higher priority.

put_all (*values, priority=100*)

Put several entries into the queue. The action only succeeds if all entries were put into the queue.

Parameters

- **values** – A list of values to put into the queue.

- **priority** – An optional priority as an integer with at most 3 digits. Lower values signify higher priority.

1.6.16 kazoo.recipe.watchers

Higher level child and data watching API's.

Maintainer Ben Bangert <ben@groovie.org>

Status Production

Note: *DataWatch* and *ChildrenWatch* may only handle a single function, attempts to associate a single instance with multiple functions will result in an exception being thrown.

Public API

class `kazoo.recipe.watchers.DataWatch` (*client, path, func=None, *args, **kwargs*)

Watches a node for data updates and calls the specified function each time it changes

The function will also be called the very first time its registered to get the data.

Returning *False* from the registered function will disable future data change calls. If the client connection is closed (using the close command), the *DataWatch* will no longer get updates.

If the function supplied takes three arguments, then the third one will be a *WatchedEvent*. It will only be set if the change to the data occurs as a result of the server notifying the watch that there has been a change. Events like reconnection or the first call will not include an event.

If the node does not exist, then the function will be called with *None* for all values.

Tip: Because *DataWatch* can watch nodes that don't exist, it can be used alternatively as a higher-level *Exists* watcher that survives reconnections and session loss.

Example with client:

```
@client.DataWatch('/path/to/watch')
def my_func(data, stat):
    print("Data is %s" % data)
    print("Version is %s" % stat.version)

# Above function is called immediately and prints

# Or if you want the event object
@client.DataWatch('/path/to/watch')
def my_func(data, stat, event):
    print("Data is %s" % data)
    print("Version is %s" % stat.version)
    print("Event is %s" % event)
```

Changed in version 1.2: *DataWatch* now ignores additional arguments that were previously passed to it and warns that they are no longer respected.

__init__ (*client, path, func=None, *args, **kwargs*)

Create a data watcher for a path

Parameters

- **client** (*KazooClient*) – A zookeeper client.
- **path** (*str*) – The path to watch for data changes on.

- **func** (*callable*) – Function to call initially and every time the node changes. *func* will be called with a tuple, the value of the node and a `ZnodeStat` instance.

__call__ (*func*)

Callable version for use as a decorator

Parameters **func** (*callable*) – Function to call initially and every time the data changes. *func* will be called with a tuple, the value of the node and a `ZnodeStat` instance.

```
class kazoo.recipe.watchers.ChildrenWatch(client, path, func=None,
                                          allow_session_lost=True,
                                          send_event=False)
```

Watches a node for children updates and calls the specified function each time it changes

The function will also be called the very first time its registered to get children.

Returning *False* from the registered function will disable future children change calls. If the client connection is closed (using the close command), the `ChildrenWatch` will no longer get updates.

if `send_event=True` in `__init__`, then the function will always be called with second parameter, `event`. Upon initial call or when recovering a lost session the `event` is always `None`. Otherwise it's a `WatchedEvent` instance.

Example with client:

```
@client.ChildrenWatch('/path/to/watch')
def my_func(children):
    print "Children are %s" % children

# Above function is called immediately and prints children
```

__init__ (*client, path, func=None, allow_session_lost=True, send_event=False*)

Create a children watcher for a path

Parameters

- **client** (`KazooClient`) – A zookeeper client.
- **path** (*str*) – The path to watch for children on.
- **func** (*callable*) – Function to call initially and every time the children change. *func* will be called with a single argument, the list of children.
- **allow_session_lost** (*bool*) – Whether the watch should be re-registered if the zookeeper session is lost.
- **send_event** (*bool*) – Whether the function should be passed the event sent by `ZooKeeper` or `None` upon initialization (see class documentation)

The path must already exist for the children watcher to run.

__call__ (*func*)

Callable version for use as a decorator

Parameters **func** (*callable*) – Function to call initially and every time the children change. *func* will be called with a single argument, the list of children.

```
class kazoo.recipe.watchers.PatientChildrenWatch(client, path,
                                                  time_boundary=30)
```

Patient Children Watch that returns values after the children of a node don't change for a period of time

A separate watcher for the children of a node, that ignores changes within a boundary time and sets the result only when the boundary time has elapsed with no children changes.

Example:

```
watcher = PatientChildrenWatch(client, '/some/path',
                               time_boundary=5)
async_object = watcher.start()

# Blocks until the children have not changed for time boundary
# (5 in this case) seconds, returns children list and an
# async_result that will be set if the children change in the
# future
children, child_async = async_object.get()
```

Note: This Watch is different from `DataWatch` and `ChildrenWatch` as it only returns once, does not take a function that is called, and provides an `IAsyncResult` object that can be checked to see if the children have changed later.

```
__init__(client, path, time_boundary=30)

start()
    Begin the watching process asynchronously
    Returns An IAsyncResult instance that will be set when no change has occurred
    to the children for time boundary seconds.
```

1.6.17 kazoo.retry

Public API

```
class kazoo.retry.KazooRetry(max_tries=1, delay=0.1, backoff=2, max_jitter=0.8,
                             max_delay=3600, ignore_expire=True, sleep_func=<built-
                             in function sleep>, deadline=None, interrupt=None)
```

Helper for retrying a method in the face of retry-able exceptions

```
__init__(max_tries=1, delay=0.1, backoff=2, max_jitter=0.8, max_delay=3600, ig-
         nore_expire=True, sleep_func=<built-in function sleep>, deadline=None, inter-
         rupt=None)
```

Create a `KazooRetry` instance for retrying function calls

Parameters

- **max_tries** – How many times to retry the command. -1 means infinite tries.
- **delay** – Initial delay between retry attempts.
- **backoff** – Backoff multiplier between retry attempts. Defaults to 2 for exponential backoff.
- **max_jitter** – Additional max jitter period to wait between retry attempts to avoid slamming the server.
- **max_delay** – Maximum delay in seconds, regardless of other backoff settings. Defaults to one hour.
- **ignore_expire** – Whether a session expiration should be ignored and treated as a retry-able command.
- **interrupt** – Function that will be called with no args that may return True if the retry should be ceased immediately. This will be called no more than every 0.1 seconds during a wait between retries.

```
__call__(func, *args, **kwargs)
```

Call a function with arguments until it completes without throwing a Kazoo exception

Parameters

- **func** – Function to call
- **args** – Positional arguments to call the function with

Params kwargs Keyword arguments to call the function with

The function will be called until it doesn't throw one of the retryable exceptions (Connection-Loss, OperationTimeout, or ForceRetryError), and optionally retrying on session expiration.

reset ()

Reset the attempt counter

copy ()

Return a clone of this retry manager

exception kazoo.retry.ForceRetryError

Raised when some recipe logic wants to force a retry.

exception kazoo.retry.RetryFailedError

Raised when retrying an operation ultimately failed, after retrying the maximum number of attempts.

exception kazoo.retry.InterruptedError

Raised when the retry is forcibly interrupted by the interrupt function

1.6.18 kazoo.security

Kazoo Security

Public API

class kazoo.security.ACL

An ACL for a Zookeeper Node

An ACL object is created by using an `Id` object along with a `Permissions` setting. For convenience, `make_digest_acl()` should be used to create an ACL object with the desired scheme, id, and permissions.

class kazoo.security.Id

`Id(scheme, id)`

`kazoo.security.make_digest_acl(username, password, read=False, write=False, create=False, delete=False, admin=False, all=False)`

Create a digest ACL for Zookeeper with the given permissions

This method combines `make_digest_acl_credential()` and `make_acl()` to create an `ACL` object appropriate for use with Kazoo's ACL methods.

Parameters

- **username** – Username to use for the ACL.
- **password** – A plain-text password to hash.
- **write** (*bool*) – Write permission.
- **create** (*bool*) – Create permission.
- **delete** (*bool*) – Delete permission.
- **admin** (*bool*) – Admin permission.
- **all** (*bool*) – All permissions.

Return type `ACL`

Private API

```
kazoo.security.make_acl(scheme, credential, read=False, write=False, create=False,
                        delete=False, admin=False, all=False)
```

Given a scheme and credential, return an [ACL](#) object appropriate for use with Kazoo.

Parameters

- **scheme** – The scheme to use. I.e. *digest*.
- **credential** – A colon separated username, password. The password should be hashed with the *scheme* specified. The `make_digest_acl_credential()` method will create and return a credential appropriate for use with the *digest* scheme.
- **write** (*bool*) – Write permission.
- **create** (*bool*) – Create permission.
- **delete** (*bool*) – Delete permission.
- **admin** (*bool*) – Admin permission.
- **all** (*bool*) – All permissions.

Return type [ACL](#)

```
kazoo.security.make_digest_acl_credential(username, password)
```

Create a SHA1 digest credential

1.6.19 kazoo.testing.harness

Kazoo testing harnesses

Public API

```
class kazoo.testing.harness.KazooTestHarness(*args, **kw)
```

Harness for testing code that uses Kazoo

This object can be used directly or as a mixin. It supports starting and stopping a complete ZooKeeper cluster locally and provides an API for simulating errors and expiring sessions.

Example:

```
class MyTestCase(KazooTestHarness):
    def setUp(self):
        self.setup_zookeeper()

        # additional test setup

    def tearDown(self):
        self.teardown_zookeeper()

    def test_something(self):
        something_that_needs_a_kazoo_client(self.client)

    def test_something_else(self):
        something_that_needs_zk_servers(self.servers)
```

```
class kazoo.testing.harness.KazooTestCase(*args, **kw)
```

1.7 Changelog

1.7.1 2.2 (unreleased)

1.7.2 2.1 (2015-05-11)

Features

- Start running tests against Zookeeper 3.5.0 alpha and explicitly configure the `admin.serverPort` in tests to avoid port conflicts. The Zookeeper alpha version is not yet officially supported.
- Integrate eventlet *handler* support into kazoo so that along with [gevent, threading] handlers there can now be a dedicated eventlet handler for projects that need to (or want to) use eventlet (such as those working in the openstack community). The `requirements_eventlet.txt` file lists the optional eventlet requirement(s) that needs to be satisfied when this new handler is used.
- Use `six` to nicely handle the cross compatibility of kazoo with python 2.x and 3.x (reducing/removing the need to have custom compatibility code that replicates what six already provides).
- Add `state_change_event` to `kazoo.recipe.partitioner.SetPartitioner` which is set on every state change.
- Add a `NonBlockingLease` recipe. The recipe allows e.g. cron jobs scheduled on multiple machines to ensure that at most N instances will run a particular job, with lease timeout for graceful handover in case of node failures.

Bug Handling

- #291: Kazoo lock recipe was only partially re-entrant in that multiple calls to *acquire* would obtain the the lock but the first call to *release* would remove the underlying lock. This would leave the X - 1 other *acquire* statements unprotected (and no longer holding there expected lock). To fix this the comment about that lock recipe being re-entrant has been removed and multiple acquires will now block when attempted.
- #78: Kazoo now uses socketpairs instead of pipes making it compatible with Windows.
- #144, #221: Let *client.command* work with IPv6 addresses.
- #216: Fixed timeout for `ConnectionHandler._invoke`.
- #261: Creating a sequential znode under / doesn't work.
- #274: Add `server_version()` retries (by default 4 attempts will be made) to better handle flakey responses.
- #271: Fixed handling of `KazooState.SUSPENDED` in `SetPartitioner`.
- #283: Fixed a race condition in `SetPartitioner` when party changes during handling of lock acquisition.
- #303: don't crash on random input as the hosts string.

Documentation

- #222: Document that `committed` on the transaction is used to ensure only one commit and is not an indicator of whether operations in the transaction returned desired results.

1.7.3 2.0 (2014-06-19)

Documentation

- Extend support to Python 3.4, deprecating Python 3.2.
- Issue #198: Mention Zake as a sophisticated kazoo mock testing library.
- Issue #181: Add documentation on basic logging setup.

1.7.4 2.0b1 (2014-04-24)

API Changes

- Null or None data is no longer treated as `""`. Pull req #165, patch by Raul Gutierrez S. This will affect how you should treat null data in a znode vs. an empty string.
- Passing `acl=[]` to `create()` now works properly instead of an `InvalidACLError` as it returned before. Patch by Raul Gutierrez S in PR #164.
- Removed the dependency on `zope.interface`. The classes in the `interfaces` module are left for documentation purposes only (issue #131).

Features

- Logging levels have been reduced.
 - Logging previously at the `logging.DEBUG` level is now logged at the `kazoo.loggingsupport.BLATHER` level (5).
 - Some low-level logging previously at the `logging.INFO` level is now logged at the `logging.DEBUG` level.
- Issue #133: Introduce a new environment variable `ZOOKEEPER_PORT_OFFSET` for the testing support, to run the testing cluster on a different range.

Bug Handling

- When authenticating via `add_auth()` the auth data will be saved to ensure that the authentication happens on reconnect (as is the case when feeding auth data via `KazooClient`'s constructor). PR #172, patch by Raul Gutierrez S.
- Change `gevent` import to remove deprecation warning when newer `gevent` is used. PR #191, patch by Hiroaki Kawai.
- Lock recipe was failing to use the client's `sleep_func` causing issues with `gevent`. Issue #150.
- Calling a `DataWatch` or `ChildrenWatch` instance twice (decorator) now throws an exception as only a single function can be associated with a single watcher. Issue #154.
- Another fix for `atexit` handling so that when disposing of connections the `atexit` handler is removed. PR #190, patch by Devaev Maxim.
- Fix `atexit` handling for kazoo threading handler, PR #183. Patch by Brian Wickman.
- `Partitioner` should handle a suspended connection properly and restore an allocated state if it was allocated previously. Patch by Manish Tomar.

- Issue #167: Closing a client that was never started throws a type error. Patch by Joshua Harlow.
- Passing dictionaries to `KazooClient.__init__()` wasn't actually working properly. Patch by Ryan Uber.
- Issue #119: Handler timeout takes the max of the random interval or the read timeout to ensure a negative number isn't used for the read timeout.
- Fix ordering of exception catches in `lock.acquire` as it was capturing a parent exception before the child. Patch by ReneSac.
- Fix issue with `client.stop()` not always setting the client state to `KeeperState.CLOSED`. Patch by Jyrki Pulliainen in PR #174.
- Issue #169: Fixed pipes leaking into child processes.

Documentation

- Add section on contributing recipes, add maintainer/status information for existing recipes.
- Add note about alternate use of `DataWatch`.

1.7.5 1.3.1 (2013-09-25)

Bug Handling

- #118, #125, #128: Fix unknown variable in `KazooClient command_retry` argument handling.
- #126: Fix `KazooRetry.copy` to correctly copy sleep function.
- #118: Correct session/socket timeout conversion (int vs. float).

Documentation

- #121: Add a note about `kazoo.recipe.queue.LockingQueue` requiring a Zookeeper 3.4+ server.

1.7.6 1.3 (2013-09-05)

Features

- #115: Limit the backends we use for SLF4J during tests.
- #112: Add IPv6 support. Patch by Dan Kruchinin.

1.7.7 1.2.1 (2013-08-01)

Bug Handling

- Issue #108: Circular import fail when importing `kazoo.recipe.watchers` directly has now been resolved. `Watchers` and `partitioner` properly import the `KazooState` from `kazoo.protocol.states` rather than `kazoo.client`.
- Issue #109: `Partials` not usable properly as a `datawatch` call can now be used. All funcs will be called with 3 args and fall back to 2 args if there's an argument error.
- Issue #106, #107: `client.create_async` didn't strip change root from the returned path.

1.7.8 1.2 (2013-07-24)

Features

- KazooClient can now be stopped more reliably even if its in the middle of a long retry sleep. This utilizes the new interrupt feature of KazooRetry which lets the sleep be broken down into chunks and an interrupt function called to determine if the retry should fail early.
- Issue #62, #92, #89, #101, #102: Allow KazooRetry to have a max deadline, transition properly when connection fails to LOST, and setup separate connection retry behavior from client command retry behavior. Patches by Mike Lundy.
- Issue #100: Make it easier to see exception context in threading and connection modules.
- Issue #85: Increase information density of logs and don't prevent dynamic reconfiguration of log levels at runtime.
- Data-watchers for the same node are no longer 'stacked'. That is, if a get and an exists call occur for the same node with the same watch function, then it will be registered only once. This change results in Kazoo behaving per Zookeeper client spec regarding repeat watch use.

Bug Handling

- Issue #53: Throw a warning upon starting if the chroot path doesn't exist so that it's more obvious when the chroot should be created before performing more operations.
- Kazoo previously would let the same function be registered as a data-watch or child-watch multiple times, and then call it multiple times upon being triggered. This was non-compliant Zookeeper client behavior, the same watch can now only be registered once for the same znode path per Zookeeper client documentation.
- Issue #105: Avoid rare import lock problems by moving module imports in client.py to the module scope.
- Issue #103: Allow prefix-less sequential znodes.
- Issue #98: Extend testing ZK harness to work with different file locations on some versions of Debian/Ubuntu.
- Issue #97: Update some docstrings to reflect current state of handlers.
- Issue #62, #92, #89, #101, #102: Allow KazooRetry to have a max deadline, transition properly when connection fails to LOST, and setup separate connection retry behavior from client command retry behavior. Patches by Mike Lundy.

API Changes

- The *kazoo.testing.harness.KazooTestHarness* class directly inherits from *unittest.TestCase* and you need to ensure to call its `__init__` method.
- DataWatch no longer takes any parameters besides for the optional function during instantiation. The additional options are now implicitly True, with the user being left to ignore events as they choose. See the DataWatch API docs for more information.
- Issue #99: Better exception raised when the writer fails to close. A *WriterNotClosedException* that inherits from *KazooException* is now raised when the writer fails to close in time.

1.7.9 1.1 (2013-06-08)

Features

- Issue #93: Add timeout option to lock/semaphore acquire methods.
- Issue #79 / #90: Add ability to pass the WatchedEvent to DataWatch and ChildWatch functions.
- Respect large client timeout values when closing the connection.
- Add a *max_leases* consistency check to the semaphore recipe.
- Issue #76: Extend testing helpers to allow customization of the Java classpath by specifying the new *ZOOKEEPER_CLASSPATH* environment variable.
- Issue #65: Allow non-blocking semaphore acquisition.

Bug Handling

- Issue #96: Provide Windows compatibility in testing harness.
- Issue #95: Handle errors deserializing connection response.
- Issue #94: Clean up stray bytes in connection pipe.
- Issue #87 / #88: Allow re-acquiring lock after cancel.
- Issue #77: Use timeout in initial socket connection.
- Issue #69: Only ensure path once in lock and semaphore recipes.
- Issue #68: Closing the connection causes exceptions to be raised by watchers which assume the connection won't be closed when running commands.
- Issue #66: Require ping reply before sending another ping, otherwise the connection will be considered dead and a ConnectionDropped will be raised to trigger a reconnect.
- Issue #63: Watchers weren't reset on lost connection.
- Issue #58: DataWatcher failed to re-register for changes after non-existent node was created then deleted.

API Changes

- KazooClient.create_async now supports the makepath argument.
- KazooClient.ensure_path now has an async version, ensure_path_async.

1.7.10 1.0 (2013-03-26)

Features

- Added a LockingQueue recipe. The queue first locks an item and removes it from the queue only after the consume() method is called. This enables other nodes to retake the item if an error occurs on the first node.

Bug Handling

- Issue #50: Avoid problems with sleep function in mixed gevent/threading setup.
- Issue #56: Avoid issues with watch callbacks evaluating to false.

1.7.11 1.0b1 (2013-02-24)

Features

- Refactored the internal connection handler to use a single thread. It now uses a deque and pipe to signal the ZK thread that there's a new command to send, so that the ZK thread can send it, or retrieve a response. Processing ZK requests and responses serially in a single thread eliminates the need for a bunch of the locking, the peekable queue and two threads working on the same underlying socket.
- Issue #48: Added documentation for the *retry* helper module.
- Issue #55: Fix *os.pipe* file descriptor leak and introduce a *KazooClient.close* method. The method is particular useful in tests, where multiple *KazooClients* are created and closed in the same process.

Bug Handling

- Issue #46: Avoid *TypeError* in *GeneratorContextManager* on process shutdown.
- Issue #43: Let *DataWatch* return node data if *allow_missing_node* is used.

1.7.12 0.9 (2013-01-07)

API Changes

- When a retry operation ultimately fails, it now raises a *kazoo.retry.RetryFailedError* exception, instead of a general *Exception* instance. *RetryFailedError* also inherits from the base *KazooException*.

Features

- Improvements to Debian packaging rules.

Bug Handling

- Issue #39 / #41: Handle connection dropped errors during session writes. Ensure client connection is re-established to a new ZK node if available.
- Issue #38: Set *CLOEXEC* flag on all sockets when available.
- Issue #37 / #40: Handle timeout errors during *select* calls on sockets.
- Issue #36: Correctly set *ConnectionHandler.writer_stopped* even if an exception is raised inside the writer, like a retry operation failing.

1.7.13 0.8 (2012-10-26)

API Changes

- The *KazooClient.__init__* took as *watcher* argument as its second keyword argument. The argument had no effect anymore since version 0.5 and was removed.

Bug Handling

- Issue #35: *KazooClient.__init__* didn't pass on *retry_max_delay* to the retry helper.
- Issue #34: Be more careful while handling socket connection errors.

1.7.14 0.7 (2012-10-15)

Features

- DataWatch now has a *allow_missing_node* setting that allows a watch to be set on a node that doesn't exist when the DataWatch is created.
- Add new Queue recipe, with optional priority support.
- Add new Counter recipe.
- Added debian packaging rules.

Bug Handling

- Issue #31 fixed: Only catch *KazooExceptions* in catch-all calls.
- Issue #15 fixed again: Force sleep delay to be a float to appease gevent.
- Issue #29 fixed: DataWatch and ChildrenWatch properly re-register their watches on server disconnect.

1.7.15 0.6 (2012-09-27)

API Changes

- Node paths are assumed to be Unicode objects. Under Python 2 pure-ascii strings will also be accepted. Node values are considered bytes. The byte type is an alias for *str* under Python 2.
- New *KeeperState.CONNECTED_RO* state for Zookeeper servers connected in read-only mode.
- New *NotReadOnlyCallError* exception when issuing a write change against a server that's currently read-only.

Features

- Add support for Python 3.2, 3.3 and PyPy (only for the threading handler).
- Handles connecting to Zookeeper 3.4+ read-only servers.
- Automatic background scanning for a Read/Write server when connected to a server in read-only mode.
- Add new Semaphore recipe.
- Add a new *retry_max_delay* argument to the client and by default limit the retry delay to at most an hour regardless of exponential backoff settings.
- Add new *randomize_hosts* argument to *KazooClient*, allowing one to disable host randomization.

Bug Handling

- Fix bug with locks not handling intermediary lock contenders disappearing.
- Fix bug with `set_data` type check failing to catch unicode values.
- Fix bug with `gevent 0.13.x` backport of peekable queue.
- Fix `PatientChildrenWatch` to use handler specific sleep function.

1.7.16 0.5 (2012-09-06)

Skipping a version to reflect the magnitude of the change. Kazoo is now a pure Python client with no C bindings. This release should run without a problem on alternate Python implementations such as PyPy and Jython. Porting to Python 3 in the future should also be much easier.

Documentation

- Docs have been restructured to handle the new classes and locations of the methods from the pure Python refactor.

Bug Handling

This change may introduce new bugs, however there is no longer the possibility of a complete Python segfault due to errors in the C library and/or the C binding.

- Possible segfaults from the C lib are gone.
- Password mangling due to the C lib is gone.
- The party recipes didn't set their participating flag to False after leaving.

Features

- New *client.command* and *client.server_version* API, exposing Zookeeper's four letter commands and giving access to structured version information.
- Added 'include_data' option for *get_children* to include the node's Stat object.
- Substantial increase in logging data with debug mode. All correspondence with the Zookeeper server can now be seen to help in debugging.

API Changes

- The testing helpers have been moved from *testing.__init__* into a *testing.harness* module. The official API's of *KazooTestCase* and *KazooTestHarness* can still be directly imported from *testing*.
- The *kazoo.handlers.util* module was removed.
- Backwards compatible exception class aliases are provided for now in *kazoo* exceptions for the prior C exception names.
- Unicode strings now work fine for node names and are properly converted to and from unicode objects.

- The data value argument for the create and create_async methods of the client was made optional and defaults to an empty byte string. The data value must be a byte string. Unicode values are no longer allowed and will raise a TypeError.

1.7.17 0.3 (2012-08-23)

API Changes

- Handler interface now has an rlock_object for use by recipes.

Bug Handling

- Fixed password bug with updated zc-zookeeper-static release, which retains null bytes in the password properly.
- Fixed reconnect hammering, so that the reconnection follows retry jitter and retry backoff's.
- Fixed possible bug with using a threading.Condition in the set partitioner. Set partitioner uses new rlock_object handler API to get an appropriate RLock for gevent.
- Issue #17 fixed: Wrap timeout exceptions with staticmethod so they can be used directly as intended. Patch by Bob Van Zant.
- Fixed bug with client reconnection looping indefinitely using an expired session id.

1.7.18 0.2 (2012-08-12)

Documentation

- Fixed doc references to start_async using an AsyncResult object, it uses an Event object.

Bug Handling

- Issue #16 fixed: gevent zookeeper logging failed to handle a monkey patched logging setup. Logging is now setup such that a greenlet is used for logging messages under gevent, and the thread one is used otherwise.
- Fixed bug similar to #14 for ChildrenWatch on the session listener.
- Issue #14 fixed: DataWatch had inconsistent handling of the node it was watching not existing. DataWatch also properly spawns its _get_data function to avoid blocking session events.
- Issue #15 fixed: sleep_func for SequentialGeventHandler was not set on the class appropriately leading to additional arguments being passed to gevent.sleep.
- Issue #9 fixed: Threads/greenlets didn't gracefully shut down. Handler now has a start/stop that is used by the client when calling start and stop that shuts down the handler workers. This addresses errors and warnings that could be emitted upon process shutdown regarding a clean exit of the workers.
- Issue #12 fixed: gevent 0.13 doesn't use the same start_new_thread as gevent 1.0 which resulted in a fully monkey-patched environment halting due to the wrong thread. Updated to use the older kazoo method of getting the real thread module object.

API Changes

- The KazooClient handler is now officially exposed as `KazooClient.handler` so that the appropriate sync objects can be used by end-users.
- Refactored `ChildrenWatcher` used by `SetPartitioner` into a publicly exposed `PatientChildrenWatch` under `recipe.watchers`.

Deprecations

- `connect/connect_async` has been renamed to `start/start_async` to better match the `stop` to indicate connection handling. The prior names are aliased for the time being.

Recipes

- Added `Barrier` and `DoubleBarrier` implementation.

1.7.19 0.2b1 (2012-07-27)

Bug Handling

- ZOOKEEPER-1318: `SystemError` is caught and rethrown as the proper invalid state exception in older zookeeper python bindings where this issue is still valid.
- ZOOKEEPER-1431: Install the latest `zc-zookeeper-static` library or use the packaged ubuntu one for ubuntu 12.04 or later.
- ZOOKEEPER-553: State handling isn't checked via this method, we track it in a simpler manner with the watcher to ensure we know the right state.

Features

- Exponential backoff with jitter for retrying commands.
- Gevent 0.13 and 1.0b support.
- Lock, Party, `SetPartitioner`, and Election recipe implementations.
- Data and Children watching API's.
- State transition handling with listener registering to handle session state changes (choose to fatal the app on session expiration, etc.)
- Zookeeper logging stream redirected into Python logging channel under the name 'Zookeeper'.
- Base client library with handler support for threading and gevent async environments.

1.8 How to contribute

We gladly accept outside contributions. We use our [Github issue tracker](#) for both discussions and talking about new features or bugs. You can also fork the project and sent us a pull request. If you have a more general topic to discuss, the user@zookeeper.apache.org mailing list is a good place to do so. You can sometimes find us on IRC in the [#zookeeper](#) channel on freenode.

1.8.1 Development

If you want to work on the code and sent us a [pull request](#), first fork the repository on github to your own account. Then clone your new repository and run the build scripts:

```
git clone git@github.com:<username>/kazoo.git
cd kazoo
make
make zookeeper
```

You need to have some supported version of Python installed and have it available as `python` in your shell. To run Zookeeper you also need a Java runtime (JRE or JDK) version 6 or 7.

You can run all the tests by calling:

```
make test
```

Or to run individual tests:

```
export ZOOKEEPER_PATH=/<path to current folder>/bin/zookeeper/
bin/nosetests -s -d kazoo.tests.test_client:TestClient.test_create
```

The nose test runner allows you to filter by test module, class or individual test method.

If you made changes to the documentation, you can build it locally:

```
make html
```

And then open `./docs/_build/html/index.html` in a web browser to verify the correct rendering.

1.8.2 Submitting changes

We appreciate getting changes sent as pull requests via github. We have travis-ci set up, which will run all tests on all supported version combinations for submitted pull requests, which makes it easy to see if new code breaks tests on some weird version combination.

If you introduce new functionality, please also add documentation and a short entry in the top-level `CHANGES.rst` file.

1.8.3 Adding Recipes

New recipes are welcome, however they should include the status/maintainer RST information so its clear who is maintaining the recipe. This does mean that if you submit a recipe for inclusion with Kazoo, you should be ready to support/maintain it, and address bugs that may be found.

Ideally a recipe should have at least two maintainers.

1.8.4 Legal

Currently we don't have any legal contributor agreement, so code ownership stays with the original authors. The project is licensed under the [Apache License Version 2](#).

Why

Using *Zookeeper* in a safe manner can be difficult due to the variety of edge-cases in *Zookeeper* and other bugs that have been present in the Python C binding. Due to how the C library utilizes a separate C thread for *Zookeeper* communication some libraries like *gevent* (or *eventlet*) also don't work properly by default.

By utilizing a pure Python implementation, Kazoo handles all of these cases and provides a new asynchronous API which is consistent when using threads or *gevent* (or *eventlet*) greenlets.

Source Code

All source code is available on [github](#) under [kazoo](#).

Bugs/Support

Bugs should be reported on the [kazoo github issue tracker](#).

The developers of `kazoo` can frequently be found on the Freenode IRC network in the `#zookeeper` channel.

For general discussions and support questions, please use the [python-zk](#) mailing list hosted on Google Groups.

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5.1 Glossary

Zookeeper [Apache Zookeeper](#) is a centralized service for maintaining configuration information, naming, providing distributed synchronization, and providing group services.

License

`kazoo` is offered under the Apache License 2.0.

Authors

kazoo started under the [Nimbus Project](#) and through collaboration with the open-source community has been merged with code from [Mozilla](#) and the [Zope Corporation](#). It has since gathered an active community of over two dozen contributors from a variety of companies (twitter, mozilla, yahoo! and others).

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